libpgf

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Class Hierarchy

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Class Documentation

CDecoder Class Reference

PGF decoder.
`#include <Decoder.h>`

Classes

- class **CMacroBlock**
  A macro block is a decoding unit of fixed size (uncoded)

Public Member Functions

- **CDecoder** (**CPGFStream** *stream, **PGFPreHeader** &preHeader, **PGFHeader** &header, **PGFPostHeader** &postHeader, UINT32 *&levelLength, UINT64 &userDataPos, bool useOMP, UINT32 userDataPolicy)
- **~CDecoder** ()
  Destructor.

- void **Partition** (**CSubband** *band, int quantParam, int width, int height, int startPos, int pitch)
- void **DecodeInterleaved** (**CWaveletTransform** *wtChannel, int level, int quantParam)
- UINT32 **GetEncodedHeaderLength** () const
- void **SetStreamPosToStart** ()
  Resets stream position to beginning of PGF pre-header.

- void **SetStreamPosToData** ()
  Resets stream position to beginning of data block.

- void **Skip** (UINT64 offset)
- void **DequantizeValue** (**CSubband** *band, UINT32 bandPos, int quantParam)
- UINT32 **ReadEncodedData** (UINT8 *target, UINT32 len) const
- void **DecodeBuffer** ()
- **CPGFStream** * **GetStream** ()
- void **GetNextMacroBlock** ()

Private Member Functions

- void **ReadMacroBlock** (**CMacroBlock** *block)
  *throws **IOException***

Private Attributes

- **CPGFStream** * **m_stream**
  input PGF stream

- UINT64 **m_startPos**
  stream position at the beginning of the PGF pre-header

- UINT64 **m_streamSizeEstimation**
  estimation of stream size

- UINT32 **m_encodedHeaderLength**
  stream offset from startPos to the beginning of the data part (highest level)

- **CMacroBlock** ** **m_macroBlocks**
  array of macroblocks

- int **m_currentBlockIndex**
  index of current macro block

- int **m_macroBlockLen**
  array length

- int **m_macroBlocksAvailable**
  number of decoded macro blocks (including currently used macro block)

- **CMacroBlock** * **m_currentBlock**
  current macro block (used by main thread)

Detailed Description

PGF decoder.

PGF decoder class.

Author:
C. Stamm, R. Spuler

Definition at line 46 of file Decoder.h.

Constructor & Destructor Documentation

CDecoder::CDecoder (CPGFStream * *stream*, PGFPreHeader & *preHeader*, PGFHeader & *header*, PGFPostHeader & *postHeader*, UINT32 *& *levelLength*, UINT64 & *userDataPos*, bool *useOMP*, UINT32 *userDataPolicy*)

Constructor: Read pre-header, header, and levelLength at current stream position. It might throw an **IOException**.

Parameters:

stream	A PGF stream
preHeader	[out] A PGF pre-header
header	[out] A PGF header
postHeader	[out] A PGF post-header
levelLength	The location of the levelLength array. The array is allocated in this method. The caller has to delete this array.
userDataPos	The stream position of the user data (metadata)
useOMP	If true, then the decoder will use multi-threading based on openMP
userDataPolicy	Policy of user data (meta-data) handling while reading PGF headers.

Constructor Read pre-header, header, and levelLength It might throw an **IOException**.

Parameters:

stream	A PGF stream
preHeader	[out] A PGF pre-header
header	[out] A PGF header
postHeader	[out] A PGF post-header
levelLength	The location of the levelLength array. The array is allocated in this method. The caller has to delete this array.
userDataPos	The stream position of the user data (metadata)
useOMP	If true, then the decoder will use multi-threading based on openMP
userDataPolicy	Policy of user data (meta-data) handling while reading PGF headers.

Definition at line 73 of file Decoder.cpp.

```
   76 : m_stream(stream)
   77 , m_startPos(0)
   78 , m_streamSizeEstimation(0)
   79 , m_encodedHeaderLength(0)
   80 , m_currentBlockIndex(0)
   81 , m_macroBlocksAvailable(0)
   82 #ifdef __PGFROISUPPORT__
   83 , m_roi(false)
   84 #endif
   85 {
   86         ASSERT(m_stream);
   87 
   88         int count, expected;
   89 
   90         // store current stream position
   91         m_startPos = m_stream->GetPos();
   92 
   93         // read magic and version
   94         count = expected = MagicVersionSize;
   95         m_stream->Read(&count, &preHeader);
   96         if (count != expected) ReturnWithError(MissingData);
   97 
   98         // read header size
   99         if (preHeader.version & Version6) {
  100                 // 32 bit header size since version 6
  101                 count = expected = 4;
  102         } else {
  103                 count = expected = 2;
  104         }
  105         m_stream->Read(&count, ((UINT8*)&preHeader) + MagicVersionSize);
  106         if (count != expected) ReturnWithError(MissingData);
  107 
  108         // make sure the values are correct read
  109         preHeader.hSize = __VAL(preHeader.hSize);
  110 
  111         // check magic number
  112         if (memcmp(preHeader.magic, PGFMagic, 3) != 0) {
  113                 // error condition: wrong Magic number
  114                 ReturnWithError(FormatCannotRead);
  115         }
  116 
  117         // read file header
  118         count = expected = (preHeader.hSize < HeaderSize) ? preHeader.hSize :
HeaderSize;
  119         m_stream->Read(&count, &header);
  120         if (count != expected) ReturnWithError(MissingData);
  121 
  122         // make sure the values are correct read
  123         header.height = __VAL(UINT32(header.height));
  124         header.width = __VAL(UINT32(header.width));
  125 
  126         // be ready to read all versions including version 0
  127         if (preHeader.version > 0) {
  128 #ifndef __PGFROISUPPORT__
  129                 // check ROI usage
  130                 if (preHeader.version & PGFROI)
ReturnWithError(FormatCannotRead);
  131 #endif
  132 
  133                 UINT32 size = preHeader.hSize;
  134 
```

```
  135                 if (size > HeaderSize) {
  136                         size -= HeaderSize;
  137                         count = 0;
  138 
  139                         // read post-header
  140                         if (header.mode == ImageModeIndexedColor) {
  141                                 if (size < ColorTableSize)
ReturnWithError(FormatCannotRead);
  142                                 // read color table
  143                                 count = expected = ColorTableSize;
  144                                 m_stream->Read(&count, postHeader.clut);
  145                                 if (count != expected)
ReturnWithError(MissingData);
  146                         }
  147 
  148                         if (size > (UINT32)count) {
  149                                 size -= count;
  150 
  151                                 // read/skip user data
  152                                 UserdataPolicy policy =
(UserdataPolicy)((userDataPolicy <= MaxUserDataSize) ? UP_CachePrefix : 0xFFFFFFFF -
userDataPolicy);
  153                                 userDataPos = m_stream->GetPos();
  154                                 postHeader.userDataLen = size;
  155 
  156                                 if (policy == UP_Skip) {
  157                                         postHeader.cachedUserDataLen = 0;
  158                                         postHeader.userData = nullptr;
  159                                         Skip(size);
  160                                 } else {
  161                                         postHeader.cachedUserDataLen =
(policy == UP_CachePrefix) ? __min(size, userDataPolicy) : size;
  162 
  163                                         // create user data memory block
  164                                         postHeader.userData =
new(std::nothrow) UINT8[postHeader.cachedUserDataLen];
  165                                         if (!postHeader.userData)
ReturnWithError(InsufficientMemory);
  166 
  167                                         // read user data
  168                                         count = expected =
postHeader.cachedUserDataLen;
  169                                         m_stream->Read(&count,
postHeader.userData);
  170                                         if (count != expected)
ReturnWithError(MissingData);
  171 
  172                                         // skip remaining user data
  173                                         if (postHeader.cachedUserDataLen <
size) Skip(size - postHeader.cachedUserDataLen);
  174                                 }
  175                         }
  176                 }
  177 
  178                 // create levelLength
  179                 levelLength = new(std::nothrow) UINT32[header.nLevels];
  180                 if (!levelLength) ReturnWithError(InsufficientMemory);
  181 
  182                 // read levelLength
  183                 count = expected = header.nLevels*WordBytes;
  184                 m_stream->Read(&count, levelLength);
  185                 if (count != expected) ReturnWithError(MissingData);
  186 
  187 #ifdef PGF_USE_BIG_ENDIAN
  188                 // make sure the values are correct read
  189                 for (int i=0; i < header.nLevels; i++) {
  190                         levelLength[i] = __VAL(levelLength[i]);
  191                 }
  192 #endif
  193 
  194                 // compute the total size in bytes; keep attention: level length
information is optional
  195                 for (int i=0; i < header.nLevels; i++) {
  196                         m_streamSizeEstimation += levelLength[i];
  197                 }
  198 
  199         }
```

```
  200
  201         // store current stream position
  202         m_encodedHeaderLength = UINT32(m_stream->GetPos() - m_startPos);
  203
  204         // set number of threads
  205 #ifdef LIBPGF_USE_OPENMP
  206         m_macroBlockLen = omp_get_num_procs();
  207 #else
  208         m_macroBlockLen = 1;
  209 #endif
  210
  211         if (useOMP && m_macroBlockLen > 1) {
  212 #ifdef LIBPGF_USE_OPENMP
  213                 omp_set_num_threads(m_macroBlockLen);
  214 #endif
  215
  216                 // create macro block array
  217                 m_macroBlocks = new(std::nothrow)
CMacroBlock*[m_macroBlockLen];
  218                 if (!m_macroBlocks) ReturnWithError(InsufficientMemory);
  219                 for (int i = 0; i < m_macroBlockLen; i++) m_macroBlocks[i] = new
CMacroBlock();
  220                 m_currentBlock = m_macroBlocks[m_currentBlockIndex];
  221         } else {
  222                 m_macroBlocks = 0;
  223                 m_macroBlockLen = 1; // there is only one macro block
  224                 m_currentBlock = new(std::nothrow) CMacroBlock();
  225                 if (!m_currentBlock) ReturnWithError(InsufficientMemory);
  226         }
  227 }
```

CDecoder::~CDecoder ()

Destructor.

Definition at line 231 of file Decoder.cpp.

```
  231                     {
  232         if (m_macroBlocks) {
  233                 for (int i=0; i < m_macroBlockLen; i++) delete m_macroBlocks[i];
  234                 delete[] m_macroBlocks;
  235         } else {
  236                 delete m_currentBlock;
  237         }
  238 }
```

Member Function Documentation

void CDecoder::DecodeBuffer ()

Reads next block(s) from stream and decodes them It might throw an **IOException**.

Definition at line 494 of file Decoder.cpp.

```
  494                             {
  495         ASSERT(m_macroBlocksAvailable <= 0);
  496
  497         // macro block management
  498         if (m_macroBlockLen == 1) {
  499                 ASSERT(m_currentBlock);
  500                 ReadMacroBlock(m_currentBlock);
  501                 m_currentBlock->BitplaneDecode();
  502                 m_macroBlocksAvailable = 1;
  503         } else {
  504                 m_macroBlocksAvailable = 0;
  505                 for (int i=0; i < m_macroBlockLen; i++) {
  506                         // read sequentially several blocks
  507                         try {
  508                                 ReadMacroBlock(m_macroBlocks[i]);
  509                                 m_macroBlocksAvailable++;
  510                         } catch(IOException& ex) {
  511                                 if (ex.error == MissingData || ex.error ==
FormatCannotRead) {
```

```
  512                                             break; // no further data available or
the data isn't valid PGF data (might occur in streaming or PPPExt)
  513                                     } else {
  514                                             throw;
  515                                     }
  516                             }
  517                     }
  518 #ifdef LIBPGF_USE_OPENMP
  519                     // decode in parallel
  520                     #pragma omp parallel for default(shared) //no declared
exceptions in next block
  521 #endif
  522                     for (int i=0; i < m_macroBlocksAvailable; i++) {
  523                             m_macroBlocks[i]->BitplaneDecode();
  524                     }
  525
  526                     // prepare current macro block
  527                     m_currentBlockIndex = 0;
  528                     m_currentBlock = m_macroBlocks[m_currentBlockIndex];
  529             }
  530 }
```

void CDecoder::DecodeInterleaved (CWaveletTransform * *wtChannel*, int *level*, int *quantParam*)

Deccoding and dequantization of HL and LH subband (interleaved) using partitioning scheme. Partitioning scheme: The plane is partitioned in squares of side length InterBlockSize. It might throw an **IOException**.

Parameters:

wtChannel	A wavelet transform channel containing the HL and HL band
level	Wavelet transform level
quantParam	Dequantization value

Definition at line 333 of file Decoder.cpp.

```
  333
{
  334         CSubband* hlBand = wtChannel->GetSubband(level, HL);
  335         CSubband* lhBand = wtChannel->GetSubband(level, LH);
  336         const div_t lhH = div(lhBand->GetHeight(), InterBlockSize);
  337         const div_t hlW = div(hlBand->GetWidth(), InterBlockSize);
  338         const int hlws = hlBand->GetWidth() - InterBlockSize;
  339         const int hlwr = hlBand->GetWidth() - hlW.rem;
  340         const int lhws = lhBand->GetWidth() - InterBlockSize;
  341         const int lhwr = lhBand->GetWidth() - hlW.rem;
  342         int hlPos, lhPos;
  343         int hlBase = 0, lhBase = 0, hlBase2, lhBase2;
  344
  345         ASSERT(lhBand->GetWidth() >= hlBand->GetWidth());
  346         ASSERT(hlBand->GetHeight() >= lhBand->GetHeight());
  347
  348         if (!hlBand->AllocMemory()) ReturnWithError(InsufficientMemory);
  349         if (!lhBand->AllocMemory()) ReturnWithError(InsufficientMemory);
  350
  351         // correct quantParam with normalization factor
  352         quantParam -= level;
  353         if (quantParam < 0) quantParam = 0;
  354
  355         // main height
  356         for (int i=0; i < lhH.quot; i++) {
  357                 // main width
  358                 hlBase2 = hlBase;
  359                 lhBase2 = lhBase;
  360                 for (int j=0; j < hlW.quot; j++) {
  361                         hlPos = hlBase2;
  362                         lhPos = lhBase2;
  363                         for (int y=0; y < InterBlockSize; y++) {
  364                                 for (int x=0; x < InterBlockSize; x++) {
  365                                         DequantizeValue(hlBand, hlPos,
quantParam);
  366                                         DequantizeValue(lhBand, lhPos,
quantParam);
  367                                         hlPos++;
  368                                         lhPos++;
```

```
                                }
                                hlPos += hlws;
                                lhPos += lhws;
                        }
                        hlBase2 += InterBlockSize;
                        lhBase2 += InterBlockSize;
                }
                // rest of width
                hlPos = hlBase2;
                lhPos = lhBase2;
                for (int y=0; y < InterBlockSize; y++) {
                        for (int x=0; x < hlW.rem; x++) {
                                DequantizeValue(hlBand, hlPos, quantParam);
                                DequantizeValue(lhBand, lhPos, quantParam);
                                hlPos++;
                                lhPos++;
                        }
                        // width difference between HL and LH
                        if (lhBand->GetWidth() > hlBand->GetWidth()) {
                                DequantizeValue(lhBand, lhPos, quantParam);
                        }
                        hlPos += hlwr;
                        lhPos += lhwr;
                        hlBase += hlBand->GetWidth();
                        lhBase += lhBand->GetWidth();
                }
        }
        // main width
        hlBase2 = hlBase;
        lhBase2 = lhBase;
        for (int j=0; j < hlW.quot; j++) {
                // rest of height
                hlPos = hlBase2;
                lhPos = lhBase2;
                for (int y=0; y < lhH.rem; y++) {
                        for (int x=0; x < InterBlockSize; x++) {
                                DequantizeValue(hlBand, hlPos, quantParam);
                                DequantizeValue(lhBand, lhPos, quantParam);
                                hlPos++;
                                lhPos++;
                        }
                        hlPos += hlws;
                        lhPos += lhws;
                }
                hlBase2 += InterBlockSize;
                lhBase2 += InterBlockSize;
        }
        // rest of height
        hlPos = hlBase2;
        lhPos = lhBase2;
        for (int y=0; y < lhH.rem; y++) {
                // rest of width
                for (int x=0; x < hlW.rem; x++) {
                        DequantizeValue(hlBand, hlPos, quantParam);
                        DequantizeValue(lhBand, lhPos, quantParam);
                        hlPos++;
                        lhPos++;
                }
                // width difference between HL and LH
                if (lhBand->GetWidth() > hlBand->GetWidth()) {
                        DequantizeValue(lhBand, lhPos, quantParam);
                }
                hlPos += hlwr;
                lhPos += lhwr;
                hlBase += hlBand->GetWidth();
        }
        // height difference between HL and LH
        if (hlBand->GetHeight() > lhBand->GetHeight()) {
                // total width
                hlPos = hlBase;
                for (int j=0; j < hlBand->GetWidth(); j++) {
                        DequantizeValue(hlBand, hlPos, quantParam);
                        hlPos++;
                }
        }
}
```

void CDecoder::DequantizeValue (CSubband * *band*, UINT32 *bandPos*, int *quantParam*)

Dequantization of a single value at given position in subband. It might throw an **IOException**.

Parameters:

band	A subband
bandPos	A valid position in subband band
quantParam	The quantization parameter

Dequantization of a single value at given position in subband. If encoded data is available, then stores dequantized band value into buffer m_value at position m_valuePos. Otherwise reads encoded data block and decodes it. It might throw an **IOException**.

Parameters:

band	A subband
bandPos	A valid position in subband band
quantParam	The quantization parameter

Definition at line 462 of file Decoder.cpp.

```
  462
{
  463         ASSERT(m_currentBlock);
  464
  465         if (m_currentBlock->IsCompletelyRead()) {
  466                 // all data of current macro block has been read --> prepare next
macro block
  467                 GetNextMacroBlock();
  468         }
  469
  470         band->SetData(bandPos,
m_currentBlock->m_value[m_currentBlock->m_valuePos] << quantParam);
  471         m_currentBlock->m_valuePos++;
  472 }
```

UINT32 CDecoder::GetEncodedHeaderLength () const[inline]

Returns the length of all encoded headers in bytes.

Returns:

The length of all encoded headers in bytes

Definition at line 136 of file Decoder.h.

```
  136 { return m_encodedHeaderLength; }
```

void CDecoder::GetNextMacroBlock ()

Gets next macro block It might throw an **IOException**.

Definition at line 477 of file Decoder.cpp.

```
  477                                 {
  478         // current block has been read --> prepare next current block
  479         m_macroBlocksAvailable--;
  480
  481         if (m_macroBlocksAvailable > 0) {
  482                 m_currentBlock = m_macroBlocks[++m_currentBlockIndex];
  483         } else {
  484                 DecodeBuffer();
  485         }
  486         ASSERT(m_currentBlock);
  487 }
```

CPGFStream* CDecoder::GetStream ()[inline]

Returns:

Stream

Definition at line 174 of file Decoder.h.

```
  174 { return m_stream; }
```

void CDecoder::Partition (CSubband * *band*, int *quantParam*, int *width*, int *height*, int *startPos*, int *pitch*)

Unpartitions a rectangular region of a given subband. Partitioning scheme: The plane is partitioned in squares of side length LinBlockSize. Read wavelet coefficients from the output buffer of a macro block. It might throw an **IOException**.

Parameters:

band	A subband
quantParam	Dequantization value
width	The width of the rectangle
height	The height of the rectangle
startPos	The relative subband position of the top left corner of the rectangular region
pitch	The number of bytes in row of the subband

Definition at line 266 of file Decoder.cpp.

```
  266
{
  267         ASSERT(band);
  268
  269         const div_t ww = div(width, LinBlockSize);
  270         const div_t hh = div(height, LinBlockSize);
  271         const int ws = pitch - LinBlockSize;
  272         const int wr = pitch - ww.rem;
  273         int pos, base = startPos, base2;
  274
  275         // main height
  276         for (int i=0; i < hh.quot; i++) {
  277                 // main width
  278                 base2 = base;
  279                 for (int j=0; j < ww.quot; j++) {
  280                         pos = base2;
  281                         for (int y=0; y < LinBlockSize; y++) {
  282                                 for (int x=0; x < LinBlockSize; x++) {
  283                                         DequantizeValue(band, pos,
quantParam);
  284                                         pos++;
  285                                 }
  286                                 pos += ws;
  287                         }
  288                         base2 += LinBlockSize;
  289                 }
  290                 // rest of width
  291                 pos = base2;
  292                 for (int y=0; y < LinBlockSize; y++) {
  293                         for (int x=0; x < ww.rem; x++) {
  294                                 DequantizeValue(band, pos, quantParam);
  295                                 pos++;
  296                         }
  297                         pos += wr;
  298                         base += pitch;
  299                 }
  300         }
  301         // main width
  302         base2 = base;
  303         for (int j=0; j < ww.quot; j++) {
  304                 // rest of height
  305                 pos = base2;
  306                 for (int y=0; y < hh.rem; y++) {
  307                         for (int x=0; x < LinBlockSize; x++) {
  308                                 DequantizeValue(band, pos, quantParam);
  309                                 pos++;
  310                         }
  311                         pos += ws;
  312                 }
  313                 base2 += LinBlockSize;
  314         }
  315         // rest of height
  316         pos = base2;
```

```
317         for (int y=0; y < hh.rem; y++) {
318                 // rest of width
319                 for (int x=0; x < ww.rem; x++) {
320                         DequantizeValue(band, pos, quantParam);
321                         pos++;
322                 }
323                 pos += wr;
324         }
325 }
```

UINT32 CDecoder::ReadEncodedData (UINT8 * *target*, UINT32 *len*) const

Copies data from the open stream to a target buffer. It might throw an **IOException**.

Parameters:

target	The target buffer
len	The number of bytes to read

Returns:

The number of bytes copied to the target buffer

Definition at line 246 of file Decoder.cpp.

```
246                                                                 {
247         ASSERT(m_stream);
248
249         int count = len;
250         m_stream->Read(&count, target);
251
252         return count;
253 }
```

void CDecoder::ReadMacroBlock (CMacroBlock * *block*)[private]

throws **IOException**

Definition at line 535 of file Decoder.cpp.

```
535                                                 {
536         ASSERT(block);
537
538         UINT16 wordLen;
539         ROIBlockHeader h(BufferSize);
540         int count, expected;
541
542 #ifdef TRACE
543         //UINT32 filePos = (UINT32)m_stream->GetPos();
544         //printf("DecodeBuffer: %d\n", filePos);
545 #endif
546
547         // read wordLen
548         count = expected = sizeof(UINT16);
549         m_stream->Read(&count, &wordLen);
550         if (count != expected) ReturnWithError(MissingData);
551         wordLen = __VAL(wordLen); // convert wordLen
552         if (wordLen > BufferSize) ReturnWithError(FormatCannotRead);
553
554 #ifdef __PGFROISUPPORT__
555         // read ROIBlockHeader
556         if (m_roi) {
557                 count = expected = sizeof(ROIBlockHeader);
558                 m_stream->Read(&count, &h.val);
559                 if (count != expected) ReturnWithError(MissingData);
560                 h.val = __VAL(h.val); // convert ROIBlockHeader
561         }
562 #endif
563         // save header
564         block->m_header = h;
565
566         // read data
567         count = expected = wordLen*WordBytes;
568         m_stream->Read(&count, block->m_codeBuffer);
569         if (count != expected) ReturnWithError(MissingData);
570
571 #ifdef PGF_USE_BIG_ENDIAN
```

```
  572         // convert data
  573         count /= WordBytes;
  574         for (int i=0; i < count; i++) {
  575                 block->m_codeBuffer[i] = __VAL(block->m_codeBuffer[i]);
  576         }
  577 #endif
  578
  579 #ifdef __PGFROISUPPORT__
  580         ASSERT(m_roi && h.rbh.bufferSize <= BufferSize || h.rbh.bufferSize ==
BufferSize);
  581 #else
  582         ASSERT(h.rbh.bufferSize == BufferSize);
  583 #endif
  584 }
```

void CDecoder::SetStreamPosToData ()[inline]

Resets stream position to beginning of data block.

Definition at line 144 of file Decoder.h.

```
  144 { ASSERT(m_stream); m_stream->SetPos(FSFromStart, m_startPos +
m_encodedHeaderLength); }
```

void CDecoder::SetStreamPosToStart ()[inline]

Resets stream position to beginning of PGF pre-header.

Definition at line 140 of file Decoder.h.

```
  140 { ASSERT(m_stream); m_stream->SetPos(FSFromStart, m_startPos); }
```

void CDecoder::Skip (UINT64 *offset*)

Skips a given number of bytes in the open stream. It might throw an **IOException**.

Definition at line 449 of file Decoder.cpp.

```
  449                                     {
  450         m_stream->SetPos(FSFromCurrent, offset);
  451 }
```

Member Data Documentation

CMacroBlock* CDecoder::m_currentBlock[private]

current macro block (used by main thread)

Definition at line 209 of file Decoder.h.

int CDecoder::m_currentBlockIndex[private]

index of current macro block

Definition at line 206 of file Decoder.h.

UINT32 CDecoder::m_encodedHeaderLength[private]

stream offset from startPos to the beginning of the data part (highest level)

Definition at line 203 of file Decoder.h.

int CDecoder::m_macroBlockLen[private]

array length
Definition at line 207 of file Decoder.h.

CMacroBlock** CDecoder::m_macroBlocks[private]

array of macroblocks
Definition at line 205 of file Decoder.h.

int CDecoder::m_macroBlocksAvailable[private]

number of decoded macro blocks (including currently used macro block)
Definition at line 208 of file Decoder.h.

UINT64 CDecoder::m_startPos[private]

stream position at the beginning of the PGF pre-header
Definition at line 201 of file Decoder.h.

CPGFStream* CDecoder::m_stream[private]

input PGF stream
Definition at line 200 of file Decoder.h.

UINT64 CDecoder::m_streamSizeEstimation[private]

estimation of stream size
Definition at line 202 of file Decoder.h.

The documentation for this class was generated from the following files:

- **Decoder.h**
- **Decoder.cpp**

CEncoder Class Reference

PGF encoder.
`#include <Encoder.h>`

Classes

- class **CMacroBlock**
  A macro block is an encoding unit of fixed size (uncoded)

Public Member Functions

- **CEncoder** (**CPGFStream** *stream, **PGFPreHeader** preHeader, **PGFHeader** header, const **PGFPostHeader** &postHeader, UINT64 &userDataPos, bool useOMP)
- **~CEncoder** ()
  Destructor.

- void **FavorSpeedOverSize** ()
  Encoder favors speed over compression size.

- void **Flush** ()
- void **UpdatePostHeaderSize** (**PGFPreHeader** preHeader)
- UINT32 **WriteLevelLength** (UINT32 *&levelLength)
- UINT32 **UpdateLevelLength** ()
- void **Partition** (**CSubband** *band, int width, int height, int startPos, int pitch)
- void **SetEncodedLevel** (int currentLevel)
- void **WriteValue** (**CSubband** *band, int bandPos)
- INT64 **ComputeHeaderLength** () const
- INT64 **ComputeBufferLength** () const
- INT64 **ComputeOffset** () const
- void **SetStreamPosToStart** ()
  Resets stream position to beginning of PGF pre-header.

- void **SetBufferStartPos** ()
  Save current stream position as beginning of current level.

Private Member Functions

- void **EncodeBuffer** (**ROIBlockHeader** h)
- void **WriteMacroBlock** (**CMacroBlock** *block)

Private Attributes

- **CPGFStream** * **m_stream**
  output PMF stream

- UINT64 **m_startPosition**
  stream position of PGF start (PreHeader)

- UINT64 **m_levelLengthPos**
  stream position of Metadata

- UINT64 **m_bufferStartPos**
  stream position of encoded buffer

- **CMacroBlock** ** **m_macroBlocks**
  array of macroblocks

- int **m_macroBlockLen**
  array length

- int **m_lastMacroBlock**
  array index of the last created macro block

- **CMacroBlock** * **m_currentBlock**
  current macro block (used by main thread)

- UINT32 * **m_levelLength**
  temporary saves the level index

- int **m_currLevelIndex**
  counts where (=index) to save next value

- UINT8 **m_nLevels**
  number of levels

- bool **m_favorSpeed**
  favor speed over size

- bool **m_forceWriting**
  all macro blocks have to be written into the stream

Detailed Description

PGF encoder.

PGF encoder class.

Author:

C. Stamm

Definition at line 46 of file Encoder.h.

Constructor & Destructor Documentation

CEncoder::CEncoder (CPGFStream * *stream*, PGFPreHeader *preHeader*, PGFHeader *header*, const PGFPostHeader & *postHeader*, UINT64 & *userDataPos*, bool *useOMP*)

Write pre-header, header, post-Header, and levelLength. It might throw an **IOException**.

Parameters:

stream	A PGF stream
preHeader	A already filled in PGF pre-header
header	An already filled in PGF header
postHeader	[in] An already filled in PGF post-header (containing color table, user data, ...)
userDataPos	[out] File position of user data
useOMP	If true, then the encoder will use multi-threading based on openMP

Write pre-header, header, postHeader, and levelLength. It might throw an **IOException**.

Parameters:

stream	A PGF stream
preHeader	A already filled in PGF pre-header
header	An already filled in PGF header
postHeader	[in] An already filled in PGF post-header (containing color table, user data, ...)
userDataPos	[out] File position of user data
useOMP	If true, then the encoder will use multi-threading based on openMP

Definition at line 70 of file Encoder.cpp.

```
   71 : m_stream(stream)
   72 , m_bufferStartPos(0)
   73 , m_currLevelIndex(0)
   74 , m_nLevels(header.nLevels)
   75 , m_favorSpeed(false)
   76 , m_forceWriting(false)
   77 #ifdef __PGFROISUPPORT__
   78 , m_roi(false)
   79 #endif
   80 {
   81         ASSERT(m_stream);
   82 
   83         int count;
   84         m_lastMacroBlock = 0;
   85         m_levelLength = nullptr;
   86 
   87         // set number of threads
   88 #ifdef LIBPGF_USE_OPENMP
   89         m_macroBlockLen = omp_get_num_procs();
   90 #else
   91         m_macroBlockLen = 1;
   92 #endif
   93 
   94         if (useOMP && m_macroBlockLen > 1) {
   95 #ifdef LIBPGF_USE_OPENMP
   96                 omp_set_num_threads(m_macroBlockLen);
   97 #endif
   98                 // create macro block array
   99                 m_macroBlocks = new(std::nothrow)
CMacroBlock*[m_macroBlockLen];
  100                 if (!m_macroBlocks) ReturnWithError(InsufficientMemory);
  101                 for (int i=0; i < m_macroBlockLen; i++) m_macroBlocks[i] = new
CMacroBlock(this);
  102                 m_currentBlock = m_macroBlocks[m_lastMacroBlock++];
  103         } else {
  104                 m_macroBlocks = 0;
  105                 m_macroBlockLen = 1;
  106                 m_currentBlock = new CMacroBlock(this);
  107         }
  108 
  109         // save file position
  110         m_startPosition = m_stream->GetPos();
  111 
  112         // write preHeader
  113         preHeader.hSize = __VAL(preHeader.hSize);
  114         count = PreHeaderSize;
  115         m_stream->Write(&count, &preHeader);
  116 
  117         // write file header
  118         header.height = __VAL(header.height);
  119         header.width = __VAL(header.width);
  120         count = HeaderSize;
  121         m_stream->Write(&count, &header);
```

```
122
123         // write postHeader
124         if (header.mode == ImageModeIndexedColor) {
125                 // write color table
126                 count = ColorTableSize;
127                 m_stream->Write(&count, (void *)postHeader.clut);
128         }
129         // save user data file position
130         userDataPos = m_stream->GetPos();
131         if (postHeader.userDataLen) {
132                 if (postHeader.userData) {
133                         // write user data
134                         count = postHeader.userDataLen;
135                         m_stream->Write(&count, postHeader.userData);
136                 } else {
137                         m_stream->SetPos(FSFromCurrent, count);
138                 }
139         }
140
141         // save level length file position
142         m_levelLengthPos = m_stream->GetPos();
143 }
```

CEncoder::~CEncoder ()

Destructor.

Definition at line 147 of file Encoder.cpp.

```
147                     {
148         if (m_macroBlocks) {
149                 for (int i=0; i < m_macroBlockLen; i++) delete m_macroBlocks[i];
150                 delete[] m_macroBlocks;
151         } else {
152                 delete m_currentBlock;
153         }
154 }
```

Member Function Documentation

INT64 CEncoder::ComputeBufferLength () const[inline]

Compute stream length of encoded buffer.

Returns:

encoded buffer length

Definition at line 179 of file Encoder.h.

```
179 { return m_stream->GetPos() - m_bufferStartPos; }
```

INT64 CEncoder::ComputeHeaderLength () const[inline]

Compute stream length of header.

Returns:

header length

Definition at line 174 of file Encoder.h.

```
174 { return m_levelLengthPos - m_startPosition; }
```

INT64 CEncoder::ComputeOffset () const[inline]

Compute file offset between real and expected levelLength position.

Returns:

file offset

Definition at line 184 of file Encoder.h.

```
184 { return m_stream->GetPos() - m_levelLengthPos; }
```

void CEncoder::EncodeBuffer (ROIBlockHeader *h*)[private]

Definition at line 341 of file Encoder.cpp.

```
341                                                 {
342         ASSERT(m_currentBlock);
343 #ifdef __PGFROISUPPORT__
344         ASSERT(m_roi && h.rbh.bufferSize <= BufferSize || h.rbh.bufferSize ==
BufferSize);
345 #else
346         ASSERT(h.rbh.bufferSize == BufferSize);
347 #endif
348         m_currentBlock->m_header = h;
349
350         // macro block management
351         if (m_macroBlockLen == 1) {
352                 m_currentBlock->BitplaneEncode();
353                 WriteMacroBlock(m_currentBlock);
354         } else {
355                 // save last level index
356                 int lastLevelIndex = m_currentBlock->m_lastLevelIndex;
357
358                 if (m_forceWriting || m_lastMacroBlock == m_macroBlockLen) {
359                         // encode macro blocks
360                         /*
361                         volatile OSError error = NoError;
362                         #ifdef LIBPGF_USE_OPENMP
363                         #pragma omp parallel for ordered default(shared)
364                         #endif
365                         for (int i=0; i < m_lastMacroBlock; i++) {
366                                 if (error == NoError) {
367                                         m_macroBlocks[i]->BitplaneEncode();
368                                         #ifdef LIBPGF_USE_OPENMP
369                                         #pragma omp ordered
370                                         #endif
371                                         {
372                                                 try {
373
WriteMacroBlock(m_macroBlocks[i]);
374                                                 } catch (IOException& e) {
375                                                         error = e.error;
376                                                 }
377                                                 delete m_macroBlocks[i];
m_macroBlocks[i] = 0;
378                                         }
379                                 }
380                         }
381                         if (error != NoError) ReturnWithError(error);
382                         */
383 #ifdef LIBPGF_USE_OPENMP
384                         #pragma omp parallel for default(shared) //no declared
exceptions in next block
385 #endif
386                         for (int i=0; i < m_lastMacroBlock; i++) {
387                                 m_macroBlocks[i]->BitplaneEncode();
388                         }
389                         for (int i=0; i < m_lastMacroBlock; i++) {
390                                 WriteMacroBlock(m_macroBlocks[i]);
391                         }
392
393                         // prepare for next round
394                         m_forceWriting = false;
395                         m_lastMacroBlock = 0;
396                 }
397                 // re-initialize macro block
398                 m_currentBlock = m_macroBlocks[m_lastMacroBlock++];
399                 m_currentBlock->Init(lastLevelIndex);
400         }
401 }
```

void CEncoder::FavorSpeedOverSize ()[inline]

Encoder favors speed over compression size.

Definition at line 121 of file Encoder.h.

```
  121 { m_favorSpeed = true; }
```

void CEncoder::Flush ()

Pad buffer with zeros and encode buffer. It might throw an **IOException**.

Definition at line 310 of file Encoder.cpp.

```
  310                     {
  311         if (m_currentBlock->m_valuePos > 0) {
  312                 // pad buffer with zeros
  313
memset(&(m_currentBlock->m_value[m_currentBlock->m_valuePos]), 0, (BufferSize -
m_currentBlock->m_valuePos)*DataTSize);
  314                 m_currentBlock->m_valuePos = BufferSize;
  315
  316                 // encode buffer
  317                 m_forceWriting = true;  // makes sure that the following
EncodeBuffer is really written into the stream
  318                 EncodeBuffer(ROIBlockHeader(m_currentBlock->m_valuePos,
true));
  319         }
  320 }
```

void CEncoder::Partition (CSubband * *band*, int *width*, int *height*, int *startPos*, int *pitch*)

Partitions a rectangular region of a given subband. Partitioning scheme: The plane is partitioned in squares of side length LinBlockSize. Write wavelet coefficients from subband into the input buffer of a macro block. It might throw an **IOException**.

Parameters:

band	A subband
width	The width of the rectangle
height	The height of the rectangle
startPos	The absolute subband position of the top left corner of the rectangular region
pitch	The number of bytes in row of the subband

Definition at line 246 of file Encoder.cpp.

```
  246
{
  247         ASSERT(band);
  248
  249         const div_t hh = div(height, LinBlockSize);
  250         const div_t ww = div(width, LinBlockSize);
  251         const int ws = pitch - LinBlockSize;
  252         const int wr = pitch - ww.rem;
  253         int pos, base = startPos, base2;
  254
  255         // main height
  256         for (int i=0; i < hh.quot; i++) {
  257                 // main width
  258                 base2 = base;
  259                 for (int j=0; j < ww.quot; j++) {
  260                         pos = base2;
  261                         for (int y=0; y < LinBlockSize; y++) {
  262                                 for (int x=0; x < LinBlockSize; x++) {
  263                                         WriteValue(band, pos);
  264                                         pos++;
  265                                 }
  266                                 pos += ws;
  267                         }
  268                         base2 += LinBlockSize;
  269                 }
  270                 // rest of width
  271                 pos = base2;
  272                 for (int y=0; y < LinBlockSize; y++) {
  273                         for (int x=0; x < ww.rem; x++) {
  274                                 WriteValue(band, pos);
  275                                 pos++;
  276                         }
  277                         pos += wr;
```

```
278                         base += pitch;
279                 }
280         }
281         // main width
282         base2 = base;
283         for (int j=0; j < ww.quot; j++) {
284                 // rest of height
285                 pos = base2;
286                 for (int y=0; y < hh.rem; y++) {
287                         for (int x=0; x < LinBlockSize; x++) {
288                                 WriteValue(band, pos);
289                                 pos++;
290                         }
291                         pos += ws;
292                 }
293                 base2 += LinBlockSize;
294         }
295         // rest of height
296         pos = base2;
297         for (int y=0; y < hh.rem; y++) {
298                 // rest of width
299                 for (int x=0; x < ww.rem; x++) {
300                         WriteValue(band, pos);
301                         pos++;
302                 }
303                 pos += wr;
304         }
305 }
```

void CEncoder::SetBufferStartPos ()[inline]

Save current stream position as beginning of current level.

Definition at line 192 of file Encoder.h.

```
192 { m_bufferStartPos = m_stream->GetPos(); }
```

void CEncoder::SetEncodedLevel (int *currentLevel*)[inline]

Informs the encoder about the encoded level.

Parameters:

currentLevel	encoded level [0, nLevels)

Definition at line 162 of file Encoder.h.

```
162 { ASSERT(currentLevel >= 0); m_currentBlock->m_lastLevelIndex = m_nLevels -
currentLevel - 1; m_forceWriting = true; }
```

void CEncoder::SetStreamPosToStart ()[inline]

Resets stream position to beginning of PGF pre-header.

Definition at line 188 of file Encoder.h.

```
188 { ASSERT(m_stream); m_stream->SetPos(FSFromStart, m_startPosition); }
```

UINT32 CEncoder::UpdateLevelLength ()

Write new levelLength into stream. It might throw an **IOException**.

Returns:

Written image bytes.

Definition at line 202 of file Encoder.cpp.

```
202                                     {
203         UINT64 curPos = m_stream->GetPos(); // end of image
204
205         // set file pos to levelLength
206         m_stream->SetPos(FSFromStart, m_levelLengthPos);
207
208         if (m_levelLength) {
209         #ifdef PGF_USE_BIG_ENDIAN
```

```
210                 UINT32 levelLength;
211                 int count = WordBytes;
212 
213                 for (int i=0; i < m_currLevelIndex; i++) {
214                         levelLength = __VAL(UINT32(m_levelLength[i]));
215                         m_stream->Write(&count, &levelLength);
216                 }
217         #else
218                 int count = m_currLevelIndex*WordBytes;
219 
220                 m_stream->Write(&count, m_levelLength);
221         #endif //PGF_USE_BIG_ENDIAN
222         } else {
223                 int count = m_currLevelIndex*WordBytes;
224                 m_stream->SetPos(FSFromCurrent, count);
225         }
226 
227         // begin of image
228         UINT32 retValue = UINT32(curPos - m_stream->GetPos());
229 
230         // restore file position
231         m_stream->SetPos(FSFromStart, curPos);
232 
233         return retValue;
234 }
```

void CEncoder::UpdatePostHeaderSize (PGFPreHeader *preHeader*)

Increase post-header size and write new size into stream.

Parameters:

preHeader	An already filled in PGF pre-header It might throw an **IOException**.

Definition at line 160 of file Encoder.cpp.

```
160                                                             {
161         UINT64 curPos = m_stream->GetPos(); // end of user data
162         int count = PreHeaderSize;
163 
164         // write preHeader
165         SetStreamPosToStart();
166         preHeader.hSize = __VAL(preHeader.hSize);
167         m_stream->Write(&count, &preHeader);
168 
169         m_stream->SetPos(FSFromStart, curPos);
170 }
```

UINT32 CEncoder::WriteLevelLength (UINT32 *& *levelLength*)

Create level length data structure and write a place holder into stream. It might throw an **IOException**.

Parameters:

levelLength	A reference to an integer array, large enough to save the relative file positions of all PGF levels

Returns:

number of bytes written into stream

Definition at line 177 of file Encoder.cpp.

```
177                                                             {
178         // renew levelLength
179         delete[] levelLength;
180         levelLength = new(std::nothrow) UINT32[m_nLevels];
181         if (!levelLength) ReturnWithError(InsufficientMemory);
182         for (UINT8 l = 0; l < m_nLevels; l++) levelLength[l] = 0;
183         m_levelLength = levelLength;
184 
185         // save level length file position
186         m_levelLengthPos = m_stream->GetPos();
187 
188         // write dummy levelLength
189         int count = m_nLevels*WordBytes;
190         m_stream->Write(&count, m_levelLength);
191 
```

```
  192         // save current file position
  193         SetBufferStartPos();
  194
  195         return count;
  196 }
```

void CEncoder::WriteMacroBlock (CMacroBlock * *block*)[private]

Definition at line 406 of file Encoder.cpp.

```
  406                                                 {
  407         ASSERT(block);
  408 #ifdef __PGFROISUPPORT__
  409         ROIBlockHeader h = block->m_header;
  410 #endif
  411         UINT16 wordLen = UINT16(NumberOfWords(block->m_codePos));
ASSERT(wordLen <= CodeBufferLen);
  412         int count = sizeof(UINT16);
  413
  414 #ifdef TRACE
  415         //UINT32 filePos = (UINT32)m_stream->GetPos();
  416         //printf("EncodeBuffer: %d\n", filePos);
  417 #endif
  418
  419 #ifdef PGF_USE_BIG_ENDIAN
  420         // write wordLen
  421         UINT16 wl = __VAL(wordLen);
  422         m_stream->Write(&count, &wl); ASSERT(count == sizeof(UINT16));
  423
  424 #ifdef __PGFROISUPPORT__
  425         // write ROIBlockHeader
  426         if (m_roi) {
  427                 count = sizeof(ROIBlockHeader);
  428                 h.val = __VAL(h.val);
  429                 m_stream->Write(&count, &h.val); ASSERT(count ==
sizeof(ROIBlockHeader));
  430         }
  431 #endif // __PGFROISUPPORT__
  432
  433         // convert data
  434         for (int i=0; i < wordLen; i++) {
  435                 block->m_codeBuffer[i] = __VAL(block->m_codeBuffer[i]);
  436         }
  437 #else
  438         // write wordLen
  439         m_stream->Write(&count, &wordLen); ASSERT(count == sizeof(UINT16));
  440
  441 #ifdef __PGFROISUPPORT__
  442         // write ROIBlockHeader
  443         if (m_roi) {
  444                 count = sizeof(ROIBlockHeader);
  445                 m_stream->Write(&count, &h.val); ASSERT(count ==
sizeof(ROIBlockHeader));
  446         }
  447 #endif // __PGFROISUPPORT__
  448 #endif // PGF_USE_BIG_ENDIAN
  449
  450         // write encoded data into stream
  451         count = wordLen*WordBytes;
  452         m_stream->Write(&count, block->m_codeBuffer);
  453
  454         // store levelLength
  455         if (m_levelLength) {
  456                 // store level length
  457                 // EncodeBuffer has been called after m_lastLevelIndex has been
updated
  458                 ASSERT(m_currLevelIndex < m_nLevels);
  459                 m_levelLength[m_currLevelIndex] +=
(UINT32)ComputeBufferLength();
  460                 m_currLevelIndex = block->m_lastLevelIndex + 1;
  461
  462         }
  463
  464         // prepare for next buffer
  465         SetBufferStartPos();
```

```
  466
  467         // reset values
  468         block->m_valuePos = 0;
  469         block->m_maxAbsValue = 0;
  470 }
```

void CEncoder::WriteValue (CSubband * *band*, int *bandPos*)

Write a single value into subband at given position. It might throw an **IOException**.

Parameters:

band	A subband
bandPos	A valid position in subband band

Definition at line 326 of file Encoder.cpp.

```
  326                                                 {
  327         if (m_currentBlock->m_valuePos == BufferSize) {
  328                 EncodeBuffer(ROIBlockHeader(BufferSize, false));
  329         }
  330         DataT val = m_currentBlock->m_value[m_currentBlock->m_valuePos++] =
band->GetData(bandPos);
  331         UINT32 v = abs(val);
  332         if (v > m_currentBlock->m_maxAbsValue) m_currentBlock->m_maxAbsValue =
v;
  333 }
```

Member Data Documentation

UINT64 CEncoder::m_bufferStartPos[private]

stream position of encoded buffer

Definition at line 216 of file Encoder.h.

CMacroBlock* CEncoder::m_currentBlock[private]

current macro block (used by main thread)

Definition at line 221 of file Encoder.h.

int CEncoder::m_currLevelIndex[private]

counts where (=index) to save next value

Definition at line 224 of file Encoder.h.

bool CEncoder::m_favorSpeed[private]

favor speed over size

Definition at line 226 of file Encoder.h.

bool CEncoder::m_forceWriting[private]

all macro blocks have to be written into the stream

Definition at line 227 of file Encoder.h.

int CEncoder::m_lastMacroBlock[private]

array index of the last created macro block

Definition at line 220 of file Encoder.h.

UINT32* CEncoder::m_levelLength[private]

temporary saves the level index

Definition at line 223 of file Encoder.h.

UINT64 CEncoder::m_levelLengthPos[private]

stream position of Metadata

Definition at line 215 of file Encoder.h.

int CEncoder::m_macroBlockLen[private]

array length

Definition at line 219 of file Encoder.h.

CMacroBlock** CEncoder::m_macroBlocks[private]

array of macroblocks

Definition at line 218 of file Encoder.h.

UINT8 CEncoder::m_nLevels[private]

number of levels

Definition at line 225 of file Encoder.h.

UINT64 CEncoder::m_startPosition[private]

stream position of PGF start (PreHeader)

Definition at line 214 of file Encoder.h.

CPGFStream* CEncoder::m_stream[private]

output PMF stream

Definition at line 213 of file Encoder.h.

The documentation for this class was generated from the following files:

- **Encoder.h**
- **Encoder.cpp**

CEncoder::CMacroBlock Class Reference

A macro block is an encoding unit of fixed size (uncoded)

Public Member Functions

- **CMacroBlock** (**CEncoder** *encoder)
- void **Init** (int lastLevelIndex)
- void **BitplaneEncode** ()

Public Attributes

- **DataT m_value** [**BufferSize**]
  input buffer of values with index m_valuePos

- UINT32 **m_codeBuffer** [**CodeBufferLen**]
  output buffer for encoded bitstream

- **ROIBlockHeader m_header**
  block header

- UINT32 **m_valuePos**
  current buffer position

- UINT32 **m_maxAbsValue**
  maximum absolute coefficient in each buffer

- UINT32 **m_codePos**
  current position in encoded bitstream

- int **m_lastLevelIndex**
  index of last encoded level: [0, nLevels); used because a level-end can occur before a buffer is full

Private Member Functions

- UINT32 **RLESigns** (UINT32 codePos, UINT32 *signBits, UINT32 signLen)
- UINT32 **DecomposeBitplane** (UINT32 bufferSize, UINT32 planeMask, UINT32 codePos, UINT32 *sigBits, UINT32 *refBits, UINT32 *signBits, UINT32 &signLen, UINT32 &codeLen)
- UINT8 **NumberOfBitplanes** ()
- bool **GetBitAtPos** (UINT32 pos, UINT32 planeMask) const

Private Attributes

- **CEncoder** * **m_encoder**
- bool **m_sigFlagVector** [**BufferSize**+1]

Detailed Description

A macro block is an encoding unit of fixed size (uncoded)

PGF encoder macro block class.

Author:

C. Stamm, I. Bauersachs

Definition at line 51 of file Encoder.h.

Constructor & Destructor Documentation

CEncoder::CMacroBlock::CMacroBlock (CEncoder * *encoder*)[inline]

Constructor: Initializes new macro block.

Parameters:

encoder	Pointer to outer class.

Definition at line 56 of file Encoder.h.

```
   57                                : 4351 )
   58                 : m_value()
   59                 , m_codeBuffer()
   60                 , m_header(0)
   61                 , m_encoder(encoder)
   62                 , m_sigFlagVector()
   63                 {
   64                         ASSERT(m_encoder);
   65                         Init(-1);
   66                 }
```

Member Function Documentation

void CEncoder::CMacroBlock::BitplaneEncode ()

Encodes this macro block into internal code buffer. Several macro blocks can be encoded in parallel. Call **CEncoder::WriteMacroBlock** after this method.

Definition at line 482 of file Encoder.cpp.

```
  482                                             {
  483         UINT8   nPlanes;
  484         UINT32  sigLen, codeLen = 0, wordPos, refLen, signLen;
  485         UINT32  sigBits[BufferLen] = { 0 };
  486         UINT32  refBits[BufferLen] = { 0 };
  487         UINT32  signBits[BufferLen] = { 0 };
  488         UINT32  planeMask;
  489         UINT32  bufferSize = m_header.rbh.bufferSize; ASSERT(bufferSize <=
BufferSize);
  490         bool    useRL;
  491
  492 #ifdef TRACE
  493         //printf("which thread: %d\n", omp_get_thread_num());
  494 #endif
  495
  496         // clear significance vector
  497         for (UINT32 k=0; k < bufferSize; k++) {
  498                 m_sigFlagVector[k] = false;
  499         }
  500         m_sigFlagVector[bufferSize] = true; // sentinel
  501
  502         // clear output buffer
  503         for (UINT32 k=0; k < bufferSize; k++) {
  504                 m_codeBuffer[k] = 0;
  505         }
  506         m_codePos = 0;
  507
  508         // compute number of bit planes and split buffer into separate bit planes
  509         nPlanes = NumberOfBitplanes();
  510
  511         // write number of bit planes to m_codeBuffer
  512         // <nPlanes>
  513         SetValueBlock(m_codeBuffer, 0, nPlanes, MaxBitPlanesLog);
  514         m_codePos += MaxBitPlanesLog;
  515
```

```
  516         // loop through all bit planes
  517         if (nPlanes == 0) nPlanes = MaxBitPlanes + 1;
  518         planeMask = 1 << (nPlanes - 1);
  519
  520         for (int plane = nPlanes - 1; plane >= 0; plane--) {
  521                 // clear significant bitset
  522                 for (UINT32 k=0; k < BufferLen; k++) {
  523                         sigBits[k] = 0;
  524                 }
  525
  526                 // split bitplane in significant bitset and refinement bitset
  527                 sigLen = DecomposeBitplane(bufferSize, planeMask, m_codePos +
RLblockSizeLen + 1, sigBits, refBits, signBits, signLen, codeLen);
  528
  529                 if (sigLen > 0 && codeLen <= MaxCodeLen && codeLen <
AlignWordPos(sigLen) + AlignWordPos(signLen) + 2*RLblockSizeLen) {
  530                         // set RL code bit
  531                         // <1><codeLen>
  532                         SetBit(m_codeBuffer, m_codePos++);
  533
  534                         // write length codeLen to m_codeBuffer
  535                         SetValueBlock(m_codeBuffer, m_codePos, codeLen,
RLblockSizeLen);
  536                         m_codePos += RLblockSizeLen + codeLen;
  537                 } else {
  538                 #ifdef TRACE
  539                         //printf("new\n");
  540                         //for (UINT32 i=0; i < bufferSize; i++) {
  541                         //      printf("%s", (GetBit(sigBits, i)) ? "1" : "_");
  542                         //      if (i%120 == 119) printf("\n");
  543                         //}
  544                         //printf("\n");
  545                 #endif // TRACE
  546
  547                         // run-length coding wasn't efficient enough
  548                         // we don't use RL coding for sigBits
  549                         // <0><sigLen>
  550                         ClearBit(m_codeBuffer, m_codePos++);
  551
  552                         // write length sigLen to m_codeBuffer
  553                         ASSERT(sigLen <= MaxCodeLen);
  554                         SetValueBlock(m_codeBuffer, m_codePos, sigLen,
RLblockSizeLen);
  555                         m_codePos += RLblockSizeLen;
  556
  557                         if (m_encoder->m_favorSpeed || signLen == 0) {
  558                                 useRL = false;
  559                         } else {
  560                                 // overwrite m_codeBuffer
  561                                 useRL = true;
  562                                 // run-length encode m_sign and append them to
the m_codeBuffer
  563                                 codeLen = RLESigns(m_codePos + RLblockSizeLen
+ 1, signBits, signLen);
  564                         }
  565
  566                         if (useRL && codeLen <= MaxCodeLen && codeLen < signLen)
{
  567                                 // RL encoding of m_sign was efficient
  568                                 // <1><codeLen><codedSignBits>_
  569                                 // write RL code bit
  570                                 SetBit(m_codeBuffer, m_codePos++);
  571
  572                                 // write codeLen to m_codeBuffer
  573                                 SetValueBlock(m_codeBuffer, m_codePos,
codeLen, RLblockSizeLen);
  574
  575                                 // compute position of sigBits
  576                                 wordPos = NumberOfWords(m_codePos +
RLblockSizeLen + codeLen);
  577                                 ASSERT(0 <= wordPos && wordPos <
CodeBufferLen);
  578                         } else {
  579                                 // RL encoding of signBits wasn't efficient
  580                                 // <0><signLen>_<signBits>_
  581                                 // clear RL code bit
  582                                 ClearBit(m_codeBuffer, m_codePos++);
```

```
  583
  584                                   // write signLen to m_codeBuffer
  585                                   ASSERT(signLen <= MaxCodeLen);
  586                                   SetValueBlock(m_codeBuffer, m_codePos,
signLen, RLblockSizeLen);
  587
  588                                   // write signBits to m_codeBuffer
  589                                   wordPos = NumberOfWords(m_codePos +
RLblockSizeLen);
  590                                   ASSERT(0 <= wordPos && wordPos <
CodeBufferLen);
  591                                   codeLen = NumberOfWords(signLen);
  592
  593                                   for (UINT32 k=0; k < codeLen; k++) {
  594                                           m_codeBuffer[wordPos++] =
signBits[k];
  595                                   }
  596                           }
  597
  598                           // write sigBits
  599                           // <sigBits>_
  600                           ASSERT(0 <= wordPos && wordPos < CodeBufferLen);
  601                           refLen = NumberOfWords(sigLen);
  602
  603                           for (UINT32 k=0; k < refLen; k++) {
  604                                   m_codeBuffer[wordPos++] = sigBits[k];
  605                           }
  606                           m_codePos = wordPos << WordWidthLog;
  607                   }
  608
  609                   // append refinement bitset (aligned to word boundary)
  610                   // _<refBits>
  611                   wordPos = NumberOfWords(m_codePos);
  612                   ASSERT(0 <= wordPos && wordPos < CodeBufferLen);
  613                   refLen = NumberOfWords(bufferSize - sigLen);
  614
  615                   for (UINT32 k=0; k < refLen; k++) {
  616                           m_codeBuffer[wordPos++] = refBits[k];
  617                   }
  618                   m_codePos = wordPos << WordWidthLog;
  619                   planeMask >>= 1;
  620           }
  621           ASSERT(0 <= m_codePos && m_codePos <= CodeBufferBitLen);
  622 }
```

UINT32 CEncoder::CMacroBlock::DecomposeBitplane (UINT32 *bufferSize*, UINT32 *planeMask*, UINT32 *codePos*, UINT32 * *sigBits*, UINT32 * *refBits*, UINT32 * *signBits*, UINT32 & *signLen*, UINT32 & *codeLen*)`[private]`

Definition at line 634 of file Encoder.cpp.

```
  634
{
  635           ASSERT(sigBits);
  636           ASSERT(refBits);
  637           ASSERT(signBits);
  638           ASSERT(codePos < CodeBufferBitLen);
  639
  640           UINT32 sigPos = 0;
  641           UINT32 valuePos = 0, valueEnd;
  642           UINT32 refPos = 0;
  643
  644           // set output value
  645           signLen = 0;
  646
  647           // prepare RLE of Sigs and Signs
  648           const UINT32 outStartPos = codePos;
  649           UINT32 k = 3;
  650           UINT32 runlen = 1 << k; // = 2^k
  651           UINT32 count = 0;
  652
  653           while (valuePos < bufferSize) {
  654                   // search next 1 in m_sigFlagVector using searching with sentinel
  655                   valueEnd = valuePos;
```

```
  656                 while(!m_sigFlagVector[valueEnd]) { valueEnd++; }
  657
  658                 // search 1's in m_value[plane][valuePos..valueEnd)
  659                 // these 1's are significant bits
  660                 while (valuePos < valueEnd) {
  661                         if (GetBitAtPos(valuePos, planeMask)) {
  662                                 // RLE encoding
  663                                 // encode run of count 0's followed by a 1
  664                                 // with codeword: 1<count>(signBits[signPos])
  665                                 SetBit(m_codeBuffer, codePos++);
  666                                 if (k > 0) {
  667                                         SetValueBlock(m_codeBuffer, codePos,
count, k);
  668                                         codePos += k;
  669
  670                                         // adapt k (half the zero run-length)
  671                                         k--;
  672                                         runlen >>= 1;
  673                                 }
  674
  675                                 // copy and write sign bit
  676                                 if (m_value[valuePos] < 0) {
  677                                         SetBit(signBits, signLen++);
  678                                         SetBit(m_codeBuffer, codePos++);
  679                                 } else {
  680                                         ClearBit(signBits, signLen++);
  681                                         ClearBit(m_codeBuffer, codePos++);
  682                                 }
  683
  684                                 // write a 1 to sigBits
  685                                 SetBit(sigBits, sigPos++);
  686
  687                                 // update m_sigFlagVector
  688                                 m_sigFlagVector[valuePos] = true;
  689
  690                                 // prepare for next run
  691                                 count = 0;
  692                         } else {
  693                                 // RLE encoding
  694                                 count++;
  695                                 if (count == runlen) {
  696                                         // encode run of 2^k zeros by a single
0
  697                                         ClearBit(m_codeBuffer, codePos++);
  698                                         // adapt k (double the zero run-length)
  699                                         if (k < WordWidth) {
  700                                                 k++;
  701                                                 runlen <<= 1;
  702                                         }
  703
  704                                         // prepare for next run
  705                                         count = 0;
  706                                 }
  707
  708                                 // write 0 to sigBits
  709                                 sigPos++;
  710                         }
  711                         valuePos++;
  712                 }
  713                 // refinement bit
  714                 if (valuePos < bufferSize) {
  715                         // write one refinement bit
  716                         if (GetBitAtPos(valuePos++, planeMask)) {
  717                                 SetBit(refBits, refPos);
  718                         } else {
  719                                 ClearBit(refBits, refPos);
  720                         }
  721                         refPos++;
  722                 }
  723         }
  724         // RLE encoding of the rest of the plane
  725         // encode run of count 0's followed by a 1
  726         // with codeword: 1<count>(signBits[signPos])
  727         SetBit(m_codeBuffer, codePos++);
  728         if (k > 0) {
  729                 SetValueBlock(m_codeBuffer, codePos, count, k);
  730                 codePos += k;
```

```
  731         }
  732         // write dmmy sign bit
  733         SetBit(m_codeBuffer, codePos++);
  734
  735         // write word filler zeros
  736
  737         ASSERT(sigPos <= bufferSize);
  738         ASSERT(refPos <= bufferSize);
  739         ASSERT(signLen <= bufferSize);
  740         ASSERT(valuePos == bufferSize);
  741         ASSERT(codePos >= outStartPos && codePos < CodeBufferBitLen);
  742         codeLen = codePos - outStartPos;
  743
  744         return sigPos;
  745 }
```

bool CEncoder::CMacroBlock::GetBitAtPos (UINT32 *pos*, UINT32 *planeMask*) const[inline], [private]

Definition at line 96 of file Encoder.h.

```
   96 { return (abs(m_value[pos]) & planeMask) > 0; }
```

void CEncoder::CMacroBlock::Init (int *lastLevelIndex*)[inline]

Reinitialzes this macro block (allows reusage).

Parameters:

lastLevelIndex	Level length directory index of last encoded level: [0, nLevels)

Definition at line 71 of file Encoder.h.

```
   71                                                  {                           //
initialize for reusage
   72                          m_valuePos = 0;
   73                          m_maxAbsValue = 0;
   74                          m_codePos = 0;
   75                          m_lastLevelIndex = lastLevelIndex;
   76                  }
```

UINT8 CEncoder::CMacroBlock::NumberOfBitplanes ()[private]

Definition at line 750 of file Encoder.cpp.

```
  750                                                 {
  751         UINT8 cnt = 0;
  752
  753         // determine number of bitplanes for max value
  754         if (m_maxAbsValue > 0) {
  755                 while (m_maxAbsValue > 0) {
  756                         m_maxAbsValue >>= 1; cnt++;
  757                 }
  758                 if (cnt == MaxBitPlanes + 1) cnt = 0;
  759                 // end cs
  760                 ASSERT(cnt <= MaxBitPlanes);
  761                 ASSERT((cnt >> MaxBitPlanesLog) == 0);
  762                 return cnt;
  763         } else {
  764                 return 1;
  765         }
  766 }
```

UINT32 CEncoder::CMacroBlock::RLESigns (UINT32 *codePos*, UINT32 * *signBits*, UINT32 *signLen*)[private]

Definition at line 774 of file Encoder.cpp.

```
  774
{
  775         ASSERT(signBits);
  776         ASSERT(0 <= codePos && codePos < CodeBufferBitLen);
```

```
  777         ASSERT(0 < signLen && signLen <= BufferSize);
  778
  779         const UINT32  outStartPos = codePos;
  780         UINT32 k = 0;
  781         UINT32 runlen = 1 << k; // = 2^k
  782         UINT32 count = 0;
  783         UINT32 signPos = 0;
  784
  785         while (signPos < signLen) {
  786                 // search next 0 in signBits starting at position signPos
  787                 count = SeekBit1Range(signBits, signPos, __min(runlen, signLen
- signPos));
  788                 // count 1's found
  789                 if (count == runlen) {
  790                         // encode run of 2^k ones by a single 1
  791                         signPos += count;
  792                         SetBit(m_codeBuffer, codePos++);
  793                         // adapt k (double the 1's run-length)
  794                         if (k < WordWidth) {
  795                                 k++;
  796                                 runlen <<= 1;
  797                         }
  798                 } else {
  799                         // encode run of count 1's followed by a 0
  800                         // with codeword: 0(count)
  801                         signPos += count + 1;
  802                         ClearBit(m_codeBuffer, codePos++);
  803                         if (k > 0) {
  804                                 SetValueBlock(m_codeBuffer, codePos, count,
k);
  805                                 codePos += k;
  806                         }
  807                         // adapt k (half the 1's run-length)
  808                         if (k > 0) {
  809                                 k--;
  810                                 runlen >>= 1;
  811                         }
  812                 }
  813         }
  814         ASSERT(signPos == signLen || signPos == signLen + 1);
  815         ASSERT(codePos >= outStartPos && codePos < CodeBufferBitLen);
  816         return codePos - outStartPos;
  817 }
```

Member Data Documentation

UINT32 CEncoder::CMacroBlock::m_codeBuffer[CodeBufferLen]

output buffer for encoded bitstream

Definition at line 85 of file Encoder.h.

UINT32 CEncoder::CMacroBlock::m_codePos

current position in encoded bitstream

Definition at line 89 of file Encoder.h.

CEncoder* CEncoder::CMacroBlock::m_encoder[private]

Definition at line 98 of file Encoder.h.

ROIBlockHeader CEncoder::CMacroBlock::m_header

block header

Definition at line 86 of file Encoder.h.

int CEncoder::CMacroBlock::m_lastLevelIndex

index of last encoded level: [0, nLevels); used because a level-end can occur before a buffer is full
Definition at line 90 of file Encoder.h.

UINT32 CEncoder::CMacroBlock::m_maxAbsValue

maximum absolute coefficient in each buffer
Definition at line 88 of file Encoder.h.

bool CEncoder::CMacroBlock::m_sigFlagVector[BufferSize+1][private]

Definition at line 99 of file Encoder.h.

DataT CEncoder::CMacroBlock::m_value[BufferSize]

input buffer of values with index m_valuePos
Definition at line 84 of file Encoder.h.

UINT32 CEncoder::CMacroBlock::m_valuePos

current buffer position
Definition at line 87 of file Encoder.h.

The documentation for this class was generated from the following files:

- **Encoder.h**
- **Encoder.cpp**

CDecoder::CMacroBlock Class Reference

A macro block is a decoding unit of fixed size (uncoded)

Public Member Functions

- **CMacroBlock** ()
  Constructor: Initializes new macro block.

- bool **IsCompletelyRead** () const
- void **BitplaneDecode** ()

Public Attributes

- **ROIBlockHeader m_header**
  block header

- **DataT m_value** [**BufferSize**]
  output buffer of values with index m_valuePos

- UINT32 **m_codeBuffer** [**CodeBufferLen**]
  input buffer for encoded bitstream

- UINT32 **m_valuePos**
  current position in m_value

Private Member Functions

- UINT32 **ComposeBitplane** (UINT32 bufferSize, **DataT** planeMask, UINT32 *sigBits, UINT32 *refBits, UINT32 *signBits)
- UINT32 **ComposeBitplaneRLD** (UINT32 bufferSize, **DataT** planeMask, UINT32 sigPos, UINT32 *refBits)
- UINT32 **ComposeBitplaneRLD** (UINT32 bufferSize, **DataT** planeMask, UINT32 *sigBits, UINT32 *refBits, UINT32 signPos)
- void **SetBitAtPos** (UINT32 pos, **DataT** planeMask)
- void **SetSign** (UINT32 pos, bool sign)

Private Attributes

- bool **m_sigFlagVector** [**BufferSize**+1]

Detailed Description

A macro block is a decoding unit of fixed size (uncoded)

PGF decoder macro block class.

Author:

C. Stamm, I. Bauersachs

Definition at line 51 of file Decoder.h.

Constructor & Destructor Documentation

CDecoder::CMacroBlock::CMacroBlock ()[inline]

Constructor: Initializes new macro block.

Definition at line 55 of file Decoder.h.

```
   56                 : m_header(0)
// makes sure that IsCompletelyRead() returns true for an empty macro block
   57 #pragma warning( suppress : 4351 )
   58                 , m_value()
   59                 , m_codeBuffer()
   60                 , m_valuePos(0)
   61                 , m_sigFlagVector()
   62                 {
   63                 }
```

Member Function Documentation

void CDecoder::CMacroBlock::BitplaneDecode ()

Decodes already read input data into this macro block. Several macro blocks can be decoded in parallel. Call **CDecoder::ReadMacroBlock** before this method.

Definition at line 650 of file Decoder.cpp.

```
  650                                             {
  651         UINT32 bufferSize = m_header.rbh.bufferSize; ASSERT(bufferSize <=
BufferSize);
  652
  653         // clear significance vector
  654         for (UINT32 k=0; k < bufferSize; k++) {
  655                 m_sigFlagVector[k] = false;
  656         }
  657         m_sigFlagVector[bufferSize] = true; // sentinel
  658
  659         // clear output buffer
  660         for (UINT32 k=0; k < BufferSize; k++) {
  661                 m_value[k] = 0;
  662         }
  663
  664         // read number of bit planes
  665         // <nPlanes>
  666         UINT32 nPlanes = GetValueBlock(m_codeBuffer, 0, MaxBitPlanesLog);
  667         UINT32 codePos = MaxBitPlanesLog;
  668
  669         // loop through all bit planes
  670         if (nPlanes == 0) nPlanes = MaxBitPlanes + 1;
  671         ASSERT(0 < nPlanes && nPlanes <= MaxBitPlanes + 1);
  672         DataT planeMask = 1 << (nPlanes - 1);
  673
  674         for (int plane = nPlanes - 1; plane >= 0; plane--) {
  675                 UINT32 sigLen = 0;
  676
  677                 // read RL code
  678                 if (GetBit(m_codeBuffer, codePos)) {
  679                         // RL coding of sigBits is used
  680                         // <1><codeLen><codedSigAndSignBits>_<refBits>
  681                         codePos++;
  682
  683                         // read codeLen
  684                         UINT32 codeLen = GetValueBlock(m_codeBuffer, codePos,
RLblockSizeLen); ASSERT(codeLen <= MaxCodeLen);
  685
  686                         // position of encoded sigBits and signBits
  687                         UINT32 sigPos = codePos + RLblockSizeLen; ASSERT(sigPos
< CodeBufferBitLen);
  688
  689                         // refinement bits
  690                         codePos = AlignWordPos(sigPos + codeLen);
ASSERT(codePos < CodeBufferBitLen);
```

```
  691
  692                           // run-length decode significant bits and signs from
m_codeBuffer and
  693                           // read refinement bits from m_codeBuffer and compose
bit plane
  694                           sigLen = ComposeBitplaneRLD(bufferSize, planeMask,
sigPos, &m_codeBuffer[codePos >> WordWidthLog]);
  695
  696                   } else {
  697                           // no RL coding is used for sigBits and signBits together
  698                           // <0><sigLen>
  699                           codePos++;
  700
  701                           // read sigLen
  702                           sigLen = GetValueBlock(m_codeBuffer, codePos,
RLblockSizeLen); ASSERT(sigLen <= MaxCodeLen);
  703                           codePos += RLblockSizeLen; ASSERT(codePos <
CodeBufferBitLen);
  704
  705                           // read RL code for signBits
  706                           if (GetBit(m_codeBuffer, codePos)) {
  707                                   // RL coding is used just for signBits
  708                                   //
<1><codeLen><codedSignBits>_<sigBits>_<refBits>
  709                                   codePos++;
  710
  711                                   // read codeLen
  712                                   UINT32 codeLen = GetValueBlock(m_codeBuffer,
codePos, RLblockSizeLen); ASSERT(codeLen <= MaxCodeLen);
  713
  714                                   // sign bits
  715                                   UINT32 signPos = codePos + RLblockSizeLen;
ASSERT(signPos < CodeBufferBitLen);
  716
  717                                   // significant bits
  718                                   UINT32 sigPos = AlignWordPos(signPos +
codeLen); ASSERT(sigPos < CodeBufferBitLen);
  719
  720                                   // refinement bits
  721                                   codePos = AlignWordPos(sigPos + sigLen);
ASSERT(codePos < CodeBufferBitLen);
  722
  723                                   // read significant and refinement bitset from
m_codeBuffer
  724                                   sigLen = ComposeBitplaneRLD(bufferSize,
planeMask, &m_codeBuffer[sigPos >> WordWidthLog], &m_codeBuffer[codePos >>
WordWidthLog], signPos);
  725
  726                           } else {
  727                                   // RL coding of signBits was not efficient and
therefore not used
  728                                   //
<0><signLen>_<signBits>_<sigBits>_<refBits>
  729                                   codePos++;
  730
  731                                   // read signLen
  732                                   UINT32 signLen = GetValueBlock(m_codeBuffer,
codePos, RLblockSizeLen); ASSERT(signLen <= MaxCodeLen);
  733
  734                                   // sign bits
  735                                   UINT32 signPos = AlignWordPos(codePos +
RLblockSizeLen); ASSERT(signPos < CodeBufferBitLen);
  736
  737                                   // significant bits
  738                                   UINT32 sigPos = AlignWordPos(signPos +
signLen); ASSERT(sigPos < CodeBufferBitLen);
  739
  740                                   // refinement bits
  741                                   codePos = AlignWordPos(sigPos + sigLen);
ASSERT(codePos < CodeBufferBitLen);
  742
  743                                   // read significant and refinement bitset from
m_codeBuffer
  744                                   sigLen = ComposeBitplane(bufferSize,
planeMask, &m_codeBuffer[sigPos >> WordWidthLog], &m_codeBuffer[codePos >>
WordWidthLog], &m_codeBuffer[signPos >> WordWidthLog]);
  745                           }
```

```
  746                 }
  747
  748                 // start of next chunk
  749                 codePos = AlignWordPos(codePos + bufferSize - sigLen);
ASSERT(codePos < CodeBufferBitLen);
  750
  751                 // next plane
  752                 planeMask >>= 1;
  753         }
  754
  755         m_valuePos = 0;
  756 }
```

UINT32 CDecoder::CMacroBlock::ComposeBitplane (UINT32 *bufferSize*, DataT *planeMask*, UINT32 * *sigBits*, UINT32 * *refBits*, UINT32 * *signBits*) [private]

Definition at line 763 of file Decoder.cpp.

```
  763
{
  764         ASSERT(sigBits);
  765         ASSERT(refBits);
  766         ASSERT(signBits);
  767
  768         UINT32 valPos = 0, signPos = 0, refPos = 0, sigPos = 0;
  769
  770         while (valPos < bufferSize) {
  771                 // search next 1 in m_sigFlagVector using searching with sentinel
  772                 UINT32 sigEnd = valPos;
  773                 while(!m_sigFlagVector[sigEnd]) { sigEnd++; }
  774                 sigEnd -= valPos;
  775                 sigEnd += sigPos;
  776
  777                 // search 1's in sigBits[sigPos..sigEnd)
  778                 // these 1's are significant bits
  779                 while (sigPos < sigEnd) {
  780                         // search 0's
  781                         UINT32 zerocnt = SeekBitRange(sigBits, sigPos, sigEnd
- sigPos);
  782                         sigPos += zerocnt;
  783                         valPos += zerocnt;
  784                         if (sigPos < sigEnd) {
  785                                 // write bit to m_value
  786                                 SetBitAtPos(valPos, planeMask);
  787
  788                                 // copy sign bit
  789                                 SetSign(valPos, GetBit(signBits, signPos++));
  790
  791                                 // update significance flag vector
  792                                 m_sigFlagVector[valPos++] = true;
  793                                 sigPos++;
  794                         }
  795                 }
  796                 // refinement bit
  797                 if (valPos < bufferSize) {
  798                         // write one refinement bit
  799                         if (GetBit(refBits, refPos)) {
  800                                 SetBitAtPos(valPos, planeMask);
  801                         }
  802                         refPos++;
  803                         valPos++;
  804                 }
  805         }
  806         ASSERT(sigPos <= bufferSize);
  807         ASSERT(refPos <= bufferSize);
  808         ASSERT(signPos <= bufferSize);
  809         ASSERT(valPos == bufferSize);
  810
  811         return sigPos;
  812 }
```

UINT32 CDecoder::CMacroBlock::ComposeBitplaneRLD (UINT32 *bufferSize*, DataT *planeMask*, UINT32 *sigPos*, UINT32 * *refBits*)[private]

Definition at line 824 of file Decoder.cpp.

```
  824
{
  825         ASSERT(refBits);
  826
  827         UINT32 valPos = 0, refPos = 0;
  828         UINT32 sigPos = 0, sigEnd;
  829         UINT32 k = 3;
  830         UINT32 runlen = 1 << k; // = 2^k
  831         UINT32 count = 0, rest = 0;
  832         bool set1 = false;
  833
  834         while (valPos < bufferSize) {
  835                 // search next 1 in m_sigFlagVector using searching with sentinel
  836                 sigEnd = valPos;
  837                 while(!m_sigFlagVector[sigEnd]) { sigEnd++; }
  838                 sigEnd -= valPos;
  839                 sigEnd += sigPos;
  840
  841                 while (sigPos < sigEnd) {
  842                         if (rest || set1) {
  843                                 // rest of last run
  844                                 sigPos += rest;
  845                                 valPos += rest;
  846                                 rest = 0;
  847                         } else {
  848                                 // decode significant bits
  849                                 if (GetBit(m_codeBuffer, codePos++)) {
  850                                         // extract counter and generate zero
run of length count
  851                                         if (k > 0) {
  852                                                 // extract counter
  853                                                 count =
GetValueBlock(m_codeBuffer, codePos, k);
  854                                                 codePos += k;
  855                                                 if (count > 0) {
  856                                                         sigPos += count;
  857                                                         valPos += count;
  858                                                 }
  859
  860                                                 // adapt k (half run-length
interval)
  861                                                 k--;
  862                                                 runlen >>= 1;
  863                                         }
  864
  865                                         set1 = true;
  866
  867                                 } else {
  868                                         // generate zero run of length 2^k
  869                                         sigPos += runlen;
  870                                         valPos += runlen;
  871
  872                                         // adapt k (double run-length interval)
  873                                         if (k < WordWidth) {
  874                                                 k++;
  875                                                 runlen <<= 1;
  876                                         }
  877                                 }
  878                         }
  879
  880                         if (sigPos < sigEnd) {
  881                                 if (set1) {
  882                                         set1 = false;
  883
  884                                         // write 1 bit
  885                                         SetBitAtPos(valPos, planeMask);
  886
  887                                         // set sign bit
  888                                         SetSign(valPos, GetBit(m_codeBuffer,
codePos++));
```

```
  889
  890                                         // update significance flag vector
  891                                         m_sigFlagVector[valPos++] = true;
  892                                         sigPos++;
  893                                 }
  894                         } else {
  895                                 rest = sigPos - sigEnd;
  896                                 sigPos = sigEnd;
  897                                 valPos -= rest;
  898                         }
  899
  900                 }
  901
  902                 // refinement bit
  903                 if (valPos < bufferSize) {
  904                         // write one refinement bit
  905                         if (GetBit(refBits, refPos)) {
  906                                 SetBitAtPos(valPos, planeMask);
  907                         }
  908                         refPos++;
  909                         valPos++;
  910                 }
  911         }
  912         ASSERT(sigPos <= bufferSize);
  913         ASSERT(refPos <= bufferSize);
  914         ASSERT(valPos == bufferSize);
  915
  916         return sigPos;
  917 }
```

UINT32 CDecoder::CMacroBlock::ComposeBitplaneRLD (UINT32 *bufferSize*, DataT *planeMask*, UINT32 * *sigBits*, UINT32 * *refBits*, UINT32 *signPos*)[private]

Definition at line 927 of file Decoder.cpp.

```
  927
{
  928         ASSERT(sigBits);
  929         ASSERT(refBits);
  930
  931         UINT32 valPos = 0, refPos = 0;
  932         UINT32 sigPos = 0, sigEnd;
  933         UINT32 zerocnt, count = 0;
  934         UINT32 k = 0;
  935         UINT32 runlen = 1 << k; // = 2^k
  936         bool signBit = false;
  937         bool zeroAfterRun = false;
  938
  939         while (valPos < bufferSize) {
  940                 // search next 1 in m_sigFlagVector using searching with sentinel
  941                 sigEnd = valPos;
  942                 while(!m_sigFlagVector[sigEnd]) { sigEnd++; }
  943                 sigEnd -= valPos;
  944                 sigEnd += sigPos;
  945
  946                 // search 1's in sigBits[sigPos..sigEnd)
  947                 // these 1's are significant bits
  948                 while (sigPos < sigEnd) {
  949                         // search 0's
  950                         zerocnt = SeekBitRange(sigBits, sigPos, sigEnd -
sigPos);
  951                         sigPos += zerocnt;
  952                         valPos += zerocnt;
  953                         if (sigPos < sigEnd) {
  954                                 // write bit to m_value
  955                                 SetBitAtPos(valPos, planeMask);
  956
  957                                 // check sign bit
  958                                 if (count == 0) {
  959                                         // all 1's have been set
  960                                         if (zeroAfterRun) {
  961                                                 // finish the run with a 0
  962                                                 signBit = false;
  963                                                 zeroAfterRun = false;
  964                                         } else {
```

```
  965                                                     // decode next sign bit
  966                                                     if (GetBit(m_codeBuffer,
signPos++)) {
  967                                                             // generate 1's run of
length 2^k
  968                                                             count = runlen - 1;
  969                                                             signBit = true;
  970
  971                                                             // adapt k (double
run-length interval)
  972                                                             if (k < WordWidth) {
  973                                                                     k++;
  974                                                                     runlen <<= 1;
  975                                                             }
  976                                                     } else {
  977                                                             // extract counter and
generate 1's run of length count
  978                                                             if (k > 0) {
  979                                                                     // extract
counter
  980                                                                     count =
GetValueBlock(m_codeBuffer, signPos, k);
  981                                                                     signPos += k;
  982
  983                                                                     // adapt k
(half run-length interval)
  984                                                                     k--;
  985                                                                     runlen >>= 1;
  986                                                             }
  987                                                             if (count > 0) {
  988                                                                     count--;
  989                                                                     signBit =
true;
  990                                                                     zeroAfterRun
= true;
  991                                                             } else {
  992                                                                     signBit =
false;
  993                                                             }
  994                                                     }
  995                                             }
  996                                     } else {
  997                                             ASSERT(count > 0);
  998                                             ASSERT(signBit);
  999                                             count--;
 1000                                     }
 1001
 1002                                     // copy sign bit
 1003                                     SetSign(valPos, signBit);
 1004
 1005                                     // update significance flag vector
 1006                                     m_sigFlagVector[valPos++] = true;
 1007                                     sigPos++;
 1008                             }
 1009                     }
 1010
 1011                     // refinement bit
 1012                     if (valPos < bufferSize) {
 1013                             // write one refinement bit
 1014                             if (GetBit(refBits, refPos)) {
 1015                                     SetBitAtPos(valPos, planeMask);
 1016                             }
 1017                             refPos++;
 1018                             valPos++;
 1019                     }
 1020             }
 1021             ASSERT(sigPos <= bufferSize);
 1022             ASSERT(refPos <= bufferSize);
 1023             ASSERT(valPos == bufferSize);
 1024
 1025             return sigPos;
 1026 }
```

bool CDecoder::CMacroBlock::IsCompletelyRead () const[inline]

Returns true if this macro block has been completely read.

Returns:

true if current value position is at block end

Definition at line 68 of file Decoder.h.

```
68 { return m_valuePos >= m_header.rbh.bufferSize; }
```

void CDecoder::CMacroBlock::SetBitAtPos (UINT32 *pos*, DataT *planeMask*)[inline], [private]

Definition at line 85 of file Decoder.h.

```
85 { (m_value[pos] >= 0) ? m_value[pos] |= planeMask : m_value[pos] -= planeMask;
}
```

void CDecoder::CMacroBlock::SetSign (UINT32 *pos*, bool *sign*)[inline], [private]

Definition at line 86 of file Decoder.h.

```
86 { m_value[pos] = -m_value[pos]*sign + m_value[pos]*(!sign); }
```

Member Data Documentation

UINT32 CDecoder::CMacroBlock::m_codeBuffer[CodeBufferLen]

input buffer for encoded bitstream

Definition at line 78 of file Decoder.h.

ROIBlockHeader CDecoder::CMacroBlock::m_header

block header

Definition at line 76 of file Decoder.h.

bool CDecoder::CMacroBlock::m_sigFlagVector[BufferSize+1][private]

Definition at line 88 of file Decoder.h.

DataT CDecoder::CMacroBlock::m_value[BufferSize]

output buffer of values with index m_valuePos

Definition at line 77 of file Decoder.h.

UINT32 CDecoder::CMacroBlock::m_valuePos

current position in m_value

Definition at line 79 of file Decoder.h.

The documentation for this class was generated from the following files:

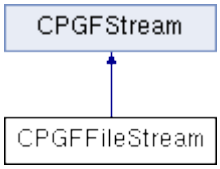
- **Decoder.h**
- **Decoder.cpp**

CPGFFileStream Class Reference

File stream class.

`#include <PGFstream.h>`

Inheritance diagram for CPGFFileStream:



Public Member Functions

- **CPGFFileStream** ()
- **CPGFFileStream** (HANDLE hFile)
- HANDLE **GetHandle** ()
- virtual **~CPGFFileStream** ()
- virtual void **Write** (int *count, void *buffer)
- virtual void **Read** (int *count, void *buffer)
- virtual void **SetPos** (short posMode, INT64 posOff)
- virtual UINT64 **GetPos** () const
- virtual bool **IsValid** () const

Protected Attributes

- HANDLE **m_hFile**
  file handle

Detailed Description

File stream class.

A PGF stream subclass for external storage files.

Author:

C. Stamm

Definition at line 82 of file PGFstream.h.

Constructor & Destructor Documentation

CPGFFileStream::CPGFFileStream ()[inline]

Definition at line 87 of file PGFstream.h.

```
87 : m_hFile(0) {}
```

CPGFFileStream::CPGFFileStream (HANDLE *hFile*)[inline]

Constructor

Parameters:

hFile	File handle

Definition at line 90 of file PGFstream.h.

```
90 : m_hFile(hFile) {}
```

virtual CPGFFileStream::~CPGFFileStream ()[inline], [virtual]

Definition at line 94 of file PGFstream.h.

```
94 { m_hFile = 0; }
```

Member Function Documentation

HANDLE CPGFFileStream::GetHandle ()[inline]

Returns:

File handle

Definition at line 92 of file PGFstream.h.

```
92 { return m_hFile; }
```

UINT64 CPGFFileStream::GetPos () const[virtual]

Get current stream position.

Returns:

Current stream position

Implements **CPGFStream** (*p.109*).

Definition at line 64 of file PGFstream.cpp.

```
64                                      {
65          ASSERT(IsValid());
66          OSError err;
67          UINT64 pos = 0;
68          if ((err = GetFPos(m_hFile, &pos)) != NoError) ReturnWithError2(err,
pos);
69          return pos;
70 }
```

virtual bool CPGFFileStream::IsValid () const[inline], [virtual]

Check stream validity.

Returns:

True if stream and current position is valid

Implements **CPGFStream** (*p.109*).

Definition at line 99 of file PGFstream.h.

```
99 { return m_hFile != 0; }
```

void CPGFFileStream::Read (int * *count*, void * *buffer*)[virtual]

Read some bytes from this stream and stores them into a buffer.

Parameters:

count	A pointer to a value containing the number of bytes should be read. After this call it contains the number of read bytes.
buffer	A memory buffer

Implements **CPGFStream** (*p.109*).

Definition at line 48 of file PGFstream.cpp.

```
48                                                      {
49          ASSERT(count);
50          ASSERT(buffPtr);
51          ASSERT(IsValid());
52          OSError err;
53          if ((err = FileRead(m_hFile, count, buffPtr)) != NoError)
ReturnWithError(err);
54 }
```

void CPGFFileStream::SetPos (short *posMode*, INT64 *posOff*)[virtual]

Set stream position either absolute or relative.

Parameters:

posMode	A position mode (FSFromStart, FSFromCurrent, FSFromEnd)
posOff	A new stream position (absolute positioning) or a position offset (relative positioning)

Implements **CPGFStream** (*p.109*).

Definition at line 57 of file PGFstream.cpp.

```
   57                                                      {
   58         ASSERT(IsValid());
   59         OSError err;
   60         if ((err = SetFPos(m_hFile, posMode, posOff)) != NoError)
ReturnWithError(err);
   61 }
```

void CPGFFileStream::Write (int * *count*, void * *buffer*)[virtual]

Write some bytes out of a buffer into this stream.

Parameters:

count	A pointer to a value containing the number of bytes should be written. After this call it contains the number of written bytes.
buffer	A memory buffer

Implements **CPGFStream** (*p.109*).

Definition at line 38 of file PGFstream.cpp.

```
   38                                                     {
   39         ASSERT(count);
   40         ASSERT(buffPtr);
   41         ASSERT(IsValid());
   42         OSError err;
   43         if ((err = FileWrite(m_hFile, count, buffPtr)) != NoError)
ReturnWithError(err);
   44
   45 }
```

Member Data Documentation

HANDLE CPGFFileStream::m_hFile[protected]

file handle

Definition at line 84 of file PGFstream.h.

The documentation for this class was generated from the following files:

- **PGFstream.h**
- **PGFstream.cpp**

CPGFImage Class Reference

PGF main class.
`#include <PGFimage.h>`

Public Member Functions

- **CPGFImage** ()
  Standard constructor.

- virtual **~CPGFImage** ()
  Destructor.

- void **Destroy** ()
- void **Open** (**CPGFStream** *stream)
- bool **IsOpen** () const
  Returns true if the PGF has been opened for reading.

- void **Read** (int level=0, CallbackPtr cb=nullptr, void *data=nullptr)
- void **Read** (**PGFRect** &rect, int level=0, CallbackPtr cb=nullptr, void *data=nullptr)
- void **ReadPreview** ()
- void **Reconstruct** (int level=0)
- void **GetBitmap** (int pitch, UINT8 *buff, BYTE bpp, int channelMap[]=nullptr, CallbackPtr cb=nullptr, void *data=nullptr) const
- void **GetYUV** (int pitch, **DataT** *buff, BYTE bpp, int channelMap[]=nullptr, CallbackPtr cb=nullptr, void *data=nullptr) const
- void **ImportBitmap** (int pitch, UINT8 *buff, BYTE bpp, int channelMap[]=nullptr, CallbackPtr cb=nullptr, void *data=nullptr)
- void **ImportYUV** (int pitch, **DataT** *buff, BYTE bpp, int channelMap[]=nullptr, CallbackPtr cb=nullptr, void *data=nullptr)
- void **Write** (**CPGFStream** *stream, UINT32 *nWrittenBytes=nullptr, CallbackPtr cb=nullptr, void *data=nullptr)
- UINT32 **WriteHeader** (**CPGFStream** *stream)
- UINT32 **WriteImage** (**CPGFStream** *stream, CallbackPtr cb=nullptr, void *data=nullptr)
- UINT32 **Write** (int level, CallbackPtr cb=nullptr, void *data=nullptr)
- void **ConfigureEncoder** (bool useOMP=true, bool favorSpeedOverSize=false)
- void **ConfigureDecoder** (bool useOMP=true, **UserdataPolicy** policy=**UP_CacheAll**, UINT32 prefixSize=0)
- void **ResetStreamPos** (bool startOfData)
- void **SetChannel** (**DataT** *channel, int c=0)
- void **SetHeader** (const **PGFHeader** &header, BYTE flags=0, const UINT8 *userData=0, UINT32 userDataLength=0)
- void **SetMaxValue** (UINT32 maxValue)
- void **SetProgressMode** (**ProgressMode** pm)
- void **SetRefreshCallback** (**RefreshCB** callback, void *arg)
- void **SetColorTable** (UINT32 iFirstColor, UINT32 nColors, const RGBQUAD *prgbColors)
- **DataT** * **GetChannel** (int c=0)
- void **GetColorTable** (UINT32 iFirstColor, UINT32 nColors, RGBQUAD *prgbColors) const
- const RGBQUAD * **GetColorTable** () const
- const **PGFHeader** * **GetHeader** () const
- UINT32 **GetMaxValue** () const
- UINT64 **GetUserDataPos** () const
- const UINT8 * **GetUserData** (UINT32 &cachedSize, UINT32 *pTotalSize=nullptr) const
- UINT32 **GetEncodedHeaderLength** () const

- UINT32 **GetEncodedLevelLength** (int level) const
- UINT32 **ReadEncodedHeader** (UINT8 *target, UINT32 targetLen) const
- UINT32 **ReadEncodedData** (int level, UINT8 *target, UINT32 targetLen) const
- UINT32 **ChannelWidth** (int c=0) const
- UINT32 **ChannelHeight** (int c=0) const
- BYTE **ChannelDepth** () const
- UINT32 **Width** (int level=0) const
- UINT32 **Height** (int level=0) const
- BYTE **Level** () const
- BYTE **Levels** () const
- bool **IsFullyRead** () const
  Return true if all levels have been read.

- BYTE **Quality** () const
- BYTE **Channels** () const
- BYTE **Mode** () const
- BYTE **BPP** () const
- bool **ROIisSupported** () const
- **PGFRect ComputeLevelROI** () const
- BYTE **UsedBitsPerChannel** () const
- BYTE **Version** () const

Static Public Member Functions

- static bool **ImportIsSupported** (BYTE mode)
- static UINT32 **LevelSizeL** (UINT32 size, int level)
- static UINT32 **LevelSizeH** (UINT32 size, int level)
- static BYTE **CodecMajorVersion** (BYTE version=**PGFVersion**)
  Return major version.

- static BYTE **MaxChannelDepth** (BYTE version=**PGFVersion**)

Protected Attributes

- **CWaveletTransform** * **m_wtChannel** [**MaxChannels**]
  wavelet transformed color channels

- **DataT** * **m_channel** [**MaxChannels**]
  untransformed channels in YUV format

- **CDecoder** * **m_decoder**
  PGF decoder.

- **CEncoder** * **m_encoder**
  PGF encoder.

- UINT32 * **m_levelLength**
  length of each level in bytes; first level starts immediately after this array

- UINT32 **m_width** [**MaxChannels**]
  width of each channel at current level

- UINT32 **m_height** [**MaxChannels**]

height of each channel at current level

- **PGFPreHeader m_preHeader**
  PGF pre-header.

- **PGFHeader m_header**
  PGF file header.

- **PGFPostHeader m_postHeader**
  PGF post-header.

- UINT64 **m_userDataPos**
  stream position of user data

- int **m_currentLevel**
  transform level of current image

- UINT32 **m_userDataPolicy**
  user data (metadata) policy during open

- BYTE **m_quant**
  quantization parameter

- bool **m_downsample**
  chrominance channels are downsampled

- bool **m_favorSpeedOverSize**
  favor encoding speed over compression ratio

- bool **m_useOMPinEncoder**
  use Open MP in encoder

- bool **m_useOMPinDecoder**
  use Open MP in decoder

- bool **m_streamReinitialized**
  stream has been reinitialized

- **PGFRect m_roi**
  region of interest

Private Member Functions

- void **Init** ()
- void **ComputeLevels** ()
- bool **CompleteHeader** ()
- void **RgbToYuv** (int pitch, UINT8 *rgbBuff, BYTE bpp, int channelMap[], CallbackPtr cb, void *data)

- void **Downsample** (int nChannel)
- UINT32 **UpdatePostHeaderSize** ()
- void **WriteLevel** ()
- **PGFRect GetAlignedROI** (int c=0) const
- void **SetROI** (**PGFRect** rect)
- UINT8 **Clamp4** (**DataT** v) const
- UINT16 **Clamp6** (**DataT** v) const
- UINT8 **Clamp8** (**DataT** v) const
- UINT16 **Clamp16** (**DataT** v) const
- UINT32 **Clamp31** (**DataT** v) const

Private Attributes

- **RefreshCB m_cb**
  pointer to refresh callback procedure

- void * **m_cbArg**
  refresh callback argument

- double **m_percent**
  progress [0..1]

- **ProgressMode m_progressMode**
  progress mode used in Read and Write; PM_Relative is default mode

---

Detailed Description

PGF main class.

PGF image class is the main class. You always need a PGF object for encoding or decoding image data. Decoding: **Open() Read() GetBitmap()** Encoding: **SetHeader() ImportBitmap() Write()**

Author:
C. Stamm, R. Spuler

Definition at line 53 of file PGFimage.h.

Constructor & Destructor Documentation

CPGFImage::CPGFImage ()

Standard constructor.

Definition at line 64 of file PGFimage.cpp.

```
64                      {
65         Init();
66 }
```

CPGFImage::~CPGFImage ()[virtual]

Destructor.

Definition at line 117 of file PGFimage.cpp.

```
117                         {
118         m_currentLevel = -100; // unusual value used as marker in Destroy()
119         Destroy();
120 }
```

Member Function Documentation

BYTE CPGFImage::BPP () const[inline]

Return the number of bits per pixel. Valid values can be 1, 8, 12, 16, 24, 32, 48, 64.

Returns:

Number of bits per pixel.

Definition at line 461 of file PGFimage.h.

```
461 { return m_header.bpp; }
```

BYTE CPGFImage::ChannelDepth () const[inline]

Return bits per channel of the image's encoder.

Returns:

Bits per channel

Definition at line 406 of file PGFimage.h.

```
406 { return MaxChannelDepth(m_preHeader.version); }
```

UINT32 CPGFImage::ChannelHeight (int *c* = 0) const[inline]

Return current image height of given channel in pixels. The returned height depends on the levels read so far and on ROI.

Parameters:

c	A channel index

Returns:

Channel height in pixels

Definition at line 401 of file PGFimage.h.

```
401 { ASSERT(c >= 0 && c < MaxChannels); return m_height[c]; }
```

BYTE CPGFImage::Channels () const[inline]

Return the number of image channels. An image of type RGB contains 3 image channels (B, G, R).

Returns:

Number of image channels

Definition at line 448 of file PGFimage.h.

```
448 { return m_header.channels; }
```

UINT32 CPGFImage::ChannelWidth (int *c* = 0) const[inline]

Return current image width of given channel in pixels. The returned width depends on the levels read so far and on ROI.

Parameters:

c	A channel index

Returns:

Channel width in pixels

Definition at line 394 of file PGFimage.h.

```
394 { ASSERT(c >= 0 && c < MaxChannels); return m_width[c]; }
```

UINT16 CPGFImage::Clamp16 (DataT *v*) const[inline], [private]

Definition at line 573 of file PGFimage.h.

```
573                                         {
574                 if (v & 0xFFFF0000) return (v < 0) ? (UINT16)0: (UINT16)65535;
else return (UINT16)v;
575         }
```

UINT32 CPGFImage::Clamp31 (DataT *v*) const[inline], [private]

Definition at line 576 of file PGFimage.h.

```
576                                         {
577                 return (v < 0) ? 0 : (UINT32)v;
578         }
```

UINT8 CPGFImage::Clamp4 (DataT *v*) const[inline], [private]

Definition at line 563 of file PGFimage.h.

```
563                                         {
564                 if (v & 0xFFFFFFF0) return (v < 0) ? (UINT8)0: (UINT8)15; else
return (UINT8)v;
565         }
```

UINT16 CPGFImage::Clamp6 (DataT *v*) const[inline], [private]

Definition at line 566 of file PGFimage.h.

```
566                                         {
567                 if (v & 0xFFFFFFC0) return (v < 0) ? (UINT16)0: (UINT16)63; else
return (UINT16)v;
568         }
```

UINT8 CPGFImage::Clamp8 (DataT *v*) const[inline], [private]

Definition at line 569 of file PGFimage.h.

```
569                                         {
570                 // needs only one test in the normal case
571                 if (v & 0xFFFFFF00) return (v < 0) ? (UINT8)0 : (UINT8)255; else
return (UINT8)v;
572         }
```

BYTE CPGFImage::CodecMajorVersion (BYTE *version* = PGFVersion)[static]

Return major version.

Return codec major version.

Parameters:

version	pgf pre-header version number

Returns:

PGF major of given version

Definition at line 767 of file PGFimage.cpp.

```
767                                                 {
768         if (version & Version7) return 7;
769         if (version & Version6) return 6;
770         if (version & Version5) return 5;
771         if (version & Version2) return 2;
772         return 1;
773 }
```

bool CPGFImage::CompleteHeader ()[private]

Definition at line 218 of file PGFimage.cpp.

```
218                                 {
219         // set current codec version
220         m_header.version = PGFVersionNumber(PGFMajorNumber, PGFYear, PGFWeek);
221 
222         if (m_header.mode == ImageModeUnknown) {
223                 // undefined mode
224                 switch(m_header.bpp) {
225                 case 1: m_header.mode = ImageModeBitmap; break;
226                 case 8: m_header.mode = ImageModeGrayScale; break;
227                 case 12: m_header.mode = ImageModeRGB12; break;
228                 case 16: m_header.mode = ImageModeRGB16; break;
229                 case 24: m_header.mode = ImageModeRGBColor; break;
230                 case 32: m_header.mode = ImageModeRGBA; break;
231                 case 48: m_header.mode = ImageModeRGB48; break;
232                 default: m_header.mode = ImageModeRGBColor; break;
233                 }
234         }
235         if (!m_header.bpp) {
236                 // undefined bpp
237                 switch(m_header.mode) {
238                 case ImageModeBitmap:
239                         m_header.bpp = 1;
240                         break;
241                 case ImageModeIndexedColor:
242                 case ImageModeGrayScale:
243                         m_header.bpp = 8;
244                         break;
245                 case ImageModeRGB12:
246                         m_header.bpp = 12;
247                         break;
248                 case ImageModeRGB16:
249                 case ImageModeGray16:
250                         m_header.bpp = 16;
251                         break;
252                 case ImageModeRGBColor:
253                 case ImageModeLabColor:
254                         m_header.bpp = 24;
255                         break;
256                 case ImageModeRGBA:
257                 case ImageModeCMYKColor:
258                 case ImageModeGray32:
259                         m_header.bpp = 32;
260                         break;
261                 case ImageModeRGB48:
262                 case ImageModeLab48:
263                         m_header.bpp = 48;
264                         break;
265                 case ImageModeCMYK64:
266                         m_header.bpp = 64;
267                         break;
268                 default:
269                         ASSERT(false);
270                         m_header.bpp = 24;
271                 }
272         }
273         if (m_header.mode == ImageModeRGBColor && m_header.bpp == 32) {
274                 // change mode
275                 m_header.mode = ImageModeRGBA;
276         }
277         if (m_header.mode == ImageModeBitmap && m_header.bpp != 1) return false;
278         if (m_header.mode == ImageModeIndexedColor && m_header.bpp != 8) return
false;
279         if (m_header.mode == ImageModeGrayScale && m_header.bpp != 8) return
false;
280         if (m_header.mode == ImageModeGray16 && m_header.bpp != 16) return false;
281         if (m_header.mode == ImageModeGray32 && m_header.bpp != 32) return false;
282         if (m_header.mode == ImageModeRGBColor && m_header.bpp != 24) return
false;
283         if (m_header.mode == ImageModeRGBA && m_header.bpp != 32) return false;
284         if (m_header.mode == ImageModeRGB12 && m_header.bpp != 12) return false;
285         if (m_header.mode == ImageModeRGB16 && m_header.bpp != 16) return false;
```

```
  286         if (m_header.mode == ImageModeRGB48 && m_header.bpp != 48) return false;
  287         if (m_header.mode == ImageModeLabColor && m_header.bpp != 24) return
false;
  288         if (m_header.mode == ImageModeLab48 && m_header.bpp != 48) return false;
  289         if (m_header.mode == ImageModeCMYKColor && m_header.bpp != 32) return
false;
  290         if (m_header.mode == ImageModeCMYK64 && m_header.bpp != 64) return false;
  291
  292         // set number of channels
  293         if (!m_header.channels) {
  294                 switch(m_header.mode) {
  295                 case ImageModeBitmap:
  296                 case ImageModeIndexedColor:
  297                 case ImageModeGrayScale:
  298                 case ImageModeGray16:
  299                 case ImageModeGray32:
  300                         m_header.channels = 1;
  301                         break;
  302                 case ImageModeRGBColor:
  303                 case ImageModeRGB12:
  304                 case ImageModeRGB16:
  305                 case ImageModeRGB48:
  306                 case ImageModeLabColor:
  307                 case ImageModeLab48:
  308                         m_header.channels = 3;
  309                         break;
  310                 case ImageModeRGBA:
  311                 case ImageModeCMYKColor:
  312                 case ImageModeCMYK64:
  313                         m_header.channels = 4;
  314                         break;
  315                 default:
  316                         return false;
  317                 }
  318         }
  319
  320         // store used bits per channel
  321         UINT8 bpc = m_header.bpp/m_header.channels;
  322         if (bpc > 31) bpc = 31;
  323         if (!m_header.usedBitsPerChannel || m_header.usedBitsPerChannel > bpc)
{
  324                 m_header.usedBitsPerChannel = bpc;
  325         }
  326
  327         return true;
  328 }
```

PGFRect CPGFImage::ComputeLevelROI () const

Return ROI of channel 0 at current level in pixels. The returned rect is only valid after reading a ROI.

Returns:

ROI in pixels

void CPGFImage::ComputeLevels ()[private]

Definition at line 853 of file PGFimage.cpp.

```
  853                                 {
  854         const int maxThumbnailWidth = 20*FilterSize;
  855         const int m = __min(m_header.width, m_header.height);
  856         int s = m;
  857
  858         if (m_header.nLevels < 1 || m_header.nLevels > MaxLevel) {
  859                 m_header.nLevels = 1;
  860                 // compute a good value depending on the size of the image
  861                 while (s > maxThumbnailWidth) {
  862                         m_header.nLevels++;
  863                         s >>= 1;
  864                 }
  865         }
  866
```

```
  867         int levels = m_header.nLevels; // we need a signed value during level
reduction
  868
  869         // reduce number of levels if the image size is smaller than
FilterSize*(2^levels)
  870         s = FilterSize*(1 << levels);   // must be at least the double filter
size because of subsampling
  871         while (m < s) {
  872                 levels--;
  873                 s >>= 1;
  874         }
  875         if (levels > MaxLevel) m_header.nLevels = MaxLevel;
  876         else if (levels < 0) m_header.nLevels = 0;
  877         else m_header.nLevels = (UINT8)levels;
  878
  879         // used in Write when PM_Absolute
  880         m_percent = pow(0.25, m_header.nLevels);
  881
  882         ASSERT(0 <= m_header.nLevels && m_header.nLevels <= MaxLevel);
  883 }
```

void CPGFImage::ConfigureDecoder (bool *useOMP* = `true`, UserdataPolicy *policy* = `UP_CacheAll`, UINT32 *prefixSize* = `0`)`[inline]`

Configures the decoder.

Parameters:

useOMP	Use parallel threading with Open MP during decoding. Default value: true. Influences the decoding only if the codec has been compiled with OpenMP support.
policy	The file might contain user data (e.g. metadata). The policy defines the behaviour during **Open()**. UP_CacheAll: User data is read and stored completely in a new allocated memory block. It can be accessed by **GetUserData()**. UP_CachePrefix: Only prefixSize bytes at the beginning of the user data are stored in a new allocated memory block. It can be accessed by **GetUserData()**. UP_Skip: User data is skipped and nothing is cached.
prefixSize	Is only used in combination with UP_CachePrefix. It defines the number of bytes cached.

Definition at line 260 of file PGFimage.h.

```
  260 { ASSERT(prefixSize <= MaxUserDataSize);  m_useOMPinDecoder = useOMP;
m_userDataPolicy = (UP_CachePrefix) ? prefixSize : 0xFFFFFFFF - policy; }
```

void CPGFImage::ConfigureEncoder (bool *useOMP* = `true`, bool *favorSpeedOverSize* = `false`)`[inline]`

Configures the encoder.

Parameters:

useOMP	Use parallel threading with Open MP during encoding. Default value: true. Influences the encoding only if the codec has been compiled with OpenMP support.
favorSpeedOverSize	Favors encoding speed over compression ratio. Default value: false

Definition at line 250 of file PGFimage.h.

```
  250 { m_useOMPinEncoder = useOMP; m_favorSpeedOverSize = favorSpeedOverSize; }
```

void CPGFImage::Destroy ()

Definition at line 124 of file PGFimage.cpp.

```
  124                         {
  125         for (int i = 0; i < m_header.channels; i++) {
  126                 delete m_wtChannel[i]; // also deletes m_channel
  127         }
  128         delete[] m_postHeader.userData;
  129         delete[] m_levelLength;
```

```
  130         delete m_decoder;
  131         delete m_encoder;
  132
  133         if (m_currentLevel != -100) Init();
  134 }
```

void CPGFImage::Downsample (int *nChannel*)[private]

Definition at line 809 of file PGFimage.cpp.

```
  809                                 {
  810         ASSERT(ch > 0);
  811
  812         const int w = m_width[0];
  813         const int w2 = w/2;
  814         const int h2 = m_height[0]/2;
  815         const int oddW = w%2;                           // don't use bool ->
problems with MaxSpeed optimization
  816         const int oddH = m_height[0]%2;         // "
  817         int loPos = 0;
  818         int hiPos = w;
  819         int sampledPos = 0;
  820         DataT* buff = m_channel[ch]; ASSERT(buff);
  821
  822         for (int i=0; i < h2; i++) {
  823                 for (int j=0; j < w2; j++) {
  824                         // compute average of pixel block
  825                         buff[sampledPos] = (buff[loPos] + buff[loPos + 1] +
buff[hiPos] + buff[hiPos + 1]) >> 2;
  826                         loPos += 2; hiPos += 2;
  827                         sampledPos++;
  828                 }
  829                 if (oddW) {
  830                         buff[sampledPos] = (buff[loPos] + buff[hiPos]) >> 1;
  831                         loPos++; hiPos++;
  832                         sampledPos++;
  833                 }
  834                 loPos += w; hiPos += w;
  835         }
  836         if (oddH) {
  837                 for (int j=0; j < w2; j++) {
  838                         buff[sampledPos] = (buff[loPos] + buff[loPos+1]) >> 1;
  839                         loPos += 2; hiPos += 2;
  840                         sampledPos++;
  841                 }
  842                 if (oddW) {
  843                         buff[sampledPos] = buff[loPos];
  844                 }
  845         }
  846
  847         // downsampled image has half width and half height
  848         m_width[ch] = (m_width[ch] + 1)/2;
  849         m_height[ch] = (m_height[ch] + 1)/2;
  850 }
```

PGFRect CPGFImage::GetAlignedROI (int *c* = 0) const[private]

void CPGFImage::GetBitmap (int *pitch*, UINT8 * *buff*, BYTE *bpp*, int *channelMap*[] = nullptr, CallbackPtr *cb* = nullptr, void * *data* = nullptr) const

Get image data in interleaved format: (ordering of RGB data is BGR[A]) Upsampling, YUV to RGB transform and interleaving are done here to reduce the number of passes over the data. The absolute value of pitch is the number of bytes of an image row of the given image buffer. If pitch is negative, then the image buffer must point to the last row of a bottom-up image (first byte on last row). if pitch is positive, then the image buffer must point to the first row of a top-down image (first byte). The sequence of output channels in the output image buffer does not need to be the same as provided by PGF. In case of different sequences you have to provide a channelMap of size of expected channels (depending on image mode). For example, PGF provides a channel sequence

BGR in RGB color mode. If your provided image buffer expects a channel sequence ARGB, then the channelMap looks like { 3, 2, 1, 0 }. It might throw an **IOException**.

Parameters:

pitch	The number of bytes of a row of the image buffer.
buff	An image buffer.
bpp	The number of bits per pixel used in image buffer.
channelMap	A integer array containing the mapping of PGF channel ordering to expected channel ordering.
cb	A pointer to a callback procedure. The procedure is called after each copied buffer row. If cb returns true, then it stops proceeding.
data	Data Pointer to C++ class container to host callback procedure.

Definition at line 1788 of file PGFimage.cpp.

```
 1788
{
 1789         ASSERT(buff);
 1790         UINT32 w = m_width[0];  // width of decoded image
 1791         UINT32 h = m_height[0]; // height of decoded image
 1792         UINT32 yw = w;                  // y-channel width
 1793         UINT32 uw = m_width[1]; // u-channel width
 1794         UINT32 roiOffsetX = 0;
 1795         UINT32 roiOffsetY = 0;
 1796         UINT32 yOffset = 0;
 1797         UINT32 uOffset = 0;
 1798
 1799 #ifdef __PGFROISUPPORT__
 1800         const PGFRect& roi = GetAlignedROI(); // in pixels, roi is usually larger
than levelRoi
 1801         ASSERT(w == roi.Width() && h == roi.Height());
 1802         const PGFRect levelRoi = ComputeLevelROI();
 1803         ASSERT(roi.left <= levelRoi.left && levelRoi.right <= roi.right);
 1804         ASSERT(roi.top <= levelRoi.top && levelRoi.bottom <= roi.bottom);
 1805
 1806         if (ROIisSupported() && (levelRoi.Width() < w || levelRoi.Height() < h))
{
 1807                 // ROI is used
 1808                 w = levelRoi.Width();
 1809                 h = levelRoi.Height();
 1810                 roiOffsetX = levelRoi.left - roi.left;
 1811                 roiOffsetY = levelRoi.top - roi.top;
 1812                 yOffset = roiOffsetX + roiOffsetY*yw;
 1813
 1814                 if (m_downsample) {
 1815                         const PGFRect& downsampledRoi = GetAlignedROI(1);
 1816                         uOffset = levelRoi.left/2 - downsampledRoi.left +
(levelRoi.top/2 - downsampledRoi.top)*m_width[1];
 1817                 } else {
 1818                         uOffset = yOffset;
 1819                 }
 1820         }
 1821 #endif
 1822
 1823         const double dP = 1.0/h;
 1824         int defMap[] = { 0, 1, 2, 3, 4, 5, 6, 7 };
ASSERT(sizeof(defMap)/sizeof(defMap[0]) == MaxChannels);
 1825         if (channelMap == nullptr) channelMap = defMap;
 1826         DataT uAvg, vAvg;
 1827         double percent = 0;
 1828         UINT32 i, j;
 1829
 1830         switch(m_header.mode) {
 1831         case ImageModeBitmap:
 1832                 {
 1833                         ASSERT(m_header.channels == 1);
 1834                         ASSERT(m_header.bpp == 1);
 1835                         ASSERT(bpp == 1);
 1836
 1837                         const UINT32 w2 = (w + 7)/8;
 1838                         DataT* y = m_channel[0]; ASSERT(y);
 1839
 1840                         if (m_preHeader.version & Version7) {
```

```
 1841                                    // new unpacked version has a little better
compression ratio
 1842                                    // since version 7
 1843                                    for (i = 0; i < h; i++) {
 1844                                            UINT32 cnt = 0;
 1845                                            for (j = 0; j < w2; j++) {
 1846                                                    UINT8 byte = 0;
 1847                                                    for (int k = 0; k < 8; k++) {
 1848                                                            byte <<= 1;
 1849                                                            UINT8 bit = 0;
 1850                                                            if (cnt < w) {
 1851                                                                    bit =
y[yOffset + cnt] & 1;
 1852                                                            }
 1853                                                            byte |= bit;
 1854                                                            cnt++;
 1855                                                    }
 1856                                                    buff[j] = byte;
 1857                                            }
 1858                                            yOffset += yw;
 1859                                            buff += pitch;
 1860
 1861                                            if (cb) {
 1862                                                    percent += dP;
 1863                                                    if ((*cb)(percent, true,
data)) ReturnWithError(EscapePressed);
 1864                                            }
 1865                                    }
 1866                            } else {
 1867                                    // old versions
 1868                                    // packed pixels: 8 pixel in 1 byte of channel[0]
 1869                                    if (!(m_preHeader.version & Version5)) yw = w2;
// not version 5 or 6
 1870                                    yOffset = roiOffsetX/8 + roiOffsetY*yw; // 1
byte in y contains 8 pixel values
 1871                                    for (i = 0; i < h; i++) {
 1872                                            for (j = 0; j < w2; j++) {
 1873                                                    buff[j] = Clamp8(y[yOffset +
j] + YUVoffset8);
 1874                                            }
 1875                                            yOffset += yw;
 1876                                            buff += pitch;
 1877
 1878                                            if (cb) {
 1879                                                    percent += dP;
 1880                                                    if ((*cb)(percent, true,
data)) ReturnWithError(EscapePressed);
 1881                                            }
 1882                                    }
 1883                            }
 1884                            break;
 1885                    }
 1886            case ImageModeIndexedColor:
 1887            case ImageModeGrayScale:
 1888            case ImageModeHSLColor:
 1889            case ImageModeHSBColor:
 1890                    {
 1891                            ASSERT(m_header.channels >= 1);
 1892                            ASSERT(m_header.bpp == m_header.channels*8);
 1893                            ASSERT(bpp%8 == 0);
 1894
 1895                            UINT32 cnt, channels = bpp/8; ASSERT(channels >=
m_header.channels);
 1896
 1897                            for (i=0; i < h; i++) {
 1898                                    UINT32 yPos = yOffset;
 1899                                    cnt = 0;
 1900                                    for (j=0; j < w; j++) {
 1901                                            for (UINT32 c=0; c < m_header.channels;
c++) {
 1902                                                    buff[cnt + channelMap[c]] =
Clamp8(m_channel[c][yPos] + YUVoffset8);
 1903                                            }
 1904                                            cnt += channels;
 1905                                            yPos++;
 1906                                    }
 1907                                    yOffset += yw;
```

```
 1908                                    buff += pitch;
 1909
 1910                                    if (cb) {
 1911                                            percent += dP;
 1912                                            if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 1913                                    }
 1914                            }
 1915                            break;
 1916                    }
 1917            case ImageModeGray16:
 1918                    {
 1919                            ASSERT(m_header.channels >= 1);
 1920                            ASSERT(m_header.bpp == m_header.channels*16);
 1921
 1922                            const DataT yuvOffset16 = 1 << (UsedBitsPerChannel() -
1);
 1923                            UINT32 cnt, channels;
 1924
 1925                            if (bpp%16 == 0) {
 1926                                    const int shift = 16 - UsedBitsPerChannel();
ASSERT(shift >= 0);
 1927                                    UINT16 *buff16 = (UINT16 *)buff;
 1928                                    int pitch16 = pitch/2;
 1929                                    channels = bpp/16; ASSERT(channels >=
m_header.channels);
 1930
 1931                                    for (i=0; i < h; i++) {
 1932                                            UINT32 yPos = yOffset;
 1933                                            cnt = 0;
 1934                                            for (j=0; j < w; j++) {
 1935                                                    for (UINT32 c=0; c <
m_header.channels; c++) {
 1936                                                            buff16[cnt +
channelMap[c]] = Clamp16((m_channel[c][yPos] + yuvOffset16) << shift);
 1937                                                    }
 1938                                                    cnt += channels;
 1939                                                    yPos++;
 1940                                            }
 1941                                            yOffset += yw;
 1942                                            buff16 += pitch16;
 1943
 1944                                            if (cb) {
 1945                                                    percent += dP;
 1946                                                    if ((*cb)(percent, true,
data)) ReturnWithError(EscapePressed);
 1947                                            }
 1948                                    }
 1949                            } else {
 1950                                    ASSERT(bpp%8 == 0);
 1951                                    const int shift = __max(0, UsedBitsPerChannel()
- 8);
 1952                                    channels = bpp/8; ASSERT(channels >=
m_header.channels);
 1953
 1954                                    for (i=0; i < h; i++) {
 1955                                            UINT32 yPos = yOffset;
 1956                                            cnt = 0;
 1957                                            for (j=0; j < w; j++) {
 1958                                                    for (UINT32 c=0; c <
m_header.channels; c++) {
 1959                                                            buff[cnt +
channelMap[c]] = Clamp8((m_channel[c][yPos] + yuvOffset16) >> shift);
 1960                                                    }
 1961                                                    cnt += channels;
 1962                                                    yPos++;
 1963                                            }
 1964                                            yOffset += yw;
 1965                                            buff += pitch;
 1966
 1967                                            if (cb) {
 1968                                                    percent += dP;
 1969                                                    if ((*cb)(percent, true,
data)) ReturnWithError(EscapePressed);
 1970                                            }
 1971                                    }
 1972                            }
```

```
 1973                           break;
 1974                   }
 1975           case ImageModeRGBColor:
 1976                   {
 1977                           ASSERT(m_header.channels == 3);
 1978                           ASSERT(m_header.bpp == m_header.channels*8);
 1979                           ASSERT(bpp%8 == 0);
 1980                           ASSERT(bpp >= m_header.bpp);
 1981
 1982                           DataT* y = m_channel[0]; ASSERT(y);
 1983                           DataT* u = m_channel[1]; ASSERT(u);
 1984                           DataT* v = m_channel[2]; ASSERT(v);
 1985                           UINT8 *buffg = &buff[channelMap[1]],
 1986                                    *buffr = &buff[channelMap[2]],
 1987                                    *buffb = &buff[channelMap[0]];
 1988                           UINT8 g;
 1989                           UINT32 cnt, channels = bpp/8;
 1990
 1991                           if (m_downsample) {
 1992                                   for (i=0; i < h; i++) {
 1993                                           UINT32 uPos = uOffset;
 1994                                           UINT32 yPos = yOffset;
 1995                                           cnt = 0;
 1996                                           for (j=0; j < w; j++) {
 1997                                                   // u and v are downsampled
 1998                                                   uAvg = u[uPos];
 1999                                                   vAvg = v[uPos];
 2000                                                   // Yuv
 2001                                                   buffg[cnt] = g =
Clamp8(y[yPos] + YUVoffset8 - ((uAvg + vAvg ) >> 2)); // must be logical shift operator
 2002                                                   buffr[cnt] = Clamp8(uAvg + g);
 2003                                                   buffb[cnt] = Clamp8(vAvg + g);
 2004                                                   cnt += channels;
 2005                                                   if (j & 1) uPos++;
 2006                                                   yPos++;
 2007                                           }
 2008                                           if (i & 1) uOffset += uw;
 2009                                           yOffset += yw;
 2010                                           buffb += pitch;
 2011                                           buffg += pitch;
 2012                                           buffr += pitch;
 2013
 2014                                           if (cb) {
 2015                                                   percent += dP;
 2016                                                   if ((*cb)(percent, true,
data)) ReturnWithError(EscapePressed);
 2017                                           }
 2018                                   }
 2019
 2020                           } else {
 2021                                   for (i=0; i < h; i++) {
 2022                                           cnt = 0;
 2023                                           UINT32 yPos = yOffset;
 2024                                           for (j = 0; j < w; j++) {
 2025                                                   uAvg = u[yPos];
 2026                                                   vAvg = v[yPos];
 2027                                                   // Yuv
 2028                                                   buffg[cnt] = g =
Clamp8(y[yPos] + YUVoffset8 - ((uAvg + vAvg ) >> 2)); // must be logical shift operator
 2029                                                   buffr[cnt] = Clamp8(uAvg + g);
 2030                                                   buffb[cnt] = Clamp8(vAvg + g);
 2031                                                   cnt += channels;
 2032                                                   yPos++;
 2033                                           }
 2034                                           yOffset += yw;
 2035                                           buffb += pitch;
 2036                                           buffg += pitch;
 2037                                           buffr += pitch;
 2038
 2039                                           if (cb) {
 2040                                                   percent += dP;
 2041                                                   if ((*cb)(percent, true,
data)) ReturnWithError(EscapePressed);
 2042                                           }
 2043                                   }
 2044                           }
 2045                           break;
```

```
 2046                 }
 2047         case ImageModeRGB48:
 2048                 {
 2049                         ASSERT(m_header.channels == 3);
 2050                         ASSERT(m_header.bpp == 48);
 2051
 2052                         const DataT yuvOffset16 = 1 << (UsedBitsPerChannel() -
1);
 2053
 2054                         DataT* y = m_channel[0]; ASSERT(y);
 2055                         DataT* u = m_channel[1]; ASSERT(u);
 2056                         DataT* v = m_channel[2]; ASSERT(v);
 2057                         UINT32 cnt, channels;
 2058                         DataT g;
 2059
 2060                         if (bpp >= 48 && bpp%16 == 0) {
 2061                                 const int shift = 16 - UsedBitsPerChannel();
ASSERT(shift >= 0);
 2062                                 UINT16 *buff16 = (UINT16 *)buff;
 2063                                 int pitch16 = pitch/2;
 2064                                 channels = bpp/16; ASSERT(channels >=
m_header.channels);
 2065
 2066                                 for (i=0; i < h; i++) {
 2067                                         UINT32 uPos = uOffset;
 2068                                         UINT32 yPos = yOffset;
 2069                                         cnt = 0;
 2070                                         for (j=0; j < w; j++) {
 2071                                                 uAvg = u[uPos];
 2072                                                 vAvg = v[uPos];
 2073                                                 // Yuv
 2074                                                 g = y[yPos] + yuvOffset16 -
((uAvg + vAvg ) >> 2); // must be logical shift operator
 2075                                                 buff16[cnt + channelMap[1]] =
Clamp16(g << shift);
 2076                                                 buff16[cnt + channelMap[2]] =
Clamp16((uAvg + g) << shift);
 2077                                                 buff16[cnt + channelMap[0]] =
Clamp16((vAvg + g) << shift);
 2078                                                 cnt += channels;
 2079                                                 if (!m_downsample || (j & 1))
uPos++;
 2080                                                 yPos++;
 2081                                         }
 2082                                         if (!m_downsample || (i & 1)) uOffset
+= uw;
 2083                                         yOffset += yw;
 2084                                         buff16 += pitch16;
 2085
 2086                                         if (cb) {
 2087                                                 percent += dP;
 2088                                                 if ((*cb)(percent, true,
data)) ReturnWithError(EscapePressed);
 2089                                         }
 2090                                 }
 2091                         } else {
 2092                                 ASSERT(bpp%8 == 0);
 2093                                 const int shift = __max(0, UsedBitsPerChannel()
- 8);
 2094                                 channels = bpp/8; ASSERT(channels >=
m_header.channels);
 2095
 2096                                 for (i=0; i < h; i++) {
 2097                                         UINT32 uPos = uOffset;
 2098                                         UINT32 yPos = yOffset;
 2099                                         cnt = 0;
 2100                                         for (j=0; j < w; j++) {
 2101                                                 uAvg = u[uPos];
 2102                                                 vAvg = v[uPos];
 2103                                                 // Yuv
 2104                                                 g = y[yPos] + yuvOffset16 -
((uAvg + vAvg ) >> 2); // must be logical shift operator
 2105                                                 buff[cnt + channelMap[1]] =
Clamp8(g >> shift);
 2106                                                 buff[cnt + channelMap[2]] =
Clamp8((uAvg + g) >> shift);
```

```
 2107                                                   buff[cnt + channelMap[0]] =
Clamp8((vAvg + g) >> shift);
 2108                                                   cnt += channels;
 2109                                                   if (!m_downsample || (j & 1))
uPos++;
 2110                                                   yPos++;
 2111                                           }
 2112                                           if (!m_downsample || (i & 1)) uOffset
+= uw;
 2113                                           yOffset += yw;
 2114                                           buff += pitch;
 2115
 2116                                           if (cb) {
 2117                                                   percent += dP;
 2118                                                   if ((*cb)(percent, true,
data)) ReturnWithError(EscapePressed);
 2119                                           }
 2120                                   }
 2121                           }
 2122                           break;
 2123                   }
 2124           case ImageModeLabColor:
 2125                   {
 2126                           ASSERT(m_header.channels == 3);
 2127                           ASSERT(m_header.bpp == m_header.channels*8);
 2128                           ASSERT(bpp%8 == 0);
 2129
 2130                           DataT* l = m_channel[0]; ASSERT(l);
 2131                           DataT* a = m_channel[1]; ASSERT(a);
 2132                           DataT* b = m_channel[2]; ASSERT(b);
 2133                           UINT32 cnt, channels = bpp/8; ASSERT(channels >=
m_header.channels);
 2134
 2135                           for (i=0; i < h; i++) {
 2136                                   UINT32 uPos = uOffset;
 2137                                   UINT32 yPos = yOffset;
 2138                                   cnt = 0;
 2139                                   for (j=0; j < w; j++) {
 2140                                           uAvg = a[uPos];
 2141                                           vAvg = b[uPos];
 2142                                           buff[cnt + channelMap[0]] =
Clamp8(l[yPos] + YUVoffset8);
 2143                                           buff[cnt + channelMap[1]] =
Clamp8(uAvg + YUVoffset8);
 2144                                           buff[cnt + channelMap[2]] =
Clamp8(vAvg + YUVoffset8);
 2145                                           cnt += channels;
 2146                                           if (!m_downsample || (j & 1)) uPos++;
 2147                                           yPos++;
 2148                                   }
 2149                                   if (!m_downsample || (i & 1)) uOffset += uw;
 2150                                   yOffset += yw;
 2151                                   buff += pitch;
 2152
 2153                                   if (cb) {
 2154                                           percent += dP;
 2155                                           if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 2156                                   }
 2157                           }
 2158                           break;
 2159                   }
 2160           case ImageModeLab48:
 2161                   {
 2162                           ASSERT(m_header.channels == 3);
 2163                           ASSERT(m_header.bpp == m_header.channels*16);
 2164
 2165                           const DataT yuvOffset16 = 1 << (UsedBitsPerChannel() -
1);
 2166
 2167                           DataT* l = m_channel[0]; ASSERT(l);
 2168                           DataT* a = m_channel[1]; ASSERT(a);
 2169                           DataT* b = m_channel[2]; ASSERT(b);
 2170                           UINT32 cnt, channels;
 2171
 2172                           if (bpp%16 == 0) {
```

```
 2173                                    const int shift = 16 - UsedBitsPerChannel();
ASSERT(shift >= 0);
 2174                                    UINT16 *buff16 = (UINT16 *)buff;
 2175                                    int pitch16 = pitch/2;
 2176                                    channels = bpp/16; ASSERT(channels >=
m_header.channels);
 2177
 2178                                    for (i=0; i < h; i++) {
 2179                                            UINT32 uPos = uOffset;
 2180                                            UINT32 yPos = yOffset;
 2181                                            cnt = 0;
 2182                                            for (j=0; j < w; j++) {
 2183                                                    uAvg = a[uPos];
 2184                                                    vAvg = b[uPos];
 2185                                                    buff16[cnt + channelMap[0]] =
Clamp16((l[yPos] + yuvOffset16) << shift);
 2186                                                    buff16[cnt + channelMap[1]] =
Clamp16((uAvg + yuvOffset16) << shift);
 2187                                                    buff16[cnt + channelMap[2]] =
Clamp16((vAvg + yuvOffset16) << shift);
 2188                                                    cnt += channels;
 2189                                                    if (!m_downsample || (j & 1))
uPos++;
 2190                                                    yPos++;
 2191                                            }
 2192                                            if (!m_downsample || (i & 1)) uOffset
+= uw;
 2193                                            yOffset += yw;
 2194                                            buff16 += pitch16;
 2195
 2196                                            if (cb) {
 2197                                                    percent += dP;
 2198                                                    if ((*cb)(percent, true,
data)) ReturnWithError(EscapePressed);
 2199                                            }
 2200                                    }
 2201                            } else {
 2202                                    ASSERT(bpp%8 == 0);
 2203                                    const int shift = __max(0, UsedBitsPerChannel()
- 8);
 2204                                    channels = bpp/8; ASSERT(channels >=
m_header.channels);
 2205
 2206                                    for (i=0; i < h; i++) {
 2207                                            UINT32 uPos = uOffset;
 2208                                            UINT32 yPos = yOffset;
 2209                                            cnt = 0;
 2210                                            for (j=0; j < w; j++) {
 2211                                                    uAvg = a[uPos];
 2212                                                    vAvg = b[uPos];
 2213                                                    buff[cnt + channelMap[0]] =
Clamp8((l[yPos] + yuvOffset16) >> shift);
 2214                                                    buff[cnt + channelMap[1]] =
Clamp8((uAvg + yuvOffset16) >> shift);
 2215                                                    buff[cnt + channelMap[2]] =
Clamp8((vAvg + yuvOffset16) >> shift);
 2216                                                    cnt += channels;
 2217                                                    if (!m_downsample || (j & 1))
uPos++;
 2218                                                    yPos++;
 2219                                            }
 2220                                            if (!m_downsample || (i & 1)) uOffset
+= uw;
 2221                                            yOffset += yw;
 2222                                            buff += pitch;
 2223
 2224                                            if (cb) {
 2225                                                    percent += dP;
 2226                                                    if ((*cb)(percent, true,
data)) ReturnWithError(EscapePressed);
 2227                                            }
 2228                                    }
 2229                            }
 2230                            break;
 2231                    }
 2232            case ImageModeRGBA:
 2233            case ImageModeCMYKColor:
```

```
 2234                    {
 2235                            ASSERT(m_header.channels == 4);
 2236                            ASSERT(m_header.bpp == m_header.channels*8);
 2237                            ASSERT(bpp%8 == 0);
 2238
 2239                            DataT* y = m_channel[0]; ASSERT(y);
 2240                            DataT* u = m_channel[1]; ASSERT(u);
 2241                            DataT* v = m_channel[2]; ASSERT(v);
 2242                            DataT* a = m_channel[3]; ASSERT(a);
 2243                            UINT8 g, aAvg;
 2244                            UINT32 cnt, channels = bpp/8; ASSERT(channels >=
m_header.channels);
 2245
 2246                            for (i=0; i < h; i++) {
 2247                                    UINT32 uPos = uOffset;
 2248                                    UINT32 yPos = yOffset;
 2249                                    cnt = 0;
 2250                                    for (j=0; j < w; j++) {
 2251                                            uAvg = u[uPos];
 2252                                            vAvg = v[uPos];
 2253                                            aAvg = Clamp8(a[uPos] + YUVoffset8);
 2254                                            // Yuv
 2255                                            buff[cnt + channelMap[1]] = g =
Clamp8(y[yPos] + YUVoffset8 - ((uAvg + vAvg ) >> 2)); // must be logical shift operator
 2256                                            buff[cnt + channelMap[2]] =
Clamp8(uAvg + g);
 2257                                            buff[cnt + channelMap[0]] =
Clamp8(vAvg + g);
 2258                                            buff[cnt + channelMap[3]] = aAvg;
 2259                                            cnt += channels;
 2260                                            if (!m_downsample || (j & 1)) uPos++;
 2261                                            yPos++;
 2262                                    }
 2263                                    if (!m_downsample || (i & 1)) uOffset += uw;
 2264                                    yOffset += yw;
 2265                                    buff += pitch;
 2266
 2267                                    if (cb) {
 2268                                            percent += dP;
 2269                                            if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 2270                                    }
 2271                            }
 2272                            break;
 2273                    }
 2274            case ImageModeCMYK64:
 2275                    {
 2276                            ASSERT(m_header.channels == 4);
 2277                            ASSERT(m_header.bpp == 64);
 2278
 2279                            const DataT yuvOffset16 = 1 << (UsedBitsPerChannel() -
1);
 2280
 2281                            DataT* y = m_channel[0]; ASSERT(y);
 2282                            DataT* u = m_channel[1]; ASSERT(u);
 2283                            DataT* v = m_channel[2]; ASSERT(v);
 2284                            DataT* a = m_channel[3]; ASSERT(a);
 2285                            DataT g, aAvg;
 2286                            UINT32 cnt, channels;
 2287
 2288                            if (bpp%16 == 0) {
 2289                                    const int shift = 16 - UsedBitsPerChannel();
ASSERT(shift >= 0);
 2290                                    UINT16 *buff16 = (UINT16 *)buff;
 2291                                    int pitch16 = pitch/2;
 2292                                    channels = bpp/16; ASSERT(channels >=
m_header.channels);
 2293
 2294                                    for (i=0; i < h; i++) {
 2295                                            UINT32 uPos = uOffset;
 2296                                            UINT32 yPos = yOffset;
 2297                                            cnt = 0;
 2298                                            for (j=0; j < w; j++) {
 2299                                                    uAvg = u[uPos];
 2300                                                    vAvg = v[uPos];
 2301                                                    aAvg = a[uPos] + yuvOffset16;
 2302                                                    // Yuv
```

```
 2303                                                   g = y[yPos] + yuvOffset16 -
((uAvg + vAvg ) >> 2); // must be logical shift operator
 2304                                                   buff16[cnt + channelMap[1]] =
Clamp16(g << shift);
 2305                                                   buff16[cnt + channelMap[2]] =
Clamp16((uAvg + g) << shift);
 2306                                                   buff16[cnt + channelMap[0]] =
Clamp16((vAvg + g) << shift);
 2307                                                   buff16[cnt + channelMap[3]] =
Clamp16(aAvg << shift);
 2308                                                   cnt += channels;
 2309                                                   if (!m_downsample || (j & 1))
uPos++;
 2310                                                   yPos++;
 2311                                           }
 2312                                           if (!m_downsample || (i & 1)) uOffset
+= uw;
 2313                                           yOffset += yw;
 2314                                           buff16 += pitch16;
 2315
 2316                                           if (cb) {
 2317                                                   percent += dP;
 2318                                                   if ((*cb)(percent, true,
data)) ReturnWithError(EscapePressed);
 2319                                           }
 2320                                   }
 2321                           } else {
 2322                                   ASSERT(bpp%8 == 0);
 2323                                   const int shift = __max(0, UsedBitsPerChannel()
- 8);
 2324                                   channels = bpp/8; ASSERT(channels >=
m_header.channels);
 2325
 2326                                   for (i=0; i < h; i++) {
 2327                                           UINT32 uPos = uOffset;
 2328                                           UINT32 yPos = yOffset;
 2329                                           cnt = 0;
 2330                                           for (j=0; j < w; j++) {
 2331                                                   uAvg = u[uPos];
 2332                                                   vAvg = v[uPos];
 2333                                                   aAvg = a[uPos] + yuvOffset16;
 2334                                                   // Yuv
 2335                                                   g = y[yPos] + yuvOffset16 -
((uAvg + vAvg ) >> 2); // must be logical shift operator
 2336                                                   buff[cnt + channelMap[1]] =
Clamp8(g >> shift);
 2337                                                   buff[cnt + channelMap[2]] =
Clamp8((uAvg + g) >> shift);
 2338                                                   buff[cnt + channelMap[0]] =
Clamp8((vAvg + g) >> shift);
 2339                                                   buff[cnt + channelMap[3]] =
Clamp8(aAvg >> shift);
 2340                                                   cnt += channels;
 2341                                                   if (!m_downsample || (j & 1))
uPos++;
 2342                                                   yPos++;
 2343                                           }
 2344                                           if (!m_downsample || (i & 1)) uOffset
+= uw;
 2345                                           yOffset += yw;
 2346                                           buff += pitch;
 2347
 2348                                           if (cb) {
 2349                                                   percent += dP;
 2350                                                   if ((*cb)(percent, true,
data)) ReturnWithError(EscapePressed);
 2351                                           }
 2352                                   }
 2353                           }
 2354                           break;
 2355                   }
 2356 #ifdef __PGF32SUPPORT__
 2357           case ImageModeGray32:
 2358                   {
 2359                           ASSERT(m_header.channels == 1);
 2360                           ASSERT(m_header.bpp == 32);
 2361
```

```
 2362                           const int yuvOffset31 = 1 << (UsedBitsPerChannel() - 1);
 2363                           DataT* y = m_channel[0]; ASSERT(y);
 2364
 2365                           if (bpp == 32) {
 2366                                   const int shift = 31 - UsedBitsPerChannel();
ASSERT(shift >= 0);
 2367                                   UINT32 *buff32 = (UINT32 *)buff;
 2368                                   int pitch32 = pitch/4;
 2369
 2370                                   for (i=0; i < h; i++) {
 2371                                           UINT32 yPos = yOffset;
 2372                                           for (j = 0; j < w; j++) {
 2373                                                   buff32[j] =
Clamp31((y[yPos++] + yuvOffset31) << shift);
 2374                                           }
 2375                                           yOffset += yw;
 2376                                           buff32 += pitch32;
 2377
 2378                                           if (cb) {
 2379                                                   percent += dP;
 2380                                                   if ((*cb)(percent, true,
data)) ReturnWithError(EscapePressed);
 2381                                           }
 2382                                   }
 2383                           } else if (bpp == 16) {
 2384                                   const int usedBits = UsedBitsPerChannel();
 2385                                   UINT16 *buff16 = (UINT16 *)buff;
 2386                                   int pitch16 = pitch/2;
 2387
 2388                                   if (usedBits < 16) {
 2389                                           const int shift = 16 - usedBits;
 2390                                           for (i=0; i < h; i++) {
 2391                                                   UINT32 yPos = yOffset;
 2392                                                   for (j = 0; j < w; j++) {
 2393                                                           buff16[j] =
Clamp16((y[yPos++] + yuvOffset31) << shift);
 2394                                                   }
 2395                                                   yOffset += yw;
 2396                                                   buff16 += pitch16;
 2397
 2398                                                   if (cb) {
 2399                                                           percent += dP;
 2400                                                           if ((*cb)(percent,
true, data)) ReturnWithError(EscapePressed);
 2401                                                   }
 2402                                           }
 2403                                   } else {
 2404                                           const int shift = __max(0, usedBits -
16);
 2405                                           for (i=0; i < h; i++) {
 2406                                                   UINT32 yPos = yOffset;
 2407                                                   for (j = 0; j < w; j++) {
 2408                                                           buff16[j] =
Clamp16((y[yPos++] + yuvOffset31) >> shift);
 2409                                                   }
 2410                                                   yOffset += yw;
 2411                                                   buff16 += pitch16;
 2412
 2413                                                   if (cb) {
 2414                                                           percent += dP;
 2415                                                           if ((*cb)(percent,
true, data)) ReturnWithError(EscapePressed);
 2416                                                   }
 2417                                           }
 2418                                   }
 2419                           } else {
 2420                                   ASSERT(bpp == 8);
 2421                                   const int shift = __max(0, UsedBitsPerChannel()
- 8);
 2422
 2423                                   for (i=0; i < h; i++) {
 2424                                           UINT32 yPos = yOffset;
 2425                                           for (j = 0; j < w; j++) {
 2426                                                   buff[j] = Clamp8((y[yPos++] +
yuvOffset31) >> shift);
 2427                                           }
 2428                                           yOffset += yw;
```

```
 2429                                           buff += pitch;
 2430
 2431                                           if (cb) {
 2432                                                   percent += dP;
 2433                                                   if ((*cb)(percent, true,
data)) ReturnWithError(EscapePressed);
 2434                                           }
 2435                                   }
 2436                           }
 2437                           break;
 2438                   }
 2439 #endif
 2440           case ImageModeRGB12:
 2441                   {
 2442                           ASSERT(m_header.channels == 3);
 2443                           ASSERT(m_header.bpp == m_header.channels*4);
 2444                           ASSERT(bpp == m_header.channels*4);
 2445                           ASSERT(!m_downsample);
 2446
 2447                           DataT* y = m_channel[0]; ASSERT(y);
 2448                           DataT* u = m_channel[1]; ASSERT(u);
 2449                           DataT* v = m_channel[2]; ASSERT(v);
 2450                           UINT16 yval;
 2451                           UINT32 cnt;
 2452
 2453                           for (i=0; i < h; i++) {
 2454                                   UINT32 yPos = yOffset;
 2455                                   cnt = 0;
 2456                                   for (j=0; j < w; j++) {
 2457                                           // Yuv
 2458                                           uAvg = u[yPos];
 2459                                           vAvg = v[yPos];
 2460                                           yval = Clamp4(y[yPos] + YUVoffset4 -
((uAvg + vAvg ) >> 2)); // must be logical shift operator
 2461                                           if (j%2 == 0) {
 2462                                                   buff[cnt] = UINT8(Clamp4(vAvg
+ yval) | (yval << 4));
 2463                                                   cnt++;
 2464                                                   buff[cnt] = Clamp4(uAvg +
yval);
 2465                                           } else {
 2466                                                   buff[cnt] |= Clamp4(vAvg +
yval) << 4;
 2467                                                   cnt++;
 2468                                                   buff[cnt] = UINT8(yval |
(Clamp4(uAvg + yval) << 4));
 2469                                                   cnt++;
 2470                                           }
 2471                                           yPos++;
 2472                                   }
 2473                                   yOffset += yw;
 2474                                   buff += pitch;
 2475
 2476                                   if (cb) {
 2477                                           percent += dP;
 2478                                           if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 2479                                   }
 2480                           }
 2481                           break;
 2482                   }
 2483           case ImageModeRGB16:
 2484                   {
 2485                           ASSERT(m_header.channels == 3);
 2486                           ASSERT(m_header.bpp == 16);
 2487                           ASSERT(bpp == 16);
 2488                           ASSERT(!m_downsample);
 2489
 2490                           DataT* y = m_channel[0]; ASSERT(y);
 2491                           DataT* u = m_channel[1]; ASSERT(u);
 2492                           DataT* v = m_channel[2]; ASSERT(v);
 2493                           UINT16 yval;
 2494                           UINT16 *buff16 = (UINT16 *)buff;
 2495                           int pitch16 = pitch/2;
 2496
 2497                           for (i=0; i < h; i++) {
 2498                                   UINT32 yPos = yOffset;
```

```
 2499                                    for (j = 0; j < w; j++) {
 2500                                            // Yuv
 2501                                            uAvg = u[yPos];
 2502                                            vAvg = v[yPos];
 2503                                            yval = Clamp6(y[yPos++] + YUVoffset6 -
((uAvg + vAvg ) >> 2)); // must be logical shift operator
 2504                                            buff16[j] = (yval << 5) | ((Clamp6(uAvg
+ yval) >> 1) << 11) | (Clamp6(vAvg + yval) >> 1);
 2505                                    }
 2506                                    yOffset += yw;
 2507                                    buff16 += pitch16;
 2508
 2509                                    if (cb) {
 2510                                            percent += dP;
 2511                                            if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 2512                                    }
 2513                            }
 2514                            break;
 2515                    }
 2516            default:
 2517                    ASSERT(false);
 2518            }
 2519
 2520 #ifdef _DEBUG
 2521            // display ROI (RGB) in debugger
 2522            roiimage.width = w;
 2523            roiimage.height = h;
 2524            if (pitch > 0) {
 2525                    roiimage.pitch = pitch;
 2526                    roiimage.data = buff;
 2527            } else {
 2528                    roiimage.pitch = -pitch;
 2529                    roiimage.data = buff + (h - 1)*pitch;
 2530            }
 2531 #endif
 2532
 2533 }
```

DataT* CPGFImage::GetChannel (int *c* = 0)[inline]

Return an internal YUV image channel.

Parameters:

c	A channel index

Returns:

An internal YUV image channel

Definition at line 317 of file PGFimage.h.

```
  317 { ASSERT(c >= 0 && c < MaxChannels); return m_channel[c]; }
```

void CPGFImage::GetColorTable (UINT32 *iFirstColor*, UINT32 *nColors*, RGBQUAD * *prgbColors*) const

Retrieves red, green, blue (RGB) color values from a range of entries in the palette of the DIB section. It might throw an **IOException**.

Parameters:

iFirstColor	The color table index of the first entry to retrieve.
nColors	The number of color table entries to retrieve.
prgbColors	A pointer to the array of RGBQUAD structures to retrieve the color table entries.

Definition at line 1349 of file PGFimage.cpp.

```
 1349
{
 1350            if (iFirstColor + nColors > ColorTableLen)
ReturnWithError(ColorTableError);
 1351
 1352            for (UINT32 i=iFirstColor, j=0; j < nColors; i++, j++) {
 1353                    prgbColors[j] = m_postHeader.clut[i];
 1354            }
```

```
1355 }
```

const RGBQUAD* CPGFImage::GetColorTable () const[inline]

Returns:

Address of color table

Definition at line 330 of file PGFimage.h.

```
330 { return m_postHeader.clut; }
```

UINT32 CPGFImage::GetEncodedHeaderLength () const

Return the length of all encoded headers in bytes. Precondition: The PGF image has been opened with a call of Open(...).

Returns:

The length of all encoded headers in bytes

Definition at line 648 of file PGFimage.cpp.

```
648                                                 {
649         ASSERT(m_decoder);
650         return m_decoder->GetEncodedHeaderLength();
651 }
```

UINT32 CPGFImage::GetEncodedLevelLength (int *level*) const[inline]

Return the length of an encoded PGF level in bytes. Precondition: The PGF image has been opened with a call of Open(...).

Parameters:

level	The image level

Returns:

The length of a PGF level in bytes

Definition at line 367 of file PGFimage.h.

```
367 { ASSERT(level >= 0 && level < m_header.nLevels); return
m_levelLength[m_header.nLevels - level - 1]; }
```

const PGFHeader* CPGFImage::GetHeader () const[inline]

Return the PGF header structure.

Returns:

A PGF header structure

Definition at line 335 of file PGFimage.h.

```
335 { return &m_header; }
```

UINT32 CPGFImage::GetMaxValue () const[inline]

Get maximum intensity value for image modes with more than eight bits per channel. Don't call this method before the PGF header has been read.

Returns:

The maximum intensity value.

Definition at line 341 of file PGFimage.h.

```
341 { return (1 << m_header.usedBitsPerChannel) - 1; }
```

const UINT8 * CPGFImage::GetUserData (UINT32 & *cachedSize*, UINT32 * *pTotalSize* = nullptr) const

Return user data and size of user data. Precondition: The PGF image has been opened with a call of Open(...).

Parameters:

cachedSize	[out] Size of returned user data in bytes.
pTotalSize	[optional out] Pointer to return the size of user data stored in image header in bytes.

Returns:

A pointer to user data or nullptr if there is no user data available.

Return user data and size of user data. Precondition: The PGF image has been opened with a call of Open(...). In an encoder scenario don't call this method before **WriteHeader()**.

Parameters:

cachedSize	[out] Size of returned user data in bytes.
pTotalSize	[optional out] Pointer to return the size of user data stored in image header in bytes.

Returns:

A pointer to user data or nullptr if there is no user data available.

Definition at line 337 of file PGFimage.cpp.

```
  337
{
  338         cachedSize = m_postHeader.cachedUserDataLen;
  339         if (pTotalSize) *pTotalSize = m_postHeader.userDataLen;
  340         return m_postHeader.userData;
  341 }
```

UINT64 CPGFImage::GetUserDataPos () const[inline]

Return the stream position of the user data or 0. Precondition: The PGF image has been opened with a call of Open(...).

Definition at line 346 of file PGFimage.h.

```
  346 { return m_userDataPos; }
```

void CPGFImage::GetYUV (int *pitch*, DataT * *buff*, BYTE *bpp*, int *channelMap*[] = nullptr, CallbackPtr *cb* = nullptr, void * *data* = nullptr) const

Get YUV image data in interleaved format: (ordering is YUV[A]) The absolute value of pitch is the number of bytes of an image row of the given image buffer. If pitch is negative, then the image buffer must point to the last row of a bottom-up image (first byte on last row). if pitch is positive, then the image buffer must point to the first row of a top-down image (first byte). The sequence of output channels in the output image buffer does not need to be the same as provided by PGF. In case of different sequences you have to provide a channelMap of size of expected channels (depending on image mode). For example, PGF provides a channel sequence BGR in RGB color mode. If your provided image buffer expects a channel sequence VUY, then the channelMap looks like { 2, 1, 0 }. It might throw an **IOException**.

Parameters:

pitch	The number of bytes of a row of the image buffer.
buff	An image buffer.
bpp	The number of bits per pixel used in image buffer.
channelMap	A integer array containing the mapping of PGF channel ordering to expected channel ordering.
cb	A pointer to a callback procedure. The procedure is called after each copied buffer row. If cb returns true, then it stops proceeding.
data	Data Pointer to C++ class container to host callback procedure.

Get YUV image data in interleaved format: (ordering is YUV[A]) The absolute value of pitch is the number of bytes of an image row of the given image buffer. If pitch is negative, then the image buffer must point to the last row of a bottom-up image (first byte on last row). if pitch is positive, then the image buffer must point to the first row of a

top-down image (first byte). The sequence of output channels in the output image buffer does not need to be the same as provided by PGF. In case of different sequences you have to provide a channelMap of size of expected channels (depending on image mode). For example, PGF provides a channel sequence BGR in RGB color mode. If your provided image buffer expects a channel sequence VUY, then the channelMap looks like { 2, 1, 0 }. It might throw an **IOException**.

Parameters:

pitch	The number of bytes of a row of the image buffer.
buff	An image buffer.
bpp	The number of bits per pixel used in image buffer.
channelMap	A integer array containing the mapping of PGF channel ordering to expected channel ordering.
cb	A pointer to a callback procedure. The procedure is called after each copied buffer row. If cb returns true, then it stops proceeding.

Definition at line 2549 of file PGFimage.cpp.

```
 2549
{
 2550         ASSERT(buff);
 2551         const UINT32 w = m_width[0];
 2552         const UINT32 h = m_height[0];
 2553         const bool wOdd = (1 == w%2);
 2554         const int dataBits = DataTSize*8; ASSERT(dataBits == 16 || dataBits ==
32);
 2555         const int pitch2 = pitch/DataTSize;
 2556         const int yuvOffset = (dataBits == 16) ? YUVoffset8 : YUVoffset16;
 2557         const double dP = 1.0/h;
 2558
 2559         int defMap[] = { 0, 1, 2, 3, 4, 5, 6, 7 };
ASSERT(sizeof(defMap)/sizeof(defMap[0]) == MaxChannels);
 2560         if (channelMap == nullptr) channelMap = defMap;
 2561         int sampledPos = 0, yPos = 0;
 2562         DataT uAvg, vAvg;
 2563         double percent = 0;
 2564         UINT32 i, j;
 2565
 2566         if (m_header.channels == 3) {
 2567                 ASSERT(bpp%dataBits == 0);
 2568
 2569                 DataT* y = m_channel[0]; ASSERT(y);
 2570                 DataT* u = m_channel[1]; ASSERT(u);
 2571                 DataT* v = m_channel[2]; ASSERT(v);
 2572                 int cnt, channels = bpp/dataBits; ASSERT(channels >=
m_header.channels);
 2573
 2574                 for (i=0; i < h; i++) {
 2575                         if (i%2) sampledPos -= (w + 1)/2;
 2576                         cnt = 0;
 2577                         for (j=0; j < w; j++) {
 2578                                 if (m_downsample) {
 2579                                         // image was downsampled
 2580                                         uAvg = u[sampledPos];
 2581                                         vAvg = v[sampledPos];
 2582                                 } else {
 2583                                         uAvg = u[yPos];
 2584                                         vAvg = v[yPos];
 2585                                 }
 2586                                 buff[cnt + channelMap[0]] = y[yPos];
 2587                                 buff[cnt + channelMap[1]] = uAvg;
 2588                                 buff[cnt + channelMap[2]] = vAvg;
 2589                                 yPos++;
 2590                                 cnt += channels;
 2591                                 if (j%2) sampledPos++;
 2592                         }
 2593                         buff += pitch2;
 2594                         if (wOdd) sampledPos++;
 2595
 2596                         if (cb) {
 2597                                 percent += dP;
 2598                                 if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
```

```
 2599                         }
 2600                 }
 2601         } else if (m_header.channels == 4) {
 2602                 ASSERT(m_header.bpp == m_header.channels*8);
 2603                 ASSERT(bpp%dataBits == 0);
 2604
 2605                 DataT* y = m_channel[0]; ASSERT(y);
 2606                 DataT* u = m_channel[1]; ASSERT(u);
 2607                 DataT* v = m_channel[2]; ASSERT(v);
 2608                 DataT* a = m_channel[3]; ASSERT(a);
 2609                 UINT8 aAvg;
 2610                 int cnt, channels = bpp/dataBits; ASSERT(channels >=
m_header.channels);
 2611
 2612                 for (i=0; i < h; i++) {
 2613                         if (i%2) sampledPos -= (w + 1)/2;
 2614                         cnt = 0;
 2615                         for (j=0; j < w; j++) {
 2616                                 if (m_downsample) {
 2617                                         // image was downsampled
 2618                                         uAvg = u[sampledPos];
 2619                                         vAvg = v[sampledPos];
 2620                                         aAvg = Clamp8(a[sampledPos] +
yuvOffset);
 2621                                 } else {
 2622                                         uAvg = u[yPos];
 2623                                         vAvg = v[yPos];
 2624                                         aAvg = Clamp8(a[yPos] + yuvOffset);
 2625                                 }
 2626                                 // Yuv
 2627                                 buff[cnt + channelMap[0]] = y[yPos];
 2628                                 buff[cnt + channelMap[1]] = uAvg;
 2629                                 buff[cnt + channelMap[2]] = vAvg;
 2630                                 buff[cnt + channelMap[3]] = aAvg;
 2631                                 yPos++;
 2632                                 cnt += channels;
 2633                                 if (j%2) sampledPos++;
 2634                         }
 2635                         buff += pitch2;
 2636                         if (wOdd) sampledPos++;
 2637
 2638                         if (cb) {
 2639                                 percent += dP;
 2640                                 if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 2641                         }
 2642                 }
 2643         }
 2644 }
```

UINT32 CPGFImage::Height (int *level* = 0) const[inline]

Return image height of channel 0 at given level in pixels. The returned height is independent of any Read-operations and ROI.

Parameters:

level	A level

Returns:

Image level height in pixels

Definition at line 420 of file PGFimage.h.

```
  420 { ASSERT(level >= 0); return LevelSizeL(m_header.height, level); }
```

void CPGFImage::ImportBitmap (int *pitch*, UINT8 * *buff*, BYTE *bpp*, int *channelMap*[] = nullptr, CallbackPtr *cb* = nullptr, void * *data* = nullptr)

Import an image from a specified image buffer. This method is usually called before Write(...) and after SetHeader(...). The absolute value of pitch is the number of bytes of an image row. If pitch is negative, then buff points to the last row of a bottom-up image (first byte on last row). If pitch is positive, then buff points to the first row of a top-down image (first byte). The sequence of input channels in the input image buffer does not need

to be the same as expected from PGF. In case of different sequences you have to provide a channelMap of size of expected channels (depending on image mode). For example, PGF expects in RGB color mode a channel sequence BGR. If your provided image buffer contains a channel sequence ARGB, then the channelMap looks like { 3, 2, 1, 0 }. It might throw an **IOException**.

Parameters:

pitch	The number of bytes of a row of the image buffer.
buff	An image buffer.
bpp	The number of bits per pixel used in image buffer.
channelMap	A integer array containing the mapping of input channel ordering to expected channel ordering.
cb	A pointer to a callback procedure. The procedure is called after each imported buffer row. If cb returns true, then it stops proceeding.
data	Data Pointer to C++ class container to host callback procedure.

Definition at line 791 of file PGFimage.cpp.

```
 791
{
 792         ASSERT(buff);
 793         ASSERT(m_channel[0]);
 794
 795         // color transform
 796         RgbToYuv(pitch, buff, bpp, channelMap, cb, data);
 797
 798         if (m_downsample) {
 799                 // Subsampling of the chrominance and alpha channels
 800                 for (int i=1; i < m_header.channels; i++) {
 801                         Downsample(i);
 802                 }
 803         }
 804 }
```

bool CPGFImage::ImportIsSupported (BYTE *mode*)[static]

Check for valid import image mode.

Parameters:

mode	Image mode

Returns:

True if an image of given mode can be imported with ImportBitmap(...)

Definition at line 1304 of file PGFimage.cpp.

```
1304                                                {
1305         size_t size = DataTSize;
1306
1307         if (size >= 2) {
1308                 switch(mode) {
1309                         case ImageModeBitmap:
1310                         case ImageModeIndexedColor:
1311                         case ImageModeGrayScale:
1312                         case ImageModeRGBColor:
1313                         case ImageModeCMYKColor:
1314                         case ImageModeHSLColor:
1315                         case ImageModeHSBColor:
1316                         //case ImageModeDuotone:
1317                         case ImageModeLabColor:
1318                         case ImageModeRGB12:
1319                         case ImageModeRGB16:
1320                         case ImageModeRGBA:
1321                                 return true;
1322                 }
1323         }
1324         if (size >= 3) {
1325                 switch(mode) {
1326                         case ImageModeGray16:
1327                         case ImageModeRGB48:
1328                         case ImageModeLab48:
1329                         case ImageModeCMYK64:
1330                         //case ImageModeDuotone16:
```

```
1331                                    return true;
1332                    }
1333            }
1334            if (size >=4) {
1335                    switch(mode) {
1336                            case ImageModeGray32:
1337                                    return true;
1338                    }
1339            }
1340            return false;
1341 }
```

void CPGFImage::ImportYUV (int *pitch*, DataT * *buff*, BYTE *bpp*, int *channelMap*[] = `nullptr`, CallbackPtr *cb* = `nullptr`, void * *data* = `nullptr`)

Import a YUV image from a specified image buffer. The absolute value of pitch is the number of bytes of an image row. If pitch is negative, then buff points to the last row of a bottom-up image (first byte on last row). If pitch is positive, then buff points to the first row of a top-down image (first byte). The sequence of input channels in the input image buffer does not need to be the same as expected from PGF. In case of different sequences you have to provide a channelMap of size of expected channels (depending on image mode). For example, PGF expects in RGB color mode a channel sequence BGR. If your provided image buffer contains a channel sequence VUY, then the channelMap looks like { 2, 1, 0 }. It might throw an **IOException**.

Parameters:

pitch	The number of bytes of a row of the image buffer.
buff	An image buffer.
bpp	The number of bits per pixel used in image buffer.
channelMap	A integer array containing the mapping of input channel ordering to expected channel ordering.
cb	A pointer to a callback procedure. The procedure is called after each imported buffer row. If cb returns true, then it stops proceeding.
data	Data Pointer to C++ class container to host callback procedure.

Import a YUV image from a specified image buffer. The absolute value of pitch is the number of bytes of an image row. If pitch is negative, then buff points to the last row of a bottom-up image (first byte on last row). If pitch is positive, then buff points to the first row of a top-down image (first byte). The sequence of input channels in the input image buffer does not need to be the same as expected from PGF. In case of different sequences you have to provide a channelMap of size of expected channels (depending on image mode). For example, PGF expects in RGB color mode a channel sequence BGR. If your provided image buffer contains a channel sequence VUY, then the channelMap looks like { 2, 1, 0 }. It might throw an **IOException**.

Parameters:

pitch	The number of bytes of a row of the image buffer.
buff	An image buffer.
bpp	The number of bits per pixel used in image buffer.
channelMap	A integer array containing the mapping of input channel ordering to expected channel ordering.
cb	A pointer to a callback procedure. The procedure is called after each imported buffer row. If cb returns true, then it stops proceeding.

Definition at line 2660 of file PGFimage.cpp.

```
2660
{
2661            ASSERT(buff);
2662            const double dP = 1.0/m_header.height;
2663            const int dataBits = DataTSize*8; ASSERT(dataBits == 16 || dataBits ==
32);
2664            const int pitch2 = pitch/DataTSize;
2665            const int yuvOffset = (dataBits == 16) ? YUVoffset8 : YUVoffset16;
2666
2667            int yPos = 0, cnt = 0;
```

```
 2668         double percent = 0;
 2669         int defMap[] = { 0, 1, 2, 3, 4, 5, 6, 7 };
ASSERT(sizeof(defMap)/sizeof(defMap[0]) == MaxChannels);
 2670
 2671         if (channelMap == nullptr) channelMap = defMap;
 2672
 2673         if (m_header.channels == 3)     {
 2674                 ASSERT(bpp%dataBits == 0);
 2675
 2676                 DataT* y = m_channel[0]; ASSERT(y);
 2677                 DataT* u = m_channel[1]; ASSERT(u);
 2678                 DataT* v = m_channel[2]; ASSERT(v);
 2679                 const int channels = bpp/dataBits; ASSERT(channels >=
m_header.channels);
 2680
 2681                 for (UINT32 h=0; h < m_header.height; h++) {
 2682                         if (cb) {
 2683                                 if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 2684                                 percent += dP;
 2685                         }
 2686
 2687                         cnt = 0;
 2688                         for (UINT32 w=0; w < m_header.width; w++) {
 2689                                 y[yPos] = buff[cnt + channelMap[0]];
 2690                                 u[yPos] = buff[cnt + channelMap[1]];
 2691                                 v[yPos] = buff[cnt + channelMap[2]];
 2692                                 yPos++;
 2693                                 cnt += channels;
 2694                         }
 2695                         buff += pitch2;
 2696                 }
 2697         } else if (m_header.channels == 4) {
 2698                 ASSERT(bpp%dataBits == 0);
 2699
 2700                 DataT* y = m_channel[0]; ASSERT(y);
 2701                 DataT* u = m_channel[1]; ASSERT(u);
 2702                 DataT* v = m_channel[2]; ASSERT(v);
 2703                 DataT* a = m_channel[3]; ASSERT(a);
 2704                 const int channels = bpp/dataBits; ASSERT(channels >=
m_header.channels);
 2705
 2706                 for (UINT32 h=0; h < m_header.height; h++) {
 2707                         if (cb) {
 2708                                 if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 2709                                 percent += dP;
 2710                         }
 2711
 2712                         cnt = 0;
 2713                         for (UINT32 w=0; w < m_header.width; w++) {
 2714                                 y[yPos] = buff[cnt + channelMap[0]];
 2715                                 u[yPos] = buff[cnt + channelMap[1]];
 2716                                 v[yPos] = buff[cnt + channelMap[2]];
 2717                                 a[yPos] = buff[cnt + channelMap[3]] -
yuvOffset;
 2718                                 yPos++;
 2719                                 cnt += channels;
 2720                         }
 2721                         buff += pitch2;
 2722                 }
 2723         }
 2724
 2725         if (m_downsample) {
 2726                 // Subsampling of the chrominance and alpha channels
 2727                 for (int i=1; i < m_header.channels; i++) {
 2728                         Downsample(i);
 2729                 }
 2730         }
 2731 }
```

void CPGFImage::Init ()[private]

Definition at line 69 of file PGFimage.cpp.

```
 69                      {
 70         // init pointers
 71         m_decoder = nullptr;
 72         m_encoder = nullptr;
 73         m_levelLength = nullptr;
 74 
 75         // init members
 76 #ifdef __PGFROISUPPORT__
 77         m_streamReinitialized = false;
 78 #endif
 79         m_currentLevel = 0;
 80         m_quant = 0;
 81         m_userDataPos = 0;
 82         m_downsample = false;
 83         m_favorSpeedOverSize = false;
 84         m_useOMPinEncoder = true;
 85         m_useOMPinDecoder = true;
 86         m_cb = nullptr;
 87         m_cbArg = nullptr;
 88         m_progressMode = PM_Relative;
 89         m_percent = 0;
 90         m_userDataPolicy = UP_CacheAll;
 91 
 92         // init preHeader
 93         memcpy(m_preHeader.magic, PGFMagic, 3);
 94         m_preHeader.version = PGFVersion;
 95         m_preHeader.hSize = 0;
 96 
 97         // init postHeader
 98         m_postHeader.userData = nullptr;
 99         m_postHeader.userDataLen = 0;
100         m_postHeader.cachedUserDataLen = 0;
101 
102         // init channels
103         for (int i = 0; i < MaxChannels; i++) {
104                 m_channel[i] = nullptr;
105                 m_wtChannel[i] = nullptr;
106         }
107 
108         // set image width and height
109         for (int i = 0; i < MaxChannels; i++) {
110                 m_width[0] = 0;
111                 m_height[0] = 0;
112         }
113 }
```

bool CPGFImage::IsFullyRead () const[inline]

Return true if all levels have been read.

Definition at line 436 of file PGFimage.h.

```
436 { return m_currentLevel == 0; }
```

bool CPGFImage::IsOpen () const[inline]

Returns true if the PGF has been opened for reading.

Definition at line 77 of file PGFimage.h.

```
 77 { return m_decoder != nullptr; }
```

BYTE CPGFImage::Level () const[inline]

Return current image level. Since Read(...) can be used to read each image level separately, it is helpful to know the current level. The current level immediately after Open(...) is **Levels()**.

Returns:

Current image level

Definition at line 427 of file PGFimage.h.

```
427 { return (BYTE)m_currentLevel; }
```

BYTE CPGFImage::Levels () const[inline]

Return the number of image levels.

Returns:

Number of image levels

Definition at line 432 of file PGFimage.h.

```
432 { return m_header.nLevels; }
```

static UINT32 CPGFImage::LevelSizeH (UINT32 *size*, int *level*)[inline], [static]

Compute and return image width/height of HH subband at given level.

Parameters:

size	Original image size (e.g. width or height at level 0)
level	An image level

Returns:

high pass size at given level in pixels

Definition at line 506 of file PGFimage.h.

```
506 { ASSERT(level >= 0); UINT32 d = 1 << (level - 1); return (size + d - 1) >> level;
}
```

static UINT32 CPGFImage::LevelSizeL (UINT32 *size*, int *level*)[inline], [static]

Compute and return image width/height of LL subband at given level.

Parameters:

size	Original image size (e.g. width or height at level 0)
level	An image level

Returns:

Image width/height at given level in pixels

Definition at line 499 of file PGFimage.h.

```
499 { ASSERT(level >= 0); UINT32 d = 1 << level; return (size + d - 1) >> level; }
```

static BYTE CPGFImage::MaxChannelDepth (BYTE *version* = PGFVersion)[inline], [static]

Return maximum channel depth.

Parameters:

version	pgf pre-header version number

Returns:

maximum channel depth in bit of given version (16 or 32 bit)

Definition at line 518 of file PGFimage.h.

```
518 { return (version & PGF32) ? 32 : 16; }
```

BYTE CPGFImage::Mode () const[inline]

Return the image mode. An image mode is a predefined constant value (see also **PGFtypes.h**) compatible with Adobe Photoshop. It represents an image type and format.

Returns:

Image mode

Definition at line 455 of file PGFimage.h.

```
455 { return m_header.mode; }
```

void CPGFImage::Open (CPGFStream * *stream*)

Open a PGF image at current stream position: read pre-header, header, and ckeck image type. Precondition: The stream has been opened for reading. It might throw an **IOException**.

Parameters:

stream	A PGF stream

Definition at line 141 of file PGFimage.cpp.

```
  141                                         {
  142         ASSERT(stream);
  143
  144         // create decoder and read PGFPreHeader PGFHeader PGFPostHeader
LevelLengths
  145         m_decoder = new CDecoder(stream, m_preHeader, m_header, m_postHeader,
m_levelLength,
  146                 m_userDataPos, m_useOMPinDecoder, m_userDataPolicy);
  147
  148         if (m_header.nLevels > MaxLevel) ReturnWithError(FormatCannotRead);
  149
  150         // set current level
  151         m_currentLevel = m_header.nLevels;
  152
  153         // set image width and height
  154         m_width[0] = m_header.width;
  155         m_height[0] = m_header.height;
  156
  157         // complete header
  158         if (!CompleteHeader()) ReturnWithError(FormatCannotRead);
  159
  160         // interpret quant parameter
  161         if (m_header.quality > DownsampleThreshold &&
  162                 (m_header.mode == ImageModeRGBColor ||
  163                  m_header.mode == ImageModeRGBA ||
  164                  m_header.mode == ImageModeRGB48 ||
  165                  m_header.mode == ImageModeCMYKColor ||
  166                  m_header.mode == ImageModeCMYK64 ||
  167                  m_header.mode == ImageModeLabColor ||
  168                  m_header.mode == ImageModeLab48)) {
  169                 m_downsample = true;
  170                 m_quant = m_header.quality - 1;
  171         } else {
  172                 m_downsample = false;
  173                 m_quant = m_header.quality;
  174         }
  175
  176         // set channel dimensions (chrominance is subsampled by factor 2)
  177         if (m_downsample) {
  178                 for (int i=1; i < m_header.channels; i++) {
  179                         m_width[i] = (m_width[0] + 1) >> 1;
  180                         m_height[i] = (m_height[0] + 1) >> 1;
  181                 }
  182         } else {
  183                 for (int i=1; i < m_header.channels; i++) {
  184                         m_width[i] = m_width[0];
  185                         m_height[i] = m_height[0];
  186                 }
  187         }
  188
  189         if (m_header.nLevels > 0) {
  190                 // init wavelet subbands
  191                 for (int i=0; i < m_header.channels; i++) {
  192                         m_wtChannel[i] = new CWaveletTransform(m_width[i],
m_height[i], m_header.nLevels);
  193                 }
  194
  195                 // used in Read when PM_Absolute
  196                 m_percent = pow(0.25, m_header.nLevels);
  197
  198         } else {
  199                 // very small image: we don't use DWT and encoding
  200
  201                 // read channels
  202                 for (int c=0; c < m_header.channels; c++) {
```

```
  203                         const UINT32 size = m_width[c]*m_height[c];
  204                         m_channel[c] = new(std::nothrow) DataT[size];
  205                         if (!m_channel[c])
ReturnWithError(InsufficientMemory);
  206
  207                         // read channel data from stream
  208                         for (UINT32 i=0; i < size; i++) {
  209                                 int count = DataTSize;
  210                                 stream->Read(&count, &m_channel[c][i]);
  211                                 if (count != DataTSize)
ReturnWithError(MissingData);
  212                         }
  213                 }
  214         }
  215 }
```

BYTE CPGFImage::Quality () const[inline]

Return the PGF quality. The quality is inbetween 0 and MaxQuality. PGF quality 0 means lossless quality.

Returns:

PGF quality

Definition at line 442 of file PGFimage.h.

```
  442 { return m_header.quality; }
```

void CPGFImage::Read (int *level* = 0, CallbackPtr *cb* = nullptr, void * *data* = nullptr)

Read and decode some levels of a PGF image at current stream position. A PGF image is structered in levels, numbered between 0 and **Levels()** - 1. Each level can be seen as a single image, containing the same content as all other levels, but in a different size (width, height). The image size at level i is double the size (width, height) of the image at level i+1. The image at level 0 contains the original size. Precondition: The PGF image has been opened with a call of Open(...). It might throw an **IOException**.

Parameters:

level	[0, nLevels) The image level of the resulting image in the internal image buffer.
cb	A pointer to a callback procedure. The procedure is called after reading a single level. If cb returns true, then it stops proceeding.
data	Data Pointer to C++ class container to host callback procedure.

Definition at line 402 of file PGFimage.cpp.

```
  402                                                                     {
  403         ASSERT((level >= 0 && level < m_header.nLevels) || m_header.nLevels ==
0); // m_header.nLevels == 0: image didn't use wavelet transform
  404         ASSERT(m_decoder);
  405
  406 #ifdef __PGFROISUPPORT__
  407         if (ROIisSupported() && m_header.nLevels > 0) {
  408                 // new encoding scheme supporting ROI
  409                 PGFRect rect(0, 0, m_header.width, m_header.height);
  410                 Read(rect, level, cb, data);
  411                 return;
  412         }
  413 #endif
  414
  415         if (m_header.nLevels == 0) {
  416                 if (level == 0) {
  417                         // the data has already been read during open
  418                         // now update progress
  419                         if (cb) {
  420                                 if ((*cb)(1.0, true, data))
ReturnWithError(EscapePressed);
  421                         }
  422                 }
  423         } else {
  424                 const int levelDiff = m_currentLevel - level;
```

```
  425                 double percent = (m_progressMode == PM_Relative) ? pow(0.25,
levelDiff) : m_percent;
  426
  427                 // encoding scheme without ROI
  428                 while (m_currentLevel > level) {
  429                         for (int i=0; i < m_header.channels; i++) {
  430                                 CWaveletTransform* wtChannel = m_wtChannel[i];
  431                                 ASSERT(wtChannel);
  432
  433                                 // decode file and write stream to m_wtChannel
  434                                 if (m_currentLevel == m_header.nLevels) {
  435                                         // last level also has LL band
  436
wtChannel->GetSubband(m_currentLevel, LL)->PlaceTile(*m_decoder, m_quant);
  437                                 }
  438                                 if (m_preHeader.version & Version5) {
  439                                         // since version 5
  440
wtChannel->GetSubband(m_currentLevel, HL)->PlaceTile(*m_decoder, m_quant);
  441
wtChannel->GetSubband(m_currentLevel, LH)->PlaceTile(*m_decoder, m_quant);
  442                                 } else {
  443                                         // until version 4
  444
m_decoder->DecodeInterleaved(wtChannel, m_currentLevel, m_quant);
  445                                 }
  446                                 wtChannel->GetSubband(m_currentLevel,
HH)->PlaceTile(*m_decoder, m_quant);
  447                         }
  448
  449                         volatile OSError error = NoError; // volatile prevents
optimizations
  450 #ifdef LIBPGF_USE_OPENMP
  451                         #pragma omp parallel for default(shared)
  452 #endif
  453                         for (int i=0; i < m_header.channels; i++) {
  454                                 // inverse transform from m_wtChannel to
m_channel
  455                                 if (error == NoError) {
  456                                         OSError err =
m_wtChannel[i]->InverseTransform(m_currentLevel, &m_width[i], &m_height[i],
&m_channel[i]);
  457                                         if (err != NoError) error = err;
  458                                 }
  459                                 ASSERT(m_channel[i]);
  460                         }
  461                         if (error != NoError) ReturnWithError(error);
  462
  463                         // set new level: must be done before refresh callback
  464                         m_currentLevel--;
  465
  466                         // now we have to refresh the display
  467                         if (m_cb) m_cb(m_cbArg);
  468
  469                         // now update progress
  470                         if (cb) {
  471                                 percent *= 4;
  472                                 if (m_progressMode == PM_Absolute) m_percent =
percent;
  473                                 if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
  474                         }
  475                 }
  476         }
  477 }
```

void CPGFImage::Read (PGFRect & *rect*, int *level* = 0, CallbackPtr *cb* = nullptr, void * *data* = nullptr)

Read a rectangular region of interest of a PGF image at current stream position. The origin of the coordinate axis is the top-left corner of the image. All coordinates are measured in pixels. It might throw an **IOException**.

Parameters:

rect	[inout] Rectangular region of interest (ROI) at level 0. The rect might be cropped.
level	[0, nLevels) The image level of the resulting image in the internal image buffer.
cb	A pointer to a callback procedure. The procedure is called after reading a single level. If cb returns true, then it stops proceeding.
data	Data Pointer to C++ class container to host callback procedure.

UINT32 CPGFImage::ReadEncodedData (int *level*, UINT8 * *target*, UINT32 *targetLen*) const

Reads the data of an encoded PGF level and copies it to a target buffer without decoding. Precondition: The PGF image has been opened with a call of Open(...). It might throw an **IOException**.

Parameters:

level	The image level
target	The target buffer
targetLen	The length of the target buffer in bytes

Returns:

The number of bytes copied to the target buffer

Definition at line 706 of file PGFimage.cpp.

```
  706
{
  707         ASSERT(level >= 0 && level < m_header.nLevels);
  708         ASSERT(target);
  709         ASSERT(targetLen > 0);
  710         ASSERT(m_decoder);
  711
  712         // reset stream position
  713         m_decoder->SetStreamPosToData();
  714
  715         // position stream
  716         UINT64 offset = 0;
  717
  718         for (int i=m_header.nLevels - 1; i > level; i--) {
  719                 offset += m_levelLength[m_header.nLevels - 1 - i];
  720         }
  721         m_decoder->Skip(offset);
  722
  723         // compute number of bytes to read
  724         UINT32 len = __min(targetLen, GetEncodedLevelLength(level));
  725
  726         // read data
  727         len = m_decoder->ReadEncodedData(target, len);
  728         ASSERT(len >= 0 && len <= targetLen);
  729
  730         return len;
  731 }
```

UINT32 CPGFImage::ReadEncodedHeader (UINT8 * *target*, UINT32 *targetLen*) const

Reads the encoded PGF header and copies it to a target buffer. Precondition: The PGF image has been opened with a call of Open(...). It might throw an **IOException**.

Parameters:

target	The target buffer
targetLen	The length of the target buffer in bytes

Returns:

The number of bytes copied to the target buffer

Definition at line 660 of file PGFimage.cpp.

```
  660                                                                     {
  661         ASSERT(target);
  662         ASSERT(targetLen > 0);
```

```
  663         ASSERT(m_decoder);
  664
  665         // reset stream position
  666         m_decoder->SetStreamPosToStart();
  667
  668         // compute number of bytes to read
  669         UINT32 len = __min(targetLen, GetEncodedHeaderLength());
  670
  671         // read data
  672         len = m_decoder->ReadEncodedData(target, len);
  673         ASSERT(len >= 0 && len <= targetLen);
  674
  675         return len;
  676 }
```

void CPGFImage::ReadPreview ()[inline]

Read and decode smallest level of a PGF image at current stream position. For details, please refert to Read(...) Precondition: The PGF image has been opened with a call of Open(...). It might throw an **IOException**.

Definition at line 111 of file PGFimage.h.

```
  111 { Read(Levels() - 1); }
```

void CPGFImage::Reconstruct (int *level* = 0)

After you've written a PGF image, you can call this method followed by GetBitmap/GetYUV to get a quick reconstruction (coded -> decoded image). It might throw an **IOException**.

Parameters:

level	The image level of the resulting image in the internal image buffer.

Definition at line 348 of file PGFimage.cpp.

```
  348                                             {
  349         if (m_header.nLevels == 0) {
  350                 // image didn't use wavelet transform
  351                 if (level == 0) {
  352                         for (int i=0; i < m_header.channels; i++) {
  353                                 ASSERT(m_wtChannel[i]);
  354                                 m_channel[i] = m_wtChannel[i]->GetSubband(0,
LL)->GetBuffer();
  355                         }
  356                 }
  357         } else {
  358                 int currentLevel = m_header.nLevels;
  359
  360         #ifdef __PGFROISUPPORT__
  361                 if (ROIisSupported()) {
  362                         // enable ROI reading
  363                         SetROI(PGFRect(0, 0, m_header.width,
m_header.height));
  364                 }
  365         #endif
  366
  367                 while (currentLevel > level) {
  368                         for (int i=0; i < m_header.channels; i++) {
  369                                 ASSERT(m_wtChannel[i]);
  370                                 // dequantize subbands
  371                                 if (currentLevel == m_header.nLevels) {
  372                                         // last level also has LL band
  373
m_wtChannel[i]->GetSubband(currentLevel, LL)->Dequantize(m_quant);
  374                                 }
  375                                 m_wtChannel[i]->GetSubband(currentLevel,
HL)->Dequantize(m_quant);
  376                                 m_wtChannel[i]->GetSubband(currentLevel,
LH)->Dequantize(m_quant);
  377                                 m_wtChannel[i]->GetSubband(currentLevel,
HH)->Dequantize(m_quant);
  378
  379                                 // inverse transform from m_wtChannel to
m_channel
```

```
  380                                 OSError err =
m_wtChannel[i]->InverseTransform(currentLevel, &m_width[i], &m_height[i],
&m_channel[i]);
  381                                 if (err != NoError) ReturnWithError(err);
  382                                 ASSERT(m_channel[i]);
  383                         }
  384
  385                         currentLevel--;
  386                 }
  387         }
  388 }
```

void CPGFImage::ResetStreamPos (bool *startOfData*)

Reset stream position to start of PGF pre-header or start of data. Must not be called before **Open()** or before **Write()**. Use this method after **Read()** if you want to read the same image several times, e.g. reading different ROIs.

Parameters:

startOfData	true: you want to read the same image several times. false: resets stream position to the initial position

Definition at line 682 of file PGFimage.cpp.

```
  682                                                     {
  683         if (startOfData) {
  684                 ASSERT(m_decoder);
  685                 m_decoder->SetStreamPosToData();
  686         } else {
  687                 if (m_decoder) {
  688                         m_decoder->SetStreamPosToStart();
  689                 } else if (m_encoder) {
  690                         m_encoder->SetStreamPosToStart();
  691                 } else {
  692                         ASSERT(false);
  693                 }
  694         }
  695 }
```

void CPGFImage::RgbToYuv (int *pitch*, UINT8 * *rgbBuff*, BYTE *bpp*, int *channelMap*[], CallbackPtr *cb*, void * *data*) [private]

Definition at line 1388 of file PGFimage.cpp.

```
 1388
{
 1389         ASSERT(buff);
 1390         UINT32 yPos = 0, cnt = 0;
 1391         double percent = 0;
 1392         const double dP = 1.0/m_header.height;
 1393         int defMap[] = { 0, 1, 2, 3, 4, 5, 6, 7 };
ASSERT(sizeof(defMap)/sizeof(defMap[0]) == MaxChannels);
 1394
 1395         if (channelMap == nullptr) channelMap = defMap;
 1396
 1397         switch(m_header.mode) {
 1398         case ImageModeBitmap:
 1399                 {
 1400                         ASSERT(m_header.channels == 1);
 1401                         ASSERT(m_header.bpp == 1);
 1402                         ASSERT(bpp == 1);
 1403
 1404                         const UINT32 w = m_header.width;
 1405                         const UINT32 w2 = (m_header.width + 7)/8;
 1406                         DataT* y = m_channel[0]; ASSERT(y);
 1407
 1408                         // new unpacked version since version 7
 1409                         for (UINT32 h = 0; h < m_header.height; h++) {
 1410                                 if (cb) {
 1411                                         if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 1412                                         percent += dP;
 1413                                 }
 1414                                 cnt = 0;
```

```
 1415                                    for (UINT32 j = 0; j < w2; j++) {
 1416                                            UINT8 byte = buff[j];
 1417                                            for (int k = 0; k < 8; k++) {
 1418                                                    UINT8 bit = (byte & 0x80) >> 7;
 1419                                                    if (cnt < w) y[yPos++] = bit;
 1420                                                    byte <<= 1;
 1421                                                    cnt++;
 1422                                            }
 1423                                    }
 1424                                    buff += pitch;
 1425                            }
 1426                            /* old version: packed values: 8 pixels in 1 byte
 1427                            for (UINT32 h = 0; h < m_header.height; h++) {
 1428                                    if (cb) {
 1429                                            if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 1430                                            percent += dP;
 1431                                    }
 1432
 1433                                    for (UINT32 j = 0; j < w2; j++) {
 1434                                            y[yPos++] = buff[j] - YUVoffset8;
 1435                                    }
 1436                                    // version 5 and 6
 1437                                    // for (UINT32 j = w2; j < w; j++) {
 1438                                    //      y[yPos++] = YUVoffset8;
 1439                                    //}
 1440                                    buff += pitch;
 1441                            }
 1442                            */
 1443                    }
 1444                    break;
 1445            case ImageModeIndexedColor:
 1446            case ImageModeGrayScale:
 1447            case ImageModeHSLColor:
 1448            case ImageModeHSBColor:
 1449            case ImageModeLabColor:
 1450                    {
 1451                            ASSERT(m_header.channels >= 1);
 1452                            ASSERT(m_header.bpp == m_header.channels*8);
 1453                            ASSERT(bpp%8 == 0);
 1454                            const int channels = bpp/8; ASSERT(channels >=
m_header.channels);
 1455
 1456                            for (UINT32 h=0; h < m_header.height; h++) {
 1457                                    if (cb) {
 1458                                            if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 1459                                            percent += dP;
 1460                                    }
 1461
 1462                                    cnt = 0;
 1463                                    for (UINT32 w=0; w < m_header.width; w++) {
 1464                                            for (int c=0; c < m_header.channels;
c++) {
 1465                                                    m_channel[c][yPos] = buff[cnt
+ channelMap[c]] - YUVoffset8;
 1466                                            }
 1467                                            cnt += channels;
 1468                                            yPos++;
 1469                                    }
 1470                                    buff += pitch;
 1471                            }
 1472                    }
 1473                    break;
 1474            case ImageModeGray16:
 1475            case ImageModeLab48:
 1476                    {
 1477                            ASSERT(m_header.channels >= 1);
 1478                            ASSERT(m_header.bpp == m_header.channels*16);
 1479                            ASSERT(bpp%16 == 0);
 1480
 1481                            UINT16 *buff16 = (UINT16 *)buff;
 1482                            const int pitch16 = pitch/2;
 1483                            const int channels = bpp/16; ASSERT(channels >=
m_header.channels);
 1484                            const int shift = 16 - UsedBitsPerChannel();
ASSERT(shift >= 0);
```

```
 1485                           const DataT yuvOffset16 = 1 << (UsedBitsPerChannel() -
1);
 1486
 1487                           for (UINT32 h=0; h < m_header.height; h++) {
 1488                                   if (cb) {
 1489                                           if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 1490                                           percent += dP;
 1491                                   }
 1492
 1493                                   cnt = 0;
 1494                                   for (UINT32 w=0; w < m_header.width; w++) {
 1495                                           for (int c=0; c < m_header.channels;
c++) {
 1496                                                   m_channel[c][yPos] =
(buff16[cnt + channelMap[c]] >> shift) - yuvOffset16;
 1497                                           }
 1498                                           cnt += channels;
 1499                                           yPos++;
 1500                                   }
 1501                                   buff16 += pitch16;
 1502                           }
 1503                   }
 1504                   break;
 1505           case ImageModeRGBColor:
 1506                   {
 1507                           ASSERT(m_header.channels == 3);
 1508                           ASSERT(m_header.bpp == m_header.channels*8);
 1509                           ASSERT(bpp%8 == 0);
 1510
 1511                           DataT* y = m_channel[0]; ASSERT(y);
 1512                           DataT* u = m_channel[1]; ASSERT(u);
 1513                           DataT* v = m_channel[2]; ASSERT(v);
 1514                           const int channels = bpp/8; ASSERT(channels >=
m_header.channels);
 1515                           UINT8 b, g, r;
 1516
 1517                           for (UINT32 h=0; h < m_header.height; h++) {
 1518                                   if (cb) {
 1519                                           if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 1520                                           percent += dP;
 1521                                   }
 1522
 1523                                   cnt = 0;
 1524                                   for (UINT32 w=0; w < m_header.width; w++) {
 1525                                           b = buff[cnt + channelMap[0]];
 1526                                           g = buff[cnt + channelMap[1]];
 1527                                           r = buff[cnt + channelMap[2]];
 1528                                           // Yuv
 1529                                           y[yPos] = ((b + (g << 1) + r) >> 2) -
YUVoffset8;
 1530                                           u[yPos] = r - g;
 1531                                           v[yPos] = b - g;
 1532                                           yPos++;
 1533                                           cnt += channels;
 1534                                   }
 1535                                   buff += pitch;
 1536                           }
 1537                   }
 1538                   break;
 1539           case ImageModeRGB48:
 1540                   {
 1541                           ASSERT(m_header.channels == 3);
 1542                           ASSERT(m_header.bpp == m_header.channels*16);
 1543                           ASSERT(bpp%16 == 0);
 1544
 1545                           UINT16 *buff16 = (UINT16 *)buff;
 1546                           const int pitch16 = pitch/2;
 1547                           const int channels = bpp/16; ASSERT(channels >=
m_header.channels);
 1548                           const int shift = 16 - UsedBitsPerChannel();
ASSERT(shift >= 0);
 1549                           const DataT yuvOffset16 = 1 << (UsedBitsPerChannel() -
1);
 1550
 1551                           DataT* y = m_channel[0]; ASSERT(y);
```

```
 1552                           DataT* u = m_channel[1]; ASSERT(u);
 1553                           DataT* v = m_channel[2]; ASSERT(v);
 1554                           UINT16 b, g, r;
 1555
 1556                           for (UINT32 h=0; h < m_header.height; h++) {
 1557                                   if (cb) {
 1558                                           if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 1559                                           percent += dP;
 1560                                   }
 1561
 1562                                   cnt = 0;
 1563                                   for (UINT32 w=0; w < m_header.width; w++) {
 1564                                           b = buff16[cnt + channelMap[0]] >>
shift;
 1565                                           g = buff16[cnt + channelMap[1]] >>
shift;
 1566                                           r = buff16[cnt + channelMap[2]] >>
shift;
 1567                                           // Yuv
 1568                                           y[yPos] = ((b + (g << 1) + r) >> 2) -
yuvOffset16;
 1569                                           u[yPos] = r - g;
 1570                                           v[yPos] = b - g;
 1571                                           yPos++;
 1572                                           cnt += channels;
 1573                                   }
 1574                                   buff16 += pitch16;
 1575                           }
 1576                   }
 1577                   break;
 1578           case ImageModeRGBA:
 1579           case ImageModeCMYKColor:
 1580                   {
 1581                           ASSERT(m_header.channels == 4);
 1582                           ASSERT(m_header.bpp == m_header.channels*8);
 1583                           ASSERT(bpp%8 == 0);
 1584                           const int channels = bpp/8; ASSERT(channels >=
m_header.channels);
 1585
 1586                           DataT* y = m_channel[0]; ASSERT(y);
 1587                           DataT* u = m_channel[1]; ASSERT(u);
 1588                           DataT* v = m_channel[2]; ASSERT(v);
 1589                           DataT* a = m_channel[3]; ASSERT(a);
 1590                           UINT8 b, g, r;
 1591
 1592                           for (UINT32 h=0; h < m_header.height; h++) {
 1593                                   if (cb) {
 1594                                           if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 1595                                           percent += dP;
 1596                                   }
 1597
 1598                                   cnt = 0;
 1599                                   for (UINT32 w=0; w < m_header.width; w++) {
 1600                                           b = buff[cnt + channelMap[0]];
 1601                                           g = buff[cnt + channelMap[1]];
 1602                                           r = buff[cnt + channelMap[2]];
 1603                                           // Yuv
 1604                                           y[yPos] = ((b + (g << 1) + r) >> 2) -
YUVoffset8;
 1605                                           u[yPos] = r - g;
 1606                                           v[yPos] = b - g;
 1607                                           a[yPos++] = buff[cnt + channelMap[3]]
- YUVoffset8;
 1608                                           cnt += channels;
 1609                                   }
 1610                                   buff += pitch;
 1611                           }
 1612                   }
 1613                   break;
 1614           case ImageModeCMYK64:
 1615                   {
 1616                           ASSERT(m_header.channels == 4);
 1617                           ASSERT(m_header.bpp == m_header.channels*16);
 1618                           ASSERT(bpp%16 == 0);
 1619
```

```
 1620                           UINT16 *buff16 = (UINT16 *)buff;
 1621                           const int pitch16 = pitch/2;
 1622                           const int channels = bpp/16; ASSERT(channels >=
m_header.channels);
 1623                           const int shift = 16 - UsedBitsPerChannel();
ASSERT(shift >= 0);
 1624                           const DataT yuvOffset16 = 1 << (UsedBitsPerChannel() -
1);
 1625
 1626                           DataT* y = m_channel[0]; ASSERT(y);
 1627                           DataT* u = m_channel[1]; ASSERT(u);
 1628                           DataT* v = m_channel[2]; ASSERT(v);
 1629                           DataT* a = m_channel[3]; ASSERT(a);
 1630                           UINT16 b, g, r;
 1631
 1632                           for (UINT32 h=0; h < m_header.height; h++) {
 1633                                   if (cb) {
 1634                                           if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 1635                                           percent += dP;
 1636                                   }
 1637
 1638                                   cnt = 0;
 1639                                   for (UINT32 w=0; w < m_header.width; w++) {
 1640                                           b = buff16[cnt + channelMap[0]] >>
shift;
 1641                                           g = buff16[cnt + channelMap[1]] >>
shift;
 1642                                           r = buff16[cnt + channelMap[2]] >>
shift;
 1643                                           // Yuv
 1644                                           y[yPos] = ((b + (g << 1) + r) >> 2) -
yuvOffset16;
 1645                                           u[yPos] = r - g;
 1646                                           v[yPos] = b - g;
 1647                                           a[yPos++] = (buff16[cnt +
channelMap[3]] >> shift) - yuvOffset16;
 1648                                           cnt += channels;
 1649                                   }
 1650                                   buff16 += pitch16;
 1651                           }
 1652                   }
 1653                   break;
 1654 #ifdef __PGF32SUPPORT__
 1655           case ImageModeGray32:
 1656                   {
 1657                           ASSERT(m_header.channels == 1);
 1658                           ASSERT(m_header.bpp == 32);
 1659                           ASSERT(bpp == 32);
 1660                           ASSERT(DataTSize == sizeof(UINT32));
 1661
 1662                           DataT* y = m_channel[0]; ASSERT(y);
 1663
 1664                           UINT32 *buff32 = (UINT32 *)buff;
 1665                           const int pitch32 = pitch/4;
 1666                           const int shift = 31 - UsedBitsPerChannel();
ASSERT(shift >= 0);
 1667                           const DataT yuvOffset31 = 1 << (UsedBitsPerChannel() -
1);
 1668
 1669                           for (UINT32 h=0; h < m_header.height; h++) {
 1670                                   if (cb) {
 1671                                           if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 1672                                           percent += dP;
 1673                                   }
 1674
 1675                                   for (UINT32 w=0; w < m_header.width; w++) {
 1676                                           y[yPos++] = (buff32[w] >> shift) -
yuvOffset31;
 1677                                   }
 1678                                   buff32 += pitch32;
 1679                           }
 1680                   }
 1681                   break;
 1682 #endif
 1683           case ImageModeRGB12:
```

```
 1684                {
 1685                        ASSERT(m_header.channels == 3);
 1686                        ASSERT(m_header.bpp == m_header.channels*4);
 1687                        ASSERT(bpp == m_header.channels*4);
 1688
 1689                        DataT* y = m_channel[0]; ASSERT(y);
 1690                        DataT* u = m_channel[1]; ASSERT(u);
 1691                        DataT* v = m_channel[2]; ASSERT(v);
 1692
 1693                        UINT8 rgb = 0, b, g, r;
 1694
 1695                        for (UINT32 h=0; h < m_header.height; h++) {
 1696                                if (cb) {
 1697                                        if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 1698                                        percent += dP;
 1699                                }
 1700
 1701                                cnt = 0;
 1702                                for (UINT32 w=0; w < m_header.width; w++) {
 1703                                        if (w%2 == 0) {
 1704                                                // even pixel position
 1705                                                rgb = buff[cnt];
 1706                                                b = rgb & 0x0F;
 1707                                                g = (rgb & 0xF0) >> 4;
 1708                                                cnt++;
 1709                                                rgb = buff[cnt];
 1710                                                r = rgb & 0x0F;
 1711                                        } else {
 1712                                                // odd pixel position
 1713                                                b = (rgb & 0xF0) >> 4;
 1714                                                cnt++;
 1715                                                rgb = buff[cnt];
 1716                                                g = rgb & 0x0F;
 1717                                                r = (rgb & 0xF0) >> 4;
 1718                                                cnt++;
 1719                                        }
 1720
 1721                                        // Yuv
 1722                                        y[yPos] = ((b + (g << 1) + r) >> 2) -
YUVoffset4;
 1723                                        u[yPos] = r - g;
 1724                                        v[yPos] = b - g;
 1725                                        yPos++;
 1726                                }
 1727                                buff += pitch;
 1728                        }
 1729                }
 1730                break;
 1731        case ImageModeRGB16:
 1732                {
 1733                        ASSERT(m_header.channels == 3);
 1734                        ASSERT(m_header.bpp == 16);
 1735                        ASSERT(bpp == 16);
 1736
 1737                        DataT* y = m_channel[0]; ASSERT(y);
 1738                        DataT* u = m_channel[1]; ASSERT(u);
 1739                        DataT* v = m_channel[2]; ASSERT(v);
 1740
 1741                        UINT16 *buff16 = (UINT16 *)buff;
 1742                        UINT16 rgb, b, g, r;
 1743                        const int pitch16 = pitch/2;
 1744
 1745                        for (UINT32 h=0; h < m_header.height; h++) {
 1746                                if (cb) {
 1747                                        if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 1748                                        percent += dP;
 1749                                }
 1750                                for (UINT32 w=0; w < m_header.width; w++) {
 1751                                        rgb = buff16[w];
 1752                                        r = (rgb & 0xF800) >> 10;       //
highest 5 bits
 1753                                        g = (rgb & 0x07E0) >> 5;        //
middle 6 bits
 1754                                        b = (rgb & 0x001F) << 1;        //
lowest 5 bits
```

```
 1755                                            // Yuv
 1756                                            y[yPos] = ((b + (g << 1) + r) >> 2) -
YUVoffset6;
 1757                                            u[yPos] = r - g;
 1758                                            v[yPos] = b - g;
 1759                                            yPos++;
 1760                                    }
 1761
 1762                                    buff16 += pitch16;
 1763                            }
 1764                    }
 1765                    break;
 1766            default:
 1767                    ASSERT(false);
 1768            }
 1769 }
```

bool CPGFImage::ROIisSupported () const[inline]

Return true if the pgf image supports Region Of Interest (ROI).

Returns:

true if the pgf image supports ROI.

Definition at line 466 of file PGFimage.h.

```
  466 { return (m_preHeader.version & PGFROI) == PGFROI; }
```

void CPGFImage::SetChannel (DataT * *channel*, int *c* = 0)[inline]

Set internal PGF image buffer channel.

Parameters:

channel	A YUV data channel
c	A channel index

Definition at line 272 of file PGFimage.h.

```
  272 { ASSERT(c >= 0 && c < MaxChannels); m_channel[c] = channel; }
```

void CPGFImage::SetColorTable (UINT32 *iFirstColor*, UINT32 *nColors*, const RGBQUAD * *prgbColors*)

Sets the red, green, blue (RGB) color values for a range of entries in the palette (clut). It might throw an **IOException**.

Parameters:

iFirstColor	The color table index of the first entry to set.
nColors	The number of color table entries to set.
prgbColors	A pointer to the array of RGBQUAD structures to set the color table entries.

Definition at line 1363 of file PGFimage.cpp.

```
 1363
{
 1364            if (iFirstColor + nColors > ColorTableLen)
ReturnWithError(ColorTableError);
 1365
 1366            for (UINT32 i=iFirstColor, j=0; j < nColors; i++, j++) {
 1367                    m_postHeader.clut[i] = prgbColors[j];
 1368            }
 1369 }
```

void CPGFImage::SetHeader (const PGFHeader & *header*, BYTE *flags* = 0, const UINT8 * *userData* = 0, UINT32 *userDataLength* = 0)

Set PGF header and user data. Precondition: The PGF image has been never opened with Open(...). It might throw an **IOException**.

Parameters:

header	A valid and already filled in PGF header structure
flags	A combination of additional version flags. In case you use level-wise encoding then set flag = PGFROI.

userData	A user-defined memory block containing any kind of cached metadata.
userDataLength	The size of user-defined memory block in bytes

Definition at line 893 of file PGFimage.cpp.

```
  893
{
  894         ASSERT(!m_decoder);     // current image must be closed
  895         ASSERT(header.quality <= MaxQuality);
  896         ASSERT(userDataLength <= MaxUserDataSize);
  897
  898         // init state
  899 #ifdef __PGFROISUPPORT__
  900         m_streamReinitialized = false;
  901 #endif
  902
  903         // init preHeader
  904         memcpy(m_preHeader.magic, PGFMagic, 3);
  905         m_preHeader.version = PGFVersion | flags;
  906         m_preHeader.hSize = HeaderSize;
  907
  908         // copy header
  909         memcpy(&m_header, &header, HeaderSize);
  910
  911         // check quality
  912         if (m_header.quality > MaxQuality) m_header.quality = MaxQuality;
  913
  914         // complete header
  915         CompleteHeader();
  916
  917         // check and set number of levels
  918         ComputeLevels();
  919
  920         // check for downsample
  921         if (m_header.quality > DownsampleThreshold &&  (m_header.mode ==
ImageModeRGBColor ||
  922
m_header.mode == ImageModeRGBA ||
  923
m_header.mode == ImageModeRGB48 ||
  924
m_header.mode == ImageModeCMYKColor ||
  925
m_header.mode == ImageModeCMYK64 ||
  926
m_header.mode == ImageModeLabColor ||
  927
m_header.mode == ImageModeLab48)) {
  928                 m_downsample = true;
  929                 m_quant = m_header.quality - 1;
  930         } else {
  931                 m_downsample = false;
  932                 m_quant = m_header.quality;
  933         }
  934
  935         // update header size and copy user data
  936         if (m_header.mode == ImageModeIndexedColor) {
  937                 // update header size
  938                 m_preHeader.hSize += ColorTableSize;
  939         }
  940         if (userDataLength && userData) {
  941                 if (userDataLength > MaxUserDataSize) userDataLength =
MaxUserDataSize;
  942                 m_postHeader.userData = new(std::nothrow)
UINT8[userDataLength];
  943                 if (!m_postHeader.userData)
ReturnWithError(InsufficientMemory);
  944                 m_postHeader.userDataLen = m_postHeader.cachedUserDataLen =
userDataLength;
  945                 memcpy(m_postHeader.userData, userData, userDataLength);
  946                 // update header size
  947                 m_preHeader.hSize += userDataLength;
  948         }
  949
  950         // allocate channels
  951         for (int i=0; i < m_header.channels; i++) {
  952                 // set current width and height
```

```
  953                 m_width[i] = m_header.width;
  954                 m_height[i] = m_header.height;
  955
  956                 // allocate channels
  957                 ASSERT(!m_channel[i]);
  958                 m_channel[i] = new(std::nothrow)
DataT[m_header.width*m_header.height];
  959                 if (!m_channel[i]) {
  960                         if (i) i--;
  961                         while(i) {
  962                                 delete[] m_channel[i]; m_channel[i] = 0;
  963                                 i--;
  964                         }
  965                         ReturnWithError(InsufficientMemory);
  966                 }
  967         }
  968 }
```

void CPGFImage::SetMaxValue (UINT32 *maxValue*)

Set maximum intensity value for image modes with more than eight bits per channel. Call this method after SetHeader, but before ImportBitmap.

Parameters:

maxValue	The maximum intensity value.

Definition at line 737 of file PGFimage.cpp.

```
  737                                                 {
  738         const BYTE bpc = m_header.bpp/m_header.channels;
  739         BYTE pot = 0;
  740
  741         while(maxValue > 0) {
  742                 pot++;
  743                 maxValue >>= 1;
  744         }
  745         // store bits per channel
  746         if (pot > bpc) pot = bpc;
  747         if (pot > 31) pot = 31;
  748         m_header.usedBitsPerChannel = pot;
  749 }
```

void CPGFImage::SetProgressMode (ProgressMode *pm*)[inline]

Set progress mode used in Read and Write. Default mode is PM_Relative. This method must be called before **Open()** or **SetHeader()**. PM_Relative: 100% = level difference between current level and target level of Read/Write PM_Absolute: 100% = number of levels

Definition at line 296 of file PGFimage.h.

```
  296 { m_progressMode = pm; }
```

void CPGFImage::SetRefreshCallback (RefreshCB *callback*, void * *arg*)[inline]

Set refresh callback procedure and its parameter. The refresh callback is called during Read(...) after each level read.

Parameters:

callback	A refresh callback procedure
arg	A parameter of the refresh callback procedure

Definition at line 303 of file PGFimage.h.

```
  303 { m_cb = callback; m_cbArg = arg; }
```

void CPGFImage::SetROI (PGFRect *rect*)[private]

UINT32 CPGFImage::UpdatePostHeaderSize ()[private]

Definition at line 1123 of file PGFimage.cpp.

```
1123                                            {
1124         ASSERT(m_encoder);
1125
1126         INT64 offset = m_encoder->ComputeOffset(); ASSERT(offset >= 0);
1127
1128         if (offset > 0) {
1129                 // update post-header size and rewrite pre-header
1130                 m_preHeader.hSize += (UINT32)offset;
1131                 m_encoder->UpdatePostHeaderSize(m_preHeader);
1132         }
1133
1134         // write dummy levelLength into stream
1135         return m_encoder->WriteLevelLength(m_levelLength);
1136 }
```

BYTE CPGFImage::UsedBitsPerChannel () const

Returns number of used bits per input/output image channel. Precondition: header must be initialized.

Returns:

number of used bits per input/output image channel.

Definition at line 755 of file PGFimage.cpp.

```
 755                                             {
 756         const BYTE bpc = m_header.bpp/m_header.channels;
 757
 758         if (bpc > 8) {
 759                 return m_header.usedBitsPerChannel;
 760         } else {
 761                 return bpc;
 762         }
 763 }
```

BYTE CPGFImage::Version () const[inline]

Returns the used codec major version of a pgf image

Returns:

PGF codec major version of this image

Definition at line 484 of file PGFimage.h.

```
 484 { BYTE ver = CodecMajorVersion(m_preHeader.version); return (ver <= 7) ? ver :
(BYTE)m_header.version.major; }
```

UINT32 CPGFImage::Width (int *level* = 0) const[inline]

Return image width of channel 0 at given level in pixels. The returned width is independent of any Read-operations and ROI.

Parameters:

level	A level

Returns:

Image level width in pixels

Definition at line 413 of file PGFimage.h.

```
 413 { ASSERT(level >= 0); return LevelSizeL(m_header.width, level); }
```

void CPGFImage::Write (CPGFStream * *stream*, UINT32 * *nWrittenBytes* = nullptr, CallbackPtr *cb* = nullptr, void * *data* = nullptr)

Encode and write an entire PGF image (header and image) at current stream position. A PGF image is structered in levels, numbered between 0 and **Levels()** - 1. Each level can be seen as a single image, containing the same content as all other levels, but in a different size (width, height). The image size at level i is double the size (width, height) of the image at level i+1. The image at level 0 contains the original size. Precondition: the PGF image contains a valid header (see also SetHeader(...)). It might throw an **IOException**.

Parameters:

stream	A PGF stream
nWrittenBytes	[in-out] The number of bytes written into stream are added to the input value.
cb	A pointer to a callback procedure. The procedure is called after writing a single level. If cb returns true, then it stops proceeding.
data	Data Pointer to C++ class container to host callback procedure.

Definition at line 1220 of file PGFimage.cpp.

```
 1220
{
 1221         ASSERT(stream);
 1222         ASSERT(m_preHeader.hSize);
 1223
 1224         // create wavelet transform channels and encoder
 1225         UINT32 nBytes = WriteHeader(stream);
 1226
 1227         // write image
 1228         nBytes += WriteImage(stream, cb, data);
 1229
 1230         // return written bytes
 1231         if (nWrittenBytes) *nWrittenBytes += nBytes;
 1232 }
```

UINT32 CPGFImage::Write (int *level*, CallbackPtr *cb* = `nullptr`, void * *data* = `nullptr`)

Encode and write down to given level at current stream position. A PGF image is structered in levels, numbered between 0 and **Levels()** - 1. Each level can be seen as a single image, containing the same content as all other levels, but in a different size (width, height). The image size at level i is double the size (width, height) of the image at level i+1. The image at level 0 contains the original size. Preconditions: the PGF image contains a valid header (see also SetHeader(...)) and **WriteHeader()** has been called before. **Levels()** > 0. The ROI encoding scheme must be used (see also SetHeader(...)). It might throw an **IOException**.

Parameters:

level	[0, nLevels) The image level of the resulting image in the internal image buffer.
cb	A pointer to a callback procedure. The procedure is called after writing a single level. If cb returns true, then it stops proceeding.
data	Data Pointer to C++ class container to host callback procedure.

Returns:

The number of bytes written into stream.

UINT32 CPGFImage::WriteHeader (CPGFStream * *stream*)

Create wavelet transform channels and encoder. Write header at current stream position. Call this method before your first call of Write(int level) or **WriteImage()**, but after **SetHeader()**. This method is called inside of Write(stream, ...). It might throw an **IOException**.

Parameters:

stream	A PGF stream

Returns:

The number of bytes written into stream.

Create wavelet transform channels and encoder. Write header at current stream position. Performs forward FWT. Call this method before your first call of Write(int level) or **WriteImage()**, but after **SetHeader()**. This method is called inside of Write(stream, ...). It might throw an **IOException**.

Parameters:

stream	A PGF stream

Returns:

The number of bytes written into stream.

Definition at line 978 of file PGFimage.cpp.

```
  978                                                 {
  979         ASSERT(m_header.nLevels <= MaxLevel);
  980         ASSERT(m_header.quality <= MaxQuality); // quality is already
initialized
  981
  982         if (m_header.nLevels > 0) {
  983                 volatile OSError error = NoError; // volatile prevents
optimizations
  984                 // create new wt channels
  985 #ifdef LIBPGF_USE_OPENMP
  986                 #pragma omp parallel for default(shared)
  987 #endif
  988                 for (int i=0; i < m_header.channels; i++) {
  989                         DataT *temp = nullptr;
  990                         if (error == NoError) {
  991                                 if (m_wtChannel[i]) {
  992                                         ASSERT(m_channel[i]);
  993                                         // copy m_channel to temp
  994                                         int size = m_height[i]*m_width[i];
  995                                         temp = new(std::nothrow) DataT[size];
  996                                         if (temp) {
  997                                                 memcpy(temp, m_channel[i],
size*DataTSize);
  998                                                 delete m_wtChannel[i];  //
also deletes m_channel
  999                                                 m_channel[i] = nullptr;
 1000                                         } else {
 1001                                                 error = InsufficientMemory;
 1002                                         }
 1003                                 }
 1004                                 if (error == NoError) {
 1005                                         if (temp) {
 1006                                                 ASSERT(!m_channel[i]);
 1007                                                 m_channel[i] = temp;
 1008                                         }
 1009                                         m_wtChannel[i] = new
CWaveletTransform(m_width[i], m_height[i], m_header.nLevels, m_channel[i]);
 1010                                         if (m_wtChannel[i]) {
 1011                                         #ifdef __PGFROISUPPORT__
 1012
m_wtChannel[i]->SetROI(PGFRect(0, 0, m_width[i], m_height[i]));
 1013                                         #endif
 1014
 1015                                                 // wavelet subband
decomposition
 1016                                                 for (int l=0; error == NoError
&& l < m_header.nLevels; l++) {
 1017                                                         OSError err =
m_wtChannel[i]->ForwardTransform(l, m_quant);
 1018                                                         if (err != NoError)
error = err;
 1019                                                 }
 1020                                         } else {
 1021                                                 delete[] m_channel[i];
 1022                                                 error = InsufficientMemory;
 1023                                         }
 1024                                 }
 1025                         }
 1026                 }
 1027                 if (error != NoError) {
 1028                         // free already allocated memory
 1029                         for (int i=0; i < m_header.channels; i++) {
 1030                                 delete m_wtChannel[i];
 1031                         }
 1032                         ReturnWithError(error);
 1033                 }
 1034
 1035                 m_currentLevel = m_header.nLevels;
 1036
 1037                 // create encoder, write headers and user data, but not
level-length area
```

```
 1038                  m_encoder = new CEncoder(stream, m_preHeader, m_header,
m_postHeader, m_userDataPos, m_useOMPinEncoder);
 1039                  if (m_favorSpeedOverSize) m_encoder->FavorSpeedOverSize();
 1040
 1041          #ifdef __PGFROISUPPORT__
 1042                  if (ROIisSupported()) {
 1043                          // new encoding scheme supporting ROI
 1044                          m_encoder->SetROI();
 1045                  }
 1046          #endif
 1047
 1048          } else {
 1049                  // very small image: we don't use DWT and encoding
 1050
 1051                  // create encoder, write headers and user data, but not
level-length area
 1052                  m_encoder = new CEncoder(stream, m_preHeader, m_header,
m_postHeader, m_userDataPos, m_useOMPinEncoder);
 1053          }
 1054
 1055          INT64 nBytes = m_encoder->ComputeHeaderLength();
 1056          return (nBytes > 0) ? (UINT32)nBytes : 0;
 1057 }
```

UINT32 CPGFImage::WriteImage (CPGFStream * *stream*, CallbackPtr *cb* = `nullptr`, void * *data* = `nullptr`)

Encode and write an image at current stream position. Call this method after **WriteHeader()**. In case you want to write uncached metadata, then do that after **WriteHeader()** and before **WriteImage()**. This method is called inside of Write(stream, ...). It might throw an **IOException**.

Parameters:

stream	A PGF stream
cb	A pointer to a callback procedure. The procedure is called after writing a single level. If cb returns true, then it stops proceeding.
data	Data Pointer to C++ class container to host callback procedure.

Returns:

The number of bytes written into stream.

Definition at line 1149 of file PGFimage.cpp.

```
 1149
{
 1150          ASSERT(stream);
 1151          ASSERT(m_preHeader.hSize);
 1152
 1153          int levels = m_header.nLevels;
 1154          double percent = pow(0.25, levels);
 1155
 1156          // update post-header size, rewrite pre-header, and write dummy
levelLength
 1157          UINT32 nWrittenBytes = UpdatePostHeaderSize();
 1158
 1159          if (levels == 0) {
 1160                  // for very small images: write channels uncoded
 1161                  for (int c=0; c < m_header.channels; c++) {
 1162                          const UINT32 size = m_width[c]*m_height[c];
 1163
 1164                          // write channel data into stream
 1165                          for (UINT32 i=0; i < size; i++) {
 1166                                  int count = DataTSize;
 1167                                  stream->Write(&count, &m_channel[c][i]);
 1168                          }
 1169                  }
 1170
 1171                  // now update progress
 1172                  if (cb) {
 1173                          if ((*cb)(1, true, data))
ReturnWithError(EscapePressed);
 1174                  }
 1175
 1176          } else {
```

```
 1177                 // encode quantized wavelet coefficients and write to PGF file
 1178                 // encode subbands, higher levels first
 1179                 // color channels are interleaved
 1180
 1181                 // encode all levels
 1182                 for (m_currentLevel = levels; m_currentLevel > 0; ) {
 1183                         WriteLevel(); // decrements m_currentLevel
 1184
 1185                         // now update progress
 1186                         if (cb) {
 1187                                 percent *= 4;
 1188                                 if ((*cb)(percent, true, data))
ReturnWithError(EscapePressed);
 1189                         }
 1190                 }
 1191
 1192                 // flush encoder and write level lengths
 1193                 m_encoder->Flush();
 1194         }
 1195
 1196         // update level lengths
 1197         nWrittenBytes += m_encoder->UpdateLevelLength(); // return written
image bytes
 1198
 1199         // delete encoder
 1200         delete m_encoder; m_encoder = nullptr;
 1201
 1202         ASSERT(!m_encoder);
 1203
 1204         return nWrittenBytes;
 1205 }
```

void CPGFImage::WriteLevel () [private]

Definition at line 1067 of file PGFimage.cpp.

```
 1067                                 {
 1068         ASSERT(m_encoder);
 1069         ASSERT(m_currentLevel > 0);
 1070         ASSERT(m_header.nLevels > 0);
 1071
 1072 #ifdef __PGFROISUPPORT__
 1073         if (ROIisSupported()) {
 1074                 const int lastChannel = m_header.channels - 1;
 1075
 1076                 for (int i=0; i < m_header.channels; i++) {
 1077                         // get number of tiles and tile indices
 1078                         const UINT32 nTiles =
m_wtChannel[i]->GetNofTiles(m_currentLevel);
 1079                         const UINT32 lastTile = nTiles - 1;
 1080
 1081                         if (m_currentLevel == m_header.nLevels) {
 1082                                 // last level also has LL band
 1083                                 ASSERT(nTiles == 1);
 1084                                 m_wtChannel[i]->GetSubband(m_currentLevel,
LL)->ExtractTile(*m_encoder);
 1085                                 m_encoder->EncodeTileBuffer(); // encode macro
block with tile-end = true
 1086                         }
 1087                         for (UINT32 tileY=0; tileY < nTiles; tileY++) {
 1088                                 for (UINT32 tileX=0; tileX < nTiles; tileX++)
{
 1089                                         // extract tile to macro block and
encode already filled macro blocks with tile-end = false
 1090
m_wtChannel[i]->GetSubband(m_currentLevel, HL)->ExtractTile(*m_encoder, true, tileX,
tileY);
 1091
m_wtChannel[i]->GetSubband(m_currentLevel, LH)->ExtractTile(*m_encoder, true, tileX,
tileY);
 1092
m_wtChannel[i]->GetSubband(m_currentLevel, HH)->ExtractTile(*m_encoder, true, tileX,
tileY);
 1093                                         if (i == lastChannel && tileY ==
lastTile && tileX == lastTile) {
```

```
 1094                                                    // all necessary data are
buffered. next call of EncodeTileBuffer will write the last piece of data of the current
level.
 1095
m_encoder->SetEncodedLevel(--m_currentLevel);
 1096                                            }
 1097                                            m_encoder->EncodeTileBuffer(); //
encode last macro block with tile-end = true
 1098                                            }
 1099                            }
 1100                    }
 1101            } else
 1102 #endif
 1103            {
 1104                    for (int i=0; i < m_header.channels; i++) {
 1105                            ASSERT(m_wtChannel[i]);
 1106                            if (m_currentLevel == m_header.nLevels) {
 1107                                    // last level also has LL band
 1108                                    m_wtChannel[i]->GetSubband(m_currentLevel,
LL)->ExtractTile(*m_encoder);
 1109                            }
 1110                            //encoder.EncodeInterleaved(m_wtChannel[i],
m_currentLevel, m_quant); // until version 4
 1111                            m_wtChannel[i]->GetSubband(m_currentLevel,
HL)->ExtractTile(*m_encoder); // since version 5
 1112                            m_wtChannel[i]->GetSubband(m_currentLevel,
LH)->ExtractTile(*m_encoder); // since version 5
 1113                            m_wtChannel[i]->GetSubband(m_currentLevel,
HH)->ExtractTile(*m_encoder);
 1114                    }
 1115
 1116                    // all necessary data are buffered. next call of EncodeBuffer
will write the last piece of data of the current level.
 1117                    m_encoder->SetEncodedLevel(--m_currentLevel);
 1118            }
 1119 }
```

Member Data Documentation

RefreshCB CPGFImage::m_cb[private]

pointer to refresh callback procedure

Definition at line 545 of file PGFimage.h.

void* CPGFImage::m_cbArg[private]

refresh callback argument

Definition at line 546 of file PGFimage.h.

DataT* CPGFImage::m_channel[MaxChannels][protected]

untransformed channels in YUV format

Definition at line 522 of file PGFimage.h.

int CPGFImage::m_currentLevel[protected]

transform level of current image

Definition at line 532 of file PGFimage.h.

CDecoder* CPGFImage::m_decoder[protected]

PGF decoder.
Definition at line 523 of file PGFimage.h.

bool CPGFImage::m_downsample[protected]

chrominance channels are downsampled
Definition at line 535 of file PGFimage.h.

CEncoder* CPGFImage::m_encoder[protected]

PGF encoder.
Definition at line 524 of file PGFimage.h.

bool CPGFImage::m_favorSpeedOverSize[protected]

favor encoding speed over compression ratio
Definition at line 536 of file PGFimage.h.

PGFHeader CPGFImage::m_header[protected]

PGF file header.
Definition at line 529 of file PGFimage.h.

UINT32 CPGFImage::m_height[MaxChannels][protected]

height of each channel at current level
Definition at line 527 of file PGFimage.h.

UINT32* CPGFImage::m_levelLength[protected]

length of each level in bytes; first level starts immediately after this array
Definition at line 525 of file PGFimage.h.

double CPGFImage::m_percent[private]

progress [0..1]
Definition at line 547 of file PGFimage.h.

PGFPostHeader CPGFImage::m_postHeader[protected]

PGF post-header.
Definition at line 530 of file PGFimage.h.

PGFPreHeader CPGFImage::m_preHeader[protected]

PGF pre-header.
Definition at line 528 of file PGFimage.h.

ProgressMode CPGFImage::m_progressMode[private]

progress mode used in Read and Write; PM_Relative is default mode
Definition at line 548 of file PGFimage.h.

BYTE CPGFImage::m_quant[protected]

quantization parameter
Definition at line 534 of file PGFimage.h.

PGFRect CPGFImage::m_roi[protected]

region of interest
Definition at line 541 of file PGFimage.h.

bool CPGFImage::m_streamReinitialized[protected]

stream has been reinitialized
Definition at line 540 of file PGFimage.h.

bool CPGFImage::m_useOMPinDecoder[protected]

use Open MP in decoder
Definition at line 538 of file PGFimage.h.

bool CPGFImage::m_useOMPinEncoder[protected]

use Open MP in encoder
Definition at line 537 of file PGFimage.h.

UINT32 CPGFImage::m_userDataPolicy[protected]

user data (metadata) policy during open
Definition at line 533 of file PGFimage.h.

UINT64 CPGFImage::m_userDataPos[protected]

stream position of user data
Definition at line 531 of file PGFimage.h.

UINT32 CPGFImage::m_width[MaxChannels][protected]

width of each channel at current level

Definition at line 526 of file PGFimage.h.

CWaveletTransform* CPGFImage::m_wtChannel[MaxChannels][protected]

wavelet transformed color channels

Definition at line 521 of file PGFimage.h.

The documentation for this class was generated from the following files:

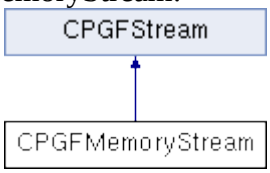
- **PGFimage.h**
- **PGFimage.cpp**

CPGFMemoryStream Class Reference

Memory stream class.

`#include <PGFstream.h>`

Inheritance diagram for CPGFMemoryStream:



Public Member Functions

- **CPGFMemoryStream** (size_t size)
- **CPGFMemoryStream** (UINT8 *pBuffer, size_t size)
- void **Reinitialize** (UINT8 *pBuffer, size_t size)
- virtual **~CPGFMemoryStream** ()
- virtual void **Write** (int *count, void *buffer)
- virtual void **Read** (int *count, void *buffer)
- virtual void **SetPos** (short posMode, INT64 posOff)
- virtual UINT64 **GetPos** () const
- virtual bool **IsValid** () const
- size_t **GetSize** () const
- const UINT8 * **GetBuffer** () const
- UINT8 * **GetBuffer** ()
- UINT64 **GetEOS** () const
- void **SetEOS** (UINT64 length)

Protected Attributes

- UINT8 * **m_buffer**
- UINT8 * **m_pos**
  buffer start address and current buffer address

- UINT8 * **m_eos**
  end of stream (first address beyond written area)

- size_t **m_size**
  buffer size

- bool **m_allocated**
  indicates a new allocated buffer

Detailed Description

Memory stream class.

A PGF stream subclass for internal memory.

Author:

C. Stamm

Definition at line 106 of file PGFstream.h.

Constructor & Destructor Documentation

CPGFMemoryStream::CPGFMemoryStream (size_t *size*)

Constructor

Parameters:

size	Size of new allocated memory buffer

Allocate memory block of given size

Parameters:

size	Memory size

Definition at line 78 of file PGFstream.cpp.

```
 79 : m_size(size)
 80 , m_allocated(true) {
 81         m_buffer = m_pos = m_eos = new(std::nothrow) UINT8[m_size];
 82         if (!m_buffer) ReturnWithError(InsufficientMemory);
 83 }
```

CPGFMemoryStream::CPGFMemoryStream (UINT8 * *pBuffer*, size_t *size*)

Constructor. Use already allocated memory of given size

Parameters:

pBuffer	Memory location
size	Memory size

Use already allocated memory of given size

Parameters:

pBuffer	Memory location
size	Memory size

Definition at line 89 of file PGFstream.cpp.

```
 90 : m_buffer(pBuffer)
 91 , m_pos(pBuffer)
 92 , m_eos(pBuffer + size)
 93 , m_size(size)
 94 , m_allocated(false) {
 95         ASSERT(IsValid());
 96 }
```

virtual CPGFMemoryStream::~CPGFMemoryStream () [inline], [virtual]

Definition at line 128 of file PGFstream.h.

```
128                                     {
129                 m_pos = 0;
130                 if (m_allocated) {
131                         // the memory buffer has been allocated inside of
CPMFmemoryStream constructor
132                         delete[] m_buffer; m_buffer = 0;
133                 }
134         }
```

Member Function Documentation

const UINT8* CPGFMemoryStream::GetBuffer () const [inline]

Returns:

Memory buffer

Definition at line 145 of file PGFstream.h.

```
145 { return m_buffer; }
```

UINT8* CPGFMemoryStream::GetBuffer () [inline]

Returns:

Memory buffer

Definition at line 147 of file PGFstream.h.

```
147 { return m_buffer; }
```

UINT64 CPGFMemoryStream::GetEOS () const [inline]

Returns:

relative position of end of stream (= stream length)

Definition at line 149 of file PGFstream.h.

```
149 { ASSERT(IsValid()); return m_eos - m_buffer; }
```

virtual UINT64 CPGFMemoryStream::GetPos () const [inline], [virtual]

Get current stream position.

Returns:

Current stream position

Implements **CPGFStream** (*p.109*).

Definition at line 139 of file PGFstream.h.

```
139 { ASSERT(IsValid()); return m_pos - m_buffer; }
```

size_t CPGFMemoryStream::GetSize () const [inline]

Returns:

Memory size

Definition at line 143 of file PGFstream.h.

```
143 { return m_size; }
```

virtual bool CPGFMemoryStream::IsValid () const [inline], [virtual]

Check stream validity.

Returns:

True if stream and current position is valid

Implements **CPGFStream** (*p.109*).

Definition at line 140 of file PGFstream.h.

```
140 { return m_buffer != 0; }
```

void CPGFMemoryStream::Read (int * *count*, void * *buffer*) [virtual]

Read some bytes from this stream and stores them into a buffer.

Parameters:

count	A pointer to a value containing the number of bytes should be read. After this call it contains the number of read bytes.
buffer	A memory buffer

Implements **CPGFStream** (*p.109*).

Definition at line 148 of file PGFstream.cpp.

```
148                                                     {
149         ASSERT(IsValid());
```

```
150         ASSERT(count);
151         ASSERT(buffPtr);
152         ASSERT(m_buffer + m_size >= m_eos);
153         ASSERT(m_pos <= m_eos);
154 
155         if (m_pos + *count <= m_eos) {
156                 memcpy(buffPtr, m_pos, *count);
157                 m_pos += *count;
158         } else {
159                 // end of memory block reached -> read only until end
160                 *count = (int)__max(0, m_eos - m_pos);
161                 memcpy(buffPtr, m_pos, *count);
162                 m_pos += *count;
163         }
164         ASSERT(m_pos <= m_eos);
165 }
```

void CPGFMemoryStream::Reinitialize (UINT8 * *pBuffer*, size_t *size*)

Use already allocated memory of given size

Parameters:

pBuffer	Memory location
size	Memory size

Definition at line 102 of file PGFstream.cpp.

```
102                                                                 {
103         if (!m_allocated) {
104                 m_buffer = m_pos = pBuffer;
105                 m_size = size;
106                 m_eos = m_buffer + size;
107         }
108 }
```

void CPGFMemoryStream::SetEOS (UINT64 *length*)[inline]

Parameters:

length	Stream length (= relative position of end of stream)

Definition at line 151 of file PGFstream.h.

```
151 { ASSERT(IsValid()); m_eos = m_buffer + length; }
```

void CPGFMemoryStream::SetPos (short *posMode*, INT64 *posOff*)[virtual]

Set stream position either absolute or relative.

Parameters:

posMode	A position mode (FSFromStart, FSFromCurrent, FSFromEnd)
posOff	A new stream position (absolute positioning) or a position offset (relative positioning)

Implements **CPGFStream** (*p.109*).

Definition at line 168 of file PGFstream.cpp.

```
168                                                                 {
169         ASSERT(IsValid());
170         switch(posMode) {
171         case FSFromStart:
172                 m_pos = m_buffer + posOff;
173                 break;
174         case FSFromCurrent:
175                 m_pos += posOff;
176                 break;
177         case FSFromEnd:
178                 m_pos = m_eos + posOff;
179                 break;
180         default:
181                 ASSERT(false);
182         }
183         if (m_pos > m_eos)
184                 ReturnWithError(InvalidStreamPos);
```

```
185 }
```

void CPGFMemoryStream::Write (int * *count*, void * *buffer*)[virtual]

Write some bytes out of a buffer into this stream.

Parameters:

count	A pointer to a value containing the number of bytes should be written. After this call it contains the number of written bytes.
buffer	A memory buffer

Implements **CPGFStream** (*p.109*).

Definition at line 111 of file PGFstream.cpp.

```
111                                                     {
112         ASSERT(count);
113         ASSERT(buffPtr);
114         ASSERT(IsValid());
115         const size_t deltaSize = 0x4000 + *count;
116
117         if (m_pos + *count <= m_buffer + m_size) {
118                 memcpy(m_pos, buffPtr, *count);
119                 m_pos += *count;
120                 if (m_pos > m_eos) m_eos = m_pos;
121         } else if (m_allocated) {
122                 // memory block is too small -> reallocate a deltaSize larger
block
123                 size_t offset = m_pos - m_buffer;
124                 UINT8 *buf_tmp = (UINT8 *)realloc(m_buffer, m_size + deltaSize);
125                 if (!buf_tmp) {
126                         delete[] m_buffer;
127                         m_buffer = 0;
128                         ReturnWithError(InsufficientMemory);
129                 } else {
130                         m_buffer = buf_tmp;
131                 }
132                 m_size += deltaSize;
133
134                 // reposition m_pos
135                 m_pos = m_buffer + offset;
136
137                 // write block
138                 memcpy(m_pos, buffPtr, *count);
139                 m_pos += *count;
140                 if (m_pos > m_eos) m_eos = m_pos;
141         } else {
142                 ReturnWithError(InsufficientMemory);
143         }
144         ASSERT(m_pos <= m_eos);
145 }
```

Member Data Documentation

bool CPGFMemoryStream::m_allocated[protected]

indicates a new allocated buffer

Definition at line 111 of file PGFstream.h.

UINT8* CPGFMemoryStream::m_buffer[protected]

Definition at line 108 of file PGFstream.h.

UINT8* CPGFMemoryStream::m_eos[protected]

end of stream (first address beyond written area)

Definition at line 109 of file PGFstream.h.

UINT8 * CPGFMemoryStream::m_pos[protected]

buffer start address and current buffer address

Definition at line 108 of file PGFstream.h.

size_t CPGFMemoryStream::m_size[protected]

buffer size

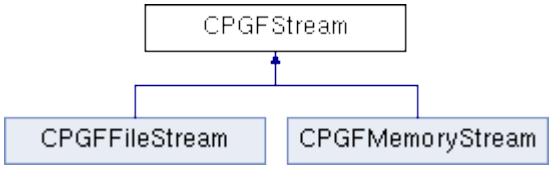
Definition at line 110 of file PGFstream.h.

The documentation for this class was generated from the following files:

- **PGFstream.h**
- **PGFstream.cpp**

CPGFStream Class Reference

Abstract stream base class.
`#include <PGFstream.h>`
Inheritance diagram for CPGFStream:



Public Member Functions

- **CPGFStream** ()
  Standard constructor.

- virtual **~CPGFStream** ()
  Standard destructor.

- virtual void **Write** (int *count, void *buffer)=0
- virtual void **Read** (int *count, void *buffer)=0
- virtual void **SetPos** (short posMode, INT64 posOff)=0
- virtual UINT64 **GetPos** () const =0
- virtual bool **IsValid** () const =0

Detailed Description

Abstract stream base class.

Abstract stream base class.

Author:
C. Stamm

Definition at line 39 of file PGFstream.h.

Constructor & Destructor Documentation

CPGFStream::CPGFStream ()[inline]

Standard constructor.

Definition at line 43 of file PGFstream.h.

```
43 {}
```

virtual CPGFStream::~CPGFStream ()[inline], [virtual]

Standard destructor.

Definition at line 47 of file PGFstream.h.

```
47 {}
```

Member Function Documentation

virtual UINT64 CPGFStream::GetPos () const[pure virtual]

Get current stream position.

Returns:

Current stream position

Implemented in **CPGFMemoryStream** (*p.104*), and **CPGFFileStream** (*p.46*).

virtual bool CPGFStream::IsValid () const[pure virtual]

Check stream validity.

Returns:

True if stream and current position is valid

Implemented in **CPGFMemoryStream** (*p.104*), and **CPGFFileStream** (*p.46*).

virtual void CPGFStream::Read (int * *count*, void * *buffer*)[pure virtual]

Read some bytes from this stream and stores them into a buffer.

Parameters:

count	A pointer to a value containing the number of bytes should be read. After this call it contains the number of read bytes.
buffer	A memory buffer

Implemented in **CPGFMemoryStream** (*p.104*), and **CPGFFileStream** (*p.46*).

virtual void CPGFStream::SetPos (short *posMode*, INT64 *posOff*)[pure virtual]

Set stream position either absolute or relative.

Parameters:

posMode	A position mode (FSFromStart, FSFromCurrent, FSFromEnd)
posOff	A new stream position (absolute positioning) or a position offset (relative positioning)

Implemented in **CPGFMemoryStream** (*p.105*), and **CPGFFileStream** (*p.47*).

virtual void CPGFStream::Write (int * *count*, void * *buffer*)[pure virtual]

Write some bytes out of a buffer into this stream.

Parameters:

count	A pointer to a value containing the number of bytes should be written. After this call it contains the number of written bytes.
buffer	A memory buffer

Implemented in **CPGFMemoryStream** (*p.106*), and **CPGFFileStream** (*p.47*).

The documentation for this class was generated from the following file:

- **PGFstream.h**

CSubband Class Reference

Wavelet channel class.
`#include <Subband.h>`

Public Member Functions

- **CSubband** ()
  Standard constructor.

- **~CSubband** ()
  Destructor.

- bool **AllocMemory** ()
- void **FreeMemory** ()
  Delete the memory buffer of this subband.

- void **ExtractTile** (**CEncoder** &encoder, bool tile=false, UINT32 tileX=0, UINT32 tileY=0)
- void **PlaceTile** (**CDecoder** &decoder, int quantParam, bool tile=false, UINT32 tileX=0, UINT32 tileY=0)
- void **Quantize** (int quantParam)
- void **Dequantize** (int quantParam)
- void **SetData** (UINT32 pos, **DataT** v)
- **DataT** * **GetBuffer** ()
- **DataT GetData** (UINT32 pos) const
- int **GetLevel** () const
- int **GetHeight** () const
- int **GetWidth** () const
- **Orientation GetOrientation** () const

Private Member Functions

- void **Initialize** (UINT32 width, UINT32 height, int level, **Orientation** orient)
- void **WriteBuffer** (**DataT** val)
- void **SetBuffer** (**DataT** *b)
- **DataT ReadBuffer** ()
- UINT32 **GetBuffPos** () const
- void **InitBuffPos** ()

Private Attributes

- UINT32 **m_width**
  width in pixels

- UINT32 **m_height**
  height in pixels

- UINT32 **m_size**
  size of data buffer m_data

- int **m_level**
  recursion level

- **Orientation m_orientation**
  0=LL, 1=HL, 2=LH, 3=HH L=lowpass filtered, H=highpass filterd

- UINT32 **m_dataPos**
  current position in m_data

- **DataT * m_data**
  buffer

Friends

- class **CWaveletTransform**
- class **CRoiIndices**

Detailed Description

Wavelet channel class.

PGF wavelet channel subband class.

Author:

C. Stamm, R. Spuler

Definition at line 42 of file Subband.h.

Constructor & Destructor Documentation

CSubband::CSubband ()

Standard constructor.

Definition at line 35 of file Subband.cpp.

```
36 : m_width(0)
37 , m_height(0)
38 , m_size(0)
39 , m_level(0)
40 , m_orientation(LL)
41 , m_data(0)
42 , m_dataPos(0)
43 #ifdef __PGFROISUPPORT__
44 , m_nTiles(0)
45 #endif
46 {
47 }
```

CSubband::~CSubband ()

Destructor.

Definition at line 51 of file Subband.cpp.

```
51                      {
52         FreeMemory();
53 }
```

Member Function Documentation

bool CSubband::AllocMemory ()

Allocate a memory buffer to store all wavelet coefficients of this subband.

Returns:

True if the allocation did work without any problems

Definition at line 77 of file Subband.cpp.

```
77                                  {
78         UINT32 oldSize = m_size;
79
80 #ifdef __PGFROISUPPORT__
81         m_size = BufferWidth()*m_ROI.Height();
82 #endif
83         ASSERT(m_size > 0);
84
85         if (m_data) {
86                 if (oldSize >= m_size) {
87                         return true;
88                 } else {
89                         delete[] m_data;
90                         m_data = new(std::nothrow) DataT[m_size];
91                         return (m_data != 0);
92                 }
93         } else {
94                 m_data = new(std::nothrow) DataT[m_size];
95                 return (m_data != 0);
96         }
97 }
```

void CSubband::Dequantize (int *quantParam*)

Perform subband dequantization with given quantization parameter. A scalar quantization (with dead-zone) is used. A large quantization value results in strong quantization and therefore in big quality loss.

Parameters:

quantParam	A quantization parameter (larger or equal to 0)

Definition at line 154 of file Subband.cpp.

```
154                                             {
155         if (m_orientation == LL) {
156                 quantParam -= m_level + 1;
157         } else if (m_orientation == HH) {
158                 quantParam -= m_level - 1;
159         } else {
160                 quantParam -= m_level;
161         }
162         if (quantParam > 0) {
163                 for (UINT32 i=0; i < m_size; i++) {
164                         m_data[i] <<= quantParam;
165                 }
166         }
167 }
```

void CSubband::ExtractTile (CEncoder & *encoder*, bool *tile* = `false`, UINT32 *tileX* = `0`, UINT32 *tileY* = `0`)

Extracts a rectangular subregion of this subband. Write wavelet coefficients into buffer. It might throw an **IOException**.

Parameters:

encoder	An encoder instance
tile	True if just a rectangular region is extracted, false if the entire subband is extracted.
tileX	Tile index in x-direction
tileY	Tile index in y-direction

Definition at line 177 of file Subband.cpp.

```
  177
{
  178 #ifdef __PGFROISUPPORT__
  179         if (tile) {
  180                 // compute tile position and size
  181                 UINT32 xPos, yPos, w, h;
  182                 TilePosition(tileX, tileY, xPos, yPos, w, h);
  183
  184                 // write values into buffer using partitiong scheme
  185                 encoder.Partition(this, w, h, xPos + yPos*m_width, m_width);
  186         } else
  187 #endif
  188         {
  189                 tileX; tileY; tile; // prevents from unreferenced formal
parameter warning
  190                 // write values into buffer using partitiong scheme
  191                 encoder.Partition(this, m_width, m_height, 0, m_width);
  192         }
  193 }
```

void CSubband::FreeMemory ()

Delete the memory buffer of this subband.

Definition at line 101 of file Subband.cpp.

```
  101                                 {
  102         if (m_data) {
  103                 delete[] m_data; m_data = 0;
  104         }
  105 }
```

DataT* CSubband::GetBuffer () [inline]

Get a pointer to an array of all wavelet coefficients of this subband.

Returns:

Pointer to array of wavelet coefficients

Definition at line 107 of file Subband.h.

```
  107 { return m_data; }
```

UINT32 CSubband::GetBuffPos () const [inline], [private]

Definition at line 151 of file Subband.h.

```
  151 { return m_dataPos; }
```

DataT CSubband::GetData (UINT32 *pos*) const [inline]

Return wavelet coefficient at given position.

Parameters:

pos	A subband position (>= 0)

Returns:

Wavelet coefficient

Definition at line 113 of file Subband.h.

```
  113 { ASSERT(pos < m_size); return m_data[pos]; }
```

int CSubband::GetHeight () const [inline]

Return height of this subband.

Returns:

Height of this subband (in pixels)

Definition at line 123 of file Subband.h.

```
  123 { return m_height; }
```

int CSubband::GetLevel () const[inline]

Return level of this subband.

Returns:

Level of this subband

Definition at line 118 of file Subband.h.

```
118 { return m_level; }
```

Orientation CSubband::GetOrientation () const[inline]

Return orientation of this subband. LL LH HL HH

Returns:

Orientation of this subband (LL, HL, LH, HH)

Definition at line 135 of file Subband.h.

```
135 { return m_orientation; }
```

int CSubband::GetWidth () const[inline]

Return width of this subband.

Returns:

Width of this subband (in pixels)

Definition at line 128 of file Subband.h.

```
128 { return m_width; }
```

void CSubband::InitBuffPos ()[inline], [private]

Definition at line 162 of file Subband.h.

```
162 { m_dataPos = 0; }
```

void CSubband::Initialize (UINT32 *width*, UINT32 *height*, int *level*, Orientation *orient*)[private]

Definition at line 57 of file Subband.cpp.

```
 57
{
 58         m_width = width;
 59         m_height = height;
 60         m_size = m_width*m_height;
 61         m_level = level;
 62         m_orientation = orient;
 63         m_data = 0;
 64         m_dataPos = 0;
 65 #ifdef __PGFROISUPPORT__
 66         m_ROI.left = 0;
 67         m_ROI.top = 0;
 68         m_ROI.right = m_width;
 69         m_ROI.bottom = m_height;
 70         m_nTiles = 0;
 71 #endif
 72 }
```

void CSubband::PlaceTile (CDecoder & *decoder*, int *quantParam*, bool *tile* = false, UINT32 *tileX* = 0, UINT32 *tileY* = 0)

Decoding and dequantization of this subband. It might throw an **IOException**.

Parameters:

decoder	A decoder instance
quantParam	Dequantization value
tile	True if just a rectangular region is placed, false if the entire subband is placed.

tileX	Tile index in x-direction
tileY	Tile index in y-direction

Definition at line 203 of file Subband.cpp.

```
  203
{
  204         // allocate memory
  205         if (!AllocMemory()) ReturnWithError(InsufficientMemory);
  206
  207         // correct quantParam with normalization factor
  208         if (m_orientation == LL) {
  209                 quantParam -= m_level + 1;
  210         } else if (m_orientation == HH) {
  211                 quantParam -= m_level - 1;
  212         } else {
  213                 quantParam -= m_level;
  214         }
  215         if (quantParam < 0) quantParam = 0;
  216
  217 #ifdef __PGFROISUPPORT__
  218         if (tile) {
  219                 UINT32 xPos, yPos, w, h;
  220
  221                 // compute tile position and size
  222                 TilePosition(tileX, tileY, xPos, yPos, w, h);
  223
  224                 ASSERT(xPos >= m_ROI.left && yPos >= m_ROI.top);
  225                 decoder.Partition(this, quantParam, w, h, (xPos - m_ROI.left)
+ (yPos - m_ROI.top)*BufferWidth(), BufferWidth());
  226         } else
  227 #endif
  228         {
  229                 tileX; tileY; tile; // prevents from unreferenced formal
parameter warning
  230                 // read values into buffer using partitiong scheme
  231                 decoder.Partition(this, quantParam, m_width, m_height, 0,
m_width);
  232         }
  233 }
```

void CSubband::Quantize (int *quantParam*)

Perform subband quantization with given quantization parameter. A scalar quantization (with dead-zone) is used. A large quantization value results in strong quantization and therefore in big quality loss.

Parameters:

quantParam	A quantization parameter (larger or equal to 0)

Definition at line 112 of file Subband.cpp.

```
  112                                     {
  113         if (m_orientation == LL) {
  114                 quantParam -= (m_level + 1);
  115                 // uniform rounding quantization
  116                 if (quantParam > 0) {
  117                         quantParam--;
  118                         for (UINT32 i=0; i < m_size; i++) {
  119                                 if (m_data[i] < 0) {
  120                                         m_data[i] = -(((-m_data[i] >>
quantParam) + 1) >> 1);
  121                                 } else {
  122                                         m_data[i] = ((m_data[i] >> quantParam)
+ 1) >> 1;
  123                                 }
  124                         }
  125                 }
  126         } else {
  127                 if (m_orientation == HH) {
  128                         quantParam -= (m_level - 1);
  129                 } else {
  130                         quantParam -= m_level;
  131                 }
  132                 // uniform deadzone quantization
  133                 if (quantParam > 0) {
```

```
  134                         int threshold = ((1 << quantParam) * 7)/5;      // good
value
  135                         quantParam--;
  136                         for (UINT32 i=0; i < m_size; i++) {
  137                                 if (m_data[i] < -threshold) {
  138                                         m_data[i] = -(((-m_data[i] >>
quantParam) + 1) >> 1);
  139                                 } else if (m_data[i] > threshold) {
  140                                         m_data[i] = ((m_data[i] >> quantParam)
+ 1) >> 1;
  141                                 } else {
  142                                         m_data[i] = 0;
  143                                 }
  144                         }
  145                 }
  146         }
  147 }
```

DataT CSubband::ReadBuffer ()[inline], [private]

Definition at line 149 of file Subband.h.

```
  149 { ASSERT(m_dataPos < m_size); return m_data[m_dataPos++]; }
```

void CSubband::SetBuffer (DataT * *b*)[inline], [private]

Definition at line 148 of file Subband.h.

```
  148 { ASSERT(b); m_data = b; }
```

void CSubband::SetData (UINT32 *pos*, DataT *v*)[inline]

Store wavelet coefficient in subband at given position.

Parameters:

pos	A subband position (>= 0)
v	A wavelet coefficient

Definition at line 102 of file Subband.h.

```
  102 { ASSERT(pos < m_size); m_data[pos] = v; }
```

void CSubband::WriteBuffer (DataT *val*)[inline], [private]

Definition at line 147 of file Subband.h.

```
  147 { ASSERT(m_dataPos < m_size); m_data[m_dataPos++] = val; }
```

Friends And Related Function Documentation

friend class CRoiIndices[friend]

Definition at line 44 of file Subband.h.

friend class CWaveletTransform[friend]

Definition at line 43 of file Subband.h.

Member Data Documentation

DataT* CSubband::m_data[private]

buffer

Definition at line 172 of file Subband.h.

UINT32 CSubband::m_dataPos[private]

current position in m_data

Definition at line 171 of file Subband.h.

UINT32 CSubband::m_height[private]

height in pixels

Definition at line 167 of file Subband.h.

int CSubband::m_level[private]

recursion level

Definition at line 169 of file Subband.h.

Orientation CSubband::m_orientation[private]

0=LL, 1=HL, 2=LH, 3=HH L=lowpass filtered, H=highpass filterd

Definition at line 170 of file Subband.h.

UINT32 CSubband::m_size[private]

size of data buffer m_data

Definition at line 168 of file Subband.h.

UINT32 CSubband::m_width[private]

width in pixels

Definition at line 166 of file Subband.h.

The documentation for this class was generated from the following files:

- **Subband.h**
- **Subband.cpp**

CWaveletTransform Class Reference

PGF wavelet transform.
`#include <WaveletTransform.h>`

Public Member Functions

- **CWaveletTransform** (UINT32 width, UINT32 height, int levels, **DataT** *data=nullptr)
- **~CWaveletTransform** ()
  Destructor.

- OSError **ForwardTransform** (int level, int quant)
- OSError **InverseTransform** (int level, UINT32 *width, UINT32 *height, **DataT** **data)
- **CSubband** * **GetSubband** (int level, **Orientation** orientation)

Private Member Functions

- void **Destroy** ()
- void **InitSubbands** (UINT32 width, UINT32 height, **DataT** *data)
- void **ForwardRow** (**DataT** *buff, UINT32 width)
- void **InverseRow** (**DataT** *buff, UINT32 width)
- void **InterleavedToSubbands** (int destLevel, **DataT** *loRow, **DataT** *hiRow, UINT32 width)
- void **SubbandsToInterleaved** (int srcLevel, **DataT** *loRow, **DataT** *hiRow, UINT32 width)

Private Attributes

- int **m_nLevels**
  number of LL levels: one more than header.nLevels in PGFimage

- **CSubband**(* **m_subband**)[**NSubbands**]
  quadtree of subbands: LL HL LH HH

Friends

- class **CSubband**

Detailed Description

PGF wavelet transform.

PGF wavelet transform class.

Author:
C. Stamm, R. Spuler

Definition at line 55 of file WaveletTransform.h.

Constructor & Destructor Documentation

CWaveletTransform::CWaveletTransform (UINT32 *width*, UINT32 *height*, int *levels*, DataT * *data* = `nullptr`)

Constructor: Constructs a wavelet transform pyramid of given size and levels.

Parameters:

width	The width of the original image (at level 0) in pixels
height	The height of the original image (at level 0) in pixels
levels	The number of levels (>= 0)
data	Input data of subband LL at level 0

Definition at line 40 of file WaveletTransform.cpp.

```
   41 : m_nLevels(levels + 1) // m_nLevels in CPGFImage determines the number of FWT
steps; this.m_nLevels determines the number subband-planes
   42 , m_subband(nullptr)
   43 #ifdef __PGFROISUPPORT__
   44 , m_indices(nullptr)
   45 #endif
   46 {
   47         ASSERT(m_nLevels > 0 && m_nLevels <= MaxLevel + 1);
   48         InitSubbands(width, height, data);
   49 }
```

CWaveletTransform::~CWaveletTransform ()[inline]

Destructor.

Definition at line 69 of file WaveletTransform.h.

```
   69 { Destroy(); }
```

Member Function Documentation

void CWaveletTransform::Destroy ()[inline], [private]

Definition at line 125 of file WaveletTransform.h.

```
  125                         {
  126                 delete[] m_subband; m_subband = nullptr;
  127         #ifdef __PGFROISUPPORT__
  128                 delete[] m_indices; m_indices = nullptr;
  129         #endif
  130         }
```

void CWaveletTransform::ForwardRow (DataT * *buff*, UINT32 *width*)[private]

Definition at line 180 of file WaveletTransform.cpp.

```
  180                                                                 {
  181         if (width >= FilterSize) {
  182                 UINT32 i = 3;
  183
  184                 // left border handling
  185                 src[1] -= ((src[0] + src[2] + c1) >> 1); // high pass
  186                 src[0] += ((src[1] + c1) >> 1); // low pass
  187
  188                 // middle part
  189                 for (; i < width-1; i += 2) {
  190                         src[i] -= ((src[i-1] + src[i+1] + c1) >> 1); // high pass
  191                         src[i-1] += ((src[i-2] + src[i] + c2) >> 2); // low pass
  192                 }
  193
  194                 // right border handling
  195                 if (width & 1) {
  196                         src[i-1] += ((src[i-2] + c1) >> 1); // low pass
  197                 } else {
  198                         src[i] -= src[i-1]; // high pass
  199                         src[i-1] += ((src[i-2] + src[i] + c2) >> 2); // low pass
  200                 }
  201         }
  202 }
```

OSError CWaveletTransform::ForwardTransform (int *level*, int *quant*)

Compute fast forward wavelet transform of LL subband at given level and stores result in all 4 subbands of level + 1.

Parameters:

level	A wavelet transform pyramid level (>= 0 && < Levels())
quant	A quantization value (linear scalar quantization)

Returns:

error in case of a memory allocation problem

Definition at line 88 of file WaveletTransform.cpp.

```
   88                                                                  {
   89         ASSERT(level >= 0 && level < m_nLevels - 1);
   90         const int destLevel = level + 1;
   91         ASSERT(m_subband[destLevel]);
   92         CSubband* srcBand = &m_subband[level][LL]; ASSERT(srcBand);
   93         const UINT32 width = srcBand->GetWidth();
   94         const UINT32 height = srcBand->GetHeight();
   95         DataT* src = srcBand->GetBuffer(); ASSERT(src);
   96         DataT *row0, *row1, *row2, *row3;
   97
   98         // Allocate memory for next transform level
   99         for (int i=0; i < NSubbands; i++) {
  100                 if (!m_subband[destLevel][i].AllocMemory()) return
InsufficientMemory;
  101         }
  102
  103         if (height >= FilterSize) { // changed from FilterSizeH to FilterSize
  104                 // top border handling
  105                 row0 = src; row1 = row0 + width; row2 = row1 + width;
  106                 ForwardRow(row0, width);
  107                 ForwardRow(row1, width);
  108                 ForwardRow(row2, width);
  109                 for (UINT32 k=0; k < width; k++) {
  110                         row1[k] -= ((row0[k] + row2[k] + c1) >> 1); // high pass
  111                         row0[k] += ((row1[k] + c1) >> 1); // low pass
  112                 }
  113                 InterleavedToSubbands(destLevel, row0, row1, width);
  114                 row0 = row1; row1 = row2; row2 += width; row3 = row2 + width;
  115
  116                 // middle part
  117                 for (UINT32 i=3; i < height-1; i += 2) {
  118                         ForwardRow(row2, width);
  119                         ForwardRow(row3, width);
  120                         for (UINT32 k=0; k < width; k++) {
  121                                 row2[k] -= ((row1[k] + row3[k] + c1) >> 1); //
high pass filter
  122                                 row1[k] += ((row0[k] + row2[k] + c2) >> 2); //
low pass filter
  123                         }
  124                         InterleavedToSubbands(destLevel, row1, row2, width);
  125                         row0 = row2; row1 = row3; row2 = row3 + width; row3 =
row2 + width;
  126                 }
  127
  128                 // bottom border handling
  129                 if (height & 1) {
  130                         for (UINT32 k=0; k < width; k++) {
  131                                 row1[k] += ((row0[k] + c1) >> 1); // low pass
  132                         }
  133                         InterleavedToSubbands(destLevel, row1, nullptr,
width);
  134                         row0 = row1; row1 += width;
  135                 } else {
  136                         ForwardRow(row2, width);
  137                         for (UINT32 k=0; k < width; k++) {
  138                                 row2[k] -= row1[k]; // high pass
  139                                 row1[k] += ((row0[k] + row2[k] + c2) >> 2); //
low pass
  140                         }
  141                         InterleavedToSubbands(destLevel, row1, row2, width);
  142                         row0 = row1; row1 = row2; row2 += width;
  143                 }
```

```
  144         } else {
  145                 // if height is too small
  146                 row0 = src; row1 = row0 + width;
  147                 // first part
  148                 for (UINT32 k=0; k < height; k += 2) {
  149                         ForwardRow(row0, width);
  150                         ForwardRow(row1, width);
  151                         InterleavedToSubbands(destLevel, row0, row1, width);
  152                         row0 += width << 1; row1 += width << 1;
  153                 }
  154                 // bottom
  155                 if (height & 1) {
  156                         InterleavedToSubbands(destLevel, row0, nullptr,
width);
  157                 }
  158         }
  159
  160         if (quant > 0) {
  161                 // subband quantization (without LL)
  162                 for (int i=1; i < NSubbands; i++) {
  163                         m_subband[destLevel][i].Quantize(quant);
  164                 }
  165                 // LL subband quantization
  166                 if (destLevel == m_nLevels - 1) {
  167                         m_subband[destLevel][LL].Quantize(quant);
  168                 }
  169         }
  170
  171         // free source band
  172         srcBand->FreeMemory();
  173         return NoError;
  174 }
```

CSubband* CWaveletTransform::GetSubband (int *level*, Orientation *orientation*)[inline]

Get pointer to one of the 4 subband at a given level.

Parameters:

level	A wavelet transform pyramid level (>= 0 && <= Levels())
orientation	A quarter of the subband (LL, LH, HL, HH)

Definition at line 93 of file WaveletTransform.h.

```
   93                                                                      {
   94                 ASSERT(level >= 0 && level < m_nLevels);
   95                 return &m_subband[level][orientation];
   96         }
```

void CWaveletTransform::InitSubbands (UINT32 *width*, UINT32 *height*, DataT * *data*)[private]

Definition at line 53 of file WaveletTransform.cpp.

```
   53
{
   54         if (m_subband) Destroy();
   55
   56         // create subbands
   57         m_subband = new CSubband[m_nLevels][NSubbands];
   58
   59         // init subbands
   60         UINT32 loWidth = width;
   61         UINT32 hiWidth = width;
   62         UINT32 loHeight = height;
   63         UINT32 hiHeight = height;
   64
   65         for (int level = 0; level < m_nLevels; level++) {
   66                 m_subband[level][LL].Initialize(loWidth, loHeight, level, LL);
// LL
   67                 m_subband[level][HL].Initialize(hiWidth, loHeight, level, HL);
//    HL
   68                 m_subband[level][LH].Initialize(loWidth, hiHeight, level, LH);
// LH
```

```
   69                 m_subband[level][HH].Initialize(hiWidth, hiHeight, level, HH);
//    HH
   70                 hiWidth = loWidth >> 1;                 hiHeight = loHeight >>
1;
   71                 loWidth = (loWidth + 1) >> 1;   loHeight = (loHeight + 1) >> 1;
   72         }
   73         if (data) {
   74                 m_subband[0][LL].SetBuffer(data);
   75         }
   76 }
```

void CWaveletTransform::InterleavedToSubbands (int *destLevel*, DataT * *loRow*, DataT * *hiRow*, UINT32 *width*)[private]

Definition at line 206 of file WaveletTransform.cpp.

```
  206
{
  207         const UINT32 wquot = width >> 1;
  208         const bool wrem = (width & 1);
  209         CSubband &ll = m_subband[destLevel][LL], &hl =
m_subband[destLevel][HL];
  210         CSubband &lh = m_subband[destLevel][LH], &hh =
m_subband[destLevel][HH];
  211
  212         if (hiRow) {
  213                 for (UINT32 i=0; i < wquot; i++) {
  214                         ll.WriteBuffer(*loRow++);       // first access, than
increment
  215                         hl.WriteBuffer(*loRow++);
  216                         lh.WriteBuffer(*hiRow++);       // first access, than
increment
  217                         hh.WriteBuffer(*hiRow++);
  218                 }
  219                 if (wrem) {
  220                         ll.WriteBuffer(*loRow);
  221                         lh.WriteBuffer(*hiRow);
  222                 }
  223         } else {
  224                 for (UINT32 i=0; i < wquot; i++) {
  225                         ll.WriteBuffer(*loRow++);       // first access, than
increment
  226                         hl.WriteBuffer(*loRow++);
  227                 }
  228                 if (wrem) ll.WriteBuffer(*loRow);
  229         }
  230 }
```

void CWaveletTransform::InverseRow (DataT * *buff*, UINT32 *width*)[private]

Definition at line 419 of file WaveletTransform.cpp.

```
  419                                                             {
  420         if (width >= FilterSize) {
  421                 UINT32 i = 2;
  422
  423                 // left border handling
  424                 dest[0] -= ((dest[1] + c1) >> 1); // even
  425
  426                 // middle part
  427                 for (; i < width - 1; i += 2) {
  428                         dest[i] -= ((dest[i-1] + dest[i+1] + c2) >> 2); // even
  429                         dest[i-1] += ((dest[i-2] + dest[i] + c1) >> 1); // odd
  430                 }
  431
  432                 // right border handling
  433                 if (width & 1) {
  434                         dest[i] -= ((dest[i-1] + c1) >> 1); // even
  435                         dest[i-1] += ((dest[i-2] + dest[i] + c1) >> 1); // odd
  436                 } else {
  437                         dest[i-1] += dest[i-2]; // odd
  438                 }
  439         }
```

```
  440 }
```

OSError CWaveletTransform::InverseTransform (int *level*, UINT32 * *width*, UINT32 * *height*, DataT ** *data*)

Compute fast inverse wavelet transform of all 4 subbands of given level and stores result in LL subband of level - 1.

Parameters:

level	A wavelet transform pyramid level (> 0 && <= Levels())
width	A pointer to the returned width of subband LL (in pixels)
height	A pointer to the returned height of subband LL (in pixels)
data	A pointer to the returned array of image data

Returns:

error in case of a memory allocation problem

Definition at line 245 of file WaveletTransform.cpp.

```
  245
{
  246         ASSERT(srcLevel > 0 && srcLevel < m_nLevels);
  247         const int destLevel = srcLevel - 1;
  248         ASSERT(m_subband[destLevel]);
  249         CSubband* destBand = &m_subband[destLevel][LL];
  250         UINT32 width, height;
  251
  252         // allocate memory for the results of the inverse transform
  253         if (!destBand->AllocMemory()) return InsufficientMemory;
  254         DataT *origin = destBand->GetBuffer(), *row0, *row1, *row2, *row3;
  255
  256 #ifdef __PGFROISUPPORT__
  257         PGFRect destROI = destBand->GetAlignedROI();
  258         const UINT32 destWidth  = destROI.Width();  // destination buffer width
  259         const UINT32 destHeight = destROI.Height(); // destination buffer height
  260         width = destWidth;              // destination working width
  261         height = destHeight;    // destination working height
  262
  263         // update destination ROI
  264         if (destROI.top & 1) {
  265                 destROI.top++;
  266                 origin += destWidth;
  267                 height--;
  268         }
  269         if (destROI.left & 1) {
  270                 destROI.left++;
  271                 origin++;
  272                 width--;
  273         }
  274
  275         // init source buffer position
  276         const UINT32 leftD = destROI.left >> 1;
  277         const UINT32 left0 = m_subband[srcLevel][LL].GetAlignedROI().left;
  278         const UINT32 left1 = m_subband[srcLevel][HL].GetAlignedROI().left;
  279         const UINT32 topD = destROI.top >> 1;
  280         const UINT32 top0 = m_subband[srcLevel][LL].GetAlignedROI().top;
  281         const UINT32 top1 = m_subband[srcLevel][LH].GetAlignedROI().top;
  282         ASSERT(m_subband[srcLevel][LH].GetAlignedROI().left == left0);
  283         ASSERT(m_subband[srcLevel][HH].GetAlignedROI().left == left1);
  284         ASSERT(m_subband[srcLevel][HL].GetAlignedROI().top == top0);
  285         ASSERT(m_subband[srcLevel][HH].GetAlignedROI().top == top1);
  286
  287         UINT32 srcOffsetX[2] = { 0, 0 };
  288         UINT32 srcOffsetY[2] = { 0, 0 };
  289
  290         if (leftD >= __max(left0, left1)) {
  291                 srcOffsetX[0] = leftD - left0;
  292                 srcOffsetX[1] = leftD - left1;
  293         } else {
  294                 if (left0 <= left1) {
  295                         const UINT32 dx = (left1 - leftD) << 1;
  296                         destROI.left += dx;
  297                         origin += dx;
  298                         width -= dx;
  299                         srcOffsetX[0] = left1 - left0;
```

```
  300                 } else {
  301                         const UINT32 dx = (left0 - leftD) << 1;
  302                         destROI.left += dx;
  303                         origin += dx;
  304                         width -= dx;
  305                         srcOffsetX[1] = left0 - left1;
  306                 }
  307         }
  308         if (topD >= __max(top0, top1)) {
  309                 srcOffsetY[0] = topD - top0;
  310                 srcOffsetY[1] = topD - top1;
  311         } else {
  312                 if (top0 <= top1) {
  313                         const UINT32 dy = (top1 - topD) << 1;
  314                         destROI.top += dy;
  315                         origin += dy*destWidth;
  316                         height -= dy;
  317                         srcOffsetY[0] = top1 - top0;
  318                 } else {
  319                         const UINT32 dy = (top0 - topD) << 1;
  320                         destROI.top += dy;
  321                         origin += dy*destWidth;
  322                         height -= dy;
  323                         srcOffsetY[1] = top0 - top1;
  324                 }
  325         }
  326
  327         m_subband[srcLevel][LL].InitBuffPos(srcOffsetX[0], srcOffsetY[0]);
  328         m_subband[srcLevel][HL].InitBuffPos(srcOffsetX[1], srcOffsetY[0]);
  329         m_subband[srcLevel][LH].InitBuffPos(srcOffsetX[0], srcOffsetY[1]);
  330         m_subband[srcLevel][HH].InitBuffPos(srcOffsetX[1], srcOffsetY[1]);
  331
  332 #else
  333         width = destBand->GetWidth();
  334         height = destBand->GetHeight();
  335         PGFRect destROI(0, 0, width, height);
  336         const UINT32 destWidth = width; // destination buffer width
  337         const UINT32 destHeight = height; // destination buffer height
  338
  339         // init source buffer position
  340         for (int i = 0; i < NSubbands; i++) {
  341                 m_subband[srcLevel][i].InitBuffPos();
  342         }
  343 #endif
  344
  345         if (destHeight >= FilterSize) { // changed from FilterSizeH to FilterSize
  346                 // top border handling
  347                 row0 = origin; row1 = row0 + destWidth;
  348                 SubbandsToInterleaved(srcLevel, row0, row1, width);
  349                 for (UINT32 k = 0; k < width; k++) {
  350                         row0[k] -= ((row1[k] + c1) >> 1); // even
  351                 }
  352
  353                 // middle part
  354                 row2 = row1 + destWidth; row3 = row2 + destWidth;
  355                 for (UINT32 i = destROI.top + 2; i < destROI.bottom - 1; i +=
2) {
  356                         SubbandsToInterleaved(srcLevel, row2, row3, width);
  357                         for (UINT32 k = 0; k < width; k++) {
  358                                 row2[k] -= ((row1[k] + row3[k] + c2) >> 2); //
even
  359                                 row1[k] += ((row0[k] + row2[k] + c1) >> 1); //
odd
  360                         }
  361                         InverseRow(row0, width);
  362                         InverseRow(row1, width);
  363                         row0 = row2; row1 = row3; row2 = row1 + destWidth; row3
= row2 + destWidth;
  364                 }
  365
  366                 // bottom border handling
  367                 if (height & 1) {
  368                         SubbandsToInterleaved(srcLevel, row2, nullptr, width);
  369                         for (UINT32 k = 0; k < width; k++) {
  370                                 row2[k] -= ((row1[k] + c1) >> 1); // even
  371                                 row1[k] += ((row0[k] + row2[k] + c1) >> 1); //
odd
```

```
372                         }
373                         InverseRow(row0, width);
374                         InverseRow(row1, width);
375                         InverseRow(row2, width);
376                         row0 = row1; row1 = row2; row2 += destWidth;
377                 } else {
378                         for (UINT32 k = 0; k < width; k++) {
379                                 row1[k] += row0[k];
380                         }
381                         InverseRow(row0, width);
382                         InverseRow(row1, width);
383                         row0 = row1; row1 += destWidth;
384                 }
385         } else {
386                 // height is too small
387                 row0 = origin; row1 = row0 + destWidth;
388                 // first part
389                 for (UINT32 k = 0; k < height; k += 2) {
390                         SubbandsToInterleaved(srcLevel, row0, row1, width);
391                         InverseRow(row0, width);
392                         InverseRow(row1, width);
393                         row0 += destWidth << 1; row1 += destWidth << 1;
394                 }
395                 // bottom
396                 if (height & 1) {
397                         SubbandsToInterleaved(srcLevel, row0, nullptr, width);
398                         InverseRow(row0, width);
399                 }
400         }
401
402         // free memory of the current srcLevel
403         for (int i = 0; i < NSubbands; i++) {
404                 m_subband[srcLevel][i].FreeMemory();
405         }
406
407         // return info
408         *w = destWidth;
409         *h = destHeight;
410         *data = destBand->GetBuffer();
411         return NoError;
412 }
```

void CWaveletTransform::SubbandsToInterleaved (int *srcLevel*, DataT * *loRow*, DataT * *hiRow*, UINT32 *width*)[private]

Definition at line 444 of file WaveletTransform.cpp.

```
444
{
445         const UINT32 wquot = width >> 1;
446         const bool wrem = (width & 1);
447         CSubband &ll = m_subband[srcLevel][LL], &hl = m_subband[srcLevel][HL];
448         CSubband &lh = m_subband[srcLevel][LH], &hh = m_subband[srcLevel][HH];
449
450         if (hiRow) {
451         #ifdef __PGFROISUPPORT__
452                 const bool storePos = wquot < ll.BufferWidth();
453                 UINT32 llPos = 0, hlPos = 0, lhPos = 0, hhPos = 0;
454
455                 if (storePos) {
456                         // save current src buffer positions
457                         llPos = ll.GetBuffPos();
458                         hlPos = hl.GetBuffPos();
459                         lhPos = lh.GetBuffPos();
460                         hhPos = hh.GetBuffPos();
461                 }
462         #endif
463
464                 for (UINT32 i=0; i < wquot; i++) {
465                         *loRow++ = ll.ReadBuffer();// first access, than
increment
466                         *loRow++ = hl.ReadBuffer();// first access, than
increment
467                         *hiRow++ = lh.ReadBuffer();// first access, than
increment
```

```
  468                         *hiRow++ = hh.ReadBuffer();// first access, than
increment
  469                 }
  470
  471                 if (wrem) {
  472                         *loRow++ = ll.ReadBuffer();// first access, than
increment
  473                         *hiRow++ = lh.ReadBuffer();// first access, than
increment
  474                 }
  475
  476         #ifdef __PGFROISUPPORT__
  477                 if (storePos) {
  478                         // increment src buffer positions
  479                         ll.IncBuffRow(llPos);
  480                         hl.IncBuffRow(hlPos);
  481                         lh.IncBuffRow(lhPos);
  482                         hh.IncBuffRow(hhPos);
  483                 }
  484         #endif
  485
  486         } else {
  487         #ifdef __PGFROISUPPORT__
  488                 const bool storePos = wquot < ll.BufferWidth();
  489                 UINT32 llPos = 0, hlPos = 0;
  490
  491                 if (storePos) {
  492                         // save current src buffer positions
  493                         llPos = ll.GetBuffPos();
  494                         hlPos = hl.GetBuffPos();
  495                 }
  496         #endif
  497
  498                 for (UINT32 i=0; i < wquot; i++) {
  499                         *loRow++ = ll.ReadBuffer();// first access, than
increment
  500                         *loRow++ = hl.ReadBuffer();// first access, than
increment
  501                 }
  502                 if (wrem) *loRow++ = ll.ReadBuffer();
  503
  504         #ifdef __PGFROISUPPORT__
  505                 if (storePos) {
  506                         // increment src buffer positions
  507                         ll.IncBuffRow(llPos);
  508                         hl.IncBuffRow(hlPos);
  509                 }
  510         #endif
  511         }
  512 }
```

Friends And Related Function Documentation

friend class CSubband[friend]

Definition at line 56 of file WaveletTransform.h.

Member Data Documentation

int CWaveletTransform::m_nLevels[private]

number of LL levels: one more than header.nLevels in PGFimage

Definition at line 141 of file WaveletTransform.h.

CSubband(* CWaveletTransform::m_subband)[NSubbands]`[private]`

quadtree of subbands: LL HL LH HH

Definition at line 142 of file WaveletTransform.h.

The documentation for this class was generated from the following files:

- **WaveletTransform.h**
- **WaveletTransform.cpp**

IOException Struct Reference

PGF exception.
`#include <PGFtypes.h>`

Public Member Functions

- **IOException** ()
  Standard constructor.

- **IOException** (OSError err)

Public Attributes

- OSError **error**
  operating system error code

Detailed Description

PGF exception.

PGF I/O exception

Author:
C. Stamm

Definition at line 209 of file PGFtypes.h.

Constructor & Destructor Documentation

IOException::IOException ()[inline]

Standard constructor.

Definition at line 213 of file PGFtypes.h.

```
213 : error(NoError) {}
```

IOException::IOException (OSError *err*)[inline]

Constructor

Parameters:

err	Run-time error

Definition at line 217 of file PGFtypes.h.

```
217 : error(err) {}
```

Member Data Documentation

OSError IOException::error

operating system error code

Definition at line 210 of file PGFtypes.h.

The documentation for this struct was generated from the following file:

- **PGFtypes.h**

PGFHeader Struct Reference

PGF header.
`#include <PGFtypes.h>`

Public Member Functions

- **PGFHeader** ()

Public Attributes

- UINT32 **width**
  image width in pixels

- UINT32 **height**
  image height in pixels

- UINT8 **nLevels**
  number of FWT transforms

- UINT8 **quality**
  quantization parameter: 0=lossless, 4=standard, 6=poor quality

- UINT8 **bpp**
  bits per pixel

- UINT8 **channels**
  number of channels

- UINT8 **mode**
  image mode according to Adobe's image modes

- UINT8 **usedBitsPerChannel**
  number of used bits per channel in 16- and 32-bit per channel modes

- **PGFVersionNumber version**
  codec version number: (since Version 7)

Detailed Description

PGF header.

PGF header contains image information

Author:
C. Stamm

Definition at line 150 of file PGFtypes.h.

Constructor & Destructor Documentation

PGFHeader::PGFHeader ()[inline]

Definition at line 151 of file PGFtypes.h.

```
  151 : width(0), height(0), nLevels(0), quality(0), bpp(0), channels(0),
mode(ImageModeUnknown), usedBitsPerChannel(0), version(0, 0, 0) {}
```

Member Data Documentation

UINT8 PGFHeader::bpp

bits per pixel

Definition at line 156 of file PGFtypes.h.

UINT8 PGFHeader::channels

number of channels

Definition at line 157 of file PGFtypes.h.

UINT32 PGFHeader::height

image height in pixels

Definition at line 153 of file PGFtypes.h.

UINT8 PGFHeader::mode

image mode according to Adobe's image modes

Definition at line 158 of file PGFtypes.h.

UINT8 PGFHeader::nLevels

number of FWT transforms

Definition at line 154 of file PGFtypes.h.

UINT8 PGFHeader::quality

quantization parameter: 0=lossless, 4=standard, 6=poor quality

Definition at line 155 of file PGFtypes.h.

UINT8 PGFHeader::usedBitsPerChannel

number of used bits per channel in 16- and 32-bit per channel modes

Definition at line 159 of file PGFtypes.h.

PGFVersionNumber PGFHeader::version

codec version number: (since Version 7)

Definition at line 160 of file PGFtypes.h.

UINT32 PGFHeader::width

image width in pixels

Definition at line 152 of file PGFtypes.h.

The documentation for this struct was generated from the following file:

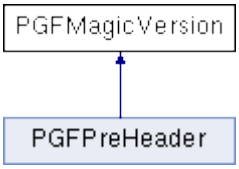
- **PGFtypes.h**

PGFMagicVersion Struct Reference

PGF identification and version.

`#include <PGFtypes.h>`

Inheritance diagram for PGFMagicVersion:



Public Attributes

- char **magic** [3]
  PGF identification = "PGF".

- UINT8 **version**
  PGF version.

Detailed Description

PGF identification and version.

general PGF file structure **PGFPreHeader PGFHeader** [**PGFPostHeader**] LevelLengths Level_n-1 Level_n-2 ... Level_0 **PGFPostHeader** ::= [ColorTable] [UserData] LevelLengths ::= UINT32[nLevels] PGF magic and version (part of PGF pre-header)

Author:

C. Stamm

Definition at line 113 of file PGFtypes.h.

Member Data Documentation

char PGFMagicVersion::magic[3]

PGF identification = "PGF".

Definition at line 114 of file PGFtypes.h.

UINT8 PGFMagicVersion::version

PGF version.

Definition at line 115 of file PGFtypes.h.

The documentation for this struct was generated from the following file:

- **PGFtypes.h**

PGFPostHeader Struct Reference

Optional PGF post-header.
`#include <PGFtypes.h>`

Public Attributes

- RGBQUAD **clut** [**ColorTableLen**]
  color table for indexed color images (optional part of file header)

- UINT8 * **userData**
  user data of size userDataLen (optional part of file header)

- UINT32 **userDataLen**
  user data size in bytes (not part of file header)

- UINT32 **cachedUserDataLen**
  cached user data size in bytes (not part of file header)

Detailed Description

Optional PGF post-header.

PGF post-header is optional. It contains color table and user data

Author:
C. Stamm

Definition at line 168 of file PGFtypes.h.

Member Data Documentation

UINT32 PGFPostHeader::cachedUserDataLen

cached user data size in bytes (not part of file header)

Definition at line 172 of file PGFtypes.h.

RGBQUAD PGFPostHeader::clut[ColorTableLen]

color table for indexed color images (optional part of file header)

Definition at line 169 of file PGFtypes.h.

UINT8* PGFPostHeader::userData

user data of size userDataLen (optional part of file header)

Definition at line 170 of file PGFtypes.h.

UINT32 PGFPostHeader::userDataLen

user data size in bytes (not part of file header)

Definition at line 171 of file PGFtypes.h.

The documentation for this struct was generated from the following file:

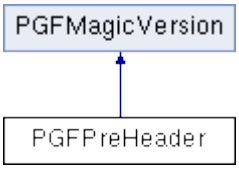
- **PGFtypes.h**

PGFPreHeader Struct Reference

PGF pre-header.

`#include <PGFtypes.h>`

Inheritance diagram for PGFPreHeader:



Public Attributes

- UINT32 **hSize**
  *total size of **PGFHeader**, [ColorTable], and [UserData] in bytes (since Version 6: 4 Bytes)*

- char **magic** [3]
  PGF identification = "PGF".

- UINT8 **version**
  PGF version.

Detailed Description

PGF pre-header.

PGF pre-header defined header length and PGF identification and version

Author:
C. Stamm

Definition at line 123 of file PGFtypes.h.

Member Data Documentation

UINT32 PGFPreHeader::hSize

total size of **PGFHeader**, [ColorTable], and [UserData] in bytes (since Version 6: 4 Bytes)

Definition at line 124 of file PGFtypes.h.

char PGFMagicVersion::magic[3] `[inherited]`

PGF identification = "PGF".

Definition at line 114 of file PGFtypes.h.

UINT8 PGFMagicVersion::version `[inherited]`

PGF version.

Definition at line 115 of file PGFtypes.h.

The documentation for this struct was generated from the following file:

- **PGFtypes.h**

PGFRect Struct Reference

Rectangle.
`#include <PGFtypes.h>`

Public Member Functions

- **PGFRect** ()
  Standard constructor.

- **PGFRect** (UINT32 x, UINT32 y, UINT32 width, UINT32 height)
- UINT32 **Width** () const
- UINT32 **Height** () const
- bool **IsInside** (UINT32 x, UINT32 y) const

Public Attributes

- UINT32 **left**
- UINT32 **top**
- UINT32 **right**
- UINT32 **bottom**

Detailed Description

Rectangle.

Rectangle

Author:
C. Stamm

Definition at line 224 of file PGFtypes.h.

Constructor & Destructor Documentation

PGFRect::PGFRect ()[inline]

Standard constructor.

Definition at line 228 of file PGFtypes.h.

```
228 : left(0), top(0), right(0), bottom(0) {}
```

PGFRect::PGFRect (UINT32 *x*, UINT32 *y*, UINT32 *width*, UINT32 *height*)[inline]

Constructor

Parameters:

x	Left offset
y	Top offset
width	Rectangle width
height	Rectangle height

Definition at line 235 of file PGFtypes.h.

```
235 : left(x), top(y), right(x + width), bottom(y + height) {}
```

Member Function Documentation

UINT32 PGFRect::Height () const[inline]

Returns:

Rectangle height

Definition at line 258 of file PGFtypes.h.

```
258 { return bottom - top; }
```

bool PGFRect::IsInside (UINT32 *x*, UINT32 *y*) const[inline]

Test if point (x,y) is inside this rectangle (inclusive top-left edges, exclusive bottom-right edges)

Parameters:

x	Point coordinate x
y	Point coordinate y

Returns:

True if point (x,y) is inside this rectangle (inclusive top-left edges, exclusive bottom-right edges)

Definition at line 264 of file PGFtypes.h.

```
264 { return (x >= left && x < right && y >= top && y < bottom); }
```

UINT32 PGFRect::Width () const[inline]

Returns:

Rectangle width

Definition at line 255 of file PGFtypes.h.

```
255 { return right - left; }
```

Member Data Documentation

UINT32 PGFRect::bottom

Definition at line 225 of file PGFtypes.h.

UINT32 PGFRect::left

Definition at line 225 of file PGFtypes.h.

UINT32 PGFRect::right

Definition at line 225 of file PGFtypes.h.

UINT32 PGFRect::top

Definition at line 225 of file PGFtypes.h.

The documentation for this struct was generated from the following file:

- **PGFtypes.h**

PGFVersionNumber Struct Reference

version number stored in header since major version 7
`#include <PGFtypes.h>`

Public Member Functions

- **PGFVersionNumber** (UINT8 _major, UINT8 _year, UINT8 _week)

Public Attributes

- UINT16 **major**: 4
  major version number

- UINT16 **year**: 6
  year since 2000 (year 2001 = 1)

- UINT16 **week**: 6
  week number in a year

Detailed Description

version number stored in header since major version 7

Version number since major version 7

Author:
C. Stamm

Definition at line 132 of file PGFtypes.h.

Constructor & Destructor Documentation

PGFVersionNumber::PGFVersionNumber (UINT8 *_major*, UINT8 *_year*, UINT8 *_week*)`[inline]`

Definition at line 133 of file PGFtypes.h.

```
133 : major(_major), year(_year), week(_week) {}
```

Member Data Documentation

UINT16 PGFVersionNumber::major

major version number

Definition at line 140 of file PGFtypes.h.

UINT16 PGFVersionNumber::week

week number in a year

Definition at line 142 of file PGFtypes.h.

UINT16 PGFVersionNumber::year

year since 2000 (year 2001 = 1)

Definition at line 141 of file PGFtypes.h.

The documentation for this struct was generated from the following file:

- **PGFtypes.h**

ROIBlockHeader::RBH Struct Reference

Named ROI block header (part of the union)
`#include <PGFtypes.h>`

Public Attributes

- UINT16 **bufferSize**: **RLblockSizeLen**
  number of uncoded UINT32 values in a block

- UINT16 **tileEnd**: 1
  1: last part of a tile

Detailed Description

Named ROI block header (part of the union)

Definition at line 182 of file PGFtypes.h.

Member Data Documentation

UINT16 ROIBlockHeader::RBH::bufferSize

number of uncoded UINT32 values in a block

Definition at line 187 of file PGFtypes.h.

UINT16 ROIBlockHeader::RBH::tileEnd

1: last part of a tile

Definition at line 188 of file PGFtypes.h.

The documentation for this struct was generated from the following file:

- **PGFtypes.h**

ROIBlockHeader Union Reference

Block header used with ROI coding scheme.
`#include <PGFtypes.h>`

Classes

- struct **RBH**
  Named ROI block header (part of the union)

Public Member Functions

- **ROIBlockHeader** (UINT16 v)
- **ROIBlockHeader** (UINT32 size, bool end)

Public Attributes

- UINT16 **val**
- struct **ROIBlockHeader::RBH rbh**
  ROI block header.

Detailed Description

Block header used with ROI coding scheme.

ROI block header is used with ROI coding scheme. It contains block size and tile end flag

Author:
C. Stamm

Definition at line 179 of file PGFtypes.h.

Constructor & Destructor Documentation

ROIBlockHeader::ROIBlockHeader (UINT16 *v*)[inline]

Constructor

Parameters:

v	Buffer size

Definition at line 195 of file PGFtypes.h.

```
195 { val = v; }
```

ROIBlockHeader::ROIBlockHeader (UINT32 *size*, bool *end*)[inline]

Constructor

Parameters:

size	Buffer size
end	0/1 Flag; 1: last part of a tile

Definition at line 200 of file PGFtypes.h.

```
200 { ASSERT(size < (1 << RLblockSizeLen)); rbh.bufferSize = size; rbh.tileEnd = end;
}
```

Member Data Documentation

struct ROIBlockHeader::RBH ROIBlockHeader::rbh

ROI block header.

UINT16 ROIBlockHeader::val

unstructured union value

Definition at line 180 of file PGFtypes.h.

The documentation for this union was generated from the following file:

- **PGFtypes.h**

File Documentation

BitStream.h File Reference

`#include "PGFtypes.h"`

Macros

- #define **MAKEU64**(a, b) ((UINT64) (((UINT32) (a)) | ((UINT64) ((UINT32) (b))) << 32))
  Make 64 bit unsigned integer from two 32 bit unsigned integers.

Functions

- void **SetBit** (UINT32 *stream, UINT32 pos)
- void **ClearBit** (UINT32 *stream, UINT32 pos)
- bool **GetBit** (UINT32 *stream, UINT32 pos)
- bool **CompareBitBlock** (UINT32 *stream, UINT32 pos, UINT32 k, UINT32 val)
- void **SetValueBlock** (UINT32 *stream, UINT32 pos, UINT32 val, UINT32 k)
- UINT32 **GetValueBlock** (UINT32 *stream, UINT32 pos, UINT32 k)
- void **ClearBitBlock** (UINT32 *stream, UINT32 pos, UINT32 len)
- void **SetBitBlock** (UINT32 *stream, UINT32 pos, UINT32 len)
- UINT32 **SeekBitRange** (UINT32 *stream, UINT32 pos, UINT32 len)
- UINT32 **SeekBit1Range** (UINT32 *stream, UINT32 pos, UINT32 len)
- UINT32 **AlignWordPos** (UINT32 pos)
- UINT32 **NumberOfWords** (UINT32 pos)

Variables

- static const UINT32 **Filled** = 0xFFFFFFFF

Macro Definition Documentation

#define MAKEU64(a, b) ((UINT64) (((UINT32) (a)) | ((UINT64) ((UINT32) (b))) << 32))

Make 64 bit unsigned integer from two 32 bit unsigned integers.

Definition at line 41 of file BitStream.h.

Function Documentation

UINT32 AlignWordPos (UINT32 *pos*)`[inline]`

Compute bit position of the next 32-bit word

Parameters:

pos	current bit stream position

Returns:

bit position of next 32-bit word

Definition at line 328 of file BitStream.h.

```
328                                         {
329 //      return ((pos + WordWidth - 1) >> WordWidthLog) << WordWidthLog;
330         return DWWIDTHBITS(pos);
331 }
```

void ClearBit (UINT32 * *stream*, UINT32 *pos*)[inline]

Set one bit of a bit stream to 0

Parameters:

stream	A bit stream stored in array of unsigned integers
pos	A valid zero-based position in the bit stream

Definition at line 70 of file BitStream.h.

```
  70                                                  {
  71         stream[pos >> WordWidthLog] &= ~(1 << (pos%WordWidth));
  72 }
```

void ClearBitBlock (UINT32 * *stream*, UINT32 *pos*, UINT32 *len*)[inline]

Clear block of size at least len at position pos in stream

Parameters:

stream	A bit stream stored in array of unsigned integers
pos	A valid zero-based position in the bit stream
len	Number of bits set to 0

Definition at line 169 of file BitStream.h.

```
 169                                                                  {
 170         ASSERT(len > 0);
 171         const UINT32 iFirstInt = pos >> WordWidthLog;
 172         const UINT32 iLastInt = (pos + len - 1) >> WordWidthLog;
 173 
 174         const UINT32 startMask = Filled << (pos%WordWidth);
 175 //      const UINT32 endMask=Filled>>(WordWidth-1-((pos+len-1)%WordWidth));
 176 
 177         if (iFirstInt == iLastInt) {
 178                 stream[iFirstInt] &= ~(startMask /*& endMask*/);
 179         } else {
 180                 stream[iFirstInt] &= ~startMask;
 181                 for (UINT32 i = iFirstInt + 1; i <= iLastInt; i++) { // changed
<=
 182                         stream[i] = 0;
 183                 }
 184                 //stream[iLastInt] &= ~endMask;
 185         }
 186 }
```

bool CompareBitBlock (UINT32 * *stream*, UINT32 *pos*, UINT32 *k*, UINT32 *val*)[inline]

Compare k-bit binary representation of stream at position pos with val

Parameters:

stream	A bit stream stored in array of unsigned integers
pos	A valid zero-based position in the bit stream
k	Number of bits to compare
val	Value to compare with

Returns:

true if equal

Definition at line 91 of file BitStream.h.

```
  91 
{
  92         const UINT32 iLoInt = pos >> WordWidthLog;
  93         const UINT32 iHiInt = (pos + k - 1) >> WordWidthLog;
  94         ASSERT(iLoInt <= iHiInt);
  95         const UINT32 mask = (Filled >> (WordWidth - k));
  96 
  97         if (iLoInt == iHiInt) {
  98                 // fits into one integer
  99                 val &= mask;
 100                 val <<= (pos%WordWidth);
 101                 return (stream[iLoInt] & val) == val;
 102         } else {
```

```
  103                 // must be splitted over integer boundary
  104                 UINT64 v1 = MAKEU64(stream[iLoInt], stream[iHiInt]);
  105                 UINT64 v2 = UINT64(val & mask) << (pos%WordWidth);
  106                 return (v1 & v2) == v2;
  107         }
  108 }
```

bool GetBit (UINT32 * *stream*, UINT32 *pos*)[inline]

Return one bit of a bit stream

Parameters:

stream	A bit stream stored in array of unsigned integers
pos	A valid zero-based position in the bit stream

Returns:

bit at position pos of bit stream stream

Definition at line 79 of file BitStream.h.

```
   79                                                  {
   80         return (stream[pos >> WordWidthLog] & (1 << (pos%WordWidth))) > 0;
   81
   82 }
```

UINT32 GetValueBlock (UINT32 * *stream*, UINT32 *pos*, UINT32 *k*)[inline]

Read k-bit number from stream at position pos

Parameters:

stream	A bit stream stored in array of unsigned integers
pos	A valid zero-based position in the bit stream
k	Number of bits to read: 1 <= k <= 32

Definition at line 142 of file BitStream.h.

```
  142                                                                 {
  143         UINT32 count, hiCount;
  144         const UINT32 iLoInt = pos >> WordWidthLog;
// integer of first bit
  145         const UINT32 iHiInt = (pos + k - 1) >> WordWidthLog;            // integer
of last bit
  146         const UINT32 loMask = Filled << (pos%WordWidth);
  147         const UINT32 hiMask = Filled >> (WordWidth - 1 - ((pos + k -
1)%WordWidth));
  148
  149         if (iLoInt == iHiInt) {
  150                 // inside integer boundary
  151                 count = stream[iLoInt] & (loMask & hiMask);
  152                 count >>= pos%WordWidth;
  153         } else {
  154                 // overlapping integer boundary
  155                 count = stream[iLoInt] & loMask;
  156                 count >>= pos%WordWidth;
  157                 hiCount = stream[iHiInt] & hiMask;
  158                 hiCount <<= WordWidth - (pos%WordWidth);
  159                 count |= hiCount;
  160         }
  161         return count;
  162 }
```

UINT32 NumberOfWords (UINT32 *pos*)[inline]

Compute number of the 32-bit words

Parameters:

pos	Current bit stream position

Returns:

Number of 32-bit words

Definition at line 337 of file BitStream.h.

```
  337                                         {
  338         return (pos + WordWidth - 1) >> WordWidthLog;
```

```
339 }
```

UINT32 SeekBit1Range (UINT32 * *stream*, UINT32 *pos*, UINT32 *len*)[inline]

Returns the distance to the next 0 in stream at position pos. If no 0 is found within len bits, then len is returned.

Parameters:

stream	A bit stream stored in array of unsigned integers
pos	A valid zero-based position in the bit stream
len	size of search area (in bits) return The distance to the next 0 in stream at position pos

Definition at line 249 of file BitStream.h.

```
249                                                                     {
250         UINT32 count = 0;
251         UINT32 testMask = 1 << (pos%WordWidth);
252         UINT32* word = stream + (pos >> WordWidthLog);
253
254         while (((*word & testMask) != 0) && (count < len)) {
255                 count++;
256                 testMask <<= 1;
257                 if (!testMask) {
258                         word++; testMask = 1;
259
260                         // fast steps if all bits in a word are one
261                         while ((count + WordWidth <= len) && (*word == Filled))
{
262                                 word++;
263                                 count += WordWidth;
264                         }
265                 }
266         }
267         return count;
268 }
```

UINT32 SeekBitRange (UINT32 * *stream*, UINT32 *pos*, UINT32 *len*)[inline]

Returns the distance to the next 1 in stream at position pos. If no 1 is found within len bits, then len is returned.

Parameters:

stream	A bit stream stored in array of unsigned integers
pos	A valid zero-based position in the bit stream
len	size of search area (in bits) return The distance to the next 1 in stream at position pos

Definition at line 220 of file BitStream.h.

```
220                                                                     {
221         UINT32 count = 0;
222         UINT32 testMask = 1 << (pos%WordWidth);
223         UINT32* word = stream + (pos >> WordWidthLog);
224
225         while (((*word & testMask) == 0) && (count < len)) {
226                 count++;
227                 testMask <<= 1;
228                 if (!testMask) {
229                         word++; testMask = 1;
230
231                         // fast steps if all bits in a word are zero
232                         while ((count + WordWidth <= len) && (*word == 0)) {
233                                 word++;
234                                 count += WordWidth;
235                         }
236                 }
237         }
238
239         return count;
240 }
```

void SetBit (UINT32 * *stream*, UINT32 *pos*)[inline]

Set one bit of a bit stream to 1

Parameters:

stream	A bit stream stored in array of unsigned integers
pos	A valid zero-based position in the bit stream

Definition at line 62 of file BitStream.h.

```
  62                                                  {
  63         stream[pos >> WordWidthLog] |= (1 << (pos%WordWidth));
  64 }
```

void SetBitBlock (UINT32 * *stream*, UINT32 *pos*, UINT32 *len*)[inline]

Set block of size at least len at position pos in stream

Parameters:

stream	A bit stream stored in array of unsigned integers
pos	A valid zero-based position in the bit stream
len	Number of bits set to 1

Definition at line 193 of file BitStream.h.

```
  193                                                                 {
  194         ASSERT(len > 0);
  195
  196         const UINT32 iFirstInt = pos >> WordWidthLog;
  197         const UINT32 iLastInt = (pos + len - 1) >> WordWidthLog;
  198
  199         const UINT32 startMask = Filled << (pos%WordWidth);
  200 //      const UINT32 endMask=Filled>>(WordWidth-1-((pos+len-1)%WordWidth));
  201
  202         if (iFirstInt == iLastInt) {
  203                 stream[iFirstInt] |= (startMask /*& endMask*/);
  204         } else {
  205                 stream[iFirstInt] |= startMask;
  206                 for (UINT32 i = iFirstInt + 1; i <= iLastInt; i++) { // changed
<=
  207                         stream[i] = Filled;
  208                 }
  209                 //stream[iLastInt] &= ~endMask;
  210         }
  211 }
```

void SetValueBlock (UINT32 * *stream*, UINT32 *pos*, UINT32 *val*, UINT32 *k*)[inline]

Store k-bit binary representation of val in stream at position pos

Parameters:

stream	A bit stream stored in array of unsigned integers
pos	A valid zero-based position in the bit stream
val	Value to store in stream at position pos
k	Number of bits of integer representation of val

Definition at line 116 of file BitStream.h.

```
  116
{
  117         const UINT32 offset = pos%WordWidth;
  118         const UINT32 iLoInt = pos >> WordWidthLog;
  119         const UINT32 iHiInt = (pos + k - 1) >> WordWidthLog;
  120         ASSERT(iLoInt <= iHiInt);
  121         const UINT32 loMask = Filled << offset;
  122         const UINT32 hiMask = Filled >> (WordWidth - 1 - ((pos + k -
1)%WordWidth));
  123
  124         if (iLoInt == iHiInt) {
  125                 // fits into one integer
  126                 stream[iLoInt] &= ~(loMask & hiMask); // clear bits
  127                 stream[iLoInt] |= val << offset; // write value
  128         } else {
  129                 // must be splitted over integer boundary
```

```
  130                 stream[iLoInt] &= ~loMask; // clear bits
  131                 stream[iLoInt] |= val << offset; // write lower part of value
  132                 stream[iHiInt] &= ~hiMask; // clear bits
  133                 stream[iHiInt] |= val >> (WordWidth - offset); // write higher
part of value
  134             }
  135 }
```

Variable Documentation

const UINT32 Filled = 0xFFFFFFFF[static]

Definition at line 38 of file BitStream.h.

Decoder.cpp File Reference

PGF decoder class implementation.
`#include "Decoder.h"`

Macros

- #define **CodeBufferBitLen** (**CodeBufferLen***WordWidth**)
  max number of bits in m_codeBuffer

- #define **MaxCodeLen** ((1 << **RLblockSizeLen**) - 1)
  max length of RL encoded block

Detailed Description

PGF decoder class implementation.

Author:
C. Stamm, R. Spuler

Macro Definition Documentation

#define CodeBufferBitLen (CodeBufferLen*WordWidth)

max number of bits in m_codeBuffer
Definition at line 58 of file Decoder.cpp.

#define MaxCodeLen ((1 << RLblockSizeLen) - 1)

max length of RL encoded block
Definition at line 59 of file Decoder.cpp.

Decoder.h File Reference

PGF decoder class.

```
#include "PGFstream.h"
#include "BitStream.h"
#include "Subband.h"
#include "WaveletTransform.h"
```

Classes

- class **CDecoder**
  PGF decoder.
- class **CDecoder::CMacroBlock**
  A macro block is a decoding unit of fixed size (uncoded)

Macros

- #define **BufferLen** (**BufferSize**/**WordWidth**)
  number of words per buffer

- #define **CodeBufferLen** **BufferSize**
  number of words in code buffer (CodeBufferLen > BufferLen)

Detailed Description

PGF decoder class.

Author:
C. Stamm, R. Spuler

Macro Definition Documentation

#define BufferLen (BufferSize/WordWidth)

number of words per buffer

Definition at line 39 of file Decoder.h.

#define CodeBufferLen BufferSize

number of words in code buffer (CodeBufferLen > BufferLen)

Definition at line 40 of file Decoder.h.

Encoder.cpp File Reference

PGF encoder class implementation.
`#include "Encoder.h"`

Macros

- #define **CodeBufferBitLen** (**CodeBufferLen***WordWidth**)
  max number of bits in m_codeBuffer

- #define **MaxCodeLen** ((1 << **RLblockSizeLen**) - 1)
  max length of RL encoded block

Detailed Description

PGF encoder class implementation.

Author:
C. Stamm, R. Spuler

Macro Definition Documentation

#define CodeBufferBitLen (CodeBufferLen*WordWidth)

max number of bits in m_codeBuffer
Definition at line 58 of file Encoder.cpp.

#define MaxCodeLen ((1 << RLblockSizeLen) - 1)

max length of RL encoded block
Definition at line 59 of file Encoder.cpp.

Encoder.h File Reference

PGF encoder class.

```
#include "PGFstream.h"
#include "BitStream.h"
#include "Subband.h"
#include "WaveletTransform.h"
```

Classes

- class **CEncoder**
  PGF encoder.
- class **CEncoder::CMacroBlock**
  A macro block is an encoding unit of fixed size (uncoded)

Macros

- #define **BufferLen** (**BufferSize**/**WordWidth**)
  number of words per buffer

- #define **CodeBufferLen** **BufferSize**
  number of words in code buffer (CodeBufferLen > BufferLen)

Detailed Description

PGF encoder class.

Author:
C. Stamm, R. Spuler

Macro Definition Documentation

#define BufferLen (BufferSize/WordWidth)

number of words per buffer

Definition at line 39 of file Encoder.h.

#define CodeBufferLen BufferSize

number of words in code buffer (CodeBufferLen > BufferLen)

Definition at line 40 of file Encoder.h.

PGFimage.cpp File Reference

PGF image class implementation.

```
#include "PGFimage.h"
#include "Decoder.h"
#include "Encoder.h"
#include "BitStream.h"
#include <cmath>
#include <cstring>
```

Macros

- #define **YUVoffset4** 8
- #define **YUVoffset6** 32
- #define **YUVoffset8** 128
- #define **YUVoffset16** 32768

Detailed Description

PGF image class implementation.

Author:

C. Stamm

Macro Definition Documentation

#define YUVoffset16 32768

Definition at line 39 of file PGFimage.cpp.

#define YUVoffset4 8

Definition at line 36 of file PGFimage.cpp.

#define YUVoffset6 32

Definition at line 37 of file PGFimage.cpp.

#define YUVoffset8 128

Definition at line 38 of file PGFimage.cpp.

PGFimage.h File Reference

PGF image class.
`#include "PGFstream.h"`

Classes

- class **CPGFImage**
  PGF main class.

Detailed Description

PGF image class.

Author:
C. Stamm

PGFplatform.h File Reference

PGF platform specific definitions.

```
#include <cassert>
#include <cmath>
#include <cstdlib>
```

Macros

- #define **__PGFROISUPPORT__**
- #define **__PGF32SUPPORT__**
- #define **WordWidth** 32
  *WordBytes*8.*

- #define **WordWidthLog** 5
  ld of WordWidth

- #define **WordMask** 0xFFFFFFE0
  least WordWidthLog bits are zero

- #define **WordBytes** 4
  sizeof(UINT32)

- #define **WordBytesMask** 0xFFFFFFFC
  least WordBytesLog bits are zero

- #define **WordBytesLog** 2
  ld of WordBytes

- #define **DWWIDTHBITS**(bits) (((bits) + **WordWidth** - 1) & **WordMask**)
  aligns scanline width in bits to DWORD value

- #define **DWWIDTH**(bytes) (((bytes) + **WordBytes** - 1) & **WordBytesMask**)
  aligns scanline width in bytes to DWORD value

- #define **DWWIDTHREST**(bytes) ((**WordBytes** - (bytes)%**WordBytes**)%**WordBytes**)
  DWWIDTH(bytes) *- bytes.*

- #define **__min**(x, y) ((x) <= (y) ? (x) : (y))
- #define **__max**(x, y) ((x) >= (y) ? (x) : (y))
- #define **ImageModeBitmap** 0
- #define **ImageModeGrayScale** 1
- #define **ImageModeIndexedColor** 2
- #define **ImageModeRGBColor** 3
- #define **ImageModeCMYKColor** 4
- #define **ImageModeHSLColor** 5
- #define **ImageModeHSBColor** 6
- #define **ImageModeMultichannel** 7
- #define **ImageModeDuotone** 8
- #define **ImageModeLabColor** 9

- #define **ImageModeGray16** 10
- #define **ImageModeRGB48** 11
- #define **ImageModeLab48** 12
- #define **ImageModeCMYK64** 13
- #define **ImageModeDeepMultichannel** 14
- #define **ImageModeDuotone16** 15
- #define **ImageModeRGBA** 17
- #define **ImageModeGray32** 18
- #define **ImageModeRGB12** 19
- #define **ImageModeRGB16** 20
- #define **ImageModeUnknown** 255
- #define **__VAL**(x) (x)

Detailed Description

PGF platform specific definitions.

Author:
C. Stamm

Macro Definition Documentation

#define __max(x, y) ((x) >= (y) ? (x) : (y))

Definition at line 92 of file PGFplatform.h.

#define __min(x, y) ((x) <= (y) ? (x) : (y))

Definition at line 91 of file PGFplatform.h.

#define __PGF32SUPPORT__

Definition at line 67 of file PGFplatform.h.

#define __PGFROISUPPORT__

Definition at line 60 of file PGFplatform.h.

#define __VAL(x) (x)

Definition at line 603 of file PGFplatform.h.

#define DWWIDTH(bytes) (((bytes) + WordBytes - 1) & WordBytesMask)

aligns scanline width in bytes to DWORD value
Definition at line 84 of file PGFplatform.h.

#define DWWIDTHBITS(bits) (((bits) + WordWidth - 1) & WordMask)

aligns scanline width in bits to DWORD value
Definition at line 83 of file PGFplatform.h.

#define DWWIDTHREST(bytes) ((WordBytes - (bytes)%WordBytes)%WordBytes)

DWWIDTH(bytes) - bytes.
Definition at line 85 of file PGFplatform.h.

#define ImageModeBitmap 0

Definition at line 98 of file PGFplatform.h.

#define ImageModeCMYK64 13

Definition at line 111 of file PGFplatform.h.

#define ImageModeCMYKColor 4

Definition at line 102 of file PGFplatform.h.

#define ImageModeDeepMultichannel 14

Definition at line 112 of file PGFplatform.h.

#define ImageModeDuotone 8

Definition at line 106 of file PGFplatform.h.

#define ImageModeDuotone16 15

Definition at line 113 of file PGFplatform.h.

#define ImageModeGray16 10

Definition at line 108 of file PGFplatform.h.

#define ImageModeGray32 18

Definition at line 116 of file PGFplatform.h.

#define ImageModeGrayScale 1

Definition at line 99 of file PGFplatform.h.

#define ImageModeHSBColor 6

Definition at line 104 of file PGFplatform.h.

#define ImageModeHSLColor 5

Definition at line 103 of file PGFplatform.h.

#define ImageModeIndexedColor 2

Definition at line 100 of file PGFplatform.h.

#define ImageModeLab48 12

Definition at line 110 of file PGFplatform.h.

#define ImageModeLabColor 9

Definition at line 107 of file PGFplatform.h.

#define ImageModeMultichannel 7

Definition at line 105 of file PGFplatform.h.

#define ImageModeRGB12 19

Definition at line 117 of file PGFplatform.h.

#define ImageModeRGB16 20

Definition at line 118 of file PGFplatform.h.

#define ImageModeRGB48 11

Definition at line 109 of file PGFplatform.h.

#define ImageModeRGBA 17

Definition at line 115 of file PGFplatform.h.

#define ImageModeRGBColor 3

Definition at line 101 of file PGFplatform.h.

#define ImageModeUnknown 255

Definition at line 119 of file PGFplatform.h.

#define WordBytes 4

sizeof(UINT32)
Definition at line 76 of file PGFplatform.h.

#define WordBytesLog 2

ld of WordBytes
Definition at line 78 of file PGFplatform.h.

#define WordBytesMask 0xFFFFFFFC

least WordBytesLog bits are zero
Definition at line 77 of file PGFplatform.h.

#define WordMask 0xFFFFFFE0

least WordWidthLog bits are zero
Definition at line 75 of file PGFplatform.h.

#define WordWidth 32

WordBytes*8.
Definition at line 73 of file PGFplatform.h.

#define WordWidthLog 5

ld of WordWidth
Definition at line 74 of file PGFplatform.h.

PGFstream.cpp File Reference

PGF stream class implementation.
`#include "PGFstream.h"`

Detailed Description

PGF stream class implementation.

Author:

C. Stamm

PGFstream.h File Reference

PGF stream class.

```
#include "PGFtypes.h"
#include <new>
```

Classes

- class **CPGFStream**
  Abstract stream base class.
- class **CPGFFileStream**
  File stream class.
- class **CPGFMemoryStream**
  Memory stream class.

Detailed Description

PGF stream class.

Author:

C. Stamm

PGFtypes.h File Reference

PGF definitions.
`#include "PGFplatform.h"`

Classes

- struct **PGFMagicVersion**
  PGF identification and version.
- struct **PGFPreHeader**
  PGF pre-header.
- struct **PGFVersionNumber**
  version number stored in header since major version 7
- struct **PGFHeader**
  PGF header.
- struct **PGFPostHeader**
  Optional PGF post-header.
- union **ROIBlockHeader**
  Block header used with ROI coding scheme.
- struct **ROIBlockHeader::RBH**
  Named ROI block header (part of the union)
- struct **IOException**
  PGF exception.
- struct **PGFRect**
  Rectangle.

Macros

- #define **PGFMajorNumber** 7
- #define **PGFYear** 21
- #define **PGFWeek** 2
- #define **PPCAT_NX**(A, B) A ## B
- #define **PPCAT**(A, B) **PPCAT_NX**(A, B)
- #define **STRINGIZE_NX**(A) #A
- #define **STRINGIZE**(A) **STRINGIZE_NX**(A)
- #define **PGFCodecVersionID** **PPCAT**(**PPCAT**(**PPCAT**(0x0, PGFMajorNumber), PGFYear), PGFWeek)
- #define **PGFCodecVersion** **STRINGIZE**(**PPCAT**(**PPCAT**(**PPCAT**(**PPCAT**(**PGFMajorNumber**, .), **PGFYear**), .), **PGFWeek**))
- #define **PGFMagic** "PGF"
  PGF identification.

- #define **MaxLevel** 30
  maximum number of transform levels

- #define **NSubbands** 4
  number of subbands per level

- #define **MaxChannels** 8
  maximum number of (color) channels

- #define **DownsampleThreshold** 3
  if quality is larger than this threshold than downsampling is used

- #define **ColorTableLen** 256
  size of color lookup table (clut)

- #define **Version2** 2
  *data structure **PGFHeader** of major version 2*

- #define **PGF32** 4
  32 bit values are used -> allows at maximum 30 input bits, otherwise 16 bit values are used -> allows at maximum 14 input bits

- #define **PGFROI** 8
  supports Regions Of Interest

- #define **Version5** 16
  new coding scheme since major version 5

- #define **Version6** 32
  *hSize in **PGFPreHeader** uses 32 bits instead of 16 bits*

- #define **Version7** 64
  *Codec major and minor version number stored in **PGFHeader**.*

- #define **PGFVersion** (**Version2** | **PGF32** | **Version5** | **Version6** | **Version7**)
  current standard version

- #define **BufferSize** 16384
  must be a multiple of WordWidth, BufferSize <= UINT16_MAX

- #define **RLblockSizeLen** 15
  *block size length (< 16): ld(BufferSize) < RLblockSizeLen <= 2*ld(BufferSize)*

- #define **LinBlockSize** 8
  side length of a coefficient block in a HH or LL subband

- #define **InterBlockSize** 4
  side length of a coefficient block in a HL or LH subband

- #define **MaxBitPlanes** 31
  maximum number of bit planes of m_value: 32 minus sign bit

- #define **MaxBitPlanesLog** 5
  number of bits to code the maximum number of bit planes (in 32 or 16 bit mode)

- #define **MaxQuality** **MaxBitPlanes**
  maximum quality

- #define **MagicVersionSize** sizeof(**PGFMagicVersion**)
- #define **PreHeaderSize** sizeof(**PGFPreHeader**)
- #define **HeaderSize** sizeof(**PGFHeader**)
- #define **ColorTableSize** (**ColorTableLen***sizeof(RGBQUAD))
- #define **DataTSize** sizeof(**DataT**)
- #define **MaxUserDataSize** 0x7FFFFFFF

Typedefs

- typedef INT32 **DataT**
- typedef void(* **RefreshCB**) (void *p)

Enumerations

- enum **Orientation** { **LL** = 0, **HL** = 1, **LH** = 2, **HH** = 3 }
- enum **ProgressMode** { **PM_Relative**, **PM_Absolute** }
- enum **UserdataPolicy** { **UP_Skip** = 0, **UP_CachePrefix** = 1, **UP_CacheAll** = 2 }

Detailed Description

PGF definitions.

Author:
C. Stamm

Macro Definition Documentation

#define BufferSize 16384

must be a multiple of WordWidth, BufferSize <= UINT16_MAX
Definition at line 84 of file PGFtypes.h.

#define ColorTableLen 256

size of color lookup table (clut)
Definition at line 66 of file PGFtypes.h.

#define ColorTableSize (ColorTableLen*sizeof(RGBQUAD))

Definition at line 281 of file PGFtypes.h.

#define DataTSize sizeof(DataT)

Definition at line 282 of file PGFtypes.h.

#define DownsampleThreshold 3

if quality is larger than this threshold than downsampling is used
Definition at line 65 of file PGFtypes.h.

#define HeaderSize sizeof(PGFHeader)

Definition at line 280 of file PGFtypes.h.

#define InterBlockSize 4

side length of a coefficient block in a HL or LH subband
Definition at line 87 of file PGFtypes.h.

#define LinBlockSize 8

side length of a coefficient block in a HH or LL subband
Definition at line 86 of file PGFtypes.h.

#define MagicVersionSize sizeof(PGFMagicVersion)

Definition at line 278 of file PGFtypes.h.

#define MaxBitPlanes 31

maximum number of bit planes of m_value: 32 minus sign bit
Definition at line 89 of file PGFtypes.h.

#define MaxBitPlanesLog 5

number of bits to code the maximum number of bit planes (in 32 or 16 bit mode)
Definition at line 93 of file PGFtypes.h.

#define MaxChannels 8

maximum number of (color) channels
Definition at line 64 of file PGFtypes.h.

#define MaxLevel 30

maximum number of transform levels
Definition at line 62 of file PGFtypes.h.

#define MaxQuality MaxBitPlanes

maximum quality
Definition at line 94 of file PGFtypes.h.

#define MaxUserDataSize 0x7FFFFFFF

Definition at line 283 of file PGFtypes.h.

#define NSubbands 4

number of subbands per level

Definition at line 63 of file PGFtypes.h.

#define PGF32 4

32 bit values are used -> allows at maximum 30 input bits, otherwise 16 bit values are used -> allows at maximum 14 input bits

Definition at line 69 of file PGFtypes.h.

#define PGFCodecVersion STRINGIZE(PPCAT(PPCAT(PPCAT(PPCAT(PGFMajorNumber, .), PGFYear), .), PGFWeek))

Definition at line 56 of file PGFtypes.h.

#define PGFCodecVersionID PPCAT(PPCAT(PPCAT(0x0, PGFMajorNumber), PGFYear), PGFWeek)

Definition at line 54 of file PGFtypes.h.

#define PGFMagic "PGF"

PGF identification.

Definition at line 61 of file PGFtypes.h.

#define PGFMajorNumber 7

Definition at line 44 of file PGFtypes.h.

#define PGFROI 8

supports Regions Of Interest

Definition at line 70 of file PGFtypes.h.

#define PGFVersion (Version2 | PGF32 | Version5 | Version6 | Version7)

current standard version

Definition at line 76 of file PGFtypes.h.

#define PGFWeek 2

Definition at line 46 of file PGFtypes.h.

#define PGFYear 21

Definition at line 45 of file PGFtypes.h.

#define PPCAT(A, B) PPCAT_NX(A, B)

Definition at line 49 of file PGFtypes.h.

#define PPCAT_NX(A, B) A ## B

Definition at line 48 of file PGFtypes.h.

#define PreHeaderSize sizeof(PGFPreHeader)

Definition at line 279 of file PGFtypes.h.

#define RLblockSizeLen 15

block size length (< 16): ld(BufferSize) < RLblockSizeLen <= 2*ld(BufferSize)
Definition at line 85 of file PGFtypes.h.

#define STRINGIZE(A) STRINGIZE_NX(A)

Definition at line 51 of file PGFtypes.h.

#define STRINGIZE_NX(A) #A

Definition at line 50 of file PGFtypes.h.

#define Version2 2

data structure **PGFHeader** of major version 2
Definition at line 68 of file PGFtypes.h.

#define Version5 16

new coding scheme since major version 5
Definition at line 71 of file PGFtypes.h.

#define Version6 32

hSize in **PGFPreHeader** uses 32 bits instead of 16 bits
Definition at line 72 of file PGFtypes.h.

#define Version7 64

Codec major and minor version number stored in **PGFHeader**.

Definition at line 73 of file PGFtypes.h.

Typedef Documentation

typedef INT32 DataT

Definition at line 268 of file PGFtypes.h.

typedef void(* RefreshCB) (void *p)

Definition at line 273 of file PGFtypes.h.

Enumeration Type Documentation

enum Orientation

Enumerator:

LL	
HL	
LH	
HH	

Definition at line 99 of file PGFtypes.h.

```
99 { LL = 0, HL = 1, LH = 2, HH = 3 };
```

enum ProgressMode

Enumerator:

PM_Relative	
PM_Absolute	

Definition at line 100 of file PGFtypes.h.

```
100 { PM_Relative, PM_Absolute };
```

enum UserdataPolicy

Enumerator:

UP_Skip	
UP_CachePrefix	
UP_CacheAll	

Definition at line 101 of file PGFtypes.h.

```
101 { UP_Skip = 0, UP_CachePrefix = 1, UP_CacheAll = 2 };
```

Subband.cpp File Reference

PGF wavelet subband class implementation.

```
#include "Subband.h"
#include "Encoder.h"
#include "Decoder.h"
```

Detailed Description

PGF wavelet subband class implementation.

Author:

C. Stamm

Subband.h File Reference

PGF wavelet subband class.
`#include "PGFtypes.h"`

Classes

- class **CSubband**
  Wavelet channel class.

Detailed Description

PGF wavelet subband class.

Author:
C. Stamm

WaveletTransform.cpp File Reference

PGF wavelet transform class implementation.
`#include "WaveletTransform.h"`

Macros

- #define **c1** 1
- #define **c2** 2

Detailed Description

PGF wavelet transform class implementation.

Author:
C. Stamm

Macro Definition Documentation

#define c1 1

Definition at line 31 of file WaveletTransform.cpp.

#define c2 2

Definition at line 32 of file WaveletTransform.cpp.

WaveletTransform.h File Reference

PGF wavelet transform class.

```
#include "PGFtypes.h"
#include "Subband.h"
```

Classes

- class **CWaveletTransform**
  PGF wavelet transform.

Variables

- const UINT32 **FilterSizeL** = 5
  number of coefficients of the low pass filter

- const UINT32 **FilterSizeH** = 3
  number of coefficients of the high pass filter

- const UINT32 **FilterSize** = **__max**(**FilterSizeL**, **FilterSizeH**)

Detailed Description

PGF wavelet transform class.

Author:
C. Stamm

Variable Documentation

const UINT32 FilterSize = __max(FilterSizeL, FilterSizeH)

Definition at line 39 of file WaveletTransform.h.

const UINT32 FilterSizeH = 3

number of coefficients of the high pass filter

Definition at line 38 of file WaveletTransform.h.

const UINT32 FilterSizeL = 5

number of coefficients of the low pass filter

Definition at line 37 of file WaveletTransform.h.

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