Integrating the Healthcare Enterprise

IHE Radiation Oncology (RO) Technical Framework

Volume 3
IHE RO TF-3
Content Modules

Revision 3.0 - Final Text

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Please verify you have the most recent version of this document, which is published here.

CONTENTS

1 Introduction

This document, Volume 3 of the IHE Radiation Oncology (RO) Technical Framework, defines content modules used in the IHE Radiation Oncology profiles.

1.1 Introduction to IHE

Integrating the Healthcare Enterprise (IHE) is an international initiative to promote the use of standards to achieve interoperability among health information technology (HIT) systems and effective use of electronic health records (EHRs). IHE provides a forum for care providers, HIT experts and other stakeholders in several clinical and operational domains to reach consensus on standards-based solutions to critical interoperability issues.

The primary output of IHE is system implementation guides, called IHE Profiles. IHE publishes each profile through a well-defined process of public review and trial implementation and gathers profiles that have reached final text status into an IHE Technical Framework, of which this volume is a part.

For more general information regarding IHE, refer to www.ihe.net. It is strongly recommended that, prior to reading this volume, the reader familiarizes themselves with the concepts defined in the IHE Technical Frameworks General Introduction.

1.2 Intended Audience

The intended audience of IHE Technical Frameworks Volume 3 is:

- IT departments of healthcare institutions
- Technical staff of vendors participating in the IHE initiative
- Experts involved in standards development

1.3 Overview of Technical Framework Volume 3

Volume 3 is comprised of several distinct sections:

- Section 1 provides background and reference material.
- Section 2 presents the conventions used in this volume to define the content modules.
- Section 3 provides an overview of Content Modules and the terminology used.
- Section 4 is reserved for domain unique Content Module specifications.
- Section 5 lists the namespaces and identifiers defined or referenced and the vocabularies defined or referenced herein.
- Section 6 defines Radiation Oncology's HL7 V3 CDA Content Modules in detail (if applicable).
- Section 7 defines Radiation Oncology's DICOM content modules.

- Section 8, 9, etc. define other types of content modules (as needed).

The appendices in Volume 3 provide clarification of technical details of the IHE data model and transactions. Code and message samples may also be stored on the IHE Google Drive. In this case, explicit links to the applicable Google Drive folder will be provided in the transaction text.

Due to the length of the document, some domains may divide Volume 3 into smaller volumes labeled 3a, 3b, etc. In this case, the Volume 3 appendices are gathered in Volume 3x.

For a brief overview of additional Technical Framework Volumes (TF-1, TF-2, TF-4), please see the IHE Technical Frameworks General Introduction, Section 5 - Structure of the IHE Technical Frameworks.

1.4 Comment Process

IHE International and AAPM welcomes comments on this document and the IHE-RO initiative. They should be submitted at http://www.ihe.net/Radiation_Oncology_Public_Comments or to:

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1.5 Copyright Licenses

IHE technical documents refer to, and make use of, a number of standards developed and published by several standards development organizations. Please refer to the IHE Technical Frameworks General Introduction, Section 9 - Copyright Licenses for copyright license information for frequently referenced base standards. Information pertaining to the use of IHE International copyrighted materials is also available there.

1.6 Trademark

IHE® and the IHE logo are trademarks of the Healthcare Information Management Systems Society in the United States and trademarks of IHE Europe in the European Community. Please refer to the IHE Technical Frameworks General Introduction, Section 10 - Trademark for information on their use.

1.7 Disclaimer Regarding Patent Rights

Attention is called to the possibility that implementation of the specifications in this document may require use of subject matter covered by patent rights. By publication of this document, no position is taken with respect to the existence or validity of any patent rights in connection therewith. IHE International is not responsible for identifying Necessary Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patents

Claims or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of the specifications in this document are expressly advised that
425 determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility. Further information about the IHE International patent disclosure process including links to forms for making disclosures is available at http://www.ihe.net/Patent_Disclosure_Process. Please address questions about the patent disclosure process to the secretary of the IHE International Board: secretary@ihe.net.

430 ## 1.8 History of Document Changes

This section provides a brief summary of changes and additions to this document.

Date	Document Revision	Change Summary
2020-04-07	2.0	Added initial content for Basic RT Objects – II, Treatment Planning Plan Content and Multi-Modality Registration 2018 profiles.
SEPT 2025	3.0	Add content for TDW-II, updates to coincide with the latest template.

2 Conventions

This document has adopted the following conventions for representing the framework concepts and specifying how the standards upon which the IHE Technical Framework is based shall be applied.

2.1 Content Module Modeling and Profiling Conventions

In order to maintain consistent documentation, modeling methods for IHE content modules and profiling conventions, for frequently used standards, are maintained in the IHE Technical Frameworks General Introduction, Appendix E - Standards Profiling and Documentation Conventions. Methods described include the standards conventions DICOM, HL7 v2.x, HL7 Clinical Document Architecture (CDA) Documents, etc. These conventions are critical to understanding this volume and should be reviewed prior to reading this text

2.2 Additional Standards Profiling Conventions

This section defines profiling conventions for standards which are not described in the IHE Technical Frameworks General Introduction.

No additional for Radiation Oncology.

3 Content Modules Overview and Terminology

In the future, there may be an appendix to the *IHE Technical Frameworks General Introduction* that will provide an overview of Content Modules. In the interim, information may be available on the IHE wiki at http://wiki.ihe.net/index.php?title=Profiles.

4 Reserved for domain specific content

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5 IHE Namespaces, Concept Domains, and Vocabularies

This section references the namespaces, concept domains, and identifiers defined or referenced by the IHE RO Technical Framework, and the vocabularies defined or referenced herein.

5.1 IHE Radiation Oncology Namespaces

No namespaces are defined.

5.2 IHE Radiation Oncology Concept Domains

No concept domains are defined.

5.3 IHE Radiation Oncology Format Codes and Vocablaries

The following vocabularies are referenced in the IHE RO Technical Framework. An extensive list of registered vocabularies can be found at http://hl7.amg-hq.net/oid/frames.cfm.

5.3.1 IHE Format Codes

For IHE Format Codes please see the IHE Format Codes wiki page at http://wiki.ihe.net/index.php/IHE_Format_Codes.

5.3.2 IHEActCode Vocabulary

- CCD ASTM/HL7 Continuity of Care Document
- CCR ASTM CCR Implementation Guide

The IHEActCode vocabulary is a small vocabulary of clinical acts that are not presently supported by the HL7 ActCode vocabulary. The root namespace (OID) for this vocabulary is 1.3.5.1.4.1.19376.1.5.3.2. These vocabulary terms are based on the vocabulary and concepts used in the CCR and CCD standards listed above.

Please see the IHEActCode Vocabulary at http://wiki.ihe.net/index.php/IHEActCode_Vocabulary.

5.3.3 IHERoleCode Vocabulary

The IHERoleCode vocabulary is a small vocabulary of role codes that are not presently supported by the HL7 Role Code vocabulary. The root namespace (OID) for this vocabulary is 1.3.5.1.4.1.19376.1.5.3.3.

Please see the IHERoleCode Vocabulary at http://wiki.ihe.net/index.php/IHERoleCode_Vocabulary

6 IHE RO HL7 V3 CDA Content Modules

No Content Modules defined.

7 Radiation Oncology DICOM Content Definitions

DICOM Content Definitions constrain the use of instances of specific DICOM IODs (also referred to as DICOM objects). This typically means placing requirements on the creators of those instances, although requirements may also be placed on the receivers and users.

The most common such requirements are to:

- Make a module that is optional (U) in a DICOM IOD be required or conditional,
- Make an attribute that is optional (Type 3) in a DICOM Module be required or conditional,
- Require that an attribute that is optional (Type 3) in a DICOM Module be absent
- Constrain the content of an attribute to be empty
- Constrain the content of an attribute to be populated in a certain way, such as:
  - Constraining the value to be taken from a specific table
  - Constraining the value to be copied from a specific source
  - Constraining the value to encode certain information
- Require that an attribute be displayed/accessible to the operator

Reiterating DICOM requirements is kept to a minimum sufficient to provide context for the IHE requirements. Implementers are still required to be familiar with, and conform to, the underlying DICOM specification.

Content Definitions may be referenced from a profile independent of transactions to constrain content without specifying the transport. Content Definitions may also be referenced from within a Transaction specification to constrain the content without duplicating the same constraint text across multiple related transactions.

For attributes that are optional, the creator is permitted but not required to include them, and the receiver is permitted but not required to ignore them.

7.1 Conventions

DICOM Conventions are defined in Appendix E to the *IHE Technical Frameworks General Introduction*.

7.1.1 Scope of Requirements

Requirements apply to all profiles which make use of the content definitions by referencing sections of this Volume. However where the uses cases covered by a profile need a different requirements, the profile may specify deviations from the definition here. This allows re-use of content definitions even in cases where only few adaptations are needed. It eliminates the need to duplicate the definitions, when the content requirements are shared in their majority and only a small number of deviations are indicated.

7.1.2 Requirements Definitions

Each content module has a list of attributes requirements. In any case, the requirements specified in the referenced DICOM Standard do apply.

Attributes not listed may or may not be present along the definition of the DICOM Standard. The producer may provide such attributes, but the receiver is not required to interpret them. Thus, it is not an error to include more than is asked for, but it is an error to reject a content based on additional attributes present.

Attributes, which may or may not be present by definition in the DICOM Standard, but shall not present under the definition of IHE-RO will be included in the specification with a requirement to be absent.

Attribute requirements are only in effect when the enclosing sequence item is present. For example, a type 1 attribute can be left out of content IF the enclosing sequence is not required and is not present.

IHE and IHE-RO have defined requirements related to the support for and use of attributes in DICOM storage transactions by both Service Class Users (SCUs) and Service Class Providers (SCPs):

IOD Table

M / C / U	As defined in DICOM PS 3.3
R	The Module is defined as Conditional (C) or User Option (U) in DICOM. The Requirement is an IHE extension of the DICOM requirements, and the module shall be present.
RC	The Module is defined as Conditional (C) or User Option (U) in DICOM. The Requirement is an IHE extension of the DICOM requirements, and the module shall be present when the specified conditions apply.

Module Table

O	The attribute or its value is optional, i.e., in DICOM it is Type 2 or 3.
O+*	The attribute is optional, but additional constraints have been added. Note: The specification approach does not force a Type 2 or Type 3 value to become a Type 1 by stating O+.
R+	The Requirement is an IHE extension of the DICOM requirements, and the attribute shall be present, i.e., is Type 1, whereas the DICOM requirement may be Type 2 or 3.
RC+	The Requirement is an IHE extension of the DICOM requirements, and the attribute shall be present when the condition is satisfied, i.e., is Type 1C, whereas the DICOM requirement may be Type 2 or 3. If the condition is not fulfilled, the DICOM definitions apply. Note, that this means that the attribute may be present / have a value also in case the condition does not apply.
D	The requirements of DICOM apply unchanged, but the attribute needs to be displayed.

-	No IHE extension of the DICOM requirements is defined. The attribute is listed for better readability or similar purpose.
X+	The attribute information is required to be absent. DICOM Type 2 attributes shall be present with no value. DICOM Type 3 attributes shall be absent.

7.1.3 Display Requirements

An asterisk (*) appearing on the attribute requirements indicates that the attribute does NOT need to be displayed

7.1.4 Service Specification

7.1.4.1 Query Keys

When a Query Key specification contains “R”, “R+” or “R+*”, the SCU is required to query for matching on the attributes. '-' indicates, that there are no additional requirements in respect to the DICOM Standard. Non-empty keys are not allowed to be provided by the SCU.

When a Query Key Return specification contains "R", the SCU must provide the key with a zero-length value for Universal Matching, in which case the SCP shall return those attributes in the response.

When the Query Key Return specification contains "O", the SCU may choose to provide such keys for Universal Matching, but the SCP must support matching on this key.

'-' in a cell means, that there are no additional requirements by IHE compared with the DICOM requirements. Implementers shall be aware though, that DICOM requires empty attributes to be present where return values are expected. Therefore '-' must not be read as permitting absence of those attributes in the C-FIND command when such return values shall be present.

7.2 General Definitions

7.2.1 Character Sets

7.2.1.1 Support of Character Sets other than ISO-IR 100

All actors shall support at least the Default Character Set and ISO-IR 100 (Latin-1) in all transactions. Other character sets as specified in Specific Character Set (0008,0005) shall be supported along the specification of the conformance statements of the involved actors. Especially that means the following:

- It shall be possible for all actors involved in a transaction to use those character sets in their communication which all actors support along their conformance statements.
- When there are no character sets shared across all actors, ISO-RO 100 shall be used.

7.2.2 Propagation of Common Patient Information

Attribute (Tag)	CT Image	RT Structure Set	Geometric RT Plan	Dosimetric RT Plan	RT Dose	RT Treatment Record
Patient's Name (0010,0010)	Source	Copy	Copy	Copy	Copy	Copy
Patient ID (0010,0020)	Source	Copy	Copy	Copy	Copy	Copy
Patient's Birth Date (0010,0030)	Source	Copy	Copy	Copy	Copy	Copy
Patient's Sex (0010,0040)	Source	Copy	Copy	Copy	Copy	Copy

Interoperable exchange requires consistent patient information. Reasonable effort should be made to reconcile inconsistent patient information.

Inconsistent data received by downstream actors must be handled safety.

7.2.3 Study Handling

It is recommended that a new Study is created for the RT Structure Set.

The RT Structure Set may copy the Study IE of the treatment planning image series.

DICOM objects that are created based on this RT Structure Set instance or further derived instances should copy the Study IE of their predecessors.

If changes to Study-related attributes are required in the RT workflow, a new Study IE shall be created.

Note 1: If one copies the Study Instance UID, no study level attributes may be altered.

7.2.4 Frame of Reference Handling

All DICOM objects based on a planning image Set shall copy the Frame of Reference Module values from this image set.

7.3 IOD Definitions

This section defines each DICOM IOD used in the IHE Radiation Oncology domain in detail, specifying the standards used and the information defined.

7.3.1 Prescription IODs

This section is present only to convey the envisioned section numbering.

7.3.2 Plan IODs

7.3.2.1 Technique Specific RT Plan IODs

7.3.2.1.1 RT Plan IOD for Photon External Beam in Planning State

595 **7.3.2.1.1.1 Referenced Standards**

DICOM 2018e PS 3.3

7.3.2.1.1.2 IOD Definition

IE	Module	Reference	Usage	IHE-RO Usage
Patient	Patient	C.7.1.1	M	M See Section **Error! Reference source not found.**
	Clinical Trial Subject	C.7.1.3	U	U
Study	General Study	C.7.2.1	M	M See Section **Error! Reference source not found.**
	Patient Study	C.7.2.2	U	U
	Clinical Trial Study	C.7.2.3	U	U
Series	RT Series	C.8.8.1	M	M See Section **Error! Reference source not found.**
	Clinical Trial Series	C.7.3.2	U	U
Frame of Reference	Frame of Reference	C.7.4.1	U	R See Section**Error! Reference source not found.**
Equipment	General Equipment	C.7.5.1	M	M See Section **Error! Reference source not found.**
Plan	RT General Plan	C.8.8.9	M	M See Section **Error! Reference source not found.**
	RT Prescription	C.8.8.10	U	R See Section 7.4.3.2.1
	RT Tolerance Tables	C.8.8.11	U	U
	RT Patient Setup	C.8.8.12	U	R See Section 7.4.5.3.1

IE	Module	Reference	Usage	IHE-RO Usage
	RT Fraction Scheme	C.8.8.13	U	R See Section 7.4.3.3.1 and 7.4.3.3.2
	RT Beams	C.8.8.14	C - Required if RT Fraction Scheme Module exists and Number of Beams (300A,0080) is greater than zero for one or more fraction groups	R Definitions see below
	RT Brachy Application Setups	C.8.8.15	C - Required if RT Fraction Scheme Module exists and Number of Brachy Application Setups (300A,00A0) is greater than zero for one or more fraction groups	Absent
	Approval	C.8.8.16	U	R
	SOP Common	C.12.1	M	M See Section **Error! Reference source not found.**

RT Beams Module is defined as follows:

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Beam Content Type	Section
Basic Static Beam	7.4.4.1
Basic Static MLC Beam	7.4.4.1.2
Arc Beam	7.4.4.1.3
MLC Fixed Aperture Arc Beam	7.4.4.1.4
MLC Variable Aperture Arc Beam	7.4.4.1.5
Hard Wedge Beam	7.4.4.1.6
Virtual Wedge Beam	7.4.4.1.7
Motorized Wedge Beam	7.4.4.1.8
Static Electron Beam	7.4.4.1.9
Step & Shoot Beam	7.4.4.1.10
Sliding Window Beam	7.4.4.1.11
IMAT/VMAT Beam	7.4.4.1.12
Photon Applicator Beam	7.4.4.1.13
Photon Applicator Arc Beam	7.4.4.1.14

7.3.2.1.2 RT Plan IOD for Photon External Beam in Delivery State

This section is present only to convey the envisioned section numbering.

7.3.2.2 RT Plan IOD for General Use

7.3.2.2.1 RT Plan IOD from Dosimetric Planning

7.3.2.2.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.3.2.2.1.2 IOD Definition

IE	Module	Reference	Usage	IHE-RO Usage
Patient	Patient	C.7.1.1	M	M See Section 7.4.1.1.1
	Clinical Trial Subject	C.7.1.3	U	U
Study	General Study	C.7.2.1	M	M See Section 7.4.1.2.1
	Patient Study	C.7.2.2	U	U
	Clinical Trial Study	C.7.2.3	U	U
Series	RT Series	C.8.8.1	M	M See Section 7.4.1.4.1
	Clinical Trial Series	C.7.3.2	U	U
Frame of Reference	Frame of Reference	C.7.4.1	U	M See Section 7.4.1.7.1
Equipment	General Equipment	C.7.5.1	M	M See Section 7.4.1.5.1
Plan	RT General Plan	C.8.8.9	M	M See Section 7.4.3.1.1
	RT Prescription	C.8.8.10	U	R See Section 7.4.3.2.1
	RT Tolerance Tables	C.8.8.11	U	U
	RT Patient Setup	C.8.8.12	U	R See below
	RT Fraction Scheme	C.8.8.13	U	R See Section 7.4.3.3.2.1
	RT Beams	C.8.8.14	C - Required if RT Fraction Scheme Module exists and Number of Beams (300A,0080) is greater than zero for one or more fraction groups	R Shall be present

IE	Module	Reference	Usage	IHE-RO Usage
	RT Brachy Application Setups	C.8.8.15	C - Required if RT Fraction Scheme Module exists and Number of Brachy Application Setups (300A,00A0) is greater than zero for one or more fraction groups	N/A
	Approval	C.8.8.16	U	M
	SOP Common	C.12.1	M	M
	Common Instance Reference	C.12.2	U	C – Required if reference information is available

RT Patient Setup Module is defined as follows:

Patient Setup Option	Section
Base Setup	See Section 7.4.3.4.1
Feet First Setup	See Section 0
Reoriented Setup	See Section 0
Decubitus Setup	See Section 0

7.3.2.2.2 RT Plan IOD for Dose Composition

This section is present only to convey the envisioned section numbering.

7.3.2.2.3 RT Plan IOD for Consistent Dose Tracking

This section is present only to convey the envisioned section numbering.

7.3.2.2.4 RT Ion Plan IOD from Dosimetric Planning

7.3.2.2.4.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.3.2.2.4.2IOD Definition

IE	Module	Reference	Usage	IHE-RO Usage
Patient	Patient	C.7.1.1	M	M See Section 7.4.1.1.1
	Clinical Trial Subject	C.7.1.3	U	U
Study	General Study	C.7.2.1	M	M See Section 7.4.1.2.1
	Patient Study	C.7.2.2	U	U
	Clinical Trial Study	C.7.2.3	U	U
Series	RT Series	C.8.8.1	M	M See Section 7.4.1.4.1
	Clinical Trial Series	C.7.3.2	U	U
Frame of Reference	Frame of Reference	C.7.4.1	U	M See Section 7.4.1.7.1
Equipment	General Equipment	C.7.5.1	M	M See Section 7.4.1.5.1
Plan	RT General Plan	C.8.8.9	M	M See Section 7.4.3.1.1
	RT Prescription	C.8.8.10	U	R See Section 7.4.3.2.1
	RT Ion Tolerance Tables	C.8.8.24	U	U
	RT Patient Setup	C.8.8.12	U	R See below
	RT Fraction Scheme	C.8.8.13	U	R See Section 7.4.3.3.2.1
	RT Ion Beams	C.8.8.25	C - Required if RT Fraction Scheme Module exists and Number of Beams (300A,0080) is greater than zero for one or more fraction groups	R Shall be present
	Approval	C.8.8.16	U	M
	SOP Common	C.12.1	M	M
	Common Instance Reference	C.12.2	U	C – Required if reference information is available

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RT Patient Setup Module is defined as follows:

Patient Setup Option	Section
Base Setup	See Section 7.4.3.4.1

Patient Setup Option	Section
Feet First Setup	See Section 0
Reoriented Setup	See Section 0
Decubitus Setup	See Section 0

7.3.2.2.5 RT Plan IOD from Geometric Planning

7.3.2.2.5.1 Referenced Standards

DICOM 2018d Edition PS 3.3

625 **7.3.2.2.5.2 Definition**

IE	Module	Reference	Usage	IHE-RO Usage
Patient	Patient	C.7.1.1	M	M See Section 7.4.1.1.1
	Clinical Trial Subject	C.7.1.3	U	U
Study	General Study	C.7.2.1	M	M See Section 7.4.1.2.1
	Patient Study	C.7.2.2	U	U
	Clinical Trial Study	C.7.2.3	U	U
Series	RT Series	C.8.8.1	M	M See Section 7.4.1.4.1
	Clinical Trial Series	C.7.3.2	U	U
Frame of Reference	Frame of Reference	C.7.4.1	U	M See Section 7.4.1.7.1
Equipment	General Equipment	C.7.5.1	M	M See Section 7.4.1.5.1
Plan	RT General Plan	C.8.8.9	M	M See Section 7.4.3.1.1
	RT Prescription	C.8.8.10	U	U
	RT Tolerance Tables	C.8.8.11	U	U
	RT Patient Setup	C.8.8.12	U	R See below
	RT Fraction Scheme	C.8.8.13	U	U
	RT Beams	C.8.8.14	C - Required if RT Fraction Scheme Module exists and Number of Beams (300A,0080) is greater than zero for one or more fraction groups	R See Section 7.4.4.4.1 (Can be excluded for zero beams with non-isocentric model)
	RT Brachy Application Setups	C.8.8.15	C - Required if RT Fraction Scheme Module exists and Number of Brachy Application Setups (300A,00A0) is greater than zero for one or more fraction groups	N/A
	Approval	C.8.8.16	U	M
	SOP Common	C.12.1	M	M
	Common Instance Reference	C.12.2	U	C – Required if reference information is available

7.3.3 Image IOD

7.3.3.1 RT Image

This section is present only to convey the envisioned section numbering.

7.3.3.2 CT Image

7.3.3.2.1 CT Image in Planning State

This section is present only to convey the envisioned section numbering.

7.3.3.2.2 CT Image in Delivery State

This section is present only to convey the envisioned section numbering.

7.3.3.2.3 CT Image for General Use

7.3.3.2.3.1 Referenced Standards

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7.3.3.2.3.2 IOD Definition

IE	Module	Reference	Usage	IHE-RO Usage
Patient	Patient	C.7.1.1	M	M
	Clinical Trial Subject	C.7.1.3	U	U
Study	General Study	C.7.2.1	M	M
	Patient Study	C.7.2.2	U	U
	Clinical Trial Study	C.7.2.3	U	U
Series	General Series	C.7.3.1	M	M See below
	Clinical Trial Series	C.7.3.2	U	U
Frame of Reference	Frame of Reference	C.7.4.1	M	M
Equipment	General Equipment	C.7.5.1	M	M
Image	General Image	C.7.6.1	M	R
	Image Plane	C.7.6.2	M	R See below
	Image Pixel	C.7.6.3	M	M

IE	Module	Reference	Usage	IHE-RO Usage
	Contrast/Bolus	C.7.6.4	C - Required if contrast media was used in this image	C - Required if contrast media was used in this image
	Device	C.7.6.12	U	U
	Specimen	C.7.6.22	U	U
	CT Image	C.8.2.1	M	M
	Overlay Plane	C.9.2	U	U
	VOI LUT	C.11.2	U	U
	SOP Common	C.12.1	M	M
	Common Instance Reference	C.12.2	U	C – Required if reference information is available

640 **General Series Module is defined as follows:**

Image Orientation Option	Section
Base Setup	See Section 7.4.1.3.1
Feet First Setup	See Section 0
Decubitus Setup	See Section 7.4.1.3.3

Image Plane Module is defined as follows:

Image Orientation Option	Section
Base Setup	See Section 7.4.6.2.1
Decubitus Setup	See Section 7.4.6.2.2

7.3.4 RT Structure Set IOD

645 #### 7.3.4.1 RT Structure Set for General Use

7.3.4.1.1 RT Structure Set for Basic Interoperability

7.3.4.1.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.3.4.1.1.2 IOD Definition

IE	Module	Reference	Usage	IHE-RO Usage
Patient	Patient	C.7.1.1	M	M See Section 7.4.1.1.1
	Clinical Trial Subject	C.7.1.3	U	U
Study	General Study	C.7.2.1	M	M See Section 7.4.1.2.1
	Patient Study	C.7.2.2	U	U
	Clinical Trial Study	C.7.2.3	U	U
Series	RT Series	C.8.8.1	M	M See Section 7.4.1.4.1
	Clinical Trial Series	C.7.3.2	U	U
Frame of Reference	Frame of Reference	C.7.4.1	U	M See Section 7.4.1.7.1
Equipment	General Equipment	C.7.5.1	M	M See Section 7.4.1.5.1
Structure Set	Structure Set	C.8.8.5	M	M See Section **Error! Reference source not found.**
	ROI Contour	C.8.8.6	M	R See below
	RT ROI Observation	C.8.8.8	M	M See Section **Error! Reference source not found.**
	Approval	C.8.8.16	U	U
	SOP Common	C.12.1	M	M
	Common Instance Reference	C.12.2	U	C – Required if reference information is available

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ROI Contour Module is defined as follows:

Contouring Option	Section
On-slice contouring	See Section 7.4.8.2.1
Off-slice contouring	See Section 7.4.8.2.2

7.3.4.1.2 RT Structure Set Multi-Modality Content

7.3.4.1.2.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.3.4.1.2.2 IOD Definition

IE	Module	Reference	Usage	IHE-RO Usage
Patient	Patient	C.7.1.1	M	M See Section 7.4.1.1.1
	Clinical Trial Subject	C.7.1.3	U	U
Study	General Study	C.7.2.1	M	M See Section 7.4.1.2.1
	Patient Study	C.7.2.2	U	U
	Clinical Trial Study	C.7.2.3	U	U
Series	RT Series	C.8.8.1	M	M See Section 7.4.1.4.1
	Clinical Trial Series	C.7.3.2	U	U
Frame of Reference	Frame of Reference	C.7.4.1	U	M See Section 7.4.1.7.1
Equipment	General Equipment	C.7.5.1	M	M See Section 7.4.1.5.1
Structure Set	Structure Set	C.8.8.5	M	M See Section 7.4.8.3.2
	ROI Contour	C.8.8.6	M	R See Section **Error! Reference source not found.**
	RT ROI Observation	C.8.8.8	M	M See Section **Error! Reference source not found.**
	Approval	C.8.8.16	U	U
	SOP Common	C.12.1	M	M
	Common Instance Reference	C.12.2	U	C – Required if reference information is available

7.3.5 RT Dose IOD

7.3.5.1 RT Dose IOD for General Use

7.3.5.1.1 RT Dose from Dosimetric Planning

7.3.5.1.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.3.5.1.1.2 IOD Definition

IE	Module	Reference	Usage	IHE-RO Usage
Patient	Patient	C.7.1.1	M	M See Section 7.4.1.1.1
	Clinical Trial Subject	C.7.1.3	U	U
Study	General Study	C.7.2.1	M	M See Section 7.4.1.2.1
	Patient Study	C.7.2.2	U	U
	Clinical Trial Study	C.7.2.3	U	U
Series	RT Series	C.8.8.1	M	M See Section 7.4.1.4.1
	Clinical Trial Series	C.7.3.2	U	U
Frame of Reference	Frame of Reference	C.7.4.1	M	M See Section 7.4.1.7.1
Equipment	General Equipment	C.7.5.1	M	M See Section 7.4.1.5.1
Dose	General Image	C.7.6.1	C - Required if dose data contains grid-based doses.	M
	Image Plane	C.7.6.2	C - Required if dose data contains grid-based doses.	R See Section 7.4.13.1.1
	Image Pixel	C.7.6.3	C - Required if dose data contains grid-based doses.	M
	Multi-Frame	C.7.6.6	C - Required if dose data contains grid-based doses and pixel data is multi-frame data.	R See Section 7.4.13.2.1
	Overlay Plane	C.9.2	U	U
	Multi-Frame Overlay	C.9.3	U	U
	Modality LUT	C.11.1	U	U
	RT Dose	C.8.8.3	M	M See Section 7.4.13.3.1

IE	Module	Reference	Usage	IHE-RO Usage
	RT DVH	C.8.8.4	U	RC Required for transactions [RO-BRTO-II-3] and [RO-BRTO-II-4] See Section 7.4.13.4.1
	Structure Set	C.8.8.5	C - Required if dose data contains dose points or isodose curves	Outside the scope of this profile.
	ROI Contour	C.8.8.6	C - Required if dose data contains dose points or isodose curves	Outside the scope of this profile.
	RT Dose ROI	C.8.8.7	C - Required if dose data contains dose points or isodose curves	Outside the scope of this profile.
	SOP Common	C.12.1	M	M
	Common Instance Reference	C.12.2	U	C – Required if reference information is available

7.3.6 Treatment Record

7.3.7 Reporting IOD

This section is present only to convey the envisioned section numbering.

7.3.8 ROI Dictionary IOD

This section is present only to convey the envisioned section numbering.

7.3.9 Workflow IOD

7.3.9.1 RT Beams Delivery Instruction IOD

7.3.9.1.1 RT Beams Delivery Instruction IOD - Treatment Delivery Workfow Use Case

7.3.9.1.1.1 Referenced Standards

DICOM Edition PS 3.3: A.64 RT Beams Delivery Instruction IOD

7.3.9.1.1.2 IOD Definition

Table 7.3.9.1.1.2-1: Usage of DICOM Modules in IHE

IE	Module	Reference	Usage	IHE-RO
Patient	Patient	C.7.1.1	M	M See 7.4.1.1.1
	Clinical Trial Subject	C.7.1.3	U	U
Study	General Study	C.7.2.1	M	M See 7.4.1.2.1
	Patient Study	C.7.2.2	U	U
	Clinical Trial Study	C.7.2.3	U	U
Series	General Series	C.7.3.1	M	M
	Clinical Trial Series	C.7.3.2	U	U
Equipment	General Equipment	C.7.5.1	M	M See 7.4.1.5.1
Plan	RT Beams Delivery Instruction	C.8.8.29	M	M See 7.4.2.1.1
	Common Instance Reference	C.12.2	C - Required if not conveyed by a Unified Procedure Step. May be present otherwise.	C
	SOP Common	C.12.1	M	M See 7.4.1.6.1

7.3.10 Spatial Registration IOD

7.3.10.1 Spatial Registration IOD for General Use

7.3.10.1.1 Spatial Registration IOD Base Content

7.3.10.1.1.1 Referenced Standards

DICOM 2018d PS 3.3

7.3.10.1.1.2 IOD Definition

IE	Module	Reference	Usage	IHE-RO Usage
Patient	Patient	C.7.1.1	M	M See Section 7.4.1.1.1

IE	Module	Reference	Usage	IHE-RO Usage
	Clinical Trial Subject	C.7.1.3	U	U
Study	General Study	C.7.2.1	M	M
	Patient Study	C.7.2.2	U	U
	Clinical Trial Study	C.7.2.3	U	U
Series	General Series	C.7.3.1	M	M
	Clinical Trial Series	C.7.3.2	U	U
	Spatial Registration Series	C.20.1	M	M
Frame of Reference	Frame of Reference	C.7.4.1	M	M
Equipment	General Equipment	C.7.5.1	M	M
Spatial Registration	Spatial Registration	C.20.2	M	R See Section 7.4.10.1
	Common Instance Reference	C.12.2	M	M
	SOP Common	C.12.1	M	M

7.4 Module Definitions

This section defines each DICOM Module used in the IHE Radiation Oncology domain in detail, specifying the standards used and the information defined.

7.4.1 General Modules

7.4.1.1 Patient Module

7.4.1.1.1 Patient Module Base Content

7.4.1.1.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.1.1.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
Patient's Name	(0010,0010)	R+	IHE requires that this element be present. This element is one of the primary patient identifying elements, and as such, all DICOM objects with the same Study Instance UID, must have the same value in this element. Equipment which creates new series based on other series (i.e., resampled series, new structure sets, plans, etc.) must preserve the value of this element to adhere to this profile.
Patient ID	(0010,0020)	R+	See Patient's Name (0010,0010) See also RAD TF-2: A.3

Attribute	Tag	Type	Attribute Note
Patient's Birth Date	(0010,0030)	O+	See Patient's Name (0010,0010) See also RAD TF-2: A.3
Patient's Sex	(0010,0040)	O+	See Patient's Name (0010,0010) See also RAD TF-2: A.3

7.4.1.2 Study Module

7.4.1.2.1 General Study Module Base Content

700 ###### 7.4.1.2.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.1.2.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
Study Instance UID	(0020,000D)	RC+*	IHE requires that this value be preserved in the following cases: If a set of images are resampled and re-exported. This new set of images will be a new series. This series will belong to the same study and will have the same study date. This is to facilitate grouping the images in a PACS. All other study level attributes mentioned in this table shall be preserved based on their existence, especially meaning to preserve an empty attribute value. Equipment which creates new series based on other series (i.e., resampled series, new structure sets, plans, etc.) must preserve the value of this element to adhere to this profile (see Section 0).
Study Date	(0008,0020)	RC+	[See Study Instance UID (0020,000D)]
Study Time	(0008,0030)	RC+	[See Study Instance UID (0020,000D)]
Study ID	(0020,0010)	RC+	[See Study Instance UID (0020,000D)]
Accession Number	(0008,0050)	RC+	[See Study Instance UID (0020,000D)]
Study Description	(0008,1030)	O+	[See Study Instance UID (0020,000D)]

7.4.1.3 General Series Module

705 ##### 7.4.1.3.1 General Series Module Base Content

7.4.1.3.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.1.3.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
Series Date	(0008,0021)	RC+	Must be used and preserved, if present. If the producer creates a new series must be defined.
Series Time	(0008,0031)	RC+	Must be used and preserved, if present. If the producer creates a new series must be defined.
Patient Position	(0018,5100)	R+	Shall be one of {HFS, HFP}.

7.4.1.3.2 General Series Module Feet First

7.4.1.3.2.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.1.3.2.2 Module Definition

Attribute	Tag	Type	Attribute Note
Series Date	(0008,0021)	RC+	Must be used and preserved, if present. If the producer creates a new series must be defined.
Series Time	(0008,0031)	RC+	Must be used and preserved, if present. If the producer creates a new series must be defined.
Patient Position	(0018,5100)	R+	Shall be one of {HFS, FFS, HFP, FFP}.

7.4.1.3.3 General Series Module Decubitus

7.4.1.3.3.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.1.3.3.2 Module Definition

Attribute	Tag	Type	Attribute Note
Series Date	(0008,0021)	RC+	Must be used and preserved, if present. If the producer creates a new series must be defined.
Series Time	(0008,0031)	RC+	Must be used and preserved, if present. If the producer creates a new series must be defined.
Patient Position	(0018,5100)	R+	Shall be one of {HFS, FFS, HFP, FFP, HFDL, HFDR, FFDL, FFDL}.

7.4.1.4 RT Series Module

7.4.1.4.1 RT Series Module Base Content

7.4.1.4.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.1.4.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
Series Date	(0008,0021)	RC+	Must be used and preserved, if present. If the producer creates a new series must be defined.
Series Time	(0008,0031)	RC+	Must be used and preserved, if present. If the producer creates a new series must be defined.

7.4.1.5 Equipment Module

7.4.1.5.1 General Equipment Module Base Content

7.4.1.5.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.1.5.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
Manufacturer	(0008,0070)	R+*	IHE requires that this element be present, and should contain the manufacturer of the equipment creating the image, structure set, plan, or dose. If the equipment is storing and forwarding information, the value of this element shall be preserved. If a new plan is created from a previous plan, the manufacturer of the equipment producing the new plan shall insert their identifier in this element. If a new structure set is created from a previous structure set, the manufacturer of the equipment producing the new structure set shall insert their identifier in this element.
Manufacturer's Model Name	(0008,1090)	R+*	If an application resamples and re-exports a series of CT images, or modifies an instance then this element must be present, and must contain the model name of the equipment doing the resampling.
Software Versions	(0018,1020)	R+*	Must be present.

7.4.1.6 SOP Common Module

7.4.1.6.1 SOP Common Module Base Content

7.4.1.6.1.1 Referenced Standards

DICOM 2018dEdition PS 3.3

7.4.1.6.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
Specific Character Set	(0008,0005)	O+*	See Section 7.2.1
Instance Creation Date	(0008,0012)	R+	Shall be present.
Instance Creation Time	(0008,0013)	R+	Shall be present.

7.4.1.7 Frame of Reference Module

7.4.1.7.1 Frame of Reference Module Base Content

7.4.1.7.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.1.7.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
Position Reference Indicator	(0020,1040)	O*	Equipment which creates new series based on other series (i.e., resampled series, new structure sets, plans, etc.) must preserve the value of this element to adhere to this profile.

7.4.1.8 General Image Module

7.4.1.8.1 General Image Module Base Content

7.4.1.8.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.1.8.1.2 Module Definition

See Treatment Delivery- Image Content (TDIC) Profile, Section 7.4.1.8.1.

7.4.2 Workflow Modules

7.4.2.1 RT Beams Delivery Instruction Module

7.4.2.1.1 RT Beams Delivery Instruction Base

7.4.2.1.1.1 Referenced Standards

DICOM Edition PS 3.3: C.8.8.29 RT Beams Delivery Instruction Module

7.4.2.1.1.2 Module Definition

Table 7.4.2.1.1.2-1: Usage of DICOM Attributes in IHE

Attribute	Tag	IHE Usage	Attribute Requirements
Referenced RT Plan Sequence	(300C,0002)	-	Reference to a single RT Plan/RT Ion Plan SOP Instance (whose UID is also supplied in the Input Information Sequence - see PS3.4) containing all the Beams and the Fraction Group referenced in this SOP Instance. Only a single item shall be included in this sequence.
>Include Table 10-11 "SOP Instance Reference Macro Attributes"			
Beam Task Sequence	(0074,1020)	-	Specification of beams to be delivered and/or verified. One or more Items shall be included in this sequence.
>Beam Task Type	(0074,1022)	-	Indication whether beam is to be verified, treated (delivered), or both. Enumerated Values: VERIFY Beam verification only TREAT Beam treatment only VERIFY_AND_TREAT Beam verification and treatment
>Treatment Delivery Type	(300A,00CE)	-	Delivery Type of treatment. Enumerated Values: TREATMENT normal patient treatment CONTINUATION continuation of interrupted treatment (Note 1)

Attribute	Tag	IHE Usage	Attribute Requirements
>Primary Dosimeter Unit	(300A,00B3)	D	Measurement unit of machine dosimeter. Enumerated Values: MU Monitor Unit MINUTE Minute NP Number of Particles This value shall be the same as in the referenced RT Plan/RT Ion Plan. It applies only to the Continuation Start Meterset (0074,0120) and Continuation End Meterset (0074,0121). Required if Treatment Delivery Type (300A,00CE) is CONTINUATION.
>Continuation Start Meterset	(0074,0120)	D	Meterset within Beam referenced by Referenced Beam Number (300C,0006) at which treatment delivery starts, in units specified by Primary Dosimeter Unit (300A,00B3). Required if Treatment Delivery Type (300A,00CE) is CONTINUATION.
>Continuation End Meterset	(0074,0121)	-	Meterset within Beam referenced by Referenced Beam Number (300C,0006) at which treatment delivery ends, in units specified by Primary Dosimeter Unit (300A,00B3). Required if Treatment Delivery Type (300A,00CE) is CONTINUATION.
>Current Fraction Number	(3008,0022)	R+	The fraction number shall not vary within this sequence.
>Referenced Fraction Group Number	(300C,0022)	-	Indicates which fraction group of the referenced plan is to be treated in the treatment session. Only one Fraction Group shall be specified per Delivery Instruction SOP Instance. Required if the referenced plan has more than one Fraction Group Sequence (300A,0070) item.
>Referenced Beam Number	(300C,0006)	-	Uniquely identifies the Beam that is specified by Beam Number (300A,00C0) within Beam Sequence (300A,00B0) in RT Beams Module of referenced RT Plan/RT Ion Plan.
>Beam Order Index	(0074,1324)	D	If present, should be used if the delivery device allows.
>Autosequence Flag	(0074,1025)	D	If present, should be used if the delivery device allows
>Delivery Verification Image Sequence	(0074,1030)	R+*	There shall be zero items in this sequence
Omitted Beam Task Sequence	(300C,0111)	R+*	Beams not to be delivered and/or verified. Zero or more Items may be present in this sequence.
>Referenced Beam Number	(300C,0006)	R+	Uniquely identifies the Beam that is specified by Beam Number (300A,00C0) within Beam Sequence (300A,00B0) in RT Beams Module of referenced RT Plan/RT Ion Plan.

Attribute	Tag	IHE Usage	Attribute Requirements
>Reason for Omission	(300C,0112)	R+	Reason why the referenced beam is not to be delivered and/or verified: Defined Terms: ALREADY_TREATED The beam has been already treated in an earlier treatment session
>Reason for Omission Description	(300C,0113)	-	Description of reason for omission.

Note 1: Treatment Delivery Type (300A,00CE) shall have the value 'CONTINUATION' for beam(s) which have been partially delivered. Beams which have not yet been delivered at all during the execution of the previous UPS shall have the value 'TREATMENT'. Note that no beam in the Beam Delivery instruction will have the value 'CONTINUATION' in the case, when some beams have been delivered completely, but the other beams of the plans have not yet been started at all during the execution of the previous UPS. In this case all the latter beams will be included in the Beam Task Sequence with the value 'TREATMENT'.

7.4.3 General Plan-Related Modules

7.4.3.1 General Plan Module

7.4.3.1.1 General Plan Module Base Content

7.4.3.1.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.3.1.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
RT Plan Label	(300A,0002)	R+	The label which serves as the identification of the plan for the user.
RT Plan Date	(300A,0006)	R+	The date when the plan was last modified.
RT Plan Time	(300A,0007)	R+	The time when the plan was last modified.
RT Plan Geometry	(300A,000C)	R+*	Shall be PATIENT. This implies that the RT Structure Set exists and is referenced in the General Plan module.

7.4.3.2 RT Prescription Module

7.4.3.2.1 RT Prescription Module Base Content

7.4.3.2.1.1 Referenced Standards

DICOM 2018e Edition PS 3.3

7.4.3.2.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
Dose Reference Sequence	(300A,0010)	R+*	See Dose reference requirements in the RT Beams module for the TPPC transactions.
> Dose Reference UID	(300A,0013)	R+*	
> Dose Reference Description	(300A,0016)	R+	
> Target Prescription Dose	(300A,0026)	O+	If present, shall be of the same type of dose as the Beam Dose Type (300A,0090) in the RT Fraction Scheme Module (see **Error! Reference source not found.**)

7.4.3.3 RT Fraction Scheme Module

780 #### 7.4.3.3.1 RT Fraction Scheme Module for Consistent Dose

This section is present only to convey the envisioned section numbering.

7.4.3.3.2 RT Fraction Scheme Module for Delivery

7.4.3.3.2.1 Referenced Standards

DICOM 2018e Edition PS 3.3

785 ##### 7.4.3.3.2.2 Module Definition

Attribute	Tag	Type	Attribute Note
Fraction Group Sequence	(300A,0070)	R+*	Shall have only a single item in the sequence
> Number of Fractions Planned	(300A,0078)	R+	
> Referenced Beam Sequence	(300C,0004)	R+*	
>> Referenced Dose Reference UID	(300A,0083)	R+*	Identifies the Dose Reference specified by Dose Reference UID (300A,0013) in the Dose Reference Sequence (300A,0010) in the RT Prescription Module which specifies the primary target for the current Beam. If present shall have a value that is present in the Dose Reference Sequence.
>> Beam Dose	(300A,0084)	-/R+	A TMS Actor is required to consume and process this value.

Attribute	Tag	Type	Attribute Note
		R+/O+*	A beam producer/consumer Actor (e.g., a TPS) may consume this value and is required to produce it.
>> Beam Dose Specification Point	(300A,0082)	R+	
>> Beam Meterset	(300A,0086)	R+	
>> Beam Dose Type	(300A,0090)	R+	Shall be present

7.4.3.3.3 RT Fraction Scheme Module for Brachy

This section is present only to convey the envisioned section numbering.

7.4.3.3.4 RT Fraction Scheme Module Base Content

7.4.3.3.4.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.3.3.4.2 Module Definition

Attribute	Tag	Type	Attribute Note
Fraction Group Sequence	(300A,0070)	R+*	Shall have only a single item in the sequence
>Number of Brachy Application Setups	(300A,00A0)	R+*	Shall be 0. Brachytherapy is not supported in the BRTO Profile.

7.4.3.4 RT Patient Setup Module

7.4.3.4.1 RT Patient Setup Module Base Content

7.4.3.4.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.3.4.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
Patient Setup Sequence	(300A,0180)	R+*	An actor must not rely on the presence of: Fixation Device Sequence Shielding Device Sequence Setup Device Sequence within the Patient Setup Sequence for proper operation.
>Patient Position	(0018,5100)	R+	Shall be one of {HFS, HFP }. In case of multiple Patient Setup items, it shall be the same.

Attribute	Tag	Type	Attribute Note
>Setup Technique	(300A,01B0)	R+*	
>Table Top Vertical Setup Displacement	(300A,01D2)	O+*	If present, shall be consistent with Isocenter position. See note below.
>Table Top Longitudinal Setup Displacement	(300A,01D4)	O+*	If present, shall be consistent with Isocenter position. See note below.
>Table Top Longitudinal Setup Displacement	(300A,01D6)	O+*	If present, shall be consistent with Isocenter position. See note below.

Note: All items in the Patient Setup Sequence (300A,0180) shall use the same initial Setup Position.

7.4.3.4.2 RT Patient Setup Module Feet First

7.4.3.4.2.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.3.4.2.2 Module Definition

Attribute	Tag	Type	Attribute Note
Patient Setup Sequence	(300A,0180)	R+*	An actor must not rely on the presence of: Fixation Device Sequence Shielding Device Sequence Setup Device Sequence within the Patient Setup Sequence for proper operation.
>Patient Position	(0018,5100)	R+	Shall be one of {HFS, FFS, HFP, FFP}.
>Setup Technique	(300A,01B0)	R+*	
>Table Top Vertical Setup Displacement	(300A,01D2)	O+*	If present, shall be consistent with Isocenter position. See note below.
>Table Top Longitudinal Setup Displacement	(300A,01D4)	O+*	If present, shall be consistent with Isocenter position. See note below.
>Table Top Longitudinal Setup Displacement	(300A,01D6)	O+*	If present, shall be consistent with Isocenter position. See note below.

Note: All items in the Patient Setup Sequence (300A,0180) shall use the same initial Setup Position.

7.4.3.4.3 RT Patient Setup Module Reoriented

7.4.3.4.3.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.3.4.3.2 Module Definition

Attribute	Tag	Type	Attribute Note
Patient Setup Sequence	(300A,0180)	R+*	An actor must not rely on the presence of: Fixation Device Sequence Shielding Device Sequence Setup Device Sequence within the Patient Setup Sequence for proper operation.
>Patient Position	(0018,5100)	R+	The reoriented Patient Position for treatment shall correspond to the following pairs with respect of the Patient Position during image acquisition: HFS ↔ FFS or HFP ↔ FFP
>Setup Technique	(300A,01B0)	R+*	
>Table Top Vertical Setup Displacement	(300A,01D2)	O+*	If present, shall be consistent with Isocenter position. See note below.
>Table Top Longitudinal Setup Displacement	(300A,01D4)	O+*	If present, shall be consistent with Isocenter position. See note below.
>Table Top Longitudinal Setup Displacement	(300A,01D6)	O+*	If present, shall be consistent with Isocenter position. See note below.

Note: All items in the Patient Setup Sequence (300A,0180) shall use the same initial Setup Position.

7.4.3.4.4 RT Patient Setup Module Decubitus

7.4.3.4.4.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.3.4.4.2 Module Definition

Attribute	Tag	Type	Attribute Note
Patient Setup Sequence	(300A,0180)	R+*	An actor must not rely on the presence of: Fixation Device Sequence Shielding Device Sequence Setup Device Sequence within the Patient Setup Sequence for proper operation.
>Patient Position	(0018,5100)	R+	Shall be one of {HFS, FFS, HFP, FFP, HFDL, HFDR, FFDL, FFDR}.
>Setup Technique	(300A,01B0)	R+*	
>Table Top Vertical Setup Displacement	(300A,01D2)	O+*	If present, shall be consistent with Isocenter position. See note below.
>Table Top Longitudinal Setup Displacement	(300A,01D4)	O+*	If present, shall be consistent with Isocenter position. See note below.

Attribute	Tag	Type	Attribute Note
>Table Top Longitudinal Setup Displacement	(300A,01D6)	O+*	If present, shall be consistent with Isocenter position. See note below.

Note: All items in the Patient Setup Sequence (300A,0180) shall use the same initial Setup Position.

7.4.4 Plan-Related Modules in Planning

7.4.4.1 Specific RT Beam Type Specifications

7.4.4.1.1 RT Beams Module for Basic Static Beam

7.4.4.1.1.1 Referenced Standards

DICOM 2018e Edition PS 3.3

7.4.4.1.1.2 Module Definition

Attribute	Tag	Beam Technique	
		Basic Static	
		Presence	Specific Rules
Beam Sequence	(300A,00B0)	R+*	
> Beam Number	(300A,00C0)	R+*	Shall be >= 1.
> Beam Name	(300A,00C2)	R+	
> Beam Type	(300A,00C4)	R+*	Shall be STATIC.
> Radiation Type	(300A,00C6)	R+*	Shall be PHOTON.
> High-Dose Technique Type	(300A,00C7)	O+*	If present, must be handled safely
> Primary Fluence Mode Sequence	(3002,0050)	R+*	
>> Fluence Mode	(3002,0051)	D	
>> Fluence Mode ID	(3002,0052)	D	
> Treatment Machine Name	(300A,00B2)	R+*	Shall be constant.
> Primary Dosimeter Unit	(300A,00B3)	R+	Shall be MU.
> Source-Axis Distance	(300A,00B4)	R+*	
> Beam Limiting Device Sequence	(300A,00B6)	R+*	
>> RT Beam Limiting Device Type	(300A,00B8)	R+*	Shall be 2 jaws, MLC shall not be present
>> Leaf Position Boundaries	(300A,00BE)	O+*	NA (no MLC) May or may not be present for jaws, may be ignored for jaws
> Referenced Patient Setup Number	(300C,006A)	R+*	Shall be >= 1.

Attribute	Tag	Beam Technique	
		Basic Static	
		Presence	Specific Rules
> Treatment Delivery Type	(300A,00CE)	R+*	
> Number of Wedges	(300A,00D0)	R+*	Shall be 0.
> Number of Compensators	(300A,00E0)	R+*	Shall be 0 or 1. If 1, see Compensator Beam Modifier.
> Number of Boli	(300A, 00ED)	R+*	Shall be >= 0. If > 0, see Bolus Beam Modifier.
> Number of Blocks	(300A,00F0)	R+*	Shall be 0-8. If > 0, see Block Beam Modifier.
> Applicator Sequence	(300A,0107)	O+	Shall not be present.
> Final Cumulative Meterset Weight	(300A,010E)	R+*	
> Number of Control Points	(300A,0110)	R+*	Shall be 2.
> Control Point Sequence	(300A,0111)	R+*	
>> Cumulative Meterset Weight	(300A,0134)	R+	
>> Referenced Dose Reference Sequence	(300C,0050)	-/R+* R+/O+*	A TMS Actor is required to consume and process this value. A beam producer/consumer Actor (e.g., a TPS) may consume this value and is required to produce it. Shall have at least one item for target dose accumulation.
>>> Cumulative Dose Reference Coefficient	(300A,010C)	R+*	Shall be present.
>> Nominal Beam Energy	(300A,0114)	R+	Shall be constant.
>> Dose Rate Set	(300A,0115)	R+	Shall be constant.
>> Wedge Position Sequence	(300A,0116)	R+*	Shall not be present
>> Beam Limiting Device Position Sequence	(300A,011A)	R+*	Shall be consistent with the Beam Limiting Device Sequence (300A,00B6).
>>>Leaf/Jaw Positions	(300A,011C)	R+*	
>> Gantry Angle	(300A,011E)	R+*	Shall be constant.
>> Gantry Rotation Direction	(300A,011F)	R+*	Shall be NONE.
>> Gantry Pitch Angle	(300A,014A)	O+*	If not present, shall be assumed to be in the zero position. If present, shall be zero.
>> Gantry Pitch Rotation Direction	(300A,014C)	O+*	If present, shall be NONE.
>> Beam Limiting Device Angle	(300A,0120)	R+*	Shall be constant.
>> Beam Limiting Device Rotation Direction	(300A,0121)	R+*	Shall be NONE.
< *Insert Control Point Sequence Fixed Attributes List* > (See Section 7.4.4.2.1)			

Attribute	Tag	Beam Technique	
		Basic Static	
		Presence	Specific Rules
>> Isocenter Position	(300A,012C)	R+	Shall be constant for all CPs.

7.4.4.1.2 RT Beams Module for Basic Static MLC Beam

7.4.4.1.2.1 Referenced Standards

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7.4.4.1.2.2 Module Definition

Attribute	Tag	Beam Technique	
		Basic Static MLC	
		Presence	Specific Rules
Beam Sequence	(300A,00B0)	R+*	
> Beam Number	(300A,00C0)	R+*	Shall be >= 1.
> Beam Name	(300A,00C2)	R+	
> Beam Type	(300A,00C4)	R+*	Shall be STATIC.
> Radiation Type	(300A,00C6)	R+*	Shall be PHOTON.
> High-Dose Technique Type	(300A,00C7)	O+*	If present, must be handled safely
> Primary Fluence Mode Sequence	(3002,0050)	R+*	
>> Fluence Mode	(3002,0051)	D	
>> Fluence Mode ID	(3002,0052)	D	
> Treatment Machine Name	(300A,00B2)	R+*	Shall be constant.
> Primary Dosimeter Unit	(300A,00B3)	R+	Shall be MU.
> Source-Axis Distance	(300A,00B4)	R+*	
> Beam Limiting Device Sequence	(300A,00B6)	R+*	
>> RT Beam Limiting Device Type	(300A,00B8)	R+*	Shall have at least 1 MLC
>> Leaf Position Boundaries	(300A,00BE)	R+*	Shall be present for MLCs May or may not be present for jaws, may be ignored for jaws
> Referenced Patient Setup Number	(300C,006A)	R+*	Shall be >= 1.
> Treatment Delivery Type	(300A,00CE)	R+*	
> Number of Wedges	(300A,00D0)	R+*	Shall be 0.

Attribute	Tag	Beam Technique	
		Basic Static MLC	
		Presence	Specific Rules
> Number of Compensators	(300A,00E0)	R+*	Shall be 0 or 1. If 1, see Compensator Beam Modifier.
> Number of Boli	(300A, 00ED)	R+*	Shall be >= 0. If > 0, see Bolus Beam Modifier.
> Number of Blocks	(300A,00F0)	R+*	Shall be 0-8. If > 0, see Block Beam Modifier.
> Applicator Sequence	(300A,0107)	R+*	Shall not be present.
> Final Cumulative Meterset Weight	(300A,010E)	R+*	
> Number of Control Points	(300A,0110)	R+*	Shall be 2.
> Control Point Sequence	(300A,0111)	R+*	
>> Cumulative Meterset Weight	(300A,0134)	R+	
>> Referenced Dose Reference Sequence	(300C,0050)	-/R+* R+/O+*	A TMS Actor is required to consume and process this value. A beam producer/consumer Actor (e.g., a TPS) may consume this value and is required to produce it. Shall have at least one item for target dose accumulation.
>>> Cumulative Dose Reference Coefficient	(300A,010C)	R+*	Shall be present.
>> Nominal Beam Energy	(300A,0114)	R+	Shall be constant.
>> Dose Rate Set	(300A,0115)	R+	Shall be constant.
>> Wedge Position Sequence	(300A,0116)	R+*	Shall not be present
>> Beam Limiting Device Position Sequence	(300A,011A)	R+*	Shall be consistent with the Beam Limiting Device Sequence (300A,00B6).
>>>Leaf/Jaw Positions	(300A,011C)	R+*	
>> Gantry Angle	(300A,011E)	R+*	Shall be constant.
>> Gantry Rotation Direction	(300A,011F)	R+*	Shall be NONE.
>> Gantry Pitch Angle	(300A,014A)	O+*	If not present, shall be assumed to be in the zero position. If present, shall be zero.
>> Gantry Pitch Rotation Direction	(300A,014C)	O+*	If present, shall be NONE.
>> Beam Limiting Device Angle	(300A,0120)	R+*	Shall be constant.
>> Beam Limiting Device Rotation Direction	(300A,0121)	R+*	Shall be NONE.
< Insert Control Point Sequence Fixed Attributes List > (See Section 7.4.4.2.1)			
>> Isocenter Position	(300A,012C)	R+	Shall be constant for all CPs.

7.4.4.1.3 RT Beams Module for Arc Beam

7.4.4.1.3.1 Referenced Standards

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7.4.4.1.3.2 Module Definition

Attribute	Tag	Beam Technique	
		Arc	
		Presence	Specific Rules
Beam Sequence	(300A,00B0)	R+*	
> Beam Number	(300A,00C0)	R+*	Shall be >= 1.
> Beam Name	(300A,00C2)	R+	
> Beam Type	(300A,00C4)	R+*	Shall be DYNAMIC.
> Radiation Type	(300A,00C6)	R+*	Shall be PHOTON.
> High-Dose Technique Type	(300A,00C7)	O+*	If present, must be handled safely
> Primary Fluence Mode Sequence	(3002,0050)	R+*	
>> Fluence Mode	(3002,0051)	D	
>> Fluence Mode ID	(3002,0052)	D	
> Treatment Machine Name	(300A,00B2)	R+*	Shall be constant.
> Primary Dosimeter Unit	(300A,00B3)	R+	Shall be MU.
> Source-Axis Distance	(300A,00B4)	R+*	
> Beam Limiting Device Sequence	(300A,00B6)	R+*	
>> RT Beam Limiting Device Type	(300A,00B8)	R+*	Shall be 2 jaws, MLC shall not be present
>> Leaf Position Boundaries	(300A,00BE)	O+*	NA (no MLC) May or may not be present for jaws, may be ignored for jaws
> Referenced Patient Setup Number	(300C,006A)	R+*	Shall be >= 1.
> Treatment Delivery Type	(300A,00CE)	R+*	
> Number of Wedges	(300A,00D0)	R+*	Shall be 0.
> Number of Compensators	(300A,00E0)	R+*	Shall be 0.
> Number of Boli	(300A, 00ED)	R+*	Shall be >= 0. If > 0, see Bolus Beam Modifier.
> Number of Blocks	(300A,00F0)	R+*	Shall be 0-8. If > 0, see Block Beam Modifier.
> Applicator Sequence	(300A,0107)	R+*	Shall not be present.
> Final Cumulative Meterset Weight	(300A,010E)	R+*	

Attribute	Tag	Beam Technique	
		Arc	
		Presence	Specific Rules
> Number of Control Points	(300A,0110)	R+*	Shall be 2. Skip arcs are not tested in this transaction.
> Control Point Sequence	(300A,0111)	R+*	
>> Cumulative Meterset Weight	(300A,0134)	R+	
>> Referenced Dose Reference Sequence	(300C,0050)	-/R+* R+/O+*	A TMS Actor is required to consume and process this value. A beam producer/consumer Actor (e.g., a TPS) may consume this value and is required to produce it Shall have at least one item for target dose accumulation.
>>> Cumulative Dose Reference Coefficient	(300A,010C)	R+*	Shall be present.
>> Nominal Beam Energy	(300A,0114)	R+	Shall be constant.
>> Dose Rate Set	(300A,0115)	R+	Shall be constant.
>> Wedge Position Sequence	(300A,0116)	R+*	Shall not be present
>> Beam Limiting Device Position Sequence	(300A,011A)	R+*	Shall be consistent with the Beam Limiting Device Sequence (300A,00B6).
>>>Leaf/Jaw Positions	(300A,011C)	R+*	
>> Gantry Angle	(300A,011E)	R+*	
>> Gantry Rotation Direction	(300A,011F)	R+*	Shall be CW or CC for Control Point 0. Can be NONE for Control Point 1.
>> Gantry Pitch Angle	(300A,014A)	O+*	If not present, shall be assumed to be in the zero position. If present, shall be zero.
>> Gantry Pitch Rotation Direction	(300A,014C)	O+*	If present, shall be NONE.
>> Beam Limiting Device Angle	(300A,0120)	R+*	Shall be constant.
>> Beam Limiting Device Rotation Direction	(300A,0121)	R+*	Shall be NONE.
< Insert Control Point Sequence Fixed Attributes List > (See Section 7.4.4.2.1)			
>> Isocenter Position	(300A,012C)	R+	Shall be constant for all CPs.

7.4.4.1.4 RT Beams Module for MLC Fixed Aperture Arc Beam

7.4.4.1.4.1 Referenced Standards

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7.4.4.1.4.2 Module Definition

Attribute	Tag	Beam Technique	
		MLC Fixed Aperture Arc	
		Presence	Specific Rules
Beam Sequence	(300A,00B0)	R+*	
> Beam Number	(300A,00C0)	R+*	Shall be >= 1.
> Beam Name	(300A,00C2)	R+	
> Beam Type	(300A,00C4)	R+*	Shall be DYNAMIC.
> Radiation Type	(300A,00C6)	R+*	Shall be PHOTON.
> High-Dose Technique Type	(300A,00C7)	O+*	If present, must be handled safely
> Primary Fluence Mode Sequence	(3002,0050)	R+*	
>> Fluence Mode	(3002,0051)	D	
>> Fluence Mode ID	(3002,0052)	D	
> Treatment Machine Name	(300A,00B2)	R+*	Shall be constant.
> Primary Dosimeter Unit	(300A,00B3)	R+	Shall be MU.
> Source-Axis Distance	(300A,00B4)	R+*	
> Beam Limiting Device Sequence	(300A,00B6)	R+*	
>> RT Beam Limiting Device Type	(300A,00B8)	R+*	Shall have at least 1 MLC.
>> Leaf Position Boundaries	(300A,00BE)	R+*	Shall be present for MLCs. May or may not be present for jaws, may be ignored for jaws
> Referenced Patient Setup Number	(300C,006A)	R+*	Shall be >= 1.
> Treatment Delivery Type	(300A,00CE)	R+*	
> Number of Wedges	(300A,00D0)	R+*	Shall be 0.
> Number of Compensators	(300A,00E0)	R+*	Shall be 0.
> Number of Boli	(300A, 00ED)	R+*	Shall be >= 0. If > 0, see Bolus Beam Modifier.
> Number of Blocks	(300A,00F0)	R+*	Shall be 0.
> Applicator Sequence	(300A,0107)	R+*	Shall not be present.
> Final Cumulative Meterset Weight	(300A,010E)	R+*	
> Number of Control Points	(300A,0110)	R+*	Shall be 2. Skip arcs are not tested in this transaction.
> Control Point Sequence	(300A,0111)	R+*	
>> Cumulative Meterset Weight	(300A,0134)	R+	

Attribute	Tag	Beam Technique	
		MLC Fixed Aperture Arc	
		Presence	Specific Rules
>> Referenced Dose Reference Sequence	(300C,0050)	-/R+* R+/O+*	A TMS Actor is required to consume and process this value. A beam producer/consumer Actor (e.g., a TPS) may consume this value and is required to produce it Shall have at least one item for target dose accumulation.
>>> Cumulative Dose Reference Coefficient	(300A,010C)	R+*	Shall be present.
>> Nominal Beam Energy	(300A,0114)	R+	Shall be constant.
>> Dose Rate Set	(300A,0115)	R+	Shall be constant.
>> Wedge Position Sequence	(300A,0116)	R+*	Shall not be present
>> Beam Limiting Device Position Sequence	(300A,011A)	R+*	Shall be consistent with the Beam Limiting Device Sequence (300A,00B6).
>>>Leaf/Jaw Positions	(300A,011C)	R+*	
>> Gantry Angle	(300A,011E)	R+*	
>> Gantry Rotation Direction	(300A,011F)	R+*	Shall be CW or CC for Control Point 0. Can be NONE for Control Point 1.
>> Gantry Pitch Angle	(300A,014A)	O+*	If not present, shall be assumed to be in the zero position. If present, shall be zero.
>> Gantry Pitch Rotation Direction	(300A,014C)	O+*	If present, shall be NONE.
>> Beam Limiting Device Angle	(300A,0120)	R+*	Shall be constant.
>> Beam Limiting Device Rotation Direction	(300A,0121)	R+*	Shall be NONE.
< Insert Control Point Sequence Fixed Attributes List > (See Section 7.4.4.2.1)			
>> Isocenter Position	(300A,012C)	R+	Shall be constant for all CPs.

840 ## 7.4.4.1.5 RT Beams Module for MLC Variable Aperture Arc Beam

7.4.4.1.5.1 Referenced Standards

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7.4.4.1.5.2 Module Definition

Attribute	Tag	Beam Technique	
		MLC Variable Aperture Arc	
		Presence	Specific Rules
Beam Sequence	(300A,00B0)	R+*	
> Beam Number	(300A,00C0)	R+*	Shall be >= 1.
> Beam Name	(300A,00C2)	R+	
> Beam Type	(300A,00C4)	R+*	Shall be DYNAMIC.
> Radiation Type	(300A,00C6)	R+*	Shall be PHOTON.
> High-Dose Technique Type	(300A,00C7)	O+*	If present, must be handled safely
> Primary Fluence Mode Sequence	(3002,0050)	R+*	
>> Fluence Mode	(3002,0051)	D	
>> Fluence Mode ID	(3002,0052)	D	
> Treatment Machine Name	(300A,00B2)	R+*	Shall be constant.
> Primary Dosimeter Unit	(300A,00B3)	R+	Shall be MU.
> Source-Axis Distance	(300A,00B4)	R+*	
> Beam Limiting Device Sequence	(300A,00B6)	R+*	
>> RT Beam Limiting Device Type	(300A,00B8)	R+*	Shall be 2 jaws, or at least 1 jaw and 1 MLC.
>> Leaf Position Boundaries	(300A,00BE)	R+*	Shall be present for MLCs. May or may not be present for jaws, may be ignored for jaws
> Referenced Patient Setup Number	(300C,006A)	R+*	Shall be >= 1.
> Treatment Delivery Type	(300A,00CE)	R+*	
> Number of Wedges	(300A,00D0)	R+*	Shall be 0.
> Number of Compensators	(300A,00E0)	R+*	Shall be 0.
> Number of Boli	(300A, 00ED)	R+*	Shall be >= 0. If > 0, see Bolus Beam Modifier.
> Number of Blocks	(300A,00F0)	R+*	Shall be 0-8. If > 0, see Block Beam Modifier.
> Applicator Sequence	(300A,0107)	R+*	Shall not be present.
> Final Cumulative Meterset Weight	(300A,010E)	R+*	
> Number of Control Points	(300A,0110)	R+*	If the Consumer has a limit, it shall document this and safely handle input that exceeds that limit.
> Control Point Sequence	(300A,0111)	R+*	
>> Cumulative Meterset Weight	(300A,0134)	R+	

Attribute	Tag	Beam Technique	
		MLC Variable Aperture Arc	
		Presence	Specific Rules
>> Referenced Dose Reference Sequence	(300C,0050)	-/R+* R+/O+*	A TMS Actor is required to consume and process this value. A beam producer/consumer Actor (e.g., a TPS) may consume this value and is required to produce it Shall have at least one item for target dose accumulation.
>>> Cumulative Dose Reference Coefficient	(300A,010C)	R+*	Shall be present.
>> Nominal Beam Energy	(300A,0114)	R+	Shall be constant.
>> Dose Rate Set	(300A,0115)	R+	Shall be constant.
>> Wedge Position Sequence	(300A,0116)	R+*	Shall not be present
>> Beam Limiting Device Position Sequence	(300A,011A)	R+*	Shall be consistent with the Beam Limiting Device Sequence (300A,00B6).
>>>Leaf/Jaw Positions	(300A,011C)	R+*	
>> Gantry Angle	(300A,011E)	R+*	
>> Gantry Rotation Direction	(300A,011F)	R+*	Shall be constant (CW or CC) for all CP except last one. Can be NONE for final CP
>> Gantry Pitch Angle	(300A,014A)	O+*	If not present, shall be assumed to be in the zero position. If present, shall be zero.
>> Gantry Pitch Rotation Direction	(300A,014C)	O+*	If present, shall be NONE.
>> Beam Limiting Device Angle	(300A,0120)	R+*	Shall be constant.
>> Beam Limiting Device Rotation Direction	(300A,0121)	R+*	Shall be NONE.
< Insert Control Point Sequence Fixed Attributes List > (See Section 7.4.4.2.1)			
>> Isocenter Position	(300A,012C)	R+	Shall be constant for all CPs.

7.4.4.1.6 RT Beams Module for Hard Wedge Beam

7.4.4.1.6.1 Referenced Standards

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7.4.4.1.6.2 Module Definition

Attribute	Tag	Beam Technique	
		Hard Wedge	
		Presence	Specific Rules
Beam Sequence	(300A,00B0)	R+*	
> Beam Number	(300A,00C0)	R+*	Shall be >= 1.
> Beam Name	(300A,00C2)	R+	
> Beam Type	(300A,00C4)	R+*	Shall be STATIC.
> Radiation Type	(300A,00C6)	R+*	Shall be PHOTON.
> High-Dose Technique Type	(300A,00C7)	O+*	If present, must be handled safely
> Primary Fluence Mode Sequence	(3002,0050)	R+*	
>> Fluence Mode	(3002,0051)	D	
>> Fluence Mode ID	(3002,0052)	D	
> Treatment Machine Name	(300A,00B2)	R+*	Shall be constant.
> Primary Dosimeter Unit	(300A,00B3)	R+	Shall be MU.
> Source-Axis Distance	(300A,00B4)	R+*	
> Beam Limiting Device Sequence	(300A,00B6)	R+*	
>> RT Beam Limiting Device Type	(300A,00B8)	R+*	Shall have at least 2 jaws or at least 1 jaw and 1 MLC.
>> Leaf Position Boundaries	(300A,00BE)	R+*	Shall be present for MLCs,. May or may not be present for jaws, may be ignored for jaws
> Referenced Patient Setup Number	(300C,006A)	R+*	Shall be >= 1.
> Treatment Delivery Type	(300A,00CE)	R+*	
> Number of Wedges	(300A,00D0)	R+*	Shall be 1.
>> Wedge Sequence	(300A,00D1)	R+*	Shall be present.
>> Wedge Type	(300A,00D3)	R+*	Shall be STANDARD (static)
>> Wedge ID	(300A,00D4)	R+	
>> Wedge Angle	(300A,00D5)	R+	
>> Wedge Orientation	(300A,00D8)	R+	
>> Source to Wedge Tray Distance	(300A,00DA)	R+	
> Number of Compensators	(300A,00E0)	R+*	Shall be 0 or 1. If 1, see Compensator Beam Modifier.
> Number of Boli	(300A, 00ED)	R+*	Shall be >= 0. If > 0, see Bolus Beam Modifier.
> Number of Blocks	(300A,00F0)	R+*	Shall be 0-8. If > 0, see Block Beam Modifier.
> Applicator Sequence	(300A,0107)	R+*	Shall not be present.
> Final Cumulative Meterset Weight	(300A,010E)	R+*	
> Number of Control Points	(300A,0110)	R+*	Shall be 2.

Attribute	Tag	Beam Technique	
		Hard Wedge	
		Presence	Specific Rules
> Control Point Sequence	(300A,0111)	R+*	
>> Cumulative Meterset Weight	(300A,0134)	R+	
>> Referenced Dose Reference Sequence	(300C,0050)	-/R+* R+/O+*	A TMS Actor is required to consume and process this value. A beam producer/consumer Actor (e.g., a TPS) may consume this value and is required to produce it Shall have at least one item for target dose accumulation.
>>> Cumulative Dose Reference Coefficient	(300A,010C)	R+*	Shall be present.
>> Nominal Beam Energy	(300A,0114)	R+	Shall be constant.
>> Dose Rate Set	(300A,0115)	R+	Shall be constant.
>> Wedge Position Sequence	(300A,0116)	R+*	Shall be present and consistent with the Wedge Sequence (300A,00D1).
>>> Wedge Position	(300A,0118)	R+*	Shall be IN.
>> Beam Limiting Device Position Sequence	(300A,011A)	R+*	Shall be consistent with the Beam Limiting Device Sequence (300A,00B6).
>>>Leaf/Jaw Positions	(300A,011C)	R+*	
>> Gantry Angle	(300A,011E)	R+*	Shall be constant.
>> Gantry Rotation Direction	(300A,011F)	R+*	Shall be NONE.
>> Gantry Pitch Angle	(300A,014A)	O+*	If not present, shall be assumed to be in the zero position. If present, shall be zero.
>> Gantry Pitch Rotation Direction	(300A,014C)	O+*	If present, shall be NONE.
>> Beam Limiting Device Angle	(300A,0120)	R+*	Shall be constant.
>> Beam Limiting Device Rotation Direction	(300A,0121)	R+*	Shall be NONE.
< Insert Control Point Sequence Fixed Attributes List >(See Section 7.4.4.2.1)			
>> Isocenter Position	(300A,012C)	R+	Shall be constant for all CPs.

7.4.4.1.7 RT Beams Module for Virtual Wedge Beam

7.4.4.1.7.1 Referenced Standards

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7.4.4.1.7.2 Module Definition

Attribute	Tag	Beam Technique	
		Virtual Wedge	
		Presence	Specific Rules
Beam Sequence	(300A,00B0)	R+*	
> Beam Number	(300A,00C0)	R+*	Shall be >= 1.
> Beam Name	(300A,00C2)	R+	
> Beam Type	(300A,00C4)	R+*	Shall be STATIC.
> Radiation Type	(300A,00C6)	R+*	Shall be PHOTON.
> High-Dose Technique Type	(300A,00C7)	O+*	If present, must be handled safely
> Primary Fluence Mode Sequence	(3002,0050)	R+*	
>> Fluence Mode	(3002,0051)	D	
>> Fluence Mode ID	(3002,0052)	D	
> Treatment Machine Name	(300A,00B2)	R+*	Shall be constant.
> Primary Dosimeter Unit	(300A,00B3)	R+	Shall be MU.
> Source-Axis Distance	(300A,00B4)	R+*	
> Beam Limiting Device Sequence	(300A,00B6)	R+*	
>> RT Beam Limiting Device Type	(300A,00B8)	R+*	Shall have at least 2 jaws or at least 1 jaw and 1 MLC.
>> Leaf Position Boundaries	(300A,00BE)	R+*	Shall be present for MLCs,. May or may not be present for jaws, may be ignored for jaws
> Referenced Patient Setup Number	(300C,006A)	R+*	Shall be >= 1.
> Treatment Delivery Type	(300A,00CE)	R+*	
> Number of Wedges	(300A,00D0)	R+*	Shall be 1 or 2. If 2, see Hard Wedge Beam Modifier.
>>Wedge Sequence	(300A,00D1)	R+*	Shall be present if number of wedges is non-zero
>> Wedge Type	(300A,00D3)	R+*	Shall be DYNAMIC. Optional Hard Wedge shall be STANDARD
>> Wedge ID	(300A,00D4)	R+	
>> Wedge Angle	(300A,00D5)	RC+	Shall be present if Wedge Type (300A,00D3) is STANDARD. May be present otherwise.
>>Effective Wedge Angle	(300A,00DE)	RC+/O+*	Shall be present if Wedge Type (300A,00D3) is DYNAMIC. A beam producer/consumer Actor (e.g., a TPS) may consume this value and is required to produce it

Attribute	Tag	Beam Technique	
		Virtual Wedge	
		Presence	Specific Rules
>> Wedge Orientation	(300A,00D8)	R+	
>> Source to Wedge Tray Distance	(300A,00DA)	RC+	Shall be present if Wedge Type (300A,00D3) is STANDARD.
> Number of Compensators	(300A,00E0)	R+*	Shall be 0 or 1. If 1, see Compensator Beam Modifier.
> Number of Boli	(300A, 00ED)	R+*	Shall be >= 0. If > 0, see Bolus Beam Modifier.
> Number of Blocks	(300A,00F0)	R+*	Shall be 0-8. If > 0, see Block Beam Modifier.
> Applicator Sequence	(300A,0107)	R+*	Shall not be present.
> Final Cumulative Meterset Weight	(300A,010E)	R+*	
> Number of Control Points	(300A,0110)	R+*	Shall be 2.
> Control Point Sequence	(300A,0111)	R+*	
>> Cumulative Meterset Weight	(300A,0134)	R+	
>> Referenced Dose Reference Sequence	(300C,0050)	-/R+* R+/O+*	A TMS Actor is required to consume and process this value. A beam producer/consumer Actor (e.g., a TPS) may consume this value and is required to produce it. Shall have at least one item for target dose accumulation.
>>> Cumulative Dose Reference Coefficient	(300A,010C)	R+*	Shall be present.
>> Nominal Beam Energy	(300A,0114)	R+	Shall be constant.
>> Dose Rate Set	(300A,0115)	R+	Shall be constant.
>> Wedge Position Sequence	(300A,0116)	R+*	Shall be present and consistent with the Wedge Sequence (300A,00D1).
>>> Wedge Position	(300A,0118)	R+*	Shall be IN.
>> Beam Limiting Device Position Sequence	(300A,011A)	R+*	Shall be consistent with the Beam Limiting Device Sequence (300A,00B6).
>>>Leaf/Jaw Positions	(300A,011C)	R+*	
>> Gantry Angle	(300A,011E)	R+*	Shall be constant.
>> Gantry Rotation Direction	(300A,011F)	R+*	Shall be NONE.
>> Gantry Pitch Angle	(300A,014A)	O+*	If not present, shall be assumed to be in the zero position. If present, shall be zero.
>> Gantry Pitch Rotation Direction	(300A,014C)	O+*	If present, shall be NONE.
>> Beam Limiting Device Angle	(300A,0120)	R+*	Shall be constant.

Attribute	Tag	Beam Technique	
		Virtual Wedge	
		Presence	Specific Rules
>> Beam Limiting Device Rotation Direction	(300A,0121)	R+*	Shall be NONE.
< Insert Control Point Sequence Fixed Attributes List > (See Section 7.4.4.2.1)			
>> Isocenter Position	(300A,012C)	R+	Shall be constant for all CPs.

7.4.4.1.8 RT Beams Module for Motorized Wedge Beam

7.4.4.1.8.1 Referenced Standards

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7.4.4.1.8.2 Module Definition

Attribute	Tag	Beam Technique	
		Motorized Wedge	
		Presence	Specific Rules
Beam Sequence	(300A,00B0)	R+*	
> Beam Number	(300A,00C0)	R+*	Shall be >= 1.
> Beam Name	(300A,00C2)	R+	
> Beam Type	(300A,00C4)	R+*	Shall be STATIC.
> Radiation Type	(300A,00C6)	R+*	Shall be PHOTON.
> High-Dose Technique Type	(300A,00C7)	O+*	If present, must be handled safely
> Primary Fluence Mode Sequence	(3002,0050)	R+*	
>> Fluence Mode	(3002,0051)	D	
>> Fluence Mode ID	(3002,0052)	D	
> Treatment Machine Name	(300A,00B2)	R+*	Shall be constant.
> Primary Dosimeter Unit	(300A,00B3)	R+	Shall be MU.
> Source-Axis Distance	(300A,00B4)	R+*	
> Beam Limiting Device Sequence	(300A,00B6)	R+*	
>> RT Beam Limiting Device Type	(300A,00B8)	R+*	Shall have at least 2 jaws or at least 1 jaw and 1 MLC.
>> Leaf Position Boundaries	(300A,00BE)	R+*	Shall be present for MLCs,. May or may not be present for jaws, may be ignored for jaws
> Referenced Patient Setup Number	(300C,006A)	R+*	Shall be >= 1.

Attribute	Tag	Beam Technique	
		Motorized Wedge	
		Presence	Specific Rules
> Treatment Delivery Type	(300A,00CE)	R+*	
> Number of Wedges	(300A,00D0)	R+*	Shall be 1 or 2. If 2, see also Hard Wedge Beam Modifier
> Wedge Sequence	(300A,00D1)	R+*	Shall be present.
>> Wedge Type	(300A,00D3)	R+*	Shall be MOTORIZED. Optional Hard Wedge shall be STANDARD
>> Wedge ID	(300A,00D4)	R+	
>> Wedge Angle	(300A,00D5)	RC+	Shall be present if Wedge Type (300A,00D3) is STANDARD. May be present otherwise.
>> Wedge Orientation	(300A,00D8)	R+	
>> Source to Wedge Tray Distance	(300A,00DA)	RC+	Shall be present if Wedge Type (300A,00D3) is STANDARD.
>>Effective Wedge Angle	(300A,00DE)	RC+/O+*	Shall be present if Wedge Type (300A,00D3) is MOTORIZED. A beam producer/consumer Actor (e.g., a TPS) may consume this value and is required to produce it
> Number of Compensators	(300A,00E0)	R+*	Shall be 0 or 1. If 1, see Compensator Beam Modifier.
> Number of Boli	(300A, 00ED)	R+*	Shall be >= 0. If > 0, see Bolus Beam Modifier.
> Number of Blocks	(300A,00F0)	R+*	Shall be 0-8. If > 0, see Block Beam Modifier.
> Applicator Sequence	(300A,0107)	R+*	Shall not be present.
> Final Cumulative Meterset Weight	(300A,010E)	R+*	
> Number of Control Points	(300A,0110)	R+*	Shall be 4.
> Control Point Sequence	(300A,0111)	R+*	
>> Cumulative Meterset Weight	(300A,0134)	R+	
>> Referenced Dose Reference Sequence	(300C,0050)	-/R+* R+/O+*	A TMS Actor is required to consume and process this value. A beam producer/consumer Actor (e.g., a TPS) may consume this value and is required to produce it. Shall have at least one item for target dose accumulation.
>>> Cumulative Dose Reference Coefficient	(300A,010C)	R+*	Shall be present.
>> Nominal Beam Energy	(300A,0114)	R+	Shall be constant.
>> Dose Rate Set	(300A,0115)	R+	Shall be constant.

Attribute	Tag	Beam Technique	
		Motorized Wedge	
		Presence	Specific Rules
>> Wedge Position Sequence	(300A,0116)	R+*	Shall be present and consistent with the Wedge Sequence (300A,00D1).
>>> Wedge Position	(300A,0118)	R+*	For Motorized Wedge, shall be IN for CPs 0 and 1, OUT for CPs 2 and 3. Shall be IN for optional Hard Wedge
>> Beam Limiting Device Position Sequence	(300A,011A)	R+*	Shall be consistent with the Beam Limiting Device Sequence (300A,00B6).
>>>Leaf/Jaw Positions	(300A,011C)	R+*	
>> Gantry Angle	(300A,011E)	R+*	Shall be constant.
>> Gantry Rotation Direction	(300A,011F)	R+*	Shall be NONE.
>> Gantry Pitch Angle	(300A,014A)	O+*	If not present, shall be assumed to be in the zero position. If present, shall be zero.
>> Gantry Pitch Rotation Direction	(300A,014C)	O+*	If present, shall be NONE.
>> Beam Limiting Device Angle	(300A,0120)	R+*	Shall be constant.
>> Beam Limiting Device Rotation Direction	(300A,0121)	R+*	Shall be NONE.
< Insert Control Point Sequence Fixed Attributes List > (See Section 7.4.4.2.1)			
>> Isocenter Position	(300A,012C)	R+	Shall be constant for all CPs.

7.4.4.1.9 RT Beams Module for Basic Static Electron Beam

7.4.4.1.9.1 Referenced Standards

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7.4.4.1.9.2 Module Definition

Attribute	Tag	Beam Technique	
		Basic Static Electron	
		Presence	Specific Rules
Beam Sequence	(300A,00B0)	R+*	
> Beam Number	(300A,00C0)	R+*	Shall be >= 1.
> Beam Name	(300A,00C2)	R+	
> Beam Type	(300A,00C4)	R+*	Shall be STATIC.
> Radiation Type	(300A,00C6)	R+*	Shall be ELECTRON.
> High-Dose Technique Type	(300A,00C7)	O+*	If present, must be handled safely

Attribute	Tag	Beam Technique	
		Basic Static Electron	
		Presence	Specific Rules
> Primary Fluence Mode Sequence	(3002,0050)	R+*	
>> Fluence Mode	(3002,0051)	D	
>> Fluence Mode ID	(3002,0052)	D	
> Treatment Machine Name	(300A,00B2)	R+*	Shall be constant.
> Primary Dosimeter Unit	(300A,00B3)	R+	Shall be MU.
> Source-Axis Distance	(300A,00B4)	R+*	
> Beam Limiting Device Sequence	(300A,00B6)	R+*	
>> RT Beam Limiting Device Type	(300A,00B8)	R+*	Shall be 2 jaws, MLC shall not be present
>> Leaf Position Boundaries	(300A,00BE)	O+*	NA (no MLC) May or may not be present for jaws, may be ignored for jaws
> Referenced Patient Setup Number	(300C,006A)	R+*	Shall be >= 1.
> Treatment Delivery Type	(300A,00CE)	R+*	
> Number of Wedges	(300A,00D0)	R+*	Shall be 0.
> Number of Compensators	(300A,00E0)	R+*	Shall be 0 or 1. If 1, see Compensator Beam Modifier.
> Number of Boli	(300A, 00ED)	R+*	Shall be >= 0. If > 0, see Bolus Beam Modifier.
> Number of Blocks	(300A,00F0)	R+*	Shall be 0-8. If > 0, see Block Beam Modifier.
> Applicator Sequence	(300A,0107)	R+*	Shall contain 1 item.
>> Applicator ID	(300A,0108)	R+	
>> Applicator Type	(300A,0109)	R+*	
>> Applicator Geometry Sequence	(300A,0431)	R+*	
> Final Cumulative Meterset Weight	(300A,010E)	R+*	
> Number of Control Points	(300A,0110)	R+*	Shall be 2.
> Control Point Sequence	(300A,0111)	R+*	
>> Cumulative Meterset Weight	(300A,0134)	R+	
>> Referenced Dose Reference Sequence	(300C,0050)	-/R+* R+/O+*	A TMS Actor is required to consume and process this value. A beam producer/consumer Actor (e.g., a TPS) may consume this value and is required to produce it. Shall have at least one item for target dose accumulation.

Attribute	Tag	Beam Technique	
		Basic Static Electron	
		Presence	Specific Rules
>>> Cumulative Dose Reference Coefficient	(300A,010C)	R+*	Shall be present.
>> Nominal Beam Energy	(300A,0114)	R+	Shall be constant.
>> Dose Rate Set	(300A,0115)	R+	Shall be constant.
>> Wedge Position Sequence	(300A,0116)	R+*	Shall not be present
>> Beam Limiting Device Position Sequence	(300A,011A)	R+*	Shall be consistent with the Beam Limiting Device Sequence (300A,00B6).
>>>Leaf/Jaw Positions	(300A,011C)	R+*	
>> Gantry Angle	(300A,011E)	R+*	Shall be constant.
>> Gantry Rotation Direction	(300A,011F)	R+*	Shall be NONE.
>> Gantry Pitch Angle	(300A,014A)	O+*	If not present, shall be assumed to be in the zero position. If present, shall be zero.
>> Gantry Pitch Rotation Direction	(300A,014C)	O+*	If present, shall be NONE.
>> Beam Limiting Device Angle	(300A,0120)	R+*	Shall be constant.
>> Beam Limiting Device Rotation Direction	(300A,0121)	R+*	Shall be NONE.
< Insert Control Point Sequence Fixed Attributes List > (See Section 7.4.4.2.1)			
>> Isocenter Position	(300A,012C)	R+	Shall be constant for all CPs.
>> Source to Surface Distance	(300A,0130)	-/R+ R+/O+*	A TMS Actor is required to consume and process this value. A beam consumer/producer Actor (e.g., a TPS) may consume this value and is required to produce it if Patient Setup Technique (300A, 01B0) is FIXED_SSD.
>>Source to External Contour Distance	(300A,0132)	-/R+ R+/O+*	A TMS Actor is required to consume and process this value. A beam consumer/producer Actor (e.g., a TPS) may consume this value and is required to produce it if Patient Setup Technique (300A, 01B0) is FIXED_SSD.

7.4.4.1.10 RT Beams Module for Step & Shoot Beam

7.4.4.1.10.1 Referenced Standards

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7.4.4.1.10.2 Module Definition

Attribute	Tag	Beam Technique	
		Step & Shoot	
		Presence	Specific Rules
Beam Sequence	(300A,00B0)	R+*	
> Beam Number	(300A,00C0)	R+*	Shall be >= 1.
> Beam Name	(300A,00C2)	R+	
> Beam Type	(300A,00C4)	R+*	Shall be STATIC.
> Radiation Type	(300A,00C6)	R+*	Shall be PHOTON.
> High-Dose Technique Type	(300A,00C7)	O+*	If present, must be handled safely
> Primary Fluence Mode Sequence	(3002,0050)	R+*	
>> Fluence Mode	(3002,0051)	D	
>> Fluence Mode ID	(3002,0052)	D	
> Treatment Machine Name	(300A,00B2)	R+*	Shall be constant.
> Primary Dosimeter Unit	(300A,00B3)	R+	Shall be MU.
> Source-Axis Distance	(300A,00B4)	R+*	
> Beam Limiting Device Sequence	(300A,00B6)	R+*	
>> RT Beam Limiting Device Type	(300A,00B8)	R+*	At least 1 MLC shall be present
>> Leaf Position Boundaries	(300A,00BE)	R+*	Shall be present for MLCs. May or may not be present for jaws, may be ignored for jaws
> Referenced Patient Setup Number	(300C,006A)	R+*	Shall be >= 1.
> Treatment Delivery Type	(300A,00CE)	R+*	
> Number of Wedges	(300A,00D0)	R+*	Shall be 0 or 1. If 1, see Hard Wedge Beam Modifier
> Number of Compensators	(300A,00E0)	R+*	Shall be 0..
> Number of Boli	(300A, 00ED)	R+*	Shall be >= 0. If > 0, see Bolus Beam Modifier.
> Number of Blocks	(300A,00F0)	R+*	Shall be 0-8. If > 0, see Block Beam Modifier.
> Applicator Sequence	(300A,0107)	R+*	Shall not be present.
> Final Cumulative Meterset Weight	(300A,010E)	R+*	

Attribute	Tag	Beam Technique	
		Step & Shoot	
		Presence	Specific Rules
> Number of Control Points	(300A,0110)	R+*	Shall be 2n, where n is the number of unique field shapes composing the beam If the Consumer has a limit, it must document this and safely handle input that exceeds the limit
> Control Point Sequence	(300A,0111)	R+*	
>> Cumulative Meterset Weight	(300A,0134)	R+	CP[0]=0.0 :: CP[2n + 1]=Cumulative Meterset Weight after completion of delivery of the field shape :: CP[2n+1] = CP[2n + 2]
>> Referenced Dose Reference Sequence	(300C,0050)	-/R+* R+/O+*	A TMS Actor is required to consume and process this value. A beam producer/consumer Actor (e.g., a TPS) may consume this value and is required to produce it. Shall have at least one item for target dose accumulation.
>>> Cumulative Dose Reference Coefficient	(300A,010C)	R+*	Shall be present.
>> Nominal Beam Energy	(300A,0114)	R+	Shall be constant.
>> Dose Rate Set	(300A,0115)	R+	Shall be constant.
>> Wedge Position Sequence	(300A,0116)	R+*	See Hard Wedge Beam Modifier If present, may not be ignored
>>> Wedge Position	(300A,0118)	R+*	Shall be IN.
>> Beam Limiting Device Position Sequence	(300A,011A)	R+*	Shall be consistent with the Beam Limiting Device Sequence (300A,00B6).
>>>Leaf/Jaw Positions	(300A,011C)	R+*	
>> Gantry Angle	(300A,011E)	R+*	Shall be constant.
>> Gantry Rotation Direction	(300A,011F)	R+*	Shall be NONE.
>> Gantry Pitch Angle	(300A,014A)	O+*	If not present, shall be assumed to be in the zero position. If present, shall be zero.
>> Gantry Pitch Rotation Direction	(300A,014C)	O+*	If present, shall be NONE.
>> Beam Limiting Device Angle	(300A,0120)	R+*	Shall be constant.
>> Beam Limiting Device Rotation Direction	(300A,0121)	R+*	Shall be NONE.
< Insert Control Point Sequence Fixed Attributes List > (See Section 7.4.4.2.1)			
>> Isocenter Position	(300A,012C)	R+	Shall be constant for all CPs.

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7.4.4.1.11 RT Beams Module for Sliding Window Beam

7.4.4.1.11.1 Referenced Standards

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7.4.4.1.11.2 Module Definition

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Attribute	Tag	Beam Technique	
		Sliding Window	
		Presence	Specific Rules
Beam Sequence	(300A,00B0)	R+*	
> Beam Number	(300A,00C0)	R+*	Shall be >= 1.
> Beam Name	(300A,00C2)	R+	
> Beam Type	(300A,00C4)	R+*	Shall be DYNAMIC.
> Radiation Type	(300A,00C6)	R+*	Shall be PHOTON.
> High-Dose Technique Type	(300A,00C7)	O+*	If present, must be handled safely
> Primary Fluence Mode Sequence	(3002,0050)	R+*	
>> Fluence Mode	(3002,0051)	D	
>> Fluence Mode ID	(3002,0052)	D	
> Treatment Machine Name	(300A,00B2)	R+*	Shall be constant.
> Primary Dosimeter Unit	(300A,00B3)	R+	Shall be MU.
> Source-Axis Distance	(300A,00B4)	R+*	
> Beam Limiting Device Sequence	(300A,00B6)	R+*	
>> RT Beam Limiting Device Type	(300A,00B8)	R+*	At least 1 MLC shall be present
>> Leaf Position Boundaries	(300A,00BE)	R+*	Shall be present for MLCs. May or may not be present for jaws, may be ignored for jaws
> Referenced Patient Setup Number	(300C,006A)	R+*	Shall be >= 1.
> Treatment Delivery Type	(300A,00CE)	R+*	
> Number of Wedges	(300A,00D0)	R+*	Shall be 0 or 1. If 1, see Hard Wedge Beam Modifier
> Number of Compensators	(300A,00E0)	R+*	Shall be 0..
> Number of Boli	(300A, 00ED)	R+*	Shall be >= 0. If > 0, see Bolus Beam Modifier.
> Number of Blocks	(300A,00F0)	R+*	Shall be 0-8. If > 0, see Block Beam Modifier.
> Applicator Sequence	(300A,0107)	R+*	Shall not be present.
> Final Cumulative Meterset Weight	(300A,010E)	R+*	

Attribute	Tag	Beam Technique	
		Sliding Window	
		Presence	Specific Rules
> Number of Control Points	(300A,0110)	R+*	Shall >2. If the Consumer has a limit, it must document this and safely handle input that exceeds the limit
> Control Point Sequence	(300A,0111)	R+*	
>> Cumulative Meterset Weight	(300A,0134)	R+	
>> Referenced Dose Reference Sequence	(300C,0050)	-/R+* R+/O+*	A TMS Actor is required to consume and process this value. A beam producer/consumer Actor (e.g., a TPS) may consume this value and is required to produce it. Shall have at least one item for target dose accumulation.
>>> Cumulative Dose Reference Coefficient	(300A,010C)	R+*	Shall be present.
>> Nominal Beam Energy	(300A,0114)	R+	Shall be constant.
>> Dose Rate Set	(300A,0115)	R+	Shall be constant.
>> Wedge Position Sequence	(300A,0116)	R+*	See Hard Wedge Beam Modifier If present, may not be ignored
>>> Wedge Position	(300A,0118)	R+*	Shall be IN.
>> Beam Limiting Device Position Sequence	(300A,011A)	R+*	Shall be consistent with the Beam Limiting Device Sequence (300A,00B6).
>>>Leaf/Jaw Positions	(300A,011C)	R+*	
>> Gantry Angle	(300A,011E)	R+*	Shall be constant.
>> Gantry Rotation Direction	(300A,011F)	R+*	Shall be NONE.
>> Gantry Pitch Angle	(300A,014A)	O+*	If not present, shall be assumed to be in the zero position. If present, shall be zero.
>> Gantry Pitch Rotation Direction	(300A,014C)	O+*	If present, shall be NONE.
>> Beam Limiting Device Angle	(300A,0120)	R+*	Shall be constant.
>> Beam Limiting Device Rotation Direction	(300A,0121)	R+*	Shall be NONE.
< Insert Control Point Sequence Fixed Attributes List > (See Section 7.4.4.2.1)			
>> Isocenter Position	(300A,012C)	R+	Shall be constant for all CPs.

7.4.4.1.12 RT Beams Module for IMAT/VMAT Beam

7.4.4.1.12.1 Referenced Standards

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Attribute	Tag	Beam Technique	
		IMAT/VMAT	
		Presence	Specific Rules
Beam Sequence	(300A,00B0)	R+*	
> Beam Number	(300A,00C0)	R+*	Shall be >= 1.
> Beam Name	(300A,00C2)	R+	
> Beam Type	(300A,00C4)	R+*	Shall be DYNAMIC.
> Radiation Type	(300A,00C6)	R+*	Shall be PHOTON.
> High-Dose Technique Type	(300A,00C7)	O+*	If present, must be handled safely
> Primary Fluence Mode Sequence	(3002,0050)	R+*	
>> Fluence Mode	(3002,0051)	D	
>> Fluence Mode ID	(3002,0052)	D	
> Treatment Machine Name	(300A,00B2)	R+*	Shall be constant.
> Primary Dosimeter Unit	(300A,00B3)	R+	Shall be MU.
> Source-Axis Distance	(300A,00B4)	R+*	
> Beam Limiting Device Sequence	(300A,00B6)	R+*	
>> RT Beam Limiting Device Type	(300A,00B8)	R+*	At least 1 MLC shall be present
>> Leaf Position Boundaries	(300A,00BE)	R+*	Shall be present for MLCs. May or may not be present for jaws, may be ignored for jaws
> Referenced Patient Setup Number	(300C,006A)	R+*	Shall be >= 1.
> Treatment Delivery Type	(300A,00CE)	R+*	
> Number of Wedges	(300A,00D0)	R+*	Shall be 0.
> Number of Compensators	(300A,00E0)	R+*	Shall be 0..
> Number of Boli	(300A, 00ED)	R+*	Shall be >= 0. If > 0, see Bolus Beam Modifier.
> Number of Blocks	(300A,00F0)	R+*	Shall be 0.
> Applicator Sequence	(300A,0107)	R+*	Shall not be present.
> Final Cumulative Meterset Weight	(300A,010E)	R+*	

Attribute	Tag	Beam Technique	
		IMAT/VMAT	
		Presence	Specific Rules
> Number of Control Points	(300A,0110)	R+*	Shall be > 2. If the Consumer has a limit, it must document this and safely handle input that exceeds the limit
> Control Point Sequence	(300A,0111)	R+*	
>> Cumulative Meterset Weight	(300A,0134)	R+	
>> Referenced Dose Reference Sequence	(300C,0050)	-/R+* R+/O+* R+*	A TMS Actor is required to consume and process this value. A beam producer/consumer Actor (e.g., a TPS) may consume this value and is required to produce it. Shall have at least one item for target dose accumulation.
>>> Cumulative Dose Reference Coefficient	(300A,010C)	R+*	Shall be present.
>> Nominal Beam Energy	(300A,0114)	R+	Shall be constant.
>> Dose Rate Set	(300A,0115)	R+	Shall be present as Nominal Dose Rate.
>> Wedge Position Sequence	(300A,0116)	R+*	Shall not be present.
>> Beam Limiting Device Position Sequence	(300A,011A)	R+*	Shall be consistent with the Beam Limiting Device Sequence (300A,00B6).
>>>Leaf/Jaw Positions	(300A,011C)	R+*	
>> Gantry Angle	(300A,011E)	R+*	
>> Gantry Rotation Direction	(300A,011F)	R+*	Shall be constant (CW or CC) for all CP except the last CP, which can be NONE.
>> Gantry Pitch Angle	(300A,014A)	O+*	If not present, shall be assumed to be in the zero position. If present, shall be zero.
>> Gantry Pitch Rotation Direction	(300A,014C)	O+*	If present, shall be NONE.
>> Beam Limiting Device Angle	(300A,0120)	R+*	
>> Beam Limiting Device Rotation Direction	(300A,0121)	R+*	If present, shall not be ignored.
< Insert Control Point Sequence Fixed Attributes List > (See Section 7.4.4.2.1)			
>> Isocenter Position	(300A,012C)	R+	Shall be constant for all CPs.

7.4.4.1.13 RT Beams Module for Photon Applicator Beam

7.4.4.1.13.1 Referenced Standards

DICOM 2018e Edition PS 3.3

7.4.4.1.13.2 Module Definition

Attribute	Tag	Beam Technique	
		Photon Applicator	
		Presence	Specific Rules
Beam Sequence	(300A,00B0)	R+*	
> Beam Number	(300A,00C0)	R+*	Shall be >= 1.
> Beam Name	(300A,00C2)	R+	
> Beam Type	(300A,00C4)	R+*	Shall be STATIC.
> Radiation Type	(300A,00C6)	R+*	Shall be PHOTON.
> High-Dose Technique Type	(300A,00C7)	O+*	If present, must be handled safely
> Primary Fluence Mode Sequence	(3002,0050)	R+*	
>> Fluence Mode	(3002,0051)	D	
>> Fluence Mode ID	(3002,0052)	D	
> Treatment Machine Name	(300A,00B2)	R+*	Shall be constant.
> Primary Dosimeter Unit	(300A,00B3)	R+	Shall be MU.
> Source-Axis Distance	(300A,00B4)	R+*	
> Beam Limiting Device Sequence	(300A,00B6)	R+*	
>> RT Beam Limiting Device Type	(300A,00B8)	R+*	Shall be 2 jaws, MLC shall not be present
>> Leaf Position Boundaries	(300A,00BE)	O+*	NA (no MLC) May or may not be present for jaws, may be ignored for jaws
> Referenced Patient Setup Number	(300C,006A)	R+*	Shall be >= 1.
> Treatment Delivery Type	(300A,00CE)	R+*	
> Number of Wedges	(300A,00D0)	R+*	Shall be 0.
> Number of Compensators	(300A,00E0)	R+*	Shall be 0.
> Number of Boli	(300A, 00ED)	R+*	Shall be >= 0. If > 0, see Bolus Beam Modifier.
> Number of Blocks	(300A,00F0)	R+*	Shall be 0.
> Applicator Sequence	(300A,0107)	R+*	Shall contain 1 item.
>> Applicator ID	(300A,0108)	R+	
>> Applicator Type	(300A,0109)	R+*	Shall be PHOTON_CIRC

Attribute	Tag	Beam Technique	
		Photon Applicator	
		Presence	Specific Rules
>> Applicator Geometry Sequence	(300A,0431)	R+*	
>>> Applicator Aperture Shape	(300A,0432)	R+	Shall be SYM_CIRCULAR
> Final Cumulative Meterset Weight	(300A,010E)	R+*	
> Number of Control Points	(300A,0110)	R+*	Shall be 2.
> Control Point Sequence	(300A,0111)	R+*	
>> Cumulative Meterset Weight	(300A,0134)	R+	
>> Referenced Dose Reference Sequence	(300C,0050)	-/R+* R+/O+*	A TMS Actor is required to consume and process this value. A beam producer/consumer Actor (e.g., a TPS) may consume this value and is required to produce it. Shall have at least one item for target dose accumulation.
>>> Cumulative Dose Reference Coefficient	(300A,010C)	R+*	Shall be present.
>> Nominal Beam Energy	(300A,0114)	R+	Shall be constant.
>> Dose Rate Set	(300A,0115)	R+	Shall be constant.
>> Wedge Position Sequence	(300A,0116)	R+*	Shall not be present
>> Beam Limiting Device Position Sequence	(300A,011A)	R+*	Shall be consistent with the Beam Limiting Device Sequence (300A,00B6).
>>>Leaf/Jaw Positions	(300A,011C)	R+*	
>> Gantry Angle	(300A,011E)	R+*	Shall be constant.
>> Gantry Rotation Direction	(300A,011F)	R+*	Shall be NONE.
>> Gantry Pitch Angle	(300A,014A)	O+*	If not present, shall be assumed to be in the zero position. If present, shall be zero.
>> Gantry Pitch Rotation Direction	(300A,014C)	O+*	If present, shall be NONE.
>> Beam Limiting Device Angle	(300A,0120)	R+*	Shall be constant.
>> Beam Limiting Device Rotation Direction	(300A,0121)	R+*	Shall be NONE.
< Insert Control Point Sequence Fixed Attributes List > (See Section 7.4.4.2.1)			
>> Isocenter Position	(300A,012C)	R+	Shall be constant for all CPs.

7.4.4.1.14 RT Beams Module for Photon Applicator Arc Beam

7.4.4.1.14.1 Referenced Standards

DICOM 2018e Edition PS 3.3

7.4.4.1.14.2 Module Definition

Attribute	Tag	Beam Technique	
		Photon Applicator Arc	
		Presence	Specific Rules
Beam Sequence	(300A,00B0)	R+*	
> Beam Number	(300A,00C0)	R+*	Shall be >= 1.
> Beam Name	(300A,00C2)	R+	
> Beam Type	(300A,00C4)	R+*	Shall be DYNAMIC.
> Radiation Type	(300A,00C6)	R+*	Shall be PHOTON.
> High-Dose Technique Type	(300A,00C7)	O+*	If present, must be handled safely
> Primary Fluence Mode Sequence	(3002,0050)	R+*	
>> Fluence Mode	(3002,0051)	D	
>> Fluence Mode ID	(3002,0052)	D	
> Treatment Machine Name	(300A,00B2)	R+*	Shall be constant.
> Primary Dosimeter Unit	(300A,00B3)	R+	Shall be MU.
> Source-Axis Distance	(300A,00B4)	R+*	
> Beam Limiting Device Sequence	(300A,00B6)	R+*	
>> RT Beam Limiting Device Type	(300A,00B8)	R+*	Shall be 2 jaws, MLC shall not be present
>> Leaf Position Boundaries	(300A,00BE)	O+*	NA (no MLC) May or may not be present for jaws, may be ignored for jaws
> Referenced Patient Setup Number	(300C,006A)	R+*	Shall be >= 1.
> Treatment Delivery Type	(300A,00CE)	R+*	
> Number of Wedges	(300A,00D0)	R+*	Shall be 0.
> Number of Compensators	(300A,00E0)	R+*	Shall be 0.
> Number of Boli	(300A, 00ED)	R+*	Shall be >= 0. If > 0, see Bolus Beam Modifier.
> Number of Blocks	(300A,00F0)	R+*	Shall be 0.
> Applicator Sequence	(300A,0107)	R+*	Shall contain 1 item.
>> Applicator ID	(300A,0108)	R+	
>> Applicator Type	(300A,0109)	R+*	Shall be PHOTON_CIRC.

Attribute	Tag	Beam Technique	
		Photon Applicator Arc	
		Presence	Specific Rules
>> Applicator Geometry Sequence	(300A,0431)	R+*	
>>> Applicator Aperture Shape	(300A,0432)	R+	Shall be SYM_CIRCULAR
> Final Cumulative Meterset Weight	(300A,010E)	R+*	
> Number of Control Points	(300A,0110)	R+*	Shall be 2.
> Control Point Sequence	(300A,0111)	R+*	
>> Cumulative Meterset Weight	(300A,0134)	R+	
>> Referenced Dose Reference Sequence	(300C,0050)	-/R+* R+/O+*	A TMS Actor is required to consume and process this value. A beam producer/consumer Actor (e.g., a TPS) may consume this value and is required to produce it. Shall have at least one item for target dose accumulation.
>>> Cumulative Dose Reference Coefficient	(300A,010C)	R+*	Shall be present.
>> Nominal Beam Energy	(300A,0114)	R+	Shall be constant.
>> Dose Rate Set	(300A,0115)	R+	Shall be constant.
>> Wedge Position Sequence	(300A,0116)	R+*	Shall not be present
>> Beam Limiting Device Position Sequence	(300A,011A)	R+*	Shall be consistent with the Beam Limiting Device Sequence (300A,00B6).
>>>Leaf/Jaw Positions	(300A,011C)	R+*	
>> Gantry Angle	(300A,011E)	R+*	
>> Gantry Rotation Direction	(300A,011F)	R+*	Shall be CW or CC for Control Point 0 Can be NONE for Control Point 1.
>> Gantry Pitch Angle	(300A,014A)	O+*	If not present, shall be assumed to be in the zero position. If present, shall be zero.
>> Gantry Pitch Rotation Direction	(300A,014C)	O+*	If present, shall be NONE.
>> Beam Limiting Device Angle	(300A,0120)	R+*	Shall be constant.
>> Beam Limiting Device Rotation Direction	(300A,0121)	R+*	Shall be NONE.
< Insert Control Point Sequence Fixed Attributes List > (See Section 7.4.4.2.1)			
>> Isocenter Position	(300A,012C)	R+	Shall be constant for all CPs.

7.4.4.2 General Beam Attribute Specifications

7.4.4.2.1 Control Point Fixed Attribute List Base Content

7.4.4.2.1.1 Referenced Standards

DICOM 2018e Edition PS 3.3

7.4.4.2.1.2 Required Attributes

The list of attributes and requirements below shall be included in all TPPC transactions as noted in the RT Beam Module specification associated with those transactions.

Attribute	Tag	Control Point Sequence	
		Fixed Attributes	
		Presence	Specific Rules
>> Patient Support Angle	(300A,0122)	R+*	Shall be constant.
>> Patient Support Rotation Direction	(300A,0123)	R+*	Shall be NONE.
>> Table Top Eccentric Axis Distance	(300A,0124)	O+*	If present, shall be constant.
>> Table Top Eccentric Angle	(300A,0125)	R+*	Shall be zero.
>>Table Top Eccentric Rotation Direction	(300A,0126)	R+*	Shall be NONE.
>> Table Top Pitch Angle	(300A,0140)	R+*	Shall be zero.
>> Table Top Pitch Rotation Direction	(300A,0142)	R+*	Shall be NONE.
>> Table Top Roll Angle	(300A,0144)	R+*	Shall be zero.
>> Table Top Roll Rotation Direction	(300A,0146)	R+*	Shall be NONE
>> Table Top Vertical Position	(300A,0128)	O+*	If value is present, shall be constant.
>> Table Top Longitudinal Position	(300A,0129)	O+*	If value is present, shall be constant.
>> Table Top Lateral Position	(300A,012A)	O+*	If value is present, shall be constant.

7.4.4.3 Beam Option Specifications

7.4.4.3.1 Bolus Beam Modifier Base Content

7.4.4.3.1.1 Referenced Standards

DICOM 2018e Edition PS 3.3

7.4.4.3.1.2 Required Attributes

One or more Boli may be optionally included in any of the Treatment Planning - Plan Content Storage and Retrieval transactions (Producer and Consumer Actors).

For actors supporting the Bolus Beam Modifier, the attributes specified in the table below have these additional requirements if Number of Boli (300A,00ED) is greater than zero.

Attribute	Tag	Beam Modifier	
		Bolus	
		Presence	Specific Rules
> Number of Boli	(300A,00ED)	R+*	Shall be >=1.
> Referenced Bolus Sequence	(300A,00B0)	R+*	
>> Bolus ID	(300A,00DC)	R+*	Shall be present.

7.4.4.3.2 Block Beam Modifier Base Content

7.4.4.3.2.1 Referenced Standards

DICOM 2018e Edition PS 3.3

7.4.4.3.2.2 Required Attributes

One or more Blocks may be optionally included in some of the Treatment Planning - Plan Content Storage and Retrieval transactions (Producer and Consumer Actors):

For actors supporting the Block Beam Modifier, the attributes specified in the table below have these additional requirements if Number of Blocks (300A,00F0) is greater than zero.

Attribute	Tag	Beam Modifier	
		Block	
		Presence	Specific Rules
> Number of Blocks	(300A,00F0)	R+*	Photon Beams: Shall be 0 - 8. Electron Beams: Shall be 0 or 1.
> Block Sequence	(300A,00F4)	R+*	
>> Block Tray ID	(300A,00F5)	R+	See Note 1.
>> Source to Block Tray Distance	(300A,00F6)	R+	
>> Block Divergence	(300A,00FA)	R+*	
>> Block Mounting Position	(300A,00FB)	R+	Shall be present, and shall be handled safely for enumerated values not supported.
>> Material ID	(300A,00E1)	R+	

Attribute	Tag	Beam Modifier	
		Block	
		Presence	Specific Rules
>> Block Thickness	(300A,0100)	R+	
>> Block Number of Points	(300A,0104)	R+*	
>> Block Data	(300A,0106)	R+*	

Note 1:

Photon Beams: There may be multiple blocks with the same Block Tray ID (i.e., placed on the same Tray, e.g., an aperture block and a shield block). If/when Treatment Delivery Verification is taking place, it is essentially the Block Tray that is verified, not the individual blocks on the tray, so one would expect the same Accessory ID to be reused for the same Block Tray ID. This is why Block Name is not made Mandatory (R+*) for the profile. Only a single Block Tray ID shall be supported for a given beam.

Electron Beams: The Block Tray ID defines the electron insert which is checked by the TDD.

7.4.4.3.3 Compensator Beam Modifier Base Content

7.4.4.3.3.1 Referenced Standards

DICOM 2018e Edition PS 3.3

7.4.4.3.3.2 Required Attributes

A single Compensator may be optionally included in some of the Treatment Planning - Plan Content Storage and Retrieve transactions (Producer and Consumer Actors):

For actors supporting the Compensator Beam Modifier, the attributes specified in the table below have these additional requirements: if Number of Compensators (300A,00E0) is equal to one.

Attribute	Tag	Beam Modifier	
		Compensator	
		Presence	Specific Rules
Beam Sequence	(300A,00B0)	R+*	
> Number of Compensators	(300A,00E0)	R+*	Shall be 1.
> Compensator Sequence	(300A,00E3)	R+*	
>> Compensator Type	(300A,00EE)	R+*	Shall be STANDARD.
>> Material ID	(300A,00E1)	R+*	
>> Compensator ID	(300A,00E5)	R+*	
>> Source to Compensator Tray Distance	(300A,00E6)	R+*	
>> Compensator Divergence	(300A,02E0)	R+*	
>> Compensator Mounting Position	(300A,02E1)	R+*	Shall be PATIENT_SIDE or SOURCE_SIDE.

Attribute	Tag	Beam Modifier	
		Compensator	
		Presence	Specific Rules
>> Compensator Transmission Data	(300A,00EB)	R+*	
>> Compensator Thickness Data	(300A,00EC)	R+*	

7.4.4.3.4 Hard Wedge Beam Modifier Base Content

7.4.4.3.4.1 Referenced Standards

DICOM 2018e Edition PS 3.3

7.4.4.3.4.2 Required Attributes

A single Hard Wedge may be optionally included in some of the Treatment Planning - Plan Content Storage and Retrieve transactions (Producer and Consumer Actors):

For actors supporting the Hard Wedge Beam Modifier, the attributes specified in the table below have these additional requirements if Number of Wedges (300A,00D0) is greater than 0.

Attribute	Tag	Beam Modifier	
		Hard Wedge	
		Presence	Specific Rules
Beam Sequence	(300A,00B0)	R+*	
> Number of Wedges	(300A,00D0)	R+*	Shall be 1 or 2; if 2, one will be Hard and the other will be either Motorized or Virtual
> Wedge Sequence	(300A,00D1)	R+*	
>> Wedge Type	(300A,00D3)	R+*	Shall be STANDARD.
>> Wedge ID	(300A,00D4)	R+	
>> Wedge Angle	(300A,00D5)	R+	
>> Wedge Orientation	(300A,00D8)	R+	
>> Source to Wedge Tray Distance	(300A,00DA)	R+	
…			
> Control Point Sequence	(300A,0111)	R+*	
>> Wedge Position Sequence	(300A,0116)	R+*	If present may not be ignored.
>>> Wedge Position	(300A,0118)	R+*	Shall be IN.

7.4.4.4 Other RT Beam Modules

7.4.4.4.1 RT Beams Module for Geometric Planner

7.4.4.4.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.4.4.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
Beam Sequence	(300A,00B0)	R+*	An actor must be able to safely handle up to 100 Beam Sequence Items (beams).
>Beam Name	(300A,00C2)	R+	The Beam Name must be unique within the sequence.
>Beam Type	(300A,00C4)	R+*	In the BRTO Profile, for Geometric Plans the value shall be STATIC. Only static beams shall be specified in Geometric Plans. This will allow non-arc-based IMRT (such as Step-and-Shoot or Sliding Window techniques, but not techniques such as fixed aperture arc beams, conformal arc beams, or intensity modulated arc beams. As a result, all beams in Geometric Plans shall consist of exactly two control points.
>Radiation Type	(300A,00C6)	R+*	Any value other than PHOTON is outside the scope of the profile
>High-Dose Technique Type	(300A,00C7)	O+*	Geometric Plans shall not specify this attribute.
>Treatment Machine Name	(300A,00B2)	O+*	An actor must not rely on the presence of this attribute.
>Source-Axis Distance	(300A,00B4)	R+*	This attribute is critical for providing information regarding beam divergence.
>Beam Limiting Device Sequence	(300A,00B6)		For the BRTO Profile, shall report at least one set of MLC descriptions or the descriptions of two sets of jaws.
>Referenced Patient Setup Number	(300C,006A)	R+*	
>Number of Wedges	(300A,00D0)	R+*	Geometric Plans are constrained to a value of 0 (i.e., a Geometric Plan must not include a Wedge).
>Number of Compensators	(300A,00E0)	R+*	Geometric Plans are constrained to a value of 0 (i.e., a Geometric Plan must not include a Compensator).
>Number of Boli	(300A,00ED)	R+*	Geometric Plans are constrained to a value of 0 (i.e., a Geometric Plan must not include any Boli).
>Number of Blocks	(300A,00F0)	R+*	All actors shall be able to handle 8 block items, of which no more than one may be an aperture
>Block Sequence	(300A,00F4)		
>>Block Divergence	(300A,00FA)	R+*	Must be present and non-null if Block Sequence is present (i.e., when Number of Blocks is 1 or more), with a value of PRESENT

Attribute	Tag	Type	Attribute Note
>>Block Number of Points	(300A,0104)	R+*	The value is constrained to be 3 or more.
>>Block Data	(300A,0106)	R+*	Shall be present and non-null. Limitations on the total number of points are limited only by DICOM limitations on representation with 'explicit VR' in total byte lengths. Systems that limit support of legal sequences shall safely handle receipt of such sequences that exceed their limitations, and document this behavior in their IHE-RO Profile adherence statement.
>Applicator Sequence	(300A,0107)		Not expected in Geometric Plans. However, if present, shall be handled in a safe manner by the receiving system (and document this behavior in their IHE-RO Profile adherence statement). Applications exporting this sequence are outside the scope of the BRTO Profile.
>Final Cumulative Meterset Weight	(300A,010E)	O+*	Shall not be present in a Geometric Plan.
>Number of Control Points	(300A,0110)	R+*	Shall have a value of 2 for Geometric Plans.
>Control Point Sequence	(300A,0111)	R+*	In the BRTO Profile, for Geometric Plans the second control point (sequence item) shall contain only: • Control Point Index (300A,0112) with a value of 1 • Cumulative Meterset Weight (300A,0134) set to NULL.
>>Cumulative Meterset Weight	(300A,0134)	O+*	Shall be NULL for Geometric Plans (in both the first and second control point).
>>Referenced Dose Reference Sequence	(300C,0050)	O+*	Shall not be present for Geometric Plans. Must not be relied upon by actors operating on the object as a Geometric Plan.
>>Nominal Beam Energy	(300A,0114)	O+*	Actors must not rely on the presence of this attribute to operate correctly. However, if this attribute is present, actors may not ignore the value.
>>Dose Rate Set	(300A,0115)	O+*	Actors must not rely on the presence of this attribute to operate correctly. However, if this attribute is present, actors may not ignore the value.
>>Wedge Position Sequence	(300A,0116)	O+*	Must not be present in a Geometric Plan
>>Beam Limiting Device Position Sequence	(300A,011A)	R+*	Must be present and correspond to those devices defined in the Beam Limiting Device Sequence. It shall be present for a Geometric Plan for Control Point Index 0 only.
>>Gantry Rotation Direction	(300A,011F)	R+*	For a Geometric Plan for Control Point Index 0 only, must have a value of NONE.

7.4.5 Plan-Related Modules in Delivery

This section is present only to convey the envisioned section numbering.

7.4.6 Image-Related Modules in Planning

7.4.6.1 RT Image Module

This section is present only to convey the envisioned section numbering.

7.4.6.2 Image Plane Module

7.4.6.2.1 Image Plane Base Content

7.4.6.2.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.6.2.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
Image Orientation (Patient)	(0020,0037)	R+*	This element shall be restricted to TRANSVERSE images only. For a transverse image, direction cosines shall be (±1, 0, 0, 0, ±1, 0) with an angle tolerance of 0.001 radians (~0.057 degrees)
Slice Thickness	(0018,0050)	-	Shall not be relied on.
Slice Location	(0020,1041)	-	Shall not be relied on.
Pixel Spacing	(0028,0030)	O+*	For CT, non-isotropic pixels are outside the scope of the profile. For RT Dose, pixel spacing may be non-isotropic.

7.4.6.2.2 Image Plane Decubitus

7.4.6.2.2.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.6.2.2.2 Module Definition

Attribute	Tag	Type	Attribute Note
Image Orientation (Patient)	(0020,0037)	R+*	This element shall be restricted to TRANSVERSE images only. For a transverse image, direction cosines shall be (±1, 0, 0, 0, ±1, 0) or (0, ±1, 0, ±1, 0, 0).with an angle tolerance of 0.001 radians (~0.057 degrees).
Slice Thickness	(0018,0050)	-	Shall not be relied on.
Slice Location	(0020,1041)	-	Shall not be relied on.

Attribute	Tag	Type	Attribute Note
Pixel Spacing	(0028,0030)	O+*	For CT, non-isotropic pixels are outside the scope of the profile. For RT Dose, pixel spacing may be non-isotropic.

7.4.7 Image-Related Modules in Delivery

This section is present only to convey the envisioned section numbering.

7.4.8 Segment-Related Modules

7.4.8.1 RT ROI Observation Module

7.4.8.1.1 RT ROI Observation Module Base Content

7.4.8.1.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.8.1.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
RT ROI Observations Sequence	(3006,0080)	R+*	This sequence contains information about an ROI. It references the ROI in Referenced ROI Number which contains a number which must match one of the ROI numbers in one of the elements of the Structure Set ROI Sequence.
>Referenced ROI Number	(3006,0084)	R+*	Specifies the ROI to which this observation applies. For every item in Structure Set ROI sequence, at least one observation is required, with values in ROI Interpreted Type.
>RT ROI Interpreted Type	(3006,00A4)	R+*	If referenced ROI has associated contours of type CLOSED_PLANAR, the content consumer must accept at minimum the following values: EXTERNAL PTV CTV GTV TREATED_VOLUME IRRAD_VOLUME BOLUS AVOIDANCE ORGAN MARKER CONTRAST_AGENT CAVITY

Attribute	Tag	Type	Attribute Note
			If referenced ROI has associated contours of type POINT, the content consumer must accept at minimum the following values: MARKER REGISTRATION ISOCENTER
> Segmented Property Category Code Sequence	(0062,0003)	-	See Note 1
> RT ROI Identification Code Sequence	(3006,0086)	-	See Note 2
>>Segmented Property Type Modifier Code Sequence	(0062,0011)	O+	Not required; Shall contain only one code if present.
>ROI Physical Properties Sequence	(3006,00B0)	O+*	Not required, but shall not be ignored if supplied.
>>ROI Physical Property	(3006,00B2)	R+*	Only relative electron density shall be supported: REL_ELEC_DENSITY

Note 1: This attribute allows preserving information by copying the content of Segmented Property Category Code Sequence (0062,0003) in case a Segmentation object is re-encoded as an RT Structure Set or vice-versa.

Note 2: In case of re-encoding a Segmentation object as an RT Structure Set or vice-versa it is suggested that the Segmented Property Type Code Sequence (0062,000F) is mapped to RT ROI Identification Code Sequence (3006,0086).

7.4.8.2 RT ROI Contour Module

7.4.8.2.1 RT ROI Contour Module Base Content

7.4.8.2.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.8.2.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
ROI Contour Sequence	(3006,0039)	R*	
>ROI Display Color	(3006,002A)	-	Not required - no compliant implementation shall rely on this element being present for proper operation. However applications are allowed to be aware of this element and use it to map display colors.
> Recommended Display Grayscale Value	(0062,000C)	-	Not required - no compliant implementation shall rely on this element being present for proper operation. However applications are allowed to be aware of this element and use it to map display colors.
> Recommended Display CIELab Value	(0062,000D)	-	Not required - no compliant implementation shall rely on this element being present for proper operation.

Attribute	Tag	Type	Attribute Note
			However applications are allowed to be aware of this element and use it to map display colors.
>Contour Sequence	(3006,0040)	R+*	Shall be present. Shall contain an item for each contour in the ROI. Compliant implementations shall be able to handle as many as 1000 contours on a single slice. That is, the number of contours in items in all Contour Sequences with the same z-coordinate (and referenced CT image) should be less than or equal to 1000.
>>Contour Image Sequence	(3006,0016)	R+*	Shall be present with a single item. This item is the image upon which this contour should be placed. If the contour type is CLOSED_PLANAR, then the z-coordinates of the contour shall match the z-coordinate of Image Position (Patient) in the image.
>>>Referenced SOP Class UID	(0008,1150)	R+*	Shall be present with a value of '1.2.840.10008.5.1.4.1.1.2'
>>>Referenced SOP Instance UID	(0008,1155)	R*	SOP Instance UID of the image being referenced.
>>>Referenced Frame Number	(0008,1160)	O+*	Shall not be present
>>Contour Geometric Type	(3006,0042)	R+*	Shall be present, with a value of POINT or CLOSED_PLANAR. If a consumer cannot import and handle contour within contour (XOR) data points, it shall detect this condition and reject the contour with a message to the user.
>>Contour Slab Thickness	(3006,0044)	-	Not required - no compliant implementation shall rely on this element being present for proper operation.
>>Contour Offset Vector	(3006,0045)	O+*	The profile requires that this attribute be zero if present.
>>Number of Contour Points	(3006,0046)	R+*	Required, and must match the actual number of points in Contour Data. Shall not exceed the number for which the Contour Data cannot be encoded when using explicit transfer syntax.
>>Contour Data	(3006,0050)	R+*	Shall be present. If contour type is CLOSED_PLANAR, then all points must have the same z-coordinate. This z-coordinate shall match the z-coordinate in the related CT image within 0.01 mm (contained in the Contour Image sequence in the same item of the ROI Contour Sequence as this data). An implication of this is that the CLOSED_PLANAR contours are transverse.

7.4.8.2.2 RT ROI Contour Module Off-slice

7.4.8.2.2.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.8.2.2.2 Module Definition

Attribute	Tag	Type	Attribute Note
ROI Contour Sequence	(3006,0039)	R*	
>ROI Display Color	(3006,002A)	-	Not required - no compliant implementation shall rely on this element being present for proper operation. However applications are allowed to be aware of this element and use it to map display colors.
> Recommended Display Grayscale Value	(0062,000C)	-	Not required - no compliant implementation shall rely on this element being present for proper operation. However applications are allowed to be aware of this element and use it to map display colors.
> Recommended Display CIELab Value	(0062,000D)	-	Not required - no compliant implementation shall rely on this element being present for proper operation. However applications are allowed to be aware of this element and use it to map display colors.
>Contour Sequence	(3006,0040)	R+*	Shall be present. Shall contain an item for each contour in the ROI. Compliant implementations shall be able to handle as many as 1000 contours on a single slice. That is, the number of contours in items in all Contour Sequences with the same z-coordinate (and referenced CT image) should be less than or equal to 1000.
>> Contour Number	(3006,0048)	R+*	Shall be present if Contour Geometry Type (3006,0042) is CLOSED_PLANAR.
>> Attached Contours	(3006,0049)	RC+*	Shall be present if Contour Geometry Type (3006,0042) is CLOSED_PLANAR and there are other contours referenced. Multiplicity equals the number of contours referenced from this contour (s. 3.3.4.1.2).
>>Contour Image Sequence	(3006,0016)	RC+*	Shall be present for contours located on image planes. This item is the image upon which this contour should be placed. If the contour type is CLOSED_PLANAR, there shall be contours whose z-coordinates match the z-coordinates of Image Position (Patient) in the image for structures that intersect this image plane.
>>>Referenced SOP Class UID	(0008,1150)	R+*	Shall be present with a value of '1.2.840.10008.5.1.4.1.1.2'
>>>Referenced SOP Instance UID	(0008,1155)	R*	SOP Instance UID of the image being referenced.
>>>Referenced Frame Number	(0008,1160)	O+*	Shall not be present
>>Contour Geometric Type	(3006,0042)	R+*	Shall be present, with a value of POINT or CLOSED_PLANAR. Conforming implementations must properly interpret this value.
>>Contour Slab Thickness	(3006,0044)	-	Not required - no compliant implementation shall rely on this element being present for proper operation.
>>Contour Offset Vector	(3006,0045)	O+*	The profile requires that this attribute be zero if present.

Attribute	Tag	Type	Attribute Note
>>Number of Contour Points	(3006,0046)	R+*	Required, and must match the actual number of points in Contour Data. Shall not exceed the number for which the Contour Data cannot be encoded when using explicit transfer syntax.
>>Contour Data	(3006,0050)	R+*	Shall be present. If contour type is CLOSED_PLANAR, then all points must have the same z-coordinate. For every image plane which is referenced in the Structure Set Module () and intersect the ROI, there shall be contours defined the image plane. The z-coordinate of those contours shall match the z-coordinate of the referenced image plane within 0.01 mm (contained in the Contour Image sequence in the same item of the ROI Contour Sequence as this data). An implication of this is that the CLOSED_PLANAR contours are transverse.

995 ### 7.4.8.3 RT Structure Set Module

7.4.8.3.1 Structure Set Module Base Content

7.4.8.3.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.8.3.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
Structure Set Label	(3006,0002)	R+	
Structure Set Date	(3006,0008)	R+	
Structure Set Time	(3006,0009)	R+	
Referenced Frame of Reference Sequence	(3006,0010)	R+*	This element is required for all 3D RT Structure Sets which are image based. It is to contain a set of references to the entire set of images which comprise the volume from which the Structure Set was constructed, and which is to be used for planning. There should only be one item in this sequence, as a BRTO Profile-based structure is based on a single set of images, which are all in the same frame of reference.
>Frame of Reference UID	(0020,0052)	R+*	This frame of reference UID shall be the same as the frame of reference of the CT series from which the Structure Set was constructed. It will also be the same as the frame of reference of any related RTPLAN's or RTDOSE's.
>RT Referenced Study Sequence	(3006,0012)	R+*	Shall be present and contain the series sequence. Only one item allowed in this sequence.
>>Referenced SOP Instance UID	(0008,1155)	R+*	This Study Instance UID shall be the same as the Study Instance UID of the related CT instances.
>>RT Referenced Series Sequence	(3006,0014)	R+*	Shall be present to contain the Contour Image Sequence. Only one item allowed in this sequence.
>>>Series Instance UID	(0020,000E)	R+*	Shall be present and contain the series to which the set of CT images upon which the structure set is based belong.

Attribute	Tag	Type	Attribute Note
>>>Contour Image Sequence	(3006,0016)	R+*	Shall be present. Contains an item for each CT image in the volume upon which the Structure Set is based.
>>>>Referenced SOP Class UID	(0008,1155)	R+*	Shall be present with a value of '1.2.840.10008.5.1.4.1.1.2' This profile is for volumes based on CT Images only
>>>>Referenced Frame Number	(0008,1160)	O+*	Shall not be present
Structure Set ROI Sequence	(3006,0020)	R+*	This sequence shall be present. It defines the ROI's in this Structure Set.
>ROI Number	(3006,0022)	R*	This defines an index to be used for referencing a particular ROI item from other sequences. It is required to be unique within the Structure Set in which it is created. No limitation on values other than uniqueness within sequence.
>Referenced Frame of Reference UID	(3006,0024)	R*	This frame of reference UID shall be the same as the frame of reference UID of the CT series from which the Structure Set was constructed. It will also be the same as the frame of reference of any related RTPLAN or RTDOSE instances.
>ROI Name	(3006,0026)	R+	This is the primary identifier for an ROI (from user perspective). Shall be present and should match UI display. Shall be unique within the Structure Set ROI sequence.
>ROI Description	(3006,0028)	-	Not required - no compliant implementation shall rely on this element being present for proper operation.
>ROI Volume	(3006,002C)	-	Not required - no compliant implementation shall rely on this element being present for proper operation.
>ROI Generation Algorithm	(3006,0036)	R+	Shall be present, with a value of AUTOMATIC, SEMIAUTOMATIC, or MANUAL. This information may be presented to a user, but no semantics for handling a Structure Set is required for this profile. Implementations which create Structure Set instances must provide an appropriate value.

7.4.8.3.2 Structure Set in Multi-Modality

7.4.8.3.2.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.8.3.2.2 Module Definition

The following table lists redefinitions of attributes within the Multimodality Image Registration for Radiation Oncology Integration Profile, which extend the definition of Structure Set Base Content (see 7.4.8.3.1). Attributes displayed in a light grey value are not modified but only added to provide the context in which a certain attribute enhancement is defined.

Attribute	Tag	Type	Attribute Note
Referenced Frame of Reference Sequence	(3006,0010)	R+*	This element is required for all 3D RT Structure Sets which are image based. It is to contain a set of references to the entire set of images which comprise the volume from which the Structure Set was constructed, and which is to be used for planning. There should only be one item in this sequence, as a BRTO Profile-based structure is based on a single set of images, which are all in the same frame of reference.
>RT Referenced Study Sequence	(3006,0012)	R+*	Shall be present and contain the series sequence. Only one item allowed in this sequence.
>>RT Referenced Series Sequence	(3006,0014)	R+*	Shall be present to contain the Contour Image Sequence. Only one item allowed in this sequence.
>>>Contour Image Sequence	(3006,0016)	R+*	Shall be present. Contains an item for each CT image in the volume upon which the Structure Set is based.
>>>>Referenced SOP Class UID	(0008,1155)	R+*	Must be present with a value of enhancement '1.2.840.10008.5.1.4.1.1.2', '1.2.840.10008.5.1.4.1.1.4' or '1.2.840.10008.5.1.4.1.1.128'
Structure Set ROI Sequence	(3006,0020)	R+*	This sequence shall be present. It defines the ROI's in this Structure Set.
>ROI Generation Algorithm	(3006,0036)	R+	Must be present, with a value of AUTOMATIC, SEMIAUTOMATIC, MANUAL, or RESAMPLED. This information may be presented to a user, but no semantics for handling an RTSTRUCT is required for this profile. RESAMPLED indicates that the ROI Contours have been resampled onto a different set of images from those on which the contours were originally created. Implementations which create RTSTRUCT instances must provide an appropriate value.

7.4.9 Segment Modules in Delivery

This section is present only to convey the envisioned section numbering.

7.4.10 Registration Modules in Planning

7.4.10.1 Registration Module

7.4.10.1.1 Registration Module Base Content

7.4.10.1.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.10.1.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
Content Label	(0070,0080)	-	
Content Description	(0070,0081)	R+	Description used to distinguish registration instances. Shall not be empty.
Registration Sequence	(0070,0308)	R	The sequence shall contain 2 registration items. One Frame of Reference will be to the Registered Frame of Reference, the other will define the spatial registration from the specified Frame of Reference to the Registered Frame of Reference. Note: The order of these items is not significant
>Frame of Reference UID	(0020,0052)	R*	Identifies a Frame of Reference that may or may not be an image set (e.g., atlas or physical space). See Section C.7.4.1.1.1 for further explanation. Shall be present.
>Referenced Image Sequence	(0008,1140)	R*	Identifies the set of images registered in this sequence item. One or more items shall be present. Represents the set of images available to the Registrator at the time of spatial registration (see RO TF-2: 3.17.4.1.2).
>Matrix Registration Sequence	(0070,0309)	R	A sequence that specifies one spatial registration. Exactly one item shall be present
>>Matrix Sequence	(0070,030A)	R	One item shall be present. The item specifies a transformation. See Section C.20.2.1.1 in the DICOM Standard
>>>Frame of Reference Transformation Matrix	(3006,00C6)	R	A 4x4 homogeneous transformation matrix that registers the referenced images to the Registered Frame of Reference. Matrix elements shall be listed in row-major order. See Section C.20.2.1.1 in the DICOM Standard
>>>Frame of Reference Transformation Matrix Type	(0070,030C)	R	The only type of Frame of Reference Transformation Matrix (3006,00C6) supported in this profile is RIGID. See Section C.20.2.1.2 in the DICOM Standard.

7.4.11 Treatment Records

This section is present only to convey the envisioned section numbering.

7.4.12 Prescription-Related Modules in Planning

This section is present only to convey the envisioned section numbering.

7.4.13 Dose-Related Modules

7.4.13.1 Image Plane Module

7.4.13.1.1 Image Plane Base Content

7.4.13.1.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.13.1.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
Image Orientation (Patient)	(0020,0037)	R+*	This element shall be restricted to TRANSVERSE images only. For a transverse image, direction cosines shall be (±1, 0, 0, 0, ±1, 0) with an angle tolerance of 0.001 radians (~0.057 degrees). The Image Orientation (Patient) shall correspond to the RT Patient Setup of the associated RT Plan (Section 7.3.2.2.1)
Slice Thickness	(0018,0050)	-	Shall not be relied on.
Slice Location	(0020,1041)	-	Shall not be relied on.
Pixel Spacing	(0028,0030)	O+*	For CT, non-isotropic pixels are outside the scope of the profile. For RT Dose, pixel spacing may be non-isotropic.

7.4.13.2 Multi-Frame Module

7.4.13.2.1 Multi-Frame Module Base Content

7.4.13.2.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.13.2.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
Frame Increment Pointer	(0028,0009)	R+*	Shall have the same value as the Grid Frame Offset Vector (3004,000C).

7.4.13.3 RT Dose Module

7.4.13.3.1 RT Dose Module Base Content

7.4.13.3.1.1 Referenced Standards

DICOM 2018d Edition PS 3.3

7.4.13.3.1.2 Module Definition

Attribute	Tag	Type	Attribute Note
Content Date	(0008,0023)	R+	Required
Content Time	(0008,0033)	R+	Required
Samples per Pixel	(0028,0002)	R+*	Shall be present and equal to 1.
Photometric Interpretation	(0028,0004)	R+*	Shall be present and equal to **MONOCHROME2.**
Bits Allocated	(0028,0100)	R+*	Shall be present and equal to 16 or 32.
Bits Stored	(0028,0101)	R+*	Shall be equal to Bits Allocated.
High Bit	(0028,0102)	R+*	Shall be one less than Bits Stored.
Pixel Representation	(0028,0103)	R+*	Shall have the value 0 = unsigned integer. Negative dose values shall not be present.
Dose Units	(3004,0002)	R+*	Shall be equal to the enumerated value **GY.**
Dose Type	(3004,0004)	R+*	Shall be equal to the defined term **PHYSICAL** or **EFFECTIVE.**
Dose Comment	(3004,0006)	RC+	Shall be present and not empty if Referenced RT Plan Sequence (300C,0002) is missing and RT Plan Description is present, in which case it should have the same value as RT Plan Description.
Normalization Point	(3004,0008)	-	Shall not be relied on.
Dose Summation Type	(3004,000A)	R+*	Shall have the value **PLAN**.
Referenced RT Plan Sequence	(300C,0002)	R+*	Shall be present if Dose Summation Type (3004,000A) has the value **PLAN**.
Grid Frame Offset Vector	(3004,000C)	R+*	First z coordinate shall be equal to zero. The remaining z coordinates shall be relative to the starting z position in Image Position (Patient) (0020,0032). The difference between neighboring values shall be constant with a tolerance of 0.01mm.
Tissue Heterogeneity Correction	(3004,0014)	R+	Shall be present.

7.4.13.4 RT DVH Module

7.4.13.4.1 RT DVH Module Base Content

7.4.13.4.1.1 Referenced Standard

DICOM 2018d Edition PS 3.3

7.4.13.4.1.2 Module Definition

Attribute Name	Tag	Type	Attribute Description
DVH Normalization Point	(3004,0040)	R+*	Shall not be present
DVH Normalization Dose Value	(3004,0042)	R+*	Shall not be present
DVH Sequence	(3004,0050)	-	Sequence of DVHs. One or more Items shall be included in this Sequence.
>DVH Type	(3004,0001)	R+*	Shall be DIFFERENTIAL or CUMULATIVE
>Dose Units	(3004,0002)	R+	Shall be GY.
>Dose Type	(3004,0004)	R+	Shall be either PHYSICAL or EFFECTIVE
>DVH Volume Units	(3004,0054)	R+	Shall be CM3

7.5 Service Definitions

This section contains attributes specifications of Services used in transactions specifying the extended IHE requirements.

7.5.1 UPS Push Workflow Service Groups

The following sections specify the information required in the Unified Procedure Step Scheduled Procedure Information when creating a UPS instance (either internally or using the N-CREATE service) prior exposing it. The first section specifies general requirements applying to any UPS whereas the subsequent sections specify requirements along the intended action (i.e. Scheduled Workitem Code) of the UPS.

7.5.1.1 N-CREATE Service

7.5.1.1.1 N-CREATE Service Base

7.5.1.1.1.1 Referenced Standards

DICOM PS 3.4: CC.2.5 Create a Unified Procedure Step (N-CREATE)

7.5.1.1.1.2 Unified Procedure Step Scheduled Procedure Information Module Definition

1060 **Table 7.5.1.1.1.2-1: Usage of DICOM Attributes in IHE**

Attribute	Tag	IHE Usage	Attribute Requirements
Scheduled Station Name Code Sequence	(0040,4025)	R*	
>Code Value	(0008,0100)	R+*	Code Value for the Scheduled Station Name shall contain the string used to definitively match the performing device instance with its representation on the TMS. It is not necessarily human-readable.
>Coding Scheme Designator	(0008,0102)	O+*	Coding Scheme Designator for the Scheduled Station Name is a private coding scheme, and is not used explicitly in the IHE-RO profiles.
>Code Meaning	(0008,0104)	R	Code Meaning for the Scheduled Station Name shall contain the human-readable description of the Station Name.
Scheduled Workitem Code Sequence	(0040,4018)	R+	When applicable the code shall use one of the following CIDs: CID 9241 Radiotherapy General Workitem Definition CID 9242 Radiotherapy Acquisition Workitem Definition CID 9243 Radiotherapy Registration Workitem Definition For other procedures, private coding scheme designator or future standardized codes may be used. See subsequent sections for use case specific workitem codes. Displayed value shall clearly state the intent of the workitem, but does not have to match the specific meaning text.
>Code Value	(0008,0100)	R*	
>Coding Scheme Designator	(0008,0102)	R*	
>Code Meaning	(0008,0104)	R	
Scheduled Processing Parameters Sequence	(0074,1210)	RC+*	Required if the performing of the UPS requires additional processing parameters. See subsequent sections for use case specific processing parameters.
Input Information Sequence	(0040,4021)	RC+*	Required if the performing of the UPS requires additional input information. See subsequent sections for use case specific input information.
Study Instance UID	(0020,000D)	R+*	Study Instance UID must be supplied by the Scheduler if performance of the procedure step is expected to create composite SOP Instances as output. The supplied Study Instance shall be used by the Performer in creation of such SOP Instances.
All other attributes	As described in DICOM Standard		

7.5.1.1.1.3 Unified Procedure Step Relationship Module Definition

Table 7.5.1.1.1.3-1: Usage of DICOM Attributes in IHE

Attribute	Tag	IHE Usage	Attribute Requirements
Patient's Name	(0010,0010)	R+	
Patient ID	(0010,0020)	R+	
All other attributes	As described in DICOM Standard		

7.5.1.1.2 N-CREATE Service for 'Treatment Delivery Workflow' Use Case

7.5.1.1.2.1 Referenced Standards

DICOM PS 3.4: CC.2.5 Create a Unified Procedure Step (N-CREATE)

DICOM PS 3.16: C Acquisition Context Module, Protocol and Workflow Context Templates

7.5.1.1.2.2 Module Definition

In addition to the requirements of section 7.5.1.1.1 the following shall apply:

- The code in the Scheduled Workitem Code Sequence (0040,4018) shall be equal to (121726, DCM, "RT Treatment with Internal Verification").
- The Input Information Sequence (0040,4021) shall contain references to at least the following items (additional items may be supplied for other reasons, but are out of scope for this profile):

Table 7.5.1.1.2.2-1: Input Information Sequence Items for Treatment Delivery

SOP Class Name	SOP Class UID	Retrieve Location
RT Plan Storage or RT Ion Plan Storage	1.2.840.10008.5.1.4.1.1.481.5 1.2.840.10008.5.1.4.1.1.481.8	Object Storage
RT Beams Delivery Instruction Storage	1.2.840.10008.5.1.4.34.7	TMS
RT Beams Treatment Record Storage or RT Ion Beams Treatment Record Storage (see Note 1)	1.2.840.10008.5.1.4.1.1.481.4 1.2.840.10008.5.1.4.1.1.481.9	Object Storage

Note 1: The presence of a Treatment Record is required, when the treatment is a continuation of a previously interrupted treatment, i.e. when 'Treatment Delivery Type' in the Scheduled Processing Parameters Sequence contains the value of 'CONTINUATION'. The set of Treatment Records included shall include all treatment records that are needed for the delivery device to exactly determine how to continue the fraction. To ensure interoperability with delivery devices requiring all treatment records previously sent for a specific fraction and all attributes of the original treatment records, supporting the Retain Original Treatment Records option shall be mandatory.

- The Scheduled Processing Parameters Sequence shall include the following:

Table 7.5.1.1.2.2-2: Scheduled Processing Parameters Sequence Items

	NL	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		TEXT	(121740, DCM, "Treatment Delivery Type")	1	M		TREATMENT CONTINUATION
2		TEXT	(2018001, 99IHERO2018, "Plan Label")	1	M		
3		NUMERIC	(2018002, 99IHERO2018, "Current Fraction Number")	1	M		
4		NUMERIC	(2018003, 99IHERO2018, "Number of Fractions Planned")	1	M		

Content Item Descriptions

Row 1	This parameter indicates whether the treatment to be delivered is a complete fraction or a continuation of previous incompletely treated fraction. A Text Value of 'CONTINUATION' shall be supplied if the delivery completes a previously interrupted treatment delivery UPS (that ended in the 'CANCELED' state). Otherwise, a Text Value of 'TREATMENT' shall be supplied.
Row 2	Shall be set to the label of the RT Plan/RT Ion Plan to be delivered. This corresponds to the RT Plan Label (300A,0002) of the referenced plan. The requirement as specified in the RT General Plan module applies here as well (see 7.4.3.1.1.2). This allows the delivery device to display the plan label upon receiving the C-FIND RSP without requiring retrieving the plan instance.
Row 3	Shall be set to the index of the fraction to be delivered. Corresponds to Current Fraction Number (3008,0022) in the referenced RT Beams Delivery Instruction IOD. The requirement as specified in the RT Beams Delivery Instruction Base module applies here as well (see 7.4.2.1.1). This allows the delivery device to display the fraction information upon receiving the C-FIND RSP without requiring retrieving the delivery instruction instance.
Row 4	Shall be set to the total number of fractions prescribed for the plan. This corresponds to Number of Fractions Planned (300A,0078) of the referenced plan. This allows the delivery device to display the fraction information upon receiving the C-FIND RSP without requiring retrieving the delivery instruction instance.

If more than one RT Plan/RT Ion Plan shall be treated in the treatment session, one UPS per plan treatment shall be present/scheduled.

- Object Retrieval

The UPS Input Information Sequence specifies AE title(s), Retrieve AE Title (0008,0054), from which input objects are to be retrieved. Storage location(s) are defined by the provider of the TMS Actor, at the discretion of this provider. Configuration of AE Titles for object retrieval is communicated out of band.

7.5.2 UPS Pull Workflow Service Groups

7.5.2.1 C-FIND Service

7.5.2.1.1 C-FIND Service for 'Treatment Delivery Workflow' Use Case

7.5.2.1.1.1 Referenced Standards

DICOM PS 3.4: CC.2.5.1.3 UPS Attribute Service Requirements (C-FIND)

7.5.2.1.1.2 C-FIND Attributes

Table 7.5.2.1.1.2-1: Usage of DICOM Attributes in IHE for Worklist Query

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
Specific Character Set	(0008,0005)	-	-	O* (Note 4)	R (Note 4)
SOP Class UID	(0008,1016)	-	-	O*	R
SOP Instance UID	(0008,0018)	-	-	R+*	R
Procedure Step State	(0074,1000)	R+* (Note 1)	R*	R*	R*
Scheduled Station Name Code Sequence	(0040,4025)	R* (Note 6)	R*	R*	R*
>Code Value	(0008,0100)	R+* (Note 2)	R	R+*	R
>Coding Scheme Designator	(0008,0102)	O+*	R	R+*	R
>Code Meaning	(0008,0104)	-	-	R+	R
Scheduled Procedure Step Start Date and Time	(0040,4005)	R* (Note 3)	R	R	R (Note 10)
Scheduled Workitem Code Sequence	(0040,4018)	R+* (Note 7)	R+*	R+	R
>Code Value	(0008,0100)	-	-	R+*	R
>Coding Scheme Designator	(0008,0102)	-	-	R+*	R
>Code Meaning	(0008,0104)	-	-	O	R
Scheduled Processing Parameters Sequence	(0074,1210)	R+* (Note 8)	-	R+ (Note 8)	R+* (Note 8)

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
Input Readiness State	(0040,4041)	-	-	R+*	-
Input Information Sequence	(0040,4021)	R+* (Note 9)	-	R+* (Note 9)	R+* (Note 9)
> (all other attributes)		-	-	R	R
Study Instance UID	(0020,000D)	-	-	R+*	R+
Patient's Name	(0010,0010)	R+ (Note 5)	R	R+	R+
Patient ID	(0010,0020)	R+ (Note 5)	R	R+	R+
All other attributes	As described in DICOM Standard				

Note 1: A Procedure Step State of 'SCHEDULED' shall be supplied.

Note 2: Code Value for the Scheduled Station Name shall contain the string used to definitively match the performing device instance with its representation on the TMS. It is not necessarily human-readable.

Note 3: A 'reasonable' date time range (such as the rest of the current day) shall be supplied to limit the size of the returned result set. If operating in a mode where the patient is selected on the SCP, the SCP is permitted to over-filter the result set based upon this selection and return just the worklist items for the selected fraction.
For "Time Zone Support" option, the date time range shall include the offset of the time zone the SCU is operating in (e.g., 20241125073000+0300-20241125235959+0300). See also Note 10 for the query key return.

Note 4: See 7.2.1.1.

Note 5: Shall be empty.

Note 6: Code Meaning (0008,0104) of the Scheduled Station Name Code Sequence (0040,4025) shall be displayed on the performing device.

Note 7: Scheduled Workitem Code Sequence shall be specified as an empty (null) sequence. The Return Key of this sequence is specified in the use case specific sections for C-FIND.

Note 8: Scheduled Processing Parameters Sequence shall be specified as an empty (null) sequence. The Return Key of this sequence is specified in the use case specific sections for C-FIND.

Note 9: Input Information Sequence shall be specified as an empty (null) sequence. The Return Key of the Input Information Sequence shall contain all the input objects that will ultimately be needed to perform the specified procedure step, and no others. This allows the performing device to determine if the instances are available prior to starting the procedure, and avoids the need for an additional N-GET on the UPS. If the performing device considers that the Input Information Sequence contains inadequate or inconsistent information, then it shall address any such inconsistencies in a safe manner before performing the Requested Procedure.

Note 10: For "Time Zone Support" option, the DT attributes in the C-FIND RSP Identifier shall be encoded using the same time zone offset as provided in the C-FIND request identifier.

7.5.2.2 N-SET Progress Update Service

7.5.2.2.1 N-SET Progress Update Service Base

7.5.2.2.1.1 Referenced Standards

DICOM PS 3.4: CC.2.5.1.3 UPS Attribute Service Requirements (N-SET)

7.5.2.2.1.2 N-SET Progress Update Attributes

In the Update Treatment Delivery Progress transaction, the performer of the UPS (SCU) uses the UPS N-SET to inform the TMS about any changes in the progress of the UPS.

The minimum requirements for SCUs using the UPS N-SET command are detailed in Table 7.5.2.2.1.2-1.

Table 7.5.2.2.1.2-1 Usage of DICOM Attributes in IHE for Progress Update

Attribute Name	Tag	Type	IHE-RO Additional Requirements on SCU
Unified Procedure Step Progress Information Module			
Procedure Step Progress Information Sequence	(0074,1002)	R+*	
>Procedure Step Progress	(0074,1004)	R+*	
Unified Procedure Step Performed Procedure Information Module			
UPS Performed Procedure Sequence	(0074,1216)	R+*	
>Output Information Sequence	(0040,4033)	R+*	Shall be empty

7.5.2.2.2 N-SET Progress Update Requirements for 'Treatment Delivery Workflow' Use Case

7.5.2.2.2.1 Referenced Standards

DICOM PS 3.4: CC.2.5.1.3 UPS Attribute Service Requirements (N-SET)

DICOM PS 3.16: C Acquisition Context Module, Protocol and Workflow Context Templates

7.5.2.2.2.2 N-SET Progress Update Attributes

In addition to the requirements in 7.5.2.2.1 N-SET Progress Update Requirements, the beam that is being in progress shall be indicated as follows:

Table 7.5.2.2.2.2-1 Usage of DICOM Attributes in IHE for Progress Update for 'Treatment Delivery'

Attribute Name	Tag	Type	IHE-RO Additional Requirements on SCU
Unified Procedure Step Progress Information Module			
Procedure Step Progress Information Sequence	(0074,1002)	R+*	
>Procedure Step Progress Parameters Sequence	(0074,1007)	R+*	See Table 7.5.2.2.2.2-2

Table 7.5.2.2.2.2-2: Procedure Step Progress Parameters Sequence Items

	NL	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		NUM	(2018004, 99IHERO2018, "Referenced Beam Number")	1	M		

7.5.2.3 N-SET Update to Final State Service

In the Update to Final State transaction, the performer of the UPS (SCU) uses the UPS N-SET to inform the TMS about any changes in the properties of the UPS prior to setting the UPS to COMPLETED or CANCELED.

Note that IHE-RO is more restrictive than DICOM Standard requiring several attributes to be set for all UPS N-SET commands. DICOM Standard only requires that the attributes have been set by any N-SET or N-ACTION message prior to the procedure step being moved into the COMPLETED or CANCELED state.

The UPS Performed Procedure Information Module is provided by the performer of the UPS in the Update Workitem to Final State transaction using the UPS N-SET command. Therefore, the Type specification for the UPS attributes correspond to the Final State requirements of the UPS. The specification only contains those attributes having a Final State requirement of 'R' (required if procedure is COMPLETED or CANCELED) or 'X' (required if procedure is CANCELED).

The SCU shall provide at least one item in the Performed Workitem Code Sequence (0040,4019). Other items may be sent as well representing other unscheduled activities performed by the SCU, but those may be ignored by the SCP.

The first section specifies general requirements applying to any type of UPS whereas the subsequent sections specify requirements along the intended action of the UPS (i.e. Scheduled/Performed Workitem Code) of the UPS.

7.5.2.3.1 N-SET Update to Final State Base

7.5.2.3.1.1 Referenced Standards

DICOM PS 3.4: CC.2.5.1.3 UPS Attribute Service Requirements (Final State)

7.5.2.3.1.2 Unified Procedure Step Performed Procedure Information Module Definition

Table 7.5.2.3.1.2-1: Usage of DICOM Attributes in IHE

Attribute	Tag	IHE Usage	Attribute Requirements
UPS Performed Procedure Sequence	(0074,1216)	R*	Supplied by the Update Workitem to Final State transaction if UPS is not CANCELED. May be supplied otherwise.
>Actual Human Performers Sequence	(0040,4035)	RC*	Shall be provided if known. Not required to be known.
>>Human Performer Code Sequence	(0040,4009)	RC*	Shall be provided if known. Not required to be known.
>>Human Performer's Name	(0040,4037)	RC	Shall be provided if known. Not required to be known.
>Performed Station Name Code Sequence	(0040,4028)	R*	Supplied by the Update Workitem to Final State transaction.
>>Code Value	(0008,0100)	R	Name of machine performing UPS. Supplied by the Update Workitem to Final State transaction
>>Coding Scheme Designator	(0008,0102)	R*	Any private coding scheme designator. Supplied by the Update Workitem to Final State transaction.
>>Code Meaning	(0008,0104)	R*	Value shall be 'Performed Station Name'. Supplied by the Update Workitem to Final State transaction.
>Performed Procedure Step Start DateTime	(0040,4050)	R	Supplied by the Update Workitem to Final State transaction. For the "Time Zone Support" option, the value shall include the offset of the time zone the TDD is operating in.
>Performed Workitem Code Sequence	(0040,4019)	R*	The code of the performed workitem. Supplied by the Update Workitem to Final State transaction. See also Scheduled Workitem Code Sequence (0040,4018) and subsequent sections for use case specific workitem codes.
>>Code Value	(0008,0100)	R*	
>>Coding Scheme Designator	(0008,0102)	R*	
>>Code Meaning	(0008,0104)	R	

Attribute	Tag	IHE Usage	Attribute Requirements
>Performed Procedure Step End DateTime	(0040,4051)	R*	Supplied by the Update Workitem to Final State transaction. For the "Time Zone Support" option, the value shall include the offset of the time zone the TDD is operating in.
>Output Information Sequence	(0040,4033)	R*	Supplied by the Update Workitem to Final State transaction. May be empty (null) if no output objects are created as a result of performing the UPS.
>>Type of Instances	(0040,E020)	R*	Value shall be 'DICOM'.
>>Study Instance UID	(0020,000D	R*	Supplied by the Update Workitem to Final State transaction.
>>Series Instance UID	(0020,000E	R*	Supplied by the Update Workitem to Final State transaction.
>>Referenced SOP Sequence	(0008,1199)	R*	Supplied by the Update Workitem to Final State transaction.
>>>Referenced SOP Class UID	(0008,1150)	R*	Supplied by the Update Workitem to Final State transaction.
>>>Referenced SOP Instance UID	(0008,1155)	R*	Supplied by the Update Workitem to Final State transaction.
>>>HL7 Instance Identifier	(0040,E001)	RC+	Shall not be used.
>>>Referenced Frame Number	(0008,1160	RC+	Shall not be used.
>>>Referenced Segment Number	(0062,000B	RC+	Shall not be used.
>>DICOM Retrieval Sequence	(0040,E021)	R	Supplied by the Update Workitem to Final State.
>>>Retrieve AE Title	(0008,0054)	R	Supplied by the Update Workitem to Final State transaction.
>>DICOM Media Retrieval Sequence	(0040,E022)	RC+	Shall not be used.
>>WADO Retrieval Sequence	(0040,E023)	RC+	Shall not be used.
>>XDS Retrieval Sequence	(0040,E024)	RC+	Shall not be used.
>>WADO-RS Retrieval Sequence	(0040,E025)	RC+	Shall not be used.
All other attributes	As described in DICOM Standard		

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7.5.2.3.2 N-SET Update to Final State for 'Treatment Delivery Workflow' Use Case

7.5.2.3.2.1 Referenced Standards

DICOM PS 3.4: CC.2.5.1.3 UPS Attribute Service Requirements (Final State)

7.5.2.3.2.2 Unified Procedure Step Performed Procedure Information Module Definition

In addition to the requirements of section 7.5.2.3.1, the following applies:

- The code of the required item in the Performed Workitem Code Sequence (0040,4019) shall be set to (121726, DCM, "RT Treatment with Internal Verification").
- The Output Information Sequence (0040,4033) shall contain references to at least the following items (additional items may be supplied for other reasons, but are out of scope for this profile):

Table 7.5.2.3.2.2-1: Output Information Sequence Items for Treatment Delivery

SOP Class Name	SOP Class UID	Retrieve Location
RT Beams Treatment Record Storage or RT Ion Beams Treatment Record Storage (see Note 1)	1.2.840.10008.5.1.4.1.1.481.4 1.2.840.10008.5.1.4.1.1.481.9	Object Storage

Note 1: Required if any therapeutic treatment was delivered to the patient while performing this UPS. May be present otherwise for example to record execution of patient setup imaging.

8 IHE RO Content Modules (type other than CDA or DICOM)

The structure for other types of "Content" sections has not yet been defined. Authors utilizing this section are encouraged to provide input to development of the template structure for this Technical Framework Volume 3 section at http://ihe.net/Templates_Public_Comments.

Appendices

None

Glossary

IHE Glossary terms are maintained via the *Standards Knowledge Management Tool* (SKMT).

SKMT contains IHE Glossary Terms from Final Text and Trial Implementation IHE profiles. Terms from Public Comment profiles are added once the profile is published for Trial Implementation.

The current published version of the IHE Glossary (Appendix D to the *IHE Technical Frameworks General Introduction*) contains IHE Glossary terms as of the publication date of the document. Always refer to the SKMT for the most up-to-date list of IHE Glossary terms.

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