

Digital Imaging and Communications in Medicine (DICOM)

Supplement 102: Radiotherapy Extensions for Ion Therapy

DICOM Standards Committee, Working Group 7 Radiotherapy Objects

1300 N. 17th Street

Rosslyn, Virginia 22209 USA

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Foreword

2 This document is a Supplement that changes the following parts of the DICOM Standard.

Part 2 Conformance

4 Part 3 Information Object Definitions

Part 4 Service Class Specifications

6 Part 6 Data Dictionary

Scope and Field of Application

8 This supplement defines new Radiotherapy Information Object Definitions to provide support for general
10 lon-based Treatment Planning and Delivery processes. The supplement defines two new IODs based on
the existing RT Plan and RT Beams Treatment Record IODs. Several good arguments exist for creating
new IODs rather than adding more attributes to the existing IODs:

- 12 1. There are many new attributes needed to support Ion Therapy that will not be needed for conventional
therapy.
- 14 2. Vendors may screen for Ion Therapy support at the Association level, rather than the attribute level.
(i.e. A C-STORE request may be rejected based on the Ion Therapy IOD).
- 16 3. In some cases, existing attributes may become conditionally dependent on the Radiation Type
attribute. This may make existing implementations non-compliant with the standard.

18 The specifics of this extension to the Radiotherapy IODs are:

- 20 – The creation of an RT Ion Plan IOD to encapsulate the attributes needed to describe an Ion
Therapy treatment plan.
- 22 – The creation of an RT Ion Beams Treatment Record IOD to encapsulate the attributes needed to
describe an Ion Therapy treatment session.

Table of Contents

2	Foreword	2
	Scope and Field of Application	2
4	Table of Contents	3
	Part 3 Addendum	4
6	10.X SOP INSTANCE REFERENCE MACRO	5
	A.X RT ION PLAN INFORMATION OBJECT DEFINITION	8
8	A.x.1 IOD Description	8
	A.x.2 IOD Modules	8
10	A.Y RT ION BEAMS TREATMENT RECORD INFORMATION OBJECT DEFINITION	8
	A.y.1 IOD Description	8
12	A.y.2 IOD Modules	9
	C.8.8.8.1 Modality.....	9
14	C.8.8.X. RT Ion Tolerance Tables Module	10
	C.8.8.y..... RT Ion Beams Module	11
16	C.8.8.y.0 Beam Identifying Information.....	30
	C.8.8.y.1 Treatment Machine Name	30
18	C.8.8.y.2 Leaf Position Boundaries.....	30
	C.8.8.y.3 Virtual Source-Axis Distances and the use of trays in ion therapy	31
20	C.8.8.y.4 Range Shifter and Lateral Spreading Device Settings	32
	C.8.8.y.5 Coordinate Systems	32
22	C.8.8.y.5.1 Fixed Beam Line	32
	C.8.8.y.5.2 Table Top Pitch and Table Top Roll	33
24	C.8.8.y.5.3 Seated Treatments.....	35
	C.8.8.y.5.4 Ocular Treatments.....	35
26	C.8.8.y.5.4.1 Gantry Beam Line	35
	C.8.8.y.5.4.2 Fixed Beam Line	37
28	C.8.8.y.5.5 Gantry Pitch Angle	37
	C.8.8.z..... RT Ion Beams Session Record Module.....	38
30	C.8.8.w Beam Limiting Device Position Macro	55
	C.8.8.v Patient Support Identification Macro	55
32	Part 4 Addendum	57
	Part 6 Addendum	59

2

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Part 3 Addendum

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Item #1: Insert the following sections in Part 3, Section 10, Miscellaneous Macros

10.X SOP INSTANCE REFERENCE MACRO

Table 10-x specifies the attributes that reference an SOP instance.

**Table 10-x
SOP INSTANCE REFERENCE MACRO ATTRIBUTES**

Attribute Name	Tag	Type	Description
Referenced SOP Class UID	(0008,1150)	1	Uniquely identifies the referenced SOP Class.
Referenced SOP Instance UID	(0008,1155)	1	Uniquely identifies the referenced SOP Instance.

Item #2: Add the following bold-underlined text into Table A.1-2 COMPOSITE INFORMATION OBJECT MODULE OVERVIEW – NON IMAGING

IODs Modules	<u>RT Ion Plan</u>	<u>RT Ion Beams Treatment Record</u>
Patient	<u>M</u>	<u>M</u>
Patient Summary		
Specimen Identification		
Clinical Trial Subject	<u>U</u>	<u>U</u>
General Study	<u>M</u>	<u>M</u>
Patient Study	<u>U</u>	<u>U</u>
Clinical Trial Study	<u>U</u>	<u>U</u>
Study Content		
General Series		
Clinical Trial Series	<u>U</u>	<u>U</u>
PET Series		
PET Isotope		
PET Multi-gated Acquisition		
RT Series	<u>M</u>	<u>M</u>
Presentation Series		
SR Document Series		
Key Object Document Series		
Frame Of Reference	<u>U</u>	

Synchronization		
Cardiac Synchronization		
Respiratory Synchronization		
Bulk Motion Synchronization		
General Equipment	<u>M</u>	<u>M</u>
General Image		
Image Plane		
Image Pixel		
Multi-frame		
Multi-frame Functional Groups		
Multi-frame Dimension		
Mask		
Display Shutter		
Bitmap Display Shutter		
Raw Data		
MR Spectroscopy		
MR Spectroscopy Pulse Sequence		
MR Spectroscopy Data		
RT Dose		
RT DVH		
Structure Set		
ROI Contour		
RT Dose ROI		
RT ROI Observations		
RT General Treatment Record		<u>M</u>
RT Treatment Machine Record		<u>M</u>
Measured Dose Reference Record		<u>U</u>
Calculated Dose Reference Record		<u>U</u>
RT Beams Session Record		
RT Ion Beams Session Record		<u>M</u>
RT Brachy Session Record		
RT Treatment Summary Record		<u>U</u>
RT General Plan	<u>M</u>	
RT Prescription	<u>U</u>	
RT Tolerance Tables	<u>U</u>	
RT Patient Setup	<u>U</u>	<u>U</u>
RT Fraction Scheme	<u>U</u>	

RT Beams		
RT Ion Beams	<u>M</u>	
RT Brachy Application Setups		
Approval	<u>U</u>	
SR Document General		
SR Document Content		
Key Object Document		
Overlay Identification		
Overlay Plane		
Multi-frame Overlay		
Curve Identification		
Curve		
PET Curve		
Audio		
Waveform Identification		
Waveform		
Waveform Annotation		
Displayed Area		
Overlay/Curve Activation		
Graphic Annotation		
Spatial Transformation		
Graphic Layer		
Modality LUT		
VOI LUT		
Softcopy VOI LUT		
Softcopy Presentation LUT		
Image Histogram		
Presentation State		
LUT Identification		
Acquisition Context		
SOP Common	<u>M</u>	<u>M</u>

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Item #3: Insert the following sections in Part 3, Annex A

A.X RT ION PLAN INFORMATION OBJECT DEFINITION

A.x.1 IOD Description

The focus for this Radiotherapy Ion Plan IOD (RT Ion Plan IOD) is to address the requirements for transfer of treatment plans generated by manual entry, a virtual simulation system, or a treatment planning system before or during a course of Ion therapy treatment. Such plans may contain fractionation information, and define Ion beams.

A.x.2 IOD Modules

Table A.x-1 identifies and defines the Modules that comprise this IOD. Modules listed are either mandatory or optional as specified in PS 3.4. Mandatory Modules contain Attributes that are included in all SOP Instances employing this IOD.

**Table A.x-1
RT ION PLAN 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	RT Series	C.8.8.1	M
	Clinical Trial Series	C.7.3.2	U
Frame of Reference	Frame of Reference	C.7.4.1	M
Equipment	General Equipment	C.7.5.1	M
Plan	RT General Plan	C.8.8.9	M
	RT Prescription	C.8.8.10	U
	RT Ion Tolerance Tables	C.8.8.x	U
	RT Patient Setup	C.8.8.12	U
	RT Fraction Scheme	C.8.8.13	U
	RT Ion Beams	C.8.8.y	C - Required if RT Fraction Scheme Module is included and Number of Beams (300A,0080) is greater than zero for one or more fraction groups
	Approval	C.8.8.16	U
SOP Common	C.12.1	M	

A.Y RT ION BEAMS TREATMENT RECORD INFORMATION OBJECT DEFINITION

A.y.1 IOD Description

The Radiotherapy Ion Beams Treatment Record IOD (RT Ion Beams Treatment Record IOD) addresses the requirements for transfer of treatment session reports generated by a treatment verification system during a course of Ion beam treatment, with optional cumulative summary information. It may also be used for transfer of treatment information during delivery.

A.y.2 IOD Modules

2 Table A.y-1 identifies and defines the Modules that comprise this IOD. Modules listed are either
4 mandatory or optional as specified in PS 3.4. Mandatory Modules contain Attributes that are included in
all SOP Instances employing this IOD.

**Table A.y-1
RT ION BEAMS TREATMENT RECORD IOD MODULES**

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
	Clinical Trial Subject	C.7.1.3	U
Study	General Study	C.7.2.1	M
	Clinical Trial Study	C.7.2.3	U
	Patient Study	C.7.2.2	U
Series	RT Series	C.8.8.1	M
	Clinical Trial Series	C.7.3.2	U
Equipment	General Equipment	C.7.5.1	M
Treatment Record	RT General Treatment Record	C.8.8.17	M
	RT Patient Setup	C.8.8.12	U
	RT Treatment Machine Record	C.8.8.18	M
	Measured Dose Reference Record	C.8.8.19	U
	Calculated Dose Reference Record	C.8.8.20	U
	RT Ion Beams Session Record	C.8.8.z	M
	RT Treatment Summary Record	C.8.8.23	U
	SOP Common	C.12.1	M

8 **Item #4: Add the bold, underlined text to the following sections in Part 3, Annex C, Section 8.8**

C.8.8.8.1 Modality

10 The Enumerated Value for Modality (0008,0060) shall be determined by the IOD:

RTIMAGE if RT Image IOD.

12 RTDOSE if RT Dose IOD.

RTSTRUCT if RT Structure Set IOD.

14 RTPLAN if RT Plan IOD **or RT Ion Plan IOD.**

16 RTRECORD if RT Beams Treatment Record IOD, **RT Ion Beams Treatment Record IOD.** RT Brachy Treatment Record IOD, or RT Treatment Summary Record IOD.

Item #5: Insert the following sections in Part 3, Annex C, Section 8.8

C.8.8.X RT Ion Tolerance Tables Module

The RT Ion Tolerance Tables Module contains information describing the maximum allowed differences between the planned and measured attributes for Ion therapy.

**Table C.8.8.X-1
RT ION TOLERANCE TABLES MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Description
Ion Tolerance Table Sequence	(300A,03A0)	1	Introduces sequence of ion tolerance tables to be used for delivery of treatment plan. One or more items shall be included in this sequence. See Note 1.
>Tolerance Table Number	(300A,0042)	1	Identification number of the Tolerance Table. The value of Tolerance Table Number (300A,0042) shall be unique within the RT Ion Plan in which it is created.
>Tolerance Table Label	(300A,0043)	3	User-defined label for Tolerance Table.
>Gantry Angle Tolerance	(300A,0044)	3	Maximum permitted difference (in degrees) between planned and delivered Gantry Angle.
>Beam Limiting Device Angle Tolerance	(300A,0046)	3	Maximum permitted difference (in degrees) between planned and delivered Beam Limiting Device Angle.
>Beam Limiting Device Tolerance Sequence	(300A,0048)	3	Introduces sequence of beam limiting device (collimator) tolerances. One or more items may be included in this sequence.
>>RT Beam Limiting Device Type	(300A,00B8)	1	Type of beam limiting device (collimator). Enumerated Values: X = symmetric jaw pair in IEC X direction Y = symmetric jaw pair in IEC Y direction ASYMX = asymmetric jaw pair in IEC X direction ASYMY = asymmetric pair in IEC Y direction MLCX = multileaf (multi-element) jaw pair in IEC X direction MLCY = multileaf (multi-element) jaw pair in IEC Y direction
>>Beam Limiting Device Position Tolerance	(300A,004A)	1	Maximum permitted difference (in mm) between planned and delivered leaf (element) or jaw positions for current beam limiting device (collimator).
>Patient Support Angle Tolerance	(300A,004C)	3	Maximum permitted difference (in degrees) between planned and delivered Patient

Attribute Name	Tag	Type	Description
			Support Angle.
>Table Top Vertical Position Tolerance	(300A,0051)	3	Maximum permitted difference (in mm) between planned and delivered Table Top Vertical Position.
>Table Top Longitudinal Position Tolerance	(300A,0052)	3	Maximum permitted difference (in mm) between planned and delivered Table Top Longitudinal Position.
>Table Top Lateral Position Tolerance	(300A,0053)	3	Maximum permitted difference (in mm) between planned and delivered Table Top Lateral Position.
>Table Top Pitch Angle Tolerance	(300A,004F)	3	Maximum permitted difference (in degrees) between planned and delivered Table Top Pitch Angle.
>Table Top Roll Angle Tolerance	(300A,0050)	3	Maximum permitted difference (in degrees) between planned and delivered Table Top Roll Angle.
>Snout Position Tolerance	(300A,004B)	3	Maximum permitted difference (in mm) between planned and delivered Snout Position.

- 2 Note 1: Tolerance Tables may be used to compare planned values to actual machine values. If
4 the absolute difference between the planned and actual values exceeds the Tolerance
4 Table value, treatment may be inhibited or the operator may be warned.

C.8.8.y RT Ion Beams Module

- 6 The RT Ion Beams Module contains information defining equipment parameters for delivery of external
6 Ion radiation beams.

8 **Table C.8.8.y-1
RT ION BEAMS MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Description
Ion Beam Sequence	(300A,03A2)	1	Introduces sequence of setup and/or treatment beams for current RT Ion Plan. One or more items shall be included in this sequence.
>Beam Number	(300A,00C0)	1	Identification number of the Beam. The value of Beam Number (300A,00C0) shall be unique within the RT Ion Plan in which it is created. See section C.8.8.y.0.
>Beam Name	(300A,00C2)	1	User-defined name for Beam. See section C.8.8.y.0.
>Beam Description	(300A,00C3)	3	User-defined description for Beam. See section C.8.8.y.0.
>Beam Type	(300A,00C4)	1	Motion characteristic of Beam. Enumerated Values: STATIC = all beam parameters remain

Attribute Name	Tag	Type	Description
			unchanged during delivery DYNAMIC = one or more beam parameters changes during delivery
>Radiation Type	(300A,00C6)	1	Particle type of Beam. Defined Terms: PHOTON PROTON ION
>Radiation Mass Number	(300A,0302)	1C	Mass number of radiation. Required if Radiation Type (300A,00C6) is ION
>Radiation Atomic Number	(300A,0304)	1C	Atomic number of radiation. Required if Radiation Type (300A,00C6) is ION
>Radiation Charge State	(300A,0306)	1C	Charge state of radiation. Required if Radiation Type (300A,00C6) is ION
>Scan Mode	(300A,0308)	1	The method of beam scanning to be used during treatment. Defined Terms: NONE = No beam scanning is performed. UNIFORM = The beam is scanned between control points to create a uniform lateral fluence distribution across the field. MODULATED = The beam is scanned between control points to create a modulated lateral fluence distribution across the field.
>Treatment Machine Name	(300A,00B2)	2	User-defined name identifying treatment machine to be used for beam delivery. See section C.8.8.y.1.
>Manufacturer	(0008,0070)	3	Manufacturer of the equipment to be used for beam delivery.
>Institution Name	(0008,0080)	3	Institution where the equipment is located that is to be used for beam delivery.
>Institution Address	(0008,0081)	3	Mailing address of the institution where the equipment is located that is to be used for beam delivery.
>Institutional Department Name	(0008,1040)	3	Department in the institution where the equipment is located that is to be used for beam delivery.
>Manufacturer's Model Name	(0008,1090)	3	Manufacturer's model name of the equipment that is to be used for beam delivery.
>Device Serial Number	(0018,1000)	3	Manufacturer's serial number of the equipment that is to be used for beam delivery.

Attribute Name	Tag	Type	Description
>Primary Dosimeter Unit	(300A,00B3)	1	Measurement unit of machine dosimeter. Enumerated Values: MU = Monitor Unit NP = number of particles
>Referenced Tolerance Table Number	(300C,00A0)	3	Uniquely identifies Tolerance Table specified by Tolerance Table Number (300A,0042) within Tolerance Table Sequence in RT Ion Tolerance Tables Module. These tolerances are to be used for verification of treatment machine settings.
>Virtual Source-Axis Distances	(300A,030A)	1	Distance (in mm) from virtual source position to gantry rotation axis or nominal isocenter position (fixed beam-lines) of the equipment to be used for beam delivery. Specified by a numeric pair - the VSAD in the IEC Gantry X direction followed by the VSAD in the IEC Gantry Y direction. The VSAD is commonly used for designing apertures in contrast to the effective source-axis-distance (ESAD) that is commonly used with the inverse square law for calculating the dose decrease with distance. See section C.8.8.y.3.
>Ion Beam Limiting Device Sequence	(300A,03A4)	3	Introduces sequence of beam limiting device (collimator) jaw or leaf (element) sets. One or more items may be included in this sequence.
>>RT Beam Limiting Device Type	(300A,00B8)	1	Type of beam limiting device (collimator). Enumerated Values: X = symmetric jaw pair in IEC X direction Y = symmetric jaw pair in IEC Y direction ASYMX = asymmetric jaw pair in IEC X direction ASYMY = asymmetric pair in IEC Y direction MLCX = multileaf (multi-element) jaw pair in IEC X direction MLCY = multileaf (multi-element) jaw pair in IEC Y direction
>>Isocenter to Beam Limiting Device Distance	(300A,00BB)	2	Isocenter to beam limiting device (collimator) distance (in mm) of the equipment that is to be used for beam delivery. See section C.8.8.y.3.

Attribute Name	Tag	Type	Description
>>Number of Leaf/Jaw Pairs	(300A,00BC)	1	Number of leaf (element) or jaw pairs (equal to 1 for standard beam limiting device jaws).
>>Leaf Position Boundaries	(300A,00BE)	1C	Boundaries of beam limiting device (collimator) leaves (in mm) in IEC BEAM LIMITING DEVICE coordinate axis appropriate to RT Beam Limiting Device Type (300A,00B8), i.e. X-axis for MLCY, Y-axis for MLCX. Contains N+1 values, where N is the Number of Leaf/Jaw Pairs (300A,00BC), starting from Leaf (Element) Pair 1. Required if RT Beam Limiting Device Type (300A,00B8) is MLCX or MLCY. See section C.8.8.y.2.
>Referenced Patient Setup Number	(300C,006A)	3	Uniquely identifies Patient Setup to be used for current beam, specified by Patient Setup Number (300A,0182) within Patient Setup Sequence of RT Patient Setup Module.
>Referenced Reference Image Sequence	(300C,0042)	3	Introduces sequence of reference images used for validation of current beam. One or more items may be included in this sequence.
>>Include SOP Instance Reference Macro Table 10-3			
>>Reference Image Number	(300A,00C8)	1	Uniquely identifies Reference Image within Referenced Reference Image Sequence (300C,0042).
>Treatment Delivery Type	(300A,00CE)	1	Delivery Type of treatment. Defined Terms: TREATMENT = normal patient treatment OPEN_PORTFILM = portal image acquisition with open field (the source of radiation is specified by Radiation Type (300A, 00C6)) TRMT_PORTFILM = portal image acquisition with treatment port (the source of radiation is specified by Radiation Type (300A, 00C6)) CONTINUATION = continuation of interrupted treatment SETUP = no treatment beam is applied for this RT Beam. To be used for specifying the gantry, couch, and other machine positions where X-ray set-up images or measurements shall be taken.

Attribute Name	Tag	Type	Description
>Referenced Dose Sequence	(300C,0080)	3	Introduces sequence of related SOP Class/Instance pairs describing related instances of RT Dose (for grids, isodose curves, and named/unnamed point doses). One or more items may be included in this sequence.
>>Include SOP Instance Reference Macro Table 10-3			<i>The Referenced Class SOP UID shall be that of the RT Dose SOP Class (1.2.840.10008.5.1.4.1.1.481.2)</i>
>Number of Wedges	(300A,00D0)	1	Number of wedges associated with current beam.
>Total Wedge Tray Water-Equivalent Thickness	(300A,00D7)	3	Shift of the wedge tray induced on the range of the ion beam as measured in water (in mm).
>Ion Wedge Sequence	(300A,03AA)	1C	Introduces sequence of treatment wedges. Required if Number of Wedges (300A,00D0) is non-zero. The number of items shall be identical to the value of Number of Wedges (300A,00D0).
>>Wedge Number	(300A,00D2)	1	Identification number of the Wedges. The value of Wedge Number (300A,00D2) shall be unique within the Beam in which it was created.
>>Wedge Type	(300A,00D3)	2	<p>Typers of wedge (if any) defined for Beam.</p> <p>Defined Terms:</p> <p>STANDARD = standard (static) wedge</p> <p>MOTORIZED = single wedge that can be removed from beam remotely.</p> <p>PARTIAL_STANDARD = wedge does not extend across the whole field and is operated manually.</p> <p>PARTIAL_MOTORIZ = wedge does not extend across the whole field and can be removed from beam remotely.</p>
>>Wedge ID	(300A,00D4)	3	User-supplied identifier for Wedge.
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.
>>Wedge Angle	(300A,00D5)	2	Nominal wedge angle (degrees).
>>Wedge Orientation	(300A,00D8)	2	Orientation of wedge, i.e. orientation of IEC WEDGE FILTER coordinate system with respect to the IEC BEAM LIMITING DEVICE coordinate systems (degrees).
>>Isocenter to Wedge Tray Distance	(300A,00D9)	1	Isocenter to downstream edge of wedge tray (mm).

Attribute Name	Tag	Type	Description
			See section C.8.8.y.3
>Number of Compensators	(300A,00E0)	1	Number of compensators associated with current Beam.
>Total Compensator Tray Water-Equivalent Thickness	(300A,02E3)	3	Water-Equivalent thickness of the compensator tray (in mm) parallel to radiation beam axis.
>Ion Range Compensator Sequence	(300A,02EA)	1C	Introduces sequence of compensators. Required if Number of Compensators (300A,00E0) is non-zero. The number of items shall be identical to the value of Number of Compensators (300A,00E0).
>>Compensator Number	(300A,00E4)	1	Identification number of the Compensator. The value of Compensator Number (300A,00E4) shall be unique within the Beam in which it is created.
>>Material ID	(300A,00E1)	2	User-supplied identifier for material used to manufacture Compensator.
>>Compensator ID	(300A,00E5)	3	User-supplied identifier for the compensator.
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.
>>Isocenter to Compensator Tray Distance	(300A,02E4)	1C	Isocenter to compensator tray attachment edge distance (in mm) for current range compensator. Required if Compensator Mounting Position (300A,02E1) is not DOUBLE_SIDED. See section C.8.8.y.3
>>Compensator Divergence	(300A,02E0)	1	Indicates presence or absence of geometrical divergence of the range compensator. Enumerated Values: PRESENT = the range compensator is shaped according to the beam geometrical divergence. ABSENT = the range compensator is not shaped according to the beam geometrical divergence.
>>Compensator Mounting Position	(300A,02E1)	1	Indicates on which side of the Compensator Tray the compensator is mounted. Enumerated Values: PATIENT_SIDE = the Compensator is mounted on the side of the Compensator Tray that is towards the patient. SOURCE_SIDE = the Compensator is mounted on the side of the Compensator Tray that is towards the radiation source. DOUBLE_SIDED = the Compensator has a

Attribute Name	Tag	Type	Description
			shaped (i.e. non-flat) surface on both sides of the Compensator Tray.
>>Compensator Rows	(300A,00E7)	1	Number of rows in the range compensator.
>>Compensator Columns	(300A,00E8)	1	Number of columns in the range compensator.
>>Compensator Pixel Spacing	(300A,00E9)	1	Physical distance (in mm) between the center of each pixel projected onto machine isocentric plane. Specified by a numeric pair - adjacent row spacing followed by adjacent column spacing.
>>Compensator Position	(300A,00EA)	1	The x and y coordinates of the upper left hand corner (first pixel transmitted) of the range compensator, projected onto the machine isocentric plane in the IEC BEAM LIMITING DEVICE coordinate system (mm).
>>Compensator Column Offset	(300A,02E5)	1C	The offset distance (in mm) applied to the x coordinate of the Compensator Position (300A,00EA) for even numbered rows. Required if the compensator pattern is hexagonal.
>>Compensator Physical Thickness Data	(300A,00EC)	1	A data stream of the pixel samples that comprise the range compensator, expressed as physical thickness (in mm), either parallel to radiation beam axis if Compensator Divergence (300A,02E0) equals ABSENT, or divergent according to the beam geometrical divergence if Compensator Divergence (300A,02E0) equals PRESENT. The order of pixels sent is left to right, top to bottom (upper left pixel, followed by the remainder of row 1, followed by the remainder of the rows).
>>Isocenter to Compensator Distances	(300A,02E6)	1C	A data stream of the pixel samples that comprise the distance from the isocenter to the compensator surface closest to the radiation source (in mm). The order of pixels sent is left to right, top to bottom (upper left pixel, followed by the remainder of row 1, followed by the remainder of the rows). Required if Material ID (300A,00E1) is non-zero length, and Compensator Mounting Position (300A,02E1) is DOUBLE_SIDED. See sections C.8.8.14.9 and C.8.8.y.3
>>Compensator Relative Linear Stopping Power Ratio	(300A,02E7)	3	Compensator Linear Stopping Power Ratio, relative to water, at the beam energy specified by the Nominal Beam Energy (300A,0114) of the first Control Point of the

Attribute Name	Tag	Type	Description
			Ion Control Point Sequence (300A,03A8).
>>Compensator Milling Tool Diameter	(300A,02E8)	3	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 projected size at isocenter.
>Number of Boli	(300A,00ED)	1	Number of boli associated with current Beam.
>Referenced Bolus Sequence	(300C,00B0)	1C	Introduces sequence of boli associated with Beam. Required if Number of Boli (300A,00ED) is non-zero. The number of items shall be identical to the value of Number of Boli (300A,00ED).
>>Referenced ROI Number	(3006,0084)	1	Uniquely identifies ROI representing the Bolus specified by ROI Number (3006,0022) in Structure Set ROI Sequence (3006,0020) in Structure Set Module within RT Structure Set in Referenced Structure Set Sequence (300C,0060) in RT General Plan Module.
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.
>Number of Blocks	(300A,00F0)	1	Number of shielding blocks associated with Beam.
>Total Block Tray Water-Equivalent Thickness	(300A,00F3)	3	Water-Equivalent thickness of the block tray (in mm) parallel to radiation beam axis.
>Ion Block Sequence	(300A,03A6)	1C	Introduces sequence of blocks associated with Beam. Required if Number of Blocks (300A,00F0) is non-zero. The number of items shall be identical to the value of Number of Blocks (300A,00F0).
>>Block Tray ID	(300A,00F5)	3	User-supplied identifier for block tray.
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.
>>Isocenter to Block Tray Distance	(300A,00F7)	1	Isocenter to downstream edge of block tray (mm). Required if Block Sequence (300A,00F4) is sent. See section C.8.8.y.3
>>Block Type	(300A,00F8)	1	Type of block. See section C.8.8.14.4. Enumerated Values: SHIELDING = blocking material is inside contour APERTURE = blocking material is outside contour
>>Block Divergence	(300A,00FA)	1	Indicates presence or otherwise of geometrical divergence.

Attribute Name	Tag	Type	Description
			Enumerated Values: PRESENT = block edges are shaped for beam divergence ABSENT = block edges are not shaped for beam divergence
>>Block Mounting Position	(300A,00FB)	1	Indicates on which side of the Block Tray the block is mounted. Enumerated Values; PATIENT_SIDE = the block is mounted on the side of the Block Tray that is towards the patient. SOURCE_SIDE = the block is mounted on the side of the Block Tray that is towards the radiation source.
>>Block Number	(300A,00FC)	1	Identification number of the Block. The value of Block Number (300A,00FC) shall be unique within the Beam in which it is created.
>>Block Name	(300A,00FE)	3	User-defined name for block.
>>Material ID	(300A,00E1)	2	User-supplied identifier for material used to manufacture Block.
>>Block Thickness	(300A,0100)	1	Physical thickness of block (in mm) parallel to radiation beam axis. See section C.8.8.14.4.
>>Block Number of Points	(300A,0104)	1	Number of (x,y) pairs defining the block edge.
>>Block Data	(300A,0106)	1	A data stream of (x,y) pairs that comprise the block edge. The number of pairs shall be equal to Block Number of Points (300A,0104), and the vertices shall be interpreted as a closed polygon. Coordinates are projected onto the machine isocentric plane in the IEC BEAM LIMITING DEVICE coordinate system (mm).
>Snout Sequence	(300A,030C)	3	Introduces sequence of Snouts associated with Beam. Only a single item shall be permitted in this sequence.
>>Snout ID	(300A,030F)	1	User or machine supplied identifier for Snout.
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.
>Applicator Sequence	(300A,0107)	3	Introduces sequence of Applicators associated with Beam. Only a single item shall be permitted in this sequence.

Attribute Name	Tag	Type	Description
>>Applicator ID	(300A,0108)	1	User or machine supplied identifier for Applicator. See section C.8.8.14.12
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.
>>Applicator Type	(300A,0109)	1	Type of applicator. Defined Terms: ION_SQUARE = square ion applicator ION_RECT = rectangular ion applicator ION_CIRC = circular ion applicator ION_SHORT = short ion applicator ION_OPEN = open (dummy) ion applicator INTEROPERATIVE = interoperative (custom) applicator STEREOTACTIC = stereotactic applicator
>>Applicator Description	(300A,010A)	3	User-defined description for Applicator.
>Number of Range Shifters	(300A,0312)	1	Number of range shifters associated with current beam.
>Range Shifter Sequence	(300A,0314)	1C	Introduces sequence of range shifters associated with Beam. Required if Number of Range Shifters (300A,0312) is non-zero. The number of items shall be identical to the value of Number of Range Shifters (300A,0312).
>>Range Shifter Number	(300A,0316)	1	Identification number of the Range Shifter. The value of Range Shifter Number (300A,0316) shall be unique within the Beam in which it is created.
>>Range Shifter ID	(300A,0318)	1	User or machine supplied identifier for Range Shifter.
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.
>>Range Shifter Type	(300A,0320)	1	Type of Range Shifter. Defined Terms: ANALOG = Device is variable thickness and is composed of opposing sliding wedges, water column or similar mechanism. BINARY = Device is composed of different thickness materials that can be moved in or out of the beam in various stepped combinations.
>>Range Shifter Description	(300A,0322)	3	User defined description of Range Shifter.

Attribute Name	Tag	Type	Description
>Number of Lateral Spreading Devices	(300A,0330)	1	Number of lateral spreading devices associated with current beam.
>Lateral Spreading Device Sequence	(300A,0332)	1C	Introduces sequence of lateral spreading devices associated with Beam. Required if Number of Lateral Spreading Devices (300A,0330) is non-zero. The number of items shall be identical to the value of Number of Lateral Spreading Devices (300A,0330).
>>Lateral Spreading Device Number	(300A,0334)	1	Identification number of the Lateral Spreading Device. The value of Lateral Spreading Device Number (300A,0334) shall be unique within the Beam in which it is created.
>>Lateral Spreading Device ID	(300A,0336)	1	User or machine supplied identifier for Lateral Spreading Device.
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.
>>Lateral Spreading Device Type	(300A,0338)	1	Type of Lateral Spreading Device. Defined Terms: SCATTERER = metal placed into the beam path to scatter charged particles laterally. MAGNET = nozzle configuration of magnet devices to expand beam laterally.
>>Lateral Spreading Device Description	(300A,033A)	3	User-defined description for lateral spreading device.
>Number of Range Modulators	(300A,0340)	1	Number of range modulators associated with current beam.
>Range Modulator Sequence	(300A,0342)	1C	Introduces sequence of range modulators associated with Beam. Required if Number of Range Modulators (300A,0340) is non-zero. The number of items shall be identical to the value of Number of Range Modulators (300A,0340).
>>Range Modulator Number	(300A,0344)	1	Identification number of the Range Modulator. The value of Range Modulator Number (300A,0344) shall be unique within the Beam in which it is created.
>>Range Modulator ID	(300A,0346)	1	User or machine supplied identifier for Range Modulator.
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.
>>Range Modulator Type	(300A,0348)	1	Type of Range Modulator. Defined Terms: FIXED = fixed modulation width and

Attribute Name	Tag	Type	Description
			<p>weights using ridge filter or constant speed wheel with constant beam current</p> <p>WHL_FIXEDWEIGHTS = selected wheel/track (Range Modulator ID) is spinning at constant speed. Modulation width is adjusted by switching constant beam current on and off at wheel steps indicated by Range Modulator Gating Values.</p> <p>WHL_MODWEIGHTS = selected wheel/track (Range Modulator ID) is spinning at constant speed. Weight per wheel step is adjusted by modulating beam current according to selected Beam Current Modulation ID (300A,034C).</p> <p>Only one item in the Range Modulator Sequence (300A,0342) can have a Range Modulator Type (300A,0348) of WHL_MODWEIGHTS.</p>
>>Range Modulator Description	(300A,034A)	3	User-defined description of Range Modulator.
>>Beam Current Modulation ID	(300A,034C)	1C	User-supplied identifier for the beam current modulation pattern. Required if Range Modulator Type (300A,0348) is WHL_MODWEIGHTS
>Include Patient Support Identification Macro Table C.8.8.v-1			
>Fixation Light Azimuthal Angle	(300A,0356)	3	Azimuthal angle (degrees) of the fixation light coordinate around IEC BEAM LIMITING DEVICE Y-axis. Used for eye treatments. See section C.8.8.y.5.4.
>Fixation Light Polar Angle	(300A,0358)	3	Polar angle (degrees) of the fixation light coordinate. Used for eye treatments. See section C.8.8.y.5.4.
>Final Cumulative Meterset Weight	(300A,010E)	1C	Value of Cumulative Meterset Weight (300A,0134) for final Control Point in Ion Control Point Sequence (300A,03A8). Required if Cumulative Meterset Weight is non-null in Control Points specified within Ion Control Point Sequence. See section C.8.8.14.1.
>Number of Control Points	(300A,0110)	1	Number of control points in Beam. Value shall be greater than or equal to 2.
>Ion Control Point Sequence	(300A,03A8)	1	Introduces sequence of machine configurations describing Ion treatment beam. The number of items shall be identical to the value of Number of Control Points (300A,0110).

Attribute Name	Tag	Type	Description
>>Control Point Index	(300A,0112)	1	Index of current Control Point, starting at 0 for first Control Point.
>>Cumulative Meterset Weight	(300A,0134)	2	Cumulative weight to current control point. Cumulative Meterset Weight for the first item in Control Point Sequence shall always be zero. Cumulative Meterset Weight for the final item in Ion Control Point Sequence shall always be equal to Final Cumulative Meterset Weight.
>>Referenced Dose Reference Sequence	(300C,0050)	3	Introduces a sequence of Dose References for current Beam. One or more items may be included in this sequence.
>>>Referenced Dose Reference Number	(300C,0051)	1	Uniquely identifies Dose Reference specified by Dose Reference Number (300A,0012) in Dose Reference Sequence (300A,0010) in RT Prescription Module.
>>>Cumulative Dose Reference Coefficient	(300A,010C)	2	Coefficient used to calculate cumulative dose contribution from this Beam to the referenced Dose Reference at the current Control Point.
>>Nominal Beam Energy	(300A,0114)	1C	Nominal Beam Energy at control point in MeV per nucleon. Defined at nozzle entrance before all Beam Modifiers. Required for first item of Control Point Sequence, or if Nominal Beam Energy changes during Beam, and KVp (0018,0060) is not present.
>>KVp	(0018,0060)	1C	Peak kilo voltage output of the setup X-Ray generator to be used. Required for first item of Control Point Sequence, or if KVp changes during setup, and Nominal Beam Energy (300A,0114) is not present.
>>Meterset Rate	(300A,035A)	3	Specifies the speed of delivery of the specified dose in units specified by Primary Dosimeter Unit (300A, 00B3) per minute.
>>Ion Wedge Position Sequence	(300A,03AC)	1C	Introduces sequence of Wedge positions for current control point. Required for first item of Ion Control Point Sequence if Number of Wedges (300A,00D0) is non-zero, and in subsequent control points if Wedge Position (300A,0118) or Wedge Thin Edge Position (300A,00DB) changes during beam. The number of items shall be identical to the value of Number of Wedges (300A,00D0).

Attribute Name	Tag	Type	Description
>>>Referenced Wedge Number	(300C,00C0)	1	Uniquely references Wedge described by Wedge Number (300A,00D2) in Wedge Sequence (300A,00D1).
>>>Wedge Position	(300A,0118)	1	Position of Wedge at current Control Point. Enumerated Values: IN OUT
>>>Wedge Thin Edge Position	(300A,00DB)	1C	Closest distance from the central axis of the beam along a wedge axis to the thin edge as projected to the machine isocentric plane (mm). Value is positive if the wedge does not cover the central axis, negative if it does. Required if Wedge Type (300A,00D3) of the wedge referenced by Referenced Wedge Number (300C,00C0) is PARTIAL_STANDARD or PARTIAL_MOTORIZED. See section C.8.8.y.5.4.
>>Range Shifter Settings Sequence	(300A,0360)	1C	Introduces sequence of Range Shifter settings for the current control point. One or more items shall be included in this sequence. Required for first item of Control Point Sequence if Number of Range Shifters (300A,0312) is non-zero, or if Range Shifter Setting (300A,0362) changes during Beam.
>>>Referenced Range Shifter Number	(300C,0100)	1	Uniquely references Range Shifter described by Range Shifter Number (300A,0316) in Range Shifter Sequence (300A,0314).
>>>Range Shifter Setting	(300A,0362)	1	Machine specific setting attribute for the range shifter. The specific encoding of this value should be documented in a Conformance Statement. See section C.8.8.y.4.
>>>Isocenter to Range Shifter Distance	(300A,0364)	3	Isocenter to downstream edge of range shifter (mm) at current control point. See section C.8.8.y.3
>>>Range Shifter Water Equivalent Thickness	(300A,0366)	3	Water equivalent thickness (in mm) of the range shifter at the central axis for the beam energy incident upon the device.
>>Lateral Spreading Device Settings Sequence	(300A,0370)	1C	Introduces sequence of Lateral Spreading Device settings for the current control point. One or more items shall be included in this sequence. Required for first item of Control Point Sequence if Number of Lateral Spreading Devices (300A,0330) is non-

Attribute Name	Tag	Type	Description
			zero, or if Lateral Spreading Device Setting (300A,0372) changes during Beam.
>>>Referenced Lateral Spreading Device Number	(300C,0102)	1	Uniquely references Lateral Spreading Device described by Lateral Spreading Device Number (300A,0334) in Lateral Spreading Device Sequence (300A,0332).
>>>Lateral Spreading Device Setting	(300A,0372)	1	Machine specific setting attribute for the lateral spreading device. The specific encoding of this value should be documented in a Conformance Statement. See section C.8.8.y.4.
>>>Isocenter to Lateral Spreading Device Distance	(300A,0374)	3	Isocenter to downstream edge of Lateral Spreading Device (mm) at current control point. See section C.8.8.y.3
>>>Lateral Spreading Device Water Equivalent Thickness	(300A,033C)	3	Water equivalent thickness (in mm) of the lateral spreading device at the central axis for the beam energy incident upon the device.
>>Range Modulator Settings Sequence	(300A,0380)	1C	Introduces sequence of Range Modulator Settings for current control point. One or more items shall be included in this sequence. Required for first item of Control Point Sequence if Number of Range Modulators (300A,0340) is non-zero, or if Range Modulator Setting changes during Beam.
>>>Referenced Range Modulator Number	(300C,0104)	1	Uniquely references Range Modulator described by Range Modulator Number (300A,0344) in Range Modulator Sequence (300A,0342).
>>>Range Modulator Gating Start Value	(300A,0382)	1C	Start position defines the range modulator position at which the beam is switched on. Required if Range Modulator Type (300A,0348) of the range modulator referenced by Referenced Range Modulator Number (300C,0104) is WHL_MODWEIGHTS or WHL_FIXEDWEIGHTS
>>>Range Modulator Gating Stop Value	(300A,0384)	1C	Stop position defines the range modulator position at which the beam is switched off. Required if Range Modulator Type (300A,0348) of the range modulator referenced by Referenced Range Modulator Number (300C,0104) is WHL_MODWEIGHTS or WHL_FIXEDWEIGHTS
>>>Range Modulator Gating Start Water Equivalent Thickness	(300A,0386)	3	If Range Modulator Type (300A,0348) is WHL_MODWEIGHTS or

Attribute Name	Tag	Type	Description
			<p>WHL_FIXEDWEIGHTS: Water equivalent thickness (in mm) of the range modulator at the position specified by Range Modulator Gating Start Value (300A,0382).</p> <p>If Range Modulator Type (300A,0348) is FIXED: Minimum water equivalent thickness (in mm) of the range modulator.</p>
>>>Range Modulator Gating Stop Water Equivalent Thickness	(300A,0388)	3	<p>If Range Modulator Type (300A,0348) is WHL_MODWEIGHTS or WHL_FIXEDWEIGHTS: Water equivalent thickness (in mm) of the range modulator at the position specified by Range Modulator Gating Stop Value (300A,0384).</p> <p>If Range Modulator Type (300A,0348) is FIXED: Maximum water equivalent thickness (in mm) of the range modulator.</p>
>>>Isocenter to Range Modulator Distance	(300A,038A)	3	Isocenter to downstream edge of range modulator (mm) at current control point. See section C.8.8.y.3
<i>>>Include Beam Limiting Device Position Macro Table C.8.8.w-1</i>			
>>Gantry Angle	(300A,011E)	1C	Gantry angle of radiation source, i.e. orientation of IEC GANTRY coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees). Required for first item of Control Point Sequence, or if Gantry Angle changes during Beam.
>>Gantry Rotation Direction	(300A,011F)	1C	<p>Direction of Gantry Rotation when viewing gantry from isocenter, for segment following Control Point. Required for first item of Control Point Sequence, or if Gantry Rotation Direction changes during Beam. See section C.8.8.14.8.</p> <p>Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation</p>
>>Gantry Pitch Angle	(300A,014A)	2C	Gantry Pitch Angle of the radiation source, i.e. the rotation of the IEC GANTRY coordinate system about the X-axis of the IEC GANTRY coordinate system (degrees). Required for first item of Control

Attribute Name	Tag	Type	Description
			Point Sequence, or if Gantry Pitch Rotation Angle changes during Beam. See C.8.8.y.5.5.
>>Gantry Pitch Rotation Direction	(300A,014C)	2C	<p>Direction of Gantry Pitch Angle when viewing along the positive X-axis of the IEC GANTRY coordinate system, for segment following Control Point. Required for first item of Control Point Sequence, or if Gantry Pitch Rotation Direction changes during Beam. See C.8.8.14.8 and C.8.8.y.5.5.</p> <p>Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation</p>
>>Beam Limiting Device Angle	(300A,0120)	1C	<p>Beam Limiting Device angle, i.e. orientation of IEC BEAM LIMITING DEVICE coordinate system with respect to IEC GANTRY coordinate system (degrees). Required for first item of Control Point Sequence, or if Beam Limiting Device Angle changes during Beam.</p>
>>Beam Limiting Device Rotation Direction	(300A,0121)	1C	<p>Direction of Beam Limiting Device Rotation when viewing beam limiting device (collimator) from radiation source, for segment following Control Point. Required for first item of Control Point Sequence, or if Beam Limiting Device Rotation Direction changes during Beam. See section C.8.8.14.8.</p> <p>Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation</p>
>>Scan Spot Tune ID	(300A,0390)	1C	<p>User-supplied or machine code identifier for machine configuration to produce beam spot. This may be the nominal spot size or some other machine specific value. Required if Scan Mode (300A,0308) is MODULATED.</p>
>>Number of Scan Spot Positions	(300A,0392)	1C	<p>Number of spot positions used to specify scanning pattern for current segment beginning at control point. Required if Scan Mode (300A,0308) is MODULATED.</p>
>>Scan Spot Position Map	(300A,0394)	1C	<p>The x and y coordinates of the scan spots are defined as projected onto the machine isocentric plane in the IEC GANTRY coordinate system (mm). Required if Scan</p>

Attribute Name	Tag	Type	Description
			Mode (300A,0308) is MODULATED. Contains 2N values where N is the Number of Scan Spot Positions (300A,0392).
>>Scan Spot Meterset Weights	(300A,0396)	1C	A data set of meterset weights corresponding to scan spot positions. The order of weights matches the positions in Scan Spot Positions (300A,0394). The sum contained in all meterset weights shall match the difference of the cumulative meterset weight of the current control point to the following control point. Required if Scan Mode (300A,0308) is MODULATED.
>>Scanning Spot Size	(300A,0398)	3	The Scanning Spot Size as calculated using the Full Width Half Maximum (FWHM). Specified by a numeric pair - the size measured in air at isocenter in IEC GANTRY X direction followed by the size in the IEC GANTRY Y direction (mm).
>>Number of Paintings	(300A,039A)	1C	The number of times the scan pattern given by Scan Spot Position Map (300A,0394) and Scan Spot Meterset Weights (300A,0396) shall be applied at the current control point. To obtain the meterset weight per painting, the values in the Scan Spot Meterset Weights (300A,0396) should be divided by the value of this attribute. Required if Scan Mode (300A,0308) is MODULATED.
>>Patient Support Angle	(300A,0122)	1C	Patient Support angle, i.e. orientation of IEC PATIENT SUPPORT (turntable) coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees). Required for first item of Control Point Sequence, or if Patient Support Angle changes during Beam.
>>Patient Support Rotation Direction	(300A,0123)	1C	Direction of Patient Support Rotation when viewing table from above, for segment following Control Point. Required for first item of Control Point Sequence, or if Patient Support Rotation Direction changes during Beam. See section C.8.8.14.8. Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation
>>Table Top Pitch Angle	(300A,0140)	2C	Table Top Pitch Angle, i.e. the rotation of the IEC TABLE TOP coordinate system about the X-axis of the IEC TABLE TOP

Attribute Name	Tag	Type	Description
			coordinate system (degrees). Required for first item of Control Point Sequence, or if Table Top Pitch Angle changes during Beam. See section C.8.8.y.5.2.
>>Table Top Pitch Rotation Direction	(300A,0142)	2C	<p>Direction of Table Top Pitch Rotation when viewing the table along the positive X-axis of the IEC TABLE TOP coordinate system, for segment following Control Point. Required for first item of Control Point Sequence, or if Table Top Pitch Rotation Direction changes during Beam. See C.8.8.14.8 and C.8.8.y.5.2.</p> <p>Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation</p>
>>Table Top Roll Angle	(300A,0144)	2C	Table Top Roll Angle, i.e. the rotation of the IEC TABLE TOP coordinate system about the Y-axis of the IEC TABLE TOP coordinate system (degrees). Required for first item of Control Point Sequence, or if Table Top Roll Angle changes during Beam. See section C.8.8.y.5.2.
>>Table Top Roll Rotation Direction	(300A,0146)	2C	<p>Direction of Table Top Roll Rotation when viewing the table along the positive Y-axis of the IEC TABLE TOP coordinate system, for segment following Control Point. Required for first item of Control Point Sequence, or if Table Top Roll Rotation Direction changes during Beam. See C.8.8.14.8 and C.8.8.y.5.2.</p> <p>Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation.</p>
>>Head Fixation Angle	(300A,0148)	3	Angle (in degrees) of the head fixation for eye treatments with respect to the Table Top Pitch Angle (300A,0140) coordinate system. Positive head fixation angle is the same direction as positive Table Top pitch. See section C.8.8.y.5.4.
>>Table Top Vertical Position	(300A,0128)	2C	Table Top Vertical position in IEC TABLE TOP coordinate system (mm). Required for first item of Control Point Sequence, or if Table Top Vertical Position changes during Beam. See section C.8.8.14.6.

Attribute Name	Tag	Type	Description
>>Table Top Longitudinal Position	(300A,0129)	2C	Table Top Longitudinal position in IEC TABLE TOP coordinate system (mm). Required for first item of Control Point Sequence, or if Table Top Longitudinal Position changes during Beam. See section C.8.8.14.6.
>>Table Top Lateral Position	(300A,012A)	2C	Table Top Lateral position in IEC TABLE TOP coordinate system (mm). Required for first item of Control Point Sequence, or if Table Top Lateral Position changes during Beam. See section C.8.8.14.6.
>>Snout Position	(300A,030D)	2C	Axial position of the snout (in mm) measured from isocenter to the downstream side of the snout (without consideration of variable length elements such as blocks, MLC and/or compensators). Required for first item in Control Point Sequence, or if Snout Position changes during Beam.
>>Isocenter Position	(300A,012C)	2C	Isocenter coordinates (x,y,z) in the patient based coordinate system described in C.7.6.2.1.1 (mm). Required for first item of Segment Control Point Sequence, or if Segment Isocenter Position changes during Beam.
>>Surface Entry Point	(300A,012E)	3	Patient surface entry point coordinates (x,y,z), along the central axis of the beam, in the patient based coordinate system described in C.7.6.2.1.1 (mm).

2 **C.8.8.y.0 Beam Identifying Information**

4 Beam Number (300A,00C0) is provided to link related information across modules, and its value has no
6 real-world interpretation. Beam Name (300A,00C2), a Type 1 attribute, is intended to store the primary
beam identifier (often referred to as “Field ID”). Beam Description (300A,00C3), a Type 3 attribute, is
intended to store additional beam identifying information (often referred to as “Field Name”).

8 **C.8.8.y.1 Treatment Machine Name**

8 The DICOM standard does not support the transmission of treatment unit modeling information such as
10 depth doses and beam profiles. In the case of Ion therapy, the Treatment Machine Name attribute is used
to uniquely identify a treatment port (or beam line), since there is in effect only one treatment machine (i.e.
synchrotron).

12 **C.8.8.y.2 Leaf Position Boundaries**

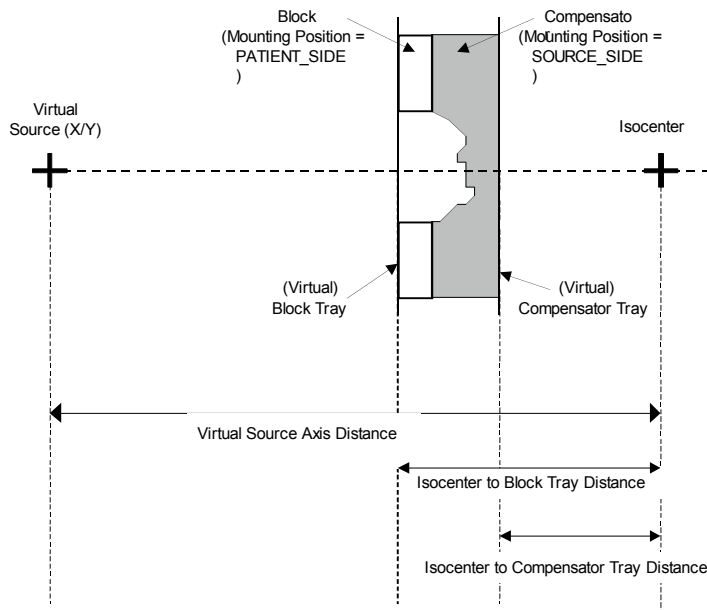
14 The Leaf Position Boundaries (300A,00BE) shall be the positions of the mechanical boundaries (projected
to the isocentric plane) between beam limiting device (collimator) leaves, fixed for a given beam limiting
device (collimator). Leaf/Jaw positions (300A, 011C) are values specific to a given control point,
16 specifying the beam limiting device (collimator) leaf (element) openings.

C.8.8.y.3 Virtual Source-Axis Distances and the use of trays in ion therapy

2 The apparent source position in ion therapy is not constant or can be different in x or y direction. The
4 apparent source position (as measured from field size projections) shall be called Virtual Source, the
distance from the virtual source to isocenter the Virtual SAD.

6 Most of the cases, no trays are used for blocks, compensators and wedges. However, the concept of
8 trays together with the mounting position is useful for specifying exactly at which point the position of
these devices shall be measured. Therefore, trays shall always be sent, even though they are only virtual
trays.

Figure C.8.8.y-1 shows an example.



10

Figure C.8.8.y-1 Virtual Source-Axis Distances

12

Examples: The use of the above attributes for snout positioning and block/compensator manufacturing:

14 a.) Snout positioning:

16 The mounting positions as depicted in the drawing are only examples. As the block tray does not
18 really exist in most of the cases, it is only used as a reference position. As some machines use the
20 downstream face of the block as a reference position for their snout positioning, it could make sense
to define for example that the block mounting position must be SOURCE_SIDE. In this case, one
uses the downstream face of the block as the reference position, which is the same side as used by
the machine. This definition is always independent of the actual thickness of the block. The
Isocenter-Block Distance is defined and the machine can deduce the position of the snout from this
22 value.

b.) Scaling of block/compensator data for manufacturing

2 The Isocenter position is always used as the reference position for all distances measured 'from
isocenter'. Real size block and compensator manufacturing should be based on the distance from
4 the Virtual Source (X/Y) to the device, i.e. $\text{VirtualSourceToDeviceDistance} = \text{VirtualSAD} - \text{IsocenterToDeviceDistance}$.

6 **C.8.8.y.4 Range Shifter and Lateral Spreading Device Settings**

8 The Range Shifter and Lateral Spreading Device Settings attributes are used to capture machine specific
values related to these devices. For example, some machines may specify the Range Shifter setting as
10 the desired Water-Equivalent Thickness (in mm). Others contain a series of interchangeable plates,
whose position in or out of the beam is specified by a series of ones and zeros (i.e. 100010 would specify
12 that plates #1 and #5 are in the beam. If the device does not a specific setting, but rather is defined by the
ID, then the enumerated values IN/OUT shall be used for the setting.

14 **C.8.8.y.5 Coordinate Systems**

14 Where explicitly specified, the coordinate systems defined by IEC 61217 shall be applied, with the
exception of the IEC Patient Coordinate System.

16 In addition, the following sections define the coordinate systems to be used in situations where IEC 61217
coordinate systems are not applicable. No other coordinate systems shall be used.

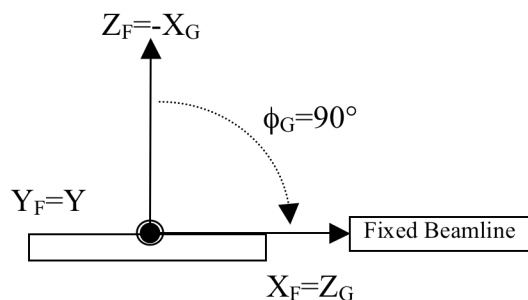
18 **C.8.8.y.5.1 Fixed Beam Line**

20 The direction of fixed beam-line can be described as a gantry system, provided that the position of the
(virtual) gantry bearing is defined. The relation between their patient support coordinate system axes and
the choice of the 'gantry' angle, e.g. 90 or 270 deg, shall be consistent with a standard gantry coordinate
22 system. All coordinate systems derived from the IEC GANTRY coordinate system (BEAM LIMITING
DEVICE, WEDGE, X-RAY IMAGE RECEPTOR) automatically follow in the same way as defined in a
24 'real' gantry system.

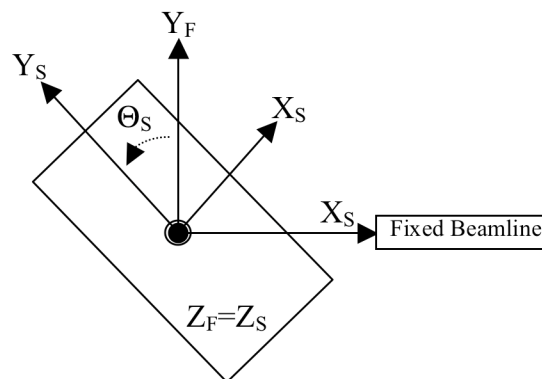
26 The IEC PATIENT SUPPORT system is linked to the IEC GANTRY coordinate system through its
common parent system, the IEC FIXED coordinate system. The Y-axis of IEC GANTRY points towards
the (virtual) gantry bearing. The Y-axis of the IEC FIXED coordinate system has to point in the same
28 direction. Z-axis in IEC FIXED coordinate system is always pointing upwards. With Y and Z-axes defined,
the X-axis of IEC FIXED is also given.

30 Figure C.8.8.y-2 shows IEC FIXED (F), GANTRY (G) and PATIENT SUPPORT (S) coordinate systems
for a horizontal fixed beam-line.

View along IEC FIXED Y-axis



View from top (opposite IEC FIXED Z-axis)



2

Figure C.8.8.y-2 Fixed Beam Line

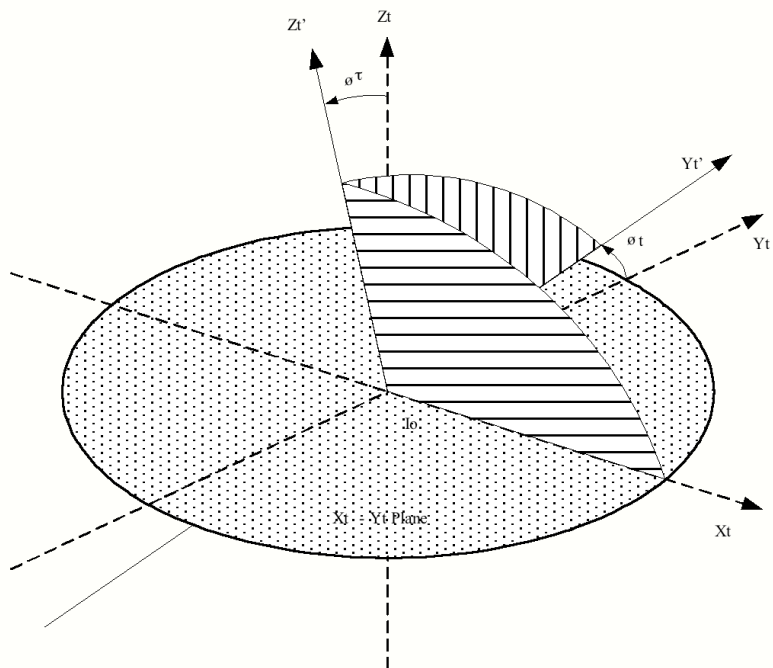
4 **C.8.8.y.5.2 Table Top Pitch and Table Top Roll**

6 Pitch and Roll Coordinate Systems of the Table Top are not defined in IEC 61217. These angles are defined in the DICOM standard in a way compatible with the current notion of IEC by introducing them as rotations of the IEC Table Top System as indicated below.

8 The Table Top Pitch Angle is defined as the rotation of the coordinate axes Y_t , Z_t about axis X_t by an angle ψ_t ; see Figure C.8.8.y-3. An increase in the value of angle ψ_t corresponds to the clockwise rotation of the Table Top as viewed from the Table Top coordinate system origin along the positive X_t axis.

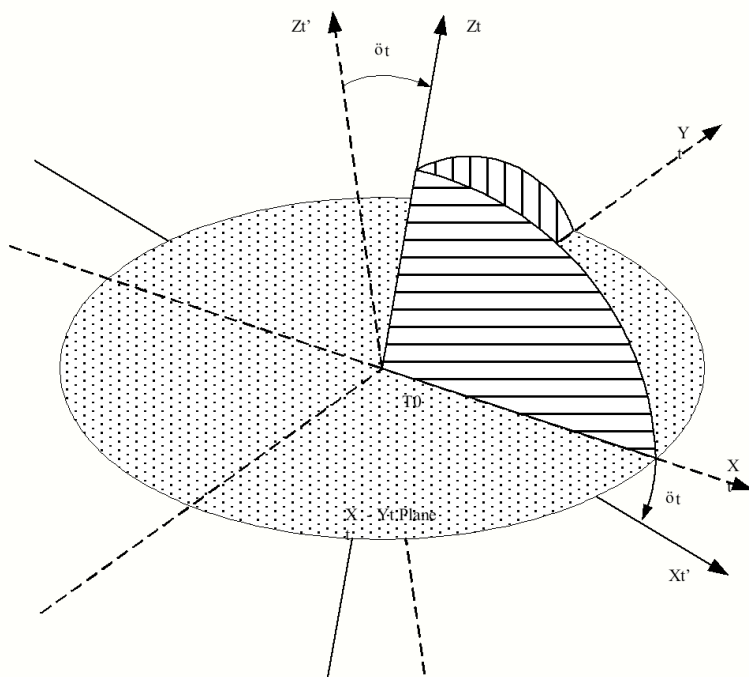
10 The Table Top Roll Angle is defined as the rotation of the coordinate axes X_t , Z_t about axis Y_t by an angle φ_t ; see Figure C.8.8.y-4. An increase in the value of angle φ_t corresponds to the clockwise rotation of the Table Top as viewed from the Table Top coordinate system origin along the positive Y_t axis.

14



2

Figure C.8.8.y-3 Table Top Pitch Angle



4

Figure C.8.8.y-4 Table Top Roll Angle

C.8.8.y.5.3 Seated Treatments

2 RT Ion Plan contains an attribute Patient Support Type (300A,0350), which can be CHAIR or TABLE. The
4 patient support type CHAIR does not change the coordinate axes of the patient support coordinate
systems relative to their parent systems. It is more an attribute of the type like the patient position in
imaging (i.e. HFS, HFP, ...).

6 The orientation of the treatment chair shall be defined with the chair positioned in such way, that the
8 patient looks towards the gantry bearing (or along the Y axis of the IEC FIXED system) if all angles,
especially IEC PATIENT SUPPORT angle are 0°. All other parameters follow straight forward, once this
definition is accepted. I.e. chair rotation is a rotation of IEC PATIENT SUPPORT coordinate system; a
10 backward tilt of the chair is a positive rotation of the PITCHED TABLE TOP coordinate system. A
translation of the chair is a translation of the IEC TABLE TOP system.

12 The roll angle is typically 0°.

For a seated treatment on a horizontal beam-line, the following angles are therefore defined:

14 If IEC GANTRY angle is 90° (270°), IEC PATIENT SUPPORT angle is 270° (90°) for the position where
the patient looks into the beam port.

C.8.8.y.5.4 Ocular Treatments

C.8.8.y.5.4.1 Gantry Beam Line

18 Eye treatments on the gantry shall use all existing IEC coordinate systems with their standard definition.
This applies especially to IEC BEAM LIMITING DEVICE, IEC WEDGE FILTER, IEC X-RAY IMAGE
20 RECEPTOR.

IEC PATIENT SUPPORT, and IEC TABLE TOP coordinate systems are defined as above. Additionally, a
22 rotation of the head fixation device is possible. The Head Fixation Angle (300A,0148) shall be defined as
the angle of the head fixation device with respect to the TABLE TOP coordinate system. Positive head
24 fixation angle is in the same direction as positive PATIENT SUPPORT pitch, i.e. backwards.

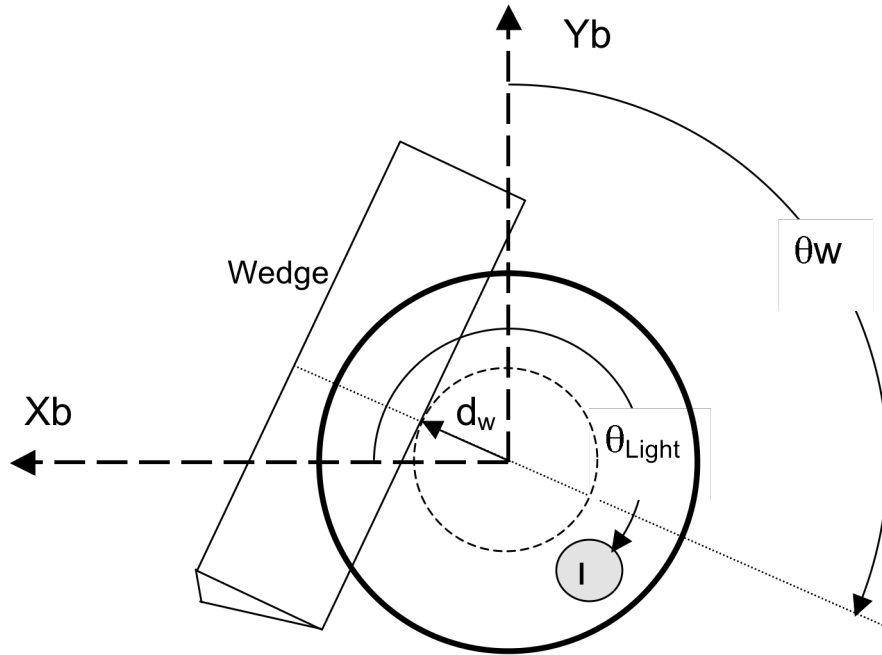
Proton eye treatments require an additional coordinate system for the placement of the fixation light.
26 Since it is usually mounted onto the beam port the 'natural' coordinate system for devices mounted there
is the IEC BEAM LIMITING DEVICE coordinate system. The angles for the fixation light positions shall
28 therefore be defined as follows:

Rotation of the fixation light about the IEC BEAM LIMITING DEVICE Z-axis (Zb) is defined as Azimuthal
30 Angle. The Azimuthal Angle is equal to 0° when the fixation light is positioned on the axis Xb of the IEC
BEAM LIMITING DEVICE coordinate system. An increase in the value of the Azimuthal Angle
32 corresponds to clockwise rotation of the fixation light as view along the axis Zb towards the virtual source.

The polar angle is always positive and defined as the angle between IEC BEAM LIMITING DEVICE Z-
34 axis and the line connecting isocenter with the fixation light position.

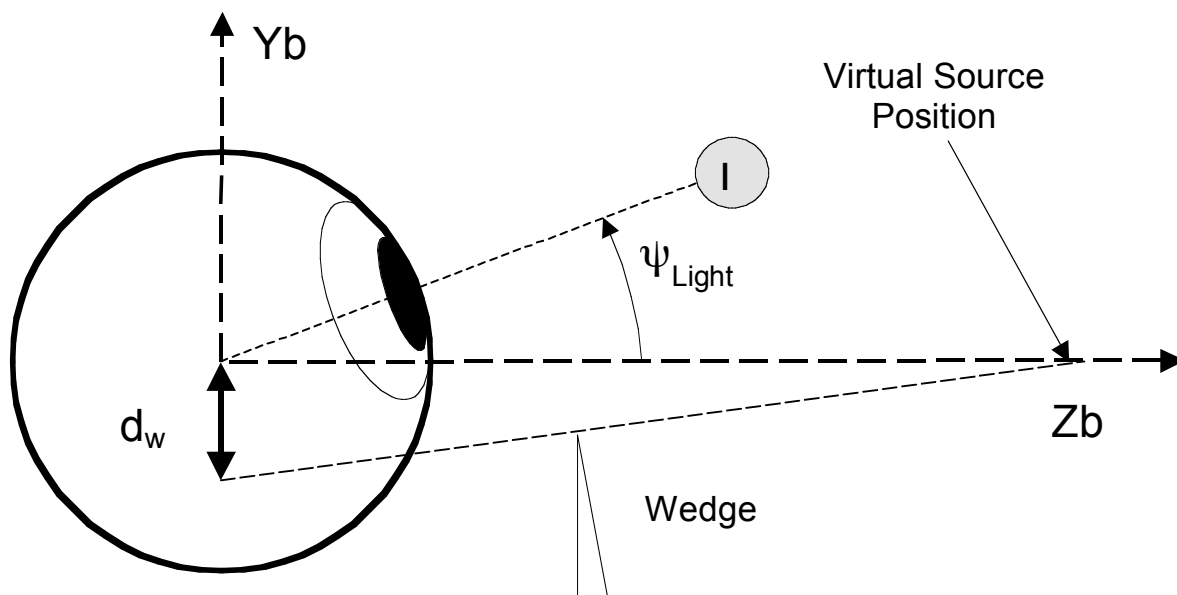
Proton eye treatments require the wedge thin edge position as one additional. The wedge thin edge
36 position allows the specification of a wedge, which does not cover the full open field. The wedge thin
edge position is positive, if the wedge does not cover the isocenter position and negative, if it does cover.

38 Figures C.8.8.y-5 and C.8.8.y-6 show the angles and attributes as described above.



L: Fixation light
 θ_{Light} : Fixation light azimuthal angle
 X_b, Y_b : axes of the IEC BEAM LIMITING DEVICE coordinate system
 d_w : Wedge thin edge position
 θ_w : Wedge orientation

Figure C.8.8.y-5 Patient's eye view



L: Fixation light
 ψ_{Light} : Fixation light polar angle
 Yb, Zb: axes of the IEC BEAM LIMITING DEVICE coordinate system
 d_w : Wedge thin edge position

2

Figure C.8.8.y-6 Lateral view along the positive axis Xb

C.8.8.y.5.4.2 Fixed Beam Line

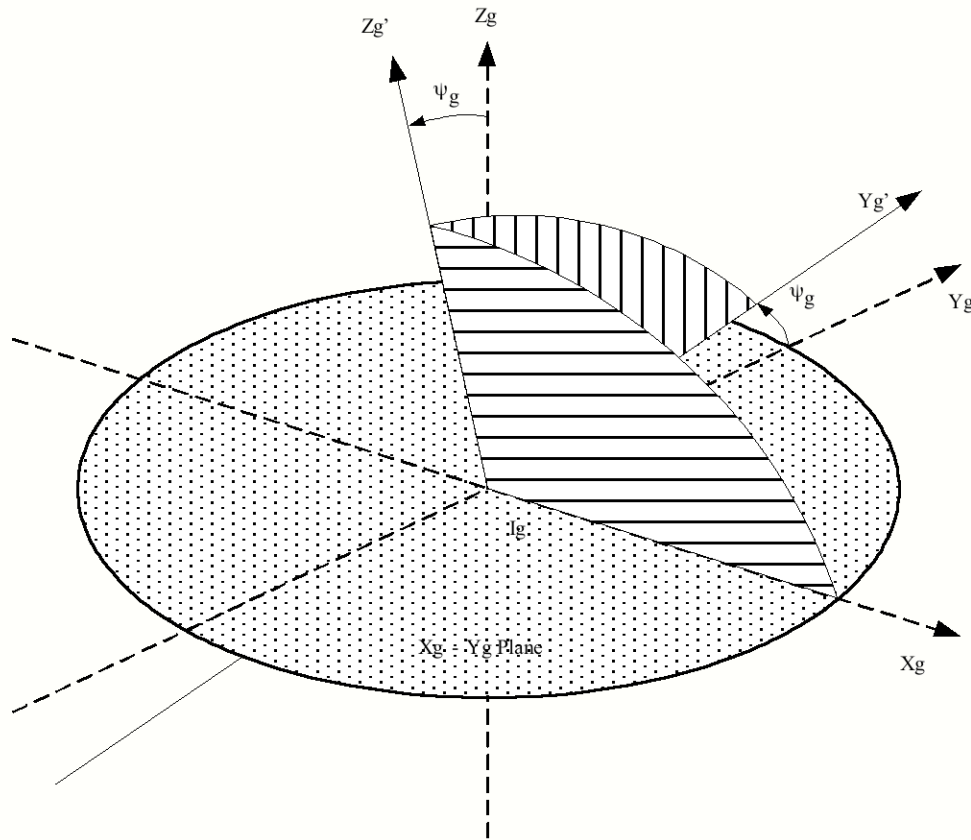
4 The coordinate systems for the treatment chair are defined above and shall also be applied to seated eye treatments.

6 In this case, it is recommended that a beam limiting device angle of 90° be formally applied (provided the gantry angle is defined to be 90° (and not 270°). This results in the same coordinates of the fixation light and wedge relative to the patient as in the treatment situation with the patient lying on the table.

C.8.8.y.5.5 Gantry Pitch Angle

10 The Gantry Pitch angle is not defined in IEC 61217. This angle is defined in the DICOM standard in a way compatible with the current notion of IEC by introducing it as rotation of the IEC GANTRY System as indicated below.

14 The Gantry Pitch Angle is defined as the rotation of the coordinate axes Yg, Zg about axis Xg by an angle ψ_g ; see Figure C.8.8.y-7. An increase in the value of angle ψ_g corresponds to the clockwise rotation as viewed from the isocenter along the positive Xg axis



2

4

Figure C.8.8.y-7 Gantry Pitch Angle

C.8.8.z RT Ion Beams Session Record Module

6 Table C.8.8.z-1 specifies the Attributes that describe the measured and recorded settings acquired during Ion Radiation Treatments.

8

**Table C.8.8.z-1
RT ION BEAMS SESSION RECORD MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Description
Operator Name	(0008,1070)	2	Name of operator administering treatment session.
Referenced Fraction Group Number	(300C,0022)	3	Identifier of fraction group within referenced RT Ion Plan.
Number of Fractions Planned	(300A,0078)	2	Total number of treatments (fractions) planned for current fraction group.
Primary Dosimeter Unit	(300A,00B3)	1	Measurement unit of the machine dosimeter. Enumerated Values:

Attribute Name	Tag	Type	Description
			MU = Monitor Units NP = Number of Particles
Treatment Session Ion Beam Sequence	(3008,0021)	1	Introduces sequence of setup and/or treatment beams administered during treatment session. One or more items shall be included in this sequence.
>Referenced Beam Number	(300C,0006)	1	References Beam specified by Beam Number (300A,00C0) in Ion Beam Sequence (300A,03A2) in RT Ion Beams Module within the referenced RT Ion Plan.
>Beam Name	(300A,00C2)	1	User-defined name for Beam. See section 8.8.y.0.
>Beam Description	(300A,00C3)	3	User-defined description for Beam. See section 8.8.y.0.
>Beam Type	(300A,00C4)	1	Motion characteristic of Beam. Enumerated Values: STATIC = all beam parameters remain unchanged during delivery DYNAMIC = one or more beam parameters changes during delivery
>Radiation Type	(300A,00C6)	1	Particle type of Beam. Defined Terms: PHOTON PROTON ION
>Radiation Mass Number	(300A,0302)	1C	Mass number of radiation. Required if Radiation Type (300A,00C6) is ION
>Radiation Atomic Number	(300A,0304)	1C	Atomic number of radiation. Required if Radiation Type (300A,00C6) is ION
>Radiation Charge State	(300A,0306)	1C	Charge state of radiation. Required if Radiation Type (300A,00C6) is ION
>Scan Mode	(300A,0308)	1	The method of beam scanning used during treatment. Defined Terms: NONE = No beam scanning is performed. UNIFORM = The beam is scanned between control points to create a uniform lateral fluence distribution across the field. MODULATED = The beam is scanned between control points to create a modulated lateral fluence distribution across the field.
>Referenced Tolerance Table Number	(300C,00A0)	3	Uniquely identifies Ion Tolerance Table specified by Tolerance Table Number

Attribute Name	Tag	Type	Description
			(300A,0042) within Ion Tolerance Table Sequence in RT Ion Tolerance Tables Module. These tolerances are to be used for verification of treatment machine settings.
>Beam Limiting Device Leaf Pairs Sequence	(3008,00A0)	3	Introduces sequence of beam limiting device (collimator) jaw or leaf (element) sets. One or more items may be included in this sequence.
>>RT Beam Limiting Device Type	(300A,00B8)	1	Type of beam limiting device (collimator). Enumerated Values: X = symmetric jaw pair in IEC X direction Y = symmetric jaw pair in IEC Y direction ASYMX = asymmetric jaw pair in IEC X direction ASYMY = asymmetric pair in IEC Y direction MLCX = multileaf (multi-element) jaw pair in IEC X direction MLCY = multileaf (multi-element) jaw pair in IEC Y direction
>>Number of Leaf/Jaw Pairs	(300A,00BC)	1	Number of leaf (element) or jaw pairs (equal to 1 for standard beam limiting device jaws).
>Referenced Patient Setup Number	(300C,006A)	3	Uniquely identifies Ion Patient Setup to be used for current beam, specified by Patient Setup Number (300A,0182) within Patient Setup Sequence of RT Patient Setup Module.
>Referenced Verification Image Sequence	(300C,0040)	3	Introduces sequence of verification images obtained during delivery of current beam. One or more items may be included in this sequence. See C.8.8.14.2.
<i>>>Include SOP Instance Reference Macro Table 10-3</i>			
>Referenced Measured Dose Reference Sequence	(3008,0080)	3	Introduces sequence of doses measured during treatment delivery for current Beam. The sequence may contain one or more items.
>>Referenced Dose Reference Number	(300C,0051)	1C	Uniquely references Dose Reference specified by Dose Reference Number (300A,0012) in Dose Reference Sequence (300A,0010) in RT Prescription Module of referenced RT Ion Plan. Required if Referenced Measured Dose Reference Number (3008,0082) is not sent.
>>Referenced Measured Dose	(3008,0082)	1C	Uniquely references Measured Dose

Attribute Name	Tag	Type	Description
Reference Number			Reference specified by Measured Dose Reference Number (3008,0064) in Measured Dose Reference Sequence (3008,0010). Required if Referenced Dose Reference Number (300C, 0051) is not sent.
>>Measured Dose Value	(3008,0016)	1	Measured Dose in units specified by Dose Units (3004,0002) in sequence referenced by Measured Dose Reference Sequence (3008,0010) or Dose Reference Sequence (300A,0010) in RT Prescription Module of Referenced RT Ion Plan as defined above.
>Referenced Calculated Dose Reference Sequence	(3008,0090)	3	Introduces sequence of doses estimated for each treatment delivery. The sequence may contain one or more items.
>>Referenced Dose Reference Number	(300C,0051)	1C	Uniquely identifies Dose Reference specified by Dose Reference Number (300A, 0012) in Dose Reference Sequence (300A, 0010) in RT Prescription Module of referenced RT Ion Plan. Required if Referenced Calculated Dose Reference Number (3008,0092) is not sent.
>>Referenced Calculated Dose Reference Number	(3008,0092)	1C	Uniquely identifies Calculated Dose Reference specified by Calculated Dose Reference Number (3008,0072) within Calculated Dose Reference Sequence (3008,0070). Required if Referenced Dose Reference Number (300C,0051) is not sent.
>>Calculated Dose Reference Dose Value	(3008,0076)	1	Calculated Dose (Gy).
>Number of Wedges	(300A,00D0)	1	Number of wedges associated with current beam.
>Recorded Wedge Sequence	(3008,00B0)	1C	Introduces sequence of treatment wedges. Required if Number of Wedges (300A,00D0) is non-zero. The number of items shall be identical to the value of Number of Wedges (300A,00D0).
>>Wedge Number	(300A,00D2)	1	Identification number of the Wedges. The value of Wedge Number (300A,00D2) shall be unique within the Beam in which it was created.
>>Wedge Type	(300A,00D3)	2	Type of wedge (if any) defined for Beam. Defined Terms: STANDARD = standard (static) wedge MOTORIZED = single wedge that can be removed from beam remotely. PARTIAL_STANDARD = wedge does not

Attribute Name	Tag	Type	Description
			extend across the whole field and is operated manually. PARTIAL_MOTORIZ = wedge does not extend across the whole field and can be removed from beam remotely.
>>Wedge ID	(300A,00D4)	3	User-supplied identifier for Wedge.
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.
>>Wedge Angle	(300A,00D5)	2	Nominal wedge angle (degrees).
>>Wedge Orientation	(300A,00D8)	2	Orientation of wedge, i.e. orientation of IEC WEDGE FILTER coordinate system with respect to the IEC BEAM LIMITING DEVICE coordinate systems (degrees).
>Number of Compensators	(300A,00E0)	1	Number of range compensators associated with current Beam.
>Recorded Compensator Sequence	(3008,00C0)	1C	Introduces sequence of treatment compensators. Required if Number of Compensators (300A,00E0) is non-zero. The number of items shall be identical to the value of Number of Compensators (300A,00E0).
>>Referenced Compensator Number	(300C,00D0)	1	Uniquely identifies compensator specified by Compensator Number (300A,00E4) within Beam referenced by Referenced Beam Number (300C,0006).
>>Compensator ID	(300A,00E5)	3	User-supplied identifier for compensator.
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.
>Number of Boli	(300A,00ED)	1	Number of boli associated with current Beam.
>Referenced Bolus Sequence	(300C,00B0)	1C	Introduces sequence of boli associated with Beam. Required if Number of Boli (300A,00ED) is non-zero. The number of items shall be identical to the value of Number of Boli (300A,00ED).
>>Referenced ROI Number	(3006,0084)	1	Uniquely identifies ROI representing the Bolus specified by ROI Number (3006,0022) in Structure Set ROI Sequence (3006,0020) in Structure Set Module within RT Structure Set in Referenced Structure Set Sequence (300C,0060) in RT General Plan Module.
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.
>Number of Blocks	(300A,00F0)	1	Number of shielding blocks associated with Beam.

Attribute Name	Tag	Type	Description
>Recorded Block Sequence	(3008,00D0)	1C	Introduces sequence of blocks associated with Beam. Required if Number of Blocks (300A,00F0) is non-zero. The number of items shall be identical to the value of Number of Blocks (300A,00F0).
>>Block Tray ID	(300A,00F5)	3	User-supplied identifier for block tray.
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.
>>Referenced Block Number	(300C,00E0)	1	Uniquely identifies block specified by Block Number (300A,00FC) within Beam referenced by Referenced Beam Number (300C,0006).
>>Block Name	(300A,00FE)	3	User-defined name for block.
>Recorded Snout Sequence	(3008,00F0)	1C	Introduces sequence of Snouts associated with Beam. Required if Snout Sequence (300A,030C) is included in the RT Ion Plan referenced within the Referenced RT Plan Sequence (300C,0002). Only a single item shall be permitted in this sequence.
>>Snout ID	(300A,030F)	1	User or machine supplied identifier for Snout.
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.
>Applicator Sequence	(300A,0107)	1C	Introduces sequence of Applicators associated with Beam. Required if Applicator Sequence (300A,0107) is included in the RT Ion Plan referenced within the Referenced RT Plan Sequence (300C,0002). Only a single item shall be permitted in this sequence.
>>Applicator ID	(300A,0108)	1	User or machine supplied identifier for Applicator. See C.8.8.14.12
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.
>>Applicator Type	(300A,0109)	1	Type of applicator. Defined Terms: ION_SQUARE = square ion applicator ION_RECT = rectangular ion applicator ION_CIRC = circular ion applicator ION_SHORT = short ion applicator

Attribute Name	Tag	Type	Description
			ION_OPEN = open (dummy) ion applicator INTEROPERATIVE = interoperative (custom) applicator STEREOTACTIC = stereotactic applicator
>>Applicator Description	(300A,010A)	3	User-defined description for Applicator.
>Number of Range Shifters	(300A,0312)	1	Number of range shifters associated with current beam.
>Recorded Range Shifter Sequence	(3008,00F2)	1C	Introduces sequence of range shifters recorded with Beam. Required if Number of Range Shifters (300A,0312) is non-zero. The number of items shall be identical to the value of Number of Range Shifters (300A,0312).
>>Referenced Range Shifter Number	(300C,0100)	1	Uniquely identifies range shifter specified by Range Shifter Number (300A,0316) within Beam referenced by Referenced Beam Number (300C,0006).
>>Range Shifter ID	(300A,0318)	1	User or machine supplied identifier for Range Modulator.
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.
>Number of Lateral Spreading Devices	(300A,0330)	1	Number of lateral spreading devices associated with current beam.
>Recorded Lateral Spreading Device Sequence	(3008,00F4)	1C	Introduces sequence of lateral spreading devices associated with Beam. Required if Number of Lateral Spreading Devices (300A,0330) is non-zero. The number of items shall be identical to the value of Number of Lateral Spreading Devices (300A,0330).
>>Referenced Lateral Spreading Device Number	(300C,0102)	1	Uniquely identifies lateral spreading device specified by Lateral Spreading Device Number (300A,0334) within Beam referenced by Referenced Beam Number (300C,0006).
>>Lateral Spreading Device ID	(300A,0336)	1	User or machine supplied identifier for Lateral Spreading Device.
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.
>Number of Range Modulators	(300A,0340)	1	Number of range modulators associated with current beam.
>Recorded Range Modulator Sequence	(3008,00F6)	1C	Introduces sequence of range modulators associated with Beam. Required if Number of Range Modulators (300A,0340) is non-zero. The number of items shall be identical to the value of Number of Range

Attribute Name	Tag	Type	Description
			Modulators (300A,0340).
>>Referenced Range Modulator Number	(300C,0104)	1	Uniquely identifies range modulator specified by Range Modulator Number (300A,0344) within Beam referenced by Referenced Beam Number (300C,0006).
>>Range Modulator ID	(300A,0346)	1	User or machine supplied identifier for Range Modulator.
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.
>>Range Modulator Type	(300A,0348)	1	Type of Range Modulator. Defined Terms: FIXED = fixed modulation width and weights using ridge filter or constant speed wheel with constant beam current WHL_FIXEDWEIGHTS = selected wheel/track (Range Modulator ID) is spinning at constant speed. Modulation width is adjusted by switching constant beam current on and off at wheel steps indicated by Range Modulator Interrupt Values WHL_MODWEIGHTS = selected wheel/track (Range Modulator ID) is spinning at constant speed. Weight per wheel step is adjusted by modulating beam current according to selected Beam Current Modulation ID (300A,034C) Only one item in the Recorded Range Modulator Sequence (3008,00F6) can have a Range Modulator Type (300A,0348) of WHL_MODWEIGHTS.
>>Beam Current Modulation ID	(300A,034C)	1C	User-supplied identifier for the beam current modulation pattern. Required if Range Modulator Type (300A,0348) is WHL_MODWEIGHTS
<i>>Include Patient Support Identification Macro Table C.8.8.v-1</i>			
>Fixation Light Azimuthal Angle	(300A,0356)	3	Azimuthal angle (degrees) of the fixation light coordinate around IEC PATIENT SUPPORT Y-axis. Used for eye treatments. See section C.8.8.y.5.4.
>Fixation Light Polar Angle	(300A,0358)	3	Polar angle (degrees) of the fixation light coordinate. Used for eye treatments. See section C.8.8.y.5.4.
>Current Fraction Number	(3008,0022)	2	Fraction number for this beam administration.

Attribute Name	Tag	Type	Description
>Treatment Delivery Type	(300A,00CE)	2	Delivery Type of treatment. Defined Terms: TREATMENT = normal patient treatment OPEN_PORTFILM = portal image acquisition with open field (the source of radiation is specified by Radiation Type (300A, 00C6)) TRMT_PORTFILM = portal image acquisition with treatment port (the source of radiation is specified by Radiation Type (300A,00C6)) CONTINUATION = continuation of interrupted treatment SETUP = no treatment beam was applied for this RT Beam. To be used for specifying the gantry, couch, and other machine positions where X-ray set-up images or measurements were taken.
>Treatment Termination Status	(3008,002A)	1	Conditions under which treatment was terminated. Enumerated Values: NORMAL = treatment terminated normally OPERATOR = operator terminated treatment MACHINE = machine terminated treatment UNKNOWN = status at termination unknown
>Treatment Termination Code	(3008,002B)	3	Treatment machine termination code. This code is dependent upon the particular application and equipment.
>Treatment Verification Status	(3008,002C)	2	Conditions under which treatment was verified by a verification system. Enumerated Values: VERIFIED = treatment verified VERIFIED_OVR = treatment verified with at least one out-of-range value overridden NOT_VERIFIED = treatment verified manually
>Specified Primary Meterset	(3008,0032)	3	Desired machine setting of primary meterset in units specified by Primary Dosimeter Unit (300A, 00B3).
>Specified Secondary Meterset	(3008,0033)	3	Desired machine setting of secondary meterset.
>Delivered Primary Meterset	(3008,0036)	3	Machine setting actually delivered as

Attribute Name	Tag	Type	Description
			recorded by primary meterset in units specified by Primary Dosimeter Unit (300A, 00B3).
>Delivered Secondary Meterset	(3008,0037)	3	Machine setting actually delivered as recorded by secondary meterset.
>Specified Treatment Time	(3008,003A)	3	Treatment Time set (sec).
>Delivered Treatment Time	(3008,003B)	3	Treatment Time actually delivered (sec).
>Number of Control Points	(300A,0110)	1	Number of control points in Beam.
>Ion Control Point Delivery Sequence	(3008,0041)	1	Introduces sequence of beam control points for current ion treatment beam. The number of items shall be identical to the value of Number of Control Points (300A,0110). See section C.8.8.21.1.
>>Referenced Control Point Index	(300C,00F0)	1	Uniquely identifies Control Point specified by Control Point Index (300A,0112) within the Beam referenced by Referenced Beam Number (300C,0006).
>>Treatment Control Point Date	(3008,0024)	1	Date administration of treatment beam began.
>>Treatment Control Point Time	(3008,0025)	1	Time administration of treatment beam began.
>>Specified Meterset	(3008,0042)	2	Desired machine setting for current control point in units specified by Primary Dosimeter Unit (300A, 00B3).
>>Delivered Meterset	(3008,0044)	1	Machine setting actually delivered at current control point in units specified by Primary Dosimeter Unit (300A, 00B3).
>>Meterset Rate Set	(3008,0045)	3	The specified speed of delivery of the specified dose in units specified by Primary Dosimeter Unit (300A, 00B3) per minute.
>>Meterset Rate Delivered	(3008,0046)	3	The delivered speed of delivery of the specified dose in units specified by Primary Dosimeter Unit (300A, 00B3) per minute.
>>Nominal Beam Energy	(300A,0114)	1C	Nominal Beam Energy at control point in MeV per nucleon. Defined at nozzle entrance before all Beam Modifiers. Required for Control Point 0 of Ion Control Point Delivery Sequence (3008,0041) or if Nominal Beam Energy (300A,0114) changes during beam administration, and KVp (0018,0060) is not present.
>>KVp	(0018,0060)	1C	Peak kilo voltage output of the setup X-Ray generator used. Required for Control Point 0 of Ion Control Point Delivery Sequence (3008,0041), or if KVp changes during setup, and Nominal Beam Energy (300A,0114) is not present.

Attribute Name	Tag	Type	Description
>>Ion Wedge Position Sequence	(300A,03AC)	1C	Introduces sequence of Wedge positions for current control point. Required for first item of Ion Control Point Sequence if Number of Wedges (300A,00D0) is non-zero, and in subsequent control points if Wedge Position (300A,0118) or Wedge Thin Edge Position (300A,00DB) changes during beam. The number of items shall be identical to the value of Number of Wedges (300A,00D0). The number of items shall be identical to the value of Number of Wedges (300A,00D0).
>>>Referenced Wedge Number	(300C,00C0)	1	Uniquely references Wedge described by Wedge Number (300A,00D2) in Wedge Sequence (300A,00D1).
>>>Wedge Position	(300A,0118)	1	Position of Wedge at current control point. Enumerated Values: IN, OUT.
>>>Wedge Thin Edge Position	(300A,00DB)	1C	Closest distance from the central axis of the beam along a wedge axis to the thin edge as projected to the machine isocentric plane (mm). Value is positive if the wedge does not cover the central axis, negative if it does. Required if Wedge Type (300A,00D3) of the wedge referenced by Referenced Wedge Number (300C,00C0) is PARTIAL_STANDARD or PARTIAL_MOTORIZED. See section C.8.8.y.5.4.
<i>>>Include Beam Limiting Device Position Macro Table C.8.8.w-1</i>			
>>Range Shifter Settings Sequence	(300A,0360)	1C	Introduces sequence of Range Shifter settings for the current control point. One or more items may be included in this sequence. Required for Control Point 0 of Ion Control Point Delivery Sequence (3008,0041) or if Range Shifter Setting (300A,0362) changes during beam administration, and Number of Range Shifters (300A,0312) is non-zero.
>>>Referenced Range Shifter Number	(300C,0100)	1	Uniquely references Range Shifter described by Range Shifter Number (300A,0316) in Range Shifter Sequence (300A,0314).
>>>Range Shifter Setting	(300A,0362)	1	Machine specific setting attribute for the range shifter. The specific encoding of this value should be documented in a Conformance Statement. See section

Attribute Name	Tag	Type	Description
			C.8.8.y.4.
>>Lateral Spreading Device Settings Sequence	(300A,0370)	1C	Introduces sequence of Lateral Spreading Device settings for the current control point. One or more items may be included in this sequence. Required for Control Point 0 of Ion Control Point Delivery Sequence (3008,0041) or if Lateral Spreading Device Setting (300A,0372) changes during beam administration, and Number of Lateral Spreading Devices (300A,0330) is non-zero.
>>>Referenced Lateral Spreading Device Number	(300C,0102)	1	Uniquely references Lateral Spreading Device described by Lateral Spreading Device Number (300A,0334) in Lateral Spreading Device Sequence (300A,0332).
>>>Lateral Spreading Device Setting	(300A,0372)	1	Machine specific setting attribute for the lateral spreading device. The specific encoding of this value should be documented in a Conformance Statement. See section C.8.8.y.4.
>>Range Modulator Settings Sequence	(300A,0380)	1C	Introduces sequence of Range Modulator Settings for current control point. Required for Control Point 0 of Ion Control Point Delivery Sequence (3008,0041), or if Range Modulator Settings change during beam administration, and Number of Range Modulators (300A,0340) is non-zero.
>>>Referenced Range Modulator Number	(300C,0104)	1	Uniquely references Range Modulator described by Range Modulator Number (300A,0344) in Range Modulator Sequence (300A,0342).
>>>Range Modulator Gating Start Value	(300A,0382)	1C	Start position defines the range modulator position at which the beam is switched on. Required if Range Modulator Type (300A,0348) of the range modulator referenced by Referenced Range Modulator Number (300C,0104) is WHL_MODWEIGHTS or WHL_FIXEDWEIGHTS
>>>Range Modulator Gating Stop Value	(300A,0384)	1C	Stop position defines the range modulator position at which the beam is switched off. Required if Range Modulator Type (300A,0348) of the range modulator referenced by Referenced Range Modulator Number (300C,0104) is WHL_MODWEIGHTS or WHL_FIXEDWEIGHTS
>>Gantry Angle	(300A,011E)	1C	Treatment machine gantry angle, i.e.

Attribute Name	Tag	Type	Description
			orientation of IEC GANTRY coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees). Required for Control Point 0 of Ion Control Point Delivery Sequence (3008,0041) or if Gantry Angle changes during beam administration.
>>Gantry Rotation Direction	(300A,011F)	1C	Direction of Gantry Rotation when viewing gantry from isocenter, for segment beginning at current Control Point. Required for Control Point 0 of Ion Control Point Delivery Sequence (3008,0041), or if Gantry Rotation Direction changes during beam administration. Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation
>>Gantry Pitch Angle	(300A,014A)	2C	Gantry Pitch Angle. i.e. the rotation of the IEC GANTRY coordinate system about the X-axis of the IEC GANTRY coordinate system (degrees). Required for first item of Control Point Sequence, or if Gantry PitchRotation Angle changes during Beam. See C.8.8.y.5.5.
>>Gantry Pitch Rotation Direction	(300A,014C)	2C	Direction of Gantry PitchAngle when viewing along the positive X-axis of the IEC GANTRY coordinate system, for segment following Control Point. Required for first item of Control Point Sequence, or if Gantry PitchRotation Direction changes during Beam. See C.8.8.14.8 and C.8.8.y.5.5. Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation
>>Beam Limiting Device Angle	(300A,0120)	1C	Beam Limiting Device (collimator) angle, i.e. orientation of IEC BEAM LIMITING DEVICE coordinate system with respect to IEC GANTRY coordinate system (degrees). Required for Control Point 0 of Ion Control Point Delivery Sequence (3008,0041) or if beam limiting device (collimator) angle changes during beam administration.
>>Beam Limiting Device Rotation Direction	(300A,0121)	1C	Direction of Beam Limiting Device Rotation when viewing beam limiting device (collimator) from radiation source, for segment beginning at current Control Point.

Attribute Name	Tag	Type	Description
			Required for Control Point 0 of Ion Control Point Delivery Sequence (3008,0041) or if Beam Limiting Device Rotation Direction changes during beam administration. Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation
>>Scan Spot Tune ID	(300A,0390)	1C	User-supplied or machine code identifier for machine configuration to produce beam spot. This may be the nominal spot size or some other machine specific value. Required if Scan Mode (300A,0308) is MODULATED.
>>Number of Scan Spot Positions	(300A,0392)	1C	Number of spot positions used to specify scanning pattern for current segment beginning at control point. Required if Scan Mode (300A,0308) is MODULATED.
>>Scan Spot Position Map	(300A,0394)	1C	The x and y coordinates of the scan spots are defined as projected onto the machine isocentric plane in the IEC GANTRY coordinate system (mm). Required if Scan Mode (300A,0308) is MODULATED. Contains 2N values where N is the Number of Scan Spot Positions (300A,0392).
>>Scan Spot Metersets Delivered	(3008,0047)	1C	A data set of metersets delivered to the scan spot positions. The order of metersets matches the positions in Scan Spot Position Map (300A,0394). The sum contained in all metersets shall match the difference of the Delivered Meterset of the current control point to the following control point. Required if Scan Mode (300A,0308) is MODULATED.
>>Scanning Spot Size	(300A,0398)	3	The Scanning Spot Size as calculated using the Full Width Half Maximum (FWHM). Specified by a numeric pair - the size measured in air at isocenter in IEC GANTRY X direction followed by the size in the IEC GANTRY Y direction (mm).
>>Number of Paintings	(300A,039A)	1C	The intended number of times the scan pattern given by Scan Spot Position Map (300A,0394) and Scan Spot Meterset Weights (300A,0396) in the Referenced RT Plan was to be applied at the current control point. Note: The actual number of paintings is not known or recorded. The Scan Spot

Attribute Name	Tag	Type	Description
			<p>Metersets Delivered (3008,0047) contains the sum of all complete and partial repaints.</p> <p>Required if Scan Mode (300A,0308) is MODULATED.</p>
>>Patient Support Angle	(300A,0122)	1C	<p>Patient Support angle, i.e. orientation of IEC PATIENT SUPPORT (turntable) coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees). Required for Control Point 0 of Ion Control Point Delivery Sequence (3008,0041) or if Patient Support Angle changes during beam administration.</p>
>>Patient Support Rotation Direction	(300A,0123)	1C	<p>Direction of Patient Support Rotation when viewing table from above, for segment beginning at current Control Point.</p> <p>Required for Control Point 0 of Ion Control Point Delivery Sequence (3008,0041), or if Patient Support Rotation Direction changes during beam administration.</p> <p>Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation</p>
>>Table Top Pitch Angle	(300A,0140)	2C	<p>Table Top Pitch Angle, i.e. the rotation of the IEC TABLE TOP coordinate system about the X-axis of the IEC TABLE TOP coordinate system (degrees). Required for first item of Control Point Sequence, or if Table Top Pitch Angle changes during Beam. See section C.8.8.y.5.2.</p>
>>Table Top Pitch Rotation Direction	(300A,0142)	2C	<p>Direction of Table Top Pitch Rotation when viewing the table along the positive X-axis of the IEC TABLE TOP coordinate system, for segment following Control Point.</p> <p>Required for first item of Control Point Sequence, or if Table Top Pitch Rotation Direction changes during Beam. See C.8.8.14.8 and C.8.8.y.5.2.</p> <p>Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation</p>
>>Table Top Roll Angle	(300A,0144)	2C	<p>Table Top Roll Angle, i.e. the rotation of the IEC TABLE TOP coordinate system about the Y-axis of the IEC TABLE TOP coordinate system (degrees). Required for first item of Control Point Sequence, or if</p>

Attribute Name	Tag	Type	Description
			Table Top Roll Angle changes during Beam. See section C.8.8.y.5.2.
>>Table Top Roll Rotation Direction	(300A,0146)	2C	Direction of Table Top Roll Rotation when viewing the table along the positive Y-axis of the IEC TABLE TOP coordinate system, for segment following Control Point. Required for first item of Control Point Sequence, or if Table Top Roll Rotation Direction changes during Beam. See C.8.8.14.8 and C.8.8.y.5.2. Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation
>>Head Fixation Angle	(300A,0148)	3	Angle (in degrees) of the head fixation for eye treatments with respect to the Table Top Pitch Angle (300A,0140) coordinate system. Positive head fixation angle is the same direction as positive Table Top Pitch. See section C.8.8.y.5.4.
>>Table Top Vertical Position	(300A,0128)	2C	Table Top Vertical position in IEC TABLE TOP coordinate system (mm). This value is interpreted as an absolute, rather than relative, Table setting. Required for Control Point 0 of Ion Control Point Delivery Sequence (3008,0041) or if Table Top Vertical Position changes during beam administration.
>>Table Top Longitudinal Position	(300A,0129)	2C	Table Top Longitudinal position in IEC TABLE TOP coordinate system (mm). This value is interpreted as an absolute, rather than relative, Table setting. Required for Control Point 0 of Ion Control Point Delivery Sequence (3008,0041) or if Table Top Longitudinal Position changes during beam administration.
>>Table Top Lateral Position	(300A,012A)	2C	Table Top Lateral position in IEC TABLE TOP coordinate system (mm). This value is interpreted as an absolute, rather than relative, Table setting. Required for Control Point 0 of Ion Control Point Delivery Sequence (3008,0041) or if Table Top Lateral Position changes during beam administration.
>>Snout Position	(300A,030D)	2C	Axial position of the snout (in mm) measured from isocenter to the downstream side of the snout (without consideration of variable length elements such as blocks, MLC and/or

Attribute Name	Tag	Type	Description
			compensators). Required for Control Point 0 of Ion Control Point Delivery Sequence (3008,0041) or if Snout Position changes during beam administration.
>>Corrected Parameter Sequence	(3008,0068)	3	Introduces a sequence of items describing corrections made to any attributes prior to delivery of the next control point. The sequence may contain one or more items.
>>>Parameter Sequence Pointer	(3008,0061)	1	Contains the Data Element Tag of the parent sequence containing the attribute that was corrected. The value is limited in scope to the Treatment Session Ion Beam Sequence (3008, 0021) and all nested sequences therein.
>>>Parameter Item Index	(3008,0063)	1	Contains the ones-based sequence item index of the corrected attribute within its parent sequence as indicated by Parameter Sequence Pointer (3008,0061).
>>>Parameter Pointer	(3008,0065)	1	Contains the Data Element Tag of the attribute that was corrected.
>>>Correction Value	(3008,006A)	1	The value that was added the value referenced by the Parameter Sequence Pointer (3008,0061), Parameter Item Index (3008,0063) and Parameter Pointer (3008,0065).
>>Override Sequence	(3008,0060)	3	Introduces sequence of parameters that were overridden during the administration of the beam segment immediately prior to the current control point. The sequence may contain one or more items.
>>>Parameter Sequence Pointer	(3008,0061)	1	Contains the Data Element Tag of the parent sequence containing the attribute that was overridden. The value is limited in scope to the Treatment Session Ion Beam Sequence (3008, 0021) and all nested sequences therein.
>>>Override Parameter Pointer	(3008,0062)	1	Contains the Data Element Tag of the attribute that was overridden.
>>>Parameter Item Index	(3008,0063)	1	Contains the ones-based sequence item index of the overridden attributes within it's parent sequence. The value is limited in scope to the Treatment Session Ion Beam Sequence (3008, 0021) and all nested sequences therein.
>>>Operator Name	(0008,1070)	2	Name of operator who authorized override.
>>>Override Reason	(3008,0066)	3	User-defined description of reason for override of parameter specified by Override Parameter Pointer (3008,0062).

2 **C.8.8.w Beam Limiting Device Position Macro**

Table C.8.8.W-1 specifies the attributes that specify the Beam Limiting Device Sequence.

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**Table C.8.8.W-1
BEAM LIMITING DEVICE POSITION MACRO ATTRIBUTES**

Attribute Name	Tag	Type	Description
Beam Limiting Device Position Sequence	(300A,011A)	1C	Introduces sequence of beam limiting device (collimator) jaw or leaf (element) positions. Required if Ion Beam Limiting Device Sequence (300A,03A4) is included and for first item of Control Point Sequence, or if Beam Limiting Device changes during Beam. One or more items shall be included in this sequence.
>RT Beam Limiting Device Type	(300A,00B8)	1	Type of beam limiting device (collimator). The value of this attribute shall correspond to RT Beam Limiting Device Type (300A,00B8) defined in an item of Ion Beam Limiting Device Sequence (300A,03A4). Enumerated Values: X = symmetric jaw pair in IEC X direction Y = symmetric jaw pair in IEC Y direction ASYMX = asymmetric jaw pair in IEC X direction ASYMY = asymmetric pair in IEC Y direction MLCX = multileaf (multi-element) jaw pair in IEC X direction MLCY = multileaf (multi-element) jaw pair in IEC Y direction
>Leaf/Jaw Positions	(300A,011C)	1	Positions of beam limiting device (collimator) leaf (element) or jaw pairs (in mm) in IEC BEAM LIMITING DEVICE coordinate axis appropriate to RT Beam Limiting Device Type (300A,00B8), e.g. X-axis for MLCX, Y-axis for MLCY. Contains 2N values, where N is the Number of Leaf/Jaw Pairs (300A,00BC) in Ion Beam Limiting Device Sequence (300A,03A4). Values shall be listed in IEC leaf (element) subscript order 101, 102, ... 1N, 201, 202, ... 2N. See section C.8.8.y.2.

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C.8.8.v Patient Support Identification Macro

8 Table C.8.8.V-1 specifies the attributes that identify the Patient Support System.

Table C.8.8.V-1
PATIENT SUPPORT IDENTIFICATION MACRO ATTRIBUTES

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Attribute Name	Tag	Type	Description
Patient Support Type	(300A,0350)	1	Defined terms: TABLE = Treatment delivery system table CHAIR = Treatment delivery system chair See section C.8.8.y.5.3.
Patient Support ID	(300A,0352)	3	User-specified identifier for manufacturer specific patient support devices.
Patient Support Accessory Code	(300A,0354)	3	A Patient Support accessory identifier to be read by a device such as a bar code reader.

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Part 4 Addendum

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2 **Item #6: Insert the following sections into Part 4, Annex B, Section B.5, Table B.5-1, just after RT**
4 **Treatment Summary Record Storage:**

SOP Class UID	SOP Class Name	IOD Specification
1.2.840.10008.5.1.4.1.1.481.8	RT Ion Plan Storage	IOD defined in PS 3.3
1.2.840.10008.5.1.4.1.1.481.9	RT Ion Beams Treatment Record Storage	IOD defined in PS 3.3

6 **Item #7: Insert the following text into Part 4, Annex I, Section I.4, Table I.4-1, just after RT Treatment**
8 **Summary Record Storage:**

SOP Class UID	SOP Class Name	IOD Specification
1.2.840.10008.5.1.4.1.1.481.8	RT Ion Plan Storage	IOD defined in PS 3.3
1.2.840.10008.5.1.4.1.1.481.9	RT Ion Beams Treatment Record Storage	IOD defined in PS 3.3

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Part 6 Addendum

2 **Item #8**
4 *Add the following Data Elements to Part 6 Section 6:*

Tag	Name	VR	VM
(3008,0021)	Treatment Session Ion Beam Sequence	SQ	1
(3008,0041)	Ion Control Point Delivery Sequence	SQ	1
(3008,0045)	Meterset Rate Set	FL	1
(3008,0046)	Meterset Rate Delivered	FL	1
(3008,0047)	Scan Spot Metersets Delivered	FL	1-n
(3008,0061)	Parameter Sequence Pointer	AT	1
(3008,0063)	Parameter Item Index	IS	1
(3008,0065)	Parameter Pointer	AT	1
(3008,0068)	Corrected Parameter Sequence	SQ	1
(3008,006A)	Corrected Value	FL	1
(3008,00F0)	Recorded Snout Sequence	SQ	1
(3008,00F2)	Recorded Range Shifter Sequence	SQ	1
(3008,00F4)	Recorded Lateral Spreading Device Sequence	SQ	1
(3008,00F6)	Recorded Range Modulator Sequence	SQ	1
(300A,004B)	Snout Position Tolerance	FL	1
(300A,004F)	Table Top Pitch Angle Tolerance	FL	1
(300A,0050)	Table Top Roll Angle Tolerance	FL	1
(300A,00BB)	Isocenter to Beam Limiting Device Distance	FL	1
(300A,00D7)	Total Wedge Tray Water-Equivalent Thickness	FL	1
(300A,00D9)	Isocenter to Wedge Tray Distance	FL	1
(300A,00DB)	Wedge Thin Edge Position	FL	1
(300A,00F3)	Total Block Tray Water-Equivalent Thickness	FL	1
(300A,00F7)	Isocenter to Block Tray Distance	FL	1
(300A,0140)	Table Top Pitch Angle	FL	1
(300A,0142)	Table Top Pitch Rotation Direction	CS	1
(300A,0144)	Table Top Roll Angle	FL	1
(300A,0146)	Table Top Roll Rotation Direction	CS	1
(300A,0148)	Head Fixation Angle	FL	1
(300A,014A)	Gantry Pitch Angle	FL	1
(300A,014C)	Gantry Pitch Rotation Direction	CS	1
(300A,02E3)	Total Compensator Tray Water-Equivalent Thickness	FL	1

Tag	Name	VR	VM
(300A,02E4)	Isocenter to Compensator Tray Distance	FL	1
(300A,02E5)	Compensator Column Offset	FL	1
(300A,02E6)	Isocenter to Compensator Distances	FL	1-n
(300A,02E7)	Compensator Relative Stopping Power Ratio	FL	1
(300A,02E8)	Compensator Milling Tool Diameter	FL	1
(300A,02EA)	Ion Range Compensator Sequence	SQ	1
(300A,0302)	Radiation Mass Number	IS	1
(300A,0304)	Radiation Atomic Number	IS	1
(300A,0306)	Radiation Charge State	SS	1
(300A,0308)	Scan Mode	CS	1
(300A,030A)	Virtual Source-Axis Distances	FL	2
(300A,030C)	Snout Sequence	SQ	1
(300A,030D)	Snout Position	FL	1
(300A,030F)	Snout ID	SH	1
(300A,0312)	Number of Range Shifters	IS	1
(300A,0314)	Range Shifter Sequence	SQ	1
(300A,0316)	Range Shifter Number	IS	1
(300A,0318)	Range Shifter ID	SH	1
(300A,0320)	Range Shifter Type	CS	1
(300A,0322)	Range Shifter Description	LO	1
(300A,0330)	Number of Lateral Spreading Devices	IS	1
(300A,0332)	Lateral Spreading Device Sequence	SQ	1
(300A,0334)	Lateral Spreading Device Number	IS	1
(300A,0336)	Lateral Spreading Device ID	SH	1
(300A,0338)	Lateral Spreading Device Type	CS	1
(300A,033A)	Lateral Spreading Device Description	LO	1
(300A,033C)	Lateral Spreading Device Water Equivalent Thickness	FL	1
(300A,0340)	Number of Range Modulators	IS	1
(300A,0342)	Range Modulator Sequence	SQ	1
(300A,0344)	Range Modulator Number	IS	1
(300A,0346)	Range Modulator ID	SH	1
(300A,0348)	Range Modulator Type	CS	1
(300A,034A)	Range Modulator Description	LO	1
(300A,034C)	Beam Current Modulation ID	SH	1
(300A,0350)	Patient Support Type	CS	1
(300A,0352)	Patient Support ID	SH	1
(300A,0354)	Patient Support Accessory Code	LO	1

Tag	Name	VR	VM
(300A,0356)	Fixation Light Azimuthal Angle	FL	1
(300A,0358)	Fixation Light Polar Angle	FL	1
(300A,035A)	Meterset Rate	FL	1
(300A,0360)	Range Shifter Settings Sequence	SQ	1
(300A,0362)	Range Shifter Setting	LO	1
(300A,0364)	Isocenter to Range Shifter Distance	FL	1
(300A,0366)	Range Shifter Water Equivalent Thickness	FL	1
(300A,0370)	Lateral Spreading Device Settings Sequence	SQ	1
(300A,0372)	Lateral Spreading Device Setting	LO	1
(300A,0374)	Isocenter to Lateral Spreading Device Distance	FL	1
(300A,0380)	Range Modulator Settings Sequence	SQ	1
(300A,0382)	Range Modulator Gating Start Value	FL	1
(300A,0384)	Range Modulator Gating Stop Value	FL	1
(300A,0386)	Range Modulator Gating Start Water Equivalent Thickness	FL	1
(300A,0388)	Range Modulator Gating Stop Water Equivalent Thickness	FL	1
(300A,038A)	Isocenter to Range Modulator Distance	FL	1
(300A,0390)	Scan Spot Tune ID	SH	1
(300A,0392)	Number of Scan Spot Positions	IS	1
(300A,0394)	Scan Spot Position Map	FL	1-n
(300A,0396)	Scan Spot Meterset Weights	FL	1-n
(300A,0398)	Scanning Spot Size	FL	2
(300A,039A)	Number of Paintings	IS	1
(300A,03A0)	Ion Tolerance Table Sequence	SQ	1
(300A,03A2)	Ion Beam Sequence	SQ	1
(300A,03A4)	Ion Beam Limiting Device Sequence	SQ	1
(300A,03A6)	Ion Block Sequence	SQ	1
(300A,03A8)	Ion Control Point Sequence	SQ	1
(300A,03AA)	Ion Wedge Sequence	SQ	1
(300A,03AC)	Ion Wedge Position Sequence	SQ	1
(300C,0100)	Referenced Range Shifter Number	IS	1
(300C,0102)	Referenced Lateral Spreading Device Number	IS	1
(300C,0104)	Referenced Range Modulator Number	IS	1

Item #9

Add the following Data Elements to Part 6 Annex A:

UID Vaue	UID Name	UID Type	Part
1.2.840.10008.5.1.4.1.1.481.8	RT Ion Plan Storage	SOP Class	PS 3.4
1.2.840.10008.5.1.4.1.1.481.9	RT Ion Beams Treatment Record Storage	SOP Class	PS 3.4