UK Health
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CT Dosimetry Calculators - UKHSA/ImPACT

Sue Edyvean, Jan Jansen, John Holroyd

Updates and Overview

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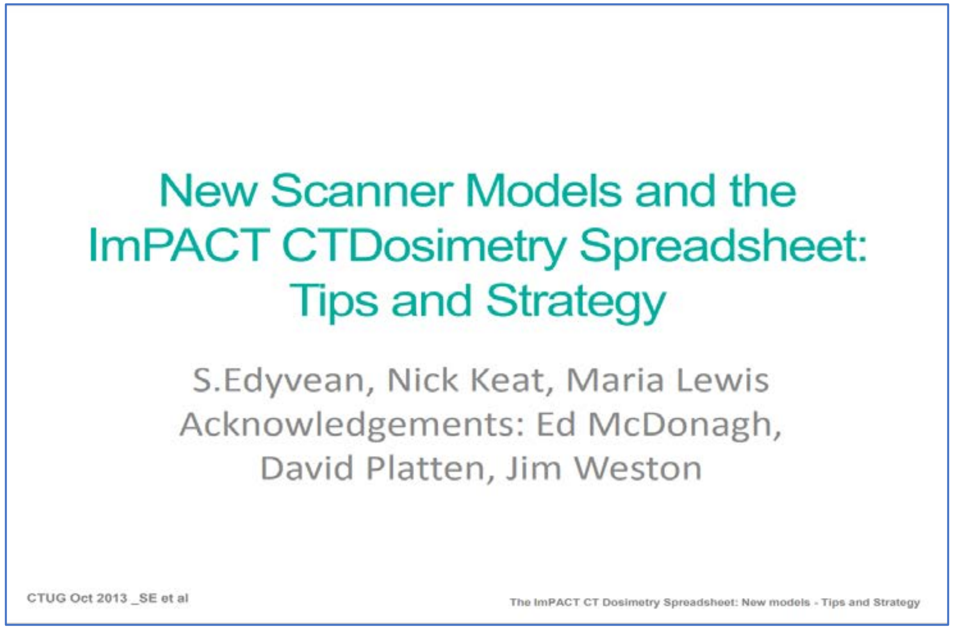
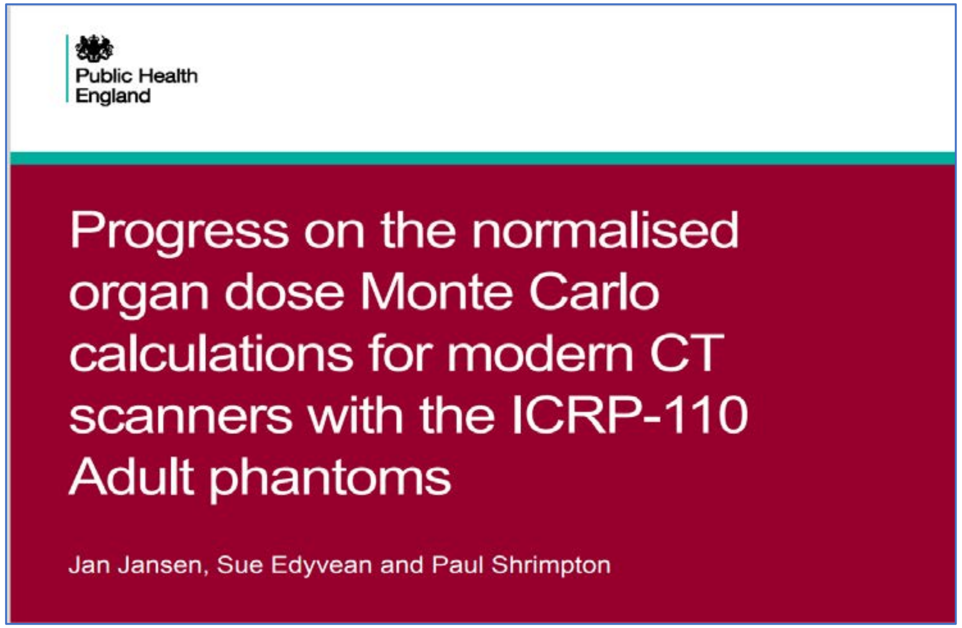
CT Dosimetry Calculators – UKHSA and ImPACT

- It is ~ 10 years since we separately presented at CTUG (Coventry November 2013)
  - ImPACT: on the method to input your own scanner into the ImPACT calculator, and

    a strategy to update the downloadable version with more scanners
  - PHE: a development version of a new calculator from PHE (now UKHSA)



CTDosimetry (ctug.org.uk)



Slide 1 (ctug.org.uk)

CT Dosimetry Calculators – UKHSA and ImPACT

- This overview is to give:
  - developments that have happened on both calculators
  - to outline some of the fundamental differences between UKHSA and ImPACT calculators
- Jan Jansen will present on the UKHSA calculator, and give a demo

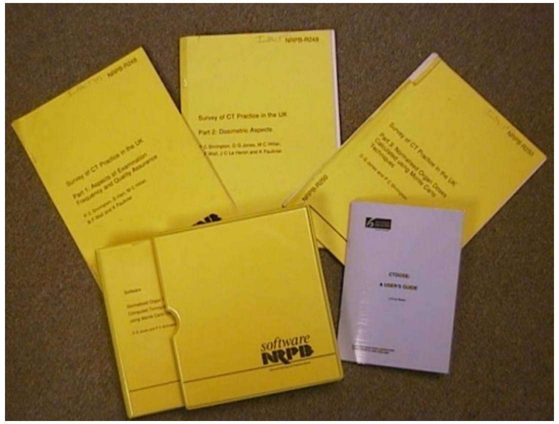
CT Dosimetry Calculators - ImPACT

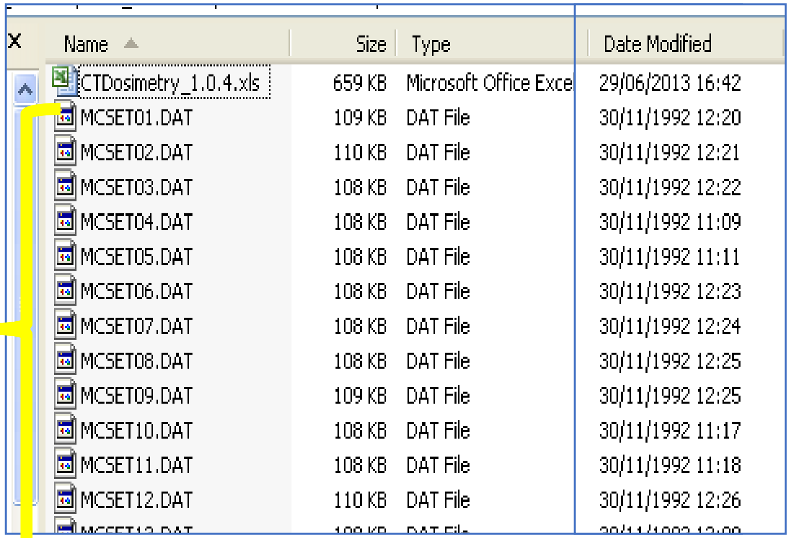
- The ImPACT calculator was based on the NRPB SR250 organ dose co-efficients generated from Monte Carlo calculations, using a range of scanner models from the 1980s. (The organ dose co-efficients were normalised to CTDI in air.)
- The calculations for each “scanner model/tube voltage/beam shaping filter” combination were undertaken on an NRPB version of the MIRD/ORNL/Cristy stylised phantom, delineating ICRP organs identified for ICRP 60.
- The calculator adapted a method to calculate effective dose for organs of interest relevant for ICRP 103 (NK)
- The method of using the calculator for new scanner models (‘matching’) was based on CTDI; measured in air and in phantom (utilising the centre and periphery measurements separately).
  - Enabled matching to a NRPB scanner dataset, in terms of nearest effective dose.
  - Separate matches for head and body region
- New scanner model matches were according to <u>model, kV, beam shaping filter, and exam region (head or body)</u>: *‘scanner model with associated operating characteristics’.*

ImPACT Calculator

- NRPB SR250 MC generated normalised organ dose co-efficients(1993)
  [Medical Dosimetry Group - Patient dose estimation tool (ukhsa-protectionservices.org.uk)]()
- ImPACT CT Dose Calculator (St. George's Hospital, NK) - Utilises NRPB SR250 (~ 2002 1st Ed.)
  www.impactscan.org (Instructions for adding own scanner: http://www.ctug.org.uk/meet13-11-07/index.html)
- Used extensively in the UK and Worldwide – IAEA promote, and teach, it

NRPB SR250 Normalised* organ dose datasets

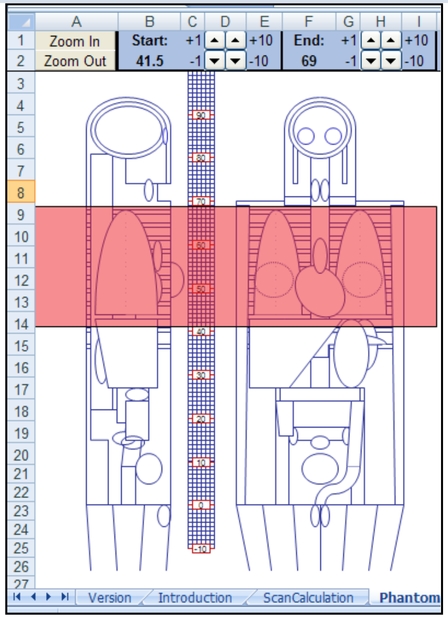


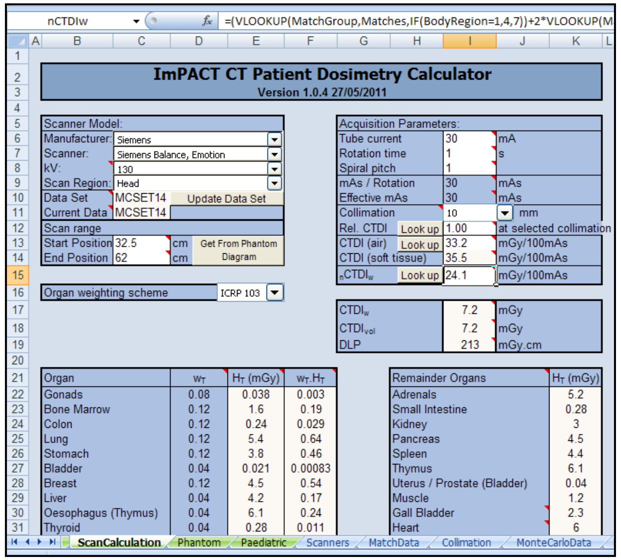


Name	Size	Type	Date Modified
CTDosimetry_1.0.4.xls	659 KB	Microsoft Office Exce	29/06/2013 16:42
MCSET01.DAT	109 KB	DAT File	30/11/1992 12:20
MCSET02.DAT	110 KB	DAT File	30/11/1992 12:21
MCSET03.DAT	108 KB	DAT File	30/11/1992 12:22
MCSET04.DAT	108 KB	DAT File	30/11/1992 11:09
MCSET05.DAT	108 KB	DAT File	30/11/1992 11:11
MCSET06.DAT	108 KB	DAT File	30/11/1992 12:23
MCSET07.DAT	108 KB	DAT File	30/11/1992 12:24
MCSET08.DAT	108 KB	DAT File	30/11/1992 12:25
MCSET09.DAT	109 KB	DAT File	30/11/1992 12:25
MCSET10.DAT	108 KB	DAT File	30/11/1992 11:17
MCSET11.DAT	108 KB	DAT File	30/11/1992 11:18
MCSET12.DAT	110 KB	DAT File	30/11/1992 12:26

*normalised to $CTDI_{free\text{- in air}}$ (dose to muscle)

ImPACT CT Patient Dosimetry Calculator
Version 1.0.4 27/05/2011



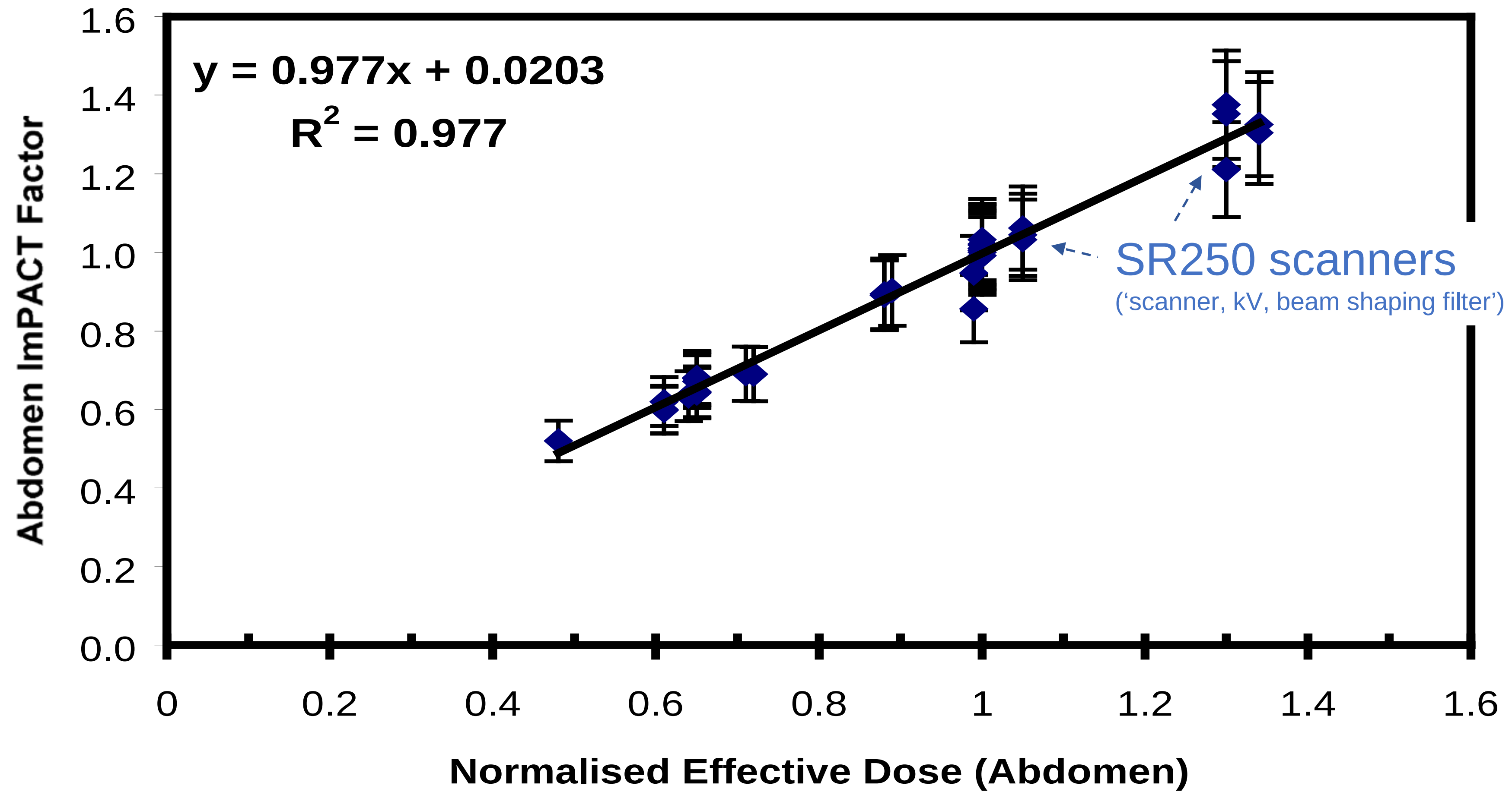


input $CTDI_{free\text{-in air}}$ (dose to air)

ImPACT Factor (ImF) vs Effective Dose

ImF (body) = a. ($CTDI_{32cm.centre}$ / $CTDI_{air}$)+ b. ($CTDI_{32cm.perpiphery}$ / $CTDI_{air}$)+ constant

Body Region

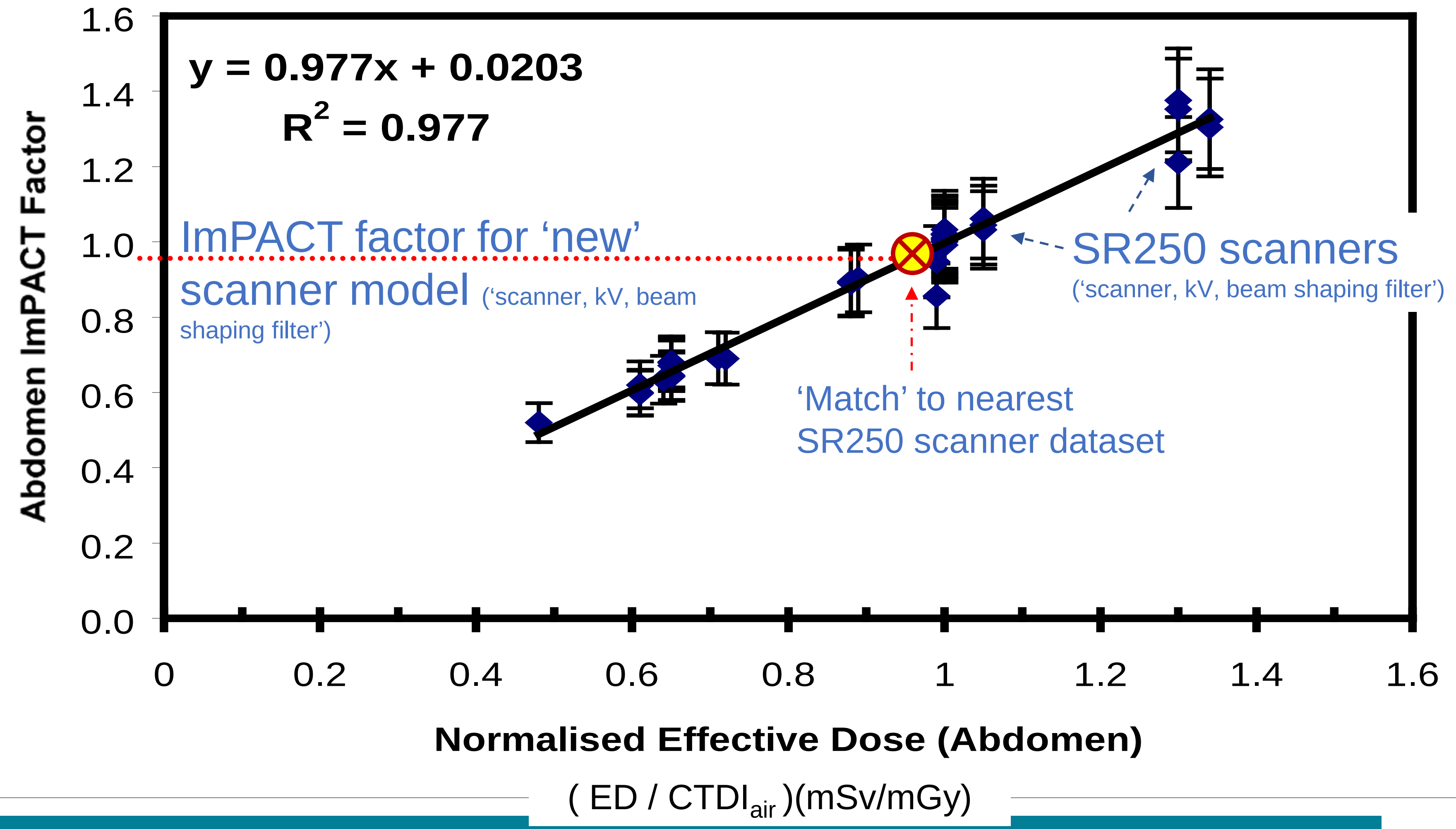


(ED / $CTDI_{air}$)(mSv/mGy)

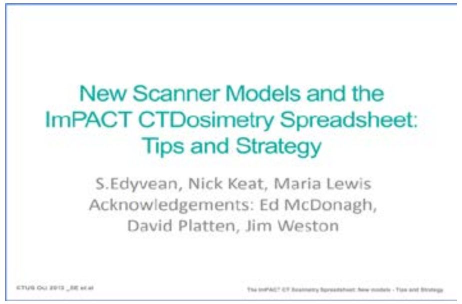
ImPACT Factor (ImF) vs Effective Dose

ImF (body) = a. ($CTDI_{32cm.centre}$ / $CTDI_{air}$)+ b. ($CTDI_{32cm.perpiphery}$ / $CTDI_{air}$)+ constant

Body Region



Adding CTDI data to Scanners Worksheet



- For each kV, beam shaping filter combination
  - Add CTDI centre and periphery and free in air for each phantom (or only head or body if that was all you wanted) (generally using 10 mm collimation, or 20 mm)
  - Add relative CTDI for each beam width (at standard kV)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Scanner	kVp	Sub-group	Scanner	CTDI (Head, mGy/100mAs)			CTDI (Body, mGy/100mAs)			ImPACT Factor				Scanner Match	
2	Group				Air	Centre	Perip	Air	Centre	Perip	Head	Body			Head	Body
57	GE.p	120	GE.p.120	GE LightSpeed VCT (small hd, large bd)	34.9	22.4	22.5	27.9	6.5	13.1	0.90	1.04	10	17	20	21
58	GE.p	140	GE.p.140	GE LightSpeed VCT (small hd, large bd)	46.8	31.3	31.0	38.8	9.6	18.5	0.92	1.10	11	19	20	16
59																
60																
61																
62																
63	PH.a	120	PH.a.120	Philips 310, 350 (G[illegible] Cu)	32.8	18.7	21.2				0.87		10	5	13	14
64	PH.b	120	PH.b.120	Philips 310, 350 (G[illegible] Cu)	15.8	11.2	11.6				1.00		14	5	14	14
65	PH.c	120	PH.c.120	Philips 310, 350 (G[illegible] Cu)				21.7	4.2	10.2		0.90	3	15	15	15
66	PH.d	120	PH.d.120	Philips 310, 350 (G[illegible] Cu)							1.11	1.14	20	20	16	16
67	PH.e	80	PH.e.080	Philips AV, LX, SR7	4.3	2.6	3.0	8.7	1.4	3.5	0.93	0.73	11	11	20	5
68	PH.e	100	PH.e.100	Philips AV, LX, SR7	13.2	8.8	9.6	13.2	2.6	5.7	0.98	0.89	13	13	22	22
69	PH.e	120	PH.e.120	Philips AV, LX, SR7	19.2	13.6	14.8	19.3	4.3	9.0	1.03	1.01	16	16	19	19
70	PH.e	130	PH.e.130	Philips AV, LX, SR7	22.6	16.0	17.6	22.8	5.3	11.1	1.04	1.05	17	18	23	23

Version | Introduction | ScanCalcula | Phantom | Paediatric | Scanners | MatchData | Collimation | MonteCarloData | Dose

	A	B	C	D	E
1	Scanner Group	Collimation setting	Sub-group	Collimation (mm)	Rel. CTDI
77	GE.p	3	GE.p.3	10	1.10
78	GE.p	4	GE.p.4	1.25	1.46
79	GE.q	1	GE.q.1	40	0.80
80	GE.q	2	GE.q.2	20	0.90
81	GE.q	3	GE.q.3	10	1.00
82	GE.q	4	GE.q.4	1.25	1.50
83	PH.e	1	PH.e.1	10	1.00
84	PH.e	2	PH.e.2	7	0.99
85	PH.e	3	PH.e.3	5	1.00
86	PH.e	4	PH.e.4	3	0.98
87	PH.e	5	PH.e.5	2	0.57
88	PH.e	6	PH.e.6	1.5	0.92
89	PH.e	7	PH.e.7	1	3.01
90	PH.e	8	PH.e.8	1 (AV)	1.11
91	PH.f	1	PH.f.1	10	1.00

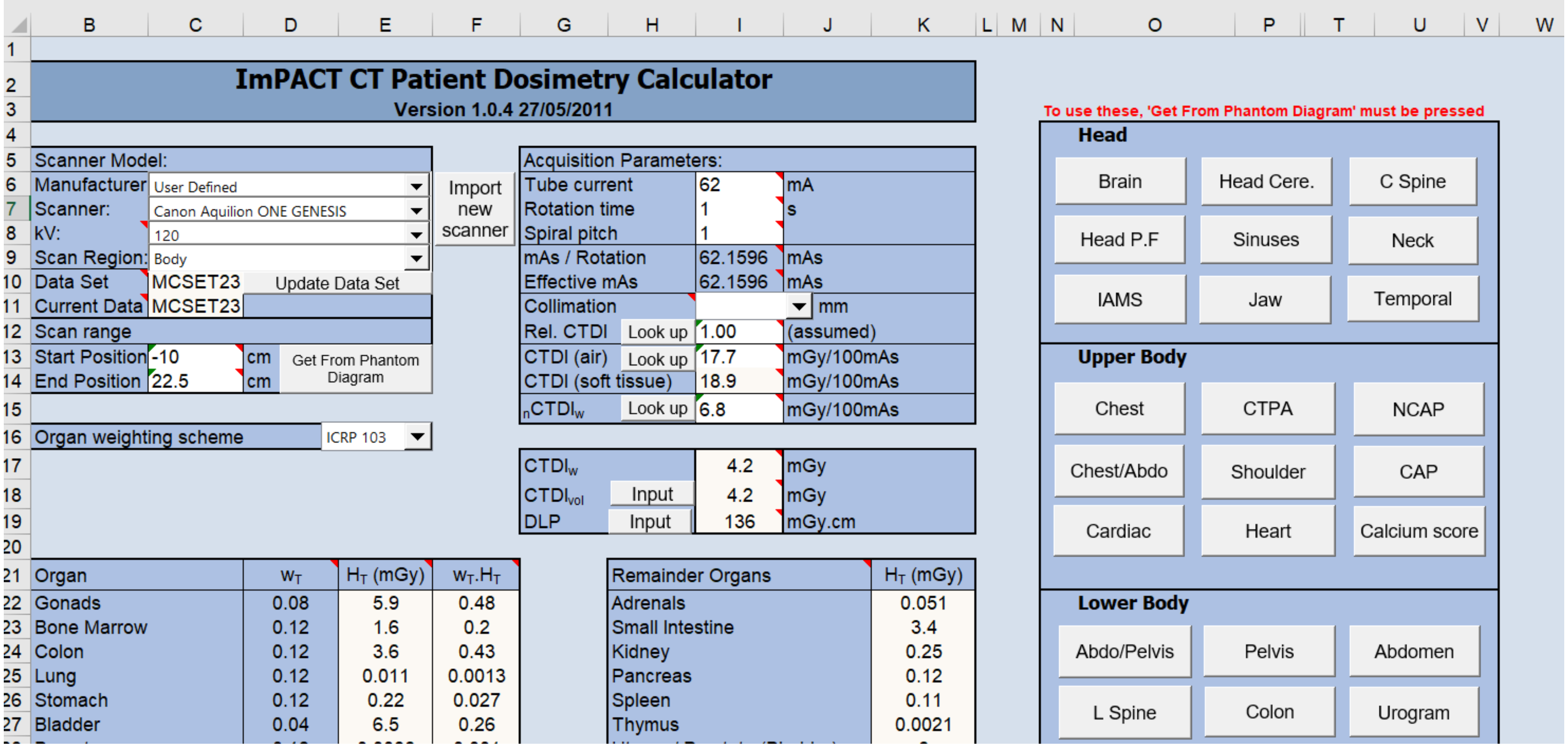
Version | Introduction | ScanCalculation | Phantom | Pae

	Scanner Group	kVp	Sub-group	Scanner	CTDI (Head, mGy/100mAs)			CTDI (Body, mGy/100mAs)			ImPACT Factor	
1–2					Air	Centre	Perip	Air	Centre	Perip	Head	Body
57	GE.p	120	GE.p.120	GE Light[illegible]d VCT (small hd, large bd)	34.9	22.4	22.5	27.9	6.5	13.1	0.90	1.04
58	GE.p	140	GE.p.140	GE LightSpeed VCT (small hd, large bd)	46.8	31.3	31.0	38.8	9.6	18.5	0.92	1.10
59	GE.q	80	GE.q.080	GE SuperNewPlus	10.0	8.0	9.0	10.0	2.0	5.0	1.18	0.94
60	GE.q	100	GE.q.100	GE SuperNewPlus	20.0	15.0	16.0	20.0	4.0	10.0	1.07	0.94
61	GE.q	120	GE.q.120	GE SuperNewPlus	30.0	25.0	25.0	30.0	6.0	15.0	1.14	0.94
62	GE.q	140	GE.q.140	GE SuperNewPlus	40.0	30.0	30.0	40.0	10.0	20.0	1.03	1.12

Collimator Tab: Add relative CTDI for each beam width

Many Sites have added their own scanners and/or modifications

e.g.



ImPACT CT Patient Dosimetry Calculator
Version 1.0.4 27/05/2011

Scanner Model:		
Manufacturer	User Defined	Import new scanner
Scanner:	Canon Aquilion ONE GENESIS	
kV:	120	
Scan Region:	Body	
Data Set	MCSET23	Update Data Set
Current Data	MCSET23	
Scan range		
Start Position	-10 cm	Get From Phantom Diagram
End Position	22.5 cm	
Organ weighting scheme	ICRP 103	

Acquisition Parameters:			
Tube current		62	mA
Rotation time		1	s
Spiral pitch		1	
mAs / Rotation		62.1596	mAs
Effective mAs		62.1596	mAs
Collimation			mm
Rel. CTDI	Look up	1.00	(assumed)
CTDI (air)	Look up	17.7	mGy/100mAs
CTDI (soft tissue)		18.9	mGy/100mAs
$_nCTDI_w$	Look up	6.8	mGy/100mAs

$CTDI_w$		4.2	mGy
$CTDI_{vol}$	Input	4.2	mGy
DLP	Input	136	mGy.cm

Organ	w_T	H_T (mGy)	$w_T.H_T$
Gonads	0.08	5.9	0.48
Bone Marrow	0.12	1.6	0.2
Colon	0.12	3.6	0.43
Lung	0.12	0.011	0.0013
Stomach	0.12	0.22	0.027
Bladder	0.04	6.5	0.26

Remainder Organs	H_T (mGy)
Adrenals	0.051
Small Intestine	3.4
Kidney	0.25
Pancreas	0.12
Spleen	0.11
Thymus	0.0021

To use these, 'Get From Phantom Diagram' must be pressed

Head: Brain, Head Cere., C Spine, Head P.F, Sinuses, Neck, IAMS, Jaw, Temporal

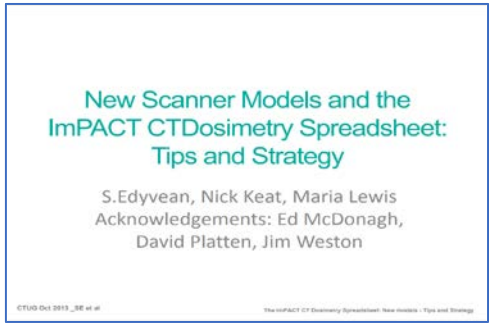
Upper Body: Chest, CTPA, NCAP, Chest/Abdo, Shoulder, CAP, Cardiac, Heart, Calcium score

Lower Body: Abdo/Pelvis, Pelvis, Abdomen, L Spine, Colon, Urogram

Royal Surrey County Hospital NHS Foundation Trust, Medical Physics Department, with permission; M Pryor.

Update of downloadable version of ImPACT

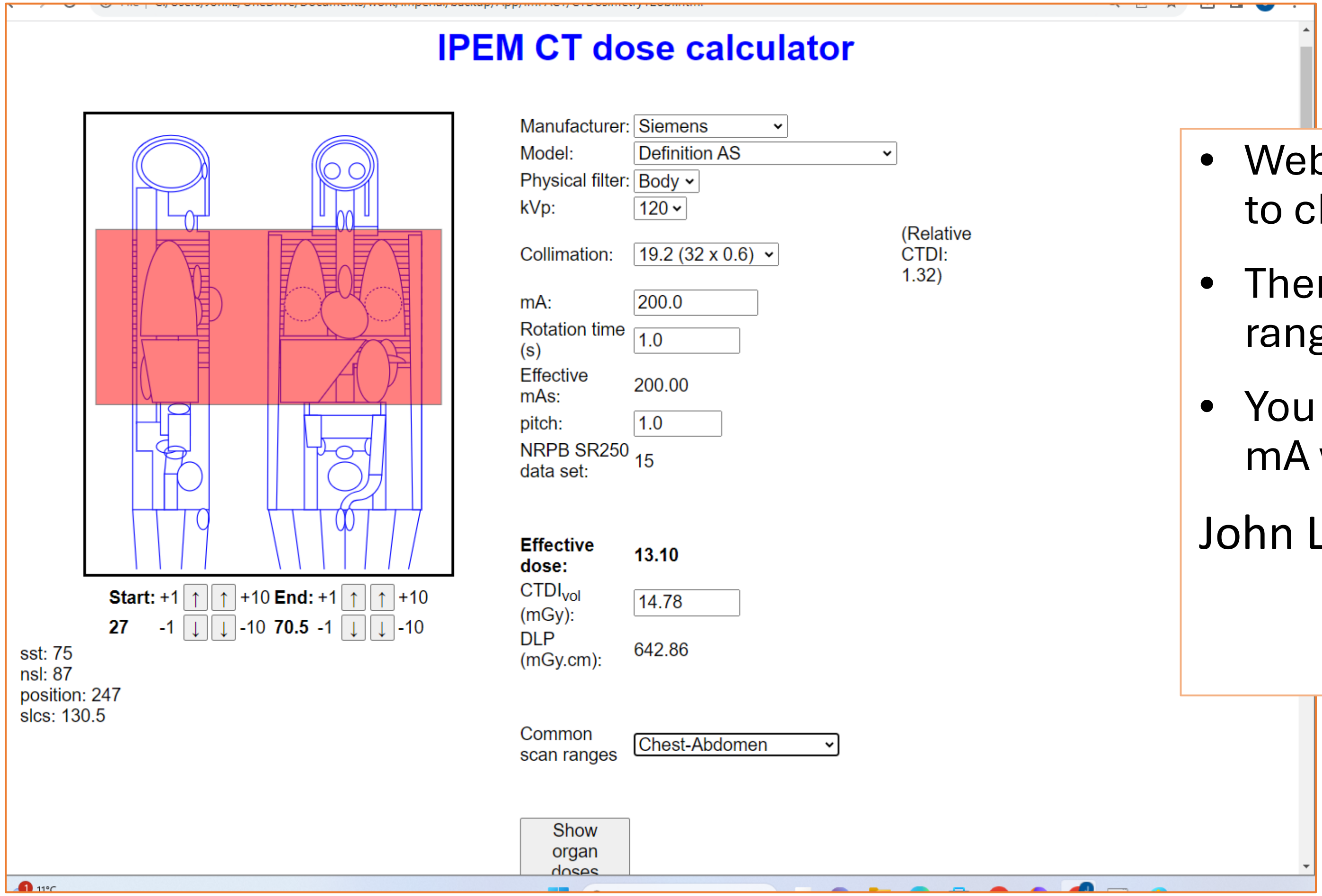
- Various strategies to acquire CTDI data from many different models
  - Request from ImPACT website, with a form (DRSIG helped)
  - Continued by trying to focus on one model at a time (Siemens Flash)
  - IPEM Working party (JL)



- All got so far – but the task got overwhelming.
  - Variable data submitted, a lot of data from a small number of centres, a lot of different models in the data, not always complete data …
  - “Ultimately there wasn't enough data to get a meaningful average for any one model “ JL
- In theory could be done with manufacturers data .. but that route was not taken – again a large task. Would need to be a new project.
- It has therefore proved to be an unwieldy task, so a new publicly available, downloadable, version with more scanners has sadly not come to fruition.
  - It still remains possible to add your own scanners on the existing version.

Web Version IPEM WP – ImPACT update

- Part of the IPEM WP aim was to issue a web- based version. (This could still go ahead if wanted. However, note – it is still not a general version updated with more scanners)



- Web version : click and drag on the diagram to choose your scan range
- There is a drop down menu for common scan ranges
- You can enter a displayed CTDIvol and the mA will automatically adjust appropriately

John Loveland

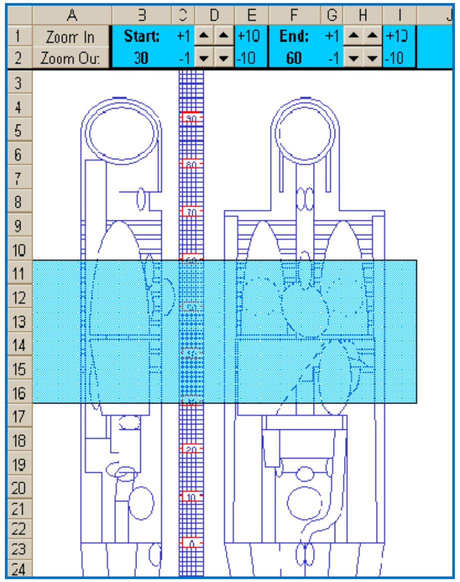
CT Dosimetry Calculators – ICRP 113

- UKHSA (Jan Jansen) are also contributing to the CT work on an ICRP web-based calculator
- ICRP Task Group 113: Reference Organ and Effective Dose Coefficients for Common Diagnostic X-ray Imaging Examinations
  - Will cover general radiology, diagnostic fluoroscopy, computed tomography, interventional fluoroscopy
- Computed Tomography (CT)
  - One reference scanner model (a virtual physical scanner based on the UKHSA scanner set)
  - Web based
  - Adult and Paediatric ICRP voxel phantoms
  - Differences in dose response function models used for bone Active Marrow (AM) and Shallow Marrow (SM) (UKHSA Johnson et al, ICRP according to ICRP 116)
  - Differences in lymph node (UKHSA ICRP 110, ICRP according to ICRP 143)
- ICRP Task Group work ongoing – to be completed in next few years

Monte Carlo organ dose conversion co-efficient (DCC) project

Extensive work on various modifications of MIRD phantom – including for quality control, organs and composition

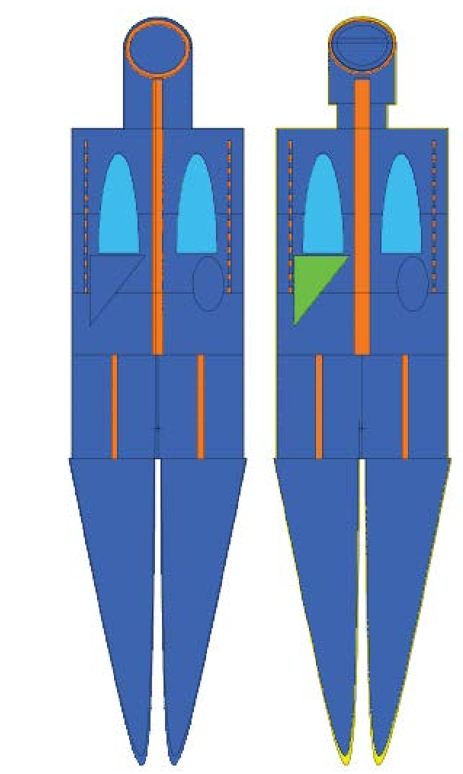
NRPB 18+DJ specific implementation



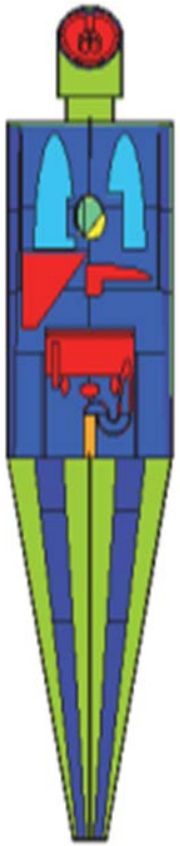
NRPB SR250

MIRD with modifications

NRPB 18+DJ (re-created) **HPA 18+** **HPA 18+**

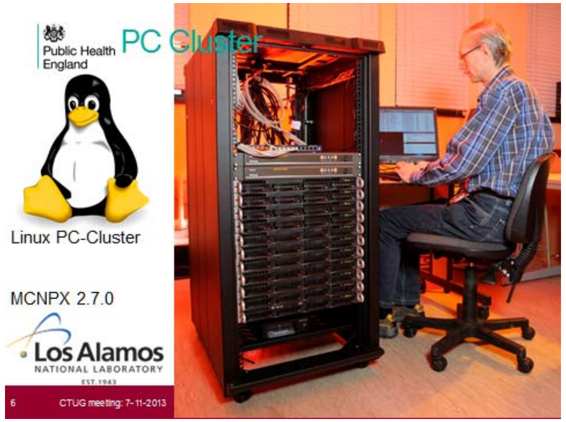


Shown as coronal planes 3.5 cm posterior to mid-planes



ICRP Computational Reference (Voxel) Phantoms - Adults ICRP Publication 110

Shown as coronal planes 3.5 cm posterior to mid-planes



UKHSA CT organ DCC project - Publications

1. **Set-up - 2016**
   - Jan T M Jansen and Paul C Shrimpton. Development of Monte Carlo simulations to provide scanner-specific organ dose coefficients for contemporary CT. Physics in Medicine and Biology, 2016 Jul 21;61(14):5356-77. doi: 10.1088/0031-9155/61/14/5356.
2. **Bone dosimetry models - 2018**
   - Jan TM Jansen, Paul C Shrimpton, John Holroyd and Sue Edyvean. Selection of bone dosimetry models for application in Monte Carlo simulations to provide CT scanner-specific organ dose coefficients. Physics in Medicine and Biology, 2018 Jun 19;63(12):25015 (22pp) doi: 10.1088/1361-6560/aac717.
3. **Adults results – CT scanner specific organ dose co-efficients - 2022**
   - Jan TM Jansen, Paul C Shrimpton and Sue Edyvean. CT scanner-specific organ dose coefficients generated by Monte Carlo calculation for the ICRP adult male and female reference computational phantoms. Physics in Medicine and Biology, 2022 Nov 16;67(22):225015. doi: 10.1088/1361-6560/ac9e3d.
4. **Methodology for additional scanners - 2023**
   - Jan TM Jansen, Paul C Shrimpton, and Sue Edyvean. Development of a generalized method to allow the estimation of doses to the ICRP reference adults from CT, on the basis of normalized organ and CTDI dose data determined by Monte Carlo calculation for a range of contemporary scanners. Physics in Medicine and Biology, 68 (2023) 035022 https://doi.org/10.1088/1361-6560/acb2a8.

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Shrimpton PC, Jansen JT, Harrison JD.
Updated estimates of typical effective doses for common CT examinations in the UK following the 2011 national review.
Br J Radiol. 2016;89(1057):20150346. doi: 10.1259/bjr.20150346. Epub 2015 Nov 6.

Nov 2015

FULL PAPER

Updated estimates of typical effective doses for common CT examinations in the UK following the 2011 national review

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Development of Monte Carlo simulations to provide scanner-specific organ dose coefficients for contemporary CT

1

Jan T M Jansen and Paul C Shrimpton

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Accepted for publication 10 June 2016
Published 30 June 2016

CrossMark

Physics in Medicine and Biology, 2016 Jul 21;61(14):5356-77. doi: 10.1088/0031-9155/61/14/5356.

PAPER

Selection of bone dosimetry models for application in Monte Carlo simulations to provide CT scanner-specific organ dose coefficients

2

Jan T M Jansen[1,3], Paul C Shrimpton[1,2], John Holroyd[1] and Sue Edyvean[1]

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Physics in Medicine & Biology, Volume 63, Number 12

Citation Jan T M Jansen *et al* 2018 *Phys. Med. Biol.* **63** 125015

Physics in Medicine and Biology, 2018 Jun 19;63(12):25015 (22pp) doi: 10.1088/1361-6560/aac717.

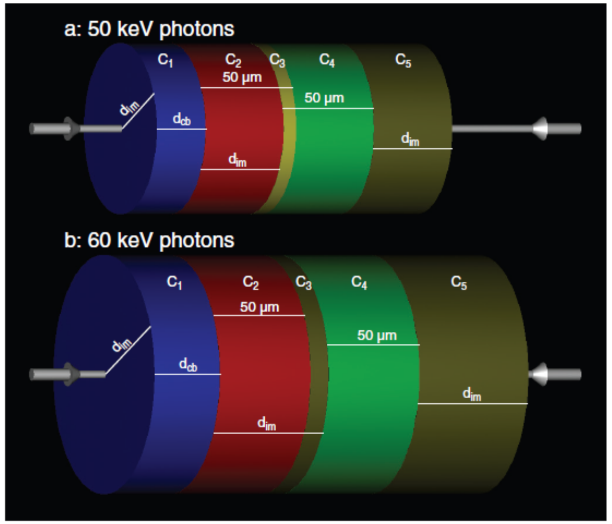
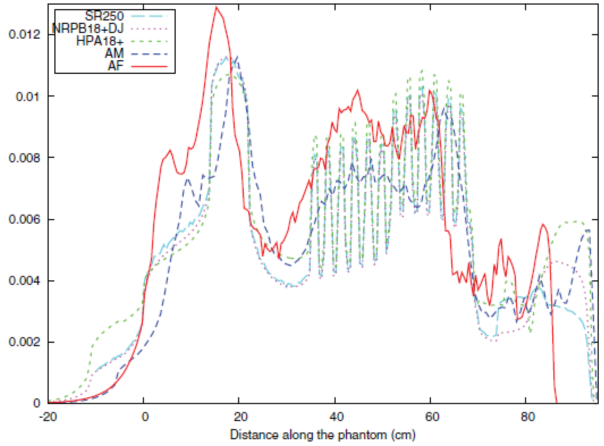


Figure 2. The simplified model used to assess enhancement factors for the dose to endosteum in medullary cavities. It consists of one cylinder composed of five compartments with the primary photons travelling on the cylinder axis in both directions. The upper part (a) shows the model for primary 50 keV photons and the lower part (b) for primary 60 keV photons, with the dimensions shown in table 3. The content of the left most compartment, C_1, is cortical bone (cb) and all other compartments consists of inactive marrow (im). The purpose and thickness (d) of each compartment is explained further in the text. The photons impinge on the cylinder along the central cylinder axis from both sides, as indicated by the arrows on the cylinder axis.



ctive marrow dose coefficients, $D_{am}/CTDI_{air}$, per 1 cm slab thickness, versus height along the phantom (where zero n of the trunk, positive values go towards the head, negative values towards the feet), calculated for the Siemens RH operated at 125 kV and various anthropomorphic phantoms: the hermaphrodite mathematical phantoms SR250), NRPB18+DJ (......) and HPA18+ (- - - -); and the male AM (— — —) and female AF (———) voxel phantoms.

Published Papers

3

CT scanner-specific organ dose coefficients generated by Monte Carlo calculation for the ICRP Adult Male and Female reference computational phantoms

Jan TM Jansen[1], Paul C Shrimpton[1], and Sue Edyvean[1]

[1] Centre for Radiation, Chemical and Environmental Hazards, Public Health England, Chilton, Didcot, Oxfordshire, OX11 0RQ, UK

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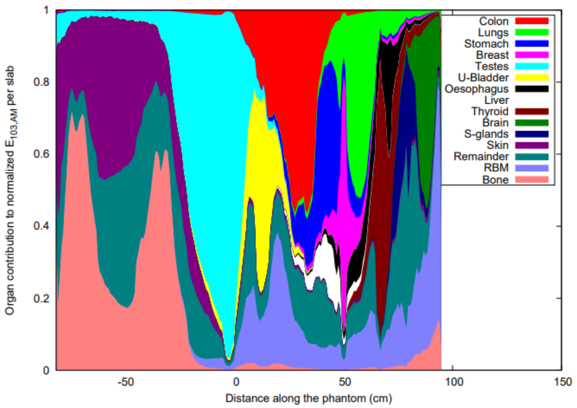
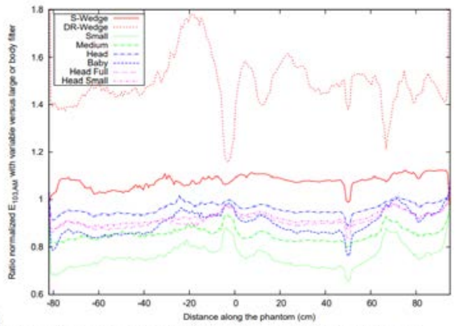


Figure 2.
Colour-coded fractional contributions by organs to the normalized sex-specific effective dose, $E_{103,AM}$, per slab of AM by position along the z-axis. Data relate to the Siemens Definition scanner (120 kV, Body shaping filter, Full-fan beam).



ure 16.
ios of the normalized sex-specific effective dose, $E_{103,AM}$, calculated per slab of with various beam shaping filters listed in the legend versus the corresponding e filter, plotted against the slab position along the z-axis. Data are for the Toshiba ilion 16 (with the S-wedge and DR-wedge), General Electric VCT (Small and lium), Philips iCT 256 (Head and Baby) and Siemens Definition (Head with full beam and Head with small fan-beam), all operated at 120 kV.

Physics in Medicine and Biology, 2022 Nov 16;67(22):225015. doi: 10.1088/1361-6560/ac9e3d.

Development of a generalized method to allow the estimation of doses to the ICRP reference adults from CT on the basis of normalized organ and CTDI dose data determined by Monte Carlo calculation for a range of contemporary scanners

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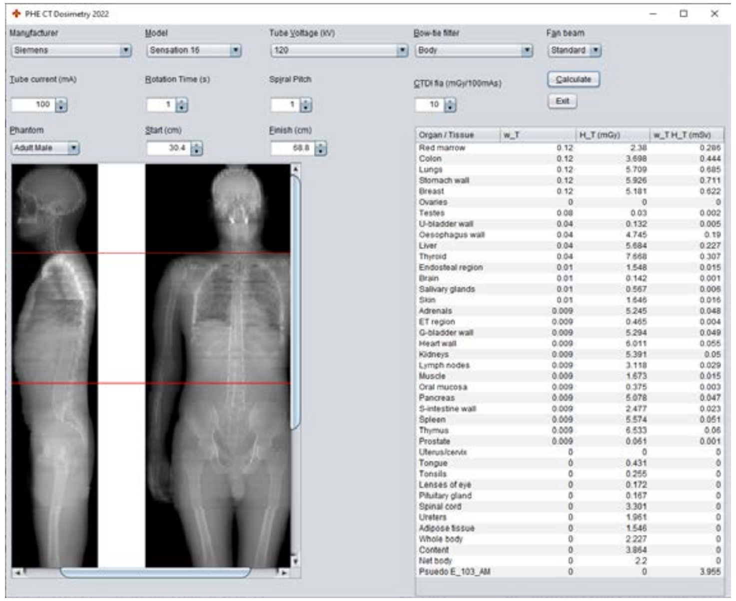
Physics in Medicine and Biology, 68 (2023) 035022
https://doi.org/10.1088/1361-6560/acb2a8.



Published Papers

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CT scanner-specific organ dose coefficients generated by Monte Carlo calculation for the ICRP Adult Male and Female reference computational phantoms

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- Investigations into effect of
  - Calculations with / without a couch
  - Influence of the arms in AM and AF
  - Influence of angular tube current modulation (ATCM)
  - Influence of body position relative to centre of scan

Development of a generalized method to allow the estimation of doses to the ICRP reference adults from CT on the basis of normalized organ and CTDI dose data determined by Monte Carlo calculation for a range of contemporary scanners

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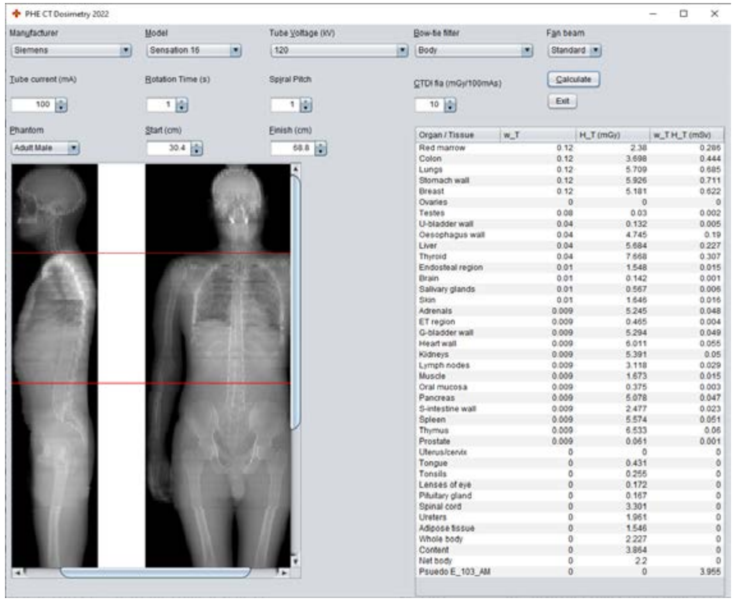
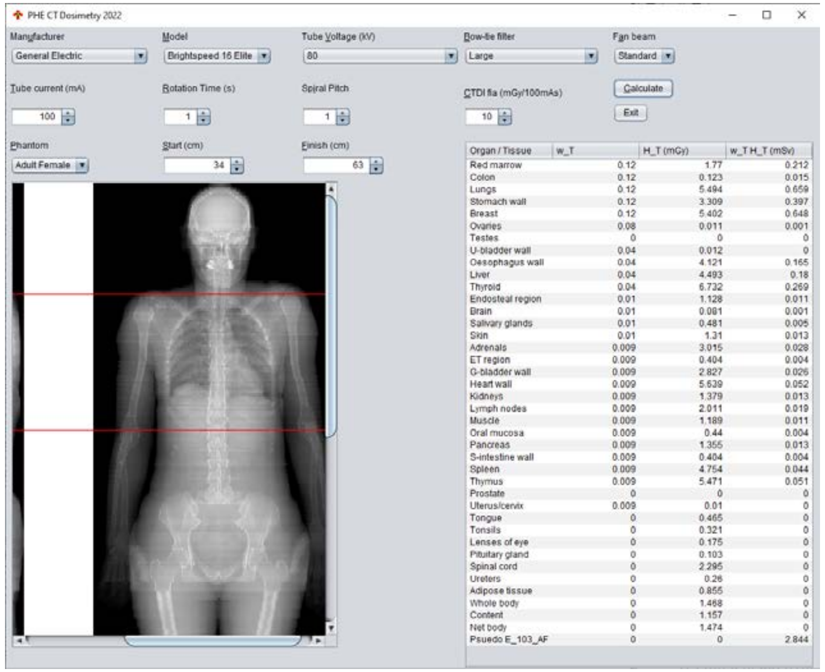


UKHSA Calculator

- With this work published, the development of the calculator now continues towards its final stages.
- Currently have an ‘Alpha’ version
  - James Stevens (RSCH) – elective placement took a first look for us from a user perspective
  - Looking for others to help comment at this stage
- Then a ‘Beta’ version for wider evaluation, and comment
- Note – it only contains the MC modelled scanners, however it does allow for the addition of new models.



Key Differences – between ImPACT and UKHSA

Name	Phantom (description)	Organ composition	# of Normalised Organ Dose Datasets (mGy/mGy)	MC code	ICRP Publication organs	'Scanner Model Matching' ('Scanner model and operating conditions')	For Matching Requires
ImPACT	MIRD-NRPB DJ implementation (Stylised phantom)	Only three tissues/organ compositions are used: bone, lung, and soft tissue.	23 (SR 250)	NRPB (DJ implementation)	60 103 (with surrogate organs)	Head exams: 'Scanner/ kV/ beam shaping filter' - - - - - Body exams: 'Scanner/ kV/ beam shaping filter'	$CTDI_{free\text{-}in\text{-}air}$ $CTDI_{16cm, (c\ and\ p)}$ - - - - - $CTDI_{free\text{-}in\text{-}air}$ $CTDI_{32cm, (c\ and\ p)}$
UKHSA	ICRP110 Voxel^ M/F	More detailed composition of organs	102 x2 (M/F)	MCNPX	103	'Scanner/kV/beam shaping filter' (M/F phantom dependent)	$CTDI_{free\text{-}in\text{-}air}$ $CTDI_{16cm, (c\ and\ p)}$ $CTDI_{32cm, (c\ and\ p)}$

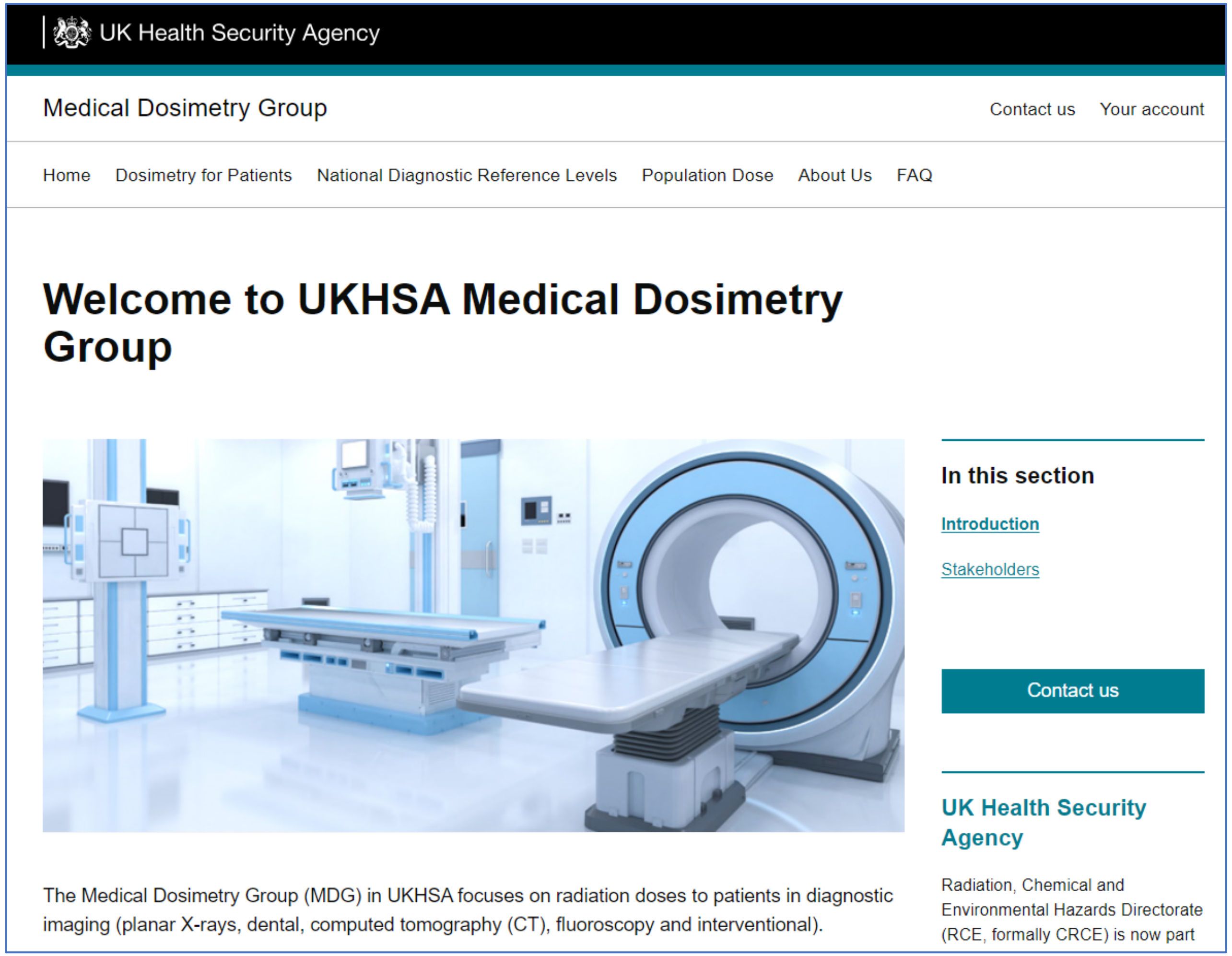
^Adult Male/Female ICRP Reference Computational voxel Phantom

- Normalisation of organ dose data sets are to $CTDI_{air}$ - hence only the $CTDI_{air}$ is needed to use the calculator, once a 'scanner with operating conditions' has been matched
- Some commercial packages use normalisation to $CTDI_{vol}$ (cf Turner et al, Med Phys 2010, Apr;37(4):1816-25). This was investigated in the UKHSA project, but was not a route chosen. (Jan T M Jansen and Paul C Shrimpton. Physics in Medicine and Biology, 2016 Jul 21;61(14))

CT Dosimetry Calculators - UKHSA/ImPACT

- A new web page has been created
  - to enable available information to be accessed easily (with the new calculator currently described as a work in progress);
  - Medical Dosimetry Group - Dosimetry for Patients (ukhsa-protectionservices.org.uk).

Medical Dosimetry Group - Introduction (ukhsa-protectionservices.org.uk)



UK Health Security Agency

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Welcome to UKHSA Medical Dosimetry Group

In this section

Introduction

Stakeholders

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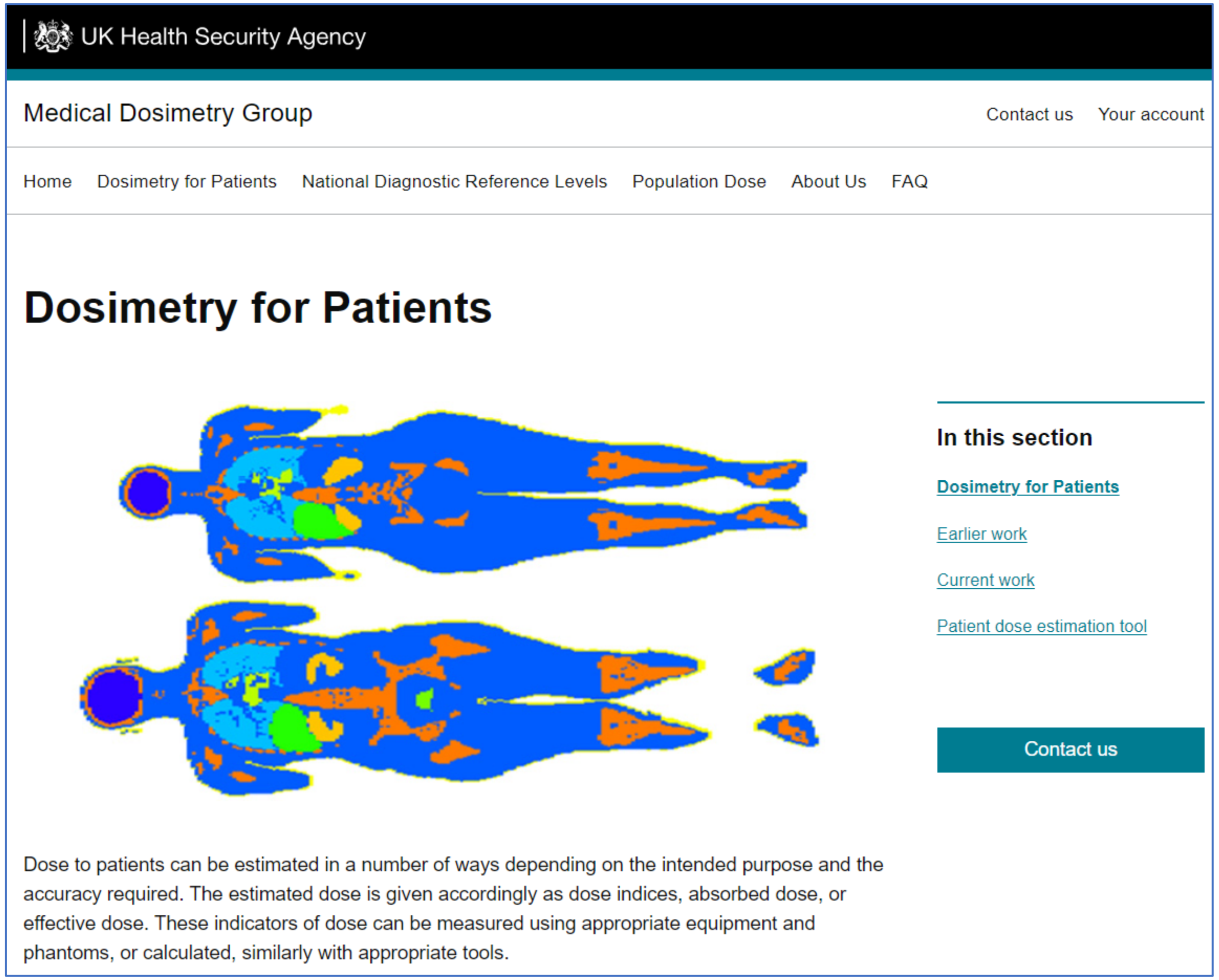
UK Health Security Agency

Radiation, Chemical and Environmental Hazards Directorate (RCE, formally CRCE) is now part

The Medical Dosimetry Group (MDG) in UKHSA focuses on radiation doses to patients in diagnostic imaging (planar X-rays, dental, computed tomography (CT), fluoroscopy and interventional).



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Dosimetry for Patients

In this section

Dosimetry for Patients

Earlier work

Current work

Patient dose estimation tool

Contact us

Dose to patients can be estimated in a number of ways depending on the intended purpose and the accuracy required. The estimated dose is given accordingly as dose indices, absorbed dose, or effective dose. These indicators of dose can be measured using appropriate equipment and phantoms, or calculated, similarly with appropriate tools.

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Earlier work

The work of the group in this area commenced in the 1980s, resulting in the SR250 normalised organ dose datasets. A front-end MS-DOS program was supplied at the time for the scanners modelled in SR250, however subsequently the ImPACT group (formerly at St George's Hospital) developed an Excel package that enabled interactive dose estimations, and also to apply the calculator to other, newer, scanner models by allowing the ability to match newer scanner models to the existing modelled scanners. The SR250 normalised organ dose datasets are still widely used and are freely available to download.

ImPACT CT Patient Dosimetry Calculator

Version 1.0.4 27/05/2011

- Utilises NRPB SR250 MC generated normalised organ dose co-efficients (free)
- ImPACT calculator. First created ~ 2002
- Instructions for adding own scanner
- Practical tips: Castellano et al Radiation Protection Dosimetry 2005 : "CT Dosimetry: Getting the best from the adult Cristy phantom"

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Current work

Most recent work utilises the ICRP Adult male and female voxel phantoms, a wide range of scanners and operating characteristics, and the application of ICRP Report 103 weighting factors.

The work is documented in the following papers:

Shrimpton PC, Jansen JT, Harrison JD.
Updated estimates of typical effective doses for common CT examinations in the UK following the 2011 national review.
Br J Radiol. 2016;89(1057):20150346. doi: 10.1259/bjr.20150346. Epub 2015 Nov 6.

Jan TM Jansen and Paul C Shrimpton.
Development of Monte Carlo simulations to provide scanner-specific organ dose coefficients for contemporary CT.
Physics in Medicine and Biology, 2016 Jul 21;61(14):5356-77. doi: 10.1088/0031-9155/61/14/5356. Epub 2016 Jun 30.

Jan TM Jansen, Paul C Shrimpton, John Holroyd and Sue Edyvean.
Selection of bone dosimetry models for application in Monte Carlo simulations to provide CT scanner-specific organ dose coefficients.
Physics in Medicine and Biology, 2018 Jun 19;63(12):125015. doi: 10.1088/1361-6560/aac717.

Jan TM Jansen, Paul C Shrimpton and Sue Edyvean.
CT scanner-specific organ dose coefficients generated by Monte Carlo calculation for the ICRP adult male and female reference computational phantoms.
Physics in Medicine and Biology, 2022 Nov 16;67(22). doi: 10.1088/1361-6560/ac9e3d.

Jan TM Jansen, Paul C Shrimpton, and Sue Edyvean.
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CT Dosimetry Calculators – ICRP 113

- UKHSA (Jan Jansen) are also contributing to the CT work on an ICRP web-based calculator
- ICRP Task Group 113: Reference Organ and Effective Dose Coefficients for Common Diagnostic X-ray Imaging Examinations
  - Will cover general radiology, diagnostic fluoroscopy, computed tomography, interventional fluoroscopy
- Computed Tomography (CT)
  - One reference scanner model (a virtual physical scanner based on Monte Carlo dose profiles of the UKHSA scanner set)
  - Web based
  - Adult and Paediatric ICRP voxel phantoms
  - Differences in dose response function models used for bone Active Marrow (AM) and Shallow Marrow (SM) (UKHSA Johnson et al, ICRP according to ICRP 116)
  - Differences in lymph node (UKHSA ICRP 110, ICRP according to ICRP 143)
- ICRP Task Group work ongoing – to be completed in next few years

UK Health Security Agency

CT Dosimetry Calculators - UKHSA/ImPACT

Sue Edyvean, Jan Jansen, John Holroyd

Updates and Overview

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