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4   **Digital Imaging and Communications in Medicine (DICOM)**

5

6   *Supplement 147: Second Generation Radiotherapy*

7   *- Prescription and Segment Annotation*

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272   **Foreword**

273   This Supplement specifies the additional IODs representing prescription and segment annotation information as a
274   base model to support the new Radiotherapy (RT) Second Generation IODs and operations.

275   This document is an extension to the following parts of the published DICOM Standard:

276   PS 3.2   Conformance
277   PS 3.3   Information Object Definitions
278   PS 3.4   Service Class Specifications
279   PS 3.6   Data Dictionary
280   PS 3.16   Content Mapping Resource
281

282   **Scope and Field of Application**

283   **INTRODUCTION**

284   Existing radiotherapy IODs were designed to provide a set of containers for use in communicating radiotherapy data
285   of all types, in a generic and flexible way.

286   Since the development of the initial IODs, both radiotherapy practice and the DICOM Standard itself have evolved
287   considerably. This supplement addresses the need for a new generation of IODs and processes required for use in
288   radiotherapy. The general principles under which these IODs and processes have been developed are documented
289   below.

290   The IODs defined in here represent a base for further definition of radiotherapy-specific IODs that will be part of
291   future Supplements that are already defined. At the time of this publication further supplements of the RT Second
292   Generation objects include Supplement 175 "Second Generation Radiotherapy – C-Arm RT Treatment Modalities",
293   Supplement 176 "Second Generation Radiotherapy – Additional RT Treatment Modalities", Supplement 177
294   "Second Generation Radiotherapy – RT Dose Objects" and Supplement 178 "Second Generation Radiotherapy –
295   RT Course".

296   In order to provide an overview of the RT Second Generation concepts the general approach is described in this
297   document going beyond the scope of the IODs defined in here.

298   **GENERAL ARCHITECTURAL PRINCIPLES**

299   The DICOM "Strategic Document Version 10.4, October 25, 2010" outlines a number of principles applicable across
300   the entire DICOM standard. The key relevant points, and how this supplement addresses those concerns, are as
301   follows:

302   • Different representations of data are encoded in different IODs. This is in contrast to first-generation objects,
303   where multiple different types of data are encoded in a single IOD, such as RT Structure Set.

304   • Where applicable the development follows the "enhanced multi-frame" paradigm, rather than stacks of 2D
305   SOP Instances. E.g. the new RT Dose Image included in Supplement 177 uses the multi-frame approach.

306   These new IODs do not define an architecture for the entire system, or functional requirements beyond behavior
307   required for specific services. This is because the mode of manual exchange of objects (see PS3.17) supports an
308   arbitrary system architecture. The worklist mode of operation does place some constraints on the architecture – for
309   example, it implies the existence of one or more workflow servers that have knowledge of department-wide
310   scheduling. The Radiation Oncology domain of the IHE initiative may adapt workflows that will utilize RT Second
311   Generation objects and define their usage in a clinical workflow, as it was done with Supplement 74 and the IHE-RO
312   Technical Profile "Treatment and Delivery Workflow".

RT ARCHITECTURAL PRINCIPLES

In addition to the general principles outlined above, additional principles specific to radiotherapy have been used in the development of this supplement:

- Support for available technologies: The new IODs are designed to support legacy and full-featured, modern equipment.

- Compatibility with First-Generation IODs: In general, where the technologies continue to be supported, it will be possible for the content of first-generation IODs to be re-encoded into the RT Second Generation IODs described in the supplement. However, such a translation will not be a basic re-encoding and will require additional information supplied by the translating device.

- New data representation approaches in DICOM: Where possible, use has been made of new and powerful approaches, such as 3D segmentation, mesh representation, rigid and deformable registrations.

- IODs specific to use cases: Explicit separate IODs have been developed for specific treatment modalities with the concept of RT Radiation IOD – for example, Tomotherapeutic, C-Arm, and Robotic beams are modeled separately. This allows more stringent conditions to be applied to the presence or absence of Attributes within those IODs, and thereby increases the potential for interoperability.

- Expandability of concept: New treatment modalities currently not considered by this standard can be modeled along the existing RT Radiation IODs and be introduced later on, fitting into the existing concept.

- New techniques in oncology: The existence of new treatment techniques (such as robotic therapy and tomotherapy) have been taken into account, along with new treatment strategies (such as image-guided therapy and adaptive therapy).

335   **Part 2 Addendum**

336 | **Add new SOP Classes to PS3.2 Table A.1-2 UID Values:** |

337

UID Value	UID Name	Category
1.2.840.10008.5.1.4.1.1.X.1.1	RT Physician Intent Storage	Transfer
1.2.840.10008.5.1.4.1.1.X.1.2	RT Segment Annotation Storage	Transfer

338

339   **Part 3 Addendum**

340 | **Add the following in PS3.3 Chapter 7 DICOM model of the real-world** |

341 **7.12   EXTENSION OF THE DICOM MODEL OF THE REAL-WORLD FOR RADIOTHERAPY SECOND**
342 **GENERATION INFORMATION OBJECTS**

343 For the purpose of RT Second Generation SOP Classes the DICOM Model of the Real-World is described in this
344 section. This subset of the real-world model covers the requirements for transferring information about planned and
345 performed radiotherapeutic treatments and associated data.

346 Figure 7.12-1 describes the most important elements involved in the radiotherapy domain in DICOM.

347
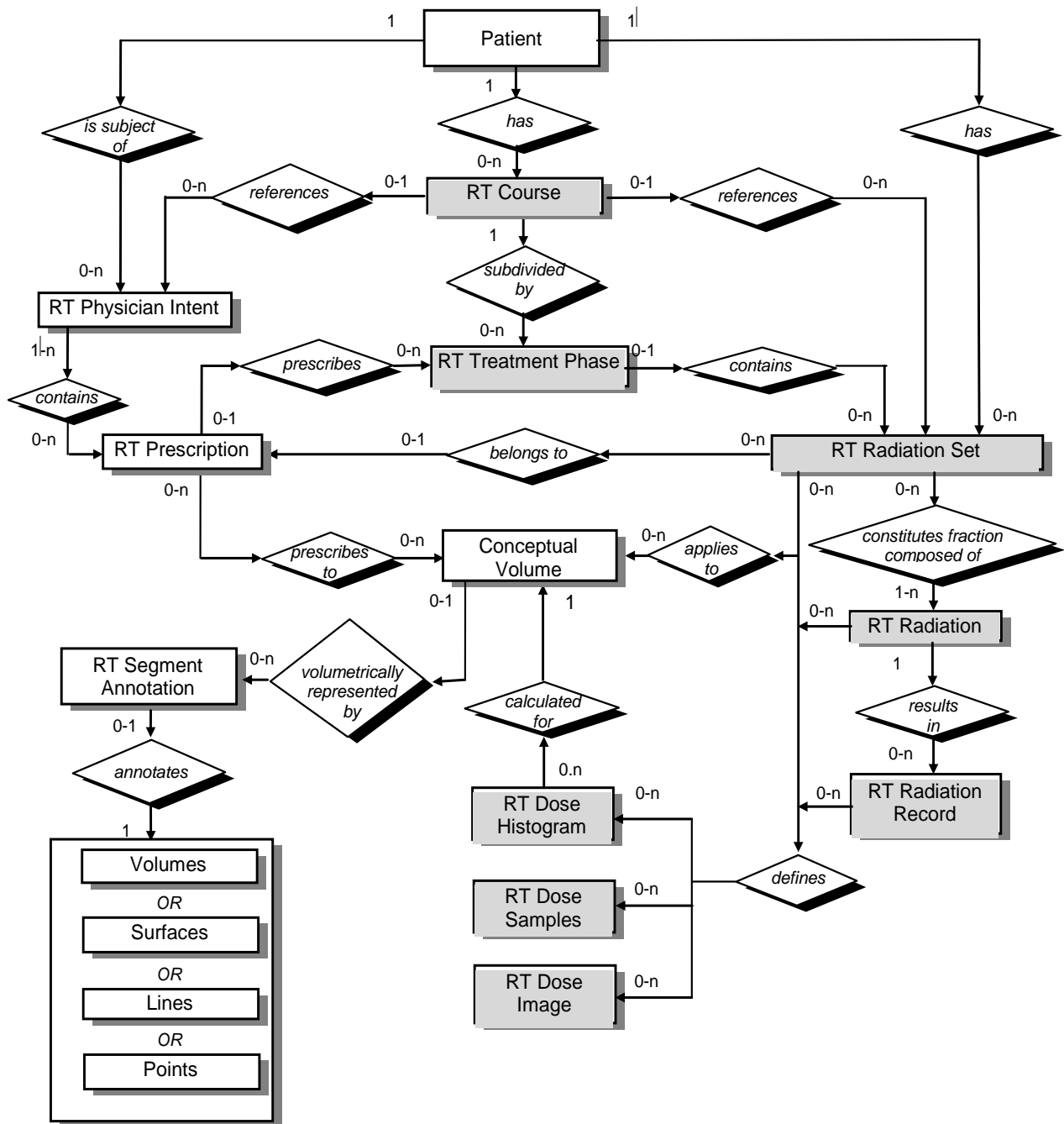
348

349   Note 1: IODs which contain a representation of Volumes, Surfaces, Lines, Points can be annotated by an RT Segment
350   Annotation.
351   Note 2: For better readability the diagram only contains the most important relationships, e.g. all objects have a relation to
352   the Patient, but not all of these relationships are part of this diagram.

353   **Figure 7.12-1. DICOM MODEL OF THE REAL WORLD – RADIOTHERAPY**

354   **7.12.1   RT Course**

355   The RT Course is a top-level entity that represents a radiotherapy treatment course, usually specified in one or
356   more RT Prescriptions, generally for a defined tumor or group of tumors. A patient undergoing treatments of
357   radiotherapy has one treatment course at a time. The RT Course may consist of several RT Treatment Phases
358   (possibly with breaks of treatment in between them). Each treatment phase may consist of one or more RT

359 Treatment Sessions. An RT Treatment Session is delivered in one patient visit to a venue with a treatment machine
360 and will typically deliver a fraction of one or more RT Radiation Sets. A new RT Course is administered, when the
361 patient is treated for a re-occurrence or a new tumor site – typically after a period of a year or more after the
362 previous RT Course has been finished.

363 The RT Course can be thought of as a container collecting all major objects which are relevant to this course. The
364 RT Physician Intent and RT Radiation Sets reference other companion objects necessary to prepare, conduct and
365 review the treatment. Timing information (start dates and phasing of treatment, breaks etc.) are also part of the RT
366 Course information. Additionally it contains information of the ongoing status in treatment planning and delivery. The
367 RT Course is a dynamic object that represents the current status of the patient's treatment.

368 The RT Course may also include information about previously conducted treatments by referencing previous RT
369 Course objects or by directly recording the information in Attributes.

370 **7.12.2   RT Physician Intent**

371 The RT Physician Intent describes how the physician wishes to achieve curative or palliative therapy. This
372 information includes, but is not limited to the use of external radiation therapy or brachytherapy, total and fractional
373 doses and fractionation schemes, treatment sites, Dosimetric Objectives, envisioned treatment technique, beam
374 energy or isotopes, and patient setup notes.

375 **7.12.3   Conceptual Volume**

376 The Conceptual Volume is a reference to a certain anatomical region or point. Conceptual Volumes may or may not
377 have a representation in segmented images. In most cases they will be related to one or more volumetric
378 representations in various image sets taken at different times.

379 For example, during a radiotherapy course at the time of prescription, physicians specify regions to which dose is
380 prescribed. Subsequently these regions are referenced in other objects in order to track calculated and delivered
381 dose in the course of treatment. This referencing capability is provided by the Conceptual Volume.

382 **7.12.4   RT Segment Annotation**

383 The RT Segment Annotation annotates segmented regions defined in other SOP Instances with radiotherapy-
384 specific information about the role and RT-specific types of the regions (e.g. clinical target volume, organ at risk,
385 bolus), and other information such as density definitions. An RT Segment Annotation SOP instance may reference
386 any geometric general-purpose representation entity defined by DICOM.

387 **7.12.5   RT Radiation Set**

388 An RT Radiation Set is a collection of RT Radiations. An RT Radiation Set defines a Radiotherapy treatment
389 fraction, which will be applied one or more times. The RT Radiation Set is delivered by delivering the radiation of all
390 referenced RT Radiations.

391 Parallel and intermittent fractionation schemes, e.g. treatment of several target sites with different timing schemes,
392 are represented by multiple RT Radiation Sets.

393 **7.12.6   RT Radiation**

394 An RT Radiation is a contiguous set of Control Points, describing machine and positioning parameters to be applied
395 during treatment delivery. An RT Radiation describes one portion of an RT Radiation Set and represents an single-
396 fraction delivery of therapeutic radiation intended to be delivered in an indivisible manner. An RT Radiation is
397 typically referred to in end-user terminology as a beam (in external beam treatment) or a catheter (in
398 brachytherapy).

399 **7.12.7   RT Radiation Record**

400 The RT Radiation Record records actual treatment parameters that have been applied during the delivery of an RT
401 Radiation in the context of a specific fraction. Typically, those parameters are the same as those described within
402 an RT Radiation, but may differ due to therapist decisions and/or circumstances of the delivery technology and/or
403 for various other reasons.

404

405 **7.12.8   RT Treatment Phase**

406 An RT Course may be divided into multiple RT Treatment Phases. Each RT Treatment Phase represents a period
407 of time during which a defined number of RT Treatment Fractions are delivered by RT Radiation Sets in order to

408   reach a specific treatment goal (see section 7.12.9 RT Fractionation, RT Fractionation Scheme and 7.12.10 RT
409   Treatment Session, RT Treatment Fraction).

410   An RT Treatment Phase also defines the chronological relationship between RT Radiation Sets that are
411   concurrently and/or subsequently treated.

7.12.9   RT Fractionation, RT Fractionation Scheme

413   Fractionation describes the splitting of a course of therapeutic radiation delivery into multiple sessions. Each
414   session may consist of the delivery of one or more RT Radiation Sets. The temporal pattern of session is called a
415   fractionation scheme.

416   Further descriptions and examples of this such schemes can seen in section 7.12.10 RT Treatment Session, RT
417   Treatment Fraction.

7.12.10   RT Treatment Session, RT Treatment Fraction

419   An RT Treatment Session is a collection of RT treatment events which are performed in a contiguous manner
420   without any break in-between (other than time needed for required preparations) during a single Visit. It denotes the
421   time period between the patient entering the treatment room and leaving the treatment room. In a treatment session
422   one or more RT Radiation Sets (RSet in diagram below) may be treated. An RT Treatment Session may also
423   include imaging. A group of radiation deliveries that are separated by an intentional delay to accommodate
424   radiobiological recovery effects are considered separate Treatment Sessions.

425   Each treatment of an RT Radiation Set is labeled as an RT Treatment Fraction (often abbreviated as Fx) with a
426   fraction number starting with 1 at the first RT Treatment Session in which the RT Radiation Set is delivered,
427   incremented by 1 at each subsequent treatment session.

428   An RT Treatment Fraction is the delivery of a portion of the total dose (whose delivery is defined by an RT Radiation
429   Set) which has been divided equally into smaller doses to be delivered over a period of time (e.g. daily for 4-6
430   weeks). In radiotherapy, this division of dose over a period of time is known as dose fractionation.

431

432
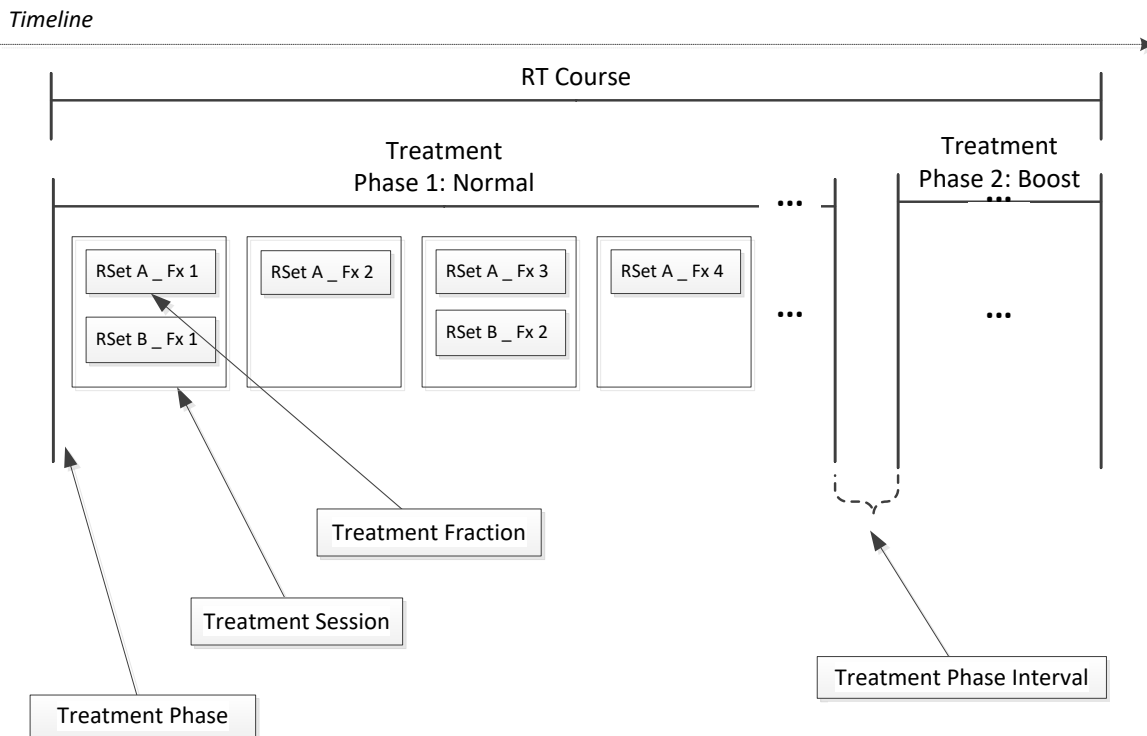
RSet = RT Radiation Set

433

434 **Figure 7.12-2. RT Treatment Phase, RT Treatment Session, RT Treatment Fraction**

435 Partial treatments annotate RT Treatment Fractions, that are not completely performed for any reason (e.g. patient
436 sickness, delivery device breakdown). The remainder of the RT Treatment Session is usually delivered at a later
437 time.This remaining portion has the same fraction number as the one of the Partial Treatment Session. Further
438 treatments will start a new RT Treatment Fraction with an incremented fraction number.

439 In Figure 7.12-3 below, the shaded areas of each Radiation Set represent the portion where dose is actually
440 delivered. Partially shaded Radation Sets therefore represents a partial treatment.

441
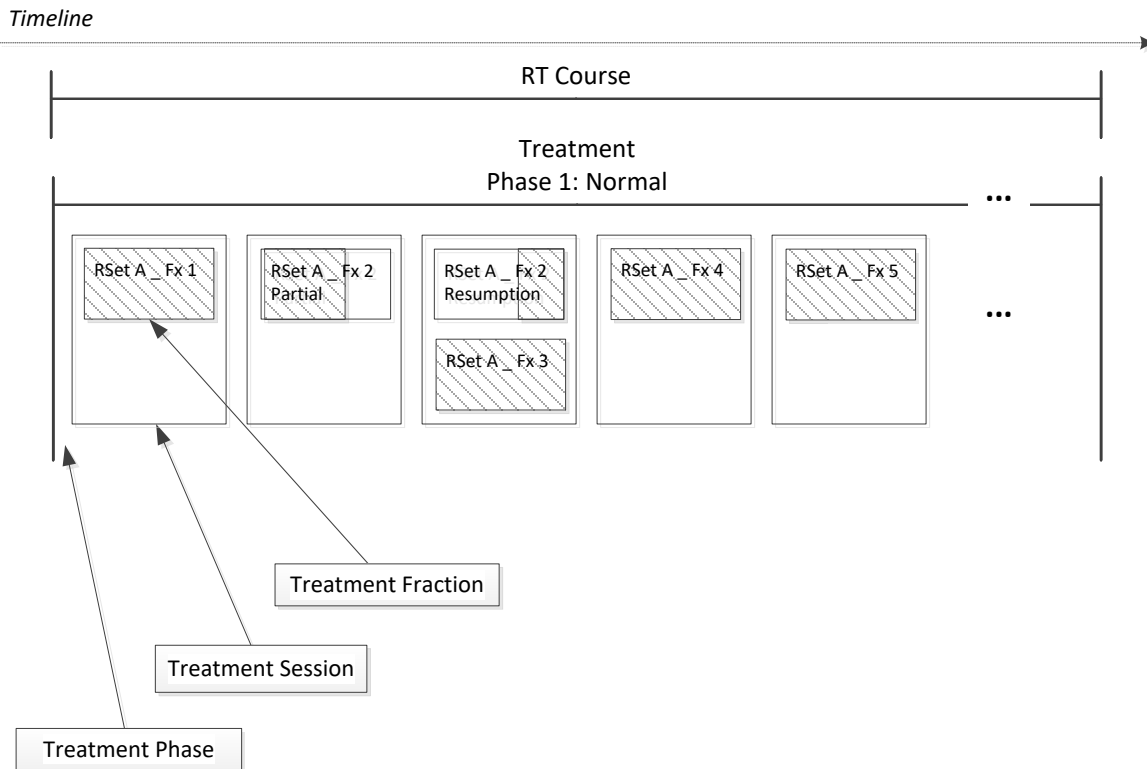
442
443

444 **Figure 7.12-3. Partial RT Treatment Fraction and Resumption**

445 **7.12.11   Dosimetric Objective**

446 The Dosimetric Objective Macro specifies an intended goal to be used in the definition of the dosimetric plan for
447 plan optimization etc. Dosimetric Objectives may define limits which affect the dose, such as dose volume
448 constraints, minimum or maximum dose, treatment time or MU limits, and radiobiologic effects.

449

450 **Add the following in PS3.3 Section 10.2 Content Item Macro**

451

452 **10.2 CONTENT ITEM MACRO**

453 A Content Item is a flexible means of encoding attribute identifiers and attribute values using the Code Sequence
454 Macro (see Section 8) for coded terminology defined by a coding scheme. The Content Item provides a name-value

455 pair, i.e., a Concept Name, encoded as a Code Sequence, and a Concept Value. The Concept Value may be
456 encoded by any of a set of generic Attributes, as specified by a Value Type, including text, personal name, numeric,
457 and coded concept (Code Sequence) values.

458 …

459   **Table 10-2. Content Item Macro Attributes Description**

460

Attribute Name	Tag	Type	Attribute Description
Value Type	(0040,A040)	1	The type of the value encoded in this name-value Item. Enumerated Values: DATE TIME DATETIME PNAME UIDREF TEXT CODE NUMERIC COMPOSITE IMAGE
…			

461

462 …

463

464 **10.2.1   CONTENT ITEM WITH MODIFIERS MACRO**

465 **Content Item with Modifiers is a means of describing structured content which needs a Content Item with**
466 **single optional level of modifiers, i.e. a two-level structure of Content Items. An invocation of the Content**
467 **Item with Modifiers Macro will usually specify the allowed values using a Protocol Context Template in**
468 **PS3.16, which allows a single Nesting Level (see Section 6.1.2 "Nesting Level (NL)" in PS3.16). Constraints**
469 **on the use of this Macro may be specified in PS3.16, Annex C, which may be invoked in IODs in PS3.3.**

470

471   **Table 10-2a Content Item with Modifiers Macro Attributes**

472

Attribute Name	Tag	Type	Attribute Description
Include Table 10-2 "Content Item Macro Attributes"			*No Baseline TID is defined.*
>Content Item Modifier Sequence	**(0040,0441)**	**3**	**Specifies modifiers for the Content Item.** **One or more Items are permitted in this Sequence.**
>Include Table 10-2 "Content Item Macro Attributes"			**No Baseline TID is defined.**

473

474 | **Add the following in PS3.3 Chapter 10 Miscellaneous Macros** |

475

10.A1   ENHANCED CONTENT IDENTIFICATION MACRO

The Enhanced Content Identification Macro identifies content using a label supporting lower case characters and specified character sets. If a Code String is required, see Content Identification Macro (Section 10.9).

Table 10.A1-1
Enhanced Content Identification Macro Attributes

Attribute Name	Tag	Type	Description
User Content Label	(gggg,51E0)	1	User-defined label for this SOP Instance. See 10.A1.1.1.
Content Description	(0070,0081)	2	User-defined description for the content of this SOP Instance. See 10.A1.1.1.
Content Creator's Name	(0070,0084)	2	Name of operator (such as a technologist or physician) creating the content of the SOP Instance.
Content Creator's Identification Code Sequence	(0070,0086)	3	Identification of the person who created the content. Only a single Item is permitted in this Sequence.
>*Include Table 10-1 "Person Identification Macro Attributes"*			

481

10.A1.1   Enhanced Content Identification Macro Attribute Descriptions

10.A1.1.1   User Content Label and Content Description

User Content Label (gggg,51E0) shall represent a user-defined short free text providing the primary identification of this entity to other users. Content Description (0070,0081) allows a longer string containing additional descriptive identifying text.

This information is intended for display to human readers. Shall not be used for structured processing.

10.A2   EXTENDED CONTENT IDENTIFICATION MACRO

The Extended Content Identification Macro identifies content using a label supporting lower case characters and specified character sets. If a Code String is required, see Content Identification Macro (Section 10.9).

Table 10.A2-1
Extended Content Identification Macro Attributes

Attribute Name	Tag	Type	Description
User Content Long Label	(gggg,51E1)	1	User-defined label for the content of this SOP Instance. See 10.A2.1.1.
Content Description	(0070,0081)	2	User-defined description for the content of this SOP Instance. See 10.A2.1.1.
Content Creator's Name	(0070,0084)	2	Name of operator (such as a technologist or physician) creating the content of the SOP Instance.
Content Creator's Identification Code Sequence	(0070,0086)	3	Identification of the person who created the content. Only a single Item is permitted in this Sequence.

Attribute Name	Tag	Type	Description
>*Include Table 10-1 "Person Identification Macro Attributes"*			

493

10.A2.1   Extended Content Identification Macro Attribute Descriptions

10.A2.1.1   User Content Long Label and Content Description

User Content Long Label (gggg,51E1) shall represent a user-defined free text providing the primary identification of this entity to other users. Content Description (0070,0081) allows a longer string containing additional descriptive identifying text.

This information is intended for display to human readers. Shall not be used for structured processing.

500

10.A3   ENTITY LABELING MACRO

The Entity Labeling Macro provides identification of an entity to a user.

This information is intended for display to human readers. Shall not be used for structured processing.

Table 10.A3-1
Entity Labeling Macro Attributes

Attribute Name	Tag	Type	Description
Entity Label	(gggg,51E2)	1	User-defined label for this entity. See 10.A3.1.1.
Entity Name	(gggg,51E3)	3	User-defined name for this entity. See 10.A3.1.2.
Entity Description	(gggg,51E4)	3	User-defined description for this entity. See 10.A3.1.2.

506

10.A3.1   Entity Labeling Macro Attribute Descriptions

10.A3.1.1   Entity Label

The Entity Label (gggg,51E2) Attribute represents a user-defined short free text providing the primary identification of this entity to other users.

10.A3.1.2   Entity Name and Entity Description

The optional Attribute Entity Name (gggg,51E3) allows a longer string containing additional descriptive identifying text. The optional Attribute Entity Description (gggg,51E4) provides additional information when needed.

10.A4   ENTITY LONG LABELING MACRO

The Entity Long Labeling Macro provides identification of an entity to a user.

This information is intended for display to human readers. Shall not be used for structured processing.

Table 10.A4-1
Entity Long Labeling Macro Attributes

Attribute Name	Tag	Type	Description
Entity Long Label	(gggg,51E5)	1	User-defined label for this entity. See 10.A3.2.1
Entity Description	(gggg,51E4)	3	User-defined description for this entity. See 10.A3.1.2.

519

10.A4.2   Entity Long Labeling Macro Attribute Descriptions

10.A4.2.1   Entity Long Label

The Entity Long Label (gggg,51E5) Attribute represents a user-defined free text providing the primary identification of this entity to other users.

10.A5   CONCEPTUAL VOLUME MACRO

A Conceptual Volume is an abstract entity used to identify an anatomic region (such as a planning target volume or a combination of multiple anatomic volumes) or non-anatomic volumes such as a bolus or a marker. A Conceptual Volume can be established without necessarily defining its spatial extent (for example a Conceptual Volume for a tumor can be established prior to segmenting it). The spatial extent of a Conceptual Volume may change over time (for example as treatment proceeds the tumor volume corresponding to the Conceptual Volume will change).

The spatial extent of a Conceptual Volume may be defined by any general-purpose entity that represents geometric information (such as Segmentation, Surface Segmentation, RT Structure Set SOP Instance and alike) or a combination thereof, although the Conceptual Volume does exist independently of a specific definition of its spatial extent.

A Conceptual Volume may also be defined as a combination of other Conceptual Volumes.

Examples for Conceptual Volumes:

1. A Conceptual Volume (with a Conceptual Volume UID (gggg,1301) can be used to represent the treatment target in an RT Physician Intent SOP Instance based upon a diagnostic image set, although the actual delineation of a specific target volume has not yet taken place. Later, the target volume is contoured. The RT Segment Annotation SOP Instance references the volume contours and associates it with the Conceptual Volume via the Conceptual Volume UID (gggg,1301).

2. In an adaptive workflow, the anatomic volume may change over time. The Conceptual Volume on the other hand does not change. Multiple RT Segment Annotation SOP Instances, each referencing different Segmentation instances, can be associated with the same Conceptual Volume via the Conceptual Volume UID (gggg,1301), making it possible to track the volume over time.

3. A Conceptual Volume may represent targets and/or anatomic regions for which manually calculated doses are tracked (for example, in emergency treatments). In this case, Conceptual Volumes may be instantiated first in an RT Physician Intent SOP instance and subsequently used in RT Radiation SOP instances, or may be first instantiated in the Radiation SOP instances. After treatment, these Conceptual Volumes will be used in RT Radiation Records to track the delivered dose. Such Conceptual Volumes may never reference a segmentation, but serve as a key for referencing the Conceptual Volume across these different SOP instances.

Table 10.A5-1
Conceptual Volume Macro Attributes

Attribute Name	Tag	Type	Attribute Description
Conceptual Volume UID	(gggg,1301)	1	A UID identifying the Conceptual Volume.
Originating SOP Instance Reference Sequence	(gggg,1302)	1C	Reference to the SOP Instance that contains the original definition of this Conceptual Volume identified by Conceptual Volume UID (gggg,1301). Required when Conceptual Volume UID (gggg,1301) was not issued in the current SOP Instance, but read from another SOP instance. Only a single Item shall be included in this Sequence.
>Include Table 10-11 "SOP Instance Reference Macro Attributes"			

Equivalent Conceptual Volumes Sequence	(gggg,1305)	3	References one or more existing Conceptual Volumes that represent the same concept as the current Conceptual Volume. This Sequence might be used when Conceptual Volume references of existing SOP instances are retrospectively identified as representing the same entity. One or more Items are permitted in this Sequence. See 10.A5.1.1.
>Referenced Conceptual Volume UID	(gggg,1306)	1	A UID identifying the Conceptual Volume.
>Equivalent Conceptual Volume Instance Reference Sequence	(gggg,1304)	1	Reference to a SOP Instance that contains the Referenced Conceptual Volume UID (gggg,1306) of the Equivalent Conceptual Volume. Only a single Item shall be included in this Sequence.
>>*Include Table 10-11 "SOP Instance Reference Macro Attributes"*			
Derivation Conceptual Volume Sequence	(gggg,1316)	3	Description of a Conceptual Volume that was used to derive this Conceptual Volume. Only a single Item is permitted in this Sequence.
>Derivation Description	(0008,2111)	3	A user-readable text description of how this Conceptual Volume was derived.
>Source Conceptual Volume Sequence	(gggg,1320)	1	The set of Conceptual Volumes that were used to derive this Conceptual Volume. One or more Items shall be included in this Sequence.
>>Source Conceptual Volume UID	(gggg,1317)	1	UID identifying the Conceptual Volume that was used to derive this Conceptual Volume.
>>Conceptual Volume Constituent Index	(gggg,1308)	1	Index of the constituent in the Source Conceptual Volume Sequence. The value shall start at 1 and increase monotonically by 1.
>>Conceptual Volume Constituent Segmentation Reference Sequence	(gggg,1314)	2	Contains the reference to the constituents of the RT Segment Annotation Instance from which Conceptual Volume is derived. Zero or one Item shall be included in this Sequence.

>>>Referenced Direct Segment Instance Sequence	(gggg,9875)	1	Reference to the SOP Instance that contains the Direct Segment Reference Sequence (gggg,1343). Only a single Item shall be included in this Sequence. See 10.A6.1.3
>>>>*Include Table 10-11 "SOP Instance Reference Macro Attributes"*			
>>>Referenced Segment Reference Index	(gggg,1340)	1	The Segment Reference Index (gggg,1342) in the Segment Reference Sequence (gggg,1341) corresponding to the segment representing this Conceptual Volume. Shall reference only segment Items that contain the Direct Segment Reference Sequence (gggg,1343).
>Conceptual Volume Derivation Algorithm Sequence	(gggg,1318)	3	Algorithm used to derive this Conceptual Volume. One or more Items are permitted in this Sequence.
>>*Include Table 10-19 "Algorithm Identification Macro Attributes"*		*No Baseline CID defined*	

554

10.A5.1   Conceptual Volume Macro Attribute Descriptions

10.A5.1.1   Equivalent Conceptual Volumes

557 Conceptual Volumes can be declared to be equivalent to other Conceptual Volumes. In such cases, the Equivalent
558 Conceptual Volumes Sequence (gggg,1305) is used in derived SOP instances which are aware of other SOP
559 instances defining a semantically equivalent volume, but using different Conceptual Volume UIDs (gggg,1301).

10.A5.1.2   Derivation Conceptual Volume Sequence

561 The Derivation Conceptual Volume Sequence (gggg,1316) may be used to describe how a Conceptual Volume is
562 derived from one or more other Conceptual Volumes in cases where it may not be possible to describe the method
563 of the derivation completely. Since the Conceptual Volume cannot be mathematically constructed from a derivation
564 description, it will be defined explicitly by a segmentation.

565 The specification of derivation is different from combining Conceptual Volumes as defined in 10.A6 "Conceptual
566 Volume Segmentation Reference and Combination Macro".

10.A6   CONCEPTUAL VOLUME SEGMENTATION REFERENCE AND COMBINATION MACRO

568 This macro allows the combination of Conceptual Volumes as constituents of a combined volume. A representative
569 example is to have the Left Lung and the Right Lung segmented, and then to declare the Lungs as a combined
570 Conceptual Volume, for which prescription constraints can be defined.

571 The macro also allows reference to RT Segment Annotation SOP instances, which contain a segmented
572 representation of the Conceptual Volume. At the invocation of this macro it is declared, whether this segmented
573 representation is required or not.

574

575

576
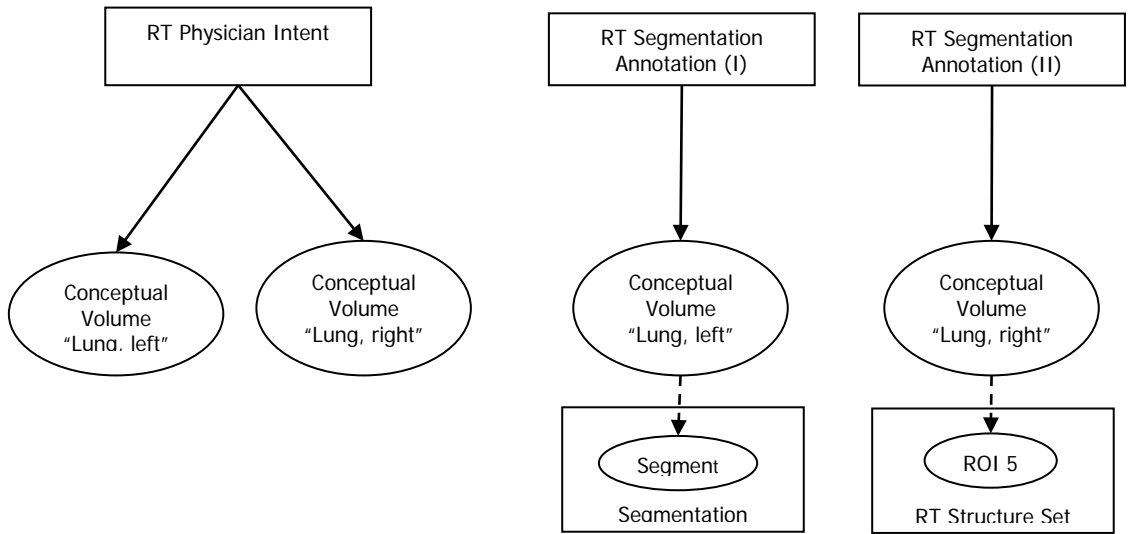
Figure 10.A6-1. Conceptual Volume References

578 Figure 10.A6-1 describes an RT Physician Intent Instance where Conceptual Volumes "Lung, left" and "Lung, right"
579 are referenced, but not defined. In this example, the RT Segmentation Annotation Instances then define the
580 volumetric information of the Conceptual Volumes by referencing a specific segment of a Segmentation Instance
581 and a specific ROI in an RT Structure Set Instance.

582

583

584

585
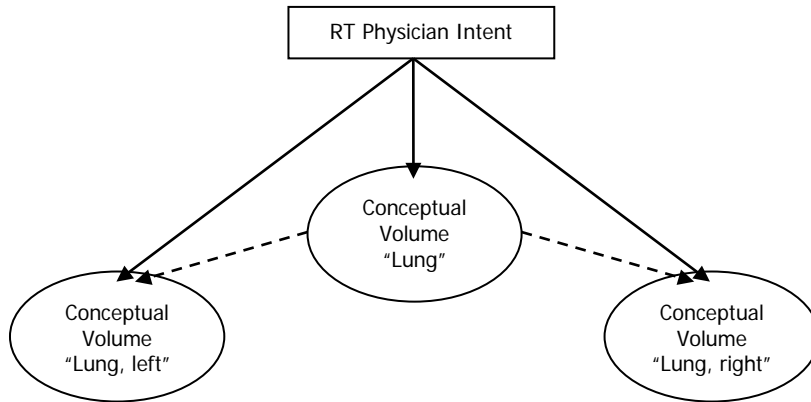
Figure 10.A6-2. Conceptual Volume Combination References

587 Figure 10.A6-2 describes an RT Physician Intent Instance defining Conceptual Volumes "Lung, left" and "Lung,
588 right" and Conceptual Volume "Lung" as a combination of the first two without a direct reference to a volume
589 definition.

590 **Table 10.A6-1**
591 **Conceptual Volume Segmentation Reference And Combination Macro Attributes**

Attribute Name	Tag	Type	Attribute Description

Include Table 10.A5-1 "Conceptual Volume Macro Attributes"			
Conceptual Volume Combination Flag	(gggg,1309)	1	Indication that this Conceptual Volume is a combination of other Conceptual Volumes. Enumerated Values: YES NO
Conceptual Volume Constituent Sequence	(gggg,1303)	1C	References to Conceptual Volumes which are constituents of this Conceptual Volume. See 10.A6.1.1. Required if Conceptual Volume Combination Flag (gggg,1309) equals YES. One or more Items shall be included in this Sequence. The combined Conceptual Volume UID shall not be included in the Sequence.
>Conceptual Volume Constituent Index	(gggg,1308)	1	An index referenced in the Conceptual Volume Combination Expression (gggg,1307) identifying the Conceptual Volume Constituent. The value shall start at 1 and increase monotonically by 1.
>Constituent Conceptual Volume UID	(gggg,1315)	1	UID identifying the Conceptual Volume that is a constituent of the combined Conceptual Volume.
>Originating SOP Instance Reference S-equence	(gggg,1302)	1	Reference to the SOP Instance that contains the original definition of the Conceptual Volume constituent identified by Constituent Conceptual Volume UID (gggg,1315) in this Sequence. If this Conceptual Volume orginated in the current SOP Instance, then the referenced SOP Instance UID is the current SOP Instance UID. Only a single Item shall be included in this Sequence.
>>Include Table 10-11 "SOP Instance Reference Macro Attributes"			

>Conceptual Volume Constituent Segmentation Reference Sequence	(gggg,1314)	1C	Contains a segmented representation of the Conceptual Volume constituent. Required if the Conceptual Volume Segmentation Defined Flag (gggg,1311) equals YES and the Conceptual Volume is not a Combination of other Conceptual Volumes. Only a single Item shall be included in this Sequence. See 10.A6.1.2.
>>Referenced Direct Segment Instance Sequence	(gggg,9875)	1	Reference to the SOP Instance that contains the Direct Segment Reference Sequence (gggg,1343). Only a single Item shall be included in this Sequence. See 10.A6.1.3
>>>*Include Table 10-11 "SOP Instance Reference Macro Attributes"*			
>>Referenced Segment Reference Index	(gggg,1340)	1	The Segment Reference Index (gggg,1342) in the Segment Reference Sequence (gggg,1341) corresponding to the segment representing this Conceptual Volume. Shall reference only segment Items that contain the Direct Segment Reference Sequence (gggg,1343).
Conceptual Volume Combination Expression	(gggg,1307)	1C	Symbolic expression specifying the combination of Conceptual Volumes as a text string consisting of Conceptual Volume Constituent Index (gggg,1308) values, combination operators and parentheses. Required if Conceptual Volume Combination Flag (gggg,1309) equals YES. See 10.A6.1.1.
Conceptual Volume Combination Description	(gggg,1310)	2C	Human-readable description of the combination of Conceptual Volumes. This information is intended for displayand shall not be used for structured processing. Required if Conceptual Volume Combination Flag (gggg,1309) equals YES.
Conceptual Volume Segmentation Defined Flag	(gggg,1311)	1	Indication that there are defined segmentations for this Conceptual Volume. Enumerated Values YES NO

Conceptual Volume Segmentation Reference Sequence	(gggg,1312)	1C	Contains a segmented representation of the Conceptual Volume.
			Required when Conceptual Volume Segmentation Defined Flag (gggg,1311) equals YES and Conceptual Volume Combination Flag Indicator (gggg,1309) equals NO.
			Only a single Item shall be included in this Sequence.
			See 10.A6.1.4.
>Referenced Direct Segment Instance Sequence	(gggg,9875)	1	Reference to the SOP Instance that contains the Segment Reference Sequence (gggg,1341) in which the segment is defined.
			Only a single Item shall be included in this Sequence.
			See 10.A6.1.3
>>*Include Table 10-11 "SOP Instance Reference Macro Attributes"*			
>Referenced Segment Reference Index	(gggg,1340)	1	The Segment Reference Index (gggg,1342) in the Segment Reference Sequence (gggg,1341) corresponding to the segment representing this Conceptual Volume.
			In the segment Item referenced, the Direct Segment Reference Sequence (gggg,1343) shall be present.

592

10.A6.1   Conceptual Volume Segmentation Reference and Combination Macro Attribute Description

10.A6.1.1   Conceptual Volume Combination Expression

For Conceptual Volumes specified as a combination of other Conceptual Volumes, the combination logic is specified by the text string value of the Conceptual Volume Combination Expression (gggg,1307).

A nested list notation is used to apply geometric operators to a set of Conceptual Volumes.

The first element of the list shall be one of the following geometric operators:

- UNION – geometric union of two or more arguments

- INTERSECTION – geometric intersection of two or more arguments

- NEGATION – geometric inverse of a single argument

- SUBTRACTION – geometric subtraction of second argument from the first

- XOR – geometric exclusive disjunction of two arguments

Note   The result of a NEGATION operation is well-defined only if used as an operand to an INTERSECTION. NEGATION without context to an INTERSECTION results in an infinite Volume.

Subsequent elements shall specify arguments of the geometric operator. An argument is either a Conceptual Volume Constituent Index (gggg,1308) value (i.e., positive integer) or a parenthesized list of operations.

The grammar for the Conceptual Volume Combination Expression (<sexpr>) is shown below in BNF (Backus Naur Form):

```
611   <sexpr>         :: <cv> | <list>
612   <cv>            :: 1 | 2 | 3 | …
613   <list>          :: ( <op1><sp><sexpr> ) |
614                      ( <op2><sp><sexpr><sp><sexpr> ) |
615                      ( <op3><sp><args> )
616   <args>          :: <sexpr><sp><sexpr> | <args><sp><sexpr>
617   <op1>           :: NEGATION
618   <op2>           :: SUBTRACTION | XOR
619   <op3>           :: UNION | INTERSECTION
620   <sp>            :: 0x20
621
```

622   Examples:

623   1.)   Union of paired organs 1 and 2 (disjoint)

624
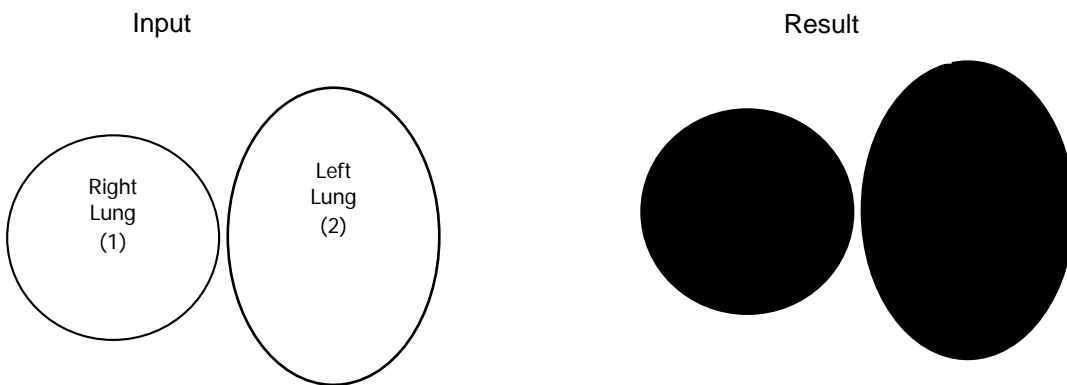
625

626

627   **Figure 10.A6.1.1-1. Conceptual Volume Example of Union of disjoint Volumes**

628

629   Conceptual Volume Combination Expression (gggg,1307):

630   (UNION 1 2)

631   Items in Conceptual Volume Constituent Sequence (gggg,1303):

632   **Table 10.A6.1.1-1**
633   **Conceptual Volume Example of Union of disjoint Volumes**

634

Conceptual Volume Constituent Index (gggg,1308)	Conceptual Volume
1	Right Lung
2	Left Lung

635

636   2.)   Union of paired organs 1 and 2 (non-disjoint)

Input   Result
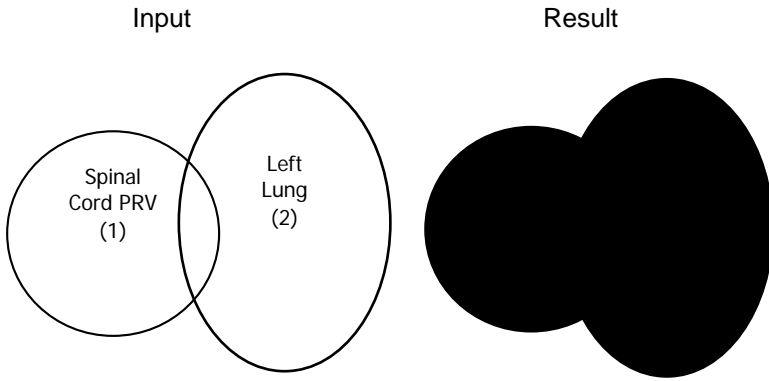
639   **Figure 10.A6.1.1-2. Conceptual Volume Example of Union of non-disjoint Volumes**

640

641   Conceptual Volume Combination Expression (gggg,1307):

642   (UNION 1 2)

643   Items in Conceptual Volume Constituent Sequence (gggg,1303):

644   **Table 10.A6.1.1-2**
645   **Conceptual Volume Example of Union of non-disjoint Volumes**
646

Conceptual Volume Constituent Index (gggg,1308)	Conceptual Volume
1	Spinal Cord PRV
2	Left Lung

647

648   3.)   Union of two organs 1 and 2 with excluded volume 3 using NEGATION

Input   Result

649

650

651   **Figure 10.A6.1.1-3. Conceptual Volume Example of Intersection and Negation**

652

653   Conceptual Volume Combination Expression (gggg,1307):

654   (INTERSECTION (UNION 1 2) (NEGATION 3))

655   Items in Conceptual Volume Constituent Sequence (gggg,1303):

656   **Table 10.A6.1.1-3**
657   **Conceptual Volume Example of Intersection and Negation**

658

Conceptual Volume Constituent Index (gggg,1308)	Conceptual Volume
1	Heart
2	Left Lung
3	CTV

659

660   4.)   Union of paired organs 1 and 2, with exclusion of multiple volumes 3, 4 and 5

661
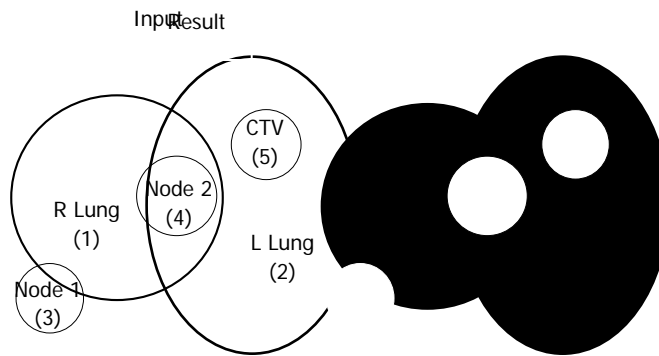
662
663

664   **Figure 10.A6.1.1-4. Conceptual Volume Example of Intersection and Union**

665

666   Conceptual Volume Combination Expression (gggg,1307):

667   (INTERSECTION (UNION 1 2) (NEGATION (UNION 3 4 5)))

668   Note: This combination can be expressed alternatively as:

669   (SUBTRACTION (UNION 1 2) (UNION 3 4 5))

670

671   Items in Conceptual Volume Constituent Sequence (gggg,1303):

672   **Table 10.A6.1.1-4**
673   **Conceptual Volume Example of Intersection and Union**

674

Conceptual Volume Constituent Index (gggg,1308)	Conceptual Volume

1	R Lung
2	L Lung
3	Node 1
4	Node 2
5	CTV

675

676   5.)   Intersection of overlapping volumes 1 and 2

677

Input   Result
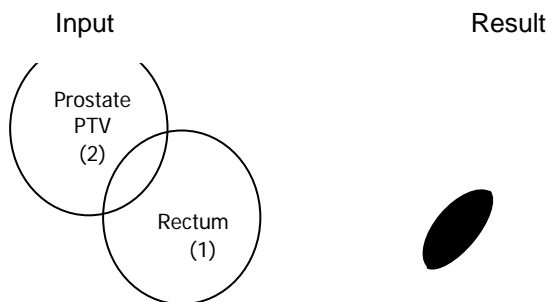
678

679

680   **Figure 10.A6.1.1-5. Conceptual Volume Example of Intersection of non-disjunct Volumes**

681

682   Conceptual Volume Combination Expression (gggg,1307):

683   (INTERSECTION 1 2)

684   Items in Conceptual Volume Constituent Sequence (gggg,1303):

685   **Table 10.A6.1.1-5**
686   **Conceptual Volume Example of Intersection of non-disjunct Volumes**

687

Conceptual Volume Constituent Index (gggg,1308)	Conceptual Volume
1	Rectum
2	Prostate PTV

688

689   6.)   Intersection of disjoint volumes 1 and 2

690

Input   Result

691
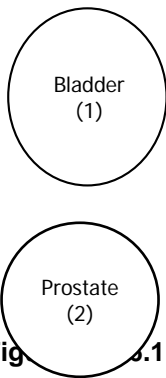
692   **Fig   6. Conceptual Volume Example of Intersection of non-disjunct Volumes**

693

694

695   Conceptual Volume Combination Expression (gggg,1307):

696   (INTERSECTION 1 2)

697   Items in Conceptual Volume Constituent Sequence (gggg,1303):

698   **Table 10.A6.1.1-6**
699   **Conceptual Volume Example of Intersection of disjunct Volumes**

700

Conceptual Volume Constituent Index (gggg,1308)	Conceptual Volume
1	Bladder
2	Prostate

701

702

703   **10.A6.1.2   Conceptual Volume Segmentation Reference Sequence**

704   The Conceptual Volume Constituent Segmentation Reference Sequence (gggg,1314) contains a reference to a
705   segmentation which represents the volume of this consituent geometrically. The referenced segmentations of the
706   constituents of a combined Conceptual Volume may be in one or more Frames of References.

707   The Conceptual Volume constituents shall not include the combined Conceptual Volume being defined.
708   Applications that wish to combine existing segmentations within the same Conceptual Volume must create a new
709   Segmentation Instance.

710   **10.A6.1.3   Referenced Direct Segment Instance Sequence**

711   A SOP Instance may only be referenced in this Sequence if it belongs to a SOP Class that includes the Segment
712   Reference Module specified in section C.AA.D2.

713   **10.A6.1.4   Conceptual Volume Segmentation Reference Sequence**

714   The Conceptual Volume Segmentation Reference Sequence (gggg,1312) contains a reference to a segmentation
715   which represents this volume geometrically.

716

717   **10.A7   DEVICE MODEL MACRO**

718   The Device Model Macro contains general Attributes needed to specify a device model other than the device
719   creating the SOP Instance.

720   **Table 10.A7-1**
721   **Device Model Macro Attributes**

Attribute Name	Tag	Type	Description
Manufacturer	(0008,0070)	2	Manufacturer of the device.
Manufacturer's Model Name	(0008,1090)	2	Manufacturer's model name of the device.
Manufacturer's Model Version	(gggg,1324)	2	A version number of the Manufacturer's model of the device.

722

723   **10.A8   DEVICE IDENTIFICATION MACRO**

724   The Device Identification Macro identifies a (physical or virtual) device.

725   **Table 10.A8-1**
726   **Device Identification Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
Device Type Code Sequence	(gggg,5026)	1	The type of the device. Only a single Item shall be included in this Sequence.
>Include Table 8.8-1 "Code Sequence Macro Attributes"			*Context ID may be defined in the macro invocation.*
Device Label	(gggg,5025)	1	User-defined label for this device.
Device Description	(gggg,5027)	3	User-defined description for this device.
Device Serial Number	(0018,1000)	2	Manufacturer's serial number of the device.
Software Versions	(0018,1020)	2	Manufacturer's designation of software version of the equipment.
UDI Sequence	(0018,100A)	3	Unique Device Identifier (UDI) of the device. Notes: Multiple Items may be present if the entire equipment has UDIs issued by different Issuing Authorities One or more Items are permitted in this Sequence.
>Include Table 10.29-1 "UDI Macro Attributes"			
Manufacturer's Device Identifier	(gggg,954D)	2	An identifier issued by the manufacturer. See Note.
Device Alternate Identifier	(gggg,1326)	2	An identifier intended to be read by a device such as a bar code reader.
Device Alternate Identifier Type	(gggg,1327)	1C	Defines the type of Device Alternate Identifier. Required if Device Alternate Identifier (gggg,1326) is present. Defined Terms: BARCODE RFID

Device Alternate Identifier Format	(gggg,1328)	1C	Description of the format in which the Device Alternate Identifier (gggg,1326) is issued.
			Required if Device Alternate Identifier (gggg,1326) is present.
			See 10.A8.1.1.

727

728   Note: Typically, the Device Identifier is a code which can be electronically read by the machine utilizing that device, e.g.
729   to verify the presence of that device.
730

731 10.A8.1   Device Component Identification Macro Attribute Descriptions

732 10.A8.1.1   Device Alternate Identifier Format

733 The Device Alternate Identifier Format (gggg,1328) specifies the format of the value of the Device Alternate
734 Identifier (gggg,1326).

735 If the value of Device Alternate Identifier Type (gggg,1327) is RFID, a big variety of RFID formats exists (some
736 examples are DOD-96, DOD-64 UID, GID-96, sgtin-96). Supported format values shall be defined in the
737 Conformance Statement.

738 For Device Alternate Identifier Type (gggg,1327) = BARCODE see C.22.1.1.

739 10.A9   RELATED INFORMATION ENTITIES MACRO

740 This Macro defines references to entities and their purpose of reference. References can be made at the Study
741 level, Series level, Instance level or Frame Level.

742 The attributes Pertinent SOP Classes in Study (gggg,98A0) and Pertinent SOP Classes in Series (gggg,98A1) allow
743 the specification of the relevant SOP Classes for the given purpose. These attributes support filtering for certain
744 SOP Classes, specification of corresponding query keys, and allowing the receiving application to assess its
745 capabilities to handle the specified objects.

746 All referenced Studies, Series and Instances share the same single Purpose of Reference.

747

748   **Table 10.A9-1 Related Information Entities Macro Attributes**

749

Attribute Name	Tag	Type	Attribute Description
Purpose of Reference Code Sequence	(0040,A170)	1	Describes the purpose for which the references are made.
			Only a single Item shall be included in this Sequence.
>Include Table 8.8-1 "Code Sequence Macro Attributes"			*Context ID may be defined in the Macro invocation.*
Referenced Study Sequence	(0008,1110)	1	Studies which are relevant for the invocation context.
			One or more Items shall be included in this Sequence.
>Study Instance UID	(0020,000D)	1	Uniquely identifies the referenced Study.
>Pertinent SOP Classes in Study	(gggg,98A0)	3	The SOP Classes in the Study which are relevant for the invocation context.
			If not present, all SOP Instances included in the referenced Study are considered relevant.
>Referenced Series Sequence	(0008,1115)	3	Series which are relevant for the invocation context.
			One or more Items are permitted in this Sequence.
>>Series Instance UID	(0020,000E)	1	Uniquely identifies the referenced Series.

Attribute Name	Tag	Type	Attribute Description
>>Pertinent SOP Classes in Series	(gggg,98A1)	3	The SOP Classes in the Series which are relevant for the invocation context.
			If not present, all SOP Instances included in the referenced Series are considered relevant.
>>Referenced Image Sequence	(0008,1140)	3	Image SOP Instances which are relevant in the invocation context.
			One or more Items are permitted for this Sequence.
>>>*Include Table 10-3 "Image SOP Instance Reference Macro Attributes"*			
>>Referenced Instance Sequence	(0008,114A)	3	Non-Image SOP Instances which are relevant in the invocation context.
			One or more Items are permitted for this Sequence.
>>>*Include Table 10-11 "SOP Instance Reference Macro Attributes"*			

750

751

752

753

754

755 **Add the following columns in PS3.3 Section A.1.4, Table A.1-1 COMPOSITE INFORMATION OBJECT**
756 **MODULES OVERVIEW – RADIOTHERAPY**

757 **A.1.4   Overview of the Composite IOD Module Content**

758 …

IODs Modules		RT Physician Intent	RT Segment Annotation
Patient		M	M
Clinical Trial Subject		U	U
General Study		M	M
Patient Study		U	U
Clinical Trial Study		U	U
General Series		M	M
Clinical Trial Series		U	U
Enhanced RT Series		M	M
General Equipment		M	M
Enhanced General Equipment		M	M
Radiotherapy Common Instance		M	M
RT Physician Intent		M	
RT Prescription		U	
RT Treatment Phase Intent		C	
RT Segment Annotation			M
Segment Reference			M
General Reference Module		M	M
Common Instance Reference Module		M	M
SOP Common		M	M

759

760 | **Add the following to PS3.3 Annex A:**

761 **A.VV   RT SECOND GENERATION**

762 **A.VV.1   RT Second Generation Objects**

763 This section provides a brief description of the IODs of RT Second Generation. Specifically, this description
764 includes:

765 • The Real-World Object which is represented by the IOD

766 • Information as to the scope of the represented object if appropriate

767 **A.VV.1.1   RT Second Generation Common Information**

768 This section provides a description of the Module structure which is shared by the RT Second Generation IODs.

769 **A.VV.1.1.1   RT Second Generation Entity-Relationship Model**

770 The E-R Model in Figure A.VV.1.1.1-1 depicts those components of the DICOM Information Model that are relevant
771 to RT Second Generation IODs.

772
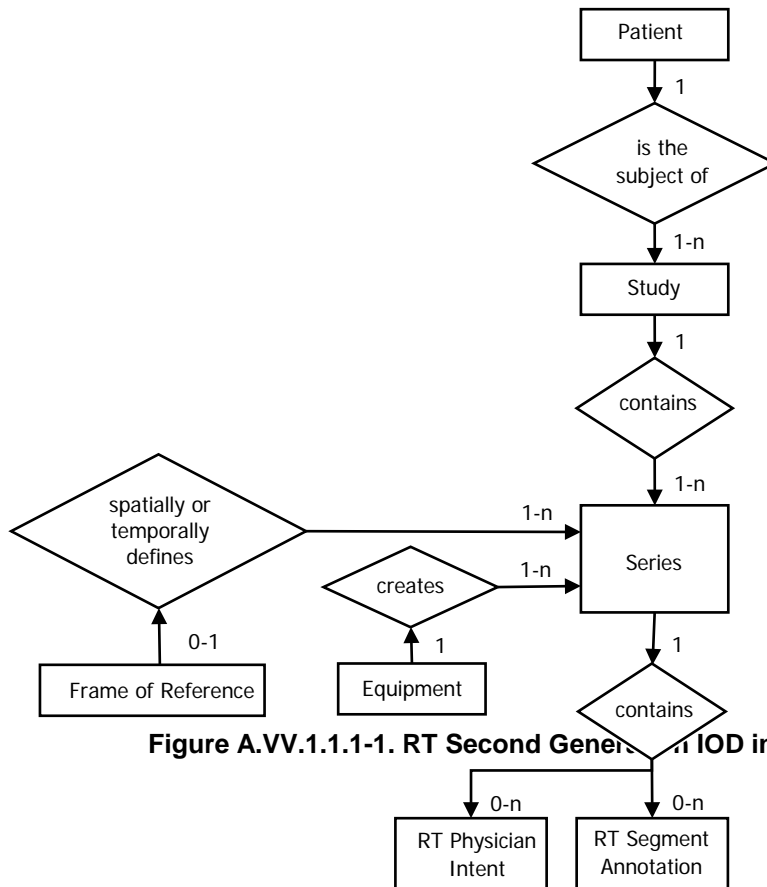
773 **Figure A.VV.1.1.1-1. RT Second Generation IOD information model**

774

775

A.VV.1.1.1.1   Use of Study and Series in RT Second Generation Radiotherapy

776

777 For first generation IODs, no specific semantics are attached to a Study or a Series in RT. Similarly, for RT Second
778 Generation IODs, internal references shall be used to relate and locate SOP Instances rather than making
779 assumptions about how related SOP Instances are grouped into Studies or Series. For practical reasons it may be
780 indicated to create a new Study separate from imaging Studies that are used for radiotherapeutic planning because
781 of billing or reimbursement for Series that contain RT instances.

782 Implementers should also note, that the DICOM standard, in general, does place some restrictions on how such
783 SOP Instances should be grouped, as defined in chapter A.1.2.3.

784 For non-image modalities like radiotherapy, the Series may not be the most efficient way to search for objects.
785 Instead, an application might find it easier to use references in the RT Course object, Key Object Selection objects
786 or Unified Worklist Procedure Steps to directly retrieve required instances rather than search for them.

787

788

789

A.VV.1.2   RT Physician Intent Information Object Definition

A.VV.1.2.1   RT Physician Intent IOD Description

The RT Physician Intent carries the prescriptions by which the physician describes the therapeutic goal and strategy for the radiotherapeutic treatment.

A.VV.1.2.2   RT Physician Intent IOD Entity-Relationship Model

See Figure A.VV.1.1.1-1.

A.VV.1.2.3   RT Physician Intent IOD Module Table

Table A.VV.1.2-1
RT Physician Intent IOD Modules

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
	Clinical Trial Subject	C.7.1.3	U
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
	Clinical Trial Study	C.7.2.3	U
Series	General Series	C.7.3.1	M
	Clinical Trial Series	C.7.3.2	U
	Enhanced RT Series	C.AA.A1	M
Equipment	General Equipment	C.7.5.1	M
	Enhanced General Equipment	C.7.5.2	M
RT Physician Intent	General Reference Module	C.12.4	M
	RT Physician Intent	C.AA.B1	M
	RT Enhanced Prescription	C.AA.B2	U
	Intended RT Treatment Phase Intent	C.AA.B3	C Required if RT Treatment Phase Intent Presence Flag (gggg,9808) equals YES.
	SOP Common	C.12.1	M
	Common Instance Reference Module	C.12.2	M
	Radiotherapy Common Instance Module	C.AA.A2	M

799

A.VV.1.2.4   RT Physician Intent IOD Constraints

A.VV.1.2.4.1   Modality Attribute

The value of Modality (0008,0060) shall be RTINTENT.

A.VV.1.2.4.2   Radiotherapy Common Instance Module

804

Code Sequence	CID

Author Identification Sequence (gggg,1321)	Defined CID for Organizational Role is CID SUP147072 "Radiotherapy Prescribing and Segmenting Person Roles"

805

806

A.VV.1.3   RT Segment Annotation Information Object Definition

A.VV.1.3.1   RT Segment Annotation IOD Description

The RT Segment Annotation IOD annotates any general-purpose entity that represents geometric information such as Segmentation IOD, Surface Segmentation IOD, and RT Structure Set IOD with radiotherapy-specific information that cannot be encoded in the content of the annotated SOP Instance, or overrides that content with new or additional interpretation.

A.VV.1.3.2   RT Segment Annotation IOD Entity-Relationship Model

See Figure A.VV.1.1.1-1.

A.VV.1.3.3   RT Segment Annotation IOD Module Table

Table A.VV.1.3-1
RT Segment Annotation IOD Modules

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
	Clinical Trial Subject	C.7.1.3	U
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
	Clinical Trial Study	C.7.2.3	U
Series	General Series	C.7.3.1	M
	Clinical Trial Series	C.7.3.2	U
	Enhanced RT Series	C.AA.A1	M
Equipment	General Equipment	C.7.5.1	M
	Enhanced General Equipment	C.7.5.2	M
RT Segment Annotation	General Reference Module	C.12.4	M
	RT Segment Annotation	C.AA.D1	M
	Segment Reference	C.AA.D2	M
	General Reference Module	C.12.4	M
	SOP Common	C.12.1	M
	Common Instance Reference Module	C.12.2	M
	Radiotherapy Common Instance Module	C.AA.A2	M

818

A.VV.1.3.4   RT Segment Annotation IOD Constraints

A.VV.1.3.4.1   Modality Attribute

The value of Modality (0008,0060) shall be RTSEGANN.

A.VV.1.2.4.2   Radiotherapy Common Instance Module

823

Code Sequence	CID
Author Identification Sequence (gggg,1321)	Defined CID for Organizational Role is CID SUP147072 "Radiotherapy Prescribing and Segmenting Person Roles"

824

825

Make the following addition to PS3.3 Annex C, Section C.7.3:

Extend the list of Defined Terms of Section C.7.3.1.1.1 Modality by the following terms:

RTINTENT

RTSEGANN

830

831

832

833

> **Add the following to PS3.3 Annex C:**
>
> **Note: C.AA.1 RT Second Generation Concepts shall be the first subsection of C.AA and will be used by other 2nd Generation supplements (Sup 175, 176ff). It shall be included by this supplement even without a subsection to ensure appropriate numbering for later use.**

C.AA   RT SECOND GENERATION MODULES

The following Attribute Macros and Modules are used by the RT Second Generation IODs.

C.AA.1   RT Second Generation Concepts

This section dicusses general concepts used in RT Second Generation Modules.

> Note: See also explanations in Section 7.12 "Extension of the DICOM model of the real-world for Radiotherapy Second Generation Information Objects"and in IOD definitions in Section A.VV.1.

844

845

846   **C.AA.2   RT Second Generation Macros**

847   **C.AA.2.1   RT Second Generation General Purpose Macros**

848   **C.AA.2.1.1   Radiation Fraction Pattern Macro**

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

851   **Table C.AA.2.1.1-1**
852   **Radiation Fraction Pattern Macro Attributes**

Attribute Name	Tag	Type	Description
Fraction Pattern Sequence	(gggg,9965)	1C	The pattern of delivery of fractions within and across days of the week in a machine-readable form. Required if a fraction pattern has been defined. Only a single Item shall be included in this Sequence.
>Number of Fraction Pattern Digits Per Day	(300A,0079)	1C	The maximum number of fractions encodable within a day in a Fraction Pattern (gggg,9993). Required if Weekday Fraction Pattern Sequence (gggg,9993) is present. See C.AA.2.1.1.1.1.
>Repeat Fraction Cycle Length	(300A,007A)	1C	Number of weeks needed to describe fraction pattern. Required if Weekday Fraction Pattern Sequence (gggg,9993) is present. See C.AA.2.1.1.1.1.
>Weekday Fraction Pattern Sequence	(gggg,9993)	3	Sequence of week-day based fraction patterns. Each Item represents an alternative pattern. One or more Items are permitted in this Sequence. See C.AA.2.1.1.1.1.
>>Fraction Pattern	(300A,007B)	3	String of 0's (no treatment) and 1's (treatment) describing the fraction pattern for the fractions defined by this set. Length of string is 7 x Number of Fraction Pattern Digits Per Day x Repeat Fraction Cycle Length. The first character of the string represents Monday. See C.AA.2.1.1.1.1.
>>Intended Start Day of Week	(gggg,9992)	3	String of 0's (no treatment) and 1's (treatment) describing the intended start fraction for this set. Length of string is 7 x Number of Fraction Pattern Digits Per Day x Repeat Fraction Cycle Length. The first character of the string represents Monday.

Attribute Name	Tag	Type	Description
			See C.AA.2.1.1.1.2.
>Minimum Hours between Fractions	(gggg,9990)	3	Minimum number of hours between consecutive fractions. Consecutive fractions are given in Number of Fraction Pattern Digits Per Day (300A,0079).
>Intended Fraction Start Time	(gggg,9991)	3	The intended time(s) of day when the first RT Treatment Fraction of the day should be started.

853

C.AA.2.1.1.1   Radiation Fraction Pattern Macro Attribute Descriptions

C.AA.2.1.1.1.1 Fraction Pattern

The Radiation Fraction Pattern describes the intended scheme, i.e. how fractions are to be distributed along calendar days for the actual radiation set.

Examples of FractionPatterns:

a)   1 fraction per day (Monday to Friday), no fractions on Saturday and Sunday, 1 week-pattern:

Number of Fraction Pattern Digits Per Day (300A,0079) = 1
Repeat Fraction Cycle Length (300A,007A) = 1
Fraction Pattern (300A,007B) = 1111100

b)   2 fractions per day (Monday to Friday), no fractions on Saturday and Sunday 1 week-pattern:

Number of Fraction Pattern Digits Per Day (300A,0079) = 2
Repeat Fraction Cycle Length (300A,007A) = 1
Fraction Pattern (300A,007B) = 11111111110000

c)   1 fraction per day (Monday, Wednesday, Friday), no fractions on Saturday and Sunday 1 week-pattern:

Number of Fraction Pattern Digits Per Day (300A,0079) = 1
Repeat Fraction Cycle Length (300A,007A) = 1
Fraction Pattern (300A,007B) = 1010100

d)   2 fractions per day (Monday, Wednesday, Friday), one fraction on Saturday morning and Sunday afternoon 1 week-pattern:

Number of Fraction Pattern Digits Per Day (300A,0079) = 2
Repeat Fraction Cycle Length (300A,007A) = 1
Fraction Pattern (300A,007B) = 11001100111001

e)   1 fraction per day every other day 2 week-pattern:

Number of Fraction Pattern Digits Per Day (300A,0079) = 1
Repeat Fraction Cycle Length (300A,007A) = 2
Fraction Pattern (300A,007B) = 10101010101010

C.AA.2.1.1.1.2 Intended Start Day of Week

The Intended Start Day of Week (gggg,9992) specifies the day(s) of the week, when the first fraction of the treatment should be delivered. If more than one day is specified, one of the days may be selected to start the treatment.

The treatment then continues as specified in Fraction Pattern (300A,007B), irrespective of when the actual delivery starts.

Examples of Intended Start Day of Week and the relation to Fraction Pattern:

a)   1 Start Day, one fraction per day

888 The treatment should start on Wednesday and be continued at Friday of the first week, followed by treatments at
889 Monday, Wednesday, Friday the next week etc. until all fractions are delivered.

890 Number of Fraction Pattern Digits Per Day (300A,0079) = 1
891 Repeat Fraction Cycle Length (300A,007A) = 1
892 Fraction Pattern (300A,007B) = 1010100
893 Intended Start Day of Week (gggg,9992) = 0010000

894 b)   Start of any of 3 days, two fractions per day

895 Treatment should start

896 - on Monday morning and continued by 1 fraction on Monday afternoon, 2 fractions on Wednesday and Friday

897 - or on Monday afternoon and continued by 2 fractions on Wednesday and Friday

898 - or on Wednesday morning, followed by a fraction on Wednesday afternoon, folloed by 2 fractions on Friday.

899 The treatment will continue the next week with 2 fractions on Monday, Wednesday, Friday etc. until all fractions are
900 delivered.

901 Number of Fraction Pattern Digits Per Day (300A,0079) = 1
902 Repeat Fraction Cycle Length (300A,007A) = 2
903 Fraction Pattern (300A,007B) = 11001100110000
904 Intended Start Day of Week (gggg,9992) = 11001000000000

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907

C.AA.2.1.2   RT Treatment Phase Macro

The treatment phase macro contains the identification and additional information about an RT Treatment Phase.

Table C.AA.2.1.2-1
RT Treatment Phase Macro Attributes

Attribute Name	Tag	Type	Description
RT Treatment Phase Index	(gggg,9116)	1	Index of the RT Treatment Phase in the Sequence.
RT Treatment Phase UID	(gggg,9117)	2	A UID by which this RT Treatment Phase can be referenced.
Include Table 10.A3-1 "Entity Labeling Macro Attributes"			
Intended Phase Start Date	(gggg,988C)	2	The date when this treatment phase is intended to start. See section C.AA.2.1.2.1.1
Intended Phase End Date	(gggg,988E)	2	The date when this treatment phase is intended to be completed. See section C.AA.2.1.2.1.1

912

C.AA.2.1.2.1   RT Treatment Phase Macro Attribute Descriptions

C.AA.2.1.2.1.1 Intended Phase Start Date, Intended Phase End Date

The Intended Phase Start Date (gggg,988C) and Intended Phase End Date (gggg,988E) contains the date when this treatment phase is intended to be started or completed. Do not confuse the content of this Attribute with the date when the treatment delivery is scheduled or when it actually starts or ends. The scheduled date is managed by workflow systems where definitive treatment session scheduling is maintained. The actual date of performed delivery will be available in the RT Radiation Record Instances. The actual dates may differ from the Intended Phase Start Date (gggg,988C) and/or Intended Phase End Date (gggg,988E).

C.AA.2.1.3   RT Treatment Phase Interval Macro

The RT Treatment Phase Interval Macro contains the information about time-relationship between RT Treatment Phases. This consists of sets of pair-wise relationships, declaring the relation of a earlier phase to a later, potentially overlapping, phase.

Table C.AA.2.1.3-1
RT Treatment Phase Interval Macro Attributes

Attribute Name	Tag	Type	Description
RT Treatment Phase Interval Sequence	(gggg,9890)	2	Intervals between treatment phases. Zero or more Items shall be included in this Sequence. See C.AA.2.1.3.2.
>Basis RT Treatment Phase Index	(gggg,9143)	1	The RT Treatment Phase which provides the basis for this interval. This index corresponds to an Item in the Intended RT Treatment Phase Sequence (gggg,9880). See C.AA.2.1.3.1.

Attribute Name	Tag	Type	Description
>Related RT Treatment Phase Index	(gggg,9144)	1	The RT Treatment Phase which is related to the phase identified by Basis RT Treatment Phase Index (gggg,9143). Each RT Treatment Phase Index value shall appear in this Attribute in only one Item within this Sequence. This index corresponds to an Item in the Intended RT Treatment Phase Sequence (gggg,9880). See C.AA.2.1.3.1.
>Temporal Relationship Interval Anchor	(gggg,9892)	1C	The anchor point of the interval specified in this Item with respect to the phase referenced by the Basis RT Treatment Phase Index (gggg,9143). Enumerated Values: START: The interval is specified with respect to the start of the basis phase. END: The interval is specified with respect to the end of the basis phase. Required if a value is present in Minimum Number of Interval Days (gggg,9894) or Maximum Number of Interval Days (gggg,9896).
>Minimum Number of Interval Days	(gggg,9894)	2	The minimum number of days that the start of the related phase should follow the basis phase referenced in Basis RT Treatment Phase Index (gggg,9143). Fractional values are allowed. Negative values are allowed if Temporal Relationship Interval Anchor (gggg,9892) has a value of END.
>Maximum Number of Interval Days	(gggg,9896)	2	The maximum number of days that the start of the related phase should follow the basis phase referenced Basis RT Treatment Phase Index (gggg,9143). Fractional values are allowed. Negative values are allowed if Temporal Relationship Interval Anchor (gggg,9892) has a value of END.

927

C.AA.2.1.3.1   Referenced RT Treatment Phases

929 The RT Treatment Phase Interval Sequence (gggg,9890) allows the definition of an interval between two treatment
930 phases. RT Treatment Phases referenced by the Basis RT Treatment Phase Index (gggg,9143) and the Related
931 RT Treatment Phase Index (gggg,9144) are related in terms of the number of days between them. Note that the

932 number of days can also be negative and therefore the related treatment phase could start before the prior
933 treatment phase starts respectively ends.

934 Each RT Treatment Phase identified by the Related RT Treatment Phase Index (gggg,9144) may be related to only
935 one RT Treatment Phase identified by the Basis RT Treatment Phase Index (gggg,9143). Therefore, any Basis RT
936 Treatment Phase Index (gggg,9143) must only appear once in Related RT Treatment Phase Index (gggg,9144)
937 within the Sequence.

938 See also section C.AA.B2.1.4.

939 As a result of the combinations possible, the maximum number of Items in the RT Treatment Phase Interval
940 Sequence (gggg,9890) shall be one less than the number of treatment phases present.

941 **C.AA.2.1.3.2   RT Treatment Phase Interval Conflicts**

942 The Standard does not preclude encoding conflicting information.

943 **C.AA.2.1.4   Dosimetric Objective Macro**

944 The Dosimetric Objective Macro specifies an intended goal to be used in the definition of the dosimetric plan, for
945 plan optimization etc. . Dosimetric Objectives may define limits which affect the dose, such as dose volume
946 constraints, minimum or maximum dose, treatment time or MU limits, and radiobiologic effects.

947 Dosimetric Objectives, such as dose volume constraints, minimum or maximum dose, etc. can be used to specify
948 dose goals for anatomical or other treatment volumes that are referenced by Conceptual Volumes. Other
949 Dosimetric Objectives can also be used to specify general plan optimization objectives not related to anatomical or
950 other treatment volumes, such as Meterset Minimization etc.

951

952   **Table C.AA.2.1.4-1**
953   **Dosimetric Objective Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
Dosimetric Objective UID	(gggg,9948)	1	A UID by which this Dosimetric Objective can be referenced. See C.AA.2.1.4.1.1.
Originating SOP Instance Reference Sequence	(gggg,1302)	1C	Reference to the SOP Instance that contains the original definition of this Dosimetric Objective identified by Dosimetric Objective UID (gggg,9948). Required when the Dosimetric Objective UID (gggg,0948) was not issued in the current SOP Instance, but read from another SOP instance. Only a single Item shall be included in this Sequence.
>Include Table 10-11 "SOP Instance Reference Macro Attributes"			
Dosimetric Objective Type Code Sequence	(gggg,9943)	1	The type of dose objective which this Item represents. Only a single Item shall be included in this Sequence.
>Include Table 8.8-1 "Code Sequence Macro Attributes"			*Defined CID SUP147001 "Dosimetric Objective Types".*

Dosimetric Objective Parameter Sequence	(gggg,9950)	2	Parameters for the objective identified in Dosimetric Objective Type Code Sequence (gggg,9943). Zero or more Items shall be included in this Sequence. See C.AA.2.1.4.1.2.
>Include Table 10-2 "Content Item Macro Attributes"			
>Radiobiological Dose Effect Sequence	(gggg,1130)	1C	Describes the radiobiological effects if any that are taken into account to compute dose. Required if Dosimetric Objective Parameter Sequence (gggg,9950) contains a parameter which represents a dose. Only a single Item shall be included in this Sequence. See C.AA.2.1.4.1.2.
>>Include Table C.AA.2.1.5-1 "Radiobiological Dose Effect Description Macro Attributes"			
Absolute Dosimetric Objective Flag	(gggg,9954)	1	Whether the objective must be met by the resulting Radiotherapy treatment plan. Enumerated Values: YES = Objective must be met. NO = Objective should be met but may be compromised Detecting whether or not a Radiotherapy treatment plan has met this Dosimetric Objective and how this situation is handled is out of scope of the Standard.
Dosimetric Objective Purpose	(gggg,9958)	2	The purpose for which the objective is to be used. Enumerated Values: OPTIMIZATION = used as an input to the optimization process EVALUATION = used as a tool for evaluation BOTH = used as both OPTIMIZATION and EVALUATION

954

C.AA.2.1.4.1   Dosimetric Objective Macro Attribute Descriptions

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C.AA.2.1.4.1.1 Dosimetric Objective UID

956

957 Dosimetric Objectives (see C.AA.B2.1.6) are identified by UIDs. These UIDs serve as a key to allow references of
958 Dosimetric Objectives within or across various SOP Instances.

C.AA.2.1.4.1.2 Dosimetric Objective Parameter Sequence

959

960 A Dosimetric Objective is described by a type expressed in the Dosimetric Objective Type Code Sequence
961 (gggg,9943), and a Sequence of zero or more parameters to quantify the objective within the Dosimetric Objective
962 Parameter Sequence (gggg,9950).

963   Table C.AA.2.1.4-2 specifies the parameters that shall be sent.

964   **Table C.AA.2.1.4-2**
965   **Dosimetric Objective Parameters**

Dosimetric Objective Type Code Sequence (gggg,9943)	Parameter Concept Name Code(s)	Parameter Value Type(s)	Parameter Measurement Units Code(s)
Code included in: CID SUP147064 "No-Parameter Dosimetric Objectives"	none	none	none
Code included in: CID SUP147060 "Single Dose Parameter Dosimetric Objectives"	EV (S147025, 99SUP147, "Specified Radiation Dose")	NUMERIC	Units = EV (Gy,UCUM,"Gray")
Code included in: CID SUP147061 "Percentage and Dose Dosimetric Objectives"	EV (S147027, 99SUP147, "Specified Volume Percentage")	NUMERIC	Units = EV (%,UCUM,"Percent")
	EV (S147025, 99SUP147, "Specified Radiation Dose")	NUMERIC	Units = EV (Gy,UCUM,"Gray")
Code included in: CID SUP147062 "Volume and Dose Dosimetric Objectives"	EV (S147026, 99SUP147, "Specified Volume Size")	NUMERIC	Units = EV (cm3,UCUM,"Cubic Centimeter")
	EV (S147025, 99SUP147, "Specified Radiation Dose")	NUMERIC	Units = EV (Gy,UCUM,"Gray")
(S147010, 99SUP147, "Minimum Conformity Index")	EV (S147120, 99SUP147, "Specified Conformity Index")	NUMERIC	Units = EV (1,UCUM,"no units")
	EV (S147025, 99SUP147, "Specified Radiation Dose")	NUMERIC	Units = EV (Gy,UCUM,"Gray")
(S147011, 99SUP147, "Minimum Healthy Tissue Conformity Index")	EV (S147121, 99SUP147, "Specified Healthy Tissue Conformity Index")	NUMERIC	Units = EV (1,UCUM,"no units")
	EV (S147025, 99SUP147, "Specified Radiation Dose")	NUMERIC	Units = EV (Gy,UCUM,"Gray")
(S147012, 99SUP147, "Minimum Conformation Number")	EV (S147122, 99SUP147, "Specified Conformation Number")	NUMERIC	Units = EV (1,UCUM,"no units")
	EV (S147025, 99SUP147, "Specified Radiation Dose")	NUMERIC	Units = EV (Gy,UCUM,"Gray")
(S147013, 99SUP147, "Maximum Homogeneity Index")	EV (S147123, 99SUP147, "Specified Homogeneity Index")	NUMERIC	Units = EV (1,UCUM,"no units")
	EV (S147025, 99SUP147, "Specified Radiation Dose")	NUMERIC	Units = EV (Gy,UCUM,"Gray")

966

967 **C.AA.2.1.4.1.2.1   Dosimetric Objective Parameter Sequence Examples**

968 To describe the objective that a maximum of 30% of the volume can receive 50 Gy or more ($V_{50} \leq 30\%$), one would
969 use the Dosimetric Objective Type Code Sequence (gggg,9943) with code value : (S147015, 99SUP147,
970 "Maximum Percent Volume at Dose") with the parameters specified in the Dosimetric Objective Parameter
971 Sequence (gggg,9950) as follows:

972 Dosimetric Objective Sequence (gggg,9942):

973 ➢ Item 1:

974 ➢ Dosimetric Objective Type Code Sequence (gggg,9943):

975 o   Item 1:

976 o   (S147015, 99SUP147, "Maximum Percent Volume at Dose")

977 ➢ Dosimetric Objective Parameter Sequence (gggg,9950)

978 o   Item 1:

979 o   Value Type (0040,A040) = NUMERIC

980 o   Concept Name Code Sequence (0040,A043)

981 ▪   Item 1:

982 ▪   (S147027, 99SUP147; "Specified Volume Percentage")

983 o   Numeric Value (0040,A30A) = 30

984 o   Measurement Units Code Sequence (0040, 08EA)

985 ▪   Item 1:

986 ▪   (%, UCUM, "Percent")

987 o   Item 2:

988 o   Value Type (0040,A040) = NUMERIC

989 o   Concept Name Code Sequence (0040,A043)

990 ▪   Item 1:

991 ▪   (S147025, 99SUP147, "Specified Radiation Dose")

992 o   Numeric Value (0040,A30A) = 50

993 o   Measurement Units Code Sequence (0040,08EA)

994 ▪   Item 1:

995 ▪   (Gy, UCUM, "Gray")

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997 **C.AA.2.1.4.1.3   Radiobiological Dose Effect Sequence**

998 The Radiobiological Dose Effect Sequence (gggg,1130) specifies whether a code value of (Gy,UCUM,"Gray") in the
999 Measurement Units Code Sequence (0040,08EA) in the Dosimetric Objective Parameter Sequence (gggg,9950)
1000 denotes physical or effective dose.

1001 **C.AA.2.1.5   Radiobiological Dose Effect Description Macro**

1002 The Radiobiological Dose Effect Description Macro describes whether dose values are provided as physical dose or
1003 effective dose. An effective dose value incorporates adjustments to dose by taking into account the radiobiological
1004 effects.

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Table C.AA.2.1.5-1
Radiobiological Dose Effect Description Macro Attributes

Attribute Name	Tag	Type	Attribute Description
Radiobiological Dose Effect Flag	(gggg,1131)	1	Whether radiobiological effects are taken into account for a given dose value. Enumerated Values: NO = physical dose YES = effective dose after correction for biological effect
Effective Dose Calculation Method Category Code Sequence	(gggg,1132)	2C	The category of the method used to calculate the effective dose. Required, if Radiobiological Dose Effect Flag (gggg,1131) equals YES. Zero or more Items shall be included in this Sequence.
>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*Defined CID SUP147080 "Effective Dose Calculation Categories".*
>Effective Dose Calculation Method Code Sequence	(gggg,1134)	3	Defines the effective dose calculation method. One or more Items are permitted in this Sequence.
>>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*See C.AA.2.1.5.1.1.*
Effective Dose Calculation Method Description	(gggg,1137)	2C	The description of the method used to calculate the effective dose. Required, if Radiobiological Dose Effect Flag (gggg,1131) is YES.

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1008 **C.AA.2.1.5.1   Radiobiological Dose Effect Description Macro Attribute Descriptions**

1009 **C.AA.2.1.5.1.1 Effective Dose Method Modifier Code Sequence**

1010 The calculation of the radiobiological effect may be further described by a specific method.

1011 If the Effective Dose Calculation Method Category Code Sequence (gggg,1132) has the code value specified in the
1012 left column below, the CID for Effective Dose Calculation Method Code Sequence (gggg,1134) shall be the one
1013 specified in the right column below.

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Table C.AA.2.1.5-2
Effective Dose Calculation Method CIDs

Effective Dose Calculation Method Category Code Sequence (gggg,1132)	CID for Effective Dose Calculation Method Code Sequence (gggg,1134)
(S147500, 99SUP147, "Radiation transport-based methods")	DCID SUP147081 "Radiation Transport-Based Effective Dose Method Modifiers"
(S147501, 99SUP147, "Fractionation-based or temporally-based methods")	DCID SUP147082 "Fractionation-Based Effective Dose Method Modifers"

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1021   **C.AA.A1   Enhanced RT Series Module**

1022   The RT Second Generation IODs use the General Series Module described in section C.7.3.1, specialized by the
1023   Enhanced RT Series Module.

1024   Table C.AA.A1-1 specifies the Attributes that identify and describe general information about the Enhanced RT
1025   Series.

1026   **Table C.AA.A1-1**
1027   **Enhanced RT Series Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Type of equipment that originally acquired the data used to create the Instances in this Series. See C.AA.A1.1.1.
Series Number	(0020,0011)	1	A number that identifies this series.
Series Date	(0008,0021)	1	Date the Series started.
Series Time	(0008,0031)	1	Time the Series started.
Referenced Performed Procedure Step Sequence	(0008,1111)	1C	Uniquely identifies the Performed Procedure Step SOP Instance that resulted in creation of the Series (e.g. a Modality or Unified Procedure Step SOP Instance). Only a single Item shall be included in this Sequence. Required if the series has been created as a result of a single procedure step request and the Instance-Level Referenced Performed Procedure Step Sequence (gggg,9802) is not present. If different instances Instances in the series are created as a result of a procedure step, the Instance-Level Referenced Performed Procedure Step Sequence (gggg,9802) in the Radiotherapy Common Instance Module shall be used.
>Include Table 10-11 "SOP Instance Reference Macro Attributes"			

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1030   **C.AA.A1.1   Enhanced RT Series Attribute Descriptions**

1031   **C.AA.A1.1.1   Modality**

1032   The Modality (0008,0060) is defined for each IOD including the Enhanced RT Series Module. -

1033   Enumerated Values are:

1034   • RTINTENT

1035   • RTSEGANN

1036   **C.AA.A2   Radiotherapy Common Instance Module**

1037   Table C.AA.A2-1 specifies the Attributes that identify and describe general information in RT Second Generation
1038   IODs.

1039   **Table C.AA.A2-1**
1040   **Radiotherapy Common Instance Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Instance Creation Date	(0008,0012)	1	Date the SOP Instance was created.
Instance Creation Time	(0008,0013)	1	Time the SOP Instance was created.
Content Date	(0008,0023)	1	The date the content creation started.
Content Time	(0008,0033)	1	The time the content creation started.
Author Identification Sequence	(gggg,1321)	2	The person that created the entire clinical content of this document. Zero or more Items shall be included in this Sequence.
>*Include Table C.17-3b "Identified Person or Device Macro Attributes"*			*Context ID may be defined in the Macro invocation.* *The Observer Type (0040,A084) shall be PSN.*
Instance-Level Referenced Performed Procedure Step Sequence	(gggg,9802)	1C	Uniquely identifies the Performed Procedure Step SOP Instance that resulted in creation of this Instance (e.g. a Modality or Unified Procedure Step SOP Instance). Required if this Instance has been created as a result of a procedure step request and the Referenced Performed Procedure Step Sequence (0008,1111) is not present. One or more Items shall be included in this Sequence.
>*Include Table 10-11 "SOP Instance Reference Macro Attributes"*			

1041

1042   **C.AA.B1   RT Physician Intent Module**

1043   The RT Physician Intent Module contains information about the overall intent of the treatment. The content is mostly
1044   descriptive text and allows for the presence of unstructured advice by the physician along the established
1045   nomenclature of the actual institution.

1046   **Table C.AA.B1-1**
1047   **RT Physician Intent Module Attributes**

Attribute Name	Tag	Type	Description
Include Table 10.A2-1 "Extended Content Identification Macro Attributes"			
RT Treatment Phase Intent Presence Flag	(gggg,9808)	1	Whether an RT Treatment Phase Intent definition is present. Enumerated Values: YES NO

Attribute Name	Tag	Type	Description
RT Physician Intent Sequence	(gggg,9912)	1	The overall goals or aims intended by the physician, for the Radiotherapy. One or more Items shall be included in this Sequence. See C.AA.B1.1.1
>RT Physician Intent Index	(gggg,9913)	1	Index of the RT Physician Intent in the Sequence. The value shall start at 1 and increase monotonically by 1.
>Treatment Site	(gggg,9961)	1	A free-text label describing the anatomical treatment site.
>Treatment Site Code Sequence	(gggg,9962)	2	Coded description of the treatment site. Zero or more Items shall be included in this Sequence.
>>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*No Baseline CID is defined.*
>RT Physician Intent Narrative	(gggg,9915)	2	Narrative of RT Physician Intent.
>RT Treatment Intent Type	(gggg,9914)	2	Type of treatment intent. Defined Terms: CURATIVE PALLIATIVE PROPHYLACTIC
>RT Physician Intent Predecessor Sequence	(gggg,9910)	1C	Reference to the RT Physician Intent SOP Instance which was replaced by this RT Physician Intent. Required if this RT Physician Intent replaces a previous version. Only a single Item shall be included in this Sequence.
>>*Include Table 10-11 "SOP Instance Reference Macro Attributes"*			
>>Reason for Superseding	(gggg,9917)	2	Reason that the previous RT Physician Intent was superseded by this RT Physician Intent.
>RT Treatment Approach Label	(gggg,9911)	2	Characterization of the case and intended treatment approach. See C.AA.B1.1.4.
>RT Protocol Code Sequence	(gggg,9916)	2	The protocol(s) selected by the RT Physician. Zero or more Items shall be included in this Sequence. See C.AA.B1.1.2.
>>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*No Baseline CID is defined.*
>RT Diagnosis Code Sequence	(gggg,9918)	2	Diagnosis codes to describe the condition handled by this RT Physician Intent. Zero or more Items shall be included in this Sequence.
>>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*No Baseline CID is defined.*

Attribute Name	Tag	Type	Description
>RT Physician Intent Input Instance Sequence	(gggg,991A)	2	References to SOP Instances used to establish the RT Physician Intent. Zero or more Items shall be included in this Sequence. See C.AA.B1.1.3.
>>*Include Table 10.A9-1 "Related Information Entities Macro Attributes"*			*Defined CID SUP147010 " Purpose of Reference for RT Physician Intent Input".*

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C.AA.B1.1   RT Physician Intent Attribute Descriptions

C.AA.B1.1.1   RT Physician Intent Sequence

The RT Physician Intent Sequence (gggg,9912) allows one or more clinical intents to be identified for treatment in a treatment course. For example, the simultaneous treatment of multiple primary targets may require separate intents to be defined, each with its own prescription(s) and having different sets of reference imaging studies.

C.AA.B1.1.2   RT Protocol Code Sequence

RT Protocol Code Sequence (gggg,9916) contains a coded description of the radiotherapy clinical protocol being followed for the patient. This is not necessarily the same as the Procedure Step protocol.

C.AA.B1.1.3   RT Physician Intent Input Instance Sequence

The purpose of this Sequence is to reference all the Instances that have been used by the RT Physician to establish the Intent. It may include the Images that were used in the treatment planning process, which are also referenced in the Planning Input Information Sequence (gggg,9960) of the RT Enhanced Prescription Module.

When there are multiple Purposes of References, one Item will be included for each purpose.

C.AA.B1.1.4   RT Treatment Approach Label

The RT Treatment Approach Label (gggg,9911) is a short human-readable text label that is meaningful in the context of the patient's disease and the treatment site. Such labels may be found in the literature, or defined as local departmental naming conventions. They are usually not standardized. Examples are terms like Conformal, Conical_Arc, Conformal_Arc, Electron Boost for Breast, TBI, TMI, TSE, CSI, IMAT_VMAT, Total_Spine.

C.AA.B2   RT Enhanced Prescription Module

The RT Enhanced Prescription Module describes the delivery objectives and labels for intended treatment for a specific target, as defined by the physician.

Table C.AA.B2-1
RT Enhanced Prescription Module Attributes

Attribute Name	Tag	Type	Description
RT Prescription Sequence	(gggg,9940)	1	Prescriptions to deliver therapeutic radiation. One or more Items shall be included in this Sequence.
>RT Prescription Label	(gggg,9902)	1	User-defined label for this prescription. See 10.A3.1.1.
>RT Prescription Index	(gggg,9118)	1	Index of the prescription in the Sequence. The value shall start at 1 and increase monotonically by 1.

Attribute Name	Tag	Type	Description
>Referenced RT Physician Intent Index	(gggg,9919)	1C	The value of the RT Physician Intent Index (gggg,9913) in the RT Physician Intent Sequence (gggg,9912) corresponding to the intent for which this prescription is created. Required if Referenced Parent RT Prescription Index (gggg,9149) is absent. See C.AA.B2.1.5.
>Referenced Parent RT Prescription Index	(gggg,9149)	1C	The value of the RT Prescription Index (gggg,9118) corresponding to a prescription that is the parent prescription to this one. This attribute shall reference a Prescription that contains Referenced RT Physician Intent Index (gggg,9919). Required if the Referenced RT Physician Intent Index (gggg,9919) is absent. See C.AA.B2.1.5.
>Referenced Dosimetric Objectives Sequence	(gggg,9951)	2	References to Dosimetric Objectives in the Dosimetric Objective Sequence (gggg,9942) applicable to this prescription. See C.AA.B2.1.6. Zero or more Items shall be included in this Sequence.
>>Referenced Dosimetric Objective UID	(gggg,9949)	1	Reference to a Dosimetric Objective UID (gggg,9948) in the Dosimetric Objective Sequence (gggg,9942).
>>Dosimetric Objective Weight	(gggg,9956)	1C	Weight of importance to be applied to the Dosimetric Objective. A higher value means that this objective is more important. Values are only meaningful within the Items in this Sequence. The use of weight value in the process of optimization and treatment parameter definition is implementation-dependent. Required if Absolute Dosimetric Objective Flag (gggg,9954) is NO.
>RT Anatomic Prescription Sequence	(gggg,9920)	1	Prescriptions for an anatomic region. One or more Items shall be included in this Sequence.
>>*Include Table 10.A3-1 "Entity Labeling Macro Attributes"*			
>>Therapeutic Role Category Code Sequence	(gggg,9930)	1	The general category of the therapeutic role of this anatomic region. Only a single Item shall be included in this Sequence.
>>>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*Defined CID SUP147004 "Radiotherapy Therapeutic Role Categories".*
>>Therapeutic Role Type Code Sequence	(gggg,9931)	1	The specific property type of the therapeutic role of this anatomic region. Only a single Item shall be included in this Sequence. See C.AA.B2.1.1.
>>>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*Defined CID is defined in C.AA.B2.1.1.*

Attribute Name	Tag	Type	Description
>>Conceptual Volume Optimization Precedence	(gggg,9933)	2	Value used to resolve usage of overlapping regions of Conceptual Volumes during dose optimization.
			An overlapping region is part of the Conceptual Volume(s) with the lowest number. An overlapping region is not part of any other Conceptual Volume with a higher number.
			Overlapping regions with equal precedence are part of all Conceptual Volumes with the same value.
			Any number takes precedence over an empty value.
>>Conceptual Volume Blocking Constraint	(gggg,9935)	2	Constraints on primary radiation passing through the current Conceptual Volume.
			Enumerated Values:
			NONE = No constraint
			UPSTREAM = The optimization is constrained to minimize primary radiation from the source passing through the current Conceptual Volume. The Conceptual Volume is upstream of the target.
			DOWNSTREAM = The optimization is constrained to minimize primary radiation from the source passing through the current Conceptual Volume. The Conceptual Volume is downstream of the target.
			TOTAL = The optimization is constrained to minimize primary radiation passing through the current Conceptual Volume.
			Primary Radiation is defined as modulated or shaped radiation, as opposed to scattered radiation or transmission radiation.
>>Conceptual Volume Category Code Sequence	(gggg,9934)	2	The general category of this Conceptual Volume for radiotherapy purposes.
			Zero or one Item shall be included in this Sequence.
>>>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*Defined CID SUP147002 "Prescription Anatomy Categories".*
>>Conceptual Volume Type Code Sequence	(gggg,9936)	1C	The specific type of this Conceptual Volume for radiotherapy purposes.
			Only a single Item shall be included in this Sequence.
			Required if Anatomy Property Category Code Sequence (gggg,0934) sequence contains one Item.
			See C.AA.B2.1.2.
>>>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*Context groups are defined in C.AA.B2.1.2.*
>>Conceptual Volume Type Modifier Code Sequence	(gggg,9937)	3	The modifier of the specific type of this Conceptual Volume for radiotherapy purposes.
			Only a single Item is permitted in this Sequence.
>>>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*Defined CID 244 "Laterality".*

Attribute Name	Tag	Type	Description
>>Conceptual Volume Sequence	(gggg,1346)	1	Conceptual Volume for which therapeutic goals are prescribed. See C.AA.B2.1.3. Only a single Item shall be included in this Sequence. The same Conceptual Volume UID (gggg,1301) shall not appear in more than one Item of the RT Anatomic Prescription Sequence (gggg,9920).
>>>*Include Table 10.A6-1 "Conceptual Volume Segmentation Reference and Combination Macro Attributes"*			
>>Conceptual Volume Description	(gggg,1319)	2	Description of the Conceptual Volume.
>Referenced RT Treatment Phase Sequence	(gggg,9870)	1C	Referenced treatment phase(s) to which this prescription applies. Required if RT Treatment Phase Intent Presence Flag (gggg,9808) of this RT Physician Intent SOP Instance equals YES. One or more Items shall be included in this Sequence.
>>Referenced RT Treatment Phase Index	(gggg,9146)	1	Value of RT Treatment Phase Index (gggg,9116) in the Intended RT Treatment Phase Sequence (gggg,9880) where this prescription is related to.
>Fraction-Based Relationship Sequence	(gggg,9982)	2	The relationship of this prescription to another prescription, expressed in fractions. Zero or one Item shall be included in this Sequence. See C.AA.B2.1.4.
>>Referenced RT Prescription Index	(gggg,9148)	1	Value of RT Prescription Index (gggg,9118) in the RT Prescription Sequence (gggg,9940) specifying the prescription to which the current prescription is related.
>>Fraction-Based Relationship Interval Anchor	(gggg,9984)	1	The anchor point of this RT Prescription Sequence Item with respect to the prescription referenced by Referenced RT Prescription Index (gggg,9148). Enumerated Values: START: The interval is specified with respect to the start of the referenced prescription. END: The interval is specified with respect to the end of the referenced prescription.

Attribute Name	Tag	Type	Description
>>Number of Interval Fractions	(gggg,9971)	1	The interval expressed in number of fractions. The Fraction-Based Relationship Interval Anchor (gggg,9984) establishes the anchor point to which the interval is tied.
			A value of 0 means that the current prescription is intended to start simultaneously with the anchor of the related prescription.
			If Fraction-Based Relationship Interval Anchor (gggg,9984) equals START, the value shall be 0 or positive. This is the number of fractions after the first fraction of the delivery of the referenced prescription that the delivery of the current prescription is intended to start.
			If Fraction-Based Relationship Interval Anchor (gggg,9984) equals END, the value shall be negative or 0. This is the number of fractions prior to the last fraction of the delivery of the referenced prescription that the delivery of the current prescription is intended to start.
>Prior Treatment Dose Description	(gggg,9924)	2	Description of radiotherapy treatment previously delivered to the patient for the purpose of evaluation of prior dose.
>Prior Treatment Reference Sequence	(gggg,9925)	2	References to SOP Instances representing prior treatments, e.g. for the purpose of extracting information about prior dose.
			Zero or more Items shall be included in this Sequence.
>>Include Table 10-11 "SOP Instance Reference Macro Attributes"			
>Planning Input Information Sequence	(gggg,9960)	2	References to SOP Instances to be used during planning for the delivery of this prescription.
			When there are multiple Purposes of References, one Item will be included for each purpose.
			Zero or more Items shall be included in this Sequence.
>>Include Table 10.A9-1 "Related Information Entities Macro Attributes"			*Defined CID SUP147011 " Purpose of Reference for RT Treatment Planning Input".*
>Prescription Notes	(gggg,9970)	3	Notes on this prescription, such as special provisions for this patient's treatment or other patient conditions.
>Number of Fractions	(gggg,9972)	3	Number of Fractions in this prescription.
>Intended Delivery Duration	(gggg,9973)	3	Number of days across which the fractions in this prescription will be delivered.
>Fractionation Notes	(gggg,9974)	3	Notes describing the fractionation approach.
>Delivery Time Structure Code Sequence	(gggg,9994)	3	The time structure, i.e. fractionation type, to be used for the delivery of treatment.
			Zero or one Items shall be included in this Sequence.
>>Include Table 8.8-1 "Code Sequence Macro Attributes"			*Baseline CID SUP147068 "Delivery Time Structure"*
>Include Table C.AA.2.1.1-1 "Radiation Fraction Pattern Macro Attributes"			
>Treatment Technique Notes	(gggg,9966)	3	Notes on the treatment technique to be used.

Attribute Name	Tag	Type	Description
>Radiotherapy Treatment Type	(gggg,9810)	3	Type of radiotherapy. Enumerated Values: TELETHERAPY = treatment in which the source of the radiation is at a distance from the body. BRACHYTHERAPY = treatment in which the source of radiation is placed close to the surface of the body or within the body.
>Teletherapy Radiation Type	(gggg,9811)	3	Type of Radiation used to deliver Teletherapy. Defined Terms: PHOTON NEUTRON ELECTRON ION Maybe present only if Radiotherapy Treatment Type (gggg,9980) has a value of TELETHERAPY.
>Brachytherapy Source Type	(gggg,9812)	3	Type of Source used to deliver Brachytherapy. Defined Terms: ISOTOPIC ELECTRONIC Maybe present only if Radiotherapy Treatment Type (gggg,9980) has a value of BRACHYTHERAPY.
>RT Treatment Technique Code Sequence	(gggg,9976)	3	Treatment technique to be used. One or more Items are permiited in this Sequence.
>>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*Defined CID SUP147047 "Radiotherapy Procedure Techniques".*
>Patient Treatment Orientation Sequence	(gggg,5032)	2	Orientation of the Patient for the treatment. Zero or one Item shall be included in this Sequence.
>>Patient Orientation Code Sequence	(0054,0410)	1	Orientation of the patient with respect to gravity. See C.8.4.6.1.1 for further explanation. Only a single Item shall be included in this Sequence.
>>>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*Defined CID 19 "Patient Orientation".*
>>>Patient Orientation Modifier Code Sequence	(0054,0412)	1C	Sequence describing the orientation of the patient with respect to gravity. Required if needed to fully specify the orientation of the patient with respect to gravity. Only a single Item shall be included in this Sequence.
>>>>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*Defined CID 20 "Patient Orientation Modifier".*
>>Patient Equipment Relationship Code Sequence	(gggg,5030)	1	Orientation of the patient with respect to equipment. Only a single Item shall be included in this Sequence. See C.AA.B2.1.8.
>>>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*Defined CID 21 "Patient Equipment Relationship".*

Attribute Name	Tag	Type	Description
>Prescription Notes Sequence	(gggg,9978)	3	Annotations on aspects of the prescription, like preparation and execution of the treatment.
			One or more Items are permitted in this Sequence.
>>Include Table 10-2 "Content Item Macro Attributes"			Defined TID SUP147001 "RT Prescription Annotation"
Dosimetric Objective Sequence	(gggg,9942)	1C	Dosimetric Objectives defined for one or more prescription within module.
			Each Dosimetric Objective referenced in the Referenced Dosimetric Objectives Sequence (gggg,9951) shall have a corresponding Item in this Sequence.
			Only Dosimetric Objectives which are referenced in the Referenced Dosimetric Objectives Sequence (gggg,9951) shall be present in this sequence.
			Required if any Item in the Referenced Dosimetric Objectives Sequence (gggg,9951) references a Dosimetric Objective.
			One or more Items shall be included in this Sequence.
			See C.AA.B2.1.6.
>Include Table C.AA.2.1.4-1 "Dosimetric Objective Macro Attributes"			
>Referenced Conceptual Volume UID	(gggg,1306)	1C	The UID of the Conceptual Volume in the RT Anatomic Prescription Sequence (gggg,9920) to which this Dosimetric Objective applies.
			Required if the Dosimetric Objective applies to a specific anatomy.
>Dosimetric Objective Evaluation Scope	(gggg,9926)	1	Whether the Dosimetric Objective is intended to be evaluated over a lifetime scope or only in respect to the current prescriptions.
			Enumerated Values:
			CURRENT The Dosimetric Objective applies to the referencing prescriptions
			LIFETIME The Dosimetric Objective applies to the referencing prescriptions and accumulated lifetime dose.
			See C.AA.B2.1.7.

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1074 **C.AA.B2.1   RT Enhanced Prescription Attribute Descriptions**

1075 **C.AA.B2.1.1   Therapeutic Role Type Code Sequence**

1076 The Therapeutic Role Type Code Sequence (gggg,9931) further specifies the role of the anatomy along the
1077 Therapeutic Role Category (gggg,9930). The following requirements apply to the codes permitted in the Therapeutic
1078 Role Type Code Sequence (gggg,9931), when the code used in the Therapeutic Role Category Code Sequence
1079 (gggg,9930) is as follows:

1080   **Table C.AA.B2-2**
1081   **Therapeutic Role Type Codes**

Code Value of Therapeutic Role Category Sequence (gggg,9930)	CID for Therapeutic Role Property Type Sequence (gggg,9931)

| (S147050, 99SUP147, "RT Target") | DCID SUP147070 "Radiotherapy Targets" |
| (S147051, 99SUP147, "RT Dose Calculation Structure") | DCID SUP147071 "Radiotherapy Dose Calculation Roles" |

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C.AA.B2.1.2   Conceptual Volume Type Code Sequence

The Conceptual Volume Type Code Sequence (gggg,9936) further specifies the type of the anatomy along the Conceptual Volume Category Code Sequence (gggg,9934). The following requireme

nts apply to the codes permitted in the Conceptual Volume Type Code Sequence (gggg,9936), when the code used in the Conceptual Volume Type Code Sequence (gggg,9936) is as follows:

Table C.AA.B2-3
Anatomy Property Type Codes

Code Value of Conceptual Volume Category Code Sequence (gggg,9934)	CID for Conceptual Volume Type Code Sequence (gggg,9936)
(T-D000A, SRT, "Anatomical Structure")	BCID SUP147023 "Anatomical Structures for Radiotherapy"
(S147059, 99SUP147, "External Body Model")	DCID SUP147008 "External Body Models"
(A-00004, 99SUP147, "Physical Object")	BCID 7157 "Device Segmentation Types", BCID 6040 "Non-lesion Object Type"
(S147057, 99SUP147, "Non-specific Volume")	DCID SUP147009 "Nonspecific Volumes"

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For code values of the Conceptual Volume Type Code Sequence (gggg,9936) not listed above no baseline CID is defined.

C.AA.B2.1.3   Conceptual Volume Sequence

The Conceptual Volume Sequence (gggg,1346) identifies the Conceptual Volume associated with an RT Anatomy Prescription Item. If the Conceptual Volume is associated with a segment, the segment is defined by the Referenced Segment Reference Index (gggg,1340) in the Conceptual Volume Reference Combination and Segmentation Macro (see section 10.A6). Alternatively, the anatomy volume may not (yet) be associated with a segment. For example, an initial prescription may be entered prior to the definition of an organ at risk.

C.AA.B2.1.4   Fraction-Based Relationship Sequence

The Fraction-Based Relationship Sequence (gggg,9982) is used to specify the relationship between two prescriptions.

The following example shows a treatment performed in 2 phases with a break of 7 days between phases.

In RT Treatment Phase 1, the treatment of Prescription B is intended to start 10 fractions prior to the end of Prescription A.

The RT Treatment Phase Intent Module C.AA.B1 is used to specify the relationship of treatment phases to each other.

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Timeline
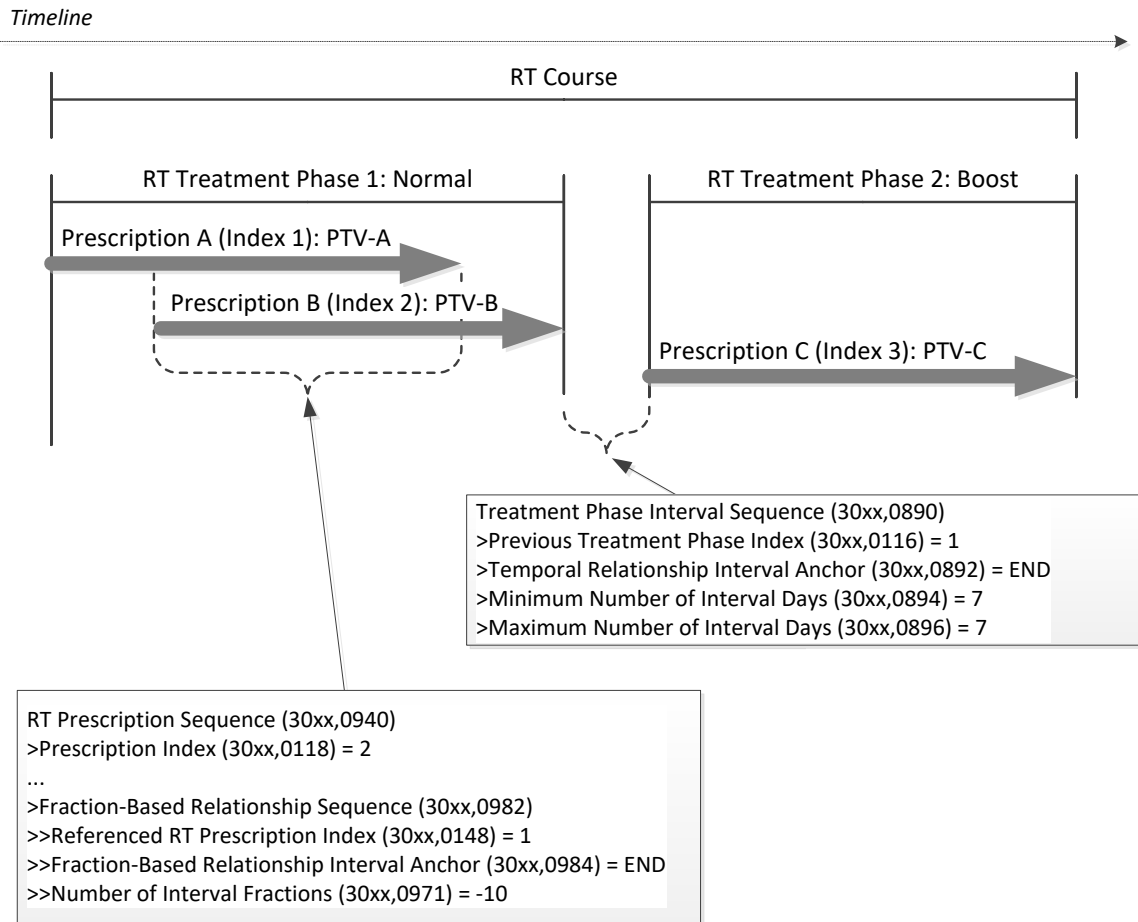
1108

Figure C.AA.B2.1-1. Relationship of Phases and Prescriptions

C.AA.B2.1.5   Parent RT Prescription

The RT Enhanced Prescription Module supports a two-level prescription model (see Figure C.AA.B2.1-2) in order to document an approach where a high-level prescription is created and then more details may be added. The first level would typically be created during the time of prescription definition with only high-level prescription information based on the RT Physician Intent. The second level, if present, would represent a derived prescription containing more detailed information, such as constraints and objectives. A third or subsequent levels are not permitted.

Parent Prescription

Right Oropharynx Cancer Treatment

• Curative

• Target Dose: 70 Gy

• Two Phase with Field Reduction

Child Prescriptions

Right Oropharynx and
Rt Neck Nodal Volumes

• Target Dose: 28 x 2 Gy = 56 Gy

• IMRT 9 Fields
• Photons 6X

Right Oropharynx PTV alone

• Target Dose: 7 x 2 Gy = 14 Gy

• IMRT 7 Field Boost
• Photons 6X
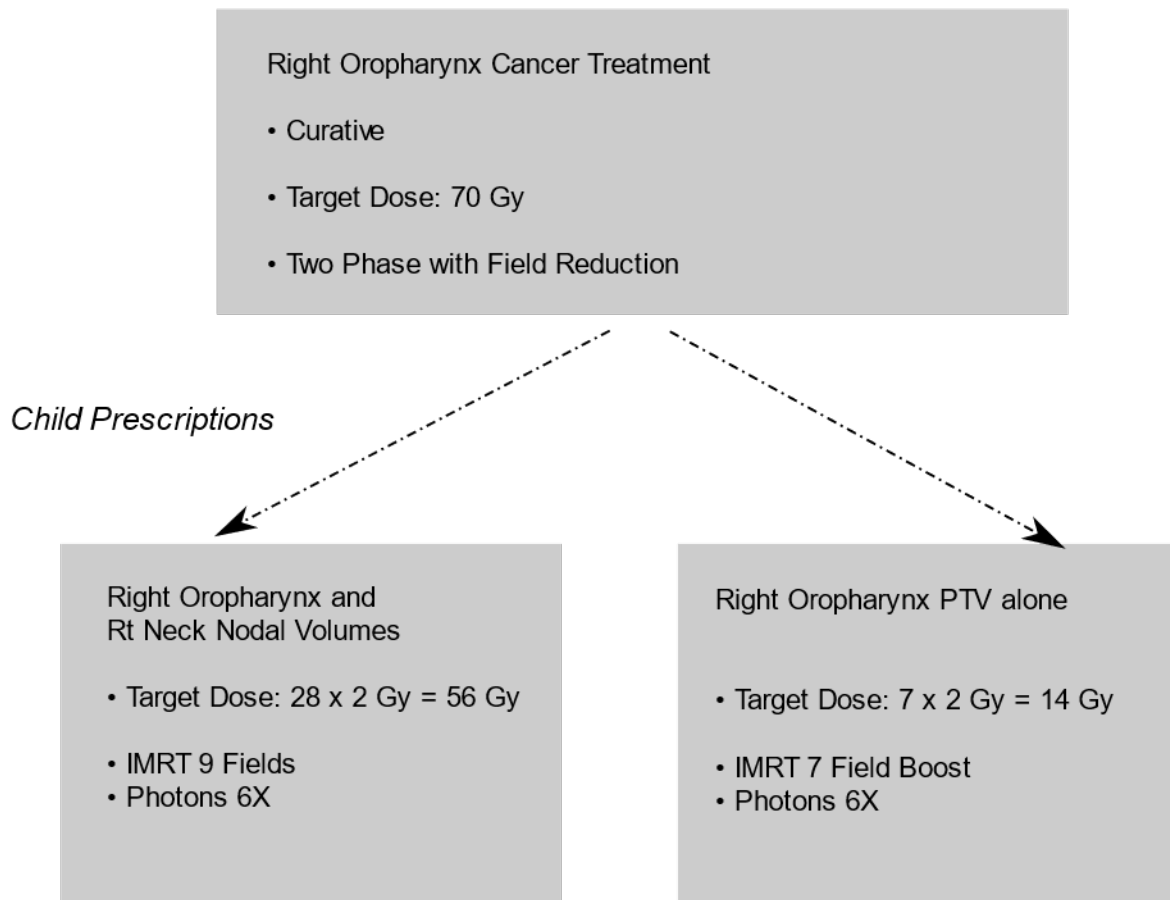
1116

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1118   **Figure C.AA.B2.1-2. Parent and Child RT Prescriptions**

1119   **C.AA.B2.1.6   Dosimetric Objective Sequence**

1120   The Dosimetric Objective Sequence (gggg,9942) specifies a set of intended dosimetric goals.

1121   Each item of the Dosimetric Objective Sequence (gggg,9942) shall be referenced by at least one item of the
1122   Referenced Dosimetric Objectives Sequence (gggg,9951) in the current Instance.

1123   Within an RT Physician Intent SOP Instance, a Dosimetric Objective is applicable to all Prescriptions in which the
1124   Dosimetric Objective UID (gggg,9948) is referenced.

1125   A Dosimetric Objective is intended to be satisfied by the combined effect of all treatments associated with
1126   prescriptions that reference the Dosimetric Objective UID (gggg,9949).

1127   For example, if there are primary and boost prescriptions that reference the same Dosimetric Objective UID
1128   (gggg,9948) then the combined effect of both prescriptions is intended to comply with the limit in this Dosimetric
1129   Objective.

1130   **C.AA.B2.1.7   Dosimetric Objective Evaluation Scope**

1131   For Dosimetric Objectives that include a dose value, the value defines the total dose for all fractions of all
1132   prescriptions referencing this Dosimetric Objective, and potentially dose from previous treatment, depending on the
1133   value of Dosimetric Objective Evaluation Scope (gggg,9926).

1134   If Dosimetric Objective Evaluation Scope (gggg,9926) has a value of LIFETIME, information from prior treatments
1135   shall be included in the evalution of the Dosimetric Objective.

1136   For example, if an organ has received dose in a prior treatment, and Dosimetric Objective Evaluation Scope
1137   (gggg,9926) is marked as LIFETIME, then the previously delivered dose shall be included in the evalution of this
1138   objective. Information about prior treatments may be described in Prior Treatment Dose Description (gggg,9924) or
1139   by Instances referenced by the Prior Treatment Reference Sequence (gggg,9925) in RT Prescription Sequence
1140   (gggg,9940).

1141   If Dosimetric Objective Evaluation Scope (gggg,9926) has a value of CURRENT, the objective includes only those
1142   prescriptions which reference the same Dosimetric Objective, even if information of a prior treatment is available.

1143   **C.AA.B2.1.8   Patient Equipment Relationship Code Sequence**

1144   The Patient Equipment Relationship Code Sequence (gggg,5030) specifies the orientation of the patient relative to
1145   the front of the equipment viewed from the patient support device. For example, in case of the equipment being a
1146   gantry, this is the direction from the table (being the patient support device) towards the gantry. In cases where it is
1147   not possible to understand unambigously the direction for a certain equipment, the equipment vendor shall
1148   document this direction in its Conformance Statement.

1149   **C.AA.B3   Intended RT Treatment Phase Module**

1150   RT Treatment Phases define the intended phases of treatment and their temporal relationship.

1151   **Table C.AA.B3-1**
1152   **RT Treatment Phase Intent Module Attributes**

Attribute Name	Tag	Type	Description
Intended RT Treatment Phase Sequence	(gggg,9880)	1	RT Treatment Phase definitions. RT Treatment Phases define the relationships between RT Radiation Set Instances which contain the treatment parameters for the radiation to be concurrently and/or subsequently delivered. The RT Treatment Phase Index (gggg,9116) shall define the temporal sequencing of the phases. One or more Items shall be included in this Sequence.
>*Include Table C.AA.2.1.2-1 "RT Treatment Phase Macro Attributes"*			*The RT Treatment Phase Index (gggg,9116) shall start at 1 and increase monotonically by 1 for successive Items in this Sequence.*
Include Table C.AA.2.1.3-1 "RT Treatment Phase Interval Macro Attributes"			

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1156 **C.AA.D1   RT Segment Annotation Module**

1157 The RT Segment Annotation Module references segments and provides radiotherapy-specific annotations for them.
1158 The geometry of each segment is defined by a referenced Segmentation, Surface Segmentation, RT Structure Set
1159 or any other general-purpose Instance that represents geometric information.

1160 The values of the following Attribute shall take precedence over values in the referenced SOP Instances:

1161 • Segment Annotation Category Code Sequence (gggg,1353)

1162 • Segment Annotation Type Code Sequence (gggg,1354)

1163   **Table C.AA.D1-1**
1164   **RT Segment Annotation Module Attributes**

Attribute Name	Tag	Type	Description
Include Table 10.A2-1 "Extended Content Identification Macro Attributes"			
Content Creator's Name	(0070,0084)	2	Name of the most recent person to significantly modify the content of this SOP Instance.
RT Segment Annotation Sequence	(gggg,1352)	1	Annotations for segments are described in this Sequence. One or more Items shall be included in this Sequence.
>RT Segment Annotation Index	(gggg,9121)	1	Index of the Segment. The value shall start at 1 and increase monotonically by 1.
>Include Table 10.A4-1 "Entity Long Labeling Macro Attributes"			
>Referenced Segment Reference Index	(gggg,1340)	1	The Segment Reference Index (gggg,1342) in the Segment Reference Sequence (gggg,1341) corresponding to the segment this Sequence Item relates to.
>Segment Annotation Category Code Sequence	(gggg,1353)	2	Category of the annotation of this segment. Zero or one Item shall be included in this Sequence.
>>Include Table 8.8-1 "Code Sequence Macro Attributes"			Defined CID SUP147003 "Radiotherapy Segment Annotation Categories".
>Segment Annotation Type Code Sequence	(gggg,1354)	1C	Specific type of the annotation of this segment. Required if Segment Annotation Category Code Sequence (gggg,1353) has a value. Only a single Item shall be included in this Sequence. See C.AA.D1.1.1.
>>Include Table 8.8-1 "Code Sequence Macro Attributes"			Defined CID is defined in C.AA.D1.1.1.
>Segmentation Creation Template Label	(gggg,1332)	3	Label for the template used to define the set of segments to be created from patient images and the names, codes, default presentation parameters associated with those segments.
>Segmented RT Accessory Device Sequence	(gggg,1349)	2	RT accessory device identification information. Zero or more Items shall be included in this Sequence. See C.AA.D1.1.2.

Attribute Name	Tag	Type	Description
>>Device Index	(gggg,9112)	1	Index of the Device. The value shall start at 1 and increase monotonically by 1.
>>Include Table 10.A7-1 "Device Model Macro Attributes"			
>>Include Table 10.A8-1 "Device Identification Macro Attributes"			Defined CID SUP147040 "Segmented RT Accessory Devices".
>Segment Characteristics Precedence	(gggg,134D)	2	Value used to resolve usage of characteristic of overlapping regions of Conceptual Volumes. In overlapping regions, the characteristic of the Conceptual Volume with the lowest number has precedence. Any number takes precedence over an empty value. The effect of precedence on the use of the characteristics is not defined in the standard. Non-empty values shall be unique within all Items of this Sequence.
>Segment Characteristics Sequence	(gggg,134B)	3	Characteristics associated with the current segment. One or more Items are permitted in this Sequence.
>>Include Table 10-2a "Content Item with Modifiers Macro Attributes"			Defined TID SUP147003 "RT Segment Characteristics"
>Recommended Display Grayscale Value	(0062,000C)	3	A default single gray unsigned value in which it is recommended that the maximum pixel value in this surface be rendered on a monochrome display. The units are specified in P-Values from a minimum of 0000H (black) up to a maximum of FFFFH (white). Note: The maximum P-Value for this Attribute may be different from the maximum P-Value from the output of the Presentation LUT, which may be less than 16 bits in depth.
>Recommended Display CIELab Value	(0062,000D)	3	A default triplet value in which it is recommended that the surface be rendered on a color display. The units are specified in PCS-Values, and the value is encoded as CIELab.
>Recommended Presentation Opacity	(0066,000C)	3	Specifies the opacity in which it is recommended that the surface be rendered. See C.27.1.1.3.
>Recommended Presentation Type	(0066,000D)	3	Specifies the representation type in which it is recommended that the surface be rendered. See C.27.1.1.3.

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1166 **C.AA.D1.1   RT Segment Annotation Attribute Descriptions**

1167 **C.AA.D1.1.1   RT Segment Annotation Type Code Sequence**

1168 If the Segment Annotation Category Code Sequence (gggg,1353) has the code value specified in the left column
1169 below, the CID for Segment Annotation Type Code Sequence (gggg,1354) shall be the one specified in the right
1170 column below.

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Table C.AA.D1-2
RT Segment Annotation Type CIDs

Code Value of Segment Annotation Category Code Sequence (gggg,1353)	CID for Segment Annotation Type Code Sequence (gggg,1354)
(S147050, 99SUP147, "RT Target")	DCID SUP147070 "Radiotherapy Targets"
(S147051, 99SUP147, "RT Dose Calculation Structure")	DCID SUP147071 "Radiotherapy Dose Calculation Roles"
(S147053, 99SUP147, "RT Geometric Information")	DCID SUP147005 "RT Geometric Information"
(S147059, 99SUP147, "External Body Model")	DCID SUP147008 "External Body Models"
(S147054, 99SUP147, "Fixation or Positioning Device")	DCID SUP147006 "Fixation or Positioning Devices"
(S147055, 99SUP147, "Brachytherapy Device")	DCID SUP147007 "Brachytherapy Devices"
(A-00004, SRT, "Physical Object")	BCID 7157 "Device Segmentation Types", BCID 6040 "Non-lesion Object Type"
(S147057, 99SUP147, "Non-specific Volume")	DCID SUP147009 "Nonspecific Volumes"

1173

1174 For code values of the Segment Annotation Category Code Sequence (gggg,1353) not listed above no baseline CID
1175 is defined.

1176 **C.AA.D1.1.2   Segmented RT Accessory Device Sequence**

1177 RT accessory device identification information when this segment represents a device.

1178   Note: For an RT accessory device, typically the Segmented Property Category Code Sequence (0062,0003) has one of
1179   the following values:
1180   (S147054, 99SUP147, "Fixation or Positioning Device")
1181   (S147055, 99SUP147, "Brachytherapy Device")
1182   (A-00004, SRT, "Physical Object")

1183

1184 **C.AA.D2   Segment Reference Module**

1185 The Segment Reference Module references geometrical representations, such as regions of interest, surfaces,
1186 lines, or points, which have been associated with a Conceptual Volume.

1187 These referenced representations are referred to as segments.

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Table C.AA.D2-1
Segment Reference Module Attributes

1190

Attribute Name	Tag	Type	Description
Segment Reference Sequence	(gggg,1341)	1	References to segments. One or more Items shall be included in this Sequence. See C.AA.D2.1.3.
>Segment Reference Index	(gggg,1342)	1	Index of the segment reference in the Sequence. The value shall start at 1 and increase monotonically by 1.
>Direct Segment Reference Sequence	(gggg,1343)	1C	Directly identifies a specific segment in a specific SOP Instance. Required if Combination Segment Reference Sequence (gggg,1344) is not present. Only a single Item shall be included in this Sequence. See C.AA.D2.1.3.

Attribute Name	Tag	Type	Description
>>*Include Table 10.A5-1 "Conceptual Volume Macro Attributes"*			
>>Referenced SOP Sequence	(0008,1199)	1	The SOP Instance that contains the referenced segment. Only a single Item shall be included in this Sequence. See C.AA.D2.1.1.
>>>*Include Table 10-11 "SOP Instance Reference Macro Attributes"*			
>>Referenced Segment Number	(0062,000B)	1C	Segment Number (0062,0004) in the referenced SOP Instance. Required as described in C.AA.D2.1.1. Only a single Item shall be included in this Sequence.
>>Referenced Fiducials UID	(gggg,5031)	1C	Fiducials UID (0070,031A) in the referenced SOP Instance. Required as described in C.AA.D2.1.1. See C.AA.D2.1.1.
>>Referenced ROI Number	(3006,0084)	1C	ROI Number (3006,0022) in the referenced SOP Instance. Required as described in C.AA.D2.1.1. See C.AA.D2.1.1.
>>Referenced Surface Number	(0066,002C)	1C	Surface Number (0066,0003) in the referenced SOP Instance. Required as described in C.AA.D2.1.1. See C.AA.D2.1.1.
>Combination Segment Reference Sequence	(gggg,1344)	1C	Defines a segment as a combination of other segment Items present in the Segment Reference Sequence (gggg,1341). Required if the Direct Segment Reference Sequence (gggg,1343) is not present. Only a single Item shall be included in this Sequence. See C.AA.D2.1.3.
>>*Include Table 10.A6-1 "Conceptual Volume Segmentation Reference and Combination Macro Attributes"*			*See C.AA.D2.1.2.*
>>Segmented Property Category Code Sequence	(0062,0003)	2	Sequence defining the general category of the property the segment combination represents. Zero or one Item shall be included in this Sequence.
>>>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*Baseline CID 7150 "Segmentation Property Categories".*
>>Segmented Property Type Code Sequence	(0062,000F)	1C	Sequence defining the modifier of the property type the segment combination represents. Required if Segmented Property Category Code Sequence (0062,0003) has a value. Only a single Item shall be included in this Sequence.
>>>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*Baseline CID 7151 "Segmentation Property Types".*

Attribute Name	Tag	Type	Description
Referenced Spatial Registration Sequence	(0070,0404)	1C	Registrations between Frames of Reference of Instances referenced in the Referenced SOP Sequence (0008,1199) in the Direct Segment Reference Sequence (gggg,1343). Required if any Item in the Combination Segment Reference Sequence (gggg,1344) combines segments that do not have the same Frame of Reference UID (0020,0052). May be present otherwise. One or more Items shall be included in this Sequence.
>*Include Table 10-11 "SOP Instance Reference Macro Attributes"*			

1191

1192

1193 **C.AA.D2.1   Segment Reference Attribute Descriptions**

1194 **C.AA.D2.1.1   Segmentation SOP Instance Reference Sequence**

1195 Only the SOP Classes contained in Table C.AA.D2-2 shall be referenced.

1196 **Table C.AA.D2-2**
1197 **Permitted SOP Classes**

1198

SOP Class Name	SOP Class UID	Referenced Attribute	Required Referencing Attribute
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	Segment Number (0062,0004)	Referenced Segment Number (0062,000B)
Surface Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.5	Segment Number (0062,0004)	Referenced Segment Number (0062,000B)
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	Fiducials UID (0070,031A)	Referenced Fiducials UID (gggg,5031)
RT Structure Set	1.2.840.10008.5.1.4.1.1.481.3	ROI Number (3006,0022)	Referenced ROI Number (3006,0084)
Surface Scan Mesh Storage	1.2.840.10008.5.1.4.1.1.68.1	Surface Number (0066,0003)	Referenced Surface Number (0066,002C)
Surface Scan Point Cloud Storage	1.2.840.10008.5.1.4.1.1.68.2	None	None

1199

1200 The column Referenced Attribute identifies the Attribute used to identify the geometric representation in the SOP
1201 Instance referenced in the Segmentation Referenced SOP Sequence (0008,1199).

1202 Depending on the SOP Class UID (0008,0016) in the Referenced SOP Sequence (0008,1199) the corresponding
1203 attribute as specified in the Required Referencing Attribute column is required to be present.

1204   It is anticipated that in future additional referencing Attributes may be needed to accommodate new representations
1205   of segmentations. Hence the collection of Required Referencing Attributes in Table C.AA.D2-1 Permitted SOP
1206   Classes and the conditionally required Type 1C Attributes in the Segment Reference Module may be extended.

1207   **C.AA.D2.1.2   Combination Segment Reference Sequence**

1208   A Conceptual Volume may be expressed as a combination of other segmented Conceptual Volumes. Those other
1209   segments are referenced in the Conceptual Volume Segmentation Reference and Combination Macro (see section
1210   10.A6).

1211   The Conceptual Volume Combination Flag (gggg,1309) shall be YES. The Conceptual Volume Segmentation
1212   Defined Flag (gggg,1311) shall be NO.

1213   The Conceptual Volume Constituent Segmentation Reference Sequence (gggg,1314) in the Conceptual Volume
1214   Constituent Sequence (gggg,1303) shall not be present since the segmented representation of a constituent of a
1215   combination is specified by an Item of the Segment Reference Sequence (gggg,1341) as follows: If a constituent in
1216   the Conceptual Volume Constituent Sequence (gggg,1303) is a combination its constituents must

1217   • either contain a reference to an Item in the Segment Reference Sequence (gggg,1341) which contains a
1218   Direct Segment Reference Sequence (gggg,1343).

1219   • or be present in an Item of the Segment Reference Sequence (gggg,1341) which contains the Combination
1220   Segment Reference Sequence (gggg,1344).

1221   All Conceptual Volume References in this macro shall reference only segments that are defined in Items in the
1222   Direct Segment Reference Sequence (gggg,1343).

1223   **C.AA.D2.1.3   Conceptual Volumes**

1224   The Conceptual Volume UIDs of the Conceptual Volumes instantiated in either the Direct Segment Reference
1225   Sequence (gggg,1343) or the Combination Segment Reference Sequence (gggg,1344) shall be unique within the
1226   Segment Reference Sequence (gggg,1341).

1227

1228 **Make the following additions to PS3.3, Annex F, Table F.4-1:**

1229 **F.4   BASIC DIRECTORY IOD INFORMATION MODEL**

1230   **Table F.4-1**
1231   **Relationship Between Directory Records**

1232

Directory Record Type	Section	Directory Record Types which may be included in the next lower-level directory Entity
(Root Directory Entity)	□	PATIENT, HANGING PROTOCOL, PALETTE, PRIVATE
PATIENT	F.5.1	STUDY, HL7 STRUC DOC, PRIVATE
STUDY	F.5.2	SERIES, PRIVATE
SERIES	F.5.3	IMAGE, RT DOSE, RT STRUCTURE SET, RT PLAN, RT TREAT RECORD, PRESENTATION, WAVEFORM, SR DOCUMENT, KEY OBJECT DOC, SPECTROSCOPY, RAW DATA, REGISTRATION, FIDUCIAL, ENCAP DOC, VALUE MAP, STEREOMETRIC, PLAN, MEASUREMENT, SURFACE, TRACT, ASSESSMENT, **RADIOTHERAPY**, PRIVATE
IMAGE	F.5.4	PRIVATE
RT DOSE	F.5.19	PRIVATE
RT STRUCTURE SET	F.5.20	PRIVATE
RT PLAN	F.5.21	PRIVATE
RT TREAT RECORD	F.5.22	PRIVATE
PRESENTATION	F.5.23	PRIVATE
…		
ASSESSMENT	F.5.36	PRIVATE
RADIOTHERAPY	F.5.X	**PRIVATE**
PRIVATE	F.6.1	PRIVATE, (any of the above as privately defined)

1233

1234

1235	**Add the "RADIOTHERAPY DR" box at the bottom of PS3.3, Annex F, Figure F.4-1:**

1236 **F.5   DEFINITION OF SPECIFIC DIRECTORY RECORDS**

1237

1238
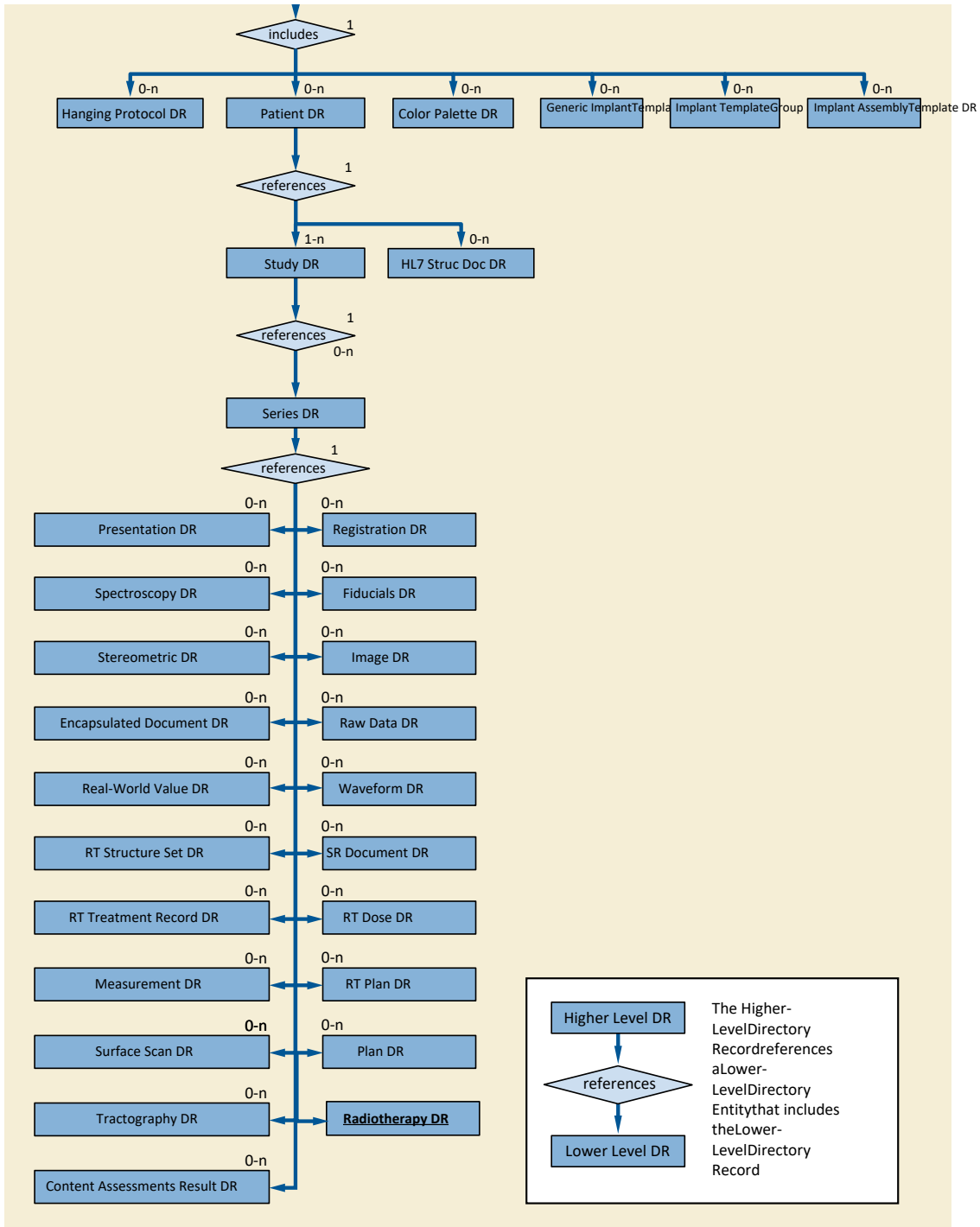
1239

1240

1241

1242   **Add the following to PS3.3, Annex F, Section F.5.X:**

1243   **F.5.X   Radiotherapy Directory Record Definition**

1244   The Directory Record is based on the specification of Section F.3. It is identified by a Directory Record Type of
1245   Value "RADIOTHERAPY". Table F.5-X lists the set of keys with their associated Types for such a Directory Record
1246   Type. The description of these keys may be found in the Modules related to the Instance-level IEs of the RT
1247   Second-Generation IODs. This Directory Record shall be used to reference one of the classes of RT Second-
1248   Generation SOP Instances having a Modality (0008,0060) of as defined in chapter A.VV.1. This type of Directory
1249   Record may reference a Lower-Level Directory Entity that includes one or more Directory Records as defined in
1250   Table F.4-1.

1251   **Table F.5-X**
1252   **RADIOTHERAPY KEYS**

Key	Tag	Type	Attribute Description
Specific Character Set	(0008,0005)	1C	Required if an extended or replacement character set is used in one of the keys.
Instance Number	(0020,0013)	1	
User Content Label	(gggg,51E0)	1C	Required if User Content Label (gggg,51E0) is present
User Content Long Label	(gggg,51E1)	1C	Required if User Content Long Label (gggg,51E1) is present
Content Description	(0070,0081)	2	
Content Creator's Name	(0070,0084)	2	
Any other Attribute of the RT Second-Generation IE Modules		3	

1253

1254   Note: Because Referenced SOP Instance UID in File (0004,1511) may be used as a "pseudo" Directory Record Key
1255   (See Table F.3-3), it is not duplicated in this list of keys.

1256

1257

1258   **Part 4 Addendum**

1259 | **Add the following to PS3.4, Appendix B.5, Table B.5-1** |

SOP Class Name	SOP Class UID	IOD Spec (defined in PS 3.3)
RT Physician Intent Storage	1.2.840.10008.5.1.4.1.1.X.1.1	RT Physician Intent IOD
RT Segment Annotation Storage	1.2.840.10008.5.1.4.1.1.X.1.2	RT Segment Annotation IOD

1260

1261

1262

1263   **Part 6 Addendum**

1264 | **Add the following in PS3.6 Chapter 2 Normative References** |

1265   **2   NORMATIVE REFERENCES**

1266   …

1267   **[FEUVRET] International Journal of Radiation Oncology, Biology, Physics, Volume 64, Issue 2, 2006, Page**
1268   **333-342**

1269   **[ICRU Report 50] International Commission on Radiation Units and Measurements. 1993. Prescribing,**
1270   **Recording, and Reporting Photon Beam Therapy.**

1271

1272 | **Add the following data elements to PS3.6:** |

1273

1274   **6   REGISTRY OF DICOM DATA ELEMENTS**

1275

(gggg,1130)	Radiobiological Dose Effect Sequence	RadiobiologicalDoseEffectSequence	SQ	1
(gggg,1131)	Radiobiological Dose Effect Flag	RadiobiologicalDoseEffectFlag	CS	1
(gggg,1132)	Effective Dose Calculation Method Category Code Sequence	EffectiveDoseCalculationMethodCategoryCodeSequence	SQ	1
(gggg,1134)	Effective Dose Calculation Method Code Sequence	EffectiveDoseCalculationMethodCodeSequence	SQ	1
(gggg,1137)	Effective Dose Calculation Method Description	EffectiveDoseMethodDescription	LO	1
(gggg,1301)	Conceptual Volume UID	ConceptualVolumeUID	UI	1
(gggg,1302)	Originating SOP Instance Reference Sequence	OriginatingSOPInstanceReferenceSequence	SQ	1
(gggg,1303)	Conceptual Volume Constituent Sequence	ConceptualVolumeConstituentSequence	SQ	1
(gggg,1304)	Equivalent Conceptual Volume Instance Reference Sequence	EquivalentConceptualVolumeInstanceReferenceSequence	SQ	1
(gggg,1305)	Equivalent Conceptual Volumes Sequence	EquivalentConceptualVolumesSequence	SQ	1
(gggg,1306)	Referenced Conceptual Volume UID	ReferencedConceptualVolumeUID	UI	1
(gggg,1307)	Conceptual Volume Combination Expression	ConceptualVolumeCombinationExpression	UT	1
(gggg,1308)	Conceptual Volume Constituent Index	ConceptualVolumeConstituentIndex	US	1
(gggg,1309)	Conceptual Volume Combination Flag	ConceptualVolumeCombinationFlag	CS	1
(gggg,1310)	Conceptual Volume Combination Description	ConceptualVolumeCombinationDescription	ST	1
(gggg,1311)	Conceptual Volume Segmentation Defined Flag	ConceptualVolumeSegmentationDefinedFlag	CS	1

(gggg,1312)	Conceptual Volume Segmentation Reference Sequence	ConceptualVolumeSegmentationReferenceSequence	SQ	1
(gggg,1314)	Conceptual Volume Constituent Segmentation Reference Sequence	ConceptualVolumeConstituentSegmentationReferenceSequence	SQ	1
(gggg,1315)	Constituent Conceptual Volume UID	ConstituentConceptualVolumeUID	UI	1
(gggg,1316)	Derivation Conceptual Volume Sequence	DerivationConceptualVolumeSequence	SQ	1
(gggg,1317)	Source Conceptual Volume UID	SourceConceptualVolumeUID	UI	1
(gggg,1318)	Conceptual Volume Derivation Algorithm Sequence	ConceptualVolumeDerivationAlgorithmSequence	SQ	1
(gggg,1319)	Conceptual Volume Description	ConceptualVolumeDescription	ST	1
(gggg,1320)	Source Conceptual Volume Sequence	SourceConceptualVolumeSequence	SQ	1
(gggg,1321)	Author Identification Sequence	AuthorIdentificationSequence	SQ	1
(gggg,1324)	Manufacturer's Model Version	ManufacturersModelVersion	LO	1
(gggg,1326)	Device Alternate Identifier	DeviceAlternateIdentifier	UC	1
(gggg,1327)	Device Alternate Identifier Type	DeviceAlternateIdentifierType	CS	1
(gggg,1328)	Device Alternate Identifier Format	DeviceAlternateIdentifierFormat	LT	1
(gggg,1332)	Segmentation Creation Template Label	SegmentationCreationTemplateLabel	LO	1
(gggg,1334)	Segmentation Template UID	SegmentationTemplateUID	UI	1
(gggg,1340)	Referenced Segment Reference Index	ReferencedSegmentReferenceIndex	US	1
(gggg,1341)	Segment Reference Sequence	SegmentReferenceSequence	SQ	1
(gggg,1342)	Segment Reference Index	SegmentReferenceIndex	US	1
(gggg,1343)	Direct Segment Reference Sequence	DirectSegmentReferenceSequence	SQ	1
(gggg,1344)	Combination Segment Reference Sequence	CombinationSegmentReferenceSequence	SQ	1
(gggg,1346)	Conceptual Volume Sequence	ConceptualVolumeSequence	SQ	1
(gggg,1349)	Segmented RT Accessory Device Sequence	SegmentedRTAccessoryDeviceSequence	SQ	1
(gggg,134B)	Segment Characteristics Sequence	SegmentCharacteristicsSequence	SQ	1
(gggg,134C)	Related Segment Characteristics Sequence	RelatedSegmentCharacteristicsSequence	SQ	1
(gggg,134D)	Segment Characteristics Precedence	SegmentCharacteristicsPrecedence	US	1
(gggg,1352)	RT Segment Annotation Sequence	RTSegmentAnnotationSequence	SQ	1
(gggg,1353)	Segment Annotation Category Code Sequence	SegmentAnnotationCategoryCodeSequence	SQ	1
(gggg,1354)	Segment Annotation Type Code Sequence	SegmentAnnotationTypeCodeSequence	SQ	1
(gggg,5025)	Device Label	DeviceLabel	LO	1
(gggg,5026)	Device Type Code Sequence	DeviceTypeCodeSequence	SQ	1
(gggg,5027)	Device Description	DeviceDescription	ST	1
(gggg,5030)	Patient Equipment Relationship Code Sequence	PatientEquipmentRelationshipCodeSequence	SQ	1
(gggg,5031)	Referenced Fiducials UID	ReferencedFiducialsUID	UI	1
(gggg,5032)	Patient Treatment Orientation Sequence	PatientTreatmentOrientationSequence	SQ	1
(gggg,51E0)	User Content Label	UserContentLabel	SH	1
(gggg,51E1)	User Content Long Label	UserContentLongLabel	LO	1

(gggg,51E2)	Entity Label	EntityLabel	SH	1
(gggg,51E3)	Entity Name	EntityName	LO	1
(gggg,51E4)	Entity Description	EntityDescription	ST	1
(gggg,51E5)	Entity Long Label	EntityLongLabel	LO	1
(gggg,9112)	Device Index	DeviceIndex	US	1
(gggg,9116)	RT Treatment Phase Index	RTTreatmentPhaseIndex	US	1
(gggg,9117)	RT Treatment Phase UID	RTTreatmentPhaseUID	UI	1
(gggg,9118)	RT Prescription Index	RTPrescriptionIndex	US	1
(gggg,9121)	RT Segment Annotation Index	RTSegmentAnnotationIndex	US	1
(gggg,9143)	Basis RT Treatment Phase Index	BasisRTTreatmentPhaseIndex	US	1
(gggg,9144)	Related RT Treatment Phase Index	RelatedRTTreatmentPhaseIndex	US	1
(gggg,9146)	Referenced RT Treatment Phase Index	ReferencedRTTreatmentPhaseIndex	US	1
(gggg,9148)	Referenced RT Prescription Index	ReferencedRTPrescriptionIndex	US	1
(gggg,9149)	Referenced Parent RT Prescription Index	ReferencedParentRTPrescriptionIndex	US	1
(gggg,954D)	Manufacturer's Device Identifier	ManufacturerDeviceIdentifier	ST	1
(gggg,9802)	Instance-Level Referenced Performed Procedure Step Sequence	InstanceLevelReferencedPerformedProcedureStepSequence	SQ	1
(gggg,9808)	RT Treatment Phase Intent Presence Flag	RTTreatmentPhaseIntentPresenceFlag	CS	1
(gggg,9810)	Radiotherapy Treatment Type	RadiotherapyTreatmentType	CS	1
(gggg,9811)	Teletherapy Radiation Type	TeletherapyRadiationType	CS	1-n
(gggg,9812)	Brachytherapy Source Type	BrachytherapySourceType	CS	1-n
(gggg,9870)	Referenced RT Treatment Phase Sequence	ReferencedRTTreatmentPhaseSequence	SQ	1
(gggg,9875)	Referenced Direct Segment Instance Sequence	ReferencedDirectSegmentInstanceSequence	SQ	1
(gggg,9880)	Intended RT Treatment Phase Sequence	IntendedRTTreatmentPhaseSequence	SQ	1
(gggg,988C)	Intended Phase Start Date	IntendedPhaseStartDate	DA	1
(gggg,988E)	Intended Phase End Date	IntendedPhaseEndDate	DA	1
(gggg,9890)	RT Treatment Phase Interval Sequence	RTTreatmentPhaseIntervalSequence	SQ	1
(gggg,9892)	Temporal Relationship Interval Anchor	TemporalRelationshipIntervalAnchor	CS	1
(gggg,9894)	Minimum Number of Interval Days	MinimumNumberOfIntervalDays	FD	1
(gggg,9896)	Maximum Number of Interval Days	MaximumNumberOfIntervalDays	FD	1
(gggg,98A0)	Pertinent SOP Classes in Study	PertinentSOPClassesInStudy	UI	1-n
(gggg,98A1)	Pertinent SOP Classes in Series	PertinentSOPClassesInSeries	UI	1-n
(gggg,9902)	RT Prescription Label	RTPrescriptionLabel	LO	1
(gggg,9910)	RT Physician Intent Predecessor Sequence	RTPhysicianIntentPredecessorSequence	SQ	1
(gggg,9911)	RT Treatment Approach Label	RTTreatmentApproachLabel	LO	1
(gggg,9912)	RT Physician Intent Sequence	RTPhysicianIntentSequence	SQ	1
(gggg,9913)	RT Physician Intent Index	RTPhysicianIntentIndex	US	1
(gggg,9914)	RT Treatment Intent Type	RTTreatmentIntentType	CS	1
(gggg,9915)	RT Physician Intent Narrative	RTPhysicianIntentNarrative	UT	1
(gggg,9916)	RT Protocol Code Sequence	RTProtocolCodeSequence	SQ	1

(gggg,9917)	Reason for Superseding	ReasonForSuperseding	ST	1
(gggg,9918)	RT Diagnosis Code Sequence	RTDiagnosisCodeSequence	SQ	1
(gggg,9919)	Referenced RT Physician Intent Index	ReferencedRTPhysicianIntentIndex	US	1
(gggg,991A)	RT Physician Intent Input Instance Sequence	RTPhysicianIntentInputInstanceSequence	SQ	1
(gggg,9920)	RT Anatomic Prescription Sequence	RTAnatomicPrescriptionSequence	SQ	1
(gggg,9924)	Prior Treatment Dose Description	PriorTreatmentDoseDescription	UT	1
(gggg,9925)	Prior Treatment Reference Sequence	PriorTreatmentReferenceSequence	SQ	1
(gggg,9926)	Dosimetric Objective Evaluation Scope	DosimetricObjectiveEvaluationScope	CS	1
(gggg,9930)	Therapeutic Role Category Code Sequence	TherapeuticRoleCategoryCodeSequence	SQ	1
(gggg,9931)	Therapeutic Role Type Code Sequence	TherapeuticRoleTypeCodeSequence	SQ	1
(gggg,9933)	Conceptual Volume Optimization Precedence	ConceptualVolumeOptimizationPrecedence	US	1
(gggg,9934)	Conceptual Volume Category Code Sequence	ConceptualVolumeCategoryCodeSequence	SQ	1
(gggg,9935)	Conceptual Volume Blocking Constraint	ConceptualVolumeBlockingConstraint	CS	1
(gggg,9936)	Conceptual Volume Type Code Sequence	ConceptualVolumeTypeCodeSequence	SQ	1
(gggg,9937)	Conceptual Volume Type Modifier Code Sequence	ConceptualVolumeTypeModifierCodeSequence	SQ	1
(gggg,9940)	RT Prescription Sequence	RTPrescriptionSequence	SQ	1
(gggg,9942)	Dosimetric Objective Sequence	DosimetricObjectiveSequence	SQ	1
(gggg,9943)	Dosimetric Objective Type Code Sequence	DosimetricObjectiveTypeCodeSequence	SQ	1
(gggg,9948)	Dosimetric Objective UID	DosimetricObjectiveUID	UI	1
(gggg,9949)	Referenced Dosimetric Objective UID	ReferencedDosimetricObjectiveUID	UI	1
(gggg,9950)	Dosimetric Objective Parameter Sequence	DosimetricObjectiveParameterSequence	SQ	1
(gggg,9951)	Referenced Dosimetric Objectives Sequence	ReferencedDosimetricObjectivesSequence	SQ	1
(gggg,9952)	Radiobiological Dose Effect Flag	RadiobiologicalDoseEffectFlag	CS	1
(gggg,9954)	Absolute Dosimetric Objective Flag	AbsoluteDosimetricObjectiveFlag	CS	1
(gggg,9956)	Dosimetric Objective Weight	DosimetricObjectiveWeight	FD	1
(gggg,9958)	Dosimetric Objective Purpose	DosimetricObjectivePurpose	CS	1
(gggg,9960)	Planning Input Information Sequence	PlanningInputInformationSequence	SQ	1
(gggg,9961)	Treatment Site	TreatmentSite	LO	1
(gggg,9962)	Treatment Site Code Sequence	TreatmentSiteCodeSequence	SQ	1
(gggg,9965)	Fraction Pattern Sequence	FractionPatternSequence	SQ	1
(gggg,9966)	Treatment Technique Notes	TreatmentTechniqueNotes	UT	1
(gggg,9970)	Prescription Notes	PrescriptionNotes	UT	1
(gggg,9971)	Number of Interval Fractions	NumberOfIntervalFractions	IS	1
(gggg,9972)	Number of Fractions	NumberOfFractions	US	1
(gggg,9973)	Intended Delivery Duration	IntendedDeliveryDuration	US	1
(gggg,9974)	Fractionation Notes	FractionationNotes	UT	1

(gggg,9976)	RT Treatment Technique Code Sequence	RTTreatmentTechniqueCodeSequence	SQ	1
(gggg,9978)	Prescription Notes Sequence	PrescriptionNotesSequence	SQ	1
(gggg,9982)	Fraction-Based Relationship Sequence	FractionBasedRelationshipSequence	SQ	1
(gggg,9984)	Fraction-Based Relationship Interval Anchor	FractionBasedRelationshipIntervalAnchor	CS	1
(gggg,9990)	Minimum Hours between Fractions	MinimumHoursBetweenFractions	FD	1
(gggg,9991)	Intended Fraction Start Time	IntendedFractionStartTime	TM	1-n
(gggg,9992)	Intended Start Day of Week	IntendedStartDayOfWeek	LT	1
(gggg,9993)	Weekday Fraction Pattern Sequence	WeekdayFractionPatternSequence	SQ	1
(gggg,9994)	Delivery Time Structure Code Sequence	DeliveryTimeStructureCodeSequence	SQ	1

1276

1277

1278 | **Add the following to PS3.6 Annex A:**

1279

1280   **ANNEX A   REGISTRY OF DICOM UNIQUE IDENTIFIERS (UIDS) (NORMATIVE)**

1281   **Table A-1 UID Values**
1282

UID Value	UID Name	UID Type	Part
1.2.840.10008.5.1.4.1.1.X.1.1	RT Physician Intent Storage	SOP Class	PS3.4
1.2.840.10008.5.1.4.1.1.X.1.2	RT Segment Annotation Storage	SOP Class	PS3.4

1283

1284   **Table A-3 Context Group UID Values**
1285

Context UID	Context Identifier	Context Group Name
1.2.840.10008.6.1.S147.1	SUP147001	Dosimetric Objective Types
1.2.840.10008.6.1.S147.2	SUP147002	Prescription Anatomy Categories
1.2.840.10008.6.1.S147.3	SUP147003	RT Segment Annotation Categories
1.2.840.10008.6.1.S147.4	SUP147004	Radiotherapy Therapeutic Role Categories
1.2.840.10008.6.1.S147.5	SUP147005	RT Geometric Information
1.2.840.10008.6.1.S147.6	SUP147006	Fixation or Positioning Devices
1.2.840.10008.6.1.S147.7	SUP147007	Brachytherapy Devices
1.2.840.10008.6.1.S147.8	SUP147008	External Body Models
1.2.840.10008.6.1.S147.9	SUP147009	Nonspecific Volumes
1.2.840.10008.6.1.S147.10	SUP147010	Purpose of Reference for RT Physician Intent Input
1.2.840.10008.6.1.S147.11	SUP147011	Purpose of Reference for RT Treatment Planning Input
1.2.840.10008.6.1.S147.12	SUP147012	General External Radiotherapy Procedure Techniques
1.2.840.10008.6.1.S147.13	SUP147013	Tomotherapeutic Radiotherapy Procedure Techniques
1.2.840.10008.6.1.S147.22	SUP147022	Fixation Devices
1.2.840.10008.6.1.S147.23	SUP147023	Anatomical Structures for Radiotherapy
1.2.840.10008.6.1.S147.25	SUP147025	RT Patient Support Devices
1.2.840.10008.6.1.S147.31	SUP147031	Radiotherapy Bolus Device Types
1.2.840.10008.6.1.S147.32	SUP147032	Radiotherapy Block Device Types
1.2.840.10008.6.1.S147.33	SUP147033	Radiotherapy Accessory No-Slot Holder Device Types
1.2.840.10008.6.1.S147.34	SUP147034	Radiotherapy Accessory Slot Holder Device Types
1.2.840.10008.6.1.S147.40	SUP147040	Segmented RT Accessory Devices
1.2.840.10008.6.1.S147.42	SUP147042	Radiotherapy Treatment Energy Unit
1.2.840.10008.6.1.S147.45	SUP147045	Multi-Source Radiotherapy Procedure Techniques
1.2.840.10008.6.1.S147.46	SUP147046	Robotic Radiotherapy Procedure Techniques
1.2.840.10008.6.1.S147.47	SUP147047	Radiotherapy Procedure Techniques
1.2.840.10008.6.1.S147.52	SUP147052	Radiation Therapy Particle

1.2.840.10008.6.1.S147.53	SUP147053	Ion Therapy Particle
1.2.840.10008.6.1.S147.56	SUP147056	Teletherapy Isotope
1.2.840.10008.6.1.S147.57	SUP147057	Brachytherapy Isotope
1.2.840.10008.6.1.S147.60	SUP147060	Single Dose Dosimetric Objectives
1.2.840.10008.6.1.S147.61	SUP147061	Percentage and Dose Dosimetric Objectives
1.2.840.10008.6.1.S147.62	SUP147062	Volume and Dose Dosimetric Objectives
1.2.840.10008.6.1.S147.64	SUP147064	No-Parameter Dosimetric Objectives
1.2.840.10008.6.1.S147.68	SUP147068	Delivery Time Structure
1.2.840.10008.6.1.S147.70	SUP147070	Radiotherapy Targets
1.2.840.10008.6.1.S147.71	SUP147071	Radiotherapy Dose Calculation Roles
1.2.840.10008.6.1.S147.72	SUP147072	Radiotherapy Prescribing and Segmenting Person Roles
1.2.840.10008.6.1.S147.80	SUP147080	Effective Dose Calculation Categories
1.2.840.10008.6.1.S147.81	SUP147081	Radiation Transport-Based Effective Dose Method Modifiers
1.2.840.10008.6.1.S147.82	SUP147082	Fractionation-Based Effective Dose Method Modifers

1286

1287

1288   **Part 16 Addendum**

1289 | **Add the following new CIDs to PS3.16, Annex B:** |

1290

1291   **ANNEX B   DCMR CONTEXT GROUPS (NORMATIVE)**

1292

1293   **CID SUP147001   DOSIMETRIC OBJECTIVE TYPES**

1294   **Context ID SUP147001**
1295   **Dosimetric Objective Types**
1296   **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1297   **Type: Extensible**
1298   **Version: 20170224**
1299   **UID: 1.2.840.10008.6.1.S147.1**

1300

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
Include CID SUP147064 "No-Parameter Dosimetric Objectives"		
Include CID SUP147060 "Single Dose Dosimetric Objectives"		
Include CID SUP147061 "Percentage and Dose Dosimetric Objectives"		
Include CID SUP147062 "Volume and Dose Dosimetric Objectives"		
99SUP147	S147120	Specified Conformity Index
99SUP147	S147121	Specified Healthy Tissue Conformity Index
99SUP147	S147122	Specified Conformation Number
99SUP147	S147123	Specified Homogeneity Index

1301

1302   **CID SUP147002   PRESCRIPTION ANATOMY CATEGORIES**

1303   **Context ID SUP147002**
1304   **Prescription Anatomy Categories**
1305   **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1306   **Type: Extensible**
1307   **Version: 20170224**
1308   **UID: 1.2.840.10008.6.1.S147.2**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
SRT	T-D000A	Anatomical Structure	91723000	
99SUP147	S147059	External Body Model		

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
SRT	A-00004	Physical Object	260787004	
99SUP147	S147057	Non-specific Volume		

1309

1310 **CID SUP147003**   **RT SEGMENT ANNOTATION CATEGORIES**

1311   **Context ID SUP147003**
1312   **RT Segment Annotation Categories**
1313   **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1314   **Type: Extensible**
1315   **Version: 20170224**
1316   **UID: 1.2.840.10008.6.1.S147.3**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
99SUP147	S147050	RT Target		
99SUP147	S147051	RT Dose Calculation Structure		
99SUP147	S147053	RT Geometric Information		
99SUP147	S147059	External Body Model		
99SUP147	S147054	Fixation or Positioning Device		
99SUP147	S147055	Brachytherapy Device		
SRT	A-00004	Physical Object	260787004	
99SUP147	S147057	Non-specific Volume		

1317

1318 **CID SUP147004**   **RADIOTHERAPY THERAPEUTIC ROLE CATEGORIES**

1319   **Context ID SUP147004**
1320   **Radiotherapy Therapeutic Role Categories**
1321   **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1322   **Type: Extensible**
1323   **Version: 20170224**
1324   **UID: 1.2.840.10008.6.1.S147.4**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147050	RT Target
99SUP147	S147051	RT Dose Calculation Structure

1325

1326

1327 **CID SUP147005**   **RT GEOMETRIC INFORMATION**

1328   **Context ID SUP147005**

1329 **RT Geometric Information**

1330 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**

1331 **Type: Extensible**

1332 **Version: 20170224**

1333 **UID: 1.2.840.10008.6.1.S147.5**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147100	Patient Setup Point
99SUP147	S147101	Room Laser Patient Setup Point
99SUP147	S147102	Moveable Laser Patient Setup Point
99SUP147	S147104	Reference Acquisition Point
99SUP147	S147105	Isocentric Treatment Location Point

1334

1335 **CID SUP147006   FIXATION OR POSITIONING DEVICES**

1336 **Context ID SUP147006**

1337 **Fixation or Positioning Devices**

1338 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**

1339 **Type: Extensible**

1340 **Version: 20170224**

1341 **UID: 1.2.840.10008.6.1.S147.6**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
Include CID SUP147022 "Fixation Devices"		
Include CID SUP147025 "RT Patient Support Devices"		

1342

1343 **CID SUP147007   BRACHYTHERAPY DEVICES**

1344 **Context ID SUP147007**

1345 **Brachytherapy Devices**

1346 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**

1347 **Type: Extensible**

1348 **Version: 20170224**

1349 **UID: 1.2.840.10008.6.1.S147.7**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147131	Brachytherapy source applicator
99SUP147	S147132	Brachytherapy channel shield
99SUP147	S147133	Brachytherapy channel

1350

1351   **CID SUP147008   EXTERNAL BODY MODELS**

1352   **Context ID SUP147008**
1353   **External Body Models**
1354   **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1355   **Type: Extensible**
1356   **Version: 20170224**
1357   **UID: 1.2.840.10008.6.1.S147.8**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147090	Patient Anatomy Model
99SUP147	S147091	Extended Patient Anatomy Model

1358

1359   **CID SUP147009   NONSPECIFIC VOLUMES**

1360   **Context ID SUP147009**
1361   **Nonspecific Volumes**
1362   **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1363   **Type: Extensible**
1364   **Version: 20170224**
1365   **UID: 1.2.840.10008.6.1.S147.9**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147060	Unclassified Volume
99SUP147	S147145	Unclassified Combination

1366

1367   **CID SUP147010   PURPOSE OF REFERENCE FOR RT PHYSICIAN INTENT INPUT**

1368   **Context ID SUP147010**
1369   **Purpose of Reference for RT Physician Intent Input**
1370   **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1371   **Type: Extensible**
1372   **Version: 20170224**
1373   **UID: 1.2.840.10008.6.1.S147.10**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147821	Historical RT Prescription
DCM	128181	Diagnostic Source Images
DCM	128182	Segmentation Result
DCM	128183	Registration Result
99SUP147	S147822	RT Prescription Input Images

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
LN	30954-2	Relevant Diagnostic Tests and/or Laboratory Data

1374

1375   **CID SUP147011   PURPOSE OF REFERENCE FOR RT TREATMENT PLANNING INPUT**

1376   **Context ID SUP147011**
1377   **Purpose of Reference for RT Treatment Planning Input**
1378   **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1379   **Type: Extensible**
1380   **Version: 20170224**
1381   **UID: 1.2.840.10008.6.1.S147.11**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	128181	Diagnostic Source Images
DCM	128182	Segmentation Result
DCM	128183	Registration Result
DCM	128186	RT Prescription Result
99SUP147	S147823	RT Treatment Planning Input Images

1382

1383

1384   **CID SUP147012   GENERAL EXTERNAL RADIOTHERAPY PROCEDURE TECHNIQUES**

1385   **Context ID SUP147012**
1386   **General External Radiotherapy Procedure Techniques**
1387   **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1388   **Type: Extensible**
1389   **Version: 20170224**
1390   **UID: 1.2.840.10008.6.1.S147.12**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147221	Static Beam
99SUP147	S147225	Arc Beam
99SUP147	S147226	Conformal Arc Beam
99SUP147	S147227	Step and Shoot Beam
99SUP147	S147228	Sliding Window Beam
99SUP147	S147229	VMAT

1391

1392   **CID SUP147013   TOMOTHERAPEUTIC RADIOTHERAPY PROCEDURE TECHNIQUES**

1393   **Context ID SUP147013**

1394	**Tomotherapeutic Radiotherapy Procedure Techniques**
1395	**Resources: HTML	FHIR JSON	FHIR XML	IHE SVS XML**
1396	**Type: Extensible**
1397	**Version: 20170224**
1398	**UID: 1.2.840.10008.6.1.S147.13**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147240	Helical Beam
99SUP147	S147241	Topographic Beam

1399

1400   CID SUP147022   FIXATION DEVICES

1401	**Context ID SUP147022**
1402	**Fixation Devices**
1403	**Resources: HTML	FHIR JSON	FHIR XML	IHE SVS XML**
1404	**Type: Extensible**
1405	**Version: 20170224**
1406	**UID: 1.2.840.10008.6.1.S147.22**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
SRT	A-01105	Bite block	228745001	
99SUP147	S147341	Headframe		
99SUP147	S147342	Head Mask		
99SUP147	S147343	Head and Neck Mask		
99SUP147	S147344	Mold		
99SUP147	S147345	Cast		
99SUP147	S147346	Headrest		
99SUP147	S147347	Breast Board		
99SUP147	S147348	Body Frame		
99SUP147	S147349	Vacuum Mold		
99SUP147	S147350	Whole Body Pod		
99SUP147	S147351	Rectal Balloon		
99SUP147	S147353	Vaginal Cylinder		

1407

1408   CID SUP147023   ANATOMICAL STRUCTURES FOR RADIOTHERAPY

1409	**Context ID SUP147023**
1410	**Anatomical Structures for Radiotherapy**
1411	**Resources: HTML	FHIR JSON	FHIR XML	IHE SVS XML**
1412	**Type: Extensible**
1413	**Version: 20170224**
1414	**UID: 1.2.840.10008.6.1.S147.23**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
Include CID 4031 "Common Anatomic Regions"				
Include CID 7192 "Anatomical Structure Segmentation Property Types"				

1415

1416 **CID SUP147025   RT PATIENT SUPPORT DEVICES**

1417   **Context ID SUP147025**
1418   **RT Patient Support Devices**
1419   **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1420   **Type: Extensible**
1421   **Version: 20170224**
1422   **UID: 1.2.840.10008.6.1.S147.25**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
SRT	A-17350	Table	86407004	
99SUP147	S147411	Chair		

1423

1424 **CID SUP147031   RADIOTHERAPY BOLUS DEVICE TYPES**

1425   **Context ID SUP147031**
1426   **Radiotherapy Bolus Device Types**
1427   **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1428   **Type: Extensible**
1429   **Version: 20170224**
1430   **UID: 1.2.840.10008.6.1.S147.31**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
SRT	A-010FB	Surface Bolus	228736002	

1431

1432

1433 **CID SUP147032   RADIOTHERAPY BLOCK DEVICE TYPES**

1434   **Context ID SUP147032**
1435   **Radiotherapy Block Device Types**
1436   **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1437   **Type: Extensible**
1438   **Version: 20170224**
1439   **UID: 1.2.840.10008.6.1.S147.32**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
SRT	A-010FE	Shielding Block	228739009	
99SUP147	S147471	Aperture Block		

1440

1441 **CID SUP147033   RADIOTHERAPY ACCESSORY NO-SLOT HOLDER DEVICE TYPES**

1442 Codes for Radiotherapy devices holding other accessories without using slots.

1443 **Context ID SUP147033**
1444 **Radiotherapy Accessory No-Slot Holder Device Types**
1445 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1446 **Type: Extensible**
1447 **Version: 20170224**
1448 **UID: 1.2.840.10008.6.1.S147.33**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147480	Accessory Tray

1449

1450 **CID SUP147034   RADIOTHERAPY ACCESSORY SLOT HOLDER DEVICE TYPES**

1451 **Codes for Radiotherapy devices holding other accessories using slots.Context ID SUP147034**
1452 **Radiotherapy Accessory Slot Holder Device Types**
1453 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1454 **Type: Extensible**
1455 **Version: 20170224**
1456 **UID: 1.2.840.10008.6.1.S147.34**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147481	Radiotherapy Applicator

1457

1458 **CID SUP147040   SEGMENTED RT ACCESSORY DEVICES**

1459 **Context ID SUP147040**
1460 **Segmented RT Accessory Devices**
1461 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1462 **Type: Extensible**
1463 **Version: 20170224**
1464 **UID: 1.2.840.10008.6.1.S147.40**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
Include CID SUP147022 "Fixation Devices"		
Include CID SUP147007 "Brachytherapy Devices"		
Include CID SUP147025 "RT Patient Support Devices"		
Include CID SUP147031 "Radiotherapy Bolus Device Types"		
Include CID SUP147032 "Radiotherapy Block Device Types"		
Include CID SUP147033 "Radiotherapy Accessory No-Slot Holder Device Types"		
Include CID SUP147034 "Radiotherapy Accessory Slot Holder Device Types"		

1465

1466 **CID SUP147042   RADIOTHERAPY TREATMENT ENERGY UNIT**

1467   **Context ID SUP147042**
1468   **Radiotherapy Treatment Energy Unit**
1469   **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1470   **Type: Extensible**
1471   **Version: 20170224**
1472   **UID: 1.2.840.10008.6.1.S147.42**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
UCUM	MV	Megavolt
UCUM	MeV	Megaelectronvolt
UCUM	kV	Kilovolt

1473

1474 **CID SUP147045   MULTI-SOURCE RADIOTHERAPY PROCEDURE TECHNIQUES**

1475   **Context ID SUP147045**
1476   **Multi-Source Radiotherapy Procedure Techniques**
1477   **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1478   **Type: Extensible**
1479   **Version: 20170224**
1480   **UID: 1.2.840.10008.6.1.S147.45**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147900	Multiple Fixed Sources

1481

1482 **CID SUP147046   ROBOTIC RADIOTHERAPY PROCEDURE TECHNIQUES**

1483   **Context ID SUP147046**

1484 **Robotic Radiotherapy Procedure Techniques**

1485 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**

1486 **Type: Extensible**

1487 **Version: 20170224**

1488 **UID: 1.2.840.10008.6.1.S147.46**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147910	Synchronized Robotic Treatment
99SUP147	S147911	Non-Synchronized Robotic Treatment

1489

1490 **CID SUP147047   RADIOTHERAPY PROCEDURE TECHNIQUES**

1491 **Context ID SUP147047**

1492 **Radiotherapy Procedure Techniques**

1493 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**

1494 **Type: Extensible**

1495 **Version: 20170224**

1496 **UID: 1.2.840.10008.6.1.S147.47**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
Include CID SUP147012 "General External Radiotherapy Procedure Techniques"		
Include CID SUP147013 "Tomotherapeutic Radiotherapy Procedure Techniques"		
Include CID SUP147045 "Multi-Source Radiotherapy Procedure Techniques"		
Include CID SUP147046 "Robotic Radiotherapy Procedure Techniques"		

1497

1498 **CID SUP147052   RADIATION THERAPY PARTICLE**

1499 **Context ID SUP147052**

1500 **Radiation Therapy Particle**

1501 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**

1502 **Type: Non-Extensible**

1503 **Version: 20170224**

1504 **UID: 1.2.840.10008.6.1.S147.52**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
SRT	F-61790	Photon	290006006	
SRT	C-10004	Electron	46602004	

1505

1506 **CID SUP147053**   **ION THERAPY PARTICLE**

1507 <div align="center">

Context ID SUP147053

</div>

1508 <div align="center">**Ion Therapy Particle**</div>

1509 <div align="center">**Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**</div>

1510 <div align="center">**Type: Non-Extensible**</div>

1511 <div align="center">**Version: 20170224**</div>

1512 <div align="center">**UID: 1.2.840.10008.6.1.S147.53**</div>

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
SRT	C-10001	Ion	48006008	
SRT	C-10005	Proton	89177007	
99SUP147	S147951	^3^Helium		
99SUP147	S147952	^4^Helium		
99SUP147	S147953	^12^Carbon		
99SUP147	S147954	^16^Oxygen		

1513

1514 **CID SUP147056**   **TELETHERAPY ISOTOPE**

1515 <div align="center">**Context ID SUP147056**</div>

1516 <div align="center">**Teletherapy Isotope**</div>

1517 <div align="center">**Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**</div>

1518 <div align="center">**Type: Extensible**</div>

1519 <div align="center">**Version: 20170224**</div>

1520 <div align="center">**UID: 1.2.840.10008.6.1.S147.56**</div>

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
SRT	C-144A6	^60^Cobalt	5405008	

1521

1522 **CID SUP147057**   **BRACHYTHERAPY ISOTOPE**

1523 <div align="center">**Context ID SUP147057**</div>

1524 <div align="center">**Brachytherapy Isotope**</div>

1525 <div align="center">**Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**</div>

1526 <div align="center">**Type: Extensible**</div>

1527 <div align="center">**Version: 20170224**</div>

1528 <div align="center">**UID: 1.2.840.10008.6.1.S147.57**</div>

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
SRT	C-142B2	^137^Cesium	55117002	
SRT	C-142A5	^131^Cesium	13237009	
SRT	C-151B2	^192^Iridium	48341001	
SRT	C-114A6	^125^Iodine	68630002	

SRT	C-160A3	^103^Palladium	9351000	
SRT	C-124B4	^252^Californium	35978008	
SRT	C-144A6	^60^Cobalt	5405008	
SRT	C-136A5	^226^Radium	28243009	
SRT	C-162A7	^90^Yttrium	14691008	
SRT	C-146A9	^198^Gold	24301009	
SRT	C-106A1	^32^Phosphorus	32505007	
SRT	C-136B6	^222^Radon	51800004	
SRT	C-158A7	^90^Strontium	14071002	
SRT	C-180A5	^106^Ruthenium	8227001	
SRT	C-181A3	^169^Ytterbium	41758004	

1529

CID SUP147060   **SINGLE DOSE DOSIMETRIC OBJECTIVES**

Context ID SUP147060

Single Dose Dosimetric Objectives

Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML

Type: Extensible

Version: 20170224

UID: 1.2.840.10008.6.1.S147.60

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147001	Minimum Surface Radiation Dose
99SUP147	S147002	Maximum Surface Radiation Dose
99SUP147	S147003	Minimum Radiation Dose
99SUP147	S147004	Maximum Radiation Dose
99SUP147	S147005	Minimum Mean Radiation Dose
99SUP147	S147006	Maximum Mean Radiation Dose
99SUP147	S147007	Minimum Equivalent Uniform Dose
99SUP147	S147008	Maximum Equivalent Uniform Dose
99SUP147	S147009	Prescription Radiation Dose

1537

CID SUP147061   **PERCENTAGE AND DOSE DOSIMETRIC OBJECTIVES**

Context ID SUP147061

Percentage and Dose Dosimetric Objectives

Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML

Type: Extensible

Version: 20170224

UID: 1.2.840.10008.6.1.S147.61

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147014	Minimum Percent Volume at Radiation Dose

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147015	Maximum Percent Volume at Radiation Dose

1545

1546 **CID SUP147062   VOLUME AND DOSE DOSIMETRIC OBJECTIVES**

1547 **Context ID SUP147062**

1548 **Volume and Dose Dosimetric Objectives**

1549 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**

1550 **Type: Extensible**

1551 **Version: 20170224**

1552 **UID: 1.2.840.10008.6.1.S147.62**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147016	Minimum Absolute Volume at Radiation Dose
99SUP147	S147017	Maximum Absolute Volume at Radiation Dose

1553

1554

1555

1556 **CID SUP147064   NO-PARAMETER DOSIMETRIC OBJECTIVES**

1557 **Context ID SUP147064**

1558 **No-Parameter Dosimetric Objectives**

1559 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**

1560 **Type: Extensible**

1561 **Version: 20170224**

1562 **UID: 1.2.840.10008.6.1.S147.64**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147018	Minimize Meterset

1563

1564 **CID SUP147068   DELIVERY TIME STRUCTURE**

1565 **Context ID SUP147068**

1566 **Delivery Time Structure**

1567 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**

1568 **Type: Extensible**

1569 **Version: 20170224**

1570 **UID: 1.2.840.10008.6.1.S147.68**

1571

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147180	Single Fraction
99SUP147	S147181	Standard Fractionation

99SUP147	S147182	Hypo-fractionation
99SUP147	S147183	Hyper-fractionation
99SUP147	S147184	Continuous Temporary
99SUP147	S147185	Continuous Permanent

1572

1573

1574   **CID SUP147070   RADIOTHERAPY TARGETS**

1575   **Context ID SUP147070**
1576   **Radiotherapy Targets**
1577   **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1578   **Type: Extensible**
1579   **Version: 20170224**
1580   **UID: 1.2.840.10008.6.1.S147.70**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
99SUP147	S147070	CTV Nodal		
99SUP147	S147071	CTV Primary		
SRT	R-429EB	CTV	228792002	
99SUP147	S147073	GTV Nodal		
99SUP147	S147074	GTV Primary		
SRT	R-429E0	GTV	228791009	
99SUP147	S147076	PTV Nodal		
99SUP147	S147077	PTV Primary		
SRT	R-429EC	PTV	228793007	
99SUP147	S147079	ITV		
99SUP147	S147082	Treated Volume		
SRT	R-429DF	Irradiated Volume	228790005	
99SUP147	S147078	Entire Body Target Volume		
99SUP147	S147086	Radiation Dose Normalization Point		
99SUP147	S147087	Radiation Dose Reference Point		

1581

1582

1583   **CID SUP147071   RADIOTHERAPY DOSE CALCULATION ROLES**

1584   **Context ID SUP147071**
1585   **Radiotherapy Dose Calculation Roles**
1586   **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1587   **Type: Extensible**
1588   **Version: 20170224**
1589   **UID: 1.2.840.10008.6.1.S147.71**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147080	Planning Organ At Risk Volume
99SUP147	S147081	Avoidance Volume
99SUP147	S147083	Organ At Risk
99SUP147	S147084	Radiation Dose Shaping Volume
99SUP147	S147085	Conformality Shell
99SUP147	S147088	Dose Calculation Bounding Volume
99SUP147	S147089	Radiation Interaction Volume

1590

1591 **CID SUP147072   RADIOTHERAPY PRESCRIBING AND SEGMENTING PERSON ROLES**

1592 **Context ID SUP147072**
1593 **Radiotherapy Prescribing and Segmenting Person Roles**
1594 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1595 **Type: Extensible**
1596 **Version: 20170224**
1597 **UID: 1.2.840.10008.6.1.S147.72**

1598

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
SRT	J-0016E	Medical Practitioner	158965000	C1306754
SRT	J-004E8	Physician	309343006	C0031831
SRT	J-00187	Radiologic Technologist	159016003	C0402007
DCM	128674	Lead Radiologic Technologist		
SRT	J-06173	Radiation Therapist	3430008	
SRT	J-00187	Radiographer	159016003	C0402007
SRT	J-005E6	Resident	405277009	C1320928
UMLS	C1441532	Consulting Physician		C1441532
UMLS	C2985483	Radiation Physicist		C2985483
UMLS	C1708969	Medical Physicist		C1708969

1599

1600

1601 **CID SUP147080   EFFECTIVE DOSE CALCULATION CATEGORIES**

1602 **Context ID SUP147080**
1603 **Effective Dose Calculation Method Categories**
1604 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**
1605 **Type: Extensible**
1606 **Version: yyyymmdd**
1607 **UID: 1.2.840.10008.6.1.S147.80**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147500	Radiation transport-based methods
99SUP147	S147501	Fractionation-based or temporally-based methods

1608

1609 **CID SUP147081   RADIATION TRANSPORT-BASED EFFECTIVE DOSE METHOD MODIFIERS**

1610 **Context ID SUP147081**

1611 **Radiation Transport-Based Effective Dose Method Modifers**

1612 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**

1613 **Type: Extensible**

1614 **Version: yyyymmdd**

1615 **UID: 1.2.840.10008.6.1.S147.81**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147510	Local Effect Model
99SUP147	S147511	Microdosimetric Kinetic Model

1616

1617 **CID SUP147082   FRACTIONATION-BASED EFFECTIVE DOSE METHOD MODIFIERS**

1618 **Context ID SUP147082**

1619 **Fractionation-Based Effective Dose Method Modifers**

1620 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**

1621 **Type: Extensible**

1622 **Version: yyyymmdd**

1623 **UID: 1.2.840.10008.6.1.S147.82**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SUP147	S147520	Equivalent 2-Gray Fractions Model
99SUP147	S147521	Linear-Quadratic Model
99SUP147	S147522	Linear-Quadratic Model with Time Factor
99SUP147	S147523	Linear-Quadratic-Linear Model
99SUP147	S147524	Linear-Quadratic Model for Low-Dose Rate Brachytherapy

1624

1625 **CID 7157   DEVICE SEGMENTATION TYPES**

1626 **Context ID 7151**

1627 **Device Segmentation Types**

1628 **Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML**

1629 **Type: Extensible**

1630 **Version: 20170224**

1631 **UID: 1.2.840.10008.6.1.503**

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	SNOMED-CT Concept ID	UMLS Concept Unique ID
Include CID SUP147006 "Fixation or Positioning Devices"				
Include CID SUP147007 "Brachytherapy Devices"				
SRT	A-12024	Bone Pin	77444004	C0175718
SRT	A-12030	Bone Screw	68183006	C0005975
SRT	A-11100	Cardiac Pacemaker	14106009	C0030163
SRT	A-11206	Defibrillator	72506001	C0162589
SRT	A-04200	Dental Prosthesis	27606000	C0162686
SRT	A-04036	Inlay Dental Restoration	272287005	C0441351
SRT	A-11FCD	Left ventricular assist device	360066001	C0181598
SRT	A-30360	Needle	79068005	C0027551
SRT	A-04034	Radioactive implant	19443004	C0521196
SRT	A-25500	Stent	65818007	C0038257

1632

1633

| 1634 | **Add the following templates to PS3.16, Annex C:** |

1635 ANNEX C   ACQUISITION AND PROTOCOL CONTEXT TEMPLATES (NORMATIVE)

1636 TID SUP147001   RT PRESCRIPTION ANNOTATION

1637 The concepts in this TID are topics of advice or information provided by the prescribing physician for planning,
1638 preparation and delivery of treatment for a prescription.

1639 **TID SUP147001**

1640 **RT Prescription Annotation**

1641 **Type: Extensible**

1642 **Order: Non-Significant**

1643 **Root: No**

	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1	TEXT	EV (S147030, 99SUP147, "Radiation Characteristics Note")	1	U		
2	TEXT	EV (S147031, 99SUP147, "Beam Shaping Note")	1	U		
3	TEXT	EV (S147032, 99SUP147, "Treatment Planning Note")	1	U		
4	TEXT	EV (S147033, 99SUP147, "Special Procedure Note")	1	U		
5	TEXT	EV (S147034, 99SUP147, "Patient Positioning Note")	1	U		
6	TEXT	EV (S147036, 99SUP147, "Patient Setup Note")	1	U		
7	TEXT	EV (S147037, 99SUP147, "Previous Treatment Note")	1	U		
8	TEXT	EV (S147038, 99SUP147, "Planning Imaging Note")	1	U		
9	TEXT	EV (S147039, 99SUP147, "Delivery Verification Note")	1	U		
10	TEXT	EV (S147040, 99SUP147, "Simulation Note")	1	U		
11	CODE	DT (S147041, 99SUP147, "Radiation Therapy Particle")	1-n	U		BCID (SUP147052) Radiation Therapy Particle
12	CODE	DT (S147045, 99SUP147, "Ion Therapy Particle")	1-n	U		BCID (SUP147053) Ion Therapy Particle
13	CODE	DT (S147046, 99SUP147, "Brachytherapy Isotope")	1-n	U		BCID (SUP147057) Brachytherapy Isotope
14	CODE	DT (S147048, 99SUP147, "Teletherapy Isotope")	1-n	U		BCID (SUP147056) Teletherapy Isotope
15	NUMERIC	DT (S147042, 99SUP147, "RT Beam Energy")	1-n	U		UNITS=DCID (SUP147042) Radiotherapy Treatment

							Energy Unit
16	CODE	DT (S147043, 99SUP147, "Patient Positioning Procedure Note")	1-n	U			BCID (9242) Radiotherapy Acquisition Workitem Definition
17	TEXT	EV (S147044, 99SUP147, "QA Process Note")	1	U			
18	TEXT	EV (S147035, 99SUP147, "4D Radiation Treatment Note")	1	U			
19	TEXT	EV (S147047, 99SUP147, "Adaptive Radiation Therapy Note")	1	U			

1644

1645   Content Item Descriptions

Row 11, 12, 13, 14	The source of radiation to be used for this RT treatment. More than one source indicates that the RT treatment may use any combination for treatment. There is no defined relationship between the entries in Row 11, 12, 13, 14 and entries in the Rows 15 and 16.
Row 15	Including several energies indicates that they may be used in any combination.
Row 16	The codes identify procedures supporting the patient positioning process prior to RT treatment. Including several procedures indicates that they may be used in any combination.

1646

1647   **TID SUP147003   RT SEGMENT CHARACTERISTICS**

1648   **TID SUP147003**

1649   **RT Segment Characteristics**

1650   **Type: Extensible   Order: Non-Significant**

1651

	NL	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		NUMERIC	EV (S147150, 99SUP147, "Relative Mass Density")	1	U		Units = EV (ratio, UCUM, "ratio")
2		NUMERIC	EV (S147151, 99SUP147, "Relative Electron Density")	1	U		Units = EV (ratio, UCUM, "ratio")
3		NUMERIC	EV (S147152, 99SUP147, "Effective Z")	1	U		Units = EV (1, UCUM, "no units")
4		NUMERIC	EV (S147153, 99SUP147, "Effective Z per A")	1	U		Units = EV (u^{-1}, UCUM, "u^{-1}")
5		NUMERIC	EV (S147154, 99SUP147, "Relative Linear Stopping Power")	1	U		Units = EV (ratio, UCUM, "ratio")
6	>	NUMERIC	EV (S147155, 99SUP147, "Reference Energy")	1	M		Units = EV ("MeV", UCUM, "Megaelectronvolt")
7		NUMERIC	EV (S147156, 99SUP147, "Linear Cell Kill Factor")	1	U		Units = EV (ratio, UCUM, "ratio")
8		NUMERIC	EV (S147157, 99SUP147, "Quadratic Cell Kill Factor")	1	U		Units = EV (ratio, UCUM, "ratio")
9		NUMERIC	EV (S147158, 99SUP147, "High Dose Fraction Linear	1	U		Units = EV (ratio, UCUM, "ratio")

			Cell Kill Factor")				
10		NUMERIC	EV (S147159, 99SUP147, "Half-time for Tissue Repair ")	1	U		Units = EV (s, UCUM, "second")
11		NUMERIC	EV (S147160, 99SUP147, "High Dose Fraction Transition Dose")	1	U		Units = EV (Gy, UCUM, "Gray")
12		NUMERIC	EV (S147161, 99SUP147, "Atomic Number")	1-n	U		Units = EV (1, UCUM, "no units")
13	>	NUMERIC	EV (S147162, 99SUP147, "Elemental Composition Atomic Mass Fraction")	1	M		Units = EV (ratio, UCUM, "ratio")
14		NUMERIC	EV (S147163, 99SUP147, "αlpha gEUD value")	1	U		Units = EV (ratio, UCUM, "ratio")

1652

1653   Content Item Descriptions

1654

Row 12, 13	The value of (S147162, 99SUP147, "Elemental Composition Atomic Mass Fraction") annotates the fractional weight of the elements identified by the (S147161, 99SUP147, "Atomic Number ") with respect to the total mass of the segment. The allowed value is in the range of [0, 1].

1655

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1657

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1659 | **Add the following to the table in PS3.16, Annex D:**

1660

1661   **ANNEX D   DICOM CONTROLLED TERMINOLOGY DEFINITIONS (NORMATIVE)**

1662

Code Value	Code Meaning	Definition	Notes
S147001	Minimum Surface Radiation Dose	An objective to achieve a radiation dose which is greater than or equal to the specified radiation dose at the surface of a volume.	
S147002	Maximum Surface Radiation Dose	An objective to achieve a radiation dose which is less than or equal to the specified radiation dose at the surface of a volume.	
S147003	Minimum Radiation Dose	An objective to achieve a radiation dose which is greater than or equal to the specified radiation dose throughout a volume.	
S147004	Maximum Radiation Dose	An objective to achieve a radiation dose which is less than or equal to the specified radiation dose throughout a volume.	
S147005	Minimum Mean Radiation Dose	An objective to achieve a mean radiation dose over the volume which is greater than or equal to the specified radiation dose.	
S147006	Maximum Mean Radiation Dose	An objective to achieve a mean radiation dose over the volume which is less than or equal to the specified radiation dose.	
S147007	Minimum Equivalent Uniform Dose	An objective to achieve an equivalent uniform dose (EUD) which is greater than or equal to the specified radiation dose.	
S147008	Maximum Equivalent Uniform Dose	An objective to achieve an equivalent uniform dose (EUD) which is less than or equal to the specified radiation dose.	
S147009	Prescription Radiation Dose	An objective to achieve a radiation dose which is equal to the specified radiation dose throughout the volume.	
S147010	Minimum Conformity Index	An objective to achieve a conformity index which is greater than or equal to the specified conformity index for a radiation dose which is equal to the specified radiation dose throughout the volume. Minimum Conformity Index as defined in [FEUVRET], page 335.	
S147011	Minimum Healthy Tissue Conformity Index	An objective to achieve a healthy tissue conformity index which is greater than or equal to the specified healthy tissue conformity index for a radiation dose which is equal to the specified radiation dose throughout the volume. Minimum Healthy Tissue Conformity Index as defined in [FEUVRET], page 335.	

Code Value	Code Meaning	Definition	Notes
S147012	Minimum Conformation Number	An objective to achieve a conformation number which is greater than or equal to the specified conformation number greater for a radiation dose which is equal to the specified radiation dose throughout the volume. Minimum Conformation Number as defined in [FEUVRET], page 335.	
S147013	Maximum Homogeneity Index	An objective to achieve a homogeneity index which is less than or equal to the specified homogenity index for a radiation dose which is equal to the specified radiation dose throughout the volume. Maximum Homogeneity Index as defined in [FEUVRET], page 335.	
S147014	Minimum Percent Volume at Radiation Dose	An objective to achieve a radiation dose which is greater than or equal to the specified radiation dose for at least a specified volume percentage.	
S147015	Maximum Percent Volume at Radiation Dose	An objective to achieve a radiation dose which is less than or equal to the specified radiation dose for at least a specified volume percentage.	
S147016	Minimum Absolute Volume at Radiation Dose	An objective to achieve a radiation dose which is greater than or equal to the specified radiation dose for at least a specified volume size.	
S147017	Maximum Absolute Volume at Radiation Dose	An objective to achieve a radiation dose which is less than or equal to the specified radiation dose for at least a specified volume size.	
S147018	Minimize Meterset	An objective to minimize the total meterset.	
S147025	Specified Radiation Dose	The radiation dose value for a Dosimetric Objective.	
S147026	Specified Volume Size	The specified volume size of an anatomical region in a Dosimetric Objective.	
S147027	Specified Volume Percentage	The percentage which represents a fractional parameter used by a Dosimetric Objective.	
S147030	Radiation Characteristics Note	Free text note describing characteristics of the radiation.	
S147031	Beam Shaping Note	Free text note describing the devices and techniques used to shape the radiation beam.	
S147032	Treatment Planning Note	Free text note to describe suggestions or advice to treatment planning.	
S147033	Special Procedure Note	Free text note describing additional activities that address individual patient needs.	
S147034	Patient Positioning Note	Free text note describing the process to position the patient for the procedure.	
S147035	4D Radiation Treatment Note	Free text note describing management of patient motion during the radiation treatment.	
S147036	Patient Setup Note	Free text note describing the setup of the patient on the patient support device(s).	

Code Value	Code Meaning	Definition	Notes
S147037	Previous Treatment Note	Free text note describing previously delivered treatments.	
S147038	Planning Imaging Note	Free text note describing the intended use of images for planning.	
S147039	Delivery Verification Note	Free text note describing how delivery is to be verified.	
S147040	Simulation Note	Free text note describing preferred simulation procedures.	
S147041	Radiation Therapy Particle	Particle used for Radiotherapy treatment.	
S147042	RT Beam Energy	Energy of the Radiotherapy treatment beam.	
S147043	Patient Positioning Procedure Note	Free text note describing the procedure for acquiring and applying information about patient position.	
S147044	QA Process Note	Free text note describing the Quality Assurance Process for the treatment of the patient.	
S147045	Ion Therapy Particle	Particle for a radiotherapeutic treatment using beams of energetic protons, positive ions or other particles.	
S147046	Brachytherapy Isotope	Isotope for a radiotherapeutic treatment where a decaying radiation source is placed inside or next to a target area, called Brachytherapy.	
S147047	Adaptive Radiation Therapy Note	Free text note describing how adaptive radiotherapy is to be performed.	
S147048	Teletherapy Isotope	Isotope for a radiotherapeutic treatment where a decaying radiation source is placed outside the body.	
S147050	RT Target	Volume containing tissues to be irradiated to a specified radiation dose, typically encompassing a tumor, and possibly including surrounding subclinical disease, and margin(s) to account for uncertainties in patient positioning and organ motion.	
S147051	RT Dose Calculation Structure	Non-target structure or volume used when calculating the radiation dose, e.g. during an optimzation process. This may be a structure whose proximity to the target and/or radiosensitivity restrict the radiation dose deliverable to the target.	
S147053	RT Geometric Information	Points or volumes used as spatial references, e.g., treatment or imaging device isocenter or fiducial markers.	
S147054	Fixation or Positioning Device	Device used to reproducibly position or limit the motion of a patient or portion of a patient during treatment.	
S147055	Brachytherapy Device	Device used to deliver Brachtherapy treatments. This includes both devices containing radioactive sources (seeds, eye plaques) and devices used to position radioactive sources (source applicators, channels etc.).	

Code Value	Code Meaning	Definition	Notes
S147057	Non-specific Volume	A volume that does not represent a named physical entity.	
S147059	External Body Structure	A volume representing the external shape of the patient body used in radiotherapeutic procedures.	
S147060	Unclassified Volume	A volume that does not correspond to an identifiable physical entity and has user specified boundaries.	
S147070	CTV Nodal	Clinical Target Volume encompassing diseased lymph node(s), with margin to include surrounding sub-clinical disease as defined in [ICRU Report 50].	
S147071	CTV Primary	Clinical Target Volume encompassing primary tumor(s), with margin to include surrounding sub-clinical disease as defined in [ICRU Report 50].	
S147073	GTV Nodal	Gross Tumor Volume encompassing diseased lymph nodes as defined in [ICRU Report 50].	
S147074	GTV Primary	Gross Tumor Volume encompassing primary tumor(s) as defined in [ICRU Report 50].	
S147076	PTV Nodal	Planning Target Volume encompassing a nodal CTV, with margin to account for uncertainty in patient positioning and organ motion as defined in [ICRU Report 50].	
S147077	PTV Primary	Planning Target Volume encompassing a primary CTV, with margin to account for uncertainty in patient positioning and organ motion as defined in [ICRU Report 50].	
S147078	Entire Body Target Volume	Entire Body as a target volume for radiotherapy treatment. The usual term for a treatment technique irradiating this target is Full Body Irradiation.	
S147079	ITV	Internal Target Volume encompassing the CTV, with margin to account for internal motion, often delineated using multiple images, e.g., acquired over a breathing cycle, cardiac cycle, etc, as defined in [ICRU Report 50].	
S147080	Planning Organ At Risk Volume	Volume encompassing the Organ At Risk (Planning organ at Risk Volume) with margin to account for uncertainty in patient positioning and organ motion as defined in [ICRU Report 50].	
S147081	Avoidance Volume	Volume to which delivered radiation dose should be minimized or limited as defined in [ICRU Report 50].	
S147082	Treated Volume	Volume enclosed by an isodose surface appropriate to achieve the purpose of treatment (e.g., tumor eradication or palliation) as defined in [ICRU Report 50].	

Code Value	Code Meaning	Definition	Notes
S147083	Organ At Risk	Normal tissue that receives undesired radiation and may be damaged by the radiation treatment as defined in [ICRU Report 50]. The treatment is typically planned to limit the radiation dose to such an organ.	
S147084	Radiation Dose Shaping Volume	A volume used to express dosimetric constraints for shaping the radiation dose distribution.	
S147085	Conformality Shell	A volume surrounding the target to achive a high radiation dose gradient using a low radiation dose constraint.	
S147086	Radiation Dose Normalization Point	A point for which a specific radiation dose value is chosen. The rest of the radiation dose distribution is normalized against this value.	
S147087	Radiation Dose Reference Point	A point at which the radiation dose is observed.	
S147088	Dose Calculation Bounding Volume	Volume for which radiation dose is calculated.	
S147089	Radiation Interaction Volume	Volume in which the interaction of radiation with matter is taken into account.	
S147090	Patient Anatomy Model	The external boundary of patient tissue without additional devices.	
S147091	Extended Patient Anatomy Model	The external boundary of patient tissue plus devices that may be attached or adjacent to the body (such as Bolus, Patient Support Devices, Patient Immobilization Devices).	
S147100	Patient Setup Point	Point at which the patient is initially positioned prior to any other positioning procedure.	
S147101	Room Laser Patient Setup Point	A reference point used for patient setup based on room lasers.	
S147102	Moveable Laser Patient Setup Point	A reference point used for patient setup based on movable lasers.	
S147104	Reference Acquisition Point	A reference point at which patient position verification references are acquired.	
S147105	Isocentric Treatment Location Point	A point representing the machine isocenter.	
S147120	Specified Conformity Index	The Conformity Index for a Dosimetric Objective as defined in [FEUVRET], page 335.	
S147121	Specified Healthy Tissue Conformity Index	The Healthy Tissue Conformity Index for a Dosimetric Objective as defined in [FEUVRET], page 335.	
S147122	Specified Conformation Number	The Conformation Number for a Dosimetric Objective as defined in [FEUVRET], page 335.	
S147123	Specified Homogeneity Index	The Homogeneity Index for a Dosimetric Objective as defined in [FEUVRET], page 335.	
S147131	Brachytherapy Source Applicator	Source applicator used in brachytherapy treatment delivery	
S147132	Brachytherapy Channel Shield	Channel shield device used in brachytherapy treatment delivery	

Code Value	Code Meaning	Definition	Notes
S147133	Brachytherapy Channel	Channel device used in brachytherapy treatment delivery	
S147145	Unclassified Combination	A logical combination of two or more volumes for which the combination is not classified.	
S147150	Relative Mass Density	Ratio of the mass density of a material relative to the mass density of water.	
S147151	Relative Electron Density	Ratio of the electron density of a material relative to the electron density of water.	
S147152	Effective Z	The average atomic number of a material.	
S147153	Effective Z per A	Ratio of effective atomic number to mass (AMU^{-1}) for a material.	
S147154	Relative Linear Stopping Power	Ratio of the linear stopping power of a material to the linear stopping power of water.	
S147155	Reference Energy	An energy value which qualifies a quantity or parameter whose value is defined in respect to this energy.	
S147156	Linear Cell Kill Factor	Linear Cell Kill Factor (α) as defined in J. Deacon et al (Rad. Onc 2(4): 317-323, 1984), page 318-	
S147157	Quadratic Cell Kill Factor	Quadratic Cell Kill Factor (β) as defined in J. Deacon et al (Rad. Onc 2(4): 317-323, 1984), page 318.	
S147158	High Dose Fraction Linear Cell Kill Factor	High Dose Fraction Linear Cell Kill Factor (γ) as defined in Frederick W. McKenna et (J. Med. Phys, 36(2): 100–106, 2011), page 102.	
S147159	Half-time for Tissue Repair	Half-time for Tissue Repair as defined in R Singh R, et al. (Medical Dosimetry 28(4): 225-259, 2003), page 256.	
S147160	High Dose Fraction Transition Dose	High Dose Fraction Transition Dose as defined in Astrahan, M. (Med. Phys., 35(9): 4161–4172, 2008), page 4164.	
S147161	Atomic Number	The atomic number of an element, i.e. the number of protons found in the nucleus of an atom.	
S147162	Elemental Composition Atomic Mass Fraction	The fractional weight of the element in a compound.	
S147163	αlpha gEUD Value	Tissue-specific parameter that describes the volume effect of radiation dose delivered to a volume. See AAPM Report 166 (http://www.aapm.org/pubs/reports/RPT_166.pdf) for additional information.	
S147180	Single Fraction	A treatment consisting of a single treatment fraction, e.g. for stereotactic treatments.	
S147181	Standard Fractionation	A treatment consisting of a one treatment fraction per day, typically 1.8-2.0Gy per treatment fraction.	
S147182	Hypo-fractionation	A treatment consisting of a reduced number of treatment fractions relative to a standard fractionation, typically with a higher radiation dose per fraction.	

Code Value	Code Meaning	Definition	Notes
S147183	Hyper-fractionation	A treatment consisting of an increased number of fractions relative to a standard fractionation, typically two per day with smaller radiation dose per fraction.	
S147184	Continuous Temporary	A treatment consisting of a continuous delivery using a temporary implant.	
S147185	Continuous Permanent	A treatment consisting of a continuous delivery using a permanent implant.	
S147221	Static Beam	A treatment technique in which the field shape and the source position do not change during delivery.	
S147225	Arc Beam	A treatment technique in which the field shape does not change during delivery while the source position follows an arc.	
S147226	Conformal Arc Beam	A treatment technique in which the field shape changes during delivery while the source position follows an arc.	
S147227	Step and Shoot Beam	A treatment technique in which the field shape does not change during an exposure. Several field shapes may be used in different exposures at the same source position.	
S147228	Sliding Window Beam	A treatment technique in which the field shape continously changes during an exposure at the same source position.	
S147229	VMAT	A treatment technique in which the field shape, gantry speed and radiation dose rate changes during delivery while the source position follows an arc. Volumetric Modulated Arc Therapy (VMAT).	
S147240	Helical Beam	A treatment technique in which the field shape continously changes during delivery while the source position follows a continous arc in parallel to a simultaneous patient support movement.	
S147241	Topographic Beam	A treatment technique in which the field shape and the source position do not change during delivery while the patient support is moving.	
S147341	Headframe	A device attached to the tabletop that is also screwed into the skull of the patient's head to position and orient the head in a prescribed geometry relative to the tabletop. The device is commonly known as a "halo".	
S147342	Head Mask	A device that is placed over the patient's face and attached to the tabletop to prevent the patient from moving relative to the tabletop.	
S147343	Head and Neck Mask	A device that is placed over the patient's face and neck and attached to the tabletop to prevent the patient from moving relative to the tabletop.	

Code Value	Code Meaning	Definition	Notes
S147344	Mold	A device that is modified by pressure (molded) to fit another object (such as the patient's anatomy) and then used to control the reproducibility of the patient's treatment position.	
S147345	Cast	A device that is fabricated from a mold of another object (like the patient's anatomy) and then used to control the reproducibility of the patient's treatment position.	
S147346	Headrest	A device placed beneath a patient to support the head in a prescribed position and orientation relative to the table top.	
S147347	Breast Board	A device placed on the tabletop to support the chest and arms of a patient in a prescribed position and orientation.	
S147348	Body Frame	A device placed beneath a patient to support the whole body in a prescribed position and orientation relative to the table top.	
S147349	Vacuum Mold	A device placed beneath a patient to support a body part in a prescribed position and orientation relative to the table top. It is commonly a bag containing low density polystyrene spheres that becomes semi-hard when vacuum is applied conforming to the bottom surface of the patient.	
S147350	Whole Body Pod	A device placed beneath a patient to support the whole body in a prescribed position and orientation relative to the table top. It is commonly shaped like a hollow half cylinder. The space between the patient and the wall is commonly filled with a dual component foam that hardens conforming to the bottom surface of the patient.	
S147351	Rectal Balloon	A flexible fluid container inserted into the rectum to maintain an immovable geometry during treatment.	
S147353	Vaginal Cylinder	An intracavity cylinder inserted into the vagina to achieve greater radiation dose control and radiation dose shaping. Radioactive sources are inserted into the cylinder for treatment.	
S147411	Chair	A device placed beneath a patient to support the patient in seated position.	
S147471	Aperture Block	A device, typically made of a low temperature alloy, such as Lipowitz's metal, that provides an opening in a beam block with constant attenuation across an area of the beam to prevent or reduce radiation dose delivery to normal tissues.	
S147480	Accessory Tray	A device placed into a machine slot or an applicator to which accessories are attached.	
S147481	Radiotherapy Applicator	A device placed into a radiotherapy machine slot which provide slot to add other devices and/or to limit the beam.	

Code Value	Code Meaning	Definition	Notes
S147500	Radiation transport-based methods	A category of methods for the calculation of effective dose that are based on radiation transport and are used to predict the Relative Biological Effectiveness of an ion beam based on the quality of the radiation used. [Wambersie A, RBE, reference RBE and clinical RBE: Applications of these concepts in hadron therapy, Strahlentherapie und Onkologie 1999 June, 175(2): 39-43] [Paganetti H, et al., Relative biological effectiveness (RBE) values for proton beam therapy, Int J Rad. Onc Biol Phys, 2002 June; 53(2): 407-421]	
S147501	Fractionation-based or temporally-based methods	A category of methods for the calculation of effective dose that are based on Fractionation or temporal patterns and are used to predict the Biologically Effective Dose. [Thames HD, Hendry JH. Fractionation in radiotherapy. New York: Taylor & Francis; 1987] [Barendsen, G.W (1982) Dose fractionation, dose rate and iso-effect relationships for normal tissue responses, Int. J. Radiat. Oncol. Biol. Phys. 8 (11): 1981-1997.]	
S147510	Local Effect Model	The Local Effect Model (LEM) method used to predict the Relative Biological Effectiveness of dose delivered using ion beams. [Grun, R. Friedrich, T. Elasasser, T. Kramer, M. Zink, K. Karger, C. P. Durante, M. Engenhard-Cabillic, R. Scholz, M. (2012) "Impact of enhancements in the local effect model (LEM) on the predicted RBE-weighted target dose distribution in carbon ion therapy" Physics in Medicine and Biology 57: 7261 - 7274.]	
S147511	Microdosimetric Kinetic Model	The Microdosimetric Kinetic Model (MKM) used to predict the Relative Biological Effectiveness of dose delivered using ion beams. [Inaniwa, T. Furukawa, T. Kase, Y. Matsufuji, N. Toshito, T. Matsumoto, Y. Furusawa, Y. Node, K. (2010) "Treatment planning for a scanned carbon beam with a modified microdosimetric kinetic model" Physics in Medicine and Biology 55: 6721 - 6737.]	
S147520	Equivalent 2-Gray Fractions Model	The linear quadratic model used to compute the equivalent Biologically Effective Dose (BED) delivered in 2 Gray dose fractions. [Fowler JF. The linear-quadratic formula and progress in fractionated radiotherapy. Br J Radiol. 1989 Aug; 62 (740): 679–94.]	

Code Value	Code Meaning	Definition	Notes
S147521	Linear-Quadratic Model	The linear quadratic model used to compute the equivalent Biologically Effective Dose (BED) delivered at an infinitely low dose-rate. [Fowler JF, Br J Radiol. 1989; 62: 679-694]	
S147522	Linear-Quadratic Model with Time Factor	The modified linear quadratic model with time factor method used to compute the equivalent Biologically Effective Dose (BED) delivered at an infinitely low dose-rate, taking into account tumor repopulation during treatment. [Fowler JF, Semin. Radiat. Oncol. 1992; 2(1): 16-21]	
S147523	Linear-Quadratic-Linear Model	The linear-quadratic-linear dose-response model used to compute the equivalent Biologically Effective Dose (BED) delivered at an infinitely low dose-rate, taking into account linear cell survival with high dose fractions. [Astrahan M, Med.Phys. 2008; 35: 4161-4172]	
S147524	Linear-Quadratic Model for Low-Dose Rate Brachytherapy	The linear-quadratic dose-response model modified for low-dose rate brachytherapy used to compute the equivalent Biologically Effective Dose (BED) delivered at an infinitely low dose-rate. [Sing R, Al-Hallaq H, Med.Dosim. 2003; 28(4): 225-259]	
S147821	Historical RT Prescription	A Radiotherapy prescription prescribed prior to the current prescription.	
S147822	RT Prescription Input Images	Image Instances available as input for prescribing a Radiotherapy treatment prescription.	
S147823	RT Treatment Planning Input Images	Image Instances available as input for planning a Radiotherapy treatment plan.	
S147900	Multiple Fixed Sources	A treatment technique using multiple decaying radiation sources at fixed spatial locations.	
S147910	Synchronized Robotic Treatment	A treatment technique using a robotic delivery device with real-time motion tracking and compensation.	
S147911	Non-Synchronized Robotic Treatment	A treatment technique using a robotic delivery device without real-time motion tracking and compensation.	
S147951	^3^Helium	Ionized helium atom with 2 protons and 1 neutron.	
S147952	^4^Helium	Ionized helium atom with 2 protons and 2 neutrons.	
S147953	^12^Carbon	Ionized carbon atom with 6 protons and 6 neutrons.	
S147954	^16^Oxygen	Ionized oxygen atom with 8 protons and 8 neutrons.	

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