DICOM Correction Item

Correction Number CP-687	
Log Summary: Dose Reporting for Mammography	
Type of Modification Addition	Name of Standard DICOM PS 3.16 2007

Rationale for Correction:

When the Diagnostic X-Ray Radiation Dose Reporting SOP Class was under development, input was requested from the mammography working group (WG 15), but the supplement proceeded through public comment and letter ballot during a time span where WG 15 did not meet. WG 15 has reviewed the final text of Supplement 94 as incorporated into DICOM 2006, and is proposing additions to the template structure to accommodate dose reporting for mammography.

Penny Butler (Senior Director, Breast Imaging Accreditation Programs & physicist) of the ACR was involved in the development of this correction proposal.

Sections of documents affected

PS 3.16, Annex A, Annex B, Annex D

Correction Wording:

See below.

Add to Annex A, TID 10001 content item description as follows:

TID 10001 Projection X-Ray Radiation Dose

This template defines a container (the root) with subsidiary content items, each of which represents a single projection X-Ray irradiation event entry or plane-specific dose accumulations. There is a defined recording observer (the system or person responsible for recording the log, generally the system). A Biplane irradiation event will be recorded as two individual events, one for each plane. Accumulated values will be kept separate for each plane.

TID 10001
PROJECTION X-RAY RADIATION DOSE
Type: Extensible

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (113701, DCM, “X-Ray Radiation Dose Report”)	1	M		
2	>	HAS CONCEPT MOD	CODE	EV (121058, DCM, ”Procedure reported”)	1	M		DT (113704, DCM, “Projection X-Ray”) **DT (111409, DCM, “Digital Mammography”)**
3	>		INCLUDE	DTID (1002) Observer Context	1-n	M		
4	>	HAS OBS CONTEXT	CODE	EV (113705, DCM, “Scope of Accumulation”)	1	M		DCID (10000) Scope of Accumulation
5	>>	HAS PROPERTIES	UIDREF	DCID (10001) UID Types	1	M		
6	>	CONTAINS	TEXT	EV (113780, DCM,	1	U		

				"Reference Point Definition")				
7	>	CONTAINS	INCLUDE	DTID (10002) Accumulated X-Ray Dose	1	MC	IFF Single Plane system	$Plane = EV (113622, DCM, "Single Plane"
8	>	CONTAINS	INCLUDE	DTID (10002) Accumulated X-Ray Dose	1	MC	IFF Biplane system	$Plane = EV (113620, DCM, "Plane A")
9	>	CONTAINS	INCLUDE	DTID (10002) Accumulated X-Ray Dose	1	MC	IFF Biplane system	$Plane = EV (113621, DCM, "Plane B")
10	>	CONTAINS	INCLUDE	DTID (10003) Irradiation Event X-Ray Data	1-n	M		
11	>	CONTAINS	TEXT	EV (121106, DCM, "Comment")	1	U		

Content Item Descriptions

Row 3	The observer context may include both a Person Observer identification, as well as the identity of the equipment providing the values for the irradiation event (Device Observer identification), if not inherited.
Row 6	This item defines the Reference Point (RP) used for RP-related dose values. The RP may be defined according to IEC 60601-2-43, or may use an implementation-specific definition. **A typical reference point for digital mammography is: "Entrance exposure to a 4.2-cm breast thickness"**

Modify Annex A, TID 10002 as follows:

TID 10002 Accumulated X-Ray Dose

This general template provides detailed information on projection X-Ray dose value accumulations over several irradiation events from the same equipment (typically a study or a performed procedure step).

Parameter Name	Parameter Usage
$Plane	Coded term identifying to which acquisition plane the encoded information belongs.

TID 10002
ACCUMULATED X-RAY DOSE
Type: Extensible

	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	TEXT	EV (113780, DCM, "Reference Point Definition")	1	U		
4	>	CONTAINS	CONTAINER	EV (122505, DCM, "Calibration")	1	M		
5	>>	HAS CONCEPT MOD	CODE	EV (113794, DCM, "Dose Measurement Device")	1-n	M		DCID (10010) Dose Measurement Devices
6	>>	CONTAINS	DATETIME	EV (113723, DCM, "Calibration Date")	1	M		
7	>>	CONTAINS	NUM	EV (122322, DCM, "Calibration Factor")	1	M		Units = EV (1, UCUM, "no units")

8	>>	CONTAINS	NUM	EV (113763, DCM, "Calibration Uncertainty")	1	M		Units = EV (%, UCUM, "Percent")
9	>>	CONTAINS	TEXT	EV (113724, DCM, "Calibration Responsible Party")	1	M		
10	**>**	**CONTAINS**	**INCLUDE**	**DTID (10004) Accumulated Projection X-Ray Dose**	**1**	**MC**	**XOR row 11, IFF TID (10001) Row 2 = (113704, DCM, "Projection X-Ray")**	
11	**>**	**CONTAINS**	**INCLUDE**	**DTID (10005) Accumulated Mammography X-Ray Dose**	**1**	**MC**	**XOR row 10, IFF TID (10001) Row 2 = (111409, DCM, "Digital Mammography")**	
~~10~~	~~>~~	~~CONTAINS~~	~~NUM~~	~~EV (113722, DCM, "Dose Area Product Total")~~	~~1~~	~~M~~		~~Units = EV (Gym2, UCUM, "Gym2")~~
~~11~~	~~>~~	~~CONTAINS~~	~~NUM~~	~~EV (113725, DCM, "Dose (RP) Total")~~	~~1~~	~~M~~		~~Units = EV (Gy, UCUM, "Gy")~~
~~12~~	~~>~~	~~CONTAINS~~	~~NUM~~	~~EV (113726, DCM, "Fluoro Dose Area Product Total")~~	~~1~~	~~MC~~	~~IFF TID(10003) Row 3 value = (P5-06000, SRT, "Fluoroscopy") for at least one irradiation event~~	~~Units = EV (Gym2, UCUM, "Gym2")~~
~~13~~	~~>~~	~~CONTAINS~~	~~NUM~~	~~EV (113728, DCM, "Fluoro Dose (RP) Total")~~	~~1~~	~~MC~~	~~IFF TID(10003) Row 3 value = (P5-06000, SRT, "Fluoroscopy") for at least one irradiation event~~	~~Units = EV (Gy, UCUM, "Gy")~~
~~14~~	~~>~~	~~CONTAINS~~	~~NUM~~	~~EV (113730, DCM, "Total Fluoro Time")~~	~~1~~	~~MC~~	~~IFF TID(10003) Row 3 value = (P5-06000, SRT, "Fluoroscopy") for at least one irradiation event.~~	~~Units = EV (s, UCUM, "s")~~
~~15~~	~~>~~	~~CONTAINS~~	~~NUM~~	~~EV (113727, DCM, "Acquisition Dose Area Product Total")~~	~~1~~	~~M~~		~~Units = EV (Gym2, UCUM, "Gym2")~~
~~16~~	~~>~~	~~CONTAINS~~	~~NUM~~	~~EV (113729, DCM, "Acquisition Dose (RP) Total")~~	~~1~~	~~M~~		~~Units = EV (Gy, UCUM, "Gy")~~
~~17~~	~~>~~	~~CONTAINS~~	~~NUM~~	~~EV (113731, DCM, "Total Number of Radiographic Frames")~~	~~1~~	~~U~~		~~Units = EV (1, UCUM, "no units")~~

Content Item Descriptions

Row 3	Reference Point definition if not provided in TID 10001**. A typical reference point for digital mammography is: "Entrance exposure to a 4.2-cm breast thickness"**
Row 4	Date that the calibration of the equipment's dose indicators was performed
Row 7	Factor by which the measured dose area product total was multiplied to obtain the Dose Area Product Total (Row 10).
Row 8	Value range from 0 to 100 percent. Uncertainty of the 'actual' value expressed as +/- of the mean.
Row 9	Identifies Individual or organization responsible for calibration
~~Row 10~~	~~Sum of acquisition and fluoroscopy~~
~~Row 11~~	~~Sum of acquisition and fluoroscopy, relative to reference point.~~
~~Rows 12-14~~	~~Fluoroscopic component only~~
~~Rows 15-16~~	~~Acquisition component only~~

Add TID 10002: rows 1-9 OK, then make 2 child templates: 1 with existing rows 10-n, other with 3 rows: Accumulated Average Glandular Dose, Anatomy, Laterality

Add to Annex A, TID 10003 as follows:

TID 10003
IRRADIATION EVENT X-RAY DATA
Type: Extensible

	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		
2	>	HAS CONCEPT MOD	CODE	EV (113764, DCM, "Acquisition Plane"	1	M		DCID (10003) Equipment Plane Identification
3	>	CONTAINS	CODE	EV (113721, DCM, "Irradiation Event Type")	1	M		DCID (10002) Irradiation Event Types
4	>	CONTAINS	TEXT	EV (125203, DCM, "Acquisition Protocol")	1	U		
5	**>**	**CONTAINS**	**CODE**	**EV (T-D0005, SRT, "Anatomical structure")**	**1**	**U**		
6	**>>**	**HAS CONCEPT MOD**	**CODE**	**EV (G-C171, SRT, "Laterality")**	**1**	**UC**	**If anatomy is bi-lateral**	**DCID (244) Laterality**
~~5~~**7**	>	CONTAINS	TEXT	EV (113780, DCM, "Reference Point Definition")	1	U		
~~6~~**8**	>	CONTAINS	IMAGE	EV (113795, DCM, "Acquired Image")	1-n	MC	IFF Image Object is created for this irradiation event	
~~7~~**9**	>	CONTAINS	UIDREF	EV (113769, DCM, "Irradiation Event UID")	1	M		
~~8~~**10**	>	CONTAINS	NUM	EV (122130, DCM, "Dose Area Product"	1	M**C**	**XOR Row 11, IFF TID (10001) Row 2 = (113704, DCM, "Projection X-Ray")**	Units = EV (Gym2, UCUM, "Gym2")
11	**>**	**CONTAINS**	**NUM**	**EV (CP-687-1, 99CP687, "Average Glandular Dose")**	**1**	**MC**	**XOR Row 10, IFF TID (10001) Row 2 = (111409, DCM, "Digital Mammography")**	**Units = EV (dGy, UCUM, "dGy"**
~~9~~**12**	>	CONTAINS	NUM	EV (113738, DCM, "Dose (RP)")	1	M**C**	**XOR Row 13, IFF TID (10001) Row 2 = (113704, DCM, "Projection X-Ray")**	Units = EV (Gy, UCUM, "Gy")
13	**>**	**CONTAINS**	**NUM**	**EV (CP-687-6, 99CP687, "Entrance Exposure at RP")**	**1**	**MC**	**XOR Row 12, IFF TID (10001) Row 2 = (111409, DCM, "Digital Mammography")**	**Units = EV (mGy, UCUM, "mGy")**
1~~0~~**4**	>	CONTAINS	NUM	EV (112011, DCM, "Positioner Primary Angle")	1	UC	XOR Row 1~~4~~**8**	Units = EV (deg, UCUM, "°")
1~~1~~**5**	>	CONTAINS	NUM	EV (112012, DCM, "Positioner	1	UC	XOR Row 1~~4~~**8**	Units = EV (deg, UCUM, "°")

				Secondary Angle")				
12 **6**	>	CONTAINS	NUM	EV (113739, DCM, "Positioner Primary End Angle"	1	UC	IFF Row 3 value = (113613, DCM, "Rotational Acquisition")	Units = EV (deg, UCUM, "°")
13 **7**	>	CONTAINS	NUM	EV (113740, DCM, "Positioner Secondary End Angle"	1	UC	IFF Row 3 value = (113613, DCM, "Rotational Acquisition")	Units = EV (deg, UCUM, "°")
14 **8**	>	CONTAINS	NUM	EV (113770, DCM, "Column Angulation")	1	UC	XOR Rows 10**4**,11**5**	Units = EV (deg, UCUM, "°")
15 **9**	>	CONTAINS	NUM	EV (113790, DCM, "Collimated Field Area"	1	U		Units = EV (m2, UCUM, "m^2")
16 **20**	>	CONTAINS	CONTAINER	EV (113771, DCM, "X-Ray Filters")	1-n	U		
17 **21**	>>	CONTAINS	CODE	EV (113772, DCM, "X-Ray Filter Type")	1	U		DCID (10007) X-Ray Filter Types
18 **22**	>>	CONTAINS	CODE	EV (113757, DCM, "X-Ray Filter Material")	1	U		DCID (10006) X-Ray Filter Materials
19 **23**	>>	CONTAINS	NUM	EV (113758, DCM, "X-Ray Filter Thickness Minimum")	1	U		Units = EV (mm, UCUM, "mm")
20 **4**	>>	CONTAINS	NUM	EV (113773, DCM, "X-Ray Filter Thickness Maximum")	1	U		Units = EV (mm, UCUM, "mm")
21 **5**	>	CONTAINS	CODE	EV (113732, DCM, "Fluoro Mode")	1	UC	IFF Row 3 value = (P5-06000, SRT, "Fluoroscopy")	DCID (10004) Fluoro Modes
22 **6**	>	CONTAINS	NUM	EV (113791, DCM, "Pulse Rate")	1	MC	IFF Row 21**5** value = (113631, DCM, "Pulsed")	Units = EV ({pulse}/s, UCUM, "pulse/s")
23 **7**	>	CONTAINS	NUM	EV (113768, DCM, "Number of Pulses")	1	M		Units = EV (1, UCUM, "no units")
24 **8**	>>	HAS CONCEPT MOD	CODE	EV (121401, DCM, "Derivation")	1	MC	IFF count of pulses in Row 23**7** is estimated	EV (R-10260, SRT, "Estimated")
25 **9**	>	CONTAINS	NUM	EV (113733, DCM, "KVP")	1-n	U		Units = EV (kV, UCUM, "kV")
26 **30**	>	CONTAINS	NUM	EV (113734, DCM, "X-Ray Tube Current")	1-n	U		Units = EV (mA, UCUM, "mA")
27 **31**	>	CONTAINS	NUM	EV (113735, DCM, "Exposure Time")	1	U		Units = EV (ms, UCUM, "ms")
28 **32**	>	CONTAINS	NUM	EV (113793, DCM, "Pulse Width")	1-n	U		Units = EV (ms, UCUM, "ms")
29 **33**	>	CONTAINS	NUM	EV (113736, DCM, "Exposure")	1-n	U		Units = EV (uAs, UCUM, "uAs")
30 **4**	>	CONTAINS	NUM	EV (113766, DCM, "Focal Spot Size")	1	U		Units = EV (mm, UCUM, "mm")
31 **5**	>	CONTAINS	NUM	EV (113742, DCM, "Irradiation Duration")	1	U		Units = EV (s, UCUM, "s")
32 **6**	>	CONTAINS	NUM	EV (113767, DCM, "Average X-Ray Tube Current")	1	U		Units = EV (mA, UCUM, "mA")
33 **7**	>	CONTAINS	CODE	EV (113745, DCM, "Patient Table Relationship")	1	U		DCID (21) Patient Gantry Relationship

3~~4~~ **8**	>	CONTAINS	CODE	EV (113743, DCM, "Patient Orientation")	1	U		DCID (19) Patient Orientation
3~~5~~ **9**	>>	HAS CONCEPT MOD	CODE	EV (113744, DCM, "Patient Orientation Modifier")	1	M		DCID (20) Patient Orientation Modifier
~~36~~ **40**	>	CONTAINS	NUM	DCID (10008) Dose Related Distance Measurements	1-n	U		Units = EV (mm, UCUM, "mm")
~~37~~ **41**	>	CONTAINS	NUM	EV (113754, DCM, "Table Head Tilt Angle")	1	U		Units = EV (deg, UCUM, "o")
~~38~~ **42**	>	CONTAINS	NUM	EV (113755, DCM, "Table Horizontal Rotation Angle")	1	U		Units = EV (deg, UCUM, "o")
~~39~~ **43**	>	CONTAINS	NUM	EV (113756, DCM, "Table Cradle Tilt Angle")	1	U		Units = EV (deg, UCUM, "o")
4~~0~~ **4**	>	CONTAINS	CODE	EV (123014 , DCM, ("Target Region")	1	U		DCID (4031) Common Anatomic Regions
45	**>**	**CONTAINS**	**CODE**	**EV (CP-687-2, 99CP687, "Anode Target Material"**	**1**	**U**		**DCID (Cxx1) Anode Target Material**
46	**>**	**CONTAINS**	**NUM**	**EV (CP-687-3, 99CP687, "Compression Thickness")**	**1**	**U**		**Units = (mm, UCUM, "millimeter")**
47	**>**	**CONTAINS**	**NUM**	**EV (CP-687-4, 99CP687, "Half Value Layer")**	**1**	**U**		**Units = (mm, UCUM, "millimeter")**
48	**>**	**CONTAINS**	**CODE**	**EV (CP-687-5, "X-Ray Grid")**	**1-n**	**U**		**DCID (Cxx2) X-Ray Grid**
49	**>**	**CONTAINS**	**CODE**	**EV (F-01710, SRT, "Breast composition")**	**1**	**U**		**DCID (6000) Overall Breast Composition**
~~41~~ **50**	>	CONTAINS	TEXT	EV (121106, DCM, "Comment")	1	U		

Content Item Descriptions

Row 5	Reference Point definition if not provided in TID 10001**. A typical reference point for digital mammography is: "Entrance exposure to a 4.2-cm breast thickness"**

Add to Annex A the following new templates:

TID 10004 Accumulated Projection X-Ray Dose

This general template provides detailed information on projection X-Ray dose value accumulations over several irradiation events from the same equipment (typically a study or a performed procedure step).

TID 10004
ACCUMULATED PROJECTION X-RAY 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 (Gym2, UCUM, "Gym2")

2			NUM	EV (113725, DCM, “Dose (RP) Total”)	1	M		Units = EV (Gy, UCUM, “Gy”)
3			NUM	EV (113726, DCM, “Fluoro Dose Area Product Total”)	1	MC	IFF TID(10003) Row 3 value = (P5-06000, SRT, “Fluoroscopy”) for at least one irradiation event	Units = EV (Gym2, UCUM, “Gym2”)
4			NUM	EV (113728, DCM, “Fluoro Dose (RP) Total”)	1	MC	IFF TID(10003) Row 3 value = (P5-06000, SRT, “Fluoroscopy”) for at least one irradiation event	Units = EV (Gy, UCUM, “Gy”)
5			NUM	EV (113730, DCM, “Total Fluoro Time”)	1	MC	IFF TID(10003) Row 3 value = (P5-06000, SRT, “Fluoroscopy”) for at least one irradiation event.	Units = EV (s, UCUM, “s”)
6			NUM	EV (113727, DCM, “Acquisition Dose Area Product Total”)	1	M		Units = EV (Gym2, UCUM, “Gym2”)
7			NUM	EV (113729, DCM, “Acquisition Dose (RP) Total”)	1	M		Units = EV (Gy, UCUM, “Gy”)
8			NUM	EV (113731, DCM, “Total Number of Radiographic Frames”)	1	U		Units = EV (1, UCUM, “no units”)

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 6-7	Acquisition component only

TID 10005 Accumulated Mammography X-Ray Dose

This modality specific template provides detailed information on mammography X-Ray dose value accumulations over several irradiation events from the same equipment (typically a study or a performed procedure step).

TID 10005
ACCUMULATED MAMMOGRAPHY X-RAY DOSE
Type: Extensible

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			NUM	EV (CP-687-7, DCM, “Accumulated Average Glandular Dose")	1-2	M		Units = EV (dGy, UCUM, “dGy”
2	>	HAS CONCEPT MOD	CODE	EV (G-C171, SRT, “Laterality")	1	M		DCID (6022) Side

Add to Annex B as follows:

CID 10002 Irradiation Event Types

Context ID 10002
Irradiation Event Types

Type: Extensible Version: 200~~51101~~ymmdd

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	P5-06000	Fluoroscopy
DCM	113611	Stationary Acquisition
DCM	113612	Stepping Acquisition
DCM	113613	Rotational Acquisition
DCM	**111409**	**Digital Mammography**

CID Cxx1 Anode Target Material

Context ID Cxx1
Anode Target Material

Type: Extensible Version: 200ymmdd

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	C-15000	Molybdenum
SRT	C-16700	Rhodium
SRT	C-16400	Tungsten

CID Cxx2 X-Ray Grid

Context ID Cxx2
X-Ray Grid

Type: Extensible Version: 200ymmdd

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99CP687	Cxx2-01	Fixed grid
99CP687	Cxx2-02	Focused grid
99CP687	Cxx2-03	Reciprocating grid
99CP687	Cxx2-04	Parallel grid
99CP687	Cxx2-05	Crossed grid
99CP687	Cxx2-06	No grid

Add to Annex D as follows:

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

Code Value	Code Meaning	Definition
CP-687-1	Average Glandular Dose	Calculated from values of entrance eposure in air, the X-ray beam quality (half-value layer), and compressed breast thickness, is the energy deposited per unit mass of glandular tissue averaged over all the glandular tissue in the breast.
CP-687-2	Anode Target Material	The primary material in the anode of an x-ray source.
CP-687-3	Compression Thickness	The average thickness of the body part examined when compressed, if compression has been applied during x-ray exposure.
CP-687-4	Half Value Layer	Thickness of Aluminum required to reduce the X-Ray output at the patient entrance surface by a factor of two.
CP-687-5	X-Ray Grid	An anti-scatter device based on radiation absorbing strips above the detector, for example in the patient support.
CP-687-6	Entrance Exposure at RP	Exposure measurement in air at the reference point that does not include back scatter, according to MQCM 1999.
CP-687-7	Accumulated Average Glandular Dose	Average Glandular Dose to a single breast accumulated over multiple images.
Cxx2-01	Fixed grid	An X-Ray Grid that does not move during exposure.
Cxx2-02	Focused grid	An X-Ray Grid with radiation absorbing strips that are focused toward the focal spot, to eliminate grid cutoff.
Cxx2-03	Reciprocating grid	An X-Ray Grid that is designed to move during exposure, to eliminate the appearance of grid lines on the image.
Cxx2-04	Parallel grid	An X-Ray Grid with radiation absorbing strips that are parallel to each other and that is used only with long source to image distances.
Cxx2-05	Crossed grid	An X-Ray Grid with crossed radation absorbing strips used for more complete cleanup of scatter radiation.
Cxx2-06	No grid	No X-Ray Grid was used due to low scatter conditions.