

Update on muon reconstruction with ASTRI

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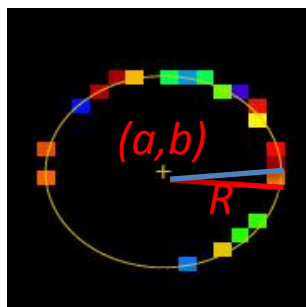
– INAF/IASF-Palermo, Italy

for the ASTRI Collaboration & the CTA Consortium



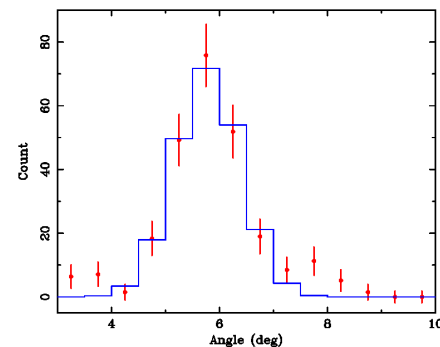
CORSIKA	N. Event	2000000 (μ^+ , μ^-)
	Site	Paranal
	Viewcone	4 deg
	Pointing	Zenith
	spectral index	2.0
	energy range	6 GeV-1 TeV
	Max Distance	2.1 m
	Starting altitude	500 m above M1
	Background	20×10^6 ct/s/pixel
ASTRI-SIMULATOR:	includes the mirror reflectivity, the SiPM PDE, the PMMA window transmission, some mounting structure over the mirror	
ANALYSIS SOFTWARE	Fortran + IDL code	

- 1) Two-level cut (inside a 3x3 pixels window) cleaning of the raw image with **cmin**=4 and **cmax**=7 counts-per-pixel
- 2) If more than 4 pixels are left, the centre and the radius are obtained with Taubin method, minimizing the displayed function. This step cut ~20% of the events



$$X = \frac{\sum_{i=1}^n (x_i - a)^2 + (y_i - b)^2 - R^2}{\sum_{i=1}^n (x_i - a)^2 + (y_i - b)^2}$$

- 4) Compute the radial profile (ArcWidth) and fit it with a Gaussian



- 5) Compute the intensity profile along the ring;

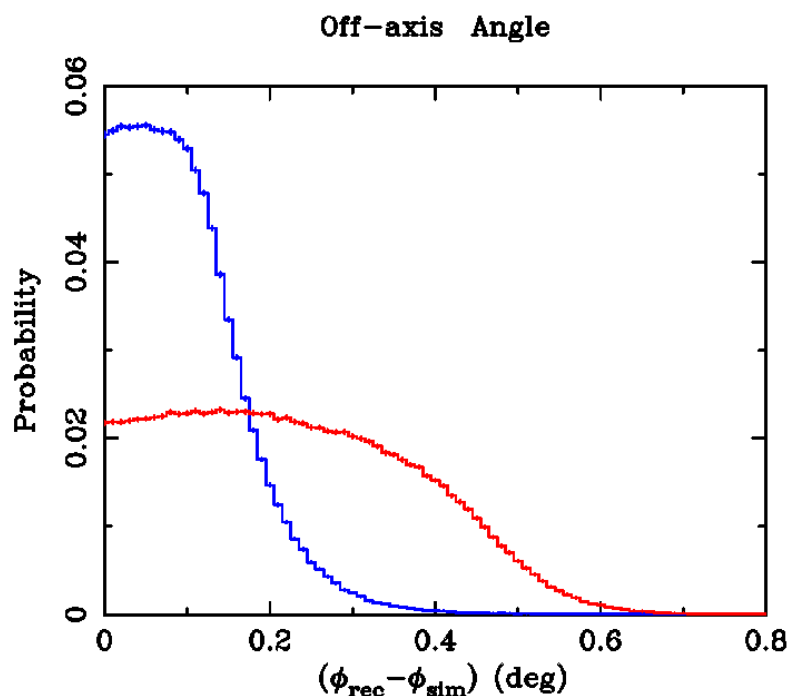
$$DF = F_{sim} - Pix \cdot \sqrt{a^2 + b^2}$$

Φ_{sim} = Simulated off-axis angle

a, b = coordinate of the ring center in pixel

Pix = 0.17° (old)

Pix = Function of the distance to take into account the non-uniform positioning of the camera sensors



Fitting with a Gaussian gives:

	Old	New
Maximum	0.18°	0.0°
Sigma	0.18°	0.10°

$$Dq = \frac{q_{sim} - q_{rec}}{q_{rec}}$$

θ_{sim} = Simulated

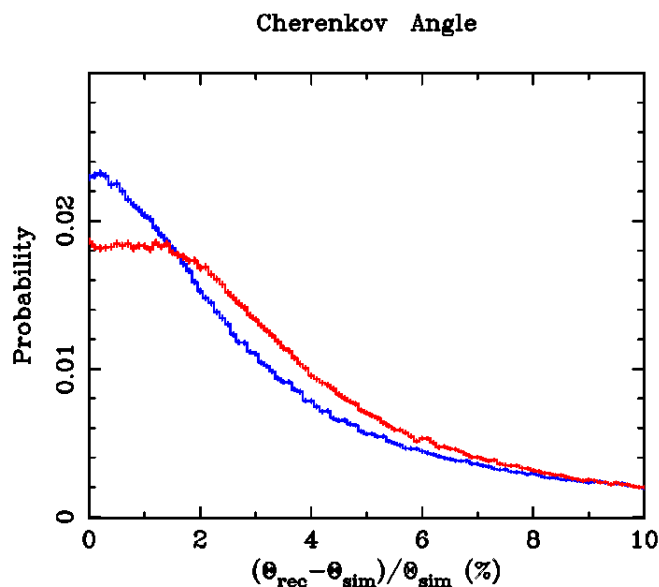
θ_{rec} = Reconstructed

$n = 1.00019$ refractive index

Pix = 0.17° (old)

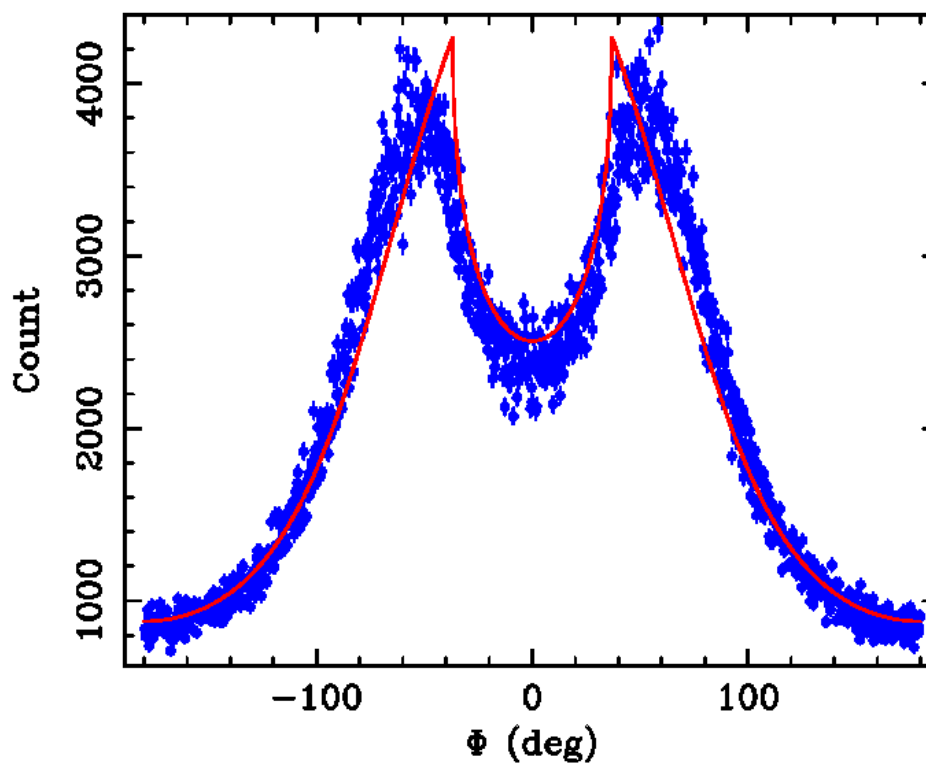
where $q_{sim} = \frac{1}{n \times \sqrt{1 - \left(\frac{0.105}{E_{sim}(\text{GeV})}\right)^2}}$

Pix = Function of the distance to take into account the non-uniform positioning of the camera sensors



Fitting with a Gaussian gives:

	Old	New
Maximum	0.9%	0.0
Sigma	6.3%	5.9%



Distribution obtained from 8000 events with energy 500 GeV, off-axis angle 3° and impact point of 1.5 m



Alison function

- Compute the error on the impact point using Alison function
- Analysis of the PSF through the muon ring thickness
- Investigate the effect of the background level
- Reconstruct events with a pointing at a zenith angles of 20° and 40°