

# Status of the high-energy performance measurement and simulation

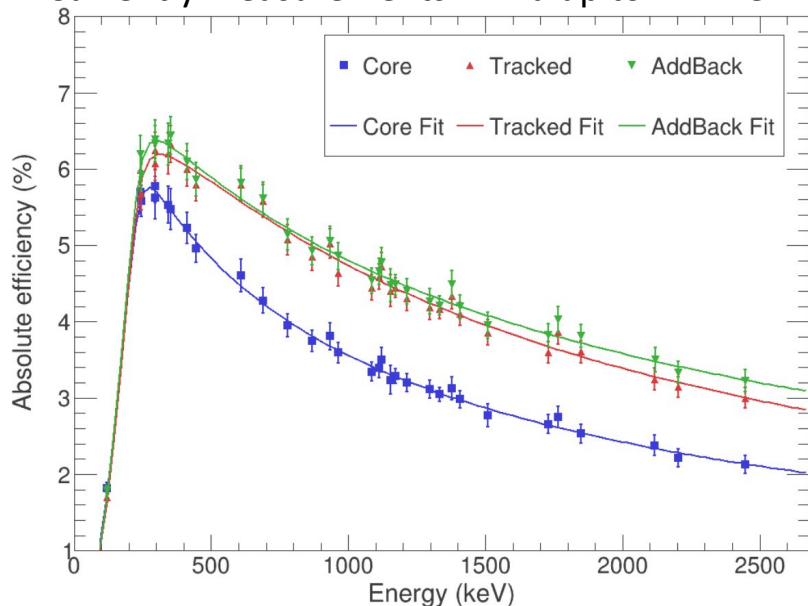
*M. Balogh, R. M. Pérez-Vidal, R. Imamoto, S. Bottoni, S. Pigliapocco  
for the AGATA collaboration*

26<sup>th</sup> AGATA Week | 11<sup>th</sup> September 2026

# Measurements

## How do the AGATA performances evolve at high energies?

Currently measurements:  $^{226}\text{Ra}$  up to 2.4 MeV



- Preparation of experimental proposals
- Analyses of  $\gamma$ -ray spectroscopic data
- Validation of GEANT4 simulations
- Optimization of the tracking algorithms

| Analysis mode | Efficiency | P/T       |
|---------------|------------|-----------|
| Core          | 3.05(9) %  | 16.8(6) % |
| Tracked       | 4.16(12) % | 32.9(9) % |
| Addback       | 4.21(13) % | 28.6(8) % |

@ 1.3 MeV

# Measurements

## Performance up to 5MeV

### 1<sup>st</sup> PHASE:

$^{56}\text{Co}$   $\gamma$ -ray source measurement:

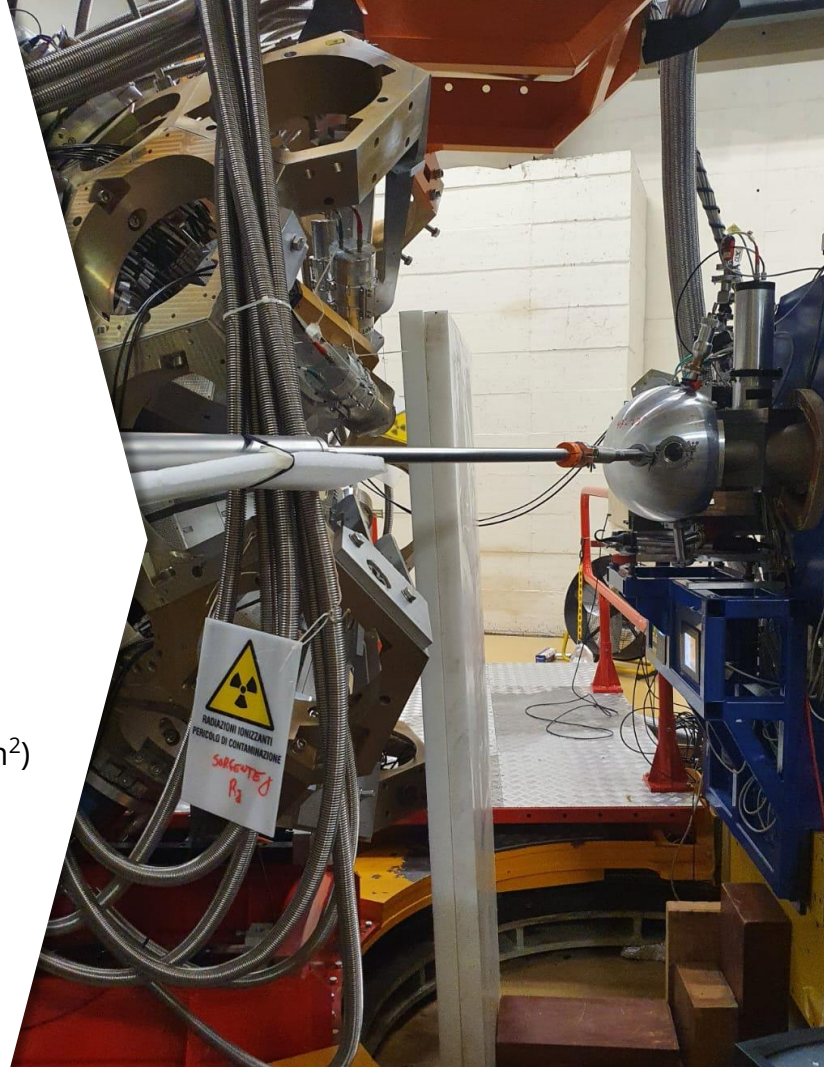
- Efficiencies up to 3.4 MeV
- Cancelled for now

### 2<sup>nd</sup> PHASE:

$^{66}\text{Zn}(p,n)$  reaction:

- Efficiencies up to 5MeV
- $E=13\text{MeV}$  ( $\sigma \approx 680 \text{ mb}$ )
- Target:  $\text{Au}$  ( $0.1\text{mg}/\text{cm}^2$ )+ $^{66}\text{Zn}$  ( $1.5\text{mg}/\text{cm}^2$ )+ $\text{Au}$  ( $1.5\text{mg}/\text{cm}^2$ )
- $I_{\text{beam}} \approx 2\text{-}10 \text{ pA}$
- AGATA @ **back-most + paraffin wall**

26<sup>th</sup>-31<sup>st</sup> July 2024



# Measurements

## Performance up to 5MeV

### 1<sup>st</sup> PHASE:

$^{56}\text{Co}$   $\gamma$ -ray source measurement:

- Efficiencies up to 3.4 MeV
- Cancelled for now

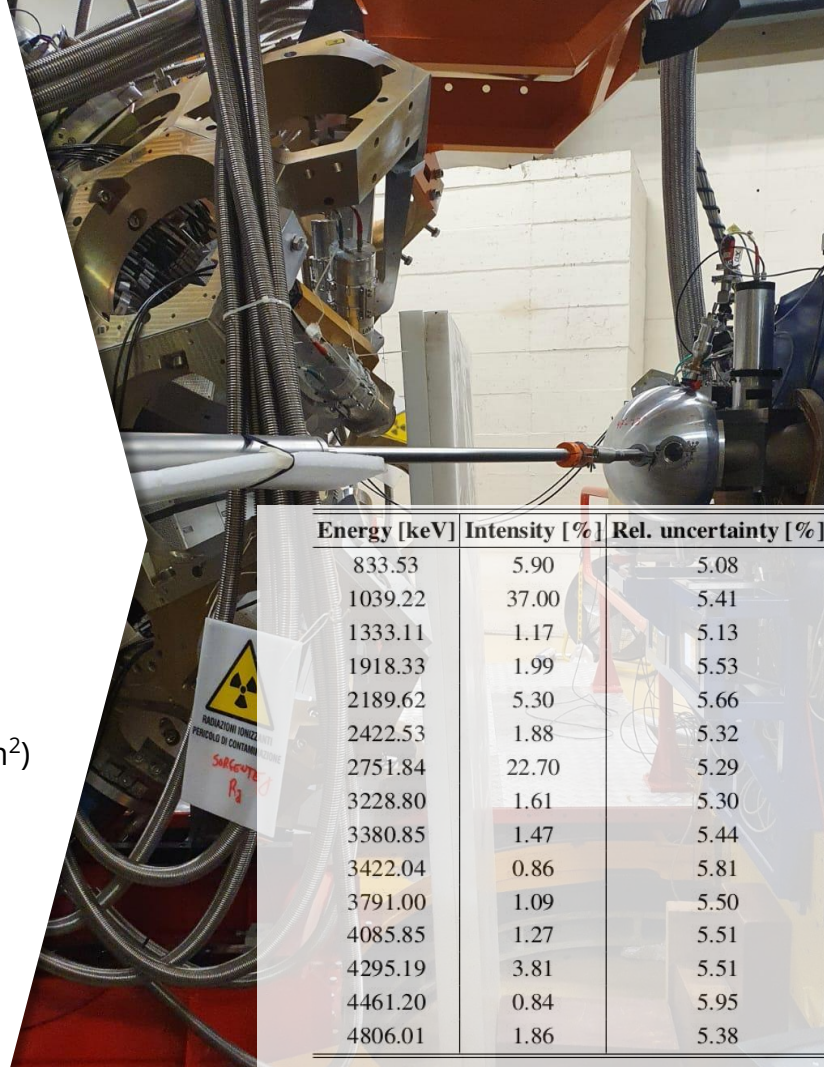
### 2<sup>nd</sup> PHASE:

$^{66}\text{Zn}(p,n)$  reaction:

- Efficiencies up to 5MeV
- $E=13\text{MeV}$  ( $\sigma \approx 680 \text{ mb}$ )
- Target: Au ( $0.1\text{mg}/\text{cm}^2$ )+ $^{66}\text{Zn}$  ( $1.5\text{mg}/\text{cm}^2$ )+Au ( $1.5\text{mg}/\text{cm}^2$ )
- $I_{\text{beam}} \approx 2\text{-}10 \text{ pA}$
- AGATA @ **back-most + paraffin wall**

26<sup>th</sup>-31<sup>st</sup> July 2024

M. Balogh, Md. S. R. Laskar, S. Bottoni, R.M. Pérez-Vidal, S. Pigliapoco  
and the AGATA performance team collaboration



| Energy [keV] | Intensity [%] | Rel. uncertainty [%] |
|--------------|---------------|----------------------|
| 833.53       | 5.90          | 5.08                 |
| 1039.22      | 37.00         | 5.41                 |
| 1333.11      | 1.17          | 5.13                 |
| 1918.33      | 1.99          | 5.53                 |
| 2189.62      | 5.30          | 5.66                 |
| 2422.53      | 1.88          | 5.32                 |
| 2751.84      | 22.70         | 5.29                 |
| 3228.80      | 1.61          | 5.30                 |
| 3380.85      | 1.47          | 5.44                 |
| 3422.04      | 0.86          | 5.81                 |
| 3791.00      | 1.09          | 5.50                 |
| 4085.85      | 1.27          | 5.51                 |
| 4295.19      | 3.81          | 5.51                 |
| 4461.20      | 0.84          | 5.95                 |
| 4806.01      | 1.86          | 5.38                 |

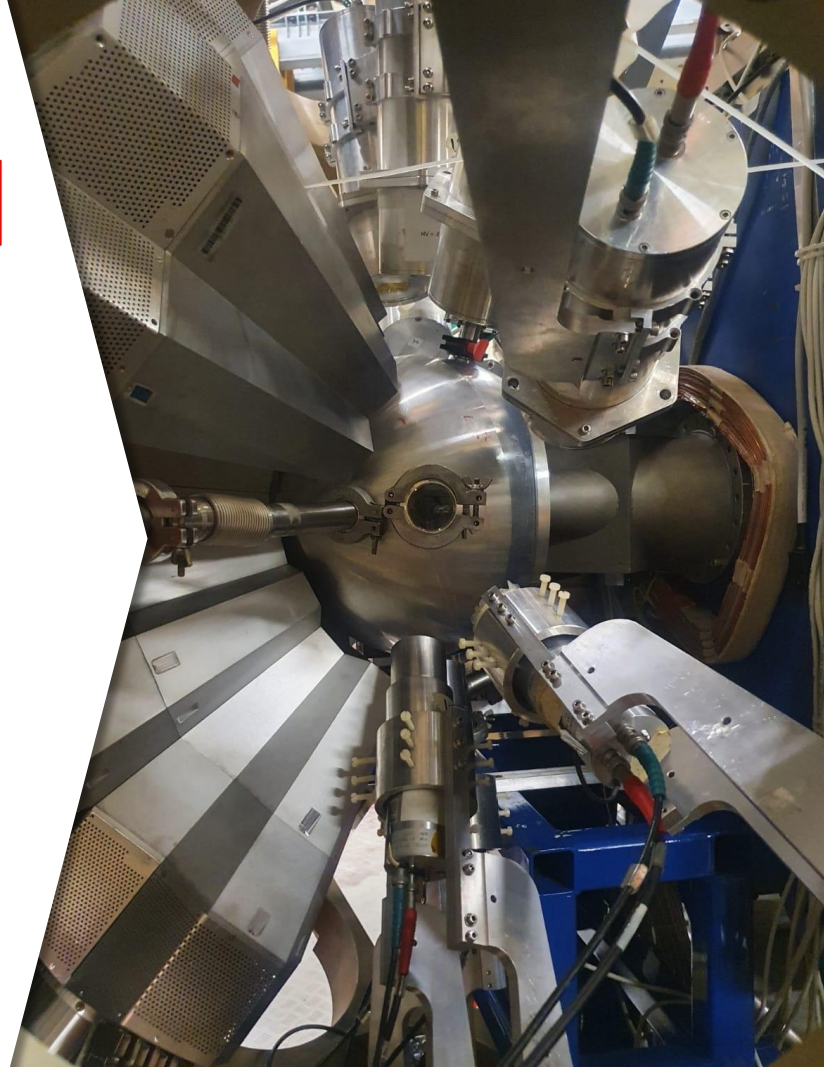
# Measurements

## Performance up to 5MeV

26<sup>th</sup>-31<sup>st</sup> July 2024

- AGATA position: Nominal (23.5 cm) and Close-up (18 cm)
- Closed chamber, Without absorbers
- 2.5 $\mu$ s
- ~110kBq Ga source

| Source | Position        | Duration  | Rate             |
|--------|-----------------|-----------|------------------|
| 60Co   | Nominal         | 2.5h      | 1.5kHz           |
|        | Nominal Traces  | 1h ; 1.5h |                  |
|        | Close-up        | 2h        | 2kHz             |
| 152Eu  | Nominal         | 4h ; 2h   | 2kHz             |
|        | Nominal Traces  | 2h ; 1.5h |                  |
|        | Close-up        | 3h ; 2h   | 3kHz             |
| 133Ba  | Nominal         | 2.3h      | 2kHz             |
|        | Close-up        | 1.6h      | 2.7kHz           |
| 226Ra  | Nominal         | 4h        | 1.6kHz           |
|        | Close-up        | 2h        | 2KHz             |
| Target | Nominal         | 5.7h      | 1.8kHz           |
|        | Nominal Traces  | 2h        | 1.2kHz           |
|        | Close-up        | 6h        | 0.7kHz           |
|        | Close-up Traces | 2h        | 0.45kHz & 1.5kHz |
| 60Co   | Far Traces      | 6h ; 6h   | 1kHz-0.8Hz       |



# Measurements

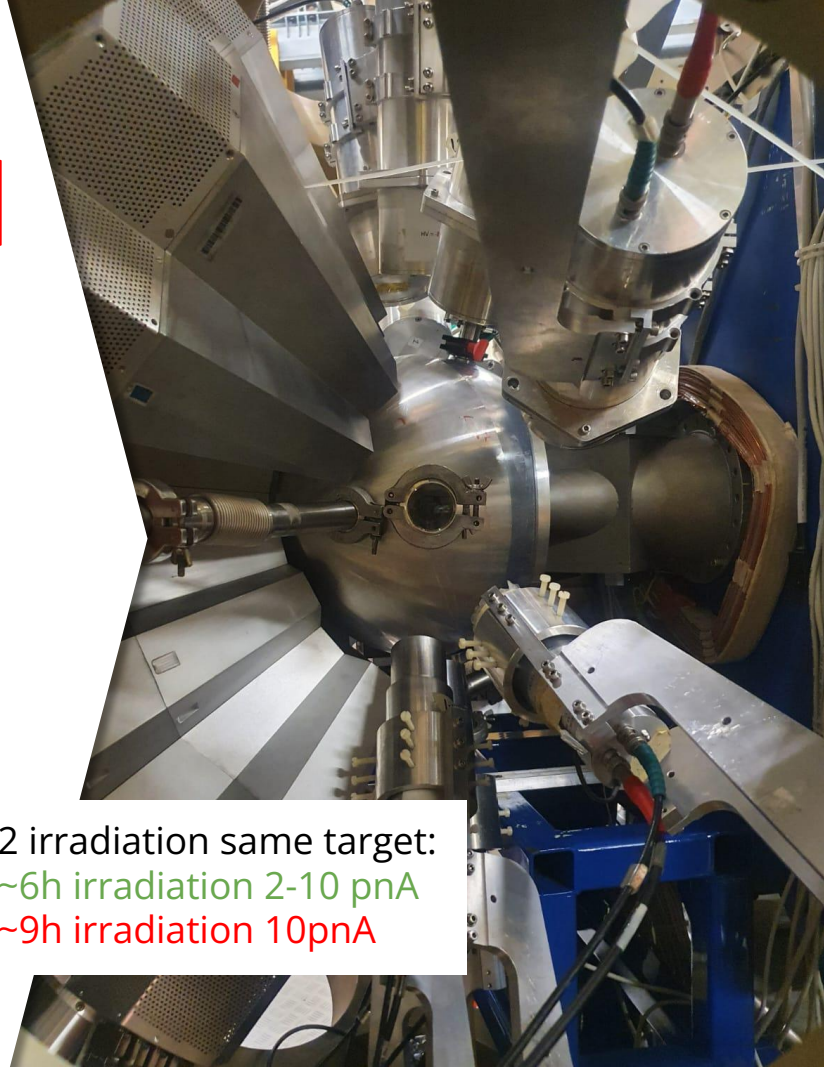
## Performance up to 5MeV

26<sup>th</sup>-31<sup>st</sup> July 2024

- AGATA position: Nominal (23.5 cm) and Close-up (18 cm)
- Closed chamber, Without absorbers
- 2.5 $\mu$ s
- ~110kBq Ga source

| Source | Position        | Duration  | Rate             |
|--------|-----------------|-----------|------------------|
| 60Co   | Nominal         | 2.5h      | 1.5kHz           |
|        | Nominal Traces  | 1h ; 1.5h |                  |
|        | Close-up        | 2h        | 2kHz             |
| 152Eu  | Nominal         | 4h ; 2h   | 2kHz             |
|        | Nominal Traces  | 2h ; 1.5h |                  |
|        | Close-up        | 3h ; 2h   | 3kHz             |
| 133Ba  | Nominal         | 2.3h      | 2kHz             |
|        | Close-up        | 1.6h      | 2.7kHz           |
| 226Ra  | Nominal         | 4h        | 1.6kHz           |
|        | Close-up        | 2h        | 2KHz             |
| Target | Nominal         | 5.7h      | 1.8kHz           |
|        | Nominal Traces  | 2h        | 1.2kHz           |
|        | Close-up        | 6h        | 0.7kHz           |
|        | Close-up Traces | 2h        | 0.45kHz & 1.5kHz |
| 60Co   | Far Traces      | 6h ; 6h   | 1kHz-0.8Hz       |

2 irradiation same target:  
~6h irradiation 2-10 p nA  
~9h irradiation 10p nA



# Measurements

## Performance up to 5MeV

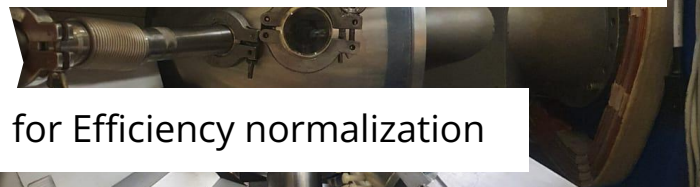
26<sup>th</sup>-31<sup>st</sup> July 2024

- AGATA position: Nominal (23.5 cm) and Close-up (18 cm)
- Closed chamber, Without absorbers
- 2.5 $\mu$ s
- ~110kBq Ga source

| Source | Position        | Duration  | Rate             |
|--------|-----------------|-----------|------------------|
| 60Co   | Nominal         | 2.5h      | 1.5kHz           |
|        | Nominal Traces  | 1h ; 1.5h |                  |
|        | Close-up        | 2h        | 2kHz             |
| 152Eu  | Nominal         | 4h ; 2h   | 2kHz             |
|        | Nominal Traces  | 2h ; 1.5h |                  |
|        | Close-up        | 3h ; 2h   | 3kHz             |
| 133Ba  | Nominal         | 2.3h      | 2kHz             |
|        | Close-up        | 1.6h      | 2.7kHz           |
| 226Ra  | Nominal         | 4h        | 1.6kHz           |
|        | Close-up        | 2h        | 2kHz             |
| Target | Nominal         | 5.7h      | 1.8kHz           |
|        | Nominal Traces  | 2h        | 1.2kHz           |
|        | Close-up        | 6h        | 0.7kHz           |
|        | Close-up Traces | 2h        | 0.45kHz & 1.5kHz |
| 60Co   | Far Traces      | 6h ; 6h   | 1kHz-0.8Hz       |



60Co for status/individual performances



152Eu for Efficiency normalization

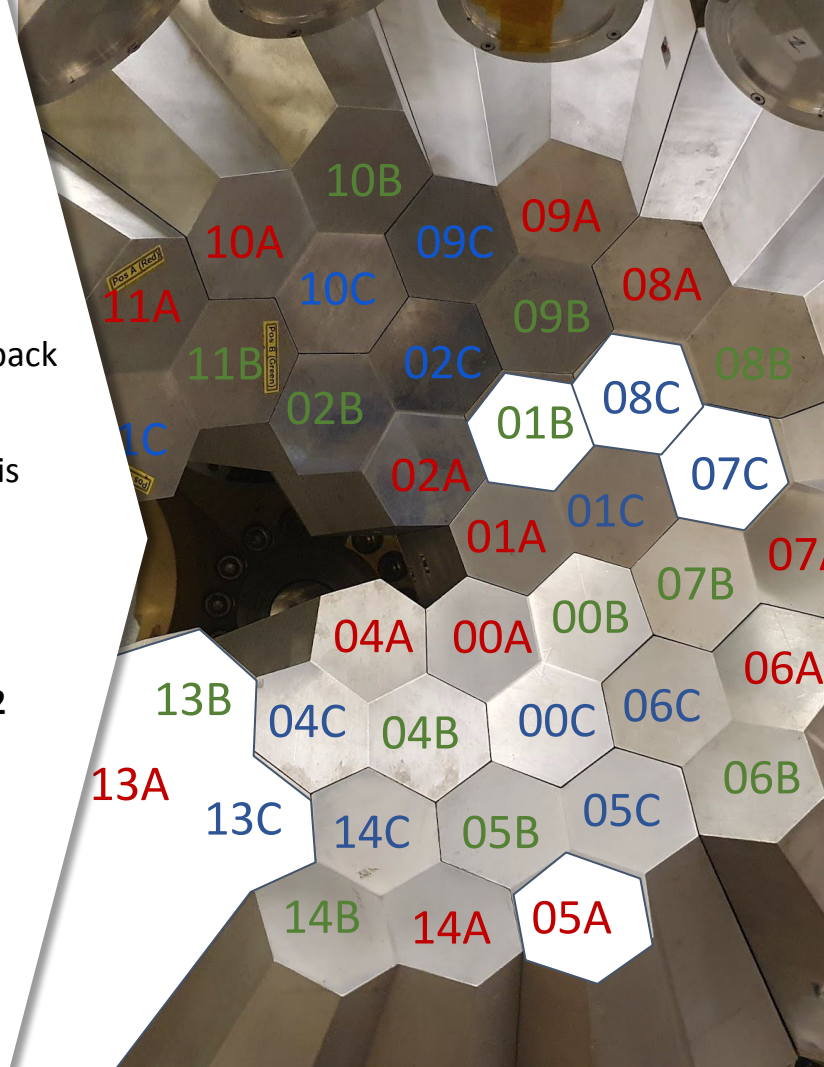


2 irradiation same target:  
~6h irradiation 2-10 pA  
~9h irradiation 10pA

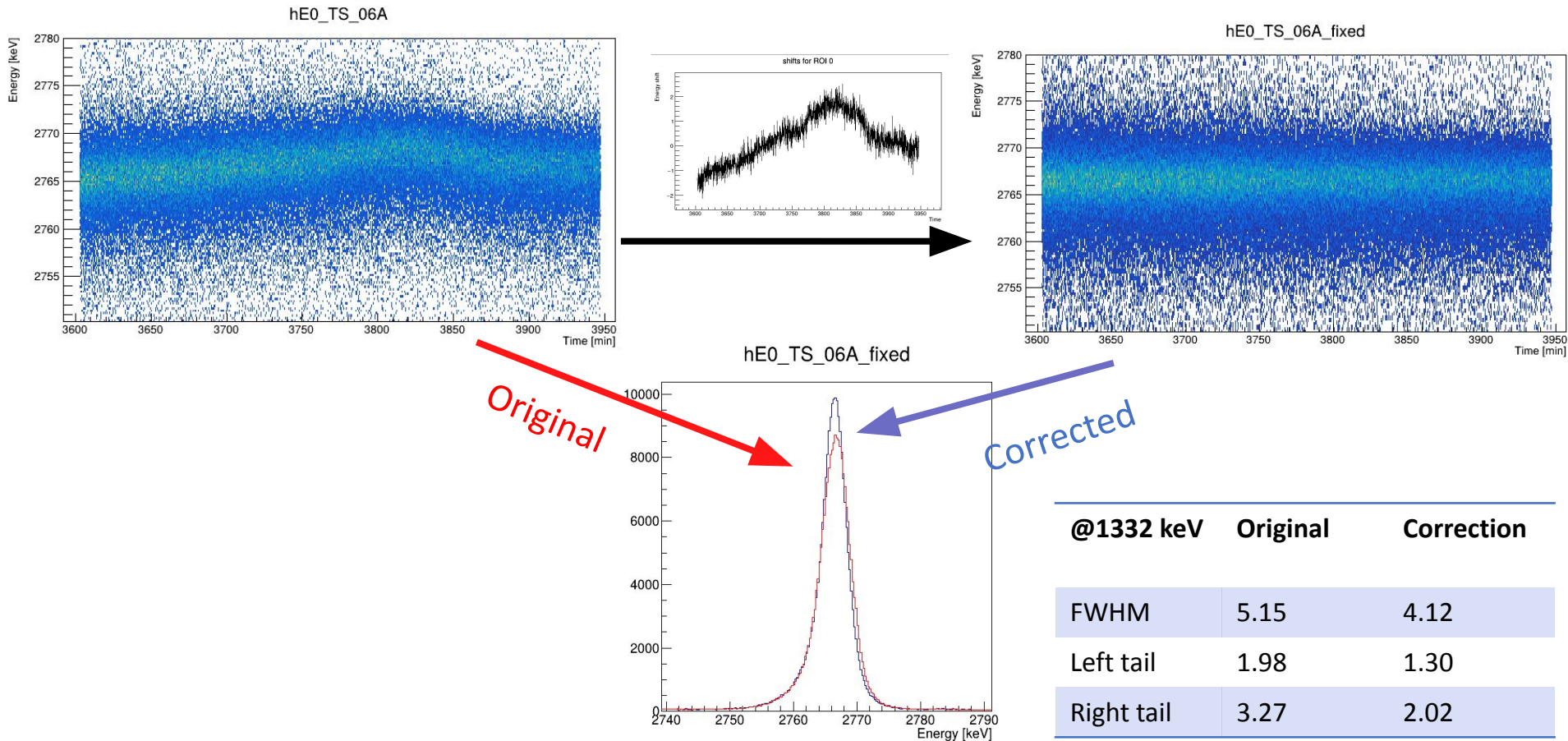
# Status July

## 12 ATC - 32 AGATA crystals

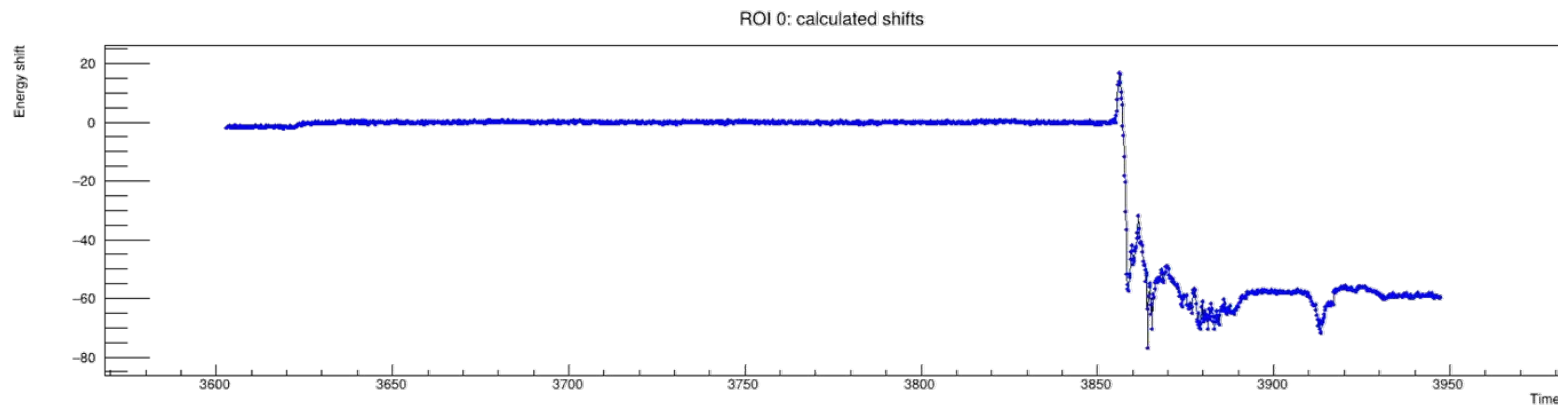
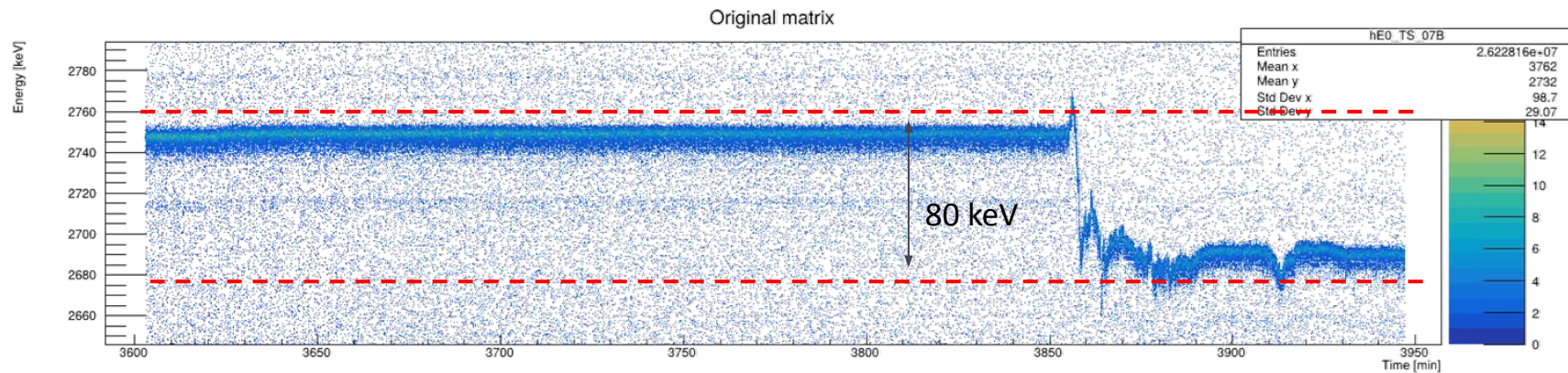
- 00C and 05B: losing validations very often
- **04B** : segments A4, A5, A6 disappearing together and coming back over time (preamp issue) + noise (not very often)
- **05C**: gain and baseline of the core jump together over time, this change affects the gain of the core and of the segments
- **07B** : bad resolution due to the continuous oscillation of the energy in the HG core (LG ok)
- **09B, 11A**: core with strange noise in the trace (same as in **C002** and **C014 - ATC 6** but with less amplitude)
- **00B**: displays a cross in the PSA hit pattern
- **02C**: seg. B4 (9) preamp issue
- **11A**: seg. F1 (30) channel digi issue



# Gain corrections



# Gain corrections



# Recalibration

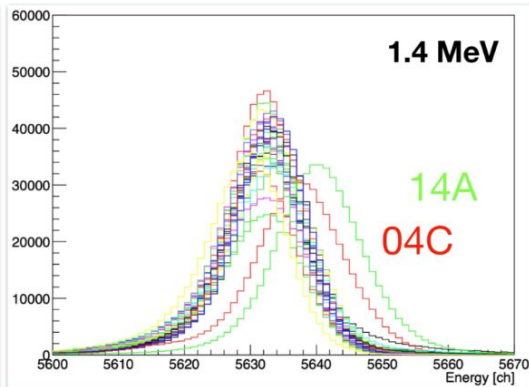
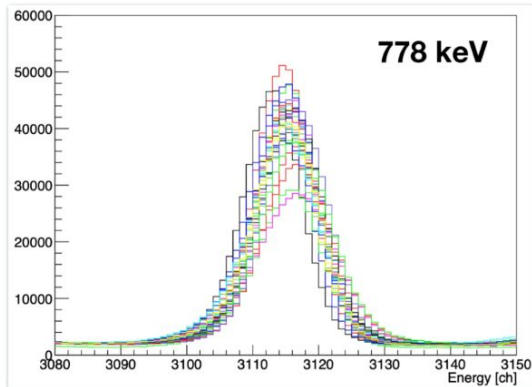
- complicated by gain corrections -> necessary to do separate recalibration for each source
- large (re)calibration residuals

$^{152}\text{Eu}$  (run1010)

Calib func = linear

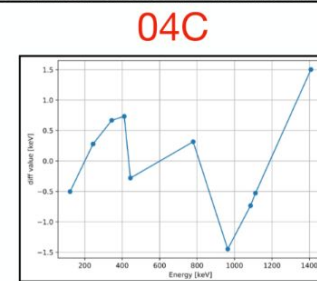
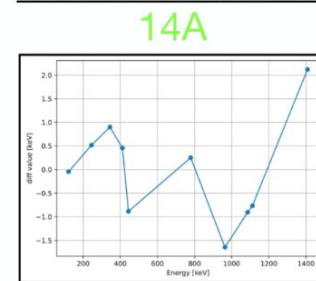
Core recalibration

The calibration was validated with the  $^{152}\text{Eu}$  778 keV, 1.4 MeV.



Selected peaks from all crystals overlaid after core recalibration

The residual from calibration function

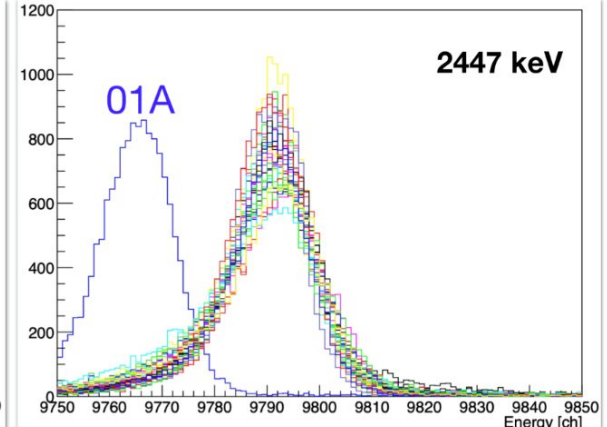
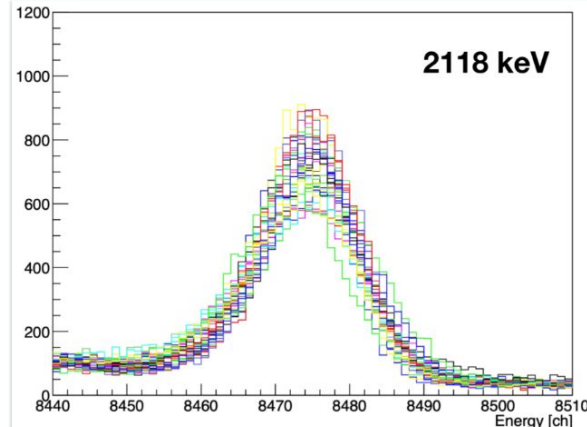
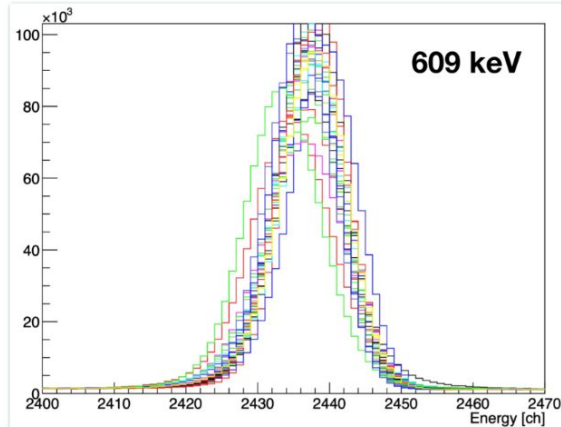


**A significant calibration non-linearity is observed around 1.4 MeV.**

# $^{226}\text{Ra}$ (run1010) Calib func = linear

## Core recalibration

The calibration was validated with the  $^{226}\text{Ra}$  609 keV, 2118 keV, 2447 keV.



Selected peaks from all crystals overlaid after core recalibration

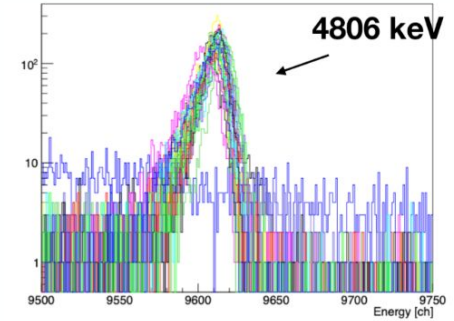
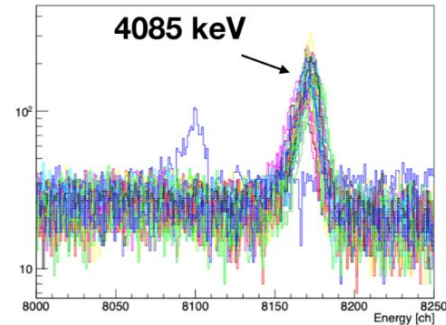
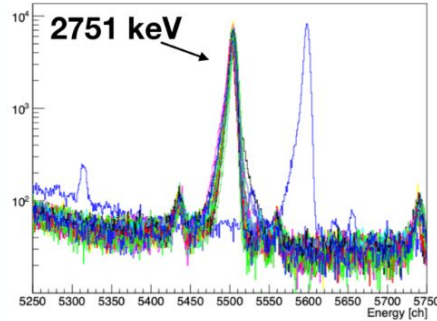
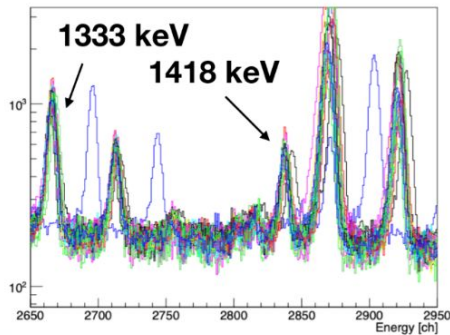
A significant calibration non-linearity is observed around 2.4 MeV for 01A.

\*energy in Ch, not keV

# $^{66}\text{Ga}$ (run0003)

## Core recalibration

The calibration was validated with the  $^{66}\text{Ga}$  1333 keV, 2751 keV, 4085 keV, 4806 keV.



Blue one corresponds to 01A.

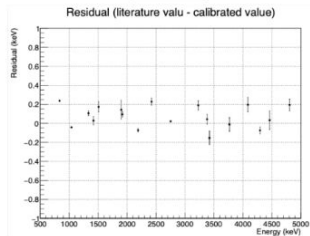
Selected peaks from all crystals overlaid after core recalibration

\*energy in Ch, not keV

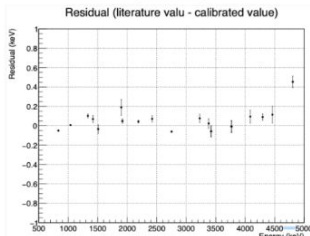
# Core nonlinearity check

Residual plots of 21  $\gamma$ -rays (0.8-4.8 MeV) for crystal-by-crystal

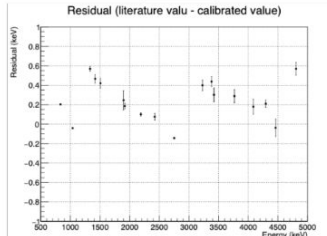
**00A**



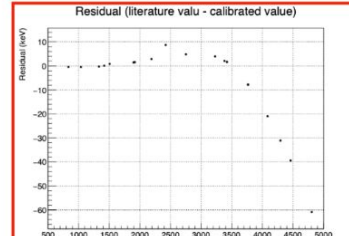
**00B**



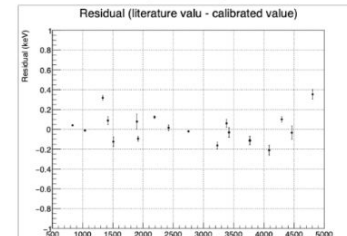
**00C**



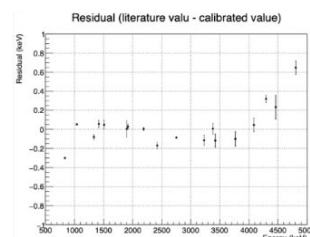
**01A**



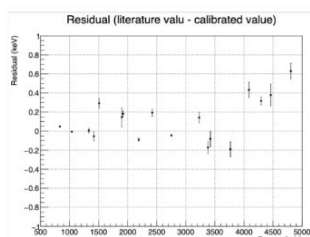
**01C**



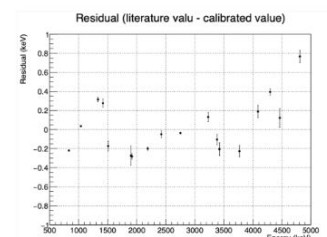
**02A**



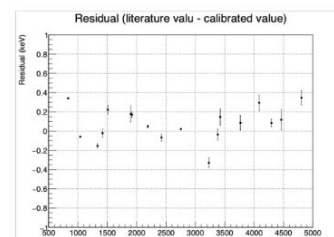
**02B**



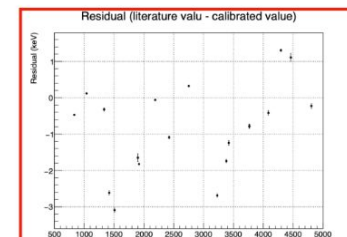
**04A**



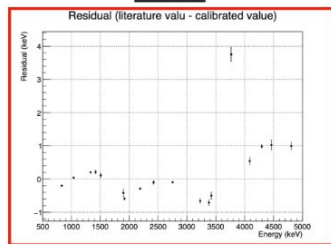
**04B**



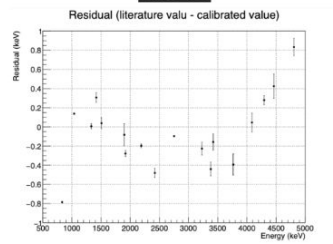
**04C**



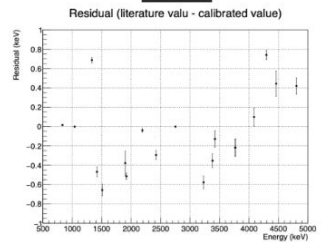
**05B**



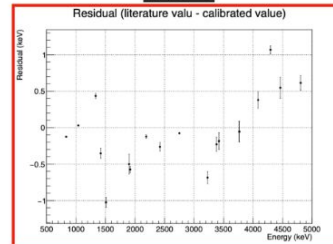
**05C**



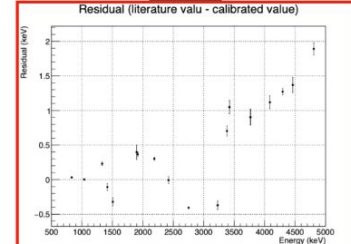
**06A**



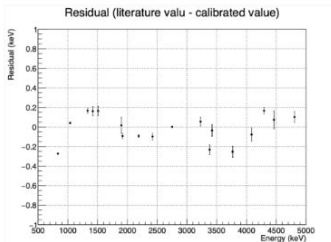
**06B**



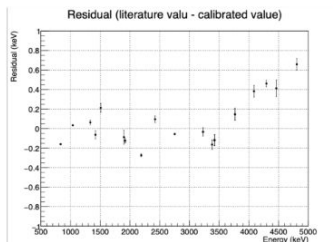
**06C**



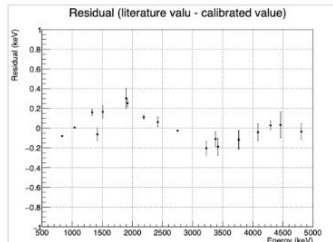
**07A**



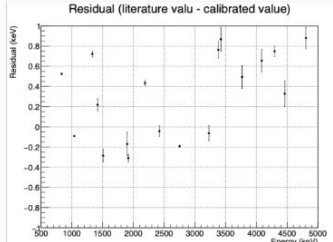
**07B**



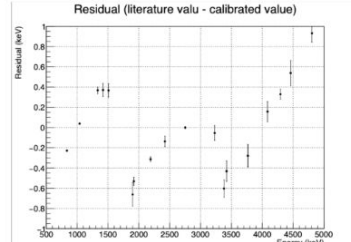
**08A**



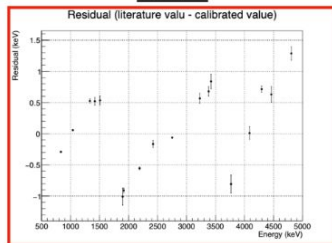
**08B**



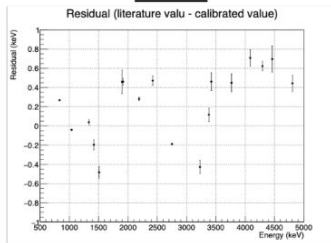
**09A**



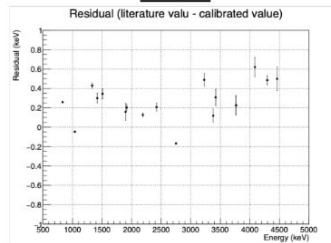
**09B**



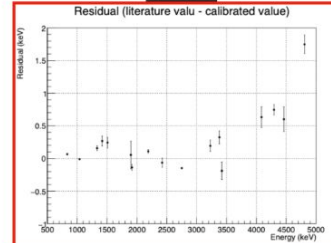
**09C**



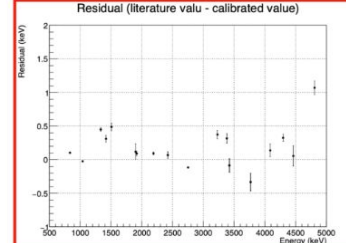
**10A**



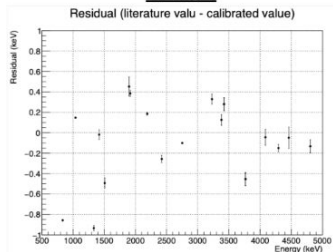
**10B**



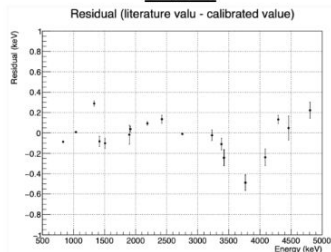
**10C**



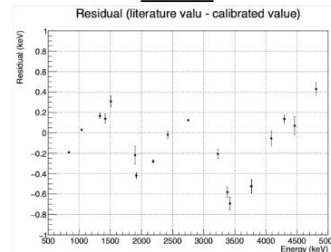
**11A**



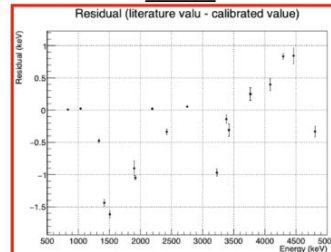
**11B**



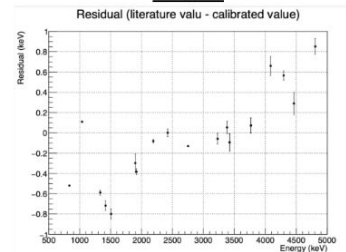
**11C**



**14A**



**14B**



# Methodology

## AGATA-efficiency code

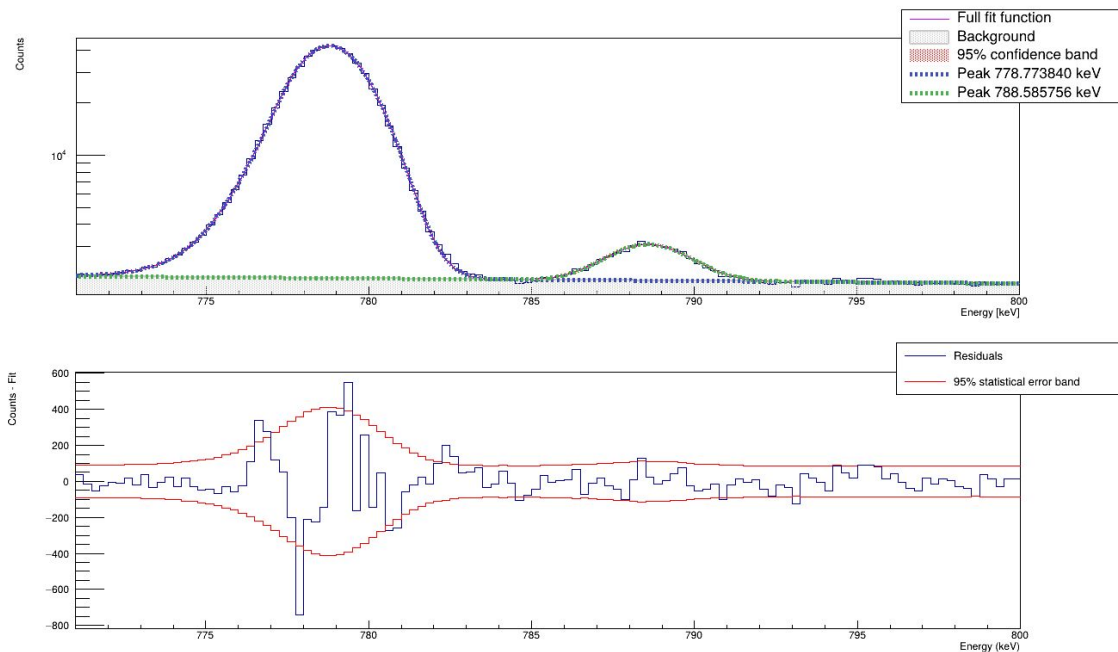
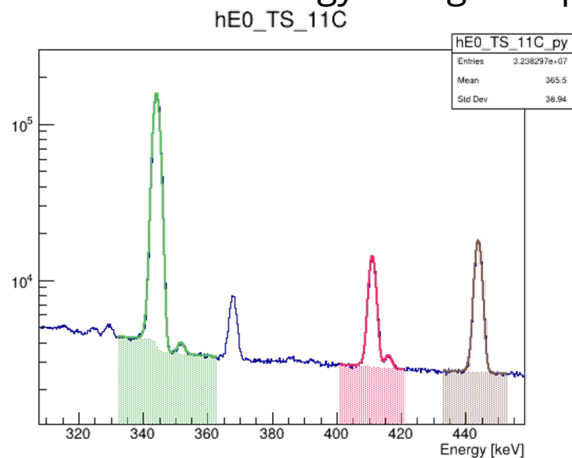
- code to streamline efficiency evaluation

<https://baltig.infn.it/gamma/agata-efficiency>

# Methodology

## AGATA-efficiency code

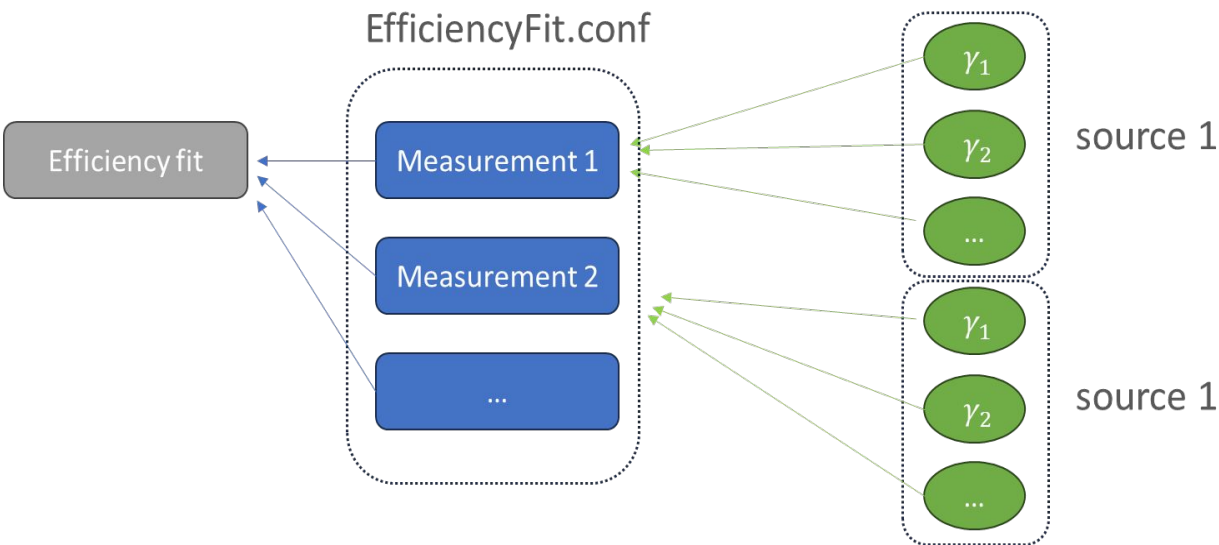
- automated energy fitting with peak model supporting *tails* and *steps*



# Methodology

## AGATA-efficiency code

- Configuration-driven



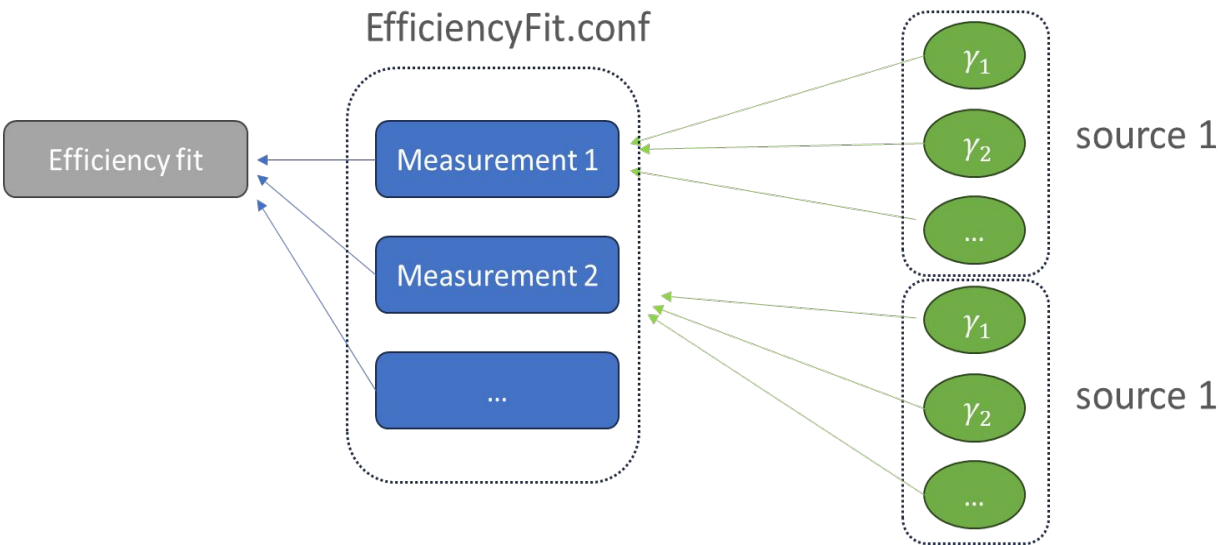
# Methodology

## AGATA-efficiency code

- Configuration-driven

```
1 # 152Eu peaks
2 ISOTOPE 152Eu
3 HALFLIFE 13.567 years
4 HALFLIFE_ERR 0.014 years
5 ACTIVITY 397 kBq
6 ACTIVITY_ERR 11.91 kBq # Bq kBq MBq GBq or %
7 REFERENCE_DATE 01/08/2010
8
9 #-----#
10 # data source https://www-pub.iaea.org/mtcd/publications/pdf/pub1287\_vol2\_web.pdf
11 GAMMA_TABLE
12
13
```

| Fit_id | #Energy[keV] | EnErr[keV] | Intensity[%] | IntErr[%] | FitEnergyRangeMin | FitEnergyRangeMax | Active? | LeftTail? | RightTail? | Step? | Background_p |   |
|--------|--------------|------------|--------------|-----------|-------------------|-------------------|---------|-----------|------------|-------|--------------|---|
| 0      | 121.7817     | 0.0003     | 28.41        | 0.13      | 115               | 140               | 1       | 0         | 0          | 1     | 2            |   |
| 1      | 244.6974     | 0.0008     | 7.550        | 0.04      | 234               | 254               | 1       | 0         | 0          | 0     | 2            |   |
| 2      | 344.2785     | 0.0012     | 26.58        | 0.12      | 332               | 354               | 1       | 1         | 0          | 0     | 2            |   |
| 3      | 411.1165     | 0.0012     | 2.237        | 0.01      | 400               | 425               | 1       | 1         | 0          | 0     | 2            |   |
| 18     | 416.1165     | 0.0012     | 0.01         | 0.025     | 400               | 425               | 0       | 1         | 0          | 0     | 2            |   |
| 19     | 443.965      | 0.003      | 3.125        | 0.014     | 433               | 453               | 1       | 0         | 0          | 0     | 2            |   |
| 20     | 577.9045     | 0.0024     | 12.96        | 0.06      | 771               | 792               | 1       | 1         | 0          | 0     | 2            |   |
| 21     | 5            | 788.9045   | 0.0024       | 0.001     | 0.15              | 771               | 800     | 0         | 1          | 0     | 0            | 2 |

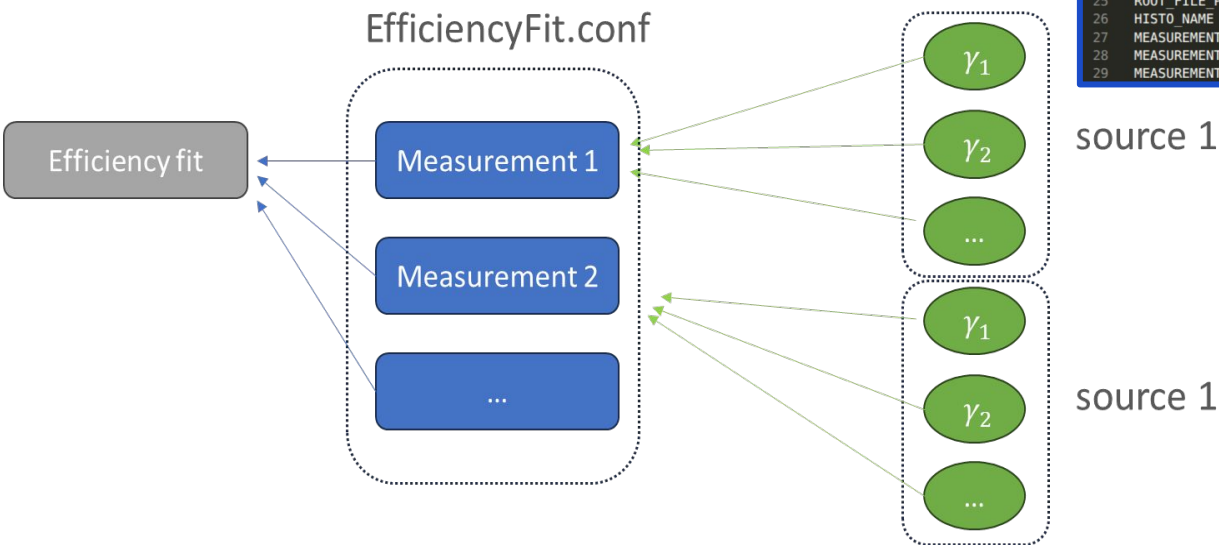


Source data taken from IAEA: [https://www-pub.iaea.org/mtcd/publications/pdf/pub1287\\_vol2\\_web.pdf](https://www-pub.iaea.org/mtcd/publications/pdf/pub1287_vol2_web.pdf)

# Methodology

## AGATA-efficiency code

- Configuration-driven



```
1  ### Data acquired for EXP 035 at INFN LNL using AGATA array
2  EFFICIENCY FIT IGNORE_INTERVAL 0 300
3  EFFICIENCY_RANGE 100 9000
4  EFFICIENCY_OUTPUT_FILE AGATAeff_core_00A.txt
5
6  EFFICIENCY FIT FUNCTION polylog 6 # radware/expo/polylog - in case of polylog define polylog
7  EFFICIENCY_OUTPUT_FILE efficiency_curve.txt
8  EFF_FCN_PARAMETER 0 p 0 -10 10 -9 # [par_index] [par_name] [par_range_min] [par_range_max]
9  EFF_FCN_PARAMETER 1 p 1 -1 1 2.3 # [par_index] [par_name] [par_range_min] [par_range_max]
10 EFF_FCN_PARAMETER 2 p 2 -0.1 0.1 -0.34 # [par_index] [par_name] [par_range_min] [par_range_max]
11 EFF_FCN_PARAMETER 3 p 3 -0.1 0.1 0.1 # [par_index] [par_name] [par_range_min] [par_range_max]
12 EFF_FCN_PARAMETER 4 p 4 -0.01 0.01 0.1 # [par_index] [par_name] [par_range_min] [par_range_max]
13 EFF_FCN_PARAMETER 5 p 5 -0.01 0.01 0.1 # [par_index] [par_name] [par_range_min] [par_range_max]
14
15 MEASUREMENT ABSOLUTE
16 SOURCE_CONF_PATH Conf/Sources/152Eu_SW103.conf
17 ROOT_FILE_PATH /home/mbalagh/perf/eff_histo/EfficiencyHistograms_1010.root
18 HISTO_NAME h_E0_00A
19 MEASUREMENT_START 28/07/2024 0:01:04 # DD/MM/YYYY HH:MM:SS
20 MEASUREMENT_END 28/07/2024 4:07:26 # DD/MM/YYYY HH:MM:SS
21 MEASUREMENT_DEADTIME_PERCENT 0 #percent
22
23 MEASUREMENT ABSOLUTE
24 SOURCE_CONF_PATH Conf/Sources/60Co_AF5909.conf
25 ROOT_FILE_PATH /home/mbalagh/perf/eff_histo/EfficiencyHistograms_1013.root
26 HISTO_NAME h_E0_00A
27 MEASUREMENT_START 28/07/2024 13:21:44 # DD/MM/YYYY HH:MM:SS
28 MEASUREMENT_END 28/07/2024 15:50:50 # DD/MM/YYYY HH:MM:SS
29 MEASUREMENT_DEADTIME_PERCENT 0 #percent
```

# Methodology

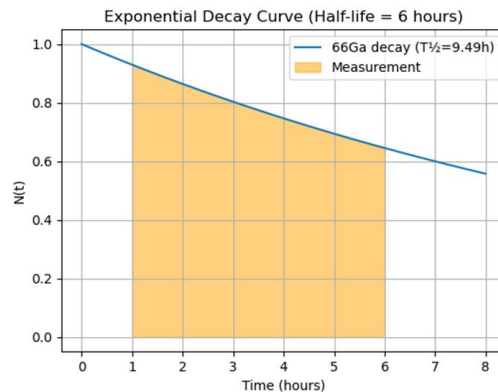
## AGATA-efficiency code

- efficiency calculation
  - treatment for short-living sources
  - inactive + dead time correction

$$\varepsilon = \frac{C_{observed}}{N_{decays} I_{\gamma}}$$

$$N_{decays} = \frac{A_{source}}{\lambda} \left( e^{-\lambda(T_{start}-t_{ref})} - e^{-\lambda(T_{end}-t_{ref})} \right) D$$

DAQ dead time



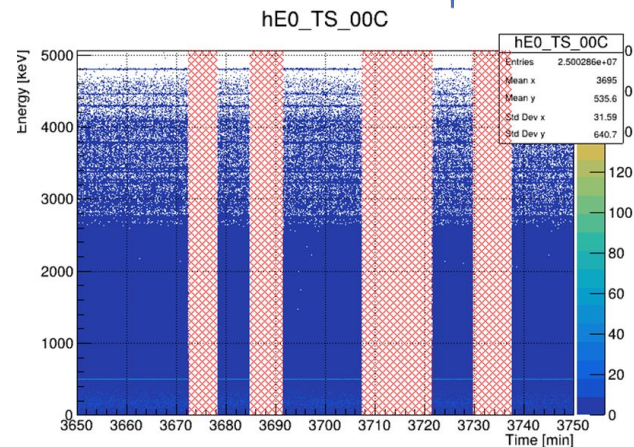
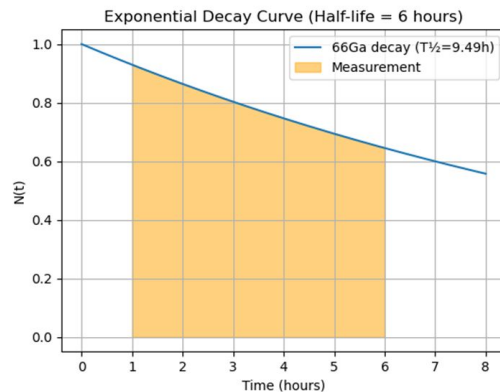
# Methodology

## AGATA-efficiency code

- efficiency calculation
  - treatment for short-living sources
  - inactive + dead time correction

$$\varepsilon = \frac{C_{observed}}{N_{decays} I_{\gamma}}$$

$$N_{decays} = \frac{A_{source}}{\lambda} \left( e^{-\lambda(T_{start}-t_{ref})} - e^{-\lambda(T_{end}-t_{ref})} \right) D$$



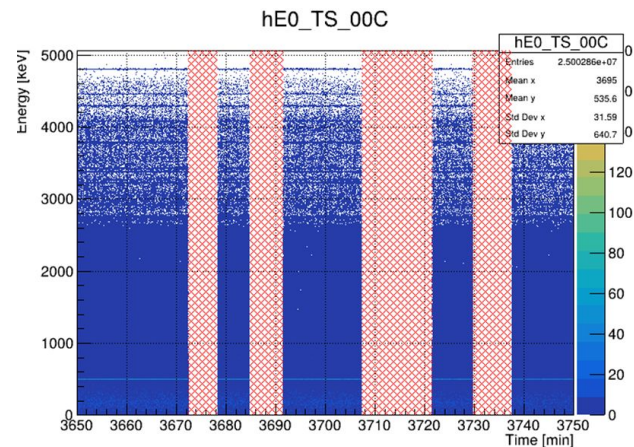
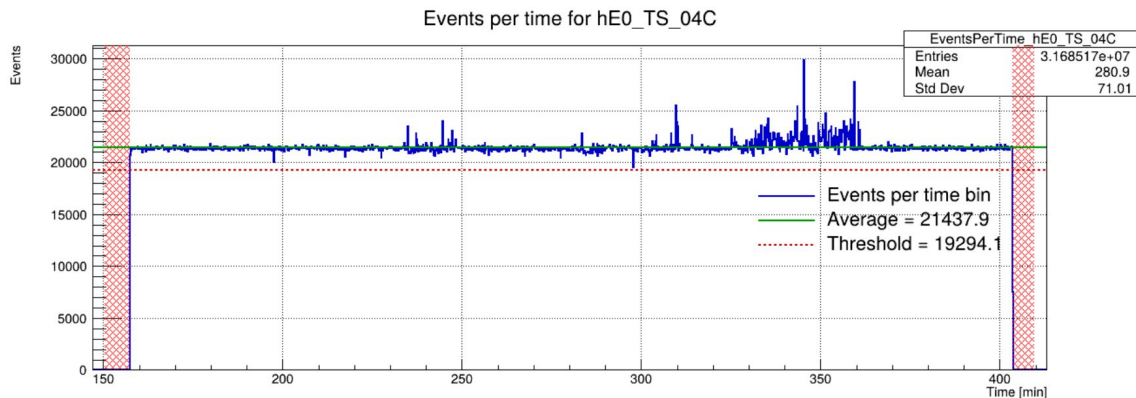
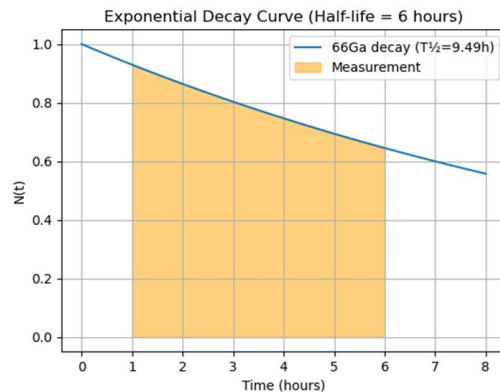
# Methodology

## AGATA-efficiency code

- efficiency calculation
  - treatment for short-living sources
  - inactive + dead time correction

$$\varepsilon = \frac{C_{observed}}{N_{decays} I_{\gamma}}$$

$$N_{decays} = \frac{A_{source}}{\lambda} \left( e^{-\lambda(T_{start}-t_{ref})} - e^{-\lambda(T_{end}-t_{ref})} \right) D$$



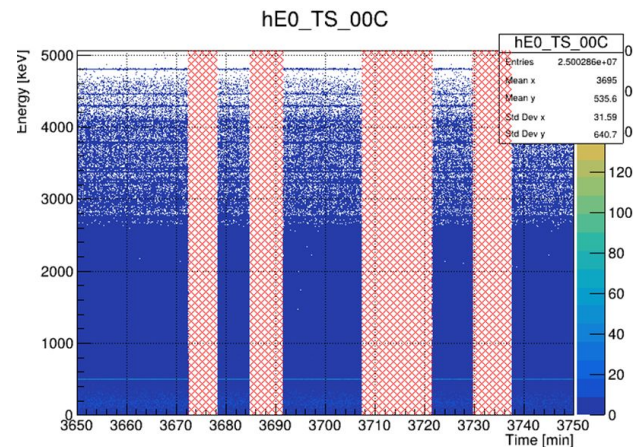
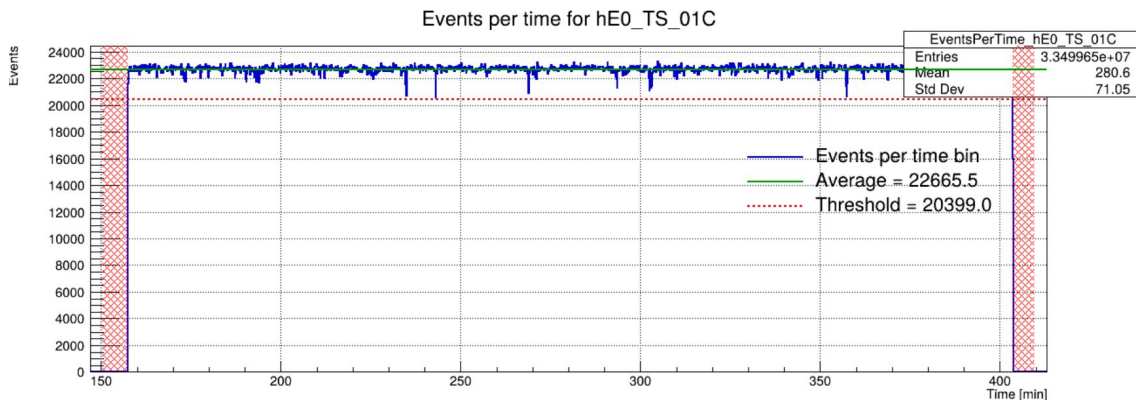
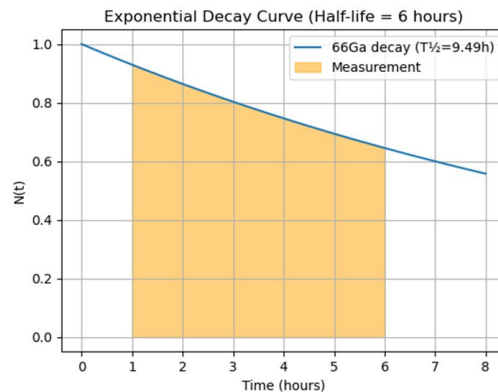
# Methodology

## AGATA-efficiency code

- efficiency calculation
  - treatment for short-living sources
  - inactive + dead time correction

$$\varepsilon = \frac{C_{observed}}{N_{decays} I_{\gamma}}$$

$$N_{decays} = \frac{A_{source}}{\lambda} \left( e^{-\lambda(T_{start}-t_{ref})} - e^{-\lambda(T_{end}-t_{ref})} \right) D$$



# Methodology

## AGATA-efficiency code

- efficiency functions

- **Exponential**

$$\varepsilon(E) = e^{(-\lambda E)}$$

- **Radware**

$$\varepsilon(E) = e^{[(A+Bx+Cx^2)^{-G} + (D+Ey+Fy^2)^{-G}]^{-1/G}}$$

- **Polynomial-logarithmic**

$$\ln(\varepsilon(E)) = \sum_{i=0}^n p_i \cdot \ln^i(E/E_0)$$

# Methodology

## AGATA-efficiency code

- efficiency functions

- **Exponential**

$$\varepsilon(E) = e^{(-\lambda E)}$$

- **Radware**

$$\varepsilon(E) = e^{[(A+Bx+Cx^2)^{-G} + (D+Ey+Fy^2)^{-G}]^{-1/G}}$$

- **Polynomial-logarithmic**

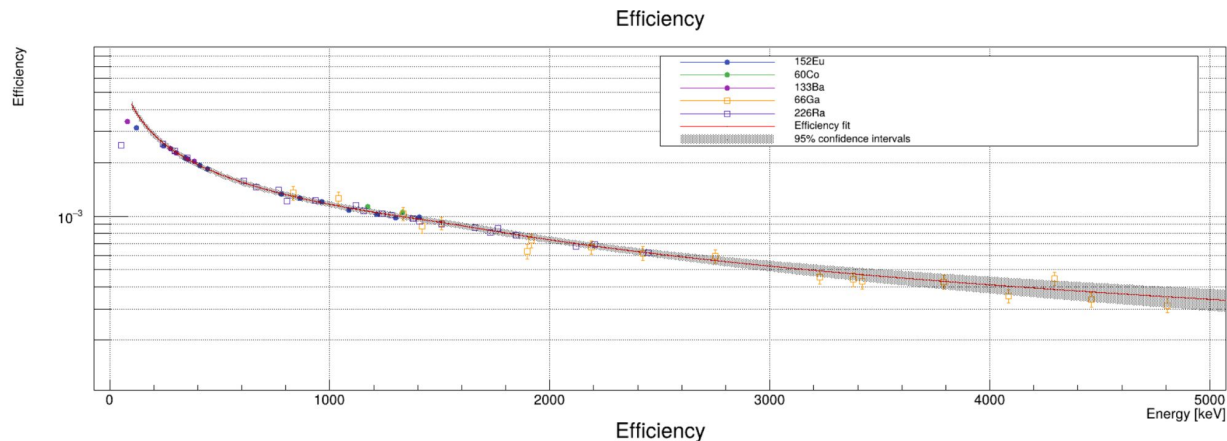
$$\ln(\varepsilon(E)) = \sum_{i=0}^n p_i \cdot \ln^i(E/E_0)$$

- huge improvement for  $E_0=500$  (keV)
- reducing covariance between  $p_i$
- better match @high-energy ( $E>4$  MeV)

# Efficiency function: RW vs polylog

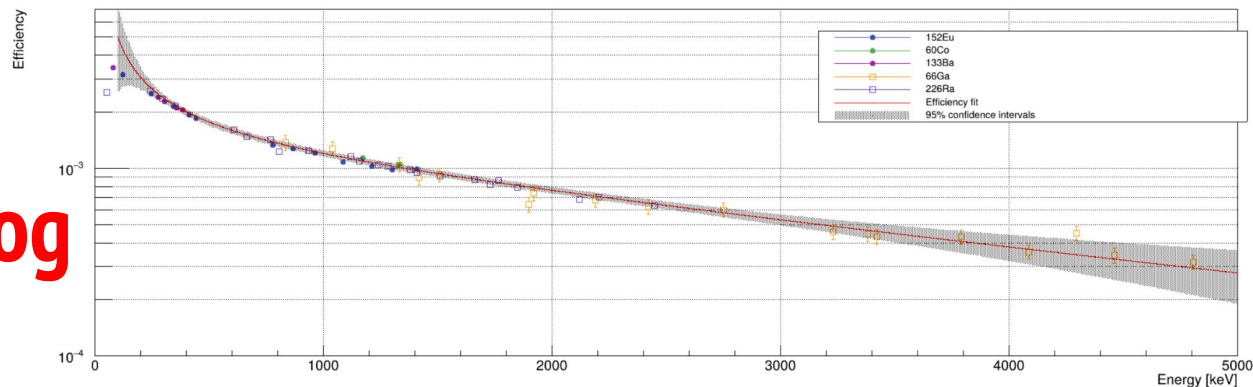
**RW**

rchi2: 6.5



**polylog**

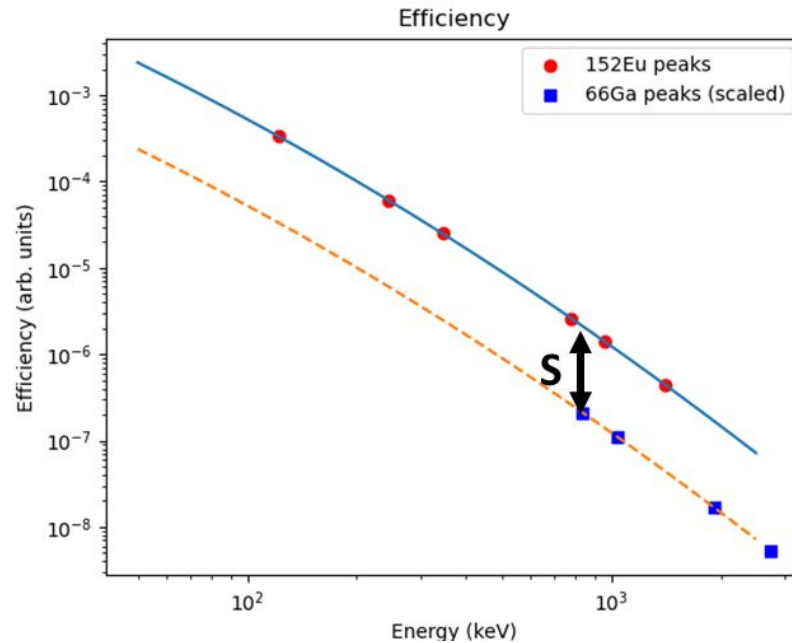
rchi2: 7.1



# Methodology

## AGATA-efficiency code

- automated normalization for sources with unknown activity



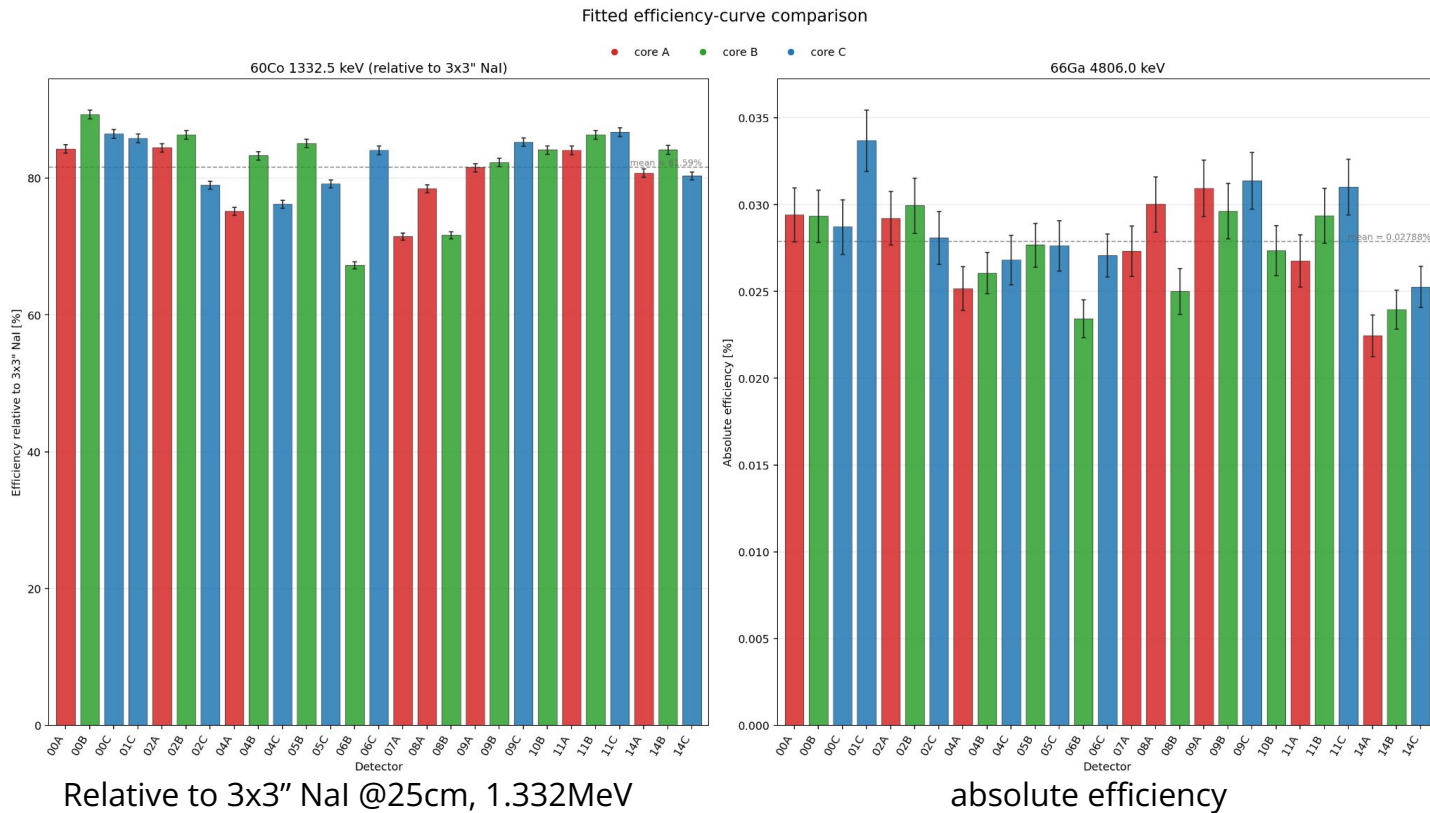
# Methodology

## AGATA-efficiency code

- calculated experimental covariance matrix used in chi2 minimization
- sources of covariance
  - source activity
  - source half-life
  - (normalization parameter for uncalibrated sources)

# Efficiency

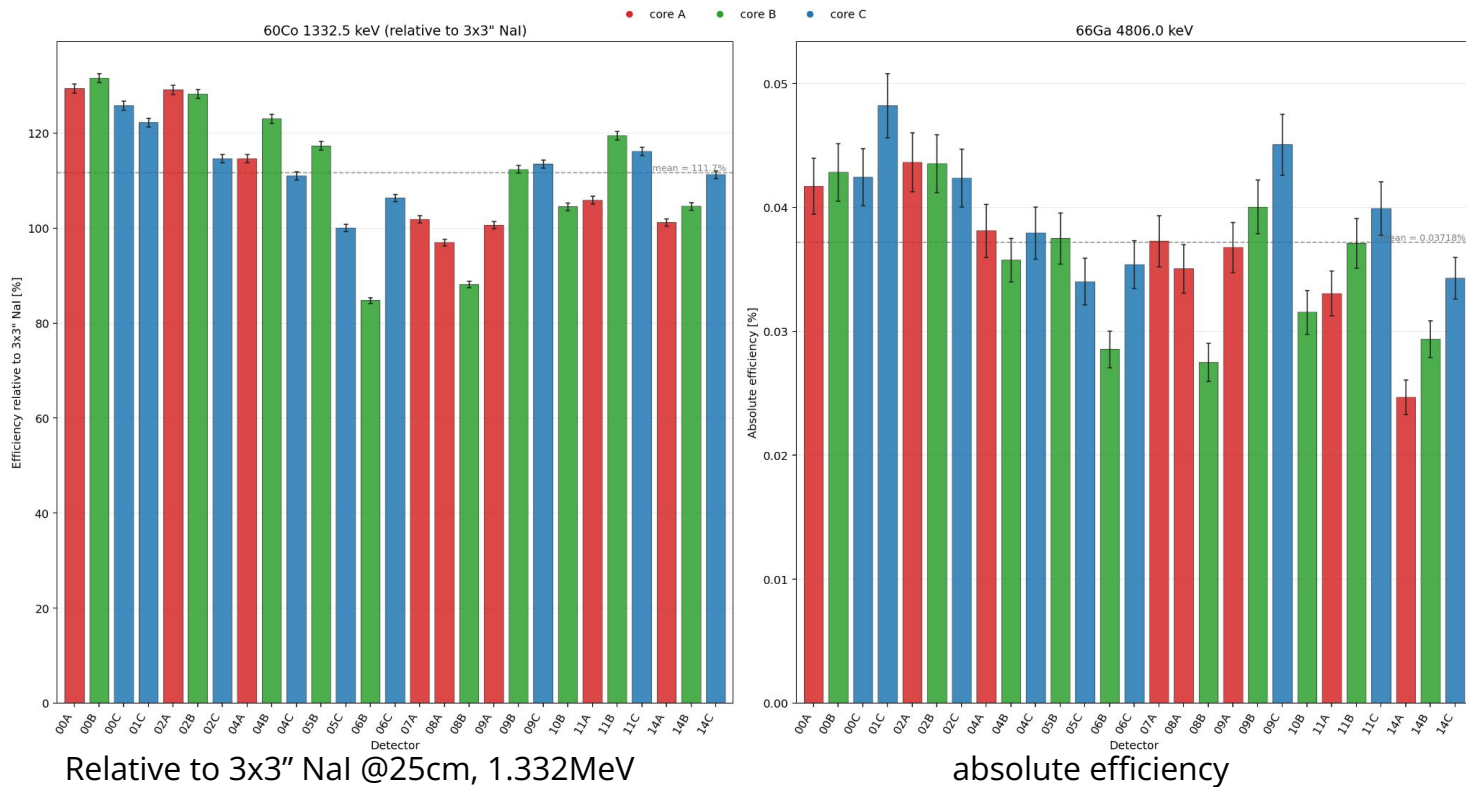
## AGATA crystals - nominal, core efficiencies



# Efficiency

## AGATA crystals - close-up, core efficiencies

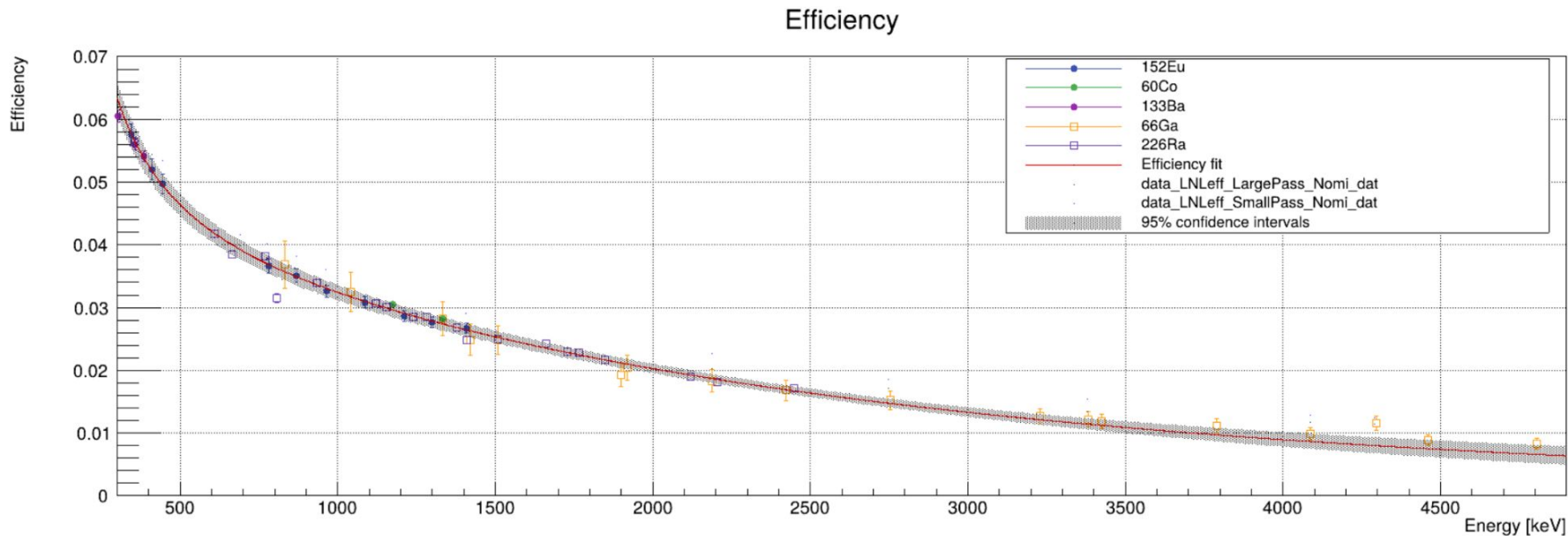
Fitted efficiency-curve comparison



# Efficiency

## AGATA crystals - nominal, core efficiencies

- 6th order polylog function,  $E > 300\text{keV}$

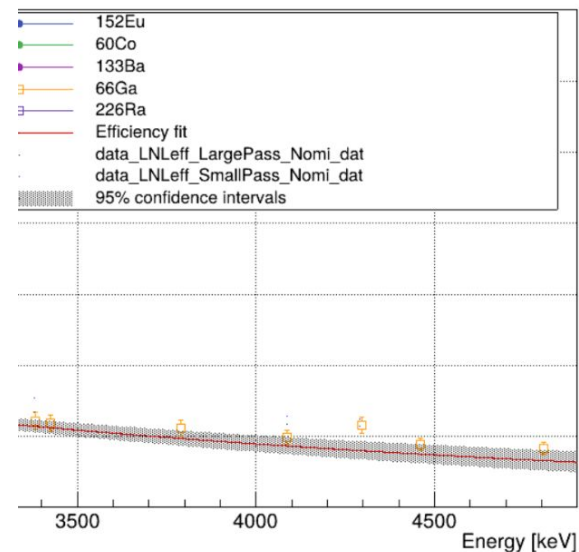
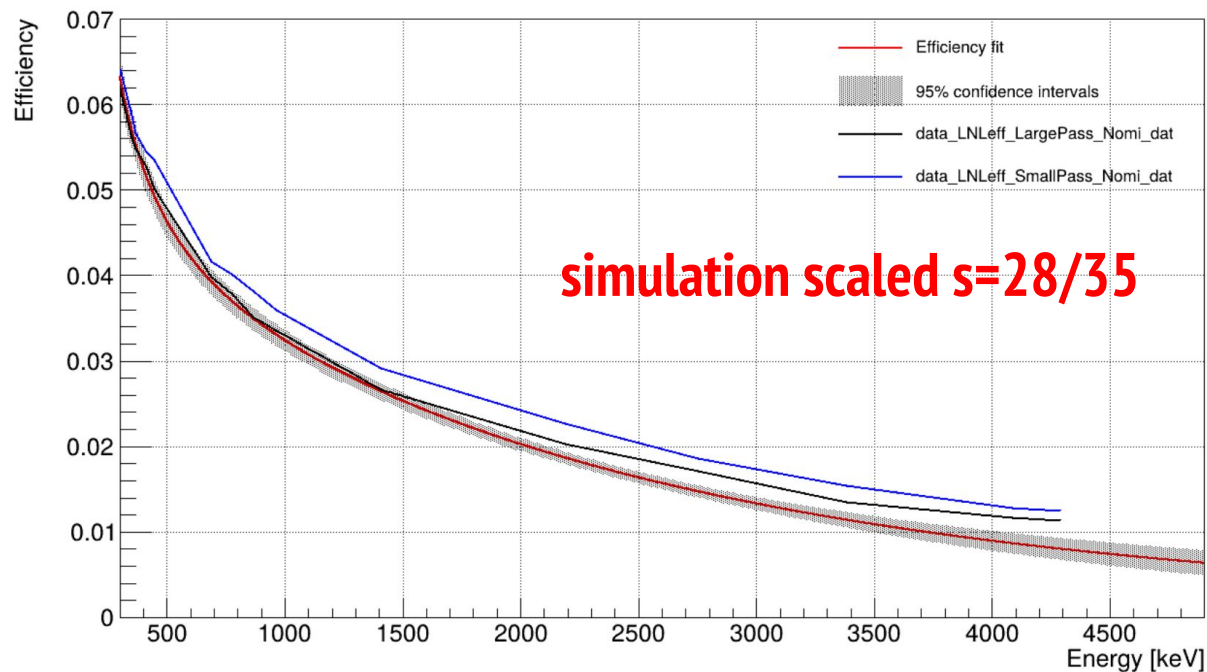


# Efficiency

## AGATA crystals - nominal, core efficiencies

- 6th order polylog function,  $E > 300 \text{ keV}$

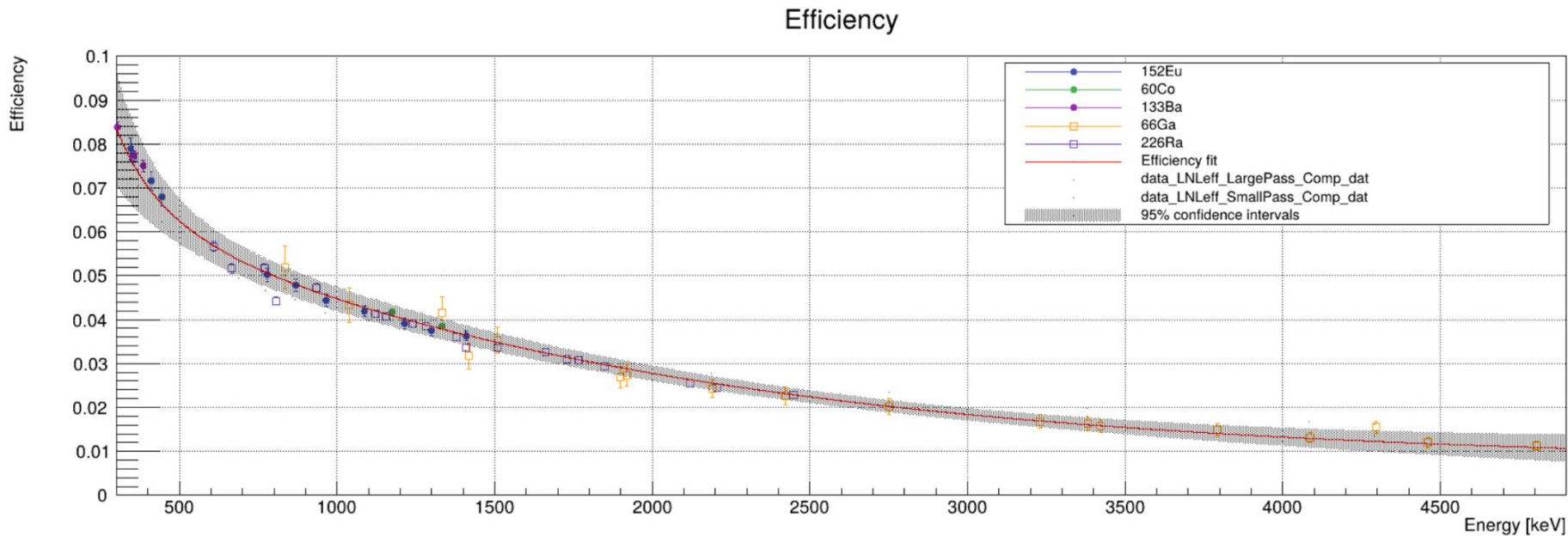
Efficiency curve and external data



# Efficiency

## AGATA crystals - close-up, core efficiencies

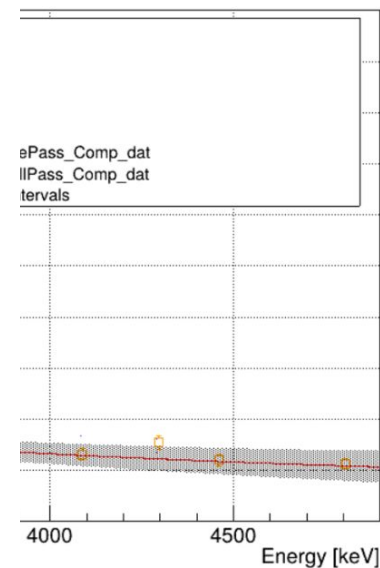
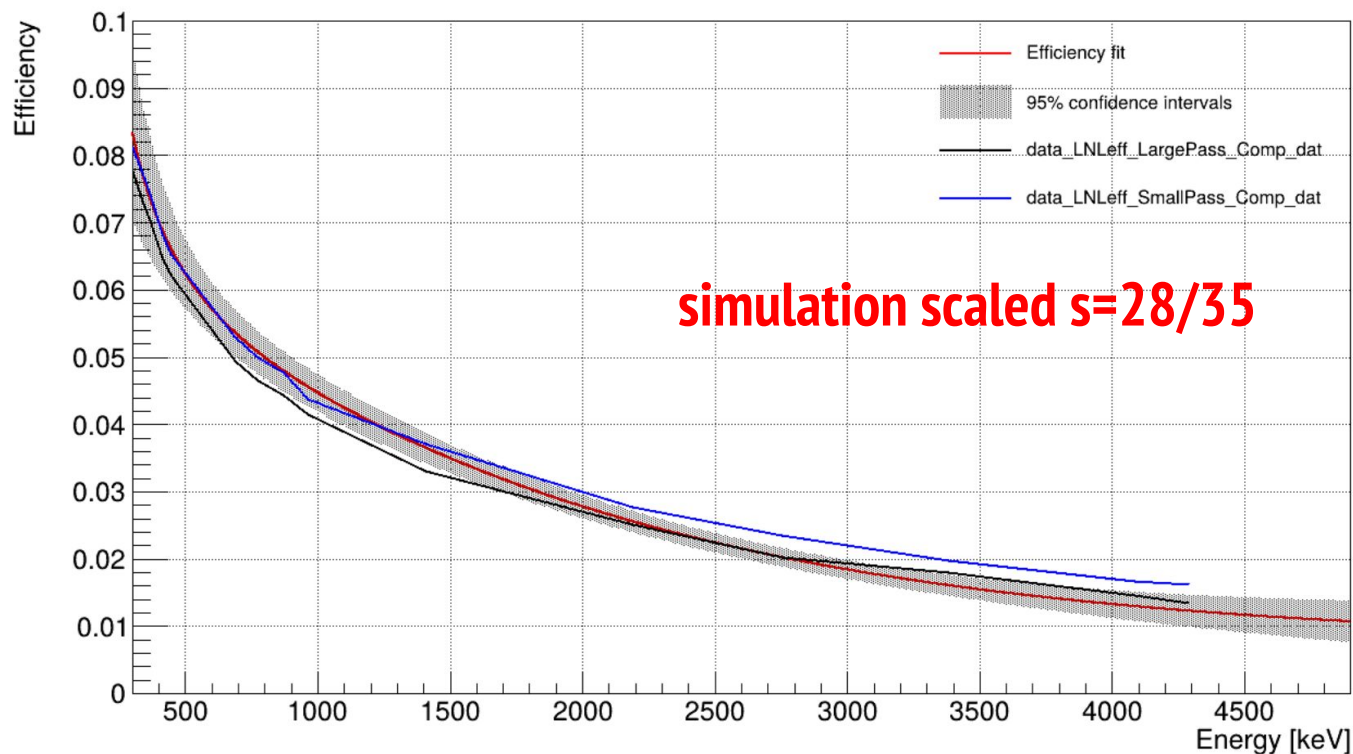
- 6th order polylog function,  $E > 300\text{keV}$



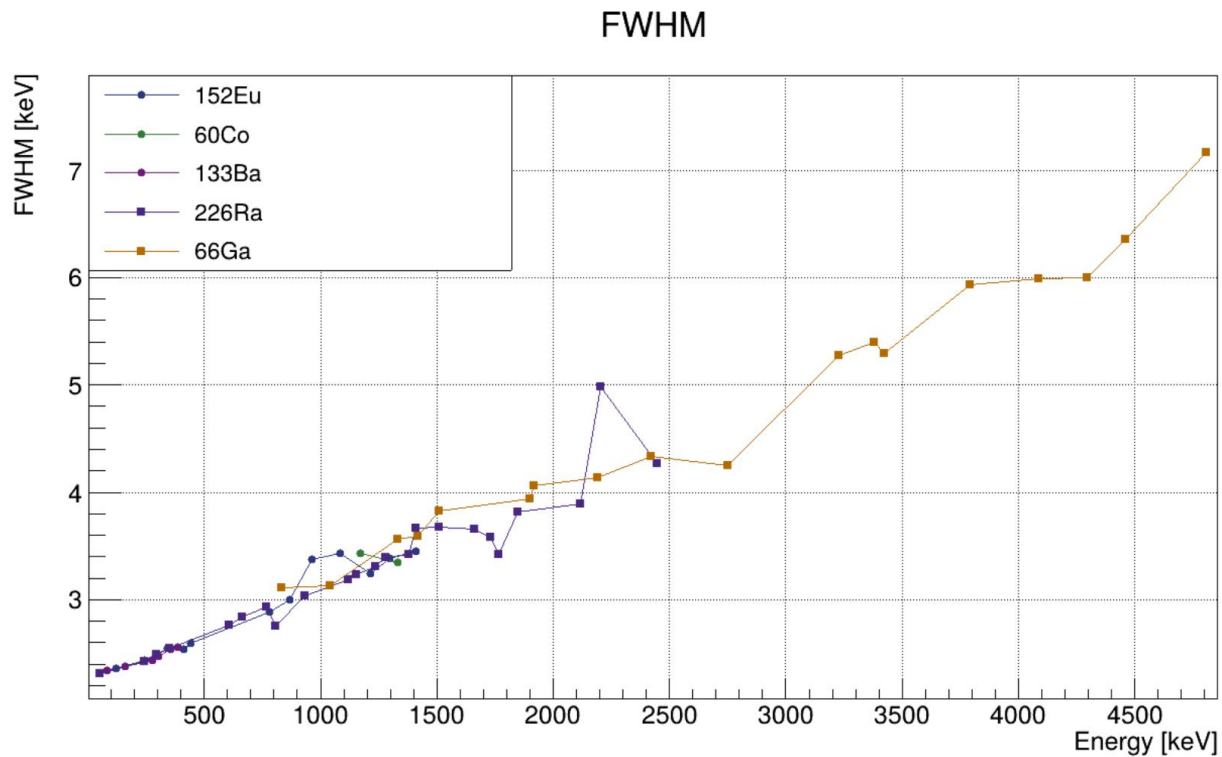
# Efficiency

## AGATA crystals - close-up, core efficiencies

Efficiency curve and external data



# FWHM - sum of 28 *good* crystals

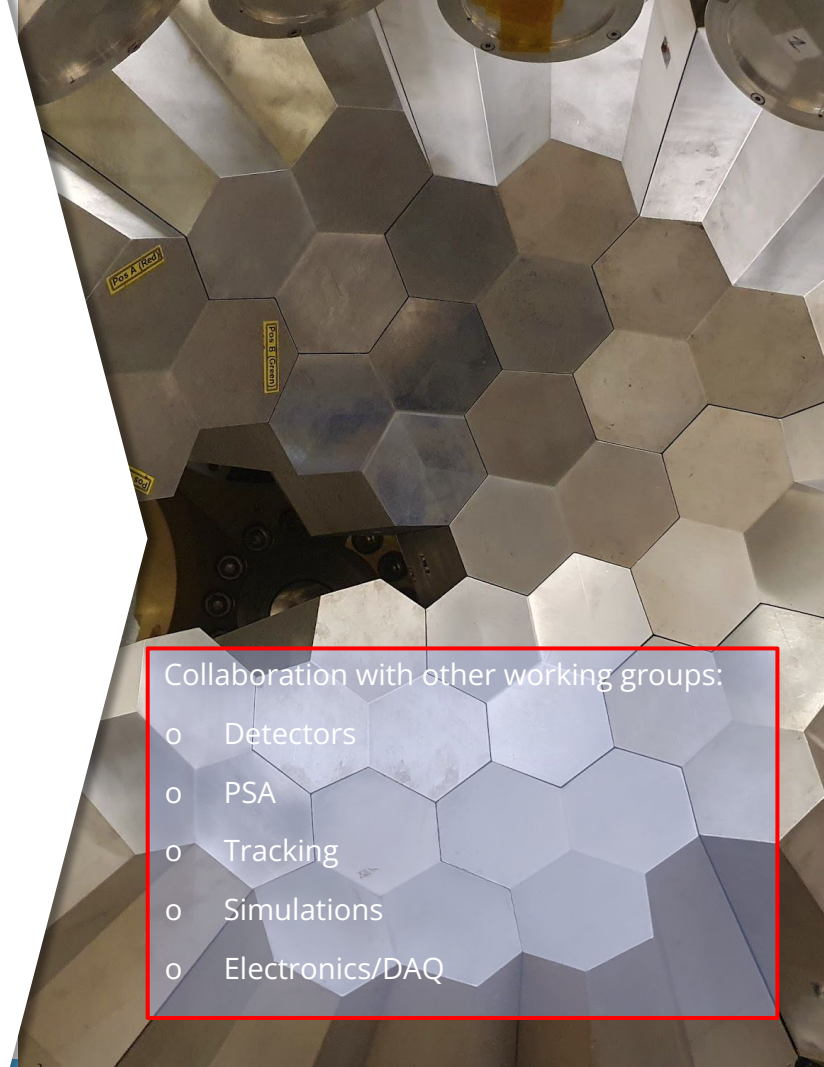


# Summary

- o Experiments looking for gamma rays in the region between 2-5 MeV where the performances in terms of calibration, efficiency and tracking are not well known.
- o **Measurement to investigate those performances up to 5 MeV realized at the end of July 2024**
- o First steps:
  - o **Deadtime evaluation**
  - o **Validation PostPSA**
  - o **Core analysis**
  - o **Validation of GEANT4 simulations**
- o Next steps:
  - o Re-calibration of misbehaving 4 detectors
  - o Optimization of the tracking algorithms
  - o Addback analysis
- o Future perspectives: towards high multiplicity events

Collaboration with other working groups:

- o Detectors
- o PSA
- o Tracking
- o Simulations
- o Electronics/DAQ



# Status of the high-energy performance measurement and simulation

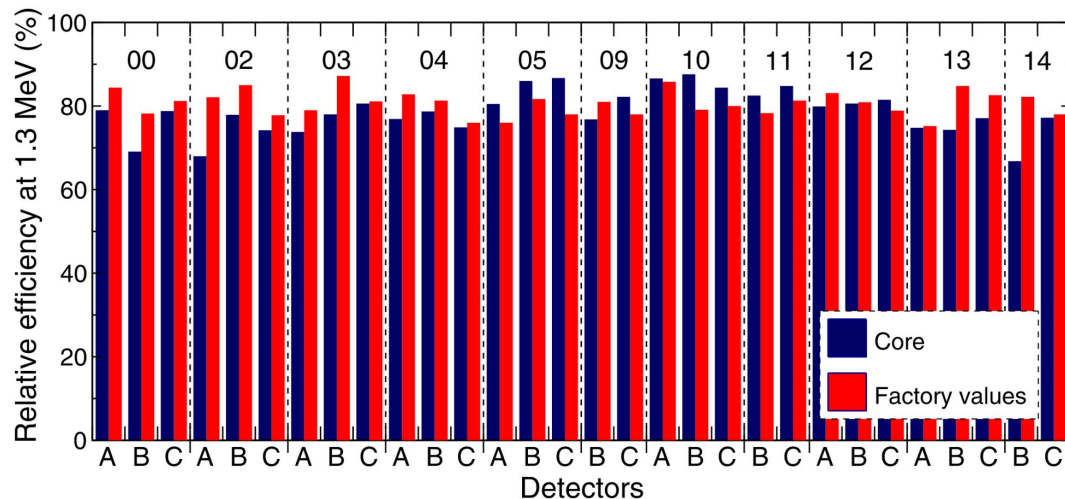
*M. Balogh, R. M. Pérez-Vidal, R. Imamoto, S. Bottoni, S. Pigliapocco  
for the AGATA collaboration*

26<sup>th</sup> AGATA Week | 11<sup>th</sup> September 2026

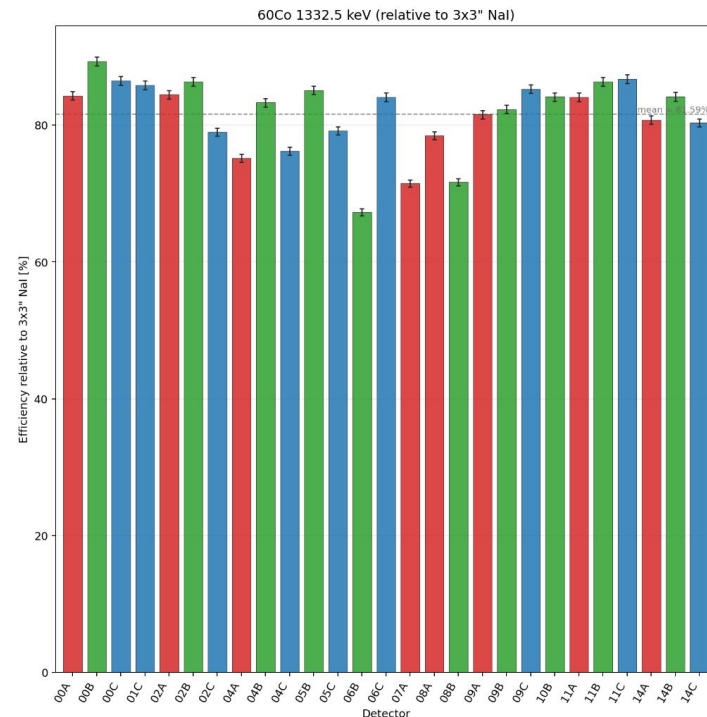
Thank you for  
your attention

0

# Nominal efficiency: @GANIL vs @LNL



GANIL



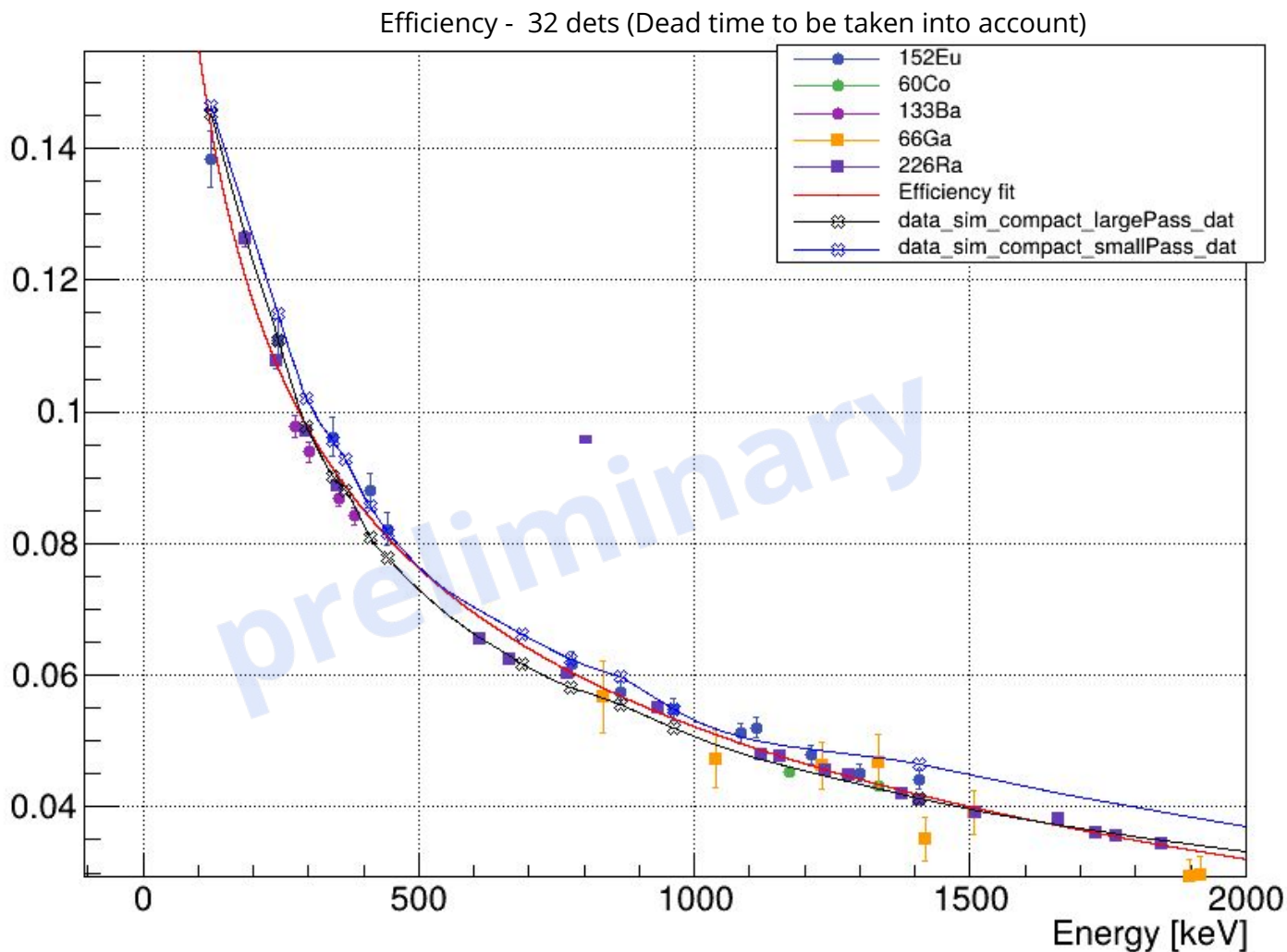
LNL

# Efficiency

## AGATA array @ Close Up core

| Source | Rate             |
|--------|------------------|
| 60Co   | 1.5kHz           |
|        | 2kHz             |
| 152Eu  | 2kHz             |
|        | 3kHz             |
| 133Ba  | 2kHz             |
|        | 2.7kHz           |
| 226Ra  | 1.6kHz           |
|        | 2KHz             |
| Target | 1.8kHz           |
|        | 1.2kHz           |
|        | 0.7kHz           |
|        | 0.45kHz & 1.5kHz |
| 60Co   | 1kHz-0.8Hz       |

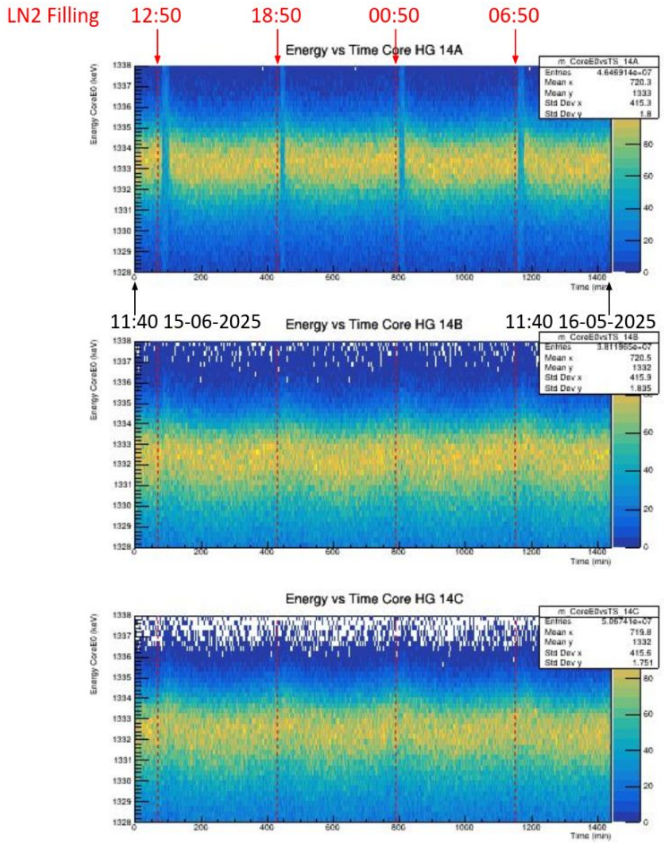
Efficiency



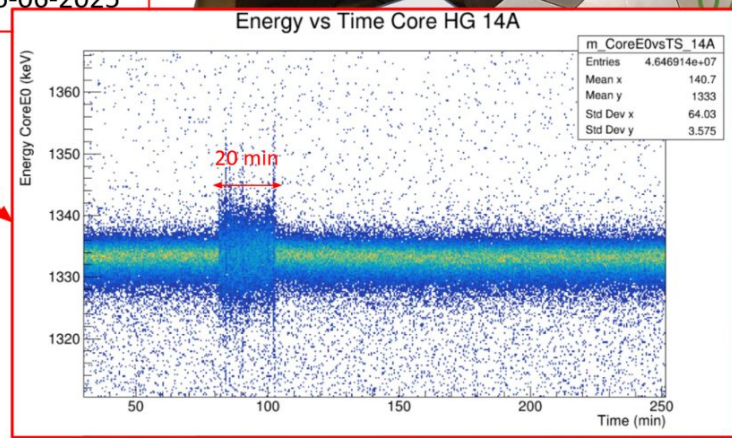
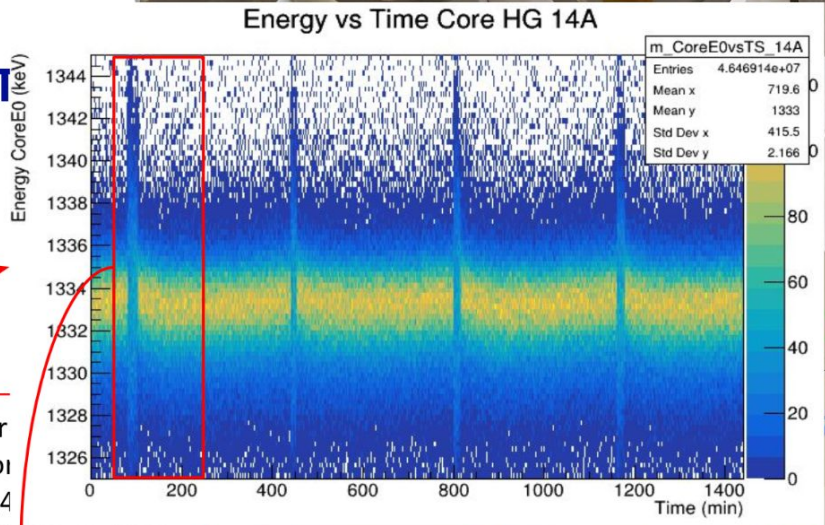


# 24h measurement

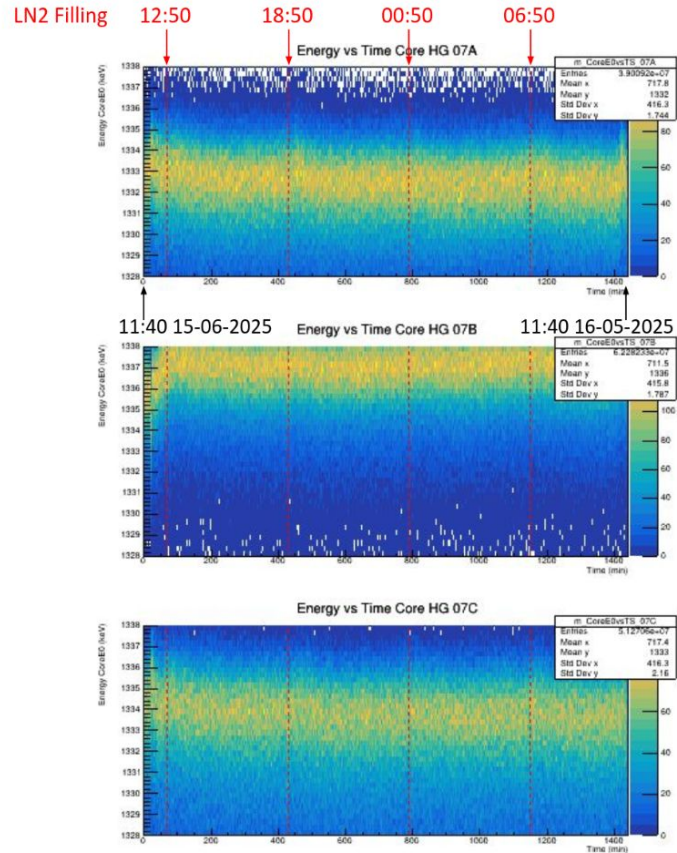
Pos 14 - AT



60Co r  
HG col  
START: 11:4  
STOP: 11:40 16-06-2025

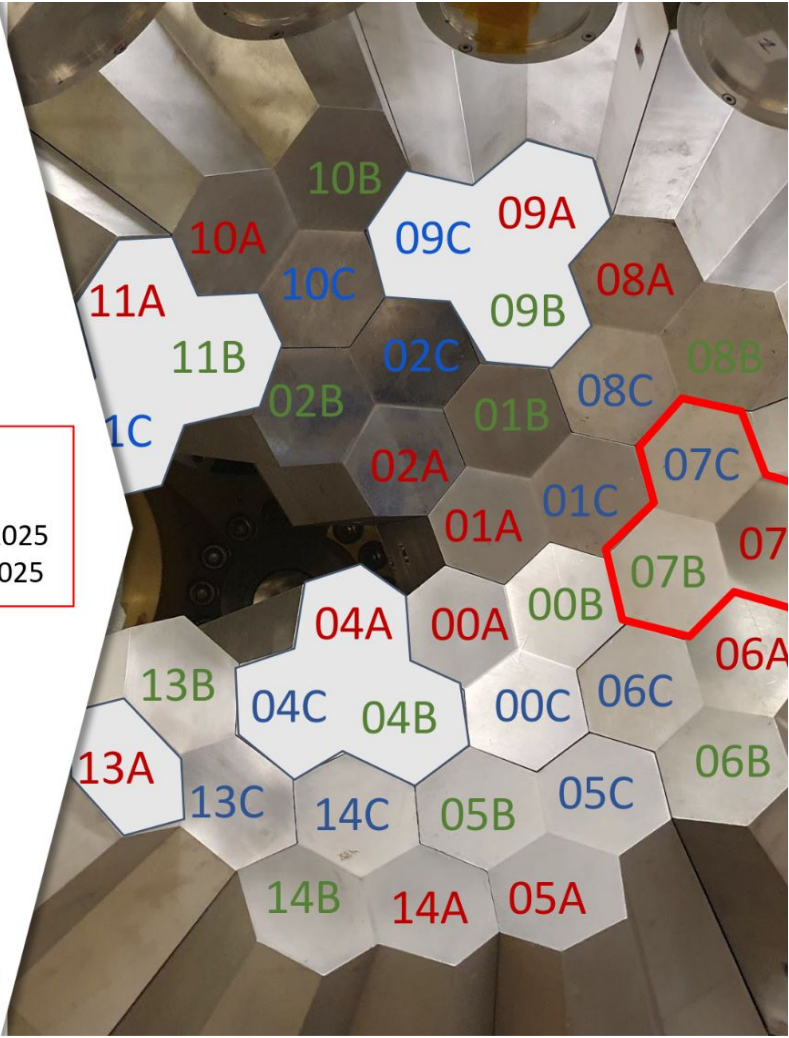


# 24h measurement Pos 7 - ATC 2

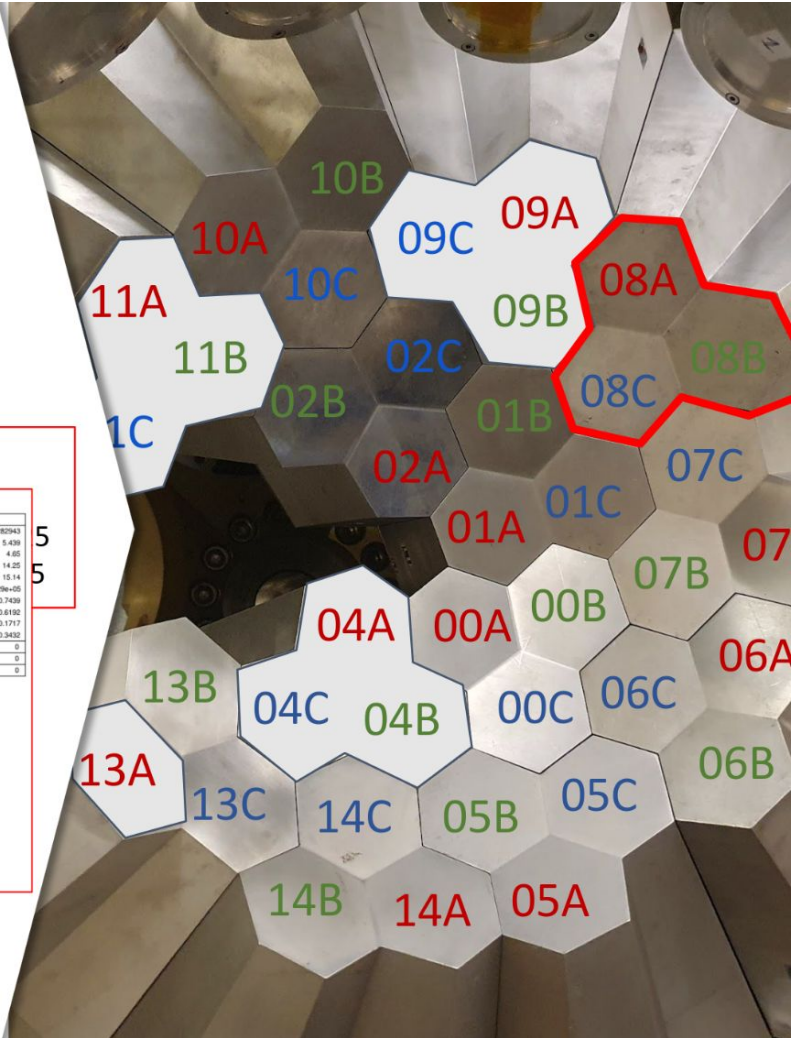
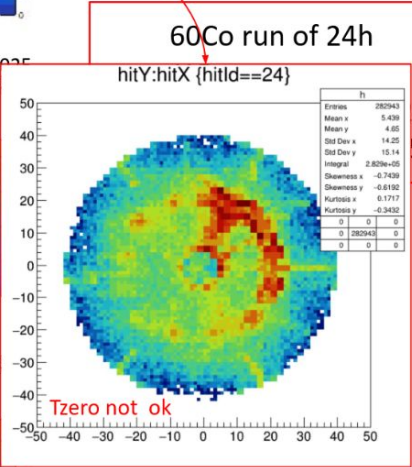
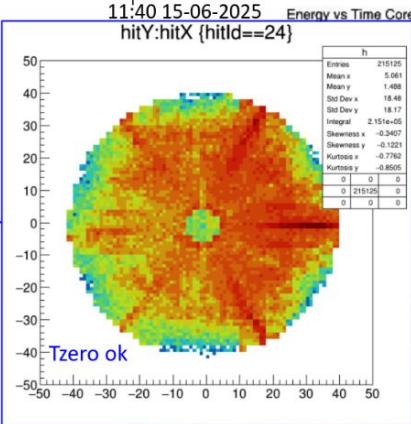
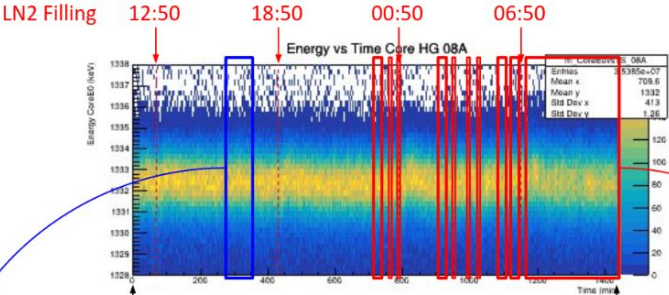


bad resolution due to  
the continuous  
oscillation of the energy  
in the HG core (LG ok)

NOT related to the filling



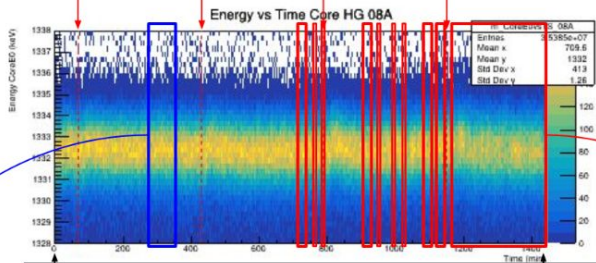
# 24h measurement Pos 8 - ATC 22



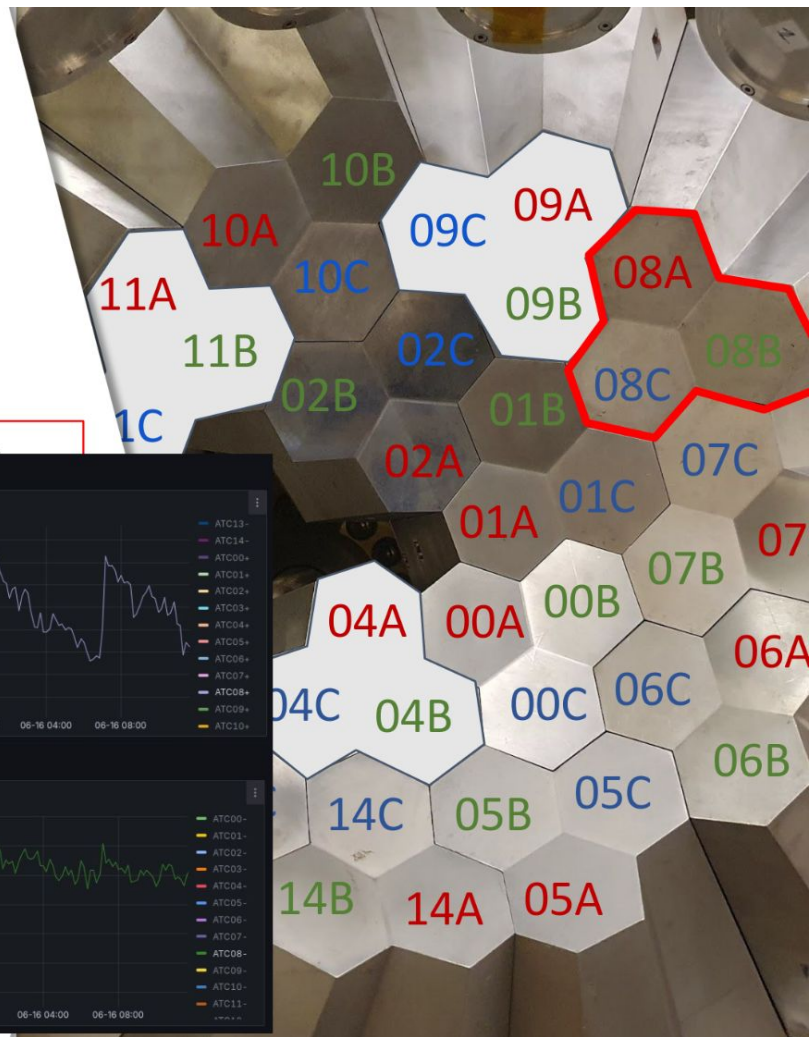
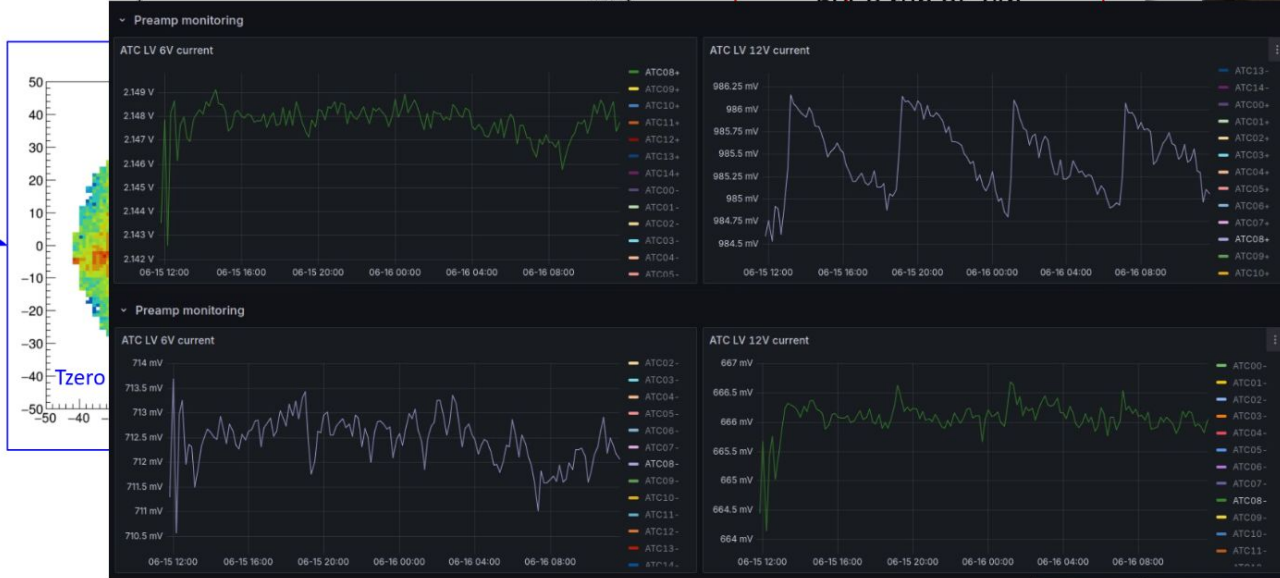
courtesy of R. M. Pérez-Vidal (slides from AW 2025)

## 24h measurement Pos 8 - ATC 22

|             |       |       |       |       |
|-------------|-------|-------|-------|-------|
| LN2 Filling | 12:50 | 18:50 | 00:50 | 06:50 |
|-------------|-------|-------|-------|-------|



60C group of 24b



# Data Processing

## Narval Actors

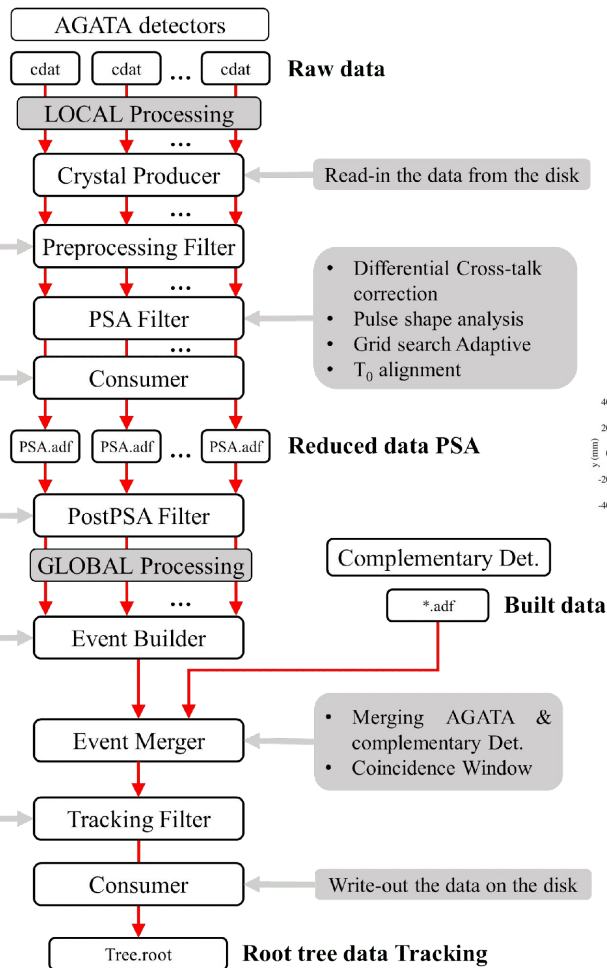
- Energy Calibration
- Time Alignment
- Cross-talk correction
- Segment correction

Write-out the data on the disk

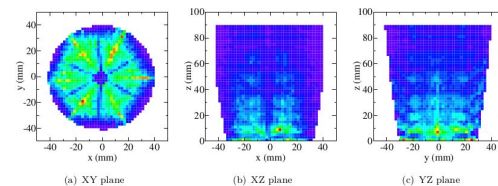
- Re-calibration
- Neutron damage correction
- Global Time alignment

- Global reference frame
- Event validation
- TimeStamp Wwndow

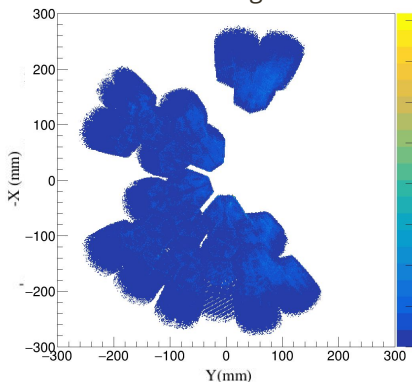
- Gamma-ray path reconstruction
- OFT algorithm



Pulse Shape Analysis



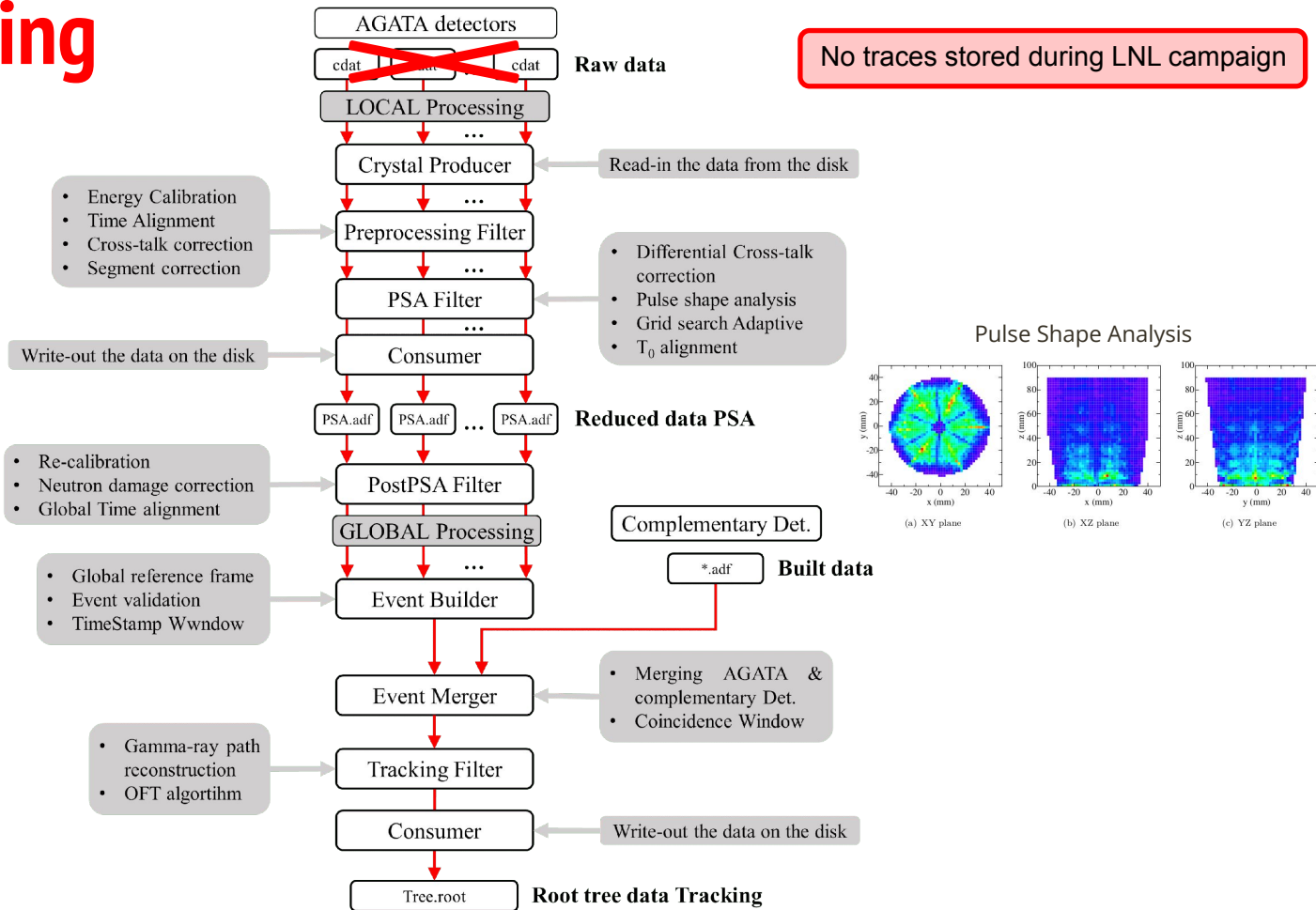
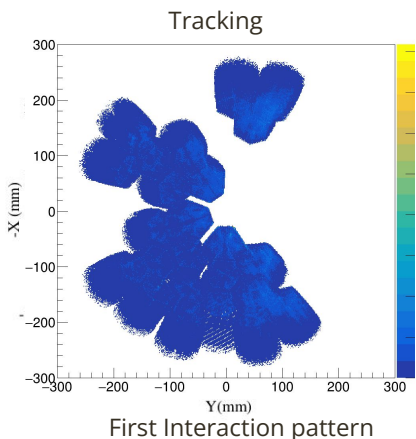
Tracking



First Interaction pattern

# Data Processing

## Narval Actors



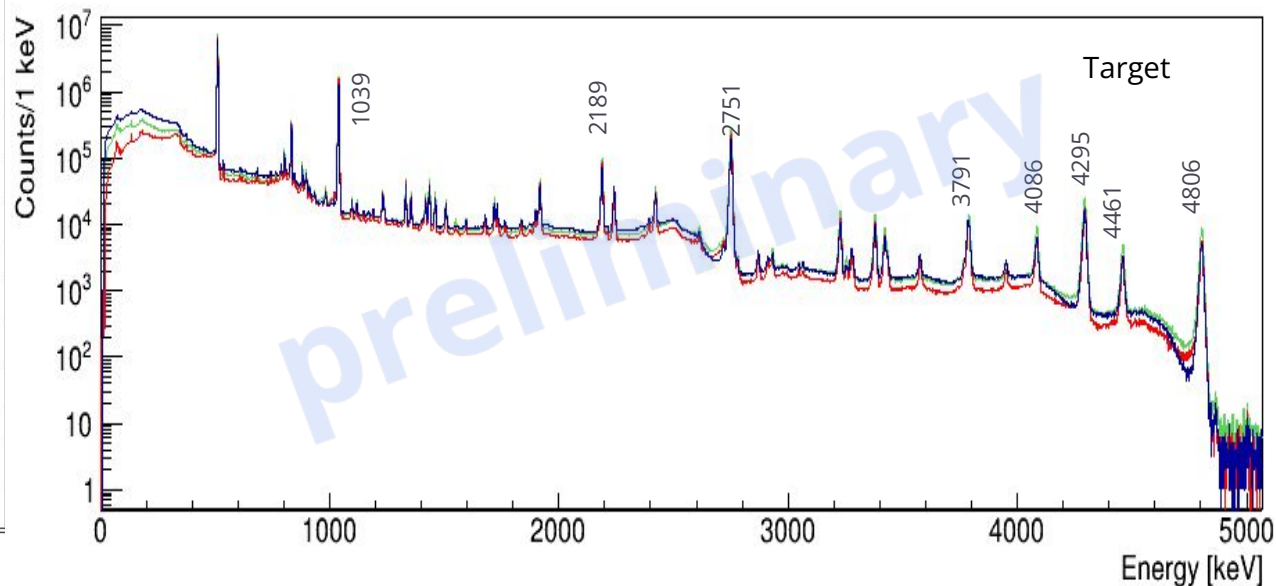
# Efficiency

## AGATA array

$^{66}\text{Zn}(p,n)^{66}\text{Ga}$  reaction:

| Energy [keV] | Intensity [%] | Rel. uncertainty [%] |
|--------------|---------------|----------------------|
| 833.53       | 5.90          | 5.08                 |
| 1039.22      | 37.00         | 5.41                 |
| 1333.11      | 1.17          | 5.13                 |
| 1918.33      | 1.99          | 5.53                 |
| 2189.62      | 5.30          | 5.66                 |
| 2422.53      | 1.88          | 5.32                 |
| 2751.84      | 22.70         | 5.29                 |
| 3228.80      | 1.61          | 5.30                 |
| 3380.85      | 1.47          | 5.44                 |
| 3422.04      | 0.86          | 5.81                 |
| 3791.00      | 1.09          | 5.50                 |
| 4085.85      | 1.27          | 5.51                 |
| 4295.19      | 3.81          | 5.51                 |
| 4461.20      | 0.84          | 5.95                 |
| 4806.01      | 1.86          | 5.38                 |

|         |                                                                                |
|---------|--------------------------------------------------------------------------------|
| Core    | sum of the core histograms over all crystals                                   |
| Tracked | energy of the reconstructed tracks after OFT algorithm                         |
| Addback | sum all the neighbouring crystal cores position is given by the highest energy |



# Data Processing

## Narval Actors

Operations up to the PSA need to be carefully prepared before the experiment and checked online

- Energy Calibration
- Time Alignment
- Cross-talk correction
- Segment correction

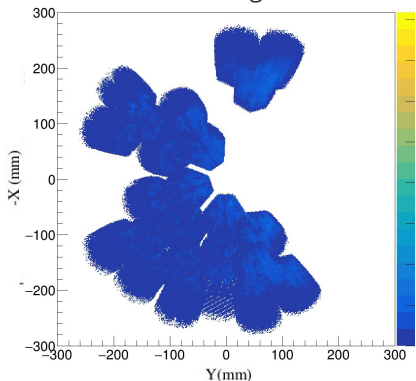
Write-out the data on the disk

- Re-calibration
- Neutron damage correction
- Global Time alignment

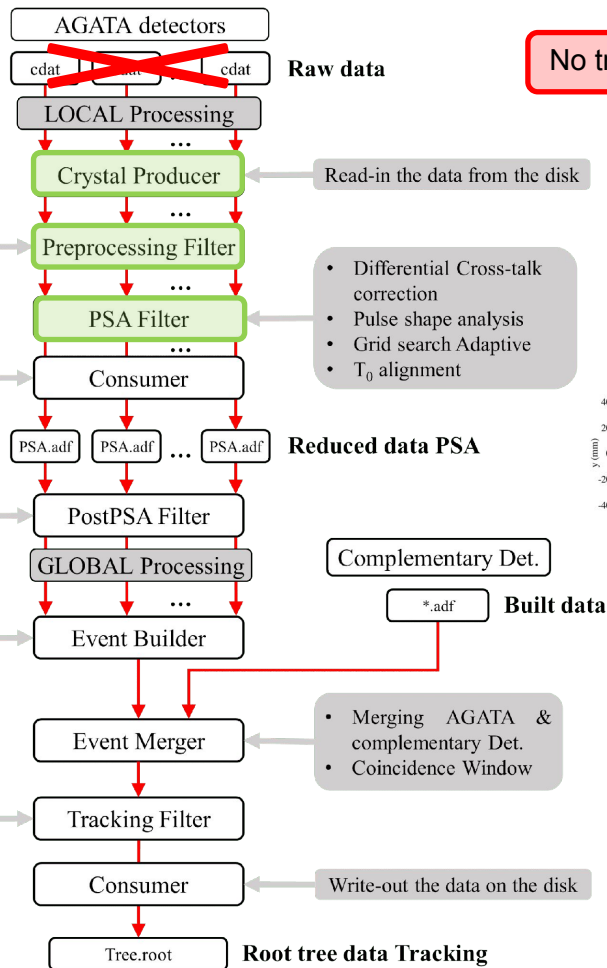
- Global reference frame
- Event validation
- TimeStamp Wwindow

- Gamma-ray path reconstruction
- OFT algorithm

Tracking

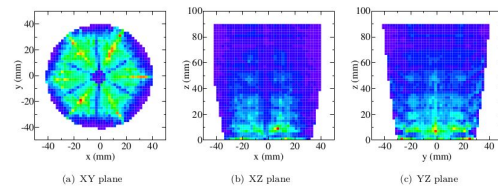


First Interaction pattern



No traces stored during LNL campaign

Pulse Shape Analysis



# Resolutions

## Before vs after irradiation

