

## DICOM Correction Proposal

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Person Assigned	Christof Schadt
Submitter Name	Ulrich Busch ( <a href="mailto:ulrich.busch@bluewin.ch">ulrich.busch@bluewin.ch</a> )
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Correction Number	CP-2203
Log Summary:	Add References between 1st and 2nd Gen Rad IODs
Name of Standard	PS3.3 2022e

Rationale for Correction:

With the introduction of RT 2<sup>nd</sup> Generation IODs, 2<sup>nd</sup> Generation RT SOP Instances may have been transcoded from RT 1<sup>st</sup> Generation SOP Instances or vice versa. In such cases it may be indicated to reference the source of transcoding in the target Instance.

<b>Concept</b>	<b>Reference From 1<sup>st</sup> Generation Object</b>	<b>To 2<sup>nd</sup> Generation Object</b>
Plan	RT Plan IOD RT Fraction Scheme Module	RT Radiation Set IOD
Beam	RT Plan IOD RT Beams Module Beam Sequence Item	RT Radiation IOD
Record	RT Beams Treatment Record IOD RT Beams Session Record Module Treatment Session Beam Sequence Item	RT Radiation Record IOD

In each 1<sup>st</sup> Generation encoding structure in the table above, attributes are added to reference the corresponding 2<sup>nd</sup> Generation encoding structure when the information has been transcoded from that source.

<b>Concept</b>	<b>Reference From 2<sup>nd</sup> Generation Object</b>	<b>To 1<sup>st</sup> Generation Object</b>
Plan	RT Radiation Set IOD RT Radiation Set Module	RT Plan IOD
Beam	RT Radiation IOD RT Radiation Common Module RT Radiation Common Base Macro	RT Plan IOD RT Beams Module Beam Sequence Item
Record	RT Radiation Record IOD RT Radiation Record Common Module RT Radiation Common Base Macro	RT Beams Treatment Record IOD RT Beams Session Record Module Treatment Session Beam Sequence Item

In each 2<sup>nd</sup> Generation encoding structure in the above table, attributes are added to reference the corresponding 1<sup>st</sup> Generation encoding structure when the information has been transcoded from that source.

IODs for Ion Plans and Treatments are not addressed.

This CP captures the relations between 1<sup>st</sup> and 2<sup>nd</sup> Generation objects. The details of performing such transcodings are not directly described in the Standard.

Note on future extension: The Referenced Beam Number (300C,0006) in the Definition Source Sequence (0008,1156) is unconditionally required. But if this Macro evolves to include additional use cases with different referenced attributes, such as for references to Brachytherapy Application Setup Number, attribute supporting such number will be added as conditional and mutually exclusive with Referenced Beam Number (300C,0006).

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**

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

**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	<p>The level of detail of content within this SOP Instance.</p> <p>Enumerated Values:</p> <p><b>FULL</b> 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.</p> <p><b>IDENT_ONLY</b> 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.</p> <p><b>GEOMETRY_ONLY</b> 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.</p>
RT Record Flag	(300A,0639)	1	<p>Whether or not device parameters about actual delivery of treatment to a patient have been recorded.</p> <p>Enumerated Values:</p> <p><b>YES</b> Values in this Instance are a record of a delivered treatment, based on e.g., read-outs or measurements.</p> <p><b>NO</b> Values in this Instance are a specification of a treatment to be delivered, e.g., by a treatment planning system.</p>
RT Treatment Technique Code Sequence	(3010,0080)	1C	<p>Type of treatment technique.</p> <p>Only a single Item shall be included in this Sequence.</p> <p>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.</p> <p>See Section C.36.2.1.6.1.1.</p>
<i>&gt;Include Table 8.8-1 "Code Sequence Macro Attributes".</i>			<i>CID is specified at invocation.</i>
<i>Include Table C.36.2.2.4-1 "RT Treatment Position Macro Attributes".</i>			<i>See Section C.36.2.1.6.1.2.</i>
RT Tolerance Set Sequence	(300A,0629)	3	<p>A set of tolerance values to be applied to parameters used for delivery of the RT Radiation.</p> <p>Only a single Item is permitted in this Sequence.</p>

Attribute Name	Tag	Type	Attribute Description
<i>&gt;Include Table C.36.2.2.17-1 "RT Tolerance Set Macro Attributes".</i>			
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.  Only a single Item shall be included in this Sequence. See Section C.36.2.1.6.1.3.
<i>&gt;Include Table 8.8-1 "Code Sequence Macro Attributes". CID is specified at invocation.</i>			
<b>Definition Source Sequence</b>	<b>(0008,1156)</b>	<b>3</b>	<b><u>Instances containing the source of the RT Radiation or RT Radiation Record information.</u></b>  <b><u>Only a single Item is permitted in this Sequence.</u></b>  <b><u>Permitted Referenced SOP Classes are defined in Section C.36.2.1.6.1.4.</u></b>  <b><u>See Section C.8.8.13.2.</u></b>
<i>&gt;Include Table 10-11 "SOP Instance Reference Macro Attributes".</i>			
<b><u>&gt;Referenced Beam Number</u></b>	<b>(300C,0006)</b>	<b>1</b>	<b><u>A number identifying the beam contained within a SOP Class specific Attribute of an Item in a SOP Class specific Sequence within the referenced SOP Instance.</u></b>  <b><u>See Section C.36.2.1.6.1.4.</u></b>

### C.36.2.1.6.1 RT Radiation Common Base Macro Attribute Descriptions

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#### C.36.2.1.6.1.4 Referenced Attribute Number

The referenced SOP Classes permitted in the Definition Source Sequence (0008,1156) are listed in Table C.36.2.1.6-2..

For each referenced SOP Class, the Referenced Beam Number (300C,0006) in the Definition Source Sequence (0008,1156) identifies an Item in a specific Sequence in the referenced Instance by specifying a number that matches the value of an Attribute contained in that Sequence as defined in Table C.36.2.1.6-2.

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

<b><u>RT Record Flag (300A,0639)</u></b>	<b><u>Referenced SOP Class</u></b>	<b><u>Sequence Attribute containing the referenced Item</u></b>	<b><u>Attribute containing the value matching Referenced Beam Number (300C,0006) in Definition Source Sequence (0008,1156)</u></b>
<b><u>NO</u></b>	<b><u>RT Plan Storage ("1.2.840.10008.5.1.4.1.1.481.5")</u></b>	<b><u>Beam Sequence (300A,00B0)</u></b>	<b><u>Beam Number (300A,00C0)</u></b>

<b>YES</b>	<b>RT Beams Treatment Record Storage</b> ("1.2.840.10008.5.1.4.1.1.481.4")	<b>Treatment Session Beam Sequence</b> (3008,0020)	<b>Referenced Beam Number (300C,0006)</b>
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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**

<b>Attribute Name</b>	<b>Tag</b>	<b>Type</b>	<b>Attribute Description</b>
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.
<b>&gt;Definition Source Sequence</b>	<b>(0008,1156)</b>	<b>3</b>	<b><u>Instances containing the source of the Fraction Group information.</u></b> <b><u>Only a single Item is permitted in this Sequence.</u></b> <b><u>Permitted Referenced SOP Class is RT Radiation Set ("1.2.840.10008.5.1.4.1.1.481.12").</u></b> <b><u>See Section C.8.8.13.2.</u></b>
<b><i>&gt;&gt;Include Table 10-11 "SOP Instance Reference Macro"</i></b>			
>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.
<b><i>&gt;&gt;Include Table 10-11 "SOP Instance Reference Macro Attributes"</i></b>			
>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.
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**C.8.8.13.2 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 has 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 them 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 transcodes 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**

<b>Attribute Name</b>	<b>Tag</b>	<b>Type</b>	<b>Attribute Description</b>
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.
<b>&gt;Definition Source Sequence</b>	<b>(0008,1156)</b>	<b>3</b>	<b><u>Instances containing the source of the Beam information.</u></b> <b><u>Only a single Item is permitted in this Sequence.</u></b> <b><u>See Section C.8.8.14.19 and Section C.8.8.13.2.</u></b>
<b>&gt;&gt;Include Table 10-11 “SOP Instance Reference Macro”</b>			
>Beam Type	(300A,00C4)	1	Motion characteristic of Beam. See Note 5. Enumerated Values: <b>STATIC</b> All Control Point Sequence (300A,0111) Attributes remain unchanged between consecutive pairs of control points with changing Cumulative Meterset Weight (300A,0134).

Attribute Name	Tag	Type	Attribute Description
			<b>DYNAMIC</b> 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.8.8.14.19 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 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: <b>MU</b> Monitor Unit <b>MINUTE</b> 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.

Attribute Name	Tag	Type	Attribute Description
>Definition Source Sequence	(0008,1156)	3	Instances containing the source of the Beam information. Only a single Item is permitted in this Sequence. See Sections C.8.8.21.3 and C.8.8.13.2.
>>Include Table 10-11 "SOP Instance Reference Macro"			
>Beam Type	(300A,00C4)	1	Motion characteristic of delivered Beam. Enumerated Values: <b>STATIC</b> All Control Point Sequence (300A,0111) Attributes remain unchanged between consecutive pairs of control points with changing Cumulative Meterset Weight (300A,0134). <b>DYNAMIC</b> 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.8.8.21.3 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 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".			



Attribute Name	Tag	Type	Attribute Description
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.
<i>Include Table C.36.2.1.1-1 "Radiation Fraction Pattern Macro Attributes".</i>			<i>See Section C.36.10.1.4.</i>
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.
<i>&gt;Include Table 10-11 "SOP Instance Reference Macro Attributes".</i>			
>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.
>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.
<i>&gt;&gt;Include Table 10-11 "SOP Instance Reference Macro Attributes".</i>			

Attribute Name	Tag	Type	Attribute Description
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.
<i>&gt;Include Table 10-11 "SOP Instance Reference Macro Attributes".</i>			
<b><u>Definition Source Sequence</u></b>	<b><u>(0008,1156)</u></b>	<b><u>3</u></b>	<b><u>Instances containing the source of the RT Radiation Set information.</u></b> <b><u>Only a single Item is permitted in this Sequence.</u></b> <b><u>Permitted Referenced SOP Class is RT Plan Storage ("1.2.840.10008.5.1.4.1.1.481.5").</u></b> <b><u>See Section C.8.8.13.2.</u></b>
<b><u>&gt;Include Table 10-11 "SOP Instance Reference Macro Attributes".</u></b>			