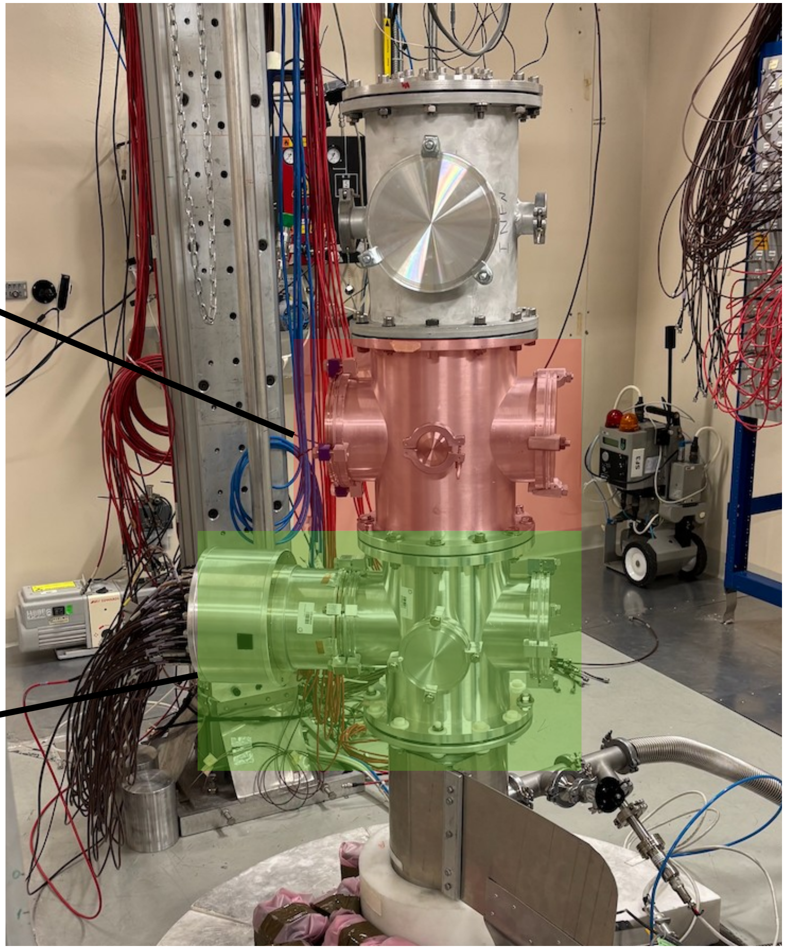
^{12}C(n,cp) con rivelatore anulare

2024 Campaign in EAR2

SiMon2



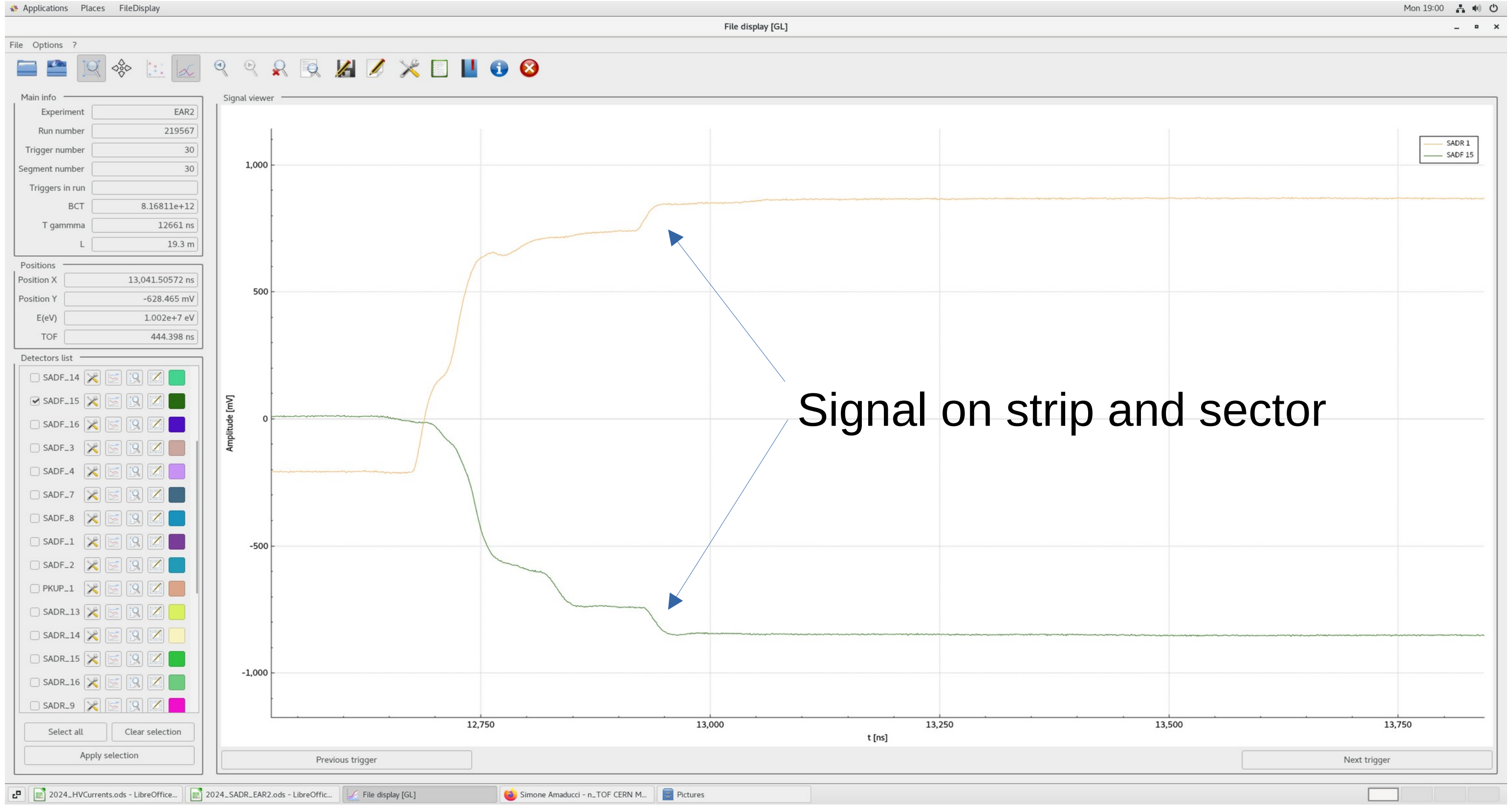
Annular

Improved configuration with respect to 2023:

- **Direct coupling with the beamline** for background reduction
- Solved issues on the read-out board
- Filtered bias for noise reduction
- Simpler sample exchange procedure and less massive sample support
- Thicker detector to increase punch through energy
- **Set of samples optimized for EAR2**
  - 4 um graphite
  - 55 mm and 3 mm diameter LiF

2024 Campaign in EAR2

From the File Display we see that the detector is able to operate up to few MeV (10-30? it make a huge difference but need analysis to be sure).



2024 Campaign in EAR2

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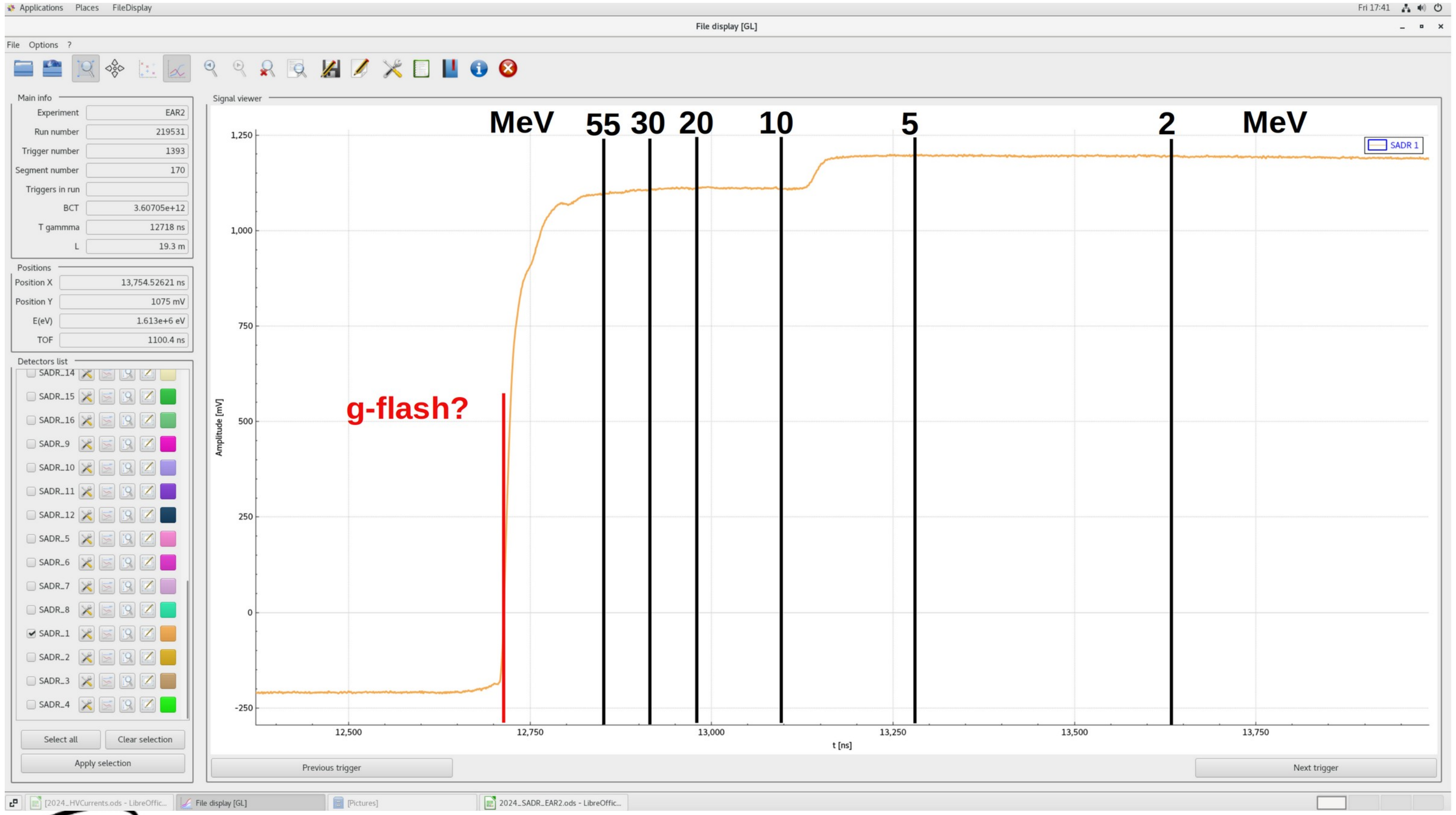
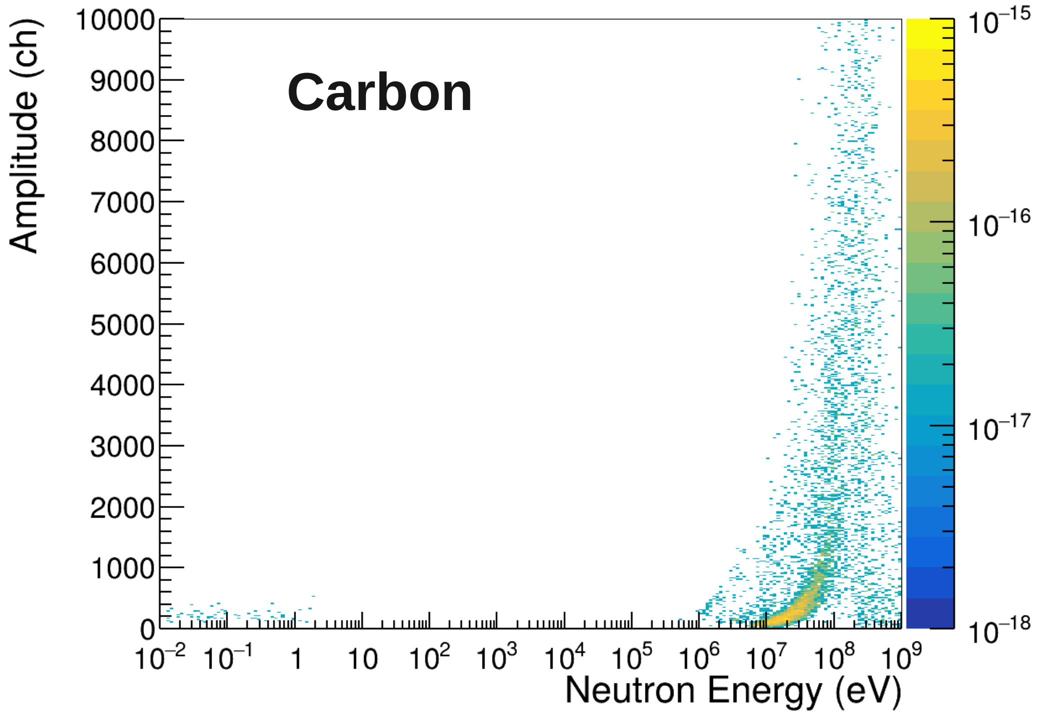
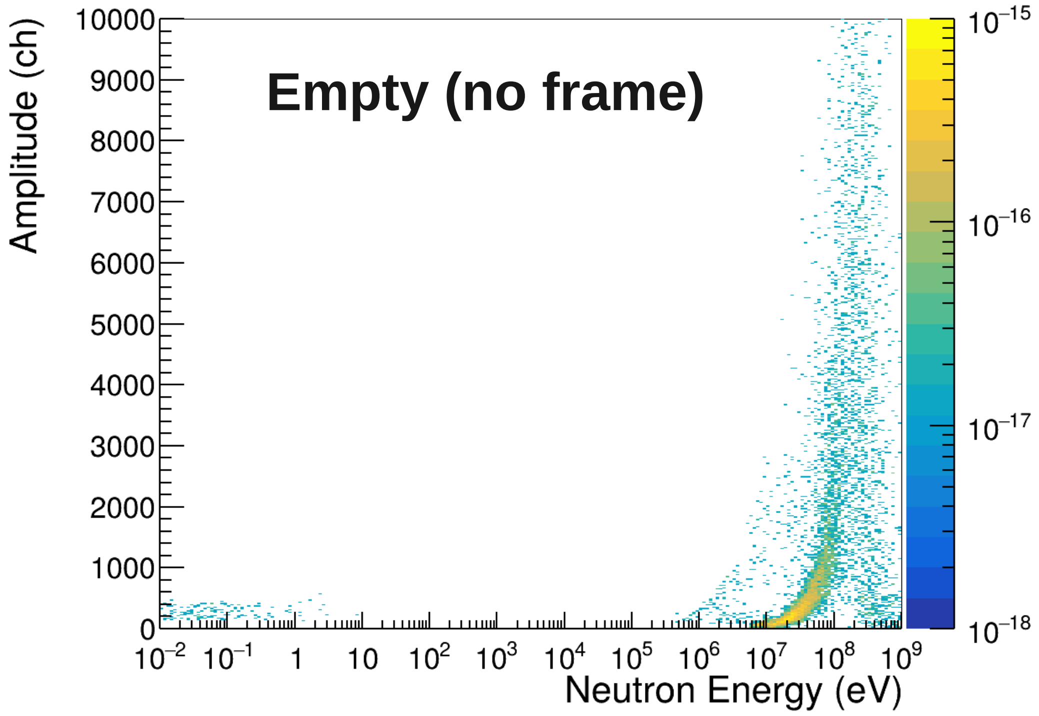


2024 Campaign in EAR2

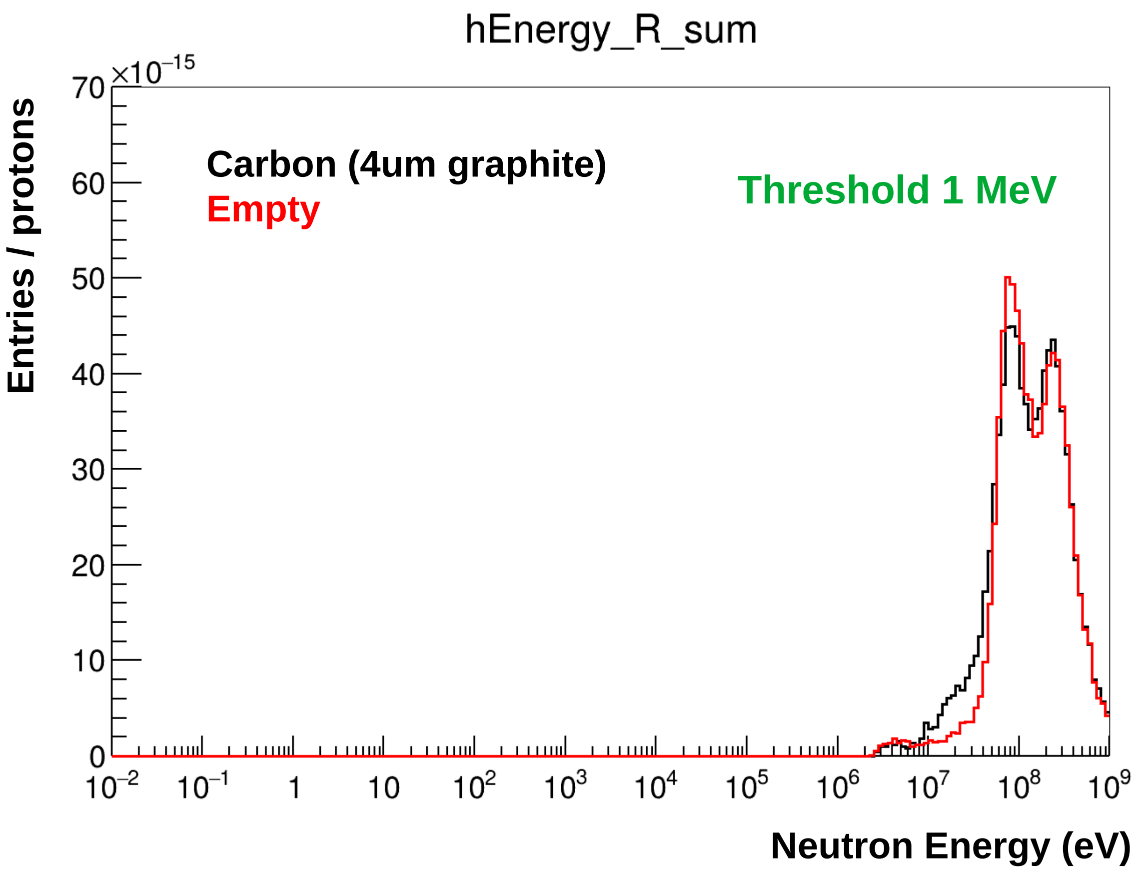
The real issue is background, by comparing data with carbon and empty it's clear that there is a dominant component (identical with and without frame).





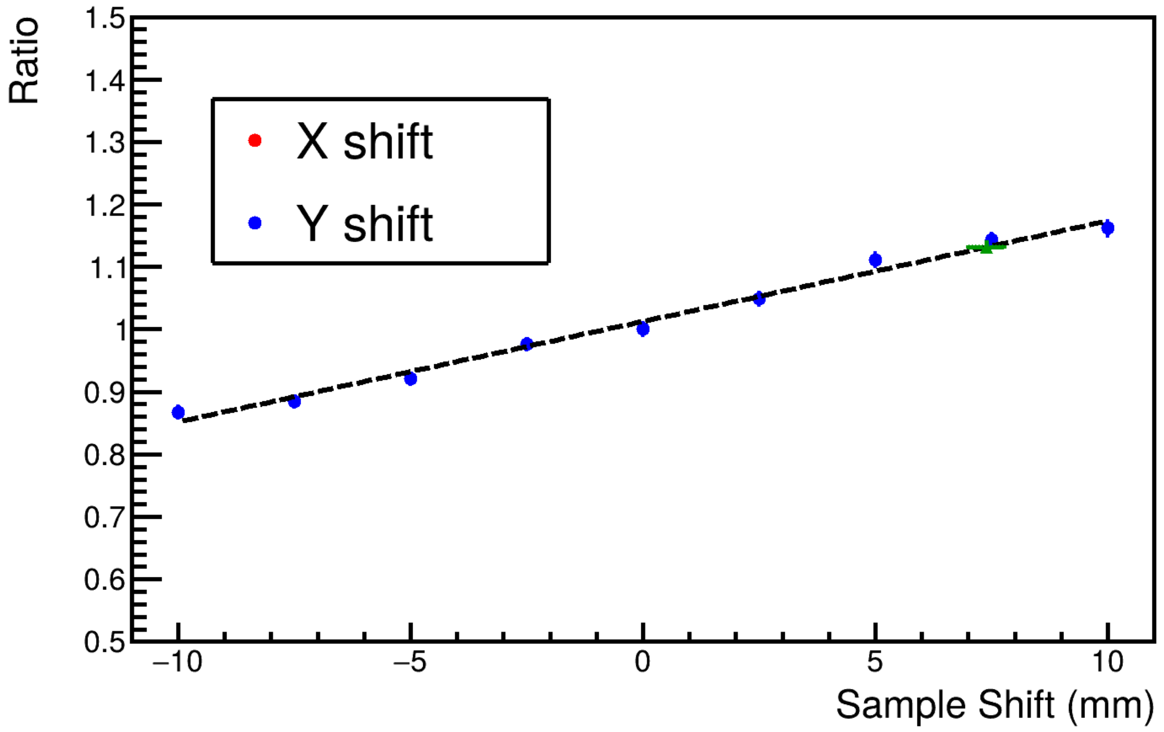
2024 Campaign in EAR2

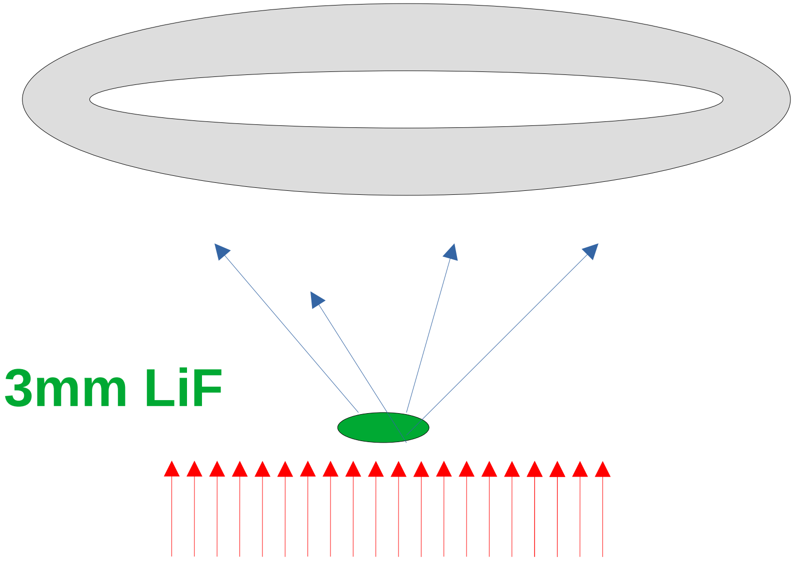
Setting one threshold at 1 MeV we see that carbon and empty are almost identical, apart for a small interval around 10 MeV.



Alignment in EAR2

The sample was initially aligned to the neutron beam with gafchromic, afterward the displacement of the detector was determined exploiting the **3mm LiF sample**. We compared the **ratios left/right and top/bottom** of the annular with a Monte Carlo simulation.

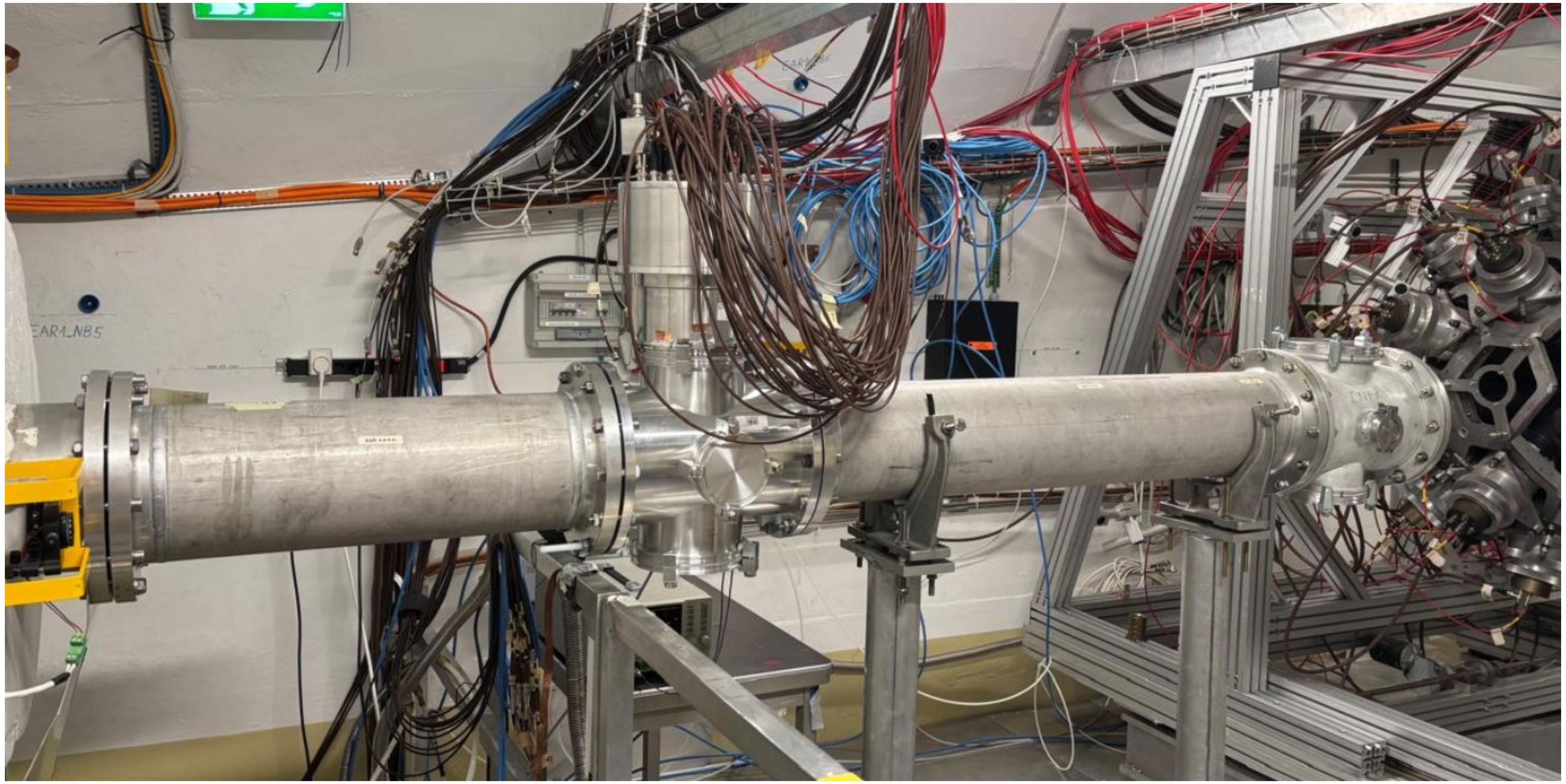




X = 0.4 +- 0.6 mm
Y = 7.4 +- 0.4 mm

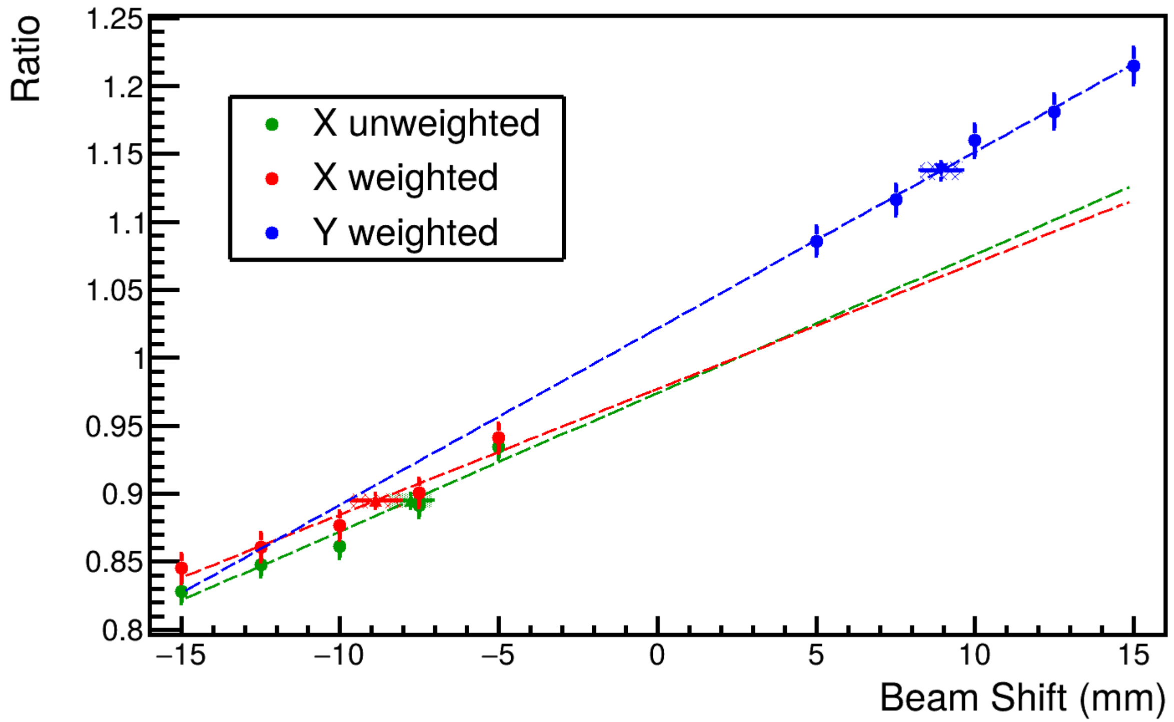
2025 Campaign in EAR1

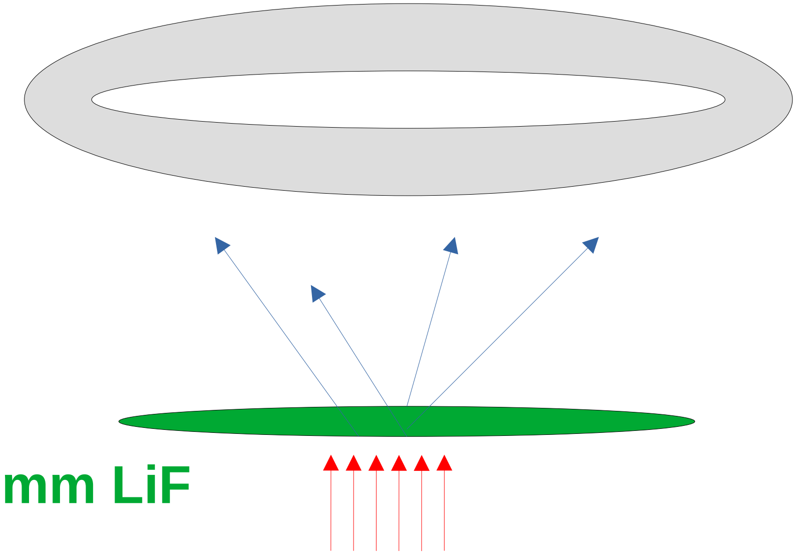
Approximately 2 weeks of data taking at the beginning of the run this year



Alignment

The system sample+detector was aligned with the beam measuring a **large and well characterized LiF sample** (55mm diameter). We compared the **ratios left/right and top/bottom** of the annular with a Monte Carlo simulation (weighted for the sample areal density).

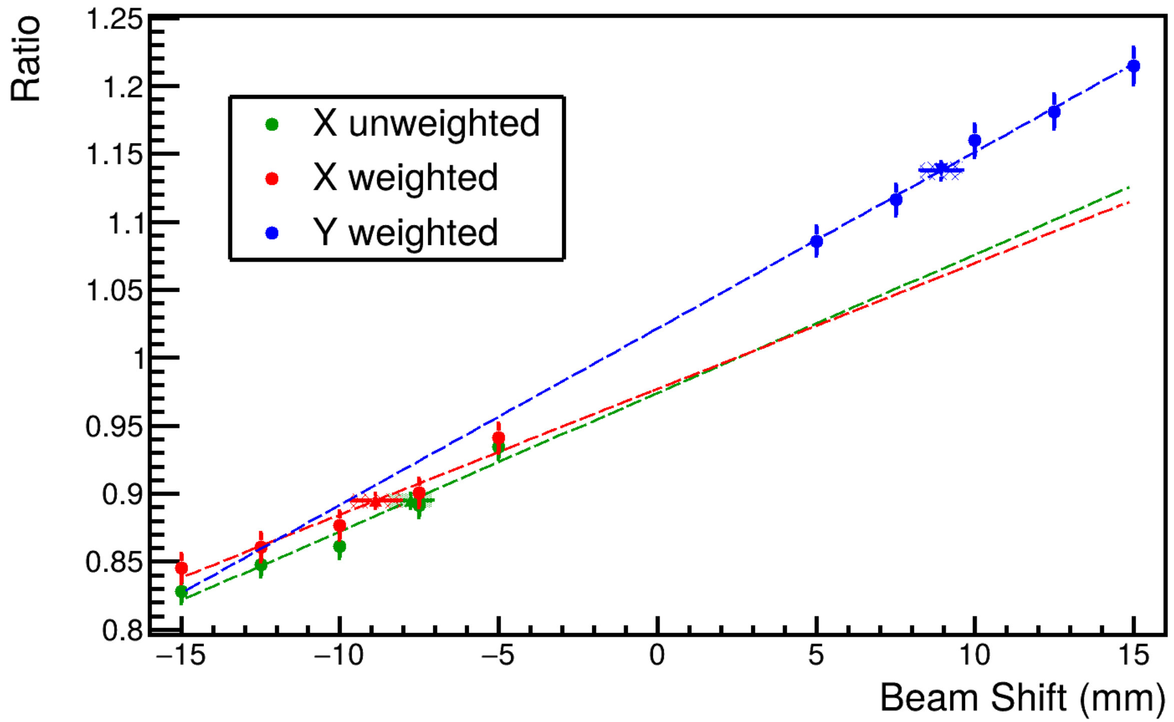


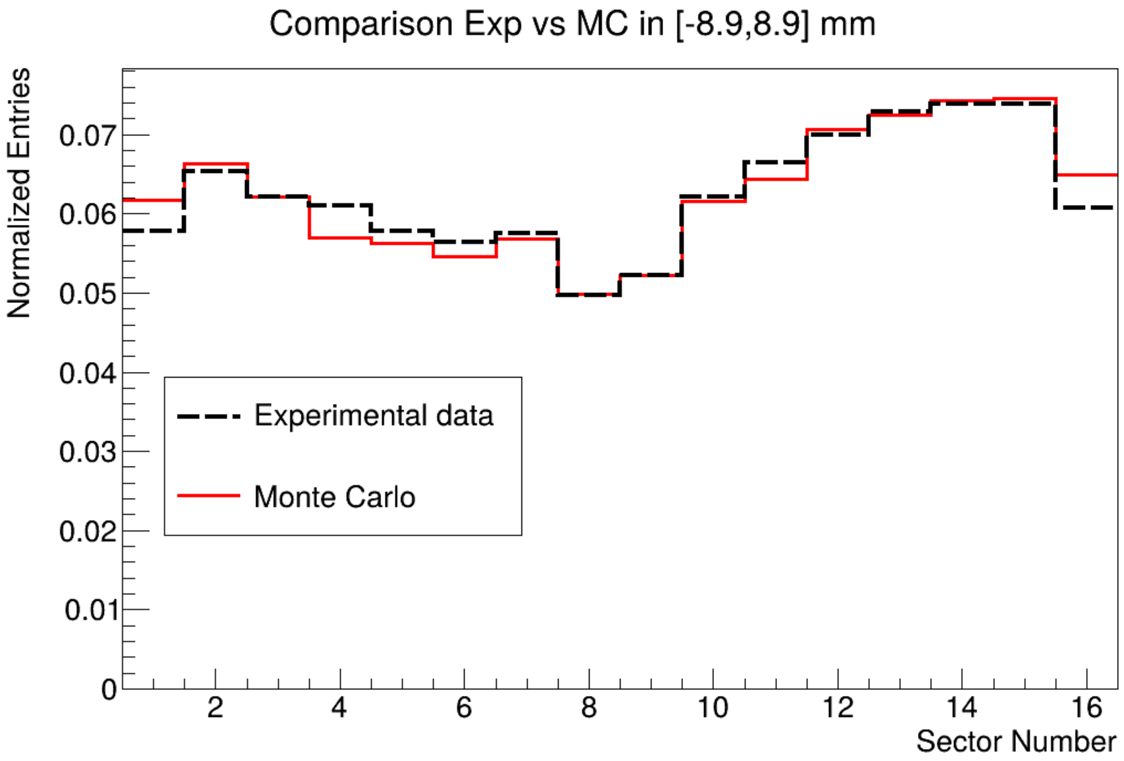


X = -8.9 +- 0.8 mm
Y = 8.9 +- 0.5 mm

Alignment

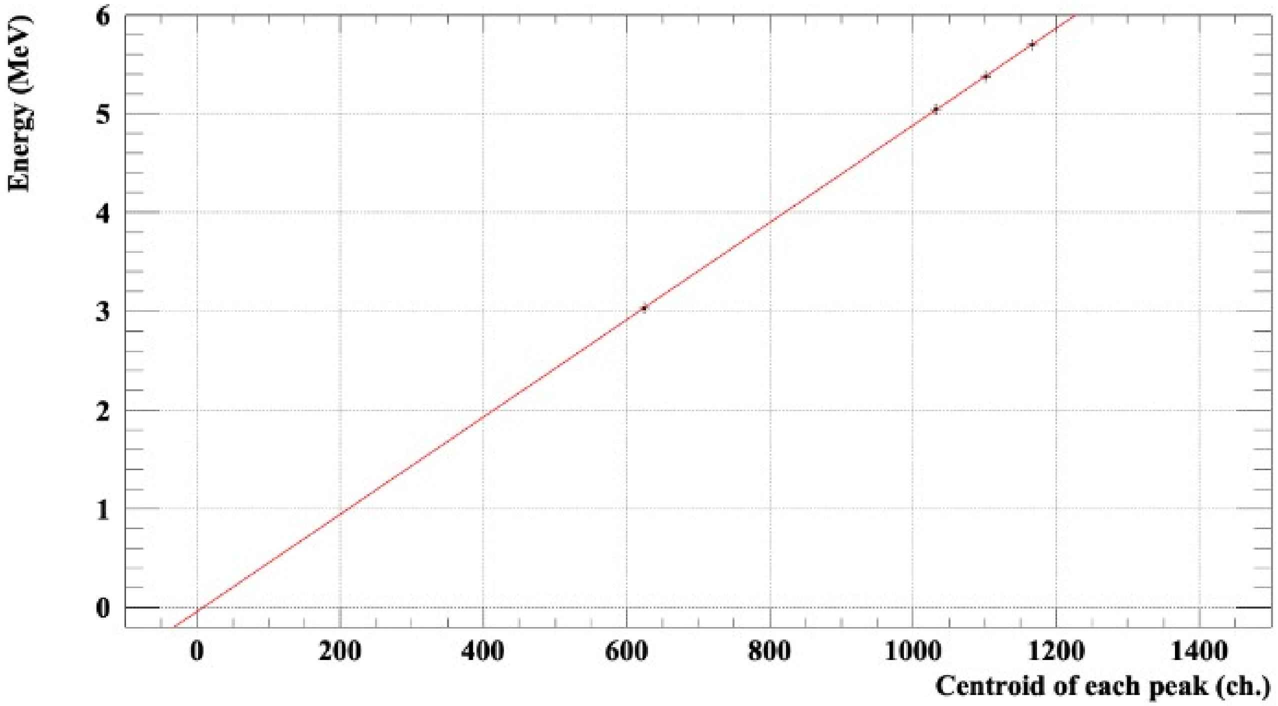
The system sample+detector was aligned with the beam measuring a **large and well characterized LiF sample** (55mm diameter). We compared the **ratios left/right and top/bottom** of the annular with a Monte Carlo simulation (weighted for the sample areal density).

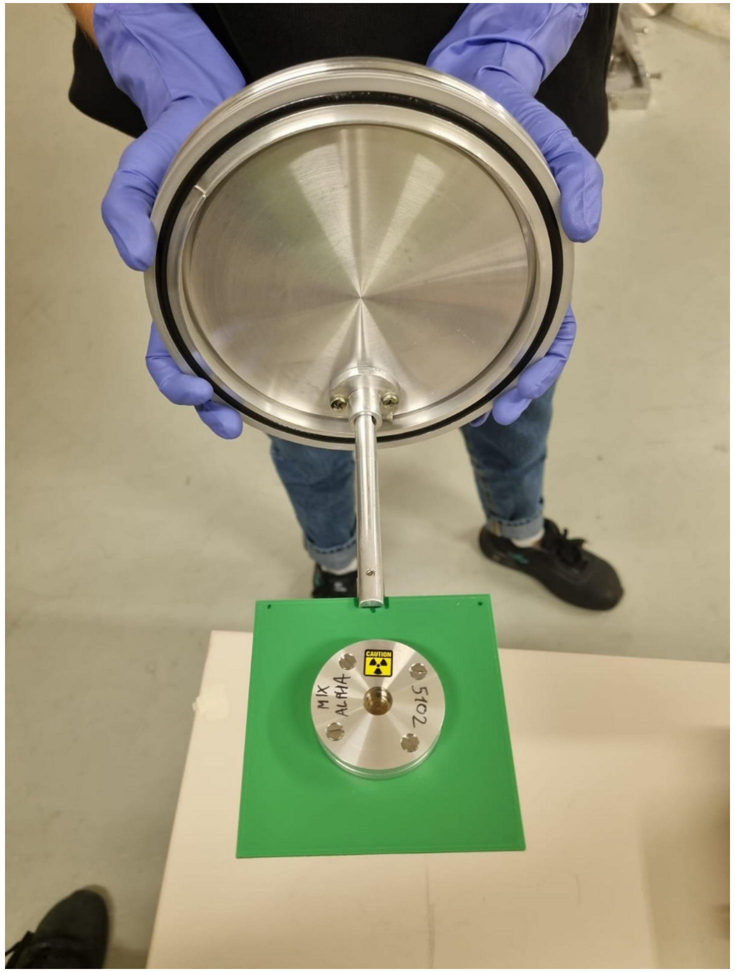




Calibration

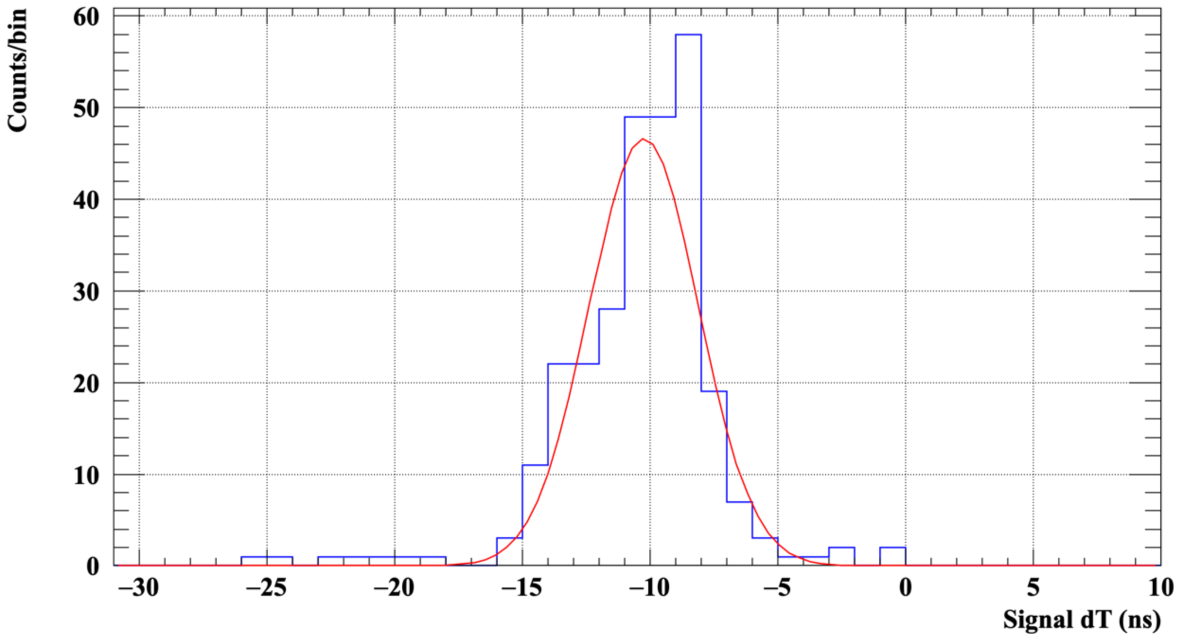
Calibration based on the data with the **4 peak alpha sources** and Monte Carlo simulations, good **linear behaviour** and negligible offset.

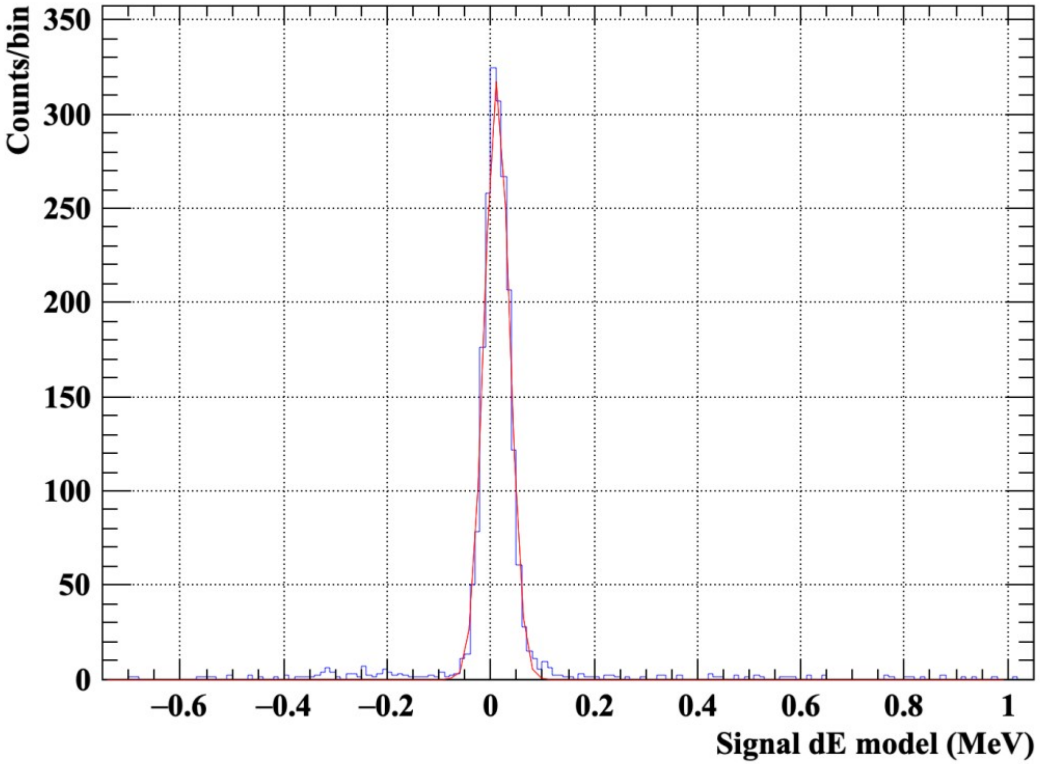




Syncronization

All the strips and sectors were **syncronized** with respect to a reference sector, removing the small difference due to cabling and electronic.



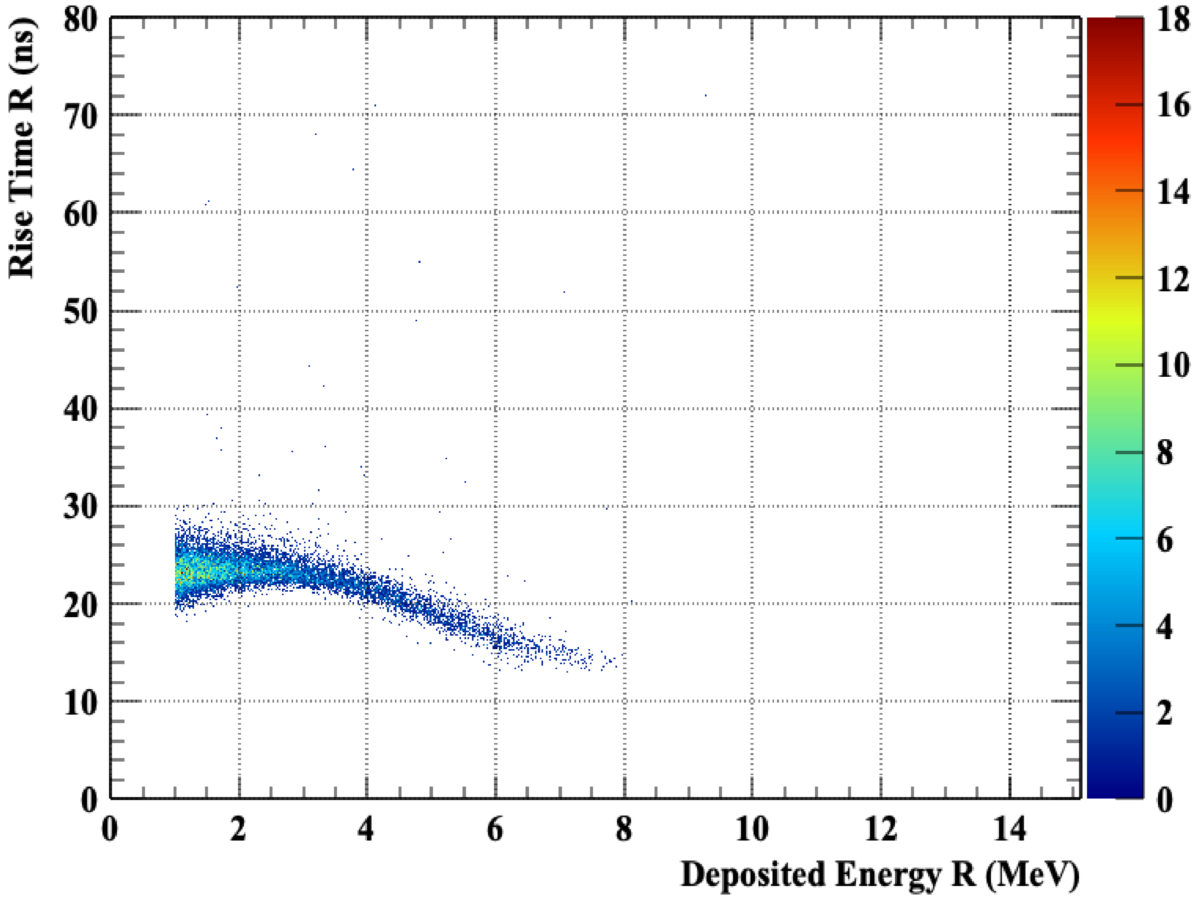


Difference in the signal amplitude between front-rear is below 100 keV at 3 MeV.

Particle identification

The first quantity we considered is the **rise time 20-80%** (not the most performing one but less parameter dependent).

Considering the gafchromic below 8 MeV of neutron energy we can identify the proton produced by n,p scattering.

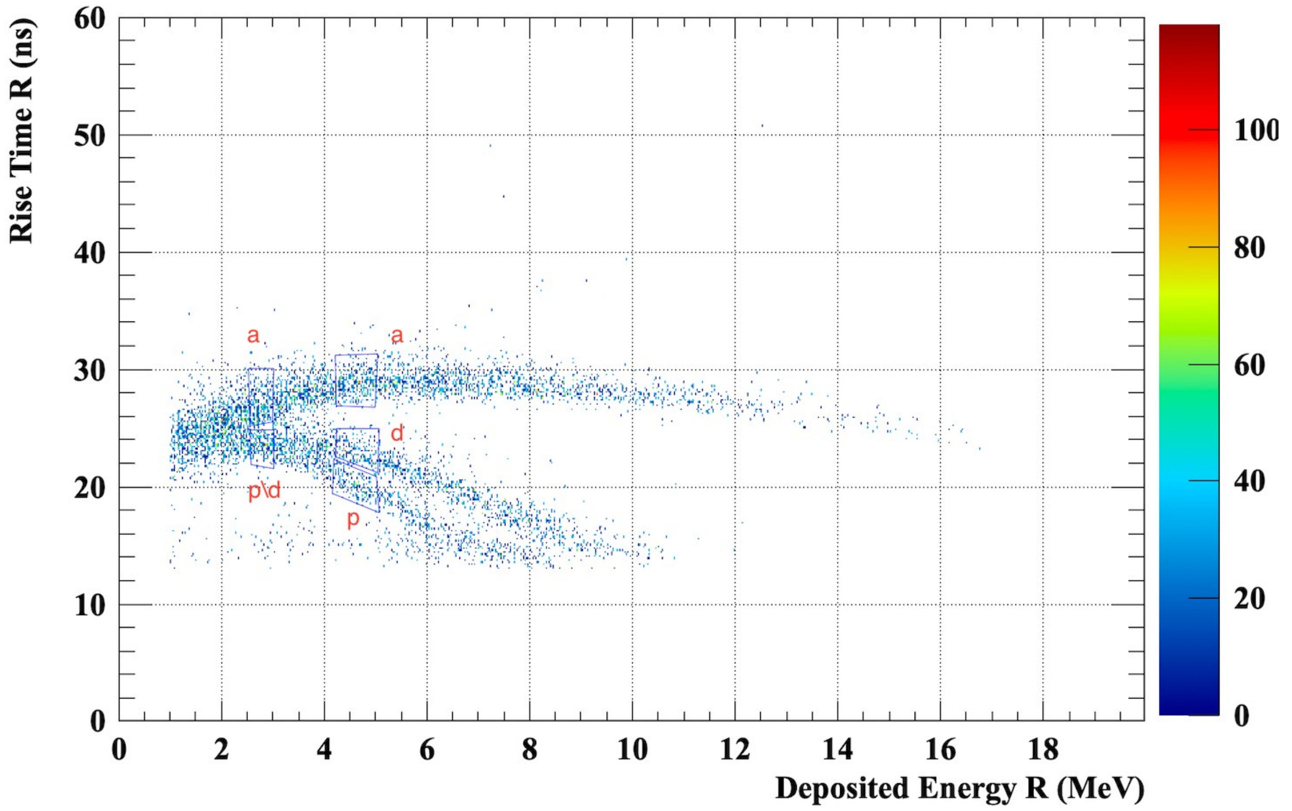


Particle identification

Carbon data for neutron energy below 20 MeV present 3 structures from protons, deuterons and alphas.

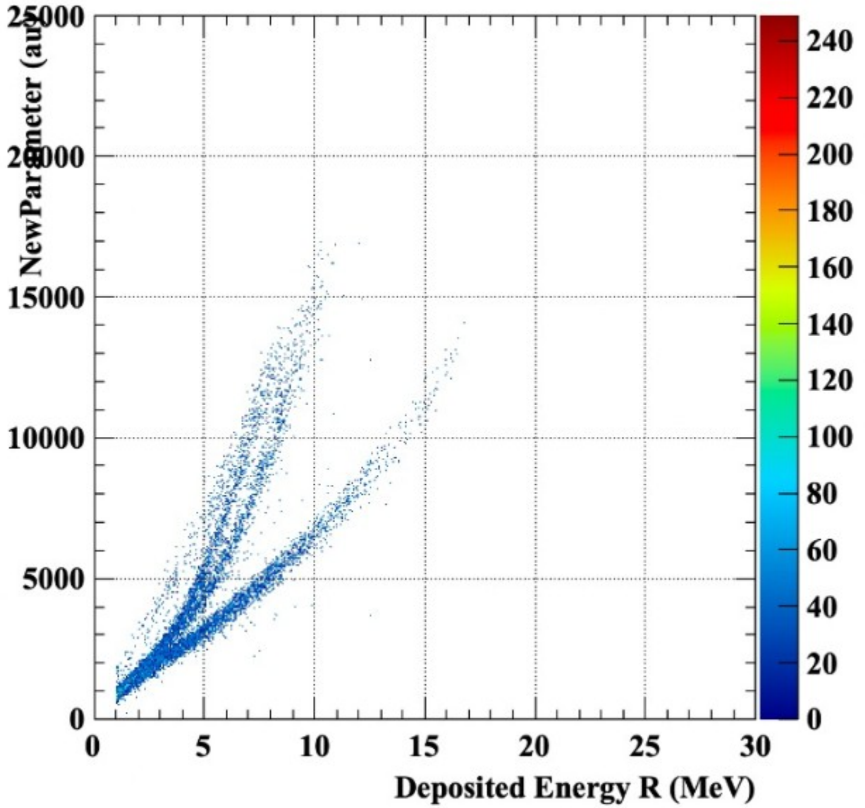
The discrimination between Z=1 and Z=2 is good from 2-3 MeV.

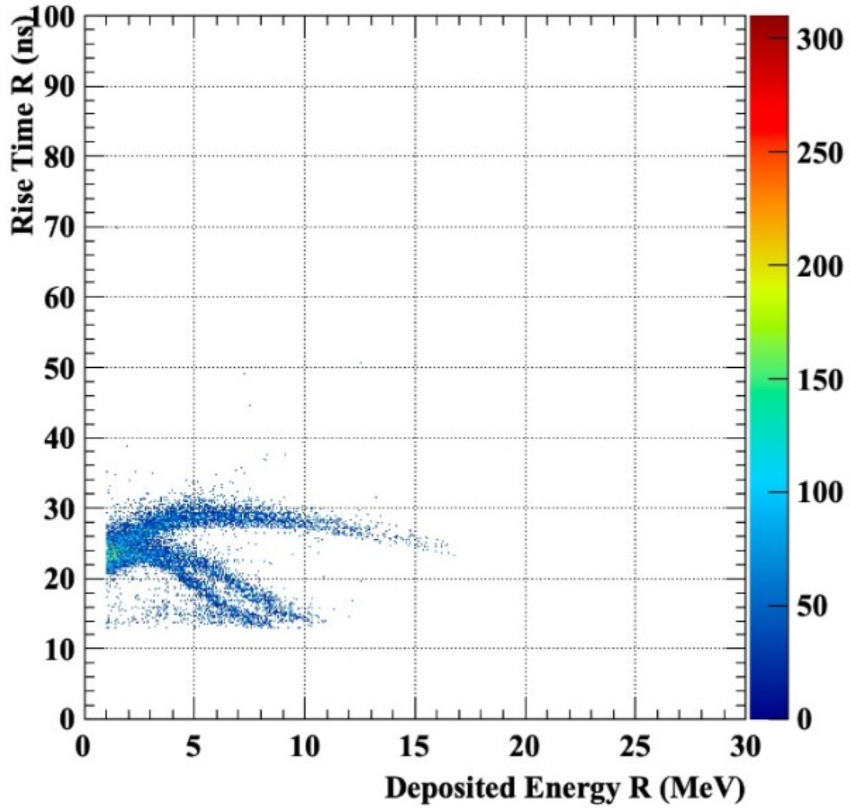
For the **first time we achieved discrimination between protons and deuterons**, starting from about 4 MeV.



Particle identification

Now we are extending the PID activity to **include more quantities**, especially the amplitude of the signal derivative, which performed much better with the previous detector.





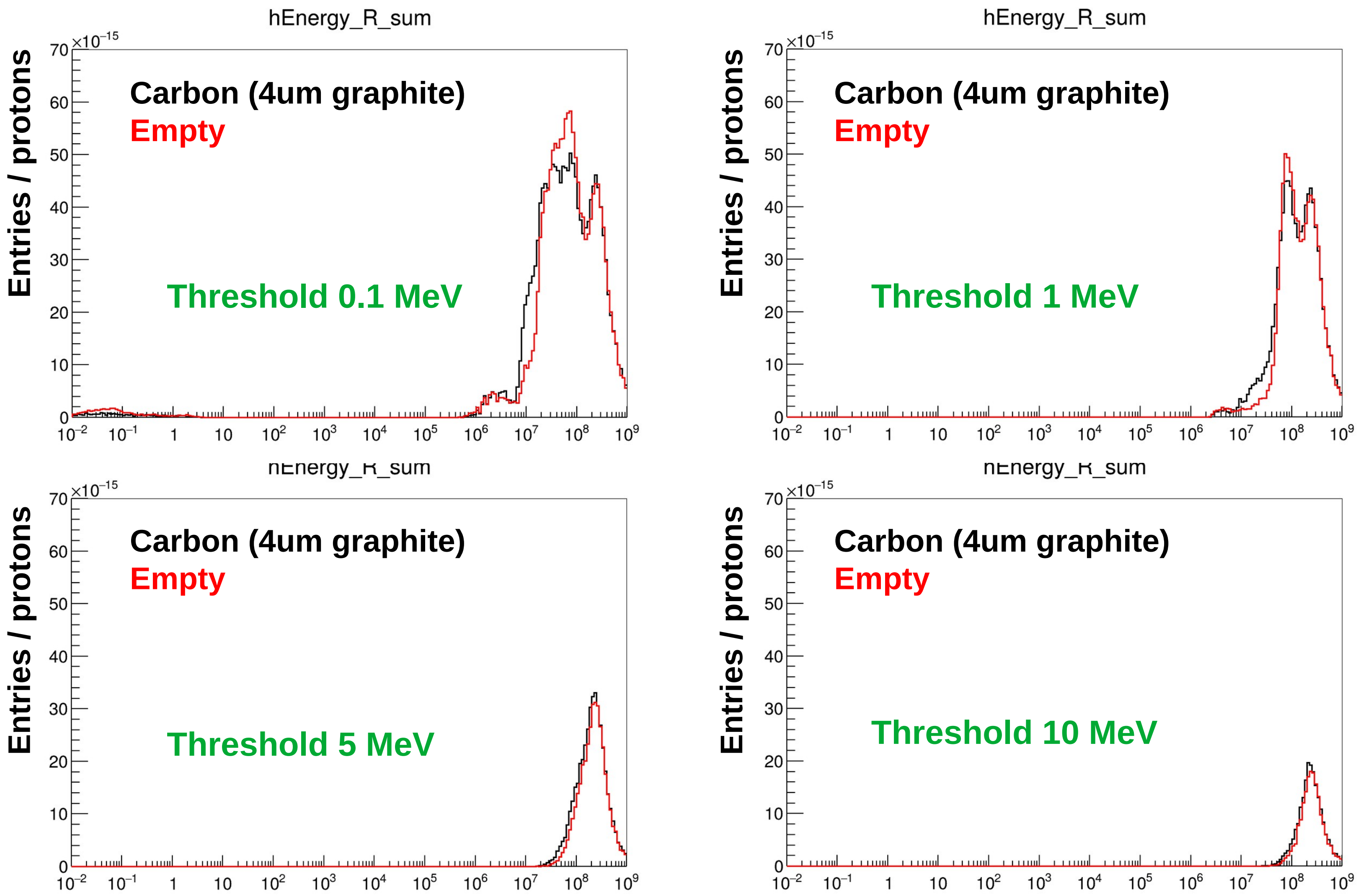
Conclusion

EAR2 is a challenging envirorement (as expected), especially above few MeV, where data are more relevant for fusion. Probably it is possible to measure at lower energies for Nuclear Astrophysics (need more work to validate).

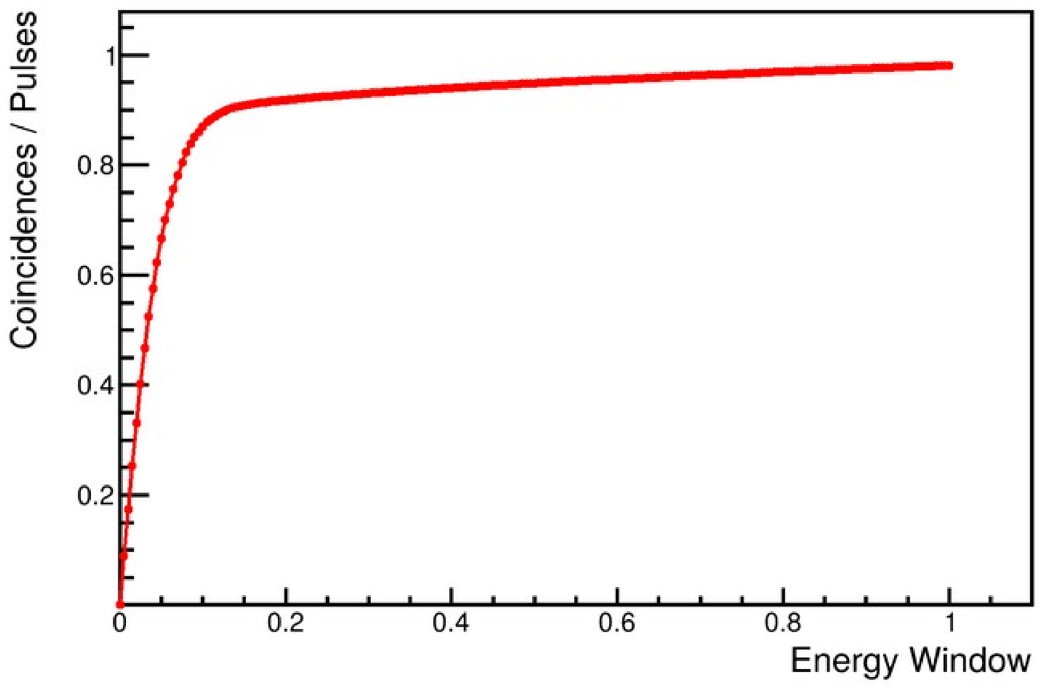
EAR1 measurement was sucesfull:

- background is around 2 order of magnitude lower than the signals.
- Preliminary Pulse Shape is nice, even if we limited to few observables.
- Discrimination **Z=1/Z=2 in the range 2-3 MeV**
- **First discrimination p/d** for deposied energy above 4 MeV
- The alignment was very challenging and a misplacement of about 1 cm was present

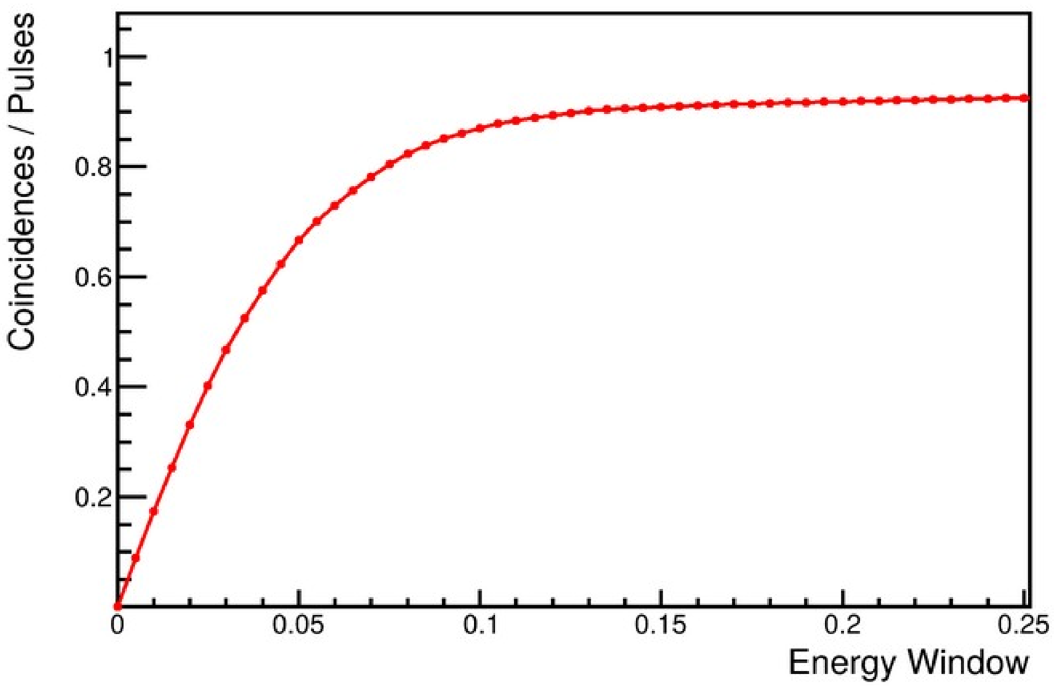
2024 Campaign in EAR2



Backup



Coincidences / Pulses
1
0.8
0.6
0.4
0.2
0
0.2
0.4
0.6
0.8
1
Energy Window



Coincidences / Pulses
1
0.8
0.6
0.4
0.2
0
0.05
0.1
0.15
0.2
0.25
Energy Window