

# Lavoro di simulazione e analisi preliminare commissionato per l'esperimento HERD

- Lavoro fatto in tempi strettissimi! (una/due settimane nel febbraio 2017)
- Fatto solo per una configurazione non realistica: particelle verticali passanti nel centro del calorimetro
- Algoritmo non verificato e non è stata studiata la solidità della procedura né analizzati eventuali banchi logici o pratici

**Questo lavoro deve essere preso solo come eventuale  
spunto per lo sviluppo di un valido algoritmo**

# Gamma: 1 – 100 GeV

- Basic crystal LYSO cubes (21×21×21)
- Total calorimeter mass **1850 kg** (LYSO + C.F. gap absorber)

Crystal Dimension: 2.85 cm

Gap Dimension: 0.5 cm

Calorimeter Side: 70.35 cm

Crystal Mass: 171.304 g

Carbon Fiber density: 1.97 g/cm<sup>3</sup>

N crystals: 9261

Total LYSO mass: 1586.44 kg

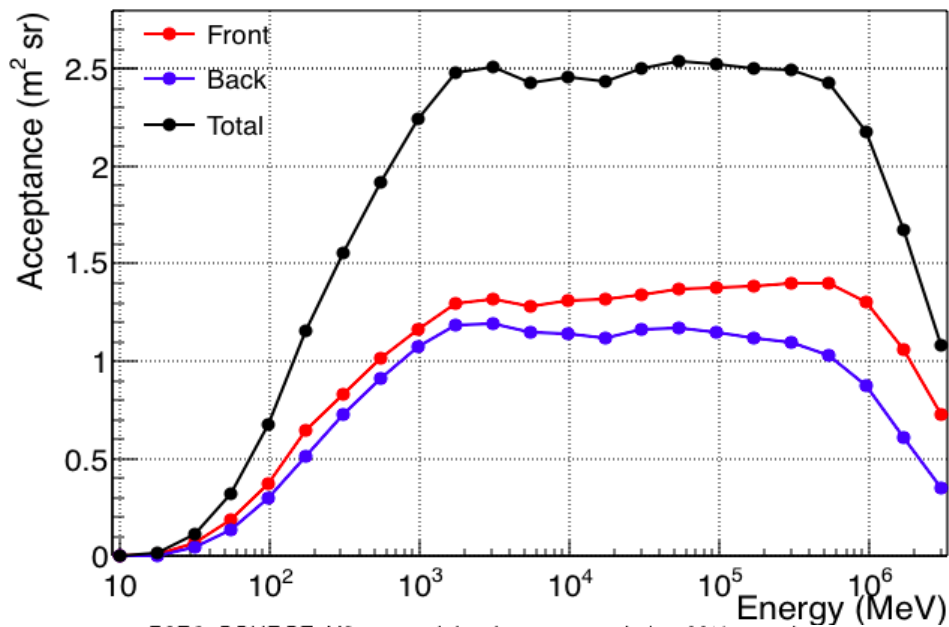
Total Mechanical mass: 263.56 kg

G.F. plane: 1.55 m<sup>2</sup> sr

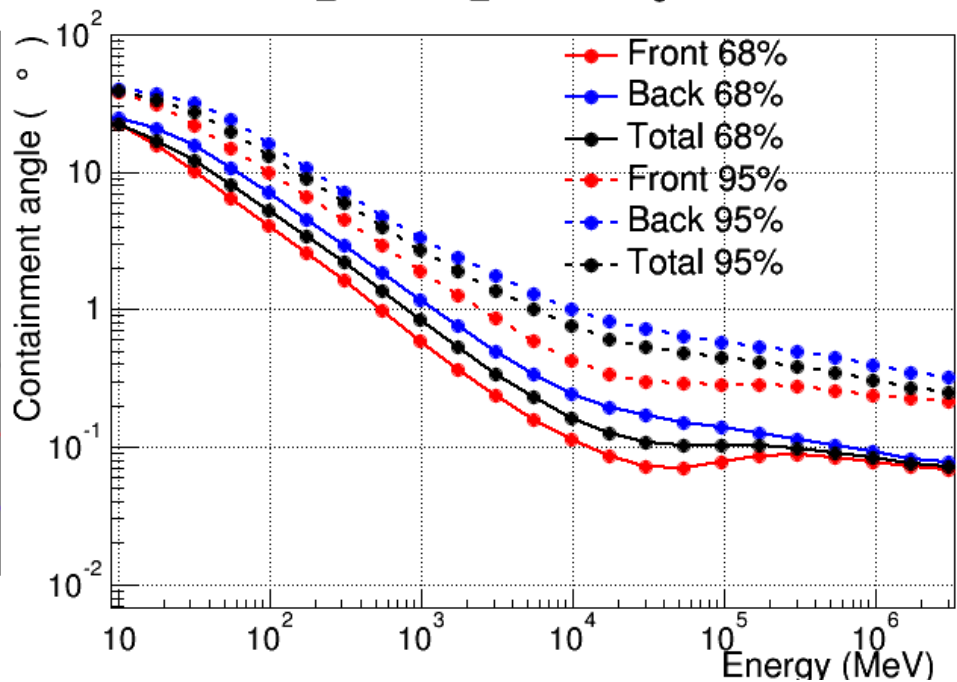
G.F. total (5 side): 7.77 m<sup>2</sup> sr

# FERMI PERFORMANCES

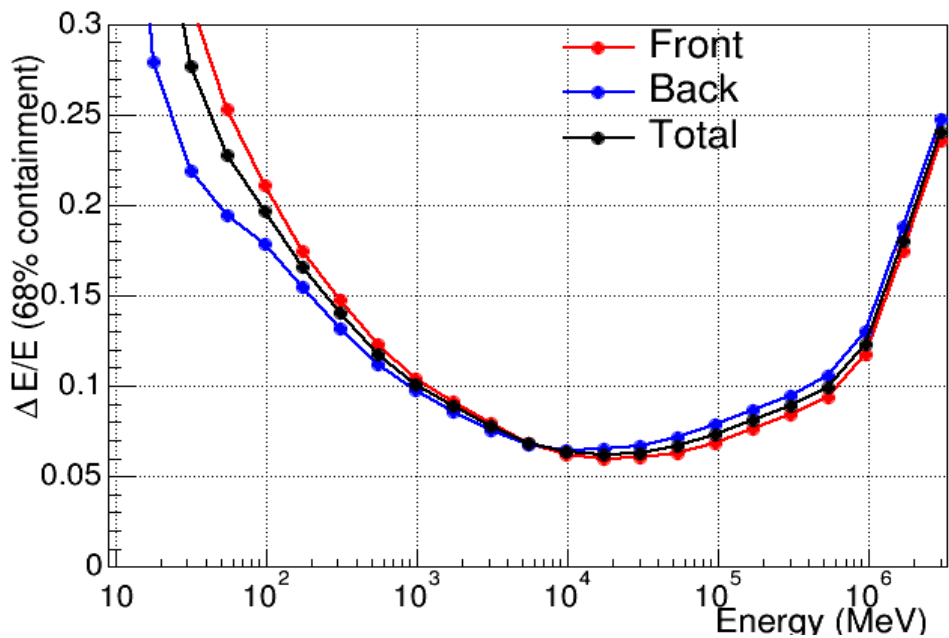
P8R2\_SOURCE\_V6 acceptance



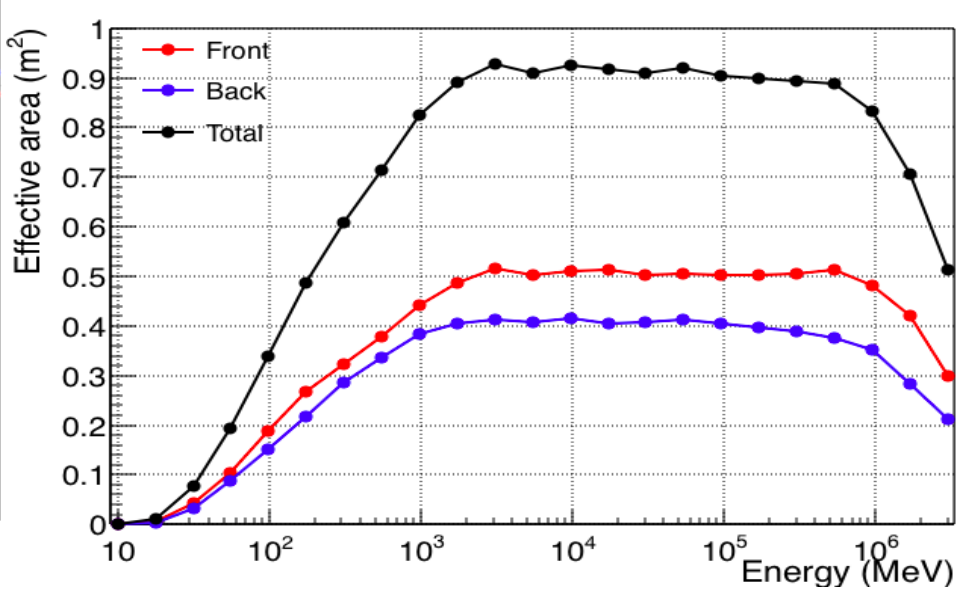
P8R2\_SOURCE\_V6 acc. weighted PSF



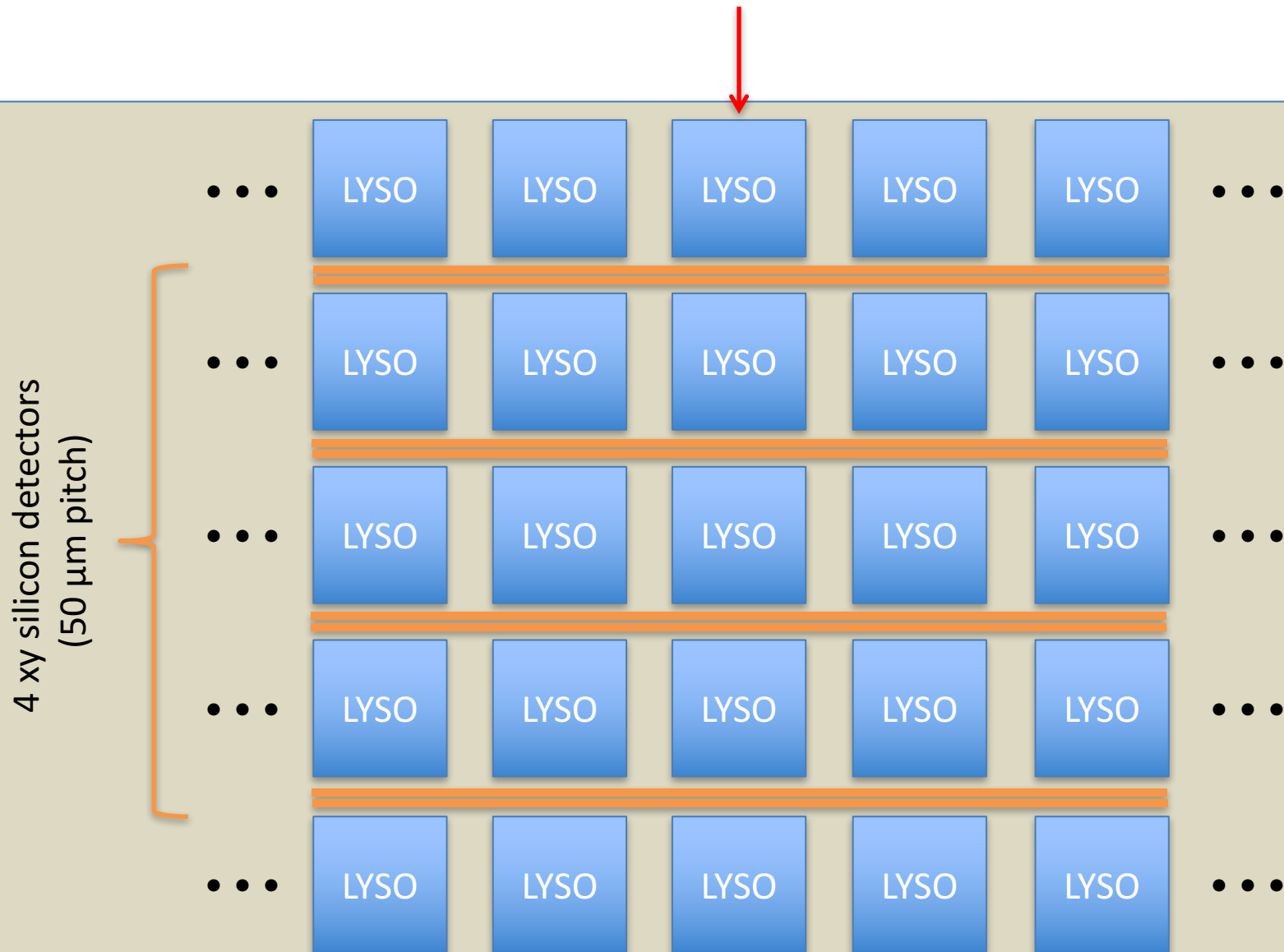
P8R2\_SOURCE\_V6 acc. weighted energy resolution 68% containment



P8R2\_SOURCE\_V6 on-axis effective area



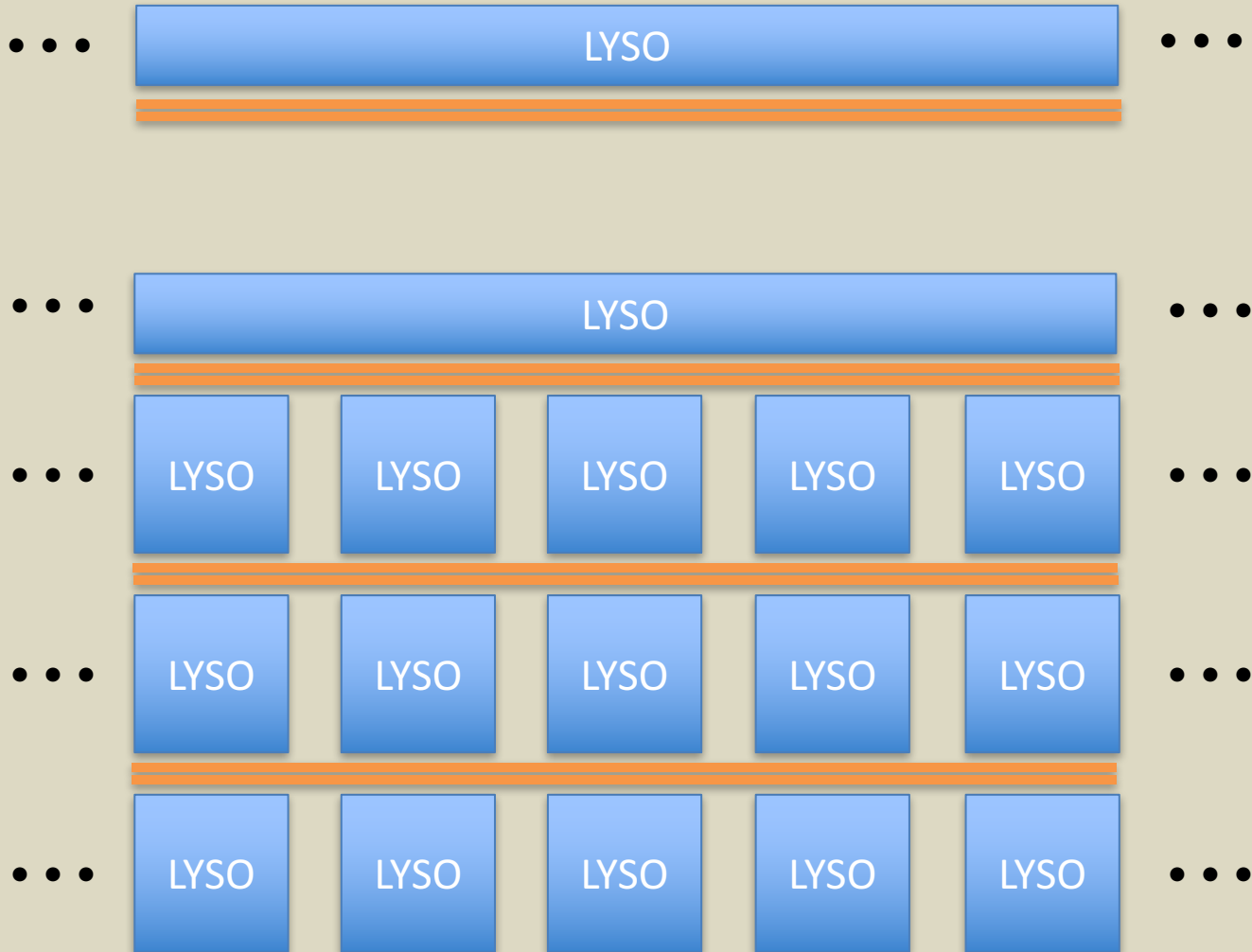
# Gamma tracking (geometry A)



# Gamma tracking (geometry B)

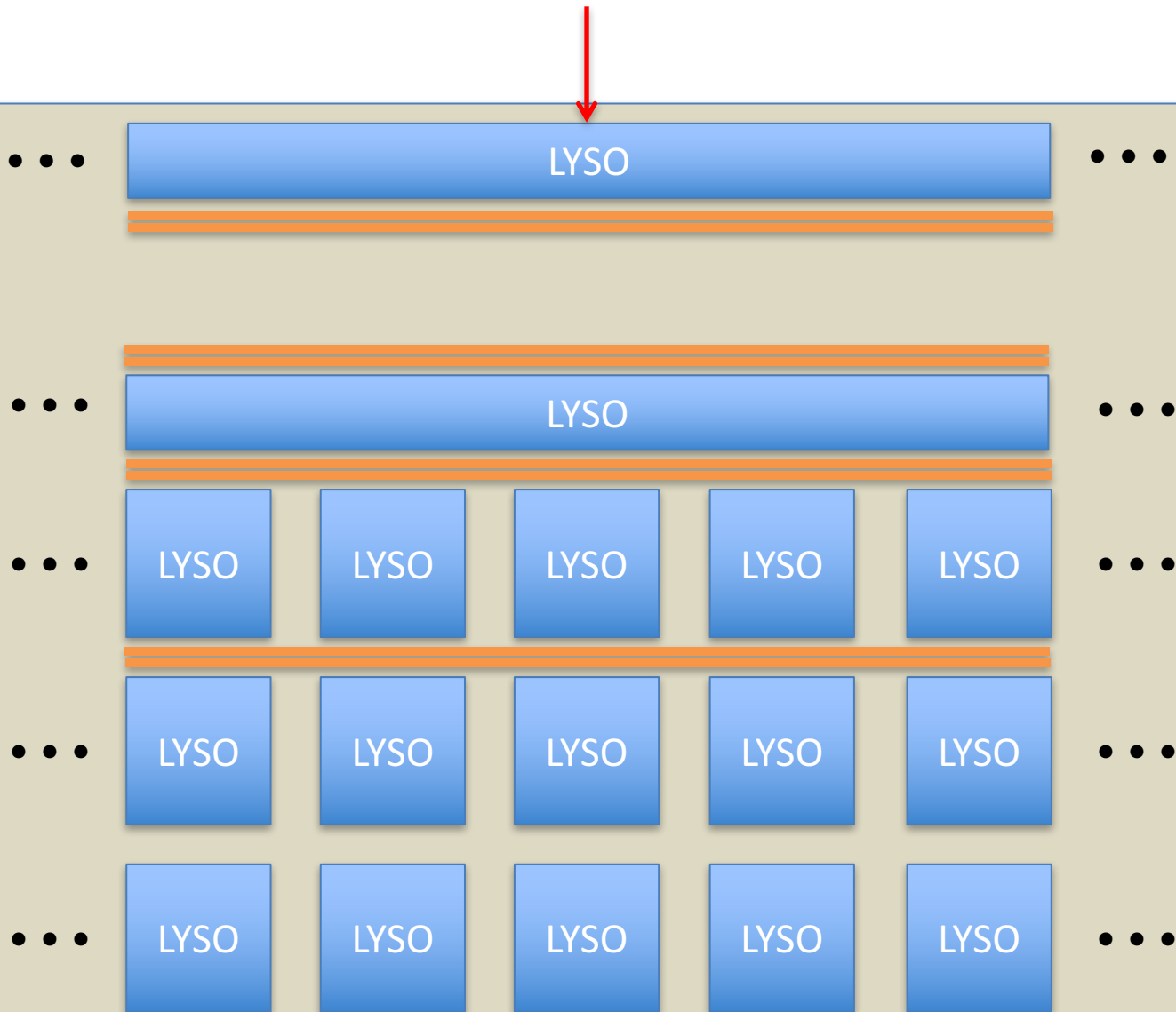


4 xy silicon detectors  
(50  $\mu\text{m}$  pitch)



# Gamma tracking (geometry C)

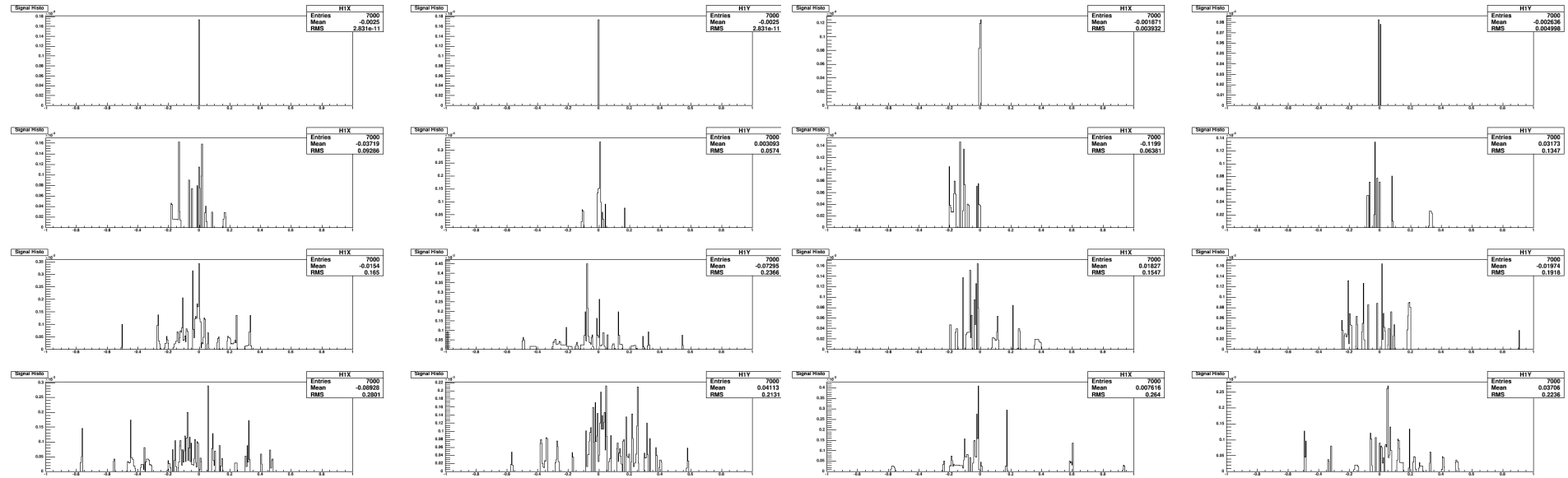
4 xy silicon  
detectors  
(50  $\mu\text{m}$  pitch)



# Gamma 10 GeV: signal distribution

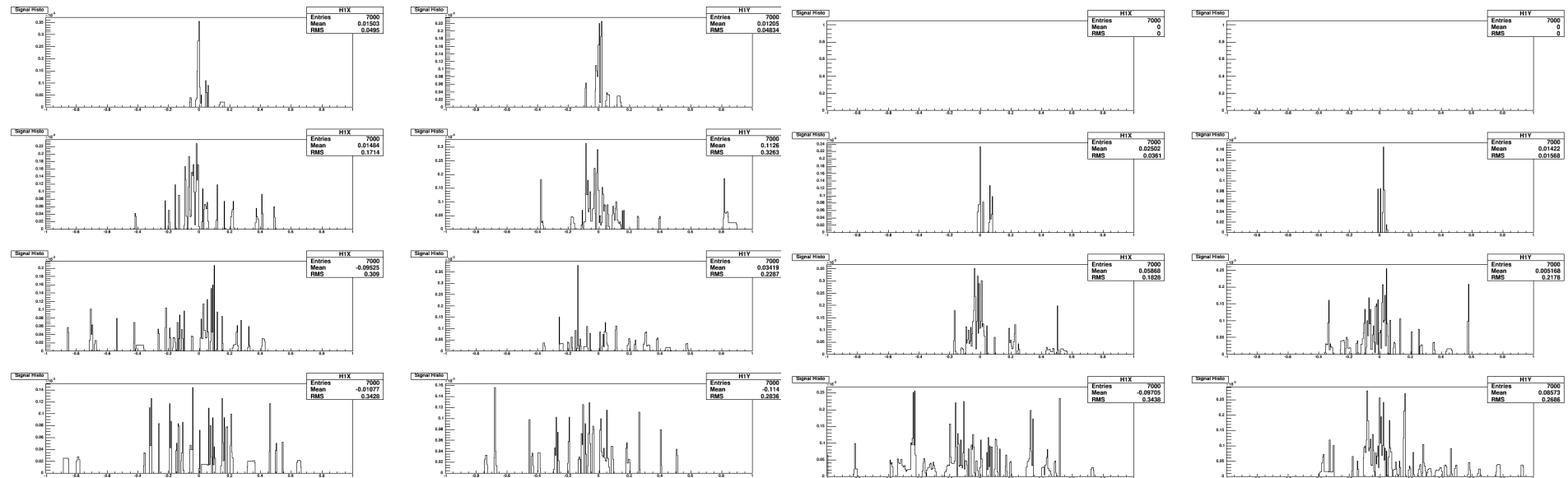
## Event 1

## Event 2

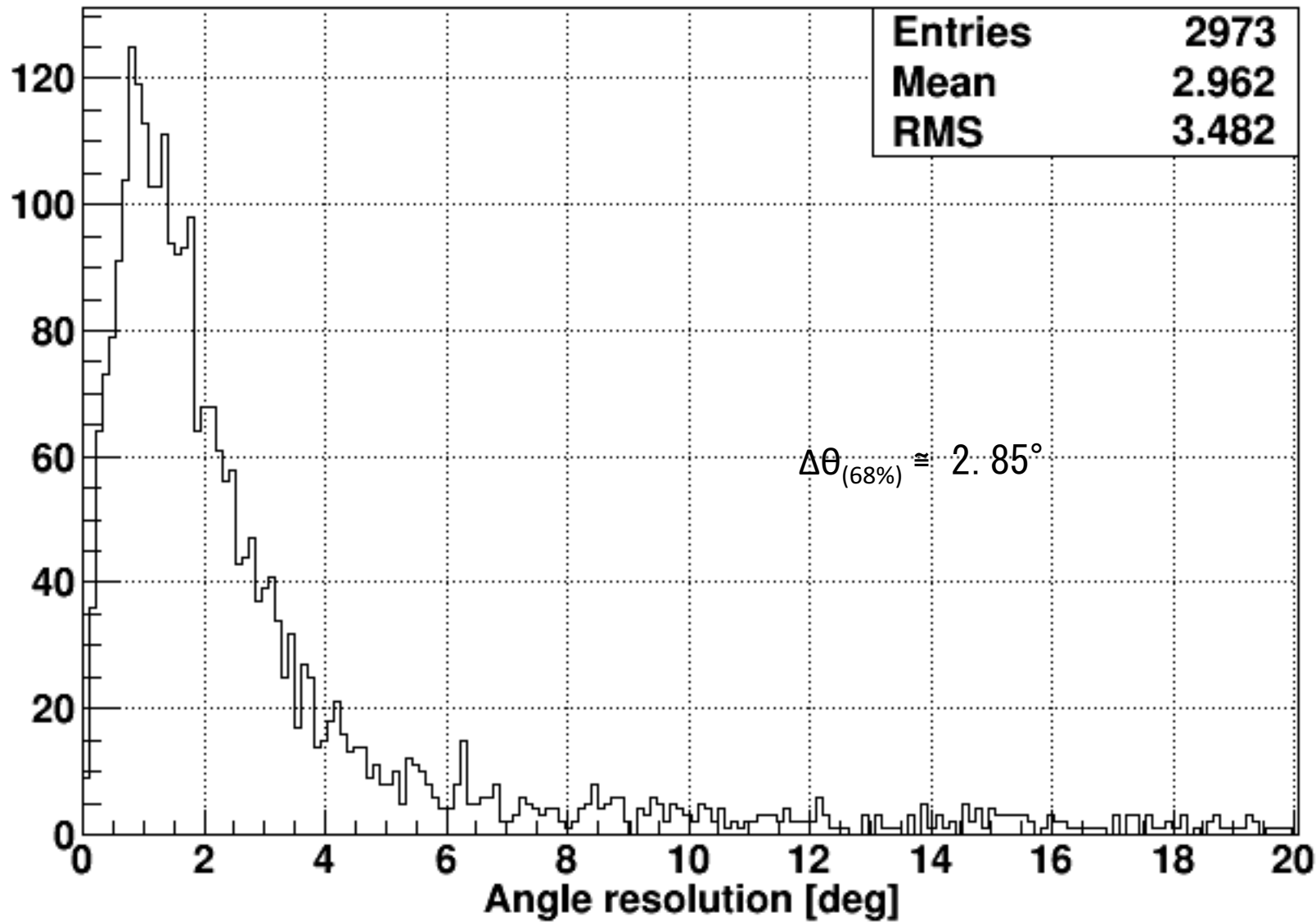


## Event 3

## Event 4



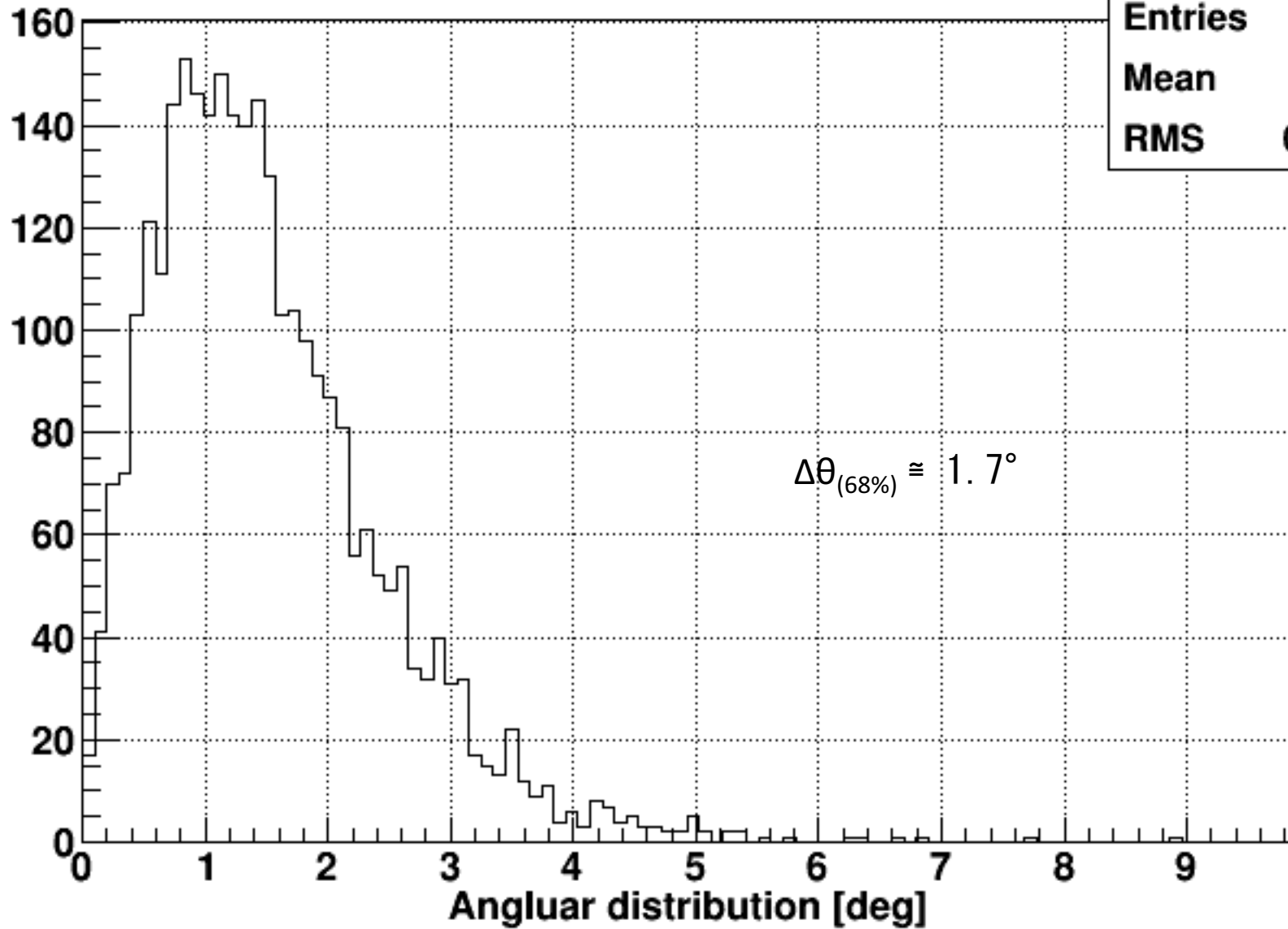
# Gamma 10 GeV - Silicon axis (simple mean algorithm)



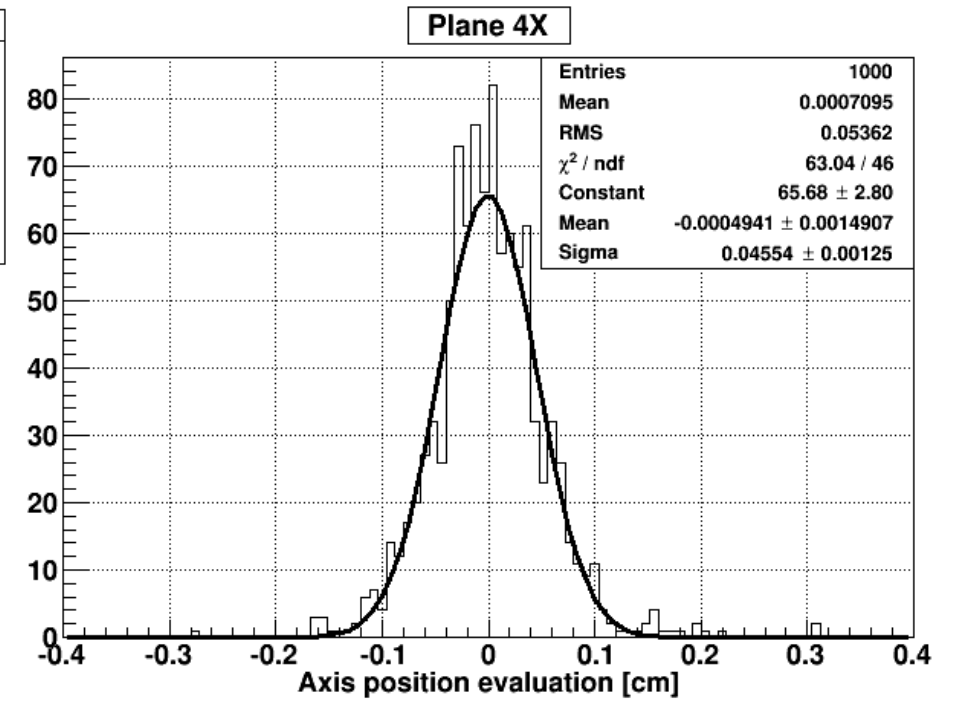
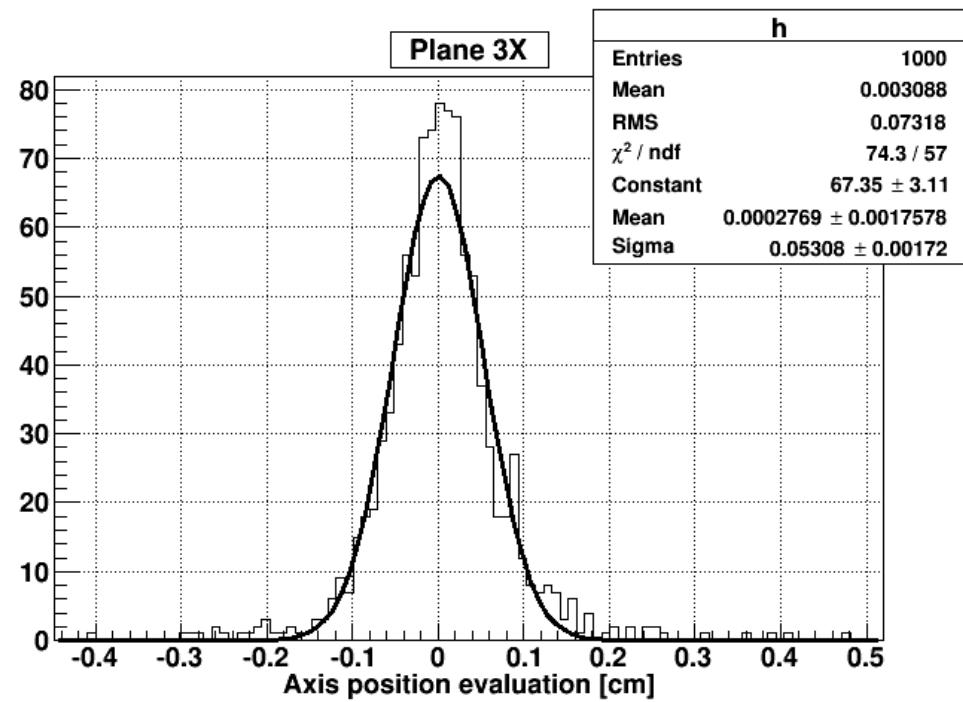
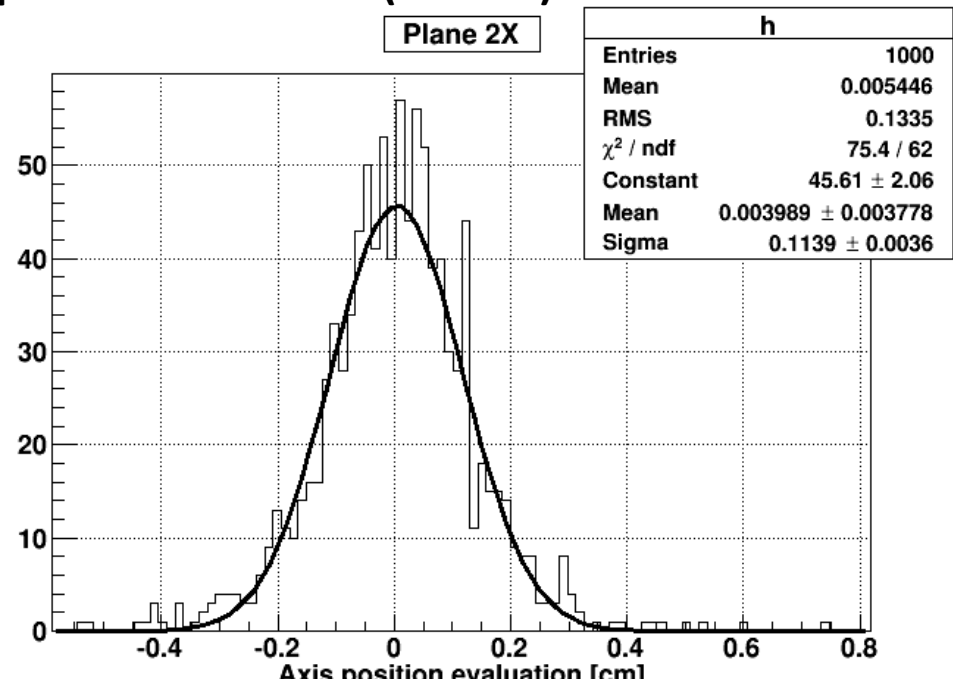
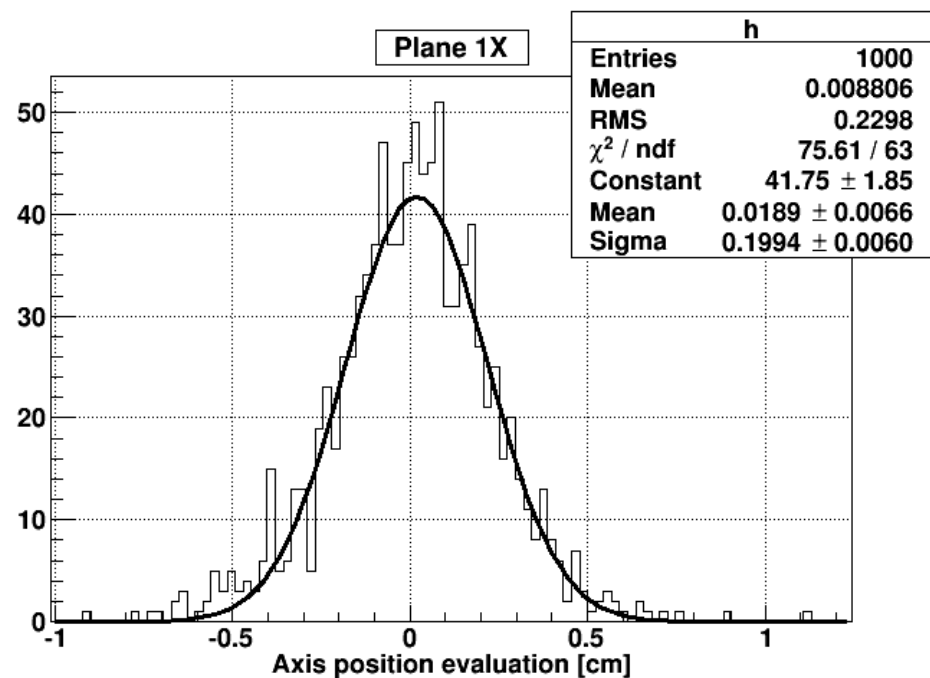


# LYSO shower axis: angle resolution (10 GeV)

**Gamma 10 GeV - LYSO cristals axis**



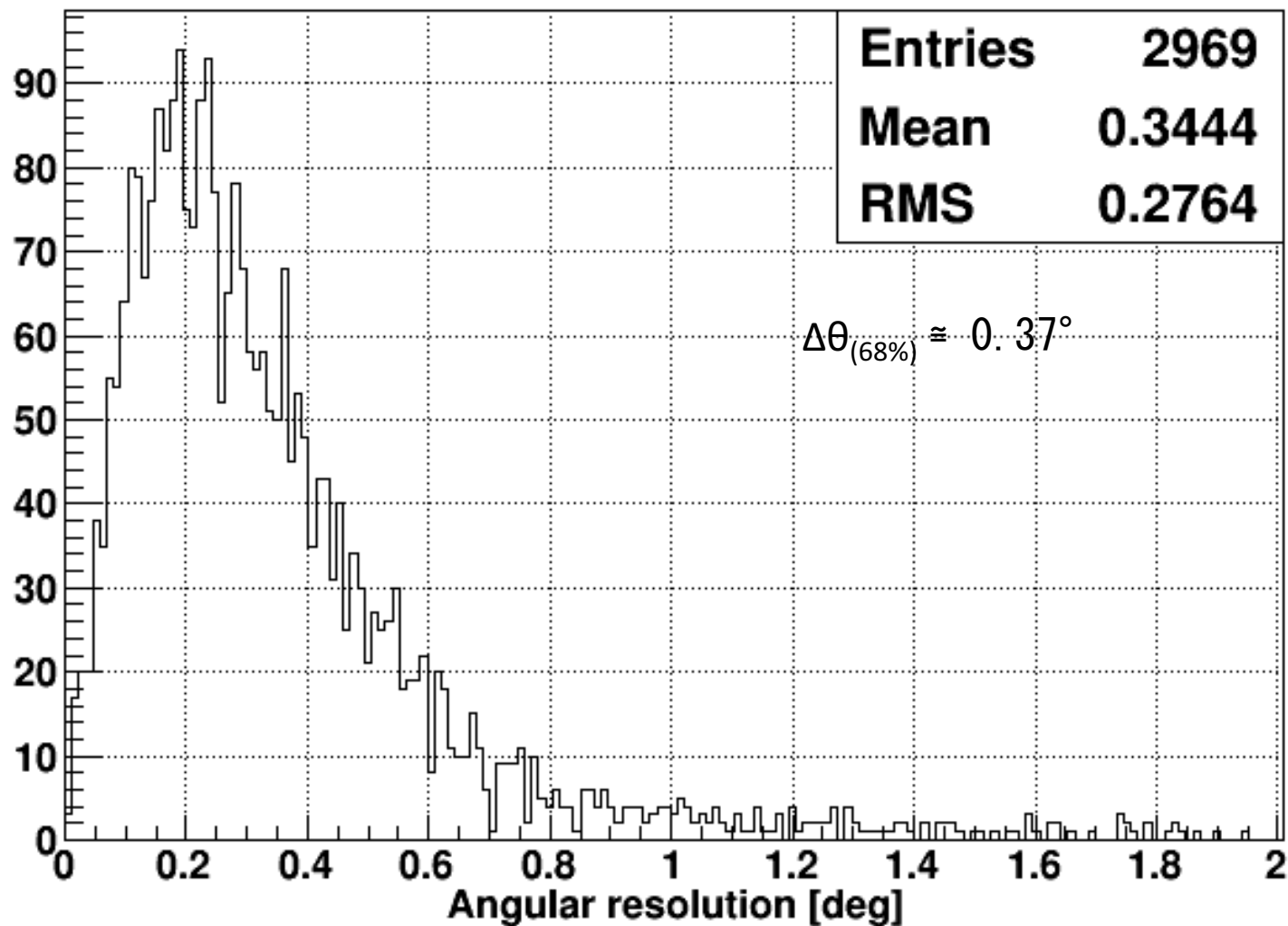
# LYSO shower axis: position resolution (10 GeV)



Mean position estimation on the plane  $\bar{x} = \frac{\sum_i [x_i \times S_i \times W_{LYSO}(x_i)]}{\sum_i [S_i \times W_{LYSO}(x_i)]}$

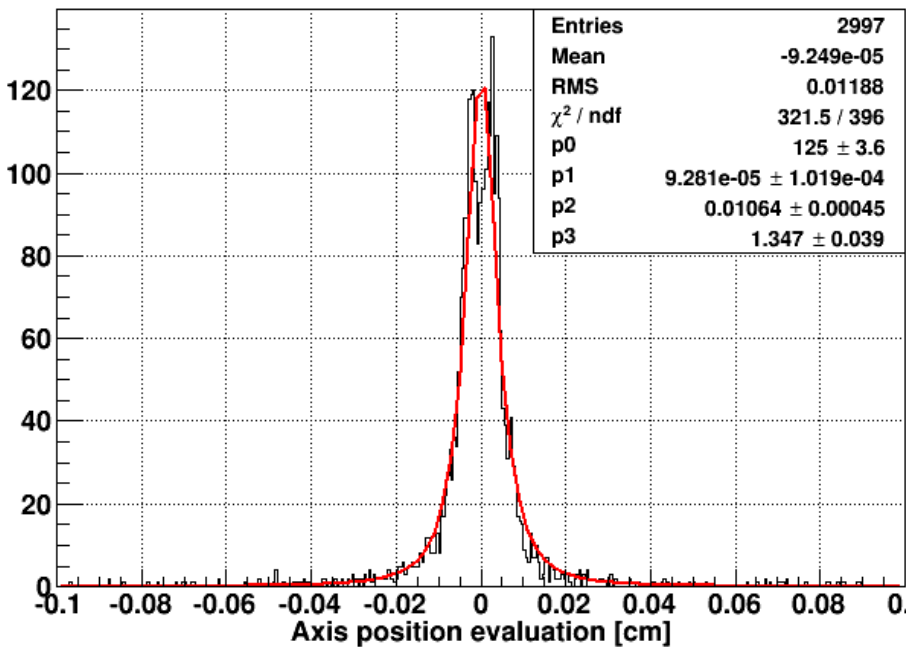
Gaussian weight  $W_{LYSO}(x) = \frac{1}{\sqrt{2\pi\sigma_{LYSO}}} \exp \left[ -\frac{1}{2} \left( \frac{x - \bar{X}_{LYSO}}{\sigma_{LYSO}} \right)^2 \right]$

### Gamma 10 GeV - Silicon axis (iteration 1)

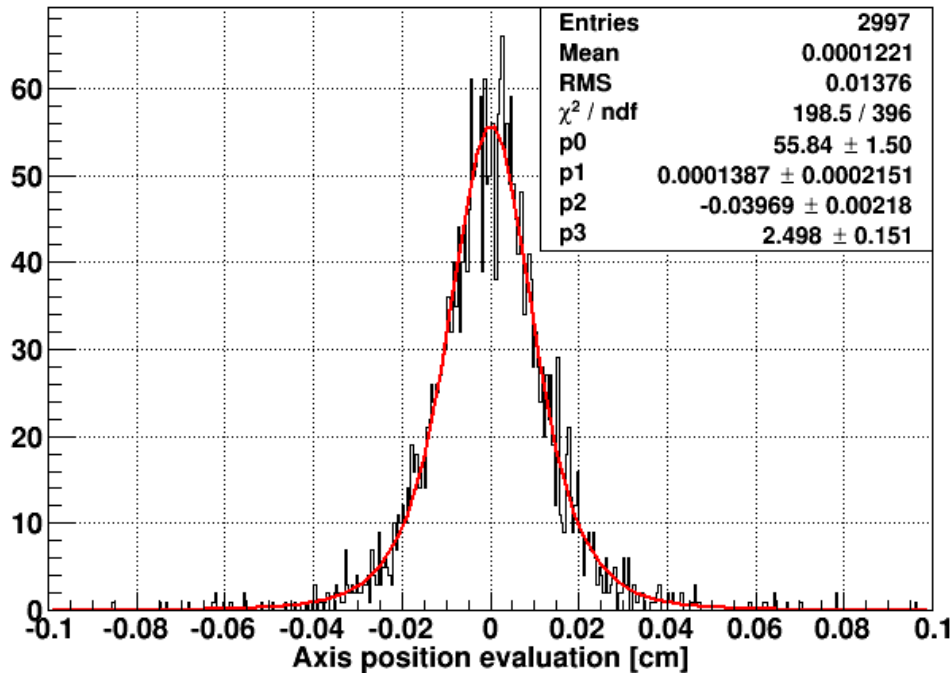


# Gamma 10 GeV: position resolution

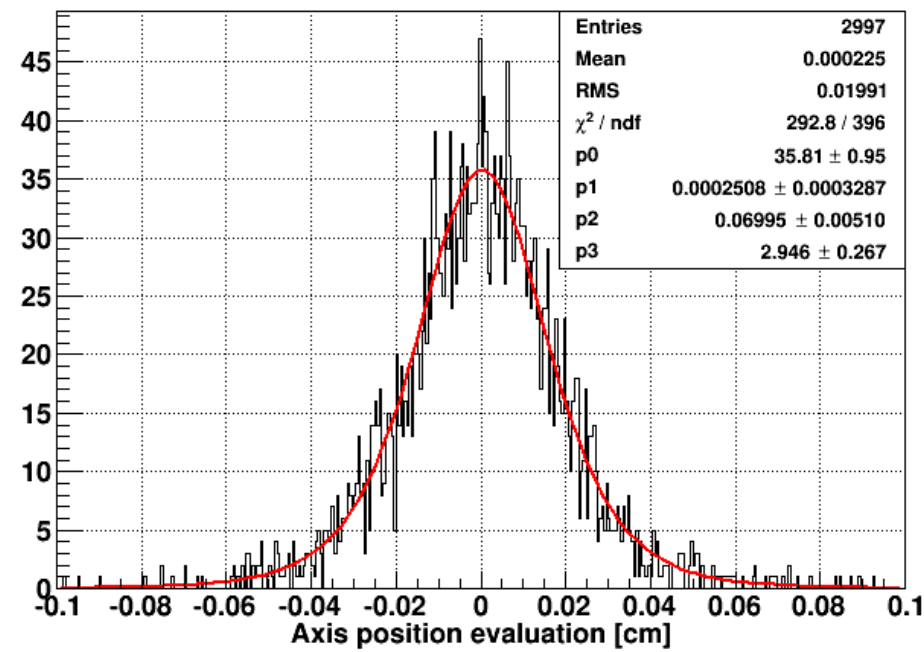
Plane 1X



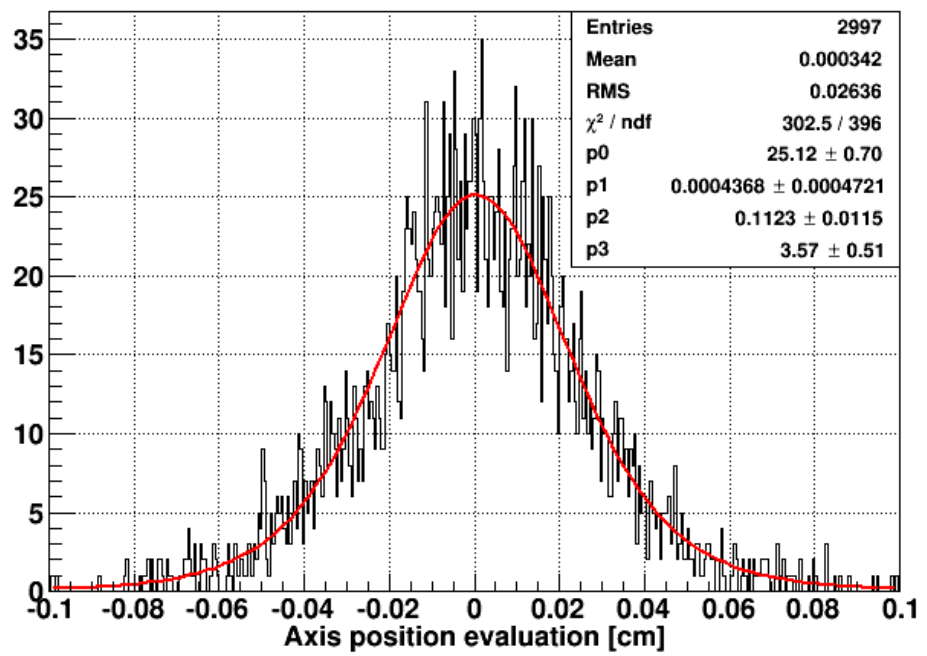
Plane 2X



Plane 3X

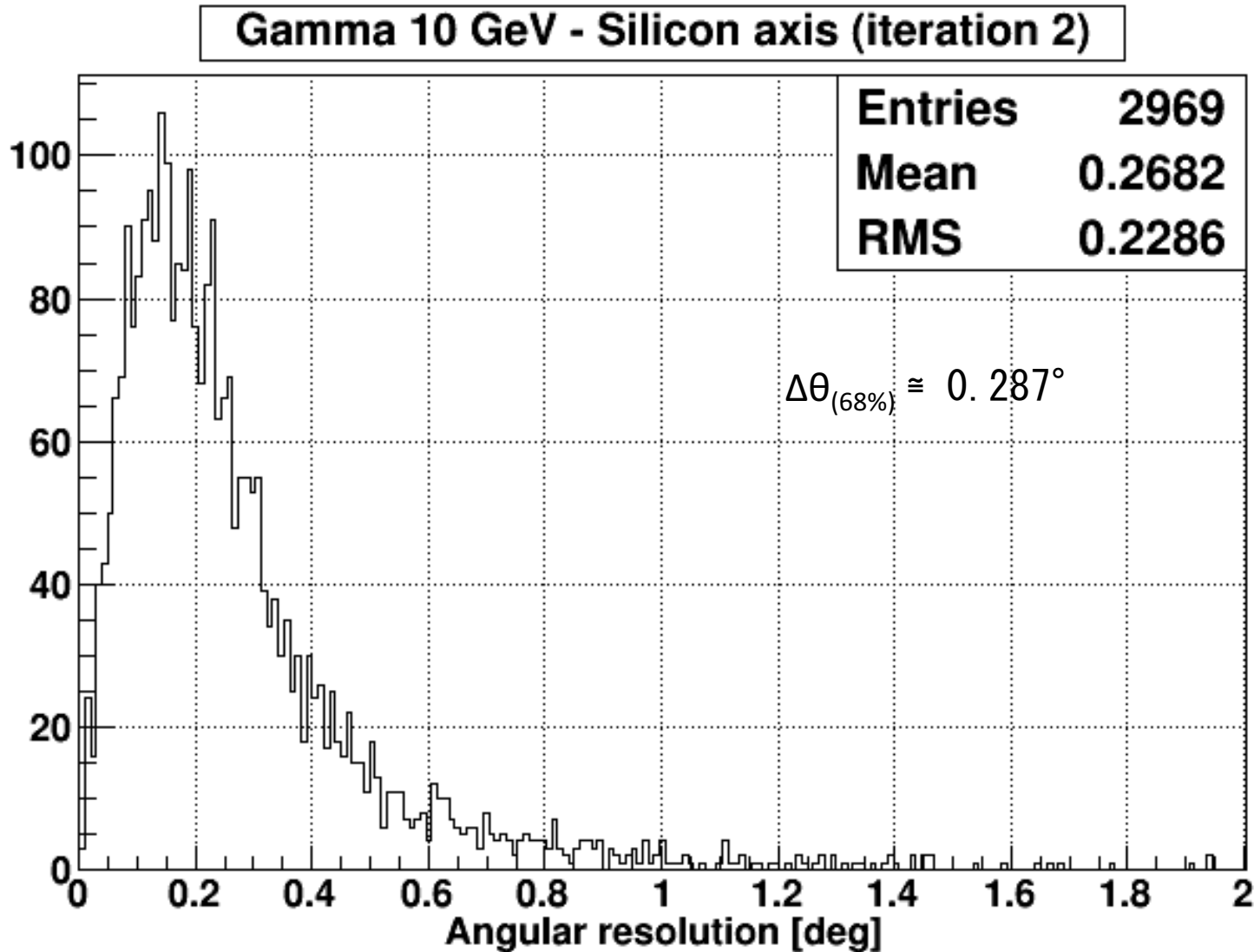


Plane 4X

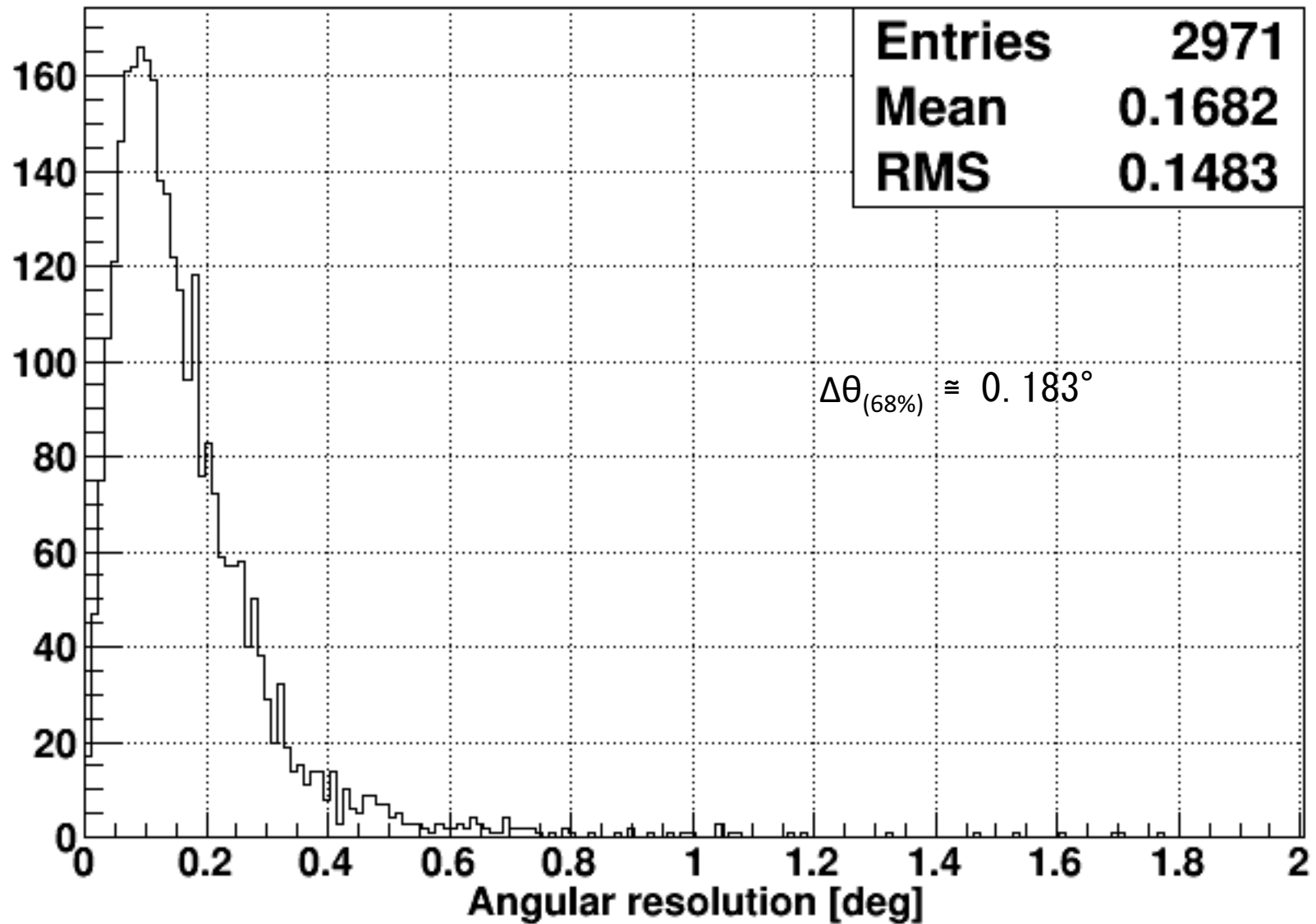


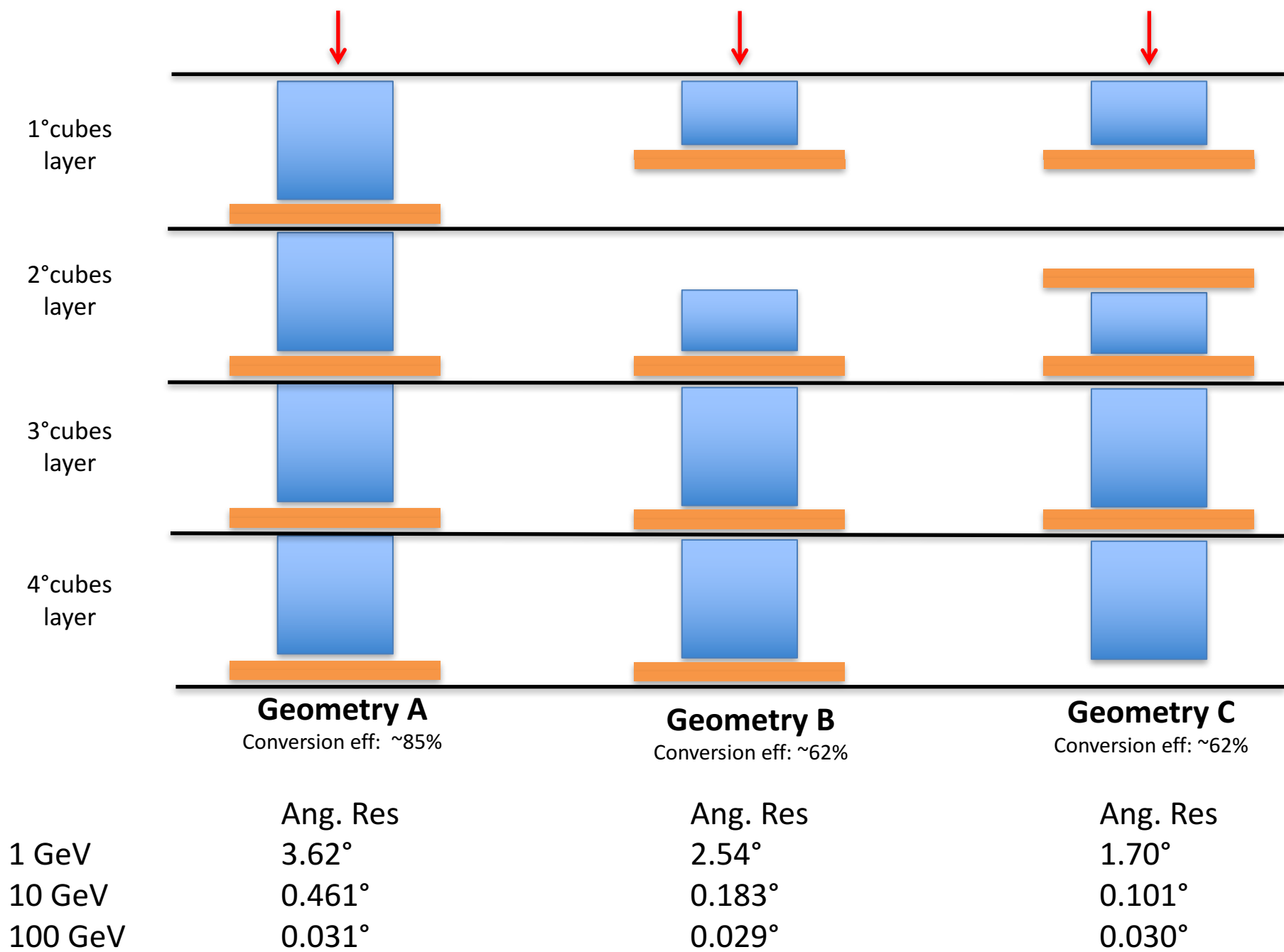
Mean position estimation on the plane  $\bar{x} = \frac{\sum_i [x_i \times S_i \times W_{SIL}(x_i)]}{\sum_i [S_i \times W_{SIL}(x_i)]}$

Gaussian weight  $W_{SIL}(x) = C \left[ 1 + \left( 2 \frac{x - \bar{X}_{SIL}}{\Delta_{SIL}} \right)^2 \right]^{-\alpha_{SIL}}$



# Gamma 10 GeV - Silicon axis (final algorithm)





# Studio futuro dell'algoritmo di ricostruzione

- Verificare, ed eventualmente modificare, la procedura in funzione del punto e dell'angolo di incidenza
- Studiare la solidità dell'algoritmo
- Studiarne le prestazioni in funzione dell'energia
- Ottimizzare la configurazione geometrica