

Oncentra[®] TCS

DICOM Conformance Statement

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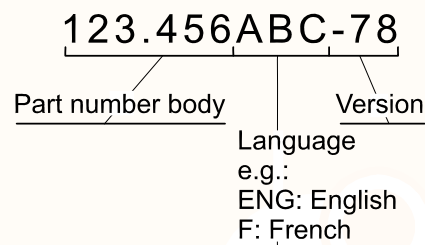
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Preface

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The part number is printed on the right bottom side of the front page. Numbers printed on other pages are for internal revision control and may differ.

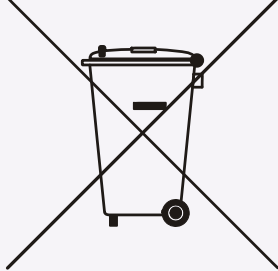

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For this reason mark  ⁰³⁴⁴ is used.

Symbols

Symbol	Meaning	Remarks
 Location: Near or on the type identification plate.	Symbol for separated collection of electrical and electronic equipment per Directive 2002/96 of the European Parliament and the Council of the European Union (Directive on Waste of Electrical and Electronic Equipment - WEEE). If applicable to the type of device, it indicates legally imposed obligations within EU member states, Iceland, Norway and Switzerland when the equipment is disposed of, at the end of its life-time.	Owners of marked equipment should contact the organization that imported the equipment into their country, when they want to dispose of the equipment, at the end of its lifetime. The Directive prioritizes re-use of equipment over re-use of components over re-use of materials over disposal as waste. Article 5 part 2d allows producers to decline the return of any used equipment that is or may be biologically or radiologically contaminated.
	Legal manufacturer	

Conventions

Throughout this manual certain conventions are used. These are Warnings, Cautions and Notes. They provide a means of prioritizing information to be brought to the attention of the user. They are given as follows:

Warning: *Designates a possibly dangerous situation. Non-observance may lead to death or the most severe injuries*

Caution: *Designates a possibly harmful situation. Non-observance may lead to minor injuries or damage to the product.*

Note: *Designates a possibly harmful situation. Non-observance may lead to damage to the product or the environment.*

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The user is expected to use the product (soft and hardware) in accordance with the instructions given in this manual, which must be read before the system is used. Any unauthorized deviation from the procedures laid down in this manual can affect the contractual obligations between purchaser and vendor.

Warning: Do not modify any part of Nucletron supplied computer's hardware, software or software configuration. Installing or running an application that has not explicitly been approved by Nucletron may compromise patient safety and will result in termination of all warranty and service contracts.

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This manual was originally drafted in the English language.



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1. Introduction

This conformance statement specifies how the Oncentra TCS application conforms to the DICOM PS 3.x-2006 standard and the IEC Technical Report 61852. This document follows the guidelines for DICOM conformance statements of IEC technical Report 62266. TCS uses the DICOM protocol to receive and transmit objects that are used in the radiation therapy process.

This conformance statement applies to Oncentra TCS v3.1.3 and higher.

1.1 Scope

Oncentra TCS is a brachytherapy Treatment Control System (TCS). The Oncentra TCS application 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 microSelectron afterloader.

Oncentra TCS supports amongst others the following functions:

- Make a new plan.
- Add a plan (from the Library).
- Import a plan (from a treatment planning system).
- Load a patient study (from the database).
- Edit, print and save Plan information.
- Execute treatment.
- Start and monitor treatment.
- Print a treatment report.
- Export a Brachy Treatment Record (BT Record).
- Maintain procedures and information.

Smoothbase

Oncentra TCS uses Smoothbase as database to store treatment plans. The Smoothbase database is used in different Nucletron products. The main features of Smoothbase are:

- User management.
- Store and retrieve patient data, treatment plans, and so on.
- Import treatment plans etc. from another DICOM source or,
- Export treatment plans etc. to another DICOM destination or,
- Import or export treatment plans etc. to a DICOM Media file.
- Print to a DICOM printer
- 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 worklist functionality (SCU) and handling of query responses.

1.2 Intended Audience

This document is intended for:

- Users of Oncentra TCS, who want to use DICOM with the 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
CIB-ARD190.238-00	AHT	Initial release	Not applicable
CIB-ARD190.238-01	CGR	TCS version 3.1.1	-Corrected 'Implementation class UID' -Added private tag descriptions -Update usage descriptions
CIB-ARD190.238-02 28/07/2008	CGR	TCS version 3.1.2 +	Updated the information (presence, value, etc) about all module and attribute according to the current code base
777.00090MAN-00	CHE	TCS version 3.1.3	This document replaces CIB-ARD190.238. Updated the information (presence, value, etc) about all module and attribute according to the current code base, and according to the PS 3.x-2006 DICOM standard

3. Related Documents

Reference	Revision	Description
[DICOM2006]	3.x-2006	Digital Imaging and Communications in Medicine
190.050ENG	*	Oncentra TCS User Manual
190.051ENG	*	Oncentra TCS Reference Manual
190.056ENG	*	Oncentra TCS Service Manual

* 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
TCS	Treatment Control System
Smoothbase	Database used in several Nucletron products to store and retrieve patient data and to exchange such data with other products using DICOM.
AE	Application Entity, according to DICOM terminology
DICOM	Digital Imaging and Communications in Medicine, a standard on image communications in medical applications
DIMSE	DICOM Message Service element
ELE	Explicit Little Endian
FSR	File-set Reader
IE	Information Entity
ILE	Implicit Little Endian
IOD	Information Object Definition, according to DICOM terminology
NEMA	National Electrical Manufacturers Association
PDU	Protocol Data Unit
SCU	Service Class User, according to DICOM terminology
SCP	Service Class Provider, according to DICOM terminology

Abbreviation	Description
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
VR	Value Representation, a data encoding method in DICOM
UID	Unique Identifier used to identify an object by a worldwide unique Identifier, according to DICOM terminology.
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-FIND	DIMSE for matching of a set of attributes to the attributes of a set of DICOM object instances on a remote AE.
C-STORE	DIMSE for transfer of a DICOM object instance to a remote AE.

5. Networking

5.1 Implementation model

5.1.1 Application data flow

The data flow diagram depicted in Figure 1 represents all DICOM Application Entities present in an instantiation of the microSelectron Digital / V3 product and maps these to real world activities and applicable user actions.

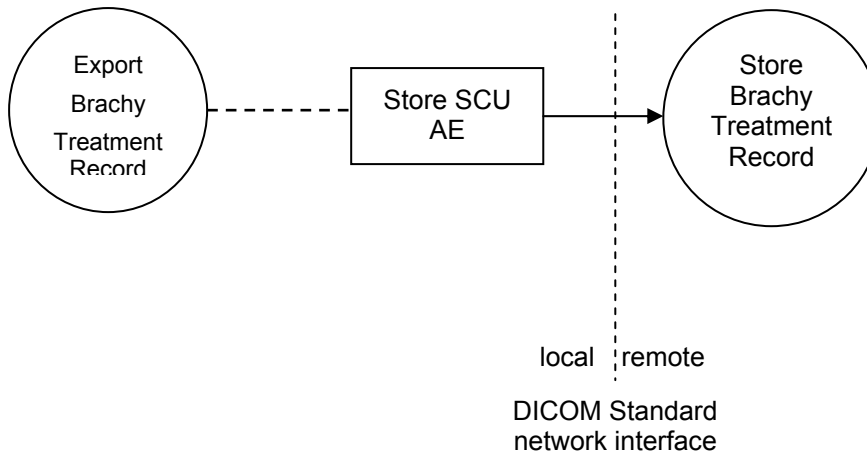


Figure 1 Application data flow

The Store SCU Application Entity of the TCS product sends BT records to a remote AE. This is associated with the real world activity Export Brachy Treatment Record. This activity is performed after a treatment has completed and the user has approved the human readable version treatment record, and at any later time when a user wants to (re)export the record.

Whether or not the record is sent automatically upon treatment completion is a configuration setting that applies to all users of the system.

5.1.2 Functional definition of AEs

5.1.2.1 Store SCU application entity

The Store SCU Application Entity will export whenever a send job is available. An association request is sent to the remote AE, and upon successful negotiation BT Record transfer is started. If the association negotiation is not successful, this is reported to the user and the user can decide whether or not to retry the job. No automatic retry mechanism is implemented.

5.1.3 Sequencing of real world activities

Only one real-world activity relates to the DICOM network interfaces, so no sequencing is required.

5.2 AE Specifications

5.2.1 Store SCU AE

5.2.1.1 SOP classes

Table 1 SOP Classes

SOP Class Name	SOP Class UID	SCU	SCP
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6	Yes	No

5.2.1.2 Association policies

5.2.1.2.1 General

The DICOM Standard application context name for DICOM 2006 is always proposed:

Application Context Name 1.2.840.10008.3.1.1.1

5.2.1.2.2 Number of associations

Maximum number of parallel associations 1.

5.2.1.2.3 Asynchronous nature

Asynchronous communications (multiple outstanding transactions within a single association) are not supported.

5.2.1.2.4 Implementation identifying information

The application entity title for this AE is as follows:

Table 2 Implementation identifying information

Implementation class UID	1.2.528.1.1007.189.1
Implementation version name	MergeCOM3_321

5.2.1.3 Association initiation policy

5.2.1.3.1 Activity export record

The export of RT Brachy Treatment Records is initiated automatically when the user signs off the treatment report –immediately after treatment has completed. As an alternative, it may be triggered by a user action ‘Export BT Record’ at any time after the record was created.

Store SCU AE will initiate an association, and upon successful negotiation send the record using C-STORE. After successful store, the association is closed, and record export completion is confirmed to the user (this may be done asynchronously, by only setting a flag in the internal database).

5.2.1.4 Association acceptance policy

The treatment system only has a Store SCU interface, and as a consequence no incoming associations can and will be accepted.

5.3 Network interfaces

5.3.1 Physical network interface

TCP/IP is the only protocol stack supported by Oncentra, using the TCP/IP stack as supported by the underlying Operating System.

Supported physical media are limited to:

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

5.3.2 Additional protocols

The product supports DICOM protocols on top of the TCP/IP version 4 stack.

5.4 Configuration

5.4.1 AE title/presentation address mapping

The Store SCU application entity title can be configured through the configuration file of the application that uses it. In case of TCS this is the file tcs.exe.config. The following settings can be configured:

Table 3 Address mapping

Setting	Description	Default value
AETitle	Application entity title used by the Store SCU	Smoothbase
Port	Port used by Smoothbase SCP for listening – not applicable for the store SCU	104
ConfigFileSet	MergeCOM DICOM configuration file name base. This value, with ‘MC3.[ini/app/pro]’ added is used to identify configuration files. These files are expected in the directory indicated in the MC3CONFIGDIR environment variable.	Smoothbase

The text box below provides an example configuration block containing the settings explained above.

```
<dicomsettings>
  <AETitle>Smoothbase</AETitle>
  <Port>104</Port>
  <ConfigFileSet>Smoothbase</ConfigFileSet>
</dicomsettings>
```

5.4.1.1 Local AE titles

The local AE titles used by TCS are listed in the table below.

Table 4 Local Application Entity Titles

Application entity	Default AE title	Default TCP/IP port
Store SCU AE	Smoothbase	N/A

5.4.1.2 Remote AE title/presentation address mapping

5.4.1.2.1 Store SCU AE

Destinations for the Store SCU AE are configured by means of the Smoothbase service application. This application allows configuration of application entity title, port number and IP addresses or hostnames. Per application entity, the type of services expected can be configured, but TCS will only make use of entities marked as Storage SCP.

Only a single Storage SCP Application Entity configured using the Smoothbase application can be addressed from TCS at any point in time.

5.4.2 Parameters

The following parameters apply to Storage transfers using the Store SCU AE – none of them is configurable in TCS.

Table 5 Parameters

Parameter	Configurable (Yes/No)	Default value
General parameters		
Max PDU receive size	No	Not applicable
Max PDU send size	No	38672
Time-out waiting for acceptance or rejection response to an association request (Application level time-out)	No	15 s
Time-out waiting for a response to an association release request (Application level time-out)	No	60 s
Time-out waiting for completion of TCP-IP connect request (low level time-out)	No	15 s
Time-out awaiting a DIMSE request (Low level time-out)	No	15 s
Time-out waiting for data between TCP/IP packets (Low level time-out)	No	15 s
Storage parameters		
Storage SCU time-out waiting for a response to a C-STORE RQ	No	120 s
Number of times a failed job may be retried	No	0 (failed jobs are not retried)
Delay between retrying failed send jobs	No	N/A
Maximum number of simultaneously initiated associations by the storage AE	No	1
Supported Transfer Syntaxes	No	Implicit VR Little Endian Explicit VR Little Endian

6. Media interchange

6.1 Implementation model

The Media AE provides standard conformance for the DICOM Media Storage and File Format (PS 3.10). No support is implemented for Media Storage Application Profiles (PS 3.11).

6.1.1 Application data flow

As depicted in Figure 2, the Real World Activity Request Plan Import on TCS results in files being read from a storage location by the TCS Media AE.

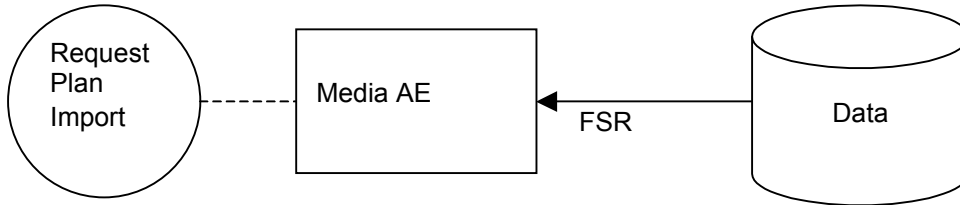


Figure 2 RT Plan Media Import Data Flow Diagram

6.1.2 Functional definition of AEs

6.1.2.1 Functional definition of the TCS media AE

The TCS Media AE supports reading of DICOM files from network drives and other media. It does not read DICOMDIR files, only DICOM Media files according PS3.10.

If contents of read files are supported by TCS, information from the files may be imported into the internal database and/or displayed on screen.

6.1.3 Sequencing of real world activities

TCS Media AE supports the SOP classes and transfer syntaxes listed in the Table 6.

Table 6 Media support

Presentation Context Table			
Abstract Syntax		Transfer Syntax	
Name	UID	Name List	UID List
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	ILE ELE	1.2.840.10008.1.2 1.2.840.10008.1.2.1

6.1.4 File meta information for implementation class and version

The TCS Media AE only implements an FSR, so no file meta information specific to TCS is ever written to the DICOM File Meta Header.

6.2 AE Specifications

6.2.1 Media AE

The following table, Table 7, shows that for one or more Application Profiles in the first column, there are a number of Real-World Activities in the second column, the roles required for each of these Real-World Activities in the third column, and the Service Class Option (Interchange or Print) is listed in the fourth column.

Table 7 Media profile support

Application Profile	Real World Activity	Roles	Service Class Option
STD-GEN-CD	Request Plan Import	FSR	Interchange

Note: The application is media neutral and dependent on the underlying hardware. Any (non-secure) General Purpose Profile can be supported. Reading DICOMDIR files is not supported.

6.2.1.1 File meta information for media AE

Not applicable.

6.2.1.2 Real world activities

6.2.1.2.1 Real world activity import DICOM plan

The FSR is activated through the user interface, when a user chooses to import a treatment plan. All media files in a user-selected location are partially read to obtain information about the contained plan (if any), study and patient, and some human readable identifying information is read for displaying. A user-selected plan is then imported by reading it completely from file and storing it to the TCS database.

6.3 Augmented and private application profiles

Not applicable.

6.4 Media configuration

Not applicable.

7. Support of Character Sets

The application supports all extended character sets defined in the [DICOM2006] standard, including single-byte and multi-byte character sets as well as code extension techniques using ISO 2022 escapes.

Support extends to correctly decoding and displaying the correct symbol for all names and strings found in storage instances from media and in the local database.

No specific support for sorting of strings other than in the default character set is provided in the browsers.

8. Security

No special security measures are taken.

9. Annexes

9.1 IOD contents

9.1.1 Created SOP instance(s)

Abbreviations used in the 'Presence of module' / 'Presence of value' columns of the tables below:

- VNAP Value Not Always Present (attribute has zero length if no value is present)
- ANAP Attribute Not Always Present (attribute may be absent)
- ALWAYS Always Present
- EMPTY Attribute is sent without a value

Abbreviations used for the source of the data values in the tables below:

- USER the attribute value source is from user input¹
- AUTO the attribute value is generated automatically
- PLAN the attribute value is identical to what is received from the DICOM Plan send by the Store SCP
- CONFIG the attribute value source is a configurable parameter

¹ Values for which the system provides a default that can be changed by the user are considered USER rather than AUTO values.

Prior to TCS version 3.0, the TCS product does not create any SOP Instances.

9.1.1.1 RT Brachy Treatment Record IOD modules

Table 8 Brachy Treatment Record IOD Modules

IE	Module	Reference	Presence of module
Patient	Patient	Table 9	ALWAYS
	Clinical Trial Subject	Table 10	OPTIONAL ¹
Study	General Study	Table 11	ALWAYS
	Patient Study	Table 12	OPTIONAL ²
	Clinical Trial Study	Table 13	OPTIONAL ¹
Series	RT Series	Table 14	ALWAYS
	Clinical Trial Series	Table 15	Not supported
Equipment	General Equipment	Table 16	ALWAYS
Treatment Record	RT General Treatment Record	Table 17	ALWAYS
	RT Patient Setup		Not supported
	RT Treatment Machine Record	Table 18	ALWAYS
	Measured Dose Reference Record		Not supported
	Calculated Dose Reference Record		Not supported
	RT Brachy Session Record	Table 19	ALWAYS
	RT Treatment Summary Record	Table 20	OPTIONAL – Included
	Curve		Not supported (Retired module; see PS 3.3 2004)
	SOP Common	Table 21	ALWAYS

¹ Clinical trial modules are supported in BT Record by TCS only as a means to pass through any Clinical Trial information contained in the RT Plan which execution is described in the BT Record. If they are not available in the RT Plan, they will also not be in the BT Record.

² Patient Study may be skipped by TCS export if all its attributes are empty in the originating plan and in the TCS database.

9.1.1.2 Common modules

Table 9 Patient Module

Attribute Name	Tag	VR	Type	Value	Presence of Value	Source
Patient's Name	0010,0010	PN	2		ALWAYS	PLAN/USER
Patient ID	0010,0020	LO	2		ALWAYS	PLAN/USER
Patient's Birth Date	0010,0030	DA	2		VNAP	PLAN/USER
Patient's Sex	0010,0040	CS	2		VNAP	PLAN/USER
Other Patient IDs	0010,1000	LO	3		ANAP	PLAN/USER
Ethnic Group	0010,2160	SH	3		ANAP	PLAN/USER
Comments	0010,4000	LT	3		ANAP	PLAN/USER

Table 10 Clinical Trial Subject Module

Attribute Name	Tag	VR	Type	Value	Presence of Value	Source
Clinical Trial Sponsor Name	0012,0010	LO	1		ALWAYS	PLAN
Clinical Trial Protocol ID	0012,0020	LO	1		ALWAYS	PLAN
Clinical Trial Protocol Name	0012,0021	LO	2		VNAP	PLAN
Clinical Trial Site ID	0012,0030	LO	2		VNAP	PLAN
Clinical Trial Site Name	0012,0031	LO	2		VNAP	PLAN
Clinical Trial Subject ID	0012,0040	LO	1C		ANAP	PLAN
Clinical Trial Subject Reading ID	0012,0042	LO	1C		ANAP	PLAN

Table 11 General Study Module

Attribute Name	Tag	VR	Type	Value	Presence of Value	Source
Study Instance UID	0020,000D	UI	1		ALWAYS	PLAN/AUTO
Study Date	0008,0020	DA	2		VNAP	PLAN/USER
Study Time	0008,0030	TM	2		VNAP	PLAN/USER
Referring Physician's Name	0008,0090	PN	2		VNAP	PLAN/USER
Study ID	0020,0010	SH	2		VNAP	PLAN/USER
Accession Number	0008,0050	SH	2		VNAP	PLAN/USER
Study Description	0008,1030	LO	3		ANAP	PLAN/USER
Physician of Record	0008,1048	PN	3		ANAP	PLAN

Table 12 Patient Study Module

Attribute Name	Tag	VR	Type	Value	Presence of Value	Source
Patient's Age	0010,1010	AS	3		ANAP	PLAN
Patient's Size	0010,1020	DS	3		ANAP	PLAN
Patient's Weight	0010,1030	DS	3		ANAP	PLAN

Table 13 Clinical Trial Study Module

Attribute Name	Tag	VR	Type	Value	Presence of Value	Source
Clinical Trial Time Point ID	0012,0050	LO	2		VNAP	PLAN
Clinical Trial Time Point Description	0012,0051	ST	3		ANAP	PLAN

Table 14 RT Series Module

Attribute Name	Tag	VR	Type	Value	Presence of Value	Source
Modality	0008,0060	CS	1	"RTRECORD"	ALWAYS	AUTO
Series Instance UID	0020,000E	UI	1		ALWAYS	AUTO
Series Number	0020,0011	IS	2	The treatment number	VNAP	AUTO
Series Description	0008,103E	LO	3		Not supported	

Table 15 Clinical Trial Series Module

Attribute Name	Tag	VR	Type	Value	Presence of Value	Source
Clinical Trial Coordinating Center Name	0012,0060	LO	2		VNAP	CONFIG

Table 16 General Equipment Module

Attribute Name	Tag	VR	Type	Value	Presence of Value	Source
Manufacturer	0008,0070	LO	2		EMPTY	
Institution Name	0008,0080	LO	3		Not supported	
Institution Address	0008,0081	ST	3		Not supported	
Institutional Department Name	0008,1040	LO	3		Not supported	
Manufacturer's Model Name	0008,1090	LO	3		Not supported	
Device Serial Number	0018,1000	LO	3		Not supported	
Software Versions	0018,1020	LO	3		Not supported	

Table 17 RT General Treatment Record

Attribute Name	Tag	VR	Type	Value	Presence of Value	Source
Instance Number	0020,0013	IS	1	The fraction/pulse number	ALWAYS	AUTO
Treatment Date	3008,0250	DA	2	Start date of the treated pulse/fraction	ALWAYS	AUTO
Treatment Time	3008,0251	TM	2	Start time of the treated pulse/fraction	ALWAYS	AUTO
Referenced RT Plan Sequence	300C,0002	SQ	2		ALWAYS	PLAN
> Referenced SOP Class UID	0008,1150	UI	1C	"1.2.840.10008.5.1.4.1.1.481.5" (RT Plan)	ALWAYS	PLAN
> Referenced SOP Instance UID	0008,1155	UI	1C	Instance UID of the plan whose treatment is described in this record	ALWAYS	PLAN
Referenced Treatment Record Sequence	3008,0030	SQ	3		Not supported	
> Referenced SOP Class UID	0008,1150	UI	1C		Not supported	
> Referenced SOP Instance UID	0008,1155	UI	1C		Not supported	

Table 18 RT Treatment machine record

Attribute Name	Tag	VR	Type	Value	Presence of Value	Source
Treatment Machine Sequence	300A,0206	SQ	1		ALWAYS	AUTO
> Treatment Machine Name	300A,00B2	SH	2	Configured Description of Treatment Unit	VNAP	CONFIG
> Manufacturer	0008,0070	LO	2	"Nucletron"	ALWAYS	AUTO
> Institution Name	0008,0080	LO	2	Hospital name (Configured Location)	VNAP	CONFIG
> Institution Address	0008,0081	ST	3		Not supported	
> Institutional Department Name	0008,1040	LO	3		Not supported	
> Manufacturers Model Name	0008,1090	LO	2	Configured Type of Treatment Unit	VNAP	CONFIG
> Device Serial Number	0018,1000	LO	2	Serial Number of Treatment Unit	ALWAYS	AUTO

Table 19 RT Brachy Session Record

Attribute Name	Tag	VR	Type	Value	Presence of Value	Source
Operator Name	0008,1070	PN	2	Modificator name (Login name)	ALWAYS	AUTO / USER
Referenced Fraction Group Number	300C,0022	IS	3	Fraction Group Number (300A,0071) from loaded plan; "2" if plan created in TCS or is unknown	ALWAYS	PLAN / AUTO
Number of Fractions Planned	300A,0078	IS	2		ALWAYS	PLAN / AUTO
Brachy Treatment Technique	300A,0200	CS	1	Brachy Treatment Technique from loaded plan; "UNDEFINED" if plan created in TCS	ALWAYS	PLAN / AUTO
Brachy Treatment Type	300A,0202	CS	1	"PDR" or "HDR"	ALWAYS	PLAN
<i>Private attributes</i>	300B,00xx	LO	1	Private creator group "PRIVATE_CODE_STRING_300B"		
TU Dwell Time Precision	300B,xx10	DS	1	"1" for real Treatment unit or "3" for Simulated treatment	ALWAYS	AUTO
<i>End private attributes</i>						
Recorded Source Sequence	3008,0100	SQ	1	Only one item	ALWAYS	AUTO
> Source Number	300A,0212	IS	1	Source Number (300A,0212) from loaded plan; "1" if plan is created in TCS	ALWAYS	PLAN / AUTO
> Source Type	300A,0214	CS	1	"LINE"	ALWAYS	AUTO
> Source Manufacturer	300A,0216	LO	2		EMPTY	
> Source Serial Number	3008,0105	LO	2	Serial Number of the source used for treatment	ALWAYS	AUTO
> Source Isotope Name	300A,0226	LO	1	"Ir-192" or "Yb-169"	ALWAYS	AUTO
> Source Isotope Half Life	300A,0228	DS	1	"0" (for unknown), "73.83" (for Ir-192) and "31.01" (for Yb-169)	ALWAYS	AUTO
> Reference Air Kerma Rate	300A,022A	DS	1	The source strength at the start time of treatment (in $\mu\text{Gy h}^{-1}$ at 1 m).	ALWAYS	AUTO
> Source Strength Reference Date	300A,022C	DA	1	Start date of treatment	ALWAYS	AUTO
> Source Strength Reference Time	300A,022E	TM	1	Start time of treatment	ALWAYS	AUTO
> <i>Private attributes</i>	300B,00xx	LO	1	Private creator group "PRIVATE_CODE_STRING_300B"		
>Calibration Reference Air Kerma Rate	300B,xx20	DS	1	The source strength of most recent calibration of the used source	ALWAYS	AUTO / USER
>Calibration Air Kerma Rate Reference Date	300B,xx22	DA	1	The date of the most recent calibration	ALWAYS	AUTO / USER
>Calibration Air Kerma Rate Reference Time	300B,xx24	TM	1	The time of the most recent calibration	ALWAYS	AUTO / USER
> <i>End private attributes</i>						
Treatment Session Application Setup Sequence	3008,0110	SQ	1	Only one item	ALWAYS	AUTO

Attribute Name	Tag	VR	Type	Value	Presence of Value	Source
> Application Setup Type	300A,0232	CS	1	Application Setup Type (300A,0232) from loaded plan; "UNDEFINED" if plan created in TCS	ALWAYS	PLAN / AUTO
> Referenced Brachy Application Setup Number	300C,000C	IS	3	Application Setup Number (300A,0234) from loaded plan; "0" if plan is created in TCS	ALWAYS	PLAN / AUTO
> Application Setup Name	300A,0236	LO	3		Not supported	
> Application Setup Manufacturer	300A,0238	LO	3		Not supported	
> Application Setup Check	3008,0116	CS	3		Not supported	
> Total Reference Air Kerma	300A,0250	DS	1	Total Reference Air Kerma delivered (in μGy at 1 m).	ALWAYS	AUTO
> Referenced Measured Dose Reference Sequence	3008,0080	SQ	3		Not supported	
>> Referenced Dose Reference Number	300C,0051	IS	1C		Not supported	
>> Referenced Measured Dose Reference Number	3008,0082	IS	1C		Not supported	
>> Measured Dose Value	3008,0016	DS	1C		Not supported	
> Referenced Calculated Dose Reference Sequence	3008,0090	SQ	3		Not supported	
>> Referenced Dose Reference Number	300C,0051	IS	1C		Not supported	
>> Referenced Calculated Dose Reference Number	3008,0092	IS	1C		Not supported	
>> Calculated Dose Reference Dose Value	3008,0076	DS	1C		Not supported	
> Current Fraction Number	3008,0022	IS	2		ALWAYS	AUTO
> Treatment Delivery Type	300A,00CE	CS	2		EMPTY	
> Treatment Termination Status	3008,002A	CS	1	"NORMAL" when treatment finishes normally; "UNKNOWN" when the treatment status is 'Incomplete', the communication is lost or on a pending error; "MACHINE" when interrupt button pressed, Power Fail or Dose Meter alarm; "OPERATOR" when emergency stop or Door Open.	ALWAYS	AUTO
> Treatment Termination Code	3008,002B	SH	3		Not supported	

Attribute Name	Tag	VR	Type	Value	Presence of Value	Source
> Treatment Verification Status	3008,002C	CS	2	NOT_VERIFIED – based on the fact that pre-treatment report is verified manually in TCS.	ALWAYS	AUTO
> Recorded Brachy Accessory Device Sequence	3008,0120	SQ	3		Not supported	
>> Referenced Brachy Accessory Device Number	3008,0122	IS	2C		Not supported	
>> Brachy Accessory Device ID	300A,0263	SH	2C		Not supported	
>> Brachy Accessory Device Type	300A,0264	CS	1C		Not supported	
>> Brachy Accessory Device Name	300A,0266	LO	3		Not supported	
> Recorded Channel Sequence	3008,0130	SQ	1	<Number of Treated Catheters> items	ALWAYS	AUTO
>> Channel Number	300A,0282	IS	1	1..<Nr of Treated Catheters>	ALWAYS	AUTO
>> Channel Length	300A,0284	DS	2	725..1500	ALWAYS	PLAN
>> Specified Channel Total Time	3008,0132	DS	1	Specified total time after recalculation (associated/actual source strength ratio)	ALWAYS	PLAN / AUTO
>> Delivered Channel Total Time	3008,0134	DS	1	The total delivered catheter total time, or “-1” if catheter is skipped	ALWAYS	AUTO
>> Source Movement Type	300A,0288	CS	1	“STEPWISE”	ALWAYS	AUTO
>> Specified Number of Pulses	3008,0136	IS	1C	Contains the number of pulses of the plan (NOT the number of scheduled pulses). This field is mandatory for PDR. For export of pre-TCS 3.0 records (i.e. after product upgrades) it always has a value of -1. TCS 3.0+ supports at most 250 pulses per plan.	ANAP (1C)	PLAN
>> Delivered Number of Pulses	3008,0138	IS	1C	Contains the number of treated pulses of the plan at the time the current pulse is executed (e.g. value will be “1” in record for pulse nr 1, “2” for record of pulse nr. 2, etc). This field is mandatory for PDR. For export of pre-TCS 3.0 records (i.e. after product upgrades) it always has a value of -1.	ANAP (1C)	AUTO
>> Specified Pulse Repetition Interval	3008,013A	DS	1C	This field is mandatory for PDR. For export of pre-TCS 3.0 records (i.e. after product upgrades) it always has a value of -1.	ANAP (1C)	PLAN

Attribute Name	Tag	VR	Type	Value	Presence of Value	Source
>> Delivered Pulse Repetition Interval	3008,013C	DS	1C	This field is mandatory for PDR. For export of pre-TCS 3.0 records (i.e. after product upgrades) it always has a value of -1.	ANAP (1C)	AUTO
>> Referenced Measured Dose Reference Sequence	3008,0080	SQ	3		Not supported	
>>> Referenced Dose Reference Number	300C,0051	IS	1C		Not supported	
>>> Referenced Measured Dose Reference Number	3008,0082	IS	1C		Not supported	
>>> Measured Dose Value	3008,0016	DS	1C		Not supported	
>> Referenced Calculated Dose Reference Sequence	3008,0090	SQ	3		Not supported	
>>> Referenced Dose Reference Number	300C,0051	IS	1C		Not supported	
>>> Referenced Calculated Dose Reference Number	3008,0092	IS	1C		Not supported	
>>> Calculated Dose Reference Dose Value	3008,0076	DS	1C		Not supported	
>> Recorded Source Applicator Sequence	3008,0140	SQ	3	Only one item	ALWAYS	AUTO
>>> Referenced Source Applicator Number	3008,0142	IS	2	Source Applicator Number (300A,0290) from loaded plan; "0" if plan created in TCS	VNAP	PLAN / AUTO
>>> Source Applicator ID	300A,0291	SH	2C	Source Applicator ID (300A,0291) from loaded plan	VNAP	PLAN / AUTO
>>> Source Applicator Type	300A,0292	CS	1C	Source Applicator Type (300A,0292) from loaded plan; "FLEXIBLE" if plan created in TCS	ALWAYS	PLAN / AUTO
>>> Source Applicator Name	300A,0294	LO	3		Not supported	
>>> Source Applicator Length	300A,0296	DS	1C	Distance between the proximal dwell position and the distal dwell position for the specified channel (active length)	ALWAYS	AUTO
>>> Source Applicator Manufacturer	300A,0298	LO	3		Not supported	
>>> Source Applicator Step Size	300A,02A0	DS	1C	"2.5", "5", "10" (mm)	ALWAYS	PLAN
>> Transfer Tube Number	300A,02A2	IS	2	Identification number of the treated channel (mapped channel number)	ALWAYS	AUTO

Attribute Name	Tag	VR	Type	Value	Presence of Value	Source
>> Transfer Tube Length	300A,02A4	DS	2C	Transfer Tube Length from plan, if value specified. Otherwise empty.	VNAP	PLAN / AUTO
>> Recorded Channel Shield Sequence	3008,0150	SQ	3		Not supported	
>>> Referenced Channel Shield Number	3008,0152	IS	2C		Not supported	
>>> Channel Shield ID	300A,02B3	SH	2C		Not supported	
>>> Channel Shield Name	300A,02B4	LO	3		Not supported	
>> Referenced Source Number	300C,000E	IS	1	Referenced Source Number (300C,000E) from loaded plan. "1" if plan created in TCS.	ALWAYS	PLAN / AUTO
>> Safe Position Exit Date	3008,0162	DA	1C	If treatment was interrupted, the date of the last exit is stored.	ALWAYS	AUTO
>> Safe Position Exit Time	3008,0164	TM	1C	If treatment was interrupted, the time of the last exit is stored.	ALWAYS	AUTO
>> Safe Position Return Date	3008,0166	DA	1C	If treatment was interrupted, the date of the last return is stored.	ALWAYS	AUTO
>> Safe Position Return Time	3008,0168	TM	1C	If treatment was interrupted, the time of the last return is stored.	ALWAYS	AUTO
>> Number of Control Points	300A,0110	IS	1	Number of control points in channel	ALWAYS	AUTO
>> Brachy Control Point Delivered Sequence	3008,0160	SQ	1	Contains one control point pair for each partially executed dwell position (i.e. if execution is interrupted during a dwell position and resumed again, 4 control points are present for that dwell position).	ALWAYS	AUTO
>>> Reference Control Point Index	300C,00F0	IS	3	0..<Nr of ControlPoints - 1>	ALWAYS	AUTO
>>> Treatment Control Point Date	3008,0024	DA	1		ALWAYS	AUTO
>>> Treatment Control Point Time	3008,0025	TM	1		ALWAYS	AUTO
>>> Control Point Relative Position	300A,02D2	DS	1	Calculated by <Dwell Position Index> * Source Applicator Step Size (300A,02A0). With <Dwell Position Index> = 0.47 and thus starting with the distal most position.	ALWAYS	AUTO
>>> Override Sequence	3008,0060	SQ	3		Not supported	
>>>> Override Parameter Pointer	3008,0062	AT	2C		Not supported	
>>>> Operator Name	0008,1070	PN	2C		Not supported	
>>>> Override Reason	3008,0066	ST	3		Not supported	
>>Private attributes	3009,00xx	LO	1	Private creator group "PRIVATE_CODE_STRING_3009"	ALWAYS	AUTO
>> Brachy Control Point Planned Sequence	3009,xx10	SQ	1		ALWAYS	PLAN / AUTO

Attribute Name	Tag	VR	Type	Value	Presence of Value	Source
>>> <i>Private attribute</i>	3009,00xx	LO	1	Private creator group "PRIVATE_CODE_STRING_3009"	ALWAYS	AUTO
>>> Relative Position	3009,xx12	DS	1		ALWAYS	PLAN / AUTO
>>> Dwell Time	3009,xx14	DS	1		ALWAYS	PLAN / AUTO
>>> <i>End private attributes</i>						
>> <i>End private attributes</i>						
>> <i>Private attributes</i>	300B,00xx	LO	1	Private creator group "PRIVATE_CODE_STRING_300B"	ALWAYS	AUTO
>> Secondary Time	300B,xx26	DS	1		ALWAYS	AUTO
>> <i>End private attributes</i>						

Table 20 RT Treatment Summary Record

Attribute Name	Tag	VR	Type	Value	Presence of Value	Source
Current Treatment Status	3008,0200	CS	1		ALWAYS	AUTO
Treatment Status Comment	3008,0202	ST	3		Not supported	
First Treatment Date	3008,0054	DA	2		VNAP	AUTO
Most Recent Treatment Date	3008,0056	DA	2		VNAP	AUTO
Fraction Group Summary Sequence	3008,0220	SQ	3	Only one item	ALWAYS	AUTO
> Referenced Fraction Group Number	300C,0022	IS	3	Fraction Group Number (300A,0071) from loaded plan; "2" if plan created in TCS	ALWAYS	PLAN / AUTO
> Fraction Group Type	3008,0224	CS	2C	"BRACHY"	ALWAYS	AUTO
> Number of Fractions Planned	300A,0078	IS	2C		ALWAYS	PLAN / AUTO
> Number of Fractions Delivered	3008,005A	IS	2C	Number of treated fractions / pulses	ALWAYS	AUTO
> Fraction Status Summary Sequence	3008,0240	SQ	3	Only one item	ALWAYS	AUTO
>> Referenced Fraction Number	3008,0223	IS	1C		ALWAYS	AUTO
>> Treatment Date	3008,0250	DA	2C	The date when the pulse or fraction finished	ALWAYS	AUTO
>> Treatment Time	3008,0251	TM	2C	The time when the pulse or fraction finished	ALWAYS	AUTO
>> Treatment Termination Status	3008,002A	CS	2C	See Treatment Termination Status (3008,002A)	ALWAYS	AUTO
Treatment Summary Measured Dose Reference Sequence	3008,00E0	SQ	3		Not supported	
> Referenced Dose Reference Number	300C,0051	IS	3		Not supported	
> Dose Reference Description	300A,0016	LO	3		Not supported	
> Cumulative Dose to Dose Reference	3008,0052	DS	1C		Not supported	
Treatment Summary Calculated Dose Reference Sequence	3008,0050	SQ	3		Not supported	
> Referenced Dose Reference Number	300C,0051	IS	3		Not supported	
> Dose Reference Description	300A,0016	CO	3		Not supported	
> Cumulative Dose to Dose Reference	3008,0052	DS	1C		Not supported	

Table 21 SOP Common

Attribute Name	Tag	VR	Type	Value	Presence of Value	Source
SOP Class UID	0008,0016	UI	1	"1.2.840.10008.5.1.4.1.1.481.6" (RT Brachy Treatment Record)	ALWAYS	AUTO
SOP Instance UID	0008,0018	UI	1	Will consist of {1}.{2}.{3}.{4}.{5}, where: {1} The Nucletron Root UID ("1.2.528.1.1007") {2} The 4 digit Nucletron Project Number ("189") {3} The Application Dependent Suffix Number ("1") {4} The System Serial Number ("32899") {5} The number of 100- nanosecond intervals that have elapsed since 12:00 A.M., January 1, 0001 {6} Counter from 0..999	ALWAYS	AUTO
Instance Creation Date	0008,0012	DA	3	The date the internal record object is created	ALWAYS	AUTO
Instance Creation Time	0008,0013	TM	3	The time the internal record object is created	ALWAYS	AUTO
Instance Creator UID	0008,0014	UI	3		Not supported	
Specific Character Set	0008,0005	CS	1C		Not supported	

9.1.2 Usage of attributes from received IODs

This section describes how the attributes of IODs received through the DICOM Plan FSR are handled.

9.1.2.1 RT Plan IOD

This section specifies what TCS expects to find in imported RT Plan IODs.

Terminology used in the tables:

- ALWAYS Presence of module or attribute is mandatory.
- IGNORE Presence of module or attribute is not required by TCS. If present it will be ignored (i.e. not stored in the internal database).
- OPTIONAL Presences of module or attribute is not required. If present, it will be stored.

Attributes that are not mentioned explicitly, are treated as if their presence of attribute is set to IGNORE.

In all cases, except where specified explicitly, TCS will consider presences of DICOM Type 1 attributes to be mandatory. The DICOM requirement that Type 2 attributes *are always present but may be empty* is relaxed to allow complete omission of these attributes.

Table 22 Modules of the RT Plan IOD

IE	Module	Reference	Presence of Module
Patient	Patient	Table 23, C.7.1.1	ALWAYS
	Clinical Trial Subject	C.7.1.3	OPTIONAL
Study	General Study	Table 24, C.7.2.1	ALWAYS
	Patient Study	C.7.2.2	OPTIONAL
	Clinical Trial Study	C.7.2.3	OPTIONAL
Series	RT Series	Table 25, C.8.8.1	ALWAYS
	Clinical Trial Series	C.7.3.2	OPTIONAL
Frame of Reference	Frame of Reference	C.7.4.1	IGNORE
Equipment	General Equipment	Table 26, C.7.5.1	ALWAYS
Plan	RT General Plan	Table 27, C.8.8.9	ALWAYS
	RT Prescription	Table 28, C.8.8.10	OPTIONAL
	RT Tolerance Tables	C.8.8.11	IGNORE
	RT Patient Setup	C.8.8.12	OPTIONAL
	RT Fraction Scheme	Table 29, C.8.8.13	OPTIONAL
	RT Beams	C.8.8.14	IGNORE (*)
	RT Brachy Application Setups	Table 30, C.8.8.15	OPTIONAL (*)
	Approval	Table 31, C.8.8.16	OPTIONAL
	Audio	C.10.3	IGNORE (Retired Module; see PS 3.3 2004)
	SOP Common	Table 32, C.12.1	ALWAYS

(*) TCS can only operate on RT Plan objects for Brachy, which do not contain an RT Beams module and one or more RT Brachy Application Setups. Note that if multiple Brachy Application Setups are found, TCS will only use the first one. If multiple Brachy Application Setups are present, TCS will only use the first one.

Table 23 Patient Module

Attribute Name	Tag	Type	TCS Handling
Patient's Name	0010,0010	2	ALWAYS – given name and family name components are mandatory for TCS database. If given name is empty, TCS will store it as “?” internally.
Patient ID	0010,0020	2	ALWAYS – used as primary key in database (Must be unique)
Patient's Birth Date	0010,0030	2	ALWAYS – $1-1-1755 \leq \text{Patient's Birth Date} < \text{Tomorrow}$
Patient's Sex	0010,0040	2	OPTIONAL. If present only 'M', 'F' or 'O' is accepted as valid value.
Other Patient IDs	0010,1000	3	OPTIONAL
Ethnic Group	0010,2160	3	OPTIONAL
Patient Comments	0010,4000	3	OPTIONAL

Table 24 General Study Module

Attribute Name	Tag	Type	TCS Handling
Study Instance UID	0020,000D	1	ALWAYS
Study Date	0008,0020	2	OPTIONAL
Study Time	0008,0030	2	OPTIONAL
Referring Physician's Name	0008,0090	2	OPTIONAL
Study ID	0020,0010	2	OPTIONAL
Accession Number	0008,0050	2	OPTIONAL
Study Description	0008,1030	3	OPTIONAL
Physician of Record	0008,1048	3	OPTIONAL

Table 25 RT Series Module

Attribute Name	Tag	Type	TCS Handling
Modality	0008,0060	1	ALWAYS
Series Instance UID	0020,000E	1	ALWAYS
Series Number	0020,0011	2	OPTIONAL

Table 26 General Equipment Module

Attribute Name	Tag	Type	TCS Handling
Manufacturer	0008,0070	2	OPTIONAL. Used to check the origin of the plan (validity check).
Institution Name	0008,0080	3	OPTIONAL
Institution Address	0008,0081	3	OPTIONAL
Institutional Department Name	0008,1040	3	OPTIONAL
Manufacturer's Model Name	0008,1090	3	OPTIONAL
Device Serial Number	0018,1000	3	OPTIONAL
Software Versions	0018,1020	3	OPTIONAL Used to check the origin of the plan (validity check version planning system).
Station Name	0008,1010	3	OPTIONAL

Table 27 RT General Plan Module

Attribute Name	Tag	Type	TCS Handling
RT Plan Label	300A,0002	1	ALWAYS – Not used
RT Plan Name	300A,0003	3	OPTIONAL – Only used on GUI and reports
RT Plan Description	300A,0004	3	OPTIONAL – Not used
Instance Number	0020,0013	3	OPTIONAL – Used as 'version number' of the plan. Is increased when creating a new plan in an existing treatment, or editing an already started treatment (basically creates a new plan).
Operators' Name	0008,1070	2	OPTIONAL – Not Used
RT Plan Date	300A,0006	2	OPTIONAL – Only used on Reports
RT Plan Time	300A,0007	2	OPTIONAL – Only used on Reports
Treatment Protocols	300A,0009	3	OPTIONAL – Not Used
Plan Intent	300A,000A	3	OPTIONAL – Not Used.
Treatment Sites	300A,000B	3	OPTIONAL – Not Used
RT Plan Geometry	300A,000C	1	ALWAYS – Not Used. If value is not equal to TREATMENT_DEVICE, TCS will still interpret it as such. This means that the Referenced Structure Set Sequence will always be ignored.
Referenced Structure Set Sequence	300C,0060	1C	IGNORE – Not Used: entire sequence
>Referenced SOP Class UID	0008,1150	1C	
>Referenced SOP Instance UID	0008,1155	1C	
Referenced Dose Sequence	300C,0080	3	OPTIONAL – Not Used: entire sequence
>Referenced SOP Class UID	0008,1150	1C	
>Referenced SOP Instance UID	0008,1155	1C	
Referenced RT Plan Sequence	300C,0002	3	OPTIONAL – Not Used: entire sequence
>Referenced SOP Class UID	0008,1150	1C	
>Referenced SOP Instance UID	0008,1155	1C	
> RT Plan Relationship	300A,0055	1C	

Table 28 RT Prescription Module

Attribute Name	Tag	Type	TCS Handling
Prescription Description	300A,000E	3	OPTIONAL – Not Used
Dose Reference Sequence	300A,0010	3	OPTIONAL – Used for 'Patient/Applicator Point' information in the Dose tab of Prepare
>Dose Reference Number	300A,0012	1C	OPTIONAL – Not used. Required if Dose Reference Sequence (300A,0010) is present.
>Dose Reference UID	300A,0013	3	IGNORE (Attribute introduced in PS3.3 2004)
>Dose Reference Structure Type	300A,0014	1C	OPTIONAL – Required if Dose Reference Sequence (300A,0010) is present. Only items in the Dose Reference Sequence (300A,0010) are used (displayed) where this value equals 'COORDINATES' or 'POINT'.
>Dose Reference Description	300A,0016	3	OPTIONAL – Only items in the Dose Reference Sequence (300A,0010) are used (displayed) where this value is not empty or does not equal "-".
>Referenced ROI Number	3006,0084	1C	OPTIONAL – Not Used. Required if Dose Reference Sequence (300A,0010) is present and Dose Reference Structure Type (300A,0014) equals 'POINT' or 'VOLUME'.
>Dose Reference Point Coordinates	300A,0018	1C	OPTIONAL – Not Used. Required if Dose Reference Sequence (300A,0010) is present and Dose Reference Structure Type (300A,0014) equals 'COORDINATES'.
>Nominal Prior Dose	300A,001A	3	IGNORE
>Dose Reference Type	300A,0020	1C	OPTIONAL – Not used. Required if Dose Reference Sequence (300A,0010) is present.
>Constraint Weight	300A,0021	3	IGNORE
>Delivery Warning Dose	300A,0022	3	IGNORE
>Delivery Maximum Dose	300A,0023	3	IGNORE
>Target Minimum Dose	300A,0025	3	OPTIONAL – Not Used.
>Target Prescription Dose	300A,0026	3	OPTIONAL – Used to describe the planned dose of an 'Patient/Applicator Point' (Dose tab in prepare screen). Mere informative. (in Gy)
>Target Maximum Dose	300A,0027	3	OPTIONAL – Not Used.
>Target Underdose Volume Fraction	300A,0028	3	IGNORE
>Organ at Risk Full-volume Dose	300A,002A	3	IGNORE
>Organ at Risk Limit Dose	300A,002B	3	IGNORE
>Organ at Risk Maximum Dose	300A,002C	3	IGNORE
>Organ at Risk Overdose Volume Fraction	300A,002D	3	IGNORE

Table 29 Fraction Scheme Module

Attribute Name	Tag	Type	TCS Handling
Fraction Group Sequence	300A,0070	1	ALWAYS – Only the first item in the sequence is used.
>Fraction Group Number	300A,0071	1	ALWAYS – Used for BT Record.
>Fraction Group Description	300A,0072	3	IGNORE (Attribute introduced in PS3.3 2004)
>Referenced Patient Setup Number	300C,006A	3	IGNORE (Retired attribute; see PS 3.3 2004)
>Referenced Dose Sequence	300C,0080	3	IGNORE – entire sequence
>>Referenced SOP Class UID	0008,1150	1C	
>>Referenced SOP Instance UID	0008,1155	1C	
>Referenced Dose ReferenceSequence	300C,0050	3	IGNORE – entire sequence
>>Referenced Dose ReferenceNumber	300C,0051	1C	
>>Constraint Weight	300A,0021	3	
>>Delivery Warning Dose	300A,0022	3	
>>Delivery Maximum Dose	300A,0023	3	
>>Target Minimum Dose	300A,0025	3	
>>Target Prescription Dose	300A,0026	3	
>>Target Maximum Dose	300A,0027	3	
>>Target Underdose Volume Fraction	300A,0028	3	
>>Organ at Risk Full-volume Dose	300A,002A	3	
>>Organ at Risk Limit Dose	300A,002B	3	
>>Organ at Risk Maximum Dose	300A,002C	3	
>>Organ at Risk Overdose Volume Fraction	300A,002D	3	
>Number of Fractions Planned	300A,0078	2	OPTIONAL. TCS uses this number to determine the number of pulses to be treated for a PDR plan and the number of fractions to be treated for an HDR plan. This value must be between 1 and 250.
>Number of Fraction Pattern Digits Per Day	300A,0079	3	OPTIONAL – Not Used.
>Repeat Fraction Cycle Length	300A,007A	3	OPTIONAL – Not Used.
>Fraction Pattern	300A,007B	3	OPTIONAL – Not Used.
>Number of Beams	300A,0080	1	IGNORE
>Referenced Beam Sequence	300C,0004	1C	IGNORE – entire sequence
>>Referenced Beam Number	300C,0006	1C	
>>Beam Dose Specification Point	300A,0082	3	
>>Beam Dose	300A,0084	3	
>>Beam Meterset	300A,0086	3	
>Number of Brachy Application Setups	300A,00A0	1	ALWAYS – Not Used.
>Referenced Brachy Application Setup	300C,000A	1C	ALWAYS – Required if Number of Brachy Application Setups (300A,00A0) is greater than zero. Only the first

Attribute Name	Tag	Type	TCS Handling
Sequence			item in the sequence is used.
>>Referenced Brachy Application Setup Number	300C,000C	1C	ALWAYS – Used for BT Record. Required if Referenced Brachy Application Setup Sequence (300C,000A) is present.
>>Brachy Application Setup Dose Specification Point	300A,00A2	3	OPTIONAL – Not Used.
>>Brachy Application Setup Dose	300A,00A4	3	OPTIONAL – Used to display 'Reference Dose' in GUI (in Gy).
>> <i>Private attributes</i>	300B,00xx	3	Private creator group "PRIVATE_CODE_STRING_300B" OPTIONAL
>>Fraction Dose Sequence	300B,xx40	3	OPTIONAL
>>> <i>Private attributes</i>	300B,00xx	3	Private creator group "PRIVATE_CODE_STRING_300B" OPTIONAL
>>>Reference Dose	300B,xx42	3	OPTIONAL – Used internally to store the value of the reference dose of a boosted pulse
>>>Referring Fraction Number	300B,xx44	3	OPTIONAL – Used internally to couple the boosted dose to a certain fraction
>>> <i>End private attributes</i>			
>> <i>End private attributes</i>			

Notes:

1. 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.
2. 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.

Table 30 RT Brachy Application Setups Module

Attribute Name	Tag	Type	TCS Handling
Brachy Treatment Technique	300A,0200	1	ALWAYS – Used for BT Record. Only the following values are accepted as valid value: 'INTRALUMENARY', 'INTRACAVITARY', 'INTERSTITIAL', 'CONTACT', 'INTRAVASCULAR', 'PERMANENT' or 'UNDEFINED' (value defined by TCS).
Brachy Treatment Type	300A,0202	1	ALWAYS – Accepted values: 'PDR' or 'HDR'.
<i>Private attributes</i>	300B,00xx	3	Private creator group "PRIVATE_CODE_STRING_300B" OPTIONAL
Origin	300B,xx30	3	OPTIONAL – Used to determine if a plan is from a planning system or is created manually (e.g. library plan). Only the following values are accepted as valid value: 'MANUAL' or 'PLANNING SYSTEM'.
Library Plan Name	300B,xx32	3	OPTIONAL – Used to store the original name of the library plan this treatment plan was based on.
<i>End private attributes</i>			
Treatment Machine Sequence	300A,0206	1	ALWAYS – Not Used
>Treatment Machine Name	300A,00B2	2	OPTIONAL – Not Used
>Manufacturer	0008,0070	3	OPTIONAL – Not Used
>Institution Name	0008,0080	3	OPTIONAL – Not Used
>Institution Address	0008,0081	3	OPTIONAL – Not Used
>Institutional Department Name	0008,1040	3	OPTIONAL – Not Used
>Manufacturer's Model Name	0008,1090	3	OPTIONAL – Not Used
>Device Serial Number	0018,1000	3	OPTIONAL – Not Used
Source Sequence	300A,0210	1	ALWAYS – Only the first item in the sequence is used.
>Source Number	300A,0212	1	ALWAYS – Used for BT Record.
>Source Type	300A,0214	1	ALWAYS – Not Used
>Source Manufacturer	300A,0216	3	OPTIONAL – Not Used
>Active Source Diameter	300A,0218	3	OPTIONAL – Not Used
>Active Source Length	300A,021A	3	OPTIONAL – Not Used
>Material ID	300A,00E1	3	OPTIONAL – Not Used
>Source Encapsulation Nominal Thickness	300A,0222	3	OPTIONAL – Not Used
>Source Encapsulation NominalTransmission	300A,0224	3	OPTIONAL – Not Used
>Source Isotope Name	300A,0226	1	ALWAYS – Used to determine half-life of isotope. Only the following values are accepted as valid value: 'Ir-192', 'Ir 192', 'Yb 169' or 'Yb-169'.
>Source Isotope Half Life	300A,0228	1	ALWAYS – Not Used
>Reference Air Kerma Rate	300A,022A	1	ALWAYS – Used as 'Associated Source Strength' of a treatment plan
> Source Strength Reference Date	300A,022C	1	ALWAYS – Not Used
> Source Strength Reference Time	300A,022E	1	ALWAYS – Not Used
Application Setup Sequence	300A,0230	1	ALWAYS – Only the first item in the sequence is used.
>Application Setup Type	300A,0232	1	ALWAYS – Used for BT Record.
>Application Setup Number	300A,0234	1	ALWAYS – Used for BT Record.
>Application Setup Name	300A,0236	3	OPTIONAL – Not Used

Attribute Name	Tag	Type	TCS Handling
>Application Setup Manufacturer	300A,0238	3	OPTIONAL – Not Used
>Template Number	300A,0240	3	OPTIONAL – Not Used
>Template Type	300A,0242	3	OPTIONAL – Not Used
>Template Name	300A,0244	3	OPTIONAL – Not Used
>Referenced Reference Image Sequence	300C,0042	3	IGNORE – entire sequence
>>Referenced SOP Class UID	0008,1150	1C	
>>Referenced SOP Class Instance	0008,1155	1C	
>Total Reference Air Kerma	300A,0250	1	ALWAYS – Not Used
>Brachy Accessory Device Sequence	300A,0260	3	OPTIONAL – Not Used
>>Brachy Accessory Device Number	300A,0262	2C	OPTIONAL – Not Used. Required if Brachy Accessory Device Sequence (300A,0260) is sent.
>>Brachy Accessory Device ID	300A,0263	2C	OPTIONAL – Not Used. Required if Brachy Accessory Device Sequence (300A,0260) is sent.
>>Brachy Accessory Device Type	300A,0264	1C	ALWAYS – Not Used. Required if Brachy Accessory Device Sequence (300A,0260) is sent.
>>Brachy Accessory Device Name	300A,0266	3	OPTIONAL – Not Used
>>Material ID	300A,00E1	3	OPTIONAL – Not Used
>> Brachy Accessory Device Nominal Thickness	300A,026A	3	OPTIONAL – Not Used
>> Brachy Accessory Device Nominal Transmission	300A,026C	3	OPTIONAL – Not Used
>>Referenced ROI Number	3006,0084	2C	OPTIONAL – Not Used. Required if Brachy Accessory Device Sequence (300A,0260) is sent.
>Channel Sequence	300A,0280	1	ALWAYS – Displayed in GUI as ‘catheters’. Maximum of 90 items are allowed.
>>Channel Number	300A,0282	1	ALWAYS – Maximum value of ‘90’ allowed.
>>Channel Length	300A,0284	2	ALWAYS – Required for TCS. Value must be between 725 and 1500 (mm).
>>Channel Total Time	300A,0286	1	ALWAYS – Used to determine the individual dwell times (dwell position weight * channel total time)
>>Source Movement Type	300A,0288	1	ALWAYS – Not Used.
>>Number of Pulses	300A,028A	1C	ALWAYS – Mandatory for PDR plans. TCS 3.x supports up to 250 pulses per plan.
>>Pulse Repetition Interval	300A,028C	1C	ALWAYS – Mandatory for PDR plans. Displayed in GUI as ‘Period Time’.
>> <i>Private attributes</i>	300B,00xx	3	Private creator group “PRIVATE_CODE_STRING_300B” OPTIONAL
>>Length Changed	300B,xx50	3	OPTIONAL – Used internally by TCS to display a warning in the reports that the indexer length has been changed (during editing).
>>Pulse Repetition Interval Changed	300B,xx52	3	OPTIONAL – Used internally by TCS to display a warning in the reports that the period time has been changed (during editing).
>>Mapped Channel Number	300B,xx54	3	OPTIONAL – Used to provide some kind of channel mapping for the PLATO proprietary interface only.
>> <i>End private attributes</i>			
>>Source Applicator Number	300A,0290	3	OPTIONAL – Used for BT Record.
>>Source Applicator ID	300A,0291	2C	ALWAYS – Used for BT Record.

Attribute Name	Tag	Type	TCS Handling
>>Source Applicator Type	300A,0292	1C	OPTIONAL – Used for BT Record. Required if Source Applicator Number (300A,0290) is sent.
>>Source Applicator Name	300A,0294	3	OPTIONAL – Not Used
>>Source Applicator Length	300A,0296	1C	ALWAYS – Not Used. Required if Source Applicator Number (300A,0290) is sent.
>>Source Applicator Manufacturer	300A,0298	3	OPTIONAL – Not Used
>>Material ID	300A,00E1	3	OPTIONAL – Not Used
>> Source Applicator Wall Nominal Thickness	300A,029C	3	OPTIONAL – Not Used
>> Source Applicator Wall Nominal Transmission	300A,029E	3	OPTIONAL – Not Used
>>Source Applicator Step Size	300A,02A0	1C	ALWAYS – Used to determine the dwell position index (1..48) from the Control Point Relative Position (300A,02D2). From an imported plan, only the value of the first channel item is used. Allowed values: '2.5', '5.0' or '10.0' (mm).
>>Referenced ROI Number	3006,0084	2C	IGNORE
>>Transfer Tube Number	300A,02A2	2	OPTIONAL – Used to determine if the plan contains channel mapping and/or subfractioning information.
>>Transfer Tube Length	300A,02A4	2C	OPTIONAL – Used for BT Record.
>>Channel Shield Sequence	300A,02B0	3	IGNORE – entire sequence
>>>Channel Shield Number	300A,02B2	1C	
>>>Channel Shield ID	300A,02B3	2C	
>>>Channel Shield Name	300A,02B4	3	
>>>Material ID	300A,00E1	3	
>>>Channel Shield Nominal Thickness	300A,02B8	3	
>>>Channel Shield NominalTransmission	300A,02BA	3	
>>>Referenced ROI Number	3006,0084	2C	
>>Referenced Source Number	300C,000E	1	ALWAYS – Used for BT Record.
>>Number of Control Points	300A,0110	1	ALWAYS – Not Used.
>>Final Cumulative Time Weight	300A,02C8	1C	ALWAYS
>>Brachy Control Point Sequence	300A,02D0	1	ALWAYS – Must be an even number of items in sequence
>>>Control Point Index	300A,0112	1	ALWAYS – Not Used
>>>Cumulative Time Weight	300A,02D6	2	ALWAYS

Attribute Name	Tag	Type	TCS Handling
>>>Control Point Relative Position	300A,02D2	1	ALWAYS – Used to calculate the Dwell Position (1..48) in a catheter: $1 + (\text{Relative Position} / \text{Source Applicator Step Size})$. Value must obey the following rules: <ul style="list-style-type: none"> • $725.0 \leq (\text{Channel Length} - \text{Relative Position}) \leq 1500.0$ • $0 \leq (\text{Relative Position} / \text{Channel Source Applicator Step Size}) \leq 47$ • $(\text{Relative Position} / \text{Source Applicator Step Size})$ must be a natural number (0, 1, 2, etc)
>>>Control Point 3D Position	300A,02D4	3	OPTIONAL – Not Used
>>>Brachy Referenced Dose Reference Sequence	300C,0055	3	OPTIONAL – entire sequence
>>>>Referenced Dose Reference Number	300C,0051	1C	
>>>>Cumulative Dose Reference Coefficient	300A,010C	1C	

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

Table 31 Approval Module

Attribute Name	Tag	Type	TCS Handling
Approval Status	300E,0002	1	ALWAYS – Not Used. Only the following values are accepted as valid value: 'APPROVED', 'UNAPPROVED' or 'REJECTED'
Review Date	300E,0004	2C	OPTIONAL – Not Used
Review Time	300E,0005	2C	OPTIONAL – Not Used
Reviewer Name	300E,0008	2C	OPTIONAL – Not Used

Table 32 SOP Common

Attribute Name	Tag	Type	TCS Handling
SOP Class UID	0008,0016	1	ALWAYS – Not Used
SOP Instance UID	0008,0018	1	ALWAYS – Not Used. When importing there may not already be an instance with the same SOP Instance UID in the internal database.

9.1.3 Attribute mapping

9.1.4 Coerced/Modified fields

During RT Plan import, attributes of Patient, Study or Series objects in the imported data set may contain information that is not yet available in the TCS database, while the objects themselves already exist from previous imports. In this case, *empty database fields* will be filled using the attributes of the imported data set as input. Table 33 provides an overview of attributes and database fields to which this applies.

Table 33 Coerced/modified fields - database to DICOM tag mapping

Database entity	Database field	DICOM Attribute	DICOM Tag	Database action
Patient	Given Name	Patient's Name	0010,0010	Extracted from this attribute if current value is "?".
	Middle Name	Patient's Name	0010,0010	Extracted from this attribute
	Name Prefix	Patient's Name	0010,0010	Extracted from this attribute
	Name Suffix	Patient's Name	0010,0010	Extracted from this attribute
	Sex	Patient's Sex	0010,0040	Copied from this attribute if current value is "OTHER".
	Birth Date	Patient's Birth Date	0010,0030	Copied from this attribute
	Comments	Patient Comments	0010,4000	Copied from this attribute
Study	Date	Study Date	0008,0020	Copied from this attribute
	Referring Physician	Referring Physician's Name	0008,0090	Copied from this attribute
	Accession Number	Accession Number	0008,0050	Copied from this attribute
	Study ID	Study ID	0020,0010	Copied from this attribute
	Description	Study Description	0008,1030	Copied from this attribute
Series	Description	Series Description	0020,103E	Copied from this attribute

Note: the database entities and fields mentioned here may change in the database design. This DICOM conformance statement does not assume a specific database structure, the entities and fields are only mentioned here to indicate structure and provide reference to information displayed in TCS about these entities.

9.2 Data dictionary of private attributes

Tag	Attribute Name	Attribute Description	VR	VM
3009,xx10	Brachy Control Point Planned Sequence	Sequence of control points planned, adjusted to source strength at time of treatment start. Weights are rounded to the treatment unit's resolution (0.1 s). Part of pre-treatment record in TCS and derived from Brachy Control Point Sequence (300A,02D0) in original RT Plan.	SQ	1
3009,xx12	Relative Position	Distance between current Control Point Position and the distal-most possible Source position in current Channel (mm) - rounded as sent to treatment unit, thus different than Control Point Relative Position (300A,02D2) as found in original RT Plan. Used in Pretreatment record.	DS	1
3009,xx14	Dwell Time	Part of control point planned. Rounded off dwelltime (s) sent to TU. Derived from the two Cumulative Time Weight (300A,02D6) values at the relative position and adjusted to source strength at time of treatment start.	DS	1
300B,xx10	TU Dwell Time Precision	Use to round values of dwell times, due to treatment unit limitations. DwellTime will scientifically rounded off (e.g. With a TUDwellTimePrecision of 1, a dwelltime of 0.25 will be delivered with dwelltime = 0.3)	DS	1
300B,xx20	Calibration Reference Air Kerma Rate	The air kerma rate in air of isotope during the most recent source calibration. (Not the same as DICOM attribute Air Kerma Rate at date of treatment)	DS	1
300B,xx22	Calibration Air Kerma Rate Reference Date	Date at which 300B,xx20 was measured.	DA	1
300B,xx24	Calibration Air Kerma Rate Reference Time	Time at which 300B,xx20 was measured.	TM	1
300B,xx26	Secondary Time	The delivered secondary timer for a channel in seconds. This is the total time the source is outside the safe during the treatment of the channel (not the same as the sum of all dwell times).	DS	1
300B,xx30	Origin	String identifying plan as created on "Plato BPS" or "Manual" on TCS.	CS	1
300B,xx32	Library Plan Name	Name of library plan used as basis for executed plan.	LO	1
300B,xx40	Fraction Dose Sequence	Sequence of user changed fraction doses per pulse (PDR). Used for boosting of individual fractions in PDRv2.	SQ	1
300B,xx42	Reference Dose	Dose delivered per fraction (in boosting scheme)	IS	1
300B,xx44	Referring Fraction Number	Sequence number of fraction in total fraction scheme.	DS	1
300B,xx50	Length Changed	Integer flag, indicating change in catheter length. 0 = length is not changed; 1 = length is changed	IS	1
300B,xx52	Pulse Repetition Interval Changed	Integer flag, indicating change in repetition interval. 0 = length is not changed; 1 = length is changed	IS	1
300B,xx54	Mapped Channel Number	Number mapping the catheter to a channel. Value range 0 or higher.	IS	1

The identification code (the value) of the Private Creator Data Elements shall be in the format "PRIVATE_CODE_STRING_<private group Number>" (e.g. "PRIVATE_CODE_STRING_3009").

