



# DICOM Conformance Statement

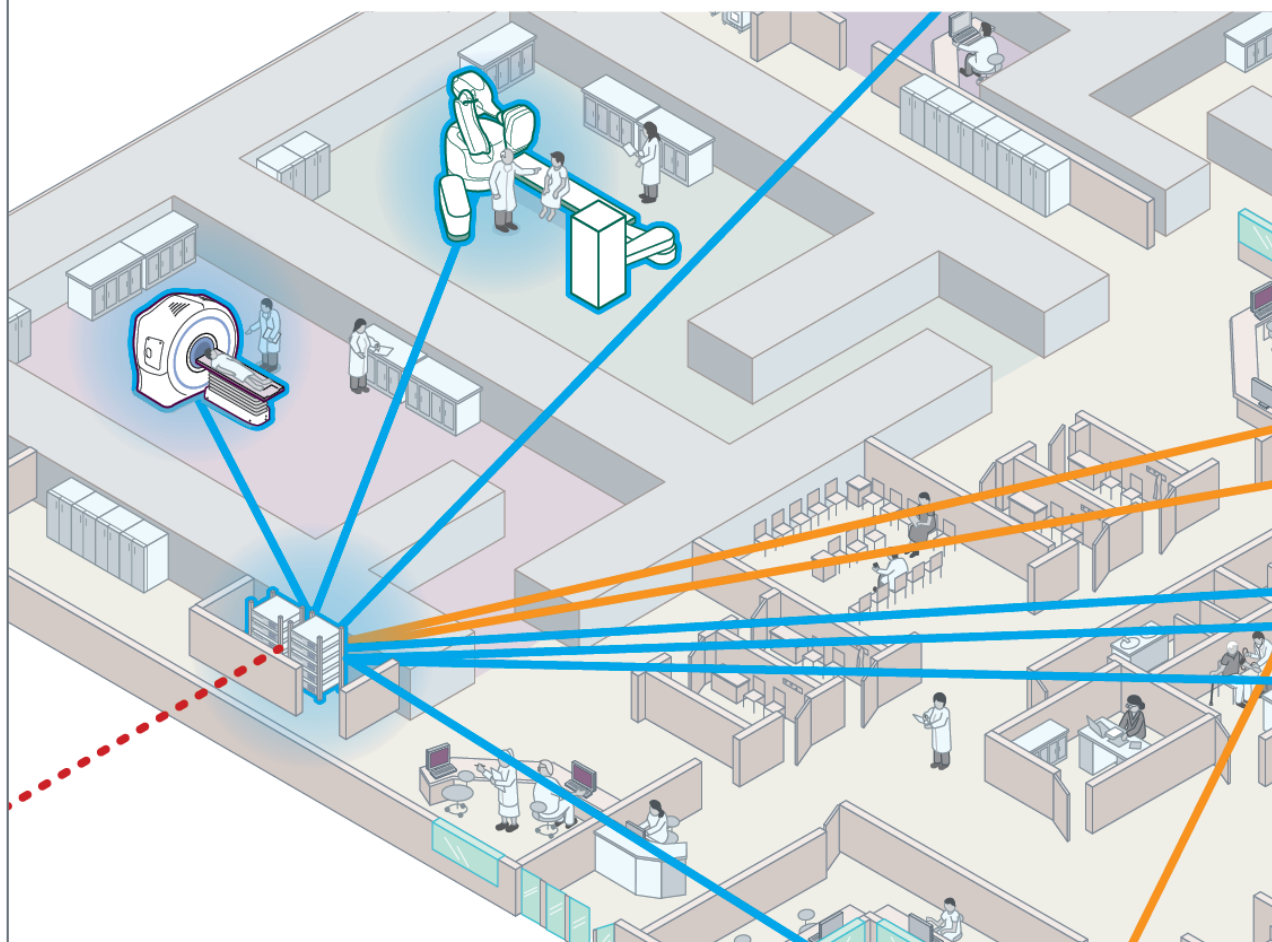
CyberKnife® Treatment Delivery System

Radixact™ Treatment Delivery System

TomoTherapy® Treatment Delivery System w/iDMS™

Accuray Precision™ Treatment Planning System

iDMS™ Data Management System





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## Prescription Device Statement



**Caution:** Federal law restricts this device to sale by or on the order of a physician.



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## TABLE OF CONTENTS

<b>1.0</b>	<b>Overview .....</b>	<b>11</b>
<b>2.0</b>	<b>Introduction .....</b>	<b>12</b>
2.1	Audience .....	12
2.2	Remarks .....	12
2.3	Acronyms/Terminology.....	13
2.4	References.....	15
<b>3.0</b>	<b>Implementation Model .....</b>	<b>15</b>
3.1	Application Data Flow Diagram .....	15
3.2	Functional Definitions of Application Entity .....	18
3.3	Sequencing of Real-World Activities.....	18
<b>4.0</b>	<b>AE Specifications .....</b>	<b>20</b>
4.1	Supported Storage Service Object Pair (SOP) Classes by iDMS System as an SCP20	
4.2	Supported Storage, Unified Procedure Step, Query/Retrieve Service Object Pair (SOP) Classes by iDMS System as an SCU .....	36
<b>5.0</b>	<b>RT Structure Set Information Object Implementation (RT Structure Set Storage SCP) .....</b>	<b>52</b>
5.1	RT Structure Set IOD Implementation .....	52
5.2	RT Structure Set IOD Module Table.....	53
5.3	Information Module Definitions – RT Structure Set.....	54
<b>6.0</b>	<b>RT Structure Set Information Object Implementation (RT Structure Set Storage SCU) .....</b>	<b>56</b>
6.1	RT Structure Set IOD Implementation .....	56
6.2	RT Structure Set IOD Module Table.....	57
6.3	Information Module Definitions – RT Structure Set.....	57
<b>7.0</b>	<b>RT Dose Information Object Implementation (RT Dose Storage SCP).....</b>	<b>61</b>
<b>8.0</b>	<b>RT Dose Information Object Implementation (RT Dose Storage SCU).....</b>	<b>61</b>
8.1	RT Dose IOD Implementation .....	61
8.2	RT Dose IOD Module Table .....	61
8.3	Information Module Definitions – RT Dose .....	62
<b>9.0</b>	<b>RT Plan IOD (RT Plan Storage SCU).....</b>	<b>65</b>
9.1	RT Plan IOD Implementation .....	65
9.2	RT Plan IOD Module Table .....	66
9.3	Information Module Definitions – RT Plan .....	66
<b>10.0</b>	<b>RT Plan IOD (RT Plan Storage SCP) .....</b>	<b>81</b>
10.1	RT Plan IOD Implementation .....	81
10.2	RT Plan IOD Module Table .....	81



---

<b>11.0</b>	<b>RT Beams Treatment Record IOD (RT Beam Treatment Record Storage SCU)</b>	<b>82</b>
11.1	RT Beams Treatment Record IOD Implementation	82
11.2	RT Beams Treatment Record IOD Module Table	82
11.3	Information Model Definitions – RT Beams Treatment Record	83
<b>12.0</b>	<b>RT Beams Delivery Instruction IOD (RT Beams Delivery Instruction Storage SCP)</b>	<b>95</b>
12.1	RT Beams Delivery Instruction IOD Implementation	95
12.2	RT Beams Delivery Instruction IOD Module Table	96
12.3	Information Module Definitions – RT Beams Delivery Instruction	96
<b>13.0</b>	<b>Raw Data Storage Class</b>	<b>97</b>
<b>14.0</b>	<b>Unified Procedure Step IOD (Unified Procedure Step – PULL SCU)</b>	<b>101</b>
14.1	Unified Procedure Step IOD Implementation	102
14.2	Unified Procedure Step IOD Module Table	102
14.3	Information Module Definitions – Unified Procedure Step	103
<b>15.0</b>	<b>CT Image IOD/CT Image Storage SCP)</b>	<b>105</b>
15.1	CT Image IOD Implementation	105
15.2	CT Image IOD Module Table	105
15.3	Information Model Definitions – CT Image	106
<b>16.0</b>	<b>Spatial Registration IOD/Spatial Registration SCP)</b>	<b>112</b>
16.1	CT Image IOD Implementation	112
16.2	Spatial Registration IOD Module Table	112
16.3	Information Model Definitions – Spatial Registration	113
<b>17.0</b>	<b>Study Root Query/Retrieve Information Model SCU</b>	<b>115</b>
17.1	Query/Retrieve (SCU) Implementation	115
17.2	Information Model Definitions—Study Root Query/Retrieve	115
<b>18.0</b>	<b>RT Treatment Summary Record IOD (RT Treatment Summary Record Storage SCP)</b>	<b>116</b>
18.1	RT Treatment Summary Record IOD Implementation	116
18.2	RT Treatment Summary Record IOD Module Table	116
18.3	Information Module Definitions – RT Treatment Summary	117
<b>19.0</b>	<b>Communication Profiles</b>	<b>118</b>
19.1	Supported Communication Stacks	118
19.2	Network Media Support	118
<b>20.0</b>	<b>Extensions, Specializations, Privatizations</b>	<b>118</b>
<b>21.0</b>	<b>Configuration</b>	<b>118</b>
<b>22.0</b>	<b>Support for Extended Character Sets</b>	<b>119</b>



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<b>23.0</b>	<b>Annexes .....</b>	<b>119</b>
23.1	Miscellaneous Macros.....	119
23.2	Data Dictionary of Private Attributes.....	119





## Conformance Statement Overview

This document specifies the compliance to DICOM conformance requirements for the relevant networking features for Precision™ Treatment Planning System, iDMS™ Data Management System, CyberKnife® Treatment Delivery System, Radixact™ Treatment Delivery System, and TomoTherapy® Treatment Delivery System (the “Products”). It requires the release versions specified in this document as the minimums for this Conformance Statement to apply.

The connectivity features described in this document support information exchange between the Products and third-party systems for the following uses:

- **Import:** objects are imported from third-party systems in order to perform treatment planning or re-planning for subsequent treatment delivery.
- **Export:** objects are exported to third-party systems in order to perform additional therapy-related activities on those systems, for gathering of clinical trial data or for reporting treatment related activities.
- **Workflow:** objects are exchanged with an Oncology Information System (OIS) in order to facilitate scheduling and billing operations.

The service and objects implemented to support the above uses are shown in Table 1.

**Table 1** Network Services

Networking SOP Classes	User of Service (SCU)	Provider of Service (SCP)
<b>Object Storage</b>		
Verification SOP Class	Yes	Yes
CT Image Storage	Yes	Yes
MR Image Storage	Yes	Yes
X-Ray Angiographic Image Storage	Yes	Yes
Positron Emission Tomography Image Storage	Yes	Yes
RT Dose Storage	Yes	Yes
RT Structure Set Storage	Yes	Yes
Spatial Registration Storage	No	Yes
RT Plan Storage	Yes	Yes
RT Beams Treatment Record Storage	Yes	No
RT Treatment Summary Record Storage	No	Yes
RT Beams Delivery Instruction Storage (Supplement 74 Frozen Draft SOP Class UID)	No	Yes
Raw Data Storage	Yes	No
Philips Private CX Image Storage	No	Yes



Networking SOP Classes	User of Service (SCU)	Provider of Service (SCP)
<b>Object Storage</b>		
Workflow Management		
Unified Procedure Step – Pull (Supplement 96 Frozen Draft SOP Class UID)	Yes	—
Study Root Query/Retrieve Information Model – MOVE	Yes	—



## 1.0 Overview

The Products currently support CT, MR, PET, 3DRA image studies with up to 4 patient positions: HFS (head-first supine), FFS (feet-first supine), HFP (head-first prone), and FFP (feet-first prone).

DICOM RT Structure Set is the RT object that can be imported from verified external nodes into the Precision System application.

DICOM CT Image, RT Structure Set, RT Dose, RT Plan are currently the objects that can be exported from the iDMS and Precision Systems. Exportable DICOM RT Dose information includes a multi-frame volume dose grid, dose volume histograms (DVH), and isodose curves.

The Products are ATC Compliant [4].

The Products export DICOM part 10 files.

The Products do not support those images that have two Image Header (0028,xxxx) for two Pixel Data (7FE0,0010), i.e. two instances of the Image Pixel Module, within one slice image file.

The iDMS and Precision Systems support 3D X-Ray rotational angiography (3DRA) in axial and coronal slices of XA modality, whose volumes are routinely generated from rotational angiography sequences - currently for Philips and Siemens machines which are capable of performing high speed rotational acquisition that enables 3D reconstruction. The iDMS System does not support 2D X-Ray angiographic projection image.

The DICOM application entity for the iDMS System supports the following AEs.

**Table 2** The DICOM Application Entity for the iDMS System.

iDMS System Version	Application Entity
iDMS System 1.1.1 and later	CDMS_STORAGE/ CDMS_SEND/ CDMS_QR/ CDMS_UPS

The iDMS System employs DICOM infrastructure based on the MergeCOM-3™ Advanced Integrator's Toolkit [7] by Merge Healthcare™. This DICOM interface is continuously implementing support for most recent updates to DICOM standards, which in turn enables the iDMS System to offer extensive DICOM capability including

- the newly added DICOM transfer syntaxes referenced below with their UIDs:
  - Implicit VR Little Endian (1.2.840.10008.1.2)
  - Explicit VR Little Endian (1.2.840.10008.1.2.1)
  - Explicit VR Big Endian (1.2.840.10008.1.2.2)
  - JPEG Lossless coding Process 14 (1.2.840.10008.1.2.4.70)
- The DICOM Files are stored in Part 10 format
- Multi-threaded DICOM Server
- DICOM Interface utilizing RT Plan, RT Beams Treatment Record, RT Beams Delivery Instruction[8], and Unified Procedure Step[9] objects.



The Standardized Uptake Value (SUV) of PET imaging for [F-18]fluorodeoxyglucose (FDG) studies that is commonly used to differentiate malignant from benign tumors and to assess the efficacy of therapy. The Precision System supports PET SUV calculation based on the standard DICOM attributes, such as SIEMENS Biograph or CPS/ECAT systems, and the private DICOM attributes, such as GE Advance and Discovery family systems and PHILIPS Allegro™ and Gemini™ systems.

An Oncology Information System (OIS) provides workflow solutions for radiation therapy and radiosurgery treatment delivery. The iDMS System utilizes the industry-standard DICOM protocol to (1) export patient treatment plan to an OIS for charting and scheduling, (2) query the OIS for scheduled treatment sessions and (3) export treatment results following delivery.

The Dynamic Contrast Enhanced MR imaging (DCE MRI) is a well-established method for detecting and quantifying tumor angiogenesis. The Precision System supports DCE MR images and the Pharmacokinetics data created by the iCAD MR Analysis System (SpectraLook, VividLook and OmniLook™) based on the standard and private DICOM attributes from iCAD system.

There are well-known Quality Assurance (QA) tools offered to compare a scanned film with a 2D planar dose created from the treatment plan. The Precision System supports 2D planar dose export in the DICOM RT Dose for axial, coronal and sagittal planes.

## 2.0 Introduction

### 2.1 Audience

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM Standards and with the terminology and concepts that are used in those Standards.

If readers are unfamiliar with DICOM terminology they should read the DICOM Standard before reading this Conformance Statement document.

### 2.2 Remarks

The use of this DICOM Conformance Statement, in conjunction with the DICOM 3.0 Standard, is intended to facilitate communication with the Products. However, by itself, it is not sufficient to ensure that inter-operation will be successful. The user (or user's agent) needs to proceed with caution and address at least four issues:

- **Integration:** The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM 3.0), and of this DICOM Conformance Statement when interoperability with non-Accuray equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates Accuray equipment with non-Accuray Systems is the user's responsibility and should not be underestimated. The user is strongly advised to ensure that such an integration analysis is correctly performed.
- **Validation:** Testing the complete range of possible interactions between the Accuray Treatment System and non-Accuray devices, before the connection is declared operational, should not be overlooked. Therefore, the user should ensure that any non-Accuray provider accepts full responsibility for all validation required for their connection with the Accuray Treatment System. This includes the accuracy of the image and treatment data once it has crossed the interface between the iDMS System and the non-Accuray device and the stability of the image for the intended applications.



Such a validation is required before any clinical use (treatment planning and/or delivery) is performed. It applies when images or dose information acquired on non-Accuray equipment are processed/displayed on iDMS or Precision System workstations, and when images and plan information are exported from the iDMS System to a non-Accuray device.

- **Future Evolution:** Accuray understands that the DICOM Standard will evolve to meet the user's growing requirements. Accuray is actively involved in the development of the DICOM 3.0 Standard. DICOM 3.0 will incorporate new features and technologies and Accuray may follow the evolution of the Standard. Evolution of the Standard may require changes to Accuray systems. In addition, Accuray reserves the right to discontinue or make changes to the support of communications features (on its products) reflected by this DICOM Conformance Statement. The user should ensure that any non-Accuray provider, which connects with the Accuray Systems, also plans for the future evolution of the DICOM Standard. Failures to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and the Accuray Systems are enhanced to support these changes.
- **Interaction:** It is the sole responsibility of the non-Accuray provider to ensure that communication with the interfaced equipment does not cause degradation of Accuray System performance and/or function.

## 2.3 Acronyms/Terminology

Acronym	Definition
3DRA	3 Dimensional X-Ray Rotational Angiography
AE	Application Entity
ANAP	Attribute Not Always Present
ATC	Advanced Technology Consortium
CKS	CyberKnife System
CT	Computerized Tomography
DCE MRI	Dynamic Contrast Enhanced Magnetic Resonance Imaging
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message
DVH	Dose-Volume Histogram
EVF	Extra-cellular Volume Fraction based on Pharmacokinetics analysis of DCE MRI
iDMS	Data management system that stores data for CyberKnife, Radixact, TomoTherapy, and Precision Systems
IOD	Information Object Definition
IRI	Image Review and Import
ITC	Image-Guided Therapy Center
Ktrans	same as PERM: permeability surface area product per unit volume of tissue
NEMA	National Electrical Manufacturers Association



Acronym	Definition
MIR	Mallinckrodt Institute of Radiology
MIRIT	Medical Image Review and Import Tool
MRI	Magnetic Resonance Imaging
OIS	Oncology Information System
PET	Positron Emission Tomography
PDU	Protocol Data Unit
PERM	vascular Permeability based on Pharmacokinetics analysis of DCE MRI
QR	Query and Retrieve
ROI	Region of Interest
RSNA	Radiological Society of North America
RT	Radiation Therapy
RTDOSE	Radiation Therapy Dose
RTOG	Radiation Therapy Oncology Group
RTPLAN	Radiation Therapy Plan
RTSS	Radiation Therapy Structure Set
SCP	Service Class Provider (receiver)
SCU	Service Class User (sender)
SOP	Service Object Pair
SQL	Structured Query Language
SUV	Standardized Uptake Values
TCP/IP	Transmission Control Protocol/Internet Protocol
TDC	Treatment Delivery Console
TMS	Treatment Management System
TPS	Treatment Planning System
UID	Unique Identification
UPS	Unified Procedure Step
Ve	same as EVF: volume of extravascular extracellular space per unit volume of tissue
VOI	Volume of Interest
VNAP	Value Not Always Present
XA	X-ray Angiography



## 2.4 References

- [1] Digital Imaging and Communications in Medicine Standard v3.0, National Electrical Manufacturers Association, 2014.
- [2] Stephen M. Moore, Conformance Statements for MIR CTN Applications, v2.11.0, Electronic Radiology Laboratory, Mallinckrodt Institute of Radiology, January 7, 2000. ([http://wuerlim.wustl.edu/DICOM/ctn-docs/doc\\_index.html](http://wuerlim.wustl.edu/DICOM/ctn-docs/doc_index.html))
- [3] ATC File Set Reader DICOM Conformance Statement v. 2.3. ([http://itc.wustl.edu/dicom/Conf\\_Stmts.htm](http://itc.wustl.edu/dicom/Conf_Stmts.htm))
- [4] [ATC Digital Data Submission Procedure](http://atc.wustl.edu/credentialing/data_submit/digital_submit_040818.htm) ([http://atc.wustl.edu/credentialing/data\\_submit/digital\\_submit\\_040818.htm](http://atc.wustl.edu/credentialing/data_submit/digital_submit_040818.htm))
- [5] ITC DICOMpiler Software (<http://itc.wustl.edu/DICOMpiler/index.htm>)
- [6] ATC Compliant Treatment Planning Systems Per Modality ([http://atc.wustl.edu/credentialing/atc\\_compliant\\_tps.html](http://atc.wustl.edu/credentialing/atc_compliant_tps.html))
- [7] MergeCOM-3 DICOM toolkit (<http://www.mergecom3.com/index.htm>)
- [8] Digital Imaging and Communications in Medicine, Supplement 74: Utilization of Worklist in Radiotherapy Treatment Delivery, Frozen Draft for Trial Implementation, 2007/10/08. ([ftp://medical.nema.org/medical/dicom/supps/sup74\\_fz2.pdf](ftp://medical.nema.org/medical/dicom/supps/sup74_fz2.pdf))
- [9] Digital Imaging and Communications in Medicine, Supplement 96: Unified Worklist and Procedure Step, Frozen Draft for Trial Use, 2007/10/08. ([ftp://medical.nema.org/medical/dicom/supps/sup96\\_fz2.pdf](ftp://medical.nema.org/medical/dicom/supps/sup96_fz2.pdf))
- [10] IHE-RO Treatment Delivery Workflow (TDW) Technical Framework V1.1

## 3.0 Implementation Model

The iDMS System uses the MergeCOM-3™ Advanced Integrator's Toolkit for creation of DICOM Storage Service Class server. The storage service classes, CDMS\_STORAGE Application Entity and CDMS\_SEND Application Entity, will act respectively in the role of an SCP and an SCU, and facilitates the transfer of a DICOM file between a remote workstation and the Precision System via a network.

### 3.1 Application Data Flow Diagram

The CDMS\_STORAGE server application stores received DICOM files onto the iDMS System. These files are moved into the iDMS System database following arrival.

The DICOM files may then be reviewed and imported into a patient record using the iDMS System IRI application.

The CDMS\_SEND application pushes the DICOM files to the remote AEs, acting as a DICOM Storage as SCP. The DICOM files can be exported from the iDMS System Data Server.

The CDMS\_SEND is initiated by the user of the Precision System after exporting DICOM image and RT files. The user can initiate CDMS\_SEND for both DICOM image and RT series from an iDMS System IRI application, Plan Administration or DICOM Administration.

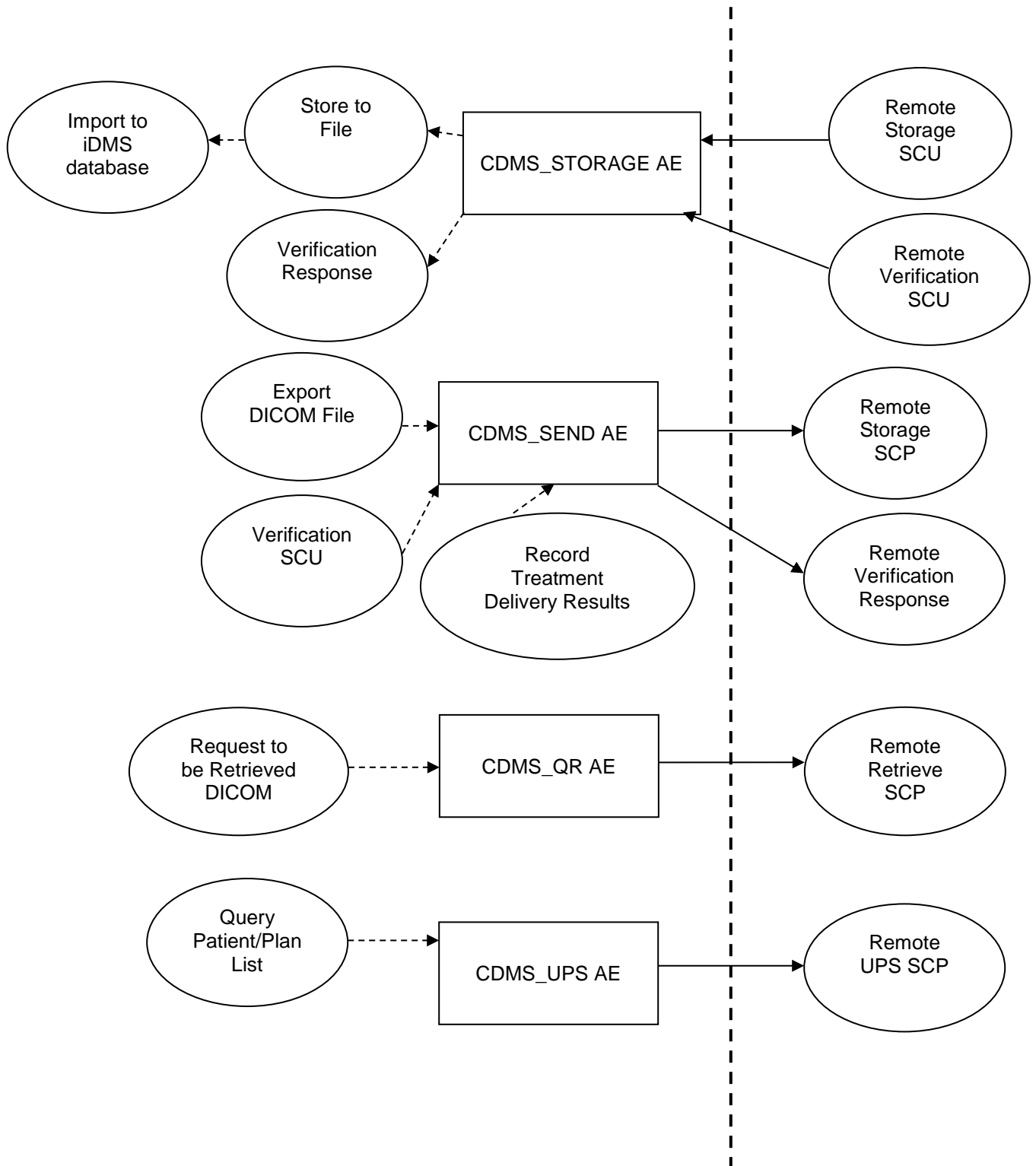


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The CDMS\_QR is used to query a remote DICOM SCP for plans available for delivery and is initiated following a request by the Accuray System.

The CDMS\_UPS is used to communicate the delivery intent to a remote Treatment Management System, and is initiated at the start of a treatment session.





**Figure 1** Application Data Flow Diagram for the iDMS System.



## 3.2 Functional Definitions of Application Entity

The CDMS\_STORAGE application entity is a server application waits until it receives a C-STORE request from a remote SCU. Upon receipt, it saves the received data to a DICOM hierarchical directory with a unique file name and then inserts the header information into the database. The server handles multiple associations simultaneously.

CDMS\_STORAGE application entity is a service, started right after booting the iDMS System workstation, which run continuously.

The CDMS\_SEND application entity invokes a C-STORE DIMSE service with a SOP instance. After this occurs, an association will be established with the AE identified by the user. Information objects will be transferred one at a time until all have been transferred.

CDMS\_SEND and CDMS\_STORAGE application entities serve in the SCU role and the SCP role respectively for SOP classes of the Storage Service Class.

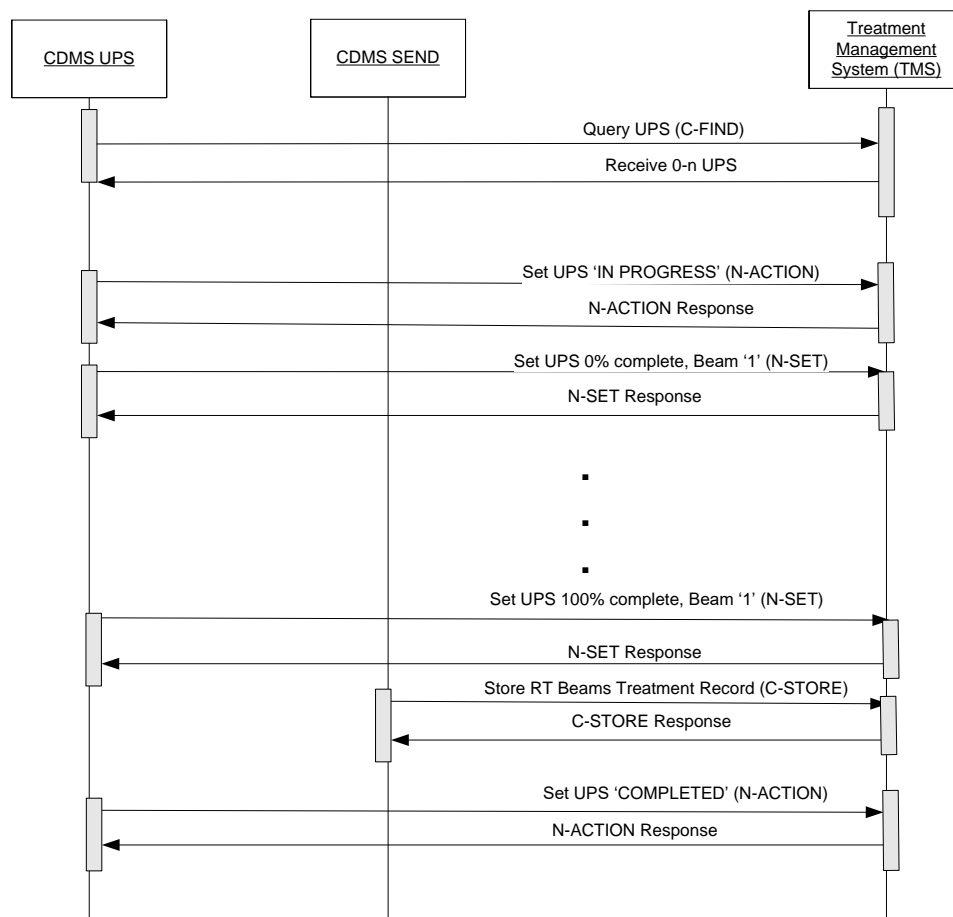
CDMS\_QR application entity serves in the SCU role for the SOP class of the Query and Retrieve Service Class.

CDMS\_UPS application entity serves in the SCU role for the SOP class of the Unified Procedure Step Service Class.

## 3.3 Sequencing of Real-World Activities

The iDMS System has no way of knowing when it has a complete study or what constitutes a complete study. Users should be aware of how many DICOM image files constitute a complete image study before importing into the iDMS System database.

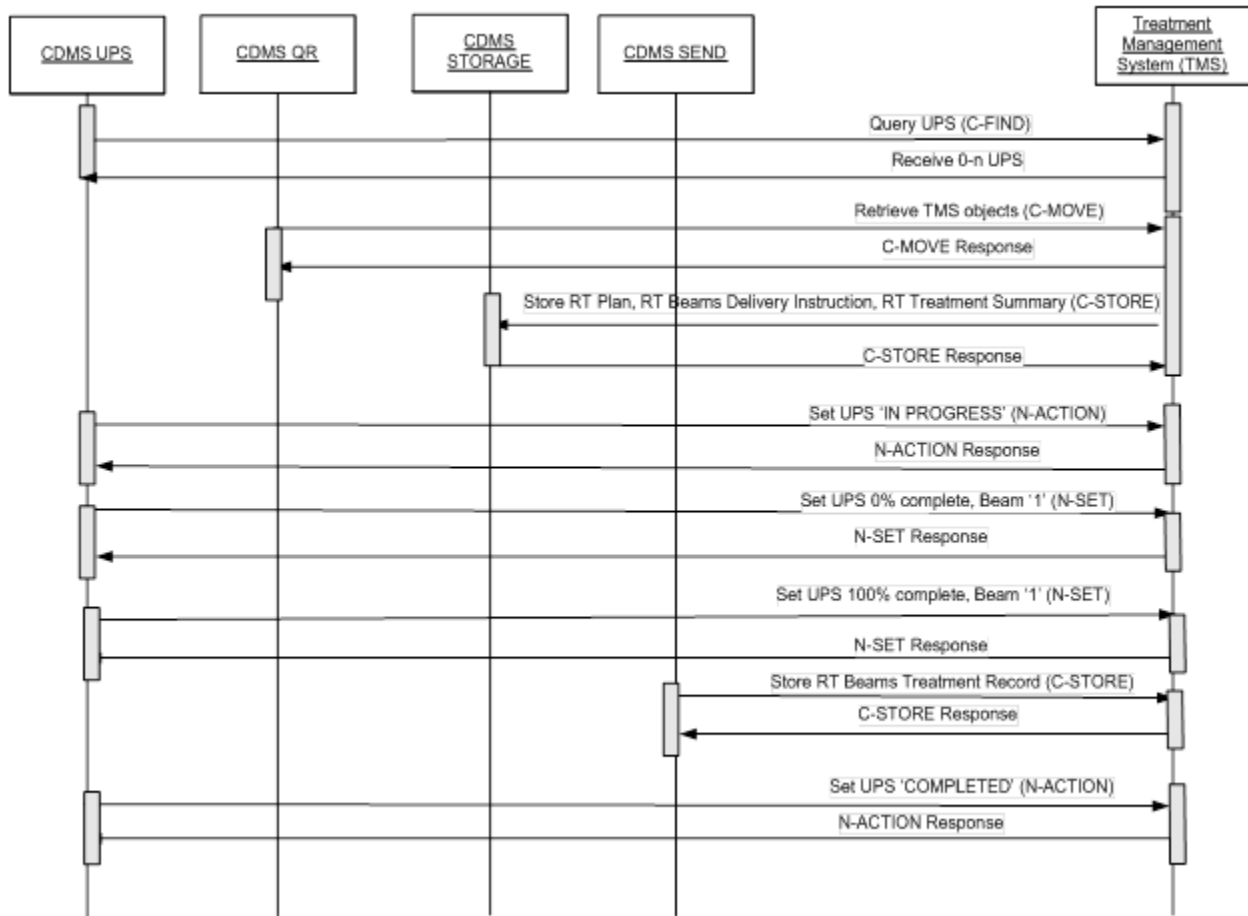
The CDMS\_UPS/CDMS\_SEND application entities perform a sequence of the treatment delivery normal activities as follows when communicating with the Aria Oncology Information System:



**Figure 2** Sequence Diagram CDMS\_UPS/CDMS\_SEND for the iDMS System and ARIA's OIS



The CDMS\_UPS/CDMS\_QR/CDMS\_STORAGE/CDMS\_SEND application entities perform a sequence of the treatment delivery normal activities as follows when communicating with the MOSAIQ Oncology Information System:



**Figure 3** Sequence Diagram CDMS\_UPS/CDMS\_QR/CDMS\_STORAGE/CDMS\_SEND for the iDMS System and MOSAIQ OIS

## 4.0 AE Specifications

### 4.1 Supported Storage Service Object Pair (SOP) Classes by iDMS System as an SCP

**Table 10** Storage SOP Classes Supported by iDMS System as an SCP

SOP Class Name	SOP Class UID
Verification SOP Class	1.2.840.10008.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
MR Image Storage	1.2.840.10008.5.1.4.1.1.4



SOP Class Name	SOP Class UID
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3
Philips Private CX Image Storage	1.3.46.670589.2.4.1.1
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5
RT Beams Delivery Instruction Storage	1.2.840.10008.5.1.4.34.1
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7

#### 4.1.1 Association Establishment Policies

##### 4.1.1.1 General

The default maximum PDU size which can be received by the CDMS\_STORAGE server is configurable with a default value of 64KB and a minimum value of 4KB.

For configuration information, see the Configuration Section 21.0.

##### 4.1.1.2 Number of Associations

The number of simultaneous associations which will be accepted by the CDMS\_STORAGE server is limited only by the kernel parameters of the underlying TCP/IP implementation. The CDMS\_STORAGE server will spawn a new process/thread for each association request that it receives. Therefore, the CDMS\_STORAGE server can have multiple simultaneous connections, and there is no inherent limitation on the total number of simultaneous associations which the CDMS\_STORAGE server can maintain.

##### 4.1.1.3 Asynchronous Nature

Not supported.

##### 4.1.1.4 Implementation Identifying Information

Not applicable.

#### 4.1.2 Association Initiation Policy

The CDMS\_STORAGE AE does not initiate associations.

#### 4.1.3 Association Acceptance Policy

When the CDMS\_STORAGE accepts an association, it will receive supported image SOP Instances and store them in the iDMS System database. The CDMS\_STORAGE does not limit who may connect to it.

When Verification SCP accepts an association it responds with a success status.



#### 4.1.3.1 Associated Real-World Activity – Store Request from an External Node

The associated Real-World activity associated with the C-STORE operation is the storage of the image on the disk of the system upon which the CDMS\_STORAGE server is running. Images are stored by routing them through the iDMS System for storage to disk.

The CDMS\_STORAGE server application responds to remote C-ECHO requests.

through the iDMS System for storage.

#### 4.1.3.2 Presentation Context Table

Any of the Presentation Contexts shown in Table 11 is acceptable to the iDMS System for receiving and importing information objects.

**Table 11** Presentation Contexts for the iDMS System

Presentation Contexts Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		JPEG Lossless coding Process 14	1.2.840.10008.1.2.4.70		
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None



Presentation Contexts Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP Name	UID	Name	UID		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		JPEG Lossless coding Process 14	1.2.840.10008.1.2.4.70		
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		JPEG Lossless coding Process 14	1.2.840.10008.1.2.4.70		
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None



Presentation Contexts Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP Name	UID	Name	UID		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Philips Private CX Image Storage	1.3.46.670589.2.4.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		JPEG Lossless coding Process 14	1.2.840.10008.1.2.4.70		
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		JPEG Lossless coding Process 14	1.2.840.10008.1.2.4.70		
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None





Presentation Contexts Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP Name	UID	Name	UID		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
RT Beams Delivery Instruction Storage	1.2.840.10008.5.1.4.34.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Little Endian	1.2.840.10008.1.2.2		
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Little Endian	1.2.840.10008.1.2.2		

#### 4.1.3.2.1 Presentation Context Acceptance Criterion

The CTN\_STORAGE/CTN\_ARCHIVE server will accept any number of storage SOP classes that are listed in Table 2 above, provided that the requesting application is known to the CTN\_ARCHIVE server and has been enabled to store images on the iDMS System (via a configuration step). The



CTN\_STORAGE/CTN\_ARCHIVE/CDMS\_STORAGE server doesn't define a limit on the number of presentation contexts accepted. In the event that the CTN\_STORAGE/CTN\_ARCHIVE/CDMS\_STORAGE server runs out of resources when trying to accept multiple presentation contexts, it will reject the association request.

The CTN\_STORAGE/CTN\_ARCHIVE server does not check for duplicate presentation contexts and will accept duplicate presentation contexts.

#### 4.1.3.2.2 Transfer Syntax Selection Policies

Note: DICOM Part 10 format is recommended to use one of the DICOM Transfer Syntaxes support explicit Value Representation encoding to facilitate interpretation of File Meta Element Values (See PS 3.5 of the DICOM Standard), such as Explicit VR Little Endian Transfer Syntax (UID=1.2.840.10008.1.2.1).

The CDMS\_STORAGE server supports the following transfer syntaxes.

- Implicit VR Little Endian,
- Explicit VR Little Endian,
- Explicit VR Big Endian, and
- JPEG Lossless coding Process 14.

Any proposed presentation context are listed in above will be accepted with the listed transfer syntax sequence in order. Any proposed presentation context that is not listed in Table 2 above will be rejected.

#### 4.1.4 SOP Specific Conformance

##### 4.1.4.1 SOP Specific Conformance to Verification SOP Class

The CDMS\_STORAGE provides standard conformance to the DICOM Verification Service Class.

##### 4.1.4.2 SOP Specific Conformance to Storage SOP Class

The table shown below lists the Modules that are received and imported by the Precision System cache database and the iDMS System database. Unlisted Modules are not used by the iDMS System. References in the right column are to the DICOM standard, Part 3 (Information Object Definitions).

Module Name	Reference
Patient	C.7.1.1
General Study	C.7.2.1
General Series	C.7.3.1
Frame of Reference	C.7.4.1
General Equipment	C.7.5.1
General Image	C.7.6.1
Image Plane	C.7.6.2
Image Pixel	C.7.6.3
Multi-Frame	C.7.6.6



Module Name	Reference
VOI LUT	C.11.2
SOP Common	C.12.1
CT Image	C.8.2.1
MR Image	C.8.3.1
XA Image	C.8.7.1
PET Image	C.8.9.4
Patient Study	C.7.2.2
PET Series	C.8.9.1
PET Isotope	C.8.9.2

The CDMS\_STORAGE implements Level 2 (Full) conformance for the Storage SOP Class, but the iDMS System only uses a subset of the attributes as described in the Notes column.

#### 4.1.4.2.1 Patient Module

Attribute Name	Tag	Type	VR	Notes
Patient Name	(0010,0010)	2	PN	Displayed to the user. User can modify the first time an image study for a given patient is imported to the iDMS System database.
Patient ID	(0010,0020)	2	LO	Only the "a-z", "A-Z", "0-9", "-", and "_" text are acceptable in the value of this attribute. Displayed to the user. This attribute is the key identifier in the iDMS System database.
Patient Birth Date	(0010,0030)	2	DA	Used to determine patient age.
Patient Birth Time	(0010,0032)	3	TM	Not used.
Patient Sex	(0010,0040)	2	CS	Sex of the named patient. Used in PET SUV calculation.

#### 4.1.4.2.2 General Study Module

Attribute Name	Tag	Type	VR	Notes
Study Instance UID	(0020,000D)	1	UI	Displayed to the user. Used to associate multiple images into a



Attribute Name	Tag	Type	VR	Notes
				single case in the central database.
Study Date	(0008,0020)	2	DA	Not used.
Study Time	(0008,0030)	2	TM	Not used.
Referring Physician Name	(0008,0090)	2	PN	Displayed to the user. Can be modified by the user when image is imported to the iDMS System database.
Study ID	(0020,0010)	2	SH	Not used.
Accession Number	(0008,0050)	2	SH	Not used.
Study Description	(0008,1030)	3	LO	Not used.

#### 4.1.4.2.3 General Series Module

Attribute Name	Tag	Type	VR	Notes
Modality	(0008,0060)	1	CS	Determine special processing required for interpretation of the image data. The iDMS System supports 'CT', 'MR', 'PT', 'XA' and 'RTSTRUCT'.
Series Instance UID	(0020,000E)	1	UI	Displayed in Administrative Applications.
Series Description	(0008,103E)	3	LO	Used to initialize the CyberKnife respiration phase for GE and SIEMENS 4D CT scanners with the below conversion protocol. The conversion of GE : Accuray T=0% (full Inhale): 50% T=10% : 60% T=20% : 70% T=30% : 80% T=40% : 90% T=50% (full Exhale): 0% T=60% : 10% T=70% : 20% T=80% : 30% T=90% : 40%



Attribute Name	Tag	Type	VR	Notes
				T=100%(full Inhale) : 50% The conversion of SIEMENS: Accuray 0% Exhale (=0% Inhale): 0% 20% Inhale: 10% 40% Inhale: 20% 60% Inhale: 30% 80% Inhale: 40% 100% Inhale (=100% Exhale): 50% 80% Exhale: 60% 60% Exhale: 70% 40% Exhale: 80% 20% Exhale: 90%  Validated 4D CT scanners include: GE MEDICAL SYSTEMS, Discovery ST SIEMENS, Sensation Open
Series Number	(0020,0011)	2	IS	Not used.
Patient Position	(0018,5100)	2C	CS	The orientation of the scan. iDMS and Precision Systems support HFS, HFP, FFP and FFS
Series Date	(0008,0021)	3	DA	Date the Series started.
Series Time	(0008,0031)	3	TM	Time the Series started.

#### 4.1.4.2.4 Frame of Reference Module

Attribute Name	Tag	Type	VR	Notes
Frame of Reference UID	(0020,0052)	1	UI	For CT and MR data, this attribute must be the same for every image in the series.
Position Reference Indicator	(0020, 1040)	2	LO	Not used.

**4.1.4.2.5 General Equipment Module**

Attribute Name	Tag	Type	VR	Notes
Manufacturer	(0008,0070)	2	LO	Required for scanner validation in the iDMS System.
Manufacturer Model Name	(0008,1090)	3	LO	Used for scanner validation.
Pixel Padding Value	(0028,0120)	3	SS	Not used.

**4.1.4.2.6 General Image Module**

Attribute Name	Tag	Type	VR	Notes
Instance Number	(0020,0013)	2	IS	Not used.
Acquisition Date	(0008 0022)	3	DT	Used in PET SUV calculation The date the acquisition of data that resulted in this image started.
Acquisition Time	(0008 0032)	3	TM	Used in PET SUV calculation The time the acquisition of data that resulted in this image started.

**4.1.4.2.7 Image Plane Module**

Attribute Name	Tag	Type	VR	Notes
Pixel Spacing	(0028,0030)	1	DS	Physical distance in the patient between the centers of each pixel.
Image Orientation (Patient)	(0020,0037)	1	DS	The iDMS System uses this information to reorient image buffer in different patient position (0018, 5100). The Precision System uses this information to define the patient coordinate system.
Image Position (Patient)	(0020,0032)	1	DS	The iDMS System uses the value of the X and Y coordinates to recalculate the ROI coordinates of RT Structure Sets. The iDMS System uses the value of the Z coordinate to determine "slice thickness" and "slice number".



Attribute Name	Tag	Type	VR	Notes
				The Precision System uses this info to define the patient coordinate system.
Slice Thickness	(0018,0050)	2	DS	The iDMS System uses to identify “variable slice thickness” errors. Default 10% tolerance can be modified.
Slice Location	(0020,1041)	3	DS	Not used.

#### 4.1.4.2.8 Image Pixel Module

Attribute Name	Tag	Type	VR	Notes
Samples per Pixel	(0028,0002)	1	US	Must be 1.
Photometric Interpretation	(0028,0004)	1	CS	Must be ‘MONOCHROME1’ or ‘MONOCHROME2’
Rows	(0028,0010)	1	US	Number of rows in the image
Columns	(0028,0011)	1	US	Number of columns image
Bits Allocated	(0028,0100)	1	US	Number of bits allocated for each pixel sample.
Bits Stored	(0028,0101)	1	US	Number of bits stored for each pixel sample.
High Bit	(0028,0102)	1	US	Most significant bit for each pixel sample.
Pixel Representation	(0028,0103)	1	US	Data representation of the pixel samples. The iDMS System supports both unsigned integer and 2’s complement.
Pixel Data	(7FE0,0010)	1	OW	Pixel Data.
Pixel Aspect Ratio	(0028,0034)	1C	IS	Not used.

#### 4.1.4.2.9 Multi-Frame

Attribute Name	Tag	Type	VR	Notes
Number of Frames	(0028,0008)	1	IS	The number of slices in the dose volume, i.e. 3D dose grid.
Frame Increment Pointer	(0028,0009)	1	AT	

**4.1.4.2.10 VOI LUT Module**

Attribute Name	Tag	Type	VR	Notes
Window Center	(0028,1050)	3	UI	Used for default window level in the Precision System.
Window Width	(0028,1051)	1C	UI	Used for default window level in the Precision System.

**4.1.4.2.11 SOP Common Module**

Attribute Name	Tag	Type	VR	Notes
SOP Class UID	(0008,0016)	1	UI	Used for consistency checks.
SOP Instance UID	(0008,0018)	1	UI	Used for consistency checks.

**4.1.4.2.12 CT Image Module**

Attribute Name	Tag	Type	VR	Notes
Image Type	(0008,0008)	1	CS	Value = 'ORIGINAL/PRIMARY/AXIAL', 'ORIGINAL/PRIMARY/LOCALIZER', 'DERIVED/SECONDARY'
Samples per Pixel	(0028,0002)	1	US	Value = 1
Photometric Interpretation	(0028,0004)	1	CS	'MONOCHROME1' or 'MONOCHROME2'
Bits Allocated	(0028,0100)	1	US	Value = 16
Bits Stored	(0028,0101)	1	US	Value = 12 to 16
High Bit	(0028,0102)	1	US	Value = 11 to 15
Rescale Intercept	(0028,1052)	1	DS	The value b in relationship between stored value (SV) and Hounsfield (HU). $HU = m * SV + b$
Rescale Slope	(0028,1053)	1	DS	m in the equation specified in Rescale Intercept (0028,1052).
Gantry/Detector Tilt	(0018,1120)	3	DS	If present, Value must be equal to 0. Otherwise, the iDMS System does not allow import to the central database.



**4.1.4.2.13 MR Image Module**

Attribute Name	Tag	Type	VR	Notes
Image Type	(0008,0008)	1	CS	'ORIGINAL/PRIMARY/OTHER' or 'DERIVED/SECONDARY' or 'T1-MAP'  'T1 MAP' indicates T1-weighted MR image and will be used by the Precision System to identify T1-weighted MR datasets.
Samples per Pixel	(0028,0002)	1	US	Value = 1
Photometric Interpretation	(0028,0004)	1	CS	'MONOCHROME1' or 'MONOCHROME2'
Bits Allocated	(0028,0100)	1	US	Value = 16

**4.1.4.2.14 XA Image Module**

Attribute Name	Tag	Type	VR	Notes
Image Type	(0008,0008)	1	CS	'DERIVED/SECONDARY'
Samples per Pixel	(0028,0002)	1	US	Value = 1
Photometric Interpretation	(0028,0004)	1	CS	'MONOCHROME2'
Bits Allocated	(0028,0100)	1	US	Value = 16

**4.1.4.2.15 PET Image Module**

Attribute Name	Tag	Type	VR	Notes
Image Type	(0008,0008)	1	CS	'ORIGINAL/PRIMARY' or 'DERIVED/SECONDARY'
Samples per Pixel	(0028,0002)	1	US	Value = 1
Photometric Interpretation	(0028,0004)	1	CS	Value = 'MONOCHROME2'
Bits Allocated	(0028,0100)	1	US	Value = 16
Bits Stored	(0028,0101)	1	US	Value = 16
High Bit	(0028,0102)	1	US	Value = 15
Rescale Intercept	(0028,1052)	1	DS	Value = 0
Rescale Slope	(0028,1053)	1	DS	m in the equation specified in Rescale Intercept (0028,1052). Used to scale data to display value.

**4.1.4.2.16 Patient Study Module**

Attribute Name	Tag	Type	VR	Notes
Patient Age	(0010,1010)	3	AS	Not used.
Patient Size	(0010,1020)	3	DS	Used in the computation of SUV.
Patient Weight	(0010,1030)	3	DS	Used in the computation of SUV.

**4.1.4.2.17 PET Series Module**

Attribute Name	Tag	Type	VR	Notes
Series Date	(0008,0021)	1	DA	
Series Time	(0008,0031)	1	TM	
Units	(0054,1001)	1	CS	Pixel value units. Value = CNTS, BQML, PROPCPS, CPS, PROPCNTS, GML
SUV Type	(0054,1006)	3	CS	Not used.
Counts Source	(0054,1002)	1	CS	Value = EMISSION, TRANSMISSION
Series Type	(0054,1000)	1	CS	Not used
Reprojection Method	(0054,1004)	2C	CS	Not used.
Number of R-R Intervals	(0054,0061)	1C	US	Not used.
Number of Time Slots	(0054,0071)	1C	US	Not used.
Number of Time Slices	(0054,0101)	1C	US	Not used
Number of Slices	(0054,0081)	1	US	Not used
Corrected Image	(0028,0051)	2	CS	Used in the computation of SUV. Value = DECY, ATTN, SCAT, DTIM, MOTN, PMOT, CLN, RAN, RADL, DCAL, NORM
Decay Correction	(0054,1102)	1	CS	Not used.
Collimator Type	(0018,1181)	2	CS	Not used.

**4.1.4.2.18 PET Isotope Module**

Attribute Name	Tag	Type	VR	Notes
Radiopharmaceutical Information Sequence	(0054,0016)	2	SQ	Up to one entry in this sequence is used.
>Radionuclide Code Sequence	(0054,0300)	2	SQ	Not used.
>Radiopharmaceutical Route	(0018,1070)	3	LO	Not used.
>Administration Route Code Sequence	(0054,0302)	3	SQ	Not used.
>Radiopharmaceutical Volume	(0018,1071)	3	DS	Not used.
>Radiopharmaceutical Start Time	(0018,1072)	3	TM	Used in the computation of SUV. If both (0018,1072) and (0018,1078) are present, (0018,1078) is preferred.
>Radiopharmaceutical Start DateTime	(0018,1078)	3	DT	Used in the computation of SUV. Preferred to (0018,1072).
>Radiopharmaceutical Stop Time	(0018,1073)	3	TM	Not used.
>Radiopharmaceutical Stop DateTime	(0018,1079)	3	DT	Not used.
>Radionuclide Total Dose	(0018,1074)	3	DS	Used in the computation of SUV.
>Radionuclide Half Life	(0018,1075)	3	DS	Used in the computation of SUV.
>Radionuclide Positron Fraction	(0018,1076)	3	DS	Not used.
>Radiopharmaceutical Specific Activity	(0018,1077)	3	DS	Not used.
>Radiopharmaceutical	(0018,0031)	3	LO	Not used.
>Radiopharmaceutical Code Sequence	(0054,0304)	3	SQ	Not used.



#### 4.1.4.3 SOP Specific Conformance to RT Structure Set Storage SCP

CDMS\_STORAGE implements Level 2 (Full) conformance for the Storage SOP Class, but the iDMS System only uses a subset of the attributes described in Section 5.0.

#### 4.1.4.4 SOP Specific Conformance to RT Dose Storage SCP

CDMS\_STORAGE implements Level 2 (Full) conformance for the Storage SOP Class, but the iDMS System only uses a subset of the attributes described in Section 7.0.

#### 4.1.4.5 SOP Specific Conformance to RT Plan Storage SCP

CDMS\_STORAGE implements Level 2 (Full) conformance for the Storage SOP Class, but the iDMS System only uses a subset of the attributes described in Section 10.0.

#### 4.1.4.6 SOP Specific Conformance to RT Beam Delivery Instruction Storage SCP

CDMS\_STORAGE implements Level 2 (Full) conformance for the Storage SOP Class, but the iDMS System only uses a subset of the attributes described in Section 12.0.

#### 4.1.4.7 SOP Specific Conformance to RT Treatment Summary Storage SCP

CDMS\_STORAGE implements Level 2 (Full) conformance for the Storage SOP Class, but the iDMS System only uses a subset of the attributes described in Section 18.3.2.

## 4.2 Supported Storage, Unified Procedure Step, Query/Retrieve Service Object Pair (SOP) Classes by iDMS System as an SCU

**Table 12** Storage, Unified Procedure Step, Query/Retrieve SOP Classes Supported by iDMS System as an SCU

SOP Class Name	SOP Class UID
Verification SOP Class	1.2.840.10008.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4
Unified Procedure Step – PULL (Sup 96 Fz Draft)	1.2.840.10008.5.1.4.34.4.3



SOP Class Name	SOP Class UID
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66

## 4.2.1 Association Establishment Policies

### 4.2.1.1 General

In the iDMS System Data Server, CDMS\_SEND attempt to establish an association when the iDMS System's client applications make the DICOM SEND request.

The CDMS\_SEND will keep the association up until the selected information objects have been sent.

The maximum PDU size which can be transmitted by the CDMS\_SEND is fixed at 64KB

For configuration information, see Configuration Section 21.0.

### 4.2.1.2 Number of Associations

The iDMS System establishes only one simultaneous association at a time.

### 4.2.1.3 Asynchronous Nature

Not supported.

### 4.2.1.4 Implementation Identifying Information

The implementation Class UID uniquely defines system. This will be **1.2.840.114358.3.5.0.37**.

## 4.2.2 Association Initiation Policy

### 4.2.2.1 Associated Real-World Activity – Push Request to an External Node

The CDMS\_SEND application sends the C-ECHO requests to the remote AE.

The CDMS\_SEND application will automatically handle request for storage services and transfer them on sending C-STORE requests.

### 4.2.2.2 Associated Real-World Activity – Pull Request to an External Node

The CDMS\_UPS application will automatically handle requests for unified procedure step - PULL services and transfer them on sending the C\_FIND/N\_ACTION/N\_SET requests in the iDMS System's Data Server.

The CDMS\_QR sends C\_MOVE request to retrieve RT objects.

### 4.2.2.3 Presentation Context Table

Any of the Presentation Contexts shown in Table 13 are acceptable to the iDMS System for pushing, exporting, retrieving and updating information objects.

**Table 13** Presentation Contexts for the iDMS System

Presentation Contexts Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
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
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		JPEG Lossless coding Process 14	1.2.840.10008.1.2.4.70		
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		



Presentation Contexts Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP Name	UID	Name	UID		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		JPEG Lossless coding Process 14	1.2.840.10008.1.2.4.70		
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		JPEG Lossless coding Process 14	1.2.840.10008.1.2.4.70		
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		



Presentation Contexts Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP Name	UID	Name	UID		
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
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		JPEG Lossless coding Process 14	1.2.840.10008.1.2.4.70		
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		





Presentation Contexts Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP Name	UID	Name	UID		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Unified Procedure Step – PULL	1.2.840.10008.5.1.4.34.4.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		



Presentation Contexts Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
SOP 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
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

#### 4.2.2.4 SOP Specific Conformance to Verification SOP Class

The CDMS\_SEND provides standard conformance to the DICOM Verification Service Class.

#### 4.2.2.5 SOP Specific Conformance to Storage SOP Class

The table shown below lists the Modules that are sent and exported by the iDMS or Precision Systems. Unlisted Modules are not used by the iDMS System. References in the right column are to DICOM standard, Part 3 (Information Object Definitions).

Module Name	Reference
Patient	C.7.1.1
General Study	C.7.2.1
General Series	C.7.3.1
Frame of Reference	C.7.4.1



Module Name	Reference
General Equipment	C.7.5.1
General Image	C.7.6.1
Image Plane	C.7.6.2
Image Pixel	C.7.6.3
Multi-Frame	C.7.6.6
VOI LUT	C.11.2
SOP Common	C.12.1
CT Image	C.8.2.1
MR Image	C.8.3.1
PET Image	C.8.9.4
Patient Study	C.7.2.2
PET Series	C.8.9.1
PET Isotope	C.8.9.2

The CDMS\_SEND implements Level 2 (Full) conformance for the Storage SOP Class, but the iDMS System only uses a subset of the attributes as described in the Notes column.

#### 4.2.2.5.1 Patient Module

Attribute Name	Tag	Type	VR	Notes
Patient Name	(0010,0010)	2	PN	Reused from the associated primary CT Image set or from the secondary Image set for the mixed or fused image export.
Patient ID	(0010,0020)	2	LO	Reused from the associated primary CT Image set or from the secondary Image set for the mixed or fused image export.
Patient Birth Date	(0010,0030)	2	TM	Reused from the associated primary CT Image set or from the secondary Image set for the mixed or fused image export.
Patient Sex	(0010,0040)	2	CS	Reused from the associated primary CT Image set or from the secondary Image set for the mixed or fused image export.

**4.2.2.5.2 General Study Module**

Attribute Name	Tag	Type	VR	Notes
Study Instance UID	(0020,000D)	1	UI	Reused from the associated CT Image set except for mixed or fused image export where a new study UID is generated. For export of RT Beams Treatment Record, will be overridden by the Study Instance UID received from the OIS, if supplied.
Study Date	(0008,0020)	2	DA	Reused from the associated CT Image set. For mixed and fused images, the current date is used. May be empty for RT Beams Treatment Record export.
Study Time	(0008,0030)	2	TM	Reused from the associated CT Image set. For mixed and fused images, the current time is used. May be empty for RT Beams Treatment Record export.
Referring Physician Name	(0008,0090)	2	PN	Reused from the associated CT Image set for the DICOM RT export. May be empty for RT Beams Treatment Record export.
Study ID	(0020,0010)	2	SH	Reused from the associated primary CT Image set or from the secondary Image set for the mixed or fused image export.
Accession Number	(0008,0050)	2	IS	Empty.
Study Description	(0008,1030)	3	LO	User option.

**4.2.2.5.3 Frame of Reference Module**

Attribute Name	Tag	Type	VR	Notes
Frame of Reference UID	(0020,0052)	1	UI	Reused from the associated primary CT Image set except for mixed or fused image export where a new UID is generated.
Position Reference Indicator	(0020,1040)	2	LO	Reused from the associated primary CT Image set or from the secondary Image set for the mixed or fused image export.

**4.2.2.5.4 General Series Module**

Attribute Name	Tag	Type	VR	Notes
Modality	(0008,0060)	1	CS	'CT', 'MR', 'PT', 'XA', 'RTSTRUCT', 'RTDOSE' The Precision System uses the modality of the secondary Image set for the mixed and/or fused image export.
Series Instance UID	(0020,000E)	1	UI	Unique instance UID
Series Number	(0020,0011)	2	IS	Blank.
Patient Position	(0018,5100)	2C	CS	Reused from the associated primary CT Image set.
Series Date	(0008,0021)	3	DA	Date the Series started.
Series Time	(0008,0031)	3	TM	Time the Series started.

**4.2.2.5.5 General Equipment Module**

Attribute Name	Tag	Type	VR	Notes
Manufacturer	(0008,0070)	2	LO	Value='Accuray Inc.'
Manufacturer's Model	(0008,1090)	3	LO	Model of the treatment machine, if a machine is available. Blank otherwise.
Device Serial Number	(0018,1000)	3	LO	Serial number of the treatment machine, if a machine is available. Blank otherwise.
Software Versions	(0018,1020)	3	LO	Appropriate software identifier and version number
Pixel Padding Value	(0028,0120)	1C	US	Not present.

**4.2.2.5.6 General Image Module**

Attribute Name	Tag	Type	VR	Notes
Instance Number	(0020,0013)	2	IS	Reused from the associated primary CT Image set or from the secondary Image set for the mixed or fused image export.



Attribute Name	Tag	Type	VR	Notes
Acquisition Date	(0008,0022)	3	DT	Always present. Reused from source image if present. Otherwise, time of image generation. Reused from the secondary Image set for the mixed or fused image export.
Acquisition Time	(0008,0032)	3	TM	Always present. Reused from source image if present. Otherwise, time of image generation. Reused from the secondary Image set for the mixed or fused image export.
Source Image Sequence	(0008,2112)	3	SQ	Present for derived CT Images. Each slice in the derived image references all the slices in the source image.
>Referenced SOP Class UID	(0008,1150)	1	UI	CT Image Storage "1.2.840.10008.5.1.4.1.1.2"
>Referenced SOP Instance UID	(0008,1155)	1	UI	Referenced image SOP Instance UID

#### 4.2.2.5.7 Image Plane Module

Attribute Name	Tag	Type	VR	Notes
Pixel Spacing	(0028,0030)	1	DS	Reused from the associated primary CT Image set
Image Orientation (Patient)	(0020,0037)	1	DS	Reused from the associated primary CT Image set.
Image Position (Patient)	(0020,0032)	1	DS	Reused from the associated primary CT Image set.
Slice Thickness	(0018,0050)	2	DS	Reused from the associated primary CT Image set.
Slice Location	(0020,1041)	3	DS	Reused from the associated primary CT Image set.

#### 4.2.2.5.8 Image Pixel Module

Attribute Name	Tag	Type	VR	Notes
Samples per Pixel	(0028,0002)	1	US	Value = 1



Attribute Name	Tag	Type	VR	Notes
Photometric Interpretation	(0028,0004)	1	CS	Value = 'MONOCHROME2'
Rows	(0028,0010)	1	US	Number of rows in the image
Columns	(0028,0011)	1	US	Number of columns in the image
Bits Allocated	(0028,0100)	1	US	Value = 16
Bits Stored	(0028,0101)	1	US	Value = 16
High Bit	(0028,0102)	1	US	Value = 15
Pixel Representation	(0028,0103)	1	US	Value = 0
Pixel Data	(7FE0,0010)	1	OW	Pixel Data.
Pixel Aspect Ratio	(0028,0034)	1C	IS	Not used

#### 4.2.2.5.9 Multi-Frame

Attribute Name	Tag	Type	VR	Notes
Number of Frames	(0028,0008)	1	IS	The number of slices in the dose volume, i.e. 3D dose grid. Value=1 for 2D planar dose export.
Frame Increment Pointer	(0028,0009)	1	AT	Value = '3004000c' which referred to Grid Frame Offset Vector (3004, 000C)

#### 4.2.2.5.10 VOI LUT Module

Attribute Name	Tag	Type	VR	Notes
Window Center	(0028,1050)	3	UI	Reused from the associated primary CT Image set or from the secondary Image set for the mixed or fused image export.
Window Width	(0028,1051)	1C	UI	Reused from the associated primary CT Image set or from the secondary Image set for the mixed or fused image export.

**4.2.2.5.11 SOP Common Module**

Attribute Name	Tag	Type	VR	Notes
SOP Class UID	(0008,0016)	1	UI	RT Dose = "1.2.840.10008.5.1.4.1.1.481.2" RT Structure Set = "1.2.840.10008.5.1.4.1.1.481.3" CT Image = "1.2.840.10008.5.1.4.1.1.2" MR Image = "1.2.840.10008.5.1.4.1.1.4" Positron Emission Tomography = "1.2.840.10008.5.1.4.1.1.128" XA Image = "1.2.840.10008.5.1.4.1.1.12.1"
SOP Instance UID	(0008,0018)	1	UI	Unique instance UID

**4.2.2.5.12 CT Image Module**

Attribute Name	Tag	Type	VR	Notes
Image Type	(0008,0008)	1	CS	Value = 'DERIVED/SECONDARY'
Samples per Pixel	(0028,0002)	1	US	Value = 1
Photometric Interpretation	(0028,0004)	1	CS	'MONOCHROME2'
Bits Allocated	(0028,0100)	1	US	Value = 16
Bits Stored	(0028,0101)	1	US	Value = 16
High Bit	(0028,0102)	1	US	Value = 15
Rescale Intercept	(0028,1052)	1	DS	Value = -1024.0 The value b in relationship between stored value (SV) and Hounsfield (HU). $HU = m * SV + b$
Rescale Slope	(0028,1053)	1	DS	Value = 1.0 m in the equation specified in Rescale Intercept (0028,1052).
Gantry/Detector Tilt	(0018,1120)	3	DS	If present, Value is 0.

**4.2.2.5.13 MR Image Module**

Attribute Name	Tag	Type	VR	Notes
Image Type	(0008,0008)	1	CS	Value = 'DERIVED/SECONDARY'





Attribute Name	Tag	Type	VR	Notes
Samples per Pixel	(0028,0002)	1	US	Value = 1
Photometric Interpretation	(0028,0004)	1	CS	'MONOCHROME2'
Bits Allocated	(0028,0100)	1	US	Value = 16

#### 4.2.2.5.14 PET Image Module

Attribute Name	Tag	Type	VR	Notes
Image Type	(0008,0008)	1	CS	Value = 'DERIVED/SECONDARY'
Samples per Pixel	(0028,0002)	1	US	Value = 1
Photometric Interpretation	(0028,0004)	1	CS	'MONOCHROME2'
Bits Allocated	(0028,0100)	1	US	Value = 16
Bits Stored	(0028,0101)	1	US	Value = 16
High Bit	(0028,0102)	1	US	Value = 15
Rescale Intercept	(0028,1052)	1	DS	Value = 0 The value b in relationship between stored value (SV) and Displayed Value (DV). $DV = m * SV + b$
Rescale Slope	(0028,1053)	1	DS	Dependent on image. m in the equation specified in Rescale Intercept (0028,1052).
Frame Reference Time	(0054,1300)	1	DS	Not used
Image Index	(0054,1330)	1	US	Not used

#### 4.2.2.5.15 Patient Study Module

Attribute Name	Tag	Type	VR	Notes
Patient Age	(0010,1010)	3	AS	Reused from the secondary Image set for the mixed or fused image export.
Patient Size	(0010,1020)	3	DS	Reused from the secondary Image set for the mixed or fused image export.
Patient Weight	(0010,1030)	3	DS	Reused from the secondary Image set for the mixed or fused image export.

**4.2.2.5.16 PET Series Module**

Attribute Name	Tag	Type	VR	Notes
Series Date	(0008,0021)	1	DA	Reused from the secondary Image set for the mixed or fused image export.
Series Time	(0008,0031)	1	TM	Reused from the secondary Image set for the mixed or fused image export.
Units	(0054,1001)	1	CS	Reused from the secondary Image set for the mixed or fused image export.
Counts Source	(0054,1002)	1	CS	Reused from the secondary Image set for the mixed or fused image export.
Series Type	(0054,1000)	1	CS	Reused from the secondary Image set for the mixed or fused image export.
Reprojection Method	(0054,1004)	2C	CS	Reused from the secondary Image set for the mixed or fused image export.
Number of R-R Intervals	(0054,0061)	1C	US	Reused from the secondary Image set for the mixed or fused image export.
Number of Time Slots	(0054,0071)	1C	US	Reused from the secondary Image set for the mixed or fused image export.
Number of Time Slices	(0054,0101)	1C	US	Reused from the secondary Image set for the mixed or fused image export.
Number of Slices	(0054,0081)	1	US	Reused from the secondary Image set for the mixed or fused image export.
Corrected Image	(0028,0051)	2	CS	Reused from the secondary Image set for the mixed or fused image export.
Decay Correction	(0054,1102)	1	CS	Reused from the secondary Image set for the mixed or fused image export.
Collimator Type	(0018,1181)	2	CS	Reused from the secondary Image set for the mixed or fused image export.

**4.2.2.5.17 PET Isotope Module**

Attribute Name	Tag	Type	VR	Notes
Radiopharmaceutical Information Sequence	(0054,0016)	2	SQ	Reused from the secondary Image set for the mixed or fused image export.
>Radionuclide Code Sequence	(0054,0300)	2	SQ	Reused from the secondary Image set for the mixed or fused image export.
>Radiopharmaceutical Route	(0018,1070)	3	LO	Reused from the secondary Image set for the mixed or fused image export.
>Radiopharmaceutical Volume	(0018,1071)	3	DS	Reused from the secondary Image set for the mixed or fused image export.
>Radiopharmaceutical Start Time	(0018,1072)	3	TM	Reused from the secondary Image set for the mixed or fused image export.
>Radiopharmaceutical Start DateTime	(0018,1078)	3	DT	Reused from the secondary Image set for the mixed or fused image export.
>Radiopharmaceutical Stop Time	(0018,1073)	3	TM	Reused from the secondary Image set for the mixed or fused image export.
>Radiopharmaceutical Stop DateTime	(0018,1079)	3	DT	Reused from the secondary Image set for the mixed or fused image export.
>Radionuclide Total Dose	(0018,1074)	3	DS	Reused from the secondary Image set for the mixed or fused image export.
>Radionuclide Half Life	(0018,1075)	3	DS	Reused from the secondary Image set for the mixed or fused image export.
>Radionuclide Positron Fraction	(0018,1076)	3	DS	Reused from the secondary Image set for the mixed or fused image export.
>Radiopharmaceutical Specific Activity	(0018,1077)	3	DS	Reused from the secondary Image set for the mixed or fused image export.



Attribute Name	Tag	Type	VR	Notes
>Radiopharmaceutical	(0018,0031)	3	LO	Reused from the secondary Image set for the mixed or fused image export.

#### 4.2.2.6 SOP Specific Conformance to RT Structure Set Storage SCU

CDMS\_SEND implement Level 2 (Full) conformance for the Storage SOP Class, but the iDMS System only uses a subset of the attributes described in Section 6.0.

#### 4.2.2.7 SOP Specific Conformance to RT Dose Storage SCU

CDMS\_SEND implement Level 2 (Full) conformance for the Storage SOP Class, but the iDMS System only uses a subset of the attributes described in Section 8.0.

#### 4.2.2.8 SOP Specific Conformance to RT Plan Storage SCU

CDMS\_SEND implements Level 2 (Full) conformance for the Storage SOP Class, but the iDMS System only uses a subset of the attributes described in Section 9.0.

#### 4.2.2.9 SOP Specific Conformance to RT Beams Treatment Record Storage SCU

CDMS\_SEND implements Level 2 (Full) conformance for the Storage SOP Class, but the iDMS System only uses a subset of the attributes described in Section 11.0.

#### 4.2.2.10 SOP Specific Conformance to Unified Procedure Step – PULL SCU

CDMS\_UPS implements Level 2 (Full) conformance for the Unified Procedures Step SOP Class, but the iDMS System only uses a subset of the attributes described in Section 12.

#### 4.2.2.11 SOP Specific Conformance to Study Root Query/Retrieve – MOVE SCU

CDMS\_QR implements Level 2 (Full) conformance for the Query/Retrieve SOP Class, but the iDMS System only uses a subset of the attributes described in Section 13.

### 4.2.3 Association Acceptance Policy

CDMS\_SEND/CDMS\_UPS/CDMS\_QR AE does not accept associations.

## 5.0 RT Structure Set Information Object Implementation (RT Structure Set Storage SCP)

This section specifies the use of the DICOM RT Structure Set Information Object Definition (IOD) by the Precision System.

### 5.1 RT Structure Set IOD Implementation

This section defines the implementation of the RT Structure Set information object by the Precision System. It refers to DICOM v3.0 standard, Part 3 (Information Object Definitions). The Precision System imports and displays an RT Structure Set as Regions of Interest (ROI) in the corresponding CT image study via the same Study UID.



### 5.1.1 Entity Relationship Model

Refer to section A.19.2 in DICOM standard, Part 3 (Information Object Definitions) for the E\_R Model of the RT Structure Set IOD and a description of each of the entities contained within it.

### 5.1.2 iDMS System Mapping of DICOM Entities

DICOM entities map to iDMS System entities in the following manner:

DICOM	iDMS System
Patient Entity	Patient Entity (set from associated CT Image)
Study Entity	Not mapped
Series Entity	Not mapping
Equipment Entity	Not used
Structure Set	Geometric information related to defined ROIs

## 5.2 RT Structure Set IOD Module Table

The table in this section describes the mandatory modules to support the RT Structure Set IOD. The Reference column refers to sections in this document.

Entity Name	Module Name	Reference	Usage
Patient	Patient	4.1.4.2.1	M
Study	General Study	4.1.4.2.2	M
	Patient Study	Not used	U
Series	RT Series	4.1.4.2.3	M
Equipment	General Equipment	4.1.4.2.5	M
Structure Set	Structure Set	5.3.1	M
	ROI Contour	5.3.2	M
	RT ROI Observations	5.3.3	M
	Approval	Not used	U
	SOP Common	4.1.4.2.10	M



## 5.3 Information Module Definitions – RT Structure Set

### 5.3.1 Structure Set Module

The table shown below lists the elements in the Structure Set Module that are read by the Precision System. Unlisted elements are not used by the applications. The Notes column describes special considerations for the usage of each element. Refer to section C.8.8.5 of the DICOM standard, Part 3 (Information Object Definitions) for the complete Structure Set Module.

Attribute Name	Tag	Type	VR	Notes
Structure Set Label	(3006,0002)	1	SH	Not used.
Structure Set Date	(3006,0008)	2	DA	Not used.
Structure Set Time	(3006,0009)	2	TM	Not used.
Referenced Frame of Reference Sequence	(3006,0010)	3	SQ	Sequence is permitted to be empty or absent.
>Frame of Reference UID	(0020,0052)	1C	UI	Must equal the Frame of Reference UID of the corresponding CT image series.
>RT Referenced Study Sequence	(3006,0012)	3	SQ	
>>Referenced SOP Class UID	(0008,1150)	1	UI	
>>Referenced SOP Instance UID	(0008,1155)	1	UI	Must equal the study UID of the corresponding CT image series.
>>RT Referenced Series Sequence	(3006,0014)	1	SQ	Used to associate the structure set to a corresponding CT image series.
>>>Series Instance UID	(0020,000E)	1	UI	Series instances UID of the primary CT image to which the structure set belongs.
>>>Contour Image Sequence	(3006,0016)	1	SQ	Reference to each instance in the CT image series.
>>>>Referenced SOP Class UID	(0008,1150)	1	UI	Value = '1.2.840.10008.5.1.4.1.1.2'
>>>>Referenced SOP Instance UID	(0008,1155)	1	UI	Must equal the instance UIDs of the corresponding CT image series.
Structure Set ROI Sequence	(3006,0020)	3	SQ	Must be present.
>ROI Number	(3006,0022)	1C	IS	



Attribute Name	Tag	Type	VR	Notes
>Referenced Frame of Reference UID	(3006,0024)	1C	UI	Not used.
>ROI Name	(3006,0026)	2C	LO	Required to be non-empty.
>ROI Generation Algorithm	(3006,0036)	2C	CS	Not used.

### 5.3.2 ROI Contour Module

The table shown below lists the elements in the ROI Contour Module that are read by the Precision System. Unlisted elements are not used by the applications. The Notes column indicates special considerations for the usage of each element. Refer to section C.8.8.6 in DICOM standard, Part 3 (Information Object Definitions) for a complete ROI Contour Module.

Attribute Name	Tag	Type	VR	Notes
ROI Contour Sequence	(3006,0039)	1	SQ	
>Referenced ROI Number	(3006,0084)	1	IS	
> ROI Display Color	(3006,002A)	3	IS	RGB triplet color representation for the ROI, specified using the range 0-255.
>Contour Sequence	(3006,0040)	3	SQ	Required.
>>Contour Number	(3006,0048)	3	IS	Not used.
>>Contour Geometric Type	(3006,0042)	1C	CS	Contours not marked CLOSED_PLANAR are ignored.
>>Number of Contour Points	(3006,0046)	1C	IS	
>>Contour Data	(3006,0050)	1C	DS	
>>Contour Image Sequence	(3006,0016)	3	SQ	Not used.
>>>Referenced SOP Class UID	(0008,1150)	1C	UI	Not used.
>>>Referenced SOP Instance UID	(0008,1155)	1C	UI	Not used.

### 5.3.3 RT ROI Observations Module

The table shown below lists the elements in the RT ROI Observations Module that are read by the Precision System. Unlisted elements are not used by the applications. The Notes column indicates special considerations for the usage of each element. Refer to section C.8.8.8 in DICOM standard, Part 3 (Information Object Definitions) for a complete RT ROI Observations Module.



Attribute Name	Tag	Type	VR	Notes
ROI Contour Observations Sequence	(3006,0080)	1	SQ	
>Observation Number	(3006,0082)	1	IS	Not used.
>Referenced ROI Number	(3006,0084)	1	IS	
>ROI Observation Label	(3006,0085)	3	SH	Not used.
>RT Related ROI Sequence	(3006,0030)	3	SQ	Not used.
>>Referenced ROI Number	(3006,0084)	1C	IS	Not used.
>>RT ROI Relationship	(3006,0033)	3	CS	Not used.
>RT ROI Interpreted Type	(3006,00A4)	2	CS	Not used.
> ROI Interpreter	(3006,00A6)	2	PN	Not used.

## 6.0 RT Structure Set Information Object Implementation (RT Structure Set Storage SCU)

This section specifies the use of the DICOM RT Structure Set Information Object Definition (IOD) by the Precision System.

### 6.1 RT Structure Set IOD Implementation

This section defines the implementation of the RT Structure Set information object by the Precision System. It refers to DICOM v3.0 standard, Part 3 (Information Object Definitions). The Precision System displays and exports an RT Structure Set as Regions of Interest (ROI) belonging to the corresponding CT image study via the same Study UID and Referenced Frame of Reference sequence (3006,0010).

#### 6.1.1 Entity Relationship Model

Refer to section A.19.2 in DICOM standard, Part 3 (Information Object Definitions) for the E\_R Model of the RT Structure Set IOD and a description of each of the entities contained within it.

#### 6.1.2 iDMS System Mapping of DICOM Entities

DICOM entities map to iDMS System entities in the following manner:

DICOM	iDMS System
Patient Entity	Patient Entity (set from associated CT Image)
Study Entity	Not mapped
Series Entity	Not mapped
Equipment Entity	Not used





DICOM	iDMS System
Structure Set	Geometric information related to defined ROIs

## 6.2 RT Structure Set IOD Module Table

The table in this section describes the mandatory modules to support the RT Structure Set IOD. The Reference column refers to sections in this document.

Entity Name	Module Name	Reference	Usage
Patient	Patient	4.2.2.5.1	M
Study	General Study	4.2.2.5.2	M
	Patient Study	Not used	U
Series	RT Series	4.2.2.5.4	M
Equipment	General Equipment	4.2.2.5.5	M
Structure Set	Structure Set	6.3.1	M
	ROI Contour	6.3.2	M
	RT ROI Observations	6.3.3	M
	SOP Common	4.2.2.5.9	M

## 6.3 Information Module Definitions – RT Structure Set

### 6.3.1 Structure Set Module

The table shown below lists the elements in the Structure Set Module that are exported by the Precision System. Unlisted elements are not used by the application. The Notes column indicates special considerations for the usage of each element. Refer to section C.8.8.5 in DICOM standard, Part 3 (Information Object Definitions) for a complete Structure Set Module.

Attribute Name	Tag	Type	VR	Notes
Structure Set Label	(3006,0002)	1	SH	Value = 'CyRISRTSS3.0.0'
Structure Set Date	(3006,0008)	2	DA	Date at which RT Structure Set was generated.
Structure Set Time	(3006,0009)	2	TM	Time at which RT Structure Set was generated.
Referenced Frame of Reference Sequence	(3006,0010)	3	SQ	Introduces the sequence describing the frame of reference



Attribute Name	Tag	Type	VR	Notes
				for the structure set. References that of the primary CT image.
>Frame of Reference UID	(0020,0052)	1	UI	Equals the Frame of Reference UID of the corresponding CT image study.
>RT Referenced Study Sequence	(3006,0012)	3	SQ	Introduces the sequence describing the study for the structure set. References that of the primary CT image.
>>Referenced SOP Class UID	(0008,1150)	1	UI	Uniquely identifies the referenced SOP Class. Value = '1.2.840.10008.3.1.2.3.2'
>>Referenced SOP Instance UID	(0008,1155)	1	UI	Uniquely identifies the referenced SOP Instance.
>>RT Referenced Series Sequence	(3006,0014)	1	SQ	Introduces the sequence referencing the series of the primary CT image to which the structure set belongs.
>>>Series Instance UID	(0020,000E)	1	UI	Series instances UID of the primary CT image to which the structure set belongs.
>>>Contour Image Sequence	(3006,0016)	1	SQ	Reference to each instance in the CT image series.
>>>>Referenced SOP Class UID	(0008,1150)	1	UI	Uniquely identifies the referenced SOP Class. Value = '1.2.840.10008.5.1.4.1.1.2'
>>>>Referenced SOP Instance UID	(0008,1155)	1	UI	Uniquely identifies the referenced SOP Instance.
Structure Set ROI Sequence	(3006,0020)	3	SQ	
>ROI Number	(3006,0022)	1	IS	ROI number used to make an association with ROI Contour Module and RT ROI Observations Module. May take any value from [0, 2 <sup>32</sup> -1]
>Referenced Frame of Reference UID	(3006,0024)	1	UI	Equal to the Frame of Reference UID above.
>ROI Name	(3006,0026)	2	LO	Structure name. A unique name is provided for each structure.



Attribute Name	Tag	Type	VR	Notes
>ROI Generation Algorithm	(3006,0036)	2	CS	Value = 'MANUAL', 'AUTOMATIC'.

### 6.3.2 ROI Contour Module

The table shown below lists the elements in the ROI Contour Module that are exported by the Precision System. Unlisted elements are not used by the applications. The Notes column indicates special considerations for the usage of each element. Refer to section C.8.8.6 in DICOM standard, Part 3 (Information Object Definitions) for a complete ROI Contour Module.

Attribute Name	Tag	Type	VR	Notes
ROI Contour Sequence	(3006,0039)	1	SQ	
>Referenced ROI Number	(3006,0084)	1	IS	ROI number used to make an association with Structure Set Module and RT ROI Observations Module.
> ROI Display Color	(3006,002A)	3	IS	RGB triplet color representation for ROI, specified using the range 0-255.
>Contour Sequence	(3006,0040)	3	SQ	Sequence contains items corresponding to the contours used to define the ROI (organs).
>>Contour Number	(3006,0048)	3	IS	May take any value from $[0, 2^{32}-1]$ , not necessarily in order.
>>Contour Geometric Type	(3006,0042)	1	CS	Value = 'CLOSED_PLANAR'
>>Number of Contour Points	(3006,0046)	1	IS	Number of points in Contour Data (3006, 0050).
>>Contour Data	(3006,0050)	1	DS	Sequence of points stored as (x, y, z) triplets defining a contour in the patient-based coordinate system.
>>Contour Image Sequence	(3006,0016)	3	SQ	Sequence contains 1 item corresponding to the image to which the contour applies. This value may be blank if the associated image slice is not defined.
>>>Referenced SOP Class UID	(0008,1150)	1	UI	Reused from the associated CT Image set.



Attribute Name	Tag	Type	VR	Notes
>>>Referenced SOP Instance UID	(0008,1155)	1	UI	Reused from the associated CT Image set.

### 6.3.3 RT ROI Observations Module

The table shown below lists the elements in the RT ROI Observations Module that are exported by the Precision System. Unlisted elements are not used by the applications. The Notes column indicates special considerations for the usage of each element. Refer to section C.8.8.8 in the DICOM standard, Part 3 (Information Object Definitions) for the complete RT ROI Observations Module.

Attribute Name	Tag	Type	VR	Notes
RT ROI Observations Sequence	(3006,0080)	1	SQ	
>Observation Number	(3006,0082)	1	IS	The same unique number as ROI Number (3006,0022).
>Referenced ROI Number	(3006,0084)	1	IS	ROI number used to make an association with Structure Set Module and ROI Contour Module.
>ROI Observation Label	(3006,0085)	3	SH	Value = 'AXIAL', 'SAGITTAL', 'CORONAL'.
>RT ROI Interpreted Type	(3006,00A4)	2	CS	Type of ROI. Target Site = 'GTV' Critical Site = 'ORGAN' Skin Type = 'EXTERNAL'
>ROI Interpreter	(3006,00A6)	2	PN	Current windows user login name.
>ROI Physical Properties Sequence	(3006,00B0)	3	SQ	Present for structures that have a density override. Sequence may contain mass density, electron density, or both.
>>ROI Physical Property	(3006,00B2)	1	CS	'REL_MASS_DENSITY' or 'REL_ELEC_DENSITY'
>>ROI Physical Property Value	(3006,00B4)	1	DS	The density override value.



## 7.0 RT Dose Information Object Implementation (RT Dose Storage SCP)

The Precision System accepts imports of RT Dose objects from external clients. However, no fields are read into the iDMS System after the successful import completes.

## 8.0 RT Dose Information Object Implementation (RT Dose Storage SCU)

This section specifies the use of the DICOM RT Dose Information Object Definition (IOD) by the Precision System.

### 8.1 RT Dose IOD Implementation

This section defines the implementation of the RT Dose information object by the Precision System. It refers to the DICOM v3.0 standard, Part 3 (Information Object Definitions). The Precision System displays and exports an RT Dose as any combination of the 3D dose grid and DVHs referencing the corresponding CT image study and RT Structure Set.

#### 8.1.1 Entity Relationship Model

Refer to section A.18.2 in the DICOM standard, Part 3 (Information Object Definitions) for the E\_R Model of the RT Dose IOD and a description of each of the entities contained within it.

#### 8.1.2 iDMS System Mapping of DICOM Entities

DICOM entities map to iDMS System entities in the following manner:

DICOM	iDMS System
Patient Entity	Patient Entity (set from associated CT Image)
Study Entity	No mapping
Series Entity	No mapping
Equipment Entity	Not used
RT Dose	Not used

## 8.2 RT Dose IOD Module Table

The table in this section describes the mandatory modules to support the RT Dose IOD. The Reference column refers to sections in this document.

Entity Name	Module Name	Reference	Usage
Patient	Patient	4.2.2.5.1	M
Study	General Study	4.2.2.5.2	M



Entity Name	Module Name	Reference	Usage
	Patient Study	Not used	U
Series	RT Series	4.2.2.5.4	M
Frame of Reference	Frame of Reference	4.2.2.5.3	M
Equipment	General Equipment	4.2.2.5.5	M
Dose	General Image	4.2.2.5.6	C
	Image Plane	4.2.2.5.7	C
	Image Pixel	4.2.2.5.8	C
	Multi-Frame	4.2.2.5.9	C
	RT Dose	8.3.1	M
	RT DVH	8.3.2	U
	Structure Set	8.3.3	C
	ROI Contour	Not Used in RT Dose	C
	RT Dose ROI	Not Used in RT Dose	C
	Common Instance Reference	8.3.4	U
	SOP Common	4.2.2.5.9	M

## 8.3 Information Module Definitions – RT Dose

### 8.3.1 RT Dose Module

The table shown below lists the elements in the RT Dose Module that are exported by the Precision System. Unlisted elements are not used by this application. Special considerations in the usage of the elements are noted in the Notes column. Refer to section C.8.8.3 in the DICOM standard, Part 3 (Information Object Definitions) for the complete RT Dose Module.

Attribute Name	Tag	Type	VR	Notes
Dose Units	(3004,0002)	1	CS	Units used to describe dose. Value = 'GY'
Dose Type	(3004,0004)	1	CS	Type of dose. Value = 'PHYSICAL'



Attribute Name	Tag	Type	VR	Notes
Dose Summation Type	(3004,000A)	1	CS	Type of dose summation. Values = 'PLAN', 'BEAM'
Referenced RT Plan Sequence	(300C,0002)	1C	SQ	References the RT Plan that generated this dose. This sequence may not be present if an RT Plan is not available.
>Referenced SOP Class UID	(0008,1150)	1	UI	Value = '1.2.840.10008.5.1.4.1.1.481.5'
>Referenced SOP Instance UID	(0008,1155)	1	UI	Uniquely identifies the referenced RT Plan SOP instance.
Grid Frame Offset Vector	(3004,000C)	1C	DS	Present whenever multi-frame data is present.
Dose Grid Scaling	(3004,000E)	1	DS	Scaling factor that when multiplied by the dose grid data found in the Pixel Data (7FE0,0010) attribute of the Image Pixel Module, yields grid doses in the dose units as specified by Dose Units (3004,0002).

### 8.3.2 RT DVH Module

The table shown below lists the elements in the RT DVH Module that are exported by the Precision System. Unlisted elements are not used by this application. Special considerations in the usage of elements are noted in the Notes column. Refer to section C.8.8.4 in the DICOM standard, Part 3 (Information Object Definitions) for the complete RT DVH Module.

Attribute Name	Tag	Type	VR	Notes
Referenced Structure Set Sequence	(300C,0060)	1	SQ	Introduces sequence of one class/instance pair describing Structure Set containing structures which are used to calculate Dose-Volume Histograms (DVHs). Only a single item shall be permitted in this sequence.
>Referenced SOP Class UID	(0008,1150)	1	UI	Value = '1.2.840.10008.5.1.4.1.1.481.3'.
>Referenced SOP Instance UID	(0008,1155)	1	UI	Uniquely identifies the referenced RT Structure Set SOP instance.
DVH Normalization Point	(3004,0040)	3	DS	Coordinates (x, y, z) of Maximum Dose value in the patient based coordinate system.
DVH Normalization Dose Value	(3004,0042)	3	DS	Maximum dose value.



Attribute Name	Tag	Type	VR	Notes
DVH Sequence	(3004,0050)	1	SQ	Introduces sequence of DVHs. One or more items may be included in this sequence.
>DVH Referenced ROI Sequence	(3004,0060)	1	SQ	Introduces sequence of referenced ROIs used to calculate DVH.
>>Referenced ROI Number	(3006,0084)	1	IS	ROI number used to make an association with Structure Set Module and RT DVH Module.
>>DVH ROI Contribution Type	(3004,0062)	1	CS	Value = 'INCLUDED'
>DVH Type	(3004,0001)	1	CS	Value = 'CUMULATIVE'
>Dose Units	(3004,0002)	1	CS	Units used to describe dose. Value = 'GY'
>Dose Type	(3004,0004)	1	CS	Type of dose. Value = 'PHYSICAL'
>DVH Dose Scaling	(3004,0052)	1	DS	Value = 0.01.
>DVH Volume Units	(3004,0054)	1	CS	Volume axis units. Value = 'CM3', cubic centimeters.
>DVH Number of Bins	(3004,0056)	1	IS	Number of bins n used to store DVH Data (3004, 0058). Value = 257.
>DVH Data	(3004,0058)	1	DS	A data stream describing the dose bin widths Dn and associated volumes Vn in cm <sup>3</sup> in the order D1V1, D2V2, ... DnVn.
>DVH Minimum Dose	(3004,0070)	3	DS	Minimum calculated dose to ROI described by DVH Referenced ROI Sequence (3004,0060) in Gy.
>DVH Maximum Dose	(3004,0072)	3	DS	Maximum calculated dose to ROI described by DVH Referenced ROI Sequence (3004,0060) in Gy.
>DVH Mean Dose	(3004,0074)	3	DS	Mean calculated dose to ROI described by DVH Referenced ROI Sequence (3004,0060) in Gy.

### 8.3.3 Structure Set Module

The table shown below lists the elements in the Structure Set Module that are exported by the Precision System. Unlisted elements are not used by this application. The Notes column indicates special





considerations for the usage of each element. Refer to section C.8.8.5 in the DICOM standard, Part 3 (Information Object Definitions) for the complete Structure Set Module.

Attribute Name	Tag	Type	VR	Notes
Structure Set Label	(3006,0002)	1	SH	Value = 'CyRISRTDOSE2.0.0'
Structure Set Date	(3006,0008)	2	DA	Date at which RT Dose was generated.
Structure Set Time	(3006,0009)	2	TM	Time at which RT Dose was generated.

### 8.3.4 Common Instance Reference

The table shown below lists the elements in the Common Instance Reference Module that are exported by the Precision System. Unlisted elements are not used by this application. The Notes column indicates special considerations for the usage of each element. Refer to section C.12.2 in the DICOM standard, Part 3 (Information Object Definitions) for the complete Common Instance Reference Module.

Attribute Name	Tag	Type	VR	Notes
Referenced Series Sequence	(0008,1115)	1C	SQ	Introduces the sequence referencing the series of the primary CT image to which the RT Dose belongs.
>Series Instance UID	(0020,000E)	1	UI	Series instances UID of the primary CT image to which the RT Dose belongs.
>Referenced Instance Sequence	(0008,114A)	1	SQ	Reference to each instance in the CT image series.
>>Referenced SOP Class UID	(0008,1150)	1	UI	Uniquely identifies the referenced SOP Class. Value = '1.2.840.10008.5.1.4.1.1.2'
>>Referenced SOP Instance UID	(0008,1155)	1	UI	Uniquely identifies the referenced SOP Instance.

## 9.0 RT Plan IOD (RT Plan Storage SCU)

This section specifies the use of the DICOM RT Plan Information Object Definition (IOD) by Accuray Systems.

**Ring Gantry:** In this section and those that follow, the term “Ring Gantry” will be used to refer collectively to the Radixact and TomoTherapy Systems as distinguished from the CyberKnife System.

### 9.1 RT Plan IOD Implementation

This section defines the implementation of the RT Plan information object by the Accuray Systems. It refers to the DICOM v3.0 standard, Part 3 (Information Object Definitions). The iDMS System exports an RT Plan.



### 9.1.1 Entity Relationship Model

Refer to section A.20.3 in the DICOM standard, Part 3 (Information Object Definitions) for the E\_R Model of the RT Plan IOD and a description of each of the entities contained within it.

## 9.2 RT Plan IOD Module Table

The table in this section describes the mandatory modules to support the RT Plan IOD. The Reference column refers to sections in this document.

Entity Name	Module Name	Reference	Usage
Patient	Patient	9.3.1	M
	Clinical Trial Subject	Not used	U
Study	General Study	9.3.2	M
	Patient Study	Not used	U
	Clinical Trial Study	Not used	U
Series	RT Series	9.3.3	M
	Clinical Trial Series	Not used	U
Frame of Reference	Frame of Reference	9.3.4	U
Equipment	General Equipment	9.3.5	M
Plan	RT General Plan	9.3.6	M
	RT Prescription	9.3.7	U
	RT Tolerance Tables	9.3.9	U
	RT Patient Setup	9.3.10	U
	RT Fraction Scheme	9.3.11	U
	RT Beams	9.3.12	C
	RT Brachy Application Setups	Not used	C
	Approval	9.3.13	U
	SOP Common	9.3.14	M

## 9.3 Information Module Definitions – RT Plan

### 9.3.1 Patient Module

Attribute Name	Tag	Type	VR	Notes
Patient Name	(0010,0010)	2	PN	The patient name.



Attribute Name	Tag	Type	VR	Notes
Patient ID	(0010,0020)	2	LO	Primary hospital identification number or code for the patient. This is set to the medical ID of the patient, or the HIS ID, if that is set.
Patient Birth Date	(0010,0030)	2	DA	Birth date of the patient.
Patient Sex	(0010,0040)	2	CS	Sex of the named patient.

### 9.3.2 General Study Module

Attribute Name	Tag	Type	VR	Notes
Study Instance UID	(0020,000D)	1	UI	Set to the Study Instance UID of the treatment plan primary fixed CT series. RT Record instances will send Study Instance UID from OIS if present in the Worklist.
Study Date	(0008,0020)	2	DA	Set to the Study Date of the treatment plan primary CT series
Study Time	(0008,0030)	2	TM	Set to the Study Time of the treatment plan primary CT series.
Referring Physician Name	(0008,0090)	2	PN	Treatment plan referring physician
Study ID	(0020,0010)	2	SH	Empty
Accession Number	(0008,0050)	2	SH	Empty

### 9.3.3 RT Series Module

Attribute Name	Tag	Type	VR	Notes
Modality	(0008,0060)	1	CS	Value = 'RTPLAN'
Series Instance UID	(0020,000E)	1	UI	Provided
Series Number	(0020,0011)	2	IS	Empty
Series Description	(0008,103E)	3	LO	Treatment plan name.



### 9.3.4 Frame of Reference Module

Attribute Name	Tag	Type	VR	Notes
Frame of Reference UID	(0020,0052)	1	UI	Value = Primary CT series Frame of Reference UID.
Position Reference Indicator	(0020,1040)	2	LO	Empty

### 9.3.5 General Equipment Module

Attribute Name	Tag	Type	VR	Notes
Manufacturer	(0008,0070)	2	LO	'Accuray Inc.' for CyberKnife. 'TomoTherapy Incorporated' for Ring Gantry Systems.
Station Name	(0008,1010)	3	SH	The name of the associated treatment device.
Manufacturer's Model	(0008,1090)	3	LO	Model name of the device.
Device Serial Number	(0018,1000)	3	LO	Device serial number.
Software Versions	(0018,1020)	3	LO	iDMS System Version that generated this object.

### 9.3.6 RT General Plan Module

Attribute Name	Tag	Type	VR	Notes
RT Plan Label	(300A,0002)	1	SH	Treatment plan name. Prepend with a 2 digit course id if MOSAIQ.
RT Plan Name	(300A,0003)	2	LO	Treatment plan name.
RT Plan Description	(300A,0004)	3	ST	Same as RT Plan Label.
Operator's Name	(0008,1070)	2	PN	Name of operator who last saved the treatment plan.
RT Plan Date	(300A,0006)	2	DA	Date treatment plan was last modified.
RT Plan Time	(300A,0007)	2	TM	Time treatment plan was last modified.
Treatment Protocol	(300A,0009)	3	LO	CyberKnife: "CyberKnife" Ring Gantry System: Attribute Not Present
Plan Intent	(300A,000A)	3	CS	'CURATIVE' for treatment plans, 'VERIFICATION' for QA plans



Attribute Name	Tag	Type	VR	Notes
RT Plan Geometry	(300A,000C)	1	CS	Value = 'PATIENT'
Referenced Structure Set Sequence	(300C,0060)	1C	SQ	Introduces sequence of one Class/Instance pair describing instance of RT Structure Set on which the RT Plan is based.
> Referenced SOP Class UID	(0008,1150)	1C	UI	RT Structure Set SOP Class UID
> Referenced SOP Instance UID	(0008,1155)	1C	UI	SOP Instance UID of the RT Structure set associated to the treatment plan.
Referenced Dose Sequence	(300C,0080)	3	SQ	Not always present: Present for Ring Gantry patient plans. Sequence, if present, will contain 1 item.
>Referenced SOP Class UID	(0008,1150)	1C	UI	RT Dose SOP Class UID
>Referenced SOP Instance UID	(0008,1155)	1C	UI	SOP Instance UID of the RT Dose associated to the treatment plan.

### 9.3.7 RT Prescription Module

For mapping between Ring Gantry System optimization parameters and DICOM attributes, see Note 1. Not present if plan is a QA Plan.

Attribute Name	Tag	Type	VR	Notes
Prescription Description	(300A,000E)	3	ST	English description of the primary prescription. Empty for Ring Gantry System QA Plans.
Dose Reference Sequence	(300A,0010)	3	SQ	Introduces sequence of Dose References. For CyberKnife, sequence contains 1 item. For Ring Gantry System, one entry for each ROI contributing to the constraints used in the optimization.
>Dose Reference Number	(300A,0012)	1	IS	CyberKnife: Value = '1' Ring Gantry with Aria: Value = '1' Ring Gantry otherwise: sequential starting with '1'
>Dose Reference UID	(300A,0013)	3	UI	The unique identifier for this dose reference.



Attribute Name	Tag	Type	VR	Notes
>Dose Reference Structure Type	(300A,0014)	1	CS	VOLUME or COORDINATES
>Dose Reference Description	(300A,0016)	3	LO	CyberKnife: Set to the treatment plan treatment site prepended by course ID if MOSAIQ. Ring Gantry System: Uses associated structure name or point location
>Referenced ROI Number	(3006,0084)	1C	IS	CyberKnife: Not present. Ring Gantry System: if Dose Reference Structure Type (300A,0014) is VOLUME, then this value is the ROI Number in the referenced structure set.
>Dose Reference Point Coordinates	(300A,0018)	1C	DS	If Dose Reference Structure Type (300A,0014) is COORDINATES, then this value is the (X, Y, Z) coordinates for the dose reference point.
>Dose Reference Type	(300A,0020)	1C	CS	CyberKnife: Value = 'TARGET' Ring Gantry System: Value "TARGET" or "ORGAN_AT_RISK" Based on optimization settings.
>Constraint Weight	(300A,0021)	3	DS	CyberKnife: Not Present Ring Gantry System: Optimization weighting of the ROI if not a forward plan.
>Target Minimum Dose	(300A,0025)	3	DS	CyberKnife: Not Present Ring Gantry System: Not Always Present: Minimum Dose to Tumor
>Target Prescription Dose	(300A,0026)	3	DS	CyberKnife: Treatment plan dose or max dose if Normalization is max dose. If the value of the configuration setting 'CKTargetPrescriptionDoseIsRxDose' is true. This is populated with the prescription dose from the plan. If false, this is populated with the reference dose from the plan. Ring Gantry System: When present, DVH Dose to Tumor
> Target Maximum Dose	(300A,0027)	3	DS	If the target OIS is ARIA, this is populated with the value of Target Prescription Dose. Otherwise, the maximum dose from the plan



Attribute Name	Tag	Type	VR	Notes
>Target Underdose Volume Fraction	(300A,0028)	3	DS	CyberKnife: Not present. Ring Gantry System: When present, Fraction of tumor permitted to receive less than the prescription dose.
>Organ at Risk Full-volume Dose	(300A,002A)	3	DS	CyberKnife: Not present. Ring Gantry System: Not always present. DVH Dose to Sensitive Structure
>Organ at Risk Maximum Dose	(300A,002C)	3	DS	CyberKnife: Not present. Ring Gantry System: Not always present. DVH Dose to Sensitive Structure.
>Organ at Risk Overdose Volume Fraction	(300A,002D)	3	DS	CyberKnife: Not Present. Ring Gantry System: Not always present. DVH Volume percentage to Sensitive Structure divided by 100.
>Private Creator	(300D,0010)	3	LO	Ring Gantry System Only: Value = "TOMO_HA_01"
>Tomo Structure Blocking	(300D,1010)	3	CS	Ring Gantry System Only: Structure blocking optimization selection: "NONE" (no blocking) "UPSTREAM_PRIMARY" (fluence blocked when structure is upstream of target) "ALL_PRIMARY" (all primary fluence is prevented from traversing the structure)
>Tomo Overlap Precedence	(300D,1012)	3	IS	Ring Gantry System Only: Integer (1-n) used to resolve ownership of voxels from two ROIs that overlap. For dose calculations, voxels belong to the structure with the highest precedence with '1' the highest.
>Tomo Target Minimum Dose Penalty	(300D, 1016)	3	IS	Ring Gantry System Only: Optimization penalty applied to not achieving Target Minimum Dose.
>Tomo Target Maximum Dose Penalty	(300D,1017)	3	IS	Ring Gantry System Only: Optimization penalty applied to exceeding Target Maximum Dose.



Attribute Name	Tag	Type	VR	Notes
>Tomo Organ at Risk Maximum Dose Penalty	(300D, 1018)	3	IS	Radoxact Only: Optimization penalty applied to exceeding Organ At Risk Maximum Dose.
>Tomo Organ at Risk Full-volume Dose Penalty	(300D, 1019)	3	IS	Ring Gantry System Only: Optimization penalty applied to exceeding Organ At Risk Full-volume Dose.
>Tomo Primary Prescription Type	(300D,101B)	3	CS	Ring Gantry System Only: Present if the Dose Reference is used for the primary prescription. Defined terms: "TO_VOLUME" "MAX_TO_TUMOR" "MIN_TO_TUMOR" "MEDIAN_TO_TUMOR"
Tomo Modulation Factor	(300D,1014)	3	DS	Ring Gantry System Only: Actual (calculated) modulation factor of plan.

**Table 14** Note 1: Ring Gantry System Constraint to DICOM Mapping

Tomo Prescription/Constraint Type	DICOM attributes Used
Tumor Minimum Dose Constraint	Tomo Target Minimum Dose Penalty Target Minimum Dose
Tumor DVH Constraint	Target Prescription Dose Target Underdose Volume Fraction
Tumor Maximum Dose Constraint	Tomo Target Maximum Dose Penalty Target Maximum Dose
Sensitive Structure DVH Point	Tomo Organ At Risk Maximum Dose Penalty Organ at Risk Maximum Dose Organ At Risk Overdose Volume Fraction
Sensitive Structure Maximum Dose Point	Tomo Organ At Risk Full-volume Dose Penalty Organ at Risk Full-volume Dose

### 9.3.8 RT Tolerance Table Module

Attribute Name	Tag	Type	VR	Notes
Tolerance Table Sequence	(300A,0040)	3	SQ	Introduces sequence of tolerance tables to be used for delivery of treatment plan. One or more items may be included in this sequence.
>Tolerance Table Number	(300A,0042)	1C	IS	Value='1'





Attribute Name	Tag	Type	VR	Notes
>Tolerance Table Label	(300A,0043)	3	SH	User-defined label for Tolerance Table. Value = 'T1'

### 9.3.9 RT Patient Setup

Attribute Name	Tag	Type	VR	Notes
Patient Setup Sequence	(300A,0180)	1	SQ	Introduces sequence of patient setup data for current plan.
>Patient Setup Number	(300A,0182)	1	IS	Value='1'
>Patient Position	(0018,5100)	1C	CS	CyberKnife: Patient position description relative to the equipment. Set to the Series table's patient position field. Ring Gantry System: Position as described in the referenced CT Image Objects
> Setup Technique	(300A,01B0)	3	CS	Setup Technique used in Patient Setup. Value = "ISOCENTRIC"
>Setup Device Sequence	(300A,01B4)	3	SQ	Ring Gantry System Only: Number of items = 3
>>Setup Device Type	(300A,01B6)	3	CS	Value = "LASER_POINTER"
>>Setup Device Label	(300A,01B8)	3	SH	1 <sup>st</sup> item: "RED IECf X" 2 <sup>nd</sup> item: "RED IECf Y" 3 <sup>rd</sup> item: "RED IECf Z"
>>Setup Device Parameter	(300A,01BC)	3	DS	1 <sup>st</sup> item: IEC fixed X red laser position in DICOM Patient Coordinate System 2 <sup>nd</sup> item: Same, for IEC fixed Y 3 <sup>rd</sup> item: Same, for IEC fixed Z

### 9.3.10 RT Fraction Scheme Module

Attribute Name	Tag	Type	VR	Notes
Fraction Group Sequence	(300A,0070)	1	SQ	Introduces sequence of Fraction Groups in current Fraction Scheme.
>Fraction Group Number	(300A,0071)	1	IS	Value='1'



Attribute Name	Tag	Type	VR	Notes
>Number of Fractions Planned	(300A,0078)	2	IS	Number of prescribed treatment plan fractions.
>Number of Beams	(300A,0080)	1	IS	CyberKnife: Number of treatment plan fraction paths. Ring Gantry System: Number of treatment plan beams (Helical deliveries count as 1 beam each)
>Referenced Beam Sequence	(300C,0004)	1C	SQ	Introduces sequence of treatment beams or paths in current Fraction Group. Number of items in this sequence will be = value of Number of Beams (300A,0080).
>>Referenced Beam Number	(300C,0006)	1C	IS	Beam Number (300A,00C0) of Beam Contribution recorded in this item, as defined in the Beam Sequence (300A,00B0).
>>Beam Dose	(300A,0084)	3	DS	CyberKnife: If the value of configuration setting 'CKTargetPrescriptionDoseIsRxDose' is true, beam doses are the path's contributions to the prescription dose. Otherwise, they are the contributions to the reference dose point. Ring Gantry System: the hard dose objective Ring Gantry System QA Plans: not present
>>Beam Meterset	(300A,0086)	3	DS	CyberKnife: Path MU to be delivered. Ring Gantry System: Scheduled beam delivery time in minutes. For QA plans, this is the Beam Meterset for this beam in the patient plan being validated.
>Number of Brachy Application Setups	(300A,00A0)	1	IS	Value = '0'.
>Referenced Dose Reference Sequence	(300C,0050)	3	SQ	Introduces sequence of Dose References for the current Fraction Group.
>>Referenced Dose Reference Number	(300C,0051)	3	IS	Value='1'



Attribute Name	Tag	Type	VR	Notes
>>Target Minimum Dose	(300A,0025)	3	DS	Ring Gantry System only: Dose in Gray that contributes to Target in related RT Structure Set. Present if prescription type is minimum dose to tumor.
>>Target Prescription Dose	(300A,0026)	3	DS	Ring Gantry System only: Dose in Gray that contributes to Target in related RT Structure Set. Present if prescription type is dose to volume or median dose to tumor.
>>Target Maximum Dose	(300A,0027)	3	DS	Ring Gantry System only: Dose in Gray that contributes to Target in related RT Structure Set. Present if prescription type is maximum dose to tumor.
>>Target Underdose Volume Fraction	(300A,0028)	3	DS	Ring Gantry System only: Value 50.0. Present if prescription type is median dose to tumor.

### 9.3.11 RT Beams Module

Attribute Name	Tag	Type	VR	Notes
Beam Sequence	(300A,00B0)	1	SQ	CyberKnife: Introduces sequence of treatment paths for current RT Plan. Ring Gantry System: For helical plan: Number of items=1 For fixed angle plan: Number of distinct fixed angles in fraction.
>Beam Number	(300A,00C0)	1	IS	Number of beams or paths in fraction.
>Beam Name	(300A,00C2)	3	LO	CyberKnife: "Path" + path_number Ring Gantry System: Helical plans: Value "H"+last group of numbers from plan instance UID. Fixed angle plans: Name of specific fixed angle beam.
>Beam Description	(300A,00C3)	3	ST	CyberKnife: Treatment plan fraction path name. Ring Gantry System:



Attribute Name	Tag	Type	VR	Notes
				For helical beam: English-language description of delivery beam pitch and field width. For fixed angle beams: 'TomoTherapy fixed-angle beam:' followed by beam angle in degrees.
>Beam Type	(300A,00C4)	1	CS	CyberKnife: Value = 'STATIC' Ring Gantry System: Value='DYNAMIC'
>Radiation Type	(300A,00C6)	2	CS	Value = 'PHOTON'
>Manufacturer	(0008,0070)	3	LO	CyberKnife: Value = 'Accuray Inc.' Ring Gantry System: Value = 'TomoTherapy Incorporated'
>Manufacturer's Model Name	(0008,1090)	3	LO	CyberKnife: Value = 'CyberKnife' Ring Gantry System: Model Name of Device
>Treatment Machine Name	(300A,00B2)	2	SH	Name of associated treatment machine.
> Device Serial Number	(0018,1000)	3	LO	Treatment Delivery System Serial Number.
>Primary Dosimeter Unit	(300A,00B3)	3	CS	CyberKnife: Value = 'MU' Ring Gantry System: Value = 'MINUTE'
>Source-Axis Distance	(300A,00B4)	3	DS	CyberKnife: Nominal fraction path SAD (mm). Ring Gantry System: SAD of Device
>Beam Limiting Device Sequence	(300A,00B6)	1	SQ	Number of items = 2.
>>RT Beam Limiting Device Type	(300A,00B8)	1	FL	CyberKnife: First item: Value = 'X' – represents the circular collimator in the X direction. Second item: Value = 'Y' – represents the circular collimator in the Y direction. Ring Gantry System: First item: Value = 'X' – represents the collimator slit length Second item: Value = 'ASYMY' – represents the jaw width.



Attribute Name	Tag	Type	VR	Notes
>>Number of Leaf/Jaw Pairs	(300A,00BC)	1	IS	Value = '1'
>Referenced Patient Setup Number	(300C,006A)	3	IS	Ring Gantry System Only: Value = 1
>Treatment Delivery Type	(300A,00CE)	3	CS	Value = 'TREATMENT'
>Number of Wedges	(300A,00D0)	1	IS	Value = '0'.
>Number of Compensators	(300A,00E0)	1	IS	Value = '0'.
>Number of Boli	(300A,00ED)	1	IS	Value = '0'
>Number of Blocks	(300A,00F0)	1	IS	Value = '0'.
>Final Cumulative Meterset Weight	(300A,010E)	1C	DS	Value = '1'
>Number of Control Points	(300A,0110)	1	IS	CyberKnife: Value = '2' Ring Gantry System: Number of (sinogram) projections in beam delivering radiation + 1. Each control point occurs at the boundary of a projection.
> Control Point Sequence	(300A,0111)	1	SQ	Number of items equal to value at (300A,0110)
>> Control Point Index	(300A,0112)	1C	IS	Present on all entries in sequence. Sequential index of control point, starting at 0
>> Cumulative Meterset Weight	(300A,0134)	2C	DS	Present on all entries in sequence. Control point index normalized over range of 0.0 to 1.0
>>Nominal Beam Energy	(300A,0114)	3	DS	CyberKnife: Nominal Beam Energy at control point (MV). Ring Gantry System: Value = 6.0
>>Dose Rate Set	(300A,0115)	3	DS	CyberKnife: Treatment Delivery System Dose Rate. Ring Gantry System: not present.
>>Referenced Dose Reference Sequence	(300C, 0050)	3	SQ	Always present, one sequence item
>>> Referenced Dose Reference Number	(300C, 0051)	1C	IS	Always 1



Attribute Name	Tag	Type	VR	Notes
>>> Cumulative Dose Reference Coefficient	(300A,010C)	2	DS	CyberKnife: empty Ring Gantry System: Coefficient used to calculate cumulative dose contribution from this Beam to the referenced Dose Reference at the current Control Point.
>>Beam Limiting Device Position Sequence	(300A,011A)	1C	SQ	If value will change over control points, the value will be populated on the first control point, and only on further control points if the value changes from previous control point
>>>RT Beam Limiting Device Type	(300A,00B8)	1C	CS	First item: Value = 'X' CyberKnife: Second item: Value = 'Y' Ring Gantry System: Second item: Value='ASYMY' (jaw width)
>>>Leaf/Jaw Positions	(300A,011C)	1C	DS	CyberKnife: Fixed Collimator - First item: Value = '(-collimator size/2, collimator size/2)' Iris Collimator – First item: Value = '(0,0)'  Fixed Collimator - Second item: Value = '(-collimator size/2, collimator size/2)'  Iris Collimator – Second item: Value = '(0,0)'  Ring Gantry System: First item: 2 values – -200.0, 200.0 Second item: 2 values – Y1 (front) and Y2 (back) jaw position at isocenter, in mm.
>>Gantry Angle	(300A,011E)	1C	DS	CyberKnife: Value = '0' Ring Gantry System: For helical beams: Tomo helical angle converted to range 0-359.9 degrees
>>Gantry Rotation Direction	(300A,011F)	1C	CS	CyberKnife: Value = 'NONE' Ring Gantry System: For helical beams: Value = 'CW'



Attribute Name	Tag	Type	VR	Notes
				For fixed-angle beams: Value = 'NONE'
>>Beam Limiting Device Angle	(300A,0120)	1C	DS	Value = '0'
>>Beam Limiting Device Rotation Direction	(300A,0121)	1C	CS	Value = 'NONE'
>>Patient Support Angle	(300A,0122)	1C	DS	Value = '0'
>>Patient Support Rotation Direction	(300A,0123)	1C	CS	Value = 'NONE'
>>Table Top Eccentric Angle	(300A,0125)	1C	DS	Value = '0'
>>Table Top Eccentric Rotation Direction	(300A,0126)	1C	CS	Value = 'NONE'
>>Table top Pitch Angle	(300A,0140)	1C	FL	Value = '0'
>>Table Top Pitch Rotation Direction	(300A,0142)	1C	CS	Value = 'NONE'
>>Table Top Roll Angle	(300A,0144)	1C	FL	Value = '0'
>>Table Top Roll Rotation Direction	(300A,0146)	1C	CS	Value = 'NONE'
>>Table Top Vertical Position	(300A,0128)	2C	DS	No value.
>>Table Top Longitudinal Position	(300A,0129)	2C	DS	No value.
>>Table Top Lateral Position	(300A,012A)	2C	DS	No value.
>>Isocenter Position	(300A,012C)	2C	DS	CyberKnife 0,0,0 Ring Gantry System: The location of the machine isocenter at the current control point, in the DICOM patient coordinate system.
>>Source to Surface Distance	(300A,0130)	3	DS	CyberKnife Only: Source to Patient Surface distance (mm). Value = '800.0'
>>Private Creator	(300D,0010)	3	CS	Ring Gantry System Only: Value='TOMO_HA_01'
>>Tomo Projection Sinogram Data	(300D,10A7)	3	DS	Ring Gantry System Only: Projection sinogram values for all 64 leaves of projection starting at the current control point. No value if all 64 leaves have a



Attribute Name	Tag	Type	VR	Notes
				sinogram value of zero. No value for last control point. Each projection sinogram value expresses the fraction of time that the leaf is open. The leaf opening is centered in time between the adjacent control point positions based on that fraction value.
>Private Creator	(300D,0010)	3	CS	Ring Gantry System Only: Value 'TOMO_HA_01'
>Tomo Gantry Period	(300D,1040)	3	DS	Ring Gantry System Only: (Helical plans only) Nominal gantry rotation period (in seconds)
>Tomo Couch Speed	(300D,1080)	3	DS	Ring Gantry System Only: Planned couch speed in mm/sec.
>Tomo Treatment Pitch	(300D,1060)	3	DS	Ring Gantry System Only: (Helical plans only) Distance in mm that treatment couch progresses in one gantry rotation divided by the total opening maximum Y jaw pair in mm.
>Tomo Plan Geometry	(300D,10A4)	3	CS	Ring Gantry System Only: Geometry of beams in TomoTherapy plan. Defined Terms: HELICAL = Helical TomoTherapy Plan FIXED_ANGLE = Fixed-angle TomoTherapy plan
>Tomo Referenced Isocenter	(300D,10A9)	3	DS	Ring Gantry System Only: Location of TomoTherapy reference planning isocenter in DICOM PATIENT coordinate system.

### 9.3.12 Approval Module

Attribute Name	Tag	Type	VR	Notes
Approval Status	(300E,0002)	1	CS	Value='APPROVED'
Review Date	(300E,0004)	2C	DA	Treatment plan authorization date.
Review Time	(300E,0005)	2C	TM	Treatment plan authorization time.
Reviewer Name	(300E,0008)	2C	PN	Name of Physician that authorized the treatment plan.





### 9.3.13 SOP Common Module

Attribute Name	Tag	Type	VR	Notes
SOP Class UID	(0008,0016)	1	UI	Value = "1.2.840.10008.5.1.4.1.1.481.5"
SOP Instance UID	(0008,0018)	1	UI	Unique instance UID for this Plan object.
Specific Character Set	(0008,0005)	1C	CS	Value='ISO_IR 100'

## 10.0 RT Plan IOD (RT Plan Storage SCP)

This section specifies the use of the DICOM RT Plan Information Object Definition (IOD) by the CyberKnife, Radixact, and TomoTherapy Systems.

### 10.1 RT Plan IOD Implementation

This section defines the implementation of the RT Plan information object by the CyberKnife, Radixact, and TomoTherapy Systems. It refers to DICOM v3.0 standard, Part 3 (Information Object Definitions). The iDMS System imports an RT Plan.

#### 10.1.1 Entity Relationship Model

Refer to section A.20.3 in DICOM standard, Part 3 (Information Object Definitions) for the E\_R Model of the RT Plan IOD and a description of each of the entities contained within it.

### 10.2 RT Plan IOD Module Table

The table in this section describes the mandatory modules to support the RT Plan IOD. The Reference column refers to sections in this document.

Entity Name	Module Name	Reference	Usage
Patient	Patient	9.3.1	M
	Clinical Trial Subject	Not used	U
Study	General Study	9.3.2	M
	Patient Study	Not used	U
	Clinical Trial Study	Not used	U
Series	RT Series	9.3.3	M
	Clinical Trial Series	Not used	U
Frame of Reference	Frame of Reference	9.3.4	U
Equipment	General Equipment	9.3.5	M
Plan	RT General Plan	9.3.6	M



Entity Name	Module Name	Reference	Usage
	RT Prescription	9.3.7	U
	RT Tolerance Tables	8.3.8	U
	RT Patient Setup	8.3.9	U
	RT Fraction Scheme	9.3.11	U
	RT Beams	9.3.12	C
	RT Brachy Application Setups	Not used	C
	Approval	9.3.13	U
	SOP Common	8.3.13	M

## 11.0 RT Beams Treatment Record IOD (RT Beam Treatment Record Storage SCU)

This section specifies the use of the DICOM RT Beam Treatment Record Information Object Definition (IOD) by the iDMS System.

### 11.1 RT Beams Treatment Record IOD Implementation

This section defines the implementation of the RT Beam Treatment information object by the iDMS System. It refers to the DICOM v3.0 standard, Part 3 (Information Object Definitions). The iDMS System exports an RT Beam Treatment Record.

#### 11.1.1 Entity Relationship Model

Refer to section A.20.3 in the DICOM standard, Part 3 (Information Object Definitions) for the E\_R Model of the RT Plan IOD and a description of each of the entities contained within it.

### 11.2 RT Beams Treatment Record IOD Module Table

The table in this section describes the mandatory modules to support the RT Beams Treatment Record IOD. The Reference column refers to sections in this document.

Entity Name	Module Name	Reference	Usage
Patient	Patient	9.3.1	M
	Clinical Trial Subject	Not used	U
Study	General Study	11.3.1	M
	Patient Study	Not used	U
	Clinical Trial Study	Not used	U
Series	RT Series	11.3.2	M



Entity Name	Module Name	Reference	Usage
	Clinical Trial Series	Not used	U
Equipment	General Equipment	9.3.5	M
Treatment Record	RT General Treatment Record	11.3.3	M
	RT Patient Setup	Table 14	U
	RT Treatment Machine Record	11.3.7	M
	Measured Dose Reference Record	Not used	U
	Calculated Dose Reference Record	Not used	U
	RT Beams Session Record	11.3.7	M
	RT Treatment Summary Record	Not used	U
	SOP Common	11.3.8	M

## 11.3 Information Model Definitions – RT Beams Treatment Record

### 11.3.1 General Study Module

Attribute Name	Tag	Type	VR	Notes
Study Instance UID	(0020,000D)	1	UI	Set to the Study Instance UID of the treatment plan primary fixed CT series. For export of RT Beams Treatment Record, will be overridden by the Study Instance UID received from the OIS, if supplied.
Study Date	(0008,0020)	2	DA	Set to the Study Date of the treatment plan primary fixed CT series. May be empty for RT Beams Treatment Record export.
Study Time	(0008,0030)	2	TM	Set to the Study Time of the treatment plan primary fixed CT series. May be empty for RT Beams Treatment Record export.
Referring Physician Name	(0008,0090)	2	PN	Identification of the physician(s) who are responsible for overall patient at



Attribute Name	Tag	Type	VR	Notes
				time of Study. - Set to the name of the treatment plan referring physician. May be empty for RT Beams Treatment Record export.
Study ID	(0020,0010)	2	SH	Reused from the associated CT Image set for the DICOM RT export. May be empty for RT Beams Treatment Record export.
Accession Number	(0008,0050)	2	SH	Reused from the associated CT Image set for the DICOM RT export. May be empty for RT Beams Treatment Record export.
Physician(s) of Record	(0008,1048)	3	PN	Attribute not always present. The attending oncologist for the original study CT images

### 11.3.2 RT Series Module

Attribute Name	Tag	Type	VR	Notes
Modality	(0008,0060)	1	CS	Value = 'RTRECORD'
Series Instance UID	(0020,000E)	1	UI	Unique identifier of the series
Series Description	(0008,103E)	3	LO	User provided description of the series – For CyberKnife: Set to the treatment plan fraction name: first path number. Fraction fulfillment id for TomoTherapy.
Series Number	(0020,0011)	2	IS	A number that identifies this series. Not always present.
Referenced Performed Procedure Step Sequence	(0008,1111)	3	SQ	ANAP: Present (one item) if procedure was performed under workflow management.
>Referenced SOP Class UID	(0008,1150)	1C	UI	ALWAYS: Value '1.2.840.10008.5.1.4.34.4.1' (Supplement 96 Frozen Draft UPS Push SOP Class)
>Referenced SOP Instance UID	(0008,1155)	1C	UI	ALWAYS: The UPS SOP Instance under which the procedure was performed.



### 11.3.3 General Equipment Module

Attribute Name	Tag	Type	VR	Notes
Manufacturer	(0008,0070)	2	LO	'Accuray Inc.' for CyberKnife. 'TomoTherapy Incorporated' for Ring Gantry System
Station Name	(0008,1010)	3	SH	The name of the treatment system that delivered the treatment. Used by TMS to support subsequent worklist queries.
Manufacturer's Model	(0008,1090)	3	LO	
Device Serial Number	(0018,1000)	3	LO	Serial number of the delivery unit
Software Versions	(0018,1020)	3	LO	iDMS System version at time of construction

### 11.3.4 RT General Treatment Record Module

Attribute Name	Tag	Type	VR	Notes
Instance Number	(0020,0013)	1	IS	CyberKnife: 1 Ring Gantry System: fraction * 100 + makeup fraction number.
Treatment Date	(3008,0250)	2	DA	Fraction delivery date.
Treatment Time	(3008,0251)	2	TM	Fraction delivery time.
Referenced RT Plan Sequence	(300C,0002)	2	SQ	A sequence which provides reference to a RT Plan SOP Class/Instance pair.
> Referenced SOP Class UID	(0008,1150)	1C	UI	RT Plan SOP Class UID
> Referenced SOP Instance UID	(0008,1155)	1C	UI	SOP Instance UID of the RT PLAN associated with the treatment plan.

### 11.3.5 RT Patient Setup

Attribute Name	Tag	Type	VR	Notes
Patient Setup Sequence	(300A,0180)	1	SQ	Introduces sequence of patient setup data for current plan.
> Patient Setup Number	(300A,0182)	1	IS	Value = '1'
> Patient Position	(0018,5100)	1C	CS	Patient position description relative to the equipment.



Attribute Name	Tag	Type	VR	Notes
				Set to the Series table's patient position field.
> Setup Technique	(300A,01B0)	3	CS	Setup Technique used in Patient Setup. Value = "ISOCENTRIC"

### 11.3.6 RT Treatment Machine Record Module

Attribute Name	Tag	Type	VR	Notes
Treatment Machine Sequence	(300A,0206)	1	SQ	Introduces sequence describing treatment machine used for treatment delivery. Only a single item shall be permitted in this Sequence.
> Treatment Machine Name	(300A,00B2)	2	SH	Accuray Treatment Delivery System name.
> Manufacturer	(0008,0070)	2	LO	CyberKnife: Value = 'Accuray, Inc.' Ring Gantry System: Value = 'TomoTherapy Incorporated'
> Institution Name	(0008,0070)	2	LO	Empty.
>Manufacturer's Model Name	(0008,1090)	2	LO	CyberKnife: Value = 'CyberKnife' Ring Gantry System: Value = 'TomoTherapy'
> Device Serial Number	(0018,1000)	2	LO	Accuray Treatment Delivery System Serial Number.

### 11.3.7 RT Beams Session Record Module

Attribute Name	Tag	Type	VR	Notes
Operators' Name	(0008,1070)	2	PN	Name of operator administering treatment session.
Referenced Fraction Group Number	(300C,0022)	3	IS	Value = '1'
Number of Fractions Planned	(300A,0078)	2	IS	Number of prescribed treatment plan fractions.
Primary Dosimeter Unit	(300A,00B3)	1	CS	CyberKnife: Value = 'MU' Ring Gantry System: Value="MINUTE"
Private Creator	(300D,0010)	3	CS	Ring Gantry System Only: Value = 'TOMO_HA_01'



Attribute Name	Tag	Type	VR	Notes
Tomo Performed Work Items	(300D,1090)	3	CS	Ring Gantry System Only: Present if exported under OIS Connectivity, absent otherwise -List of 3 items representing tasks performed in delivering or attempting to deliver the procedure. 1 <sup>st</sup> value: TOMOIMAGE if one or more CTrue Images were performed, else NO_TOMOIMAGE 2 <sup>nd</sup> value: REGISTRATION if a registration was performed for at least one of the CTrue Images, else NO_REGISTRATION 3 <sup>rd</sup> value: TREATMENT if a treatment was delivered, else NO_TREATMENT
Treatment Session Beam Sequence	(3008,0020)	1	SQ	CyberKnife: Introduces sequence of Paths administered during treatment session. The sequence may contain one or more items.Only paths that have been treated will appear within sequence. Ring Gantry System Helical: Number of items = 1 Fixed Angle: If exported under OIS Connectivity-Number of items between 1 (if treatment interrupted on first beam) to the total number of beams in the Fraction (if fraction did not interrupt, or interrupted on last beam) Fixed Angle: If exported separate from OIS Connectivity – total number of beams in the delivery
>Referenced Beam Number	(300C,0006)	3	IS	References Beam specified by Beam Number (300A,00C0) in Beam Sequence (300A,00B0) in RT Beams Module within referenced RT Plan.
>Beam Name	(300A,00C2)	3	LO	References Beam specified by Beam Name (300A, 00C2) in RT Beams Module within referenced RT Plan
>Beam Description	(300A,00C3)	3	ST	CyberKnife: Treatment plan fraction path file name. Ring Gantry System: For helical beams: English-language description of delivery beam pitch and field size



Attribute Name	Tag	Type	VR	Notes
				<p>For fixed angle beams: 'TomoTherapy fixed-angle beam:' followed by beam angle in degrees.</p> <p>For both helical and fixed angle beams, the IECf registration offsets follow.</p> <p>An example beam description appears as:</p> <p>Pitch = 0.192 Field Size = 25.12 IECf X(LAT)=0.10000 IECf Y(LONG)=1.20000 IECf Z(VERT)=0.00000 RX(PITCH)=0.00000 RY(ROLL)=0.20000 RZ(YAW)=0.00000</p>
>Beam Type	(300A,00C4)	1	CS	CyberKnife:Value = 'STATIC' Ring Gantry System: Value='DYNAMIC'
>Radiation Type	(300A,00C6)	1	CS	Value = 'PHOTON'
>Referenced Verification Image Sequence	(300C,0040)	3	SQ	Ring Gantry System Only: Present if one or more CTrue Image sets were acquired and registered in order to position patient. Number of items = number of images in CTrue Image scan acquired and registered immediately prior to delivery. If the last CTrue Image set was acquired but not registered, this sequence will not be present.
>>Referenced SOP Class UID	(0008,1150)	1C	UI	Value '1.2.840.10008.5.1.4.1.1.2' (CT Image)
>>Referenced SOP Instance UID	(0008,1155)	1C	UI	The DICOM Series instance UID of the CTrue Image data object, suffixed with '.' followed by the image number
>Private Creator	(300D,0010)	3	CS	Ring Gantry System Only: Present if Registration Translations and Rotations were generated: Value = 'TOMO_HA_01'
>Tomo Registration Translations	(300D,10B0)	3	DS	Ring Gantry Only:Present if a registration was performed and accepted : X,Y,Z translations in mm between reference image set and registered CTrue image PRIVATE ATTRIBUTE.





Attribute Name	Tag	Type	VR	Notes
>Tomo Registration Rotations	(300D,10B1)	3	DS	Ring Gantry Only: Present if a registration was performed and accepted : X,Y,Z rotations in degrees between reference image set and registered CTrue image, if a registration was performed and accepted. PRIVATE ATTRIBUTE.
>Referenced Calculated Dose Reference Sequence	(3008,0090)	3	SQ	Introduces sequence of doses estimated for each treatment delivery. CyberKnife: The sequence may contain one or more items. Ring Gantry System: Sequence will only contain one item.
>>Referenced Dose Reference Number	(300C,0051)	1C	IS	Uniquely identifies Dose Reference specified by Dose Reference Number (300A,0012) in Dose Reference Sequence (300A,0010) in RT Prescription Module of referenced RT Plan.
>>Calculated Dose Reference Dose Value	(3008,0076)	1C	DS	Treatment plan fraction calculated dose in Gy. If the value of configuration setting 'CKTargetPrescriptionDoseIsRxDose' is true, the dose is with respect to the prescription dose. Otherwise, with respect to the reference point dose.
>Source-Axis Distance	(300A,00B4)	3	DS	CyberKnife: Nominal fraction path Source-Axis Distance. Ring Gantry System: Value=850.0
>Beam Limiting Device Leaf Pairs Sequence	(3008,00A0)	1	IS	Introduces sequence of beam limiting device (collimator) jaw or leaf (element) leaf pair values. CyberKnife: First item used to define the circular collimator in the X direction. – Second item used to define the circular collimator in the Y direction. Ring Gantry: First item used to define collimator slit length. Second item is jaw description
>>RT Beam Limiting Device Type	(300A,00B8)	1	CS	First item: Value = 'X' CyberKnife: Second item: Value = 'Y'



Attribute Name	Tag	Type	VR	Notes
				Ring Gantry System: Second item: 'ASYMY'
>>Number of Leaf/Jaw Pairs	(300A,00BC)	1	IS	Value = '1'
>Referenced Patient Setup Number	(300C,006A)	3	IS	Value = '1'
>Number of Wedges	(300A,00D0)	1	IS	Value = '0'
>Number of Compensators	(300A,00E0)	2	IS	Value = '0'
>Number of Boli	(300A,00ED)	2	IS	Value = '0'
>Number of Blocks	(300A,00F0)	2	IS	Value = '0'
>Current Fraction Number	(3008,0022)	2	IS	Delivered treatment plan fraction number.
>Treatment Delivery Type	(300A,00CE)	2	CS	Value 'CONTINUATION' if part of the fraction was attempted in a previous unified procedure step., Value = 'TREATMENT' otherwise.
>Treatment Termination Status	(3008,002A)	1	CS	Conditions under which treatment was terminated. Enumerated Values: NORMAL = treatment terminated normally OPERATOR = operator terminated treatment MACHINE = machine terminated treatment UNKNOWN = status at termination unknown Ring Gantry: Fixed angle beams not yet attempted in an interrupted fraction will be encoded as 'MACHINE' with a Delivered Meterset (3008,0036) of 0.0
>Treatment Verification Status	(3008,002C)	2	CS	Value = 'VERIFIED'
>Specified Primary Meterset	(3008,0032)	3	DS	CyberKnife: Specified treatment plan fraction path MU. Ring Gantry System: Expected total treatment time in minutes when delivery is completed.



Attribute Name	Tag	Type	VR	Notes
>Specified Secondary Meterset	(3008,0033)	3	DS	Ring Gantry System Only: Expected total Monitor Units (MU) for the beam when delivery is completed. This includes MU for this beam from all previous interrupted procedures for the fraction. See Note 923
>Delivered Primary Meterset	(3008,0036)	3	DS	CyberKnife: Delivered treatment plan fraction path MU Ring Gantry System: Delivered treatment plan fraction time in minutes.
>Delivered Secondary Meterset	(3008,0037)	3	DS	Ring Gantry System Only: Recorded total Monitor Units (MU) for the beam when delivery is completed. This includes MU for this beam from all previous interrupted procedures for the fraction. See Note 2
>Specified Treatment Time	(3008,003A)	3	DS	Ring Gantry System Only: Expected total treatment time in <u>seconds</u> when beam is completed. This includes treatment time for this beam from all previous interrupted procedures for the fraction. Equal to Specified Primary Meterset (3008,0032) multiplied by 60.
>Delivered Treatment Time	(3008,003B)	3	DS	Ring Gantry System Only: Recorded total treatment time in <u>seconds</u> when beam is completed. This includes treatment time for this beam from all previous interrupted procedures for the fraction. Value will be 0.0 if beam delivery was never attempted.
>Number of Control Points	(300A,0110)	1	DS	Value = '2'
>Control Point Delivery Sequence	(3008,0040)	1	SQ	Introduces sequence of beam control points for current treatment beam. CyberKnife: The sequence will contain one item. Ring Gantry System: The sequence will contain two items. It will contain the start control point of the delivery, and the end point of the actual delivery. If the treatment does not complete normally,



Attribute Name	Tag	Type	VR	Notes
				the end control point will not coincide with the last control point in the plan.
>>Referenced Control Point Index	(300C,00F0)	3	IS	Value = '0' Ring Gantry System: Second item: Index of last Control Point in plan if the delivery terminated normally, otherwise ABSENT.
>>Treatment Control Point Date	(3008,0024)	1	DA	Completion date of treatment fraction path delivery.
>>Treatment Control Point Time	(3008,0025)	1	TM	CyberKnife: Completion time of treatment fraction path delivery. Ring Gantry System: 1 <sup>st</sup> item: Time at which first beam started during delivery. 2 <sup>nd</sup> item: Time at which last beam ended during delivery. Indicative value only – use Delivered Meterset as measure of delivery progress. Note: For Fixed Angle plans, this value is meaningful only for the first control point of the first beam, and last control point of the last beam.
>>Specified Meterset	(3008,0042)	2	DS	CyberKnife: Values = 0, n MU to be delivered for treatment plan fraction path. Ring Gantry System: Expected treatment time in minutes for current control point. 1 <sup>st</sup> item: Value 0.0 2 <sup>nd</sup> item: Expected treatment time in minutes.
>>Delivered Meterset	(3008,0044)	1	DS	CyberKnife: Values = 0, Delivered Path MU from current session + Sum of Delivered Path MU from previous sessions. Ring Gantry System: Actual treatment time in minutes when treatment control point is reached. 1 <sup>st</sup> item: 0.0 for all procedures in initial unified procedure step (UPS) for this fraction, or end Delivered Meterset of previous unified procedure step (UPS) delivery for continuation treatments. See also Treatment Delivery Type (300A,00CE).



Attribute Name	Tag	Type	VR	Notes
				2 <sup>nd</sup> item: Actual treatment time in minutes when the treatment terminated (normally or otherwise).
>>Private Creator	(300D,0010)	3	CS	Ring Gantry System Only: Value='TOMO_HA_01'
>>TomoDelivered Secondary Meterset	(300D,10B5)	3	DS	Ring Gantry System Only: Actual delivery MU when treatment control point is reached.  1 <sup>st</sup> item: 0.0 for all procedures in initial unified procedure step (UPS) for this fraction, or end Delivered Secondary Meterset of previous unified procedure step (UPS) delivery for continuation treatments. See also Treatment Delivery Type (300A,00CE).  2 <sup>nd</sup> item: Actual total delivery MU when the treatment terminated (normally or otherwise).  PRIVATE ATTRIBUTE. See Note 923.
>>Dose Rate Set	(300A,0115)	2	DS	CyberKnife: Treatment Delivery System Dose Rate. Ring Gantry System: Value not present
>>Dose Rate Delivered	(3008,0048)	2	DS	CyberKnife: Treatment Delivery System Dose Rate. Ring Gantry: Value not present
>>Nominal Beam Energy	(300A,0114)	3	DS	Value = '6'
>>Nominal Beam Energy Unit	(300A,0015)	1C	CS	Value = 'MV'
>>Beam Limiting Device Position Sequence	(300A,011A)	1C	SQ	Introduces sequence of beam limiting device (collimator) jaw or leaf (element) positions. Required for Control Point 0 of Control Point Delivery Sequence (3008,0040) or if beam limiting device (collimator) changes during beam administration. The sequence may contain one or more items.
>>>RT Beam Limiting Device Type	(300A,00B8)	1C	CS	First item: Value = 'X' CyberKnife: Second item: Value = 'Y' Ring Gantry System: Second item: Value= 'ASYM'



Attribute Name	Tag	Type	VR	Notes
>>>Leaf/Jaw Positions	(300A,011C)	1C	DS	CyberKnife: Fixed Collimator - First item: Value = '(collimator size/2, collimator size/2)' Iris Collimator – First item: Value = '(0,0)' Fixed Collimator - Second item: Value = '(collimator size/2, collimator size/2)' Iris Collimator – Second item: Value = '(0,0)' Ring Gantry: 1 <sup>st</sup> item: 2 values, -200.0 and 200.0 2 <sup>nd</sup> item: 2 values, Y1 (front) and Y2 (back) jaw position at isocenter, in mm.
>>Gantry Angle	(300A,011E)	1C	DS	CyberKnife: Value = '0' Ring Gantry System: TomoTherapy continuous gantry angle represented on IEC 0-359.9 degree scale (IEC GANTRY coordinate system)
>>Gantry Rotation Direction	(300A,011F)	1C	CS	CyberKnife: Value = 'NONE' Ring Gantry System: Helical: Value 'CW' Fixed Angle: Value 'NONE'
>>Beam Limiting Device Angle	(300A,0120)	1C	DS	Value = '0'
>>Beam Limiting Device Rotation Direction	(300A,0121)	1C	CS	Value = 'NONE'
>>Patient Support Angle	(300A,0122)	1C	DS	Value = '0'
>>Patient Support Rotation Direction	(300A,0123)	1C	CS	Value = 'NONE'
>>Table Top Eccentric Angle	(300A,0125)	1C	DS	Value = '0'
>>Table Top Eccentric Rotation Direction	(300A,0126)	1C	CS	Value = 'NONE'
>>Table Top Pitch Angle	(300A,0140)	1C	FL	Value = '0'
>> Table Top Pitch Rotation Direction	(300A,0142)	1C	CS	Value = 'NONE'
>>Table Top Roll Angle	(300A,0144)	1C	FL	Value = '0'
>> Table Top Roll Rotation Direction	(300A,0146)	1C	CS	Value = 'NONE'



Attribute Name	Tag	Type	VR	Notes
>>Table Top Vertical Position	(300A,0128)	2C	DS	No value.
>>Table Top Longitudinal Position	(300A,0129)	2C	DS	No value.
>>Table Top Lateral Position	(300A,012A)	2C	DS	Ring Gantry: if OIS Server type is Varian, then value = 0, otherwise no value.

**NOTE 2:** When a treatment fraction (procedure) is started on one Delivery Machine but completed on another, the delivered dose rate for the second machine may not be equal to that of the initial machine. In such a case, Delivered Secondary Meterset (3008,0037) and the Tomo Delivered Secondary Meterset (300D,10B5) for the control points (both specified in MU) will no longer correspond to the expected secondary metersets in some cases. In all cases, the delivery times recorded in Delivered Primary Meterset (3008,0036) and Delivered Meterset (3008,0044) shall be used as the primary indication of treatment progress.

### 11.3.8 SOP Common Module

Attribute Name	Tag	Type	VR	Notes
SOP Class UID	(0008,0016)	1	UI	Value = 1.2.840.10008.5.1.4.1.1.481.4
SOP Instance UID	(0008,0018)	1	UI	Unique instance UID
Specific Character Set	(0008,0005)	1C	CS	Value='ISO_IR 100'
Instance Creation Date	(0008,0012)	3	DA	Date of actual object construction
Instance Creation Time	(0008,0013)	3	TM	Time of actual object construction

## 12.0 RT Beams Delivery Instruction IOD (RT Beams Delivery Instruction Storage SCP)

This section specifies the use of the DICOM RT Beams Delivery Instruction Object Definition (IOD) by the CyberKnife System.

### 12.1 RT Beams Delivery Instruction IOD Implementation

This section defines the implementation of the RT Beams Delivery Instruction by the CyberKnife System. It refers to the DICOM v3.0 standard, Part 3 (Information Object Definitions). The iDMS System imports an RT Beams Delivery Instruction.

#### 12.1.1 Entity Relationship Model

Refer to section A.tt.3 in the DICOM Supplement 74 for the E\_R Model of the RT Beams Delivery Instruction IOD and a description of each of the entities contained within it.



## 12.2 RT Beams Delivery Instruction IOD Module Table

The table in this section describes the mandatory modules to support the RT Beams Delivery Instruction IOD. The Reference column refers to sections in this document.

Entity Name	Module Name	Reference	Usage
Patient	Patient	9.3.1	M
	Clinical Trial Subject	Not used	U
Study	General Study	9.3.2	M
	Patient Study	Not used	U
	Clinical Trial Study	Not used	U
Series	RT Series	9.3.3	M
	Clinical Trial Series	Not used	U
Frame of Reference	Frame of Reference	9.3.4	U
Equipment	General Equipment	9.3.5	M
Treatment Delivery	RT Beams Delivery Instruction	12.3.1	M
	SOP Common	8.3.13	M

## 12.3 Information Module Definitions – RT Beams Delivery Instruction

### 12.3.1 RT Beams Delivery Instruction Module

Attribute Name	Tag	Type	VR	Notes
Beam Task Sequence	(0074,1020)	1C	SQ	Sequence of items identifying the beams to be delivered and/or verified. Required if beams are to be delivered or verified in this treatment session. One or more items may be included in this sequence.
>Beam Task Type	(0074,1022)	1	CS	Not used
>Treatment Delivery Type	(300A,00CE)	1	CS	Delivery Type of treatment. Enumerated Values: TREATMENT = normal patient treatment CONTINUATION = continuation of interrupted treatment
Referenced RT Plan Sequence	(300C,0002)	2	SQ	A sequence which provides reference to a RT Plan SOP Class/Instance pair.





Attribute Name	Tag	Type	VR	Notes
> Referenced SOP Class UID	(0008,1150)	1C	UI	RT Plan SOP Class UID
> Referenced SOP Instance UID	(0008,1155)	1C	UI	SOP Instance UID of the RT Plan associated with the treatment plan.
>Current Fraction Number	(3008,0022)	1	IS	The index of the fraction that is to be delivered or completed in this session. See C.8.8.aa.1.
>Referenced Fraction Group Number	(300C,0022)	1C	IS	Not used.
>Referenced Beam Number	(300C,0006)	1	IS	Not used.

## 13.0 Raw Data Storage Class

This section describes the implementation of the Information Object named Detector Data Raw Data IOD. This IOD presents the Detector Data from a delivered Ring Gantry System fraction. The following tables identify the entities for each IOD module for the Raw Data Storage Request operation.

The implementation is described to the extent that client vendor's applications can utilize these objects.

Note: this section identifies data that is otherwise not described in this document. The content is not guaranteed and is subject to change without notice.

**Table 15** Detector Data Raw Data Record IOD Entities

Entity Name	Module Name	Usage	Reference
Patient	Patient	M	4.1.4.2.1
	Clinical Trial Subject	U	Not used
Study	General Study	M	4.1.4.2.2
	Patient Study	U	4.2.2.5.15
	Clinical Trial Study	U	Not used
Series	General Series	M	Table 7
	Clinical Trial Series	U	Not used
Equipment	General Equipment	M	4.1.4.2.5
Raw Data	Frame of Reference	U	Not used
	Synchronization	C	Not used
	Specimen	U	Not used
	Raw Data	M	Table 8



Entity Name	Module Name	Usage	Reference
	Acquisition Context	M	Table 12
	SOP Common	M	Table 13

**Table 16** General Series

Attribute Name	Element Tag	Type	Usage notes
Modality	(0008,0060)	1	ALWAYS: Value 'CT' if procedure type is a scan; value 'RTRECORD' if procedure type is a treatment delivery.
Series Instance UID	(0020,000E)	1	ALWAYS: Unique series UID.
Series Number	(0020,0011)	2	ALWAYS: Value equal to the Series Date month and day values (with any leading zero removed), concatenated with the Series Time hour, minute, and whole-number second portions, e.g. '1231235959'.
Laterality	(0020,0060)	2C	ABSENT
Series Description	(0008,103E)	3	ALWAYS: 'Detector Data'
Patient Position	(0018,5100)	2C	ABSENT
No other fields sent from the General Series Module			

**Table 17** Raw Data Module

Attribute Name	Element Tag	Type	Usage notes
Instance Number	(0020,0013)	2	ALWAYS: 1
Content Date	(0008,0023)	1	ALWAYS: the date the detector data was created
Content Time	(0008,0033)	1	ALWAYS: the time the detector data was created
Creator-Version UID	(0008,9123)	1	ALWAYS: an identifier that uniquely specifies the software version and detector model combination.
Referenced Instance Sequence	(0008,114A)	3	SNAP: a sequence that establishes a correlation between the RT plan which was used to develop the delivery that was performed to produce this raw data object
>Referenced SOP Class UID	(0008,1150)	1C	ALWAYS: 1.2.840.10008.5.1.4.1.1.481.5



Attribute Name	Element Tag	Type	Usage notes
>Referenced SOP Instance UID	(0008,1155)	1	ALWAYS: the unique identifier associated with RT Plan that was used to create the procedure that was delivered.
>Purpose of Reference Code Sequence	(0040,A170)	1	The single reference purpose
>>Code Value	(0008, 0100)	1	ALWAYS: '111401'
>>Coding Scheme Designator	(0008,0102)	1	ALWAYS: 'DCM'
>>Code Meaning	(0008,0104)	1	ALWAYS: if Modality is 'RTRECORD', then 'Patient fraction fulfillment'. If Modality is 'CT' then 'Imaging scan'.

**Table 18** Procedure Identification Module

Attribute Name	Element Tag	Type	Usage notes
Private Creator ID	(300D,0020)	1	ALWAYS: TOMO_DD_01
Procedure Number	(300D,2010)	2	VNAP
Procedure Type	(300D,2011)	1	ALWAYS: either 'IMAGE' or 'TREATMENT'
Procedure Purpose	(300D,2012)	1	ALWAYS: one of 'DQA', 'DQA_STATIC', 'PATIENT', 'PATIENT_QA' or 'MACHINE_QA'

**Table 19** Detector Data Module

Attribute Name	Element Tag	Type	Usage notes
Private Creator ID	(300D,0020)	1	ALWAYS: TOMO_DD_01
Detector channel count	(300D,2020)	1	ALWAYS: number of detector array elements composing a frame
Dataset length	(300D,2021)	1	ALWAYS: the number of detector channel frames
Active Projection Beam Sequence	(300D,2026)	3	ANAP: Provides the beam control point to detector data sample association
>Referenced Beam Number	(300C,0006)	1	ALWAYS: the beam number
>Referenced Start Control Point Index	(300C,00F4)	1	ALWAYS: identifies the control point within the Beam referenced by the Referenced Beam



Attribute Name	Element Tag	Type	Usage notes
			Number for start of the capture sequence for the first data frame
>Start Trim	(0008,2142)	1	ALWAYS: identifies the first frame corresponding to the first control point of the referenced beam
>Referenced Stop Control Point Index	(300C,00F6)	1	ALWAYS: identifies the control point within the Beam referenced by the Referenced Beam Number for the start of the capture sequence for the last data frame
>Stop Trim	(0008,2143)	1	ALWAYS: identifies the last frame corresponding to the Referenced Stop Control Point Index (300C,00F6) of the Referenced Beam Number (300C,0006)
Bits Allocated	(0028,0100)	1	ALWAYS: 32 indicating the number of bits per detector data element
Detector data scaling factor	(300D,2022)	1	ALWAYS: the scaling factor for the contained data
Pixel Data	(7FE0,0010)	1	ALWAYS: the detector data, row order by sample set, column order by channel ascending
Compression Type	(300D,2024)	1	ALWAYS: one of 'PROJECTION' <sup>1</sup> or 'COMPRESSION'
Compression Factor	(300D,2025)	1C	VNAP: conditional if (300D,2024) is of value 'COMPRESSION'

**Table 20** Detector Characteristics Module

Attribute Name	Element Tag	Type	Usage notes
Private Creator ID	(300D,0020)	1	ALWAYS: TOMO_DD_01
Detector unit of measure	(300D,2030)	1	ALWAYS: 'CM'
Detector element width	(300D,2031)	2	VNAP: the physical width measured at the center of an individual detector element in the direction parallel to the plane of rotation
Curvature radius	(300D,2032)	2	VNAP: the radius to the center of the arc associated with the detector

<sup>1</sup> The time between two contiguous control points from the RT Plan's Beams module is the length of a projection.



Attribute Name	Element Tag	Type	Usage notes
Surface to Axis Distance	(300D,2033)	2	VNAP: the distance from the peripheral edges of the detector to the beamline
Surface to Center Distance	(300D,2034)	2	VNAP: the distance from the surface of the detector to its center
Channel range	(300D,2035)	2	VNAP: the zero-based beginning and ending channel value indices that identify where the fluence is expected to travel based on MLC constraints
Dose Chamber Start Channel	(300D,2036)	2	VNAP: the zero-based channel

**Table 21** Acquisition Context Module

Attribute Name	Element Tag	Type	Usage notes
Acquisition Context Sequence	(0040,0555)	2	An empty sequence is always sent.

**Table 22** SOP Common Module

Attribute Name	Element Tag	Type	Usage notes
SOP Class UID	(0008,0016)	1	ALWAYS: Value '1.2.840.10008.5.1.4.1.1.66'
SOP Instance UID	(0008,0018)	1	ALWAYS: An identifier uniquely associated with the transmitted raw data set
Specific Character Set	(0008,0005)	1C	ALWAYS: Value 'ISO_IR 100'
Instance Creation Date	(0008,0012)	3	ALWAYS: Date of actual object construction (object send time)
Instance Creation Time	(0008,0013)	3	ALWAYS: Time of actual object construction (object send time)
No other fields sent from the SOP Common Module			

## 14.0 Unified Procedure Step IOD (Unified Procedure Step – PULL SCU)

This section specifies the use of the DICOM Unified Procedure Step IOD by the Ring Gantry and CyberKnife Systems.



## 14.1 Unified Procedure Step IOD Implementation

This section defines the implementation of the Unified Procedure Step by the Ring Gantry and CyberKnife Systems. It refers to the DICOM v3.0 standard, Part 3 (Information Object Definitions) in the Supplement 96.

### 14.1.1 Entity Relationship Model

Refer to Part 3 in the DICOM Supplement 96 for the Unified Procedure Step IOD Modules and a description of each of the entities contained within it.

## 14.2 Unified Procedure Step IOD Module Table

The table in this section describes the mandatory modules to support the Unified Procedure Step IOD. The Reference column refers to sections in this document.

Module Name	Reference	Module Description
SOP Common	8.3.13	Contains SOP common information
Unified Procedure Step Relationship Module	12.3.3	References the related SOPs and IEs
Unified Procedure Step Scheduled Procedure Information	12.3.2	Describes the UPS task to be performed including information about place, time, priority and input data
Unified Procedure Step Progress Information	12.3.1	Describes the progress of a UPS task
Unified Procedure Step Performed Procedure Information	Not used.	Describes the work performed including information about status, place, time and result data.



## 14.3 Information Module Definitions – Unified Procedure Step

### 14.3.1 Unified Procedure Step Progress Information Module

Attribute Name	Tag	VR	Notes
Unified Procedure Step State	(0074,1000)	CS	Contains the state of the Unified Procedure Step. Value = 'SCHEDULED' Enumerated Values: SCHEDULED = The UPS is scheduled to be performed. IN PROGRESS = An SCU has taken ownership of the UPS and has likely started performing the procedure step. This is the only state that implies an exclusive lock. CANCELED = The UPS has been permanently stopped before or during execution of the step due to voluntary or involuntary action by a human or machine. COMPLETED = The UPS has been completed.

### 14.3.2 Unified Procedure Step Schedule Procedure Information Module

Attribute Name	Tag	VR	Notes
Unified Procedure Step Priority	(0074,1200)	CS	Priority of the schedule Unified Procedure Step. Not used.
Scheduled Procedure Step Start Date and Time	(0040,4005)	DA	Date and time on which the Unified Procedure Step is scheduled to start.
Scheduled Workitem Code Sequence	(0040,4018)	SQ	Exactly one sequence item provided.
>Code Value	(0008,0100)	SH	Value = 121726
>Code Scheme Designator	(0008,0102)	SH	Value = 'DCM'
>Code Meaning	(0008,0104)	LO	Value = 'RT Treatment with Internal Verification'



Attribute Name	Tag	VR	Notes
Scheduled Station Name Code Sequence	(0040,4025)	SQ	Exactly one sequence item provided.
>Code Value	(0008,0100)	SH	The Station Name of the treatment delivery system for which a query is being made.
>Code Scheme Designator	(0008,0102)	SH	CyberKnife: value is 'Accuray' Ring Gantry: value is '99_TOMO_STN_NAME'
>Code Meaning	(0008,0104)	LO	The Station Name of the treatment delivery system for which a query is being made.
Scheduled Processing Parameters Sequence	(0074,1210)	SQ	Empty.
Input Information Sequence	(0040,4021)	SQ	Empty.
Study Instance UID	(0020,000D)	UI	Empty.

### 14.3.3 Unified Procedure Step Relationship Module

Attribute Name	Tag	VR	Notes
Patient's Name	(0010,0010)	PN	Empty.
Patient ID	(0010,0020)	LO	Empty.
Patient's Birth Date	(0010,0030)	DA	Empty.





Attribute Name	Tag	VR	Notes
Patient's Sex	(0010,0040)	CS	Empty.
Admitting Diagnoses Description	(0008,1080)	LO	Empty.
Admitting Diagnoses Code Sequence	(0008,1084)	SQ	Empty sequence.

## 15.0 CT Image IOD/CT Image Storage SCP)

This section specifies the use of the DICOM Computed Tomography (CT) Image Information Object Definition (IOD) by the Ring Gantry System.

### 15.1 CT Image IOD Implementation

This section defines the implementation of the CT Image information object by the Ring Gantry System. It refers to the DICOM v3.0 standard, Part 3 (Information Object Definitions).

#### 15.1.1 Entity Relationship Model

Refer to section A.3.3 in the DICOM standard, Part 3 (Information Object Definitions) for the E-R Model of the CT Image IOD and a description of each of the entities contained within it.

### 15.2 CT Image IOD Module Table

Entity Name	Module Name	Usage	Reference
Patient	Patient	M	15.3.1
	Clinical Trial Subject	U	Not used
Study	General Study	M	15.3.2
	Patient Study	U	15.3.3
	Clinical Trial Study	U	Not used
Series	General Series	M	15.3.4
	Clinical Trial Series	U	Not used
Frame of Reference	Frame of Reference	M	15.3.5
Equipment	General Equipment	M	15.3.6
Image	General Image	M	15.3.7
	Image Plane	M	15.3.8
	Image Pixel	M	15.3.9
	Contrast/bolus	C	15.3.10
	Device	U	Not used



Entity Name	Module Name	Usage	Reference
	Specimen	U	Not used
	CT Image	M	15.3.11
	Overlay Plane	U	Not used
	VOI LUT	U	Not used
	SOP Common	M	15.3.12
	Common Instance Reference	U	Not used

## 15.3 Information Model Definitions – CT Image

### 15.3.1 Patient Module

Attribute Name	Element Tag	Type	VR	Usage notes
Patient's Name	(0010,0010)	2	PN	ALWAYS: The selected patient's name
Patient ID	(0010,0020)	2	LO	ALWAYS: The selected patient's medical record number
Patient's Birth Date	(0010,0030)	2	DA	VNAP: The selected patient's birth date
Patient's Sex	(0010,0040)	2	CS	VNAP: For the selected patient: 'M' if Male, 'F' if Female, 'O' if Other, not valued if unknown
Patient's Birth Time	(0010,0032)	3	TM	ANAP: The selected patient's time of birth

### 15.3.2 General Study Module

Attribute Name	Element Tag	Type	VR	Usage notes
Study Instance UID	(0020,000D)	1	UI	ALWAYS: The study instance UID from the original CT images study.
Study Date	(0008,0020)	2	DA	ALWAYS: The date of creation from the original CT images study.
Study Time	(0008,0030)	2	TM	ALWAYS: The time of creation from the original CT images study.
Referring Physician's Name	(0008,0090)	2	PN	ALWAYS: The referring physician from the original CT images study.
Study ID	(0020,0010)	2	SH	ALWAYS: The study ID from the original CT images study.



Attribute Name	Element Tag	Type	VR	Usage notes
Accession Number	(0008,0050)	2	SH	ALWAYS: The accession number from the original CT images study.
Study Description	(0008,1030)	3	LO	ALWAYS: The study description from the original CT images study, otherwise 'TomoTherapy Patient Disease' if absent
Physician(s) of Record	(0008,1048)	3	LO	ANAP: The attending oncologist from the original CT images study.

### 15.3.3 Patient Study Module

Attribute Name	Element Tag	Type	VR	Usage notes
Admitting Diagnoses Description	(0008,1080)	3	LO	ANAP: The admitting diagnoses description for the original study CT images
Patient Age	(0010,1010)	3	AS	ANAP: The patient's age for the original study CT images
Patient Size	(0010,1020)	3	DS	ANAP: The patient's height in meters for the original study CT images
Patient Weight	(0010,1030)	3	DS	ANAP: The patient's weight in kg for the original study CT images.
Additional Patient History	(0010,21B0)	3	LO	ANAP: Additional patient's history for the original study CT images

### 15.3.4 General Series Module

Attribute Name	Element Tag	Type	VR	Usage notes
Modality	(0008,0060)	1	CS	ALWAYS: CT Image Value = 'CT' Spatial Registration Value = 'REG'
Series Instance UID	(0020,000E)	1	UI	ALWAYS: The Accuray UID from the database for the object being transmitted
Series Number	(0020,0011)	2	IS	ALWAYS: Value equals a numeric formatting of the creation date & time of the object in the Accuray database. The format used is 'MMddHHmmss', e.g. '1231285959'.



Attribute Name	Element Tag	Type	VR	Usage notes
Laterality	(0020,0060)	2C	CS	ABSENT
Series Date	(0008,0021)	3	DA	ANAP: The date the image was created in the Accuray database
Series Time	(0008,0031)	3	TM	ANAP: The time the image was created in the Accuray database
Series Description	(0008,103E)	3	LO	ALWAYS: CT Image Value = 'CTTrue Image Set' Spatial Registration Value = 'TomoTherapy Image Registration'
Patient Position	(0018,5100)	2C	CS	ANAP: The patient position for the object being transmitted. The value will be one of the following: HFP, FFP, HFS, FFS.

### 15.3.5 Frame of Reference Module

Attribute Name	Element Tag	Type	VR	Usage notes
Frame of Reference UID	(0020,0052)	1	UI	ALWAYS: CT Image value is the original Frame of Reference UID from the the images transmitted to the Accuray System, if present, otherwise the Accuray UID from the database being transmitted suffixed with '.1.1'. Spatial Registration value is the Frame of Reference from the Reference Image.
Position Reference Indicator	(0020,1040)	2	LO	ANAP: The Position Reference Indicator associated with the original study images

### 15.3.6 General Equipment Module

Attribute Name	Element Tag	Type	VR	Usage notes
Manufacturer	(0008,0070)	2	LO	ALWAYS: Manufacturer of equipment that created object. Value 'TomoTherapy Incorporated' for all exported objects.
Institution Name	(0008,0080)	3	LO	ANAP: Name of institution that created object as recorded in the configuration file on the Ring Gantry System host node.



Attribute Name	Element Tag	Type	VR	Usage notes
Station Name	(0008,1010)	3	LO	ANAP: The name of the treatment system that created object.
Manufacturer Model Name	(0008,1090)	3	LO	ALWAYS: The machine model type associated with the equipment that created object.
Device Serial Number	(0018,1000)	3	LO	ANAP: The device serial number associated with the equipment that created object.
Software Versions	(0018,1020)	3	LO	ALWAYS: Value of treatment system software version for all exported objects. (Multiplicity is always 1.)
Pixel Padding Value	(0028,0120)	1C	US	ABSENT

### 15.3.7 General Image Module

Attribute Name	Element Tag	Type	VR	Usage notes
Instance Number	(0020,0013)	2	IS	ALWAYS: Accuray Image slice number for this slice, starting at 1.
Patient Orientation	(0020,0020)	2C	CS	ABSENT
Content Date	(0008,0023)	2C	DA	ABSENT
Content Time	(0008,0033)	2C	TM	ABSENT
Image Type	(0008,0008)	1	CS	See CT Image Module
Acquisition Date	(0008,0022)	3	DA	ALWAYS: Creation date of the image
Acquisition Time	(0008,0032)	3	TM	ALWAYS: Creation time of the image
Derivation Description	(0008,2111)	3	ST	ABSENT
Images in Acquisition	(0020,1002)	3	US	ALWAYS: Total number of slices in the image series

### 15.3.8 Image Plane Module

Attribute Name	Element Tag	Type	VR	Usage notes
Pixel Spacing	(0028,0030)	1	DS	ALWAYS: The pixel-to-pixel spacing from the CT image converted to mm. X and Y dimensions are provided.



Attribute Name	Element Tag	Type	VR	Usage notes
Image Orientation (Patient)	(0020,0037)	1	DS	ALWAYS: –1.0 (FFS, HFP) or 1.0 (HFS, FFP) 0.0 0.0 0.0 –1.0 (HFP, FFP) or 1.0 (HFS, FFS) 0.0
Image Position (Patient)	(0020,0032)	1	DS	ALWAYS: The coordinates in patient space for the center of the first pixel sent in the array data, converted to mm. X, Y, and Z coordinates provided.
Slice Thickness	(0018,0050)	2	DS	ALWAYS: The slice thickness from the CT image converted to mm.
Slice Location	(0020,1041)	3	DS	ALWAYS: The longitudinal location of the slice in Accuray machine coordinates, converted to mm. This is equivalent to the position along the IEC Yt or Yf axis, but where the location origin coincides with the origin of the DICOM Patient Coordinate System. Note that slice location is of opposite sign to the contour z (DICOM) coordinates for head first patients.

### 15.3.9 Image Pixel Module

Attribute Name	Element Tag	Type	VR	Usage notes
Samples per Pixel	(0028,0002)	1	US	See CT Image Module
Photometric Interpretation	(0028,0004)	1	CS	See CT Image Module
Rows	(0028,0010)	1	US	ALWAYS: The number of rows in the image
Columns	(0028,0011)	1	US	ALWAYS: The number of columns in the image
Bits Allocated	(0028,0100)	1	US	See CT Image Module
Bits Stored	(0028,0101)	1	US	See CT Image Module
High Bit	(0028,0102)	1	US	See CT Image Module
Pixel Representation	(0028,0103)	1	US	ALWAYS: Value 0



Attribute Name	Element Tag	Type	VR	Usage notes
Pixel Data	(7FE0,0010)	1C	OW	ALWAYS: The 16-bit array data for the given slice
Planar Configuration	(0028,0006)	1C	US	ABSENT
Pixel Aspect Ratio	(0028,0034)	1C	IS	ABSENT

### 15.3.10 Contrast/bolus Module

Attribute Name	Element Tag	Type	VR	Usage notes
Contrast/Bolus Agent	(0018,0010)	2	LO	EMPTY

### 15.3.11 CT Image Module

Attribute Name	Element Tag	Type	VR	Usage notes
Image Type	(0008,0008)	1	CS	ALWAYS: 1st value: 'ORIGINAL' 2nd value: 'PRIMARY' 3rd value: 'AXIAL'
Samples per Pixel	(0028,0002)	1	US	ALWAYS: Value 1
Photometric Interpretation	(0028,0004)	1	CS	ALWAYS: Value 'MONOCHROME2'
Bits Allocated	(0028,0100)	1	US	ALWAYS: Value 16
Bits Stored	(0028,0101)	1	US	ALWAYS: Value 16
High Bit	(0028,0102)	1	US	ALWAYS: Value 15
Rescale Intercept	(0028,1052)	1	DS	ALWAYS: Value -1024.0
Rescale Slope	(0028,1053)	1	DS	ALWAYS: Value 1.0
Rescale Type	(0028,1054)	1C	LO	ABSENT
KVP	(0018,0060)	2	DS	VNAP: Value 6000.0
Acquisition Number	(0020,0012)	2	IS	EMPTY



### 15.3.12 SOP Common Module

Attribute Name	Element Tag	Type	VR	Usage notes
SOP Class UID	(0008,0016)	1	UI	ALWAYS: CT Image Value = '1.2.840.10008.5.1.4.1.1.2' Spatial Registration Value = '1.2.840.10008.5.1.4.1.1.66.1'
SOP Instance UID	(0008,0018)	1	UI	CT Image Value = Unique Accuray UID for the series followed by a '.' and the slice number. Spatial Registration Value = Unique Accuray UID.
Specific Character Set	(0008,0005)	1C	CS	ALWAYS: Value 'ISO_IR 192'
Instance Creation Date	(0008,0012)	3	DA	ALWAYS: Date of actual object construction.
Instance Creation Time	(0008,0013)	3	TM	ALWAYS: Time of actual object construction.

## 16.0 Spatial Registration IOD/Spatial Registration SCP)

This section specifies the use of the DICOM Spatial Registration Information Object Definition (IOD) by the Ring Gantry System.

### 16.1 CT Image IOD Implementation

This section defines the implementation of the Spatial Registration information object by the Ring Gantry System. It refers to the DICOM v3.0 standard, Part 3 (Information Object Definitions).

#### 16.1.1 Entity Relationship Model

Refer to section A.39.1.3 in the DICOM standard, Part 3 (Information Object Definitions) for the E-R Model of the Spatial Registration IOD and a description of each of the entities contained within it.

### 16.2 Spatial Registration IOD Module Table

Entity Name	Module Name	Usage	Reference
Patient	Patient	M	15.3.1
	Clinical Trial Subject	U	Not used
Study	General Study	M	15.3.2
	Patient Study	U	15.3.3
	Clinical Trial Study	U	Not used
Series	General Series	M	15.3.4





Entity Name	Module Name	Usage	Reference
	Clinical Trial Series	U	Not used
	Spatial Registration Series	M	16.3.1
Frame of Reference	Frame of Reference	M	15.3.5
Equipment	General Equipment	M	15.3.6
Spatial Registration	Spatial Registration	M	16.3.2
	Common Instance Reference	M	16.3.3
	SOP Common	M	15.3.12

## 16.3 Information Model Definitions – Spatial Registration

### 16.3.1 Spatial Registration Series Module

Attribute Name	Element Tag	Type	VR	Usage notes
Modality	(0008,0060)	1	CS	REG

### 16.3.2 Spatial Registration Module

Attribute Name	Element Tag	Type	VR	Usage notes
Content Date	(0008,0023)	1	DA	ALWAYS: The date the registration was saved to the database.
Content Time	(0008,0033)	1	TM	ALWAYS: The time of registration was saved to the database.
Instance Number	(0020,0013)	1	US	ALWAYS: Value 7.
Content Label	(0070,0080)	1	LO	ALWAYS: The date and time of the actual object's construction, formatted as 'YYMMddHHmmss'.
Content Description	(0070,0081)	2	LO	VNAP: Value = The RT Plan's UID
Content Creator's Name	(0070,0084)	2	PN	ALWAYS: Value "NA"
Registration Sequence	(0070,0308)	1	SQ	ALWAYS: Multiplicity is 2; one for the planning image and one for the registered image.
>Frame of Reference UID	(0070,0308)	1C	UI	ALWAYS: The frame of reference from the image.



Attribute Name	Element Tag	Type	VR	Usage notes
>Referenced Image Sequence	(0008,1140)	1C	SQ	Couch-replaced CT image.
>>Referenced SOP Class UID	(0008,1150)	1	UI	ALWAYS: Value = '1.2.840.10008.5.1.4.1.1.2'
>>Referenced SOP Instance UID	(0008,1155)	1	UI	CT image instance UIDs for each slice in the series.
>Matrix Registration Sequence	(0070,0309)	1	SQ	ALWAYS: Multiplicity is 1.
>>Registration Sub Type	(3275,1000)		LO	ALWAYS: Value = 'Online3D'
>> Private Creator Data Element	(3275, 0010)		LO	ALWAYS: Value = 'Varian Medical Systems VISION 3275'
>>Frame of Reference Transformation Comment	(3006,00C8)	3	LO	ABSENT
>>Registration Type Code Sequence	(0070,030D)	2	SQ	ALWAYS: Multiplicity is 1.
>>>Code Value	(0008,0100)	1	SH	ALWAYS: Value = '125024'
>>>Coding Scheme Designator	(0008,0102)	1	SH	ALWAYS: Value = 'DCM'
>>>Code Meaning	(0008,0104)	1	SH	ALWAYS: Value = 'Image Content-based Alignment'
>>Matrix Sequence	(0070,030A)	1	SQ	ALWAYS: Multiplicity is 1.
>>>Frame of Reference Transformation Matrix	(3006,00C6)	1	LO	ALWAYS: Planning Image value is a 4-dimentional identity matrix. Registered Image value is a 4-dimentional matrix containing the translation and rotational offsets used to register it to the planning image.
>>>Frame of Reference Transformation Matrix Type	(0070,030C)	1	SH	ALWAYS: Value = 'RIGID'
>Used Fiducials Sequence	(0070,0314)	3	SQ	ABSENT
>Used Segments Sequence	(0062,0012)	3	SQ	ABSENT



### 16.3.3 Common Instance Reference Module

Attribute Name	Element Tag	Type	VR	Usage notes
Referenced Series Sequence	(0008,1115)	1C	SQ	ALWAYS: Multiplicity is 2; one for the planning image and one for the registered image.
>Series Instance UID	(0020,000E)	1	UI	ALWAYS: The Accuray UID from the database for the image.
>Referenced Instance Sequence	(0008,114A)	1	SQ	ALWAYS: Multiplicity is always equal to the number of slices.
>>Referenced SOP Class UID	(0008,1150)	1	UI	ALWAYS: Value = '1.2.840.10008.5.1.4.1.1.2'
>>Referenced SOP Instance UID	(0008,1155)	1	UI	CT image instance UIDs for each slice in the respective series.
Studies Containing Other Referenced Instances Sequence	(0008,1200)	1C	SQ	ABSENT

## 17.0 Study Root Query/Retrieve Information Model SCU

This section specifies the use of the DICOM Study Root Query/Retrieve Information Model by the iDMS System.

### 17.1 Query/Retrieve (SCU) Implementation

This section defines the implementation of the Study Root Query/Retrieve Information Model by the iDMS System. It refers to the DICOM v3.0 standard, Part 3 (Information Object Definitions).

### 17.2 Information Model Definitions—Study Root Query/Retrieve

Attribute Name	Tag	VR	Notes
Study Date	(0008,0020)	DA	Date the study started.
Patient's Name	(0010,0010)	PN	Patient's full name.
Patient ID	(0010,0020)	LO	Primary hospital identification number or code for the patient.
Study Instance UID	(0020,000D)	UI	Unique identifier for the study.
Series Instance UID	(0020,000E)	UI	Unique identifier for the series.



## 18.0 RT Treatment Summary Record IOD (RT Treatment Summary Record Storage SCP)

This section specifies the use of the DICOM RT Treatment Summary Record Object Definition (IOD) by the iDMS System.

### 18.1 RT Treatment Summary Record IOD Implementation

This section defines the implementation of the RT Treatment Summary Record by the CyberKnife System. It refers to the DICOM v3.0 standard, Part 3 (Information Object Definitions). The iDMS System imports an RT Treatment Summary Record.

#### 18.1.1 Entity Relationship Model

Refer to section A.31.2 in the DICOM standard, Part 3 (Information Object Definitions) for the E\_R Model of the RT Plan IOD and a description of each of the entities contained within it.

### 18.2 RT Treatment Summary Record IOD Module Table

The table in this section describes the mandatory modules to support the RT Treatment Summary Record IOD. The Reference column refers to sections in this document.

Entity Name	Module Name	Reference	Usage
Patient	Patient	9.3.1	M
	Clinical Trial Subject	Not used	U
Study	General Study	9.3.2	M
	Patient Study	Not used	U
	Clinical Trial Study	Not used	U
Series	RT Series	9.3.3	M
	Clinical Trial Series	Not used	U
Equipment	General Equipment	9.3.5	M
Treatment Record	RT General Treatment Record	18.3.1	M
	RT Treatment Summary Record	18.3.2	M
	SOP Common	8.3.13	M



## 18.3 Information Module Definitions – RT Treatment Summary

### 18.3.1 RT General Treatment Module

Attribute Name	Tag	Type	VR	Notes
Instance Number	(0020,0013)	1	IS	Used to ensure requested object received.
Treatment Date	(3008,0250)	2	DA	Not used.
Treatment Time	(3008,0251)	2	TM	Not used.
Referenced RT Plan Sequence	(300C,0002)	2	SQ	Not used.
> Referenced SOP Class UID	(0008,1150)	1	UI	RT Plan SOP Class UID
> Referenced SOP Instance UID	(0008,1155)	1	UI	SOP Instance UID of the RT Plan associated with the treatment plan – used to check that appropriate plan used.
Referenced Treatment Record Sequence	(3008,0030)	3	SQ	Not used.

### 18.3.2 RT Treatment Summary Record

Attribute Name	Tag	Type	VR	Notes
Current Treatment Status	(3008,0200)	1	CS	Not used.
Treatment Status Comment	(3008,0202)	3	ST	Not used.
First Treatment Date	(3008,0054)	2	DA	Not used.
Most Recent Treatment Date	(3008,0056)	2	DA	Not used.
Fraction Group Summary Sequence	(3008,0220)	3	SQ	Not used.
>Fraction Status Summary Sequence	(3008,0240)	3	SQ	Not used.
Treatment Summary Measured Dose Reference Sequence	(3008,00E0)	3	DQ	Not used.
Treatment Summary Calculated Dose Reference Sequence	(3008,0050)	3	DQ	Sequence of references to Calculated Dose References



Attribute Name	Tag	Type	VR	Notes
>Referenced Dose Reference Number	(300C,0051)	3	IS	Dose Reference specified by Dose Reference Number (300A,0012) in Dose Reference Sequence (300A,0010) in RT Prescription Module of referenced RT Plan
>Dose Reference Description	(300A,0016)	3	LO	Not used.
>Cumulative Dose to Dose Reference	(3008,0052)	1C	DS	Cumulative Dose delivered to Dose Reference (Gy). – Used to compare dose delivered against dose recorded in OIS.

## 19.0 Communication Profiles

### 19.1 Supported Communication Stacks

The iDMS System AE supports the TCP/IP stack as defined in Part 8 of the DICOM 3.0 standard.

### 19.2 Network Media Support

The iDMS System AE is not concerned about the physical network media, as long as it is based on the TCP/IP stack. The default physical media is 100baseT Ethernet.

## 20.0 Extensions, Specializations, Privatizations

Not applicable.

## 21.0 Configuration

The iDMS System AE DICOM configuration is intended to be performed by Accuray personnel only. The host name mapping to an IP address is defined in the local host table.

The default AE title and listening port of the iDMS System operating as an SCP is **N1000\_STORAGE** and **104** respectively.

The default AE title of the iDMS System operating as an SCU is **N1000\_TDS**.

The System Administration application provides the capability for configuring the destination DICOM services used for Treatment Delivery Workflow (TDW) protocol for all connected delivery devices.

The iDMS provides a means for users to select the criteria matching parameters for patients used in the Treatment Delivery Workflow. Users can elect to use either 1) Medical Record number and Last Name (default) or 2) Medical Record number and birth date.



For the detailed configuration information, see the Installation Instructions of the Products.

## 22.0 Support for Extended Character Sets

Extended character sets are not supported by the Products. Only Support for DICOM's default character set repertoire, i.e. ISO-IR 100, is provided.

## 23.0 Annexes

### 23.1 Miscellaneous Macros

#### 23.1.1 Standard Attributes Sets for Code Sequence Attributes (Code Sequence Macro)

Attribute Name	Tag	Type	VR	Notes
Code Value	(0008,0100)	1	SH	
Coding Scheme Designator	(0008,0102)	1	SH	
Coding Scheme Version	(0008,0103)	1C	SH	
Code Meaning	(0008,0104)	1	LO	

### 23.2 Data Dictionary of Private Attributes

Any private attributes should be specified, including VR and VM, should be specified.

#### 23.2.1 Private Creator Identification (TOMO\_HA\_01)

**Table 23** Private Attributes for Treatment Record and RT Plan IODs

Tag	Attribute Name	VR	VM
(300D,0010)	Private Creator	LO	1
(300D,1010)	Tomo Structure Blocking	CS	1
(300D,1012)	Tomo Overlap Precedence	IS	1
(300D,1014)	Tomo Modulation Factor	DS	1
(300D,1016)	Tomo Target Minimum Dose Penalty	IS	1
(300D,1017)	Tomo Target Maximum Dose Penalty	IS	1
(300D,1018)	Tomo Organ At Risk Maximum Dose Penalty	IS	1
(300D,1019)	Tomo Organ At Risk Full Volume Dose Penalty	IS	1
(300D,101B)	Tomo Primary Prescription Type	CS	1
(300D,1040)	Tomo Gantry Period	DS	1



Tag	Attribute Name	VR	VM
(300D,1050)	Tomo Machine UID	UI	1
(300D,1060)	Tomo Treatment Pitch	DS	1
(300D,1080)	Tomo Couch Speed	DS	1
(300D,1090)	Tomo Performed Work Items	CS	3
(300D,10A4)	Tomo Plan Geometry	CS	1
(300D,10A7)	Tomo Projection Sinogram Data	DS	64
(300D,10A9)	Tomo Reference Isocenter	DS	3
(300D,10B0)	Tomo Registration Translations	DS	3
(300D,10B1)	Tomo Registration Rotations	DS	3
(300D,10B5)	Tomo Delivered Secondary Meterset	DS	1
(300D,10C0)	Tomo Plan IVDT Sequence	SQ	NA
(300D,10C1)	Tomo IVDT HU Entry	DS	1
(300D,10C2)	Tomo IVDT Density Entry	DS	1

### 23.2.2 Private Creator Identification (TOMO\_DD\_01)

**Table 24** Private Attributes for Raw Data IE

Tag	Attribute Name	VR	VM
(300D,0020)	Private Creator	LO	1
(300D,2010)	Procedure Number	SH	1
(300D,2011)	Procedure Type	CS	1
(300D,2012)	Procedure Purpose	CS	1
(300D,2020)	Detector channel count	IS	1
(300D,2021)	Dataset length	IS	1
(300D,2022)	Detector data scaling factor	DS	1
(300D,2024)	Compression Type	CS	1
(300D,2025)	Compression Factor	IS	1
(300D,2026)	Active Projection Beam Sequence	SQ	1
(300D,2030)	Detector unit of measure	CS	1
(300D,2031)	Element width	DS	1





Tag	Attribute Name	VR	VM
(300D,2032)	Curvature radius	DS	1
(300D,2033)	Surface to Axis Distance	DS	1
(300D,2034)	Surface to Center Distance	DS	1
(300D,2035)	Channel range	IS	2

### 23.2.3 GE Private Attributes for PET Images

The GE Advance and Discovery family systems reserves private attribute values in group number 0x0009. The private attributes added to PET SOP instances are listed in the following table:

Attribute Name	Tag	Type	VR	VM	Notes
Private Creator Data Element	(0009,0010)	1	SH	1	Private Creator Identification. Value = 'GEMS_PETD_01'

#### 23.2.3.1 GE Scan Module

Attribute Name	Tag	Type	VR	VM	Notes
Scan.scan_datetime	(0009,100D)	3	DT	1	
Scan.tracer_activity	(0009,1038)	3	FL	1	Unit in Million Becquerels (MBq)
Scan.meas_datetime	(0009,1039)	3	DT	1	
Scan.admin_datetime	(0009,103B)	3	DT	1	
Scan.post_inj_activity	(0009,103C)	3	FL	1	Unit in Million Becquerels (MBq)
Scan.post_inj_datetime	(0009,103D)	3	DT	1	
Scan.half_life	(0009,103F)	3	FL	1	Unit in seconds (Sec)

### 23.2.4 PHILIPS Private Attributes for PET Images

The PHILIPS Allegro™ and Gemini™ systems reserves private attribute values in group number 0x7053. The private attributes added to PET SOP instances are listed in the following table:

Attribute Name	Tag	Type	VR	VM	Notes
Private Creator Data Element	(7053,0010)	3	LO	1	Private Creator Identification. Value = 'Philips PET Private Group'
SUV Factor	(7053,1000)	3	DS	1	SUV Factor. The SUV Factor is used to convert the pixel data from counts to a body



					mass SUV value. This is done by multiplying each pixel value by the SUV Factor. If the SUV Factor is 0.0, then the pixel data cannot be converted from counts to an SUV value.
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### 23.2.5 VARIAN Private Attributes for OIS Interface

The VARIAN System Server product family reserves private attribute values in group number 0x32xx. The private attribute added to the Beam Sequence in the RT Beams Module and the RT Beams Session Record Module is listed in the following table:

Attribute Name	Tag	Type	VR	VM	Notes
Private Creator Data Element	(3243,0010)	3	LO	1	Private Creator Identification. Value = 'Varian Medical Systems VISION 3243'
Beam Secondary Name	(3243,1009)	3	SH	1	Secondary beam name. Set to the path name.

The VARIAN System Server product family reserves private attribute values in group number 0x3249. The private attributes are added the RT Fraction Scheme module as specified in the Notes column:

Attribute Name	Tag	Type	VR	VM	Notes
Private Creator Data Element	(3249,0010)	3	LO	1	Private Creator Identification. Value = 'Varian Medical Systems VISION 3249'
Maximum Treatment Time	(3249,1000)	3	DS	1	Maximum treatment time. Value = '30' (minutes) Included in Referenced Beam Sequence for CyberKnife
Referenced Primary Dose Reference UID	(3249,1010)	3	UI	1	Set to the Dose Reference UID that meters the dose. Included in Referenced Beam Sequence for Ring Gantry

The VARIAN System Server product family reserves private attribute values in group number 0x3275. The private attributes added to the Spatial Registration Module are listed in the following table:

Attribute Name	Tag	Type	VR	VM	Notes
Private Creator Data Element	(3275,0010)	3	LO	1	Private Creator Identification.



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Attribute Name	Tag	Type	VR	VM	Notes
					Value = 'Varian Medical Systems VISION 3275'
Registration Sub Type	(3275,1000)	3	DS	1	ALWAYS: Value = 'Online3D'

### 23.2.6 iCAD Private Attributes for MR DCE Images

The iCAD system reserves private attribute values in group number 0x3335. The private attributes added to MR SOP instances are listed in the following table:

Attribute Name	Tag	Type	VR	VM	Notes
Private Creator Data Element	(3335,0011)	3	LO	1	Private Creator Identification. Value = 'iCAD PK'
PERM CAP Value	(3335,1170)	3	LO	1	PERM CAP Value. The PERM CAP Value is used to cap the permeability value in DCE Ktrans series for the color overlay generation.
Ktrans series UID	(3335,0016)	3	LO	1	Ktrans series UID and Ve series UID are matching information for a pair of iCAD DCE series
Ve series UID	(3335,0017)	3	LO	1	Ktrans series UID and Ve series UID are matching information for a pair of iCAD DCE series