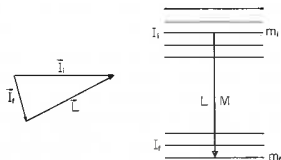# Angular Correlations with AGATA

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$\gamma\gamma$ angular correlations (naïve version)
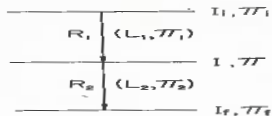
Direction of γ rays $F_L^M(\theta)$

$$\sum_{m_i m_f} P(m_i) G(m_i m_f) F_L^M(\theta)$$

In γ-ray spectroscopy different m-states unresolved

One γ fixes m population and coordinate system

All π_i same population when direction of γ_1 used as reference$\rightarrow$ π distribtion known (m$_i$ to the left)

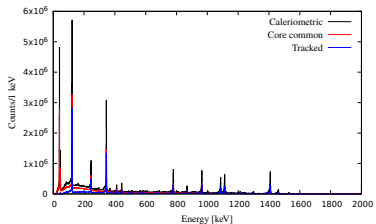# Why look at $\gamma\gamma$ angular correlations?

- Multipolarity of γ ray important information
- Proves we understand the spectrometer
- To correlate or look at distribution relative something else than another γ ray we need to "train".

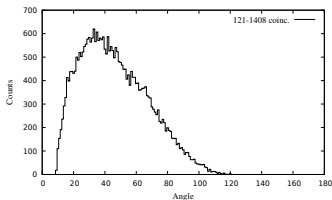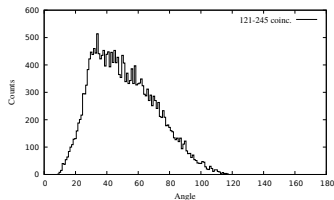# Data from ^{152}Eu source run Mars 2016

30 detectors
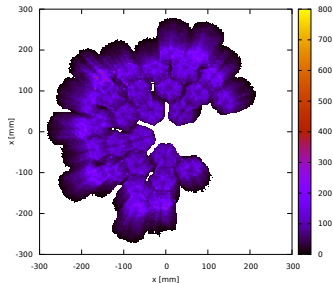
Energy spectra

How to extract an angular correlation from a γ-ray tracking Array?

Make historgram of angles between tracked γ rays

121-1408 keV

121-245 keV

Divide with something to normalize for angular coverage efficiencies etc

Divide with what?

Geometrical coverage for $\gamma\gamma$ or

Using tracked γ rays from different events or

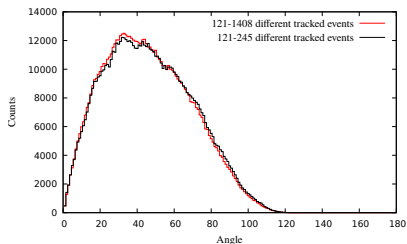Create "realistic non-correlated events" to track

Divide with what?

Geometrical coverage for $\gamma\gamma$ or
This looks almost exactly as the next so skip. . .

Details

Divide with what?

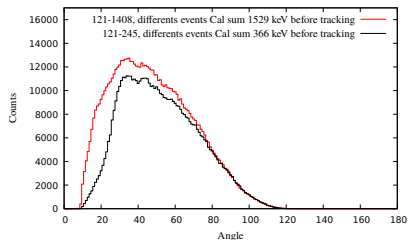## Using tracked γ rays from different events or

Details

- Do γ-ray tracking
- Take γ_1 from one event, γ_2 another event
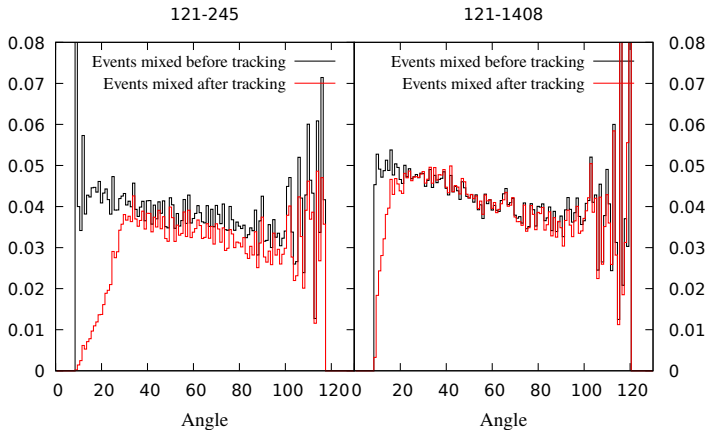- Calculate the angle

Divide with what?

Create "realistic non-correlated events" to track
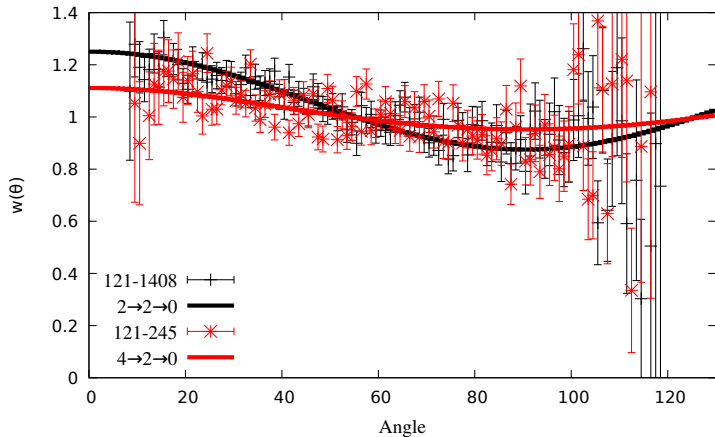

Details

- Pairs of uncorrelated events with a calerometric energy corresponding to the γ rays
- Concat interactions in pairs into single events
- Do γ-ray tracking
- Take γ_1 and γ_2 from same tracked event
- Calculate the angle between γ_1 and γ_2

How does it look?

How does it look?

Some conclusions

Non trivial dependencies

- Efficiency as a function of angle between γ rays
- Goes both ways - to get precis intensities in cascade one needs angular correlations
- Geometrical coverage not enough, tracking has to be included

Question to be answered

- How to handle "real" data with large background?
- "Mixing before tracking" ambigious. . .

Emacs 24.3.1 (Org mode 8.2.6)