

Total OMC rate analysis in ^{76}Se

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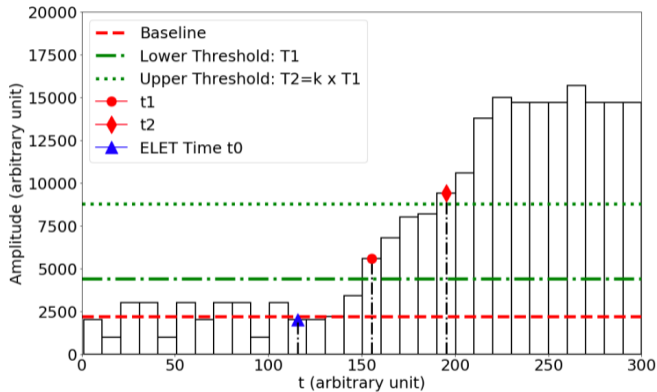
Steps:

- Muon- & gamma-event timestamps calculation
- Main Trigger (OMC) definition and filling correlated spectra from Ge-event after Main Trigger
- Analysis of correlated spectra evolution for the list of lines (183, 199, 265, 280 keV) for each detector
- Getting average τ_{total} from all of the lines and detectors
- Calculation of systematics uncertainties

Muon- & gamma-event timestamp's calculation

- MIDAS writes hardware Struck SIS3316 timestamps with 4 ns resolution for muon events. (hardware defined, unchangeable)
- For Ge-events we use a special ELET (*Extrapolated Leading Edge Threshold*) algorithm for time calculation: timestamp is a cross-section of flat background before pulse and line which is going through 2 threshold's points (software defined, changeable)

ELET



Idea : We tune the coefficient k and the lower threshold to implement such conditions

- $\Delta t = t_1 - t_0$
- $\Delta t = t_2 - t_1$

And than we calculate t_0 like this:

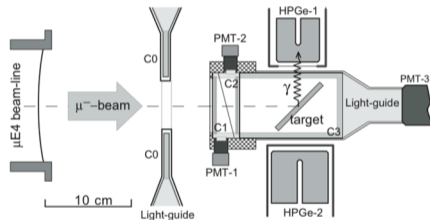
$$t_0 = 2t_1 - t_2$$

Muon- & gamma-event timestamp's calculation. Systematics

- Muon-event timestamp slightly depends on energy (constant hardware threshold).
- ELET (Ge-event timestamp) depends on energy, it works good for average pulses and bad for small or big ones. That is why we have a bad time binding for BEGe detectors #2 and #6 with MIDAS data.

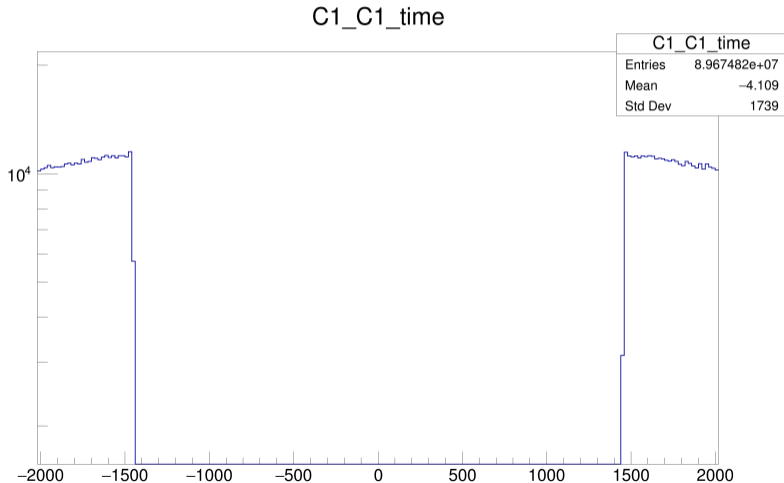
Main trigger variations

- C1&C2 at 100 ns.
- C1&C2 at 100 ns with hardware pileup protection
- C1&C2 at 100 ns + $\overline{C0} + \overline{C3}$ at 1440 ns
- C1&C2 at 100 ns + $\overline{C0} + \overline{C3}$ at 1440 ns with hardware pileup protection
- C1&C2 at 100 ns + $\overline{C0}$ at 1440 ns
- C1&C2 at 100 ns + $\overline{C0}$ at 1440 ns with hardware pileup protection



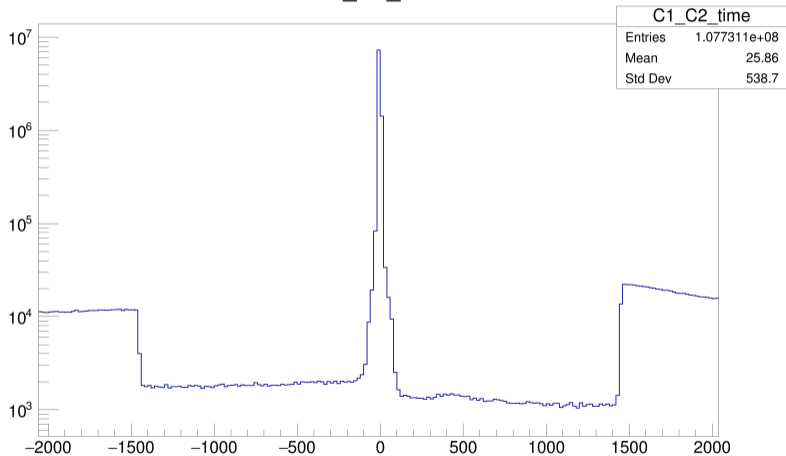
Why 1440 ns ?

We have 1440 dead time for C# counters applying hardware trapezoid filter



Why 100 ns ?

C1_C2_time



Additional cuts (in question)

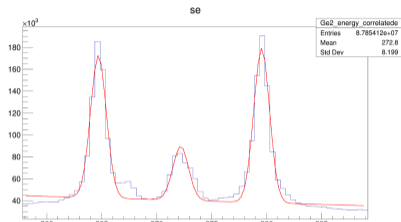
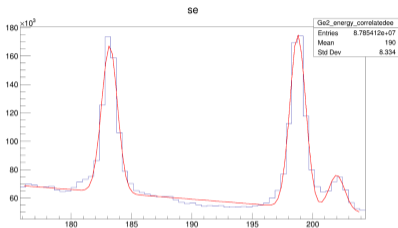
- No C0 and/or C3 event during special time window :
9120 ns = 12000 - 2*1440 ns (looks not necessary)

- No any C# event at 2*1440ns before main trigger
(special cut for missed C# events)

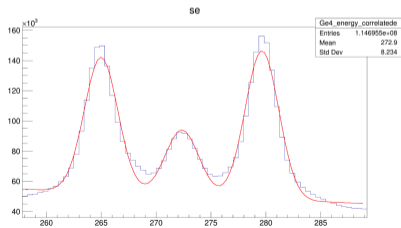
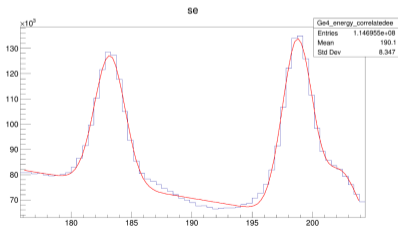
Analysis of gamma-line evolution

- Fill correlated spectra from Ge-events (2d-histogram, E vs Time) after Main Trigger with 12 ns steps
- Fit selected gamma lines at integral correlated spectra by "gaus+pol1(3)" function (gaus + linear background). Fix sigma, energy and fit lines with steps every 12 ns after Main Trigger.
- Plot histograms for intensities time evolution
- Fit left tail of the time evolution data with "expo(0)+pol0(2)" model (exponent + flat background)

Fit of multiplets in ^{76}Se (2-3-4 etc)



GE2 (BEGe)

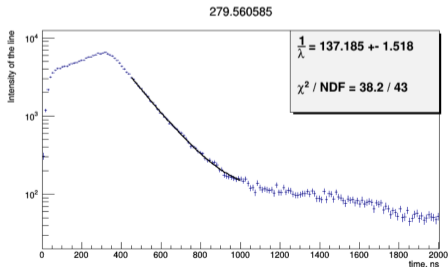
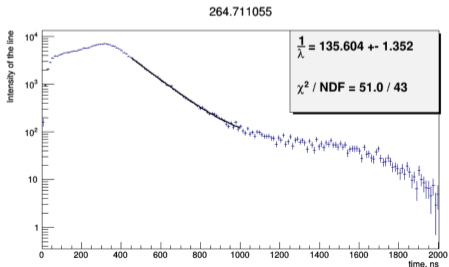
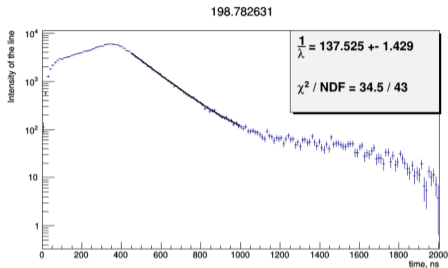
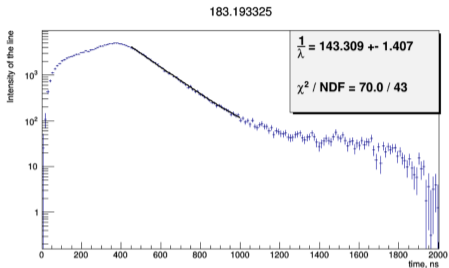


GE4 (REGe)

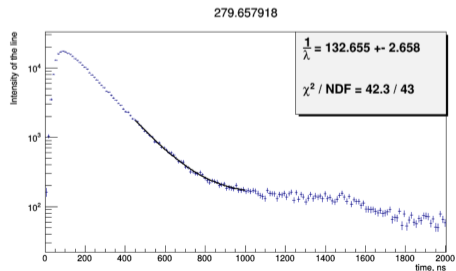
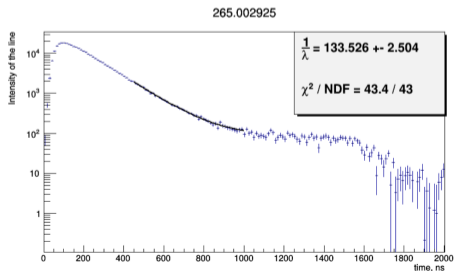
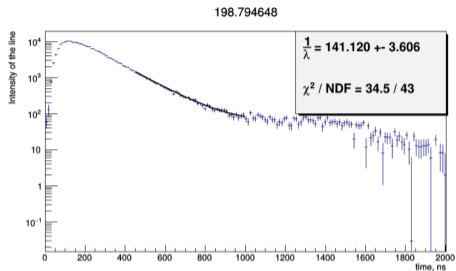
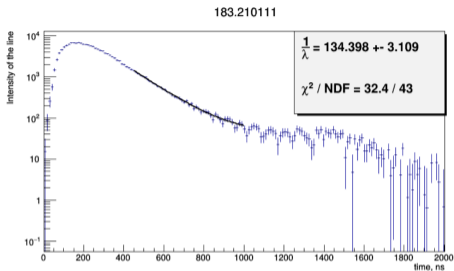
Fit of multiplets in ^{76}Se . Systematics

- Missed lines
- Gain shift during the beam time (not yet checked)
- Very simple model (without left/right tails and/maybe steps)

^{76}Se lines at Ge2. Correlated spectra.

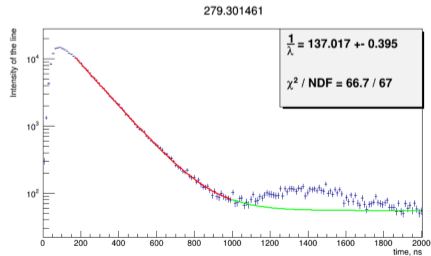
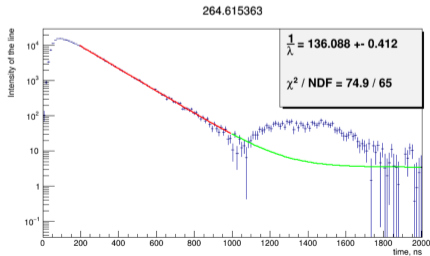
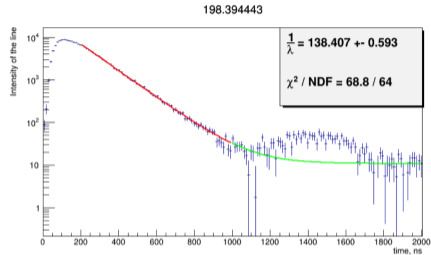
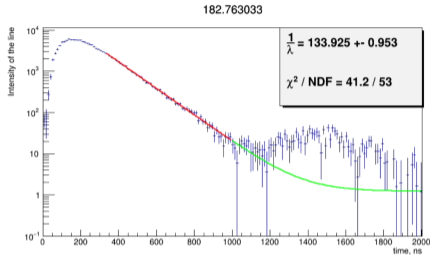


^{76}Se lines at Ge4. Correlated spectra.



Time evolution fit

(red – real fit, green – extrapolation over time range with hardware distortion after 1000ns)



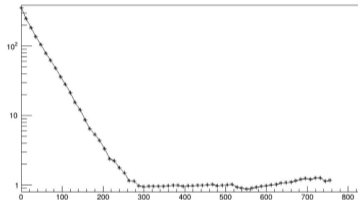
Time evolution fit. Systematics

- Why $\text{expo} + \text{pol0}(2)$?
- Maybe $\text{expo}(0) + \text{expo}(2) + \text{pol0}(4)$?
- Maybe something else ?

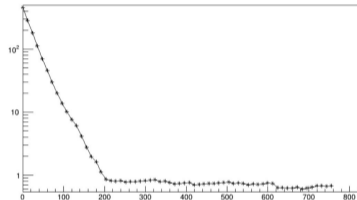
χ^2/NDF vs left border of the fit range

(Ge1, right border = 1000ns)

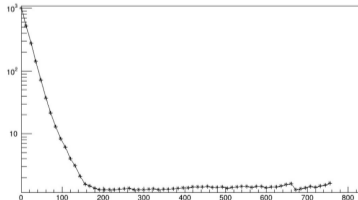
Ge1 182.923996 graph



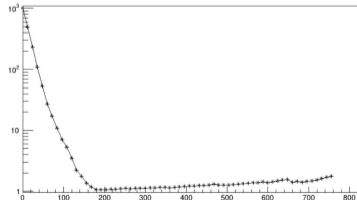
Ge1 198.539482 graph



Ge1 264.592711 graph



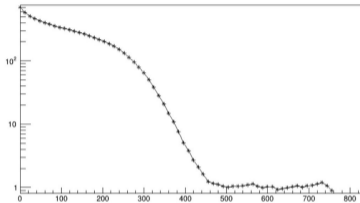
Ge1 279.216296 graph



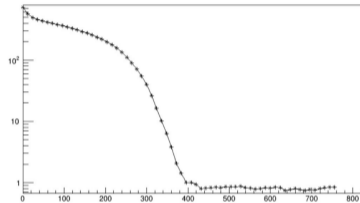
χ^2/NDF vs left border of the fit range

(Ge2, right border = 1000ns)

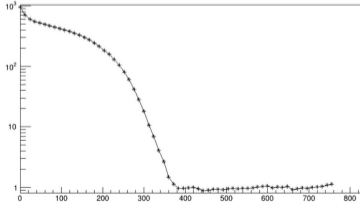
Ge2 183.193325 graph



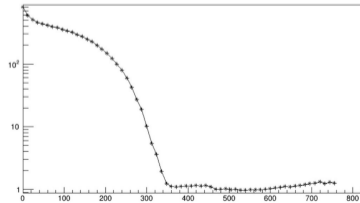
Ge2 198.782631 graph



Ge2 264.711055 graph

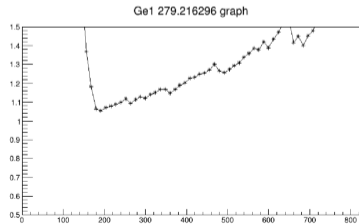
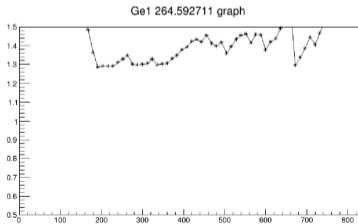
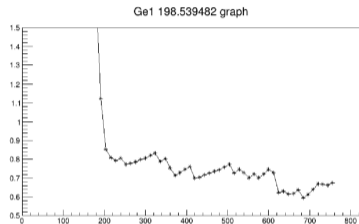
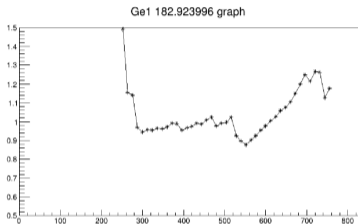


Ge2 279.560585 graph



χ^2/NDF vs left border of the fit range

(Ge1, right border = 1000ns, zoom)



Getting average from all lines and detectors

$$\frac{1}{\lambda_{total}} = \tau_{total} = \frac{\sum_{lines} \sum_{detectors} \tau_{ij}}{N_{lines} N_{detectors}}$$

$$\tau_{total} = 137.030 \pm 0.046_{stat} ns$$

Calculation of systematics incertanties

In progress

THE END