RAYSTATION 11A

DICOM Conformance Statement Varian Driver

Declaration of conformity

CE 0413

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

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1 OVERVIEW

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

1.1 NETWORK SERVICES

SOP Class Name	SOP Class UID	Provider of Service (SCP)	User of Service (SCU)
Transfer			
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	No
RT 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
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Yes	No
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	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
2020-11-27	1.0	Varian Driver DCS for RayStation Release 10B
2021-05-12	1.0	Varian Driver DCS for RayStation Release 11A

3.1.1 VARIAN Driver changelog

3.1.1.1 Updates between 10.1.0 (RayStation 10B) - 11.0.0 (RayStation 11A)

- Separated storage of photos to reduce unnecessary load time.

3.2 AUDIENCE

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

3.3 REMARKS

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

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

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

3.3.1 Interoperability validation needed

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

3.3.2 DICOM revision

The module tables listed in the last two chapters are based on part 3 of the DICOM-standard edition 2020a. For extra clarity all attributes in the referenced modules have been listed, even the ones that are not used by Varian.

3.4 TERMS AND DEFINITIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3.5 BASICS OF DICOM COMMUNICATION

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

Two Application Entities (devices) that want to communicate with each other over a network using DICOM protocol must first agree on several things during an intial network "handshake". One of the two devices must initiate an Association (a connection to the other

device), and ask if specific services, information, and encoding can be supported by the other device (Negotiation).

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

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

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

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

3.6 ABBREVIATIONS

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

3.7 REFERENCES

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

4 NETWORKING

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

4.1 IMPLEMENTATION MODEL

4.1.1 Application data flow

Not applicable. The application flow between the RayTreat Varian Driver and the TDD includes FHIR requests.

4.1.2 Functional Definition of AEs

4.1.2.1 Functional Definition of "Varian Application Entity"

The following operations are supported:

CT Image

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

RT Structure Set

- C-MOVE for planning RT Structure Set.

Spartial Registration (SRO)

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

RT Image

- C-STORE for setup RT Images.

RT Plan

- C-STORE of RT Plan with changes made during treatment.
- C-MOVE for RT Plan referenced in the Procedure Request.

RT Beams Treatment Record

- C-STORE of delivery result.
- C-FIND for previously delivered Treatment Records for a specific plan and fraction number.

RT Treatment Summary Record

- C-MOVE for the treatment summary record for the current plan to be delivered.

Verification

- C-ECHO for connection verification.

4.1.3 Sequence of Real World Activities

Not applicable.

4.2 AE SPECIFICATIONS:

4.2.1 RayTreat Varian Driver Application Entity

4.2.1.1 SOP Classes

SOP Class Name	SOP Class UID	Provider of Service (SCP)	User of Service (SCU)
Transfer			

CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	No
RT 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
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Yes	No
Query/Retrieve			
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Verification			
Verification SOP Class	1.2.840.10008.1.1	Yes	No

4.2.1.2 Association Policies

Not applicable

4.2.1.3 General

The DICOM standard Application context shall be specified.

Application Context Name	1.2.840.10008.3.1.1.1

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

4.2.1.4 Number of Associations

Any number of incoming concurrent associations are accepted.

4.2.1.5 Asynchronous Nature

RayTreat Varian Driver supports multiple asynchronous C-MOVE requests.

4.2.1.6 Implementation Identity Information

Not applicable

4.2.1.7 Association Initiation Policy

The implementation for this Application Entity is:

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

4.2.1.8 Activity C-ECHO

4.2.1.8.1 Description and Sequencing of Activities

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

4.2.1.8.2 Accepted Presentation Context

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

		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.9 Activity C-FIND

4.2.1.9.1 Description and Sequencing of Activities

Not applicable

4.2.1.9.2 Accepted Presentation Context

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax name	Transfer Syntax UID	Role	Extended Negotiation
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.10 Activity C-MOVE

4.2.1.10.1 Description and Sequencing of Activities

Not applicable

4.2.1.10.2 Accepted Presentation Context

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

4.2.1.11 Activity C-STORE

4.2.1.11.1 Description and Sequencing of Activities

Not applicable

4.2.1.11.2 Accepted Presentation Context

Abstract Syntax Name	Abstract Syntax UID	Transfer Syntax name	Transfer Syntax UID	Role	Extended Negotiation
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
RT 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		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.11.3 Status Response

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

5 MEDIA INTERCHANGE

Not applicable

6 TRANSFORMATION OF DICOM TO CDA

Not applicable

7 SUPPORT OF CHARACTER SETS

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

- ISO_IR 192

8 SECURITY

8.1 SECURITY PROFILES

No Security Profiles are supported.

8.2 ASSOCIATION LEVEL SECURITY

RayTreat Varian 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

IE	Module	Used
Patient	Patient Module	No
Study	General Study Module	No
Series	RT Series Module	Yes
Equipment	General Equipment Module	Yes
Plan	RT General Plan Module	Yes
	RT Tolerance Tables Module	Yes
	RT Patient Setup Module	Yes
	RT Beams Module	Yes
	RT Brachy Application Setups Module	No
	SOP Common Module	Yes

9.1.1.1.1 RT Series Module

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

9.1.1.1.2 General Equipment Module

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

9.1.1.1.3 RT General Plan Module

Attribute name	Tag	Vr	Type	Comment
Plan Intent	(300A,000A)	CS	3	Possible values: CURATIVE, VERIFICATION.
Referenced RT Plan Sequence	(300C,0002)	SQ	3	
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	
>RT Plan Relationship	(300A,0055)	CS	1	Always PREDECESSOR.

9.1.1.1.4 RT Tolerance Tables Module

Attribute name	Tag	Vr	Type	Comment
Tolerance Table Sequence	(300A,0040)	SQ	3	
>Tolerance Table Number	(300A,0042)	IS	1	
>Tolerance Table Label	(300A,0043)	SH	3	

>Gantry Angle Tolerance	(300A,0044)	DS	3	
>Gantry Pitch Angle Tolerance	(300A,014E)	FL	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	
>>Beam Limiting Device Position Tolerance	(300A,004A)	DS	1	
>Patient Support Angle Tolerance	(300A,004C)	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	

9.1.1.1.5 RT Patient Setup Module

Attribute name	Tag	Vr	Type	Comment
Patient Setup Sequence	(300A,0180)	SQ	1	
>Setup Technique Description	(300A,01B2)	ST	3	Set on delivery plan

9.1.1.1.6 RT Beams Module

Attribute name	Tag	Vr	Type	Comment
Beam Sequence	(300A,00B0)	SQ	1	
>Manufacturer	(0008,0070)	LO	3	
>Manufacturer's Model Name	(0008,1090)	LO	3	
>Referenced Tolerance Table Number	(300C,00A0)	IS	3	
>Referenced Reference Image Sequence	(300C,0042)	SQ	3	
>>Referenced SOP Class UID	(0008,1150)	UI	1	
>>Referenced SOP Instance UID	(0008,1155)	UI	1	
>>Reference Image Number	(300A,00C8)	IS	1	
>Control Point Sequence	(300A,0111)	SQ	1	
>>Table Top Vertical Position	(300A,0128)	DS	2C	
>>Table Top Longitudinal Position	(300A,0129)	DS	2C	
>>Table Top Lateral Position	(300A,012A)	DS	2C	
Varian 3253	(3253,0010)	LO	3	Varian Medical Systems VISION 3253

Extended Interface Format	(3253,1002)	LO	1	Identifier string defining format of Extended Interface Data (3253,xx00). Applications should be able to unambiguously map this string to an XML schema definition. Value will always be 'ExtendedIF'.
Extended Interface Data	(3253,1000)	OB	1	Contains private extensions as an XML stream. Schema of XML is defined by Extended Interface Format (3253,xx02).
Extended Interface Length	(3253,1001)	IS	1	Length of XML stream contained in Extended Interface Data (3253,xx00). Usually is equal to attribute length of Extended Interface Data (3253,xx00) if length is even and is one less than attribute length if length is odd.

9.1.1.1.7 SOP Common Module

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

9.1.1.2 RT Treatment Summary Record IOD

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

9.1.1.2.1 Patient Module

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

9.1.1.2.2 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	

9.1.1.2.3 RT Series Module

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

9.1.1.2.4 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Manufacturer	(0008,0070)	LO	2	
Station Name	(0008,1010)	SH	3	
Manufacturer's Model Name	(0008,1090)	LO	3	
Device Serial Number	(0018,1000)	LO	3	
Software Versions	(0018,1020)	LO	3	

9.1.1.2.5 RT General Treatment Record Module

Attribute name	Tag	Vr	Type	Comment
Treatment Date	(3008,0250)	DA	2	
Treatment Time	(3008,0251)	TM	2	
Referenced RT Plan Sequence	(300C,0002)	SQ	2	
>Referenced SOP Class UID	(0008,1150)	UI	1	
>Referenced SOP Instance UID	(0008,1155)	UI	1	

9.1.1.2.6 RT Treatment Summary Record Module

Attribute name	Tag	Vr	Type	Comment
Current Treatment Status	(3008,0200)	CS	1	Always ON_TREATMENT.
First Treatment Date	(3008,0054)	DA	2	
Most Recent Treatment Date	(3008,0056)	DA	2	
Fraction Group Summary Sequence	(3008,0220)	SQ	3	
>Referenced Fraction Group Number	(300C,0022)	IS	3	
>Fraction Group Type	(3008,0224)	CS	2	Always EXTERNAL_BEAM.
>Number of Fractions Planned	(300A,0078)	IS	2	
>Number of Fractions Delivered	(3008,005A)	IS	2	
>Fraction Status Summary Sequence	(3008,0240)	SQ	3	
>>Referenced Fraction Number	(3008,0223)	IS	1	

>>Treatment Date	(3008,0250)	DA	2	
>>Treatment Time	(3008,0251)	TM	2	
>>Treatment Termination Status	(3008,002A)	CS	2	Possible values: NORMAL, OPERATOR, MACHINE.
Treatment Summary Calculated Dose Reference Sequence	(3008,0050)	SQ	3	
>Referenced Dose Reference Number	(300C,0051)	IS	3	
>Dose Reference Description	(300A,0016)	LO	3	
>Cumulative Dose to Dose Reference	(3008,0052)	DS	1	
Varian 3265	(3265,0010)	LO	3	Varian Medical Systems VISION 3265
Total Number of Fractions	(3265,1000)	SL	1	
Last Treated Fraction	(3265,1001)	SL	1	

9.1.1.2.7 SOP Common Module

Attribute name	Tag	Vr	Type	Comment
SOP Class UID	(0008,0016)	UI	1	
SOP Instance UID	(0008,0018)	UI	1	
Specific Character Set	(0008,0005)	CS	1C	
Instance Creation Date	(0008,0012)	DA	3	
Instance Creation Time	(0008,0013)	TM	3	
Instance Number	(0020,0013)	IS	3	

9.1.2 Usage of Attributes From Received IODs

9.1.2.1 CT Image IOD

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	General Series Module	Yes
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	No
Image	General Image Module	No
	Image Plane Module	No
	Image Pixel Module	No
	Contrast/Bolus Module	No
	CT Image Module	Yes
	Multi-energy CT Image Module	No

	SOP Common Module	Yes

9.1.2.1.1 Patient Module

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

9.1.2.1.2 General Study Module

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

9.1.2.1.3 General Series Module

Attribute name	Tag	Vr	Type	Comment
Modality	(0008,0060)	CS	1	Value not read
Series Instance UID	(0020,000E)	UI	1	
Series Date	(0008,0021)	DA	3	
Series Time	(0008,0031)	TM	3	
Series Description	(0008,103E)	LO	3	
Patient Position	(0018,5100)	CS	2C	

9.1.2.1.4 Frame of Reference Module

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

9.1.2.1.5 CT Image Module

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

Table Top Roll Angle	(300A,0144)	FL	3	
Table Top Longitudinal Position	(300A,0129)	DS	3	
Table Top Lateral Position	(300A,012A)	DS	3	

9.1.2.1.6 SOP Common Module

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

9.1.2.2 RT Image IOD

IE	Module	Used
Patient	Patient Module	Yes
Study	General Study Module	Yes
Series	RT Series Module	Yes
Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	No
Image	General Image Module	No
	Image Pixel Module	No
	Contrast/Bolus Module	No
	Cine Module	No
	Multi-frame Module	No
	RT Image Module	Yes
	SOP Common Module	Yes
	Frame Extraction Module	No

9.1.2.2.1 Patient Module

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

9.1.2.2.2 General Study Module

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

9.1.2.2.3 RT Series Module

Attribute name	Tag	Vr	Type	Comment

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

9.1.2.2.4 Frame of Reference Module

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

9.1.2.2.5 RT Image Module

Attribute name	Tag	Vr	Type	Comment
Samples per Pixel	(0028,0002)	US	1	Value not read
Photometric Interpretation	(0028,0004)	CS	1	Value not read
Bits Allocated	(0028,0100)	US	1	Value not read
Bits Stored	(0028,0101)	US	1	Value not read
High Bit	(0028,0102)	US	1	Value not read
Pixel Representation	(0028,0103)	US	1	Value not read
RT Image Label	(3002,0002)	SH	1	
Image Type	(0008,0008)	CS	1	Supported values: DERIVED, SECONDARY, DRR, CT_PROJECTION, PORTAL, ORIGINAL, PRIMARY.
RT Image Plane	(3002,000C)	CS	1	Value not read
Patient Support Angle	(300A,0122)	DS	3	
Table Top Pitch Angle	(300A,0140)	FL	3	
Table Top Roll Angle	(300A,0144)	FL	3	
Table Top Vertical Position	(300A,0128)	DS	3	
Table Top Longitudinal Position	(300A,0129)	DS	3	
Table Top Lateral Position	(300A,012A)	DS	3	
Patient Position	(0018,5100)	CS	1C	

9.1.2.2.6 SOP Common Module

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

9.1.2.3 RT Plan IOD

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

Frame of Reference	Frame of Reference Module	Yes
Equipment	General Equipment Module	Yes
Plan	RT General Plan Module	Yes
	RT Patient Setup Module	Yes
	RT Beams Module	Yes
	RT Brachy Application Setups Module	No
	SOP Common Module	Yes

9.1.2.3.1 Patient Module

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

9.1.2.3.2 General Study Module

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

9.1.2.3.3 RT Series Module

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

9.1.2.3.4 Frame of Reference Module

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

9.1.2.3.5 General Equipment Module

Attribute name	Tag	Vr	Type	Comment
Software Versions	(0018,1020)	LO	3	Read from the plan to determine if checksum validation shall be run.

9.1.2.3.6 RT General Plan Module

Attribute name	Tag	Vr	Type	Comment

RT Plan Label	(300A,0002)	SH	1	
RT Plan Geometry	(300A,000C)	CS	1	Value not read

9.1.2.3.7 RT Patient Setup Module

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

9.1.2.3.8 RT Beams Module

Attribute name	Tag	Vr	Type	Comment
Beam Sequence	(300A,00B0)	SQ	1	
>Beam Number	(300A,00C0)	IS	1	
>Beam Type	(300A,00C4)	CS	1	Value not read
>Beam Limiting Device Sequence	(300A,00B6)	SQ	1	Value not read
>Referenced Patient Setup Number	(300C,006A)	IS	3	
>Treatment Delivery Type	(300A,00CE)	CS	3	Supported values: TREATMENT, SETUP.
>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	
>>Control Point Index	(300A,0112)	IS	1	

9.1.2.3.9 SOP Common Module

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

9.1.2.4 RT Beams Treatment Record IOD

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

Equipment	General Equipment Module	No
Treatment Record	RT General Treatment Record Module	Yes
	RT Treatment Machine Record Module	Yes
	RT Beams Session Record Module	Yes
	SOP Common Module	Yes
	Common Instance Reference Module	Yes

9.1.2.4.1 Patient Module

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

9.1.2.4.2 General Study Module

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

9.1.2.4.3 RT Series Module

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

9.1.2.4.4 RT General Treatment Record Module

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

9.1.2.4.5 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	

9.1.2.4.6 RT Beams Session Record Module

Attribute name	Tag	Vr	Type	Comment
Primary Dosimeter Unit	(300A,00B3)	CS	1	

Treatment Session Beam Sequence	(3008,0020)	SQ	1	
>Referenced Beam Number	(300C,0006)	IS	3	
>Beam Name	(300A,00C2)	LO	3	
>Beam Type	(300A,00C4)	CS	1	
>Radiation Type	(300A,00C6)	CS	1	Value not read
>Beam Limiting Device Leaf Pairs Sequence	(3008,00A0)	SQ	1	Value not read
>Number of Wedges	(300A,00D0)	IS	1	Value not read
>Current Fraction Number	(3008,0022)	IS	2	
>Treatment Delivery Type	(300A,00CE)	CS	2	
>Treatment Termination Status	(3008,002A)	CS	1	Supported values: UNKNOWN, NORMAL, OPERATOR, MACHINE.
>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	
>>Treatment Control Point Date	(3008,0024)	DA	1	Value not read
>>Treatment Control Point Time	(3008,0025)	TM	1	Value not read
>>Specified Meterset	(3008,0042)	DS	2	
>>Delivered Meterset	(3008,0044)	DS	1	
>>Gantry Angle	(300A,011E)	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	

9.1.2.4.7 SOP Common Module

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

9.1.2.4.8 Common Instance Reference Module

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

>>Referenced SOP Class UID	(0008,1150)	UI	1	Used to find the series of the Referenced RT Plan (300C,0002).
>>Referenced SOP Instance UID	(0008,1155)	UI	1	Used to find the series of the Referenced RT Plan (300C,0002).

9.1.2.5 RT Treatment Summary Record IOD

IE	Module	Used
Patient	Patient Module	No
Study	General Study Module	No
Series	RT Series Module	No
Equipment	General Equipment Module	No
Treatment Record	RT General Treatment Record Module	No
	RT Treatment Summary Record Module	Yes
	SOP Common Module	No

9.1.2.5.1 RT Treatment Summary Record Module

Attribute name	Tag	Vr	Type	Comment
Current Treatment Status	(3008,0200)	CS	1	Value not read

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
	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	

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	Value not read
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	Value not read
Content Time	(0008,0033)	TM	1	Value not read
Instance Number	(0020,0013)	IS	1	Value not read
Content Label	(0070,0080)	CS	1	Value not read
Registration Sequence	(0070,0308)	SQ	1	
>Frame of Reference UID	(0020,0052)	UI	1C	
>Referenced Image Sequence	(0008,1140)	SQ	1C	
>>Referenced SOP Class UID	(0008,1150)	UI	1	
>>Referenced SOP Instance UID	(0008,1155)	UI	1	
>Matrix Registration Sequence	(0070,0309)	SQ	1	Value not read

9.1.2.6.6 Common Instance Reference Module

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 SOP Common Module

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

9.1.3 Attribute Mapping

Not applicable

9.1.4 Coerced/Modified Fields

Not applicable

9.2 DATA DICTIONARY OF PRIVATE ATTRIBUTES

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

Attribute name	Tag	VR	VM	Value
RaySearch Private Creator	(4001,0010)	LO	1	RAYSEARCHLABS 2.0
Varian 3253	(3253,0010)	LO	1	Varian Medical Systems VISION 3253
Varian 3259	(3259,1000)	LO	1	Varian Medical Systems VISION 3259
Varian 3265	(3265,0010)	LO	1	Varian Medical Systems VISION 3265

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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