



ICRM Gamma Spectrometry Workshop

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COINCIDENCE-SUMMING CORRECTION FACTORS
OF ICRM INTERCOMPARISON EXERCISE
USING GEANT4

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COMPUTATIONAL ENVIRONMENT

- ❑ **GEANT4 v. 9.1**
- ❑ **Linux Ubuntu 8.10**
- ❑ **AMD Athlon 64 3700+**
- ❑ **gcc-4.3.2**
- ❑ **ROOT 5.14**

PHYSICS

Standard EM Gammas :

- photo-electric effect
- Compton scattering
- Pair production
- electron, muon pair production

Cuts:

- 0.001 mm**

(Ge: 250 eV gamma –
2.7 keV electron)

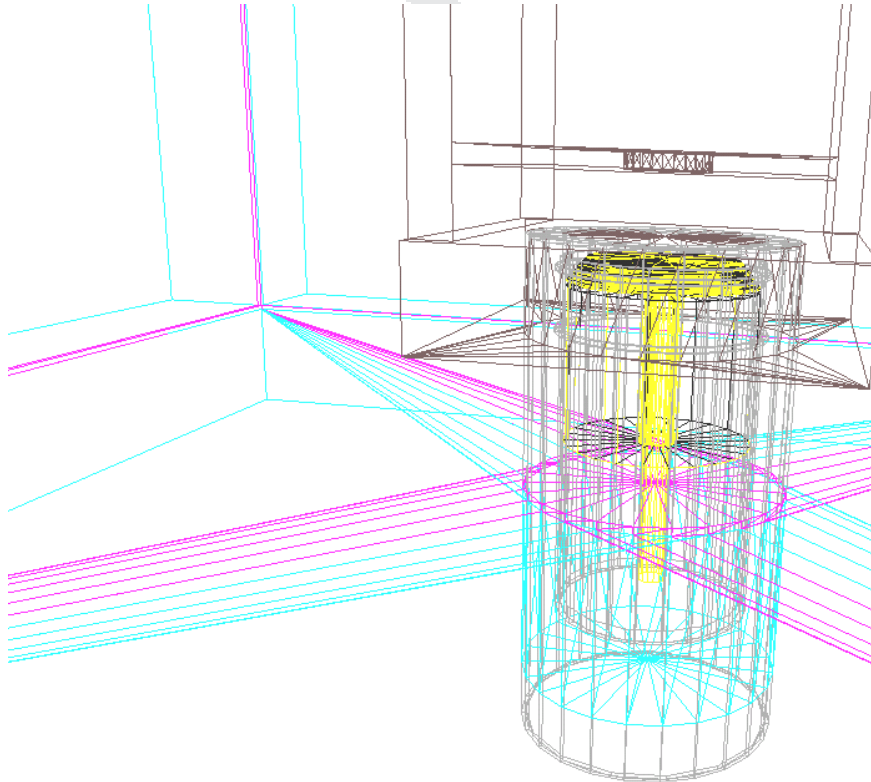
Standard EM Electrons/Positrons :

- Ionization and delta ray production
- Bremsstrahlung
- e+e- annihilation
- synchrotron radiation

Nuclear Database:

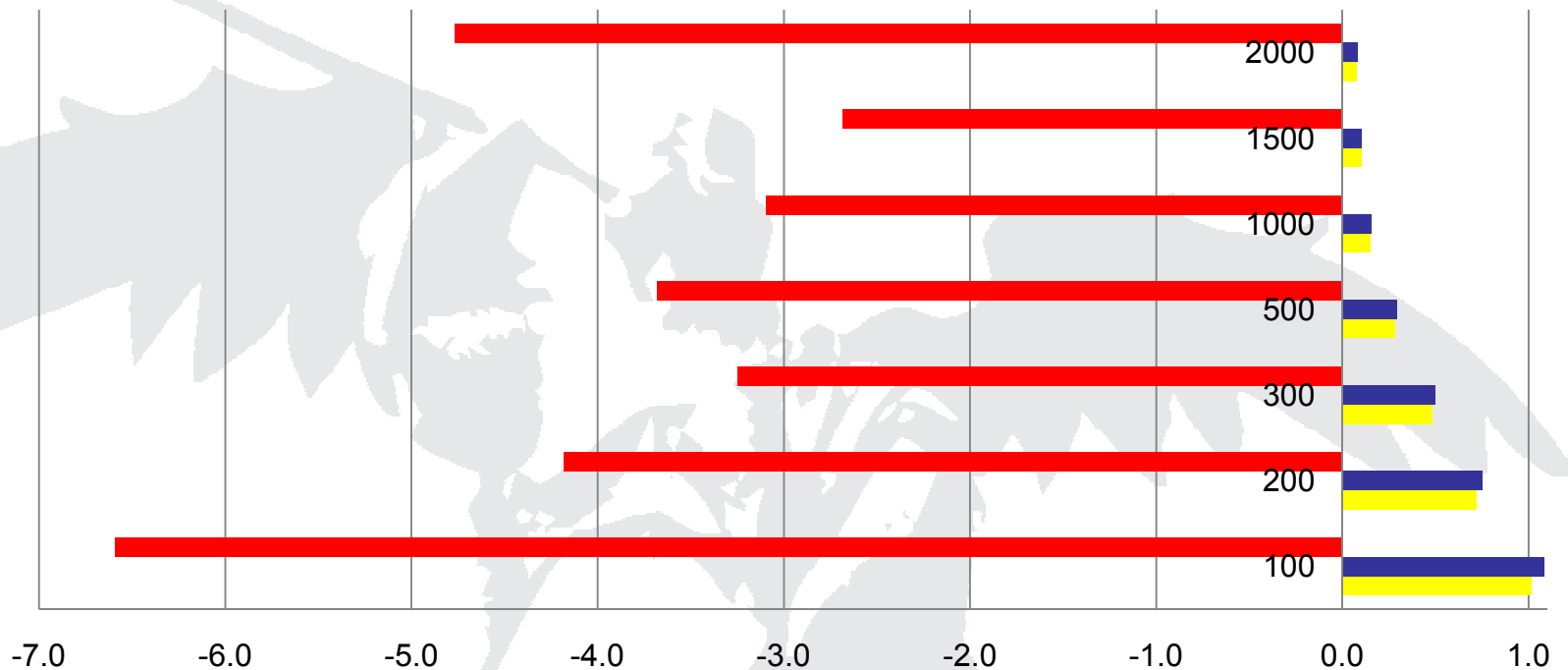
- NUCLÉIDE**
(¹⁵²Eu and ¹³⁴Cs)

DETECTOR SETUP



PARAMETER	X-ray
Crystal radius R	24.75 mm
Crystal height L	47.81 mm
Distance to window D	5.0 mm
Hole inner radius r	4.4 mm
Hole height d	39.5 mm
Inner dead layer t_h	1.0 mm
Front dead layer t_f	0.3 μm

F.E.P. EFFICIENCY Experimental vs MC (10 cm)



	100	200	300	500	1000	1500	2000
■ D (%)	-6.6	-4.2	-3.2	-3.7	-3.1	-2.7	-4.8
■ MC	1.08E+00	7.51E-01	4.98E-01	2.92E-01	1.53E-01	1.05E-01	8.03E-02
■ Experimental	1.02E+00	7.21E-01	4.83E-01	2.81E-01	1.48E-01	1.02E-01	7.66E-02

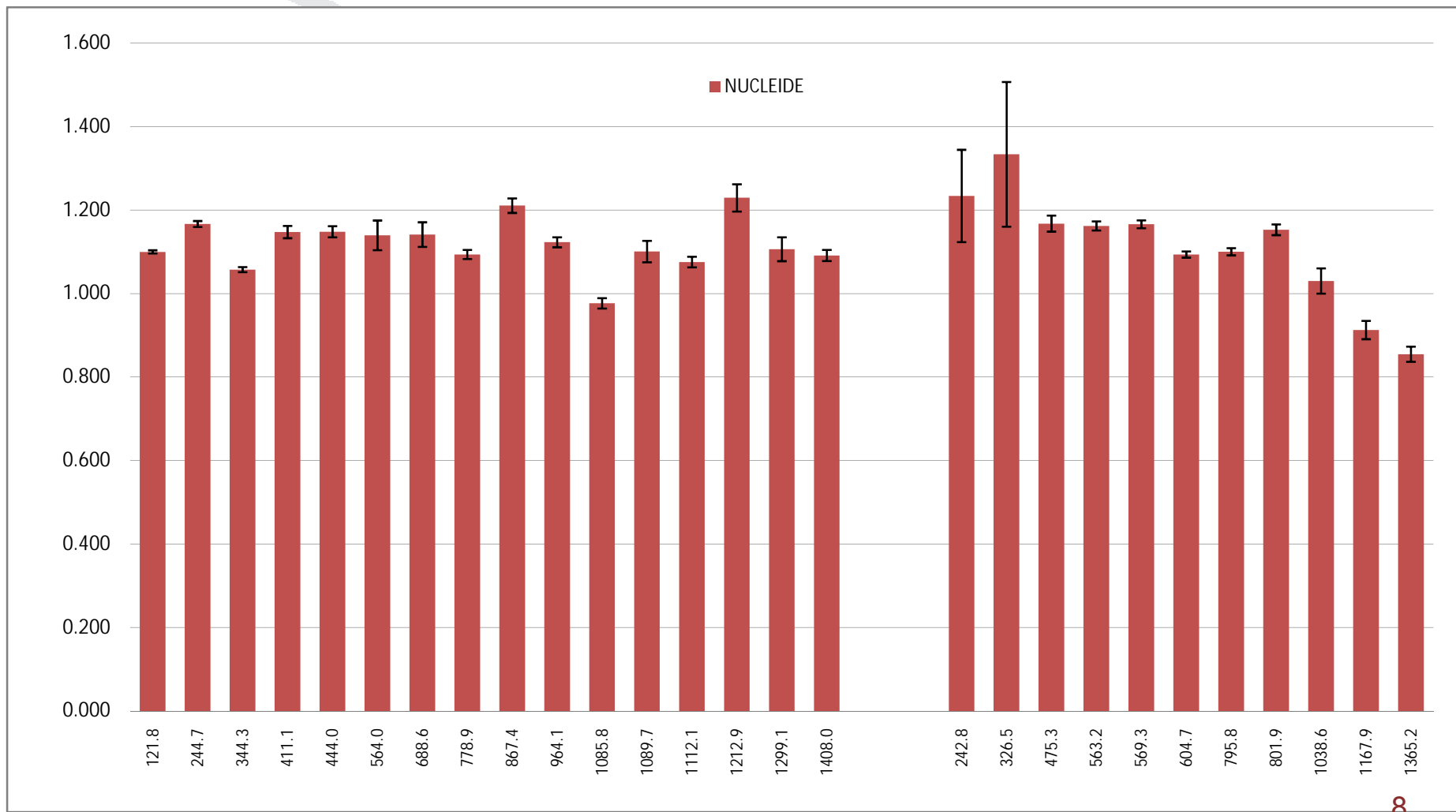
SIMULATION OF DECAY SCHEME

- Sampling decay mode:
 β^- decay or EC / β^+ decay
- Nuclear transition:
 γ emission or IC
- Atomic relaxation:
X-rays and Auger e^- by IC or EC

RESULTS – 2 cm

¹⁵² Eu			¹³⁴ Cs		
Energy/keV	C	error	Energy/keV	C	error
121.8	1.100	0.001	242.8	1.234	0.036
244.7	1.167	0.002	326.5	1.334	0.057
344.3	1.058	0.002	475.3	1.168	0.006
411.1	1.148	0.004	563.2	1.162	0.003
444.0	1.148	0.004	569.3	1.166	0.003
564.0	1.140	0.011	604.7	1.094	0.002
688.6	1.142	0.009	795.8	1.100	0.002
778.9	1.094	0.003	801.9	1.153	0.004
867.4	1.211	0.005	1038.6	1.030	0.010
964.1	1.123	0.003	1167.9	0.913	0.007
1085.8	0.977	0.004	1365.2	0.855	0.006
1089.7	1.101	0.008			
1112.1	1.076	0.004			
1212.9	1.230	0.010			
1299.1	1.107	0.009			
1408.0	1.091	0.004			

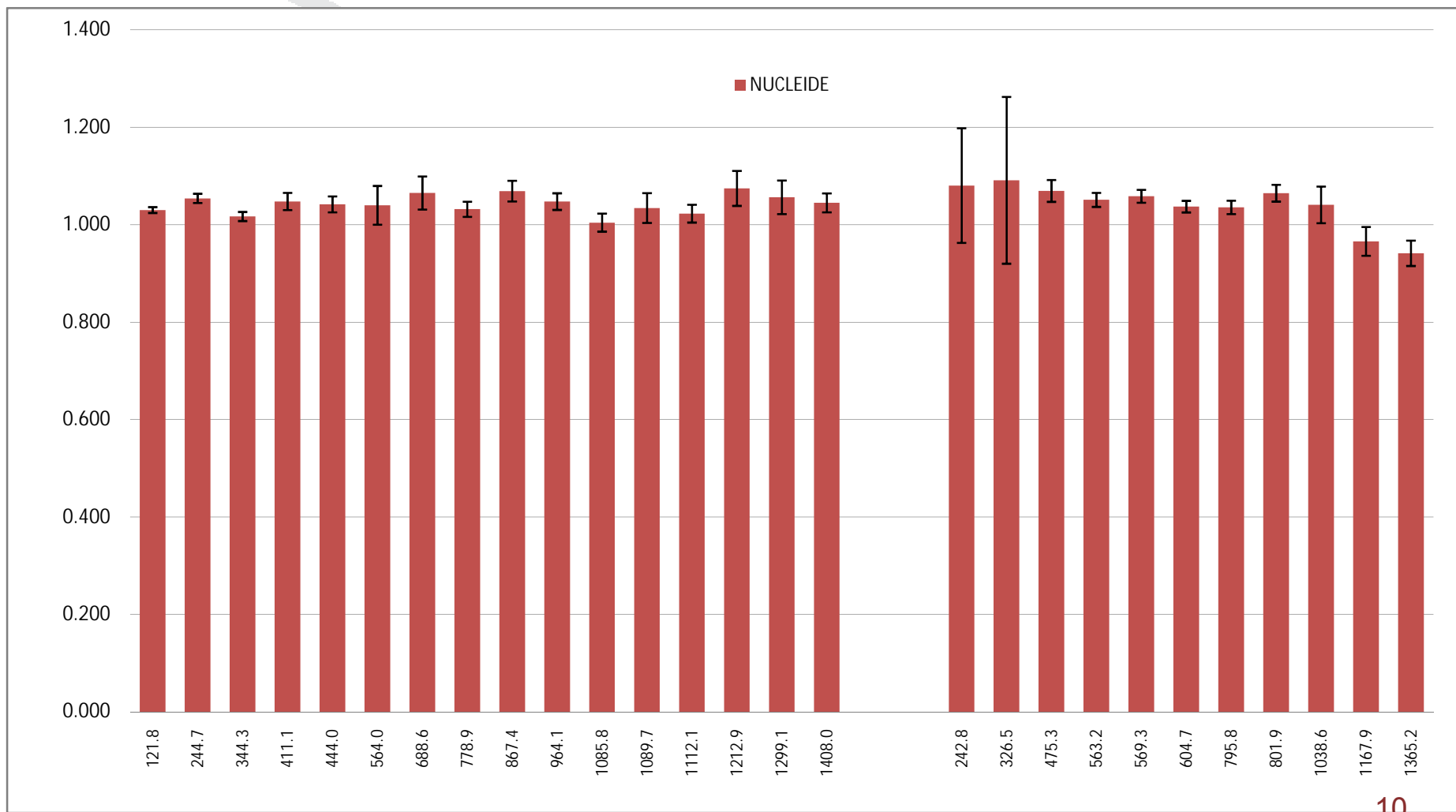
RESULTS – 2 cm



RESULTS – 5 cm

¹⁵² Eu			¹³⁴ Cs		
Energy/keV	C	error	Energy/keV	C	error
121.8	1.030	0.001	242.8	1.080	0.039
244.7	1.054	0.003	326.5	1.091	0.057
344.3	1.017	0.003	475.3	1.069	0.007
411.1	1.048	0.005	563.2	1.051	0.004
444.0	1.042	0.005	569.3	1.058	0.004
564.0	1.040	0.013	604.7	1.037	0.003
688.6	1.065	0.011	795.8	1.036	0.004
778.9	1.032	0.005	801.9	1.065	0.005
867.4	1.069	0.007	1038.6	1.041	0.012
964.1	1.047	0.005	1167.9	0.966	0.009
1085.8	1.004	0.006	1365.2	0.941	0.008
1089.7	1.034	0.010			
1112.1	1.023	0.006			
1212.9	1.075	0.011			
1299.1	1.056	0.011			
1408.0	1.045	0.006			

RESULTS – 5 cm



RESULTS – 10 cm

¹⁵² Eu			¹³⁴ Cs		
Energy/keV	C	error	Energy/keV	C	error
121.8	1.005	0.003	242.8	1.127	0.044
244.7	1.021	0.004	326.5	0.928	0.051
344.3	1.011	0.005	475.3	1.024	0.008
411.1	1.019	0.007	563.2	1.022	0.006
444.0	1.018	0.007	569.3	1.019	0.006
564.0	1.011	0.014	604.7	1.023	0.006
688.6	1.010	0.012	795.8	1.013	0.007
778.9	1.027	0.007	801.9	1.014	0.008
867.4	1.032	0.009	1038.6	1.018	0.014
964.1	1.039	0.008	1167.9	0.985	0.012
1085.8	1.017	0.009	1365.2	1.000	0.012
1089.7	0.986	0.012			
1112.1	0.991	0.009			
1212.9	1.027	0.014			
1299.1	1.035	0.013			
1408.0	1.004	0.009			

RESULTS – 10 cm

