



# DicomImageViewer

## Release Notes

Software version: yyyy/mm/dd Maintenance Release

Document version: 2007/01/26

## **Installation.**

The database tables have not changed since the 2006/12/19 Release.

## **Software tool features added and issues resolved.**

Since the 2006/12/19 CT and MR release, the following issues have been fixed and minor features have been added:

- Update validator to warn when coding scheme version is present unexpectedly (000284)
- Update validator to check enhanced contrast/bolus module properly (000285)

Since the 2006/10/22 CT and MR release, the following issues have been fixed and minor features have been added:

- Update validator to use corrections and changes to standard use of Enhanced General Equipment Module (000273)
- Update validator to detect value of zero for critical pixel data and spectroscopy data related attributes (000274), including Number of Frames and Data Point Rows, and update the display code to ignore these when displaying spectra if necessary (000276).
- Update validator to look for common part of Multiframe Functional Groups Module in Spectroscopy instances (000275)

Since the 2005/06/10 CT and MR release, the following issues have been fixed and minor features have been added:

- Update validator to use corrections and changes to standard including removal of Softcopy Presentation LUT Module and addition of Presentation LUT Shape with fixed value of IDENTITY, addition of Respiratory Trigger Macro, addition of Burned In Annotation with fixed value of NO, addition of Lossy Image Compression Method, addition of RR Interval Time Measured to Cardiac Trigger Sequence, use of General Anatomy Mandatory Macro, addition of Irradiation Event Identification Macro, warning about presence of retired Largest Monochrome Pixel Value, and additional values for common Image and Frame Type Value 3.
- Updated data dictionary to include new attributes from recently added supplements and corrections.
- Removed display support for choosing between multiple sets of dimensions based on Dimension Organization UID, since this was based on an incorrect interpretation of the meaning and intent of Dimension Organization UID, i.e., the enhanced objects do not actually support multiple sets of dimensions in the same instance after all, and the Dimension Organization UID is only for correlation of dimensions across different instances
- Additional libraries (jar files) on which application depends are now nested in a directory structure in the distribution and expected to be there in the supplied batch and shell files
- Additional annotation overlaid on periphery of displayed images for lossy compression, diffusion parameters
- Use memory mapped files rather than loading entire large multi-frame grayscale images into memory, which allows display of larger numbers of frames (limited by size of memory mapped file that the host operating system will allow to be mapped)
- Use of multi-cast DNS self-discovery (Bonjour) for DICOM network configuration
- Numerous performance and robustness improvements, enhancements and bug fixes to database and networking code
- Query and retrieve SCP capability, including C-FIND, C-MOVE and C-GET.
- Group lower and uppercase together during sort in query, database, DICOMDIR trees (000226)

- Make pixel value padding values always black when window changed (000206)
- Use Units rather than Rescale Type for single frame PET images (000223)

Since the 2005/03/06 CT and MR release, the following issues have been fixed and minor features have been added:

- The validator incorporates the change to the VR from SS to FD for Tag Spacing Second Dimension (0018,9218) in CP 379 (000179)
- Example of command line IO redirection (for logging) added to windows batch file
- Error in sample properties file corrected
- Correct send failure to systems proposing zero (maximum) length PDU that was introduced recently during performance tuning (000182)
- More verbose descriptions at series and image levels in remote query tree browser
- The validator now complains when it does not recognize the IOD (SOP Class), rather than doing nothing at all (000184)
- The validator was flagging an error when the MR Spectroscopy Frame Type Sequence was in a shared rather than per-frame functional group (000186)
- The validator now checks the Raw Data IOD (000187)
- Update data dictionary to include recent standard extension as well as fix data element number for Parallel Reduction Factor In-plane
- The validator was flagging an error when the Diffusion Gradient Direction Sequence was present, even though it was supposed to be when Diffusion Directionality was DIRECTIONAL (000189)
- Private attribute tags for Dimension Index Pointer were not being displayed in the user interface, and are now displayed with their hexadecimal group and element values (since there is no private data dictionary) (000190)
- The validator now also checks the file meta information (000191)
- The validator now checks the contents of attribute values against the value representation (for attributes in the IOD only, but not additional (standard extended) attributes) (000183)
- The attribute tree in the viewer can now be sorted by name or element number (000194)

Since the 2005/01/19 CT release, the following issues have been fixed and minor features have been added:

- Multiple dimension organizations are supported and are displayed in the image and spectroscopy panel; when sorting of the frames by dimension is selected, use of each of the different organizations can be selected
- The toolkit is now more robust in the face of incorrect encoding of per-frame functional group sequences and tolerates the presence of private creator attributes (that are not SQ VR) in functional group items
- A recently introduced bug that did not apply per frame window width and center has been fixed (000168)
- Double-clicking in the DICOMDIR or database browser will load the image (as if one selected the item first and then pushing the View button) (000084)
- Query will tolerate zero length values in the response that are related to pixel data arrangement (e.g. Number of Frames) (000178)

- Validator accepts contrast/bolus usage to be in shared functional group (CP 503)
- Validator accepts defined term of MIXED for Filter Material in enhanced CT (CP 515)
- Validator accepts rescale type other than HU for localizers (CP 519)

Since the 2004/12/19 CT release, the following issues have been fixed and minor features have been added:

- The viewer now annotates the periphery of the displayed image and shows the patient relative orientation
- Images with PALETTE COLOR photometric interpretation are now supported
- The validator detects unrecognized defined terms for Window Center and Width Explanation

Since the 2004/10/31 CT release, the following issues have been fixed and minor features have been added:

- The validator now spells fluoroscopy correctly
- The 1.7.2 release of hsqldb is supported and various related minor changes to the database code are incorporated
- Handling of pixel padding values for signed images that do not actually have negative pixels is corrected (an earlier CT-related change had caused pixel padding values of zero for MR to appear as very black relative to other pixels for some windows) - left "offending" MR test images with pixel padding value of zero and signed pixel representation but no negative values alone, since potentially legitimate (?) and often seen from one vendor (000152)
- Internal changes to handling of slice thickness and slice interval for localizer posting which affect API but not application behavior (000156)

Since the 2004/04/27 MR Phase 2 release, the following issues have been fixed and minor features have been added:

- The validator now supports the Enhanced CT image object
- The validator aggressively reports attributes with compliant, but unlikely values (e.g., zero) or values that are inconsistent with other related attributes
- The localizer and spectroscopy background refreshes properly when the same localizer is selected as was used with a previous image
- A multiple image importation command has been added (via DICOMDIR or recursive directory search)
- Studies in browser now displayed with and sort by date
- Network code fixed to handle sending and receiving command and data in same PDU (was causing failures with some systems)
- Database now much faster for large numbers of records
- DICOMDIR browser now much faster for very large directories
- DICOMDIR browser now correctly separates studies with same ID but different UID
- JPEG, JPEG-LS and JPEG 2000 Transfer Syntaxes now supported for display from files, if JAI JIIO codecs made available on those platforms that Sun supports (Windows, Linux x86, Solaris)
- Pixel padding for signed CT images with negative values handled correctly

Since the 2003/12/12 interim Phase 2 release, the following issues have been fixed and minor features have been added:

- The image display and spectroscopy tabs are now inactive unless an image or spectrum is loaded, and are mutually exclusive
- The local database browser automatically refreshes at startup and on selection of that tab rather than the user having to manually refresh
- A property has been added to control what compressed transfer syntaxes are proposed during Association Negotiation for the Storage SCU, and bzip2 is not proposed if the codec is not available unless the file is already bzip2'd.

Since the 2003/09/14 interim Phase 2 release, the following issues have been fixed and minor features have been added:

- Fixed incorrect localizer position when frames already scrolled past first frame when localizer selected
- Local database selection above instance level now behaves like DICOMDIR browser (i.e. shows first instance of many)
- Include more attributes in local database, including those describing pixel characteristics as well as source AE title of received objects and transfer syntax
- Dynamically load more classes to reduce dependence on unused jar files (e.g. for compressed transfer syntaxes)
- Include Photometric Interpretation in description of images in browsers, and include Modality in series level description
- Add dictionary for Sup 58 Letter Ballot text CT attributes and SOP Class (not validating these objects yet though)
- Re-factored validator descriptions of MR objects as per Sup 58 Letter Ballot text
- Fixed geometry extraction for single frame image objects (those without Number of Frames)
- Better handling of incorrectly configured network properties in properties file (report error rather than hanging)
- Fixed re-sampling of 16 bit unsigned that was incorrectly sign extending
- Ignore supplied window values if width is zero (and use statistical default instead)
- Fixed networking bug that was ignoring very short PDVs (e.g. empty with last fragment set)
- Organize remote query filter panel attributes by information entity
- Full screen display mode, activated by new Display.FullScreen property
- Logistic curve support for better windowing of projection radiography images
- Uses compressed (bzip2 and deflate) transfer syntaxes on the network, if supported by the other AE
- Dimensions for spectroscopy (frame sort order) now properly supported (were being ignored)

Since the 2003/06/02 interim Phase 2 release, the following issues have been fixed and minor features have been added:

- Don't attempt compact database on close if open failed in the first place
- Lazy instantiation of validator to speed up start up

- Use GeneralPath to draw spectra rather than individual line segments (faster and more reliable on some platforms)
- Add window center/width feedback on image status line
- Add sample offset feedback on spectroscopy status line
- Tidy up statistical default values for window in case of signed images
- Improve handling of signed pixels esp. for < 8 bits, and handle sign on status reporting
- Implement ARTIM association release time out, in order to not close the transport connection immediately after sending an A-RELEASE-RP or A-ABORT PDU (was upsetting GE AW)

Since the 2003/04/04 Post-SPIE fix release, the following features have been added:

- Added the spectroscopy IOD to the validator.
- Added extended description of images to the DICOMDIR and database browsers to make searching for images of a particular type easier – these include image flavor, acquisition contrast, pixel presentation (color), as well as automatic derivation of the image plane and orientation (if shared throughout an image); as before concatenation is indicated by the presence or absence of a concatenation hierarchy
- Added keystrokes to completely expand (or collapse) the selected level of the browser tree: select a node (including the root node) and press alt (or option) and right arrow to expand (or left arrow to collapse); the windows explorer convention of numeric \* and – keys also do the same thing
- Added reference image selection and displayed of selected image for localization of images and spectra; all available images in the same frame of reference are displayed; selecting one triggers automatic posting of the position of the current frame on the selected reference image (by means of intersection of the volume of the frame with the plane of the localizer); for spectra, the volume localization slabs are also shown.
- Added background image selection for spectra; all images in the same frame of reference with the same image orientation direction cosines are made available for selection and display “behind” the displayed spectra – the image with the “closest” image position (patient) (actually distance along the normal to the plane) will be displayed behind the spectra; the selection will be updated as the spectra frames are scrolled; note that the pixel aspect ratio of the displayed background may not be square since the spectra fill the available space and the background is adjusted to fit.

Since the 2003/02/02 test release and SPIE demonstration, the following features have been added:

- Add a “validation” button to the image display tabbed pane which will validate the currently displayed image against the standard IOD for the enhanced MR multi-frame object; other IODs are not yet included, nor is the spectroscopy IOD, even though there is a button for it.
- Split out attributes in shared functional group macros (with an “s.” prefix) to distinguish them from the same attributes occurring at the top-level dataset (e.g. Pixel Presentation) in the attribute table.
- Resolved a bug with resizing windows containing color images on Windows and Linux
- Resolved a bug causing spurious premature association release error messages from the storage SCP
- Improved window resizing responsiveness for very large grayscale image matrices by doing own bilinear interpolation
- Worked around the Sun JIS 0208 bug by using our own code tables when the bug is detected. This has not been done for JIS 0212 yet.

- Additional extended negotiation items were added, including implementation version and class UID, which prevents association establishment from failing when talking to fussy SCPs that require these be present.
- More recent releases of XML and HSQLDB are used

Since the 2002/10/28 test release and RSNA demonstration, the following features have been added:

- Display in status bar of pixel value and real-world value mapping of pixel under cursor
- Support of linear Modality LUT attributes prior to windowing (000032)
- Support of linear VOI LUT attributes as used in new MR object
- Default to actual VOI (window center/width) on per-frame basis (if present) rather than statistical default
- Report file load fail in status bar rather than just console window (000028)
- Blank image display prior to loading to avoid confusion with prior image if loading fails (000028)
- Frame slider now numbered from zero (000030)
- Sorting frames by implicit order after dimension order now fixed (000022)

Since the 2002/09/30 test release that accompanied the first official release of the images, the following features have been added:

- Spectroscopy display
- XML export
- Network query and retrieve, with query filtering
- Cine slider for frame selection
- Sorting of frames by dimensions if present in object
- International character set support in strings

### **CT Images.**

The image collection has changed since 2006/12/19 release.

The image collection has changed since 2005/06/10 release, specifically:

- Images with multiple dimension organizations have been removed, since these were based on an incorrect interpretation of the use of Dimension Organization UID, i.e., the enhanced objects do not actually support multiple dimension organizations in the same instance after all (CT0079, CT0079B\*, CT0079C\*, CT0111)
- Cardiac images now contain RR Interval Time Measured (CT0020, CT0021, CT0110)
- Irradiation Event UID and Burned In Annotation == NO are now included in all images
- Anatomic Region Sequence is no longer empty in the minimal attribute set
- Anatomy codes changed from head to head and neck now that composite codes are defined in SNOMED and DCMR (CT0002, CT0104)
- Anatomy codes changed from pelvis to abdomen and pelvis now that composite codes are defined in SNOMED and DCMR (CT0070, CT0071, CT0072, CT0073, CT0074\_\*, CT0075\_\*, CT0076\_\*, CT0077, CT0078)

The image collection has changed since 2005/01/19 release, specifically:

- Images with multiple dimension organizations have been added (CT0079, CT0111) as well as different dimension organizations across concatenations (CT0079B) and series (CT0079C).
- Stationary cardiac gated images have been added (CT0110 and CT0111).
- A smaller cardiac gated image with real world value mapping has been added (CT0021).
- Contrast/bolus usage is moved to shared functional groups where appropriate (CP 503) (CT0002, CT0003, CT0010, CT0011, CT0012, CT0013, CT0014, CT0015, CT0020, CT0031, CT0032, CT0033, CT0034, CT0035, CT0058, CT0059, CT0060, CT0061, CT0072, CT0073, CT0075\_\*, CT0076\_\*, CT0078, CT0082, CT0083, CT0104, CT0105, CT0106)
- Remove contrast/bolus usage as dimension where now in shared functional group since was always constant single value anyway (CT0072, CT0073)
- Rescale type for localizers changes to US (CP 519) (CT0051, CT0052, CT0055, CT0056, CT0059, CT0081, CT0102)

The image collection has changed since 2004/12/19 release, specifically:

- The left and right laterality values of the MPRs of the IACs were incorrect in CT0053 and CT0062 and have been swapped to their correct values.
- Non-standard defined terms (e.g. "WINDOW1") for Window Center and Width Explanation have been replaced with standard values in CT0001, CT0010, CT0030, CT0090, CT0105, different for each frame and some empty in CT0011 and CT0015, and removed in CT0012, CT0013, CT0014, CT0031, CT0032, CT0033, CT0034, CT0035
- Renumbered frame acquisition number for venous phase in CT0030
- Set Fluoroscopy Flag to YES for CT0090
- Add stack to CT0078
- Add Derivation Image Sequence to CT0031, CT0032, CT0033, CT0034, CT0035
- Replaced private codes with CP570 codes in CT0031, CT0032, CT0033, CT0034, CT0035, CT0053 and CT0062

The image collection has changed since the 2004/10/31 release, specifically:

- A fluoroscopy example, CT0090, has been added, with changing acquisition time, table height and image position.

A set of Enhanced CT images has been added for the 2004/10/31 release.

The features of these images are summarized in the documents ImageFeatures.xml and ImageFeatures.xls.

### **MR Images.**

The image collection has changed since 2006/12/19 release.

The image collection has changed since 2006/10/22 release, specifically:

- The images with minimal attributes now include those attributes required by the Enhanced General Equipment Module (LUMAXT1M, ONECSPIM, ONEMPRSM)

The image collection has changed since 2005/06/10 release, specifically:

- Cardiac images now contain RR Interval Time Measured (BIGHEART, ONEHEART, PCHEART, SMHEART)

- Projection images now have an Image Type value 4 (derivation) of the standard defined term RESAMPLED rather than the non-standard OTHER (ONEBRSRF, RENALAN3)
- Images with mixed contrasts and/or multiple planes now have an Image Type value 3 (flavor) of the standard PARALLEL or NON\_PARALLEL rather than the non-standard OTHER (BRFLAIR, BRMULTI)
- Unrecognized defined terms are no longer used for coil type and a standard type is specified (GFUNCST, PCHEART)
- Non-standard defined terms for Window Center and Width Explanation are removed (MPRSAGBR, ONEBRSRF, ONEMPRC, ONEMPRS)
- Burned In Annotation == NO is now included in all images
- Anatomic Region Sequence is no longer empty in the minimal attribute set (LUMAXT1M, ONECSPIM, ONEMPRSM)

The image collection has changed since 2005/03/06 release, specifically:

- Series description in TIMESP has been shorted (was exceeding allowable length of value representation)
- Deprecated date form in calibration date fixed in BRFLAIR
- Add required Number of Frames attribute to spectroscopy records in DICOMDIR

The image collection has changed since 2005/01/19 release, specifically:

- Contrast/bolus usage is moved to shared functional groups where appropriate (CP 503) (BRFSFLA, BRFSMPRS, BRFSPPGR, BRTUM008, BRTUM009, BRTUM010, BRTUM014, BRTUMMM1, DYNAMAMMO, DYNAMAMSM, MRVPWCB2, MRVPWTTP, MRVPWCBV, MRVPWMTP, MRVPWCBF, ONEABDOM, ONEILSUB, ONEILMIP, ONEPWCBV, PERVASC, RENALAN1, RENALAN2, RENALAN3)

The image collection has changed since the 2004/12/19 release, specifically:

- The real world value scaling for the phase contrast velocity encoding has been corrected to use the scaling factor from the source images to give the correct velocities in cm/second for PCHEART.
- The acquisition time has been corrected for MOVEKNNT, MOVEKNIN, MOVEKNEE and LOCKNEE.

The image collection has changed since the 2004/11/01 release, specifically:

- The Pixel Padding Value attribute has been removed from all images; specifically this was present in some images with a value of zero even though there was no pixel padding actually being performed. This triggered a bug in the viewer when the Pixel Representation was signed, which has been fixed, but which highlighted the inappropriateness of having the Pixel Padding Value attribute present when it was not being used as intended. Note that this problem propagated itself from the source images from one vendor's single frame images. This affects ABDFATDS, ABDFATDY, BRFSFLA, BRFSPPGR, BRTUM001, BRTUM002, BRTUM003, BRTUM004, BRTUM005, BRTUM008, BRTUM009, BRTUM010, BRTUM014, GFUNCST, GFUNCST2, ILIACSM, ILIACSUB, KNEE3D, KNEE3DSM, LIVERAN, LUMAXT1, LUMAXT2, LUMSAGT2, PCHEART, PERVASC, VHMFLGSM, VHMFLGSM.

The image collection has changed since the 2004/04/27 phase 2 release, specifically:

- The Enhanced Contrast Bolus and Contrast Bolus Usage Macro are now used. This affects DYNAMAMMO, DYNAMAMSM, ONEILSUB, ONEILMIP, ILIACSUB, ILIACSM, BRFLAIR, RENALAN1, RENALAN2, RENALAN3, ABDFATDY, BRMULTI, LIVERAN, PERVASC,

BRTUM008, BRTUM009, BRTUM010, BRTUM014, BRTUMSP1\*, BRTUMSP2\*, BRTUMSP3\*, BRTUMMM1, MRVPWTTP, MRVPWCBV, MRVPWMTP, MRVPWCBF, ONEPWCBV, MRVPWCB2, BRFSFLA, BRFSPPGR, BRFSPPC1\*, BRFSMPRS\*.

\*old removed, but enhanced not added for spectroscopy objects

- Replace value four if Image Type for MIPs to use MAXIMUM rather than NONE, and Volumetric Properties to SAMPLED rather than VOLUME. This affects ONEANGIO, ONECWILL, ONEABDOM, ONEILMIP, CARANGIO, RENALAN1, RENALAN2.
- Replace value four if Image Type for Surface and Volume Rendering to use OTHER rather than NONE. There does not seem to be any appropriate standard defined term. This affects ONEBRSRF, RENALAN3.
- Various missing attribute values including echo train lengths and pixel bandwidths have been added.
- Referenced Raw Data Sequence has been added.
- SAR and Gradient Output dummy values of 0 have not been corrected.
- Zero values for technique attributes some MIXED image types are present as a consequence of all per-frame functional group sequence items being required to contain the same functional group macros, and the attributes within those macros being required to be present with values.
- Zero values for phase and frequency encoding steps have been left for metabolite maps; unclear how to deal with this.

The image collection has changed since the 2003/09/14 interim phase 2 release, specifically:

- Replace value four if Image Type for MPRs to use RESAMPLED rather than NONE, as per Supplement 58. This affects BRFSMPRS, MPRSAGBR, ONEMPRC, ONEMPRS and ONEMPRSM.
- Fixed incorrect empty values for Patient ID, Patient Name and Series Number for minimal files – these now appear as patient “Nobody^ NOPATIENTID”, though the attributes in the image files themselves remain zero length.
- Made all dates (e.g. Study Date, Content Date) the release date, in order to make it easier to determine what release of objects is in use.
- Added CP 353 RF and Gradient Echo Train Length attributes
- Changed all spectroscopy objects to use Echo Pulse Sequence of SPIN, not BOTH, and hence removed Spoiling.
- Make GFUNCST2 Pixel Presentation at frame level COLOR, not MIXED.
- Use Sup 58 term POST\_CONTRAST (not POSTCONTRAST) in BRFLAIR.
- Tidied up common frames of reference.
- Added more single voxel single frame spectroscopy objects with different pulse sequences (BRSV002 and BRSV003).
- Added a single voxel multi-frame spectroscopy object with frames varying by time and water suppression method, with use of dimensions, a single stack and temporal positions, with the dimension of Frame Comment used to distinguish the two water suppression methods, since there is no such attribute or functional group (TIMESP).

The image collection has changed since the 2003/06/02 interim phase 2 release, specifically:

- Added some more spectroscopy objects including BRSV001 (Brain^SingleVoxel), and LGMV001 (Leg^MultiVoxel), the latter with a corresponding localizer (LGMV001L), and OHSP1

(Spectroscopy^MultiVoxel) – these all need further work to make the various descriptive attributes sane and sensible, little was available from the source data in this regard; thanks to GE and OHSU.

- Added some metabolite maps derived from the spectroscopy objects, specifically OHSP1MM, OHSP1M1 (Spectroscopy^MultiVoxel), and BRTUMMM1 (Brain^RfrontalTumorWSpectro) – again, descriptors need work; these are encoded as per CP 386 (version 02) and make use of coded metabolite descriptions.
- Fixed BRFSMPRS, BRFSPPGR, BRFSPPC1 and BRFSFLA to share study and FoR UIDs to make localization work.
- New color LUT for GFUNCST2
- Added Image Comments attribute to the spectroscopy DICOMDIR records.

The image collection has changed since the 2003/04/04 Post-SPIE fix release, specifically:

- Added some more spectroscopy objects including single frame with single and multiple voxels, and rename subject “Brain^Tumor” to “Brain^RfrontalTumorWSpectro” accordingly (BRTUM\*).
- Added a sagittal MPR to use as a spectroscopy localizer (BRFSMPRS).
- Make multi-frame spectroscopy object little-endian rather than big-endian (BRFSPPC1).
- Fixed Frame Of Reference UIDs within same studies that should have been the same and were causing localizers or orthogonal images not be available for reference.
- Corrected some incorrect Image Orientation (Patient) values on localizers (e.g. some were not unit vectors in vendor’s source images).
- Fixed incorrect Image Position (Patient) in moving knees (vendor had L-R, A-P sign inverted in source images)
- Removed Largest Monochrome Pixel Value as per CP.

The image collection has changed since the SPIE 2003/02/02 demonstration release, specifically:

- Laterality has been removed as per CP 365
- Velocity encoding example added: PCHEART
- Some reworking of rescale values and real world value mapping
- Proper handling of per-frame empty functional group macros for derived frames of mixed image types, such as CARANGIO, GFUNCTST and ILIACSUB – all per-frame functional groups for all frames should contain the same macros (sequences), even if empty for that frame.
- Number of Frames and Pixel Presentation attributes now included in DICOMDIR
- Missing Cardiac Synchronization Technique attribute added to ONEHEART, BIGHEART and SMHEART
- Examples of bare minimum attributes added ONECSPIM, ONEMPRSM and LUMAXT1M – these really are minimal without even a Patient Name or ID and appear in the DICOMDIR and database browsers as null patients with separate studies each labeled 19000101.
- Gradient Output and Type attributes added to VOLBRAIN, LUMAXT2, KNEE3D and KNEE3DSM.
- ILIACSUB now uses Frame Type rather than Frame Acquisition Number as the 4<sup>th</sup> dimension
- Frame Acquisition Contrast of GFUNCST2 is now UNKNOWN rather than MIXED

- Zero length MR Spatial Saturation Slab added to images with Spatial Presaturation = SLAB but values unknown, e.g. CARANGIO. See CP 364.
- Referenced and/or Source Image Evidence Sequences added (MOVEKNEE, MOVEKNIN, MPRSAGBR)
- Largest Monochrome Pixel Value removed as per CP 367 (GFUNCTST2, MRVPWCB2)
- Invert the color map on MRVPWCB2 (otherwise background shows as white when Largest Monochrome Pixel Value removed – was inadvertently overriding the zero index)

The image collection has changed since the 2002/10/28 test release, specifically:

- ILIACSUB now has 4 dimensions to better interleave mask/dynamic/subtracted display; acquisition date-time for subtraction now set to dynamic rather than mask, and subtracted acquisition number set to 4 (000031)
- TWOBRAIN has been added to test the rescale (modality LUT) attributes being applied before VOI LUT (windowing) – images should appear identical with default values
- Window center/width and rescale slope/intercept values in many images have been cleaned up to better defaults and to cascade correctly
- Some “smaller” versions of very large image sets made so as to fit on single SPIE workshop CD

The image collection has changed since the 2002/09/30 test release, specifically:

- DYNMAMMO has been changed to reorder the frames and dimensions to better demonstrate the new dimension-based frame sorting capability
- A new set of brain tumor images with an accompanying multi-slice multi-voxel spectroscopy instance (BRFSSPC1) has been added to demonstrate the basic spectroscopy display capability
- DICOMDIR has been changed to include spectroscopy directory records as is proposed in a draft change proposal (CP 343), as well as to include Specific Character Set

### Known Issues.

**Network support - testing.** The send, receive, query and retrieve functionality has been tested with various vendor's workstations using older DICOM image objects only, since they do not yet support the Enhanced MR, Spectroscopy and Raw Data objects.

**Network support – multithreading (or lack thereof).** The storage SCP listener is multi-threaded but the send, query and retrieve functions invoked from the GUI are not (yet), which means that the user will not be able to initiate any other interaction until the operation has completed (successfully or not). Furthermore, no timeouts are supported to abort an operation that takes too long.

**Network support – error reporting.** Errors are still logged only to the console and not to the status bar or a dialog box.

**Slow display after window resize.** Scrolling through frames or adjusting the window level and width will be slower if the image display panel is resized to anything other than the initial 512x512 since additional transformations on the pixels are performed to scale to the new window size.

**Large attribute sets may break validator.** A bug is present in the default XSLT processor, which for very large sets of attributes (a few of the images in the test set) causes validation to fail, unless the property is set to force use of the xsltC validator as described in the user manual.

**Tabbed pane and what is the source of attribute and frame descriptions remain obscure.** After the last round of testing the comment was made that the source of what is displayed in the attribute browser and frame panels is confusing, especially when switching between the DICOMDIR browser and images or spectra ... the plan is to blank these at appropriate changes in context and to merge the spectra and image panels but this has not been done yet.

**Imaginary image sample not valid.** The pixel data in the sample imaginary image is meaningless and needs to be replaced or removed.