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Digital Imaging and Communications in Medicine (DICOM)

*Supplement 213: Second Generation Radiotherapy
- Enhanced RT Image and RT Patient Position Acquisition Instruction*

Prepared by:

DICOM Standards Committee, Working Group 07, Radiation Therapy
1300 N. 17th Street, Suite 900
Rosslyn, Virginia 22209 USA

Status: Letter Ballot

2022-01-17

Developed pursuant to DICOM Work Item 2018-04-A

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Closed Issues for Public Comment

#	Item
1	<p>Special Cone-Beam Use Cases: Instructions for Cone-Beam do not yet cover a specification of the extent of acquisition (“stitching” use cases and alike). How should these use cases be addressed? RESPONSE No comment received for this Item. The Supplement will not be extended</p>
2	<p>Constraints for Bit specification Attributes: Bits Allocated (0028,0100), Bits Stored (0028,0101) and High Bit (0028,0102) in A.86.1.a1.4.3 Image Pixel Module restrict the allowed values to 2 options: 8 and 16 for Bits Allocated (and corresponding values for Bits Stored and High Bit). Is this restriction appropriate? RESPONSE No comment received for this Item. The specification remains restricted to 8 and 16 bit</p>
3	<p>Inclusion of mobile X-Ray Devices: In CID SUP213030, should a code be covering mobile X-Ray devices already? Devices using the RT Patient Position Acquisition Instruction need to understand the 2nd Generation approach to describe geometries (namely the notion of Equipment Frame of Reference), but if this is the case, this instruction can be used by such devices as well. RESPONSE No comment received for this Item. The surrcnet code set remains, and new codes may be added later.</p>
4	<p>Use of Volumetric Properties: Are the Volumetric Properties Attributes of C.8.16.2 useful to be included for Enhanced RT Image SOP classes? RT Images are not volumetric images, but they are located in a 3D space and therefore these Attributes may have relevance. RESPONSE No comment received for this Item. These attributes will not be added since no specific applicability was identified.</p>
5	<p>Consideration of X-Ray 3D isocenter model: Is there anything to consider for the geometric model of the IODs in this Supplement in comparison to the X-Ray 3D isocenter model? RESPONSE No comment received for this Item. With IEC there is a established isocentric mode for RT to safely related imaging geometry to therapeutic geometry systems.</p>

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178

179

Foreword

180 This Supplement specifies additional IODs representing projection images constructed for or acquired at
181 Radiotherapy treatment sessions and instructions to acquire images and other artifacts for positioning the patient
182 for Radiotherapy treatments.

183 This document is an extension to the following parts of the published DICOM Standard:

184	PS 3.2	Conformance
185	PS 3.3	Information Object Definitions
186	PS 3.4	Service Class Specifications
187	PS 3.6	Data Dictionary
188	PS 3.15	Security and System Management Profiles
189	PS 3.16	Content Mapping Resource

190

191

Scope and Field of Application

192 The Supplement addresses Imaging and acquiring patient positioning information performed in the context of
193 Radiotherapy treatment sessions.

194 The supplement adds two IODs supporting projection images and one IOD supporting acquisition instructions for
195 images and other artifacts to be used for patient positioning.

196 **Enhanced RT Image and Enhanced Continuous RT Image**

197 The Supplement adds two new IODs to support projection images reconstructed for use during or acquired during
198 Radiotherapy treatment sessions to support patient position verification for Radiotherapy treatment delivery
199 sessions (“RT Images”).

- 200 • Enhanced RT Image IOD
- 201 • Enhanced Continuous RT Image IOD

202 The first IOD covers the images with a smaller number of frames, where the per-frame functional group macros are
203 populated for all frames.

204 The second IOD covers images which are continuously acquired, resulting in high number of frames due to a high
205 frame rate. In this case it is sufficient to populate only a subset of frames to avoid a huge amount of superfluous
206 data.

207 E.g. an imaging device may continuously acquire image frames and store them using an MPEG Transfer syntax. A
208 typical frame rate of 25 fps would result in 1500 frames per minute. A typical treatment may last several minutes,
209 resulting in several thousand frames. To populate each frame with the set of required functional group macros is
210 not necessary for most use cases of positioning and review, but will slow down processing and presentation of
211 images. Further, it may not always be possible to populate functional groups with such frame rates when devices
212 providing the macro content do not have the same sampling rate as the image receptor. This IOD supports
213 populating macros for a selected subset of frames only (instead of all frames) for such cases.

214 Both IODs represent projection images of the patient geometry in relation to the treatment device equipment. They
215 may be used to guide the positioning of the patient in respect to the treatment delivery device to ensure delivery of
216 the therapeutic dose to the intended region. They may also be used to verify the position of the patient when
217 acquired prior, during or after the delivery of the therapeutic radiation.

218 The existing RT Image IOD is insufficient to support features needed for positioning in modern Radiotherapy, such
219 as a generic approach to reference control points of therapeutic beams, capturing of use-case-specific data related
220 to monitoring and tracking and providing well-structured technical data related to the acquisition.

221 **RT Patient Position Acquisition Instruction**

222 The Supplement specifies a new IOD to convey parameters instructing devices on how to acquire images or other
223 artifacts used for patient position verification in Radiotherapy treatment delivery sessions.

- 224 • RT Patient Position Acquisition Instruction IOD

225 This IOD contains the definition of the procedures, devices and related parameters to be used for the assessment
226 and/or verification of the patient position. The technical parameters can be defined on any level of detail as needed
227 by a specific device. Procedures can be paired to represent related operations like a paired orthogonal MV/kV
228 image acquisition. The scope of therapeutic radiation whose position is verified is specified by referencing SOP
229 Instances identifying objects like RT Radiation Set IOD of RT Radiation IODs. The instruction defined in this
230 supplement supports projection imaging and volumetric imaging for MV and kV image acquisitions. It is constructed
231 in a way that it is possible to cover other acquisition techniques like MR, US or Surface Scanning at a later time.

232 The 1st Generation DICOM RT Plan IOD provided various different ways to include imaging instructions. These
233 instructions were heavily underspecified and came in various forms, like co-called “setup beams”, port film beams
234 or verification image sequences in therapeutic beams. These specifications suffer from lack of generality and
235 comprehensiveness. Further, such instructions often vary from fraction to fraction, while the treatment beams stay
236 unaltered. Therefore, such instructions must be provided by separate IODs with their independent lifetime.
237 Therefore concept of using therapeutic beam definitions to represent workflow steps for positioning procedures is
238 no longer part of the 2nd Generation RT approach. Dedicated instruction objects such as this one are used instead.

239 **IODs as part of 2nd Generation**

240 The IODs of this Supplement are part of the 2nd Generation RT Objects family and use the concepts developed
241 there.

242 Within this family it covers the positioning imaging in close coordination with other 2nd Generation Radiotherapy
243 Objects and makes use of the strong concepts developed there. E.g. the generalizing to diverse types of devices,
244 the systematic description of geometries and the annotation of devices used in the beam line will significantly
245 streamline and tighten the semantic in the new IOD.

246

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248

Part 2 Addendum

249

Add new SOP Classes to PS3.2 Table A.1-2 UID Values:

250

UID Value	UID Name	Category
<u>1.2.840.10008.5.1.4.1.1.481.S213.1</u>	<u>Enhanced RT Image</u>	<u>Transfer</u>
<u>1.2.840.10008.5.1.4.1.1.481.S213.2</u>	<u>Enhanced Continuous RT Image</u>	<u>Transfer</u>
<u>1.2.840.10008.5.1.4.1.1.481.S213.3</u>	<u>RT Patient Position Acquisition Instruction</u>	<u>Transfer</u>

251

252

Part 3 Addendum

253

Add the following reference to PS 3.3, Chapter 2.6

254

2.6 Other References

255

256 ...
 257 **[MEDPHYS 23464308] Medical Physics March 2013, PMID: 23464308. Chytyk-Praznik K, VanUytven E,**
 258 **vanBeek TA, Greer PB, McCurdy BM. Model-based prediction of portal dose images during patient**
 259 **treatment. <https://pubmed.ncbi.nlm.nih.gov/23464308/>**

260

261

262

Add the following columns in PS3.3 Section A.1.4, Table A.1-1 Composite Information Object Modules Overview - Images

A.1 Elements of An Information Object Definition

265 ...

A.1.4 Overview of the Composite IOD Module Content

266 ...

IODs Modules	<u>Enhanced RT Image</u>	<u>Enhanced Continuous RT Image</u>	<u>RT Patient Position Acquisition Instruction</u>
Patient	<u>M</u>	<u>M</u>	<u>M</u>
Clinical Trial Subject	<u>U</u>	<u>U</u>	<u>U</u>
General Study	<u>M</u>	<u>M</u>	<u>M</u>
Patient Study	<u>U</u>	<u>U</u>	<u>U</u>
Clinical Trial Study	<u>U</u>	<u>U</u>	<u>U</u>
General Series	<u>M</u>	<u>M</u>	<u>M</u>

IODs Modules	<u>Enhanced RT Image</u>	<u>Enhanced Continuous RT Image</u>	<u>RT Patient Position Acquisition Instruction</u>
Clinical Trial Series	<u>M</u>	<u>M</u>	<u>M</u>
<u>Enhanced RT Series</u>	<u>M</u>	<u>M</u>	<u>M</u>
...			
Frame Of Reference	<u>M</u>	<u>M</u>	
Synchronization	<u>C</u>	<u>C</u>	
...			
Respiratory Synchronization	<u>C</u>	<u>C</u>	
...			
General Equipment	<u>M</u>	<u>M</u>	<u>M</u>
Enhanced General Equipment	<u>M</u>	<u>M</u>	<u>M</u>
Image Pixel	<u>M</u>	<u>M</u>	
...			
<u>Enhanced RT Image Device</u>	<u>M</u>	<u>M</u>	
<u>Enhanced RT Image</u>	<u>M</u>	<u>M</u>	
<u>RT Patient Position Acquisition Instruction Device</u>			<u>M</u>
<u>RT Patient Position Acquisition Instruction</u>			<u>M</u>
...			
Multi-frame Functional Groups	<u>M</u>		
<u>Sparse Multi-frame Functional Groups</u>		<u>M</u>	
Multi-frame Dimension	<u>M</u>		
...			
Contrast/Bolus	<u>C</u>	<u>C</u>	
Device	<u>M</u>	<u>M</u>	
...			
General Reference Module	<u>M</u>	<u>M</u>	<u>M</u>
Common Instance Reference Module	<u>M</u>	<u>M</u>	<u>M</u>
...			
SOP Common	<u>M</u>	<u>M</u>	<u>M</u>
Radiotherapy Common Instance	<u>M</u>	<u>M</u>	<u>M</u>
Frame Extraction	<u>C</u>		

270 **Add the following to PS3.3 Annex A:**

271 **A.86 RT Second Generation**

272 ...

273 **A.86.1.a1 Enhanced RT Image Information Object Definition**

274 **A.86.1.a1.1 Enhanced RT Image IOD Description**

275 The Enhanced RT Image IOD represents projection images generated before, during or after Radiotherapy
 276 treatment sessions. The projection images may be acquired directly or may be derived ("reconstructed") from
 277 volumetric data such as CT. Such images capture the patient geometry to guide, or record, the positioning of the
 278 patient on a patient support device to deliver therapeutic dose to an intended location.

279 **A.86.1.a1.2 Enhanced RT Image IOD Entity-Relationship Model**

280 See Figure A.86.1.1.1-1.

281 **A.86.1.a1.3 Enhanced RT Image IOD Module Table**

282 Table A.86.1.a1-5 specifies the Modules of the Enhanced RT Image IOD.

283 **Table A.86.1.a1-1**
 284 **Enhanced RT Image IOD Modules**

285

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
	Clinical Trial Subject	C.7.1.3	U
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
	Clinical Trial Study	C.7.2.3	U
Series	General Series	C.7.3.1	M
	Clinical Trial Series	C.7.3.2	U
	Enhanced RT Series	C.36.3	M
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	C.7.5.1	M
	Enhanced General Equipment	C.7.5.2	M
RT Image	General Reference	C.12.4	M
	Image Pixel	C.7.6.3	M
	Multi-frame Functional Groups	C.7.6.16	M
	Multi-frame Dimension	C.7.6.17	M
	Respiratory Synchronization	C.7.6.18.2	C – Required if respiratory synchronization was applied.
	Enhanced Contrast/Bolus	C.7.6.4b	C - Required if contrast media was used when this image was acquired
	Device	C.7.6.12	U
	Enhanced RT Image Device	C.36.m1	M
	Enhanced RT Image	C.36.m2	M

	SOP Common	C.12.1	M
	Common Instance Reference	C.12.2	M
	Radiotherapy Common Instance	C.36.4	M
	Frame Extraction	C.12.3	C - Required if the SOP Instance was created in response to a Frame-Level retrieve request

286
287

288 **A.86.1.a1.4 Enhanced RT Image IOD Content Constraints**

289 **A.86.1.a1.4.1 Modality Attribute**

290 The value of Modality (0008,0060) shall be RTIMAGE.

291 **A.86.1.a1.4.2 Inclusion of Modules in Standard Extended SOP Classes**

292 The General Image Module, Overlay Plane Module, Curve Module, Modality LUT Module and VOI LUT Module
293 shall not be used in a Standard Extended SOP Class of the Enhanced RT Image IOD.

294 **A.86.1.a1.4.3 Image Pixel Module**

295 In the Image Pixel Module C.7.6.3, the following constraints apply:

- 296 • Samples per Pixel (0028,0002) shall be 1
- 297 • Photometric Interpretation (0028,0004) shall be MONOCHROME2
- 298 • Bits Allocated (0028,0100) shall be 8 or 16
- 299 • Bits Stored (0028,0101) shall be equal to Bits Allocated (0028,0100)
- 300 • High Bit (0028,0102) shall be one less than the value of Bits Stored (0028,0101).
- 301 • Pixel Representation (0028,0103) shall be 0

302 **A.86.1.a1.5 Enhanced RT Image Functional Group Macros**

303 Table A.86.1.a1-2 specifies the use of the Functional Group Macros used in the Multi-frame Functional Groups
304 Module for the Enhanced RT Image IOD.

305
306

**Table A.86.1.a1-2
ENHANCED RT IMAGE FUNCTIONAL GROUP MACROS**

Function Group Macro	Section	Usage
Pixel Measures	C.7.6.16.2.1	M - Shall be used as a Shared Functional Group.
Frame Content	C.7.6.16.2.2	M - May not be used as a Shared Functional Group.
Plane Position (Patient)	C.7.6.16.2.3	M
Plane Orientation (Patient)	C.7.6.16.2.4	M
Referenced Image	C.7.6.16.2.5	U
Derivation Image	C.7.6.16.2.6	C - Required if the image or frame has been derived from another SOP Instance.
Respiratory Synchronization	C.7.6.16.2.17	U
Cardiac Synchronization	C.7.6.16.2.7	U

Contrast/Bolus Usage	C.7.6.16.2.12	C - Required if Contrast/Bolus Agent Sequence (0018,0012) is used.
RT Image Frame General Content	C.36.2.n.X12	M
RT Image Frame Imaging Device Position	C.36.2.n.X13	M
RT Image Frame Radiation Acquisition Parameters	C.36.2.n.X14	C – Required if Image Type (0008,0008) Value 1 is ORIGINAL. May be present otherwise.
RT Image Frame Context	C.36.2.n.X15	C - Required if the SOP Instance was created for the purpose of controlling the treatment position of the patient.
RT Beam Limiting Device Opening Sequence	C.36.2.2.X20	M
Frame VOI LUT	C.7.6.16.2.10	U
Real World Value Mapping	C.7.6.16.2.11	U

307

308 **A.86.1.a1.5.1 Pixel Spacing**

309 The Pixel Spacing (0028,0030) is measured on the x/y plane of the Image Receptor Coordinate System at z = 0.
 310 Imager Pixel Spacing (0018,1164) shall not be used.

311 See Section C.7.6.16.2.1 for a description of Pixel Spacing (0028,0030).

312 See Section C.36.1.1.n2 for a description of the Image Receptor Coordinate System.

313 **A.86.1.a2 Enhanced Continuous RT Image Information Object Definition**314 **A.86.1.a2.1 Enhanced Continuous RT Image IOD Description**

315 The Enhanced Continuous RT Image IOD represents projection images generated before, during or after
 316 Radiotherapy treatment sessions. The projection images may be acquired directly or may be derived
 317 ("reconstructed") from volumetric data such as CT. Such images capture the patient geometry to guide, or record,
 318 the positioning of the patient on a patient support device to deliver therapeutic dose to an intended location.

319 This IOD limits the content to a selected set of frames in the per-frame functional group when a high number of
 320 frames are present due to a high frame rate (e.g. 25 frames / second).

321 **A.86.1.a2.2 Enhanced Continuous RT Image IOD Entity-Relationship Model**

322 See Figure A.86.1.1.1-1.

323 **A.86.1.a2.3 Enhanced Continuous RT Image IOD Module Table**

324 Table A.86.1.a1-5 specifies the Modules of the Enhanced RT Image IOD.

325 **Table A.86.1.a2-1**
 326 **Enhanced Continuous RT Image IOD Modules**

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
	Clinical Trial Subject	C.7.1.3	U
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U

327

	Clinical Trial Study	C.7.2.3	U
Series	General Series	C.7.3.1	M
	Clinical Trial Series	C.7.3.2	U
	Enhanced RT Series	C.36.3	M
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	C.7.5.1	M
	Enhanced General Equipment	C.7.5.2	M
RT Image	General Reference	C.12.4	M
	Image Pixel	C.7.6.3	M
	Sparse Multi-frame Functional Groups	C.36.m3	M
	Respiratory Synchronization	C.7.6.18.2	C – Required if respiratory synchronization was applied.
	Contrast/Bolus	C.7.6.4	C - Required if contrast media was used when this image was acquired
	Device	C.7.6.12	U
	Enhanced RT Image Device	C.36.m1	M
	Enhanced RT Image	C.36.m2	M
	SOP Common	C.12.1	M
	Common Instance Reference	C.12.2	M
	Radiotherapy Common Instance	C.36.4	M

328

329

330

331 **A.86.1.a2.4 Enhanced Continuous RT Image IOD Content Constraints**332 **A.86.1.a2.4.1 Modality Attribute**

333 The value of Modality (0008,0060) shall be RTIMAGE.

334 **A.86.1.a2.4.2 Inclusion of Modules in Standard Extended SOP Classes**335 The General Image Module, Overlay Plane Module, Curve Module, Modality LUT Module and VOI LUT Module
336 shall not be used in a Standard Extended SOP Class of the Enhanced RT Image IOD.337 **A.86.1.a2.4.3 Image Pixel Module**

338 In Section Image Pixel Module C.7.6.3, the constraints apply as specified in A.86.1.a1.4.3 Image Pixel Module.

339 **A.86.1.a2.5 Enhanced Continuous RT Image Functional Group Macros**340 Table A.86.1.a2-2 specifies the use of the Functional Group Macros used in the Multi-frame Functional Groups
341 Module for the Enhanced RT Image IOD.

342

343

**Table A.86.1.a2-2
ENHANCED CONTINOUS RT IMAGE FUNCTIONAL GROUP MACROS**

Function Group Macro	Section	Usage
Pixel Measures	C.7.6.16.2.1	M - Shall be used as a Shared Functional Group.

Frame Content	C.7.6.16.2.2	M - May not be used as a Shared Functional Group.
Plane Position (Patient)	C.7.6.16.2.3	M
Plane Orientation (Patient)	C.7.6.16.2.4	M
Referenced Image	C.7.6.16.2.5	U
Derivation Image	C.7.6.16.2.6	C - Required if the image has been derived from another SOP Instance.
Respiratory Synchronization	C.7.6.16.2.17	U
Cardiac Synchronization	C.7.6.16.2.7	U
Contrast/Bolus Usage	C.7.6.16.2.12	C - Required if Contrast/Bolus Agent Sequence (0018,0012) is used.
RT Image Frame General Content	C.36.2.n.X12	M
RT Image Frame Imaging Device Position	C.36.2.n.X13	M
RT Image Frame Radiation Acquisition Parameters	C.36.2.n.X14	C – Required if Image Type (0008,0008) Value 1 is ORIGINAL. May be present otherwise.
RT Image Frame Context	C.36.2.n.X15	C - Required if the SOP Instance was created for the purpose of controlling the treatment position of the patient.
RT Beam Limiting Device Opening Sequence	C.36.2.2.X20	M
Frame VOI LUT	C.7.6.16.2.10	U
Real World Value Mapping	C.7.6.16.2.11	U

344

345 **A.86.1.a2.5.1 Pixel Spacing**

346 The Pixel Spacing (0028,0030) is measured on the x/y plane of the Image Receptor Coordinate System at z = 0.
 347 Imager Pixel Spacing (0018,1164) shall not be used.

348 See Section C.7.6.16.2.1 for a description of Pixel Spacing (0028,0030).

349 See Section C.36.1.1.n2 for a description of the Image Receptor Coordinate System.

350 **A.86.1.a3 RT Patient Position Acquisition Instruction Information Object Definition**351 **A.86.1.a3.1 RT Patient Position Acquisition Instruction IOD Description**

352 The RT Patient Position Acquisition Instruction IOD contains parameters needed to acquire the actual patient
 353 position.

354 **A.86.1.a3.2 RT Patient Position Acquisition Instruction IOD Entity-Relationship Model**

355 See Figure A.86.1.1.1-1.

356 **A.86.1.a3.3 RT Patient Position Acquisition Instruction IOD Module Table**

357

358
359

**Table A.86.1.a3-1
RT Patient Position Acquisition Instruction IOD Modules**

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
	Clinical Trial Subject	C.7.1.3	U
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
	Clinical Trial Study	C.7.2.3	U
Series	General Series	C.7.3.1	M
	Clinical Trial Series	C.7.3.2	U
	Enhanced RT Series	C.36.3	M
Equipment	General Equipment	C.7.5.1	M
	Enhanced General Equipment	C.7.5.2	M
Plan	General Reference	C.12.4	M
	RT Patient Position Acquisition Device	C.36.m4	M
	RT Patient Position Acquisition Instruction	C.36.m5	M
	SOP Common	C.12.1	M
	Common Instance Reference	C.12.2	M
	Radiotherapy Common Instance	C.36.4	M

360

361 **A.86.1.a3.4 RT Patient Position Acquisition Instruction IOD Constraints**

362 **A.86.1.a3.4.1 Modality Attribute**

363 The value of Modality (0008,0060) shall be PLAN.

364

365 **Extend PS3.3 Annex C, Section C.7.6.16.2.1 Pixel Measures Macro and C.7.6.16.2.4 Plane Orientation**
366 **(Patient) Macro by the following:**

367 **C.7.6 Common Image IE Modules**

368 ...

369 **C.7.6.16 Multi-frame Functional Groups Module**

370 **C.7.6.16.2 Common Functional Group Macros**

371 ...

372 **C.7.6.16.2.1 Pixel Measures Macro**

373 Table C.7.6.16-2 specifies the attributes of the Pixel Measures Functional Group Macro.

374 **Table C.7.6.16-2. Pixel Measures Macro Attributes**

375

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.
>Pixel Spacing	(0028,0030)	1C	Physical distance in the imaging target (patient, specimen, or phantom) between the centers of each pixel, specified by a

Attribute Name	Tag	Type	Attribute Description
			<p>numeric pair - adjacent row spacing (delimiter) adjacent column spacing in mm. See Section 10.7.1.3 for further explanation of the value order.</p> <p>Note</p> <p>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.</p> <p><u>In the case of Enhanced RT Image ("1.2.840.10008.5.1.4.1.1.481.S213.1") or Enhanced Continuous RT Image ("1.2.840.10008.5.1.4.1.1.481.S213.2") the pixel spacing is defined on the x/y plane at z = 0 of the Image Receptor Coordinate System.</u></p> <p>Required if:</p> <ul style="list-style-type: none"> Volumetric Properties (0008,9206) is other than DISTORTED or SAMPLED, 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 <u>SOP Class UID is Enhanced RT Image ("1.2.840.10008.5.1.4.1.1.481.S213.1"), or</u> <u>SOP Class UID is Enhanced Continuous RT Image ("1.2.840.10008.5.1.4.1.1.481.S213.2")</u> <p>May be present otherwise.</p>
>Slice Thickness	(0018,0050)	1C	<p>Nominal reconstructed slice thickness (for tomographic imaging) or depth of field (for optical non-tomographic imaging), in mm.</p> <p>See Section C.7.6.16.2.3.1 for further explanation.</p> <p>Note</p> <p>Depth of field may be an extended depth of field created by focus stacking (see Section C.8.12.4).</p> <p>Required if:</p> <ul style="list-style-type: none"> Volumetric Properties (0008,9206) is VOLUME or SAMPLED, 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

Attribute Name	Tag	Type	Attribute Description
			<p>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").</p> <p>May be present otherwise, <u>if</u></p> <p><u>SOP Class UID is not Enhanced RT Image ("1.2.840.10008.5.1.4.1.1.481.S213.1") or Enhanced Continuous RT Image ("1.2.840.10008.5.1.4.1.1.481.S213.2").</u></p>
>Spacing Between Slices	(0018,0088)	3	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.

376

377 **C.7.6.16.2.4 Plane Orientation (Patient) Macro**

378 Table C.7.6.16-5 specifies the attributes of the Plane Orientation (Patient) Functional Group Macro.

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

380

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.
>Image Orientation (Patient)	(0020,0037)	1C	<p>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.</p> <p>Required if:</p> <ul style="list-style-type: none"> 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 <u>SOP Class UID is Enhanced RT Image ("1.2.840.10008.5.1.4.1.1.481.S213.1"), or</u> <u>SOP Class UID is Enhanced Continuous RT Image ("1.2.840.10008.5.1.4.1.1.481.S213.2").</u> <p>May be present otherwise.</p>

381

382 **Add the following Sections to PS3.3 Annex C; Section 36.1:**

383 **C.36.1 RT Second Generation Concepts**

384 ...

385 **C.36.1.1 RT Second Generation Radiation Concepts**

386 ...

387 **C.36.1.1.n1 Imaging Source Coordinate System**

388 The Imaging Source Coordinate System describes the location of the imaging source with respect to the Equipment
389 Frame of Reference coordinate system identified by the Equipment Frame of Reference UID (300A,0675), i.e. the
390 Equipment Frame of Reference coordinate system is the parent system of the Imaging Source Coordinate System.

391 The Device Position to Equipment Mapping Matrix (gggg,7121) relates the two coordinate systems, and when it is
392 identity:

- 393 • The origin of Imaging Source Coordinate System is located at the origin of the Equipment Frame of
394 Reference coordinate system
- 395 • The axes of Imaging Source Coordinate System are aligned with the axes of the Equipment Frame of
396 Reference coordinate system

397 The Imaging Source Coordinate System is aligned with the imaging source as follows:

- 398 • The origin of the Imaging Source Coordinate System is the nominal location of the imaging source.
- 399 • The z-axis is aligned with the central ray of the diverging rays of the imaging source
- 400 • The positive z-axis is in the direction from the image receptor to the imaging source

401 Beam modifying devices attached to the imaging source, such as Beam Limiting Devices, use a Base Beam
402 Modifier Coordinate System, if they use coordinates in their specification.

403 The Base Beam Modifier Coordinate System, defined in C.36.1.1.9 Beam Modifier Coordinate System, is related to
404 the Image Source Coordinate System as follows:

- 405 • The parent system of the Base Beam Modifier Coordinate System is the Imaging Source Coordinate System.
- 406 • The Base Beam Modifier Plane is located at a distance specified by RT Beam Modifier Definition Distance
407 (300A,0688) along the z-axis from the reference location specified by RT Device Distance Reference
408 Location Code Sequence (300A,0659).
- 409 • If the radiation used for imaging is generated by an imaging-specific source, the RT Device Distance
410 Reference Location Code Sequence (300A,0659) shall have the value (S213200, 99SUP213, "Imaging
411 Source Location")
- 412 • If the radiation used for imaging is generated by the therapeutic source ("MV Imaging"), the RT Device
413 Distance Reference Location Code Sequence (300A,0659) shall have the value (130358, DCM, "Nominal
414 Radiation Source Location")

415 **C.36.1.1.n2 Image Receptor Coordinate System**

416 The Image Receptor Coordinate System describes the location of the image acquisition receptor device with
417 respect to the Equipment Frame of Reference coordinate system identified by the Equipment Frame of Reference
418 UID (300A,0675), i.e. the Equipment Frame of Reference coordinate system is the parent system of the Image
419 Receptor Coordinate System.

420 The Image Receptor Coordinate System is also used when describing the location of an acquisition plane of a
421 virtual imaging device without presence of physical image receptor, e.g. in case of a digital reconstructed
422 radiograph (DRR).

423 The Pixel Spacing (0028,0030) is measured on the x/y plane of the Image Receptor Coordinate System at $z = 0$.

424 The Device Position to Equipment Mapping Matrix (gggg,7121) relates the two coordinate systems, and when it is
425 identity:

- 426 • The origin of Image Receptor Coordinate System is located at the origin of the Equipment Frame of
427 Reference coordinate system
- 428 • The axes of Image Receptor Coordinate System are aligned with the axes of the Equipment Frame of
429 Reference coordinate system

430 The Image Receptor Coordinate System is aligned with the image receptor as follows.

- 431 • The z-axis passes through the center of the image receptor
- 432 • For rectangular receptors, the x-axis and y-axis are aligned with the edges of the image receptor.

433 The alignment shall be documented in the Conformance Statement for the device.

434

435 **Modify the following Macros to PS3.3 Annex C, Section C.36.2:**

436 **C.36.2 RT Second Generation Macros**

437 ...

438 **C.36.2.2 RT Second Generation Device Macros**

439 ...

440 **C.36.2.2.4 RT Treatment Position Macro**

441 The RT Treatment Position Macro establishes a connection between the patient's geometry and the treatment
442 delivery equipment to define the treatment position. When used in an RT Radiation object, this treatment position is
443 the prescribed position. When used in an RT Radiation Record object, this treatment position is the record of the
444 actual position **during treatment delivery. When used in an Enhanced RT Image object, this position is the**
445 **record of the actual position during acquisition.**

446 **Table C.36.2.2.4-1. RT Treatment Position Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
<i>Include Table 10-15a "Patient Orientation And Equipment Relationship Macro Attributes".</i>			
Treatment Position Sequence	(300A,063F)	1C	Patient positions during treatment, being prescribed or recorded. Required if the SOP Class of the SOP Instance including this Module is not <u>SOP Class UID is not RT Radiation Salvage Record Storage ("1.2.840.10008.5.1.4.1.1.481.17") and</u> <u>SOP Class UID is not Enhanced RT Image ("1.2.840.10008.5.1.4.1.1.481.S213.1") and</u> <u>SOP Class UID is not Enhanced Continuous RT Image ("1.2.840.10008.5.1.4.1.1.481.S213.2").</u> May be present otherwise. One or more Items shall be included in this Sequence.
>Treatment Position Index	(300A,0606)	1	Index of this Item in this Sequence. The value shall start at 1 and increase monotonically by 1.
<i>>Include Table 10.39-1 "Patient to Equipment Relationship Macro Attributes".</i>			<i>DCID 9553 "Treatment Points".</i>

447

448 ...

449

450 **C.36.2.2.9 RT Beam Limiting Device Opening Macro**451 This Macro defines the opening created by RT Beam Limiting Devices at a specific Control Point or set of Control
452 Points.

453

454

Table C.36.2.2.9-1. RT Beam Limiting Device Opening Macro Attributes

Attribute Name	Tag	Type	Attribute Description
Number of RT Beam Limiting Device Openings	(300A,0657)	1C	Number of RT Beam Limiting Device Openings in the RT Beam Limiting Device Opening Sequence (300A,0656). Required if Number of RT Beam Limiting Devices (300A,0641) is present and has a non-zero value.
RT Beam Limiting Device Opening Sequence	(300A,0656)	1C	Beam limiting device (collimator) settings defining the opening for the current Control Point. Required if Number of RT Beam Limiting Device Openings (300A,0657) is present and has a non-zero value and the conditions in Section C.36.2.2.5.1.1 are satisfied. The number of Items included in this Sequence shall equal the value of Number of RT Beam Limiting Device Openings (300A,0657).
<u>>Include Table C.36.2.2.X21-1. "RT Beam Limiting Device Opening Definition Macro Attributes"</u>			
<u>>Referenced Device Index</u>	<u>(300A,0607)</u>	<u>1</u>	<u>The value of Device Index (3010,0039) from the RT Beam Limiting Device Definition Sequence (300A,064D) corresponding to the Beam Limiting Device used in this Item.</u>
<u>>RT Beam Limiting Device Offset</u>	<u>(300A,064B)</u>	<u>1C</u>	<u>The offsets (x,y) in mm of the Parallel RT Beam Delimiter Positions (300A,064A) along the x-axis and the Parallel RT Beam Delimiter Boundaries (300A,0649) along the y-axis of the Beam Modifier Coordinate System after the Beam Modifier Orientation Angle (300A,0645) is applied.</u> <u>See Section C.36.2.2.9.1.1 and Section C.36.2.2.8.1.2.</u> <u>Required if the conditions in Section C.36.2.2.5.1.1 are satisfied.</u>
<u>>Parallel RT Beam Delimiter Positions</u>	<u>(300A,064A)</u>	<u>1C</u>	<u>One-dimensional positions of the tip in mm of beam delimiters.</u> <u>If Device Type Code Sequence (3010,002E) contains (130333, DCM, "Single Leaves"), N values shall be provided where N is the Number of Parallel RT Beam Delimiters (300A,0648).</u> <u>If Device Type Code Sequence contains (130330, DCM, "Jaw Pair") or (130331, DCM, "Leaf Pairs"),</u>

Attribute Name	Tag	Type	Attribute Description
			<p>2N values shall be provided where N is the Number of Parallel RT Beam Delimiters (300A,0648). The values shall be grouped by the mounting side identified by the Parallel RT Beam Delimiter Leaf Mounting Side (300A,064F) with the values of RT Beam Delimiter Elements on the negative mounting side first.</p> <p>The order of values shall correspond to the order of the Parallel RT Beam Delimiter Boundaries (300A,0649).</p> <p>See Section C.36.2.2.9.1.1, Section C.36.2.2.9.1.2 and Section C.36.2.2.9.1.3.</p> <p>Required if the conditions in Section C.36.2.2.5.1.1 are satisfied and if Device Type Code Sequence contains (130330, DCM, "Jaw Pair"), (130331, DCM, "Leaf Pairs") or (130333, DCM, "Single Leaves").</p>
<p>>RT Beam Delimiter Geometry Sequence</p>	<p>(300A,064C)</p>	<p>1C</p>	<p>The outline of the Beam Limiting Device opening. Required if the conditions in Section C.36.2.2.5.1.1 are satisfied and if DeviceType Code Sequence (3010,002E) contains (130332, DCM, "Variable Circular Collimator").</p> <p>See Section C.36.2.2.9.1.1 and Section C.36.2.2.9.1.3.</p> <p>Only a single Item shall be included in this Sequence.</p>
<p>>>Include Table 10.38-1 "Outline Definition Macro Attributes".</p>			<p>The Outline Shape Type (0018,1630) shall be CIRCULAR.</p> <p>The plane is defined in Section C.36.2.2.9.1.1.</p>

455 **C.36.2.2.9.1 RT Beam Limiting Device Opening Attribute Descriptions**

456 **C.36.2.2.9.1.1 Geometric Value Attributes**

457 **All geometric values in Table C.36.2.2.9-1 are defined in the Beam Modifier Definition Plane.**

458 **C.36.2.2.9.1.2 RT Beam Delimiter Element Positions**

459 **For Device Type Code Sequence (3010,002E) values of (130330, DCM, "Jaw Pair") or (130331, DCM, "Leaf**
 460 **Pairs"), the order of values are**

461 **N1, N2, Nn**

462 **P1, P2, Pn**

463 **where N denotes the negative mounting side, P the positive mounting side and the indices increasing**
 464 **corresponding to the order of the values of Parallel RT Beam Delimiter Boundaries (300A,0649).**

465 **C.36.2.2.9.1.3 RT Beam Delimiter Geometry**

466 **The definition of the tip positions in Parallel RT Beam Delimiter Positions (300A,064A) or delimiter outline**
 467 **in the RT Beam Delimiter Geometry Sequence (300A,064C) is as defined by the manufacturer and shall be**
 468 **documented in the Conformance Statement. Typically, this will be the radiological or physical edge.**

469

470 ...

471 **Add the following Macros to PS3.3 Annex C, Section C.36.2:**

472

473 **C.36.2 RT Second Generation Macros**

474 ...

475 **C.36.2.2 RT Second Generation Device Macros**

476 ...

477 **C.36.2.2.X20 RT Beam Limiting Device Opening Sequence Macro**

478 This Macro defines the opening created by RT Beam Limiting Devices for a specific frame.

479 **Table C.36.2.2.X20-1. RT Beam Limiting Device Opening Sequence Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
RT Beam Limiting Device Opening Sequence	(300A,0656)	1C	Beam limiting device (collimator) settings defining the opening for the current Control Point. Required if Number of RT Beam Limiting Devices (300A,0641) is present and has a non-zero value. One or more Items shall be included in this Sequence.
<i>>Include Table C.36.2.2.X21-1. "RT Beam Limiting Device Opening Definition Macro Attributes"</i>			

480

481 **C.36.2.2.X21 RT Beam Limiting Device Opening Definition Macro**

482 This Macro defines the opening created by RT Beam Limiting Devices.

483 **Table C.36.2.2.X21-1. RT Beam Limiting Device Opening Definition Macro Attributes**

484

Attribute Name	Tag	Type	Attribute Description
Referenced Device Index	(300A,0607)	1	The value of Device Index (3010,0039) from the RT Beam Limiting Device Definition Sequence (300A,064D) corresponding to the Beam Limiting Device used in this Item.
RT Beam Limiting Device Offset	(300A,064B)	1C	The offsets (x,y) in mm of the Parallel RT Beam Delimiter Positions (300A,064A) along the x-axis and the Parallel RT Beam Delimiter Boundaries (300A,0649) along the y-axis of the Beam Modifier Coordinate System after the Beam Modifier Orientation Angle (300A,0645) is applied. See Section C.36.2.2.X21.1.1 and Section C.36.2.2.8.1.2. Required if the conditions in Section C.36.2.2.5.1.1 are satisfied.
Parallel RT Beam Delimiter Positions	(300A,064A)	1C	One-dimensional positions of the tip in mm of beam delimiters. If Device Type Code Sequence (3010,002E) contains (130333, DCM, "Single Leaves"), N values shall be provided where N is the Number of Parallel RT Beam Delimiters (300A,0648). If Device Type Code Sequence contains (130330, DCM, "Jaw Pair") or (130331, DCM, "Leaf Pairs"), 2N

Attribute Name	Tag	Type	Attribute Description
			<p>values shall be provided where N is the Number of Parallel RT Beam Delimiters (300A,0648). The values shall be grouped by the mounting side identified by the Parallel RT Beam Delimiter Leaf Mounting Side (300A,064F) with the values of RT Beam Delimiter Elements on the negative mounting side first.</p> <p>The order of values shall correspond to the order of the Parallel RT Beam Delimiter Boundaries (300A,0649).</p> <p>See Section C.36.2.2.X21.1.1, Section C.36.2.2.X21.1.2 and Section C.36.2.2.X21.1.3.</p> <p>Required if the conditions in Section C.36.2.2.5.1.1 are satisfied and if Device Type Code Sequence contains (130330, DCM, "Jaw Pair"), (130331, DCM, "Leaf Pairs") or (130333, DCM, "Single Leaves").</p>
RT Beam Delimiter Geometry Sequence	(300A,064C)	1C	<p>The outline of the Beam Limiting Device opening. Required if the conditions in Section C.36.2.2.5.1.1 are satisfied and if DeviceType Code Sequence (3010,002E) contains (130332, DCM, "Variable Circular Collimator").</p> <p>See Section C.36.2.2.X21.1.1 and Section C.36.2.2.X21.1.3.</p> <p>Only a single Item shall be included in this Sequence.</p>
<i>>Include Table 10.38-1 "Outline Definition Macro Attributes".</i>			<p><i>The Outline Shape Type (0018,1630) shall be CIRCULAR.</i></p> <p><i>The plane is defined in</i><i>See Section C.36.2.2.X21.1.1.</i></p>

485

486 **C.36.2.2.X21.1 RT Beam Limiting Device Opening Macro Attribute Descriptions**

487 **C.36.2.2.X21.1.1 Geometric Value Attributes**

488 All geometric values in Table C.36.2.2.X21-1 are defined in the Beam Modifier Definition Plane.

489 **C.36.2.2.X21.1.2 Parallel RT Beam Delimiter Element Positions**

490 For Device Type Code Sequence (3010,002E) values of (130330, DCM, "Jaw Pair") or (130331, DCM, "Leaf Pairs"), the order of **the Parallel RT Beam Delimiter Element Positions** values are

492 N1, N2, Nn

493 P1, P2, Pn

494 where N denotes the negative mounting side, P the positive mounting side and the indices increasing
495 corresponding to the order of the values of Parallel RT Beam Delimiter Boundaries (300A,0649).

496 **C.36.2.2.X21.1.3 RT Beam Delimiter Geometry**

497 The definition of the tip positions in Parallel RT Beam Delimiter Positions (300A,064A) or delimiter outline in the RT
498 Beam Delimiter Geometry Sequence (300A,064C) is as defined by the manufacturer and shall be documented in
499 the Conformance Statement. Typically, this will be the radiological or physical edge.

500 ...

501 **C.36.2.3 RT Second Generation Positioning Macros**

502 ...

503 **C.36.2.3.X30 RT Patient Position Scope With Legacy Support Macro**

504 The RT Patient Position Scope Macro With Legacy Support defines the RT Radiation Set, RT Radiation Instances
 505 or the Treatment Position Groups to which a set of positioning parameters apply.

506
 507

**Table C.36.2.3.X30-1
 RT Patient Position Scope Macro Attributes**

Attribute Name	Tag	Type	Description
Referenced RT Radiation Sequence	(300A,0630)	1C	A set of RT Radiation Instances for which the positioning parameters apply. Required if Referenced RT Radiation Set Sequence (300A,0702) and Referenced RT Plan Sequence (300C,0002) are absent. One or more Items shall be included in this Sequence.
<i>>Include Table 10-11 "SOP Instance Reference Macro Attributes"</i>			
Referenced RT Radiation Set Sequence	(300A,0702)	1C	A collection of RT Radiation Sets for which the positioning parameters apply. Required if Referenced RT Radiation Sequence (300A,0630) and Referenced RT Plan Sequence (300C,0002) are absent. One or more Items shall be included in this Sequence.
<i>>Include Table 10-11 "SOP Instance Reference Macro Attributes"</i>			
>Referenced RT Radiation Sequence	(300A,0630)	1C	A subset of the SOP Instances referenced in the RT Radiation Set SOP Instance for which the parameters apply. Required if Treatment Position Group Sequence (300A,060A) is absent and the scope is limited to a subset of RT Radiation SOP Instances of the referenced RT Radiation Set. One or more Items shall be included in this Sequence. The maximum number of Items is one less than the number of RT Radiation SOP Instances in the referenced RT Radiation Set SOP Instance.
<i>>>Include Table 10-11 "SOP Instance Reference Macro Attributes"</i>			

Attribute Name	Tag	Type	Description
>Treatment Position Group Sequence	(300A,060A)	1C	Treatment Position Groups defining patient positions for which the parameters apply. Required if Referenced RT Radiation Sequence (300A,0630) is absent and Treatment Position Groups to which the positioning parameters apply are defined in the referenced RT Radiation Set. One or more Items shall be included in this Sequence. See C.36.10.1.3.
>>Referenced Treatment Position Group UID	(300A,0785)	1	Referenced unique identifier of the Treatment Position Group.
Referenced RT Plan Sequence	(300C,0002)	1C	A collection of RT Plans and/or RT Ion Plans for which the positioning parameters apply. Required if Referenced RT Radiation Sequence (300A,0630) and Referenced RT Radiation Set Sequence (300A,0702) are absent. One or more Items shall be included in this Sequence.
<i>>Include Table 10-11 "SOP Instance Reference Macro Attributes"</i>			
>Beam Sequence	(300A,00B0)	1C	A subset of RT Beams included in the RT Plan SOP Instance for which the parameters apply. Required if the scope is limited to a subset of RT Beams of the referenced RT Plan and the Number Of Beams (300A,0080) is not zero. One or more Items shall be included in this Sequence. The maximum number of Items is one less than the number of RT Beams in the referenced RT Plan SOP Instance.
>>Referenced Beam Number	(300C,0006)	1	Beam Number identifying the referenced RT Beam or RT Ion Beam.

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509 **C.36.2.n RT Second Generation Imaging Macros**

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511 **C.36.2.n.X2 Patient Position Acquisition Device Macro**512 The Patient Position Acquisition Device Macro contains all parameters that describe a device to acquire artifacts to
513 detect the patient position.

514

515

**Table C.36.2.n.X2-1
Patient Position Acquisition Device Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
Number of Acquisition Devices	(gggg,7452)	1	Number of Acquisition Devices defined in the Acquisition Device Sequence (gggg,7453).
Acquisition Device Sequence	(gggg,7453)	1C	Devices used to generate images. The devices may be physical imaging devices that performed acquisition or virtual imaging devices for which acquisition was simulated. Required if the Number of Acquisition Devices (gggg,7452) has a non-zero value. The number of Items included in this Sequence shall equal the value of Number of Acquisition Devices (gggg,7452).
>Include Table C.36.2.2.3-1 "RT Accessory Device Identification Macro Attributes"			CID is specified at invocation.
>Device Index	(3010,0039)	1	Index of the Device in this Sequence. The value shall start at 1 and increase monotonically by 1.
>Referenced Defined Device Index	(300A,0602)	1C	Device Index value that links the device defined by this Sequence Item to the corresponding device in another SOP Radiation Instance. The description of the two devices may or may not be the same. The value is the index of a device in the Acquisition Device Sequence (gggg,7453) within the single SOP Instance referenced by a SOP Instance Sequence defined in the Macro invocation. Required if the Instance referenced in the SOP Instance Sequence contains the device that corresponds to the device defined by this Sequence Item. See Section C.36.2.2.8.1.5.

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519 **C.36.2.n.X4 RT Projection Imaging Request Geometry Macro**

520 The RT Projection Imaging Request Geometry Macro describes the location of the imaging source and image
521 receptor to be used for acquisition.

522

523

**Table C.36.2.n.X4-1
RT Projection Imaging Request Geometry Macro Attributes**

Attribute Name	Tag	Type	Description
Imaging Source Location Specification Type	(gggg,7410)	1	The method of specifying the location and orientation of the imaging source. Enumerated Values: ABSOLUTE_MATRIX: Specified using absolute values represented by matrices describing the Imaging Source Coordinate System with respect to the Equipment Frame of Reference. ABSOLUTE_PARAMS: Specified using absolute values for native parameters of a specific device.

Attribute Name	Tag	Type	Description
			RELATIVE_PARAMS: Specified using values for native parameters relative to the values referenced in Baseline Parameters RT Radiation Sequence (gggg,7470).
Imaging Device Location Matrix Sequence	(gggg,7411)	1C	Parameters describing the location of the Imaging Source and the Image Receptor by the means of matrices. Required if Imaging Source Location Specification Type (gggg,7410) is present and has a value of ABSOLUTE_MATRIX. Only a single Item shall be included in this Sequence.
<i>>Include Table C.36.2.n.X5-1 “Matrix-based RT Imaging Geometry Macro Attributes”</i>			
Imaging Device Location Parameter Sequence	(gggg,7412)	1C	Parameters describing the location and orientation of the image receptor by the means of parameters. Required if Imaging Source Location Specification Type (gggg,7410) is present and has a value of ABSOLUTE_PARAMS or RELATIVE_PARAMS. Only a single Item shall be included in this Sequence. See C.36.2.n.X4.1.1.
>Referenced Radiation RT Control Point Index	(300A,073B)	1C	Index of the RT Control Point of the RT Radiation SOP Instance referenced in the Baseline Parameters RT Radiation Sequence (gggg,7470) which defines the values against which the relative values have to be applied. Required if Imaging Source Location Specification Type (gggg,7410) has a value of RELATIVE_PARAMS.
<i>>Include Table C.36.2.n.X6-1 “Parameterized RT Imaging Geometry Macro Attributes”</i>			

524

525 **C.36.2.n.X4.1 RT Projection Imaging Request Geometry Macro Attribute Descriptions**526 **C.36.2.n.X4.1.1 Imaging Device Location Parameter Sequence**

527 If Imaging Source Location Specification Type (gggg,7410) has a value of ABSOLUTE_PARAMS the parameters
528 have to be applied as is.

529 If Imaging Source Location Specification Type (gggg,7410) has a value of RELATIVE_PARAMS the parameters
530 represent delta values between the parameters of the referenced RT Control Point in Radiation SOP Instance
531 referenced in the Baseline Parameters RT Radiation Sequence (gggg,7470). Only those parameters whose value
532 is not zero shall be included in the Imaging Device Location Parameter Sequence (gggg,7412).

533 **C.36.2.n.X5 Matrix-based RT Imaging Geometry Macro**

534 The Matrix-based RT Imaging Geometry Macro describes the location of the imaging source and image receptor by
535 the means of matrices with respect to the Equipment Frame of Reference.

536

537

**Table C.36.2.n.X5-1
Matrix-based RT Imaging Geometry Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
Imaging Source Position Sequence	(gggg,7115)	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 (gggg,7453) corresponding to the Acquisition Device used in this Item.

Attribute Name	Tag	Type	Attribute Description
			Required if Value 1 of Image Type (0008,0008) has the value ORIGINAL or the current Instance was derived from an Instance where this Attribute was present. May be present otherwise.
>Device Position to Equipment Mapping Matrix	(gggg,7121)	1	A rigid, homogeneous 4x4 transformation matrix that maps the Imaging Source Coordinate System to the Equipment Coordinate System. Matrix elements shall be listed in row-major order. See C.36.1.1.n1.
>Device Position Parameter Sequence	(gggg,7123)	2	Device-specific parameters, derived from the Device Position to Equipment Mapping Matrix (gggg,7121). See C.36.2.n.X5.1.1. Zero or more Items shall be included in this sequence.
>>Include Table 10-2 "Content Item Macro Attributes"			Defined TID is TID SUP213T02 "Imaging Source Geometry Parameters".
Image Receptor Position Sequence	(gggg,7116)	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 (gggg,7453) corresponding to the Acquisition Device used in this Item. Required if Value 1 of Image Type (0008,0008) has the value ORIGINAL or the current Instance was derived from an Instance where this Attribute was present. May be present otherwise.
>Device Position to Equipment Mapping Matrix	(gggg,7121)	1	A rigid, homogeneous 4x4 transformation matrix that maps the Image Receptor Coordinate System to the Equipment Coordinate System. Matrix elements shall be listed in row-major order. See C.36.1.1.n2.
>Device Position Parameter Sequence	(gggg,7123)	2	Device-specific parameters, derived from the Device Position to Equipment Mapping Matrix (gggg,7121). See C.36.2.n.X5.1.1. Zero or more Items shall be included in this sequence.
>>Include Table 10-2 "Content Item Macro Attributes"			Defined TID is TID SUP213T03 "Image Receptor Geometry Parameters".

538

539 **C.36.2.n.X5.1 Matrix-based RT Imaging Geometry Macro Attribute Descriptions**540 **C.36.2.n.X5.1.1 Imaging Source Position Parameter Sequence and the Image Receptor Position**
541 **Parameter Sequence**

542 The Device Position to Equipment Mapping Matrix (gggg,7121) is the exclusive source of information to define the
543 location of the imaging source respectively the image receptor. Imaging devices will solely derive the displacement
544 by this matrix.

545 Some applications, which do not act as imaging devices and cannot de-compose these matrices into device-
546 specific parameters, may want to informatively display device-specific parameters to the user. The purpose of the
547 Device Position Parameter Sequence (gggg,7123) is to facilitate such display. These Sequences are not a
548 substitute for the Device Position to Equipment Mapping Matrix (gggg,7121).

549 **C.36.2.n.X6 Parameterized RT Imaging Geometry Macro**550 This macro defines positioning of the image radiation source and the image receptor by the means of device
551 parameters.552
553

**Table C.36.2.n.X6-1
Parameterized RT Imaging Geometry Macro Attributes**

Attribute Name	Tag	Type	Description
Imaging Source Position Sequence	(gggg,7115)	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 (gggg,7453) corresponding to the Acquisition Device used in this Item. Required if Value 1 of Image Type (0008,0008) has the value ORIGINAL or the current Instance was derived from an Instance where this Attribute was present. May be present otherwise.
>Device Position Parameter Sequence	(gggg,7123)	1	Parameters describing the position of the imaging source. One or more Items shall be included in this sequence.
<i>>>Include Table 10-2 "Content Item Macro Attributes"</i>			<i>Defined TID is TID SUP213T02 "Imaging Source Geometry Parameters".</i>
Image Receptor Position Sequence	(gggg,7116)	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 (gggg,7453) corresponding to the Acquisition Device used in this Item. Required if Value 1 of Image Type (0008,0008) has the value ORIGINAL or the current Instance was derived from an Instance where this Attribute was present. May be present otherwise.
>Device Position Parameter Sequence	(gggg,7123)	1	Parameters describing the position of the image receptor. One or more Items shall be included in this sequence.
<i>>>Include Table 10-2 "Content Item Macro Attributes"</i>			<i>Defined TID is TID SUP213T03 "Image Receptor Geometry Parameters".</i>

554

555 **C.36.2.n.X7 RT Imaging Aperture Macro**

556 The RT Imaging Aperture Macro defines the aperture of the imaging device to be applied during image acquisition.

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**Table C.36.2.n.X7-1
RT Imaging Aperture Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
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Imaging Aperture Specification Type	(gggg,7425)	3	Type of specification of field aperture for imaging. Enumerated Values: OPEN: The aperture is specified to be fully opened. BEAM: The aperture is specified to be the aperture in an RT Control point of the RT Radiation SOP Instance referenced in the Baseline Parameters RT Radiation Sequence (gggg,7470). RELATIVE_TO_BEAM: The aperture is specified relative to the aperture in an RT Control point of the RT Radiation SOP Instance referenced in the Baseline Parameters RT Radiation Sequence (gggg,7470). CUSTOM: The aperture is fully specified by the provided parameter values.
Imaging Source to Beam Modifier Definition Plane Distance	(gggg,74C5)	1C	Distance in mm from the Radiation Source to the origin of the Base Beam Modifier System. Required if Imaging Aperture Specification Type (gggg,7425) does not have a value of OPEN.
Referenced Radiation RT Control Point Index	(300A,073B)	1C	Index of the RT Control Point of the RT Radiation SOP Instance referenced in the Baseline Parameters RT Radiation Sequence (gggg,7470) which provides the basis for the aperture definition of the imaging source. Required if Imaging Aperture Specification Type (gggg,7425) has a value of BEAM or RELATIVE_TO_BEAM.
Imaging Aperture Sequence	(gggg,7413)	1C	Parameters describing the aperture of the imaging source. If Imaging Aperture Specification Type (gggg,7425) has a value of CUSTOM, the provided parameter values fully specify the aperture. If Imaging Aperture Specification Type (gggg,7425) has a value of RELATIVE_TO_BEAM, the provided parameter values represent delta values with respect to the values in the referenced RT Control Point in the RT Radiation SOP Instance referenced in the Baseline Parameters RT Radiation Sequence (gggg,7470). Required if Imaging Aperture Specification Type (gggg,7425) has a value of CUSTOM or RELATIVE_TO_BEAM. Only a single Item shall be included in this Sequence.
>Include Table C.36.2.2.20-1 "RT Beam Limiting Device Opening Sequence Macro Attributes"			

559

560 **C.36.2.n.X8 3D RT Cone-Beam Imaging Geometry Macro**561 The 3D RT Cone-Beam Imaging Geometry Macro describes the parameters to be applied for a Cone-Beam
562 acquisition in a Radiotherapy context.

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564

**Table C.36.2.n.X8-1
3D RT Cone-Beam Imaging Geometry Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
Scan Arc Type	(gggg,74D1)	3	Categorization of the amount of rotation of the scan.

Attribute Name	Tag	Type	Attribute Description
			Enumerated Values: FULL_ARC = 360 deg HALF_ARC = 180 deg CUSTOM_ARC = user defined scan range
Scan Start Position Sequence	(gggg,74C2)	1	Start Position of the 3D RT Cone Beam Radiation Imaging Acquisition. The angle is a Continuous Rotation Angle, see Section C.36.1.1.5 . Only a single Item shall be included in this Sequence.
<i>>Include Table C.36.2.n.X6-1 "Parameterized RT Imaging Geometry Macro Attributes"</i>			
Scan Stop Position Sequence	(gggg,74C3)	1	Stop Position of the 3D RT Cone Beam Radiation Imaging Acquisition. The angle is a Continuous Rotation Angle, see Section C.36.1.1.5 . Only a single Item shall be included in this Sequence.
<i>>Include Table C.36.2.n.X6-1 "Parameterized RT Imaging Geometry Macro Attributes"</i>			
Detector Positioning Type	(gggg,74D2)	3	Fan type of acquisition. Enumerated Values: CENTERED = full fan, detector is centered, resulting in a normal field of view SHIFTED = half fan, detector is laterally shifted by half of the detector size to increase the field of view.
Parameters Specification Sequence	(0018,9913)	3	Acquisition parameters. One or more Items are permitted in this Sequence.
<i>>Include Table 10.25-1 "Attribute Value Constraint Macro Attributes"</i>			<p><i>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.</i></p> <p><i>The semantics of values of Constraint Violation Significance (0082,0036) in the Macro are assigned in Section C.34.9.3.</i></p> <p><i>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).</i></p>

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566

567 **C.36.2.n.X10 kV Radiation Image Acquisition Parameters Macro**

568 The kV Radiation Image Acquisition Parameters Macro contains parameters specifying details of X-Ray generation
569 for image acquisition using kV-level radiation.

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**Table C.36.2.n.X10-1
kV Radiation Image Acquisition Parameters Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
Imaging Energy Category Code Sequence	(gggg,74F0)	1C	Specification of the imaging energy category. Required if KVP (0018,0060) is not present. Only a single Item shall be included in this Sequence. See C.36.2.n.X10.1.1.
>Include Table 8.8-1 “Code Sequence Macro Attributes”			Baseline CID SUP213007 “Imaging Energy Categories”
KVP	(0018,0060)	2C	Peak kilo voltage of the X-Ray generator used to acquire the image. Required if Imaging Energy Category Code Sequence (gggg,74F0) is not present. See C.36.2.n.X10.1.1.
X-Ray Tube Current in μ A	(0018,8151)	3	X-Ray Tube Current in μ A.
Exposure Time in μ S	(0018,8150)	3	Duration of X-Ray exposure in μ sec.
Average Pulse Width	(0018,1154)	3	Average width of X-Ray pulse in msec.
Radiation Mode	(0018,115A)	3	Specifies X-Ray radiation mode. Enumerated Values: CONTINUOUS PULSED
X-Ray Filter Sequence	(0018,9556)	3	Image filter inserted into the X-Ray beam. One or more Items are permitted in this Sequence.
>Include Table 10.36-1 “Device Identification Macro Attributes”			Baseline CID 10007 “X-Ray Filter Types”.

572

573 **C.36.2.n.X10.1 kV Radiation Image Acquisition Parameters Macro Attribute Descriptions**574 **C.36.2.n.X10.1.1 Imaging Energy Category Code Sequence**

575 The Imaging Energy can be described in either Imaging Energy Category Code Sequence (gggg,74F0) or KVP
576 (0018,0060).

577 When KVP (0018,0060) is present and has no value, no Imaging Energy is described.

578 **C.36.2.n.X11 MV Radiation Image Acquisition Parameters Macro**

579 The MV Radiation Image Acquisition Parameters Macro contains parameters specifying details of X-Ray
580 generation for image acquisition using MV-level radiation.

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**Table C.36.2.n.X11-1
MV Radiation Image Acquisition Parameters Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
Imaging Energy Category Code Sequence	(gggg,74F0)	1C	Specification of the imaging energy category. Required if Radiation Generation Mode Sequence (300A,067B) is not present. Only a single Item shall be included in this Sequence. See C.36.2.n.X11.1.1.
>Include Table 8.8-1 “Code Sequence Macro Attributes”			Baseline CID SUP213007 “Imaging Energy Categories”

Attribute Name	Tag	Type	Attribute Description
Radiation Generation Mode Sequence	(300A,067B)	2C	The beam parameters of the imaging energy. Required if Imaging Energy Category Code Sequence (gggg,74F0) is not present. Zero or one Items shall be included in this Sequence. See C.36.2.n.X11.1.1.
>Include Table C.36.2.2.7-1 “Radiation Generation Mode Macro Attributes”			Defined CID for Radiation Type Code Sequence (300A,067F) is CID 9525 “Radiation Therapy Particle”. Defined CID for Energy Unit Code Sequence (300A,0684) is CID 9521 “Radiotherapy Treatment Energy Unit”. Defined CID for Radiation Fluence Modifier Code Sequence (300A,0683) is CID 9549 “Radiation Generation Mode Types”. The Number of Radiation Generation Modes (300A,0685) shall have the value one.
Maximum Cumulative Meterset Exposure	(gggg,74F2)	3	The maximum allowed exposure described in Meterset values between start and stop of acquisition. The radiation shall be stopped at latest when the difference between the start value and the current value exceeds this value. The unit is defined in the Radiation Dosimeter Unit Sequence (300A,0658).
Radiation Dosimeter Unit Sequence	(300A,0658)	1C	Measurement unit of the machine dosimeter. Required if Maximum Cumulative Meterset Exposure (gggg,74F2) is present. Only a single Item shall be included in this Sequence.
>Include Table 8.8-1 “Code Sequence Macro Attributes”			Defined CID SUP213031 “RT Radiation Meterset Units”
Delivery Rate	(300A,063D)	2C	The nominal rate of delivery of the Meterset during acquisition. Required is the acquisition is not taken simultaneously during the delivery of the therapeutic radiation. The unit is defined in the Delivery Rate Unit Sequence (300A,063E).
Delivery Rate Unit Sequence	(300A,063E)	1C	The unit of a delivery rate value. Required if Delivery Rate (300A,063D) is present and has a value. Only a single Item shall be included in this Sequence.
>Include Table 8.8-1 “Code Sequence Macro Attributes”			No Baseline CID defined.

583

584 **C.36.2.n.X11.1 MV Radiation Image Acquisition Request Parameters Macro Attribute Description**585 **C.36.2.n.X11.1.1 Energy-related Attributes**586 The Imaging Energy can be described in either Imaging Energy Category Code Sequence (gggg,74F0) or
587 Radiation Generation Mode Sequence (300A,067B).588 When the Radiation Generation Mode Sequence (300A,067B) is present with zero Items, the imaging energy may
589 be defined as follows:

- 590 • When the acquisition occurs before or after the therapeutic radiation delivery, the energy may be defined by the
591 imaging protocol or set by the user.
- 592 • When the acquisition occurs during the therapeutic radiation delivery, the energy is defined by parameters set
593 for the therapeutic beam.

594 **C.36.2.n.X12 RT Image Frame General Content Macro**

595 The RT Image Frame General Content Macro contains information about the geometric and dosimetric context of a
596 frame reconstructed for use in or acquired during Radiotherapy treatment sessions.

597 **Table C.36.2.n.X12-1**
598 **RT Image Frame General Content Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
RT Image Frame General Content Sequence	(gggg,7020)	1	Identifies RT-specific characteristics of the frame. Only a single Item shall be included in this Sequence.
>Frame Type	(0008,9007)	1	Type of Frame. A multi-valued Attribute analogous to Image Type (0008,0008). See C.36.2.n.X12.1.1 and C.36.m2.1.1.
>Referenced Treatment Position Index	(300A,060B)	1C	The value of Treatment Position Index (300A,0606) from the Treatment Position Sequence (300A,063F) within this IOD describing the position when the frame was taken. Required if the Treatment Position Sequence (300A,063F) is present and the current Frame was acquired at a position specified in an Item of this Sequence.
>Start Cumulative Meterset	(gggg,7030)	2	The value of the Cumulative Meterset when the acquisition of the current frame started.

599

600 **C.36.2.n.X12.1 RT Image Frame General Content Macro Attribute Descriptions**

601 **C.36.2.n.X12.1.1 Frame Type**

602 Frame Type (0008,9007) Value 1 and Value 2 shall identify the Pixel Data Characteristics in accordance with
603 Section C.7.6.1.1.2.

604 Values 3 and 4 are required to be present.

605 Defined Terms for Value 3:

606 PLANNED: Image representing planned treatment position

607 TREATMENT: Image acquired at the actual treatment position or reconstructed based on the information
608 about the actual treatment position

609 SIMULATION: Image acquired at a treatment device to simulate a potential treatment by a conventional
610 simulator image

611 Defined Terms for Value 4:

612 IMAGE: Image

613 PORTFILM: Digitized Portal Image

614 DOSE: Integrated dose map at the imaging device plane [MEDPHYS 23464308]

615 FLUENCE: Fluence map

616 Defined Terms for Value 5:

617 PREDICTED: Expected values of integrated dose or fluence

618 ACQUIRED: Image, dose or fluence as acquired by image receptor

619 REF_MATCHING: Image reconstructed to compare against an image acquired at treatment position

620

621 C.36.2.n.X13 RT Image Frame Imaging Device Position Macro

622 The RT Image Frame Imaging Device Position Macro contains the specification of the position of the imaging
623 source and the imaging device.

624

625

**Table C.36.2.n.X13-1
RT Image Frame Imaging Device Position Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
RT Image Frame Imaging Device Position Sequence	(gggg,7040)	1	The position of the imaging source and the imaging device for this frame. Only a single Item shall be included in this Sequence.
>Include Table C.36.2.n.X5-1 "Matrix-based RT Imaging Geometry Macro Attributes"			

626

627 C.36.2.n.X14 RT Image Frame Radiation Acquisition Parameters Macro

628 The Radiation Image Acquisition Parameters Macro contains parameters specifying details of generation of the
629 radiation used for image acquisition.

630

631

**Table C.36.2.n.X14-1
RT Image Frame Radiation Acquisition Parameters Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
RT Image Frame Radiation Acquisition Sequence	(gggg,7043)	1	The acquisition parameters describing the generation of radiation of the frame. Only a single Item shall be included in this Sequence.
>RT Image Frame kV Radiation Acquisition Sequence	(gggg,7041)	1C	The kV photon acquisition parameters of the frame. Required if RT Image Frame MV Radiation Acquisition Sequence (gggg,7042) is not present. Only a single Item shall be included in this Sequence.
>>Include Table C.36.2.n.X10-1 "kV Radiation Image Acquisition Parameters Macro Attributes"			
>RT Image Frame MV Radiation Acquisition Sequence	(gggg,7042)	1C	The MV photon or particle acquisition parameters of the frame. Required if RT Image Frame kV Radiation Acquisition Sequence (gggg,7041) is not present. Only a single Item shall be included in this Sequence.
>>Include Table C.36.2.n.X11-1 "MV Radiation Image Acquisition Parameters Macro Attributes"			

632

633 C.36.2.n.X15 RT Image Frame Context Macro

634 The RT Image Frame Context Macro contains information about the context of a frame constructed for use in, or
635 acquired during, Radiotherapy treatment sessions.

636

637

**Table C.36.2.n.X12-1
RT Image Frame Context Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
RT Image Frame Context Sequence	(gggg,7021)	1	Contextual information of the frame. Only a single Item shall be included in this Sequence.
>RT Image Scope Sequence	(gggg,7022)	1	The RT Radiation Instances or the Treatment Position Groups for which the Frame is reconstructed or acquired. Only a single Item shall be included in this Sequence.
>>Include Table C.36.2.3.X30-1 “RT Patient Position Scope With Legacy Support Macro Attributes”			
>RT Radiation Set Delivery Number	(300A,0704)	1C	Identification of the RT Radiation Set Delivery of the referenced RT Radiation Set Instance that this frame refers to. Required if the Frame is related to a specific Fraction. See C.36.20.1.2.
>Clinical Fraction Number	(300A,0705)	1C	Identification of the RT Treatment Fraction of the referenced RT Radiation Set Instance that this frame refers to. Required if the Frame is related to a specific Fraction. See C.36.20.1.2.

638

639 Add the following Module to PS3.3 Annex C, Section C.7.6

640 **C.7.6 C.7.6 Common Image IE Modules**

641 ...

642 **C.7.6.n Sparse Multi-frame Functional Groups Module**

643 Table C.7.6.n-1 specifies the Attributes of the Sparse Multi-frame Functional Groups Module. This Module is
644 included in SOP Instances which contain frames acquired continuously with a high frame rate, resulting in a high
645 number of frames.

646 Unlike the Per-frame Functional Groups Sequence (5200,9230) where functional groups that are not shared must
647 be populated on every frame, the Selected Frame Functional Groups Sequence (gggg,7011) allows a selected
648 subset of frames to be populated. Frames that are not selected, the functional groups that are not shared are not
649 present. The Selected Frame Functional Groups Sequence (gggg,7011) allows frames to be omitted, but does not
650 allow required Attributes within the selected frames to be omitted.

651 The Per-frame Functional Group Macros of a frame shall be populated if any value of the required Attributes of the
652 per-frame Functional Group Macro changes; the definition of the change is up to the discretion to the implementer
653 and shall be documented in the Conformance Statement.

654 Per-frame Functional Group Macros for Frames may also be populated even if all required Attribute values do not
655 change, e.g. when frames are populated with a constant sampling rate.

656 The frames in this SOP Instance are identified by a number. The first frame is identified as frame number 1 and
657 subsequent frames are identified by a number incremented by 1. The values in Selected Frame Number
658 (gggg,7010) correspond to these numbered frames.

659 The rest of the semantics of C.7.6.16 Multi-frame Functional Groups Module applies to this Module.

660

661 **Table C.7.6.n-1. Sparse Multi-frame Functional Groups Module Attributes**

662

Attribute Name	Tag	Type	Attribute Description
Shared Functional Groups Sequence	(5200,9229)	1	Sequence that contains the Functional Group Macros that are shared for all frames in this SOP Instance and Concatenation. Note The contents of this Sequence are the same in all SOP Instances that comprise a Concatenation. Only a single Item shall be included in this Sequence. See Section C.7.6.16.1.1 for further explanation.
<i>>Include one or more Functional Group Macros that are shared by all frames. The selected Functional Group Macros shall not be present in the Per-frame Functional Groups Sequence (5200,9230).</i>			<i>For each IOD that includes this Module, a table is defined in which the permitted Functional Group Macros and their usage is specified. The Item may be empty if the requirements for inclusion of the Functional Groups are not satisfied.</i>
Selected Frame Functional Groups Sequence	(gggg,7011)	1C	Sequence that contains the Functional Group Sequence Attributes corresponding to selected frames of the Multi-frame Image. One or more Items shall be included in this Sequence. The number of Items shall be greater than zero and the less as the number of frames in the Multi-frame image. See Section C.7.6.n.1.1 for further explanation.
<i>>Selected Frame Number</i>	<i>(gggg,7010)</i>	<i>1</i>	<i>Identifies the corresponding frame in the SOP Instance.</i>
<i>>Include one or more Functional Group Macros.</i>			<i>For each IOD that includes this Module, a table is defined in which the permitted Functional Group Macros and their usage is specified.</i>
Instance Number	(0020,0013)	1	A number that identifies this Instance. The value shall be the same for all SOP Instances of a Concatenation, and different for each separate Concatenation and for each SOP Instance not within a Concatenation in a Series.
Content Date	(0008,0023)	1	The date the data creation was started. Note For Instance, this is the date the pixel data is created, not the date the data is acquired.
Content Time	(0008,0033)	1	The time the data creation was started. Note For Instance, this is the time the pixel data is created, not the time the data is acquired.
Number of Frames	(0028,0008)	1	Number of frames in a multi-frame image. See Section C.7.6.6.1.1 for further explanation.
Stereo Pairs Present	(0022,0028)	3	The multi-frame pixel data consists of left and right stereoscopic pairs. See Section C.7.6.6.1.3 for further explanation.

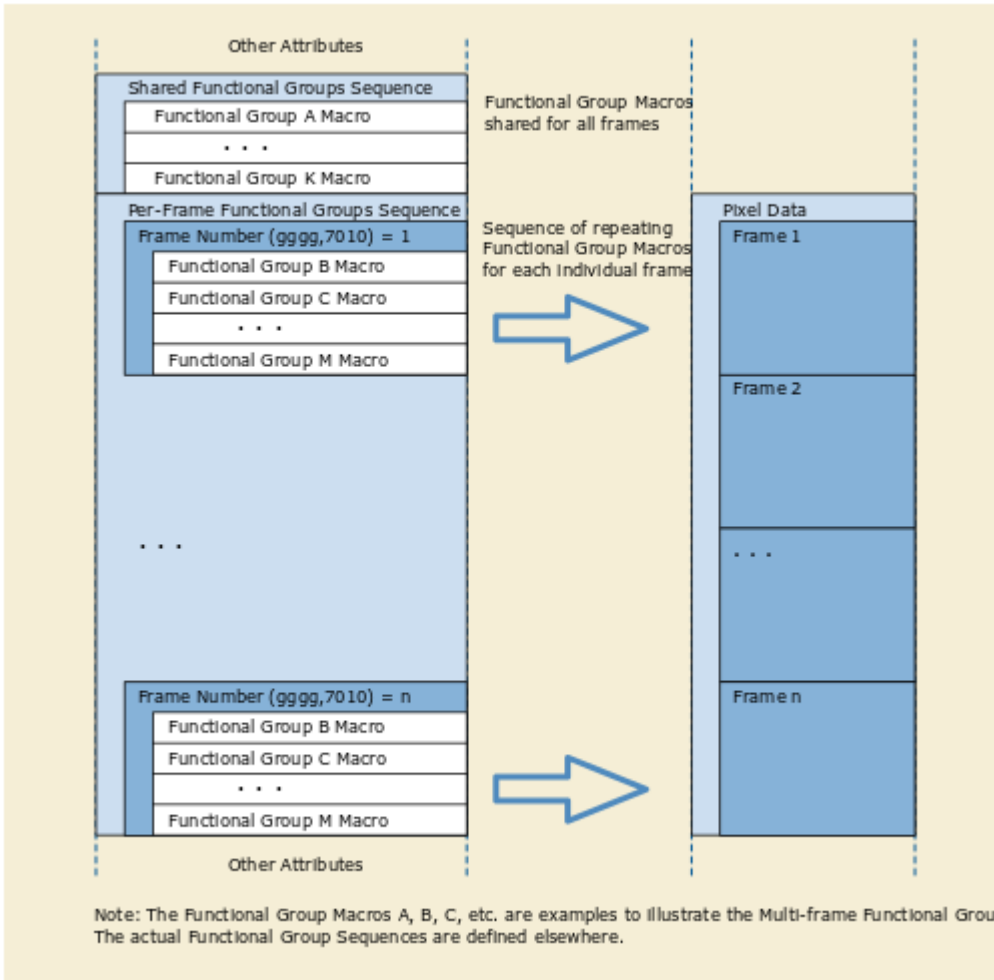
Attribute Name	Tag	Type	Attribute Description
			Enumerated Values: YES NO
Concatenation Frame Offset Number	(0020,9228)	1C	Offset of the first frame in a multi-frame image of a concatenation. Logical frame numbers in a concatenation can be used across all its SOP Instances. This offset can be applied to the implicit frame number to find the logical frame number in a concatenation. The offset is numbered from zero; i.e., the instance of a concatenation that begins with the first frame of the concatenation has a Concatenation Frame Offset Number (0020,9228) of zero. Required if Concatenation UID (0020,9161) is present.
Representative Frame Number	(0028,6010)	3	The frame number selected for use as a pictorial representation (e.g., icon) of the multi-frame Image.
Concatenation UID	(0020,9161)	1C	Identifier of all SOP Instances that belong to the same concatenation. Required if a group of multi-frame image SOP Instances within a Series are part of a Concatenation.
SOP Instance UID of Concatenation Source	(0020,0242)	1C	The SOP Instance UID of the single composite SOP Instance of which the Concatenation is a part. All SOP Instances of a concatenation shall use the same value for this Attribute, see Section C.7.6.16.1.3. Note May be used to reference the entire Instance rather than individual Instances of the concatenation, which may be transient (e.g., from a presentation state). Required if Concatenation UID (0020,9161) is present.
In-concatenation Number	(0020,9162)	1C	Identifier for one SOP Instance belonging to a concatenation. See Section C.7.6.16.2.2.4 for further specification. The first Instance in a concatenation (that with the lowest Concatenation Frame Offset Number (0020,9228) value) shall have an In-concatenation Number (0020,9162) value of 1, and subsequent Instances shall have values monotonically increasing by 1. Required if Concatenation UID (0020,9161) is present.
In-concatenation Total Number	(0020,9163)	3	The number of SOP Instances sharing the same Concatenation UID. If present, shall have a value greater than one, unless an IOD overrides this constraint to enumerate a value of 1 to prevent the use of Concatenations (e.g., see Section C.8.17.7 and Section C.8.17.16).

663

664 **C.7.6.n.1 Sparse Multi-frame Functional Groups Module Attribute Descriptions**

665 **C.7.6.n.1.1 Selected Frame Functional Groups Sequence**

666 The Selected Frame Functional Groups Sequence (gggg,7011) Attribute consists of a Sequence of Items. Each
667 Item describes a frame in the multi-frame pixel data, identified by Selected Frame Number (gggg,7010). Frames
668 are implicitly numbered starting from 1. See Figure C.7.6.n-1.



669

670 **Figure C.7.6.n-1. A Graphical Presentation of the Multi-frame Functional Groups Structure for Sparse Multi-**
671 **frame Functional Groups**

672

673

674

675

Add the following Modules to PS3.3 Annex C, Section C.36

676

677 **C.36.m1 Enhanced RT Image Device Module**

678 The Enhanced RT Image Module contains information about the devices used in the image.

679

680

**Table C.36.m1-1
Enhanced RT Image Device Module Attributes**

Attribute Name	Tag	Type	Description
Equipment Frame of Reference UID	(300A,0675)	1	Frame of Reference identifier identifying the Equipment Frame of Reference coordinate system which is the parent for Imaging Source Coordinate System and/or the Image Receptor Coordinate System. See 10.39.1.1 and C.36.1.1.n1 and C.36.1.1.n2
Beam Modifier Coordinates Presence Flag	(gggg,7025)	1	Whether Beam Modifiers which contain coordinates referring to the Beam Modifier Coordinate System are present in the current SOP Instance. Enumerate Values: YES: Beam Modifiers containing such coordinates are present. NO: Beam Modifiers containing such coordinates are not present.
RT Device Distance Reference Location Code Sequence	(300A,0659)	1C	Point of reference used for measuring the distance to various devices. Required if Beam Modifier Coordinates Presence Flag (gggg,7025) equals YES. Only a single item shall be included in this Sequence.
>Include Table 8.8-1 "Code Sequence Macro Attributes".			DCID SUP213006 "Patient Position Acquisition Radiation Source Locations".
RT Beam Modifier Definition Distance	(300A,0688)	1C	Absolute distance in mm along the z-axis of the Base Beam Modifier Coordinate System from the reference location as specified by RT Device Distance Reference Location Code Sequence (300A,0659) to the Beam Modifier Definition Plane. The value shall be greater than or equal to zero. Required if Beam Modifier Coordinates Presence Flag (gggg,7025) equals YES. See Section C.36.1.1.9.
Include Table C.36.2.2.2-1 "RT Patient Support Devices Macro Attributes"			
Include Table C.36.2.2.15-1 "General Accessories Definition Macro Attributes"			

Attribute Name	Tag	Type	Description
<i>Include Table C.36.2.2.8-1 “RT Beam Limiting Devices Definition Macro Attributes”</i>			
<i>Include Table C.36.2.n.X2-1 “Patient Position Acquisition Device Macro Attributes”</i>			<i>Defined CID SUP213033 “RT Image Patient Position Acquisition Devices”.</i> <i>The Referenced Defined Device Index (300A,0602) is absent because the SOP Instance containing this Module does not define the SOP Instance Sequence the Referenced Defined Device Index (300A,0602) refers to.</i>

681

682 **C.36.m2 Enhanced RT Image Module**

683 Table C.36.m2-1 contains IOD Attributes that describe an Enhanced RT Image.

684

685

**Table C.36.m2-1
Enhanced RT Image Module Attributes**

Attribute Name	Tag	Type	Description
<i>Include Table 10.32-1 “Entity Long Labeling Macro Attributes”</i>			
Image Type	(0008,0008)	1	Image characteristics. See Section C.8.16.1 and Section C.36.m2.1.1.
Start Cumulative Meterset	(gggg,7030)	2C	The value of the Cumulative Meterset when the acquisition of the first frame started. Required if the image was acquired while therapeutic radiation was applied. May be present otherwise.
Stop Cumulative Meterset	(gggg,7031)	2C	The value of the Cumulative Meterset when the acquisition of the last frame was finished. Required if the image was acquired while therapeutic radiation was applied. May be present otherwise.
Exposure Time in μ S	(0018,8150)	2	Cumulative X-Ray exposure time in μ sec summed across all frames in this SOP Instance.
<i>Include Table C.36.2.2.4-1 “RT Treatment Position Macro Attributes”</i>			

686

687 **C.36.m2.1 Enhanced RT Image Module Attribute Descriptions**688 **C.36.m2.1.1 Image Type and Frame Type**

689 Image Type (0008,0008) and associated Image Type related Attributes provide a high level description of a multi-
690 frame SOP Instance. These Attributes describe properties that provide key summary information to users of the
691 SOP Instance. Image Type (0008,0008) contains the highest level summary of what is in the SOP Instance.

692 Frame Type (0008,9007) mirrors the corresponding Image Type Attribute and applies to the frame level rather than
693 to the image level.

694 If more than one value is used by the set of frames for a given Frame Type (0008,9007) Attribute value or
695 associated Attribute value then the corresponding value of Image Type (0008,0008) or associated Attribute shall
696 contain a value of MIXED. This indicates that a mixed set of values exists within the multi-frame SOP Instance.

697 The value MIXED shall only be used in Image Type (0008,0008) when the corresponding values for the individual
698 frames are not equal. When a value of an Attribute is equal for all frames, the same value shall be used for the
699 corresponding value of Image Type (0008,0008).

700

701 **C.36.m4 RT Patient Position Acquisition Device Module**

702 The RT Patient Position Acquisition Device Module contains information about the devices specified to be used
703 during acquiring artifacts to detect the patient position before, during or after delivering of a Radiation.

704 More devices as listed in this macro may be used during acquisition. Only devices for which parameters are
705 prescribed in the current SOP Instance may be present. The use of other devices may be implied by other
706 information such as the identification of acquisition protocols as defined by Position Acquisition Template
707 Identification Name (gggg,7475).

708

709

**Table C.36.m4-1
RT Patient Position Acquisition Device Module Attributes**

Attribute Name	Tag	Type	Description
Equipment Frame of Reference UID	(300A,0675)	1C	Frame of Reference identifier for the Treatment Delivery Device defining the coordinate system in which the geometric parameters are defined. Required if Image to Equipment Mapping Matrix (0028,9520), Device Position to Equipment Mapping Matrix (gggg,7121) is present in the current SOP Instance. See C.36.12.1.1.
<i>Include Table C.36.2.2.2-1 “RT Patient Support Devices Macro Attributes”</i>			
<i>Include Table C.36.2.2.14-1 “RT Accessory Holders Definition Macro Attributes”</i>			
<i>Include Table C.36.2.2.15-1 “General Accessories Definition Macro Attributes”</i>			
<i>Include Table C.36.2.2.8-1 “RT Beam Limiting Devices Definition Macro Attributes”</i>			<i>Defined CID for Device Type Code Sequence (3010,002E) within “RT Accessory Device Identification Macro” is CID 9541 “Beam Limiting Device Types”.</i>
<i>Include Table C.36.2.n.X2-1 “Patient Position Acquisition Device Macro Attributes”</i>			<i>Defined CID SUP213030 “Patient Position Acquisition Devices”.</i> <i>The SOP Instance Sequence referred to by the Referenced Defined Device Index (300A,0602) is not declared.</i>

710

711 **C.36.m5 RT Patient Position Acquisition Instruction Module**

712 The RT Patient Position Acquisition Instruction Module contains information required by a Patient Position
713 Acquisition System (PPAS) when specifying acquisition of data to detect the patient position before, during or after
714 the delivery specified by an RT Radiation SOP Instance or Treatment Position Group.

715 The RT Patient Position Acquisition Instruction Module consists of a sequence of one or more acquisition tasks.
716 Every acquisition task consists of one or more acquisition subtasks (e.g. two subtasks are required in case of a
717 dual plane acquisition task).

718

719

**Table C.36.m5-1
RT Patient Position Acquisition Instruction Module Attributes**

Attribute Name	Tag	Type	Description
<i>Include Table 10.32-1 “Entity Long Labeling Macro Attributes”</i>			

Attribute Name	Tag	Type	Description
Acquisition Task Sequence	(gggg,7463)	1	Sequence of acquisition tasks. One or more Items shall be included in this Sequence.
>Acquisition Task Index	(gggg,7468)	1	Index of this acquisition task in this Sequence. The value shall start at 1 and increase monotonically by 1.
>RT Acquisition Workitem Code Sequence	(gggg,7464)	1	The Workitem code of the acquisition task. Only a single Item shall be included in this Sequence.
<i>>>Include Table 8.8-1 "Code Sequence Macro Attributes"</i>			<i>Defined CID 9242 "Radiotherapy Acquisition Workitem Definition"</i>
>Acquisition Task Applicability Sequence	(gggg,7478)	1C	The RT Radiation Set, RT Radiation Instances or the Treatment Position Groups to which the acquisition task is applicable. Required if RT Radiation Set, RT Radiation Instances or Treatment Position Groups exist whose treatment position is guided by this acquisition task. Note: In some treatment scenarios, acquisition may be performed prior to the completion of RT Radiation Instances or Treatment Position Groups.
<i>>>Include Table C.36.2.3.X30-1 "RT Patient Position Scope With Legacy Support Macro Attributes"</i>			
>RT Acquisition Patient Position Sequence	(gggg,7039)	2	The position of the patient when performing this acquisition task. Only a single Item shall be included in this Sequence.
<i>>>Include Table C.36.2.3.2-1 "RT Patient Position Macro Attributes"</i>			
>Acquisition Subtask Sequence	(gggg,7465)	1	Sequence of acquisition subtasks. One or more Items shall be included in this Sequence. The number of Items shall be as defined in C.36.m5.1.
>>Acquisition Subtask Index	(gggg,7469)	1	Index of this acquisition subtask in this Sequence. The value shall start at 1 and increase monotonically by 1.
>>Position Acquisition Template Identification Sequence	(gggg,7472)	1C	Identification of an Acquisition template containing a set of parameters to be used when acquiring data for patient position detection. Parameter values which are explicitly included in this module have precedence over values implied by the specified protocol. Required if acquisition parameters are identified by a protocol. Only a single Item shall be included in this Sequence.
>>>Position Acquisition Template Identification Name	(gggg,7475)	1	User defined name of the position acquisition template to be used to acquire this data.
>>>Position Acquisition Template Identification Code Sequence	(gggg,7476)	1C	Code identifying the position acquisition template to be used to acquire this data. Required if Position Acquisition Template Identification ID (gggg,7474) not present. Only a single Item shall be included in this Sequence.

Attribute Name	Tag	Type	Description
>>>>Include Table 8.8-1 “Code Sequence Macro Attributes”			No Baseline CID defined.
>>>Position Acquisition Template Identification ID	(gggg,7474)	1C	Identifier of the position acquisition template. Required if Position Acquisition Template Identification Code Sequence (gggg,7476) is not present. May be present otherwise.
>>>Position Acquisition Template Identification Description	(gggg,7477)	2	User-defined description of the position acquisition template to be used to acquire this data.
>>RT Acquisition Specialization Workitem Code Sequence	(gggg,7466)	1	The Workitem code of the acquisition subtask. Only a single Item shall be included in this Sequence.
>>>Include Table 8.8-1 “Code Sequence Macro Attributes”			Defined CID SUP213005 “Radiotherapy Acquisition WorkItem Subtasks”
>>Baseline Parameters RT Radiation Sequence	(gggg,7470)	1C	RT Radiation SOP Instance defining the baseline parameters for acquisition. Required if one or more parameters for the acquisition are based upon the parameters of an RT Radiation SOP Instance. Required if Imaging Source Location Specification Type (gggg,7410) has the value RELATIVE_PARAMS or Imaging Aperture Specification Type (gggg,7425) has the value BEAM or RELATIVE_TO_BEAM. Only a single Item shall be included in this Sequence.
>>>Include Table 10-11 “SOP Instance Reference Macro Attributes”			
>>>Referenced Beam Number	(300C,0006)	1C	Uniquely identifies the Beam specified by Beam Number (300A,00C0) in the referenced SOP Instance. Required, if the referenced SOP Instance has the SOP Class UID RT Plan (“1.2.840.10008.5.1.4.1.1.481.5”) or RT Ion Plan (“1.2.840.10008.5.1.4.1.1.481.8”).
>>Referenced Device Index	(300A,0607)	1C	The value of device of Device Index (3010,0039) from the Acquisition Device Sequence (gggg,7453) corresponding to the device to be used for acquisition. Required if Number of Acquisition Devices (gggg,7452) is greater than one.
>>RT Device Distance Reference Location Code Sequence	(300A,0659)	1C	Point of reference used for measuring the distance to various devices. Required if the current Item contains any Attributes which refer to the Base Beam Modifier Coordinate System. Only a single item shall be included in this Sequence.
>>>>Include Table 8.8-1 “Code Sequence Macro Attributes”.			DCID SUP213006 “Patient Position Acquisition Radiation Source Locations”.

Attribute Name	Tag	Type	Description
>>RT Beam Modifier Definition Distance	(300A,0688)	1C	Absolute distance in mm along the z-axis of the Base Beam Modifier Coordinate System from the reference location specified by RT Device Distance Reference Location Code Sequence (300A,0659) to the Beam Modifier Definition Plane. The value shall be greater than or equal to zero. Required if RT Device Distance Reference Location Code Sequence(300A,0659) is present. See Section C.36.1.1.9.
>>Acquisition Initiation Sequence	(gggg,74F5)	3	Sequence describing how to trigger the acquisition. One or more Items are permitted in this Sequence.
>>>Include Table 10-2 "Content Item Macro Attributes"			DTID SUP213T01 "Acquisition Initiation Parameters"
>>kV Generation Imaging Parameters Sequence	(gggg,7490)	1C	Parameters for kV Imaging Acquisitions. Required if the code in RT Acquisition Specialization Workitem Code Sequence (gggg,7466) is part of CID SUP213008 "kV Imaging Acquisition Techniques". Only a single Item shall be included in this Sequence.
>>>Include Table C.36.2.n.X10-1 "kV Radiation Image Acquisition Parameters Macro Attributes"			
>>MV Generation Imaging Parameters Sequence	(gggg,7491)	1C	Parameters for MV Imaging Acquisitions. Required if the code in RT Acquisition Specialization Workitem Code Sequence (gggg,7466) is part of CID SUP213009 "MV Imaging Acquisition Techniques". Only a single Item shall be included in this Sequence.
>>>Include Table C.36.2.n.X11-1 "MV Radiation Image Acquisition Parameters Macro Attributes"			
>>Projection Imaging Acquisition Parameter Sequence	(gggg,7480)	1C	Parameters for Projection Image Acquisitions. Required if the code in RT Acquisition Specialization Workitem Code Sequence (gggg,7466) is part of CID SUP213010 "Patient Position Acquisition - Projection Techniques". May be present otherwise. Only a single Item shall be included in this Sequence.
>>>Include Table C.36.2.n.X4-1 "RT Projection Imaging Request Geometry Macro"			
>>>Include Table C.36.2.n.X7-1 "RT Imaging Aperture Macro Attributes"			
>>CT Imaging Acquisition Parameter Sequence	(gggg,7481)	1C	Parameters for CT Image Acquisitions. Required if the code in RT Acquisition Specialization Workitem Code Sequence (gggg,7466) is part of CID SUP213011 "Patient Position Acquisition – CT Techniques". May be present otherwise. Only a single Item shall be included in this Sequence.
>>>Include Table C.36.2.n.X8-1 "3D RT Cone-Beam Imaging Geometry Macro Attributes"			

Attribute Name	Tag	Type	Description
>>Device-Specific Acquisition Parameter Sequence	(gggg,74E2)	3	User-specified device-specific acquisition parameters applicable to the device executing this Acquisition Subtask. One or more Items are permitted in this Sequence.
>>>Include Table 10-2 “Content Item Macro Attributes”			No Baseline TID defined.
>>Additional RT Accessory Device Sequence	(gggg,74E1)	1C	Additional devices used during the acquisition of the reference position artifacts. Required if additional RT Accessory Devices are to be used during patient position acquisition. One or more Items shall be included in this Sequence.
>>>Referenced Device Index	(300A,0607)	1	Reference to the General Accessory Definition Sequence (300A,0671).
>>>Device-Specific Acquisition Parameter Sequence	(gggg,74E2)	3	User-specified device-specific acquisition parameters applicable to the device of the current Item. One or more Items are permitted in this Sequence.
>>>>Include Table 10-2 “Content Item Macro Attributes”			No Baseline TID defined.
>>Referenced Position Reference Instance Sequence	(gggg,74E3)	3	SOP Instances which may be used for verification of patient position in the current acquisition subtask. One or more Items are permitted in this Sequence.
>>>>Include Table 10.37-1 “Related Information Entities Macro Attributes”			Defined CID SUP213012 “Patient Positioning Related Object Purposes”

720

721 **C.36.m5.1 Patient Position Reference Acquisition Subtask Sequence Multiplicity**

722 For the codes defined in Table C.36.m5.1-2 the number of items in the Acquisition Subtask Sequence (gggg,7465)
723 is determined by the code in the RT Acquisition Workitem Code Sequence (gggg,7464) as follows:

724

725

**Table C.36.m5.1-1
Workitem Codes and Subtask Multiplicity**

Code Value (0008,0100)	Code Meaning (0008,0104)	Number of Sequence Items
121702	RT Patient Position Acquisition, single plane MV	1
121703	RT Patient Position Acquisition, dual plane MV	2
121704	RT Patient Position Acquisition, single plane kV	1
121705	RT Patient Position Acquisition, dual plane kV	2
121706	RT Patient Position Acquisition, dual plane kV/MV	2
121707	RT Patient Position Acquisition, CT kV	1
121708	RT Patient Position Acquisition, CT MV	1

726

727

728

Part 4 Addendum

729

Add the following to PS3.4, Appendix B.5, Table B.5-1

SOP Class Name	SOP Class UID	IOD Spec (defined in PS 3.3)
<u>Enhanced RT Image Storage</u>	<u>1.2.840.10008.5.1.4.1.1.481.S213.1</u>	<u>Enhanced RT Image IOD</u>
<u>Enhanced Continuous RT Image Storage</u>	<u>1.2.840.10008.5.1.4.1.1.481.S213.2</u>	<u>Enhanced Continuous RT Image IOD</u>
<u>RT Patient Position Acquisition Instruction Storage</u>	<u>1.2.840.10008.5.1.4.1.1.481.S213.3</u>	<u>RT Patient Position Acquisition Instruction IOD</u>

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Part 6 Addendum

734

Add the following data elements to PS3.6, Chapter 6:

735

736

6 Registry of DICOM Data Elements

737

(gggg,7010)	Selected Frame Number	SelectedFrameNumber	IS	1
(gggg,7011)	Selected Frame Functional Groups Sequence	SelectedFrameFunctionalGroups Sequence	SQ	1
(gggg,7020)	RT Image Frame General Content Sequence	RTImageFrameGeneralContentSequence	SQ	1
(gggg,7021)	RT Image Frame Context Sequence	RTImageFrameContextSequence	SQ	1
(gggg,7022)	RT Image Scope Sequence	RTImageScopeSequence	SQ	1
(gggg,7025)	Beam Modifier Coordinates Presence Flag	BeamModifierCoordinatesPresenceFlag	CS	1
(gggg,7030)	Start Cumulative Meterset	StartCumulativeMeterset	FD	1
(gggg,7031)	Stop Cumulative Meterset	StopCumulativeMeterset	FD	1
(gggg,7039)	RT Acquisition Patient Position Sequence	RTAcquisitionPatientPositionSequence	SQ	1
(gggg,7040)	RT Image Frame Imaging Device Position Sequence	RTImageFrameImagingDevicePositionSequence	SQ	1
(gggg,7041)	RT Image Frame kV Radiation Acquisition Sequence	RTImageFramekVRadiationAcquisitionSequence	SQ	1
(gggg,7042)	RT Image Frame MV Radiation Acquisition Sequence	RTImageFrameMVRadiationAcquisitionSequence	SQ	1
(gggg,7043)	RT Image Frame Radiation Acquisition Sequence	RTImageFrameRadiationAcquisitionSequence	SQ	1
(gggg,7115)	Imaging Source Position Sequence	ImagingSourcePositionSequence	SQ	1
(gggg,7116)	Image Receptor Position Sequence	ImageReceptorPositionSequence	SQ	1
(gggg,7121)	Device Position to Equipment Mapping Matrix	DevicePositionToEquipmentMappingMatrix	FD	16
(gggg,7123)	Device Position Parameter Sequence	DevicePositionParameterSequence	SQ	1
(gggg,7410)	Imaging Source Location Specification Type	ImagingSourceLocationSpecificationType	CS	1
(gggg,7411)	Imaging Device Location Matrix Sequence	ImagingDeviceLocationMatrixSequence	SQ	1
(gggg,7412)	Imaging Device Location Parameter Sequence	ImagingDeviceLocationParameterSequence	SQ	1
(gggg,7413)	Imaging Aperture Sequence	ImagingApertureSequence	SQ	1

(gggg,7425)	Imaging Aperture Specification Type	ImagingApertureSpecificationType	CS	1
(gggg,7452)	Number of Acquisition Devices	NumberOfAcquisitionDevices	US	1
(gggg,7453)	Acquisition Device Sequence	AcquisitionDeviceSequence	SQ	1
(gggg,7463)	Acquisition Task Sequence	AcquisitionTaskSequence	SQ	1
(gggg,7464)	RT Acquisition Workitem Code Sequence	RTAcquisitionWorkitemCodeSequence	SQ	1
(gggg,7465)	Acquisition Subtask Sequence	AcquisitionSubtaskSequence	SQ	1
(gggg,7466)	RT Acquisition Specialization Workitem Code Sequence	RTAcquisitionSpecializationWorkitemCodeSequence	SQ	1
(gggg,7468)	Acquisition Task Index	AcquisitionTaskIndex	US	1
(gggg,7469)	Acquisition Subtask Index	AcquisitionSubtaskIndex	US	1
(gggg,7470)	Baseline Parameters RT Radiation Sequence	BaselineParametersRTRadiationSequence	SQ	1
(gggg,7472)	Position Acquisition Template Identification Sequence	PositionAcquisitionTemplateIdentificationSequence	SQ	1
(gggg,7474)	Position Acquisition Template Identification ID	PositionAcquisitionTemplateIdentificationID	ST	1
(gggg,7475)	Position Acquisition Template Identification Name	PositionAcquisitionTemplateIdentificationName	LO	1
(gggg,7476)	Position Acquisition Template Identification Code Sequence	PositionAcquisitionTemplateIdentificationCodeSequence	SQ	1
(gggg,7477)	Position Acquisition Template Identification Description	PositionAcquisitionTemplateIdentificationDescription	LT	1
(gggg,7478)	Acquisition Task Applicability Sequence	AcquisitionTaskApplicabilitySequence	SQ	1
(gggg,7480)	Projection Imaging Acquisition Parameter Sequence	ProjectionImagingAcquisitionParameterSequence	SQ	1
(gggg,7481)	CT Imaging Acquisition Parameter Sequence	CTImagingAcquisitionParameterSequence	SQ	1
(gggg,7490)	kV Generation Imaging Parameter Sequence	kVGenerationImagingParameterSequence	SQ	1
(gggg,7491)	MV Generation Imaging Parameter Sequence	MVGenerationImagingParameterSequence	SQ	1
(gggg,74C2)	Scan Start Position Sequence	ScanStartPositionSequence	SQ	1
(gggg,74C3)	Scan Stop Position Sequence	ScanStopPositionSequence	SQ	1
(gggg,74C5)	Imaging Source to Beam Modifier Definition Plane Distance	ImagingSourceToBeamModifierDefinitionPlaneDistance	FD	1
(gggg,74D1)	Scan Arc Type	ScanArcType	CS	1
(gggg,74D2)	Detector Positioning Type	DetectorPositioningType	CS	1
(gggg,74E1)	Additional RT Accessory Device Sequence	AdditionalRTAccessoryDeviceSequence	SQ	1
(gggg,74E2)	Device-Specific Acquisition Parameter Sequence	DeviceSpecificAcquisitionParameterSequence	SQ	1
(gggg,74E3)	Referenced Position Reference Instance Sequence	ReferencedPositionReferenceInstanceSequence	SQ	1

(gggg,74F0)	Imaging Energy Category Code Sequence	ImagingEnergyCategoryCodeSequence	SQ	1
(gggg,74F2)	Maximum Cumulative Meterset Exposure	MaximumCumulativeMetersetExposure	FD	1
(gggg,74F5)	Acquisition Initiation Sequence	AcquisitionInitiationSequence	SQ	1

738

739 **Add the following to PS3.6 Annex A:**

740

741 **Annex A Registry of DICOM unique identifiers (UIDs) (Normative)**

742

Table A-1 UID Values

743

UID Value	UID Name	UID Type	Part
<u>1.2.840.10008.5.1.4.1.1.481.S213.1</u>	Enhanced RT Image Storage	SOP Class	PS3.4
<u>1.2.840.10008.5.1.4.1.1.481.S213.2</u>	Enhanced Continuous RT Image Storage	SOP Class	PS3.4
<u>1.2.840.10008.5.1.4.1.1.481.S213.3</u>	RT Patient Position Acquisition Instruction Storage	SOP Class	PS 3.4

744

Table A-3 Context Group UID Values

745

746

Context UID	Context Identifier	Context Group Name
<u>1.2.840.10008.6.1.S213.5</u>	SUP213005	Radiotherapy Acquisition WorkItem Subtasks
<u>1.2.840.10008.6.1.S213.6</u>	SUP213006	Patient Position Acquisition Radiation Source Locations
<u>1.2.840.10008.6.1.S213.7</u>	SUP213007	Imaging Energy Categories
<u>1.2.840.10008.6.1.S213.8</u>	SUP213008	kV Imaging Acquisition Techniques
<u>1.2.840.10008.6.1.S213.9</u>	SUP213009	MV Imaging Acquisition Techniques
<u>1.2.840.10008.6.1.S213.10</u>	SUP213010	Patient Position Acquisition - Projection Techniques
<u>1.2.840.10008.6.1.S213.11</u>	SUP213011	Patient Position Acquisition - CT Techniques
<u>1.2.840.10008.6.1.S213.12</u>	SUP213012	Patient Positioning Related Object Purposes
<u>1.2.840.10008.6.1.S213.30</u>	SUP213030	Patient Position Acquisition Devices
<u>1.2.840.10008.6.1.S213.31</u>	SUP213031	RT Radiation Meterset Units
<u>1.2.840.10008.6.1.S213.32</u>	SUP213032	Acquisition Initiation Types
<u>1.2.840.10008.6.1.S213.33</u>	SUP213033	RT Image Patient Position Acquisition Devices

747

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749

Part 15 Addendum

750

Add the following definitions PS3.15, Annex E:

751

Table E.1-1. Application Level Confidentiality Profile Attributes

Attribute Name	Tag	Retired (from PS3.6)	In Std. Comp. IOD (from PS3.3)	Basic Profile	Retain Safe Private Option	Retain UIDs Option	Retain Device Ident. Option	Retain Inst. Ident. Option	Retain Patient Chars. Option	Retain Long. Full Dates Option	Retain Long. Modif. Dates Option	Clean Desc. Option	Clean Struct. Cont. Option	Clean Graph. Option
Position Acquisition Template Identification Description	(gggg,7477)	N	Y	X								C		
Device-Specific Acquisition Parameter Sequence	(gggg,74E2)	N	Y	K										

752

753

754

Part 16 Addendum

755

Modify the following CIDs to PS3.16, Annex B:

756

Annex B DCMR Context Groups (Normative)

757

...

758

CID 9242 Radiotherapy Acquisition Workitem Definition

759

Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML

760

Type: Extensible

761

Version: yyyyymmdd

762

UID: 1.2.840.10008.6.1.932

763

Table CID 9242. Radiotherapy Acquisition Workitem Definition

764

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
<i>Include CID SUP213010 "Patient Position Acquisition - Projection Techniques"</i>		
<i>Include CID SUP213011 "Patient Position Acquisition - CT Techniques"</i>		
DCM	121702	RT Patient Position Acquisition, single plane MV
DCM	121703	RT Patient Position Acquisition, dual plane MV
DCM	121704	RT Patient Position Acquisition, single plane kV
DCM	121705	RT Patient Position Acquisition, dual plane kV
DCM	121706	RT Patient Position Acquisition, dual plane kV/MV

DCM	121707	RT Patient Position Acquisition, CT kV
DCM	121708	RT Patient Position Acquisition, CT MV
DCM	121709	RT Patient Position Acquisition, Optical
DCM	121710	RT Patient Position Acquisition, Ultrasound
DCM	121711	RT Patient Position Acquisition, Spatial Fiducials

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767

Add the following new CIDs to PS3.16, Annex B:

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770
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776

CID SUP213005 Radiotherapy Acquisition WorkItem Subtasks

Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML

Type: Extensible

Version: yyyyymmdd

UID: 1.2.840.10008.6.1.S213.5

Table CID SUP213005. Radiotherapy Acquisition WorkItem Subtasks

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	121702	RT Patient Position Acquisition, single plane MV
DCM	121703	RT Patient Position Acquisition, dual plane MV
DCM	121704	RT Patient Position Acquisition, single plane kV
DCM	121705	RT Patient Position Acquisition, dual plane kV
DCM	S213160	RT Patient Position Acquisition, integrated dose MV
DCM	S213161	RT Patient Position Acquisition, Film Cassette MV
DCM	S213162	RT Patient Position Acquisition, Film Cassette kV
DCM	121707	RT Patient Position Acquisition, CT kV
DCM	121708	RT Patient Position Acquisition, CT MV
DCM	S213163	RT Patient Position Acquisition, Cone-Beam kV
DCM	S213164	RT Patient Position Acquisition, Conventional CT kV
DCM	S213165	RT Patient Position Acquisition, Cone-Beam MV
DCM	S213166	RT Patient Position Acquisition, Conventional CT MV

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CID SUP213006 Patient Position Acquisition Radiation Source Locations

Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML

Type: Extensible

Version: yyyyymmdd

UID: 1.2.840.10008.6.1.S213.6

Table CID SUP213006. Patient Position Acquisition Radiation Source Locations

784

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	130358	Nominal Radiation Source Location
99SUP213	S213200	Nominal Imaging Source Location

785

786 **CID SUP213007 Imaging Energy Categories**787 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**788 **Type: Extensible**789 **Version: yyyyymmdd**790 **UID: 1.2.840.10008.6.1.S213.7**791 **Table CID SUP213007. Imaging Energy Categories**

792

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP213	S213700	Configured Lowest Imaging Energy
99SUP213	S213701	Configured Default Imaging Energy

793

794 **CID SUP213008 kV Imaging Acquisition Techniques**795 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**796 **Type: Extensible**797 **Version: yyyyymmdd**798 **UID: 1.2.840.10008.6.1.S213.8**799 **Table CID SUP213008. kV Imaging Acquisition Techniques**

800

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	121704	RT Patient Position Acquisition, single plane kV
DCM	121705	RT Patient Position Acquisition, dual plane kV
DCM	121707	RT Patient Position Acquisition, CT kV
DCM	S213163	RT Patient Position Acquisition, Cone-Beam CT kV
DCM	S213164	RT Patient Position Acquisition, Conventional CT kV
DCM	S213162	RT Patient Position Acquisition, Film Cassette kV

801

802 **CID SUP213009 MV Imaging Acquisition Techniques**803 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**804 **Type: Extensible**805 **Version: yyyyymmdd**806 **UID: 1.2.840.10008.6.1.S213.9**

807
808**Table CID SUP213009. MV Imaging Acquisition Techniques**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	121702	RT Patient Position Acquisition, single plane MV
DCM	121703	RT Patient Position Acquisition, dual plane MV
DCM	121708	RT Patient Position Acquisition, CT MV
DCM	S213165	RT Patient Position Acquisition, Cone-Beam CT MV
DCM	S213166	RT Patient Position Acquisition, Conventional CT MV
DCM	S213160	RT Patient Position Acquisition, integrated dose MV
DCM	S213161	RT Patient Position Acquisition, Film Cassette MV

809

810 **CID SUP213010 Patient Position Acquisition - Projection Techniques**811 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**812 **Type: Extensible**813 **Version: yyyyymmdd**814 **UID: 1.2.840.10008.6.1.S213.10**815 **Table CID SUP213010. Patient Position Acquisition - Projection Techniques**

816

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	121702	RT Patient Position Acquisition, single plane MV
DCM	121703	RT Patient Position Acquisition, dual plane MV
DCM	121704	RT Patient Position Acquisition, single plane kV
DCM	121705	RT Patient Position Acquisition, dual plane kV
DCM	121706	RT Patient Position Acquisition, dual plane kV/MV
DCM	S213160	RT Patient Position Acquisition, integrated dose MV
DCM	S213161	RT Patient Position Acquisition, Film Cassette MV
DCM	S213162	RT Patient Position Acquisition, Film Cassette kV

817

818 **CID SUP213011 Patient Position Acquisition – CT Techniques**819 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**820 **Type: Extensible**821 **Version: yyyyymmdd**822 **UID: 1.2.840.10008.6.1.S213.11**823 **Table CID SUP213011. Patient Position Acquisition – CT Techniques**

824

825

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	121707	RT Patient Position Acquisition, CT kV
DCM	S213163	RT Patient Position Acquisition, Cone-Beam CT kV
DCM	S213164	RT Patient Position Acquisition, Conventional CT kV
DCM	121708	RT Patient Position Acquisition, CT MV
DCM	S213165	RT Patient Position Acquisition, Cone-Beam CT MV
DCM	S213166	RT Patient Position Acquisition, Conventional CT MV

826

827 **CID SUP213012 Patient Positioning Related Object Purposes**828 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**829 **Type: Extensible**830 **Version: yyyyymmdd**831 **UID: 1.2.840.10008.6.1.S213.12**832 **Table CID SUP213012. Patient Positioning Related Object Purposes**

833

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	S213300	RT Patient Positioning Reference Image

834

835

836 **CID SUP213030 Patient Position Acquisition Devices**837 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**838 **Type: Extensible**839 **Version: yyyyymmdd**840 **UID: 1.2.840.10008.6.1.S213.30**841 **Table CID 213030. Patient Position Acquisition Devices**

842

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SCT	468886001	Digital imaging scanner, computed radiography
SCT	468440006	Digital imager, radiation therapy
SCT	466556008	X-ray film cassette, manual

843

844 **CID SUP213031 RT Radiation Meterset Units**845 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**846 **Type: Extensible**847 **Version: yyyyymmdd**848 **UID: 1.2.840.10008.6.1.S213.31**

849
850

Table CID SUP213031. RT Radiation Meterset Units

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
<i>Include CID 9552 "C-Arm Photon-Electron Dosimeter Units"</i>		
<i>Include CID 9557 "Tomotherapeutic Dosimeter Units"</i>		
<i>Include CID 9559 "Robotic Delivery Device Dosimeter Units"</i>		

851

852 **CID SUP213032 Acquisition Initiation Types**

853 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**

854 **Type: Extensible**

855 **Version: yyyyymmdd**

856 **UID: 1.2.840.10008.6.1.S213.32**

857 **Table CID SUP213032. Acquisition Initiation Types**

858

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP213	S213501	Acquisition Initiation not defined
99SUP213	S213502	Acquisition Initiation before start of Radiation
99SUP213	S213503	Acquisition Initiation after end of Radiation
99SUP213	S213504	Acquisition Initiation by triggering parameter

859

860 **CID SUP213033 RT Image Patient Position Acquisition Devices**

861 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**

862 **Type: Extensible**

863 **Version: yyyyymmdd**

864 **UID: 1.2.840.10008.6.1.S213.33**

865 **Table CID 213033. RT Image Patient Position Acquisition Devices**

866

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SCT	468440006	Digital imager, radiation therapy
SCT	466556008	X-ray film cassette, manual
DCM	S213800	Radiotherapy Treatment Planning System
DCM	S213801	Patient Position Determination System

867

868

869 **Add the following template to PS3.16, Annex C:**

870 **Annex C Acquisition and Protocol Context Templates (Normative)**

871

872

873 **TID SUP213T01 Acquisition Initiation Parameters**

874 This Template specifies how an acquisition of data by devices is to be initiated, which perform such operations to
 875 construct images or similar objects (like surfaces, fiducials etc.). Acquisitions may be initiated manually or triggered
 876 when parameters have the specified values. Parameterized acquisitions may be initiated once or repetitively along
 877 start, interval and stop values as present and specified.

878 This TID does not contain patient-related parameters; however, the TID is extensible and implementations may
 879 include such parameters (e.g. a measurement of a certain value of distance between a device and the patient
 880 surface triggering the acquisition).

881

Type: Extensible

882

Order: Non-Significant

883

Root: No

884

	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1	CODE	EV (S213500, DCM, "Acquisition Initiation Type")	1	M		BCID SUP213032 "Acquisition Initiation Types"
2	CODE	EV (S213510, DCM, "Acquisition Repetition")	1	MC	IFF value of Row 1 is (S213504, DCM, "Acquisition Initiation by triggering parameter")	DCID 231 "Yes-No Only"
3	NUMERIC	EV (S213520, DCM, "Meterset")	1-n	MC	IFF value of Row 1 is (S213504, DCM, "Acquisition Initiation at specified value") XOR Rows 4, 5, 6	UNITS = DCID SUP213031 "RT Radiation Meterset Units".
4	NUMERIC	EV (S213521, DCM, "Source Continuous Roll Angle")	1-n	MC	IFF value of Row 1 is (S213504, DCM, "Acquisition Initiation at specified value") XOR Rows 3, 5, 6	UNITS = EV (deg, UCUM, "deg")
5	NUMERIC	EV (S213522, DCM, "Time after start of Radiation")	1-n	MC	IFF value of Row 1 is (S213504, DCM, "Acquisition Initiation at specified value") XOR Rows 3, 4, 6	UNITS = EV (s, UCUM, "s")
6	NUMERIC	EV (S213523, DCM, "Percentage of expected beam-on time of Radiation")	1-n	MC	IFF value of Row 1 is (S213504, DCM, "Acquisition Initiation at specified value") XOR Rows 3, 4, 5	UNITS = EV (% , UCUM, "%")

885

886 **Content Item Descriptions**

Row 3 - 6	<p>These rows provide the value(s) of a triggering parameter associated with acquisition initiation.</p> <p>If Row 2 has the value of (373066001, SCT, "Yes") these rows contain 2 or 3 values. Value 1 represents the start value at which the repeated acquisition starts and value 2 contains the interval value by which the start value is repeatedly incremented to trigger subsequent acquisitions. Value 3 if present contains the stop value at which, when exceeded, no further acquisitions are started. If the stop value is not provided, the acquisition is triggered until the end of the therapeutic radiation.</p> <p>If Row 2 has the value of (373066001, SCT, "No") these rows shall contain a distinct value for the start of each acquisition. If more than one value is present, the values shall be specified in increasing order.</p>
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887

888

889 **TID SUP213T02 Imaging Source Geometry Parameters**

Type: Extensible

Order: Non-Significant

Root: No

890

891

892

893 This Template specifies the location and orientation of an imaging source coordinate system by specific device
894 parameters.

	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1	NUMERIC	EV (126809, DCM, "IEC61217 Gantry Continuous Roll Angle")	1	U		Units = EV (deg, UCUM, "deg")
2	NUMERIC	EV (126810, DCM, "IEC61217 Gantry Continuous Pitch Angle")	1	U		Units = EV (deg, UCUM, "deg")
3	NUMERIC	EV (126811, DCM, "IEC61217 Gantry Continuous Yaw Angle")	1	U		Units = EV (deg, UCUM, "deg")
4	NUMERIC	EV (S213600, 99SUP213, "IEC61217 Imaging Source to Axis Distance")	1	U		Units = EV (mm, UCUM, "mm")

895

896 Note: The Z-axis of the IEC 61217 GANTRY coordinate system passes through and is directed towards the radiation
897 source, which in this context is the imaging source.

898

899 **TID SUP213T03 Image Receptor Geometry Parameters**

Type: Extensible

Order: Non-Significant

Root: No

900

901

902

903 This Template specifies the location and orientation of an image receptor coordinate system by specific device
904 parameters.

	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1	NUMERIC	EV (126809, DCM, "IEC61217 Gantry Continuous Roll Angle")	1	U		Units = EV (deg, UCUM, "deg")
2	NUMERIC	EV (126810, DCM, "IEC61217 Gantry Continuous Pitch Angle")	1	U		Units = EV (deg, UCUM, "deg")
3	NUMERIC	EV (126811, DCM, "IEC61217 Gantry Continuous Yaw Angle")	1	U		Units = EV (deg, UCUM, "deg")
4	NUMERIC	EV (S213620, 99SUP213, "IEC61217 X-Ray image receptor radial displacement from Isocenter")	1	U		Units = EV (mm, UCUM, "mm")

5	NUMERIC	EV (S213621, 99SUP213, "IEC61217 X-Ray Image Receptor longitudinal displacement")	1	U		Units = EV (mm, UCUM, "mm")
6	NUMERIC	EV (S213622, 99SUP213, "IEC61217 X-Ray Image Receptor lateral displacement")	1	U		Units = EV (mm, UCUM, "mm")
7	NUMERIC	EV (S213623, 99SUP213, "IEC61217 X-Ray Image Receptor Rotation")	1	U		Units = EV (deg, UCUM, "deg")

905

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908

Note: The Z-axis of the IEC 61217 GANTRY coordinate system passes through and is directed towards the radiation source, which in this context is the imaging source.

909

Change the following codes to the table in PS3.16, Annex D:

910

Code Value	Code Meaning	Definition	Notes
121702	RT Patient Position Acquisition, single plane MV	Acquisition of patient positioning information- prior to treatment delivery , using single-plane megavoltage imaging.	
121703	RT Patient Position Acquisition, dual plane MV	Acquisition of patient positioning information- prior to treatment delivery , using dual-plane megavoltage imaging.	
121704	RT Patient Position Acquisition, single plane kV	Acquisition of patient positioning information- prior to treatment delivery , using single-plane kilovoltage imaging.	
121705	RT Patient Position Acquisition, dual plane kV	Acquisition of patient positioning information- prior to treatment delivery , using dual-plane kilovoltage imaging.	
121706	RT Patient Position Acquisition, dual plane kV/MV	Acquisition of patient positioning information- prior to treatment delivery , using dual-plane combination kilovoltage and megavoltage imaging.	
121707	RT Patient Position Acquisition, CT kV	Acquisition of patient positioning information- prior to treatment delivery , using kilovoltage CT imaging. Note: This code encompasses both Cone-Beam CT and conventional CT	
121708	RT Patient Position Acquisition, CT MV	Acquisition of patient positioning information- prior to treatment delivery , using megavoltage CT imaging. Note: This code encompasses both Cone-Beam CT and conventional CT.	
121709	RT Patient Position Acquisition, Optical	Acquisition of patient positioning information- prior to treatment delivery , using optical imaging.	
121710	RT Patient Position Acquisition, Ultrasound	Acquisition of patient positioning information- prior to treatment delivery , using ultrasound imaging.	
121711	RT Patient Position Acquisition, Spatial Fiducials	Acquisition of patient positioning information- prior to treatment delivery , using spatial fiducials.	

911

912

Add the following codes to the table in PS3.16, Annex D:

913

914

Annex D Dicom controlled terminology definitions (normative)

915

Code Value	Code Meaning	Definition	Notes
S213160	RT Patient Position Acquisition, integrated dose MV	Acquisition of patient positioning information using continuous megavoltage acquisition during treatment delivery.	
S213161	RT Patient Position Acquisition, Film Cassette MV	Acquisition of patient positioning information using a radiation-sensitive film suited for megavoltage radiation.	
S213162	RT Patient Position Acquisition, Film Cassette kV	Acquisition of patient positioning information using a radiation-sensitive film suited for photon radiation.	
S213163	RT Patient Position Acquisition, Cone-Beam CT kV	Acquisition of patient positioning information using kilovoltage Cone-Beam CT imaging.	
S213164	RT Patient Position Acquisition, Conventional CT kV	Acquisition of patient positioning information using kilovoltage conventional CT imaging.	
S213165	RT Patient Position Acquisition, Cone-Beam CT MV	Acquisition of patient positioning information using megavoltage Cone-Beam CT imaging.	
S213166	RT Patient Position Acquisition, Conventional CT MV	Acquisition of patient positioning information using megavoltage conventional CT imaging.	
S213200	Nominal Imaging Source Location	The point location defined as the nominal source of radiation used for imaging.	
S213300	RT Patient Positioning Reference Image	Image(s) used to provide a reference for the planned treatment position.	
S213500	Acquisition Initiation Type	The type of the initiation to be used to start the acquisition.	
S213501	Acquisition Initiation not defined	The acquisition trigger is not specified. Acquisition may be initiated manually by the device operator.	
S213502	Acquisition Initiation before start of Radiation	The acquisition is started before delivering the therapeutic radiation.	
S213503	Acquisition Initiation after end of Radiation	The acquisition is started after delivering the therapeutic radiation.	
S213504	Acquisition Initiation by triggering parameter	The acquisition is started when the triggering parameter reaches specific value(s).	
S213510	Acquisition Repetition	Flag denoting whether the acquisition is to be repeated in regular intervals.	
S213520	Meterset	A single parameter from which the absorbed dose delivered can be calculated through a calibration procedure with additional information.	
S213521	Source Continuous Roll Angle	Angle in degrees about the Y-axis of the Equipment Coordinate System by which the source is rotated. A Continuous Rotation Angle is an angle in the range ($-\infty, +\infty$). Continuous Rotation Angle represent a rotation direction and magnitude. The magnitude is not limited to be between 0 and 360 degrees.	
S213522	Time after start of Radiation	Time elapsed after the start of the delivery of an RT Radiation.	

Code Value	Code Meaning	Definition	Notes
S213523	Percentage of expected beam-on time of Radiation	Percentage of the duration of a Radiation, where duration is the expected time with beam-on between the start and the end of the delivery of an RT Radiation, excluding periods where the radiation is interrupted (“beam-off periods”).	
S213600	IEC61217 Imaging Source to Axis Distance	The distance from the imaging source to the rotation axis of a C-Arm Device [IEC61217].	
S213620	IEC61217 X-Ray Image Receptor radial displacement from Isocenter	IEC X-RAY Image Receptor radial displacement in the direction of the z-Axis of the IEC GANTRY Coordinate System [IEC 61217].	
S213621	IEC61217 X-Ray Image Receptor longitudinal displacement	IEC X-RAY Image Receptor longitudinal displacement in the direction of the y-Axis of the IEC GANTRY Coordinate System [IEC 61217].	
S213622	IEC61217 X-Ray Image Receptor lateral displacement	IEC X-RAY Image Receptor lateral displacement in the direction of the x-Axis of the IEC GANTRY Coordinate System [IEC 61217].	
S213623	IEC61217 X-Ray Image Receptor Rotation	IEC X-RAY Image Receptor rotation around the z-axis of the X-RAY Image Receptor Coordinate System [IEC61217].	
S213700	Configured Lowest Imaging Energy	Lowest energy for acquiring an image as configured on the device.	
S213701	Configured Default Imaging Energy	Default energy for acquiring an image as configured on the device.	
S213800	Radiotherapy Treatment Planning System	A computer system which supports the planning process to determine the geometric and dosimetric parameters for performing Radiotherapy Treatments.	
S213801	Patient Position Determination System	A system which assesses the suitability of the patient position and/or determines corrections to the patient position to ensure precise delivery of a Radiotherapy Treatment.	

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