TASK GROUP 113
Reference Organ and Effective Dose Coefficients for Common Diagnostic X-ray Imaging Examinations
## Under Committee 2 & Committee 3

MAIN POINTS

- The ICRP has established TG113 to provide reference dose coefficients for radiographic, CT and fluoroscopic x-ray imaging procedures.

- The Task Group is performing Monte Carlo radiation transport simulations on a series of reference imaging examinations to report the resulting organ absorbed dose and effective dose coefficients.

- The scope of this work includes the use of the reference voxel computational phantoms of the ICRP, male and female new-born, 1-year-old, 5-year-old, 10-year-old, 15-year-old and adult. Additionally, the pregnant mesh type phantoms are being used.

- The work of the Task Group is leading to publications and electronic materials covering adult, paediatric and fetal organ absorbed and effective dose coefficients.

RADIOGRAPHY – PUBLICATION IN PRESS

- Dose coefficients (DCs) are provided for some "typical" examples of x-ray spectra and examinations, 384 in total for adults and 496 for paediatric, at 50 to 130 kV and filtration of 2.5, 3.0, 3.5 mm Al and for paediatric cases additionally for 3.0 mm Al+0.1 mm Cu. These coefficients are reported as organ absorbed and effective doses per Kerma Area Product (KAP or PKA) and per air kerma free-in-air at 1 m distance from the source and can be obtained using the tables and the viewers included with the publication or the ICRP Dose viewer.

- Data are also provided in 1 keV bins as dose per fluence at 1 m distance from the source and can then be convolved with any user-defined x-ray spectral distribution to obtain spectrum-specific coefficients.

COMPUTED TOMOGRAPHY

- Rather than developing a tool that is specific to any one CT scanner or to a pre-determined set of scanners, the Task Group has developed the ICRP reference scanner, based on the characteristics of 13 CT scanners.

- The results from the ICRP scanner are made representative for any scanner by entering the selected $CTDI_{vol}$ and tube voltage of the protocol, and the relevant CTDI phantom.

- Results from the ICRP scanner will be accessed using a purpose-designed GUI hosted by ICRP.
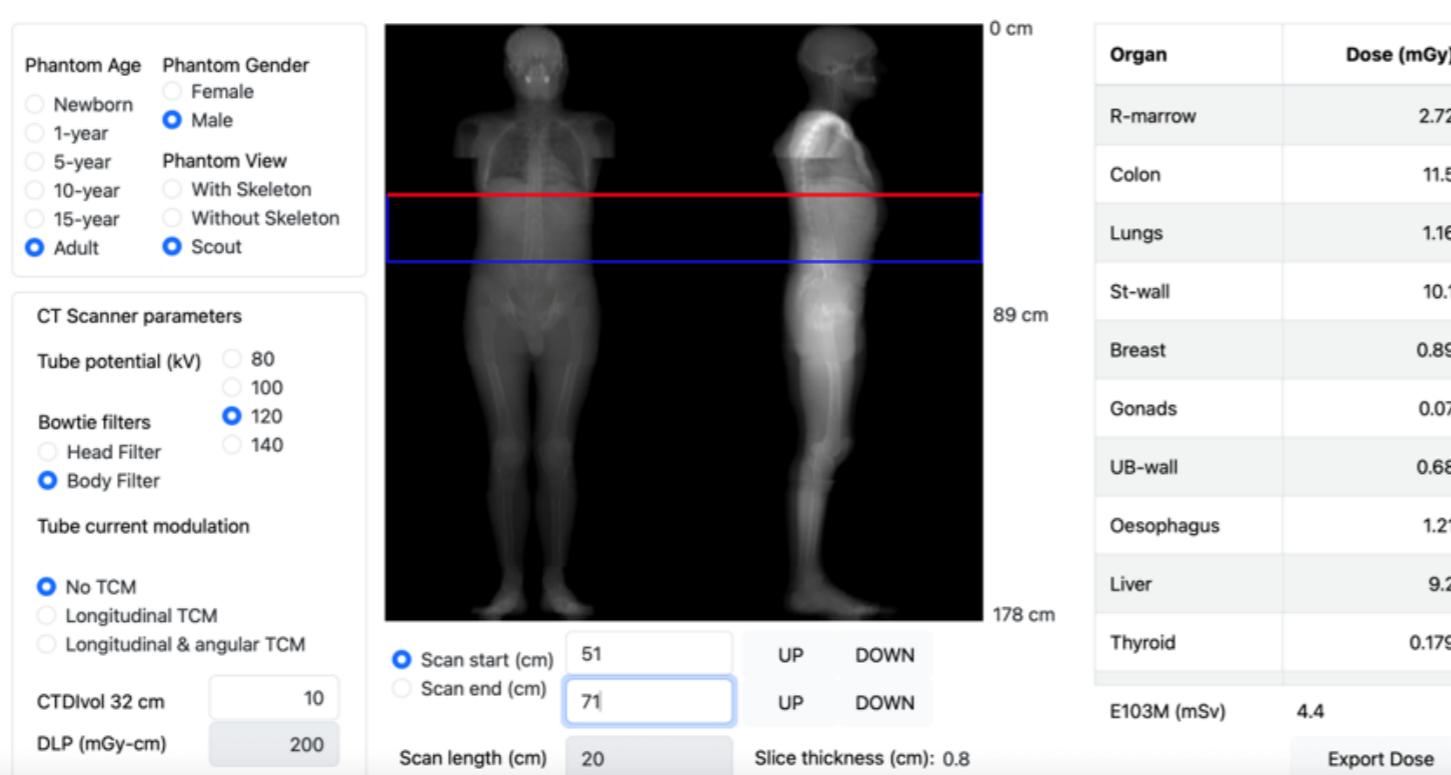
FETAL DOSIMETRY

- Dose coefficients for the fetus and mother due to radiographic and CT imaging to a pregnant patient will be provided by using the ICRP mesh-type reference pregnant phantoms, covering 8 gestational stages for male and female fetuses.

- Firstly, CT dose coefficients have been calculated by implementing the ICRP reference scanner to the 16 phantoms using Geant4. For quality assurance, spot-check calculations will be performed with the codes PHITS and MCNP6.

Maternal uterus dose and 10-week fetal organ doses normalised to the $CTDI_{free-in-air}$ for a CT scan, shown for every slice along the long axis of the phantom
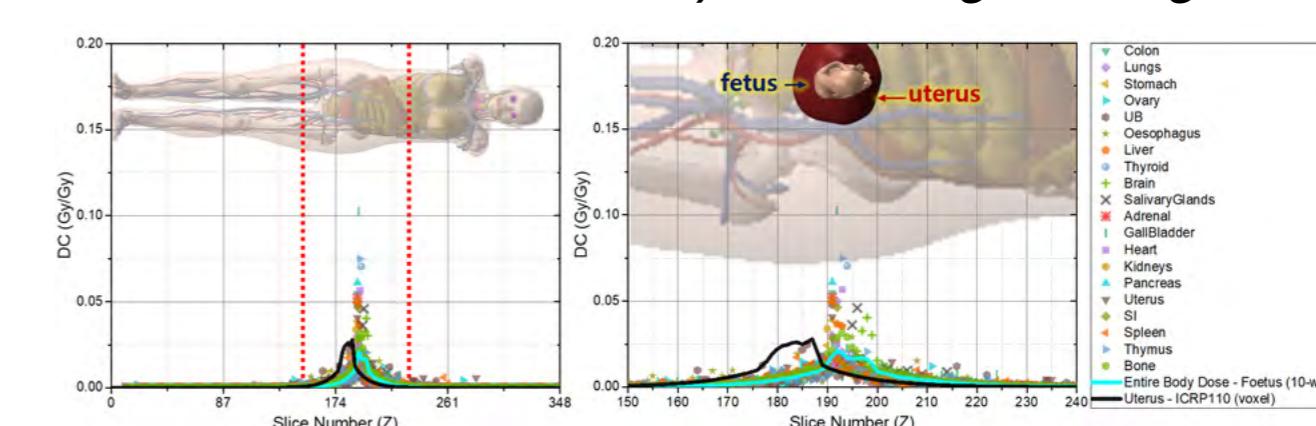
PAEDIATRIC DIAGNOSTIC FLUOROSCOPIC EXAMINATIONS

- Diagnostic fluoroscopy protocol outlines, encompassing 545 total x-ray fields were developed for the voiding cystourethrogram, contrast enema, upper GI series, and modified barium swallow examinations. These were developed considering world-wide radiographic practice and standard conditions for a general radiologists. Other sources included the open-access American College of Radiology (ACR) practice parameters.

- DC were determined using Monte Carlo radiation transport simulations for nine x-ray spectral distributions to encompass the range of technique factors commonly encountered in the clinic. QA of the data is being performed.

FLUOROSCOPICALLY GUIDED INTERVENTIONS

- All FGI procedures are tailored to the individual patient whose organ dose is dependent on many factors. Thus, it is not possible to define a reference examination.

- Radiation Dose Structured Reports (RDSR) data for 11 types of procedure have been collected from three health care institutions in the United States. The RDSR data have been translated to the input data for Monte Carlo simulations using a library of body size-dependent computational human phantoms for individualized- and event-specific organ dose calculations.

- From the resulting data, "typical" or "average" organ and effective doses will be estimated per FGI procedure.
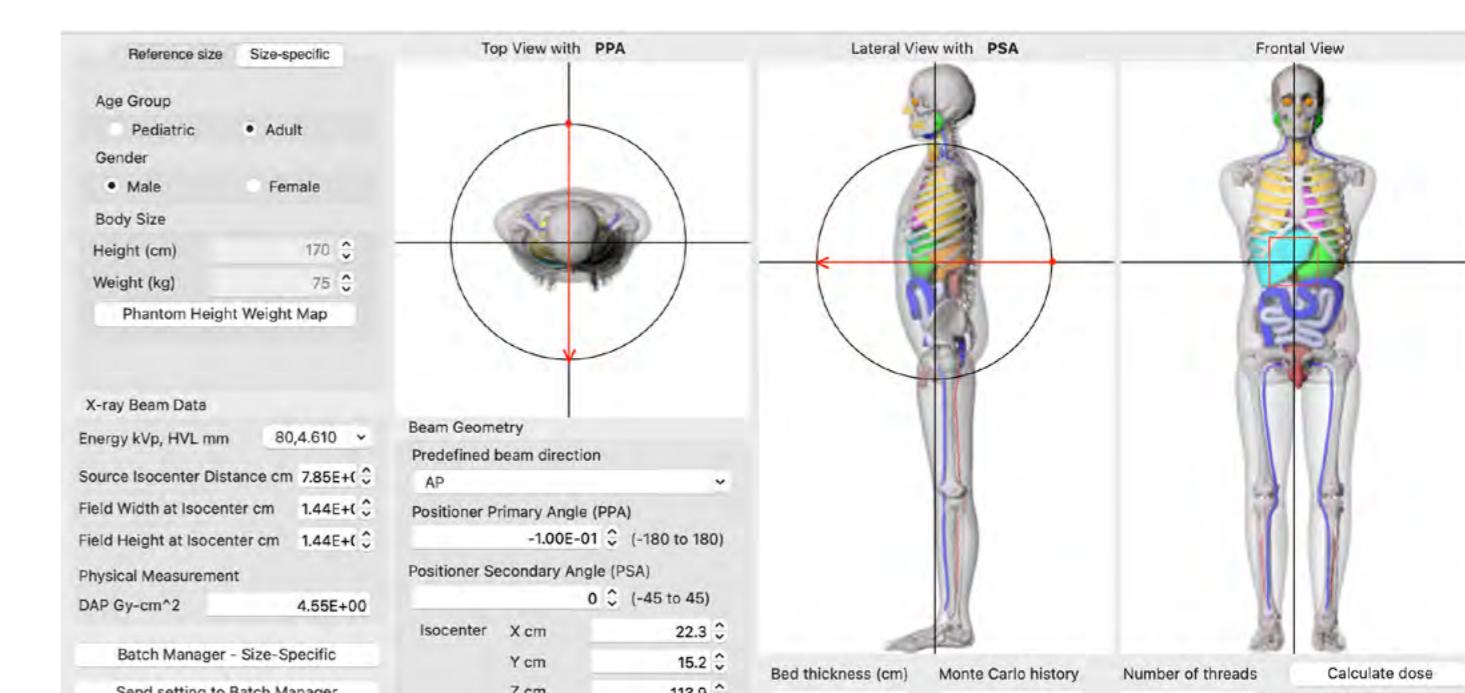
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