



Dose-in

DICOM Conformance Statement

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ETIAM Head Office in Europe:
ETIAM Technopole Atalante-Champeaux
2, rue du Pierre-Joseph Colin
35000 Rennes
France

Phone: +33.(0)2.99.14.33.88
Fax: +33.(0)2.99.14.33.80
E-mail: info@etiam.com
www.etiam.com

ETIAM Head Office in America:
ETIAM Corp.
185 Alewife Brook Parkway
Cambridge, MA 02138
USA

Toll Free: +1 (877) 384-2662 (USA & Canada)
Phone/Fax: +1 (617) 395-5809
E-mail: info@etiam.com
www.etiam.com

1. Conformance Statement Overview

Dose-in is an Ubuntu Linux application that reads patient X-Ray dose exposure measured by a third-party dosimeter and sends the dose to a RIS and/or PACS system.

Dose-in is used in complement to the X-Ray modality and uses the DICOM Worklist Management service to access the same patient and study information as the modality.

Dose-in implements the necessary services to:

- Support the Echo (Verification) service as SCU
- Support Secondary Capture Image Storage as SCU
- Support Projection X-Ray radiation Dose SR Storage as SCU
- Support Modality Worklist Service as SCU
- Support the Modality Performed Procedure Step Service as SCU

This document is intended to describe Dose-in's conformance to DICOM.

Table 1-1: Network Services for Dose-in

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Communication		
Verification (ECHO)	Yes	No
Transfer		
Secondary Capture Image Storage	Yes	No
Projection X-Ray radiation Dose SR Storage	Yes	No
Workflow Management		
Basic Modality Worklist (C-FIND)	Yes	No
Modality Performed Procedure Step	Yes	No

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3. Introduction

3.1 Revision History

Document Version	Date	Author	Description
1	January 2011	François Gousset	Creation

3.2 Audience

This document is intended for:

- Potential users
- System integrators of medical equipment
- Software designers implementing DICOM interfaces

It is assumed that the reader has a working understanding of DICOM.

Experience and familiarity with DICOM Conformance Statements is helpful but not required.

3.3 Remarks

DICOM, by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality.

This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of information intended.

The scope of this Conformance Statement is to facilitate communication between Dose-in and other DICOM systems. The Conformance Statement should be read and understood in conjunction with the DICOM Standard (DICOM). However, by itself it is not guaranteed to ensure the desired interoperability and successful interconnectivity.

The user should be aware of the following important issues:

- The comparison of different Conformance Statements is the first step towards assessing interconnectivity between Dose-in and other DICOM-conformant equipment.
- Test procedures should be defined to validate the desired level of connectivity.
- The DICOM standard will evolve to meet users' future requirements. ETIAM is actively involved in developing the standard further and therefore reserves the right to make changes to its products or to discontinue its delivery.

3.4 Definitions, Terms and Abbreviations

Definitions, terms and abbreviations used in this document are defined within the different parts of the DICOM standard.

Abbreviations and terms are as follows:

AE	Application Entity
AET	Application Entity Title
DICOM	Digital Imaging and COmmunications in Medicine
DIMSE	DICOM Message Service Element
DIMSE-C	DICOM Message Service Element-Composite
DIMSE-N	DICOM Message Service Element-Normalized
HIS/RIS	Hospital Information System/Radiology Information System.
IOD	Information Object Definition
ISO	International Standard Organization
NEMA	National Electrical Manufacturers Association
PACS	Picture Archiving and Communication System
PDU	Protocol Data Unit
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier

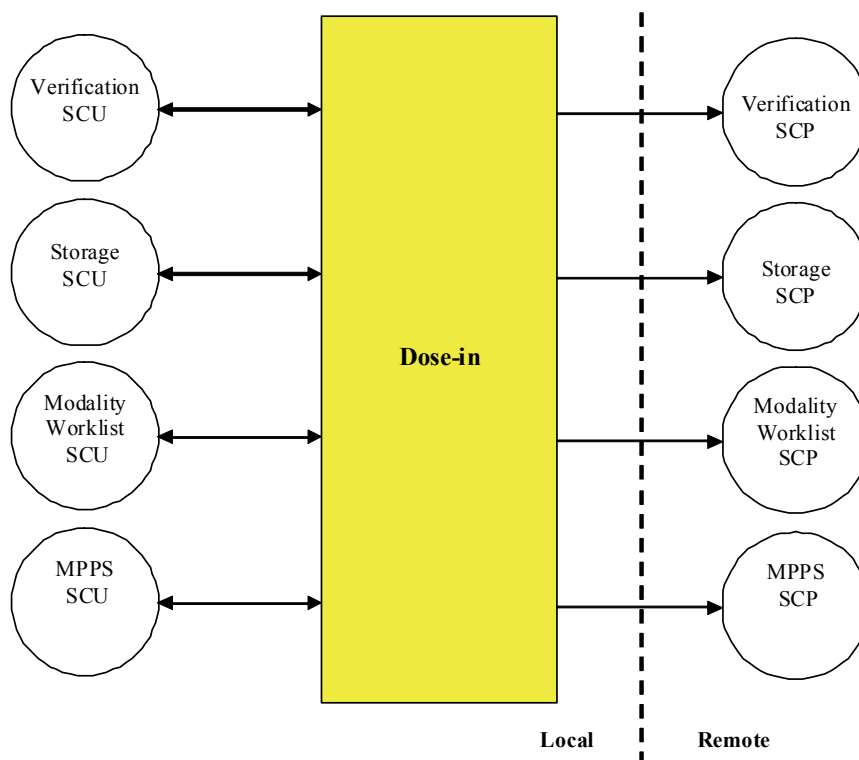
4. Networking

4.1 Implementation Model

Each installed Dose-in acts as a single Application Entity, maintaining at most one association per connected remote DICOM SCP.

4.1.1 Application Data flow

Figure 4.1-1: Application Data Flow



After installing Dose-in, the software administrator will use Dose-in settings window to declare the DICOM peers that Dose-in will communicate with. These peers may include a DICOM Worklist provider (labeled as SIR), and PACS (DICOM Store SCP) servers. At installation or whenever a problem occurs, the network communication between Dose-in and other DICOM peers can be checked within the Verification service from Dose-in.

To fill-in patient's information in the DICOM datasets created, Dose-in will send a request to a Worklist Provider in order to get the patient's information available on the local HIS or RIS system. Dose-in should be configured to retrieve the same worklist as the modality for which Dose-in reports X-Ray dose information.

Once the study is complete, the dose information may be reported to the HIS or SIR using the DICOM MPPS service. The dose information may also be reported to the declared PACS servers using the DICOM Store service.

4.1.2 Functional Definitions of Application Entities

As a SCU, Dose-in connects to other DICOM applications.

4.1.2.1 Verification Service as SCU

On the user's demand, Dose-in can initiate an association with Presentation Contexts for the Verification service SOP class. It will send a C-ECHO request to another DICOM application and wait for a response to complete the verification.

4.1.2.2 Basic Modality Worklist Management Service as SCU

Dose-in uses the Modality Worklist service to get required patient and study information to generate dose information reports for the same patient and study as the X-Ray modality performing the image acquisition.

It establishes one association with the remote Worklist SCP, performs a Find request, waits for responses, and then releases the association.

4.1.2.3 Dose Information Reporting Using the MPPS Service as SCU

To store dose information reports to the HIS or RIS, Dose-in establishes an association with a remote Modality Performed Procedure Step (MPPS) SCP, notifies that a study is being performed using an N-CREATE message and releases the association. Then, Dose-in establishes an association with a remote MPPS SCP, and reports the dose and performed study information using an N-SET message and releases the association.

4.1.2.4 Dose Information Reporting Using the Storage Service as SCU

To store dose information reports, Dose-in establishes an association with a remote Storage SCP, negotiates its presentation contexts, and sends the DICOM instances according to their related Storage SOP Class. It then releases the association.

According to Dose-in settings, the dose information may be reported as a Secondary Capture Image with burned-in text describing the dose information. The dose information may also be reported as a Structured Report based on the X-Ray Radiation Dose SR information object.

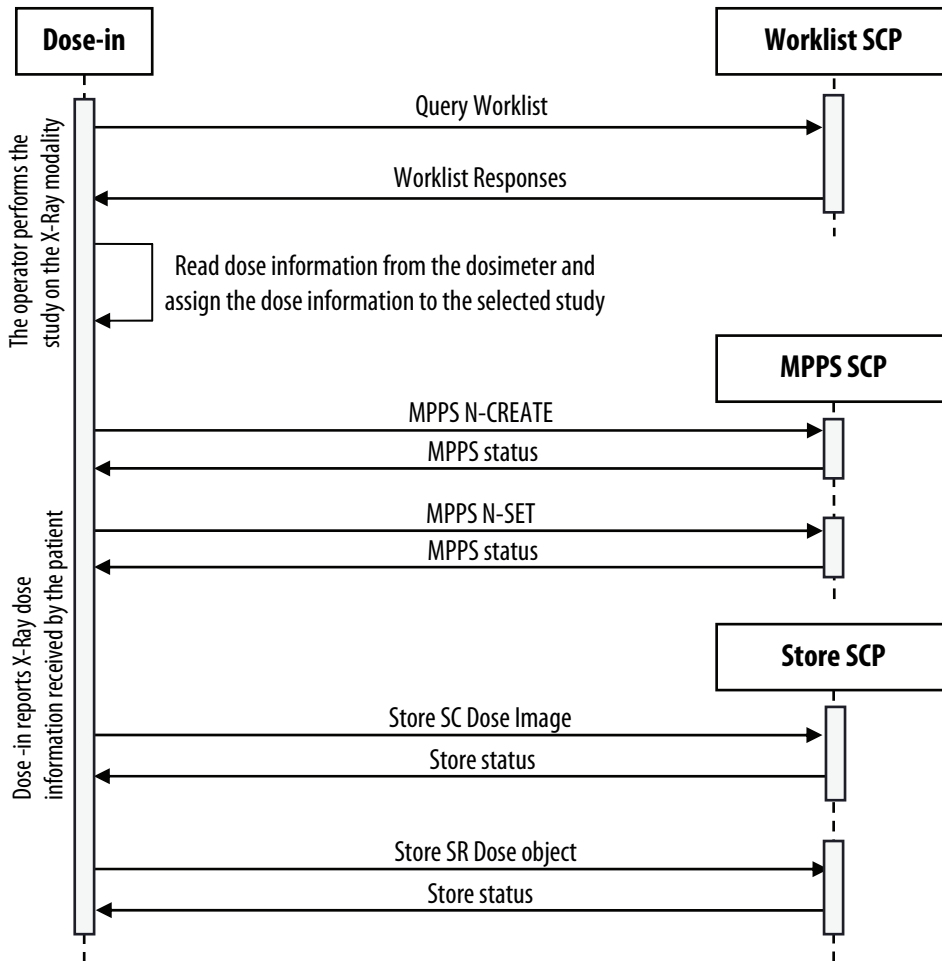
4.1.3 Sequencing of Real-World Activities

Real-World Activity for Verification operation is independent from other operations.

Real-World Activity for Basic Modality Worklist Management query is independent from other operations.

Real-World Activity for Modality Performed Procedure Step operation is independent from other operations.

Real-World Activity for Storage operation is independent from other operations.



4.2 Application Entity Specifications

4.2.1 SOP Classes

Dose-in AE provides standard conformance to the following DICOM V3.0 SOP Classes:

Table 4.2-1: SOP Classes for Dose-in AE

SOP Class Name	SOP Class UID	SCU	SCP
Supported SOP Classes for Verification SCU			
Verification	1.2.840.10008.1.1	Yes	No
Supported SOP Classes for Storage SCU			
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	No
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67	Yes	No
Supported SOP Class For Modality Worklist SCU			
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Yes	No
Supported SOP Class For Modality Performed Procedure Step SCU			
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Yes	No

4.2.2 Association Policies

4.2.2.1 General

Before any SOP classes can be exchanged between Dose-in (SCU) and a SCP Application Entity, an association stage takes place to negotiate and exchange the capabilities of the SCU and SCP.

Only Dose-in shall release an association. Dose-in or the SCP may however abort the association.

The calling AE Title for Dose-in can be configured in the user interface.

Dose-in contains the following limitations for PDU size:

Minimum PDU size	8,192 bytes
Maximum PDU size	16,384 bytes

4.2.2.2 Number of Associations

Table 4.2-2: Number of Associations as an Association Initiator SCU for Dose-in AE

Maximum number of simultaneous Associations	1
---	---

4.2.2.3 Asynchronous Nature

Dose-in does not support asynchronous communication.

4.2.2.4 Implementation Identifying Information

The implementation information for the Application Entity is:

Table 4.2-3: DICOM Implementation Class and Version for Dose-in AE

Implementation class UID	1.2.250.1.59.3.0.3.5.3
Application Context Name	1.2.840.10008.3.1.1.1
Implementation version name	ETIAM_DCMTK_353

4.2.2.5 Association Initiation Policy

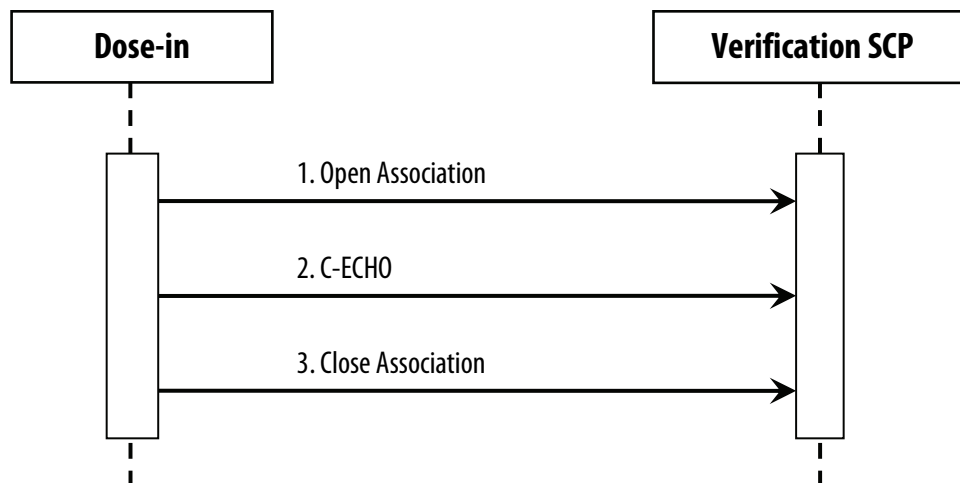
Dose-in AE initiates association for implementation of the Verification service Class, Basic Worklist Management, Modality Performed Procedure Step, and Storage as SCU.

4.2.2.5.1 Activity – Verification SCU

4.2.2.5.1.1 Description and Sequencing of Activities

Dose-in will initiate an association with a Verification SCP within the Configuration panel to check SCP availability. Association is then opened, negotiated and closed synchronously.

Figure 4.2-4: Sequencing of Activity – Verification



4.2.2.5.1.2 Proposed Presentation Contexts

Table 4.2-5: Proposed Presentation Contexts for Dose-in AE and Verification Activity

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

4.2.2.5.1.3 SOP Specific Conformance to the Verification SOP Class

Dose-in provides standard conformance to the DICOM Verification Service Class as a SCU. The status code for the C-ECHO is shown in the following table:

Table 4.2-6: C-ECHO Response Status Handling Behavior

Code	Status	Meaning
0000	Success	The C-ECHO request is accepted.

Table 4.2-7: C-ECHO Communication Failure Behavior

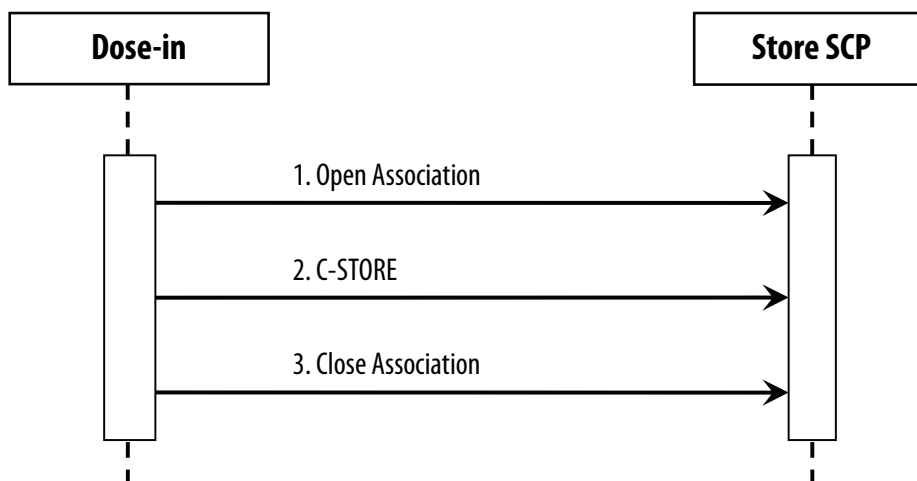
Exception	Behavior
Timeout	The Association is aborted using A-ABORT.

4.2.2.5.2 Activity – Storage SCU

4.2.2.5.2.1 Description and Sequencing of Activities

Dose-in will initiate an association with a Storage SCP to store dose objects. Each object is stored individually on an association.

Figure 4.2-8: Sequencing of Activity – Storage



4.2.2.5.2.2 Proposed Presentation Contexts

Table 4.2-9: Proposed Presentation Contexts for Dose-in AE and Storage Activity

Presentation Context Table				
Abstract Syntax	Transfer Syntax		Role	Extended Negotiation
See note below	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
	JPEG Baseline : Default Transfer Syntax for Lossy JPEG 8 Bit Image Compression	1.2.840.10008.1.2.4.50	SCU	None
	JPEG Lossless, Non-Hierarchical, First-Order Prediction	1.2.840.10008.1.2.4.70	SCU	None

Note: Transfer syntaxes referenced in the above table apply to the Storage Abstract Syntaxes whose names and UIDs are listed in Table 4.2-1. The encoded transfer syntaxes do not apply to non-image abstract syntaxes.

Dose-in applies the following rules for its proposed presentation contexts:

- All uncompressed transfer syntaxes are proposed for Storage operations.

- If an image is encoded, its corresponding native transfer syntax is also proposed, and will be preferred by SCU if both compressed and uncompressed transfer syntaxes are accepted by SCP.
- If SCP does not accept encoded transfer syntaxes, Dose-in will uncompress the related images on the fly.

4.2.2.5.2.3 SOP Specific Conformance to the Storage SOP Class

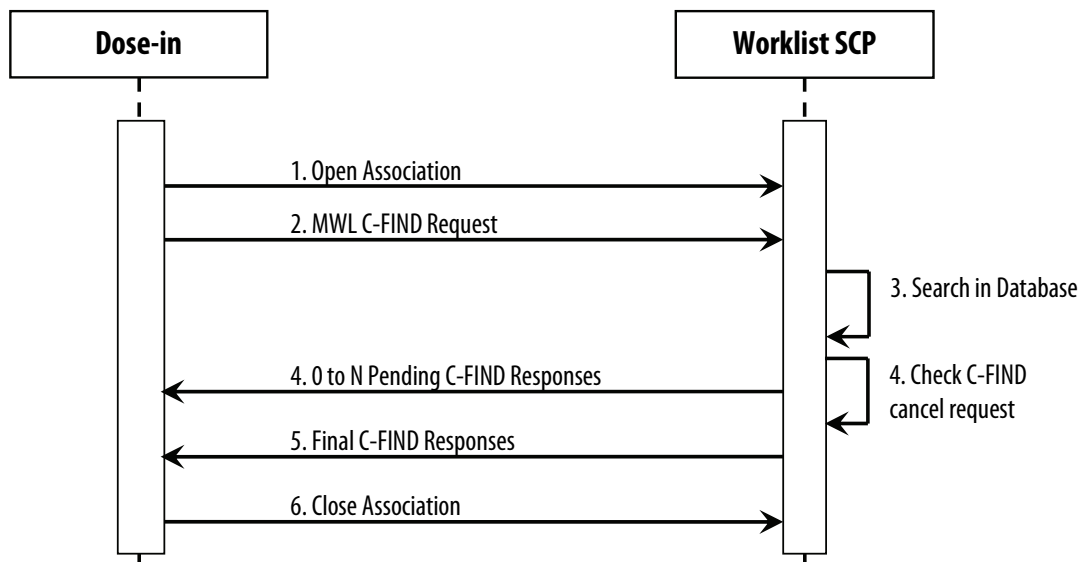
Secondary Capture Images and SR sent by Dose-in using Storage SCU operation contain their native information. Dose-in never attempts to modify local datasets before sending.

4.2.2.5.3 Activity – Worklist Management SCU

4.2.2.5.3.1 Description and Sequencing of Activities

Dose-in will initiate a separate association for each Find request.

Figure 4.2-10: Sequencing of Activity – Storage



4.2.2.5.3.2 Proposed Presentation Contexts

Table 4.2-11: Proposed Presentation Contexts for Dose-in AE and Worklist Management Activity

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Worklist Information Model	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

4.2.2.5.3.3 SOP Specific Conformance to the Worklist Management SOP Class

Dose-in provides standard conformance to the DICOM Basic Worklist Management Service Class. Dose-in requests the following matching key types:

Table 4.2-12: Modality Worklist Matching Key Type

Key Type Matching	
SV	Single Value matching
WC	Wild Card matching
RM	Range matching
	No matching Returns value when available

Table 4.2-13: Modality Worklist Supported Attributes

Module	Attribute Name	Tag	Match
SOP Common	Specific Character Set	(0008,0005)	
Scheduled Procedure Step	Scheduled Procedure Step Sequence	(0040,0100)	
	> Scheduled Station AETitle	(0040,0001)	SV
	> Scheduled Procedure Step Start Date	(0040,0002)	RM
	> Scheduled Procedure Step Start Time	(0040,0003)	
	> Scheduled Procedure Step End Date	(0040, 0004)	
	> Scheduled Procedure Step End Time	(0040, 0005)	
	> Modality	(0008,0060)	SV
	> Scheduled Performing Physician's Name	(0040,0006)	
	> Scheduled Station Name	(0040,0010)	
	> Scheduled Procedure Step Location	(0040,0011)	
	> Scheduled Procedure Step Description	(0040,0070)	
	> Pre Medication	(0040,0012)	
	> Scheduled Procedure Step ID	(0040,0009)	
	> Scheduled Procedure Step Status	(0040, 0020)	
	> Comments On Scheduled Procedure Step Status	(0040, 0400)	
	> Requested Contrast Agent	(0032,1070)	
	> Scheduled Protocol Code Sequence	(0040,0008)	
	>> Code Value	(0008,0100)	
	>> Coding Scheme Designator	(0008,0102)	
>> Coding Scheme Version	(0008,0103)		
>> Code Meaning	(0008,0104)		
Requested Procedure	Requested Procedure ID	(0040,1001)	
	Study Instance UID	(0020,000D)	
	Reason For The Requested Procedure	(0020, 1002)	
	Requested Procedure Description	(0032,1060)	
	Requested Procedure Priority	(0040,1003)	
	Patient Transport Arrangements	(0040,1004)	

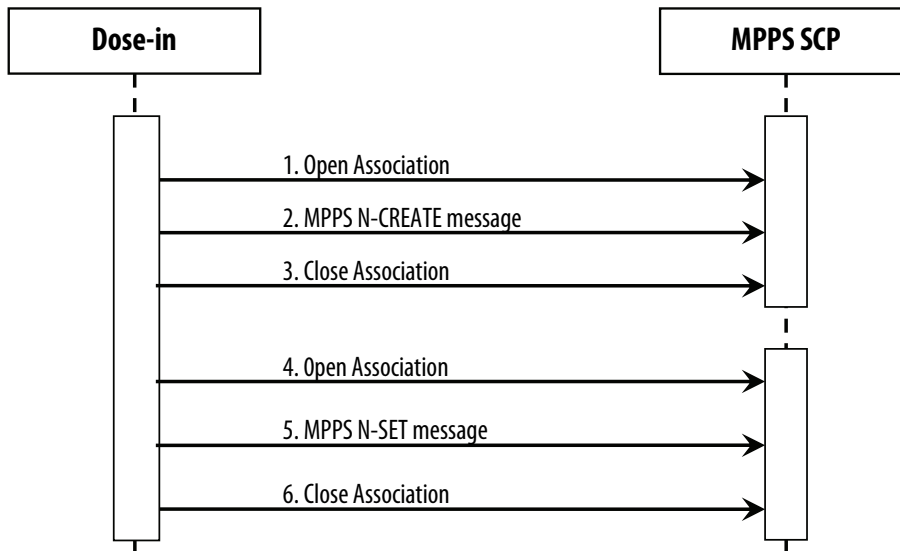
Module	Attribute Name	Tag	Match
	Names Of Intended Recipients Of Results	(0040, 1010)	
	Requested Procedure Comments	(0040, 1400)	
	Requested Procedure Code Sequence	(0032, 1064)	
	> Code Value	(0008, 0100)	
	> Coding Scheme Designator	(0008, 0102)	
	> Coding Scheme Version	(0008, 0103)	
	> Code Meaning	(0008, 0104)	
Imaging Service Request	Accession Number	(0008, 0050)	SV
	Requesting Physician	(0032, 1032)	
	Referring Physician's Name	(0008, 0090)	
	Requesting Service	(0032, 1033)	
	Reason For The Imaging Service Request	(0040, 2001)	
	Imaging Service Request Comments	(0040, 2400)	
	Placer Order Number / Imaging Service Request	(0040, 2016)	
Visit Identification	Admission ID	(0038, 0010)	
Visit Status	Current Patient Location	(0038, 0300)	
Patient Identification	Patient's Name	(0010, 0010)	SV / WC
	Patient ID	(0010, 0020)	SV
	Issuer of Patient ID	(0010, 0021)	
	Other Patient IDs	(0010, 1000)	
Patient Demographic	Patient's Birth Date	(0010, 0030)	RM
	Patient's Birth Time	(0010, 0032)	
	Patient's Sex	(0010, 0040)	SV
	Patient's Size	(0010, 1020)	
	Patient's Weight	(0010, 1030)	
	Confidentiality Constraint On Patient Data Description	(0010, 3001)	
	Ethnic Group	(0010, 2160)	
	Patient Comments	(0010, 4000)	
Patient Medical	Patient State	(0038, 0500)	
	Medical Alerts	(0010, 2000)	
	Contrast Allergies	(0010, 2110)	
	Special Needs	(0038, 0050)	
	Additional Patient History	(0010, 21B0)	
	Last Patient Menstrual Date	(0010, 21D0)	

4.2.2.5.4 Activity – Modality Performed Procedure Step SCU

4.2.2.5.4.1 Description and Sequencing of Activities

The associated real-world activity for Dose-in MPPS SCU is to keep a MPPS manager informed of dose objects being created and to report the dose information to the SIR using the Dose Module of the MPPS information object.

Figure 4.2-14: Sequencing of Activity – Storage



4.2.2.5.4.2 Proposed Presentation Contexts

Table 4.2-15: Proposed Presentation Contexts for Dose-in AE and Modality Performed Procedure Step Activity

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

4.2.2.5.4.3 SOP Specific Conformance to the Basic Modality Worklist Management SOP Class

Dose-in provides standard conformance to the DICOM Modality Performed Procedure Step Service Class. Dose-in supports the following attributes:

Table 4.2-16: Modality Performed Procedure Step Attributes

Attribute Name	Tag	N-CREATE	N-SET
SOP Common			
Specific Character Set	(0008,0005)	ISO_IR 100 or any other charset	<i>Not present</i>
Performed Procedure Step Relationship			
Patient's Name	(0010,0010)	MWL	<i>Not present</i>
Patient ID	(0010,0020)	MWL	<i>Not present</i>
Issuer of Patient ID	(0010, 0021)	MWL	<i>Not present</i>
Other Patient IDs	(0010, 1000)	MWL	<i>Not present</i>
Patient's Birth Date	(0010,0030)	MWL	<i>Not present</i>
Patient's Sex	(0010,0040)	MWL	<i>Not present</i>
Referenced Patient Sequence	(0008,1120)	EMPTY	<i>Not present</i>
Scheduled Step Attribute Sequence	(0040,0270)		<i>Not present</i>
>Study Instance UID	(0020,000D)	MWL	<i>Not present</i>
>Referenced Study Sequence	(0008,1110)		<i>Not present</i>
>>Referenced SOP Class UID	(0008,1150)	1.2.840.10008.3.1.2.3.1	<i>Not present</i>
>>Referenced SOP Class UID	(0008,1155)	MWL	<i>Not present</i>
>Referenced Performed Procedure Step Sequence	(0008,1111)		<i>Not present</i>
>>Referenced SOP Class UID	(0008,1150)	1.2.840.10008.3.1.2.3.3	<i>Not present</i>
>>Referenced SOP Class UID	(0008,1155)	AUTO	<i>Not present</i>
>Accession Number	(0008,0050)	MWL	<i>Not present</i>
>Requested Procedure ID	(0010,0030)	MWL	<i>Not present</i>
>Requested Procedure Description	(0032,1060)	MWL	<i>Not present</i>
>Scheduled Procedure Step ID	(0040,0009)	MWL	<i>Not present</i>
> Scheduled Procedure Step Description	(0040,0007)	MWL	<i>Not present</i>
>Scheduled Protocol Code Sequence	(0040,0008)	MWL	<i>Not present</i>
Performed Procedure Step Information			
Performed Station AE Title	(0040, 0241)	Dose-in AE Title	<i>Not present</i>
Performed Station Name	(0040, 0242)	Hostname or settings	<i>Not present</i>
Performed Location	(0040, 0243)		<i>Not present</i>
Performed Procedure Step Start Date	(0040,0244)	AUTO	<i>Not present</i>
Performed Procedure Step Start Time	(0040,0245)	AUTO	<i>Not present</i>
Performed Procedure Step ID	(0040,0253)	MWL	<i>Not present</i>
Performed Procedure Step End Date	(0040,0250)		AUTO
Performed Procedure Step End Time	(0040,0251)		AUTO
Performed Procedure Step Status	(0040,0252)	IN PROGRESS	COMPLETED or DISCONTINUED
Performed Procedure Step Description	(0040,0254)	MWL	MWL
Performed Procedure Type Description	(0040,0255)	EMPTY	<i>Not present</i>
Procedure Code Sequence	(0008,1032)	EMPTY	<i>Not present</i>
Performed Procedure Step Discontinuation Reason Code Sequence	(0040,0281)	EMPTY	Not present or { DCM, 110513, "Discontinued for unspecified reason" }

Attribute Name	Tag	N-CREATE	N-SET
Image Acquisition Results			
Modality	(0008,0060)	MWL	<i>Not present</i>
Study ID	(0020,0010)	EMPTY	<i>Not present</i>
Performed Protocol Code Sequence	(0040,0260)	EMPTY	<i>Not present</i>
Performed Series Sequence	(0040,0340)	EMPTY	
>Performing Physician's Name	(0008,1050)		EMPTY
>Operator's Name	(0008,1070)		EMPTY
>Protocol Name	(0018,1030)		EMPTY
>Series Instance UID	(0020,000E)		AUTO
>Series Description	(0008,103E)		AUTO
>Retrieve AE Title	(0008,0054)		EMPTY
>Referenced Image Sequence	(0008,1140)		
>>Referenced SOP Class UID	(0008,1150)		AUTO
>>Referenced SOP Instance UID	(0008,1155)		AUTO
>Referenced Non Image Composite SOP Instance Sequence	(0040,0220)		
>>Referenced SOP Class UID	(0008,1150)		AUTO
>>Referenced SOP Instance UID	(0008,1155)		AUTO
Radiation Dose			
Anatomic Structure, Space or Region Sequence	(0008,2229)	EMPTY	AUTO (User input)
Image and Fluoroscopy Area Dose Product	(0018,115E)		AUTO : Total DAP value for study read from dosimeter (dGy.cm ²)
Comments on Radiation Dose	(0040,0310)		AUTO + CONFIG

4.2.2.6 Association Acceptance Policy

Dose-in will not accept any associations since it acts only as a SCU for Basic Modality Worklist Management, Modality Performed Procedure Step, Storage and Verification.

4.3 Network Interfaces

4.3.1 Physical Network Interface

Dose-in provides DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

Dose-in inherits its TCP/IP stack from the Linux system where it runs. Default Unix TCP/IP stack is supported.

4.3.2 Additional Protocols

None.

4.4 Configuration

Dose-in configuration is detailed in Dose-in User's Guide.

4.4.1 AE Titles / Presentation Address Mapping

AE Titles, host names and port numbers for remote applications are configured in the **DICOM** tab of the Dose-in settings window. One Worklist/MPPS (SIR) and up to 2 Store SCPs can be defined.

4.4.2 Parameters

Dose-in configurable parameters can be defined in the **Settings** panels or via configuration files. They are the following:

- AE Title: Default is "AET_MODALITE".
- Debug and Verbose modes: To get or not detailed information about connections.

5. Media Interchange

The Dose-in product does not support media interchange.

6. Support of Character Sets

6.1 Handling of Character Sets

Dose-in supports all character sets defined by the DICOM standard.

If Dose-in needs to encode new strings before adding them to a dataset, it may extend the Specific Character Set using the extension technique described in DICOM PS 3.5. The only exception is if the new string requires a multi-byte character set without a code extension, the entire dataset will not be re-encoded and Dose-in will strip “non-encodable” characters of the new string.

If a decoding error is encountered while processing a string with the supplied character set, the character will be replaced with \xxx (where xxx is the octal code of the character) for display purposes. The dataset won't be altered.

Additionally, when decoding worklist responses, Dose-in can be configured to use a default character set when the Specific Character Set in the response is missing or set to the default repertoire. It is also possible to configure a Specific Character Set that will be used instead of the response Specific Character Set.

Whether or not characters are displayed correctly depends on the presence of font support in the underlying operating system. It may be necessary for the user to add additional Unicode fonts to their system configuration in order to correctly display characters that would not typically be used in the default locale.

6.2 List of Supported Character Sets

Table 6.2-1: Supported specific character set defined terms

Character Set Description	Defined Term	Decoding	Encoding
Single-byte character sets without code extensions			
Default Repertoire	None	YES	YES
Latin alphabet No. 1	ISO_IR 100	YES	YES
Latin alphabet No. 2	ISO_IR 101	YES	YES
Latin alphabet No. 3	ISO_IR 109	YES	YES
Latin alphabet No. 4	ISO_IR 110	YES	YES
Cyrillic	ISO_IR 144	YES	YES
Arabic	ISO_IR 127	YES	YES
Greek	ISO_IR 126	YES	YES
Hebrew	ISO_IR 138	YES	YES
Latin alphabet No. 5	ISO_IR 148	YES	YES
Japanese	ISO_IR 13	YES	YES
Thai	ISO_IR 166	YES	YES
Single-byte character sets with code extensions			
Default Repertoire	ISO 2022 IR 6	YES	YES
Latin alphabet No. 1	ISO 2022 IR 100	YES	YES
Latin alphabet No. 2	ISO 2022 IR 101	YES	YES
Latin alphabet No. 3	ISO 2022 IR 109	YES	YES

Character Set Description	Defined Term	Decoding	Encoding
Latin alphabet No. 4	ISO 2022 IR 110	YES	YES
Cyrillic	ISO 2022 IR 144	YES	YES
Arabic	ISO 2022 IR 127	YES	YES
Greek	ISO 2022 IR 126	YES	YES
Hebrew	ISO 2022 IR 138	YES	YES
Latin alphabet No. 5	ISO 2022 IR 148	YES	YES
Japanese	ISO 2022 IR 13	YES	YES
Thai	ISO 2022 IR 166	YES	YES
Multi-byte character sets with code extensions			
Japanese	ISO 2022 IR 87	YES	YES
Japanese	ISO 2022 IR 159	YES	YES
Korean	ISO 2022 IR 149	YES	YES
Multi-byte character sets without code extensions			
Unicode in UTF-8	ISO_IR 192	YES	YES, but will not re-encode dataset
Chinese GB18030	GB18030	YES	YES, but will not re-encode dataset

7. Security

Dose-in does not support any specific security measures.

It is assumed that Dose-in is used within a secured environment, including:

- Router protections to ensure that only approved external hosts have network access to Dose-in
- Router protections to ensure that Dose-in only has network access to approved external hosts and services
- Any communication with external hosts and services outside the locally secured environment use appropriate secure network channels

8. IOD Contents

Dose-in can create Secondary Capture Images and X-Ray Radiation Dose SR instances to report dose information to declared Store SCP servers.

8.1 Secondary Capture Dose Image

Dose-in can create Secondary Capture Images to report dose information to declared Store SCP servers. The pixel data is a black image with burnt-in white text reporting total Dose Area Product and Target Region. Dose-in can be configured to create uncompressed or jpeg encoded pixel data. Encoded datasets can be uncompressed on the fly during store operation (see “Activity - Storage SCU” on page 13).

Table 8.1-1: Secondary Capture Image Attributes

Attribute Name	Tag	VR	Value
SOP Common			
SOP Class UID	(0008,0016)	UI	1.2.840.10008.5.1.4.1.1.7
SOP Instance UID	(0008,0018)	UI	AUTO
Specific Character Set	(0008,0005)	CS	AUTO
Patient			
Patient's Name	(0010,0010)	PN	MWL
Patient ID	(0010,0020)	LO	MWL
Patient's Birth Date	(0010,0030)	DA	MWL
Patient's Sex	(0010,0040)	CS	MWL
Study			
Study Instance UID	(0020,000D)	UI	MWL
Study Date	(0008,0020)	DA	AUTO
Study Time	(0008,0030)	TM	EMPTY or AUTO according to CONFIG
Referring Physician's Name	(0008,0090)	PN	EMPTY or MWL according to CONFIG
Study ID	(0020,0010)	SH	EMPTY
Accession Number	(0008,0050)	SH	MWL
Study Description	(0008,1030)	LO	EMPTY or MWL according to CONFIG
Series			
Modality	(0008,0060)	CS	"OT"
Series Instance UID	(0020,000E)	UI	AUTO
Series Number	(0020,0011)	IS	CONFIG - default "6054"
Series Date	(0008,0021)	DA	AUTO
Series Time	(0008,0031)	TM	AUTO
Performing Physician's Name	(0008,1050)	PN	EMPTY
Series Description	(0008,103E)	LO	CONFIG – default: "X-Ray Dose Information"
Equipment			
Manufacturer	(0008,0070)	LO	"ETIAM"
Station Name	(0008,1010)	SH	hostname
Manufacturer's Model Name	(0008,1090)	LO	"Dose-in"

Attribute Name	Tag	VR	Value
Device Serial Number	(0018,1000)	LO	AUTO
Software Versions	(0018,1020)	LO	AUTO – ex: “Dose-in 1.02”
Conversion Type	(0008,0064)	CS	“WSD”
Image			
Instance Number	(0020,0013)	IS	AUTO
Patient Orientation	(0020,0020)	CS	EMPTY
Image Comments	(0020,4000)	LT	AUTO+CONFIG – Total DAP Value
Lossy Image Compression	(0020,2110)	CS	“01”
Samples Per Pixel	(0028,0002)	US	“1”
Photometric Interpretation	(0028,0004)	CS	“MONOCHROME2”
Rows	(0028,0010)	US	AUTO – “512”
Columns	(0028,0011)	US	AUTO – “512”
Bits Allocated	(0028,0100)	US	“8”
Bits Stored	(0028,0101)	US	“8”
High Bit	(0028,0102)	US	“7”
Pixel Representation	(0028,0103)	US	“0”
Pixel Data	(7FE0,0010)	OB	AUTO
Nominal Scanned Pixel Spacing	(0018,2010)	DS	EMPTY
Window Center	(0028,1050)	DS	127
Window Width	(0028,1051)	DS	255
Dose Comment	(3004,0006)	LO	AUTO+CONFIG – Total DAP Value & Target

8.2 X-Ray Radiation Dose SR

Dose-in may create X-Ray Radiation Dose SR instances to report dose information to declared Store SCP servers.

The template used for the SR is template TID 10001 "Projection X-Ray Radiation Dose Report".

NOTE: As "Dose-in" is a distinct equipment not connected to the X-Ray Source, the Modality nor the acquisition table, **some mandatory information in the X-Ray Radiation Dose SR IOD is missing** and therefore is not filled-in in the instances created. In particular, parameters describing the X-Ray Source, the reference point, the dose at the reference point, and fluoroscopy information are missing. A new template dedicated to CR is being discussed by the DICOM Committee but is not yet available for implementation.

The following macro is used to define Code Sequences in the list of attributes for the SR Document. The VR used is "cSQ" for such items.

Table 8.2-1: Code Sequence Macro

Attribute Name	Tag	VR	Value
<Name Of Code Sequence>			
<Name Of Code Sequence>	(gggg,eeee)	cSQ	{ VALUE, CSD, MEANING [, CSV] }
Is expanded as:			
<Name Of Code Sequence>	(gggg,eeee)	SQ	
>Code Value	(0008,0100)	SH	VALUE
>Coding Scheme Designator	(0008,0102)	SH	CSD
>Coding Scheme Version	(0008,0103)	SH	CSV, if provided
>Code Meaning	(0008,0104)	LO	MEANING

Table 8.2-2: X-Ray Radiation Dose SR Document Attributes

Attribute Name	Tag	VR	Value
SOP Common			
SOP Class UID	(0008,0016)	UI	"1.2.840.10008.5.1.4.1.1.88.67"
SOP Instance UID	(0008,0018)	UI	AUTO
Specific Character Set	(0008,0005)	CS	AUTO
Patient			
Patient's Name	(0010,0010)	PN	MWL
Patient ID	(0010,0020)	LO	MWL
Patient's Birth Date	(0010,0030)	DA	MWL
Patient's Sex	(0010,0040)	CS	MWL
Study			
Study Instance UID	(0020,000D)	UI	MWL
Study Date	(0008,0020)	DA	AUTO

Attribute Name	Tag	VR	Value
Study Time	(0008,0030)	TM	EMPTY or AUTO according to CONFIG
Referring Physician's Name	(0008,0090)	PN	EMPTY or MWL according to CONFIG
Study ID	(0020,0010)	SH	EMPTY or MWL according to CONFIG
Accession Number	(0008,0050)	SH	MWL
Study Description	(0008,1030)	LO	NOT PRESENT or MWL according to CONFIG
Series			
Modality	(0008,0060)	CS	"SR"
Series Instance UID	(0020,000E)	UI	AUTO
Series Number	(0020,0011)	IS	CONFIG - default "6053"
Series Date	(0008,0021)	DA	AUTO
Series Time	(0008,0031)	TM	AUTO
Series Description	(0008,103E)	LO	CONFIG – default: "Radiation Dose Information"
Referenced Performed Procedure Step Sequence	(0008,1111)	SQ	EMPTY
Equipment			
Manufacturer	(0008,0070)	LO	"ETIAM"
Station Name	(0008,1010)	SH	hostname
Manufacturer's Model Name	(0008,1090)	LO	"Dose-in"
Device Serial Number	(0018,1000)	LO	AUTO
Software Versions	(0018,1020)	LO	AUTO – ex: "Dose-in 1.02"
Document			
Instance Number	(0020,0013)	IS	AUTO
Completion Flag	(0040,A491)	CS	COMPLETED
Verification Flag	(0040,A493)	CS	UNVERIFIED
Content Date	(0008,0023)	DA	AUTO
Content Time	(0008,0033)	TM	AUTO
Referenced Request Sequence	(0040,A370)	SQ	
>Study Instance UID	(0020,000D)	UI	MWL
>Referenced Study Sequence	(0008,1110)	SQ	EMPTY
>Accession Number	(0008,0050)	SH	MWL
>Placer Order Number/Imaging Service Request	(0040,2016)	LO	EMPTY
>Filler Order Number/Imaging Service Request	(0040,2016)	LO	EMPTY
>Requested Procedure ID	(0040,1001)	SH	MWL
>Requested Procedure Description	(0032,1060)	LO	MWL
>Requested Procedure Code Sequence	(0032,1064)	SQ	MWL
Performed Procedure Code Sequence	(0040,A372)	SQ	EMPTY
Value Type	(0040,0040)	CS	CONTAINER
Concept Name Code Sequence	(0040,0043)	cSQ	{ "113701", "DCMR", "X-Ray Radiation Dose Report" }
Continuity Of Content	(0040,0050)	CS	SEPARATE
Content Template Sequence	(0040,A504)	SQ	
>Mapping Resource	(0008,0105)	CS	"DCMR"
>Template Identifier	(0040,DB00)	CS	"10001"
Content Sequence	(0040,A730)	SQ	

Attribute Name	Tag	VR	Value
>Relationship Type	(0040,A010)	CS	HAS CONCEPT MOD
>Value Type	(0040,0040)	CS	CODE
>Concept Name Code Sequence	(0040,0043)	cSQ	{ "121058", "DCM", "Procedure Reported" }
>Concept Code Sequence	(0040,A168)	cSQ	{ "113704", "DCM", "Projection X-Ray" }
>Content Sequence	(0040,A730)	SQ	
>>Relationship Type	(0040,A010)	CS	HAS CONCEPT MOD
>>Value Type	(0040,0040)	CS	CODE
>>Concept Name Code Sequence	(0040,0043)	cSQ	{ "G-COE8", "SRT", "Has Intent" }
>>Concept Code Sequence	(0040,A168)	cSQ	{ "R-408C3", "SRT", "Diagnostic Intent" }
>Relationship Type	(0040,A010)	CS	HAS OBS CONTEXT
>Value Type	(0040,0040)	CS	CODE
>Concept Name Code Sequence	(0040,0043)	cSQ	{ "121005", "DCM", "Observer Type" }
>Concept Code Sequence	(0040,A168)	cSQ	{ "121007", "DCM", "Device" }
>Relationship Type	(0040,A010)	CS	HAS OBS CONTEXT
>Value Type	(0040,0040)	CS	UIDREF
>Concept Name Code Sequence	(0040,0043)	cSQ	{ "121012", "DCM", "Device Observer UID" }
>UID	(0040,A124)	UI	AUTO
>Relationship Type	(0040,A010)	CS	HAS OBS CONTEXT
>Value Type	(0040,0040)	CS	CODE
>Concept Name Code Sequence	(0040,0043)	cSQ	{ "113705", "DCM", "Scope Of Accumulation" }
>Concept Code Sequence	(0040,A168)	cSQ	{ "113014", "DCM", "Study" }
>Content Sequence	(0040,A730)	SQ	
>>Relationship Type	(0040,A010)	CS	HAS PROPERTIES
>>Value Type	(0040,0040)	CS	UIDREF
>>Concept Name Code Sequence	(0040,0043)	cSQ	{ "110180", "DCM", "Study Instance UID" }
>>UID	(0040,A124)	UI	MWL
>Relationship Type	(0040,A010)	CS	CONTAINS
>Value Type	(0040,0040)	CS	CONTAINER
>Concept Name Code Sequence	(0040,0043)	cSQ	{ "113702", "DCM", "Accumulated X-Ray Dose Data" }
>Continuity Of Content	(0040,0050)	CS	SEPARATE
>Content Sequence	(0040,A730)	SQ	
>>Relationship Type	(0040,A010)	CS	HAS CONCEPT MOD
>>Value Type	(0040,0040)	CS	CODE
>>Concept Name Code Sequence	(0040,0043)	cSQ	{ "113764", "DCM", "Acquisition Plane" }
>>Concept Code Sequence	(0040,A168)	cSQ	{ "113622", "DCM", "Single Plane" }
>>Relationship Type	(0040,A010)	CS	CONTAINS
>>Value Type	(0040,0040)	CS	NUM
>>Concept Name Code Sequence	(0040,0043)	cSQ	{ "113722", "DCM", "Dose Area Product Total" }
>>Measured Value Sequence	(0040,A300)	SQ	
>>>Measurement Units Code Sequence	(0040,08EA)	cSQ	{ "Gym2", "UCUM", "Gym2" }
>>>Numeric Value	(0040,A30A)	DS	AUTO
>>Relationship Type	(0040,A010)	CS	CONTAINS
>>Value Type	(0040,0040)	CS	NUM

Attribute Name	Tag	VR	Value
>>Concept Name Code Sequence	(0040,0043)	cSQ	{ "113727", "DCM", "Acquisition Dose Area Product Total" }
>>Measured Value Sequence	(0040,A300)	SQ	
>>>Measurement Units Code Sequence	(0040,08EA)	cSQ	{ "Gym2", "UCUM", "Gym2" }
>>>Numeric Value	(0040,A30A)	DS	AUTO
>>Relationship Type	(0040,A010)	CS	CONTAINS
>>Value Type	(0040,0040)	CS	NUM
>>Concept Name Code Sequence	(0040,0043)	cSQ	{ "113855", "DCM", "Total Acquisition Time" }
>>Measured Value Sequence	(0040,A300)	SQ	
>>>Measurement Units Code Sequence	(0040,08EA)	cSQ	{ "s", "UCUM", "s" }
>>>Numeric Value	(0040,A30A)	DS	AUTO
>Relationship Type	(0040,A010)	CS	CONTAINS
>Value Type	(0040,0040)	CS	CONTAINER
>Concept Name Code Sequence	(0040,0043)	cSQ	{ "113706", "DCM", "Irradiation Event X-Ray Data" }
>Continuity Of Content	(0040,0050)	CS	SEPARATE
>Content Sequence	(0040,A730)	SQ	
>>Relationship Type	(0040,A010)	CS	HAS CONCEPT MOD
>>Value Type	(0040,0040)	CS	CODE
>>Concept Name Code Sequence	(0040,0043)	cSQ	{ "113764", "DCM", "Acquisition Plane" }
>>Concept Code Sequence	(0040,A168)	cSQ	{ "113622", "DCM", "Single Plane" }
>>Relationship Type	(0040,A010)	CS	CONTAINS
>>Value Type	(0040,0040)	CS	DATETIME
>>Concept Name Code Sequence	(0040,0043)	cSQ	{ "111526", "DCM", "Date Time Started" }
>>DATETIME	(0040,A120)	DT	AUTO
>>Relationship Type	(0040,A010)	CS	CONTAINS
>>Value Type	(0040,0040)	CS	CODE
>>Concept Name Code Sequence	(0040,0043)	cSQ	{ "113721", "DCM", "Irradiation Event Type" }
>>Concept Code Sequence	(0040,A168)	cSQ	{ "113611", "DCM", "Stationary Acquisition" }
>>Relationship Type	(0040,A010)	CS	CONTAINS
>>Value Type	(0040,0040)	CS	UIDREF
>>Concept Name Code Sequence	(0040,0043)	cSQ	{ "113769", "DCM", "Irradiation Event UID" }
>>UID	(0040,A124)	UI	AUTO
>>Relationship Type	(0040,A010)	CS	CONTAINS
>>Value Type	(0040,0040)	CS	NUM
>>Concept Name Code Sequence	(0040,0043)	cSQ	{ "122130", "DCM", "Dose Area Product" }
>>Measured Value Sequence	(0040,A300)	SQ	
>>>Measurement Units Code Sequence	(0040,08EA)	cSQ	{ "Gym2", "UCUM", "Gym2" }
>>>Numeric Value	(0040,A30A)	DS	AUTO
>>Relationship Type	(0040,A010)	CS	CONTAINS
>>Value Type	(0040,0040)	CS	CODE
>>Concept Name Code Sequence	(0040,0043)	cSQ	{ "123014", "DCM", "Target Region" }
>>Concept Code Sequence	(0040,A168)	cSQ	User Selected from configured DCID (4031) Common Anatomic Regions
>Relationship Type	(0040,A010)	CS	CONTAINS

Attribute Name	Tag	VR	Value
>Value Type	(0040,0040)	CS	CODE
>Concept Name Code Sequence	(0040,0043)	cSQ	{ "113854", "DCM", "Source of Dose Information" }
>Concept Code Sequence	(0040,A168)	cSQ	{ "A-2C090", "SRT", "Dosimeter" }