

# Investigation of metrological characteristics of Whole Body Spectrometer

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## Introduction

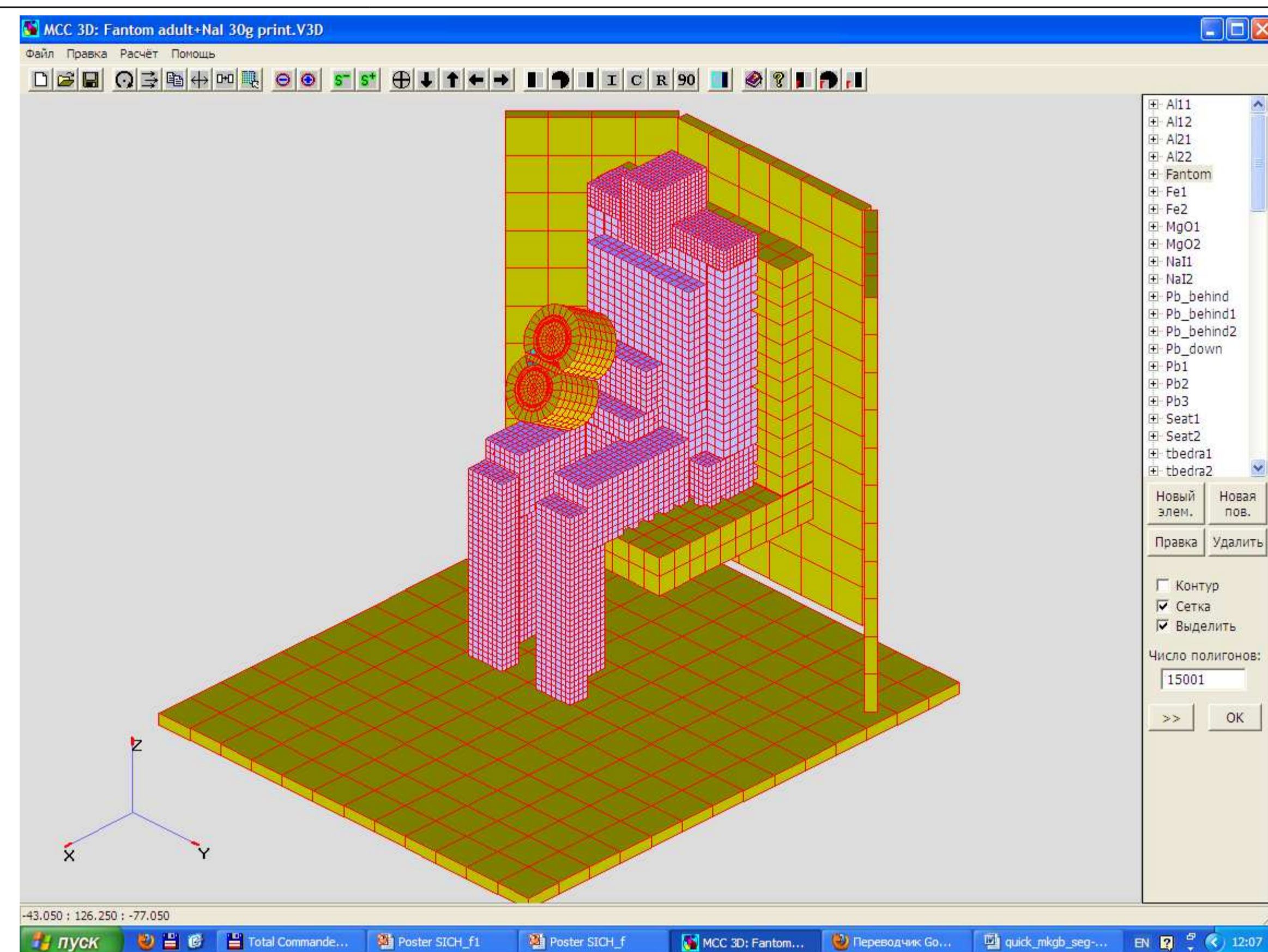
- Whole Body Spectrometer SEG-10P (STC "RADEK") with two 80x80 mm NaI(Tl) crystals
- Phantom of human body (baby 12 kg, teenager 27 kg, adult 70 kg)
- Monte-Carlo code MCC3D (Russia)

## Objectives

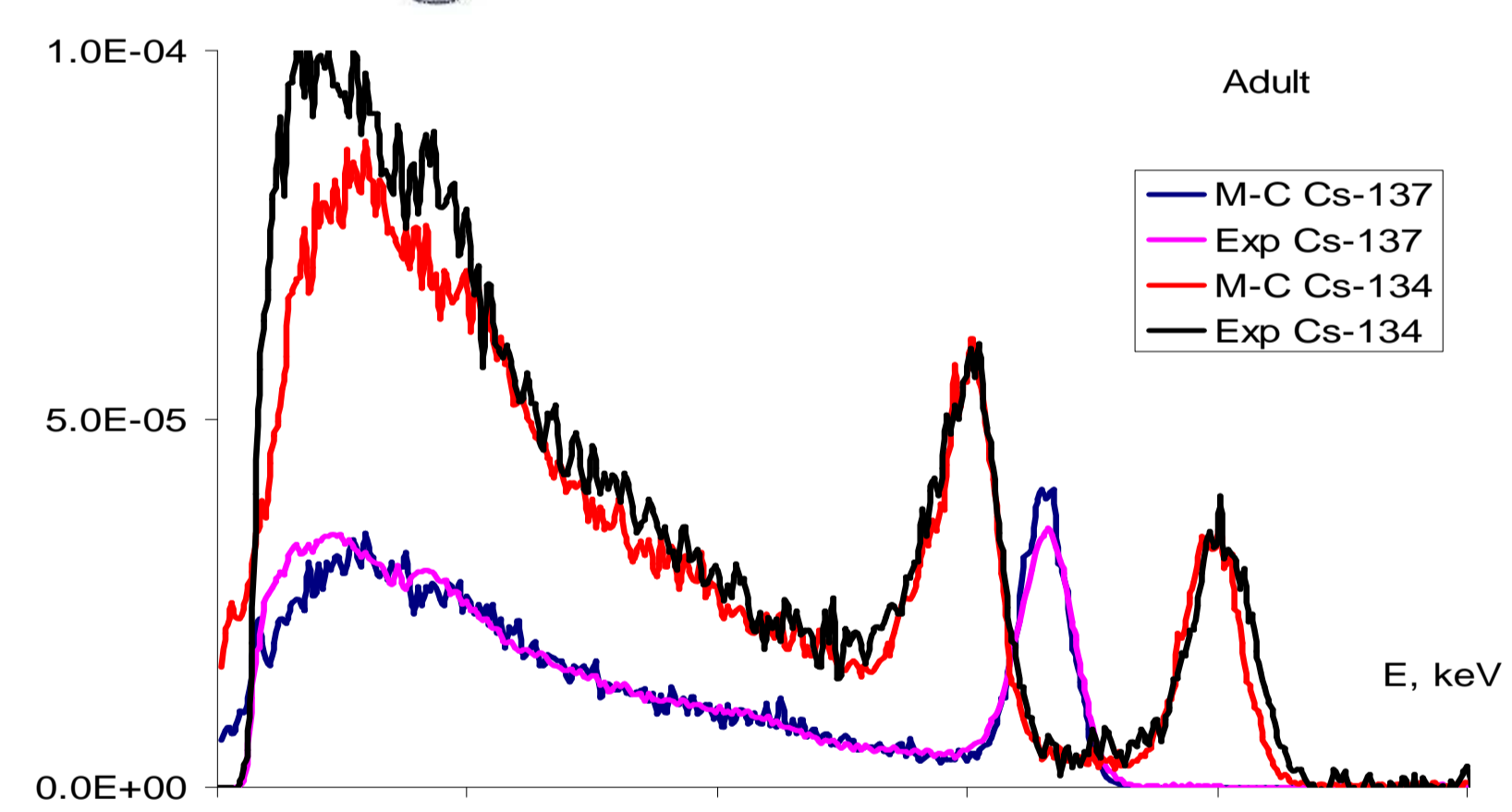
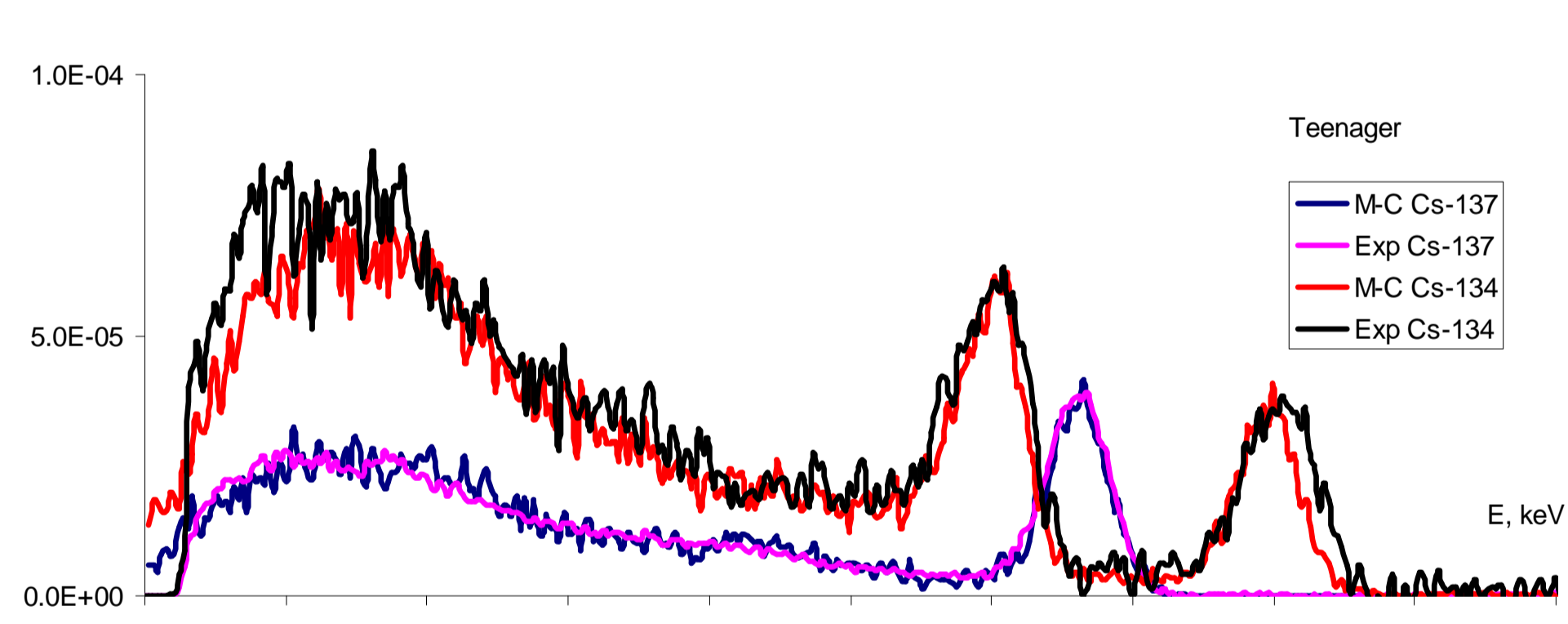
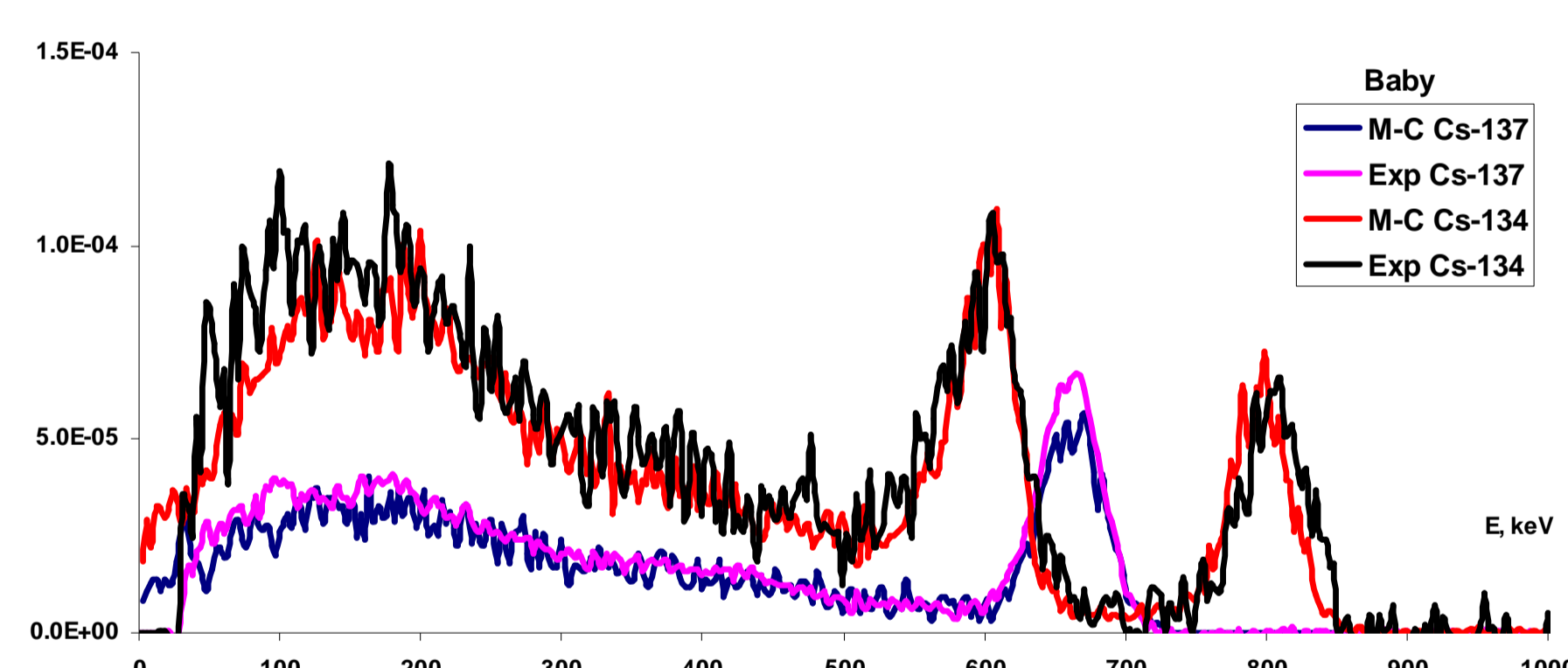
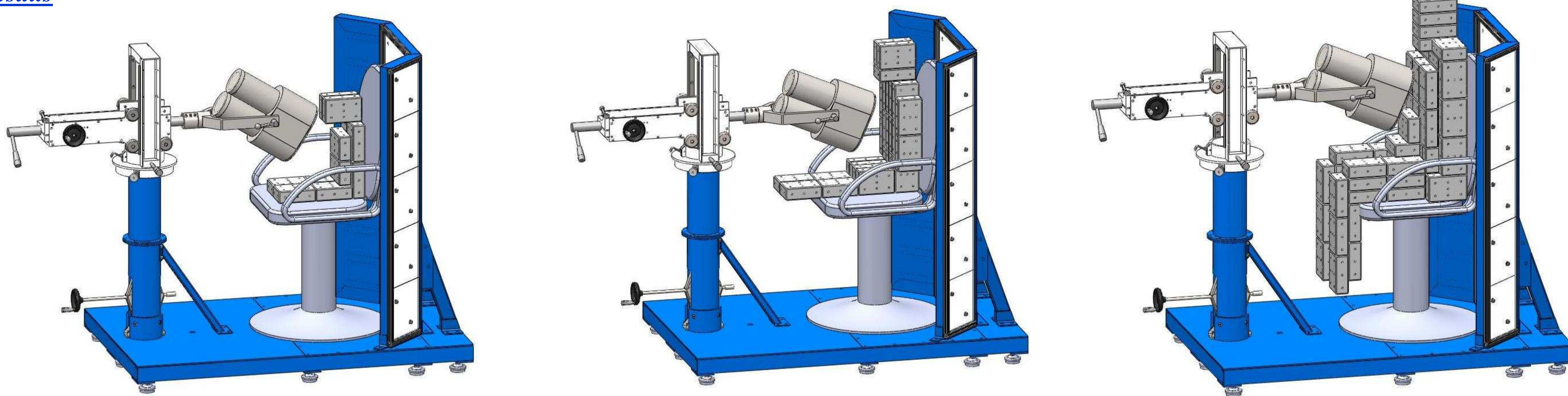
- The <sup>137</sup>Cs and <sup>134</sup>Cs registration efficiency
- Minimum detectable activity
- Detectors inclination influence
- "Phantom – detector" distance influence
- Background protection (Pb 3 mm) influence
- Uncertainty of result

## Methods

- Simulation of the <sup>137</sup>Cs and <sup>134</sup>Cs spectra by Monte-Carlo code with different inclination and "phantom-detector" distances
- Experimental and calculated results comparison



## Results



	Detectors efficiency for <sup>137</sup> Cs dependency of a detectors inclination. R=50 cm, 10 <sup>-4</sup> pulses /photon		Difference
	45°	30°	
Baby	9.5	10	5 %
Teenager	6.5	6.7	3 %
Adult	6.3	6.6	4 %

	Detectors efficiency for <sup>137</sup> Cs dependency of a "detector-phantom" distance. Angle=30°, 10 <sup>-4</sup> pulses /photon		Difference
	35 cm	50cm	
Baby	18	10	55 %
Teenager	9.1	6.7	37 %
Adult	7.8	6.6	20 %

## Discussion

- The Monte-Carlo method allows to calculate <sup>137</sup>Cs and <sup>134</sup>Cs registration efficiency with an Uc=20% (k=2).
- Minimum detectable activity 200 Bq for <sup>137</sup>Cs and 360 Bq for <sup>134</sup>Cs during 20 min.
- Detectors inclination influence is insignificant (<5%).
- Accuracy of the phantom-detector distance determination should be less than 5 cm for baby, 10 cm for teenager and 15 cm for adult person.
- Background protection of the phantom reduces the influence of natural radionuclides to negligibly small values.

## Conclusions

- Method of calibration of Whole Body Spectrometer by Monte-Carlo method without ionizing radiation sources was developed.
- Requirements for operating conditions of Whole Body Spectrometer were settled.
- Accessible uncertainty of the results were evaluated.
- The results obtained are in good coincidence with the computation results.
- Monte-Carlo method allows to calculate spectrometer efficiency for other radionuclides.