Digital Imaging and Communications in Medicine (DICOM)

Supplement 175: Second Generation Radiotherapy –

C-Arm RT Treatment Modalities

DICOM Standards Committee, Working Group 7, Radiation Therapy

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Foreword

This Supplement specifies additional IODs necessary to support the new Second Generation Radiotherapy IODs and operations.

Scope and Field of Application

Introduction

This Supplement introduces the RT Radiation IOD and the RT Radiation Set IOD. An RT Radiation Set IOD defines a Radiotherapy Treatment Fraction as a collection of instances of RT Radiation IODs. RT Radiation IODs represent different treatment modalities. This Supplement introduces the representation of the C-Arm techniques.

General Architectural Principles

- Different types of treatment devices are supported by different IODs, for example, C-Arm devices, Tomotherapeutic devices, Multiple Fixed Source devices and Robotic devices are modeled separately. This allows more stringent conditions to be applied to the presence or absence of Attributes within those IODs, and thereby increases the potential for interoperability.
- The Second Generation RT Objects definitions provide the basis to support all current treatment modalities and be extensible for future modalities and new equipment.
- Compatibility with First-Generation IODs: It will be possible for the content of First Generation IODs to be represented in Second Generation IODs. However, information beyond the content of a First Generation SOP Instance will be needed to create a valid Second Generation SOP Instance.

Editorial Note: All existing occurrences of the term Meterset in the current DICOM Standard should be capitalized.

Part 2 Addendum

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

UID Value	UID Name	Category
1.2.840.10008.5.1.4.1.1.481.XN.3	RT Radiation Set Storage	Transfer
1.2.840.10008.5.1.4.1.1.481.XN.5.2	C-Arm Photon-Electron Radiation Storage	Transfer

178 **Part 3 Addendum**

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

IODs Modules	RT Rad Set	C-Arm Ph-El Rad
Patient	**M**	**M**
Clinical Trial Subject	**U**	**U**
General Study	**M**	**M**
Patient Study	**U**	**U**
Clinical Trial Study	**U**	**U**
General Series	**M**	**M**
Clinical Trial Series	**U**	**U**
Enhanced RT Series	**M**	**M**
General Equipment	**M**	**M**
Enhanced General Equipment	**M**	**M**
Frame Of Reference		**M**
…		
Radiotherapy Common Instance	**M**	**M**
RT Radiation Set	**M**	
RT Dose Contribution	**C**	
RT Delivery Device Common		**M**
RT Radiation Common		**M**
C-Arm Photon-Electron Delivery Device		**M**
C-Arm Photon-Electron Beam		**M**
…		
Common Instance Reference Module	**M**	**M**
SOP Common	**M**	**M**

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Add the following to PS3.3 Chapter 10 Miscellaneous Macros:

184 **10.A9 OUTLINE DEFINITION MACRO**

The Outline Definition Macro describes a 2D outline in a given coordinate system.

186 **Table 10.A9-1**
OUTLINE DEFINITON MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Outline Shape Type	(gggg,5200)	1	Type of shape of the outline. Enumerated values: RECTANGULAR CIRCULAR POLYGONAL See 10.A9.1.1.
Outline Left Vertical Edge	(gggg,5201)	1C	X-coordinate in mm of the left edge of the rectangular outline (parallel to the y-axis of the coordinate system). Required if Outline Shape Type (gggg,5200) is RECTANGULAR. See 10.A9.1.2.
Outline Right Vertical Edge	(gggg,5202)	1C	X-coordinate in mm of the right edge of the rectangular outline (parallel to the y-axis of the coordinate system). Required if Outline Shape Type (gggg,5200) is RECTANGULAR. See 10.A9.1.2.
Outline Upper Horizontal Edge	(gggg,5203)	1C	Y-coordinate in mm of the upper edge of the rectangular outline (parallel to the x-axis of the coordinate system). Required if Outline Shape Type (gggg,5200) is RECTANGULAR. See 10.A9.1.2.
Outline Lower Horizontal Edge	(gggg,5204)	1C	Y-coordinate in mm of the lower edge of the rectangular outline (parallel to the x-axis of the coordinate system). Required if Outline Shape Type (gggg,5200) is RECTANGULAR. See 10.A9.1.2.
Center of Circular Outline	(gggg,5205)	1C	Location (x,y) in mm of the center of the circular outline. Required if Outline Shape Type (gggg,5200) is CIRCULAR. See 10.A9.1.2.
Diameter of Circular Outline	(gggg,5206)	1C	Diameter in mm of the circular outline. Required if Outline Shape Type

			(gggg,5200) is CIRCULAR. See 10.A9.1.2.
Number of Polygonal Vertices	(gggg,5207)	1C	Number of Vertices in Vertices of the Polygonal Outline (gggg,5208). Required if Outline Shape Type (gggg,5200) is POLYGONAL.
Vertices of the Polygonal Outline	(gggg,5208)	1C	A data stream of pairs of x and y in mm. Polygonal outlines are implicitly closed from the last vertex to the origin vertex and all edges shall be non-intersecting except at the vertices. Required if Outline Shape Type (gggg,5200) is POLYGONAL. See 10.A9.1.2.

10.A9.1 Outline Definition Macro Attribute Description

10.A9.1.1 Outline Shape Type

When outline shape is a rectangle or a circle per design, the Outline Shape Type (gggg,5200) shall have the value RECTANGULAR respectively CIRCULAR and the outline shall not be represented as a polyline.

10.A9.1.2 Coordinate Definitions

The values are defined in a plane that is declared in the invocation of the macro.

10.A10 PATIENT TO EQUIPMENT RELATIONSHIP MACRO

The Patient to Equipment Relationship Macro describes a position of the patient with respect to a device. The position is defined by means of a transformation matrix between a Patient Frame of Reference and an Equipment Frame of Reference.

Table 10.A10-1
PATIENT TO EQUIPMENT RELATIONSHIP MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image to Equipment Mapping Matrix	(0028,9520)	1	A rigid, homogeneous 4x4 transformation matrix that maps the patient coordinate space in the Frame of Reference used for the patient model to the coordinate system defined by the treatment delivery equipment. Matrix elements shall be listed in row-major order. See 10.A10.1.1 and C.7.6.21.1.
Frame of Reference Transformation Comment	(3006,00C8)	3	Comments entered by a human operator about the relationship between the patient frame of reference and the equipment. For display purposes only, shall not be used for other purposes.
Patient Location Coordinates Sequence	(gggg,6042)	2	Specific points in the patient coordinate system which further characterize the position of the patient with respect to the equipment.

			Zero or more Items shall be included in this Sequence.
>3D Point Coordinate	(0068,6590)	1	Coordinate (x,y,z) in mm describing a location in the patient Frame of Reference that will be transformed to the Equipment Frame of Reference by using the Image to Equipment Mapping Matrix (0028,9520).
>Patient Location Coordinates Code Sequence	(gggg,6044)	1	Identifies the type of Patient Location Coordinate. One or more Items shall be included in this Sequence.
>>Include Table 8.8-1 "Code Sequence Macro Attributes"			*CID is defined by invocation.*
Patient Support Position Sequence	(gggg,6046)	2	Actual Patient Support Position Parameters. Shall be consistent with the Image to Equipment Mapping Matrix (0028,9520). See 10.A10.1.1. Zero or one Items shall be included in this Sequence.
>Include Table 10.A11-1 "Patient Support Position Macro Attributes"			

10.A10.1 Patient to Equipment Relationship Macro Attributes Description

10.A10.1.1 Image to Equipment Mapping Matrix and Patient Support Position Macro

The Image to Equipment Mapping Matrix (0028,9520) describes the relationship between the Patient-oriented coordinate system and an Equipment Coordinate System. This matrix ${}^{A}M_{B}$ describes a rigid transformation of a point (${}^{B}x,{}^{B}y,{}^{B}z$) with respect to the Patient coordinate system into (${}^{A}x,{}^{A}y,{}^{A}z$) with respect to the Equipment Coordinate System as defined in section C.7.6.21.1.

The Equipment Coordinate System is identified by the Equipment Frame of Reference UID (gggg,51A0). For further information on the definition of the Equipment Frame of Reference, see C.36.E1.1.1. The patient-oriented coordinate system is identified by the Frame Of Reference UID (0020,0052) in the Frame of Reference Module of the SOP instance it is used within. Both coordinate systems are expressed in millimeters.

The Patient Support Position Macro invoked by Patient Support Position Sequence (gggg,6046) allows the exchange of device-specific parameters for the patient support device. Applications designed to guide a specific patient support device will be able to de-compose the transformation into device-specific parameters or derive a transformation matrix out of these parameters. Applications that are unable to know the decomposition of the transformation to those parameters and vice versa will still be able to display the native labels and numerical values of those parameters to human readers.

The Patient Support Position Sequence (gggg,6046) may be present to annotate the matrix and visualize the decomposed matrix contents. The content of the Patient Support Position Macro shall be used for display purposes only. It shall not be used for other purposes. The content of this macro shall not be used as a substitute for the Image to Equipment Mapping Matrix (0028,9520). In general, there is more than one way to reach the point in space that is described by the Image to Equipment Mapping Matrix (0028,9520). Hence it is explicitly not implied how this position is reached.

In some cases (e.g. emergency treatments in Radiotherapy), the Patient Frame of Reference is not defined by an image series. In this case an arbitrary Frame of Reference is used for the patient

coordinate system in the Frame of Reference Module of the SOP instance. The Image to Equipment Mapping Matrix (0028,9520) has the same meaning as in the case of image-based Patient Frame of Reference.

If the Image to Equipment Mapping Matrix (0028,9520) and the Patient Support Position Sequence (gggg,6046) are both present, the information in both locations shall be consistent.

10.A11 PATIENT SUPPORT POSITION MACRO

This macro provides the device-specific geometric settings for the Patient Support device.

The information is intended for display to human readers and to support non-image-based patient positioning. The authoritative definition of the patient position with respect to the device is contained in the Image to Equipment Mapping Matrix (0028,9520).

Table 10.A11-1
PATIENT SUPPORT POSITION MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient Support Position Specification Method	(gggg,5144)	1	Method of specification for patient support parameters. Enumerated Values ABSENT - no parameters are specified GLOBAL – parameters are specified using a globally known method, irrespective of the device in use DEVICE_SPECIFIC – parameters are specified using a device-specific method
Patient Support Position Device Parameter Sequence	(gggg,5145)	1C	Translational and rotational parameters for Patient Support devices. Required if Position Specification Method (gggg,5144) does not equal ABSENT. One or more Items shall be included in this Sequence if Position Specification Method (gggg,5144) equals DEVICE_SPECIFIC. Only one Item shall be included in this Sequence if Position Specification Method (gggg,5144) equals GLOBAL.
>Referenced Device Index	(gggg,9142)	1C	The value of Device Index (3010,0039) in Patient Support Devices Sequence (gggg,51F0) corresponding to the Patient Support Device in use. Required if Position Specification Method (gggg,5144) equals DEVICE_SPECIFIC.
>Device Order Index	(gggg,5146)	1C	Index defining the order in which the Items in the Patient Support Position Device Parameter Sequence (gggg,5145) are applied. The value shall start at 1 and increase monotonically by 1. Required if Position Specification Method (gggg,5144) equals DEVICE_SPECIFIC.

Attribute Name	Tag	Type	Attribute Description
			See 10.A11.1.
>Patient Support Position Parameter Sequence	(gggg,5142)	1	Translational and rotational parameters for a particular Patient Support device. One or more Items shall be included in this Sequence.
>>Patient Support Position Parameter Order Index	(gggg,5147)	1C	Index defining the order in which the Items in the Patient Support Position Parameter Sequence (gggg,5142) are applied. The value shall start at 1 and increase monotonically by 1. Required if Position Specification Method (gggg,5144) equals DEVICE_SPECIFIC. See 10.A11.1.
>>Include Table 10-2 "Content Item Macro Attributes"			*Defined TID is TID SUP175001.*

10.A11.1 Position Parameters and Order Index

The Device Order Index (gggg,5146) and the Patient Support Position Parameter Order Index (gggg,5147) are hierarchical, meaning all the Items in a Patient Support Position Parameter Sequence (gggg,5142) are applied before proceeding to the Item in the Patient Support Position Device Parameter Sequence (gggg,5145) specified by the next Device Order Index (gggg,5146) value.

A vendor may specify codes that are not included in TID 175001. The vendor shall document these codes, the corresponding parameters, their geometric interpretation, and their order in the Conformance Statement. These parameters shall use UCUM units of mm and degrees where applicable.

The codes in Table 10.A11-2, if used, shall have the Patient Support Position Parameter Order Index (gggg,5147) value shown in the table.

Table Table 10.A11-2
Isocentric Patient Support Position Parameter Order Index

Code Value (0008,0100)	Code Meaning (0008,0104)	Patient Support Position Parameter Order Index (gggg,5147)
S175307	Isocentric Patient Support Continuous Yaw Angle	1
S175305	Isocentric Patient Support Continuous Pitch Angle	2
S175306	Isocentric Patient Support Continuous Roll Angle	3
S175308	Isocentric Patient Support Lateral Position	4
S175309	Isocentric Table Top Longitudinal Position	5
S175310	Isocentric Table Top Vertical Position	6

Add the following to PS3.3 Annex A, in Figure A.86.1.1.1-1:

A.86 RT SECOND GENERATION

A.86.1. RT Second Generation Objects

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A.86.1.1 RT Second Generation Common Information

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A.86.1.1.1 RT Second Generation Entity-Relationship Model

The E-R Model in Figure A.VV.1.1.1-1 depicts those components of the DICOM Information Model that are relevant to second-generation RT IODs.

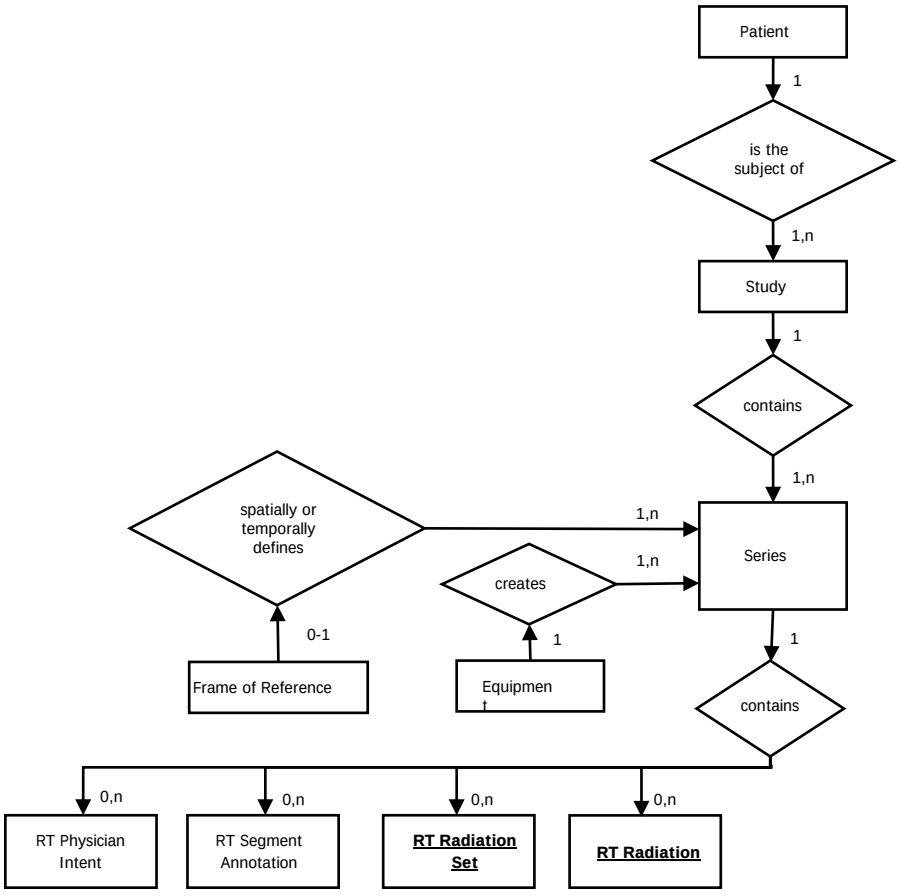

Figure A.86.1.1.1-1 — RT Second Generation IOD information model

Add the following Section to A.86.1:

A.86.1.N1 RT Radiation Set Information Object Definition

A.86.1.N1.1 RT Radiation Set IOD Description

The RT Radiation Set represents a set of radiation deliveries which are intended to be delivered together in a single fraction. The RT Radiation Set also contains a description of the fractionation pattern and the Number of Fractions and the associated dose contributions.

A.86.1.N1.2 RT Radiation Set IOD Entity-Relationship Model

See Figure A.86.1.1.1-1.

A.86.1.N1.3 RT Radiation Set IOD Module Table

Table A.86.1.N1-1
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
RT Radiation Set	General Reference Module	C.12.4	M
	RT Radiation Set	C.36.C1	M
	RT Dose Contribution	C.36.C2	C Required if RT Dose Contribution Presence Flag (gggg,5012) equals YES.
	SOP Common	C.12.1	M
	Common Instance Reference Module	C.12.2	M
	Radiotherapy Common Instance Module	C.36.4	M

A.86.1.N1.4 RT Radiation Set IOD Constraints

A.86.1.N1.4.1 Modality Attribute

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

A.86.1.N1.4.2 RT Radiation Set and Referenced RT Radiation Instances

The User Content Label (3010,0033) defined in the RT Common Instance Module is intended to be unique across all SOP Instances referenced by the RT Radiation Set.

A.86.1.N1.4.3 Radiotherapy Common Instance Module

Code Sequence	CID
Author Identification Sequence (3010,0019)	Defined CID for Organizational Role is CID SUP175015 “Radiotherapy Treatment Planning Person Roles”

A.86.1.N2 C-Arm Photon-Electron Radiation Information Object Definition

A.86.1.N2.1 C-Arm Photon-Electron Radiation IOD Description

The C-Arm Photon-Electron Radiation IOD describes a radiotherapy treatment on a C-Arm delivery device using photon or electron radiation.

A.86.1.N2.2 C-Arm Photon-Electron Radiation IOD Entity-Relationship Model

See Figure A.86.1.1.1-1.

A.86.1.N2.3 C-Arm Photon-Electron Radiation IOD Module Table

Table A.86.1.N2-1
C-ARM PHOTON-ELECTRON RADIATION 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	General Reference Module	C.12.4	M
	RT Delivery Device Common	C.36.E1	M
	RT Radiation Common	C.36.E2	M
	C-Arm Photon-Electron Delivery Device	C.36.G1	M
	C-Arm Photon-Electron Beam	C.36.G2	M
	SOP Common	C.12.1	M
	Common Instance Reference Module	C.12.2	M
	Radiotherapy Common Instance Module	C.36.4	M

Note: The Frame of Reference identifies the Patient Coordinate System used to define the geometric setup of the radiation beam with respect to the patient. The relationship of the patient-based coordinates to the Equipment Frame of Reference is specified by a transformation (see 10.A10).

A.86.1.N2.4 C-Arm Photon-Electron Radiation IOD Constraints

A.86.1.N2.4.1 Modality Attribute

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

A.86.1.N2.4.2 RT Delivery Device Common Module

The Equipment Frame of Reference UID (gggg,51A0) shall be 1.2.840.10008.1.4.RRR.1.

Code Sequence	CID
Treatment Machine Special Mode Sequence (gggg,9C97)	Defined CID SUP175003 “Radiotherapy Treatment Machine Modes”
Radiation Dosimeter Unit Sequence (gggg,5113)	Defined CID SUP175012 “C-Arm Photon-Electron Dosimeter Units”

A.86.1.N2.4.3 RT Radiation Common Module

The value of RT Record Flag (gggg,5014) shall be NO.

Code Sequence	CID
RT Treatment Technique Code Sequence (3010,0080)	Defined CID 9511 “General External Radiotherapy Procedure Techniques”

A.86.1.N2.4.4 Radiotherapy Common Instance Module

Code Sequence	CID
Author Identification Sequence (3010,0019)	Defined CID for Organizational Role is CID SUP175015 “Radiotherapy Treatment Planning Person Roles”

Extend the Equipment Module in PS3.3 Annex C, Section C.7.5:

C.7.5 Common Equipment IE Modules

The following Equipment IE Module is common to all Composite IODs that reference the Equipment IE.

C.7.5.1 General Equipment Module

Table C.7-8 specifies the Attributes that identify and describe the piece of equipment that produced a Series of Composite Instances.

Table C.7-8.General Equipment Module Attributes

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Manufacturer of the equipment that produced the composite instances.
Institution Name	(0008,0080)	3	Institution where the equipment that produced the composite instances is located.
Institution Address	(0008,0081)	3	Mailing address of the institution where the equipment that produced the composite instances is located.
Station Name	(0008,1010)	3	User defined name identifying the machine that produced the composite instances.
Institutional Department Name	(0008,1040)	3	Department in the institution where the equipment that produced the composite instances is located.
Manufacturer's Model Name	(0008,1090)	3	Manufacturer's model name of the equipment that produced the composite instances.
Manufacturer's Device Class UID	**(gggg,9BB0)**	**3**	**Manufacturer's Unique Identifier (UID) for the class of the device.** **A class is manufacturer-specific grouping concept with no DICOM-defined scope or criteria. A class is independent from a marketing-defined make, model or version.** **A class allows to define a group of devices with a similar set of capabilities.**
Device Serial Number	(0018,1000)	3	Manufacturer's serial number of the equipment that produced the composite instances. Note This identifier corresponds to the device that actually created the images, such as a CR plate reader or a CT console, and may not be sufficient to identify all of the equipment in the imaging chain, such as the generator or gantry or plate.
Software Versions	(0018,1020)	3	Manufacturer's designation of software version of the equipment that produced the composite instances.

Attribute Name	Tag	Type	Attribute Description
			See Section C.7.5.1.1.3.
Gantry ID	(0018,1008)	3	Identifier of the gantry or positioner.
…			

Add the following to PS3.3 Annex C:

C.36 RT SECOND GENERATION MODULES

The following macros and modules are used by the RT Second Generation radiotherapy IODs.

C.36.1 RT Second Generation Concepts

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C.36.1.N1 Control Points

A Control Point represents the state of a delivery device in a sequence of states defined by a progress variable. For radiation delivery the Cumulative Meterset (gggg,5021) is the progress variable.

A Control Point represents the geometric and radiological parameters. Control Points are used by the delivery device to implement a planned delivery and to record the actual delivery.

C.36.1.N2 Nominal Energy

A nominal energy characterizes the penetration of the beam into a material. The values are defined by the Manufacturer to label a specific beam spectrum. For photon beam delivery, the maximum energy of the delivered photon spectrum is typically specified. For electron beam delivery, the most probable energy of the spectrum is typically specified.

C.36.1.N3 Treatment RT Radiation Set

A Treatment RT Radiation Set is an RT Radiation Set that has been selected for delivery to the patient, is being delivered to the patient, or has been delivered to the patient. Alternatives or rejected proposals for treatment are not called Treatment RT Radiation Sets.

C.36.1.N4 Meterset

A Meterset is a single parameter from which the absorbed dose delivered can be calculated through a calibration procedure with additional information. The Meterset is used to measure the progress of radiation delivery during treatment, or report on progress after treatment.

See IEC 60601-2-64 for more information on using monitor units as the unit for the Meterset.

C.36.1.N5 Radiation Dose Point

A point chosen in space, or in the patient treatment volume, to measure or plan for a specific amount of radiation. The point usually is placed at a significant location, such as within a tumor (where radiation will be delivered), or within healthy tissue (where radiation will be minimized) or where a measurement device can be positioned.

C.36.1.N6 Continuous Rotation Angles

A Continuous Rotation Angle is an angle in the range (-∞,+∞).

Continuous Rotation Angle represent a rotation direction and magnitude. The magnitude is not limited to be between 0 and 360 degrees.

All rotations are defined in a right-handed coordinate system, thus the direction of a positive rotation is seen as clockwise when viewed in the positive direction of the axis of rotation.

C.36.1.N7 External Contour

The External Contour is the spatial extent of matter that is taken into account for dose calculation. The External Contour includes the Patient Anatomy Model, Bolus, Patient Positioning Devices, Patient Immobilization Devices or other devices in the path of the radiation.

C.36.1.N8 C-Arm Linac

A C-Arm Linac is a linear accelerator that follows the coordinate definitions of IEC 61217 Edition 2.0 2011-12. Any hardware belonging to this category may or may not represent an actual C-Arm gantry.

C.36.1.N9 Virtual Simulation

Virtual Simulation is a form of Radiotherapy treatment simulation that uses volumetric imaging studies in a computer to model the geometry of a radiation beam with respect to a patient's anatomy. The spatial relationship between beam and anatomy is verified in Digitally Reconstructed Radiograph (DRR) images that conceptually represent actual beam portal images.

C.36.1.N10 Equipment Coordinate System

A piece of equipment has an Equipment Coordinate System which can be used for expressing geometric concepts such as locations and orientations. The coordinate system is characterized by the location of 0the origin and the orientation of coordinate axes with respect to the equipment. The Equipment Coordinate System is a right-handed coordinate system.

Equipment Coordinate Systems are typically based on a standardized definition of axes. The choice of origin is often device-specific or device-type-specific. It may be any significant location on the machine such as the manufacturer-dependent machine isocenter.

The Equipment Coordinate System can also be used as the basis for child coordinate systems.

C.36.1.N11 Beam Modifier Coordinate System

Beam modifiers, e.g. beam limiting devices, compensators and blocks, are specified by geometric coordinates.

A Base Beam Modifier Coordinate System is defined with respect to the Equipment Coordinate System. The x/y plane of the Base Beam Modifier Coordinate System is referred to as the Base Beam Modifier Definition Plane. The orientation of the Base Beam Modifier Coordinate System is such that the Base Beam Modifier Definition Plane is parallel to the x/y plane of the Equipment Coordinate System. The origin of the Base Beam Modifier Coordinate System is offset from the by the RT Beam Modifier Definition Distance (gggg,5210) as shown in see Figure C.36.1-N.

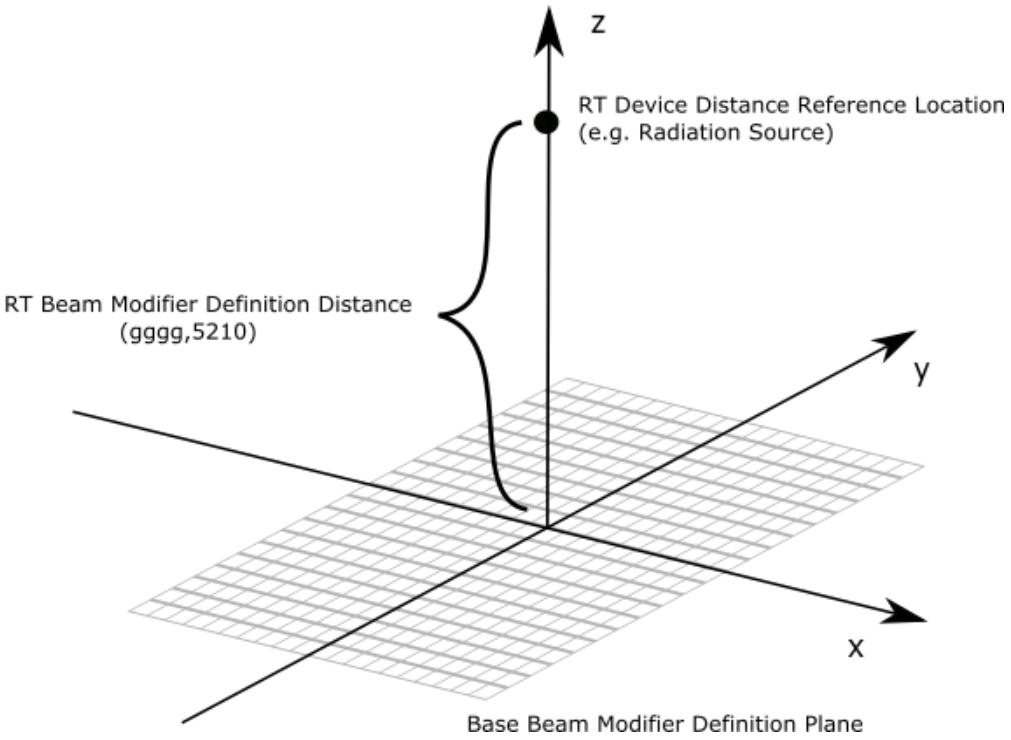

Figure C.36.1-N
Base Beam Modifier Coordinate System

Each beam modifier is defined in its own Beam Modifier Coordinate System with the following characteristics:

- is defined with respect to the Base Beam Modifier Coordinate System.
- right-handed Cartesian coordinate system, with the positive z-axis pointing towards the radiation source.
- the orientation at a zero angle about the z-axis is the same as the Base Beam Modifier Coordinate System, i.e. the x- and y-axes are aligned.
- the x/y plane of the Beam Modifier Coordinate System is referred to as the Beam Modifier Definition Plane.

C.36.2 RT Second Generation Macros

404 ### C.36.2.N RT Second Generation Device Macros

C.36.2.N.1 Treatment Device Identification Macro

406 The Treatment Device Identification Macro identifies a device used to deliver radiation to the patient during a radiotherapy treatment session.

408 **Table C.36.2.N.1-1**
TREATMENT DEVICE IDENTIFICATION MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Treatment Device Identification Sequence	(gggg,5015)	1	Identifies treatment device. Only a single Item shall be included in this Sequence.
>Include Table 10.35-1 "Device Model Macro Attributes"			*Identifies the device model for the Treatment Device.*
>Manufacturer's Device Class UID	(gggg,9BB0)	2	Manufacturer's Unique Identifier (UID) for the class of the device. A class is a manufacturer-specific grouping concept with no DICOM-defined scope or criteria. A class is independent from a marketing-defined make, model or version. A class allows definition of a group of devices with a similar set of capabilities.
>Include Table 10.36-1 "Device Identification Macro Attributes"			*Defined CID SUP175011 "Treatment Delivery Device Types".*
>Institution Name	(0008,0080)	3	Institution where the equipment is located.
>Institution Address	(0008,0081)	3	Mailing address of the institution where the equipment is located.
>Institutional Department Name	(0008,1040)	3	Department in the institution where the equipment is located.

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C.36.2.N.2 RT Patient Support Devices Macro

412 The RT Patient Support Devices Macro identifies a patient support device (table, table top, chair or similar) which shall be used for treatment.

414 **Table C.36.2.N.2-1**
RT PATIENT SUPPORT DEVICES MACRO ATTRIBUTES

Attribute Name	Tag	Type	Description
Number of Patient Support Devices	(gggg,51F1)	1	Number of Patient Support Devices defined in the Patient Support Devices Sequence (gggg,51F0).
Patient Support Devices Sequence	(gggg,51F0)	1C	Patient support device definitions. Required if the Number of Patient Support Devices (gggg,51F1) is not-zero.

Attribute Name	Tag	Type	Description
			The number of Items included in this Sequence shall equal the value of Number of Patient Support Devices (gggg,51F1).
>Device Index	(3010,0039)	1	Index of the Device in this Sequence. The value shall start at 1 and increase monotonically by 1.
>Include Table 10.35-1 "Device Model Macro Attributes"			
>Include Table 10.36-1 "Device Identification Macro Attributes"			*Defined CID 9505 "Fixation or Positioning Devices".*
>Conceptual Volume Sequence	(3010,0025)	2	References a conceptual volume that describes the geometry and properties of the patient support device. Zero or one Item be included in this Sequence.
>>Include Table 10.34-1 "Conceptual Volume Segmentation Reference and Combination Macro Attributes"			

416

C.36.2.N.3 RT Accessory Device Identification Macro

418 The RT Accessory Device Identification Macro identifies an RT accessory device and its location.

Table C.36.2.N.3-1

420 **RT ACCESSORY DEVICE IDENTIFICATION MACRO ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Include Table 10.35-1 "Device Model Macro Attributes"			
Include Table 10.36-1 "Device Identification Macro Attributes"			*CID is defined by invocation.*
RT Accessory Device Slot ID	(gggg,954B)	2C	Identifier for location (slot) of radiation modifier accessory where the current accessory is inserted. Required if accessory is located in a slot and Referenced RT Accessory Holder Device Index (gggg,9540) is not present.
RT Accessory Slot Distance	(gggg,9548)	2C	Distance in mm from the reference location as specified by RT Beam Distance Reference Location Code Sequence (gggg,5114) to the Accessory Slot. Required if RT Accessory Device Slot ID (gggg,954B) is present and has a value.

Referenced RT Accessory Holder Device Index	(gggg,9540)	2C	The value of Device Index (3010,0039) of the Accessory Holder device in the RT Accessory Holder Definition Sequence (gggg,954A). Required if accessory is mounted on a holder device and RT Accessory Device Slot ID (gggg,954B) is not present.
RT Accessory Holder Slot ID	(gggg,9544)	2C	Identifier for location (slot) of radiation modifier in the Accessory Holding device where the current accessory is inserted. Required if Referenced RT Accessory Holder Device Index (gggg,9540) is present and has a value and the referenced Accessory Holder Device contains an RT Accessory Holder Slot Sequence (gggg,9542).

C.36.2.N.4 RT Treatment Position Macro

The RT Treatment Position Macro establishes a connection between the patient's geometry and the treatment delivery equipment to define the treatment position. This treatment position is the one as prescribed, when used in an RT Radiation object, and one as recorded in the RT Radiation Record object.

Table C.36.2.N.4-1
RT TREATMENT POSITION MACRO ATTRIBUTES

Attribute Name	Tag	Type	Description
Patient Orientation Code Sequence	(0054,0410)	1	Sequence that describes the orientation of the patient with respect to gravity. See C.8.4.6.1.1 for further explanation. Only a single item shall be included in this Sequence.
>Include Table 8.8-1 "Code Sequence Macro Attributes"			*Defined CID 19 "Patient Orientation"*
>Patient Orientation Modifier Code Sequence	(0054,0412)	1C	Patient Orientation Modifier. Required if needed to fully specify the orientation of the patient with respect to gravity. Only a single Item shall be included in this Sequence.
>>Include Table 8.8-1 "Code Sequence Macro Attributes"			*Defined CID 20 "Patient Orientation Modifier"*

Attribute Name	Tag	Type	Description
Patient Equipment Relationship Code Sequence	(3010,0030)	1	Sequence describing the orientation of the patient with respect to equipment. Only a single Item shall be included in this Sequence.
>Include Table 8.8-1 "Code Sequence Macro Attributes"			*Defined CID 21 "Patient Equipment Relationship"*
Patient Setup UID	(gggg,5060)	1C	Identifies a conceptual patient setup that may or may not be realized by one or more RT Patient Setup instances. Required if Referenced RT Patient Setup Sequence (gggg,9C20) is present. May be present otherwise.
Referenced RT Patient Setup Sequence	(gggg,9C20)	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 defined 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	(gggg,5028)	1	Patient positions during treatment, being prescribed or recorded. One or more Items shall be included in this Sequence.
>Treatment Position Index	(gggg,9141)	1	Index of this Item in this Sequence. The value shall start at 1 and increase monotonically by 1.
>Include Table 10.A10-1 "Patient to Equipment Relationship Macro Attributes"			*Defined CID is SUP175013 "Treatment Points"*

C.36.2.N.5 RT Control Point General Macro

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	(gggg,9111)	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	(gggg,5021)	1C	Meterset at the RT Control Point. The units are specified by Radiation Dosimeter Unit Sequence (gggg,5113). 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 (gggg,5013) equals FULL or IDENT_ONLY or RT Record Flag (gggg,5014) equals YES and if the conditions in Section C.36.2.N.5.1.1 are satisfied. May be present otherwise only if the conditions in section C.36.2.N.5.1.1 are satisfied. See C.36.2.N.5.1.3.
Referenced Treatment Position Index	(gggg,9147)	1C	The value of Treatment Position Index (gggg,0141) from the Treatment Position Sequence (gggg,5028) within this IOD that this RT Control Point refers to. Required if the conditions in Section C.36.2.N.5.1.1 are satisfied.

C.36.2.N.5.1 RT Control Point Attribute Concept

The treatment-modality Modules use a common formalism to represent parameters that define the behaviour of a delivery device during delivery of radiation. These parameters are communicated as a sequence of values, organized as 'Control Points', see C.36.1.N1 and represented as RT Control Points. The resolution of RT Control Points depends on the level of detail required to define the behaviour of the delivery device.

A Control Point is a point on a timeline of a delivery process. RT Control Points are sequenced using an index number starting with 1, e.g. 1, 2, 3, 4. The RT Control Point parameters reflect the state of the delivery device at that point in time. The Control Point Cumulative Meterset reflects the dose that has been delivered from the beginning of the delivery process up to that point in time.

For all beam deliveries there are at least two RT Control Points, corresponding to the start and end of delivery. E.g. for a simple Static Beam delivery with a constant field aperture, only two RT Control Points are needed to define the start and end, as there are no changes in-between. For a dynamic delivery, in which the MLC leaves are changing while radiation is delivered, the number of Control Points will be higher to provide enough detail to define the leaf movement with sufficient resolution to achieve the radiation fluence distribution expected for the prescribed dose.

DICOM does not specify the behavior of the machine parameters between Control Points. The planning system needs to know the hardware-specific characteristics of the delivery system for which the plan is being created.

C.36.2.N.5.1.1 Requirements for Changing Values within RT Control Point Sequence Attributes

The RT Control Point Sequence specifies a certain order of execution.

At each Control Point the value of various Attributes may be specified as an explicit value (which in the case of a type 2C attribute may be a null value) and if absent remain at the same value as specified previously. There are physical and mechanical implications of specifying a new value as opposed to staying at the same value, for example gear lash, floating point jitter, etc.

At the first Sequence Item in RT Control Point Sequences (i.e. with an RT Control Point Index (gggg,9111) equal to 1) all Attributes affected by this Section shall be present (whether Type 1C or 2C).

For Sequence Items other than the first Sequence Item, Attributes shall be present only if the value is different from the previously populated value for the same Attribute (in the case of a type 2C attribute, a null value is considered as a value). The previously populated value is the value from the Item where the Attribute was present with the greatest value of RT Control Point Index (gggg,9111) less than the value of the RT Control Point Index (gggg,9111) in the current Item.

This means that for an Item in which an Attribute is absent, the application stays at the value of the previously populated Item.

For Sequences inside a RT Control Point Sequence Item, the Sequence shall be present if any of the nested Attributes affected by this Section differ from the corresponding previously populated Item.

For multi-valued Attributes, such as Parallel RT Beam Delimiter Positions (gggg,504A), all values shall be present if any value changes.

C.36.2.N.5.1.2 Control Point Attribute Example

The following examples illustrate RT Control Points:

1. Static Beam delivery:

RT Control Point Index (gggg,9111)	Cumulative Meterset (gggg,5021)	All other parameters
1	0	<defined>
2	76	<not present>

At completion this beam delivers 76 Monitor Units using a fixed static set of treatment parameters defined in RT Control Point 1.

2. Arc delivery:

RT Control Point Index (gggg,9111)	Cumulative Meterset (gggg,5021)	Source Roll Continuous Angle (gggg,51B5)	All other parameters
1	0	<initial angle>	<defined>
2	56	<final angle>	<not present>

At completion this delivers 56 Monitor Units while rotating the gantry from initial angle to final angle.

3. Dynamic delivery of two equally weighted segments:

RT Control Point Index (gggg,9111)	Cumulative Meterset (gggg,5021)	Parallel RT Beam Delimiter Positions (gggg,504A) X Referenced Device Index 1	Parallel RT Beam Delimiter Positions (gggg,504A) Y Referenced Device Index 2	RT Beam Limiting Device Continuous Angle (gggg,51B4)	All other parameters
1	0	2\2	2\2	30	<defined>
2	40	<not present>	4\4	<not present>	<not present>
3	80	4\4	<not present>	<not present>	<not present>

At completion this delivers 80 Monitor Units while first increasing the Y opening and then increasing the X opening, while the beam limiting device angle stays fixed. For the RT Beam Limiting Device Opening Sequence (gggg,5070) this results in having three Items for the first Control Point and only one for Control Points 2 (Referenced Device Index 2 only) and 3 (Referenced Device Index 1 only). See also Figure C.36.2.N.5.1-1.

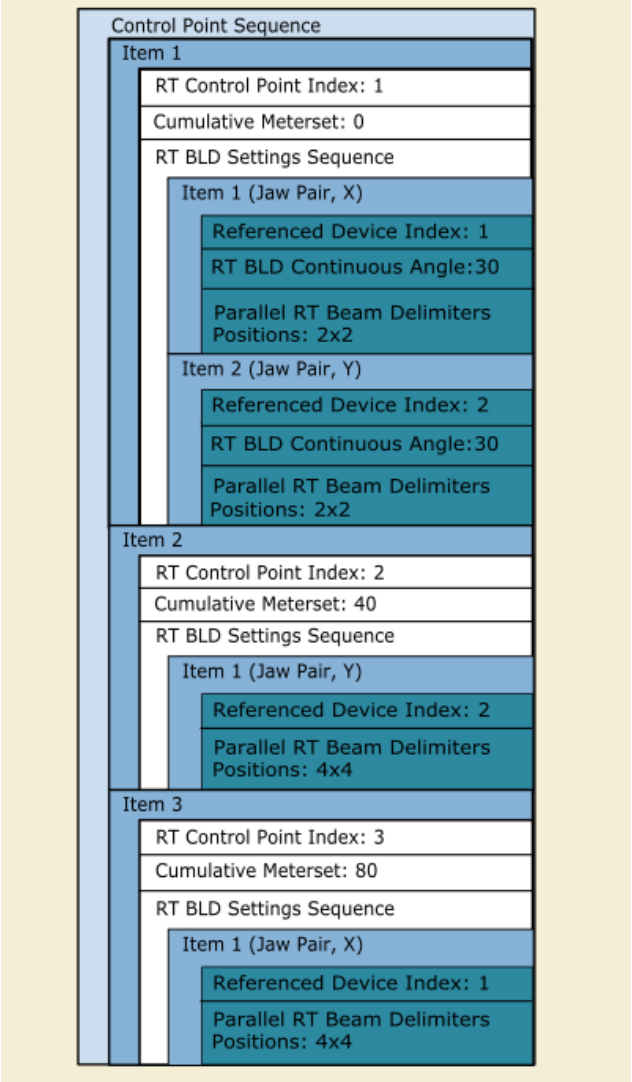

Figure C.36.2.N.5.1-1
Control Points Sub-Sequence Attribute Presence

4. Dynamic Delivery of two unequally weighted segments with a step change of 5 degrees in the positive direction of the Patient Support Angle:

Note Patient Support Angle is represented by the Image to Equipment Mapping Matrix (0028,9520). The table contains the effective angle and not the complete matrix.

RT Control Point Index (gggg,9111)	Cumulative Meterset (gggg,5021)	Image to Equipment Mapping Matrix (0028,9520)	Source Roll Continuous Angle (gggg,51B5)	All other parameters
1	0	0	-90	<defined>
2	30	<not present>	<not present>	<not present>
3	<not present>	5	0	<not present>
4	90	<not present>	<not present>	<not present>

At completion this delivers 90 Monitor Units. Between RT Control Point 2 and 3 the Patient Support Angle and Source Roll Continuous Angle are changed and no radiation is delivered.

C.36.2.N.5.1.3 Cumulative Meterset

The Meterset at a given Control Point is specified by Cumulative Meterset (gggg,5021). That value is specified in units defined by Radiation Dosimeter Unit Sequence (gggg,5113) in the RT Delivery Device Common Module in section C.36.E1. The Meterset values are intended to correspond to the values produced by the primary or only Meterset-measuring device of a RT Radiation Delivery Device.

C.36.2.N.6 External Beam Control Point General Macro

This macro specifies the RT Control Point Attributes used to model external beam radiation.

Table C.36.2.N.6-1
EXTERNAL BEAM CONTROL POINT GENERAL MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Include Table C.36.2.N.5-1 "RT Control Point General Macro Attributes"			
Delivery Rate	(gggg,5023)	2C	The intended nominal rate of delivery of the specified Cumulative Meterset (gggg,5021). Required if the conditions in Section C.36.2.N.5.1.1 are satisfied. See C.36.2.N.5.1.
Delivery Rate Unit Sequence	(gggg,5024)	1C	The unit of the Delivery Rate (gggg,5023). Required if Delivery Rate (gggg,5023) is present. See C.36.2.N.5.1. Only a single Item shall be included in this Sequence.

>Include Table 8.8-1 'Code Sequence Macro'			*CID is defined by invocation.*
Beam Area Limit Sequence	(gggg,6050)	1C	Area within which the treatment beam must be contained, for example when using MLC tracking for a moving target. Only a single Item shall be included in this Sequence. Required if beam shall be limited. See C.36.2.N.5.1.
>Include Table 10.A9-1 "Outline Definition Macro Attributes"			*The Outline is defined on the Beam Modifier Definition Plane.*

C.36.2.N.7 Radiation Generation Mode Macro

The Radiation Generation Mode Macro contains Attributes required to generate radiation by a delivery device.

Treatment devices can produce a multitude of different beams with properties such as energy spectrum, depth dose, surface dose and beam profile. A particular combination of such properties is referred to as a Radiation Generation Mode. Such Radiation Generation Modes are created by the machine by using different primary electron / particle beams, flattening and scattering filters, etc., creating a specific physical and geometric distribution of radiation. In many cases the Radiation Generation Mode characterizes the fluence just below the Monitor Chamber. Subsequently these primary beams may be modulated by beam modifiers such as Beam Limiting Devices, Wedges, Spreaders etc. While these beam modifiers are described in the Control Point Sequence, the primary beam is assumed to have fixed characteristics. In many cases, the Radiation Generation Mode will be constant throughout the radiation.

Radiation Generation Modes specify the beam fluence. To convey content other than the beam fluence, such as annotating the role of the beam in the clinical process or the usage of that beam during a treatment session, annotate treatment constraints, use other Attributes like RT Radiation Set Intent (gggg,5011) in the RT Radiation Set Module and information provided by the workflow protocols.

Table C.36.2.N.7-1
RADIATION GENERATION MODE MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Number of Radiation Generation Modes	(gggg,51CB)	1	Number of Radiation Generation Modes defined in the Radiation Generation Mode Sequence (gggg,51C0). The Number shall be greater than zero.
Radiation Generation Mode Sequence	(gggg,51C0)	1	Radiation Generation Modes defining the type of radiation and characteristics of the beam generated. Radiation Generation Modes shall characterize different primary beam fluence. The number of Items included in this Sequence shall equal the value of Number of Radiation Generation Modes (gggg,51CB).

>Radiation Generation Mode Index	(gggg,9113)	1	Index of this Item in this Sequence. The value shall start at 1 and increase monotonically by 1.
>Radiation Generation Mode Label	(gggg,51C1)	1	User defined label that identifies this Radiation Generation mode. See C.36.2.N.7.1.3.
>Radiation Generation Mode Description	(gggg,51C2)	2	User-defined description of the Radiation Generation mode.
>Radiation Generation Mode Machine Code Sequence	(gggg,51C3)	1C	A vendor-specified machine-readable code that unambiguously identifies this Radiation Generation mode. Only a single Item shall be included in this Sequence. Required if RT Radiation Physical and Geometric Content Detail Flag (gggg,5013) equals FULL. May be present otherwise. See C.36.2.N.7.1.2.
>>Include Table 8.8-1 "Code Sequence Macro Attributes"			*No Baseline CID is defined.*
>Radiation Type Code Sequence	(gggg,51C4)	1	Type of radiation for this Radiation Generation Mode. Only a single Item shall be included in this Sequence.
>>Include Table 8.8-1 'Code Sequence Macro'			*CID is defined by invocation.*
>Energy Unit Code Sequence	(gggg,51C9)	1	The unit of energy values specified in Nominal Energy (gggg,51C5), Minimum Nominal Energy (gggg,51C6), Maximum Nominal Energy (gggg,51C7). Only a single Item shall be included in this Sequence.
>>Include Table 8.8-1 "Code Sequence Macro Attributes"			*CID is defined by invocation.*
>Nominal Energy	(gggg,51C5)	1C	The nominal beam energy in units as defined in the Energy Unit Code Sequence (gggg,51C9). Required if Minimum Nominal Energy (gggg,51C6) and Maximum Nominal Energy (gggg,51C7) are not present. See C.36.2.N.7.1.1.
>Minimum Nominal Energy	(gggg,51C6)	1C	The minimum nominal beam energy in units as defined in the Energy Unit Code Sequence (gggg,51C9). Required if Nominal Energy (gggg,51C5) is not present. See C.36.2.N.7.1.1.

>Maximum Nominal Energy	(gggg,51C7)	1C	The maximum nominal beam energy in units as defined in the Energy Unit Code Sequence (gggg,51C9). Required if Nominal Energy (gggg,51C5) is not present. See C.36.2.N.7.1.1.
>Radiation Fluence Modifier Code Sequence	(gggg,51C8)	1	Identifies the type of fluence modifier of this Radiation Generation Mode. One or more Items shall be included in this Sequence.
>>Include Table 8.8-1 "Code Sequence Macro Attributes"			*CID is defined by invocation.*
>Radiation Device Configuration and Commissioning Key Sequence	(gggg,5115)	2	Keys identifying the configuration and commissioning data used as input for treatment planning of this Instance. Value Type (0040,A040) is constrained to value UIDREF. One or more Items shall be included in this Sequence.
>>Include Table 10-2 "Content Item Macro Attributes"			*No Baseline CID defined.*

C.36.2.N.7.1 Radiation Generation Mode Macro Attribute Description

C.36.2.N.7.1.1 Energy Attributes

The Nominal Energy (gggg,51C5) parameter is provided for beams where a single discrete energy is annotated by that value. Energy modulation can be used at the Control Point level (both discrete and continuous), in which case the Minimal Nominal Energy (gggg,51C6) and Maximal Nominal Energy (gggg,51C7) is used.

C.36.2.N.7.1.2 Radiation Generation Mode Machine Code

When two Radiation Generation Modes differ in any value of Radiation Type Code (gggg,51C4), the Nominal Energy (gggg,51C5), Minimum Nominal Energy (gggg,51C6), Maximum Nominal Energy (gggg,51C7) and code value(s) of the Radiation Fluence Modifier Code Sequence (gggg,51C8) they must have different values for Radiation Generation Mode Machine Code. Even if all those attributes have the same values, the two modes may still have a different value for Radiation Generation Mode Machine Code, e.g. when other device-specific beam generation steering parameters differ.

C.36.2.N.7.1.3 Radiation Generation Mode Label

Radiation Generation Mode Label (gggg,51C1) should uniquely identify a specific mode within a treatment device. The label is intended only for display to human readers, while the authoritative definition of the Radiation Generation Mode is contained in the other attributes of the Sequence.

C.36.2.N.8 RT Beam Limiting Devices Definition Macro

This Macro describes the configuration of Beam Limiting Devices which cannot vary during delivery.

Table C.36.2.N.8-1
RT BEAM LIMITING DEVICES DEFINITION MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Number of RT Beam	(gggg,5041)	1C	Number of RT Beam Limiting Devices in the

Attribute Name	Tag	Type	Attribute Description
Limiting Devices			RT Beam Limiting Device Definition Sequence (gggg,504D). Required if RT Radiation Physical and Geometric Content Detail Flag (gggg,5013) equals FULL. May be present otherwise.
RT Beam Limiting Device Definition Sequence	(gggg,504D)	1C	Beam limiting device (collimator), such as jaw or leaf (element) sets. The number of Items included in this Sequence shall equal the value of Number of RT Beam Limiting Devices (gggg,5041). Required if Number of RT Beam Limiting Devices (gggg,5041) is present and has a non-zero value.
>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	(gggg,9119)	1C	Device Index value that links the device defined by this Sequence Item to the corresponding device in an RT Radiation Instance. The device description in this Sequence Item may or may not have changed. The value is the index of a device in the RT Beam Limiting Device Definition Sequence (gggg,504D) within the single SOP Instance referenced by Referenced RT Instance Sequence (gggg,9C05). Required if the Instance referenced in Referenced RT Instance Sequence (gggg,9C05) contains the device that corresponds to the device defined by this Sequence Item.
>Include Table C.36.2.N.3-1 "RT Accessory Device Identification Macro Attributes"			*CID is defined by invocation.*
>Beam Modifier Orientation Angle	(gggg,5045)	1	Angle in degrees of the Beam Modifier Coordinate System with respect to the Base Beam Modifier Coordinate System. If Device Type Code Sequence (3010,002E) contains either (S175172, 99SUP175, "Leaf Pairs"),or (S175175, 99SUP175, "Single Leaves") the motion of the RT Beam Delimiters is along the x-axis of the Beam Modifier Definition Plane. See C.36.1.N11
>RT Beam Limiting Device Proximal Distance	(gggg,5042)	2	Distance in mm from the reference location as specified by RT Beam Distance Reference Location Code Sequence (gggg,5114) to the proximal end of beam limiting device (collimator) along the beam axis.

Attribute Name	Tag	Type	Attribute Description
>RT Beam Limiting Device Distal Distance	(gggg,5043)	2	Distance in mm from the reference location as specified by RT Beam Distance Reference Location Code Sequence (gggg,5114) to the distal end of beam limiting device (collimator) along the beam axis.
>Parallel RT Beam Delimiter Device Sequence	(gggg,5047)	1C	Device that uses parallel beam delimiters to limit the beam. Required if Device Type Code Sequence (3010,002E) contains either (S175172, 99SUP175, “Leaf Pairs”),or (S175175, 99SUP175, “Single Leaves”). Only a single Item shall be present in the Sequence.
>>Number of Parallel RT Beam Delimiters	(gggg,5048)	1	Number of beam delimiters parallel to the axis of motion. E.g. a beam limiting device jaw pair is represented as 1 parallel delimiter, an MLC with 100 leaf pairs or with 100 single leaves is represented as 100 parallel delimiters. See C.36.2.N.8.1.3
>>Parallel RT Beam Delimiter Device Orientation Label Code Sequence	(gggg,5044)	1	A code used to identify the orientation of the beam limiting device. Only a single Item shall be present in the Sequence.
>>>Include Table 8.8-1 “‘Code Sequence Macro Attributes”			*Defined CID SUP175007 “RT Beam Limiting Device Orientation Labels”* *See C.36.2.N.8.1.1*
>>Parallel RT Beam Delimiter Opening Mode	(gggg,504E)	1	The operation mode of Parallel RT Beam Delimiters used to define a treatment aperture. Enumerated Values: BINARY leaf positions constrained to two states: open and closed VARIABLE any leaf position may be specified
>>Parallel RT Beam Delimiter Boundaries	(gggg,5049)	1	Boundaries in mm of parallel beam delimiters. These are defined along the axis perpendicular to the motion of the delimiters of the RT Beam Limiting Device Type (300A,00B8) with respect to the Beam Modifier Coordinate System. The order of values shall increase monotonically. See C.36.2.N.8.1.2. N+1 values shall be provided, where N is the Number of Parallel RT Beam Delimiters (gggg,5048).
>>Parallel RT Beam Delimiter Leaf Mounting Side	(gggg,504F)	1C	Specifies the mounting side identified by the direction from the tip to the tail of the delimiter parallel to the axis specified by Device Type Code Sequence (3010,002E).

Attribute Name	Tag	Type	Attribute Description
			Enumerated Values: P Positive mounting side. The axis intercept of the leaf tip is less than the axis intercept of the leaf tail N Negative mounting side. The axis intercept of the leaf tip is greater than the axis intercept of the leaf tail M values shall be provided, where M is the Number of Parallel RT Beam Delimiters (gggg,5048), in the order of the Parallel RT Beam Delimiter Element Position Boundaries (gggg,5049). Required if Device Type Code Sequence (3010,002E) contains (S175175, 99SUP175, "Single Leaves"). See C.36.2.N.8.1.3.
>Fixed RT Beam Delimiter Device Sequence	(gggg,504C)	1C	Device that uses a fixed aperture to limit the beam. Required if Device Type Code Sequence (3010,002E) is part of CID SUP175005 "Fixed Beam Limiting Device Types". Only a single Item shall be included in this Sequence.
>>Include Table 10.A9-1 "Outline Definition Macro Attributes"			*The Outline is defined on the Beam Modifier Definition Plane.*

C.36.2.N.8.1 RT Beam Limiting Device Definition Macro Attribute Description

C.36.2.N.8.1.1 Parallel RT Beam Delimiter Device Orientation Label Code

The value of Parallel RT Beam Delimiter Device Orientation Label Code Sequence (gggg,5044) shall be choosen as follows:

- When the value of Beam Modifier Orientation Angle (gggg,5045) equals zero the code shall be (S175190, 99SUP175, "X").
- When the value of Beam Modifier Orientation Angle (gggg,5045) equals 90 the code shall be (S175191, 99SUP175, "Y").
- When the value of Beam Modifier Orientation Angle (gggg,5045) is not zero or 90, the label should be chosen to best reflect the user perception or another code may be used.

C.36.2.N.8.1.2 Parallel RT Beam Delimiter Boundaries

The Parallel RT Beam Delimiter Boundaries (gggg,5049) shall be the positions of the mechanical boundaries (projected on the Beam Modifier Definition Plane defined by the RT Beam Modifier Definition Distance (gggg,5210)) between beam delimiter elements. These are fixed for a given beam limiting device. Parallel RT Beam Delimiter Positions (gggg,504A) are values specific to a given Control Point, specifying the beam limiting device element openings.

C.36.2.N.8.1.3 Number of Parallel RT Beam Delimiters

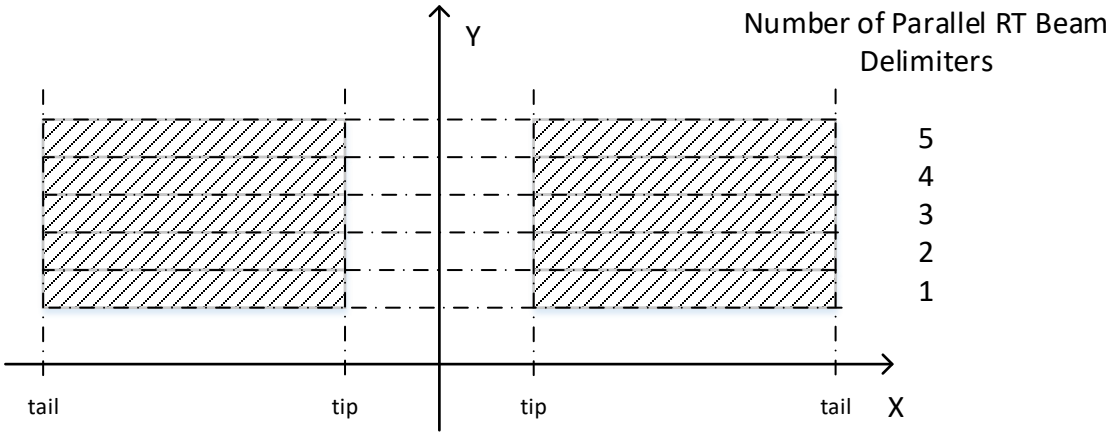

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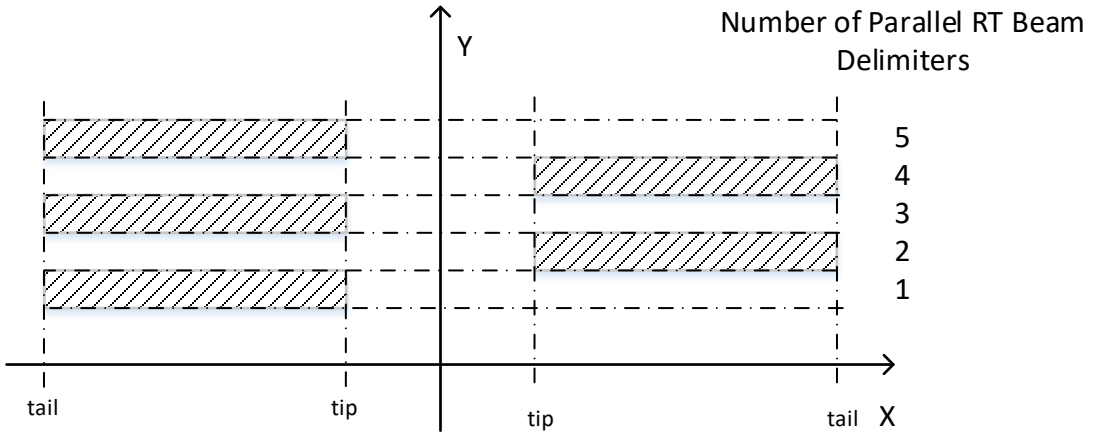
Figure C.36.2.N.8.1-1
576 **Number of Parallel RT Beam Delimiters for X Leaf Pairs**



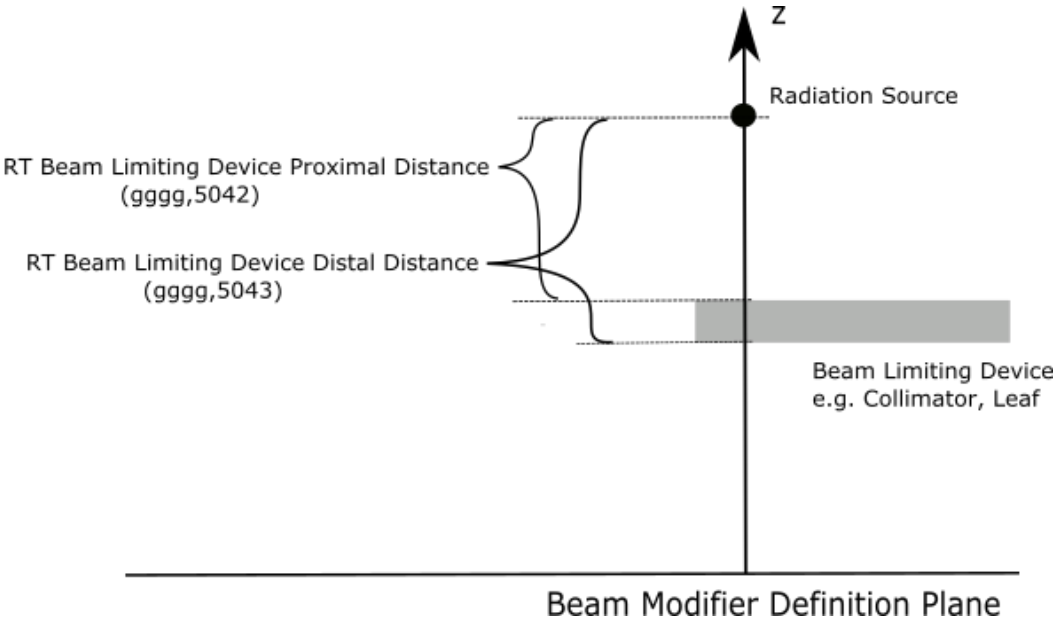
578 **Figure C.36.2.N.8.1-2**
Number of Parallel RT Beam Delimiters for X Single Leaves

580 In example in Figure C.36.2.N.8.1-2 the delimiters labeled 1, 3 and 5 have a Parallel RT Beam Delimiter Leaf Mounting Side (gggg,504F) value of N (negative direction) and the delimiters labeled 2
582 and 4 have a Parallel RT Beam Delimiter Leaf Mounting Side value of P (positive direction).

C.36.2.N.8.1.4 RT Beam Limiting Device Proximal Distance and RT Beam Limiting Device
584 **Distal Distance**

The following figure shows the RT Beam Limiting Device Proximal Distance (gggg,5042) and RT
586 Beam Limiting Device Distal Distance (gggg,5043).

In this example the reference location specifed by the RT Beam Distance Reference Location Code
588 Sequence (gggg,5114) has the value (S175772, 99SUP175, “Radiation Source”).



590 **Figure C.36.2.N.8.1-3**
RT Beam Limiting Device Proximal and Distal Distance

592 **C.36.2.N.9 RT Beam Limiting Device Opening Macro**

This Macro defines the opening created by RT Beam Limiting Devices at a specific Control Point or
594 set of Control Points.

Table C.36.2.N.9-1
596 **RT BEAM LIMITING DEVICE OPENING MACRO ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Number of RT Beam Limiting Device Openings	(gggg,5071)	1C	Number of RT Beam Limiting Device Openings in the RT Beam Limiting Device Opening Sequence (gggg,5070). Required if Number of RT Beam Limiting Devices (gggg,5041) is present and has a non-zero value.
RT Beam Limiting Device Opening Sequence	(gggg,5070)	1C	Beam limiting device (collimator) settings defining the opening for the current Control Point. Required if the conditions in Section C.36.2.N.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 (gggg,5071).
>Referenced Device Index	(gggg,9142)	1	The value of Device Index (3010,0039) from the RT Beam Limiting Device Definition Sequence (gggg,504D) corresponding to the Beam Limiting Device used in this Item.
>RT Beam Limiting Device Offset	(gggg,504B)	1C	The offsets (x,y) in mm of the Parallel RT Beam Delimiter Positions (gggg,504A) from the central

Attribute Name	Tag	Type	Attribute Description
			beam axis. See C.36.2.N.9.1.1 and C.36.2.N.8.1.2. Required if the conditions in Section C.36.2.N.5.1.1 are satisfied.
>Parallel RT Beam Delimiter Positions	(gggg,504A)	1C	One-dimensional positions of the tip in mm of beam delimiters. If Device Type Code Sequence (3010,002E) contains (S175175, 99SUP175, “Single Leaves”), N values shall be provided where N is the Number of Parallel RT Beam Delimiters (gggg,5048). If Device Type Code Sequence contains (S175170, 99SUP175, “Jaw Pair”) or (S175172, 99SUP175, “Leaf Pairs”), 2N values shall be provided where N is the Number of Parallel RT Beam Delimiters (gggg,5048). The values shall be grouped by the mounting side identified by the Parallel RT Beam Delimiter Leaf Mounting Side (gggg,504F) with the values of RT Beam Delimiter Elements on the negative mounting side first. The order of values shall correspond to the order of the Parallel RT Beam Delimiter Element Boundaries (gggg,5049). See C.36.2.N.9.1.1, C.36.2.N.9.1.2 and C.36.2.N.9.1.3. Required if the conditions in Section C.36.2.N.5.1.1 are satisfied and if Device Type Code Sequence (3010,002E) contains (S175170, 99SUP175, “Jaw Pair”), (S175172, 99SUP175, “Leaf Pairs”) or (S175175, 99SUP175, “Single Leaves”).
>RT Beam Delimiter Geometry Sequence	(gggg,504C)	1C	The outline of the Beam Limiting Device opening. Required if the conditions in Section C.36.2.N.5.1.1 are satisfied and if Device Type Code Sequence (3010,002E) contains (S175174, 99SUP175, “Variable Circular Collimator”). See C.36.2.N.9.1.1 and C.36.2.N.9.1.3. Only a single Item shall be included in this Sequence.
>>Include Table 10.A9-1 “Outline Definition Macro Attributes”			*The Outline Shape Type (gggg,5200) shall be CIRCULAR.* *The plane is defined in C.36.2.N.9.1.1.*

598 **C.36.2.N.9.1 RT Beam Limiting Device Opening Attribute Descriptions**

C.36.2.N.9.1.1 Geometric Value Attributes

600 All geometric values in Table C.36.2.N.9-1 are defined in the Beam Modifier Definition Plane.

C.36.2.N.9.1.2 RT Beam Delimiter Element Positions

602 For Device Type Code Sequence (3010,002E) values of (S175170, 99SUP175, “Jaw Pair”) or (S175172, 99SUP175, “Leaf Pairs”), the order of values are

604 N1, N2, … Nn

P1, P2, … Pn

606 where N denotes the negative mounting side, P the positive mounting side and the indices increasing corresponding to the order of the values of Parallel RT Beam Delimiter Boundaries (gggg,5049).

608 **C.36.2.N.9.1.3 RT Beam Delimiter Geometry**

The definition of the tip positions in Parallel RT Beam Delimiter Positions (gggg,504A) or delimiter
610 outline in the RT Beam Delimiter Geometry Sequence (gggg,504C) is as defined by the manufacturer and shall be documented in the Conformance Statement. Typically, this will be the radiological or
612 physical edge.

C.36.2.N.10 Wedges Definition Macro

614 This macro defines the geometric configuration of wedges which cannot vary during delivery.

Table C.36.2.N.10-1
616 **WEDGES DEFINITION MACRO ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Number of Wedges	(300A,00D0)	1C	Number of Wedges defined in the Wedge Definition Sequence (gggg,5062). Required if RT Radiation Physical and Geometric Content Detail Flag (gggg,5013) equals FULL. May be present otherwise.
Wedge Definition Sequence	(gggg,5062)	1C	Treatment wedge definitions. Required if Number of Wedges (300A,00D0) is present and has a non-zero value. The number of Items included in this Sequence shall equal the value of Number of Wedges (300A,00D0).
>Include Table C.36.2.N.3-1 “RT Accessory Device Identification Macro Attributes”			*Defined CID SUP175006 “Radiotherapy Wedge Types”.*
>Device Index	(3010,0039)	1	Index of this Item in this Sequence. The value shall start at 1 and increase monotonically by 1.
>Referenced Defined Device Index	(gggg,9119)	1C	Device Index value that links the device defined by this Sequence Item to the corresponding device in an RT Radiation Instance. The device description in this Sequence Item may or may not have changed. The value is the index of a device in the RT Beam Limiting Device Definition Sequence (gggg,504D) within the single SOP Instance

Attribute Name	Tag	Type	Attribute Description
			referenced by Referenced RT Instance Sequence (gggg,9C05). Required if the Instance referenced in Referenced RT Instance Sequence (gggg,9C05) contains the device that corresponds to the device defined by this Sequence Item.
>Radiation Beam Wedge Angle	(gggg,5063)	1	Nominal wedge angle in degrees. See C.36.2.N.10.1.1.
>Radiation Beam Effective Wedge Angle	(gggg,5066)	2	Effective wedge angle in degrees. See C.8.8.14.14.
>Beam Modifier Orientation Angle	(gggg,5045)	1	Angle in degrees of the Beam Modifier Coordinate System with respect to the Base Beam Modifier Coordinate System. The direction from thick edge to thin edge is along the positive x-axis of the Beam Modifier Definition Plane. See C.36.1.N11

C.36.2.N.10.1 Wedges Definition Macro Attribute Description

C.36.2.N.10.1.1 Radiation Beam Wedge Orientation and Radiation Beam Wedge Angle

For an Equipment Frame of Reference UID 1.2.840.10008.1.4.RRR.1 the wedge orientation has the value of 0 degree when the thin edge of the wedge is directed towards the positive direction of the Y-axis of the Beam Modifier Coordinate system.

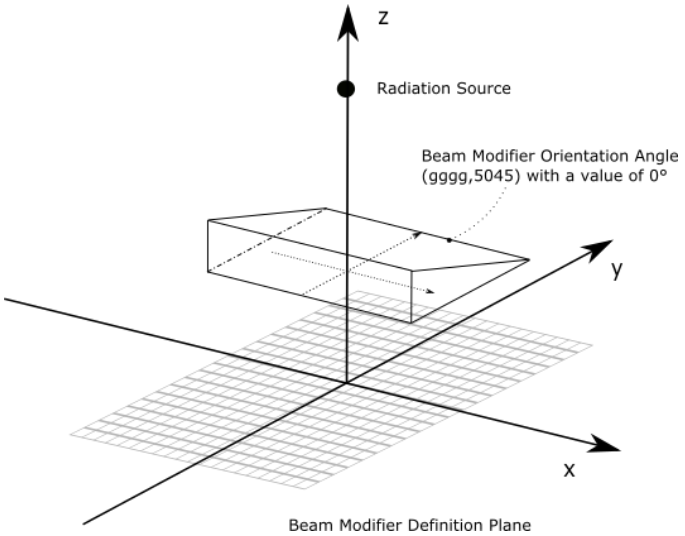


Figure C.36.2.N.10.1-1
Beam Modifier Orientation Angle

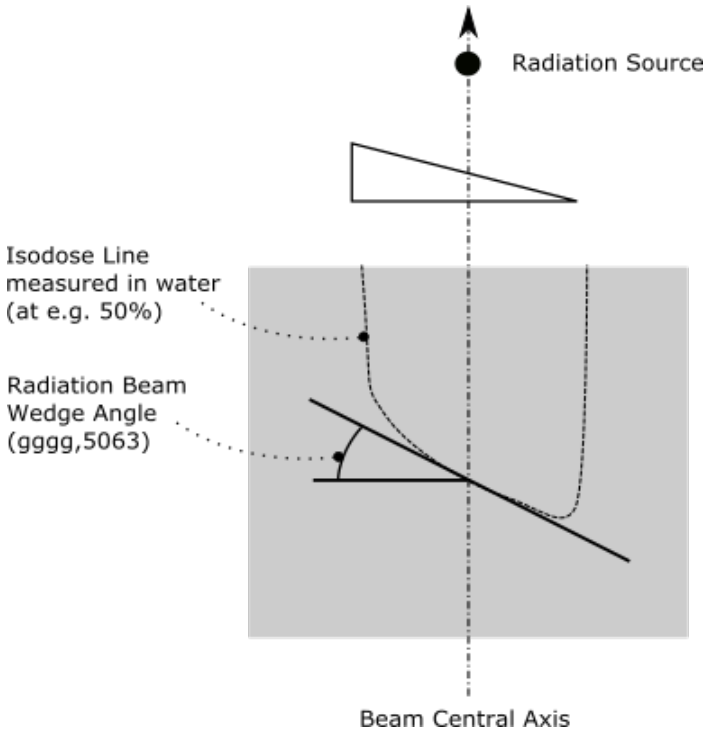


Figure C.36.2.N.10.1-2
Radiation Beam Wedge Angle

Update the following section in PS3.3 Annex C:

C.8.8.14.14 Effective Wedge Angle

The Effective Wedge Angle (300A,00DE) **and Radiation Beam Effective Wedge Angle (gggg,5066)** describe~~s~~ the dosimetric angle of a motorized wedge accounting for the partial presence of the wedge in the beam. The presence of the wedge in the beam is **either** specified by the Wedge Position (300A,0118) in the Wedge Position Sequence (300A,0116) included in the Control Point Sequence (300A,0111) of the current beam **or the RT Control Point Sequence of the current Radiation**. When the wedge is in the beam throughout all control points, the Effective Wedge Angle **(300A,00DE) and Radiation Beam Effective Wedge Angle (gggg,5066)** will have the same value as the Wedge Angle (300A,00D5)**/Radiation Beam Wedge Angle (gggg,5063)**. Otherwise the Effective Wedge Angle**/Radiation Beam Effective Wedge Angle** will have a lower value than the Wedge Angle**/Radiation Beam Wedge Angle**.

Add the following section to PS3.3 Annex C:

C.36.2.N.11 Wedge Positions Macro

This macro defines the positions of Wedges used in a specific Control Point or set of Control Points.

646

Table C.36.2.N.11-1
WEDGE POSITIONS MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Number of Wedge Positions	(gggg,5067)	1C	Number of Wedge Positions defined in the Wedge Position Sequence (300a,0116). Required if Number of Wedges (300A,00D0) is present and has a non-zero value.
Wedge Position Sequence	(300A,0116)	1C	Position for each Wedge for the current Control Point. Required if the conditions in Section C.36.2.N.5.1.1 are satisfied. The number of Items included in this Sequence shall equal the value of Number of Positions (gggg,5067).
>Referenced Device Index	(gggg,9142)	1	The value of Device Index (3010,0039) in Wedge Definition Sequence (gggg,5062) for the Wedge being used.
>Wedge Position	(300A,0118)	1	Position of Wedge at current Control Point. Enumerated Values: IN Wedge is in fully inserted position OUT Wedge is in fully retracted position PARTIAL Wedge is inserted only part of the way to the fully inserted position
>Radiation Beam Wedge Thin Edge Distance	(gggg,5065)	1C	Closest distance in mm from the central axis of the beam along the wedge angle direction to the thin edge as projected on the Beam Modifier Definition Plane defined by the RT Beam Modifier Definition Distance (gggg,5210). Value is negative if the position of the thin edge located in the positive direction compared with the central axis, positive otherwise. Required if Wedge Position (300A,0118) is PARTIAL. See C.36.2.N.11.1.1.

C.36.2.N.11.1 Wedge Positions Macro Attribute Description

C.36.2.N.11.1.1 Radiation Beam Wedge Thin Edge Distance

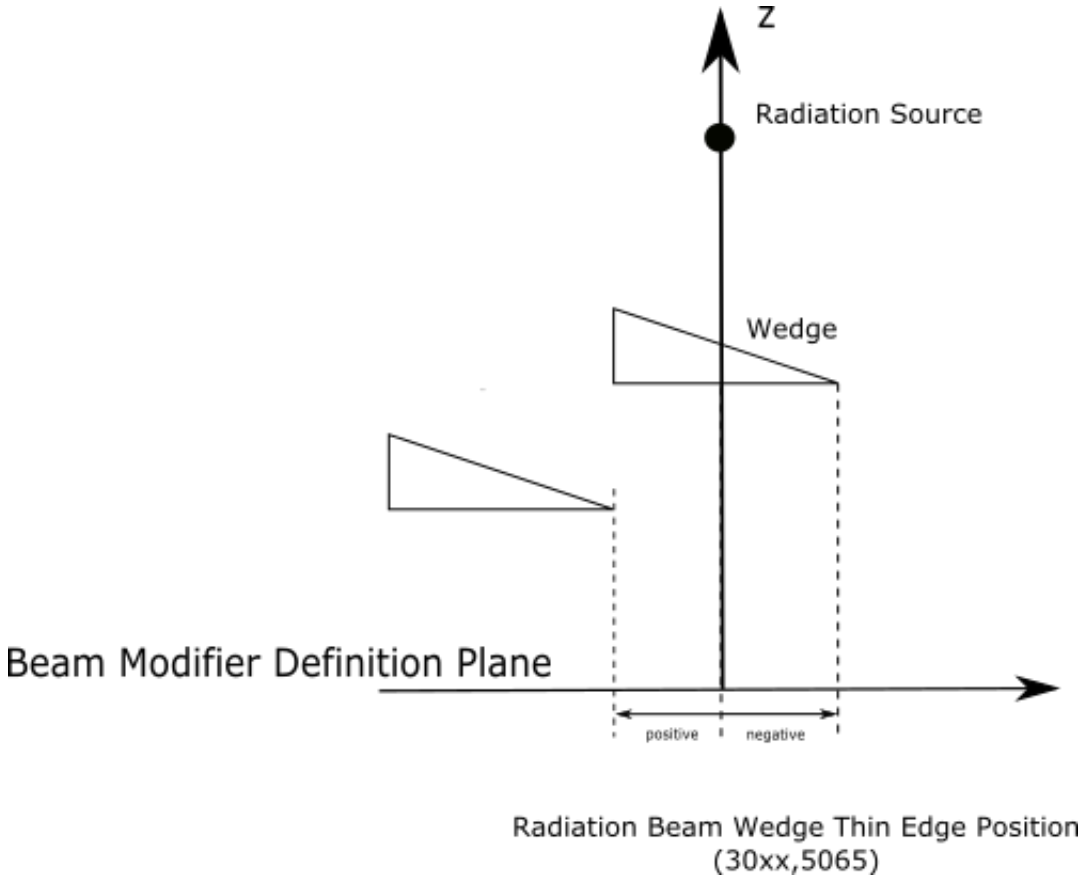


Figure C.36.2.N.11.1-1
Radiation Beam Wedge Thin Edge Position

C.36.2.N.12 Compensators Definition Macro

This macro defines the geometric configuration of compensators which cannot vary during delivery.

Table C.36.2.N.12-1
COMPENSATORS DEFINITION MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Number of Compensators	(300A,00E0)	1C	Number of Compensators defined in the Compensator Definition Sequence (gggg,5150). Required if RT Radiation Physical and Geometric Content Detail Flag (gggg,5013) equals FULL. May be present otherwise.
Compensator Definition Sequence	(gggg,5150)	1C	Treatment compensator definitions. Required if Number of Compensators (300A,00E0) is present and has a non-zero value.

Attribute Name	Tag	Type	Attribute Description
			The number of Items included in this Sequence shall equal the value of Number of Compensators (300A,00E0).
>Include Table C.36.2.N.3-1 "RT Accessory Device Identification Macro Attributes"			*Defined CID SUP175002 "Compensator Device Types".*
>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	(gggg,9119)	1C	Device Index value that links the device defined by this Sequence Item to the corresponding device in an RT Radiation Instance. The device description in this Sequence Item may or may not have changed. The value is the index of a device in the RT Beam Limiting Device Definition Sequence (gggg,504D) within the single SOP Instance referenced by Referenced RT Instance Sequence (gggg,9C05). Required if the Instance referenced in Referenced RT Instance Sequence (gggg,9C05) contains the device that corresponds to the device defined by this Sequence Item.
>Beam Modifier Orientation Angle	(gggg,5045)	1	Angle in degrees of the Beam Modifier Coordinate System with respect to the Base Beam Modifier Coordinate System. See C.36.1.N11
>Compensator Base Plane Offset	(gggg,5154)	1C	The distance in mm between the mounting plane and the base plane of the compensator. The value shall be positive when the base plane is further away from the reference location, as specified by RT Beam Distance Reference Location Code Sequence (gggg,5114), than the mounting plane. Required if RT Radiation Physical and Geometric Content Detail Flag (gggg,5013) equals FULL. May be present otherwise. See C.36.2.N.12.1.2
>Compensator Map Orientation	(gggg,5151)	1C	Side of the compensator base that the compensator surface shape faces. Enumerated Values: PATIENT_SIDE the compensator surface shape is directed towards the patient. SOURCE_SIDE the compensator surface shape is directed towards the radiation source. DOUBLE_SIDED the compensator has two compensator surface shapes which are directed towards the patient and source

Attribute Name	Tag	Type	Attribute Description
			respectively. Required if RT Radiation Physical and Geometric Content Detail Flag (gggg,5013) equals FULL. May be present otherwise.
>Compensator Shape Sequence	(gggg,5156)	1C	Description of the shape of the Compensator and the fabrication parameters. Required if RT Radiation Physical and Geometric Content Detail Flag (gggg,5013) equals FULL. May be present otherwise. Only one Item shall be present.
>>Compensator Divergence	(300A,02E0)	1	Whether or not the compensator is shaped according to the beam geometrical divergence. Enumerated Values: PRESENT the compensator is shaped according to the beam geometrical divergence. ABSENT the compensator is not shaped according to the beam geometrical divergence.
>>Material ID	(300A,00E1)	2	User-defined identifier for the material used to manufacture the Compensator.
>>Compensator Proximal Thickness Map	(gggg,5152)	1C	A data stream of triplets of x, y and thickness in mm representing a map of the coordinates in the Beam Modifier Definition Plane and thicknesses from the compensator base plane. The order of triplets is not significant. Required if Compensator Map Orientation (gggg,5151) is SOURCE_SIDE or DOUBLE_SIDED. See C.36.2.N.12.1.1 and C.36.2.N.12.1.3.
>>Compensator Distal Thickness Map	(gggg,5153)	1C	A list of triplets of x, y and thickness in mm representing a map of the coordinates in the Beam Modifier Definition Plane and thicknesses from the compensator base plane. The order of triplets is not significant. Required if Compensator Map Orientation (gggg,5151) is PATIENT_SIDE or DOUBLE_SIDED. See C.36.2.N.12.1.1 and C.36.2.N.12.1.3.
>>Compensator Shape Fabrication Code Sequence	(gggg,5155)	2	The method of fabrication such as shape of tools to be used, surface modelling technique. Zero or more Items shall be included in this Sequence.
>>>Include Table 8.8-1 "Code Sequence Macro Attributes"			*No Baseline CID is defined.*
>>Radiation Beam Compensator Milling Tool Diameter	(gggg,5157)	2	The diameter in mm of the milling tool to be used to create the compensator. The diameter is expressed as the actual physical size and not a size projected on the Beam Modifier Definition

Attribute Name	Tag	Type	Attribute Description
			Plane.

658

C.36.2.N.12.1 Compensators Definition Macro Attribute Descriptions

660 #### C.36.2.N.12.1.1 Compensators Thickness Map and Tray Distance

The values stored in Compensator Proximal Thickness Map (gggg,5152) and Compensator Distal
662 Thickness Map (gggg,5153) shall be parallel to the radiation beam axis if Compensator Divergence (300A,02E0) equals ABSENT, or divergent according to the beam geometrical divergence if
664 Compensator Divergence (300A,02E0) equals PRESENT.

C.36.2.N.12.1.2 Compensator Base Plane Offset

666 The compensator base plane is the side of the compensator which is flat. In case of a double-sided compensator, the base plane is the plane from which the compensator thickness is specified.

668

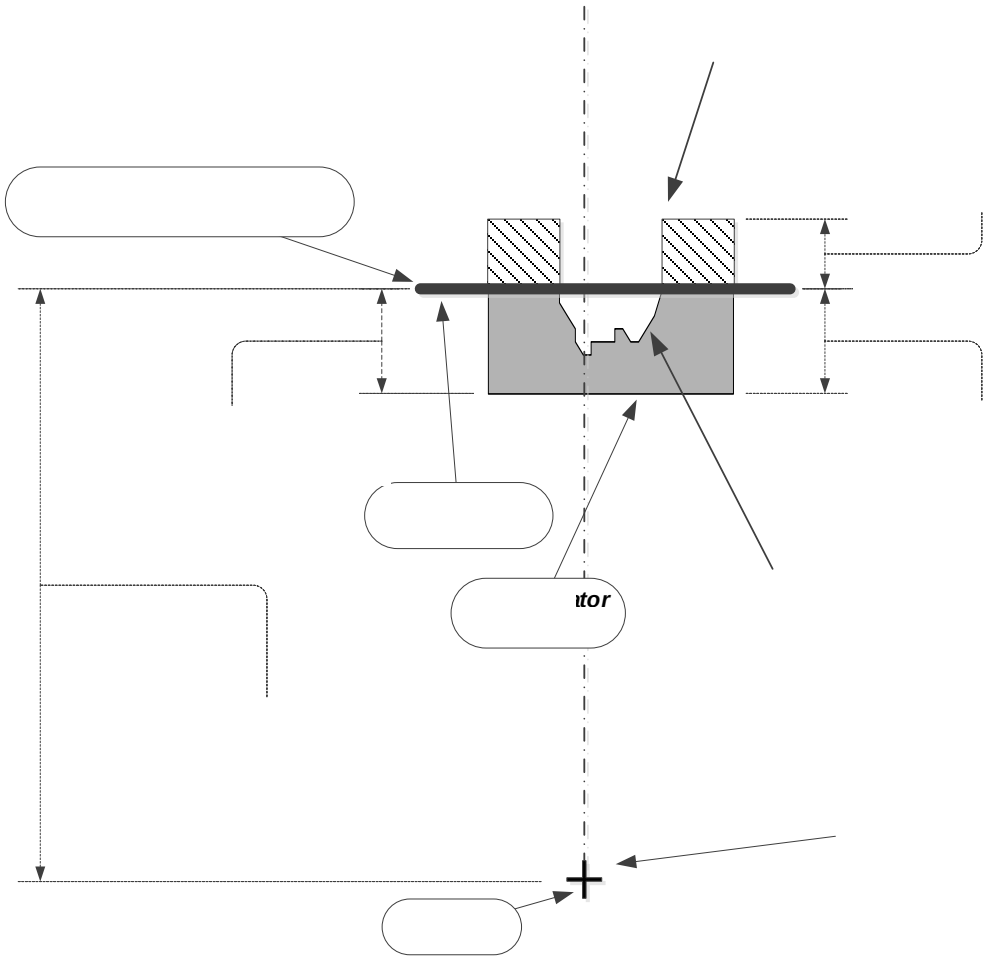


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Figure C.36.2.N.12.1-1
Compensator Geometry

C.36.2.N.12.1.3 Compensator Thickness Data Direction

The direction of the rows and columns in Compensator Proximal Thickness Map (gggg,5152) and Compensator Distal Thickness Map (gggg,5153) is defined as follows: The direction of rows goes along the positive x direction and the direction of the columns goes along the negative y direction of the Beam Modifier Coordinate System. Other interpretations shall be documented in the Conformance Statement.

C.36.2.N.13 Blocks Definition Macro

This macro defines the geometric configuration of blocks which cannot vary during delivery.

Table C.36.2.N.13-1
BLOCKS DEFINITION MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Number of Blocks	(300A,00F0)	1C	Number of Blocks defined in the Block Definition Sequence (gggg,5160). Required if RT Radiation Physical and Geometric Content Detail Flag (gggg,5013) is FULL. May be present otherwise.
Block Definition Sequence	(gggg,5160)	1C	Block definitions. Required if Number of Blocks (300A,00F0) is present and has a non-zero value. The number of Items included in this Sequence shall equal the value of Number of Blocks (300A,00F0).
>Include Table C.36.2.N.3-1 "RT Accessory Device Identification Macro Attributes"			*Defined CID 9517 "Radiotherapy Block Device Types".* *The Device Alternate Identifier (3010,001B) Attribute of the RT Accessory Device Identification Macro shall not contain a value when the Number of Block Slab Items (300A,0440) is non-zero.*
>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	(gggg,9119)	1C	Device Index value that links the device defined by this Sequence Item to the corresponding device in an RT Radiation Instance. The device description in this Sequence Item may or may not have changed. The value is the index of a device in the RT Beam Limiting Device Definition Sequence (gggg,504D) within the single SOP Instance referenced by Referenced RT Instance Sequence (gggg,9C05). Required if the Instance referenced in Referenced RT Instance Sequence (gggg,9C05) contains the device that corresponds to the device defined by this Sequence Item.

Attribute Name	Tag	Type	Attribute Description
>Beam Modifier Orientation Angle	(gggg,5045)	1	Angle in degrees of the Beam Modifier Coordinate System with respect to the Base Beam Modifier Coordinate System. See C.36.1.N11
>Material ID	(300A,00E1)	2	User-defined identifier for material used to manufacture the Block.
>Block Divergence	(300A,00FA)	1C	Whether or not the block is shaped according to the beam geometrical divergence. Enumerated Values: PRESENT block edges are shaped for beam divergence ABSENT block edges are not shaped for beam divergence Required if RT Radiation Physical and Geometric Content Detail Flag (gggg,5013) equals FULL. May be present otherwise.
>Block Orientation	(gggg,5162)	1C	Specifies on which side of the block base the block extends. Enumerated Values: PATIENT_SIDE the block extends from its base towards the patient. SOURCE_SIDE the block extends from its base towards the radiation source. Required if RT Radiation Physical and Geometric Content Detail Flag (gggg,5013) equals FULL. May be present otherwise.
>Radiation Beam Block Thickness	(gggg,5163)	2C	Physical thickness of block in mm parallel to the central radiation beam axis. Required if Material ID (300A,00E1) has a value. May be present otherwise. See C.36.2.N.13.1.1.
>Block Edge Data	(gggg,5161)	2	A data stream of coordinate pairs in mm which comprise the block edge. The pairs shall be interpreted as a closed polygon. Coordinates are projected on the Beam Modifier Definition Plane.
>Number of Block Slab Items	(300A,0440)	1C	Number of Block Slabs composing the Block. Required if RT Radiation Physical and Geometric Content Detail Flag (gggg,5013) equals FULL. May be present otherwise.
>Block Slab Sequence	(300A,0441)	1C	Sequence of slab(s) that comprise the block. Required if Number of Block Slab Items (300A,0440) is present and a value greater than 1. If several items in the Block Definition Sequence (gggg,5160) are present where the Device Type Code Sequence (3010,002E) has the code value (130123, DCM, “Aperture Block”) the Block Slab

Attribute Name	Tag	Type	Attribute Description
			Sequence shall be present only in the first item. The number of Items included in this Sequence shall equal the value of Number of Block Slab Items (300A,0440).
>>Block Slab Number	(300A,0043)	1	Identification number of the Block Slab. The value shall start at 1, and increase monotonically by 1. The number indicates the order of the slabs with respect to the source, where Number 1 corresponds to the slab nearest to the source.
>>Radiation Beam Block Slab Thickness	(gggg,5164)	3	Physical thickness of block slab in mm parallel to radiation beam axis. Sum of Block Slab Thickness (300A,0042) of Items of this Sequence must equal Block Thickness (300A,0100) of the block.
>>Device Alternate Identifier	(3010,001B)	2	An identifier intended to be read by a device such as a bar code reader.
>>Device Alternate Identifier Type	(3010,001C)	1C	Defines the type of Device Alternate Identifier. Required if Device Alternate Identifier (gggg,1326) is present. Defined Terms: BARCODE RFID
>>Device Alternate Identifier Format	(3010,001D)	1C	Description of the format in which the Device Alternate Identifier (3010,001B) is issued. Required if Device Alternate Identifier (3010,001B) is present. See 10.A8.1.1.

C.36.2.N.13.1 Blocks Definition Macro Attribute Description

C.36.2.N.13.1.1 Multiple aperture blocks

All blocks with Device Type Code Sequence (3010,002E) with a value of (130123, DCM, “Aperture Block”) for a given beam shall have equal values of Block Thickness (300A,0100) if they are specified. The composite aperture shall be evaluated as the union of the individual apertures within a single Block.

C.36.2.N.14 RT Accessory Holders Definition Macro

This macro defines the accessory holders which cannot vary during delivery which are used to hold accessories such as blocks or compensators.

Table C.36.2.N.14-1
RT ACCESSORY HOLDERS DEFINITION MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Number of RT Accessory Holders	(gggg,5171)	1C	Number of RT Accessory Holders defined in the RT Accessory Holder Definition Sequence (gggg,954A).

Attribute Name	Tag	Type	Attribute Description
			Required if RT Radiation Physical and Geometric Content Detail Flag (gggg,5013) equals FULL. May be present otherwise.
RT Accessory Holder Definition Sequence	(gggg,954A)	1C	Accessory Holder device definitions. Required if Number of RT Accessory Holders (gggg,5171) is present and has a non-zero value. The number of Items included in this Sequence shall equal the value of Number of RT Accessory Holders (gggg,5171).
>Include Table C.36.2.N.3-1 "RT Accessory Device Identification Macro Attributes"			*Defined CID 9518 "Radiotherapy Accessory No-Slot Holder Device Types" and 9519 "Radiotherapy Accessory Slot Holder Device Types".*
>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	(gggg,9119)	1C	Device Index value that links the device defined by this Sequence Item to the corresponding device in an RT Radiation Instance. The device description in this Sequence Item may or may not have changed. The value is the index of a device in the RT Beam Limiting Device Definition Sequence (gggg,504D) within the single SOP Instance referenced by Referenced RT Instance Sequence (gggg,9C05). Required if the Instance referenced in Referenced RT Instance Sequence (gggg,9C05) contains the device that corresponds to the device defined by this Sequence Item.
>Beam Modifier Orientation Angle	(gggg,5045)	1	Angle in degrees of the Beam Modifier Coordinate System with respect to the Base Beam Modifier Coordinate System. See C.36.1.N11
>RT Accessory Holder Water-Equivalent Thickness	(gggg,92E3)	2	Water-Equivalent thickness of the Accessory Holder in mm parallel to the radiation beam axis.
>RT Accessory Holder Slot Sequence	(gggg,9542)	1C	Slots being available in this Accessory Holder. Required if RT Radiation Physical and Geometric Content Detail Flag (gggg,5013) equals FULL and Device Type Code Sequence (3010,002E) is a code from CID 9519 "Radiotherapy Accessory Slot Holder Device Types". May be present if Device Type Code Sequence (3010,002E) is a code from CID 9519 "Radiotherapy Accessory Slot Holder Device Types". One or more Items shall be included in this

Attribute Name	Tag	Type	Attribute Description
			Sequence.
>>RT Accessory Holder Slot ID	(gggg,9544)	1	The ID of the slot where accessories are inserted.
>>RT Accessory Holder Slot Distance	(gggg,9546)	2	Distance in mm from the reference location as specified by RT Beam Distance Reference Location Code Sequence (gggg,5114) to the slot along the radiation beam axis.

C.36.2.N.14.1 RT Accessory Holders Description

A treatment delivery unit may allow the attachment of one or more accessory holders within which the user may install various devices for applying the beam to the patient. These installed devices may include, but not be limited to, one or more of the following items:

- custom blocks for patient-specific lateral collimation (beam limiting),
- pre-collimators for general lateral collimation (beam limiting),
- uniform thickness range shifter for modifying the range uniformly across the beam,
- two-dimensional range shifters (custom boluses) for modifying the range differentially across the defined field,
- ridge filters for creating multiple ranges within the beam,
- cross-wires for aligning the patient with the beam,
- a mirror or camera for aligning or viewing the irradiated area,
- beam monitoring detectors,
- applicator sealer for preventing fluids from entering the applicator.

Several beam applicators may be available with a single radiation head to reduce the weight of components lifted by therapists, decrease the block and/or bolus to skin distance, and reduce leakage of radiation.

The following example illustrates the use of the RT Accessory Holders Macro and the RT Accessory Device Identification Macro:

- The Gantry Head has a slot called ‘Acc Mount’.
- In this example, an electron applicator is mounted in that slot. The electron applicator itself has a slot called ‘E Aperture’, where other accessories can be mounted. Therefore the electron applicator is an RT Accessory Holder, which includes a slot sequence to model that slot.
- In this example, a block tray is mounted in the ‘E Aperture’ slot. The block tray can support blocks, therefore it is an RT Accessory Holder, but the slot sequence is absent in the block tray definition, since the tray has no slots.
- The block is an RT Accessory, which is mounted in the block tray.

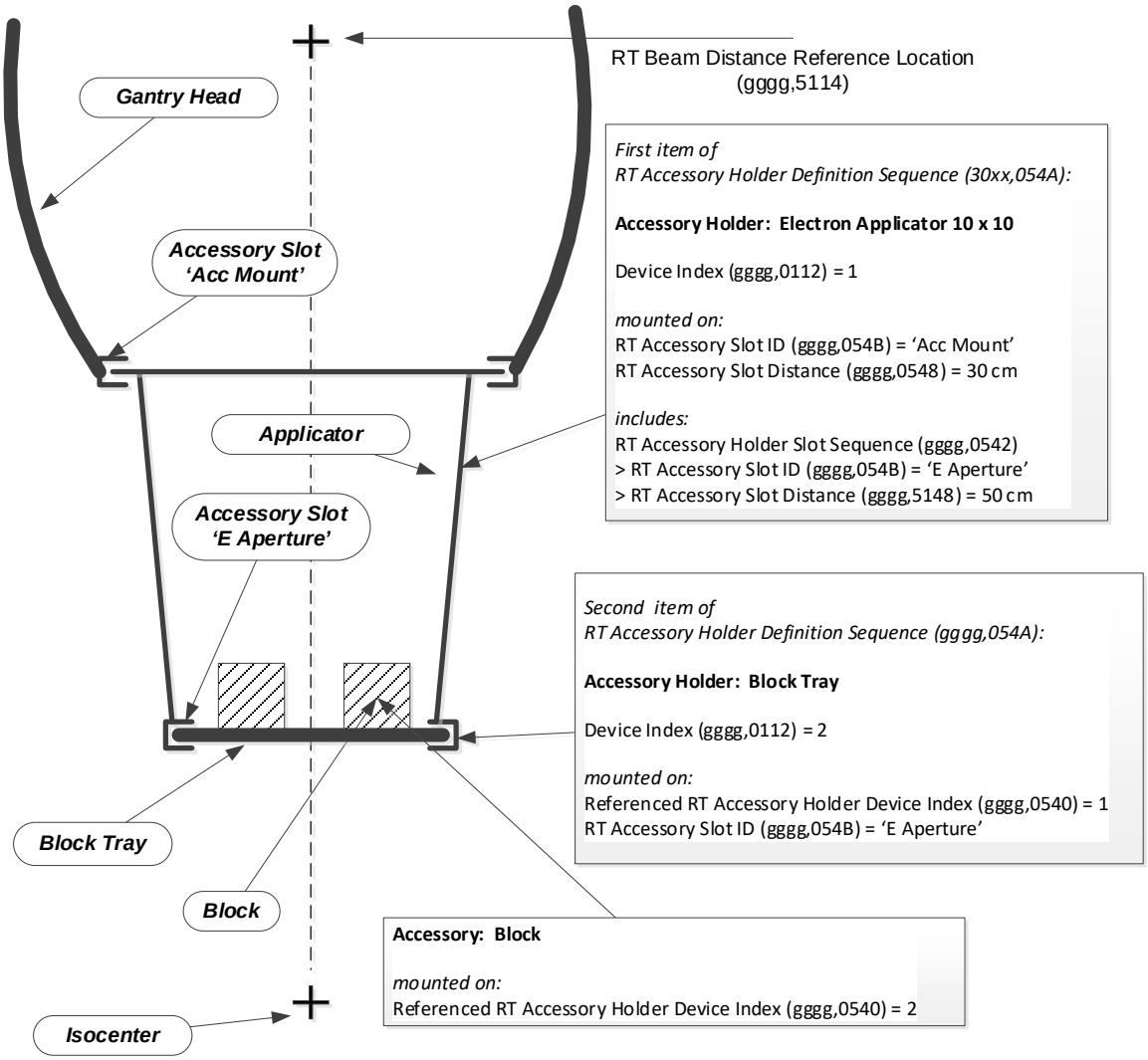

Figure C.36.2.N.14.1-1
RT Accessory Holders

C.36.2.N.15 General Accessories Definition Macro

This macro defines the geometric configuration of general accessories which cannot vary during delivery.

Table C.36.2.N.15-1
GENERAL ACCESSORIES DEFINITION MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Number of General Accessories	(gggg,5181)	1C	Number of General Accessories defined in the General Accessory Definition Sequence (gggg,5180). Required if RT Radiation Physical and Geometric Content Detail Flag (gggg,5013)

Attribute Name	Tag	Type	Attribute Description
			equals FULL. May be present otherwise.
General Accessory Definition Sequence	(gggg,5180)	1C	General accessory devices. Required if the Number of General Accessories (gggg,5181) is present and has a non-zero value. The number of Items included in this Sequence shall equal the value of Number of General Accessories (gggg,5181).
>Include Table C.36.2.N.3-1 "RT Accessory Device Identification Macro Attributes"			*Baseline CID SUP175008 "General Accessory Device Types".*
>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	(gggg,9119)	1C	Device Index value that links the device defined by this Sequence Item to the corresponding device in an RT Radiation Instance. The device description in this Sequence Item may or may not have changed. The value is the index of a device in the RT Beam Limiting Device Definition Sequence (gggg,504D) within the single SOP Instance referenced by Referenced RT Instance Sequence (gggg,9C05). Required if the Instance referenced in Referenced RT Instance Sequence (gggg,9C05) contains the device that corresponds to the device defined by this Sequence Item.
>Beam Modifier Orientation Angle	(gggg,5045)	1	Angle in degrees of the Beam Modifier Coordinate System with respect to the Base Beam Modifier Coordinate System. See C.36.1.N11

734 **C.36.2.N.16 Boluses Definition Macro**

This Macro defines the geometric configuration of a Bolus which cannot vary during delivery.

736 **Table C.36.2.N.16-1**
BOLUSES DEFINITION MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Number of Boluses	(gggg,5191)	1C	Number of boluses defined in the Bolus Definition Sequence (gggg,5190). Required if RT Radiation Physical and Geometric Content Detail Flag (gggg,5013) equals FULL. May be present otherwise.
Bolus Definition Sequence	(gggg,5190)	1C	Bolus device definitions. Required if Number of Boluses (gggg,5191) is

Attribute Name	Tag	Type	Attribute Description
			present and has a non-zero value. The number of Items included in this Sequence shall equal the value of Number of Boluses (gggg,5191).
>Include Table C.36.2.N.3-1 "RT Accessory Device Identification Macro Attributes"			*Defined CID 9516 "Radiotherapy Bolus Device Types".*
>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	(gggg,9119)	1C	Device Index value that links the device defined by this Sequence Item to the corresponding device in an RT Radiation Instance. The device description in this Sequence Item may or may not have changed. The value is the index of a device in the RT Beam Limiting Device Definition Sequence (gggg,504D) within the single SOP Instance referenced by Referenced RT Instance Sequence (gggg,9C05). Required if the Instance referenced in Referenced RT Instance Sequence (gggg,9C05) contains the device that corresponds to the device defined by this Sequence Item.
>Conceptual Volume Sequence	(3010,0025)	2	References a Conceptual Volume that describes the geometry and properties of the bolus. See Section C.36.2.N.16.1.1. Zero or one Item shall be included in this Sequence.
>>Include Table 10.34-1 "Conceptual Volume Segmentation Reference and Combination Macro Attributes"			

738

C.36.2.N.16.1 Boluses Definition Macro Attribute Description

740 #### C.36.2.N.16.1.1 Conceptual Volume Sequence

The Conceptual Volume Sequence (3010,0025), if present, identifies the segmented Conceptual
742 Volume used to define the bolus. The segment is defined by the Referenced Segment Reference Index (3010,0020) in the Conceptual Volume Segmentation Reference and Combination Macro (see
744 10.34).

Alternatively, the bolus may not be associated with a Conceptual Volume. For example, a bolus may
746 cover the entire area of radiation and not require a specific segmentation for definition.

C.36.2.N.17 RT Tolerance Set Macro

748 The RT Tolerance Set Macro contains information describing the maximum permitted differences between planned and delivered values. This information is used in the context of delivery of the RT
750 Radiation Set. If the absolute difference between a planned and delivered value exceeds the

tolerance value, then delivery of the RT Radiation Set shall be inhibited unless an authorized operator
752 confirms that the tolerance may be exceeded.

Table C.36.2.N.17-1
754 **RT TOLERANCE SET MACRO ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
RT Tolerance Set Label	(gggg,9BA2)	1	User defined label for the Tolerance Set.
RT Tolerance Set Index	(gggg,9114)	1	Index of the Tolerance Set in the Sequence. The value shall start at 1 and increase monotonically by 1.
Attribute Tolerance Values Sequence	(gggg,9BA6)	2	Tolerance values representing the allowed difference between the planned and actual values. The Selector Attribute Macro identifies the Attributes for which the tolerances are specified. Required if a tolerance value is specified for at least one Attribute which can be referenced by the Selector Attribute Macro. See C.36.2.N.17.1. Zero or more Items shall be included in this Sequence.
>Include Table 10-20 "Selector Attribute Macro Attributes"			
>Tolerance Value	(gggg,9BA8)	1	Maximum permitted difference between the planned and the delivered value. Units are those specified for the corresponding Attribute referenced by the Selector Attribute Macro.
Patient Support Position Specification Method	(gggg,5144)	1	Method of specification for patient support parameters. Enumerated Values ABSENT no parameters are specified GLOBAL parameters are specified irrespective of the devices in use DEVICE_SPECIFIC parameters are specified per device
Patient Support Position Device Tolerance Sequence	(gggg,5148)	1C	Tolerance values for Patient Support devices. Required if Position Specification Method (gggg,5144) does not equal ABSENT. One or more Items shall be included in this Sequence if Position Specification Method (gggg,5144) equals DEVICE_SPECIFIC. Only one Item shall be included in this Sequence if Position Specification Method (gggg,5144) equals GLOBAL. See C.36.2.N.17.1.2.
>Referenced Device Index	(gggg,9142)	1C	The value of Device Index (3010,0039) in Patient Support Devices Sequence (gggg,51F0)

			corresponding to the Patient Support Device in use. Required if Position Specification Method (gggg,5144) equals DEVICE_SPECIFIC.
>Device Order Index	(gggg,5146)	1C	Index defining the order in which the Items in the Patient Support Position Device Tolerance Sequence (gggg,5148) are applied. The value shall start at 1 and increase monotonically by 1. Required if Position Specification Method (gggg,5144) equals DEVICE_SPECIFIC. See 10.A11.1
>Patient Support Position Tolerance Sequence	(gggg,9BAA)	1	Tolerance values for a particular Patient Support device. One or more Items shall be included in this Sequence.
>>Patient Support Position Tolerance Order Index	(gggg,5149)	1	Index defining the order in which the Items in the Patient Support Position Tolerance Sequence (gggg,9BAA) are applied. The value shall start at 1 and increase monotonically by 1. Required if Position Specification Method (gggg,5144) equalps DEVICE_SPECIFIC. See 10.A11.1.
>>Include Table 10-2 "Content Item Macro Attributes"			*Baseline TID of Concept Name Code Sequence is TID SUP175001.* *Content items shall use UCUM units of mm and degrees where applicable.*

C.36.2.N.17.1 RT Tolerance Set Attribute Description

C.36.2.N.17.1.1 Attribute Tolerance Values Sequence

The Attribute Tolerance Values Sequence (gggg,9BA6) allows for the reference to any numerical parameter in an RT Radiation IOD. The RT Tolerance Set Macro is invoked to specify a tolerance value for this parameter. The reference specification is conveyed by the Selector Attribute Macro, which allows reference to a tag on any level of nested Sequences, and to refer to specific Items in the Sequence. The unit of the tolerance value is the unit as specified by the data element tag referenced in the Selector Attribute (0072,0026).

C.36.2.N.17.1.2 Patient Support Position Tolerance Sequence

When describing a tolerance for a specific patient support position value, the patient support device parameter is defined using the same code used in the Patient Support Position Macro in section 10.A11.

C.36.C1 RT Radiation Set Module

The RT Radiation Set Module describes treatment fractions which contain a set of beams or brachytherapy setups used within a treatment session to help achieve the dosimetric requirements of a given Treatment Phase.The Module references a set of RT Radiation instances that describe the geometric and physical parameters which define the delivery of dose for a single fraction. In addition, the overall number of treatment fractions is defined, as well as possibly the fractionation scheme along which fractions will be delivered.

A Treatment Phase is achieved by delivering one or more RT Radiation Sets. One or more new RT Radiation Sets may be required each time adaptive therapy is used to attempt maintain a phase prescription.

The chronological relationships between RT Radiation Sets (the actual start of each set, the order or timing among sets, etc.) are recorded in Attributes outside the RT Radiation Set Module.

Table C.36.C1-1
RT RADIATION SET MODULE ATTRIBUTES

Attribute Name	Tag	Type	Description
Include Table 10.9.1-1 "Enhanced Content Identification Macro Attributes"			
Number of Fractions	(3010,007D)	1	Number of Fractions for which this RT Radiation Set will be repeated.
Include Table C.36.2.1.1-1 "Radiation Fraction Pattern Macro Attributes"			
RT Radiation Set Intent	(gggg,5011)	1	A general indication of the type of information contained within this RT Radiation Set. Defined Terms: TREATMENT PLAN_QA MACHINE_QA RESEARCH SERVICE See C.36.C1.1.1.
RT Dose Contribution Presence Flag	(gggg,5012)	1	Indicates whether the RT Dose Contribution Module is present in this Instance. Enumerated Values YES NO
Treatment Position Group Sequence	(gggg,9145)	2	Treatment Position Groups defined for the included Radiation Instances. Zero or more Items shall be included in this Sequence. See C.36.C1.1.3.
>Treatment Position Group UID	(gggg,9144)	1	Unique identifier of the Treatment Position Group.
>Treatment Position Group Label	(gggg,9143)	1	User-defined label of the Treatment Position Group.

Attribute Name	Tag	Type	Description
>Referenced RT Radiation Sequence	(gggg,9C04)	1	RT Radiation Instances that belong to the Treatment Position Group. Each referenced Radiation Instance shall appear once and only once in the Treatment Position Group Sequence (gggg,9145). One or more Items shall be included in this Sequence.
>>Include Table 10-11 "SOP Instance Reference Macro Attributes"			
RT Radiation Sequence	(gggg,9B26)	1	RT Radiation instances which are referenced by this RT Radiation Set. One or more Items shall be included in this Sequence. See C.36.C1.1.2.
>Include Table 10-11 "SOP Instance Reference Macro Attributes"			

784 **C.36.C1.1 RT Radiation Set Attribute Description**

C.36.C1.1.1 RT Radiation Set Intent

786 Defined Terms for RT Radiation Set Intent (gggg,5011) are

Table C.36.C1-2

788 **DEFINED TERMS OF RT RADIATION SET INTENT (gggg,5011)**

Enumerated Value	Definition
TREATMENT	The RT Radiation Set is for the purpose of treatment delivery. This does not constitute an approval for treatment. All parameters necessary to guide the delivery of RT Radiations are included.
PLAN_QA	The RT Radiation Set is for validating the patient-specific dose 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 is for system quality assurance and calibration (geometric, dosimetric or both) procedures of the delivery machine and is not patient-specific.
RESEARCH	The RT Radiation Set is for performing research and is not delivered to a patient.
SERVICE	The RT Radiation Set is for diagnostics and assessment for machine repair or to perform measurements for a maintenance or calibration operation by a service technician.

790 **C.36.C1.1.2 RT Radiation Sequence**

All SOP Instances referenced in this Sequence shall

792 • share the same Frame of Reference (defined by the Frame of Reference UID (0020,0052) in the Frame Of Reference Module),

- be defined for the same treatment device (specified by the Treatment Device Identification Macro within the RT Delivery Device Common Module).

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

- Enhanced RT Series 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.E1.
- RT Radiation Common Module specified in section C.36.E2.

C.36.C1.1.3 Treatment Position Groups

Radiation Instances that share a fixed spatial relation and thus can share the result of a position verification can be assigned to the same Treatment Position Group because the relationship of positions in one Instance to those in other Instances in the Treatment Position Group can be known with reasonable certainty.

Whether it is reasonable to put Instances together in Treatment Position Group can depend on several factors and may involve a degree of judgement.

For example,

1) In a Radiation Set treating a single target with two beams at the same spatial location, both Radiation Instances belong to the same Treatment Position Group.

2) In a Radiation Set treating two targets in different anatomical regions (e.g. lung and pelvis), typically the Radiation Instances belong to different Treatment Position Groups, because a separate setup verification is required to establish the treatment position for each Radiation.

3) In a Radiation Set treating two targets whose spatial relationship is fixed such that a single setup verification is sufficient, the Radiation Instances may belong to the same Treatment Position Group, but the planner may choose to assign them to different Treatment Position Groups.

C.36.C2 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 anatomies 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 C.36.C2.1.1.

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.

836 **Table C.36.C2-1**
RT DOSE CONTRIBUTION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Description
Radiation Dose Identification Sequence	(gggg,9B42)	1	Parameters to identify and scope 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	(gggg,9120)	1	Index of this Item in this Sequence. The value shall start at 1 and increase monotonically by 1.
>Radiation Dose Identification Label	(gggg,9B46)	1	Label of this Radiation Dose for the user.
>Reference Dose Type	(gggg,9B48)	1	Type of reference dose. Defined terms: RADIATION Dose values are specifically calculated for each referenced RT Radiation SOP Instance. NOMINAL Nominal values are assigned to the individual RT Radiation SOP Instances. Dose may be calculated on the Fraction level only or otherwise be assigned to individual RT Radiation SOP Instances without instance-specific calculations.
>Reference Dose Point Coordinates	(gggg,9B62)	1C	Coordinates (x,y,z) in mm of the reference dose point in the DICOM Patient Coordinate System at which the dose values are calculated. Required if dose is calculated at a point.
>Conceptual Volume Sequence	(3010,0025)	1	Reference to a Conceptual Volume that receives dose. See C.36.C2.1.2. Only a single Item shall be included in this Sequence. Each Conceptual Volume UID (3010,0006) shall appear only once in the Radiation Dose Identification Sequence (gggg,9B42).
>>Include Table 10.34-1 "Conceptual Volume Segmentation Reference and Combination Macro Attributes"			

Attribute Name	Tag	Type	Description
Radiation Dose Sequence	(gggg,9B40)	1	Parameters that describe dose contributed by referenced RT Radiation SOP instances. For every SOP instance referenced in RT Radiation Sequence (gggg,9B26) exactly one item shall be present in this Sequence.
>Referenced RT Radiation Sequence	(gggg,9C04)	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"			
>Radiation Dose Values Parameters Sequence	(gggg,9B64)	1	Dose values of this RT Radiation with respect to the dose identification items defined in the Radiation Dose Identification Sequence (gggg,9B42). The number of Items included in this Sequence shall be the same as the number of Items in the Radiation Dose Identification Sequence (gggg,9B42).
>>Primary Dose Value Indicator	(gggg,9B49)	1	Whether the dose value serves as the primary dose indicator for this RT Radiation Set. Enumerated Values: YES NO Exactly one item in the Radiation Dose Values Parameters Sequence (gggg,9B64) shall have the value YES. See C.36.C2.1.3.
>>Referenced Radiation Dose Identification Index	(gggg,9150)	1	The value of Radiation Dose Identification Index (gggg,9120) in the Radiation Dose Identification Sequence (gggg,9B42) identifying the dose contribution to which this Item in the Radiation Dose Values Parameters Sequence (gggg,9B64) applies.
>>Dose Values Sequence	(gggg,9B4A)	1C	Dose values. Required if the Meterset to dose mapping is defined. One or more Items shall be present. Each Radiobiological Dose Effect Flag (gggg,1131) value shall appear no more than once in this Sequence.

Attribute Name	Tag	Type	Description
>>>Dose Value Purpose	(gggg,9B5A)	1	Purpose(s) for which dose values in this Sequence Item are provided. Defined Terms: TRACKING – The dose values are used for tracking or billing and typically represent nominal values. QA – The dose values are used for quality assurance and typically represent actual dose values.
>>>Include Table C.36.2.1.5-1 "Radiobiological Dose Effect Description Macro Attributes"			
>>>Meterset to Dose Mapping Sequence	(gggg,9B68)	1	Mapping of Cumulative Meterset (gggg,5021) to Radiation Dose Value (gggg,9B7B). See C.36.C2.1.1 Two or more Items shall be included in this Sequence.
>>>>Cumulative Meterset	(gggg,5021)	1	Cumulative Meterset where a dose value is delivered. See C.36.C2.1.1.
>>>>Radiation Dose Value	(gggg,9B7B)	1	Dose value (in Gy) delivered at the corresponding Cumulative Meterset (gggg,5021). See C.36.C2.1.5
>Expected In Vivo Measurement Values Sequence	(gggg,9B76)	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. One or more Items shall be included in this Sequence.
>>Expected In Vivo Measurement Value Index	(gggg,9B77)	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	(gggg,9B78)	1	Label to identify the in vivo measurement point. See 10.31.1.1.
>>Radiation Dose Central Axis Displacement	(gggg,9B7A)	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 (gggg,9B7D) is empty.

Attribute Name	Tag	Type	Description
>>Radiation Dose Value	(gggg,9B7B)	1	Dose Value in Gy at the measurement point.
>>Radiation Dose Source to Skin Distance	(gggg,9B7C)	2	Distance in mm from the radiation source to the patient skin along the central beam axis from the source to the measurement point.
>>Radiation Dose Source to External Contour Distance	(gggg,9B7E)	2	Distance in mm from the radiation source 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 (gggg,9B7C). See C.36.C2.1.4.
>>Radiation Dose Measurement Point Coordinates	(gggg,9B7D)	2	Coordinates (x,y,z) in mm in the DICOM Patient Coordinate System of the measurement point.

C.36.C2.1 RT Dose Contribution Attribute Description

C.36.C2.1.1 Meterset to Dose Mapping Sequence

The Meterset to Dose Mapping Sequence (gggg,9B68) contains for each Meterset value the corresponding dose value.

In the first item, the value of Cumulative Meterset (gggg,5021) and of Radiation Dose Value (gggg,9B7B) shall always be zero.

In the last item, the value of Cumulative Meterset (gggg,5021) shall be the Meterset of the final Control Point. The value of Radiation Dose Value (gggg,9B7B) in the last item represents the dose delivered to the referenced anatomy when one fraction is completely delivered.

Cumulative Meterset Values shall be strictly monotonically increasing. Radiation Dose Values shall be monotonically non-decreasing. The increase of dose between two adjacent points of the lookup table shall be interpreted as linear.

C.36.C2.1.2 Conceptual Volume Sequence

The Conceptual Volume Sequence (3010,0025) identifies a Conceptual Volume defining a volume for which dose is tracked 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 may not be associated with a segment. For example, dose tracking may be specified using a nominal dose to an anatomical region of interest and the tracking coefficients approximated by Meterset values.

C.36.C2.1.3 Primary Dose Value Indicator

The Primary Dose Value Indicator (gggg,9B49) is intended to be used to indicate the representative dose value out of the list of dose values which is used for display purposes. Typically this value refers to the primary target while the other non-primary values may refer to e.g. organs at risk.

C.36.C2.1.4 Radiation Dose Source to External Contour Distance

The Radiation Dpse Source to External Contour Distance (gggg,9C62) is the distance to the beam entry point, which may include Bolus, Patient Positioning Devices, Patient Immobilization Devices or other devices. This value is useful for including the attenuation effects of external devices on the dose calculation and for patient setup.

C.36.C2.1.5 Radiation Dose Value

The Radiation Dose Value (gggg,9B7B) represents the cumulative dose delivered from the beginning of radiation delivery to the Cumulative Meterset (gggg,5021).

C.36.E1 RT Delivery Device Common Module

The RT Delivery Device Common Module contains general information pertaining to the physical device used to deliver the treatment.

Table C.36.E1-1
RT DELIVERY DEVICE COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Description
Include Table C.36.2.N.1-1 "Treatment Device Identification Macro Attributes"			
Radiation Dosimeter Unit Sequence	(gggg,5113)	1	Measurement unit of the machine dosimeter. Only a single item shall be included in this Sequence.
>Include Table 8.8-1 "Code Sequence Macro Attributes"			*CID is specified in the IOD*
RT Device Distance Reference Location Code Sequence	(gggg,5114)	1	Point of reference used for measuring the distance to various devices. Only a single item shall be included in this Sequence.
>Include Table 8.8-1 "Code Sequence Macro Attributes"			*Defined CID SUP175004 "Radiotherapy Distance Reference Locations"*
RT Beam Modifier Definition Distance	(gggg,5210)	1	Absolute distance in mm along the z-axis of the Base Beam Modifier Coordinate System from the reference location as specified by RT Beam Distance Reference Location Code Sequence (gggg,5114) to the Beam Modifier Definition Plane. The value shall be greater than or equal to zero. See C.36.1.N11.
Equipment Frame of Reference UID	(gggg,51A0)	1	Frame of Reference identifier for the Treatment Delivery Device. See C.36.E1.1.1.

Attribute Name	Tag	Type	Description
Equipment Frame of Reference Description	(gggg,51A1)	3	Description of Equipment Coordinate System identified by the Equipment Frame of Reference UID (gggg,51A0). See C.36.E1.1.1.
Equipment Reference Point Coordinates Sequence	(gggg,51A2)	2	Coordinates of device-specific reference points. Zero or more Items shall be included in this Sequence.
>3D Point Coordinate	(0068,6590)	1	Coordinates (x,y,z) in mm of the device-specific reference point in the Equipment Coordinate System.
>Equipment Reference Point Code Sequence	(gggg,51A3)	1	Identifies the type of reference point. Only a single Item shall be included in this Sequence.
>>Include Table 8.8-1 "Code Sequence Macro Attributes"			*Defined CID SUP175014 "Equipment Reference Points"*
Include Table C.36.2.N.2-1 "RT Patient Support Devices Macro Attributes"			

C.36.E1.1 RT Delivery Device Common Module Attribute Description

C.36.E1.1.1 Equipment Frame of Reference UID

The Equipment Frame of Reference UID (gggg,51A0) identifies the Equipment Coordinate System for a Treatment Delivery Device, see C.36.1.N10.

The RT Radiation SOP Classes are bound by the Standard to specific Well-known Frames of Reference as defined in Part 6, Annex A, Table A-2. For C-arm based devices delivering radiation at a single machine isocenter this may be the IEC 61217 coordinate system. Devices are calibrated to a specific Well-known Frame of Reference and thus use the corresponding Well-known UID in Equipment Frame of Reference UID (gggg,51A0).

For RT Radiation SOP Classes the result of the transformation between the Patient-based Coordinate System and the Equipment Frame of Reference UID (gggg,51A0) is used to describe the intended treatment position. If two or more transformation matrices describe the relation between two or more Patient-based coordinate systems and a single Equipment Coordinate System, any calculations assuming transitivity via the Equipment Coordinate System must be performed with great care because the Patient's anatomy may have changed.

For RT Radiation Record SOP Classes the result of the transformation between the Patient-based Coordinate System and the Equipment Frame of Reference UID (gggg,51A0) is used to describe the actual treatment position. In this case the transformation matrices between different Patient-Based coordinate Systems and a single Equipment Coordinate System shall not be considered transitive from an anatomical point of view and may only be used to compare different treatment positions with respect to the treatment delivery device.

C.36.E1.1.2 Equipment Frame of Reference Description

The Equipment Frame of Reference Description (gggg,51A1) is an informal annotation only and shall not be used for any normative description of the Equipment Coordinate System.

C.36.E1.2 Well-known Frame of Reference for Equipment

The following sections contain specifications of Well-known Frames of Reference used as the Equipment Frame of Reference.

C.36.E1.2.1 IEC 61217 Fixed Reference System Frame of Reference

A value of 1.2.840.10008.1.4.RRR.1 for Equipment Frame of Reference UID (gggg,51A0) defines the IEC 61217 Fixed Coordinate System Frame of Reference as follows:

- the Equipment Coordinate System is the IEC 61217 FIXED coordinate system.
- the Base Beam Modifier Coordinate System for all beam modifiers is the IEC 61217 GANTRY coordinate system. However, RT Radiation SOP Classes allow each Beam Modifier Coordinate Systems to rotate independently from the Base Beam Modifier Coordinate System.

Note: IEC 61217 refers to the X-axis, Y-axis and Z-axis of the various coordinate systems. When referenced in this Standard the capital X/Y/Z is preserved which is not otherwise a DICOM convention.

C.36.E2 RT Radiation Common Module

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

920 **Table C.36.E2-1**
RT RADIATION COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Description
Include Table 10.9.1-1 "Enhanced User Content Identification Macro Attributes"			
RT Radiation Physical and Geometric Content Detail Flag	(gggg,5013)	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	(gggg,5014)	1	Whether or not device parameters about actual delivery of treatment to a patient have been recorded. Enumerated Values: YES NO See C.36.E2.1.5.
RT Treatment Technique Code Sequence	(3010,0080)	1	Type of treatment technique. Only a single Item shall be included in this Sequence. See C.36.E2.1.1.
>Include Table 8.8-1 "Code Sequence Macro Attributes"			*CID is defined in the IOD including this Module.*
Include Table C.36.2.N.4-1 "RT Treatment Position Macro Attributes"			*See C.36.E2.1.2*

Attribute Name	Tag	Type	Description
RT Tolerance Set Sequence	(gggg,9BA0)	3	A set of tolerance values to be applied to parameters used for delivery of the RT Radiation. Only a single Item shall be included in this Sequence.
>Include Table C.36.2.N.17-1 "RT Tolerance Set Macro Attributes"			
Treatment Time Limit	(gggg,9BAD)	3	The expected maximum delivery time in seconds. The behavior of the treatment delivery device on exceeding the Treatment Time Limit is up to the implementation. See C.36.E2.1.3.
Treatment Machine Special Mode Sequence	(gggg,9C97)	1C	Activates a mode of operation on the treatment machine. Required if a special delivery mode is used for treatment. Only one Item shall be included in this Sequence. See C.36.E2.1.4.
>Include Table 8.8-1 "Code Sequence Macro Attributes"			*Defined CID is defined in the IOD including this Module.*

C.36.E2.1 RT Radiation Common Attribute Description

C.36.E2.1.1 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. The content of this Sequence provides a coded summary of the radiation technique implemented by this RT Radiation SOP instance.

C.36.E2.1.2 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 (Treatment Position).

No assumptions are made about the behavior of the machine regarding the patient position between specified Control Points, and communicating devices shall agree on this behavior outside the current standard.

C.36.E2.1.3 Treatment Time Limit

The Treatment Time Limit (gggg,9BAD) is the maximum time span allowed to deliver a single fraction of this RT Radiation SOP instance. Treatment is expected to be terminated upon reaching the Treatment Time Limit (gggg,9BAD) independent of the Meterset. The value of this attribute shall accommodate normal variations in delivery.

C.36.E2.1.4 Treatment Machine Special Mode Sequence

The Treatment Machine Special Mode Sequence (gggg,9C97) contains a code (for example, total body irradiation, total skin irradiation), which selects a set of vendor- and machine-specific parameters that alter the treatment parameters and/or safety constraints.

C.36.E2.1.5 RT Record Flag

Enumerated Values for RT Record Flag (gggg,5014) are

Table C.36.E2-2
ENUMERATED VALUES OF RT RECORD FLAG (gggg,5014)

Enumerated Value	Definition
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.

C.36.G1 C-Arm Photon-Electron Delivery Device Module

The C-Arm Photon-Electron Delivery Device Module defines constant C-Arm-specific parameters pertaining to the physical device used to deliver photon and electron treatments, including geometrical parameters of the collimation system.

Table C.36.G1-1
C-ARM PHOTON-ELECTRON DELIVERY DEVICE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Description
Radiation Source-Axis Distance	(gggg,5029)	1	Distance in mm from the radiation source to the gantry rotation axis.
Include Table C.36.2.N.7-1 "Radiation Generation Mode Macro Attributes"			*Defined CID for Radiation Type Code Sequence (gggg,51C4) is CID 9525 "Radiation Therapy Particle".* *Defined CID for Energy Unit Code Sequence (gggg,51C9) is CID 9521 "Radiotherapy Treatment Energy Unit".* *Defined CID for Radiation Fluence Modifier Code Sequence (gggg,51C8) is CID SUP175009 "Radiation Generation Mode Types".*
Include Table C.36.2.N.8-1 "RT Beam Limiting Device Definition Macro Attributes"			*Defined CID for included 'RT Accessory Device Identification Macro' is CID SUP175001 "Beam Limiting Device Types".*
Include Table C.36.2.N.10-1 "Wedges Definition Macro Attributes"			
Include Table C.36.2.N.12-1 "Compensators Definition Macro Attributes"			
Include Table C.36.2.N.13-1 "Blocks Definition Macro Attributes"			
Include Table C.36.2.N.14-1 "RT Accessory Holders Definition Macro Attributes"			
Include Table C.36.2.N.15-1 "General Accessories Definition Macro Attributes"			
Include Table C.36.2.N.16-1 "Boluses Definition Macro Attributes"			

C.36.G2 C-Arm Photon-Electron Beam Module

The C-Arm Photon-Electron Beam Module specifies how a C-Arm photon or electron treatment beam is to be delivered.

958 **Table C.36.G2-1**
C-ARM PHOTON-ELECTRON BEAM MODULE ATTRIBUTES

Attribute Name	Tag	Type	Description
Number of RT Control Points	(gggg,9122)	1	Number of RT Control Points in the C-Arm Photon-Electron Control Point Sequence (gggg,9C00). The value shall be equal to or greater than 2.
C-Arm Photon-Electron Control Point Sequence	(gggg,9C00)	1	Control Points used to model the beam delivery. The number of Items included in this Sequence shall equal the value of Number of RT Control Points (gggg,9122).
>Include Table C.36.2.N.6-1 "External Beam Control Point General Macro Attributes"			*Defined CID SUP175010 "C-Arm Photon-Electron Delivery Rate Unit"*
>Referenced Radiation Generation Mode Index	(gggg,9124)	1C	Radiation Generation Mode Index (gggg,9113) in the Radiation Generation Mode Sequence (gggg,51C0) in this IOD. Required if the conditions in Section C.36.2.N.5.1.1 are satisfied.
>Include Table C.36.2.N.9-1 "RT Beam Limiting Device Opening Macro Attributes"			
>Include Table C.36.2.N.11-1 "Wedge Positions Macro Attributes"			
>Source Roll Continuous Angle	(gggg,51B5)	1C	Continuous gantry roll angle in degrees of the radiation source at the Control Point with respect to the Equipment Coordinate System. See C.36.G2.1.1 and C.36.E1.1.1. Required if the conditions in Section C.36.2.N.5.1.1 are satisfied.
>RT Beam Limiting Device Continuous Angle	(gggg,51B4)	1C	Angle in degrees of the Base Beam Modifier Coordinate System about the Z-axis relative to the parent coordinate system. See C.36.G2.1.2. Required if the conditions in Section C.36.2.N.5.1.1 are satisfied.
>Source to Patient Surface Distance	(gggg,9C63)	2C	Distance in mm from the radiation source to the Patient surface (skin) along the central beam axis from the source. Required if the conditions in Section C.36.2.N.5.1.1 are satisfied.

Attribute Name	Tag	Type	Description
>Source to External Contour Distance	(gggg,9C62)	2C	Source to External Contour distance in mm along the central beam axis from the source including devices associated with the patient anatomy model. For dosimetric purposes this value may differ from the Source to Patient Surface Distance (gggg,9C63). See C.36.C2.1.4. Required if the conditions in Section C.36.2.N.5.1.1 are satisfied.

960

C.36.G2.1 C-Arm Photon-Electron Beam Attribute Description

962 #### C.36.G2.1.1 Source Roll Continuous Angle

For an Equipment Frame of Reference UID (gggg,51A0) of 1.2.840.10008.1.4.RRR.1 (IEC 61217
964 Fixed Coordinate System Frame of Reference), the source roll angle is the rotation of the IEC 61217 GANTRY coordinate system about the Y-axis of the IEC 61217 FIXED coordinate system.

966 #### C.36.G2.1.2 RT Beam Limiting Device Continuous Angle

For an Equipment Frame of Reference UID (gggg,51A0) of 1.2.840.10008.1.4.RRR.1 (IEC 61217
968 Fixed Coordinate System Frame of Reference), the RT Beam Limiting Device Continuous Angle (gggg,51B4) is the rotation of the Base Beam Modifier Coordinate System about the Z-axis of the IEC
970 61217 GANTRY coordinate system.

972

Part 4 Addendum

974 **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 Set Storage	**1.2.840.10008.5.1.4.1.1.481.XN.3**	**RT Radiation Set IOD**
C-Arm Photon-Electron Radiation Storage	**1.2.840.10008.5.1.4.1.1.481.XN.5.2**	**C-Arm Photon-Electron Radiation IOD**

976

978 **Part 6 Addendum**

Add the following data elements to PS3.6:

980

6 REGISTRY OF DICOM DATA ELEMENTS

(gggg,9111)	RT Control Point Index	RTControlPointIndex	US	1
(gggg,9113)	Radiation Generation Mode Index	RadiationGenerationModeIndex	US	1
(gggg,9114)	RT Tolerance Set Index	RTToleranceSetIndex	US	1
(gggg,9115)	Referenced RT Control Point Index	ReferencedRTControlPointIndex	US	1
(gggg,9119)	Referenced Defined Device Index	ReferencedDefinedDeviceIndex	US	1
(gggg,9120)	Radiation Dose Identification Index	RadiationDoseIdentificationIndex	US	1
(gggg,9122)	Number of RT Control Points	NumberOfRTControlPoints	US	1
(gggg,9124)	Referenced Radiation Generation Mode Index	ReferencedRadiationGenerationModeIndex	US	1
(gggg,9141)	Treatment Position Index	TreatmentPositionIndex	US	1
(gggg,9142)	Referenced Device Index	ReferencedDeviceIndex	US	1
(gggg,9143)	Treatment Position Group Label	TreatmentPositionGroupLabel	LO	1
(gggg,9144)	Treatment Position Group UID	TreatmentPositionGroupUID	UI	1
(gggg,9145)	Treatment Position Group Sequence	TreatmentPositionGroupSequence	SQ	1
(gggg,9147)	Referenced Treatment Position Index	ReferencedTreatmentPositionIndex	US	1
(gggg,9150)	Referenced Radiation Dose Identification Index	ReferencedRadiationDoseIdentificationIndex	US	1
(gggg,92E3)	RT Accessory Holder Water-Equivalent Thickness	RTAccessoryHolderWaterEquivalentThickness	FD	1
(gggg,9540)	Referenced RT Accessory Holder Device Index	ReferencedRTAccessoryHolderDeviceIndex	US	1
(gggg,9542)	RT Accessory Holder Slot Sequence	RTAccessoryHolderSlotSequence	SQ	1

(gggg,9544)	RT Accessory Holder Slot ID	RTAccessoryHolderSlotID	LO	1
(gggg,9546)	RT Accessory Holder Slot Distance	RTAccessoryHolderSlotDistance	FD	1
(gggg,9548)	RT Accessory Slot Distance	RTAccessorySlotDistance	FD	1
(gggg,954A)	RT Accessory Holder Definition Sequence	RTAccessoryHolderDefinitionSequence	SQ	1
(gggg,954B)	RT Accessory Device Slot ID	RTAccessoryDeviceSlotID	LO	1
(gggg,9B26)	RT Radiation Sequence	RTRadiationSequence	SQ	1
(gggg,9B40)	Radiation Dose Sequence	RadiationDoseSequence	SQ	1
(gggg,9B42)	Radiation Dose Identification Sequence	RadiationDoseIdentificationSequence	SQ	1
(gggg,9B46)	Radiation Dose Identification Label	RadiationDoseIdentificationLabel	LO	1
(gggg,9B48)	Reference Dose Type	ReferenceDoseType	CS	1
(gggg,9B49)	Primary Dose Value Indicator	PrimaryDoseValueIndicator	CS	1
(gggg,9B4A)	Dose Values Sequence	DoseValuesSequence	SQ	1
(gggg,9B5A)	Dose Value Purpose	DoseValuePurpose	CS	1-n
(gggg,9B62)	Reference Dose Point Coordinates	ReferenceDosePointCoordinates	FD	3
(gggg,9B64)	Radiation Dose Values Parameters Sequence	RadiationDoseValuesParametersSequence	SQ	1
(gggg,9B68)	Meterset to Dose Mapping Sequence	MetersetToDoseMappingSequence	SQ	1
(gggg,9B76)	Expected In Vivo Measurement Values Sequence	ExpectedInVivoMeasurementValuesSequence	SQ	1
(gggg,9B77)	Expected In Vivo Measurement Value Index	ExpectedInVivoMeasurementValueIndex	US	1
(gggg,9B78)	Radiation Dose In Vivo Measurement Label	RadiationDoseInVivoMeasurementLabel	LO	1
(gggg,9B7A)	Radiation Dose Central Axis Displacement	RadiationDoseCentralAxisDisplacement	FD	2
(gggg,9B7B)	Radiation Dose Value	RadiationDoseValue	FD	1
(gggg,9B7C)	Radiation Dose Source to Skin Distance	RadiationDoseSourceToSkinDistance	FD	1
(gggg,9B7D)	Radiation Dose Measurement Point Coordinates	RadiationDoseMeasurementPointCoordinates	FD	3
(gggg,9B7E)	Radiation Dose Source to External Contour Distance	RadiationDoseSourceToExternalContourDistance	FD	1
(gggg,9BA0)	RT Tolerance Set Sequence	RTToleranceSetSequence	SQ	1

(gggg,9BA2)	RT Tolerance Set Label	RTToleranceSetLabel	LO	1
(gggg,9BA6)	Attribute Tolerance Values Sequence	AttributeToleranceValuesSequence	SQ	1
(gggg,9BA8)	Tolerance Value	ToleranceValue	FD	1
(gggg,9BAA)	Patient Support Position Tolerance Sequence	PatientSupportPositionToleranceSequence	SQ	1
(gggg,9BAD)	Treatment Time Limit	TreatmentTimeLimit	FD	1
(gggg,9BB0)	Manufacturer's Device Class UID	ManufacturersDeviceClassUID	UI	1
(gggg,9C00)	C-Arm Photon-Electron Control Point Sequence	CArmPhotonElectronControlPointSequence	SQ	1
(gggg,9C04)	Referenced RT Radiation Sequence	ReferencedRTRadiationSequence	SQ	1
(gggg,9C05)	Referenced RT Instance Sequence	ReferencedRTInstanceSequence	SQ	1
(gggg,9C20)	Referenced RT Patient Setup Sequence	ReferencedRTPatientSetupSequence	SQ	1
(gggg,9C62)	Source to External Contour Distance	SourceToExternalContourDistance	FD	1
(gggg,9C63)	Source to Patient Surface Distance	SourceToPatientSurfaceDistance	FD	1
(gggg,9C97)	Treatment Machine Special Mode Sequence	TreatmentMachineSpecialModeSequence	SQ	1
(gggg,5011)	RT Radiation Set Intent	RTRadiationSetIntent	CS	1
(gggg,5012)	RT Dose Contribution Presence Flag	RTDoseContributionPresenceFlag	CS	1
(gggg,5013)	RT Radiation Physical and Geometric Content Detail Flag	RTRadiationPhysicalAndGeometricContentDetailFlag	CS	1
(gggg,5014)	RT Record Flag	RTRecordFlag	CS	1
(gggg,5015)	Treatment Device Identification Sequence	TreatmentDeviceIdentificationSequence	SQ	1
(gggg,5021)	Cumulative Meterset	CumulativeMeterset	FD	1
(gggg,5023)	Delivery Rate	DeliveryRate	FD	1
(gggg,5024)	Delivery Rate Unit Sequence	DeliveryRateUnitSequence	SQ	1
(gggg,5028)	Treatment Position Sequence	TreatmentPositionSequence	SQ	1
(gggg,5029)	Radiation Source-Axis Distance	RadiationSourceAxisDistance	FD	1
(gggg,5041)	Number of RT Beam Limiting Devices	NumberOfRTBeamLimitingDevices	US	1
(gggg,5042)	RT Beam Limiting Device Proximal Distance	RTBeamLimitingDeviceProximalDistance	FD	1

(gggg,5043)	RT Beam Limiting Device Distal Distance	RTBeamLimitingDeviceDistalDistance	FD	1
(gggg,5044)	Parallel RT Beam Delimiter Device Orientation Label Code Sequence	ParallelRTBeamDelimiterDeviceOrientationLabelCodeSequence	SQ	1
(gggg,5045)	Beam Modifier Orientation Angle	BeamsModifierOrientationAngle	FD	1
(gggg,5047)	Parallel RT Beam Delimiter Device Sequence	ParallelRTBeamDelimiterDeviceSequence	SQ	1
(gggg,5048)	Number of Parallel RT Beam Delimiters	NumberOfParallelRTBeamDelimiters	US	1
(gggg,5049)	Parallel RT Beam Delimiter Boundaries	ParallelRTBeamDelimiterBoundaries	FD	2-n
(gggg,504A)	Parallel RT Beam Delimiter Positions	ParallelRTBeamDelimiterPositions	FD	2-n
(gggg,504B)	RT Beam Limiting Device Offset	RTBeamLimitingDeviceOffset	FD	2
(gggg,504C)	Fixed RT Beam Delimiter Device Sequence	FixedRTBeamDelimiterDeviceSequence	SQ	1
(gggg,504D)	RT Beam Limiting Device Definition Sequence	RTBeamLimitingDeviceDefinitionSequence	SQ	1
(gggg,504E)	Parallel RT Beam Delimiter Opening Mode	ParallelRTBeamDelimiterOpeningMode	CS	1
(gggg,504F)	Parallel RT Beam Delimiter Leaf Mounting Side	ParallelRTBeamDelimiterLeafMountingSide	CS	1-n
(gggg,5060)	Patient Setup UID	PatientSetupUID	UI	1
(gggg,5062)	Wedge Definition Sequence	WedgeDefinitionSequence	SQ	1
(gggg,5063)	Radiation Beam Wedge Angle	RadiationBeamWedgeAngle	FD	1
(gggg,5065)	Radiation Beam Wedge Thin Edge Distance	RadiationBeamWedgeThinEdgeDistance	FD	1
(gggg,5066)	Radiation Beam Effective Wedge Angle	RadiationBeamEffectiveWedgeAngle	FD	1
(gggg,5067)	Number of Wedge Positions	NumberOfWedgePositions	US	1
(gggg,5070)	RT Beam Limiting Device Opening Sequence	RTBeamLimitingDeviceOpeningSequence	SQ	1
(gggg,5069)	Number of RT Beam Limiting Device Openings	NumberOfRTBeamLimitingDeviceOpenings	US	1
(gggg,5113)	Radiation Dosimeter Unit Sequence	RadiationDosimeterUnitSequence	SQ	1

(gggg,5114)	RT Device Distance Reference Location Code Sequence	RTDeviceDistanceReferenceLocationCodeSequence	SQ	1
(gggg,5115)	Radiation Device Configuration and Commissioning Key Sequence	RadiationDeviceConfigurationAndCommissioningKeySequence	SQ	1
(gggg,5116)	Radiation Device Calibration Protocol Code Sequence	RadiationDeviceCalibrationProtocolCodeSequence	SQ	1
(gggg,5142)	Patient Support Position Parameter Sequence	PatientSupportPositionParameterSequence	SQ	1
(gggg,5144)	Patient Support Position Specification Method	PatientSupportPositionSpecificationMethod	CS	1
(gggg,5145)	Patient Support Position Device Parameter Sequence	PatientSupportPositionDeviceParameterSequence	SQ	1
(gggg,5146)	Device Order Index	DeviceOrderIndex	US	1
(gggg,5147)	Patient Support Position Parameter Order Index	PatientSupportPositionParameterOrderIndex	US	1
(gggg,5148)	Patient Support Position Device Tolerance Sequence	PatientSupportPositionDeviceToleranceSequence	SQ	1
(gggg,5149)	Patient Support Position Tolerance Order Index	PatientSupportPositionToleranceOrderIndex	US	1
(gggg,5150)	Compensator Definition Sequence	CompensatorDefinitionSequence	SQ	1
(gggg,5151)	Compensator Map Orientation	CompensatorMapOrientation	CS	1
(gggg,5152)	Compensator Proximal Thickness Map	CompensatorProximalThicknessMap	OF	1
(gggg,5153)	Compensator Distal Thickness Map	CompensatorDistalThicknessMap	OF	1
(gggg,5154)	Compensator Base Plane Offset	CompensatorBasePlaneOffset	FD	1
(gggg,5155)	Compensator Shape Fabrication Code Sequence	CompensatorShapeFabricationCodeSequence	SQ	1
(gggg,5156)	Compensator Shape Sequence	CompensatorShapeSequence	SQ	1
(gggg,5157)	Radiation Beam Compensator Milling Tool Diameter	RadiationBeamCompensatorMillingToolDiameter	FD	1
(gggg,5160)	Block Definition Sequence	BlockDefinitionSequence	SQ	1
(gggg,5161)	Block Edge Data	BlockEdgeData	OF	1
(gggg,5162)	Block Orientation	BlockOrientation	CS	1

(gggg,5163)	Radiation Beam Block Thickness	RadiationBeamBlockThickness	FD	1
(gggg,5164)	Radiation Beam Block Slab Thickness	RadiationBeamBlockSlabThickness	FD	1
(gggg,5171)	Number of RT Accessory Holders	NumberOfRTAccessoryHolders	US	1
(gggg,5180)	General Accessory Definition Sequence	GeneralAccessoryDefinitionSequence	SQ	1
(gggg,5181)	Number of General Accessories	NumberOfGeneralAccessories	US	1
(gggg,5190)	Bolus Definition Sequence	BolusDefinitionSequence	SQ	1
(gggg,5191)	Number of Boluses	NumberOfBoluses	US	1
(gggg,51A0)	Equipment Frame of Reference UID	EquipmentFrameOfReferenceUID	UI	1
(gggg,51A1)	Equipment Frame of Reference Description	EquipmentFrameOfReferenceDescription	ST	1
(gggg,51A2)	Equipment Reference Point Coordinates Sequence	EquipmentReferencePointCoordinatesSequence	SQ	1
(gggg,51A3)	Equipment Reference Point Code Sequence	EquipmentReferencePointCodeSequence	SQ	1
(gggg,51B4)	RT Beam Limiting Device Continuous Angle	RTBeamLimitingDeviceContinuousAngle	FD	1
(gggg,51B5)	Source Roll Continuous Angle	SourceRollContinuousAngle	FD	1
(gggg,51C0)	Radiation Generation Mode Sequence	RadiationGenerationModeSequence	SQ	1
(gggg,51C1)	Radiation Generation Mode Label	RadiationGenerationModeLabel	SH	1
(gggg,51C2)	Radiation Generation Mode Description	RadiationGenerationModeDescription	ST	1
(gggg,51C3)	Radiation Generation Mode Machine Code Sequence	RadiationGenerationModeMachineCodeSequence	SQ	1
(gggg,51C4)	Radiation Type Code Sequence	RadiationTypeCodeSequence	SQ	1
(gggg,51C5)	Nominal Energy	NominalEnergy	DS	1
(gggg,51C6)	Minimum Nominal Energy	MinimumNominalEnergy	DS	1
(gggg,51C7)	Maximum Nominal Energy	MaximumNominalEnergy	DS	1
(gggg,51C8)	Radiation Fluence Modifier Code Sequence	RadiationFluenceModifierCodeSequence	SQ	1
(gggg,51C9)	Energy Unit Code Sequence	EnergyUnitCodeSequence	SQ	1
(gggg,51CB)	Number of Radiation Generation Modes	NumberOfRadiationGenerationModes	US	1

(gggg,51F0)	Patient Support Devices Sequence	PatientSupportDevicesSequence	SQ	1
(gggg,51F1)	Number of Patient Support Devices	NumberOfPatientSupportDevices	US	1
(gggg,5200)	Outline Shape Type	OutlineShapeType	CS	1
(gggg,5201)	Outline Left Vertical Edge	OutlineLeftVerticalEdge	FD	1
(gggg,5202)	Outline Right Vertical Edge	OutlineRightVerticalEdge	FD	1
(gggg,5203)	Outline Upper Horizontal Edge	OutlineUpperHorizontalEdge	FD	1
(gggg,5204)	Outline Lower Horizontal Edge	OutlineLowerHorizontalEdge	FD	1
(gggg,5205)	Center of Circular Outline	CenterOfCircularOutline	FD	2
(gggg,5206)	Diameter of Circular Outline	DiameterOfCircularOutline	FD	1
(gggg,5207)	Number of Polygonal Vertices	NumberOfPolygonalVerticesx	UL	1
(gggg,5208)	Vertices of the Polygonal Outline	VerticesOfThePolygonalOutline	OF	1
(gggg,5210)	RT Beam Modifier Definition Distance	RTBeamModifierDefinitionDistance	FD	1
(gggg,6042)	Patient Location Coordinates Sequence	PatientLocationCoordinatesSequence	SQ	1
(gggg,6044)	Patient Location Coordinates Code Sequence	PatientLocationCoordinatesCodeSequence	SQ	1
(gggg,6046)	Patient Support Position Sequence	PatientSupportPositionSequence	SQ	1
(gggg,6050)	Beam Area Limit Sequence	BeamAreaLimitSequence	SQ	1

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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.XN.3	RT Radiation Set Storage	SOP Class	PS3.4
1.2.840.10008.5.1.4.1.1.481.XN.5.2	C-Arm Photon-Electron Radiation Storage	SOP Class	PS3.4
1.2.840.10008.1.4.RRR.1	IEC 61217 Fixed Coordinate System Frame of Reference	Well-known Frame of Reference	PS3.3

Table A-2 Well-known Frames of Reference

UID Value	UID Name	Normative Reference
1.2.840.10008.1.4.RRR.1	IEC 61217 Fixed Coordinate System Frame of Reference	Fixed coordinate system (“f”) of IEC 61217, Edition 2.0, 2011-12 "Radiotherapy equipment – Coordinates, movements and scales" and C.36.E1.2.1.

Table A-3 Context Group UID Values

Context UID	Context Identifier	Context Group Name
1.2.840.10008.6.1.S175.01	SUP175001	Beam Limiting Device Types
1.2.840.10008.6.1.S175.02	SUP175002	Compensator Device Types
1.2.840.10008.6.1.S175.03	SUP175003	Radiotherapy Treatment Machine Modes
1.2.840.10008.6.1.S175.04	SUP175004	Radiotherapy Distance Reference Locations
1.2.840.10008.6.1.S175.05	SUP175005	Fixed Beam Limiting Device Types
1.2.840.10008.6.1.S175.06	SUP175006	Radiotherapy Wedge Types
1.2.840.10008.6.1.S175.07	SUP175007	RT Beam Limiting Device Orientation Labels
1.2.840.10008.6.1.S175.08	SUP175008	General Accessory Device Types
1.2.840.10008.6.1.S175.09	SUP175009	Radiation Generation Mode Types
1.2.840.10008.6.1.S175.10	SUP175010	C-Arm Photon-Electron Delivery Rate Units
1.2.840.10008.6.1.S175.11	SUP175011	Treatment Delivery Device Types
1.2.840.10008.6.1.S175.12	SUP175012	C-Arm Photon-Electron Dosimeter Units

1.2.840.10008.6.1.S175.13	**SUP175013**	**Treatment Points**
1.2.840.10008.6.1.S175.14	**SUP175014**	**Equipment Reference Points**
1.2.840.10008.6.1.S175.15	**SUP175015**	**Radiotherapy Treatment Planning Person Roles**

996

998 **Part 16 Addendum**

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

1000 **CID SUP175001 BEAM LIMITING DEVICE TYPES**

Context ID SUP175001

1002 **Beam Limiting Device Types**

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

1004 **Type: Non-Extensible**

Version: yyyymmdd

1006 **UID: 1.2.840.10008.6.1.S175.01**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP175	S175170	Jaw Pair
99SUP175	S175172	Leaf Pairs
99SUP175	S175174	Variable Circular Collimator
99SUP175	S175175	Single Leaves
Include CID SUP175005 "Fixed Beam Limiting Device Types"		

1008 **CID SUP175002 COMPENSATOR DEVICE TYPES**

Context ID SUP175002

1010 **Compensator Device Types**

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

1012 **Type: Extensible**

Version: yyyymmdd

1014 **UID: 1.2.840.10008.6.1.S175.02**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP175	S175270	Physical Compensator

1016 **CID SUP175003 RADIOTHERAPY TREATMENT MACHINE MODES**

Context ID SUP175003

1018 **Radiotherapy Treatment Machine Modes**

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

Type: Extensible

Version: yyyymmdd

UID: 1.2.840.10008.6.1.S175.03

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP175	S175281	Total Body Irradiation
99SUP175	S175282	Total Skin Irradiation

CID SUP175004 RADIOTHERAPY DISTANCE REFERENCE LOCATIONS

Context ID SUP175004

Radiotherapy Distance Reference Locations

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

Type: Non-Extensible

Version: yyyymmdd

UID: 1.2.840.10008.6.1.S175.04

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP175	S175772	Radiation Source
99SUP175	S175773	Machine Isocenter

CID SUP175005 FIXED BEAM LIMITING DEVICE TYPES

Context ID SUP175005

Fixed Beam Limiting Device Types

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

Type: Extensible

Version: yyyymmdd

UID: 1.2.840.10008.6.1.S175.05

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
Include CID 9517 "Radiotherapy Block Device Types"		
99SUP175	S175431	Electron Fixed Aperture
99SUP175	S175432	Photon Fixed Aperture

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP175	S175433	Intraoperative Aperture

CID SUP175006 RADIOTHERAPY WEDGE TYPES

Context ID SUP175006

Radiotherapy Wedge Types

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

Type: Extensible

Version: yyyymmdd

UID: 1.2.840.10008.6.1.S175.06

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP175	S175440	Hard Wedge
99SUP175	S175441	Motorized Wedge
99SUP175	S175442	Dynamic Wedge

CID SUP175007 RT BEAM LIMITING DEVICE ORIENTATION LABELS

Context ID SUP175007

RT Beam Limiting Device Orientation Labels

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

Type: Extensible

Version: yyyymmdd

UID: 1.2.840.10008.6.1.S175.07

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP175	S175190	X
99SUP175	S175191	Y

CID SUP175008 GENERAL ACCESSORY DEVICE TYPES

Context ID SUP175008

General Accessory Device Types

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

Type: Extensible

Version: yyyymmdd

UID: 1.2.840.10008.6.1.S175.08

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP175	S175451	Graticule
99SUP175	S175452	Reticle
99SUP175	S175453	Image Detector
99SUP175	S175454	Film Holder
99SUP175	S175455	Winston-Lutz Pointer
99SUP175	S175456	Bowtie Filter

CID SUP175009 RADIATION GENERATION MODE TYPES

Context ID SUP175009

Radiation Generation Mode Types

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

Type: Extensible

Version: yyyymmdd

UID: 1.2.840.10008.6.1.S175.09

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP175	S175560	Flattening Filter Beam
99SUP175	S175561	Non-Flattening Filter Beam
99SUP175	S175562	Partial Flattening Filter Beam

CID SUP175010 C-ARM PHOTON-ELECTRON DELIVERY RATE UNITS

Context ID SUP175010

C-Arm Photon-Electron Delivery Rate Units

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

Type: Non-Extensible

Version: yyyymmdd

UID: 1.2.840.10008.6.1.S175.10

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
UCUM	{MU}/s	Monitor Units / Second

CID SUP175011 TREATMENT DELIVERY DEVICE TYPES

Context ID SUP175011

Treatment Delivery Device Types

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

Type: Extensible

Version: yyyymmdd

UID: 1.2.840.10008.6.1.S175.11

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP175	S175890	Radiotherapy Treatment Device

CID SUP175012 C-ARM PHOTON-ELECTRON DOSIMETER UNITS

Context ID SUP175012

C-Arm Photon-Electron Dosimeter Units

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

Type: Non-Extensible

Version: yyyymmdd

UID: 1.2.840.10008.6.1.S175.12

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
UCUM	{MU}	Monitor Units

CID SUP175013 TREATMENT POINTS

Context ID SUP175013

Treatment Points

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

Type: Extensible

Version: yyyymmdd

UID: 1.2.840.10008.6.1.S175.13

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	130073	Isocentric Treatment Location Point

CID SUP175014 EQUIPMENT REFERENCE POINTS

Context ID SUP175014

Equipment Reference Points

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

Type: Extensible

Version: yyyymmdd

UID: 1.2.840.10008.6.1.S175.14

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
Include CID SUP175004 "Radiotherapy Distance Reference Locations"		
99SUP175	S175774	Fixed Laser Setup Point

CID SUP175015 RADIOTHERAPY TREATMENT PLANNING PERSON ROLES

Context ID SUP175015

Radiotherapy Treatment Planning Person Roles

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

Type: Extensible

Version: yyyymmdd

UID: 1.2.840.10008.6.1.S175.15

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
SRT	J-0016E	Medical Practitioner	158965000	C1306754
SRT	J-004E8	Physician	309343006	C0031831
99SUP175	S175600	Dosimetrist		
SRT	J-005E6	Resident	405277009	C1320928
UMLS	C1441532	Consulting Physician		C1441532
UMLS	C2985483	Radiation Physicist		C2985483
99SUP175	S175601	Physics Assistant		
UMLS	C1708969	Medical Physicist		C1708969

Add the following templates to PS3.16, Annex A:

TID SUP175001 PATIENT SUPPORT POSITION PARAMETERS

TID SUP175001

Patient Support Position Parameters

Type: Extensible Order: Non-Significant

	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint

1	NUMERIC	EV (126802, DCM, "IEC61217 Table Top Continuous Pitch Angle")	1	U		Units = EV (deg, UCUM, "deg")
2	NUMERIC	EV (126803, DCM, "IEC61217 Table Top Continuous Roll Angle")	1	U		Units = EV (deg, UCUM, "deg")
3	NUMERIC	EV (126801, DCM, "IEC61217 Patient Support Continuous Yaw Angle")	1	U		Units = EV (deg, UCUM, "deg")
4	NUMERIC	EV (126804, DCM, "IEC61217 Table Top Eccentric Axis Distance")	1	U		Units = EV (mm, UCUM, "mm")
5	NUMERIC	EV (126805, DCM, "IEC61217 Table Top Continuous Eccentric Angle")	1	U		Units = EV (deg, UCUM, "deg")
6	NUMERIC	EV (126806, DCM, "IEC61217 Table Top Lateral Position")	1	U		Units = EV (mm, UCUM, "mm")
7	NUMERIC	EV (126807, DCM, "IEC61217 Table Top Longitudinal Position")	1	U		Units = EV (mm, UCUM, "mm")
8	NUMERIC	EV (126808, DCM, "IEC61217 Table Top Vertical Position")	1	U		Units = EV (mm, UCUM, "mm")
9	NUMERIC	EV (S175305, 99SUP175, "Isocentric Patient Support Continuous Pitch Angle")	1	U		Units = EV (deg, UCUM, "deg")
10	NUMERIC	EV (S175306, 99SUP175, "Isocentric Patient Support Continuous Roll Angle")	1	U		Units = EV (deg, UCUM, "deg")
11	NUMERIC	EV (S175307, 99SUP175, "Isocentric Patient Support Continuous Yaw Angle")	1	U		Units = EV (deg, UCUM, "deg")
12	NUMERIC	EV (S175308, 99SUP175, "Isocentric Patient Support Lateral Position")	1	U		Units = EV (mm, UCUM, "mm")
13	NUMERIC	EV (S175309, 99SUP175, "Isocentric Patient Support Longitudinal Position")	1	U		Units = EV (mm, UCUM, "mm")
14	NUMERIC	EV (S175310, 99SUP175, "Isocentric Patient Support Vertical Position")	1	U		Units = EV (mm, UCUM, "mm")

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

Editorial Note: Additionally update the existing code (126801, DCM, "IEC61217 Patient Support Continuous Angle") to (126801, DCM, "IEC61217 Patient Support Continuous Yaw Angle") and adapt the description.

ANNEX D DICOM CONTROLLED TERMINOLOGY DEFINITIONS (NORMATIVE)

Code Value	Code Meaning	Definition	Notes
S175120	Volumetric Planning Data Scope	Data defined for a treatment where volumetric treatment planning is prospectively performed.	
S175121	Treatment Recording Data Scope	Data is recorded for a treatment session.	
S175122	Non-Volumetric Planning Data Scope	Data defined for a treatment where no volumetric treatment planning is prospectively performed (e.g. for an emergency treatment).	
S175123	Geometric Plan Data Scope	Data defining beam geometry (i.e. direction and aperture with respect to the patient), e.g. for Virtual Simulation.	
S175170	Jaw Pair	RT beam limiting device jaw pair	
S175172	Leaf Pairs	RT beam limiting device multi-element leaf pairs	
S175174	Variable Circular Collimator	A circular, aperture size adjustable beam limiting device for an RT treatment device.	
S175175	Single Leaves	RT beam limiting device multi-element unpaired leaves	
S175190	X	Oriented in the X direction.	
S175191	Y	Oriented in the Y direction.	
S175270	Physical Compensator	Physical RT external beam compensator to compensate for inhomogeneity.	
S175281	Total Body Irradiation	An RT Treatment irradiating the body of the Patient in part or in whole.	
S175282	Total Skin Irradiation	An RT Treatment irradiating the surface of the skin of the Patient in part or in whole.	
S175305	Isocentric Patient Support Continuous Pitch Angle	Patient Support Continuous Pitch Angle at the isocenter position about the x-axis of the Equipment Coordinate System.	
S175306	Isocentric Patient Support Continuous Roll Angle	Patient Support Continuous Roll Angle at the isocenter position about the y-axis of the Equipment Coordinate System.	

Code Value	Code Meaning	Definition	Notes
S175307	Isocentric Patient Support Continuous Yaw Angle	Patient Support Continuous Yaw Angle at the isocenter position about the z-axis of the Equipment Coordinate System.	
S175308	Isocentric Patient Support Lateral Position	Patient Support Lateral Position along the x-axis of the Equipment Coordinate System.	
S175309	Isocentric Table Top Longitudinal Position	Patient Support Lateral Position along the y-axis of the Equipment Coordinate System.	
S175310	Isocentric Table Top Vertical Position	Patient Support Lateral Position along the z-axis of the Equipment Coordinate System.	
126801	IEC61217 Patient Support Continuous **Yaw** Angle	Patient Support Continuous **Yaw** Angle in IEC PATIENT SUPPORT Coordinate System [IEC 61217] **about the Z-axis of the IEC FIXED REFERENCE** system.	
S175431	Electron Fixed Aperture	A type of device (or “cone”) for electron treatments that attaches to the applicator carriage of an RT treatment device for the purpose of holding an aperture and a bolus close to the patient's skin. Several beam applicators may be available to reduce the weight of apertures lifted by therapists, decrease the aperture/bolus-to-skin distance, and reduce leakage radiation.	
S175432	Photon Fixed Aperture	A type of device (or “cone”) for photon treatments that is attached to the radiation head of an RT treatment device into which beam modifiers are installed.	
S175433	Intraoperative Fixed Aperture	A type of device which is used to delimit the radiation of an RT treatment device in case of an intraoperative radiotherapeutic treatment.	
S175440	Hard Wedge	A physical device placed inside the radiation head used to modify the fluence distribution across the field.	
S175441	Motorized Wedge	A physical device manually placed between the radiation head and the patient used to modify the fluence distribution across the field. It is motorized and can be inserted/extracted from the beam path.	
S175442	Dynamic Wedge	An effective wedge generated by the movement of a jaw across the treatment field while delivering radiation.	
S175451	Graticule	Mechanical grid to embed scaling information in a radiographic image	
S175452	Reticle	Mechanical crosshair to embed a crosshair representing axes and scaling information in a radiographic image	

Code Value	Code Meaning	Definition	Notes
S175453	Image Detector	An electronic radiographic imaging device	
S175454	Film Holder	Mechanical device to hold imaging film	
S175455	Winston-Lutz Pointer	A spherical mechanical indicator used for alignment	
S175456	Bowtie Filter	A bowtie-shaped filter used in imaging	
S175560	Flattening Filter Beam	Beam that uses a filter to produce a nearly uniform intensity profile.	
S175561	Non-Flattening Filter Beam	Beam that does not use a filter to produce a nearly uniform intensity profile.	
S175562	Partial Flattening Filter Beam	Beam that uses a filter to produce a nearly uniform region across part of the intensity profile.	
S175600	Dosimetrist	A medical professional capable of developing a radiotherapy plan from a Physician's prescription.	
S175601	Physics Assistant	A medical professional capable of developing a radiotherapy plan from a Physician's prescription and assisting in radiation machine calibration and other radiotherapy quality assurance work under supervision of a Medical Physicist.	
S175772	Radiation Source	The geometric location of the source of the beam.	
S175773	Machine Isocenter	The center point of the treatment machine through which all beam central axes pass under all gantry angles.	
S175774	Fixed Laser Setup Point	A fixed point at which initial patient setup is performed based on room lasers.	
S175890	Radiotherapy Treatment Device	A device delivering radiotherapy treatments.	
MU	Monitor Units	A measure of machine output of radiotherapy treatment devices. The devices are calibrated to give a particular absorbed dose under particular conditions, although the definition and measurement configuration will vary between facilities.	

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