



A. Serafini, D. Abbado, M. Alberi, P. Carconi, E. Chiarelli, P. De Felice, A. Deserventi, M. Donati, E. Fanchini, L. Fanucci, A. Fazio, F. Giordano, P. Grignani, G. Guiducci, A. Iovene, L. Luciani, G. Manessi, F. Mantovani, M. Marini, A. Masuelli, S. Mohsen, M. Morichi, G. Merlino, A. Pepperosa, K. G. C. Raptis, F. Rogo, V. Strati, G. Tona

08 May 2020 – EGU General Assembly 2020

CORSAIR

Making radioactivity measurements on building materials accessible to everyone



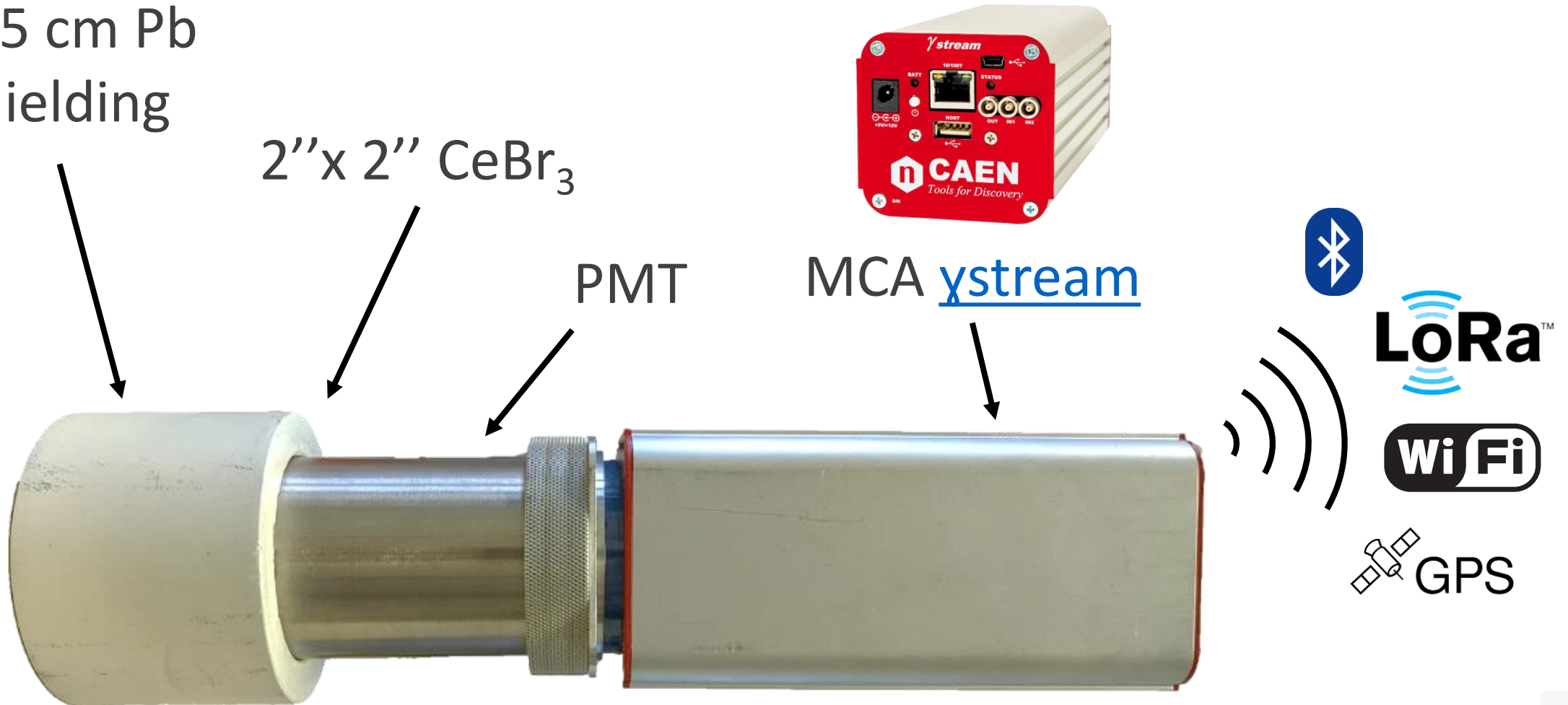
Our detector: a full γ -spectroscopic laboratory packed in 4 kg

1.25 cm Pb
shielding

2''x 2'' CeBr_3

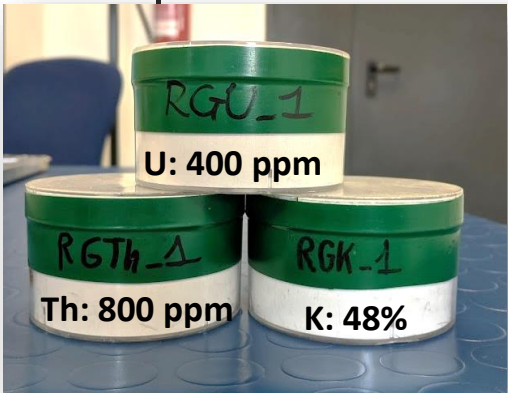
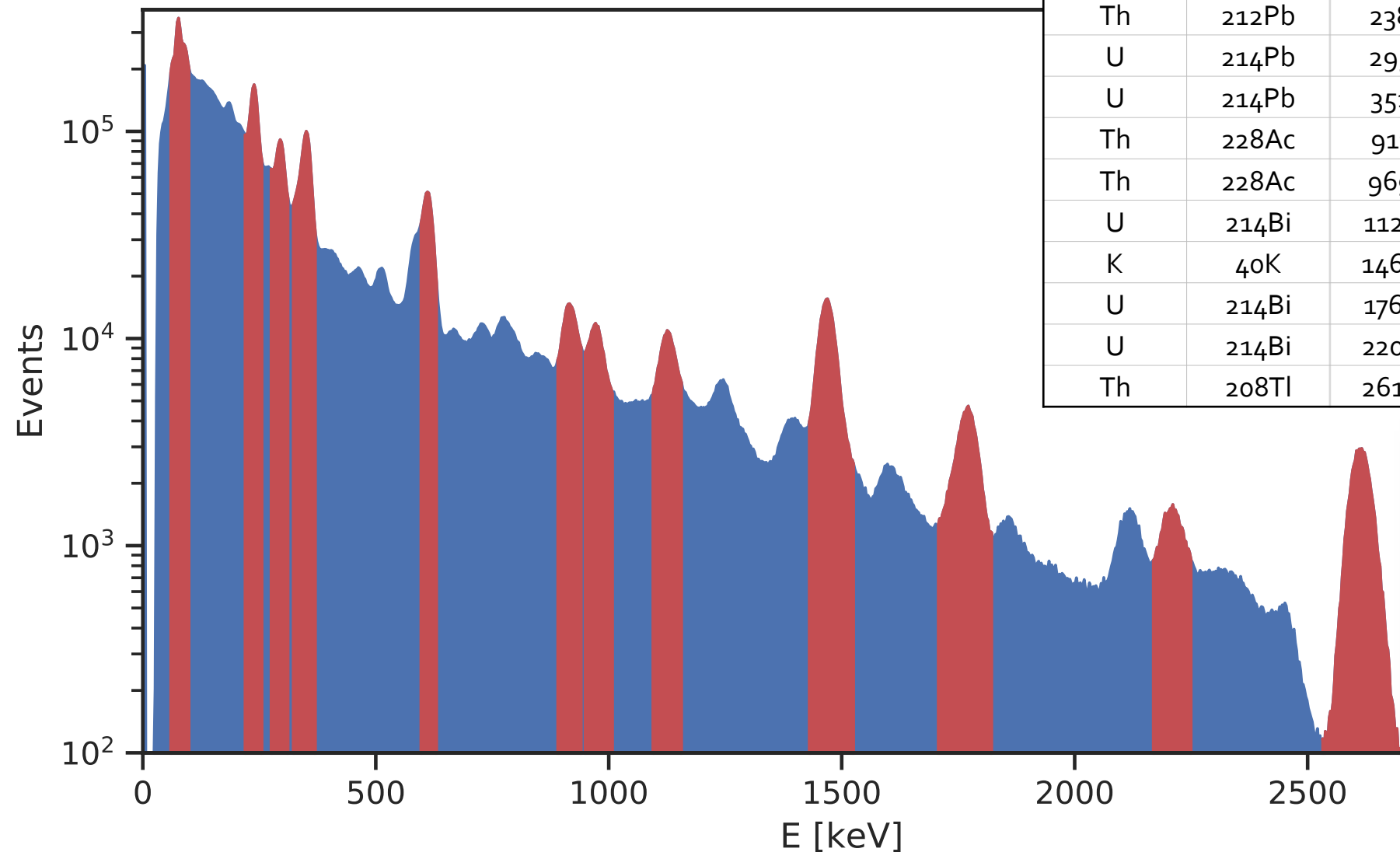
PMT

MCA [ystream](#)



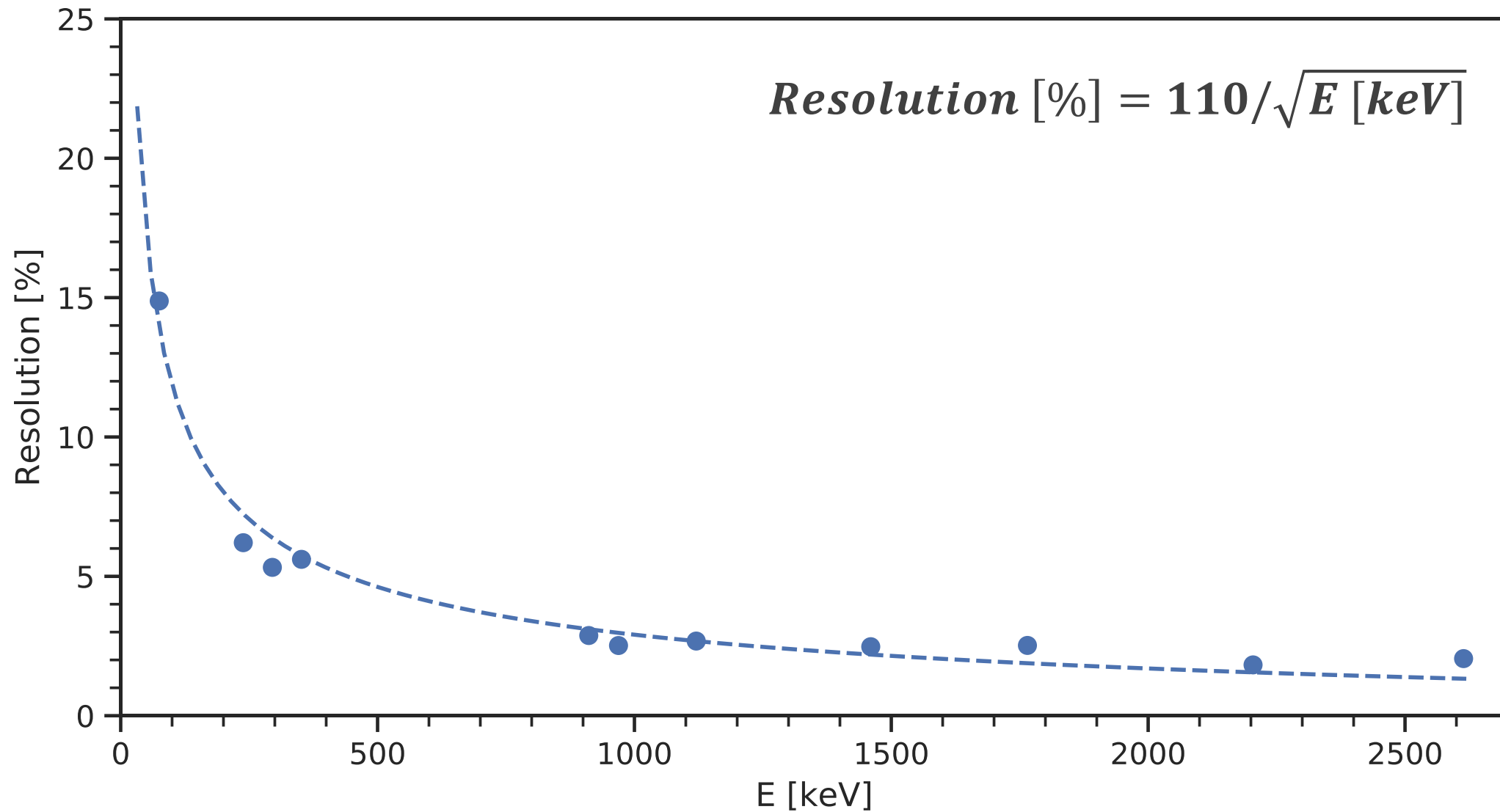
Characterization of the detector resolution

Element		Energy [keV]	FWHM [keV]	Resolution [%]
Pb	KX-ray	75.0	11.2	14.9
Th	212Pb	238.6	14.8	6.2
U	214Pb	295.2	15.7	5.3
U	214Pb	351.9	19.7	5.6
Th	228Ac	911.1	26.2	2.9
Th	228Ac	969.0	24.4	2.5
U	214Bi	1120.3	30.0	2.7
K	40K	1460.8	36.1	2.5
U	214Bi	1765.0	44.5	2.5
U	214Bi	2204.2	40.2	1.8
Th	208Tl	2614.0	53.5	2.0



Measurement duration: 16 h

Characterization of the detector resolution

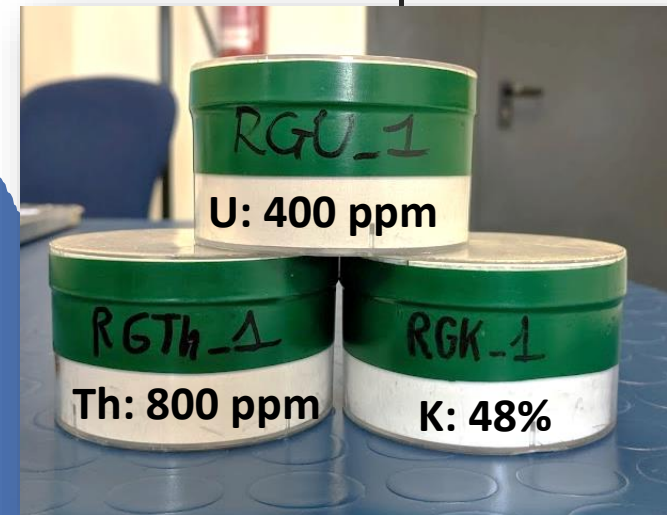
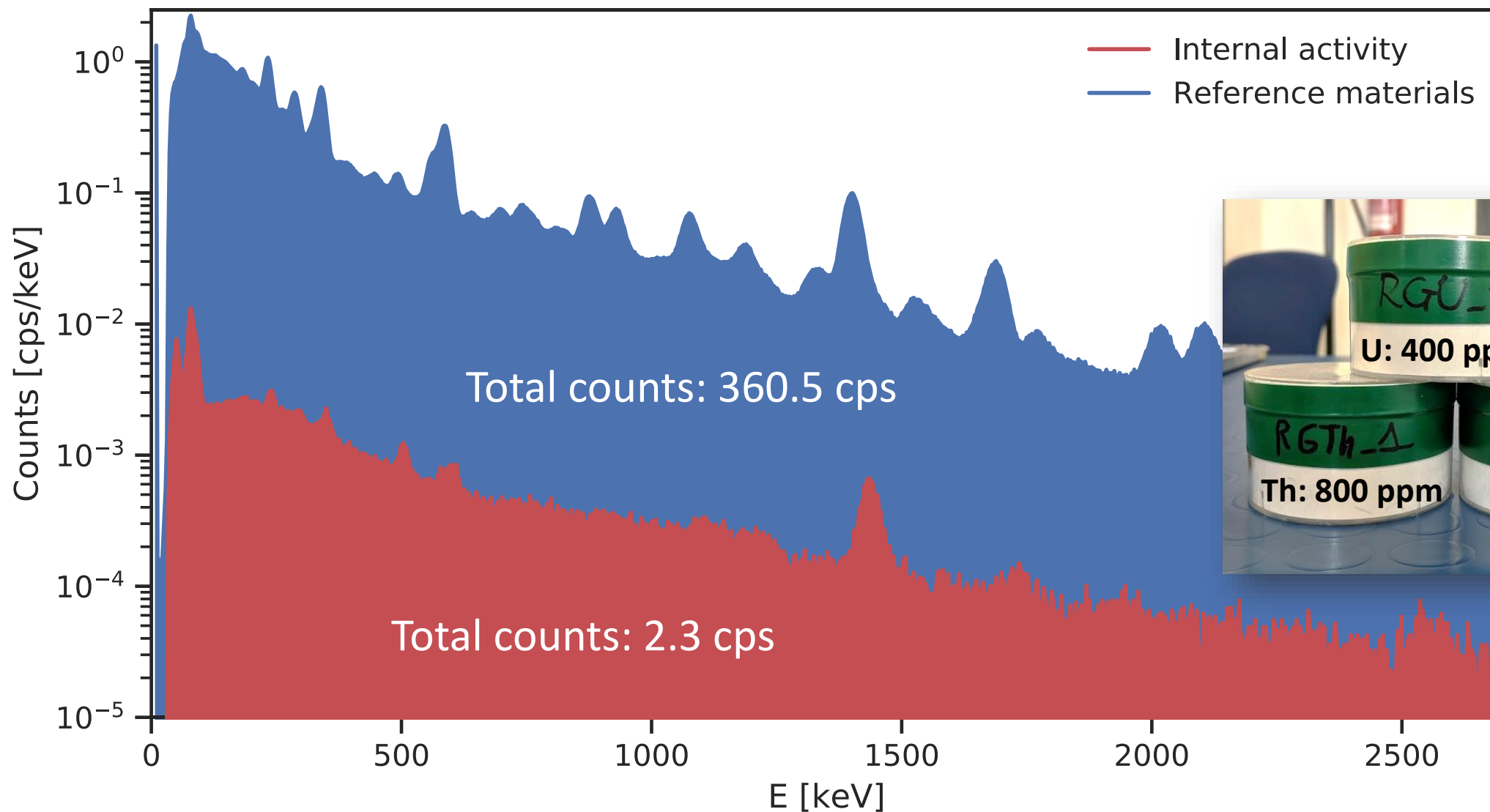


Characterization of the internal activity

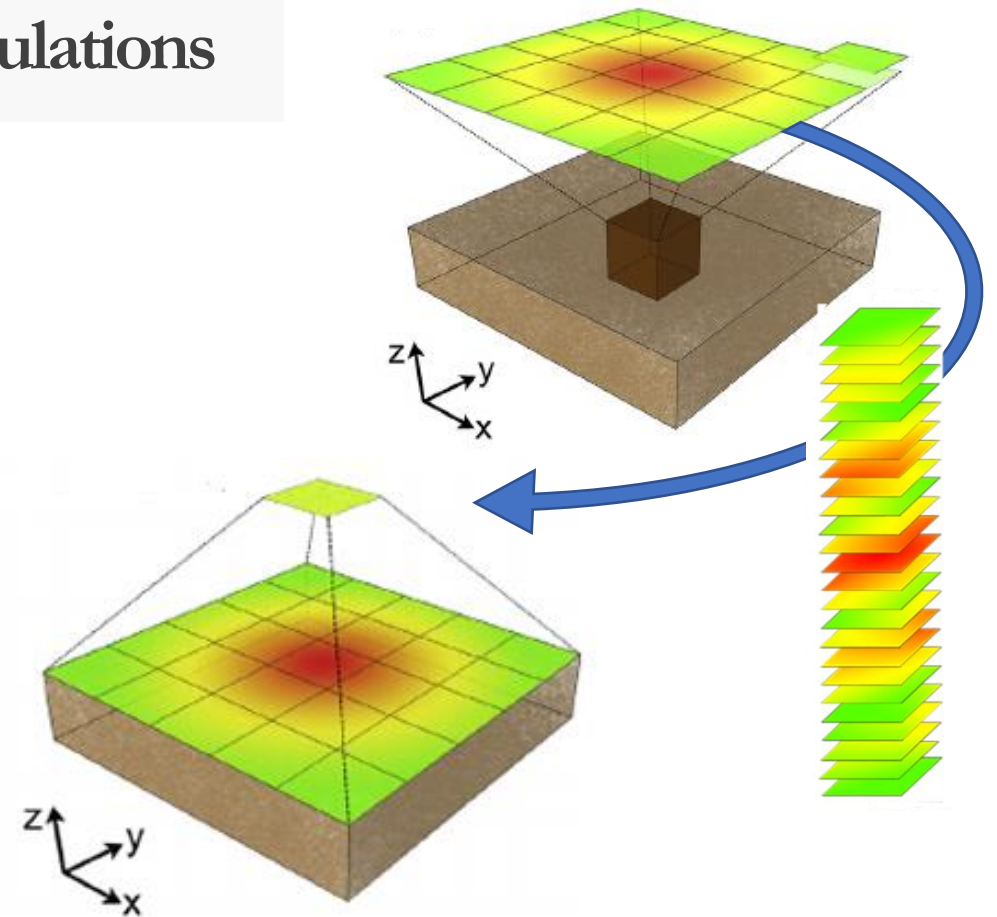
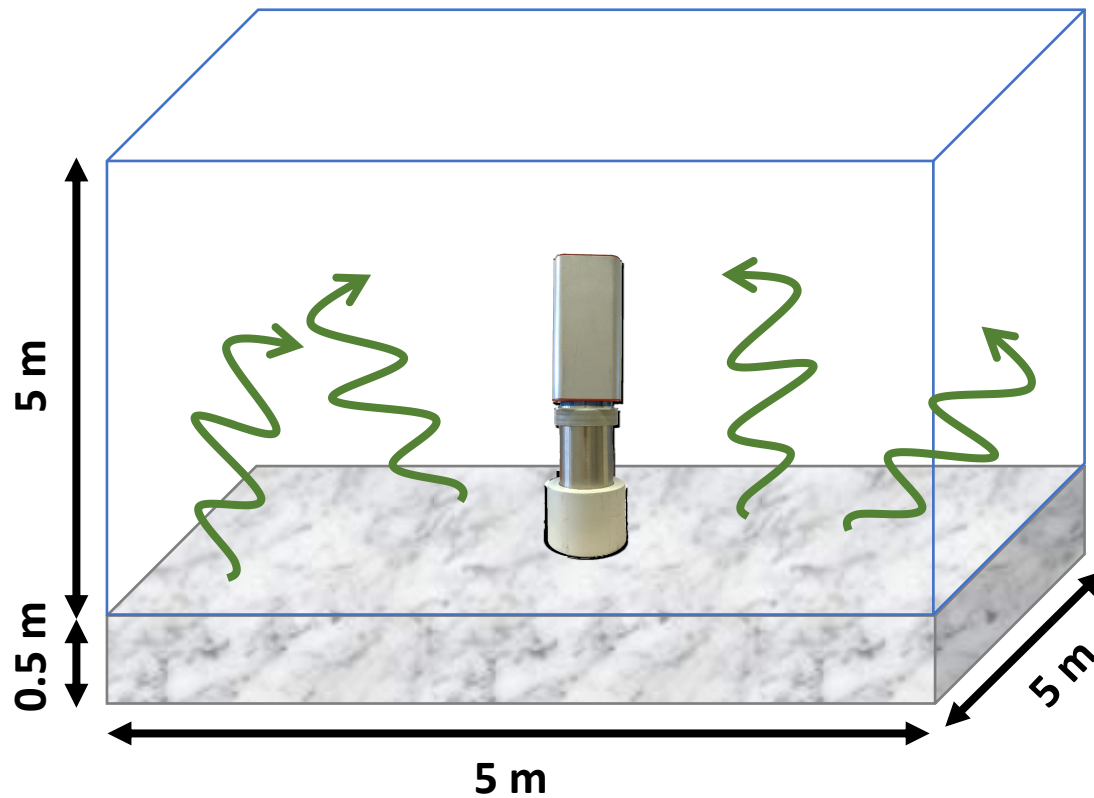
- » Initial 10 min measurement with reference materials used for energy calibration.
- » **32 h** measurement with detector shielded by **> 10 cm of lead** on each side.
- » Final 10 min measurement with reference materials for confirming initial energy calibration.



Characterization of the internal activity



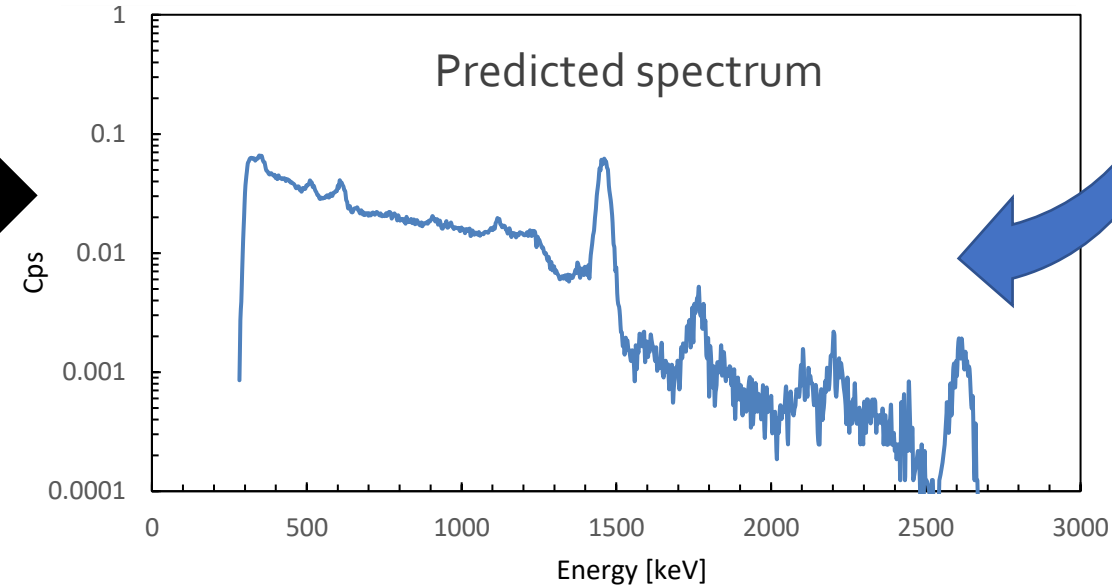
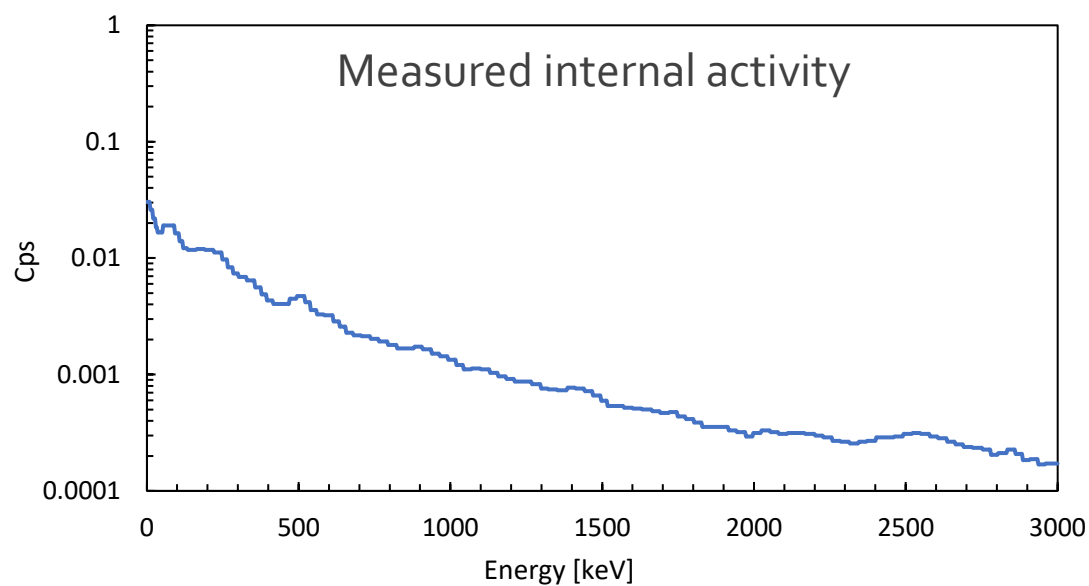
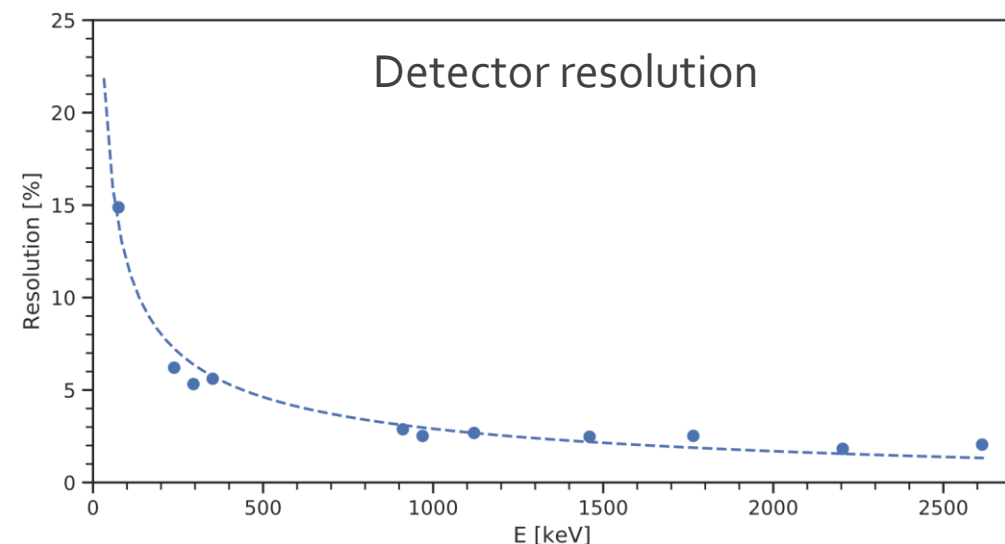
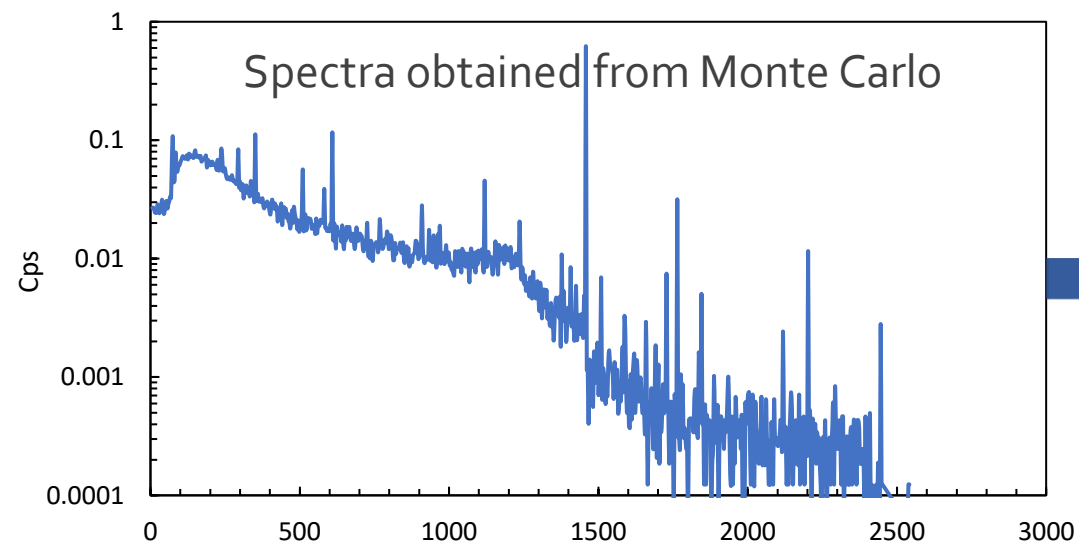
Shielding characterization via Monte Carlo simulations



Investigating the potentialities of Monte Carlo simulation for assessing soil water content via proximal gamma-ray spectroscopy

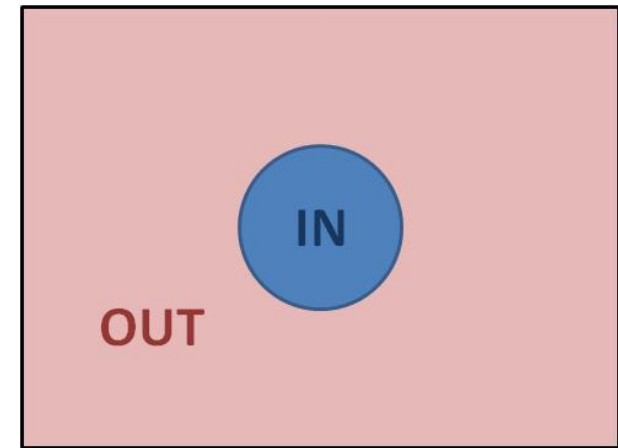
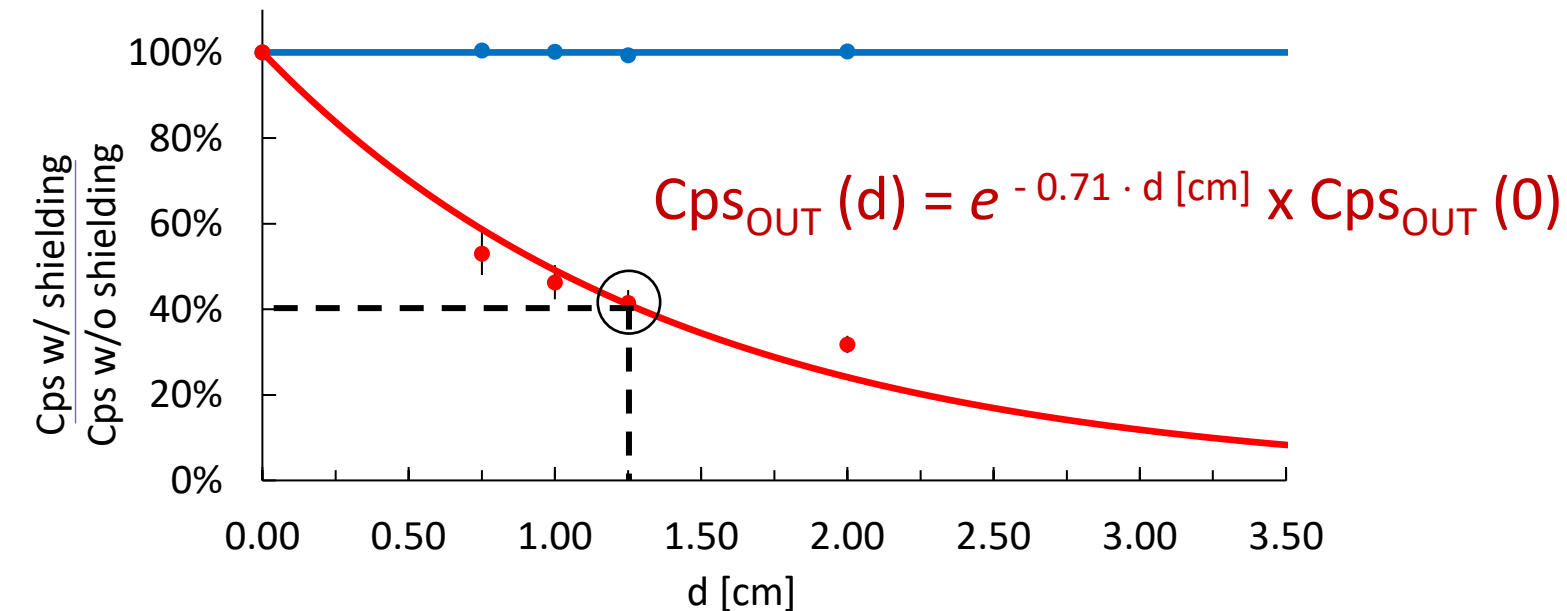
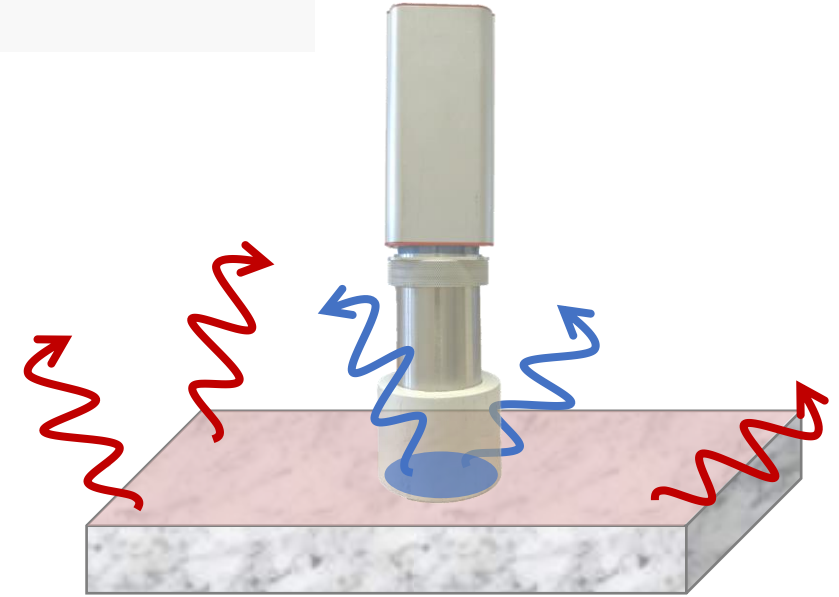
Baldoncini, M., M. Albéri, C. Bottardi, E. Chiarelli, K. G. C. Raptis, V. Strati, and F. Mantovani
Journal of Environmental Radioactivity, 192, 105-116 (2018)

From Monte Carlo simulations to reality

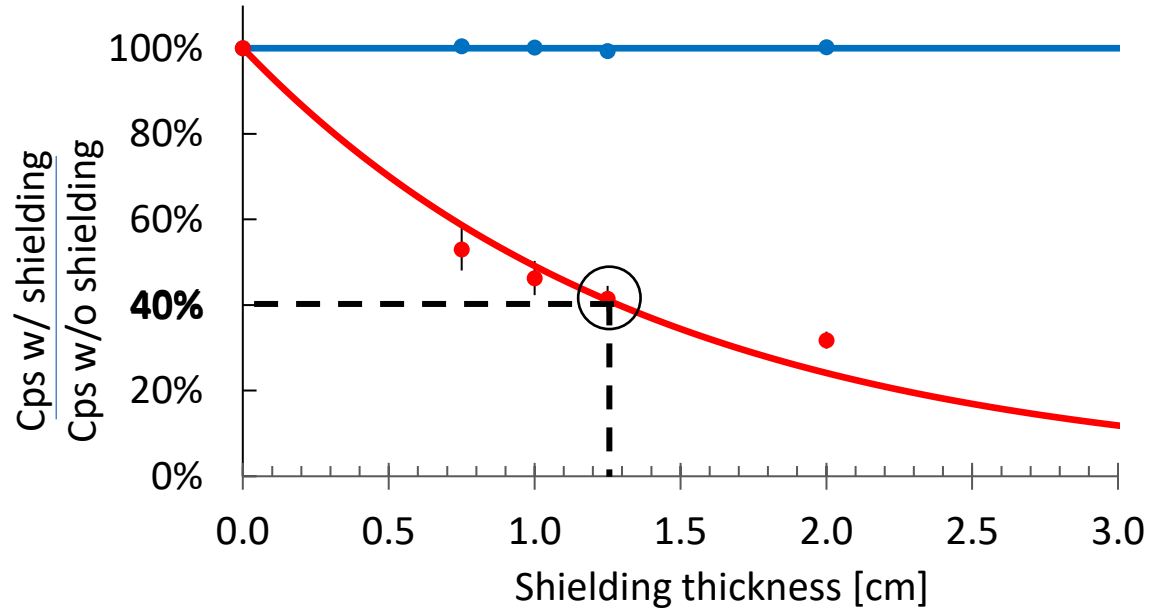


Understanding the shielding effect via Monte Carlo simulations

Shielding thickness d	Total counts between 0.3 MeV and 3.0 MeV		
	IN [cps]	OUT [cps]	TOT [cps]
0.00 cm	16	32	48
0.75 cm	16	17	33
1.00 cm	16	15	31
1.25 cm	16	13	29
2.00 cm	16	10	26

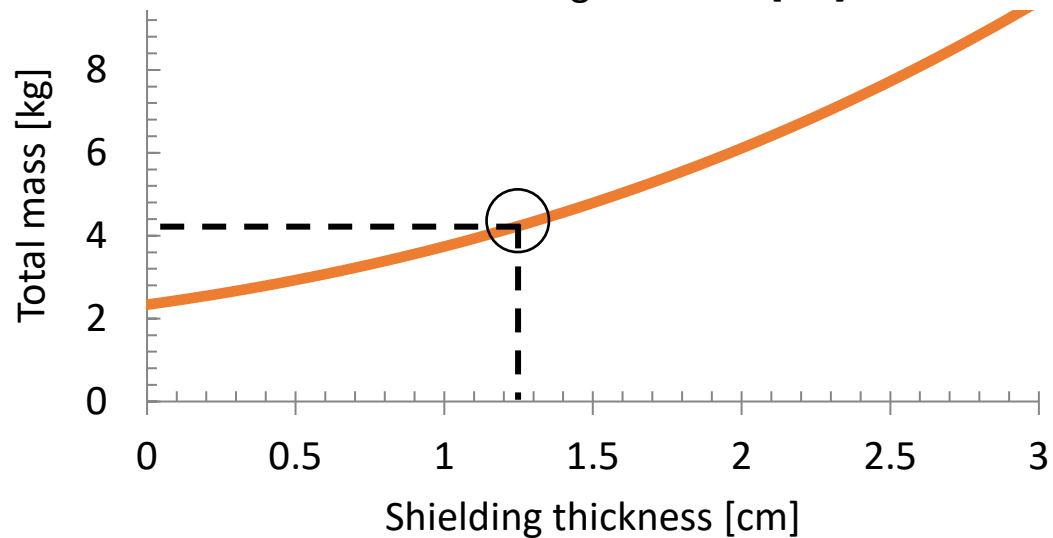


Optimizing shielding thickness for detector portability



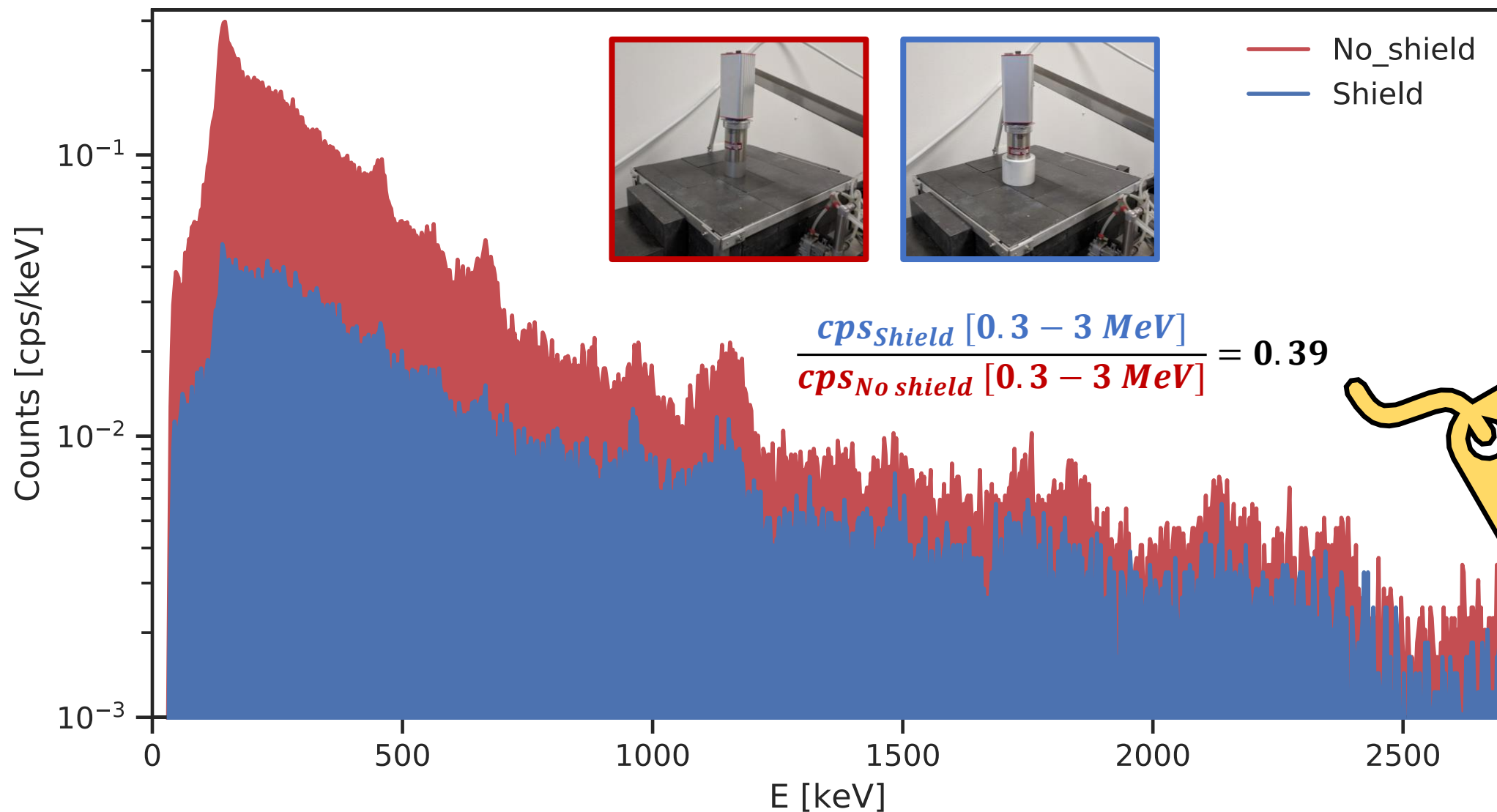
Shielded thickness has been chosen to be **1.25 cm**:

- » Expected to enable a **60% reduction of background** signal (gamma rays coming from the sides and the top of the detector);
- » Allows to maintain the detector lightweight and portable with a total mass of 4.2 kg.



Components	Mass
2"x 2" CeBr ₃ crystal	0.53 kg
PMT	1.05 kg
1.25 cm Pb shielding	1.90 kg
MCA ystream	0.70 kg
Total mass	4.18 kg

Experimental validation of Monte Carlo simulation



To be compared to **0.40** expected from MC

CORSAIR system measuring stone materials at quarries

