Characterization status at IPHC

AGATA Week – Strasbourg – 11-14 September 2018

B. De Canditiis, G. Duchêne, F. Didierjean, M. Filliger, M.H. Sigward

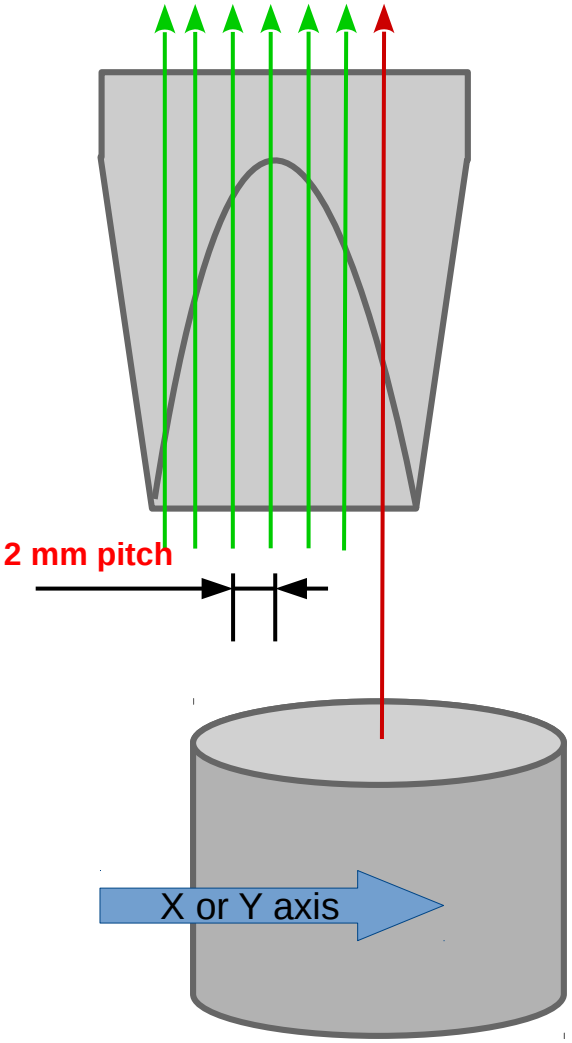
Summary

I. Simulated scans on a 3x3 segmented HPGe Detector

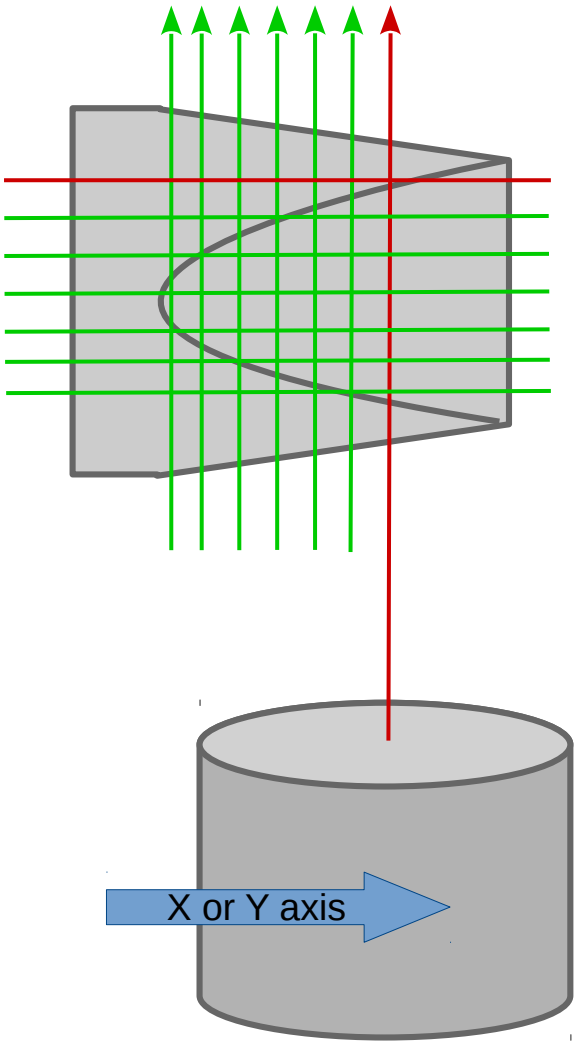
II. Real scans on A015 detector

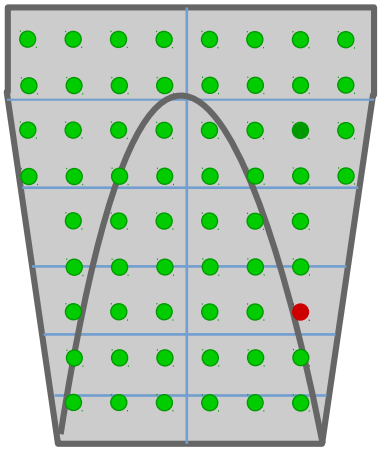
PSCS technique [1]

VERTICAL CONF.



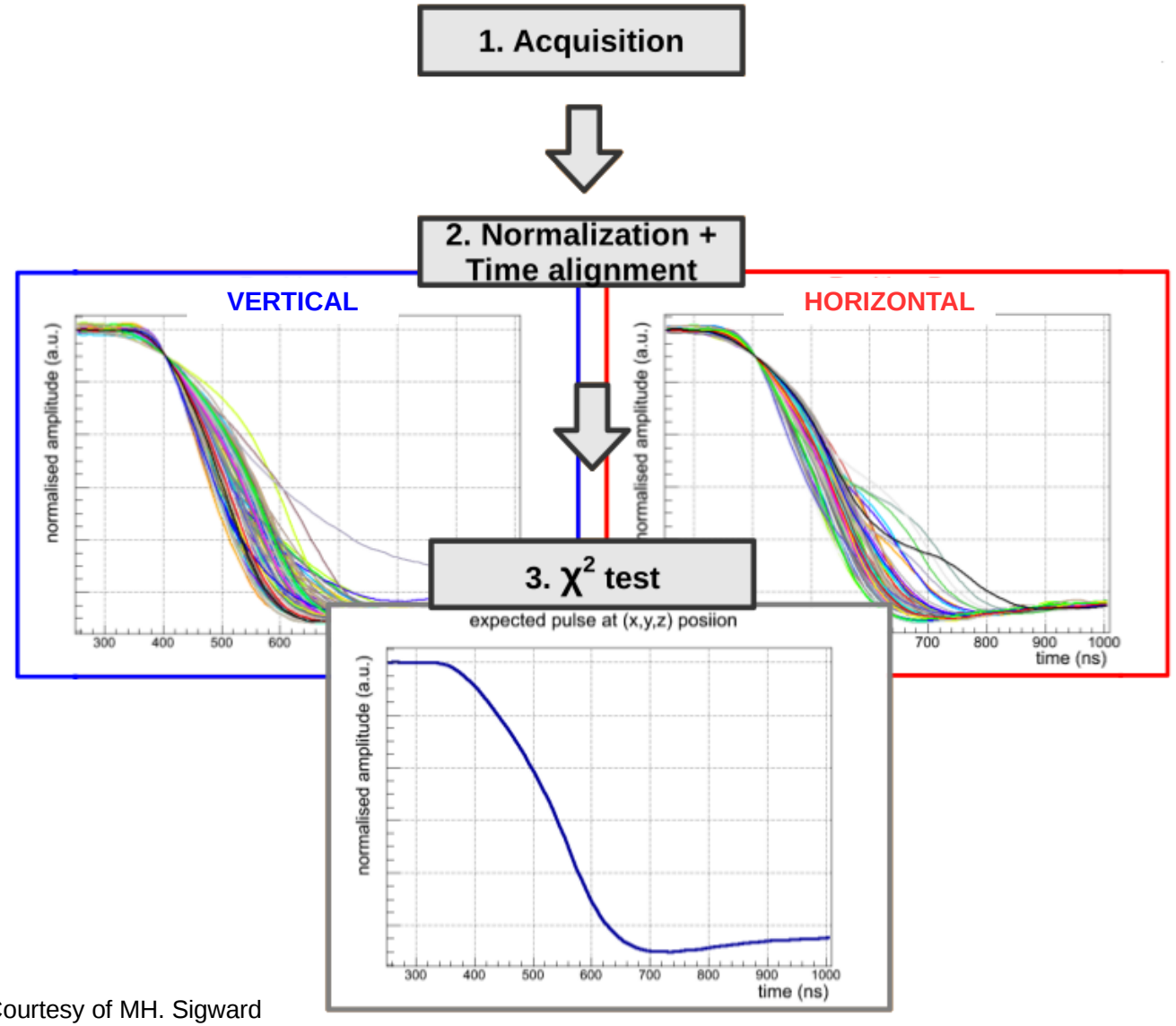
HORIZONTAL CONF.



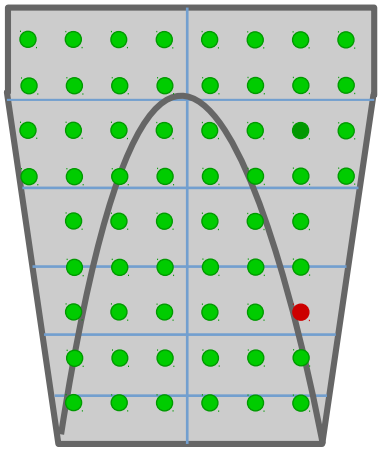


Using pulse shape comparison algorithms it is possible to extract the specific pulse shape at each crossing point of the grid.

PSCS technique [2]

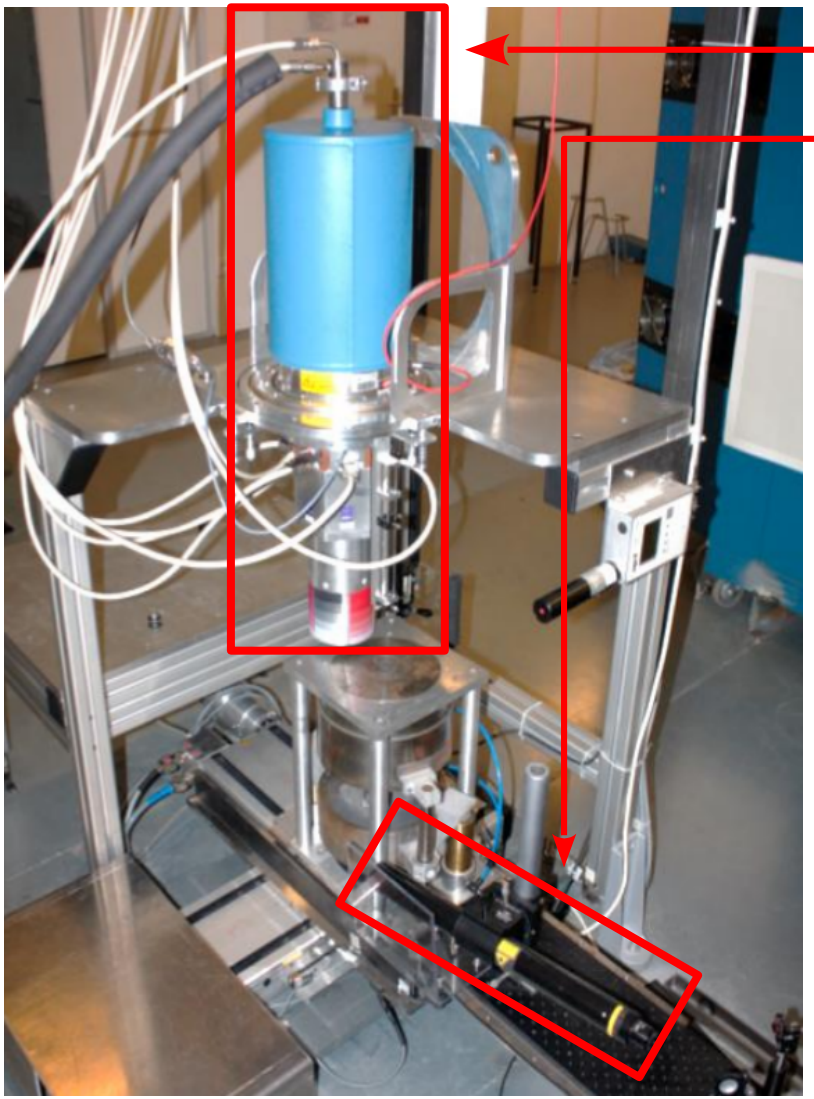


Courtesy of MH. Sigward



Using pulse shape comparison algorithms it is possible to extract the specific pulse shape at each crossing point of the grid.

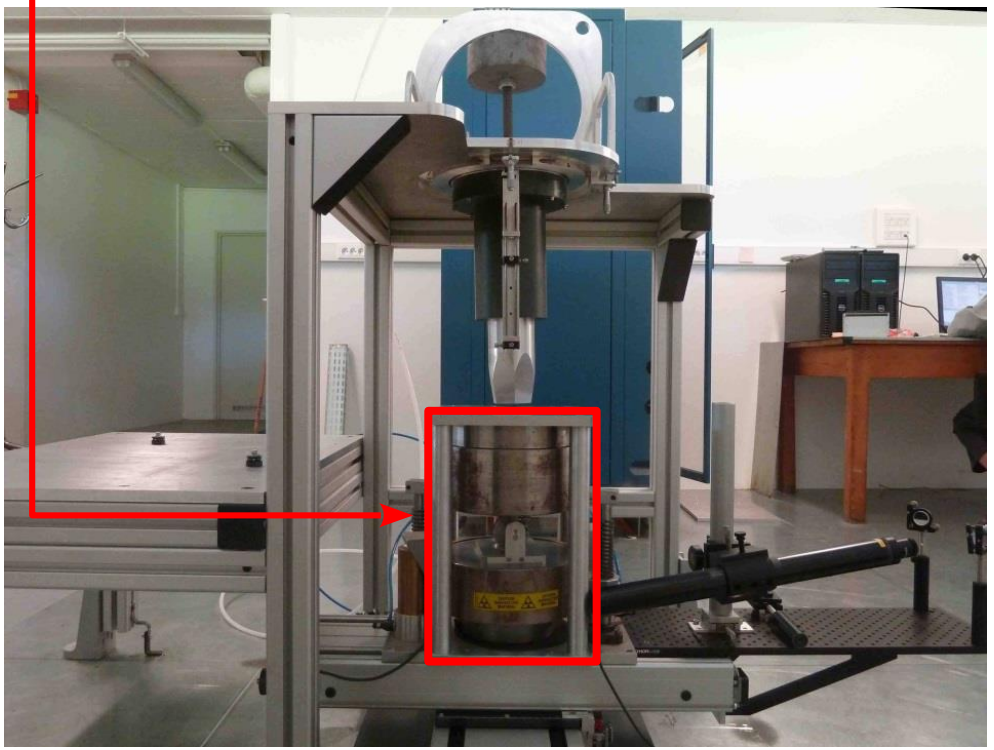
The IPHC scanning table



The detector can be put on table in **vertical** or **horizontal** configuration

A **laser system** is used to align the detector

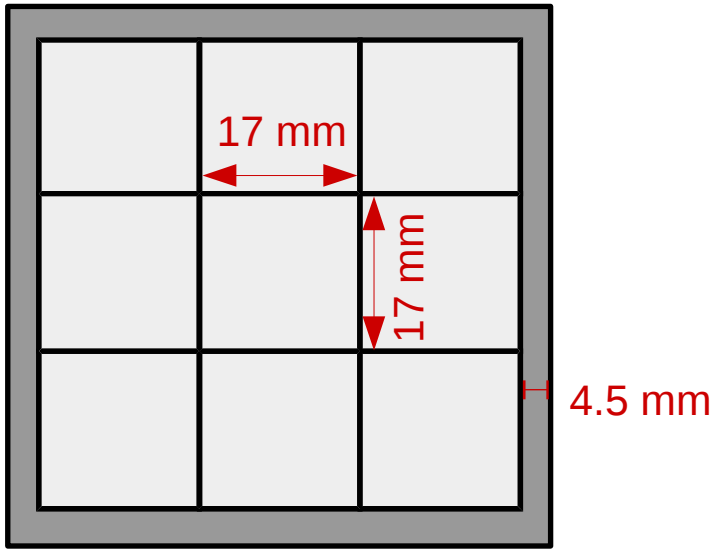
A cylindrical **collimator** collimates a strong gamma source into a **pencil-like beam**. It is moved in a plane by two perpendicular servo motors.



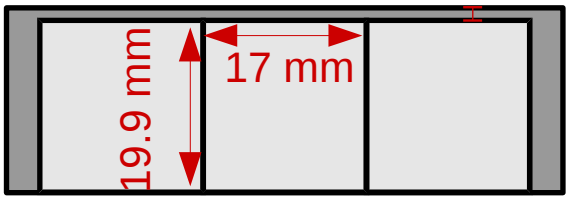
Simulations on a planar detector

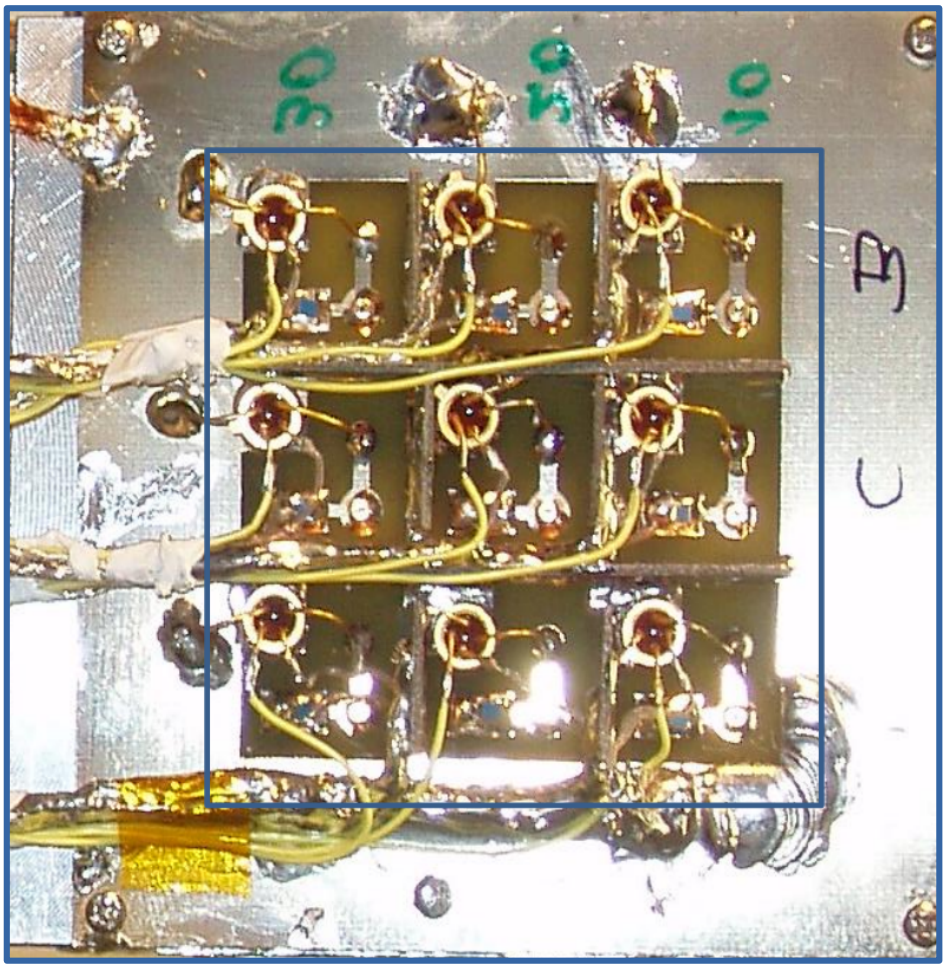
- **3x3 segmented HPGe planar** detector
- Simple geometry

FRONT



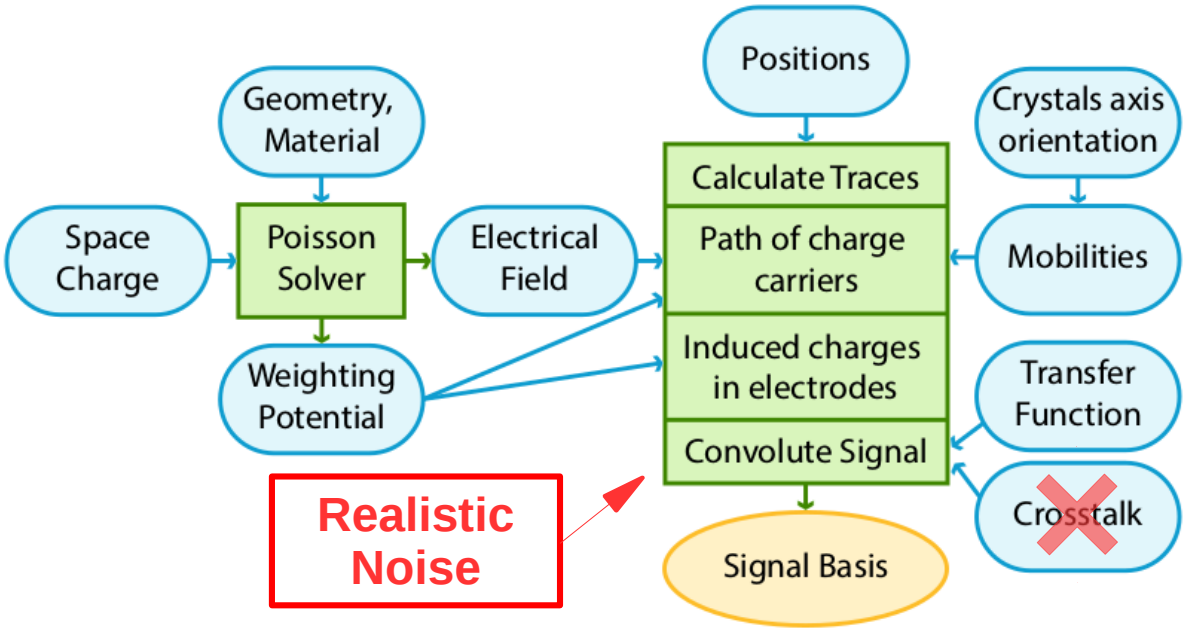
SIDE





Simulation tools

G4 + SIMION + ADL → Pulse shape calculation

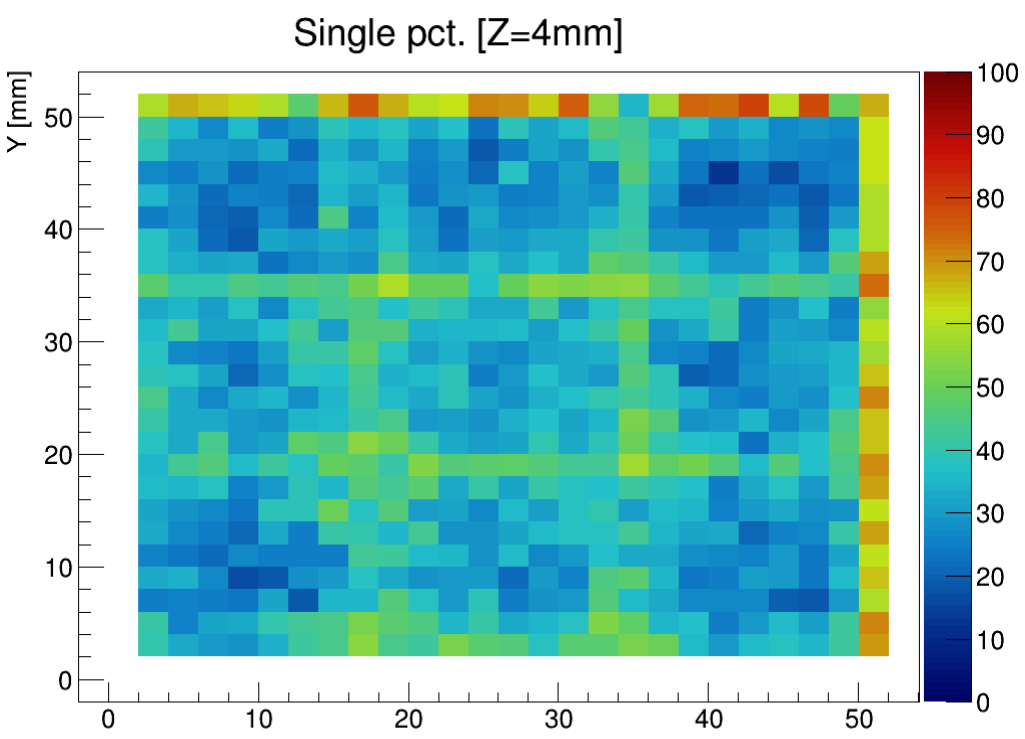


B. Bruyneel et al.
DOI: 10.1140/epja/i2016-16070-9

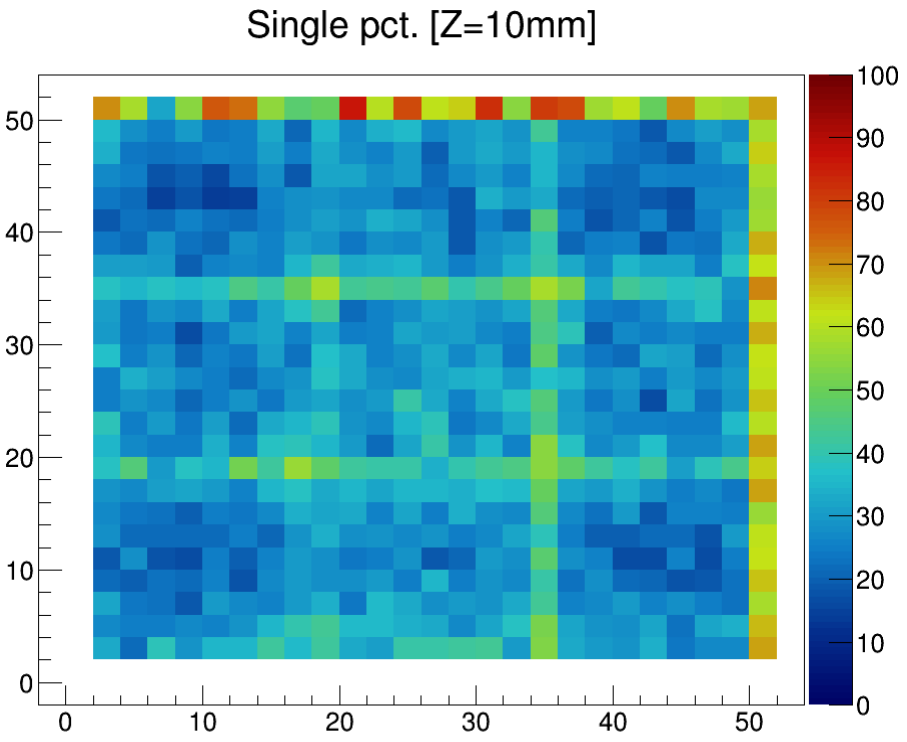
Electron mobility parameters			
Mobility along ⟨100⟩		Inter valley scattering rate	
E_0 [V/cm]	507.7	E_0 [V/cm]	1200
β	0.804	ν_0	0.459
μ_0 [cm^2/V s]	37165	ν_1	0.0294
μ_n [cm^2/V s]	−145	ν_2	0.000054
Hole mobility parameters			
Mobility along ⟨100⟩		Mobility along ⟨111⟩	
E_0 [V/cm]	181.9	E_0 [V/cm]	143.9
β	0.735	β	0.749
μ [cm^2/V s]	62934	μ [cm^2/V s]	62383

Single-interaction percentage distribution

- Simulation: 2mm pitch ^{137}Cs scan (5625 database points)
- Thickness of the slices is 2mm (grid unit size)
- Depth of the slices: Z=4mm and Z=10mm
- ~235 pulses are selected for each scan point

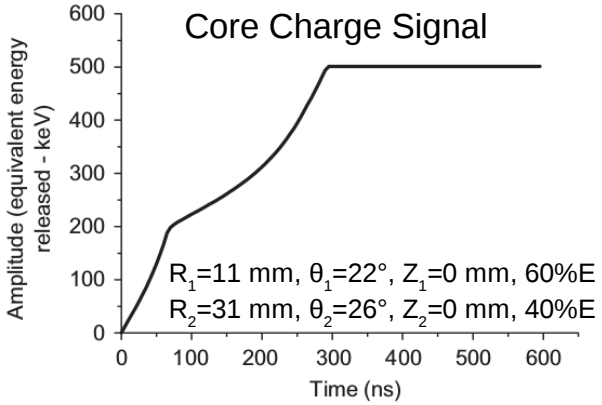


(Near seg. electrodes)

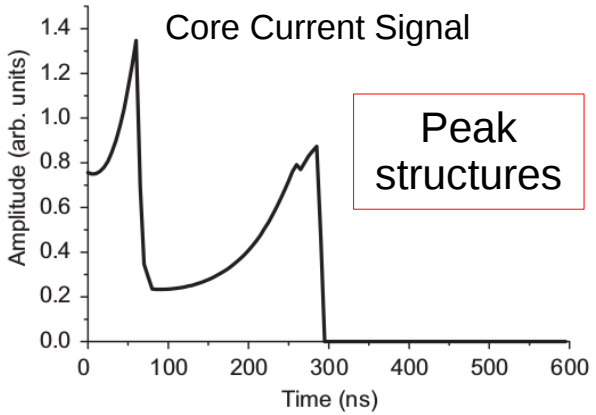


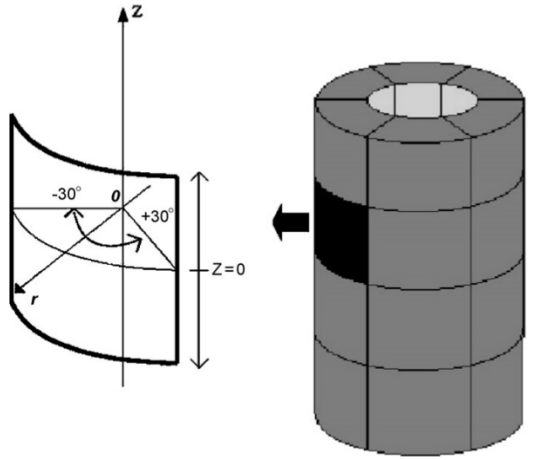
(Around the middle of the detector)

Crespi's second PSCS technique



FIRST ORDER DERIVATIVE





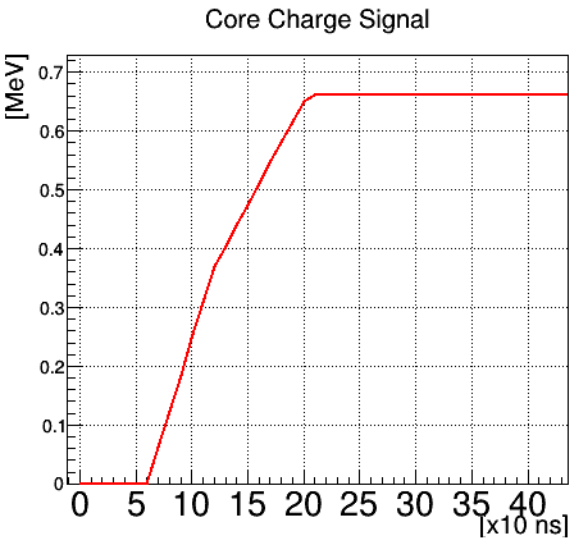
MARS detector (coaxial)

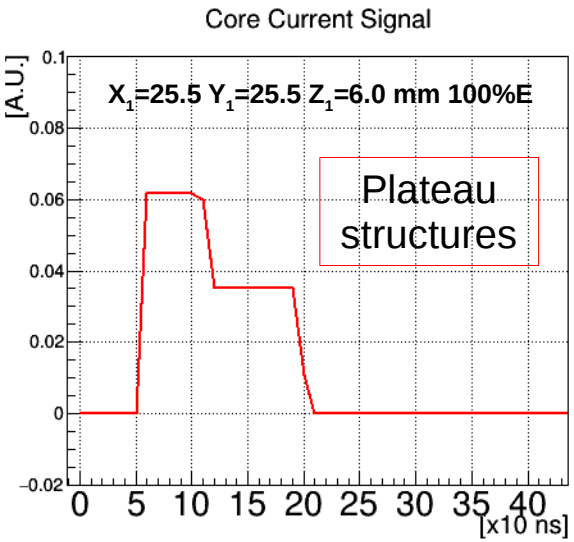
- By deriving the charge signal it is possible to obtain the corresponding current signal.
- **The number of peak structures is related to the number of interactions of the gamma-ray.**
- The positions of the peaks depend on the interaction radii(COAXIAL)/depth(PLANAR).

Crespi et. al.'s "A pulse shape analysis algorithm for HPGe detector" [10.106/j.nima.2006.10.003].

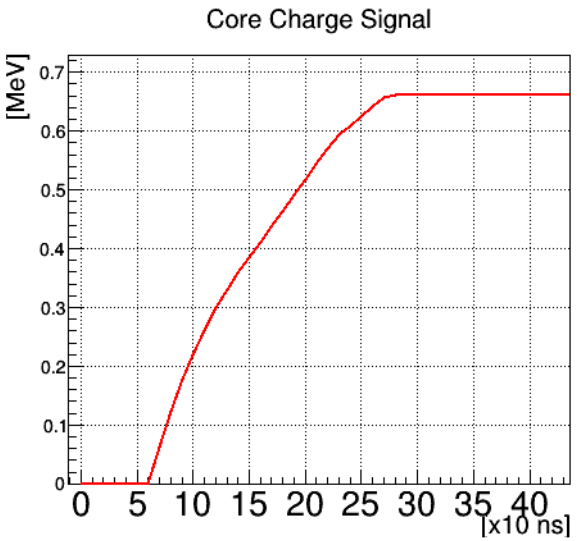
3x3 detector config.: No Noise, no transfer fct.

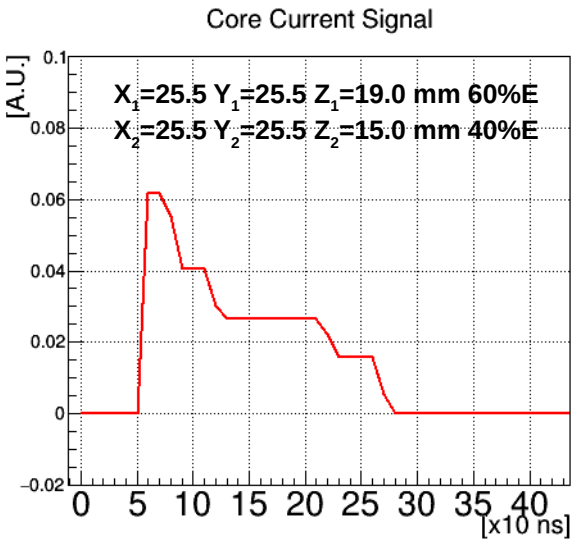
SINGLE



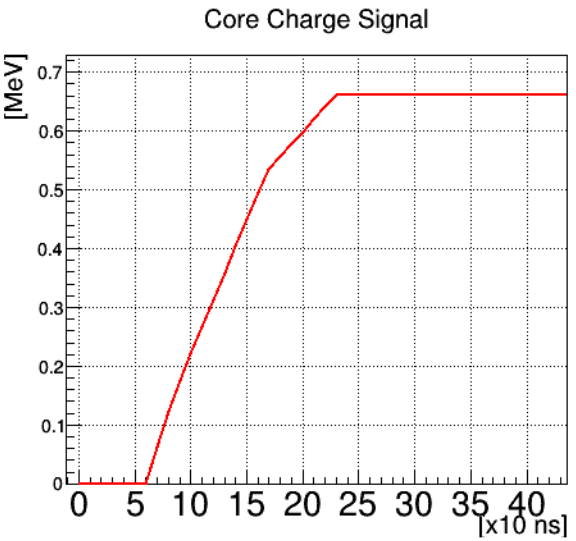


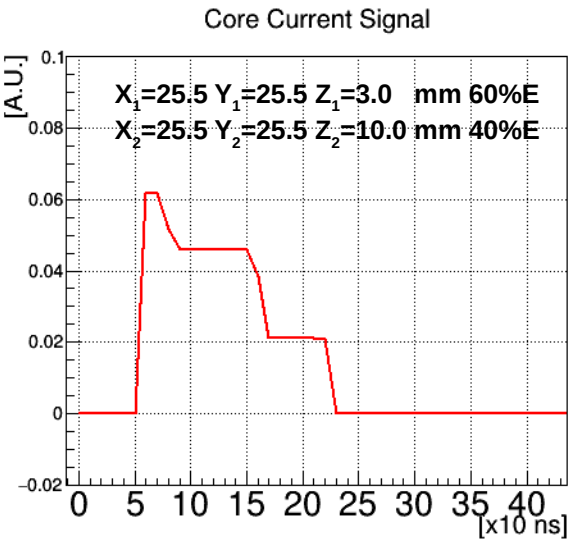
DOUBLE[1]





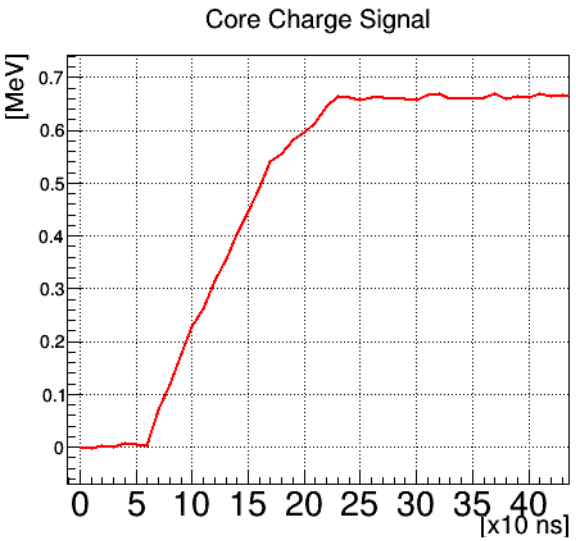
DOUBLE[2]

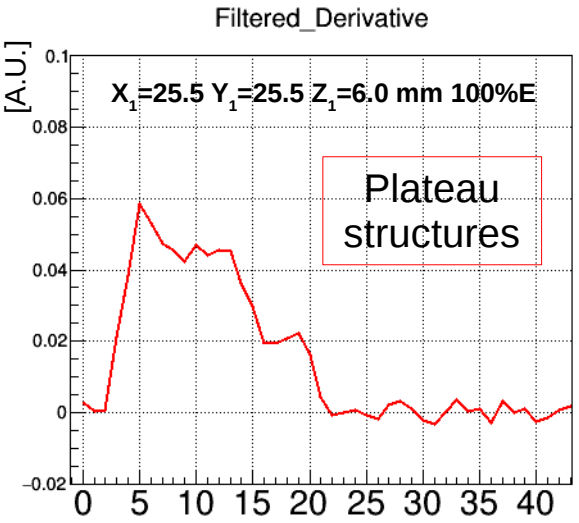




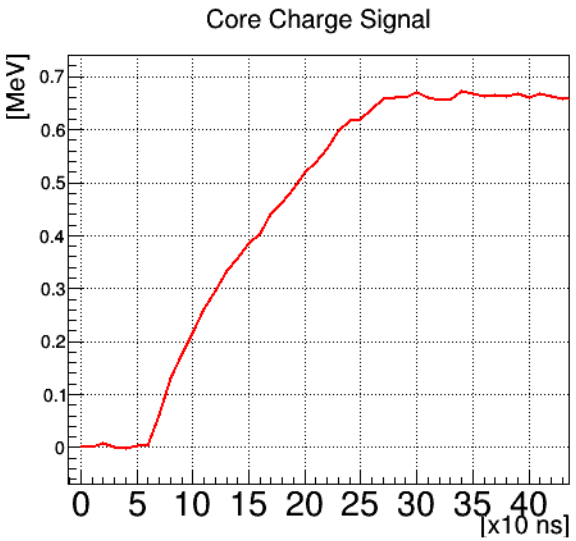
3x3 detector config.: Noise included, no transfer fct.

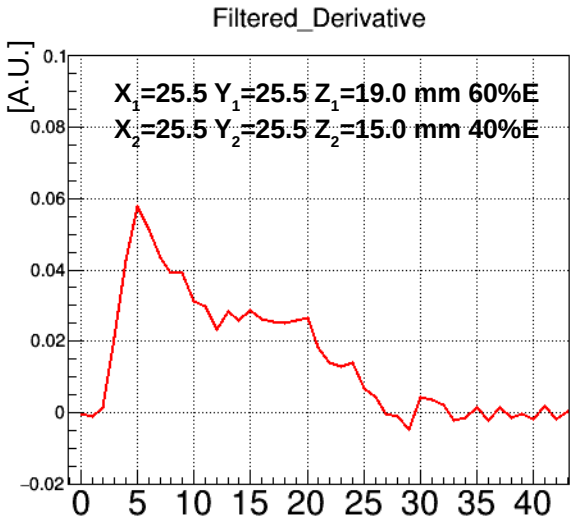
SINGLE



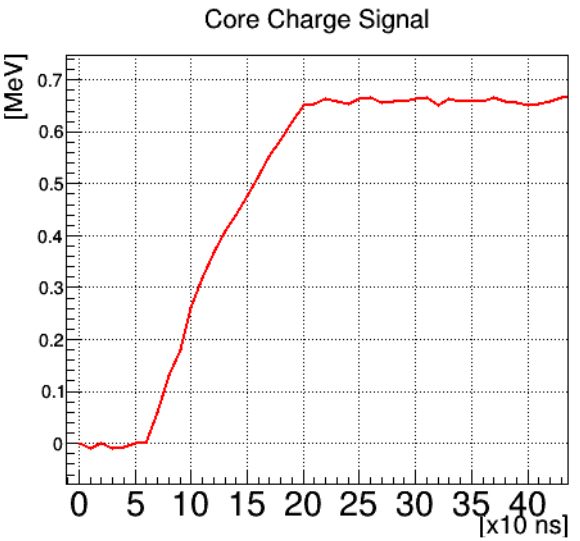


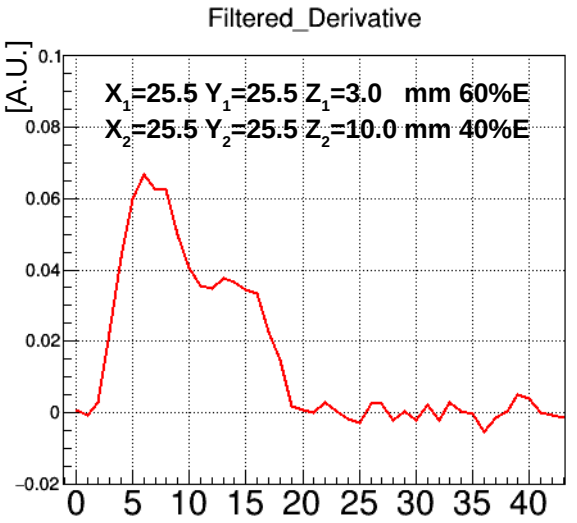
DOUBLE[1]





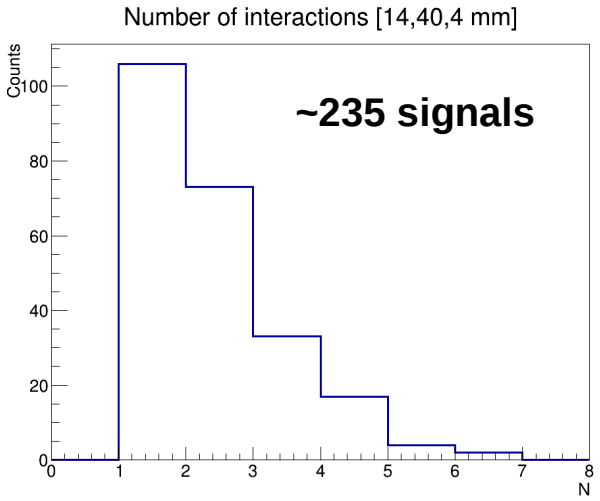
DOUBLE[2]

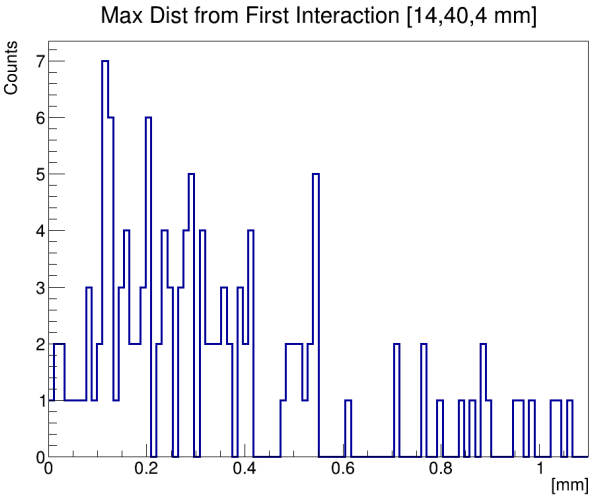


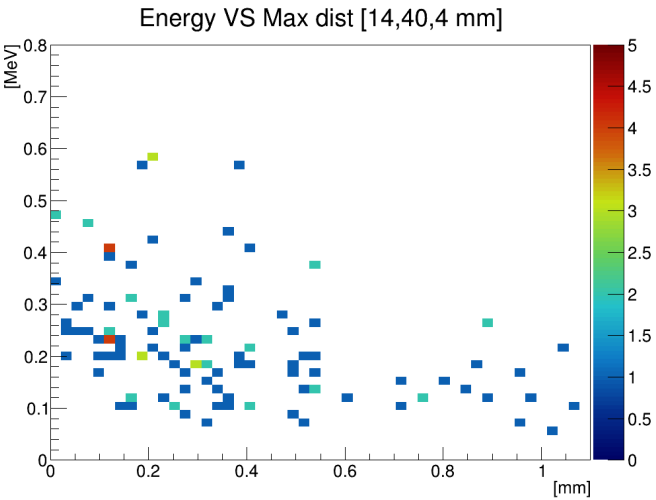


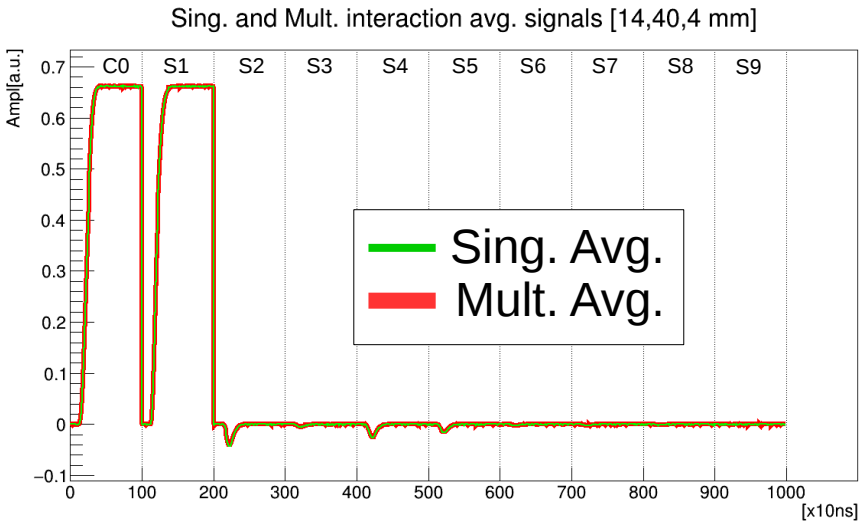
Single vs Multiple [1]

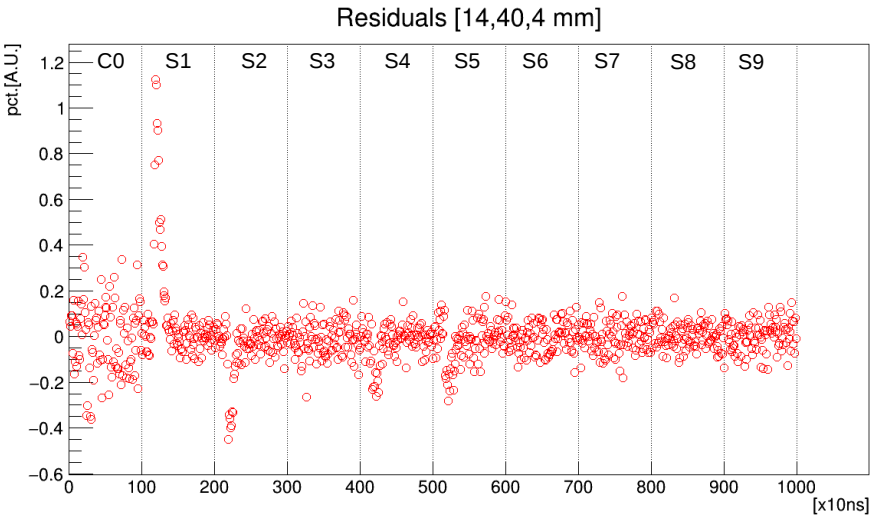
- Database point at [14,40,4 mm] coordinates
- Reminder: scan was realized simulating ^{137}Cs source. (Transfer fct. included)



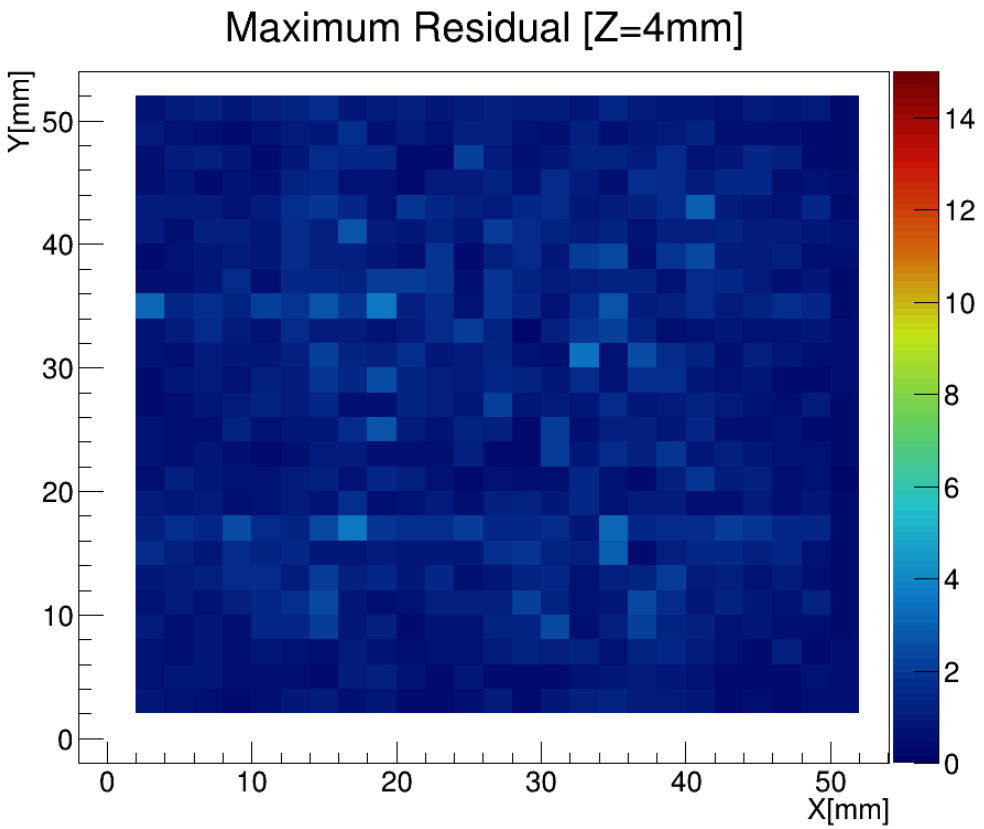


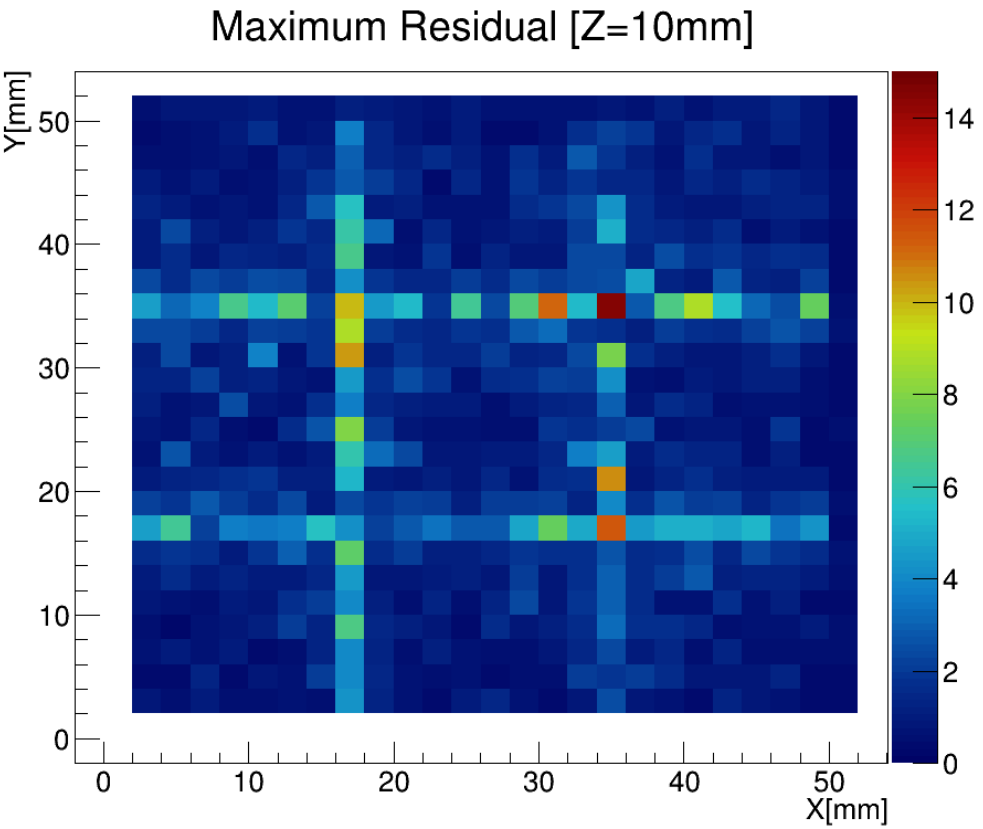






Maximum Residual Maps





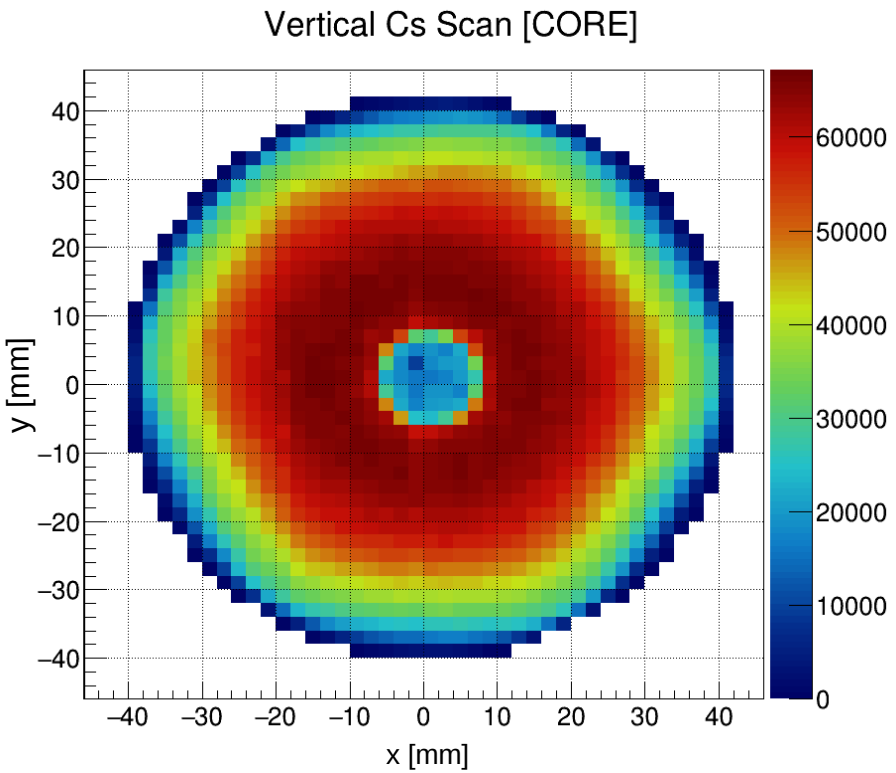
To recap:

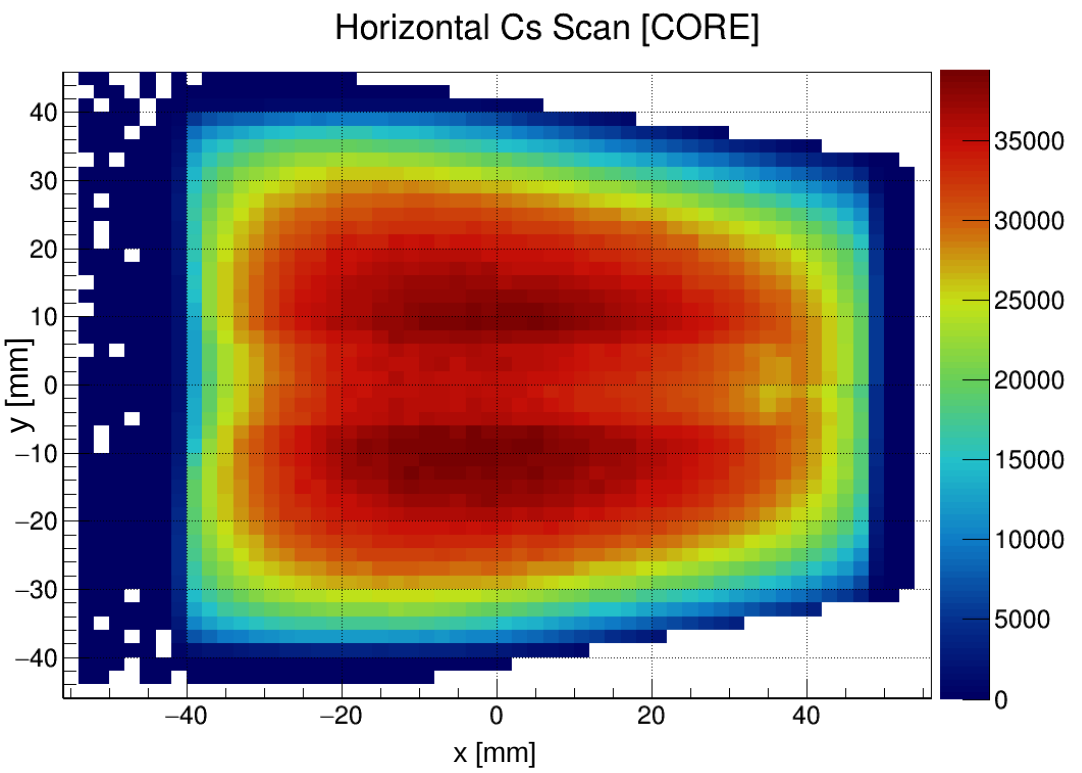
1. For multiple interactions, the furthest interaction from the first interaction is within the beam spot
2. The furthest interaction, generally, has low energy (minor impact on the pulse shape)
3. In average multiple interaction pulses and single interaction pulses differ by low percentage

PSCS technique seams reasonable [for 3x3 planar detector]

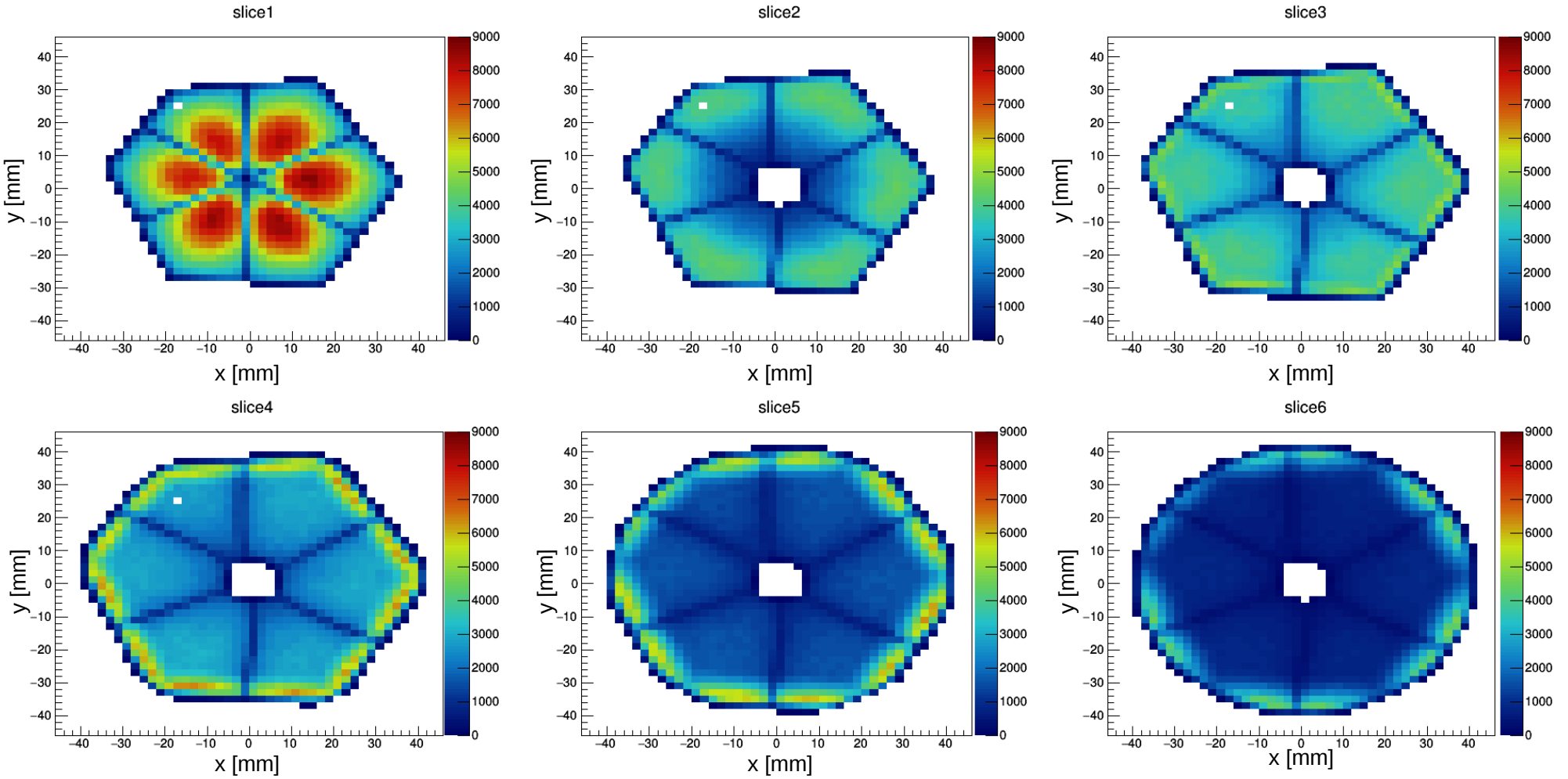
A015 Scans [1]

- Scanning procedure was “re-discovered” (last one 3 y. ago)
- 2 mm pitch scan with ^{137}Cs





A015 Scans [2]



- Next: database will be created and analyzed

Conclusions

- Simulations on the 3x3 detector show that the PSCS technique used at the IPHC gives reasonable results. Single detection is around ~15÷40%, but signals from multiple interactions are very similar to the single interaction ones.

- Data from the A015 was collected (the whole procedure was “dusted”) and will be analyzed soon (database creation).

What’s next?

- Simulated scan of A015 detector
- A015 database creation and analysis
- New collimator and new Eu source:
  - Charge cloud tests
  - Scan with the new source (multiple energies at the same time)