

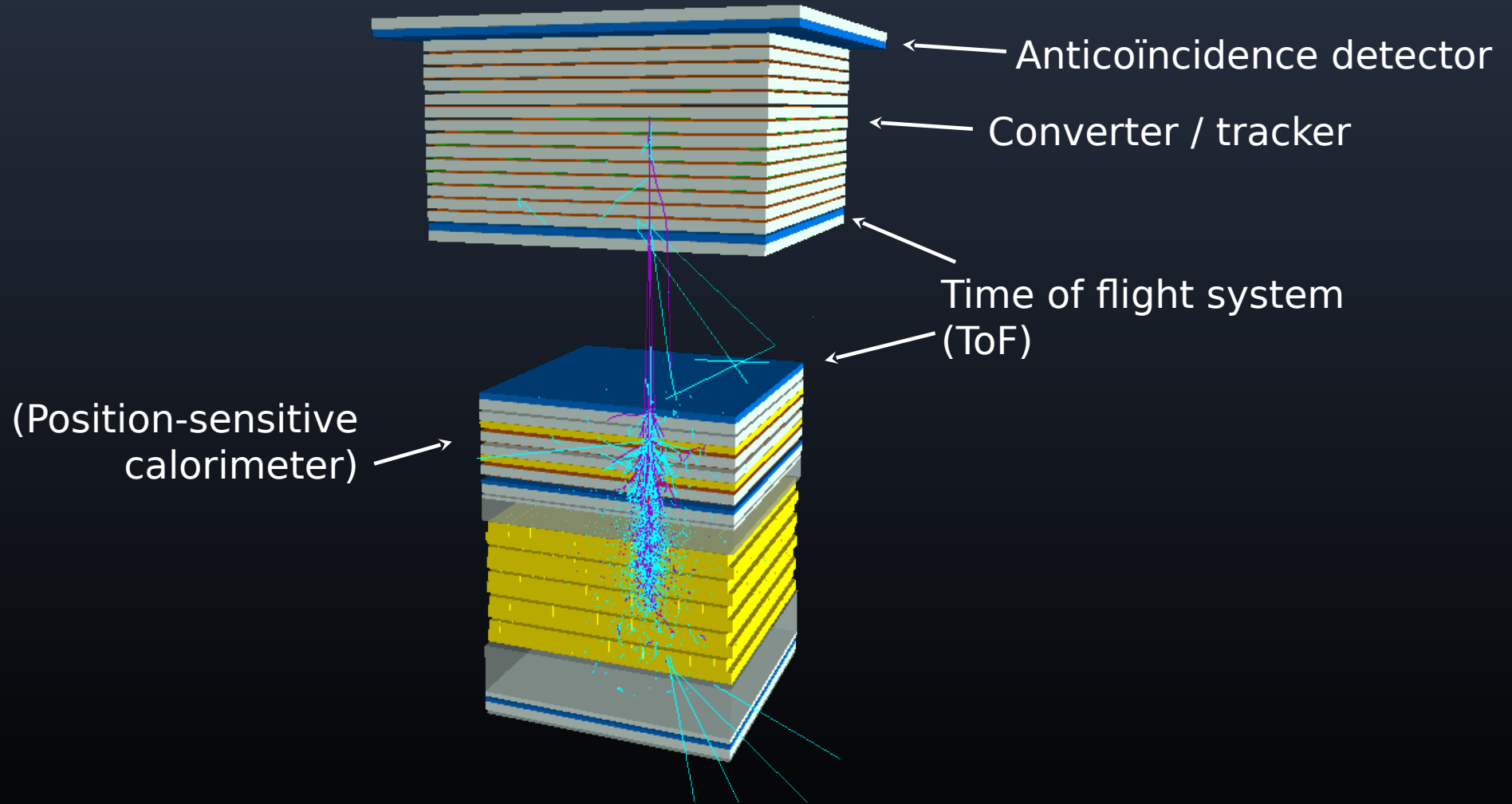
# New method of high-energy gamma ray direction reconstruction in multi-layered converters

M. Kheymits, A. Galper, I. Arkhangelskaja,  
A. Arkhangelskij, A. Bakaldin, Yu. Gusakov, O. Dalkarov,  
E. Djivelikyan, A. Egorov, A. Leonov, P. Naumov, N. Pappe,  
M. Runtso, Y. Stozhkov, S. Suchkov, N. Topchiev,  
Yu. Yurkin, V. Zverev

# Contents

- Method of  $\gamma$ -ray direction reconstruction for  $E > 300$  MeV in a gamma-ray detector with multi-layered converter.
- Use data from a position-sensitive multi-layered converter and a calorimeter, if available.
- Algorithm has parameters to gain a trade-off between the angular resolution and the effective area.
- The algorithm is applied to simulated data of the GAMMA-400 gamma-ray space telescope.

# Typical detector scheme



# Prior event selection

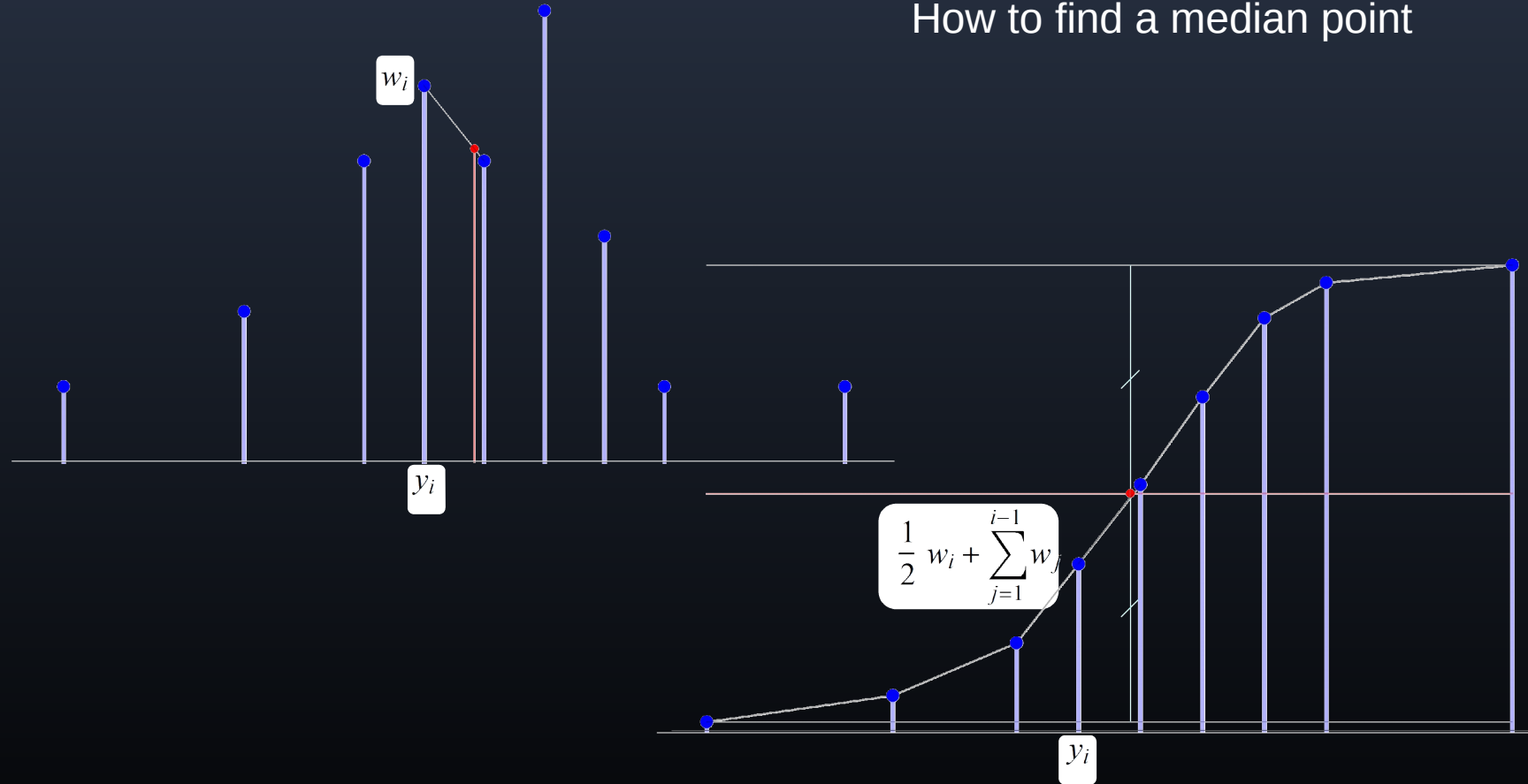
- Conversion  $\gamma \rightarrow e^-e^+$  in the converter:
  - Signal in `ToF[1]` before that in `ToF[2]`;
  - Signal in the last two converter layers.

# Direction reconstruction

- To find a  $\gamma$ -ray momentum direction, signals from converter strips (or fibers, or whatever) and, if available, calorimeter are used.
- We use a median point—the median of the energy deposit in a layer—as an estimate of a track/shower position.

# Direction reconstruction

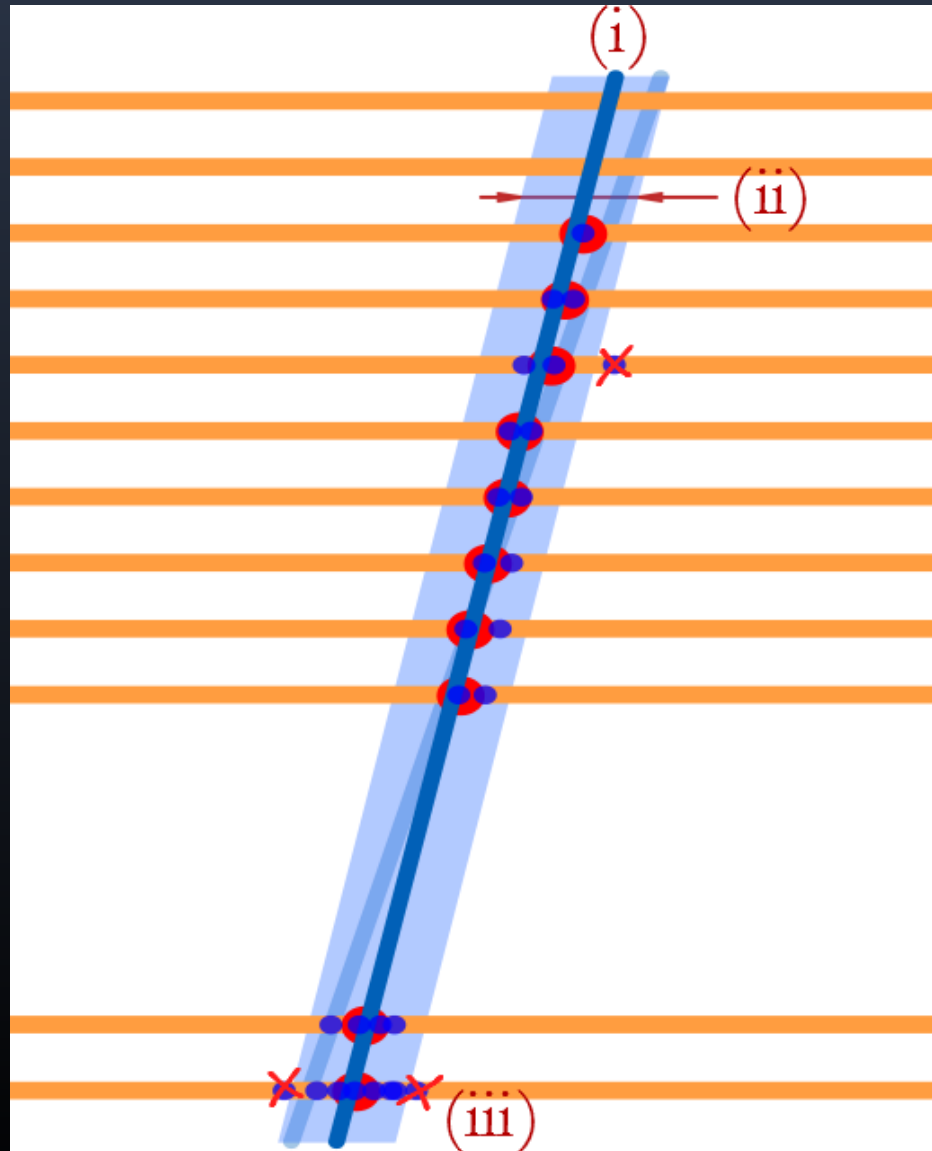
How to find a median point



# Direction reconstruction

- Track reconstruction is done in several iterations.
- At each iteration, a linear weighted fit is done through the median points in each layer for each orientation...
- ... and then all strips, placed farther than some distance from the line reconstructed, are excluded.

# Direction reconstruction



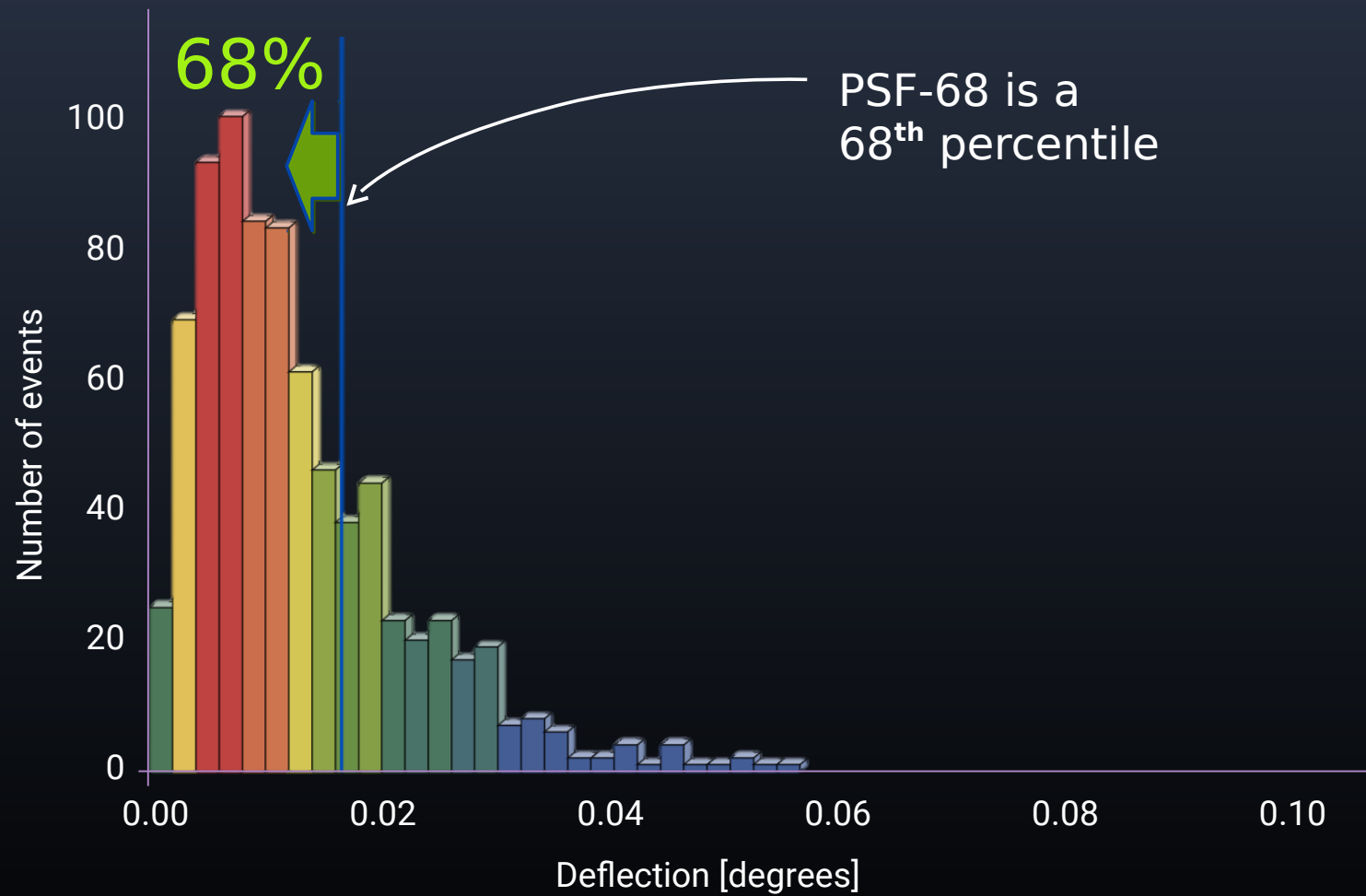
If less than  $N$  points left,  
reject this event



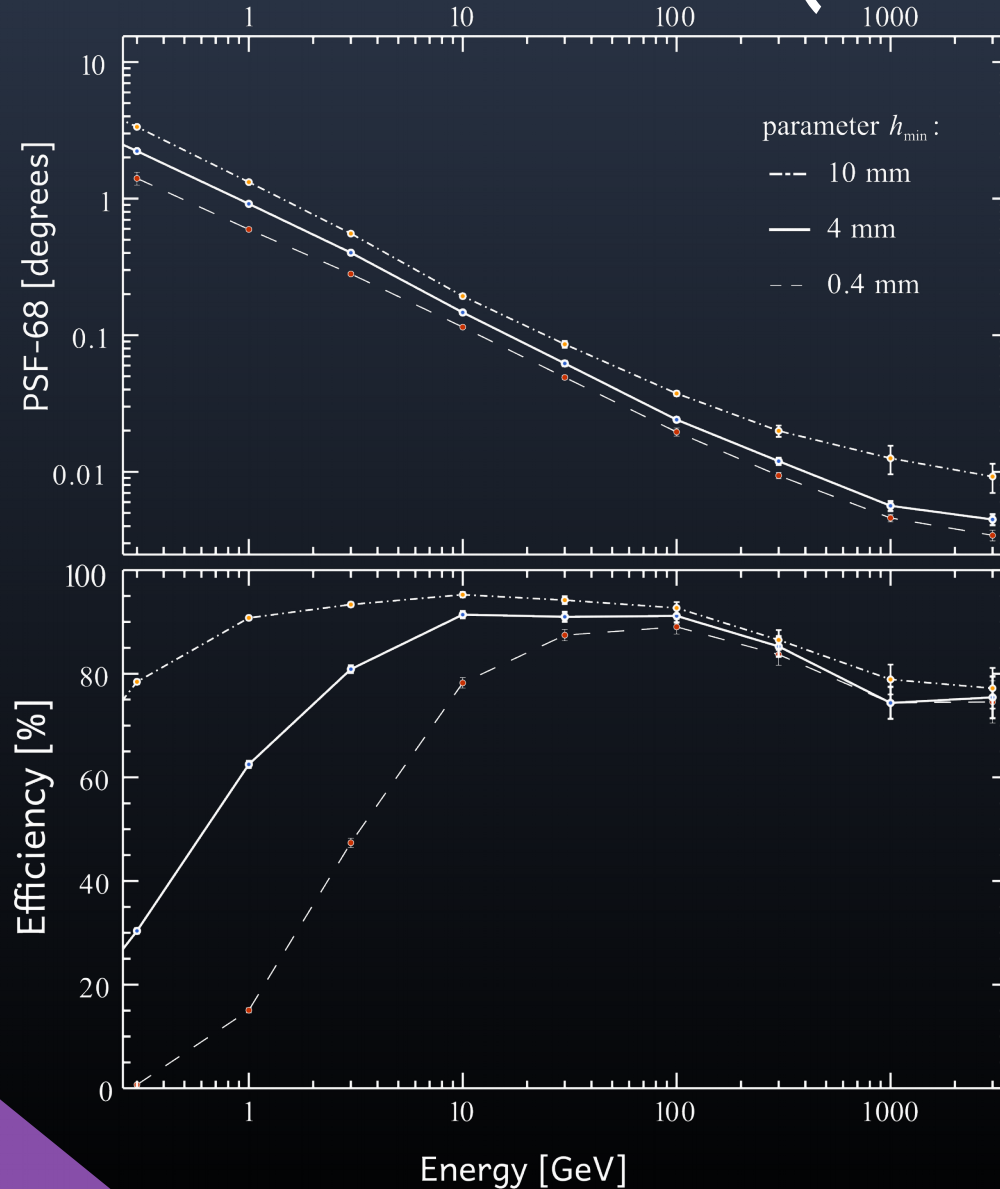
# Angular resolution calculation

- Simulate a flat flux of gamma-ray particles.
- Find a median between all reconstructed directions.
- Angular resolution here means PSF-68, **semiopening of a cone**, coaxial with a median direction, containing **68%** of reconstructed directions.
- The median direction deflects from the real direction much less than by PSF-68.

# Angular resolution calculation



# Results (for GAMMA-400)



## Conclusions

- A method of direction reconstruction is designed and applied to GAMMA-400.
- The method has a number of parameters.
- Their values can be found to meet a trade-off between the angular resolution and the efficiency.



# Thank you for your attention!