## **DICOM Correction Proposal**

| Status              | Final Text                             |
|---------------------|--|
| Date of Last Update | 2022/12/24                             |
| Person Assigned     | Christof Schadt                        |
| Submitter Name      | Ulrich Busch (ulrich.busch@bluewin.ch) |
| Submission Date     | 2022/03/15                             |

Correction Number

CP-2229

Log Summary: Support of new MLC types

Name of Standard

PS3.3, PS3.6, PS3.16 2022d

Rationale for Correction:

Currently the RT 1<sup>st</sup> Generation objects support a limited modelling of multi-leaf collimators (MLC).

Newer Radiotherapy devices may use MLCs with two levels of leaves moving in the same direction ("dual layer MLC"), binary leaf positions or movable carriages.

The Correction Proposal extends the flexibility in RT Plan IOD, RT Image IOD and RT Beams Treatment Record IOD to support these new MLC types and future developments.

For safety reasons, it should be possible to express these new MLC types while assuring that systems that do not support them can still operate safely by not consuming RT Plans that use these new MLC types. To ensure safe operation the introduction of the new MLC types is mutual exclusive to the definition of existing Beam Limiting Device Sequence.

Additionally, the description of the enumerated values of the currently supported MLC types is improved.

Correction Wording:

Modify PS3.3 Section C.8.8.2 RT Image Module:

## C.8.8.2 RT Image Module

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## Table C.8-38. RT Image Module Attributes

| Attribute Name                                      | Tag                | Туре | Attribute Description   |
|---|--------------------|------|---|
| Samples per Pixel                                   | (0028,0002)        | 1    | Number of samples (planes) in this image. See Section C.8.8.2.6.1 for specialization.                             |
|   |                    |      |   |
| Radiation Machine SAD                               | (3002,0022)        | 2    | Radiation source to Gantry rotation axis distance of radiation machine used in acquiring or computing image (mm). |
| Radiation Machine SSD                               | (3002,0024)        | 3    | Source to Patient surface distance (in mm) of radiation machine used in acquiring or computing image.             |
| RT Image SID  | (3002,0026)        | 2    | Distance from radiation machine source to image plane (in mm) along radiation beam axis. See Section C.8.8.2.3.   |
| Enhanced RT Beam Limiting Device<br>Definition Flag | <u>(3008,00A3)</u> | 3    | Whether the RT Beam Limiting Devices are specified by the Enhanced RT Beam Limiting Device Sequence (3008,00A1).  |

| Attribute Name   | Tag                | Туре   | Attribute Description   |
|--|--------------------|--|---|
|  |                    |  | Enumerated Values:<br>YES<br>NO   |
| Enhanced RT Beam Limiting Device<br>Sequence   | <u>(3008,00A1)</u> | <u>1C</u>  | Enhanced RT Beam Limiting Device Descriptions.<br>Required if Enhanced RT Beam Limiting Device Definition<br>Flag (3008,00A3) is present and has the value YES.<br>One or more Items shall be included in this Sequence.  |
| >Include Table C.36.2.2.19-1 "RT Beam Limiting Device<br>Definition Macro Attributes". |                    | Device Type Code Sequence (3010,002E) within RT<br>Accessory Device Identification Macro DCID 9540<br>"Movable Beam Limiting Device Types".<br>See Section C.8.8.14.17 |   |
|  |                    |  |   |
| Exposure Sequence  | (3002,0030)        | 3  | Sequence of Exposure parameter sets, corresponding to exposures used in generating the image.<br>One or more Items are permitted in this Sequence. See Section C.8.8.2.4.   |
|  |                    |  |   |
| >Diaphragm Position  | (3002,0034)        | 3  | Positions of diaphragm jaw pairs (in mm) in IEC BEAM<br>LIMITING DEVICE coordinate axis in the IEC order X1, X2,<br>Y1, Y2.   |
| >Beam Limiting Device Sequence   | (300A,00B6)        | 3  | Sequence of beam limiting device (collimator) jaw or leaf<br>(element) positions for given exposure.<br>Shall not be present if Enhanced RT Beam Limiting<br>Device Definition Flag (3008,00A3) is present and has the<br>value YES.<br>One or more Items are permitted in this Sequence.   |
| >>RT Beam Limiting Device Type   | (300A,00B8)        | 1  | Type of beam limiting device (collimator).Enumerated Values:Xsymmetric jaw pair in IEC X directionYsymmetric jaw pair in IEC Y directionASYMX asymmetric jaw pair in IEC X directionASYMY asymmetric jaw pair in IEC Y directionMLCXsingle layermultileaf (multi-element) jaw paircollimatorin IEC X directionMLCYsingle layermultileaf (multi-element) jaw paircollimatorin IEC Y direction  |
| >>Source to Beam Limiting Device<br>Distance   | (300A,00BA)        | 3  | Radiation source to beam limiting device (collimator) distance (mm).  |
| >>Number of Leaf/Jaw Pairs   | (300A,00BC)        | 1  | Number of leaf (element) or jaw pairs (equal to 1 for standard beam limiting device jaws).  |
| >>Leaf Position Boundaries   | (300A,00BE)        | 2C   | Boundaries (in mm) of beam limiting device (collimator) leaves<br>(elements) in IEC BEAM LIMITING DEVICE coordinate axis<br>appropriate to RT Beam Limiting Device Type (300A,00B8),<br>i.e., X-axis for MLCY, Y-axis for MLCX. Contains N+1 values,<br>where N is the Number of Leaf/Jaw Pairs (300A,00BC),<br>starting from Leaf (Element) Pair 1.<br>Required if RT Beam Limiting Device Type (300A,00B8) is<br>MLCX or MLCY.<br>May be present otherwise. |

| Attribute Name   | Tag                | Туре       | Attribute Description   |
|--|--------------------|------------|---|
| >>Leaf/Jaw Positions   | (300A,011C)        | 1 <u>C</u> | Positions of beam limiting device (collimator) leaf or jaw<br>(element) pairs (in mm) in IEC BEAM LIMITING DEVICE<br>coordinate axis appropriate to RT Beam Limiting Device Type<br>(300A,00B8), e.g., X-axis for MLCX, Y-axis for MLCY).<br>Contains 2N values, where N is the Number of Leaf/Jaw Pairs<br>(300A,00BC), in IEC leaf (element) subscript order 101, 102,<br>1N, 201, 202, 2N.<br><b>Required if Enhanced RT Beam Limiting Device Definition</b><br><b>Flag (3008,00A3) is absent, or is present and has the</b><br><u>value NO.</u> |
| >Enhanced RT Beam Limiting<br>Opening Sequence   | <u>(3008,00A2)</u> | <u>2C</u>  | Sequence of beam limiting device (collimator) jaw or leaf<br>(element) positions.<br>Required if Enhanced RT Beam Limiting Device Definition<br>Flag (3008,00A3) is present and has the value YES.<br>Zero or more Items shall be included in this Sequence.  |
| >>Include Table C.36.2.2.20-1 "RT Beam Limiting Device<br>Opening Definition Macro Attributes" |                    | ice        | See Section C.8.8.14.17.  |
| >Gantry Angle  | (300A,011E)        | 3          | Treatment machine gantry angle, i.e., orientation of IEC<br>GANTRY coordinate system with respect to IEC FIXED<br>REFERENCE coordinate system (degrees).  |
| >Gantry Pitch Angle  | (300A,014A)        | 3          | Gantry Pitch Angle. i.e., the rotation of the IEC GANTRY coordinate system about the X-axis of the IEC GANTRY coordinate system (degrees). See Section C.8.8.25.6.5.  |
| >Beam Limiting Device Angle  | (300A,0120)        | 3          | Treatment machine beam limiting device (collimator) angle,<br>i.e., orientation of IEC BEAM LIMITING DEVICE coordinate<br>system with respect to IEC GANTRY coordinate system<br>(degrees).   |
|  |                    |            |   |

Modify PS3.3 section C.8.8.14 RT Beams Module:

## C.8.8.14 RT Beams Module

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## Table C.8-50. RT Beams Module Attributes

| Attribute Name        | Tag         | Туре | Attribute Description  |
|-----------------------|-------------|------|--|
|                       |             |      |  |
| Beam Sequence         | (300A,00B0) | 1    | Sequence of treatment beams for current RT Plan.<br>One or more Items shall be included in this Sequence.  |
| >Beam Number          | (300A,00C0) | 1    | Identification number of the Beam. The value of Beam<br>Number (300A,00C0) shall be unique within the RT Plan in<br>which it is created. See Note 1. |
|                       |             |      |  |
| >Source-Axis Distance | (300A,00B4) | 3    | Radiation source to Gantry rotation axis distance of the equipment that is to be used for beam delivery (mm).  |

| Attribute Name   | Tag                | Туре       | Attribute Description   |
|--|--------------------|------------|---|
| Enhanced RT Beam Limiting<br>Device Definition Flag                                    | <u>(3008,00A3)</u> | <u>3</u>   | Whether the RT Beam Limiting Devices are specified by         the Enhanced RT Beam Limiting Device Sequence         (3008,00A1).         Enumerated Values:         YES         NO  |
| >Beam Limiting Device Sequence   | (300A,00B6)        | 1 <u>C</u> | Sequence of beam limiting device (collimator) jaw or leaf<br>(element) sets.<br><u>Required if Enhanced RT Beam Limiting Device</u><br><u>Definition Flag (3008,00A3) is absent, or is present and</u><br><u>has the value NO.</u><br>One or more Items shall be included in this Sequence.   |
| >>RT Beam Limiting Device Type   | (300A,00B8)        | 1          | Type of beam limiting device (collimator).         Enumerated Values:         X       symmetric jaw pair in IEC X direction         Y       symmetric jaw pair in IEC Y direction         ASYMX asymmetric jaw pair in IEC X direction         ASYMY asymmetric jaw pair in IEC Y direction         MLCX       single layer multileaf (multi-element) jaw pair collimator in IEC X direction         MLCY       single layer multileaf (multi-element) jaw pair collimator in IEC Y direction |
| >>Source to Beam Limiting Device<br>Distance   | (300A,00BA)        | 3          | Radiation source to beam limiting device (collimator) distance of the equipment that is to be used for beam delivery (mm).  |
| >>Number of Leaf/Jaw Pairs   | (300A,00BC)        | 1          | Number of leaf (element) or jaw pairs (equal to 1 for standard beam limiting device jaws).  |
| >>Leaf Position Boundaries   | (300A,00BE)        | 2C         | Boundaries of beam limiting device (collimator) leaves (in<br>mm) in IEC BEAM LIMITING DEVICE coordinate axis<br>appropriate to RT Beam Limiting Device Type (300A,00B8),<br>i.e., X-axis for MLCY, Y-axis for MLCX. Contains N+1 values,<br>where N is the Number of Leaf/Jaw Pairs (300A,00BC),<br>starting from Leaf (Element) Pair 1. Required if RT Beam<br>Limiting Device Type (300A,00B8) is MLCX or MLCY. May<br>be present otherwise. See Note 3.                                   |
| >Enhanced RT Beam Limiting<br>Device Sequence  | <u>(3008,00A1)</u> | <u>1C</u>  | Enhanced RT Beam Limiting Device Descriptions.<br>Required if Enhanced RT Beam Limiting Device<br>Definition Flag (3008,00A3) is present and has the value<br>YES.<br>One or more Items shall be included in this Sequence.   |
| Sinclude Table C.36.2.2.19-1 "RT Beam Limiting Device<br>Definition Macro Attributes". |                    | ice        | Device Type Code Sequence (3010.002E) within RT<br>Accessory Device Identification Macro DCID 9540<br>"Movable Beam Limiting Device Types".<br>See Section C.8.8.14.17  |
| >Referenced Patient Setup Number   | (300C,006A)        | 3          | Uniquely identifies Patient Setup to be used for current<br>beam, specified by Patient Setup Number (300A,0182) within<br>Patient Setup Sequence of RT Patient Setup Module.  |
|  |                    |            |   |
| >Number of Control Points  | (300A,0110)        | 1          | Number of control points in Beam.<br>Value shall be greater than or equal to 2.   |

| Attribute Name  | Tag                | Туре      | Attribute Description   |
|---|--------------------|-----------|---|
| >Control Point Sequence   | (300A,0111)        | 1         | Sequence of machine configurations describing treatment beam.   |
|   |                    |           | The number of Items in this Sequence shall equal the value of Number of Control Points (300A,0110). See Section C.8.8.14.5 and Section C.8.8.14.6.  |
| >>Control Point Index   | (300A,0112)        | 1         | Index of current Control Point, starting at 0 for first Control Point.  |
|   |                    |           |   |
| >>Beam Limiting Device Position<br>Sequence   | (300A,011A)        | 1C        | Sequence of beam limiting device (collimator) jaw or leaf<br>(element) positions.<br>One or more Items shall be included in this Sequence.<br>Required for first Item of Control Point Sequence, or if <u>the</u><br><u>values of the</u> Beam Limiting Device changes during Beam-   |
|   |                    |           | (3008,00A3) is absent, or is present and has the value NO.  |
| >>>RT Beam Limiting Device Type   | (300A,00B8)        | 1         | Type of beam limiting device (collimator). The value of this<br>Attribute shall correspond to RT Beam Limiting Device Type<br>(300A,00B8) defined in an Item of Beam Limiting Device<br>Sequence (300A,00B6).<br>Enumerated Values:   |
|   |                    |           | Y symmetric jaw pair in IEC Y direction   |
|   |                    |           | ASYMX asymmetric jaw pair in IEC X direction  |
|   |                    |           | <b>ASYMY</b> asymmetric <b>jaw</b> pair in IEC Y direction  |
|   |                    |           | MLCX <u>single layer</u> multileaf <del>(multi-element) jaw pair</del><br><u>collimator</u> in IEC X direction  |
|   |                    |           | MLCY <u>single layer</u> multileaf <del>(multi-element) jaw pair</del><br><u>collimator</u> in IEC Y direction  |
| >>>Leaf/Jaw Positions   | (300A,011C)        | 1         | Positions of beam limiting device (collimator) leaf (element)<br>or jaw pairs (in mm) in IEC BEAM LIMITING DEVICE<br>coordinate axis appropriate to RT Beam Limiting Device<br>Type (300A,00B8), e.g., X-axis for MLCX, Y-axis for MLCY.<br>Contains 2N values, where N is the Number of Leaf/Jaw<br>Pairs (300A,00BC) in Beam Limiting Device Sequence<br>(300A,00B6). Values shall be listed in IEC leaf (element)<br>subscript order 101, 102, 1N, 201, 202, 2N. See Note<br>3.  |
| >>Enhanced RT Beam Limiting<br>Opening Sequence   | <u>(3008.00A2)</u> | <u>1C</u> | Sequence of beam limiting device (collimator) jaw or leaf<br>(element) positions.<br>Required for first Item of Control Point Sequence, or if<br>the values of the Beam Limiting Device change during<br>Beam and if Enhanced RT Beam Limiting Device<br>Definition Flag (3008,00A3) is present and has the value<br>YES.<br>One or more Items shall be included in this Sequence.<br>The number of Items shall equal the number of Items in<br>Enhanced RT Beam Limiting Device Sequence<br>(3008,00A1) in the first Control Point and be equal or<br>less in subsequent Control Points.<br>See Section C.8.8.14.18. |
| >>>Include Table C.36.2.2.20-1 "RT Beam Limiting Device<br>Opening Definition Macro Attributes" |                    |           | <u>See Section C.8.8.14.17.</u>   |

| Attribute Name | Tag | Туре | Attribute Description |
|----------------|-----|------|-----------------------|
|                |     |      |                       |

Add the following sections to PS3.3 as subsections of C.8.8.14 RT Beams Module:

# C.8.8.14.17 Enhanced RT Beam Limiting Device Sequence and Enhanced RT Beam Limiting Opening Sequence

When the value of Enhanced RT Beam Limiting Device Definition Flag (3008,00A3) has the value YES, the following applies to the content of Enhanced RT Beam Limiting Device Sequence (3008,00A1) and Enhanced RT Beam Limiting Opening Sequence (3008,00A2):

- For the Beam Modifier Definition Coordinate System used the following applies:
  - The Base Beam Modifier Definition Coordinate System is the [IEC 61217] GANTRY coordinate system.
  - The RT Device Distance Reference Location is (130358, DCM, "Nominal Radiation Source Location").
  - The value of the RT Beam Modifier Definition Distance (300A,0688) equals the value of Source-Axis Distance (300A,00B4).
  - The value of the Beam Modifier Orientation Angle (300A,0645) is 0 for IEC X direction and 90 for IEC Y direction.
- Note: The values of boundaries and openings are therefore the same as if comparable parameters would be expressed in the Beam Limiting Device Sequence (300A,00B6).
- Values of Attributes of the Module RT Tolerance Tables C.8.8.11 apply to the Enhanced RT Beam Limiting Device Openings as follows:

| Tolerance Module<br>C.8.8.11                              | RT Beam<br>Limiting<br>Device<br>Type<br>(300A,00B8) | Enhanced RT Beam Limiting<br>Opening Sequence (3008,00A2) | Device Type Code Sequence<br>(3010,002E)<br>and<br>Beam Modifier Orientation Angle<br>(300A,0645)                      |
|---|--|---|--|
| Beam Limiting Device<br>Position Tolerance<br>(300A,004A) | X, ASYMX   | Parallel RT Beam Delimiter<br>Positions (300A,064A)       | (130330, DCM, "Jaw Pair")<br>Beam Modifier Orientation Angle<br>(300A,0645) = 0  |
| Beam Limiting Device<br>Position Tolerance<br>(300A,004A) | Y, ASYMY   | Parallel RT Beam Delimiter<br>Positions (300A,064A)       | (130330, DCM, "Jaw Pair")<br>Beam Modifier Orientation Angle<br>(300A,0645) = 90                                       |
| Beam Limiting Device<br>Position Tolerance<br>(300A,004A) | MLCX   | RT Beam Limiting Device Offset<br>(300A,064B)             | (130331, DCM, "Leaf Pair") or<br>(130333, DCM, "Single Leaves")<br>Beam Modifier Orientation Angle<br>(300A,0645) = 0  |
| Beam Limiting Device<br>Position Tolerance<br>(300A,004A) | MLCY   | RT Beam Limiting Device Offset<br>(300A,064B)             | (130331, DCM, "Leaf Pair") or<br>(130333, DCM, "Single Leaves")<br>Beam Modifier Orientation Angle<br>(300A,0645) = 90 |

## C.8.8.14.18 Presence of Items within Sequences in the Control Point Sequence

Items within Sequences in the Control Point Sequence shall be present in the first Control Point or if the value of any Attribute in an Item changes during the Beam.

If an Item is present, all Attributes of that Item shall be present if the Attribute requirements apply, even if the value of the Attribute does not change during the Beam.

#### Example:

A beam may be delivered with two MLCs "A" and "B", where the values of MLC positions for MLC "A" do not change during the Beam, while the values for MLC "B" are changing. Each MLC has a constant value for its RT Beam Limiting Device Offset (300A,064B).

The Item describing MLC "A" is present in the first Control Point only.

The Items describing MLC "B" will be present in all Control Points containing the values of Parallel RT Beam Delimiter Positions. The values of RT Beam Limiting Device Offset (300A,064B) for that MLC will be also present in all Items, even if these values remain constant during the Beam.

Modify PS3.3 section C.8.8.21 RT Beams Session Record Module:

## C.8.8.21 RT Beams Session Record Module

| Attribute Name                                       | Tag                | Туре       | Attribute Description   |
|--|--------------------|------------|---|
|  |                    |            |   |
| Treatment Session Beam Sequence                      | (3008,0020)        | 1          | Sequence of Beams administered during treatment session.<br>One or more Items shall be included in this Sequence.   |
| >Referenced Beam Number                              | (300C,0006)        | 3          | References Beam specified by Beam Number (300A,00C0)<br>in Beam Sequence (300A,00B0) in RT Beams Module within<br>referenced RT Plan.   |
|  |                    |            |   |
| >Source-Axis Distance                                | (300A,00B4)        | 3          | Radiation source to gantry rotation axis distance of the equipment that was used for beam delivery (mm).  |
| >Enhanced RT Beam Limiting<br>Device Definition Flag | <u>(3008,00A3)</u> | <u>3</u>   | Whether the RT Beam Limiting Devices are specified by         the Enhanced RT Beam Limiting Device Sequence         (3008,00A1).         Enumerated Values:         YES         NO  |
| >Beam Limiting Device Leaf Pairs<br>Sequence         | (3008,00A0)        | 1 <u>C</u> | Sequence of beam limiting device (collimator) jaw or leaf<br>(element) leaf pair values.<br><u>Required if Enhanced RT Beam Limiting Device</u><br><u>Definition Flag (3008,00A3) is absent, or is present and</u><br><u>has the value NO.</u><br>One or more Items shall be included in this Sequence.   |
| >>RT Beam Limiting Device Type                       | (300A,00B8)        | 1          | Type of beam limiting device (collimator).         Enumerated Values:         X       symmetric jaw pair in IEC X direction         Y       symmetric jaw pair in IEC Y direction         ASYMX asymmetric jaw pair in IEC X direction         ASYMY asymmetric jaw pair in IEC Y direction         MLCX       single layer multileaf (multi-element) jaw pair collimator in IEC X direction         MLCY       single layer multileaf (multi-element) jaw pair collimator in IEC X direction |
| >>Number of Leaf/Jaw Pairs                           | (300A,00BC)        | 1          | Number of leaf (element) or jaw pairs (equal to 1 for standard beam limiting device jaws).  |

## Table C.8-57. RT Beams Session Record Module Attributes

| Attribute Name  | Tag                | Туре      | Attribute Description  |
|---|--------------------|-----------|--|
| >Enhanced RT Beam Limiting<br>Device Sequence                         | <u>(3008,00A1)</u> | <u>1C</u> | Enhanced RT Beam Limiting Device Descriptions.<br>Required if Enhanced RT Beam Limiting Device<br>Definition Flag (3008,00A3) is present and has the value<br>YES.<br>One or more Items shall be included in this Sequence.  |
| >>Include Table C.36.2.2.19-1 "RT Be<br>Definition Macro Attributes". | am Limiting Dev    | ice       | Device Type Code Sequence (3010,002E) within RT<br>Accessory Device Identification Macro DCID 9540<br>"Movable Beam Limiting Device Types".<br>See C.8.8.14.17   |
|   |                    |           |  |
| >Number of Control Points   | (300A,0110)        | 1         | Number of control points delivered.<br>Value shall be greater than or equal to 2.  |
| >Control Point Delivery Sequence                                      | (3008,0040)        | 1         | Sequence of beam control points for current treatment beam.<br>The number of Items in this Sequence shall equal the value<br>of Number of Control Points (300A,0110).<br>See Section C.8.8.21.1.   |
| >>Referenced Control Point Index                                      | (300C,00F0)        | 3         | Uniquely identifies Control Point specified by Control Point<br>Index (300A,0112) within Beam referenced by Referenced<br>Beam Number (300C,0006).   |
|   |                    |           |  |
| >>Beam Limiting Device Position<br>Sequence                           | (300A,011A)        | 1C        | Sequence of beam limiting device (collimator) jaw or leaf<br>(element) positions.<br>One or more Items shall be included in this Sequence.<br>Required for <u>the first</u> Control Point <b>0</b> -of Control Point<br>Delivery Sequence (3008,0040), or if beam limiting device<br>(collimator) changes during beam administration<br><u>and if Enhanced RT Beam Limiting Device Definition</u><br>Flag (3008,00A3) is absent, or is present has the value<br><u>NO.</u>   |
| >>>RT Beam Limiting Device Type                                       | (300A,00B8)        | 1         | Type of beam limiting device. The value of this Attribute shall<br>correspond to RT Beam Limiting Device Type (300A,00B8)<br>defined in an element of Beam Limiting Device Leaf Pairs<br>Sequence (3008,00A0).Enumerated Values:XXsymmetric jaw pair in IEC X direction<br>YYsymmetric jaw pair in IEC Y directionASYMXasymmetric jaw pair in IEC X directionASYMYasymmetric jaw pair in IEC Y directionMLCXmultileaf (multi-element) jaw pair in IEC X direction            |
| >>>Leaf/Jaw Positions   | (300A,011C)        | 1         | Positions of beam limiting device (collimator) leaf (element)<br>or jaw pairs (mm) in IEC BEAM LIMITING DEVICE<br>coordinate axis appropriate to RT Beam Limiting Device<br>Type (300A,00B8), e.g., X-axis for MLCX, Y-axis for MLCY.<br>Contains 2N values, where N is the Number of Leaf/Jaw<br>Pairs (300A,00BC) defined in element of Beam Limiting<br>Device Leaf Pairs Sequence (3008,00A0). Values shall be in<br>IEC leaf subscript order 101, 102, 1N, 201, 202 2N. |
| >Enhanced RT Beam Limiting<br>Opening Sequence                        | <u>(3008,00A2)</u> | <u>1C</u> | Sequence of beam limiting device (collimator) jaw or leaf<br>(element) positions.<br>Required for the first Control Point of Control Point<br>Delivery Sequence (3008,0040), or if Beam Limiting   |

| Attribute Name   | Tag             | Туре        | Attribute Description   |
|--|-----------------|-------------|---|
|  |                 |             | Device change during Beam and if Enhanced RT Beam<br>Limiting Device Definition Flag (3008,00A3) has the value<br>YES.<br>One or more Items shall be included in this Sequence.   |
|  |                 |             | The number of Items shall equal the number of Items in<br>Enhanced RT Beam Limiting Device Sequence<br>(3008,00A1) in the first Control Point and be equal or<br>less in subsequent Control Points.<br>See Section C.8.8.14.18. |
| >>>Include Table C.36.2.2.20-1 "RT E<br>Opening Definition Macro Attributes" | eam Limiting De | <u>vice</u> | See Section C.8.8.14.17.  |
|  |                 |             |   |

Modify PS3.3 Section C.36.2.2.8 RT Beam Limiting Devices Definition Macro:

(The content removed will become the content of the new Macro C.36.2.2.19 "RT Beam Limiting Device Definition Macro" further below)

## C.36.2.2.8 RT Beam Limiting Devices Definition Macro

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

| Attribute Name  | Tag                    | Туре          | Attribute Description   |
|---|------------------------|---------------|---|
| Number of RT Beam Limiting Devices  | (300A,0641)            | 1C            | Number of RT Beam Limiting Devices in the RT Beam<br>Limiting Device Definition Sequence (300A,064D).<br>Required if RT Radiation Physical and Geometric Content<br>Detail Flag (300A,0638) equals FULL. May be present<br>otherwise.   |
| RT Beam Limiting Device Definition Sequence   | (300A,064D)            | 1C            | Beam limiting device (collimator), such as jaw or leaf<br>(element) sets.<br>The number of Items included in this Sequence shall equal<br>the value of Number of RT Beam Limiting Devices<br>(300A,0641).<br>Required if Number of RT Beam Limiting Devices<br>(300A,0641) is present and has a non-zero value.   |
| >Include Table C.36.2.2.19-1 "RT Beam Limiting Device<br>Definition Macro Attributes" |                        |               |   |
| >Device Index   | <del>(3010,0039)</del> | 4             | Index of the Device in this Sequence.<br>The value shall start at 1 and increase monotonically<br>by 1.   |
| >Referenced Defined Device Index  | <del>(300A,0602)</del> | <del>1C</del> | Device Index value that links the device defined by this<br>Sequence Item to the corresponding device in an RT<br>Radiation Instance. The device identification of the two<br>devices may or may not be the same.<br>The value is the index of a device in the RT Beam<br>Limiting Device Definition Sequence (300A,064D) within<br>the single SOP Instance referenced by Referenced RT<br>Instance Sequence (300A,0631). |

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

| Attribute Name   | Tag                    | Туре          | Attribute Description   |
|--|------------------------|---------------|---|
|  |                        |               | Required if the Instance referenced in Referenced RT<br>Instance Sequence (300A,0631) contains the device<br>that corresponds to the device defined by this<br>Sequence Item.<br>See Section C.36.2.2.8.1.5.  |
| >Include Table C.36.2.2.3-1 "RT Accessory D<br>Macro Attributes".      | evice Identific        | ation         | CID is specified at invocation.   |
| >Beam Modifier Orientation Angle                                       | <del>(300A,0645)</del> | 4             | Angle in degrees of the Beam Modifier Coordinate<br>System with respect to the Base Beam Modifier<br>Coordinate System. The angle is a Continuous Rotation<br>Angle, see Section C.36.1.1.5.<br>If Device Type Code Sequence (3010,002E) contains<br>either (130331, DCM, "Leaf Pairs"), or (130333, DCM,<br>"Single Leaves") the motion of the RT Beam Delimiters<br>is along the x-axis of the Beam Modifier Definition<br>Plane. |
|  |                        |               | See Section C.36.1.1.9.   |
| > <del>RT Beam Limiting Device Proximal</del><br><del>Distance</del>   | <del>(300A,0642)</del> | 2             | Distance in mm from the reference location as<br>specified by RT Device Distance Reference Location<br>Code Sequence (300A,0659) to the proximal end of<br>beam limiting device (collimator) along the beam axis.<br>See Section C.36.2.2.8.1.4.  |
| >RT Beam Limiting Device Distal Distance                               | <del>(300A,0643)</del> | 2             | Distance in mm from the reference location as<br>specified by RT Device Distance Reference Location<br>Code Sequence (300A,0659) to the distal end of beam<br>limiting device (collimator) along the beam axis.<br>See Section C.36.2.2.8.1.4.  |
| >Parallel RT Beam Delimiter Device<br>Sequence                         | <del>(300A,0647)</del> | <del>1C</del> | Device that uses parallel beam delimiters to limit the<br>beam.<br>Required if Device Type Code Sequence (3010,002E)<br>contains either (130331, DCM, "Leaf Pairs") or (130333,<br>DCM, "Single Leaves").<br>Only a single Item shall be present in the Sequence.   |
| >>Number of Parallel RT Beam Delimiters                                | <del>(300A,0648)</del> | 1             | Number of beam delimiters parallel to the axis of<br>motion. E.g., a beam limiting device jaw pair is<br>represented as 1 parallel delimiter, an MLC with 100<br>leaf pairs or with 100 single leaves is represented as<br>100 parallel delimiters.<br>See Section C.36.2.2.8.1.3.  |
| >>Parallel RT Beam Delimiter Device<br>Orientation Label Code Sequence | <del>(300A,0644)</del> | 4             | A code used to identify the orientation of the beam<br>limiting device.<br>Only a single Item shall be present in the Sequence.   |
| >>>Include Table 8.8-1 "Code Sequence Macro Attributes".               |                        |               | DCID 9547 "RT Beam Limiting Device Orientation<br>Labels".<br>See Section C.36.2.2.8.1.1.   |
| >>Parallel RT Beam Delimiter Opening Mode                              | <del>(300A,064E)</del> | 1             | The operation mode of Parallel RT Beam Delimiters<br>used to define a treatment aperture.<br>Enumerated Values:<br>BINARY leaf positions constrained to two states: open<br>and closed<br>VARIABLE any leaf position may be specified   |

| Attribute Name   | Tag                    | Туре          | Attribute Description  |
|--|------------------------|---------------|--|
| >>Parallel RT Beam Delimiter Boundaries                        | <del>(300A,0649)</del> | 1             | Boundaries in mm of parallel beam delimiters. These<br>are defined along the axis perpendicular to the motion<br>of the delimiters of the RT Beam Limiting Device Type<br>(300A,00B8) with respect to the Beam Modifier<br>Coordinate System. The order of values shall increase<br>monotonically.<br>See Section C.36.2.2.8.1.2.<br>N+1 values shall be provided, where N is the Number of<br>Parallel RT Beam Delimiters (300A,0648).  |
| >>Parallel RT Beam Delimiter Leaf Mounting<br>Side             | <del>(300A,064F)</del> | 16            | Specifies the mounting side identified by the direction from the tip to the tail of the delimiter parallel to the axis specified by Device Type Code Sequence (3010,002E).         Enumerated Values:         P       Positive mounting side. The axis intercept of the leaf tip is less than the axis intercept of the leaf tip is greater than the axis intercept of the leaf tip is greater than the axis intercept of the leaf tip is greater than the axis intercept of the leaf tip.         M       values shall be provided, where M is the Number of Parallel RT Beam Delimiters (300A,0648), in the order of the Parallel RT Beam Delimiter Boundaries (300A,0649).         Required if Device Type Code Sequence (3010,002E) contains (130333, DCM, "Single Leaves").         See Section C.36.2.2.8.1.3. |
| >Fixed RT Beam Delimiter Device Sequence                       | <del>(300A,0646)</del> | <del>1C</del> | Device that uses a fixed aperture to limit the beam.<br>Required if Device Type Code Sequence (3010,002E) is<br>part of CID 9545 Fixed Beam Limiting Device Types.<br>Only a single Item shall be included in this Sequence.   |
| >>Include Table 10.38-1 "Outline Definition Macro Attributes". |                        |               | The Outline is defined on the Beam Modifier Definition Plane.  |

C.36.2.2.8.1 RT Beam Limiting Device Definition Macro Attribute Description

C.36.2.2.8.1.1 Parallel RT Beam Delimiter Device Orientation Label Code

The value of Parallel RT Beam Delimiter Device Orientation Label Code Sequence (300A,0644) shall be chosen as follows:

When the value of Beam Modifier Orientation Angle (300A,0645) equals zero the code shall be (130334, DCM, "X Orientation").

When the value of Beam Modifier Orientation Angle (300A,0645) equals 90 the code shall be (130335, DCM, "Y Orientation").

When the value of Beam Modifier Orientation Angle (300A,0645) is not zero or 90, the label should be chosen to best reflect the user perception or another code may be used.

C.36.2.2.8.1.2 Parallel RT Beam Delimiter Boundaries

The Parallel RT Beam Delimiter Boundaries (300A,0649) shall be the positions of the mechanical boundaries (projected on the Beam Modifier Definition Plane defined by the RT Beam Modifier Definition Distance (300A,0688)) between beam delimiter elements. These are fixed for a given beam limiting device. Parallel RT Beam Delimiter Positions (300A,064A) are values specific to a given Control Point, specifying the beam limiting device element openings.

C.36.2.2.8.1.3 Number of Parallel RT Beam Delimiters



Figure C.36.2.2.8.1-1. Number of Parallel RT Beam Delimiters for X Leaf Pairs



In example in Figure C.36.2.2.8.1-2 the delimiters labeled 1, 3 and 5 have a Parallel RT Beam Delimiter Leaf Mounting Side (300A,064F) 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.36.2.2.8.1.4 RT Beam Limiting Device Proximal Distance and RT Beam Limiting Device Distal Distance

Figure C.36.2.2.8.1-3 shows the RT Beam Limiting Device Proximal Distance (300A,0642) and RT Beam Limiting Device Distal Distance (300A,0643).

In this example the reference location specified by the RT Device Distance Reference Location Code Sequence (300A,0659) has the value (130358, DCM, "Nominal Radiation Source Location").





#### C.36.2.2.8.1.5 Referenced Defined Device Index

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

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

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

 Device Index = 1: Type (130331, DCM, "Leaf Pairs") with one leaf pair and the orientation (130334, DCM, "X Orientation"), representing X-Jaws

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

However, the treatment may have been executed on a different machine which has the X-Jaws and the X-MLC, but a fixed collimator in the Y direction instead of the Y-Jaws. Therefore, the Y-Jaws will not be recorded as they have not been used. Also, the fixed collimator in Y direction is not recorded, as this is not a device which is part of the RT Beam Limiting Device Definition Sequence (300A,064D). The Referenced Defined Device Index (300A,0602) will then point to the indices in the referenced RT Radiation Instance to annotate which device in the RT Radiation Record corresponds to the device in the RT Radiation. In this case, the RT Radiation Record would contain the devices as listed in the following:

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

Add the following new Macro to PS3.3 Section C.36.2.2:

(Note:

This Macro is extracted out of C.36.2.2.8 RT Beam Limiting Devices Definition Macro above without any change but the following. One additional Attribute was added which had not been present at the original location. To put this to reader's attention, the new Attribute is marked with **bold / underline**.

## C.36.2.2.19 RT Beam Limiting Device Definition Macro

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

| Attribute Name   | Tag         | Туре          | Attribute Description   |
|--|-------------|---------------|---|
| Device Index   | (3010,0039) | 1             | Index of the Device in this Sequence.<br>The value shall start at 1 and increase monotonically by 1.  |
| Referenced Defined Device Index                                | (300A,0602) | 1C            | Device Index value that links the device defined by this<br>Sequence Item to the corresponding device in an RT<br>Radiation Instance. The device identification of the two<br>devices may or may not be the same.<br>The value is the index of a device in the RT Beam Limiting<br>Device Definition Sequence (300A,064D) within the single<br>SOP Instance referenced by Referenced RT Instance<br>Sequence (300A,0631).<br>Required if the Instance referenced in Referenced RT<br>Instance Sequence (300A,0631) contains the device that<br>corresponds to the device defined by this Sequence Item. |
| Include Table C.36.2.2.3-1 "RT Accessory Device Identification |             | <u>ן</u><br>ז | CID is specified at invocation.   |
| Macro Attributes".   |             |               |   |
| Beam Modifier Orientation Angle                                | (300A,0645) | 1             | Angle in degrees of the Beam Modifier Coordinate System<br>with respect to the Base Beam Modifier Coordinate System.<br>The angle is a Continuous Rotation Angle, see<br>Section C.36.1.1.5.<br>If Device Type Code Sequence (3010,002E) contains either<br>(130331, DCM, "Leaf Pairs"), or (130333, DCM, "Single   |

## Table C.36.2.2.19-1 RT Beam Limiting Device Definition Macro Attributes

| Attribute Name  | Tag         | Туре  | Attribute Description   |
|---|-------------|---|---|
|   |             |   | Leaves") the motion of the RT Beam Delimiters is along the x-axis of the Beam Modifier Definition Plane.<br>See Section C.36.1.1.9.   |
| RT Beam Limiting Device Proximal Distance                             | (300A,0642) | 2   | Distance in mm from the reference location as specified by<br>RT Device Distance Reference Location Code Sequence<br>(300A,0659) to the proximal end of beam limiting device<br>(collimator) along the beam axis.<br>See Section C.36.2.2.19.1.4.   |
| RT Beam Limiting Device Distal Distance                               | (300A,0643) | 2   | Distance in mm from the reference location as specified by<br>RT Device Distance Reference Location Code Sequence<br>(300A,0659) to the distal end of beam limiting device<br>(collimator) along the beam axis.<br>See Section C.36.2.2.19.1.4.   |
| Parallel RT Beam Delimiter Device Sequence                            | (300A,0647) | 1C  | Device that uses parallel beam delimiters to limit the beam.<br>Required if Device Type Code Sequence (3010,002E)<br>contains either (130331, DCM, "Leaf Pairs") or (130333,<br>DCM, "Single Leaves").<br>Only a single Item shall be present in the Sequence.  |
| >Number of Parallel RT Beam Delimiters                                | (300A,0648) | 1   | Number of beam delimiters parallel to the axis of motion.<br>E.g., a beam limiting device jaw pair is represented as 1<br>parallel delimiter, an MLC with 100 leaf pairs or with 100<br>single leaves is represented as 100 parallel delimiters.<br>See Section C.36.2.2.19.1.3.  |
| >Parallel RT Beam Delimiter Device Orientation<br>Label Code Sequence | (300A,0644) | 1   | A code used to identify the orientation of the beam limiting<br>device.<br>Only a single Item shall be present in the Sequence.   |
| >>Include Table 8.8-1 "Code Sequence Macro Attributes".               |             | DCID 9547 "RT Beam Limiting Device Orientation Labels".<br>See Section C.36.2.2.19.1.1. |   |
| >Parallel RT Beam Delimiter Opening Mode                              | (300A,064E) | 1   | The operation mode of Parallel RT Beam Delimiters used to define a treatment aperture.<br>Enumerated Values:<br><b>BINARY</b> leaf positions constrained to two states: open and closed<br><b>VARIABLE</b> any leaf position may be specified   |
| >Parallel RT Beam Delimiter Boundaries                                | (300A,0649) | 1   | Boundaries in mm of parallel beam delimiters. These are<br>defined along the axis perpendicular to the motion of the<br>delimiters of the RT Beam Limiting Device Type<br>(300A,00B8) with respect to the Beam Modifier Coordinate<br>System. The order of values shall increase monotonically.<br>See Section C.36.2.2.19.1.2.<br>N+1 values shall be provided, where N is the Number of<br>Parallel RT Beam Delimiters (300A,0648).   |
| >Parallel RT Beam Delimiter Leaf Mounting<br>Side                     | (300A,064F) | 1C  | <ul> <li>Specifies the mounting side identified by the direction from the tip to the tail of the delimiter parallel to the axis specified by Device Type Code Sequence (3010,002E).</li> <li>Enumerated Values:</li> <li>P Positive mounting side. The axis intercept of the leaf tip is less than the axis intercept of the leaf tail.</li> <li>N Negative mounting side. The axis intercept of the leaf tip is greater than the axis intercept of the leaf tail.</li> </ul> |

| Attribute Name  | Тад                | Туре      | Attribute Description   |
|---|--------------------|-----------|---|
|   |                    |           | M values shall be provided, where M is the Number<br>of Parallel RT Beam Delimiters (300A,0648), in the order of<br>the Parallel RT Beam Delimiter Boundaries (300A,0649).<br>Required if Device Type Code Sequence (3010,002E)<br>contains (130333, DCM, "Single Leaves").<br>See Section C.36.2.2.19.1.3.   |
| <u>&gt;Parallel RT Beam Delimiter Opening</u><br>Extents      | <u>(3008,00A4)</u> | <u>1C</u> | Minimum and maximum opening position in mm         describing the extent of the aperture when the delimiter         is fully open.         2N values shall be provided, where N is the Number of         Parallel RT Beam Delimiters (300A,0648). The order of         values shall start with the minimum values for all         delimiters, followed by the maximum values, each in         the order corresponding to the order of the Parallel RT         Beam Delimiter Boundaries (300A,0649).         These are defined along the axis parallel to the motion         of the delimiters of the RT Beam Limiting Device Type         (300A,00B8) with respect to the Beam Modifier         Coordinate System.         Required if Parallel RT Beam Delimiter Opening Mode         (300A,064E) has the value BINARY. Maybe be present         otherwise. |
| Fixed RT Beam Delimiter Device Sequence                       | (300A,0646)        | 1C        | Device that uses a fixed aperture to limit the beam.<br>Required if Device Type Code Sequence (3010,002E) is<br>part of CID 9545 Fixed Beam Limiting Device Types.<br>Only a single Item shall be included in this Sequence.  |
| >Include Table 10.38-1 "Outline Definition Macro Attributes". |                    |           | The Outline is defined on the Beam Modifier Definition Plane.   |

## C.36.2.2.19.1 RT Beam Limiting Device Definition Macro Attribute Description

## C.36.2.2.19.1.1 Parallel RT Beam Delimiter Device Orientation Label Code

The value of Parallel RT Beam Delimiter Device Orientation Label Code Sequence (300A,0644) shall be chosen as follows:

When the value of Beam Modifier Orientation Angle (300A,0645) equals zero the code shall be (130334, DCM, "X Orientation").

When the value of Beam Modifier Orientation Angle (300A,0645) equals 90 the code shall be (130335, DCM, "Y Orientation").

When the value of Beam Modifier Orientation Angle (300A,0645) is not zero or 90, the label should be chosen to best reflect the user perception or another code may be used.

## C.36.2.2.19.1.2 Parallel RT Beam Delimiter Boundaries

The Parallel RT Beam Delimiter Boundaries (300A,0649) shall be the positions of the mechanical boundaries (projected on the Beam Modifier Definition Plane defined by the RT Beam Modifier Definition Distance (300A,0688)) between beam delimiter elements. These are fixed for a given beam limiting device. Parallel RT Beam Delimiter Positions (300A,064A) are values specific to a given Control Point, specifying the beam limiting device element openings.

## C.36.2.2.19.1.3 Number of Parallel RT Beam Delimiters



Figure C.36.2.2.19.1-1. Number of Parallel RT Beam Delimiters for X Leaf Pairs



#### Figure C.36.2.2.19.1-2. Number of Parallel RT Beam Delimiters for X Single Leaves

In example in Figure C.36.2.2.19.1-2 the delimiters labeled 1, 3 and 5 have a Parallel RT Beam Delimiter Leaf Mounting Side (300A,064F) 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.36.2.2.19.1.4 RT Beam Limiting Device Proximal Distance and RT Beam Limiting Device Distal Distance

Figure C.36.2.2.19.1-3 shows the RT Beam Limiting Device Proximal Distance (300A,0642) and RT Beam Limiting Device Distal Distance (300A,0643).

In this example the reference location specified by the RT Device Distance Reference Location Code Sequence (300A,0659) has the value (130358, DCM, "Nominal Radiation Source Location").



#### Figure C.36.2.2.19.1-3. RT Beam Limiting Device Proximal and Distal Distance

#### C.36.2.2.19.1.5 Referenced Defined Device Index

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

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

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

• Device Index = 1: Type (130331, DCM, "Leaf Pairs") with one leaf pair and the orientation (130334, DCM, "X Orientation"), representing X-Jaws

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

However, the treatment may have been executed on a different machine which has the X-Jaws and the X-MLC, but a fixed collimator in the Y direction instead of the Y-Jaws. Therefore, the Y-Jaws will not be recorded as they have not been used. Also, the fixed collimator in Y direction is not recorded, as this is not a device which is part of the RT Beam Limiting Device Definition Sequence (300A,064D). The Referenced Defined Device Index (300A,0602) will then point to the indices in the referenced RT Radiation Instance to annotate which device in the RT Radiation Record corresponds to the device in the RT Radiation. In this case, the RT Radiation Record would contain the devices as listed in the following:

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

Modify PS3.3 Section C.36.2.2.9 RT Beam Limiting Device Opening Macro:

(The content removed will become the content of the new Macro C.36.2.2.20 "RT Beam Limiting Device Opening Definition Macro" further below)

## C.36.2.2.9 RT Beam Limiting Device Opening Macro

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

| Attribute Name  | Tag                    | Туре          | Attribute Description  |
|---|------------------------|---------------|--|
| Number of RT Beam Limiting Device<br>Openings   | (300A,0657)            | 1C            | Number of RT Beam Limiting Device Openings in the RT<br>Beam Limiting Device Opening Sequence (300A,0656).<br>Required if Number of RT Beam Limiting Devices<br>(300A,0641) is present and has a non-zero value.   |
| RT Beam Limiting Device Opening<br>Sequence   | (300A,0656)            | 1C            | Beam limiting device (collimator) settings defining the opening for the current Control Point.<br>Required if Number of RT Beam Limiting Device Openings (300A,0657) is present and has a non-zero value and the conditions in Section C.36.2.2.5.1.1 are satisfied.<br>The number of Items included in this Sequence shall equal the value of Number of RT Beam Limiting Device Openings (300A,0657). |
| Include Table C.36.2.2.20-1. "RT Beam Limiting Device<br>Opening Definition Macro Attributes" |                        |               |  |
| >Referenced Device Index  | <del>(300A,0607)</del> | 1             | The value of Device Index (3010,0039) from the RT<br>Beam Limiting Device Definition Sequence (300A,064D)<br>corresponding to the Beam Limiting Device used in this<br>Item.   |
| >RT Beam Limiting Device Offset   | (300A,064B)            | <del>1C</del> | The offsets (x,y) in mm of the Parallel RT Beam<br>Delimiter Positions (300A,064A) along the x-axis and the<br>Parallel RT Beam Delimiter Boundaries (300A,0649)<br>along the y-axis of the Beam Modifier Coordinate   |

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

|  | 1                      | 1  |  |
|--|------------------------|--|--|
| Attribute Name   | Tag                    | Туре   | Attribute Description  |
|  |                        |  | System after the Beam Modifier Orientation Angle<br>(300A,0645) is applied.  |
|  |                        |  | See Section C.36.2.2.9.1.1 and Section C.36.2.2.8.1.2.   |
|  |                        |  | Required if the conditions in Section C.36.2.2.5.1.1 are satisfied.  |
| >Parallel RT Beam Delimiter Positions                          | <del>(300A,064A)</del> | <del>1C</del>  | One-dimensional positions of the tip in mm of beam delimiters.   |
|  |                        |  | If Device Type Code Sequence (3010,002E) contains<br>(130333, DCM, "Single Leaves"), N values shall be<br>provided where N is the Number of Parallel RT Beam<br>Delimiters (300A,0648).  |
|  |                        |  | If Device Type Code Sequence contains (130330, DCM,<br>"Jaw Pair") or (130331, DCM, "Leaf Pairs"), 2N values<br>shall be provided where N is the Number of Parallel RT<br>Beam Delimiters (300A,0648). The values shall be   |
|  |                        |  | grouped by the mounting side identified by the Parallel<br>RT Beam Delimiter Leaf Mounting Side (300A,064F) with<br>the values of RT Beam Delimiter Elements on the<br>negative mounting side first.   |
|  |                        |  | The order of values shall correspond to the order of the Parallel RT Beam Delimiter Boundaries (300A,0649).  |
|  |                        |  | See Section C.36.2.2.9.1.1, Section C.36.2.2.9.1.2 and<br>Section C.36.2.2.9.1.3.  |
|  |                        |  | Required if the conditions in Section C.36.2.2.5.1.1 are<br>satisfied and if Device Type Code Sequence contains<br>(130330, DCM, "Jaw Pair"), (130331, DCM, "Leaf Pairs")<br>or (130333, DCM, "Single Leaves").  |
| RT Beam Delimiter Geometry Sequence                            | <del>(300A,064C)</del> | <del>16</del>  | The outline of the Beam Limiting Device opening.<br>Required if the conditions in Section C.36.2.2.5.1.1 are<br>satisfied and if DeviceType Code Sequence (3010,002E)<br>contains (130332, DCM, "Variable Circular Collimator").<br>See Section C.36.2.2.9.1.1 and Section C.36.2.2.9.1.3.<br>Only a single Item shall be included in this Sequence. |
| >>Include Table 10.38-1 "Outline Definition Macro Attributes". |                        | The Outline Shape Type (0018,1630) shall be<br>CIRCULAR. |  |
|  |                        |  | The plane is defined in Section C.36.2.2.9.1.1.  |

C.36.2.2.9.1 RT Beam Limiting Device Opening Attribute Descriptions

C.36.2.2.9.1.1 Geometric Value Attributes

All geometric values in Table C.36.2.2.9-1 are defined in the Beam Modifier Definition Plane. C.36.2.2.9.1.2 RT Beam Delimiter Element Positions

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

<del>N1, N2, Nn</del>

<del>P1, P2, Pn</del>

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 (300A,0649). C.36.2.2.9.1.3 RT Beam Delimiter Geometry

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

• • •

(Note:

This Macro is extracted out of C.36.2.2.9 RT Beam Limiting Device Opening Macro above without any change but the following. One additional requirement was added which had not been present at the original location. To put this to reader's attention, the new requirement is marked with **bold / underline**.

## C.36.2.2.20 RT Beam Limiting Device Opening Definition Macro

This Macro defines the opening created by a RT Beam Limiting Device.

## Table C.36.2.2.20-1. RT Beam Limiting Device Opening Definition Macro Attributes

| Attribute Name  | Tag         | Туре  | Attribute Description  |
|---|-------------|---|--|
| Referenced Device Index                                       | (300A,0607) | 1   | The value of Device Index (3010,0039) from the RT Beam<br>Limiting Device Definition Sequence (300A,064D)<br>corresponding to the Beam Limiting Device used in this<br>Item.   |
| RT Beam Limiting Device Offset                                | (300A,064B) | 1C  | The offsets (x,y) in mm of the Parallel RT Beam Delimiter<br>Positions (300A,064A) along the x-axis and the Parallel RT<br>Beam Delimiter Boundaries (300A,0649) along the y-axis of<br>the Beam Modifier Coordinate System after the Beam<br>Modifier Orientation Angle (300A,0645) is applied.<br>See Section C.36.2.2.20.1.1 and Section C.36.2.2.8.1.2.<br>Required if the conditions in Section C.36.2.2.5.1.1 are<br>satisfied.  |
| Parallel RT Beam Delimiter Positions                          | (300A,064A) | 1C  | One-dimensional positions in mm of the tip of beam<br>delimiters.<br>If Device Type Code Sequence (3010,002E) contains<br>(130333, DCM, "Single Leaves"), N values shall be provided<br>where N is the Number of Parallel RT Beam Delimiters<br>(300A,0648).<br>If Device Type Code Sequence contains (130330, DCM,<br>"Jaw Pair") or (130331, DCM, "Leaf Pairs"), 2N values shall<br>be provided where N is the Number of Parallel RT Beam<br>Delimiters (300A,0648). The values shall be grouped by the<br>mounting side identified by the Parallel RT Beam Delimiter<br>Leaf Mounting Side (300A,064F) with the values of RT<br>Beam Delimiter Elements on the negative mounting side<br>first.<br>The order of values shall correspond to the order of the<br>Parallel RT Beam Delimiter Boundaries (300A,0649).<br>See Section C.36.2.2.20.1.1, Section C.36.2.2.20.1.2 and<br>Section C.36.2.2.20.1.3.<br>Required if the conditions in Section C.36.2.2.5.1.1 are<br>satisfied, and if Device Type Code Sequence has a value of<br>(130330, DCM, "Jaw Pair"), or (130331, DCM, "Leaf Pairs"),<br>or (130333, DCM, "Single Leaves"), and if the Parallel RT<br>Beam Delimiter Opening Mode (300A,064E) is present<br>and does not have the value BINARY. |
| RT Beam Delimiter Geometry Sequence                           | (300A,064C) | 1C  | The outline of the Beam Limiting Device opening.<br>Required if the conditions in Section C.36.2.2.5.1.1 are<br>satisfied and if Device Type Code Sequence (3010,002E)<br>contains (130332, DCM, "Variable Circular Collimator").<br>See Section C.36.2.2.20.1.1 and Section C.36.2.2.20.1.3.<br>Only a single Item shall be included in this Sequence.  |
| >Include Table 10.38-1 "Outline Definition Macro Attributes". |             | The Outline Shape Type (0018,1630) shall be CIRCULAR.<br>See Section C.36.2.2.20.1.1. |  |

## C.36.2.2.20.1 RT Beam Limiting Device Opening Macro Attribute Descriptions

## C.36.2.2.20.1.1 Geometric Value Attributes

All geometric values in Table C.36.2.2.20-1 are defined in the Beam Modifier Definition Plane (see Section C.36.1.1.9).

## C.36.2.2.20.1.2 Parallel RT Beam Delimiter Element Positions

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

N1, N2, Nn

P1, P2, 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 (300A,0649).

## C.36.2.2.20.1.3 RT Beam Delimiter Geometry

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

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

## 6 Registry of DICOM Data Elements

| (3008,00A1) | Enhanced RT Beam Limiting Device Sequence           | EnhancedRTBeamLimitingDeviceSeq uence          | SQ | 1    |
|-------------|---|--|----|------|
| (3008,00A2) | Enhanced RT Beam Limiting<br>Opening Sequence       | EnhancedRTBeamLimitingOpeningS equence         | SQ | 1    |
| (3008,00A3) | Enhanced RT Beam Limiting Device<br>Definition Flag | EnhancedRTBeamLimitingDeviceDefi<br>nitionFlag | CS | 1    |
| (3008,00A4) | Parallel RT Beam Delimiter Opening Extents          | ParallelRTBeamDelimiterOpeningExt ents         | FD | 2-2n |

Add the following UID to PS3.6, Annex A:

## Annex A Registry of DICOM unique identifiers (UIDs) (Normative)

#### Table A-3 Context Group UID Values

| Context UID                   | Context<br>Identifier | Context Group Name                 |
|-------------------------------|-----------------------|------------------------------------|
| <u>1.2.840.10008.6.1.1458</u> | <u>9540</u>           | Movable Beam Limiting Device Types |

Modify the following CID in PS3.16, Annex B:

## CID 9541 Beam Limiting Device Types

**Resources:** 

## rces: <u>HTML | FHIR JSON | FHIR XML | IHE SVS XML</u> Type: <del>Non-Extensible</del> Version: 20190715 UID: 1.2.840.10008.6.1.1288 Table CID 9541. Beam Limiting Device Types

| Coding Scheme Designator | Code Value        | Code Meaning                 |  |  |  |  |
|--------------------------|-------------------|------------------------------|--|--|--|--|
| DCM                      | <del>130330</del> | Jaw Pair                     |  |  |  |  |
| DCM                      | <del>130331</del> | Leaf Pairs                   |  |  |  |  |
| DCM                      | <del>130332</del> | Variable Circular Collimator |  |  |  |  |
| DCM                      | <del>130333</del> | Single Leaves                |  |  |  |  |
|                          |                   |                              |  |  |  |  |

## Include CID 9540 "Movable Beam Limiting Device Types"

Include CID 9545 "Fixed Beam Limiting Device Types"

Add the following CID to PS3.16, Annex B:

## CID 9540 Movable Beam Limiting Device Types

## Resources: HTML I FHIR JSON I FHIR XML I IHE SVS XML Type: Extensible Version: 20221224 UID: 1.2.840.10008.6.1.1458 Table CID 9540. Movable Beam Limiting Device Types

| Coding Scheme<br>Designator<br>(0008,0102) | Code Value<br>(0008,0100) | Code Meaning<br>(0008,0104)  |
|--|---------------------------|------------------------------|
| DCM  | 130330                    | Jaw Pair                     |
| DCM  | 130331                    | Leaf Pairs                   |
| DCM  | 130332                    | Variable Circular Collimator |
| DCM  | 130333                    | Single Leaves                |