Status	Final Text
Date of Last Update	2024/03/24
Person Assigned	David Clunie mailto:dclunie@dclunie.com
Submitter Name	David Clunie mailto:dclunie@dclunie.com
Submission Date	2023/07/26

Correction Number CP-2330
Log Summary: Add Spatial Information to Secondary Capture IOD
Name of Standard PS3.3 2024a
Rationale for Correction: CP 600 added the Pixel Measures, Plane Position and Plane Orientation functional group macros and the Frame of Reference Module to the Multi-frame Grayscale and True Color SC objects, for use cases that generate information as a result of processing that is not modality specific and often contains color information, but which to be useful requires preservation of spatial location information in a 3D patient-relative coordinate system. At the time, it was thought that it was not necessary for CP 600 to extend the traditional single-frame SC. It has become common practice to use a Standard Extended form of the traditional single frame Secondary Capture SOP Class in a similar manner to the CP 600 approach, particularly for those applications that create very large individual image frames (e.g., of photographic size), so this CP proposes adding the Image Plane and Frame of Reference Modules to the SC IOD. This provides symmetry with the capabilities in the traditional single frame CT and MR image IODs. Ideally the Frame of Reference Module would be added as conditional upon the Image Plane Module attributes being present, however this might invalidate some existing Standard Extended SOP Class uses. Text is also added to clarify the meaning of the presence of PixelSpacing in this context. Further, since it has proven impractical to actually retire use of the traditional single frame Secondary Capture IOD, the note deprecating it is removed.
Correction Wording:

*Amend DICOM PS3.3 as follows (changes to existing text are bold and **underlined** for additions and **~~struckthrough~~** for removals):*

A.8 Secondary Capture Image IOD

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A.8.1 Secondary Capture Image IOD

A.8.1.1 Secondary Capture Image IOD Description

The Secondary Capture Image IOD specifies single-frame images that are converted from a non-DICOM format to a modality independent DICOM format, without any constraints on pixel data format.

Note

~~The use of this IOD is deprecated, and other more specific SC Image IODs should be used.~~

A.8.1.3 Secondary Capture Image IOD Module Table

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Table A.8-1. Secondary Capture Image IOD Modules

IE	Module	Reference	Usage
Patient	Patient	???	M
	Clinical Trial Subject	???	U
Study	General Study	???	M
	Patient Study	???	U
	Clinical Trial Study	???	U
Series	General Series	???	M
	Clinical Trial Series	???	U
Frame of Reference	**Frame of Reference**	C.7.4.1	**C - Required if Image Position (Patient) (0020,0032) or Image Orientation (Patient) (0020,0037) are present. May be present otherwise.**
	Synchronization	C.7.4.2	**U**
Equipment	General Equipment	???	U
	SC Equipment	C.8.6.1	M
Acquisition	General Acquisition	???	M
Image	General Image	???	M
	General Reference	???	U
	Image Plane	C.7.6.2	**U**
	Image Pixel	???	M
	Device	???	U
	Specimen	???	U
	SC Image	C.8.6.2	M
	Overlay Plane	???	U
	Modality LUT	???	U
	VOI LUT	???	U

IE	Module	Reference	Usage
	ICC Profile	???	U
	SOP Common	???	M
	Common Instance Reference	???	U

Note

If Image Position (Patient) (0020,0032) and Image Orientation (Patient) (0020,0037) (from the Image Plane Module) are present, then the values of Pixel Spacing (0028,0030) (from the Image Plane Module and the Basic Pixel Spacing Calibration Macro included from the SC Image Module) are intended to be used for 3D spatial computations, rather than any values of Nominal Scanned Pixel Spacing (0018,2010) (from the SC Image Module), which may also be present.

A.8.3 Multi-frame Grayscale Byte Secondary Capture Image IOD

A.8.3.3 Multi-frame Grayscale Byte Secondary Capture Image IOD Module Table

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Table A.8-3. Multi-frame Grayscale Byte Secondary Capture Image IOD Modules

IE	Module	Reference	Usage
Patient	Patient	???	M
	Clinical Trial Subject	???	U
Study	General Study	???	M
	Patient Study	???	U
	Clinical Trial Study	???	U
Series	General Series	???	M
	Clinical Trial Series	???	U
Equipment	General Equipment	???	U
	SC Equipment	C.8.6.1	M
Frame of Reference	Frame of Reference	C.7.4.1	C - Required if Pixel Measures or Plane Position (Patient) or Plane Orientation (Patient) Functional Group Macros Present
	Synchronization	C.7.4.2	U
Acquisition	General Acquisition	???	M
Image	General Image	???	M
	General Reference	???	U
	Image Pixel	???	M
	Cine	???	C - Required if Frame Increment Pointer (0028,0009) is Frame Time (0018,1063) or Frame Time Vector (0018,1065)
	Multi-frame	???	M
	Frame Pointers	???	U
	Device	???	U
	Multi-frame Functional Groups	???	U
	Multi-frame Dimension	???	U
	Specimen	???	U
	SC Image	C.8.6.2	U

IE	Module	Reference	Usage
	SC Multi-frame Image	C.8.6.3	M
	SC Multi-frame Vector	???	C - Required if Number of Frames is greater than 1
	VOI LUT	???	C - Required if the VOI LUT stage is not an identity transformation
	SOP Common	???	M
	Common Instance Reference	???	U
	Frame Extraction	???	C - Required if the SOP Instance was created in response to a Frame-Level retrieve request

A.8.3.5 Multi-frame Grayscale Byte Secondary Capture Image Functional Group Macros

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Table A.8-3b. Multi-frame Grayscale Byte Secondary Capture Image Functional Group Macros

Functional Group Macro	Section	Usage
Pixel Measures	C.7.6.16.2.1	C - Required if Plane Position (Patient) or Plane Orientation (Patient) Macros Present
Plane Position (Patient)	C.7.6.16.2.3	C - Required if Pixel Measures or Plane Orientation (Patient) Macros Present
Plane Orientation (Patient)	C.7.6.16.2.4	C - Required if Pixel Measures or Plane Position (Patient) Macros Present

Note

If the Pixel Measures Macro is present, then the values of Pixel Spacing (0028,0030) therein are intended to be used for 3D spatial computations, rather than any values of Nominal Scanned Pixel Spacing (0018,2010) (from the SC Multi-frame Image Module), which may also be present.

A.8.4 Multi-frame Grayscale Word Secondary Capture Image IOD

A.8.4.3 Multi-frame Grayscale Word Secondary Capture Image IOD Module Table

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Table A.8-4. Multi-frame Grayscale Word Secondary Capture Image IOD Modules

IE	Module	Reference	Usage
Patient	Patient	???	M
	Clinical Trial Subject	???	U
Study	General Study	???	M
	Patient Study	???	U
	Clinical Trial Study	???	U
Series	General Series	???	M
	Clinical Trial Series	???	U
Equipment	General Equipment	???	U
	SC Equipment	C.8.6.1	M

IE	Module	Reference	Usage
Frame of Reference	Frame of Reference	C.7.4.1	C - Required if Pixel Measures or Plane Position (Patient) or Plane Orientation (Patient) Functional Group Macros Present
	Synchronization	C.7.4.2	U
Acquisition	General Acquisition	???	M
Image	General Image	???	M
	General Reference	???	U
	Image Pixel	???	M
	Cine	???	C - Required if Frame Increment Pointer (0028,0009) is Frame Time (0018,1063) or Frame Time Vector (0018,1065)
	Multi-frame	???	M
	Frame Pointers	???	U
	Device	???	U
	Multi-frame Functional Groups	???	U
	Multi-frame Dimension	???	U
	Specimen	???	U
	SC Image	C.8.6.2	U
	SC Multi-frame Image	C.8.6.3	M
	SC Multi-frame Vector	???	C - Required if Number of Frames is greater than 1
	VOI LUT	???	C - Required if the VOI LUT stage is not an identity transformation
	SOP Common	???	M
	Common Instance Reference	???	U
	Frame Extraction	???	C - Required if the SOP Instance was created in response to a Frame-Level retrieve request

A.8.4.5 Multi-frame Grayscale Word Secondary Capture Image Functional Group Macros

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Table A.8-4b. Multi-frame Grayscale Word Secondary Capture Image Functional Group Macros

Functional Group Macro	Section	Usage
Pixel Measures	C.7.6.16.2.1	C - Required if Plane Position (Patient) or Plane Orientation (Patient) Macros Present
Plane Position (Patient)	C.7.6.16.2.3	C - Required if Pixel Measures or Plane Orientation (Patient) Macros Present
Plane Orientation (Patient)	C.7.6.16.2.4	C - Required if Pixel Measures or Plane Position (Patient) Macros Present

Note

If the Pixel Measures Macro is present, then the values of Pixel Spacing (0028,0030) therein are intended to be used for 3D spatial computations, rather than any values of Nominal Scanned Pixel Spacing (0018,2010) (from the SC Multi-frame Image Module), which may also be present.

A.8.5 Multi-frame True Color Secondary Capture Image IOD

A.8.5.3 Multi-frame True Color Secondary Capture Image IOD Module Table

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Table A.8-5. Multi-frame True Color Secondary Capture Image IOD Modules

IE	Module	Reference	Usage
Patient	Patient	???	M
	Clinical Trial Subject	???	U
Study	General Study	???	M
	Patient Study	???	U
	Clinical Trial Study	???	U
Series	General Series	???	M
	Clinical Trial Series	???	U
Frame of Reference	Frame of Reference	C.7.4.1	C - Required if Pixel Measures or Plane Position (Patient) or Plane Orientation (Patient) Functional Group Macros Present
	Synchronization	C.7.4.2	U
Equipment	General Equipment	???	U
	SC Equipment	C.8.6.1	M
Acquisition	General Acquisition	???	M
Image	General Image	???	M
	General Reference	???	U
	Image Pixel	???	M
	Cine	???	C - Required if Frame Increment Pointer (0028,0009) is Frame Time (0018,1063) or Frame Time Vector (0018,1065)
	Multi-frame	???	M
	Frame Pointers	???	U
	Device	???	U
	Multi-frame Functional Groups	???	U
	Multi-frame Dimension	???	U
	Specimen	???	U
	SC Image	C.8.6.2	U
	SC Multi-frame Image	C.8.6.3	M
	SC Multi-frame Vector	???	C - Required if Number of Frames is greater than 1
	ICC Profile	???	U
	SOP Common	???	M
	Common Instance Reference	???	U
	Frame Extraction	???	C - Required if the SOP Instance was created in response to a Frame-Level retrieve request

A.8.5.5 Multi-frame True Color Secondary Capture Image Functional Group Macros

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Table A.8-5b. Multi-frame True Color Secondary Capture Image Functional Group Macros

Functional Group Macro	Section	Usage
Pixel Measures	C.7.6.16.2.1	C - Required if Plane Position (Patient) or Plane Orientation (Patient) Macros Present
Plane Position (Patient)	C.7.6.16.2.3	C - Required if Pixel Measures or Plane Orientation (Patient) Macros Present
Plane Orientation (Patient)	C.7.6.16.2.4	C - Required if Pixel Measures or Plane Position (Patient) Macros Present

Note

If the Pixel Measures Macro is present, then the values of Pixel Spacing (0028,0030) therein are intended to be used for 3D spatial computations, rather than any values of Nominal Scanned Pixel Spacing (0018,2010) (from the SC Multi-frame Image Module), which may also be present.

For reference unchanged:

A.3 CT Image IOD

A.3.1 CT Image IOD Description

The Computed Tomography (CT) Image IOD specifies an image that has been created by a computed tomography imaging device.

A.3.2 CT Image IOD Entity-Relationship Model

This IOD uses the E-R Model in ???, with only the Image IE below the Series IE.

A.3.3 CT Image IOD Module Table

Table A.3-1 specifies the Modules of the CT Image IOD.

Table A.3-1. CT Image IOD Modules

IE	Module	Reference	Usage
Patient	Patient	???	M
	Clinical Trial Subject	???	U
Study	General Study	???	M
	Patient Study	???	U
	Clinical Trial Study	???	U
Series	General Series	???	M
	Clinical Trial Series	???	U
Frame of Reference	Frame of Reference	C.7.4.1	M
	Synchronization	C.7.4.2	C - Required if time synchronization was applied.
Equipment	General Equipment	???	M
Acquisition	General Acquisition	???	M
Image	General Image	???	M

IE	Module	Reference	Usage
	General Reference	???	U
	Image Plane	C.7.6.2	M
	Image Pixel	???	M
	Contrast/Bolus	???	C - Required if contrast media was used in this image
	Device	???	U
	Specimen	???	U
	CT Image	???	M
	Multi-energy CT Image	???	C - Required if Multi-energy CT Acquisition (0018,9361) is YES.
	Overlay Plane	???	U
	VOI LUT	???	U
	SOP Common	???	M
	Common Instance Reference	???	U

C.7.4 Common Frame of Reference Information Entity Modules

C.7.4.1 Frame of Reference Module

...

Table C.7-6. Frame of Reference Module Attributes

Attribute Name	Tag	Type	Attribute Description
Frame of Reference UID	(0020,0052)	1	Uniquely identifies the Frame of Reference for a Series. See Section C.7.4.1.1.1 for further explanation.
Position Reference Indicator	(0020,1040)	2	Part of the imaging target used as a reference. See Section C.7.4.1.1.2 for further explanation.

C.7.4.1.1 Frame of Reference Module Attribute Descriptions

C.7.4.1.1.1 Frame of Reference UID

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C.7.4.1.1.2 Position Reference Indicator

...

C.7.4.2 Synchronization Module

...

C.7.6.2 Image Plane Module

...

Table C.7-10. Image Plane Module Attributes

Attribute Name	Tag	Type	Attribute Description
Pixel Spacing	(0028,0030)	1	Physical distance in the patient between the center of each pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing in mm. See Section 10.7.1.3 for further explanation.
Image Orientation (Patient)	(0020,0037)	1	The direction cosines of the first row and the first column with respect to the patient. See Section C.7.6.2.1.1 for further explanation.
Image Position (Patient)	(0020,0032)	1	The x, y, and z coordinates of the upper left hand corner (center of the first voxel transmitted) of the image, in mm. See Section C.7.6.2.1.1 for further explanation.
Slice Thickness	(0018,0050)	2	Nominal slice thickness, in mm.
Spacing Between Slices	(0018,0088)	3	Spacing between adjacent slices, in mm. The spacing is measured from the center-to-center of each slice. If present, shall not be negative, unless specialized to define the meaning of the sign in a specialized IOD, e.g., as in the ???.
Slice Location	(0020,1041)	3	Relative position of the image plane expressed in mm. See Section C.7.6.2.1.2 for further explanation.

C.7.6.2.1 Image Plane Module Attribute Descriptions

C.7.6.2.1.1 Image Position and Image Orientation

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C.7.6.2.1.2 Slice Location

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C.7.6.16.2.1 Pixel Measures Macro

...

Table C.7.6.16-2. Pixel Measures Macro Attributes

Attribute Name	Tag	Type	Attribute Description
Pixel Measures Sequence	(0028,9110)	1	Identifies the physical characteristics of the pixels of this frame. Only a single Item shall be included in this Sequence.

Attribute Name	Tag	Type	Attribute Description
>Pixel Spacing	(0028,0030)	1C	Physical distance in the imaging target (patient, specimen, or phantom) between the centers of each pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing in mm. See Section 10.7.1.3 for further explanation of the value order. **Note** 1. In the case of CT images with an Acquisition Type (0018,9302) of CONSTANT_ANGLE, the pixel spacing is that in a plane normal to the central ray of the diverging X-Ray beam as it passes through the data collection center. 2. In the case of Enhanced RT Image ("1.2.840.10008.5.1.4.1.1.481.23") or Enhanced Continuous RT Image ("1.2.840.10008.5.1.4.1.1.481.24") the pixel spacing is defined on the x/y plane at z = 0 of the Image Receptor Coordinate System. Required if: • Volumetric Properties (0008,9206) is other than DISTORTED or SAMPLED, and Image Type (0008,0008) Value 3 is not LABEL or OVERVIEW, or • SOP Class UID is Segmentation Storage ("1.2.840.10008.5.1.4.1.1.66.4") and Frame of Reference UID (0020,0052) is present, or • SOP Class UID is Ophthalmic Tomography Image Storage ("1.2.840.10008.5.1.4.1.1.77.1.5.4") and Ophthalmic Volumetric Properties Flag (0022,1622) is YES, or • SOP Class UID is Ophthalmic Optical Coherence Tomography B-scan Volume Analysis Storage ("1.2.840.10008.5.1.4.1.1.77.1.5.8"), or • SOP Class UID is Enhanced RT Image ("1.2.840.10008.5.1.4.1.1.481.23"), or • SOP Class UID is Enhanced Continuous RT Image ("1.2.840.10008.5.1.4.1.1.481.24"). May be present otherwise.

Attribute Name	Tag	Type	Attribute Description
>Slice Thickness	(0018,0050)	1C	Nominal reconstructed slice thickness (for tomographic imaging) or depth of field (for optical non-tomographic imaging), in mm. See Section C.7.6.16.2.3.1 for further explanation. **Note** Depth of field may be an extended depth of field created by focus stacking (see ???). Required if: • Volumetric Properties (0008,9206) is VOLUME or SAMPLED, and Image Type (0008,0008) Value 3 is not LABEL or OVERVIEW, or • SOP Class UID is Segmentation Storage ("1.2.840.10008.5.1.4.1.1.66.4") and Frame of Reference UID (0020,0052) is present, or • SOP Class UID is Ophthalmic Tomography Image Storage ("1.2.840.10008.5.1.4.1.1.77.1.5.4") and Ophthalmic Volumetric Properties Flag (0022,1622) is YES, or • SOP Class UID is Ophthalmic Optical Coherence Tomography B-scan Volume Analysis Storage ("1.2.840.10008.5.1.4.1.1.77.1.5.8"). May be present otherwise, if • SOP Class UID is not Enhanced RT Image ("1.2.840.10008.5.1.4.1.1.481.23"), and • SOP Class UID is not Enhanced Continuous RT Image ("1.2.840.10008.5.1.4.1.1.481.24").
>Spacing Between Slices	(0018,0088)	1C	Spacing between adjacent slices, in mm. The spacing is measured from the center-to-center of each slice, and if present shall not be negative. Required if Dimension Organization Type (0020,9311) is TILED_FULL and Total Pixel Matrix Focal Planes (0048,0303) is greater than 1. May be present otherwise. **Note** In the case of Whole Slide Images, Spacing Between Slices (0018,0088) describes the spacing of focal planes separately encoded, and is distinct from Distance Between Focal Planes (0048,0014), which describes in what manner different focal planes were combined into a single encoded plane (focus stacking).

C.7.6.16.2.3 Plane Position (Patient) Macro

...

Table C.7.6.16-4. Plane Position (Patient) Macro Attributes

Attribute Name	Tag	Type	Attribute Description
Plane Position Sequence	(0020,9113)	1	Identifies the position of the plane of this frame. Only a single Item shall be included in this Sequence.

Attribute Name	Tag	Type	Attribute Description
>Image Position (Patient)	(0020,0032)	1C	The x, y, and z coordinates of the upper left hand corner (center of the first voxel transmitted) of the frame, in mm. See Section C.7.6.2.1.1 and Section C.7.6.16.2.3.1 for further explanation. **Note** In the case of CT images with an Acquisition Type (0018,9302) of CONSTANT_ANGLE the image plane is defined to pass through the data collection center and be normal to the central ray of the diverging X-Ray beam. Required if: • Frame Type (0008,9007) Value 1 of this frame is ORIGINAL and Volumetric Properties (0008,9206) of this frame is other than DISTORTED, or • SOP Class UID is Segmentation Storage ("1.2.840.10008.5.1.4.1.1.66.4") and Frame of Reference UID (0020,0052) is present, or • SOP Class UID is Ophthalmic Tomography Image Storage ("1.2.840.10008.5.1.4.1.1.77.1.5.4") and Ophthalmic Volumetric Properties Flag (0022,1622) is YES, or • SOP Class UID is Ophthalmic Optical Coherence Tomography B-scan Volume Analysis Storage ("1.2.840.10008.5.1.4.1.1.77.1.5.8"). May be present otherwise.

C.7.6.16.2.3.1 Position and Orientation for SAMPLED Frames

In the case of Volumetric Properties (0008,9206) having a value of SAMPLED, Image Position (0020,0032), Image Orientation (0020,0037) and Slice Thickness (0018,0050) shall represent the volume from which the frame was derived based on the orientation of the sampling performed.

Note

For example in the case of MAX_IP:

The Image Orientation shall be the direction of the ray used for projection of the center of the plane.

The image position shall contain the x, y, and z coordinates of the intersection of the mid-plane of the sampled volume with the ray used to project the upper left hand corner of the frame.

The Slice Thickness shall contain the distance that the ray used for projection of the center of the plane traveled through the volume.

C.7.6.16.2.4 Plane Orientation (Patient) Macro

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Table C.7.6.16-5. Plane Orientation (Patient) Macro Attributes

Attribute Name	Tag	Type	Attribute Description
Plane Orientation Sequence	(0020,9116)	1	Identifies orientation of the plane of this frame. Only a single Item shall be included in this Sequence.

Attribute Name	Tag	Type	Attribute Description
>Image Orientation (Patient)	(0020,0037)	1C	The direction cosines of the first row and the first column with respect to the patient. See Section C.7.6.2.1.1 and Section C.7.6.16.2.3.1 for further explanation. Required if: • Frame Type (0008,9007) Value 1 of this frame is ORIGINAL and Volumetric Properties (0008,9206) of this frame is other than DISTORTED, or • SOP Class UID is Segmentation Storage ("1.2.840.10008.5.1.4.1.1.66.4") and Frame of Reference UID (0020,0052) is present, or • SOP Class UID is Ophthalmic Tomography Image Storage ("1.2.840.10008.5.1.4.1.1.77.1.5.4") and Ophthalmic Volumetric Properties Flag (0022,1622) is YES, or • SOP Class UID is Ophthalmic Optical Coherence Tomography B-scan Volume Analysis Storage ("1.2.840.10008.5.1.4.1.1.77.1.5.8"), or • SOP Class UID is Enhanced RT Image ("1.2.840.10008.5.1.4.1.1.481.23"), or • SOP Class UID is Enhanced Continuous RT Image ("1.2.840.10008.5.1.4.1.1.481.24"). May be present otherwise.

C.8.6 Secondary Capture Modules

C.8.6.1 SC Equipment Module

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C.8.6.2 SC Image Module

...

Table C.8-25. SC Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
...			
Nominal Scanned Pixel Spacing	(0018,2010)	3	Physical distance on the media being digitized or scanned between the center of each pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing in mm. See Section 10.7.1.3 for further explanation of the value order. Shall be consistent with Pixel Aspect Ratio (0028,0034), if present.
...			...
Include Table 10-10 "Basic Pixel Spacing Calibration Macro Attributes"			
...			

C.8.6.3 SC Multi-frame Image Module

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Table C.8-25b. SC Multi-frame Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
...			
Nominal Scanned Pixel Spacing	(0018,2010)	1C	Physical distance on the media being digitized or scanned between the center of each pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing in mm. See Section 10.7.1.3 for further explanation of the value order. Required if Conversion Type (0008,0064) is DF (Digitized Film). May also be present if Conversion Type (0008,0064) is SD (Scanned Document) or SI (Scanned Image). Shall be consistent with Pixel Aspect Ratio (0028,0034), if present.
Include Table 10-10 "Basic Pixel Spacing Calibration Macro Attributes"			
...			

10.7 Basic Pixel Spacing Calibration Macro

...

Table 10-10. Basic Pixel Spacing Calibration Macro Attributes

Attribute Name	Tag	Type	Attribute Description
Pixel Spacing	(0028,0030)	1C	Physical distance in the Patient between the center of each pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing in mm. See Section 10.7.1.1 and Section 10.7.1.3. Required if the image has been calibrated. May be present otherwise.
Pixel Spacing Calibration Type	(0028,0A02)	3	The type of correction for the effect of geometric magnification or calibration against an object of known size, if any. See Section 10.7.1.2.
Pixel Spacing Calibration Description	(0028,0A04)	1C	A free text description of the type of correction or calibration performed. **Note** 1. In the case of correction, the text might include description of the assumptions made about the body part and geometry and depth within the Patient. 2. in the case of calibration, the text might include a description of the fiducial and where it is located (e.g., "XYZ device applied to the skin over the greater trochanter"). 3. Though it is not required, the ??? may be used to describe the specific characteristics and size of the calibration device. Required if Pixel Spacing Calibration Type (0028,0A02) is present.

10.7.1 Basic Pixel Spacing Calibration Macro Attribute Descriptions

10.7.1.1 Pixel Spacing

Pixel Spacing (0028,0030) specifies the physical distance in the Patient between the center of each pixel.

If Pixel Spacing (0028,0030) is present and the image has not been calibrated to correct for the effect of geometric magnification, the values of this Attribute shall be the same as in Imager Pixel Spacing (0018,1164) or Nominal Scanned Pixel Spacing (0018,2010), if either of those Attributes are present.

If Pixel Spacing (0028,0030) is present and the values are different from those in Imager Pixel Spacing (0018,1164) or Nominal Scanned Pixel Spacing (0018,2010), then the image has been corrected for known or assumed geometric magnification or calibrated with respect to some object of known size at known depth within the Patient.

If Pixel Spacing Calibration Type (0028,0A02) and Imager Pixel Spacing (0018,1164) and Nominal Scanned Pixel Spacing (0018,2010) are absent, then it cannot be determined whether or not correction or calibration have been performed.

Note

1. Imager Pixel Spacing (0018,1164) is a required Attribute in DX family IODs.

2. Nominal Scanned Pixel Spacing (0018,2010) is a required Attribute in Multi-frame SC family IODs

10.7.1.2 Pixel Spacing Calibration Type

The Pixel Spacing Calibration Type (0028,0A02) Attribute specifies the type of correction for the effect of geometric magnification or calibration against an object of known size, if any.

Enumerated Values:

GEOMETRY The Pixel Spacing (0028,0030) values account for assumed or known geometric magnification effects and correspond to some unspecified depth within the Patient; the Pixel Spacing (0028,0030) values may thus be used for measurements of objects located close to the central ray and at the same depth.

FIDUCIAL The Pixel Spacing (0028,0030) values have been calibrated by the operator or image processing software by measurement of an object (fiducial) that is visible in the pixel data and is of known size and is located close to the central ray; the Pixel Spacing (0028,0030) values may thus be used for measurements of objects located close to the central ray and located at the same depth within the Patient as the fiducial.

10.7.1.3 Pixel Spacing Value Order and Valid Values

...