# RAYCARE V2025

DICOM Conformance Statement Accuray CyberKnife

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CE 2862

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# 1 OVERVIEW

This document specifies the DICOM interface for the RaySearch Laboratories RayCare treatment management system driver for use with external treatment delivery devices. The driver can export DICOM data associated with a treatment delivery session to the treatment delivery device, as well accept, validate, and store DICOM data related to patient positioning and treatment delivery results received from the treatment delivery device.

## 1.1 NETWORK SERVICES

| SOP Class Name | SOP Class UID | Provider of Service (SCP) | User of Service (SCU) |
|---|---|---|---|
| Transfer | | | |
| RT Plan Storage | 1.2.840.10008.5.1.4.1.1.481.5 | Yes | No |
| RT Beams Delivery Instruction Storage - Trial (Retired) | 1.2.840.10008.5.1.4.34.1 | Yes | No |
| CT Image Storage | 1.2.840.10008.5.1.4.1.1.2 | Yes | No |
| RT Beams Treatment Record Storage | 1.2.840.10008.5.1.4.1.1.481.4 | 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 |
| Study Root Query/Retrieve Information Model - MOVE | 1.2.840.10008.5.1.4.1.2.2.2 | 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 |
|---|---|---|
| 2025-06-18 | 1.0 | Accuray CyberKnife Driver DCS for RayCare v2025 |

## 3.2 AUDIENCE

This document is written for users that need to understand how the RayCare Accuray CyberKnife driver (hereafter referred to simply as "the 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.

## 3.3 REMARKS

The scope of this DICOM Conformance Statement is to facilitate integration between the driver 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 shall not replace validation with other DICOM equipment to ensure proper exchange of intended information. In fact, it is the user's responsibility to perform the following validation activities:
    - The comparison of Conformance Statements from the driver and other DICOM conformant equipment is the first step towards assessing interconnectivity and interoperability between those systems.
    - Test procedures shall be defined and executed to validate the required level of interoperability with specific DICOM conformant equipment, as established by the healthcare facility.

RaySearch is also active within the IHE-RO. Contact RaySearch for more information regarding adherence to IHE-RO profiles.

### 3.3.1 DICOM revision

The module tables listed in the last two chapters are based on part 3 of the DICOM-standard edition 2024c. For extra clarity all attributes in the referenced modules have been listed, even the ones that are not used by the driver.

## 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 definitions 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.

### 3.4.1 RayCare specific terminology

Some terminology used in this Conformance Statement refers to internal concepts used within the application. This section contains a description of these terms.

**Beam set** – Another name for an RT Plan.

**TPS plan** – refers to an RT Plan or RT Ion Plan as created by a Treatment Planning System, e.g. RayStation.

**Delivery plan** – refers to an RT Plan or RT Ion Plan generated by the driver. The plan is generated by taking a TPS plan as input and do some modifications/updates to reflect the current state of the plan in RayCare. Examples of modification are updates dose reference information for nominal dose tracking and setting of absolute table top positions.

**Session** – A session is one visit of the patient for treatment, typically from when the patient enters the treatment room to when they leave the treatment room. In practice, an Appointment is scheduled for each Treatment Session.

**Fraction delivery** – One or more Fraction Deliveries are treated during a Session. A fraction delivery entails either a nominal or continuation treatment for a specific RT Plan.

**Fraction number** – This is referring to the fraction number in the treatment series. A Treatment series can contain different RT Plans.

**Fraction number in beam set** – The fraction number within a RT Plan.

## 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 perform a 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 specifies a number of network services and types of information objects, each of which is called an Abstract Syntax for the Negotiation. DICOM also specifies 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 |
| AET | Application Entity Title |
| 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 |
| 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 |
| UPS | Unified Procedure Step |

## 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 data flow between the driver and the specific TDD.

## 4.1 IMPLEMENTATION MODEL

### 4.1.1 Application data flow

The diagram displayed in Figure 1 illustrates the application data flow between the driver and the treatment delivery device.

The scenario starts with a C-FIND query for Unified Procedure Steps from the treatment delivery device. The treatment delivery device can then take responsibility for the UPS by setting it to IN PROGRESS. Once the UPS is IN PROGRESS, the driver will only allow requests corresponding to the current session until the session has been completed by the treatment delivery device.

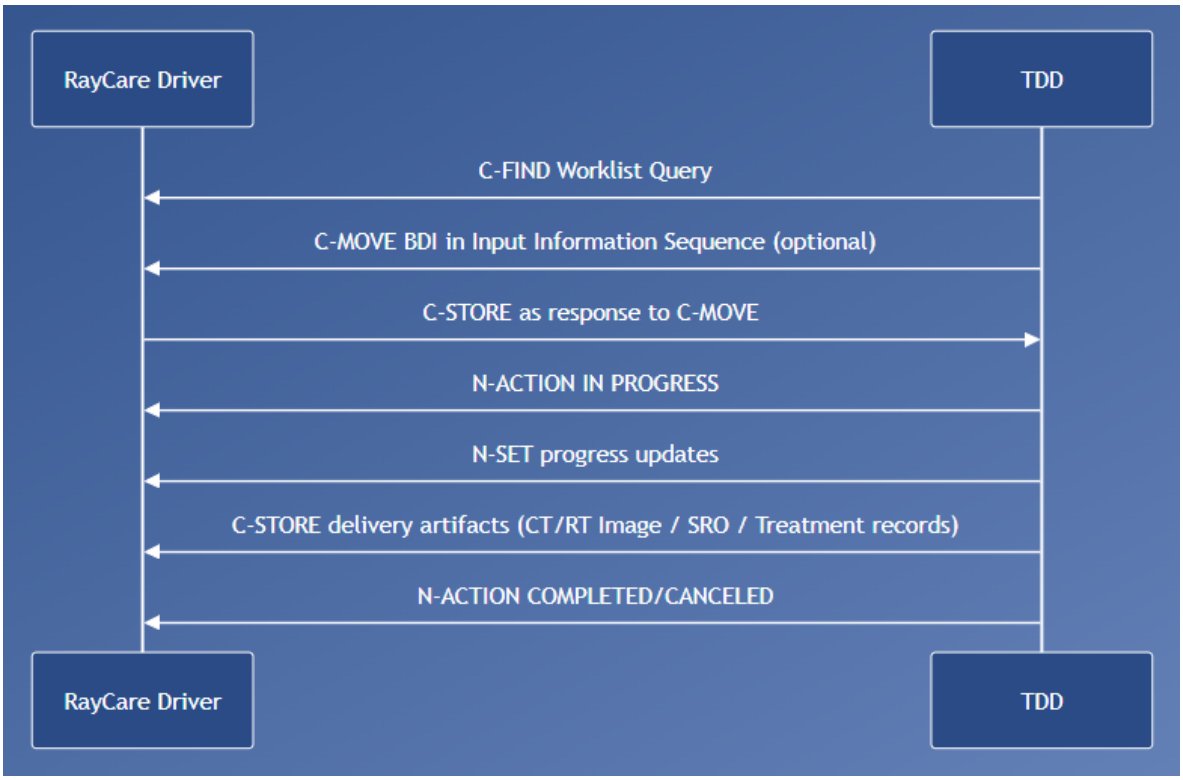


**Figure 1**

### 4.1.2 Functional Definition of AEs

#### 4.1.2.1 Functional Definition of the driver Application Entity

The driver Application Entity resides on a workstation that is connected to RayCare. It is a Windows Service which starts up when the workstation on which it resides is started and runs continuously until the workstation is shut down or the service is stopped via services management console. The driver waits for a remote Application Entity to request an association. The driver Application Entity (RAYSEARCH_TX) accepts the association if the proposed context is valid and supported. The driver waits for C-ECHO, C-FIND, N-ACTION, C-STORE and N-SET commands from the remote Application Entity. The associations are maintained by the driver until the remote Application Entity initiates the release process or an abort. The following operations are supported:

**Verification**

- C-ECHO for connection verification

**Unified Procedure Step - Push**

- N-ACTION for UPS status changes.
- N-SET for progress update.

**Unified Procedure Step - Pull**

- C-FIND for worklist query.

**RT Beams Delivery Instructions**

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

**RT Plan/RT Ion Plan**

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

**RT Beams Treatment Record/RT Ion Beams Treatment Record**

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

**CT Image**

- C-MOVE for planning CT images.

**RT Structure Set**

- C-MOVE for planning RT Structure Set.

**Other delivery artifacts**

- C-STORE can be done for any SOP Class supported by the RayCare PACS. They will be forwarded as is to the PACS.

## 4.1.3 Sequence of Real World Activities

### 4.1.3.1 Prepare session

Once the session is opened in RayCare Treatment UI the Unified Procedure Step will be created and available for Worklist queries.

### 4.1.3.2 Session delivery

The driver Application Entity does not control the sequence, but it expects the requests to be sent in a certain order. The different activities and their sequencing are described below.

1. C-FIND to get the worklist that consists of zero or many unified procedure steps
    - Request: *Study Root Query/Retrieve Information Model – FIND*
    - Response: Zero or more Unified Procedure Steps (UPS)
2. C-MOVE to get RT Beams Delivery Instruction
    - Options: can be done before or after the UPS is set to *IN PROGRESS*, or skipped if not required by SCU.
    - Request: *Study Root Query/Retrieve Information Model – MOVE*. The requested instances shall be listed in at least one UPS. The following attributes must be included in the request:
        - Query/Retrieve Level (0008,0052) - Needs to be IMAGE
        - SOP Instance UID (0008,0018)
    - Response: The requested RT Beams Delivery Instruction instance
3. C-MOVE to get RT Beams Treatment Record or RT Ion Beams Treatment Record for previous deliveries
    - Options: can be done before or after the UPS is set to *IN PROGRESS*, or skipped if not required by SCU.
    - Request: *Study Root Query/Retrieve Information Model – MOVE*. The requested instances shall be listed in at least one UPS. The following attributes must be included in the request:
        - Query/Retrieve Level (0008,0052) - Needs to be IMAGE
        - SOP Instance UID (0008,0018)
    - Response: The requested Treatment Record
4. C-MOVE to get images referenced in the UPS Input Information Sequence (0040,4021)
    - Options: can be done before or after the UPS is set to *IN PROGRESS*, or skipped if not required by SCU.
    - Request: *Study Root Query/Retrieve Information Model – MOVE*. The requested instances shall be listed in at least one UPS. The following attributes must be included in the request:
        - Query/Retrieve Level (0008,0052) - Needs to be SERIES
        - Series Instance UID (0008,0018)
    - Response: All instances in the requested image series
5. C-MOVE to get other items listed in the UPS Input Information Sequence (0040,4021)
    - Options: can be done before or after the UPS is set to *IN PROGRESS*.
    - Request: *Study Root Query/Retrieve Information Model – MOVE*.
        - Query/Retrieve Level (0008,0052) - Needs to be IMAGE
        - SOP Instance UID (0008,0018)
    - Response: The requested instance
6. N-ACTION to claim UPS and set it to *IN PROGRESS*

- Request: *UPS Push SOP Class*. The following attributes shall be included in the request in addition to the command attributes defined in the DICOM standard:
  - Procedure Step State (0074,1000) - shall have value *IN PROGRESS*
- Response: *UPS Push SOP Class*. If the response status is anything other than successful, it is expected that the TDD does not allow delivery.
  - Transaction UID (0008,1195) - Generated 'Locking UID'. No other actor is allowed to update the UPS if the N-Action request is accepted.
  - Procedure Step State (0074,1000) - confirmation of the current state

7. *[Conditional]* If the TDD determines that the delivery can not be performed after an UPS has been set to *IN PROGRESS*, the UPS can be canceled using a N-ACTION command
   - Request: *UPS Push SOP Class*. The following attributes shall be included in the request in addition to the command attributes defined in the DICOM standard:
     - Transaction UID (0008,1195) - Must match 'Locking UID' from when UPS was set to *IN PROGRESS*
     - Procedure Step State (0074,1000) - shall have value *CANCELED*
   - Response: *UPS Push SOP Class*
     - Transaction UID (0008,1195) - confirmation of the 'Locking UID'
     - Procedure Step State (0074,1000) - confirmation of the current state
8. N-SET with progress update sent from TDD to driver.
   - At least a N-SET with progress 0 to indicate that work is about to start is required.
   - If delivery completes as intended a N-SET with progress 100 to indicate that work finished is required.
   - If N-SET is sent for UPS not in state *IN PROGRESS*, the driver responds with an error status code.
   - Request: *UPS Push SOP Class*. The following attributes shall be included in the request in addition to the command attributes defined in the DICOM standard:
     - Transaction UID (0008,1195) - Must match 'Locking UID' from when UPS was set to *IN PROGRESS*
     - Procedure Step Progress Information Sequence (0074,1002)
       - Procedure Step Progress (0074,1004) - will be logged in TMS as progress. Does not need to be related to delivered meterset.
       - *Optional:* Procedure Step Progress Description (0074,1006) - will be logged in TMS as progress description.
       - *Optional:* Procedure Step Progress Parameters Sequence (0074,1007) - If an item with concept 'Referenced Beam Number' is included it will be logged in TMS as beam in progress.
   - Response: *UPS Push SOP Class*
     - Transaction UID (0008,1195) - confirmation of 'Locking UID'
     - Procedure Step Progress Information Sequence (0074,1002)
       - Procedure Step Progress (0074,1004) - confirmation of progress.
       - *Optional:* Procedure Step Progress Description (0074,1006) - confirmation of description.
       - *Optional:* Procedure Step Progress Parameters Sequence (0074,1007) - Confirmation of 'Referenced Beam Number'.
9. C-STORE of delivery artifacts can be sent at any time. Other delivery artifacts than the ones listed below can be sent to the driver. They will be forwarded to the RayCare PACS but they will not be linked to the session. The following artifacts can be stored and linked to session delivery:
   - CT Image Storage
   - Spatial Registration Storage
   - RT Beams Treatment Record Storage
10. N-ACTION to set UPS as *COMPLETED*
    - Request: *UPS Push SOP Class*. The following attributes shall be included in the request in addition to the command attributes defined in the DICOM standard:
      - Transaction UID (0008,1195) - Must match 'Locking UID' from when UPS was set to *IN PROGRESS*
      - Procedure Step State (0074,1000) - shall have value *COMPLETED*
    - Response: *UPS Push SOP Class*. If the response status is anything other than successful, it is expected that the TDD does not allow delivery.
      - Transaction UID (0008,1195) - confirmation of the 'Locking UID'
      - Procedure Step State (0074,1000) - confirmation of the current state

*Note: For all N-ACTION and N-SET commands described above, the UPS-Pull SOP Class is negotiated as the Abstract Syntax, but the UPS-Push SOP Class is used as the Requested SOP Class UID the UPS in all subsequent DIMSE messaging.*

#### 4.1.3.3 Manual cancellation

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

#### 4.1.3.4 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 FUNCTIONAL DEFINITION OF AE:

### 4.2.1 Driver Application Entity

#### 4.2.1.1 SOP Classes

| SOP Class Name | SOP Class UID | Provider of Service (SCP) | User of Service (SCU) |
|---|---|---|---|
| Transfer | | | |
| RT Plan Storage | 1.2.840.10008.5.1.4.1.1.481.5 | Yes | No |
| RT Beams Delivery Instruction Storage - Trial (Retired) | 1.2.840.10008.5.1.4.34.1 | Yes | No |
| CT Image Storage | 1.2.840.10008.5.1.4.1.1.2 | Yes | No |
| RT Beams Treatment Record Storage | 1.2.840.10008.5.1.4.1.1.481.4 | 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 |
| Study Root Query/Retrieve Information Model - MOVE | 1.2.840.10008.5.1.4.1.2.2.2 | 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 |

#### 4.2.1.4 Number of Associations

Any number of incoming concurrent associations are accepted.

#### 4.2.1.5 Asynchronous Nature

The 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 | 1.2.752.243.2 |
| Implementation Version Name | fo-dicom 5.1.3 |

#### 4.2.1.8 Accepted Transfer Syntaxes

The Transfer Syntaxes accepted for each activity is described in the respective section below. Other Transfer Syntaxes might be supported. For questions about other supported values, please contact RaySearch Laboratories.

#### 4.2.1.9 Activity C-ECHO

##### 4.2.1.9.1 Description and Sequencing of Activities

See C-ECHO in the DICOM standard, PS3.7 Chapter 9 http://dicom.nema.org/medical/dicom/current/output/chtml/part07/chapter_9.html

##### 4.2.1.9.2 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 | | |

#### 4.2.1.10 Activity C-FIND

##### 4.2.1.10.1 Description and Sequencing of Activities

See C-FIND in the DICOM standard, PS3.7 Chapter 9 http://dicom.nema.org/medical/dicom/current/output/chtml/part07/chapter_9.html

##### 4.2.1.10.2 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 | | |
| 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 | | |

##### 4.2.1.10.3 SOP Specific Conformance for Query SOP Classes - Worklist query

For C-FINDs for Unified Procedure Steps the matching is done as described below.

| Attribute Name | Tag | VR | Types of Matching | Comment |
|---|---|---|---|---|
| Procedure Step State | (0074,1000) | CS | S | The value *SCHEDULED* is required. |
| Scheduled Station Name Code Sequence | (0040,4025) | SQ | SQ | A sequence with a single item is required. |
| > Code Value | (0008,0100) | SH | S | The name of the device that the UPS must be assigned to |
| Scheduled Procedure Step Start Date and Time | (0040,4005) | DT | R | The date time is expressed in local driver time. |

The table should be read as follows:

**Types of matching** (See section C.2.2.2 "Attribute Matching" in PS3.4; https://dicom.nema.org/medical/dicom/current/output/chtml/part04/sect_C.2.2.2.html):

**S** - Indicates the identifier attributes uses Single Value Matching.

**SQ** - Indicates the identifier attributes uses Sequence Matching.

**R** - Indicates Range Matching.

The returned Query Keys are described in the Created SOP Instance(s) section.

#### 4.2.1.11 Activity C-MOVE

##### 4.2.1.11.1 Description and Sequencing of Activities

See C-MOVE in the DICOM standard, PS3.7 Chapter 9 http://dicom.nema.org/medical/dicom/current/output/chtml/part07/chapter_9.html

##### 4.2.1.11.2 Accepted Presentation Context

| Abstract Syntax Name | Abstract Syntax UID | Transfer Syntax name | Transfer Syntax UID | Role | Extended Negotiation |
|---|---|---|---|---|---|
| RT Beams Delivery Instruction Storage - Trial (Retired) | 1.2.840.10008.5.1.4.34.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | | |
| 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 | | |

#### 4.2.1.12 Activity C-STORE

##### 4.2.1.12.1 Description and Sequencing of Activities

The driver accepts storage requests for any artifacts created during a treatment. All received datasets will be archived in the RayCare PACS by the driver. For the SOP Classes listed in the table below, the datasets will also be linked to the current session delivery.

See C-STORE in the DICOM standard, PS3.7 Chapter 9
http://dicom.nema.org/medical/dicom/current/output/chtml/part07/chapter_9.html

##### 4.2.1.12.2 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 | | |
| 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 | | |
| 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 | | |
| 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 | | |
| RT Beams Treatment Record Storage | 1.2.840.10008.5.1.4.1.1.481.4 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | | |

| | | | | | |
|---|---|---|---|---|---|
| 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 | | |

#### 4.2.1.12.3 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 | |

### 4.2.1.13 Activity N-ACTION

#### 4.2.1.13.1 Description and Sequencing of Activities

See N-ACTION in the DICOM standard, PS3.7 Chapter 10
https://dicom.nema.org/medical/dicom/current/output/chtml/part07/chapter_10.html

#### 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 - Push SOP Class - Trial (Retired) | 1.2.840.10008.5.1.4.34.4.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | | |

#### 4.2.1.13.3 SOP Specific Conformance for Status Change

If the Requested SOP Class UID (0000,0003) is *Unified Procedure Step - Push SOP Class - Trial*, the Requested SOP Instance UID (0000,1001) matches an existing UPS and Action Type ID (0000,1008) has value "1", the status change is done as described below.

| Attribute Name | Tag | VR | Comment |
|---|---|---|---|
| Procedure Step State | (0074,1000) | CS | Either of the values below are supported:<br>• IN PROGRESS<br>• CANCELED<br>• COMPLETED |
| Transaction UID | (0008,1195) | UI | Value is generated by the Driver when a N-ACTION request sets the UPS to IN PROGRESS. The value is stored as a 'Locking UID' and no other actor is allowed to update the UPS if the N-ACTION request is accepted. The same value must be used throughout the whole UPS lifecycle to change its state and progress. |

#### 4.2.1.13.4 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 |
| | SopInstanceUidDoesNotExists | C307 | Specified SOP Instance UID does not exist or is not a UPS instance managed by this SCP |

| | | | |
|---|---|---|---|
| Failure | AlreadyCanceled | B304 | The UPS is already in the requested state of CANCELED. |
| | AlreadyCompleted | B306 | The UPS is already in the requested state of COMPLETED. |
| Success | Success | 0000 | |

#### 4.2.1.14 Activity N-SET

##### 4.2.1.14.1 Description and Sequencing of Activities

See N-SET in the DICOM standard, PS3.7 Chapter 10
https://dicom.nema.org/medical/dicom/current/output/chtml/part07/chapter_10.html

##### 4.2.1.14.2 Accepted Presentation Context

| Abstract Syntax Name | Abstract Syntax UID | Transfer Syntax name | Transfer Syntax UID | Role | Extended Negotiation |
|---|---|---|---|---|---|
| Unified Procedure Step - Push SOP Class - Trial (Retired) | 1.2.840.10008.5.1.4.34.4.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | | |

##### 4.2.1.14.3 SOP Specific Conformance for Progress Update

If the Requested SOP Class UID (0000,0003) is *Unified Procedure Step - Push SOP Class - Trial (Retired)* and the Requested SOP Instance UID (0000,1001) matches an existing UPS, the status change is done as described below.

| Attribute Name | Tag | VR | Comment |
|---|---|---|---|
| Transaction UID | (0008,1195) | UI | Must match UID received in N-ACTION response when Procedure Step State is set to *IN PROGRESS*. |
| Procedure Step Progress Information Sequence | (0074,1002) | SQ | A single item required in the sequence. |
| > Procedure Step Progress | (0074,1004) | DS | Value representing the current progress. Values between 0 and 100 expected. |
| > Procedure Step Progress Description | (0074,1006) | ST | Can optionally be sent. Logged by the driver. |
| > Procedure Step Progress Parameters Sequence | (0074,1007) | SQ | Can optionally be sent. The driver will log a value representing the 'Referenced Beam Number' concept. For more details see section Usage of Attributes From Received IODs in the Annex. |

##### 4.2.1.14.4 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 not a UPS instance managed by this SCP |
| Success | Success | 0000 | |

## 4.3 NETWORK INTERFACES

### 4.3.1 Physical Network Interface

The application is indifferent to the physical medium over which TCP/IP executes, which is dependent on the underlying operating system and hardware.

### 4.3.2 Additional protocols

None.

### 4.3.3 IPv4 and IPv6 Support

The driver supports both IPv4 and IPv6. It does not utilize any of the optional configuration identification or security features of IPv6.

### 4.3.4 Configuration

All configuration is performed with configuration files stored at the installation location. More information about the configuration can be found in the driver installation instructions.

# 5 MEDIA INTERCHANGE

Not applicable

# 6 TRANSFORMATION OF DICOM TO CDA

Not applicable

# 7 SUPPORT OF CHARACTER SETS

The driver supports the following character sets in addition to the default.

- ISO_IR 192

For instances created by the driver, the possible Specific Character Set values are defined in the Created SOP Instance(s) section.

For use cases where the driver only acts as a proxy for the RayCare PACS, character set handling is done according to the RayCare PACS DICOM Conformance Statement.

# 8 SECURITY

It is the responsibility of the clinic to ensure that the environment where the driver is running is secure. It is assumed that a secured environment includes at a minimum:

- Firewall or router protections to ensure that only approved external hosts have network access to the driver.
- Firewall and router protections to ensure that the driver only has access to approved external hosts and services.
- Any communication with external hosts and services outside the locally secured environment use appropriate secure network channels (e.g. such as a Virtual Private Network (VPN)).

## 8.1 SECURITY PROFILES

No Security Profiles are supported.

## 8.2 ASSOCIATION LEVEL SECURITY

The 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 Plan IOD

Delivery plan is created based on TPS plan. The attributes below are modified when the delivery plan is created.

| 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 Tolerance Tables Module | Yes |
| | RT Patient Setup Module | Yes |
| | RT Fraction Scheme Module | Yes |
| | RT Beams Module | Yes |
| | RT Brachy Application Setups Module | No |
| | SOP Common Module | Yes |

##### 9.1.1.1.1 Patient Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Patient's Name | (0010,0010) | PN | 2 | Only read. Not updated. |
| Patient ID | (0010,0020) | LO | 2 | Only read. Not updated. |
| Patient's Birth Date | (0010,0030) | DA | 2 | Only read. Not updated. |
| Patient's Sex | (0010,0040) | CS | 2 | Only read. Not updated.<br>Supported values:<br>• M - Male<br>• F - Female<br>• O - Other |

##### 9.1.1.1.2 General Study Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Study Instance UID | (0020,000D) | UI | 1 | Only read. Not updated. |

##### 9.1.1.1.3 RT Series Module

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

| | | | | |
|---|---|---|---|---|
| Series Instance UID | (0020,000E) | UI | 1 | A new UID is generated where ".200" is appended to the Series Instance UID of the TPS plan. |
| Series Number | (0020,0011) | IS | 2 | |
| Series Date | (0008,0021) | DA | 3 | |
| Series Time | (0008,0031) | TM | 3 | |
| Series Description | (0008,103E) | LO | 3 | "Delivery plan" is prepended to the series description of the TPS plan. |
| Operators' Name | (0008,1070) | PN | 2 | |

#### 9.1.1.1.4 Frame of Reference Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Frame of Reference UID | (0020,0052) | UI | 1 | Only read. Not updated. |

#### 9.1.1.1.5 General Equipment Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Software Versions | (0018,1020) | LO | 3 | |

#### 9.1.1.1.6 RT General Plan Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Plan Intent | (300A,000A) | CS | 3 | For QA sessions the value is set to VERIFICATION. For treatment sessions the value is not modified. Supported values: VERIFICATION, CURATIVE, PALLIATIVE, PROPHYLACTIC, MACHINE_QA, RESEARCH, SERVICE. |
| Referenced Structure Set Sequence | (300C,0060) | SQ | 1C | |
| >Referenced SOP Instance UID | (0008,1155) | UI | 1 | Only read. Not updated. |
| Referenced RT Plan Sequence | (300C,0002) | SQ | 3 | Contains reference to TPS plan. |
| >Referenced SOP Class UID | (0008,1150) | UI | 1 | |
| >Referenced SOP Instance UID | (0008,1155) | UI | 1 | |
| >RT Plan Relationship | (300A,0055) | CS | 1 | Supported values: PREDECESSOR, VERIFIED_PLAN. |

#### 9.1.1.1.7 RT Prescription Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Dose Reference Sequence | (300A,0010) | SQ | 3 | |
| >Dose Reference Number | (300A,0012) | IS | 1 | |
| >Dose Reference UID | (300A,0013) | UI | 3 | |
| >Dose Reference Description | (300A,0016) | LO | 3 | Only read. Not updated. |
| >Dose Reference Type | (300A,0020) | CS | 1 | Supported values: TARGET, ORGAN_AT_RISK. |
| >Delivery Maximum Dose | (300A,0023) | DS | 3 | |
| >Target Prescription Dose | (300A,0026) | DS | 3 | Updated with the nominal beam set dose specified in RayCare. |
| >Target Maximum Dose | (300A,0027) | DS | 3 | |
| >Organ at Risk Maximum Dose | (300A,002C) | DS | 3 | |

#### 9.1.1.1.8 RT Tolerance Tables Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Tolerance Table Sequence | (300A,0040) | SQ | 3 | At least one tolerance table must exist. Can either be as defined in TPS plan or as defined in RayCare. |
| >Tolerance Table Number | (300A,0042) | IS | 1 | Always set to '1'. |
| >Tolerance Table Label | (300A,0043) | SH | 3 | |
| >Gantry Angle Tolerance | (300A,0044) | DS | 3 | |
| >Beam Limiting Device Angle Tolerance | (300A,0046) | DS | 3 | |
| >Beam Limiting Device Tolerance Sequence | (300A,0048) | SQ | 3 | |
| >>RT Beam Limiting Device Type | (300A,00B8) | CS | 1 | Supported values: X, Y, ASYMX, ASYMY, MLCX, MLCY. |
| >>Beam Limiting Device Position Tolerance | (300A,004A) | DS | 1 | |
| >Patient Support Angle Tolerance | (300A,004C) | DS | 3 | |
| >Table Top Eccentric Angle Tolerance | (300A,004E) | DS | 3 | |
| >Table Top Pitch Angle Tolerance | (300A,004F) | FL | 3 | |
| >Table Top Roll Angle Tolerance | (300A,0050) | FL | 3 | |
| >Table Top Vertical Position Tolerance | (300A,0051) | DS | 3 | |
| >Table Top Longitudinal Position Tolerance | (300A,0052) | DS | 3 | |
| >Table Top Lateral Position Tolerance | (300A,0053) | DS | 3 | |

#### 9.1.1.1.9 RT Patient Setup Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Patient Setup Sequence | (300A,0180) | SQ | 1 | |
| >Patient Setup Number | (300A,0182) | IS | 1 | |

#### 9.1.1.1.10 RT Fraction Scheme Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Fraction Group Sequence | (300A,0070) | SQ | 1 | |
| >Number of Fractions Planned | (300A,0078) | IS | 2 | |
| >Referenced Beam Sequence | (300C,0004) | SQ | 1C | |
| >>Referenced Beam Number | (300C,0006) | IS | 1 | Only read. Not updated. |
| >>Beam Meterset | (300A,0086) | DS | 3 | Only read. Not updated. |

#### 9.1.1.1.11 RT Beams Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Beam Sequence | (300A,00B0) | SQ | 1 | |
| >Beam Number | (300A,00C0) | IS | 1 | Only read. Not updated. |
| >Beam Name | (300A,00C2) | LO | 3 | Only read. Not updated. |

| | | | | |
|---|---|---|---|---|
| >Primary Dosimeter Unit | (300A,00B3) | CS | 3 | Only read. Not updated.<br>Supported values: MU, MINUTE. |
| >Referenced Tolerance Table Number | (300C,00A0) | IS | 3 | Always set to '1'. |
| >Source-Axis Distance | (300A,00B4) | DS | 3 | |
| >Referenced Patient Setup Number | (300C,006A) | IS | 3 | Only read. Not updated. |
| >Planned Verification Image Sequence | (300A,00CA) | SQ | 3 | |
| >>RT Image Plane | (3002,000C) | CS | 3 | Supported value: NORMAL. |
| >>RT Image Position | (3002,0012) | DS | 3 | |
| >>RT Image SID | (3002,0026) | DS | 3 | |
| >>Imaging Device-Specific Acquisition Parameters | (300A,00CC) | LO | 3 | |
| >Treatment Delivery Type | (300A,00CE) | CS | 3 | Only read. Not updated.<br>Supported values: TREATMENT, OPEN_PORTFILM, SETUP, CONTINUATION, TRMT_PORTFILM. |
| >Number of Wedges | (300A,00D0) | IS | 1 | Only read. Not updated. |
| >Number of Boli | (300A,00ED) | IS | 1 | Only read. Not updated. |
| >Referenced Bolus Sequence | (300C,00B0) | SQ | 1C | Only read and displayed in Treat UI. Not updated. |
| >>Referenced ROI Number | (3006,0084) | IS | 1 | |
| >>Bolus ID | (300A,00DC) | SH | 3 | |
| >Applicator Sequence | (300A,0107) | SQ | 3 | |
| >>Applicator ID | (300A,0108) | SH | 1 | Only read. Not updated. |
| >>Applicator Description | (300A,010A) | LO | 3 | Only read. Not updated. |
| >General Accessory Sequence | (300A,0420) | SQ | 3 | |
| >>General Accessory ID | (300A,0421) | SH | 1 | Only read. Not updated. |
| >>General Accessory Description | (300A,0422) | ST | 3 | Only read. Not updated. |
| >>General Accessory Type | (300A,0423) | CS | 3 | Only read. Not updated.<br>Supported values: GRATICULE, IMAGE_DETECTOR, RETICLE. |
| >Control Point Sequence | (300A,0111) | SQ | 1 | |
| >>Control Point Index | (300A,0112) | IS | 1 | Only read. Not updated. |
| >>Dose Rate Set | (300A,0115) | DS | 3 | Only read. Not updated. |
| >>Gantry Angle | (300A,011E) | DS | 1C | Only read. Not updated. |
| >>Beam Limiting Device Angle | (300A,0120) | DS | 1C | Only read. Not updated. |
| >>Patient Support Angle | (300A,0122) | DS | 1C | Only read. Not updated. |
| >>Table Top Pitch Angle | (300A,0140) | FL | 1C | Only read. Not updated. |
| >>Table Top Roll Angle | (300A,0144) | FL | 1C | Only read. Not updated. |
| >>Table Top Vertical Position | (300A,0128) | DS | 2C | Set to delivery table top position defined in RayCare for the beam. Only set in first control point. |
| >>Table Top Longitudinal Position | (300A,0129) | DS | 2C | Set to delivery table top position defined in RayCare for the beam. Only set in first control point. |

| | | | | |
|---|---|---|---|---|
| >>Table Top Lateral Position | (300A,012A) | DS | 2C | Set to delivery table top position defined in RayCare for the beam. Only set in first control point. |
| >>Isocenter Position | (300A,012C) | DS | 2C | Only read. Not updated. |

9.1.1.1.12 SOP Common Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| SOP Class UID | (0008,0016) | UI | 1 | Copied from TPS plan |
| SOP Instance UID | (0008,0018) | UI | 1 | Treatment: A new UID is generated where ".100" is appended to the SOP Instance UID of the TPS plan.<br><br>QA: A new UID is generated |
| Instance Creation Date | (0008,0012) | DA | 3 | |
| Instance Creation Time | (0008,0013) | TM | 3 | |

### 9.1.1.2 RT Ion Plan IOD

Delivery plan is created based on TPS plan. The attributes below are modified when the delivery plan is created.

| 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 Ion Tolerance Tables Module | Yes |
| | RT Patient Setup Module | Yes |
| | RT Fraction Scheme Module | Yes |
| | RT Ion Beams 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 | Only read. Not updated. |
| Patient ID | (0010,0020) | LO | 2 | Only read. Not updated. |
| Patient's Birth Date | (0010,0030) | DA | 2 | Only read. Not updated. |
| Patient's Sex | (0010,0040) | CS | 2 | Only read. Not updated.<br>Supported values:<br>• M - Male<br>• F - Female<br>• O - Other |

9.1.1.2.2 General Study Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Study Instance UID | (0020,000D) | UI | 1 | Only read. Not updated. |

9.1.1.2.3 RT Series Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Modality | (0008,0060) | CS | 1 | Supported value: RTPLAN. |
| Series Instance UID | (0020,000E) | UI | 1 | A new UID is generated where ".200" is appended to the Series Instance UID of the TPS plan. |
| Series Number | (0020,0011) | IS | 2 | |
| Series Date | (0008,0021) | DA | 3 | |
| Series Time | (0008,0031) | TM | 3 | |
| Series Description | (0008,103E) | LO | 3 | "Delivery plan" is prepended to the series description of the TPS plan. |
| Operators' Name | (0008,1070) | PN | 2 | |

9.1.1.2.4 Frame of Reference Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Frame of Reference UID | (0020,0052) | UI | 1 | Only read. Not updated. |

9.1.1.2.5 General Equipment Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Software Versions | (0018,1020) | LO | 3 | |

9.1.1.2.6 RT General Plan Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Plan Intent | (300A,000A) | CS | 3 | For QA sessions the value is set to VERIFICATION. For treatment sessions the value is not modified. Supported values: VERIFICATION, CURATIVE, PALLIATIVE, PROPHYLACTIC, MACHINE_QA, RESEARCH, SERVICE. |
| Referenced Structure Set Sequence | (300C,0060) | SQ | 1C | |
| >Referenced SOP Instance UID | (0008,1155) | UI | 1 | Only read. Not updated. |
| Referenced RT Plan Sequence | (300C,0002) | SQ | 3 | Contains reference to TPS plan. |
| >Referenced SOP Class UID | (0008,1150) | UI | 1 | |
| >Referenced SOP Instance UID | (0008,1155) | UI | 1 | |
| >RT Plan Relationship | (300A,0055) | CS | 1 | Supported values: PREDECESSOR, VERIFIED_PLAN. |

9.1.1.2.7 RT Prescription Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Dose Reference Sequence | (300A,0010) | SQ | 3 | |
| >Dose Reference Number | (300A,0012) | IS | 1 | |
| >Dose Reference UID | (300A,0013) | UI | 3 | |
| >Dose Reference Description | (300A,0016) | LO | 3 | Only read. Not updated. |
| >Dose Reference Type | (300A,0020) | CS | 1 | Supported values: TARGET, ORGAN_AT_RISK. |

| | | | | |
|---|---|---|---|---|
| >Delivery Maximum Dose | (300A,0023) | DS | 3 | |
| >Target Prescription Dose | (300A,0026) | DS | 3 | Updated with the nominal beam set dose specified in RayCare. |
| >Target Maximum Dose | (300A,0027) | DS | 3 | |
| >Organ at Risk Maximum Dose | (300A,002C) | DS | 3 | |

#### 9.1.1.2.8 RT Ion Tolerance Tables Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Ion Tolerance Table Sequence | (300A,03A0) | SQ | 1 | At least one tolerance table must exist. Can either be as defined in TPS plan or as defined in RayCare. |
| >Tolerance Table Number | (300A,0042) | IS | 1 | Always set to 1. |
| >Tolerance Table Label | (300A,0043) | SH | 3 | |
| >Gantry Angle Tolerance | (300A,0044) | DS | 3 | |
| >Beam Limiting Device Angle Tolerance | (300A,0046) | DS | 3 | |
| >Beam Limiting Device Tolerance Sequence | (300A,0048) | SQ | 3 | |
| >>RT Beam Limiting Device Type | (300A,00B8) | CS | 1 | Supported values: X, Y, ASYMX, ASYMY, MLCX, MLCY. |
| >>Beam Limiting Device Position Tolerance | (300A,004A) | DS | 1 | |
| >Patient Support Angle Tolerance | (300A,004C) | DS | 3 | |
| >Table Top Vertical Position Tolerance | (300A,0051) | DS | 3 | |
| >Table Top Longitudinal Position Tolerance | (300A,0052) | DS | 3 | |
| >Table Top Lateral Position Tolerance | (300A,0053) | DS | 3 | |
| >Table Top Pitch Angle Tolerance | (300A,004F) | FL | 3 | |
| >Table Top Roll Angle Tolerance | (300A,0050) | FL | 3 | |
| >Snout Position Tolerance | (300A,004B) | FL | 3 | |
| >Head Fixation Angle Tolerance | (300A,0152) | DS | 3 | |
| >Chair Head Frame Position Tolerance | (300A,0153) | DS | 3 | |
| >Fixation Light Azimuthal Angle Tolerance | (300A,0154) | DS | 3 | |
| >Fixation Light Polar Angle Tolerance | (300A,0155) | DS | 3 | |

#### 9.1.1.2.9 RT Patient Setup Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Patient Setup Sequence | (300A,0180) | SQ | 1 | |
| >Patient Setup Number | (300A,0182) | IS | 1 | Only read. Not updated. |

#### 9.1.1.2.10 RT Fraction Scheme Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Fraction Group Sequence | (300A,0070) | SQ | 1 | |
| >Number of Fractions Planned | (300A,0078) | IS | 2 | |
| >Referenced Beam Sequence | (300C,0004) | SQ | 1C | |
| >>Referenced Beam Number | (300C,0006) | IS | 1 | Only read. Not updated. |
| >>Beam Meterset | (300A,0086) | DS | 3 | Only read. Not updated. |

9.1.1.2.11 RT Ion Beams Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Ion Beam Sequence | (300A,03A2) | SQ | 1 | |
| >Beam Number | (300A,00C0) | IS | 1 | Only read. Not updated. |
| >Beam Name | (300A,00C2) | LO | 1 | Only read. Not updated. |
| >Primary Dosimeter Unit | (300A,00B3) | CS | 1 | Only read. Not updated.<br>Supported values: MU, NP. |
| >Referenced Tolerance Table Number | (300C,00A0) | IS | 3 | Always set to 1. |
| >Referenced Patient Setup Number | (300C,006A) | IS | 3 | Only read. Not updated. |
| >Treatment Delivery Type | (300A,00CE) | CS | 1 | Only read. Not updated.<br>Supported values: TREATMENT, SETUP, OPEN_PORTFILM, TRMT_PORTFILM, CONTINUATION. |
| >Number of Wedges | (300A,00D0) | IS | 1 | Only read. Not updated. |
| >Number of Boli | (300A,00ED) | IS | 1 | Only read. Not updated. |
| >Referenced Bolus Sequence | (300C,00B0) | SQ | 1C | Only read and displayed in Treat UI. Not updated. |
| >>Referenced ROI Number | (3006,0084) | IS | 1 | |
| >>Bolus ID | (300A,00DC) | SH | 3 | |
| >Snout Sequence | (300A,030C) | SQ | 3 | |
| >>Snout ID | (300A,030F) | SH | 1 | Only read. Not updated. |
| >Applicator Sequence | (300A,0107) | SQ | 3 | Only read. Not updated. |
| >>Applicator ID | (300A,0108) | SH | 1 | Only read. Not updated. |
| >>Applicator Description | (300A,010A) | LO | 3 | Only read. Not updated. |
| >General Accessory Sequence | (300A,0420) | SQ | 3 | Only read. Not updated. |
| >>General Accessory ID | (300A,0421) | SH | 1 | Only read. Not updated. |
| >>General Accessory Description | (300A,0422) | ST | 3 | Only read. Not updated. |
| >>General Accessory Type | (300A,0423) | CS | 3 | Only read. Not updated.<br>Supported values: GRATICULE, IMAGE_DETECTOR, RETICLE. |
| >Ion Control Point Sequence | (300A,03A8) | SQ | 1 | |
| >>Control Point Index | (300A,0112) | IS | 1 | Only read. Not updated. |
| >>Meterset Rate | (300A,035A) | FL | 3 | Only read. Not updated. |
| >>Gantry Angle | (300A,011E) | DS | 1C | Only read. Not updated. |
| >>Beam Limiting Device Angle | (300A,0120) | DS | 1C | Only read. Not updated. |
| >>Patient Support Angle | (300A,0122) | DS | 1C | Only read. Not updated. |

| | | | | |
|---|---|---|---|---|
| >>Table Top Pitch Angle | (300A,0140) | FL | 2C | Only read. Not updated. |
| >>Table Top Roll Angle | (300A,0144) | FL | 2C | Only read. Not updated. |
| >>Table Top Vertical Position | (300A,0128) | DS | 2C | Set to delivery table top position defined in RayCare for the beam. Only set in first control point. |
| >>Table Top Longitudinal Position | (300A,0129) | DS | 2C | Set to delivery table top position defined in RayCare for the beam. Only set in first control point. |
| >>Table Top Lateral Position | (300A,012A) | DS | 2C | Set to delivery table top position defined in RayCare for the beam. Only set in first control point. |
| >>Snout Position | (300A,030D) | FL | 2C | Only read. Not updated. |
| >>Isocenter Position | (300A,012C) | DS | 2C | Only read. Not updated. |

#### 9.1.1.2.12 SOP Common Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| SOP Class UID | (0008,0016) | UI | 1 | Copied from TPS plan |
| SOP Instance UID | (0008,0018) | UI | 1 | Treatment: A new UID is generated where ".100" is appended to the SOP Instance UID of the TPS plan.<br><br>QA: A new UID is generated |
| Instance Creation Date | (0008,0012) | DA | 3 | |
| Instance Creation Time | (0008,0013) | TM | 3 | |

### 9.1.1.3 RT Beams Delivery Instruction IOD

| IE | Module | Used |
|---|---|---|
| Patient | Patient Module | Yes |
| Study | General Study Module | Yes |
| Series | General Series Module | Yes |
| Equipment | General Equipment Module | Yes |
| Plan | RT Beams Delivery Instruction Module | Yes |
| | Common Instance 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 | Supported values:<br><br>• M - Male<br>• F - Female<br>• O - Other |

#### 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 | Supported value: 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 | Supported value: RaySearch Laboratories. |
| Station Name | (0008,1010) | SH | 3 | Set to driver machine name |
| Manufacturer's Model Name | (0008,1090) | LO | 3 | Supported value: RayCare. |
| Device Serial Number | (0018,1000) | LO | 3 | Always set to '0' |
| Software Versions | (0018,1020) | LO | 3 | Contains current RayCare version number |

#### 9.1.1.3.5 RT Beams Delivery Instruction Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Referenced RT Plan Sequence | (300C,0002) | SQ | 1 | |
| >Referenced SOP Class UID | (0008,1150) | UI | 1 | Supported values:<br>• 1.2.840.10008.5.1.4.1.1.481.5 - RT Plan Storage<br>• 1.2.840.10008.5.1.4.1.1.481.8 - RT Ion Plan Storage |
| >Referenced SOP Instance UID | (0008,1155) | UI | 1 | |
| Beam Task Sequence | (0074,1020) | SQ | 1 | Will contain references to all beams not already treated in the current fraction. |
| >Beam Task Type | (0074,1022) | CS | 1 | Set to TREAT for beams with TreatmentDeliveryType TREATMENT. Otherwise set to VERIFY.<br>Supported values: TREAT, VERIFY. |
| >Treatment Delivery Type | (300A,00CE) | CS | 1 | Set based on result (record) from last treatment of beam.<br>Supported values: TREATMENT, CONTINUATION. |

| | | | | |
|---|---|---|---|---|
| >Primary Dosimeter Unit | (300A,00B3) | CS | 1C | Supported values: MU, MINUTE, NP. |
| >Continuation Start Meterset | (0074,0120) | FD | 1C | |
| >Continuation End Meterset | (0074,0121) | FD | 1C | |
| >Current Fraction Number | (3008,0022) | IS | 1 | Populated with "fraction number in beam set". |
| >Referenced Beam Number | (300C,0006) | IS | 1 | |
| Omitted Beam Task Sequence | (300C,0111) | SQ | 3 | Will contain references to all beams that has already been treated in the current fraction. |
| >Referenced Beam Number | (300C,0006) | IS | 1 | |
| >Reason for Omission | (300C,0112) | CS | 1 | Supported value: ALREADY_TREATED. |

9.1.1.3.6 SOP Common Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| SOP Class UID | (0008,0016) | UI | 1 | Supported values:<br>• 1.2.840.10008.5.1.4.34.7 - TDW2: RT Beams Delivery Instruction Storage<br>• 1.2.840.10008.5.1.4.34.1 - TDW1: RT Beams Delivery Instruction Storage - Trial (Retired) |
| SOP Instance UID | (0008,0018) | UI | 1 | |
| Specific Character Set | (0008,0005) | CS | 1C | Supported value: ISO_IR 192. |
| Instance Creation Date | (0008,0012) | DA | 3 | Creation date in local time |
| Instance Creation Time | (0008,0013) | TM | 3 | Creation time in local time |

### 9.1.1.4 Unified Procedure Step IOD

This section describes the UPS information returned in the worklist C-FIND queries.

| 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 |

9.1.1.4.1 SOP Common Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| SOP Class UID | (0008,0016) | UI | 1 | Supported values:<br>• 1.2.840.10008.5.1.4.34.6.1 - TDW2: Unified Procedure Step - Push<br>• 1.2.840.10008.5.1.4.34.4.1 - TDW1: Unified Procedure Step - Push SOP Class - Trial (Retired) |
| SOP Instance UID | (0008,0018) | UI | 1 | |
| Specific Character Set | (0008,0005) | CS | 1C | Supported value: ISO_IR 192. |
| Instance Creation Date | (0008,0012) | DA | 3 | |
| Instance Creation Time | (0008,0013) | TM | 3 | |
| Timezone Offset From UTC | (0008,0201) | SH | 3 | Only included if part of the request. |

#### 9.1.1.4.2 Unified Procedure Step Relationship Module

Information copied from TPS plan.

| 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 | | Supported values:<br>• M - Male<br>• F - Female<br>• O - Other |

#### 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 | | Supported value: MEDIUM. |
| Procedure Step Label | (0074,1204) | LO | | Contains RayCare session description. |
| Scheduled Station Name Code Sequence | (0040,4025) | SQ | | |
| >Code Value | (0008,0100) | SH | 1C | Contains the device name for the driver. |
| >Coding Scheme Designator | (0008,0102) | SH | 1C | Supported value: 99IHER02018. |
| >Code Meaning | (0008,0104) | LO | 1 | Contains the device name for the driver. |
| Scheduled Procedure Step Start DateTime | (0040,4005) | DT | | Treatment: set to appointment start time.<br><br>QA: set to start of the day |
| Expected Completion DateTime | (0040,4011) | DT | | Treatment: set to appointment end time<br><br>QA: set to start of the day |
| Scheduled Workitem Code Sequence | (0040,4018) | SQ | | |

| | | | | |
|---|---|---|---|---|
| >Code Value | (0008,0100) | SH | 1C | Supported values:<br><br>• 121726 - RT Treatment with Internal Verification<br>• 121728 - RT Treatment QA with Internal Verification |
| >Coding Scheme Designator | (0008,0102) | SH | 1C | Supported value: DCM. |
| >Code Meaning | (0008,0104) | LO | 1 | Supported values: RT Treatment with Internal Verification, RT Treatment QA with Internal Verification. |
| Scheduled Processing Parameters Sequence | (0074,1210) | SQ | | Will always contain four items. One for each of the following concepts:<br><br>- Treatment Delivery Type<br>- Plan Label<br>- Current Fraction Number<br>- Number of Fractions Planned |
| >Value Type | (0040,A040) | CS | 1 | Will use TEXT for concepts "Treatment Delivery Type" and “Plan Label”.<br><br>Will use NUMERIC for concepts "Current Fraction Number" and “Number of Fractions Planned”.<br>Supported values: TEXT, NUMERIC. |
| >Concept Name Code Sequence | (0040,A043) | SQ | 1 | |
| >>Code Value | (0008,0100) | SH | 1C | Supported values:<br><br>• 121740 - Treatment Delivery Type<br>• 2018001 - Plan Label<br>• 2018002 - Current Fraction Number<br>• 2018003 - Number of Fractions Planned |
| >>Coding Scheme Designator | (0008,0102) | SH | 1C | Supported values: DCM, 99IHER02018. |
| >>Code Meaning | (0008,0104) | LO | 1 | Supported values: Treatment Delivery Type, Plan Label, Current Fraction Number, Number of Fractions Planned. |
| >Text Value | (0040,A160) | UT | 1C | For concept "Plan Label" the value will be populated with the RT Plan Label (300A,0002) of the delivery plan.<br><br>For concept "Treatment Delivery Type" the value will be populated with either of the supported values below.<br>Supported values:<br><br>• TREATMENT - Used for concept Treatment Delivery Type if the UPS' fraction delivery is a nominal fraction delivery, that is, no previous partial treatment has occurred for this fraction.<br>• CONTINUATION - Used for concept Treatment Delivery Type if the UPS' fraction delivery is a continuation of a nominal fraction delivery, that is, a previous partial treatment has occurred for this fraction |

| | | | | |
|---|---|---|---|---|
| >Numeric Value | (0040,A30A) | DS | 1C | For concept "Current Fraction Number" the value will be populated with the "fraction number in beam set". If no treatment session exists the value "0" is set.<br><br>For concept "Number of Fractions Planned" the value will be populated with the number of planned fractions for the beam set. |
| >Measurement Units Code Sequence | (0040,08EA) | SQ | 1C | |
| >>Code Value | (0008,0100) | SH | 1C | Supported value: 1. |
| >>Coding Scheme Designator | (0008,0102) | SH | 1C | Supported value: UCUM. |
| >>Code Meaning | (0008,0104) | LO | 1 | Supported value: no units. |
| Input Information Sequence | (0040,4021) | SQ | | Will contain references to DICOM data related to this UPS, including<br><br>- Delivery plan (RT Plan or RT Ion Plan), one item<br>- RT Beams Delivery Instruction, one item<br>- Treatment Records (RT Beams Treatment Record or RT Ion Beams Treatment Record), one item for each previous treatment record in the same fraction for the delivery plan. |
| >Study Instance UID | (0020,000D) | UI | 1C | |
| >Referenced Series Sequence | (0008,1115) | SQ | 3 | |
| >>Referenced SOP Sequence | (0008,1199) | SQ | 3 | |
| >>>Referenced SOP Class UID | (0008,1150) | UI | 3 | Supported values:<br><br>• 1.2.840.10008.5.1.4.1.1.481.5 - Used if delivery plan is RT Plan<br>• 1.2.840.10008.5.1.4.1.1.481.8 - Used if delivery plan is RT Ion Plan<br>• 1.2.840.10008.5.1.4.34.7 - RT Beams Delivery Instruction Storage<br>• 1.2.840.10008.5.1.4.1.1.481.4 - RT Beams Treatment Record Storage<br>• 1.2.840.10008.5.1.4.1.1.481.9 - RT Ion Beams Treatment Record Storage |
| >>>Referenced SOP Instance UID | (0008,1155) | UI | 3 | |
| >>Retrieve AE Title | (0008,0054) | AE | 3 | |
| >>Series Instance UID | (0020,000E) | UI | 3 | |
| Study Instance UID | (0020,000D) | UI | | |
| Input Availability Flag | (0040,4020) | CS | 3 | Supported values:<br><br>• COMPLETE - An UPS has the COMPLETE state when its session has been locked in RayCare and the UPS has fully populated its Input Information Sequence and is ready to be treated.<br>• PARTIAL - An UPS has the PARTIAL state when its session is not yet locked in RayCare, meaning, treatment relevant properties can still be updated. The Input Information Sequence will not be populated with the needed DICOM references. |

9.1.1.4.4 Unified Procedure Step Progress Information Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Procedure Step State | (0074,1000) | CS | | Supported value: SCHEDULED. |

## 9.1.2 Usage of Attributes From Received IODs

### 9.1.2.1 CT Image IOD

Storage of CT images created during a session.

| IE | Module | Used |
|---|---|---|
| Patient | Patient Module | Yes |
| Study | General Study Module | Yes |
| Series | General Series Module | Yes |
| Frame of Reference | Frame of Reference Module | No |
| | Synchronization Module | No |
| Equipment | General Equipment Module | No |
| Acquisition | General Acquisition Module | Yes |
| Image | General Image Module | No |
| | General Reference Module | Yes |
| | 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 | Supported values:<br>• M - Male<br>• F - Female<br>• O - Other |

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 | Supported value: CT. |
| Series Instance UID | (0020,000E) | UI | 1 | |

#### 9.1.2.1.4 General Acquisition Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Acquisition Date | (0008,0022) | DA | 3 | |
| Acquisition Time | (0008,0032) | TM | 3 | |

#### 9.1.2.1.5 General Reference Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Referenced Instance Sequence | (0008,114A) | SQ | 3 | |
| >Referenced SOP Class UID | (0008,1150) | UI | 1 | Value not read |
| >Referenced SOP Instance UID | (0008,1155) | UI | 1 | If reference matches delivery plan, the image will be linked to the session in RayCare. |
| >Purpose of Reference Code Sequence | (0040,A170) | SQ | 1 | Value not read |

#### 9.1.2.1.6 CT Image Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Image Type | (0008,0008) | CS | 1 | Value not read |
| 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 Lateral Position | (300A,012A) | DS | 3 | |
| Table Top Longitudinal Position | (300A,0129) | DS | 3 | |
| Table Top Pitch Angle | (300A,0140) | FL | 3 | |
| Table Top Roll Angle | (300A,0144) | FL | 3 | |

#### 9.1.2.1.7 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 | |

### 9.1.2.2 RT Image IOD

| IE | Module | Used |
|---|---|---|

| | | |
|---|---|---|
| Patient | Patient Module | Yes |
| Study | General Study Module | Yes |
| Series | RT Series Module | Yes |
| Equipment | General Equipment Module | No |
| Acquisition | General Acquisition 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 | Supported values:<br>• M - Male<br>• F - Female<br>• O - Other |

#### 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 | Supported value: RTIMAGE. |
| Series Instance UID | (0020,000E) | UI | 1 | |

#### 9.1.2.2.4 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 | Value not read |
| Image Type | (0008,0008) | CS | 1 | Supported values: ORIGINAL, DERIVED, PRIMARY, SECONDARY, DRR, PORTAL, SIMULATOR, RADIOGRAPH, BLANK, FLUENCE, UNKNOWN. |
| RT Image Plane | (3002,000C) | CS | 1 | Value not read |
| Referenced RT Plan Sequence | (300C,0002) | SQ | 3 | |
| >Referenced SOP Class UID | (0008,1150) | UI | 1 | |
| >Referenced SOP Instance UID | (0008,1155) | UI | 1 | If value matches delivery plan, the RT Image will be linked to the current session. |
| Referenced Beam Number | (300C,0006) | IS | 3 | Read when reporting acquired image position, to RayCare. |
| Fraction Number | (3002,0029) | IS | 3 | |
| Patient Support Angle | (300A,0122) | DS | 3 | Read when reporting acquired image position, to RayCare. |
| Table Top Pitch Angle | (300A,0140) | FL | 3 | Read when reporting acquired image position, to RayCare. |
| Table Top Roll Angle | (300A,0144) | FL | 3 | Read when reporting acquired image position, to RayCare. |
| Table Top Vertical Position | (300A,0128) | DS | 3 | Read when reporting acquired image position, to RayCare. |
| Table Top Longitudinal Position | (300A,0129) | DS | 3 | Read when reporting acquired image position, to RayCare. |
| Table Top Lateral Position | (300A,012A) | DS | 3 | Read when reporting acquired image position, to RayCare. |

#### 9.1.2.2.5 SOP Common Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| SOP Class UID | (0008,0016) | UI | 1 | Supported value: 1.2.840.10008.5.1.4.1.1.481.1. |
| SOP Instance UID | (0008,0018) | UI | 1 | |

### 9.1.2.3 RT Structure Set IOD

| IE | Module | Used |
|---|---|---|
| Patient | Patient Module | No |
| Study | General Study Module | No |
| Series | RT Series Module | No |
| 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 Structure Set Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Structure Set Label | (3006,0002) | SH | 1 | Value not read |
| Structure Set Date | (3006,0008) | DA | 2 | |
| Structure Set Time | (3006,0009) | TM | 2 | |
| Referenced Frame of Reference Sequence | (3006,0010) | SQ | 3 | |
| >Frame of Reference UID | (0020,0052) | UI | 1 | Only read if Referenced Frame of Reference Sequence contains a single item. |
| >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 | Value not read |
| >>>>Referenced SOP Instance UID | (0008,1155) | UI | 1 | |
| Structure Set ROI Sequence | (3006,0020) | SQ | 1 | Value not read |

9.1.2.3.2 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 | Only POINT contours are parsed. |
| >>Contour Geometric Type | (3006,0042) | CS | 1 | Supported value: POINT. |
| >>Number of Contour Points | (3006,0046) | IS | 1 | Value not read |
| >>Contour Data | (3006,0050) | DS | 1 | |

9.1.2.3.3 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: ACQ_ISOCENTER, INITLASERISO, INITMATCHISO. |
| >Material ID | (300A,00E1) | SH | 3 | Used for bolus material |

9.1.2.3.4 SOP Common Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| SOP Class UID | (0008,0016) | UI | 1 | Read and stored. |
| SOP Instance UID | (0008,0018) | UI | 1 | Read and stored. |
| Specific Character Set | (0008,0005) | CS | 1C | |

| | | | | |
|---|---|---|---|---|
| Instance Creation Date | (0008,0012) | DA | 3 | |
| Instance Creation Time | (0008,0013) | TM | 3 | |

#### 9.1.2.4 RT Plan IOD

| IE | Module | Used |
|---|---|---|
| Patient | Patient Module | No |
| Study | General Study Module | No |
| Series | RT Series Module | No |
| Equipment | General Equipment Module | No |
| Plan | RT General Plan Module | No |
| | RT Patient Setup Module | Yes |
| | RT Fraction Scheme Module | Yes |
| | RT Beams Module | Yes |
| | RT Brachy Application Setups Module | No |
| | SOP Common Module | No |

##### 9.1.2.4.1 RT Patient Setup Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Patient Setup Sequence | (300A,0180) | SQ | 1 | |
| >Patient Setup Number | (300A,0182) | IS | 1 | Value not read |
| >Setup Technique Description | (300A,01B2) | ST | 3 | |

##### 9.1.2.4.2 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 |
| >Definition Source Sequence | (0008,1156) | SQ | 3 | |
| >>Referenced SOP Class UID | (0008,1150) | UI | 1 | Supported value:<br>• 1.2.840.10008.5.1.4.1.1.481.12 - RT Radiation Set SOP Class UID |
| >>Referenced SOP Instance UID | (0008,1155) | UI | 1 | |
| >Number of Fractions Planned | (300A,0078) | IS | 2 | |
| >Number of Beams | (300A,0080) | IS | 1 | Value not read |
| >Number of Brachy Application Setups | (300A,00A0) | IS | 1 | Value not read |

##### 9.1.2.4.3 RT Beams Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Beam Sequence | (300A,00B0) | SQ | 1 | |
| >Beam Number | (300A,00C0) | IS | 1 | Value not read |

| | | | | |
|---|---|---|---|---|
| >Definition Source Sequence | (0008,1156) | SQ | 3 | |
| >>Referenced SOP Class UID | (0008,1150) | UI | 1 | Supported value:<br>• 1.2.840.10008.5.1.4.1.1.481.15 - Robotic-Arm Radiation SOP Class UID |
| >>Referenced SOP Instance UID | (0008,1155) | UI | 1 | |
| >Beam Type | (300A,00C4) | 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 |
| >Number of Boli | (300A,00ED) | IS | 1 | Value not read |
| >Number of Blocks | (300A,00F0) | IS | 1 | Value not read |
| >Number of Control Points | (300A,0110) | IS | 1 | Value not read |
| >Control Point Sequence | (300A,0111) | SQ | 1 | Value not read |

#### 9.1.2.5 RT Beams Treatment Record IOD

Storage of Treatment Record created during a session.

| 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 Beams Session Record 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 | Supported values:<br>• M - Male<br>• F - Female<br>• O - Other |

##### 9.1.2.5.2 General Study Module

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

##### 9.1.2.5.3 RT Series Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Modality | (0008,0060) | CS | 1 | Supported value: RTRECORD. |
| Series Instance UID | (0020,000E) | UI | 1 | |
| Operators' Name | (0008,1070) | PN | 2 | |

9.1.2.5.4 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 | Value stored in RayCare. |
| Treatment Time | (3008,0251) | TM | 2 | Value stored in RayCare. |
| Referenced RT Plan Sequence | (300C,0002) | SQ | 2 | |
| >Referenced SOP Class UID | (0008,1150) | UI | 1 | |
| >Referenced SOP Instance UID | (0008,1155) | UI | 1 | |

9.1.2.5.5 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 | |

9.1.2.5.6 RT Beams Session Record Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Primary Dosimeter Unit | (300A,00B3) | CS | 1 | Supported values: MU, MINUTE. |
| Treatment Session Beam Sequence | (3008,0020) | SQ | 1 | |
| >Referenced Beam Number | (300C,0006) | IS | 3 | |
| >Beam Name | (300A,00C2) | LO | 3 | |
| >Beam Description | (300A,00C3) | ST | 3 | |
| >Beam Type | (300A,00C4) | CS | 1 | Value not read |
| >Radiation Type | (300A,00C6) | CS | 1 | Value not read |
| >Number of Wedges | (300A,00D0) | IS | 1 | Value not read |
| >Applicator Sequence | (300A,0107) | SQ | 3 | |
| >>Applicator ID | (300A,0108) | SH | 1 | |
| >>Applicator Type | (300A,0109) | CS | 1 | Value not read |
| >>Applicator Description | (300A,010A) | LO | 3 | |
| >General Accessory Sequence | (300A,0420) | SQ | 3 | |
| >>General Accessory Number | (300A,0424) | IS | 1 | Value not read |
| >>General Accessory ID | (300A,0421) | SH | 1 | |
| >>General Accessory Description | (300A,0422) | ST | 3 | |
| >>General Accessory Type | (300A,0423) | CS | 3 | Supported values: GRATICULE, IMAGE_DETECTOR, RETICLE. |
| >Current Fraction Number | (3008,0022) | IS | 2 | |

| | | | | |
|---|---|---|---|---|
| >Treatment Delivery Type | (300A,00CE) | CS | 2 | Supported values: TREATMENT, OPEN_PORTFILM, TRMT_PORTFILM, CONTINUATION, SETUP, VERIFICATION. |
| >Treatment Termination Status | (3008,002A) | CS | 1 | Supported values: NORMAL, OPERATOR, MACHINE, UNKNOWN. |
| >Specified Primary Meterset | (3008,0032) | DS | 3 | |
| >Delivered Primary Meterset | (3008,0036) | 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 |
| >Control Point Delivery Sequence | (3008,0040) | SQ | 1 | |
| >>Referenced Control Point Index | (300C,00F0) | IS | 3 | |
| >>Treatment Control Point Date | (3008,0024) | DA | 1 | Value stored in RayCare. |
| >>Treatment Control Point Time | (3008,0025) | TM | 1 | Value stored in RayCare. |
| >>Specified Meterset | (3008,0042) | DS | 2 | |
| >>Delivered Meterset | (3008,0044) | DS | 1 | |
| >>Dose Rate Set | (300A,0115) | DS | 2 | |
| >>Dose Rate Delivered | (3008,0048) | DS | 2 | |
| >>Nominal Beam Energy | (300A,0114) | DS | 3 | |
| >>Nominal Beam Energy Unit | (300A,0015) | CS | 1C | Supported values: MV, MEV. |
| >>Gantry Angle | (300A,011E) | DS | 1C | |
| >>Gantry Rotation Direction | (300A,011F) | CS | 1C | Supported values: NONE, CW, CC. |
| >>Beam Limiting Device Angle | (300A,0120) | DS | 1C | |
| >>Patient Support Angle | (300A,0122) | DS | 1C | |
| >>Table Top Pitch Angle | (300A,0140) | FL | 1C | |
| >>Table Top Roll Angle | (300A,0144) | FL | 1C | |
| >>Table Top Vertical Position | (300A,0128) | DS | 2C | |
| >>Table Top Longitudinal Position | (300A,0129) | DS | 2C | |
| >>Table Top Lateral Position | (300A,012A) | DS | 2C | |
| >>Override Sequence | (3008,0060) | SQ | 3 | |
| >>>Override Parameter Pointer | (3008,0062) | AT | 2 | |
| >>>Operators' Name | (0008,1070) | PN | 2 | |

#### 9.1.2.5.7 SOP Common Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| SOP Class UID | (0008,0016) | UI | 1 | Supported value: 1.2.840.10008.5.1.4.1.1.481.4. |
| SOP Instance UID | (0008,0018) | UI | 1 | |

### 9.1.2.6 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 | Yes |
| | General Reference Module | Yes |
| | SOP Common 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 | Supported values:<br>• M - Male<br>• F - Female<br>• O - Other |

#### 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 General Series Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Modality | (0008,0060) | CS | 1 | |
| Series Instance UID | (0020,000E) | UI | 1 | |

#### 9.1.2.6.4 Frame of Reference Module

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

#### 9.1.2.6.5 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 | Value not read |
| Content Label | (0070,0080) | CS | 1 | Value not read |

| | | | | |
|---|---|---|---|---|
| Content Description | (0070,0081) | LO | 2 | If content description matches delivery plan SOP Instance UID, the spatial registration will be linked to the session in RayCare. |
| Registration Sequence | (0070,0308) | SQ | 1 | Value not read |

#### 9.1.2.6.6 Common Instance Reference Module

The information in this module is used to locate the two image IODs used to create the registration.

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Referenced Series Sequence | (0008,1115) | SQ | 1C | |
| >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 | |
| >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 | |

#### 9.1.2.6.7 General Reference Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Referenced Instance Sequence | (0008,114A) | SQ | 3 | |
| >Referenced SOP Class UID | (0008,1150) | UI | 1 | Supported value:<br>• 1.2.840.10008.5.1.4.1.1.481.8 - RT Ion Plan Storage |
| >Referenced SOP Instance UID | (0008,1155) | UI | 1 | |
| >Purpose of Reference Code Sequence | (0040,A170) | SQ | 1 | Value not read |

#### 9.1.2.6.8 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 | |

### 9.1.2.7 RT Ion Plan IOD

| IE | Module | Used |
|---|---|---|
| Patient | Patient Module | No |
| Study | General Study Module | No |

| | | |
|---|---|---|
| Series | RT Series Module | No |
| Frame of Reference | Frame of Reference Module | No |
| Equipment | General Equipment Module | No |
| Plan | RT General Plan Module | Yes |
| | RT Patient Setup Module | Yes |
| | RT Fraction Scheme Module | Yes |
| | RT Ion Beams Module | No |
| | SOP Common Module | No |

#### 9.1.2.7.1 RT General Plan Module

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

#### 9.1.2.7.2 RT Patient Setup Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Patient Setup Sequence | (300A,0180) | SQ | 1 | |
| >Patient Setup Number | (300A,0182) | IS | 1 | Value not read |
| >Setup Technique Description | (300A,01B2) | ST | 3 | |

#### 9.1.2.7.3 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 |
| >Number of Brachy Application Setups | (300A,00A0) | IS | 1 | Value not read |

### 9.1.2.8 RT Ion Beams Treatment Record IOD

Storage of Treatment Record created during a session.

| 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 |

#### 9.1.2.8.1 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 | Supported values:<br>• M - Male<br>• F - Female<br>• O - Other |

#### 9.1.2.8.2 General Study Module

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

#### 9.1.2.8.3 RT Series Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Modality | (0008,0060) | CS | 1 | Supported value: RTRECORD. |
| Series Instance UID | (0020,000E) | UI | 1 | |
| Operators' Name | (0008,1070) | PN | 2 | |

#### 9.1.2.8.4 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 | Value stored in RayCare. |
| Treatment Time | (3008,0251) | TM | 2 | Value stored in RayCare. |
| Referenced RT Plan Sequence | (300C,0002) | SQ | 2 | |
| >Referenced SOP Class UID | (0008,1150) | UI | 1 | |
| >Referenced SOP Instance UID | (0008,1155) | UI | 1 | |

#### 9.1.2.8.5 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 | |

#### 9.1.2.8.6 RT Ion Beams Session Record Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Primary Dosimeter Unit | (300A,00B3) | CS | 1 | Supported values: MU, NP. |
| Treatment Session Ion Beam Sequence | (3008,0021) | SQ | 1 | |
| >Referenced Beam Number | (300C,0006) | IS | 1 | |

| | | | | |
|---|---|---|---|---|
| >Beam Name | (300A,00C2) | LO | 1 | |
| >Beam Description | (300A,00C3) | ST | 3 | |
| >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 |
| >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 | |
| >Applicator Sequence | (300A,0107) | SQ | 1C | |
| >>Applicator ID | (300A,0108) | SH | 1 | |
| >>Applicator Type | (300A,0109) | CS | 1 | Value not read |
| >>Applicator Description | (300A,010A) | LO | 3 | |
| >General Accessory Sequence | (300A,0420) | SQ | 3 | |
| >>General Accessory Number | (300A,0424) | IS | 1 | Value not read |
| >>General Accessory ID | (300A,0421) | SH | 1 | |
| >>General Accessory Description | (300A,0422) | ST | 3 | |
| >>General Accessory Type | (300A,0423) | CS | 3 | Supported values: GRATICULE, IMAGE_DETECTOR, RETICLE. |
| >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, CONTINUATION. |
| >Treatment Termination Status | (3008,002A) | CS | 1 | Supported values: NORMAL, OPERATOR, MACHINE, UNKNOWN. |
| >Specified Primary Meterset | (3008,0032) | DS | 3 | |
| >Delivered Primary Meterset | (3008,0036) | 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 | |
| >>Treatment Control Point Date | (3008,0024) | DA | 1 | Value stored in RayCare. |

| | | | | |
|---|---|---|---|---|
| >>Treatment Control Point Time | (3008,0025) | TM | 1 | Value stored in RayCare. |
| >>Specified Meterset | (3008,0042) | DS | 2 | |
| >>Delivered Meterset | (3008,0044) | DS | 1 | |
| >>Meterset Rate Delivered | (3008,0046) | FL | 3 | |
| >>Nominal Beam Energy | (300A,0114) | DS | 1C | |
| >>Gantry Angle | (300A,011E) | DS | 1C | |
| >>Gantry Rotation Direction | (300A,011F) | CS | 1C | Supported values: NONE, CW, CC. |
| >>Beam Limiting Device Angle | (300A,0120) | 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 | |
| >>Override Sequence | (3008,0060) | SQ | 3 | |
| >>>Parameter Sequence Pointer | (3008,0061) | AT | 1 | Value not read |
| >>>Override Parameter Pointer | (3008,0062) | AT | 1 | |
| >>>Parameter Item Index | (3008,0063) | IS | 1 | Value not read |
| >>>Operators' Name | (0008,1070) | PN | 2 | |

#### 9.1.2.8.7 SOP Common Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| SOP Class UID | (0008,0016) | UI | 1 | Supported value: 1.2.840.10008.5.1.4.1.1.481.9. |
| SOP Instance UID | (0008,0018) | UI | 1 | |

### 9.1.2.9 RT Radiation Set IOD

| IE | Module | Used |
|---|---|---|
| Patient | Patient Module | No |
| Study | General Study Module | Yes |
| Series | General Series Module | Yes |
| | Enhanced RT Series Module | No |
| Equipment | General Equipment Module | No |
| | Enhanced General Equipment Module | No |
| Frame of Reference | Frame of Reference Module | No |
| RT Radiation Set | General Reference Module | No |
| | RT Radiation Set Module | No |
| | RT Dose Contribution Module | No |

| | | |
|---|---|---|
| | SOP Common Module | Yes |
| | Common Instance Reference Module | No |
| | Radiotherapy Common Instance Module | No |

9.1.2.9.1 General Study Module

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

9.1.2.9.2 General Series Module

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

9.1.2.9.3 SOP Common Module

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

### 9.1.2.10 Robotic-Arm Radiation IOD

Only used in Accuray CyberKnife integration

| IE | Module | Used |
|---|---|---|
| Patient | Patient Module | No |
| Study | General Study Module | Yes |
| Series | General Series Module | Yes |
| | Enhanced RT Series Module | No |
| Equipment | General Equipment Module | No |
| | Enhanced General Equipment Module | No |
| Frame of Reference | Frame of Reference Module | No |
| RT Radiation | General Reference Module | No |
| | RT Delivery Device Common Module | No |
| | RT Radiation Common Module | No |
| | Robotic-Arm Delivery Device Module | No |
| | Robotic-Arm Path Module | No |
| | SOP Common Module | Yes |
| | Common Instance Reference Module | No |
| | Radiotherapy Common Instance Module | No |

9.1.2.10.1 General Study Module

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

#### 9.1.2.10.2 General Series Module

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

#### 9.1.2.10.3 SOP Common Module

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

### 9.1.2.11 Unified Procedure Step IOD

This section describes how attributes received in N-ACTION and N-SET command are used.

| IE | Module | Used |
|---|---|---|
| Unified Procedure Step | SOP Common Module | No |
| | Unified Procedure Step Relationship Module | No |
| | Unified Procedure Step Scheduled Procedure Information Module | No |
| | 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 |

#### 9.1.2.11.1 Unified Procedure Step Progress Information Module

| Attribute name | Tag | Vr | Type | Comment |
|---|---|---|---|---|
| Procedure Step State | (0074,1000) | CS | | Supported values:<br>• IN PROGRESS - Set in N-ACTION by TDD<br>• CANCELED - Set in N-ACTION by the TDD when a session is canceled<br>• COMPLETED - Set in N-ACTION by the TDD when a session is completed normally |
| Procedure Step Progress Information Sequence | (0074,1002) | SQ | | Sent in N-SET requests by the TDD. |
| >Procedure Step Progress | (0074,1004) | DS | | A numerical value in the range between '0' and '100' is supported. Value logged in application. |
| >Procedure Step Progress Description | (0074,1006) | ST | | Optionally a description for the current progress can be supplied. Value logged in application. |
| >Procedure Step Progress Parameters Sequence | (0074,1007) | SQ | | Optionally an item describing the Referenced Beam Number can be read and logged by the application. Other items are ignored. |

| | | | | |
|---|---|---|---|---|
| >>Value Type | (0040,A040) | CS | 1 | Supported value: NUMERIC. |
| >>Concept Name Code Sequence | (0040,A043) | SQ | 1 | |
| >>>Code Value | (0008,0100) | SH | 1C | Supported value:<br>• 2018004 - Referenced Beam Number |
| >>>Coding Scheme Designator | (0008,0102) | SH | 1C | Supported value: 99IHER02018. |
| >>>Code Meaning | (0008,0104) | LO | 1 | Supported value: Referenced Beam Number. |
| >>Numeric Value | (0040,A30A) | DS | 1C | Integer value matching a Beam Number from the delivery plan. |
| Transaction UID | (0008,1195) | UI | 3 | TDW-1: Value is generated by the Driver when a N-ACTION request sets the UPS to IN PROGRESS.<br><br>Stored by the driver and need to match all subsequent N-SET and N-ACTION requests related to this specific UPS. |

### 9.1.3 Attribute Mapping

Not applicable

### 9.1.4 Coerced/Modified Fields

Not applicable

## 9.2 DATA DICTIONARY OF PRIVATE ATTRIBUTES

No private attributes are used by the driver.

## 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

### 9.5.2 Specialized SOP Class

Not applicable

### 9.5.3 Private SOP Class

Not applicable

## 9.6 PRIVATE TRANSFER SYNTAXES

Not applicable

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