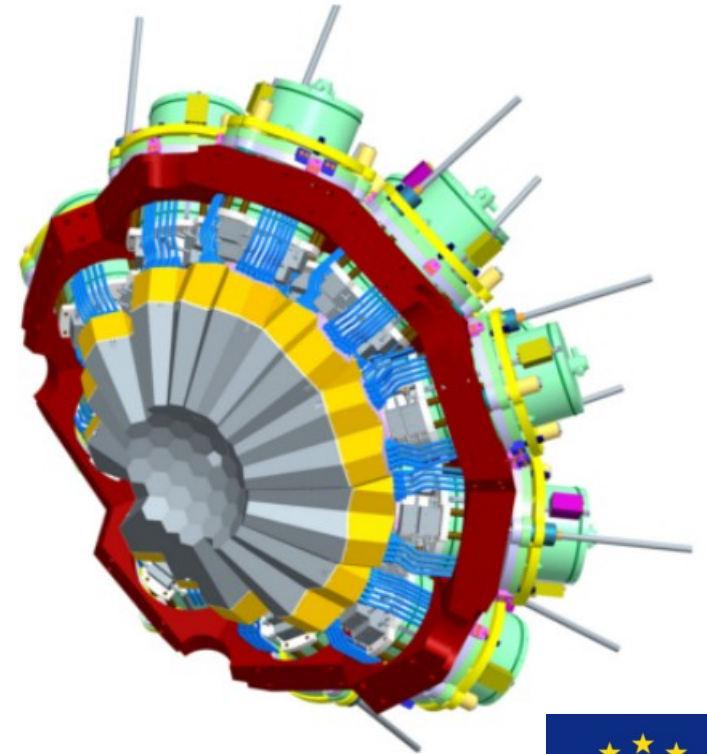


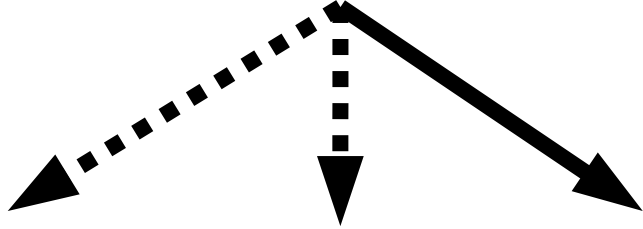
# Large-volume trapping area in Symmetric AGATA crystal (S001)

Mohamad MOUKADDAM  
Université de Strasbourg / IPHC

Journées AGATA France  
21 Nov 2022



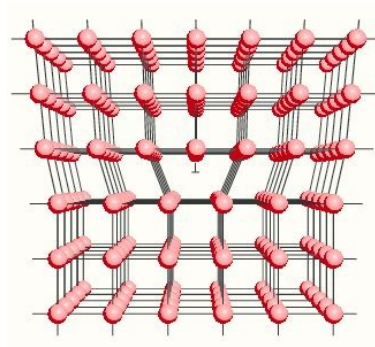
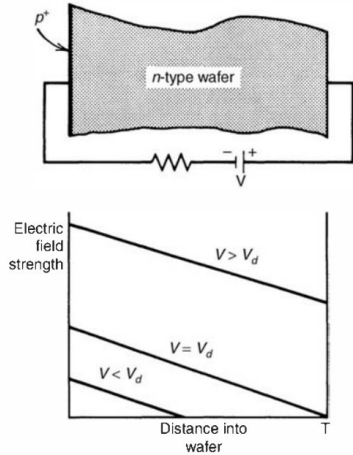
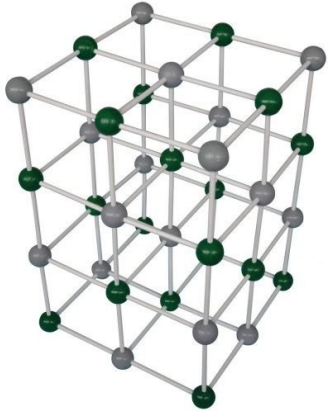
# Typical Traps



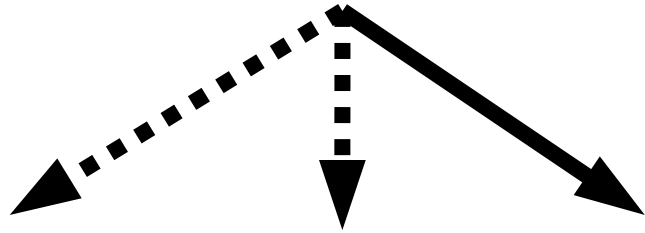
Recombination of the carriers  
(perfect crystallin structure)

Loss of charges in specific areas  
(near the junction or at the surface where the E is small)

Trapping of the carriers in impurities and defects in the crystal



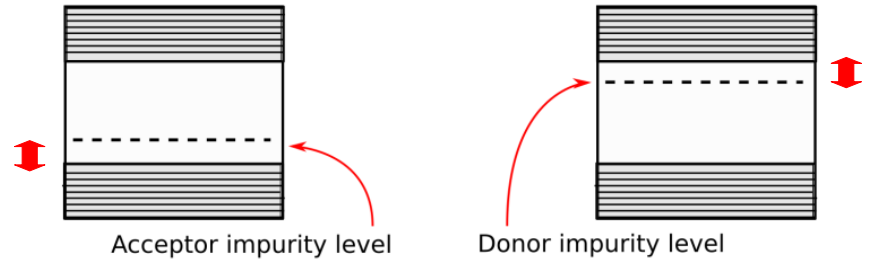
# Typical Traps



Recombination of the carriers (perfect crystallin structure)

Loss of charges in specific areas (near the junction or at the surface where the E is small)

Trapping of the carriers in impurities and defects in the crystal



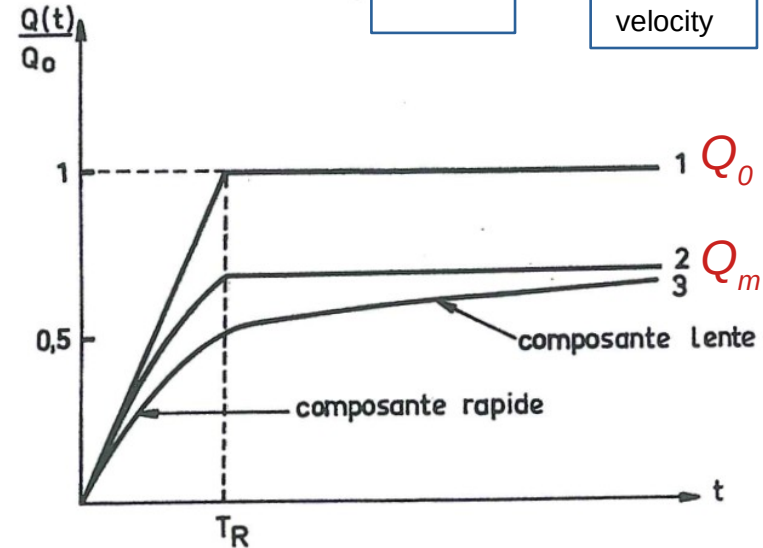
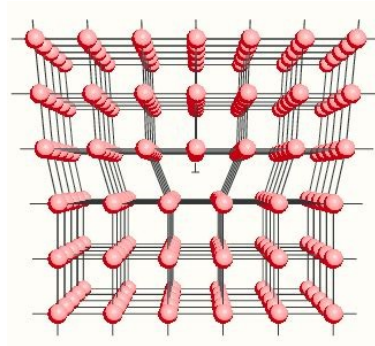
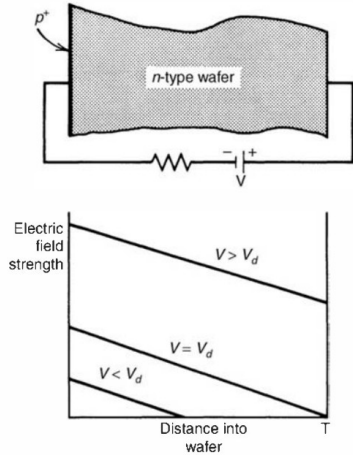
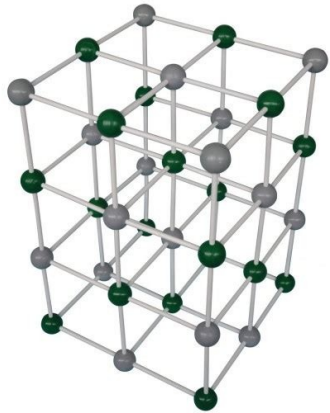
time before capture

$$\tau_{n0} = \frac{1}{\sigma_n v_{th} N_i}$$

Cross section

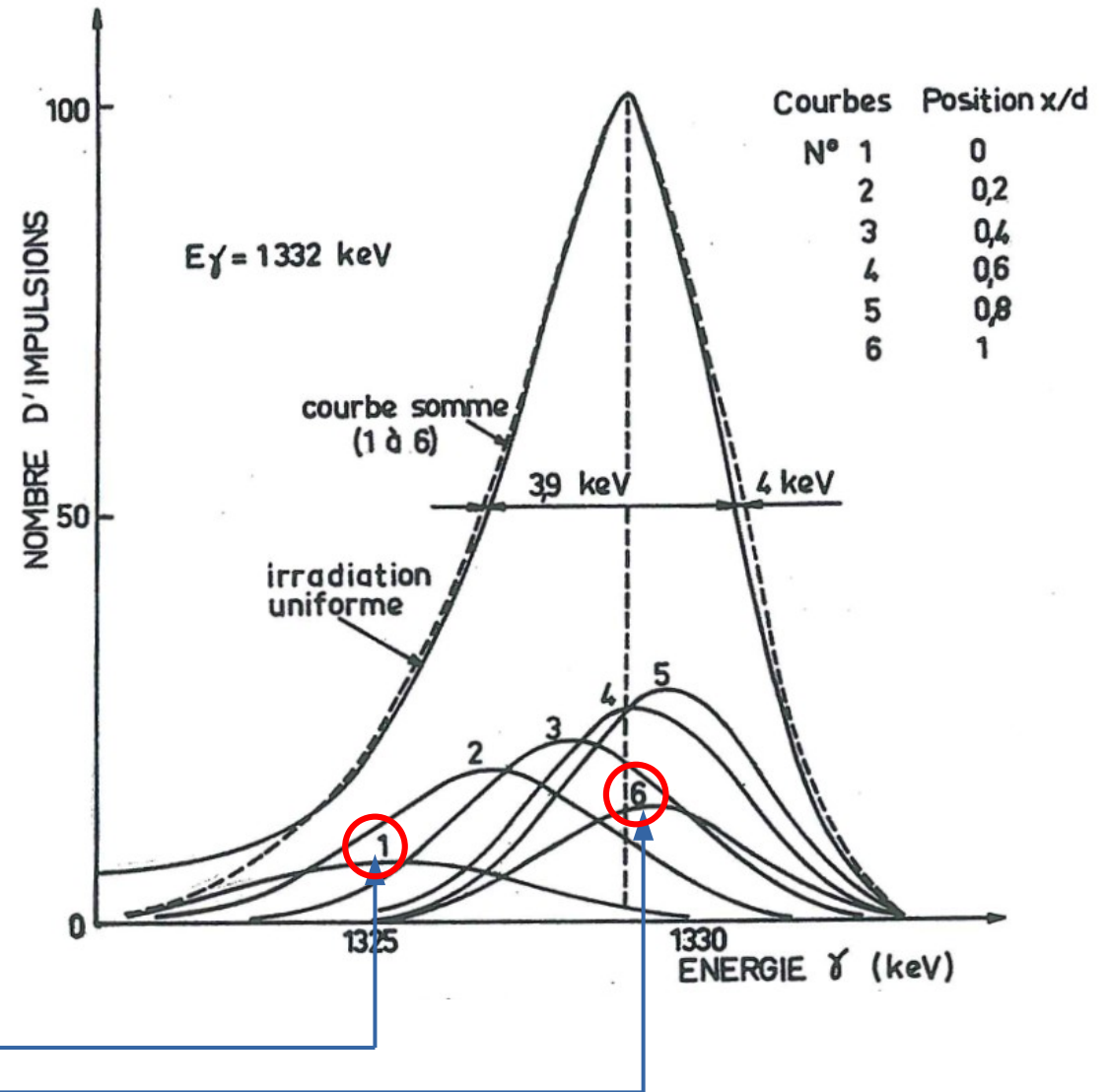
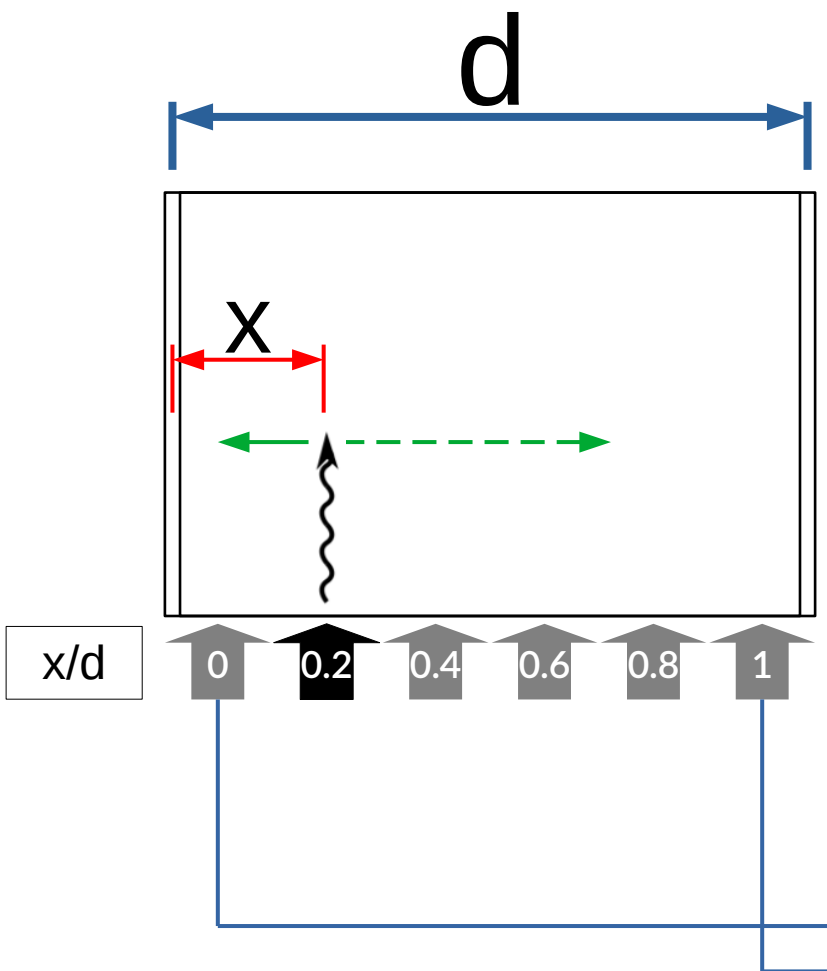
Mean Thermal velocity

Level density

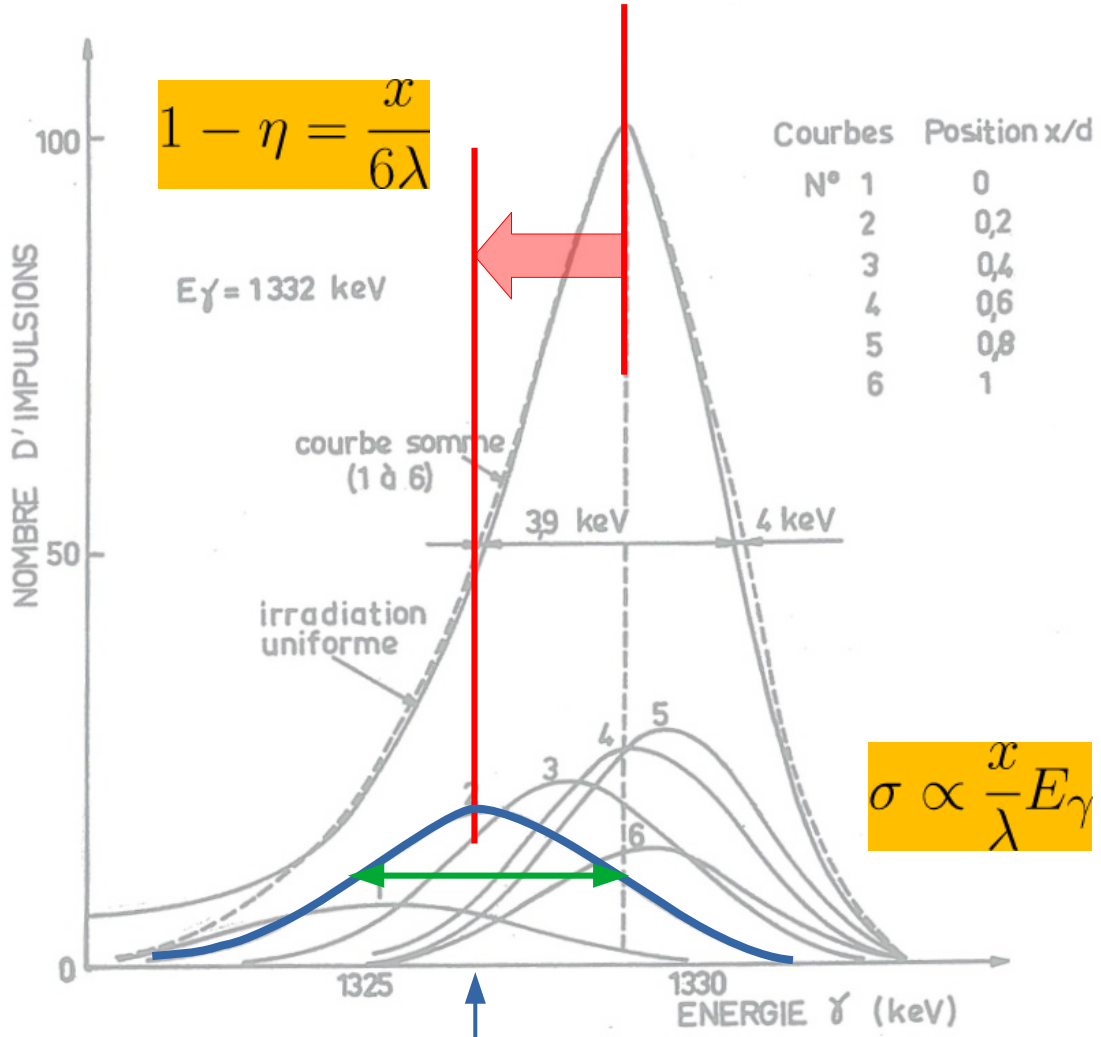
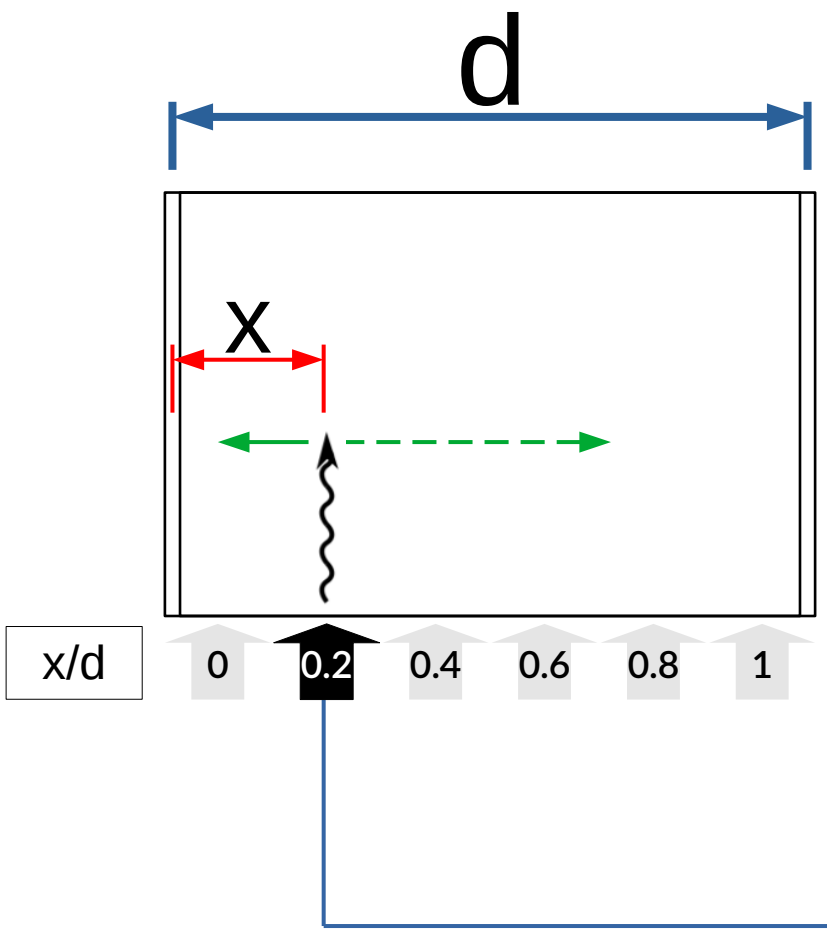


$$\eta = \frac{Q_m}{Q_0}$$

# Trap "markers"

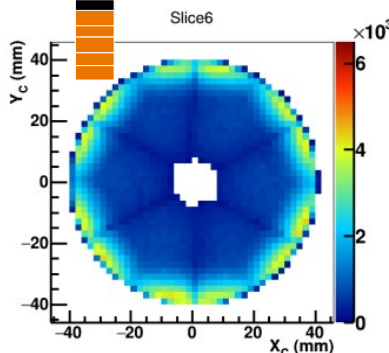
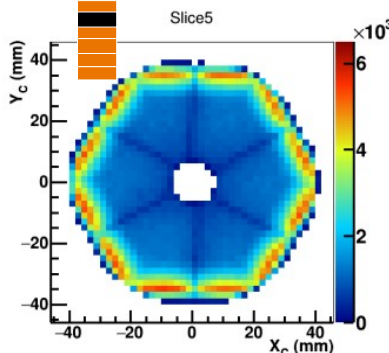
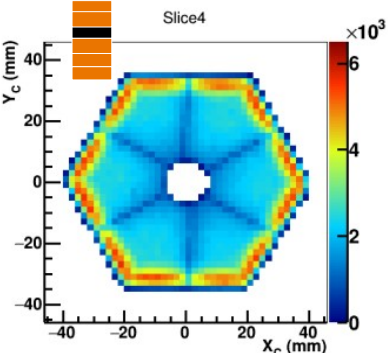
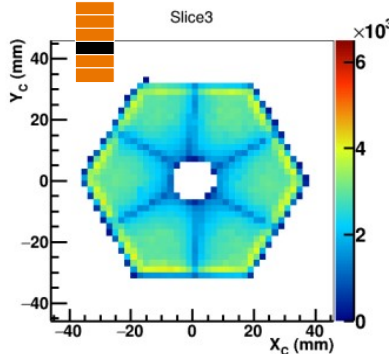
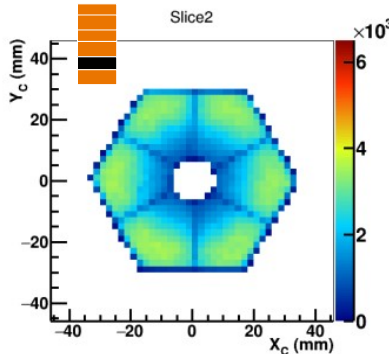
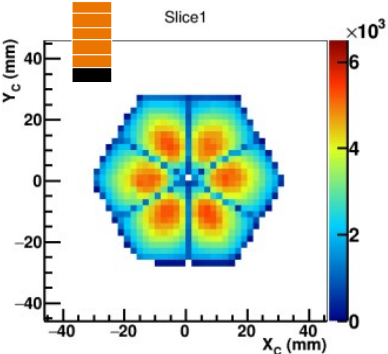
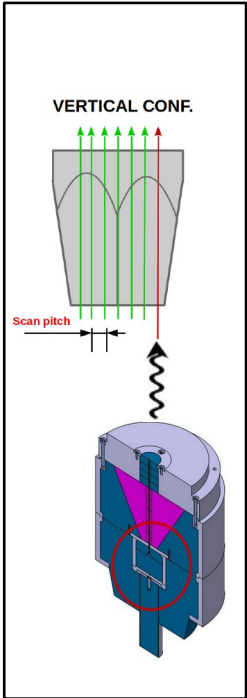
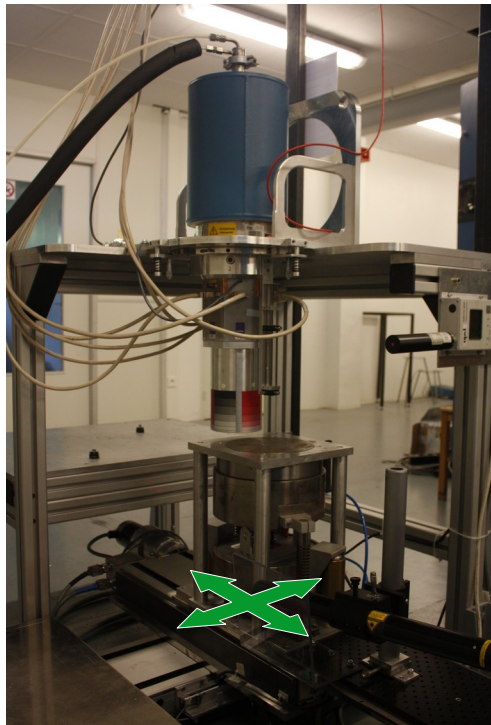


# Trap "markers"



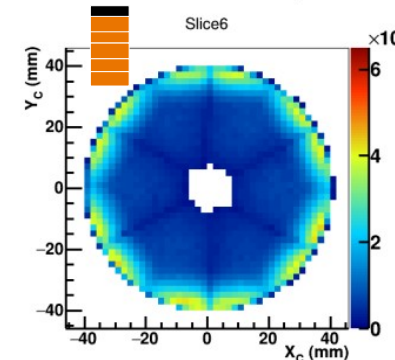
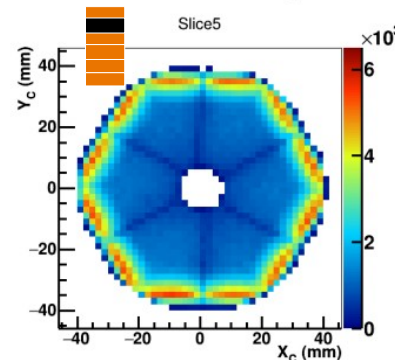
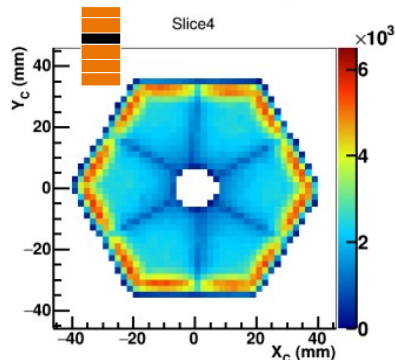
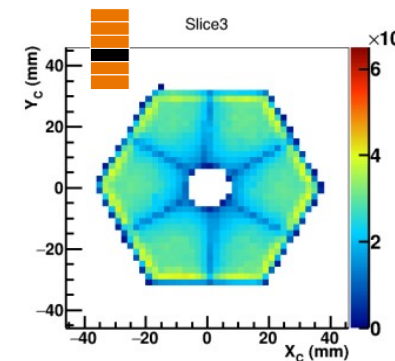
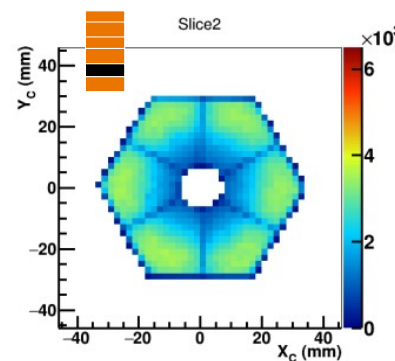
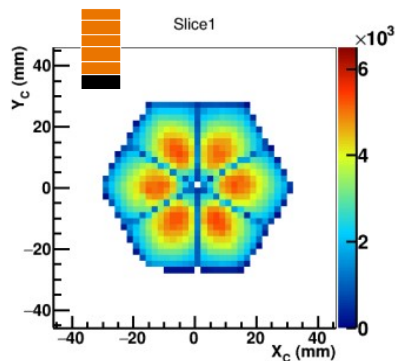
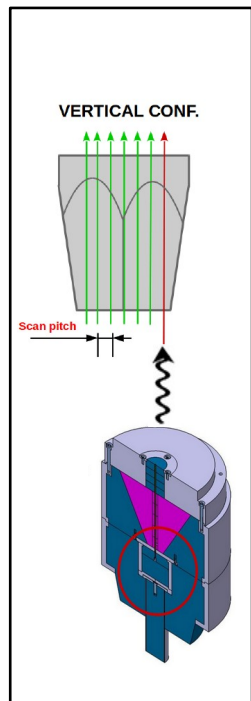
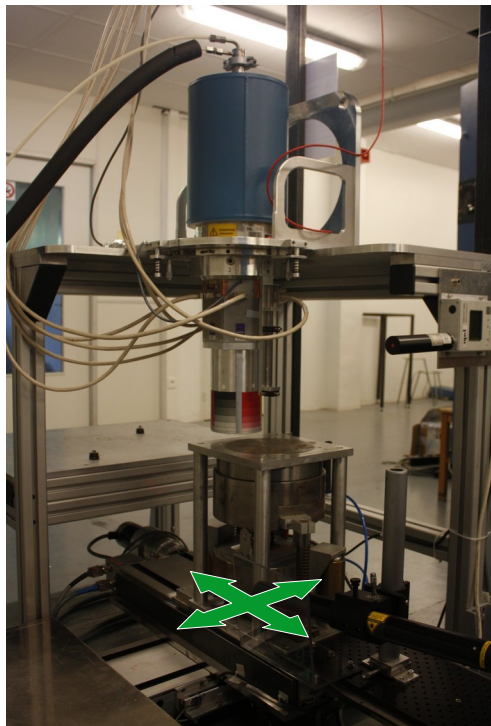


# Scanning Table

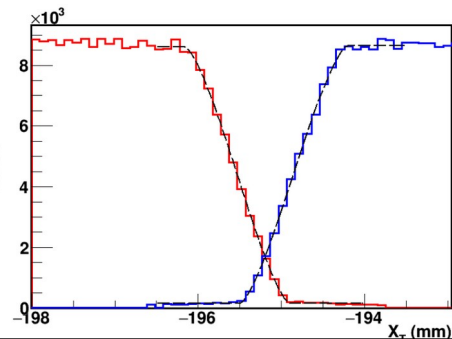
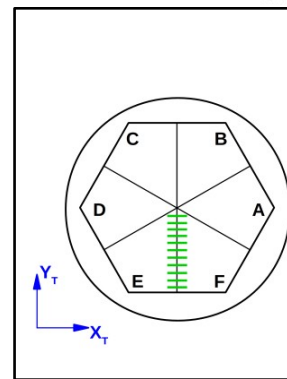
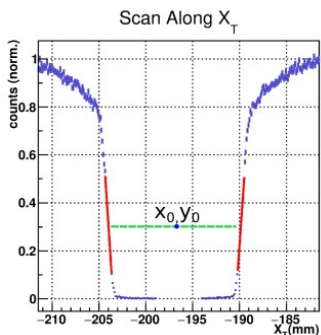
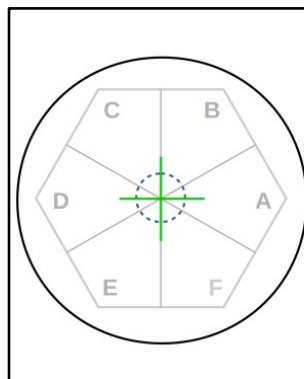


- $dx, dy \sim 0.02$  mm
- Vert. / Horiz. configuration
- Sources ( $^{241}\text{Am}$ ,  $^{137}\text{Cs}$ ,  $^{152}\text{Eu}$ )
- Collimator 0.5, 1.0, 1.5 mm

# Scanning Table

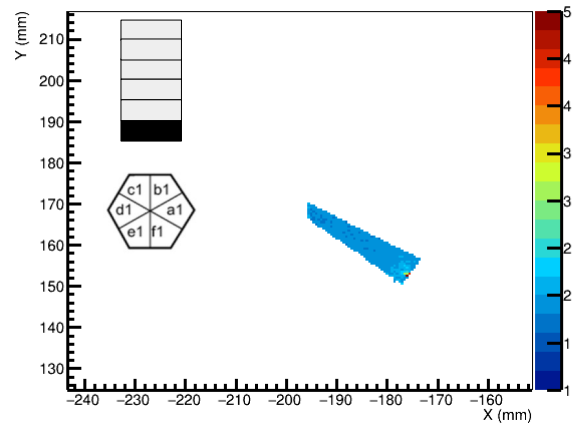


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- Vert. / Horiz. configuration
- Sources ( $^{241}\text{Am}$ ,  $^{137}\text{Cs}$ ,  $^{152}\text{Eu}$ )
- Collimator 0.5, 1.0, 1.5 mm

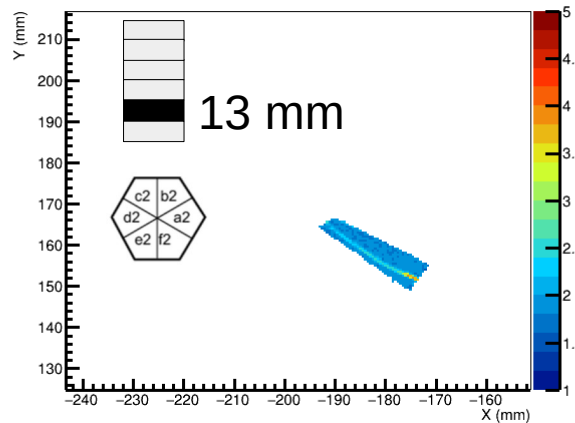


# Detecting Anomalies

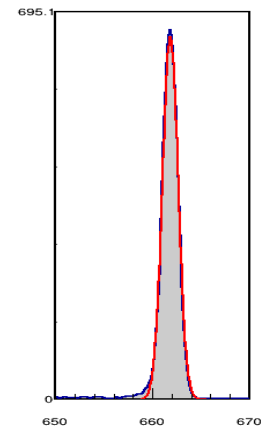
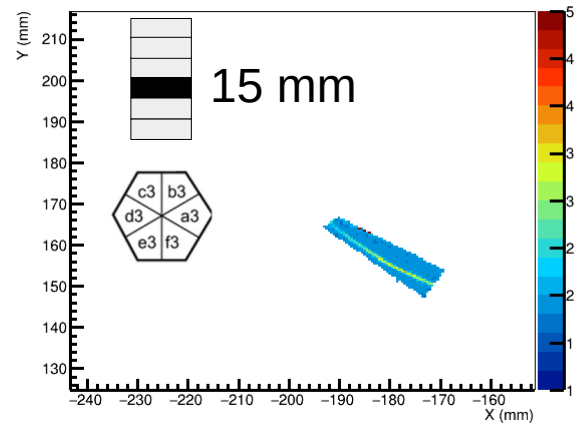
Segment resolution slice 1



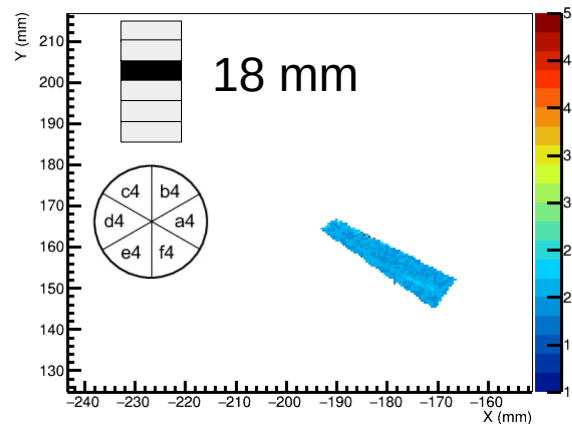
Segment resolution slice 2



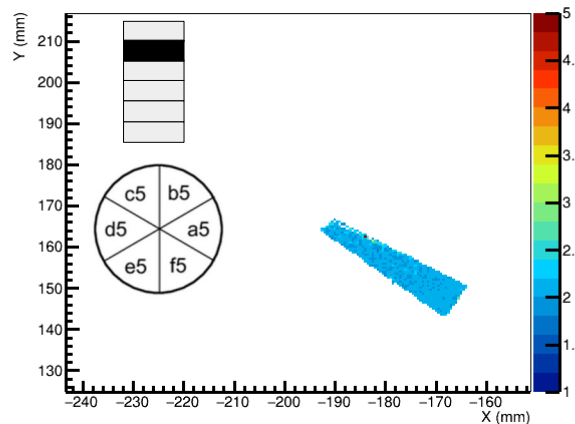
Segment resolution slice 3



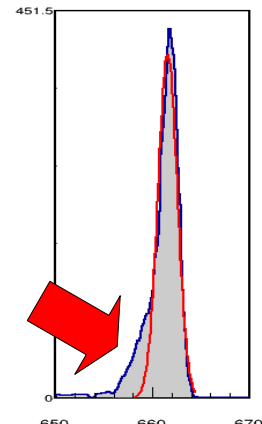
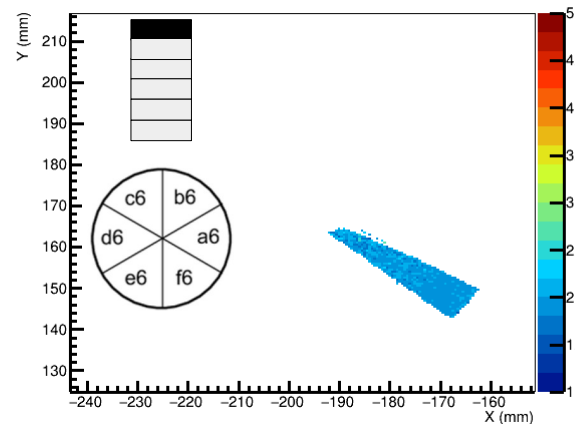
Segment resolution slice 4



Segment resolution slice 5



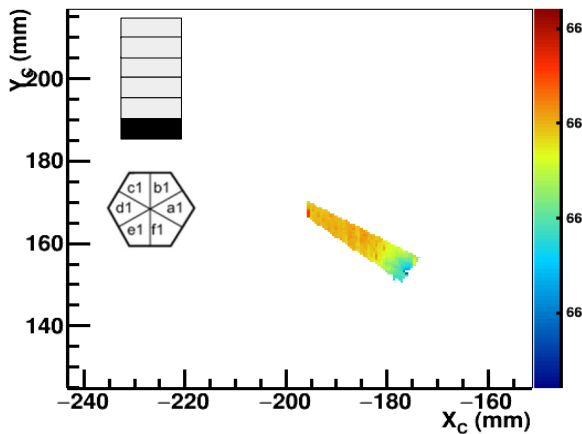
Segment resolution slice 6



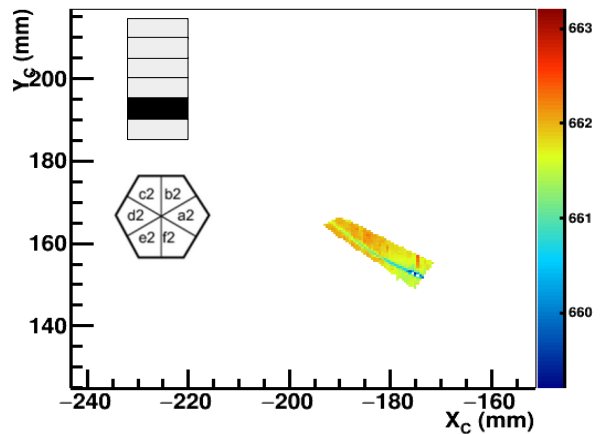


# Detecting Anomalies

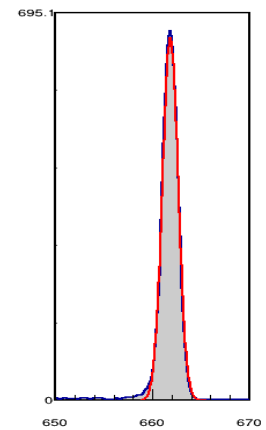
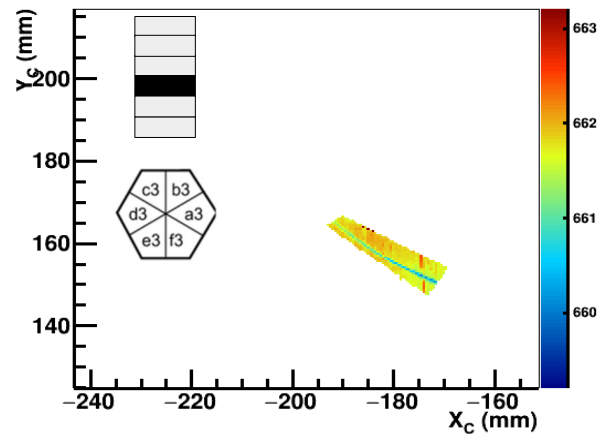
Centroid Shift 1



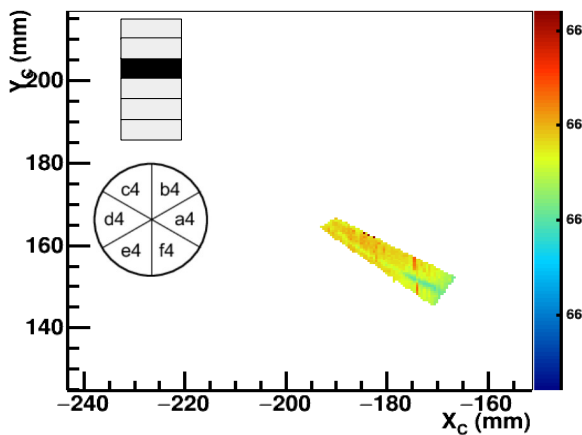
Centroid Shift 2



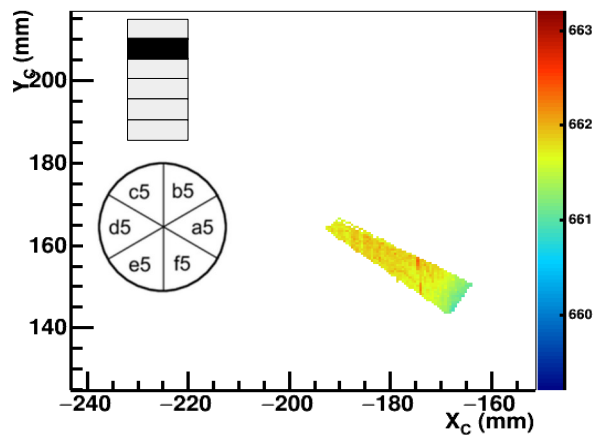
Centroid Shift 3



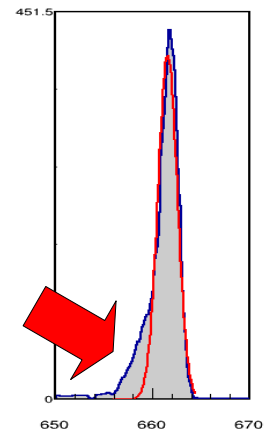
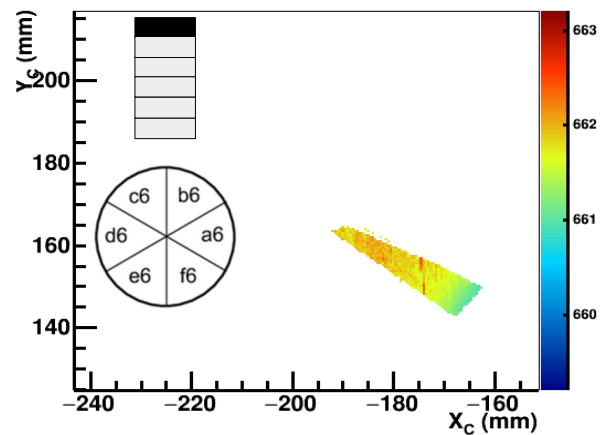
Centroid Shift 4



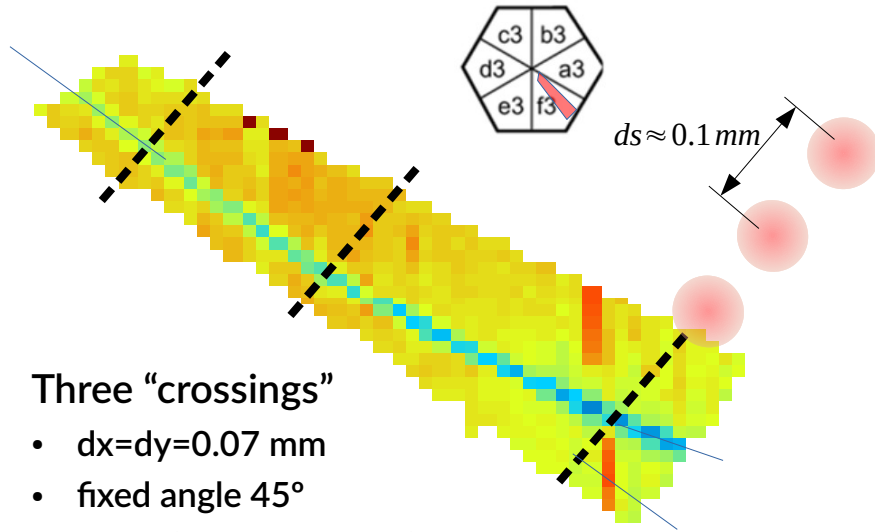
Centroid Shift 5



Centroid Shift 6

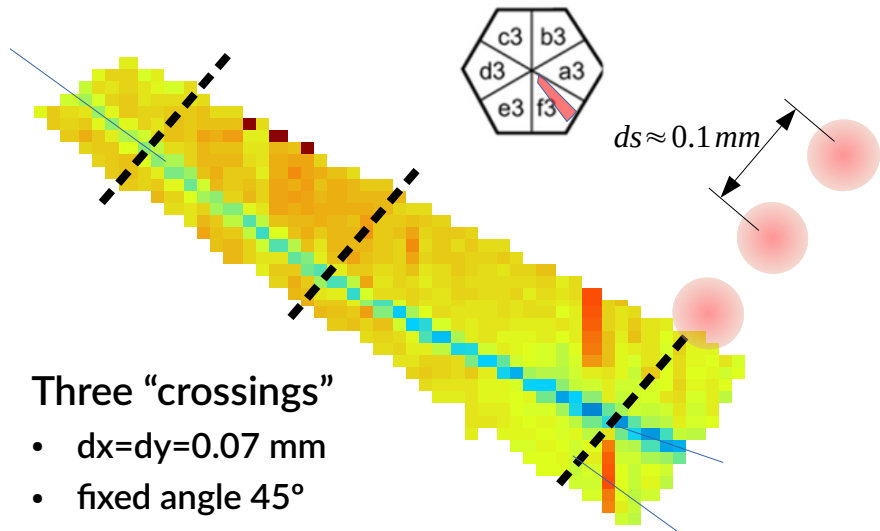


# Measured width



- Three “crossings”
  - $dx=dy=0.07 \text{ mm}$
  - fixed angle  $45^\circ$   
(w.r.t scan table)
- Collimator :  $0.5 \text{ mm}$
- Cs-137 source :  $661.7 \text{ keV}$

# Measured width

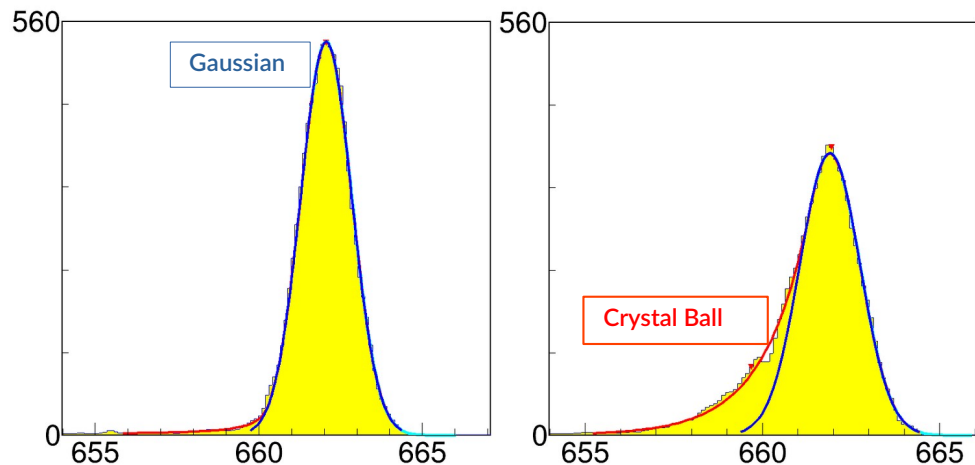
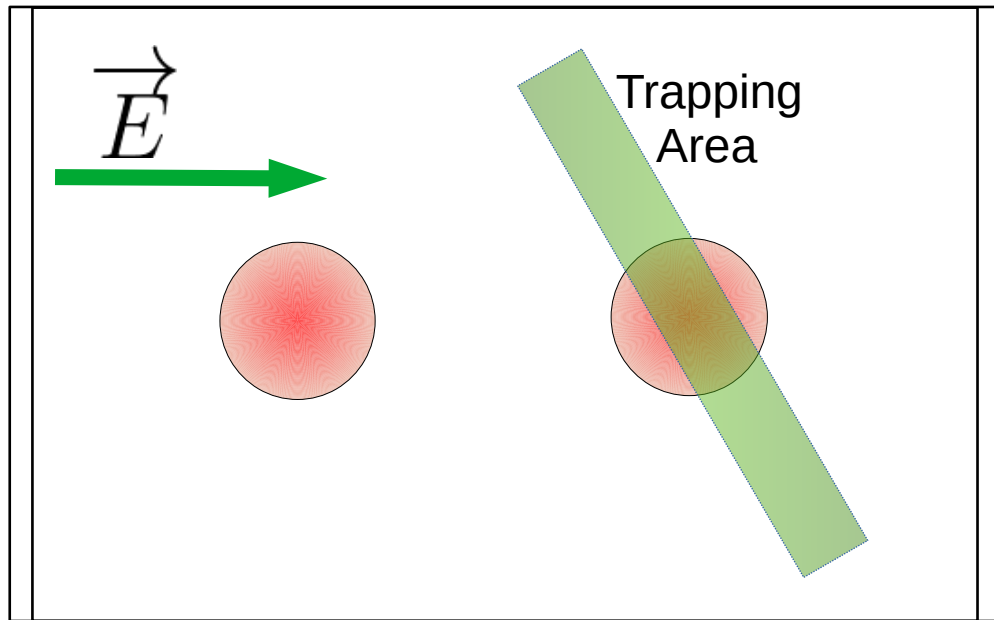


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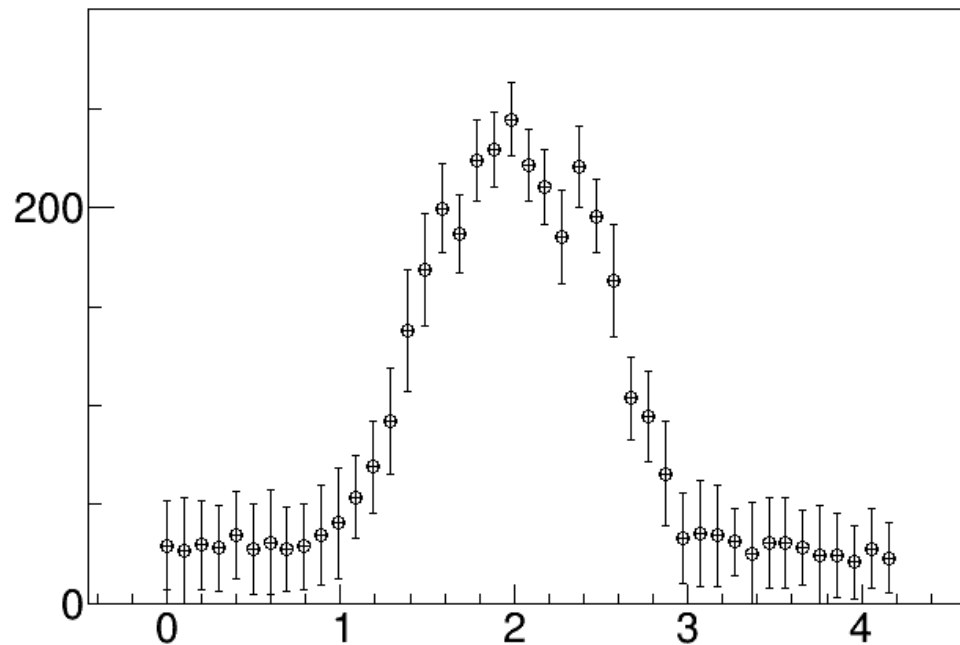
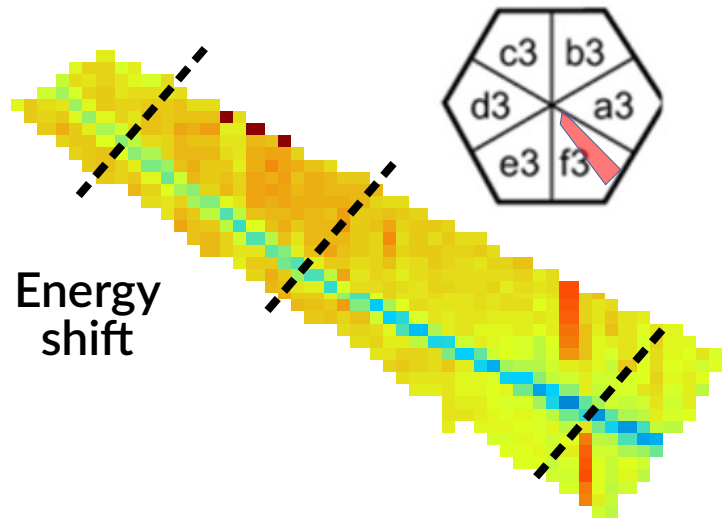
- Collimator : 0.5 mm
- Cs-137 source : 661.7 keV

Crystal Ball

$$f(x; \alpha, n, \bar{x}, \sigma) = N \cdot \begin{cases} \exp\left(-\frac{(x-\bar{x})^2}{2\sigma^2}\right), & \text{for } \frac{x-\bar{x}}{\sigma} > -\alpha \\ A \cdot \left(B - \frac{x-\bar{x}}{\sigma}\right)^{-n}, & \text{for } \frac{x-\bar{x}}{\sigma} \leq -\alpha \end{cases}$$



# Measured width



S3 F X=-176.45 Y=151.73

S3 F X=-176.10 Y=152.08

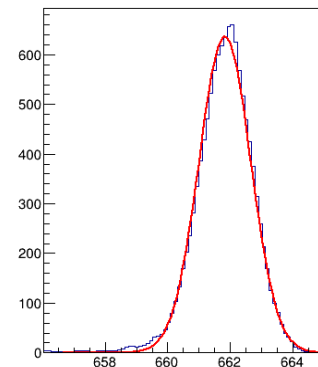
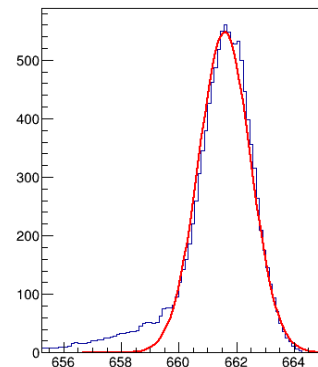
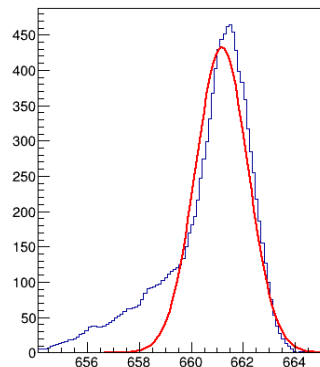
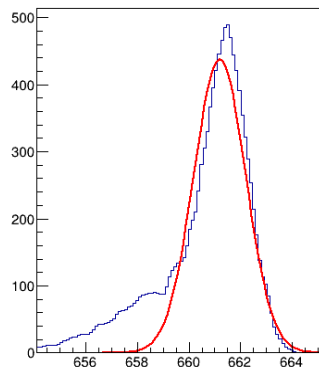
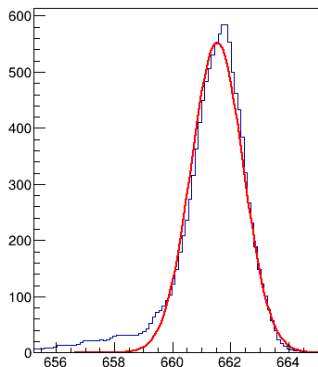
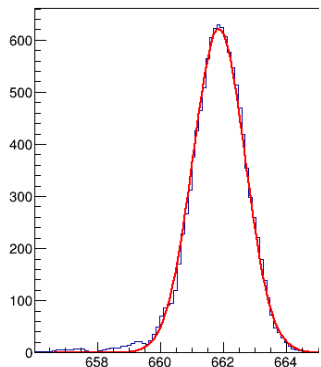
S3 F X=-175.75 Y=152.43

S3 F X=-175.40 Y=152.78

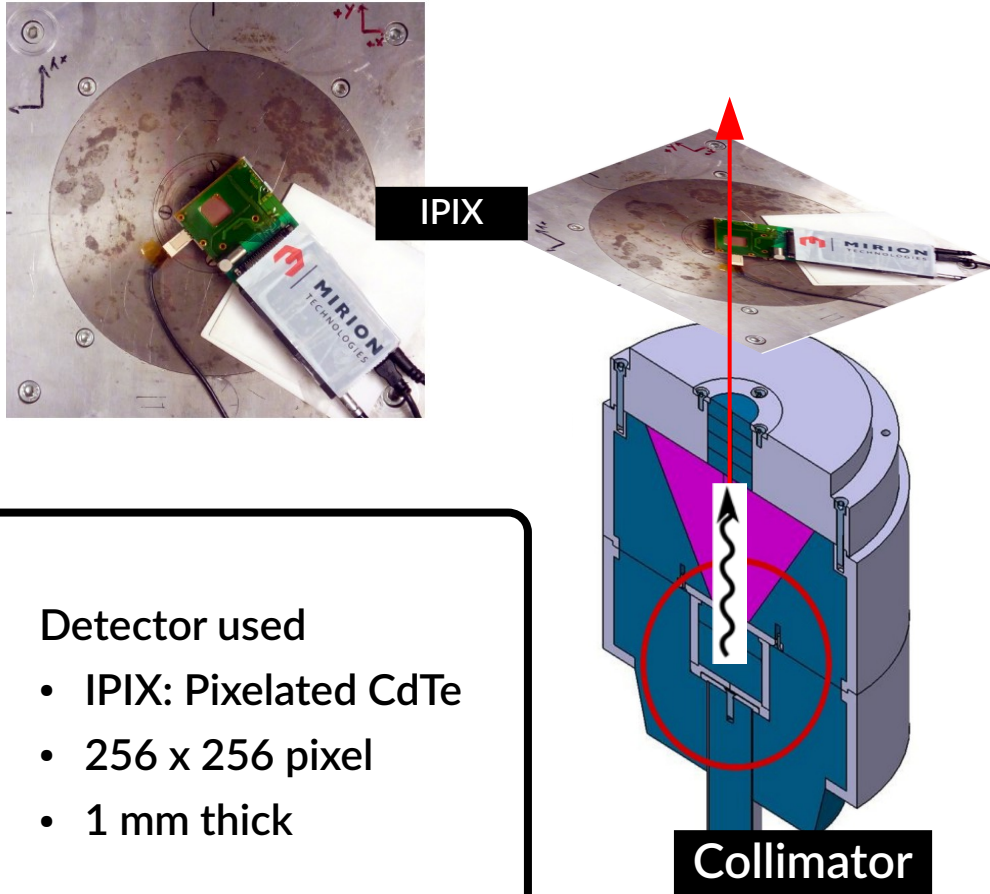
S3 F X=-175.05 Y=153.13

S3 F X=-174.70 Y=153.48

S3 F X=-174.70 Y=153.48
Entries 333789
Mean 661.8
Std Dev 0.9432



# Measuring the Gamma-beam profile

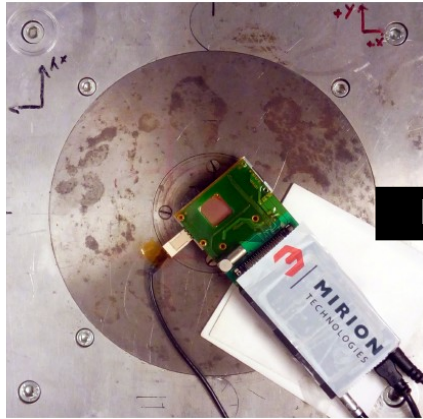


Detector used

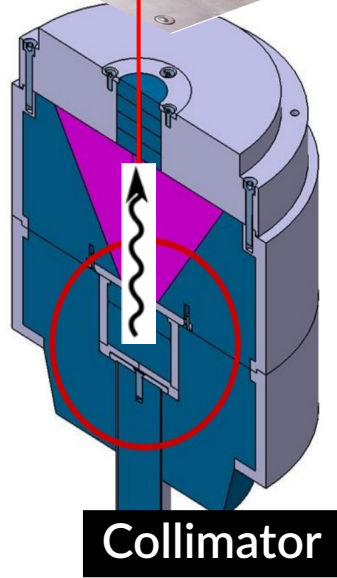
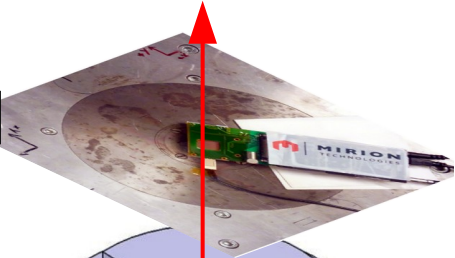
- IPIX: Pixelated CdTe
- 256 x 256 pixel
- 1 mm thick



# Measuring the Gamma-beam profile



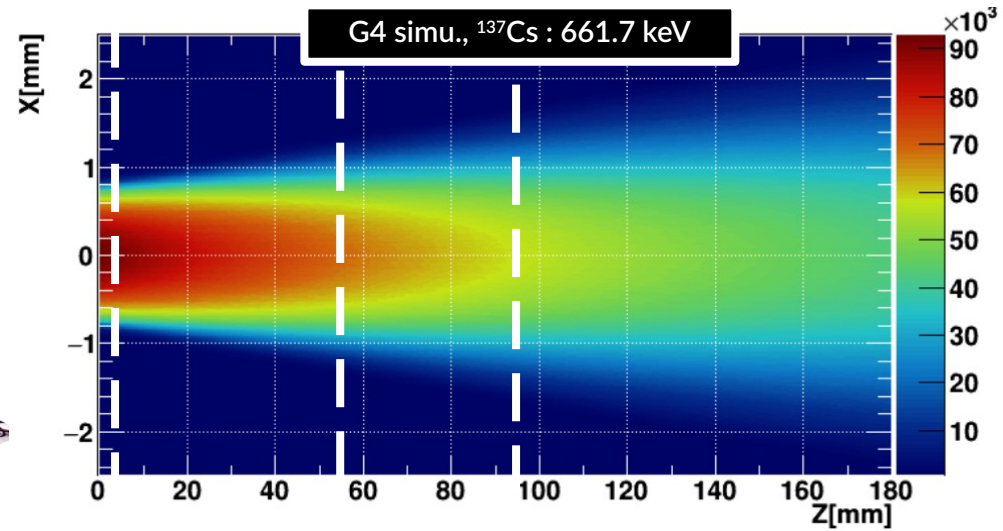
IPIX



Collimator

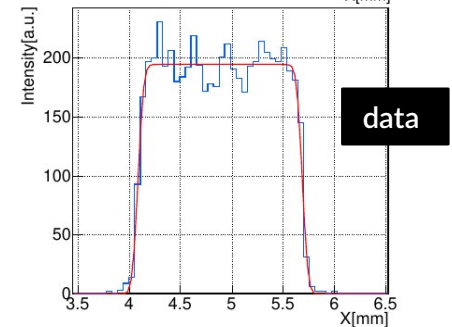
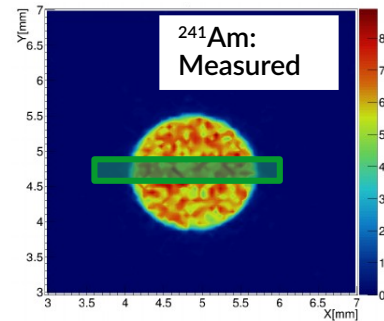
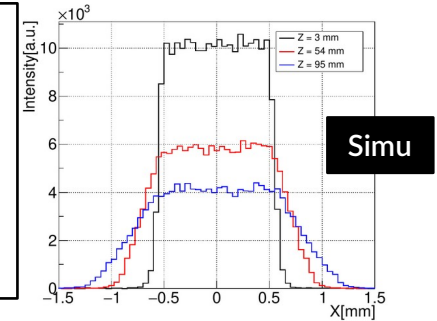
## Detector used

- IPIX: Pixelated CdTe
- 256 x 256 pixel
- 1 mm thick

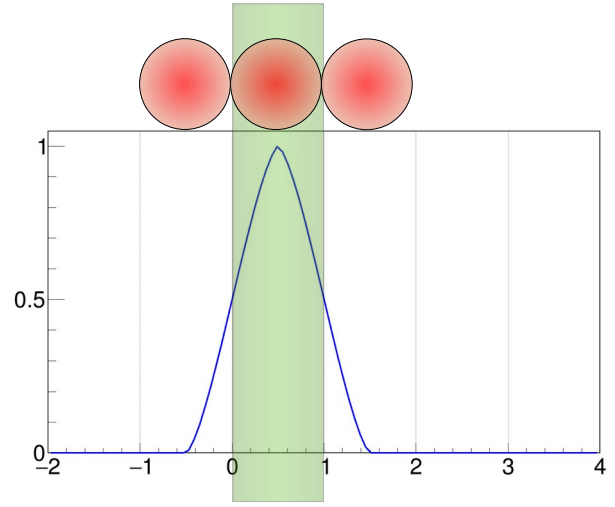
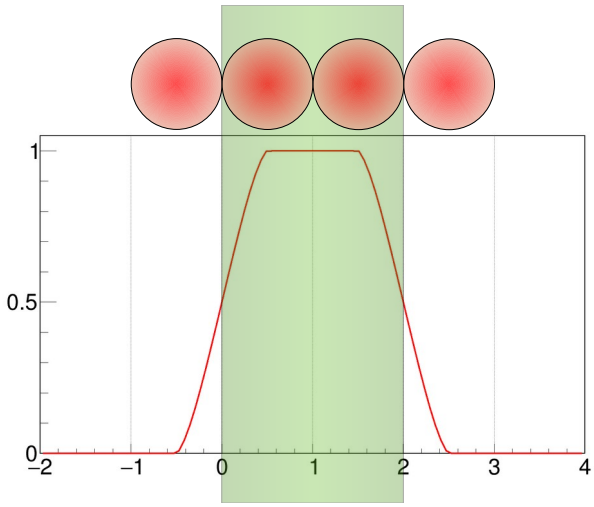
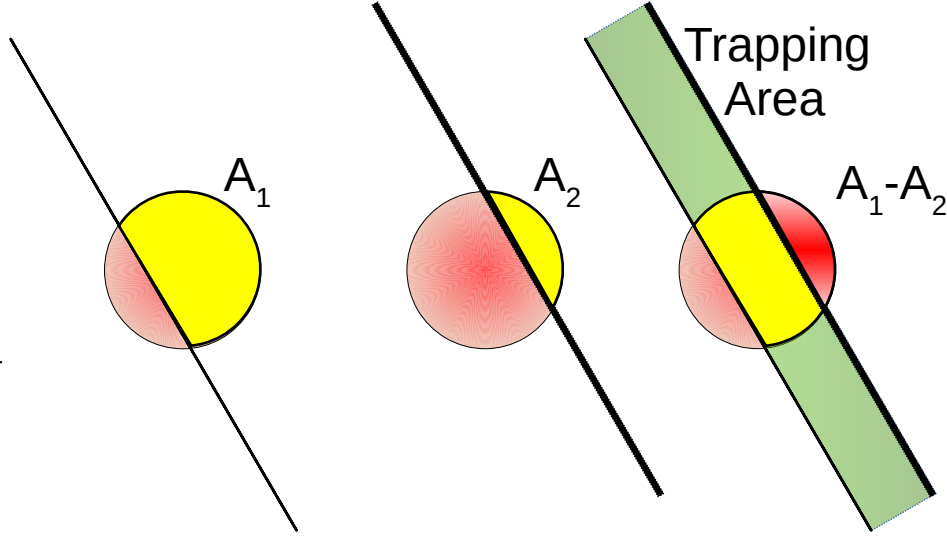
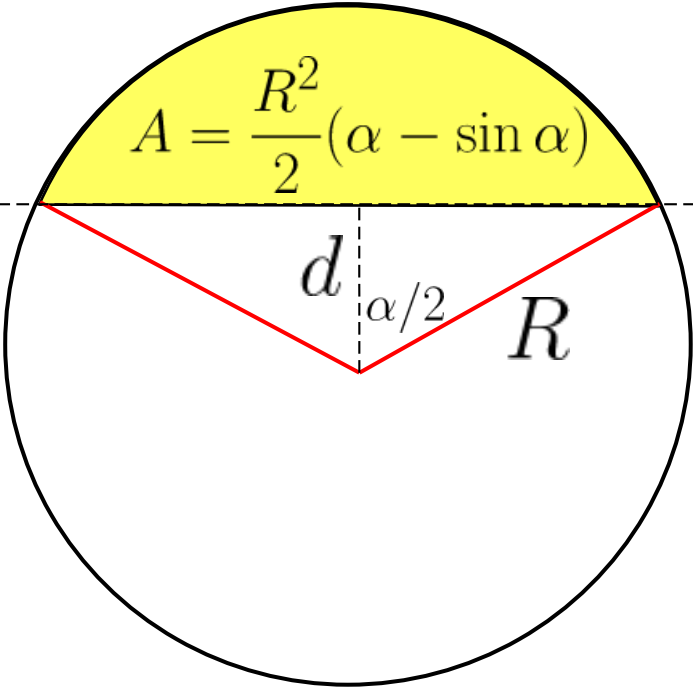


## Consolidated with measurements

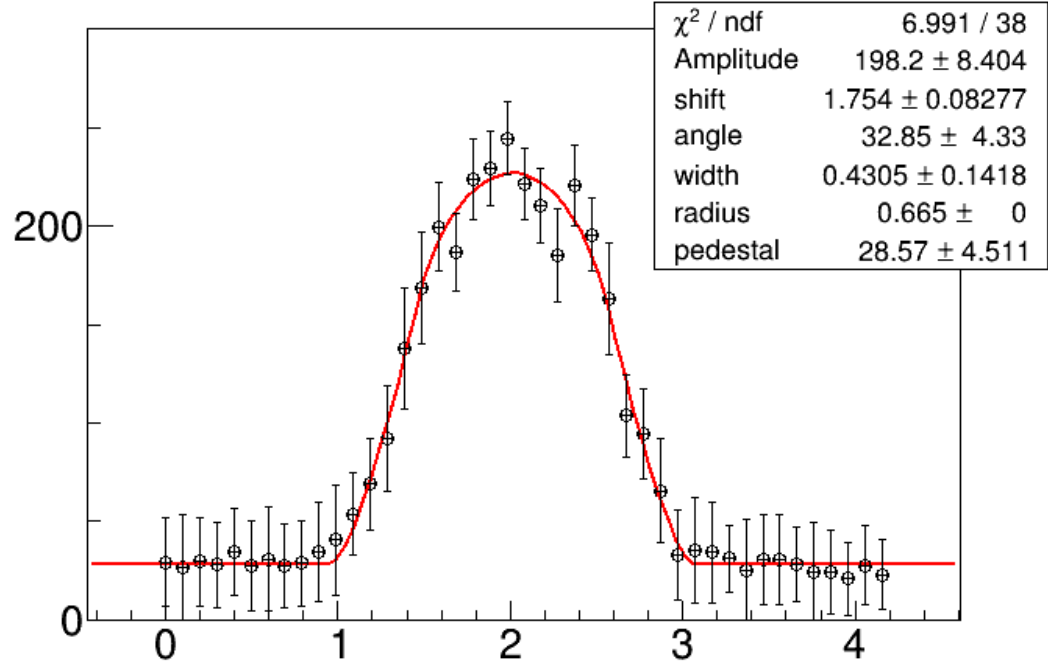
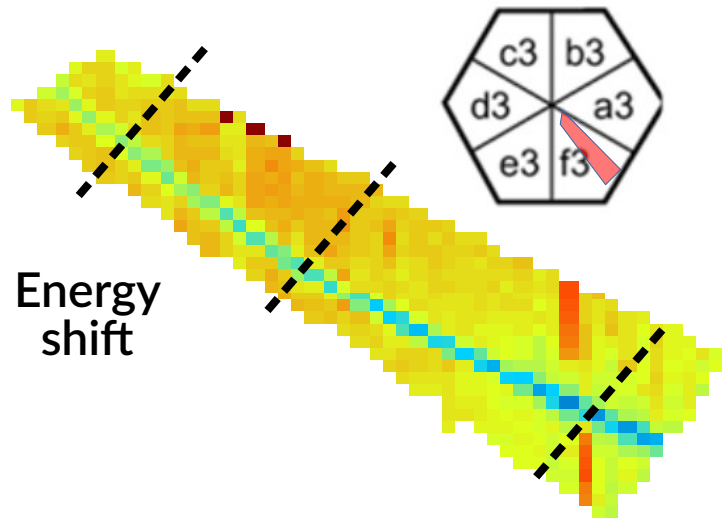
- collimator diam.: 0.5, 1.0 and 1.5 mm
- @ energies 59.5, 661.7, 1408 keV
- @ Z = 3, 54, 95 mm
- Ave. width @ Slice3 : 0.665mm



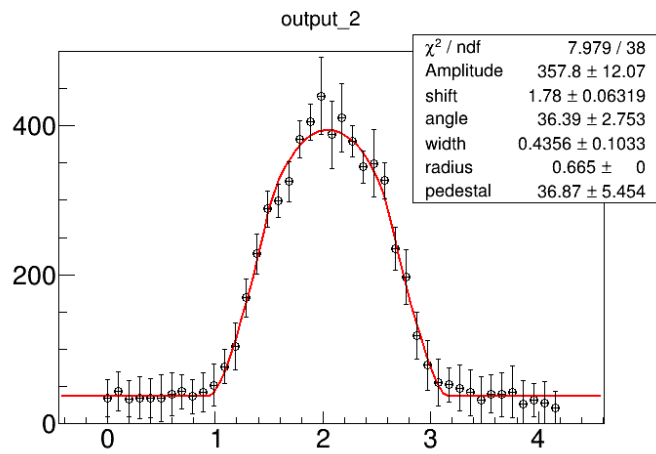
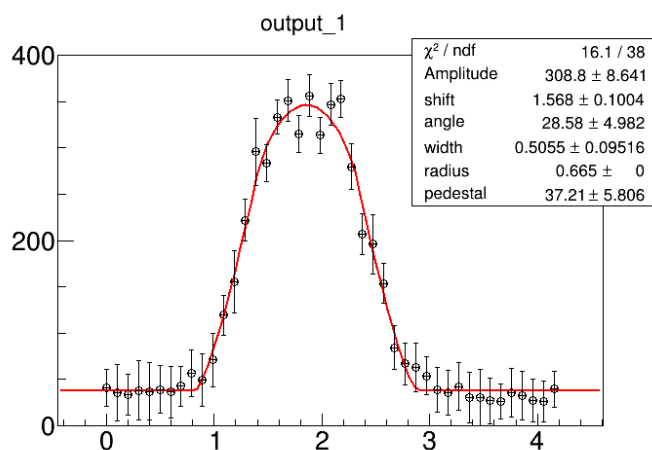
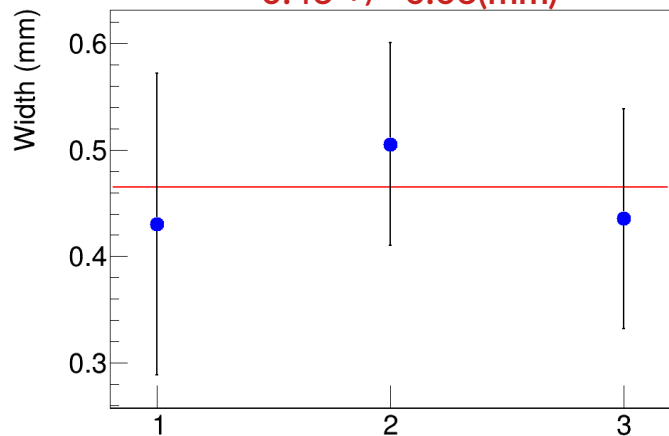
# Fitting-function Model



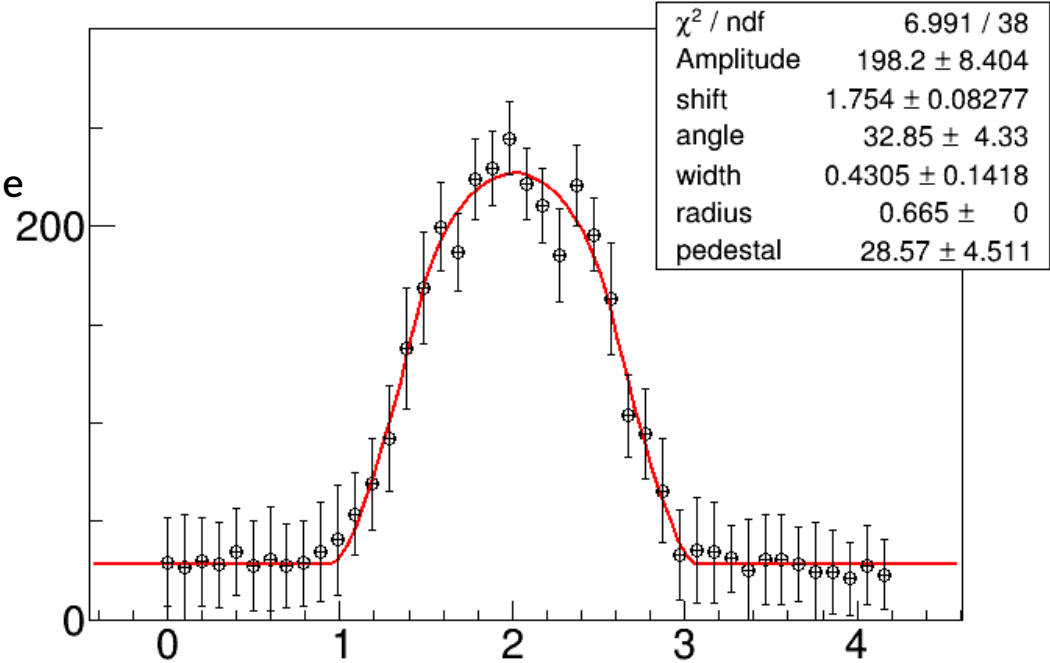
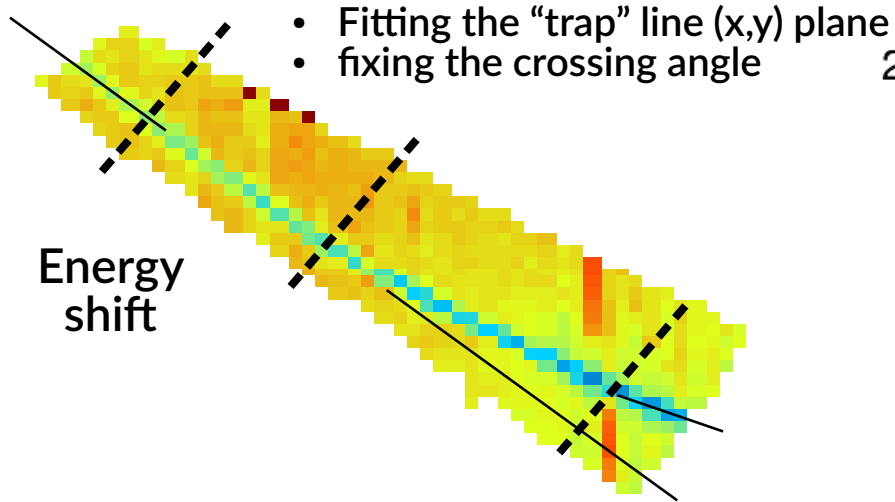
# Measured width



$0.46 \pm 0.06(\text{mm})$

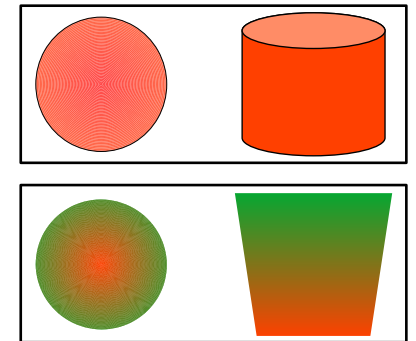
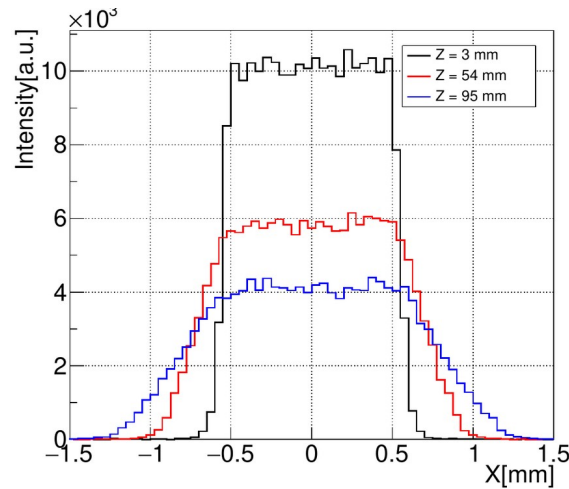


# Possible improvements



## Conclusion on the dimensions

$w : 0.46(6) \text{ mm}$   
 $R : \sim 13 \text{ mm}$  (Phd B.D.C)  
 $Z : \geq 28 \text{ mm}$



Use realistic beam profile to reproduce better the tails

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Thanks for your attention

Big Thank you for IKP for lending  
the S001 AGATA Crystal