Status	JLetter Ballot
Date of Last Update	2016/01/18
Person Assigned	David Clunie mailto:dclunie@dclunie.com
Submitter Name	Jörg Riesmeier mailto:mail@jriesmeier.com
Submission Date	2015/08/21

Correction Number CP-1526
Log Summary: Correct order of reference to pixel spacing values in SR Image Library
Name of Standard PS3.16
Rationale for Correction: Sup 50 (Mammo CAD) introduced the concept of an Image Library, which contains descriptions of relevant Attributes of images extracted from the images. This included pixel spacing information, which in images is contained in a single multi-valued Attribute, whereas in SR, spacing is split into separate horizontal and vertical content items. The concept of an Image Library has been reused in other CAD and measurement applications, and the same concepts used in other templates. In specifying the source of which value was horizontal and which vertical when copying into the separate concepts, the order was specified opposite that of the PS3.3 definition. CP 626 was intended to clarify once and for all the (not terribly clear) PS3.3 Attribute description, which is "specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing", but only addressed the description in PS3.3. CP 626 uses the same words as the names of the SR concepts ("horizontal spacing" and "vertical spacing"). In practice, pixels are almost always square, so no issue is encountered in the installed base when using the values (e.g., for measurements), but the order in PS3.16 should be corrected.
Correction Wording:

Amend PS 3.16 to correct order of reference to spacing values

TID 1603 Image Library Entry Descriptors for Projection Radiography

...

Table TID 1603. Image Library Entry Descriptors for Projection Radiography

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
...	...	...	...	...	...	...	...	...
5		HAS ACQ CONTEXT	NUM	EV (111026, DCM, "Horizontal Pixel Spacing")	1	U		UNITS = EV (mm, UCUM, "millimeter")
6		HAS ACQ CONTEXT	NUM	EV (111066, DCM, "Vertical Pixel Spacing")	1	U		UNITS = EV (mm, UCUM, "millimeter")
...	...	...	...	...	...	...	...	...

Content Item Descriptions

...	...
Horizontal Imager Pixel Spacing	The ~~**row (first)**~~ **second** component of Imager Pixel Spacing (0018,1164) in the Image IOD. See Section C.8.11.4 “DX Detector Module”.
Vertical Imager Pixel Spacing	The ~~**column (second)**~~ **first** component of Imager Pixel Spacing (0018,1164) in the Image IOD. See Section C.8.11.4 “DX Detector Module”.

TID 1604 Image Library Entry Descriptors for Cross-Sectional Modalities

...

Table TID 1604. Image Library Entry Descriptors for Cross-Sectional Modalities

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS ACQ CONTEXT	NUM	EV (111026, DCM, "Horizontal Pixel Spacing")	1	U		UNITS = EV (mm, UCUM, "millimeter")
2		HAS ACQ CONTEXT	NUM	EV (111066, DCM, "Vertical Pixel Spacing")	1	U		UNITS = EV (mm, UCUM, "millimeter")
...	...	...	...	...	...	...	...	...

Content Item Descriptions

Horizontal Imager Pixel Spacing	The ~~**row (first)**~~ **second** component of Pixel Spacing (0028,0030) in the Image IOD. See Section 10.7.1.1 “Pixel Spacing” and Section C.7.6.2 “Image Plane Module”.
Vertical Imager Pixel Spacing	The ~~**column (second)**~~ **first** component of Pixel Spacing (0028,0030) in the Image IOD. See Section 10.7.1.1 “Pixel Spacing” and Section C.7.6.2 “Image Plane Module”.

TID 3205 Calibration

...

Table TID 3205. Calibration

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
...	...	...	...	...	...	...	...	...
9	>	CONTAINS	INCLUDE	DTID 300 "Measurement"	1	M		$Measurement = EV (111026, DCM, "Horizontal Pixel Spacing") $Unit = DT (mm/{pixel}, UCUM, "mm/pixel") $ImagePurpose = EV (121112, DCM, "Source of Measurement")
10	>	CONTAINS	INCLUDE	DTID 300 "Measurement"	1	M		$Measurement = EV (111066, DCM, "Vertical Pixel Spacing") $Unit = DT (mm/{pixel}, UCUM, "mm/pixel") $ImagePurpose = EV (121112, DCM, "Source of Measurement")
...	...	...	...	...	...	...	...	...

Content Item Descriptions

...	...
Row 9, 10	Spacing in the patient body. Point to a single frame containing the image used for calibration if applicable, the actual measurements may be indicated by a SCOORD (see TID 320 "Image or Spatial Coordinates", row 3)
...	...

TID 4020 CAD Image Library Entry

...

Table TID 4020. CAD Image Library Entry

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
...	...	...	...	...	...	...	...	...
11	>	HAS ACQ CONTEXT	NUM	EV (111026, DCM, "Horizontal Pixel Spacing")	1	MC	Shall be present if (0018,1164) or (0028,0030) is in the Image Instance	UNITS = EV (um, UCUM, "micrometer") UNITS = EV (mm, UCUM, "millimeter")
12	>	HAS ACQ CONTEXT	NUM	EV (111066, DCM, "Vertical Pixel Spacing")	1	MC	Shall be present if (0018,1164) or (0028,0030) is in the Image Instance	UNITS = EV (um, UCUM, "micrometer") UNITS = EV (mm, UCUM, "millimeter")
...	...	...	...	...	...	...	...	...

Content Item Descriptions

...	...

Horizontal Imager Pixel Spacing	The ~~**row (first)**~~ **second** component of Imager Pixel Spacing (0018,1164) in the Image IOD. See Section C.8.11.4.
Vertical Imager Pixel Spacing	The ~~**column (second)**~~ **first** component of Imager Pixel Spacing (0018,1164) in the Image IOD. See Section C.8.11.4.

TID 4122 CAD Common Image Properties Entry

...

Table TID 4122. CAD Common Image Properties Entry

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
...	...	...	...	...	...	...	...	...
7	>	CONTAINS	NUM	EV (111026, DCM, "Horizontal Pixel Spacing")	1	M		Shall be taken from value 1 of Pixel Spacing (0028,0030) in the Image Instances. UNITS = EV (mm/{pixel}, UCUM, "millimeters per pixel")
8	>	CONTAINS	NUM	EV (111066, DCM, "Vertical Pixel Spacing")	1	M		Shall be taken from value 2 of Pixel Spacing (0028,0030) in the Image Instances. UNITS = EV (mm/{pixel}, UCUM, "millimeters per pixel")
...	...	...	...	...	...	...	...	...

TID 7000 Implantation Plan

...

Table TID 7000. Implantation Plan

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
...	...	...	...	...	...	...	...	...
31	>>>	HAS PROPERTIES	NUM	EV (111026, DCM, "Horizontal Pixel Spacing")	1	M		UNITS = EV (mm/{pixel}, UCUM, "mm/pixel")
32	>>>	HAS PROPERTIES	NUM	EV (111026, DCM, "Vertical Pixel Spacing")	1	M		UNITS = EV (mm/{pixel}, UCUM, "mm/pixel")
...	...	...	...	...	...	...	...	...

Content Item Descriptions

...	...
Row 31	Defines the calibrated Horizontal Pixel Spacing that was used by the planning application, which may be different from the spacing encoded in the referenced Image SOP Instance.
Row 32	Defines the calibrated Vertical Pixel Spacing that was used by the planning application, which may be different from the spacing encoded in the referenced Image SOP Instance.
...	...

For reference DICOM PS 3.3 pixel spacing description:

10.7 Basic Pixel Spacing Calibration Macro

Table 10-10 defines the Attributes for the 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.
...	...	...	...

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.

...

10.7.1.3 Pixel Spacing Value Order and Valid Values

All pixel spacing related attributes are encoded as the physical distance between the centers of each two-dimensional pixel, specified by two numeric values.

The first value is the row spacing in mm, that is the spacing between the centers of adjacent rows, or vertical spacing.

The second value is the column spacing in mm, that is the spacing between the centers of adjacent columns, or horizontal spacing.

To illustrate, consider the example shown in Figure 10.7.1.3-1.

Figure 10.7.1.3-1. Example of Pixel Spacing Value Order

Pixel Spacing = Row Spacing \ Column Spacing = 0.30\0.25.

All pixel spacing related attributes shall have positive non-zero values, except when there is only a single row or column or pixel of data present, in which case the corresponding value may be zero.

Note

A single row or column or "pixel" may occur in MR Spectroscopy instances.

This description applies to:

- Pixel Spacing (0028,0030)
- Imager Pixel Spacing (0018,1164)
- Nominal Scanned Pixel Spacing (0018,2010)
- Image Plane Pixel Spacing (3002,0011)
- Compensator Pixel Spacing (300A,00E9)
- Detector Element Spacing (0018,7022)

- Presentation Pixel Spacing (0070,0101)
- Printer Pixel Spacing (2010,0376)
- Object Pixel Spacing in Center of Beam (0018,9404)

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.
...	...	...	...

C.8.11.4 DX Detector Module

Table C.8-71 contains IOD Attributes that describe a DX detector.

Table C.8-71. DX Detector Module Attributes

Attribute Name	Tag	Type	Attribute Description
...	...	...	...
Imager Pixel Spacing	(0018,1164)	1	Physical distance measured at the front plane of the detector housing between the center of each image pixel specified by a numeric pair - row spacing value(delimiter) column spacing value in mm. See Section 10.7.1.3 for further explanation of the value order. The value of this attribute shall never be adjusted to account for correction for the effect of geometric magnification or calibration against an object of known size; Pixel Spacing (0028,0030) is specified for that purpose.
...	...	...	...

For reference DICOM PS3.16 concept definitions:

Table D-1. DICOM Controlled Terminology Definitions

Code Value	Code Meaning	Definition	Notes
111026	Horizontal Pixel Spacing	For projection radiography, the horizontal physical distance measured at the front plane of an Image Receptor housing between the center of each pixel **(spacing between the centers of adjacent columns)**. For tomographic images, the horizontal physical distance in the patient between the center of each pixel.	
111066	Vertical Pixel Spacing	For projection radiography, the vertical physical distance measured at the front plane of an Image Receptor housing between the center of each pixel **(spacing between the centers of adjacent rows)**. For tomographic images, the vertical physical distance in the patient between the center of each pixel.	