

Background survey

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Survey: HPGe detector's background

- Participants were asked to fill a form:
 - about their best experimental setup regarding the background
 - Detector type, dimensions
 - Shield configuration
- Provide a spectrum
- 7 participants: THANK YOU !

All setups are located in a 'standard laboratory'

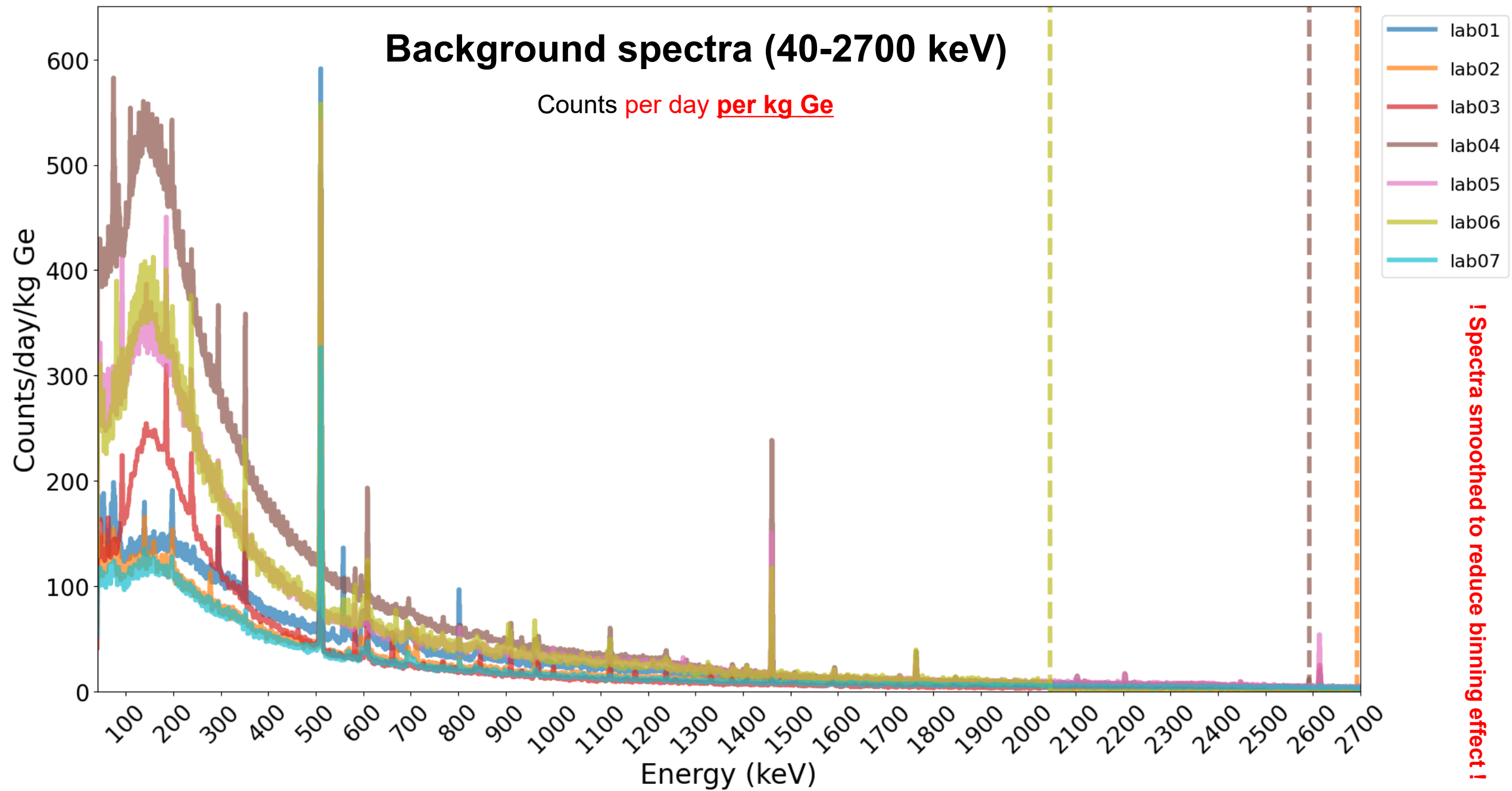
Detectors

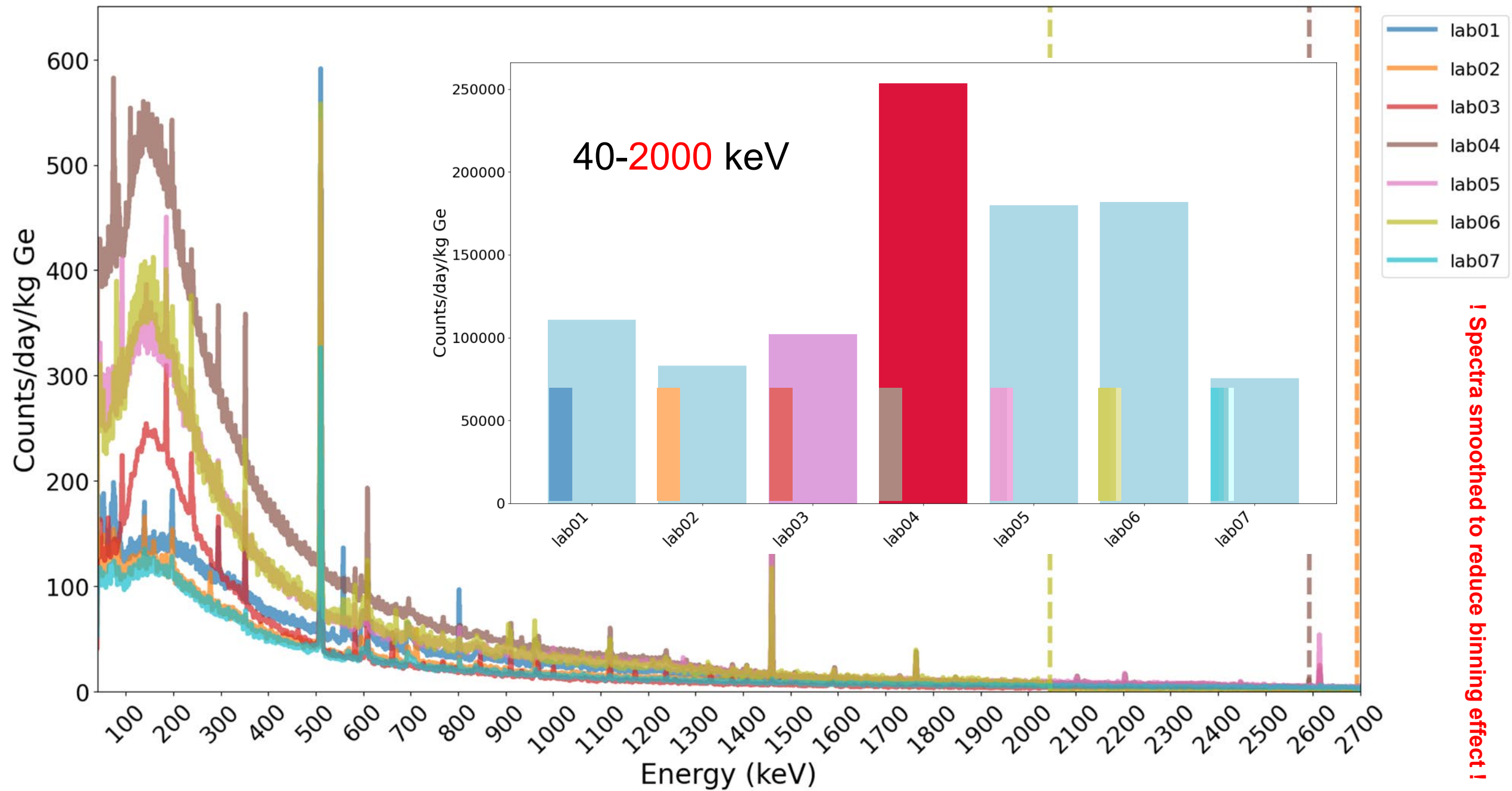
Laboratory	Detector type/geometry	Dimensions (crystal/active volume)	Estimated Ge mass (kg)
LAB01	Planar (ultra-low background) BE5030P	Ø 80.6 mm × 32.0 mm; active area 5000 mm ²	0.85
LAB02	BEGe (ultra-low background) BE5030P	Ø 80.5 mm × 31.5 mm; active area 5000 mm ²	0.84
LAB03	Well detector (coaxial) GCW6023	Active volume 289 cm ³ (well depth 35 mm)	1.54
LAB04	Coaxial GEM-FX7025-LB-C	Ø 69.8 mm × 26.9 mm; active area 3826 mm ²	0.80
LAB05	Planar BE5030P	Ø 80 mm × 30 mm; active area 5000 mm ²	0.84
LAB06	Planar (low-background) BE5030	Ø 80.7 mm × 31.5 mm; active area 5000 mm ²	0.84
LAB07	Planar (low-background) BE5030P/S	Ø 81 mm × 30.5 mm; active area 5150 mm ²	0.70

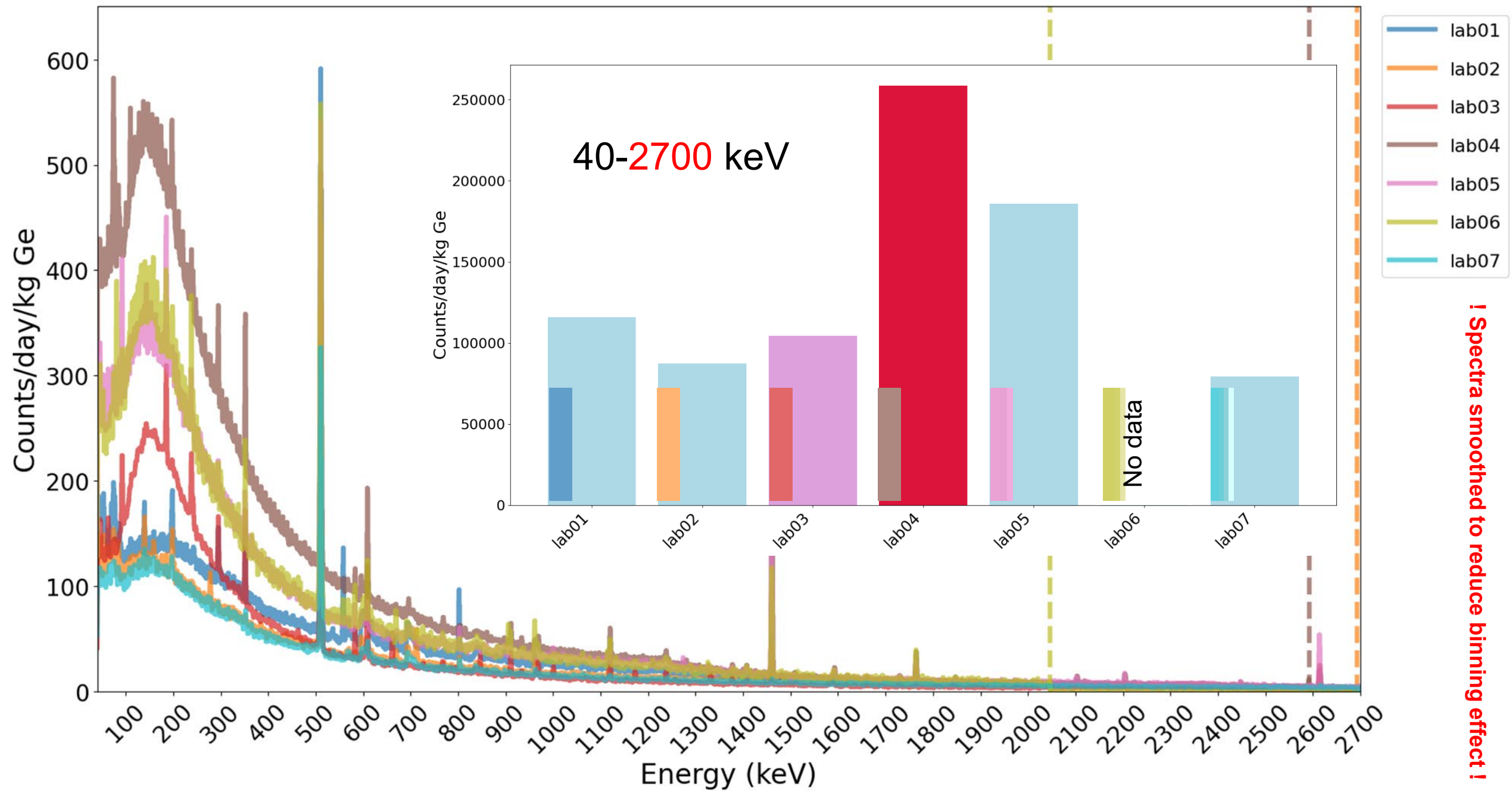
Shields

Laboratory	Manufacturer	Outer shield	Inner shield	Radon: Purge & sealing	Radon: monitoring
LAB01	In house	LB Pb 100 mm	Cd 2 mm	No purge, not sealed	None
LAB02	Von Gahlen	ULB Pb 150 mm	ULB Cu 2 mm	No purge, not sealed	None
LAB03	In house	LB Fe 185–215 mm	Std Cu 1.5 mm	Attempted N ₂ purge, not sealed	None
LAB04	In house	PB 110 mm	Cu + Plexiglas (2 + 5 mm)	No purge, not sealed, ventilation	None
LAB05	Techmart	LB Pb 100 mm	LB Sn+Cu 2.5 mm	No purge, sealed (partially)	Yes AirThings Wave Plus
LAB06	Von Gahlen	LB Pb 100 mm	LB Cu 10 mm	No purge, not sealed	None
LAB07	Canberra	ULB Pb 163 mm	ULB Cu	No purge, not sealed	Yes AlphaGuard

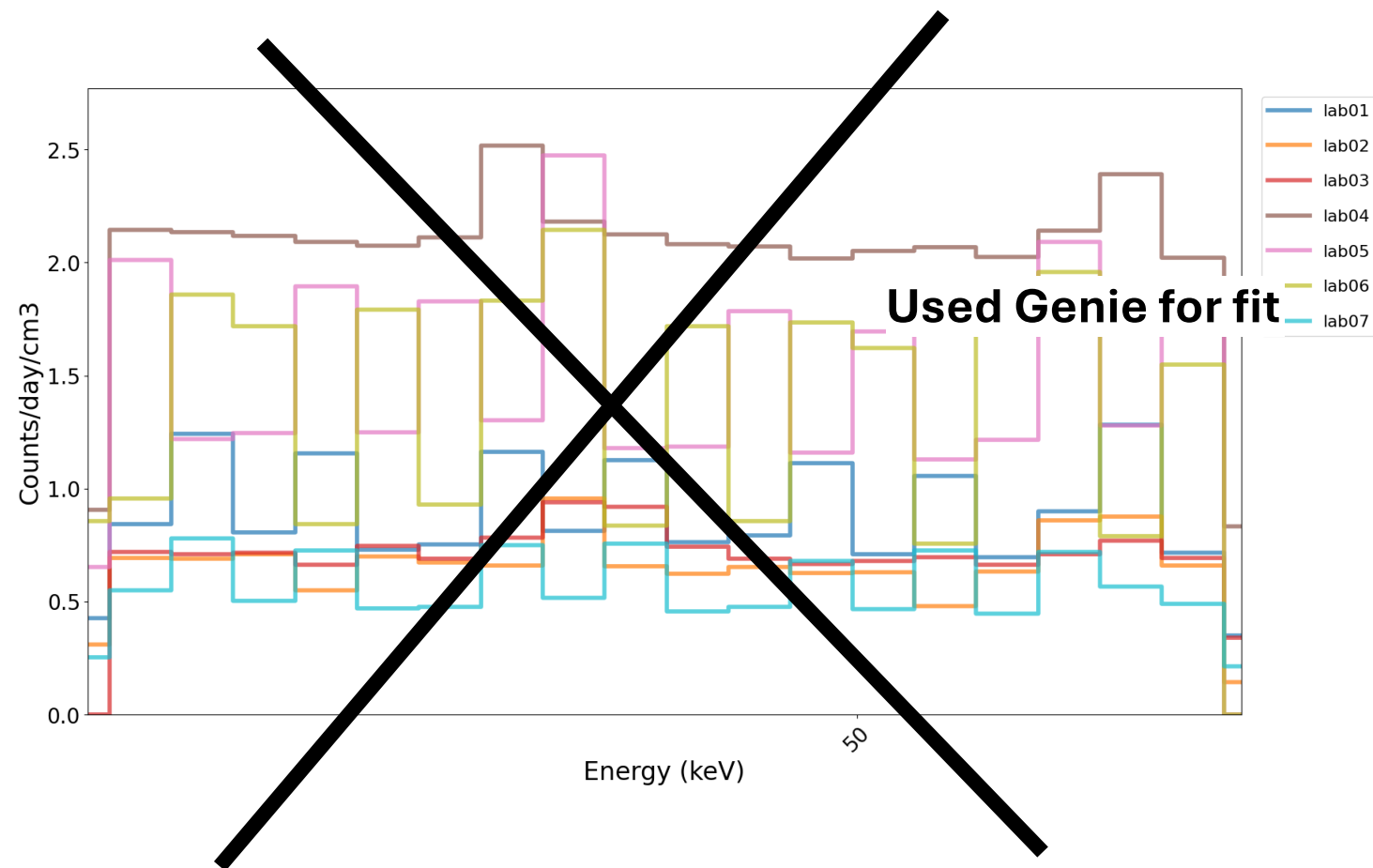
This analysis is qualitative,
intended for relative & limited comparison of setups.







Pb-210

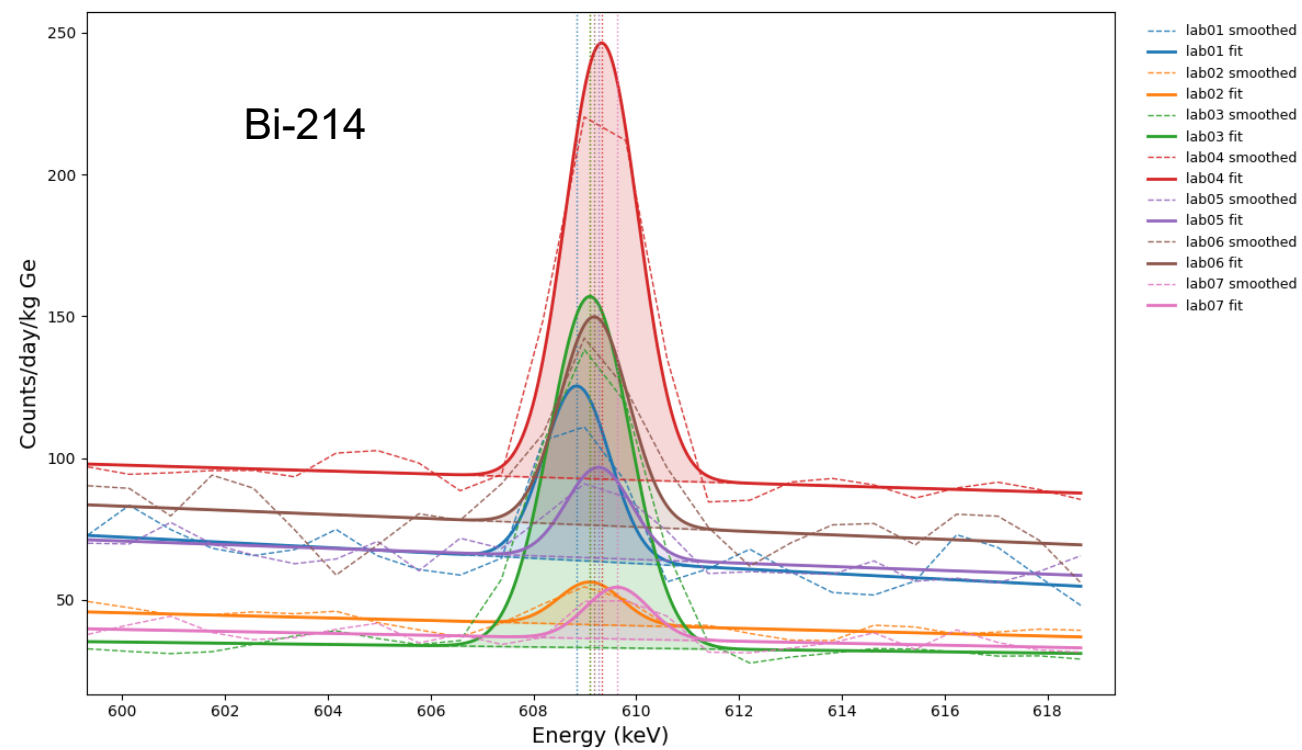
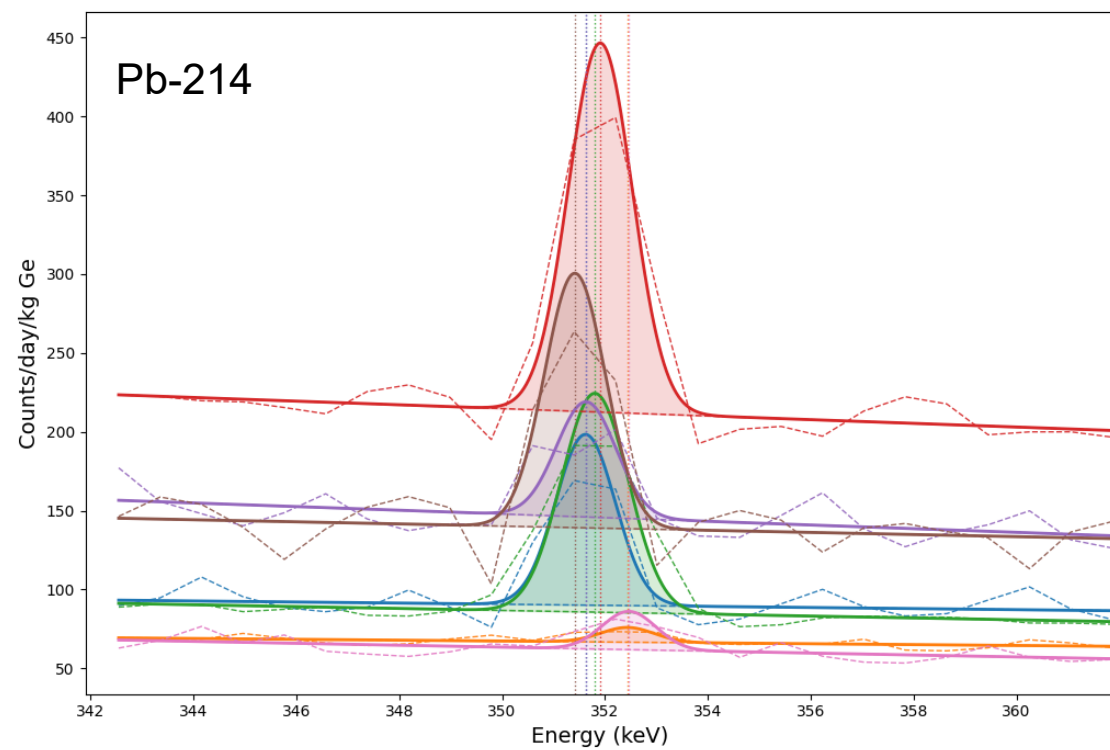


counts/day/kg Ge

	val	unc.
lab01	DL	
lab07	15	3
lab04	25	6
lab02	89	7
lab06	129	18
lab05	131	14
lab03	217	19

lab01	Planar	LB Pb 10 cm	Cd 2 mm
lab02	Planar	ULB Pb 15 cm	ULB Cu 2mm
lab03	Well	LB Fe 18-21 cm	std Cu 1.5 mm
lab04	Coax	Pb 11 cm	Cu 2 mm + Plex 5mm
lab05	Planar	LB Pb 10 cm	LB Sn+Cu 2.5mm
lab06	Planar	LB Pb 10 cm	LB Cu 10 mm
lab07	Planar	ULB Pb 16 cm	ULB Cu

Pb-214 & Bi-214



Pb-214 & Bi-214

$$\sum 352 \text{ keV} + 609 \text{ keV}$$

	counts/day/kg Ge	
lab02	~40	
lab07	60	± 30
lab05	160	± 50
lab01	260	± 50
lab06	360	± 60
lab03	470	± 60
lab04	640	± 75

lab01	Planar	LB Pb 10 cm	Cd 2 mm
lab02	Planar	ULB Pb 15 cm	ULB Cu 2mm
lab03	Well	LB Fe 18-21 cm	std Cu 1.5 mm
lab04	Coax	Pb 11 cm	Cu 2 mm + Plex 5mm
lab05	Planar	LB Pb 10 cm	LB Sn+Cu 2.5mm
lab06	Planar	LB Pb 10 cm	LB Cu 10 mm
lab07	Planar	ULB Pb 16 cm	ULB Cu

**lab02, lab07 & lab05: commercial shield
(lab06 also)**

lab04, continious ventilation

! Fluctuation over time not taken into account !

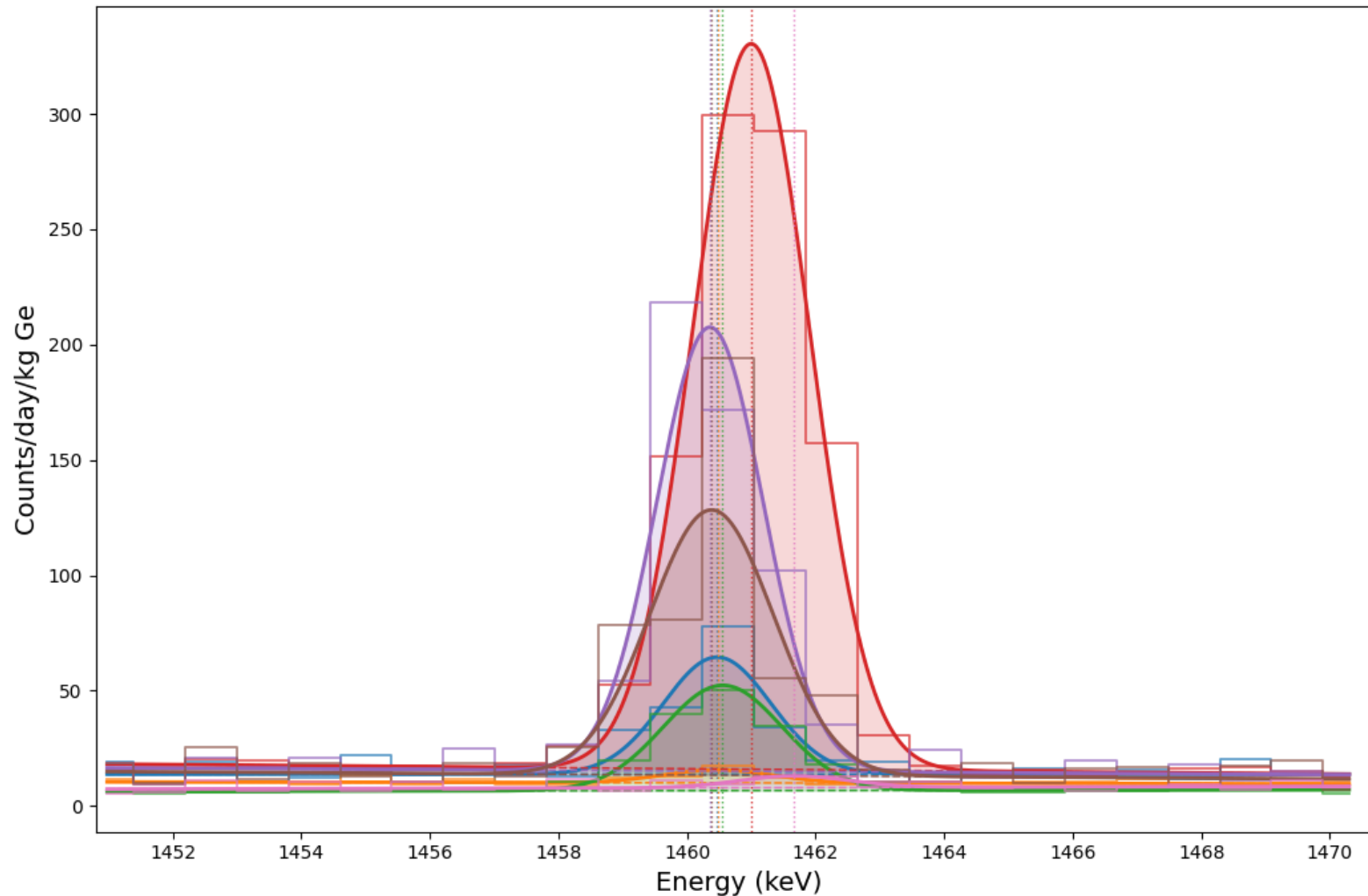
K-40

counts/day/cm3

val unc.

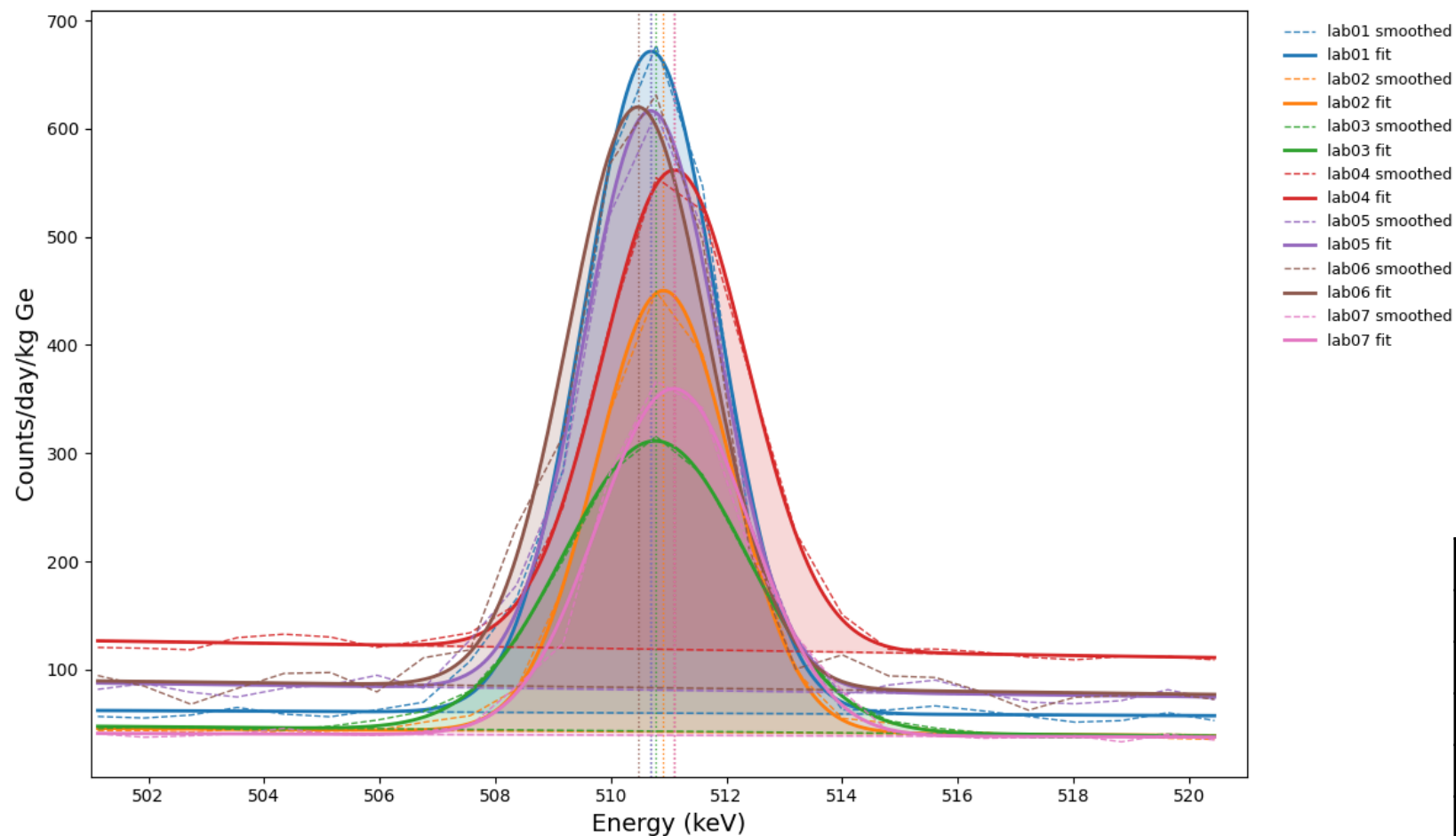
lab07	11	6
lab02	12	6
lab03	106	11
lab01	106	12
lab06	277	17
lab05	400	20
lab04	717	26

lab01 (raw)
lab01 fit
lab02 (raw)
lab02 fit
lab03 (raw)
lab03 fit
lab04 (raw)
lab04 fit
lab05 (raw)
lab05 fit
lab06 (raw)
lab06 fit
lab07 (raw)
lab07 fit



lab01	Planar	LB Pb 10 cm	Cd 2 mm
lab02	Planar	ULB Pb 15 cm	ULB Cu 2mm
lab03	Well	LB Fe 18-21 cm	std Cu 1.5 mm
lab04	Coax	Pb 11 cm	Cu 2 mm + Plex 5mm
lab05	Planar	LB Pb 10 cm	LB Sn+Cu 2.5mm
lab06	Planar	LB Pb 10 cm	LB Cu 10 mm
lab07	Planar	ULB Pb 16 cm	ULB Cu

511 keV



counts/day/cm3

val unc.

lab07	1010	34
lab03	1062	37
lab02	1178	36
lab04	1371	45
lab06	1423	40
lab05	1483	42
lab01	1709	43

lab01	Planar	LB Pb 10 cm	Cd 2 mm
lab02	Planar	ULB Pb 15 cm	ULB Cu 2mm
lab03	Well	LB Fe 18-21 cm	std Cu 1.5 mm
lab04	Coax	Pb 11 cm	Cu 2 mm + Plex 5mm
lab05	Planar	LB Pb 10 cm	LB Sn+Cu 2.5mm
lab06	Planar	LB Pb 10 cm	LB Cu 10 mm
lab07	Planar	ULB Pb 16 cm	ULB Cu

Activation products

- Cd:



- Cu:



- H:



- Ge:



lab01	Planar	LB Pb 10 cm	Cd 2 mm
lab02	Planar	ULB Pb 15 cm	ULB Cu 2mm
lab03	Well	LB Fe 18-21 cm	std Cu 1.5 mm
lab04	Coax	Pb 11 cm	Cu 2 mm + Plex 5mm
lab05	Planar	LB Pb 10 cm	LB Sn+Cu 2.5mm
lab06	Planar	LB Pb 10 cm	LB Cu 10 mm
lab07	Planar	ULB Pb 16 cm	ULB Cu

Activation products

Counts/day/kg Ge

Nuclide Energy (keV)	Cd		Cu				Fe	
	558.6		669.6	962.1			846.8	
	val	unc	val	unc	val	unc	val	unc
lab01	220	9	<20		27	5	89	7
lab02			17	4	48	4		
lab03								
lab04			28	7	35	5		
lab05					28	8		
lab06			138	16	125	15		
lab07					25	5		

No 2223 keV peak in lab04

lab01: Crystal holder = Cu

lab01	Planar	LB Pb 10 cm	Cd 2 mm
lab02	Planar	ULB Pb 15 cm	ULB Cu 2mm
lab03	Well	LB Fe 18-21 cm	std Cu 1.5 mm
lab04	Coax	Pb 11 cm	Cu 2 mm + Plex 5mm
lab05	Planar	LB Pb 10 cm	LB Sn+Cu 2.5mm
lab06	Planar	LB Pb 10 cm	LB Cu 10 mm
lab07	Planar	ULB Pb 16 cm	ULB Cu

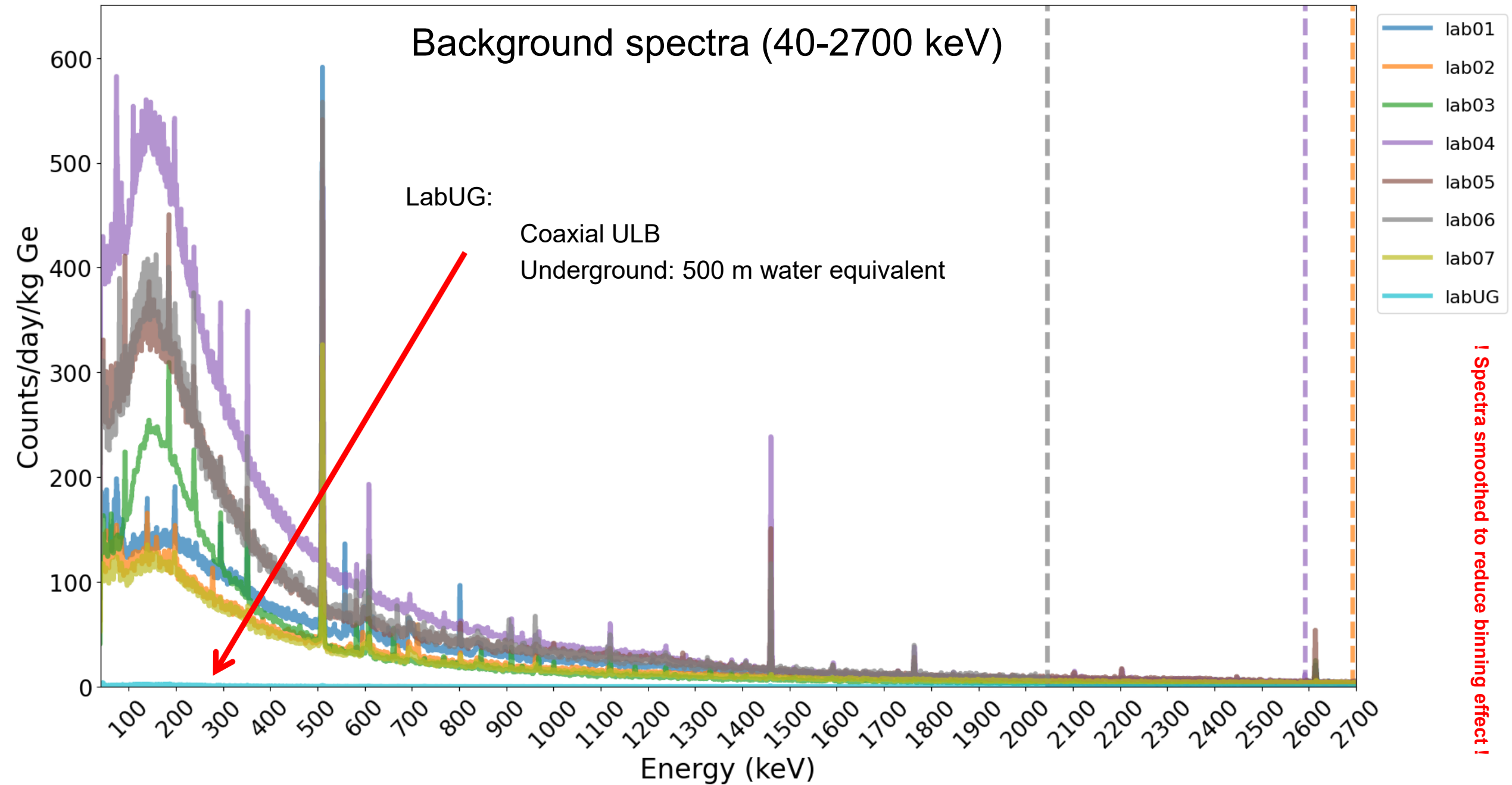
Activation products: Ge

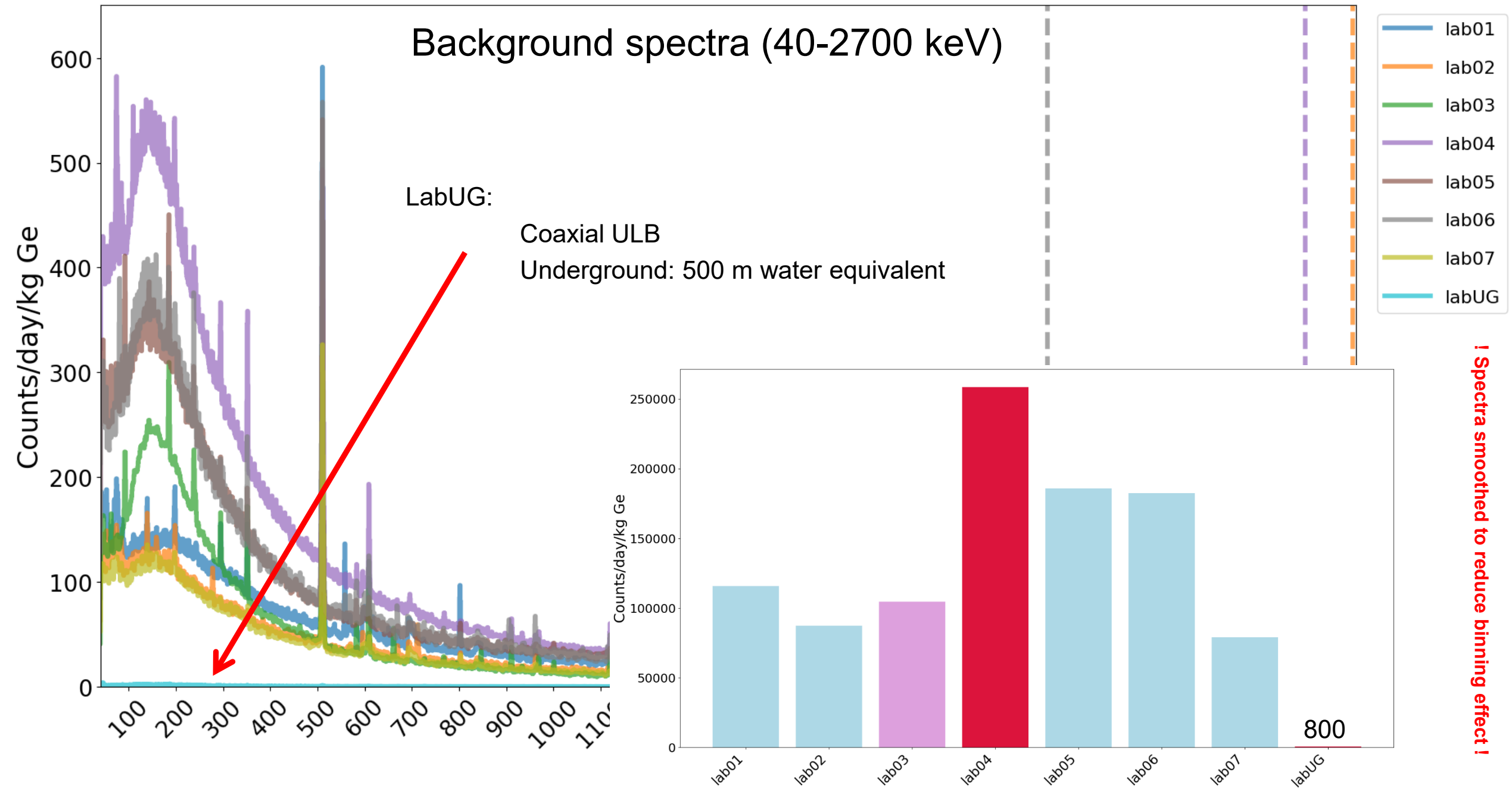
Counts/day/kg Ge

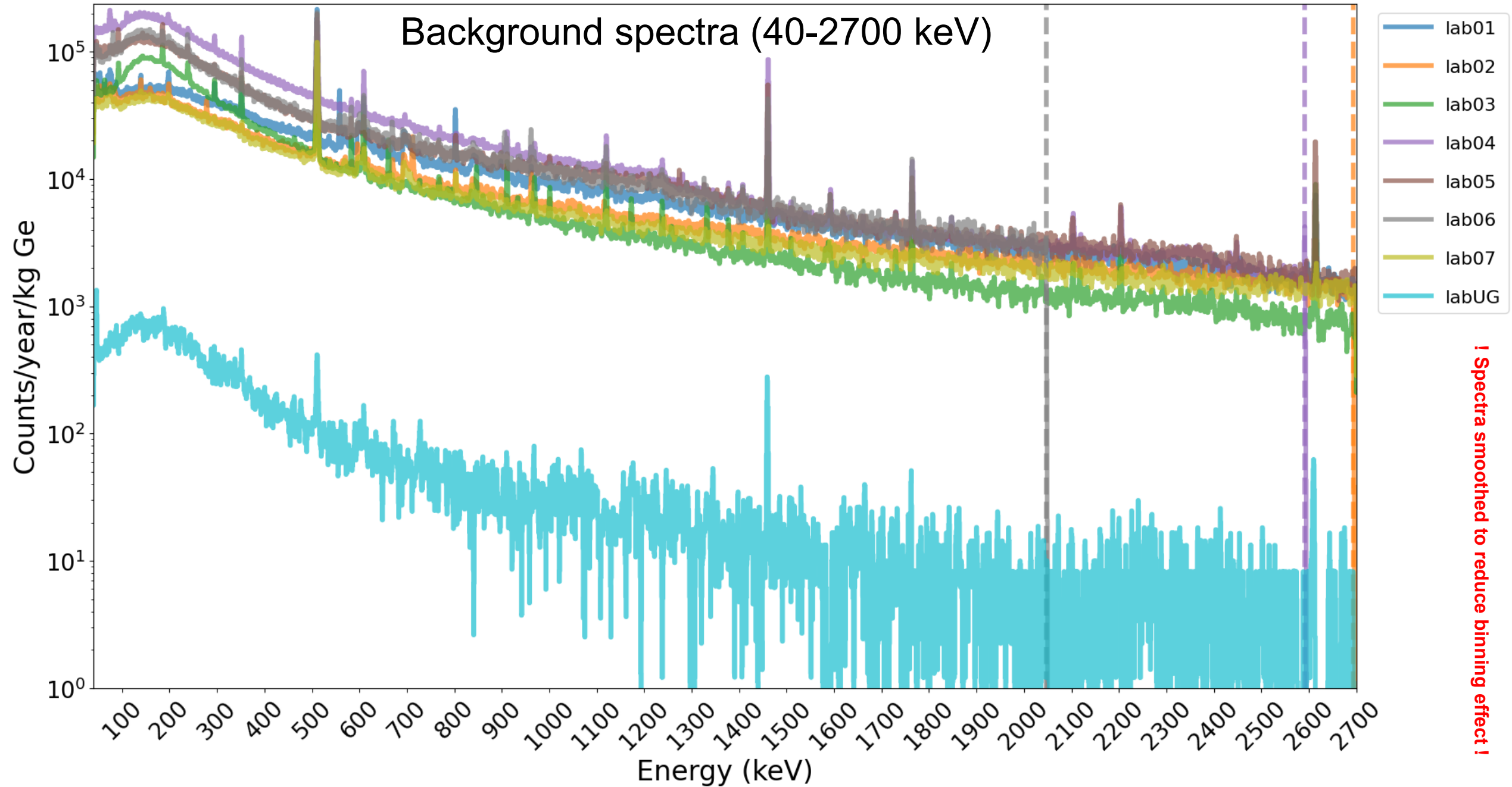
Nuclide Energy (keV)	Ge			
	139.7		198.4	
	val	unc	val	unc
lab01	83	9	148	10
lab02	138	8	168	8
lab03				
lab04	113	13	151	13
lab05	86	20	81	19
lab06	94	24	117	35
lab07	85	10	67	10

lab01	Planar	LB Pb 10 cm	Cd 2 mm
lab02	Planar	ULB Pb 15 cm	ULB Cu 2mm
lab03	Well	LB Fe 18-21 cm	std Cu 1.5 mm
lab04	Coax	Pb 11 cm	Cu 2 mm + Plex 5mm
lab05	Planar	LB Pb 10 cm	LB Sn+Cu 2.5mm
lab06	Planar	LB Pb 10 cm	LB Cu 10 mm
lab07	Planar	ULB Pb 16 cm	ULB Cu

One more laboratory







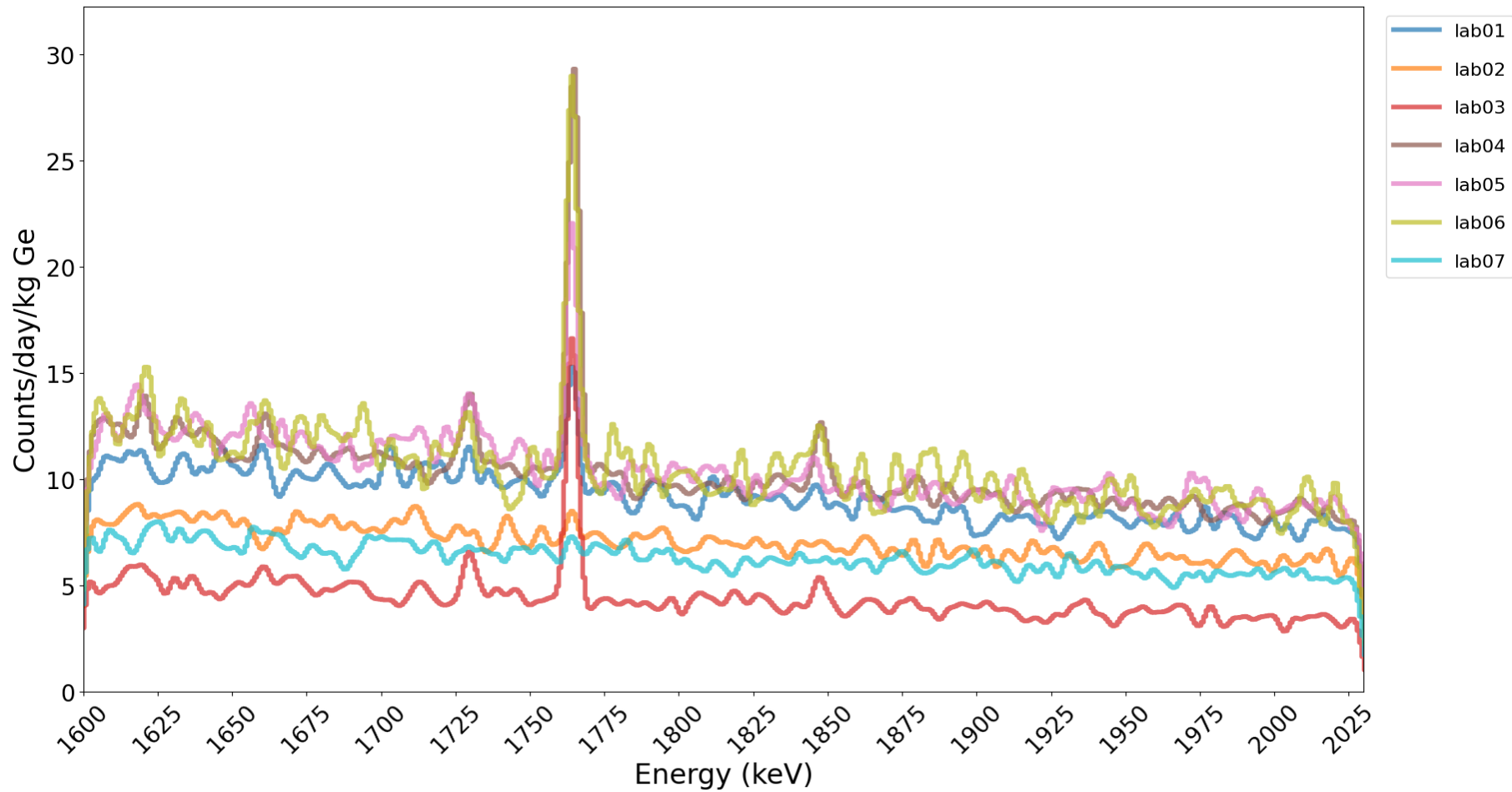
‘Ideal’ shield composition ?

See next presentation !

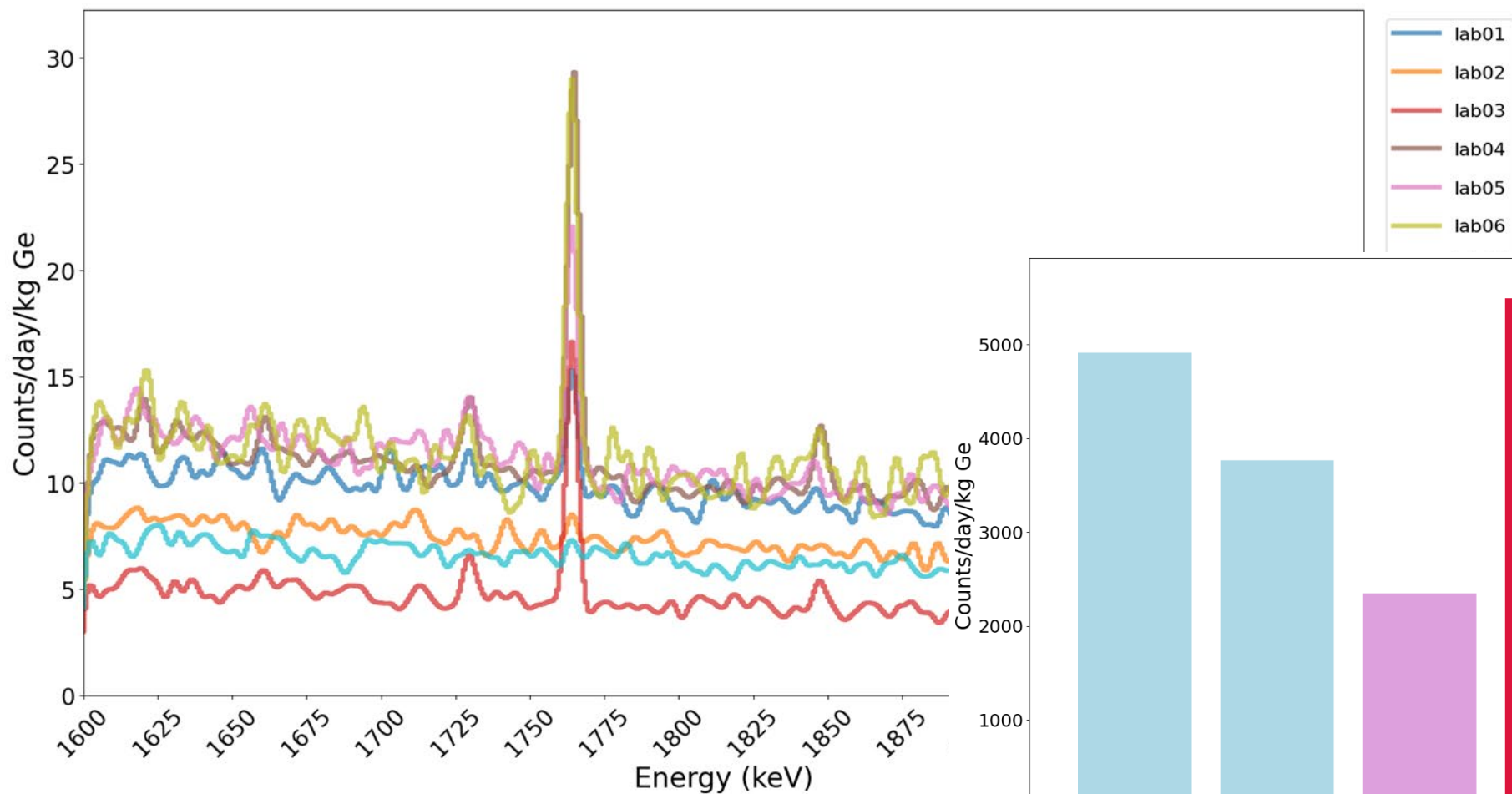


EXTRA

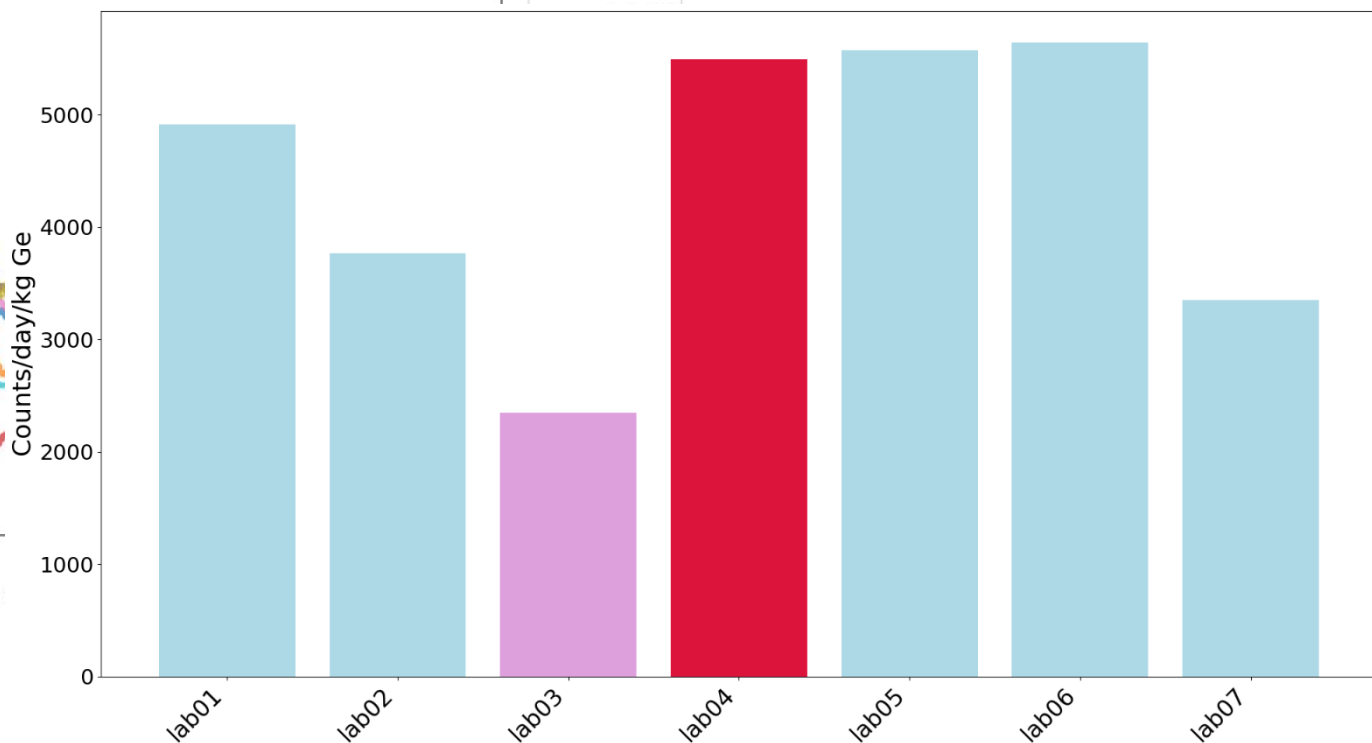
Energy: 1.60 - 2.03 MeV



Energy: 1.60 - 2.03 MeV

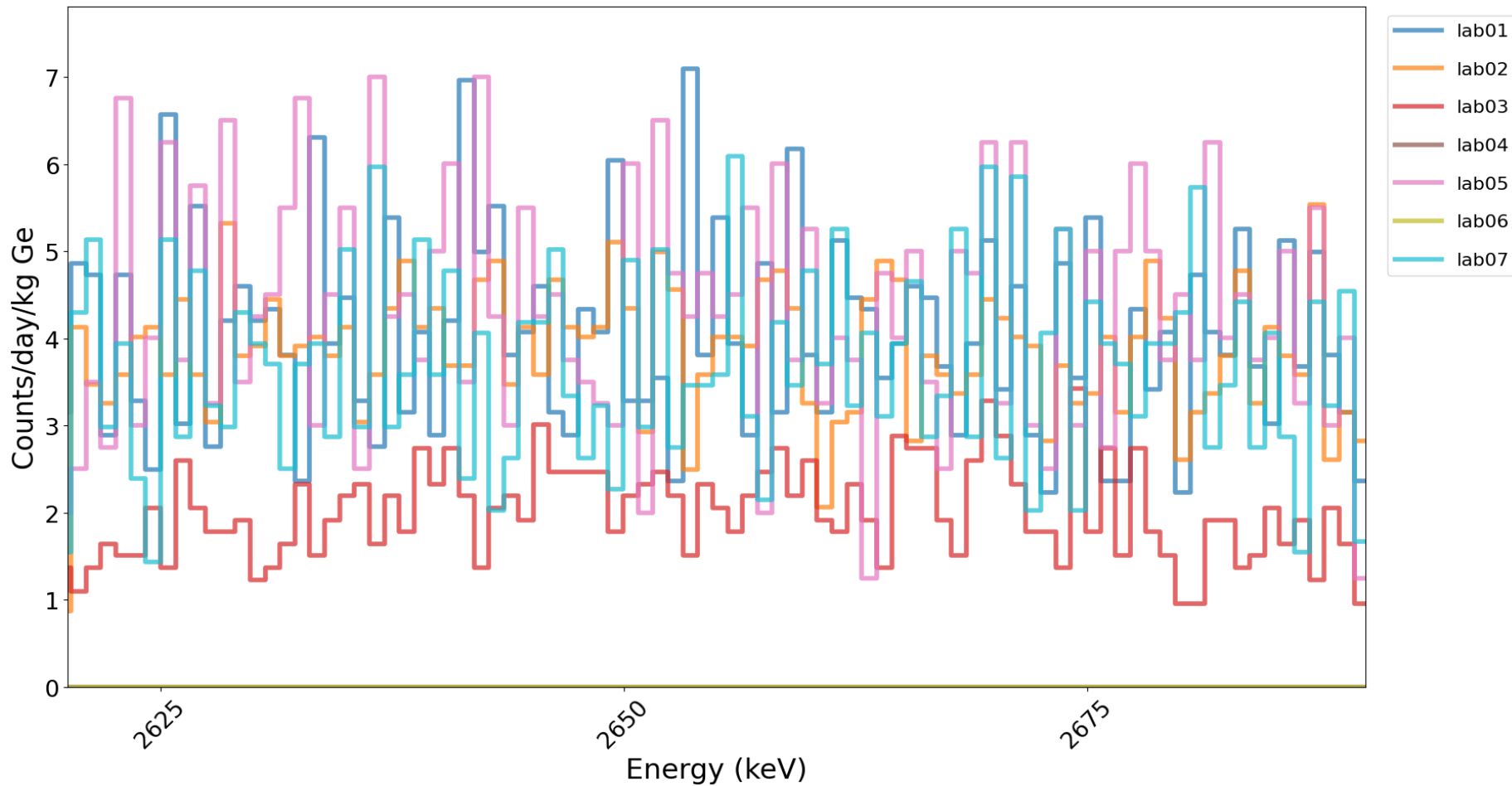


lab01	Planar	LB Pb 10 cm
lab02	Planar	ULB Pb 15 cm
lab03	Well	LB Fe 18-21 cm
lab04	Coax	Pb 11 cm
lab05	Planar	LB Pb 10 cm
lab06	Planar	LB Pb 10 cm
lab07	Planar	ULB Pb 16 cm



Energy: 2.62 - 2.69 MeV

lab01	Planar	LB Pb 10 cm
lab02	Planar	ULB Pb 15 cm
lab03	Well	LB Fe 18-21 cm
lab04	Coax	Pb 11 cm
lab05	Planar	LB Pb 10 cm
lab06	Planar	LB Pb 10 cm
lab07	Planar	ULB Pb 16 cm



Energy: 2.62 - 2.69 MeV

lab01	Planar	LB Pb 10 cm
lab02	Planar	ULB Pb 15 cm
lab03	Well	LB Fe 18-21 cm
lab04	Coax	Pb 11 cm
lab05	Planar	LB Pb 10 cm
lab06	Planar	LB Pb 10 cm
lab07	Planar	ULB Pb 16 cm

