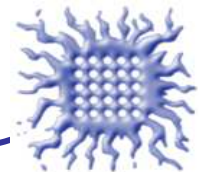


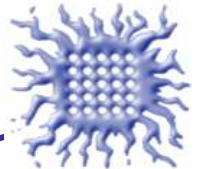
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Comparison of different methods for shielding design in computed tomography



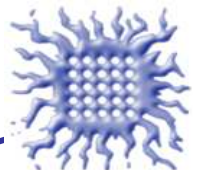
Introduction

- Scattered dose distribution in computed tomography (CT) is unique for each model of scanner:
 - *Collimation, exposure parameters, filtration.....*
- Shielding design:
 - *Basic principles of radiation protection*
 - *Protection of public and workers*



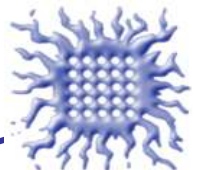
Methods of shielding design in CT

- BIR-IPEM (British Institute of Radiology and Institute of Physics in Engineering in Medicine):
 - *Isodose contours, scattered dose distribution*
- NCRP (National Council on Radiation Protection)
 - *CT dose index (CTDI), scatter factor*



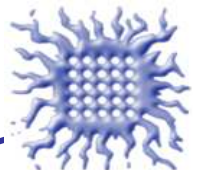
Purpose

- Comparison of different methods for shielding calculation in computed tomography
 - *Example of mobile computed tomography unit*
 - *Taking into account modern technologies in imaging and basic radiation protection principles*

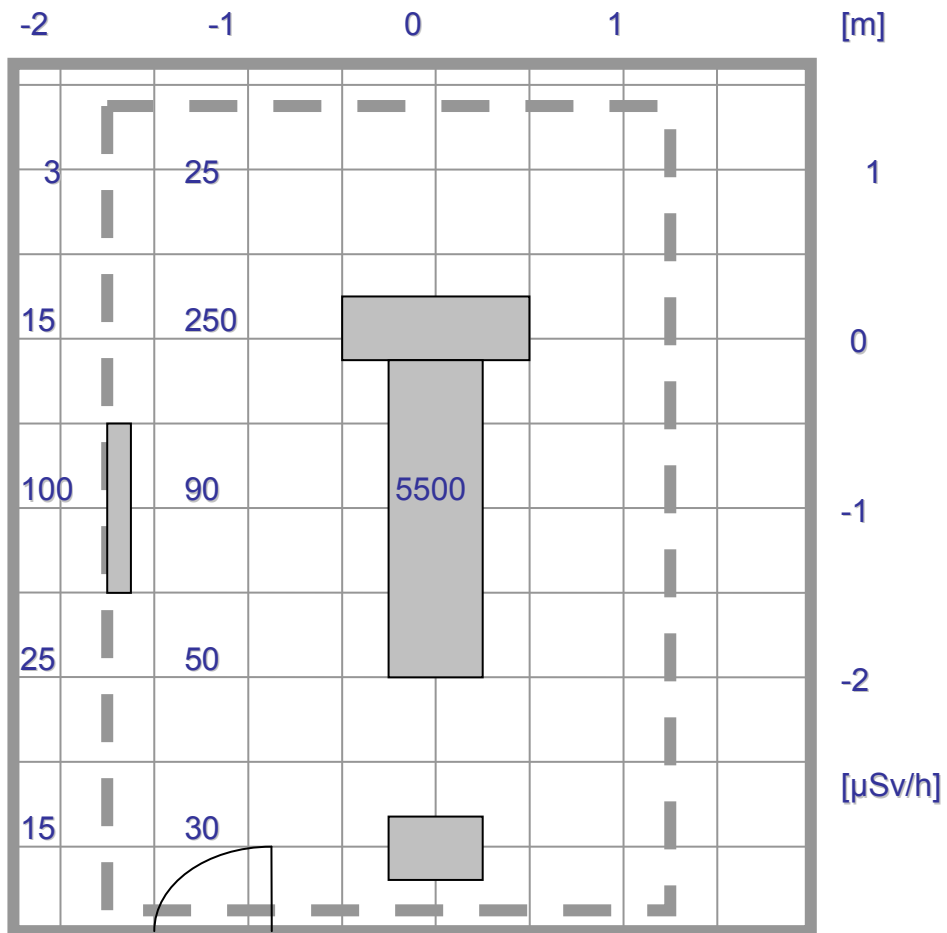


Methods

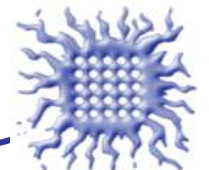
- Calculation methods: BIR–IPEM and NCRP
- Comparison to scatter dose measurements results in terms of ambient dose equivalent
- Scanner: CereTom (NeuroLogica, USA), 120 kVp, 7 mA, 2 s gantry rotation time, collimation 8 x 1.25 mm, 16 cm head phantom
- Other parameters: unity occupational factor, dose constraint of 0.3 mSv/year, workload of 80 patients/week



Results

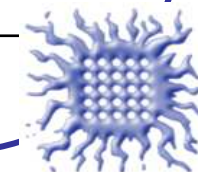


Measured scattered dose levels in the vicinity of CT unit CereTom, NeuroLogica



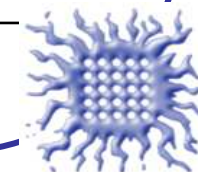
Results

Position	Distance from isocenter (m)	Measured	BIR-IPEM	NCRP
			K (mGy)	
(-2,1)	2.20	1.2	0.52	2.8
(-2,0)	2.00	1.4	1.3	3.4
(-2,-1)	2.20	1.2	1.2	2.8
(-2,-2)	2.80	0.72	1.2	1.7
(-2,-3)	3.60	0.43	0.77	1.0



Results

Position	Distance from isocenter (m)	Measured	BIR-IPEM	NCRP
			d (mm)	
(-2,1)	2.20	1.4	1.1	1.8
(-2,0)	2.00	1.5	1.4	1.9
(-2,-1)	2.20	1.4	1.4	1.8
(-2,-2)	2.80	1.2	1.4	1.7
(-2,-3)	3.60	1.0	1.3	1.4



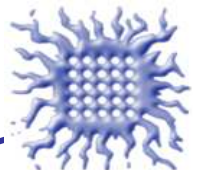
Results

Measured scattered dose levels were typically lower than calculated:

- BIR-IPEM: calculated dose was 16% higher in average
- NCRP: calculated dose had similar trend in all points (130% higher than measured ones)

Minimal requirement for protective barriers:

- BIR-IPEM: underestimation of up to 20% and overestimation of up to 30% when compared with thicknesses based on measured dose levels
- NCRP: calculated thicknesses were 33% higher in average (27% - 42%)



Conclusions

- If NCRP methodology is used, minimum required lead shielding were found to be overestimated compared to the measured dose
- BIR-IPEM methodology based results were comparable with values based of scattered dose measurements
- NCRP method is based on isotropic scatter dose distribution
- BIR-IPEM method takes into account presence of the gentry
- Thus, differences are the most significant in the area of gentry
- Challenge: realistic assessment of the workload

