DIRC reconstruction studies

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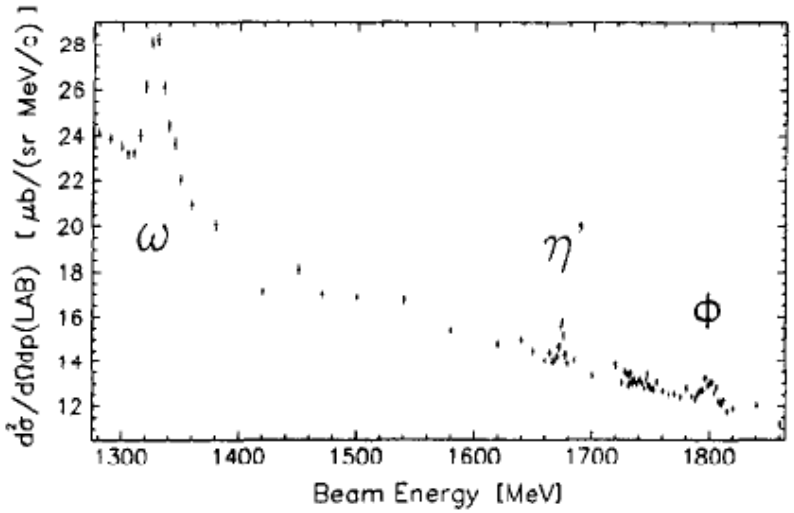
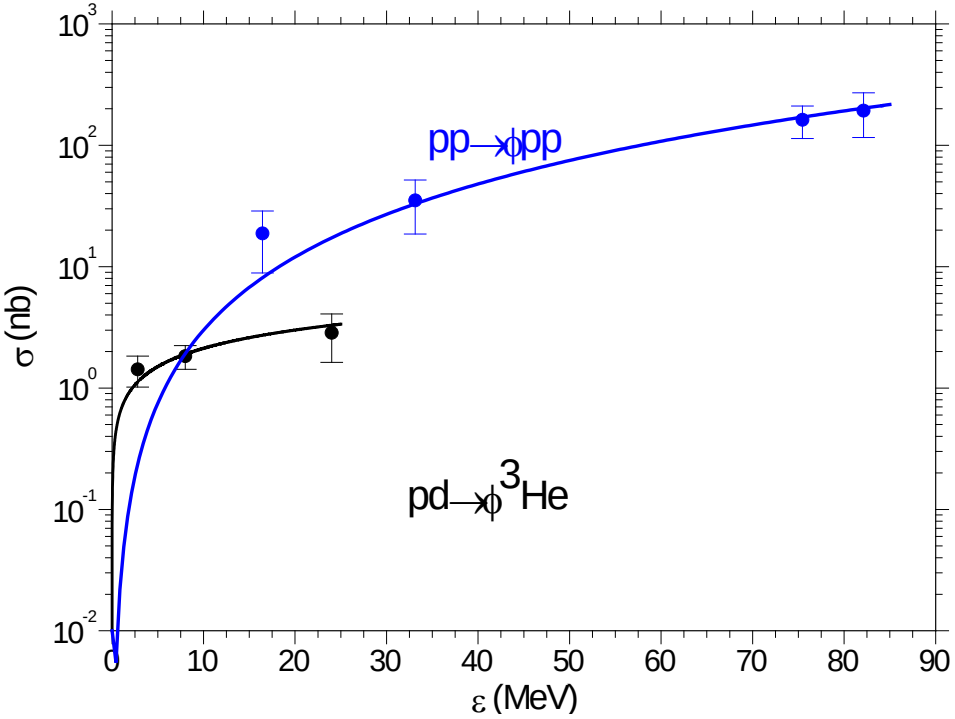
Motivation

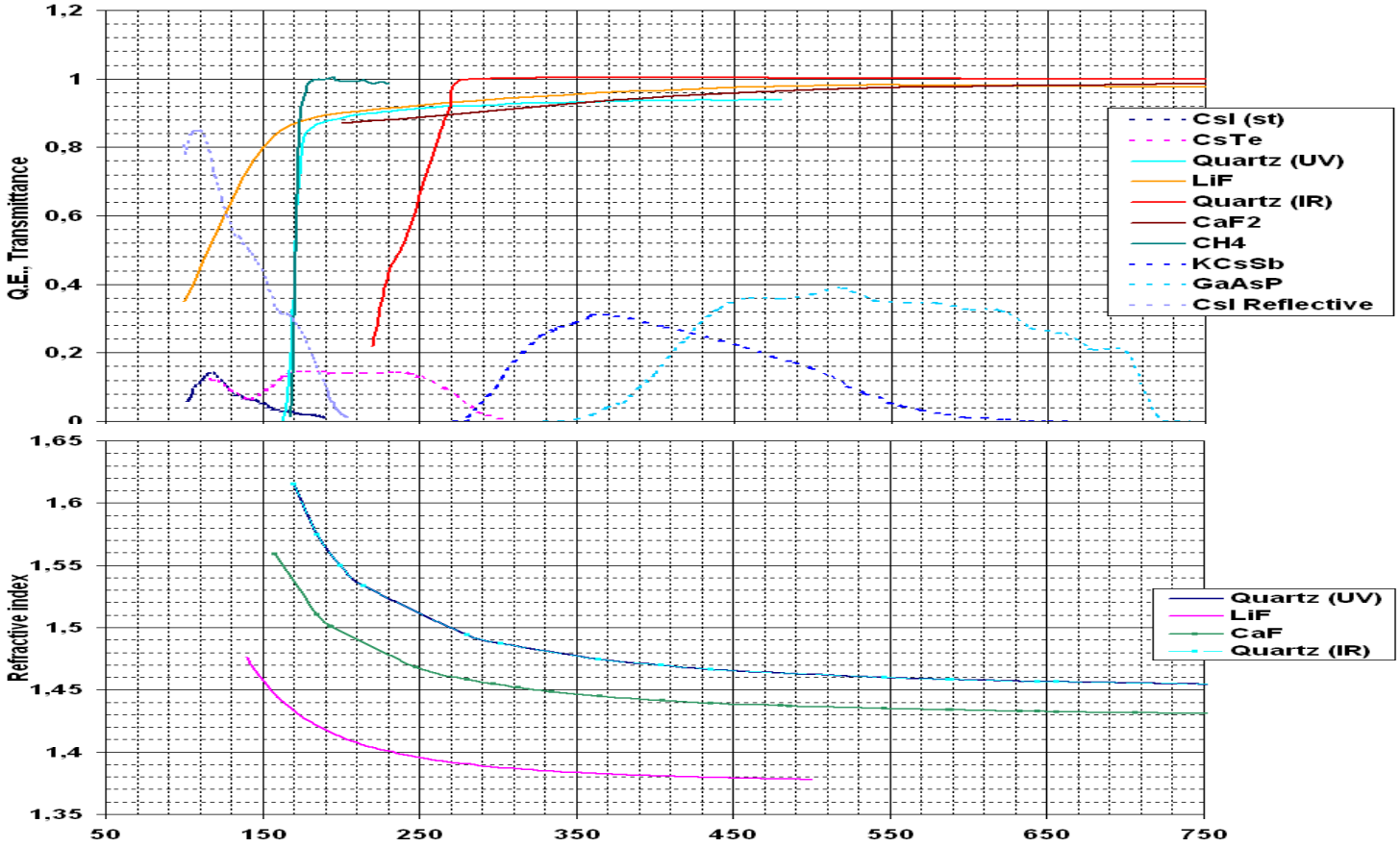
- To measure rare or forbidden decays of η‘
- May be produced in pp→ppη‘ or pd→^{3}Heη‘ reactions
- How large is the cross section?
- Same order of magnitude as Φ production.





Protons from 0.4-1.0 GeV

Properties: radiator and photocathode

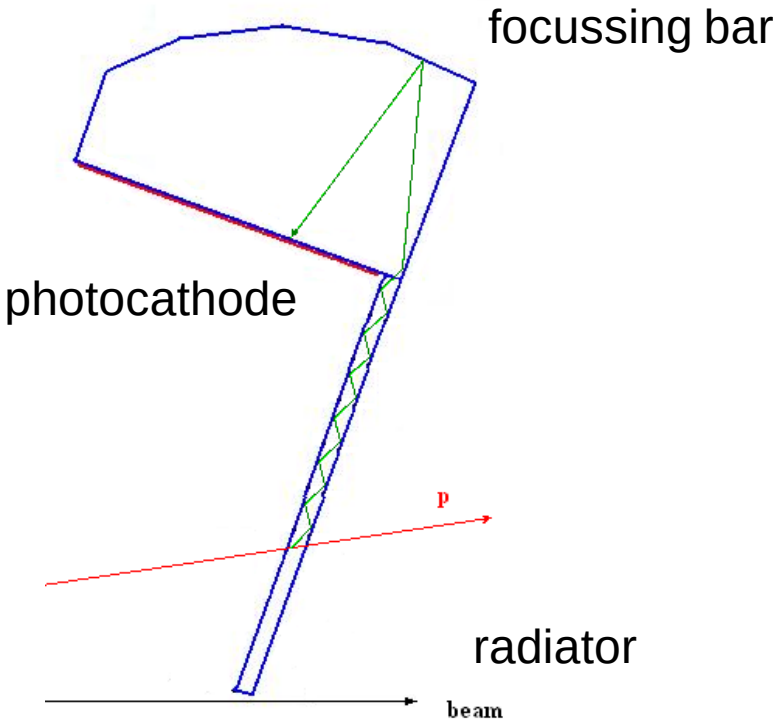


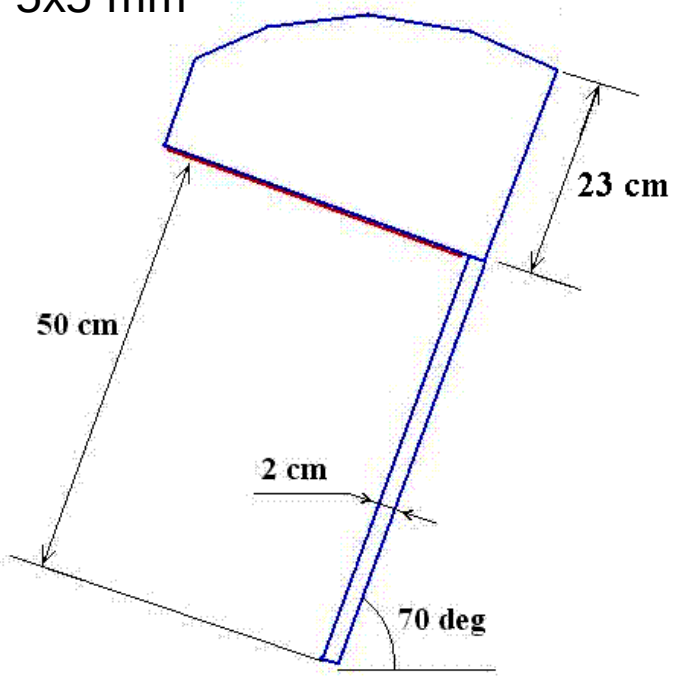
Geometry

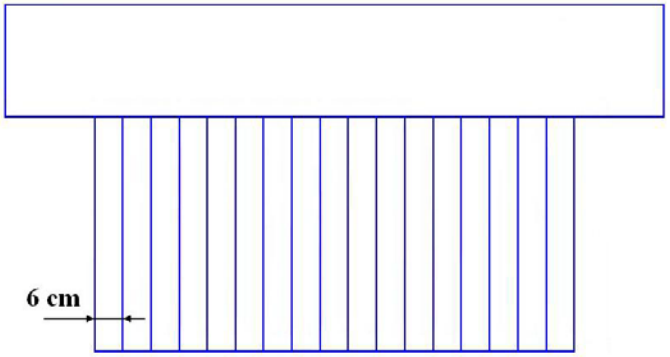
radiator: quartz glas (fused silica) 2 mm

•photocathode bialkai (KCsSb)

5x5 mm^2

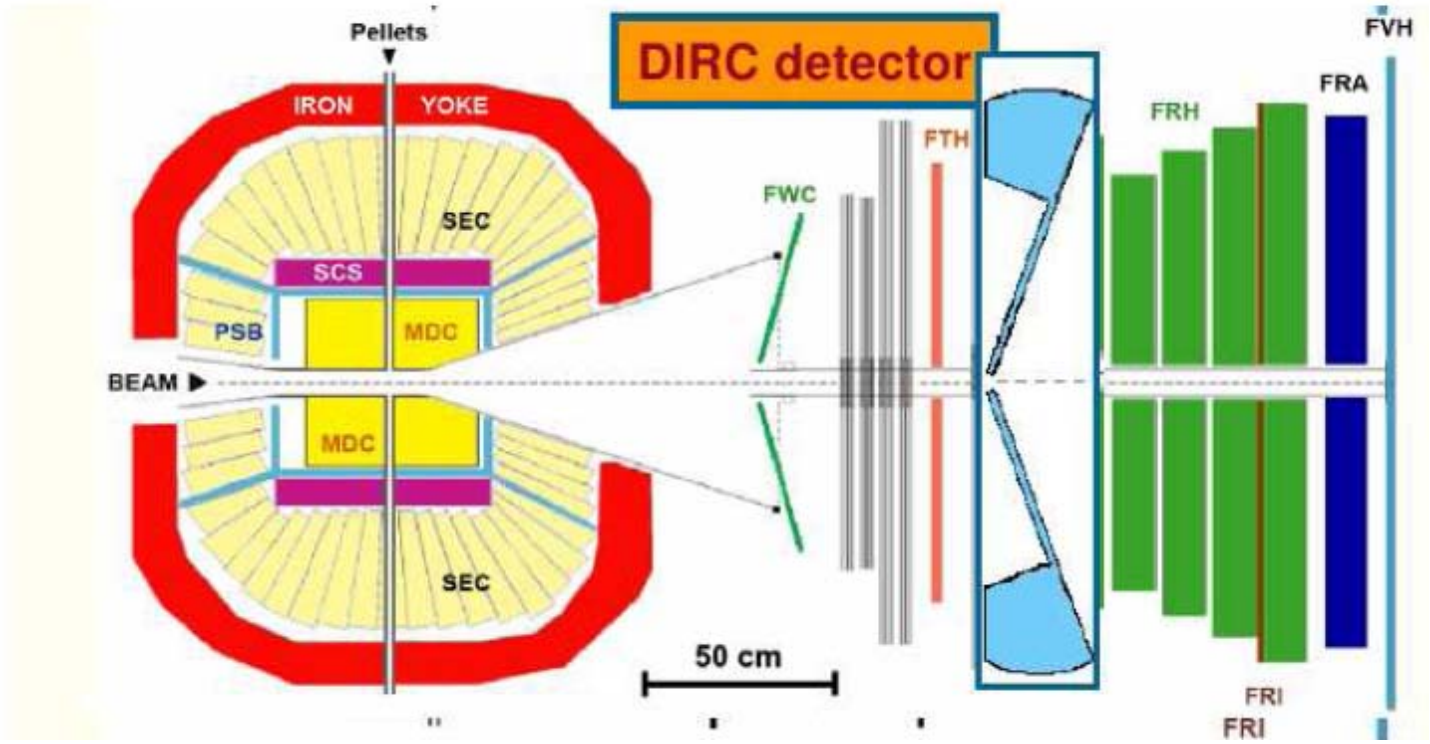




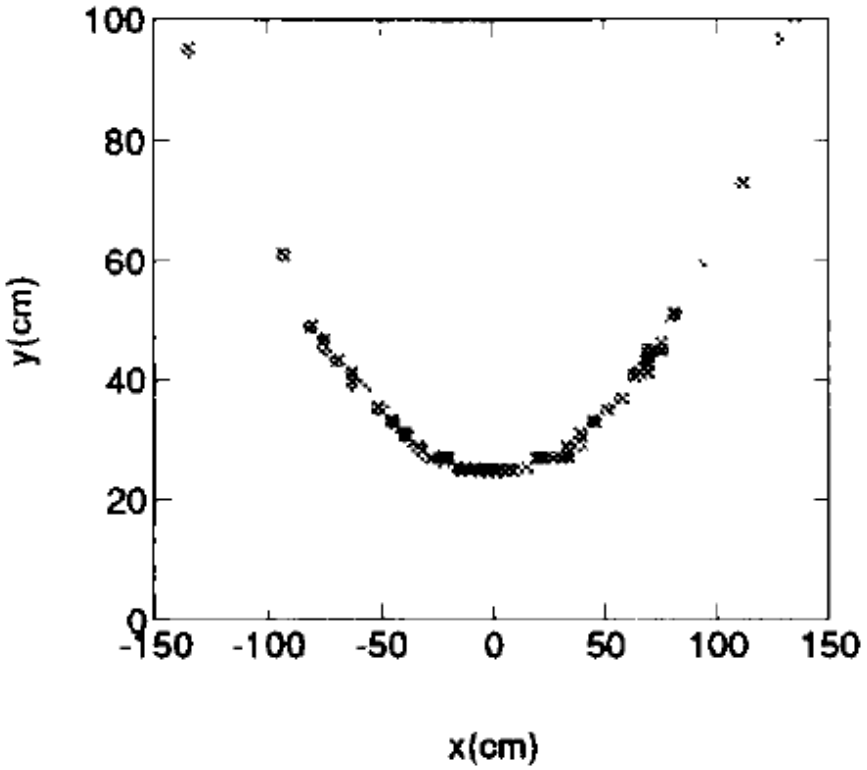


WASA at COSY

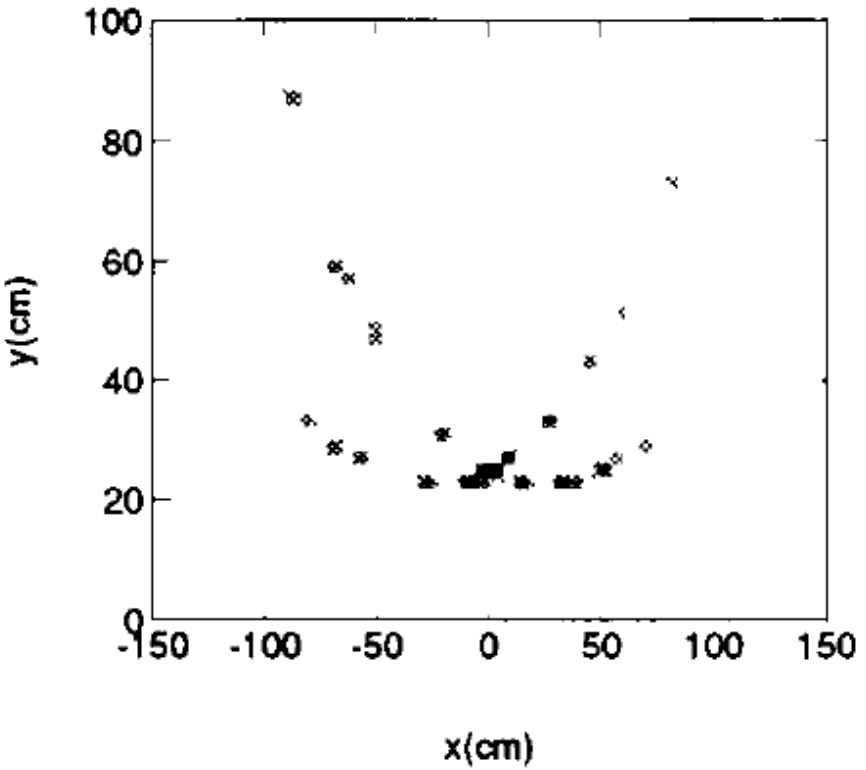
Experimental Setup



Loci of Cherenkov Images



Azimuthal angle =0^{o}

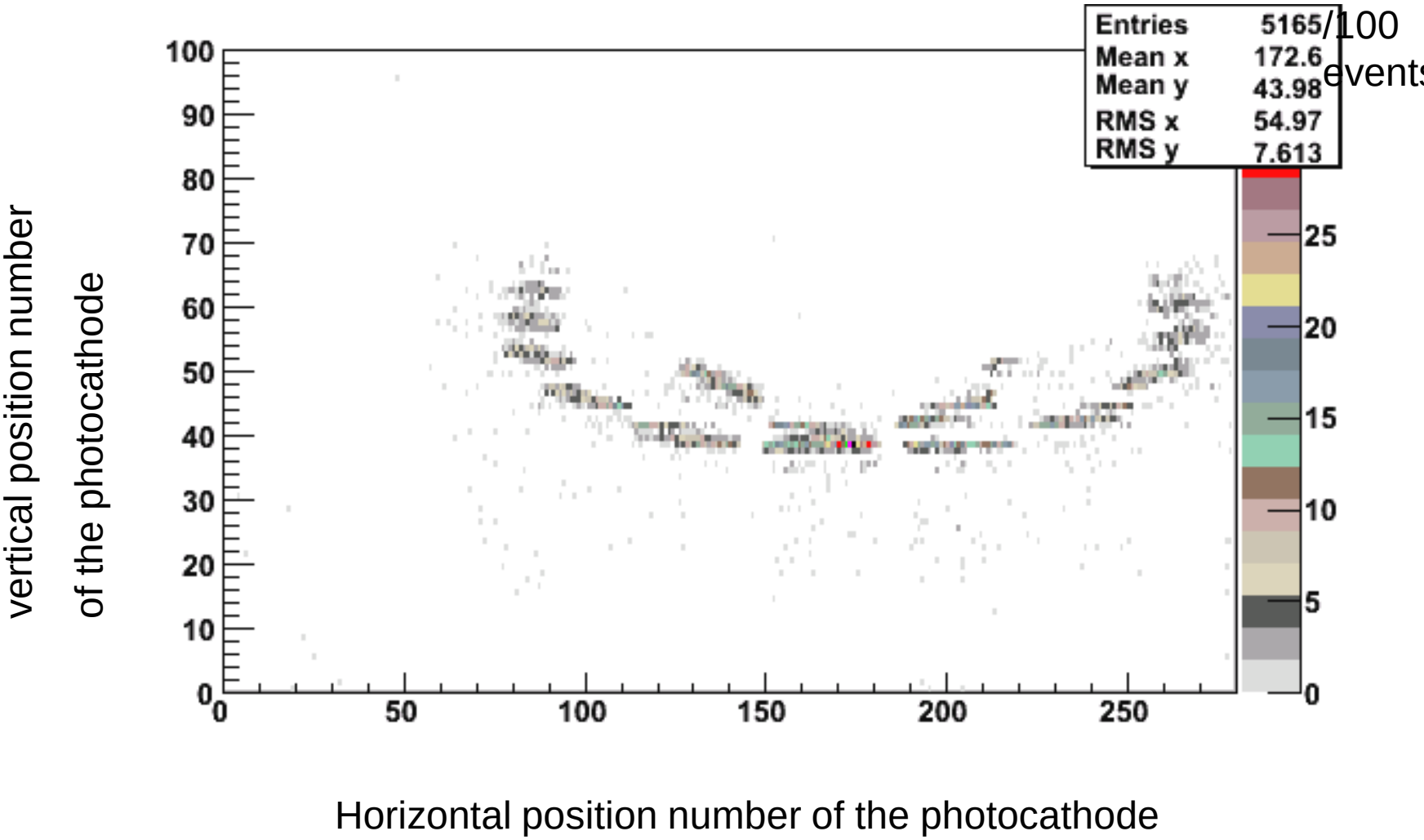


Azimuthal angle = 10^{o}

Reflections on the left and right side of the radiator bar lead to two arcs. Relative position depends on the azimuthal angle. Shapes depend on particle type and energy.

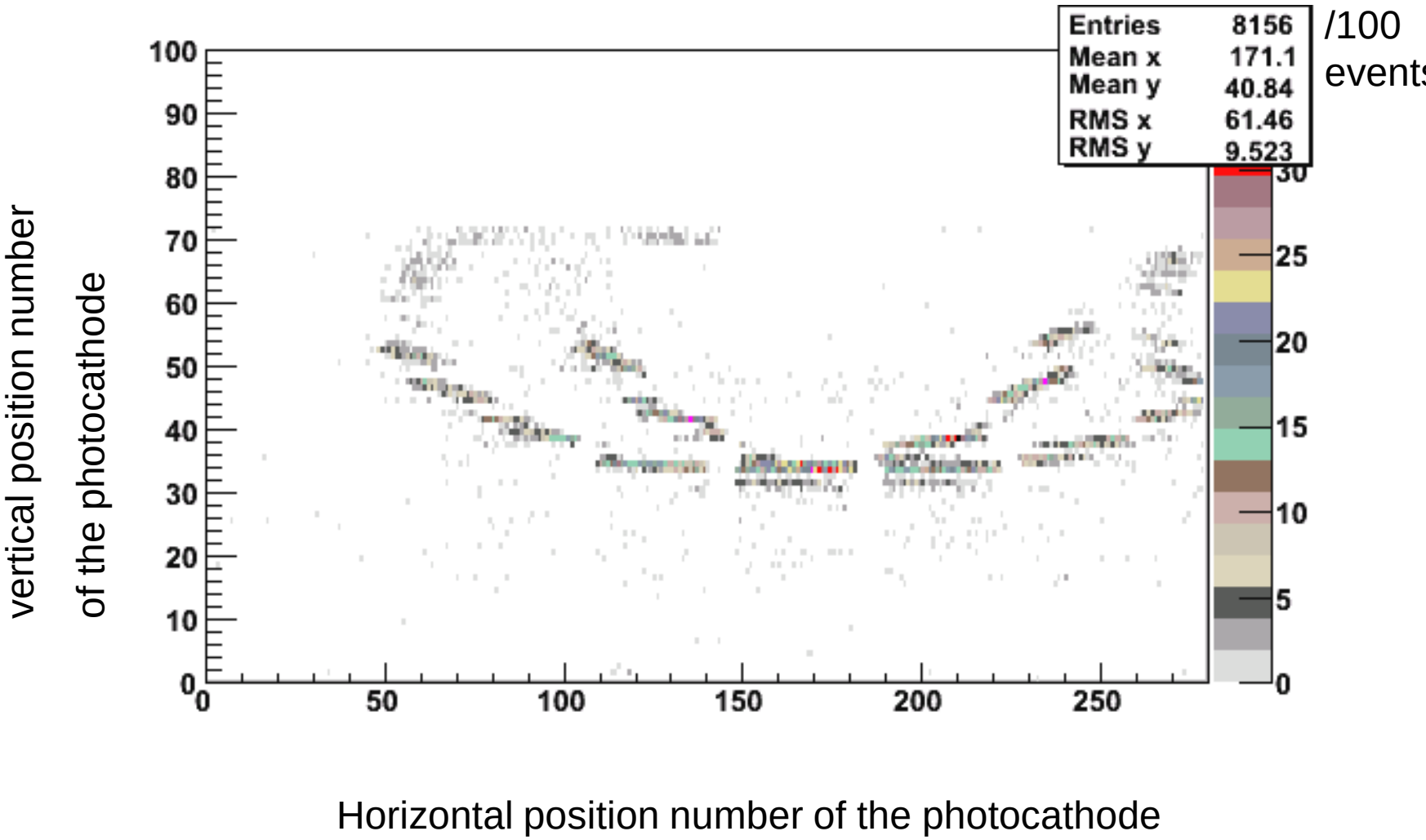
Simulations I

Θ_x and θ_y =8.531^0 protons 0.60 GeV

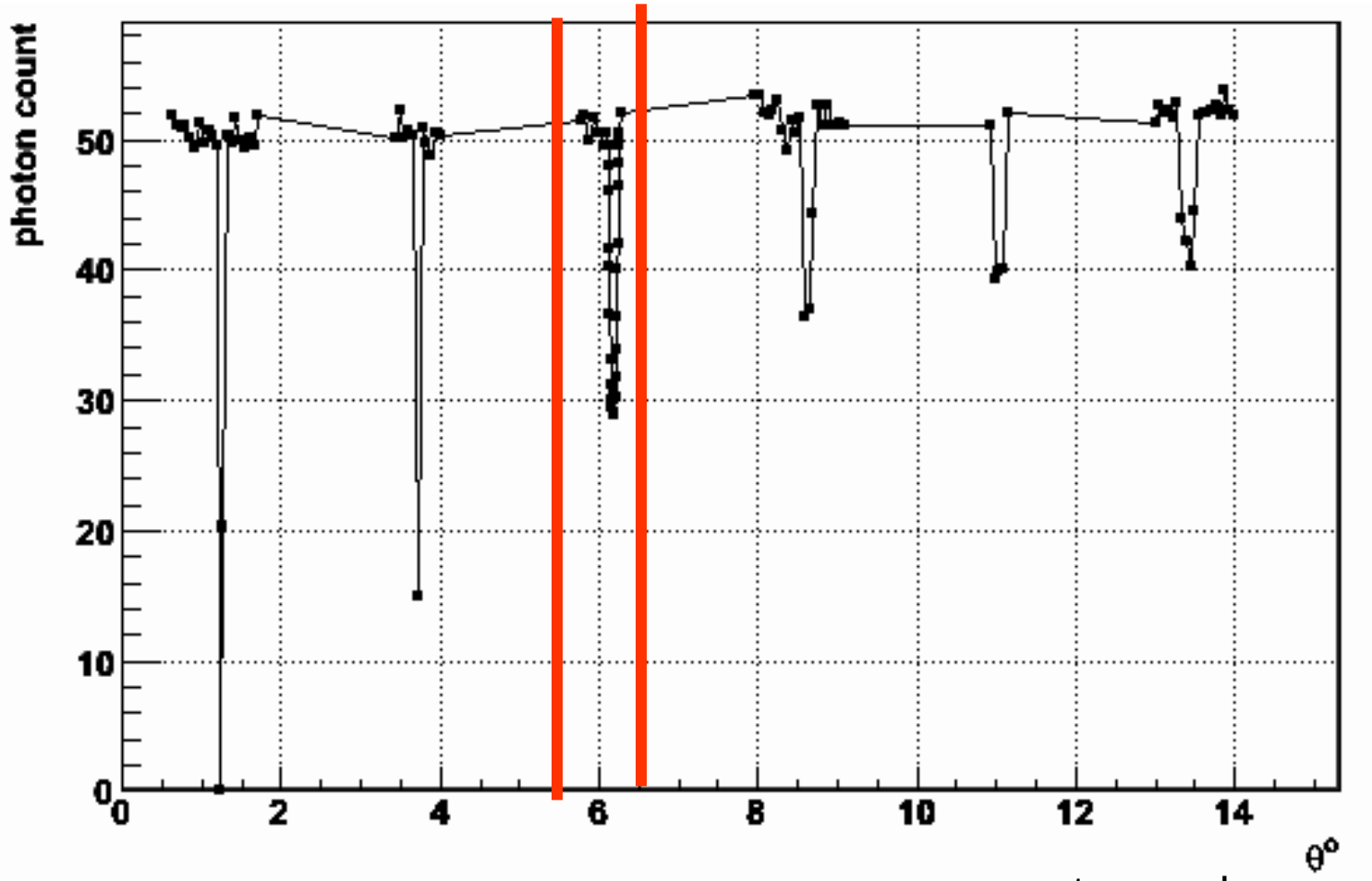


Simulations II

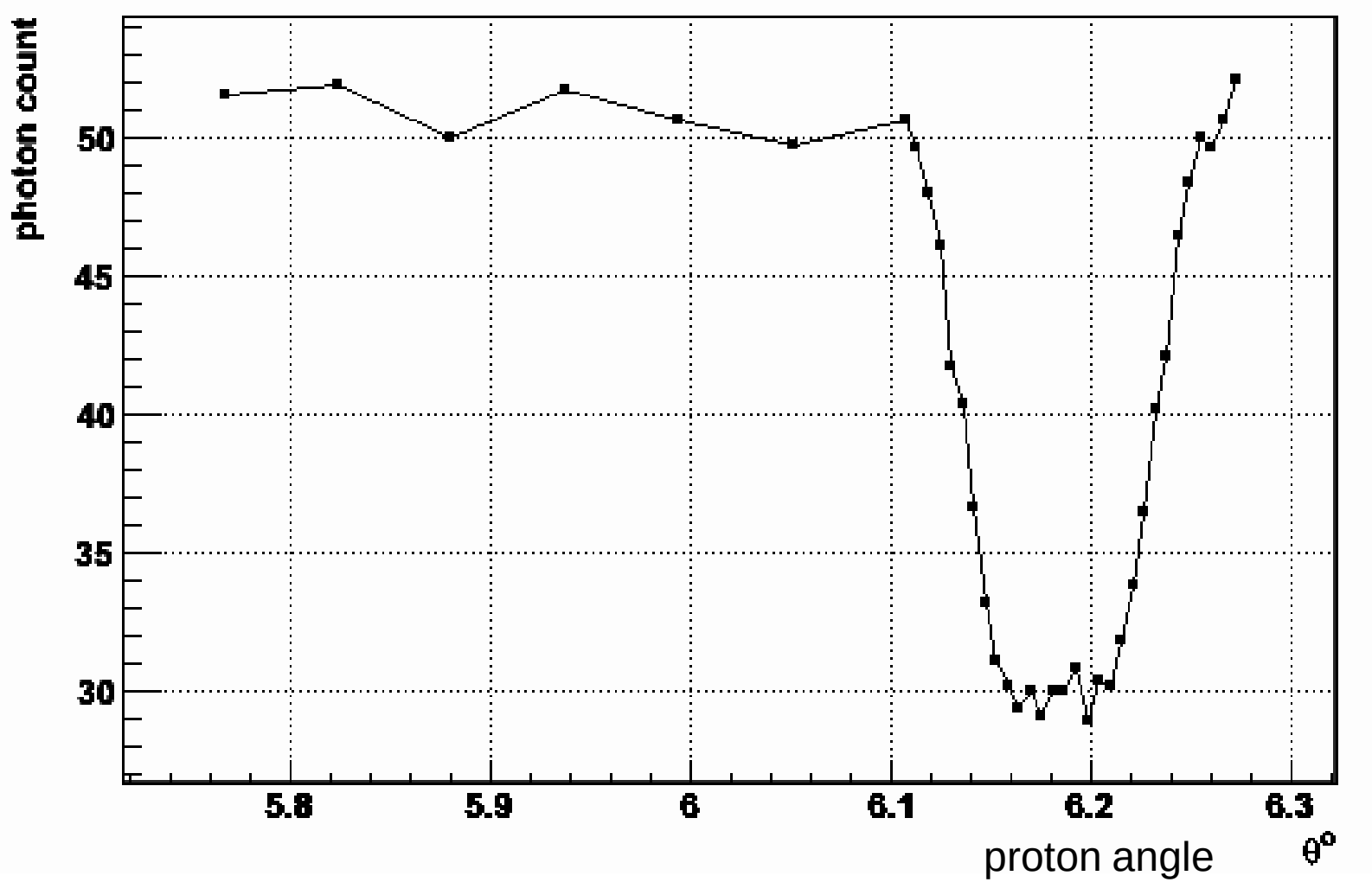
θ_x and θ_y =8.531^0 protons 1.00 GeV



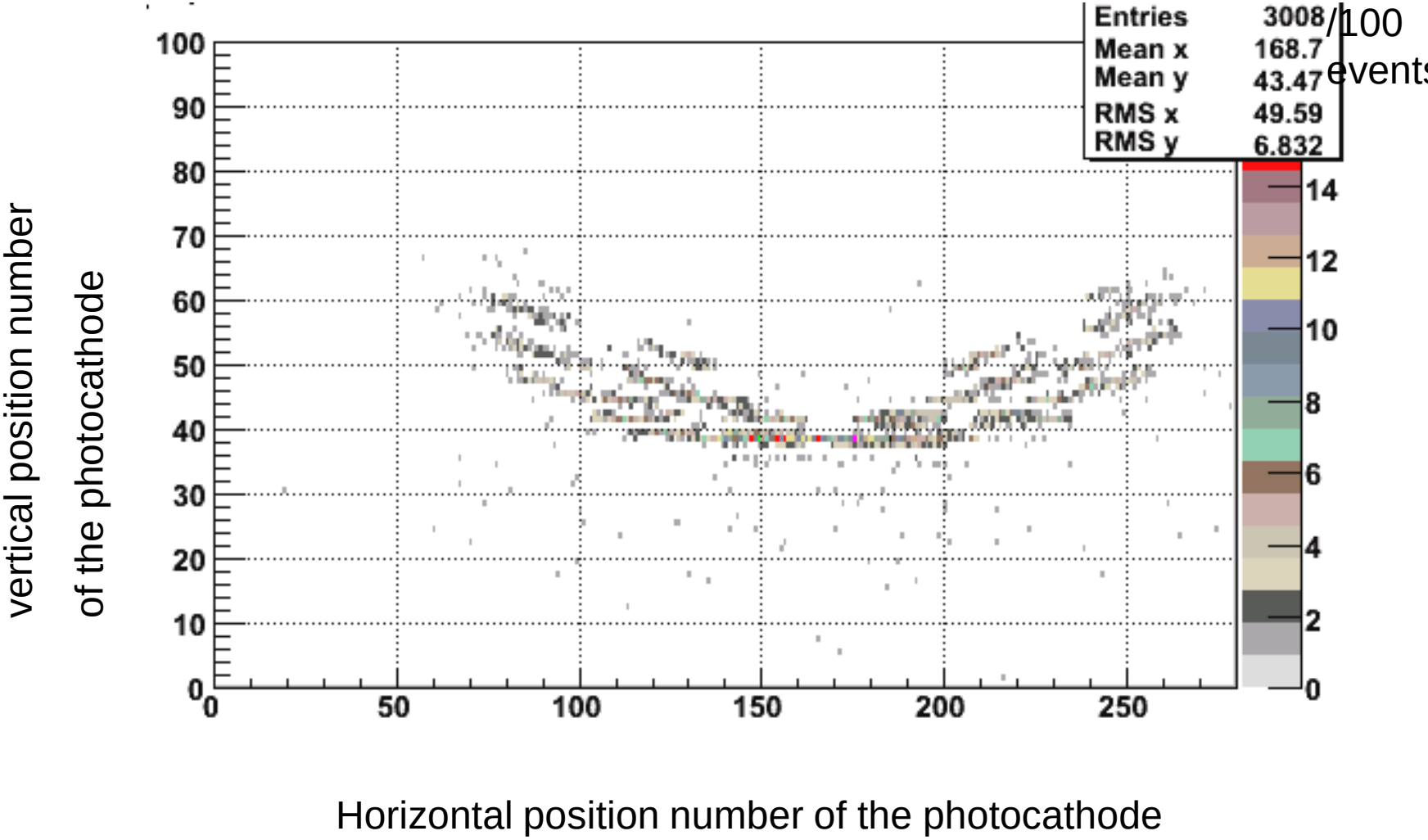
Average number of photons



Average number of photons



0.60 GeV protons edge deformation



Reconstruction

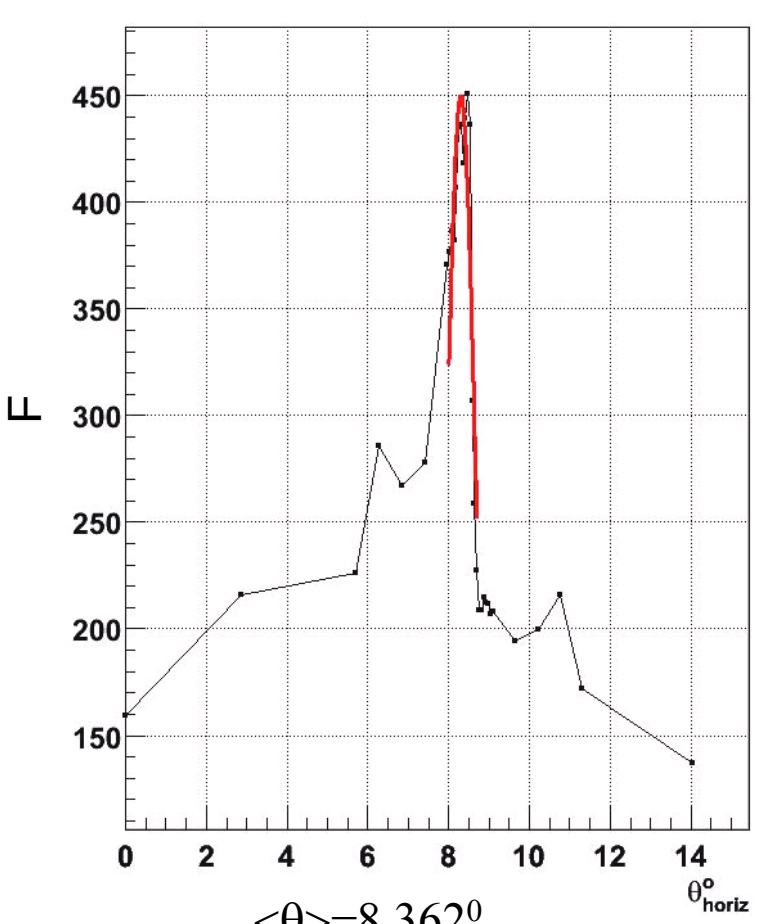
$$F(k,(E,p)) = \sum_{i,j} \text{experiment}(i,j) \cdot \overline{\text{simul}(i,j)}$$

k– particle type,
E,p – energy and momentum of the particle,
experiment([*i,j)* – experimental number of the detected photons in (i,j) photoelement,
$\overline{simul(I,j)}$ – simulated average number of detected photons in (i,j)-th photoelement

F is maximal, when the image in the experiment is similar to the simulated one. Thus direction and velocity (β) can be extracted.

Track reconstruction

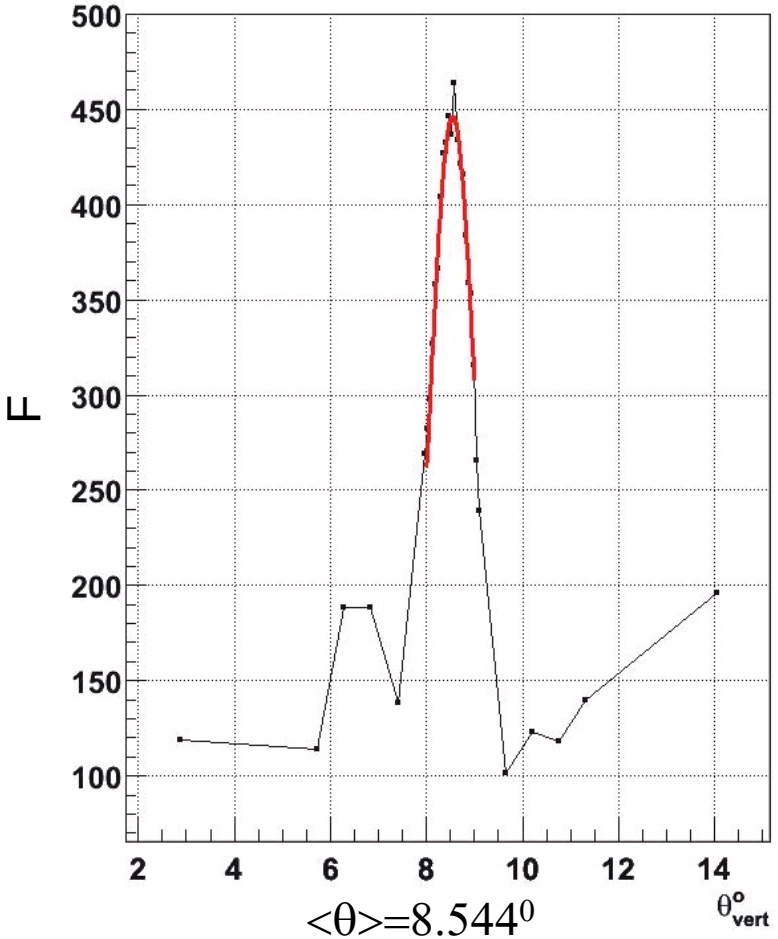
$\theta^{o}_{vert} = 8.531$ = fixed



$<\theta>=8.362^{0}$

$\sigma=0.38^{0}$

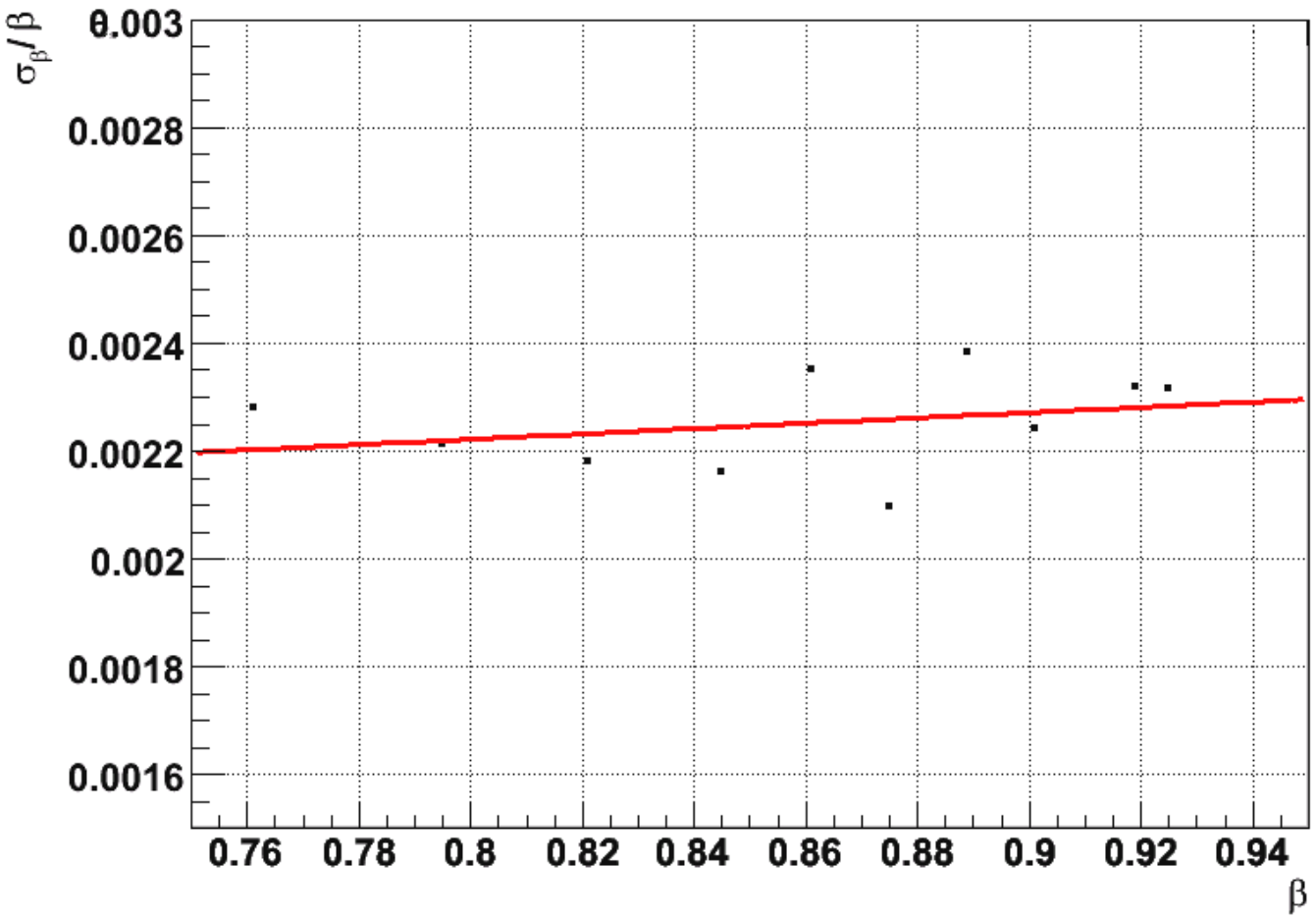
$\theta^{o}_{horiz} = 8.531$ = fixed



$<\theta>=8.544^{0}$

$\sigma=0.52^{0}$

Velocity resolution



Summary

- DIRC allows track direction and velocity measurement when PID comes from additional detectors
- ß in the range of 2.5 per mille
- angle measurement better than 6 percent
- Large data base of simulated events is required, efficient algorithms needed.