

Philips Medical Systems

DICOM

Conformance Statement



Pinnacle³/DICOM

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1. INTRODUCTION

This chapter provides general information about the purpose, scope and contents of this Conformance Statement.

1.1. Scope and Field of Application

The scope of this DICOM Conformance Statement is to facilitate data exchange with equipment of Philips Medical Systems. This document specifies the compliance to the DICOM standard (formally called the NEMA PS 3.X standards). It contains a short description of the applications involved and provides technical information about the data exchange capabilities of the equipment. The main elements describing these capabilities are: the supported DICOM Service Object Pair (SOP) Classes, Roles, Information Object Definitions (IOD) and Transfer Syntaxes.

The field of application is the integration of the Philips Medical Systems equipment into an environment of medical devices. This Conformance Statement should be read in conjunction with the DICOM standard and its addenda.

This conformance statement describes the DICOM conformance of the Pinnacle³ Radiation Treatment Planning System. Pinnacle³ sets the standard for 3D treatment planning and visualization systems. As an imaging workstation, Pinnacle³'s sophisticated 2D and 3D imaging options, multi-modality image fusion, and treatment simulation tools allow users to accurately localize and delineate target and critical structures. Fully integrated photon, electron, stereotactic radiosurgery, and brachytherapy treatment planning allow users to perform all of their treatment planning from a single platform. Finally, accurate 3D dose calculation algorithms and plan evaluation tools facilitate the applications of new treatment techniques.

This application was developed using the MergeCOM-3 Advanced Software Tool Kit for DICOM Services supplied by Merge Technologies Incorporated, Milwaukee, Wisconsin USA.

1.2. Intended Audience

This Conformance Statement is intended for:

- (potential) customers
- system integrators of medical equipment
- marketing staff interested in system functionality
- software designers implementing DICOM interfaces

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

1.3. Contents and Structure

The DICOM Conformance Statement is contained in chapters 2 through 7 and follows the contents and structuring requirements of DICOM PS 3.2.

1.4. Used Definitions, Terms and Abbreviations

DICOM definitions, terms and abbreviations are used throughout this Conformance Statement. For a description of these, see NEMA DICOM Standard, PS 3.3 and PS 3.4.

The word Philips in this document refers to Philips Medical Systems.

1.5. References

1.5.1. [DICOM] The Digital Imaging and Communications in Medicine

(DICOM) standard (NEMA DICOM Standard, PS 3.X):
National Electrical Manufacturers Association (NEMA)
Publication Sales 1300 N. 17th Street, Suite 1847
Rosslyn, Va. 22209, United States of America

1.6. Important Note to the Reader

This Conformance Statement by itself does not guarantee successful interoperability of Philips equipment with non-Philips equipment. The user (or user's agent) should be aware of the following issues:

➤ Interoperability

Interoperability refers to the ability of application functions, distributed over two or more systems, to work successfully together. The integration of medical devices into an IT environment may require application functions that are not specified within the scope of DICOM. Consequently, using only the information provided by this Conformance Statement does not guarantee interoperability of Philips equipment with non-Philips equipment.

It is the user's responsibility to analyze thoroughly the application requirements and to specify a solution that integrates Philips equipment with non-Philips equipment.

➤ Validation

Philips equipment has been carefully tested to assure that the actual implementation of the DICOM interface corresponds with this Conformance Statement.

Where Philips equipment is linked to non-Philips equipment, the first step is to compare the relevant Conformance Statements. If the Conformance Statements indicate that successful information exchange should be possible, additional validation tests will be necessary to ensure the functionality, performance, accuracy and stability of image and image related data. It is the responsibility of the user (or user's agent) to specify the appropriate test suite and to carry out the additional validation tests.

➤ New versions of the DICOM Standard

The DICOM Standard will evolve in the future to meet the user's growing requirements and to incorporate new features and technologies. Philips is actively involved in this evolution and plans to adapt its equipment to future versions of the DICOM Standard. In order to do so, Philips reserves the right to make changes to its products or to discontinue their delivery.

The user should ensure that any non-Philips provider linking to Philips equipment also adapts to future versions of the DICOM Standard. If not, the incorporation of DICOM enhancements into Philips equipment may lead to loss of connectivity (in case of networking) and incompatibility (in case of media).

1.7. General Acronyms and Abbreviations

The following acronyms and abbreviations are used in the document.

- ACC American College of Cardiology
- AE Application Entity
- ACR American College of Radiology
- ANSI American National Standards Institute
- DICOM Digital Imaging and Communications in Medicine
- DIMSE DICOM Message Service Element
- ELE Explicit VR Little Endian
- EBE Explicit VR Big Endian
- ILE Implicit VR Little Endian
- IOD Information Object Definition
- NEMA National Electrical Manufacturers Association
- PDU Protocol Data Unit
- RIS Radiology Information System
- RWA Real World Activity
- SCP Service Class Provider
- SCU Service Class User
- SOP Service Object Pair
- TCP/IP Transmission Control Protocol/Internet Protocol
- UID Unique Identifier

2. IMPLEMENTATION MODEL

This document is the DICOM Conformance statement for the Philips Medical Systems Pinnacle³ Radiation Treatment Planning Software, later referred to as Pinnacle³.

2.1. Application Data Flow Diagram

The ADACRTP_SCP server application stores received DICOM message information within a standard UNIX directory. This directory is specified on the command line of the application launched at system boot. The messages may then be imported into the Pinnacle³ database via the Launch Pad application's Import capability.

For DICOM RT messages, import is performed within the Pinnacle³ application. The Plan or Structure Set information is added to the plan being edited.

ADACRTP_SCP is a daemon, started at system boot, which runs continuously. Launch Pad is a Pinnacle³ application which utilizes an associated DICOM-to-Pinnacle³ file format converter to import DICOM image data to the Pinnacle³ database.

ADACRTP_SCU is the Pinnacle³ application. (Note that the actual AE Title will be the name of the workstation, capitalized; the default name ADACRTP_SCU will only be used if the workstation name cannot be determined.) ADACRTP_SCU will answer Verification requests only if the application is running. Print and RT transmission requests are submitted as requested by the user. It can also send the received CT, MR, NM, and PET images back to the remote server via the DICOM Image Export feature of Launch Pad or CT images used as the primary dataset of the Pinnacle³ plan via the DICOM Image Export feature of Pinnacle³.

The Pinnacle³-related Implementation Model is shown in figure.

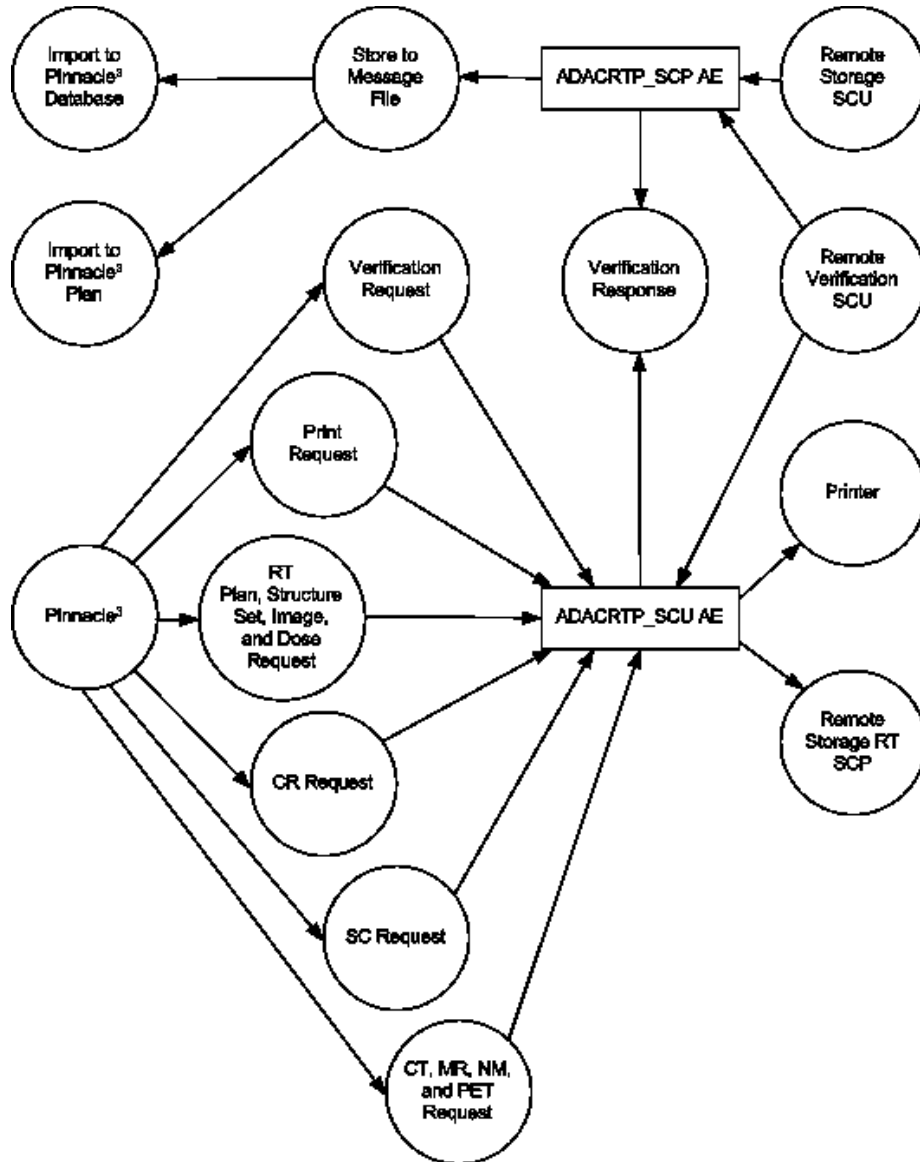


Figure 1: Pinnacle³ Implementation Model

As documented in PS 3.4, the arrows in the diagram have the following meanings:

- An arrow pointing to the right indicates the local application entity initiates an association.
- An arrow pointing to the left indicates the local application entity accepts an association.

2.2. Functional Definition of Application Entities

2.2.1. ADACRTP_SCP

The ADACRTP_SCP server application waits until it receives a C-STORE request from a remote SCU. Upon receipt it will save the received data to a directory with a unique file name. The server is capable of handling multiple associations.

ADACRTP_SCP is a daemon, started at system boot, which runs continuously.

When invoked, the DICOM-to-Pinnacle³ file format converter will scan the directory of files for image messages written by ADACRTP_SCP to determine if individual files may be associated. The association criterion is a matching Series Instance UID. If files belong to the same series, they will be imported to Pinnacle³ as a single data set.

Launch Pad is a Pinnacle³ application that utilizes the DICOM-to-Pinnacle³ file format converter to import DICOM image data to the Pinnacle³ database.

2.2.2. ADACRTP_SCU

Import of RT Plan and RT Structure Set IODs is accomplished within Pinnacle³. The user creates a plan, edits it, and invokes the import operation. The message files will be scanned for RT messages and the selections presented to the user. On import the plan will be populated with the information as described in the selected RT Plan and/or RT Structure Set messages.

The Pinnacle³ application, using the workstation's name as the AE Title or failing that, ADACRTP_SCU, communicates with the remote application using the DICOM protocol. At the user's request an association is established with the AE defined in the printer configuration just prior to sending a print request to that AE. After completion of the transmission the association is closed.

The Pinnacle³ application also communicates with a remote SCP to transfer RT Plan, RT Structure Set, RT Dose, and RT Image IODs. At the user's request an association is established with an AE defined during installation. After completion of the transmission the association is closed. It is also capable of sending the CT, MR, NM and PET images back to the remote server, via the DICOM Image Export feature of Launch Pad or CT images used as the primary dataset of the Pinnacle³ plan within the DICOM Image Export feature of Pinnacle³.

The Pinnacle³ application also communicates with a remote SCP to transfer computed radiography and secondary capture IODs. At the user's request an association is established with an AE defined during installation. After completion of the transmission the association is closed.

2.3. Sequencing of Real World Activities

Not applicable.

3. AE SPECIFICATIONS

The Network capabilities of the system consist of two DICOM Application Entities:

- An Imaging and RT Plan and Structure Set Import Storage AE (ADACRTP_SCP)
- A Send Print, RT Plan, Image, Dose, and Structure Set, Computed Radiography, Secondary Capture, and Imaging AE (ADACRTP_SCU)

Throughout this document ADACRTP_SCU is used to specify the AE Title representing the Pinnacle³ application. In the field the presented AE Title will be the capitalized hostname of the machine sending the message.

3.1. ADACRTP_SCP

The ADACRTP_SCP Application Entity provides Standard Conformance to the DICOM SOP classes as an SCP specified in Table 1.

3.1.1. Association Establishment Policies

Table 1: Supported SOP Classes as SCP by ADACRTP_SCP AE

SOP Class Name	UID
Verification	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
PET Image Storage	1.2.840.10008.5.1.4.1.1.128
NM Image Storage	1.2.840.10008.5.1.4.1.1.20
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3

3.1.1.1. General

The ADACRTP_SCP AE and the ADACRTP_SCU AE always propose the following DICOM Application Context Name (ACN): 1.2.840.10008.3.1.1.1.

The maximum PDU length negotiation is included in all association establishment requests. For all services the maximum PDU size is 28672 bytes.

3.1.1.1.1. Number of Associations

The number of simultaneous associations that will be accepted by ADACRTP_SCP is limited only by system resources. ADACRTP_SCP will spawn a new process to handle each connection request it receives. Therefore, ADACRTP_SCP can support multiple simultaneous connections, and there are no inherent limitations on the total number of simultaneous associations.

The ADACRTP_SCU application entity opens a single association for each request.

3.1.1.1.2. Asynchronous Nature

DICOM asynchronous mode is not supported, meaning that only one transaction may be outstanding over an association at any given point in time.

3.1.1.1.3. Implementation Identifying Information

Implementation Class UID: 2.16.840.1.113669.2.931128

Implementation version name: ADAC_RTP_XX

The implementation version name for ADACRTP_SCU may vary per release. An example of its value is "ADAC_RTP_XX," where XX may vary per release.

3.1.2. Association Acceptance Policy

When ADACRTP_SCP accepts an association it will receive supported SOP Instances and store the messages to disk. There are neither limitations on who may connect to the SCP, nor on the number of simultaneous associations it will support.

When ADACRTP_SCP receives a verification request it responds with a success status.

Import of the data into Pinnacle³ is a separate operation requested by the user. Upon import the attribute values contained in the message will be verified. Import may be performed from the standard directory, written by the SCP, or from CD that conforms to the media interchange format as described in PS3.10.

3.1.2.1. Storage

3.1.2.1.1. Associated Real-World Activity

The ADACRTP_SCP server application responds to remote C-ECHO requests with success status.

The ADACRTP_SCP server application will automatically handle requests for image storage and store them on receipt of C-STORE requests. The file will be stored in the directory specified at startup of the daemon.

The timers used for the management of associations and DICOM services (i.e., C-STORE) are specified in the configuration files for the server.

3.1.2.1.2. Presentation Context Table

Any of the presentation contexts in Table 2 are acceptable for ADACRTP_SCP to receive images. Transfer syntax will be selected based on the following ordering: Explicit Little Endian, then Implicit Little Endian.

Table 2: Supported Presentation Context for the Store Services by ADACRTP_SCP

Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	ELE, ILE	1.2.840.10008.2.1, 1.2.840.10008.2	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	ELE, ILE	1.2.840.10008.2.1, 1.2.840.10008.2	SCP	None
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	ELE, ILE	1.2.840.10008.2.1, 1.2.840.10008.2	SCP	None
NM Image Storage	1.2.840.10008.5.1.4.1.1.20	ELE, ILE	1.2.840.10008.2.1, 1.2.840.10008.2	SCP	None
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	ELE, ILE	1.2.840.10008.2.1, 1.2.840.10008.2	SCP	None
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	ELE, ILE	1.2.840.10008.2.1, 1.2.840.10008.2	SCP	None

3.1.2.1.3. Storage Conformance

ADACRTP_SCP conforms to the SOPs of the Image Storage Service Class at Level 0, meaning a subset of the attributes associated with the image will be stored. All others will be discarded. Stored attributes are described in the tables following.

Upon receipt of a C-STORE request by ADACRTP_SCP, the message is saved to a file in the directory specified to the process at startup. Upon saving the data to this file, a successful C-STORE-RSP is returned to the sender.

If insufficient resources exist to store the messages, a response indicating such will be transmitted and the association aborted. Images transferred prior to depleting the resources will be preserved. The image in the process of transfer upon depletion of resources will be removed.

Minimal interpretation of the transferred images is performed by the Image Storage SCP. Data consistency and orientation issues are addressed when the data is imported to Pinnacle³.

Voxel sizing information is required for image data to be used within Pinnacle³. If the X, Y, or Z voxel dimensions are missing from the DICOM message, the user will be prompted for proper dimensions on import to Pinnacle³.

Pinnacle³ will not accept non-axial data sets for use as a primary data set.

On receipt of Nuclear Medicine data in a multi-image format, each frame of the multi-image is treated as a slice within a volume. The volume is spaced isotropically in the Z dimension.

The following table lists the actions that are performed when an exception occurs. The Service Name Status Responses that are returned by ADACRTP_SCP are given.

Table 3: Exception handling by the C-STORE service

Error Type	Error	Action	Status Response
Error	Insufficient resources	Notification sent, logging and connection aborted	0xA700
Success	NA	NA	0x0000

3.1.2.1.4. SOP Specific Conformance to Verification SOP Class

ADACRTP_SCP provides standard conformance to the DICOM Verification Service Class.

3.1.2.1.5. SOP Specific Conformance to Storage SOP Classes

ADACRTP_SCP conforms to the Image Storage Service Classes at Level 0, meaning a subset of the attributes associated with the image will be stored. All others will be discarded. Stored attributes are described below.

Table 4: Patient Module Attributes

Attribute Name	Tag	Type	Attribute Use
Patient's Name	(0010,0010)	2	Displayed to user.
Patient ID	(0010,0020)	2	Patient ID. Used in the "Medical Record Number" part of the Patient Demographics feature of AcQSim ³ .
Patient's Birth Date	(0010,0030)	2	Birth date of the patient. Used in the Patient Demographics feature of AcQSim ³ .
Patient's Sex	(0010,0040)	2	Displayed to user.

Table 5: General Study Module Attributes

Attribute Name	Tag	Type	Attribute Use
Study Instance UID	(0020,000D)	1	Used to associate multiple images into a single Pinnacle ³ data file.
Study Date	(0008,0020)	2	Displayed to user. Need to contain same value throughout the study or null.
Study Time	(0008,0030)	2	Displayed to user. Need to contain same value throughout the study or null.
Referring Physician's Name	(0008,0090)	2	Patient's referring physician. Used in the Patient Demographics feature of AcQSim ³ .
Study Description	(0008,1030)	3	Study description. Used in the "Comments" field of the Patient Demographics feature of AcQSim ³ .

Table 6: General Series Module Attributes

Attribute Name	Tag	Type	Attribute Use
Modality	(0008,0060)	1	Determine special processing required for interpretation of the image data.
Series Instance UID	(0020,000E)	1	Used to associate multiple images into a single Pinnacle ³ data file.
Patient Position	(0018,5100)	2C	Used to determine the patient's original position/orientation at the scanner. Should contain one of the following enumerated values: HFS, HFP, HF DL, HFDR, FFS, FFP, FF DL, FFDR. (Although this is a type 2 attribute in DICOM Standards, it is important that this info is provided to be used in Pinnacle ³ .)

Table 7: Frame of Reference Module Attributes

Attribute Name	Tag	Type	Attribute Use
Frame of Reference UID	(0020,0052)	1	Uniquely identify the Frame of Reference for the series. For CT and MR data, must be the same for every image in the series.

Table 8: General Equipment Module Attributes

Attribute Name	Tag	Type	Attribute Use
Manufacturer	(0008,0070)	2	Required for licensing.
Manufacturer's Model Name	(0008,1090)	3	Manufacturer's model name.
Pixel Padding Value	(0028,0120)	3	Value of pixels added to non-rectangular image to pad to rectangular format.

Table 9: General Image Module Attributes

Attribute Name	Tag	Type	Attribute Use
Image Number (Instance Number)	(0020,0013)	2	Used as slice number. If no value exists or values are the same throughout the dataset, Pinnacle ³ uses its own slice numbering mechanism.

Table 10: Image Plane Module Attributes

Attribute Name	Tag	Type	Attribute Use
Pixel Spacing	(0028,0030)	1	Physical distance in the patient between the center of each pixel.
Slice Thickness	(0018,0050)	2	Nominal slice thickness, in mm.
Image Position (Patient)	(0020,0032)	1	The x, y, and z coordinates of the upper left corner (center of first voxel transmitted) of the image in mm. Used to properly position each slice in the dataset.
Image Orientation (Patient)	(0020,0037)	1	Used to find out how the image is stored (how it is reconstructed as compared to the original patient scan orientation). In combination with information from "Patient Position" (0018, 5100) field, this is used to properly import the images in the original orientation of the patient scan.
Slice Location	(0020,1041)	3	Position of slice relative to an unspecified implementation-specific reference point. Used to represent horizontal couch position in Philips scanners only.

Table 11: Image Pixel Module Attributes

Attribute Name	Tag	Type	Attribute Use
Samples per Pixel	(0028,0002)	1	Must be 1.
Photometric Interpretation	(0028,0004)	1	Must be MONOCHROME2.
Rows	(0028,0010)	1	Number of rows in the image.
Columns	(0028,0011)	1	Number of columns in the image.
Bits Allocated	(0028,0100)	1	Number of bits allocated for each pixel sample.
Bits Stored	(0028,0101)	1	Number of bits stored for each pixel sample.
Pixel Representation	(0028,0103)	1	Data representation of the pixel samples.
Pixel Data	(7FE0,0010)	1	Pixel data.
Pixel Aspect Ratio	(0028,0034)	1C	Must be 1/1.

Table 12: Multi-Frame Module Attributes

Attribute Name	Tag	Type	Attribute Use
Number of Frames	(0028,0008)	1	The number of frames in a multi-frame message.

Table 13: CT Image Module Attributes

Attribute Name	Tag	Type	Attribute Use
Image Type	(0008,0008)	1	Image identification characteristics.
Rescale Intercept	(0028,1052)	1	Used to scale data to Hounsfield Units.
Rescale Slope	(0028,1053)	1	Used to scale data to Hounsfield Units.
Gantry/Detector Tilt	(0018,1120)	3	If present, must be zero.
Table Height	(0018,1130)	3	Couch height.
High Bit	(0028,0102)	1	Most significant bit for pixel sample data. For CT, NM and PT, value is one less than the value in Bits Stored.

Table 14: MR Image Module Attributes

Attribute Name	Tag	Type	Attribute Use
Image Type	(0008,0008)	1	Image identification characteristics.

Table 15: NM Image Pixel Module Attributes

Attribute Name	Tag	Type	Attribute Use
Image Type	(0008,0008)	1	Image identification characteristics.
High Bit	(0028,0102)	1	Most significant bit for pixel sample data. For CT, NM and PT, value is one less than the value in Bits Stored.

Table 16: NM Reconstruction Module Attributes

Attribute Name	Tag	Type	Attribute Use
Spacing Between Slices	(0018,0088)	2	Used to determine the spacing of the slices for rendering.

Table 17: PET Image Module Attributes

Attribute Name	Tag	Type	Attribute Use
Image Type	(0008,0008)	1	Image identification characteristics.
High Bit	(0028,0102)	1	Most significant bit for pixel sample data. For CT, NM and PT, value is one less than the value in Bits Stored.
Rescale Intercept	(0028,1052)	1	Used to scale data to appropriate units. Always zero for PET images.
Rescale Slope	(0028,1053)	1	Used to scale data to appropriate Units.

Table 18: SOP Common Module Attributes

Attribute Name	Tag	Type	Attribute Use
SOP Class UID	(0008,0016)	1	Used in identifying the SOP class.
SOP Instance UID	(0008,0018)	1	Used in identifying the SOP instance.

3.1.2.1.6. SOP Specific Conformance to RT Structure Set Storage SOP Class

ADACRTP_SCP conforms to the RT Structure Set Storage Service Class at Level 0, meaning a subset of the attributes associated with the image will be stored. All others will be discarded. Stored attributes are described below.

Table 19: Patient Module

Attribute Name	Tag	Type	Attribute Use
Patient's Name	(0010,0010)	2	Used to verify the patient plan matches with the data. Matched with the patient name as entered in Launch Pad.
Patient ID	(0010,0020)	2	Used to verify the patient plan matches with the data. Matched with the medical record number as entered in Launch Pad.
Patient's Birth Date	(0010,0030)	2	Not used.
Patient's Sex	(0010,0040)	2	Used to verify the patient plan matches with the data.

Table 20: RT Series Module

Attribute Name	Tag	Type	Attribute Use
Modality	(0008,0060)	1	RTSTRUCT
Series Instance UID	(0020,000E)	1	Written to transfer log.
Series Number	(0020,0011)	2	Not used.
Series Description	(0008,103E)	3	Not used.

Table 21: General Equipment Module

Attribute Name	Tag	Type	Attribute Use
Manufacturer	(0008,0070)	2	Written to transfer log.
Station Name	(0008,1010)	3	Written to transfer log.
Manufacturer's Model Name	(0008,1090)	3	Written to transfer log.
Software Version	(0018,1020)	3	Written to transfer log.

Table 22: Structure Set Module

Attribute Name	Tag	Type	Attribute Use
Structure Set Label	(3006,0002)	1	Not used.
Structure Set Name	(3006,0004)	3	Not used.
Structure Set Date	(3006,0008)	2	Not used.
Structure Set Time	(3006,0009)	2	Not used.
Referenced Frame of Reference Sequence	(3006,0010)	3	Introduces the sequence describing the frame of reference for the data set. Data must have been transferred to Pinnacle ³ via DICOM.
>Frame of Reference UID	(0020,0052)	1C	Must equal the Frame of Reference UID of the plan data set.
>RT Referenced Study Sequence	(3006,0012)	3	Introduces the sequence describing studies referenced by this structure set. In Pinnacle ³ this identifies the data set used by the plan.
>>Referenced SOP Class UID	(0008,1150)	1C	Not used.
>>Referenced SOP Instance UID	(0008,1155)	1C	Used to verify that the structure set corresponds to the current plan. If not the discrepancy is logged and the user warned.

Table 22: Structure Set Module

Attribute Name	Tag	Type	Attribute Use
>>RT Referenced Series Sequence	(3006,0014)	1C	Introduces the sequence describing the series referenced by this structure set. In Pinnacle ³ this identifies the data set.
>>>Series Instance UID	(0020,000E)	1C	Used to verify that the structure set corresponds to the current plan. If not the discrepancy is logged and the user warned.
>>>Contour Image Sequence	(3006,0016)	1C	Introduces the list of Image Class and Instance UIDs within the data set series. May include images that have no contours assigned.
>>>>Referenced SOP Class UID	(0008,1150)	1C	Used to verify that images used to define contours are of the correct class. If not the discrepancy is logged and the user warned.
>>>>Referenced SOP Instance UID	(0008,1155)	1C	Used to verify that the image to which the contour is assigned has been transferred to Pinnacle ³ . If not the discrepancy is logged and the user warned.
Structure Set ROI Sequence	(3006,0020)	3	Introduces the sequence of structures. One entry per ROI.
>ROI Number	(3006,0022)	1C	Uniquely identifies an ROI when referenced by an ROI Contour and RT ROI Observations modules.
>Referenced Frame of Reference UID	(3006,0024)	1C	Must match the Frame of Reference UID for the data set. If not the discrepancy is logged and the user notified.
>ROI Name	(3006,0026)	2C	Used as the ROI or POI name in Pinnacle ³ . If the name is not a valid Pinnacle ³ name or duplicates an existing name, a new unique name will be generated, the action logged, and the user warned.
>ROI Volume	(3006,002C)	3	Not used.
>ROI Generation Algorithm	(3006,0036)	2C	Not used.

Table 23: ROI Contour Module

Attribute Name	Tag	Type	Attribute Use
ROI Contour Sequence	(3006,0039)	1	Introduces the sequence of Contour Sequences defining ROIs.
>Referenced ROI Number	(3006,0084)	1	Used to match the contours with the ROI data in the Structure Set.
>ROI Display Color	(3006,002A)	3	Used to assign a color to the ROI.
>Contour Sequence	(3006,0040)	3	Introduces the sequence of Contours defining an ROI.
>>Contour Image Sequence	(3006,0016)	3	Introduces the sequence of image UIDs to which this contour corresponds. The sequence will contain 1 item.
>>>Referenced SOP Class UID	(0008,1150)	1C	Required that all Class UIDs are the same. If not the discrepancy will be logged.

Table 23: ROI Contour Module

Attribute Name	Tag	Type	Attribute Use
>>>Referenced SOP Instance UID	(0008,1155)	1C	If present, and if the contour is transverse, the contour is assigned to the image identified by this UID, ignoring the z coordinate specified in the contour data.
>>Contour Geometric Type	(3006,0042)	1C	If POINT, the contour represents a POI. If CLOSED_PLANAR, the contour represents an ROI.
>>Number of Contour Points	(3006,0046)	1C	The number of points describing the contour in the Contour Data attribute.
>>Contour Data	(3006,0050)	1C	The (x, y, z) coordinates of the vertices of a single contour in the ROI.

Table 24: RT ROI Observations Module

Attribute Name	Tag	Type	Attribute Use
RT ROI Observation Sequence	(3006,0080)	1	Introduces a sequence of ROI observations. 1 per beam.
>Observation Number	(3006,0082)	1	Not used.
>Referenced ROI Number	(3006,0084)	1	Not used.

Table 25: SOP Common Module

Attribute Name	Tag	Type	Attribute Use
SOP Class UID	(0008,0016)	1	Must equal 1.2.840.10008.5.1.4.1.1.481.3.
SOP Instance UID	(0008,0018)	1	Not used.
Specific Character Set	(0008,0005)	1C	Written to transfer log.
Instance Creation Date	(0008,0012)	3	Written to transfer log.
Instance Creation Time	(0008,0013)	3	Written to transfer log.

3.1.2.1.7. SOP Specific Conformance to RT Plan Storage SOP Class

ADACRTP_SCP conforms to the RT Plan Storage Service Class at Level 0, meaning a subset of the attributes associated with the image will be stored. All others will be discarded. Stored attributes are described below.

Table 26: Patient Module

Attribute Name	Tag	Type	Attribute Use
Patient's Name	(0010,0010)	2	Used to verify the patient plan matches with the data. Matched with the patient name as entered in Launch Pad.
Patient ID	(0010,0020)	2	Used to verify the patient plan matches with the data. Matched with the medical record number as entered in Launch Pad.
Patient's Birth Date	(0010,0030)	2	Not used.
Patient's Sex	(0010,0040)	2	Used to verify the patient plan matches with the data.

Table 27: RT Series Module

Attribute Name	Tag	Type	Attribute Use
Modality	(0008,0060)	1	RTPLAN
Series Instance UID	(0020,000E)	1	Written to transfer log.
Series Number	(0020,0011)	2	Not used.
Series Description	(0008,103E)	3	Not used.

Table 28: General Equipment Module

Attribute Name	Tag	Type	Attribute Use
Manufacturer	(0008,0070)	2	Written to transfer log.
Station Name	(0008,1010)	3	Written to transfer log.
Manufacturer's Model Name	(0008,1090)	3	Written to transfer log.
Software Version	(0018,1020)	3	Written to transfer log.

Table 29: RT General Plan Module

Attribute Name	Tag	Type	Attribute Use
RT Plan Label	(300A,0002)	1	Not used.
RT Plan Name	(300A,0003)	3	Not used.
RT Plan Description	(300A,0004)	3	Not used.
Operator's Name	(0008,1070)	2	Not used.
RT Plan Date	(300A,0006)	2	Not used.
RT Plan Time	(300A,0007)	2	Not used.
RT Plan Geometry	(300A,000C)	1	Not used.

Table 30: RT Fraction Scheme Module*

Attribute Name	Tag	Type	Attribute Use
Fraction Group Sequence	(300A,0070)	1	Introduces sequence of Fraction Groups in current Fraction Scheme. Each Fraction Group is translated to a Prescription in Pinnacle ³ .
>Fraction Group Number	(300A,0071)	1	Identifies the fraction scheme for a beam.
>Number of Fractions Planned	(300A,0078)	2	The number of fractions for a prescription.

Table 30: RT Fraction Scheme Module*

Attribute Name	Tag	Type	Attribute Use
>Number of Beams	(300A,0080)	1	Used to verify the consistency of the transmitted plan. If this does not match the actual number of beams using this plan, the discrepancy is logged and the user warned.
>Referenced Beam Sequence	(300C,0004)	1C	Introduces the sequence of treatment beams in the current Fraction Group.
>>Referenced Beam Number	(300C,0006)	1C	Associates a prescription with a beam.
>>Beam Dose	(300A,0084)	3	Not used.
>>Beam Meterset	(300A,0086)	3	Not used.
>Number of Brachy Application Setups	(300A,00A0)	1	Not used.

*Attributes related to brachytherapy treatments are not supported.

Table 31: RT Beams Module

Attribute Name	Tag	Type	Attribute Use
Beam Sequence	(300A,00B0)	1	Introduces the sequence of treatment beams for this RT Plan. 1 entry per beam.
>Beam Number	(300A,00C0)	1	Associates the beam with other aspects of the plan, including the Fraction scheme.
>Beam Name	(300A,00C2)	3	The name of the beam. If the name of the beam is illegal within Pinnacle ³ , a new name will be created, the change logged, and the user notified.
>Beam Type	(300A,00C4)	1	DYNAMIC for a beam in which treatment geometry or characteristics are modified during delivery: an Arc beam. STATIC for a stationary, fixed-field beam: a Static or MLC Step-and-Shoot beam.
>Radiation Type	(300A,00C6)	2	The modality of the beam. If it is other than PHOTON or ELECTRON the beam will be rejected.
>Treatment Machine Name	(300A,00B2)	2	The name of the machine assigned to the beam. If a machine of the same name does not exist in the database, the beam will be rejected.
>Manufacturer	(0008,0070)	3	If available, the value is validated against the manufacturer of the machine in the Pinnacle ³ database. If there is a discrepancy it will be logged and the user will be notified.
>Institution Name	(0008,0080)	3	Not used.
>Primary Dosimeter Unit	(300A,00B3)	3	If not MU the beam will be rejected.
>Source to Axis Distance	(300A,00B4)	3	The SAD of the machine assigned to this beam. Verified against the definition of the machine in the Pinnacle ³ database. If it does not match, the discrepancy will be logged and the user notified.
>Beam Limiting Device Sequence	(300A,00B6)	1	Introduces the sequence of beam limiting devices (collimator) jaw or leaf (element) sets.

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Table 31: RT Beams Module

Attribute Name	Tag	Type	Attribute Use
>>Beam Limiting Device Type	(300A,00B8)	1	X = symmetric jaw pair in X direction Y = symmetric jaw pair in Y direction ASYMX = asymmetric jaw pair in X direction ASYMY = asymmetric jaw pair in Y direction MLCX = multileaf jaw pair in X direction MLCY = multileaf jaw pair in Y direction.
>>Source to Beam Limiting Device Distance	(300A,00BA)	3	Verified against the Pinnacle ³ machine definition. If a discrepancy exists, it will be logged and the user notified.
>>Number of Leaf/Jaw Pairs	(300A,00BC)	1	1 signifies a jaw pair, others signify the number of leaf pairs for the MLC assigned to the machine. The value will be verified against the Pinnacle ³ machine definition. If a discrepancy exists, the beam will be rejected.
>>Leaf Position Boundaries	(300A,00BE)	2C	Verified against the machine definition. If a discrepancy exists, the beam will be rejected.
>Referenced Patient Setup Number	(300C,006A)	3	Associates the patient setup and the beam.
>Treatment Delivery Type	(300A,00CE)	3	If not TREATMENT, the beam is rejected.
>Number of Wedges	(300A,00D0)	1	If not 0 or 1, the beam is rejected.
>Wedge Sequence	(300A,00D1)	1C	Introduces sequence of treatment wedges. Required if Number of Wedges is non-zero.
>>Wedge Number	(300A,00D2)	1C	Not used.
>>Wedge Type	(300A,00D3)	2C	Verified against the definition of the wedge specified by the Wedge ID attribute. If a discrepancy exists, the reason will be logged and the user notified. Potential values: STANDARD = standard (static) wedge DYNAMIC = moving beam limiting device, jaw-simulating wedge MOTORIZED = single wedge that can be removed from beam remotely.
>>Wedge ID	(300A,00D4)	3	The wedge assigned to the beam. If the wedge cannot be found in the Pinnacle ³ machine definition the beam will be rejected.
>>Wedge Angle	(300A,00D5)	2C	The angle of the wedge. Used to verify that the wedge specified by Wedge ID matches the definition in the Pinnacle ³ database. If not, the beam is rejected.
>>Wedge Factor	(300A,00D6)	2C	Not used.
>>Wedge Orientation	(300A,00D8)	2C	The orientation of the wedge.
>Number of Compensators	(300A,00E0)	1	Indicates the presence of a compensator. Must be 0 or 1.
>Compensator Sequence	(300A,00E3)	1C	Compensators are not currently imported by Pinnacle ³ .

Table 31: RT Beams Module

Attribute Name	Tag	Type	Attribute Use
>Number of Boluses	(300A,00ED)	1	Bolus is not currently imported by Pinnacle ³ .
>Number of Blocks	(300A,00F0)	1	The number of contours required to describe the block.
>Total Block Tray Factor	(300A,00F2)	3	The tray factor of the beam.
>Block Sequence	(300A,00F4)	1C	Introduces sequence of blocks associated with Beam. Required if Number of Blocks is non-zero.
>> Block Tray ID	(300A,00F5)	3	Not used.
>>Source to Block Tray Distance	(300A,00F6)	2C	The Source to Tray Distance of the machine. Must equal the source to block tray distance in the Pinnacle ³ machine definition. If a discrepancy exists it will be logged and the user notified.
>>Block Type	(300A,00F8)	1C	SHIELDING or APERTURE.
>>Block Divergence	(300A,00FA)	2C	If not PRESENT the discrepancy will be logged and the user notified.
>>Block Number	(300A,00FC)	1C	Treated as the priority of the contour when building the blocking mask.
>>Material ID	(300A,00E1)	2C	Not used.
>>Block Thickness	(300A,0100)	2C	Not used.
>>Block Transmission	(300A,0102)	2C	The block and tray factor of the beam.
>>Block Number of Points	(300A,0104)	2C	The number of points describing the block contour.
>>Block Data	(300A,0106)	2C	Data describing the edge of the block contour.
>Applicator Sequence	(300A,0107)	3	Introduces the sequence of Applicators. Only a single item shall be permitted in this sequence.
>>Applicator ID	(300A,0108)	1C	The user name assigned to the applicator or circular collimator. If the Applicator Type (300A,0109) attribute is STEREOTACTIC, used to select the circular collimator from the Pinnacle ³ database. Otherwise it is used to select the electron applicator from the Pinnacle ³ database. If the collimator or applicator cannot be found in the database, the beam will be rejected.
>>Applicator Type	(300A,0109)	1C	Used to select the proper circular collimator or electron applicator from the Pinnacle ³ database. If the value is STEREOTACTIC, a search will be made of the circular collimators. For ELECTRON_SQUARE and ELECTRON_RECT a search will be made of the electron applicators. Otherwise, the beam will be rejected.
>Final Cumulative Meterset Weight	(300A,010E)	1C	Not used.
>Number of Control Points	(300A,0110)	1	Defines the number of control points for the beam.

Table 31: RT Beams Module

Attribute Name	Tag	Type	Attribute Use
>Control Point Sequence	(300A,0111)	1	Introduces the sequence of machine configurations describing this treatment beam.
>>Control Point Index	(300A,0112)	1C	Not used.
>>Cumulative Meterset Weight	(300A,0134)	2C	Specifies the treatment weight for this control point.
>>Nominal Beam Energy	(300A,0114)	3	The machine energy for this machine. If not found, the beam is rejected.
>>Wedge Position Sequence	(300A,0116)	3	Introduces sequence of wedge positions and identities for this control point.
>>>Referenced Wedge Number	(300C,01C0)	1C	Specifies the wedge assigned to the beam.
>>>Wedge Position	(300A,0118)	1C	IN or OUT.
>>Beam Limiting Device Position Sequence	(300A,011A)	1C	Introduces the sequence of beam limiting device (collimator) jaw or leaf (element) positions.
>>>RT Beam Limiting Device Type	(300A,00B8)	1C	Specifies the type of beam limiting device for this control point. Valid values: X = symmetric jaw pair in X direction Y = symmetric jaw pair in Y direction ASYMX = asymmetric jaw pair in X direction ASYMY = asymmetric jaw pair in Y direction MLCX = multileaf jaw pair in X direction MLCY = multileaf jaw pair in Y direction.
>>>Leaf/Jaw Positions	(300A,011C)	1C	The jaw or MLC leaf positions for this control point. Beam Limiting Device Types of X, Y, ASYMX, and ASYMY will be assigned to the jaws. MLCX and MLCY will set the MLC leaf positions.
>>Gantry Angle	(300A,011E)	1C	The gantry angle of the beam at this control point.
>>Gantry Rotation Direction	(300A,011F)	1C	Specifies the direction of rotation of the gantry. Possible values: NONE, CW, or CC.
>>Beam Limiting Device Angle	(300A,0120)	1C	The collimator angle for the beam.
>>Beam Limiting Device Rotation Direction	(300A,0121)	1C	Must be NONE.
>>Patient Support Angle	(300A,0122)	1C	The couch angle for the beam.
>>Patient Support Rotation Direction	(300A,0123)	1C	Must be NONE.
>>Table Top Eccentric Angle	(300A,0125)	1C	Not used.
>>Table Top Eccentric Rotation Direction	(300A,0126)	1C	Not used.
>>Table Top Vertical Position	(300A,0128)	2C	Not used.
>>Table Top Longitudinal Position	(300A,0129)	2C	Not used.
>>Table Top Lateral Position	(300A,012A)	2C	Not used.
>>Isocenter Position	(300A,012C)	2C	Import as POI, and set isocenter position of beam.
>>Source to Surface Distance	(300A,0130)	3	SSD of the beam.

Table 32: SOP Common Module

Attribute Name	Tag	Type	Attribute Use
SOP Class UID	(0008,0016)	1	Must be '1.2.840.10008.5.1.4.1.1.481.5' or the plan is rejected.
SOP Instance UID	(0008,0018)	1	Not used.
Specific Character Set	(0008,0005)	1C	Written to the transfer log.
Instance Creation Date	(0008,0012)	3	Written to the transfer log.
Instance Creation Time	(0008,0013)	3	Written to the transfer log.

3.2. ADACRTP_SCU Specification

The ADACRTP_SCU provides standard conformance to the DICOM Basic Color Print Management Meta and Basic Grayscale Print Management Meta SOP classes, as well as the Print Job SOP class as a DICOM Basic Print User (SCU). ADACRTP_SCU also provides standard conformance to the DICOM RT Plan, RT Structure Set, RT Image, RT Dose, Computed Radiography, Secondary Capture, CT, MR, NM, and PET Storage SOP classes.

3.2.1. Association Establishment Policies

Table 33: Supported SOP Classes as SCU by ADACRTP_SCU

SOP Class Name	UID
Verification	1.2.840.10008.1.1
Basic Grayscale Print Management (META)	1.2.840.10008.5.1.1.9
Basic Film Session	1.2.840.10008.5.1.1.1
Basic Film Box	1.2.840.10008.5.1.1.2
Basic Grayscale Image Box	1.2.840.10008.5.1.1.4
Printer	1.2.840.10008.5.1.1.16
Basic Color Print Management (META)	1.2.840.10008.5.1.1.18
Basic Film Session	1.2.840.10008.5.1.1.1
Basic Film Box	1.2.840.10008.5.1.1.2
Basic Color Image Box	1.2.840.10008.5.1.1.4.1
Printer	1.2.840.10008.5.1.1.16
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1
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
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
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
PET Image Storage	1.2.840.10008.5.1.4.1.1.128
NM Image Storage	1.2.840.10008.5.1.4.1.1.20

3.2.1.1. General

The ADACRTP_SCU Network AE always proposes the following DICOM Application Context Name (ACN): 1.2.840.10008.3.1.1.1.

The maximum PDU length negotiation is included in all association establishment requests. The maximum PDU size is: 28 KB.

Note that the actual local AE Title will be the name of the workstation, capitalized: the default name 'ADACRTP_SCU' will only be used if the workstation name cannot be determined.

3.2.1.1.1. Number of Associations

The ADACRTP_SCU application entity opens a single association for each user requested transfer.

3.2.1.1.2. Asynchronous Nature

DICOM asynchronous mode is not supported meaning that only one transaction may be outstanding over an association at any given point in time.

3.2.1.1.3. Implementation Identifying Information

Implementation Class UID: 2.16.840.1.113669.2.931128

Implementation version name: ADAC_RTP_XX

The implementation version name for ADACRTP_SCU may vary per release. An example of its value is "ADAC_RTP_XX," where XX may vary per release.

3.2.2. Association Initiation Policy**3.2.2.1. Storage****3.2.2.1.1. Associated Real-World Activity**

When transmitting RT IODs, ADACRTP_SCU initiates an association for RT Plan, RT Image, RT Dose, and RT Structure Set based on the information selected by the user. If both ROIs and POIs are transferred both ROIs and POIs will be include in a single RT Structure Set instance. The association is closed after completion of the transfer.

The configuration of the printer in Pinnacle³ also includes the time-out value to wait for a reply message from the SCP. The default value is 30 seconds. If the time-out is exceeded, ADACRTP_SCU will abort the association.

3.2.2.1.2. Associated Real-World Activity for Storage Operations

ADACRTP_SCU initiates associations on request from the user. An association is established with the specified application entity. ADACRTP_SCU sends a C_STORE request for each message to be sent. When the user requests transfer of ROIs and POIs, they will be transferred over the same association but as separate C_STORE requests.

3.2.2.1.3. Presentation Context Table

ADACRTP_SCU will initiate the presentation contexts as given in the following table.

Table 34: Supported Presentation Context for the Store Services by ADACRTP_SCU

Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	ELE, EBE, ILE	1.2.840.10008.2.1, 1.2.840.10008.2.2, 1.2.840.10008.2	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	ELE, EBE, ILE	1.2.840.10008.2.1, 1.2.840.10008.2.2, 1.2.840.10008.2	SCU	None
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	ELE, EBE, ILE	1.2.840.10008.2.1, 1.2.840.10008.2.2, 1.2.840.10008.2	SCU	None
NM Image Storage	1.2.840.10008.5.1.4.1.1.20	ELE, EBE, ILE	1.2.840.10008.2.1, 1.2.840.10008.2.2, 1.2.840.10008.2	SCU	None

Table 34: Supported Presentation Context for the Store Services by ADACRTP_SCU

Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
Basic Grayscale Print Management (META)	1.2.840.10008.5.1.1.9	ELE, EBE, ILE	1.2.840.10008.2.1, 1.2.840.10008.2.2, 1.2.840.10008.2	SCU	None
Basic Color Print Management (META)	1.2.840.10008.5.1.1.18	ELE, EBE, ILE	1.2.840.10008.2.1, 1.2.840.10008.2.2, 1.2.840.10008.2	SCU	None
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	ELE, EBE, ILE	1.2.840.10008.2.1, 1.2.840.10008.2.2, 1.2.840.10008.2	SCU	None
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	ELE, EBE, ILE	1.2.840.10008.2.1, 1.2.840.10008.2.2, 1.2.840.10008.2	SCU	None
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	ELE, EBE, ILE	1.2.840.10008.2.1, 1.2.840.10008.2.2, 1.2.840.10008.2	SCU	None
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	ELE, EBE, ILE	1.2.840.10008.2.1, 1.2.840.10008.2.2, 1.2.840.10008.2	SCU	None
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	ELE, EBE, ILE	1.2.840.10008.2.1, 1.2.840.10008.2.2, 1.2.840.10008.2	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	ELE, EBE, ILE	1.2.840.10008.2.1, 1.2.840.10008.2.2, 1.2.840.10008.2	SCU	None

3.2.2.1.4. Storage Conformance

ADACRTP_SCU provides standard conformance to the DICOM Storage Service Class.

3.2.2.1.5. SOP Specific Conformance to Verification SOP Class

ADACRTP_SCU provides standard conformance to the DICOM Verification Service Class.

3.2.2.1.6. SOP Specific Conformance to RT Image Storage SOP Class

Attribute values for the RT Image SOP class proposed by ADACRTP_SCU are described below.

Table 35: Patient Module

Attribute Name	Tag	Type	Attribute Use
Patient's Name	(0010,0010)	2	Patient's full legal name, as entered in Launch Pad.
Patient ID	(0010,0020)	2	The patient's Medical Record Number, as entered in Launch Pad.
Patient's Birth Date	(0010,0030)	2	The patient's Birthdate, as entered in Launch Pad.
Patient's Sex	(0010,0040)	2	M, F, or O as appropriate based on Launch Pad entry.

Table 36: General Study Module

Attribute Name	Tag	Type	Attribute Use
Study Instance UID	(0020,000D)	1	Generated.
Study Date	(0008,0020)	2	Copied from the Primary Image set, if transferred via DICOM.
Study Time	(0008,0030)	2	Copied from the Primary Image set, if transferred via DICOM.
Referring Physician's name	(0008,0090)	2	Empty.
Study ID	(0020,0010)	2	Empty.
Accession Number	(0008,0050)	2	Empty.
Study Description	(0008,1030)	3	Comment as entered in Launch Pad.
Physician of Record	(0008,1048)	3	Physician as entered in Launch Pad.
Referenced Study Sequence	(0008,1110)	3	Introduces the sequence describing the study containing the data set for which this set of ROIs was defined.
>Referenced SOP Class UID	(0008,1150)	1C	'1.2.840.10008.3.1.2.3.2'.
>Referenced SOP Instance UID	(0008, 1155)	1C	Study UID of the data set from which this image was defined.

Table 37: RT Series Module

Attribute Name	Tag	Type	Attribute Use
Modality	(0008,0060)	1	'RTIMAGE'.
Series Instance UID	(0020,000E)	1	Generated.
Series Number	(0020,0011)	2	Empty.
Series Description	(0008,103E)	3	Empty.

Table 38: Frame of Reference Module

Attribute Name	Tag	Type	Attribute Use
Frame of Reference UID	(0020,0052)	1	Matches the Frame of Reference UID for the primary image set if the patient position has not been altered on import. If the patient position was altered on import, a new Frame of Reference UID will be generated.
Position Reference Indicator	(0020,1040)	2	Empty.

Table 39: General Equipment Module

Attribute Name	Tag	Type	Attribute Use
Manufacturer	(0008,0070)	2	'ADAC'.
Station Name	(0008,1010)	3	The host name of the workstation which transmits the data.
Manufacturer's Model Name	(0008,1090)	3	'Pinnacle3'.
Software Version	(0018,1020)	3	Current version of Pinnacle ³ which transmits the data.

Table 40: General Image Module

Attribute Name	Tag	Type	Attribute Use
Instance Number	(0020,0013)	2	A unique number for each IOD instance sent in a single transfer operation.
Patient Orientation	(0020,0020)	2C	Empty.
Content Date	(0008,0023)	2C	Date the transfer was performed.
Content Time	(0008,0033)	2C	Time the transfer was performed..

Table 41: Image Pixel Module Attributes

Attribute Name	Tag	Type	Attribute Use
Samples per Pixel	(0028,0002)	1	'1'.
Photometric Interpretation	(0028,0004)	1	'MONOCHROME2'.
Rows	(0028,0010)	1	Number of rows in the image.
Columns	(0028,0011)	1	Number of columns in the image.
Bits Allocated	(0028,0100)	1	Number of bits allocated for each pixel sample. (16)
Bits Stored	(0028,0101)	1	Number of bits stored for each pixel sample. ('16')
High Bit	(0028,0102)	1	Most significant bit for pixel sample data. ('15')
Pixel Representation	(0028,0103)	1	Data representation of the pixel samples. ('0')
Pixel Data	(7FE0,0010)	1	Pixel data.

Table 42: RT Image Module Attributes

Attribute Name	Tag	Type	Attribute Use
RT Image Label	(3002,0002)	1	Beam Name appended with BEV
Operator's Name	(0008,1070)	2	Dosimetrist Name as entered in Launch Pad.
Image Type	(0008,0008)	1	'DERIVED\SECONDARY\DRR'.
Conversion Type	(0008,0064)	2	'WSD'.
Samples per Pixel	(0028,0002)	1	'1'.
Photometric Interpretation	(0028,0004)	1	'MONOCHROME2'.
Rows	(0028,0010)	1	Number of rows in the image.
Columns	(0028,0011)	1	Number of columns in the image.
Bits Allocated	(0028,0100)	1	Number of bits allocated for each pixel sample. ('16')
Bits Stored	(0028,0101)	1	Number of bits stored for each pixel sample. ('16')
High Bit	(0028,0102)	1	Most significant bit for pixel sample data. ('15')

Table 42: RT Image Module Attributes

Attribute Name	Tag	Type	Attribute Use
Pixel Representation	(0028,0103)	1	Data representation of the pixel samples. ('0')
RT Image Label	(3002,0002)	1	Name of the beam from which the DRR is generated.
RT Image Plane	(3002,000C)	1	'NORMAL'.
X-Ray Image Receptor Translation	(3002,000D)	3	'0.0\0.0\0.0'.
X-Ray Image Receptor Angle	(3002,000E)	2	If Image Type (0008,0008) is DRR set to 0, otherwise it is equivalent to the collimator angle of the beam.
Image Plane Pixel Spacing	(3002,0011)	2	Pixel size in the format X\Y in mm.
RT Image Position	(3002,0012)	2	Coordinate of the center of the first pixel transmitted.
Radiation Machine Name	(3002,0020)	2	The name of the machine assigned to the beam corresponding to this image.
Primary Dosimeter Unit	(300A,00B3)	2	'MU'.
Radiation Machine SAD	(3002,0022)	2	Distance from source to gantry rotation axis for the beam in mm.
Radiation Machine SSD	(3002,0024)	3	Distance from source to patient surface for the beam in mm.
RT Image SID	(3002,0026)	2	SAD for the beam in mm.
Gantry Angle	(300A,011E)	3	The gantry angle of the beam for this control point. Control point zero will always represent the starting angle for the beam.
Beam Limiting Device Angle	(300A,0120)	3	The collimator angle for the beam.
Patient Support Angle	(300A,0122)	3	The couch angle for the beam.
Referenced RT Plan Sequence	(300C,0002)	3	The sequence is included only if the export of an RT Plan is performed within the same association as RT Image instance.
>Referenced SOP Class UID	(0008,1150)	1C	'1.2.840.10008.5.1.4.1.1.481.5'.
>Referenced SOP Instance UID	(0008,1155)	1C	Instance UID of RT plan object exported in the same association as this RT Image instance.
Referenced Beam Number	(300C,0006)	3	Identifies the beam number of this beam within that RT Plan instance exported simultaneously with the RT Image instance.

Table 43: Modality LUT Module

Attribute Name	Tag	Type	Attribute Use
Rescale Intercept	(0028,1052)	1C	'0.0'.
Rescale Slope	(0028,1053)	1C	'1.0'.
Rescale Type	(0028,1054)	1C	'US'.

Table 44: VOI LUT Module

Attribute Name	Tag	Type	Attribute Use
Window Center	(0028,1050)	1C	The default window center value for the image, for display purposes.
Window Width	(0028,1051)	1C	The default window width value for the image, for display purposes.

Table 45: SOP Common Module

Attribute Name	Tag	Type	Attribute Use
Instance Creation Date	(0008,0012)	3	The date the message was created.
Instance Creation Time	(0008,0013)	3	The time the message was created.

3.2.2.1.7. SOP Specific Conformance to RT Dose Storage SOP Class

Attribute values for the RT Dose SOP class proposed by ADACRTP_SCU are described below.

Table 46: Patient Module

Attribute Name	Tag	Type	Attribute Use
Patient's Name	(0010,0010)	2	Patient's full legal name, as entered in Launch Pad.
Patient ID	(0010,0020)	2	The patient's Medical Record Number, as entered in Launch Pad.
Patient's Birth Date	(0010,0030)	2	The patient's Birthdate, as entered in Launch Pad.
Patient's Sex	(0010,0040)	2	M, F, or O as appropriate based on Launch Pad entry.

Table 47: General Study Module

Attribute Name	Tag	Type	Attribute Use
Study Instance UID	(0020,000D)	1	Generated.
Study Date	(0008,0020)	2	Copied from the Primary Image set, if transferred via DICOM.
Study Time	(0008,0030)	2	Copied from the Primary Image set, if transferred via DICOM.
Referring Physician's name	(0008,0090)	2	Empty.
Study ID	(0020,0010)	2	Empty.
Accession Number	(0008,0050)	2	Empty.
Study Description	(0008,1030)	3	Comment as entered in Launch Pad.
Physician of Record	(0008,1048)	3	Physician as entered in Launch Pad.
Referenced Study Sequence	(0008,1110)	3	Introduces the sequence describing the study containing the data set for which this set of ROIs was defined.
>Referenced SOP Class UID	(0008,1150)	1C	'1.2.840.10008.3.1.2.3.2'.
>Referenced SOP Instance UID	(0008,1155)	1C	Study UID of the data set from which this image was defined.

Table 48: RT Series Module

Attribute Name	Tag	Type	Attribute Use
Modality	(0008,0060)	1	'RTDOSE'.
Series Instance UID	(0020,000E)	1	Generated.
Series Number	(0020,0011)	2	Empty.
Series Description	(0008,103E)	3	Empty.

Table 49: Frame Of Reference

Attribute Name	Tag	Type	Attribute Use
Frame of Reference UID	(0020,0052)	1	Matches the Frame of Reference UID for the primary image set if the patient position has not been altered on import. If the patient position was altered on import, a new Frame of Reference UID will be generated.
Position Reference Indicator	(0020,1040)	2	Empty.

Table 50: General Equipment Module

Attribute Name	Tag	Type	Attribute Use
Manufacturer	(0008,0070)	2	'ADAC'.
Station Name	(0008,1010)	3	The host name of the workstation which transmits the data.
Manufacturer's Model Name	(0008,1090)	3	'Pinnacle3'.
Software Version	(0018,1020)	3	Current version of Pinnacle ³ which transmits the data.

Table 51: General Image Module

Attribute Name	Tag	Type	Attribute Use
Instance Number	(0020,0013)	2	A unique number for each IOD instance sent in a single transfer operation.
Patient Orientation	(0020,0020)	2C	Empty.
Content Date	(0008,0023)	2C	Date the transfer was performed.
Content Time	(0008,0033)	2C	Time the transfer was performed..

Table 52: Image Plane Module

Attribute Name	Tag	Type	Attribute Use
Pixel Spacing	(0028,0030)	1	Physical distance in the patient between the center of each voxel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing in mm.
Image Orientation (Patient)	(0020,0037)	1	The direction cosines of the first row and the first column with respect to the patient. Matches the orientation of the Primary Image Set.
Image Position (Patient)	(0020,0032)	1	The x, y, and z coordinates of the upper left hand corner (center of the first voxel transmitted) of the image, in mm.
Slice Thickness	(0018,0050)	2	The spacing, in mm, between slices of the dose grid planes.

Table 53: RT Dose Module

Attribute Name	Tag	Type	Attribute Use
Samples per Pixel	(0028,0002)	1	'1'.
Photometric Interpretation	(0028,0004)	1	'MONOCHROME2'.
Rows	(0028,0010)	1	Number of rows in the dose grid.
Columns	(0028,0011)	1	Number of columns in the dose grid.
Bits Allocated	(0028,0100)	1	'16'.
Bits Stored	(0028,0101)	1	'16'.
High Bit	(0028,0102)	1	'15'.
Pixel Representation	(0028,0103)	1	'0'. (unsigned integer)
Dose Units	(3004,0002)	1	Units used to describe dose: 'GY' (Gray)
Dose Type	(3004,0004)	1	'PHYSICAL' (physical dose)
Dose Summation Type	(3004,000A)	1	'PLAN' (dose calculated for a single Prescription (Fraction Group) within an RT Plan)
Normalization Point	(3004,0008)	3	If specified for the plan, the position of the dose normalization point in the patient coordinate system.
Grid Frame Offset Vector	(3004,000C)	1C	An array which contains the z coordinates (in mm) of the image frames in a multiframe dose. All coordinates are relative to Image Position (Patient) (0020,0032).
Dose Grid Scaling	(3004,000E)	1	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).
Referenced RT Plan Sequence	(300C,0002)	1C	Introduces sequence of one Class/Instance pair describing the RT Plan associated with the dose.
>Referenced SOP Class UID	(0008,1150)	1C	'1.2.840.10008.5.1.4.1.1.481.5' (RT Plan Storage)
>Referenced SOP Instance UID	(0008,1155)	1C	Unique identifier of the referenced RT Plan SOP Instance.
Pixel Data	(7FE0,0010)	1	A data stream of the pixel samples that comprise the values of the dose grid.

Table 54: Multi-Frame Module

Attribute Name	Tag	Type	Attribute Use
Number of Frames	(0028,0008)	1	Number of frames in a Multi-frame Image. See C.7.6.6.1.1 for further explanation.
Frame Increment Pointer	(0028,0009)	1	Contains the Data Element Tag of the attribute that is used as the frame increment in Multi-frame pixel data. Points to Grid Frame Offset Vector (300C,0004). See C.7.6.6.1.1 for further explanation.

Table 55: SOP Common Module

Attribute Name	Tag	Type	Attribute Use
Instance Creation Date	(0008,0012)	3	The date the message was created.
Instance Creation Time	(0008,0013)	3	The time the message was created.

3.2.2.1.8. SOP Specific Conformance to RT Structure Set Storage SOP Class

Attribute values for the RT Structure Set SOP class proposed by ADACRTP_SCU are described below.

Table 56: Patient Module

Attribute Name	Tag	Type	Attribute Use
Patient's Name	(0010,0010)	2	Patient's full legal name, as entered in Launch Pad.
Patient ID	(0010,0020)	2	The patient's Medical Record Number, as entered in Launch Pad.
Patient's Birth Date	(0010,0030)	2	The patient's Birthdate, as entered in Launch Pad.
Patient's Sex	(0010,0040)	2	M, F, or O as appropriate based on Launch Pad entry.

Table 57: General Study Module

Attribute Name	Tag	Type	Attribute Use
Study Instance UID	(0020,000D)	1	Generated.
Study Date	(0008,0020)	2	Copied from the Primary Image set, if transferred via DICOM.
Study Time	(0008,0030)	2	Copied from the Primary Image set, if transferred via DICOM.
Referring Physician's name	(0008,0090)	2	Empty.
Study ID	(0020,0010)	2	Empty.
Accession Number	(0008,0050)	2	Empty.
Study Description	(0008,1030)	3	Comment as entered in Launch Pad.
Physician of Record	(0008,1048)	3	Physician as entered in Launch Pad.
Referenced Study Sequence	(0008,1110)	3	Introduces the sequence describing the study containing the data set for which this set of ROIs was defined.
>Referenced SOP Class UID	(0008,1150)	1C	'1.2.840.10008.3.1.2.3.2'.
>Referenced SOP Instance UID	(0008, 1155)	1C	Study UID of the data set from which this image was defined.

Table 58: RT Series Module

Attribute Name	Tag	Type	Attribute Use
Modality	(0008,0060)	1	'RTSTRUCT'.
Series Instance UID	(0020,000E)	1	Generated.
Series Number	(0020,0011)	2	Empty.
Series Description	(0008,103E)	3	'POI' for transfer of POIs, 'ROI' for transfer of ROIs, or 'POI and ROI' if transferring both.

Table 59: General Equipment Module

Attribute Name	Tag	Type	Attribute Use
Manufacturer	(0008,0070)	2	'ADAC'.
Station Name	(0008,1010)	3	The host name of the workstation which transmits the data.
Manufacturer's Model Name	(0008,1090)	3	'Pinnacle3'.

Table 59: General Equipment Module

Attribute Name	Tag	Type	Attribute Use
Software Version	(0018,1020)	3	Current version of Pinnacle ³ which transmits the data.

Table 60: Structure Set Module

Attribute Name	Tag	Type	Attribute Use
Structure Set Label	(3006,0002)	1	The name of the plan.
Structure Set Name	(3006,0004)	3	'ROI' for a structure set containing ROIs. 'POI' for a structure set containing POIs. 'POIandROI' for a structure set containing both POIs and ROIs
Structure Set Date	(3006,0008)	2	Date of transfer.
Structure Set Time	(3006,0009)	2	Time of transfer.
Referenced Frame of Reference Sequence	(3006,0010)	3	Introduces the sequence describing the frame of reference for the data set.
>Frame of Reference UID	(0020,0052)	1C	Duplicated from the primary image data set as transferred via DICOM.
>RT Referenced Study Sequence	(3006,0012)	3	Introduces the sequence describing studies referenced by this structure set.
>>Referenced SOP Class UID	(0008,1150)	1C	'1.2.840.10008.3.1.2.3.2'.
>>Referenced SOP Instance UID	(0008,1155)	1C	The Study UID duplicated from the image data set as transferred via DICOM.
>>RT Referenced Series Sequence	(3006,0014)	1C	Introduces the sequence describing the series referenced by this structure set.
>>>Series Instance UID	(0020,000E)	1C	The Series UID duplicated from the image data set as transferred via DICOM.
>>>Contour Image Sequence	(3006,0016)	1C	Introduces the list of Image Class and Instance UIDs within the data set series. There will be 1 entry per slice.
>>>>Referenced SOP Class UID	(0008,1150)	1C	The Image Class UID duplicated from the image data set as transferred via DICOM.
>>>>Referenced SOP Instance UID	(0008,1155)	1C	The instance UID duplicated from the image instance for the contour as transferred via DICOM.
Structure Set ROI Sequence	(3006,0020)	3	Introduces the sequence of structures. One entry per ROI or POI.
>ROI Number	(3006,0022)	1C	A unique number for POIs and ROIs within the message.
>Referenced Frame of Reference UID	(3006,0024)	1C	The Frame of Reference UID for each instance UID, duplicated from the image.
>ROI Name	(3006,0026)	2C	The name of the ROI or POI as entered in Pinnacle ³ .
>ROI Volume	(3006,002C)	3	The volume of the ROI in cubic cm.
>ROI Generation Algorithm	(3006,0036)	2C	Empty.

Table 61: ROI Contour

Attribute Name	Tag	Type	Attribute Use
ROI Contour Sequence	(3006,0039)	1	Introduces the sequence of Contour Sequences defining ROIs or POIs.

Table 61: ROI Contour

Attribute Name	Tag	Type	Attribute Use
>Referenced ROI Number	(3006,0084)	1	Unique identifier of POI or ROI within this message instance.
>ROI Display Color	(3006,002A)	3	The color of the ROI.
>Contour Sequence	(3006,0040)	3	Introduces the sequence of Contours defining an ROI.
>>Contour Image Sequence	(3006,0016)	3	Introduces the sequence of image UIDs to which this contour corresponds. The sequence will contain 1 item.
>>>Referenced SOP Class UID	(0008,1150)	1C	Image class UID duplicated from the DICOM transfer of the primary data set. Requires that the image data set has been transferred via DICOM.
>>>Referenced SOP Instance UID	(0008,1155)	1C	Image instance UID duplicated from the DICOM transfer of the data set. Requires that the image data set has been transferred via DICOM.
>>Contour Geometric Type	(3006,0042)	1C	For POIs: POINT. For ROIs: CLOSED_PLANAR.
>>Number of Contour Points	(3006,0046)	1C	1 for a POI; otherwise, the number of points describing the contour in the Contour Data attribute (3006,0050).
>>Contour Data	(3006,0050)	1C	x\y\z triplets describing the vertices of the ROI or point of the POI.

Table 62: RT ROI Observations Module

Attribute Name	Tag	Type	Attribute Use
RT ROI Observation Sequence	(3006,0080)	1	Introduces a sequence of ROI observations. 1 per beam.
>Observation Number	(3006,0082)	1	Unique identifier of POI or ROI within this message instance.
>Referenced ROI Number	(3006,0084)	1	Unique identifier of POI or ROI within this message instance.
>RT ROI Interpreted Type	(3006,00A4)	2	Empty for each ROI and "MARKER" for each POI.
>ROI Interpreter	(3006,00A6)	2	Empty.

Table 63: SOP Common Module

Attribute Name	Tag	Type	Attribute Use
Instance Creation Date	(0008,0012)	3	The date the message was created.
Instance Creation Time	(0008,0013)	3	The time the message was created.

3.2.2.1.9. SOP Specific Conformance to RT Plan Storage SOP Class

Attribute values for the RT Plan SOP class proposed by ADACRTP_SCU are described below.

Table 64: Patient Module

Attribute Name	Tag	Type	Attribute Use
Patient's Name	(0010,0010)	2	Patient's full legal name, as entered in Launch Pad.
Patient ID	(0010,0020)	2	The patient's Medical Record Number, as entered in Launch Pad.
Patient's Birth Date*	(0010,0030)	2	The patient's Birthdate, as entered in Launch Pad.
Patient's Sex	(0010,0040)	2	M, F, or O as appropriate based on Launch Pad entry.

*This date will be in yyyyymmdd format. If entered or imported in yyyy-mm-dd format, the date will be converted automatically upon export. Other date formats will not be exported.

Table 65: General Study Module

Attribute Name	Tag	Type	Attribute Use
Study Instance UID	(0020,000D)	1	Generated.
Study Date	(0008,0020)	2	Copied from the Primary Image set, if transferred via DICOM.
Study Time	(0008,0030)	2	Copied from the Primary Image set, if transferred via DICOM.
Referring Physician's name	(0008,0090)	2	Empty.
Study ID	(0020,0010)	2	Empty.
Accession Number	(0008,0050)	2	Empty.
Study Description	(0008,1030)	3	Comment as entered in Launch Pad.
Physician of Record	(0008,1048)	3	Physician as entered in Launch Pad.
Referenced Study Sequence	(0008,1110)	3	Introduces the sequence describing the study containing the data set for which this plan was defined.
>Referenced SOP Class UID	(0008,1150)	1C	'1.2.840.10008.3.1.2.3.2'.
>Referenced SOP Instance UID	(0008, 1155)	1C	Study UID of the data set from which this image was defined.

Table 66: RT Series Module

Attribute Name	Tag	Type	Attribute Use
Modality	(0008,0060)	1	'RTPLAN'.
Series Instance UID	(0020,000E)	1	Generated.
Series Number	(0020,0011)	2	Empty.
Series Description	(0008,103E)	3	'Pinnacle Plan'.

Table 67: General Equipment Module

Attribute Name	Tag	Type	Attribute Use
Manufacturer	(0008,0070)	2	'ADAC'.
Station Name	(0008,1010)	3	The host name of the workstation which transmits the data.
Manufacturer's Model Name	(0008,1090)	3	'Pinnacle3'.

Table 67: General Equipment Module

Attribute Name	Tag	Type	Attribute Use
Software Version	(0018,1020)	3	Current version of Pinnacle ³ which transmits the data.

Table 68: RT General Plan Module

Attribute Name	Tag	Type	Attribute Use
RT Plan Label	(300A,0002)	1	The plan name as entered in Launch Pad concatenated with the Trial Number (i.e., <planName>-<Trial#>).
RT Plan Name	(300A,0003)	3	The plan name as entered in Launch Pad.
RT Plan Description	(300A,0004)	3	The comment as entered in Launch Pad.
Operator's Name	(0008,1070)	2	The Dosimetrist name as entered in Launch Pad.
RT Plan Date	(300A,0006)	2	The date that the message was created.
RT Plan Time	(300A,0007)	2	The time that the message was created.
RT Plan Geometry	(300A,000C)	1	Set to PATIENT if the primary data set was transferred via DICOM. If the primary data set was not transferred via DICOM, the value is TREATMENT_DEVICE.
Referenced Structure Set Sequence	(300C,0060)	1C	Sent if RT Plan Geometry is PATIENT.
>Referenced SOP Class UID	(0008,1150)	1C	'1.2.840.10008.5.1.4.1.1.481.3'.
>Referenced SOP Instance UID	(0008,1155)	1C	Indicates the structure set that references the patient's coordinate system frame of reference.

Table 69: RT Patient Setup Module

Attribute Name	Tag	Type	Attribute Use
Patient Setup Sequence	(300A,0180)	1	Introduces the sequence of patient setup data.
>Patient Setup Number	(300A,0182)	1	'1'.
>Patient Position	(0018,5100)	1C	The treatment position defined by the CT scan. Duplicated from the Primary data set on which the plan was created.

Table 70: RT Fraction Scheme Module*

Attribute Name	Tag	Type	Attribute Use
Fraction Group Sequence	(300A,0070)	1	Introduces sequence of Fraction Groups in current Fraction Scheme. Each Fraction Group is translated to a Prescription in Pinnacle ³ .
>Fraction Group Number	(300A,0071)	1	'0'.
>Number of Fractions Planned	(300A,0078)	2	The number of fractions for the selected prescription.
>Number of Beams	(300A,0080)	1	The number of beams using this prescription. The number will include 2 additional beams if setup beams are being exported.
>Referenced Beam Sequence	(300C,0004)	1C	Introduces the sequence of treatment beams in the current Fraction Group.
>>Referenced Beam Number	(300C,0006)	1C	Specifies the Beam Number (300A,00C0) of the beam using this prescription.
>>Beam Dose Specification Point	(300A,0082)	3	The location of the Dose Reference Point for the beam, as specified in the Monitor Units window.
>>Beam Dose	(300A,0084)	3	The dose in Gy, to the reference point, calculated for this beam. This will be a value of '0' for setup beams.
>>Beam Meterset	(300A,0086)	3	The monitor units calculated for this beam. This will be a value of '0' for setup beams.
>Number of Brachy Application Setups	(300A,00A0)	1	'0'.

*There will be only 1 element in the Fraction Group Sequence (300A,0070), representing the prescription specified by the user for export.

*Attributes related to brachytherapy treatments are not supported

Table 71: RT Beams Module

Attribute Name	Tag	Type	Attribute Use
Beam Sequence	(300A,00B0)	1	Introduces the sequence of treatment beams for this RT Plan. There will be 1 entry per beam.
>Beam Number	(300A,00C0)	1	The ordinal representing the position of the beam in the beam list as displayed in Pinnacle ³ .
>Beam Name	(300A,00C2)	3	If the Field ID is specified for the beam, its value is exported in this attribute and the Pinnacle ³ Beam Name is exported in the Beam Description attribute (300A,00C3). If the Field ID is not specified this attribute contains the name of the beam as specified in Pinnacle ³ .
>Beam Description	(300A,00C3)	3	If Field ID is specified for the beam, this attribute contains the Pinnacle ³ Beam Name.
>Beam Type	(300A,00C4)	1	'DYNAMIC' for a beam in which treatment geometry or characteristics are modified during delivery. 'STATIC' for a fixed field, fixed beam. (Note that there is a method to override this field. See our latest DICOM RT Release Note for more detail.)

Table 71: RT Beams Module

Attribute Name	Tag	Type	Attribute Use
>Radiation Type	(300A,00C6)	2	'PHOTON' or 'ELECTRON'.
>Treatment Machine Name	(300A,00B2)	2	The name of the machine assigned to this beam.
>Manufacturer	(0008,0070)	3	The manufacturer of the machine assigned to this beam.
>Institution Name	(0008,0080)	3	The name of the institution in Pinnacle ³ .
>Primary Dosimeter Unit	(300A,00B3)	3	'MU'.
>Source to Axis Distance	(300A,00B4)	3	The SAD of the machine assigned to this beam in mm.
>Beam Limiting Device Sequence	(300A,00B6)	1	Introduces the sequence of beam limiting devices (collimator) jaw or leaf (element) sets.
>>Beam Limiting Device Type	(300A,00B8)	1	As appropriate: X = symmetric jaw pair in X direction Y = symmetric jaw pair in Y direction ASYMX = asymmetric jaw pair in X direction ASYMY = asymmetric jaw pair in Y direction MLCX = multileaf jaw pair in X direction MLCY = multileaf jaw pair in Y direction.
>>Source to Beam Limiting Device Distance	(300A,00BA)	3	The Source to Beam Limiting Device distance in mm. As entered for the device in the machine definition. (Note that this is suppressible via script. See our latest DICOM RT Release Note for more detail.)
>>Number of Leaf/Jaw Pairs	(300A,00BC)	1	1 for jaws or the number of leaf pairs for an MLC.
>>Leaf Position Boundaries	(300A,00BE)	2C	The position of the edges of the leaf boundaries with respect to the central axis. There will be the number of leaf pairs + 1 entries.
>Referenced Patient Setup Number	(300C,006A)	3	References the Patient Setup number (300A,0182) as defined in the Patient Setup Module.
>Treatment Delivery Type*	(300A,00CE)	3	'TREATMENT'.
>Number of Wedges	(300A,00D0)	1	'0' or '1'.
>Wedge Sequence	(300A,00D1)	1C	Introduces sequence of treatment wedges. Required if Number of Wedges is non-zero.
>>Wedge Number	(300A,00D2)	1C	'0'.
>>Wedge Type	(300A,00D3)	2C	As appropriate: STANDARD = standard (static) wedge DYNAMIC = moving beam limiting device jaw simulating wedge MOTORIZED = single wedge that can be removed from beam remotely.
>>Wedge ID	(300A,00D4)	3	The Manufacturer code of the wedge assigned to the beam.
>>Wedge Angle	(300A,00D5)	2C	The angle of the wedge for the beam.
>>Wedge Factor	(300A,00D6)	2C	Empty.
>>Wedge Orientation	(300A,00D8)	2C	The orientation of the wedge.

Table 71: RT Beams Module

Attribute Name	Tag	Type	Attribute Use
>Number of Compensators	(300A,00E0)	1	'0' or '1'.
>Compensator Sequence	(300A,00E3)	1C	Compensators are not currently exported by Pinnacle ³ .
>Number of Boluses	(300A,00ED)	1	'0' or '1'.
>Referenced Bolus Sequence	(300C,00B0)	1C	Introduces the sequence of boluses associated with the beam.
>>Referenced ROI Number	(3006,0084)	1C	Indicates that bolus is specified for the beam.
>Number of Blocks	(300A,00F0)	1	The number of contours required to describe the block.
>Total Block Tray Factor	(300A,00F2)	3	The tray factor of the beam.
>Block Sequence	(300A,00F4)	1C	Introduces sequence of blocks associated with Beam. Required if Number of Blocks is non-zero.
>>Block Tray ID	(300A,00F5)	3	The tray number, if any, otherwise UNKNOWN TRAY ID.
>>Source to Block Tray Distance	(300A,00F6)	2C	The Source to Tray Distance as defined for the machine.
>>Block Type	(300A,00F8)	1C	'SHIELDING' or 'APERTURE'.
>>Block Divergence	(300A,00FA)	2C	'PRESENT'.
>>Block Number	(300A,00FC)	1C	The identifying number for this contour.
>>Material ID	(300A,00E1)	2C	Empty.
>>Block Thickness	(300A,0100)	2C	Empty.
>>Block Transmission	(300A,0102)	2C	The block and tray factor of the beam.
>>Block Number of Points	(300A,0104)	2C	The number of points used to describe the contour.
>>Block Data	(300A,0106)	2C	Data containing the (x, y) pairs describing the edge of the contour.
>Applicator Sequence	(300A,0107)	3	Introduces the sequence of Applicators. Only a single item shall be permitted in this sequence.
>>Applicator ID	(300A,0108)	1C	The user name assigned to the applicator or circular collimator. For a stereo beam, send the name of the circular collimator. For electron beams, send the electron applicator name.
>>Applicator Type	(300A,0109)	1C	For a stereo beam, set to 'STEREOTACTIC'. For an electron beam the dimensions of the applicator will be checked, if length = height 'ELECTRON_SQUARE' will be sent. Otherwise 'ELECTRON_RECT'.
>Final Cumulative Meterset Weight	(300A,010E)	1C	'100'.
>Number of Control Points	(300A,0110)	1	The number of control points used to describe the beam behavior during treatment. (Setup beams will each use 2 control points.)
>Control Point Sequence	(300A,0111)	1	Introduces the sequence of machine configurations describing this treatment beam.
>>Control Point Index	(300A,0112)	1C	Sequentially numbered starting at 0.

Table 71: RT Beams Module

Attribute Name	Tag	Type	Attribute Use
>>Cumulative Meterset Weight	(300A,0134)	2C	For control point 0, this is 0.0. For each subsequent control point this represents the weight of the MU delivered during this control point, expressed as a percentage. The final value will be 100.0.
>>Nominal Beam Energy	(300A,0114)	3	The selected machine energy for this beam.
>>Wedge Position Sequence	(300A,0116)	3	Introduces sequence of Wedge positions and identities for this control point.
>>>Referenced Wedge Number	(300C,00C0)	1C	The Wedge Number (300A,00D2) assigned to the selected wedge for this control point.
>>>Wedge Position	(300A,0118)	1C	'IN' or 'OUT'.
>>Beam Limiting Device Position Sequence	(300A,011A)	1C	Introduces the sequence of beam limiting device (collimator) jaw or leaf (element) positions.
>>>RT Beam Limiting Device Type	(300A,00B8)	1C	Assigned as appropriate: X = symmetric jaw pair in X direction Y = symmetric jaw pair in Y direction ASYMX = asymmetric jaw pair in X direction ASYMY = asymmetric jaw pair in Y direction MLCX = multileaf jaw pair in X direction MLCY = multileaf jaw pair in Y direction.
>>>Leaf/Jaw Positions	(300A,011C)	1C	The jaw or MLC leaf positions for this control point in mm.
>>Gantry Angle	(300A,011E)	1C	The gantry angle of the beam for this control point. Control point zero will always represent the starting angle for the beam.
>>Gantry Rotation Direction	(300A,011F)	1C	If an arc is being described, this will represent the direction of the gantry rotation ('CW' or 'CC'). If this is a fixed treatment the value will be 'NONE'.
>>Beam Limiting Device Angle	(300A,0120)	1C	The collimator angle for the beam.
>>Beam Limiting Device Rotation Direction	(300A,0121)	1C	'NONE'.
>>Patient Support Angle	(300A,0122)	1C	The couch angle for the beam.
>>Patient Support Rotation Direction	(300A,0123)	1C	'NONE'.
>>Table Top Eccentric Angle	(300A,0125)	1C	'0'.
>>Table Top Eccentric Rotation Direction	(300A,0126)	1C	'NONE'.
>>Table Top Vertical Position	(300A,0128)	2C	Empty.
>>Table Top Longitudinal Position	(300A,0129)	2C	Empty.
>>Table Top Lateral Position	(300A,012A)	2C	Empty.
>>Isocenter Position	(300A,012C)	2C	Sent in mm in the DICOM Patient coordinate system, if RT Plan Geometry (300A,000C) is PATIENT. Empty, if RT Plan Geometry is TREATMENT_DEVICE.
>>Source to Surface Distance	(300A,0130)	3	SSD of the beam in mm.

*Setup beams will also indicate 'TREATMENT' because there is no setup identifier available yet per DICOM. However, the associated beam dose (300A, 0084) will be '0'.

Table 72: SOP Common Module

Attribute Name	Tag	Type	Attribute Use
Instance Creation Date	(0008,0012)	3	The date the message was created.
Instance Creation Time	(0008,0013)	3	The time the message was created.

Table 73: Varian Private Attributes*

Attribute Name	Tag	Type	Attribute Use
Private Creator Code	(3253,0010)	1	Introduces the Varian extended interface for Setup beam support with the OBI. Contains 'Varian'.
>OBI Field Type Specification	(3253,1000)	1C	An XML string describing each field's purpose, SETUP or TREATMENT.
>OBI Information Length	(3253,1001)	1C	Number of characters in the OBI Field Type Specification (3253,1000) attribute.
Extended Interface Format	(3253, 1002)	1C	'Extended IF'

* The Varian Private attributes are only included if Varian OBI support has been enabled and Setup beams are being exported.

3.2.2.1.10. SOP Specific Conformance to Computed Radiography Image Storage SOP Class

Attribute values for the Computed Radiography SOP class proposed by ADACRTP_SCU are described below.

Table 74: Patient Module

Attribute Name	Tag	Type	Attribute Use
Patient's Name	(0010,0010)	2	Patient's full legal name, as entered in Launch Pad.
Patient ID	(0010,0020)	2	The patient's Medical Record Number, as entered in Launch Pad.
Patient's Birth Date	(0010,0030)	2	The patient's Birthdate, as entered in Launch Pad.
Patient's Sex	(0010,0040)	2	M, F, or O as appropriate based on Launch Pad entry.

Table 75: General Study Module

Attribute Name	Tag	Type	Attribute Use
Study Instance UID	(0020,000D)	1	Generated.
Study Date	(0008,0020)	2	Copied from the Primary Image set, if transferred via DICOM.
Study Time	(0008,0030)	2	Copied from the Primary Image set, if transferred via DICOM.
Referring Physician's name	(0008,0090)	2	Empty.
Study ID	(0020,0010)	2	Empty.
Accession Number	(0008,0050)	2	Empty.
Study Description	(0008,1030)	3	Comment as entered in Launch Pad.
Physician of Record	(0008,1048)	3	Physician as entered in Launch Pad.

Table 76: General Series Module

Attribute Name	Tag	Type	Attribute Use
Modality	(0008,0060)	1	'CR'.
Series Instance UID	(0020,000E)	1	Generated on Export.
Series Number	(0020,0011)	2	Empty.
Laterality	(0020,0060)	2C	Empty.

Table 77: CR Series Module

Attribute Name	Tag	Type	Attribute Use
Body Part Examined	(0018,0015)	2	Empty.
View Position	(0018,5101)	2	Empty.

Table 78: General Equipment Module

Attribute Name	Tag	Type	Attribute Use
Manufacturer	(0008,0070)	2	'ADAC'.
Station Name	(0008,1010)	3	The host name of the workstation which transmits the data.
Manufacturer's Model Name	(0008,1090)	3	'Pinnacle3'.
Software Version	(0018,1020)	3	Current version of Pinnacle ³ which transmits the data.

Table 79: General Image Module

Attribute Name	Tag	Type	Attribute Use
Instance Number	(0020,0013)	2	'1'.
Patient Orientation	(0020,0020)	2C	Empty.
Content Date	(0008,0023)	2C	Date the transfer was performed.
Content Time	(0008,0033)	2C	Time the transfer was performed..

Table 80: CR Image Module

Attribute Name	Tag	Type	Attribute Use
Photometric Interpretation	(0028,0004)	1	'MONOCHROME2'.
Imager Pixel Spacing	(0018,1164)	3	Multivalued X\Y resolution of the image pixels.

Table 81: VOI LUT Module

Attribute Name	Tag	Type	Attribute Use
Window Center	(0028,1050)	1C	The default window center value for the image, for display purposes.
Window Width	(0028,1051)	1C	The default window width value for the image, for display purposes.

Table 82: SOP Common Module

Attribute Name	Tag	Type	Attribute Use
Instance Creation Date	(0008,0012)	3	The date the message was created.
Instance Creation Time	(0008,0013)	3	The time the message was created.

3.2.2.1.11. SOP Specific Conformance to Secondary Capture Image Storage SOP Class

Attribute values for the Secondary Capture SOP class proposed by ADACRTP_SCU are described below.

Table 83: Patient Module

Attribute Name	Tag	Type	Attribute Use
Patient's Name	(0010,0010)	2	Patient's full legal name, as entered in Launch Pad.
Patient ID	(0010,0020)	2	The patient's Medical Record Number, as entered in Launch Pad.
Patient's Birth Date	(0010,0030)	2	The patient's Birthdate, as entered in Launch Pad.
Patient's Sex	(0010,0040)	2	M, F, or O as appropriate based on Launch Pad entry.

Table 84: General Study Module

Attribute Name	Tag	Type	Attribute Use
Study Instance UID	(0020,000D)	1	Generated.
Study Date	(0008,0020)	2	Copied from the Primary Image set, if transferred via DICOM.
Study Time	(0008,0030)	2	Copied from the Primary Image set, if transferred via DICOM.
Referring Physician's name	(0008,0090)	2	Empty.
Study ID	(0020,0010)	2	Empty.
Accession Number	(0008,0050)	2	Empty.
Study Description	(0008,1030)	3	Comment as entered in Launch Pad.
Physician of Record	(0008,1048)	3	Physician as entered in Launch Pad.

Table 85: General Series Module

Attribute Name	Tag	Type	Attribute Use
Modality	(0008,0060)	1	'OT'.
Series Instance UID	(0020,000E)	1	Generated on Export.
Series Number	(0020,0011)	2	Empty.
Laterality	(0020,0060)	2C	Empty.

Table 86: General Equipment Module

Attribute Name	Tag	Type	Attribute Use
Manufacturer	(0008,0070)	2	'ADAC'.
Station Name	(0008,1010)	3	The host name of the workstation which transmits the data.
Manufacturer's Model Name	(0008,1090)	3	'Pinnacle3'.
Software Version	(0018,1020)	3	Current version of Pinnacle ³ which transmits the data.

Table 87: General Image Module

Attribute Name	Tag	Type	Attribute Use
Instance Number	(0020,0013)	2	'1'.
Patient Orientation	(0020,0020)	2C	Empty.

Table 87: General Image Module

Attribute Name	Tag	Type	Attribute Use
Content Date	(0008,0023)	2C	Date the transfer was performed.
Content Time	(0008,0033)	2C	Time the transfer was performed..

Table 88: SC Equipment Module

Attribute Name	Tag	Type	Attribute Use
Conversion Type	(0008,0064)	1	'WSD'.

Table 89: VOI LUT Module

Attribute Name	Tag	Type	Attribute Use
Window Center	(0028,1050)	1C	The default window center value for the image, for display purposes.
Window Width	(0028,1051)	1C	The default window width value for the image, for display purposes.

Table 90: SOP Common Module

Attribute Name	Tag	Type	Attribute Use
Instance Creation Date	(0008,0012)	3	The date the message was created.
Instance Creation Time	(0008,0013)	3	The time the message was created.

The System conforms to the SOP's of the Storage Service Class at level 2 (full). No data elements are discarded or coerced by the System.

3.2.2.1.12. SOP Specific Conformance to CT, MR, NM, and PET Image Storage SOP Class

The CT, MR, NM and PET Image IOD are forwarded verbatim. If the SCP has been configured to remove private tags prior to import, only the non-private attributes will be forwarded. The SOP Instance UID will be preserved regardless.

3.2.2.2. Print

3.2.2.2.1. *Associated Real-World Activity*

The ADACRTP_SCU application entity initiates an association for the Color or Grayscale print services class based on the configuration of the printer in Pinnacle³. The association is closed when the response to the N-ACTION on the Basic Film Session or Basic Film Box SOP classes is received.

The configuration of the printer in Pinnacle³ also includes the time-out value to wait for a reply message from the SCP. The default value is 30 seconds. If the time-out is exceeded, ADACRTP_SCU will abort the association.

3.2.2.2.2. *Associated Real-World Activity for Print Image Operations*

The ADACRTP_SCU application entity initiates associations for the printing of images to a Basic Print SCP. The image to be printed is specified by the user.

3.2.2.2.3. *Associated Real-World Activity for Print Image Operations*

When the user requests a print, an association is established with the configured application entity. ADACRTP_SCU sends a Printer, N-GET message to the Basic Print SCP to determine the status of the printer. This is followed by a Basic Film Session N-CREATE message, which in turn is followed by a Basic Film Box N-Create. Depending on the configuration of the printer, ADACRTP_SCU will then transmit a N-SET message on a Basic Grayscale or Color Image Box. Finally, an N-ACTION message is sent to instruct the Basic Print SCP to print either at the Basic Film Session or at the Basic Film Box level, depending on printer configuration.

3.2.2.2.4. *Presentation Context Table*

ADACRTP_SCU will initiate the presentation contexts as given in the following table.

Table 91: Supported Presentation Context for Print by ADACRTP_SCU

Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name	UID		
Basic Grayscale Print Management (META)	1.2.840.10008.5.1.1.9	ILE	1.2.840.10008.2	SCU	None
Basic Color Print Management (META)	1.2.840.10008.5.1.1.18	ILE	1.2.840.10008.2	SCU	None

3.2.2.2.5. *Print Conformance*

ADACRTP_SCU provides standard conformance to the DICOM Print Service Classes.

3.2.2.2.6. *SOP Specific Conformance to Verification SOP Class*

ADACRTP_SCU provides standard conformance to the DICOM Verification Service Class.

3.2.2.2.7. SOP Specific Conformance to Print SOP Classes

Attribute values for SOP classes proposed by ADACRTP_SCU are specified in the following table.

Table 92: Print Actions and Attributes

SOP Class Name	Command	Attribute Name	Valid Values	Default Value	
Basic Film Session	N-CREATE	Number of Copies	1	1	
		Print Priority	MEDIUM	MEDIUM	
		Medium Type	PAPER, CLEAR FILM, BLUE FILM	PAPER	
		Film Destination	MAGAZINE, PROCESSOR, BIN_1, BIN_2, BIN_3, BIN_4, BIN_5, BIN_6, BIN_7, BIN_8	MAGAZINE	
	N-ACTION	Referenced Print Job Sequence	(none, indicates start of sequence)	None	
Basic Film Box	N-CREATE	Image Display Format	STANDARD\1,1	STANDARD\1,1	
		Film Orientation	PORTRAIT	PORTRAIT	
		Film Size ID	14INX17IN, 14INX14IN, 11INX14IN, 10INX14IN, 10INX12IN, 8INX10IN, 24CMX30CM, 24CMX24CM	14INX17IN	
		Magnification Type	CUBIC, BILINEAR, REPLICATE	CUBIC	
		Max Density	Printer Specific	None	
		Smoothing Type	Printer Specific	None	
		Empty Image Density	BLACK, WHITE	BLACK	
		Trim	YES, NO	NO	
		Border Density	BLACK, WHITE	WHITE	
		Configuration Information	Printer specific	None	
		N-ACTION	Referenced Print Job Sequence	(none, indicates start of sequence)	None

Table 92: Print Actions and Attributes

SOP Class Name	Command	Attribute Name	Valid Values	Default Value
Basic Grayscale Image Box	N-SET	Samples Per Pixel	1	1
		Photometric Interpretation	MONOCHROME2	MONOCHROME2
		Pixel Representation	0000	0000
		Rows	Image specific	None
		Columns	Image specific	None
		Pixel Data	Image specific	None
		Pixel Aspect Ratio	1\1	1\1
		Bits Allocated	8	8
		Bits Stored	8	8
		High Bit	7	7
		Image Position	1	1
		Requested Image Size	Image specific	None
		Polarity	NORMAL, REVERSE	NORMAL
		Basic Color Image Box	N-SET	Samples Per Pixel
Planar Configuration	0			0
Photometric Interpretation	RGB			RGB
Pixel Representation	0000			0000
Rows	Image specific			None
Columns	Image specific			None
Pixel Data	Image specific			None
Pixel Aspect Ratio	1\1			1\1
Bits Allocated	8			8
Bits Stored	8			8
High Bit	7			7
Image Position	1			1
Requested Image Size	Image specific			None
Polarity	NORMAL, REVERSE			NORMAL
Printer	N-GET	Printer Status	*	None
		Printer Status Info	*	None
		Manufacturer	*	None
		Manufacturer's Model Name	*	None
		Device Serial Number	*	None
		Software Versions	*	None

*The actual values depend on the type of printer.

The System conforms to the SOPs of the Print Service Class at level 2 (full). No data elements are discarded or coerced by the System.

4. COMMUNICATION PROFILES

4.1. Supported Communication Stacks

The TCP/IP protocol stack is used.

4.2. Physical Media Support

Any physical interconnection media supporting the TCP/IP protocol stack are supported, including:

- IEEE 802.3-1995 (Fast Ethernet) 100BASE-TX
- IEEE 802.3-1995 10BASE-TX

5. EXTENSIONS/SPECIALIZATIONS/PRIVATIZATIONS

Table 93: Mapping between UI elements and DICOM

DICOM Attribute name	Tag	UI element
Physician of Record	(0008,1048)	Radiation Oncologist
Operator's Name	(0008,1070)	Dosimetrist
Study Description	(0008,1110)	Comment
Patient's Name	(0010,0010)	Patient Last, First, Middle Names
Patient ID	(0010,0020)	Medical Record Number
Patient's Birth Date	(0010,0030)	Date of Birth
Patient's Sex	(0010,0040)	Gender

6. CONFIGURATION

Configurable communication parameters include:

- **Maximum PDU Size.** The maximum size of a Protocol Data Unit (default: 28672 bytes).
- **Association Time-out.** The number of seconds to use as a time-out after waiting for an association request (default: 30 seconds).
- **Association Reply Time-out.** The number of seconds to wait for a reply to an association request (default: 15 seconds).
- **Association Release Time-out.** The number of seconds to wait for a reply to an association release (default: 15 seconds).
- **Connection Time-out.** The number of seconds to wait for a network connection to be accepted (default: 15 seconds).
- **Inactivity Time-out.** The number of seconds to wait for data between TCP/IP packets (default: 15 seconds).
- **TCP/IP Listen Port.** The TCP/IP port on which ADACRTP_SCP will listen for TCP/IP packets (default: 104).
- **DICOM Port.** The port number combined with the application entity title identifying ADACRTP_SCP to DICOM clients on the network (default: 104).
- **Application Entity Title.** The name of ADACRTP_SCP by which, combined with the DICOM Port number, DICOM clients may address the server (default: ADACRTP_SCP).

These configurations may be performed by Customer Support.

7. SUPPORT OF EXTENDED CHARACTER SETS

Extended Character Sets are not supported.