Digital Imaging and Communications in Medicine (DICOM)

Supplement 175: Second Generation Radiotherapy –
C-Arm RT Treatment Modalities

DICOM Standards Committee, Working Group 7, Radiation Therapy
1300 N. 17th Street, Suite 1752
Rosslyn, Virginia 22209 USA

VERSION: Draft Letter Ballot
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Developed pursuant to DICOM Work Item 2007-06-B

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# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Table of Contents</td>
</tr>
<tr>
<td>5</td>
<td>Closed Issues</td>
</tr>
<tr>
<td>6</td>
<td>Foreword</td>
</tr>
<tr>
<td>6</td>
<td>Scope and Field of Application</td>
</tr>
<tr>
<td>8</td>
<td>Part 2 Addendum</td>
</tr>
<tr>
<td>9</td>
<td>Part 3 Addendum</td>
</tr>
<tr>
<td>10</td>
<td>A.VV.1.1 RT Second Generation Entity-Relationship Model</td>
</tr>
<tr>
<td>11</td>
<td>A.VV.1.4 RT Radiation Set Information Object Definition</td>
</tr>
<tr>
<td>11</td>
<td>A.VV.1.4.1 RT Radiation Set IOD Description</td>
</tr>
<tr>
<td>11</td>
<td>A.VV.1.4.2 RT Radiation Set IOD Entity-Relationship Model</td>
</tr>
<tr>
<td>11</td>
<td>A.VV.1.4.3 RT Radiation Set IOD Module Table</td>
</tr>
<tr>
<td>12</td>
<td>A.VV.1.4.4 RT Radiation Set IOD Constraints</td>
</tr>
<tr>
<td>12</td>
<td>A.VV.1.7.1 C-Arm Photon-Electron Radiation Information Object Definition</td>
</tr>
<tr>
<td>12</td>
<td>A.VV.1.7.2 C-Arm Photon-Electron Radiation IOD Description</td>
</tr>
<tr>
<td>12</td>
<td>A.VV.1.7.3 C-Arm Photon-Electron Radiation IOD Module Table</td>
</tr>
<tr>
<td>12</td>
<td>C.7.5 Common Equipment IE Modules</td>
</tr>
<tr>
<td>14</td>
<td>C.7.5.1 General Equipment Module</td>
</tr>
<tr>
<td>15</td>
<td>C.AA.1 RT SECOND GENERATION MODULES</td>
</tr>
<tr>
<td>15</td>
<td>C.AA.1.1 Control Points</td>
</tr>
<tr>
<td>15</td>
<td>C.AA.1.1.1 Verification Control Points</td>
</tr>
<tr>
<td>15</td>
<td>C.AA.1.2 Nominal Energy</td>
</tr>
<tr>
<td>15</td>
<td>C.AA.1.3 Treatment RT Radiation Set</td>
</tr>
<tr>
<td>15</td>
<td>C.AA.1.4Meterset</td>
</tr>
<tr>
<td>16</td>
<td>C.AA.1.5 Radiation Dose Point</td>
</tr>
<tr>
<td>16</td>
<td>C.AA.1.6 Continuous Rotation Angles</td>
</tr>
<tr>
<td>16</td>
<td>C.AA.1.7 External Contour</td>
</tr>
<tr>
<td>16</td>
<td>C.AA.1.8 C-Arm Linac</td>
</tr>
<tr>
<td>16</td>
<td>C.AA.1.9 Virtual Simulation</td>
</tr>
<tr>
<td>16</td>
<td>C.AA.1.10 Beam Modifier Definition Plane</td>
</tr>
<tr>
<td>18</td>
<td>C.AA.2 RT Second Generation General Purpose Macros</td>
</tr>
<tr>
<td>18</td>
<td>C.AA.2.10 Treatment Device Identification Macro</td>
</tr>
<tr>
<td>18</td>
<td>C.AA.2.12 RT Patient Support Devices Macro</td>
</tr>
<tr>
<td>19</td>
<td>C.AA.2.13 Patient Support Position Macro</td>
</tr>
<tr>
<td>21</td>
<td>C.AA.2.15 RT Accessory Device Identification Macro</td>
</tr>
<tr>
<td>22</td>
<td>C.AA.2.16 RT Control Point General Macro</td>
</tr>
<tr>
<td>23</td>
<td>C.AA.2.16.1 RT Control Point Attribute Concept</td>
</tr>
<tr>
<td>26</td>
<td>C.AA.2.17 External Beam Control Point General Macro</td>
</tr>
<tr>
<td>26</td>
<td>C.AA.2.19 Radiation Generation Mode Macro</td>
</tr>
<tr>
<td>29</td>
<td>C.AA.2.19.1 Radiation Generation Mode Macro Attribute Description</td>
</tr>
</tbody>
</table>
C.AA.2.20.1 .......RT Beam Limiting Device Definition Macro Attribute Description ..........31
C.AA.2.21 .... RT Beam Limiting Device Opening Macro ............................33
C.AA.2.21.1 ....RT Beam Limiting Device Positions Attribute Descriptions ......35
C.AA.2.22 .... Wedges Definition Macro .............................................36
C.AA.2.22.1 .... Wedges Definition Macro Attribute Description ..........36
C.AA.2.23 .... Wedge Positions Macro ................................................38
C.AA.2.24 .... Compensators Definition Macro ......................................39
C.AA.2.24.1 .... Compensators Definition Macro Attribute Descriptions ......41
C.AA.2.25 .... Blocks Definition Macro ................................................42
C.AA.2.25.1 .... Blocks Definition Macro Attribute Description ...........45
C.AA.2.26 .... Accessory Holders Definition Macro ................36
C.AA.2.26.1 .... Accessory Holders Description ..................................46
C.AA.2.27 .... General Accessories Definition Macro .........................48
C.AA.2.28 .... Boluses Definition Macro ..............................................48
C.AA.2.28.1 .... Boluses Definition Macro Attribute Description ..........49
C.AA.2.29 .... Outline Definition Macro ...............................................49
C.AA.2.29.1 .... Outline Definition Macro Attribute Description ...........50
C.AA.2.30 .... RT Tolerance Set Macro .................................................50
C.AA.2.30.1 .... RT Tolerance Set Attribute Description .......................52
C.AA.2.31 .... Patient to Equipment Relationship Macro ........................52
C.AA.2.31.1 .... Patient to Equipment Relationship Macro Attributes Description ..........................................................53
C.AA.2.32 .... RT Treatment Position Macro .........................................54
C.AA.C1 .... RT Radiation Set Module .................................................55
C.AA.C1.1 .... RT Radiation Set Attribute Description ............................56
C.AA.C1.1.1 .... RT Radiation Set Intent ...............................................56
C.AA.C1.1.2 .... RT Radiation Sequence .............................................56
C.AA.C2 .... RT Dose Contribution Module ...........................................57
C.AA.C2.1 .... RT Dose Contribution Attribute Description .....................60
C.AA.C2.1.1 .... Meterset to Dose Mapping Sequence ............................60
C.AA.C2.1.2 .... Conceptual Volume Sequence ....................................60
C.AA.C2.1.3 .... Primary Dose Value Indicator ....................................61
C.AA.C2.1.4 .... Source to External Contour Distance .............................61
C.AA.C2.2 .... Radiation Verification Control Point Description .......... Error! Bookmark not defined.
C.AA.E1 .... RT Delivery Device Common Module ................................61
C.AA.E1.1 .... RT Delivery Device Common Module Attribute Description ......62
C.AA.E1.2 .... Well-known Frame of Reference for Equipment ...............63
C.AA.E2 .... RT Radiation Common Module ........................................64
C.AA.E2.1 .... RT Radiation Common Attribute Description ..........................65
C.AA.E2.1.1 .... Radiotherapy Procedure Technique Sequence .............65
C.AA.E2.1.2 .... RT Treatment Position Macro .....................................65
C.AA.E2.1.3 .... Treatment Time Limit ...............................................65
C.AA.E2.1.4 .... Treatment Machine Special Mode Sequence ................65
C.AA.G1 .... C-Arm Photon-Electron Delivery Device Module ...............65
C.AA.G2 .... C-Arm Photon-Electron Beam Module .................................66
C.AA.G2.1 .... C-Arm Photon-Electron Beam Attribute Description ..........67
C.AA.G2.1.1 .... Source Roll Continuous Angle ....................................67
Part 4 Addendum .................................................................................69
6 .......... REGISTRY OF DICOM DATA ELEMENTS .................................70
ANNEX A REGISTRY OF DICOM UNIQUE IDENTIFIERS (UID) (NORMATIVE). 76

Part 16 Addendum ........................................................................................................... 78

CID SUP175001 BEAM LIMITING DEVICE TYPES.................................................. 78
CID SUP175002 COMPENSATOR DEVICE TYPES.................................................... 78
CID SUP175003 RADIOThERAPY TREATMENT MACHINE MODES .................. 78
CID SUP175004 RADIOThERAPY DISTANCE REFERENCE LOCATIONS........... 79
CID SUP175005 FIXED BEAM LIMITING DEVICE TYPES................................. 79
CID SUP175006 RADIOTHERAPY WEDGE TYPES............................................... 79
CID SUP175007 RT BEAM LIMITING DEVICE ORIENTATION LABELS .......... 80
CID SUP175008 GENERAL ACCESSORY DEVICE TYPES................................. 80
CID SUP175009 RADIATION GENERATION MODE TYPE................................. 80
CID SUP175010 C-ARM PHOTON-ELECTRON DELIVERY RATE UNITS ........... 81
CID SUP175011 TREATMENT DELIVERY DEVICE TYPE................................. 81
CID SUP175012 C-ARM PHOTON-ELECTRON DOSIMETER UNIT..................... 81
CID SUP175013 TREATMENT POINTS................................................................. 81
CID SUP175014 EQUIPMENT LOCATION CODES............................................. 82
CID SUP175015 RADIATION DEVICE CALIBRATION PROTOCOL CODES ....... 82
TID SUP175001 PATIENT SUPPORT POSITION PARAMETERS......................... 82

ANNEX D DICOM CONTROLLED TERMINOLOGY DEFINITIONS (NORMATIVE) 84

132
134
136
138
140
142
144
146
148
150
152
Closed Issues
(TODO: Clarify offline with WG-06 whether to leave this in)

<table>
<thead>
<tr>
<th>#</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Compensators and Block are now only described by Thickness Maps in 2nd Generation and the Compensator Transmission Map and the Block Transmission Map have been removed. Is this acceptable? 2017-03-23 WG-07: No opposing comments. Transmission Maps will not be included.</td>
</tr>
<tr>
<td>2</td>
<td>In the First Generation DICOM RT Plan there is the concept of the Leaf Position Boundaries which has been reworked and generalized for different beam delimiters using Number of Parallel RT Beam Delimiters (30xx,5048) and Parallel RT Beam Delimiter Boundaries (30xx,5049). Is this new concept, which is now also open for single (so-called “binary”) leaves comprehensible? 2017-03-23 WG-07: No opposing comments. The approach will stay.</td>
</tr>
<tr>
<td>3</td>
<td>The presence of RT Control Point Sequence Attributes has been changed. See C.AA.2.16.1.1 for details on the new requirements and the Attributes within C-Arm Photon-Electron Control Point Sequence (30xx,9C00) where these requirements apply. Is this approach comprehensive and are the requirements clear? 2017-09-12 U. Busch: Has been revised by WG-06 after PC in coordination with WG-07.</td>
</tr>
</tbody>
</table>
Foreword

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

Scope and Field of Application

Introduction

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

This Supplement is based on the real-world model and specifications defined in Supplement 147. References, definitions etc. not present in this Supplement can be found in Supplement 147.

General Architectural Principles

- Different types of data are encoded in different IODs. This is in contrast to First Generation objects, where different types of data are encoded in a single IOD, such as RT Plan.
- The new IODs are designed to support all current treatment modalities and be extensible for future modalities and new equipment.
- Compatibility with First-Generation IODs: It will be possible for the content of First Generation IODs to be represented in Second Generation IODs. However, information beyond the content of a First Generation SOP Instance will be needed to create a valid Second Generation SOP Instance.
- IODs specific to use cases: Explicit separate IODs have been developed for specific treatment modalities with the concept of RT Radiation IOD – for example, Tomotherapeutic treatments, C-Arm beams, Robotic beams are modeled separately. This allows more stringent conditions to be applied to the presence or absence of Attributes within those IODs, and thereby increases the potential for interoperability.
- Treatment techniques already in use but not yet covered in First Generation (such as robotic therapy and tomotherapy) have been taken into account.
Editorial Note: All existing occurrences of the term Meterset in the current DICOM Standard should be capitalized.
Part 2 Addendum

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

<table>
<thead>
<tr>
<th>UID Value</th>
<th>UID Name</th>
<th>Category</th>
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<tbody>
<tr>
<td>1.2.840.10008.5.1.4.1.481.XN.3</td>
<td>RT Radiation Set Storage</td>
<td>Transfer</td>
</tr>
<tr>
<td>1.2.840.10008.5.1.4.1.481.XN.5.2</td>
<td>C-Arm Photon-Electron Radiation Storage</td>
<td>Transfer</td>
</tr>
</tbody>
</table>
Add the following columns in PS3.3 Section A.1.4, Table A.1-1 COMPOSITE INFORMATION
OBJECT MODULES OVERVIEW – RADIOTHERAPY

<table>
<thead>
<tr>
<th>IOOs Modules</th>
<th>RT Rad Set</th>
<th>C-Arm Rad Ph-Et Rad</th>
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<td>Patient</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Clinical Trial Subject</td>
<td>U</td>
<td>U</td>
</tr>
<tr>
<td>General Study</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Patient Study</td>
<td>U</td>
<td>U</td>
</tr>
<tr>
<td>Clinical Trial Study</td>
<td>U</td>
<td>U</td>
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<tr>
<td>General Series</td>
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<tr>
<td>Clinical Trial Series</td>
<td>U</td>
<td>U</td>
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<tr>
<td>Enhanced RT Series</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>General Equipment</td>
<td>M</td>
<td>M</td>
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<tr>
<td>Enhanced General Equipment</td>
<td></td>
<td>M</td>
</tr>
<tr>
<td>Frame Of Reference</td>
<td>M</td>
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<tr>
<td>Radiotherapy Common Instance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT Radiation Set</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>RT Dose Contribution</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>RT Delivery Device</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>Common Reference Module</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>SOP Common</td>
<td>M</td>
<td>M</td>
</tr>
</tbody>
</table>
Add the following to PS3.3 Annex A:

A.VV RT SECOND GENERATION

A.VV.1.1.1 RT Second Generation Entity-Relationship Model

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

Add the following Section to A.VV.1.1:

A.VV.1.1.4 RT Radiation IOD Modules Macro
Specific RT Radiation IODs (Tomotherapy Radiation IOD, C-Arm Photon-Electron Radiation IOD, etc.) share common modules as defined in the following Table A.VV.1.1.2. This macro is always used in conjunction with the specific RT Radiation IODs.

Table A.VV.1.1.2
RT RADIATION IOD MODULES MACRO

<table>
<thead>
<tr>
<th>IE</th>
<th>Module</th>
<th>Reference</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Include Table A.VV.1.1.1 &quot;RT Second Generation IOD Modules Macro&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frame of Reference</td>
<td>Frame of Reference</td>
<td>C.7.4.1</td>
<td>M</td>
</tr>
<tr>
<td>RT Radiation</td>
<td>RT Delivery Device Common</td>
<td>C.AA.E1</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>RT Radiation Common</td>
<td>C.AA.E2</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>General Reference Module</td>
<td>C.12.4</td>
<td>M</td>
</tr>
</tbody>
</table>

Note: The Frame of Reference identifies the Patient Coordinate System used to define the geometric setup of the radiation beam with respect to the patient. The relationship of the patient-based coordinates to the Equipment Frame of Reference is specified by a transformation (see C.AA.2.31).

The value of RT Radiation Planning Content Type (30xx,5013) shall not be NONE.

The value of RT Radiation Recording Content Type (30xx,5014) shall be NO.

Add the following Section to A.VV.1.4:

A.VV.1.4 RT Radiation Set Information Object Definition
A.VV.1.4.1 RT Radiation Set IOD Description
The RT Radiation Set represents a set of radiation deliveries which are intended to be delivered together in a single fraction. The RT Radiation Set also contains a description of the fractionation pattern and the Number of Fractions and the associated dose contributions. See Part 17 for further explanation.

A.VV.1.4.2 RT Radiation Set IOD Entity-Relationship Model
See Figure A.VV.1.1.1-1.

A.VV.1.4.3 RT Radiation Set IOD Module Table

Table A.VV.1.4-1
RT RADIATION SET IOD MODULES

<table>
<thead>
<tr>
<th>IE</th>
<th>Module</th>
<th>Reference</th>
<th>Usage</th>
</tr>
</thead>
</table>
236 A.VV.1.4.4  RT Radiation Set IOD Constraints
238 A.VV.1.4.4.1  Modality Attribute
238 The value of Modality (0008,0060) shall be RTRAD.
240 A.VV.1.4.4.2  RT Radiation Set and Referenced RT Radiation Instances.
240 The User Content Label (30xx,51E0) defined in the RT Common Instance Module is intended to be
240 unique across all SOP Instances referenced by the RT Radiation Set.
242 Add the following Section to A.VV.1.7:

244 A.VV.1.7  C-Arm Photon-Electron Radiation Information Object Definition
246 A.VV.1.7.1  C-Arm Photon-Electron Radiation IOD Description
246 The C-Arm Photon-Electron Radiation IOD describes a radiotherapy treatment on a C-Arm delivery
device using photon or electron radiation.
248 A.VV.1.7.2  C-Arm Photon-Electron Radiation IOD Entity-Relationship Model
248 See Figure A.VV.1.1.1-1.
250 A.VV.1.7.3  C-Arm Photon-Electron Radiation IOD Module Table
252 Table A.VV.1.7-1

<table>
<thead>
<tr>
<th>IE</th>
<th>Module</th>
<th>Reference</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>RT Radiation</td>
<td>C-Arm Photon-Electron Delivery Device</td>
<td>C.AA.G1</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>C-Arm Photon-Electron Beam</td>
<td>C.AA.G2</td>
<td>M</td>
</tr>
</tbody>
</table>

254 A.VV.1.7.4  C-Arm Photon-Electron Radiation IOD Constraints
256 A.VV.1.7.4.1  Modality Attribute
256 The value of Modality (0008,0060) shall be RTRAD.
258 A.VV.1.7.4.2  RT Delivery Device Common Module
258 The Equipment Frame of Reference UID (30xx,51A0) shall be 1.2.840.10008.1.4.RRR.1.
### Code Sequence | CID
---|---
Treatment Machine Special Mode Sequence (30xx,9C97) | Defined CID SUP175003 “Radiotherapy Treatment Machine Modes”
Radiation Dosimeter Unit Sequence (30xx,5113) | Defined CID SUP175012 “C-Arm Photon-Electron Dosimeter Unit”

260 **A.VV.1.7.4.3 RT Radiation Common Module**

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

<table>
<thead>
<tr>
<th>Code Sequence</th>
<th>CID</th>
</tr>
</thead>
<tbody>
<tr>
<td>RT Treatment Technique Code Sequence (30xx,9976)</td>
<td>Defined CID SUP147012 “General External Radiotherapy Procedure Techniques”</td>
</tr>
</tbody>
</table>
Extend the Equipment Module in PS3.3 Annex C, Section C.7.5:

C.7.5 Common Equipment IE Modules

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

C.7.5.1 General Equipment Module

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

### Table C.7-8 General Equipment Module Attributes

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>(0008,0070)</td>
<td>2</td>
<td>Manufacturer of the equipment that produced the composite instances.</td>
</tr>
<tr>
<td>Institution Name</td>
<td>(0008,0080)</td>
<td>3</td>
<td>Institution where the equipment that produced the composite instances is located.</td>
</tr>
<tr>
<td>Institution Address</td>
<td>(0008,0081)</td>
<td>3</td>
<td>Mailing address of the institution where the equipment that produced the composite instances is located.</td>
</tr>
<tr>
<td>Station Name</td>
<td>(0008,1010)</td>
<td>3</td>
<td>User defined name identifying the machine that produced the composite instances.</td>
</tr>
<tr>
<td>Institutional Department Name</td>
<td>(0008,1040)</td>
<td>3</td>
<td>Department in the institution where the equipment that produced the composite instances is located.</td>
</tr>
<tr>
<td>Manufacturer's Model Name</td>
<td>(0008,1090)</td>
<td>3</td>
<td>Manufacturer's model name of the equipment that produced the composite instances.</td>
</tr>
<tr>
<td>Manufacturer's Device Class UID</td>
<td>(30xx,9BB0)</td>
<td>3</td>
<td>Manufacturer’s Unique Identifier (UID) for the class of the device.</td>
</tr>
</tbody>
</table>

A class is manufacturer-specific grouping concept with no DICOM-defined scope or criteria. A class is independent from a marketing-defined make, model or version. A class allows to define a group of devices with a similar set of capabilities.

| Device Serial Number           | (0018,1000)  | 3    | Manufacturer’s serial number of the equipment that produced the composite instances.   |

Note
This identifier corresponds to the device that actually created the images, such as a CR plate reader or a CT console, and may not be sufficient to identify all of the equipment in the imaging chain, such as the generator or gantry or plate.

| Software Versions              | (0018,1020)  | 3    | Manufacturer’s designation of software version of the                                |
The following macros and modules are used by the RT Second Generation radiotherapy IODs.

C.AA.1 RT Second Generation Concepts

The following terms are used in Radiotherapy Modules and Macros.

See also:

- Section 7.12 “Extension of the DICOM model of the real-world for Radiotherapy Second Generation Information Objects”
- Section A.VV.1 “RT Second Generation Objects”

C.AA.1.1 Control Points

A Control Point represents the state of a delivery device in a sequence of states defined by a progress variable. For radiation delivery the Cumulative Meterset (30xx,5021) is the progress variable.

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

C.AA.1.2 Nominal Energy

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

C.AA.1.3 Treatment RT Radiation Set

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

C.AA.1.4 Meterset

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

See IEC 60601-2-64 for more information on using monitor units as the unit for the Meterset.
C.AA.1.5 Radiation Dose Point
A point chosen in space, or in the patient treatment volume, to measure or plan for a specific amount of radiation. The point usually is placed at a significant location, such as within a tumor (where radiation will be delivered), or within healthy tissue (where radiation will be minimized) or where a measurement device can be positioned.

C.AA.1.6 Continuous Rotation Angles
Continuous Rotation Angles represent a rotation direction and magnitude. The magnitude is not limited to be between 0 and 360 degrees. All rotations are defined in a right-handed coordinate system, thus the direction of a positive rotation is seen as clockwise when viewed in the positive direction of the axis of rotation.

C.AA.1.7 External Contour
The External Contour is the spatial extent of matter that is taken into account for dose calculation. The External Contour includes the Patient Anatomy Model, Bolus, Patient Positioning Devices, Patient Immobilization Devices or other devices in the path of the radiation.

C.AA.1.8 C-Arm Linac
A C-Arm Linac is a linear accelerator that follows the coordinate definitions of IEC 61217 Edition 2.0 2011-12. Any hardware belonging to this category may or may not represent an actual C-Arm gantry.

C.AA.1.9 Virtual Simulation
Virtual Simulation is a form of Radiotherapy treatment simulation that uses volumetric imaging studies in a computer to model the geometry of a radiation beam with respect to a patient's anatomy. The spatial relationship between beam and anatomy is verified in Digitally Reconstructed Radiograph (DRR) images that conceptually represent actual beam portal images.

Note (TODO: Check with WG-06 if they still insist on having this sentence)
Virtual Simulation is distinct from any other computer simulation used in Radiotherapy such as Monte Carlo simulation.

C.AA.1.10 Beam Modifier Coordinate System
Every beam modifier which is specified by geometric coordinates, e.g. beam limiting devices, compensators and blocks, is defined in its Beam Modifier Coordinate System with respect to a Base Beam Modifier Coordinate System with the following characteristics:

- It is a right-handed Cartesian coordinate system, with the positive z-axis pointing towards the radiation source.
- All Beam Modifier Coordinate Systems for any beam modifier have the same orientation at a zero angle about the z-axis of the parent Base Beam Modifier Coordinate System.

The origin of this coordinate system and orientation of the x-axis and y-axis with respect to the Base Beam Modifier Coordinate System shall be declared in the specification of the coordinate systems identified by the Equipment Frame of Reference.

The plane spanned by the x-axis and y-axis is referred to as Beam Modifier Definition Plane.
Figure C.AA.E1.1-1
Beam Modifier Coordinate System
C.AA.2 RT Second Generation General Purpose Macros

C.AA.2.10 Treatment Device Identification Macro

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

Table C.AA.2.10-1
TREATMENT DEVICE IDENTIFICATION MACRO ATTRIBUTES

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment Device Identification Sequence</td>
<td>(30xx,5015)</td>
<td>1</td>
<td>Identifies treatment device. Only a single item shall be included in this Sequence.</td>
</tr>
<tr>
<td>&gt;Include Table C.AA.2.11 'Device Model Macro'</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;Manufacturer's Device Class UID</td>
<td>(30xx,9BB0)</td>
<td>2</td>
<td>Manufacturer's Unique Identifier (UID) for the class of the device. A class is a manufacturer-specific grouping concept with no DICOM-defined scope or criteria. A class is independent from a marketing-defined make, model or version. A class allows definition of a group of devices with a similar set of capabilities.</td>
</tr>
<tr>
<td>&gt;Include Table C.AA.2.14-1 'Device Identification Macro'</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;Institution Name</td>
<td>(0008,0080)</td>
<td>3</td>
<td>Institution where the equipment is located.</td>
</tr>
<tr>
<td>&gt;Institution Address</td>
<td>(0008,0081)</td>
<td>3</td>
<td>Mailing address of the institution where the equipment is located.</td>
</tr>
<tr>
<td>&gt;Institutional Department Name</td>
<td>(0008,1040)</td>
<td>3</td>
<td>Department in the institution where the equipment is located.</td>
</tr>
</tbody>
</table>

C.AA.2.12 RT Patient Support Devices Macro

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

Table C.AA.2.12-1
RT PATIENT SUPPORT DEVICES MACRO ATTRIBUTES

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Patient Support Devices</td>
<td>(30xx,51F1)</td>
<td>1</td>
<td>Number of Patient Support Devices Sequence defined in the Patient Support Devices Sequence (30xx,51F0).</td>
</tr>
<tr>
<td>Patient Support Devices Sequence</td>
<td>(30xx,51F0)</td>
<td>1C</td>
<td>Patient support device definitions. Required if the Number of Patient Support Devices (30xx,51F1) is not-zero. The number of items included in</td>
</tr>
</tbody>
</table>
### C.AA.2.13 Patient Support Position Macro

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

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

#### Table C.AA.2.13-0031

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Support Position Specification Method</td>
<td>(30xx,5144)</td>
<td>1</td>
<td>Method of specification for patient support parameters. Enumerated Values: ABSENT - no parameters are specified, GLOBAL – parameters are specified irrespective of the devices in use, DEVICE_SPECIFIC – parameters are specified per device. See C.AA.2.13.1</td>
</tr>
</tbody>
</table>
| Patient Support Device Parameter Sequence | (30xx,5145) | 1C   | Translational and rotational parameters for Patient Support devices. Required if Position Specification Method (30xx,5144) does not equal ABSENT. One or more Items shall be included in this Sequence if Position Specification Method (30xx,5144) equals DEVICE_SPECIFIC. Only one Item shall be included in this Sequence.
### Attribute Name | Tag | Type | Attribute Description
--- | --- | --- | ---
>Referenced Device Index | (30xx,9142) | 1C | The value of Device Index (30xx,9112) in Patient Support Devices Sequence (30xx,51F0) corresponding to the Patient Support Device in use. Required if Position Specification Method (30xx,5144) equals DEVICE_SPECIFIC.
>Device Order Index | (30xx,5146) | 1C | Index defining the order in which the parameter set of the device is applied starting at 1. The value shall start at 1 and increase monotonically by 1. Required if Position Specification Method (30xx,5144) equals DEVICE_SPECIFIC.
>Patient Support Position Parameter Sequence | (30xx,5142) | 1 | Translational and rotational parameters for a particular Patient Support device. One or more Items shall be included in this Sequence.
>›Patient Support Position Parameter Order Index | (30xx,5147) | 1 | Index defining the order in which the parameter of the referenced device is applied starting at 1. The value shall start at 1 and increase monotonically by 1.

---

**C.AA.2.13.1 Patient Support Position Parameters**

A Patient Support Position Parameter specifies a rotation about or a translation along an axis. The Patient Support Position Parameter Order Index (30xx,5147) specifies the order in which these operations are applied. The Device Order Index (30xx,5146) specifies the order in which each device’s parameter set is applied.

A vendor may specify codes that are not included in TID 175001 to describe a parameter set of a device. The vendor shall document these codes, the corresponding parameters, their geometric interpretation, and the order of operations in its Conformance Statement. These parameters shall be defined using UCUM units of mm and degrees where applicable.

If the following codes are used, the defined order applies:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>S175307</td>
<td>Isocentric Patient Support Continuous Yaw Angle</td>
<td>1</td>
</tr>
<tr>
<td>S175305</td>
<td>Isocentric Patient Support Continuous Pitch Angle</td>
<td>2</td>
</tr>
</tbody>
</table>

Commented [CS3]: Is this really necessary? Why don’t we repeat this also in other locations where we have angles? Proposal: remove it!
### Table C.AA.2.15-1
RT ACCESSORY DEVICE IDENTIFICATION MACRO ATTRIBUTES

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Include Table C.AA.2.11-1 ‘Device Model Macro’</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Include Table C.AA.2.14-1 ‘Device Identification Macro’</strong></td>
<td></td>
<td></td>
<td>CId is defined by invocation.</td>
</tr>
<tr>
<td>RT Accessory Device Slot ID</td>
<td>(30xx,954B)</td>
<td>2C</td>
<td>Identifier for location (slot) of radiation modifier accessory where the current accessory is inserted. Required if accessory is located in a slot and Referenced RT Accessory Holder Device Index (30xx,9540) is not present.</td>
</tr>
<tr>
<td>RT Accessory Slot Distance</td>
<td>(30xx,9548)</td>
<td>2C</td>
<td>Distance in mm from the reference location as specified by RT Beam Distance Reference Location Code Sequence (30xx,5114) to the Accessory Slot. Required if RT Accessory Device Slot ID (30xx,954B) is present and has a value.</td>
</tr>
<tr>
<td>Referenced RT Accessory Holder Device Index</td>
<td>(30xx,9540)</td>
<td>2C</td>
<td>The value of Device Index (30xx,9112) of the Accessory Holder device in the RT Accessory Holder Definition Sequence (30xx,954A). Required if accessory is mounted on a holder device and RT Accessory Device Slot ID (30xx,954B) is not present.</td>
</tr>
</tbody>
</table>
C.AA.2.16  RT Control Point General Macro

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

Table C.AA.2.16-1

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RT Control Point Index</td>
<td>(30xx,9111)</td>
<td>1</td>
<td>The index of the RT Control Point within the Sequence where this Macro is included. RT Control Points shall be executed in the order of the RT Control Point Index. The value shall start at 1 and increase monotonically by 1 within the Sequence where this Macro is included.</td>
</tr>
<tr>
<td>Cumulative Meterset</td>
<td>(30xx,5021)</td>
<td>1C</td>
<td>Meterset at the RT Control Point. The units are specified by Radiation Dosimeter Unit Sequence (30xx,5113). For the Item with RT Control Point Index equal 1, the Cumulative Meterset shall be equal to 0.0. Required if RT Radiation Planning Content Type (30xx,5013) equals VOLUMETRIC or RT Radiation Planning Content Type (30xx,5013) equals NON_VOLUMETRIC or RT Radiation Recording Content Type (30xx,5014) equals YES and if the conditions in Section C.AA.2.16.1.1 are satisfied. May be present otherwise only if the conditions in section C.AA.2.16.1.1 are satisfied. See C.AA.2.16.1.3.</td>
</tr>
<tr>
<td>Referenced Treatment Position Index</td>
<td>(30xx,9147)</td>
<td>1C</td>
<td>The value of Treatment Position Index (30xx,0141) from the Treatment Position Sequence (30xx,5028) within this IOD that this</td>
</tr>
</tbody>
</table>
The following examples illustrate RT Control Points:

<table>
<thead>
<tr>
<th>RT Control Point Attribute Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required if the conditions in Section C.AA.2.16.1.1 are satisfied.</td>
</tr>
</tbody>
</table>

**C.AA.2.16.1** RT Control Point Attribute Concept

The treatment-modality Modules use a common formalism to represent parameters that define the behaviour of a delivery device during delivery of radiation. These parameters are communicated as a sequence of values, organized as 'Control Points', see C.AA.1.1 and represented as RT Control Points. The resolution of RT Control Points depends on the level of detail required to define the behaviour of the delivery device.

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

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

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

**C.AA.2.16.1.1** Requirements for Changing Values within RT Control Point Sequence Attributes

The RT Control Point Sequence specifies a certain order of execution and at each Control Point the Value of various Attributes may be specified either as an explicit Value or if absent remain at the same Value as specified previously. There are physical and mechanical implications of specifying a new value as opposed to staying at the same value, for example gear lash, floating point jitter, etc.

At the first Sequence Item in RT Control Point Sequences (i.e. with an RT Control Point Index (30xx,9111) equal to 1) all Attributes affected by this Section shall be present (whether Type 1C or 2C).

For Sequence Items other than the first Sequence Item, Attributes shall be present only if the Value is different from the previously populated Value for the same Attribute. The previously populated Value is the Value from the Item where the Attribute was present with the greatest value of RT Control Point Index (30xx,9111) less than the Value of the RT Control Point Index (30xx,9111) in the current Item.

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

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

For multi-valued Attributes, such as Parallel RT Beam Delimiter Positions (30xx.504A), all Values shall be present if any Value changes.

**C.AA.2.16.1.2** Control Point Attribute Example

The following examples illustrate RT Control Points:
1. Static Beam delivery:

<table>
<thead>
<tr>
<th>RT Control Point Index (30xx,9111)</th>
<th>Cumulative Meterset (30xx,5021)</th>
<th>All other parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>&lt;defined&gt;</td>
</tr>
<tr>
<td>2</td>
<td>76</td>
<td>&lt;not present&gt;</td>
</tr>
</tbody>
</table>

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

2. Arc delivery:

<table>
<thead>
<tr>
<th>RT Control Point Index (30xx,9111)</th>
<th>Cumulative Meterset (30xx,5021)</th>
<th>Source Roll Continuous Angle (30xx,51B5)</th>
<th>All other parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>&lt;initial angle&gt;</td>
<td>&lt;defined&gt;</td>
</tr>
<tr>
<td>2</td>
<td>56</td>
<td>&lt;final angle&gt;</td>
<td>&lt;not present&gt;</td>
</tr>
</tbody>
</table>

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

3. Dynamic delivery of two equally weighted segments:

<table>
<thead>
<tr>
<th>RT Control Point Index (30xx,9111)</th>
<th>Cumulative Meterset (30xx,5021)</th>
<th>Parallel RT Beam Delimiter Positions (30xx,504A) X Referenced Device Index 1</th>
<th>Parallel RT Beam Delimiter Positions (30xx,504A) Y Referenced Device Index 2</th>
<th>RT Beam Limiting Device Continuous Angle (30xx,51B4)</th>
<th>All other parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>2/2</td>
<td>2/2</td>
<td>30</td>
<td>&lt;defined&gt;</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>&lt;not present&gt;</td>
<td>4/4</td>
<td>&lt;not present&gt;</td>
<td>&lt;not present&gt;</td>
</tr>
<tr>
<td>3</td>
<td>80</td>
<td>4/4</td>
<td>&lt;not present&gt;</td>
<td>&lt;not present&gt;</td>
<td>&lt;not present&gt;</td>
</tr>
</tbody>
</table>

At completion this delivers 80 Monitor Units while first increasing the Y opening and then increasing the X opening, while the beam limiting device angle stays fixed. For the RT Beam Limiting Device Opening Sequence (30xx,5070) this results in having three Items for the first Control Point and only one for Control Points 2 (Referenced Device Index 2 only) and 3 (Referenced Device Index 1 only). See also Figure C.AA.2.16.1-1.
446

Figure C.AA.2.16.1-1
Control Points Sub-Sequence Attribute Presence

448

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

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

<table>
<thead>
<tr>
<th>RT Control Point Index (30xx,9111)</th>
<th>Cumulative Meterset (30xx,5021)</th>
<th>Image to Equipment Mapping Matrix (0028,9520)</th>
<th>Source Roll Continuous Angle (30xx,51B5)</th>
<th>All other parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>-90</td>
<td>&lt;defined&gt;</td>
</tr>
</tbody>
</table>
At completion this delivers 90 Monitor Units. Between RT Control Point 2 and 3 the Patient Support Angle and Source Roll Continuous Angle are changed and no radiation is delivered.

C.AA.2.16.1.3 Cumulative Meterset

The Meterset at a given Control Point is specified by Cumulative Meterset (30xx,5021). That value is specified in units defined by Radiation Dosimeter Unit Sequence (30xx,5113) in the RT Delivery Device Common Module in section C.AA.E1. The Meterset values are intended to correspond to the values produced by the primary or only Meterset-measuring device of a RT Radiation Delivery Device.

C.AA.2.17 External Beam Control Point General Macro

This macro may be invoked to specify the RT Control Point Attributes used to model external beam radiation.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery Rate</td>
<td>(30xx,5023)</td>
<td>2C</td>
<td>The intended nominal rate of delivery of the specified Cumulative Meterset (30xx,5021). Required if the conditions in Section C.AA.2.16.1.1 are satisfied. See C.AA.2.16.1 and C.AA.2.17.1.1.</td>
</tr>
<tr>
<td>Delivery Rate Unit Sequence</td>
<td>(30xx,5024)</td>
<td>1C</td>
<td>The unit of the Delivery Rate (30xx,5023). Required if Delivery Rate (30xx,5023) is present. See C.AA.2.16.1 and C.AA.2.17.1.1. Only a single item shall be included in this Sequence.</td>
</tr>
<tr>
<td>Beam Area Limit Sequence</td>
<td>(30xx,6050)</td>
<td>1C</td>
<td>Area within which the treatment beam must be contained, for example when using MLC tracking for a moving target. Only a single item shall be included in this Sequence. Required if beam shall be limited. See C.AA.2.16.1.</td>
</tr>
</tbody>
</table>

C.AA.2.19 Radiation Generation Mode Macro

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

Radiation Generation Modes specify the beam fluence. To convey content other than the beam fluence, such as annotating the role of the beam in the clinical process or the usage of that beam during a treatment session, annotate treatment constraints, use other Attributes like RT Radiation Set Intent (30xx,5011) in the RT Radiation Set Module and information provided by the workflow protocols.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Radiation Generation Modes</td>
<td>(30xx,51CB)</td>
<td>1</td>
<td>Number of Radiation Generation Modes defined in the Radiation Generation Mode Sequence (30xx,51C0). The Number shall be greater than zero.</td>
</tr>
<tr>
<td>Radiation Generation Mode Sequence</td>
<td>(30xx,51C0)</td>
<td>1</td>
<td>Radiation Generation Modes defining the type of radiation and characteristics of the beam generated. Radiation Generation Modes shall characterize different primary beam fluence. The number of Items included in this Sequence shall equal the value of Number of Radiation Generation Modes (30xx,51CB).</td>
</tr>
<tr>
<td>Radiation Generation Mode Index</td>
<td>(30xx,9113)</td>
<td>1</td>
<td>Index of this Item in this Sequence. The value shall start at 1 and increase monotonically by 1.</td>
</tr>
<tr>
<td>Radiation Generation Mode Label</td>
<td>(30xx,51C1)</td>
<td>1</td>
<td>User readable label that identifies this Radiation Generation mode. See C.AA.2.19.1.3.</td>
</tr>
<tr>
<td>Radiation Generation Mode Description</td>
<td>(30xx,51C2)</td>
<td>2</td>
<td>User-defined description of the Radiation Generation mode.</td>
</tr>
<tr>
<td>Radiation Generation Mode Machine Code Sequence</td>
<td>(30xx,51C3)</td>
<td>1</td>
<td>A vendor-specified machine-readable code that unambiguously identifies this Radiation Generation mode. See C.AA.2.19.1.2.</td>
</tr>
</tbody>
</table>

>>Include Table 8.8-1 'Code Sequence Macro' No Baseline CID is defined.
<table>
<thead>
<tr>
<th>Description</th>
<th>Code Sequence</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation Type Code</td>
<td>(30xx,51C4)</td>
<td>1</td>
<td>Type of radiation for this Radiation Generation Mode. Only a single Item shall be included in this Sequence.</td>
</tr>
<tr>
<td>Energy Unit Code Sequence</td>
<td>(30xx,51C9)</td>
<td>1</td>
<td>The unit of energy values specified in Nominal Energy (30xx,51C5), Minimum Nominal Energy (30xx,51C6), Maximum Nominal Energy (30xx,51C7). CID is defined by invocation.</td>
</tr>
<tr>
<td>Nominal Energy</td>
<td>(30xx,51C5)</td>
<td>1C</td>
<td>The nominal beam energy in units as defined in the Energy Unit Code Sequence (30xx,51C9). Required if Minimum Nominal Energy (30xx,51C6) and Maximum Nominal Energy (30xx,51C7) are not present. See C.AA.2.19.1.1.</td>
</tr>
<tr>
<td>Minimum Nominal Energy</td>
<td>(30xx,51C6)</td>
<td>1C</td>
<td>The minimum nominal beam energy in units as defined in the Energy Unit Code Sequence (30xx,51C9). Required if Nominal Energy (30xx,51C5) is not present. See C.AA.2.19.1.1.</td>
</tr>
<tr>
<td>Maximum Nominal Energy</td>
<td>(30xx,51C7)</td>
<td>1C</td>
<td>The maximum nominal beam energy in units as defined in the Energy Unit Code Sequence (30xx,51C9). Required if Nominal Energy (30xx,51C5) is not present. See C.AA.2.19.1.1.</td>
</tr>
<tr>
<td>Radiation Fluence Modifier Code Sequence</td>
<td>(30xx,51C8)</td>
<td>1</td>
<td>Identifies the type of fluence modifier of this Radiation Generation Mode. One or more Items shall be included in this Sequence.</td>
</tr>
</tbody>
</table>

C.AA.2.19.1 Radiation Generation Mode Macro Attribute Description

C.AA.2.19.1.1 Energy Attributes

The Nominal Energy (30xx,51C5) parameter is provided for beams where a single discrete energy is annotated by that value. Energy modulation can be used at the Control Point level (both discrete and continuous), in which case the Minimal Nominal Energy (30xx,51C6) and Maximal Nominal Energy (30xx,51C7) is used.

C.AA.2.19.1.2 Radiation Generation Mode Machine Code

When two Radiation Generation Modes differ in any value of Radiation Type Code (30xx,51C4), the Nominal Energy (30xx,51C5), Minimum Nominal Energy (30xx,51C6), Maximum Nominal Energy (30xx,51C7) and code value(s) of the Radiation Fluence Modifier Code Sequence (30xx,51C8) they
must have different values for Radiation Generation Mode Machine Code. Even if all those attributes have the same values, the two Modes may still have a different value for Radiation Generation Mode Machine Code, e.g. when other device-specific beam generation steering parameters differ.

C.AA.2.19.1.3 Radiation Generation Mode Label

Radiation Generation Mode Label (30xx,51C1) should uniquely identify a specific mode within a treatment device. The label is intended only for display to human readers, while the authoritative definition of the Radiation Generation Mode is contained in the other attributes of the Sequence.

C.AA.2.20 RT Beam Limiting Devices Definition Macro

This Macro describes the configuration of Beam Limiting Devices.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of RT Beam Limiting Devices</td>
<td>(30xx,5041)</td>
<td>1</td>
<td>Number of RT Beam Limiting Devices in the RT Beam Limiting Device Definition Sequence (30xx,504D). The number shall be greater than zero.</td>
</tr>
<tr>
<td>RT Beam Limiting Device Definition Sequence</td>
<td>(30xx,504D)</td>
<td>1</td>
<td>Beam limiting device (collimator), such as jaw or leaf (element) sets. The number of items included in this Sequence shall equal the value of Number of RT Beam Limiting Devices (30xx,5041).</td>
</tr>
<tr>
<td>Device Index</td>
<td>(30xx,9112)</td>
<td>1</td>
<td>Index of the Device in this Sequence. The value shall start at 1 and increase monotonically by 1.</td>
</tr>
</tbody>
</table>

CID is defined by invocation.

A code used to identify the orientation of the beam limiting device. Only a single item shall be present in the Sequence.

Defined CID SUP175007 “RT Beam Limiting Device Orientation Labels”

See C.AA.2.20.1.1

Angle in degrees of the Beam Modifier Coordinate System with respect to the Base Beam Modifier Coordinate System.

If Device Type Code Sequence (30xx,502B) contains either (S175172, 99SUP175, “Leaf Pairs”), or (S175175, 99SUP175, “Single Leaves”) the motion of the RT Beam Delimiters is along the x-axis of the Beam Modifier Definition Plane.

See C.AA.E1.1.1.1

Distance in mm from the reference location as specified by RT Beam Distance Reference Location Code Sequence (30xx,5114) to the
<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;RT Beam Limiting Device Distal Distance</td>
<td>(30xx,5043)</td>
<td>2</td>
<td>Distance in mm from the reference location as specified by RT Beam Distance Reference Location Code Sequence (30xx,5114) to the distal end of beam limiting device (collimator) along the beam axis.</td>
</tr>
<tr>
<td>&gt;Number of Parallel RT Beam Delimiters</td>
<td>(30xx,5048)</td>
<td>1C</td>
<td>Number of beam delimiters parallel to the axis of motion. E.g. a beam limiting device jaw pair is represented as 1 parallel delimiter, an MLC with 100 leaf pairs or with 100 single leaves is represented as 100 parallel delimiters. Required if Device Type Code Sequence (30xx,5026) contains either (S175172, 99SUP175, “Leaf Pairs”), or (S175175, 99SUP175, “Single Leaves”). May be present otherwise. See C.AA.2.20.1.3</td>
</tr>
</tbody>
</table>
| >Parallel RT BeamDelimiter Opening Mode | (30xx,504E) | 1 | The operation mode of Parallel RT Beam Delimiters used to define a treatment aperture. Enumerated Values: 
  - BINARY – leaf positions constrained to two states: open and closed 
  - VARIABLE – any leaf position may be specified |
| >Parallel RT BeamDelimiter Boundaries | (30xx,5049) | 1C | Boundaries in mm of parallel beam delimiters. These are defined along the axis perpendicular to the motion of the delimiters of the RT Beam Limiting Device Type (300A,00B8) with respect to the Equipment Frame of Reference UID (30xx,51A0). The order of values shall increase monotonically. See C.AA.2.20.1.2. N+1 values shall be provided, where N is the Number of Parallel RT Beam Delimiters (30xx,5048). Required if Device Type Code Sequence (30xx,5026) contains either (S175172, 99SUP175, “Leaf Pairs”), or (S175175, 99SUP175, “Single Leaves”). May be present otherwise. |
| >Parallel RT BeamDelimiter Leaf Mounting Side | (30xx,504F) | 1C | Specifies the mounting side identified by the direction from the tip to the tail of the delimiter parallel to the axis specified by Device Type Code Sequence (30xx,5026). Enumerated Values: 
  - P – Positive mounting side. The axis intercept of the leaf tip is less than the axis intercept of the leaf tail |
<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N – Negative mounting side. The axis intercept of the leaf tip is greater than the axis intercept of the leaf tail.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M values shall be provided, where M is the Number of Parallel RT Beam Delimiters (30xx,5048), in the order of the Parallel RT Beam Delimiter Element Position Boundaries (30xx,5049). Required if Device Type Code Sequence (30xx,5026) contains (S175175, 99SUP175, “Single Leaves”). See C.AA.2.20.1.3.</td>
<td>(30xx,504C)</td>
<td>1C</td>
<td></td>
</tr>
<tr>
<td>The outline of the Beam Limiting Device shape defined on the Beam Modifier Definition Plane. Required if Device Type Code Sequence (30xx,5026) is part of CID SUP175005 “Fixed Beam Limiting Device Types”. Only a single item shall be included in this Sequence.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

>>Include Table C.AA.2.29-1 ‘Outline Definition Macro’

512 C.AA.2.20.1 RT Beam Limiting Device Definition Macro Attribute Description

C.AA.2.20.1.1 RT Beam Limiting Device Label Code

The RT Beam Limiting Device Label Code shall be chosen as follows:

- When the value of RT Beam Limiting Device Mount Angle (30xx,5045) equals zero the code shall be (S175190, 99SUP175, “X”).

- When the value of RT Beam Limiting Device Mount Angle (30xx,yyyy) equals 90 the code shall be (S175191, 99SUP175, “Y”).

- When the value of RT Beam Limiting Device Mount Angle (30xx,yyyy) is not zero or 90, the label should be chosen to best reflect the user perception or another code may be used.

C.AA.2.20.1.2 Parallel RT Beam Delimiter Boundaries

The Parallel RT Beam Delimiter Boundaries (30xx,5049) shall be the positions of the mechanical boundaries (projected on the Beam Modifier Definition Plane defined by the RT Beam Modifier Definition Distance (30xx,5210)) between beam delimiter elements. These are fixed for a given beam limiting device. Parallel RT Beam Delimiter Positions (30xx,504A) are values specific to a given Control Point, specifying the beam limiting device element openings.
### C.AA.2.20.1.3 Number of Parallel RT Beam Delimiters

<table>
<thead>
<tr>
<th>Y</th>
<th>Number of Parallel RT Beam Delimiters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

![Diagram of C.AA.2.20.1.3](image)

**Figure C.AA.2.20.1-1**
Number of Parallel RT Beam Delimiters for X Leaf Pairs

### C.AA.2.20.1.4 RT Beam Limiting Device Proximal Distance and RT Beam Limiting Device Distal Distance

In example in Figure C.AA.2.20.1-2 the delimiters labeled 1, 3 and 5 have a Parallel RT Beam Delimiter Leaf Mounting Side (30xx,504F) value of N (negative direction) and the delimiters labeled 2 and 4 have a Parallel RT Beam Delimiter Leaf Mounting Side value of P (positive direction).

### C.AA.2.20.1.4 Number of Parallel RT Beam Delimiters for X Single Leaves

<table>
<thead>
<tr>
<th>Y</th>
<th>Number of Parallel RT Beam Delimiters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

![Diagram of C.AA.2.20.1.4](image)

**Figure C.AA.2.20.1-2**
Number of Parallel RT Beam Delimiters for X Single Leaves

In this example the reference location specified by the RT Beam Distance Reference Location Code Sequence (30xx,5114) has the value (S175772, 99SUP175, “Radiation Source”).
C.AA.2.21 RT Beam Limiting Device Opening Macro

This macro may be invoked to define the opening created by RT Beam Limiting Devices at a specific Control Point or set of Control Points.

Table C.AA.2.21-1

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RT Beam Limiting Device Opening Sequence</td>
<td>(30xx,5070)</td>
<td>1C</td>
<td>Beam limiting device (collimator) settings defining the opening for the current Control Point. Required if the conditions in Section C.AA.2.16.1.1 are satisfied.</td>
</tr>
<tr>
<td>&gt;-Referenced Device Index</td>
<td>(30xx,9142)</td>
<td>1</td>
<td>The value of Device Index (30xx,9112) from the RT Beam Limiting Device Definition Sequence (30xx,504D) corresponding to the Beam Limiting Device used in this Item.</td>
</tr>
<tr>
<td>&gt;-RT Beam Limiting Device Offset</td>
<td>(30xx,504B)</td>
<td>1C</td>
<td>The offsets (x,y) in mm of the Parallel RT Beam Delimiter Positions (30xx,504A) from the central beam axis in the Beam Modifier</td>
</tr>
<tr>
<td>Attribute Name</td>
<td>Tag</td>
<td>Type</td>
<td>Attribute Description</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>--------------</td>
<td>------</td>
<td>---------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>&gt;Parallel RT Beam Delimiter Positions</td>
<td>(30xx,504A)</td>
<td>1C</td>
<td>One-dimensional positions in mm of beam delimiters.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>If Device Type Code Sequence (30xx,5026) contains (S175175, 99SUP175, “Single Leaves”), N values shall be provided where N is the Number of Parallel RT Beam Delimiters (30xx,5048).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>If Device Type Code Sequence contains (S175170, 99SUP175, “Jaw Pair”) or (S175172, 99SUP175, “Leaf Pairs”), 2N values shall be provided where N is the Number of Parallel RT Beam Delimiters (30xx,5048). The values shall be grouped by the mounting side identified by the Parallel RT Beam Delimiter Leaf Mounting Side (30xx,504F) with the values of RT Beam Delimiter Elements on the negative mounting side first. The order of values shall correspond to the order of the Parallel RT Beam Delimiter Element Boundaries (30xx,5049).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>See C.AA.2.21.1.1 and C.AA.2.21.1.2. Required if the conditions in Section C.AA.2.16.1.1 are satisfied and if Device Type Code Sequence (30xx,5026) contains (S175174, 99SUP175, “Variable Circular Collimator”).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>See C.AA.2.21.1.1. Only a single Item shall be included in this Sequence.</td>
</tr>
<tr>
<td>&gt;RT Beam Delimiter Geometry Sequence</td>
<td>(30xx,504C)</td>
<td>1C</td>
<td>The outline of the Beam Limiting Device opening.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Required if the conditions in Section C.AA.2.16.1.1 are satisfied and</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>if Device Type Code Sequence (30xx,5026) contains (S175174, 99SUP175, “Variable Circular Collimator”).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>See C.AA.2.21.1.1. Only a single Item shall be included in this Sequence.</td>
</tr>
<tr>
<td>&gt;&gt;Include Table C.AA.2.29-1 'Outline Definition Macro'</td>
<td>(30xx,5200)</td>
<td>1C</td>
<td>The Outline Shape Type (30xx,5200) shall be CIRCULAR.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The plane is defined in C.AA.2.21.1.1.</td>
</tr>
</tbody>
</table>
C.AA.2.21.1  RT Beam Limiting Device Opening Attribute Descriptions

C.AA.2.21.1.1  Geometric Value Attributes

All geometric values in Table C.AA.2.21-1 are defined in the Beam Modifier Definition Plane.

C.AA.2.21.1.2  RT Beam Delimiter Element Positions

For Device Type Code Sequence (30xx,5026) values of (S175170, 99SUP175, “Jaw Pair”) or (S175172, 99SUP175, “Leaf Pairs”), the order of values are

N01, N02, … Nn
P01, P02, … Pn

where N denotes the negative mounting side, P the positive mounting side and the indices increasing corresponding to the order of the values of Parallel RT Beam Delimiter Boundaries (30xx,5049).

C.AA.2.22  Wedges Definition Macro

This macro defines the geometric configuration of wedges.

Table C.AA.2.22-1

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Wedges</td>
<td>(300A,00D0)</td>
<td>1C</td>
<td>Number of Wedges defined in the Wedge Definition Sequence (30xx,5062). Required if RT Radiation Planning Content Type (30xx,5013) equals VOLUMETRIC. May be present otherwise.</td>
</tr>
<tr>
<td>Wedge Definition Sequence</td>
<td>(30xx,5062)</td>
<td>1C</td>
<td>Treatment wedge definitions. Required if Number of Wedges (300A,00D0) is present and has a non-zero value. The number of Items included in this Sequence shall equal the value of Number of Wedges (300A,00D0).</td>
</tr>
</tbody>
</table>

>Include Table C.AA.2.15-1 ‘RT Accessory Device Identification Macro’  Defined CID SUP175006 “Radiotherapy Wedge Types”.

>Device Index                     | (30xx,9112) | 1    | Index of this Item in this Sequence. The value shall start at 1 and increase monotonically by 1. |

>Radiation Beam Wedge Angle       | (30xx,5063) | 1    | Nominal wedge angle in degrees. See C.AA.2.22.1.1.                                   |


>Beam Modifier Orientation Angle  | (30xx,5045) | 1    | Angle in degrees of the Beam Modifier Coordinate System with respect to the Base Beam Modifier Coordinate System. The direction from thick edge to thin edge is along the positive x-axis of the Beam Modifier Definition Plane. See C.AA.2.22.1.1. |
C.AA.2.22.1 Wedges Definition Macro Attribute Description

C.AA.2.22.1.1 Radiation Beam Wedge Orientation and Radiation Beam Wedge Angle

For an Equipment Frame of Reference UID 1.2.840.10008.1.4.RRR.1 the wedge orientation has the value of 0 degree when the thin edge of the wedge is directed towards the positive direction of the Y-axis of the IEC BEAM LIMITING DEVICE system.
Update the following section in PS3.3 Annex C:

C.8.8.14.14 Effective Wedge Angle

The Effective Wedge Angle (300A,00DE) and Radiation Beam Effective Wedge Angle (30xx,5066) describe the dosimetric angle of a motorized wedge accounting for the partial presence of the wedge in the beam. The presence of the wedge in the beam is either specified by the Wedge Position (300A,0118) in the Wedge Position Sequence (300A,0116) included in the Control Point Sequence (300A,0111) of the current beam or the RT Control Point Sequence of the current Radiation.

When the wedge is in the beam throughout all control points, the Effective Wedge Angle (300A,00DE) and Radiation Beam Effective Wedge Angle (30xx,5066) will have the same value as the Wedge Angle (300A,00D5)/Radiation Beam Wedge Angle (30xx,5063). Otherwise the Effective Wedge Angle/Radiation Beam Effective Wedge Angle will have a lower value than the Wedge Angle/Radiation Beam Wedge Angle.
Add the following section to PS3.3 Annex C:

C.AA.2.23 Wedge Positions Macro
This macro may be invoked to define the positions of Wedges used in a specific Control Point or set of Control Points.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wedge Position Sequence</td>
<td>(300A,0116)</td>
<td>1C</td>
<td>Position for each Wedge for the current Control Point. Required if the conditions in Section C.AA.2.16.1.1 are satisfied.</td>
</tr>
<tr>
<td>&gt;Referenced Device Index</td>
<td>(30xx,9142)</td>
<td>1</td>
<td>The value of Device Index (30xx,9112) in Wedge Definition Sequence (30xx,5062) for the Wedge being used.</td>
</tr>
<tr>
<td>&gt;Wedge Position</td>
<td>(300A,0118)</td>
<td>1</td>
<td>Position of Wedge at current Control Point. Enumerated Values: IN = Wedge is in fully inserted position, OUT = Wedge is in fully retracted position, PARTIAL = wedge is inserted only part of the way to the fully inserted position</td>
</tr>
<tr>
<td>&gt;Radiation Beam Wedge Thin Edge Distance</td>
<td>(30xx,5065)</td>
<td>1C</td>
<td>Closest distance in mm from the central axis of the beam along the wedge angle direction to the thin edge as projected on the Beam Modifier Definition Plane defined by the RT Beam Modifier Definition Distance (30xx,5210). Value is negative if the position of the thin edge located in the positive direction compared with the central axis, positive otherwise. Required if Wedge Position (300A,0118) is PARTIAL. See C.AA.2.23.1.1.</td>
</tr>
</tbody>
</table>
598 C.AA.2.23.1 Wedge Positions Macro Attribute Description

C.AA.2.23.1.1 Radiation Beam Wedge Thin Edge Distance

![Diagram of Radiation Beam Wedge Thin Edge Distance](image)

Figure C.AA.2.23.1-1
Radiation Beam Wedge Thin Edge Position

(30xx,5065)

600

C.AA.2.24 Compensators Definition Macro

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

606 Table C.AA.2.24-1

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Compensators</td>
<td>(300A,00E0)</td>
<td>1C</td>
<td>Number of Compensators defined in the Compensator Definition Sequence (30xx,5150). Required if RT Radiation Planning Content Type (30xx,5013) equals VOLUMETRIC. May be present otherwise.</td>
</tr>
<tr>
<td>Compensator Definition Sequence</td>
<td>(30xx,5150)</td>
<td>1C</td>
<td>Treatment compensator definitions. Required if the Number of Compensators (300A,00E0) is present and has a non-zero value.</td>
</tr>
<tr>
<td>Attribute Name</td>
<td>Tag</td>
<td>Type</td>
<td>Attribute Description</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>-------------</td>
<td>------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The number of Items included in this Sequence shall equal the value of Number of Compensators (300A.00E0).</td>
</tr>
<tr>
<td>&gt;Include Table C.AA.2.15-1 ‘RT Accessory Device Identification Macro’</td>
<td></td>
<td></td>
<td>Defined CID SUP175002 “Compensator Device Types”.</td>
</tr>
<tr>
<td>&gt;Device Index</td>
<td>(30xx,9112)</td>
<td>1</td>
<td>Index of the Device in this Sequence. The value shall start at 1 and increase monotonically by 1.</td>
</tr>
<tr>
<td>&gt;Beam Modifier Orientation Angle</td>
<td>(300x.5045)</td>
<td>1</td>
<td>Angle in degrees of the Beam Modifier Coordinate System with respect to the Base Beam Modifier Coordinate System.</td>
</tr>
<tr>
<td>&gt;Compensator Base Plane Offset</td>
<td>(300x.5154)</td>
<td>1C</td>
<td>The distance in mm between the mounting plane and the base plane of the compensator. The value shall be positive when the base plane is further away from the reference location, as specified by RT Beam Distance Reference Location Code Sequence (300x.5114), than the mounting plane. Required if RT Radiation Planning Content Type (300x.5013) equals VOLUMETRIC. May be present otherwise. See C.AA.2.24.1.2</td>
</tr>
</tbody>
</table>
| >Compensator Map Orientation       | (300x.5151)| 1C   | Side of the compensator base that the compensator surface shape faces. Enumerated Values:  
|                                    |             |      | PATIENT_SIDE = the compensator surface shape is directed towards the patient.  
|                                    |             |      | SOURCE_SIDE = the compensator surface shape is directed towards the radiation source.  
|                                    |             |      | DOUBLE_SIDED = the compensator has two compensator surface shapes which are directed towards the patient and source respectively.  |
|                                    |             |      | Required if RT Radiation Planning Content Type (300x.5013) equals VOLUMETRIC. May be present otherwise.                                                    |
| >Compensator Shape Sequence        | (300x.5156)| 1C   | Shape of the Compensator and the fabrication parameters. Only one Item shall be present. Required if RT Radiation Planning Content Type (300x.5013) equals VOLUMETRIC. May be present otherwise. |
| >>Compensator Divergence           | (300A.02E0)| 1    | Whether or not the compensator is shaped according to the beam geometrical divergence. Enumerated Values:  
|                                    |             |      | PRESENT = the compensator is                                                                                                                             |

Commented [CS4]: Review with WG-06 in January 2018 continues here.
<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;&gt;Material ID</td>
<td>(300A,00E1)</td>
<td>2</td>
<td>User-supplied identifier for material used to manufacture Compensator.</td>
</tr>
<tr>
<td>&gt;&gt;Compensator Proximal Thickness Map</td>
<td>(30xx,5152)</td>
<td>1C</td>
<td>A triplet of x, y and thickness in mm representing a map of the coordinates in the Beam Modifier Definition Plane and thicknesses from the compensator base plane. Required if Compensator Map Orientation (30xx,5151) is SOURCE_SIDE or DOUBLE_SIDED. See C.8.8.14.10 and C.AA.2.24.1.1.</td>
</tr>
<tr>
<td>&gt;&gt;Compensator Distal Thickness Map</td>
<td>(30xx,5153)</td>
<td>1C</td>
<td>A triplet of x, y and thickness in mm representing a map of the coordinates in the Beam Modifier Definition Plane and thicknesses from the compensator base plane. Required if Compensator Map Orientation (30xx,5151) is PATIENT_SIDE or DOUBLE_SIDED. See C.8.8.14.10 and C.AA.2.24.1.1.</td>
</tr>
<tr>
<td>&gt;&gt;Compensator Shape Fabrication Code Sequence</td>
<td>(30xx,5155)</td>
<td>2</td>
<td>The method of fabrication such as shape of tools to be used, surface modelling technique. Zero or more Items shall be included in this Sequence.</td>
</tr>
<tr>
<td>&gt;&gt;&gt;Include Table 8.8-1 ‘Code Sequence Macro’</td>
<td>No Baseline CID is defined.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt;&gt;Radiation Beam Compensator Milling Tool Diameter</td>
<td>(30xx,5157)</td>
<td>2</td>
<td>The diameter in mm of the milling tool to be used to create the compensator. The diameter is expressed as the actual physical size and not a size projected on the Beam Modifier Definition Plane defined by the RT Beam Modifier Definition Distance (30xx,5210).</td>
</tr>
</tbody>
</table>

**C.AA.2.24.1 Compensators Definition Macro Attribute Descriptions**

**C.AA.2.24.1.1 Compensators Thickness Map and Tray Distance**

The values stored in Compensator Proximal Thickness Map (30xx,5152) and Compensator Distal Thickness Map (30xx,5153) shall be parallel to the radiation beam axis if Compensator Divergence (300A,02E0) equals ABSENT, or divergent according to the beam geometrical divergence if Compensator Divergence (300A,02E0) equals PRESENT.

**C.AA.2.24.1.2 Compensator Base Plane**

The compensator base plane is the side of the compensator which is flat. In case of a double–sided compensator, the base plane is the plane from which the compensator thickness is specified.
C.AA.2.25 Blocks Definition Macro

This macro may be invoked to define those Attributes describing the geometric configuration of blocks or apertures which cannot vary during delivery.

Table C.AA.2.25-1

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Blocks</td>
<td>(300A,00F0)</td>
<td>1C</td>
<td>Number of Blocks defined in the Block Definition Sequence (30xx,5160). Required if RT Radiation Planning Content Type (30xx,5013) is VOLUMETRIC. May be present otherwise.</td>
</tr>
<tr>
<td>Block Definition Sequence</td>
<td>(30xx,5160)</td>
<td>1C</td>
<td>Block definitions. Required if Number of Blocks (300A,00F0)</td>
</tr>
<tr>
<td>Attribute Name</td>
<td>Tag</td>
<td>Type</td>
<td>Attribute Description</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-------------</td>
<td>------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>&gt;Include Table C.AA.2.15-1 'RT Accessory Device Identification Macro'</td>
<td></td>
<td></td>
<td>Defined CID SUP147032 “Radiotherapy Block Device Types”. The Device Alternate Identifier (30xx,1326) Attribute of the RT Accessory Device Identification Macro shall not contain a value when the Number of Block Slab Item (300A,0440) is non-zero.</td>
</tr>
<tr>
<td>&gt;Device Index</td>
<td>(30xx,9112)</td>
<td>1</td>
<td>Index of the Device in this Sequence. The value shall start at 1 and increase monotonically by 1.</td>
</tr>
<tr>
<td>&gt;Beam Modifier Orientation Angle</td>
<td>(30xx,5045)</td>
<td>1</td>
<td>Angle in degrees of the Beam Modifier Coordinate System with respect to the Base Beam Modifier Coordinate System.</td>
</tr>
<tr>
<td>&gt;Material ID</td>
<td>(300A,00E1)</td>
<td>2</td>
<td>User-supplied identifier for material used to manufacture the Block.</td>
</tr>
<tr>
<td>&gt;Block Divergence</td>
<td>(300A,00FA)</td>
<td>1C</td>
<td>Whether or not the block is shaped according to the beam geometrical divergence. Enumerated Values: PRESENT = block edges are shaped for beam divergence ABSENT = block edges are not shaped for beam divergence Required if RT Radiation Planning Content Type (30xx,5013) equals VOLUMETRIC. May be present otherwise.</td>
</tr>
<tr>
<td>&gt;Block Orientation</td>
<td>(30xx,5162)</td>
<td>1C</td>
<td>Specifies on which side of the block base the block extends. Enumerated Values: PATIENT_SIDE = the block extends from its base towards the patient. SOURCE_SIDE = the block extends from its base towards the radiation source. Required if RT Radiation Planning Content Type (30xx,5013) equals VOLUMETRIC. May be present otherwise.</td>
</tr>
<tr>
<td>&gt;Radiation Beam Block Thickness</td>
<td>(30xx,5163)</td>
<td>2C</td>
<td>Physical thickness of block in mm parallel to the central radiation beam axis. Required if Material ID (300A,00E1) has a value. May be present otherwise. See C.AA.2.25.1.1.</td>
</tr>
<tr>
<td>Attribute Name</td>
<td>Tag</td>
<td>Type</td>
<td>Attribute Description</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>--------------</td>
<td>------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Block Edge Data</td>
<td>(30xx,5161)</td>
<td>2</td>
<td>A data stream of coordinate pairs in mm which comprise the block edge. The pairs shall be interpreted as a closed polygon. Coordinates are projected on the Beam Modifier Definition Plane. See C.AA.2.25.1.1.</td>
</tr>
<tr>
<td>Number of Block Slab Items</td>
<td>(300A,0440)</td>
<td>1C</td>
<td>Number of Block Slabs composing the Block. Required if RT Radiation Planning Content Type (30xx,5013) equals VOLUMETRIC. May be present otherwise.</td>
</tr>
<tr>
<td>Block Slab Sequence</td>
<td>(300A,0441)</td>
<td>1C</td>
<td>Sequence of slab(s) that comprise the block. Required if Number of Block Slab Items (300A,0440) is present and a value greater than 1.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>If several items in the Block Definition Sequence (30xx,5160) are present where the Device Type Code Sequence (30xx,5026) has the code value (S175471, 99SUP175, &quot;Aperture Block&quot;) the Block Slab Sequence shall be present only in the first item.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The number of Items included in this Sequence shall equal the value of Number of Block Slab Items (300A,0440).</td>
</tr>
<tr>
<td>Block Slab Number</td>
<td>(300A,0043)</td>
<td>1</td>
<td>Identification number of the Block Slab. The value shall start at 1, and increase monotonically by 1. The number indicates the order of the slabs with respect to the source, where Number 1 corresponds to the slab nearest to the source.</td>
</tr>
<tr>
<td>Radiation Beam Block Slab Thickness</td>
<td>(30xx,5164)</td>
<td>3</td>
<td>Physical thickness of block slab in mm parallel to radiation beam axis. Sum of Block Slab Thickness (300A,0042) of Items of this Sequence must equal Block Thickness (300A,0100) of the block.</td>
</tr>
<tr>
<td>Device Alternate Identifier</td>
<td>(30xx,1326)</td>
<td>2</td>
<td>An identifier intended to be read by a device such as a bar code reader.</td>
</tr>
<tr>
<td>Device Alternate Identifier Type</td>
<td>(30xx,1327)</td>
<td>1C</td>
<td>Defines the type of Device Alternate Identifier. Required if Device Alternate Identifier (30xx,1326) is present. Defined Terms: BARCODE, RFID</td>
</tr>
</tbody>
</table>
| Device Alternate                      | (30xx,1328)  | 1C   | Description of the format in which the
### C.AA.2.25 Blocks Definition Macro Attribute Description

#### C.AA.2.25.1 Multiple aperture blocks

All blocks with Device Type Code Sequence (30xx,5026) with a value of (S175471, 99SUP175, "Aperture Block") for a given beam shall have equal values of Block Thickness (300A,0100) if they are specified. The composite aperture shall be evaluated as the union of the individual apertures within a single Block. Shielding block transmission(s) shall be applied multiplicatively after the (composite) aperture has been evaluated.

#### C.AA.2.25.1.2 Block Edge Data

For an Equipment Frame of Reference UID (30xx,51A0) 1.2.840.10008.1.4.RRR.1 the coordinate pairs are defined as (x,y) coordinates in the IEC Beam Limiting Device Coordinate System.

### C.AA.2.26 Accessory Holders Definition Macro

This macro may be invoked to define those Attributes describing the Accessory Holders which are used to hold accessories.

#### Table C.AA.2.26.1 ACCESSORY HOLDERS DEFINITION MACRO ATTRIBUTES

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of RT Accessory Holders</td>
<td>(30xx,5171)</td>
<td>1C</td>
<td>Number of RT Accessory Holders defined in the RT Accessory Holder Definition Sequence (30xx,954A). Required if RT Radiation Planning Content Type (30xx,5013) equals VOLUMETRIC. May be present otherwise.</td>
</tr>
<tr>
<td>RT Accessory Holder Definition Sequence</td>
<td>(30xx,954A)</td>
<td>1C</td>
<td>Accessory Holder definitions. Required if the Number of RT Accessory Holders (30xx,5171) is present and has a non-zero value. The number of Items included in this Sequence shall equal the value of Number of RT Accessory Holders (30xx,5171).</td>
</tr>
<tr>
<td>Beam Modifier Orientation Angle</td>
<td>(30xx,5049)</td>
<td>1</td>
<td>Angle in degrees of the Beam Modifier Coordinate System with respect to the Base Beam Modifier Coordinate System.</td>
</tr>
</tbody>
</table>

>Include Table C.AA.2.15-1 ‘RT Accessory Device Identification Macro’

>Device Index (30xx,9112) 1 Index of the Device in this Sequence. The value shall start at 1 and increase monotonically by 1.

>Beam Modifier Orientation Angle (30xx,5049) 1 Angle in degrees of the Beam Modifier Coordinate System with respect to the Base Beam Modifier Coordinate System.
<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;RT Accessory Holder Water-Equivalent Thickness</td>
<td>(30xx,92E3)</td>
<td>2</td>
<td>Water-Equivalent thickness of the Accessory Holder in mm parallel to radiation beam axis.</td>
</tr>
<tr>
<td>&gt;RT Accessory Holder Slot Sequence</td>
<td>(30xx,9542)</td>
<td>1C</td>
<td>Slots being available in this Accessory Holder. Required if RT Radiation Planning Content Type (30xx,5013) equals VOLUMETRIC. May be present otherwise. Only allowed to be present if the Device Type Code Sequence (30xx,5026) is part of CID SUP147034 &quot;Radiotherapy Accessory Slot Holder Device Types&quot;. One or more Items shall be included in this Sequence.</td>
</tr>
<tr>
<td>&gt;&gt;RT Accessory Holder Slot ID</td>
<td>(30xx,9544)</td>
<td>1</td>
<td>The ID of the slot where accessories are inserted.</td>
</tr>
<tr>
<td>&gt;&gt;RT Accessory Holder Slot Distance</td>
<td>(30xx,9546)</td>
<td>2</td>
<td>Distance in mm from the reference location as specified by RT Beam Distance Reference Location Code Sequence (30xx,5114) to the slot along the radiation beam axis.</td>
</tr>
</tbody>
</table>

### C.AA.26.1 Accessory Holders Description

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

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

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

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

Figure C.AA.26.1-1
Accessory Holders
C.AA.2.27 General Accessories Definition Macro

This macro may be invoked to define those Attributes describing the geometric configuration of general accessories which cannot vary during delivery.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of General Accessories</td>
<td>(30xx,5181)</td>
<td>1C</td>
<td>Number of General Accessories defined in the General Accessory Definition Sequence (30xx,5180). Required if RT Radiation Planning Content Type (30xx,5013) equals VOLUMETRIC. May be present otherwise.</td>
</tr>
<tr>
<td>General Accessory Definition Sequence</td>
<td>(30xx,5180)</td>
<td>1C</td>
<td>General accessories. Required if the Number of General Accessories (30xx,5181) is present and has a non-zero value. The number of Items included in this Sequence shall equal the value of Number of General Accessories (30xx,5181).</td>
</tr>
</tbody>
</table>

>Include Table C.AA.2.15-1 'RT Accessory Device Identification Macro'

>Device Index (30xx,9112) 1 Index of the Device in this Sequence. The value shall start at 1 and increase monotonically by 1.

C.AA.2.28 Boluses Definition Macro

This macro may be invoked to define those Attributes describing the geometric configuration of a Bolus which cannot vary during delivery.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Boli</td>
<td>(300A,00ED)</td>
<td>1C</td>
<td>Number of boli defined in the Boli Definition Sequence (300A,5190). Required if RT Radiation Planning Content Type (30xx,5013) equals VOLUMETRIC. May be present otherwise.</td>
</tr>
<tr>
<td>Bolus Definition Sequence</td>
<td>(30xx,5190)</td>
<td>1C</td>
<td>Bolus definitions. Required if the Number of Boli (300A,00ED) is present and has a non-zero value. The number of Items included in this Sequence shall equal the value of Number of Boli (300A,00ED).</td>
</tr>
</tbody>
</table>

>Include Table C.AA.2.15-1 'RT Accessory Device Identification Macro'

>Device Index (30xx,9112) 1 Index of the Device in this Sequence.
Sup 175: 2nd Generation RT – C-Arm RT Treatment Modalities

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>The value shall start at 1 and increase monotonically by 1.</td>
</tr>
<tr>
<td>&gt;Conceptual Volume Sequence</td>
<td>(30xx,1346)</td>
<td>2</td>
<td>References a Conceptual Volume that describes the geometry and properties of the bolus. See Section C.AA.2.8.1.1. Zero or one item is permitted in this Sequence.</td>
</tr>
</tbody>
</table>

>>Include Table C.AA.2.6-1 'Conceptual Volume Segmentation Reference and Combination Macro’

C.AA.2.28.1 Boluses Definition Macro Attribute Description

C.AA.2.28.1.1 Conceptual Volume Sequence

The Conceptual Volume Sequence (30xx,1346), if present, identifies the segmented Conceptual Volume used to define the bolus. The segment is defined by the Referenced Segment Annotation Index (30xx,9151) in the Conceptual Volume Segmentation Reference and Combination Macro (see section C.AA.2.6). Alternatively, the bolus may not be associated with a segment. For example, a bolus may cover the entire area of radiation and not require a specific segmentation for definition.

C.AA.2.29 Outline Definition Macro

The Outline Definition Macro describes a 2D outline in a given coordinate system. The values are defined in a plane declared in the invocation of the macro.

Table C.AA.2.29-1 OUTLINE DEFINITION MACRO ATTRIBUTES

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outline Shape Type</td>
<td>(30xx,5200)</td>
<td>1</td>
<td>Shape of the outline. Enumerated values: RECTANGULAR CIRCULAR POLYGONAL See C.AA.2.29.1.1.</td>
</tr>
</tbody>
</table>

Outline Corners | (30xx,5202) | 1C | Positions (x1,y1,x2,y2) in mm of two corners of a rectangular outline. Required if Outline Shape Type (30xx,5200) is RECTANGULAR. See C.AA.2.29.1.2 |

Center of Circular Outline | (30xx,5204) | 1C | Location (x,y) in mm of the center of the circular outline. Required if Outline Shape Type (30xx,5200) is CIRCULAR. See C.AA.2.29.1.2 |

Diameter of Circular Outline | (30xx,5205) | 1C | Diameter in mm of circular outline. Required if Outline Shape Type (30xx,5200) is CIRCULAR. |
C.AA.2.29.1 Outline Definition Macro Attribute Description

C.AA.2.29.1.1 Outline Shape Type

When outline shape is a rectangle or a circle per design, the Outline Shape Type (30xx,5200) shall have the value RECTANGULAR respectively CIRCULAR and the outline shall not be represented as a polyline.

C.AA.2.29.1.2 Coordinate Definitions

The values for the attributes referencing to this section are on the Beam Modifier Definition Plane as defined by the RT Beam Modifier Definition Distance (30xx,5210).

For an Equipment Frame of Reference UID (30xx,51A0) 1.2.840.10008.1.4.RRR.1 the X and Y definitions of the Beam Modifier Definition Plane refer to the IEC Beam Limiting Device Coordinate system.

C.AA.2.30 RT Tolerance Set Macro

The RT Tolerance Set Macro contains information describing the maximum permitted differences between planned and delivered values. This information is used in the context of delivery of the RT Radiation Set. If the absolute difference between a planned and delivered value exceeds the tolerance value, then delivery of the RT Radiation Set shall be inhibited unless an authorized operator confirms that the tolerance may be exceeded.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RT Tolerance Set Label</td>
<td>(30xx,9BA2)</td>
<td>1</td>
<td>User defined label for the Tolerance Set.</td>
</tr>
<tr>
<td>RT Tolerance Set Index</td>
<td>(30xx,9114)</td>
<td>1</td>
<td>Index of the Tolerance Set in the Sequence. The value shall start at 1 and increase monotonically by 1.</td>
</tr>
<tr>
<td>Attribute Tolerance Values Sequence</td>
<td>(30xx,9BA6)</td>
<td>2</td>
<td>Tolerance values representing the allowed difference between the planned and actual values. The Selector Attribute Macro identifies the Attributes for which the tolerances are specified. Required if a tolerance value is specified for at</td>
</tr>
<tr>
<td>Attribute</td>
<td>Code</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>------------</td>
<td>----------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Tolerance Value</td>
<td>(30xx,9BA8)</td>
<td>Maximum permitted difference between the planned and the delivered value. Units are those specified for the corresponding Attribute referenced by the Selector Attribute Macro.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Enumerated Values</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ABSENT - no parameters are specified</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>GLOBAL – parameters are specified irrespective of the devices in use</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DEVICE_SPECIFIC – parameters are specified per device</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Required if Position Specification Method (30xx,5144) does not equal ABSENT.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>One or more Items shall be included in this Sequence if Position Specification Method (30xx,5144) equals DEVICE_SPECIFIC.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Only one Item shall be included in this Sequence if Position Specification Method (30xx,5144) equals GLOBAL.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>See C.AA.2.13.1</td>
<td></td>
</tr>
<tr>
<td>Referenced Device Index</td>
<td>(30xx,9142)</td>
<td>The value of Device Index (30xx,9112) in Patient Support Devices Sequence (30xx,51F0) corresponding to the Patient Support Device in use.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Required if Position Specification Method (30xx,5144) equals DEVICE_SPECIFIC.</td>
<td></td>
</tr>
<tr>
<td>Device Order Index</td>
<td>(30xx,5146)</td>
<td>Index defining the order in which the tolerance parameter set of the device is applied starting at 1.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The value shall start at 1 and increase monotonically by 1.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Required if Position Specification Method (30xx,5144) equals DEVICE_SPECIFIC.</td>
<td></td>
</tr>
<tr>
<td>Patient Support Position Tolerance Sequence</td>
<td>(30xx,9BAA)</td>
<td>Tolerance values for a particular Patient Support device.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>One or more Items shall be included in this Sequence.</td>
<td></td>
</tr>
<tr>
<td>Patient Support</td>
<td>(30xx,5149)</td>
<td>Index defining the order in which the tolerances</td>
<td></td>
</tr>
</tbody>
</table>
The value shall start at 1 and increase monotonically by 1.

Include Table 10-2 'Content Item Macro’ Baseline TID of Concept Name Code Sequence is TID SUP175001. Content items shall use UCUM units of mm and degrees where applicable.

<table>
<thead>
<tr>
<th>Position Tolerance Order Index</th>
<th>of the referenced device are applied starting at 1.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The value shall start at 1 and increase monotonically by 1.</td>
</tr>
</tbody>
</table>

C.AA.2.30.1 RT Tolerance Set Attribute Description

C.AA.2.30.1.1 Attribute Tolerance Values Sequence

The Attribute Tolerance Values Sequence (30xx,9BA6) allows for the reference to any numerical parameter in an RT Radiation IOD. The RT Tolerance Set Macro is invoked to specify a tolerance value for this parameter. The reference specification is conveyed by the Selector Attribute Macro, which allows reference to a tag on any level of nested Sequences, and to refer to specific Items in the Sequence. The unit of the tolerance value is the unit as specified by the data element tag referenced in the Selector Attribute (0072,0026).

C.AA.2.31 Patient to Equipment Relationship Macro

The Patient to Equipment Relationship Macro describes a position of the patient in respect to an RT device. This position could be a Treatment Position, an Imaging Position, a Setup Position or anything else. The purpose of the patient position in the equipment system is defined at the invocation of the macro. The position is defined by means of a transformation matrix between a patient frame of reference and an equipment system.

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Attribute Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image to Equipment Mapping Matrix</td>
<td>(0028,9520)</td>
<td>1</td>
<td>A rigid, homogeneous 4x4 transformation matrix that maps the patient coordinate space in the Frame of Reference used for the patient model to the coordinate system defined by the treatment delivery equipment. Matrix elements shall be listed in row-major order. See C.AA.2.31.1 and C.7.6.21.1.</td>
</tr>
<tr>
<td>Frame of Reference Transformation Comment</td>
<td>(3006,00CB)</td>
<td>3</td>
<td>Comments entered by a human operator about the relationship between the patient frame of reference and the equipment. For display purposes only, shall not be used for other purposes.</td>
</tr>
<tr>
<td>Patient Location Coordinates Sequence</td>
<td>(30xx,6042)</td>
<td>2</td>
<td>Specific points in the patient coordinate system which further characterize the position of the patient with respect to the equipment. One or more Items shall be included in this Sequence.</td>
</tr>
</tbody>
</table>
In the Frame of Reference Module image series in some cases (e.g. emergency treatments), the Patient Frame of Reference is not defined by an image series. In this case an arbitrary Frame of Reference is used for the patient coordinate system in the Frame of Reference Module of the SOP instance. The Image to Equipment Mapping Matrix (0028,9520) has the same meaning as in the case of image-based Patient Frame of Reference.

C.AA.2.31.1 Patient to Equipment Relationship Macro Attributes Description

C.AA.2.31.1.1 Image to Equipment Mapping Matrix and Patient Support Position Macro

The Image to Equipment Mapping Matrix (0028,9520) describes the relationship between the Patient-oriented coordinate system and an RT Device-Specific coordinate system. This matrix \( A \) describes a rigid transformation of a point \((x, y, z)\) with respect to the Patient coordinate system into \((x', y', z')\) with respect to the equipment coordinate system as defined in section C.7.6.21.1.

The RT Device-specific coordinate system is identified by the Equipment Frame of Reference UID (30xx,6046). For further information on the definition of the Equipment Frame of Reference, see Section C.AA.E1.1.1. The patient-oriented coordinate system is identified by the Frame Of Reference UID (0020,0052) in the Frame of Reference Module of the SOP instance it is used within. Both coordinate systems are expressed in millimeters.

The Patient Support Position Macro invoked by Patient Support Position Sequence (30xx,6046) allows the exchange of device-specific parameters for the patient support device. Applications designed to guide a specific patient support device will be able to de-compose the transformation into device-specific parameters or derive a transformation matrix out of these parameters. Applications that are unable to know the decomposition of the transformation to those parameters and vice versa will still be able to display the native labels and numerical values of those parameters to human readers.

In standard planning cases where the relation between the patient system and the equipment system is known, the Image to Equipment Mapping Matrix (0028,9520) shall be used. The Patient Support Position Sequence (30xx,6046) may be present in this case to annotate the matrix and visualize the decomposed matrix contents. The content of the Patient Support Position Macro shall be used for display purposes only. It shall not be used for other purposes. The content of this macro shall not be used as a substitute for the Image to Equipment Mapping Matrix (0028,9520). In general, there is more than one way to reach the point in space that is described by the Image to Equipment Mapping Matrix (0028,9520). Hence it is explicitly not implied how this position is reached.

In some cases (e.g. emergency treatments), the Patient Frame of Reference is not defined by an image series. In this case an arbitrary Frame of Reference is used for the patient coordinate system in the Frame of Reference Module of the SOP instance. The Image to Equipment Mapping Matrix (0028,9520) has the same meaning as in the case of image-based Patient Frame of Reference.

---

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D Point Coordinate</td>
<td>(0068,6590)</td>
<td>Coordinate ((x,y,z)) in mm describing a location in the patient Frame of Reference that will be transformed to the Equipment Frame of Reference by using the Image to Equipment Mapping Matrix (0028,9520).</td>
</tr>
<tr>
<td>Patient Location Coordinates Code Sequence</td>
<td>(30xx,6044)</td>
<td>Identifies the type of Patient Location Coordinate.</td>
</tr>
</tbody>
</table>

---

**Include Table 8.8-1 'Code Sequence Macro'**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Support Position Sequence</td>
<td>(30xx,6046)</td>
<td>Required if the patient position is only available by machine-parameters of the patient support system. May be present otherwise. See C.AA.2.31.1. Only a single Item shall be included in this Sequence.</td>
</tr>
</tbody>
</table>

**Include Table C.AA.2.13-1 'Patient Support Position Macro'**
If the Image to Equipment Mapping Matrix (0028,9520) and the Patient Support Position Sequence (30xx,6046) are both present, the information in both locations shall be consistent.

### C.AA.2.32 RT Treatment Position Macro

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

#### Table C.AA.2.32-1

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Orientation Code Sequence</td>
<td>(0054,0410)</td>
<td>1</td>
<td>Sequence that describes the orientation of the patient with respect to gravity. See C.8.4.6.1.1 for further explanation. Only one item shall be present.</td>
</tr>
<tr>
<td><strong>&gt;Include Table 8.8-1 'Code Sequence Macro'</strong></td>
<td>Defined CID 19 &quot;Patient Orientation&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient Orientation Modifier Code Sequence</td>
<td>(0054,0412)</td>
<td>1C</td>
<td>Sequence describing the orientation of the patient with respect to gravity. Required if needed to fully specify the orientation of the patient with respect to gravity. Only one item shall be present.</td>
</tr>
<tr>
<td><strong>&gt;Include Table 8.8-1 'Code Sequence Macro'</strong></td>
<td>Defined CID 20 &quot;Patient Orientation Modifier&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient Equipment Relationship Code Sequence</td>
<td>(30xx,5030)</td>
<td>1</td>
<td>Sequence describing the orientation of the patient with respect to equipment. Only one item shall be present. See C.AA.B2.1.8.</td>
</tr>
<tr>
<td><strong>&gt;Include Table 8.8-1 'Code Sequence Macro'</strong></td>
<td>Defined CID 21 &quot;Patient Equipment Relationship&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient Setup UID</td>
<td>(30xx,5060)</td>
<td>1C</td>
<td>Identifies a conceptual patient setup that may or may not be realized by one or more RT Patient Setup instances. Required if Referenced RT Patient Setup Sequence (30xx,9C20) is present. May be present otherwise.</td>
</tr>
<tr>
<td>Referenced RT Patient Setup Sequence</td>
<td>(30xx,9C20)</td>
<td>1C</td>
<td>References the RT Patient Setup SOP Instance that was used as the setup instruction for the patient prior to delivery of the radiation. Required if there was a Patient Setup SOP Instance defined providing the instructions to the delivery system. Only a single Item shall be included in this Sequence.</td>
</tr>
</tbody>
</table>
C.AA.C1  RT Radiation Set Module

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

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

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

Table C.AA.C1-1

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Include Table C.AA.2.37-1 'User content Identification Macro'</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Fractions</td>
<td>(30xx,9972)</td>
<td>1</td>
<td>Number of Fractions for which this RT Radiation Set will be repeated.</td>
</tr>
<tr>
<td>Include Table C.AA.2.9-1 'Radiation Fraction Pattern Macro'</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT Radiation Set Intent</td>
<td>(30xx,5011)</td>
<td>1</td>
<td>A general indication of the type of information contained within this RT Radiation Set. Defined Terms: PATIENT_TREATMENT, PLAN_QA, MACHINE_QA, RESEARCH, SERVICE. See C.AA.C1.1.1.</td>
</tr>
</tbody>
</table>
### Attribute Name Description
<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RT Dose Contribution Presence Flag</td>
<td>(30xx,5012)</td>
<td>1</td>
<td>Indicates whether this object contains an RT Dose Contribution. Enumerated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Values YES, NO</td>
</tr>
<tr>
<td>RT Radiation Sequence</td>
<td>(30xx,9B26)</td>
<td>1</td>
<td>RT Radiation instances which are referenced by this RT Radiation Set.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>See C.AA.C1.1.2.</td>
</tr>
</tbody>
</table>

> Include Table 10-11 ‘SOP Instance Reference Macro’

---

### C.AA.C1.1 RT Radiation Set Attribute Description

#### C.AA.C1.1.1 RT Radiation Set Intent

- **PATIENT_TREATMENT** = The RT Radiation Set is for the purpose of treatment delivery. This does not constitute an approval for treatment. All parameters necessary to guide the delivery of RT Radiations are included.

- **PLAN_QA** = The RT Radiation Set is for validating the patient-specific dose by delivering the RT Radiations to a phantom and comparing the calculated dose to the phantom with actual measurements made in the phantom.

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

- **RESEARCH** = The RT Radiation Set is for performing independent research on the treatment planning system or the delivery system.

- **SERVICE** = The RT Radiation Set is for machine repair or to perform a maintenance operation by a service technician.

#### C.AA.C1.1.2 RT Radiation Sequence

All SOP Instances referenced in this Sequence shall

- be of the same SOP Class,

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

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

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

- Modules specified in Table A.VV.1.1.1.2 RT RADIATION IOD MODULES MACRO.

- RT Delivery Device Common Module specified in section C.AA.E1.

- RT Radiation Common Module specified in section C.AA.E2.
C.AA.C2 RT Dose Contribution Module

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

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

Dose contributions are defined using Meterset values. The definition points in the Meterset to Dose Mapping Sequence may or may not align with the Meterset values at the RT Control Points of the RT Radiation SOP Instance. For example, where a dose deposition between Control Points cannot be determined individually per segment or where this definition is not useful, the lookup table may just contain the Meterset of first and last Control Points. The Meterset and dose contribution of the first Control Point are always zero. Further details see C.AA.C2.1.1.

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

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation Dose Identification Sequence</td>
<td>(30xx,9B42)</td>
<td>1</td>
<td>Parameters to identify and scope the dose values that are delivered by this RT Radiation. One or more items shall be included in this Sequence.</td>
</tr>
<tr>
<td>&gt;Radiation Dose Identification Index</td>
<td>(30xx,9120)</td>
<td>1</td>
<td>Index of this Item in this Sequence. The value shall start at 1 and increase monotonically by 1.</td>
</tr>
<tr>
<td>&gt;Radiation Dose Identification Label</td>
<td>(30xx,9B46)</td>
<td>1</td>
<td>Label of the Radiation Dose for the user that serves as the primary identification.</td>
</tr>
<tr>
<td>&gt;Reference Dose Type</td>
<td>(30xx,9B48)</td>
<td>1</td>
<td>Type of reference dose for the RT Radiation. Defined terms: NOMINAL: Nominal radiation dose. Dose values are nominally assigned to the individual RT Radiation SOP instances only. Dose may be calculated on the Fraction level only or otherwise be assigned to individual RT Radiation instance without instance-specific calculations. RADIATION: Dose values carry a representative dose specifically calculated for each referenced RT Radiation SOP instance.</td>
</tr>
<tr>
<td>Attribute Name</td>
<td>Tag</td>
<td>Type</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-----------</td>
<td>------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>&gt;Reference Dose Point Coordinates</td>
<td>(30xx,9B62)</td>
<td>1C</td>
<td>Coordinates (x,y,z) in mm of the reference dose point in DICOM Patient Coordinate System. If present, the dose values shall be calculated at the specified point. Required if dose is calculated at a point.</td>
</tr>
<tr>
<td>&gt;Conceptual Volume Sequence</td>
<td>(30xx,1346)</td>
<td>1</td>
<td>Reference to a Conceptual Volume that receives dose. See C.AA.C2.1.2. Only a single Item shall be included in this Sequence. Each Conceptual Volume UID (30xx,1301) shall only appear once in this Sequence.</td>
</tr>
</tbody>
</table>

Including Table C.AA.2.6-1 ‘Conceptual Volume Segmentation Reference and Combination Macro’

| Radiation Dose Sequence              | (30xx,9B40) | 1    | Parameters that describe dose contributed by referenced RT Radiation SOP instances. For every SOP instance referenced in RT Radiation Sequence (30xx,9B26) exactly one item shall be present in this Sequence. |
| >Referenced RT Radiation Sequence    | (30xx,9C04) | 1    | References the RT Radiation SOP Instance that describes parameters for dose delivery. Only a single Item shall be included in this Sequence. |

Including Table 10-11 ‘SOP Instance Reference Macro’

<p>| &gt;Radiation Dose Values Sequence      | (30xx,9B64) | 1    | Dose values of this RT Radiation with respect to the dose identification items defined in the Radiation Dose Identification Sequence (30xx,9B42). The number of Items included in this Sequence shall be exactly the number of Items in the Radiation Dose Identification Sequence (30xx,9B42). |
| &gt;&gt;Referenced Radiation Dose Identification Index | (30xx,9150) | 1    | The value of Radiation Dose Identification Index (30xx,9120) in the Radiation Dose Identification Sequence (30xx,9B42) identifying the dose contribution. |</p>
<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;&gt; Radiation Dose Tracking Sequence</td>
<td>(30xx,9B4A)</td>
<td>1C</td>
<td>Radiation Dose Tracking values. Required if the Meterset to dose mapping is known. One or more Items shall be present. Each Dose Type (3004,0004) value shall appear no more than once in this Sequence.</td>
</tr>
<tr>
<td>&gt;&gt; Primary Dose Value Indicator</td>
<td>(30xx,9B49)</td>
<td>1</td>
<td>Whether the dose value serves as the primary dose indicator for this RT Radiation Set. Enumerated Values: YES, NO. Exactly one item in the Radiation Dose Values Sequence (30xx,9B64) shall have the value YES. See C.AA.C2.1.3.</td>
</tr>
<tr>
<td>&gt;&gt; Dose Type</td>
<td>(3004,0004)</td>
<td>1</td>
<td>Type of dose of the Radiation Dose Value (30xx,9B6C). Defined Terms: PHYSICAL, EFFECTIVE</td>
</tr>
<tr>
<td>&gt;&gt; Meterset to Dose Mapping Sequence</td>
<td>(30xx,9B68)</td>
<td>1</td>
<td>Mapping of Cumulative Meterset (30xx,5021) to Radiation Dose Value (30xx,9B7B). See C.AA.C2.1.1. Two or more Items shall be included in this Sequence.</td>
</tr>
<tr>
<td>&gt;&gt;&gt; Cumulative Meterset</td>
<td>(30xx,5021)</td>
<td>1</td>
<td>Cumulative Meterset where a dose value is delivered. See C.AA.C2.1.</td>
</tr>
<tr>
<td>&gt;&gt;&gt; Radiation Dose Value</td>
<td>(30xx,9B7B)</td>
<td>1</td>
<td>Dose value (in Gy) delivered at the corresponding Cumulative Meterset (30xx,5021). See C.AA.C2.1.</td>
</tr>
<tr>
<td>&gt;&gt;&gt; Radiation Dose In Vivo Measurement Sequence</td>
<td>(30xx,9B76)</td>
<td>1C</td>
<td>In vivo measurement reference doses. Required if in vivo measurement doses are calculated for this RT Radiation SOP Instance. One or more Items shall be included in this Sequence.</td>
</tr>
<tr>
<td>&gt;&gt;&gt; Radiation Dose In Vivo Measurement Label</td>
<td>(30xx,9B78)</td>
<td>1</td>
<td>Label to identify the in vivo measurement point. See C.AA.2.1.1.1.</td>
</tr>
<tr>
<td>Attribute Name</td>
<td>Tag</td>
<td>Type</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------------------------------------------</td>
<td>-----------</td>
<td>------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>&gt;&gt;Radiation Dose Central Axis Displacement</td>
<td>(30xx,9B7A)</td>
<td>1C</td>
<td>Displacement in mm of the point from the central axis along the x-axis and y-axis of the Beam Modifier Definition Plane. Required if radiation technique uses a central beam axis and the Radiation Dose Measurement Point Coordinates (30xx,9B7D) has not value.</td>
</tr>
<tr>
<td>&gt;&gt;Radiation Dose Value</td>
<td>(30xx,9B7B)</td>
<td>1</td>
<td>Dose Value in Gy for comparison to the measured dose.</td>
</tr>
<tr>
<td>&gt;&gt;Radiation Dose Source to Skin Distance</td>
<td>(30xx,9B7C)</td>
<td>2</td>
<td>Source to patient skin distance along the ray from the source to the in vivo measurement point in mm.</td>
</tr>
<tr>
<td>&gt;&gt;Radiation Dose Source to External Contour Distance</td>
<td>(30xx,9B7E)</td>
<td>2</td>
<td>Source to External Contour distance in mm including devices associated with the patient anatomy model. For dosimetric purposes this value may differ from the Radiation Dose Source to Skin Distance (30xx,9B7C). See C.AA.C2.1.4.</td>
</tr>
<tr>
<td>&gt;&gt;Radiation Dose Measurement Point Coordinates</td>
<td>(30xx,9B7D)</td>
<td>2</td>
<td>Coordinates (x,y,z) in mm in DICOM Patient Coordinate System of the point in the Frame of Reference as referred to by this RT Radiation Set SOP Instance.</td>
</tr>
</tbody>
</table>

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

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

The Meterset to Dose Mapping Sequence (30xx,9B68) establishes a lookup table of dose values delivered at certain Metersets.

In the first item, the value of Cumulative Meterset (30xx,5021) and of Radiation Dose Value (30xx,9B7B) shall always be zero.

In the last item, the value of Cumulative Meterset (30xx,5021) shall be the Meterset of the final Control Point. The value of Radiation Dose Value (30xx,9B7B) in the last item represents the dose delivered to the referenced anatomy when one fraction is completely delivered.

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

C.AA.C2.1.2 Conceptual Volume Sequence

The Conceptual Volume Sequence (30xx,1346) identifies a Conceptual Volume defining a volume for which dose is tracked during treatments. If the Conceptual Volume is associated with a segment, the segment is defined by the Referenced Segment Annotation Index (30xx,9151) in the Conceptual Volume Segmentation Reference and Combination Macro (see section C.AA.2.6). Alternatively, the dosimetric volume may not be associated with a segment. For example, dose tracking may be specified using a nominal dose to a anatomical region of interest and the tracking coefficients approximated by Meterset values.
Primary Dose Value Indicator

The Primary Dose Value Indicator (30xx,9B49) is intended to be used to indicate the one representative dose value out of the list of doses which is used for display purposes. Typically this value refers to the primary target while the other non-primary values may refer to e.g. organs at risk.

Source to External Contour Distance

The Source to External Contour Distance (30xx,9C62) is the distance to the beam entry point, which may include Bolus, Patient Positioning Devices, Patient Immobilization Devices or other devices. This value is useful for including the attenuation effects of external devices on the dose calculation and for patient setup.

Radiation Dose Value

The Radiation Dose Value (30xx,9B7B) represents the cumulative dose delivered from the beginning of radiation delivery to the Cumulative Meterset (30xx,5021).

RT Delivery Device Common Module

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

---

### Table C.AA.E1-1

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation Dosimeter Unit Sequence</td>
<td>(30xx,5113)</td>
<td>1</td>
<td>Measurement unit of machine dosimeter. Only a single item shall be present in the Sequence.</td>
</tr>
<tr>
<td>&gt;Include Table 8.8-1 ‘Code Sequence Macro’</td>
<td></td>
<td></td>
<td>CID is specified in the IOD</td>
</tr>
<tr>
<td>Radiation Device Configuration and Commissioning Key Sequence</td>
<td>(30xx,5115)</td>
<td>2</td>
<td>Keys identifying the configuration and commissioning data used as input for treatment planning of this Instance. Value Type (0040,A040) is constrained to value UIDREF. One or more Items shall be present in this Sequence.</td>
</tr>
<tr>
<td>&gt;Include Table 10-2 ‘Content Item Macro’</td>
<td></td>
<td></td>
<td>No Baseline CID defined.</td>
</tr>
<tr>
<td>Radiation Device Calibration Protocol Code Sequence</td>
<td>(30xx,5116)</td>
<td>2</td>
<td>The protocol used to calibrate the Radiation Device See Note 1.</td>
</tr>
<tr>
<td>&gt;Include Table 8.8-1 ‘Code Sequence Macro’</td>
<td></td>
<td></td>
<td>Baseline CID SUP175015 “Radiation Device Calibration Protocol Codes”.</td>
</tr>
<tr>
<td>RT Device Distance Reference Location Code Sequence</td>
<td>(30xx,5114)</td>
<td>1</td>
<td>Point of reference for the distances measured to various devices. Only a single item shall be present in the Sequence.</td>
</tr>
<tr>
<td>&gt;Include Table 8.8-1 ‘Code Sequence Macro’</td>
<td></td>
<td></td>
<td>Defined CID SUP175004 “Radiotherapy Distance Reference Locations”</td>
</tr>
<tr>
<td>Attribute Name</td>
<td>Tag</td>
<td>Type</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>--------------</td>
<td>------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>RT Beam Modifier Definition Distance</td>
<td>(30xx,5210)</td>
<td>1</td>
<td>Distance in mm along the beam line from the reference location as specified by RT Beam Distance Reference Location Code Sequence (30xx,5114) to the Beam Modifier Definition Plane. The value shall be greater than zero. See C.AA.1.10.</td>
</tr>
<tr>
<td>Equipment Frame of Reference UID</td>
<td>(30xx,51A0)</td>
<td>1</td>
<td>Frame of Reference identifier for the Treatment Delivery Device. See C.AA.E1.1.1.</td>
</tr>
<tr>
<td>Equipment Frame of Reference Description</td>
<td>(30xx,51A1)</td>
<td>3</td>
<td>Informal description of equipment coordinate system identified by the Equipment Frame of Reference UID (30xx,51A0) used for the Treatment Delivery Device. See C.AA.E1.1.1.</td>
</tr>
<tr>
<td>Equipment Location Coordinates Sequence</td>
<td>(30xx,51A2)</td>
<td>1C</td>
<td>Equipment coordinates in the equipment coordinate system. Required if any specific points should be annotated which are of relevance with respect to the equipment. One or more Items shall be included in this Sequence.</td>
</tr>
<tr>
<td>&gt;3D Point Coordinate</td>
<td>(0068,6590)</td>
<td>1C</td>
<td>Coordinate (x,y,z) in mm describing a location in the Equipment Frame of Reference. Required if Fiducial UID (0070,031A) is not present.</td>
</tr>
<tr>
<td>&gt;Fiducial UID</td>
<td>(0070,031A)</td>
<td>1C</td>
<td>The UID that identifies the fiducial describing a location in the equipment Frame of Reference. Required if 3D Point Coordinate (0068,6590) is not present.</td>
</tr>
<tr>
<td>&gt;Equipment Location Coordinates Code Sequence</td>
<td>(30xx,51A3)</td>
<td>1</td>
<td>Identifies the type of Equipment Location Coordinate.</td>
</tr>
</tbody>
</table>

- Include Table C.AA.2.12-1 ‘RT Patient Support Devices Macro’

880

**C.AA.E1.1** RT Delivery Device Common Module Attribute Description

**C.AA.E1.1.1** Equipment Frame of Reference UID

The Equipment Frame of Reference UID (30xx,51A0) uniquely identifies the coordinate system of the Treatment Device.
The Equipment Frame of Reference (30xx,51A0) is defined for any class of devices that share a common coordinate system. The coordinate system is fully characterized by the location of the origin and the orientation of coordinate axes with respect to the device. The choice of origin for an RT Delivery Device is device-specific. It may be any significant location on the machine such as the manufacturer-dependent machine isocenter (not necessarily the IEC Isocenter). The Equipment Frame of Reference (30xx,51A0) is a right-handed system, i.e. the vector cross product of a unit vector along the positive x-axis and a unit vector along the positive y-axis is equal to a unit vector along the positive z-axis. No recommendation is made concerning the orientation of the axes.

It is the responsibility of the device manufacturer or other organization to provide a new well-known Equipment Frame of Reference UID (30xx,51A0) for that device if it does not comply with a standard Frame of Reference, e.g. IEC 61217. This Equipment Frame of Reference UID (30xx,51A0) shall be provided in the Conformance Statement along a definition of the location of the origin and orientation of the coordinate axes. For RT Delivery Device sub-components additional child coordinate system(s) may be defined. All geometric parameters (e.g. x and y directions for rows and columns for compensators, x and y directions for wedges, ...) used in a RT Radiation IOD shall be declared with respect to a coordinate system.

Note:
1. Equipment Frame of Reference Description (30xx,51A1) is an informal annotation only and shall not be used for any normative description of the equipment coordinate system.
2. The use of the Equipment Frame of Reference UID (30xx,51A0) is restricted to the classification of the equipment coordinate system and shall not be used to define any patient-based Frame of Reference.

C.AA.E1.2 Well-known Frame of Reference for Equipment
The following sections contain specifications of Well-known Frame of References used as Equipment Frame of References.

C.AA.E1.2.1 IEC 61217 Fixed Reference System Frame of Reference
For the Equipment Frame of Reference UID (30xx,51A0) 1.2.840.10008.1.4.RRR.1 the following applies:

- The Equipment Frame of Reference Coordinate System is the IEC 61217 FIXED system
- The Beam Modifier Coordinate Systems of all beam modifiers are the IEC 61217 BEAM LIMITING DEVICE system and the parent system is the IEC 61217 GANTRY system.
- In addition to the IEC 61217 definition, RT Radiation SOP Classes allow Beam Modifier Coordinate Systems to rotate independently from each beam modifier.
C.AA.E2  RT Radiation Common Module

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

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RT Radiation Planning Content Type</td>
<td>(30xx,5013)</td>
<td>1</td>
<td>The type of acquired or planned content within this SOP Instance. Enumerated Values: NONE VOLUMETRIC Volumetric planning. NON-VOLUMETRIC Non-volumetric planning or acquisition. GEOMETRY_ONLY Geometric information without dosimetric information (e.g. Virtual Simulation).</td>
</tr>
<tr>
<td>RT Radiation Recording Content Type</td>
<td>(30xx,5014)</td>
<td>1</td>
<td>Whether or not this SOP Instance contains a record of how treatment was delivered. Enumerated Values: YES NO</td>
</tr>
<tr>
<td>RT Treatment Technique Code Sequence</td>
<td>(30xx,9976)</td>
<td>1</td>
<td>Type of treatment technique. Only a single Item shall be included in this Sequence. See C.AA.E2.1.1.</td>
</tr>
<tr>
<td>RT Tolerance Set Sequence</td>
<td>(30xx,9BA0)</td>
<td>3</td>
<td>A set of tolerance values to be applied to delivery of the RT Radiation. Only a single Item is permitted in this Sequence.</td>
</tr>
<tr>
<td>Treatment Time Limit</td>
<td>(30xx,9BAD)</td>
<td>3</td>
<td>The expected maximum delivery time in [sec]. See C.AA.E2.1.3.</td>
</tr>
</tbody>
</table>
**Table C.AA.G1-1 C-ARM PHOTON-ELECTRON DELIVERY DEVICE MODULE ATTRIBUTES**

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation Source-Axis Distance</td>
<td>(30xx,5029)</td>
<td>3</td>
<td>Distance in mm from the radiation source to the gantry rotation axis.</td>
</tr>
</tbody>
</table>
Editorial Note: Update all existing locations of Source-Axis Distance in the Standard.

C.AA.G2  C-Arm Photon-Electron Beam Module
The C-Arm Photon-Electron Beam Module specifies how a C-Arm photon or electron treatment beam is to be delivered.

Table C.AA.G2-1
C-ARM PHOTON-ELECTRON BEAM MODULE ATTRIBUTES

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-Arm Photon-Electron Control Point Sequence</td>
<td>(30xx,9C00)</td>
<td>1</td>
<td>Control Points used to model the beam delivery. Two or more Items shall be included in this Sequence.</td>
</tr>
</tbody>
</table>

>Include Table C.AA.2.17-1 'External Beam Control Point General Macro’  
Defined CID SUP175010 "C-Arm Photon-Electron Delivery Dose Rate Unit"
<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;Referenced Radiation Generation Mode Index</td>
<td>(30xx,9124)</td>
<td>1C</td>
<td>Radiation Generation Mode Index (30xx,9113) in the Radiation Generation Mode Sequence (30xx,51C0) in this IOD. Required if the conditions in Section C.AA.2.16.1.1 are satisfied.</td>
</tr>
</tbody>
</table>

>Include Table C.AA.2.21-1 'RT Beam Limiting Device Opening Macro'

>Include Table C.AA.2.23-1 'Wedge Positions Macro'

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Tag</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;Source Roll Continuous Angle</td>
<td>(30xx,51B5)</td>
<td>1C</td>
<td>Continuous gantry roll angle in degrees of the radiation source at the Control Point with respect to the Equipment Frame of Reference. See C.AA.G2.1.1, C.AA.1.8 and C.AA.E1.1.1. Required if the conditions in Section C.AA.2.16.1.1 are satisfied.</td>
</tr>
<tr>
<td>&gt;RT Beam Limiting Device Continuous Angle</td>
<td>(30xx,51B4)</td>
<td>1C</td>
<td>Angle in degrees of the Beam Modifier Coordinate System about the Z-axis relative to the parent coordinate system. See C.AA.1.8 and C.AA.G2.1.2. Required if the conditions in Section C.AA.2.16.1.1 are satisfied.</td>
</tr>
<tr>
<td>&gt;Source to Patient Surface Distance</td>
<td>(30xx,9C63)</td>
<td>2C</td>
<td>Source to Patient Surface (skin) distance in mm. Required if the conditions in Section C.AA.2.16.1.1 are satisfied.</td>
</tr>
<tr>
<td>&gt;Source to External Contour Distance</td>
<td>(30xx,9C62)</td>
<td>2C</td>
<td>Source to External Contour distance in mm including devices associated with the patient anatomy model. For dosimetric purposes this value may differ from the Source to Surface Distance (300A,0130). See C.AA.C2.1.4. Required if the conditions in Section C.AA.2.16.1.1 are satisfied.</td>
</tr>
</tbody>
</table>

964 C.AA.G2.1  C-Arm Photon-Electron Beam Attribute Description

C.AA.G2.1.1  Source Roll Continuous Angle

For an Equipment Frame of Reference UID (30xx,51A0) 1.2.840.10008.1.4.RRR.1 the source roll angle is the rotation of the IEC 61217 GANTRY coordinate system about the Y-axis of the IEC 61217 FIXED coordinate system.

C.AA.G2.1.2  RT Beam Limiting Device Continuous Angle

For an Equipment Frame of Reference UID (30xx,51A0) 1.2.840.10008.1.4.RRR.1 the RT Beam Limiting Device Continuous Angle (30xx,51B4) is the rotation of the IEC 61217 BEAM LIMITING DEVICE system about the Z-axis of the IEC 61217 GANTRY system.
Part 4 Addendum

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

<table>
<thead>
<tr>
<th>SOP Class Name</th>
<th>SOP Class UID</th>
<th>IOD Spec (defined in PS 3.3)</th>
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<tr>
<td>RT Radiation Set Storage</td>
<td>1.2.840.10008.5.1.4.1.1.481.XN.3</td>
<td>RT Radiation Set IOD</td>
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<tr>
<td>C-Arm Photon-Electron Radiation Storage</td>
<td>1.2.840.10008.5.1.4.1.1.481.XN.5.2</td>
<td>C-Arm Photon-Electron Radiation IOD</td>
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</tbody>
</table>
Add the following data elements to PS3.6:

### 6 REGISTRY OF DICOM DATA ELEMENTS

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<td>Patient Location Coordinates Code Sequence</td>
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<td>PatientSupportPositionSequence</td>
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</table>
Add the following to PS3.6 Annex A:

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

Table A-1 UID Values

<table>
<thead>
<tr>
<th>UID Value</th>
<th>UID NAME</th>
<th>UID TYPE</th>
<th>Part</th>
</tr>
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<tr>
<td>1.2.840.10008.5.1.1.1.481.XN.3</td>
<td>RT Radiation Set Storage</td>
<td>SOP Class</td>
<td>PS3.4</td>
</tr>
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<td>1.2.840.10008.5.1.1.1.481.XN.5.2</td>
<td>C-Arm Photon-Electron Radiation Storage</td>
<td>SOP Class</td>
<td>PS3.4</td>
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<tr>
<td>1.2.840.10008.1.4.RRR.1</td>
<td>IEC 61217 Fixed Coordinate System Frame of Reference</td>
<td>Well-known Frame of Reference</td>
<td>PS3.3</td>
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</table>

Table A-2. Well-known Frames of Reference

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<th>UID Value</th>
<th>UID Name</th>
<th>Normative Reference</th>
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<td>1.2.840.10008.1.4.RRR.1</td>
<td>IEC 61217 Fixed Coordinate System Frame of Reference</td>
<td>Fixed coordinate system (&quot;f&quot;) of IEC 61217, Edition 2.0, 2011-12 &quot;Radiotherapy equipment – Coordinates, movements and scales&quot;</td>
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Table A-3 Context Group UID Values

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<th>Context Group Name</th>
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<td>1.2.840.10008.6.1.S175.01</td>
<td>SUP175001</td>
<td>Beam Limiting Device Types</td>
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<td>1.2.840.10008.6.1.S175.02</td>
<td>SUP175002</td>
<td>Compensator Device Types</td>
</tr>
<tr>
<td>1.2.840.10008.6.1.S175.03</td>
<td>SUP175003</td>
<td>Radiotherapy Treatment Machine Modes</td>
</tr>
<tr>
<td>1.2.840.10008.6.1.S175.04</td>
<td>SUP175004</td>
<td>Radiotherapy Distance Reference Locations</td>
</tr>
<tr>
<td>1.2.840.10008.6.1.S175.05</td>
<td>SUP175005</td>
<td>Fixed Beam Limiting Device Types</td>
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<td>SUP175006</td>
<td>Radiotherapy Wedge Types</td>
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<tr>
<td>1.2.840.10008.6.1.S175.07</td>
<td>SUP175007</td>
<td>RT Beam Limiting Device Orientation Labels</td>
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<tr>
<td>1.2.840.10008.6.1.S175.08</td>
<td>SUP175008</td>
<td>General Accessory Device Types</td>
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<td>1.2.840.10008.6.1.S175.09</td>
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<td>Radiation Generation Mode Type</td>
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<td>SUP175010</td>
<td>C-Arm Photon-Electron Delivery Rate Units</td>
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<td>SUP175014 Equipment Location Codes</td>
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<td>SUP175015 Radiation Device Calibration Protocol Codes</td>
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</table>
**Part 16 Addendum**

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

### CID SUP175001 BEAM LIMITING DEVICE TYPES

**Context ID SUP175001**

**Beam Limiting Device Types**

<table>
<thead>
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<th>Coding Scheme Designator (0008,0102)</th>
<th>Code Value (0008,0100)</th>
<th>Code Meaning (0008,0104)</th>
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<tr>
<td>99SUP175</td>
<td>S175170</td>
<td>Jaw Pair</td>
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<tr>
<td>99SUP175</td>
<td>S175172</td>
<td>Leaf Pairs</td>
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<td>99SUP175</td>
<td>S175174</td>
<td>Variable Circular Collimator</td>
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<td>99SUP175</td>
<td>S175175</td>
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*Include CID SUP175005 “Fixed Beam Limiting Device Types”*

### CID SUP175002 COMPENSATOR DEVICE TYPES

**Context ID SUP175002**

**Compensator Device Types**

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<tr>
<td>99SUP175</td>
<td>S175270</td>
<td>Standard Compensator</td>
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### CID SUP175003 RADIOThERAPy TREATMENT MACHINE MODES

**Context ID SUP175003**

**Radiotherapy Treatment Machine Modes**

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<td>S175281</td>
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## CID SUP175004  RADIOThERAPY DISTANCE REFERENCE LOCATIONS

**Context ID** SUP175004  
**Radiotherapy Distance Reference Locations**

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<td>(0008,0104)</td>
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<td>S175772</td>
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<td>S175773</td>
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## CID SUP175005  FIXED BEAM LIMITING DEVICE TYPES

**Context ID** SUP175005  
**Fixed Beam Limiting Device Types**

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## CID SUP175006  RADIOThERAPY WEDGE TYPES

**Context ID** SUP175006  
**Radiotherapy Wedge Types**

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### CID SUP175007  RT BEAM LIMITING DEVICE ORIENTATION LABELS

**Context ID SUP175007**

**RT Beam Limiting Device Orientation Labels**

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### CID SUP175008  GENERAL ACCESSORY DEVICE TYPES

**Context ID SUP175008**

**General Accessory Device Types**

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<th>Code Meaning (0008,0104)</th>
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<td>S175452</td>
<td>Reticle</td>
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<td>S175453</td>
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<td>S175454</td>
<td>Film Holder</td>
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<td>99SUP175</td>
<td>S175455</td>
<td>Winston-Lutz Pointer</td>
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<td>S175456</td>
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### CID SUP175009  RADIATION GENERATION MODE TYPE

**Context ID SUP175009**

**Radiation Generation Mode Type**

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<th>Coding Scheme Designator</th>
<th>Code Value (0008,0100)</th>
<th>Code Meaning (0008,0104)</th>
</tr>
</thead>
<tbody>
<tr>
<td>99SUP175</td>
<td>S175560</td>
<td>Flattening Filter Beam</td>
</tr>
<tr>
<td>99SUP175</td>
<td>S175561</td>
<td>No Flattening Filter Beam</td>
</tr>
<tr>
<td>CID SUP175010</td>
<td>C-ARM PHOTON-ELECTRON DELIVERY RATE UNITS</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Context ID SUP175010</td>
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<td></td>
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<tr>
<td>Type: Non-Extensible Version: yyyyymmdd</td>
<td></td>
<td></td>
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<tr>
<td>Coding Scheme Designator (0008,0102)</td>
<td>Code Value (0008,0100)</td>
<td>Code Meaning (0008,0104)</td>
</tr>
<tr>
<td>UCUM</td>
<td>(MU)/s</td>
<td>Monitor Units / Second</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CID SUP175011</th>
<th>TREATMENT DELIVERY DEVICE TYPE</th>
</tr>
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<tbody>
<tr>
<td>Context ID SUP175011</td>
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<tr>
<td>Coding Scheme Designator (0008,0102)</td>
<td>Code Value (0008,0100)</td>
</tr>
<tr>
<td>99SUP175</td>
<td>S175890</td>
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</table>

<table>
<thead>
<tr>
<th>CID SUP175012</th>
<th>C-ARM PHOTON-ELECTRON DOSIMETER UNIT</th>
</tr>
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<tbody>
<tr>
<td>Context ID SUP175012</td>
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<td>Code Value (0008,0100)</td>
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<tr>
<td>UCUM</td>
<td>(MU)</td>
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</table>

<table>
<thead>
<tr>
<th>CID SUP175013</th>
<th>TREATMENT POINTS</th>
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<tbody>
<tr>
<td>Context ID SUP175013</td>
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</tr>
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<td>Type: Extensible Version: yyyyymmdd</td>
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<tr>
<td>Coding Scheme Designator (0008,0102)</td>
<td>Code Value (0008,0100)</td>
</tr>
<tr>
<td>99SUP175</td>
<td>S175105</td>
</tr>
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</table>
CID SUP175014  EQUIPMENT LOCATION CODES

Context ID SUP175014

<table>
<thead>
<tr>
<th>Equipment Location Codes</th>
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<tbody>
<tr>
<td>Coding Scheme Designator</td>
</tr>
<tr>
<td>CID SUP175014</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type: Extensible</th>
<th>Version: yyyyymmdd</th>
</tr>
</thead>
</table>

| 99SUP175 | S175774 | Fixed Laser Setup Point |

CID SUP175015  RADIATION DEVICE CALIBRATION PROTOCOL CODES

Context ID SUP175015

<table>
<thead>
<tr>
<th>Radiation Device Calibration Protocol Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coding Scheme Designator</td>
</tr>
<tr>
<td>----------------------------</td>
</tr>
<tr>
<td>99SUP175</td>
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<tr>
<td>99SUP175</td>
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<td>99SUP175</td>
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<tr>
<td>99SUP175</td>
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</table>

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

TID SUP175001  PATIENT SUPPORT POSITION PARAMETERS

Context ID SUP175001

<table>
<thead>
<tr>
<th>Patient Support Position Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type: Extensible</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Value Type</th>
<th>Concept Name</th>
<th>VM</th>
<th>Req Type</th>
<th>Condition</th>
<th>Value Set Constraint</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NUMERIC</td>
<td>EV (126802, DCM; “IEC61217 Table Top Continuous Pitch Angle”)</td>
<td>1 U</td>
<td>Units = EV (deg, UCUM, °)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>NUMERIC</td>
<td>EV (126803, DCM; “IEC61217 Table Top Continuous Roll Angle”)</td>
<td>1 U</td>
<td>Units = EV (deg, UCUM, °)</td>
<td></td>
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<tr>
<td></td>
<td>3</td>
<td>NUMERIC</td>
<td>EV (126801, DCM, &quot;IEC61217 Patient Support Continuous Yaw Angle&quot;)</td>
<td>1</td>
<td>U</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---------</td>
<td>-------------------------------------------------</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>NUMERIC</td>
<td>EV (126804, DCM, &quot;IEC61217 Table Top Eccentric Axis Distance&quot;)</td>
<td>1</td>
<td>U</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>NUMERIC</td>
<td>EV (126805, DCM, &quot;IEC61217 Table Top Continuous Eccentric Angle&quot;)</td>
<td>1</td>
<td>U</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>NUMERIC</td>
<td>EV (126806, DCM, &quot;IEC61217 Table Top Lateral Position&quot;)</td>
<td>1</td>
<td>U</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>NUMERIC</td>
<td>EV (126807, DCM, &quot;IEC61217 Table Top Longitudinal Position&quot;)</td>
<td>1</td>
<td>U</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>NUMERIC</td>
<td>EV (126808, DCM, &quot;IEC61217 Table Top Vertical Position&quot;)</td>
<td>1</td>
<td>U</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>NUMERIC</td>
<td>EV (S175305, 99SUP175, &quot;Isocentric Patient Support Continuous Pitch Angle&quot;)</td>
<td>1</td>
<td>U</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>NUMERIC</td>
<td>EV (S175306, 99SUP175, &quot;Isocentric Patient Support Continuous Roll Angle&quot;)</td>
<td>1</td>
<td>U</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>NUMERIC</td>
<td>EV (S175307, 99SUP175, &quot;Isocentric Patient Support Continuous Yaw Angle&quot;)</td>
<td>1</td>
<td>U</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>NUMERIC</td>
<td>EV (S175308, 99SUP175, &quot;Isocentric Patient Support Lateral Position&quot;)</td>
<td>1</td>
<td>U</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>NUMERIC</td>
<td>EV (S175309, 99SUP175, &quot;Isocentric Patient Support Longitudinal Position&quot;)</td>
<td>1</td>
<td>U</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>NUMERIC</td>
<td>EV (S175310, 99SUP175, &quot;Isocentric Patient Support Vertical Position&quot;)</td>
<td>1</td>
<td>U</td>
</tr>
</tbody>
</table>
Add the following codes to the table in PS3.16, Annex D:

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

ANNEX D  DICOM CONTROLLED TERMINOLOGY DEFINITIONS (NORMATIVE)

<table>
<thead>
<tr>
<th>Code Value</th>
<th>Code Meaning</th>
<th>Definition</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>S175120</td>
<td>Volumetric Planning Data Scope</td>
<td>Data defined for a treatment where volumetric treatment planning is prospectively performed.</td>
<td></td>
</tr>
<tr>
<td>S175121</td>
<td>Treatment Recording Data Scope</td>
<td>Data is recorded for a treatment session.</td>
<td></td>
</tr>
<tr>
<td>S175122</td>
<td>Non-Volumetric Planning Data Scope</td>
<td>Data defined for a treatment where no volumetric treatment planning is prospectively performed (e.g. for an emergency treatment).</td>
<td></td>
</tr>
<tr>
<td>S175123</td>
<td>Geometric Plan Data Scope</td>
<td>Data defining beam geometry (i.e. direction and aperture with respect to the patient), e.g. for Virtual Simulation.</td>
<td></td>
</tr>
<tr>
<td>S175170</td>
<td>Jaw Pair</td>
<td>RT beam limiting device jaw pair</td>
<td></td>
</tr>
<tr>
<td>S175172</td>
<td>Leaf Pairs</td>
<td>RT beam limiting device multi-element leaf pairs</td>
<td></td>
</tr>
<tr>
<td>S175174</td>
<td>Variable Circular Collimator</td>
<td>A circular, aperture size adjustable beam limiting device for an RT treatment device.</td>
<td></td>
</tr>
<tr>
<td>S175175</td>
<td>Single Leaves</td>
<td>RT beam limiting device multi-element unpaired leaves</td>
<td></td>
</tr>
<tr>
<td>S175190</td>
<td>X</td>
<td>RT beam limiting device that moves in X direction</td>
<td></td>
</tr>
<tr>
<td>S175191</td>
<td>Y</td>
<td>RT beam limiting device that moves in Y direction</td>
<td></td>
</tr>
<tr>
<td>S175270</td>
<td>Compensator</td>
<td>External beam compensator</td>
<td></td>
</tr>
<tr>
<td>S175281</td>
<td>Total Body Irradiation</td>
<td>An RT Treatment irradiating the whole body.</td>
<td></td>
</tr>
<tr>
<td>S175282</td>
<td>Total Skin Irradiation</td>
<td>An RT Treatment irradiating the entire surface of the skin of the whole body or in a certain area of the patient.</td>
<td></td>
</tr>
<tr>
<td>S175305</td>
<td>Isocentric Patient Support Continuous Pitch Angle</td>
<td>Patient Support Continuous Pitch Angle in degrees at the isocenter position about the x-axis of the Equipment Frame of Reference coordinate system.</td>
<td></td>
</tr>
<tr>
<td>Code Value</td>
<td>Code Meaning</td>
<td>Definition</td>
<td>Notes</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>S175306</td>
<td>Isocentric Patient Support</td>
<td>Patient Support Continuous Roll Angle in degrees at the isocenter position about the y-axis of the Equipment Frame of Reference coordinate system.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Continuous Roll Angle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S175307</td>
<td>Isocentric Patient Support</td>
<td>Patient Support Continuous Yaw Angle in degrees at the isocenter position about the z-axis of the Equipment Frame of Reference coordinate system.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Continuous Yaw Angle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S175308</td>
<td>Isocentric Patient Support</td>
<td>Patient Support Lateral Position in mm along the x-axis of the Equipment Frame of Reference coordinate system.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lateral Position</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S175309</td>
<td>Isocentric Table Top</td>
<td>Patient Support Lateral Position in mm along the y-axis of the Equipment Frame of Reference coordinate system.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Longitudinal Position</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S175310</td>
<td>Isocentric Table Top</td>
<td>Patient Support Lateral Position in mm along the z-axis of the Equipment Frame of Reference coordinate system.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vertical Position</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Continuous Yaw Angle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S175431</td>
<td>Electron Fixed Aperture</td>
<td>A device that is attached to the radiation head of an RT treatment device into which beam modifiers are installed. This device is also commonly known as a &quot;cone&quot;.</td>
<td></td>
</tr>
<tr>
<td>S175432</td>
<td>Photon Fixed Aperture</td>
<td>A device that attaches to the applicator carriage of an RT treatment device for the purpose of holding an aperture and a bolus close to the patient’s skin. Several beam applicators may be available to reduce the weight of apertures lifted by therapists, decrease the aperture/bolus-to-skin distance, and reduce leakage radiation. This device is also commonly known as a &quot;cone&quot;.</td>
<td></td>
</tr>
<tr>
<td>S175433</td>
<td>Intraoperative Fixed Aperture</td>
<td>A device which is used to delimit the radiation of an RT treatment device in case of an intraoperative radiotherapeutic treatment.</td>
<td></td>
</tr>
<tr>
<td>S175440</td>
<td>Hard Wedge</td>
<td>A physical device placed inside the radiation head used to modify the fluence distribution across the field.</td>
<td></td>
</tr>
<tr>
<td>S175441</td>
<td>Motorized Wedge</td>
<td>A physical device manually placed between the radiation head and the patient used to modify the fluence distribution across the field. It is motorized and can be inserting/extracted from the beam path without user action.</td>
<td></td>
</tr>
<tr>
<td>Code Value</td>
<td>Code Meaning</td>
<td>Definition</td>
<td>Notes</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>S175442</td>
<td>Dynamic Wedge</td>
<td>An effective wedge generated by the movement of a jaw across the treatment field while delivering radiation.</td>
<td></td>
</tr>
<tr>
<td>S175451</td>
<td>Graticule</td>
<td>Mechanical grid to embed scaling information in a radiographic image (kV/MV)</td>
<td></td>
</tr>
<tr>
<td>S175452</td>
<td>Reticle</td>
<td>Mechanical crosshair to embed a crosshair representing axes and scaling information in a radiographic image (kV/MV)</td>
<td></td>
</tr>
<tr>
<td>S175453</td>
<td>Image Detector</td>
<td>An electronic radiographic imaging device (kV/MV)</td>
<td></td>
</tr>
<tr>
<td>S175454</td>
<td>Film Holder</td>
<td>Mechanical device to hold imaging film</td>
<td></td>
</tr>
<tr>
<td>S175455</td>
<td>Winston-Lutz Pointer</td>
<td>A spherical mechanical indicator used for alignment</td>
<td></td>
</tr>
<tr>
<td>S175456</td>
<td>Bowtie Filter</td>
<td>A bowtie filter used in kV imaging to account for patient shape</td>
<td></td>
</tr>
<tr>
<td>S175561</td>
<td>No Flattening Filter Beam</td>
<td>Beam that does not use a filter to produce a nearly uniform intensity profile.</td>
<td></td>
</tr>
<tr>
<td>S175562</td>
<td>Partial Flattening Filter Beam</td>
<td>Beam that uses a filter to produce a nearly uniform region across part of the intensity profile.</td>
<td></td>
</tr>
<tr>
<td>S175470</td>
<td>Shielding Block</td>
<td>Block that shields parts of the irradiated area in order to minimize the radiation dose to sensitive structures.</td>
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<tr>
<td>S175471</td>
<td>Aperture Block</td>
<td>Block that forms an aperture to shape the irradiated area of a beam</td>
<td></td>
</tr>
<tr>
<td>S175772</td>
<td>Radiation Source</td>
<td>The geometric location of the source of the beam.</td>
<td></td>
</tr>
<tr>
<td>S175773</td>
<td>Machine Isocenter</td>
<td>The center point of the treatment machine through which all beam central axes pass under all gantry angles.</td>
<td></td>
</tr>
<tr>
<td>S175774</td>
<td>Fixed Laser Setup Point</td>
<td>A fixed point at which initial patient setup is performed based on room lasers.</td>
<td></td>
</tr>
<tr>
<td>S175890</td>
<td>Radiotherapy Treatment Device</td>
<td>A device delivering radiotherapy treatments.</td>
<td></td>
</tr>
<tr>
<td>MU</td>
<td>Monitor Units</td>
<td>A measure of machine output of a radiotherapy treatment devices. The devices are calibrated to give a particular absorbed dose under particular conditions, although the definition and measurement configuration will vary between centers.</td>
<td></td>
</tr>
<tr>
<td>NP</td>
<td>Number of Particles</td>
<td>A measure of machine output of a radiotherapy treatment devices along the number of particles, used by some ion therapy devices.</td>
<td></td>
</tr>
</tbody>
</table>