

Best Limits Today obtained with Ge diodes: experiments Heidelberg-Moscow & IGEX

Enriched Germanium diodes (86% in ^{76}Ge , $Q_{\beta\beta}=2038,5 \text{ keV}$)

Heidelberg-Moscow

1990-2000 Gran Sasso Underground Laboratory

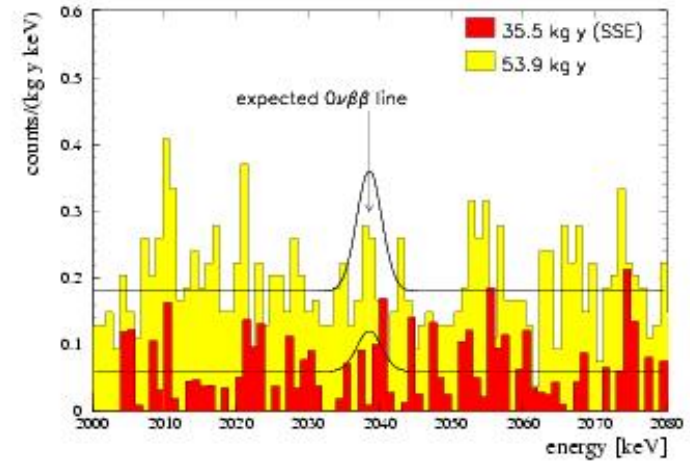
5 detectors Ge (total mass = 10,9 kg)

FWHM = 3,85 keV

$N_{\text{Bkg}} = 0,06 \text{ counts y}^{-1} \text{ kg}^{-1} \text{ keV}^{-1}$ (SSE)

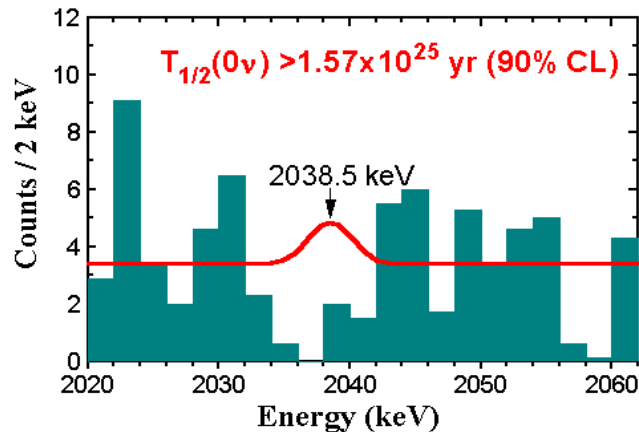
$$T_{1/2}^{0\nu} > 1.9 \cdot 10^{25} \text{ y (90\% C.L.)}$$

$$\langle m_{\nu} \rangle < 0.3 - 1.0 \text{ eV}$$



Klapdor et al. Eur Phys. J. 12 (2001) 147

IGEX (International Ge EXperiment)



Gonzales et al. Nucl. Phys. B (Proc. Suppl.) 87 (2000) 278

1994-2000 Baksan – Canfranc Underground Laboratories

6 detectors Ge (total mass = 10 kg)

FWHM = 4 keV

$N_{\text{BDF}} = 0,07 \text{ counts y}^{-1} \text{ kg}^{-1} \text{ keV}^{-1}$ (SSE)

$$T_{1/2}^{0\nu} > 1,57 \cdot 10^{25} \text{ y (90\% C.L.)}$$

$$\langle m_{\nu} \rangle < 0,33 - 1.07 \text{ eV}$$

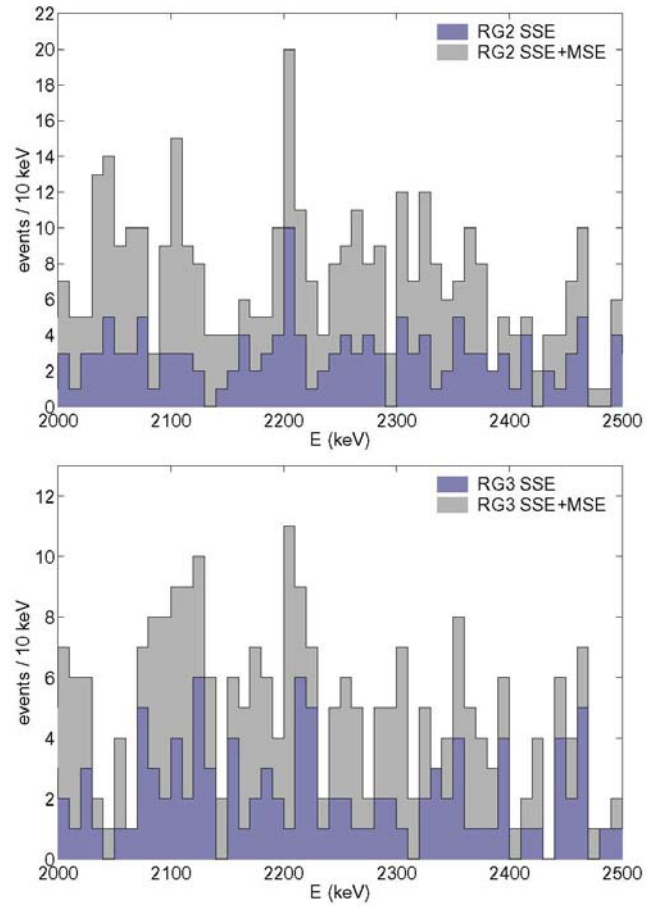


Figure 10: Background spectra before and after the PSD based on the counting of the number of lobes for detectors RG2 (top) and RG3 (bottom).

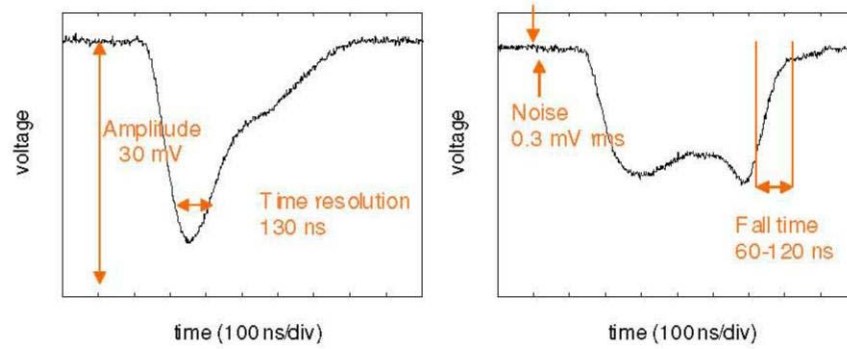


Figure 1: Main features of the digitized experimental pulses.

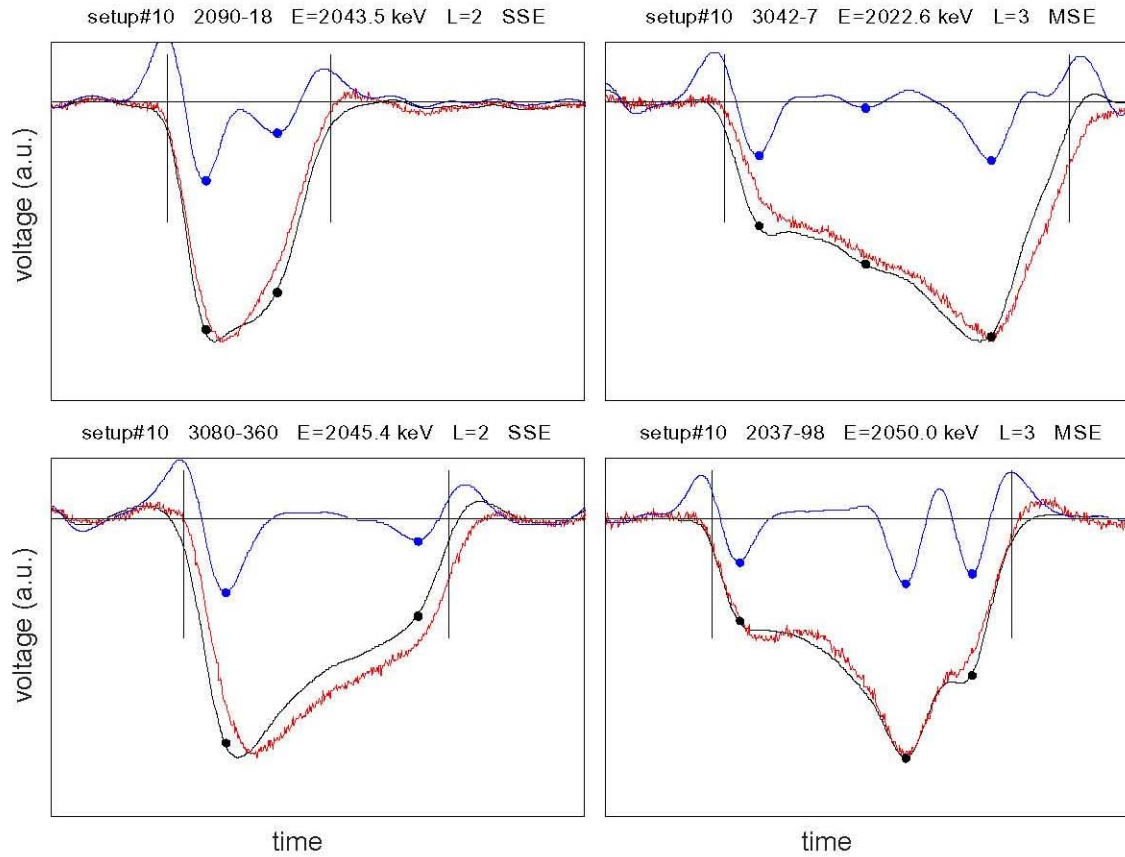


Figure 5: Examples of the effect of applying the "mexican-hat" filter to detect significant lobes in the digitized pulses. Events on the left are accepted (having two lobes) while those on the right are rejected (having three lobes).

Table 2: Results of applying the PSD (exposure, background levels b in the 2-25 MeV region before and after the discrimination and rejection factors).

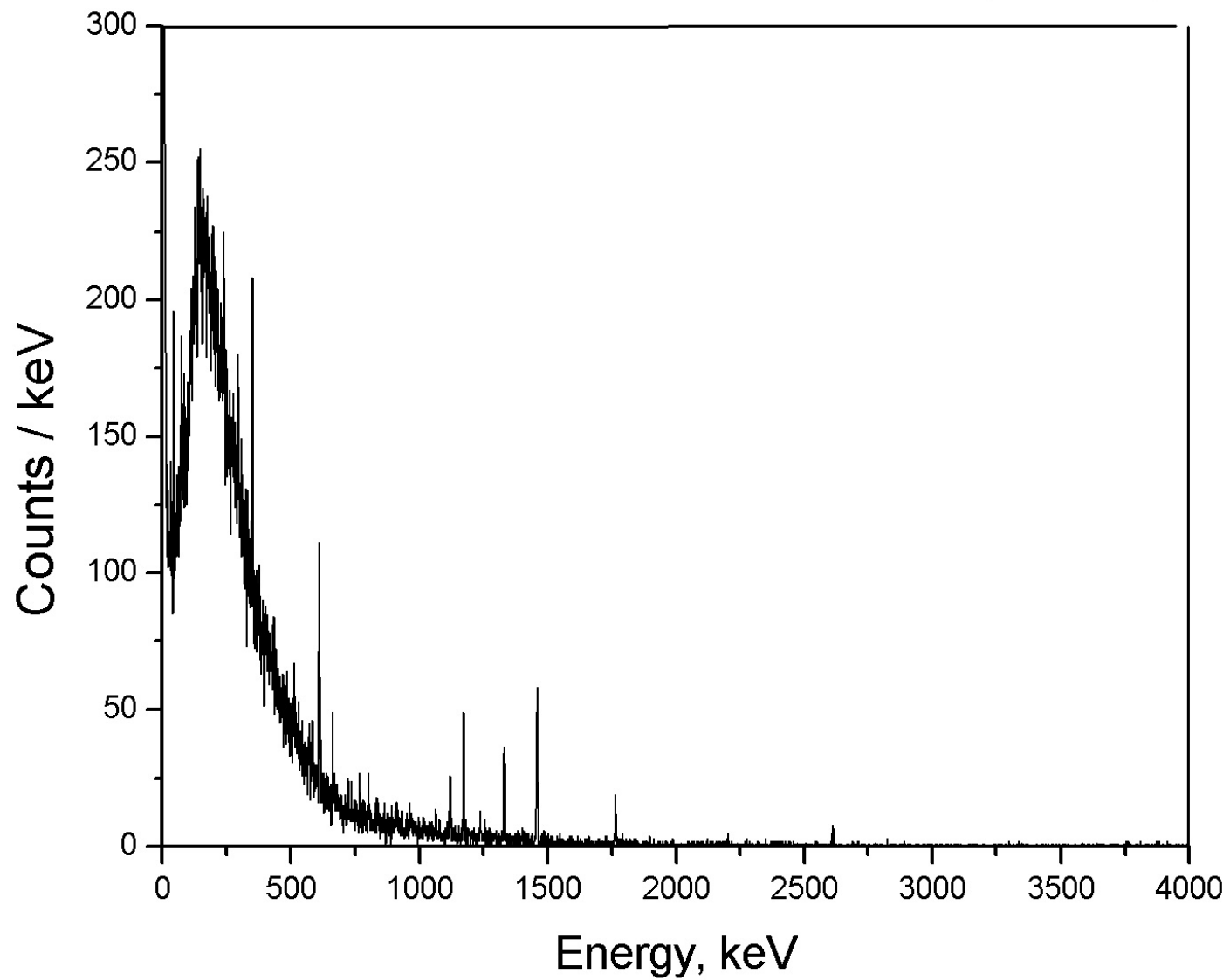
	exposure	b before	b after	rejection factor
	kg γ	$c/(ksV \text{ kg } \gamma)$	$c/(ksV \text{ kg } \gamma)$	(%)
RG2	2.75	0.27	0.10	62.19
RG3	1.90	0.28	0.11	57.81
total	4.65	0.28	0.10	60.98

Table 5: IGEX Data bins for 8.87 kg.y In ^{76}Ge

E(low) keV	SSE data set	Complete data set
2020	2.9	3.9
2022	9.1	10.1
2024	2.4	4.4
2028	2.0	6.0
2028	5.8	7.8
2030	6.5	7.5
2032	3.3	5.3
2034	0.8	1.8
2038	1.0	4.0
2038	2.0	3.0
2040	0.5	2.5
2042	3.5	5.5
2044	4.0	7.0
2048	2.7	2.7
2048	5.3	7.3
2050	3.4	5.4
2052	4.8	7.8
2054	5.0	7.0
2058	0.8	1.8
2058	0.1	0.1
2060	3.3	6.3
Expected counts	13.0	20.3
Observed counts	4.1	11.1
Upper limit A (90% CL)	3.1	4.3
$\ln 2 N_{\gamma} / A$	$1.57 \times 10^{26} \text{y}$	$1.13 \times 10^{26} \text{y}$

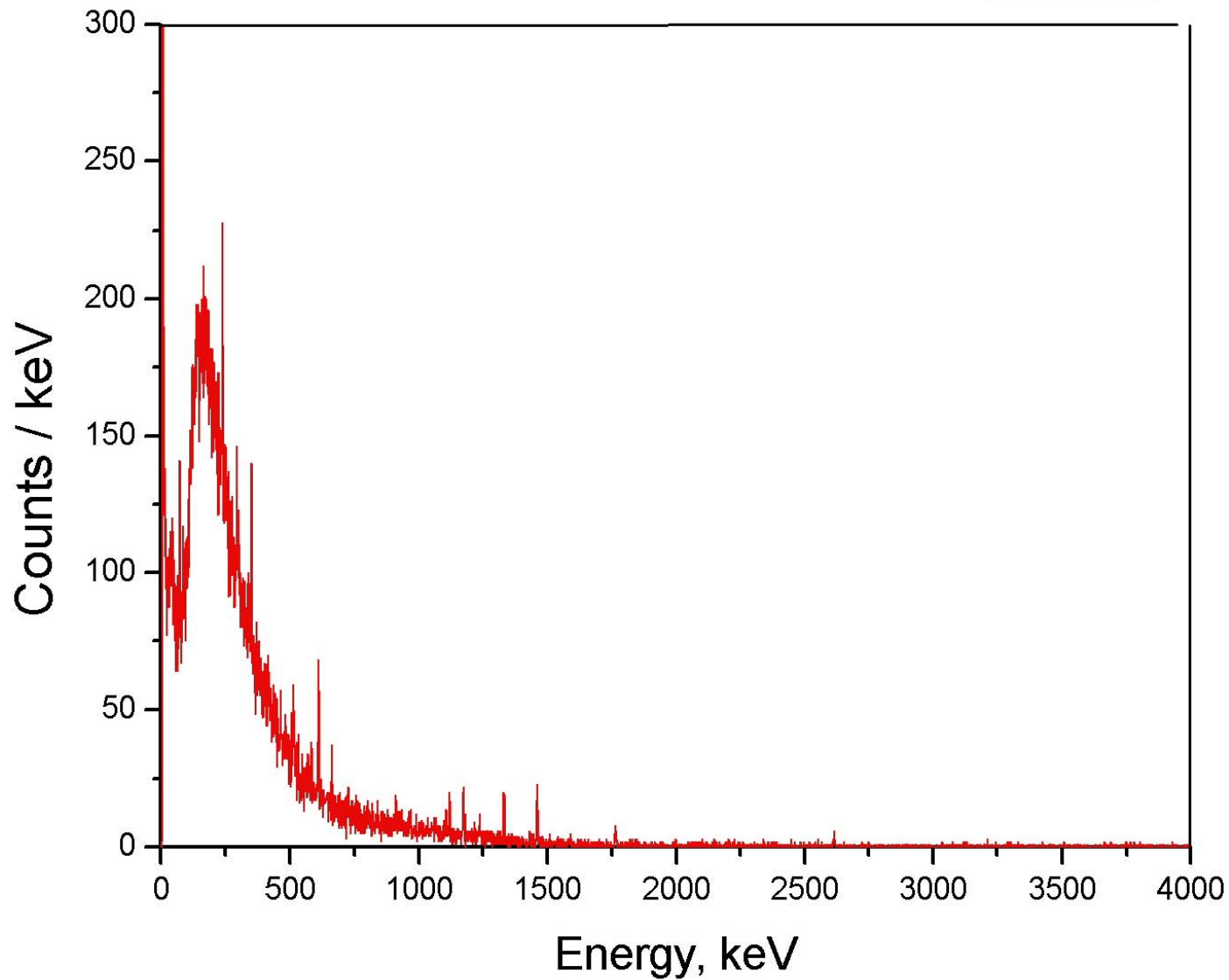
Ge-Natural, 1kg, t = 810 days

— B



Ge-76, 1kg, Baksan, t = 810 days

— B



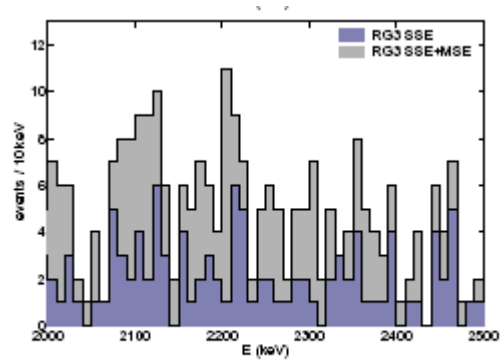
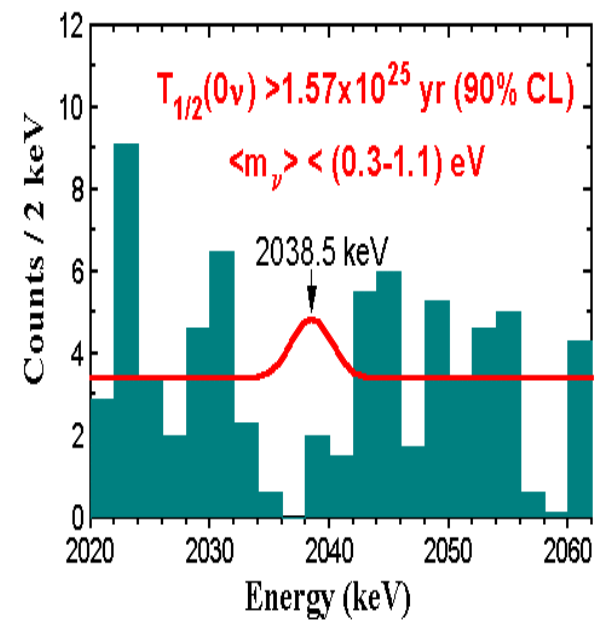
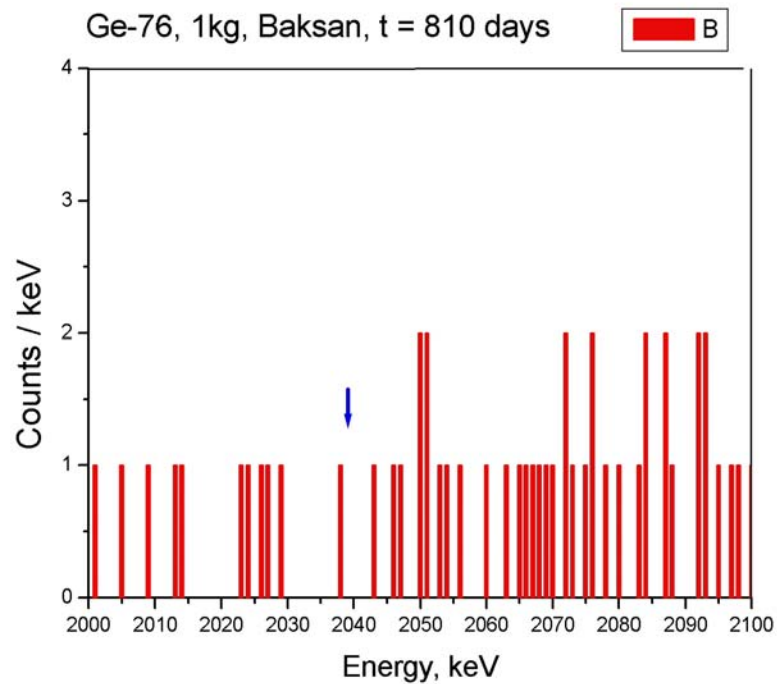
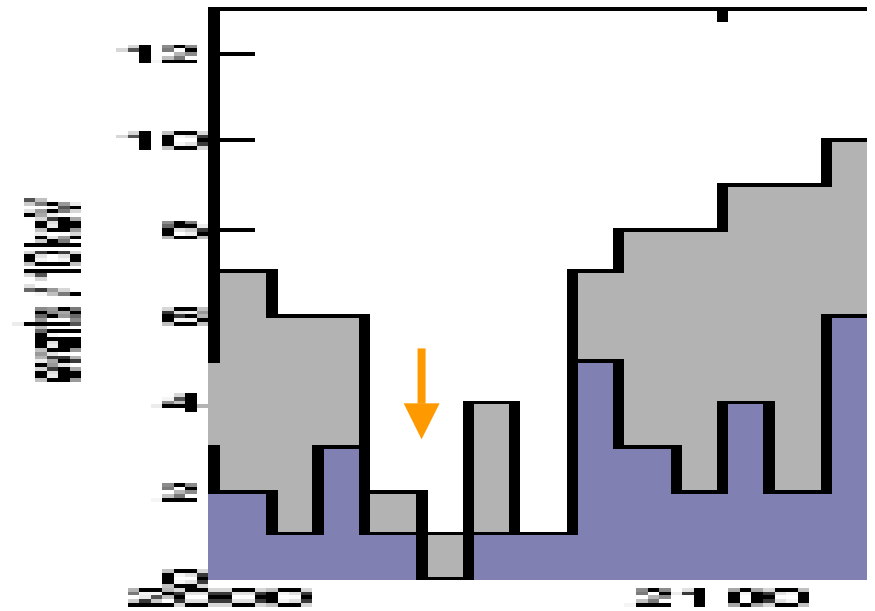
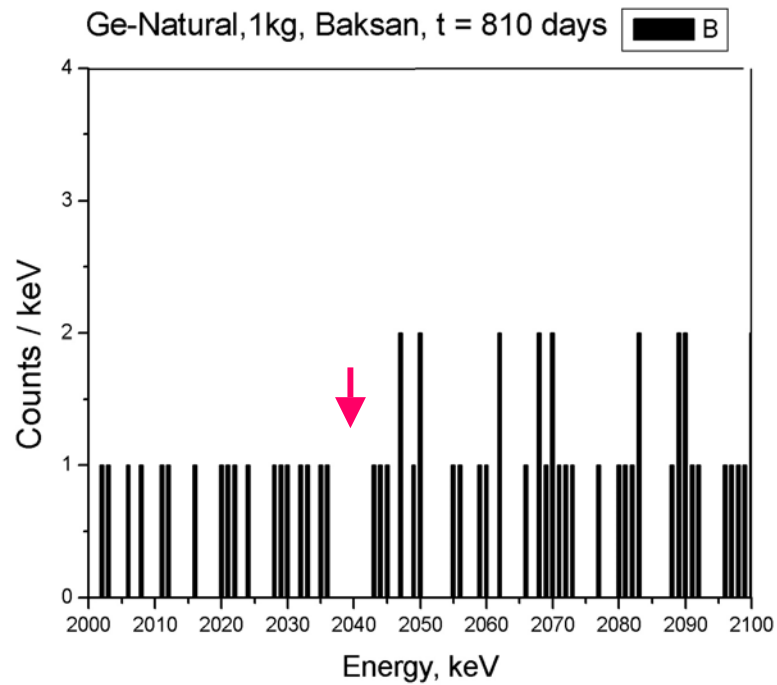
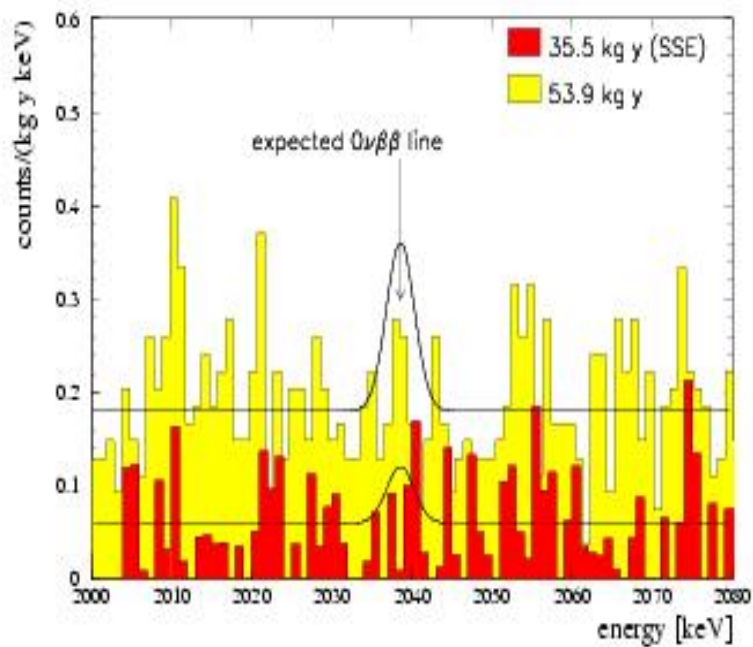
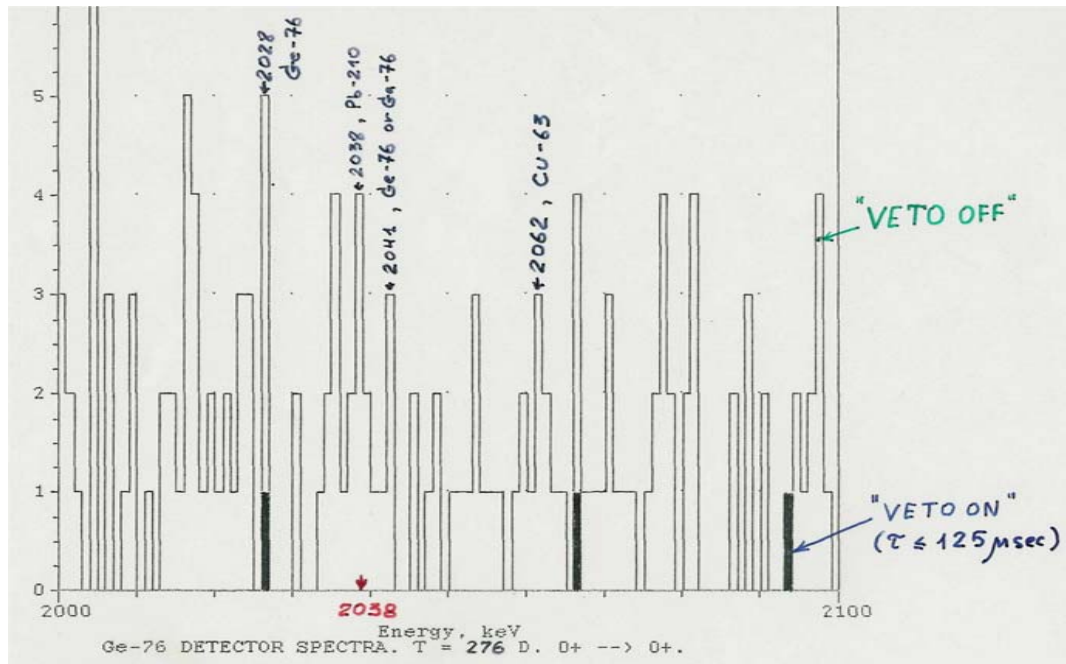


Figure 10: Background spectra before and after the PSD based on the counting of the number of lobes for detectors RG2 (top) and RG3 (bottom).







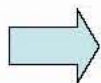
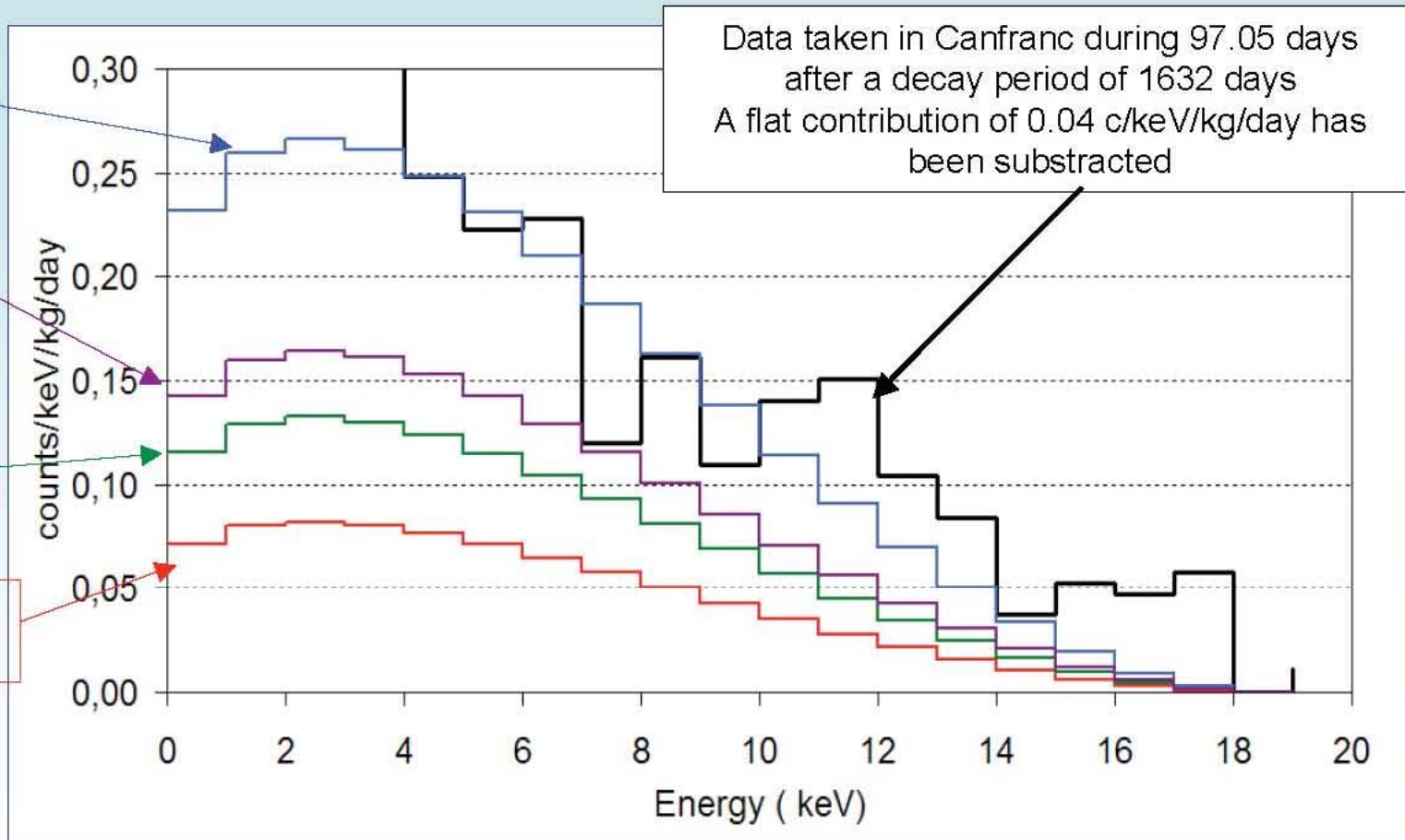
IGEX-DM: Low energy background

Tritium Best Fit
2.58 c/kg/day

Tritium [2]
1.85 c/kg/day

Tritium [1]
1.48 c/kg/day

Tritium [3]
0.92 c/kg/day

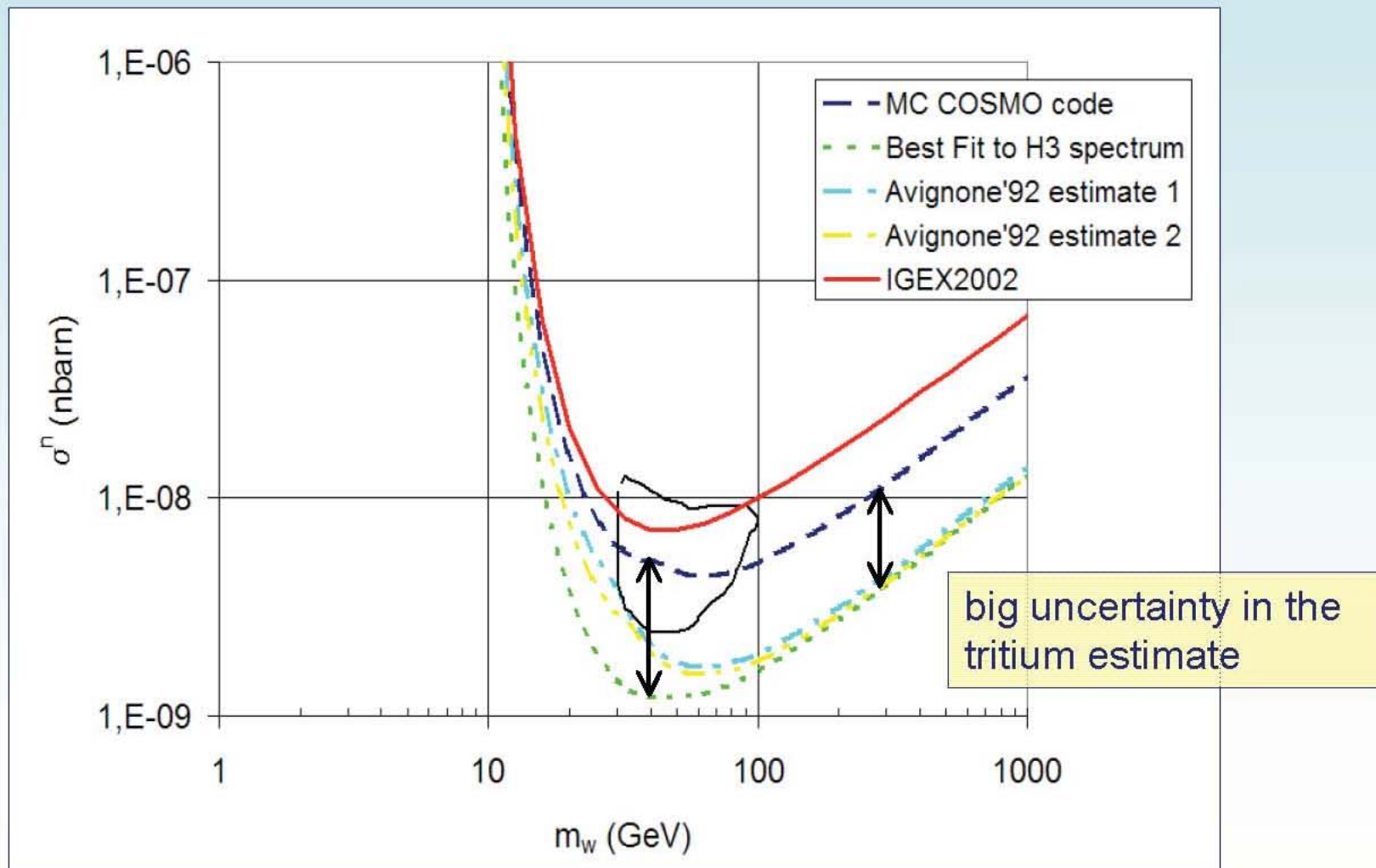


A substantial part (but not all) of the remaining background may be due to ^3H



IGEX-DM: Results

Exclusion plots subtracting the tritium contribution from the IGEX spectrum



Background identification

Simulations and estimations:

- ✓ ^{40}K
- ✓ $^{238}\text{U} / ^{222}\text{Rn}$
- ✓ ^{232}Th
- ✓ ^{60}Co
- ✓ ^{210}Pb
- ✓ $2\beta 2\nu$
- ✓ non-vetoed muons

