

# DICOM Correction Proposal

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Correction Number	CP-2220
Log Summary:	Differentiate acquisition techniques for RT 3D CBCT imaging
Name of Standard	PS3.3, PS3.6
Rationale for Correction:	<p>In image-guided radiation therapy, a cone beam CT (CBCT) is often used to precisely localize targets in soft tissues. However, its image quality, Field-Of-View (FOV) and clinical usage are different from those of a primary simulation CT.</p> <p>Based on the parameters used on the CBCT device, specific calibration curves can be selected by the consuming application to correct the HU to electron/mass density mapping for subsequent radiotherapeutic treatment planning processes.</p> <p>As the corresponding required parameters are already defined in section C.36.2.4.5, these are added to the CT Image Module as an RT-specific attribute, as well as a Functional Group Macro in the Enhanced CT Image IOD.</p>
Correction wording:	

*In PS 3.3, A.38.1.4, add the following:*

## A.38.1.4 Enhanced CT Image Functional Group Macros

Table A.38-2 specifies the use of the Functional Group Macros used in the Multi-frame Functional Groups Module for the Enhanced CT Image IOD.

**Table A.38-2. Enhanced CT Image Functional Group Macros**

Functional Group Macro	Section	Usage
...		
Multi-energy CT Processing	C.8.15.3.13	C - Required if the image pixel data contains the results of Multi-energy material processing.
Multi-energy CT Characteristics	C.8.15.3.12	U
Temporal Position	C.7.6.16.2.23	U
<b><u>RT Cone-Beam Imaging</u></b>	<b><u>C.36.2.4.N</u></b>	<b><u>U</u></b>



*In PS 3.3, C.8.2.1, add the following text:*

### 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
Image Type	(0008,0008)	1	Image identification characteristics. See Section C.8.2.1.1.1 for specialization.
...			
<b><i>Include Table C.36.2.4.N-1 "RT Cone-Beam Imaging Macro Attributes"</i></b>			
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 Table 10-27 "RT Equipment Correlation Macro Attributes"</i>			

*Add the following macro to PS3.3, C.36.2.4*

### C.36.2.4.N RT Cone-Beam Imaging Macro

The 3D RT Cone-Beam Imaging Geometry Macro describes the parameters to be applied for a Cone-Beam acquisition in a Radiotherapy context.

**Table C.36.2.4.N-1. RT Cone-Beam Imaging Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
RT Cone-Beam Imaging Geometry Sequence	(gggg,eeee)	3	Geometric parameters used for radiotherapeutic Cone-beam CT Image acquisitions. Only a single Item shall be included in this Sequence.
<i>&gt;Include Table C.36.2.4.5-1 "3D RT Cone-Beam Imaging Geometry Macro Attributes"</i>			

*No changes in the following section - this table is only present to provide the complete picture. May be deleted for FT.*

### C.36.2.4.5 3D RT Cone-beam Imaging Geometry Macro

The 3D RT Cone-Beam Imaging Geometry Macro describes the parameters to be applied for a Cone-Beam acquisition in a Radiotherapy context.

**Table C.36.2.4.5-1. 3D RT Cone-Beam Imaging Geometry Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
Scan Arc Type	(3002,012E)	3	Categorization of the amount of rotation of the scan.

Attribute Name	Tag	Type	Attribute Description
			<p>Enumerated Values:</p> <p><b>FULL_ARC</b> 360 deg</p> <p><b>HALF_ARC</b> 180 deg</p> <p><b>CUSTOM_ARC</b> user defined scan range</p>
Scan Start Position Sequence	(3002,012B)	1	<p>Start Position of the 3D RT Cone Beam Radiation Imaging Acquisition. The angle is a Continuous Rotation Angle; see <a href="#">Section C.36.1.1.5</a>.</p> <p>Only a single Item shall be included in this Sequence.</p>
<i>&gt;Include Table C.36.2.4.3-1 "Parameterized RT Imaging Geometry Macro Attributes"</i>			
Scan Stop Position Sequence	(3002,012C)	1	<p>Stop Position of the 3D RT Cone Beam Radiation Imaging Acquisition. The angle is a Continuous Rotation Angle; see <a href="#">Section C.36.1.1.5</a>.</p> <p>Only a single Item shall be included in this Sequence.</p>
<i>&gt;Include Table C.36.2.4.3-1 "Parameterized RT Imaging Geometry Macro Attributes"</i>			
Detector Positioning Type	(3002,012F)	3	<p>Fan type of acquisition.</p> <p>Enumerated Values:</p> <p><b>CENTERED</b> Full fan, detector is centered, resulting in a normal field of view.</p> <p><b>SHIFTED</b> Half fan, detector is laterally shifted by half of the detector size to increase the field of view.</p>
Parameters Specification Sequence	(0018,9913)	3	<p>Acquisition parameters.</p> <p>One or more Items are permitted in this Sequence.</p>
<p><i>&gt;Include Table 10.25-1 "Attribute Value Constraint Macro Attributes"</i></p> <p>Only Attributes defined in Table C.34.10-1 (i.e., in the Acquisition Protocol Element Sequence (0018,9920) in the Performed CT Acquisition Module) and Private Data Elements associated with this acquisition protocol element may be specified as Selector Attributes.</p> <p>The semantics of values of Constraint Violation Significance (0082,0036) in the Macro are assigned in Section C.34.9.3.</p> <p>The same Attribute shall not appear in more than one Item in the Sequence with the same values for Selector Sequence Pointer (0072,0052) and Selector Sequence Pointer Items (0074,1057).</p>			

In PS 3.3, C.36.2.4.3, update the following table:

### C.36.2.4.3 Parameterized RT Imaging Geometry Macro

This Macro defines positioning of the image radiation source and the image receptor by the means of device parameters.

**Table C.36.2.4.3-1. Parameterized RT Imaging Geometry Macro Attributes**

Attribute Name	Tag	Type	Description
Imaging Source Position Sequence	(3002,010D)	1	The position of the imaging source. Only a single Item shall be included in this Sequence.
>Referenced Defined Device Index	(300A,0602)	1C	The value of Device Index (3010,0039) from the Acquisition Device Sequence (3002,0117) corresponding to the Acquisition Device used in this Item.  Required if <b>Acquisition Device Sequence (3002,0117) is present and</b> Value 1 of Image Type (0008,0008) has the value ORIGINAL or the current Instance was derived from an Instance where Referenced Defined Device Index (300A,0602) was present in the Imaging Source Position Sequence (3002,010D). May be present otherwise.
>Device Position Parameter Sequence	(3002,0110)	1	Parameters describing the position of the imaging source. One or more Items shall be included in this sequence.
>>Include Table 10-2 "Content Item Macro Attributes"			<u>DTID 15308 "Imaging Source Geometry Parameters"</u>
Image Receptor Position Sequence	(3002,010E)	1	The position of the image receptor. Only a single Item shall be included in this Sequence.
>Referenced Defined Device Index	(300A,0602)	1C	The value of Device Index (3010,0039) from the Acquisition Device Sequence (3002,0117) corresponding to the Acquisition Device used in this Item.  Required if <b>Acquisition Device Sequence (3002,0117) is present and</b> Value 1 of Image Type (0008,0008) has the value ORIGINAL or the current Instance was derived from an Instance where Referenced Defined Device Index (300A,0602) was present in the Image Receptor Position Sequence (3002,010E). May be present otherwise.
>Device Position Parameter Sequence	(3002,0110)	1	Parameters describing the position of the image receptor. One or more Items shall be included in this sequence.
>>Include Table 10-2 "Content Item Macro Attributes"			<u>DTID 15309 "Image Receptor Geometry Parameters"</u>

**Table 6-1. Registry of DICOM Data Elements**

Tag	Name	Keyword	VR	VM	
...					
<u>(gggg.eeee)</u>	<u>RT Cone-Beam Imaging Geometry Sequence</u>	<u>RTConeBeamImagingGeometrySeque nce</u>	<u>SQ</u>	<u>1</u>	