

DICOM Correction Proposal

STATUS	Final Text
Date of Last Update	2013/10/29
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Submission Date	2012/03/29

Correction Number	CP- 1223
Log Summary:	Additional Items for Dose SR (by IEC PT 61910-1)
Name of Standard	PS 3.2 2011, PS 3.16 2011 and CP 1077

Rationale for Correction:

The IEC Project Team (PT) 61910-1 has the task to convert the related PAS into an International Standard. While working on this topic, the PT has identified several issues to be amended in the DICOM Standard in order to successfully complete the work on the new Dose Monitoring Standard. This CP certainly needs to be reviewed by WG-28 (Physics) and WG-02 (Projection Radiography and Angiography).

- 1) The new PAS successor document will more explicitly define the use of the streaming of Dose SR objects from the Acquisition modality to a dose information consumer. To better separate such intermediate reports from the final reports, the CID 10000 "Scope of Accumulation" needs to be extended by one additional code.
- 2) To consistently support Basic Dose Monitoring level in Radiography, the IEC requirement to encode "Dose (RP) Total" is only meaningful if supported by the possibility to provide a general location of the Reference Point used for calculating such a Dose. Therefore one of the existing CID Dose Related Distance Measurements terms shall be available in the TID 10004 "Accumulated Projection X-Ray Dose" and related TID 10007 "Accumulated Integrated Projection Radiography Dose" too.
- 3) The DICOM Standard defines for some of the Distance Related measurements that "the origin can be arbitrary chosen by the manufacturer". The IEC is recommending that certain choices should be publicized in the "Accompanying Documentation" of the equipment. It would be helpful if the DICOM Part 2 could open the possibility to add such information to the DICOM Conformance Statement.
- 4) To complete the documentation of parameters used to release the ionizing radiation, also the possibility to encode the basic control variable of the X-Ray control closed loop shall be optionally enabled in the Dose SR for each Irradiation Event.
- 5) During the inaugural meeting of DICOM WG-28 there was a discussion that multiple calibration factors are needed in Dose SR. The details about these factors need to be elaborated first. The current Calibration container in PS 3.16 TID 10002 is already tagged with a "1-n" multiplicity. During a second meeting with WG-28 it was worked out that content items are need to describe the Method, Setup and Conditions for a certain Calibration. Multiple encodings of the containers can then be used if more than one calibration factor is needed and the new content items will identify their use. IEC PT 61910-1 only recommends to add the element to specify the applied Calibration Protocol, the Method, Setup an Conditions are not needed.
- 6) The current definition of the "Collimated Field Area" gives no details on the geometry of the rectangular collimated field. Therefore additional content items are suggested to describe a more irregular, but still rectangular Collimator.
- 7) Similar to Start and End angles in case of gantry movement, the CID 10008 should be extended to include table end positions, in case table moved during the irradiation event.
- 8) The definition of Irradiation Event was reworked for IEC Standard proposal and therefore the sections in the standard currently using PAS terminology should be revisited for taking over the new term from the IEC Standard proposal. (Affects PS3.3 Dose SR IOD, PS 3.16 Definition of coded term and PS3.17 Annex AA)
- 9) During the final review of the IEC 61910-1 FIDS script, the project team identified that the currently defined Filter Types do not allow to clearly specific "spectral filters" are applied. The mentioning of wedges as "modulating filters" is unexpected in interventional equipment. Typically there are only spectral filters used and for those a suitable type shall be added to CID 10007 "Filter Types".

Correction Wording:

Corrections to Part 3.16 under the assumption that CP 1077 is accepted by WG-06 in March 2012.

1) PS 3.16: Amend CID 10000 by one code

CID 10000 Scope of Accumulation

**Context ID 10000
Scope of Accumulation**

Type: Extensible Version: 2008402820131010

Coding Scheme Designator	Code Value (0008,0100)	Code Meaning (0008,0104)
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(0008,0102)		
DCM	113014	Study
DCM	113015	Series
DCM	113016	Performed Procedure Step
<u>DCM</u>	<u>113970</u>	<u>Procedure Step To This Point</u>
DCM	113852	Irradiation Event

1) PS 3.16: Amend Annex D by one code.

DICOM Code Definitions (Coding Scheme Designator “DCM” Coding Scheme Version “01”)

Code Value	Code Meaning	Definition	Notes
...			
<u>113970</u>	<u>Procedure Step To This Point</u>	<u>The period of time from the start of a Procedure Step until the time point established by the context of the reference.</u>	
...			

2) PS 3.16 2011 + CP 1077: Amend CP 1077 TID 10007 “Accumulated Integrated Projection Radiography Dose”

**TID 10007
ACCUMULATED INTEGRATED PROJECTION RADIOGRAPHY DOSE
Type: Extensible**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			NUM	EV (113722, DCM, “Dose Area Product Total”)	1	M		Units = EV (Gy.m2, UCUM, “Gy.m2”)
2			NUM	EV (113725, DCM, “Dose (RP) Total”)	1	M		Units = EV (Gy, UCUM, “Gy”)
<u>2b</u>			<u>NUM</u>	<u>EV (113737, DCM, “Distance Source to Reference Point”)</u>	<u>1</u>	<u>U</u>		<u>Units = EV (mm, UCUM, “mm”)</u>
3			NUM	EV (113731, DCM, “Total Number of Radiographic Frames”)	1	U		Units = EV (1, UCUM, “no units”)
4			CODE	EV (113780, DCM, “Reference Point Definition”)	1	MC	IF Row 5 is not present.	DCID (10025) Radiation Dose Reference Points
5			TEXT	EV (113780, DCM, “Reference Point Definition”)	1	MC	IF Row 4 is not present.	

Content Item Descriptions

Row 1	Accumulated Dose Area Product
Row 2	Accumulated dose relative to reference point.
<u>Row 2b</u>	<u>A single value for Radiography systems calculating reference point dose based on fixed distance.</u>
Row 4	A coded definition of the Reference Point (RP) used for RP-related dose values.

Row 5	A text definition of the Reference Point (RP) used for RP-related dose values.
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2) PS 3.16 2011: Amend TID 10004 "Accumulated Projection X-Ray Dose"

TID 10004
ACCUMULATED PROJECTION X-RAY DOSE
Type: Extensible Order: Significant

NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
8		NUM	EV (113855, DCM, "Total Acquisition Time")	1	M		Units = EV (s, UCUM, "s")
8b		NUM	EV (113737, DCM, "Distance Source to Reference Point")	1	U		Units = EV (mm, UCUM, "mm")
9		NUM	EV (113731, DCM, "Total Number of Radiographic Frames")	1	U		Units = EV (1, UCUM, "no units")
10		CODE	EV (113780, DCM, "Reference Point Definition")	1	MC	IF Row 2, Row 4 or Row 7 is present and Row 11 is not present.	DCID (10025) Radiation Dose Reference Points
11		TEXT	EV (113780, DCM, "Reference Point Definition")	1	MC	IF Row 2, Row 4 or Row 7 is present and Row 10 is not present.	

Content Item Descriptions

Row 1	Sum of acquisition and fluoroscopy
Row 2	Sum of acquisition and fluoroscopy, relative to reference point.
Rows 3-5	Fluoroscopic component only
Rows 6-8	Acquisition component only
Row 8b	<u>A single value for Radiography systems calculating reference point dose based on fixed distance.</u>
Row 10	A coded definition of the Reference Point (RP) used for RP-related dose values.
Row 11	A text definition of the Reference Point (RP) used for RP-related dose values.

3) PS 3.2 2011: Amend section A.4.4.2 Parameters, Table A.4.4-2 Configuration Parameters Table

Table A.4.4-2
Configuration Parameters table

Parameter	Configurable (Yes/No)	Default Value
General Parameters		
...		
Any changes to default TCP/IP settings, such as configurable stack parameters.		
<u>Definition of arbitrarily chosen origins</u>		
<u>Definition of constant values used in Dose Related Distance Measurements</u>		
Other configurable parameters		

Parameter	Configurable (Yes/No)	Default Value
General Parameters		
AE Specific Parameters		
Size constraint in maximum object size (see note 1)		
...		

4) PS 3.16 2011 + CP 1077: Amend new TID 10003 to include a new content item

TID 10003
IRRADIATION EVENT X-RAY DATA
Type: Extensible Order: Non-Significant

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (113706, DCM, "Irradiation Event X-Ray Data")	1	M		
16 48	>	CONTAINS	NUM	EV (111634, DCM, "Half Value Layer")	1	U		Units = (mm, UCUM, "mm")
16 b	>	CONTAINS	NUM	EV (111638, DCM, "Patient Equivalent Thickness")	1	U		Units = (mm, UCUM, "mm")
17 44	>	CONTAINS	NUM	EV (111636, DCM, "Entrance Exposure at RP")	1	MC	IFF TID (10001) Row 2 = (P5-40010, SRT, "Mammography") and (TID (10001) Row 8 is absent or value is (R-0038D, SRT, "Yes")) and (TID (10001) Row 9 is absent or value is (R-0038D, SRT, "Yes"))	Units = EV (mGy, UCUM, "mGy")

4) PS 3.16 2011: Amend Annex D by one code

DICOM Code Definitions (Coding Scheme Designator "DCM" Coding Scheme Version "01")

Code Value	Code Meaning	Definition	Notes
...			
111638	Patient Equivalent Thickness	Value of the control variable used to parameterize the Automatic Exposure Control (AEC) closed loop (e.g. "Water Value").	
...			

5) PS 3.16 2011: Amend TID 10002 "Calibration" Container with new items

TID 10002
ACCUMULATED X-RAY DOSE
Type: Extensible Order: Significant

NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		CONTAINER	EV (113702, DCM, "Accumulated X-Ray Dose Data")	1	M		
2	>	HAS CONCEPT MOD	CODE EV (113764, DCM, "Acquisition Plane")	1	M		\$Plane
3	>	CONTAINS	CONTAINER EV (122505, DCM, "Calibration")	1-n	MC	IFF Calibration Data is available	
4	>>	HAS CONCEPT MOD	CODE EV (113794, DCM, "Dose Measurement Device")	1	M		DCID (10010) Dose Measurement Devices
5	>>	CONTAINS	DATETIME EV (113723, DCM, "Calibration Date")	1	M		
6	>>	CONTAINS	NUM EV (122322, DCM, "Calibration Factor")	1	M		Units = EV (1, UCUM, "no units")
7	>>	CONTAINS	NUM EV (113763, DCM, "Calibration Uncertainty")	1	M		Units = EV (% , UCUM, "Percent")
8	>>	CONTAINS	TEXT EV (113724, DCM, "Calibration Responsible Party")	1	M		
9	>>	CONTAINS	TEXT <u>EV (113720, DCM, "Calibration Protocol")</u>	1	U		
910	>	CONTAINS	INCLUDE DTID (10004) Accumulated Projection X-Ray Dose	1	MC	XOR row 10, IFF TID (10001) Row 2 = (113704, DCM, "Projection X-Ray")	
1011	>	CONTAINS	INCLUDE DTID (10005) Accumulated Mammography X-Ray Dose	1	MC	XOR row 9, IFF TID (10001) Row 2 = (P5-40010, SRT, "Mammography")	
1412	>	CONTAINS	INCLUDE DTID (1021) Device Participant	1	MC	Required if the irradiating device is not the recording device and the dose was accumulated on a single device.	\$DeviceProcedureRole = EV (113859, DCM, "Irradiating Device")

Content Item Descriptions

...	
Row 8	Identifies Individual or organization responsible for calibration
Row 9	<u>Describes calibration protocol according to equipment standards or local guidelines.</u>
Row 4412	The device which produced the irradiation accumulated in this template. I.e. the X-Ray source. This is not required to be present if the information is the same as that already recorded in the Device Observer Context (TID 1004) encoded via the inclusion of Observer Context (TID 1002) in TID 10001 Row 4, which in turn may be absent if identical to the content in the Enhanced General Equipment Module, or if more than one device produced the accumulated irradiation.

5) PS 3.16 2011: Amend Annex D by needed codes

DICOM Code Definitions (Coding Scheme Designator "DCM" Coding Scheme Version "01")

Code Value	Code Meaning	Definition	Notes
...			
113720	<u>Calibration Protocol</u>	<u>Describes the method used to derive the calibration factor.</u>	
...			

6) PS 3.16 2011+ CP 1077: Amend new TID 10003b to include new content items

**TID 10003b
IRRADIATION EVENT X-RAY SOURCE DATA
Type: Extensible**

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		CONTAINS	NUM	EV (113738, DCM, "Dose (RP)")	1	MC	IF TID (10001) Row 2 = (113704, DCM, "Projection X-Ray") AND any of the values of TID (10001) Row 14 are not (113858, DCM, "MPPS Content")	Units = EV (Gy, UCUM, "Gy")
...								
22		CONTAINS	NUM	EV (113790, DCM, "Collimated Field Area")	1	U		Units = EV (m2, UCUM, "m^2")
22 b		<u>CONTAINS</u>	<u>NUM</u>	<u>EV (113788, DCM, "Collimated Field Height")</u>	<u>1</u>	<u>U</u>		<u>Units = (mm, UCUM, "mm")</u>
22 c		<u>CONTAINS</u>	<u>NUM</u>	<u>EV (113789, DCM, "Collimated Field Width")</u>	<u>1</u>	<u>U</u>		<u>Units = (mm, UCUM, "mm")</u>
23		CONTAINS	CODE	EV (111635, DCM, "X-Ray Grid")	1-n	U		DCID (10017) X-Ray Grid
24		CONTAINS	INCLUDE	DTID (1021) Device Participant	1	M		\$DeviceProcedureRole = EV (113859, DCM, "Irradiating Device")

Content Item Descriptions

Row 1	Dose applied by this irradiation event, relative to defined reference point.
Row 6	If a precise count of pulses is not available, an estimated number shall be provided, and the Row 7 Concept Modifier shall indicate "Estimated"
Row 8	Pulse width as measured/recorded by the system, either as a single total value, or as multiple values. If multiple values are provided, their number shall match the value in Row 6 "Number of Pulses".
Row 10	KVP value as measured/recorded by system, either as a single mean value, or as multiple values. If multiple values are provided, their number shall match the value in Row 6 "Number of Pulses".
Row 11	Tube current as measured/recorded by system, either as a single mean value, or as multiple values. If multiple values are provided, their number shall match the value in Row 6 "Number of Pulses".
Row 13	Exposure time as measured/recorded by the system.
Row 14	Exposure as measured/recorded by system, either as a single total value, or as multiple values. If multiple values are provided, their number shall match the value in Row 6 "Number of Pulses". The Exposure will be affected by the shape of the pulse and other factors, and may not be a simple multiplication of tube current and exposure time.
Row 17	If one or more Filter(s) were applied during this irradiation event
Row 22	Collimated area at the receptor plane.

Row 24	The device which produced the irradiation in this Irradiation Event. I.e. the X-Ray source.

6) PS 3.16 2011: Amend Annex D by needed codes

DICOM Code Definitions (Coding Scheme Designator “DCM” Coding Scheme Version “01”)

Code Value	Code Meaning	Definition	Notes
...			
<u>113788</u>	<u>Collimated Field Height</u>	<u>Distance between the collimator blades in pixel column direction as projected at the detector plane.</u>	
<u>113789</u>	<u>Collimated Field Width</u>	<u>Distance between the collimator blades in pixel row direction as projected at the detector plane.</u>	
...			

7) PS 3.16 2011: Amend CID 10008 by three codes for table END positions

CID 10008 Dose Related Distance Measurements

Context ID 10008

Dose Related Distance Measurements

Type: Extensible Version: ~~20051404~~20131010

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
...		
<u>DCM</u>	<u>113759</u>	<u>Table Longitudinal End Position</u>
<u>DCM</u>	<u>113760</u>	<u>Table Lateral End Position</u>
<u>DCM</u>	<u>113761</u>	<u>Table Height End Position</u>

7) PS 3.16 2011: Amend Annex D by needed codes

DICOM Code Definitions (Coding Scheme Designator “DCM” Coding Scheme Version “01”)

Code Value	Code Meaning	Definition	Notes
...			
<u>113759</u>	<u>Table Longitudinal End Position</u>	<u>Table Longitudinal Position at the end of an irradiation event. See (113751,DCM,“Table Longitudinal Position”)</u>	
<u>113760</u>	<u>Table Lateral End</u>	<u>Table Lateral Position at the end</u>	

	<u>Position</u>	<u>of an irradiation event. See (113752,DCM,"Table Lateral Position")</u>	
<u>113761</u>	<u>Table Height End Position</u>	<u>Table Height Position at the end of an irradiation event. See (113753,DCM,"Table Height Position")</u>	

8) PS 3.3 2011: Correct section C.7.6.1.1.7

C.7.6.1.1.7 Irradiation Event UID

An irradiation event is the ~~occurrence of radiation being applied to a patient in single continuous time-frame between the start (release) and the stop (cease) of the irradiation loading of X-Ray equipment caused by a single continuous actuation of the equipment's irradiation switch, from the start of the loading time of the first pulse until the loading time trailing edge of the final pulse.~~
 Any on-off switching of the irradiation source during the event shall not be treated as separate events, rather the event includes the time between start and stop of irradiation as triggered by the user. E.g., a pulsed fluoro X-Ray acquisition shall be treated as a single irradiation event.

8) PS 3.16 2011: Correct intro text for TID 10003

TID 10003 Irradiation Event X-Ray Data

This template conveys the dose and equipment parameters of a single irradiation event.

An irradiation event is the ~~occurrence of radiation being applied to a patient in single continuous time-frame between the start (release) and the stop (cease) of the irradiation loading of X-Ray equipment caused by a single continuous actuation of the equipment's irradiation switch, from the start of the loading time of the first pulse until the loading time trailing edge of the final pulse.~~
 The irradiation event is the "smallest" information entity to be recorded in the realm of Radiation Dose reporting. Individual Irradiation Events are described by a set of accompanying physical parameters that are sufficient to understand the "quality" of irradiation that is being applied. This set of parameters may be different for the various types of equipment that are able to create irradiation events. Any automatic on-off switching of the irradiation source during the event shall not be treated as separate events, rather the event includes the time between start and stop of irradiation as triggered by the user. E.g., a pulsed fluoro X-Ray acquisition shall be treated as a single irradiation event.

8) PS 3.16 2011: Correct intro text for TID 10013

TID 10013 CT Irradiation Event Data

This template conveys the dose and equipment parameters of a single irradiation event.

A CT irradiation event is the ~~occurrence of irradiation being applied to a patient in single continuous time-frame between the start (release) and the stop (cease) of the irradiation loading of X-Ray equipment caused by a single continuous actuation of the equipment's irradiation switch, from the start of the loading time of the first pulse until the loading time trailing edge of the final pulse.~~
 Any on-off switching of the radiation source during the event shall not be treated as separate events; rather the event includes the time between start and stop of radiation as triggered by the user, e.g., a single sequence of scanning comprised of multiple slices acquired with successive tube rotations and table increments shall be treated as a single irradiation event. Depending on the examination workflow and the anatomical target region the CT irradiation event data may split into multiple instances of this template for better dose estimation. The irradiation event is the "smallest" information entity to be recorded in the realm of Radiation Dose reporting. Individual Irradiation Events are described by a set of accompanying physical parameters that are sufficient to understand the "quality" of irradiation that is

being applied. This set of parameters may be different for the various types of equipment that are able to create irradiation events.

8) PS 3.16 2011: Correct definition in Annex D table

...			
113852	Irradiation Event	<p>An irradiation event is the occurrence of radiation being applied to a patient in a single continuous time-frame between the start (release) and the stop (cease) of the irradiation<u>loading of X-Ray equipment caused by a single continuous actuation of the equipment's irradiation switch, from the start of the loading time of the first pulse until the loading time trailing edge of the final pulse.</u> Any automatic on-off switching of the irradiation source during the event is not treated as separate events, rather the event includes the time between start and stop of irradiation as triggered by the user. E.g., a pulsed fluoro X-Ray acquisition shall be treated as a single irradiation event.</p>	
...			

8) PS 3.17 2011: Correct intro in Annex AA

AA.2 DEFINITIONS

Irradiation Event

An irradiation event is the ~~occurrence of radiation being applied to a patient in single continuous time-frame between the start (release) and the stop (cease) of the irradiation~~loading of X-Ray equipment caused by a single continuous actuation of the equipment's irradiation switch, from the start of the loading time of the first pulse until the loading time trailing edge of the final pulse.

The irradiation event is the "smallest" information entity to be recorded in the realm of Radiation Dose reporting. Individual Irradiation Events are described by a set of accompanying physical parameters that are sufficient to understand the "quality" of irradiation that is being applied. This set of parameters may be different for the various types of equipment that are able to create irradiation events. Any on-off switching of the irradiation source during the event is not treated as separate events, rather the event includes the time between start and stop of irradiation as triggered by the user. E.g., a pulsed fluoro X-Ray acquisition is treated as a single irradiation event.

9) PS 3.17 2011: Add Filter Type to CID 10007

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
<u>DCM</u>	<u>113653</u>	<u>Flat filter</u>
...		

9) PS 3.16 2011: Amend Annex D by needed codes

DICOM Code Definitions (Coding Scheme Designator “DCM” Coding Scheme Version “01”)

Code Value	Code Meaning	Definition	Notes
...			
113650	Strip Filter	Filter with uniform thickness.	
<u>113653</u>	<u>Flat filter</u>	<u>Filter with uniform thickness that is for spectral filtering only (e.g. filter out low energy portion of the X-Ray that would only contribute to skin dose, but not to image)</u>	
...			