DICOM Correction Proposal

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Correction Number CP-2203
Log Summary: Add References between 1st and 2nd Gen Rad IODs
Name of Standard PS3.3, PS3.6
Rationale for Correction: With the introduction of RT 2nd Generation IODs, 2nd Generation RT SOP Instances may have been transcoded from RT 1st Generation SOP Instances or vice versa. In such cases it may be indicated to reference the source of transcoding in the target Instance. To support this tracking the CP adds the following references: From 2nd Generation objects to 1st Generation objects / Items: - RT Radiation Set IOD to RT Plan or RT Ion Plan - RT Radiation IOD to Beam Sequence Item in RT Plan IOD or Ion Beam Sequence Item in RT Ion Plan IOD - RT Radiation Record IOD to Treatment Session Beam Sequence Item in RT Beams Treatment Record IOD or Treatment Session Ion Beam Sequence Item in RT Ion Beams Treatment Record IOD. From 1st Generation objects / Items to 2nd Generation objects: - RT Plan or RT Ion Plan to RT Radiation Set IOD - Beam Sequence Item in RT Plan IOD or Ion Beam Sequence Item RT Ion Plan IOD to RT Radiation IOD - Treatment Session Beam Sequence Item in RT Beams Treatment Record IOD or Treatment Session Ion Beam Sequence Item in RT Ion Beams Treatment Record IOD to RT Radiation Record IOD
Correction Wording:

In PS3.3, Appendix C, Section C.36, extend the following Macro:

C.36.2 RT Second Generation Macros

C.36.2.1 RT Second Generation General Purpose Macros

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C.36.2.1.6 RT Radiation Common Base Macro

The Radiation Fraction Pattern Macro specifies the intended fraction pattern to be used to deliver the radiation treatment.

Table C.36.2.1.6-1. RT Radiation Common Base Macro Attributes

Attribute Name	Tag	Type	Attribute Description
RT Radiation Physical and Geometric Content Detail Flag	(300A,0638)	1	The level of detail of content within this SOP Instance. Enumerated Values: **FULL** The physical and geometric parameters of all devices are fully defined and dosimetric information is present. This level of detail is typically present after volumetric planning. **IDENT_ONLY** The physical and geometric parameters of all devices may not be fully specified, but the devices can be identified. This level of detail is typically present after non-volumetric planning (e.g., 2D planning) or in records of delivered treatments. **GEOMETRY_ONLY** The geometric parameters of all devices are fully specified, but no dosimetric information is present. This level of detail is typically present after Virtual Simulation.
RT Record Flag	(300A,0639)	1	Whether or not device parameters about actual delivery of treatment to a patient have been recorded. Enumerated Values: **YES** Values in this Instance are a record of a delivered treatment, based on e.g., read-outs or measurements. **NO** Values in this Instance are a specification of a treatment to be delivered, e.g., by a treatment planning system.
RT Treatment Technique Code Sequence	(3010,0080)	1C	Type of treatment technique. Only a single Item shall be included in this Sequence. Required if the SOP Class of the SOP Instance including this Module is not RT Radiation Salvage Record Storage ("1.2.840.10008.5.1.4.1.1.481.17"). May be present otherwise. See Section C.36.2.1.6.1.1.
>Include Table 8.8-1 "Code Sequence Macro Attributes".			*CID is specified at invocation.*
Include Table C.36.2.2.4-1 "RT Treatment Position Macro Attributes".			*See Section C.36.2.1.6.1.2.*
RT Tolerance Set Sequence	(300A,0629)	3	A set of tolerance values to be applied to parameters used for delivery of the RT Radiation. Only a single Item is permitted in this Sequence.
>Include Table C.36.2.2.17-1 "RT Tolerance Set Macro Attributes".			
Treatment Machine Special Mode Code Sequence	(300A,0635)	1C	A mode of operation on the treatment machine. Required if a special delivery mode is used for treatment and the SOP Class of the SOP Instance including this Module is not RT Radiation Salvage Record Storage ("1.2.840.10008.5.1.4.1.1.481.17"). May be present otherwise.

Attribute Name	Tag	Type	Attribute Description
			Only a single Item shall be included in this Sequence. See Section C.36.2.1.6.1.3.
>Include Table 8.8-1 "Code Sequence Macro Attributes".			*CID is specified at invocation.*
Definition Source Sequence	**(0008,1156)**	**3**	**Instances containing the source of the RT Radiation or RT Radiation Record information.** **Only a single Item shall be included in this Sequence.** **Permitted SOP Classes are defined in Section C.36.2.1.6.1.n1.** **See Section C.8.8.13.n.**
>Include Table 10-11 "SOP Instance Reference Macro Attributes".			
>Referenced Number	**(gggg,xxx1)**	**1**	**Number identifying the Item in the SOP Instance referenced.** **See Section C.36.2.1.6.1.n1**
…			

C.36.2.1.6.1 RT Radiation Common Attribute Descriptions

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C.36.2.1.6.1.n1 Referenced Number

The SOP Classes permitted in the Definition Source Sequence (0008,1156) are listed in the following table. For each SOP Class the Referenced Number (gggg,xxx1) references an Item of a specific Sequence containing the Items identified by a Number in a specific Attribute as defined in the following table.

Table C.36.2.1.6-2. SOP Classes and Referenced Number

RT Record Flag (300A,0639)	Permitted SOP Class	Sequence Attribute containing the referenced Item	Attribute containing the Number referenced by Referenced Number (gggg,xxx1)
NO	RT Plan Storage ("1.2.840.10008.5.1.4.1.1.481.5")	Beam Sequence (300A,00B0) See Note	Beam Number (300A,00C0)
YES	RT Beams Treatment Record Storage ("1.2.840.10008.5.1.4.1.1.481.4")	Treatment Session Beam Sequence (3008,0020)	Referenced Beam Number (300C,0006)

In PS3.3, Appendix C, extend Module C.8.8.13 RT Fraction Scheme Module:

C.8.8.13 RT Fraction Scheme Module

The RT Fraction Scheme Module contains Attributes that describe a single or multiple scheme of dose descriptions. Each Sequence Item contains dose specification information, fractionation patterns, and either beam or brachytherapy application setup specifications. The design of the RT Fraction Scheme Module allows a beam or brachytherapy application setup to be used in multiple fraction schemes.

Table C.8-49. RT Fraction Scheme Module Attributes

Attribute Name	Tag	Type	Attribute Description
Fraction Group Sequence	(300A,0070)	1	Sequence of Fraction Groups in current Fraction Scheme. One or more Items shall be included in this Sequence.
>Fraction Group Number	(300A,0071)	1	Identification number of the Fraction Group. The value of Fraction Group Number (300A,0071) shall be unique within the RT Plan in which it is created.
>Fraction Group Description	(300A,0072)	3	The user defined description for the fraction group.
>Definition Source Sequence	**(0008,1156)**	**3**	**Instances containing the source of the Fraction Group information.** **Only a single Item shall be included in this Sequence.** **Permitted SOP Class is RT Radiation Set ("1.2.840.10008.5.1.4.1.1.481.12").** **See Section C.8.8.13.n.**
>>Include Table 10-11 "SOP Instance Reference Macro"			
>Referenced Dose Sequence	(300C,0080)	3	Related instances of RT Dose (for grids, isodose curves and named/unnamed point doses). One or more Items are permitted in this Sequence. See Note 1.
>>Include Table 10-11 "SOP Instance Reference Macro Attributes"			
>Referenced Dose Reference Sequence	(300C,0050)	3	Sequence of Dose References for the current Fraction Group. One or more Items are permitted in this Sequence.
…			

C.8.8.13.n Definition Source Sequence

The Definition Source Sequence (0008,1156) references SOP Instances of First or Second Generation Radiotherapy IODs as the source of the information which have been transcoded to the current SOP Instance up to the capability of the current SOP Class. The Definition Source Sequence shall not be used when the current SOP Instance represents a derivation or successor of the source Instance. The source Instance shall not contain a reference to the current Instance.

Typical use cases are: A device (e.g. a treatment planning system or treatment delivery system) is creating Second Generation SOP Instances and additionally encoding it in First Generation SOP Instances for other receivers supporting First Generation RT IODs only. Another use case is that an application receives Second Generation SOP Instances and transcode them to First Generation SOP Instances to make the content available to receivers supporting First Generation IODs only.

The same applies for the reverse use cases when the source Instance is a First Generation SOP Instance and the current SOP Instance is a transcoded Second Generation SOP Instance.

In PS3.3, Appendix C, extend Module C.8.8.14 RT Beams Module:

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.
>Beam Name	(300A,00C2)	3	User-defined name for Beam. See Note 1.
>Beam Description	(300A,00C3)	3	User-defined description for Beam. See Note 1.
>Definition Source Sequence	**(0008,1156)**	**3**	**Instances containing the source of the Beam information.** **Only a single Item shall be included in this Sequence.** **See Sections C.8.8.14.n and C.8.8.13.n.**
>>Include Table 10-11 "SOP Instance Reference Macro"			
>Beam Type	(300A,00C4)	1	Motion characteristic of Beam. See Note 5. Enumerated Values: **STATIC** All Control Point Sequence (300A,0111) Attributes remain unchanged between consecutive pairs of control points with changing Cumulative Meterset Weight (300A,0134). **DYNAMIC** One or more Control Point Sequence (300A,0111) Attributes change between one or more consecutive pairs of control points with changing Cumulative Meterset Weight (300A,0134).
…			

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C.8.8.14.n Definition Source Sequence

The Definition Source Sequence (0008,1156) may reference SOP Instances of Second Generation Radiotherapy IODs containing the same clinical content as the current Item.

Permitted SOP Classes in this Sequence shall contain the following Modules:

- **Section C.36.3 Enhanced RT Series Module.**
- **Section C.36.4 Radiotherapy Common Instance Module.**
- **Section C.36.12 RT Delivery Device Common Module.**
- **Section C.36.13 RT Radiation Common Module.**

In PS3.3, Appendix C, extend Module C.8.8.21 RT Beams Session Record Module:

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.
Primary Dosimeter Unit	(300A,00B3)	1	Measurement unit of machine dosimeter. Enumerated Values: **MU** Monitor Unit **MINUTE** minute
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 Name	(300A,00C2)	3	User-defined name for delivered Beam.
>Beam Description	(300A,00C3)	3	User-defined description for delivered Beam.
>Definition Source Sequence	**(0008,1156)**	**3**	**Instances containing the source of the Beam information.** **Only a single Item shall be included in this Sequence.** **See Sections C.8.8.21.n and C.8.8.13.n.**
>>Include Table 10-11 "SOP Instance Reference Macro"			
>Beam Type	(300A,00C4)	1	Motion characteristic of delivered Beam. Enumerated Values: **STATIC** All Control Point Sequence (300A,0111) Attributes remain unchanged between consecutive pairs of control points with changing Cumulative Meterset Weight (300A,0134). **DYNAMIC** One or more Control Point Sequence (300A,0111) Attributes change between one or more consecutive pairs of control points with changing Cumulative Meterset Weight (300A,0134).
…			

C.8.8.21.n Definition Source Sequence

The Definition Source Sequence (0008,1156) may reference SOP Instances of Second Generation Radiotherapy IODs containing the same clinical content as the current Item.

Permitted SOP Classes in this Sequence shall contain the following Modules:

- **Section C.36.3 Enhanced RT Series Module.**
- **Section C.36.4 Radiotherapy Common Instance Module.**
- **Section C.36.12 RT Delivery Device Common Module.**
- **Section C.36.22 RT Radiation Record Common Module.**

In PS3.3, Appendix C, extend Module C.36.10 RT Radiation Set Module:

C.36.10 RT Radiation Set Module

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

A Treatment Phase is achieved by delivering one or more RT Radiation Sets. The chronological relationships between RT Radiation Sets (the actual start of each set, the order or timing among sets, etc.) are recorded in Attributes outside the RT Radiation Set Module.

Table C.36.10-1. RT Radiation Set Module Attributes

Attribute Name	Tag	Type	Attribute Description
Include Table 10.9.1-1 "Enhanced Content Identification Macro Attributes".			
Intended Number of Fractions	(300A,0636)	1C	Number of Fractions for which this RT Radiation Set is intended to be repeated. Required if Referenced RT Physician Intent Sequence (300A,063B) is empty. May be present otherwise. See Section C.36.10.1.4.
Include Table C.36.2.1.1-1 "Radiation Fraction Pattern Macro Attributes".			*See Section C.36.10.1.4.*
Referenced RT Physician Intent Sequence	(300A,063B)	2	RT Physician Intent Instance this Radiation Set is based upon. Zero or more Items shall be included in this Sequence.
>Include Table 10-11 "SOP Instance Reference Macro Attributes".			
>Referenced RT Prescription Sequence	(300A,068A)	1	Sequence of RT Prescription Prescription Indices. One or more Items shall be included in this Sequence.
>>Referenced RT Prescription Index	(3010,0041)	1	Value of RT Prescription Index (3010,003C) in the RT Prescription Sequence (3010,006B) specifying the prescription to which this RT Radiation Set is related.
RT Radiation Set Intent	(300A,0637)	1	A general indication of the type of information contained within this RT Radiation Set. See Section C.36.10.1.1.
Treatment Position Group Sequence	(300A,060A)	2	Treatment Position Groups defined for the included Radiation Instances. Zero or more Items shall be included in this Sequence. See Section C.36.10.1.3.
>Treatment Position Group UID	(300A,0609)	1	Unique identifier of the Treatment Position Group.

Attribute Name	Tag	Type	Attribute Description
>Treatment Position Group Label	(300A,0608)	1	User-defined label of the Treatment Position Group.
>Referenced RT Radiation Sequence	(300A,0630)	1	RT Radiation Instances that belong to the Treatment Position Group. Each referenced Radiation Instance shall appear once and only once in the Treatment Position Group Sequence (300A,060A). One or more Items shall be included in this Sequence.
>>Include Table 10-11 "SOP Instance Reference Macro Attributes".			
RT Radiation Sequence	(300A,0616)	1	RT Radiation Instances which are referenced by this RT Radiation Set. One or more Items shall be included in this Sequence. See Section C.36.10.1.2.
>Include Table 10-11 "SOP Instance Reference Macro Attributes".			
Definition Source Sequence	**(0008,1156)**	**3**	**Instances containing the source of the RT Radiation Set information.** **Only a single Item shall be included in this Sequence.** **Permitted SOP Classes are:** **- RT Plan Storage ("1.2.840.10008.5.1.4.1.1.481.5")** **See Section C.8.8.13.n.**
>Include Table 10-11 "SOP Instance Reference Macro Attributes".			

Add to PS 3.6, Section 6, add the following Attribute:

(gggg,xxx1)	**Referenced Number**	**ReferencedNumber**	**IS**	**1**