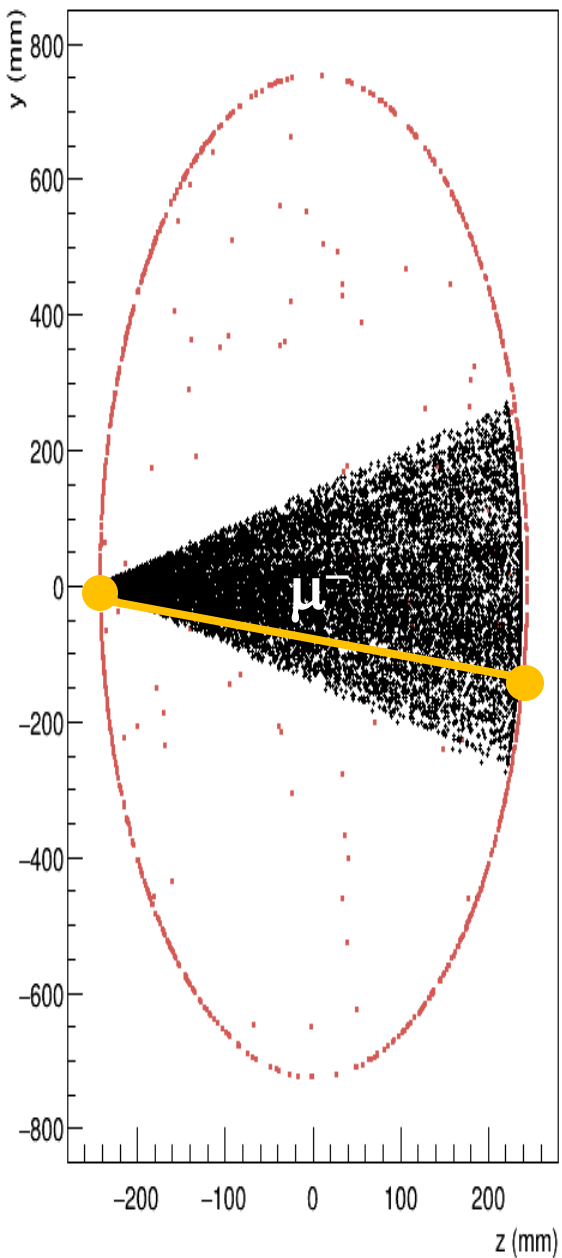


3D reconstruction with lens-based cameras (Mathematica -> Root)

P. Bernardini, G. De Matteis, L. Martina, A. Surdo

GRAIN zoom meeting - December 20, 2024



GRAIN with 38 lens-cameras

A SiPM 32x32 array for each camera

10^3 negative muons (1 GeV) entering GRAIN,
at the center

Initial angle w.r.t. z axis in the range $0^\circ - 30^\circ$

Multiple Scattering and magnetic field
are simulated

True track estimated by entrance and
exit points

Each α camera is associated with a 4x3 matrix: $P_\alpha[4][3]$

example

0	0	100	9000
0	-100	0	-47500
1	0	0	399

Each track on each camera is associated with a 3x1 matrix:

$L_\alpha[3][1]$

m_α	-1	q_α
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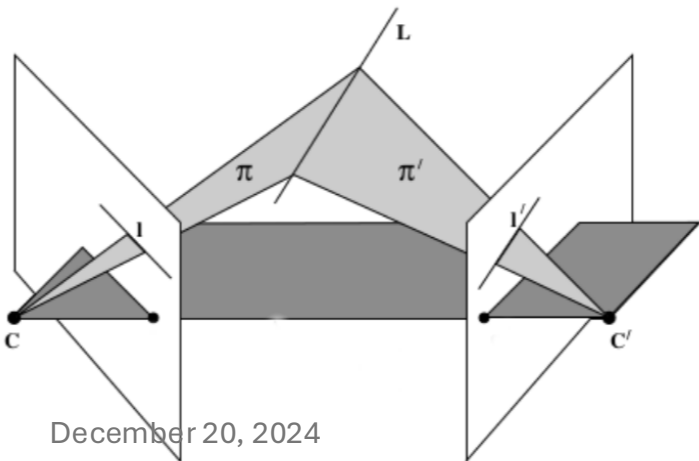
track parameters

The plane from the product of two matrixes

a_α	b_α	c_α	d_α
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plane parameters

$$P_\alpha^T[3][4] L_\alpha[3][1] = \pi_\alpha [4][1]$$



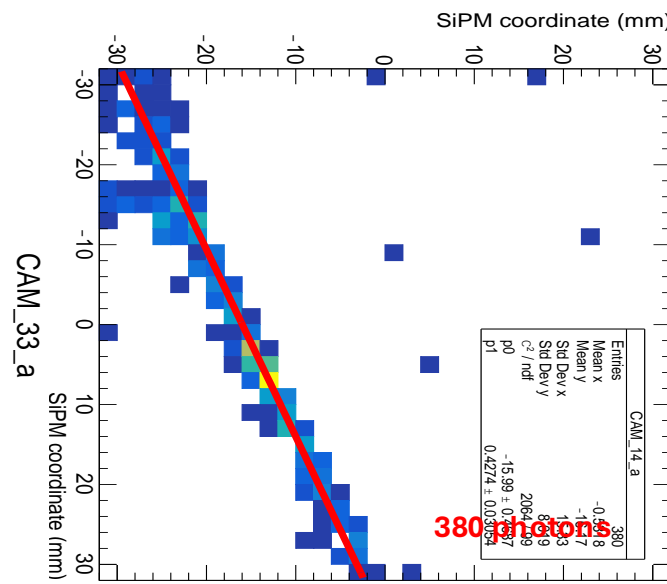
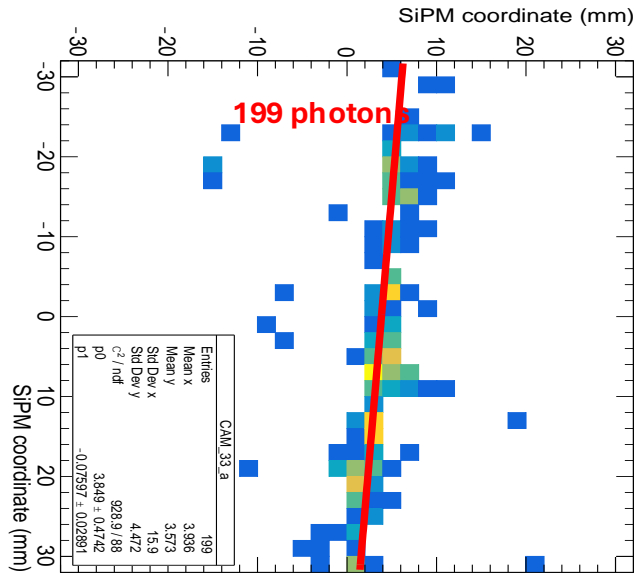
Track in the space from the intersection of two planes

In this analysis only pairs of orthogonal cameras

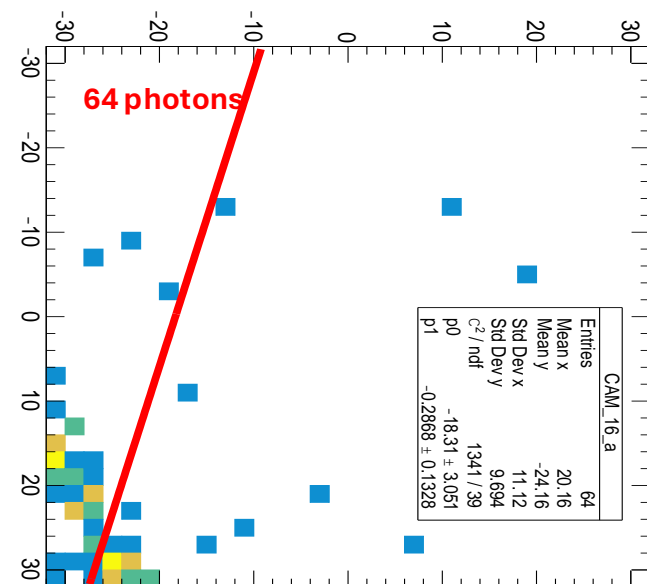
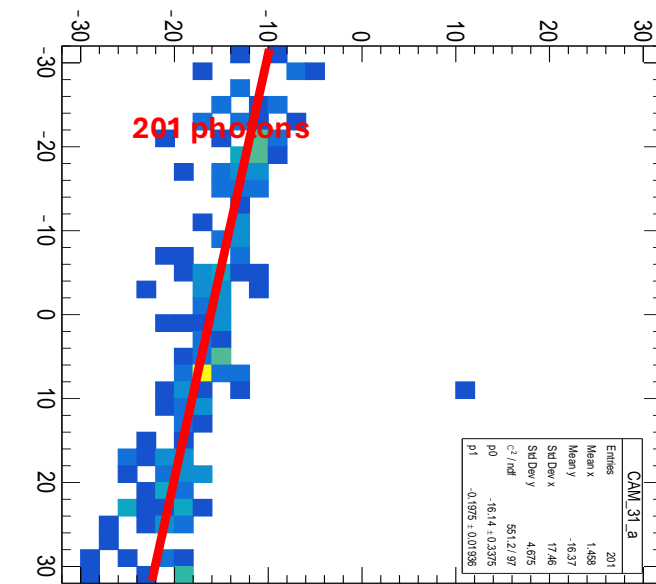
Rough Linear Fit

Cut: $N_\gamma > 100$

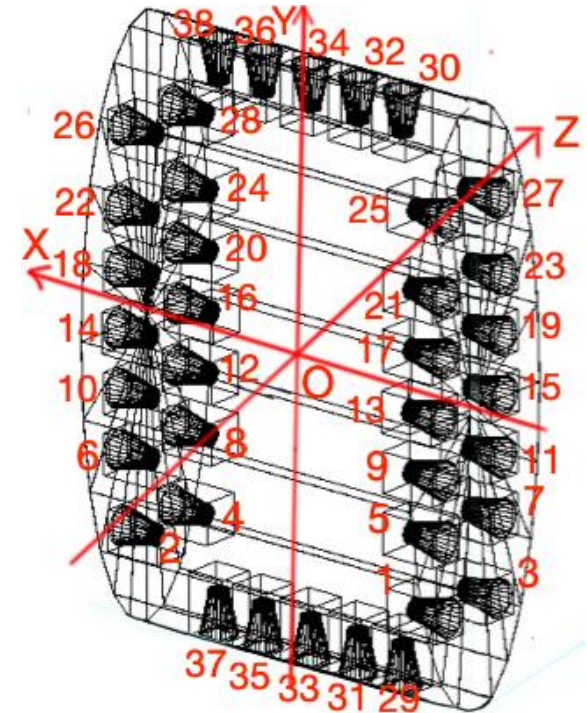
Improvements expected from pixel selection



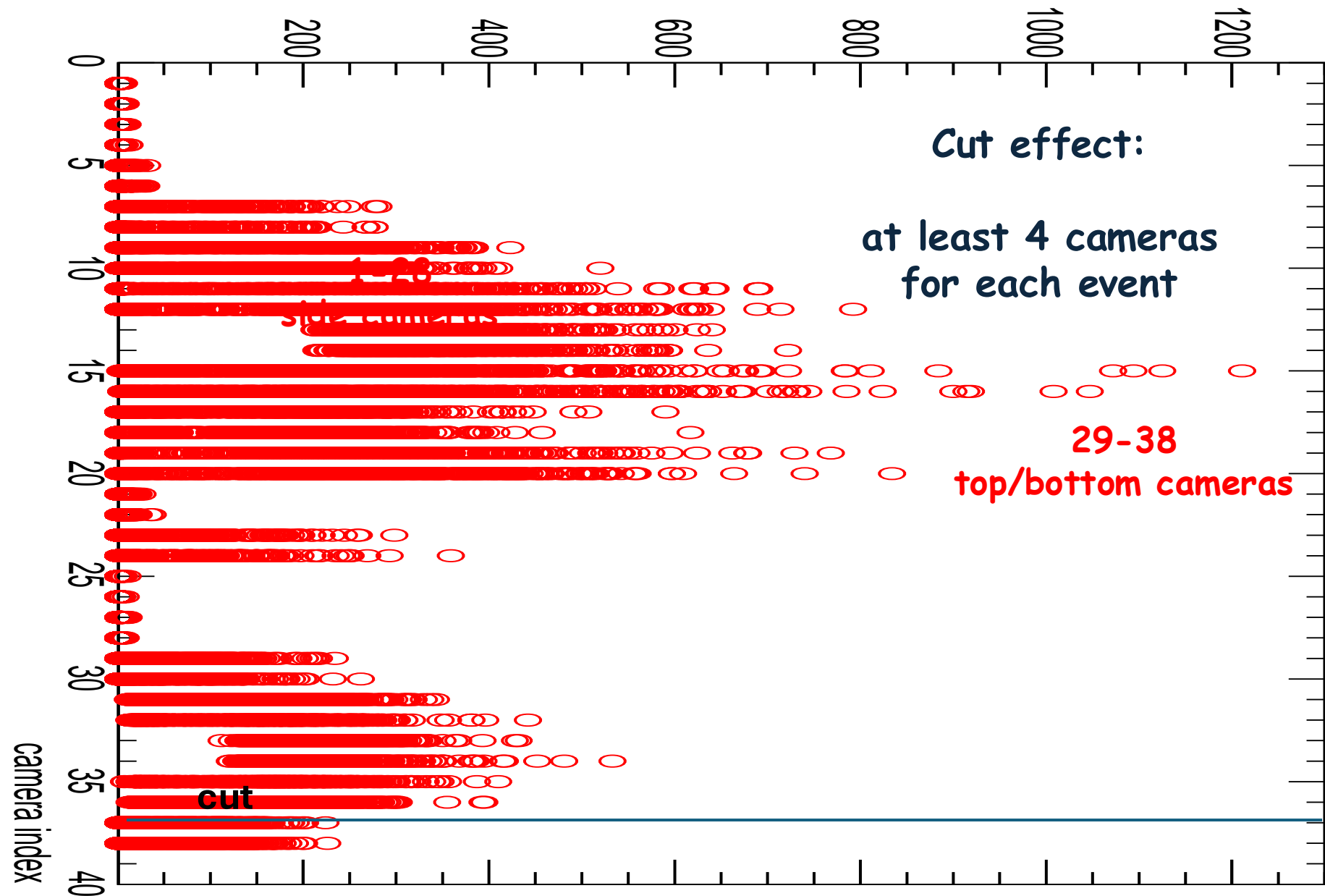
CAM_14_a



CAM_16_a

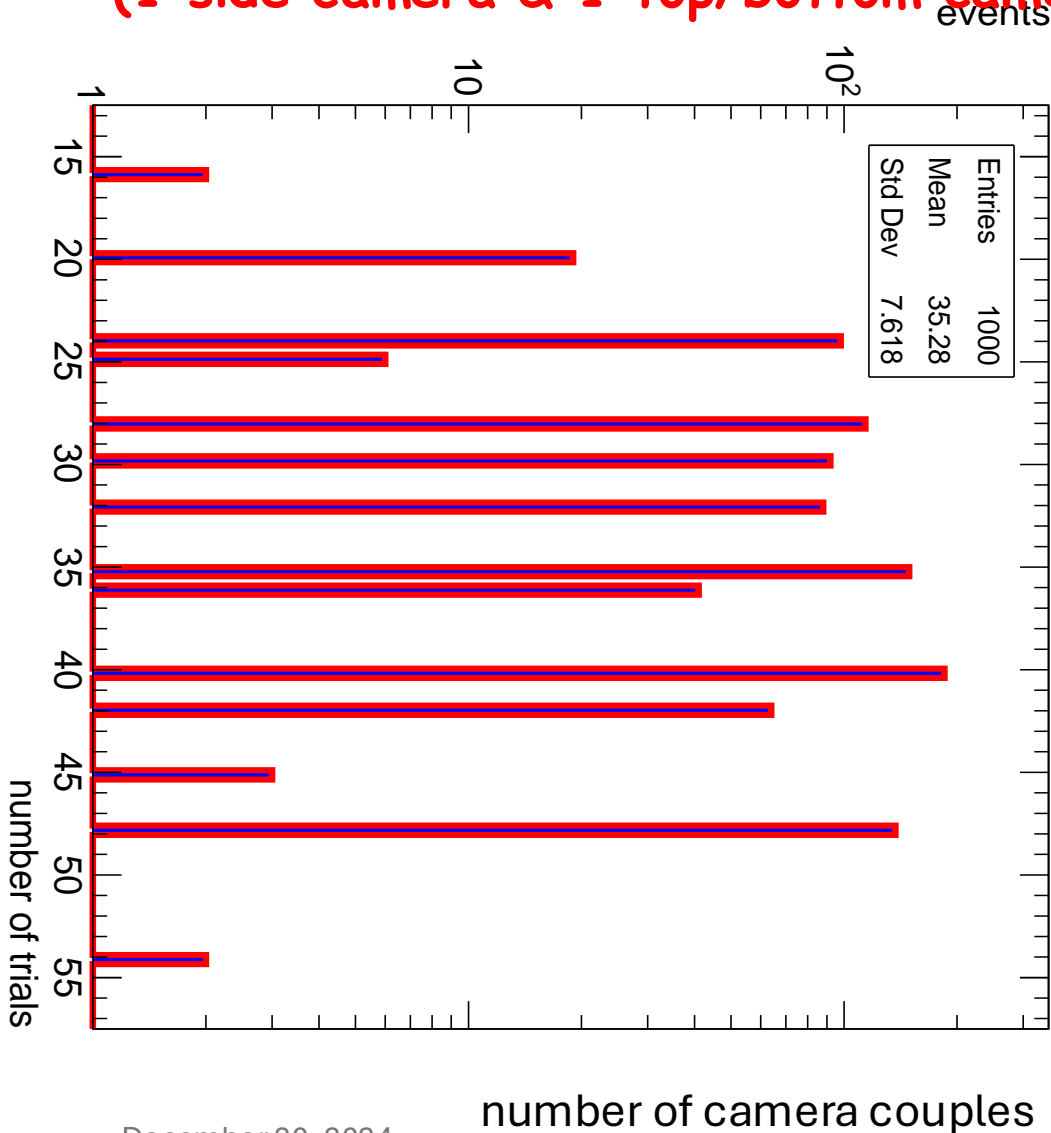


number of collected photons



At least 16 couples of orthogonal cameras / event

(1 side camera & 1 top/bottom camera)

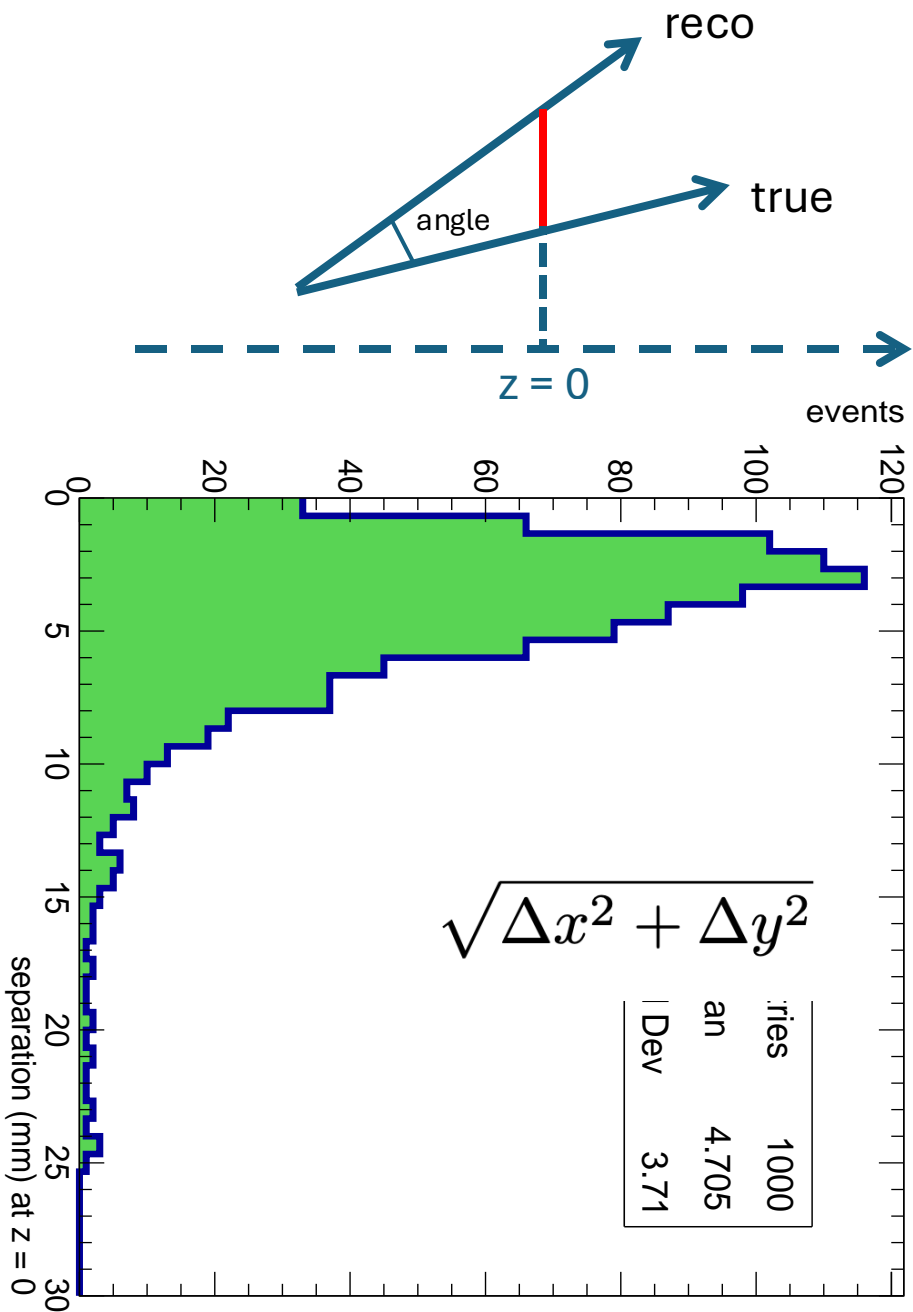
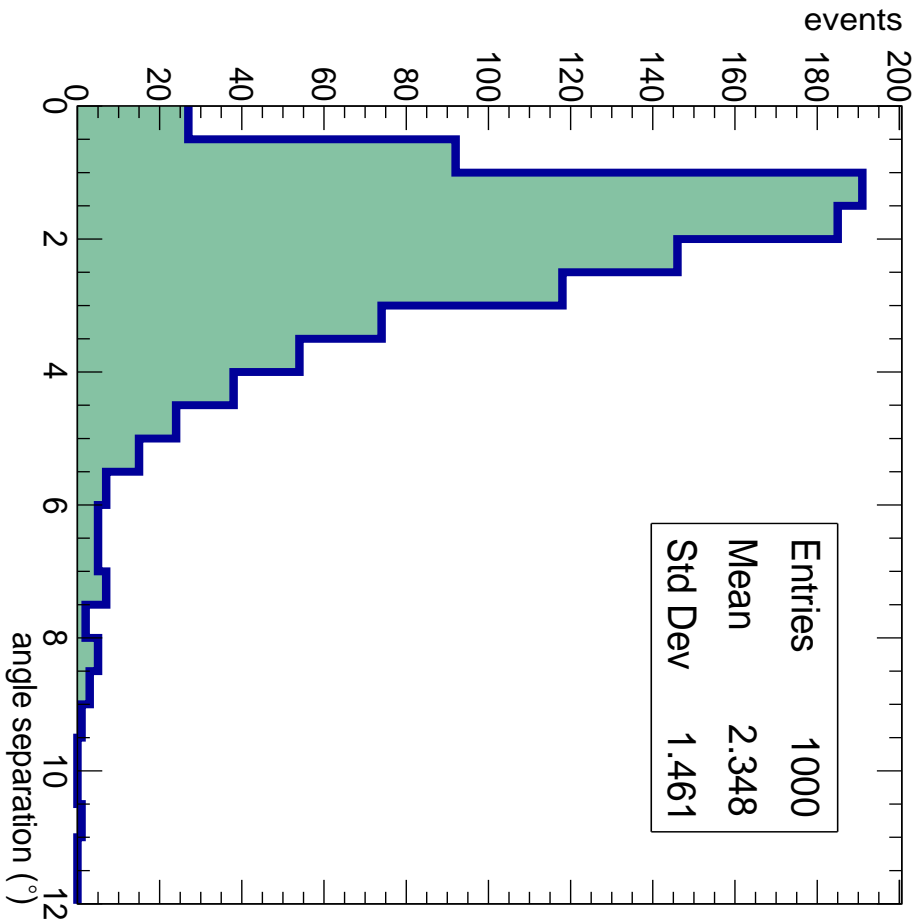


Up to now :
average estimate for
slope and intercept

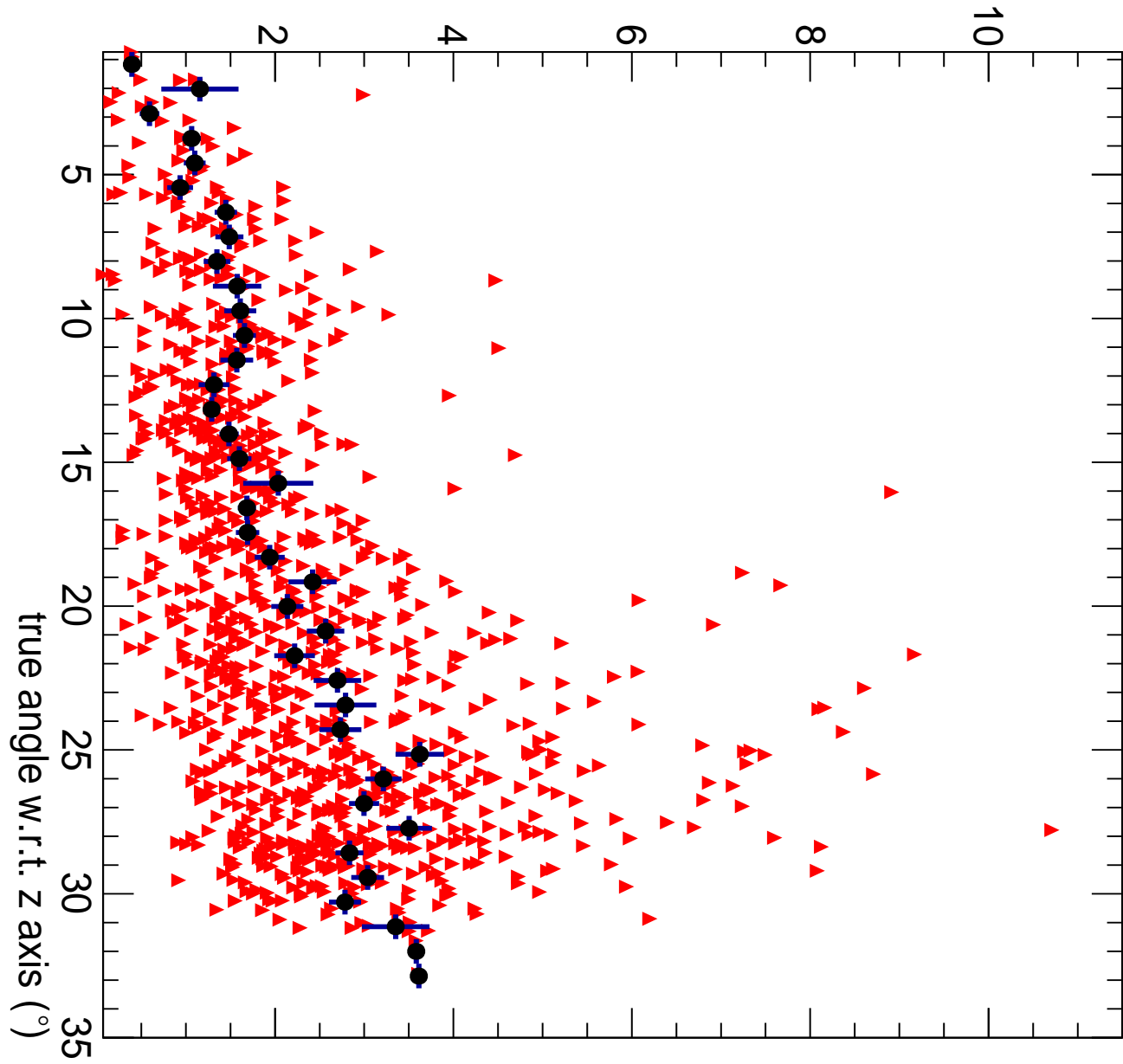
Other methods will be
tested in order to choose
the best parameters:

- weighed average
- number of photons
- fit quality on the camera

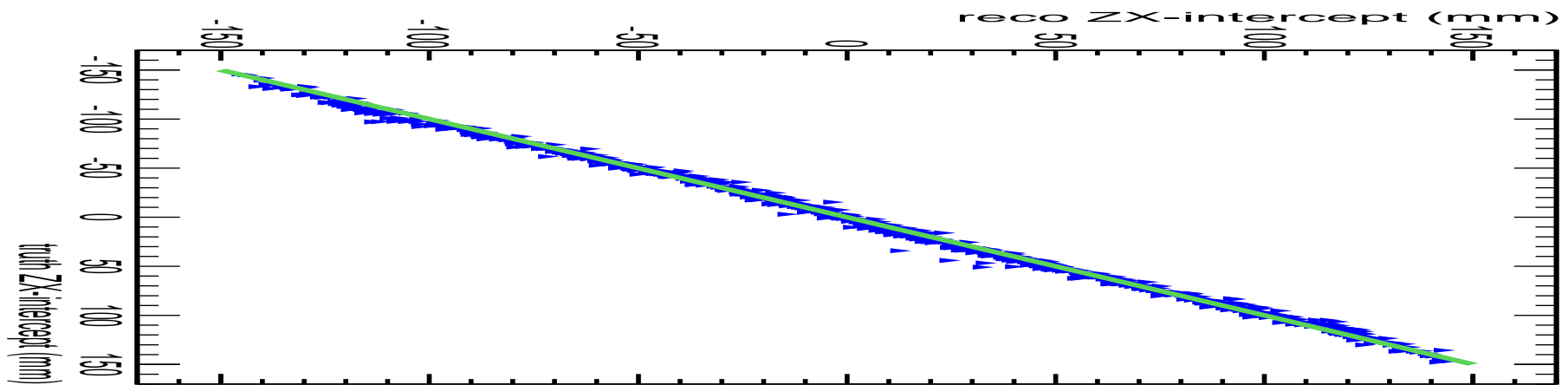
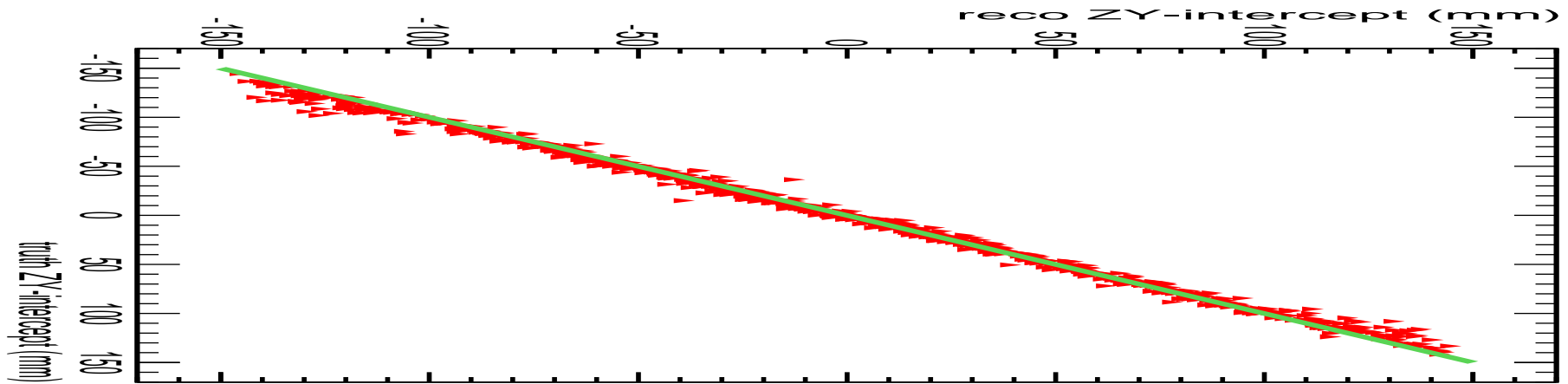
RESULTS



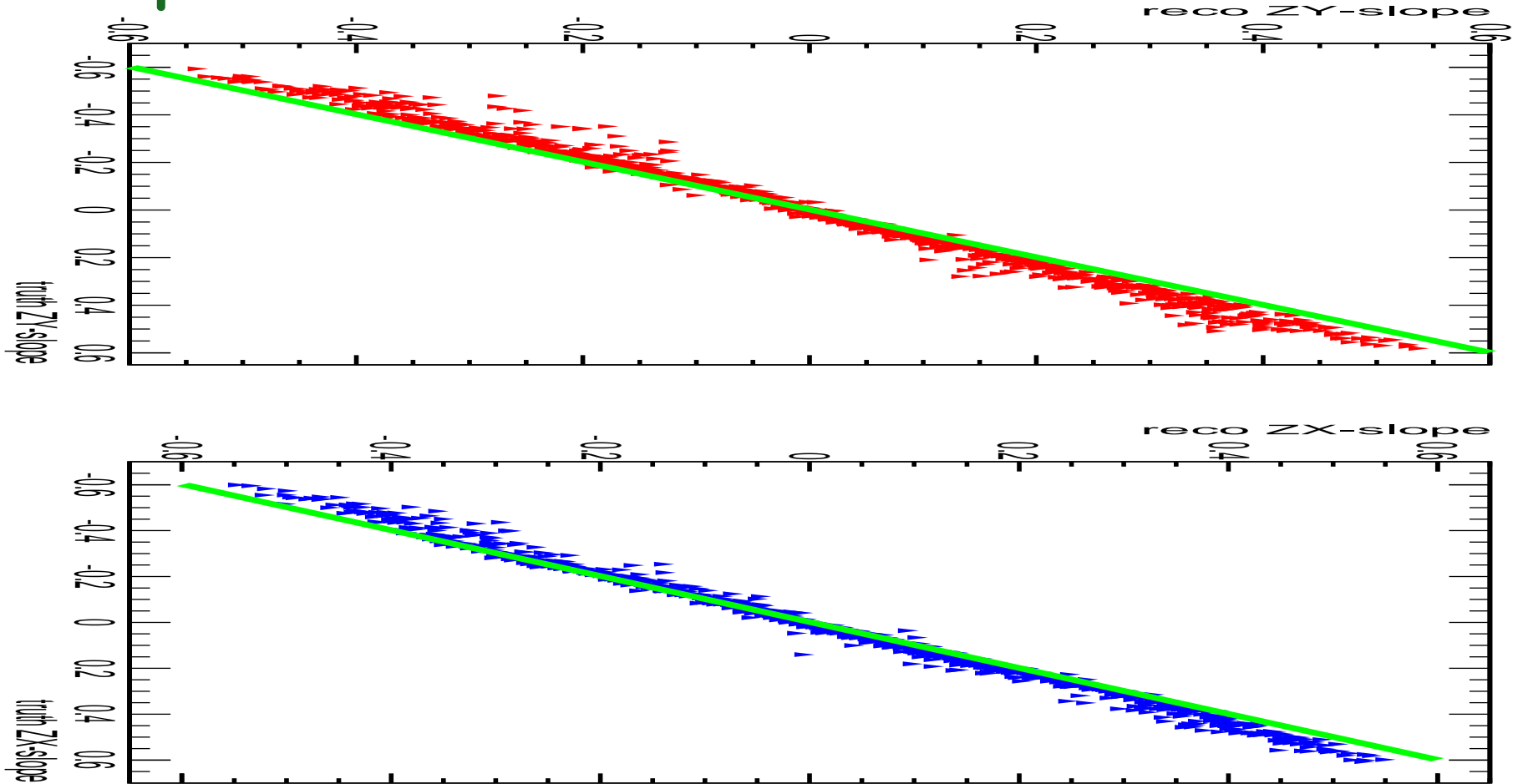
angle separation ($^{\circ}$)



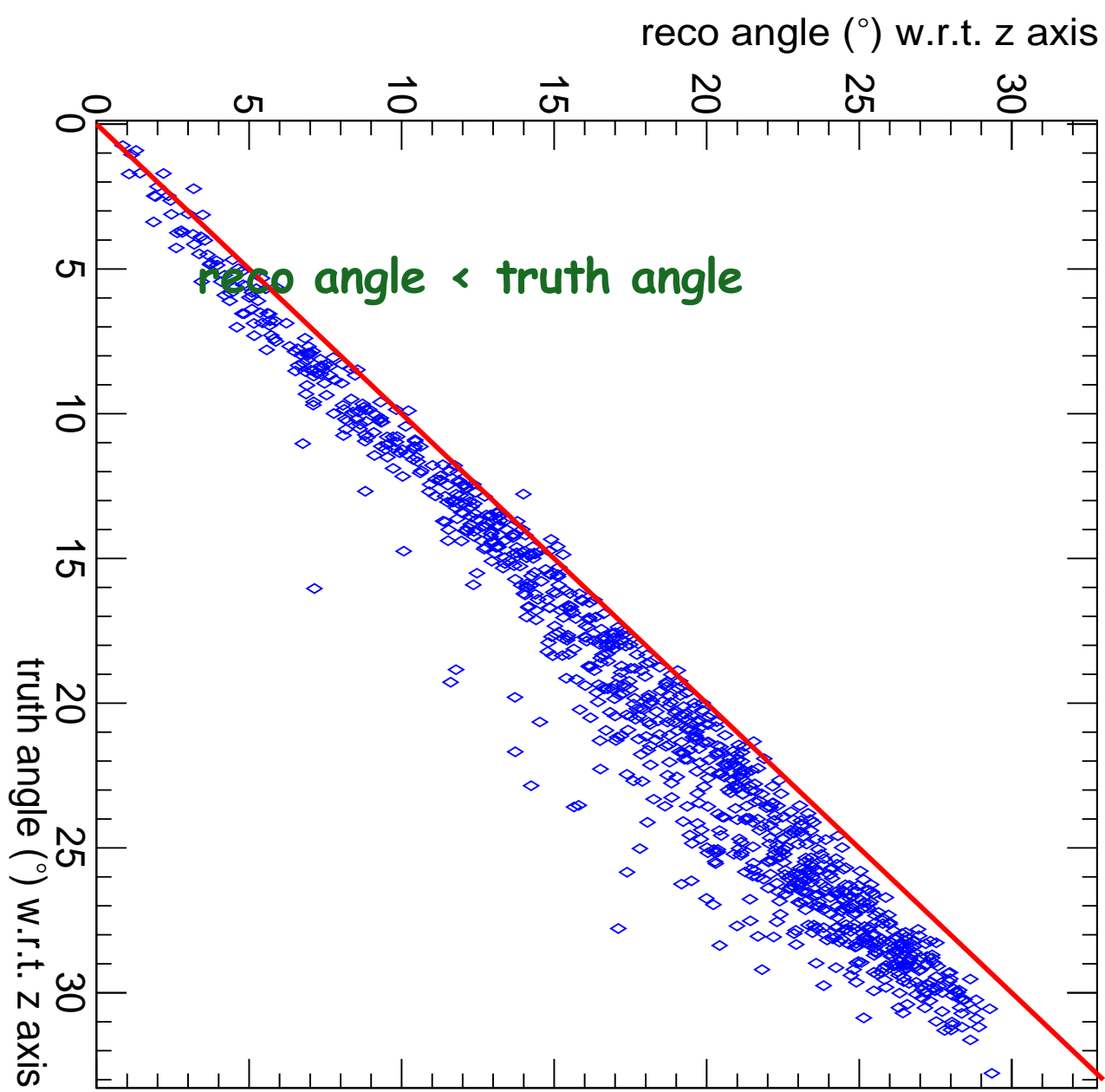
Intercepts in both views



Slopes in both views



Systematics ?

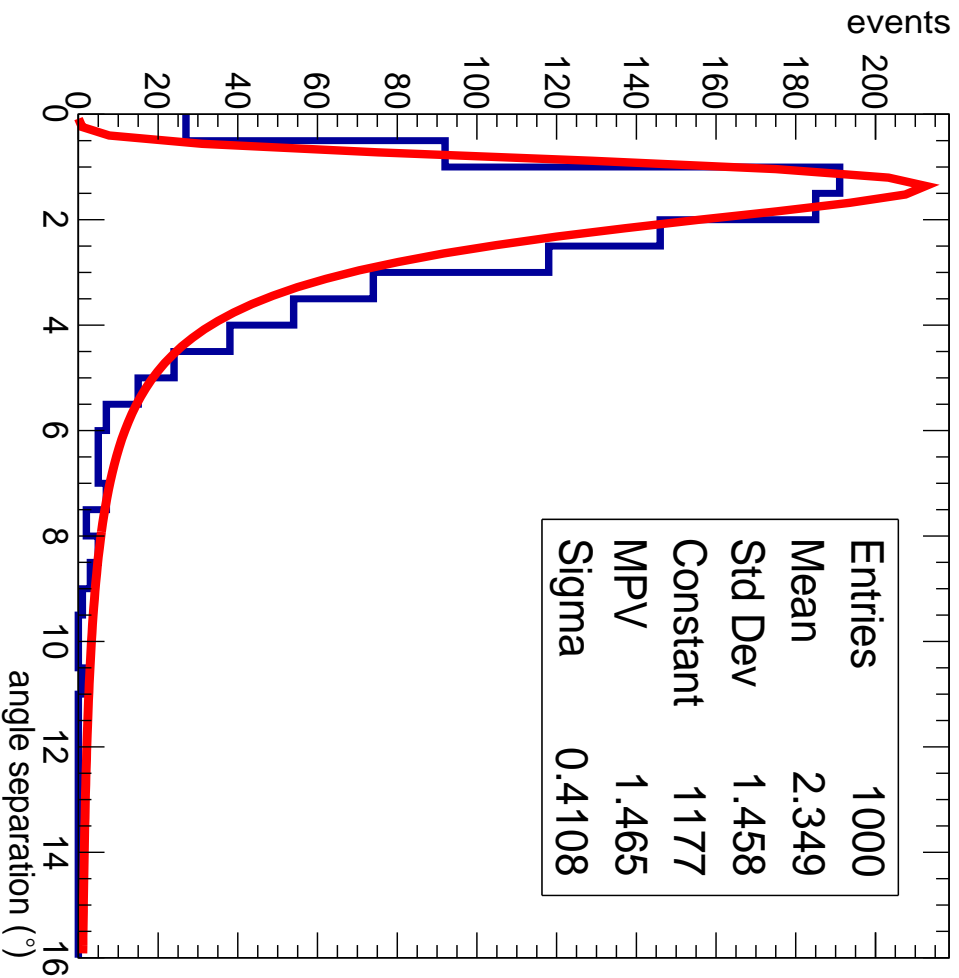
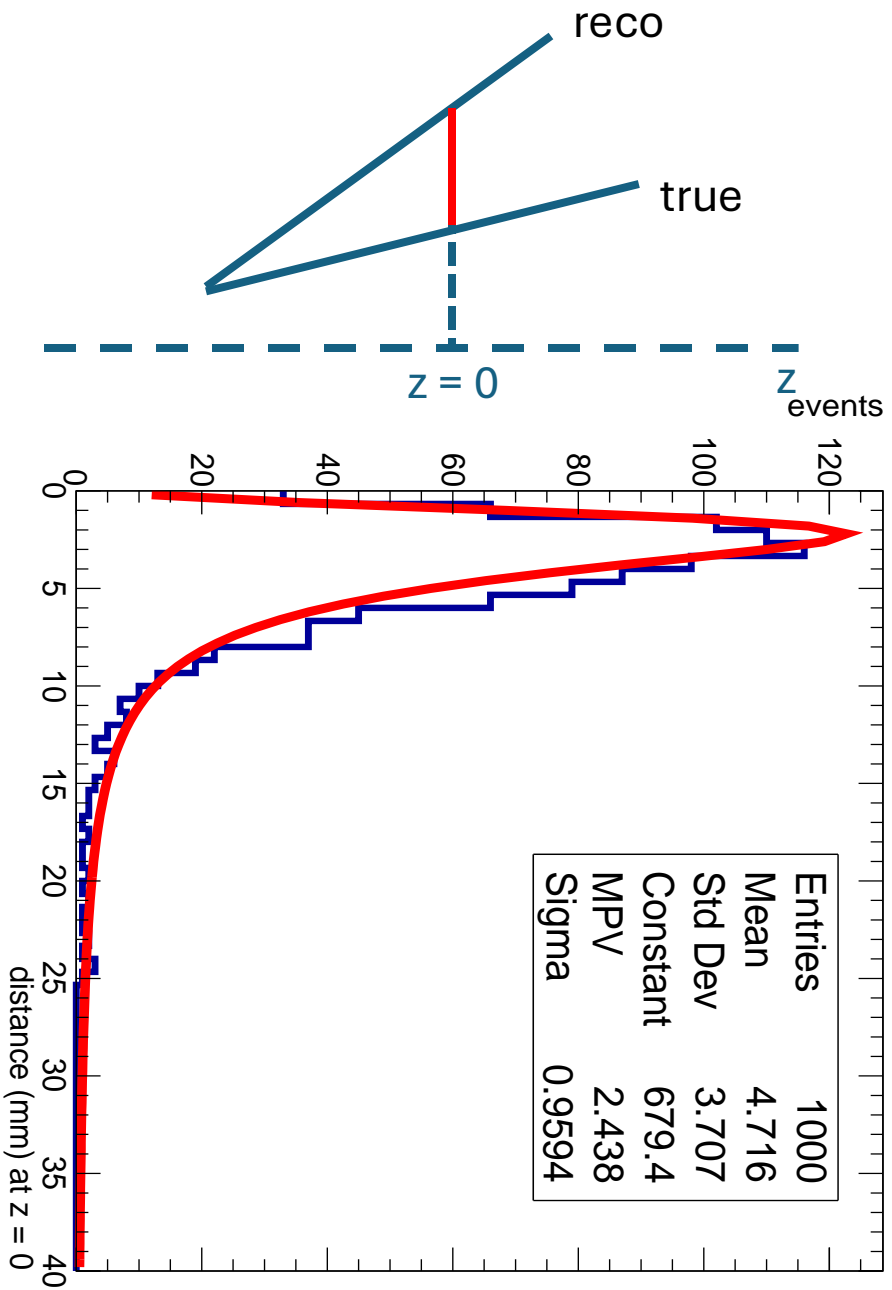


This angular effect
must be studied and
corrected

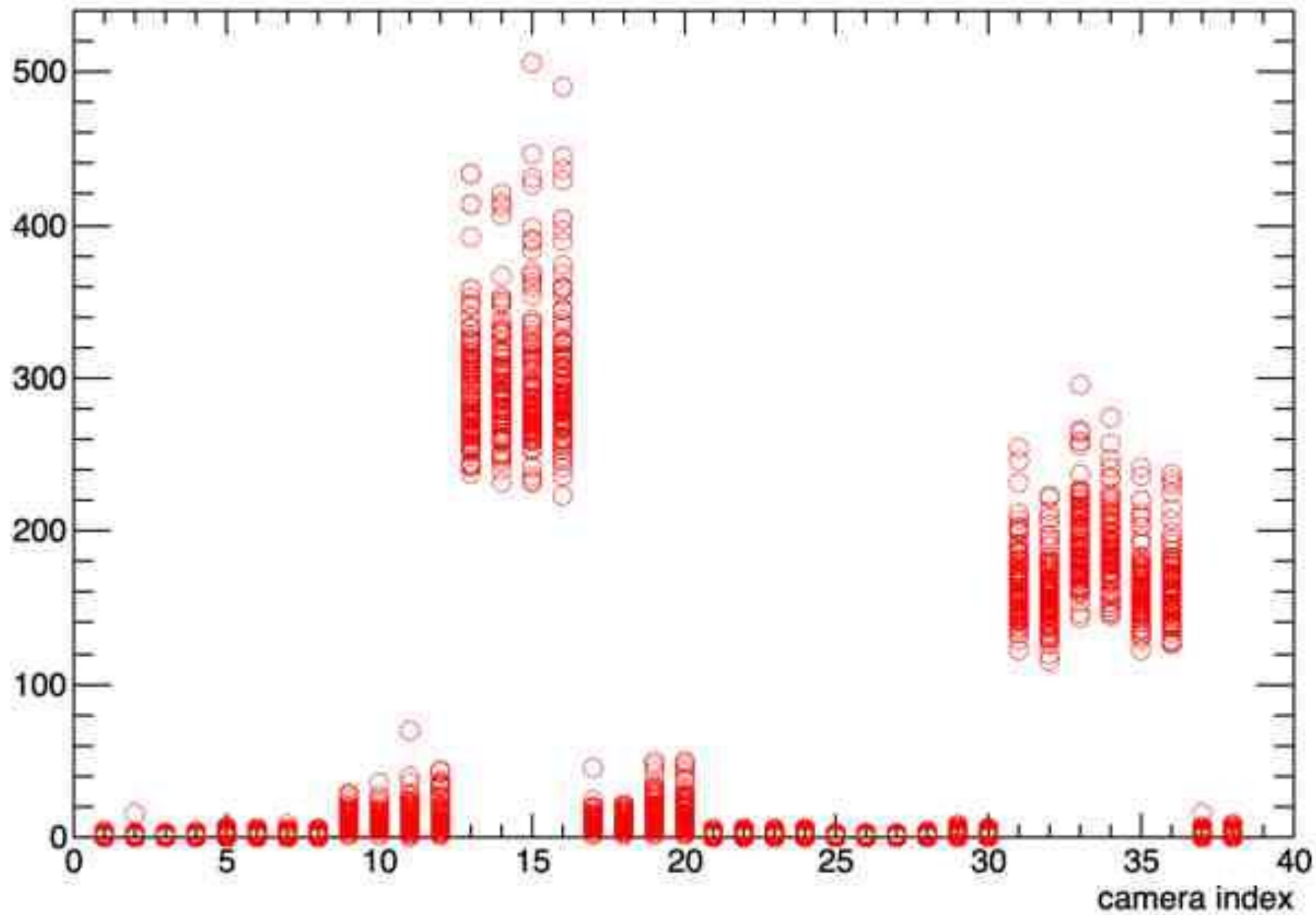
To do

- Pixel selection for the fit
- Choice of best track parameters for each event
- More statistics
- Study systematics on angle
- Tracks association
- 53-camera geometry
- Reconstruction with two tracks
- Vertex position

Backup



number of collected photons



Plane parameters (A, B, C, D)

