



**TrueBeam Imaging**  
**Release 2.0** **DICOM Conformance Statement**



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**Abstract** This document provides information about the DICOM Conformance of the TrueBeam Imaging version 2.0.

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# 1 Introduction

## 1.1 Audience

This document is intended for the following groups of persons:

- System integrators of medical equipment
- Other vendors offering interfacing via DICOM
- Marketing and sales persons

It is assumed, that the reader is familiar with the DICOM standard.

The document is structured firmly along the template definition as specified in Part 2 of the DICOM standard.

## 1.2 Overview

The TrueBeam Imaging application is an application that is used to setup a patient for treatment purposes. To support this function the following DICOM services for receiving and sending diagnostic imaging modalities are supported.

Table 1-1 lists network services supported by TrueBeam Imaging

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
<b>Transfer</b>		
CT Image Storage	Yes	Yes
Spatial Registration Storage	Yes	No
RT Structure Set Storage	Yes	Yes
RT Image Storage	Yes	Yes
RT Plan Storage	No	Yes
<b>Query/Retrieve</b>		
Study Root Query/Retrieve Information Model – FIND	Yes	No
Study Root Query/Retrieve Information Model – MOVE	Yes	No

**Table 1-1: Network Services used by TrueBeam Imaging**

Table 1-2 lists Media File SOP Classes supported for file based export and import. These SOP classes are only supported when the TrueBeam Imaging application is operating in file mode.

SOP Classes	DICOM Media File Export	DICOM Media File Import
CT Image Storage	Yes	Yes
Spatial Registration Storage	Yes	No
RT Structure Set Storage	Yes	Yes
RT Image Storage	Yes	Yes
RT Plan Storage	No	Yes

**Table 1-2: Media File SOP Classes TrueBeam Imaging**

### 1.3 Remarks

The scope of this Conformance Statement is to facilitate communication of the TrueBeam Imaging application and other vendor’s medical equipment. The Conformance Statement should be read and understood in conjunction with the DICOM standard [1].

The DICOM standard in the current version evolved in 1993 with DICOM 3.0. The definition of the DICOM standard for radiotherapy data started in 1994 and has now reached a mature state. Nowadays DICOM is the primary choice for exchanging data with an open standard protocol for the majority of vendors and institutions. Varian Medical Systems is committed to this notion of standard-based cross-vendor interoperability as well as making use of the DICOM protocol among its own products.

DICOM, by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality.

This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of information intended.

Because the DICOM standard is subject to ongoing changes, enhancements and improvements, Varian Medical Systems reserves the right to advance their products by making use of upcoming DICOM features.

This document contains definitions which are specific for the TrueBeam Imaging product. For definitions which are specific for the TrueBeam Treatment Console application see [2]. Otherwise, all definitions of the Varian System Server DICOM conformance statement apply as applicable, see [3].

## 1.4 References

- [1] Digital Imaging and Communications in Medicine (DICOM), Parts 1-18 (2011), National Electrical Manufacturers Association (NEMA)  
Rosslyn, VA, USA
- [2] TrueBeam Treatment Console DICOM Conformance Statement  
P/N P1012061  
Varian Medical Systems Inc  
Palo Alto, CA, USA
- [3] Varian System Server DICOM Conformance Statement  
P/N VA1302D3CS  
Varian Medical Systems International AG  
Baden, Switzerland
- [4] TrueBeam Administrators Guide  
P/N 1000058502  
Varian Medical Systems Inc  
Palo Alto, CA, USA
- [5] IHE Radiation Oncology  
Technical Framework Supplement  
Multimodality Image Registration for Radiation Oncology 2012  
(MMRO-II)  
[ftp://ftp.ihe.net/RadiationOncology/Supplements/MMRO-II/IHE-RO\\_MMRO-II\\_Supplement\\_V1-0\\_2012-02-29.docx](ftp://ftp.ihe.net/RadiationOncology/Supplements/MMRO-II/IHE-RO_MMRO-II_Supplement_V1-0_2012-02-29.docx)

## 1.5 Definitions, Terms and Abbreviations

This section provides the definitions of terms, acronyms and abbreviations that are used throughout the document

AE	Application Entity
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service element
IOD	Information Object Definition (→DICOM term)
NEMA	National Electrical Manufacturers Association
PDU	Protocol Data Unit (→DICOM term)
SCU	Service Class User
SCP	Service Class Provider
SOP	Service Object Pair
TCP/IP	Transmission Control Protocol / Internet Protocol, a widely used computer networking protocol
Treatment Management System	DICOM entity from which TrueBeam Imaging application retrieves structure set data
UID	Unique Identifier used to identify an object by a worldwide unique identifier (→DICOM term)
VR	Value Representation, a data encoding method in →DICOM

# 2 Networking

## 2.1 Implementation Model

### 2.1.1 Application Data Flow

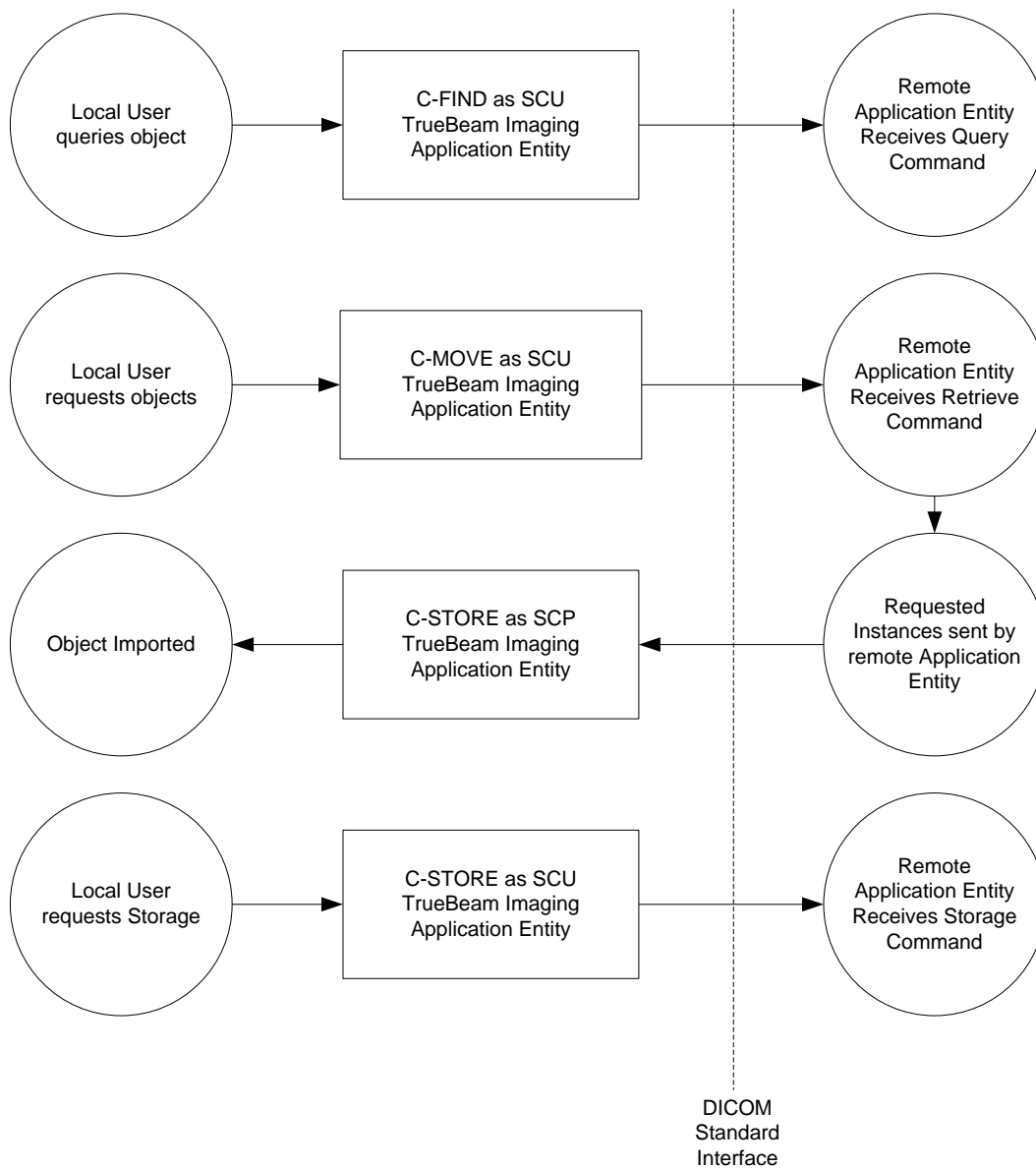


Figure 2-1 Implementation Model

Conceptually, the network services may be modeled as the following separate AEs, though in fact all the AEs share a single (configurable) AE Title:

- STORAGE-SCP, receives incoming RT images, CT images, RT Plans and Structure Sets.
- STORAGE-SCU, sends outbound RT images, CT images, Structure Sets and Spatial Registrations.
- FIND-SCU, which queries remote AE's for lists of studies, series and instances.
- MOVE-SCU, which retrieves selected studies, series or instances.
- ECHO-SCU which sends outgoing echo request to Remote Application Entity

## 2.1.2 Functional Definition of AE's

Note that conceptually the network services may be modeled as the following separate AEs, though in fact all the AEs share a single (configurable) AE Title.

### 2.1.2.1 TrueBeam Imaging Client Storage SCU Application Entity

The Storage SCU Application Entity is invoked when

- A simple 2D, 2D/2D, marker or 3D/3D matching has been performed and Spatial Registrations or Markers must be sent to the Remote AE.
- A 3D/3D matching has been performed and the acquired CT set must be sent to the Remote AE
- Marker Detection has been performed and the markers must be sent to the Remote AE as Structure set linked to the current reference CT image. Each marker is defined as own point set with a single point in it.
- Marker Match has been performed, the markers are stored as curves in the image object and the image object must be sent to the Remote AE.
- When the user saves an acquired image through the UI, the image is then sent to the Remote AE.
- The treatment fraction is closed and all unsaved acquired images and other IODs are sent to the Remote AE.

### 2.1.2.2 TrueBeam Imaging Client Query/Retrieve SCU Application Entity

The Query/Retrieve Application Entity is invoked when

- The patient is loaded in the TrueBeam Treatment application, and reference images need to be loaded in TrueBeam Imaging
- Structure Set and CT images must be loaded in order to perform marker detection/matching, 2D/3D matching, 3D/3D matching or to generate DRRs.

### 2.1.2.3 TrueBeam Imaging Client Storage SCP Application Entity

The Storage SCP Application Entity is invoked in order to receive objects requested from a remote Query/Retrieve SCP, such as:

- Reference Images
- Structure Sets
- RT Plan
- Reference CT image set

### 2.1.3 Sequencing of Real World Activities

When a patient is loaded into the application, it loads each reference image by requesting them from the remote AE.

Referenced structure set and related CT images are loaded if the plan defines the RT structure set on which the RT plan is based on in the plan's Referenced Structure Set Sequence (300C, 0060). The application invokes a move command for each CT Image related to the structure set represented by the *CT Image Query/Retrieve SCU*. For this purpose, the application provides the *CT Image Storage SCP*.

When Marker Detection is performed, Storage SCU entity is invoked and the Marker Data (as Structure Set) are stored to the remote AE.

When either a Simple 2D, 2D/2D, 2D/3D, 3D/3D or marker matching is performed, the Storage SCU entity is invoked and stores a Spatial Registration to the remote AE

When loading from or saving to the Remote Application Entity, the ECHO-SCU entity is typically invoked to ensure that the remote AE is alive and responsive.

The loading of a reference CT set is described by the following sequence diagram, which illustrates, that the plan and the structure set is retrieved as well to follow the appropriate references:

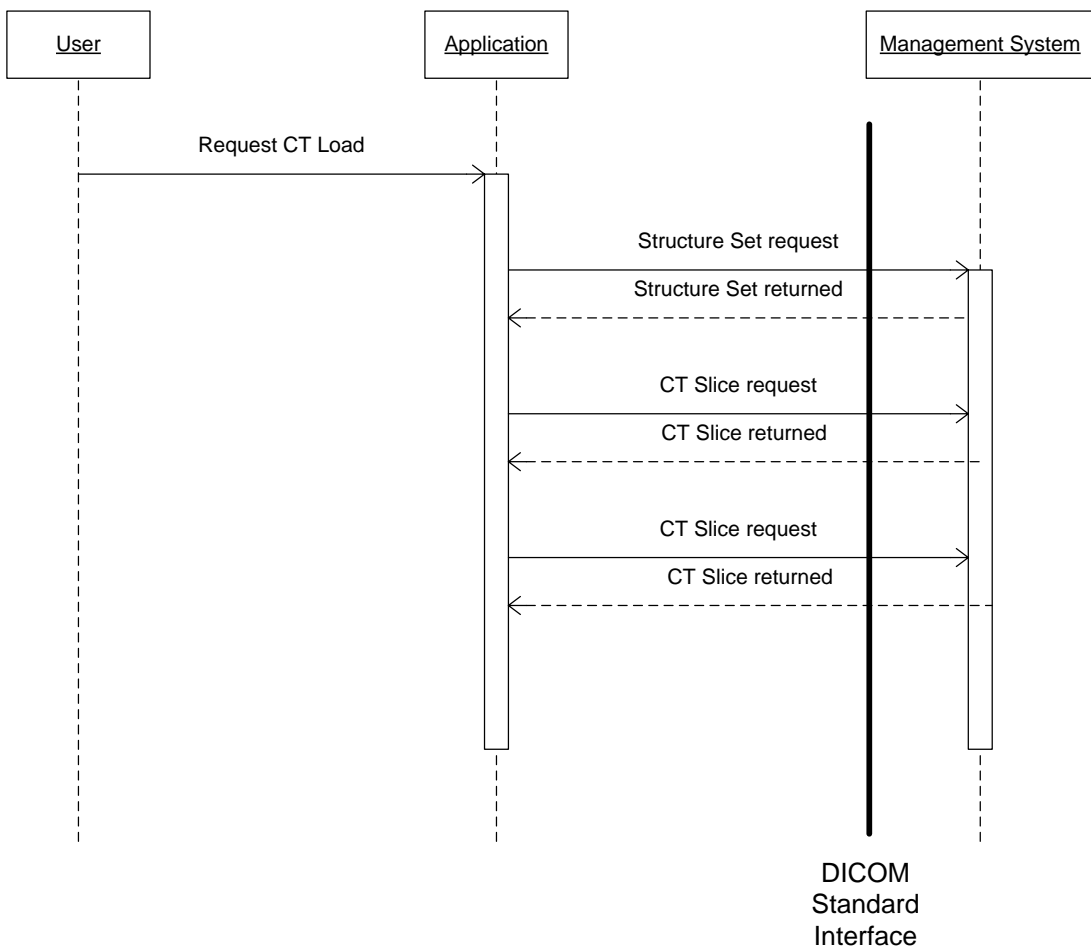


Figure 2-2 Sequence Diagram for CT Set loading

## 2.2 AE Specifications

### 2.2.1 TrueBeam Imaging Entity Specification

#### 2.2.1.1 SOP Classes

The TrueBeam Imaging Entity provides standard conformance to the following DICOM SOP classes.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
RT Image Storage	1.2.840.10008.5.1.4.1.1.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		DICOM MPEG2 Image Compression	1.2.840.10008.1.2.4.100	SCU	None
RT Plan Storage	1.2.840.10008.5.1.4.1.1.5	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
Study Root Query/Retrieve information model- FIND	1.2.840.10008.5.1.4.1.2.2.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Study Root Query/Retrieve information model- MOVE	1.2.840.10008.5.1.4.1.2.2.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

**Table 2-1 Supported SCU/SCP SOP Classes for TrueBeam Imaging Entity**

## 2.2.1.2 Association Policies

### 2.2.1.2.1 General

The DICOM standard application context name for DICOM 3.0 is always proposed.

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

**Table 2-2 DICOM Application Context for TrueBeam Imaging Client Application Entity**

### 2.2.1.2.2 Number of Associations

The TrueBeam Imaging Client Application Entity can initiate (by default) up to three associations at a time. This value is configurable.

### 2.2.1.2.3 Asynchronous Nature

TrueBeam Imaging Client Application Entity does not support asynchronous communication.

### 2.2.1.2.4 Implementation Identifying Information

The following Implementation Class UIDs can be configured through system administration. The correct setting depends on the management system interfaced. For further information refer to the TrueBeam Administrators guide [4].

UID Value	UID Name
1.2.246.352.70.2.1.9	VMS Console System 6.5 SCU (VMS Console Interface 1)
1.2.246.352.70.2.1.70.1	VMS TDS Interface 1

**Table 2-3 Used implementation class UIDs**

## 2.2.1.3 Association Initiation Policy

The TrueBeam Imaging Client Application Entity does initiate Associations.

### 2.2.1.3.1 Activity – Store

#### 2.2.1.3.1.1 Description and Sequencing of Activities

When the user performs a Simple 2D, 2D/2D, 2D/3D, marker or 3D/3D matching, the match transformation will be stored as a Spatial Registration IOD. The TrueBeam Imaging administration tool can be configured to disable the storage of spatial registrations.

When the user performs marker detection on the reference CT image, the positions of the detected markers will be stored in the Structure Set and linked to the current reference CT image. The TrueBeam Imaging administration tool can be configured to disable the storage of the marker data.

When the user performs a marker match, the positions of the matched markers will be stored in the acquired RT Image object as curves. The TrueBeam Imaging administration tool can be configured to disable the storage of the marker data. The Curve Dimensions (5002,0005) will be 2, the Number of Points (5002,0010) will be 1, Type of Data (5000,0020) will be POLY, Axis Units (5000,0030) will be PIXL\PIXL, Axis Labels (5000,0040) will be Marker\Marker and Data Value Representation (5000,0103) will be 3.



When the user acquires a verification CT set, each CT Image will be stored. The following isocenters are stored as Points in the Structure Set which is linked to the acquired verification CT set. The values of the RT ROI Interpreted Type (3006,00A4) will be as follows:

- Initial Laser Isocenter (position before acquisition, e.g. initial setup position): INITLASERISO
- Acquisition Isocenter (position during acquisition): ACQ\_ISOCENTER
- Initial Match Isocenter (position when first match was started): INITMATCHISO

The TrueBeam Imaging administration tool can be configured to disable the storage of CT images and isocenters.

The Storage SCU will be invoked and attempts to initiate a new Association. If multiple objects shall be transferred then multiple C-STORE requests will be issued over this Association.

Object Category	SOP Class Name	SOP Class UID
Structure Set	RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3
Spatial Registration	Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1
RT Image	RT Image Storage	1.2.840.10008.5.1.4.1.1.1
CT Image	CT Image Storage	1.2.840.10008.5.1.4.1.1.2

**Table 2-4 Object Categories used by TrueBeam Imaging Client Storage SCU Application Entity**

### 2.2.1.3.1.2 Proposed Presentation Contexts

TrueBeam Imaging Client Storage SCU is capable of proposing the Presentation Contexts shown in the following table.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Implicit VR Big Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Implicit VR Big 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	SCU	None
		Implicit VR Big Endian	1.2.840.10008.1.2.1		

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
RT Image Storage	1.2.840.10008.5.1.4.1.1.48 1.1	MPEG2 Main Profile @ Main Level	1.2.840.10008.1.2.4. 100	SCU	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Implicit VR Big Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

**Table 2-5 Proposed Presentation Contexts for TrueBeam Imaging Client Storage SCU Application Entity**

**2.2.1.3.1.3 SOP Specific Conformance for all Storage SOP Classes**

The behavior of TrueBeam Imaging Client Storage SCU upon storage is summarized in table below

Service Status	Further Meaning	Error Code	Behavior
Refused	Out of Resources	A7xx	The user is informed that the C-STORE request has failed. Status Comment (0000,0902) is logged and displayed along with additional error information.
Failure	Data Set does not match SOP Class	A9xx	
	Cannot understand	Cxxx	
Warning	Coercion of Data Elements	B000	The SCP has successfully stored the SOP Instance. Because a warning status was received Status Comment (0000,0902) is logged .
	Data Set does not match SOP Class	B007	
	Elements Discarded	B006	
Success	Success	0000	The SCP has successfully stored the SOP Instance. No user feedback is received.
*	*	Any other status code.	Depending on the type of the Error Code it is either handled like a Failure or Warning. However, Error Codes other than listed above in this table should not occur, as they are not defined for C-STORE (see [1], PS 3.4, Table B.2-1).

**Table 2-6 TrueBeam Imaging Client C-STORE Response Status Handling Behavior**

After sending all SOP Instances, either successfully or not, the Association is released using A-RELEASE and the results are presented to the user.

Exception	Behavior
Timeout	The Association is released using A-RELEASE and the whole task of sending SOP Instances is aborted. The user is informed about the timeout and available information about it is logged.
Association aborted by the SCP or network layers	The whole task of sending SOP Instances is aborted. The user is informed about the aborted associations and available information about it is logged.

**Table 2-7 TrueBeam Imaging Client Storage SCU Communication Failure Behavior**

#### 2.2.1.3.1.4 SOP Specific Conformance for RT Structure Set Storage

Detected marker positions will be saved to a new structure set. This structure set references the planning CT Frame of Reference and contains the detected marker positions as they are projected on the planning CT. The modified structure set gets a new UID and the private referenced structure set sequence (3263,1001) is used to denote the original structure set (with the old UID). This sequence maybe used by the Treatment Management System to combine the new structure set and the original one to add the markers as detected by TrueBeam Imaging.

The ROI Contour Sequence (3006, 0040) shall have the following definitions:

- Contour Geometric type (3006, 0042) = POINT
- Number of Contour Points (3006, 0046) = 1

The ROI observation module shall have the following definitions:

- RT ROI Interpreted Type (3006,00A4) = MARKER.

Marker position may be located between slice positions.

Before exporting modified volumetric structures, they get resampled onto the planes of the 3D patient model. The volumetric ROI Contours of an exported RT Structure Set will thus always reference an image slice.

All images used to construct the 3D patient model are referenced in Contour Image Sequence (3006,0016) of RT Structure Set Module, even if they do not have any contours defined on them.

#### 2.2.1.3.1.5 SOP Specific Conformance for Spatial Registration Storage

If the application is configured to store spatial registration IODs according to the IHE Radiation Oncology format then spatial registration storage complies to IHE-RO\_MMRO-II Supplement (see [5]).

Otherwise the following SOP specific conformance applies:

The spatial registration of the 2D and 2D/2D Match will be used in the following way:

- The Registration Sequence (0070,0308) will include all images (the reference images and the acquired verification RT images) and the Frame of Reference UID of the Frame of Reference of the reference RT images.
- The Frame of Reference module of the spatial registration will belong to the Frame of Reference of the acquired verification RT images.
- The transformation matrix type will be RIGID.

The spatial registration of the 3D/3D Match will be used in the following way:

- The Registration Sequence (0070,0308) will include all image slices (the reference CT slices and the acquired verification CT slices) and the Frame of Reference UID of the Frame of Reference of the reference CT slices.
- The Frame of Reference module of the spatial registration will belong to the Frame of Reference of the acquired verification CT image slices.
- The transformation matrix type will be RIGID.

The spatial registration of the 2D/3D Match will be used in the following way:

- The Registration Sequence (0070,0308) will include all image slices (the reference CT slices and the acquired verification RT images) and the Frame of Reference UID of the Frame of Reference of the reference CT slices.
- The Frame of Reference module of the spatial registration will belong to the Frame of Reference of the acquired verification RT images.
- The transformation matrix type will be RIGID.

The spatial registration of the Marker Match will be used in the following way:

- The Registration Sequence (0070,0308) will include all image slices (the reference CT slices and the acquired verification RT images) and the Frame of Reference UID of the Frame of Reference of the reference CT slices.
- The Frame of Reference module of the spatial registration will belong to the Frame of Reference of the acquired verification RT images.
- The transformation matrix type will be RIGID.

**2.2.1.3.2 Activity – Query/Retrieve**

**2.2.1.3.2.1 Description and Sequencing of Activities**

This function is typically performed by the application to load the reference images as well as to load the reference CT and its structure set. At this time an Association is requested.

This application supports Query/Retrieve in the SCU role. The table below shows the supported values for the tag Query/Retrieve Level (0008,0052):

Query/Retrieve Level	Value in (0008,0052)
Composite Object Instance Information	IMAGE

**Table 2-8 Supported Query/Retrieve Levels for Query/Retrieve SCU**

### 2.2.1.3.2.2 Proposed Presentation Contexts

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
Study Root Query/Retrieve information model – FIND	1.2.840.10008.5.1.4.1.2.2.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Study Root Query/Retrieve information model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

**Table 2-9 Proposed Presentation Contexts for TrueBeam Imaging Client Q/R SCU Application Entity**

### 2.2.1.3.2.3 SOP Specific Conformance for C-FIND SOP Classes

The behavior of TrueBeam Imaging Client Query/Retrieve SCU when encountering status codes in a C-FIND response is summarized in the table below.

Service Status	Further Meaning	Error Code	Behavior
Refused	Out of Resources	A7xx	The object is not found, the user is advised.
Failure	Data Set does not match SOP Class	A9xx	
	Cannot understand	Cxxx	
Cancel	Matching terminated due to Cancel Request	FE00	Cancel is handled like Failure, i.e. the object is not found and the user is advised.
Success	Matching is complete – No final Identifier is supplied	0000	The SCP has completed the match, the user is advised.
*	*	Any other status code.	Handled like failure.

**Table 2-10 TrueBeam Imaging Client C-FIND Response Status Handling Behavior**

No C-CANCEL-FIND requests are ever issued.

Relational-queries are not supported.

Specific Character Set is not supported. It is not included in a query and will be ignored when present in the response.

Exception	Behavior
Timeout	The user is informed that the operation has timed out.
Association aborted by the SCP or network layers	When the Association is aborted during a C-MOVE operation the user is informed.

**Table 2-11 TrueBeam Imaging Client Q/R C-FIND SCU Communication Failure Behavior**

The table below lists the Attributes supported by the C-FIND SCU.

Name	Tag	VR	Type
Query/Retrieve Level	(0008,0052)	CS	R
SOP Instance UID	(0008,0018)	UI	U
Study Instance UID	(0020,000D)	UI	U
Series Instance UID	(0020,000E)	UI	U

**Table 2-12 Study Root Request Identifier for TrueBeam Imaging Client Q/R C-FIND SCU**

The Types of Matching column in the above table should be read as follows:

U Universal Matching

R Range Matching

One or more matching types of the above list may be supported per Attribute.

#### 2.2.1.3.2.4 SOP Specific Conformance for C-MOVE SOP Classes

The behavior of TrueBeam Imaging Client Query/Retrieve SCU when encountering status codes in a C-MOVE response is summarized in the following table.

Service Status	Further Meaning	Error Code	Behavior
Refused	Out of Resources – Unable to calculate number of matches	A701	None of the requested SOP Instances could be retrieved. The user will be informed about the failure.
	Out of Resources – Unable to perform sub-operations	A702	
	Move Destination unknown	A801	
Failure	Identifier does not match SOP Class	A900	
	Unable to Process	Cxxx	
Cancel	Sub-operations terminated due to Cancel Indication	FE00	Cancel is handled like Failure.
Warning	Sub-operations complete – One or more Failures	B000	Some or all SOP Instances have not been transmitted successfully. The user is informed.

Service Status	Further Meaning	Error Code	Behavior
Success	Sub-operations complete – No Failures	0000	All SOP Instances have successfully been transmitted.
Pending	Sub-operations are continuing	FF00	Transferring requested SOP Instances is continuing. This message is ignored.
*	*	Any other status code.	Any other status code is handled like Failure.

**Table 2-13 TrueBeam Imaging Client C-MOVE Response Status Handling Behavior**

After having received all requested SOP Instances or when the user aborts the operation the Association is released using A-RELEASE. All events occurring during querying and retrieving SOP Instances are logged. If any log entries are marked with internal category Error they will be shown to the user automatically.

No C-CANCEL-MOVE requests are ever issued.

Exception	Behavior
Timeout	The user is informed that the operation has timed out.
Association aborted by the SCP or network layers	When the Association is aborted during a C-MOVE operation the user is informed.

**Table 2-14 TrueBeam Imaging Q/R C-MOVE SCU Communication Failure Behavior**

The table below lists the Attributes that will be sent by the C-MOVE SCU.

Name	Tag	VR	Type
Query/Retrieve Level	(0008,0052)	CS	R
SOP Instance UID	(0008,0018)	UI	U
Study Instance UID	(0020,000D)	UI	U
Series Instance UID	(0020,000E)	UI	U

**Table 2-15 Study Root Request Identifier for TrueBeam Imaging Client Q/R C-MOVE SCU**

The Types of Matching column in the above table should be read as follows:

U Universal Matching

R Range Matching

One or more matching types of the above list may be supported per Attribute.

#### 2.2.1.3.2.5 Supported Operations

This application performs only the operations listed in the table below. This table also shows which of the key values (see [1]) are used for a request.

Operation	Target IOD	Key value used for Request
C-FIND	RT Structure Set	SOP Instance UID
C-MOVE	RT Structure Set	SOP Instance UID
C-MOVE	RT Plan	SOP Instance UID
C-FIND	RT Image	SOP Instance UID
C-MOVE	RT Image	SOP Instance UID
C-MOVE	CT Image	SOP Instance UID

**Table 2-16 Supported Operations**

## 2.2.1.4 Association Acceptance Policy

The TrueBeam Imaging Client Application Entity does accept storage requests for those objects requested by the MOVE SCU

### 2.2.1.4.1 Activity – Receive Storage Request

#### 2.2.1.4.1.1 Description and Sequencing of Activities

Received SOP Instances are received and cached on the file system, as well as being passed to the application.

#### 2.2.1.4.1.2 General Preconditions

The following precondition for matching shall be fulfilled:

In a valid TrueBeam Imaging plan every treatment beam and every used reference image shall contain the same Isocenter Position (300A, 012C). Tolerance for the “same” Isocenter Position is that isocenter positions of any pair of beams/reference images within the plan shall deviate less than 1.0 mm.

In a valid TrueBeam Imaging plan every treatment beam shall contain the same couch translation values (vertical, lateral, and longitudinal). It is allowed to have different couch rotation values in the plan.

Tolerances for couch values being interpreted as equal are: 2 mm per axis for longitudinal, lateral and vertical..

The plan should contain valid Imaging Device-Specific Acquisition Parameters (300A,00CC) to allow automatic initiation of imaging procedures. However, if no Verification Image Sequence items are present or they do not contain device-specific acquisition parameters as specified above, it is still possible to initiate imaging procedures manually.

TrueBeam Imaging differentiates between treatment and setup fields. Treatment fields and setup fields (kV and MV) can be used for TrueBeam Imaging use cases.

TrueBeam Imaging supports the “Treatment Delivery Type” (300A,00CE) “SETUP”. This attribute should be the preferred method.



For backwards compatibility, the parameter `FieldType` in the Extended Interface (3253,1000) can be used to indicate the field type for each beam in the plan as well (please note, that this is a deprecated approach):

```
<ExtendedVAPlanInterface>
  <Beams>
    <Beam>
      <ReferencedBeamNumber>1</ReferencedBeamNumber>
      <BeamExtension>
        <FieldType>SETUP</FieldType>
      </BeamExtension>
    </Beam>
    <Beam>
      <ReferencedBeamNumber>2</ReferencedBeamNumber>
      <BeamExtension>
        <FieldType>TREATMENT</FieldType>
      </BeamExtension>
    </Beam>
  </Beams>
</ExtendedVAPlanInterface>
```

Note that the aforementioned interface is only a portion of the entire interface, which is available in Section C.1.1.

If a beam is a setup field and planned verification image sequence contains a single item representing a kV image (see definition below), this beam is referred to as a '**kV beam**' in the following.

Tag	Description	T	Convention / Interpretation
Beam Sequence (300A,00B0)	Introduces sequence of treatment beams for current RT Plan. One or more items may be included in this sequence.	1	
>Planned Verification Image Sequence (300A,00CA)	Introduces sequence of planned verification images to be acquired during current beam. One or more items may be included in this sequence. See C.8.8.14.2.	3	Used to plan RT images (kV or MV) or (CB)CT images to be acquired with this beam.

Tag	Description	T	Convention / Interpretation
>>Imaging Device-Specific Acquisition Parameters (300A,00CC)	User-specified device-specific parameters which describe how the imager will acquire the image.	3	<p>This tag is multivalued, values are separated with a backslash character (\).</p> <p>If this tag is missing completely, the planned verification image is interpreted as film.</p> <p>The following values are currently used for portal (MV) imaging:</p> <p>PortImageHighQuality PortImageLowDose PortImageIntegrated PortImageContinuous</p> <p>The following values are currently used for kV imaging:</p> <p>KV\&lt;ImageType&gt;</p> <p>Defined terms for ImageType:</p> <p>Image CBCT</p> <p>Examples: KV\Image KV\CBCT</p>
>Beam Limiting Device Sequence (300A,00B6)	Introduces sequence of beam limiting device (jaw or leaf).	1	For kV beams, this sequence will not be interpreted.
>Number of Wedges (300A,00D0)	Number of wedges associated with current Beam.	1	For kV beams, this number shall be 0 (no accessories)
>Number of Compensators (300A,00E0)	Number of compensators associated with current Beam.	1	For kV beams, this number shall be 0 (no accessories)
>Number of Boli (300A,00ED)	Number of boli associated with current Beam.	1	For kV beams, this number shall be 0 (no accessories)
>Number of Blocks (300A,00ED)	Number of shielding blocks associated with Beam.	1	For kV beams, this number shall be 0 (no accessories)
>Control Point Sequence (300A,0111)	Introduces sequence of machine configurations describing treatment beam. Two or more items may be included in this sequence. See C.8.8.14.5 and C.8.8.14.6.	1	For kV beams, this sequence shall always include exactly 2 items.

Tag	Description	T	Convention / Interpretation
>>Beam Limiting Device Position Sequence (300A,011A)	Introduces sequence of beam limiting device (collimator) jaw or leaf (element) positions. Required for first item of Control Point Sequence, or if Beam Limiting Device changes during Beam. One or more items may be included in this sequence.	1C	For kV beams, this sequence will not be interpreted.
>>Beam Limiting Device Angle (300A,0120)	Beam Limiting Device angle, i.e. orientation of IEC BEAM LIMITING DEVICE coordinate system with respect to IEC GANTRY coordinate system (degrees). Required for first item of Control Point Sequence, or if Beam Limiting Device Angle changes during Beam.	1C	For kV beams, this number shall be 0.0
>>Beam Limiting Device Rotation Direction (300A,0121)	Direction of Beam Limiting Device Rotation when viewing beam limiting device (collimator) from radiation source, for segment following Control Point. Required for first item of Control Point Sequence, or if Beam Limiting Device Rotation Direction changes during Beam. See C.8.8.14.8. Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation	1C	For kV beams, this value shall be NONE.

Tag	Description	T	Convention / Interpretation
>>Gantry Angle (300A,011E)	Gantry angle of radiation source, i.e. orientation of IEC GANTRY coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees). Required for first item of Control Point Sequence, or if Gantry Angle changes during Beam.	1C	For kV beams, this value specifies the orientation of the kV radiation source with respect to IEC FIXED REFERENCE coordinate system. For MV beams, this value specifies the orientation of the MV radiation source (main gantry) with respect to IEC FIXED REFERENCE coordinate system.
>>Gantry Rotation Direction (300A,011F)	Direction of Gantry Rotation when viewing gantry from isocenter, for segment following Control Point. Required for first item of Control Point Sequence, or if Gantry Rotation Direction changes during Beam. See C.8.8.14.8. Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation	1C	For kV beams, this value shall be NONE.

**Table 2-17 Beam Setup kV extensions**

#### 2.2.1.4.1.3 Preconditions for Reference RT Images

RT Images, which are used as reference images (for 2D, 2D/2D), must be scaled and contain all geometrical parameters needed to determine the position/orientation of the Image in IEC61217. The images must contain a Patient Position (0018, 5100), a Frame of Reference UID (0020, 0052) and the Isocenter Position (300A, 012C) in their Frame of Reference.

The following geometrical parameters may be missing:

- RT Image Position (3002,0012). If missing, the image is assumed as centered around the z-axis of the Image Receptor system.
- Table Top Pitch Angle (300A,0140). If missing, 0deg is assumed.
- Table Top Roll Angle (300A,0144). If missing, 0deg is assumed.
- Gantry Pitch Angle (300A,014A). If missing, 0deg is assumed.
- RT Image SID (3002,0026). Images with missing source to image distance are interpreted at isocenter level according to DICOM standard PS 3.3 C.8.8.2.3.

RT Images can only be used as reference images if the following parameters match the planned parameters of the respective beam for which matching is done:

Patient Position (0018, 5100),

Gantry Angle (300A, 011E), (tolerance 0.5deg)

Patient Support Angle (300A, 0122) (tolerance 0.5deg)

Non-zero values for the following parameters are not supported in the beam and therefore also have to be zero (with a tolerance of 0.5deg) in reference RT Images:

Table Top Pitch Angle (300A,0140),

Table Top Roll Angle (300A,0144),

Gantry Pitch Angle (300A,014A)

For reference images of type DRR (third value of Image Type (0008,0008) is 'DRR'), the Frame of Reference UID has to match between plan and reference image.

The Isocenter Position (300A, 012C) has to match between reference image and beam if plan and reference image have the same Frame of Reference UID (tolerance 2mm Euclidean distance).

#### **2.2.1.4.1.4 Preconditions for reference CT Images**

To load the slices of the reference CT image TrueBeam Imaging loads the plan's structure set, which corresponds to the Referenced RT Structure Set (300C,0060), from the Treatment Management System, and subsequently loads all CT slices referenced in the Contour Image Sequence (3006,0016).

##### **Conditions for CT Slices:**

- All CT slices shall have the same Frame of Reference.
- The spacing between CT slices positions in z-direction (DICOM Patient coordinate system) may vary, although it is recommended, that they are equal throughout all slices referenced by the Structure Set.
- The maximal difference in x-direction and in y-direction (DICOM Patient coordinate system) between all CT slices shall be less or equal 0.1 mm.

##### **Conditions for Structure Set (except Structures of Contour Geometric type (3006, 0042) POINT):**

- The contour points within a contour shall be positioned on the same contour plane within a maximal Epsilon of  $10^{-6}$  in z direction (DICOM Patient coordinate system).
- Structures with contour(s) having contour points that are not positioned on the same contour plane (see point above, i.e. non-transversal structures) are ignored (they are not imported and a corresponding warning message is issued) and the import will continue with the other structures.
- Contour Geometric Type (3006, 0042) has to be either CLOSED\_PLANAR or OPEN\_PLANAR for all contours of the structure. Structures with mixed contour types are not supported.
- Contour Geometric type (3006, 0042) POINT doesn't need to fulfill the conditions mentioned above.

#### **2.2.1.4.1.5 Preconditions for 2D Match**

Besides the General Preconditions and preconditions for Reference RT images, the following condition shall be fulfilled:

If the plan contains multiple isocenters, the 2D match can be performed, but the couch shifts cannot be applied.

#### **2.2.1.4.1.6 Preconditions for 2D/2D Match**

Besides the General Preconditions and preconditions for Reference RT images, the following conditions shall be fulfilled:

Reference images for paired match (2D/2D) shall have the same FOR and isocenter position defined.

The plan shall contain two valid setup beams configured as a kV or MV image beam.

A delta of 90.0 degrees between the gantry/source angles (300A,011E) of the two beams is required. The two beams must have adjacent field order numbers.

If the plan contains multiple isocenters, the 2D/2D match can be performed, but the couch shifts cannot be applied.

#### **2.2.1.4.1.7 Preconditions for 2D3D Match**

Besides the General Preconditions, the following condition shall be fulfilled:

To load the slices of the reference CT image the conditions listed in paragraph 2.2.1.4.1.4 apply.

If the plan contains multiple isocenters, the 2D3D match can be performed, but the couch shifts cannot be applied.

#### **2.2.1.4.1.8 Preconditions for 2D/3D paired Match**

Besides the General Preconditions, the following condition shall be fulfilled:

The plan shall contain two valid setup beams configured as a kV or MV image beam.

A delta of 90.0 degrees between the gantry/source angles (300A,011E) of the two beams is required.

Alternatively, if setup beams are not available 2D3D paired match can be activated adding a paired procedure to any of the treatment beams.

To load the slices of the reference CT image the conditions listed in paragraph 2.2.1.4.1.4 apply.

If the plan contains multiple isocenters, the 2D3D paired match can be performed, but the couch shifts cannot be applied.

#### **2.2.1.4.1.9 Preconditions for Marker Match**

Besides the General Preconditions, the following condition shall be fulfilled:

The plan shall contain two valid setup beams configured as a kV or MV image beam.

A delta of 90.0 degrees between the gantry/source angles (300A,011E) of the two beams is required. The two beams shall have adjacent field order numbers.

Alternatively, if setup beams are not available marker match can be activated adding a paired procedure to any of the treatment beams.

To load the slices of the reference CT image the conditions listed in paragraph 2.2.1.4.1.4 apply.

**Conditions for Marker Point Structures:**

- The markers shall be in the structure set referenced by the plan.
- Marker position may be located between slice positions.
- The ROI Contour Sequence (3006, 0040) shall have the following definitions:
  - Contour Geometric type (3006, 0042) = POINT
  - Number of Contour Points(3006, 0046) = 1
- The ROI observation module shall have the following definitions:
  - RT ROI Interpreted Type (3006,00A4) = MARKER.
  - Private tag: Marker Subtype (3271,1000) = MARKER

If the plan contains multiple isocenters, the 2D3D paired match can be performed, but the couch shifts cannot be applied.

**2.2.1.4.1.10 Preconditions for 3D/3D Match**

Besides the General Preconditions, the following condition shall be fulfilled:

The plan shall contain a valid setup beam. The tag "Beam Type" (300A,00C4) shall have the value "STATIC" configured as a CBCT beam. The tag "Imaging Device Specific Acquisition Parameters" (300A,00CC) shall have the value "KV\CBCT".

To load the slices of the reference CT image the conditions listed in paragraph 2.2.1.4.1.4 apply.

**2.2.1.4.1.11 Preconditions for integrated gating**

In a valid TrueBeam Imaging plan, which is meant for gated treatment every item in the RT Patient Setup sequence (300A, 0180) must define the Motion Synchronization Sequence (300A,0410) with the Respiratory Motion Compensation Technique (0018, 9170) set to GATING and the Respiratory Signal Source (0018, 9171) set to EXTERNAL\_MARKER.

Attribute Name	Tag	T	Description	Handling
Patient Setup Sequence	(300A,0180)	1	Introduces sequence of patient setup data for current plan. One or more items may be included in this sequence.	
> Motion Synchronization Sequence	(300A,0410)	3	Introduces sequence of Motion Synchronization. One or more items may be included in this sequence.	Reading only first item of sequence.

Attribute Name	Tag	T	Description	Handling
>> Respiratory Motion Compensation Technique	(0018,9170)	1	Technique applied to reduce respiratory motion artifacts. Defined Terms: NONE BREATH_HOLD REALTIME = image acquisition shorter than respiratory cycle GATING = Prospective gating TRACKING = prospective through-plane or in-plane motion tracking PHASE_ORDERING = prospective phase ordering PHASE_RESCANNING = prospective techniques, such as real-time averaging, diminishing variance and motion adaptive gating RETROSPECTIVE = retrospective gating CORRECTION = retrospective image correction UNKNOWN = technique not known	GATING must be set for gated plans. Any other term is ignored.



Attribute Name	Tag	T	Description	Handling
>> Respiratory Signal Source	(0018,9171)	1	Signal source from which respiratory motion is derived. Defined Terms: NONE BELT NASAL_PROBE CO2_SENSOR NAVIGATOR = MR navigator and organ edge detection MR_PHASE = phase (of center k-space line) ECG = baseline demodulation of the ECG SPIROMETER = Signal derived from flow sensor EXTERNAL_MARKER = Signal determined from external motion surrogate INTERNAL_MARKER = Signal determined from internal motion surrogate IMAGE = Signal derived from an image UNKNOWN = Signal source not known	EXTERNAL_MARKER must be set for gated plans. Any other term is ignored.
>> Respiratory Motion Compensation Technique Description	(0018,9185)	3	Description of respiratory motion compensation technique.	Not supported
>> Respiratory Signal Source ID	(0018,9186)	3	Identifies the device providing the respiratory signal.	Not supported

**Table 2-18 Motion Synchronization Sequence to define gating**

**2.2.1.4.1.12 Accepted Presentation Contexts**

TrueBeam Imaging Client Storage SCP Application Entity accepts Presentation Contexts shown in the following table.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
All Storage SOP Classes in Table 4-1	All Storage SOP Classes in Table 4-1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1		

**Table 2-19 Acceptable Presentation Contexts for TrueBeam Imaging Client Storage SCP Application Entity and Receive Storage Request**

**2.2.1.4.1.13 SOP Specific Conformance for all Storage SOP Classes**

**2.2.1.4.1.13.1 Presentation Context Acceptance Criterion**

TrueBeam Imaging Client Storage SCP will always accept any Presentation Context for the supported SOP Classes with the supported Transfer Syntaxes. More than one proposed Presentation Context will be accepted for the same Abstract Syntax if the Transfer Syntax is supported, whether or not it is the same as another Presentation Context.

**2.2.1.4.1.13.2 Transfer Syntax Selection Policies**

If offered a choice of Transfer Syntaxes in a Presentation Context, TrueBeam Imaging Client Storage SCP will select the first Transfer Syntax that is listed in the Presentation Context.

TrueBeam Imaging Client Storage SCP will accept duplicate Presentation Contexts, that is, if it is offered multiple Presentation Contexts, each of which offers acceptable Transfer Syntaxes, it will accept all Presentation Contexts, applying the same rule for selecting a Transfer Syntax for each as described above.

**2.2.1.4.1.13.3 Response Status**

TrueBeam Imaging Client Storage SCP will behave as described in the Table below when generating the C-STORE response command message.

Service Status	Further Meaning	Error Code	Behavior
Refused	Out of Resources	A700	Failed to receive incoming DICOM Stream. Problem is logged on the SCP side.
	Out of Resources	A7xx	
Failure	Invalid object instance	0117	
	Data Set does not match SOP Class	A9xx	
	Invalid C-STORE request	C000	

Service Status	Further Meaning	Error Code	Behavior
Warning	Coercion of Data Elements	B000	Image successfully stored in temporary file.
	Data Set does not match SOP Class	B007	
	Elements Discarded	B006	
Success		0000	Instance successfully stored in temporary file.

**Table 2-20 Response Status of TrueBeam Imaging Client Storage SCP and Receive Storage Request**

## 2.3 Network Interfaces

See [3].

## 2.4 Configuration

### 2.4.1 AE Title/Presentation Address Mapping

#### 2.4.1.1 Local AE Titles

The local TrueBeam Imaging Client Application Entity uses the AE Title and TCP/IP port number configured via the Daemon configuration option in the TrueBeam Imaging system administration. Note that conceptually the network services have been modeled as separate AEs, though in fact all the AEs share a single (configurable) AE Title.

Application Entity	Default AE Title	Default TCP/IP Port
TrueBeam Imaging Application Entity	StreamService (configurable)	58051 (configurable)
TrueBeam Imaging Storage SCU	See above	See above
TrueBeam Imaging Query/Retrieve SCU	See above	See above

**Table 2-21 AE Title Configuration Table**

#### 2.4.1.2 Remote AE Title/Presentation Address Mapping

##### 2.4.1.2.1 TrueBeam Imaging Client Storage SCU

For the Storage service class SCU, TCP/IP address, called AE title and port number of the destination are configurable as well as the calling AE title used by TrueBeam Imaging.

##### 2.4.1.2.2 TrueBeam Imaging Client Query/Retrieve SCU

For the TrueBeam Imaging Client Query/Retrieve SCU, TCP/IP address, called AE title and port number of the provider are configurable. The calling AE title of the local application, which is also the Move Destination AE title, is configurable too. The local port is the port of the Storage SCP for receiving the data. The Storage SCP will accept only connection requests from the configured remote AE Title and IP Address.

## 2.4.2 Parameters

The following table shows DICOM relevant configuration parameters. While some of them may be configured directly via a configuration dialog or a configuration application, other values can only be accessed via the Registry or cannot be configured at all.

Parameter	Configurable (Yes/No)	Default Value
<b>General Parameters</b>		
Max PDU Receive Size	No	Unlimited
Max PDU Send Size	No	32768 Bytes (32kB)
Time-out waiting for an acceptance or rejection response to an Association request or Association Release request (Application Level Timeout)	Yes	300s
Spatial Registration formatted along IHE-RO specification 2008	Yes	No
<b>TrueBeam Imaging Client Storage SCU Specific Parameters</b> <b>TrueBeam Imaging Client Query/Retrieve SCU Specific Parameters</b>		
Time-out awaiting a Response to a DIMSE Request (Low-Level Timeout)	Yes	300s
Maximum number of simultaneously initiated Associations	No	1

**Table 2-22 Configuration Parameters Table**

### 3 Media Interchange

TrueBeam Imaging Client Application Entity allows importing and exporting DICOM Media Files. Various import and export filters are available in the TrueBeam Imaging Client application to read and create DICOM Media Files. This functionality is only available when the TrueBeam Imaging Application is operating in file mode.

The files conform to the Part 10 format. However, the Basic Directory IOD as defined in Media Interchange Application Profiles is not present.

Table 3-1 shows Transfer Syntaxes used in DICOM Media files created by TrueBeam. The Transfer Syntax to be used for writing a file is selected automatically based on the IOD's content (see row labeled "Context of Usage").

Context of Usage	Transfer Syntax	
	Name	UID
MPEG-encoded multi-frame RT Images	MPEG2 Main Profile @ Main Level	1.2.840.10008.1.2.4.100
All other IODs	DICOM Implicit VR Little Endian	1.2.840.10008.1.2

**Table 3-1: Transfer Syntaxes used in DICOM Media Files**

# 4 Support of Character Sets

## 4.1 Character Sets

The default character set has to be configured in the TrueBeam system administration. For further information refer to the TrueBeam administration guide [4]. The configuration of the TrueBeam imaging application has to be synchronized with the configuration of the TrueBeam treatment application.

### 4.1.1 Standard Support

#### 4.1.1.1 Encoding / Decoding

The character sets listed in Table 4-1 below are supported for encoding data to DICOM and decoding data from DICOM.

Encoding of a data set fails with an error, if any of the affected text attributes cannot be encoded completely with the selected character set.

Character Set Description	Defined Term
<b>Single-Byte Character Sets Without Code Extensions</b>	
Latin alphabet No. 1	ISO_IR 100
Latin alphabet No. 2	ISO_IR 101
Latin alphabet No. 3	ISO_IR 109
Cyrillic	ISO_IR 144
Japanese	ISO_IR 13
Thai	ISO_IR 166
<b>Multi-Byte Character Sets with Code Extensions</b>	
Japanese	ISO 2022 IR 87
<b>Multi-Byte Character Sets Without Code Extensions</b>	
Unicode in UTF-8	ISO_IR 192
GB18030	GB18030

**Table 4-1: Character sets supported for decoding from DICOM**

## 4.1.2 Legacy Support

For maintaining connectivity with legacy applications that do not support the Specific Character Set (0008,0005) attribute it is possible to configure the Application Entities described in this conformance statement to use one of the Windows® code pages listed in Table 4-2 below.

Character Set Description	Windows® Code Page
ANSI/OEM Japanese; Japanese (Shift-JIS)	932
ANSI/OEM Simplified Chinese (PRC, Singapore); Chinese Simplified (GB2312)	936
ANSI Latin 1; Western European (Windows)	1252

**Table 4-2: Windows code pages supported for decoding from and encoding to DICOM**

If a data set is encoded with one of the Windows code pages listed in Table 4-2, then the Specific Character Set (0008,0005) attribute is written with value "ISO\_IR 100" for code page 1252 and it is not written for code pages 932 and 936.

## **5 Security**

### **5.1 Security Profiles**

No Security Profiles are supported.

### **5.2 Association Level Security**

#### **5.2.1 TrueBeam Imaging Client**

Storage SCU does not support Association Level Security.

The Storage SCP instantiated to receive Instances requested by Query/Retrieve SCU checks the following additional values when determining whether to accept Association Open Requests:

- Called AE Title
- Calling AE Title
- IP address of Association Request originator

The Treatment Daemon Application Entity optionally checks following values when determining whether to accept Association Open Requests:

- Implementation Class UID

### **5.3 Application Level Security**

#### **5.3.1 TrueBeam Imaging Application**

In order to load patient information into the TrueBeam Imaging application, the user opens the patient in the treatment application, which requires the user identification in the form of a user name and password.



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# Appendix A Specialization

## A.1 IOD Contents

### A.1.1 Created SOP Instances

IODs created by the TrueBeam Imaging Application Entity are listed in Appendix B IOD Details

### A.1.2 Usage of Attributes from received IOD's

The TrueBeam Imaging Application Entity requires all Type 1 Attributes to be present.

## A.2 Data Dictionary of Private Attributes

The TrueBeam Imaging application does not use any private attributes that are not outlined in this document or [3].

## A.3 Coded Terminology and Templates

### A.3.1 Context Groups

Information will be published in a future version of this document.

### A.3.2 Template Specifications

No standard templates are extended and no private templates are used.

### A.3.3 Private Code Definitions

There are no private code definitions.

## A.4 Grayscale Image Consistency

Not supported.

## A.5 Standard Extended/Specialized/Private SOP Classes

Not Used

## A.6 Private Transfer Syntaxes

No private Transfer Syntaxes are used.

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# Appendix B IOD Details

## B.1 Supported IODs

For better reference with DICOM Standard [1], section titles of the following sub-sections are listed with section number of DICOM Standard Part 3 where the corresponding IOD Module table can be found.

### B.1.1 Computed Tomography Image – A.3.3

IE	Module	Reference	Usage	Presence
Patient	Patient	C.7.1.1	M	
	Clinical Trial Subject	C.7.1.3	U	Not supported
Study	General Study	C.7.2.1	M	
	Patient Study	C.7.2.2	U	Not supported
	Clinical Trial Study	C.7.2.3	U	Not supported
Series	General Series	C.7.3.1	M	
	Clinical Trial Series	C.7.3.2	U	Not supported
Frame of Reference	Frame of Reference	C.7.4.1	M	
Equipment	General Equipment	C.7.5.1	M	
Image	General Image	C.7.6.1	M	
	Image Plane	C.7.6.2	M	
	Image Pixel	C.7.6.3	M	
	Contrast/Bolus	C.7.6.4	C	Not supported
	CT Image	C.8.2.1	M	
	Overlay Plane	C.9.2	U	Not supported
	VOI LUT	C.11.2	U	
	SOP Common	C.12.1	M	

Table B-1 Computed Tomography Image IOD Modules Support

### B.1.2 Spatial Registration – A.39.1.3

IE	Module	Reference	Usage	Presence
Patient	Patient	C.7.1.1	M	
	Clinical Trial Subject	C.7.1.3	U	Not supported
Study	General Study	C.7.2.1	M	
	Patient Study	C.7.2.2	U	Not supported
	Clinical Trial Study	C.7.2.3	U	Not supported
Series	General Series	C.7.3.1	M	
	Clinical Trial Series	C.7.3.2	U	Not supported

IE	Module	Reference	Usage	Presence
	Spatial Registration Series	C.20.1	M	
Frame of Reference	Frame of Reference	C.7.4.1	M	
Equipment	General Equipment	C.7.5.1	M	
Spatial Registration	Spatial Registration	C.20.2	M	
	Common Instance Reference	C.12.2	M	
	SOP Common	C.12.1	M	

**Table B-2 Spatial Registration Image IOD Modules Support**

### B.1.3 RT Structure Set – A.19.3

IE	Module	Reference	Usage	Presence
Patient	Patient	C.7.1.1	M	
	Clinical Trial Subject	C.7.1.3	U	Not supported
Study	General Study	C.7.2.1	M	
	Patient Study	C.7.2.2	U	Not supported
	Clinical Trial Study	C.7.2.3	U	Not supported
Series	RT Series	C.8.8.1	M	
	Clinical Trial Series	C.7.3.2	U	Not supported
Equipment	General Equipment	C.7.5.1	M	Not Supported
Structure Set	Structure Set	C.8.8.5	M	
	ROI Contour	C.8.8.6	M	
	RT ROI Observations	C.8.8.8	M	
	Approval	C.8.8.16	U	
	SOP Common	C.12.1	M	

**Table B-3 RT Structure Set IOD Modules Support**

### B.1.4 RT Image – A.17.3

IE	Module	Reference	Usage	Presence
Patient	Patient	C.7.1.1	M	
	Clinical Trial Subject	C.7.1.3	U	Not supported
Study	General Study	C.7.2.1	M	
	Patient Study	C.7.2.2	U	Not supported
	Clinical Trial Study	C.7.2.3	U	Not supported
Series	RT Series	C.8.8.1	M	
	Clinical Trial Series	C.7.3.2	U	Not supported

IE	Module	Reference	Usage	Presence
Frame of Reference	Frame of Reference	C.7.4.1	U	Supported and required for Import
Equipment	General Equipment	C.7.5.1	M	
Image	General Image	C.7.6.1	M	
	Image Pixel	C.7.6.3	M	
	Contrast/Bolus	C.7.6.4	C	Not supported
	Cine	C.7.6.5	C	
	Multi Frame	C.7.6.6	C	For multi-frame RT images only
	RT Image	C.8.8.2	M	
	Modality LUT	C.11.1	U	
	VOI LUT	C.11.2	U	
	Approval	C.8.8.16	U	
	Curve (Retired)	C.10.2	U	
SOP Common	C.12.1	M		
Extended Interface	Extended Interface	N/A	U	Private

**Table B-4 RT Image IOD Modules Support**

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## B.2 Modules and Attributes

For better reference with DICOM Standard [1] section titles of the following sub-sections are decorated with section number of DICOM Standard Part 3 where the corresponding Module Attribute table can be found.

The first four columns in the following tables contain definitions from the DICOM standard. References in those columns refer to the DICOM standard and not to this document.

The “Handling” column describes for each attribute whether it is supported and to which value in the TrueBeam Imaging system it maps. A value of “*Not supported*” indicates that an attribute is unknown and therefore ignored by the application.

The application creates objects of the type RT Image, CT Image, RT Structure Set and Spatial Registration. These objects are exported through DICOM. Therefore only the export is described in the following tables.

### B.2.1 Patient – C.7.1.1

Attribute Name	Tag	T	Description	Handling
Patient's Name	(0010,0010)	2	Patient's full name.	Supported
Patient ID	(0010,0020)	2	Primary hospital identification number or code for the patient.	Supported
Issuer of Patient ID	(0010,0021)	3	Identifier of the Assigning Authority that issued the Patient ID.	Not supported
Patient's Birth Date	(0010,0030)	2	Birth date of the patient.	Supported
Patient's Sex	(0010,0040)	2	Sex of the named patient. Enumerated Values: M = male F = female O = other	Supported Export: 'Female': F, 'Male': M, anything else: O
Referenced Patient Sequence	(0008,1120)	3	A sequence that provides reference to a Patient SOP Class/Instance pair. Only a single Item shall be permitted in this Sequence.	Not supported
<i>&gt; Content of not supported sequence is not listed.</i>				
Patient's Birth Time	(0010,0032)	3	Birth time of the Patient.	Supported

Attribute Name	Tag	T	Description	Handling
Other Patient IDs	(0010,1000)	3	Other identification numbers or codes used to identify the patient.	Not supported
Other Patient Names	(0010,1001)	3	Other names used to identify the patient.	Not supported
Ethnic Group	(0010,2160)	3	Ethnic group or race of the patient.	Not supported
Patient Comments	(0010,4000)	3	User-defined additional information about the patient.	Not supported
Patient Identify Removed	(0012,0062)	3	The true identity of the patient has been removed from the Attributes and the Pixel Data Enumerated Values: YES NO	Not supported
De-identification Method	(0012,0063)	1C	A description or label of the mechanism or method use to remove the patient's identity. May be multi-valued if successive de-identification steps have been performed. Note: This may be used to describe the extent or thoroughness of the de- identification, for example whether or not the de-identification is for a "Limited Data Set" (as per HIPAA Privacy Rule). Required if Patient Identity Removed (0012,0062) is present and has a value of YES and De-identification Method Code Sequence (0012,0064) is not present.	Not supported
De-identification Method Code Sequence	(0012,0064)	1C	A code describing the mechanism or method use to remove the patient's identity. One or more Items shall be present. Multiple items are used if successive de-identification steps have been performed Required if Patient Identity Removed (0012,0062) is present and has a value of YES and De-identification Method (0012,0063) is not present.	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				



## B.2.2 General Study - C.7.2.1

Attribute Name	Tag	T	Description	Handling
Study Instance UID	(0020,000D)	1	Unique identifier for the Study.	Supported
Study Date	(0008,0020)	2	Date the Study started.	Supported
Study Time	(0008,0030)	2	Time the Study started.	Supported
Referring Physician's Name	(0008,0090)	2	Name of the patient's referring physician	Not supported
Referring Physician Identification Sequence	(0008,0096)	3	Identification of the patient's referring physician. Only a single item shall be permitted in this sequence.	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				
Study ID	(0020,0010)	2	User or equipment generated Study identifier.	Supported
Accession Number	(0008,0050)	2	A RIS generated number that identifies the order for the Study.	Supported
Study Description	(0008,1030)	3	Institution-generated description or classification of the Study (component) performed.	Not supported
Physician(s) of Record	(0008,1048)	3	Names of the physician(s) who are responsible for overall patient care at time of Study (see Section C.7.3.1 for Performing Physician)	Not supported
Physician(s) of Record Identification Sequence	(0008,1049)	3	Identification of the physician(s) who are responsible for overall patient care at time of Study. One or more items shall be included in this sequence. If more than one item, the number and order shall correspond to the value of Physician(s) of Record (0008,1048), if present.	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				
Name of Physician(s) Reading Study	(0008,1060)	3	Names of the physician(s) reading the Study.	Not supported

Attribute Name	Tag	T	Description	Handling
Physician(s) Reading Study Identification Sequence	(0008,1062)	3	Identification of the physician(s) reading the Study. One or more items shall be included in this sequence. If more than one Item, the number and order shall correspond to the value of Name of Physician(s) Reading Study (0008,1060), if present.	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				
Referenced Study Sequence	(0008,1110)	3	A sequence that provides reference to a Study SOP Class/Instance pair. The sequence may have zero or more Items.	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				
Procedure Code Sequence	(0008,1032)	3	A Sequence that conveys the type of procedure performed. One or more Items may be included in this Sequence.	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				

### B.2.3 General Series – C.7.3.1

Attribute Name	Tag	T	Description	Handling
Modality	(0008,0060)	1	Type of equipment that originally acquired the data used to create the images in this Series. See C.7.3.1.1.1 for Defined Terms.	Supported
Series Instance UID	(0020,000E)	1	Unique identifier of the Series.	Supported
Series Number	(0020,0011)	2	A number that identifies this Series.	Supported Export: A number incrementing with every series created throughout a session. It starts with 1 and is reset at the end of a session.

Attribute Name	Tag	T	Description	Handling
Acquisition Number	(0020,0012)	3	A number identifying the single continuous gathering of data over a period of time that resulted in this image.	Supported Export: Identifier from the acquisition system
Laterality	(0020,0060)	2C	Laterality of (paired) body part examined. Required if the body part examined is a paired structure and Image Laterality (0020,0062) or Frame Laterality (0020,9072) are not sent. Enumerated Values: R = right L = left Note: Some IODs support Image Laterality (0020,0062) at the Image level or Frame Laterality(0020,9072) at the Frame level in the Frame Anatomy functional group macro, which can provide a more comprehensive mechanism for specifying the laterality of the body part(s) being examined.	Not supported
Series Date	(0008,0021)	3	Date the Series started.	Supported for: Computed Tomography Image RT Structure Set Spatial Registration
Series Time	(0008,0031)	3	Time the Series started.	Supported for: Computed Tomography Image RT Structure Set Spatial Registration
Performing Physician's Name	(0008,1050)	3	Name of the physician(s) administering the Series.	Not supported
Performing Physician Identification Sequence	(0008,1052)	3	Identification of the physician(s) administering the Series. One or more items shall be included in this sequence. If more than one Item, the number and order shall correspond to the value of Performing Physicians' Name (0008,1050), if present.	Not supported

Attribute Name	Tag	T	Description	Handling
<i>&gt; Content of not supported sequence is not listed</i>				
Protocol Name	(0018,1030)	3	User-defined description of the conditions under which the Series was performed. Note: This attribute conveys series-specific protocol identification and may or may not be identical to the one presented in the Performed Protocol Code Sequence (0040,0260).	Not supported
Series Description	(0008,103E)	3	User provided description of the Series	Not supported
Operators' Name	(0008,1070)	3	Name(s) of the operator(s) supporting the Series.	Not supported
Operator Identification Sequence	(0008,1072)	3	Identification of the operator(s) supporting the Series. One or more items shall be included in this sequence. If more than one Item, the number and order shall correspond to the value of Operators' Name (0008,1070), if present.	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				
Referenced Performed Procedure Step Sequence	(0008,1111)	3	Uniquely identifies the Performed Procedure Step SOP Instance to which the Series is related (e.g. a Modality or General-Purpose Performed Procedure Step SOP Instance). The Sequence shall have zero or one Item.	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				

Attribute Name	Tag	T	Description	Handling
Related Series Sequence	(0008,1250)	3	<p>Identification of Series significantly related to this Series. Zero or more Items may be present.</p> <p>Notes:</p> <ol style="list-style-type: none"> <li>1. For example, for a combined CT and PET acquisition, the CT images and PET images would be in separate series that could cross- reference each other with multiple purpose of reference codes meaning same anatomy, simultaneously acquired and same indication.</li> <li>2. The related series may have different Frames of Reference and hence require some sort of registration before spatial coordinates can be directly compared.</li> <li>3. This attribute is not intended for conveying localizer reference information, for which Referenced Image Sequence (0008,1140) should be used.</li> </ol>	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				
Body Part Examined	(0018,0015)	3	<p>Text description of the part of the body examined.</p> <p>Defined Terms: SKULL, CSPINE, TSPINE, LSPINE, SSPINE, COCCYX, CHEST, CLAVICLE, BREAST, ABDOMEN, PELVIS, HIP, SHOULDER, ELBOW, KNEE, ANKLE, HAND, FOOT, EXTREMITY, HEAD, HEART, NECK, LEG, ARM, JAW</p> <p>Note: Some IODs support the Anatomic Region Sequence (0008,2218), which can provide a more comprehensive mechanism for specifying the body part being examined.</p>	Not supported
Patient Position	(0018,5100)	2C	<p>Patient position descriptor relative to the equipment. Required for CT and MR images; shall not be present if Patient Orientation Code Sequence (0054,0410) is present; may be present otherwise. See C.7.3.1.1.2 for Defined Terms and further explanation.</p>	Supported for: RT Image Computed Tomography Image
Smallest Pixel Value in Series	(0028,0108)	3	The minimum value of all images in this Series.	Not supported

Attribute Name	Tag	T	Description	Handling
Largest Pixel Value in Series	(0028,0109)	3	The maximum value of all images in this Series.	Not supported
Request Attributes Sequence	(0040,0275)	3	Sequence that contains attributes from the Imaging Service Request. The sequence may have one or more Items.	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				
Performed Procedure Step ID	(0040,0253)	3	User or equipment generated identifier of that part of a Procedure that has been carried out within this step.	Not supported
Performed Procedure Step Start Date	(0040,0244)	3	Date on which the Performed Procedure Step started.	Not supported
Performed Procedure Step Start Time	(0040,0245)	3	Time on which the Performed Procedure Step started.	Not supported
Performed Procedure Step Description	(0040,0254)	3	Institution-generated description or classification of the Procedure Step that was performed.	Not supported
Performed Protocol Code Sequence	(0040,0260)	3	Sequence describing the Protocol performed for this Procedure Step. One or more Items may be included in this Sequence.	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				
Comments on the Performed Procedure Step	(0040,0280)	3	User-defined comments on the Performed Procedure Step.	Not supported

**B.2.4 Frame of Reference – C.7.4.1**

Attribute Name	Tag	T	Description	Handling
Frame of Reference UID	(0020,0052)	1	Uniquely identifies the frame of reference for a Series. See C.7.4.1.1.1 for further explanation.	Supported
Position Reference Indicator	(0020,1040)	2	Part of the patient's anatomy used as a reference, such as the iliac crest, orbital- medial, sternal notch, symphysis pubis, xiphoid, lower coastal margin, external auditory meatus. See C.7.4.1.1.2 for further explanation.	Supported Export: Empty

**B.2.5 General Equipment – C.7.5.1**

Attribute Name	Tag	T	Description	Handling
Manufacturer	(0008,0070)	2	Manufacturer of the equipment that produced the composite instances.	Supported
Institution Name	(0008,0080)	3	Institution where the equipment that produced the composite instances is located.	Not supported
Institution Address	(0008,0081)	3	Mailing address of the institution where the equipment that produced the composite instances is located.	Not supported
Station Name	(0008,1010)	3	User defined name identifying the machine that produced the composite instances.	Supported
Institutional Department Name	(0008,1040)	3	Department in the institution where the equipment that produced the composite instances is located.	Not supported
Manufacturer's Model Name	(0008,1090)	3	Manufacturer's model name of the equipment that produced the composite instances.	Supported
Device Serial Number	(0018,1000)	3	Manufacturer's serial number of the equipment that produced the composite instances.	Supported
Software Version(s)	(0018,1020)	3	Manufacturer's designation of software version of the equipment that produced the composite instances.	Supported

Attribute Name	Tag	T	Description	Handling
Spatial Resolution	(0018,1050)	3	The inherent limiting resolution in mm of the acquisition equipment for high contrast objects for the data gathering and reconstruction technique chosen. If variable across the images of the series, the value at the image center.	Not supported
Date of Last Calibration	(0018,1200)	3	Date when the image acquisition device calibration was last changed in any way. Multiple entries may be used for additional calibrations at other times. See C.7.5.1.1.1 for further explanation.	Not supported
Time of Last Calibration	(0018,1201)	3	Time when the image acquisition device calibration was last changed in any way. Multiple entries may be used. See C.7.5.1.1.1 for further explanation.	Not supported
Pixel Padding Value	(0028,0120)	1C	<p>Single pixel value or one limit (inclusive) of a range of pixel values used in an image to pad to rectangular format or to signal background that may be suppressed. See C.7.5.1.1.2 for further explanation.</p> <p>Required if Pixel Padding Range Limit (0028,0121) is present. May be present otherwise.</p> <p>Note: The Value Representation of this Attribute is determined by the value of Pixel Representation (0028,0103).</p>	Not supported



## B.2.6 General Image – C.7.6.1

Attribute Name	Tag	T	Description	Handling
Instance Number	(0020,0013)	2	A number that identifies this image. Note: This Attribute was named Image Number in earlier versions of this Standard.	Supported for: RT Image Computed Tomography Image
Patient Orientation	(0020,0020)	2C	Patient direction of the rows and columns of the image. Required if image does not require Image Orientation (Patient) (0020,0037) and Image Position (Patient) (0020,0032). See C.7.6.1.1.1 for further explanation. Note: IOD's may have attributes other than Patient Orientation, Image Orientation, or Image Position (Patient) to describe orientation in which case this attribute will be zero length.	Not supported
Content Date	(0008,0023)	2C	The date the image pixel data creation started. Required if image is part of a series in which the images are temporally related. Note: This Attribute was formerly known as Image Date.	Supported for: RT Image Computed Tomography Image
Content Time	(0008,0033)	2C	The time the image pixel data creation started. Required if image is part of a series in which the images are temporally related.	Supported for: RT Image Computed Tomography Image

Attribute Name	Tag	T	Description	Handling
Image Type	(0008,0008)	3	Image identification characteristics. See C.7.6.1.1.2 for Defined Terms and further explanation.	Supported for: RT Image Computed Tomography Image  Export RT Image kV: ORIGINAL\PRIMARY\PORTAL MV: ORIGINAL\PRIMARY\PORTAL  Export acquired portal dose: ORIGINAL\PRIMARY\AQUIRED_DOS E  Export Computed Tomography Image: ORIGINAL\PRIMARY\AXIAL ORIGINAL\PRIMARY\LOCALIZER
Acquisition Number	(0020,0012)	3	A number identifying the single continuous gathering of data over a period of time that resulted in this image.	Supported for: RT Image Computed Tomography Image
Acquisition Date	(0008,0022)	3	The date the acquisition of data that resulted in this image started	Not supported
Acquisition Time	(0008,0032)	3	The time the acquisition of data that resulted in this image started	Not supported
Acquisition Datetime	(0008,002A)	3	The date and time that the acquisition of data that resulted in this image started.  Note: The synchronization of this time with an external clock is specified in the Synchronization Module in Acquisition Time Synchronized (0018,1800).	Not supported

Attribute Name	Tag	T	Description	Handling
Referenced Image Sequence	(0008,1140)	3	A sequence that references other images significantly related to this image (e.g. post-localizer CT image or Mammographic biopsy or partial view images). One or more Items may be included in this sequence.	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				
Derivation Description	(0008,2111)	3	A text description of how this image was derived. See C.7.6.1.1.3 for further explanation.	Not supported
Derivation Code Sequence	(0008,9215)	3	A coded description of how this image was derived. See C.7.6.1.1.3 for further explanation. One or more Items may be included in this Sequence. More than one Item indicates that successive derivation steps have been applied.	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				
Source Image Sequence	(0008,2112)	3	A Sequence that identifies the set of Image SOP Class/Instance pairs of the Images that were used to derive this Image. Zero or more Items may be included in this Sequence. See C.7.6.1.1.4 for further explanation.	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				
Referenced Instance Sequence	(0008,114A)	3	Sequence specifying SOP Instances significantly related to the current SOP Instance.	Supported for: CT Image  Export Reference to the plan in which context the CT Image was acquired.
> Referenced SOP Class UID	(0008,1150)	3	Uniquely identifies the referenced SOP Class.	Supported  Export RT Plan Storage

Attribute Name	Tag	T	Description	Handling
> Referenced SOP Instance UID	(0008,1155)	3	Uniquely identifies the referenced SOP Instance.	Supported  Export UID of the RT Plan
> Purpose of Reference Code Sequence	(0040,a170)	3	Describes the purpose for which the reference is made. Only a single Item shall be permitted in this sequence.	Supported
>> Code Value	(0008,0100)	1C	See Section 8.1. Required if a sequence item is present.	Supported  Export Value set to 1000
>> Coding Scheme Designator	(0008,0102)	1C	See Section 8.2. Required if a sequence item is present.	Supported  Export Value set to 99VMS_PURPREFOBJ
>> Coding Scheme Version	(0008,0103)	1C	See Section 8.2. Required if a sequence item is present and the value of Coding Scheme Designator (0008,0102) is not sufficient to identify the Code Value (0008,0100) unambiguously.	Supported  Export Value set to 1.0
>> Code Meaning	(0008,0104)	1C	See Section 8.3. Required if a sequence item is present.	Supported  Export Value set to "RT Plan or Radiation Set to be verified"
Images in Acquisition	(0020,1002)	3	Number of images that resulted from this acquisition of data	Not supported
Image Comments	(0020,4000)	3	User-defined comments about the image	Not supported

Attribute Name	Tag	T	Description	Handling
Quality Control Image	(0028,0300)	3	Indicates whether or not this image is a quality control or phantom image. Enumerated Values: YES NO If this Attribute is absent, then the image may or may not be a quality control or phantom image.	Not supported
Burned In Annotation	(0028,0301)	3	Indicates whether or not image contains sufficient burned in annotation to identify the patient and date the image was acquired. Enumerated Values: YES NO If this Attribute is absent, then the image may or may not contain burned in annotation.	Not supported
Lossy Image Compression	(0028,2110)	3	Specifies whether an Image has undergone lossy compression. Enumerated Values: 00 = Image has NOT been subjected to lossy compression. 01 = Image has been subjected to lossy compression. See C.7.6.1.1.5	Not supported
Lossy Image Compression Ratio	(0028,2112)	3	Describes the approximate lossy compression ratio(s) that have been applied to this image. See C.7.6.1.1.5 for further explanation. May be multivalued if successive lossy compression steps have been applied. Notes: 1. For example, a compression ratio of 30:1 would be described in this Attribute with a single value of 30. 2. For historical reasons, the lossy compression ratio may also be described in Derivation Description (0008,2111).	Not supported

Attribute Name	Tag	T	Description	Handling
Lossy Image Compression Method	(0028,2114)	3	A label for the lossy compression method(s) that have been applied to this image. See C.7.6.1.1.5 for further explanation. May be multivalued if successive lossy compression steps have been applied; the value order shall correspond to the values of Lossy Image Compression Ratio (0028,2112). Note: For historical reasons, the lossy compression method may also be described in Derivation Description (0008,2111).	Not supported
Icon Image Sequence	(0088,0200)	3	This icon image is representative of the Image.	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				
Presentation LUT Shape	(2050,0020)	3	When present, specifies an identity transformation for the Presentation LUT such that the output of all grayscale transformations, if any, are defined to be in P-Values. Enumerated Values are: IDENTITY = output is in P-Values - shall be used if Photometric Interpretation (0028,0004) is MONOCHROME2 or any color photometric interpretation. INVERSE = output after inversion is in P- Values - shall be used if Photometric Interpretation (0028,0004) is MONOCHROME1. When this attribute is used with a color photometric interpretation then the luminance component is in P-Values.	Not supported
Irradiation Event UID	(0008,3010)	3	Unique identification of the irradiation event(s) associated with the acquisition of this image. See C.7.6.1.1.7.	Not supported

**B.2.7 Image Plane – C.7.6.2**

Attribute Name	Tag	T	Description	Handling
Pixel Spacing	(0028,0030)	1	Physical distance in the patient between the center of each pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing in mm.	Supported for: Computed Tomography Image
Image Orientation (Patient)	(0020,0037)	1	The direction cosines of the first row and the first column with respect to the patient. See C.7.6.2.1.1 for further explanation.	Supported for: Computed Tomography Image
Image Position (Patient)	(0020,0032)	1	The x, y, and z coordinates of the upper left hand corner (center of the first voxel transmitted) of the image, in mm. See C.7.6.2.1.1 for further explanation.	Supported for: Computed Tomography Image
Slice Thickness	(0018,0050)	2	Nominal slice thickness, in mm.	Supported for: Computed Tomography Image
Slice Location	(0020,1041)	3	Relative position of exposure expressed in mm. C.7.6.2.1.2 for further explanation.	Not supported

**B.2.8 Image Pixel – C.7.6.3**

Attribute Name	Tag	T	Description	Handling
Samples per Pixel	(0028,0002)	1	Number of samples (planes) in this image. See C.7.6.3.1.1 for further explanation.	Supported for: RT Image Computed Tomography Image  Export Value set to 1.

Attribute Name	Tag	T	Description	Handling
Photometric Interpretation	(0028,0004)	1	Specifies the intended interpretation of the pixel data. See C.7.6.3.1.2 for further explanation.	Supported for: RT Image uncompressed: and Computed Tomography Image  Export Value set to MONOCHROME2 RT Image MPEG compressed: Value set to YBR_PARTIAL_420
Rows	(0028,0010)	1	Number of rows in the image.	Supported for: RT Image Computed Tomography Image
Columns	(0028,0011)	1	Number of columns in the image.	Supported for: RT Image Computed Tomography Image
Bits Allocated	(0028,0100)	1	Number of bits allocated for each pixel sample. Each sample shall have the same number of bits allocated. See PS 3.5 for further explanation.	Supported for: RT Image Computed Tomography Image
Bits Stored	(0028,0101)	1	Number of bits stored for each pixel sample. Each sample shall have the same number of bits stored. See PS 3.5 for further explanation.	Supported for: RT Image Computed Tomography Image
High Bit	(0028,0102)	1	Most significant bit for pixel sample data. Each sample shall have the same high bit. See PS 3.5 for further explanation.	Supported for: RT Image Computed Tomography Image
Pixel Representation	(0028,0103)	1	Data representation of the pixel samples. Each sample shall have the same pixel representation. Enumerated Values: 0000H = unsigned integer. 0001H = 2's complement	Supported for: RT Image Computed Tomography Image



Attribute Name	Tag	T	Description	Handling
Pixel Data	(7FE0,0010)	1C	A data stream of the pixel samples that comprise the Image. See C.7.6.3.1.4 for further explanation. Required if Pixel Data Provider URL (0028,7FE0) is not present.	Supported for: RT Image Computed Tomography Image
Planar Configuration	(0028,0006)	1C	Indicates whether the pixel data are sent color-by-plane or color-by-pixel. Required if Samples per Pixel (0028,0002) has a value greater than 1. See C.7.6.3.1.3 for further explanation.	Not supported
Pixel Aspect Ratio	(0028,0034)	1C	Ratio of the vertical size and horizontal size of the pixels in the image specified by a pair of integer values where the first value is the vertical pixel size, and the second value is the horizontal pixel size. Required if the aspect ratio is not 1 and the Image Plane Module or the Pixel Measures Macro is not applicable to this Image. See C.7.6.3.1.7.	Not supported
Smallest Image Pixel Value	(0028,0106)	3	The minimum actual pixel value encountered in this image.	Not supported
Largest Image Pixel Value	(0028,0107)	3	The maximum actual pixel value encountered in this image.	Not supported
Red Palette Color Lookup Table Descriptor US or	(0028,1101)	1C	Specifies the format of the Red Palette Color Lookup Table Data (0028,1201) Required if Photometric Interpretation (0028,0004) has a value of PALETTE COLOR or Pixel Presentation (0008,9205) at the image level equals COLOR or MIXED. See C.7.6.3.1.5 for further explanation.	Not supported
Green Palette Color Lookup Table Descriptor US or	(0028,1102)	1C	Specifies the format of the Green Palette Color Lookup Table Data (0028,1202) Required if Photometric Interpretation (0028,0004) has a value of PALETTE COLOR or Pixel Presentation (0008,9205) at the image level equals COLOR or MIXED. See C.7.6.3.1.5 for further explanation.	Not supported

Attribute Name	Tag	T	Description	Handling
Blue Palette Color Lookup Table Descriptor US or	(0028,1103)	1C	Specifies the format of the Blue Palette Color Lookup Table Data (0028,1203) Required if Photometric Interpretation (0028,0004) has a value of PALETTE COLOR or Pixel Presentation (0008,9205) at the image level equals COLOR or MIXED. See C.7.6.3.1.5 for further explanation.	Not supported
Red Palette Color Lookup Table Data	(0028,1201)	1C	Red Palette Color Lookup Table Data. Required if Photometric Interpretation (0028,0004) has a value of PALETTE COLOR or Pixel Presentation (0008,9205) at the image level equals COLOR or MIXED. See C.7.6.3.1.6 for further explanation.	Not supported
Green Palette Color Lookup Table Data	(0028,1202)	1C	Green Palette Color Lookup Table Data. Required if Photometric Interpretation (0028,0004) has a value of PALETTE COLOR or Pixel Presentation (0008,9205) at the image level equals COLOR or MIXED. See C.7.6.3.1.6 for further explanation.	Not supported
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Blue Palette Color Lookup Table Data. Required if Photometric Interpretation (0028,0004) has a value of PALETTE COLOR or Pixel Presentation (0008,9205) at the image level equals COLOR or MIXED. See C.7.6.3.1.6 for further explanation.	Not supported
ICC Profile	(0028,2000)	3	An ICC Profile encoding the transformation of device-dependent color stored pixel values into PCS-Values. See Section C.11.15.1.1.1. When present, defines the color space of color Pixel Data (7FE0,0010) values, and the output of Palette Color Lookup Table. Data (0028,1201-1203). Note: The profile applies only to the Pixel Data (7FE0,0010) attribute at the same level of the dataset and not to any icons nested within sequences, which may or may not have their own ICC profile specified.	Not supported

Attribute Name	Tag	T	Description	Handling
Pixel Data Provider URL	(0028,7FE0)	1C	A URL of a provider service that supplies the pixel data of the Image. Required if the image is to be transferred in one of the following presentation contexts identified by Transfer Syntax UID: 1.2.840.10008.1.2.4.94 (DICOM JPIP Referenced Transfer Syntax) 1.2.840.10008.1.2.4.95 (DICOM JPIP Referenced Deflate Transfer Syntax)	Not supported

## B.2.9 CT Image – C.8.2.1

Attribute Name	Tag	T	Description	Handling
Image Type	(0008,0008)	1	Image identification characteristics. See C.8.2.1.1.1 for specialization.	Supported  Export ORIGINAL\PRIMARYAXIAL ORIGINAL\PRIMARYLOCALIZER
Samples per Pixel	(0028,0002)	1	Number of samples (planes) in this image. See C.8.2.1.1.2 for specialization.	Supported  Export Value set to 1
Photometric Interpretation	(0028,0004)	1	Specifies the intended interpretation of the pixel data. See C.8.2.1.1.3 for specialization.	Supported  Export Value set to MONOCHROME2
Bits Allocated	(0028,0100)	1	Number of bits allocated for each pixel sample. Each sample shall have the same number of bits allocated. See C.8.2.1.1.4 for specialization.	Supported
Bits Stored	(0028,0101)	1	Number of bits stored for each pixel sample. Each sample shall have the same number of bits stored. See C.8.2.1.1.5 for specialization.	Supported

Attribute Name	Tag	T	Description	Handling
High Bit	(0028,0102)	1	Most significant bit for pixel sample data. Each sample shall have the same high bit. See C.8.2.1.1.6 for specialization.	Supported
Rescale Intercept	(0028,1052)	1	The value b in relationship between stored values (SV) and Hounsfield (HU). $HU = m \cdot SV + b$	Supported
Rescale Slope	(0028,1053)	1	m in the equation specified in Rescale Intercept (0028,1052).	Supported
KVP	(0018,0060)	2	Peak kilo voltage output of the x-ray generator used	Supported
Acquisition Number	(0020,0012)	2	A number identifying the single continuous gathering of data over a period of time which resulted in this image	Supported
Scan Options	(0018,0022)	3	Parameters of scanning sequence.	Supported Export Value set to STANDARD
Data Collection Diameter	(0018,0090)	3	The diameter in mm of the region over which data were collected	Supported
Reconstruction Diameter	(0018,1100)	3	Diameter in mm of the region from within which data were used in creating the reconstruction of the image. Data may exist outside this region and portions of the patient may exist outside this region.	Supported
Distance Source to Detector	(0018,1110)	3	Distance in mm from source to detector center. Note: This value is traditionally referred to as Source Image Receptor Distance (SID).	Supported
Distance Source to Patient	(0018,1111)	3	Distance in mm from source to isocenter (center of field of view). Note: This value is traditionally referred to as Source Object Distance (SOD).	Supported Export Value set to 1000.

Attribute Name	Tag	T	Description	Handling
Gantry/Detector Tilt	(0018,1120)	3	Nominal angle of tilt in degrees of the scanning gantry. Not intended for mathematical computations.	Supported Export Value set to 0.
Table Height	(0018,1130)	3	The distance in mm of the top of the patient table to the center of rotation; below the center is positive.	Supported See Note 1)
Table Top Longitudinal Position	(300A,0129)	3		Supported See Note 1)
Table Top Lateral Position	(300A,012A)	3		Supported See Note 1)
Patient Support Angle	(300A,0122)	3		Supported See Note 1)
Table Top Pitch Angle	(300A,0140)	3	Table Top Pitch Angle, i.e. the rotation of the IEC TABLE TOP coordinate system about the X-axis of the IEC TABLE TOP coordinate system (degrees).	Supported See Note 1) Import: If missing, 0deg is assumed
Table Top Roll Angle	(300A,0144)	3	Table Top Roll Angle, i.e. the rotation of the IEC TABLE TOP coordinate system about the Y-axis of the IEC TABLE TOP coordinate system (degrees)	Supported See Note 1) Import: If missing, 0deg is assumed
Rotation Direction	(0018,1140)	3	Direction of rotation of the source when relevant, about nearest principal axis of equipment. Enumerated Values: CW = clockwise CC = counter clockwise	Not supported
Exposure Time	(0018,1150)	3	Time of x-ray exposure in msec	Supported
X-ray Tube Current	(0018,1151)	3	X-ray Tube Current in mA.	Supported

Attribute Name	Tag	T	Description	Handling
Exposure	(0018,1152)	3	The exposure expressed in mAs, for example calculated from Exposure Time and X-ray Tube Current.	Supported
Exposure in uAs	(0018,1153)	3	The exposure expressed in $\mu$ As, for example calculated from Exposure Time and X-ray Tube Current.	Not supported
Filter Type	(0018,1160)	3	Label for the type of filter inserted into the x-ray beam.	Supported
Generator Power	(0018,1170)	3	Power in kW to the x-ray generator.	Not supported
Focal Spot(s)	(0018,1190)	3	Size of the focal spot in mm. For devices with variable focal spot or multiple focal spots, small dimension followed by large dimension.	Supported
Convolution Kernel	(0018,1210)	3	A label describing the convolution kernel or algorithm used to reconstruct the data	Supported
Revolution Time	(0018,9305)	3	The time in seconds of a complete revolution of the source around the gantry orbit.	Not supported
Single Collimation Width	(0018,9306)	3	The width of a single row of acquired data (in mm). Note: Adjacent physical detector rows may have been combined to form a single effective acquisition row.	Not supported
Total Collimation Width	(0018,9307)	3	The width of the total collimation (in mm) over the area of active x-ray detection. Note: This will be equal the number of effective detector rows multiplied by single collimation width.	Not supported
Table Speed	(0018,9309)	3	The distance in mm that the table moves in one second during the gathering of data that resulted in this image.	Not supported
Table Feed per Rotation	(0018,9310)	3	Motion of the table (in mm) during a complete revolution of the source around the gantry orbit.	Not supported
Spiral Pitch Factor	(0018,9311)	3	Ratio of the Table Feed per Rotation (0018,9310) to the Total Collimation Width (0018,9307).	Not supported

Attribute Name	Tag	T	Description	Handling
Exposure Modulation Type	(0018,9323)	3	A label describing the type of exposure modulation used for the purpose of limiting the dose. Defined Terms: NONE	Not supported
Estimated Dose Saving	(0018,9324)	3	A percent value of dose saving due to the use of Exposure Modulation Type (0018,9323). A negative percent value of dose savings reflects an increase of exposure.	Not supported
CTDIvol	(0018,9345)	3	Computed Tomography Dose Index (CTDIvol), in mGy according to IEC 60601-2-44, Ed.2.1 (Clause 29.1.103.4), The Volume CTDIvol. It describes the average dose for this image for the selected CT conditions of operation.	Not supported
Anatomic Region Sequence	(0008,2218)	3	Sequence that identifies the anatomic region of interest in this Instance (i.e. external anatomy, surface anatomy, or general region of the body). Only a single Item shall be permitted in this sequence.	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				
Primary Anatomic Structure Sequence	(0008,2228)	3	Sequence of Items that identifies the primary anatomic structure(s) of interest in this Instance. One or more Items may be included in this Sequence.	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				

Note 1) Table Top Pitch and Roll are not rotations around the isocenter, but around the origin of the IEC TABLE TOP coordinate system that is translated with respect to the IEC PATIENT SUPPORT system by Table Top Lateral, Table Top Longitudinal Position and negative Table Height. To correctly interpret the position and orientation of the Table Top relative to the isocenter, all six values have to be taken into account:

- Table Top Pitch Angle (300A,0140)
- Table Top Roll Angle (300A,0144)
- Patient Support Angle (300A,0122)
- Table Top Lateral Position (300A,012A)
- Table Top Longitudinal Position (300A,0129)
- Table Height (0018,1130)

## B.2.10 RT Image – C.8.8.2

Attribute Name	Tag	T	Description	Handling
Samples per Pixel	(0028,0002)	1	Number of samples (planes) in this image. See C.8.8.2.6.1 for specialization.	Supported
Photometric Interpretation	(0028,0004)	1	Specifies the intended interpretation of the pixel data. See C.7.6.3.1.2 for further explanation.	Supported  Export RT Image uncompressed: Value set to MONOCHROME2 RT Image MPEG compressed: Value set to YBR_PARTIAL_420
Bits Allocated	(0028,0100)	1	Number of bits allocated for each pixel sample. Each sample shall have the same number of bits allocated. See PS 3.5 for further explanation.	Supported
Bits Stored	(0028,0101)	1	Number of bits stored for each pixel sample. Each sample shall have the same number of bits stored. See PS 3.5 for further explanation.	Supported
High Bit	(0028,0102)	1	Most significant bit for pixel sample data. Each sample shall have the same high bit. See PS 3.5 for further explanation.	Supported
Pixel Representation	(0028,0103)	1	Data representation of the pixel samples. Each sample shall have the same pixel representation. Enumerated Values: 0000H = unsigned integer. 0001H = 2's complement	Supported



Attribute Name	Tag	T	Description	Handling
Pixel Intensity Relationship	(0028,1040)	3	The relationship between the Pixel sample values and the X-Ray beam intensity. Enumerated Values: LIN = Linearly proportional to X-Ray beam intensity LOG = Logarithmically proportional to X-Ray beam intensity See C.8.11.3.1.2 for further explanation.	Not supported
Pixel Intensity Relationship Sign	(0028,1041)	1C	The sign of the relationship between the Pixel sample values stored in Pixel Data (7FE0,0010) and the X-Ray beam intensity. Required if Pixel Intensity Relationship (0028,1040) is present. Enumerated Values; 1 = Lower pixel values correspond to less X-Ray beam intensity -1 = Higher pixel values correspond to less X-Ray beam intensity See C.8.11.3.1.2 for further explanation.	Not supported
RT Image Label	(3002,0002)	1	User-defined label for RT Image.	Supported  Export Used as Image ID.
RT Image Name	(3002,0003)	3	User-defined name for RT Image.	Not supported
RT Image Description	(3002,0004)	3	User-defined description of RT Image.	Supported
Operators' Name	(0008,1070)	2	Name of operator(s) acquiring or creating RT Image.	Supported

Attribute Name	Tag	T	Description	Handling
Image Type	(0008,0008)	1	Image identification characteristics (see Section C.7.6.1.1.2). RT Images shall use one of the following Defined Terms for Value 3: DRR = digitally reconstructed radiograph PORTAL = digital portal image or portal film image SIMULATOR = conventional simulator image RADIOGRAPH = radiographic image BLANK = image pixels set to background value FLUENCE = fluence map	Supported  Export kV: ORIGINAL\PRIMARY\PORTAL MV: ORIGINAL\PRIMARY\PORTAL Value for acquired portal dose: ORIGINAL\PRIMARY\PORTAL\ACQUIRED_DOSE
Conversion Type	(0008,0064)	2	Describes the kind of image conversion. Defined Terms: DV = Digitized Video DI = Digital Interface DF = Digitized Film WSD = Workstation	Supported Value set to DI
Reported Values Origin	(3002,000A)	2C	Describes the origin of the parameter values reported in the image. Required if Value 3 of Image Type (0008,0008) is SIMULATOR or PORTAL. Enumerated Values: OPERATOR = manually entered by operator PLAN = planned parameter values ACTUAL = electronically recorded	Supported  Export Value set to ACTUAL
RT Image Plane	(3002,000C)	1	Describes whether or not image plane is normal to beam axis. Enumerated Values: NORMAL = image plane normal to beam axis NON_NORMAL = image plane non-normal to beam axis	Supported  Export Value set to NORMAL
X-Ray Image Receptor Translation	(3002,000D)	3	Position in (x,y,z) coordinates of origin of IEC X-RAY IMAGE RECEPTOR System in the IEC GANTRY coordinate system (mm). See Note 2.	Supported

Attribute Name	Tag	T	Description	Handling
X-Ray Image Receptor Angle	(3002,000E)	2	X-Ray Image Receptor Angle i.e. orientation of IEC X-RAY IMAGE RECEPTOR coordinate system with respect to IEC GANTRY coordinate system (degrees). See C.8.8.2.2.	Supported
RT Image Orientation	(3002,0010)	2C	The direction cosines of the first row and the first column with respect to the IEC XRAY IMAGE RECEPTOR coordinate system. Required if RT Image Plane (3002,000C) is NON_NORMAL. May be present otherwise.	Supported
Image Plane Pixel Spacing	(3002,0011)	2	Physical distance (in mm) between the center of each image pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing. See C.8.8.2.3.	Supported
RT Image Position	(3002,0012)	2	The x and y coordinates (in mm) of the upper left hand corner of the image, in the IEC X-RAY IMAGE RECEPTOR coordinate system. This is the center of the first pixel transmitted. See C.8.8.2.7.	Supported
Radiation Machine Name	(3002,0020)	2	User-defined name identifying radiation machine used in acquiring or computing image (i.e. name of conventional simulator, electron accelerator, X-ray device, or machine modeled when calculating DRR).	Not supported
Primary Dosimeter Unit	(300A,00B3)	2	Measurement unit of machine dosimeter. Enumerated Values: MU = Monitor Unit MINUTE = minute	Supported  Export Value for MV Image: MU Value for kV Image: MINUTE
Radiation Machine SAD	(3002,0022)	2	Radiation source to Gantry rotation axis distance of radiation machine used in acquiring or computing image (mm).	Supported
Radiation Machine SSD	(3002,0024)	3	Source to patient surface distance (in mm) of radiation machine used in acquiring or computing image.	Not supported

Attribute Name	Tag	T	Description	Handling
RT Image SID	(3002,0026)	2	Distance from radiation machine source to image plane (in mm) along radiation beam axis. See C.8.8.2.3.	Supported:
Source to Reference Object Distance	(3002,0028)	3	Source to reference object distance (in mm), as used for magnification calculation of RADIOGRAPH and SIMULATOR images.	Not supported
Referenced RT Plan Sequence	(300C,0002)	3	Introduces sequence of one Class/Instance pair describing RT Plan associated with image. Only a single item shall be permitted in this sequence.	Supported
> Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced RT Plan Sequence (300C,0002) is sent.	Supported  Export Supported values: SOP Class UID of RT Plan and RT Ion Plan.
> Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced RT Plan Sequence (300C,0002) is sent.	Supported  Export Plan UID of the plan where this image is a field image.
Referenced Beam Number	(300C,0006)	3	Uniquely identifies the corresponding N- segment treatment beam specified by Beam Number (300A,00C0) within Beam Sequence in RT Beams Module within the RT Plan referenced in Referenced RT Plan Sequence (300C,0002).	Supported
Referenced Fraction Group Number	(300C,0022)	3	Identifier of Fraction Group within RT Plan referenced in Referenced RT Plan Sequence (300C,0002).	Not supported
Fraction Number	(3002,0029)	3	Fraction Number of fraction during which image was acquired, within Fraction Group referenced by Referenced Fraction Group Number (300C,0022) within RT Plan referenced in Referenced RT Plan Sequence (300C,0002).	Not supported

Attribute Name	Tag	T	Description	Handling
Start Cumulative Meterset Weight	(300C,0008)	3	Cumulative Meterset Weight within Beam referenced by Referenced Beam Number (300C,0006) at which image acquisition starts.	Supported
End Cumulative Meterset Weight	(300C,0009)	3	Cumulative Meterset Weight within Beam referenced by Referenced Beam Number (300C,0006) at which image acquisition ends.	Supported
Exposure Sequence	(3002,0030)	3	Introduces sequence of Exposure parameter sets, corresponding to exposures used in generating the image. One or more items may be included in this sequence. See C.8.8.2.4.	Supported
> Referenced Frame Number	(0008,1160)	1C	Identifies corresponding image frame in multi-frame image. Required if Exposure Sequence (3002,0030) is sent, there is more than one item in Exposure Sequence (3002,0030), and image is a multi-frame image.	Supported
> KVP	(0018,0060)	2C	Peak kilo voltage output (kV) of X-ray generator used to acquire image. Required if Value 3 of Image Type (0008,0008) is PORTAL, SIMULATOR or RADIOGRAPH and Exposure Sequence (3002,0030) is sent.	Supported
> X-ray Tube Current	(0018,1151)	2C	Imaging device X-ray Tube Current (mA). Required if Value 3 of Image Type (0008,0008) is SIMULATOR or RADIOGRAPH and Exposure Sequence (3002,0030) is sent.	Supported for kV images
> Exposure Time	(0018,1150)	2C	Time of X-ray exposure (msec). Required if Value 3 of Image Type (0008,0008) is SIMULATOR or RADIOGRAPH and Exposure Sequence (3002,0030) is sent.	Supported for kV Image
> Meterset Exposure	(3002,0032)	2C	Treatment machine Meterset duration over which image has been acquired, specified in Monitor units (MU) or minutes as defined by Primary Dosimeter Unit (300A,00B3). Required if Value 3 of Image Type (0008,0008) is PORTAL and Exposure Sequence (3002,0030) is sent.	Supported

Attribute Name	Tag	T	Description	Handling
> Diaphragm Position	(3002,0034)	3	Positions of diaphragm jaw pairs (in mm) in IEC BEAM LIMITING DEVICE coordinate axis in the IEC order X1, X2, Y1, Y2.	Not supported
> Beam Limiting Device Sequence	(300A,00B6)	3	Introduces sequence of beam limiting device (collimator) jaw or leaf (element) positions for given exposure. One or more items may be included in this sequence.	Supported
>> RT Beam Limiting Device Type	(300A,00B8)	1C	Type of beam limiting device (collimator). Required if Beam Limiting Device Sequence (300A,00B6) is sent. Enumerated Values: X = symmetric jaw pair in IEC X direction Y = symmetric jaw pair in IEC Y direction ASYMX = asymmetric jaw pair in IEC X direction ASYMY = asymmetric pair in IEC Y direction MLCX = multileaf (multi-element) jaw pair in IEC X direction MLCY = multileaf (multi-element) jaw pair in IEC Y direction	Supported Supported values: X, Y, ASYMX, ASYMY.
>> Source to Beam Limiting Device Distance	(300A,00BA)	3	Radiation source to beam limiting device (collimator) distance (mm).	Not supported
>> Number of Leaf/Jaw Pairs	(300A,00BC)	1C	Number of leaf (element) or jaw pairs (equal to 1 for standard beam limiting device jaws). Required if Beam Limiting Device Sequence (300A,00B6) is sent.	Supported
>> Leaf Position Boundaries	(300A,00BE)	2C	Boundaries (in mm) of beam limiting device (collimator) leaves (elements) in IEC BEAM LIMITING DEVICE coordinate axis appropriate to RT Beam Limiting Device Type (300A,00B8), i.e. X-axis for MLCY, Y- axis for MLCX. Contains N+1 values, where N is the Number of Leaf/Jaw Pairs (300A,00BC), starting from Leaf (Element) Pair 1. Required if RT Beam Limiting Device Type (300A,00B8) is MLCX or MLCY.	Not supported

Attribute Name	Tag	T	Description	Handling
>> Leaf/Jaw Positions	(300A,011C)	1C	Positions of beam limiting device (collimator) leaf or jaw (element) pairs (in mm) in IEC BEAM LIMITING DEVICE coordinate axis appropriate to RT Beam Limiting Device Type (300A,00B8), e.g. X- axis for MLCX, Y-axis for MLCY). Contains 2N values, where N is the Number of Leaf/Jaw Pairs (300A,00BC), in IEC leaf (element) subscript order 101, 102, ... 1N, 201, 202, ... 2N. Required if Beam Limiting Device Sequence (300A,00B6) is sent.	Supported
> Applicator Sequence	(300A,0107)	3	Introduces sequence of Applicators associated with Beam. Only a single item shall be permitted in this sequence.	Not supported
<i>&gt;&gt; Content of not supported sequence is not listed</i>				
> Number of Blocks	(300A,00F0)	1C	Number of shielding blocks associated with Beam. Required if Exposure Sequence (3002,0030) is sent.	Supported  Export Value always 0.
> Block Sequence	(300A,00F4)	2C	Introduces sequence of blocks associated with Beam. Required if Number of Blocks (300A,00F0) is non-zero. One or more items may be included in this sequence.	Not supported
<i>&gt;&gt; Content of not supported sequence is not listed</i>				
> Primary Fluence Mode Sequence	(3285,XX00)	3	Sequence defining whether the primary fluence of the treatment beam uses a non-standard fluence-shaping. Only a single Item shall be permitted in this sequence.	Not supported
<i>&gt;&gt; Content of not supported sequence is not listed</i>				
> Gantry Angle	(300A,011E)	3	Treatment machine gantry angle, i.e. orientation of IEC GANTRY coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees).	Supported
> Beam Limiting Device Angle	(300A,0120)	3	Treatment machine beam limiting device (collimator) angle, i.e. orientation of IEC BEAM LIMITING DEVICE coordinate system with respect to IEC GANTRY coordinate system (degrees).	Supported

Attribute Name	Tag	T	Description	Handling
> Patient Support Angle	(300A,0122)	3	Patient Support angle, i.e. orientation of IEC PATIENT SUPPORT coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees).	Supported See Note 1)
> Table Top Vertical Position	(300A,0128)	3	Table Top Vertical position in IEC TABLE TOP coordinate system (mm).	Supported See Note 1)
> Table Top Longitudinal Position	(300A,0129)	3	Table Top Longitudinal position in IEC TABLE TOP coordinate system (mm).	Supported See Note 1)
> Table Top Lateral Position	(300A,012A)	3	Table Top Lateral position in IEC TABLE TOP coordinate system (mm).	Supported See Note 1)
> Table Top Pitch Angle	(300A,0140)	3	Table Top Pitch Angle in IEC TABLE TOP coordinate system (deg)	Supported See Note 1)
> Table Top Roll Angle	(300A,0144)	3	Table Top Roll Angle in IEC TABLE TOP coordinate system (deg)	Supported See Note 1)
Fluence Map Sequence	(3002,0040)	1C	A Sequence of data describing the fluence map attributes for a radiotherapy beam. Only one item may be included in this sequence.  Required if the third value of Image Type (0008,0008) is FLUENCE.	Not supported
<i>&gt;&gt; Content of not supported sequence is not listed</i>				
Gantry Angle	(300A,011E)	3	Treatment machine gantry angle, i.e. orientation of IEC GANTRY coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees).	Supported



Attribute Name	Tag	T	Description	Handling
Beam Limiting Device Angle	(300A,0120)	3	Treatment machine beam limiting device (collimator) angle, i.e. orientation of IEC BEAM LIMITING DEVICE coordinate system with respect to IEC GANTRY coordinate system (degrees).	Supported
Patient Support Angle	(300A,0122)	3	Patient Support angle, i.e. orientation of IEC PATIENT SUPPORT coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees).	Supported See Note 1)
Table Top Eccentric Axis Distance	(300A,0124)	3	Distance (positive) from the IEC PATIENT SUPPORT vertical axis to the IEC TABLE TOP ECCENTRIC vertical axis (mm).	Not supported
Table Top Eccentric Angle	(300A,0125)	3	Table Top (non-isocentric) angle, i.e. orientation of IEC TABLE TOP ECCENTRIC coordinate system with respect to IEC PATIENT SUPPORT system (degrees).	Not supported
Table Top Vertical Position	(300A,0128)	3	Table Top Vertical position in IEC TABLE TOP coordinate system (mm).	Supported See Note 1)
Table Top Longitudinal Position	(300A,0129)	3	Table Top Longitudinal position in IEC TABLE TOP coordinate system (mm).	Supported See Note 1)
Table Top Lateral Position	(300A,012A)	3	Table Top Lateral position in IEC TABLE TOP coordinate system (mm).	Supported See Note 1)
Isocenter Position	(300A,012C)	3	Isocenter coordinates (x,y,z), in mm. Specifies the location of the machine isocenter in the patient-based coordinate system associated with the Frame of Reference. It allows transformation from the equipment-based IEC coordinate system to the patient-based coordinate system.	Supported

Attribute Name	Tag	T	Description	Handling
Table Top Pitch Angle	(300A,0140)	3	Table Top Pitch Angle in IEC TABLE TOP coordinate system (deg)	Supported See Note 1) Import: If missing, 0deg is assumed
Table Top Roll Angle	(300A,0144)	3	Table Top Roll Angle in IEC TABLE TOP coordinate system (deg)	Supported See Note 1) Import: If missing, 0deg is assumed
Patient Position	(0018,5100)	1C	<p>Patient position descriptor relative to the patient support device.</p> <p>Required if Isocenter Position (300A,012C) is present. May be present otherwise. See Section C.7.3.1.1.2 for Defined Terms and further explanation.</p> <p>Note:</p> <p>The orientation of the patient relative to the patient support device is denoted in the same manner as in the RT Patient Setup module. It defines the relation of the patient-based DICOM coordinate system identified by the frame of reference module of the RT Image to the IEC coordinate system and together with the Isocenter Position (300A,012C) allows the RT Image to be placed into the patient frame of reference. It also allows a system using an RT Image to verify that the patient is setup in a similar position relative to the patient support device.</p>	Supported

Attribute Name	Tag	T	Description	Handling
RT Image Isocenter Position	(3273,XX00)	3	The isocenter position in the FOR as defined in the FOR module. For DRRs, this is typically the FOR of the diagnostic image and the isocenter coordinate correspond to those of the associated beam. For treatment / simulator images, the acquisition systems create the FOR and define it's origin (typically the isocenter position of the first image acquired).	Supported
RT Image Patient Position	(3273,XX01)	3	The patient position at the time, when the image was taken (or created in case of DRRs).	Supported
LT Archive Primary Reference Image Flag	(3279,XX00)	3	If present indicates if image is primary reference image of beam referenced by Referenced RT Plan Sequence (300C,0002) and Referenced Beam Number (300C,0006). If absent then it is not a primary reference image.  Enumerated Values: PRIMARY NOT_PRIMARY	Not supported

Note 1) Table Top Pitch and Roll are not rotations around the isocenter, but around the origin of the IEC TABLE TOP coordinate system that is translated with respect to the IEC PATIENT SUPPORT system by Table Top Lateral, Longitudinal, and Vertical Position. To correctly interpret the position and orientation of the Table Top relative to the isocenter, all six values have to be taken into account:

Table Top Pitch Angle (300A,0140)  
Table Top Roll Angle (300A,0144)  
Patient Support Angle (300A,0122)  
Table Top Lateral Position (300A,012A)  
Table Top Longitudinal Position (300A,0129)  
Table Top Vertical Position (300A,0128)

**B.2.11 Structure Set – C.8.8.5**

Attribute Name	Tag	T	Description	Handling
Structure Set Label	(3006,0002)	1	User-defined label for Structure Set.	Supported
Structure Set Name	(3006,0004)	3	User-defined name for Structure Set.	Not supported
Structure Set Description	(3006,0006)	3	User-defined description for Structure Set.	Not supported
Instance Number	(0020,0013)	3	A number that identifies this object instance.	Not supported
Structure Set Date	(3006,0008)	2	Date at which Structure Set was last modified.	Supported
Structure Set Time	(3006,0009)	2	Time at which Structure Set was last modified.	Supported
Referenced Frame of Reference Sequence	(3006,0010)	3	Introduces sequence of items describing Frames of Reference in which the ROIs are defined. One or more items may be included in this sequence. See C.8.8.5.1.	Supported
> Frame of Reference UID	(0020,0052)	1C	Uniquely identifies Frame of Reference within Structure Set. Required if Referenced Frame of Reference Sequence (3006,0010) is sent.	Supported
> Frame of Reference Relationship Sequence	(3006,00C0)	3	Introduces sequence of transforms that relate other Frames of Reference to this Frame of Reference.	Not supported
<i>&gt;&gt; Content of not supported sequence is not listed</i>				
> RT Referenced Study Sequence	(3006,0012)	3	Introduces sequence of Studies containing series to be referenced. One or more items may be included in this sequence.	Supported
>> Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if RT Referenced Study Sequence (3006,0012) is sent.	Supported

Attribute Name	Tag	T	Description	Handling
>> Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if RT Referenced Study Sequence (3006,0012) is sent.	Supported
>> RT Referenced Series Sequence	(3006,0014)	1C	Introduces sequence of items describing series of images within the referenced study which are used in defining the Structure Set. Required if RT Referenced Study Sequence (3006,0012) is sent. One or more items may be included in this sequence.	Supported
>>> Series Instance UID	(0020,000E)	1C	Unique identifier for the series containing the images. Required if RT Referenced Series Sequence (3006,0014) is sent.	Supported
>>> Contour Image Sequence	(3006,0016)	1C	Introduces sequence of items describing images in a given series used in defining the Structure Set (typically CT or MR images). Required if RT Referenced Series Sequence (3006,0014) is sent. One or more items may be included in this sequence.	Supported
>>>> Referenced SOP Class UID	(0008,1150)	1	Uniquely identifies the referenced SOP Class.	Supported
>>>> Referenced SOP Instance UID	(0008,1155)	1	Uniquely identifies the referenced SOP Instance.	Supported
>>>> Referenced Frame Number	(0008,1160)	1	Identifies the frame numbers within the Referenced SOP Instance to which the reference applies. The first frame shall be denoted as frame number 1. Note: This Attribute may be multi-valued. Required if the Referenced SOP Instance is a multi-frame image and the reference does not apply to all frames.	Not supported
Structure Set ROI Sequence	(3006,0020)	3	Introduces sequence of ROIs for current Structure Set. One or more items may be included in this sequence.	Supported
> ROI Number	(3006,0022)	1C	Identification number of the ROI. The value of ROI Number (3006,0022) shall be unique within the Structure Set in which it is created. Required if Structure Set ROI Sequence (3006,0020) is sent.	Supported

Attribute Name	Tag	T	Description	Handling
> Referenced Frame of Reference UID	(3006,0024)	1C	Uniquely identifies Frame of Reference in which ROI is defined, specified by Frame of Reference UID (0020,0052) in Referenced Frame of Reference Sequence (3006,0010). Required if Structure Set ROI Sequence (3006,0020) is sent.	Supported
> ROI Name	(3006,0026)	2C	User-defined name for ROI. Required if Structure Set ROI Sequence (3006,0020) is sent.	Supported
> ROI Description	(3006,0028)	3	User-defined description for ROI.	Not supported
> ROI Volume	(3006,002C)	3	Volume of ROI (cubic centimeters).	Not supported
> ROI Generation Algorithm	(3006,0036)	2C	Type of algorithm used to generate ROI. Required if Structure Set ROI Sequence (3006,0020) is sent. Defined Terms: AUTOMATIC = calculated ROI SEMIAUTOMATIC = ROI calculated with user assistance MANUAL = user-entered ROI	Supported
> ROI Generation Description	(3006,0038)	3	User-defined description of technique used to generate ROI.	Not supported
ROI Contour Sequence	(3006,0039)	1	Introduces sequence of Contour Sequences defining ROIs. One or more items may be included in this sequence.	Supported
> Referenced ROI Number	(3006,0084)	1	Uniquely identifies the referenced ROI described in the Structure Set ROI Sequence (3006,0020).	Supported
> ROI Display Color	(3006,002A)	3	RGB triplet color representation for ROI, specified using the range 0-255.	Supported
> Contour Sequence	(3006,0040)	3	Introduces sequence of Contours defining ROI. One or more items may be included in this sequence.	Supported

Attribute Name	Tag	T	Description	Handling
>>> Contour Image Sequence	(3006,0016)	1C	Introduces sequence of items describing images in a given series used in defining the Structure Set (typically CT or MR images). Required if RT Referenced Series Sequence (3006,0014) is sent. One or more items may be included in this sequence.	Supported
>>>> Referenced SOP Class UID	(0008,1150)	1	Uniquely identifies the referenced SOP Class.	Supported
>>>> Referenced SOP Instance UID	(0008,1155)	1	Uniquely identifies the referenced SOP Instance.	Supported
>> Contour Geometric Type	(3006,0042)	1	Geometric type of contour. Enumerated Values: POINT = single point	Supported
>> Number of Contour Points	(3006,0046)	1	Number of points (triplets) in Contour Data (3006,0050).	Supported
>> Contour Number	(3006,0048)	3	Identification number of the contour. The value of Contour Number (3006,0048) shall be unique within the Contour Sequence (3006,0040) in which it is defined. No semantics or ordering shall be inferred from this attribute.	Supported
>> Contour Data	(3006,0050)	1	Sequence of (x,y,z) triplets defining a contour in the patient based coordinate system (mm). Note: Contour Data may not be properly encoded if Explicit-VR transfer syntax is used and the VL of this attribute exceeds 65534 bytes.	Supported
RT ROI Observations Sequence	(3006,0080)	1	Introduces sequence of observations related to ROIs defined in the ROI Module. One or more items may be included in this sequence.	Supported
> Observation Number	(3006,0082)	1	Identification number of the Observation. The value of Observation Number (3006,0082) shall be unique within the RT ROI Observations Sequence (3006,0080).	Supported
> Referenced ROI Number	(3006,0084)	1	Uniquely identifies the referenced ROI described in the Structure Set ROI Sequence (3006,0020).	Supported

Attribute Name	Tag	T	Description	Handling
> ROI Observation Label	(3006,0085)	3	User-defined label for ROI Observation. Defined Terms: InitLaserIso InitMatchIso AcqIsocenter	Supported
> RT ROI Interpreted Type	(3006,00A4)	2	Type of ROI. Defined Terms: INITLASERISO INITMATCHISO ACQ_ISOCENTER	Supported
> ROI Interpreter	(3006,00A6)	2	Name of person performing the interpretation.	Supported
> ROI Physical Properties Sequence	(3006,00B0)	3	Introduces sequence describing physical properties associated with current ROI interpretation. One or more items may be included in this sequence.	Supported
>> ROI Physical Property	(3006,00B2)	1	Physical property specified by ROI Physical Property Value (3006,00B4). Defined Terms: PAT SUPPORT_ANGLE T TOP_PITCH_ANGLE T TOP_ROLL_ANGLE	Supported
>> ROI Physical Property Value	(3006,00B4)	1	User-assigned value for physical property.	Supported
Referenced Structure Set Relationship Sequence	(3263,XX01)	3	Introduces sequence of related SOP Class/Instance pairs describing related instances of structure sets. One or more items may be included in this sequence.	Supported  Export This sequence is exported for structure sets created during marker detection only.



Attribute Name	Tag	T	Description	Handling
> Referenced SOP Class UID	(0008,1150)	1	Uniquely identifies the referenced SOP Class.	Supported
> Referenced SOP Instance UID	(0008,1155)	1	Uniquely identifies the referenced SOP Instance.	Supported
> Structure Set Relationship	(3263,XX02)	3	Relationship of referenced structure set with respect to current structure set. Required if Referenced Structure Set Sequence (3263,1002) is sent. Defined Terms: PREDECESSOR = structure set used in derivation of current structure set ADDITION = structure set, for which the current structure set is an addition	Supported  Export ADDITION is used for new marker structures defined during marker detection

## B.2.12 Approval – C.8.8.16

Attribute Name	Tag	T	Description	Handling
Approval Status	(300E,0002)	1	Instance was created. Enumerated Values: APPROVED = Reviewer recorded that object met an implied criterion UNAPPROVED = No review of object has been recorded REJECTED = Reviewer recorded that object failed to meet an implied criterion	Supported
Review Date	(300E,0004)	2C	Date on which object was reviewed. Required if Approval Status (300E,0002) is APPROVED or REJECTED.	Supported

Attribute Name	Tag	T	Description	Handling
Review Time	(300E,0005)	2C	Time at which object was reviewed. Required if Approval Status (300E,0002) is APPROVED or REJECTED.	Supported
Reviewer Name	(300E,0008)	2C	Name of person who reviewed object. Required if Approval Status (300E,0002) is APPROVED or REJECTED.	Supported

### B.2.13 Modality LUT – C.11.1

Attribute Name	Tag	T	Description	Handling
Modality LUT Sequence	(0028,3000)	1C	Defines a sequence of Modality LUTs. Only one Item may be present. Shall not be present if Rescale Intercept (0028,1052) is present.	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				
Rescale Intercept	(0028,1052)	1C	The value b in relationship between stored values (SV) and the output units specified in Rescale Type (0028,1054). Output units = $m \cdot SV + b$ . Required if Modality LUT Sequence (0028,3000) is not present. Shall not be present otherwise.	Supported for: RT Image
Rescale Slope	(0028,1053)	1C	m in the equation specified by Rescale Intercept (0028,1052). Required if Rescale Intercept is present.	Supported for: RT Image

Attribute Name	Tag	T	Description	Handling
Rescale Type	(0028,1054)	1C	Specifies the output units of Rescale Slope (0028,1053) and Rescale Intercept (0028,1052). See C.11.1.1.2 for further explanation. Required if Rescale Intercept is present.	Supported Export  Defined Terms supported: CU = Calibration Units Gy/MU = Gray per MU RD = Relative Dose HU = Hounsfield Units  For portal dose images roundtrip is supported for CU, Gy/MU and RD. All other values are mapped to US.

## B.2.14 VOI LUT – C.11.2

Attribute Name	Tag	T	Description	Handling
VOI LUT Sequence	(0028,3010)	1C	Defines a sequence of VOI LUTs. One or more Items shall be present. Required if Window Center (0028,1050) is not present. May be present otherwise	Not supported
<i>&gt; Content of not supported sequence is not listed</i>				
Window Center	(0028,1050)	1C	Window Center for display. See C.11.2.1.2 for further explanation. Required if VOI LUT Sequence (0028,3010) is not present. May be present otherwise.	Supported

Attribute Name	Tag	T	Description	Handling
Window Width	(0028,1051)	1C	Window Width for display. See C.11.2.1.2 for further explanation. Required if Window Center (0028,1050) is sent	Supported

### B.2.15 SOP Common – C.12.1

Attribute Name	Tag	T	Description	Handling
SOP Class UID	(0008,0016)	1	Uniquely identifies the SOP Class. See C.12.1.1.1 for further explanation. See also PS 3.4.	Supported
SOP Instance UID	(0008,0018)	1	Uniquely identifies the SOP Instance. See C.12.1.1.1 for further explanation. See also PS 3.4.	Supported
Specific Character Set	(0008,0005)	1C	Character Set that expands or replaces the Basic Graphic Set. Required if an expanded or replacement character set is used. See C.12.1.1.2 for Defined Terms.	Supported Supported encodings: DICOM defined character sets: ISO_IR 6, ISO_IR 13, ISO_IR 100, ISO_IR 101, ISO_IR 109, ISO_IR 110, ISO_IR 126, ISO_IR 127, ISO_IR 138, ISO_IR 144, ISO_IR 148, ISO_IR 166, ISO_IR 192, GB18030 Windows Code Pages: 932, 936, 1252
Instance Creation Date	(0008,0012)	3	Date the SOP Instance was created.	Supported.
Instance Creation Time	(0008,0013)	3	Time the SOP Instance was created.	Supported

**B.2.16 Spatial Registration – C.20.2**

Attribute Name	Tag	T	Description	Handling
Content Date	(0008,0023)	1	The date the content creation started.	Supported
Content Time	(0008,0033)	1	The time the content creation started.	Supported
Instance Number	(0020,0013)	1	A number that identifies this instance	Supported  Export Value is set to 0.
Content Label	(0070,0080)	1	A label that is used to identify this registration.	Supported
Content Description	(0070,0081)	2	A description of this registration.	Supported
Content Creator's Name	(0070,0084)	2	Name of operator performing the registration (such as a technologist or physician).	Not supported
Registration Sequence	(0070,0308)	1	A sequence of one or more registration items. Each item defines a spatial registration to the referenced images in that item. All referenced images are in the same spatial frame of reference or atlas.	Supported
> Frame of Reference UID	(0020,0052)	1C	Identifies a Frame of Reference that may or may not be an image set (e.g. atlas or physical space). See C.7.4.1.1.1 for further explanation. Required if Referenced Image Sequence (0008,1140) is absent. May be present otherwise.	Supported
> Referenced Image Sequence	(0008,1140)	1C	Identifies the set of images registered in this sequence item. One or more items shall be present. Required if Frame of Reference UID (0020,0052) is absent. May be present otherwise.	Supported
>> Referenced SOP Class UID	(0008,1150)	1	Uniquely identifies the referenced SOP Class.	Supported
>> Referenced SOP Instance UID	(0008,1155)	1	Uniquely identifies the referenced SOP Instance.	Supported

Attribute Name	Tag	T	Description	Handling
>> Referenced Frame Number	(0008,1160)	1	Identifies the frame numbers within the Referenced SOP Instance to which the reference applies. The first frame shall be denoted as frame number 1. Note: This Attribute may be multi-valued. Required if the Referenced SOP Instance is a multi-frame image and the reference does not apply to all frames.	Not supported
> Matrix Registration Sequence	(0070,0309)	1	A sequence that specifies one spatial registration. Exactly one item shall be present	Supported
>> Frame of Reference Transformation Comment	(3006,00C8)	3	User description or comments about the Transformation Comment registration.	Not supported
>> Registration Type Code Sequence	(0070,030D)	2	Describes the information input into the registration process. Only one item may be present.	Supported
>>> Code Value	(0008,0100)	1C	See Section 8.1. Required if a sequence item is present.	Supported
>>> Coding Scheme Designator	(0008,0102)	1C	See Section 8.2. Required if a sequence item is present.	Supported
>>> Coding Scheme Version	(0008,0103)	1C	See Section 8.2. Required if a sequence item is present and the value of Coding Scheme Designator (0008,0102) is not sufficient to identify the Code Value (0008,0100) unambiguously.	Supported
>>> Code Meaning	(0008,0104)	1C	See Section 8.3. Required if a sequence item is present.	Supported
>> Matrix Sequence	(0070,030A)	1	One or more items shall be present. Each item specifies a transformation. The item order is significant and corresponds to matrix multiplication order. See C.20.2.1.1.	Supported  Export Always one item is exported which incorporates the combination of all matrices of the original sequence.

Attribute Name	Tag	T	Description	Handling
>>> Frame of Reference Transformation Matrix	(3006,00C6)	1	A 4x4 homogeneous transformation matrix that registers the referenced images to the local RCS. Matrix elements shall be listed in row-major order. See C.20.2.1.1.	Supported
>>> Frame of Reference Transformation Matrix Type	(0070,030C)	1	Type of Frame of Reference Transformation Matrix (3006,00C6). Defined terms: RIGID RIGID_SCALE AFFINE See C.20.2.1.2	Supported  Export Value set to RIGID
>> Registration Sub Type	(3275,XX00)	3	Identifies the application or application context in which this registration object has been created.	Supported  Export The value exported is one of the following: "Online2D", "Online2DPaired", "Online3D", "OnlineMarker", "Online2D3D", "Online2D3DPaired"
> Used Fiducials Sequence	(0070,0314)	3	The fiducials used to determine the Frame of Reference Transformation Matrix. One or more Items may be present.	Not supported
>> <i>Content of not supported sequence is not listed</i>				

**B.2.17 Cine C.7.6.5**

Attribute Name	Tag	T	Description	Handling
Preferred Playback Sequencing	(0018,1244)	3	Describes the preferred playback sequencing for a multi-frame image. Enumerated Values: 0 = Looping (1,2...n,1,2,...n,1,2,...n,...) 1 = Sweeping (1,2,...n,n-1,...2,1,2,...n,...)	Not supported
Frame Time	(0018,1063)	1C	Nominal time (in msec) per individual frame. See C.7.6.5.1.1 for further explanation. Required if Frame Increment Pointer (0028,0009) points to Frame Time.	Supported
Frame Time Vector	(0018,1065)	1C	An array that contains the real time increments (in msec) between frames for a Multi-frame image. See C.7.6.5.1.2 for further explanation. Required if Frame Increment Pointer (0028,0009) points to Frame Time Vector. Note: Frame Time Vector arrays may not be properly encoded if Explicit-VR transfer syntax is used and the VL of this attribute exceeds 65534 bytes.	Supported for multi-frame RT images
Start Trim	(0008,2142)	3	The frame number of the first frame of the Multi-frame image to be displayed	Not supported
Stop Trim	(0008,2143)	3	The Frame Number of the last frame of a Multi-frame image to be displayed.	Not supported
Recommended Display Frame Rate	(0008,2144)	3	Recommended rate at which the frames of a Multi-frame image should be displayed in frames/second.	Not supported
Cine Rate	(0018,0040)	3	Number of frames per second.	Supported
Frame Delay	(0018,1066)	3	Time (in msec) from Content Time (0008,0033) to the start of the first frame in a Multi-frame image.	Not supported



Attribute Name	Tag	T	Description	Handling
Image Trigger Delay	(0018,1067)	3	Delay time in milliseconds from trigger (e.g., X-Ray on pulse) to the first frame of a Multi-frame image.	Not supported
Effective Duration	(0018,0072)	3	Total time in seconds that data was actually taken for the entire Multi-frame image.	Not supported
Actual Frame Duration	(0018,1242)	3	Elapsed time of data acquisition in msec per each frame.	Not supported
Multiplexed Audio Channels Description Code Sequence	(003A,0300)	2C	Description of any multiplexed audio channels. See Section C.7.6.5.1.3. Required if the Transfer Syntax used to encode the multi-frame image contains multiplexed (interleaved) audio channels, such as is possible with MPEG2. Zero or more items may be present in this sequence.	Supported  Export zero items exported
>Channel Identification Code	(003A,0301)	1	A reference to the audio channel as identified within Transfer Syntax encoded bit stream (1 for the main channel, 2 for the second channel and 3 to 9 to the complementary channels).	Not supported
>Channel Mode	(003A,0302)	1	A coded descriptor qualifying the mode of the channel: Enumerated Values: MONO = 1 signal STEREO = 2 simultaneously acquired (left and right) signals	Not supported
>Channel Source Sequence	(003A,0208)	1	A coded descriptor of the audio channel source. Only a single Item shall be permitted in this sequence.	Not supported
<i>&gt;&gt; Content of not supported sequence is not listed</i>				

**B.2.18 Multi-frame C.7.6.6**

Attribute Name	Tag	T	Description	Handling
Number of Frames	(0028,0008)	1	Number of frames in a Multi-frame Image. See C.7.6.6.1.1 for further explanation.	Supported
Frame Increment Pointer	(0028,0009)	1	Contains the Data Element Tag of the attribute that is used as the frame increment in Multi-frame pixel data. See C.7.6.6.1.1 for further explanation.	Supported

## Appendix C Extended Interface

The following IODs have private Attributes containing an XML data structure for transporting structured non-DICOM data:

- RT Plan
- CR/CT/MR/SC/RT Image

The following sections specify Attributes containing the XML data and describe the structure of the XML data.

### C.1.1 RT Plan

Node Name	Min occurs	Max occurs	Data Type	Node Description
ExtendedVAPlanInterface	0	1		
> Beams	0	1		
>> Beam	0	Unbounded		
>>> ReferencedBeamNumber	1	1	int	Beam identifier
>>> BeamExtension	1	1		Additional items provided from Vision to expand the features of RT Beams.
>>>> FieldType	1	1	string	TREATMENT or SETUP
>>>> RelatedTreatBeamNumber	0	1	int	Relation from the image beams to the treatment and/or setup beams.
>>>> FieldOrder	1	1	int	Order in which the fields are shown
>>>> GantryRtnExtendedStart	0	1	int	When true, gantry angle position is in the extended range, which means it has an over travel (a Gantry can move most typical 400' and not only 360').
>>>> GantryRtnExtendedStop	0	1	int	When true, gantry angle position is in the extended range, which means it has an over travel (a Gantry can move most typical 400' and not only 360').
>>>> MUSubtraction	0	1	int	MUSubtraction defines whether some MUs have to be subtracted from the related treatment beam to take images in the before phase and/or after phase.

Node Name	Min occurs	Max occurs	Data Type	Node Description
>>>> FieldSetupPhotos	0	1		
>>>>> FieldSetupPhoto	0	2		Two setup photos max
>>>>>> SetupPhotoNumber	1	1	int	Increasing number of setup photos. The value has to start from 1 and up.
>>>>>>> SetupPhotoFormat	1	1	string	The format of the pixel information. Supported values are 'JPG' and 'BMP'
>>>>>>>> SetupPhotoPicture	1	1	hex binary	Pixel information of the photo in the corresponding format.
>>>>>>>>> PhotoModified	1	1	string	Photo has been modified. PhotoModified may have 'true' or 'false'
>>> CustomAddOns	0	1		
>>>> CustomAddOn	0	4		
>>>>> CustomAddOnType	1	1	string	Three Add On Type to choose from: BLOCK COMPENSATOR TRAY
>>>>>> CustomCode	0	1	int	Codes for accessory which may be custom made or factory made (in that case the internal code in equal the custom code.)
>>>>>>> ReferencedAddOnNumber	0	1	int	Reference to the identification number of the Block or Compensator.
>>>>>>>> TraySpecification	0	1		In case the CustomAddOn is a tray, it gets reported back through this node
>>>>>>>>> TrayID	1	1	string	User-supplied identifier for tray. Max length is 16 characters.
>>>>>>>>>> SourceTrayDistance	0	1	int	The distance from source to slot. This information is needed to distinguish the slot
> ToleranceTables	0	1		

Node Name	Min occurs	Max occurs	Data Type	Node Description
>> ToleranceTable	0	Unbounded		Additional items provided from Vision to expand the features of Tolerance Tables with AutoSetup capabilities
>>> ReferencedToleranceTableNumber	1	1	int	Refers to the tolerance table in RT Tolerance Table module
>>> ToleranceTableExtension	1	1		
>>>> GantryRtnSetup	0	1	string	Setup attributes may have following type: Automatic Manual Remote
>>>> CollRtnSetup	0	1	string	
>>>> CollXSetup	0	1	string	
>>>> CollYSetup	0	1	string	
>>>> PatientSupportAngleSetup	0	1	string	
>>>> CouchLngSetup	0	1	string	
>>>> CouchVrtSetup	0	1	string	
>>>> CouchLatSetup	0	1	string	
>>>> TableTopEccentricAngleSetup	0	1	string	
> DoseReferences	0	1		
>> DoseReference	0	Unbounded		

Node Name	Min occurs	Max occurs	Data Type	Node Description
>>> ReferencedDoseReferenceNumber	1	1	int	Reference to the identification number of the Dose Reference (300A,0012) in the RT Prescription module which is a representation of our reference point
>>> DoseReferenceExtension	1	1		Additional items provided from Vision to expand the features of reference points.
>>>> DailyDoseLimit	0	1	decimal	Unit is [Gy]
>>>> SessionDoseLimit	0	1	decimal	Unit is [Gy]
>>>> Breakpoints	0	1		
>>>>> Breakpoint	0	Unbounded		Breakpoint extensions, since DICOM has just one DeliveryWarningDose without a description this is needed.
>>>>>> BreakpointDose	1	1	decimal	Unit is [Gy]
>>>>>> BreakpointWarning	1	1	string	Text which describes the breakpoint. Max length is 254 characters

**Table C-5 RT Plan Extended Interface**