Flexitron® HDR and Flexitron® Cobalt-60

DICOM Conformance Statement for: Treatment Communication Console (TCC)

Nucletron

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1. Introduction

This conformance statement specifies how the Flexitron TCC application conforms to the DICOM 2011 V3.0 standard and the IEC Technical Report 61852. This document follows the guidelines for DICOM conformance statements of IEC technical Report 62266. Flexitron TCC uses the DICOM protocol to receive and transmit objects that are used in the radiation therapy process.

This conformance statement is valid for Flexitron TCC v3.2.1.

1.1 Scope

1.1.1 Flexitron Treatment Communication Console (TCC)

The Flexitron TCC is a brachytherapy Treatment Communication Console (TCC). The Flexitron TCC is a software application that enables an operator to apply, by remote control, a radionuclide source into the body (including interstitial, intracavitary, intraluminal, bronchial, endovascular and intra-operative) or to the surface of the body for radiation therapy using Nucletron's Flexitron afterloader.

Flexitron TCC supports, amongst others, the following functions:

- Make a new plan.
- Add a plan (from a Library Plan).
- Edit, print and save Plan information.
- Import a plan (from a treatment planning system).
- Load a patient study (from the database).
- Execute treatment.
- Start and monitor treatment.
- Print from a treatment report, Pre-Treatment Report and brachy treatment record report.
- Export a Brachy Treatment Record (BT Record).
- Maintain procedures and information.
- Unified Worklist Query and Retrieve (SCU) and handling of query responses

1.1.2 Smoothbase

Flexitron TCC uses Smoothbase as a database to store plans and images. The Smoothbase database is used in different Nucletron products. The main features of Smoothbase are:

- User management.
- Store and retrieve images, treatment plans, etc.
- Import treatment plans, images, etc. from another DICOM source or,
- Export treatment plans, images, etc. to another DICOM destination or,
- Import or export treatment plans, images, etc. to a DICOM Media file.
- Query and Retrieve User (SCU) functionality, which may be used to query and retrieve DICOM objects from a remote Query and Retrieve Provider (SCP).
- Query modality worklist functionality (SCU) and handling of query responses.

1.2   Intended Audience

This document is intended for:

- Users of Flexitron TCC, who want to execute DICOM plan from an Oncentra Application.
- Marketing and Sales persons.
- System Integrators of medical equipment.
- Other vendors offering interfacing via DICOM.

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

2.   Document History

Revision	Who	Reason for Change	Changes
00	John de Ridder	Initial version for Flexitron TCC v3.0	All
01	Yavor Hristov	Several changes throughout the document.	N/A
02	Andre Voskuilen	Copyright section updated. No other changes.	N/A
03	Atiqullah Sardar Shah	Unified Worklist	Added Unified Worklist AE specification, removed DICOM print.

3.   Related Documents

Reference	Revision	Description
777.00160MAN	*	Flexitron HDR User Manual
777.00271MAN	*	Flexitron Cobalt-60 User Manual
190.033ENG	*	Smoothbase User Manual
DICOM2011	*	Digital Imaging and Communications in Medicine

* Latest version (available via the Nucletron Extranet).

4.   Definitions, Terms and Abbreviations

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

Abbreviation	Description
AE	Application Entity, according to DICOM terminology
C-FIND	DIMSE for matching of a set of attributes to the attributes of a set of DICOM object instances on a remote AE.
C-MOVE	DIMSE for transfer of object instance(s) from a remote AE, whose attributes match a specified set of attributes, to another remote AE, which could be the AE of the requestor.
C-STORE	DIMSE for transfer of a DICOM object instance to a remote AE.
DICOM	Digital Imaging and Communications in Medicine, a standard on image communications in medical applications
DIMSE	DICOM Message Service element
Flexitron TCC	Software to perform RT Plan from an Oncentra Prostate or Oncentra Brachy Application.
IE	Information Entity
IOD	Information Object Definition, according to DICOM terminology

Abbreviation	Description
NEMA	National Electrical Manufacturers Association
PDU	Protocol Data Unit
ROI	Region of Interest; defined contour on a slice
SCP	Service Class Provider, according to DICOM terminology
SCU	Service Class User, according to DICOM terminology
Smoothbase	Database used in several Nucletron products to store and retrieve patient data and to exchange such data with other products using DICOM.
SOP	Service-Object-Pair, a definition of an information object (like an image) and of a service (like storage) that can be performed for the object
TCP/IP	Transmission Control Protocol / Internet Protocol, a widely used computer networking protocol
UID	Unique Identifier used to identify an object by a worldwide unique Identifier, according to DICOM terminology.
UPS	Unified Procedure Step. Also sometimes, refer to the whole concept of Unified Worklist and Procedure Step – Unified Workflow.
VOI	Volume of interest; consists of multiple ROI's
VR	Value Representation, a data encoding method in DICOM

5.   Implementation Model

In its current version, Smoothbase is, very basically, an implementation of:

- Export Command, which can send DICOM objects to a Remote Storage SCP or DICOM media file.
- Import Command, which can receive DICOM objects from a Remote Storage SCU or DICOM media file.
- Query and Retrieve User (SCU) functionality, which may be used to query and retrieve DICOM objects from a remote Query and Retrieve Provider (SCP).
- Query modality worklist (SCU) functionality, which can be used to query a worklist from a remote worklist provider.

The data flow diagram shown in Figure 5-1and Figure 5-2 represents all DICOM Application Entities present in an instantiation of the Flexitron TCC product and maps these to real world activities and applicable user actions.

5.1   Application Data Flow Diagram

The following figures show a diagram illustrating the data flow in the application model.
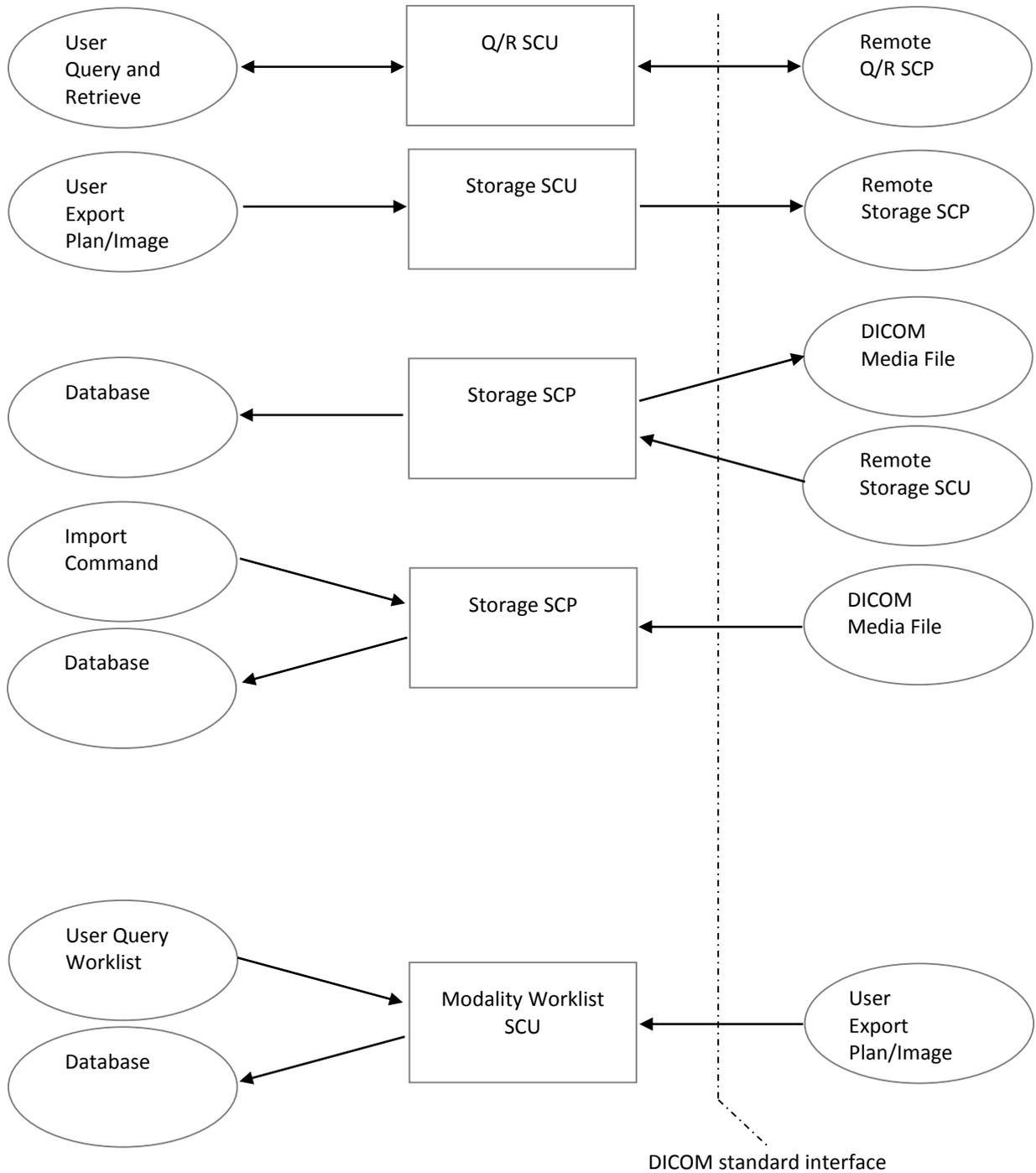
Figure 5-1 Data flow
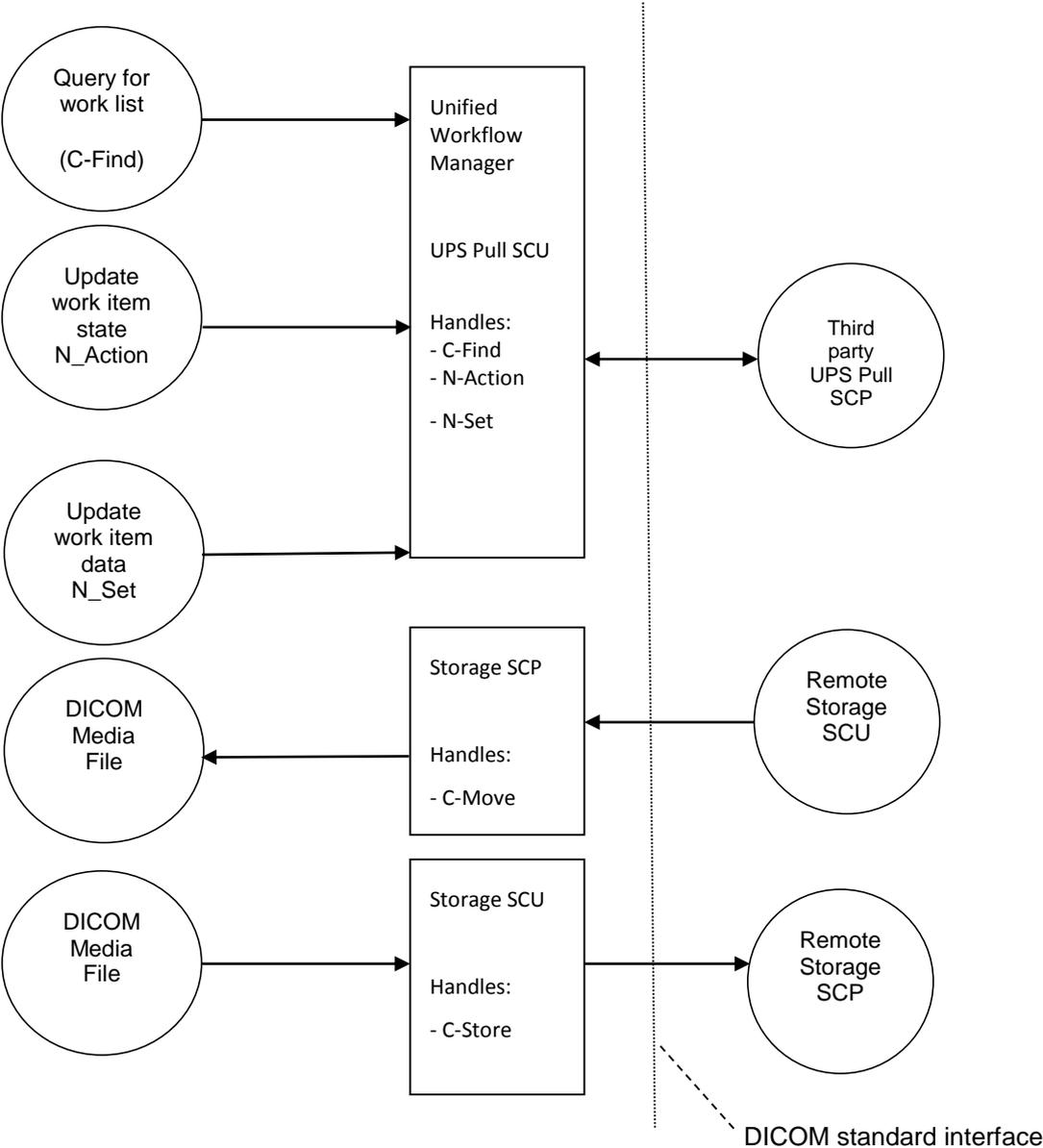
Figure 5-2 Data flow

The Export Command is invoked when a user requests to transfer objects to a Remote Storage SCP. The objects are retrieved from the database and sent to the remote system or to a DICOM media file

The Storage SCP is a background process, which is started when the system boots. When an association is received, the incoming objects will be validated and stored in the database.

The Import command is invoked when a user requests to import from a DICOM media file. The selected DICOM media is imported and incoming objects will be validated and stored in the database.

On request of the user, the Modality Worklist is queried at the remote modality worklist SCP. The worklist items returned are made available to the user. The user can select a worklist item from the worklist. The attributes settings that belong to the selected worklist item will be applied to the objects created, at the moment that the requested task in the selected worklist item is carried out.

5.2   Data Types

Smoothbase supports the following data types:

- Brachy Treatment plans
- Brachy Treatment records

The previously handled volumes are calculated automatically from the frames during loading.

The supported data types are stored using the DICOM format using the following mapping to the supported DICOM standard:

Data Type	DICOM format
Brachy Treatment plans	RT Brachy Plan
Brachy Treatment records	RT Brachy Record

5.3 Data Hierarchy

The following figure shows the relationship between the different data.
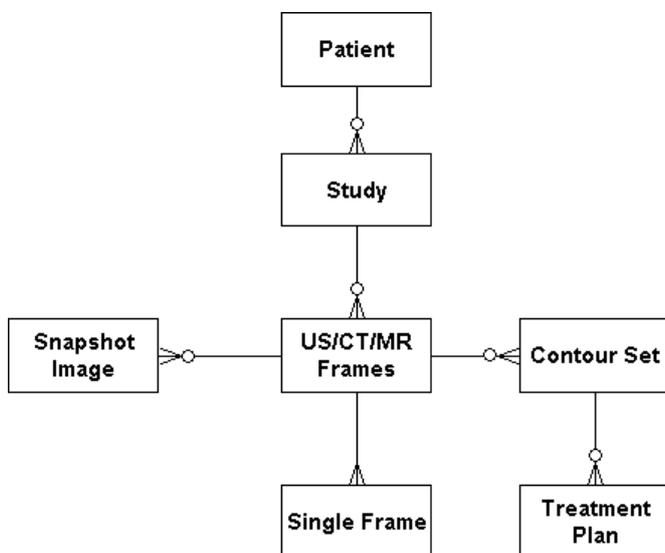
Figure 5-3 Data hierarchy

5.4 Functional Definitions of AE's

All communications and transfer with the remote application is accomplished utilizing the DICOM protocol over a network using the TCP/IP protocol stack or the DICOM Media File.

The system configuration contains a value for a DICOM Character set. The configured Character Set is included in the sent DICOM messages. The default character set ISO IR 6 will be included when needed (see chapter 10). If the Character Set is not configured then "ISO _IR 100" will be used.

5.4.1 Query/Retrieve SCU AE

The Query/Retrieve SCU AE supports negotiation and establishment of association with a Query/Retrieve SCP AE. It supports querying for patients, studies, series and series items (plans/images), as well as issuing of C-MOVE requests for selected information objects. If a Find or Move request is issued, the SCU AE will synchronously wait for a response from the remote SCP AE.

5.4.2 Storage SCU AE

The Storage SCU AE establishes an association with a user selected remote AE just prior to sending a Store request to that AE.

5.4.3 Storage SCP AE

The Storage SCP AE waits for an association to accept at the TCP/IP port number 104. When an association request is received with valid connections criteria, the Storage SCP AE responds with a list of SOP class UIDs that it will accept. It then waits for a Store request. If a Store is received, then from all incoming plans and images that are conformant to the association, Smoothbase domain objects are created. These domain objects are validated against their validation rules and stored in the database when valid.

5.4.4 Unified Worklist SCU AE

The Unified Worklist SCU AE supports negotiation and establishment of association with Unified Worklist SCP AE. It supports querying for the DICOM Unified Worklist.

Unified workflow has commands to get work list, change state of work item and update work item. These are translated into C-Find, N-Action and N-Set requests as appropriate and processed over an association.

5.4.5 Modality worklist SCU AE

The modality worklist SCU AE supports negotiation and establishment of association with modality worklist SCP AE. It supports querying for the basic worklist.

5.5 Sequencing of Real-World Activities

Not applicable.

5.6 File Meta Information Options

The Implementation Class UID is 1.2.528.1.1007.189.1.

The Implementation Version Name is 'SMOOTBASE_2_3'.

The Source Application Entity Title is 'Smoothbase'.

6. AE Specifications

6.1 Query Retrieve SCU AE – Specification

The Query Retrieve SCU AE provides Standard Conformance to the following DICOM V3.0 SOP Classes as a Query Retrieve SCU.

SOP Class Name	SOP Class UID
RT Brachy Plan Storage	1.2.840.10008.5.1.4.1.1.481.5
RT Brachy Record Storage	1.2.840.10008.5.1.4.1.1.481.6

6.1.1 Association Establishment Policies

6.1.1.1 General

The Query Retrieve SCU AE will initiate an association as a Query Retrieve Service Class User, requesting data about object instances and object instances themselves.

The PDU size is configurable and should be defined between 4096 byes and 28672K bytes.

6.1.1.2 Number of Associations

The maximum number of simultaneous associations is one.

6.1.1.3 Asynchronous Nature

The Query Retrieve SCU AE does not support asynchronous communication (multiple outstanding transactions over a single association).

6.1.1.4 Implementation Identifying Information

The Implementation Identifying information is defined as followed:
- The implementation class UID is 1.2.528.1.1007.189.1.
- The implementation version name is SMOOTHBASE_2_3

6.1.2 Association Initiation by Real-World Activity

The Query Retrieve SCU AE initiates an association for the appropriate Query Retrieve Service Class that corresponds to the set of information objects that is requested for lookup or for transfer. The association is closed when all queries have been performed or all requested information objects have been transferred or when an error occurs.

The user selects a function for querying and retrieving messages from a known source that supports Query and Retrieve as a Provider.

6.1.2.1 Real-World Activity for Find and Move execution operations of Oncentra Application

The Oncentra application opens associations to do C-FINDs and C-MOVEs. The associations are closed after an error or when the initiator requests them to be closed.

6.1.2.2 Associated Real-World Activity for the Find and Move operations

The Oncentra application can load patient data by means of a DICOM Query Retrieve dialog.

Based on operator supplied search parameters, the application selects an appropriate query model to be used in a C-FIND request to a selected Query Retrieve Provider.

The result returned from the Query Retrieve Provider, if any, is displayed in a dialog, from which the operator may select candidates for retrieval to the Smoothbase Storage Provider.

The selected retrieval candidate data, if any selected, is used in a new association with a C-MOVE request to the Query Retrieve Provider. The result, if successful, is displayed in the application and may be used for further processing.

6.1.2.3 Proposed Presentation Contexts

The presentation contexts that are proposed by the Query Retrieve SCU AE for the Query Retrieve operations are specified in the following table.

Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	**UID**	**Name List**	**UID List**		
Study Root Query Retrieve Information Model - Find	1.2.840.10008.5.1.4.1.2.2.1	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCU	None
Study Root Query Retrieve Information Model - Move	1.2.840.10008.5.1.4.1.2.2.2	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCU	None

Note: *Big Endian is not yet supported in the current version of Smoothbase.*

6.1.3   Association Acceptance Policy

The Query Retrieve SCU AE never accepts an association.

6.2   Storage SCU AE – Specification

The Storage SCU AE provides Standard Conformance to the following DICOM V3.0 SOP Classes as a Storage SCU.

SOP Class Name	SOP Class UID
RT Brachy Plan Storage	1.2.840.10008.5.1.4.1.1.481.5
RT Brachy Record Storage	1.2.840.10008.5.1.4.1.1.481.6

6.2.1   Association Establishment Policies

6.2.1.1   General

The Storage SCU AE will initiate an association as an SCU of Storage Services when a local operator requests to send objects over the network to a remote Storage SCP. The association is closed when the object has been sent to the remote Storage SCP. The Storage SCU AE is able to abort the association when an error occurs.

The PDU size is configurable and should be defined between 4096 byes and 28672K bytes.

6.2.1.2   Number of Associations

The maximum number of simultaneous associations is one.

6.2.1.3   Asynchronous Nature

The Storage SCU AE does not support asynchronous communication (multiple outstanding transactions over a single association).

6.2.1.4   Implementation Identifying Information

The Implementation Identifying information is defined as followed:
- The implementation class UID is 1.2.528.1.1007.189.1.
- The implementation version name is SMOOTHBASE_2_3

6.2.2   Association Initiation by Real-World Activity

The Storage SCU AE initiates an association for the appropriate Storage Services Class that corresponds to the set of objects requested for transfer. The association is closed when all objects have been sent to the remote DICOM system or when an error occurs.

6.2.2.1   Real-World Activity for the Transfer Objects operation

The Storage SCU AE initiates associations for the transfer of objects to a remote DICOM system.

6.2.2.1.1   Associated Real-World Activity

The user selects the Export Command and the DICOM destination. The DICOM destination can be configured with one or more DICOM Export adapters.

Once the association has been established, the Storage SCU AE sends a Store message.

6.2.2.1.2 Proposed Presentation Contexts

The presentation contexts that are proposed by the Storage SCU AE for the Transfer Objects operation are specified in the following table.

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Applies to all supported storage SOP classes		Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCU	None

6.2.3 Association Acceptance Policy

The Storage SCU AE never accepts an association.

6.3 Storage SCP AE – Specification

The Storage SCP AE provides Standard Conformance to the following DICOM V3.0 SOP Classes as a Verification SCP.

SOP Class Name	SOP Class UID
Verification SOP Class	1.2.840.10008.1.1

The Storage SCP AE provides Standard Conformance to the following DICOM V3.0 SOP Classes as a Storage SCP.

6.3.1 Association Establishment Policies

SOP Class Name	SOP Class UID
RT Brachy Plan Storage	1.2.840.10008.5.1.4.1.1.481.5
RT Brachy Record Storage	1.2.840.10008.5.1.4.1.1.481.6

6.3.1.1 General

The Storage SCP AE will wait for an association as an SCP of Storage Services. When a Store request is received, the corresponding objects are validated and when valid, stored in the database.

The PDU size is configurable and should be defined between 4096 byes and 28672K bytes.

6.3.1.2 Number of Associations

The maximum number of simultaneous associations is one.

6.3.1.3 Asynchronous Nature

The Storage SCP AE does not support asynchronous communication (multiple outstanding transactions over a single association).

6.3.1.4   Implementation Identifying Information

The Implementation Identifying information is defined as followed:
- The implementation class UID is 1.2.528.1.1007.189.1.
- The implementation version name is SMOOTHBASE_2_3

6.3.2   Association Initiation by Real-World Activity

The Storage SCP AE never initiates an association.

6.3.3   Association Acceptance Policy

The Storage SCP AE accepts an association for the Verification and Storage Service Class. The Storage SCP is able to abort the association when an error occurs.

Note:	*Only those associations are accepted that are registered with the Storage SCP AE.*

6.3.3.1   Real-World Activity for the Echo Response operation

The Storage SCP AE waits for an association request and accepts associations to do, among other things, the Verification Service. The association is closed after an error or when the initiator requests it to be closed.

6.3.3.1.1   Presentation Context table

Only the presentation context listed in the following table will be accepted by the Storage SCP AE for the Verification Service Class.

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Verification Service Class	1.2.840.10008.1.1	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCP	None

6.3.3.2   Real-World Activity for the Receive Objects operation

The Storage SCP AE waits for an association and offers to do the Storage service. The association is closed after an error or when the initiator requests it to be closed.

6.3.3.2.1   Associated Real-World Activity

Once the association has been established, the Storage SCP AE waits for the transmission of conformant Storage Service messages.

6.3.3.2.2   Presentation Context table

Only the presentation contexts listed in the following table will be accepted by the Storage SCP AE for the Storage Service Class.

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Applies to all supported storage SOP classes		Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCP	None

6.3.3.2.3 SOP Specific Conformance for all storage SOP Classes

The Storage SCP AE, responds to a C-STORE request with one of the following response codes.

Service Status	Status Description	Status Code (0000,0900)	Related Fields
Success		0000	None
Error	Incoming object was not valid or could not be written to the database.	0110	None
Error	The new SOP Instance Value supplied by the invoking DIMSE-service-user was already registered for a SOP Instance of the specified SOP Class (Duplicate SOP Instance UID).	0111	
Error	Data Set does not match SOP Class.	A900	
Error	Send Study Instance UID (0020,000D) is already known under a different Patient ID (0010,0020).	A9A8	
Error	Send Series Instance UID (0020,000E) is already known under a different Study Instance UID (0020,000D).	A9A9	
Warning	Certain attributes have been changed in order to coerce the SOP Instance into the Query Model of the SCP.	B000	

Note: *Attributes with a value type of 'Coded String (CS)' will only be accepted if they have a value as defined in the DICOM standard, unless stated otherwise in Appendix A. When the CS value is not recognized as a defined term, then status code 0110 is returned.*

6.3.3.2.4 Presentation Context Acceptance Criterion

Not applicable since only a single presentation context for each Storage Service Class is supported.

6.3.3.2.5 Transfer Syntax Selection Policies

Transfer syntaxes are accepted in the following order.

Transfer Syntax Name
Explicit VR Little Endian
Implicit VR Little Endian

6.4 Unified Worklist SCU AE – Specification

6.4.1 Unified Procedure Step Pull SCU – Specification

DICOM Unified Worklist module provides Standard Conformance to the following DICOM Service Object Pair (SOP) Class as a Unified Worklist and Procedure Step Service Class User (SCU).

SOP Class Name	SOP Class UID
UPS Pull SOP Class	1.2.840.10008.5.1.4.34.4.3

6.4.2   Association Establishment Policies

6.4.2.1   General

When DICOM Unified Worklist module needs to execute command(s) it creates an association and then closes the association immediately when the commands have been performed. Hence, all associations are short lived and in general there is no open association between the SCU and the SCP.

6.4.2.2   Number of Associations

DICOM Unified Worklist module will establish at most one association per client workstation.

6.4.2.3   Asynchronous Nature

DICOM Unified Worklist module does not support asynchronous communication (multiple outstanding transactions over a single association).

6.4.2.4   Implementation Identifying Information

The Implementation Identifying information is defined as followed:
- The implementation class UID is 2.16.840.1 (i.e. that of MergeCom-3).
- The implementation version name is SMOOTHBASE_2_3.

6.4.2.5   Association Initiation policy

DICOM Unified Worklist module keeps no long living associations with the management system. Instead it creates short-lived associations each time it needs to perform some work and then closes it immediately. Depending on the nature of the work to be done, one or more commands can be sent while the association is open. The work to be done during an association is triggered by user actions, but associations are never kept open while waiting for user input.

6.4.2.6   Association Acceptance policy

Not applicable in this version.

6.4.2.7   Real-World Activity for operations in DICOM Unified Worklist module
6.4.2.7.1   Associated Real-World Activities

The following table is a map between the real world operations of DICOM Unified Worklist module and how they map to DICOM commands. Each real world operation maps to one association being established and closed.

Operation		DICOM command	
Command	**Description**	**Command**	**Description**
Get Worklist	Get a list of work items for a given station and date	C-Find	Query for the list and process respond messages.
Start Work item	Indicates to the management system that this workstation intends to perform the work of this work item.	N-Action	Update the status from SCHEDULED to IN PROGRESS.
		N-Set	Set Procedure Step Progress to 0%.
Update Work item	Gives the management system an intermediate indication of the progress of the work item.	N-Set	Set Procedure Step Progress to any value (0 – 100%).
Complete Work item	Tells the management system that this work item has been completed.	N-Set	Set Procedure Step Progress to 100%. Set Station, Start Date, End Date, Comment and actual human performer.
		N-Action	Update the status from IN PROGRESS to COMPLETED.
Cancel Work item	Tells the management system that the work on this work item has	N-Set	Set Procedure Step Progress to any value (0 – 100%)..

Operation		DICOM command	
Command	**Description**	**Command**	**Description**
	been cancelled. The progress indicator and the comments give further information about the state of the work at cancellation.		Set Station, Start Date, End Date, Comment and actual human performer.
		N-Action	Update the status from IN PROGRESS to CANCELLED.

6.4.2.7.2 Accepted presentation Context for C-FIND and C-MOVE execution operations

The presentation contexts that are proposed by the Query Retrieve SCP AE for the Query Retrieve operations are specified in the following table:

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	**UID**	**Name List**	**UID List**		
Unified Procedure Step Pull	1.2.840.10008.5.1.4.34.4.3	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

6.4.3 Specific Conformance for Unified Procedure Step Pull SOP class

6.4.3.1 C-FIND

The work list query uses the following keys and return values:

Level Name / Attribute Name	Tag	Key Type	Comments
Study Instance UID	0020,000D	R	
PatientsName	0010,0010	R	
PatientID	0010,0020	R	
Scheduled Procedure Step Start Date And Time	0040,4005	M	A range corresponding to one day.
Scheduled Procedure Step Priority	0074,1200	R	
Procedure Step Label	0074,1204	R	
Work List Label	0074,1202	R	
Scheduled Station Name Code Sequence	0040,4025	M	
>CodeValue	0008,0100	M	
Scheduled Workitem Code Sequence	0040,4018	M	
>Code Value	0008,0100	M	Always "121726".
>Coding Scheme Designator	0008,0102	M	Always "DCM".
>Code Meaning	0008,0104	R	
Input Information Sequence	0040,4021	R	
Referenced Request Sequence	0040,A370	R	
>Requested Procedure Description	0032,1060	R	

Level Name / Attribute Name	Tag	Key Type	Comments
Scheduled Processing Parameter Sequence	0074,1210	R	Used to get delivery type (TREATMENT or CONTINUATION)
Unified Procedure Step State	0074,1000	M	Always "SCHEDULED".

Key Types of Matching:
- M : This key is used for matching.
- R : This key is requested for return without matching.

Response status return behavior

Service Status	Status Description	Status Code (0000,0900)
Success	All rows fetched, no error.	0000
Pending	One row fetched successfully, potentially more rows	FF00
Pending – No optional keys	to fetch.	FF01
Any other response	Will be reported as an error.	

6.4.3.2   N-SET

Updating a work item uses the following attributes:

Level Name / Attribute Name	Tag	Update type	Comments
UPS Progress Information Sequence	(0074,1002)	Any	
>Unified Procedure Step Progress	(0074,1004)	Any	
UPS Performed Procedure Sequence	(0074,1216)	Any	
>Performed Processing Parameter Sequence	(0074,1212)	Any	
>>Value Type	(0040,A040)	Any	"TEXT"
>>Text Value	(0040,A160)	Any	"-1"
>>Concept Name Code Sequence	(0040,A168)	Any	
>>>Code Value	(0008,0100)	Any	"121700"
>>>Coding Scheme Designator	(0008,0102)	Any	"DCM"
>>>Code Meaning	(0008,0104)	Any	"Referenced Beam Number in Progress"
>Actual Human Performers Sequence	(0040,4035)	Final	
>>Human Performer Code Sequence	(0040,4009)	Final	
>>>Code Value	(0008,0100)	Final	Performers id
>>>Coding Scheme Designator	(0008,0102)	Final	Performers designator
>>>Coding Scheme Version	(0008,0103)	Final	Performers Version
>>>Code Meaning	(0008,0104)	Final	Performers name
>>Human Performers Organization	(0040,4036)	Final	Empty
>>Human Performers Name	(0040,4037)	Final	
>Performed Station Name Code Sequence	(0040,4028)	Final	
>>Code Value	(0008,0100)	Final	Station id

Level Name / Attribute Name	Tag	Update type	Comments
>>Coding Scheme Designator	(0008,0102)	Final	Station designator
>>Coding Scheme Version	(0008,0103)	Final	Station version
>>Code Meaning	(0008,0104)	Final	Station name
>Performed Procedure Step Start Date	(0040,0244)	Final	
>Performed Procedure Step Start Time	(0040,0245)	Final	
>Performed Procedure Step End Date	(0040,0250)	Final	
>Performed Procedure Step End Time	(0040,0251)	Final	
>Performed Workitem Code Sequence	(0040,4019)	Final	As received from SCP
>>Code Value	(0008,0100)	Final	
>>Coding Scheme Designator	(0008,0102)	Final	
>>Coding Scheme Version	(0008,0103)	Final	
>>Code Meaning	(0008,0104)	Final	
>Performed Procedure Step Description	(0040,0254)	Final	
>Comments On The Performed Procedure Step	(0040,0280)	Final	
>Output Information Sequence	(0040,4033)	Any	Empty sequence
>Non DICOM Output Code Sequence	(0040,4032)	Any	Empty sequence

Update types:
- Any: Included in all updates.
- Final: Included in final update only, i.e. just before Complete/Cancel.

Response status return behavior

Service Status	Status Description	Status Code (0000,0900)
Success	All rows fetched, no error.	0000
Any other response	Will be reported as an error.	

6.4.3.3 N-ACTION

Changing the state of a work item uses the following attributes:

Attribute name	Tag	Comments
Transaction UID	(0008,1195)	Used and included according to DICOM supplement 96.
Unified Procedure Step State	(0074,1000)	

Response status return behavior

Service Status	Status Description	Status Code (0000,0900)
Success	All rows fetched, no error.	0000
Transaction UID not provided	The work item is already owned by another workstation.	C301
Any other response	Will be reported as an error.	

6.5 Modality Worklist SCU AE – Specification

The Modality Worklist SCU AE provides Standard Conformance to the following DICOM V3.0 SOP Classes as a Modality Worklist SCU.

SOP Class Name	SOP Class UID
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31

6.5.1 Association Establishment Policies

6.5.1.1 General

The Modality Worklist SCU AE will initiate an association as a Service Class User, requesting data about object instances and object instances themselves.

The PDU size is configurable and should be defined between 4096 byes and 28672K bytes.

6.5.1.2 Number of Associations

The maximum number of simultaneous associations is one.

6.5.1.3 Asynchronous Nature

The Modality Worklist SCU AE does not support asynchronous communication (multiple outstanding transactions over a single association).

6.5.1.4 Implementation Identifying Information

The Implementation Identifying information is defined as followed:
- The implementation class UID is 1.2.528.1.1007.189.1.
- The implementation version name is SMOOTHBASE_2_3

6.5.2 Association Initiation by Real-World Activity

The Modality Worklist SCU AE initiates an association for the appropriate Modality Worklist Service Class that corresponds to the set of worklist objects that is requested for lookup or for transfer. The association is closed when all queries have been performed or all requested information objects have been transferred or when an error occurs.

The Oncentra user selects a function for querying and retrieving messages from a known source that supports Modality Worklist as a Provider.

6.5.2.1 Real-World Activity for Find execution operations of Flexitron TCC

The Flexitron application opens associations to do C-FINDs. The associations are closed after an error or when the initiator requests them to be closed.

6.5.2.1.1 Associated Real-World Activity for the Find and Move operations

The Oncentra application can load worklist data by means of a DICOM Modality Worklist dialog.

Based on operator supplied search parameters, the application uses a C-FIND request to a selected Modality Worklist Provider.

The result returned from the Modality Worklist Provider, if any, is displayed in a list, from which the operator may select a worklist item. The attribute values that belong to the selected worklist item will be used by the application while performing the tasks requested in the selected worklist item or any other task for which these attribute values can be used.

6.5.2.1.2   Proposed Presentation Contexts

The presentation contexts that are proposed by the Modality Worklist SCU AE for the Modality Worklist operation(s) are specified in the following table.

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Worklist Information Model - Find	1.2.840.10008.5.1.4.31	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCU	None

Note: *Big Endian is not yet supported in the current version of Smoothbase.*

6.5.3   Association Acceptance Policy

The Modality Worklist SCU AE never accepts an association.

6.5.4   SOP Specific Conformance - Modality Worklist Management

6.5.4.1   Matching keys and return keys

The user can configure/select the matching keys that will be used in the query. The following keys are provided to the user:

Module / Attribute Name	Tag	Match Key Type	Match
Scheduled Procedure Step			
Scheduled Station AE Title	(0040,0001)	R	SV
Scheduled Procedure Step Start Date	(0040,0002	R	SV or RM
Scheduled Procedure Step Start Time	(0040,0003)	R	SV or RM

Start Date: The user can select the start date from a list, containing the following values: Today, (= everything from today and later), Yesterday, (=everything from yesterday and later), Last 3 days, Last 7 days, all values are mapped in Scheduled Procedure Start Date (0040,0002).

SV - single value

RM - range matching

WC - wildcard matching

SM - Sequence matching

The Oncentra application will provide support for requests on the following information:

Module / Attribute Name	Tag	Return Key Type
Scheduled Procedure Step		
Scheduled Station AE Title	(0040,0001)	1
Scheduled Procedure Step Start Date	(0040,0002	1
Scheduled Procedure Step Start Time	(0040,0003)	1
Scheduled Performing Physician's Name	(0040,0006)	2
Scheduled Procedure Step Description	(0040,0005)	1C
Patient Identification		
Patient ID	(0010,0020)	1
Patients Name	(0010,0010)	1
Patient Demographic		
Patients Birth Date	(0010,0030)	2
Patients Sex	(0010,0040)	2
Patients Weight	(0010,1030)	2
Patient's Age	(0010,1010)	3
Patient's Size	(0010,1020)	3
Patient Comments	(0010,4000)	3
Imaging Service Request		
Accession Number	(0008,0050)	2
Referring Physician's Name	(0008,0090)	2
Requested Procedure		
Study Instance UID	(0020,000D)	1
Study ID	(0020,0010)	3
Study Description	(0008,1030)	3
Study Date	(0008,0020)	3
Study Time	(0008,0030)	3
Visit Status		
Current Patient Location	(0038,0300)	2

6.5.4.2   Status codes processed when receiving messages from a modality worklist SCP

Service Status	Further Meaning	Status Codes	Flexitron TCC Behavior
Refused	Out of resources	A700	No worklist
Failed	Identifier does not match SOP class	A900	No worklist

Service Status	Further Meaning	Status Codes	Flexitron TCC Behavior
	Unable to process	Cxxx	No worklist
Cancel	Matching terminated due to cancel request	FE00	No worklist
Success	Matching is complete - No final identifies will be supplied	0000	Worklist displayed
Pending	Matches are continued - Current match is supplied and any Optional Keys were supported in the same manner as required keys	FF00	Indication that the Worklist is retrieved
	Matches are continuing - Warning that one or more Optional Keys were not supported for this identifier	FF01	Indication that the Worklist is retrieved

7.   Communication Profiles

7.1   Supported Communication Stacks

Smoothbase, in conjunction with MergeCOM-3, provides DICOM V3.0 TCP/IP Network Communication Support as defined in PS 3.8.

7.2   TCP/IP Stack

Smoothbase uses the MergeCOM-3 Advanced DICOM Tool Kit to communicate over the TCP/IP protocol stack on any physical interconnection media supporting the TCP/IP stack. The tool kit inherits the TCP/IP stack from the Microsoft Windows operating system upon which it executes.

7.3   Physical Media Support

The Smoothbase AE is indifferent to the physical medium over which TCP/IP executes; it inherits this from the Microsoft Windows operating system upon which it executes.

8. Extensions/Specializations/Privatizations

8.1 Standard Extended/Specialized/Private SOPs

None supported.

8.2 Private Transfer Syntaxes

None supported.

9. Configuration

The lower-level configuration parameters are default set during the installation of the software. These settings work for the most systems, but it is possible that some modifications are needed to improve the communication with a remote system.

Most parameters should NEVER be changed. Doing so could break DICOM conformance. Never change lower-level communication parameters. Contact Nucletron service department for advice.

9.1 AE Title/Presentation Address Mapping

Presentation address mapping is configured through the Configure DICOM dialog of Smoothbase application.

The Presentation Address of the application is specified according to the following table:

AE Title/Presentation Address Mapping	Defaults	Description
AE Title	Smoothbase	The default SCU and SCP for Flexitron TCC. Note that the AE title for SCU and SCP should be equal for correct working.
TCP/IP port	104	

These parameters are configurable by a Nucletron Service engineer.

In case there are multiple workstations with Smoothbase applications, each workstation must have a unique AE title for the storage provider to ensure that external systems can address them uniquely.

9.2 Configurable Parameters

The logging of error messages, warning messages, informational messages and trace messages can be enabled or disabled in the configuration file.

The maximum PDU size can be configured in the configuration file.

- The default size is 28672 bytes.

10. Support of Extended Character Sets

The System supports the following character sets:

ISO_IR 6:	Default repertoire
ISO_IR 100:	Latin alphabet No. 1
ISO_IR 101:	Latin alphabet No. 2
ISO_IR 109:	Latin alphabet No. 3
ISO_IR 110:	Latin alphabet No. 4
ISO_IR 144:	Cyrillic
ISO_IR 127:	Arabic
ISO_IR 126:	Greek
ISO_IR 138:	Hebrew
ISO_IR 148:	Latin alphabet No. 5
ISO_IR 13:	Japanese Katakana / Romaji
ISO_IR 166:	Thai
ISO 2022 IR 87:	Japanese Kanji
ISO 2022 IR 159:	Japanese Supplementary Kanji
ISO 2022 IR 149:	Korean
ISO_IR 192:	Unicode in UTF-8
GB18030:	GB18030

For Japanese and Korean character sets the system will also include ISO 2022 IR 6 character set.

The System supplies this value in the Specific Character Set Attribute (0008,0005). This attribute is supplied in the SOP common module and in any sequence item.

11. Codes and Controlled Terminology

Not supported.

12. Security Profiles

Not supported.

13.   DICOM – Flexitron TCC; Specific Implementations Details

This appendix lists the supported Information Object Definitions (IODs). In each section header, a reference is given between brackets to the corresponding section in the official DICOM Standard document, part 3.

13.1   Definitions

	SCP (Importer)	Description
Modules		
	SCP - Not supported	The module is not supported by the application. That means that the received module is ignored during import.
	SCP - Not used	The module Is not used by the application, but the received module is made persistent. On an export the module is used for export.
Attribute		
	SCP - Not Supported	
	SCP - Used	Means that the application uses this attribute.
	SCP - Not used.	The attribute is not used by the application. The content of the attribute is remained and re-used on an export.
	SCP - Ignored	The attribute is ignored by the application. The content of the attribute is lost on export.
	SCP - Supported by application if supplied …	The attribute is supported by the application when specified parameters are supplied.
	SCP - Supported if supplied …	The attribute is supported by the "Storage SCP" when specified parameters are supplied.

	SCU (Exporter)	Description
Modules		
	SCU - Provided	The Module as it initially is provided by the application. When the module has been imported, the original content is provided on export.
	SCU - Not provided	The module is not provided by the application when a new IOD is made.
Attribute		
	SCU - Provided	The attribute as it initially is provided by the application. When the attribute is imported, this value is provided on an export.
	SCU - Not provided	The attribute is not provided by the application on an export. When the attribute is imported, this value is provided on an export. Note that: DICOM type 1 is always sent. In case type 2 a "null" value is sent.
	SCU – Not Provided Conditionally	The attribute is not provided by the application on an export. When the attribute is imported, this value is provided or not provided on an export depending on application activities. Note that: DICOM type 1 is always sent. In case type 2 a "null" value is sent.
	SCU - Supported values	If not all options are supported, a list with supported options follows e.g. Beam Type: SCU: Supported Values "Photons and Electrons"

14. RT Treatment Plan & RT Brachy Record

14.1 RT Plan IOD (A.20)

IE	Module	Section	DICOM Usage	Comments
Patient	Patient	14.1.1 (C.7.1.1)	M	
	Clinical Trial Subject	(C.7.1.3)	U	SCP - Not used SCU - Not provided
Study	General Study	14.1.2 (C.7.2.1)	M	
	Patient Study	14.1.3 (C.7.2.2)	U	SCP - Used SCU - Provided
	Clinical Trial Study	(C.7.2.3)	U	SCP - Not used SCU - Not provided
Series	RT Series	14.1.4 (C.8.8.1)	M	
	Clinical Trial Series	(C.7.3.2)	U	SCP - Not used SCU - Not provided
Frame of Reference	Frame of Reference	14.1.5 (C.7.4.1)	U (see note in DICOM description)	SCP - Not used SCU - Not provided
Equipment	General Equipment	14.1.5 (C.7.5.1)	M	
Plan	RT General Plan	14.1.6 (C.8.8.9)	M	
	RT Prescription	(C.8.8.10)	U	SCP - Not used SCU - Not provided
	RT Tolerance Tables	(C.8.8.11)	U	SCP - Not used SCU - Not provided
	RT Patient Setup	(C.8.8.12)	U	SCP - Not Used SCU – Not Supported
	RT Fraction Scheme	14.1.7 (C.8.8.13)	U	SCP - Used SCU - Provided
	RT Beams	(C.8.8.14)	C - Required if RT Fraction Scheme Module exists and Number of Beams (300A,0080) is greater than zero for one or more fraction groups	SCP - Not used SCU - Not provided
	RT Brachy Application Setups	14.1.8 (C.8.8.15)	C - Required if RT Fraction Scheme Module exists and Number of Brachy Application Setups (300A,00A0) is greater than zero for one or more fraction groups	SCP - Used SCU – Provided
	Approval	14.1.9 (C.8.8.16)	U	SCP - Used SCU - Provided
	SOP Common	14.1.10 (C.12.1)	M	

14.1.1 Patient Module (C.7.1.1)

Attribute Name	Tag	Type	Notes
Patient Name	(0010,0010)	2	SCU - Provided SCP – Used
Patient ID	(0010,0020)	2	SCU - Provided SCP - Must be entered on import to Flexitron TCC by user if not specified via DICOM.
Patient's Birth Date	(0010,0030)	2	SCU - Provided SCP – Used
Patient's Sex	(0010,0040)	2	SCU – Provided SCP - Used
Referenced Patient Sequence	(0008,1120)	3	SCU - Not provided SCP - Not used
>Referenced SOP Class UID	(0008,1150)	1	SCU – Not provided SCP – Not used
>Referenced SOP Instance UID	(0008,1155)	1	SCU – Not provided SCP – Not used
Patient's Birth Time	(0010,0032)	3	SCU – Not Provided SCP – Not Used
Other Patient Ids	(0010,1000)	3	SCU - Not provided SCP - Not used
Other Patient Names	(0010,1001)	3	SCU - Not provided SCP - Not used
Ethnic Group	(0010,2160)	3	SCU - Not provided SCP - Not used
Patient Comments	(0010,4000)	3	SCU - Not provided SCP - Not used

14.1.2 General Study (C.7.2.1)

Attribute Name	Tag	Type	Notes
Study Instance UID	(0020,000D)	1	SCU - Provided SCP - Used to validate study/series contents.
Study Date	(0008,0020)	2	SCU - Provided SCP - Used
Study Time	(0008,0030)	2	SCU - Provided; set as local time because the study is used from RT Plan. SCP - Used
Referring Physician's Name	(0008,0090)	2	SCU - Provided SCP - Used
Study ID	(0020,0010)	2	SCU - Provided SCP - Used
Accession Number	(0008,0050)	2	SCU - Provided SCP - Used
Study Description	(0008,1030)	3	SCU - Provided SCP - Used
Physician(s) of Record	(0008,1048)	3	SCU - Not provided SCP - Not used
Name of Physician(s) Reading Study	(0008,1060)	3	SCU - Not provided SCP - Not used
Referenced Study Sequence	(0008,1120)	3	SCU - Not provided SCP - Not used
>Referenced SOP Class UID	(0008,1150)	1	SCU – Not provided SCP – Not used
>Referenced SOP Instance UID	(0008,1155)	1	SCU – Not provided SCP – Not used
Procedure Code Sequence	(0008,1032)	3	SCU - Not provided SCP - Not used

14.1.3   Patient Study Module Attributes (C.7.2.2)

Attribute Name	Tag	Type	Notes
Admitting Diagnoses Description	(0008,1080)	3	SCP - Not used SCU - Not supported
Admitting Diagnoses Code Sequence	(0008,1084)	3	SCP - Not used SCU - Not supported
>Code Sequence Macro	(Table 8.8-1)		SCP - Not used SCU - Not supported
Patient's Age	(0010,1010)	3	SCU - Provided SCP - Used
Patient's Size	(0010,1020)	3	SCU - Provided SCP - Used
Patient's Weight	(0010,1030)	3	SCU - Provided SCP - Used
Occupation	(0010,2180)	3	SCP - Not used SCU - Not supported
Additional Patient History	(0010,21B0)	3	SCP - Not used SCU - Not supported

14.1.4   RT Series Module (C.8.8.1)

Attribute Name	Tag	Type	Notes
Modality	(0008,0060)	1	SCU – "RTPLAN" SCP - Used
Series Instance UID	(0020,000E)	1	SCU - Provided SCP - Used
Series Number	(0020,0011)	2	SCU – Not provided SCP - Not used
Series Description	(0008,103E)	3	SCU - Not provided SCP - Not used
Referenced Study Component Sequence	(0008,1111)	3	SCU - Not provided SCP - Not used
>Referenced SOP Class UID	(0008,1150)	1	SCU – Not provided SCP – Not used
>Referenced SOP Instance UID	(0008,1155)	1	SCU – Not provided SCP – Not used

14.1.5   Module General Equipment (C.7.5.1)

Attribute Name	Tag	Type	Notes
Manufacturer	(0008,0070)	2	SCU – Provided; "Nucletron" SCP - Used
Institution Name	(0008,0080)	3	SCU - Not Provided SCP - Not Used
Institution Address	(0008,0081)	3	SCU - Not provided SCP - Not used
Station Name	(0008,1010)	3	SCU – Provided; Windows Machine name. SCP - Not used
Institutional Department Name	(0008,1040)	3	SCU - Not provided SCP - Not used
Manufacturer's Model Name	(0008,1090)	3	SCU – "Flexitron Plan Manager" SCP – Used; Support manufacturers are Oncentra and Flexitron Plan Manager

Attribute Name	Tag	Type	Notes
Device Serial Number	(0018,1000)	3	SCU - Not provided SCP - Not used
Software Versions	(0018,1020)	3	SCU – Provided;Version number of TCC 3.2.1 SCP – Used; Support versions are: • OTP V4 and higher • OCP v4.1 and higher • Any version of FPM
Spatial Resolution	(0018,1050)	3	SCU - Not provided SCP - Not used
Date of Last Calibration	(0018,1200)	3	SCU - Not provided SCP - Not used
Time of Last Calibration	(0018,1201)	3	SCU - Not provided SCP - Not used
Pixel Padding Value	(0028,0120)	3	SCU - Not provided SCP - Not used

14.1.6   RT General Plan Module (C.8.8.9)

Attribute Name	Tag	Type	Notes
RT Plan Label	(300A,0002)	1	SCU - Provided SCP - Used
RT Plan Name	(300A,0003)	3	SCU - Provided SCP - Used
RT Plan Description	(300A,0004)	3	SCU – Provided, always "Brachy Plan" SCP - Used
Instance Number	(0020,0013)	3	SCU - Not provided SCP - Not used
Operators' Name	(0008,1070)	2	SCU - Provided SCP - Used
RT Plan Date	(300A,0006)	2	SCU - Provided SCP - Used
RT Plan Time	(300A,0007)	2	SCU - Provided SCP - Used
Treatment Protocols	(300A,0009)	3	SCU - Not provided SCP - Not used

Plan Intent	(300A,000A)	3	SCU - Provided
			    Non QA plan -> always CURATIVE
			    QA plan -> always MACHINE_QASCP - Used

Treatment Sites	(300A,000B)	3	SCU - Not provided SCP - Not used

RT Plan Geometry	(300A,000C)	1	SCU – Provided;
			   New Plan → always TREATMENT_DEVICE
			   Duplicated Plan → Derived value from original Plan
			SCP – Not Used

Referenced Structure Set Sequence	(300C,0060)	1C	SCU – Provided when supplied by original Plan SCP – Not Used
Referenced Dose Sequence	(300C,0080)	3	SCU – Not Provided; Always deleted when the plan is modified. SCP – Not Used

Attribute Name	Tag	Type	Notes
Private attributes	(300B,0010)	3	Private group creator, value "Nucletron"
Flexitron Plan Code	(300B,1029)	3	This is only used for brachy plans. SCU –Provided SCP – Used if provided
End private attributes			
Referenced RT Plan Sequence	(300C,0002)	3	SCU – Not provided SCP – Not used
> Referenced SOP Class UID	(0008,1150)	1	SCU – Not provided SCP – Not used
> Referenced SOP Instance UID	(0008,1155)	1	SCU – Not provided SCP – Not used

14.1.7   Fraction Scheme Module (C.8.8.13)

Attribute Name	Tag	Type	Notes
Fraction Group	(300A,0070)	1	SCU –Provided SCP –Used
>Fraction Group Number	(300A,0071)	1	SCU – Provided; Always one fraction. SCP – Used; Plan is rejected when more than one fraction is supplied.
>Referenced Patient Setup Number	(300C,006A)	3	SCU – Not Provided SCP – Not Used
>Number of Fractions Planned	(300A,0078)	2	SCU – Provided SCP – Used
>Number of Fraction Pattern Digits PerDay	(300A,0079)	3	SCU – Not Provided SCP – Not Used
>Repeat Fraction Cycle Length	(300A,007A)	3	SCU – Not provided SCP – Not Used
>Fraction Pattern	(300A,007B)	3	SCU – Not provided SCP – Not Used
>Number of Beams	(300A,0080)	1	SCU – Provided; Always 0. SCP – Not Used
>Number of Brachy Application Setups	(300A,00A0)	1	SCU – Provided; SCP – Used
>Referenced Brachy Application Setup Sequence	(300C,000A)	1C	SCU – Provided; SCP – Used
>>Referenced Brachy ApplicationSetup Number	(300C,000C)	1C	SCU – Provided; SCP – Used
>>Brachy Application Setup DoseSpecification Point	(300A,00A2)	3	SCU – Not Provided SCP – Not Used

Attribute Name	Tag	Type	Notes
>>Brachy Application Setup Dose	(300A,00A4)	3	SCU – Not Provided SCP – Not Used

Note: *An RT Dose IOD referenced within the Referenced Dose Sequence (300C,0080) can be used for storing grid-based (pixel) data, isodose curves, and/or individual dose points (with optional dose point names) for the current Fraction Group.*

Note: *The fractionation pattern does not indicate the actual start of treatment, or the order or timing of fraction delivery. If treatment does not commence as outlined in the pattern, it is the application's responsibility to make any necessary adjustments.*

14.1.8 RT Brachy Application Setups Module (C.8.8.15)

Attribute Name	Tag	Type	Notes
Brachy Treatment Technique	(300A,0200)	1	SCU – Provided SCP – Used
Brachy Treatment Type	(300A,0202)	1	SCU – Provided; Always HDR. SCP – Used; Only HDR Supported
Treatment Machine Sequence	(300A,0206)	1	SCU – Provided SCP – Used
>Treatment Machine Name	(300A,00B2)	2	SCU – Not provided SCP – Not used
>Manufacturer	(0008,0070)	3	SCU – Provided; "Nucletron" SCP – Used
>Institution Name	(0008,0080)	3	SCU – Provided SCP – Used
>Institution Address	(0008,0081)	3	SCU – Not Provided SCP – Not Used
>Institutional Department Name	(0008,1040)	3	SCU – Not Provided SCP – Not Used
>Manufacturer"s Model Name	(0008,1090)	3	SCU – Provided; "Flexitron" SCP – Used; Must be "Flexitron"
>Device Serial Number	(0018,1000)	3	SCU – Not Provided SCP – Not Used
Source Sequence	(300A,0210)	1	SCU – Provided SCP – Used; Plan is rejected when more than one source is supplied.
>Source Number	(300A,0212)	1	SCU – Provided SCP – Used

Attribute Name	Tag	Type	Notes
>Source Type	(300A,0214)	1	SCU – Provided, always "LINE" SCP – Used
>Source Manufacturer	(300A,0216)	3	SCU – Provided, always "Nucletron" SCP – Used
>Active Source Diameter	(300A,0218)	3	SCU – Provided if available SCP – Not Used
>Active Source Length	(300A,021A)	3	SCU – Provided if available SCP – Not Used
>Material ID	(300A,00E1)	3	SCU – Not Provided SCP – Not Used
>Source Encapsulation NominalThickness	(300A,0222)	3	SCU – Not Provided SCP – Not Used
>Source Encapsulation NominalTransmission	(300A,0224)	3	SCU – Not Provided SCP – Not Used
>Source Isotope Name	(300A,0226)	1	SCU – Provided; Ir-192 or Co-60 SCP – Used; Only Ir-192 or Co-60 are supported.
>Source Isotope Half Life	(300A,0228)	1	SCU – Provided SCP – Used;
>Source Strength Units	((300A,0229)	1C	SCU – Not Provided; No Beta source supported SCP – Not Used
>Reference Air Kerma Rate	(300A,022A)	1	SCU – Provided SCP – Used
>Source Strength	(300A,022B)	1C	SCU – Not Provided; No Beta source supported SCP – Not Used
> Source Strength Reference Date	(300A,022C)	1	SCU – Provided SCP – Used
> Source Strength Reference Time	(300A,022E)	1	SCU – Provided SCP – Used
>Private attributes	(300B,0010)	3	SCU – Provided SCP – Used
>Source Identification Number	(300B,100C)	3	SCU – Provided; Ir-192 = 0900001 or Co-60= 0900003 SCP – Used; Identification of the source as provided by the afterloader manufacturer should match
>End Private attributes	(300B,0010)	3	SCU – Provided SCP – Used
Application Setup Sequence	(300A,0230)	1	SCU – Provided SCP – Used; Plan is rejected when more than one application Setup is supplied.

Attribute Name	Tag	Type	Notes
>Application Setup Type	(300A,0232)	1	SCU – Provided; Always "UNDEFINED" SCP – Used
>Application Setup Number	(300A,0234)	1	SCU – Provided, always 0 SCP – Used
>Application Setup Name	(300A,0236)	3	SCU – Provided if available SCP – Not Used
>Application Setup Manufacturer	(300A,0238)	3	SCU – Provided if available SCP – Not Used
>Template Number	(300A,0240)	3	SCU – Provided if available SCP – Not Used
>Template Type	(300A,0242)	3	SCU – Provided if available SCP – Not Used
>Template Name	(300A,0244)	3	SCU – Provided if available SCP – Not Used
>Total Reference Air Kerma	(300A,0250)	1	SCU – Provided SCP – Used
>Brachy Accessory Device Sequence	(300A,0260)	3	SCU – Not Provided SCP – Not Used
>>Brachy Accessory Device Number	(300A,0262)	2C	SCU – Not Provided SCP – Not Used
>>Brachy Accessory Device ID	(300A,0263)	2C	SCU – Not provided SCP – Not used
>>Brachy Accessory Device Type	(300A,0264)	1C	SCU – Not provided SCP – Not used
>>Brachy Accessory Device Name	(300A,0266)	3	SCU – Not provided SCP – Not used
>>Material ID	(300A,00E1)	3	SCU – Not provided SCP – Not used
>> Brachy Accessory Device NominalThickness	(300A,026A)	3	SCU – Not provided SCP – Not used
>> Brachy Accessory Device NominalTransmission	(300A,026C)	3	SCU – Not provided SCP – Not used
>>Referenced ROI Number	(3006,0084)	2C	SCU – Not provided SCP – Not used
>Channel Sequence	(300A,0280)	1	SCU – Provided SCP – Used; Plan is rejected when more than 40 channels are defined.
>>Channel Number	(300A,0282)	1	SCU – Provided SCP – Used; Allow range[1, 40]

Attribute Name	Tag	Type	Notes
>>Channel Length	(300A,0284)	2	SCU – Provided; Supported Range: [1000mm, 1400mm] SCP – Used; Channel Length must be greater than Transfer Tube Length.
>>Channel Total Time	(300A,0286)	1	SCU – Provided SCP – Used
>>Source Movement Type	(300A,0288)	1	SCU – Provided; Always "STEPWISE" SCP – Used
>>Number of Pulses	(300A,028A)	1C	SCU – Not Provided SCP – Not Used
>>Pulse Repetition Interval	(300A,028C)	1C	SCU – Not Provided SCP – Not Used
>>Source Applicator Number	(300A,0290)	3	SCU – Not Provided SCP – Not Used
>>Source Applicator ID	(300A,0291)	2C	SCU – Not Provided SCP – Not Used
>>Source Applicator Type	(300A,0292)	1C	SCU – Not Provided SCP – Not Used
>>Source Applicator Name	(300A,0294)	3	SCU – Not Provided SCP – Not Used
>>Source Applicator Length	(300A,0296)	1C	SCU – Not Provided SCP – Not Used
>>Source Applicator Manufacturer	(300A,0298)	3	SCU – Not Provided SCP – Not Used
>>Material ID	(300A,00E1)	3	SCU – Not Provided SCP – Not Used
>> Source Applicator Wall NominalThickness	(300A,029C)	3	SCU – Not Provided SCP – Not Used
>> Source Applicator Wall NominalTransmission	(300A,029E)	3	SCU – Not Provided SCP – Not Used
>>Source Applicator Step Size	(300A,02A0)	1C	SCU – Provided – Always 1 mm SCP – Used
>>Transfer Tube Number	(300A,02A2)	2	SCU – Provided SCP – Used; "Transfer Tube Number" is mandatory and must be unique.
>>Transfer Tube Length	(300A,02A4)	2C	SCU – Provided; Always "1000 mm" SCP – Used; Accept only "1000 mm"
>>Channel Shield Sequence	(300A,02B0)	3	SCU – Not Provided SCP – Not Used

Attribute Name	Tag	Type	Notes
>>Referenced Source Number	(300C,000E)	1	SCU – Provided; Refers to Source Number (300A,0212) of Source Sequence (300A,0210) SCP – Used
>>Number of Control Points	(300A,0110)	1	SCU – Provided SCP – Used
>>Final Cumulative Time Weight	(300A,02C8)	1C	SCU – Provided; Always "100" SCP – Used
>>Brachy Control Point Sequence	(300A,02D0)	1	SCU – Provided SCP – Used
>>>Control Point Index	(300A,0112)	1	SCU – Provided SCP – Used
>>>Cumulative Time Weight	(300A,02D6)	2	SCU – Provided SCP – Used
>>>Control Point Relative Position	(300A,02D2)	1	SCU – Provided SCP – Used
>>>Control Point 3D Position	(300A,02D4)	3	SCU – Not Provided SCP – Not Used
>>>Brachy Referenced Dose Reference Sequence	(300C,0055)	3	SCU – Not Provided SCP – Not Used
>>>>Referenced Dose Reference Number	(300C,0051)	1C	SCU – Not Provided SCP – Not Used
>>>>Cumulative Dose Reference	(300A,010C)	1C	SCU – Not Provided SCP – Not Used

Note: *An Material ID (300A,00E1) may also be specified within a referenced ROI, if an ROI is used to describe the object.*

14.1.9   Approval Module (C.8.8.9)

Attribute Name	Tag	Type	Notes
Approval Status	300E,0002	1	SCP - Used SCU - Provided; Only "Approved" plans are accepted
Review Date	300E,0004	2C	SCP - Used SCU - Provided
Review Time	300E,0005	2C	SCP - Used SCU - Provided
Reviewer Name	300E,0008	2C	SCP - Used SCU - Provided

14.1.10 SOP Common (C.8.8.9)

Attribute Name	Tag	Type	Notes
SOP Class UID	(0008,0016)	1	SCP – Used SCU – Provided
SOP Instance UID	(0008,0018)	1	SCP – Used SCU – Provided
Specific Character Set	(0008,0005)	1C	SCP – Not Used SCU – Not Provided
Instance Creation Date	(0008,0012)	3	SCP – Not Used SCU – Not Provided
Instance Creation Time	(0008,0013)	3	SCP – Not Used SCU – Not Provided
Timezone Offset From UTC	(0008,0201)	3	See 14.1.11 for details on times and Timezone offset from UTC. SCP – Not Used SCU – Not Provided

14.1.11 Note on interpretation of DT and TM attributes in TCC

Smoothbase ignores the Timezone Offset from UTC for a plan on import. This means that when an imported plan is exported, the tag is no longer present. Smoothbase interpretes the times in a plan and preplan always as local time on import.

14.2 RT Brachy Record IOD Module Table (A.30)

IE	Module	Reference		DICOM Usage	Notes
Patient	Patient	14.1.1	C.7.1.1	M	
	Clinical Trial Subject		C.7.1.3	U	SCP - Not used SCU - Not provided
Study	General Study	14.1.2	C.7.2.1	M	
	Patient Study	14.1.3	C.7.2.2	U	SCP - Used SCU - Supported
	Clinical Trial Study		C.7.2.3	U	SCP - Not used SCU - Not provided
Series	RT Series	0	C.8.8.1	M	
Equipment	General Equipment	14.2.4	C.7.5.1	M	
Treatment Record	RT General Treatment Record	14.2.5	C.8.8.17	M	
	RT Patient Setup		C.8.8.12	U	SCU - Not supported SCP - Not used
	RT Treatment Machine Record	14.2.6	C.8.8.18	M	
	Measured Dose Reference Record		C.8.8.19	U	SCU - Supported SCP - Used
	Calculated Dose Reference Record		C.8.8.20	U	SCU - Not supported SCP - Not used
	RT Brachy Session Record	14.2.7	C.8.8.22	M	
	RT Treatment Summary Record		C.8.8.23	U	
	SOP Common		C.12.1	M	

14.2.1   Patient Module (C.7.1.1)

Attribute Name	Tag	Type	Notes
Patient Name	(0010,0010)	2	SCU - Provided SCP – Used
Patient ID	(0010,0020)	2	SCU - Provided SCP - Used
Patient's Birth Date	(0010,0030)	2	SCU – Not provided SCP – Not used
Patient's Sex	(0010,0040)	2	SCU - Provided SCP - Used
Referenced Patient Sequence	(0008,1120)	3	SCU - Not provided SCP - Not used
>Referenced SOP Class UID	(0008,1150)	1	SCU - Not provided SCP - Not used
>Referenced SOP Instance UID	(0008,1155)	1	SCU - Not provided SCP - Not used
Patient's Birth Time	(0010,0032)	3	SCU - Not provided SCP - Not used
Other Patient Ids	(0010,1000)	3	SCU - Not provided SCP - Not used
Other Patient Names	(0010,1001)	3	SCU - Not provided SCP - Not used
Ethnic Group	(0010,2160)	3	SCU - Not provided SCP - Not used
Patient Comments	(0010,4000)	3	SCU - Not provided SCP - Not used

14.2.2   General Study (C.7.2.1)

Attribute Name	Tag	Type	Notes
Study Instance UID	(0020,000D)	1	SCU - Provided SCP - Used
Study Date	(0008,0020)	2	SCU – Not provided SCP – Not used
Study Time	(0008,0030)	2	SCU – Not provided SCP – Not used
Referring Physician's Name	(0008,0090)	2	SCU – Not provided SCP – Not used
Study ID	(0020,0010)	2	SCU - Provided SCP - Used
Accession Number	(0008,0050)	2	SCU - Not provided SCP - Not used
Study Description	(0008,1030)	3	SCU - Provided SCP - Not used
Physician(s) of Record	(0008,1048)	3	SCU - Not provided SCP - Not used
Name of Physician(s) Reading Study	(0008,1060)	3	SCU - Not provided SCP - Not used
Referenced Study Sequence	(0008,1120)	3	SCU - Not provided SCP - Not used
>Referenced SOP Class UID	(0008,1150)	1	SCU - Not provided SCP - Not used
>Referenced SOP Instance UID	(0008,1155)	1	SCU - Not provided SCP - Not used
Procedure Code Sequence	(0008,1032)	3	SCU - Not provided SCP - Not used

14.2.3   RT Series Module (C.8.8.1)

Attribute Name	Tag	Type	Notes
Modality	(0008,0060)	1	SCU - "RTRECORD" SCP - Used
Series Instance UID	(0020,000E)	1	SCU - Provided SCP - Used
Series Number	(0020,0011)	2	SCU - Provided SCP - Used
Series Description	(0008,103E)	3	SCU - Provided SCP - Used
Referenced Study Component Sequence	(0008,1111)	3	SCU - Not provided SCP - Not used
>Referenced SOP Class UID	(0008,1150)	1	SCU – Not provided SCP – Not used
>Referenced SOP Instance UID	(0008,1155)	1	SCU – Not provided SCP – Not used

14.2.4   Module General Equipment (C.7.5.1)

Attribute Name	Tag	Type	Notes
Manufacturer	(0008,0070)	2	SCU – Provided; "Nucletron" SCP - Used
Institution Name	(0008,0080)	3	SCU – Not Provided SCP – Not Used
Institution Address	(0008,0081)	3	SCU - Not provided SCP - Not used
Station Name	(0008,1010)	3	SCU – Provided; Windows Machine name. SCP - Not used
Institutional Department Name	(0008,1040)	3	SCU - Not provided SCP - Not used
Manufacturer's Model Name	(0008,1090)	3	SCU – Provided; "Flexitron TCC" SCP – Used;
Device Serial Number	(0018,1000)	3	SCU - Not provided SCP - Not used
Software Versions	(0018,1020)	3	SCU – Provided; Version number of TCC 3.2.1 SCP – Used;
Spatial Resolution	(0018,1050)	3	SCU - Not provided SCP - Not used
Date of Last Calibration	(0018,1200)	3	SCU - Not provided SCP - Not used
Time of Last Calibration	(0018,1201)	3	SCU - Not provided SCP - Not used
Pixel Padding Value	(0028,0120)	3	SCU - Not provided SCP - Not used

14.2.5 RT General Treatment Record (C.8.8.17)

Attribute Name	Tag	Type	Notes
Instance Number	(0020,0013)	1	SCU – Provided; The fraction number SCP - Used
Treatment Date	(3008,0250)	2	SCU - Provided SCP – Used; Start date of the treated fraction
Treatment Time	(3008,0251)	2	SCU - Provided SCP – Used; Start time of the treated pulse/fraction
Referenced RT Plan Sequence	(300C,0002)	2	SCU - Provided SCP - Used
> Referenced SOP Class UID	(0008,1150)	1C	SCU – Provided "1.2.840.10008.5.1.4.1.1.481.5" (RT Pl SCP - Used
> Referenced SOP Instance UID	(0008,1155)	1C	SCU – Provided; Instance UID of the plan whose treatment is described in this record SCP - Used
Referenced Treatment Record Sequence	(3008,0030)	3	SCU - Not provided SCP - Not used
> Referenced SOP Class UID	(0008,1150)	1	SCU – Not provided SCP – Not used
> Referenced SOP Instance UID	(0008,1155)	1	SCU – Not provided SCP – Not used

14.2.6 RT Treatment machine record (C.8.8.18)

Attribute Name	Tag	Type	Notes
Treatment Machine Sequence	(300A,0206)	1	SCU - Provided SCP - Used
> Treatment Machine Name	(300A,00B2)	2	SCU - Provided; Device Serial Number of the TDU SCP - Used
> Manufacturer	(0008,0070)	2	SCU - Provided; "Nucletron" SCP - Used
> Institution Name	(0008,0080)	2	SCU - Provided; Hospital name (Configured Location) SCP - Used
> Institution Address	(0008,0081)	3	SCU - Not provided SCP - Not used
> Institutional Department Name	(0008,1040)	3	SCU - Not provided SCP - Not used
> Manufacturers Model Name	(0008,1090)	2	SCU - Provided; "Flexitron" SCP - Used
> Device Serial Number	(0018,1000)	2	SCU - Provided; Device Serial Number of the TDU SCP - Used

14.2.7 RT Brachy Session Record

Attribute Name	Tag	Type	Value
Operator Name	(0008,1070)	2	SCU - Provided; TCC logged in username. SCP - Used
Referenced Fraction Group Number	(300C,0022)	3	SCU - Provided SCP - Used
Number of Fractions Planned	(300A,0078)	2	SCU - Provided SCP - Used
Brachy Treatment Technique	(300A,0200)	1	SCU - Provided; Derived from RT Plan SCP - Used
Brachy Treatment Type	(300A,0202)	1	SCU - Provided; Derived from RT Plan SCP - Used
Private attributes	(300B,00xx)	1	Private creator group "PRIVATE_CODE_STRING_300B"
TU Dwell Time Precision	(300B,xx10)	1	Always "0.1 sec"

Attribute Name	Tag	Type	Value
End private attributes			
Recorded Source Sequence	(3008,0100)	1	Only one item
> Source Number	(300A,0212)	1	SCU - Provided; Drive Number of the used source. SCP - Used
> Source Type	(300A,0214)	1	SCU – Provided; Always "LINE" SCP - Used
> Source Manufacturer	(300A,0216)	2	SCU – Provided; Always "Nucletron" SCP - Used
> Source Serial Number	(3008,0105)	2	SCU - Provided; Serial Number of the source used for treatment SCP - Used
> Source Isotope Name	(300A,0226)	1	SCU – Provided; "Ir-192" or "Co-60" SCP - Used
> Source Isotope Half Life	(300A,0228)	1	SCU – Provided; "73.83" (Ir-192) and "1924.90" (Co-60) SCP - Used
> Source Strength Units	(300A,0229)	1C	SCU – Not Provided; No Beta source supported SCP – Not Used
> Reference Air Kerma Rate	(300A,022A)	1	SCU – Provided The source strength at the start time of treatment (in µGy h^{-1} at 1 m). SCP - Used
> Source Strength	(300A,022B)	1C	SCU – Not Provided; No Beta source supported SCP – Not Used
> Source Strength Reference Date	(300A,022C)	1	SCU – Provided; Start date of treatment in UTC SCP - Used
> Source Strength Reference Time	(300A,022E)	1	SCU – Provided; Start time of treatment in UTC SCP - Used
>*Private attributes*	(300B,00xx)	1	Private creator group "Nucletron"
>Source Identification Number	(300B,xx0C)	1	SCU - Provided; SCP - Used
>*End private attributes*			
Treatment Session Application Setup Sequence	(3008,0110)	1	SCU – Provided; Only one item SCP - Used
> Application Setup Type	(300A,0232)	1	SCU - Provided; Derived from RT Plan. SCP - Used
> Referenced Brachy Application Setup Number	(300C,000C)	3	SCU - Provided; Derived from RT Plan. SCP - Used
> Application Setup Name	(300A,0236)	3	SCU - Provided; Derived from RT Plan. SCP - Used
> Application Setup Manufacturer	(300A,0238)	3	SCU - Provided; Derived from RT Plan. SCP - Used
>Template Number	(300A,0240)	3	SCU - Provided; Derived from RT Plan. SCP - Used
>Template Type	(300A,0242)	3	SCU - Provided; Derived from RT Plan. SCP - Used
>Template Name	(300A,0244)	3	SCU - Provided; Derived from RT Plan. SCP - Used
> Application Setup Check	(3008,0116)	3	SCU - Provided; Always UNKNOWN SCP - Used
> Total Reference Air Kerma	(300A,0250)	1	SCU - Provided; Total Reference Air Kerma delivered (in µGy at 1 m). SCP - Used
> Referenced Measured Dose Reference Sequence	(3008,0080)	3	SCU – Not Provided SCP – Not Used
>> Referenced Dose Reference Number	(300C,0051)	1C	SCU – Not provided SCP – Not used
>> Referenced Measured Dose Reference Number	(3008,0082)	1C	SCU – Not provided SCP – Not used

Attribute Name	Tag	Type	Value
>> Measured Dose Value	(3008,0016)	1C	SCU – Not provided SCP – Not used
> Referenced Calculated Dose Reference Sequence	(3008,0090)	3	SCU – Not Provided SCP – Not Used
>> Referenced Dose Reference Number	(300C,0051)	1C	SCU – Not provided SCP – Not used
>> Referenced Calculated Dose Reference Number	(3008,0092)	1C	SCU – Not provided SCP – Not used
>> Calculated Dose Reference Dose Value	(3008,0076)	1C	SCU – Not provided SCP – Not used
> Current Fraction Number	(3008,0022)	2	SCU – Provided SCP – Used
> Treatment Delivery Type	(300A,00CE)	2	SCU – Provided; Always "TREATMENT". SCP – Used

> Treatment Termination Status	(3008,002A)	1	SCU – Provided
			    "NORMAL" when treatment finishes normally;
			    "MACHINE" when interrupt button pressed,
			    Power Fail or Dose
			    "OPERATOR" when emergency stop or Door
			    Open.
			SCP – Used

> Treatment Termination Code	(3008,002B)	3	SCU – Not Provided SCP – Not Used
> Treatment Verification Status	(3008,002C)	2	NOT_VERIFIED – based on the fact that the post-treatment report is verified manually SCU – Provided SCP – Not Used
> Recorded Brachy Accessory Device Sequence	(3008,0120)	3	SCU – Not Provided SCP – Not Used
>> Referenced Brachy Accessory Device Number	(3008,0122)	2C	SCU – Not provided SCP – Not used
>> Brachy Accessory Device ID	(300A,0263)	2C	SCU – Not provided SCP – Not used
>> Brachy Accessory Device Type	(300A,0264)	1C	SCU – Not provided SCP – Not used
>> Brachy Accessory Device Name	(300A,0266)	3	SCU – Not provided SCP – Not used
> Recorded Channel Sequence	(3008,0130)	1	SCU – Provided; <Number of Treated Catheters> items SCP – Used
>> Channel Number	(300A,0282)	1	SCU – Provided; 1..<Nr of Treated Catheters> SCP – Used
>> Channel Length	(300A,0284)	2	SCU – Provided; Supported Range: [1000mm, 1400mm] SCP – Used
>> Specified Channel Total Time	(3008,0132)	1	SCU – Provided; Specified total time from Pre-Plan SCP – Used
>> Delivered Channel Total Time	(3008,0134)	1	SCU – Provided; The recorded catheter total time. SCP – Used
>> Source Movement Type	(300A,0288)	1	SCU – Not Provided; "STEPWISE" (configurable). SCP – Not Used
>> Specified Number of Pulses	(3008,0136)	1C	SCU – Not Provided SCP – Not Used
>> Delivered Number of Pulses	(3008,0138)	1C	SCU – Not Provided SCP – Not Used
>> Specified Pulse Repetition Interval	(3008,013A)	1C	SCU – Not Provided SCP – Not Used
>> Delivered Pulse Repetition Interval	(3008,013C)	1C	SCU – Not Provided SCP – Not Used
>> Referenced Measured Dose Reference Sequence	(3008,0080)	3	SCU – Not Provided SCP – Not Used

Attribute Name	Tag	Type	Value
>>> Referenced Dose Reference Number	(300C,0051)	1C	SCU – Not provided SCP – Not used
>>> Referenced Measured Dose Reference Number	(3008,0082)	1C	SCU – Not provided SCP – Not used
>>> Measured Dose Value	(3008,0016)	1C	SCU – Not provided SCP – Not used
>> Referenced Calculated Dose Reference Sequence	(3008,0090)	3	SCU – Not Provided SCP – Not Used
>>> Referenced Dose Reference Number	(300C,0051)	1C	SCU – Not provided SCP – Not used
>>> Referenced Calculated Dose Reference Number	(3008,0092)	1C	SCU – Not provided SCP – Not used
>>> Calculated Dose Reference Dose Value	(3008,0076)	1C	SCU – Not provided SCP – Not used
>> Recorded Source Applicator Sequence	(3008,0140)	3	SCU – Provided SCP - Used
>>> Referenced Source Applicator Number	(3008,0142)	2	SCU - Provided; Derived from RT Plan. SCP - Used
>>> Source Applicator ID	(300A,0291)	2C	SCU - Provided; Derived from RT Plan. SCP - Used
>>> Source Applicator Type	(300A,0292)	1C	SCU - Provided; Derived from RT Plan. SCP - Used
>>> Source Applicator Name	(300A,0294)	3	SCU - Provided; Derived from RT Plan. SCP - Used
>>> Source Applicator Length	(300A,0296)	1C	SCU - Provided; Channel Length - Transfer Tube Length SCP - Used
>>> Source Applicator Manufacturer	(300A,0298)	3	SCU - Provided; Derived from RT Plan. SCP - Used
>>> Source Applicator Step Size	(300A,02A0)	1C	SCU - Provided; 1 mm (configurable). SCP - Used
>> Transfer Tube Number	(300A,02A2)	2	SCU – Provided Identification number of the treated channel (mapped channel number) SCP - Used
>> Transfer Tube Length	(300A,02A4)	2C	SCU – Provided; Always "1000 mm" SCP - Used
>> Recorded Channel Shield Sequence	(3008,0150)	3	SCU - Not Provided SCP - Not Used
>>> Referenced Channel Shield Number	(3008,0152)	2C	SCU – Not provided SCP – Not used
>>> Channel Shield ID	(300A,02B3)	2C	SCU – Not provided SCP – Not used
>>> Channel Shield Name	(300A,02B4)	3	SCU – Not provided SCP – Not used
>> Referenced Source Number	(300C,000E)	1	SCU - Provided; Refers to Source Number (300A,0212) of Recorded Source Sequence (3008,0100) SCP - Used
>> Safe Position Exit Date	(3008,0162)	1C	SCU - Provided; Source Exit Date. SCP - Used
>> Safe Position Exit Time	(3008,0164)	1C	SCU - Provided; Source Exit Time. SCP - Used
>> Safe Position Return Date	(3008,0166)	1C	SCU - Provided; Source Return Date. SCP - Used
>> Safe Position Return Time	(3008,0168)	1C	SCU - Provided; Source Return Time. SCP - Used
>> Number of Control Points	(300A,0110)	1	Number of control points in channel SCU - Provided SCP - Used

Attribute Name	Tag	Type	Value
>> Brachy Control Point Delivered Sequence	(3008,0160)	1	SCU – Provided Contains one control point pair for each executed dwell position. SCP - Used
>>> Reference Control Point Index	(300C,00F0)	3	SCU – Provided; [0, Nr of ControlPoints-1] SCP - Used
>>> Treatment Control Point Date	(3008,0024)	1	SCU - Provided SCP - Used
>>> Treatment Control Point Time	(3008,0025)	1	SCU - Provided SCP - Used
>>> Control Point Relative Position	(300A,02D2)	1	SCU - Provided; As retrieved from TDU. SCP - Used
>>> Override Sequence	(3008,0060)	3	SCU - Not Provided SCP - Not Used
>>>> Override Parameter Pointer	(3008,0062)	2C	SCU – Not provided SCP – Not used
>>>> Operator Name	(0008,1070)	2C	SCU – Not provided SCP – Not used
>>>> Override Reason	(3008,0066)	3	SCU – Not provided SCP – Not used

14.2.8   RT Treatment Summary Record Module

Attribute Name	Tag	Type	Value
Current Treatment Status	(3008,0200)	1	SCU - Provided; Derived from RT Record's "Treatment Termination Status" Enumerated Values: NOT_STARTED, ON_TREATMENT, ON_BREAK, SUSPENDED, STOPPED, COMPLETED SCP - Used
Treatment Status Comment	(3008,0202)	3	SCU - Provided; Includes the TDU Summary Report after a recovery. SCP - Used

14.2.9   SOP Common (C.8.8.9)

Attribute Name	Tag	Type	Notes
SOP Class UID	(0008,0016)	1	SCP - Used SCU - Provided
SOP Instance UID	(0008,0018)	1	SCP - Used SCU - Provided
Specific Character Set	(0008,0005)	1C	SCP - Used SCU - Provided
Instance Creation Date	(0008,0012)	3	SCP - Used SCU - Provided
Instance Creation Time	(0008,0013)	3	SCP - Used SCU - Provided
Timezone Offset From UTC	(0008,0201)	3	See 14.2.10 for details on times and Timezone offset from UTC. SCP – Used; SCU – Provided; Always "+0000"

14.2.10 Note on interpretation of DT and TM attributes in TCC

Smoothbase stores the Timezone Offset from UTC for a record on import. The times in a record are always interpreted as local time, also if the Timezone Offset from UTC tag is present. Smoothbase always exports a record with an offset from UTC of +0000 and the times in a record specified in UTC.

15. RT Pre-treatment Plan

15.1 RT Plan IOD (A.20)

IE	Module	Section	DICOM Usage	Comments
Patient	Patient	14.1.1 (C.7.1.1)	M	
	Clinical Trial Subject	(C.7.1.3)	U	SCP - Not used SCU - Not provided
Study	General Study	14.1.2 (C.7.2.1)	M	
	Patient Study	14.1.3 (C.7.2.2)	U	SCP - Used SCU - Provided
	Clinical Trial Study	(C.7.2.3)	U	SCP - Not used SCU - Not provided
Series	RT Series	14.1.4 (C.8.8.1)	M	
	Clinical Trial Series	(C.7.3.2)	U	SCP - Not used SCU - Not provided
Frame of Reference	Frame of Reference	14.1.5 (C.7.4.1)	U (see note in DICOM description)	SCP - Not used SCU - Not provided
Equipment	General Equipment	14.1.5 (C.7.5.1)	M	
Plan	RT General Plan	14.1.6 (C.8.8.9)	M	
	RT Prescription	(C.8.8.10)	U	SCP - Not used SCU - Not provided
	RT Tolerance Tables	(C.8.8.11)	U	SCP - Not used SCU - Not provided
	RT Patient Setup	(C.8.8.12)	U	SCP - Not Used SCU – Not Supported
	RT Fraction Scheme	14.1.7 (C.8.8.13)	U	SCP - Used SCU - Provided
	RT Beams	(C.8.8.14)	C - Required if RT Fraction Scheme Module exists and Number of Beams (300A,0080) is greater than zero for one or more fraction groups	SCP - Not used SCU - Not provided
	RT Brachy Application Setups	14.1.8 (C.8.8.15)	C - Required if RT Fraction Scheme Module exists and Number of Brachy Application Setups (300A,00A0) is greater than zero for one or more fraction groups	SCP - Used SCU – Provided
	Approval	14.1.9 (C.8.8.16)	U	SCP - Used SCU - Provided
	SOP Common	14.1.10 (C.12.1)	M	

15.1.1 Patient Module (C.7.1.1)

Attribute Name	Tag	Type	Notes
Patient Name	(0010,0010)	2	SCU - Provided SCP – Used
Patient ID	(0010,0020)	2	SCU - Provided SCP - Must be entered on import to Flexitron TCC by user if not specified via DICOM.
Patient's Birth Date	(0010,0030)	2	SCU - Provided SCP – Used
Patient's Sex	(0010,0040)	2	SCU - Provided SCP - Used
Referenced Patient Sequence	(0008,1120)	3	SCU - Not provided SCP - Not used
>Referenced SOP Class UID	(0008,1150)	1	SCU - Not provided SCP - Not used
>Referenced SOP Instance UID	(0008,1155)	1	SCU - Not provided SCP - Not used
Patient's Birth Time	(0010,0032)	3	SCU – Not Provided SCP – Not Used
Other Patient Ids	(0010,1000)	3	SCU - Not provided SCP - Not used
Other Patient Names	(0010,1001)	3	SCU - Not provided SCP - Not used
Ethnic Group	(0010,2160)	3	SCU - Not provided SCP - Not used
Patient Comments	(0010,4000)	3	SCU - Not provided SCP - Not used

15.1.2 General Study (C.7.2.1)

Attribute Name	Tag	Type	Notes
Study Instance UID	(0020,000D)	1	SCU - Provided SCP - Used to validate study/series contents.
Study Date	(0008,0020)	2	SCU - Provided SCP - Used
Study Time	(0008,0030)	2	SCU - Provided; set as local time because the study is used from RT Plan. SCP - Used
Referring Physician's Name	(0008,0090)	2	SCU - Provided SCP - Used
Study ID	(0020,0010)	2	SCU - Provided SCP - Used
Accession Number	(0008,0050)	2	SCU - Provided SCP - Used
Study Description	(0008,1030)	3	SCU - Provided SCP - Used
Physician(s) of Record	(0008,1048)	3	SCU - Not provided SCP - Not used
Name of Physician(s) Reading Study	(0008,1060)	3	SCU - Not provided SCP - Not used
Referenced Study Sequence	(0008,1120)	3	SCU - Not provided SCP - Not used
>Referenced SOP Class UID	(0008,1150)	1	SCU - Not provided SCP - Not used
>Referenced SOP Instance UID	(0008,1155)	1	SCU - Not provided SCP - Not used
Procedure Code Sequence	(0008,1032)	3	SCU - Not provided SCP - Not used

15.1.3 Patient Study Module Attributes (C.7.2.2)

Attribute Name	Tag	Type	Notes
Admitting Diagnoses Description	(0008,1080)	3	SCP - Not used SCU - Not supported
Admitting Diagnoses Code Sequence	(0008,1084)	3	SCP - Not used SCU - Not supported
>Code Sequence Macro	(Table 8.8-1)		SCP - Not used SCU - Not supported
Patient's Age	(0010,1010)	3	SCU - Provided SCP - Used
Patient's Size	(0010,1020)	3	SCU - Provided SCP - Used
Patient's Weight	(0010,1030)	3	SCU - Provided SCP - Used
Occupation	(0010,2180)	3	SCP - Not used SCU - Not supported
Additional Patient History	(0010,21B0)	3	SCP - Not used SCU - Not provided

15.1.4 RT Series Module (C.8.8.1)

Attribute Name	Tag	Type	Notes
Modality	(0008,0060)	1	SCU – "RTPLAN" SCP - Used
Series Instance UID	(0020,000E)	1	SCU - Provided SCP - Used
Series Number	(0020,0011)	2	SCU – Not provided SCP - Not used
Series Description	(0008,103E)	3	SCU - Not provided SCP - Not used
Referenced Study Component Sequence	(0008,1111)	3	SCU - Not provided SCP - Not used
>Referenced SOP Class UID	(0008,1150)	1	SCU – Not provided SCP – Not used
>Referenced SOP Instance UID	(0008,1155)	1	SCU – Not provided SCP – Not used

15.1.5 Module General Equipment (C.7.5.1)

Attribute Name	Tag	Type	Notes
Manufacturer	(0008,0070)	2	SCU – Provided; "Nucletron" SCP - Used
Institution Name	(0008,0080)	3	SCU - Not Provided SCP - Not Used
Institution Address	(0008,0081)	3	SCU - Not provided SCP - Not used
Station Name	(0008,1010)	3	SCU – Provided; Windows Machine name. SCP - Not used
Institutional Department Name	(0008,1040)	3	SCU - Not provided SCP - Not used
Manufacturer's Model Name	(0008,1090)	3	SCU – "Flexitron TCC" SCP – Used

Attribute Name	Tag	Type	Notes
Device Serial Number	(0018,1000)	3	SCU – Provided – number of the Treatment delivery unit SCP – Not used
Software Versions	(0018,1020)	3	SCU – Provided; TCC version number 3.2.1 SCP – Used
Spatial Resolution	(0018,1050)	3	SCU - Not provided SCP - Not used
Date of Last Calibration	(0018,1200)	3	SCU - Not provided SCP - Not used
Time of Last Calibration	(0018,1201)	3	SCU - Not provided SCP - Not used
Pixel Padding Value	(0028,0120)	3	SCU - Not provided SCP - Not used

15.1.6   RT General Plan Module (C.8.8.9)

Attribute Name	Tag	Type	Notes
RT Plan Label	(300A,0002)	1	SCU - Provided SCP - Used
RT Plan Name	(300A,0003)	3	SCU - Provided SCP - Used
RT Plan Description	(300A,0004)	3	SCU – Provided, always "Brachy Plan" SCP - Used
Instance Number	(0020,0013)	3	SCU - Not provided SCP - Not used
Operators' Name	(0008,1070)	2	SCU - Provided SCP - Used
RT Plan Date	(300A,0006)	2	SCU - Provided SCP - Used
RT Plan Time	(300A,0007)	2	SCU - Provided SCP - Used
Treatment Protocols	(300A,0009)	3	SCU - Not provided SCP - Not used
Plan Intent	(300A,000A)	3	SCU - Provided Always PREPLAN SCP - Used
Treatment Sites	(300A,000B)	3	SCU - Not provided SCP - Not used

RT Plan Geometry	(300A,000C)	1	SCU – Provided;
			   New Plan → always TREATMENT_DEVICE
			   Duplicated Plan → Derived value from original Plan
			
			SCP – Not Used

Referenced Structure Set Sequence	(300C,0060)	1C	SCU – Provided when supplied by original Plan SCP – Not Used
Referenced Dose Sequence	(300C,0080)	3	SCU – Not Provided; Always deleted when the plan is modified. SCP – Not Used
Private attributes	(300B,0010)	3	Private group creator, value "Nucletron"

Attribute Name	Tag	Type	Notes
Flexitron Plan Code	(300B,1029)	3	This is only used for brachy plans. SCU –Provided SCP – Used if provided
End private attributes			
Referenced RT Plan Sequence	(300C,0002)	3	SCU – Not provided SCP – Not used
> Referenced SOP Class UID	(0008,1150)	1	SCU – Not provided SCP – Not used
> Referenced SOP Instance UID	(0008,1155)	1	SCU – Not provided SCP – Not used

15.1.7   Fraction Scheme Module (C.8.8.13)

Attribute Name	Tag	Type	Notes
Fraction Group	(300A,0070)	1	SCU –Provided SCP –Used
>Fraction Group Number	(300A,0071)	1	SCU – Provided; Always one fraction. SCP – Used; Plan is rejected when more than one fraction is supplied.
>Referenced Patient Setup Number	(300C,006A)	3	SCU – Not Provided SCP – Not Used
>Number of Fractions Planned	(300A,0078)	2	SCU – Provided SCP – Used
>Number of Fraction Pattern Digits PerDay	(300A,0079)	3	SCU – Not Provided SCP – Not Used
>Repeat Fraction Cycle Length	(300A,007A)	3	SCU – Provided SCP – Not Used
>Fraction Pattern	(300A,007B)	3	SCU – Provided SCP – Not Used
>Number of Beams	(300A,0080)	1	SCU – Provided; Always 0. SCP – Not Used
>Number of Brachy Application Setups	(300A,00A0)	1	SCU – Provided; SCP – Used
>Referenced Brachy Application Setup Sequence	(300C,000A)	1C	SCU – Provided; SCP – Used
>>Referenced Brachy ApplicationSetup Number	(300C,000C)	1C	SCU – Provided; SCP – Used
>>Brachy Application Setup DoseSpecification Point	(300A,00A2)	3	SCU – Not Provided SCP – Not Used
>>Brachy Application Setup Dose	(300A,00A4)	3	SCU – Not Provided SCP – Not Used

Note: *An RT Dose IOD referenced within the Referenced Dose Sequence (300C,0080) can be used for storing grid-based (pixel) data, isodose curves, and/or individual dose points (with optional dose point names) for the current Fraction Group.*

Note: *The fractionation pattern does not indicate the actual start of treatment, or the order or timing of fraction delivery. If treatment does not commence as outlined in the pattern, it is the application's responsibility to make any necessary adjustments.*

15.1.8   RT Brachy Application Setups Module (C.8.8.15)

Attribute Name	Tag	Type	Notes
Brachy Treatment Technique	(300A,0200)	1	SCU – Provided; SCP – Used
Brachy Treatment Type	(300A,0202)	1	SCU – Provided; Always HDR. SCP – Used; Only HDR Supported
Treatment Machine Sequence	(300A,0206)	1	SCU – Provided SCP – Used
>Treatment Machine Name	(300A,00B2)	2	SCU – Provided; no value SCP – Used
>Manufacturer	(0008,0070)	3	SCU – Provided; "Nucletron" SCP – Used
>Institution Name	(0008,0080)	3	SCU – Provided SCP – Used
>Institution Address	(0008,0081)	3	SCU – Not Provided SCP – Not Used
>Institutional Department Name	(0008,1040)	3	SCU – Not Provided SCP – Not Used
>Manufacturer"s Model Name	(0008,1090)	3	SCU – Provided; "Flexitron" SCP – Used; Must be "Flexitron"
>Device Serial Number	(0018,1000)	3	SCU – Provided – number of the Treatment delivery unit SCP –Used
Source Sequence	(300A,0210)	1	SCU – Provided SCP – Used; Plan is rejected when more than one source is supplied.
>Source Number	(300A,0212)	1	SCU – Provided SCP – Used
>Source Type	(300A,0214)	1	SCU – Provided, always "LINE" SCP – Used

Attribute Name	Tag	Type	Notes
>Source Manufacturer	(300A,0216)	3	SCU – Provided, always "Nucletron" SCP – Used
>Active Source Diameter	(300A,0218)	3	SCU – Provided if available SCP – Not Used
>Active Source Length	(300A,021A)	3	SCU – Provided if available SCP – Not Used
>Material ID	(300A,00E1)	3	SCU – Not Provided SCP – Not Used
>Source Encapsulation NominalThickness	(300A,0222)	3	SCU – Not Provided SCP – Not Used
>Source Encapsulation NominalTransmission	(300A,0224)	3	SCU – Not Provided SCP – Not Used
>Source Isotope Name	(300A,0226)	1	SCU – Provided; Ir-192 or Co-60 SCP – Used; Only Ir-192 or Co-60 are supported.
>Source Isotope Half Life	(300A,0228)	1	SCU – Provided SCP – Used;
>Source Strength Units	((300A,0229)	1C	SCU – Not Provided; No Beta source supported SCP – Not Used
>Reference Air Kerma Rate	(300A,022A)	1	SCU – Provided SCP – Used
>Source Strength	(300A,022B)	1C	SCU – Not Provided; No Beta source supported SCP – Not Used
> Source Strength Reference Date	(300A,022C)	1	SCU – Provided SCP – Used
> Source Strength Reference Time	(300A,022E)	1	SCU – Provided SCP – Used
>Private attributes	(300B,0010)	3	SCU – Provided SCP – Used
>Source Identification Number	(300B,100C)	3	SCU – Provided; Ir-192 = 0900001 or Co-60= 0900003 SCP – Used; Identification of the source as provided by the afterloader manufacturer should match
>End Private attributes	(300B,0010)	3	SCU – Provided SCP – Used
Application Setup Sequence	(300A,0230)	1	SCU – Provided SCP – Used; Plan is rejected when more than one application Setup is supplied.
>Application Setup Type	(300A,0232)	1	SCU – Provided; Always "UNDEFINED" SCP – Used

Attribute Name	Tag	Type	Notes
>Application Setup Number	(300A,0234)	1	SCU – Provided, always 0 SCP – Used
>Application Setup Name	(300A,0236)	3	SCU – Provided if available SCP – Not Used
>Application Setup Manufacturer	(300A,0238)	3	SCU – Provided if available SCP – Not Used
>Template Number	(300A,0240)	3	SCU – Provided if available SCP – Not Used
>Template Type	(300A,0242)	3	SCU – Provided if available SCP – Not Used
>Template Name	(300A,0244)	3	SCU – Provided if available SCP – Not Used
>Total Reference Air Kerma	(300A,0250)	1	SCU – Provided SCP – Used
>Brachy Accessory Device Sequence	(300A,0260)	3	SCU – Not Provided SCP – Not Used
>>Brachy Accessory Device Number	(300A,0262)	2C	SCU – Not Provided SCP – Not Used
>>Brachy Accessory Device ID	(300A,0263)	2C	SCU – Not provided SCP – Not used
>>Brachy Accessory Device Type	(300A,0264)	1C	SCU – Not provided SCP – Not used
>>Brachy Accessory Device Name	(300A,0266)	3	SCU – Not provided SCP – Not used
>>Material ID	(300A,00E1)	3	SCU – Not provided SCP – Not used
>> Brachy Accessory Device NominalThickness	(300A,026A)	3	SCU – Not provided SCP – Not used
>> Brachy Accessory Device NominalTransmission	(300A,026C)	3	SCU – Not provided SCP – Not used
>>Referenced ROI Number	(3006,0084)	2C	SCU – Not provided SCP – Not used
>Channel Sequence	(300A,0280)	1	SCU – Provided SCP – Used; Plan is rejected when more than 40 channels are defined.
>>Channel Number	(300A,0282)	1	SCU – Provided SCP – Used; Allow range[1, 40]
>>Channel Length	(300A,0284)	2	SCU – Provided; Supported Range: [1000mm, 1400mm] SCP – Used; Channel Length must be greater than Transfer Tube Length.

Attribute Name	Tag	Type	Notes
>>Channel Total Time	(300A,0286)	1	SCU – Provided SCP – Used
>>Source Movement Type	(300A,0288)	1	SCU – Provided; Always "STEPWISE" SCP – Used
>>Number of Pulses	(300A,028A)	1C	SCU – Not Provided SCP – Not Used
>>Pulse Repetition Interval	(300A,028C)	1C	SCU – Not Provided SCP – Not Used
>>Source Applicator Number	(300A,0290)	3	SCU – Not Provided SCP – Not Used
>>Source Applicator ID	(300A,0291)	2C	SCU – Not Provided SCP – Not Used
>>Source Applicator Type	(300A,0292)	1C	SCU – Not Provided SCP – Not Used
>>Source Applicator Name	(300A,0294)	3	SCU – Not Provided SCP – Not Used
>>Source Applicator Length	(300A,0296)	1C	SCU – Not Provided SCP – Not Used
>>Source Applicator Manufacturer	(300A,0298)	3	SCU – Not Provided SCP – Not Used
>>Material ID	(300A,00E1)	3	SCU – Not Provided SCP – Not Used
>> Source Applicator Wall NominalThickness	(300A,029C)	3	SCU – Not Provided SCP – Not Used
>> Source Applicator Wall NominalTransmission	(300A,029E)	3	SCU – Not Provided SCP – Not Used
>>Source Applicator Step Size	(300A,02A0)	1C	SCU – Provided – Always 1 mm SCP – Used
>>Transfer Tube Number	(300A,02A2)	2	SCU – Provided SCP – Used; "Transfer Tube Number" is mandatory and must be unique.
>>Transfer Tube Length	(300A,02A4)	2C	SCU – Provided; Always "1000 mm" SCP – Used; Accept only "1000 mm"
>>Channel Shield Sequence	(300A,02B0)	3	SCU – Not Provided SCP – Not Used
>>Referenced Source Number	(300C,000E)	1	SCU – Provided; Refers to Source Number (300A,0212) of Source Sequence (300A,0210) SCP – Used

Attribute Name	Tag	Type	Notes
>>Number of Control Points	(300A,0110)	1	SCU – Provided SCP – Used
>>Final Cumulative Time Weight	(300A,02C8)	1C	SCU – Provided SCP – Used
>>Brachy Control Point Sequence	(300A,02D0)	1	SCU – Provided SCP – Used
>>>Control Point Index	(300A,0112)	1	SCU – Provided SCP – Used
>>>Cumulative Time Weight	(300A,02D6)	2	SCU – Provided SCP – Used
>>>Control Point Relative Position	(300A,02D2)	1	SCU – Provided SCP – Used
>>>Control Point 3D Position	(300A,02D4)	3	SCU – Not Provided SCP – Not Used
>>>Brachy Referenced Dose Reference Sequence	(300C,0055)	3	SCU – Not Provided SCP – Not Used
>>>>Referenced Dose Reference Number	(300C,0051)	1C	SCU – Not Provided SCP – Not Used
>>>>Cumulative Dose Reference	(300A,010C)	1C	SCU – Not Provided SCP – Not Used
Referenced Fraction Group Number	(300C,0022)	3	SCU – Provided; Current fraction number SCP - Used

Note: *An Material ID (300A,00E1) may also be specified within a referenced ROI, if an ROI is used to describe the object.*

15.1.9   Approval Module (C.8.8.9)

Attribute Name	Tag	Type	Notes
Approval Status	300E,0002	1	SCP - Used SCU - Provided; Only "Approved" plans are accepted
Review Date	300E,0004	2C	SCP - Used SCU - Provided
Review Time	300E,0005	2C	SCP - Used SCU - Provided
Reviewer Name	300E,0008	2C	SCP - Used SCU - Provided

15.1.10 SOP Common (C.8.8.9)

Attribute Name	Tag	Type	Notes
SOP Class UID	(0008,0016)	1	SCP - Used SCU - Provided
SOP Instance UID	(0008,0018)	1	SCP - Used SCU - Provided
Specific Character Set	(0008,0005)	1C	SCP – Not Used SCU – Not Provided
Instance Creation Date	(0008,0012)	3	SCP – Used SCU – Provided
Instance Creation Time	(0008,0013)	3	SCP – Not Used SCU - Not Provided
Timezone Offset From UTC	(0008,0201)	3	See 14.1.11 for details on times and Timezone offset from UTC. SCP – Not Used SCU – Not Provided

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