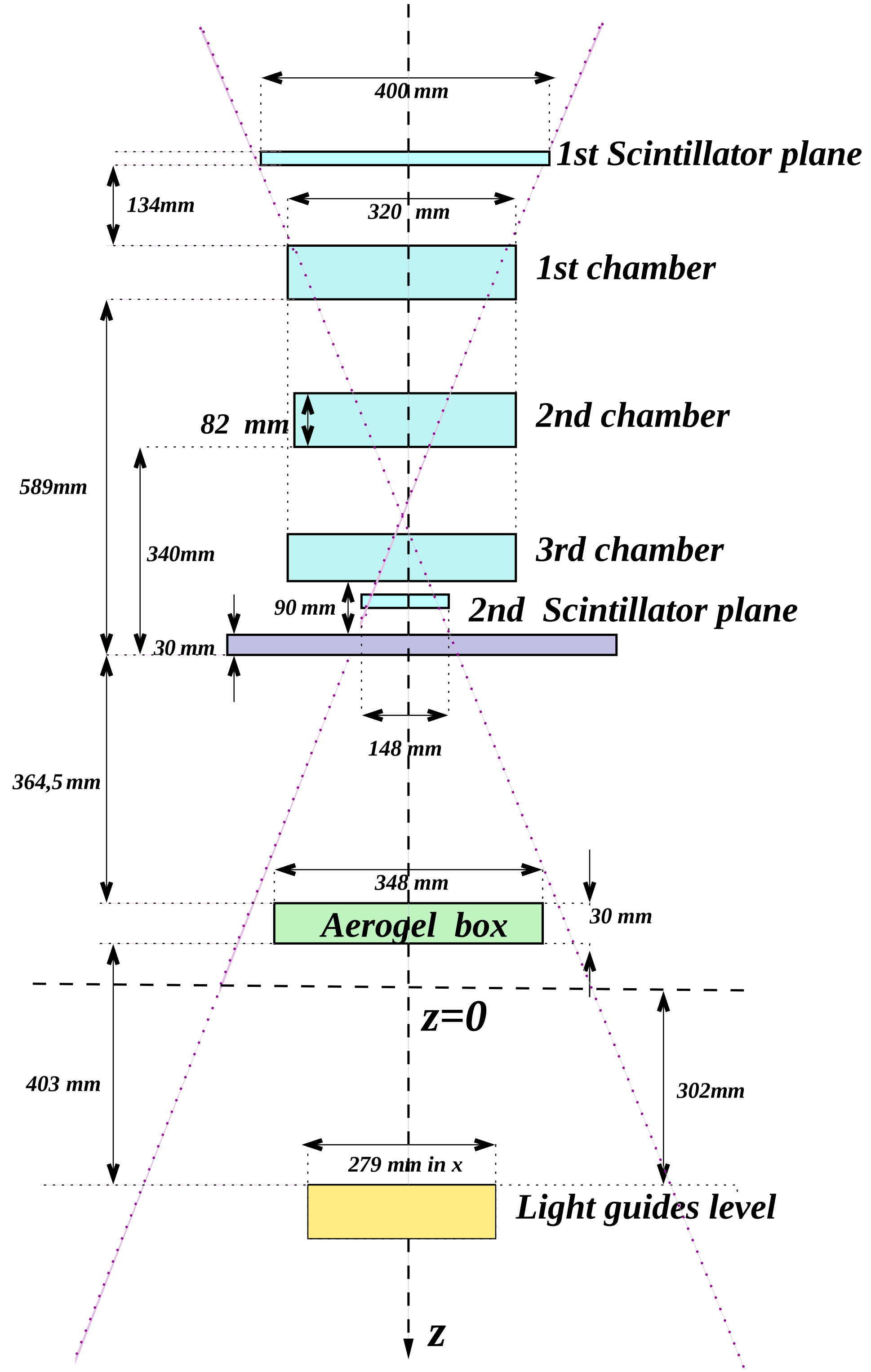
Preliminary Results of the RICH Prototype Data Analysis

Summary

- Alignment Procedures
- Selection of Events
- The β Reconstruction Procedure
- Results
- Conclusions

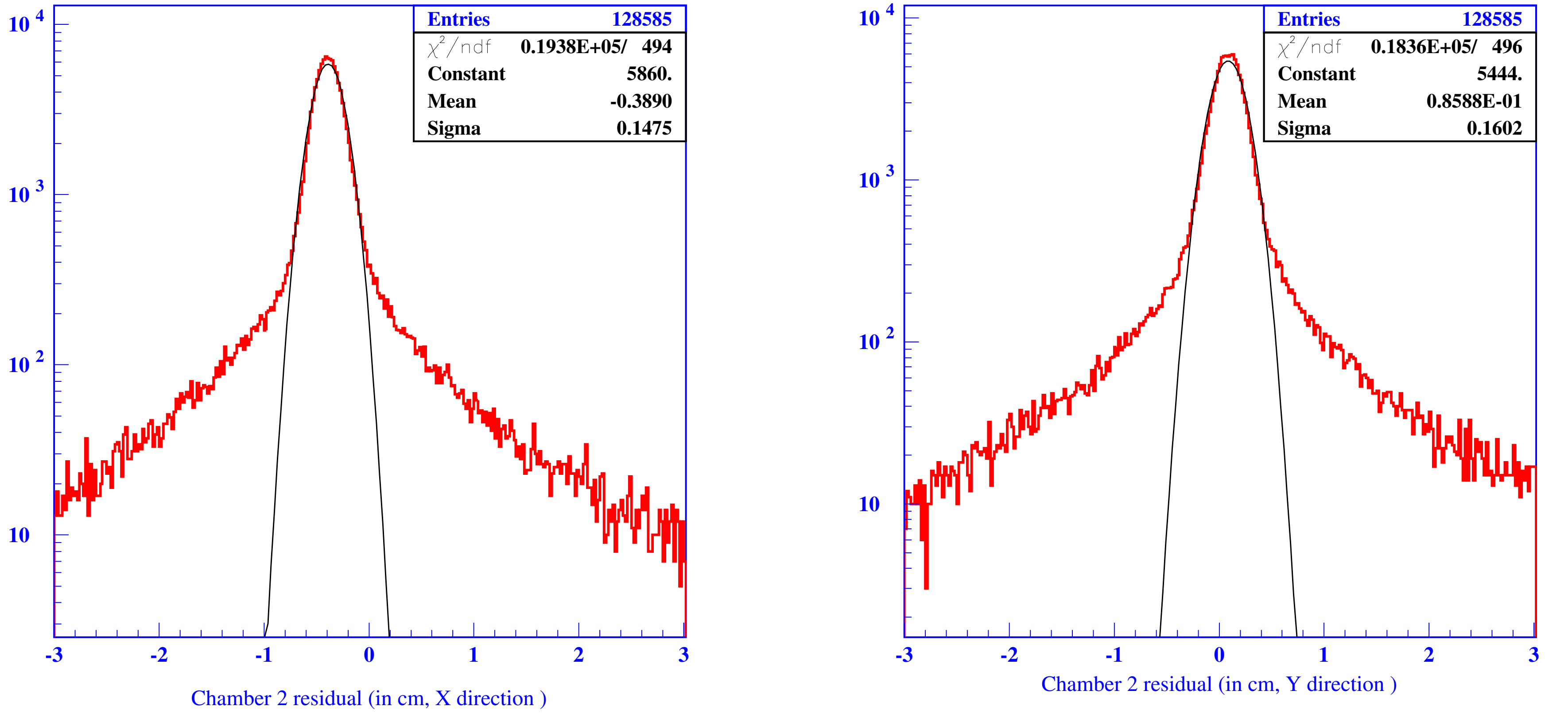
AMS2 prototype



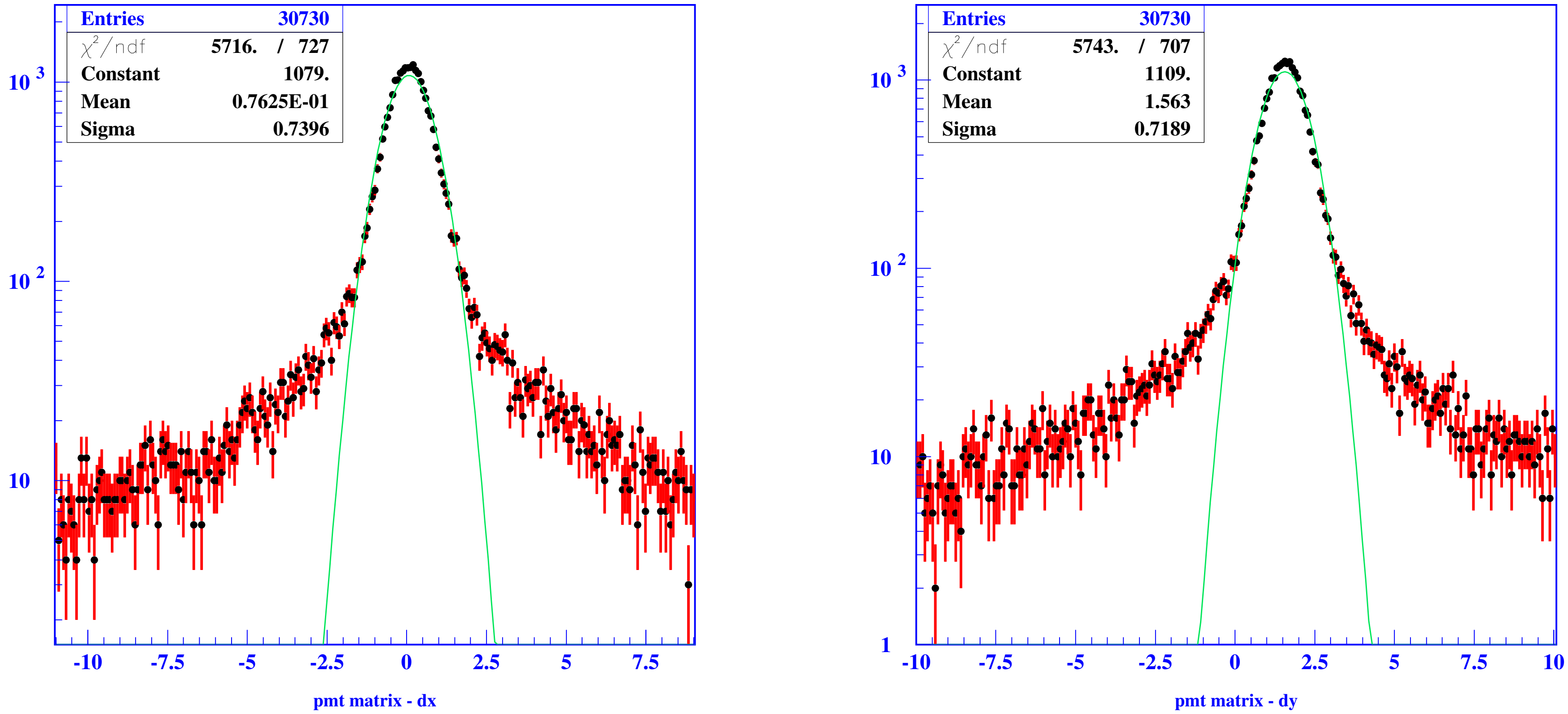
MWPC inter-alignment

Check misalignment between Chambers planes

Take residuals of hit in 2nd chamber with respect to line defined by 1st and 3rd chambers hits.



MWPC-PMTmatrix Alignment



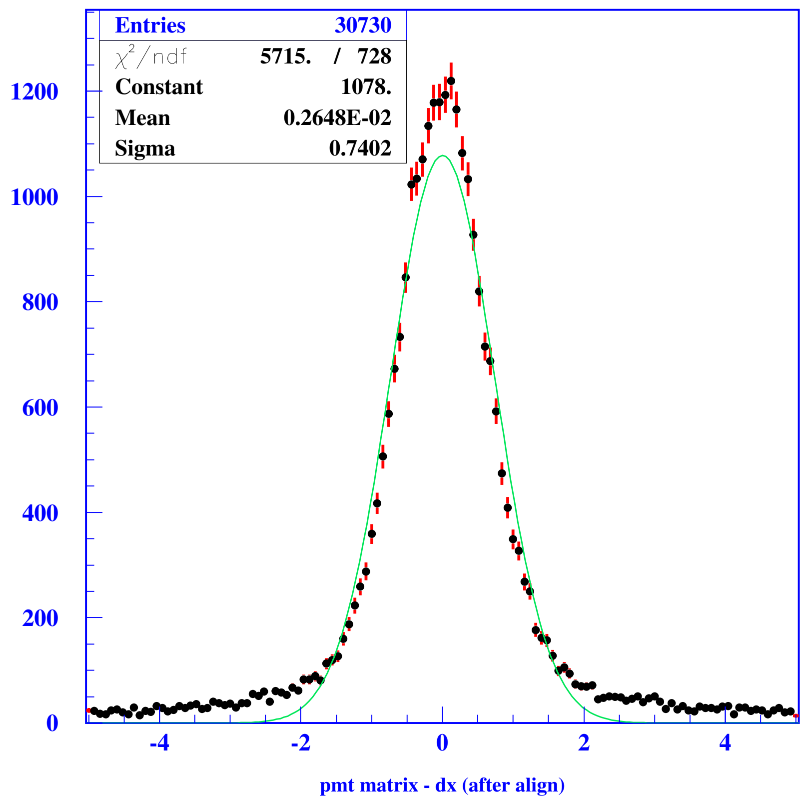
Check misalignment between MWPC and PMT matrix by comparison of :

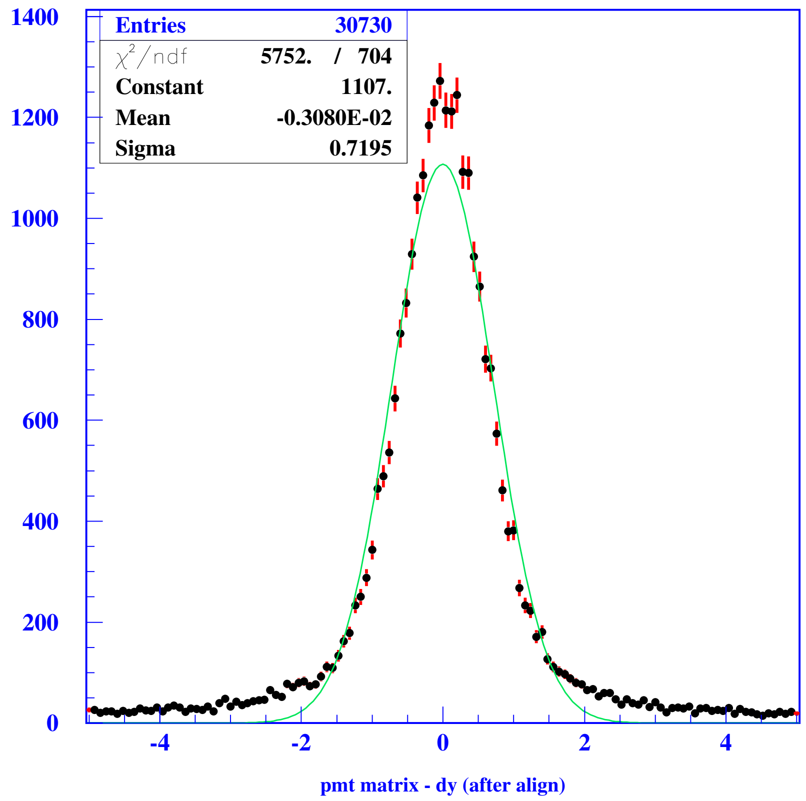
Particle extrapolated point to PMT matrix

Light Guide (L.G.) Signal ($\geq$ 5 phe) position

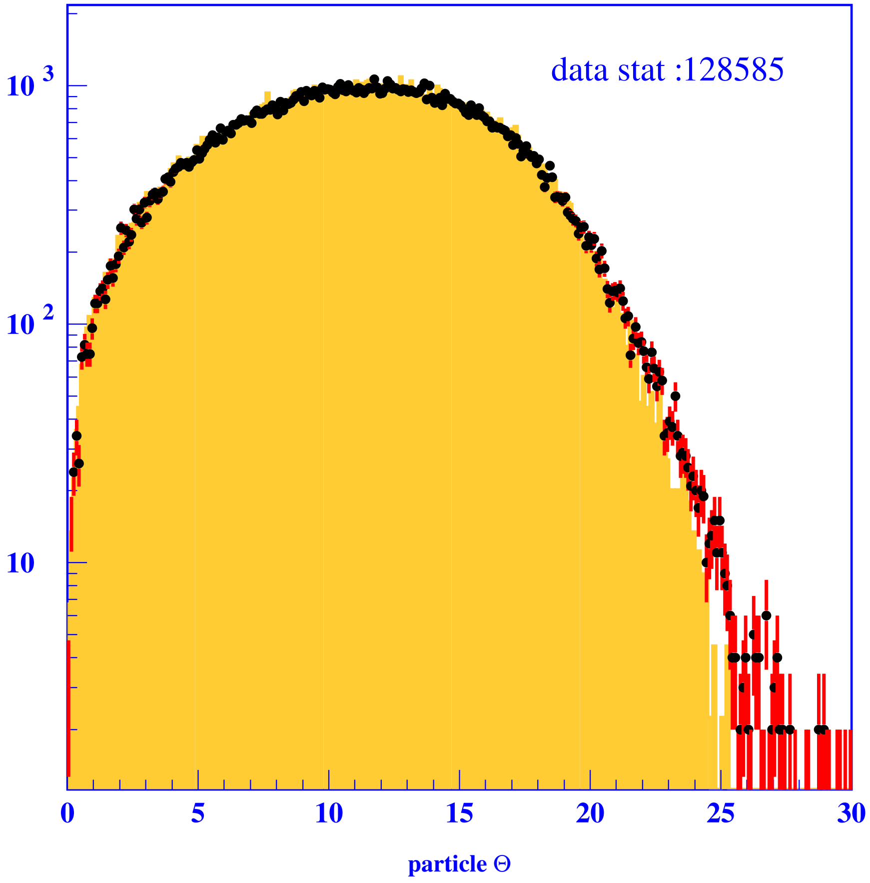
Track Selection

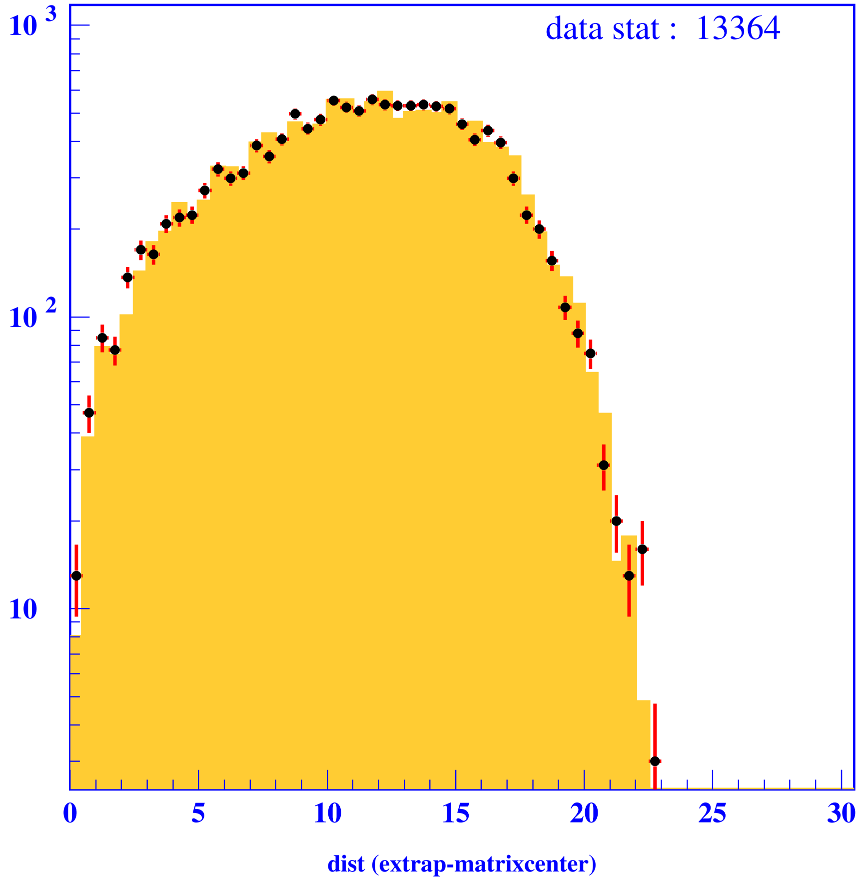
Select tracks with a good matching between MWPC hits and L.G. Signal





Comparing acceptances between MonteCarlo and Data



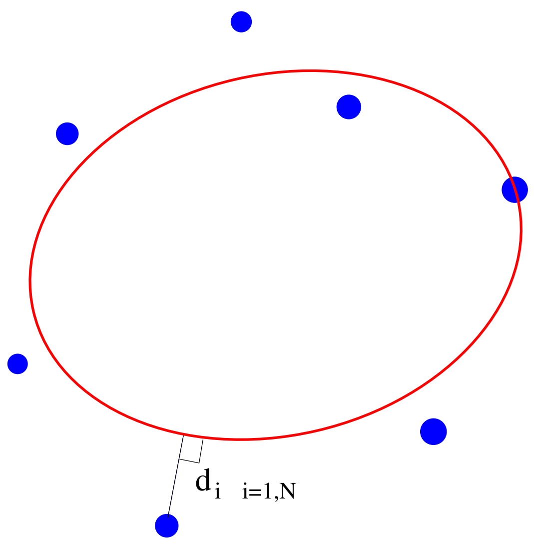


Statistics : all tracks (3 hits in MWPC)

Statistics : Nb evts selected for β reconst

The velocity Reconstruction Method

The Tracking System gives us the direction of the particle (θ,Φ) and allows us to estimate the mean vertex of the Cherenkov photons inside the radiator.
A tracing procedure for the Cherenkov photons (along the RICH detector up to the PMT's layer) is used in order to generate a *'Cherenkov pattern'* event by event.



By a minimization procedure, look for the pattern (θ_c) that better fits the hits.

The Maximum Likelihood approach:

maximize $\mathcal{L}(\theta_c) = \prod_{nb\ hits} p_i(\theta_c; d_i)$

where the function $p(\theta_c; x)$ describes the probability of a hit belonging to a pattern with θ_c aperture .

Dealing with Noise (Rayleigh Scattering) ...

Uncertainties:

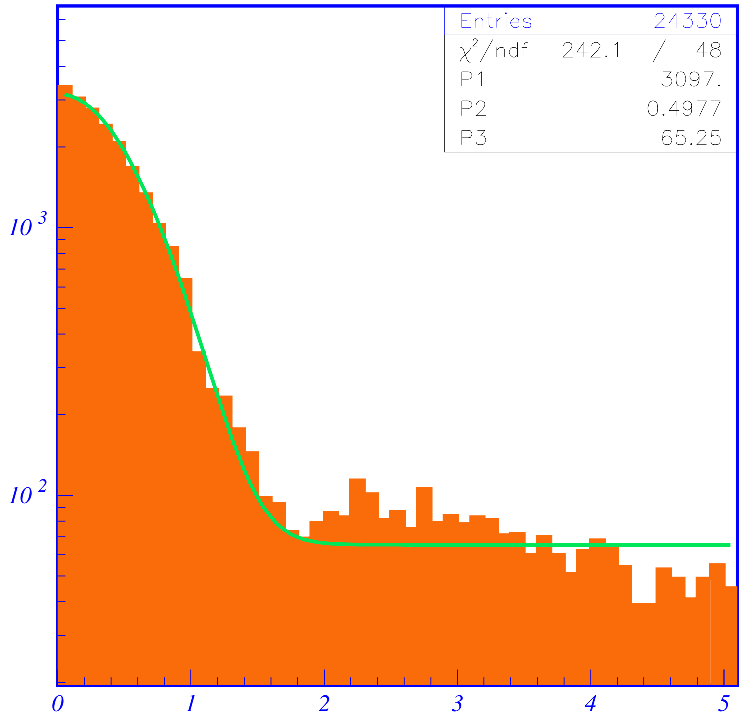
- pixel size prevails
- Radiator thickness
- chromaticity
- Rayleigh Scattering gives a nearly flat background

In a good 1st aproximation :

$$p(x) = Ne^{-\frac{1}{2}(\frac{x}{\sigma})^2} + K$$

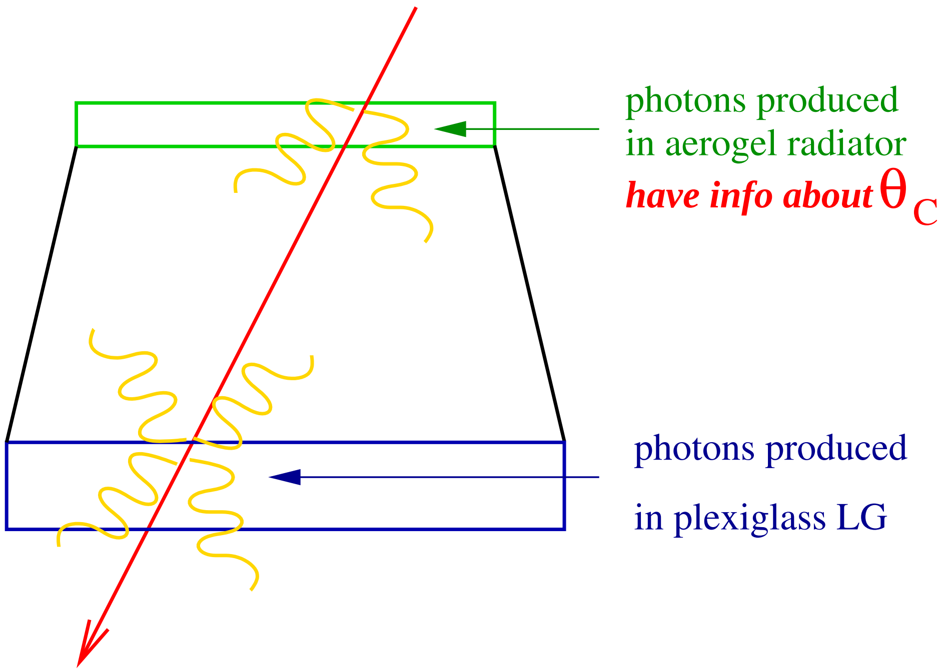
$\frac{K}{N} = 0.003$

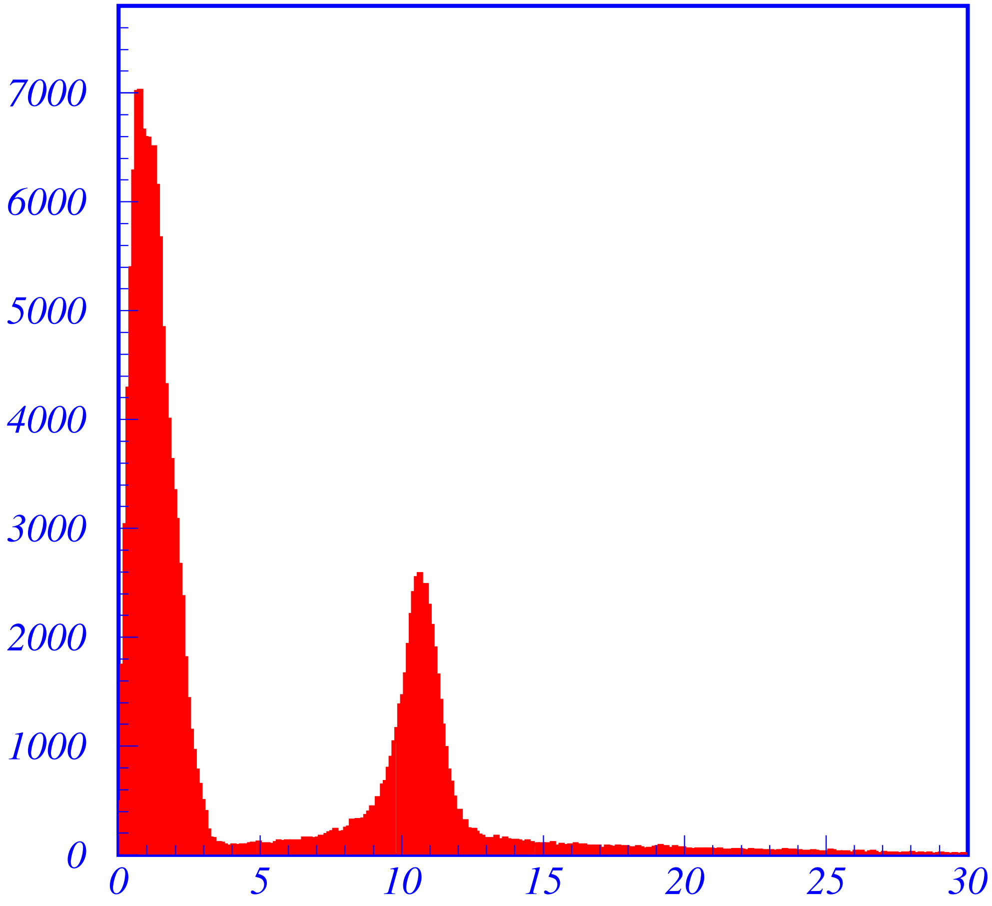
$\sigma = 0.5cm$



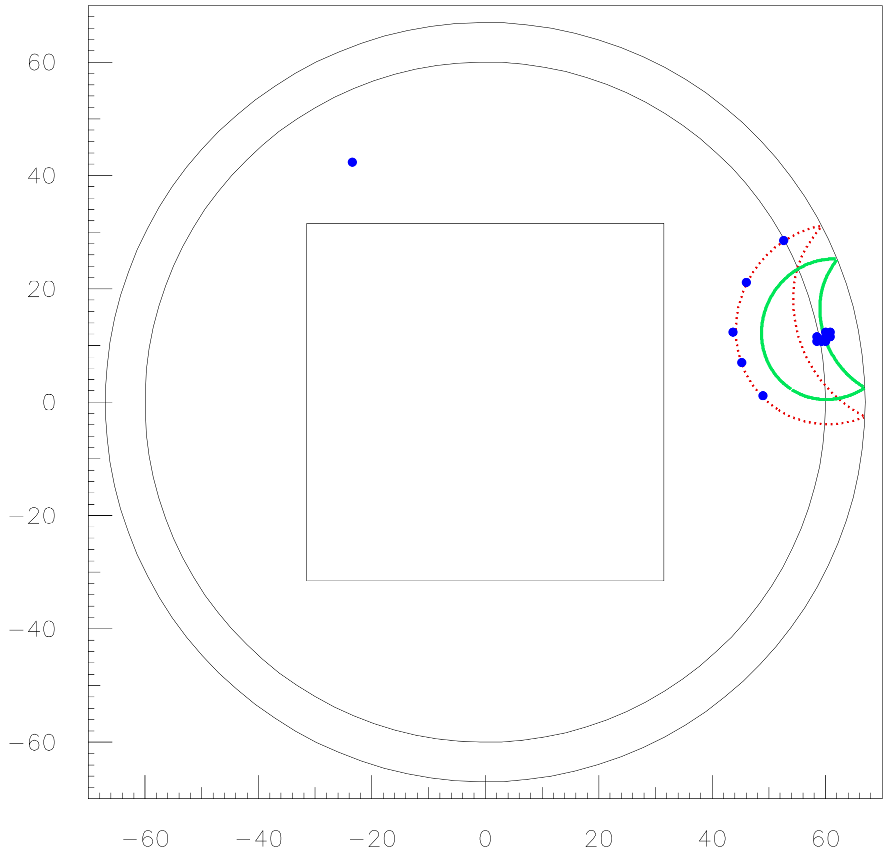
The cluster of the Particle

It is crucial take out hits without information about θ_c !

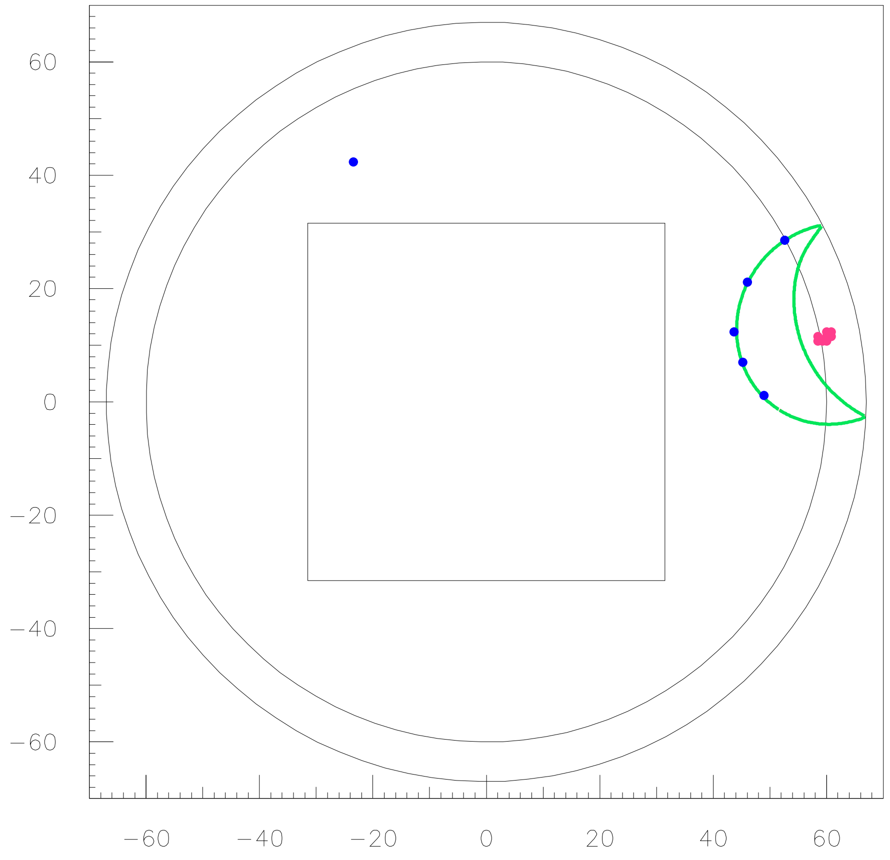




The Cluster of the Particle ...

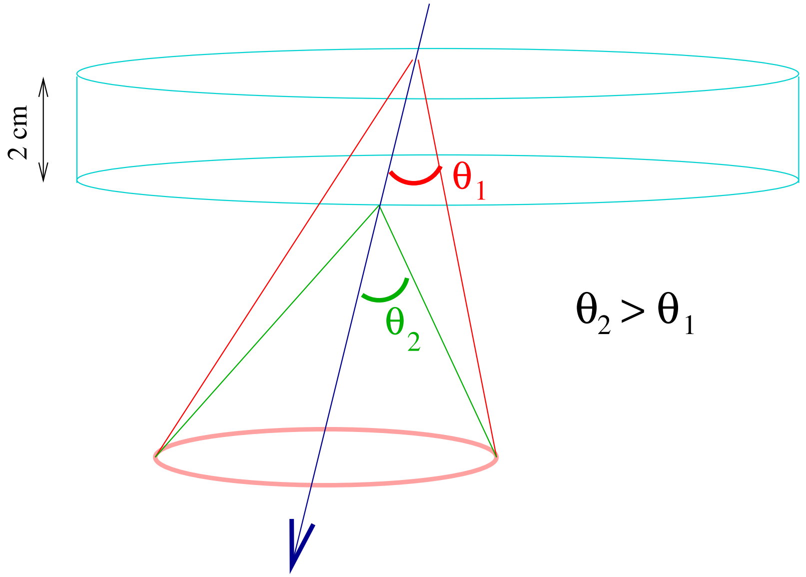


The Fit is biased by hits of particle cluster

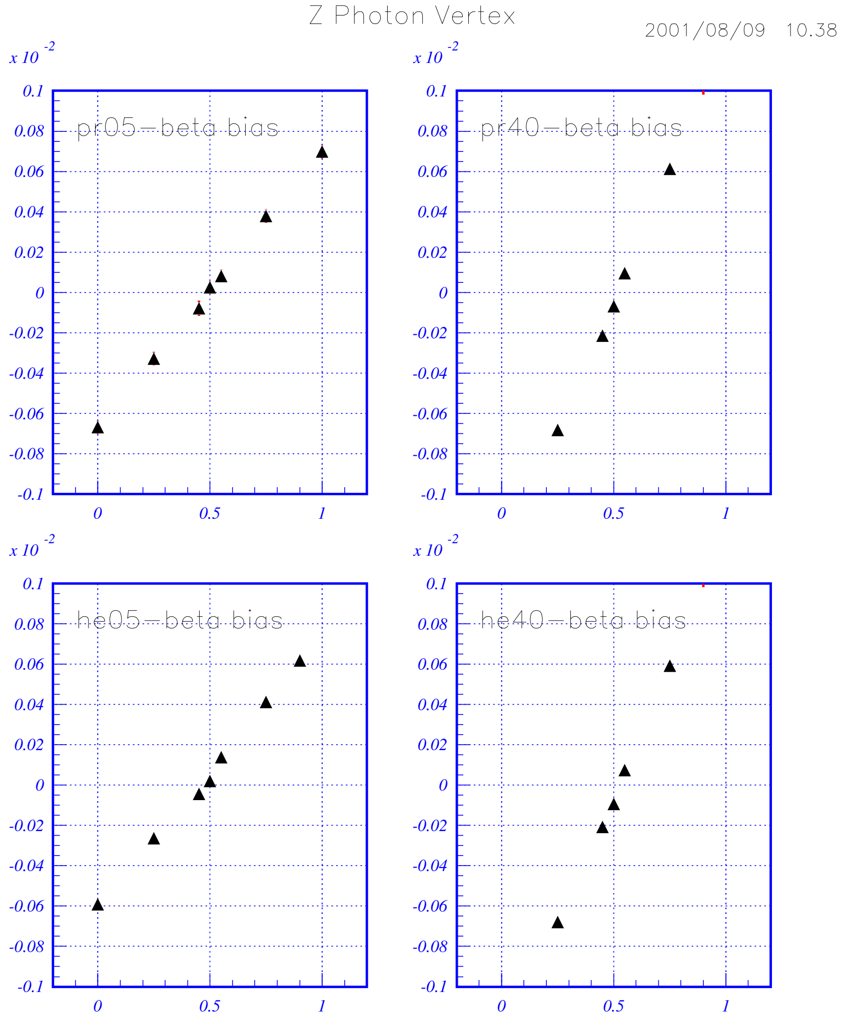


Taking particle cluster out, the fit is O.K.

Tunning of the mean photon emission point

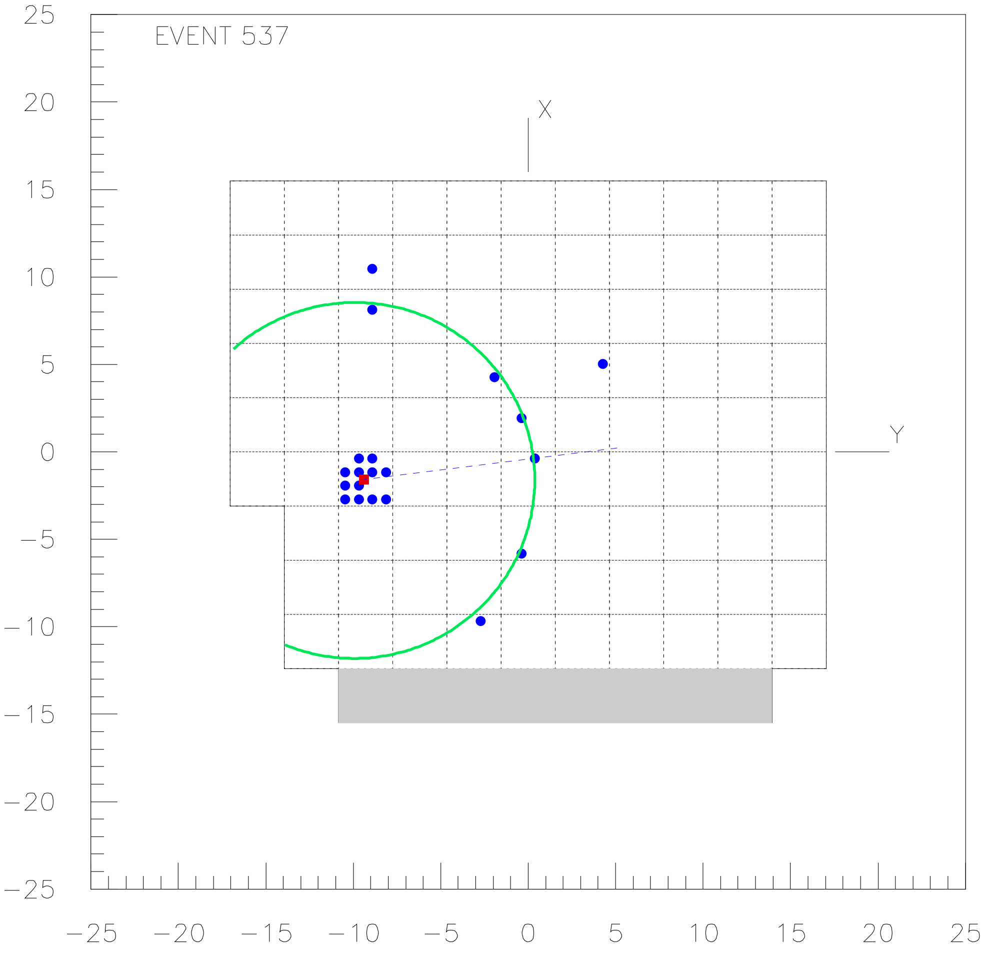


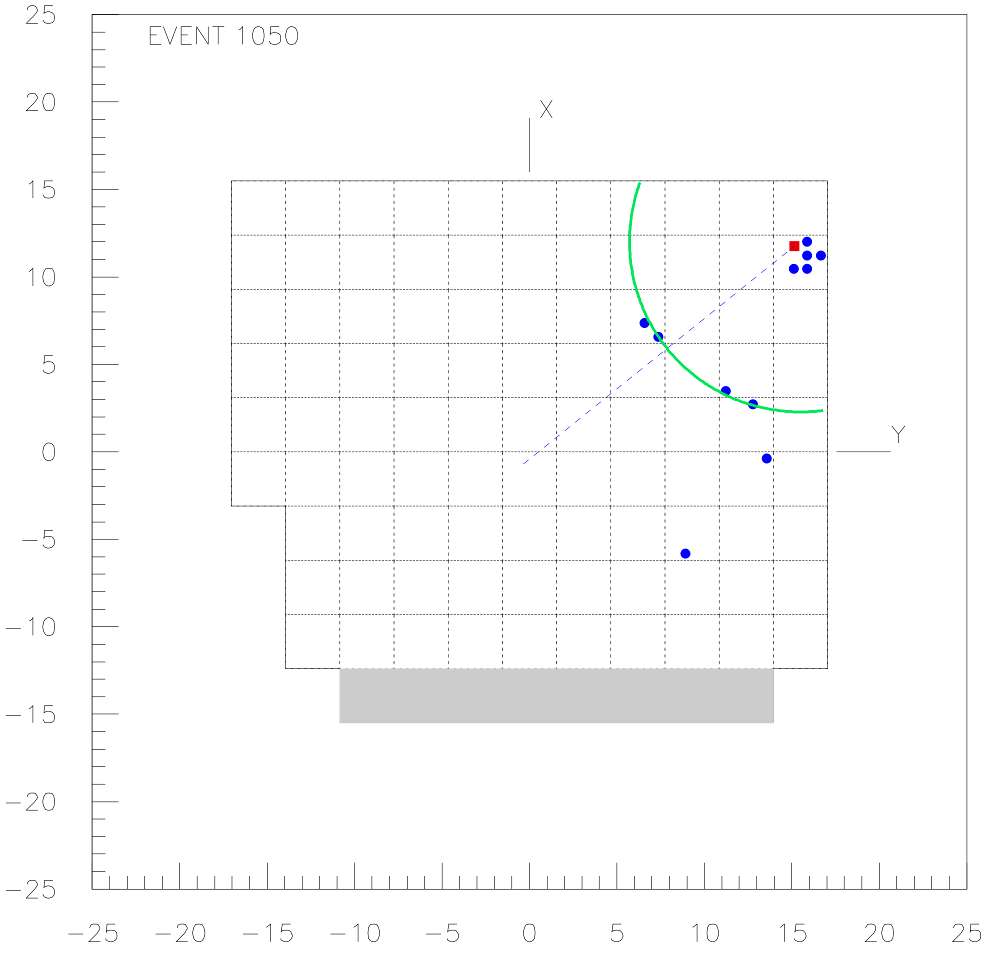
$\theta_2 > \theta_1$



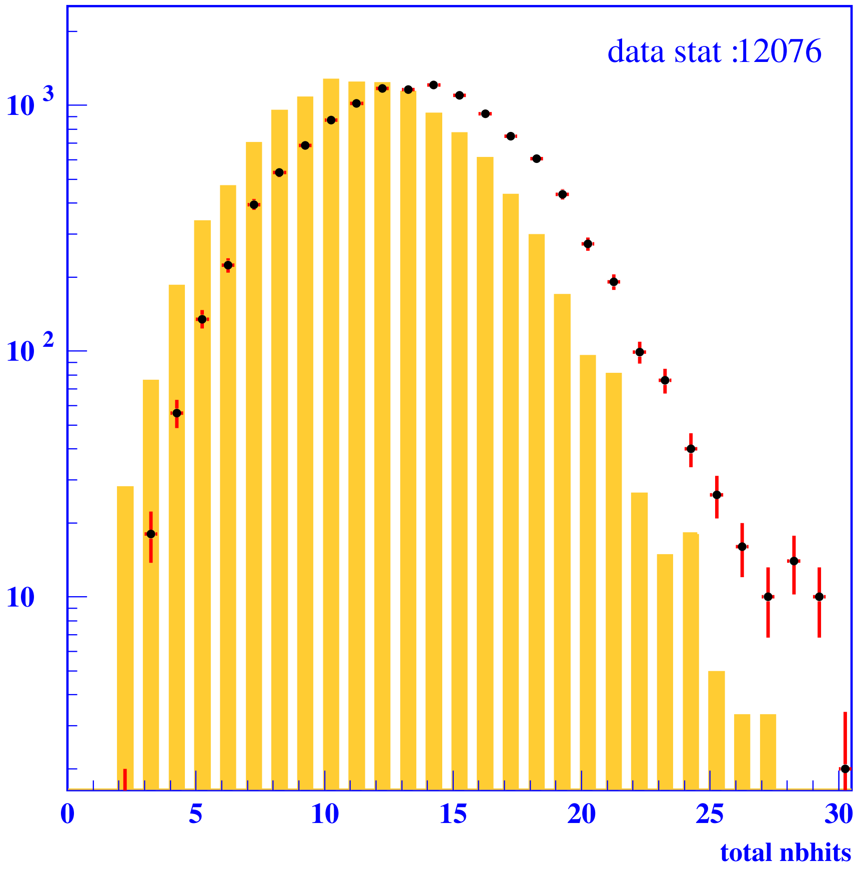
optimal Z emission = 1 cm

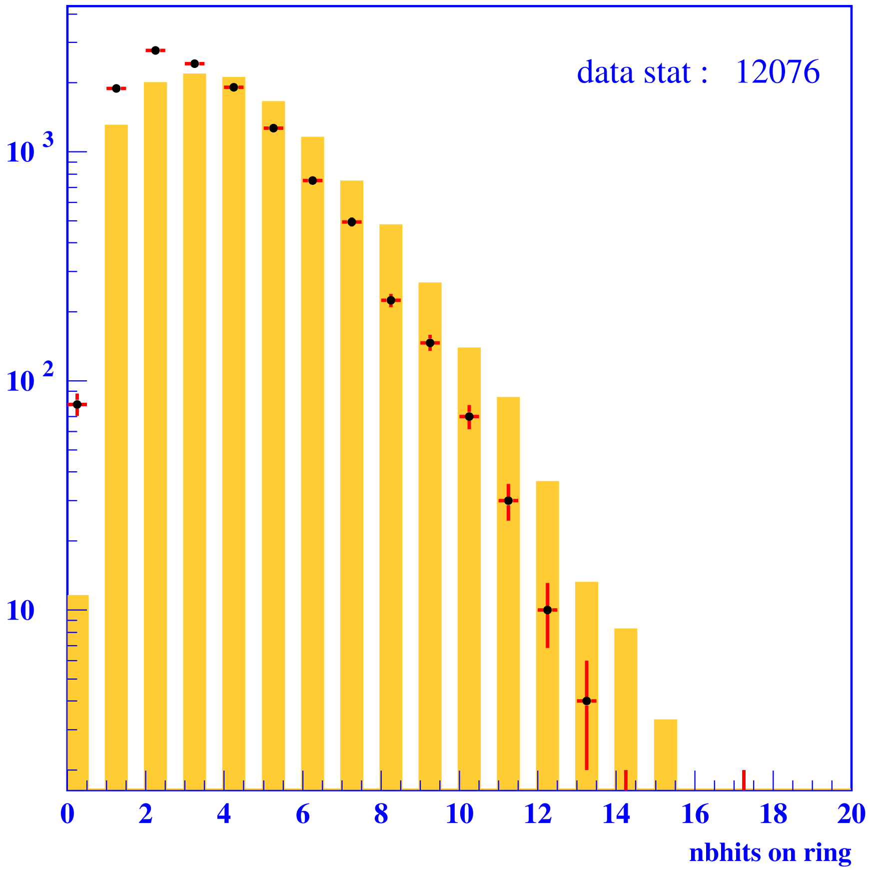
Results: Some events from "RUN 21"



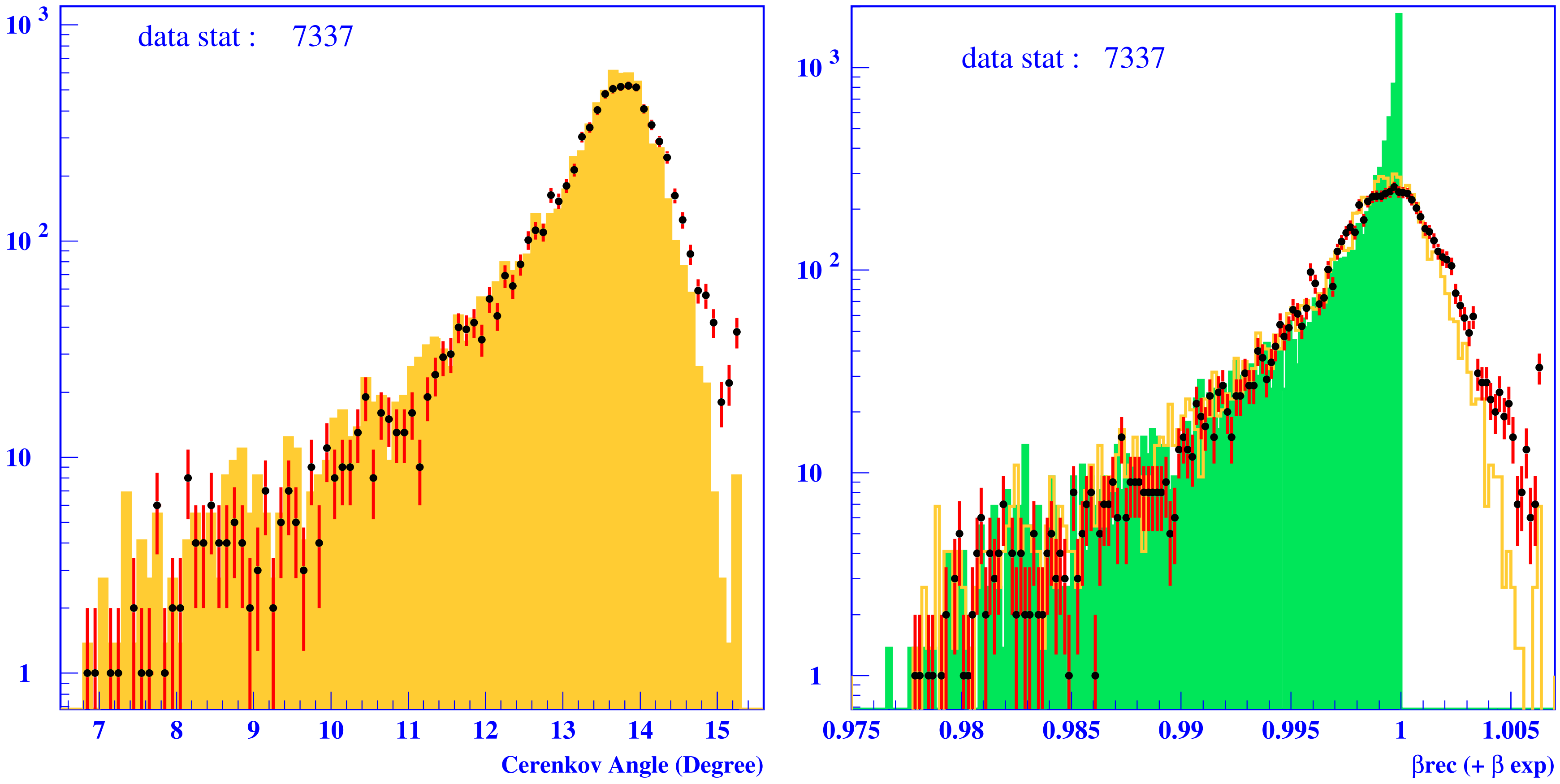


Results: The number of hits





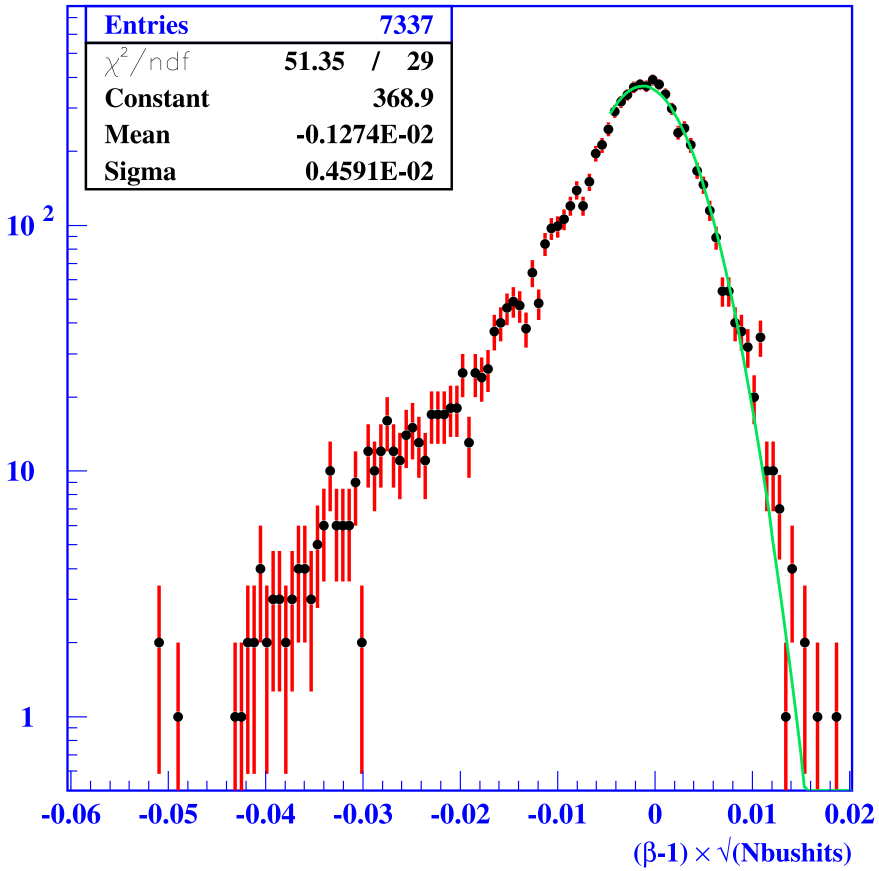
Results: Reconstructed Spectrum

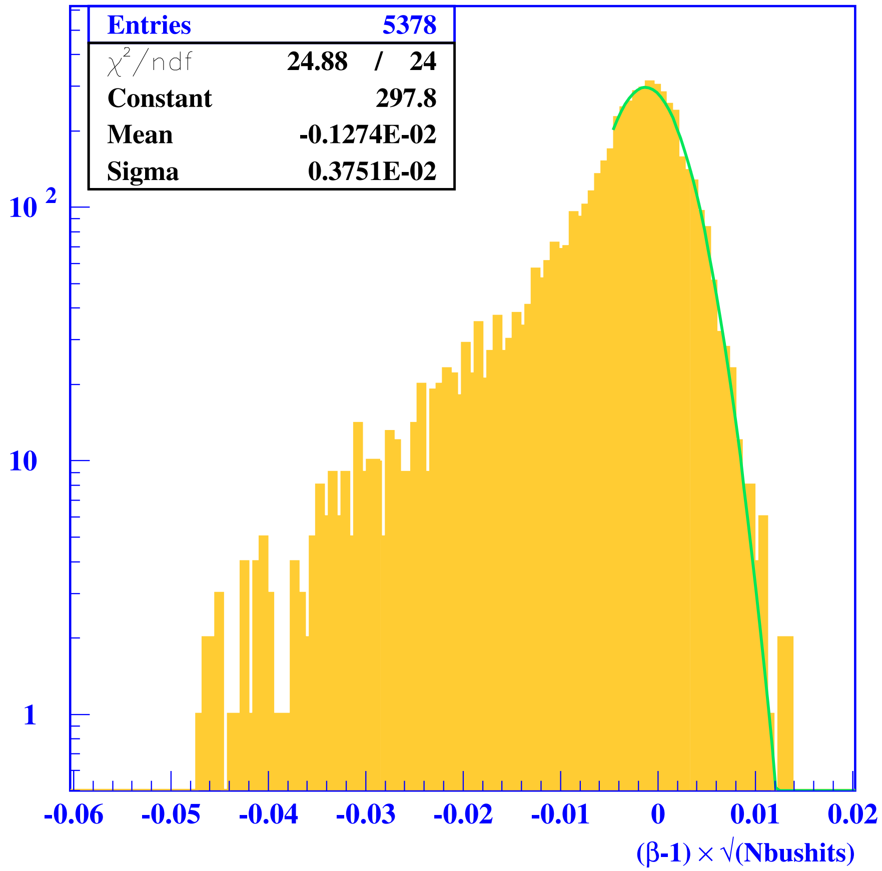


reconstructions with at least 3 hits

Results: Estimate of Resolution

The used estimator is $(\beta_{rec} - 1)\sqrt{(Nbushits)}$ above ~ 1.0

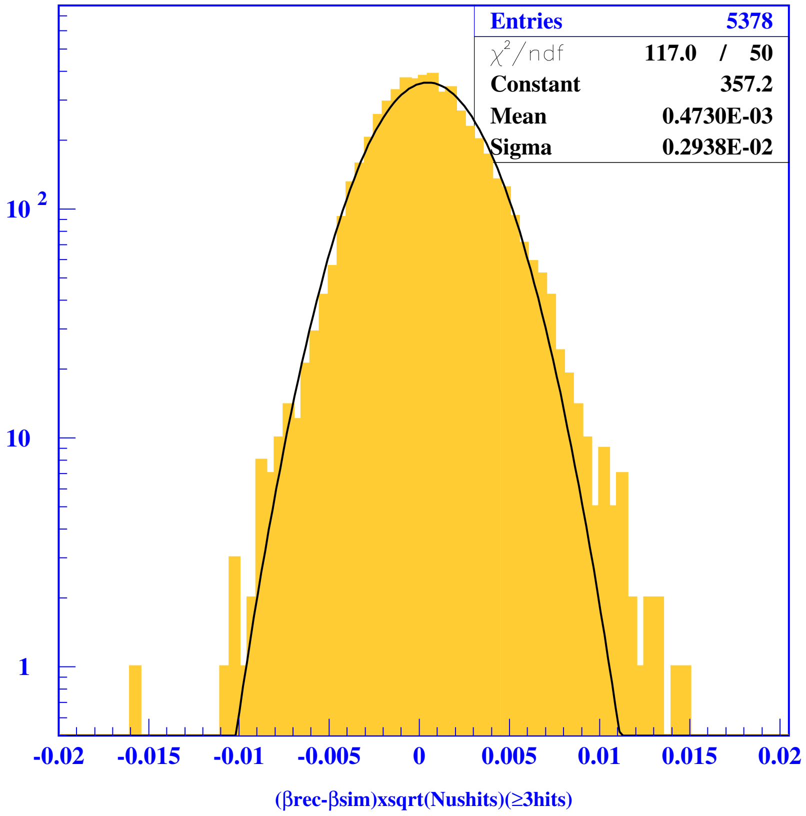


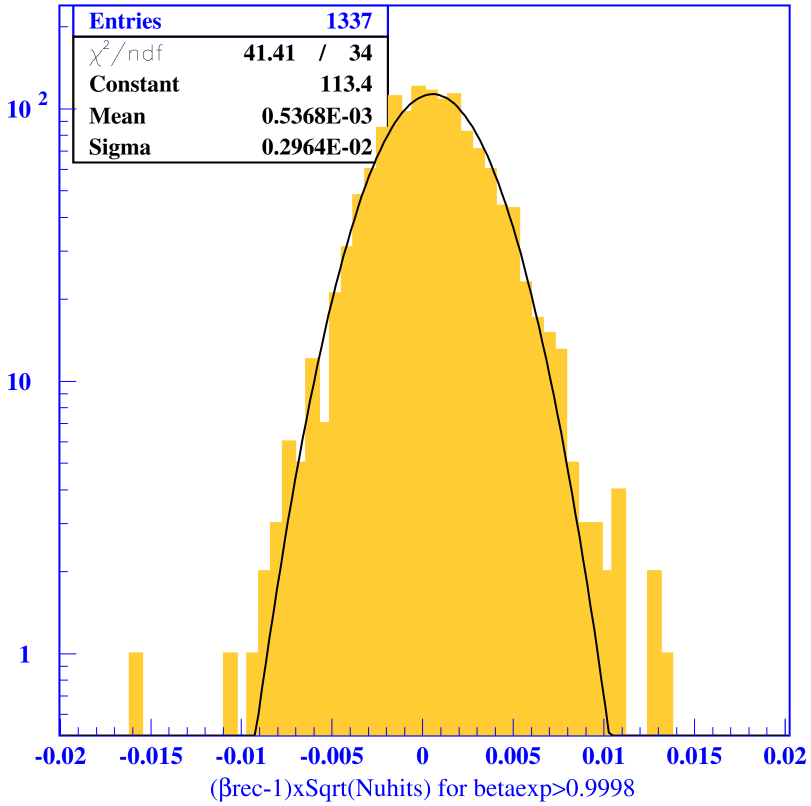


Bias of the estimator

Comparing estimator in simulation with real resolution per hit ...

Estimator overestimates the resolution in $\sim 30\ \%$





Conclusion

- β was reconstruted using prototype data using a likelihood approach
- A systematic comparison between simulation and data was performed
  - Nb hits associated to Cherenkov pattern lower on data
  - β resolution lower on data ($\sim$ 20%)