

DICOM Correction Proposal

Status	Letter Ballot
Date of Last Update	2023/09/02
Person Assigned	Christof Schadt
Submitter Name	Ulrich Busch (ulrich.busch@bluewin.ch)
Submission Date	2023/03/05

Correction Number	CP2298
Log Summary:	Synchronize 1st Generation BLD definitions
Name of Standard	PS3.3
Rationale for Correction:	<p>CP 2229 "Support of New MLC Types" added support for new types of MLCs in the RT Beams Module. Several Modules were affected. In this context the description of Enumerated Values used for RT Beam Limiting Device Type (300A,00B8) have been enhanced as well. These enhancements were only applied to Modules whose MLC Types have been extended. Further on it was noted during LB that some requirement specifications could be enhanced, even if they have been missing already prior to CP 2229.</p> <p>Therefore, other Modules containing RT Beam Limiting Device specifications are synchronized with CP2229 and the enhancements requested during LB are added to conventional and Ion Beam Modules. Additionally, the Ion Beams Modules are extended in the same way as in CP 2229 to support new MLC Types.</p> <p>The current CP addresses such issues as follows:</p> <ul style="list-style-type: none"> - Updates descriptions of MLC types of these terms in those Modules which have not been covered by CP 2229. - Adds tag numbers to Attribute Descriptions where they have been missing - Refers explicitly to Leaf/Jaw Positions (300A,011C) in the requirement conditions in Beam Limiting Device Position Sequence (300A,011A). - Defines missing multiplicity specification of the Sequence specifying the openings of the devices. - Adds support of new MLC Types to Ions Beams.
Correction Wording:	

In PS3.3, Appendix C, change or extend the following Modules

C.8.8.14 RT Beams Module

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

Table C.8-50. RT Beams Module Attributes

Attribute Name	Tag	Type	Attribute Description
Beam Sequence	(300A,00B0)	1	Sequence of treatment beams for current RT Plan. One or more Items shall be included in this Sequence.
>Beam Number	(300A,00C0)	1	Identification number of the Beam. The value of Beam Number (300A,00C0) shall be unique within the RT Plan in which it is created. See Note 1.

Attribute Name	Tag	Type	Attribute Description
...			
>Beam Limiting Device Sequence	(300A,00B6)	1C	Sequence of beam limiting device (collimator) jaw or leaf (element) sets. Required if Enhanced RT Beam Limiting Device Definition Flag (3008,00A3) is absent, or is present and has the value NO. 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 collimator in IEC X direction MLCY single layer multileaf collimator in IEC Y direction
...			
>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 Sequence	(300A,011A)	1C	Sequence of beam limiting device (collimator) jaw or leaf (element) positions. One or more Items shall be included in this Sequence. Required for first Item of Control Point Sequence, or if the values of the Beam Limiting Device change during Beam, and if Enhanced RT Beam Limiting Device Definition Flag (3008,00A3) is absent, or is present and has the value NO. <u>One or more Items shall be included in this Sequence.</u> <u>In the first Control Point the number of Items shall be equal to the number of Items of Beam Limiting Device Sequence (300A,00B6).</u> <u>In subsequent Control Points the Items present shall be only those, whose values change during Beam.</u>
>>>>RT Beam Limiting Device Type	(300A,00B8)	1	Type of beam limiting device (collimator). The value of this Attribute shall correspond to RT Beam Limiting Device Type (300A,00B8) defined in an Item of Beam Limiting Device Sequence (300A,00B6). Enumerated Values: X symmetric jaw pair in IEC X direction

Attribute Name	Tag	Type	Attribute Description
			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 collimator in IEC X direction MLCY single layer multileaf collimator in IEC Y direction
...			

C.8.8.14.5 Control Point Sequence

The RT Beams Module uses a single beam model to handle static, arc, and dynamic delivery of external beam radiation by a medical accelerator or gamma beam therapy equipment (cobalt unit). All applicable parameters shall be specified at Control Point 0, with the exception of couch positions (see Section C.8.8.14.6). All parameters that change at any control point of a given beam shall be specified explicitly at all control points (including those preceding the change). No assumptions are made about the behavior of machine parameters between specified control points, and communicating devices shall agree on this behavior outside the current Standard.

...

e) Dynamic delivery with moving MLC leaves and stationary collimator jaws:

In this example the collimator jaws stay in the same position throughout the Beam, while the MLC leaves change positions.

The following table illustrates the presence of Items in the Beam Limiting Device Position Sequence (300A,011A) and sample values.

Table C.8-nn. Example of dynamic collimation in RT Beams Module

<u>Control Point Index (300A,0112)</u>	<u>Number of Items present in Beam Limiting Device Position Sequence (300A,011A)</u>	<u>Values in Leaf/Jaw Positions (300A,011C) for RT Beam Limiting Device Type (300A,00B8) = X</u>	<u>Values in Leaf/Jaw Positions (300A,011C) for RT Beam Limiting Device Type (300A,00B8) = Y</u>	<u>Values in Leaf/Jaw Positions (300A,011C) for RT Beam Limiting Device Type (300A,00B8) = MLCX</u>
<u>0</u>	<u>3</u>	<u>present with values -5/5</u>	<u>present with values -4/4</u>	<u>present with values -4.9/-4.8/.../3.9/3.8</u>
<u>1</u>	<u>1</u>	<u>absent</u>	<u>absent</u>	<u>-4.8/-4.7/.../3.8/3.7</u>
<u>2</u>	<u>1</u>	<u>absent</u>	<u>absent</u>	<u>-4.7/-4.6/.../3.7/3.6</u>
<u>3</u>	<u>1</u>	<u>absent</u>	<u>absent</u>	<u>-4.6/-4.5/.../3.6/3.5</u>
<u>4</u>	<u>1</u>	<u>absent</u>	<u>absent</u>	<u>-4.5/-4.4/.../3.5/3.4</u>
<u>5</u>	<u>1</u>	<u>absent</u>	<u>absent</u>	<u>-4.4/-4.3/.../3.4/3.3</u>

<u>6</u>	<u>1</u>	<u>absent</u>	<u>absent</u>	<u>-4.3/-4.2/.../3.3/3.2</u>
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C.8.8.11 RT Tolerance Tables Module

Table C.8-47. RT Tolerance Tables Module Attributes

Attribute Name	Tag	Type	Attribute Description
Tolerance Table Sequence	(300A,0040)	3	Sequence of tolerance tables to be used for delivery of treatment plan. One or more Items are permitted in this Sequence. See Note 1.
>Tolerance Table Number	(300A,0042)	1	Identification number of the Tolerance Table. The value of Tolerance Table Number (300A,0042) shall be unique within the RT Plan in which it is created.
>Tolerance Table Label	(300A,0043)	3	User-defined label for Tolerance Table.
...			
>Beam Limiting Device Tolerance Sequence	(300A,0048)	3	Sequence of beam limiting device (collimator) tolerances. 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: 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 <u>jaw</u> pair in IEC Y direction MLCX <u>single layer</u> multileaf (multi-element) <u>jaw pair</u> <u>collimator</u> in IEC X direction MLCY <u>single layer</u> multileaf (multi-element) <u>jaw pair</u> <u>collimator</u> in IEC Y direction
>>Beam Limiting Device Position Tolerance	(300A,004A)	1	Maximum permitted difference (in mm) between planned and delivered leaf (element) or jaw positions for current beam limiting device (collimator).
...			

C.8.8.21 RT Beams Session Record Module

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

Attribute Name	Tag	Type	Attribute Description
Referenced Fraction Group Number	(300C,0022)	3	Identifier of Fraction Group within referenced RT Plan.
Number of Fractions Planned	(300A,0078)	2	Total number of treatments (Fractions) planned for current Fraction Group.

Attribute Name	Tag	Type	Attribute Description
...			
Treatment Session Beam Sequence	(3008,0020)	1	Sequence of Beams administered during treatment session. One or more Items shall be included in this Sequence.
>Referenced Beam Number	(300C,0006)	3	References Beam specified by Beam Number (300A,00C0) in Beam Sequence (300A,00B0) in RT Beams Module within referenced RT Plan.
...			
>Beam Limiting Device Leaf Pairs Sequence	(3008,00A0)	1C	Sequence of beam limiting device (collimator) jaw or leaf (element) leaf pair values. Required if Enhanced RT Beam Limiting Device Definition Flag (3008,00A3) is absent, or is present and has the value NO. 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 collimator in IEC X direction MLCY single layer multileaf collimator in IEC Y direction
...			
>Number of Control Points	(300A,0110)	1	Number of control points delivered. 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. The number of Items in this Sequence shall equal the value of Number of Control Points (300A,0110). See Section C.8.8.21.1.
...			
>>Referenced Control Point Index	(300C,00F0)	3	Uniquely identifies Control Point specified by Control Point Index (300A,0112) within Beam referenced by Referenced Beam Number (300C,0006).
>>Beam Limiting Device Position Sequence	(300A,011A)	1C	Sequence of beam limiting device (collimator) jaw or leaf (element) positions. One or more Items shall be included in this Sequence. Required for the first Control Point of Control Point Delivery Sequence (3008,0040), or if any value of the Leaf/Jaw Positions (300A,011C) the beam limiting device (collimator) changes during beam administration and if Enhanced RT Beam Limiting Device Definition Flag (3008,00A3) is absent, or is present has the value NO.

Attribute Name	Tag	Type	Attribute Description
			<p><u>One or more Items shall be included in this Sequence.</u></p> <p><u>In the first Control Point the number of Items shall be equal to the number of Items of Beam Limiting Device Leaf Pairs Sequence (3008,00A0).</u></p> <p><u>In subsequent Control Points the Items present shall be only those, whose values change during Beam.</u></p>
>>>RT Beam Limiting Device Type	(300A,00B8)	1	<p>Type of beam limiting device. The value of this Attribute shall correspond to RT Beam Limiting Device Type (300A,00B8) defined in an element of Beam Limiting Device Leaf Pairs Sequence (3008,00A0).</p> <p>Enumerated Values:</p> <p>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 <u>single layer</u> multileaf (multi-element) jaw paircollimator in IEC X direction MLCY <u>single layer</u> multileaf (multi-element) jaw paircollimator in IEC Y direction</p>
>>>Leaf/Jaw Positions	(300A,011C)	1	<p>Positions of beam limiting device (collimator) leaf (element) or jaw pairs (mm) in IEC BEAM LIMITING DEVICE coordinate axis appropriate to RT Beam Limiting Device Type (300A,00B8), e.g., X-axis for MLCX, Y-axis for MLCY. Contains 2N values, where N is the Number of Leaf/Jaw Pairs (300A,00BC) defined in element of Beam Limiting Device Leaf Pairs Sequence (3008,00A0). Values shall be in IEC leaf subscript order 101, 102, ... 1N, 201, 202 ... 2N.</p>
>>Enhanced RT Beam Limiting Opening Sequence	(3008,00A2)	2C	<p>Sequence of beam limiting device (collimator) jaw or leaf (element) positions.</p> <p>Required for the first Control Point of Control Point Delivery Sequence (3008,0040), or if Beam Limiting Device change during Beam and if Enhanced RT Beam Limiting Device Definition Flag (3008,00A3) has the value YES.</p> <p>One or more Items shall be included in this Sequence.</p> <p>The number of Items shall equal the number of Items in Enhanced RT Beam Limiting Device Sequence (3008,00A1) in the first Control Point and be equal or less in subsequent Control Points.</p> <p>See Section C.8.8.14.18 "Presence of Items within Sequences in the Control Point Sequence".</p>
>>>Include Table C.36.2.2.20-1 "RT Beam Limiting Device Opening Definition Macro Attributes"			See Section C.8.8.14.17 "Enhanced RT Beam Limiting Device Sequence and Enhanced RT Beam Limiting Opening Sequence".
>>Gantry Angle	(300A,011E)	1C	<p>Treatment machine gantry angle, i.e., orientation of IEC GANTRY coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees). Required for Control Point 0 of Control Point Delivery Sequence (3008,0040) or if Gantry Angle changes during beam administration.</p>

Attribute Name	Tag	Type	Attribute Description
...			

C.8.8.24 RT Ion Tolerance Tables Module

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

Table C.8.8.24-1. RT Ion Tolerance Tables Module Attributes

Attribute Name	Tag	Type	Attribute Description
Ion Tolerance Table Sequence	(300A,03A0)	1	Sequence of ion tolerance tables to be used for delivery of treatment plan. One or more Items shall be included in this Sequence. See Note 1.
>Tolerance Table Number	(300A,0042)	1	Identification number of the Tolerance Table. The value of Tolerance Table Number (300A,0042) shall be unique within the RT Ion Plan in which it is created.
...			
>Beam Limiting Device Tolerance Sequence	(300A,0048)	3	Sequence of beam limiting device (collimator) tolerances. 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: 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 <u>jaw</u> pair in IEC Y direction MLCX <u>single layer</u> multileaf (multi-element) <u>jaw pair</u> <u>collimator</u> in IEC X direction MLCY <u>single layer</u> multileaf (multi-element) <u>jaw pair</u> <u>collimator</u> in IEC Y direction
>>Beam Limiting Device Position Tolerance	(300A,004A)	1	Maximum permitted difference (in mm) between planned and delivered leaf (element) or jaw positions for current beam limiting device (collimator).
>Patient Support Angle Tolerance	(300A,004C)	3	Maximum permitted difference (in degrees) between planned and delivered Patient Support Angle.
...			

C.8.8.25 RT Ion Beams Module

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

Table C.8.8.25-1. RT Ion Beams Module Attributes

Attribute Name	Tag	Type	Attribute Description
Ion Beam Sequence	(300A,03A2)	1	Sequence of setup and/or treatment beams for current RT Ion Plan. One or more Items shall be included in this Sequence.
>Beam Number	(300A,00C0)	1	Identification number of the Beam. The value of Beam Number (300A,00C0) shall be unique within the RT Ion Plan in which it is created. See Section C.8.8.25.1.
...			
>Enhanced RT Beam Limiting Device Definition Flag	(3008,00A3)	3	<u>Whether the RT Beam Limiting Devices are specified by the Enhanced RT Beam Limiting Device Sequence (3008,00A1).</u> <u>Enumerated Values:</u> <u>YES</u> <u>NO</u>
>Ion Beam Limiting Device Sequence	(300A,03A4)	3	Sequence of beam limiting device (collimator) jaw or leaf (element) sets. <u>Shall not be present if Enhanced RT Beam Limiting Device Definition Flag (3008,00A3) is present and has the value YES.</u> 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: 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 <u>jaw</u> pair in IEC Y direction MLCX <u>single layer</u> multileaf (multi-element) jaw pair <u>collimator</u> in IEC X direction MLCY <u>single layer</u> multileaf (multi-element) jaw pair <u>collimator</u> in IEC Y direction
>>Isocenter to Beam Limiting Device Distance	(300A,00BB)	2	Isocenter to beam limiting device (collimator) distance (in mm) of the equipment that is to be used for beam delivery. See Section C.8.8.25.4 and Section C.8.8.25.10.
>>Number of Leaf/Jaw Pairs	(300A,00BC)	1	Number of leaf (element) or jaw pairs (equal to 1 for standard beam limiting device jaws).
>>Leaf Position Boundaries	(300A,00BE)	1C	Boundaries of beam limiting device (collimator) leaves (in mm) in IEC BEAM LIMITING DEVICE coordinate axis appropriate to RT Beam Limiting Device Type (300A,00B8), i.e., X-axis for MLCY, Y-axis for MLCX. Contains N+1 values, where N is the Number of Leaf/Jaw Pairs (300A,00BC), starting from Leaf (Element) Pair 1. Required if RT Beam Limiting Device Type (300A,00B8) is MLCX or MLCY. May be present otherwise. See Section C.8.8.25.3.
>Enhanced RT Beam Limiting Device Sequence	(3008,00A1)	1C	<u>Enhanced RT Beam Limiting Device Descriptions.</u> <u>Required if Enhanced RT Beam Limiting Device Definition Flag (3008,00A3) is present and has the value YES.</u> <u>One or more Items shall be included in this Sequence.</u>

Attribute Name	Tag	Type	Attribute Description
>>Include Table C.36.2.2.19-1 “RT Beam Limiting Device Definition Macro Attributes”.			Device Type Code Sequence (3010.002E) within RT Accessory Device Identification Macro DCID 9540 “Movable Beam Limiting Device Types”. See Section C.8.8.25.12
>Referenced Patient Setup Number	(300C,006A)	3	Uniquely identifies Patient Setup to be used for current beam, specified by Patient Setup Number (300A,0182) within Patient Setup Sequence of RT Patient Setup Module.
...			
>Number of Control Points	(300A,0110)	1	Number of control points in Beam. Value shall be greater than or equal to 2.
>Ion Control Point Sequence	(300A,03A8)	1	Sequence of machine configurations describing Ion treatment beam. The number of Items shall be identical to the value of Number of Control Points (300A,0110). See Section C.8.8.25.7.
>>Control Point Index	(300A,0112)	1	Index of current Control Point, starting at 0 for first Control Point.
...			
>>Include Table C.8.8.27-1 “Beam Limiting Device Position Macro Attributes”			
>>Enhanced RT Beam Limiting Opening Sequence	(3008,00A2)	1C	Sequence of beam limiting device (collimator) jaw or leaf (element) positions. Required for first Item of Control Point Sequence, or if the values of the Beam Limiting Device change during Beam and if Enhanced RT Beam Limiting Device Definition Flag (3008,00A3) is present and has the value YES. One or more Items shall be included in this Sequence. The number of Items shall equal the number of Items in Enhanced RT Beam Limiting Device Sequence (3008,00A1) in the first Control Point and be equal or less in subsequent Control Points. See Section C.8.8.14.18.
>>>Include Table C.36.2.2.20-1 “RT Beam Limiting Device Opening Definition Macro Attributes”			See Section C.8.8.25.n.
...			

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C.8.8.25.n 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):

- **The following applies to the Beam Modifier Definition Coordinate System used:**

- The Base Beam Modifier Definition Coordinate System is the [IEC 61217] GANTRY coordinate system.
- The RT Device Distance Reference Location is (130359, DCM, “Treatment Machine Isocenter”).
- The value of the RT Beam Modifier Definition Distance (300A,0688) equals 0 since the plane of the RT Beam Modifier Definition is at the Isocenter.
- The value of the Beam Modifier Orientation Angle (300A,0645) is 0 for IEC X direction and 90 for IEC Y direction.

Note 1: The values of boundaries and openings are therefore the same as if comparable parameters would be expressed in the Ion Beam Limiting Device Sequence (300A,03A4).

Note 2: The values of the boundaries in the Ion Beam Limiting Device Sequence (300A,03A4) correspond to the Snout Position (300A,030D) of the first Control Point only.

- Values of Attributes of the Module RT Tolerance Tables C.8.8.11 apply to the Enhanced RT Beam Limiting Device Openings as specified in Section C.8.8.14.17.

C.8.8.26 RT Ion Beams Session Record Module

Table C.8.8.26-1 specifies the Attributes of the RT Ion Beams Session Record Module, which describe the measured and recorded settings acquired during Ion Radiation Treatments.

Table C.8.8.26-1. RT Ion Beams Session Record Module Attributes

Attribute Name	Tag	Type	Attribute Description
Referenced Fraction Group Number	(300C,0022)	3	Identifier of fraction group within referenced RT Ion Plan.
Number of Fractions Planned	(300A,0078)	2	Total number of treatments (fractions) planned for current fraction group.
...			
Treatment Session Ion Beam Sequence	(3008,0021)	1	Sequence of setup and/or treatment beams administered during treatment session. One or more Items shall be included in this Sequence.
>Referenced Beam Number	(300C,0006)	1	References Beam specified by Beam Number (300A,00C0) in Ion Beam Sequence (300A,03A2) in RT Ion Beams Module within the referenced RT Ion Plan.
...			
>Enhanced RT Beam Limiting Device Definition Flag	(3008,00A3)	3	<u>Whether the RT Beam Limiting Devices are specified by the Enhanced RT Beam Limiting Device Sequence (3008,00A1).</u> <u>Enumerated Values:</u> <u>YES</u> <u>NO</u>
>Beam Limiting Device Leaf Pairs Sequence	(3008,00A0)	3	Sequence of beam limiting device (collimator) jaw or leaf (element) sets. <u>Shall not be present if Enhanced RT Beam Limiting Device Definition Flag (3008,00A3) is present and has the value YES.</u> One or more Items are permitted in this Sequence.
>>RT Beam Limiting Device Type	(300A,00B8)	1	Type of beam limiting device (collimator).

Attribute Name	Tag	Type	Attribute Description
			<p>Enumerated Values:</p> <p>X symmetric jaw pair in IEC X direction</p> <p>Y symmetric jaw pair in IEC Y direction</p> <p>ASYMX asymmetric jaw pair in IEC X direction</p> <p>ASYMY asymmetric <u>jaw</u> pair in IEC Y direction</p> <p>MLCX <u>single layer</u> multileaf (multi-element) <u>jaw</u> <u>pair</u> <u>collimator</u> in IEC X direction</p> <p>MLCY <u>single layer</u> multileaf (multi-element) <u>jaw</u> <u>pair</u> <u>collimator</u> in IEC Y direction</p>
>>Number of Leaf/Jaw Pairs	(300A,00BC)	1	Number of leaf (element) or jaw pairs (equal to 1 for standard beam limiting device jaws).
<u>>Enhanced RT Beam Limiting Device Sequence</u>	<u>(3008,00A1)</u>	<u>1C</u>	<p><u>Enhanced RT Beam Limiting Device Descriptions.</u></p> <p><u>Required if Enhanced RT Beam Limiting Device Definition Flag (3008,00A3) is present and has the value YES.</u></p> <p><u>One or more Items shall be included in this Sequence.</u></p>
<u>>>Include Table C.36.2.2.19-1 “RT Beam Limiting Device Definition Macro Attributes”.</u>			<p><u>Device Type Code Sequence (3010,002E) within RT Accessory Device Identification Macro DCID 9540 “Movable Beam Limiting Device Types”.</u></p> <p><u>See C.8.8.25.n</u></p>
>Referenced Patient Setup Number	(300C,006A)	3	Uniquely identifies Ion Patient Setup to be used for current beam, specified by Patient Setup Number (300A,0182) within Patient Setup Sequence of RT Patient Setup Module.
...			
>Number of Control Points	(300A,0110)	1	Number of control points in Beam.
>Ion Control Point Delivery Sequence	(3008,0041)	1	<p>Sequence of beam control points for current ion treatment beam.</p> <p>One or more Items shall be included in this Sequence.</p> <p>The number of Items shall be identical to the value of Number of Control Points (300A,0110).</p> <p>See Section C.8.8.21.1.</p>
>>Referenced Control Point Index	(300C,00F0)	1	Uniquely identifies Control Point specified by Control Point Index (300A,0112) within the Beam referenced by Referenced Beam Number (300C,0006).
...			
>Number of Control Points	(300A,0110)	1	Number of control points in Beam.
>Ion Control Point Delivery Sequence	(3008,0041)	1	<p>Sequence of beam control points for current ion treatment beam.</p> <p>One or more Items shall be included in this Sequence.</p> <p>The number of Items shall be identical to the value of Number of Control Points (300A,0110).</p> <p>See Section C.8.8.21.1.</p>

Attribute Name	Tag	Type	Attribute Description
>>Referenced Control Point Index	(300C,00F0)	1	Uniquely identifies Control Point specified by Control Point Index (300A,0112) within the Beam referenced by Referenced Beam Number (300C,0006).
...			
>>Include Table C.8.8.27-1 "Beam Limiting Device Position Macro Attributes"			
>>Enhanced RT Beam Limiting Opening Sequence	(3008,00A2)	1C	Sequence of beam limiting device (collimator) jaw or leaf (element) positions. Required for the first Control Point of Control Point Delivery Sequence (3008,0040), or if Beam Limiting Device change during Beam and if Enhanced RT Beam Limiting Device Definition Flag (3008,00A3) has the value YES. One or more Items shall be included in this Sequence. The number of Items shall equal the number of Items in Enhanced RT Beam Limiting Device Sequence (3008,00A1) in the first Control Point and be equal or less in subsequent Control Points. See Section C.8.8.14.18.
>>>Include Table C.36.2.2.20-1 "RT Beam Limiting Device Opening Definition Macro Attributes"			See Section C.8.8.14.25.n.
...			

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C.8.8.27 Beam Limiting Device Position Macro

Table C.8.8.27-1 specifies the Attributes of the Beam Limiting Device Position Macro, which specify the Beam Limiting Device Sequence.

Table C.8.8.27-1. Beam Limiting Device Position Macro Attributes

Attribute Name	Tag	Type	Attribute Description
Beam Limiting Device Position Sequence	(300A,011A)	1C	Sequence of beam limiting device (collimator) jaw or leaf (element) positions. One or more Items shall be included in this Sequence. Required if Ion Beam Limiting Device Sequence (300A,03A4) or Beam Limiting Device Leaf Pairs Sequence (3008,00A0) is included in this SOP Instance and for first Item of the Ion Control Point Sequence including control point Sequence (either Ion Control Point Sequence (300A,03A8) or Ion Control Point Delivery Sequence (3008,0041)), or if <u>any value of Leaf/Jaw Positions (300A,011C) Beam Limiting Device</u> changes during Beam. One or more Items shall be included in this Sequence. <u>In the first Control Point the number of Items shall be equal to the number of Items of corresponding device definition sequence (Ion Beam Limiting Device Sequence (300A,03A4) or Beam Limiting Device Leaf Pairs Sequence (3008,00A0)).</u>

Attribute Name	Tag	Type	Attribute Description
			<u>In subsequent Control Points the Items present shall be only those, whose values change during Beam.</u>
>RT Beam Limiting Device Type	(300A,00B8)	1	<p>Type of beam limiting device (collimator). The value of this Attribute shall correspond to RT Beam Limiting Device Type (300A,00B8) defined in an Item of Ion Beam Limiting Device Sequence (300A,03A4).</p> <p>Enumerated Values:</p> <p>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 <u>jaw</u> pair in IEC Y direction MLCX <u>single layer</u> multileaf (multi-element) jaw paircollimator in IEC X direction MLCY <u>single layer</u> multileaf (multi-element) jaw paircollimator in IEC Y direction</p>
>Leaf/Jaw Positions	(300A,011C)	1	<p>Positions of beam limiting device (collimator) leaf (element) or jaw pairs (in mm) in IEC BEAM LIMITING DEVICE coordinate axis appropriate to RT Beam Limiting Device Type (300A,00B8), e.g., X-axis for MLCX, Y-axis for MLCY. Contains 2N values, where N is the Number of Leaf/Jaw Pairs (300A,00BC) in Ion Beam Limiting Device Sequence (300A,03A4). Values shall be listed in IEC leaf (element) subscript order 101, 102, ... 1N, 201, 202, ... 2N. See Section C.8.8.25.3.</p>

C.31.1 RT General Machine Verification Module

Table C.31-1 specifies the Attributes used to convey the parameters used in external verification of both conventional radiotherapy (photon or electron) and ion treatment deliveries.

Table C.31-1. RT General Machine Verification Module Attributes

Attribute Name	Tag	Attribute Description
Referenced RT Plan Sequence	(300C,0002)	<p>A reference to an RT Plan SOP Class/Instance pair.</p> <p>Only a single Item shall be included in this Sequence.</p>
...		
>Beam Limiting Device Leaf Pairs Sequence	(3008,00A0)	<p>Beam limiting device (collimator) jaw or leaf (element) leaf pair values.</p> <p>One or more Items shall be included in this Sequence.</p>
>>RT Beam Limiting Device Type	(300A,00B8)	<p>Type of beam limiting device (collimator).</p> <p>Enumerated Values:</p> <p>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 <u>jaw</u> pair in IEC Y direction MLCX <u>single layer</u> multileaf (multi-element) jaw paircollimator in IEC X direction MLCY <u>single layer</u> multileaf (multi-element) jaw paircollimator in IEC Y direction</p>

Attribute Name	Tag	Attribute Description
>>Number of Leaf/Jaw Pairs	(300A,00BC)	Number of leaf (element) or jaw pairs (equal to 1 for standard beam limiting device jaws).
>Recorded Wedge Sequence	(3008,00B0)	Treatment wedges present during delivered Beam. Zero or more Items shall be included in this Sequence.
...		

C.31.2 RT Conventional Machine Verification Module

Table C.31-2 specifies the Attributes used to convey the parameters used in external verification of a conventional radiotherapy (photon or electron) treatment delivery.

Table C.31-2. RT Conventional Machine Verification Module Attributes

Attribute Name	Tag	Attribute Description
Conventional Machine Verification Sequence	(0074,1044)	Sequence containing conventional machine verification parameters. Zero or one Item shall be included in this Sequence.
>Conventional Control Point Verification Sequence	(0074,104C)	Beam control points for current treatment beam. Only a single Item shall be included in this Sequence.
...		
>>Beam Limiting Device Position Sequence	(300A,011A)	Beam limiting device (collimator) jaw or leaf (element) positions. One or more Items shall be included in this Sequence.
>>>RT Beam Limiting Device Type	(300A,00B8)	Type of beam limiting device (collimator). The value of this Attribute shall correspond to RT Beam Limiting Device Type (300A,00B8) defined in an Item of Beam Limiting Device Sequence (300A,00B6) 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 <u>single layer</u> multileaf (multi-element) jaw paircollimator in IEC X direction MLCY <u>single layer</u> multileaf (multi-element) jaw paircollimator in IEC Y direction
>>>Leaf/Jaw Positions	(300A,011C)	Positions of beam limiting device (collimator) leaf (element) or jaw pairs in mm in the IEC BEAM LIMITING DEVICE coordinate axis appropriate to RT Beam Limiting Device Type (300A,00B8), e.g., X-axis for MLCX, Y-axis for MLCY. Contains 2N values, where N is the Number of Leaf/Jaw Pairs (300A,00BC) in Beam Limiting Device Sequence (300A,00B6). Values shall be listed in the IEC leaf (element) subscript order 101, 102, ... 1N, 201, 202, ... 2N.

Attribute Name	Tag	Attribute Description
>>Gantry Angle	(300A,011E)	Gantry angle in degrees of radiation source, i.e., orientation of the IEC GANTRY coordinate system with respect to the IEC FIXED REFERENCE coordinate system.
...		

C.31.3 RT Ion Machine Verification Module

Table C.31-3 specifies the Attributes used to convey the parameters used in external verification of a radiotherapy ion treatment delivery.

Table C.31-3. RT Ion Machine Verification Module Attributes

Attribute Name	Tag	Attribute Description
Ion Machine Verification Sequence	(0074,1046)	Sequence containing ion machine verification parameters. Zero or one Item shall be included in this Sequence.
>Ion Control Point Verification Sequence	(0074,104E)	Beam control points for current ion treatment beam. Only a single Item shall be included in this Sequence.
...		
>>Beam Limiting Device Position Sequence	(300A,011A)	Beam limiting device (collimator) jaw or leaf (element) positions. One or more Items shall be included in this Sequence.
>>>RT Beam Limiting Device Type	(300A,00B8)	Type of beam limiting device (collimator). The value of this Attribute shall correspond to RT Beam Limiting Device Type (300A,00B8) defined in an Item of Beam Limiting Device Sequence (300A,00B6) 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 <u>jaw</u> pair in IEC Y direction MLCX <u>single layer</u> multileaf (multi-element) jaw pair <u>collimator</u> in IEC X direction MLCY <u>single layer</u> multileaf (multi-element) jaw pair <u>collimator</u> in IEC Y direction
>>>Leaf/Jaw Positions	(300A,011C)	Positions of beam limiting device (collimator) leaf (element) or jaw pairs in mm in the IEC BEAM LIMITING DEVICE coordinate axis appropriate to RT Beam Limiting Device Type (300A,00B8), e.g., X-axis for MLCX, Y-axis for MLCY. Contains 2N values, where N is the Number of Leaf/Jaw Pairs (300A,00BC) in Beam Limiting Device Sequence (300A,00B6). Values shall be listed in the IEC leaf (element) subscript order 101, 102, ... 1N, 201, 202, ... 2N.
>>Gantry Angle	(300A,011E)	Gantry angle of radiation source in degrees, i.e., orientation of the IEC GANTRY coordinate system with respect to the IEC FIXED REFERENCE coordinate system.

Attribute Name	Tag	Attribute Description
...		