DICOM Correction Proposal

STATUS	Assigned
Date of Last Update	2025/03/20
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Correction Number	CP-2428
Log Summary: Add Dose Reporting Mode and Dose Calculation Model to RT Dose	
Name of Standard PS3.3, PS3.6, PS3.16	
Rationale for Correction: This CP adds information about the dose reporting mode and the dose calculation model that produced the dose data. In a treatment planning system there can be multiple calculation models using the same calculation algorithm, e.g., the models may be configured with different measurement input data. The content has already been factored out in a Macro, as it is going to be re-used during the effort to re-use as much of the Second Generation RT approach as possible by moving more concepts over to the 1st Generation RT Dose IOD.	
Correction Wording:	

Update PS 3.3 section C.8.8.3 RT Dose Module

Table C.8-39. RT Dose Module Attributes

Attribute Name	Tag	Type	Attribute Description
…			
Tissue Heterogeneity Correction	(3004,0014)	3	Specifies a list of patient heterogeneity characteristics used for calculating dose. This Attribute shall be multi-valued if beams used to compute the dose have differing correction techniques. Enumerated Values: **IMAGE** image data **ROI_OVERRIDE** one or more ROI densities override image or water values where they exist **WATER** entire volume treated as water equivalent
Dose Reporting Mode	**(gggg,nnn6)**	**3**	**Describes how energy deposition is done to a calculation voxel.** **Enumerated Value:** **DOSE_TO_WATER** **Calculation voxel is assumed to be water** **DOSE_TO_MEDIUM** **Calculation voxel is modelled using material properties, e.g., adipose tissue, muscle, cartilage, bone**

Attribute Name	Tag	Type	Attribute Description
Dose Calculation Model Sequence	**(gggg,nnn1)**	**3**	**Dose calculation models used to generate this Instance.** **One or more Items are permitted in this Sequence.**
>Include Table C.36.2.n.1-1 "RT Dose Calculation Model Macro Attributes"			
Derivation Code Sequence	(0008,9215)	3	A coded description of how this dose was derived from other RT Dose and/or RT Plan objects. One or more Items are permitted in this Sequence. More than one Item indicates that successive derivation steps have been applied.
>Include Table 8.8-1 "Code Sequence Macro Attributes"			*DCID 7220 "RT Dose Derivation".*
Referenced Instance Sequence	(0008,114A)	3	The set of SOP Instances used to derive this RT Dose SOP Instance. One or more Items are permitted in this Sequence.
>Include Table 10-11 "SOP Instance Reference Macro Attributes"			

Add to PS 3.3 section C.36.2 RT Second Generation Macros

C.36.2. RT Second Generation Macros

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C.36.2.n RT Second Generation Dose Macros

C.36.2.n.1 RT Dose Calculation Model Macro

The RT Dose Calculation Model Macro describes the algorithm and parameters used for calculating a dose distribution.

Table C.36.2.n.1-1. RT Dose Calculation Model Macro Attributes

Attribute Name	Tag	Type	Attribute Description
Dose Calculation Model Name	(gggg,nnn2)	3	Name of the dose calculation model.
Dose Calculation Algorithm Sequence	(gggg,nnn3)	3	Software Algorithm used to calculate the dose. Single item is permitted in this Sequence.
>Include Table 10-19 "Algorithm Identification Macro Attributes"			*DCID XXXX "RT Dose Calculation Algorithm Family" shall be used for Algorithm Family Code Sequence (0066,002F)*
Commissioning Status	(gggg,nnn4)	3	Specifies if the calculation model was commissioned when the dose data was produced. Enumerated Values: NOT_COMMISSIONED COMMISSIONED
Radiation Device Configuration and Commissioning Key Sequence	(300A,065A)	3	Keys identifying the configuration and commissioning data used as input for treatment planning of this Instance.

Attribute Name	Tag	Type	Attribute Description
			Value Type (0040,A040) is constrained to value UIDREF. One or more Items are permitted in this Sequence.
>Include Table 10-2 "Content Item Macro Attributes"			*No Baseline TID defined.*
Dose Calculation Model Parameter Sequence	(gggg,nnn5)	3	A set of parameters used by the dose calculation model when calculating the dose. One or more Items are permitted in this Sequence.
>Include Table 10.2.1-1. "Content Item with Modifiers Macro Attributes"			*Defined TID YYYY "RT Dose Calculation Model Parameters"*

Add to PS3.6, section 6

Tag	Name	Keyword	VR	VM	
(gggg,nnn1)	Dose Calculation Model Sequence	DoseCalculationModelSequence	SQ	1	
(gggg,nnn2)	Dose Calculation Model Name	DoseCalculationModelName	LO	1	
(gggg,nnn3)	Dose Calculation Algorithm Sequence	DoseCalculationAlgorithmSequence	SQ	1	
(gggg,nnn4)	Commissioning Status	CommissioningStatus	CS	1	
(gggg,nnn5)	Dose Calculation Model Parameter Sequence	DoseCalculationModelParameterSequence	SQ	1	
(gggg,nnn6)	Dose Reporting Mode	DoseReportingMode	CS		

Add to PS3.6 Annex A, Table A-3

Table A-3 CONTEXT GROUP UID VALUES

Context UID	Context Identifier	Context Group Name
1.2.840.10008.6.1.CCC1	XXXX	RT Dose Calculation Algorithm Family

Add to PS3.16, Annex B.1

CID XXXX RT Dose Calculation Algorithm Family

Resources: **HTML | FHIR JSON | FHIR XML | IHE SVS XML**
Keyword: **RTDoseCalculationAlgorithmFamily**
FHIR Keyword: **dicom-cid-XXXX- RTDoseCalculationAlgorithmFamily**
Type: **Extensible**
Version: **2024MMDD**
UID: **YYYYYYYYYYYYYYY**

Table CID XXXX RT Dose Calculation Algorithm Family

Coding Scheme Designator	Code Value	Code Meaning
DCM	vvv1	Monte Carlo
DCM	vvv2	Linear Boltzmann Transport Equation
DCM	vvv3	Pencil Beam Convolution
DCM	vvv6	Convolution Superposition
DCM	vvv4	TMR and OAR Ratios
DCM	vvv5	AAPM TG-43

Add to PS3.16, Annex C:

TID YYYY RT Dose Calculation Model Parameters

Type: **Extensible**
Order: **Non-Significant**
Root: **No**

Table TID YYYY. RT Dose Calculation Model Parameters

	NL	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		NUMERIC	EV (vvv7, DCM, "Number of Histories")	1	U		Units = EV (1, UCUM, "no units")
2		NUMERIC	EV (vvv8, DCM, "Uncertainty")	1	U		Units = EV (%, UCUM, "Percent")

Table D-1. DICOM Controlled Terminology Definitions (Coding Scheme Designator "DCM" Coding Scheme Version "01")

Code Value	Code Meaning	Definition	Notes
vvv1	**Monte Carlo**	**Absorbed dose distribution calculation using stochastic Monte Carlo methods.**	
vvv2	**Linear Boltzmann Transport Equation**	**Absorbed dose distribution calculation through solving the linear Boltzmann transport equation.**	
vvv3	**Pencil Beam Convolution**	**Absorbed dose distribution calculation using Pencil Beam Convolution methods**	
vvv4	**TMR and OAR Ratios**	**Absorbed dose distribution calculation using Tissue Maximum Ratios (TMR) and Off-Axis Ratios (OAR)**	
vvv5	**AAPM TG-43**	**Absorbed dose distribution calculation using AAPM TG-43 protocol.**	
vvv6	**Convolution Superposition**	**Absorbed dose distribution calculation using Convolution Superposition methods**	
vvv7	**Number of Histories**	**The number of Monte Carlo simulations of radiation absorption that are run to predict the dose pattern in the patient or phantom.**	
vvv8	**Uncertainty**	**The specified uncertainty in Monte Carlo dose result that is acceptable to the user. The lower the uncertainty required, the more histories have to be employed.**	