**Integrating the Healthcare Enterprise**



**IHE Radiation Oncology**

**Technical Framework Supplement**

**Treatment Planning – Plan Content Brachy**

**(TPPC-Brachy)**

**(Version 2 – Revision 3)**

<The IHE Documentation Specialist will change the title to just “Draft for Public Comment” upon publication for public comment; leave “as is” until then.>

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**Foreword**

This is a supplement to the IHE Radiation Oncology Technical Framework V 1.7. Each supplement undergoes a process of public comment and trial implementation before being incorporated into the volumes of the Technical Frameworks.

<For Public Comment:> This supplement is published on <Month XX, 201x> for Public Comment. Comments are invited and may be submitted at [http://www.ihe.net/<domain>/<domain>comments.cfm](http://www.ihe.net/Technical_Framework/public_comment.cfm). In order to be considered in development of the Trial Implementation version of the supplement, comments must be received by <Month XX, 201X>.

<For Trial Implementation:> This supplement is published on <Month XX, 201X> for Trial Implementation and may be available for testing at subsequent IHE Connectathons. The supplement may be amended based on the results of testing. Following successful testing it will be incorporated into the <Domain Name> Technical Framework. Comments are invited and may be submitted at [http://www.ihe.net/<domain>/<domain>comments.cfm](http://www.ihe.net/%3Cdomain%3E/%3Cdomain%3Ecomments.cfm).

This supplement describes changes to the existing technical framework documents.

“Boxed” instructions like the sample below indicate to the Volume Editor how to integrate the relevant section(s) into the relevant Technical Framework volume.

Amend section X.X by the following:

Where the amendment adds text, make the added text bold underline. Where the amendment removes text, make the removed text bold strikethrough. When entire new sections are added, introduce with editor’s instructions to “add new text” or similar, which for readability are not bolded or underlined.

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Table of Contents

[Introduction to this Supplement 7](#_Toc33695259)

[History 7](#_Toc33695260)

[Open Issues and Questions 9](#_Toc33695261)

[Closed Issues 9](#_Toc33695262)

[General Introduction 10](#_Toc33695263)

[Glossary 10](#_Toc33695264)

[Volume 1 – Profiles 11](#_Toc33695265)

[X Brachy Treatment Planning – Plan Content Integration (TPPC-Brachy) Profile 11](#_Toc33695266)

[X.1 TPPC-BRACHY Actors, Transactions, and Content Modules 11](#_Toc33695267)

[X.1.1 Actor Descriptions and Actor Profile Requirements 12](#_Toc33695268)

[X.2 TPPC-Brachy Transaction Options 13](#_Toc33695269)

[X.4 TPPC-Brachy Document Content Module 13](#_Toc33695270)

[X.5 TPPC-Brachy Overview 14](#_Toc33695271)

[X.5.1 Concepts 14](#_Toc33695272)

[X.6 TPPC-Brachy Security Considerations 14](#_Toc33695273)

[X.7 TPPC-Brachy Cross Profile Considerations 14](#_Toc33695274)

[Appendices 15](#_Toc33695275)

[Actor Definitions 15](#_Toc33695276)

[Transaction Summary Definitions 15](#_Toc33695277)

[Volume 2 – Transactions 17](#_Toc33695278)

[3.Y1 HDR Plan Storage [TPPC-Brachy 01] 17](#_Toc33695279)

[3.Y1.1 Scope 17](#_Toc33695280)

[3.Y1.2 Actor Roles 17](#_Toc33695281)

[3.Y1.3 Referenced Standards 17](#_Toc33695282)

[3.Y1.4 Interaction Diagram 17](#_Toc33695283)

[3.Y1.5 Security Considerations 18](#_Toc33695284)

[3.Y2 PDR Plan Storage [TPPC-Brachy 02] 19](#_Toc33695285)

[3.Y2.1 Scope 19](#_Toc33695286)

[3.Y2.2 Actor Roles 19](#_Toc33695287)

[3.Y2.3 Referenced Standards 19](#_Toc33695288)

[3.Y2.4 Interaction Diagram 19](#_Toc33695289)

[3.Y2.5 Security Considerations 20](#_Toc33695290)

[3.Y3 LDR Permanent Plan Storage [TPPC-Brachy 03] 21](#_Toc33695291)

[3.Y3.1 Scope 21](#_Toc33695292)

[3.Y3.2 Actor Roles 21](#_Toc33695293)

[3.Y3.3 Referenced Standards 21](#_Toc33695294)

[3.Y3.4 Interaction Diagram 21](#_Toc33695295)

[3.Y3.5 Security Considerations 22](#_Toc33695296)

[3.Y4 LDR Temporary Plan Storage [TPPC-Brachy 04] 23](#_Toc33695297)

[3.Y4.1 Scope 23](#_Toc33695298)

[3.Y4.2 Actor Roles 23](#_Toc33695299)

[3.Y4.3 Referenced Standards 23](#_Toc33695300)

[3.Y4.4 Interaction Diagram 23](#_Toc33695301)

[3.Y4.5 Security Considerations 24](#_Toc33695302)

[Appendices 26](#_Toc33695303)

[Volume 3 – Content Modules 27](#_Toc33695304)

[5. Namespaces and Vocabularies 27](#_Toc33695305)

[6. Content Modules 27](#_Toc33695306)

[7. DICOM Content Definition 27](#_Toc33695307)

[7.1 Conventions 27](#_Toc33695308)

[7.2 General Definitions 27](#_Toc33695309)

[7.3 IOD Definitions 27](#_Toc33695310)

[7.3.1 Prescription IODs 27](#_Toc33695311)

[7.3.2 Plan IODs 27](#_Toc33695312)

[7.3.2 Image IODs 29](#_Toc33695313)

[7.3.3 Segment IODs 29](#_Toc33695314)

[7.3.5 Dose IODs 29](#_Toc33695315)

[7.3.6 Treatment Record IODs 29](#_Toc33695316)

[7.4 Module Definitions 29](#_Toc33695317)

[7.4.1 General Modules 29](#_Toc33695318)

[7.4.2 Workflow-Related Modules 29](#_Toc33695319)

[7.4.3 General Plan-Related Modules 30](#_Toc33695320)

[7.4.4 Plan-Related Modules in Planning 31](#_Toc33695321)

[7.4.5 Plan-Related Modules in Delivery 41](#_Toc33695322)

[7.4.6 Image-related Modules in Planning 42](#_Toc33695323)

[7.4.7 Image-related Modules in Delivery 42](#_Toc33695324)

[7.4.8 Image-related Modules in Delivery 42](#_Toc33695325)

[7.4.8 Segment Modules 42](#_Toc33695326)

[7.4.9 Segment Modules in Delivery 44](#_Toc33695327)

[7.4.10 Registration Modules 44](#_Toc33695328)

[7.4.11 Treatment Record Modules 44](#_Toc33695329)

[Appendices 45](#_Toc33695330)

[Volume 4 – National Extensions 46](#_Toc33695331)

# Introduction to this Supplement

This content profile is motivated by medical physicists working with brachytherapy planning systems, who face an increasing demand from patient-care, data-quality and research perspectives to increase the usefulness, exchangeability and availability of clinical data across the various treatment planning systems.

The main role of this profile is to address a solution for such interoperability using the DICOM objects provided in its 1st generation.

The aim is to streamline the implementation of the DICOM objects in order to identify a common understanding and key reading of the standard. This supplement provides the guidelines to handle techniques that exist in brachytherapy that benefit from digital data storage. The involved actors are either producers or consumers of a DICOM RT Plan for brachytherapy.

## History

|  |  |  |  |
| --- | --- | --- | --- |
| Date | R. | Author | Change Summary |
|  | 1.0 | Milena Donato | Initial Version |
| 2015-07-08 | 1.1 | Milena Donato |  |
| 2015-07-10 | 1.2 | Ulrich Busch | (without change bars to keep document readable):- Cleaned up document- Synchronized with Supplement Template- Structures Chapter 7 along the systematics in development by IHE-RO TC. Finally, all sections will be combined in the Technical Framework and therefore the section numbering must follow the general scheme.Note: At this time, I have provided a Chapter 7 template to IHE for discussion and approval. Once this is done, a final version of the section numbering will be determined and may differ. Especially I intend to increase all 7.3.<n> IOD sections by 1 and reserve 7.3.1 for 2nd Gen Prescription IODs. However, the structure will not change substantially. |
| 2015-07-10 | 1.2 | Milena Donato | Introduced use case #3, #4, #5 |
| 2015-08-20 | 1.2 | Milena Donato | Updates on use case #2 and #3. Integrated updates for use case #4 and #5 from Jan-Pieter DieterUpdated content information about Control Point Orientation (300A,0412) in chapter 7.4.4.2 |
| 2015-11-25 | 1.3 | Milena Donato | Added Issue 5 |
| 2015-12-11 | 1.4 | Milena Donato, Ulrich Busch | Updated section numbers along stabilized Chapter 4 section repository (see IHE\_RO Wiki: <http://www.ihe-ro.org/doku.php>) |
| 2016-01-13 | 1.4 | Ulrich Busch | Version includes results of:WG-07 Brachy Subgroup Tcon 2016-01-13 |
| 2016-04-21 | 1.5 | Yury Niatsetski | Version includes results of WG-07 Brachy Subgroup Tcons 2016-03-23 and 2016-04-20  |
| 2016-05-18 | 1.6 | Yury Niatsetski | Includes results of WG-07 Brachy Subgroup Tcon 2016-05-18: accept agreed changes to the document. |
| 2016-06-01 | 1.7 | Yury Niatsetski | Results of the WG-07 Brachy Subgroup T-con 2016-06-01: addressed question marks, remained unanswered, HDR profile. |
| 2017-05-23 | 1.8 | John de Ridder, Rob van der Laarse, Yury Niatsetski | Adaptation to CP1657 |
| 2017-06-29 | 1.9 | Yury Niatsetski | Accept changes, based on the WG-07 Brachy decision (24-May-2017) |
| 2018-01-03 | 1.10 | Yury Niatsetski | Seeds profile update after Tcon 2018-01-03 |
| 2018-02-07 | 1.11 | Yury Niatsetski | Seeds profile update after Tcon 2018-02-07. Changes accepted, new clean version created. |
| 2018-03-07 | 1.12 | Ulrich Busch | X.1 BWF Actors, Transactions, and Content Modules: Actor / Transaction list setup (besides TMS)X.<n>: Some General Sections clarified – see not colored sections3.Y1 HDR Plan Storage [BWF-01]: FinalizedChapter 7 sections: Section number synchronized with actual numbering scheme of Technical FrameworkYellow Color: Parts which need to be reworked / finalized. |
| 2018-08-31 | 1.13 | Yury Niatsetski | Replaced temporary attributes numbers with the official ones from the latest DICOM release |
| 2018-11-21 | 1.14 | Ulrich Busch | Results of TCon 2018-11-21 WG-07 Brachy Subgroup:Added Issue 6, 7, 8.Added section 7.4.11.6.2 RT Brachy Session Record Module for Seed treatment (not worked out yet – see 6.Added technique-specific lookup for RT Brachy Session Record Module in 7.3.6.3.1.2 IOD Definition |
| 2019-03-27 | 1.15 | Yury Niatsetski | Minor changes based on the feedback from Erik Roelofs + partial filling of the table 7.4.11.6.2 (as of March 27, 2019) |
| 2019-05-13 | 1.16 | Yury Niatsetski | Table 7.4.11.6.2 completed after the TCon of March 27, 2019. Changes accepted, also for the table 7.4.11.6.1. |
| 2019-05-16 | 1.17 | Roel Zinkstok | Includes results of TCon 2019-05-15/Removed Treatment Management System and added Brachytherapy Treatment Record Consumer to list of actors (Table X.1-1).Added sections in Volume 2 for plan storage/retrieval transactions. |
| 2019-07-09 | 2.0 | Roel Zinkstok | Removes everything related to treatment record; converts to TPPC-Brachy, adopting the document structure of TPPC. |
| 2019-07-25 | 2.1 | Jim Percy | Continued transition to TPPC format |
| 2019-12-9 | 2.2 | Chris Pauer | Review with IHE-RO TC |
| 2020-02-27 | 2.3 | Yury Niatsetski | Reviewed version 2.2, accepted changes, removed addressed comments. |

## Open Issues and Questions

|  |  |
| --- | --- |
| # | Open Issue Description |
| 5 | How is the contour of the applicator or seed transferred to DICOM?There are two optional information in DICOM:1. Through the referenced ROI number it is possible to go back to the contour of each applicator (ROI Contour Module)2. With the attributes Control Point 3D Position and Control Point Orientation it is possible to identify the coordinates of the single source positionsIn order to display a brachy plan in different systems the applicators contours shall be transferred to DICOM. Which of the two representations above would address better this interoperability question?Comment from TC: Working Group will need to address this. |
| 6 | 2018-11-21 WG-07 Brachy Subgroup: Added LDR Treatment Record Storage [BWF-11]. No specification is yet written for the Treatment Record Storage for Seeds. It was consensus that at least a manual recording would be useful. The main purpose is recording for archiving / charge capture. The record would be written by a TPS/TMS application.Added a module definition by 7.4.11.6.2 RT Brachy Session Record Module for Seed treatment. Currently rules are a copy form HRD. They have to be revised all over the place but kept for convenience.Rebecca Park will prepare a proposal for the meeting as a starting point. |
| 7 | 2018-11-21 WG-07 Brachy Subgroup: The transactions and the IOD content they refer to do not depend on variations of uses cases. Therefore, the Use case section should be reworked to be an informal description of variations in workflows covered, but not suggesting a different set of actors and transaction for each use case.Chris’s comment: the plan transfer and use is a well-understood use case, so spending a lot of time and effort on defining these is not worthwhile. If there are options involved in the use of Brachy Plan info, then the WG for Brachy would be best to highlight this, and that area would be where time should be spent. |
| 8 | 2018-11-21 WG-07 Brachy Subgroup: The use of DICOM Unified Worklist suggested in some use cases will not be covered in this Profile. The use case section shall state, that the use case variations using worklist are included only for illustration of the clinical environment.The Technical Committee should look into eventually integrating Brachytherapy into TDW II, since the framework is basically the same. Alternatively, a separate TDW-style profiles could be written for Brachytherapy. |
| 9 | 2019-12-9 TC: Consider how Structure Sets may have specialized content for Brachy plans, and do they need to be added to the Volume 3 Section 7? It could be added to this profile, another profile, or delivered via it’s own content profile. Could involve (3006,0084) |

## Closed Issues

|  |  |
| --- | --- |
| # | Closed Issue Description/Resolution |
| 3 | Definition of the general workflow2015-12-10; Various use case scenarios are described in X.4.2 |
| 1 | Profile name: Brachytherapy Workflow Profile.DONE: Changed to TPPC-Brachy  |
| 2 | Content definition (based on different techniques) – Content is defined in this supplement |
| 4 | Definition of the list of transactions (see Appendices A and B, X.1 Actors, Transactions …) |
|  |  |
|  |  |
|  |  |
|  |  |

# General Introduction

Update the following Appendices to the General Introduction as indicated below. Note that these are not appendices to Volume 1.

Appendix A - Actor Summary Definitions

Add the following actors to the IHE Technical Frameworks General Introduction list of Actors:

<Add any actor definitions for new actors defined specifically for this profile. These will be added to the IHE TF General Introduction list of Actors namespace.>

|  |  |
| --- | --- |
| Actor | Definition |
|  |  |
|  |  |

Appendix B - Transaction Summary Definitions

Add the following transactions to the IHE Technical Frameworks General Introduction list of Transactions:

<Add any transaction definitions for new transactions defined specifically for this profile. These will be added to the IHE TF General Introduction list of Transactions namespace.>

|  |  |
| --- | --- |
| Transaction | Definition |
|  |  |
|  |  |

Glossary

Add the following glossary terms to the IHE Technical Frameworks General Introduction Glossary:

<Any glossary additions associated with the profile draft go here.>

|  |  |
| --- | --- |
| Glossary Term | Definition |
| HDR | High dose rate |
| PDR | Pulse dose rate |
| LDR | Low dose rate |
| Applicator | Device, consisting out of one or more catheters, holding the radioactive source(s) during brachytherapy |

Volume 1 – Profiles

# X Brachy Treatment Planning – Plan Content Integration (TPPC-Brachy) Profile

This integration profile involves the exchange of RT Plan information:

* Between treatment planning systems
* Between treatment planning systems and treatment management systems and / or treatment delivery systems.

The transactions revolve around the brachytherapy treatment specific workflows (e.g. specifying the process of transferring the treatment planning data to a treatment management system). On the basis of the planned technique for the treatment the content of the DICOM object has an additional specification defined in chapter 7 in order to address the interoperability within different vendors.

The workflow description will make use of the content description defined in the chapter 7.

This profile addresses the techniques that exist in Brachytherapy. The actors are either producers or consumers of a DICOM RT Plan.

## X.1 TPPC-BRACHY Actors, Transactions, and Content Modules

In figure X.1-1 is showed how this content profile is used in the exchanging of DICOM plans between actors that are identified as producers and actors that are identified as consumers.

The DICOM objects that are exchanged between producers and consumers have to implement the requirements listed in this profile in order to be IHE compliant.

HDR Plan Consumer

PDR Plan Producer

PDR Plan Consumer

LDR Permanent Plan Producer

LDR Permanent Plan Consumer

HDR Plan Storage

LLDR Permanent Plan Storage

LDR Temporary Plan Producer

LDR Temporary Plan Consumer

LDR Temporary Plan Storage

HDR Plan Producer

PDR Plan Storage

Figure X.1-1: TPPC-Brachy Actor Diagram

Transactions Overview:

Table X.1-1 lists the transactions for each actor directly involved in the TPPC-Brachy Profile. To claim compliance with this Profile, an actor shall support all required transactions (labeled “R”) and may support the optional transactions (labeled “O”).

Table X.1-1: TPPC-Brachy Profile - Actors and Transactions

| Actors | Transactions  | Optionality | Section in Vol. 2 |
| --- | --- | --- | --- |
| Treatment Management System (TMS)(See Note Below) | HDR Plan Storage | O | [TPPC-Brachy 01] |
|  | PDR Plan Storage | O | [TPPC-Brachy 02] |
|  | LDR Permanent Plan Storage | O | [TPPC-Brachy 03] |
|  | LDR Temporary Plan Storage | O | [TPPC-Brachy 04] |
| Brachytherapy HDR Plan Producer | HDR Plan Storage | R | [TPPC-Brachy 01] |
| Brachytherapy PDR Plan Producer | PDR Plan Storage | R | [TPPC-Brachy 02] |
| Brachytherapy LDR Permanent Plan Producer | LDR Permanent Plan Storage | R | [TPPC-Brachy 03] |
| Brachytherapy LDR Temporary Plan Producer | LDR Temporary Plan Storage | R | [TPPC-Brachy 04] |
| Brachytherapy HDR Plan Consumer | HDR Plan Storage | R | [TPPC-Brachy 01] |
| Brachytherapy PDR Plan Consumer | PDR Plan Storage | R | [TPPC-Brachy 02] |
| Brachytherapy LDR Permanent Plan Consumer | LDR Permanent Plan Storage | R | [TPPC-Brachy 03] |
| Brachytherapy LDR Temporary Plan Consumer | LDR Temporary Plan Storage | R | [TPPC-Brachy 04] |

Note: The TMS Integration Statement will indicate which transactions it is capable of supporting. In general, these will be grouped according to the overall functionality of the TMS actor. For example, a general TMS would likely support all transactions, while a Brachy only TMS may only support the brachy plans. In addition, for cases where there are insufficient actors for complete testing of the TMS, the TMS can pass the Connectathon by claiming those transactions it successfully completed.

### X.1.1 Actor Descriptions and Actor Profile Requirements

Most requirements are documented in Transactions (Volume 2) and Content Modules (Volume 3). This section documents any additional requirements on profile’s actors.

## X.2 TPPC-Brachy Transaction Options

None

## X.4 TPPC-Brachy Document Content Module

Not applicable.

## X.5 TPPC-Brachy Overview

The main roles of this profile are:

* To describe the content of RT Plan information for exchange between treatment planning systems and treatment management systems for Brachytherapy treatments.

### X.5.1 Concepts

This profile enhances the content of the DICOM plan objects as regard the brachytherapy scope. This is fulfilled by providing specialized actors for each technique and role (producer or consumer).

Typically, a Treatment Planning System (TPS) is expected to implement one or more of the “producer” actors.

A TPS that is intended to be able to perform a re-planning based on the output of another TPS is expected to adhere to one or more of the “consumers” actors.

The transactions included in this profile provide the guidelines that indicate how the DICOM object shall be filled focusing in the content description rather than in the workflow description.

The most important attributes that have to be properly included in the DICOM object in order to avoid ambiguities and safety implications on interpreting the object have been identified in the transactions.

## X.6 TPPC-Brachy Security Considerations

Not Applicable.

## X.7 TPPC-Brachy Cross Profile Considerations

Not Applicable

Appendices

## Actor Definitions

HDR Plan Producer

A Treatment Planning System (TPS) capable of producing an HDR treatment plan.

HDR Plan Consumer

A system like a Treatment Planning System (TPS) or Treatment Management System (TMS) capable of consuming a HDR treatment plan

PDR Plan Producer

A Treatment Planning System (TPS) capable of producing a PDR treatment plan.

PDR Plan Consumer

A system like a Treatment Planning System (TPS) or Treatment Management System (TMS) capable of consuming a PDR treatment plan

LDR Permanent Plan Producer

A Treatment Planning System (TPS) capable of producing a permanent LDR treatment plan.

LDR Permanent Consumer

A system like a Treatment Planning System (TPS) or Treatment Management System (TMS) capable of consuming a permanent LDR treatment plan

LDR Temporary Plan Producer

A Treatment Planning System (TPS) capable of producing a temporary LDR treatment plan.

LDR Temporary Plan Consumer

A system like a Treatment Planning System (TPS) or Treatment Management System (TMS) capable of consuming a temporary LDR treatment plan

## Transaction Summary Definitions

TPPC-BRACHY-01: HDR Plan Storage

In the HDR Plan Storage, a ***HDR Plan Producer*** stores a treatment plan to a ***HDR Plan Consumer.***

TPPC-BRACHY-02: PDR Plan Storage

In the PDR Plan Storage, a ***PDR Plan Producer*** stores a treatment plan to a ***PDR Plan Consumer.***

TPPC-BRACHY-03: LDR Permanent Plan Storage

In the LDR Permanent Plan Storage, a ***LDR Permanent Plan Producer*** stores a treatment plan to a ***LDR Permanent Plan Consumer.***

TPPC-BRACHY-04: LDR Temporary Plan Storage

In the LDR Temporary Plan Storage, a ***LDR Temporary Plan Producer*** stores a treatment plan to a ***LDR Temporary Plan Consumer.***

Volume 2 – Transactions

Add section 3.Y

## 3.Y1 HDR Plan Storage [TPPC-Brachy 01]

### 3.Y1.1 Scope

In the HDR Plan Storage transaction, a Producer of an RT Plan that incorporates the brachytherapy technique identified in TPPC-Brachy-01: HDR Plan Storage stores the plan to an HDR Plan Consumer. In this example, we diagram a DICOM C-Store, but other forms of transmission are acceptable for this content profile.

### 3.Y1.2 Actor Roles

HDR Plan Consumer

HDR Plan Producer

HDR Plan

Storage

|  |  |
| --- | --- |
| Actor: | HDR Plan Producer |
| Role: | Creates an HDR plan for a treatment that shall be delivered using a treatment delivery system and stores it to an HDR Plan Consumer. |
| Actor: | HDR Plan Consumer |
| Role: | Accepts and stores the RT Plan and RT Structure Set from the HDR Plan Producer |

### 3.Y1.3 Referenced Standards

DICOM 2019c Edition. PS 3.3: RT Modules, PS 3.4: Storage Service Class.

### 3.Y1.4 Interaction Diagram

HDR

Plan Consumer

HDR

Plan Producer

C-STORE (RT Plan)

#### 3.Y1.4.1 HDR Plan Storage

##### 3.Y1.4.1.1 Trigger Events

The HDR Plan Producer transfers the plan to a storage or HDR Plan Consumer once the plan is created and the dose calculation is finished.

##### 3.Y1.4.1.2 Message Semantics

The HDR Plan Producer uses the DICOM C-STORE message to transfer the plan.

The HDR Plan Producer is the DICOM Storage SCU and the TMS is the DICOM Storage SCP.

The HDR Plan Producer may create a new series containing the plan or may use an existing series, where previous plan(s) are contained.

The study where the series of the plan is contained shall be the same study as the one containing the structure set referenced in the plan.

The requirements for the content of the RT Plan are specified in section 7.3.2.1.3.

##### 3.Y1.4.1.3 Expected Actions

The HDR Plan Consumer stores the RT Plan. and its RT Structure Set.

### 3.Y1.5 Security Considerations

There are no specific security considerations.

## 3.Y2 PDR Plan Storage [TPPC-Brachy 02]

### 3.Y2.1 Scope

In the PDR Plan Storage transaction, a Producer of an RT Plan that incorporates the brachytherapy technique identified in TPPC-Brachy-XX: PDR Plan Storage stores the plan to an HDR Plan Consumer. In this example, we diagram a DICOM C-Store, but other forms of transmission are acceptable for this content profile.

### 3.Y2.2 Actor Roles

PDR Plan Consumer

PDR Plan Producer

PDR Plan

Storage

|  |  |
| --- | --- |
| Actor: | PDR Plan Producer |
| Role: | Creates an PDR plan for a treatment that shall be delivered using a treatment delivery system and stores it to aPDR Plan Consumer. |
| Actor: | PDR Plan Consumer |
| Role: | Accepts and stores the RT Plan and its RT Structure Set from the PDR Plan Producer |

### 3.Y2.3 Referenced Standards

DICOM 2019c Edition. PS 3.3: RT Modules, PS 3.4: Storage Service Class.

### 3.Y2.4 Interaction Diagram

PDR

Plan Consumer

PDR

Plan Producer

C-STORE (RT Plan)

#### 3.Y2.4.1 PDR Plan Storage

##### 3.Y2.4.1.1 Trigger Events

The PDR Plan Producer transfers the plan to a storage or PDR Plan Consumer once the plan is created and the dose calculation is finished.

##### 3.Y2.4.1.2 Message Semantics

The PDR Plan Producer uses the DICOM C-STORE message to transfer the plan.

The PDR Plan Producer is the DICOM Storage SCU and the TMS is the DICOM Storage SCP.

The PDR Plan Producer may create a new series containing the plan or may use an existing series, where previous plan(s) are contained.

The study where the series of the plan is contained shall be the same study as the one containing the structure set referenced in the plan.

The requirements for the content of the RT Plan are specified in section 7.3.2.1.3.

##### 3.Y2.4.1.3 Expected Actions

The PDR Plan Consumer stores the RT Plan and its RT Structure Set.

### 3.Y2.5 Security Considerations

There are no specific security considerations.

## 3.Y3 LDR Permanent Plan Storage [TPPC-Brachy 03]

### 3.Y3.1 Scope

In the LDR Permanent Plan Storage transaction, a Producer of an RT Plan that incorporates the brachytherapy technique identified in TPPC-Brachy-03: LDR Permanent Plan Storage stores the plan to an LDR Permanent Plan Consumer. In this example, we diagram a DICOM C-Store, but other forms of transmission are acceptable for this content profile.

### 3.Y3.2 Actor Roles

LDR Permanent Plan Consumer

LDR Permanent Plan Producer

LDR Permanent Plan

Storage

|  |  |
| --- | --- |
| Actor: | LDR Permanent Plan Producer |
| Role: | Creates an LDR Permanent plan for a treatment that shall be delivered using a treatment delivery system and stores it to a LDR Permanent Plan consumer |
| Actor: | LDR Permanent Plan Consumer |
| Role: | Accepts and stores the RT Plan and its RT Structure Set from the LDR Permanent Plan Producer |

### 3.Y3.3 Referenced Standards

DICOM 2019c Edition. PS 3.3: RT Modules, PS 3.4: Storage Service Class.

### 3.Y3.4 Interaction Diagram

LDR Permanent Plan Consumer

LDR Permanent Plan Producer

C-STORE (RT Plan)

#### 3.Y3.4.1 LDR Permanent Plan Storage

##### 3.Y3.4.1.1 Trigger Events

The LDR Permanent Plan Producer transfers the plan to a storage or LDR Permanent Plan Consumer once the plan is created and the dose calculation is finished.

##### 3.Y3.4.1.2 Message Semantics

The LDR Permanent Plan Producer uses the DICOM C-STORE message to transfer the plan.

The LDR Permanent Plan Producer is the DICOM Storage SCU and the TMS is the DICOM Storage SCP.

The LDR Permanent Plan Producer may create a new series containing the plan or may use an existing series, where previous plan(s) are contained.

The study where the series of the plan is contained shall be the same study as the one containing the structure set referenced in the plan.

The requirements for the content of the RT Plan are specified in section 7.3.2.1.3.

##### 3.Y3.4.1.3 Expected Actions

The LDR Permanent Plan Consumer stores the RT Plan and its RT Structure Set.

### 3.Y3.5 Security Considerations

There are no specific security considerations.

## 3.Y4 LDR Temporary Plan Storage [TPPC-Brachy 04]

### 3.Y4.1 Scope

In the LDR Temporary Plan Storage transaction, a Producer of an RT Plan that incorporates the brachytherapy technique identified in TPPC-Brachy-04: LDR Temporary Plan Storage stores the plan to an LDR Temporary Plan Consumer. In this example, we diagram a DICOM C-Store, but other forms of transmission are acceptable for this content profile.

### 3.Y4.2 Actor Roles

LDR Temporary Plan Consumer

LDR Temporary Plan Producer

LDR Temporary Plan

Storage

|  |  |
| --- | --- |
| Actor: | LDR Temporary Plan Producer |
| Role: | Creates an LDR Temporary plan for a treatment that shall be delivered using a treatment delivery system and stores it to a LDR Temporary Plan Consumer |
| Actor: | LDR Temporary Plan Consumer |
| Role: | Accepts and stores the RT Plan and its RT Structure Set from the LDR Temporary Plan Producer |

### 3.Y4.3 Referenced Standards

DICOM 2019c Edition. PS 3.3: RT Modules, PS 3.4: Storage Service Class.

### 3.Y4.4 Interaction Diagram

LDR Temporary Plan Consumer

LDR Temporary Plan Producer

C-STORE (RT Plan)

#### 3.Y4.4.1 LDR Temporary Plan Storage

##### 3.Y4.4.1.1 Trigger Events

The LDR Temporary Plan Producer transfers the plan to a storage or LDR Temporary Plan Consumer once the plan is created and the dose calculation is finished.

##### 3.Y4.4.1.2 Message Semantics

The LDR Temporary Plan Producer uses the DICOM C-STORE message to transfer the plan.

The LDR Temporary Plan Producer is the DICOM Storage SCU and the TMS is the DICOM Storage SCP.

The LDR Temporary Plan Producer may create a new series containing the plan or may use an existing series, where previous plan(s) are contained.

The study where the series of the plan is contained shall be the same study as the one containing the structure set referenced in the plan.

The requirements for the content of the RT Plan are specified in section 7.3.2.1.3.

##### 3.Y4.4.1.3 Expected Actions

The LDR Temporary Plan Consumer stores the RT Plan and its RT Structure Set.

### 3.Y4.5 Security Considerations

There are no specific security considerations.

Appendices

Not applicable.

Volume 3 – Content Modules

# 5. Namespaces and Vocabularies

# 6. Content Modules

No Content Modules defined.

# 7. DICOM Content Definition

## 7.1 Conventions

This section is currently located in BRTO-II (Basic Radiotherapy Object, version II).

## 7.2 General Definitions

This section is currently located in BRTO-II (Basic Radiotherapy Object, version II).

## 7.3 IOD Definitions

### 7.3.1 Prescription IODs

This section is present only to convey the envisioned section numbering.

### 7.3.2 Plan IODs

#### 7.3.2.1 RT Plan IOD

##### 7.3.2.1.1 RT Plan IOD for Photon External Beam in Planning State

This section is present only to convey the envisioned section numbering.

##### 7.3.2.1.2 RT Plan IOD for Photon External Beam in Delivery State

This section is present only to convey the envisioned section numbering.

##### 7.3.2.1.3 RT Plan for Brachytherapy

###### 7.3.2.1.3.1 Referenced Standards

DICOM 2019c Edition. PS 3.3

###### 7.3.2.1.3.2 IOD Definition

| IE | Module | Reference | Usage | IHE-RO Usage |
| --- | --- | --- | --- | --- |
| Patient | Patient  | C.7.1.1 | M | MSee 7.4.1.1.1 |
| Clinical Trial Subject | C.7.1.3 | U | U |
| Study | General Study | C.7.2.1 | M | MSee 7.4.1.2.1 |
| Patient Study | C.7.2.2 | U | U |
| Clinical Trial Study | C.7.2.3 | U | U |
| Series | RT Series | C.8.8.1 | M | MSee 7.4.1.4.1 |
| Clinical Trial Series | C.7.3.2 | U | U |
| Frame of Reference | Frame of Reference | C.7.4.1 | U | MSee 7.4.1.7.1 |
| Equipment | General Equipment | C.7.5.1 | M | MSee 7.4.1.5.1 |
| Plan | RT General Plan | C.8.8.9 | M | MSee 7.4.3.1.1 |
| RT Prescription | C.8.8.10 | U | MSee 7.4.3.2.1 |
| RT Tolerance Tables | C.8.8.11 | U | Shall not be present |
| RT Patient Setup | C.8.8.12 | U | RSee 7.4.3.4.3 |
| RT Fraction Scheme | C.8.8.13 | U | MSee 7.4.3.3.3 |
| 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 | Shall not be present |
| RT Brachy Application Setups | 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 | MDefinitions see below |
| Approval | C.8.8.16 | U | M |
| SOP Common | C.12.1 | M | MSee 7.4.1.6.1 |

RT Brachy Application Setup Module is defined as follows:

|  |  |
| --- | --- |
| Application Setup Type | Section |
| HDR | 7.4.4.6.1 |
| PDR | 7.4.4.6.2 |
| LDR Permanent | 7.4.4.6.3 |
| LDR Temporary | 7.4.4.6.4 |

### 7.3.2 Image IODs

This section is present only to convey the envisioned section numbering.

### 7.3.3 Segment IODs

This section is present only to convey the envisioned section numbering.

### 7.3.5 Dose IODs

This section is present only to convey the envisioned section numbering.

### 7.3.6 Treatment Record IODs

#### 7.3.6.1 Technique Specific RT Treatment Record

This section is present only to convey the envisioned section numbering.

#### 7.3.6.2 RT Treatment Record for General Use

This section is present only to convey the envisioned section numbering.

#### 7.3.6.3 RT Brachy Treatment Records

#### 7.3.6.3.1 RT Brachy Treatment Record

###### 7.3.6.3.1.1 Referenced Standards

DICOM 2019c Edition. PS 3.3

###### 7.3.6.3.1.2 IOD Definition

##

## 7.4 Module Definitions

### 7.4.1 General Modules

This section is present only to convey the envisioned section numbering.

### 7.4.2 Workflow-Related Modules

This section is present only to convey the envisioned section numbering.

### 7.4.3 General Plan-Related Modules

This section is present only to convey the envisioned section numbering.

#### 7.4.3.1 General Plan Module

This section is present only to convey the envisioned section numbering.

#### 7.4.3.2 RT Prescription Module

##### 7.4.3.2.1 RT Prescription Module Base Content

This section is present only to convey the envisioned section numbering.

##### 7.4.3.2.2 RT Prescription Module for Consistent Dose

This section is present only to convey the envisioned section numbering.

#### 7.4.3.2.3 RT Prescription Module (C.8.8.10)

| Attribute | Tag | Type | Attribute Note |
| --- | --- | --- | --- |
| Prescription Description | (300A,000E) |  |  |
| Dose Reference Sequence | (300A,0010) | R+\* |  |
| >Dose Reference Number | (300A,0012) |  |  |
| >Dose Reference UID | (300A,0013) | R+\* |  |
| >Dose Reference Structure Type | (300A,0014) |  |  |
| >Dose Reference Description | (300A,0016) | R+\* |  |
| >Referenced ROI Number | (3006,0084) |  |  |
| >Dose Reference Point Coordinates | (300A,0018) |  |  |
| >Nominal Prior Dose | (300A,001A) |  |  |
| >Dose Reference Type | (300A,0020) |  |  |
| >Constraint Weight | (300A,0021) |  |  |
| >Delivery Warning Dose  | (300A,0022) |  |  |
| >Delivery Maximum Dose  | (300A,0023) |  |  |
| >Target Minimum Dose  | (300A,0025) |  |  |
| >Target Prescription Dose  | (300A,0026) |  |  |
| >Target Maximum Dose  | (300A,0027) |  |  |
| >Target Underdose Volume Fraction  | (300A,0028) |  |  |
| >Organ at Risk Full-volume Dose  | (300A,002A) |  |  |
| >Organ at Risk Limit Dose  | (300A,002B) |  |  |
| >Organ at Risk Maximum Dose  | (300A,002C) |  |  |
| >Organ at Risk Overdose Volume Fraction | (300A,002D) |  |  |
|  |  |  |  |

#### 7.4.3.3 Fraction Scheme

##### 7.4.3.3.1 RT Fraction Scheme Module for Consistent Dose

This section is present only to convey the envisioned section numbering.

##### 7.4.3.3.1 RT Fraction Scheme Module for Delivery

This section is present only to convey the envisioned section numbering.

##### 7.4.3.3.3 RT Fraction Scheme Module for Brachy

| Attribute | Tag | Presence | Specific Rules |
| --- | --- | --- | --- |
| Fraction Group Sequence | (300A,0070) | R+\* | Shall have only a single item in the sequence. |
| > Referenced Dose Reference Sequence | (300C,0050) |  |  |
| >> Referenced Dose Reference Number | (300C,0051) |  |  |
| >Number of Fractions Planned | (300A,0078) | R+ | If value differs from 1 must be displayed to the user |
| > Number of Beams | (300A,0080) | R+\* | Shall be 0.  |
| > Number of Brachy Application Setups | (300A,000A) | R+\* | Shall be equal to the number of items under "Application Setup Sequence" (300A,0230) |
| > Referenced Brachy Application Setup Sequence | (300C,000C) | - |  |
| >> Brachy Application Setup Dose Specification Point | (300A,00A2) | - |  |
| >> Brachy Application Setup Dose | (300A,00A4) | R+\* | If the plan contains multiple Application Setups, the sum of the Brachy Application Setup Doses represents the dose per fraction for the plan. |
| >>Referenced Dose Reference UID | (300A,0083) | R+\* | Identifies the Dose Reference specified by Dose Reference UID (300A,0013) in the Dose Reference Sequence (300A,0010) in the RT Prescription Module which specifies the primary target for the current Application Setup.If present shall have a value that is present in the Dose Reference Sequence. |

### 7.4.4 Plan-Related Modules in Planning

#### 7.4.4.1 Specific RT Beam Type Specifications

This section is present only to convey the envisioned section numbering.

#### 7.4.4.2 General Beam Attribute Specifications

This section is present only to convey the envisioned section numbering.

#### 7.4.4.3 Beam Option Specifications

This section is present only to convey the envisioned section numbering.

#### 7.4.4.4 Other RT Beams Modules

This section is present only to convey the envisioned section numbering.

#### 7.4.4.5 – reserved -

This section is present only to convey the envisioned section numbering.

#### 7.4.4.6 RT Brachy Application Setups

##### 7.4.4.6.1 RT Application Setup Module for HDR Plan and PDR Plan

| Attribute | Tag | HDR and PDR Technique |
| --- | --- | --- |
|  | Presence | Specific Rules |
| Brachy Treatment Technique | (300A,0200) | 1 |  |  |
| Brachy Treatment Type | (300A,0202) | 1 |  | Shall be HDR or PDR |
| Treatment Machine Sequence | (300A,0206)  | 1 |  |  |
| >Treatment Machine Name  | (300A,00B2)  | 2 | R+ | Shall have a value. |
| >Manufacturer  | (0008,0070)  | 3 | R+ | Shall have a value. |
| >Institution Name  | (0008,0080)  | 3 | - |  |
| >Institution Address  | (0008,0081)  | 3 | - |  |
| >Institutional Department Name  | (0008,1040)  | 3 | - |  |
| >Manufacturer's Model Name  | (0008,1090)  | 3 | R+ | Shall have a value. |
| >Device Serial Number  | (0018,1000)  | 3 | - |  |
| Source Sequence  | (300A,0210)  | 1 |  |  |
| >Source Number  | (300A,0212)  | 1 |  |  |
| >Source Serial Number |  | 3 | - |  |
| >Source Model ID |  | 3 | R | The name of the source model |
| >Source Description |  | 3 | - |  |
| >Source Type  | (300A,0214)  | 1 |  |  |
| >Source Manufacturer  | (300A,0216)  | 3 | - |  |
| >Active Source Diameter  | (300A,0218)  | 3 | - |  |
| >Active Source Length  | (300A,021A)  | 3 | - |  |
| >Material ID  | (300A,00E1)  | 3 | - |  |
| >Source Encapsulation NominalThickness | (300A,0222)  | 3 | - |  |
| >Source Encapsulation NominalTransmission | (300A,0224)  | 3 | - |  |
| >Source Isotope Name  | (300A,0226)  | 1 |  | Representation of the Source shall be as defined in: <Element>-<number of protons>e.g. Ir-192 |
| >Source Isotope Half Life  | (300A,0228)  | 1 |  |  |
| >Source Strength Units  | (300A,0229)  | 1C | R+ | Shall have a value without constraint for gamma-emitting source.Measurement unit of Source Strength.Enumerated Values:**AIR\_KERMA\_RATE** Air Kerma Rate DOSE\_RATE\_WATER Dose Rate in Water. |
| >Reference Air Kerma Rate  | (300A,022A)  | 1 | R+ | Required if source is calibrated in Air-Kerma-Rate. If not, value shall be 0 |
| >Source Strength  | (300A,022B)  | 1C | R+ | Source strength used to calculate the dwell times.Required if source is calibrated in Dose Rate in water. If not, value shall be 0. |
| >Source Strength Reference Date  | (300A,022C)  | 1 |  |  Reference date is planned date of treatment. |
| >Source Strength Reference Time  | (300A,022E)  | 1 |  | Reference time is planned time of treatment. |
| Application Setup Sequence | (300A,0230) | 1 |  | Number of items shall be 1. |
| >Application Setup Type  | (300A,0232) | 1 |  |  |
| >Application Setup Number  | (300A,0234)  | 1 |  |  |
| >Application Setup Name  | (300A,0236) | 3 | - |  |
| >Application Setup Manufacturer  | (300A,0238)  | 3 | - |  |
| >Template Number  | (300A,0240)  | 3 | - |  |
| >Template Type  | (300A,0242)  | 3 | - |  |
| >Template Name  | (300A,0244)  | 3 | - |  |
| >Referenced Reference ImageSequence | (300C,0042) | 3 | - |  |
| >Total Reference Air Kerma  | (300A,0250)  | 1 |  |  |
| >Brachy Accessory Device Sequence  | (300A,0260)  | 1C? | - | Possibly: “If HDR, this sequence should contain at least 1 item” ? |
| >>Brachy Accessory Device Number  | (300A,0262)  | 2 | - |  |
| >>Brachy Accessory Device ID  | (300A,0263) | 2 | - |  |
| >>Brachy Accessory Device Type  | (300A,0264)  | 1 |  |  |
| >>Brachy Accessory Device Name  | (300A,0266) | 3 | - |  |
| >>Material ID  | (300A,00E1)  | 3 | - |  |
| >>Brachy Accessory Device NominalThickness | (300A,026A)  | 3 | - |  |
| >>Brachy Accessory Device NominalTransmission | (300A,026C)  | 3 | - |  |
| >>Referenced ROI Number  | (3006,0084) | 2 | - |  |
| >Channel Sequence  | (300A,0280) | 1 |  |  |
| >>Channel Number  | (300A,0282)  | 1 |  | Shall be equal to the id number (DICOM sequence number) of the applicator (needle, catheter, etc.). |
| >>Referenced Channel Number | (0074,1406) | 3 | R+ | Shall be present to specify the channel to be delivered. |
| >>Channel Length  | (300A,0284) | 2 | R+ |  |
| >>Channel Effective Length | (300A,0271) | 3 | R+ | Shall be present to correctly specify the distance between connector on the afterloader and the center of the distal-most possible position of the source. |
| >>Channel Inner Length | (300A,0272) | 2C | R+ | Shall be present to correctly specify the distance between connector on afterloader and the end of the channel. |
| >>Afterloader Channel ID | (300A,0273) | 2C | R+ | Shall be present to correctly identify the channel connection on the afterloader. |
| >>Channel Total Time  | (300A,0286) | 1 |  |  |
| >>Source Movement Type  | (300A,0288)  | 1 |  |  |
| >>Number of Pulses  | (300A,028A)  | 1C |  | Shall only be used if Brachy Treatment Type ((300A,0202) is PDR. . |
| >>Pulse Repetition Interval  | (300A,028C)  | 1C |  |  Shall only be used if Brachy Treatment Type ((300A,0202) is PDR. |
| >>Source Applicator Number  | (300A,0290)  | 3 | R+ | Shall be present for enabling (300A,0291) for channel mapping |
| >>Source Applicator ID  | (300A,0291)  | 2C | R+ | Shall be present in the plan for correct channel mapping |
| >>Source Applicator Type  | (300A,0292)  | 1C | - |  |
| >>Source Applicator Name  | (300A,0294) | 3 | - |  |
| >>Source Applicator Length  | (300A,0296)  | 1C | - |  |
| >>>Source Applicator Tip Length | (300A,0274) | 2C | R+ | Shall be present to specify the distance between the outer tip of the applicator and the center of the distal-most possible position of the source. |
| >>Source Applicator Manufacturer  | (300A,0298)  | 3 | - |  |
| >>Material ID  | (300A,00E1)  | 3 | - |  |
| >>Source Applicator Wall NominalThickness | (300A,029C)  | 3 | - |  |
| >>Source Applicator Wall NominalTransmission | (300A,029E)  | 3 | - |  |
| >>Source Applicator Step Size  | (300A,02A0)  | 1C | - |  |
| >>Referenced ROI Number  | (3006,0084)  | 2C | R+ | Shall be present in order to reproduce the channel of the applicator. RT ROI Interpreted Type (3006,00A4) for the referenced ROI shall be BRACHY\_CHANNEL |
| >>Transfer Tube Number  | (300A,02A2) | 2 | R+ |  |
| >>Transfer Tube Length  | (300A,02A4)  | 2C | R+ |  |
| >>Channel Shield Sequence  | (300A,02B0)  | 3 | - |  |
| >>>Channel Shield Number  | (300A,02B2) | 1 |  |  |
| >>>Channel Shield ID  | (300A,02B3)  | 2 | - |  |
| >>>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)  | 2 | - |  |
| >>Referenced Source Number  | (300C,000E)  | 1 |  |  |
| >>Number of Control Points  | (300A,0110)  | 1 |  |  |
| >>Final Cumulative Time Weight  | (300A,02C8)  | 1C | R+ |  |
| >>Brachy Control Point Sequence  | (300A,02D0)  | 1 |  |  |
| >>>Control Point Index  | (300A,0112) | 1 |  |  |
| >>>Cumulative Time Weight  | (300A,02D6) | 2 | R+ |  |
| >>>Control Point Relative Position  | (300A,02D2) | 1 |  |  |
| >>>Control Point 3D Position  | (300A,02D4) | 3 | R+ | If present it has to be consistent with the related information in the structure. The structure is defined by the Referenced ROI Number (3006,0084). |
| >>>Control Point Orientation | (300A,0412) | 3 | R+ | If present it has to be consistent with the related information in the structure. The structure is defined by the Referenced ROI Number (3006,0084).Shall be present for line HDR source. |
| >>>Brachy Referenced DoseReference Sequence | (300C,0055)  | 3 | R+\* | .Mandatory for the last Control Point, see DICOM PS 3.3 C.8.8.15.11. |
| >>>>Referenced Dose ReferenceNumber | (300C,0051)  | 1 |  |  |
| >>>>Cumulative Dose ReferenceCoefficient | (300A,010C)  | 1 |  |  |

##### 7.4.4.6.2 RT Application Setup Module for LDR Permanent Plan

| Attribute | Tag | LDR Permanent Technique |
| --- | --- | --- |
|  | Presence | Specific Rules |
| Brachy Treatment Technique | (300A,0200) | 1 |  | Shall be PERMANENT for permanent implants |
| Brachy Treatment Type | (300A,0202) | 1 |  | Allowed values are MANUAL or LDR |
| Treatment Machine Sequence | (300A,0206)  | 1 |  |  |
| >Treatment Machine Name  | (300A,00B2)  | 2 | - |  |
| >Manufacturer  | (0008,0070)  | 3 | - |  |
| >Institution Name  | (0008,0080)  | 3 | - |  |
| >Institution Address  | (0008,0081)  | 3 | - |  |
| >Institutional Department Name  | (0008,1040)  | 3 | - |  |
| >Manufacturer's Model Name  | (0008,1090)  | 3 | - |  |
| >Device Serial Number  | (0018,1000)  | 3 | - |  |
| Source Sequence  | (300A,0210)  | 1 |  |  |
| >Source Number  | (300A,0212)  | 1 |  |  |
| >Source Serial Number | (3008,0105) | 3 | - |  |
| >Source Model ID | (300A,021B) | 3 | R+ | Actual source model name |
| >Source Description | (300A,021C) | 3 | - |  |
| >Source Type  | (300A,0214)  | 1 |  | Defined terms: POINT, LINE, CYLINDER, SPHERE |
| >Source Manufacturer  | (300A,0216)  | 3 | - |  |
| >Active Source Diameter  | (300A,0218)  | 3 | RC+ | Shall be present for Source Type CYLINDER, SPHERE |
| >Active Source Length  | (300A,021A)  | 3 | RC+ | Shall be present for Source Type LINE, CYLINDAR |
| >Material ID  | (300A,00E1)  | 3 | - |  |
| >Source Encapsulation NominalThickness | (300A,0222)  | 3 | - |  |
| >Source Encapsulation NominalTransmission | (300A,0224)  | 3 | - |  |
| >Source Isotope Name  | (300A,0226)  | 1 |  | In format of I-125 |
| >Source Isotope Half Life  | (300A,0228)  | 1 |  |  |
| >Source Strength Units  | (300A,0229)  | 1C | - |  |
| >Reference Air Kerma Rate  | (300A,022A)  | 1 |  |  |
| >Source Strength  | (300A,022B)  | 1C | R | Source strength used to calculate the effective dose distribution.  |
| >Source Strength Reference Date  | (300A,022C)  | 1 |  |  |
| >Source Strength Reference Time  | (300A,022E)  | 1 |  |  |
| Application Setup Sequence | (300A,0230) | 1 |  |  |
| >Application Setup Type  | (300A,0232) | 1 |  |  |
| >Application Setup Number  | (300A,0234)  | 1 |  |  |
| >Application Setup Name  | (300A,0236) | 3 | - |  |
| >Application Setup Manufacturer  | (300A,0238)  | 3 | - |  |
| >Template Number  | (300A,0240)  | 3 | - |  |
| >Template Type  | (300A,0242)  | 3 | - |  |
| >Template Name  | (300A,0244)  | 3 | - |  |
| >Referenced Reference ImageSequence | (300C,0042) | 3 | - |  |
| >Total Reference Air Kerma  | (300A,0250)  | 1 |  |  |
| >Brachy Accessory Device Sequence  | (300A,0260)  | 3 | - |  |
| >>Brachy Accessory Device Number  | (300A,0262)  | 2 | - |  |
| >>Brachy Accessory Device ID  | (300A,0263) | 2 | - |  |
| >>Brachy Accessory Device Type  | (300A,0264)  | 1 |  |  |
| >>Brachy Accessory Device Name  | (300A,0266) | 3 | - |  |
| >>Material ID  | (300A,00E1)  | 3 | - |  |
| >>Brachy Accessory Device NominalThickness | (300A,026A)  | 3 | - |  |
| >>Brachy Accessory Device NominalTransmission | (300A,026C)  | 3 | - |  |
| >>Referenced ROI Number  | (3006,0084) | 2 | - |  |
| >Channel Sequence  | (300A,0280) | 1 |  |  |
| >>Channel Number  | (300A,0282)  | 1 |  |  |
| >>Channel Length  | (300A,0284) | 2 | x | Shall have no value |
| >>Channel Total Time  | (300A,0286) | 1 |  | Calculated treatment time |
| >>Source Movement Type  | (300A,0288)  | 1 |  | FIXED |
| >>Number of Pulses  | (300A,028A)  | 1C | - |  |
| >>Pulse Repetition Interval  | (300A,028C)  | 1C | - |  |
| >>Source Applicator Number  | (300A,0290)  | 3 | - |  |
| >>Source Applicator ID  | (300A,0291)  | 2C | - |  |
| >>Source Applicator Type  | (300A,0292)  | 1C | - |  |
| >>Source Applicator Name  | (300A,0294) | 3 | - |  |
| >>Source Applicator Length  | (300A,0296)  | 1C | - |  |
| >>Source Applicator Manufacturer  | (300A,0298)  | 3 | - |  |
| >>Material ID  | (300A,00E1)  | 3 | - |  |
| >>Source Applicator Wall NominalThickness | (300A,029C)  | 3 | - |  |
| >>Source Applicator Wall NominalTransmission | (300A,029E)  | 3 | - |  |
| >>Source Applicator Step Size  | (300A,02A0)  | 1C | - |  |
| >>Referenced ROI Number  | (3006,0084)  | 2C | - |  |
| >>Transfer Tube Number  | (300A,02A2) | 2 | x | Shall have no value |
| >>Transfer Tube Length  | (300A,02A4)  | 2C | - |  |
| >>Channel Shield Sequence  | (300A,02B0)  | 3 | - |  |
| >>>Channel Shield Number  | (300A,02B2) | 1 |  |  |
| >>>Channel Shield ID  | (300A,02B3)  | 2 | - |  |
| >>>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)  | 2 | - |  |
| >>Referenced Source Number  | (300C,000E)  | 1 |  |  |
|

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| >>Number of Control Points  | (300A,0110)  | 1 | - | Value shall be 2 |

 | (300A,0110)  | 1 | - | Value shall be 2 |
| >>Final Cumulative Time Weight  | (300A,02C8)  | 1C | - |  |
| >>Brachy Control Point Sequence  | (300A,02D0)  | 1 |  |  |
| >>>Control Point Index  | (300A,0112) | 1 |  |  |
| >>>Cumulative Time Weight  | (300A,02D6) | 2 | - |  |
| >>>Control Point Relative Position  | (300A,02D2) | 1 |  |  |
| >>>Control Point 3D Position  | (300A,02D4) | 3 | R+ | Shall be present. |
| >>>Control Point Orientation  | (300A,0412) | 3 | - |  |
| >>>Brachy Referenced DoseReference Sequence | (300C,0055)  | 3 | R+ | Mandatory for the last Control Point, see DICOM PS 3.3 C.8.8.15.11. |
| >>>>Referenced Dose ReferenceNumber | (300C,0051)  | 1 |  |  |
| >>>>Cumulative Dose ReferenceCoefficient | (300A,010C)  | 1 |  |  |

##### 7.4.4.6.3 RT Application Setup Module for LDR Temporary Plan

| Attribute | Tag | LDR Temporary Technique |
| --- | --- | --- |
|  | Presence | Specific Rules |
| Brachy Treatment Technique | (300A,0200) | 1 |  | Shall be TEMPORARY  |
| Brachy Treatment Type | (300A,0202) | 1 |  | Allowed values are MANUAL or LDR |
| Treatment Machine Sequence | (300A,0206)  | 1 | - |  |
| >Treatment Machine Name  | (300A,00B2)  | 2 | - |  |
| >Manufacturer  | (0008,0070)  | 3 | - |  |
| >Institution Name  | (0008,0080)  | 3 | - |  |
| >Institution Address  | (0008,0081)  | 3 | - |  |
| >Institutional Department Name  | (0008,1040)  | 3 | - |  |
| >Manufacturer's Model Name  | (0008,1090)  | 3 | - |  |
| >Device Serial Number  | (0018,1000)  | 3 | - |  |
| Source Sequence  | (300A,0210)  | 1 |  |  |
| >Source Number  | (300A,0212)  | 1 |  |  |
| >Source Serial Number | (3008,0105) | 3 | - |  |
| >Source Model ID | (300A,021B) | 3 | R+ | Actual source model name |
| >Source Description | (300A,021C) | 3 | - |  |
| >Source Type  | (300A,0214)  | 1 |  | Defined terms: POINT, LINE, CYLINDER, SPHERE |
| >Source Manufacturer  | (300A,0216)  | 3 | - |  |
| >Active Source Diameter  | (300A,0218)  | 3 | + | Shall be included for CYLINDER, SPHERE |
| >Active Source Length  | (300A,021A)  | 3 | + | Shall be included if Source Type other that POINT, SPHERE |
| >Material ID  | (300A,00E1)  | 3 | - |  |
| >Source Encapsulation NominalThickness | (300A,0222)  | 3 | - |  |
| >Source Encapsulation NominalTransmission | (300A,0224)  | 3 | - |  |
| >Source Isotope Name  | (300A,0226)  | 1 |  | In format of I-125 |
| >Source Isotope Half Life  | (300A,0228)  | 1 |  |  |
| >Source Strength Units  | (300A,0229)  | 1C | - |  |
| >Reference Air Kerma Rate  | (300A,022A)  | 1 |  |  |
| >Source Strength  | (300A,022B)  | 1C | R | Source strength used to calculate the effective dose distribution.  |
| >Source Strength Reference Date  | (300A,022C)  | 1 |  |  |
| >Source Strength Reference Time  | (300A,022E)  | 1 |  |  |
| Application Setup Sequence | (300A,0230) | 1 |  |  |
| >Application Setup Type  | (300A,0232) | 1 |  |  |
| >Application Setup Number  | (300A,0234)  | 1 |  |  |
| >Application Setup Name  | (300A,0236) | 3 | - |  |
| >Application Setup Manufacturer  | (300A,0238)  | 3 | - |  |
| >Template Number  | (300A,0240)  | 3 | - |  |
| >Template Type  | (300A,0242)  | 3 | - |  |
| >Template Name  | (300A,0244)  | 3 | - |  |
| >Referenced Reference ImageSequence | (300C,0042) | 3 | - |  |
| >Total Reference Air Kerma  | (300A,0250)  | 1 |  |  |
| >Brachy Accessory Device Sequence  | (300A,0260)  | 3 | - |  |
| >>Brachy Accessory Device Number  | (300A,0262)  | 2 | - |  |
| >>Brachy Accessory Device ID  | (300A,0263) | 2 | - |  |
| >>Brachy Accessory Device Type  | (300A,0264)  | 1 |  |  |
| >>Brachy Accessory Device Name  | (300A,0266) | 3 | - |  |
| >>Material ID  | (300A,00E1)  | 3 | - |  |
| >>Brachy Accessory Device NominalThickness | (300A,026A)  | 3 | - |  |
| >>Brachy Accessory Device NominalTransmission | (300A,026C)  | 3 | - |  |
| >>Referenced ROI Number  | (3006,0084) | 2 | - |  |
| >Channel Sequence  | (300A,0280) | 1 |  |  |
| >>Channel Number  | (300A,0282)  | 1 |  |  |
| >>Channel Length  | (300A,0284) | 2 | x | Shall have no value |
| >>Channel Total Time  | (300A,0286) | 1 |  | Calculated treatment time |
| >>Source Movement Type  | (300A,0288)  | 1 |  | FIXED |
| >>Number of Pulses  | (300A,028A)  | 1C | - |  |
| >>Pulse Repetition Interval  | (300A,028C)  | 1C | - |  |
| >>Source Applicator Number  | (300A,0290)  | 3 | - |  |
| >>Source Applicator ID  | (300A,0291)  | 2C | - |  |
| >>Source Applicator Type  | (300A,0292)  | 1C | - |  |
| >>Source Applicator Name  | (300A,0294) | 3 | - |  |
| >>Source Applicator Length  | (300A,0296)  | 1C | - |  |
| >>Source Applicator Manufacturer  | (300A,0298)  | 3 | - |  |
| >>Material ID  | (300A,00E1)  | 3 | - |  |
| >>Source Applicator Wall NominalThickness | (300A,029C)  | 3 | - |  |
| >>Source Applicator Wall NominalTransmission | (300A,029E)  | 3 | - |  |
| >>Source Applicator Step Size  | (300A,02A0)  | 1C | - |  |
| >>Referenced ROI Number  | (3006,0084)  | 2C | - |  |
| >>Transfer Tube Number  | (300A,02A2) | 2 | x | Shall have no value |
| >>Transfer Tube Length  | (300A,02A4)  | 2C | - |  |
| >>Channel Shield Sequence  | (300A,02B0)  | 3 | - |  |
| >>>Channel Shield Number  | (300A,02B2) | 1 |  |  |
| >>>Channel Shield ID  | (300A,02B3)  | 2 | - |  |
| >>>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)  | 2 | - |  |
| >>Referenced Source Number  | (300C,000E)  | 1 |  |  |
| >>Number of Control Points  | (300A,0110)  | 1 |  |  |
| >>Final Cumulative Time Weight  | (300A,02C8)  | 1C | - |  |
| >>Brachy Control Point Sequence  | (300A,02D0)  | 1 |  |  |
| >>>Control Point Index  | (300A,0112) | 1 |  |  |
| >>>Cumulative Time Weight  | (300A,02D6) | 2 | - |  |
| >>>Control Point Relative Position  | (300A,02D2) | 1 |  |  |
| >>>Control Point 3D Position  | (300A,02D4) | 3 | R+ | Shall be present. |
| >>>Control Point Orientation  | (300A,0412) | 3 | - |  |
| >>>Brachy Referenced DoseReference Sequence | (300C,0055)  | 3 | R+ | Shall be present |
| >>>>Referenced Dose ReferenceNumber | (300C,0051)  | 1 |  |  |
| >>>>Cumulative Dose ReferenceCoefficient | (300A,010C)  | 1 |  |  |

### 7.4.5 Plan-Related Modules in Delivery

#### 7.4.5.1 RT Beams

This section is present only to convey the envisioned section numbering.

#### 7.4.5.2 RT Tolerance Table

This section is present only to convey the envisioned section numbering.

#### 7.4.5.3 RT Patient Setup Module

##### 7.4.5.3.1 RT Patient Setup Module for Treatment Delivery

This section is present only to convey the envisioned section numbering.

##### 7.4.5.3.2 RT Patient Setup Module for Brachy Treatment Delivery

### 7.4.6 Image-related Modules in Planning

This section is present only to convey the envisioned section numbering.

### 7.4.7 Image-related Modules in Delivery

This section is present only to convey the envisioned section numbering.

### 7.4.8 Image-related Modules in Delivery

This section is present only to convey the envisioned section numbering.

### 7.4.8 Segment Modules

#### 7.4.8.1 ROI Observations Module

##### 7.4.8.1.1 ROI Observations Base Content

This section is present only to convey the envisioned section numbering.

##### 7.4.8.1.2 ROI Observations Base TBD

This section is present only to convey the envisioned section numbering.

##### 7.4.8.1.3 ROI Observations Base In Brachy

Multiple RT Plans may reference the same RT Structure Set instance. For brachytherapy this means that the RT Structure Set can contain brachytherapy channel contours from multiple plans.

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute | Tag | Type | Attribute Note |
| RT ROI Observations Sequence | (3006,0080) |  |  |
| >Observation Number | (3006,0082) |  |  |
| >Referenced ROI Number | (3006,0084) |  |  |
| >ROI Observation Label | (3006,0085) |  |  |
| >ROI Observation Description | (3006,0088) |  |  |
| >RT Related ROI Sequence | (3006,0030) |  |  |
| >>Referenced ROI Number | (3006,0084) |  |  |
| >>RT ROI Relationship | (3006,0033) |  |  |
| >RT ROI Identification Code Sequence | (3006,0086) |  |  |
| >Related RT ROI Observations Sequence | (3006,00A0) |  |  |
| >>Observation Number | (3006,0082) |  |  |
| >RT ROI Interpreted Type | (3006,00A4) | R+\* | *In addition to BRTO II requirements*If referenced ROI has associated contours of type OPEN\_NONPLANAR, the content consumer must accept at minimum the following values:BRACHY\_CHANNEL |
| >ROI Interpreter | (3006,00A6) |  |  |
| >Material ID | (300A,00E1) |  |  |
| >ROI Physical Properties Sequence | (3006,00B0) |  |  |
| >>ROI Physical Property | (3006,00B2) |  |  |
| >>ROI Elemental Composition Sequence | (3006,00B6) |  |  |
| >>>ROI Elemental Composition Atomic Number | (3006,00B7) |  |  |
| >>>ROI Elemental CompositionAtomic Mass Fraction | (3006,00B8) |  |  |
| >>ROI Physical Property Value | (3006,00B4) |  |  |

#### 7.4.8.2 ROI Contour Module

##### 7.4.8.2.1 ROI Contour Base Content

This section is present only to convey the envisioned section numbering.

##### 7.4.8.2.2 ROI Contour Base TBD

This section is present only to convey the envisioned section numbering.

##### 7.4.8.2.3 ROI Contour Base In Brachy

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute | Tag | Type | Attribute Note |
| ROI Contour Sequence  | (3006,0039)  |  |  |
| > Referenced ROI Number | (3006,0084) |  |  |
| > ROI Display Color | (3006,002A) |  |  |
| > Contour Sequence  | (3006,0040) |  |  |
| >> Contour Number  | (3006,0048) |  |  |
| >> Attached Contours  | (3006,0049) |  |  |
| >> Contour Image Sequence  | (3006,0016) | R+\* | If the contour type is CLOSED\_PLANAR, shall be present with a single item. This item is the image upon which this contour should be placed. The z-coordinates of the contour shall match the z-coordinate of Image Position (Patient) in the image.*(BRTO II wording should be updated accordingly)* |
| >> Contour Geometric Type  | (3006,0042) | R+\* | Shall be present, with a value of POINT, CLOSED\_PLANAR or OPEN\_NONPLANARConforming implementations must properly interpret this value. |
| >> Contour Slab Thickness  | (3006,0044) |  |  |
| >> Contour Offset Vector  | (3006,0045) |  |  |
| >> Number of Contour Points  | (3006,0046) |  |  |
| >> Contour Data  | (3006,0050) |  |  |

### 7.4.9 Segment Modules in Delivery

This section is present only to convey the envisioned section numbering.

### 7.4.10 Registration Modules

This section is present only to convey the envisioned section numbering.

### 7.4.11 Treatment Record Modules

#### 7.4.11.1 RT General Treatment Record

This section is present only to convey the envisioned section numbering.

#### 7.4.11.2 General Beam Attribute Specifications

This section is present only to convey the envisioned section numbering.

#### 7.4.11.3 Beam Option Specifications

This section is present only to convey the envisioned section numbering.

#### 7.4.11.4 Measured Dose Reference Record

This section is present only to convey the envisioned section numbering.

#### 7.4.11.5 Calculated Dose Reference Record

This section is present only to convey the envisioned section numbering.

#### 7.4.11.6 RT Brachy Session Record Modules

This section is present only to convey the envisioned section numbering.

##### 7.4.11.6.1 RT Brachy Session Record Module for HDR and PDR Plan

This section is present only to convey the envisioned section numbering.

##### 7.4.11.6.2 RT Brachy Session Record Module for LDR Permanent Plan

 This section is present only to convey the envisioned section numbering.

##### 7.4.11.6.3 RT Brachy Session Record Module for LDR Temporary Plan

This section is present only to convey the envisioned section numbering.

Appendices

Not applicable.

Volume 4 – National Extensions

4 National Extensions

Not applicable.