

DICOM Correction Proposal

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Correction Number	CP-1658
Log Summary:	Dose Reference Beam Dose Verification
Name of Standard	PS3.3 2017c
Rationale for Correction:	<p>CP 1138 introduced the capability to specify depth values for beam dose verification at a specific point with a Control Point resolution different than the actual delivery Control Points of a beam. This was done by introducing a Verification Control Point Sequence in the Fraction Group Sequence.</p> <p>Defining this Sequence in the Fraction Group has the disadvantage that verification parameters can only be provided for a single target, as the Referenced Beams in the Fraction Group only refer to a single Beam Dose Specification Point.</p> <p>It is therefore proposed to retire the Verification Control Point Sequence at the existing location and introduce it inside the Dose Reference Sequence along with the necessary adaptations to reference the corresponding beams.</p> <p>In addition, the notion of “average” for the beam dose depth values may not be addressed by a planning system, as this requires some effort to calculate additional values to represent an average value. But especially when it comes to small arc steps, an average value may not be required and thus opens the question down to which resolution an average is meaningful to be calculated (which actually cannot be answered by the DICOM standard, anyways). It is therefore proposed to introduce an indication whether an average value is available or not that is populated at the implementer’s discretion.</p> <p>RT Ion Plan implementations do not use the retired construct within the RT Fraction Scheme Module.</p>
Correction Wording:	

In PS 3.3, Section C.8.8.13 RT Fraction Scheme Module, Table C.8-49, make the following changes:

Table C.8-49 RT FRACTION SCHEME MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Fraction Group Sequence	(300A,0070)	1	Introduces sequence of Fraction Groups in current Fraction Scheme. One or more items may be included in this sequence
...			
>Referenced Beam Sequence	(300C,0004)	1C	Introduces sequence of treatment beams in current Fraction Group. Required if Number of Beams (300A,0080) is greater than zero. One or more items may be included in this sequence.
...			

>>Beam Dose Verification Control Point Sequence	(300A,008C)	3	Sequence of Items containing Beam Dose Verification Control Points. Two or more items may be included in this sequence.
>>>Cumulative Meterset Weight	(300A,0134)	4	The cumulative meterset weight value, at which the beam dose point geometrical parameters apply.
>>>Referenced Control Point Index	(300C,00F0)	1C	Uniquely identifies the Control Point specified by Control Point Index (300A,0112) within Beam referenced by Referenced Beam Number (300C,0006). See C.8.8.13.1.4 Required, if the Referenced Cumulative Meterset corresponds to a Control Point in the Control Point Sequence (300A,0111).
>>>Average Beam Dose Point Depth	(300A,008D)	2C	The average depth (in mm) in the patient along a ray from the source to the dose point specified by the Beam Dose Specification Point (300A,0082) from the current Beam Dose Verification Control Point to the next one. See C.8.8.13.1.2 Required for all but the last items in that sequence.
>>>Average Beam Dose Point Equivalent Depth	(300A,008E)	2C	The average radiological depth in mm (water equivalent depth, taking tissue heterogeneity into account) in the patient along a ray from the source to the dose point specified by the Beam Dose Specification Point (300A,0082) from the current Beam Dose Verification Control Point to the next one. See C.8.8.13.1.2 Required for all but the last items in that sequence.
>>>Average Beam Dose Point SSD	(300A,008F)	2C	Average Source to patient surface distance in mm along a ray from the source to the dose point specified by the Beam Dose Specification Point (300A,0082) from the current Beam Dose Verification Control Point to the next one. See C.8.8.13.1.2 Required for all but the last items in that sequence.

Notes: ...

6. Attributes Beam Dose Point Depth, Beam Dose Point Equivalent Depth and Beam Dose Point SSD were previously included in this Module as optional Attributes but have been retired. See PS 3.3 2011.
7. The Beam Dose Verification Control Point Sequence was previously included and has been retired. See PS 3.3 2017c. The information is now described in the Referenced Dose Reference Sequence (300C,0050) in the C.8.8.14 RT Beams Module.

C.8.8.13.1 Beam Dose Verification Parameters

Retired. See PS3.3 2017c.

C.8.8.13.1.1 Referenced Control Point

The number of items in the Beam Dose Verification Control Point Sequence (300A,008B) is not required to be the same as in the Control Point Sequence (300A,0111). A different sampling can be chosen for the Beam Dose Verification Control Point Sequence, but where the Cumulative Meterset Weight of a Control Point Sequence Item is the same it shall be referenced by the Referenced Control Point Index (300C,00F0).

C.8.8.13.1.2 Distance Parameters

The values given in Average Beam Dose Point Depth (300A,008D), Average Beam Dose Point Equivalent Depth (300A,008E) and Average Beam Dose Point SSD (300A,008F) shall always contain average values from the current Beam Dose Verification Control Point to the next. In case of e.g. an arc therapy, these values reflect the changing depth parameters. In case these distances do not change, e.g. for a static beam treatment, the average value equals the static value under the given geometric conditions.

In PS 3.3, Section C.8.8.14 RT Beams Module, Table C.8-50, make the following changes:

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.
...			
>General Accessory Sequence	(300A,0420)	3	Introduces a Sequence of General Accessories associated with this Beam. One or more Items are permitted in this Sequence.
...			
>>Accessory Code	(300A,00F9)	3	Machine-readable identifier for this accessory
>>Source to General Accessory Distance	(300A,0425)	3	Radiation source to general accessory distance (in mm) for current accessory.
>Referenced Dose Reference Sequence	(300C,0050)	3	A sequence of Dose References for which verification control points are defined. One or more Items are permitted in this Sequence.
>>Referenced Dose Reference Number	(300C,0051)	1	Uniquely identifies Dose Reference specified by Dose Reference Number (300A,0012) in Dose Reference Sequence (300A,0010) in RT

			Prescription Module.
>>Depth Value Averaging Flag	(300A,0093)	1C	Whether or not the depth values have been averaged. Enumerated Values: _____ NO – the values refer to a single location _____ YES – the values represent average values from the current Verification Control Point to the next. Required if the referenced beam describes an angular movement and the depth values change during movement.
>>Beam Dose Verification Control Point Sequence	(300A,008C)	1	Sequence of Items containing Beam Dose Coordinate Verification Control Points. Two or more items Items shall be included in this Sequence.
>>>Cumulative Meterset Weight	(300A,0134)	1	The cumulative meterset weight value, at which the beam dose point geometrical parameters apply.
>>>Referenced Control Point Index	(300C,00F0)	1C	Uniquely identifies the Control Point specified by Control Point Index (300A,0112) within Beam referenced by Referenced Beam Number (300C,0006). See C.8.8.14.16 Required, if the Referenced Cumulative Meterset corresponds to a Control Point in the Control Point Sequence (300A,0111).
>>>Beam Dose Point Depth	(300A,0088)	1C	The depth (in mm) in the patient along a ray from the source to the dose point specified by the Dose Reference Point Coordinates (300A,0018) or the referenced ROI. Required for all but the last Item in this Sequence and for the last Item if Depth Value Averaging Flag (300A,0093) has a value of NO. See Note 6.
>>>Beam Dose Point Equivalent Depth	(300A 0089)	1C	The radiological depth in mm (water-equivalent depth, taking tissue heterogeneity into account) in the patient along a ray from the source to the dose point specified by the Dose Reference Point Coordinates (300A,0018) or the referenced ROI. Required for all but the last Item in this Sequence and for the last Item if Depth Value Averaging Flag (300A,0093) has a value of NO. See Note 6.
>>>Beam Dose Point SSD	(300A, 008A)	1C	Source to patient surface distance in mm along a ray from the source to the dose point specified by the Dose Reference Point Coordinates

			(300A,0018) or the referenced ROI. Required for all but the last Item in this Sequence and for the last Item if Depth Value Averaging Flag (300A,0093) has a value of NO. See Note 6.
>Final Cumulative Meterset Weight	(300A,010E)	1C	Value of Cumulative Meterset Weight (300A,0134) for final Control Point in Control Point Sequence (300A,0111). Required if Cumulative Meterset Weight is non-null in Control Points specified within Control Point Sequence (300A,0111). See Section C.8.8.14.1.
>Number of Control Points	(300A,0110)	1	Number of control points in Beam. Value shall be greater than or equal to 2.
>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.
>>...			

Note

6. Attributes Beam Dose Point Depth (300A,0088), Beam Dose Point Equivalent Depth (300A,0089), Beam Dose Point SSD (300A,008A) were previously present in this Module **on the level of Beam Sequence (300A,00B0) > Control Points Beam Sequence (300A,0111) > Referenced Dose Reference Sequence (300C,0050)** but. **These attributes** have been retired **at this location**. See PS3.3-2011.

...

C.8.8.14.16 Referenced Control Point

The number of items in the Beam Dose Verification Control Point Sequence (300A,008C) is not required to be the same as in the Control Point Sequence (300A,0111). A different sampling can be chosen for the Beam Dose Verification Control Point Sequence, but where the Cumulative Meterset Weight of a Control Point Sequence Item is the same it shall be referenced by the Referenced Control Point Index (300C,00F0).

In PS 3.6, Section 6 Registry of DICOM data elements:

Tag	Name	Keyword	VR	VM	
(300A,0088)	Beam Dose Point Depth	BeamDosePointDepth	FL	1	RET

(300A,0089)	Beam Dose Point Equivalent Depth	BeamDosePointEquivalent Depth	FL	1	RET
(300A,008A)	Beam Dose Point SSD	BeamDosePointSSD	FL	1	RET
(300A,008D)	Average Beam Dose Point Depth	AverageBeamDosePointDepth	FL	1	<u>RET</u>
(300A,008E)	Average Beam Dose Point Equivalent Depth	AverageBeamDosePointEquivalentDepth	FL	1	<u>RET</u>
(300A,008F)	Average Beam Dose Point SSD	AverageBeamDosePointSSD	FL	1	<u>RET</u>
(300A,0093)	Depth Value Averaging Flag	DepthValueAveragingFlag	CS	1	