Digital Imaging and Communications in Medicine (DICOM)

Supplement 199: Second Generation Radiotherapy –

RT Radiation Records

DICOM Standards Committee, Working Group 7, Radiation Therapy

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Scope and Field of Application

This Supplement defines several IODs for RT Radiation Records based on the real-world model and specifications defined for 2nd Generation RT Objects in DICOM, see PS3.3 A.86.

The SOP Classes in this document are defined to record how a treatment was performed. This comprises acquired machine parameter values, measured dose values, overrides, etc. In addition, recording of a salvage record is covered where recording by the modality-specific RT Radiation Record IOD was not possible, see PS3.3 A.86.1.9.

Part 2 Addendum

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

UID Value	UID Name	UIDKeyword	Category
1.2.840.10008.5.1.4.1.1.481.16	RT Radiation Record Set Storage	RTRadiationRecordSetStorage	Transfer
1.2.840.10008.5.1.4.1.1.481.17	RT Radiation Salvage Record Storage	RTRadiationSalvageRecordStorage	Transfer
1.2.840.10008.5.1.4.1.1.481.18	Tomotherapeutic Radiation Record Storage	TomotherapeuticRadiationRecordStorage	Transfer
1.2.840.10008.5.1.4.1.1.481.19	C-Arm Photon Electron Radiation Record Storage	CArmPhotonElectronRadiationRecordStorage	Transfer
1.2.840.10008.5.1.4.1.1.481.20	Robotic-Arm Radiation Record Storage	RoboticArmRadiationRecordStorage	Transfer

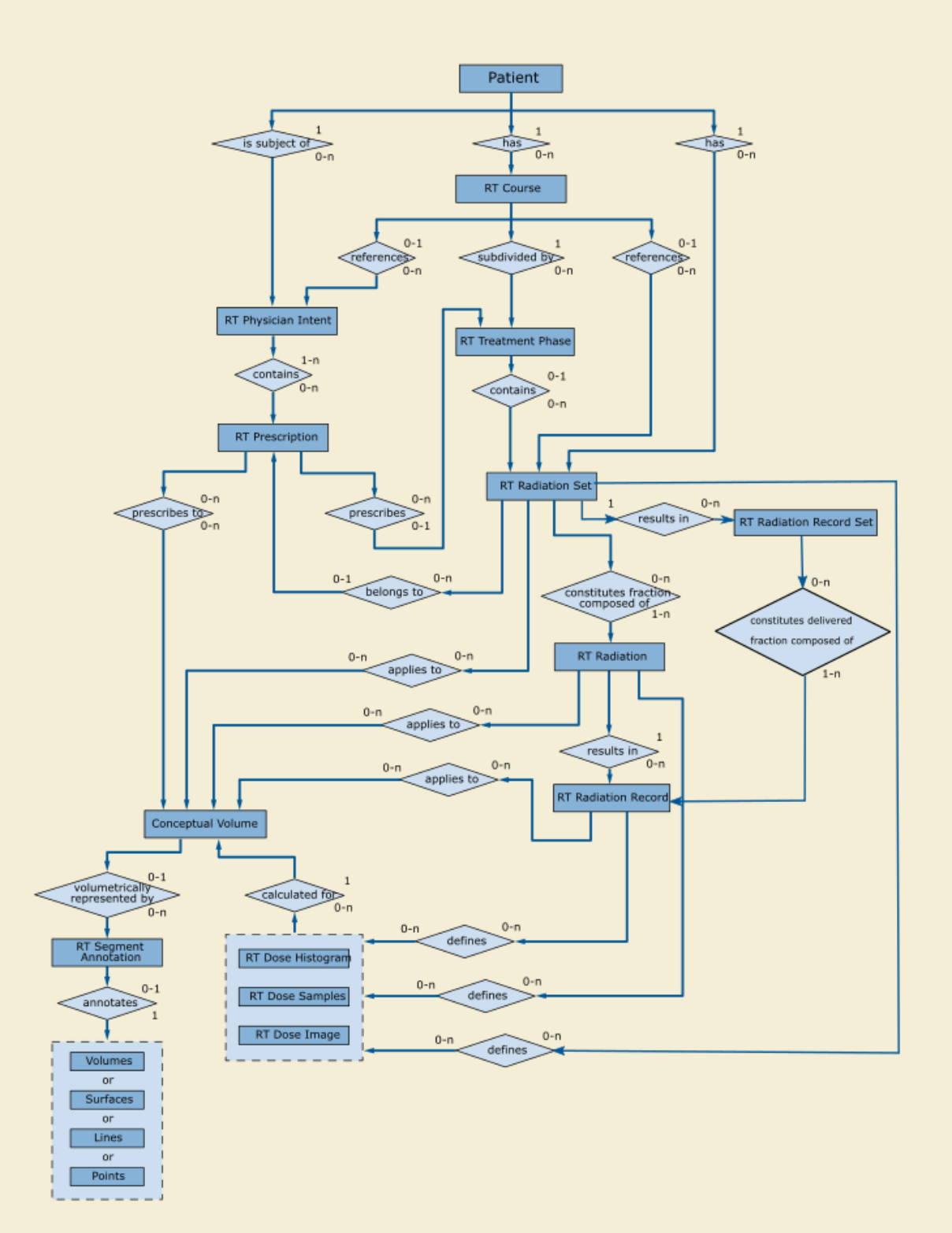
Part 3 Addendum

Update Figure 7.14-1:
- add the box "RT Radiation Record Set"
- add the related diamond "results in" and "constitutes delivered fraction composed of"
- add the related arrows and multiplicities

7.14 EXTENSION OF THE DICOM MODEL OF THE REAL-WORLD FOR RADIOTHERAPY SECOND GENERATION INFORMATION OBJECTS

For the purpose of RT Second Generation SOP Classes the DICOM Model of the Real-World is described in this section. This subset of the real-world model covers the requirements for transferring information about planned and performed radiotherapeutic treatments and associated data.

Figure 7.14-1 describes the most important elements involved in the radiotherapy domain in DICOM.



2 Note 1: IODs which contain a representation of Volumes, Surfaces, Lines, Points can be annotated by an RT Segment Annotation.

4 Note 2: For better readability the diagram only contains the most important relationships, e.g. all objects have a relation to the Patient, but not all of these relationships are part of this diagram.

Figure 7.14-1 DICOM MODEL OF THE REAL WORLD – RADIOTHERAPY

Add the following columns in PS3.3 Section A.1.4, Table A.1-1 COMPOSITE INFORMATION OBJECT MODULES OVERVIEW – RADIOTHERAPY

IODs Modules	RT Radiation Record Set	RT Radiation Salvage Rec	C-Arm Photon-Electron Rec	Tomo Rec	Rob Rec
Patient	M	M	M	M	M
Clinical Trial Subject	U	U	U	U	U
General Study	M	M	M	M	M
Patient Study	U	U	U	U	U
Clinical Trial Study	U	U	U	U	U
General Series	M	M	M	M	M
Clinical Trial Series	U	U	U	U	U
Enhanced RT Series	M	M	M	M	M
General Equipment	M	M	M	M	M
Enhanced General Equipment	M	M	M	M	M
Frame Of Reference		U	M	M	M
Synchronization			C	C	C
…					
General Reference Module	M	M	M	M	M
…					
RT Radiation Record Set	M				
RT Dose Contribution Record	C				
RT Delivery Device Common		M	M	M	M
RT Radiation Record Common		M	M	M	M
RT Radiation Salvage Record		M			
C-Arm Photon-Electron Delivery Device			M		
C-Arm Photon-Electron Beam			M		

IODs Modules	RT Radiation Record Set	RT Radiation Salvage Rec	C-Arm Photon-Electron Rec	Tomo Rec	Rob Rec
Tomotherapeutic Delivery Device				M	
Tomotherapeutic Beam				M	
Robotic-Arm Delivery Device					M
Robotic-Arm Path					M
...					
Common Instance Reference Module	M	M	M	M	M
Radiotherapy Common Instance	M	M	M	M	M
SOP Common	M	M	M	M	M

2

Add the following to PS3.3 Annex A:

A.86 SECOND GENERATION RADIATION THERAPY

A.86.1 RT Second Generation Objects

…

A.86.1.1 RT Second Generation Common Information

…

A.86.1.1.1 Second Generation Radiation Therapy Entity-Relationship Model

…

Update Figure A.86.1.1.1-1 in PS3.3 Annex A with the following:
- add box "RT Radiation Record Set"
- add box "RT Radiation Record"

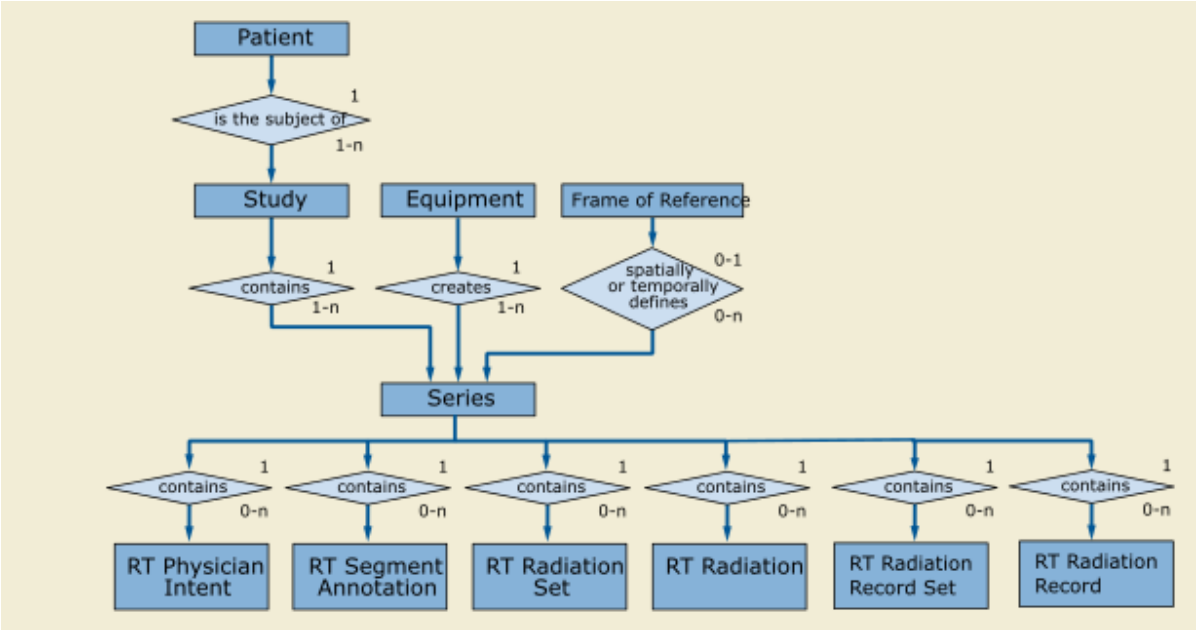


Figure A.86.1.1.1-1. RT Second Generation IOD information model

Add section A.86.1.4.4.4 to the following section to PS3.3 Annex A, A.86.1.4.4 RT Radiation Set IOD Constraints:

A.86.1.4 RT Radiation Set IOD

A.86.1.4.1 RT Radiation Set IOD Description

…

A.86.1.4.3 RT Radiation Set IOD Module Table

Table A.86.1.4-1. RT Radiation Set 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
Frame of Reference	Frame of Reference	C.7.4.1	M
RT Radiation Set	General Reference	C.12.4	M
	RT Radiation Set	C.36.10	M
	RT Dose Contribution	C.36.11	C - Required if the dose delivered is tracked.
	SOP Common	C.12.1	M
	Common Instance Reference	C.12.2	M
	Radiotherapy Common Instance	C.36.4	M

A.86.1.4.4 RT Radiation Set IOD Constraints

A.86.1.4.4.1 Modality Attribute

…

A.86.1.4.4.x RT Dose Contribution Module

Where dose contributions are not available at the time of RT Radiation Set definition and application (e.g., for emergency treatments) this Module may be absent. This does not exclude retrospective dose calculation and creation of associated RT Dose Image objects.

Add the following to PS3.3 Annex A:

A.86.1.8 RT Radiation Record Set Information Object Definition

The RT Radiation Record Set IOD contains the record of a radiotherapy treatment that has been performed based on an RT Radiation Set SOP Instance.

A.86.1.8.1 RT Radiation Record Set IOD Description

A.86.1.8.2 RT Radiation Record Set IOD Entity-Relationship Model

See Figure A.86.1.1.1-1.

A.86.1.8.3 RT Radiation Record Set IOD Module Table

Table A.86.1.8-1
RT Radiation Record Set 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
RT Delivered Radiation	General Reference	C.12.4	M
	RT Radiation Record Set	C.36.20	M
	RT Dose Contribution Record	C.36.21	C - Required if the dose delivered is tracked.
	SOP Common	C.12.1	M
	Common Instance Reference	C.12.2	M
	Radiotherapy Common Instance	C.36.4	M

A.86.1.8.4 RT Radiation Record Set IOD Constraints

A.86.1.8.4.1 RT Dose Contribution Record

Where dose contributions are not available at the time of delivery of the radiotherapeutic treatments specified by the RT Radiation Set IOD (e.g., for emergency treatments), the RT Dose Contribution Record Module may be absent. This does not exclude retrospective dose calculation and creation of associated RT Dose Image objects.

A.86.1.9 RT Radiation Salvage Record Information Object Definition

A.86.1.9.1 RT Radiation Salvage Record IOD Description

The RT Radiation Salvage Record IOD contains the record of a complete or partial fraction of therapeutic radiation delivered using any therapeutic device where recording by the modality-specific RT Radiation Record IOD was not possible.

A device usually creates RT Radiation Record SOP Instances using modality-specific RT Radiation Record IODs and transfers these Instances to a system that captures treatment records. If this process fails (e.g. because of failed transfer operations) and the recorded SOP Instances are not recoverable from the device, the RT Radiation Salvage Record IOD may be used to represent radiation delivery captured by a manual entry of the delivered treatment. Systems providing manual entry capabilities might not be able to create a modality-specific RT Radiation Record SOP Instance covering all device-specific parameters in question and/or the user might not know all the details. Therefore, the modality-specific RT Radiation Record IODs cannot be properly populated. The RT Radiation Salvage Record IOD allows essential information to be recorded.

A.86.1.9.2 RT Radiation Salvage Record IOD Entity-Relationship Model

See Figure A.86.1.1.1-1.

A.86.1.9.3 RT Radiation Salvage Record IOD Module Table

Table A.86.1.9-1
RT Radiation Salvage Record 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
Frame of Reference	Frame of Reference	C.7.4.1	U
RT Delivered Radiation	General Reference	C.12.4	M
	RT Delivery Device Common	C.36.12	M
	RT Radiation Record Common	C.36.22	M
	RT Radiation Salvage Record Module	C.36.23	M
	SOP Common	C.12.1	M

	Common Instance Reference	C.12.2	M
	Radiotherapy Common Instance	C.36.4	M

A.86.1.9.4 RT Radiation Salvage Record IOD Constraints

A.86.1.9.4.1 Modality Attribute

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

A.86.1.9.4.2 RT Delivery Device Common Module

The Equipment Frame of Reference UID (300A,0675) shall have the value used by the SOP Instance referenced in the Referenced RT Instance Sequence (300A,0631) of the RT Radiation Record Common Module.

The following code sequences shall have values from the identified CIDs:

Code Sequence	CID
Radiation Dosimeter Unit Sequence (300A,0658)	Defined CID is the CID specified for the SOP Instance referenced in the Referenced RT Instance Sequence (300A,0631) of the RT Radiation Record Common Module.

A.86.1.9.4.3 RT Radiation Record Common Module

The value of RT Record Flag (300A,0639) shall be YES.

The value of Treatment Record Content Origin (300A,0709) shall be USER.

The following code sequences shall have values from the identified CIDs:

Code Sequence	CID
RT Treatment Technique Code Sequence (3010,0080)	Defined CID is the CID specified for the SOP Instance referenced in the Referenced RT Instance Sequence (300A,0631) of the RT Radiation Record Common Module.
Treatment Machine Special Mode Sequence (300A,0635)	Defined CID is the CID specified for the SOP Instance referenced in the Referenced RT Instance Sequence (300A,0631) of the RT Radiation Record Common Module.

A.86.1.9.4.4 Radiotherapy Common Instance Module

The following code sequences shall have values from the identified CIDs:

Code Sequence	CID
Author Identification Sequence (3010,0019)	Defined CID for Organizational Role Code Sequence (0044,010A) is CID 9562 “Radiotherapy Treatment Delivery Person Roles”

A.86.1.9.4.5 Frame of Reference Module

The Frame of Reference UID (0020,0052) identifies the patient-based Frame of Reference while the therapeutic radiation was delivered. The Frame of Reference UID relates the geometric parameters of this SOP Instance to other SOP Instances such as Images, Segmentations, etc. If the patient moves with respect to the patient positioning device between the delivery recorded by the current SOP Instance and another SOP Instance, a new Frame of Reference UID shall be issued for any SOP Instances created after the move. See also C.7.4.1.

The relationship between the patient-oriented coordinate system identified by this Frame of Reference and the Equipment Coordinate System is described in 10.39.1.

A.86.1.10 C-Arm Photon-Electron Radiation Record Information Object Definition

A.86.1.10.1 C-Arm Photon-Electron Radiation Record IOD Description

The C-Arm Photon-Electron Radiation Record IOD contains the record of a radiotherapy treatment that has been performed using a C-Arm Photon-Electron Radiation SOP Instance.

A.86.1.10.2 C-Arm Photon-Electron Radiation Record IOD Entity-Relationship Model

See Figure A.86.1.1.1-1.

A.86.1.10.3 C-Arm Photon-Electron Radiation Record IOD Module Table

Table A.86.1.x3-1
C-Arm Photon-Electron Radiation Record 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
Frame of Reference	Frame of Reference	C.7.4.1	M
	Synchronization	C.7.4.2	C - Required if time synchronization was applied
RT Delivered Radiation	General Reference	C.12.4	M
	RT Delivery Device Common	C.36.12	M
	RT Radiation Record Common	C.36.22	M
	C-Arm Photon-Electron Delivery Device	C.36.14	M

	C-Arm Photon-Electron Beam	C.36.15	M
	SOP Common	C.12.1	M
	Common Instance Reference	C.12.2	M
	Radiotherapy Common Instance	C.36.4	M

A.86.1.10.4 C-Arm Photon-Electron Radiation Record IOD Constraints

A.86.1.10.4.1 Modality Attribute

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

A.86.1.10.4.2 RT Delivery Device Common Module

The Equipment Frame of Reference UID (300A,0675) shall be 1.2.840.10008.1.4.3.1, which identifies the IEC 61217 Fixed Coordinate System Frame of Reference, see C.36.12.2.1.

The following code sequences shall have values from the identified CIDs:

Code Sequence	CID
Radiation Dosimeter Unit Sequence (300A,0658)	Defined CID 9552 “C-Arm Photon-Electron Dosimeter Units”

The RT Device Distance Reference Location Code Sequence (300A,0659) shall contain the value (130358, DCM, “Nominal Radiation Source Location”).

A.86.1.10.4.3 RT Radiation Record Common Module

The value of RT Record Flag (300A,0639) shall be YES. The value of RT Radiation Physical and Geometric Content Detail Flag (300A,0638) shall be IDENT_ONLY.

The following code sequences shall have a value from the identified CIDs:

Code Sequence	CID
RT Treatment Technique Code Sequence (3010,0080)	Defined CID 9511 “General External Radiotherapy Procedure Techniques”
Treatment Machine Special Mode Sequence (300A,0635)	Defined CID 9543 “Radiotherapy Treatment Machine Modes”

A.86.1.10.4.4 Radiotherapy Common Instance Module

The following code sequences shall have values from the identified CIDs:

Code Sequence	CID
Author Identification Sequence (3010,0019)	Defined CID for Organizational Role Code Sequence (0044,010A) is CID 9562 “Radiotherapy Treatment Delivery Person Roles”

A.86.1.10.4.5 Frame of Reference Module

See A.86.1.9.4.5.

A.86.1.11 Tomotherapeutic Radiation Record Information Object Definition

A.86.1.11.1 Tomotherapeutic Radiation Record IOD Description

The Tomotherapeutic Radiation Record IOD contains the record of a radiotherapy treatment that has been performed using a Tomotherapeutic Radiation SOP Instance.

A.86.1.11.2 Tomotherapeutic Radiation Record IOD Entity-Relationship Model

See Figure A.86.1.1.1-1.

A.86.1.11.3 Tomotherapeutic Radiation Record IOD Module Table

Table A.86.1.11-1
Tomotherapeutic Radiation Record 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
Frame of Reference	Frame of Reference	C.7.4.1	M
	Synchronization	C.7.4.2	C - Required if time synchronization was applied
RT Delivered Radiation	General Reference	C.12.4	M
	RT Delivery Device Common	C.36.12	M
	RT Radiation Record Common	C.36.22	M
	Tomotherapeutic Delivery Device	C.36.16	M
	Tomotherapeutic Beam	C.36.17	M
	SOP Common	C.12.1	M
	Common Instance Reference	C.12.2	M
	Radiotherapy Common Instance	C.36.4	M

A.86.1.11.4 Tomotherapeutic Radiation Record IOD Constraints

A.86.1.11.4.1 Modality Attribute

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

A.86.1.11.4.2 RT Delivery Device Common Module

The Equipment Frame of Reference UID (300A,0675) shall be 1.2.840.10008.1.4.3.1, which identifies the IEC 61217 Fixed Coordinate System Frame of Reference, see C.36.12.2.1.

The following code sequences shall have values from the identified CIDs:

Code Sequence	CID
Radiation Dosimeter Unit Sequence (300A,0658)	Defined CID 9557 “Tomotherapeutic Dosimeter Units”

The RT Device Distance Reference Location Code Sequence (300A,0659) shall contain the value (130358, DCM, “Nominal Radiation Source Location”).

A.86.1.11.4.3 RT Radiation Record Common Module

The value of RT Record Flag (300A,0639) shall be YES. The value of RT Radiation Physical and Geometric Content Detail Flag (300A,0638) shall be IDENT_ONLY.

The following code sequences shall have a value from the identified CIDs:

Code Sequence	CID
RT Treatment Technique Code Sequence (3010,0080)	Defined CID 9512 “Tomotherapeutic Radiotherapy Procedure Techniques”
Treatment Machine Special Mode Sequence (300A,0635)	Defined CID 9543 “Radiotherapy Treatment Machine Modes”

A.86.1.11.4.4 Radiotherapy Common Instance Module

The following code sequences shall have values from the identified CIDs:

Code Sequence	CID
Author Identification Sequence (3010,0019)	Defined CID for Organizational Role Code Sequence (0044,010A) is CID 9562 “Radiotherapy Treatment Delivery Person Roles”

A.86.1.11.4.5 Frame of Reference Module

See A.86.1.9.4.5.

A.86.1.12 Robotic-Arm Radiation Record Information Object Definition

A.86.1.12.1 Robotic-Arm, Radiation Record IOD Description

The Robotic-Arm Radiation Record IOD contains the record of a radiotherapy treatment that has been performed using a Robotic-Arm Radiation SOP Instance.

A.86.1.12.2 Robotic-Arm Radiation Record IOD Entity-Relationship Model

See Figure A.86.1.1.1-1.

A.86.1.12.3 Robotic-Arm Radiation Record IOD Module Table

Table A.86.1.12-1
Robotic-Arm Radiation Record 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
Frame of Reference	Frame of Reference	C.7.4.1	M
	Synchronization	C.7.4.2	C - Required if time synchronization was applied
RT Delivered Radiation	General Reference	C.12.4	M
	RT Delivery Device Common	C.36.12	M
	RT Radiation Record Common	C.36.22	M
	Robotic-Arm Delivery Device	C.36.18	M
	Robotic-Arm Path	C.36.19	M
	SOP Common	C.12.1	M
	Common Instance Reference	C.12.2	M
	Radiotherapy Common Instance	C.36.4	M

A.86.1.12.4 Robotic-Arm Radiation Record IOD Constraints

A.86.1.12.4.1 Modality Attribute

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

A.86.1.12.4.2 RT Delivery Device Common Module

The Equipment Frame of Reference UID (300A,0675) shall be 1.2.840.10008.1.4..3.2, which identifies the Standard Robotic-Arm Coordinate System Frame of Reference, see C.36.12.2.2.

The following code sequences shall have values from the identified CIDs:

Code Sequence	CID
Radiation Dosimeter Unit Sequence (300A,0658)	Defined CID 9559 “Robotic Delivery Dosimeter Units”

The RT Device Distance Reference Location Code Sequence (300A,0659) shall contain the value (130358, DCM, “Nominal Radiation Source Location”).

A.86.1.12.4.3 RT Radiation Record Common Module

The value of RT Record Flag (300A,0639) shall be YES. The value of RT Radiation Physical and Geometric Content Detail Flag (300A,0638) shall be IDENT_ONLY.

The following code sequences shall have a value from the identified CIDs:

Code Sequence	CID
RT Treatment Technique Code Sequence (3010,0080)	Defined CID 9523 “Robotic Radiation Procedure Techniques”
Treatment Machine Special Mode Sequence (300A,0635)	Defined CID 9543 “Radiotherapy Treatment Machine Modes”

A.86.1.12.4.4 Radiotherapy Common Instance Module

The following code sequences shall have values from the identified CIDs:

Code Sequence	CID
Author Identification Sequence (3010,0019)	Defined CID for Organizational Role Code Sequence (0044,010A) is CID 9562 “Radiotherapy Treatment Delivery Person Roles”

A.86.1.12.4.5 Frame of Reference Module

See A.86.1.9.4.5.

Append the following in PS3.3 Annex C:

C.7.4.2.1.4 Acquisition Time Synchronized

The Acquisition Time Synchronized (0018,1800) Attribute specifies whether Acquisition DateTime (0008,002A) of the Waveform Identification Module or the General Image Module represents an accurate synchronized timestamp for the acquisition of the waveform and/or image data. For triggered multi-frame images, the Acquisition DateTime applies to the trigger for the first image frame (see Attribute Image Trigger Delay (0018.1067) in the Cine Module).

Note The degree of precision of the Acquisition DateTime and its accuracy relative to the external clock are not specified, but need to be appropriate for the clinical application.

For IODs that include the SR Document Content Module, the Acquisition Time Synchronized (0018,1800) Attribute specifies whether Observation DateTime (0040,A032) of Items in Content Sequence (0040,A730) of the SR Document Content Module represents an accurate synchronized timestamp for the Item.

For IODs that include the RT Radiation Record Common Module, the Acquisition Time Synchronized (0018,1800) Attribute specifies whether the following Attributes represent a synchronized timestamp.

- Recorded RT Control Point DateTime (300A,073A)

- Interlock DateTime (300A,0741)

Add the following section to PS3.3 Annex C, section C.36.2.2.8.1:

C.36.2.2.8.1.5 Referenced Defined Device Index

The Referenced Defined Device Index (300A,0602) provides the facility to relate devices from one Instance to the other. Device Macros such as the RT Beam Limiting Device Definition Macro are used in Sequences which list the devices used in the context of a SOP Instance. Each device is identified by the Device Index (3010,0039). These devices may be described in other related SOP Instances. The values of Device Index (3010,0039) are not required to be the same in different SOP Instances.

For example, an RT Radiation Instance may contain the RT Beam Limiting Device Definition Sequence (300A,064D), listing the Beam Limiting Devices to be used for treatment. A related RT Radiation Record Instance for the same type of delivery device will contain the same Sequences. However, the collection of devices used may not be the same:

E.g., the RT Radiation Instance may describe a treatment that contains three Items with the following indices:

- Device Index = 1: Type (130331, DCM, “Leaf Pairs”) with one leaf pair and the orientation (130334, DCM, “X Orientation”), representing X-Jaws
- Device Index = 2: Type (130331, DCM, “Leaf Pairs”) with one leaf pair and the orientation (130335, DCM, “Y Orientation”), representing Y-Jaws
- Device Index = 3: Type (130331, DCM, “Leaf Pairs”) with 80 leaf pairs and the orientation (130334, DCM, “X Orientation”), representing an X-MLC

However, the treatment may have been executed on a different machine which has the X-Jaws and the X-MLC, but a fixed collimator in the Y direction instead of the Y-Jaws. Therefore, the Y-Jaws will

not be recorded as they have not been used. Also, the fixed collimator in Y direction is not recorded, as this is not a device which is part of the RT Beam Limiting Device Definition Sequence (300A,064D). The Referenced Defined Device Index (300A,0602) will then point to the indices in the referenced RT Radiation Instance to annotate which device in the RT Radiation Record corresponds to the device in the RT Radiation. In this case, the RT Radiation Record would contain the devices as listed in the following:

- Device Index = 1: Type (130331, DCM, “Leaf Pairs”) with one leaf pair and the orientation (130334, DCM, “X Orientation”), representing X-Jaws
  -> Referenced Defined Device Index = 1
- Device Index = 2: Type (130331, DCM, “Leaf Pairs”) with 80 leaf pairs and the orientation (130334, DCM, “X Orientation”), representing an X-MLC
  -> Referenced Defined Device Index = 3

Make the following changes to PS3.3 Annex C in all Attribute descriptions for Referenced Defined Device Index (300A,0602) in the following tables:

Table C.36.2.2.8-1 RT Beam Limiting Devices Definition Macro Attributes

Table C.36.2.2.10-1 Wedges Definition Macro Attributes

Table C.36.2.2.12-1 Compensators Definition Macro Attributes

Table C.36.2.2.13-1 Blocks Definition Macro Attributes

Table C.36.2.2.14-1 RT Accessory Holders Definition Macro Attributes

Table C.36.2.2.15-1 General Accessories Definition Macro Attributes

Table C.36.2.2.16-1 Boluses Definition Macro Attributes

…			
>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 an RT Radiation Instance. The ~~**description**~~ **device identification** of the two devices may or may not be the same. The value is the index of a device in the RT Beam Limiting Device Definition Sequence (300A,064D) within the single SOP Instance

			referenced by Referenced RT Instance Sequence (300A,0631). Required if the Instance referenced in Referenced RT Instance Sequence (300A,0631) contains the device that corresponds to the device defined by this Sequence Item. **See C.36.2.2.8.1.5.**
…			

Update the following in PS3.3 Annex C:

C.36.2.2.4 RT Treatment Position Macro

….

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

Attribute Name	Tag	Type	Attribute Description
…			
Referenced RT Patient Setup Sequence	(300A,0632)	1C	References the RT Patient Setup SOP Instance that was used as the setup instruction for the patient prior to delivery of the radiation. Required if there was a Patient Setup SOP Instance available providing the instructions to the delivery system. Only a single Item shall be included in this Sequence.
>Include Table 10-11 "SOP Instance Reference Macro Attributes".			
Treatment Position Sequence	(300A,063F)	1**C**	Patient positions during treatment, being prescribed or recorded. **Required if the SOP Class of the SOP Instance including this Module is not RT Radiation Salvage Record Storage ("1.2.840.10008.5.1.4.1.1.481.17"). 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.
>Include Table 10.39-1 "Patient to Equipment Relationship Macro Attributes".			*DCID 9553 "Treatment Points".*

C.36.2.2.5 RT Control Point General Macro

2 This Macro specifies the base Attributes for the definition of an RT Radiation Control Point.

Table C.36.2.2.5-1. RT Control Point General Macro Attributes

Attribute Name	Tag	Type	Attribute Description
RT Control Point Index	(300A,0600)	1	The index of the RT Control Point within the Sequence where this Macro is included. RT Control Points shall be executed in the order of the RT Control Point Index. The value shall start at 1 and increase monotonically by 1 within the Sequence where this Macro is included.
Cumulative Meterset	(300A,063C)	1C	Meterset at the RT Control Point. The units are specified by Radiation Dosimeter Unit Sequence (300A,0658). For the Item with RT Control Point Index equal 1, the Cumulative Meterset shall be equal to 0.0. Required if RT Radiation Physical and Geometric Content Detail Flag (300A,0638) equals FULL or IDENT_ONLY or RT Record Flag (300A,0639) equals YES and if the conditions in Section C.36.2.2.5.1.1 are satisfied. May be present otherwise only if the conditions in Section C.36.2.2.5.1.1 are satisfied. See Section C.36.2.2.5.1.3 and C.36.2.2.5.1.4.
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 that this RT Control Point refers to. Required if **Treatment Position Sequence (300A,063F) is present and** the conditions in Section C.36.2.2.5.1.1 are satisfied.
Recorded RT Control Point DateTime	**(300A,073A)**	**1C**	**Date and time of the Recorded RT Control Point.** **For all but the final Control Point this shall be the date and time when the delivery of radiation at this Control Point began. For the final Control Point this shall be the date and time when the previous control point ended.** **Required if RT Record Flag (300A,0639) equals YES and if the SOP Class of the SOP Instance including this Module is not RT Radiation Salvage Record Storage ("1.2.840.10008.5.1.4.1.1.481.17").** **May be present otherwise only if RT Record Flag (300A,0639) equals YES.**

Attribute Name	Tag	Type	Attribute Description
Referenced Radiation RT Control Point Index	**(300A,073B)**	**2C**	**The value of RT Control Point Index (300A,0600) of the RT Control Point in the RT Radiation SOP Instance referenced by Referenced RT Instance Sequence (300A,0631) in this Instance.** **Required if RT Record Flag (300A,0639) equals YES and if the recorded RT Control Point Index corresponds to a planned RT Radiation Control Point Index.**

C.36.10.1 RT Radiation Set Attribute Description

C.36.10.1.1 RT Radiation Set Intent, RT Radiation Record Set Usage and RT Radiation Usage

Defined Terms for RT Radiation Set Intent (300A,0637)**, RT Radiation Set Usage (300A,0707) and RT Radiation Usage (300A,0701)** are

TREATMENT

~~The RT Radiation Set~~ **This Instance** is for ~~the purpose~~ **performing or recording** ~~of~~ treatment delivery.

PLAN_QA

~~The RT Radiation Set~~ **This Instance** is for validating **or recording** the patient-specific dose. For example, by delivering the RT Radiations to a phantom and comparing the calculated dose to the phantom with actual measurements made in the phantom.

MACHINE_QA

~~The RT Radiation Set~~ **This Instance** is for **performing or recording** system quality assurance and calibration (geometric, dosimetric or both) procedures of the delivery machine and is not patient-specific.

RESEARCH

~~The RT Radiation Set~~ **This Instance** is for performing **or recording** research and is not delivered to a patient.

SERVICE

~~The RT Radiation Set~~ **This Instance** is for **performing or recording** diagnostics**, calibration or** ~~and~~ **machine** assessment ~~of machine repair or to perform measurements for a maintenance or calibration operation~~ by a service technician.

…

C.36.11 RT Dose Contribution Module

The RT Dose Contribution Module contains information about the contribution of dose of the RT Radiations referenced by this RT Radiation Set IOD. Dose contributions refer to the RT Radiations delivering the dose and to anatomical structures receiving the dose.

Note that an anatomical structure (as defined by the Conceptual Volume Macro) can either be a textually tagged definition, or a reference to a Conceptual Volume defined in the RT Segment Annotation IOD. In all cases, Conceptual Volumes are identified by a UID which allows accumulation of dose to a given Conceptual Volume across RT Radiation Sets and comparison with prescribed Dosimetric Objectives.

Dose contributions are defined using Meterset values. The definition points in the Meterset to Dose Mapping Sequence may or may not align with the Meterset values at the Control Points of the RT Radiation SOP Instance. For example, where a dose deposition between Control Points cannot be determined individually per segment or where this definition is not useful, the lookup table may just contain the Meterset of first and last Control Points. The Meterset and dose contribution of the first Control Point are always zero. For further details see Section C.36.11.1.1.

~~**Where dose contributions are not available at the time of RT Radiation Set definition and application (e.g., for emergency treatments) this Module may be absent. This does not exclude retrospective dose calculation and creation of associated RT Dose Image objects.**~~

Table C.36.11-1. RT Dose Contribution Module Attributes

Attribute Name	Tag	Type	Attribute Description
Radiation Dose Identification Sequence	(300A,0618)	1	~~**Parameters to identify and scope**~~**Identifies** the dose values that are delivered by this RT Radiation Set SOP Instance. One or more Items shall be included in this Sequence.
>Radiation Dose Identification Index	(300A,0603)	1	Index of this Item in this Sequence. The value shall start at 1 and increase monotonically by 1.
…			
Radiation Dose Sequence	(300A,0617)	1	Parameters that describe dose contributed by referenced RT Radiation SOP instances. For every SOP instance referenced in RT Radiation Sequence (300A,0616) exactly one item shall be present in this Sequence.
>Referenced RT Radiation Sequence	(300A,0630)	1	References the RT Radiation SOP Instance that describes parameters for dose delivery. Only a single Item shall be included in this Sequence.
>>Include Table 10-11 “SOP Instance Reference Macro Attributes”.			
…			
>Expected In-Vivo Measurement Values Sequence	(300A,0621)	1C	Expected values against which in-vivo measurements may be compared. Required if expected values are calculated for in-vivo measurement for this RT Radiation SOP Instance.

Attribute Name	Tag	Type	Attribute Description
			One or more Items shall be included in this Sequence.
>>Expected In-Vivo Measurement Value Index	(300A,0622)	1	Index of this Item in this Sequence. The value shall start at 1 and increase monotonically by 1.
>>Radiation Dose In-Vivo Measurement Label	(300A,0623)	1	Label to identify the in-vivo measurement point. See Section 10.31.1.1.
>>Radiation Dose Central Axis Displacement	(300A,0624)	1C	Displacement (x,y) in mm of the measurement point from the central axis along the x-axis and y-axis of the Beam Modifier Definition Plane. Required if a central beam axis is defined for the Treatment Delivery Device and the Radiation Dose Measurement Point Coordinates (300A,0627) is not present.
>>Meterset to Dose Mapping Sequence	**(300A,0620)**	**1**	**Mapping of Cumulative Meterset (300A,063C) to Radiation Dose Value (300A,0625).** **One or more Items shall be included in this Sequence.**
>>>Cumulative Meterset	**(300A,063C)**	**1**	**Cumulative Meterset where a dose value is delivered.** **See C.36.11.1.1.**
>>>Radiation Dose Value	(300A,0625)	1	Dose Value in Gy at the measurement point. **See C.36.11.1.5.**
>>Radiation Dose Source to Skin Distance	(300A,0626)	2	Distance in mm from the nominal Radiation Source location to the patient skin along the central beam axis from the source to the measurement point.
>>Radiation Dose Source to External Contour Distance	(300A,0628)	2	Distance in mm from the nominal Radiation Source location to the External Contour along the central beam axis from the source to the measurement point including devices associated with the patient anatomy model. For dosimetric purposes this value may differ from the Radiation Dose Source to Skin Distance(300A,0626). See ~~**Section**~~ C.36.11.1.4.
>>Radiation Dose Measurement Point Coordinates	(300A,0627)	1C	Coordinates (x,y,z) in mm in the DICOM Patient Coordinate System of the measurement point. Required if Radiation Dose Central Axis Displacement (300A,0624) is not present.

Update the following in PS3.3 Annex C, and extract many of the Attributes in to the new Macro macro1.

C.36.13 RT Radiation Common Module

The RT Radiation Common Module contains the Attributes shared by all RT Radiation IODs used for radiation treatment delivery.

Table C.36.13-1. RT Radiation Common Module Attributes

Attribute Name	Tag	Type	Attribute Description
Include Table 10.9.1-1 "Enhanced Content Identification Macro Attributes"			
Include Table C.36.2.1.6-1 "RT Radiation Common Base Macro Attributes"			
~~**RT Radiation Physical and Geometric Content Detail Flag**~~	~~**(300A,0638)**~~	~~**1**~~	~~**The level of detail of content within this SOP Instance.**~~ ~~**Enumerated Values:**~~ ~~**FULL – The physical and geometric parameters of all devices are fully defined and dosimetric information is present. This level of detail is typically present after volumetric planning.**~~ ~~**IDENT_ONLY – The physical and geometric parameters of all devices may not be fully specified, but the devices can be identified and dosimetric information is present. This level of detail is typically present after non-volumetric planning (e.g., 2D planning).**~~ ~~**GEOMETRY_ONLY – The geometric parameters of all devices are fully specified, but no dosimetric information is present. This level of detail is typically present after Virtual Simulation.**~~
~~**RT Record Flag**~~	~~**(300A,0639)**~~	~~**1**~~	~~**Whether or not device parameters about actual delivery of treatment to a patient have been recorded.**~~ ~~**Enumerated Values:**~~ ~~**YES – Values in this Instance are a record of a delivered treatment, based on e.g., read-outs or measurements.**~~ ~~**NO – Values in this Instance are a specification of a treatment to be delivered, e.g., by a treatment planning system.**~~
~~**RT Treatment Technique Code Sequence**~~	~~**(3010,0080)**~~	~~**1**~~	~~**Type of treatment technique.**~~ ~~**Only a single Item shall be included in this Sequence.**~~ ~~**See Section C.36.13.1.1.**~~
~~***>Include Table 8.8-1 "Code Sequence Macro Attributes".***~~			~~***CID is defined in the IOD including this Module.***~~
~~***Include Table C.36.2.2.4-1 "RT Treatment Position Macro Attributes".***~~			~~***See Section C.36.13.1.2.***~~

Attribute Name	Tag	Type	Attribute Description
~~RT Tolerance Set Sequence~~	~~(300A,0629)~~	~~3~~	~~A set of tolerance values to be applied to parameters used for delivery of the RT Radiation.~~ ~~Only a single Item is permitted in this Sequence.~~
~~*>Include Table C.36.2.2.17-1 "RT Tolerance Set Macro Attributes".*~~			
Treatment Time Limit	(300A,062E)	3	The maximum delivery time in seconds. See Section C.36.13.1.3.
~~Treatment Machine Special Mode Code Sequence~~	~~(300A,0635)~~	~~1C~~	~~A mode of operation on the treatment machine.~~ ~~Required if a special delivery mode is used for treatment.~~ ~~Only a single Item shall be included in this Sequence.~~ ~~See Section C.36.13.1.4.~~
~~*>Include Table 8.8-1 "Code Sequence Macro Attributes".*~~			~~*Defined CID is defined in the IOD including this Module.*~~

C.36.13.1 RT Radiation Common Attribute Descriptions

C.36.13.1.1 Radiotherapy Procedure Technique Sequence

See C.36.2.1.6.1.1.~~The RT Treatment Technique Code Sequence (3010,0080) describes the treatment technique, i.e., how the radiation beam is shaped and targeted.~~

C.36.13.1.2 RT Treatment Position Macro

See C.36.2.1.6.1.2.~~The RT Treatment Position Macro describes how the patient is to be positioned with respect to the delivery device for treatment.~~

~~The behavior of the machine regarding the patient position between specified Control Points is outside the scope of this Standard. Communicating devices shall agree on this behavior.~~

C.36.13.1.3 Treatment Time Limit

The Treatment Time Limit (300A,062E) is the maximum time span allowed to deliver a single fraction of this RT Radiation SOP instance. The behavior of the treatment delivery device on exceeding the Treatment Time Limit is up to the implementation. Treatment is expected to terminate upon reaching the Treatment Time Limit (300A,062E) independent of the Meterset and so this Attribute should have a value that accommodates normal variations in delivery.

C.36.13.1.4 Treatment Machine Special Mode Sequence

See C.36.2.1.6.1.3.~~The Treatment Machine Special Mode Code Sequence (300A,0635) contains a code, for example, (130341, DCM, "Total Body Irradiation") or (130342, DCM, "Total Skin Irradiation"), which selects a set of vendor- and machine-specific parameters that alter the treatment parameters and/or safety constraints.~~

Add C.36.2.1.6 to PS3.3 Annex C.36.2.1:

C.36.2 RT Second Generation Macros

C.36.2.1 RT Second Generation General Purpose Macros

…

C.36.2.1.6 RT Radiation Common Base Macro

The Radiation Fraction Pattern Macro specifies the intended fraction pattern to be used to deliver the radiation treatment.

Table C.36.2.1.6-1. RT Radiation Common Base Macro Attributes

Attribute Name	Tag	Type	Attribute Description
RT Radiation Physical and Geometric Content Detail Flag	(300A,0638)	1	The level of detail of content within this SOP Instance. Enumerated Values: FULL The physical and geometric parameters of all devices are fully defined and dosimetric information is present. This level of detail is typically present after volumetric planning. IDENT_ONLY The physical and geometric parameters of all devices may not be fully specified, but the devices can be identified. This level of detail is typically present after non-volumetric planning (e.g., 2D planning) or in records of delivered treatments. GEOMETRY_ONLY The geometric parameters of all devices are fully specified, but no dosimetric information is present. This level of detail is typically present after Virtual Simulation.
RT Record Flag	(300A,0639)	1	Whether or not device parameters about actual delivery of treatment to a patient have been recorded. Enumerated Values: YES Values in this Instance are a record of a delivered treatment, based on e.g., read-outs or measurements. NO Values in this Instance are a specification of a treatment to be delivered, e.g., by a treatment planning system.
RT Treatment Technique Code Sequence	(3010,0080)	1C	Type of treatment technique. Only a single Item shall be included in this Sequence. Required if the SOP Class of the SOP Instance including this Module is not RT Radiation Salvage Record Storage (“1.2.840.10008.5.1.4.1.1.481.17”). May be present otherwise. See Section C.36.2.1.6.1.1.
>Include Table 8.8-1 “Code Sequence Macro Attributes”.			*CID is defined in the IOD including this Module.*
Include Table C.36.2.2.4-1 “RT Treatment Position Macro Attributes”.			*See Section C.36.2.1.6.1.2.*

Attribute Name	Tag	Type	Attribute Description
RT Tolerance Set Sequence	(300A,0629)	3	A set of tolerance values to be applied to parameters used for delivery of the RT Radiation. Only a single Item is permitted in this Sequence.
>Include Table C.36.2.2.17-1 "RT Tolerance Set Macro Attributes".			
Treatment Machine Special Mode Code Sequence	(300A,0635)	1C	A mode of operation on the treatment machine. Required if a special delivery mode is used for treatment and the SOP Class of the SOP Instance including this Module is not RT Radiation Salvage Record Storage ("1.2.840.10008.5.1.4.1.1.481.17"). May be present otherwise. Only a single Item shall be included in this Sequence. See Section C.36.2.1.6.1.3.
>Include Table 8.8-1 "Code Sequence Macro Attributes".			*Defined CID is defined in the IOD including this Module.*

C.36.2.1.6.1 RT Radiation Common Attribute Descriptions

C.36.2.1.6.1.1 Radiotherapy Procedure Technique Sequence

The RT Treatment Technique Code Sequence (3010,0080) describes the treatment technique, i.e., how the radiation beam is shaped and targeted.

C.36.2.1.6.1.2 RT Treatment Position Macro

The RT Treatment Position Macro describes how the patient is to be positioned with respect to the delivery device for treatment.

The behavior of the machine regarding the patient position between specified Control Points is outside the scope of this Standard. Communicating devices shall agree on this behavior.

C.36.2.1.6.1.3 Treatment Machine Special Mode Sequence

The Treatment Machine Special Mode Code Sequence (300A,0635) contains a code, for example, (130341, DCM, "Total Body Irradiation") or (130342, DCM, "Total Skin Irradiation"), which selects a set of vendor- and machine-specific parameters that alter the treatment parameters and/or safety constraints.

Add the following to PS3.3 Annex C.36:

C.36.20 RT Radiation Record Set Module

The RT Radiation Record Set Module contains treatment-modality-independent information about a set of delivered RT Radiations.

The RT Radiation Record Set may refer to an RT Radiation Set SOP Instance that has been used to define the treatment delivery. It may also record ad hoc delivery.

Table C.36.20-1
RT Radiation Record Set Module Attributes

Attribute Name	Tag	Type	Attribute Description
Include Table 10.9.2-1 "Extended Content Identification Macro"			
Treatment Session UID	(300A,0700)	1	A unique identifier of the RT Treatment Session to which this Instance belongs.
Referenced RT Radiation Set Sequence	(300A,0702)	1C	The RT Radiation Set that contains the RT Radiation Instance(s) referenced by the Instances of the Referenced RT Radiation Record Sequence (300A,0703). Required if an RT Radiation Set Instance provided instructions to the treatment delivery system. Only a single Item shall be included in this Sequence.
>Include Table 10-11 "SOP Instance Reference Macro Attributes"			
RT Radiation Set Usage	(300A,0707)	1	A general indication of how the referenced RT Radiation Set was used. The Defined Terms are specified in C.36.10.1.1. This value may differ from the RT Radiation Set Intent (300A,0637) within the Instance referenced by the Referenced RT Radiation Set Sequence (300A,0702). See C.36.m1.1.4.
Referenced RT Radiation Record Sequence	(300A,0703)	1	RT Radiation Record SOP Instance(s) representing the record of the current treatment set that has been delivered. One or more Items shall be included in this Sequence. See C.36.20.1.1.
>Include Table 10-11 "SOP Instance Reference Macro Attributes"			
RT Radiation Set Delivery Number	(300A,0704)	1C	Count of the delivery of the referenced RT Radiation Set as represented by the current SOP Instance. Required if Referenced RT Radiation Set Sequence (300A,0702) is present and RT Radiation Set Usage (300A,0707) is TREATMENT. May be present otherwise. See C.36.20.1.2.

Clinical Fraction Number	(300A,0705)	1C	Count of the RT Treatment Fractions that have been delivered, irrespective of the RT Radiation Set(s) used. Required if Referenced RT Radiation Set Sequence (300A,0702) is present and RT Radiation Set Usage (300A,0707) is TREATMENT. May be present otherwise. See C.36.20.1.2.
RT Treatment Fraction Completion Status	(300A,0706)	1	Defines if the current SOP Instance records a complete treatment delivery of a RT Treatment Fraction. Enumerated Values: COMPLETE PARTIAL See C.36.20.1.3.

C.36.20.1 RT Radiation Record Set Attribute Descriptions

C.36.20.1.1 Referenced RT Radiation Record Sequence

All SOP Instances referenced in this Sequence shall be recorded by the same treatment device (specified by the Treatment Device Identification Macro within the RT Delivery Device Common Module).

An RT Radiation Record instance shall be referenced in exactly one RT Radiation Record Set instance.

The Treatment Session UID within the RT Radiation Record Set shall be identical to those in the Referenced RT Radiation Record instances.

The SOP Classes referenced in this Sequence shall contain the following Modules:

- Enhanced RT Series Module specified in section C.36.3.
- Radiotherapy Common Instance Module specified in section C.36.4.
- RT Delivery Device Common Module specified in section C.36.12.
- RT Radiation Record Common Module specified in section C.36.22.

C.36.20.1.2 RT Radiation Set Delivery Number and Clinical Fraction Number

The Clinical Fraction Number (300A,0705) tracks the clinical progress of treatment delivery. It is a counter that represents the number of times that an RT Radiation Set Instance or any Instance derived within an adaptive radiotherapy treatment process was delivered.

The RT Radiation Set Delivery Number (300A,0704) is a counter that represents the number of times the referenced RT Radiation Set Instance has been delivered.

The RT Radiation Set Delivery Number (300A,0704) of the delivered RT Treatment Fraction shall start with 1 for its first fraction and increase monotonically by 1, throughout all RT Radiation Record

Set Instances referencing the same RT Radiation Set Instance identified by its SOP Instance UID (0008,0018), see 7.14.10.

If the same RT Radiation Set is used for all treatments, the values of RT Radiation Set Delivery Number (300A,0704) and the Clinical Fraction Number (300A,0705) have the same values.

For some adaptive treatment approaches, details of the device parameters may be altered at the treatment session to accommodate the current position and shape of the patient. In this case, a new RT Radiation Set SOP Instance is used for the subsequent RT Treatment Fractions and the RT Radiation Set Delivery Number (300A,0704) re-starts at 1.

The Clinical Fraction Number (300A,0705) is continuously incremented to reflect the clinical progress of a therapeutic series of treatments. In the RT Radiation Record Set for the last of the intended RT Treatment Fractions, this value will be equal to the Number of Fractions (3010,007D) present in the corresponding RT Prescription.

Example

RT Radiation Set P contains RT Radiations A, B; Adapted RT Radiations indicated by (‘) and (“); RT Radiation Sets created are P, P’ and P”.

Table C.36.20-3
Delivery of multiple RT Radiation Set Instances

Treatment Session	RT Radiation Set	Delivered RT Radiations	Clinical Fraction Number (300A,0705)	RT Radiation Set Delivery Number (300A,0704)
1	P	A,B	1	1 (of P)
2	P	A,B	2	2 (of P)
3	P’	A’,B’	3	1 (of P’)
4	P’	A’,B’	4	2 (of P’)
5	P”	A”,B”	5	1 (of P”)
6	P	A,B	6	3 (of P)

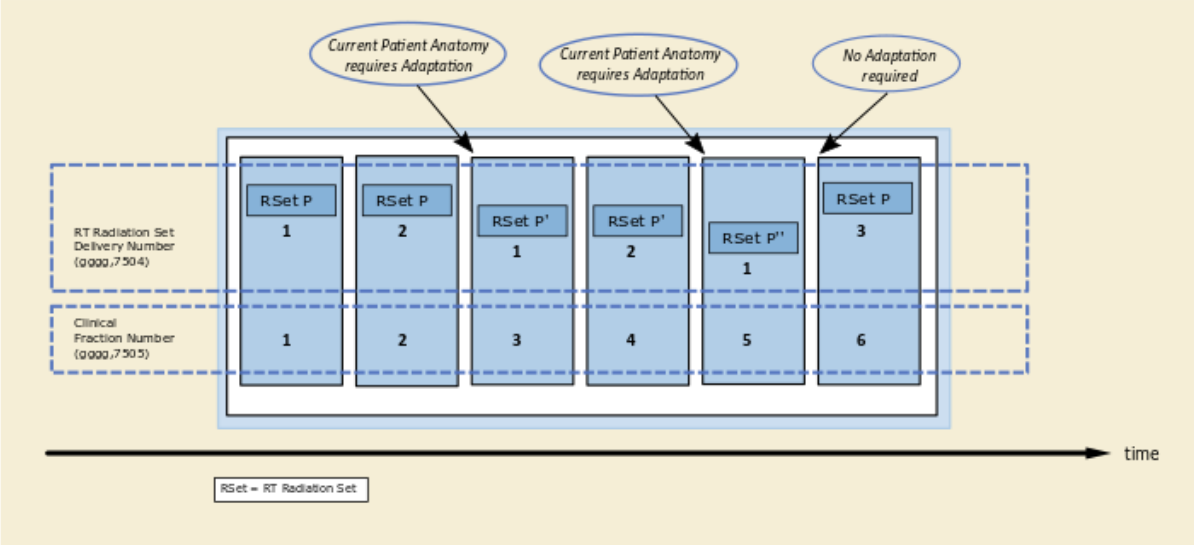


Figure C.36.20-1
Delivery of a single RT Radiation Set Instance with Adaptive Treatments

C.36.20.1.3 Complete versus Partial Fraction

When there is an RT Radiation Record Instance present for all of the RT Radiation Instances for this RT Treatment Fraction and they all have a Treatment Delivery Continuation Flag (300A,0708) of NO and have an RT Treatment Termination Status (300A,0714) of NORMAL the value of RT Radiation RT Treatment Fraction Completion Status (300A,0706) shall be COMPLETE. The expression “all of the RT Radiation Instances” refers to the referenced Instances in the RT Radiation Set, to which this current RT Radiation Record Set refers.

Otherwise the value of RT Treatment Fraction Completion Status (300A,0706) shall be PARTIAL.

Example

RT Radiation Set P contains RT Radiations A and B.

RT Radiation Record Sets created are W, X, Y, and Z.

Table C.36.20-2
Delivery of a single RT Radiation Set Instance with Partial Treatments

Treatment Session	RT Radiation Set	Delivered RT Radiations	Treatment Delivery Continuation Flag (300A,0708)	RT Treatment Termination Status (300A,0714)	RT Radiation Record Set	RT Treatment Fraction Completion Status (300A,0706)	Clinical Fraction Number (300A,0705)	RT Radiation Set Delivery Number (300A,0704)
1	P	A	NO	NORMAL	W	PARTIAL	1	1
		B	NO	ABNORMAL				
2	P	B	YES	NORMAL	X	PARTIAL	1	1
		A	NO	NORMAL	Y	COMPLETE	2	2
		B	NO	NORMAL				

3	P	A	NO	NORMAL	Z	COMPLETE	3	3
		B	NO	NORMAL				

C.36.20.1.4 RT Radiation Set Usage

A typical example for different values of RT Radiation Set Usage (300A,0707) in the current RT Radiation Record Set SOP Instance versus in the SOP Instance referenced by the Referenced RT Radiation Set Sequence (300A,0702) is as follows: The treatment defined by the RT Radiation Set SOP Instance, in which RT Radiation Set Usage (300A,0707) has the value TREATMENT, may be sent to the treatment device and applied for quality assurance without a patient being present. In this case, RT Radiation Set Usage (300A,0707) in the current SOP Instance has the value PLAN_QA.

C.36.21 RT Dose Contribution Record Module

The RT Dose Contribution Record Module contains information about the delivered dose.

Table C.36.21-1
RT Dose Contribution Record Module Attributes

Attribute Name	Tag	Type	Attribute Description
Radiation Dose Identification Sequence	(300A,0618)	1	Identifies the dose values that are recorded by this RT Radiation Record Set IOD. One or more Items shall be included in this Sequence.
>Radiation Dose Identification Index	(300A,0603)	1	Index of this Item in this Sequence. The value shall start at 1 and increase monotonically by 1.
>Referenced Radiation Dose Identification Index	(300A,060C)	1C	Radiation Dose Identification Index value that links the Radiation Dose Identification defined by this Sequence Item to the corresponding Item in an RT Radiation Set Instance. Required if the Instance referenced in Referenced RT Radiation Set Sequence (300A,0702) contains a Radiation Dose Identification Sequence Item that corresponds to this Radiation Dose Identification Item.
>Radiation Dose Identification Label	(300A,0619)	1	User-defined label for the Radiation Dose Identification. See C.36.2.1.1.1.
>Conceptual Volume Sequence	(3010,0025)	1	Reference to a Conceptual Volume which received dose during treatment delivery. See C.36.21.1.1. Only a single Item shall be included in this Sequence.

>>Include Table 10.34-1 "Conceptual Volume Segmentation Reference and Combination Macro Attributes"			
Radiation Dose Sequence	(300A,0617)	1	Describes dose contributed by referenced RT Radiation Record SOP instances. For every SOP instance referenced in Referenced RT Radiation Record Sequence (300A,0703) exactly one item shall be present in this Sequence.
>Referenced RT Radiation Record Sequence	(300A,0703)	1	The RT Radiation Record SOP Instance that describes parameters for dose delivery of the recorded Radiotherapy treatment for the Fraction specified in RT Radiation Set Delivery Number (300A,0704). Only a single Item shall be included in this Sequence. See C.36.20.1.1.
>>Include Table 10-11 "SOP Instance Reference Macro Attributes"			
>Radiation Dose Values Parameters Sequence	(300A,061F)	1C	Dose values of this RT Radiation Record with respect to the dose identification items defined in the Radiation Dose Identification Sequence (300A,0618). Required if Measured Meterset to Dose Mapping Sequence (300A,0772) is not present. May be present otherwise. The number of Items included in this Sequence shall be the same as the number of Items in the Radiation Dose Identification Sequence (300A,0618).
>>Referenced Radiation Dose Identification Index	(300A,060C)	1	The value of Radiation Dose Identification Index (300A,0603) in the Radiation Dose Identification Sequence (300A,0618) identifying the dose contribution to which this Item in the Radiation Dose Values Parameters Sequence (300A,061F) applies.
>>Meterset to Dose Mapping Sequence	(300A,0620)	1	Mapping of Cumulative Meterset (300A,063C) to Radiation Dose Value (300A,0625). This may be as defined in the RT Radiation Set for the RT Radiation or calculated for this RT Radiation Record Set.

			See Section C.36.11.1.1. Two or more Items shall be included in this Sequence.
>>>Cumulative Meterset	(300A,063C)	1	Cumulative Meterset where a dose value is delivered. See Section C.36.11.1.1.
>>>Radiation Dose Value	(300A,0625)	1	Dose value (in Gy) delivered at the corresponding Cumulative Meterset (300A,063C). See Section C.36.11.1.5.
>>>Include Table C.36.2.1.5-1 "Radiobiological Dose Effect Description Macro Attributes"			
>Measured Meterset to Dose Mapping Sequence	(300A,0772)	1C	Measured dose values of this delivered radiation mapped to Meterset values. Required if Dose Mapping Sequence (300A,0620) is not present. May be present otherwise. One or more Items shall be included in this Sequence.
>>Referenced Expected In-Vivo Measurement Value Index	(300A,0773)	3	Expected In-Vivo Measurement Value Index (300A,0622) in the Expected In-Vivo Measurement Value Sequence (300A,0621) from the RT Radiation Set Instance that is being recorded.
>>Cumulative Meterset	(300A,063C)	1	Cumulative Meterset where a dose value is delivered.
>>Radiation Dose Value	(300A,0625)	1	Dose value in Gy delivered at the corresponding Cumulative Meterset (300A,063C) of the current SOP Instance.
>>Dose Measurement Device Code Sequence	(300A,0774)	2	Device used to measure the dose data. Zero or one Item shall be included in this Sequence.
>>>Include Table 8.8-1 "Code Sequence Macro Attributes"			*Defined CID 7026 "Radiotherapeutic Dose Measurement Devices"*
>>Measured Dose Description	(3008,9012)	3	User-defined description of Measured Dose (e.g. "Exit dose", "Point A").

C.36.21.1 RT Dose Contribution Record Module Attribute Descriptions

C.36.21.1.1 Conceptual Volume Sequence

The Conceptual Volume Sequence (3010,0025) identifies a Conceptual Volume defining a volume for which dose has been recorded during treatments.

If the Conceptual Volume is associated with a segment, the segment is defined by the Referenced Segment Reference Index (3010,0020) in the Conceptual Volume Segmentation Reference and Combination Macro (see section 10.34).

Alternatively, the Conceptual Volume might not be associated with a segment; for example, when dose recording is specified using a nominal dose to a volume and the tracking coefficients are approximated by Meterset values.

Typically, this Module references Conceptual Volumes which have been used in the RT Dose Contribution Module of the RT Radiation Set SOP Instance referenced by the Referenced RT Radiation Set Sequence (3147,7502).

C.36.22 RT Radiation Record Common Module

The RT Radiation Record Common Module contains treatment-modality-independent information about a delivered RT Radiation. A delivered RT Radiation may be radiation to a patient or radiation without a patient being present (e.g. for QA purposes).

Table C.36.22-1
RT Radiation Record Common Module Attributes

Attribute Name	Tag	Type	Attribute Description
Include Table 10.9.2-1 "Extended Content Identification Macro"			
Include Table C.36.2.1.6-1 "RT Radiation Common Base Macro Attributes"			
Treatment Session UID	(300A,0700)	1	Uniquely identifies the RT Treatment Session to which this instance belongs.
Referenced RT Instance Sequence	(300A,0631)	1C	The RT Radiation SOP Instance that provided the instruction to deliver the radiation. Required if an RT Radiation SOP Instance was used to provide the instructions to the delivery system. Only a single Item shall be included in this Sequence. See C.36.10.1.2.
>Include Table 10-11 "SOP Instance Reference Macro Attributes"			
RT Radiation Usage	(300A,0701)	1	A general indication of how the referenced RT Radiation was used. The Defined Terms are specified in C.36.10.1.1. This value may differ from the RT Radiation Set Intent (300A,0637) within the Instance referenced by the Referenced RT Radiation Set Sequence (300A,0702). See C.36.20.1.4.

Treatment Record Content Origin	(300A,0709)	1	The origin of the content of this SOP Instance. Enumerated Values: DEVICE = The content has been recorded by the treatment device which performed the treatment delivery. USER = The content has been constructed based on user inputs.
Treatment Delivery Continuation Flag	(300A,0708)	1	Indicates whether this SOP Instance represents the record of a treatment delivery which was a continuation of a previously interrupted treatment delivery of the RT Treatment Fraction specified by the RT Radiation Set Delivery Number (300A,0704). Enumerated Values: YES: The record represents a continuation. NO: The record represents a treatment delivery that was started at the first RT Control Point.
RT Treatment Termination Status	(300A,0714)	1	Termination status of the recorded treatment. Enumerated Values: NORMAL The delivery of the fraction represented by the referenced RT Radiation IOD terminated as expected and the fraction has been correctly delivered. ABNORMAL The delivery of the fraction represented by the referenced RT Radiation IOD did not terminate as expected and the fraction has been incorrectly delivered.
RT Treatment Termination Reason Code Sequence	(300A,0715)	2C	Treatment machine termination code. This code is dependent upon the particular application and equipment. Required if RT Treatment Termination Status (300A,0714) is ABNORMAL. Zero or more items shall be included in this Sequence.
>Include Table 8.8-1 "Code Sequence Macro Attributes"			*Defined CID 9561 "Treatment Termination Reasons"*

Machine-Specific Treatment Termination Code Sequence	(300A,0716)	3	Machine-specific termination codes. One or more Items are permitted in this Sequence.
>Include Table 8.8-1 "Code Sequence Macro Attributes"			*No Baseline CID is defined.*
Treatment Termination Description	(300A,0730)	2C	A user-readable description for an abnormal termination. Required if RT Treatment Termination Status (300A,0714) is ABNORMAL.
Treatment Tolerance Violation Sequence	(300A,0731)	2	Reports violations of tolerances that occurred during treatment delivery. Zero or more items shall be included in this Sequence.
>Treatment Tolerance Violation DateTime	(300A,0736)	1	Datetime when Treatment Tolerance Violation occurred.
>Treatment Tolerance Violation Category	(300A,0732)	1	The category of tolerance violation which was exceeded. Defined Terms: CLINICAL = Delivery went out of clinically allowed tolerance. MACHINE = Delivery went out of machine tolerance.
>Treatment Tolerance Violation Type Code Sequence	(300A,0761)	1	Type of treatment tolerance violation. One or more Items shall be included in this Sequence.
>>Include Table 8.8-1 "Code Sequence Macro Attributes"			*If Treatment Tolerance Violation Category (300A,0732) has the value CLINICAL, Defined CID is 9566 "Clinical Tolerance Violation Types"* *If Treatment Tolerance Violation Category (300A,0732) has the value MACHINE, Defined CID is 9567 "Machine Tolerance Violation Types"*
>Treatment Tolerance Violation Cause Code Sequence	(300A,0762)	1	Cause of treatment tolerance violation. One or more Items shall be included in this Sequence.
>>Include Table 8.8-1 "Code Sequence Macro Attributes"			*Defined CID 9565 "Treatment Tolerance Violation Causes"*

>Treatment Tolerance Violation Attribute Sequence	(300A,0733)	2C	The Attribute whose value exceeded the tolerance. Required if the violation corresponds to an Attribute in the current SOP Instance. Zero or one Item shall be included in this Sequence.
>>Include Table 10-20a "Extended Selector Attribute Macro Attributes"			
>Treatment Tolerance Violation Identification	(300A,0735)	1C	An identification of the parameter(s) which exceeded the tolerance, intended for structured processing. Required if Treatment Tolerance Violation Attribute Sequence (300A,0734) is not present or has zero Items. May be present otherwise.
>Treatment Tolerance Violation Description	(300A,0734)	1C	User-defined description of the treatment tolerance violation. This information is intended for display to human readers. Shall not be used for structured processing. Required if Treatment Tolerance Violation Attribute Sequence (300A,0734) is not present or has zero Items. May be present otherwise.
>Override Sequence	(3008,0060)	2	Overrides of this treatment tolerance violation, including the authorization by a qualified person to continue treatment delivery. Zero or one Items shall be included in this Sequence.
>>Operator Identification Sequence	(0008,1072)	1	Identification of the operator who authorized the override. One or more Items shall be present.
>>>Include Table C.17-3b. "Identified Person or Device Macro Attributes"			*The Observer Type (0040,A084) shall be PSN.*
>>Override DateTime	(300A,0760)	1	Date and Time when the user authorized the override.
>>Override Reason	(3008,0066)	2	User-defined reason of the override. May contain notes, e.g. on the justification why the treatment was delivered in the presence of an interlock or unexpected machine condition.

>>Alternate Value Sequence	(300A,073E)	2	The alternate value for the parameter as accepted by the user when the override was entered. The actual value applied during treatment may be different. Zero or one Item shall be included in this Sequence.
>>>Include Table 10-2 "Content Item Macro Attributes Description"			*Baseline CID is CID 9570 "RT Overridden Treatment Parameters"*
Confirmation Sequence	(300A,073F)	2	Records confirmations (sign-offs) by treatment session operators of details that may not be verified electronically (e.g. the presence of devices). Zero or more Items shall be included in this Sequence.
>Include Table 10-30-1 "Assertion Macro Attributes"			*Baseline CID for Assertion Code Sequence (0044,0101) is CID 9564 "Treatment Session Confirmation Assertions".*
Interlock Sequence	(300A,0740)	2	Interlocks which occurred prior, during or after the delivery of radiation covered by this SOP Instance. Zero or more Items shall be included in this Sequence.
>Interlock DateTime	(300A,0741)	1	Date and Time when the Interlock occurred. The date and time of occurrence may be when the interlock occurred (e.g. by a real-time system) or when the interlock was recorded. See C.7.4.2.1.4:
>Interlock Description	(300A,0742)	1	User-readable description of the interlock.
>Interlock Origin Description	(300A,0783)	1C	Description of the origin of the interlock. Required if Interlock Originating Device Sequence (300A,0743) is not present.
>Interlock Originating Device Sequence	(300A,0743)	1C	Contains the attributes that identify the device that originated the interlock. Only a single Item shall be included in this Sequence. Required if Interlock Origin Description (300A,0783) is not present.

>>Include Table 10.36-1 "Device Identification Macro Attributes"			*No Baseline CID is defined.*
>Interlock Code Sequence	(300A,0744)	1	Code(s) that describe the interlock(s) that occurred. One or more Items shall be included in this Sequence.
>>Include Table 8.8-1 "Code Sequence Macro Attributes"			*Baseline CID is 9568 "Treatment Interlocks".*
>Interlock Resolution Code Sequence	(300A,0745)	1	The action applied to resolve the interlock. One or more Items shall be included in this Sequence.
>>Include Table 8.8-1 "Code Sequence Macro Attributes"			*Defined CID 9563 "Interlock Resolutions"*
>Interlock Resolution User Sequence	(300A,0746)	1	The user that resolved the interlock. One or more Items shall be included in this Sequence.
>>Include Table 10-1 "Person Identification Macro Attributes"			
Additional Parameter Recording Instance Sequence	(300A,0780)	3	SOP Instances that contain additional recording of treatment parameters. One or more Items are permitted in this Sequence. See C.36.22.1.1.
>Include Table 10-11 "SOP Instance Reference Macro Attributes"			
>Creator-Version UID	(0008,9123)	1C	Unique identification of the equipment and version of the software that has created the referenced Instance that contains the additional parameters. The UID allows one to avoid attempting to interpret the additional parameters with an unknown format. Required if the Referenced SOP Class UID (0008,1150) is Raw Data Storage ("1.2.840.10008.5.1.4.1.1.66"). May be present otherwise. Note: this value corresponds to the Creator-Version UID of a referenced Raw Data SOP Instance.

C.36.22.1 RT Radiation Record Common Attribute Descriptions

C.36.22.1.1 Additional Parameter Recording Instance Sequence

The Additional Parameter Recording Instance Sequence (300A,0780) allows referencing of a SOP Instance which contains additional parameters recorded during the delivery. For example, the

recording may be high-frequency samples of certain parameters to allow in-depth analysis for quality assurance or other purposes.

C.36.23 RT Radiation Salvage Record Module

The RT Radiation Salvage Record Module contains information about the values which have been recorded when recording by the modality-specific RT Radiation Record IOD was not possible and thus only a minimal subset of attributes is present.

Table C.36.23-1
RT Radiation Salvage Record Module Attributes

Attribute Name	Tag	Type	Attribute Description
Include Table C.36.2.2.7-1 “Radiation Generation Mode Macro Attributes”.			
Starting Meterset Value Known Flag	(300A,0723)	1	Whether it is known that the value of the Cumulative Meterset at the first recorded RT Control Point represents the actual value at the start of the treatment delivery. NO: The Cumulative Meterset at the first recorded RT Control Point may have an estimated or arbitrary value. YES: The Cumulative Meterset at the first recorded RT Control Point has the actual value at which the treatment was started or resumed.
Optionally, all other Attributes at Instance level which are part of the RT Radiation SOP Instance referenced in Referenced RT Instance Sequence (300A,0631), describing the delivery device. See C.36.23.1.1.			
Number of RT Control Points	(300A,0604)	1	Number of RT Control Points in the RT Radiation Salvage Record Control Point Sequence (300A,0722). The value shall be equal to or greater than 2.
RT Radiation Salvage Record Control Point Sequence	(300A,0722)	1	Control Points used to record the beam delivery. The number of Items included in this Sequence shall equal the value of Number of RT Control Points (300A,0604).
>Include Table C.36.2.2.5-1 “RT Control Point General Macro Attributes”			
>Referenced Radiation Generation Mode Index	(300A,0605)	1C	The value of Radiation Generation Mode Index (300A,0601) in the Radiation Generation Mode Sequence (300A,067B) in this IOD that defines the Radiation Generation Mode used for this Control Point. Required if Number of Radiation Generation Modes (300A,0685) is

			present and the conditions in Section C.36.2.2.5.1.1 are satisfied.
>Optionally, all other Attributes at RT Control Point level which are part of the RT Radiation SOP Instance referenced in Referenced RT Instance Sequence (300A,0631). See C.36.23.1.1.			

C.36.23.1 RT Radiation Salvage Record Module Attribute Descriptions

C.36.23.1.1 Recorded Parameter

Additional optional attributes contain values which are known after the termination of the treatment delivery. Any subset of Attributes of the referenced RT Radiation SOP Instance may be provided. If present, an Attribute shall be enclosed in the nested Sequence as it appears in the referenced RT Radiation SOP Instance. If additional parameters are supported these are expected to be documented in an implementation's Conformance Statement.

Example

The following example shows the recording of a Source Gantry Angle of 5 deg and the Y Jaw Openings of 2/3 mm at Control Point 7.

Table C.36.23-1
Additional Optional Parameter Example

Attribute	Tag	Additional Optional Parameter	Value
…			
Starting Meterset Value Known Flag	(300A,0723)	No	YES
…			
RT Beam Limiting Device Definition Sequence	(300A,0641)	Yes	
>Device Index	(3010,0039)	Yes	2
>Beam Modifier Orientation Angle	(300A,0645)	Yes	90
>Device Type Code Sequence	(3010,002E)	Yes	(130330, DCM, "Jaw Pair")
>Parallel RT Beam Delimiter Device Sequence	(300A,0648)	Yes	
>>Parallel RT Beam Delimiter Device Orientation Label Code Sequence	(300A,0644)	Yes	(130335, DCM, "Y Orientation")
…			
RT Radiation Salvage Record Control Point Sequence	(300A,0722)	No	
>RT Control Point Index	(300A,0600)	No	7
…			
>Source Roll Angle	(300A,067A)	Yes	5
>RT Beam Limiting Device Opening Sequence	(300A,0656)	Yes	

>>Referenced Device Index	(300A,0607)	Yes	2
>>Parallel RT Beam Delimiter Positions	(300A,064A)	Yes	2/3

2

Part 4 Addendum

4 **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)
RT Radiation Record Set Storage	**1.2.840.10008.5.1.4.1.1.481.16**	**RT Radiation Record Set IOD**
RT Radiation Salvage Record Storage	**1.2.840.10008.5.1.4.1.1.481.17**	**RT Radiation Salvage Record IOD**
Tomotherapeutic Radiation Record Storage	**1.2.840.10008.5.1.4.1.1.481.18**	**Tomotherapeutic Radiation Record IOD**
C-Arm Photon-Electron Radiation Record Storage	**1.2.840.10008.5.1.4.1.1.481.19**	**C-Arm Photon-Electron Radiation Record IOD**
Robotic Radiation Record Storage	**1.2.840.10008.5.1.4.1.1.481.20**	**Robotic Radiation Record IOD**

6

Part 6 Addendum

Add the following data elements to PS3.6:

6 REGISTRY OF DICOM DATA ELEMENTS

(300A,0700)	Treatment Session UID	TreatmentSessionUID	UI	1
(300A,0701)	RT Radiation Usage	RTRadiationUsage	CS	1
(300A,0702)	Referenced RT Radiation Set Sequence	ReferencedRTRadiationSetSequence	SQ	1
(300A,0703)	Referenced RT Radiation Record Sequence	ReferencedRTRadiationRecordSequence	SQ	1
(300A,0704)	RT Radiation Set Delivery Number	RTRadiationSetDeliveryNumber	US	1
(300A,0705)	Clinical Fraction Number	ClinicalFractionNumber	US	1
(300A,0706)	RT Treatment Fraction Completion Status	RTTreatmentFractionCompletionStatus	CS	1
(300A,0707)	RT Radiation Set Usage	RTRadiationSetUsage	CS	1
(300A,0708)	Treatment Delivery Continuation Flag	TreatmentDeliveryContinuationFlag	CS	1
(300A,0709)	Treatment Record Content Origin	TreatmentRecordContentOrigin	CS	1
(300A,0714)	RT Treatment Termination Status	RTTreatmentTerminationStatus	CS	1
(300A,0715)	RT Treatment Termination Reason Code Sequence	RTTreatmentTerminationReasonCodeSequence	SQ	1
(300A,0716)	Machine-Specific Treatment Termination Code Sequence	MachineSpecificTreatmentTerminationCodeSequence	SQ	1
(300A,0722)	RT Radiation Salvage Record Control Point Sequence	RTRadiationSalvageRecordControlPointSequence	SQ	1
(300A,0723)	Starting Meterset Value Known Flag	StartingMetersetValueKnownFlag	CS	1
(300A,0730)	Treatment Termination Description	TreatmentTerminationDescription	ST	1
(300A,0731)	Treatment Tolerance Violation Sequence	TreatmentToleranceViolationSequence	SQ	1
(300A,0732)	Treatment Tolerance Violation Category	TreatmentToleranceViolationCategory	CS	1
(300A,0733)	Treatment Tolerance Violation Attribute Sequence	TreatmentToleranceViolationAttributeSequence	SQ	1
(300A,0734)	Treatment Tolerance Violation Description	TreatmentToleranceViolationDescription	ST	1
(300A,0735)	Treatment Tolerance Violation Identification	TreatmentToleranceViolationIdentification	ST	1
(300A,0736)	Treatment Tolerance Violation DateTime	TreatmentToleranceViolationDateTime	DT	1

(300A,073A)	Recorded RT Control Point DateTime	RecordedRTControlPointDateTime	DT	1
(300A,073B)	Referenced Radiation RT Control Point Index	ReferencedRadiationRTControlPoint Index	US	1
(300A,073E)	Alternate Value Sequence	AlternateValueSequence	SQ	1
(300A,073F)	Confirmation Sequence	ConfirmationSequence	SQ	1
(300A,0740)	Interlock Sequence	InterlockSequence	SQ	1
(300A,0741)	Interlock DateTime	InterlockDateTime	DT	1
(300A,0742)	Interlock Description	InterlockDescription	ST	1
(300A,0743)	Interlock Originating Device Sequence	InterlockOriginatingDeviceSequence	SQ	1
(300A,0744)	Interlock Code Sequence	InterlockCodeSequence	SQ	1
(300A,0745)	Interlock Resolution Code Sequence	InterlockResolutionCodeSequence	SQ	1
(300A,0746)	Interlock Resolution User Sequence	InterlockResolutionUserSequence	SQ	1
(300A,0760)	Override DateTime	OverrideDateTime	DT	1
(300A,0761)	Treatment Tolerance Violation Type Code Sequence	TreatmentToleranceViolationTypeC odeSequence	SQ	1
(300A,0762)	Treatment Tolerance Violation Cause Code Sequence	TreatmentToleranceViolationCause CodeSequence	SQ	1
(300A,0772)	Measured Meterset to Dose Mapping Sequence	MeasuredMetersetToDoseMapping Sequence	SQ	1
(300A,0773)	Referenced Expected In-Vivo Measurement Value Index	ReferencedExpectedInVivoMeasure mentValueIndex	US	1
(300A,0774)	Dose Measurement Device Code Sequence	DoseMeasurementDeviceCodeSequ ence	SQ	1
(300A,0780)	Additional Parameter Recording Instance Sequence	AdditionalParameterRecordingInsta nceSequence	SQ	1
(300A,0783)	Interlock Origin Description	InterlockOriginDescription	ST	1

Add the following to PS3.6 Annex A:

ANNEX A REGISTRY OF DICOM UNIQUE IDENTIFIERS (UID) (NORMATIVE)

Table A-1 UID Values

UID Value	UID NAME	UID TYPE	Part
1.2.840.10008.5.1.4.1.1.481.16	RT Radiation Record Set Storage	SOP Class	PS 3.4
1.2.840.10008.5.1.4.1.1.481.17	RT Radiation Salvage Record Storage	SOP Class	PS 3.4
1.2.840.10008.5.1.4.1.1.481.18	Tomotherapeutic Radiation Record Storage	SOP Class	PS 3.4
1.2.840.10008.5.1.4.1.1.481.19	C-Arm Photon-Electron Radiation Record Storage	SOP Class	PS 3.4
1.2.840.10008.5.1.4.1.1.481.20	Robotic Radiation Record Storage	SOP Class	PS 3.4

Table A-3 Context Group UID Values

Context UID	Context Identifier	Context Group Name
1.2.840.10008.6.1.1318	9561	Treatment Termination Reasons
1.2.840.10008.6.1.1319	9562	Radiotherapy Treatment Delivery Person Roles
1.2.840.10008.6.1.1320	9563	Interlock Resolutions
1.2.840.10008.6.1.1321	9564	Treatment Session Confirmation Assertions
1.2.840.10008.6.1.1322	9565	Treatment Tolerance Violation Causes
1.2.840.10008.6.1.1323	9566	Clinical Tolerance Violation Types
1.2.840.10008.6.1.1324	9567	Machine Tolerance Violation Types
1.2.840.10008.6.1.1325	9568	Treatment Interlocks
1.2.840.10008.6.1.1326	9569	Isocentric Patient Support Position Parameters
1.2.840.10008.6.1.1327	9570	RT Overridden Treatment Parameters

Part 15 Addendum

2 **Add the following to PS3.15 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
Treatment Session UID	(300A,0700)	N	Y	U		K								
Treatment Tolerance Violation Description	(300A,0734)	N	Y	D								C		
Treatment Tolerance Violation DateTime	(300A,0736)	N	Y	D						K	C			
Recorded RT Control Point DateTime	(300A,073A)	N	Y	D						K	C			
Interlock DateTime	(300A,0741)	N	Y	D						K	C			
Interlock Description	(300A,0742)	N	Y	D								C		
Override DateTime	(300A,0760)	N	Y	D						K	C			
Interlock Origin Description	(300A,0783)	N	Y	D								C		

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Part 16 Addendum

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

CID 9561 TREATMENT TERMINATION REASONS

Context ID 9561

Treatment Termination Reasons

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

Type: Extensible

Version: 20200624

UID: 1.2.840.10008.6.1.1318

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-RT Concept ID	UMLS Concept Unique ID
Include CID 9568 "Treatment Interlocks"				
DCM	110504	Patient died		
DCM	110505	Patient refused to continue procedure		
DCM	110513	Discontinued for unspecified reason		
DCM	110515	Patient condition prevented continuing		
DCM	110500	Doctor canceled procedure		
DCM	110501	Equipment failure		
DCM	110518	Patient Movement		
DCM	110519	Operator Error		

CID 9562 RADIOTHERAPY TREATMENT DELIVERY PERSON ROLES

Context ID 9562

Radiotherapy Treatment Delivery Person Roles

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

Type: Extensible

Version: 20200624

UID: 1.2.840.10008.6.1.1319

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-RT Concept ID	UMLS Concept Unique ID
SCT	3430008	Radiation Therapist	J-06173	C0278604
SCT	158965000	Medical Practitioner	J-0016E	C1306754
SCT	309343006	Physician	J-004E8	C0031831
NCIt	C93176	Dosimetrist		C2985479
SCT	405277009	Resident	J-005E6	C1320928

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-RT Concept ID	UMLS Concept Unique ID
UMLS	C1441532	Consulting Physician		C1441532
UMLS	C2985483	Radiation Physicist		C2985483
DCM	128678	Physics Assistant		
UMLS	C1708969	Medical Physicist		C1708969

CID 9563 INTERLOCK RESOLUTIONS

Context ID 9563

Interlock Resolutions

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

Type: Extensible

Version: 20200624

UID: 1.2.840.10008.6.1.1320

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
DCM	130453	Treatment Terminated		
DCM	130454	Interlock Overridden		
DCM	130455	Patient Repositioned		

CID 9564 TREATMENT SESSION CONFIRMATION ASSERTIONS

Context ID 9564

Treatment Session Confirmation Assertions

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

Type: Extensible

Version: 20200624

UID: 1.2.840.10008.6.1.1321

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
DCM	130456	Bolus Present		
DCM	130457	Cone Present		
DCM	130458	Block Present		
DCM	130459	Applicator Present		
DCM	130460	Headframe Present		

CID 9565 TREATMENT TOLERANCE VIOLATION CAUSES

Context ID 9565

Treatment Tolerance Violation Causes

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

Type: Extensible

Version: 20200624

UID: 1.2.840.10008.6.1.1322

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
DCM	130461	Inappropriate Patient Orientation		
DCM	130462	Inappropriate Patient Position		
DCM	130463	Machine Not Available		
DCM	130464	Change in Patient Anatomy		
DCM	130465	Machine Calibration Adjustment		
DCM	130466	Unavailability of a Beam Modifier		
DCM	130467	Machine Capability License Expired		

CID 9566 CLINICAL TOLERANCE VIOLATION TYPES

Context ID 9566

Clinical Tolerance Violation Types

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

Type: Extensible

Version: 20200624

UID: 1.2.840.10008.6.1.1323

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
DCM	130468	Beam Targeting Tolerance Violation		
DCM	130469	Meterset Tolerance Violation		
DCM	130470	Delivery Rate Tolerance Violation		

CID 9567 MACHINE TOLERANCE VIOLATION TYPES

Context ID 9567

Machine Tolerance Violation Types

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

Type: Extensible

Version: 20200624

UID: 1.2.840.10008.6.1.1324

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
DCM	130471	Jaw Position Tolerance Violation		
DCM	130472	MLC Position Tolerance Violation		
DCM	130473	Source Position Tolerance Violation		
DCM	130474	Dose Rate Tolerance Violation		

CID 9568 TREATMENT INTERLOCKS

Context ID 9568

Treatment Interlocks

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

Type: Extensible

Version: 20200624

UID: 1.2.840.10008.6.1.1325

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-RT Concept ID	UMLS Concept Unique ID
DCM	130476	Secondary Fluence Monitoring System Interlock		
DCM	130477	Timer Interlock		
DCM	130478	Door Interlock		
DCM	130479	Patient Motion Interlock		

CID 9569 ISOCENTRIC PATIENT SUPPORT POSITION PARAMETERS

Context ID 9569

Isocentric Patient Support Position Parameters

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

Type: Extensible

Version: 20200624

UID: 1.2.840.10008.6.1.1326

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-RT Concept ID	UMLS Concept Unique ID
DCM	126812	Isocentric Patient Support Continuous Pitch Angle		

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-RT Concept ID	UMLS Concept Unique ID
DCM	126813	Isocentric Patient Support Continuous Roll Angle		
DCM	126814	Isocentric Patient Support Continuous Yaw Angle		
DCM	126815	Isocentric Patient Support Lateral Position		
DCM	126816	Isocentric Patient Support Longitudinal Position		
DCM	126817	Isocentric Patient Support Vertical Position		

CID 9570 RT OVERRIDDEN TREATMENT PARAMETERS

Context ID 9570

RT Overriden Treatment Parameters

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

Type: Extensible

Version: 20200624

UID: 1.2.840.10008.6.1.1327

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-RT Concept ID	UMLS Concept Unique ID
Include CID 9401 "IEC61217 Device Position Parameters"				
Include CID 9569 "Isocentric Patient Support Position Parameters"				

Change the following code definitions to PS3.16, Annex D:

ANNEX D DICOM CONTROLLED TERMINOLOGY DEFINITIONS (NORMATIVE)

Code Value	Code Meaning	Definition	Notes
…			
110518	Patient Movement	A movement of the patient **preventing continuation of procedure or** affecting ~~**test**~~**result** quality.	
110519	Operator Error	An error of the operator **preventing continuation of procedure or** affecting ~~**test**~~**result** quality.	
…			

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

2 ANNEX D DICOM CONTROLLED TERMINOLOGY DEFINITIONS (NORMATIVE)

Code Value	Code Meaning	Definition	Notes
130450	Operator decision to terminate treatment	Decision was made by the operator of the equipment to discontinue treatment.	
130451	Patient decision to terminate treatment	Decision was made by the patient to discontinue treatment.	
130452	Physician decision to terminate treatment	Decision was made by the physician to discontinue treatment.	
130453	Treatment Terminated	Treatment delivery of this RT Radiation was terminated.	
130454	Resolved by overriding Interlock	An out-of-tolerance delivery parameter was accepted or re-specified and treatment delivery was continued.	
130455	Resolved by repositioning Patient	The patient was re-positioned and treatment delivery was continued.	
130456	Bolus Present	A bolus is confirmed to be present.	
130457	Cone Present	A cone is confirmed to be present.	
130458	Block Present	A block is confirmed to be present.	
130459	Applicator Present	An applicator is confirmed to be present.	
130460	Headframe Present	A headframe is confirmed to be present.	
130461	Inappropriate Patient Orientation	The patient could not be positioned on the patient positioning device in a way, that the shape of treatment area has an unacceptable orientation to match the intended target area.	
130462	Inappropriate Patient Position	The patient could not be positioned on the patient positioning device in a way, that the that the shape of treatment area radiated the intended target area.	
130463	Machine Not Available	The machine intended to be used for treatment was not available.	
130464	Change in Patient Anatomy	The patient´s anatomy is found to be inconsistent with the patient model used during planning to the extent that treatment delivery was impacted.	
130465	Machine Calibration Adjustment	A re-calibration of the treatment device impacted the treatment delivery.	
130466	Unavailability of a Beam Modifier	A planned Beam Modifier was not available at the time of treatment.	
130467	Machine Capability License Expired	A capability of the treatment device was not available because the corresponding license expired.	

Code Value	Code Meaning	Definition	Notes
130468	Beam Targeting Tolerance Violation	Beam targeting parameters have been adjusted in a way that violated a clinical tolerance.	
130469	Meterset Tolerance Violation	A Meterset value has been adjusted in a way that violated a clinical tolerance.	
130470	Delivery Rate Tolerance Violation	A Delivery Rate has been adjusted in a way that violated a clinical tolerance.	
130471	Jaw Position Tolerance Violation	Jaw positions exceeded the machine tolerance.	
130472	MLC Position Tolerance Violation	One or more MLC leave positions exceeded the machine tolerance.	
130473	Source Position Tolerance Violation	The Source Position angle exceeded the machine tolerance.	
130474	Dose Rate Tolerance Violation	The dose rate exceeded the machine tolerance.	
130475	Primary Fluence Monitoring System Interlock	An interlock triggered by failure of the primary system monitoring fluence.	
130476	Secondary Fluence Monitoring System Interlock	An interlock triggered by failure of the secondary system monitoring fluence.	
130477	Timer Interlock	An interlock triggered by a timer.	
130478	Door Interlock	An interlock triggered by a door being open.	
130479	Patient Motion Interlock	An interlock triggered by patient movement.	