

DICOM Correction Proposal

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Correction Number	CP-1337
Log Summary: Add Isocenter Position to MR/PET/Enhanced CT/MR/PET and RT Equipment Correlation to Enhanced CT	
Name of Standard	PS 3.3 2013
<p>Rationale for Correction:</p> <p>CP 1205 added optional Isocenter Position and the RT Equipment Correlation to the legacy CT Image IOD, but not the Enhanced CT IOD.</p> <p>Also, the concept of an Isocenter is also applicable to MR and PET, and should be added to the legacy MR and PET and Enhanced MR and PET IODs.</p> <p>The attributes are added at the instance (Image and spectroscopy) (not frame) level, since they will not vary during the acquisition.</p> <p><i>[Another option would be to add Isocenter Position to the Frame of Reference Module instead, and that way everything inherits it, but lot's of other things use Frame of Reference to which it might not be applicable]</i></p>	
Correction Wording:	

For reference PS 3.3 Frame of Reference Module:

C.7.4.1 Frame Of Reference Module

Table C.7-6 specifies the Attributes necessary to uniquely identify a frame of reference which insures the spatial relationship of Images within a Series. It also allows Images across multiple Series to share the same Frame Of Reference. This Frame Of Reference (or coordinate system) shall be constant for all Images related to a specific Frame Of Reference.

When a Frame of Reference is identified, it is not important how the imaging target (Patient, specimen, or phantom) is positioned relative to the imaging equipment or where the origin of the Frame Of Reference is located. It is important that the position of the imaging target and the origin are constant in relationship to a specific Frame Of Reference.

Note: Since the criteria used to group images into a Series is application specific, it is possible for imaging applications to define multiple Series within a Study that share the same imaging space. Previous versions of the DICOM Standard specified that all images within the Series must be spatially related. However, insufficient information was available to determine if multiple Series within a Study were spatially related.

**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 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 C.7.4.1.1.2 for further explanation.

C.7.4.1.1 Frame Of Reference Attribute Descriptions

C.7.4.1.1.1 Frame Of Reference UID

The Frame of Reference UID (0020,0052) shall be used to uniquely identify a frame of reference for a series. Each series shall have a single Frame of Reference UID. However, multiple Series within a Study may share a Frame of Reference UID. All images in a Series that share the same Frame of Reference UID shall be spatially related to each other.

- Notes:
1. Previous versions of this Standard defined a Data Element "Location", which has been retired. Frame of Reference UID provides a completely unambiguous identification of the image location reference used to indicate position.
 2. A common Frame of Reference UID may be used to spatially relate localizer images with a set of transverse images. However, in some cases (eg. multiple localizer images being related to a single set of transverse images) a common Frame of Reference UID may not be sufficient. The Referenced Image Sequence (0008,1140) provides an unambiguous method for relating localizer images.

C.7.4.1.1.2 Position Reference Indicator

The Position Reference Indicator (0020,1040) specifies the part of the imaging target that was used as a reference point associated with a specific Frame of Reference UID. The Position Reference Indicator may or may not coincide with the origin of the fixed frame of reference related to the Frame of Reference UID.

For a Patient-related Frame of Reference, this is an anatomical reference point such as the iliac crest, orbital-medial, sternal notch, symphysis pubis, xiphoid, lower costal margin, or external auditory meatus, or a fiducial marker placed on the patient. The patient-based coordinate system is described in C.7.6.2.1.1.

For a slide-related Frame of Reference, this is the slide corner as specified in C.8.12.2.1 and shall be identified in this attribute with the value "SLIDE_CORNER". The slide-based coordinate system is described in C.8.12.2.1.

The Position Reference Indicator shall be used only for annotation purposes and is not intended to be used as a mathematical spatial reference.

- Note: The Position Reference Indicator may be sent zero length when it has no meaning, for example, when the Frame of Reference Module is required to relate mammographic images of the breast acquired without releasing breast compression, but where there is no meaningful anatomical reference point as such.

For reference PS 3.3 as amended by CP 1205 for legacy CT Image:

C.8.2.1 CT Image Module

The table in this Section contains IOD Attributes that describe CT images.

**Table C.8-3
CT IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
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...
Isocenter Position	(300A,012C)	3	Isocenter coordinates (x,y,z), in mm. Specifies the location of the machine isocenter in the patient-based coordinate system associated with the Frame of Reference. It allows transformation from the equipment-based coordinate system to the patient-based coordinate system.
<i>Include RT Equipment Correlation Macro Table 10-27</i>			

Amend PS 3.3 to add Isocenter Position (only) to legacy MR Image:

C.8.3.1 MR Image Module

Table C.8-4 contains the Attributes that describe MR images.

**Table C.8-4
MR IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
...
<u>Isocenter Position</u>	<u>(300A,012C)</u>	<u>3</u>	<u>Isocenter coordinates (x,y,z), in mm. Specifies the location of the machine isocenter in the patient-based coordinate system associated with the Frame of Reference. It allows transformation from the equipment-based coordinate system to the patient-based coordinate system.</u>

Amend PS 3.3 to add Isocenter Position (only) to legacy PET Image:

C.8.9.4 PET Image Module

Table C.8-63 contains IOD Attributes that describe PET images.

Table C.8-63 - PET IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
...
<u>Isocenter Position</u>	<u>(300A,012C)</u>	<u>3</u>	<u>Isocenter coordinates (x,y,z), in mm. Specifies the location of the machine isocenter in the patient-based coordinate system associated with the Frame of Reference. It allows transformation from the equipment-based coordinate system to the patient-based coordinate system.</u>

Amend PS 3.3 to add Isocenter Position (only) to Enhanced MR Image and Spectroscopy:

C.8.13.1 Enhanced MR Image Module

This section describes the Enhanced MR Image Module.

Table C.8-79 specifies the attributes of the Enhanced MR Image module.

**Table C.8-79
ENHANCED MR IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
<i>Include ' MR Image and Spectroscopy Instance Macro' Table C.8-83</i>			
...

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C.8.13.2 MR Image and Spectroscopy Instance Macro

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**Table C.8-83
MR IMAGE AND SPECTROSCOPY INSTANCE MACRO**

Attribute Name	Tag	Type	Attribute Description
...
<u>Isocenter Position</u>	<u>(300A,012C)</u>	<u>3</u>	<u>Isocenter coordinates (x,y,z), in mm. Specifies the location of the machine isocenter in the patient-based coordinate system associated with the Frame of Reference. It allows transformation from the equipment-based coordinate system to the patient-based coordinate system.</u>

Amend PS 3.3 to add both Isocenter Position and RT Equipment Correlation Macro to Enhanced CT:

C.8.15.2 Enhanced CT Image Module

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**Table C.8-114
ENHANCED CT IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
...
<u>Isocenter Position</u>	<u>(300A,012C)</u>	<u>3</u>	<u>Isocenter coordinates (x,y,z), in mm. Specifies the location of the machine isocenter in the patient-based coordinate system associated with the Frame of Reference. It allows transformation from the equipment-based coordinate system to the patient-based coordinate system.</u>
<u>Include RT Equipment Correlation Macro Table 10-27</u>			

Amend PS 3.3 to add Isocenter Position (only) to Enhanced PET:

C.8.22.2 Enhanced PET Acquisition Module

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**Table C.8.22-2
ENHANCED PET ACQUISITION MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
...
<u>Isocenter Position</u>	<u>(300A,012C)</u>	<u>3</u>	<u>Isocenter coordinates (x,y,z), in mm. Specifies the location of the machine isocenter in the patient-based coordinate system associated with the Frame of Reference. It allows transformation from the equipment-based coordinate system to the patient-based coordinate system.</u>