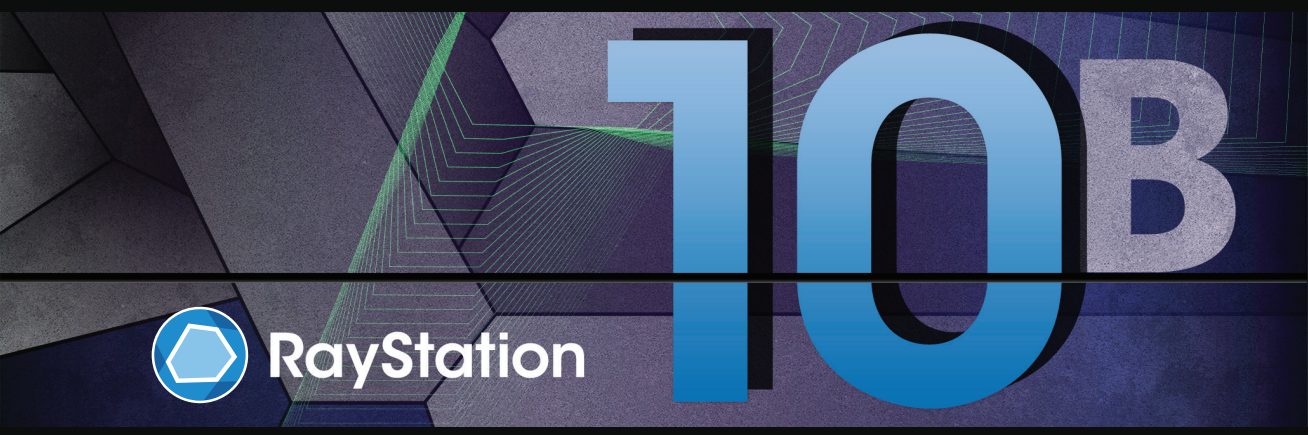
RAYSTATION 10B

DICOM Conformance Statement IBA Driver



Declaration of conformity

CE 0413

Complies with 93/42/EEC Medical Device Directive as amended by M1 to M5. A copy of the corresponding Declaration of Conformity is available on request.

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1 OVERVIEW

This document specifies the DICOM interface for the treatment management system (TMS) RayTreat IBA driver with Treatment Delivery Devices (TDD) from IBA. RayTreat IBA driver can export data associated to a treatment delivery session such as RT Ion Plans, Beams Delivery Instructions, CT images and RT Structure Sets and recieve result for the treatment delivery session such as RT Ion Beams Delivery Results, CT and RT images, RT Structure Sets and Spatial Registration objects.

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	No
RT Ion Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.9	Yes	No
Spatial Registration (REG) Storage	1.2.840.10008.5.1.4.1.1.66.1	Yes	No
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Workflow Management			
Unified Procedure Step - Push SOP Class-Trial (Retired)	1.2.840.10008.5.1.4.34.4.1	Yes	No
Unified Procedure Step - Pull SOP Class-Trial (Retired)	1.2.840.10008.5.1.4.34.4.3	Yes	No
Verification			
Verification SOP Class	1.2.840.10008.1.1	Yes	No

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3 INTRODUCTION

3.1 REVISION HISTORY

Date	Version	Comment
2018-12-13	1.0	IBA Driver DCS for RayStation Release 8B
2019-02-14	2.0	IBA Driver DCS for RayStation Release 8B SP1
2019-05-24	1.0	IBA Driver DCS for RayStation Release 9A
2019-12-03	1.0	IBA Driver DCS for RayStation Release 9B
2020-03-04	2.0	IBA Driver DCS for RayStation Release 9B SP1
2020-05-11	1.0	IBA Driver DCS for RayStation Release 10A
2020-11-27	1.0	IBA Driver DCS for RayStation Release 10B

3.1.1 IBA Driver changelog

3.1.1.1 Updates between 2.2.0.0 (RayStation 8B) - 2.3.0.0 (RayStation 8B SP1)

- If an exception is thrown when processing the request queue, the driver application will now be taken down. It should then be automatically restarted by the Windows service manager. Previously, any further requests would instead fail and the driver would have to be restarted manually.
- For a continuation session we now expect `Specified Primary Meterset` to be the same independently of whether anything has already been delivered during the same fraction for the same beam. This is done to match IBA R12.
- Validation has been added to ensure that for plans with multiple isocenters, the differences in the delivery positions for each beam are as expected. This is done by comparing to the relative positions of the isocenters for each beam in the plan to the table top displacements in the patient setup sequence and the absolute table top positions in the control point sequence.

3.1.1.2 Updates between 2.3.0.0 (RayStation 8B SP1) - 2.4.0.0 (RayStation 8B SP2)

- Always requires one single setup beam in plan validation.
- More detail in logging of plan validation results.
- Fixed a bug where the recorded `Study Instance UID` of image series acquired during a session would be wrong.

3.1.1.3 Updates between 2.4.0.0 (RayStation 8B SP2) - 3.0.0.0 (RayStation 9A)

- Blocks check in of continuation session when a previous session for the same fraction has a manual treatment record.
- Reading snout id and snout position from the treatment records received from the device and forwarding them to RayTreat.
- Adding validation to make it impossible to have a second drivers connected to the same database as the first driver if the drivers has somehow been severely misconfigured.
- Blocks check in of sessions if any beam with `Treatment Delivery Type` equal to `TREATMENT` has a Treatment Machine Name different from the configured DeviceName.

3.1.1.4 Updates between 3.0.0.0 (RayStation 9A) - 9.1.0 (RayStation 9B)

- Uses the same version numbering as the corresponding RayStation release.
- Validates the checksum that are produced by RayStation DICOM export when plan is created by a RayStation version above 9.1.0.0 (RayStation 9B) and when the plan has DICOM attribute `Manufacturer` set to `RaySearch Laboratories`.
- When creating delivery plan, a new checksum is recalculated and and an additional software version is appended to the DICOM plans `Software Versions` as "RaySearch.Driver.IBA-9.1.0.0";
- No longer validates that the plan has been asked for when setting session in progress.
- No longer requires machine to exist in MachineDB to be able to create tolerance tables.
- Automatic configuration of driver features, synchronizable through Clinic Settings.
- Logs more session information when first receiving it on the driver.
- Validates the private RaySearch DICOM attribute `Internal Treatment Machine Name` in the RT Ion Beam instead of `Treatment Machine Name` since `Treatment Machine Name` may contain alias not matching machine model name.
- Displays progress percentage in RayTreat while session is in progress.
- UPS and BDI is no longer sent as `CONTINUATION` if no meterset has been delivered, even if a treatment record has been received in a previous session for that fraction.
- Enables parsing of treatment records outside of a session context for offline recording. Validating the `Treatment Machine Name`, `Current Fraction Number`, `Patient ID`, `Patient's Name`, `Patient's Sex`, `Patient's Birth Date` and the `Referenced SOP Instance UID` of the `Referenced RT Plan`, in the Treatment Record.
- Now prefers the `Study Instance UID` of the Treatment Record to be the same as the plan that was delivered, also prefers the `Referenced Series Sequence` of the treatment record to contain a reference to the plan that was delivered. If set, this will enable better possiblities for offline treatment recording.
- Improved readability of DCS. Shows the correct indentation of attributes inside a sequence. Removes all attributes from the "Created SOP Instance(s)" chapter where the value is just read but never written. Type 1 values that are not actually read by us now has the comment "Value not read".

3.1.1.5 Updates between 9.1.0 (RayStation 9B) - 9.2.0 (RayStation 9B SP1)

- Fixing problem where a UPS for a session with a previous treatment record of 0 delivered MU would not send its treatment records in the `Input Information Sequence` as part of the UPS.
- Table top positions are now included when delivering QA session.

3.1.1.6 Updates between 9.2.0 (RayStation 9B SP1) - 10.0.0 (RayStation 10A)

- No changes affecting driver in this release.

3.1.1.7 Updates between 10.0.0 (RayStation 10A) - 10.1.0 (RayStation 10B)

- Setting `MoveOriginatorMessageID` and `MoveOriginatorApplicationEntityTitle` on all CSTORE requests which originates from a CMOVE.
- Parses out the `CurrentFractionNumber` for all beams in the treatment records and always expects all to be the same.
- Introduced IsClinical concept to the driver. A Clinical driver can never communicate with non-clinical RayTreat. Or vice versa.
- Made connection between driver and RayTreat more secure by forcing the usage of HTTPS for a clinical driver.
- New RaaS service now handles the data synchronization with the driver (all drivers will be connected to the same RaaS service). Driver will also always send the PACS data to this service instead of to RayTreat.
- Fixed bug related to when multiple CMOVEs was processed simultaneously.

3.2 AUDIENCE

This document is written for users that need to understand how IBA 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

This document is written for users that need to understand how RayTreat IBA Driver 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.

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 RayTreat IBA Driver 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 edition 2020a. For extra clarity all attributes in the referenced modules have been listed, even the ones that are not used by IBA.

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
TDD	Treatment Delivery Device
TMS	Treatment Management System
TPS	Treatment Planning System

3.7 REFERENCES

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

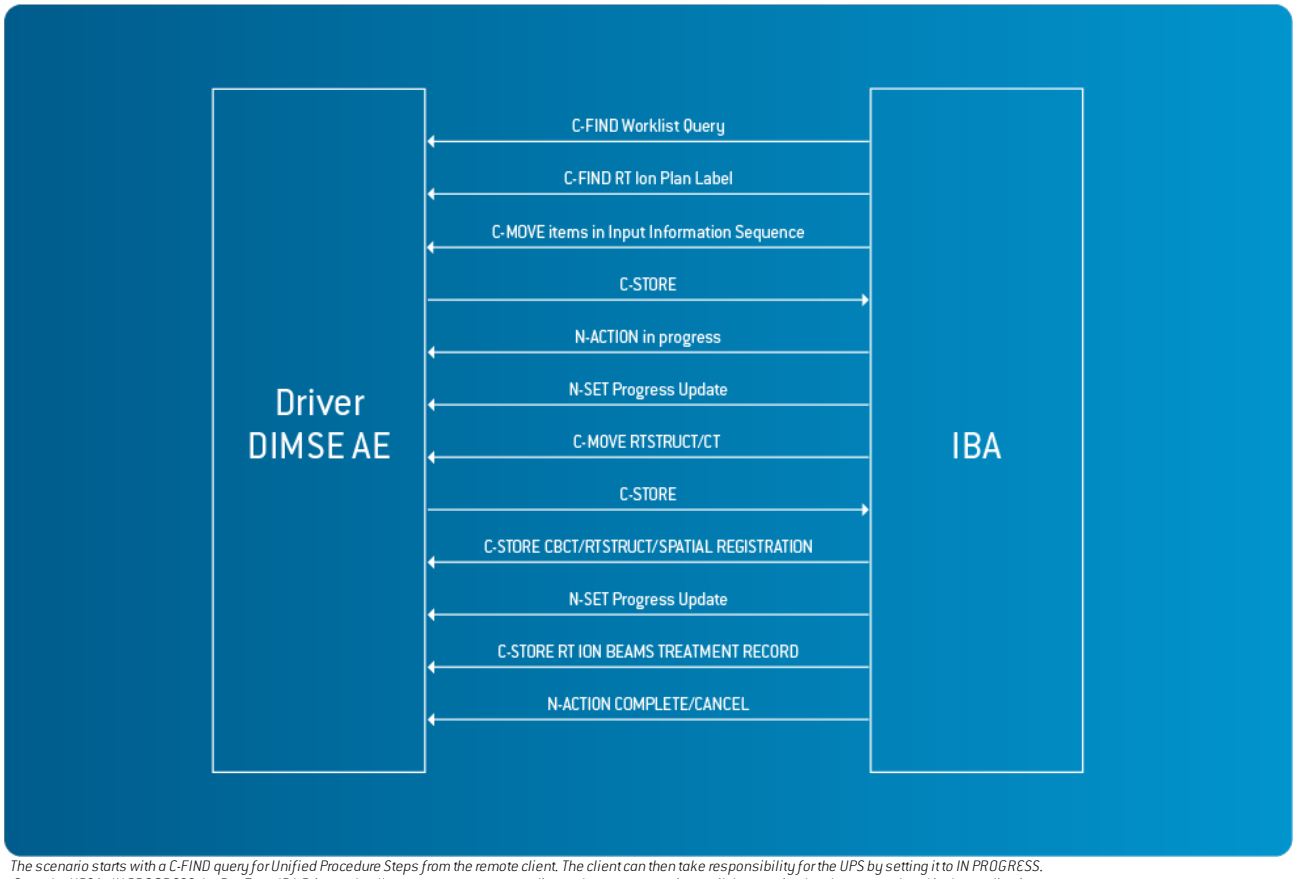
4 NETWORKING

The following diagram illustrates the application dataflow between RayTreat IBA Driver and the specific TDD.

4.1 IMPLEMENTATION MODEL

4.1.1 Application data flow

The following diagram illustrates the application data flow between RayTreat IBA Driver and the specific TDD



The scenario starts with a C-FIND query for Unified Procedure Steps from the remote client. The client can then take responsibility for the UPS by setting it to IN PROGRESS. Once the UPS is IN PROGRESS the RayTreat IBA Driver only allows requests corresponding to the current session until the session has been completed in the application.

4.1.2 Functional Definition of AEs

4.1.2.1 Functional Definition of "IBA Application Entity"

The following operations are supported:

CT Image

- C-STORE for setup CT images
- C-MOVE for planning CT images

Spartial Registration (SRO)

- C-STORE for registration between setup and planning images.

RT Image

- C-STORE for setup RT Images.

RT Structure Set

- C-STORE for RT Structure Set for the isocenter of the MVCT volume.
- C-MOVE for planning RT Structure Set.

RT Ion Beams Treatment Record

- C-STORE for delivery result.
- C-MOVE for previous delivered results.

Beams Delivery Instructions

- C-MOVE for BDIs related to the Unified Procedure Step.

RT Ion Plan

- C-MOVE for RT Ion Plan related to the Unified Procedure Step.
- C-FIND for RT Ion Plan Plan Label.

Modality Performed Procedure Step - PULL

- C-FIND for worklist query.
- N-ACTION for UPS status changes.
- N-SET for progress update.

Verification

- C-ECHO for connection verification

4.1.3 Sequence of Real World Activities

4.1.3.1 Prepare session

Once the patient is checked in to the session, Unified Procedure Steps will be created and available for Worklist queries.

4.1.3.2 Manual cancellation

The procedure step can be canceled by the user in the application. Further requests relation to the session will be rejected.

4.1.3.3 Complete session

All sessions, including canceled sessions, needs to be completed by the user in the application before another session can be started.

4.2 AE SPECIFICATIONS:

4.2.1 RayTreat IBA Driver Application Entity

4.2.1.1 SOP Classes

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	No
RT Ion Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.9	Yes	No
Spatial Registration (REG) Storage	1.2.840.10008.5.1.4.1.1.66.1	Yes	No
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Workflow Management			
Unified Procedure Step - Push SOP Class-Trial (Retired)	1.2.840.10008.5.1.4.34.4.1	Yes	No
Unified Procedure Step - Pull SOP Class-Trial (Retired)	1.2.840.10008.5.1.4.34.4.3	Yes	No
Verification			
Verification SOP Class	1.2.840.10008.1.1	Yes	No

4.2.1.2 Association Policies

Not applicable

4.2.1.3 General

The DICOM standard Application context shall be specified.

Application Context Name	1.2.840.10008.3.1.1.1

The maximum PDU size in not configurable and is set to 16384 for SCU and unlimited for SCP.

4.2.1.4 Number of Associations

Any number of incoming concurrent associations are accepted.

4.2.1.5 Asynchronous Nature

RayTreat IBA Driver does not support asynchronous communication (multiple outstanding transactions over a single Association).

4.2.1.6 Implementation Identity Information

Not applicable

4.2.1.7 Association Initiation Policy

The implementation for this Application Entity is:

Implementation Class UID	1.3.6.1.4.1.30071.8
Implementation Version Name	fo-dicom-raysearch 4.0.4 (based on official fo-dicom 4.0.2)

4.2.1.8 Activity C-ECHO

4.2.1.8.1 Description and Sequencing of Activities

A C-ECHO request can always be sent to the IBA driver.

4.2.1.8.2 Accepted Presentation Context

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax name	Transfer Syntax UID	Role	Extended Negotiation
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.9 Activity C-FIND

4.2.1.9.1 Description and Sequencing of Activities

Not applicable

4.2.1.9.2 Accepted Presentation Context

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax name	Transfer Syntax UID	Role	Extended Negotiation
Unified Procedure Step - Pull SOP Class - Trial (Retired)	1.2.840.10008.5.1.4.34.4.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.10 Activity C-MOVE

4.2.1.10.1 Description and Sequencing of Activities

Not applicable

4.2.1.10.2 Accepted Presentation Context

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax name	Transfer Syntax UID	Role	Extended Negotiation
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.11 Activity C-STORE

4.2.1.11.1 Description and Sequencing of Activities

Not applicable

4.2.1.11.2 Accepted Presentation Context

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax name	Transfer Syntax UID	Role	Extended Negotiation
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
RT Ion Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.9	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.11.3 Status Response

Service Status	Further meaning	Error Code	Reason
Failure	Storage Cannot Understand	Cxxx	Cannot find session or validation failed.
	SOP class not supported	0122	SOP class not supported.
Success	Success	0000	

4.2.1.12 Activity N-ACTION

4.2.1.12.1 Description and Sequencing of Activities

Not applicable

4.2.1.12.2 Accepted Presentation Context

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax name	Transfer Syntax UID	Role	Extended Negotiation
Unified Procedure Step - Pull SOP Class - Trial (Retired)	1.2.840.10008.5.1.4.34.4.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.12.3 Status Response

Service Status	Further meaning	Error Code	Reason
Refused	QueryRetrieveUnableToProcess	C000	Unknown SOP Instance UID.
	NoLongerUpdateUps	C300	The UPS may no longer be updated.
	IncorrectTransactionUid	C301	The correct Transaction UID was not provided.
	AlreadyInProgress	C302	The UPS is already IN PROGRESS
	IncorrectTransactionUid	C301	The correct Transaction UID was not provided.
	SopInstanceUidDoesNotExists	C307	Specified SOP Instance UID does not exist or is nota UPS Instancemanaged by this SCP
Failure	AlreadyCanceled	B304	The UPS isalready in the requested state of CANCELED.

	AlreadyCompleted	B306	The UPS isalready in the requested state of COMPLETED.
Success	Success	0000	

4.2.1.13 Activity N-SET

4.2.1.13.1 Description and Sequencing of Activities

Not applicable

4.2.1.13.2 Accepted Presentation Context

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax name	Transfer Syntax UID	Role	Extended Negotiation
Unified Procedure Step - Pull SOP Class - Trial (Retired)	1.2.840.10008.5.1.4.34.4.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.13.3 Status Response

Service Status	Further meaning	Error Code	Reason
Refused	QueryRetrieveUnableToProcess	C000	Unknown SOP Instance UID.
	NoLongerUpdateUps	C300	The UPS may no longer be updated.
	IncorrectTransactionUid	C301	The correct Transaction UID was not provided.
	SopInstanceUidDoesNotExists	C307	Specified SOP Instance UID does not exist or is nota UPS Instancemanaged by this SCP
Success	Success	0000	

5 MEDIA INTERCHANGE

Not applicable

6 TRANSFORMATION OF DICOM TO CDA

Not applicable

7 SUPPORT OF CHARACTER SETS

RayTreat IBA Driver support the following charactersets in addition to the default

- ISO_IR 192

8 SECURITY

8.1 SECURITY PROFILES

No Security Profiles are supported.

8.2 ASSOCIATION LEVEL SECURITY

RayTreat IBA Driver checks the following values for validation of received Association Open Requests:

- Called AE Title.

8.3 APPLICATION LEVEL SECURITY

None supported.

9 ANNEXES

9.1 IOD CONTENTS

9.1.1 Created SOP Instance(s)

9.1.1.1 RT Ion Plan IOD

IE	Module	Used
Patient	Patient Module	No
Study	General Study Module	Yes
Series	RT Series Module	Yes
Frame of Reference	Frame of Reference Module	No
Equipment	General Equipment Module	Yes
Plan	RT General Plan Module	Yes
	RT Ion Tolerance Tables Module	Yes
	RT Fraction Scheme Module	Yes
	RT Ion Beams Module	Yes
	SOP Common Module	Yes

9.1.1.1.1 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study ID	(0020,0010)	SH	2	

9.1.1.1.2 RT Series Module

Attribute name	Tag	Vr	Type	Comment
Series Instance UID	(0020,000E)	UI	1	Generated.

9.1.1.1.3 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Software Versions	(0018,1020)	LO	3	When delivery plan is created, version of the driver is appended.

9.1.1.1.4 RT General Plan Module

Attribute name	Tag	Vr	Type	Comment
Plan Intent	(300A,000A)	CS	3	Set to VERIFICATION if QA. Copied from TPS RT Ion Plan otherwise.
Referenced RT Plan Sequence	(300C,0002)	SQ	3	Referenced TMS RT Ion Plan
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	
>RT Plan Relationship	(300A,0055)	CS	1	Always PREDECESSOR.

9.1.1.1.5 RT Ion Tolerance Tables Module

Attribute name	Tag	Vr	Type	Comment
Ion Tolerance Table Sequence	(300A,03A0)	SQ	1	
>Tolerance Table Number	(300A,0042)	IS	1	Always 1.
>Tolerance Table Label	(300A,0043)	SH	3	Configurable.
>Gantry Angle Tolerance	(300A,0044)	DS	3	Configurable.
>Beam Limiting Device Angle Tolerance	(300A,0046)	DS	3	Configurable.
>Beam Limiting Device Tolerance Sequence	(300A,0048)	SQ	3	
>>RT Beam Limiting Device Type	(300A,00B8)	CS	1	Configured.

>>Beam Limiting Device Position Tolerance	(300A,004A)	DS	1	
>Patient Support Angle Tolerance	(300A,004C)	DS	3	Configurable.
>Table Top Vertical Position Tolerance	(300A,0051)	DS	3	Configurable.
>Table Top Longitudinal Position Tolerance	(300A,0052)	DS	3	Configurable.
>Table Top Lateral Position Tolerance	(300A,0053)	DS	3	Configurable.
>Table Top Pitch Angle Tolerance	(300A,004F)	FL	3	Configurable.
>Table Top Roll Angle Tolerance	(300A,0050)	FL	3	Configurable.
>Snout Position Tolerance	(300A,004B)	FL	3	Configurable.
>Head Fixation Angle Tolerance	(300A,0152)	DS	3	Configurable.
>Chair Head Frame Position Tolerance	(300A,0153)	DS	3	Configurable.

9.1.1.1.6 RT Fraction Scheme Module

Attribute name	Tag	Vr	Type	Comment
Fraction Group Sequence	(300A,0070)	SQ	1	
>Number of Beams	(300A,0080)	IS	1	
>Referenced Beam Sequence	(300C,0004)	SQ	1C	
>>Referenced Beam Number	(300C,0006)	IS	1	

9.1.1.1.7 RT Ion Beams Module

Attribute name	Tag	Vr	Type	Comment
Ion Beam Sequence	(300A,03A2)	SQ	1	
>Referenced Tolerance Table Number	(300C,00A0)	IS	3	Always 1.
>Ion Control Point Sequence	(300A,03A8)	SQ	1	
>>Patient Support Angle	(300A,0122)	DS	1C	
>>Table Top Pitch Angle	(300A,0140)	FL	2C	
>>Table Top Roll Angle	(300A,0144)	FL	2C	
>>Table Top Vertical Position	(300A,0128)	DS	2C	
>>Table Top Longitudinal Position	(300A,0129)	DS	2C	
>>Table Top Lateral Position	(300A,012A)	DS	2C	
>Planned Verification Image Sequence	(300A,00CA)	SQ	3	
>>Imaging Device-Specific Acquisition Parameters	(300A,00CC)	LO	3	

9.1.1.1.8 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Instance UID	(0008,0018)	UI	1	Generated.
RaySearch Private Creator	(4001,0010)	LO	3	RAYSEARCHLABS 2.0
RaySearch Checksum Algorithm Version	(4001,1060)	LO	3	Set on delivery plan.
RaySearch Checksum Data	(4001,1061)	OB	3	Set on delivery plan.

9.1.1.2 RT Ion Beams Treatment Record IOD

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	RT Series Module	Yes
Equipment	General Equipment Module	Yes
Treatment Record	RT General Treatment Record Module	Yes

RT Treatment Machine Record Module	Yes
RT Ion Beams Session Record Module	Yes
SOP Common Module	Yes

9.1.1.2.1 Patient Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN	2	Copied from RT Ion Plan.
Patient ID	(0010,0020)	LO	2	Copied from RT Ion Plan.
Patient's Birth Date	(0010,0030)	DA	2	Copied from RT Ion Plan.
Patient's Sex	(0010,0040)	CS	2	Copied from RT Ion Plan.

9.1.1.2.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	Copied from RT Ion Plan.
Study Date	(0008,0020)	DA	2	Copied from RT Ion Plan.
Study Time	(0008,0030)	TM	2	Copied from RT Ion Plan.
Referring Physician's Name	(0008,0090)	PN	2	Copied from RT Ion Plan.
Study ID	(0020,0010)	SH	2	Copied from RT Ion Plan.
Study Description	(0008,1030)	LO	3	Copied from RT Ion Plan.

9.1.1.2.3 RT Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Always RTRECORD.
Series Instance UID	(0020,000E)	UI	1	Generated.
Series Number	(0020,0011)	IS	2	Copied from RT Ion Plan.

9.1.1.2.4 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 RayTreatment.
Software Versions	(0018,1020)	LO	3	

9.1.1.2.5 RT General Treatment Record Module

Attribute name	Tag	Vr	Type	Comment
Instance Number	(0020,0013)	IS	1	Always 1.
Treatment Date	(3008,0250)	DA	2	Set to current day.
Treatment Time	(3008,0251)	TM	2	Set to current time.
Referenced RT Plan Sequence	(300C,0002)	SQ	2	References to RT Ion Plan
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	
Referenced Treatment Record Sequence	(3008,0030)	SQ	3	References all already received Treatment Record from the current session.
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	

9.1.1.2.6 RT Treatment Machine Record Module

Attribute name	Tag	Vr	Type	Comment
Treatment Machine Sequence	(300A,0206)	SQ	1	

>Manufacturer	(0008,0070)	LO	2	Always RaySearch Laboratories.
>Manufacturer's Model Name	(0008,1090)	LO	2	Always RayTreatment.
>Device Serial Number	(0018,1000)	LO	2	Set to empty string.

9.1.1.2.7 RT Ion Beams Session Record Module

Attribute name	Tag	Vr	Type	Comment
Number of Fractions Planned	(300A,0078)	IS	2	Copied from RT Ion Plan.
Primary Dosimeter Unit	(300A,00B3)	CS	1	Always • MU - Monitor Unit
Treatment Session Ion Beam Sequence	(3008,0021)	SQ	1	
>Referenced Beam Number	(300C,0006)	IS	1	Manual edit beam number
>Beam Name	(300A,00C2)	LO	1	Copied from RT Ion Plan.
>Beam Type	(300A,00C4)	CS	1	Copied from RT Ion Plan.
>Radiation Type	(300A,00C6)	CS	1	Copied from RT Ion Plan.
>Scan Mode	(300A,0308)	CS	1	Copied from RT Ion Plan.
>Number of Wedges	(300A,00D0)	IS	1	Copied from RT Ion Plan.
>Number of Compensators	(300A,00E0)	IS	1	Copied from RT Ion Plan.
>Recorded Compensator Sequence	(3008,00C0)	SQ	1C	
>>Referenced Compensator Number	(300C,00D0)	IS	1	Copied from RT Ion Plan.
>>Compensator ID	(300A,00E5)	SH	3	
>Number of Boli	(300A,00ED)	IS	1	Copied from RT Ion Plan.
>Referenced Bolus Sequence	(300C,00B0)	SQ	1C	
>>Referenced ROI Number	(3006,0084)	IS	1	Copied from RT Ion Plan.
>Number of Blocks	(300A,00F0)	IS	1	Copied from RT Ion Plan.
>Recorded Block Sequence	(3008,00D0)	SQ	1C	
>>Referenced Block Number	(300C,00E0)	IS	1	Copied from RT Ion Plan.
>Recorded Snout Sequence	(3008,00F0)	SQ	1C	
>>Snout ID	(300A,030F)	SH	1	Copied from RT Ion Plan.
>Applicator Sequence	(300A,0107)	SQ	1C	
>>Applicator ID	(300A,0108)	SH	1	Copied from RT Ion Plan.
>>Applicator Type	(300A,0109)	CS	1	Copied from RT Ion Plan.
>Number of Range Shifters	(300A,0312)	IS	1	Copied from RT Ion Plan.
>Recorded Range Shifter Sequence	(3008,00F2)	SQ	1C	
>>Referenced Range Shifter Number	(300C,0100)	IS	1	Copied from RT Ion Plan.
>>Range Shifter ID	(300A,0318)	SH	1	Copied from RT Ion Plan.
>Number of Lateral Spreading Devices	(300A,0330)	IS	1	Copied from RT Ion Plan.
>Recorded Lateral Spreading Device Sequence	(3008,00F4)	SQ	1C	
>>Referenced Lateral Spreading Device Number	(300C,0102)	IS	1	Copied from RT Ion Plan.
>>Lateral Spreading Device ID	(300A,0336)	SH	1	Copied from RT Ion Plan.
>Number of Range Modulators	(300A,0340)	IS	1	Copied from RT Ion Plan.
>Recorded Range Modulator Sequence	(3008,00F6)	SQ	1C	
>>Referenced Range Modulator Number	(300C,0104)	IS	1	Copied from RT Ion Plan.
>>Range Modulator ID	(300A,0346)	SH	1	Copied from RT Ion Plan.

>>Range Modulator Type	(300A,0348)	CS	1	Copied from RT Ion Plan.
>>Beam Current Modulation ID	(300A,034C)	SH	1C	Copied from RT Ion Plan.
>Patient Support Type	(300A,0350)	CS	1	Copied from RT Ion Plan. Possible values: • TABLE - Treatment delivery system table • CHAIR - Treatment delivery system chair
>Current Fraction Number	(3008,0022)	IS	2	Set to fraction number of the current session.
>Treatment Delivery Type	(300A,00CE)	CS	2	Copied from beam delivery instruction for the current session.
>Treatment Termination Status	(3008,002A)	CS	1	Set to UNKNOWN Possible values: • NORMAL - treatment terminated normally • OPERATOR - operator terminated treatment • MACHINE - machine terminated treatment • UNKNOWN - status at termination unknown
>Treatment Verification Status	(3008,002C)	CS	2	Always UNKNOWN.
>Specified Primary Meterset	(3008,0032)	DS	3	Set to manual edit value.
>Delivered Primary Meterset	(3008,0036)	DS	3	Set to manual edit value.
>Number of Control Points	(300A,0110)	IS	1	Always 2.
>Ion Control Point Delivery Sequence	(3008,0041)	SQ	1	Always 2 items.
>>Referenced Control Point Index	(300C,00F0)	IS	1	If first: Copied from the first control point item in the RT Ion Plan. If second: Copied from the last control point item in the RT Ion Plan.
>>Treatment Control Point Date	(3008,0024)	DA	1	Set to current date.
>>Treatment Control Point Time	(3008,0025)	TM	1	Set to current time.
>>Specified Meterset	(3008,0042)	DS	2	If first: Set to 0. If second: Set to manual edit value.
>>Delivered Meterset	(3008,0044)	DS	1	If first: set to 0. If second: Set to manual edit value.
>>Nominal Beam Energy	(300A,0114)	DS	1C	If first: Copied from the first control point item in the RT Ion Plan. If second: Copied from the last control point item in the RT Ion Plan.
>>Ion Wedge Position Sequence	(300A,03AC)	SQ	1C	
>>>Referenced Wedge Number	(300C,00C0)	IS	1	If first: Copied from the first control point item in the RT Ion Plan. If second: Copied from the last control point item in the RT Ion Plan.
>>>Wedge Position	(300A,0118)	CS	1	If first: Copied from the first control point item in the RT Ion Plan. If second: Copied from the last control point item in the RT Ion Plan.
>>>Wedge Thin Edge Position	(300A,00DB)	FL	1C	If first: Copied from the first control point item in the RT Ion Plan. If second: Copied from the last control point item in the RT Ion Plan.
>>Beam Limiting Device Position Sequence	(300A,011A)	SQ	1C	If second: Not set.
>>>RT Beam Limiting Device Type	(300A,00B8)	CS	1	If first: Copied from the first control point item in the RT Ion Plan.
>>>Leaf/Jaw Positions	(300A,011C)	DS	1	If first: Copied from the first control point item in the RT Ion Plan.
>>Range Shifter Settings Sequence	(300A,0360)	SQ	1C	If second: Not Set.
>>>Referenced Range Shifter Number	(300C,0100)	IS	1	If first: Copied from the first control point item in the RT Ion Plan.
>>>Range Shifter Setting	(300A,0362)	LO	1	If first: Copied from the first control point item in the RT Ion Plan.
>>Lateral Spreading Device Settings Sequence	(300A,0370)	SQ	1C	If second: Not set.
>>>Referenced Lateral Spreading Device Number	(300C,0102)	IS	1	If first: Copied from the first control point item in the RT Ion Plan.
>>>Lateral Spreading Device Setting	(300A,0372)	LO	1	If first: Copied from the first control point item in the RT Ion Plan.
>>Range Modulator Settings Sequence	(300A,0380)	SQ	1C	If second: Not set.
>>>Referenced Range Modulator Number	(300C,0104)	IS	1	If first: Copied from the first control point item in the RT Ion Plan.
>>>Range Modulator Gating Start Value	(300A,0382)	FL	1C	If first: Copied from the first control point item in the RT Ion Plan.

>>>Range Modulator Gating Stop Value	(300A,0384)	FL	1C	If first: Copied from the first control point item in the RT Ion Plan.
>>Gantry Angle	(300A,011E)	DS	1C	If first: Copied from the RT Ion Plan. If second: Not set.
>>Gantry Rotation Direction	(300A,011F)	CS	1C	If first: Copied from the RT Ion Plan. If second: Not set.
>>Gantry Pitch Rotation Direction	(300A,014C)	CS	2C	Always NONE.
>>Beam Limiting Device Angle	(300A,0120)	DS	1C	If first: Copied from the RT Ion Plan. If second: Not set.
>>Beam Limiting Device Rotation Direction	(300A,0121)	CS	1C	If first: Copied from the RT Ion Plan. If second: Not set.
>>Scan Spot Tune ID	(300A,0390)	SH	1C	If first: Copied from the RT Ion Plan. If second: Not set.
>>Number of Scan Spot Positions	(300A,0392)	IS	1C	If first: Copied from the RT Ion Plan. If second: Not set.
>>Scan Spot Position Map	(300A,0394)	FL	1C	If first: Copied from the RT Ion Plan. If second: Not set.
>>Scan Spot Metersets Delivered	(3008,0047)	FL	1C	If first: A n-list of zeros where n is equal to the number of scan spot positions in the first control point copied from the RT Ion Plan. If second: Not set.
>>Number of Paintings	(300A,039A)	IS	1C	If first: Copied from the RT Ion Plan. If second: Not set.
>>Patient Support Angle	(300A,0122)	DS	1C	If first: Copied from the RT Ion Plan. If second: Not set.
>>Patient Support Rotation Direction	(300A,0123)	CS	1C	If first: Copied from the RT Ion Plan. If second: Not set.
>>Table Top Pitch Angle	(300A,0140)	FL	2C	If first: Copied from the RT Ion Plan. If second: Not set.
>>Table Top Pitch Rotation Direction	(300A,0142)	CS	2C	If first: Copied from the RT Ion Plan. If second: Not set.
>>Table Top Roll Angle	(300A,0144)	FL	2C	If first: Copied from the RT Ion Plan. If second: Not set.
>>Table Top Roll Rotation Direction	(300A,0146)	CS	2C	If first: Copied from the RT Ion Plan. If second: Not set.
>>Table Top Vertical Position	(300A,0128)	DS	2C	If first: Copied from the RT Ion Plan. If second: Not set.
>>Table Top Longitudinal Position	(300A,0129)	DS	2C	If first: Copied from the RT Ion Plan. If second: Not set.
>>Table Top Lateral Position	(300A,012A)	DS	2C	If first: Copied from the RT Ion Plan. If second: Not set.
>>Snout Position	(300A,030D)	FL	2C	If first: Copied from the RT Ion Plan. If second: Not set.

9.1.1.2.8 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	
SOP Instance UID	(0008,0018)	UI	1	Generated.

9.1.1.3 RT Beams Delivery InstructionRETIRED IOD

IE	Module	Used
Patient	Patient Module	Yes
	Clinical Trial Subject Module	No
Study	General Study Module	Yes
	Patient Study Module	No
	Clinical Trial Study Module	No
Series	General Series Module	Yes
	Clinical Trial Series Module	No
Equipment	General Equipment Module	Yes
Plan	RT Beams Delivery Instruction Module	Yes
	Common Instance Reference Module	No
	General Reference Module	No
	SOP Common Module	Yes

9.1.1.3.1 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, F, O.

9.1.1.3.2 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	
Study Description	(0008,1030)	LO	3	

9.1.1.3.3 General Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Always PLAN.
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	
Series Description	(0008,103E)	LO	3	

9.1.1.3.4 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Manufacturer	(0008,0070)	LO	2	Always RaySearch Laboratories.
Station Name	(0008,1010)	SH	3	

9.1.1.3.5 RT Beams Delivery Instruction Module

Attribute name	Tag	Vr	Type	Comment
Beam Task Sequence	(0074,1020)	SQ	1	
>Beam Task Type	(0074,1022)	CS	1	Possible values: • TREAT - Treat • VERIFY - Beam verification only
>Treatment Delivery Type	(300A,00CE)	CS	1	Possible values: TREATMENT, CONTINUATION.
>Continuation Start Meterset	(0074,0120)	FD	1C	
>Continuation End Meterset	(0074,0121)	FD	1C	
>Current Fraction Number	(3008,0022)	IS	1	
>Referenced Beam Number	(300C,0006)	IS	1	
>Table Top Vertical Setup Displacement	(300A,01D2)	DS	2	
>Table Top Longitudinal Setup Displacement	(300A,01D4)	DS	2	
>Table Top Lateral Setup Displacement	(300A,01D6)	DS	2	
>Delivery Verification Image Sequence	(0074,1030)	SQ	2C	
>>Verification Image Timing	(0074,1032)	CS	1	Always DURING_BEAM.
>>Start Cumulative Meterset Weight	(300C,0008)	DS	1C	

>>End Cumulative Meterset Weight	(300C,0009)	DS	2C	
>>Double Exposure Flag	(0074,1034)	CS	1	Always • SINGLE - single exposure
>Referenced RT Plan Sequence	(300C,0002)	SQ	3	
>>Referenced Series Sequence	(0008,1115)	SQ	1C	
>>>Series Instance UID	(0020,000E)	UI	1	
>>>Retrieve AE Title	(0008,0054)	AE		
>>>Referenced SOP Sequence	(0008,1199)	SQ	1	
>>>>Referenced SOP Class UID	(0008,1150)	UI	1	
>>>>Referenced SOP Instance UID	(0008,1155)	UI	1	
>>Study Instance UID	(0020,000D)	UI	1	
Omitted Beam Task Sequence	(300C,0111)	SQ	3	
>Referenced Beam Number	(300C,0006)	IS	1	
>Reason for Omission	(300C,0112)	CS	1	Always ALREADY_TREATED.

9.1.1.3.6 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	
SOP Instance UID	(0008,0018)	UI	1	
Specific Character Set	(0008,0005)	CS	1C	
Instance Creation Date	(0008,0012)	DA	3	
Instance Creation Time	(0008,0013)	TM	3	

9.1.1.4 Unified Procedure StepRETIRED IOD

IE	Module	Used
Unified Procedure Step	SOP Common Module	Yes
	Unified Procedure Step Relationship Module	Yes
	Unified Procedure Step Scheduled Procedure Information Module	Yes
	Unified Procedure Step Progress Information Module	Yes
	Unified Procedure Step Performed Procedure Information Module	No
	Patient Demographic Module	No
	Patient Medical Module	No
	Visit Identification Module	No
	Visit Status Module	No
	Visit Admission Module	No
	Transaction Module	Yes

9.1.1.4.1 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	
SOP Instance UID	(0008,0018)	UI	1	
Timezone Offset From UTC	(0008,0201)	SH	3	

9.1.1.4.2 Unified Procedure Step Relationship Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN		

Patient ID	(0010,0020)	LO		
Patient's Birth Date	(0010,0030)	DA		
Patient's Sex	(0010,0040)	CS		Possible values: • M - Male • F - Female • O - Other
Referenced Request Sequence	(0040,A370)	SQ		
>Requested Procedure Code Sequence	(0032,1064)	SQ		
>>Code Value	(0008,0100)	SH	1C	
>>Coding Scheme Designator	(0008,0102)	SH	1C	Always 99RAYSEARCH.
>>Coding Scheme Version	(0008,0103)	SH	1C	Always 1.
>>Code Meaning	(0008,0104)	LO	1	
>Requested Procedure ID	(0040,1001)	SH		

9.1.1.4.3 Unified Procedure Step Scheduled Procedure Information Module

Attribute name	Tag	Vr	Type	Comment
Scheduled Procedure Step Priority	(0074,1200)	CS		Possible values: • HIGH - High • MEDIUM - Medium • LOW - Low
Procedure Step Label	(0074,1204)	LO		
Scheduled Station Name Code Sequence	(0040,4025)	SQ		
>Code Value	(0008,0100)	SH	1C	
>Coding Scheme Designator	(0008,0102)	SH	1C	
>Code Meaning	(0008,0104)	LO	1	
Scheduled Procedure Step Start DateTime	(0040,4005)	DT		
Expected Completion DateTime	(0040,4011)	DT		
Scheduled Workitem Code Sequence	(0040,4018)	SQ		
>Code Value	(0008,0100)	SH	1C	Possible values: • 121726 - RT Treatment with Internal Verification • 121707 - RT Patient Position Acquisition, CT kV • 121728 - RT Treatment QA with Internal Verification
>Coding Scheme Designator	(0008,0102)	SH	1C	Always DCM.
>Code Meaning	(0008,0104)	LO	1	Possible values: RT Treatment with Internal Verification, RT Patient Position Acquisition, CT kV, RT Treatment QA with Internal Verification.
Scheduled Processing Parameters Sequence	(0074,1210)	SQ		
>Value Type	(0040,A040)	CS	1	Always • TEXT - Text
>Concept Name Code Sequence	(0040,A043)	SQ	1	
>>Code Value	(0008,0100)	SH	1C	
>>Coding Scheme Designator	(0008,0102)	SH	1C	
>>Code Meaning	(0008,0104)	LO	1	
>Text Value	(0040,A160)	UT	1C	
Input Information Sequence	(0040,4021)	SQ		
>Study Instance UID	(0020,000D)	UI	1	

>Referenced Series Sequence	(0008,1115)	SQ	1C	
>>Series Instance UID	(0020,000E)	UI	1	
>>Retrieve AE Title	(0008,0054)	AE		
>>Referenced SOP Sequence	(0008,1199)	SQ	1	
>>>Referenced SOP Class UID	(0008,1150)	UI	1	
>>>Referenced SOP Instance UID	(0008,1155)	UI	1	
Study Instance UID	(0020,000D)	UI		
Input Availability Flag	(0040,4020)	CS	1	Possible values: • COMPLETE - Complete • INCOMPLETE - Incomplete

9.1.1.4.4 Unified Procedure Step Progress Information Module

Attribute name	Tag	Vr	Type	Comment
Procedure Step State	(0074,1000)	CS		Possible values: • SCHEDULED - Scheduled • IN PROGRESS - In Progress • CANCELED - Canceled • COMPLETED - Completed

9.1.1.4.5 Transaction Module

Attribute name	Tag	Vr	Type	Comment
Transaction UID	(0008,1195)	UI	3	

9.1.2 Usage of Attributes From Received IODs

9.1.2.1 CT Image IOD

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	No
Image	General Image Module	No
	Image Plane Module	No
	Image Pixel Module	No
	Contrast/Bolus Module	No
	CT Image Module	Yes
	Multi-energy CT Image Module	No
	SOP Common Module	Yes

9.1.2.1.1 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	

9.1.2.1.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	

9.1.2.1.3 General Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Value not read
Series Instance UID	(0020,000E)	UI	1	
Series Date	(0008,0021)	DA	3	
Series Time	(0008,0031)	TM	3	
Series Description	(0008,103E)	LO	3	
Patient Position	(0018,5100)	CS	2C	Supported values: • FFDL - Feet First-Decubitus Left. • FFDR - Feet First-Decubitus Right. • FFP - Feet First-Prone. • FFS - Feet First-Supine. • HFDL - Head First-Decubitus Left • HFDR - Head First-Decubitus Right • HFP - Head First-Prone. • HFS - Head First-Supine

9.1.2.1.4 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	(0020,0052)	UI	1	

9.1.2.1.5 CT Image Module

Attribute name	Tag	Vr	Type	Comment
Image Type	(0008,0008)	CS	1	Supported values: DERIVED, SECONDARY, AXIAL, CBCT, ORIGINAL, PRIMARY.
Samples per Pixel	(0028,0002)	US	1	Value not read
Photometric Interpretation	(0028,0004)	CS	1	Value not read
Bits Allocated	(0028,0100)	US	1	Value not read
Bits Stored	(0028,0101)	US	1	Value not read
High Bit	(0028,0102)	US	1	Value not read
Rescale Intercept	(0028,1052)	DS	1	Value not read
Rescale Slope	(0028,1053)	DS	1	Value not read
Table Height	(0018,1130)	DS	3	
Patient Support Angle	(300A,0122)	DS	3	
Table Top Pitch Angle	(300A,0140)	FL	3	
Table Top Roll Angle	(300A,0144)	FL	3	
Table Top Longitudinal Position	(300A,0129)	DS	3	
Table Top Lateral Position	(300A,012A)	DS	3	

9.1.2.1.6 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	
SOP Instance UID	(0008,0018)	UI	1	

9.1.2.2 RT Image IOD

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	No
Image	General Image Module	No
	Image Pixel Module	No
	Contrast/Bolus Module	No
	Cine Module	No
	Multi-frame Module	No
	RT Image Module	Yes
	SOP Common Module	Yes
	Frame Extraction Module	No

9.1.2.2.1 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	

9.1.2.2.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	

9.1.2.2.3 RT Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Value not read
Series Instance UID	(0020,000E)	UI	1	
Series Date	(0008,0021)	DA	3	
Series Time	(0008,0031)	TM	3	

9.1.2.2.4 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	(0020,0052)	UI	1	

9.1.2.2.5 RT Image Module

Attribute name	Tag	Vr	Type	Comment
Samples per Pixel	(0028,0002)	US	1	Value not read
Photometric Interpretation	(0028,0004)	CS	1	Value not read
Bits Allocated	(0028,0100)	US	1	Value not read
Bits Stored	(0028,0101)	US	1	Value not read
High Bit	(0028,0102)	US	1	Value not read
Pixel Representation	(0028,0103)	US	1	Value not read
RT Image Label	(3002,0002)	SH	1	
Image Type	(0008,0008)	CS	1	Supported values: ORIGINAL, PRIMARY, RADIOGRAPH, CBCT_PROJECTION, DERIVED, SECONDARY, DRR, CT_PROJECTION, PORTAL.
RT Image Plane	(3002,000C)	CS	1	Value not read
Patient Support Angle	(300A,0122)	DS	3	

Table Top Pitch Angle	(300A,0140)	FL	3	
Table Top Roll Angle	(300A,0144)	FL	3	
Table Top Vertical Position	(300A,0128)	DS	3	
Table Top Longitudinal Position	(300A,0129)	DS	3	
Table Top Lateral Position	(300A,012A)	DS	3	
Patient Position	(0018,5100)	CS	1C	Supported values: • HFP - Head First-Prone. • HFS - Head First-Supine • HFDR - Head First-Decubitus Right • HFDL - Head First-Decubitus Left • FFDR - Feet First-Decubitus Right. • FFDL - Feet First-Decubitus Left. • FFP - Feet First-Prone. • FFS - Feet First-Supine.

9.1.2.2.6 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	
SOP Instance UID	(0008,0018)	UI	1	

9.1.2.3 RT Structure Set IOD

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	RT Series Module	Yes
Equipment	General Equipment Module	No
Structure Set	Structure Set Module	Yes
	ROI Contour Module	Yes
	RT ROI Observations Module	Yes
	SOP Common Module	Yes

9.1.2.3.1 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	

9.1.2.3.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	

9.1.2.3.3 RT Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Value not read
Series Instance UID	(0020,000E)	UI	1	

9.1.2.3.4 Structure Set Module

Attribute name	Tag	Vr	Type	Comment
Structure Set Label	(3006,0002)	SH	1	Value not read

Referenced Frame of Reference Sequence	(3006,0010)	SQ	3	
>Frame of Reference UID	(0020,0052)	UI	1	Value not read
>RT Referenced Study Sequence	(3006,0012)	SQ	3	
>>Referenced SOP Class UID	(0008,1150)	UI	1	Value not read
>>Referenced SOP Instance UID	(0008,1155)	UI	1	Value not read
>>RT Referenced Series Sequence	(3006,0014)	SQ	1	
>>>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	
Structure Set ROI Sequence	(3006,0020)	SQ	1	Value not read

9.1.2.3.5 ROI Contour Module

Attribute name	Tag	Vr	Type	Comment
ROI Contour Sequence	(3006,0039)	SQ	1	
>Referenced ROI Number	(3006,0084)	IS	1	
>Contour Sequence	(3006,0040)	SQ	3	
>>Contour Geometric Type	(3006,0042)	CS	1	Value not read
>>Number of Contour Points	(3006,0046)	IS	1	Value not read
>>Contour Data	(3006,0050)	DS	1	

9.1.2.3.6 RT ROI Observations Module

Attribute name	Tag	Vr	Type	Comment
RT ROI Observations Sequence	(3006,0080)	SQ	1	
>Observation Number	(3006,0082)	IS	1	Value not read
>Referenced ROI Number	(3006,0084)	IS	1	
>RT ROI Interpreted Type	(3006,00A4)	CS	2	Supported values: • INITLASERISO - Planned table position for treatment. • ACQ_ISOCENTER - Acquisition table position. • INITMATCHISO - Table position at beginning of actual registration.
>ROI Physical Properties Sequence	(3006,00B0)	SQ	3	
>>ROI Physical Property	(3006,00B2)	CS	1	Supported values: • PATSUPPORT_ANGLE - Table yaw angle. • TTOP_PITCH_ANGLE - Table pitch angle. • TTOP_ROLL_ANGLE - Table roll angle.
>>ROI Physical Property Value	(3006,00B4)	DS	1	

9.1.2.3.7 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	
SOP Instance UID	(0008,0018)	UI	1	

9.1.2.4 Spatial Registration IOD

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	General Series Module	Yes

	Spatial Registration Series Module	No
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	No
Spatial Registration	Spatial Registration Module	Yes
	Common Instance Reference Module	No
	General Reference Module	Yes
	SOP Common Module	Yes

9.1.2.4.1 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	

9.1.2.4.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	

9.1.2.4.3 General Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Value not read
Series Instance UID	(0020,000E)	UI	1	
Patient Position	(0018,5100)	CS	2C	Supported values: • HFP - Head First-Prone • HFS - Head First-Supine • HFDR - Head First-Decubitus Right • HFDL - Head First-Decubitus Left • FFDR - Feet First-Decubitus Right • FFDL - Feet First-Decubitus Left • FFP - Feet First-Prone • FFS - Feet First-Supine

9.1.2.4.4 Frame of Reference Module

Attribute name	Tag	Vr	Type	Comment
Frame of Reference UID	(0020,0052)	UI	1	

9.1.2.4.5 Spatial Registration Module

Attribute name	Tag	Vr	Type	Comment
Content Date	(0008,0023)	DA	1	Value not read
Content Time	(0008,0033)	TM	1	Value not read
Instance Number	(0020,0013)	IS	1	Value not read
Content Label	(0070,0080)	CS	1	Value not read
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	
>>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.

9.1.2.4.6 General Reference Module

Attribute name	Tag	Vr	Type	Comment

9.1.2.4.7 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	
SOP Instance UID	(0008,0018)	UI	1	

9.1.2.5 RT Ion Plan IOD

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	RT Series Module	Yes
Frame of Reference	Frame of Reference Module	No
Equipment	General Equipment Module	Yes
Plan	RT General Plan Module	Yes
	RT Patient Setup Module	Yes
	RT Fraction Scheme Module	Yes
	RT Ion Beams Module	Yes
	SOP Common Module	Yes

9.1.2.5.1 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	

9.1.2.5.2 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	
Study Description	(0008,1030)	LO	3	

9.1.2.5.3 RT Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Value not read
Series Instance UID	(0020,000E)	UI	1	

9.1.2.5.4 General Equipment Module

Attribute name	Tag	Vr	Type	Comment

Software Versions	(0018,1020)	LO	3	Used in checksum validation. Checksum is validated if plan is newer than 9.1.0.0

9.1.2.5.5 RT General Plan Module

Attribute name	Tag	Vr	Type	Comment
RT Plan Label	(300A,0002)	SH	1	
RT Plan Geometry	(300A,000C)	CS	1	Value not read

9.1.2.5.6 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	Supported values: • HFS - Head First-Supine • HFP - Head First-Prone. • FFS - Feet First-Supine. • FFP - Feet First-Prone.
>Table Top Vertical Setup Displacement	(300A,01D2)	DS	3	
>Table Top Longitudinal Setup Displacement	(300A,01D4)	DS	3	
>Table Top Lateral Setup Displacement	(300A,01D6)	DS	3	

9.1.2.5.7 RT Fraction Scheme Module

Attribute name	Tag	Vr	Type	Comment
Fraction Group Sequence	(300A,0070)	SQ	1	
>Fraction Group Number	(300A,0071)	IS	1	Value not read
>Number of Fractions Planned	(300A,0078)	IS	2	
>Number of Beams	(300A,0080)	IS	1	Value not read
>Referenced Beam Sequence	(300C,0004)	SQ	1C	
>>Referenced Beam Number	(300C,0006)	IS	1	Value not read
>Number of Brachy Application Setups	(300A,00A0)	IS	1	Value not read

9.1.2.5.8 RT Ion Beams Module

Attribute name	Tag	Vr	Type	Comment
Ion Beam Sequence	(300A,03A2)	SQ	1	
>Beam Number	(300A,00C0)	IS	1	
>Beam Name	(300A,00C2)	LO	1	
>Beam Type	(300A,00C4)	CS	1	
>Radiation Type	(300A,00C6)	CS	1	Supported values: PHOTON, PROTON, ION.
>Scan Mode	(300A,0308)	CS	1	
>Treatment Machine Name	(300A,00B2)	SH	2	
>Primary Dosimeter Unit	(300A,00B3)	CS	1	Value not read
>Referenced Tolerance Table Number	(300C,00A0)	IS	3	
>Virtual Source-Axis Distances	(300A,030A)	FL	1	Value not read
>Referenced Patient Setup Number	(300C,006A)	IS	3	
>Treatment Delivery Type	(300A,00CE)	CS	1	Supported values: TREATMENT, SETUP.
>Number of Wedges	(300A,00D0)	IS	1	
>Number of Compensators	(300A,00E0)	IS	1	
>Ion Range Compensator Sequence	(300A,02EA)	SQ	1C	

>>Compensator Number	(300A,00E4)	IS	1	
>>Compensator ID	(300A,00E5)	SH	3	
>>Compensator Divergence	(300A,02E0)	CS	1	Value not read
>>Compensator Mounting Position	(300A,02E1)	CS	1	Value not read
>>Compensator Rows	(300A,00E7)	IS	1	Value not read
>>Compensator Columns	(300A,00E8)	IS	1	Value not read
>>Compensator Pixel Spacing	(300A,00E9)	DS	1	Value not read
>>Compensator Position	(300A,00EA)	DS	1	Value not read
>>Compensator Thickness Data	(300A,00EC)	DS	1	Value not read
>Number of Boli	(300A,00ED)	IS	1	
>Referenced Bolus Sequence	(300C,00B0)	SQ	1C	
>>Referenced ROI Number	(3006,0084)	IS	1	
>Number of Blocks	(300A,00F0)	IS	1	
>Ion Block Sequence	(300A,03A6)	SQ	1C	
>>Isocenter to Block Tray Distance	(300A,00F7)	FL	1	Value not read
>>Block Type	(300A,00F8)	CS	1	Value not read
>>Block Divergence	(300A,00FA)	CS	1	Value not read
>>Block Mounting Position	(300A,00FB)	CS	1	Value not read
>>Block Number	(300A,00FC)	IS	1	
>>Block Thickness	(300A,0100)	DS	1	Value not read
>>Block Number of Points	(300A,0104)	IS	1	Value not read
>>Block Data	(300A,0106)	DS	1	Value not read
>Snout Sequence	(300A,030C)	SQ	3	
>>Snout ID	(300A,030F)	SH	1	
>Applicator Sequence	(300A,0107)	SQ	3	
>>Applicator ID	(300A,0108)	SH	1	
>>Applicator Type	(300A,0109)	CS	1	
>Number of Range Shifters	(300A,0312)	IS	1	
>Range Shifter Sequence	(300A,0314)	SQ	1C	
>>Range Shifter Number	(300A,0316)	IS	1	
>>Range Shifter ID	(300A,0318)	SH	1	
>>Range Shifter Type	(300A,0320)	CS	1	Value not read
>Number of Lateral Spreading Devices	(300A,0330)	IS	1	
>Lateral Spreading Device Sequence	(300A,0332)	SQ	1C	
>>Lateral Spreading Device Number	(300A,0334)	IS	1	
>>Lateral Spreading Device ID	(300A,0336)	SH	1	
>>Lateral Spreading Device Type	(300A,0338)	CS	1	Value not read
>Number of Range Modulators	(300A,0340)	IS	1	
>Range Modulator Sequence	(300A,0342)	SQ	1C	
>>Range Modulator Number	(300A,0344)	IS	1	
>>Range Modulator ID	(300A,0346)	SH	1	Value not read
>>Range Modulator Type	(300A,0348)	CS	1	
>>Beam Current Modulation ID	(300A,034C)	SH	1C	
>Patient Support Type	(300A,0350)	CS	1	

>Number of Control Points	(300A,0110)	IS	1	
>Ion Control Point Sequence	(300A,03A8)	SQ	1	
>>Control Point Index	(300A,0112)	IS	1	
>>Nominal Beam Energy	(300A,0114)	DS	1C	
>>Ion Wedge Position Sequence	(300A,03AC)	SQ	1C	
>>>Referenced Wedge Number	(300C,00C0)	IS	1	
>>>Wedge Position	(300A,0118)	CS	1	
>>>Wedge Thin Edge Position	(300A,00DB)	FL	1C	
>>Range Shifter Settings Sequence	(300A,0360)	SQ	1C	
>>>Referenced Range Shifter Number	(300C,0100)	IS	1	
>>>Range Shifter Setting	(300A,0362)	LO	1	
>>Lateral Spreading Device Settings Sequence	(300A,0370)	SQ	1C	
>>>Referenced Lateral Spreading Device Number	(300C,0102)	IS	1	
>>>Lateral Spreading Device Setting	(300A,0372)	LO	1	
>>Range Modulator Settings Sequence	(300A,0380)	SQ	1C	
>>>Referenced Range Modulator Number	(300C,0104)	IS	1	
>>>Range Modulator Gating Start Value	(300A,0382)	FL	1C	
>>>Range Modulator Gating Stop Value	(300A,0384)	FL	1C	
>>Gantry Angle	(300A,011E)	DS	1C	
>>Gantry Rotation Direction	(300A,011F)	CS	1C	
>>Gantry Pitch Rotation Direction	(300A,014C)	CS	2C	
>>Beam Limiting Device Angle	(300A,0120)	DS	1C	
>>Beam Limiting Device Rotation Direction	(300A,0121)	CS	1C	
>>Scan Spot Tune ID	(300A,0390)	SH	1C	
>>Number of Scan Spot Positions	(300A,0392)	IS	1C	
>>Scan Spot Position Map	(300A,0394)	FL	1C	
>>Scanning Spot Size	(300A,0398)	FL	3	
>>Number of Paintings	(300A,039A)	IS	1C	
>>Patient Support Angle	(300A,0122)	DS	1C	
>>Patient Support Rotation Direction	(300A,0123)	CS	1C	
>>Table Top Pitch Angle	(300A,0140)	FL	2C	
>>Table Top Pitch Rotation Direction	(300A,0142)	CS	2C	
>>Table Top Roll Angle	(300A,0144)	FL	2C	
>>Table Top Roll Rotation Direction	(300A,0146)	CS	2C	
>>Table Top Vertical Position	(300A,0128)	DS	2C	
>>Table Top Longitudinal Position	(300A,0129)	DS	2C	
>>Table Top Lateral Position	(300A,012A)	DS	2C	
>>Snout Position	(300A,030D)	FL	2C	
>>Isocenter Position	(300A,012C)	DS	2C	
>RaySearch Private Creator	(4001,0010)	LO	3	RAYSEARCHLABS 2.0
>Internal Treatment Machine Name	(4001,1012)	SH	3	RaySearch Private tag. The internal treatment machine name. This value will differ from Treatment Machine Name (300A,00B2) if a treatment machine name alias have been specified on the ion beam quality.

9.1.2.5.9 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	
SOP Instance UID	(0008,0018)	UI	1	
RaySearch Private Creator	(4001,0010)	LO	3	RAYSEARCHLABS 2.0
RaySearch Checksum Algorithm Version	(4001,1060)	LO	3	RaySearch checksum algorithm version used to calculate the checksum of the plan.
RaySearch Checksum Data	(4001,1061)	OB	3	RaySearch custom checksum calcuation specific for the current checksum alogorithm version.

9.1.2.6 RT Ion Beams Treatment Record IOD

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	RT Series Module	Yes
Equipment	General Equipment Module	No
Treatment Record	RT General Treatment Record Module	Yes
	RT Treatment Machine Record Module	Yes
	RT Ion Beams Session Record Module	Yes
	SOP Common Module	Yes
	Common Instance Reference Module	Yes

9.1.2.6.1 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	

9.1.2.6.2 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	

9.1.2.6.3 RT Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Value not read
Series Instance UID	(0020,000E)	UI	1	

9.1.2.6.4 RT General Treatment Record Module

Attribute name	Tag	Vr	Type	Comment
Instance Number	(0020,0013)	IS	1	Value not read
Treatment Date	(3008,0250)	DA	2	
Treatment Time	(3008,0251)	TM	2	
Referenced RT Plan Sequence	(300C,0002)	SQ	2	
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	

9.1.2.6.5 RT Treatment Machine Record Module

Attribute name	Tag	Vr	Type	Comment

Treatment Machine Sequence	(300A,0206)	SQ	1	
>Treatment Machine Name	(300A,00B2)	SH	2	

9.1.2.6.6 RT Ion Beams Session Record Module

Attribute name	Tag	Vr	Type	Comment
Primary Dosimeter Unit	(300A,00B3)	CS	1	Unit used for both primary and secondary meterset. Supported value: • MU - Monitor Unit
Treatment Session Ion Beam Sequence	(3008,0021)	SQ	1	
>Referenced Beam Number	(300C,0006)	IS	1	
>Beam Name	(300A,00C2)	LO	1	
>Beam Type	(300A,00C4)	CS	1	Value not read
>Radiation Type	(300A,00C6)	CS	1	Value not read
>Scan Mode	(300A,0308)	CS	1	Value not read
>Number of Wedges	(300A,00D0)	IS	1	Value not read
>Number of Compensators	(300A,00E0)	IS	1	Value not read
>Recorded Compensator Sequence	(3008,00C0)	SQ	1C	
>>Referenced Compensator Number	(300C,00D0)	IS	1	Value not read
>Number of Boli	(300A,00ED)	IS	1	Value not read
>Number of Blocks	(300A,00F0)	IS	1	Value not read
>Recorded Snout Sequence	(3008,00F0)	SQ	1C	
>>Snout ID	(300A,030F)	SH	1	
>Number of Range Shifters	(300A,0312)	IS	1	Value not read
>Number of Lateral Spreading Devices	(300A,0330)	IS	1	Value not read
>Number of Range Modulators	(300A,0340)	IS	1	Value not read
>Patient Support Type	(300A,0350)	CS	1	Value not read
>Current Fraction Number	(3008,0022)	IS	2	
>Treatment Delivery Type	(300A,00CE)	CS	2	Supported values: • TREATMENT - Normal patient treatment • SETUP - No treatment beam is applied for this RT Beam. To be used for specifying the gantry, couch, and other machine positions where X-Ray set-up images or measurements are to be taken. • CONTINUATION - continuation of interrupted treatment
>Treatment Termination Status	(3008,002A)	CS	1	Supported values: • NORMAL - treatment terminated normally • OPERATOR - operator terminated treatment • MACHINE - machine terminated treatment • UNKNOWN - status at termination unknown
>Specified Primary Meterset	(3008,0032)	DS	3	
>Specified Secondary Meterset	(3008,0033)	DS	3	
>Delivered Primary Meterset	(3008,0036)	DS	3	
>Delivered Secondary Meterset	(3008,0037)	DS	3	
>Specified Treatment Time	(3008,003A)	DS	3	
>Delivered Treatment Time	(3008,003B)	DS	3	
>Number of Control Points	(300A,0110)	IS	1	Value not read
>Ion Control Point Delivery Sequence	(3008,0041)	SQ	1	

>>Referenced Control Point Index	(300C,00F0)	IS	1	Value not read
>>Treatment Control Point Date	(3008,0024)	DA	1	Value not read
>>Treatment Control Point Time	(3008,0025)	TM	1	Value not read
>>Delivered Meterset	(3008,0044)	DS	1	Value not read
>>Gantry Angle	(300A,011E)	DS	1C	
>>Patient Support Angle	(300A,0122)	DS	1C	
>>Table Top Pitch Angle	(300A,0140)	FL	2C	
>>Table Top Roll Angle	(300A,0144)	FL	2C	
>>Table Top Vertical Position	(300A,0128)	DS	2C	
>>Table Top Longitudinal Position	(300A,0129)	DS	2C	
>>Table Top Lateral Position	(300A,012A)	DS	2C	
>>Snout Position	(300A,030D)	FL	2C	

9.1.2.6.7 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	
SOP Instance UID	(0008,0018)	UI	1	

9.1.2.6.8 Common Instance Reference Module

Attribute name	Tag	Vr	Type	Comment
Referenced Series Sequence	(0008,1115)	SQ	1C	
>Series Instance UID	(0020,000E)	UI	1	Used to find the series of the Referenced RT Plan (300C,0002).
>Referenced Instance Sequence	(0008,114A)	SQ	1	
>>Referenced SOP Class UID	(0008,1150)	UI	1	Used to find the series of the Referenced RT Plan (300C,0002).
>>Referenced SOP Instance UID	(0008,1155)	UI	1	Used to find the series of the Referenced RT Plan (300C,0002).

9.1.2.7 RT Beams Delivery InstructionRETIRED IOD

IE	Module	Used
Patient	Patient Module	No
	Clinical Trial Subject Module	No
Study	General Study Module	Yes
	Patient Study Module	No
	Clinical Trial Study Module	No
Series	General Series Module	Yes
	Clinical Trial Series Module	No
Equipment	General Equipment Module	No
Plan	RT Beams Delivery Instruction Module	Yes
	Common Instance Reference Module	No
	General Reference Module	No
	SOP Common Module	Yes

9.1.2.7.1 General Study Module

Attribute name	Tag	Vr	Type	Comment
Study Instance UID	(0020,000D)	UI	1	

9.1.2.7.2 General Series Module

Attribute name	Tag	Vr	Type	Comment

Modality	(0008,0060)	CS	1	Value not read
Series Instance UID	(0020,000E)	UI	1	

9.1.2.7.3 RT Beams Delivery Instruction Module

Attribute name	Tag	Vr	Type	Comment
Beam Task Sequence	(0074,1020)	SQ	1	
>Beam Task Type	(0074,1022)	CS	1	Value not read
>Treatment Delivery Type	(300A,00CE)	CS	1	Supported values: TREATMENT, CONTINUATION.
>Continuation Start Meterset	(0074,0120)	FD	1C	
>Continuation End Meterset	(0074,0121)	FD	1C	
>Current Fraction Number	(3008,0022)	IS	1	Value not read
>Referenced Beam Number	(300C,0006)	IS	1	
Omitted Beam Task Sequence	(300C,0111)	SQ	3	
>Referenced Beam Number	(300C,0006)	IS	1	
>Reason for Omission	(300C,0112)	CS	1	Value not read

9.1.2.7.4 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	
SOP Instance UID	(0008,0018)	UI	1	

9.1.2.8 Unified Procedure StepRETIRED IOD

IE	Module	Used
Unified Procedure Step	SOP Common Module	Yes
	Unified Procedure Step Relationship Module	Yes
	Unified Procedure Step Scheduled Procedure Information Module	Yes
	Unified Procedure Step Progress Information Module	Yes
	Unified Procedure Step Performed Procedure Information Module	No
	Patient Demographic Module	No
	Patient Medical Module	No
	Visit Identification Module	No
	Visit Status Module	No
	Visit Admission Module	No
	Transaction Module	Yes

9.1.2.8.1 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	Value not read
SOP Instance UID	(0008,0018)	UI	1	
Timezone Offset From UTC	(0008,0201)	SH	3	

9.1.2.8.2 Unified Procedure Step Relationship Module

Attribute name	Tag	Vr	Type	Comment
Patient's Name	(0010,0010)	PN		
Patient ID	(0010,0020)	LO		

9.1.2.8.3 Unified Procedure Step Scheduled Procedure Information Module

Attribute name	Tag	Vr	Type	Comment
Scheduled Station Name Code Sequence	(0040,4025)	SQ		
>Code Value	(0008,0100)	SH	1C	
>Coding Scheme Designator	(0008,0102)	SH	1C	
>Code Meaning	(0008,0104)	LO	1	Value not read
Scheduled Procedure Step Start DateTime	(0040,4005)	DT		
Scheduled Workitem Code Sequence	(0040,4018)	SQ		
>Code Value	(0008,0100)	SH	1C	
>Coding Scheme Designator	(0008,0102)	SH	1C	
>Code Meaning	(0008,0104)	LO	1	
Input Availability Flag	(0040,4020)	CS	1	Value not read

9.1.2.8.4 Unified Procedure Step Progress Information Module

Attribute name	Tag	Vr	Type	Comment
Procedure Step State	(0074,1000)	CS		
Procedure Step Progress Information Sequence	(0074,1002)	SQ		
>Procedure Step Progress	(0074,1004)	DS		
>Procedure Step Progress Description	(0074,1006)	ST		

9.1.2.8.5 Transaction Module

Attribute name	Tag	Vr	Type	Comment
Transaction UID	(0008,1195)	UI	3	

9.1.3 Attribute Mapping

Not applicable

9.1.4 Coerced/Modified Fields

Not applicable

9.2 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
RaySearch Private Creator	(4001,0010)	LO	1	RAYSEARCHLABS 2.0

9.3 CODE TERMINOLOGY AND TEMPLATES

Not applicable

9.4 GRAYSCALE IMAGE CONSISTENCY

Not applicable

9.5 STANDARD EXTENDED/SPECIALIZED/PRIVATE SOP CLASSES

9.5.1 Standard extended SOP Class

9.5.1.1 RT Ion Plan IOD

Attribute name	Tag	Vr	Type	Comment
Ion Beam Sequence	(300A,03A2)	SQ	1	
>Planned Verification Image Sequence	(300A,00CA)	SQ	3	
>>Imaging Device-Specific Acquisition Parameters	(300A,00CC)	LO	3	

9.5.2 Specialized SOP Class

Not applicable

9.5.3 Private SOP Class

Not applicable

9.6 PRIVATE TRANSFER SYNTAXES

Not applicable

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