



Medical Physicists, the DICOM Standard and Working Group 28

Donald Peck, PhD FAAPM, FACR
Vice Chair, Department of Radiology
Henry Ford Medical Group

DICOM Review



- Utilizes an open standards development process that encourages the involvement and consensus of both manufacturers and users
- Specification of a conformance mechanism so that a user can determine whether or not devices are likely to interoperate

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DICOM Review



- DICOM Standards Committee (DSC)
 - DICOM's executive body whose members are imaging equipment manufacturers, physician organizations, and other interested groups
 - 27 manufacturer members
 - 20 user members
 - 11 general interest members
- AAPM now a voting member of the DSC as a "User" organization
- DICOM's activities are coordinated through MITA, a division of the National Electrical Manufacturers Association (NEMA)

The DICOM Standards Committee

Secretary	MITA (Medical Imaging & Technology Alliance)
General Secretary	Stephen Vastak, MITA svastak@medicalimaging.org
Producer Co-Chair	Kevin O'Donnell, Toshiba Medical Research Institute USA kodonnell@tmriusa.com
User Co-Chair	John A. Carrino, MD, MPH, American College of Radiology Johns Hopkins School of Medicine JCarrino@jhmi.edu

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DICOM Standards Committee (DSC)



- Development of DICOM Standard is done through committees termed "Working Groups" (WG)
 - AAPM members can participate in any Working Group as a member representing the AAPM or as an observer
 - AAPM can only have one voting member on each WG

WG-01: Cardiac and Vascular Information	WG-15: Digital Mammography and CAD
WG-02: Projection Radiography and Angiography	WG-16: Magnetic Resonance
WG-03: Nuclear Medicine	WG-17: 3D
WG-04: Compression	WG-18: Clinical Trials and Education
WG-05: Exchange Media	WG-19: Dermatologic Standards
WG-06: Base Standard	WG-20: Integration of Imaging and Information Systems
WG-07: Radiotherapy	WG-21: Computed Tomography
WG-08: Structured Reporting	WG-22: Dentistry
WG-09: Ophthalmology	WG-23: Application Hosting
WG-10: Strategic Advisory	WG-24: Surgery
WG-11: Display Function Standard	WG-25: Veterinary Medicine
WG-12: Ultrasound	WG-26: Pathology
WG-13: Visible Light	WG-27: Web Technology for DICOM
WG-14: Security	WG-28: Physics

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DICOM "workflow"

- Working groups propose "Work Items" based on suggestions from members, users or at the direction of the DSC
- Work Items are divided into Supplements and Change Proposals (sometimes called Correction Proposal or Items)
 - Supplements define new objects, content or structure
 - Change Proposals modify the existing Standard

* <http://medical.nema.org/>

DICOM Standard Status*

Maintained by David A. Clunie dclunie@dclunie.com
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DICOM "workflow"

- Base Standards working group (WG06) maintains the overall consistency of the DICOM standard
 - Some of WG06 responsibilities include:
 - Execution of the DICOM Maintenance Process (i.e. development of Change Proposals)
 - Technical coordination and guidance for all WGs
 - Review and official approval of all Work Items before Public Comment, Letter Ballot and Final Text releases
- Once the Work Item is complete, WG06 petitions the DSC to approve the Work Item and it is sent out for Public Comment

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DICOM "workflow"

- During Public Comment phase anyone can make comments on the Work Item
 - All comments must be responded to before the Work Item can proceed in the approval process
- DSC then authorizes the Work Item for Letter Ballot by DICOM members
 - Each of the 58 members are allowed one vote
- Change proposals do not always require the same rigorous review process and are often "batched" for Public Comment and Letter Ballot e.g. for typographical errors, etc.

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New DICOM Working Group

- Recently the DSC established a Working Group on Physics (i.e. WG28)
 - Established at 2011 RSNA

WG-01: Cardiac and Vascular Information	WG-15: Digital Mammography and CAD
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WG-13: Visible Light	WG-27: Web Technology for DICOM
WG-14: Security	WG-28: Physics

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WG28 Physics



- Currently has Chairs and Secretariats from both Europe and United States
- Recommendation is to also have a manufacturer Co-Chair

Secretariat-U.S. Meetings Secretary	AAPM (American Association of Physicists in Medicine) Lynee Furr@aacr.org lynee.furr@aacr.org
Secretariat-European Meetings Secretary	EFOMP (European Federation of Organizations for Medical Physics) Alberto Tortora, EFOMP alberto.tortora@unimi.it
Co-Chair-User-EFOMP	Amelita Trianni, EFOMP Trianni.Amelita@cond.sns.it
Co-Chair-User-AAPM	Donald Peck, PhD, Emory Food Hospital dpeck@rad.mh.emory.edu
Co-Chair-Manufacturer	TBD

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WG28 Physics



Scope

- To develop or consult on Supplements and Change Proposals requiring detailed expertise on physics and/or the needs and work of medical physicists
- To serve as a *liaison* body to facilitate including data relevant to the physics community in the DICOM Standard

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WG28 Physics



Risks Identified

- Physics wish-list could get too far ahead of vendor and user expectations
- Might not be able to recruit enough physicists, equipment vendors & service providers for the resulting specifications to be effective, balanced and adopted

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WG28 Physics - Current Roadmap:



1. Evaluation of the accuracy of data registered in the DICOM Radiation Dose Structured Report (SR)
2. Definition of details for patient organ dose
3. Methods for capturing and recording operator dose
4. Work with MITA X-Ray Interventional Working Group on development of "Physics Mode"

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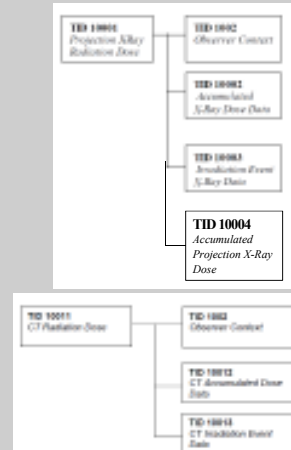
Structured Report (SR)

- Supplement 23 for new Image Object Definition (IOD)
 - approved in April 2000
- Support for conventional free text reports and provide the capability to record structured information
 - Convey the interpretation text and record the DICOM identifiers (i.e. attributes) of selected images and/or data
- Information stored in "Templates" (TID)
 - Templates are given in Part 16: Content Mapping Resource

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Radiation Dose SR

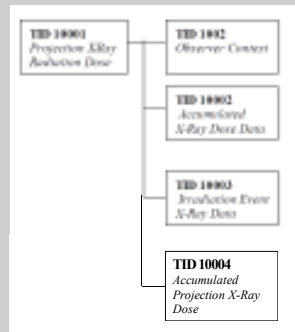
- Used to convey exposure characteristics and dose from X-Rays generated by imaging devices
 - Therapeutic dose is reported in RT Dose IOD
- Records "radiation output" information, not patient dose



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Radiation Dose SR - Projection Radiography

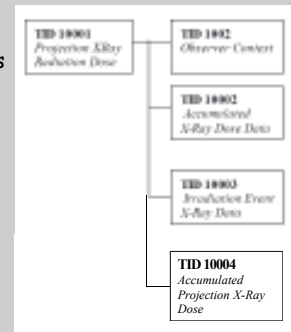
- TID 1002
 - General attributes for:
 - Subject, procedure and observer (i.e. operator)
- TID 10002
 - Container for accumulated x-ray dose for all irradiation events



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Radiation Dose SR - Projection Radiography

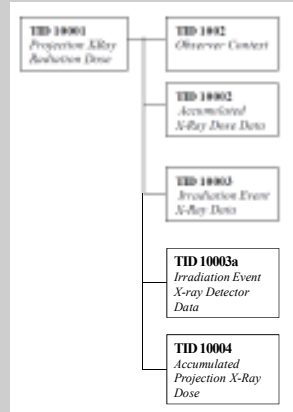
- TID 10003
 - Dose and equipment parameters from each irradiation event, e.g.:
 - X-ray exposure techniques
 - Table, Gantry Angle, Beam Geometry, ...
 - Dose measurement values
- TID 10004
 - Detailed accumulated dose for all irradiation events



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Correction Proposal - Add CR/DR to RDSR

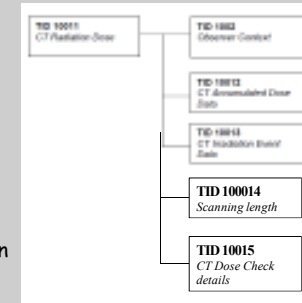
- CP1077 approved April 2012
- Adds ability to include dose information from all types of digital detector systems
- Three integration options:
 - X-ray detector data available
 - Integrated
 - Cassette-based
 - X-ray source data available
 - X-ray mechanical data available



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Radiation Dose SR - CT Radiation Dose

- TID 10012
 - Detailed accumulated CT dose for all irradiation events
- TID 10013
 - Dose and equipment parameters from each irradiation event
- TID 10014
 - Scan exposure range information
- TID 100015
 - Dose check alert values



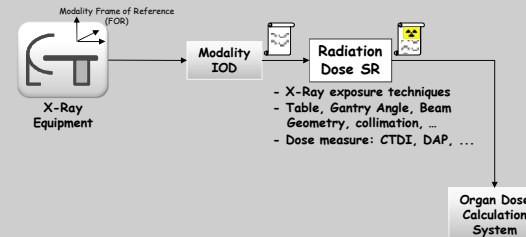
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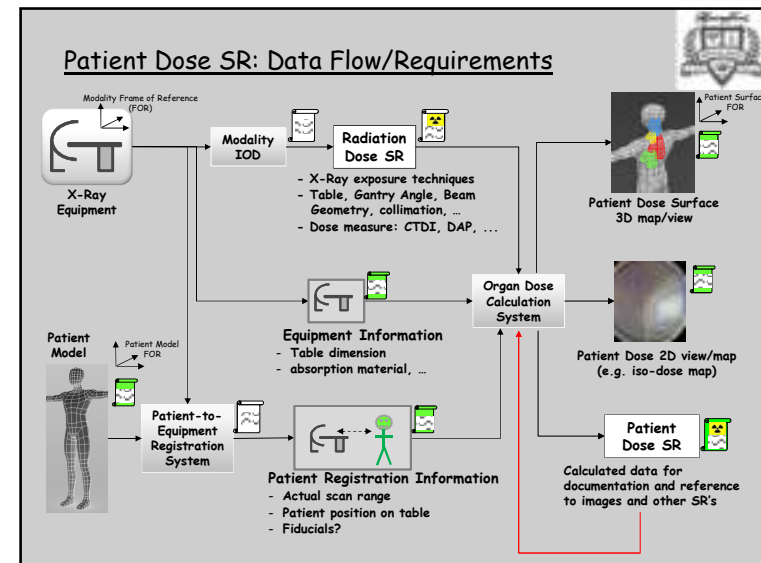
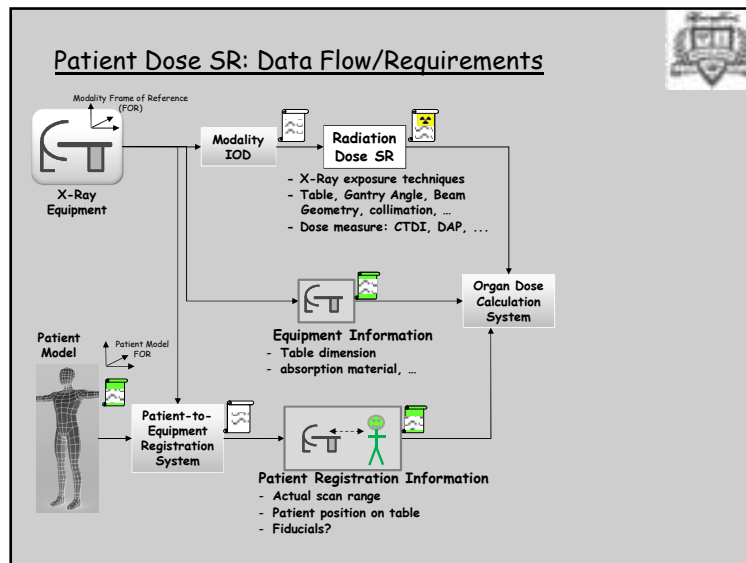
Development of Patient Dose SR Work Item

- Current Radiation Dose SR contains only information about the x-ray system or information the x-ray system can determine, e.g.:
 - radiation output, geometry, x-ray source, detector system, etc.
- Estimation of patient or organ dose requires:
 - X-ray system information
 - Models of the patient/organs
 - Radiation interaction within the patient
- Methods to do patient dose estimations are being developed and improved continuously
 - storage of these estimations in a different object would allow more versatile utilization of the data

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Patient Dose SR: Data Flow/Requirements





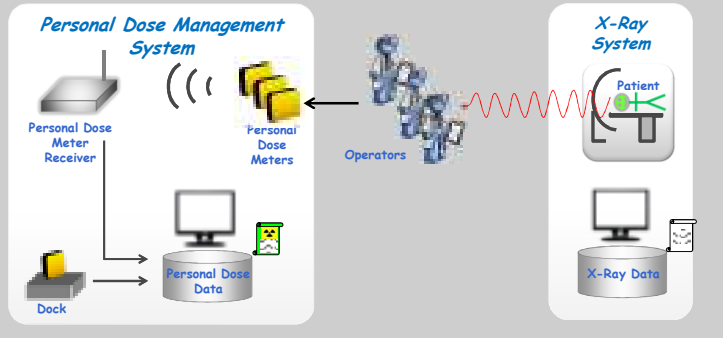
- ### Patient Dose SR: Requirements for Organ Dose
- Calculation Information
 - Algorithm details
 - Assumptions of calculation model
 - table attenuation, backscatter model, ...
 - Interpretation of Results
 - Accuracy/Uncertainty model
 - Referenced Objects (UID's)
 - Irradiation context: Radiation Dose SR - one or more?
 - Patient model: skin surface, organs, ...
 - Patient location and orientation: registration, fiducials, ...
 - 2D map or 3D dose map: Iso-dose image, ...
 - Calculated Data for Documentation
 - Peak Dose locations
 - Iso-dose lines
 - Registry data

- ### Development of Operator Dose SR Work Item
- Personal Dosimetry Management System (PDMS)
 - An external system independent from the x-ray system that has the ability to register the dose received by operators of radiographic equipment procedure, e.g.:
 - interventional radiography
 - cardiology
 - Termed "ambient dose" from procedure
 - Ability to register the ambient dose of the equipment for each x-ray procedure

Operator Dose SR: Data Flow/Requirements



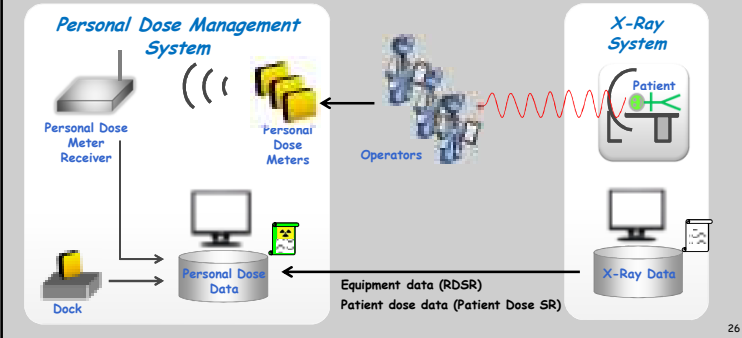
- During each X-Ray procedure, the PDMS:
 - gathers the dose of all operators who participate in a procedure
 - generates the Operator Dose SR at the end of the procedure



Operator Dose SR: Data Flow/Requirements



- Correlate Operator Dose with the associated procedure, equipment and patient dose
 - RDSR
 - Patient Dose SR



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MITA Interventional Working Group



- User Quality Control Mode
 - Standard that applies to x-ray equipment intended to perform interventional procedures
 - Defines a set of minimum requirements designed to more easily facilitate quality control at the facility level
 - Items pertinent to the following quality control elements are contained in the Standard:
 - physical testing of equipment
 - electronic audit of system configuration
 - electronic reporting of relevant data and information

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Goals - User Quality Control Mode



- Provide a set of quality tools on imaging equipment for:
 - Quality Control testing to detect degradation of X-ray related components.
 - Access to and export of "for processing", and "for presentation" images suitable for external digital image quality testing
 - Calibration inputs from the physicist required for fields in the Radiation Dose Structured Report (RDSR)
 - Electronic documentation of system configuration and technical factors invoked by each Exam Protocol Selection Button (EPSB)
 - Export in spreadsheet format
 - Access to RDSR

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