Data analysis and simulations for GERDA

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Analysis of calibration data

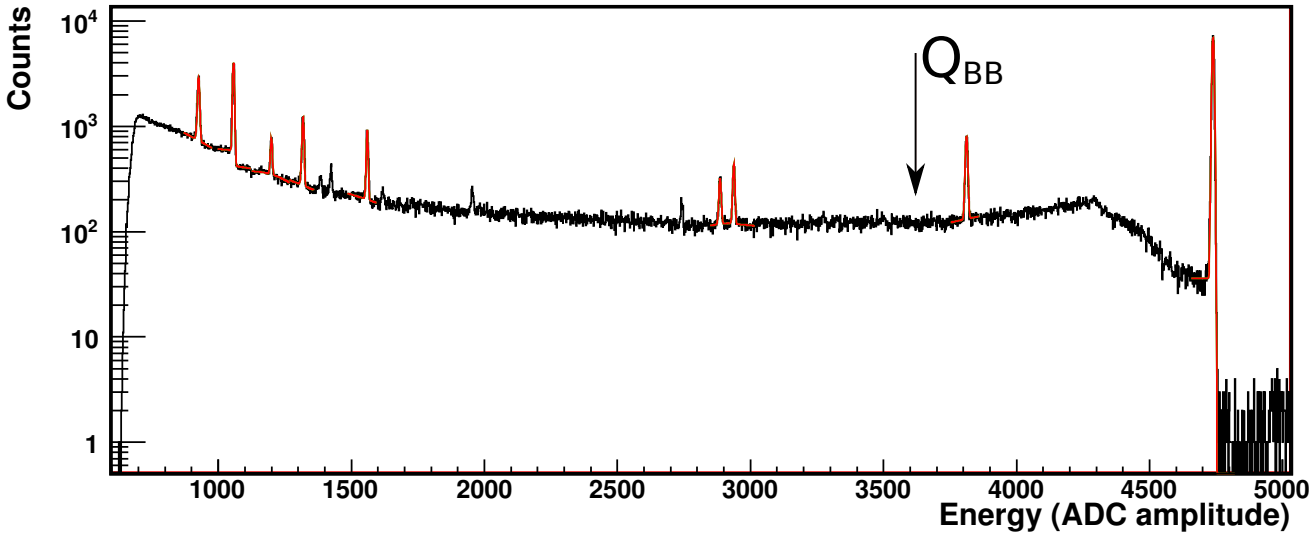
- Problem: complex experiment $\rightarrow$ possible instabilities
- Solution: pulser monitoring + bi-weekly calibrations with $^{228}\mathrm{Th}$ source

Calibration procedure in GERDA

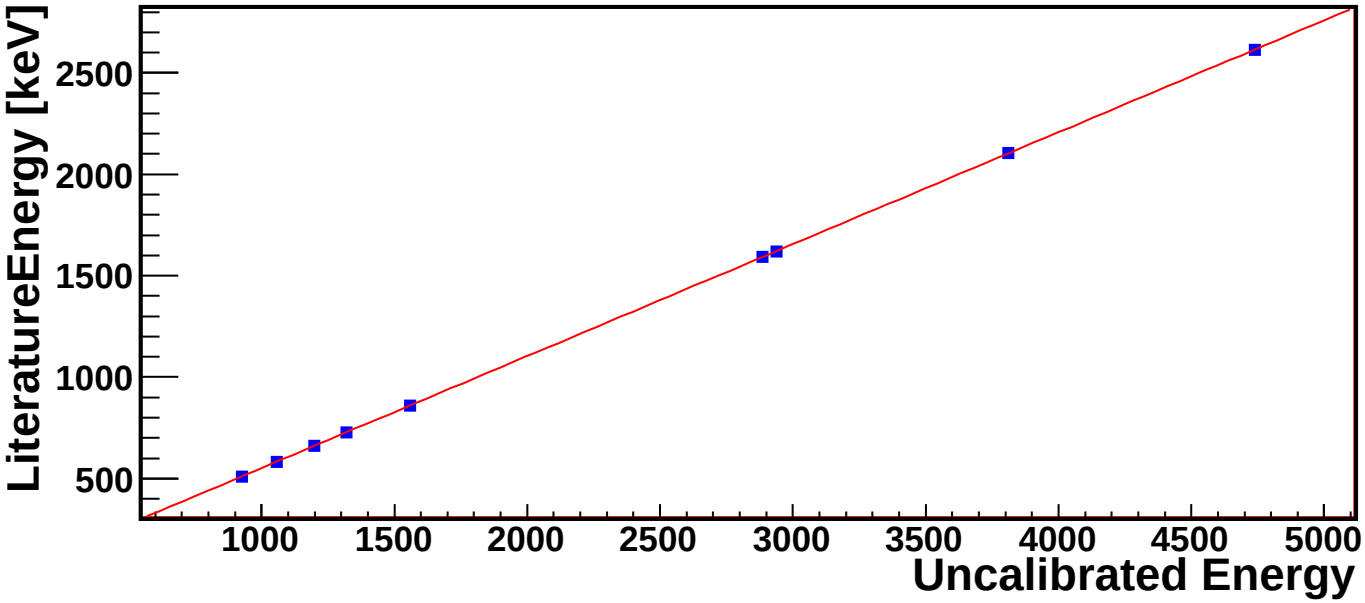
- 3 calibration sources lowered from above to the vicinity of the detectors ($1-2$ hour exposure)
- Calibration run taken after each modification in the setup or any hint of instability given by the pulser

Calibration infos:

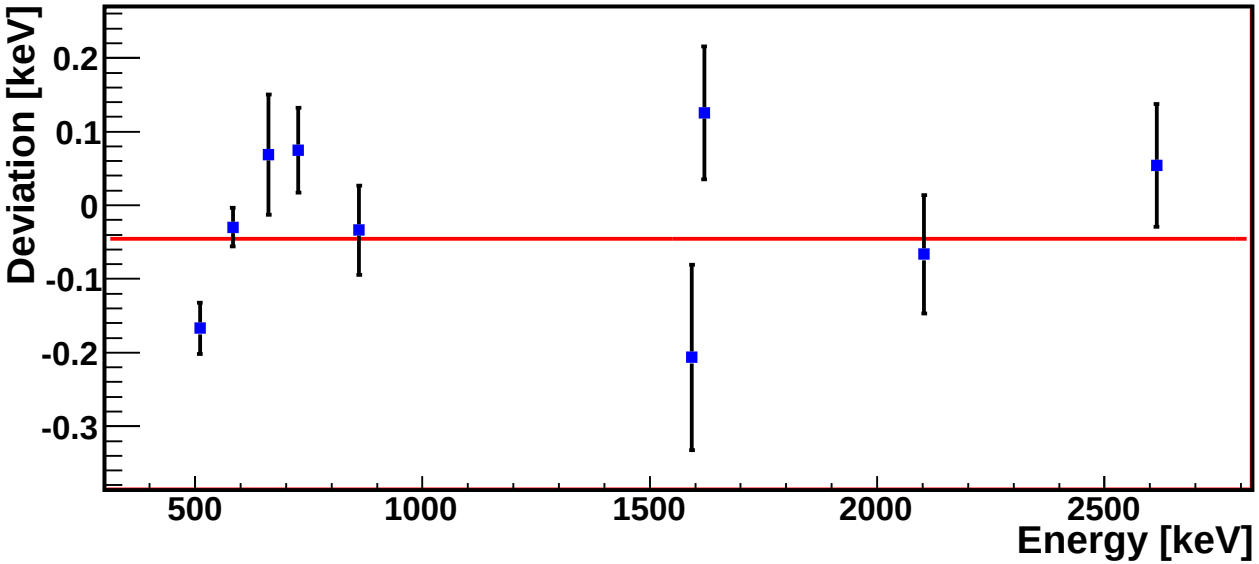
- Calibration curves $\rightarrow$ Get the energy of interacting particles;
- Resolution curves $\rightarrow$ Needed to smear the MC spectra
- Parameters for quality cuts $\rightarrow$ Reject non-physical events and some background events.
- Calibration parameters also used to study stability properties.



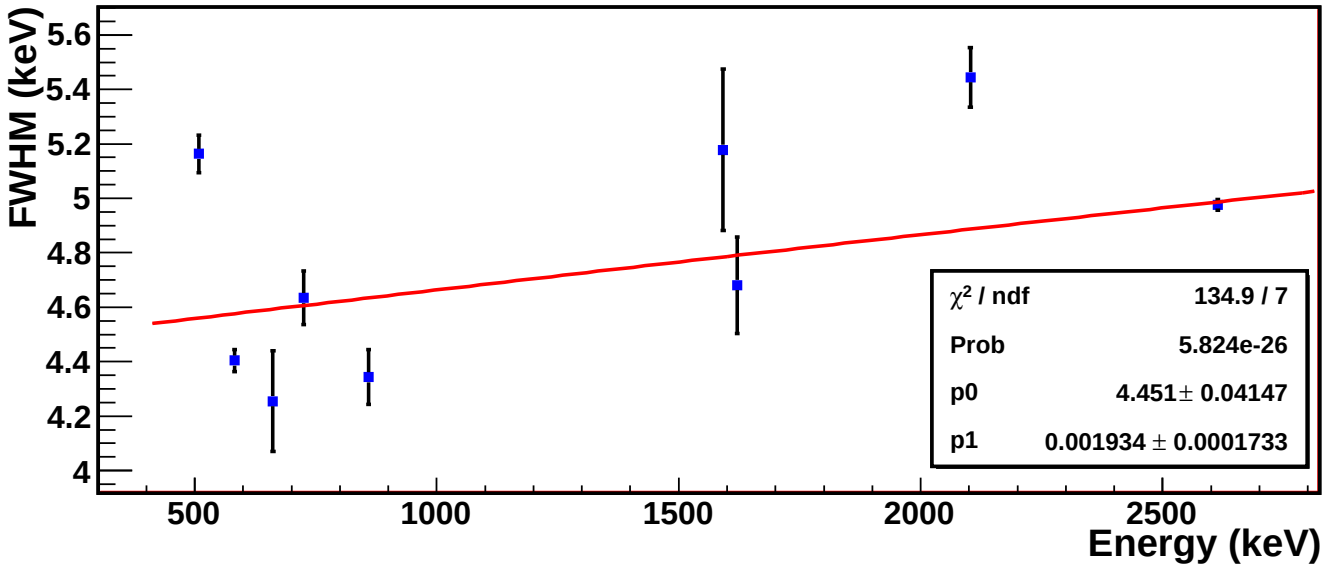
Uncalibrated spectrum recorded using ^{228}Th sources.



Calibration curve extracted from a ^{228}Th spectrum.

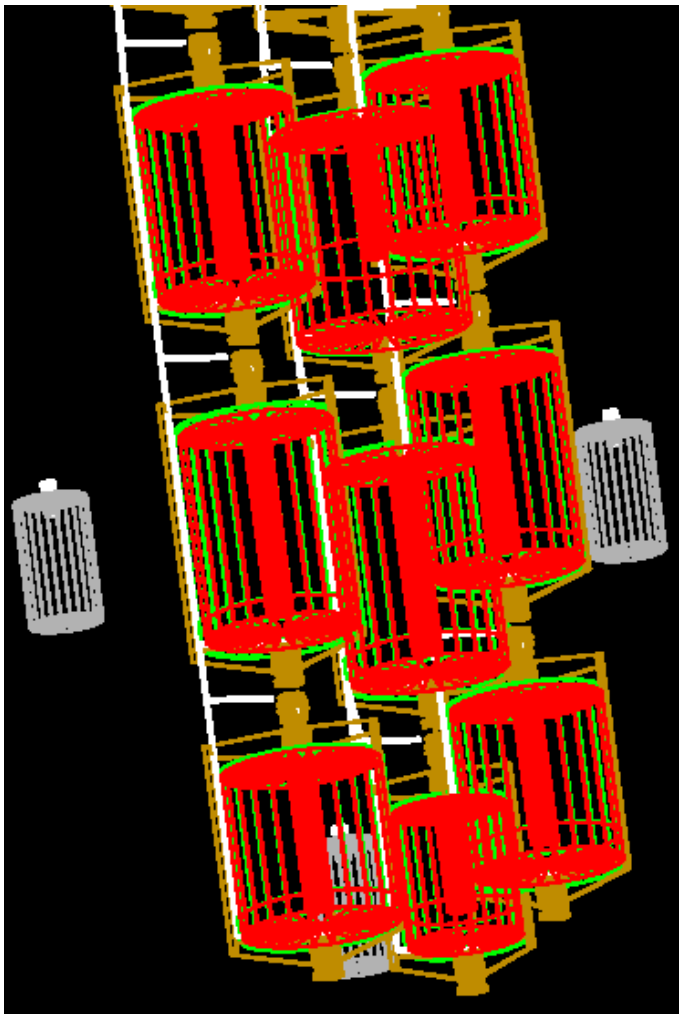


Residuals of the peaks from a 2^{nd} degree polinomial



Resolution as function of energy.

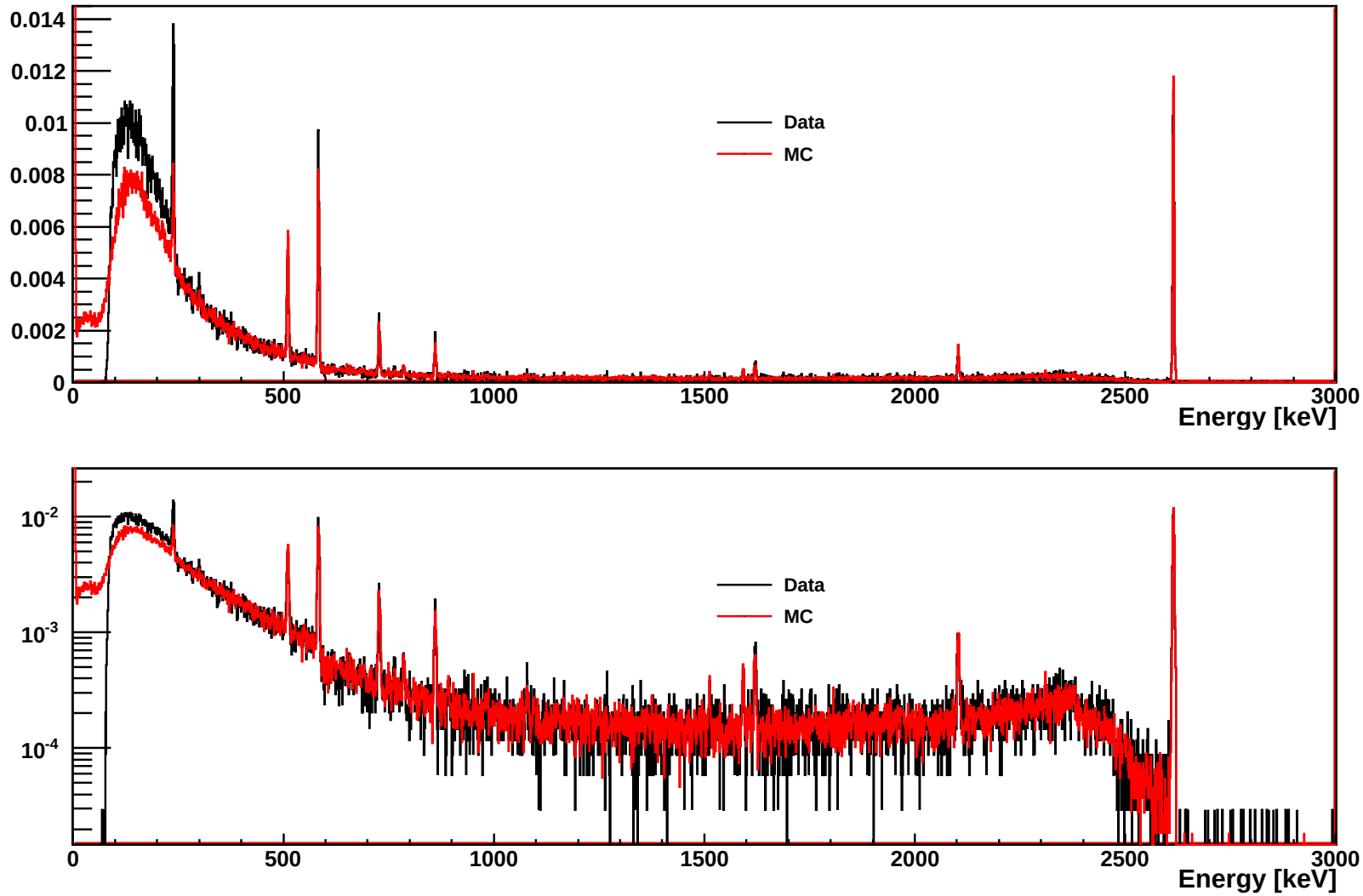
Simulations of calibrations



Aim of simulations

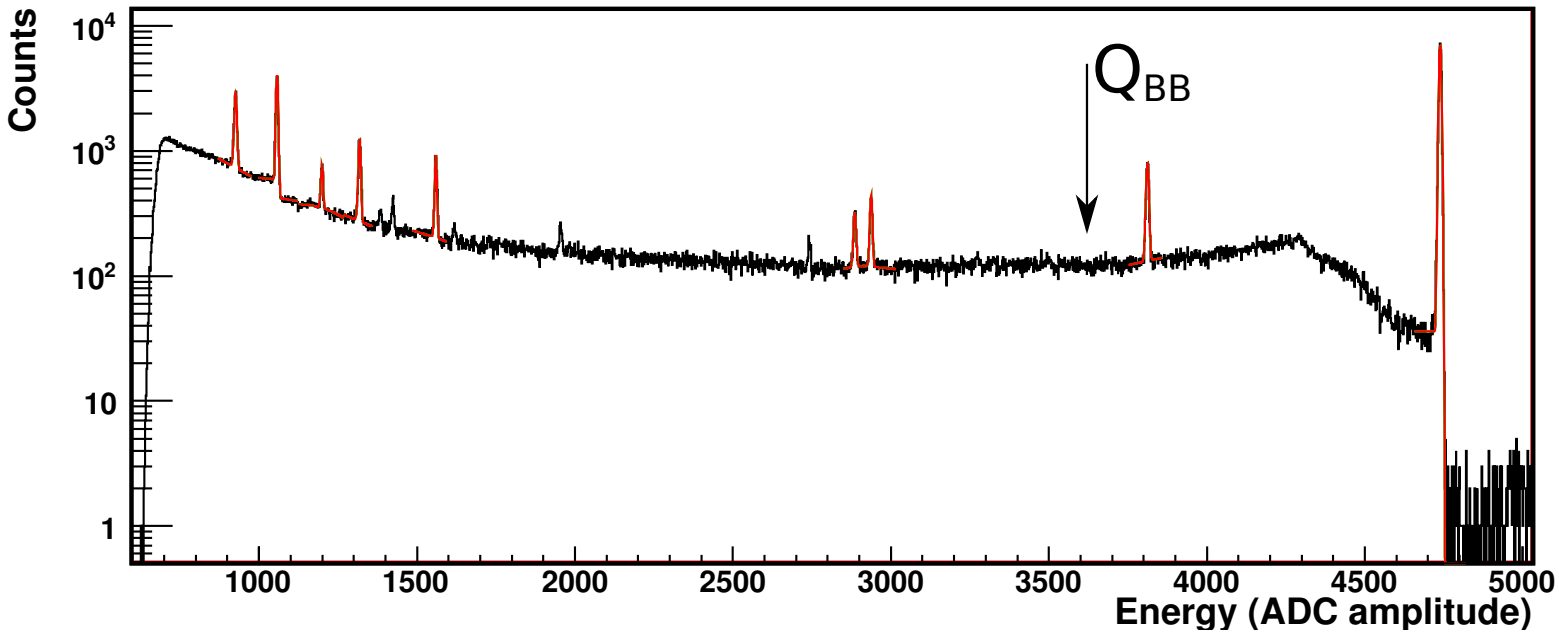
- Cross check the Majorana-GERDA simulation framework (MAGE)
- Estimate detector positions in GERDA
- Estimate ratio of Single Site Events (SSE) vs Multi Site Events (MSE) for Pulse Shape Analysis
- Estimate thickness of detector deadlayers
- Estimate best sources configuration for Phase II

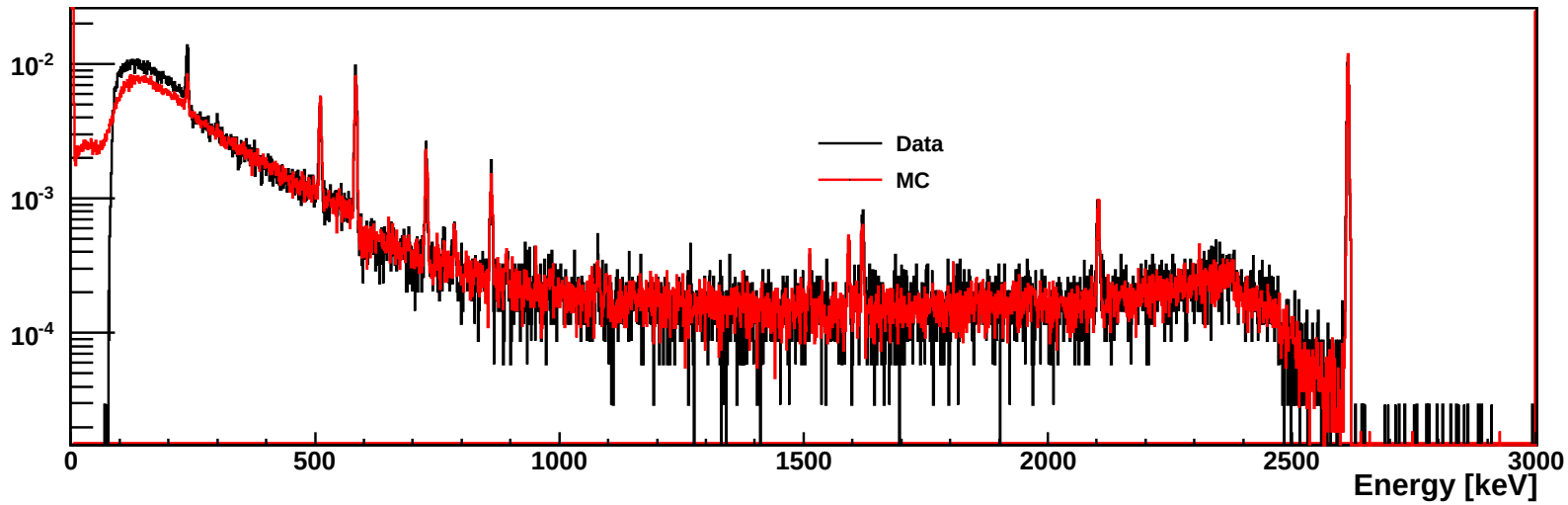
Comparison of data and MC



Experimental and simulated calibration spectra normalized in the $100 - 3000$ *keV region.*

Conclusion


Counts
10^4
10^3
10^2
10
1
Q_{BB}
1000
1500
2000
2500
3000
3500
4000
4500
5000
Energy (ADC amplitude)


10^{-2}
10^{-3}
10^{-4}
Data
MC
0
500
1000
1500
2000
2500
3000
Energy [keV]

Backup

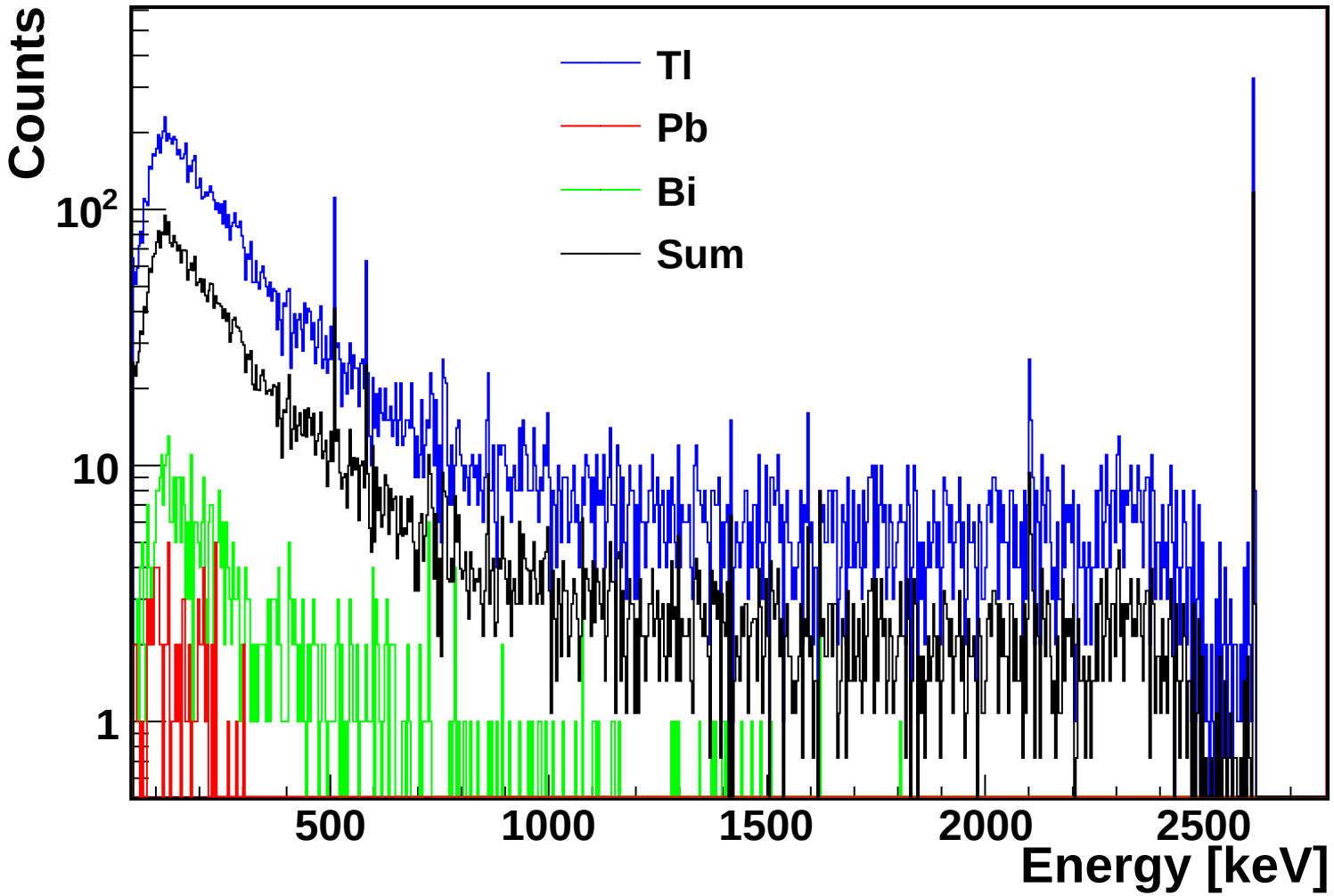
MC

- Simulate only gamma emitters of Thorium chain: $^{212}\mathrm{Pb}$, $^{212}\mathrm{Bi}$, $^{208}\mathrm{Tl}$
- Simulate 10^7 events for each isotope
- Merge simulated spectra according to the branching ratios
- Smear simulated spectra according to detector energy resolution

Data

- Use calibration data taken only with one of the three sources
- Select data taken when the sources are not moving

Backup



Spectra of all the simulated isotopes of the ^{228}Th chain and their weighted sum