



Electronic recording of radiography, fluoroscopy and computed tomography dose metrics: When should they be included in the patient chart?



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Disclosures

- ▶ Member, Medical Advisory Board – Bayer Radimetrics



Presentation sequence

- **What** – what are dose metrics?
- **Why** – why record dose metrics?
- **How** – how are dose metrics recorded?
- **When** – when (if) dose metrics should be included in patient chart?

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➤ **What – what are dose metrics?**

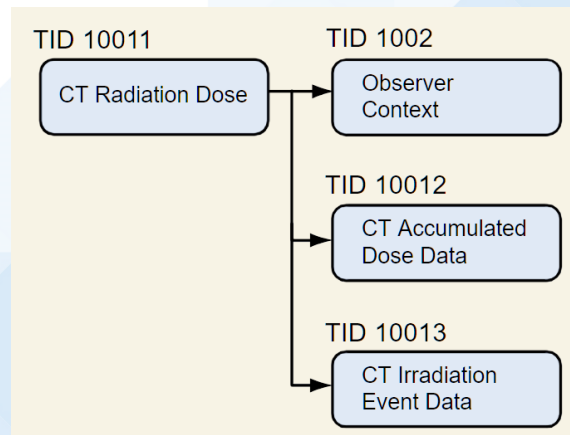
➤ **Why** – why record dose metrics?

➤ **How** – how are dose metrics recorded?

➤ **When** – when (if) dose metrics should be included in patient chart?

What are dose metrics?

- A parameter associated with the radiation dose for an exam
- May or may not represent “patient dose”
- Defined in DICOM Radiation Dose Structured Report TIDs
 - CT Radiation Dose
 - Projection X-ray Radiation Dose
 - Radiopharmaceutical Radiation Dose



Dose metrics

- Often not a dose measure
 - Exposure Index to detector
 - Deviation Index - feedback to radiographer
 - X-ray technique factors for estimating dose
 - Number of images in a sequence
- Often used in determining DRLs



IEC 62494-1

Edition 1.0 2008-08

INTERNATIONAL STANDARD

Medical electrical equipment – Exposure index of digital X-ray imaging
systems –
Part 1: Definitions and requirements for general radiography

Dose metrics

Radiography, Mammography, Fluoroscopy

- ▶ Entrance surface air kerma ($K_{a,e}$)
- ▶ Incident air kerma ($K_{a,i}$)
- ▶ Incident air kerma at reference point ($K_{a,r}$)
- ▶ Mean glandular dose (D_G)
- ▶ Kerma Area Product (P_{KA})

Dose metrics

Computed Tomography

- Volume CT Dose Index (CTDI_{vol})
- Size Specific Dose Estimate (SSDE)
- Dose Length Product (DLP)

AAPM Report No. 204



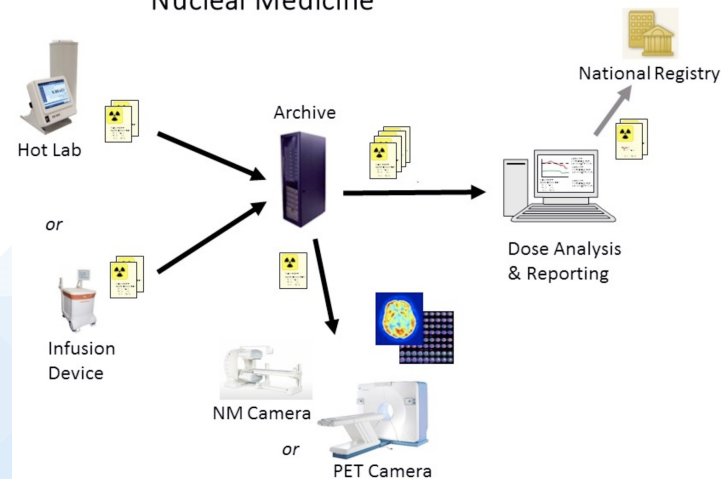
Size-Specific Dose Estimates (SSDE) in Pediatric
and Adult Body CT Examinations

Dose metrics

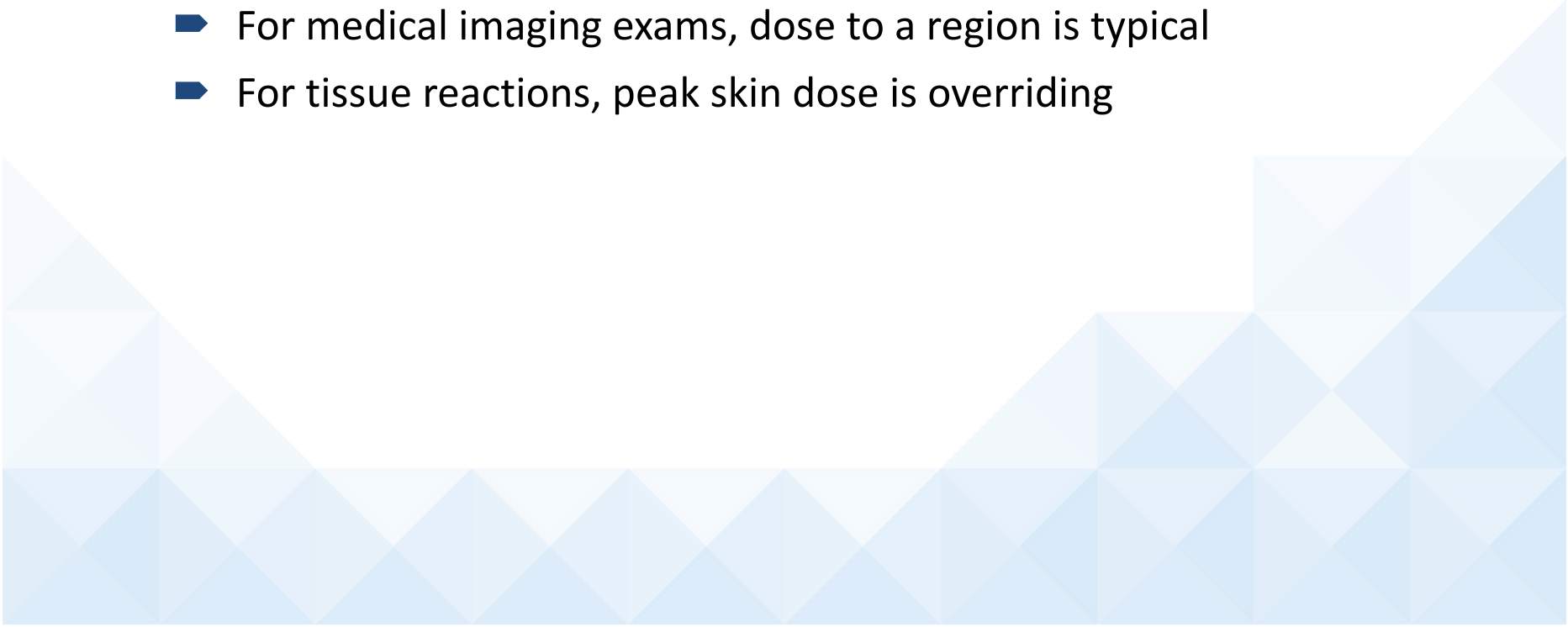
Injected Radiopharmaceuticals

- Injected radiopharmaceutical activity
- DICOM Radiopharmaceutical RDSR (R-RDSR)
- Provides estimate of effective dose
- Systems Interoperability? IHE REM-NM

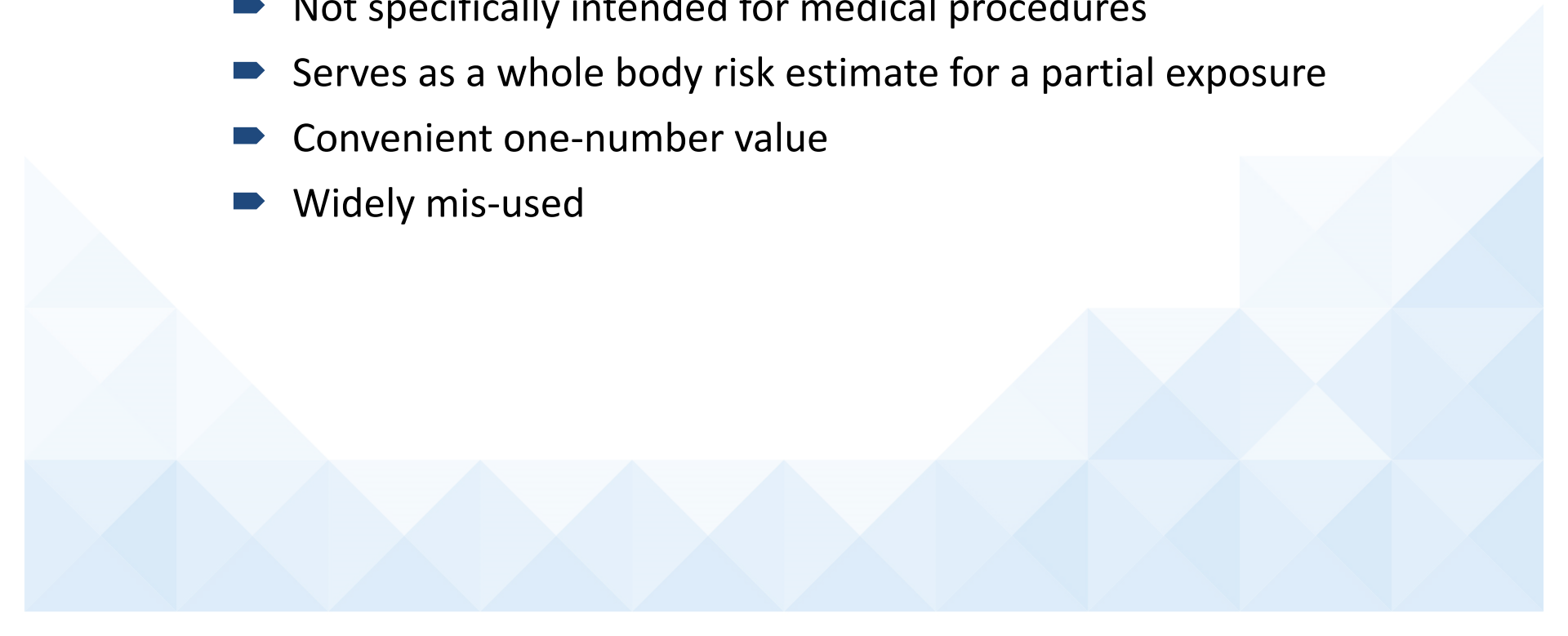
IHE Radiation Exposure Monitoring for
Nuclear Medicine



Patient Dose

- ▶ Energy imparted and absorbed in tissues and organs
 - ▶ For medical imaging exams, dose to a region is typical
 - ▶ For tissue reactions, peak skin dose is overriding
- 

Effective Dose

- Not really a “dose” but an estimate of risk
 - Not specifically intended for medical procedures
 - Serves as a whole body risk estimate for a partial exposure
 - Convenient one-number value
 - Widely mis-used
- 

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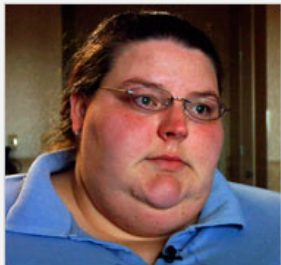
- **What** – what are dose metrics?
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Radiation Dose Monitoring

Radiation Overdoses Point Up Dangers of CT Scans

Written by Humboldt Online Editor on 16 October 2009

New York Times
Raven
Knickerbocker,
then an X-ray
technologist at
Mad River
Community
Hospital in
Arcata, Calif.,
activated a CT



Roth family

U.S. Department of Health & Human Services www.hhs.gov

FDA U.S. Food and Drug Administration

Home | Food | Drugs | Medical Devices | Vaccines, Blood & Biologics | Animal & Veterinary | Cosmetics | Radiation-Emitting Products | Tobacco Products

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Medical Devices

Home > Medical Devices > Medical Device Safety > Alerts and Notices (Medical Devices)

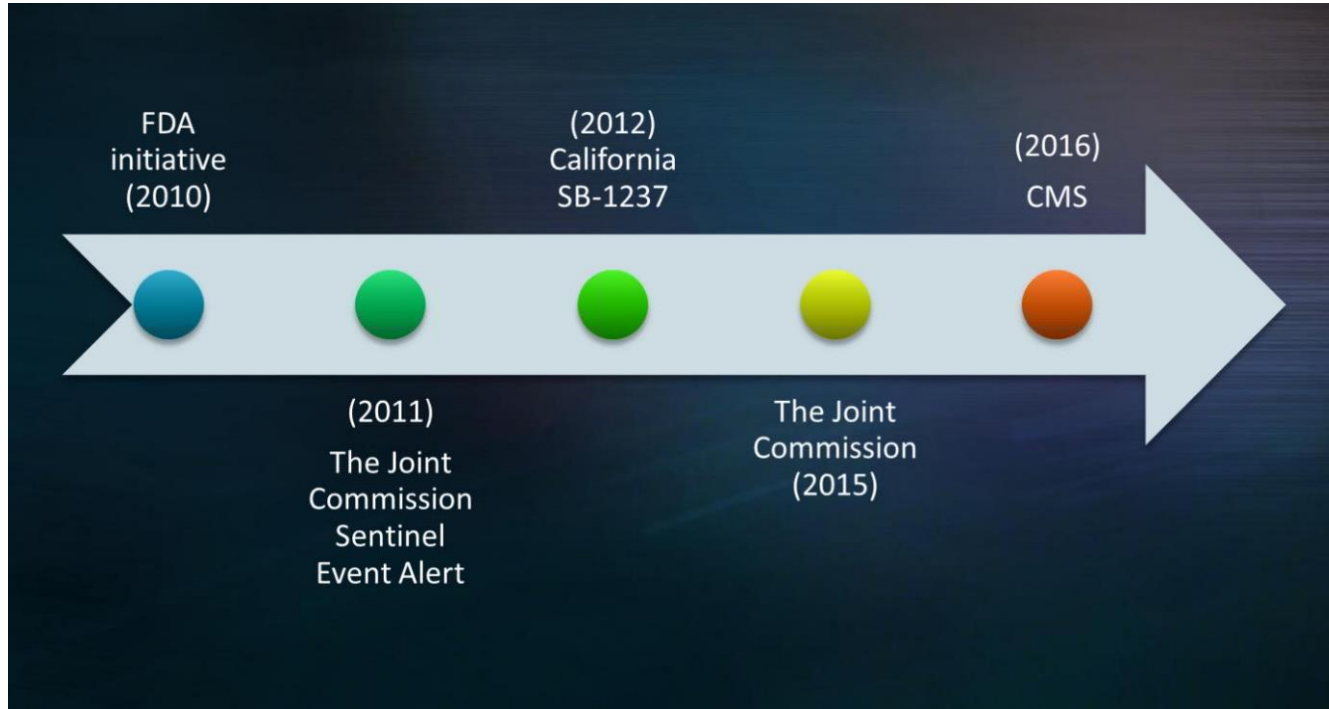
Safety Investigation of CT Brain Perfusion



► Legislation with California State Law SB-1237

Radiation Dose Monitoring

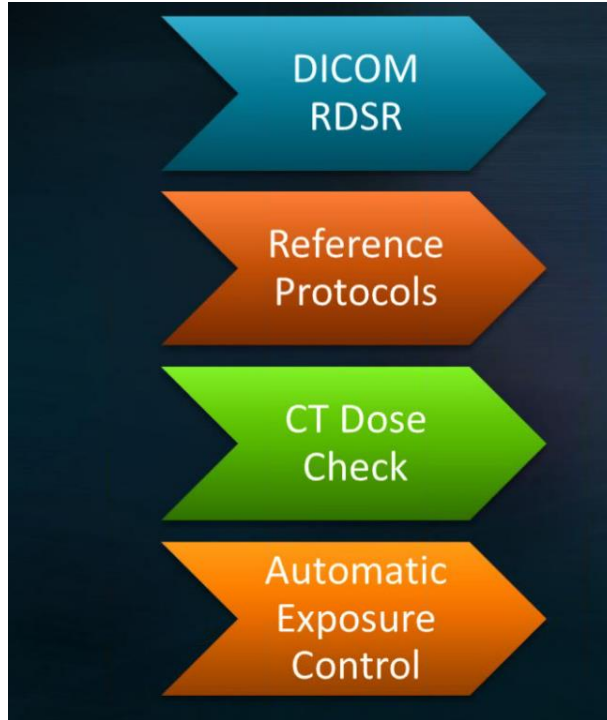
Requirements in the United States



Components of the FDA Initiative



MITA Smart Dose CT



- NEMA XR 29 – 2013
Standard attributes on CT equipment related to dose optimization & management
- PAMA – 2014
15% CMS reduction in reimbursement for non-compliant exams after January 1, 2017

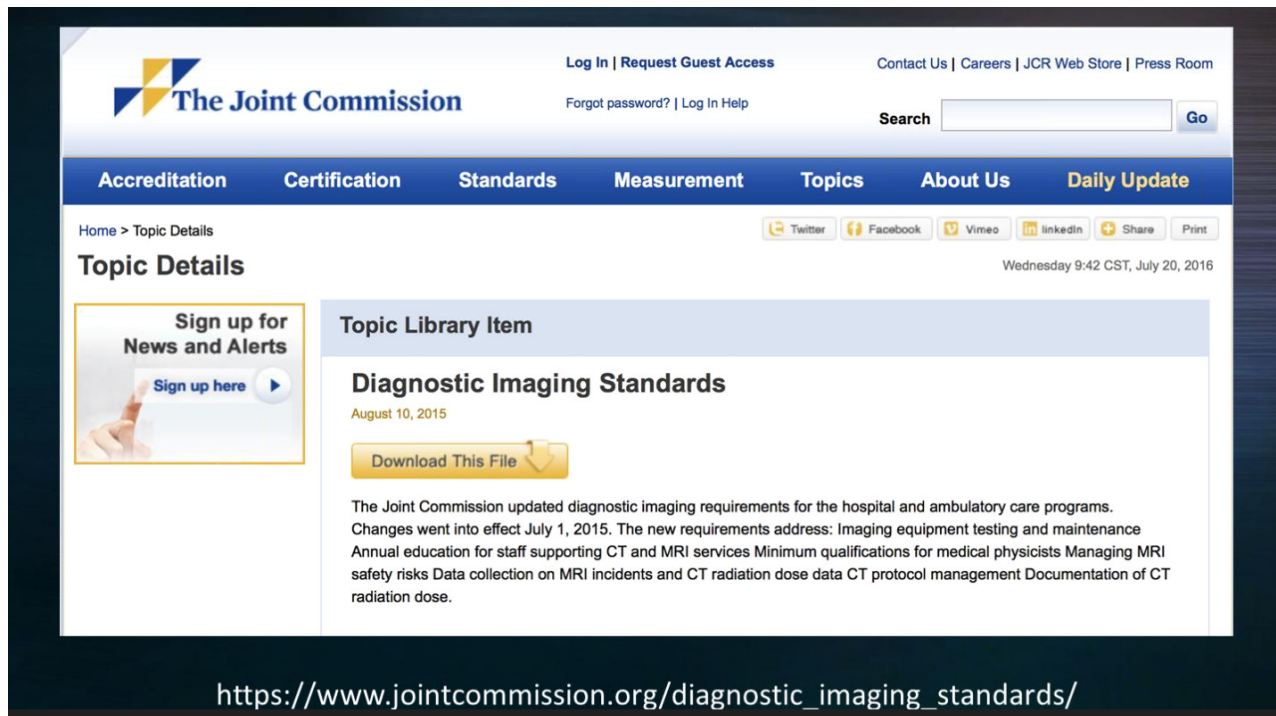
<http://www.medicalimaging.org/policy-and-positions/mita-smart-dose/mita-smart-dose-ct/>

Adapted from Tessa Cook, MD

Joint Commission Reporting Requirements

Major accreditation body for hospitals in the USA

- Recording sentinel events
- CT, PET, MRI requirements
- Interventional imaging requirements



The screenshot displays the homepage of The Joint Commission website. At the top, the logo is on the left, and navigation links for 'Log In', 'Request Guest Access', 'Contact Us', 'Careers', 'JCR Web Store', and 'Press Room' are on the right. Below the logo, there are links for 'Forgot password?' and 'Log In Help'. A search bar with a 'Go' button is also present. A blue navigation bar contains links for 'Accreditation', 'Certification', 'Standards', 'Measurement', 'Topics', 'About Us', and 'Daily Update'. Below this, a breadcrumb trail reads 'Home > Topic Details'. The main heading is 'Topic Details'. On the left, there is a 'Sign up for News and Alerts' box with a 'Sign up here' button. On the right, under 'Topic Library Item', the title 'Diagnostic Imaging Standards' is shown with a date of 'August 10, 2015'. Below this is a 'Download This File' button. The text below the button states: 'The Joint Commission updated diagnostic imaging requirements for the hospital and ambulatory care programs. Changes went into effect July 1, 2015. The new requirements address: Imaging equipment testing and maintenance Annual education for staff supporting CT and MRI services Minimum qualifications for medical physicists Managing MRI safety risks Data collection on MRI incidents and CT radiation dose data CT protocol management Documentation of CT radiation dose.' At the bottom of the screenshot, the URL 'https://www.jointcommission.org/diagnostic_imaging_standards/' is displayed.

https://www.jointcommission.org/diagnostic_imaging_standards/

California “CT Dose” Reporting Requirements

Medical Radiation Safety Act of 2010 Preventing Excessive Exposure To Radiation

SB 1237
Author:
Senator Alex Padilla

- Implemented 2010, law in effect on January 1, 2012
- Requires CTDI_{vol} and DLP to be entered into the Interpretive Report
- Requires CT systems to be accredited
- Requires dose reporting to State DPH if doses exceed stated values

USA: Merit-based Incentive Payment System - MIPS

- Driven by Centers for Medicare and Medicaid Services
- Designed to incentivize patient safety issues and lower costs
- ACR is the primary measure steward
- Relevant to this discussion:
 - Quality ID #145: Radiology: Exposure Dose or Time Reported for Procedures Using Fluoroscopy – National Quality Strategy Domain: Patient Safety

MIPS - 2018 Measure 145 - reporting requirements

- Definition: Radiation exposure indices - For this measure, radiation exposure indices should, if possible, include at least one of the following:
 1. Skin dose mapping
 2. Peak skin dose (PSD)
 3. Reference air kerma ($K_{a,r}$)
 4. Kerma-area product (P_{KA}) or Dose area product (DAP)
- Report must state what radiation quantity is being submitted - reporting dose in mGy is insufficient. Example: PSD in mGy is very different from $K_{a,r}$ in mGy.
- If fluoroscopic equipment does not provide any above indices, exposure time and number of fluorographic images taken during the procedure may be used

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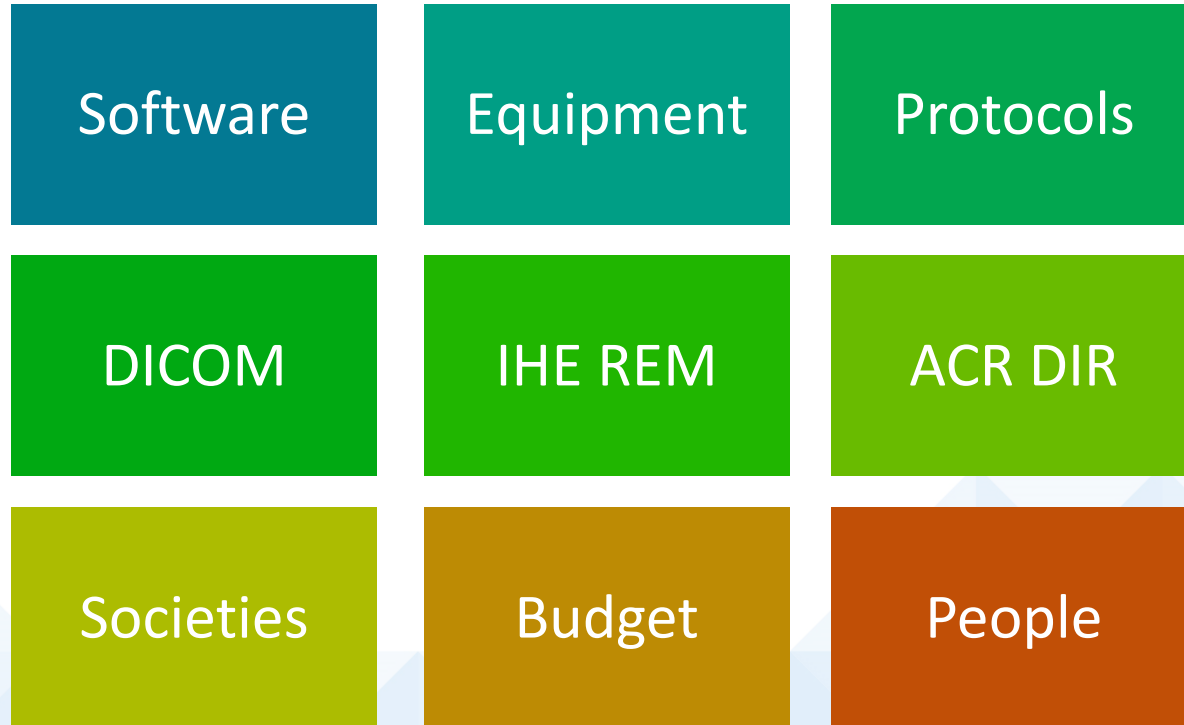


- **What** – what are dose metrics?
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How are dose metric values recorded?

- Manual recording and reporting
- Radiation Dose Management System (RDMS)
- Collection of dose metric values from imaging systems (DICOM, RDSR)
- Synthesis of radiation dose events, for example:
 - Cumulative radiation dose
 - Peak Skin Dose
- *Patient-specific?* -- Use of DICOM P-RDSR

Implementing Electronic Radiation Dose Monitoring



Adapted from Tessa Cook, MD

Automated Reporting of CT dose metrics

- Use of RDMS and system interfaces to scanner, PACS, RIS, Voice, EHR

EXAM: CT ABDOMEN + CT PELVIS, WITH CONTRAST

DATE OF STUDY: 10/9/2012 11:29 AM

CLINICAL INFORMATION: Pain(acute), location: Pelvis: Left Other,
specify: left hernia Bowel Comments:

TECHNIQUE: Helically acquired contrast enhanced multidetector CT of the abdomen and pelvis acquired in the portal venous phase, extending from the lung bases through the groins. Uneventful administration of 125 ml of Omnipaque 350 injected at a rate of 2.5 ml/sec. Images are reconstructed in the axial plane with subsequent reformatting in coronal and sagittal planes.

No P.O. contrast was administered.

DOSE REPORT: This study involved (1) CT acquisition(s). The CTDIvol and DLP values are included below as required by state law:

1; Series: 3; Abdomen; 32 cm; CTDIvol=17.7 mGy; DLP=856.7 mGy-cm

For further information on CT radiation dose, see
<http://www.ucdmc.ucdavis.edu/radiology/RadiationDose.html>

COMPARISON: None.

FINDINGS:

LOWER CHEST:

There is a calcified granuloma noted in the posterior left lung base.
The lung bases are otherwise clear.

CT dose metrics in report:
single series

Automated Reporting of CT dose metrics

- Use of RDMS and system interfaces to scanner, PACS, RIS, Voice, EHR

DATE: 10/9/2012 11:42 AM

EXAM TYPE: CT ANGIO CHEST WITH / WITHOUT CONTRAST

COMPARISON: 8/12/2011

INDICATION: History of 4-cm ectatic aorta. Follow-up CT.

TECHNIQUE: Helical scanning from the thoracic inlet through the adrenals was performed following the uneventful administration of 100 mL of Omnipaque 350 at a rate of 4.0-mL/s through a 20-gauge left antecubital vein. Reconstruction of 5-mm and 1.0 mm contiguous axial images was performed. 5-mm contiguous coronal and sagittal images and 10 mm contiguous MIP axial images were reformatted.

RADIATION DOSE:

This study involved (3) CT acquisition(s). The CTDIvol and DLP values are included below as required by state law:

1; Series: 2; Chest; 32 cm; CTDIvol=2.9 mGy; DLP=3 mGy-cm

2; Series: 3; Chest; 32 cm; CTDIvol=26.4 mGy; DLP=26 mGy-cm

3; Series: 5; Chest; 32 cm; CTDIvol=13.5 mGy; DLP=692 mGy-cm

For further information on CT radiation dose, see















<http://www.ucdmc.ucdavis.edu/radiology/RadiationDose.html>

FINDINGS:

Neck: The visualized portion of the lower neck shows normal caliber of vessels. Normal trachea. No masses.

CT dose metrics in report:
multiple series

Modalities (beyond CT)

▼  UC Davis Health System (2)
▼  UC Davis Clinics (2)
▼  UC Davis Spine Center (1)
 DX
▼  Placer Center for Health (1)
 CT
▼  UC Davis Medical Center (5)
 CT
 RF
 CT/PT
 MG
▼  XA (2)
 Interventional Radiology
 Cardiology

x469	XA Neuro IR CEREBRAL ANGIOPLASTY Performed: 12/23/2014 5:57 PM AXIOM-Artis IRMH 1627 Bi-PL	Fluoro time 7454 s	DAP 448.3 Gy-m2	Ref. Point 11007 mGy
x230	XA IR CEREBRAL ANGIOPLASTY IR CEREBRAL ANGIOPLASTY Performed: 01/13/2013 2:43 PM AXIOM-Artis IRMH 1627 Bi-PL	Fluoro time 3714.3 s	DAP 761.5 Gy-m2	Ref. Point 9213.8 mGy
x364	XA IR CAROTID CEREBRAL, BILATERAL IR CAROTID CEREBRAL, BILATERAL Performed: 06/12/2013 8:21 AM AXIOM-Artis IRMH 1627 Bi-PL	Fluoro time 5383.7 s	DAP 746.7 Gy-m2	Ref. Point 9026.7 mGy
x249	XA IR CAROTID CEREBRAL, BILATERAL IR CEREBRAL ANGIOPLASTY,IR CAROTID CEREBRAL, BILATERAL Performed: 02/05/2013 2:03 PM AXIOM-Artis IRMH 1627 Bi-PL	Fluoro time 4093.3 s	DAP 359.3 Gy-m2	Ref. Point 8046.8 mGy
x170	XA IR URETERAL EMBOLIZATION IR URETERAL EMBOLIZATION Performed: 04/18/2013 8:36 AM AXIOM-Artis IRMH 1623	Fluoro time 1128.2 s	DAP 2266.9 Gy-m2	Ref. Point 7547.5 mGy
x501	XA Neuro IR CAROTID CEREBRAL, BILATERAL Performed: 02/22/2015 9:01 AM AXIOM-Artis IRMH 1627 Bi-PL	Fluoro time 10775 s	DAP 483.6 Gy-m2	Ref. Point 7161.9 mGy
x209	XA IR CAROTID CEREBRAL, BILATERAL IR CAROTID CEREBRAL, BILATERAL Performed: 10/24/2012 8:11 AM AXIOM-Artis IRMH 1627 Bi-PL	Fluoro time 2568.1 s	DAP 332.5 Gy-m2	Ref. Point 7071.3 mGy
—	XA Unknown Protocol Unknown Procedure Code Performed: 06/06/2014 9:19 AM AlluraXper 722013-105	Fluoro time 4163 s	DAP 636.3 Gy-m2	Ref. Point 6587.8 mGy
x293	XA Neuro IR CAROTID CEREBRAL, BILATERAL Performed: 02/14/2015 10:45 AM AXIOM-Artis IRMH 1627 Bi-PL	Fluoro time 4061 s	DAP 336 Gy-m2	Ref. Point 6278 mGy
x203	XA IR CAROTID CERVICAL, BILATERAL IR CAROTID CERVICAL, BILATERAL Performed: 11/26/2014 11:36 AM AXIOM-Artis IRMH 1627 Bi-PL	Fluoro time 2195 s	DAP 522.9 Gy-m2	Ref. Point 6110.9 mGy
x208	XA IR VISCERAL, SELECTIVE IR VISCERAL, SELECTIVE Performed: 07/17/2014 11:08 AM AXIOM-Artis IRMH 1625	Fluoro time 1537 s	DAP 885.5 Gy-m2	Ref. Point 6104 mGy

Interventional RDSR



XA Neuro
IR CEREBRAL ANGIOPLASTY
Performed: 2014 5:57 PM
AXIOM Artis RMH 1627 Bi-PL



M DOB

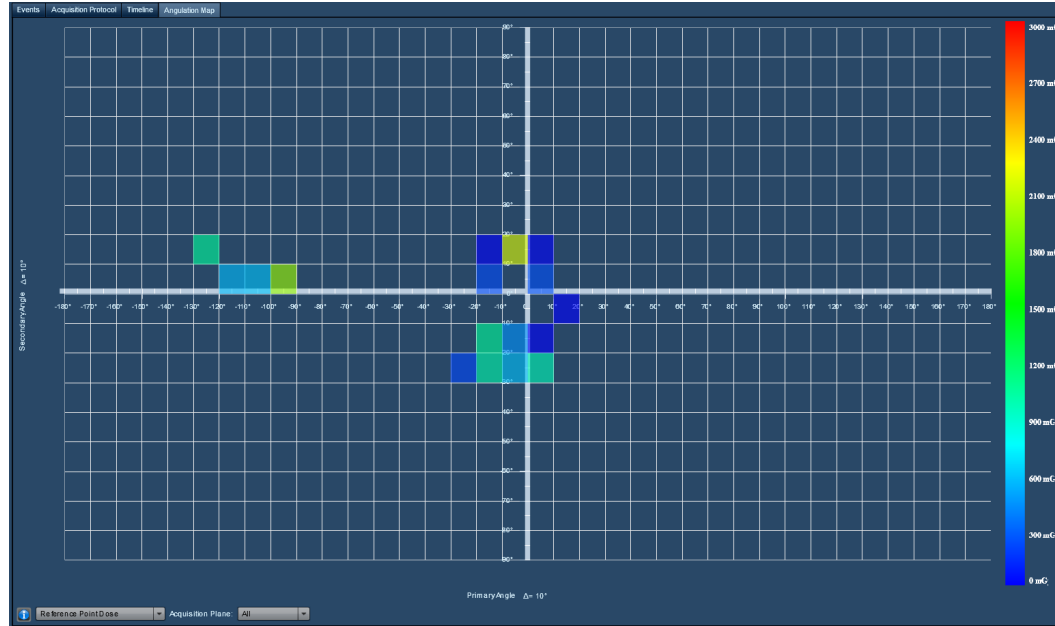
Age at Exam: 29y

Dosimetry Patient Protocols RDSR DICOM Protocol Logbook

PDF Table

Type	Protocol	DAP [mGy-cm2]	Reference Point	Reference Point L	Beam On Time [s]	kVp	mA	mAs	Start Time	Primary Angle [de]	Secondary Angle	Fluoro Mode	Pulses per Secor	Number of Pulses	Pulse Width [ms]	Focal Spot Size [mm]	Distance Source	Distance Source
Stationary Acquis	LICA	21809	15cm from Isocer	106.29	3537.3	75	159	562.43	2014-12-24 01:48	-117.8	5		4	39	90.7	0.3	1217	750
Stationary Acquis	LICA	20788	15cm from Isocer	172.59	3537.3	88	223	788.817	2014-12-24 01:48	-8.1	18.9		4	39	90.7	0.6	1200	750
Fluoroscopy	FL- Neuro	616	15cm from Isocer	5.11	3987.8	75	64.7	259.01	2014-12-24 01:47	-8.1	18.9	Pulsed	7.5	157	25.4	0.3	1200	750
Fluoroscopy	FL- Neuro	72	15cm from Isocer	0.35	527.1	70	47.8	25.089	2014-12-24 01:47	-117.8	5	Pulsed	7.5	21	25.1	0.3	1217	750
Fluoroscopy	FL- Neuro	97	15cm from Isocer	0.8	637.5	75	64.5	41.118	2014-12-24 01:47	-8.1	18.9	Pulsed	7.5	25	25.5	0.3	1200	750
Fluoroscopy	FL- Neuro	260	15cm from Isocer	1.33	2152.8	70	40.1	86.327	2014-12-24 01:46	-117.8	5	Pulsed	7.5	104	20.7	0.3	1217	750
Fluoroscopy	FL- Neuro	10	15cm from Isocer	0.33	301.2	71	65.5	19.728	2014-12-24 01:46	-117.8	5	Pulsed	7.5	12	25.1	0.3	1217	750
Fluoroscopy	FL- Neuro	613	15cm from Isocer	3.98	1447.8	75	64.7	93.672	2014-12-24 01:46	-14.3	18.9	Pulsed	7.5	57	25.4	0.3	1200	750
Fluoroscopy	FL- Neuro	425	15cm from Isocer	6.98	2359.5	90	64.7	152.594	2014-12-24 01:46	6.5	-25.6	Pulsed	7.5	89	26.5	0.3	1200	750
Fluoroscopy	FL- Neuro	240	15cm from Isocer	7.93	1569.4	104	64.8	101.383	2014-12-24 01:45	6.5	-25.6	Pulsed	7.5	59	26.6	0.3	1200	750
Fluoroscopy	FL- Neuro	738	15cm from Isocer	24.41	4867.8	104	64.8	314.469	2014-12-24 01:45	6.5	-25.6	Pulsed	7.5	183	26.6	0.3	1200	750
Fluoroscopy	FL- Neuro	204	15cm from Isocer	6.74	1330	104	64.5	65.785	2014-12-24 01:44	6.5	-25.6	Pulsed	7.5	50	26.6	0.3	1200	750
Fluoroscopy	FL- Neuro	335	15cm from Isocer	22.31	3005.8	115	64.5	193.874	2014-12-24 01:44	6.5	-25.6	Pulsed	7.5	113	26.6	0.3	1200	750
Fluoroscopy	FL- Neuro	439	15cm from Isocer	29.24	3990	115	64.5	257.365	2014-12-24 01:43	6.5	-25.6	Pulsed	7.5	150	26.6	0.3	1200	750
Fluoroscopy	FL- Neuro	712	15cm from Isocer	47.42	6394	115	64.8	412.406	2014-12-24 01:43	6.5	-25.6	Pulsed	7.5	240	26.8	0.3	1200	750
Fluoroscopy	FL- Neuro	1227	15cm from Isocer	81.69	11331.6	115	64.8	732.021	2014-12-24 01:42	6.5	-25.6	Pulsed	7.5	426	26.8	0.3	1200	750
Fluoroscopy	FL- Neuro	497	15cm from Isocer	8.17	2340.8	84	64.8	151.215	2014-12-24 01:41	5.3	-25.6	Pulsed	7.5	88	26.6	0.3	1200	750
Stationary Acquis	LICA	5934	15cm from Isocer	203.58	3174.5	99	199.3	632.677	2014-12-24 01:40	-117.8	5		4	36	90.7	0.6	1217	750
Stationary Acquis	LICA	12532	15cm from Isocer	205.97	3268.8	113	174.1	569.098	2014-12-24 01:40	5.3	-25.6		4	36	90.8	0.6	1200	750
Fluoroscopy	FL- Neuro	290	15cm from Isocer	4.76	1303.4	95	64.5	84.069	2014-12-24 01:40	5.3	-25.6	Pulsed	7.5	49	26.6	0.3	1200	750
Fluoroscopy	FL- Neuro	23	15cm from Isocer	1.25	180.6	84	65.5	11.829	2014-12-24 01:40	-117.8	5	Pulsed	7.5	7	25.8	0.3	1217	750
Fluoroscopy	FL- Neuro	83	15cm from Isocer	2.64	160.2	105	64.4	10.316	2014-12-24 01:39	5.3	-25.6	Pulsed	7.5	6	26.7	0.3	1200	750
Fluoroscopy	FL- Neuro	977	15cm from Isocer	85.07	7926.8	119	64.5	511.278	2014-12-24 01:39	5.3	-25.6	Pulsed	7.5	298	26.6	0.3	1200	750
Fluoroscopy	FL- Neuro	119	15cm from Isocer	7.93	961.2	119	64.4	61.901	2014-12-24 01:38	5.3	-25.6	Pulsed	7.5	36	26.7	0.3	1200	750
Fluoroscopy	FL- Neuro	62	15cm from Isocer	4.3	1703	86	65.6	111.716	2014-12-24 01:38	-117.8	5	Pulsed	7.5	85	26.2	0.3	1217	750
Fluoroscopy	FL- Neuro	1076	15cm from Isocer	71.63	8818.4	119	64.5	555.886	2014-12-24 01:37	5.3	-25.6	Pulsed	7.5	324	26.6	0.3	1200	750
Fluoroscopy	FL- Neuro	202	15cm from Isocer	13.98	5554.4	86	65.5	363.813	2014-12-24 01:37	-117.8	5	Pulsed	7.5	212	26.2	0.3	1217	750
Fluoroscopy	FL- Neuro	41	15cm from Isocer	2.82	348.4	119	64.1	22.332	2014-12-24 01:37	5.3	-25.6	Pulsed	7.5	13	26.8	0.3	1200	750
Fluoroscopy	FL- Neuro	378	15cm from Isocer	24.28	2899.4	118	64.5	187.011	2014-12-24 01:34	5.3	-25.6	Pulsed	7.5	109	26.6	0.3	1200	750
Fluoroscopy	FL- Neuro	50	15cm from Isocer	3.49	1414.8	85	65.5	92.689	2014-12-24 01:34	-117.8	5	Pulsed	7.5	54	26.2	0.3	1217	750
Fluoroscopy	FL- Neuro	27	15cm from Isocer	0.93	502	80	65.5	32.881	2014-12-24 01:34	-117.8	5	Pulsed	7.5	20	25.1	0.3	1217	750
Fluoroscopy	FL- Neuro	190	15cm from Isocer	6.28	1121.4	107	64.5	72.33	2014-12-24 01:34	5.3	-25.6	Pulsed	7.5	42	26.7	0.3	1200	750
Fluoroscopy	FL- Neuro	510	15cm from Isocer	16.86	3005.8	107	64.5	193.874	2014-12-24 01:31	5.3	-25.6	Pulsed	7.5	113	26.6	0.3	1200	750
Stationary Acquis	LICA	5873	15cm from Isocer	201.47	3080.4	102	193.7	596.673	2014-12-24 01:30	-117.8	5		4	34	90.6	0.6	1217	750
Stationary Acquis	LICA	6651	15cm from Isocer	219.88	3400	125	146.4	497.76	2014-12-24 01:30	5.3	-25.6		4	34	100	0.6	1200	750
Fluoroscopy	FL- Neuro	173	15cm from Isocer	8.55	507.3	114	64.5	32.72	2014-12-24 01:29	5.3	-25.6	Pulsed	7.5	19	26.7	0.3	1200	750

Angulation map



- Reference point: 11007 mGy
- Largest dose by position: 2200 mGy
- Soon: peak skin-dose mapping

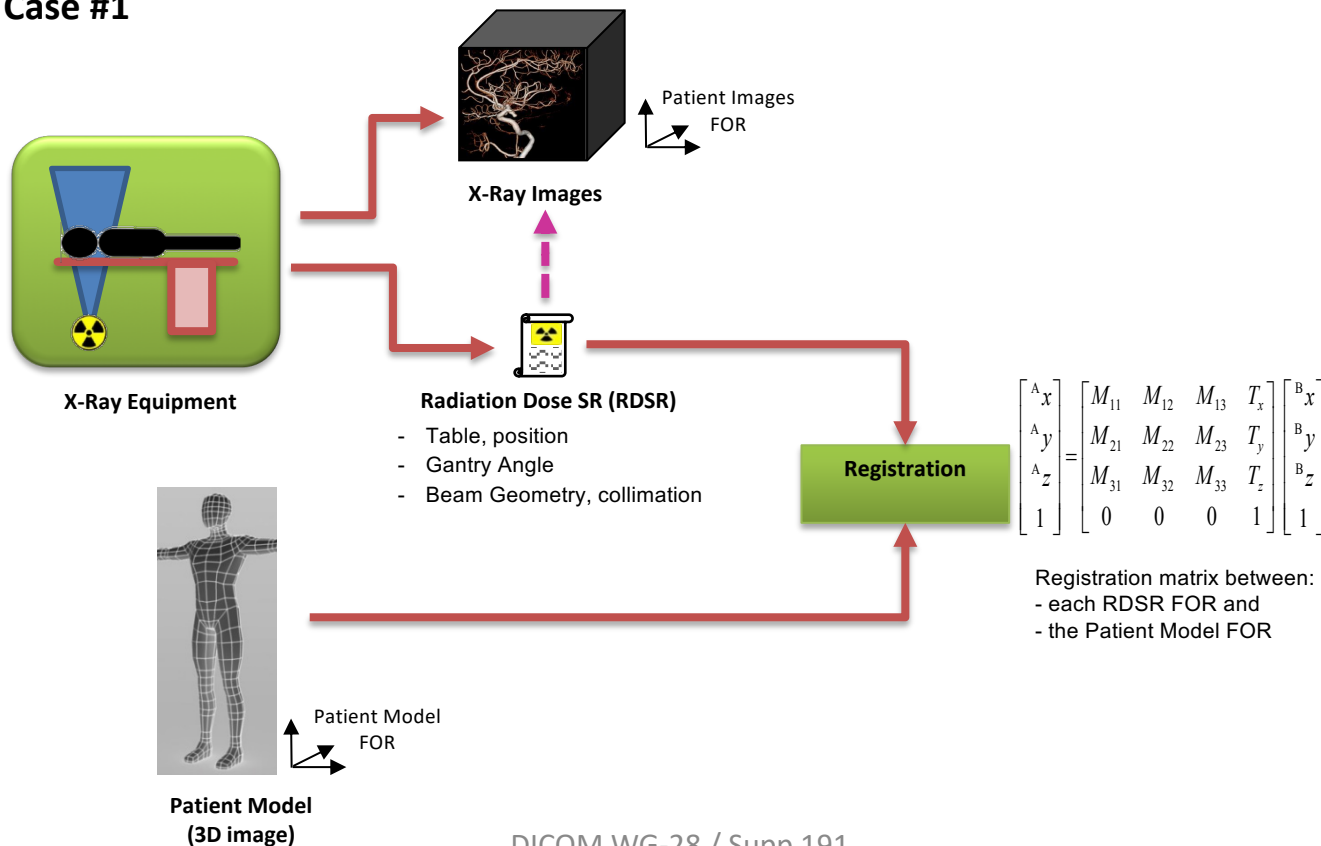
Patient-Specific Dose Reporting

- Patient Radiation Dose Reporting (P-RDSR) -- DICOM WG-28-Physics
- Current SR contains only information about x-ray system
 - Radiation output, geometry, x-ray source, detector system
- Estimation of patient / organ dose requires knowledge of:
 - Radiation beam characteristics
 - Models of the patient and organs
 - Models of radiation interaction within the patient

Patient Radiation Dose SR (P-RDSR)

Registration between Patient Model and RDSR

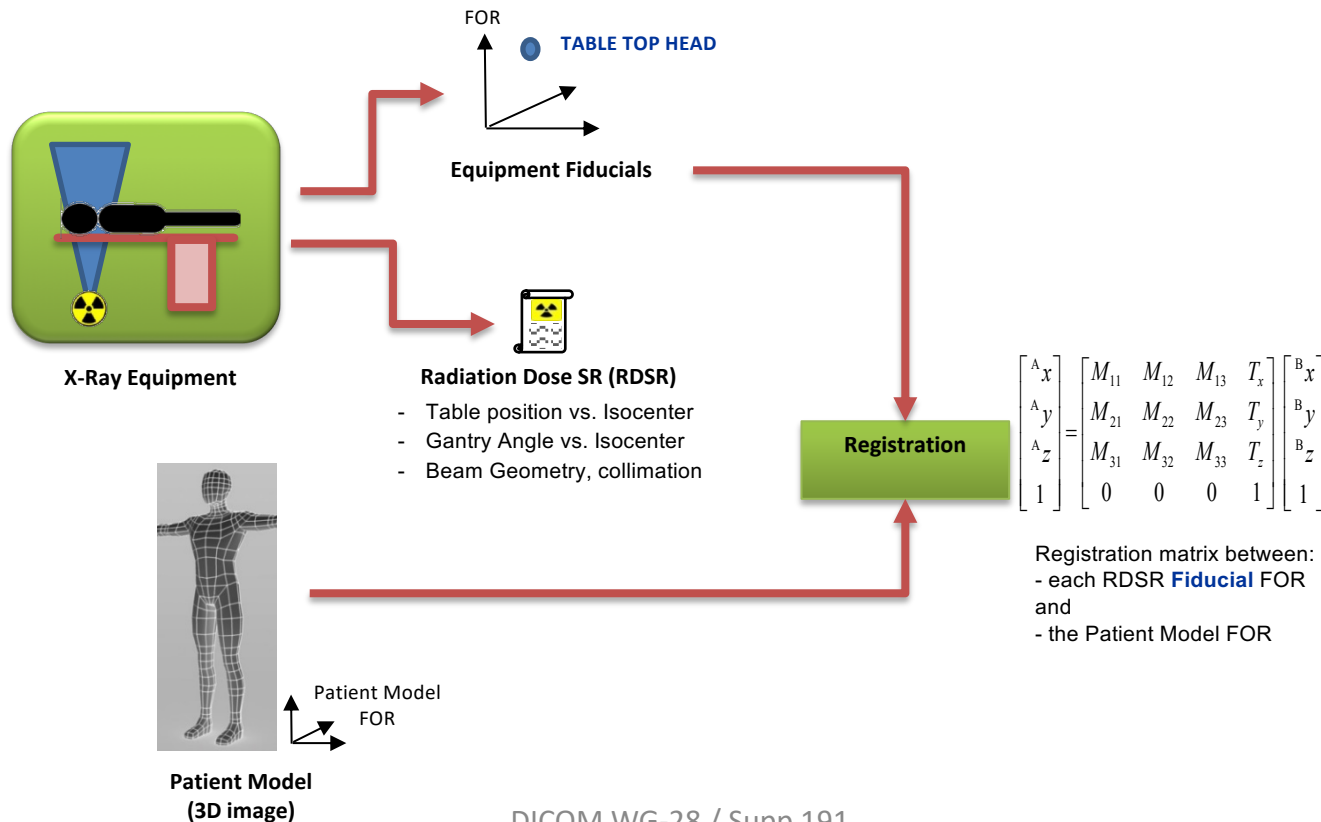
Case #1



Patient Radiation Dose SR (P-RDSR)

Registration between Patient Model and RDSR

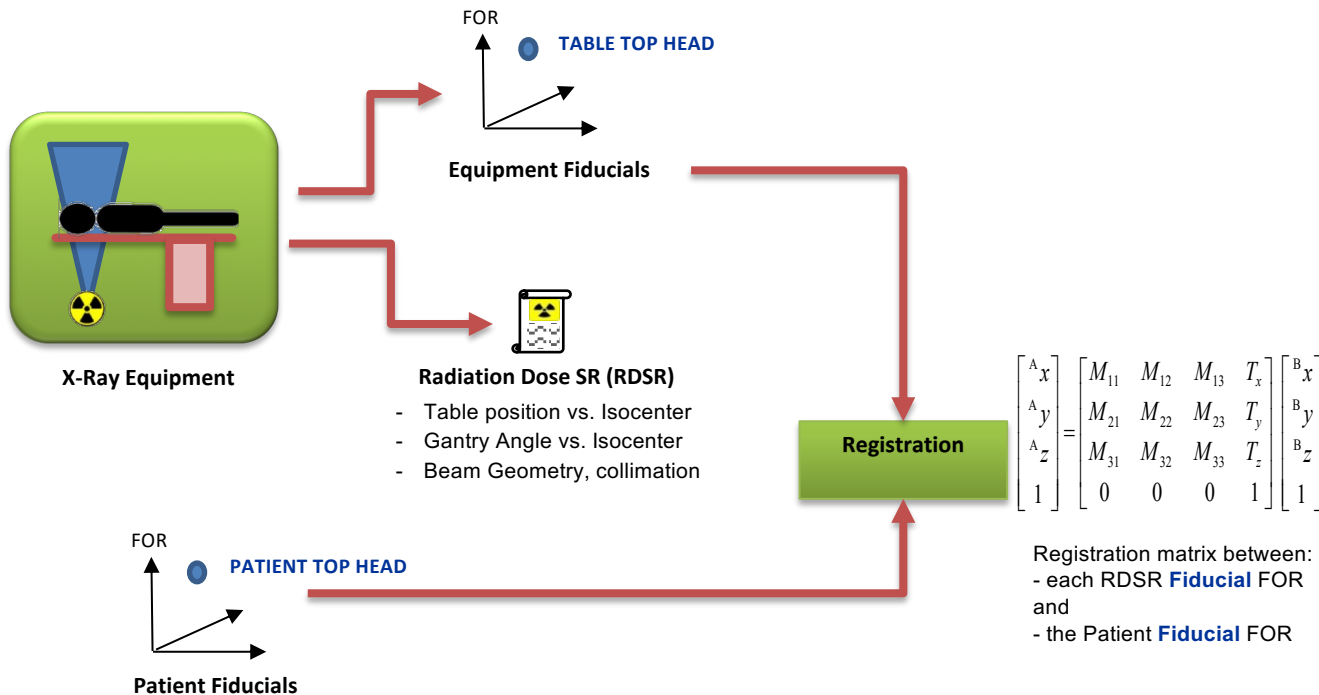
Case #2



Patient Radiation Dose SR (P-RDSR)

Registration between Patient Model and RDSR

Case #3

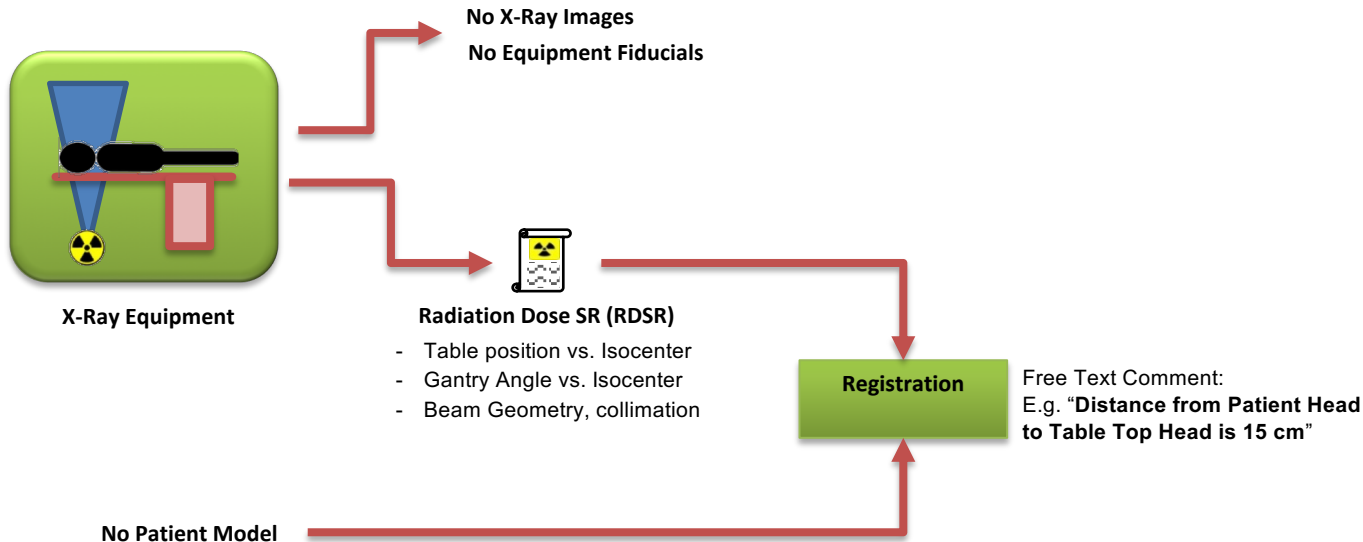


Note: the patient fiducials can be defined through a manual measurement on the actual patient landmarks, or through image-based measurements of landmarks visible on the X-Ray images.

Patient Radiation Dose SR (P-RDSR)

Registration between Patient Model and RDSR

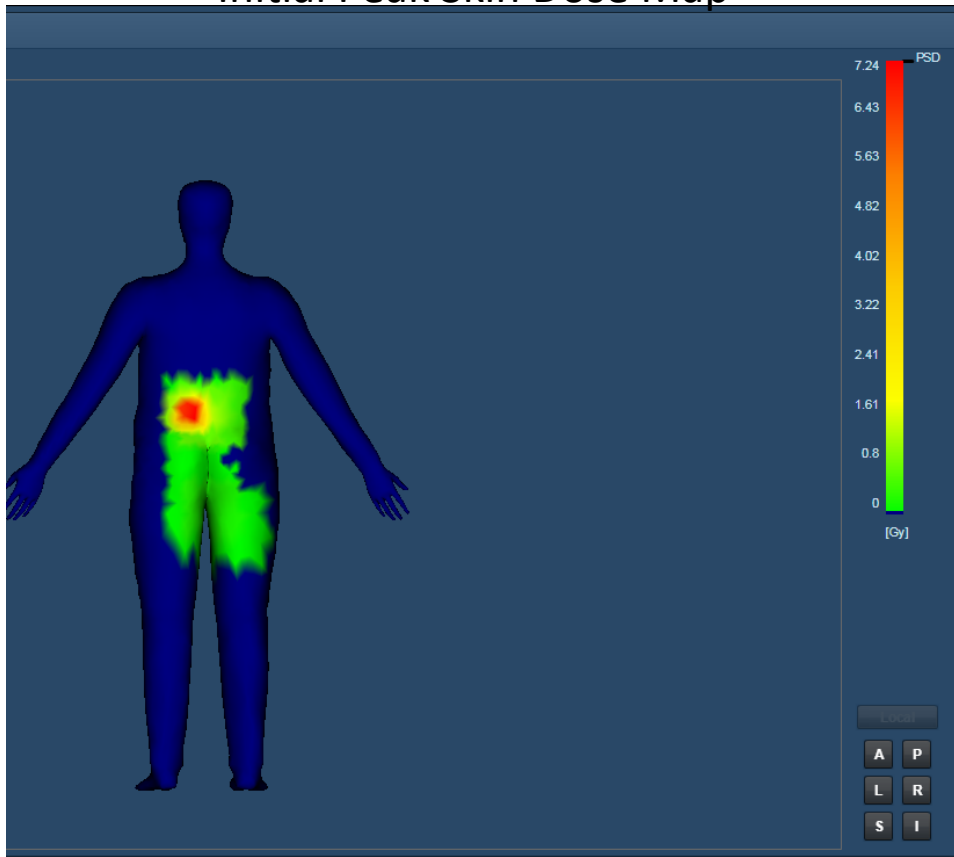
Case #4



Peak Skin Dose Mapping

Courtesy of Mark Supanich PhD, Rush Memorial Hospital

Initial Peak Skin Dose Map

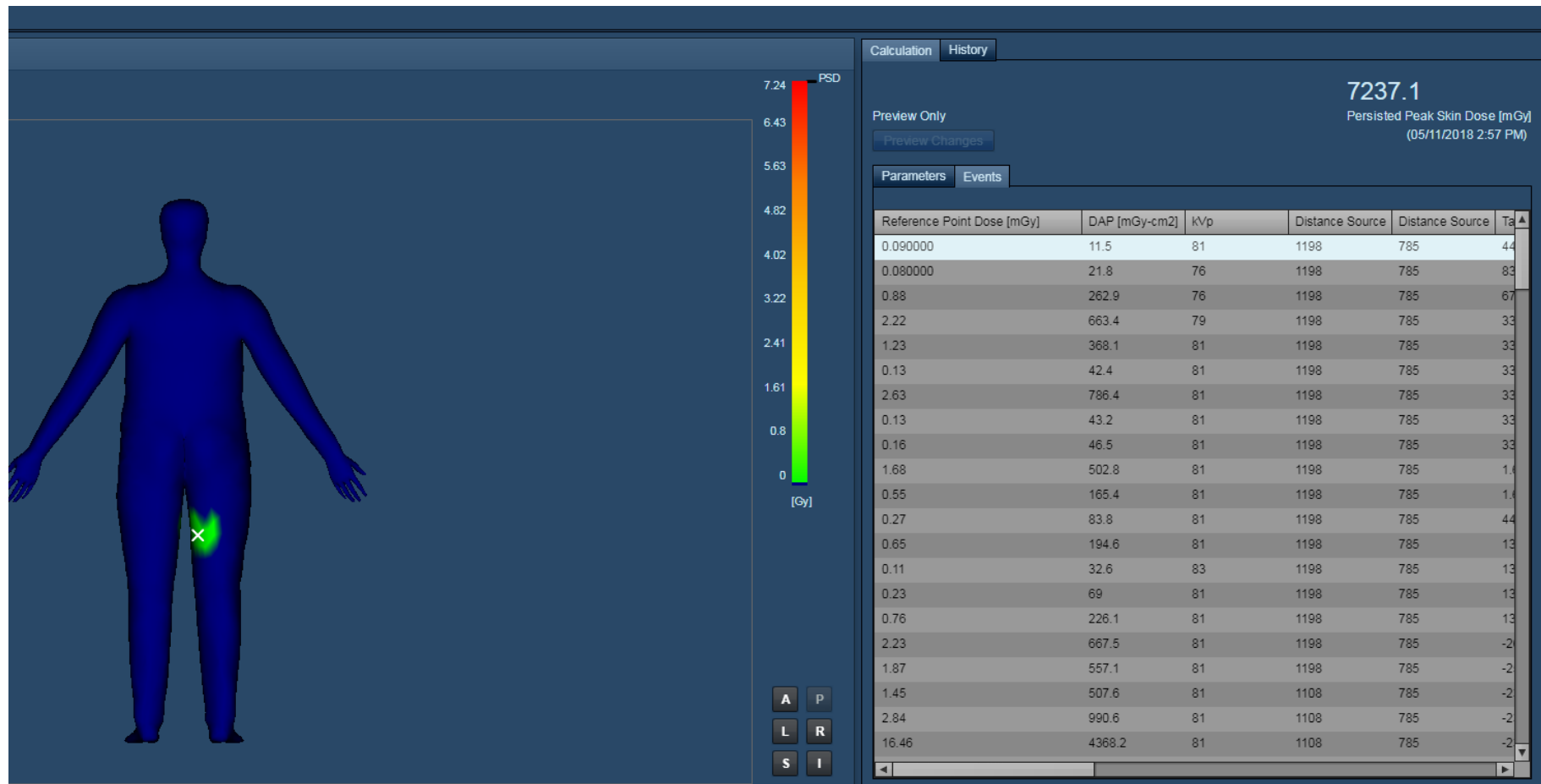


Parameter adjustment inputs

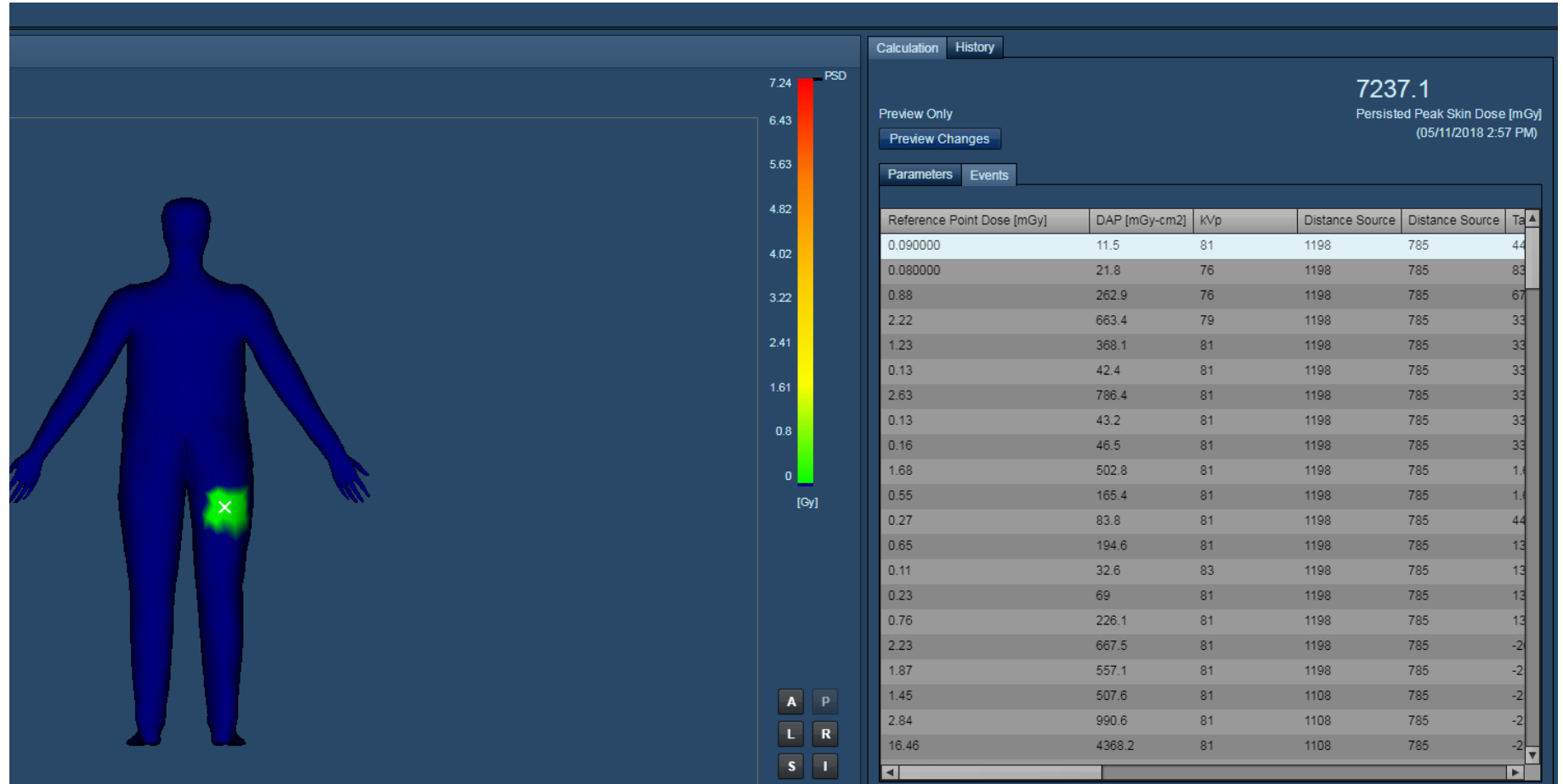
The 'Parameter adjustment inputs' window contains the following settings:

- Calculation** (selected) | **History**
- 7300** Interactive Peak Skin Dose [mGy] | **7300** Persisted Peak Skin Dose [mGy] (05/11/2018 2:57 PM)
- Preview Changes**
- Parameters** (selected) | **Events**
- Total Correction Factor**: ☐ 1.00
- Patient Orientation**: **Supine**
- Patient Table**: **None**
- Skin Model**: **Adult Male - 95th weight percentile**
- Advanced Parameters**
 - Table Head Tilt Angle (°): **0**
 - Table Longitudinal Offset (mm): **0**
 - Beam Half Value Layer (mm Al): **5**
 - Collimation Shape: **SQUARE**
 - Table Horizontal Rotation Angle (°): **0**
 - Table Energy Absorption Coefficient: **0**
 - Table Lateral Offset (mm): **0**
 - Longitudinal Beam Position (mm): **0**
 - Table Height Offset (mm): **-150**
 - Table Cradle Tilt Angle (°): **0**
 - Patient Longitudinal Offset (mm): **77.3636**
 - Patient Lateral Offset (mm): **-90.2575**
- Buttons**: **Exit** **Cancel** **Clear Changes** **Save Changes**

Placement of first fluoro position

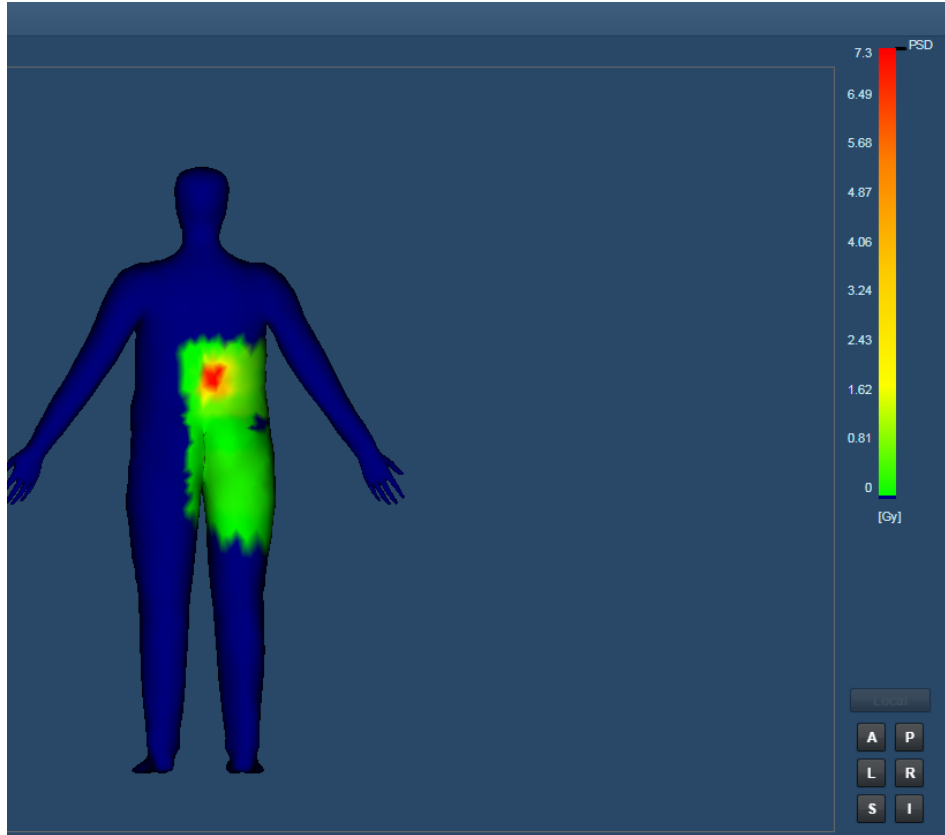


Re-adjustment to new position



PSD Final Map after adjustment

Frame of Reference adjusted



Original Peak Skin Dose Map





Presentation sequence

- **What** – what are dose metrics?
- **Why** – why record dose metrics?
- **How** – how are dose metrics recorded?
- **When** – when should be included in patient chart?

When should dose metrics be placed in the patient chart?

- When required by law
- When required by an accreditation agency
- When required by local policies & procedures
- When other related procedures might have an impact on patient health, for example, a punch biopsy in a high skin dose area of an IR patient

Exceeding Investigational Levels

HEART AND VASCULAR CENTER: CARDIOVASCULAR SERVICES POLICY AND PROCEDURES

Radiation Safety Invasive Cardiovascular Services

Approved By: Reginald Low, MD

Section:

Issued By: Kori Harder RN, MS

Page(s): 2 of 4

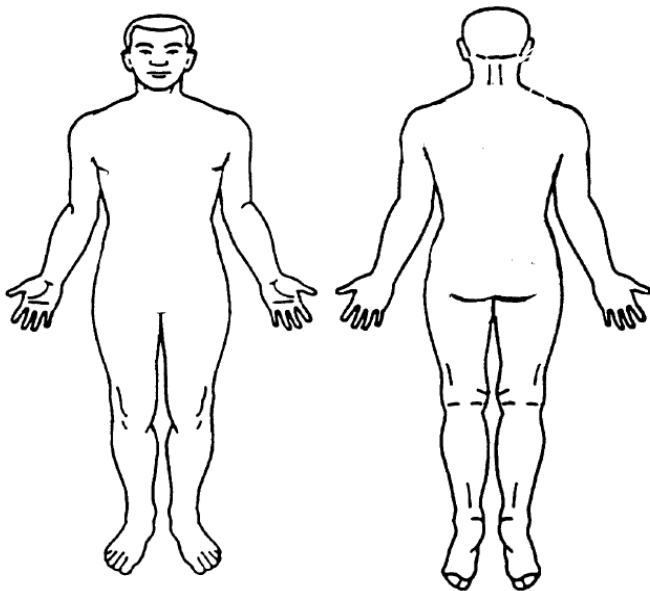
Supersedes: NEW

Date: 02-2017

Patient Room(s)	Procedural Pause	Dose Received within 7 days	6 Month Cumulative
Adult: 1745A, 1745B, All Pavilion	6,000 mGy	8,000 mGy	12,000 mGy
Peds: 1745A, 1745B, All Pavilion	1,500 mGy	2,000 mGy	3,000 mGy

Patient Exposure Form

PATIENT IDENTIFICATION STICKER OR
(NAME AND MR#)



Indicate irradiated areas on the diagram above.

Comments _____

Date: _____ Room: _____

Fluoroscopist: _____

Exam: _____

DAP/KAP: _____ (circle unit)
(mGy or cGy-cm²)

Fluoro Time: _____ (minutes) # Digital Images: _____

Dates of previous similar fluoro procedures involving the same
areas of the body within the past year: _____

Procedure Summary (circle response)
Do you anticipate a repeat of the procedure within a year? Yes No
If yes, was the patient counseled to look for skin changes? Yes No

Patient: Room(s)	Investigational Levels (mGy)		
	Procedural Pause	Received Within 7 Days	6 Month Cumulative
Adult: 1623, 1625, 1627	4,500	6,000	9,000
Peds/Neuro: 1623, 1625, 1627	3,000	4,000	6,000
Adult: 2326 Vascular	2,250	3,000	4,500
Peds: 2326 Vascular	1,125	1,500	2,250
Adult: 1745A, 1745B, All Pavilion	6,000	8,000	12,000
Peds: 1745A, 1745B, All Pavilion	1,500	2,000	3,000
Units for numbers beneath this row ►	Investigational Levels (cGy-cm ²)		
Adult: 1629 Puncture	67,500	90,000	135,000
Peds: 1629 Puncture	33,750	45,000	67,500

Patient Exposure Assessment

SECTION I	PATIENT DATA	SECTION II	PATIENT DOSE DATA
Patient Name		Estimated Patient Skin Dose	(mGy)
MR Number		Date(s) Received	

Patient Contact: Call #1 at 2 weeks, and Call #2 at 4 weeks from the latest date in section II.
If any effect is identified, the patient will be followed quarterly for 2 years.

SECTION III FOLLOW UP CALLS				
CALL NUMBER	DATE	TIME	PATIENT CONTACTED Y/N?	Comments
1				
2				

Indicate if any of the effects in the table below have been reported by the patient and/or the patient's physician.
Specifically inquire about hair loss, skin redness, or rash.

Effect	Date Reported	Effect	Date Reported
Early transient erythema		Dermal atrophy	
Temporary epilation		Telangiectasis	
Main erythema		Moist desquamation	
Permanent epilation		Late erythema	
Dry desquamation		Dermal necrosis	
Invasive Fibrosis		Secondary ulceration	

Directives and Opportunities

- Interface all imaging ionizing radiation devices to RDMS
- Identify pertinent parameters to track
- Require RDSR when purchasing new equipment
- Track patient radiation dose metrics history in RDMS
- Define a path to electronic health record
- Develop pathways to dose index registries
- Achieve and maintain high patient safety goals

Conclusions

- Understanding dose metrics requires understanding nuances
- Ideally, all ionizing radiation encounters should be recorded
- Access to patient longitudinal history should be available
- When to include dose metrics in the patient chart requires careful consideration