RAYPLAN 2

DICOM Conformance Statement

2

1 OVERVIEW

This document specifies the DICOM interface for the treatment planning system RayPlan. RayPlan can import CT, MR and PET images, RT Structure Sets, RT Plans, RT Doses and Spatial Registration objects and can export all of the aforementioned plus DRR Images (RT Image) for setup and treatment beams.

RayPlan supports import either from disc or over the DICOM network protocol. The latter can be performed either via either Query/Retrieve (typically from PACS) or by accepting data pushed to RayPlan via a separate Storage SCP service. RayPlan can export either to disk or over the DICOM network protocol.

1.1 NETWORK SERVICES

SOP Class Name	SOP Class UID	Provider of Service (SCP)	User of Service (SCU)
Transfer			
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Yes	Yes
Spatial Registration (REG) Storage	1.2.840.10008.5.1.4.1.1.66.1	Yes	Yes
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Yes	Yes
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	No	Yes
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	Yes	Yes
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Yes	Yes
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Yes	Yes
Query/Retrieve			
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	No	Yes
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	No	Yes
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	No	Yes

2 TABLE OF CONTENTS

3 INTRODUCTION

3.1 REVISION HISTORY

Date	Version	Comment
2016-12-22	1.0	First version
2017-04-27	2.0	Revised for Service Pack 1

3.2 AUDIENCE

This document is written for users that need to understand how RayPlan will integrate into their healthcare facility. This includes both those responsible for overall imaging network policy and architecture, as well as integrators who need to have a detailed understanding of the DICOM features of the product. This document contains some basic DICOM definitions so that any reader may understand how this product implements DICOM features. However, integrators are expected to fully understand all the DICOM terminology, how the tables in this document relate to the product's functionality, and how that functionality integrates with other devices that support compatible DICOM features.

3.3 REMARKS

The scope of this DICOM Conformance Statement is to facilitate integration between RayPlan and other DICOM products. The Conformance Statement should be read and understood in conjunction with the DICOM Standard. DICOM by itself does not guarantee interoperability. The Conformance Statement does, however, facilitate a first-level comparison for interoperability between different applications supporting compatible DICOM functionality.

This Conformance Statement is not supposed to replace validation with other DICOM equipment to ensure proper exchange of intended information. In fact, the user should be aware of the following important issues:

- The comparison of different Conformance Statements is just the first step towards assessing interconnectivity and interoperability between the product and other DICOM conformant equipment.
- Test procedures should be defined and executed to validate the required level of interoperability with specific compatible DICOM equipment, as established by the healthcare facility.

3.3.1 Interoperability validation needed

When using RayPlan together with other software, the DICOM conformance statements must be compared and relevant validation tests run. The DICOM standard by itself does not guarantee interoperability. The Conformance Statement does, however, facilitate a first-level comparison for interoperability between different applications supporting compatible DICOM functionality. RaySearch is also active within the IHE-RO. Contact RaySearch for more info regarding adherence to IHE-RO profiles.

3.3.2 DICOM revision

The module tables listed in the last two chapters are based on part 3 of the DICOM-standard revision 2009. For extra clarity all attributes in the referenced modules have been listed, even the ones that are not used by RayPlan.

3.4 TERMS AND DEFINITIONS

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitons of these terms.

Abstract Syntax – the information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples : Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE) — an end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title — the externally known name of an Application Entity, used to identify a DICOM application to other DICOM applications on the network.

Application Context — the specification of the type of communication used between Application Entities. Example: DICOM network protocol.

Association — a network communication channel set up between Application Entities.

Attribute — a unit of information in an object definition; a data element identified by a tag. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Information Object Definition (IOD) — the specified set of Attributes that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The Attributes may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG) — a set of standardized image compression techniques, available for use by DICOM applications.

Module — a set of Attributes within an Information Object Definition that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation — first phase of Association establishment that allows Application Entities to agree on the types of data to be exchanged and how that data will be encoded.

Protocol Data Unit (PDU) — a packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Service Class Provider (SCP) — role of an Application Entity that provides a DICOM network service; typically, a server that performs operations requested by another Application Entity (Service Class User). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU) — role of an Application Entity that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)

Service/Object Pair (SOP) Class — the specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance — an information object; a specific occurrence of information exchanged in a SOP Class. Examples: a specific x-ray image.

Tag — a 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the "group" and the "element". If the "group" number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]

Transfer Syntax — the encoding used for exchange of DICOM information objects and messages. Examples: JPEG compressed (images), little endian explicit value representation.

Unique Identifier (UID) — a globally unique "dotted decimal" string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR) — the format type of an individual DICOM data element, such as text, an integer, a person's name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

3.5 BASICS OF DICOM COMMUNICATION

This section describes terminology used in this Conformance Statement for the non-specialist. This section is not a substitute for training about DICOM, and it makes many simplifications about the meanings of DICOM terms.

Two Application Entities (devices) that want to communicate with each other over a network using DICOM protocol must first agree on

several things during an intial network "handshake". One of the two devices must initiate an Association (a connection to the other device), and ask if specific services, information, and encoding can be supported by the other device (Negotiation).

DICOM specifes a number of network services and types of information objects, each of which is called an Abstract Syntax for the Negotiation. DICOM also specifes a variety of methods for encoding data, denoted Transfer Syntaxes. The Negotiation allows the initiating Application Entity to propose combinations of Abstract Syntax and Transfer Syntax to be used on the Association; these combinations are called Presentation Contexts. The receiving Application Entity accepts the Presentation Contexts it supports.

For each Presentation Context, the Association Negotiation also allows the devices to agree on Roles — which one is the Service Class User (SCU - client) and which is the Service Class Provider (SCP - server). Normally the device initiating the connection is the SCU, i.e., the client system calls the server, but not always.

The Association Negotiation finally enables exchange of maximum network packet (PDU) size, security information, and network service options (called Extended Negotiation information). The Application Entities, having negotiated the Association parameters, may now commence exchanging data. Common data exchanges include queries for worklists and lists of stored images, transfer of image objects and analyses (structured reports), and sending images to film printers. Each exchangeable unit of data is formatted by the sender in accordance with the appropriate Information Object Definition, and sent using the negotiated Transfer Syntax. There is a Default Transfer Syntax that all systems must accept, but it may not be the most efficient for some use cases. Each transfer is explicitly acknowledged by the receiver with a Response Status indicating success, failure, or that query or retrieve operations are still in process.

Two Application Entities may also communicate with each other by exchanging media (such as a CD-R). Since there is no Association Negotiation possible, they both use a Media Application Profile that specifies "pre-negotiated" exchange media format, Abstract Syntax, and Transfer Syntax.

3.6 ABBREVIATIONS

Name	Meaning
AE	Application Entity
CT	Computed Tomography
DICOM	Digital Imaging and Communications in Medicine
IHE / IHE-RO	Integrating the Healthcare Enterprise. IHE-RO deals with integrating Radiation Oncology.
IOD	Information Object Definition
JPEG	Joint Photographic Experts Group
MR	Magnetic Resonance Imaging
PACS	Picture Archiving and Communication System
PET	Positron Emission Tomography
PTS	Proton Planning System (used by IBA)
RT	Radiotherapy
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
TPS	Treatment Planning System

3.7 REFERENCES

- NEMA PS3 Digital Imaging and Communications in Medicine (DICOM) Standard, available free at http://medical.nema.org/

4 NETWORKING

RayPlan supports both file-based and network-based data transfer. The network communication involves datasets pushed to and from RayPlan via C-STORE commands and Query/Retrieve.

4.1 APPLICATION DATA FLOW

RayPlan is a treatment planning system, i.e. a software program for planning and analysis of radiation therapy plans. Typically, a treatment plan is created by importing patient images obtained from a CT scanner, importing and/or defining regions of interest (possibly with the help of MR and PET-images), deciding on a treatment setup and objectives, optimizing the treatment parameters, comparing rival plans to find the best compromise, computing the clinical dose distribution, approving the plan and finally exporting the data. The diagram below describes how RayPlan interacts with the DICOM world. RayPlan consists of two AE Titles, the client and the standalone Storage SCP service.
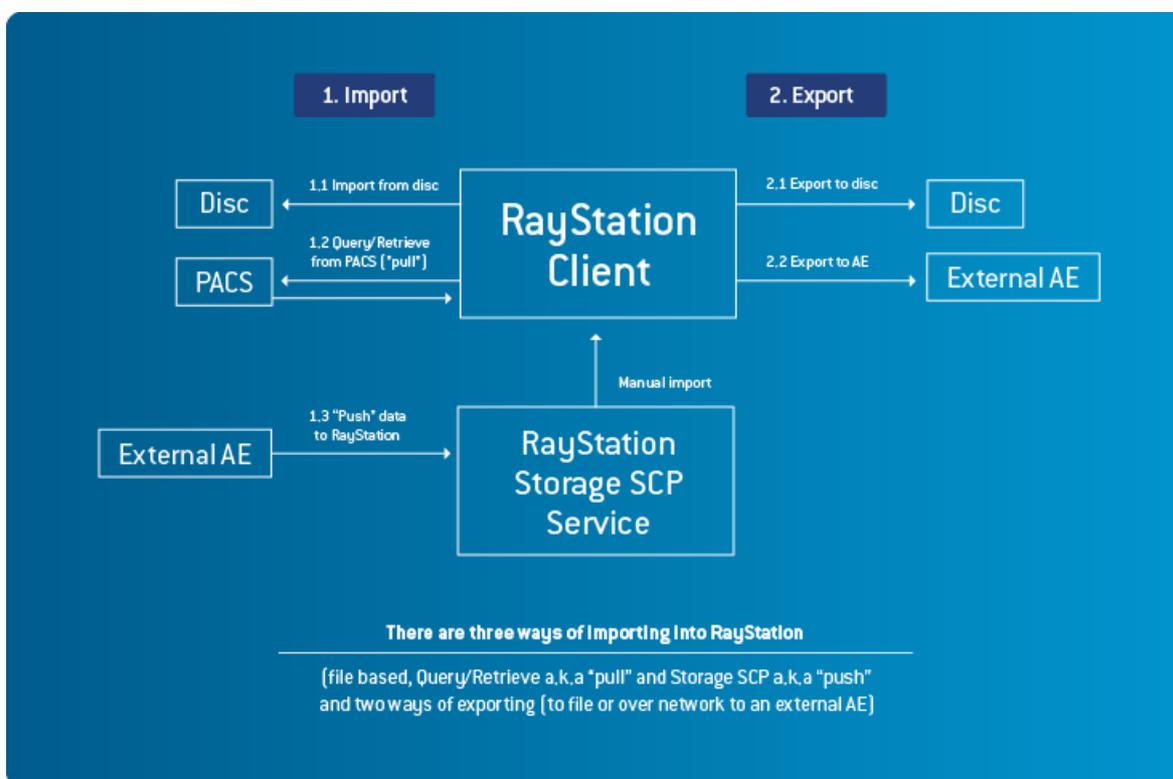
There are three ways of importing into RayPlan (file based, Query/Retrieve a.k.a "pull" and Storage SCP a.ka. "push") and two ways of exporting (to file or over network to an external AE)

4.1.1 Functional Definition of AEs

4.1.1.1 Functional Definition of "RayPlan Application Entity"

RayPlan can act both as an SCU and SCP. When RayPlan performs import using Query/Retrieve an internal Storage SCP temporarily is invoked automatically when quering the PACS. AE settings for RayPlan are done in the separate ClinicSettings application.

4.1.1.2 Functional Definition of "RayPlan Storage SCP Service"

For transfers when the RayPlan client is not running the RayPlan Storage SCP Service is provided. This is a standalone Storage SCP service accepting incoming DICOM transfers and saving the files to a network share. The user then manually imports the data to the RayPlan database using a version of the file-based import in the RayPlan client. Settings for RayPlan Storage SCP Service are located in an separate .xml-file. They can be entered automatically during installation.

4.1.2 Transfer syntax

All data exported from RayPlan, both via file and network, uses implicit VR. This is due to the inherit limits of DICOM, where explicit VR limits the length of attributes like ROI contour data in RT Structs and block data in RT Plans or RT Ion Plans.

4.2 IMPORTING DATA TO RAYPLAN

There are three ways to import DICOM datasets into RayPlan, File-based, Query/Retrieve and via RayPlan's Storage SCP Service. When importing to a currently open patient, datasets that are detected as already imported are greyed out in the GUI.

4.2.1 File based

RayPlan will search recursively through all folders for DICOM datasets in the specified path. The patient information is retrieved from the found datasets and a list of found patients is displayed for the user, regardless of folder structure. When the user selects a patient, RayPlan will list importable datasets (CT, MR, PET, RT Struct, RT Plan, RT Ion Plan, and RT Dose) that can be selected for import to the RayPlan patient database.

4.2.2 Query/Retrieve

When DICOM import using Query/Retrieve is selected, the user selects a pre-defined AE-title. RayPlan will then query the server for all patients available or a specific patients if the search criteria is provided, using the C-FIND service with a query on Patient level, root set to Patient and with Patient ID set to "*" (wildcard). Note that some PACS require the Patient ID-field to be blank, in which case try quering again with an empty Patient ID. The list of patients is presented to the user.

When the user expands a patient, first a new C-FIND is sent to the remote server, this time on Series level, root set to Study and with the specified patient as search criteria. Next C-FIND (for all image series) and C-MOVE (for all other modalities) requests are performed for each found series. These are recieved over a separate DICOM association, running in RayPlan on port 104. This is done to obtain more information about each series, helping the user to select what series to import into the RayPlan database. When the information has been obtained all series that supported are listed. The user can then select whole studies or individual series for import, but only from one patient at the time.

By clicking on the import button, the user initiates new C-MOVE requests on series level, with root set to Patient for each of the series selected.

4.2.3 Storage SCP

RayPlan provides a separate Storeage SCP service that can be run either locally or on a separate machine. This service is designed to listen to C-MOVE-requests and save incoming datasets to a "DICOM Inbox". Sending datasets to the Storage SCP does in other words not automatically store them in the RayPlan database. All incoming datasets are saved as files with implicit VR and separated into folders depending on Patient ID and transfer date. If the service is unable to save the incoming files (e.g. disc full), the network assocation is aborted. As the DICOM Inbox is only regarded as a temporary storage location, the service is setup to delete the folders in the DICOM Inbox after a defined number of days.

If the location of the DICOM Inbox has been setup in RayPlan a third import option, SCP, will appear in the GUI. This option shows the folders located in the DICOM Inbox and allows the user to choose from which folder to list the data sets that are available for import to the RayPlan database. The user also has the option of automatically deleting the files from the DICOM Inbox after succesful import.

4.3 EXPORTING DATA FROM RAYPLAN

RayPlan supports exporting data either to files or via C-STORE requests to a Storage SCP (e.g. a PACS). All images (CT, MR and PET) are always exported identically as imported to the RayPlan patient database. No tags are removed by RayPlan.

If RayPlan's import filters have modified the files, the modified version will be exported and not the original.

If certain patient data is changed after import, images will be modified to match the patient when exported. This is limited to the following patient data: Patient ID, Name, Gender and Date of birth.

RayPlan always generates new RT Structs, RT Ion Plans, and RT Plans, with new SOP Instance UID's, even if the data is originally imported to RayPlan. Each BeamSet in RayPlan is exported as one RT Plan or RT Ion Plan. Calculated dose distribution will be exported as RT Dose datasets.

DRR's will be exported as RT Images.

4.4 RAYPLAN DICOM UID'S

DICOM UID's generated by RayPlan follow the following pattern:
1.2.752.243.1.1.YYYY.MM.DDhh.mm.ss.ms.ii.rr

YYYY = Year
MM = Month
DD = Day
hh = Hour (24h)
mm = Minute
ss = Second
ms = Millisecond
ii = Sequence number
rr = 4 digit random number

For each modality generated by RayPlan, the Series Instance UID is the same as the SOP Instance UID, followed by a ".1". For example, if the RT Plan or RT Ion Plan SOP Instance UID is 1.2.826.0.1.3680043.8.176.2011.11.2911.22.33.44.1.1234567890, then the Series Instance UID will be 1.2.826.0.1.3680043.8.176.2011.11.2911.22.33.44.1.1234567890.1. For RT Dose of type Beam, the Series Instance UID is based on the SOP Instance UID for the first beam.

5 SUPPORT FOR CHARACTER SETS

RayPlan currently supports DICOM import and export of ISO_IR 100 (ISO 8859-1 / Latin 1) and ISO_IR 192 (Unicode in UTF-8). This is controlled via the RayPlan configuration file. RayPlan will replace characters that are not included in the specific character set with a question mark during export.

6 SECURITY PROFILES

Currently no security profiles are supported during network communication.

7 IMPORT IOD DEFINITIONS

7.1 CT IMAGE IOD

Images are imported without modification except in two cases. Import filters will modify the datasets and original data may be lost. If certain patient data is changed after import, images will be modified to match the patient when exported. This is limited to the following patient data: Patient ID, Name, Gender and Date of birth. Only used attributes are listed. Attributes not listed will not be used during import.

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	General Series Module	Yes
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	Yes
Image	General Image Module	No
	Image Plane Module	Yes
	Image Pixel Module	Yes
	CT Image Module	Yes
	SOP Common Module	Yes

7.1.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN	2	Used when importing a new patient.
Patient ID	(0010,0020)	LO	2	Used when importing a new patient. Unique identifier for patient in combination with Patient's Name.
Patient's Birth Date	(0010,0030)	DA	2	Used when importing a new patient.
Patient's Sex	(0010,0040)	CS	2	Used when importing a new patient. Defaults to 'O' if omitted. Supported values: • M - Male • F - Female • O - Other

7.1.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	Used when importing a new case.
Study Date	(0008,0020)	DA	2	

Study Time	(0008,0030)	TM	2	
Referring Physician's Name	(0008,0090)	PN	2	Used when importing a new case.
Study ID	(0020,0010)	SH	2	
Accession Number	(0008,0050)	SH	2	
Study Description	(0008,1030)	LO	3	

7.1.3 General Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Supported value: CT.
Series Instance UID	(0020,000E)	UI	1	
Series Number	(0020,0011)	IS	2	
Series Date	(0008,0021)	DA	3	
Series Time	(0008,0031)	TM	3	
Protocol Name	(0018,1030)	LO	3	Used to identify Imaging System during import.
Series Description	(0008,103E)	LO	3	Only used for display.
Patient Position	(0018,5100)	CS	2C	Supported values: HFS, HFP, FFS, FFP, HFDR, HFDL, FFDR, FFDL.

7.1.4 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	(0020,0052)	UI	1	Must be unique within the series.
Position Reference Indicator	(0020,1040)	LO	2	

7.1.5 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Station Name	(0008,1010)	SH	3	Used to identify the correct CT-to-Density table.
Pixel Padding Value	(0028,0120)	US_SS	1C	If pixel padding is present within the region used for dose computation, the resulting dose may be wrong.

7.1.6 Image Plane Module

Attribute name	Tag	Vr	Type	Comment
Pixel Spacing	(0028,0030)	DS	1	Cannot be greater than 5 mm.
Image Orientation (Patient)	(0020,0037)	DS	1	Image orientation must be transversal.
Image Position (Patient)	(0020,0032)	DS	1	Converted to internal image corner. Used to find slice direction, which must be constant througout the series and along the Z-axis.

7.1.7 Image Pixel Module

Attribute name	Tag	Vr	Type	Comment
Samples per Pixel	(0028,0002)	US	1	Supported value: 1.
Photometric Interpretation	(0028,0004)	CS	1	Supported value: MONOCHROME2.
Rows	(0028,0010)	US	1	
Columns	(0028,0011)	US	1	
Bits Allocated	(0028,0100)	US	1	Supported value: 16.
Bits Stored	(0028,0101)	US	1	
High Bit	(0028,0102)	US	1	
Pixel Representation	(0028,0103)	US	1	Supported values: 0, 1.
Pixel Data	(7FE0,0010)	OB_OW	1C	
Pixel Padding Range Limit	(0028,0121)	US_SS	1C	

7.1.8 CT Image Module

Attribute name	Tag	Vr	Type	Comment
Image Type	(0008,0008)	CS	1	
Samples per Pixel	(0028,0002)	US	1	Supported value: 1.
Photometric Interpretation	(0028,0004)	CS	1	Supported value: MONOCHROME2.
Bits Allocated	(0028,0100)	US	1	Supported value: 16.
Bits Stored	(0028,0101)	US	1	Must be greater than 0 and less than or equal to Bits Allocated. Supported values: 12, 13, 14, 15, 16.
High Bit	(0028,0102)	US	1	Must be equal to "Bits Stored - 1".
Rescale Intercept	(0028,1052)	DS	1	
Rescale Slope	(0028,1053)	DS	1	
Rescale Type	(0028,1054)	LO	1C	Supported value: HU.

7.1.9 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	Supported value: 1.2.840.10008.5.1.4.1.1.2.
SOP Instance UID	(0008,0018)	UI	1	Stored internally to be used if referenced from other dataset.
Specific Character Set	(0008,0005)	CS	1C	Supported values: ISO_IR 100, ISO_IR 192.
Instance Creation Date	(0008,0012)	DA	3	
Instance Creation Time	(0008,0013)	TM	3	

7.2 MR IMAGE IOD

Images are imported without modification except in two cases. Import filters will modify the datasets and original data may be lost. If certain patient data is changed after import, images will be modified to match the patient when exported. This is limited to the following patient data: Patient ID, Name, Gender and Date of birth. Only used attributes are listed. Attributes not listed will not be used during import.

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	General Series Module	Yes
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	Yes
Image	General Image Module	No
	Image Plane Module	Yes
	Image Pixel Module	Yes
	MR Image Module	Yes
	SOP Common Module	Yes

7.2.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN	2	Used when importing a new patient.
Patient ID	(0010,0020)	LO	2	Used when importing a new patient. Unique identifier for patient in combination with Patient's Name.
Patient's Birth Date	(0010,0030)	DA	2	Used when importing a new patient.
Patient's Sex	(0010,0040)	CS	2	Used when importing a new patient. Defaults to 'O' if omitted. Supported values: • M - Male • F - Female • O - Other

7.2.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	Used when importing a new case.
Study Date	(0008,0020)	DA	2	
Study Time	(0008,0030)	TM	2	
Referring Physician's Name	(0008,0090)	PN	2	Used when importing a new case.
Study ID	(0020,0010)	SH	2	
Accession Number	(0008,0050)	SH	2	

7.2.3 General Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Supported value: MR.
Series Instance UID	(0020,000E)	UI	1	
Series Number	(0020,0011)	IS	2	
Series Date	(0008,0021)	DA	3	
Series Time	(0008,0031)	TM	3	
Protocol Name	(0018,1030)	LO	3	Used to identify Imaging System during import.
Series Description	(0008,103E)	LO	3	Only used for display.
Patient Position	(0018,5100)	CS	2C	Supported values: HFS, HFP, FFS, FFP.

7.2.4 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	(0020,0052)	UI	1	Must be unique within the series.
Position Reference Indicator	(0020,1040)	LO	2	

7.2.5 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Pixel Padding Value	(0028,0120)	US_SS	1C	If pixel padding is present within the region used for dose computation, the resulting dose may be wrong.

7.2.6 Image Plane Module

Attribute name	Tag	Vr	Type	Comment
Pixel Spacing	(0028,0030)	DS	1	Cannot be greater than 5 mm.
Image Orientation (Patient)	(0020,0037)	DS	1	All image orientations are supported, as long as row and column directions are orthogonal.
Image Position (Patient)	(0020,0032)	DS	1	Converted to internal image corner. Used to find slice direction, which must be constant throughout the series.

7.2.7 Image Pixel Module

Attribute name	Tag	Vr	Type	Comment
Samples per Pixel	(0028,0002)	US	1	Supported value: 1.
Photometric Interpretation	(0028,0004)	CS	1	Supported value: MONOCHROME2.
Rows	(0028,0010)	US	1	
Columns	(0028,0011)	US	1	
Bits Allocated	(0028,0100)	US	1	Supported value: 16.
Bits Stored	(0028,0101)	US	1	Must be equal to or less than Bits Allocated.

High Bit	(0028,0102)	US	1	
Pixel Representation	(0028,0103)	US	1	Supported values: 0, 1.
Pixel Data	(7FE0,0010)	OB_OW	1C	
Pixel Padding Range Limit	(0028,0121)	US_SS	1C	

7.2.8 MR Image Module

Attribute name	Tag	Vr	Type	Comment
Image Type	(0008,0008)	CS	1	
Samples per Pixel	(0028,0002)	US	1	Supported value: 1.
Photometric Interpretation	(0028,0004)	CS	1	Supported value: MONOCHROME2.
Bits Allocated	(0028,0100)	US	1	Supported value: 16.
Scanning Sequence	(0018,0020)	CS	1	
Sequence Variant	(0018,0021)	CS	1	

7.2.9 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	Supported value: 1.2.840.10008.5.1.4.1.1.4.
SOP Instance UID	(0008,0018)	UI	1	Stored internally to be used if referenced from other dataset.
Specific Character Set	(0008,0005)	CS	1C	Supported values: ISO_IR 100, ISO_IR 192.
Instance Creation Date	(0008,0012)	DA	3	
Instance Creation Time	(0008,0013)	TM	3	

7.3 PET IMAGE IOD

Images are imported without modification except in two cases. Import filters will modify the datasets and original data may be lost. If certain patient data is changed after import, images will be modified to match the patient when exported. This is limited to the following patient data: Patient ID, Name, Gender and Date of birth. Only used attributes are listed. Attributes not listed will not be used during import.

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
	Patient Study Module	Yes
Series	General Series Module	Yes
	PET Series Module	Yes
	PET Isotope Module	Yes
	NM/PET Patient Orientation Module	Yes
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	Yes
Image	General Image Module	No
	Image Plane Module	Yes
	Image Pixel Module	Yes
	PET Image Module	Yes
	SOP Common Module	Yes

7.3.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN	2	Used when importing a new patient.
Patient ID	(0010,0020)	LO	2	Used when importing a new patient. Unique identifier for patient in combination with Patient's Name.
Patient's Birth Date	(0010,0030)	DA	2	Used when importing a new patient.
Patient's Sex	(0010,0040)	CS	2	Used when importing a new patient. Defaults to 'O' if omitted. Supported values: • M - Male • F - Female • O - Other

7.3.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	Used when importing a new case.
Study Date	(0008,0020)	DA	2	

Study Time	(0008,0030)	TM	2	
Referring Physician's Name	(0008,0090)	PN	2	Used when importing a new case.
Study ID	(0020,0010)	SH	2	
Accession Number	(0008,0050)	SH	2	

7.3.3 Patient Study Module

Attribute name	Tag	Vr	Type	Comment
Patient's Weight	(0010,1030)	DS	3	Used for SUV calculation.

7.3.4 General Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Supported value: PT.
Series Instance UID	(0020,000E)	UI	1	
Series Number	(0020,0011)	IS	2	
Series Date	(0008,0021)	DA	3	
Series Time	(0008,0031)	TM	3	
Protocol Name	(0018,1030)	LO	3	Used to identify the protocol during import.
Series Description	(0008,103E)	LO	3	Only used for display.
Patient Position	(0018,5100)	CS	2C	Supported values: HFS, HFP, FFS, FFP.

7.3.5 PET Series Module

Attribute name	Tag	Vr	Type	Comment
Series Date	(0008,0021)	DA	1	
Series Time	(0008,0031)	TM	1	
Units	(0054,1001)	CS	1	Supported values: CNTS, NONE, CM2, PCNT, CPS, BQML, MGMINML, UMOLMINML, MLMING, MLG, 1CM, UMOLML, PROPCNTS, PROPCPS, MLMINML, MLML, GML, STDDEV.
Counts Source	(0054,1002)	CS	1	
Series Type	(0054,1000)	CS	1	
Number of Slices	(0054,0081)	US	1	
Corrected Image	(0028,0051)	CS	2	Must contain DECY\ATTN in order to compute SUV.
Decay Correction	(0054,1102)	CS	1	Supported values: • NONE • START - Required to compute SUV • ADMIN

7.3.6 PET Isotope Module

Attribute name	Tag	Vr	Type	Comment
Radiopharmaceutical Information Sequence	(0054,0016)	SQ	2	
>Radiopharmaceutical Start Time	(0018,1072)	TM	3	
>Radionuclide Total Dose	(0018,1074)	DS	3	
>Radionuclide Half Life	(0018,1075)	DS	3	

7.3.7 NM/PET Patient Orientation Module

Attribute name	Tag	Vr	Type	Comment
Patient Orientation Code Sequence	(0054,0410)	SQ	2	
>Code Value	(0008,0100)	SH	1C	Supported value: • F-10450 - recumbent
>Coding Scheme Designator	(0008,0102)	SH	1C	Supported value: 99SDM.
>Code Meaning	(0008,0104)	LO	3	Supported value: recumbent.
>Patient Orientation Modifier Code Sequence	(0054,0412)	SQ	2C	
>Code Value	(0008,0100)	SH	1C	Supported values: • F-10340 - supine • F-10310 - prone
>Coding Scheme Designator	(0008,0102)	SH	1C	Supported value: 99SDM.
>Code Meaning	(0008,0104)	LO	3	Supported values: supine, prone.
Patient Gantry Relationship Code Sequence	(0054,0414)	SQ	2	
>Code Value	(0008,0100)	SH	1C	Supported values: • F-10470 - headfirst • F-10480 - feet-first • G-5190 - headfirst • G-5191 - feet-first
>Coding Scheme Designator	(0008,0102)	SH	1C	Supported value: 99SDM.
>Code Meaning	(0008,0104)	LO	3	Supported values: headfirst, feet-first.

7.3.8 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	(0020,0052)	UI	1	Must be unique within the series.
Position Reference Indicator	(0020,1040)	LO	2	

7.3.9 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Pixel Padding Value	(0028,0120)	US_SS	1C	If pixel padding is present within the region used for dose computation, the resulting dose may be wrong.

7.3.10 Image Plane Module

Attribute name	Tag	Vr	Type	Comment
Pixel Spacing	(0028,0030)	DS	1	Cannot be greater than 5 mm.
Image Orientation (Patient)	(0020,0037)	DS	1	Image orientation must be transversal.
Image Position (Patient)	(0020,0032)	DS	1	Converted to internal image corner. Used to find slice direction, which must be constant througout the series and along the Z-axis.

7.3.11 Image Pixel Module

Attribute name	Tag	Vr	Type	Comment
Samples per Pixel	(0028,0002)	US	1	Supported value: 1.
Photometric Interpretation	(0028,0004)	CS	1	Supported value: MONOCHROME2.
Rows	(0028,0010)	US	1	
Columns	(0028,0011)	US	1	
Bits Allocated	(0028,0100)	US	1	Supported value: 16.
Bits Stored	(0028,0101)	US	1	Must be equal to or less than Bits Allocated.
High Bit	(0028,0102)	US	1	
Pixel Representation	(0028,0103)	US	1	Supported values: 0, 1.
Pixel Data	(7FE0,0010)	OB_OW	1C	
Pixel Padding Range Limit	(0028,0121)	US_SS	1C	

7.3.12 PET Image Module

Attribute name	Tag	Vr	Type	Comment
Image Type	(0008,0008)	CS	1	
Samples per Pixel	(0028,0002)	US	1	Supported value: 1.
Photometric Interpretation	(0028,0004)	CS	1	Supported value: MONOCHROME2.
Bits Allocated	(0028,0100)	US	1	Supported value: 16.
Bits Stored	(0028,0101)	US	1	Must be greater than 0 and less than or equal to Bits Allocated.
High Bit	(0028,0102)	US	1	HighBit must be equal to Bits Stored - 1.
Rescale Intercept	(0028,1052)	DS	1	Supported value: 0.0.
Rescale Slope	(0028,1053)	DS	1	
Frame Reference Time	(0054,1300)	DS	1	
Image Index	(0054,1330)	US	1	

Acquisition Date	(0008,0022)	DA	2	
Acquisition Time	(0008,0032)	TM	2	
Actual Frame Duration	(0018,1242)	IS	2	
Decay Factor	(0054,1321)	DS	1C	
Philips Private Creator	(7053,0010)	LO	3	Philips PET Private Group
Philips SUV Scale Factor	(7053,1000)	DS	3	
Philips Activity Concentration Scale Factor	(7053,1009)	DS	3	
GE Private Creator	(0009,0010)	LO	3	GEMS_PETD_01
GE PET Scan Time	(0009,100D)	DT	3	

7.3.13 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	Supported value: 1.2.840.10008.5.1.4.1.1.128.
SOP Instance UID	(0008,0018)	UI	1	Stored internally to be used if referenced from other dataset.
Specific Character Set	(0008,0005)	CS	1C	Supported values: ISO_IR 100, ISO_IR 192.
Instance Creation Date	(0008,0012)	DA	3	
Instance Creation Time	(0008,0013)	TM	3	

7.4 RT STRUCTURE SET IOD

Imported RT Structure Sets are always converted into internal representations. Because of this exported structure sets may not be identical to the imported structure set. Only used attributes are listed. Attributes not listed will not be used during import.

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	RT Series Module	Yes
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	Yes
Structure Set	Structure Set Module	Yes
	ROI Contour Module	Yes
	RT ROI Observations Module	Yes
	Approval Module	Yes
	SOP Common Module	Yes

7.4.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN	2	Only used for matching patient.
Patient ID	(0010,0020)	LO	2	Only used for matching patient.
Patient's Birth Date	(0010,0030)	DA	2	Only used for matching patient.
Patient's Sex	(0010,0040)	CS	2	Only used for matching patient. Supported values: • M - Male • F - Female • O - Other

7.4.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	
Study Date	(0008,0020)	DA	2	
Study Time	(0008,0030)	TM	2	
Referring Physician's Name	(0008,0090)	PN	2	
Study ID	(0020,0010)	SH	2	
Accession Number	(0008,0050)	SH	2	

7.4.3 RT Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Supported value: RTSTRUCT.
Series Instance UID	(0020,000E)	UI	1	
Series Number	(0020,0011)	IS	2	
Series Description	(0008,103E)	LO	3	Only used for display.

7.4.4 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	(0020,0052)	UI	1	Must be the same as the referenced image set.
Position Reference Indicator	(0020,1040)	LO	2	

7.4.5 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Manufacturer	(0008,0070)	LO	2	Used to handle TomoTherapy HiArt and Nucletron's deviations from the DICOM standard for ROI Physical Properties.
Pixel Padding Value	(0028,0120)	US_SS	1C	

7.4.6 Structure Set Module

Attribute name	Tag	Vr	Type	Comment
Structure Set Label	(3006,0002)	SH	1	
Referenced Frame of Reference Sequence	(3006,0010)	SQ	3	May contain more than one item. At least one of the referenced Examinations must be found in the system. ROI's contoured on examinations that are not found will be skipped.
>Frame of Reference UID	(0020,0052)	UI	1	Must be the same as the referenced image set.
>RT Referenced Study Sequence	(3006,0012)	SQ	3	Must contain exactly one referenced study.
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	
>RT Referenced Series Sequence	(3006,0014)	SQ	1	Must contain exactly one referenced series.
>Series Instance UID	(0020,000E)	UI	1	
>Contour Image Sequence	(3006,0016)	SQ	1	
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	Referenced image has to be imported to patient (prior or at the same time as the RTSTRUCT dataset is imported).
Structure Set ROI Sequence	(3006,0020)	SQ	3	Number of elements must match number of elements in ROI Contour Sequence (3006,0039). At least one sequence must be defined.
>ROI Number	(3006,0022)	IS	1	

>Referenced Frame of Reference UID	(3006,0024)	UI	1	
>ROI Name	(3006,0026)	LO	2	ROI:s are shared internally between multiple structure sets. If a ROI with the same name is already contoured on the referenced examination these contours will be skipped.

7.4.7 ROI Contour Module

Attribute name	Tag	Vr	Type	Comment
ROI Contour Sequence	(3006,0039)	SQ	1	
>Referenced ROI Number	(3006,0084)	IS	1	
>ROI Display Color	(3006,002A)	IS	3	Used for visualization.
>Contour Sequence	(3006,0040)	SQ	3	Number of elements must match number of elements in Structure Set ROI Sequence (3006,0020). At least one sequence must be defined.
>Attached Contours	(3006,0049)	IS	3	Information about attached contours are not imported.
>Contour Image Sequence	(3006,0016)	SQ	3	
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	Must be found in the referenced Examination.
>Contour Geometric Type	(3006,0042)	CS	1	
>Number of Contour Points	(3006,0046)	IS	1	
>Contour Data	(3006,0050)	DS	1	Converted to internal contour representation. All contour vertices are required to be located in the same slice.

7.4.8 RT ROI Observations Module

Attribute name	Tag	Vr	Type	Comment
RT ROI Observations Sequence	(3006,0080)	SQ	1	
>Observation Number	(3006,0082)	IS	1	
>Referenced ROI Number	(3006,0084)	IS	1	
>ROI Observation Label	(3006,0085)	SH	3	If value is "Localization Poi" and ROI Interpreted Type is "MARKER", then the ROI is automatically converted to a localization point.

>RT ROI Interpreted Type	(3006,00A4)	CS	2	All types in the DICOM standard are supported and converted to internal equivalent. Furthermore if ROI Observation Label has value "Localization Poi" and ROI Interpreted Type is "MARKER", then the ROI is automatically converted to a localization point. Supported values: ACQ_ISOCENTER, AVOIDANCE, BOLUS, BRACHY_ACCESSORY, BRACHY_CHANNEL, BRACHY_CHNL_SHLD, BRACHY_SRC_APP, CAVITY, CONTRAST_AGENT, CONTROL, CTV, DOSE_REGION, EXTERNAL, FIXATION, GTV, INIT_LASER_ISO, INIT_MATCH_ISO, IRRAD_VOLUME, ISOCENTER, MARKER, ORGAN, PTV, REGISTRATION, SUPPORT, TREATED_VOLUME, NONE.
>Material ID	(300A,00E1)	SH	3	Imported as material name. Note that material names must be unique.
>ROI Physical Properties Sequence	(3006,00B0)	SQ	3	The values REL_MASS_DENSITY, REL_ELEC_DENSITY, EFFECTIVE_Z, EFF_Z_PER_A and ELEM_FRACTION are supported. However at least one of REL_MASS_DENSITY or REL_ELEC_DENSITY is needed to create a density override. If only one of these values exist, the physical properties of water is used (except that the mean excitation energy is set to zero) and the mass density is set primarily from REL_MASS_DENSITY and secondarily from REL_ELEC_DENSITY.
>ROI Physical Property	(3006,00B2)	CS	1	Relative mass and electron densities must be between 0.0 - 22.7. MEAN_EXCI_ENERGY depicts the Mean Excitation Energy for a given material. Supported values: REL_MASS_DENSITY, REL_ELEC_DENSITY, EFFECTIVE_Z, EFF_Z_PER_A, ELEM_FRACTION, MEAN_EXCI_ENERGY.
>ROI Elemental Composition Sequence	(3006,00B6)	SQ	1C	
>ROI Elemental Composition Atomic Number	(3006,00B7)	US	1	
>ROI Elemental Composition Atomic Mass Fraction	(3006,00B8)	FL	1	
>ROI Physical Property Value	(3006,00B4)	DS	1	
>RaySearch Private Creator	(4001,0010)	LO	3	RAYSEARCHLABS 2.0
>Tissue Name	(4001,1010)	ST	3	RaySearch Private Tag. Contains the tissue name given to this Region of Interest.
>RBE Cell Type Name	(4001,1014)	ST	3	RaySearch Private Tag. Contains the RBE Cell Type Name given to this Region of Interest.

7.4.9 Approval Module

Attribute name	Tag	Vr	Type	Comment

Approval Status	[300E,0002]	CS	1	The approval status will be set in the imported Structure Set. If the RTSTRUCT is APPROVED, the imported Structure Set will be read-only. Supported values: • APPROVED - No changes allowed to imported Structure Set. • UNAPPROVED - Changes allowed to imported Structure Set. • REJECTED - Same rules as for UNAPPROVED.
Review Date	[300E,0004]	DA	2C	
Review Time	[300E,0005]	TM	2C	
Reviewer Name	[300E,0008]	PN	2C	

7.4.10 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	[0008,0016]	UI	1	Supported value: 1.2.840.10008.5.1.4.1.1.481.3.
SOP Instance UID	[0008,0018]	UI	1	Stored internally to be used if referenced from other dataset.
Specific Character Set	[0008,0005]	CS	1C	Supported values: ISO_IR 100, ISO_IR 192.
Instance Creation Date	[0008,0012]	DA	3	
Instance Creation Time	[0008,0013]	TM	3	

7.5 RT PLAN IOD

Imported RT Plans are always converted into internal representations. Because of this exported plans may not be identical to the imported plan. Only used attributes are listed. Attributes not listed will not be used during import.

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	RT Series Module	Yes
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	Yes
Plan	RT General Plan Module	Yes
	RT Prescription Module	Yes
	RT Patient Setup Module	Yes
	RT Fraction Scheme Module	Yes
	RT Beams Module	Yes
	Approval Module	Yes
	SOP Common Module	Yes

7.5.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN	2	Only used for matching patient.
Patient ID	(0010,0020)	LO	2	Only used for matching patient.
Patient's Birth Date	(0010,0030)	DA	2	Only used for matching patient.
Patient's Sex	(0010,0040)	CS	2	Only used for matching patient. Supported values: • M - Male • F - Female • O - Other

7.5.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	
Study Date	(0008,0020)	DA	2	
Study Time	(0008,0030)	TM	2	
Referring Physician's Name	(0008,0090)	PN	2	
Study ID	(0020,0010)	SH	2	
Accession Number	(0008,0050)	SH	2	

7.5.3 RT Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Supported value: RTPLAN.
Series Instance UID	(0020,000E)	UI	1	
Series Number	(0020,0011)	IS	2	
Series Description	(0008,103E)	LO	3	Only used for display.

7.5.4 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	(0020,0052)	UI	1	Must be the same as the referenced RT Structure Set.
Position Reference Indicator	(0020,1040)	LO	2	

7.5.5 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Manufacturer	(0008,0070)	LO	2	Used to detect fluence maps that are sometimes stored as compensators in plans from Varian.
Manufacturer's Model Name	(0008,1090)	LO	3	
Pixel Padding Value	(0028,0120)	US_SS	1C	

7.5.6 RT General Plan Module

Attribute name	Tag	Vr	Type	Comment
RT Plan Label	(300A,0002)	SH	1	Imported as the Beam Set Name.
RT Plan Name	(300A,0003)	LO	3	Imported as the Treatment Plan Name.
Plan Intent	(300A,000A)	CS	3	
RT Plan Geometry	(300A,000C)	CS	1	Supported value: PATIENT.
Referenced Structure Set Sequence	(300C,0060)	SQ	1C	Is required to contain one and only one item.
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	Referenced Structure Set has to be imported to patient (prior or at the same time as the RT Plan dataset is imported).

7.5.7 RT Prescription Module

Attribute name	Tag	Vr	Type	Comment
Prescription Description	(300A,000E)	ST	3	
Dose Reference Sequence	(300A,0010)	SQ	3	Since only primary prescriptions are supported, this must have length 1.
>Dose Reference Number	(300A,0012)	IS	1	
>Dose Reference Structure Type	(300A,0014)	CS	1	Supported values: POINT, VOLUME.

>Dose Reference Description	(300A,0016)	LO	3	
>Referenced ROI Number	(3006,0084)	IS	1C	
>Nominal Prior Dose	(300A,001A)	DS	3	Supported value: 0.
>Dose Reference Type	(300A,0020)	CS	1	Supported values: TARGET, ORGAN_AT_RISK.
>Constraint Weight	(300A,0021)	DS	3	
>Target Minimum Dose	(300A,0025)	DS	3	
>Target Prescription Dose	(300A,0026)	DS	3	
>Target Maximum Dose	(300A,0027)	DS	3	
>Target Underdose Volume Fraction	(300A,0028)	DS	3	
>Organ at Risk Full-volume Dose	(300A,002A)	DS	3	
>Organ at Risk Limit Dose	(300A,002B)	DS	3	
>Organ at Risk Maximum Dose	(300A,002C)	DS	3	
>Organ at Risk Overdose Volume Fraction	(300A,002D)	DS	3	

7.5.8 RT Patient Setup Module

Attribute name	Tag	Vr	Type	Comment
Patient Setup Sequence	(300A,0180)	SQ	1	Must contain at least one entry.
>Patient Setup Number	(300A,0182)	IS	1	
>Patient Position	(0018,5100)	CS	1C	Must be compatible with the planning CT's patient position. i.e. cannot mix prone and supine. Supported values: HFS, HFP, FFS, FFP, HFDR, HFDL, FFDR, FFDL.
medPhoton Private Creator	(30BB,0010)	LO	3	medPhoton 1.0
medPhoton Patient Setup ID	(30BB,1000)	SH	3	
medPhoton Imaging Protocol ID	(30BB,1001)	SH	3	

7.5.9 RT Fraction Scheme Module

Attribute name	Tag	Vr	Type	Comment
Fraction Group Sequence	(300A,0070)	SQ	1	Multiple fraction groups are supported and are converted to separate Beam Sets in RayStation. Dose cannot be imported to a plan with multiple Beam Sets.
>Fraction Group Number	(300A,0071)	IS	1	Used to identify fraction groups.
>Number of Fractions Planned	(300A,0078)	IS	2	Used to create fraction schedule. If this value is 0 it is interpreted as a one-fraction plan.
>Number of Fraction Pattern Digits Per Day	(300A,0079)	IS	3	
>Repeat Fraction Cycle Length	(300A,007A)	IS	3	

Attribute name	Tag	Vr	Type	Comment
>Fraction Pattern	(300A,007B)	LT	3	
>Number of Beams	(300A,0080)	IS	1	
>Referenced Beam Sequence	(300C,0004)	SQ	1C	There must be at least one beam in the fraction group.
>Referenced Beam Number	(300C,0006)	IS	1C	
>Beam Meterset	(300A,0086)	DS	3	Must be defined in MU.
>Number of Brachy Application Setups	(300A,00A0)	IS	1	Supported value: 0.

7.5.10 RT Beams Module

Attribute name	Tag	Vr	Type	Comment
Beam Sequence	(300A,00B0)	SQ	1	
>Beam Number	(300A,00C0)	IS	1	
>Beam Name	(300A,00C2)	LO	3	
>Beam Description	(300A,00C3)	ST	3	
>Beam Type	(300A,00C4)	CS	1	Plans with Beam Type STATIC are converted to SMLC plans. Plans with Beam Type DYNAMIC which have Gantry Rotation Direction != NONE are converted to Arc plans. Otherwise the plans are considered to be DMLC plans. Supported values: STATIC, DYNAMIC.
>Radiation Type	(300A,00C6)	CS	2	Supported values: PHOTON, ELECTRON.
>Treatment Machine Name	(300A,00B2)	SH	2	Used to identify the correct treatment machine.
>Primary Dosimeter Unit	(300A,00B3)	CS	3	Supported values: MU, MINUTE.
>Source-Axis Distance	(300A,00B4)	DS	3	
>Beam Limiting Device Sequence	(300A,00B6)	SQ	1	
>RT Beam Limiting Device Type	(300A,00B8)	CS	1	Y or ASYMY is always required. Supported values: X, Y, ASYMX, ASYMY, MLCX, MLCY.
>Number of Leaf/Jaw Pairs	(300A,00BC)	IS	1	
>Leaf Position Boundaries	(300A,00BE)	DS	2C	
>Referenced Patient Setup Number	(300C,006A)	IS	3	If this attribute is not set, the patient setup sequence must contain one patient setup. If multiple patient setups are defined in the patient setup sequence, this attribute must be set. All referenced patient setups must use the same patient position.
>Treatment Delivery Type	(300A,00CE)	CS	3	If the Treatment Delivery type is null, beam is assumed to be of type TREATMENT. Supported values: TREATMENT, SETUP.
>Number of Wedges	(300A,00D0)	IS	1	
>Wedge Sequence	(300A,00D1)	SQ	1C	
>Wedge Number	(300A,00D2)	IS	1	
>Wedge Type	(300A,00D3)	CS	2	Supported values: STANDARD, DYNAMIC, MOTORIZED.

>Wedge ID	(300A,00D4)	SH	3	
>Wedge Angle	(300A,00D5)	IS	2	
>Wedge Factor	(300A,00D6)	DS	2	
>Wedge Orientation	(300A,00D8)	DS	2	Supported values: 0.0, 90.0, 180.0, 270.0.
>Source to Wedge Tray Distance	(300A,00DA)	DS	3	
>Number of Compensators	(300A,00E0)	IS	1	
>Compensator Sequence	(300A,00E3)	SQ	1C	
>Compensator Description	(300A,02EB)	LT	3	
>Compensator Number	(300A,00E4)	IS	1C	
>Compensator Type	(300A,00EE)	CS	3	
>Material ID	(300A,00E1)	SH	2C	
>Compensator ID	(300A,00E5)	SH	3	
>Source to Compensator Tray Distance	(300A,00E6)	DS	2	
>Compensator Divergence	(300A,02E0)	CS	3	Supported values: ABSENT, PRESENT.
>Compensator Mounting Position	(300A,02E1)	CS	3	Supported values: PATIENT_SIDE, SOURCE_SIDE, DOUBLE_SIDED.
>Compensator Rows	(300A,00E7)	IS	1	
>Compensator Columns	(300A,00E8)	IS	1	
>Compensator Pixel Spacing	(300A,00E9)	DS	1	
>Compensator Position	(300A,00EA)	DS	1	
>Compensator Transmission Data	(300A,00EB)	DS	1C	
>Compensator Thickness Data	(300A,00EC)	DS	1C	
>Number of Boli	(300A,00ED)	IS	1	
>Referenced Bolus Sequence	(300C,00B0)	SQ	1C	
>Referenced ROI Number	(3006,0084)	IS	1	
>Bolus ID	(300A,00DC)	SH	3	
>Number of Blocks	(300A,00F0)	IS	1	
>Total Block Tray Factor	(300A,00F2)	DS	3	Must be 0.9 - 1.0.
>Block Sequence	(300A,00F4)	SQ	1C	Compensators are not yet supported. If Manufacturer (0008,0070) in General Equipment Module equals 'Varian Medical Systems' or 'VARIAN Medical Systems' and Compensator Type (300A,00EE) equals 'OPTIMAL', 'TOTAL ACTUAL' or 'TOTAL_ACTUAL', this compensator will be ignored by the DICOM import.
>Block Tray ID	(300A,00F5)	SH	3	
>Source to Block Tray Distance	(300A,00F6)	DS	2	
>Block Type	(300A,00F8)	CS	1	Supported values: SHIELDING, APERTURE.

>Block Divergence	(300A,00FA)	CS	2	Supported values: PRESENT, ABSENT.
>Block Mounting Position	(300A,00FB)	CS	3	Supported values: PATIENT_SIDE, SOURCE_SIDE.
>Block Number	(300A,00FC)	IS	1	
>Block Name	(300A,00FE)	LO	3	
>Material ID	(300A,00E1)	SH	2	Must be null.
>Block Thickness	(300A,0100)	DS	2C	Must be null.
>Block Transmission	(300A,0102)	DS	2C	Must be between 0.0 - 0.2.
>Block Number of Points	(300A,0104)	IS	2	
>Block Data	(300A,0106)	DS	2	
>Applicator Sequence	(300A,0107)	SQ	3	Interpreted as Electron applicator or Photon cone depending on Radiation Type.
>Applicator ID	(300A,0108)	SH	1	
>Applicator Type	(300A,0109)	CS	1	Supported values: ELECTRON_SQUARE, ELECTRON_RECT, ELECTRON_CIRC, ELECTRON_SHORT, ELECTRON_OPEN, PHOTON_CIRC, STEREOTACTIC.
>Applicator Geometry Sequence	(300A,0431)	SQ	3	Only used for photon cones, not electron applicators.
>Applicator Aperture Shape	(300A,0432)	CS	1	Supported value: SYM_CIRCULAR.
>Applicator Opening	(300A,0433)	FL	1C	
>Applicator Description	(300A,010A)	LO	3	
>Final Cumulative Meterset Weight	(300A,010E)	DS	1C	
>Number of Control Points	(300A,0110)	IS	1	Must be greater than or equal to 2. Must be exactly 2 if Radiation Type (300A, 00C6) is ELECTRON.
>Control Point Sequence	(300A,0111)	SQ	1	
>Control Point Index	(300A,0112)	IS	1	
>Cumulative Meterset Weight	(300A,0134)	DS	2	
>Nominal Beam Energy	(300A,0114)	DS	3	Required for the first control point. Is assumed to be constant throughout beam. Nominal Beam Energy will be mapped against nominal energy of a RayStation machine beam quality when assigning imported beams to a machine. The nominal energy can differ from the energy used internally for dose calculation.
>Dose Rate Set	(300A,0115)	DS	3	
>Wedge Positions Sequence	(300A,0116)	SQ	3	
>Referenced Wedge Number	(300C,00C0)	IS	1	
>Wedge Position	(300A,0118)	CS	1	Supported values: IN, OUT.
>Beam Limiting Device Position Sequence	(300A,011A)	SQ	1C	Leaf/jaw positions are required to be constant within a control point pair for an SMLC plan.
>RT Beam Limiting Device Type	(300A,00B8)	CS	1	Supported values: X, Y, ASYMX, ASYMY, MLCX, MLCY.
>Leaf/Jaw Positions	(300A,011C)	DS	1	

>Gantry Angle	(300A,011E)	DS	1C	Required for the first control point and required to not change for SMLC and DMLC. See Beam Type (300A,00C4) for more information.
>Gantry Rotation Direction	(300A,011F)	CS	1C	Required for the first control point and required to not be "NONE" for SMLC and DMLC. See Beam Type (300A,00C4) for more information. Supported values: NONE, CW, CC.
>Gantry Pitch Angle	(300A,014A)	FL	3	Must be null or 0.
>Gantry Pitch Rotation Direction	(300A,014C)	CS	3	Supported values: NONE, CW, CC.
>Beam Limiting Device Angle	(300A,0120)	DS	1C	Required for the first control point, must be empty for subsequent control points or have the same value as in the first control point.
>Beam Limiting Device Rotation Direction	(300A,0121)	CS	1C	Required for the first control point. Supported values: NONE, CW, CC.
>Patient Support Angle	(300A,0122)	DS	1C	Required for the first control point, must be empty for subsequent control points or have the same value as in the first control point.
>Patient Support Rotation Direction	(300A,0123)	CS	1C	Required for the first control point. Supported values: NONE, CW, CC.
>Table Top Eccentric Axis Distance	(300A,0124)	DS	3	
>Table Top Eccentric Angle	(300A,0125)	DS	1C	Required for the first control point. Supported value: 0.0.
>Table Top Eccentric Rotation Direction	(300A,0126)	CS	1C	Required for the first control point. Supported values: NONE, CW, CC.
>Table Top Pitch Angle	(300A,0140)	FL	1C	Supported value: 0.0.
>Table Top Pitch Rotation Direction	(300A,0142)	CS	1C	Supported values: NONE, CW, CC.
>Table Top Roll Angle	(300A,0144)	FL	1C	Supported value: 0.0.
>Table Top Roll Rotation Direction	(300A,0146)	CS	1C	Supported values: NONE, CW, CC.
>Table Top Vertical Position	(300A,0128)	DS	2C	
>Table Top Longitudinal Position	(300A,0129)	DS	2C	
>Table Top Lateral Position	(300A,012A)	DS	2C	
>Isocenter Position	(300A,012C)	DS	2C	Required for the first control point. Must be constant throughout beam.
>TomoTherapy HA Private Creator	(300D,0010)	LO	3	TOMO_HA_01
>Tomo Projection Sinogram Data	(300D,10A7)	DS	3	Projection sinogram values for all 64 leaves of projection starting at the current control point. Empty if all 64 leaves have a sinogram value of zero. Empty for last control point.
>RaySearch Private Creator	(4001,0010)	LO	3	RAYSEARCHLABS 2.0
>Treatment Machine Commission Time	(4001,1001)	DT	3	The commission time of the treatment machine. Used together with Treatment Machine Name to determine the correct machine.
>Tomo IDMS Beam ID	(4001,1021)	LO	3	
>Tomo IDMS Machine ID	(4001,1020)	LO	3	

>Tomo Beam Isocenter	(4001,1023)	DS	3	
>Tomo machine revision	(4001,1025)	IS	3	
>Tomo beam revision	(4001,1026)	IS	3	
>Tomo intended back jaw position	(4001,1027)	DS	3	
>Tomo intended front jaw position	(4001,1028)	DS	3	

7.5.11 Approval Module

Attribute name	Tag	Vr	Type	Comment
Approval Status	(300E,0002)	CS	1	The approval status will be set in the created treatment plan. If the plan is APPROVED, the imported treatment plan will be read-only. Supported values: • APPROVED - No changes allowed to imported treatment plan. If the plan is approved, the Structure Set for the referenced image series will be approved too. • UNAPPROVED - Changes allowed to imported treatment plan. • REJECTED - Same rules as for UNAPPROVED.
Review Date	(300E,0004)	DA	2C	
Review Time	(300E,0005)	TM	2C	
Reviewer Name	(300E,0008)	PN	2C	

7.5.12 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	Supported value: 1.2.840.10008.5.1.4.1.1.481.5.
SOP Instance UID	(0008,0018)	UI	1	Stored internally to be used if referenced from other dataset.
Specific Character Set	(0008,0005)	CS	1C	Supported values: ISO_IR 100, ISO_IR 192.
Instance Creation Date	(0008,0012)	DA	3	
Instance Creation Time	(0008,0013)	TM	3	

7.6 RT DOSE IOD

Imported RT Doses are always converted into internal representations. It is not possible to export an imported dose. A plan's dose must be recomputed in order to be exported. Only used attributes are listed. Attributes not listed will not be used during import.

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	RT Series Module	Yes
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	Yes
Dose	General Image Module	No
	Image Plane Module	Yes
	Multi-Frame Module	Yes
	Image Pixel Module	Yes
	RT Dose Module	Yes
	Structure Set Module	No
	ROI Contour Module	No
	SOP Common Module	Yes

7.6.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN	2	Only used for matching patient.
Patient ID	(0010,0020)	LO	2	Only used for matching patient.
Patient's Birth Date	(0010,0030)	DA	2	Only used for matching patient.
Patient's Sex	(0010,0040)	CS	2	Only used for matching patient. Supported values: - M - Male - F - Female - O - Other

7.6.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	
Study Date	(0008,0020)	DA	2	
Study Time	(0008,0030)	TM	2	
Referring Physician's Name	(0008,0090)	PN	2	
Study ID	(0020,0010)	SH	2	

Accession Number	(0008,0050)	SH	2	

7.6.3 RT Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Supported value: RTDOSE.
Series Instance UID	(0020,000E)	UI	1	
Series Number	(0020,0011)	IS	2	
Series Description	(0008,103E)	LO	3	Only used for display.

7.6.4 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	(0020,0052)	UI	1	Must be the same as the referenced RT Plan.
Position Reference Indicator	(0020,1040)	LO	2	

7.6.5 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Pixel Padding Value	(0028,0120)	US_SS	1C	If pixel padding is present within the region used for dose computation, the resulting dose may be wrong.

7.6.6 Image Plane Module

Attribute name	Tag	Vr	Type	Comment
Pixel Spacing	(0028,0030)	DS	1	
Image Orientation (Patient)	(0020,0037)	DS	1	All non-oblique image orientations are supported (i.e. row and column directions must be along an axis) .
Image Position (Patient)	(0020,0032)	DS	1	Note that this is the center of the first pixel, i.e. the corner of the image offset by half a pixel.

7.6.7 Multi-Frame Module

Attribute name	Tag	Vr	Type	Comment
Number of Frames	(0028,0008)	IS	1	
Frame Increment Pointer	(0028,0009)	AT	1	

7.6.8 Image Pixel Module

Attribute name	Tag	Vr	Type	Comment
Samples per Pixel	(0028,0002)	US	1	Supported value: 1.
Photometric Interpretation	(0028,0004)	CS	1	Supported value: MONOCHROME2.
Rows	(0028,0010)	US	1	

Columns	(0028,0011)	US	1	
Bits Allocated	(0028,0100)	US	1	Supported values: 16, 32.
Bits Stored	(0028,0101)	US	1	Must be equal to Bits Allocated.
High Bit	(0028,0102)	US	1	HighBit must be BitsStored-1.
Pixel Representation	(0028,0103)	US	1	Supported value: 0.
Pixel Data	(7FE0,0010)	OB_OW	1C	
Pixel Padding Range Limit	(0028,0121)	US_SS	1C	

7.6.9 RT Dose Module

Attribute name	Tag	Vr	Type	Comment
Samples per Pixel	(0028,0002)	US	1C	Supported value: 1.
Photometric Interpretation	(0028,0004)	CS	1C	Supported value: MONOCHROME2.
Bits Allocated	(0028,0100)	US	1C	Supported values: 16, 32.
Bits Stored	(0028,0101)	US	1C	Bits Stored must be equal to Bits Allocated.
High Bit	(0028,0102)	US	1C	High Bit must be Bits Stored - 1.
Pixel Representation	(0028,0103)	US	1C	Supported value: 0.
Dose Units	(3004,0002)	CS	1	Supported value: GY.
Dose Type	(3004,0004)	CS	1	Supported values: PHYSICAL, EFFECTIVE.
Dose Summation Type	(3004,000A)	CS	1	Note: Summation type BEAM is interpreted as the dose contribution from this beam over the entire treatment course, not per fraction. Supported values: • PLAN • BEAM • FRACTION • TOTALHOMO - Interpreted as PLAN • TOTALHETERO - Interpreted as PLAN
Referenced RT Plan Sequence	(300C,0002)	SQ	1C	Is required to contain only one item. For doses with summation type BEAM the referenced plan must be found and all beam doses must be imported together. For doses with summation type PLAN a dummy plan will be created if the referenced plan couldn't be found but an examination with a matching Frame of Reference UID is found.
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	Plan UID, used to establish references.
>Referenced Fraction Group Sequence	(300C,0020)	SQ	1C	
>Referenced Fraction Group Number	(300C,0022)	IS	1	Identifies fraction group within plan
>Referenced Beam Sequence	(300C,0004)	SQ	1C	
>Referenced Beam Number	(300C,0006)	IS	1	Identify a beam within a plan

Grid Frame Offset Vector	(3004,000C)	DS	1C	If the first element of the Grid Frame Offset Vector is zero, the vector should be interpreted as relative positive offsets in the direction of the cross product of the row and column directions. This means that if Image Orientation (Patient) (0020,0037) is for example (1,0,0,0,-1,0), the cross product will be negative and hence the elements in the Grid Frame Offset Vector should be read/written with opposite sign. It should be noted that some manufacturers are non-compliant regarding this and do not change the sign of the elements in the Grid Frame Offset Vector. If RTDose files exported from such a system are imported into RayStation, the dose grid will not be positioned correctly around the patient.
Dose Grid Scaling	(3004,000E)	DS	1C	
Tissue Heterogeneity Correction	(3004,0014)	CS	3	Supported values: WATER, IMAGE, ROI_OVERRIDE.

7.6.10 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	Supported value: 1.2.840.10008.5.1.4.1.1.481.2.
SOP Instance UID	(0008,0018)	UI	1	Stored internally to be used if referenced from other dataset.
Specific Character Set	(0008,0005)	CS	1C	Supported values: ISO_IR 100, ISO_IR 192.
Instance Creation Date	(0008,0012)	DA	3	
Instance Creation Time	(0008,0013)	TM	3	

7.7 SPATIAL REGISTRATION IOD

Imported Spatial Registrations are always converted into internal representations. Because of this exported registations may not be identical to the imported registration. Only used attributes are listed. Attributes not listed will not be used during import.

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	General Series Module	Yes
	Spatial Registration Series Module	Yes
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	Yes
Spatial Registration	Spatial Registration Module	Yes
	SOP Common Module	Yes
	Common Instance Reference Module	Yes

7.7.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN	2	Only used for matching patient.
Patient ID	(0010,0020)	LO	2	Only used for matching patient.
Patient's Birth Date	(0010,0030)	DA	2	Only used for matching patient.
Patient's Sex	(0010,0040)	CS	2	Only used for matching patient. Supported values: • M - Male • F - Female • O - Other

7.7.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	
Study Date	(0008,0020)	DA	2	
Study Time	(0008,0030)	TM	2	
Referring Physician's Name	(0008,0090)	PN	2	
Study ID	(0020,0010)	SH	2	
Accession Number	(0008,0050)	SH	2	

7.7.3 General Series Module

Attribute name	Tag	Vr	Type	Comment

Modality	(0008,0060)	CS	1	Supported value: REG.
Series Instance UID	(0020,000E)	UI	1	
Series Number	(0020,0011)	IS	2	
Series Date	(0008,0021)	DA	3	
Series Time	(0008,0031)	TM	3	
Protocol Name	(0018,1030)	LO	3	
Series Description	(0008,103E)	LO	3	
Patient Position	(0018,5100)	CS	2C	

7.7.4 Spatial Registration Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Supported value: REG.

7.7.5 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	(0020,0052)	UI	1	Must be the same as the referenced image set.
Position Reference Indicator	(0020,1040)	LO	2	

7.7.6 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Pixel Padding Value	(0028,0120)	US_SS	1C	If pixel padding is present within the region used for dose computation, the resulting dose may be wrong.

7.7.7 Spatial Registration Module

Attribute name	Tag	Vr	Type	Comment
Content Date	(0008,0023)	DA	1	
Content Time	(0008,0033)	TM	1	
Instance Number	(0020,0013)	IS	1	
Content Label	(0070,0080)	CS	1	
Content Description	(0070,0081)	LO	2	
Content Creator's Name	(0070,0084)	PN	2	
Registration Sequence	(0070,0308)	SQ	1	
>Frame of Reference UID	(0020,0052)	UI	1C	
>Referenced Image Sequence	(0008,1140)	SQ	1C	
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	

>Matrix Registration Sequence	(0070,0309)	SQ	1	
>Registration Type Code Sequence	(0070,030D)	SQ	2	
>Matrix Sequence	(0070,030A)	SQ	1	
>Frame of Reference Transformation Matrix	(3006,00C6)	DS	1	
>Frame of Reference Transformation Matrix Type	(0070,030C)	CS	1	Supported value: RIGID.

7.7.8 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	Supported value: 1.2.840.10008.5.1.4.1.1.66.1.
SOP Instance UID	(0008,0018)	UI	1	Stored internally to be used if referenced from other dataset.
Specific Character Set	(0008,0005)	CS	1C	Supported values: ISO_IR 100, ISO_IR 192.
Instance Creation Date	(0008,0012)	DA	3	
Instance Creation Time	(0008,0013)	TM	3	

7.7.9 Common Instance Reference Module

Attribute name	Tag	Vr	Type	Comment
Referenced Series Sequence	(0008,1115)	SQ	1	
>Series Instance UID	(0020,000E)	UI	1	
>Referenced Instance Sequence	(0008,114A)	SQ	1	
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	
Studies Containing Other Referenced Instances Sequence	(0008,1200)	SQ	1C	If referenced images are located in a Study different from the REG object.
>Study Instance UID	(0020,000D)	UI	1	
>Referenced Series Sequence	(0008,1115)	SQ	1	
>Series Instance UID	(0020,000E)	UI	1	
>Referenced Instance Sequence	(0008,114A)	SQ	1	
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	

8 EXPORT IOD DEFINITIONS

8.1 CT IMAGE IOD

If certain patient data is changed after import, images will be modified to match the patient when exported. This is limited to the following patient data: Patient ID, Name, Gender and Date of birth. The following applies to 4DCT projections created inside RayStation.

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	General Series Module	Yes
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	Yes
Image	General Image Module	No
	Image Plane Module	Yes
	Image Pixel Module	Yes
	CT Image Module	Yes
	SOP Common Module	Yes

8.1.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN	2	
Patient ID	(0010,0020)	LO	2	
Patient's Birth Date	(0010,0030)	DA	2	
Patient's Sex	(0010,0040)	CS	2	Possible values: ● M - Male ● F - Female ● O - Other
Other Patient IDs	(0010,1000)	LO	3	Populated with the original Patient ID if different from patient.
Other Patient Names	(0010,1001)	PN	3	Populated with the original Patient's Name if different from patient.

8.1.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	Generated by RaySearch.
Study Date	(0008,0020)	DA	2	Date when 4DCT projection was created.

Study Time	(0008,0030)	TM	2	Time when 4DCT projection was created.
Accession Number	(0008,0050)	SH	2	
Study Description	(0008,1030)	LO	3	Always: "4DCT Projection".

8.1.3 General Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Always CT.
Series Instance UID	(0020,000E)	UI	1	Created by RaySearch.
Series Number	(0020,0011)	IS	2	
Series Date	(0008,0021)	DA	3	
Series Time	(0008,0031)	TM	3	
Series Description	(0008,103E)	LO	3	Always: "Projection method: [projection method used]".
Patient Position	(0018,5100)	CS	2C	

8.1.4 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	(0020,0052)	UI	1	Same as in image stacks used for projection.

8.1.5 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Manufacturer	(0008,0070)	LO	2	Always RaySearch Laboratories.
Manufacturer's Model Name	(0008,1090)	LO	3	Always RayStation.
Software Versions	(0018,1020)	LO	3	Always written as the current software version of RayStation.

8.1.6 Image Plane Module

Attribute name	Tag	Vr	Type	Comment
Pixel Spacing	(0028,0030)	DS	1	
Image Orientation (Patient)	(0020,0037)	DS	1	
Image Position (Patient)	(0020,0032)	DS	1	Note that this is the center of the first pixel, i.e. the corner of the image offset by half a pixel.

8.1.7 Image Pixel Module

Attribute name	Tag	Vr	Type	Comment
Samples per Pixel	(0028,0002)	US	1	Always 1.
Photometric Interpretation	(0028,0004)	CS	1	Always MONOCHROME2.

Rows	(0028,0010)	US	1	
Columns	(0028,0011)	US	1	
Bits Allocated	(0028,0100)	US	1	Always 16.
Bits Stored	(0028,0101)	US	1	Always 16.
High Bit	(0028,0102)	US	1	Always 15.
Pixel Representation	(0028,0103)	US	1	Always 1.
Pixel Data	(7FE0,0010)	OB_OW	1C	
Pixel Padding Range Limit	(0028,0121)	US_SS	1C	

8.1.8 CT Image Module

Attribute name	Tag	Vr	Type	Comment
Image Type	(0008,0008)	CS	1	
Samples per Pixel	(0028,0002)	US	1	Always 1.
Photometric Interpretation	(0028,0004)	CS	1	Always MONOCHROME2.
Bits Allocated	(0028,0100)	US	1	Always 16.
Bits Stored	(0028,0101)	US	1	Always 16.
High Bit	(0028,0102)	US	1	Always 16.
Rescale Intercept	(0028,1052)	DS	1	Always 0.0.
Rescale Slope	(0028,1053)	DS	1	Always 1.0.
Rescale Type	(0028,1054)	LO	1C	Always HU.

8.1.9 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	Always 1.2.840.10008.5.1.4.1.1.2.
SOP Instance UID	(0008,0018)	UI	1	Generated from the RaySearch UID-series, see introduction for more details.
Specific Character Set	(0008,0005)	CS	1C	Possible values: ISO_IR 100, ISO_IR 192.
Instance Creation Date	(0008,0012)	DA	3	
Instance Creation Time	(0008,0013)	TM	3	

8.2 MR IMAGE IOD

If certain patient data is changed after import, images will be modified to match the patient when exported. This is limited to the following patient data: Patient ID, Name, Gender and Date of birth.

8.3 PET IMAGE IOD

If certain patient data is changed after import, images will be modified to match the patient when exported. This is limited to the following patient data: Patient ID, Name, Gender and Date of birth.

8.4 RT STRUCTURE SET IOD

Only written attributes are listed.

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	RT Series Module	Yes
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	Yes
Structure Set	Structure Set Module	Yes
	ROI Contour Module	Yes
	RT ROI Observations Module	Yes
	Approval Module	Yes
	SOP Common Module	Yes

8.4.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN	2	
Patient ID	(0010,0020)	LO	2	
Patient's Birth Date	(0010,0030)	DA	2	
Patient's Sex	(0010,0040)	CS	2	Possible values: • M - Male • F - Female • O - Other

8.4.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	Exported identical as specified in the referenced image series.
Study Date	(0008,0020)	DA	2	Exported identical as specified in the referenced image series.
Study Time	(0008,0030)	TM	2	Exported identical as specified in the referenced image series.
Referring Physician's Name	(0008,0090)	PN	2	
Study ID	(0020,0010)	SH	2	Exported identical as specified in the referenced image series.
Accession Number	(0008,0050)	SH	2	
Study Description	(0008,1030)	LO	3	

8.4.3 RT Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Always RTSTRUCT.
Series Instance UID	(0020,000E)	UI	1	Generated from the RaySearch UID-series, see introduction for more details.
Series Number	(0020,0011)	IS	2	
Operators' Name	(0008,1070)	PN	2	

8.4.4 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	(0020,0052)	UI	1	
Position Reference Indicator	(0020,1040)	LO	2	

8.4.5 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Manufacturer	(0008,0070)	LO	2	Always RaySearch Laboratories.
Manufacturer's Model Name	(0008,1090)	LO	3	Always RayStation.
Software Versions	(0018,1020)	LO	3	Always written as the current software version of RayStation.

8.4.6 Structure Set Module

Attribute name	Tag	Vr	Type	Comment
Structure Set Label	(3006,0002)	SH	1	Always 'RS: [approval status of the ROIs]'.
Structure Set Date	(3006,0008)	DA	2	The date of last modification to the structure set.
Structure Set Time	(3006,0009)	TM	2	The time of last modification to the structure set.
Referenced Frame of Reference Sequence	(3006,0010)	SQ	3	
>Frame of Reference UID	(0020,0052)	UI	1	Always same as the image series frame of reference for which the structure set is created.
>RT Referenced Study Sequence	(3006,0012)	SQ	3	Always contains one referenced study.
>Referenced SOP Class UID	(0008,1150)	UI	1	RT Detached Study Storage UID.
>Referenced SOP Instance UID	(0008,1155)	UI	1	Study UID from the image series for which the structure set is created.
>RT Referenced Series Sequence	(3006,0014)	SQ	1	Always contains one referenced series.
>Series Instance UID	(0020,000E)	UI	1	Series UID from the image series for which the structure set is created.
>Contour Image Sequence	(3006,0016)	SQ	1	All images from the image series for which the structure set is created is added to the sequence. Images for which there is no contour defined are also added.

>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	
Structure Set ROI Sequence	(3006,0020)	SQ	3	All ROI:s and POI:s for which there exists a contour/point on the referenced image series are added to the sequence.
>ROI Number	(3006,0022)	IS	1	
>Referenced Frame of Reference UID	(3006,0024)	UI	1	Always same as the image series frame of reference for which the structure set is created.
>ROI Name	(3006,0026)	LO	2	
>ROI Generation Algorithm	(3006,0036)	CS	2	Always SEMIAUTOMATIC.

8.4.7 ROI Contour Module

Attribute name	Tag	Vr	Type	Comment
ROI Contour Sequence	(3006,0039)	SQ	1	
>Referenced ROI Number	(3006,0084)	IS	1	
>ROI Display Color	(3006,002A)	IS	3	
>Contour Sequence	(3006,0040)	SQ	3	
>Contour Number	(3006,0048)	IS	3	
>Contour Image Sequence	(3006,0016)	SQ	3	May contain one or no contour image. If there is an image in the referenced image series that that is positioned on the same z-coordinate as the contour, that image will be referenced in this sequence. If no image is found, the sequence will be empty.
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	
>Contour Geometric Type	(3006,0042)	CS	1	Possible values: POINT, CLOSED_PLANAR, OPEN_PLANAR.
>Number of Contour Points	(3006,0046)	IS	1	
>Contour Data	(3006,0050)	DS	1	

8.4.8 RT ROI Observations Module

Attribute name	Tag	Vr	Type	Comment
RT ROI Observations Sequence	(3006,0080)	SQ	1	All ROIs and POIs that are included in the Structure Set Module (Structure Set ROI Sequence) will be included in this sequence.
>Observation Number	(3006,0082)	IS	1	
>Referenced ROI Number	(3006,0084)	IS	1	
>ROI Observation Label	(3006,0085)	SH	3	Same as the name of the referenced ROI, except if the ROI is of type Localization Poi, in which case the label is set to "Localization Poi".

>RT ROI Interpreted Type	(3006,00A4)	CS	2	All types in the DICOM standard are supported in RayStation and are exported as the DICOM equivalent. Localization Poi's are exported as type "MARKER".
>ROI Interpreter	(3006,00A6)	PN	2	
>Material ID	(300A,00E1)	SH	3	Exported from material name.
>ROI Physical Properties Sequence	(3006,00B0)	SQ	3	The values REL_MASS_DENSITY, REL_ELEC_DENSITY, EFFECTIVE_Z, EFF_Z_PER_A and ELEM_FRACTION are supported. However at least one of REL_MASS_DENSITY or REL_ELEC_DENSITY is needed to create a density override. If only one of these values exist, the physical properties of water is used and mass density is set primarily from REL_MASS_DENSITY and secondarily from REL_ELEC_DENSITY.
>ROI Physical Property	(3006,00B2)	CS	1	MEAN_EXCI_ENERGY depicts the Mean Excitation Energy for a given material. Possible values: REL_MASS_DENSITY, REL_ELEC_DENSITY, EFFECTIVE_Z, EFF_Z_PER_A, ELEM_FRACTION, MEAN_EXCI_ENERGY.
>ROI Elemental Composition Sequence	(3006,00B6)	SQ	1C	
>ROI Elemental Composition Atomic Number	(3006,00B7)	US	1	
>ROI Elemental Composition Atomic Mass Fraction	(3006,00B8)	FL	1	
>ROI Physical Property Value	(3006,00B4)	DS	1	
>RaySearch Private Creator	(4001,0010)	LO	3	RAYSEARCHLABS 2.0
>Tissue Name	(4001,1010)	ST	3	RaySearch Private Tag. Contains the tissue name given to this Region of Interest.
>RBE Cell Type Name	(4001,1014)	ST	3	RaySearch Private Tag. Contains the RBE Cell Type Name given to this Region of Interest.

8.4.9 Approval Module

Attribute name	Tag	Vr	Type	Comment
Approval Status	(300E,0002)	CS	1	Possible values: • APPROVED - Structure set is approved in RayStation. • UNAPPROVED - Structure set is not approved in RayStation.
Review Date	(300E,0004)	DA	2C	The date when the structure set was approved in RayStation.
Review Time	(300E,0005)	TM	2C	
Reviewer Name	(300E,0008)	PN	2C	

8.4.10 SOP Common Module

Attribute name	Tag	Vr	Type	Comment

SOP Class UID	(0008,0016)	UI	1	Always 1.2.840.10008.5.1.4.1.1.481.3.
SOP Instance UID	(0008,0018)	UI	1	Generated from the RaySearch UID-series, see introduction for more details.
Specific Character Set	(0008,0005)	CS	1C	Possible values: ISO_IR 100, ISO_IR 192.
Instance Creation Date	(0008,0012)	DA	3	
Instance Creation Time	(0008,0013)	TM	3	

8.5 RT PLAN IOD

Only written attributes are listed.

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	RT Series Module	Yes
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	Yes
Plan	RT General Plan Module	Yes
	RT Prescription Module	Yes
	RT Patient Setup Module	Yes
	RT Fraction Scheme Module	Yes
	RT Beams Module	Yes
	Approval Module	Yes
	SOP Common Module	Yes

8.5.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN	2	
Patient ID	(0010,0020)	LO	2	
Patient's Birth Date	(0010,0030)	DA	2	
Patient's Sex	(0010,0040)	CS	2	Possible values: • M - Male • F - Female • O - Other

8.5.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	Exported identical as specified in the referenced image series.
Study Date	(0008,0020)	DA	2	Exported identical as specified in the referenced image series.
Study Time	(0008,0030)	TM	2	Exported identical as specified in the referenced image series.
Referring Physician's Name	(0008,0090)	PN	2	
Study ID	(0020,0010)	SH	2	Exported identical as specified in the referenced image series.

Accession Number	(0008,0050)	SH	2	
Study Description	(0008,1030)	LO	3	

8.5.3 RT Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Always RTPLAN.
Series Instance UID	(0020,000E)	UI	1	Generated from the RaySearch UID-series, see introduction for more details.
Series Number	(0020,0011)	IS	2	
Operators' Name	(0008,1070)	PN	2	

8.5.4 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	(0020,0052)	UI	1	Always same as the referenced image series.
Position Reference Indicator	(0020,1040)	LO	2	

8.5.5 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Manufacturer	(0008,0070)	LO	2	Always RaySearch Laboratories.
Manufacturer's Model Name	(0008,1090)	LO	3	Always RayStation.
Software Versions	(0018,1020)	LO	3	Always written as the current software version of RayStation.

8.5.6 RT General Plan Module

Attribute name	Tag	Vr	Type	Comment
RT Plan Label	(300A,0002)	SH	1	Exported from Beam Set Name.
RT Plan Name	(300A,0003)	LO	3	Exported from Treatment Plan Name.
RT Plan Date	(300A,0006)	DA	2	
RT Plan Time	(300A,0007)	TM	2	
Treatment Protocols	(300A,0009)	LO	3	Exported as plan delivery technique. Possible values: SMLC, DMLC, Arc, TomoHelical, TomoStatic.
Plan Intent	(300A,000A)	CS	3	Treatment plans created in RayStation always have the value CURATIVE. QA plans created in RayStation always have the value VERIFICATION. Plans created in Rayhysics have the value RESEARCH. Plans with recalculated dose might have RECALCULATION. Possible values: CURATIVE, VERIFICATION, MACHINE_QA, RESEARCH, RECALCULATION.
Treatment Sites	(300A,000B)	LO	3	

RT Plan Geometry	(300A,000C)	CS	1	Always PATIENT.
Referenced Structure Set Sequence	(300C,0060)	SQ	1C	The structure set for the image series for which the plan is created is always referenced.
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	
Referenced RT Plan Sequence	(300C,0002)	SQ	3	
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	
>RT Plan Relationship	(300A,0055)	CS	1	Possible values: VERIFIED_PLAN, EQUIVALENT, CONCURRENT.
>Brainlab Private Creator	(300B,0012)	LO	3	Brainlab - ONC - Beam Parameters
>Referenced Beam List	(300B,1210)	IS	3	Only used for Brainlab plans.

8.5.7 RT Prescription Module

Attribute name	Tag	Vr	Type	Comment
Prescription Description	(300A,000E)	ST	3	
Dose Reference Sequence	(300A,0010)	SQ	3	
>Dose Reference Number	(300A,0012)	IS	1	Always 1.
>Dose Reference UID	(300A,0013)	UI	3	
>Dose Reference Structure Type	(300A,0014)	CS	1	Possible values: POINT, VOLUME.
>Dose Reference Description	(300A,0016)	LO	3	
>Referenced ROI Number	(3006,0084)	IS	1C	
>Dose Reference Type	(300A,0020)	CS	1	Always TARGET.
>Constraint Weight	(300A,0021)	DS	3	
>Target Minimum Dose	(300A,0025)	DS	3	
>Target Prescription Dose	(300A,0026)	DS	3	
>Target Underdose Volume Fraction	(300A,0028)	DS	3	Written for prescriptions of type Dose At Volume, Median Dose (always 50) and Near Minimum Dose (always 2).
>Organ at Risk Maximum Dose	(300A,002C)	DS	3	
>Organ at Risk Overdose Volume Fraction	(300A,002D)	DS	3	
>RaySearch Private Creator	(4001,0010)	LO	3	RAYSEARCHLABS 2.0
>Target Prescription Effective Dose	(4001,1011)	DS	3	RaySearch Private Tag. Prescribed dose to Dose Reference if Dose Reference Type (300A,0020) is TARGET. The dose is physical dose after correction for biological effect using user-defined modeling technique.

8.5.8 RT Patient Setup Module

Attribute name	Tag	Vr	Type	Comment
Patient Setup Sequence	(300A,0180)	SQ	1	
>Patient Setup Number	(300A,0182)	IS	1	
>Patient Position	(0018,5100)	CS	1C	Possible values: HFS, HFP, FFS, FFP, HFDR, HFDL, FFDR, FFDL.
>Referenced Setup Image Sequence	(300A,0401)	SQ	3	
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	
>Table Top Vertical Setup Displacement	(300A,01D2)	DS	3	Vertical displacement in IEC TABLE TOP coordinate system (in mm) relative to Localization Poi. Value is only written if the Localization Poi is defined on the planning CT. The displacement is defined as (Localization Poi - isocenter). Export of table top displacement can be disabled in the RayPhysics per machine.
>Table Top Longitudinal Setup Displacement	(300A,01D4)	DS	3	Longitudinal displacement in IEC TABLE TOP coordinate system (in mm) relative to Localization Poi. Value is only written if the Localization Poi is defined on the planning CT. The displacement is defined as (Localization Poi - isocenter). Export of table top displacement can be disabled in the RayPhysics per machine.
>Table Top Lateral Setup Displacement	(300A,01D6)	DS	3	Lateral displacement in IEC TABLE TOP coordinate system (in mm) relative to Localization Poi. Value is only written if the Localization Poi is defined on the planning CT. The displacement is defined as (Localization Poi - isocenter). Export of table top displacement can be disabled in the RayPhysics per machine.
>RaySearch Private Creator	(4001,0010)	LO	3	RAYSEARCHLABS 2.0
>Tomo Localization point	(4001,1022)	DS	3	
medPhoton Private Creator	(30BB,0010)	LO	3	medPhoton 1.0
medPhoton Patient Setup ID	(30BB,1000)	SH	3	
medPhoton Imaging Protocol ID	(30BB,1001)	SH	3	

8.5.9 RT Fraction Scheme Module

Attribute name	Tag	Vr	Type	Comment
Fraction Group Sequence	(300A,0070)	SQ	1	This sequence will always contain one item. Multiple fraction groups are not supported.
>Fraction Group Number	(300A,0071)	IS	1	Always 1.
>Referenced Dose Reference Sequence	(300C,0050)	SQ	3	
>Referenced Dose Reference Number	(300C,0051)	IS	1	Always 1.
>Number of Fractions Planned	(300A,0078)	IS	2	

>Number of Fraction Pattern Digits Per Day	[300A,0079]	IS	3	
>Repeat Fraction Cycle Length	[300A,007A]	IS	3	
>Fraction Pattern	[300A,007B]	LT	3	
>Number of Beams	[300A,0080]	IS	1	
>Referenced Beam Sequence	[300C,0004]	SQ	1C	
>Referenced Beam Number	[300C,0006]	IS	1C	
>Beam Dose Specification Point	[300A,0082]	DS	3	Can be different for each beam.
>Beam Dose	[300A,0084]	DS	3	
>Beam Dose Point Depth	[300A,0088]	FL	3	Should be interpreted as the distance from the surface of the patient to the beam dose specification point, i.e. including support, fixture and boli.
>Beam Dose Point Equivalent Depth	[300A,0089]	FL	3	The water equivalent depth of the beam dose specification point, including support, fixation and boli.
>Beam Dose Point SSD	[300A,008A]	FL	3	Should be interpreted as the distance to the surface of the patient, including support, fixation and boli.
>Beam Meterset	[300A,0086]	DS	3	Total MU for beam.
>RaySearch Private Creator	[4001,0010]	LO	3	RAYSEARCHLABS 2.0
>Beam Dose Specification Point Name	[4001,1029]	ST	3	The name of the Beam Dose Specification Point.
>Number of Brachy Application Setups	[300A,00A0]	IS	1	Always 0.

8.5.10 RT Beams Module

Attribute name	Tag	Vr	Type	Comment
Beam Sequence	[300A,00B0]	SQ	1	
>Beam Number	[300A,00C0]	IS	1	
>Beam Name	[300A,00C2]	LO	3	
>Beam Description	[300A,00C3]	ST	3	
>Beam Type	[300A,00C4]	CS	1	Possible values: STATIC, DYNAMIC.
>Radiation Type	[300A,00C6]	CS	2	Possible values: PHOTON, ELECTRON.
>Primary Fluence Mode Sequence	[3002,0050]	SQ	3	
>Fluence Mode	[3002,0051]	CS	1	If the "Flattening filter free" checkbox is checked for the used machine this attribute will be set to NON_STANDARD. Otherwise this attribute is STANDARD Possible values: STANDARD, NON_STANDARD.
>Fluence Mode ID	[3002,0052]	SH	1C	If the "Flattening filter free" checkbox is checked for the used machine this attribute will be set to "FFF". Otherwise this attribute is null. Possible values: FFF, null.
>Treatment Machine Name	[300A,00B2]	SH	2	

>Primary Dosimeter Unit	(300A,00B3)	CS	3	Possible values: MU, MINUTE.
>Source-Axis Distance	(300A,00B4)	DS	3	
>Beam Limiting Device Sequence	(300A,00B6)	SQ	1	
>RT Beam Limiting Device Type	(300A,00B8)	CS	1	Possible values: X, Y, ASYMX, ASYMY, MLCX, MLCY.
>Number of Leaf/Jaw Pairs	(300A,00BC)	IS	1	
>Leaf Position Boundaries	(300A,00BE)	DS	2C	
>Referenced Patient Setup Number	(300C,006A)	IS	3	
>Referenced Reference Image Sequence	(300C,0042)	SQ	3	
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	
>Treatment Delivery Type	(300A,00CE)	CS	3	Possible values: TREATMENT, SETUP.
>Number of Wedges	(300A,00D0)	IS	1	Possible values: 0, 1.
>Wedge Sequence	(300A,00D1)	SQ	1C	
>Wedge Number	(300A,00D2)	IS	1	Always 1.
>Wedge Type	(300A,00D3)	CS	2	Possible values: STANDARD, DYNAMIC, MOTORIZED.
>Wedge ID	(300A,00D4)	SH	3	
>Wedge Angle	(300A,00D5)	IS	2	Always 60 for motorized wedges.
>Wedge Factor	(300A,00D6)	DS	2	
>Wedge Orientation	(300A,00D8)	DS	2	Possible values: 0.0, 90.0, 180.0, 270.0.
>Number of Compensators	(300A,00E0)	IS	1	Always 0.
>Number of Boli	(300A,00ED)	IS	1	
>Referenced Bolus Sequence	(300C,00B0)	SQ	1C	
>Referenced ROI Number	(3006,0084)	IS	1	
>Bolus ID	(300A,00DC)	SH	3	
>Number of Blocks	(300A,00F0)	IS	1	For Electron plans: 0 or 1 blocks are supported. For Photon plans: 0, 1 or 2 blocks are supported. Possible values: 0, 1, 2.
>Total Block Tray Factor	(300A,00F2)	DS	3	
>Block Sequence	(300A,00F4)	SQ	1C	If plan uses blocks.
>Block Tray ID	(300A,00F5)	SH	3	
>Source to Block Tray Distance	(300A,00F6)	DS	2	
>Block Type	(300A,00F8)	CS	1	Possible values: SHIELDING, APERTURE.
>Block Divergence	(300A,00FA)	CS	2	Possible values: PRESENT, ABSENT.
>Block Mounting Position	(300A,00FB)	CS	3	Possible values: PATIENT_SIDE, SOURCE_SIDE.
>Block Number	(300A,00FC)	IS	1	
>Block Name	(300A,00FE)	LO	3	

>Block Transmission	(300A,0102)	DS	2C	
>Block Number of Points	(300A,0104)	IS	2	
>Block Data	(300A,0106)	DS	2	
>Applicator Sequence	(300A,0107)	SQ	3	Used for Electron applicators or Photon cones.
>Applicator ID	(300A,0108)	SH	1	
>Applicator Type	(300A,0109)	CS	1	Possible values: ELECTRON_SQUARE, ELECTRON_RECT, ELECTRON_CIRC, ELECTRON_SHORT, ELECTRON_OPEN, PHOTON_CIRC, STEREOTACTIC.
>Applicator Geometry Sequence	(300A,0431)	SQ	3	Only used for photon cones, not electron applicators.
>Applicator Aperture Shape	(300A,0432)	CS	1	Always SYM_CIRCULAR.
>Applicator Opening	(300A,0433)	FL	1C	
>Applicator Description	(300A,010A)	LO	3	
>Final Cumulative Meterset Weight	(300A,010E)	DS	1C	Always 1.0.
>Number of Control Points	(300A,0110)	IS	1	
>Control Point Sequence	(300A,0111)	SQ	1	
>Control Point Index	(300A,0112)	IS	1	
>Cumulative Meterset Weight	(300A,0134)	DS	2	Meterset weight at beginning of control point. Final control point will always have value 1.
>Referenced Dose Reference Sequence	(300C,0050)	SQ	3	
>Referenced Dose Reference Number	(300C,0051)	IS	1	Always 1.
>Cumulative Dose Reference Coefficient	(300A,010C)	DS	2	Be aware these values are linearly interpolated from 0 to the final value and are not accurate.
>Nominal Beam Energy	(300A,0114)	DS	3	The Nominal Beam Energy will be written as the nominal energy of the RayStation machine beam quality assigned to the beam. The energy used internally for dose calculation may differ from the nominal energy and will not be exported.
>Dose Rate Set	(300A,0115)	DS	3	
>Wedge Positions Sequence	(300A,0116)	SQ	3	If plan contains wedges.
>Referenced Wedge Number	(300C,00C0)	IS	1	Always 1.
>Wedge Position	(300A,0118)	CS	1	Possible values: IN, OUT.
>Beam Limiting Device Position Sequence	(300A,011A)	SQ	1C	
>RT Beam Limiting Device Type	(300A,00B8)	CS	1	Possible values: X, Y, ASYMX, ASYMY, MLCX, MLCY.
>Leaf/Jaw Positions	(300A,011C)	DS	1	
>Gantry Angle	(300A,011E)	DS	1C	
>Gantry Rotation Direction	(300A,011F)	CS	1C	Possible values: NONE, CW, CC.
>Gantry Pitch Rotation Direction	(300A,014C)	CS	3	Possible values: NONE, CW, CC.
>Beam Limiting Device Angle	(300A,0120)	DS	1C	Same throughout entire beam.

>Beam Limiting Device Rotation Direction	(300A,0121)	CS	1C	Possible values: NONE, CW, CC.
>Patient Support Angle	(300A,0122)	DS	1C	Same throughout entire beam except for Wave Arc plans.
>Patient Support Rotation Direction	(300A,0123)	CS	1C	Possible values: NONE, CW, CC.
>Table Top Eccentric Axis Distance	(300A,0124)	DS	3	
>Table Top Eccentric Angle	(300A,0125)	DS	1C	Always 0.0.
>Table Top Eccentric Rotation Direction	(300A,0126)	CS	1C	Possible values: NONE, CW, CC.
>Table Top Pitch Angle	(300A,0140)	FL	1C	Always 0.0.
>Table Top Pitch Rotation Direction	(300A,0142)	CS	1C	Only written in first control point for SMLC, DMLC and Static Arc. Possible values: NONE, CW, CC.
>Table Top Roll Angle	(300A,0144)	FL	1C	Always 0.0.
>Table Top Roll Rotation Direction	(300A,0146)	CS	1C	Only written in first control point for SMLC and DMLC. Possible values: NONE, CW, CC.
>Table Top Vertical Position	(300A,0128)	DS	2C	Always 0.0.
>Table Top Longitudinal Position	(300A,0129)	DS	2C	Always 0.0.
>Table Top Lateral Position	(300A,012A)	DS	2C	
>Isocenter Position	(300A,012C)	DS	2C	Always written in first control point.
>Source to Surface Distance	(300A,0130)	DS	3	Should be interpreted as the distance to the surface of the patient, i.e. including support, fixation and boli.
>TomoTherapy HA Private Creator	(300D,0010)	LO	3	TOMO_HA_01
>Tomo Projection Sinogram Data	(300D,10A7)	DS	3	TomoHelical plans only. Projection sinogram values for all 64 leaves of projection starting at the current control point. Empty if all 64 leaves have a sinogram value of zero. Empty for last control point.
>Brainlab Private Creator	(320B,0010)	LO	3	Brainlab - ONC - Multi-axial treatment machine
>Dynamic Tracking	(320B,1001)	CS	3	Dynamic Tracking for Vero. Possible values: ENABLED, DISABLED.
>RaySearch Private Creator	(4001,0010)	LO	3	RAYSEARCHLABS 2.0
>Treatment Machine Commission Time	(4001,1001)	DT	3	The commission time of the treatment machine. Used together with Treatment Machine Name to determine the correct machine.
>Tomo IDMS Beam ID	(4001,1021)	LO	3	
>Tomo IDMS Machine ID	(4001,1020)	LO	3	
>Tomo Beam Isocenter	(4001,1023)	DS	3	
>Tomo machine revision	(4001,1025)	IS	3	
>Tomo beam revision	(4001,1026)	IS	3	
>Tomo intended back jaw position	(4001,1027)	DS	3	
>Tomo intended front jaw position	(4001,1028)	DS	3	
>TomoTherapy HA Private Creator	(300D,0010)	LO	3	TOMO_HA_01

>Tomo Gantry Period	(300D,1040)	DS	3	TomoHelical plans only. Nominal gantry rotation period in seconds.
>Tomo Couch Speed	(300D,1080)	DS	3	TomoHelical plans only. Planned couch speed in mm/sec.
>Tomo Treatment Pitch	(300D,1060)	DS	3	TomoHelical plans only. Distance in mm that treatment couch progresses in one gantry rotation divided by the total opening of the Y jaw pair in mm (the 'field width').

8.5.11 Approval Module

Attribute name	Tag	Vr	Type	Comment
Approval Status	(300E,0002)	CS	1	Possible values: • APPROVED - Plan is approved in RayStation. • UNAPPROVED - Plan is not approved in RayStation.
Review Date	(300E,0004)	DA	2C	The date when the plan was approved in RayStation.
Review Time	(300E,0005)	TM	2C	The time when the plan was approved in RayStation.
Reviewer Name	(300E,0008)	PN	2C	

8.5.12 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	Always 1.2.840.10008.5.1.4.1.1.481.5.
SOP Instance UID	(0008,0018)	UI	1	Generated from the RaySearch UID-series, see introduction for more details.
Specific Character Set	(0008,0005)	CS	1C	Possible values: ISO_IR 100, ISO_IR 192.
Instance Creation Date	(0008,0012)	DA	3	
Instance Creation Time	(0008,0013)	TM	3	

8.6 RT DOSE IOD

Only written attributes are listed.

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	RT Series Module	Yes
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	Yes
Dose	General Image Module	No
	Image Plane Module	Yes
	Multi-Frame Module	Yes
	Image Pixel Module	Yes
	RT Dose Module	Yes
	Structure Set Module	No
	ROI Contour Module	No
	SOP Common Module	Yes

8.6.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN	2	
Patient ID	(0010,0020)	LO	2	
Patient's Birth Date	(0010,0030)	DA	2	
Patient's Sex	(0010,0040)	CS	2	Possible values: • M - Male • F - Female • O - Other

8.6.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	Exported identical as specified in the referenced image series.
Study Date	(0008,0020)	DA	2	Exported identical as specified in the referenced image series.
Study Time	(0008,0030)	TM	2	Exported identical as specified in the referenced image series.
Referring Physician's Name	(0008,0090)	PN	2	

Study ID	(0020,0010)	SH	2	Exported identical as specified in the referenced image series.
Accession Number	(0008,0050)	SH	2	
Study Description	(0008,1030)	LO	3	

8.6.3 RT Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Always RTDOSE.
Series Instance UID	(0020,000E)	UI	1	Generated from the RaySearch UID-series, see introduction for more details.
Series Number	(0020,0011)	IS	2	
Operators' Name	(0008,1070)	PN	2	

8.6.4 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	(0020,0052)	UI	1	Always same as the referenced image series frame of reference.
Position Reference Indicator	(0020,1040)	LO	2	

8.6.5 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Manufacturer	(0008,0070)	LO	2	Always RaySearch Laboratories.
Manufacturer's Model Name	(0008,1090)	LO	3	Always RayStation.
Software Versions	(0018,1020)	LO	3	Always written as the current software version of RayStation.

8.6.6 Image Plane Module

Attribute name	Tag	Vr	Type	Comment
Pixel Spacing	(0028,0030)	DS	1	
Image Orientation (Patient)	(0020,0037)	DS	1	Always '1\0\0\0\1\0' for 3D doses. Plane dependant for 2D doses.
Image Position (Patient)	(0020,0032)	DS	1	Note that this is the center of the first pixel, i.e. the corner of the image offset by half a pixel.
Slice Thickness	(0018,0050)	DS	2	Null for 2D doses.

8.6.7 Multi-Frame Module

Attribute name	Tag	Vr	Type	Comment
Number of Frames	(0028,0008)	IS	1	Only used for 3D doses. Always equal the number of dose slices in z-direction.

Frame Increment Pointer	(0028,0009)	AT	1	Only used for 3D doses. Always '(3004,000c)'.

8.6.8 Image Pixel Module

Attribute name	Tag	Vr	Type	Comment
Samples per Pixel	(0028,0002)	US	1	Always 1.
Photometric Interpretation	(0028,0004)	CS	1	Always MONOCHROME2.
Rows	(0028,0010)	US	1	
Columns	(0028,0011)	US	1	
Bits Allocated	(0028,0100)	US	1	Always 16.
Bits Stored	(0028,0101)	US	1	Always 16.
High Bit	(0028,0102)	US	1	Always 15.
Pixel Representation	(0028,0103)	US	1	Always 0.
Pixel Data	(7FE0,0010)	OB_OW	1C	
Pixel Padding Range Limit	(0028,0121)	US_SS	1C	

8.6.9 RT Dose Module

Attribute name	Tag	Vr	Type	Comment
Samples per Pixel	(0028,0002)	US	1C	Always 1.
Photometric Interpretation	(0028,0004)	CS	1C	Always MONOCHROME2.
Bits Allocated	(0028,0100)	US	1C	Always 16.
Bits Stored	(0028,0101)	US	1C	Always 16.
High Bit	(0028,0102)	US	1C	Always 15.
Pixel Representation	(0028,0103)	US	1C	Always 0.
Dose Units	(3004,0002)	CS	1	Always GY.
Dose Type	(3004,0004)	CS	1	Possible values: PHYSICAL, EFFECTIVE.
Dose Summation Type	(3004,000A)	CS	1	Always PLAN or BEAM. Dose Summation Type FRACTION is not exported. Summation type BEAM referes to the dose contribution from this beam over the entire treatment course, not per fraction. Possible values: PLAN, BEAM, FRACTION.
Referenced RT Plan Sequence	(300C,0002)	SQ	1C	
>Referenced SOP Class UID	(0008,1150)	UI	1	Always '1.2.840.10008.5.1.4.1.1.481.5'.
>Referenced SOP Instance UID	(0008,1155)	UI	1	SOP Instance UID for the referenced plan. For evaluation doses a new UID is generated that does not reference an existing plan.
>Referenced Fraction Group Sequence	(300C,0020)	SQ	1C	Not exported if dose summation type is PLAN.
>Referenced Fraction Group Number	(300C,0022)	IS	1	Always 1.

>Referenced Beam Sequence	(300C,0004)	SQ	1C	
>Referenced Beam Number	(300C,0006)	IS	1	
Grid Frame Offset Vector	(3004,000C)	DS	1C	Only written for 3D doses.
Dose Grid Scaling	(3004,000E)	DS	1C	Dose Grid Scaling is always maximized for highest possible resolution.

8.6.10 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	Always 1.2.840.10008.5.1.4.1.1.481.2.
SOP Instance UID	(0008,0018)	UI	1	Generated from the RaySearch UID-series, see introduction for more details.
Specific Character Set	(0008,0005)	CS	1C	Possible values: ISO_IR 100, ISO_IR 192.
Instance Creation Date	(0008,0012)	DA	3	
Instance Creation Time	(0008,0013)	TM	3	

8.7 SPATIAL REGISTRATION IOD

Only written attributes are listed.

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	General Series Module	Yes
	Spatial Registration Series Module	Yes
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	Yes
Spatial Registration	Spatial Registration Module	Yes
	SOP Common Module	Yes
	Common Instance Reference Module	Yes

8.7.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN	2	
Patient ID	(0010,0020)	LO	2	
Patient's Birth Date	(0010,0030)	DA	2	
Patient's Sex	(0010,0040)	CS	2	Possible values: • M - Male • F - Female • O - Other

8.7.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	Exported identical as specified in the referenced image series.
Study Date	(0008,0020)	DA	2	Exported identical as specified in the referenced image series.
Study Time	(0008,0030)	TM	2	Exported identical as specified in the referenced image series.
Referring Physician's Name	(0008,0090)	PN	2	
Study ID	(0020,0010)	SH	2	Exported identical as specified in the referenced image series.
Accession Number	(0008,0050)	SH	2	
Study Description	(0008,1030)	LO	3	

8.7.3 General Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Always REG.
Series Instance UID	(0020,000E)	UI	1	
Series Number	(0020,0011)	IS	2	
Series Date	(0008,0021)	DA	3	
Series Time	(0008,0031)	TM	3	
Protocol Name	(0018,1030)	LO	3	
Series Description	(0008,103E)	LO	3	
Patient Position	(0018,5100)	CS	2C	

8.7.4 Spatial Registration Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Always REG.

8.7.5 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	(0020,0052)	UI	1	Always same as the referenced image series frame of reference.
Position Reference Indicator	(0020,1040)	LO	2	

8.7.6 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Manufacturer	(0008,0070)	LO	2	Always RaySearch Laboratories.
Manufacturer's Model Name	(0008,1090)	LO	3	Always RayStation.
Software Versions	(0018,1020)	LO	3	Always written as the current software version of RayStation.

8.7.7 Spatial Registration Module

Attribute name	Tag	Vr	Type	Comment
Content Date	(0008,0023)	DA	1	
Content Time	(0008,0033)	TM	1	
Instance Number	(0020,0013)	IS	1	
Content Label	(0070,0080)	CS	1	
Content Description	(0070,0081)	LO	2	
Content Creator's Name	(0070,0084)	PN	2	
Registration Sequence	(0070,0308)	SQ	1	
>Frame of Reference UID	(0020,0052)	UI	1C	

>Referenced Image Sequence	(0008,1140)	SQ	1C	
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	
>Matrix Registration Sequence	(0070,0309)	SQ	1	
>Registration Type Code Sequence	(0070,030D)	SQ	2	
>Matrix Sequence	(0070,030A)	SQ	1	
>Frame of Reference Transformation Matrix	(3006,00C6)	DS	1	
>Frame of Reference Transformation Matrix Type	(0070,030C)	CS	1	Always RIGID.

8.7.8 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	Always 1.2.840.10008.5.1.4.1.1.66.1.
SOP Instance UID	(0008,0018)	UI	1	Generated from the RaySearch UID-series, see introduction for more details.
Specific Character Set	(0008,0005)	CS	1C	Possible values: ISO_IR 100, ISO_IR 192.
Instance Creation Date	(0008,0012)	DA	3	
Instance Creation Time	(0008,0013)	TM	3	

8.7.9 Common Instance Reference Module

Attribute name	Tag	Vr	Type	Comment
Referenced Series Sequence	(0008,1115)	SQ	1	
>Series Instance UID	(0020,000E)	UI	1	
>Referenced Instance Sequence	(0008,114A)	SQ	1	
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	
Studies Containing Other Referenced Instances Sequence	(0008,1200)	SQ	1C	If referenced images are located in a Study different from the REG object.
>Study Instance UID	(0020,000D)	UI	1	
>Referenced Series Sequence	(0008,1115)	SQ	1	
>Series Instance UID	(0020,000E)	UI	1	
>Referenced Instance Sequence	(0008,114A)	SQ	1	
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	

8.8 RT IMAGE IOD

RT Images (DRR) will be created during the export. The content and annotations of DRR images may nto be identical to the presentation. Only written attributes are listed.

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	RT Series Module	Yes
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	Yes
Image	General Image Module	Yes
	Image Pixel Module	Yes
	Multi-Frame Module	No
	RT Image Module	Yes
	VOI LUT Module	Yes
	SOP Common Module	Yes

8.8.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN	2	
Patient ID	(0010,0020)	LO	2	
Patient's Birth Date	(0010,0030)	DA	2	
Patient's Sex	(0010,0040)	CS	2	Possible values: • M - Male • F - Female • O - Other

8.8.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	Exported identical as specified in the referenced image series.
Study Date	(0008,0020)	DA	2	Exported identical as specified in the referenced image series.
Study Time	(0008,0030)	TM	2	Exported identical as specified in the referenced image series.
Referring Physician's Name	(0008,0090)	PN	2	
Study ID	(0020,0010)	SH	2	Exported identical as specified in the referenced image series.
Accession Number	(0008,0050)	SH	2	

| Study Description | (0008,1030) | LO | 3 | Contains the study diagnosis. |

8.8.3 RT Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Always RTIMAGE.
Series Instance UID	(0020,000E)	UI	1	Generated from the RaySearch UID-series, see introduction for more details.
Series Number	(0020,0011)	IS	2	

8.8.4 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	(0020,0052)	UI	1	Always same as the referenced image series frame of reference.
Position Reference Indicator	(0020,1040)	LO	2	

8.8.5 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Manufacturer	(0008,0070)	LO	2	Always RaySearch Laboratories.
Manufacturer's Model Name	(0008,1090)	LO	3	Always RayStation.
Software Versions	(0018,1020)	LO	3	Always written as the current software version of RayStation.

8.8.6 General Image Module

Attribute name	Tag	Vr	Type	Comment
Instance Number	(0020,0013)	IS	2	Exported from originating Beam Number.
Patient Orientation	(0020,0020)	CS	2C	
Content Date	(0008,0023)	DA	2C	Treatment Plan last save time is used.
Content Time	(0008,0033)	TM	2C	Treatment Plan last save time is used.
Acquisition Number	(0020,0012)	IS	3	
Burned In Annotation	(0028,0301)	CS	3	Possible values: YES, NO.

8.8.7 Image Pixel Module

Attribute name	Tag	Vr	Type	Comment
Samples per Pixel	(0028,0002)	US	1	Always 1.
Photometric Interpretation	(0028,0004)	CS	1	Always MONOCHROME2.
Rows	(0028,0010)	US	1	
Columns	(0028,0011)	US	1	

Bits Allocated	(0028,0100)	US	1	Always 16.
Bits Stored	(0028,0101)	US	1	Always 16.
High Bit	(0028,0102)	US	1	Always 15.
Pixel Representation	(0028,0103)	US	1	
Pixel Data	(7FE0,0010)	OB_OW	1C	
Pixel Padding Range Limit	(0028,0121)	US_SS	1C	

8.8.8 RT Image Module

Attribute name	Tag	Vr	Type	Comment
Samples per Pixel	(0028,0002)	US	1	Always 1.
Photometric Interpretation	(0028,0004)	CS	1	Always MONOCHROME2.
Bits Allocated	(0028,0100)	US	1	Always 16.
Bits Stored	(0028,0101)	US	1	Always 16.
High Bit	(0028,0102)	US	1	Always 15.
Pixel Representation	(0028,0103)	US	1	Always 0.
RT Image Label	(3002,0002)	SH	1	Exported from originating Beam Number or Name.
RT Image Name	(3002,0003)	LO	3	Exported from originating Beam Number or Name.
RT Image Description	(3002,0004)	ST	3	Exported from originating Beam Name and Description.
Image Type	(0008,0008)	CS	1	Possible values: DERIVED, SECONDARY, DRR.
Conversion Type	(0008,0064)	CS	2	Always WSD.
RT Image Plane	(3002,000C)	CS	1	Always NORMAL.
X-Ray Image Receptor Angle	(3002,000E)	DS	2	Always 0.0.
RT Image Orientation	(3002,0010)	DS	2C	
Image Plane Pixel Spacing	(3002,0011)	DS	2	
RT Image Position	(3002,0012)	DS	2	
Radiation Machine Name	(3002,0020)	SH	2	Name of treatment machine.
Primary Dosimeter Unit	(300A,00B3)	CS	2	
Radiation Machine SAD	(3002,0022)	DS	2	
RT Image SID	(3002,0026)	DS	2	
Referenced RT Plan Sequence	(300C,0002)	SQ	3	
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	
Referenced Beam Number	(300C,0006)	IS	3	Only if DRR does not belong to a setup beam.
Referenced Fraction Group Number	(300C,0022)	IS	3	
Gantry Angle	(300A,011E)	DS	3	

Beam Limiting Device Angle	(300A,0120)	DS	3	
Patient Support Angle	(300A,0122)	DS	3	
Isocenter Position	(300A,012C)	DS	3	
Patient Position	(0018,5100)	CS	1C	

8.8.9 VOI LUT Module

Attribute name	Tag	Vr	Type	Comment
Window Center	(0028,1050)	DS	1C	
Window Width	(0028,1051)	DS	1C	

8.8.10 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	Always 1.2.840.10008.5.1.4.1.1.481.1.
SOP Instance UID	(0008,0018)	UI	1	Generated from the RaySearch UID-series, see introduction for more details.
Specific Character Set	(0008,0005)	CS	1C	Possible values: ISO_IR 100, ISO_IR 192.
Instance Creation Date	(0008,0012)	DA	3	
Instance Creation Time	(0008,0013)	TM	3	

9 DATA DICTIONARY OF PRIVATE ATTRIBUTES

All used Private Creators are listed in the table below. Usage of Private Attributes are listed in each module specification.

Attribute name	Tag	VR	VM	Value
GE Private Creator	(0009,0010)	LO	1	GEMS_PETD_01
RaySearch Private Creator	(3001,0011)	LO	1	RAYSEARCHLABS 1.0
IMPAC Private Creator	(300B,0010)	LO	1	IMPAC
Brainlab Private Creator	(300B,0012)	LO	1	Brainlab - ONC - Beam Parameters
IBA Private Creator	(300D,0010)	LO	1	IBA
medPhoton Private Creator	(30BB,0010)	LO	1	medPhoton 1.0
Brainlab Private Creator	(320B,0010)	LO	1	Brainlab - ONC - Multi-axial treatment machine
RaySearch Private Creator	(4001,0010)	LO	1	RAYSEARCHLABS 2.0
Philips Private Creator	(7053,0010)	LO	1	Philips PET Private Group
TomoTherapy HA Private Creator	(300D,0010)	LO	1	TOMO_HA_01
TomoTherapy DD Private Creator	(300D,0020)	LO	1	TOMO_DD_01

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