Dual-RICH update 2-29-2016
Alessio Del Dotto

- Focal position and focal plane shaping

  - The method presented in

    Križan Peter and Marko Starič. "The optimal detector surface of a fixed target RICH with a tilte mirror." NIM A 379.1 (1996): 124-129.

  has been partially followed.

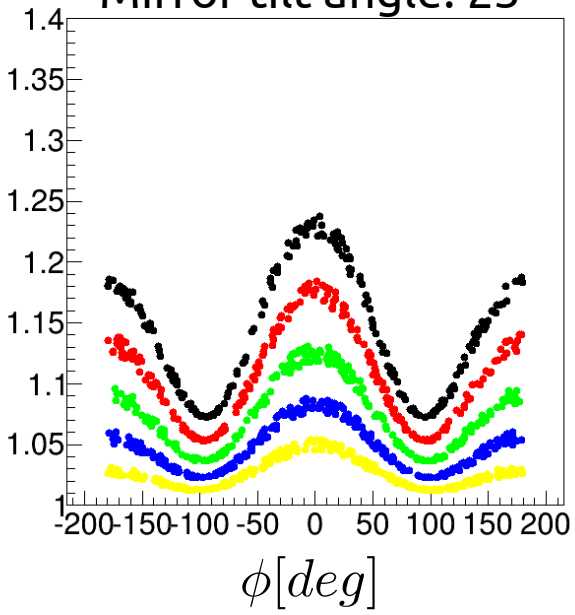
Position of the focal with respect to the “naive” sphere

$r_m = 280\ cm$

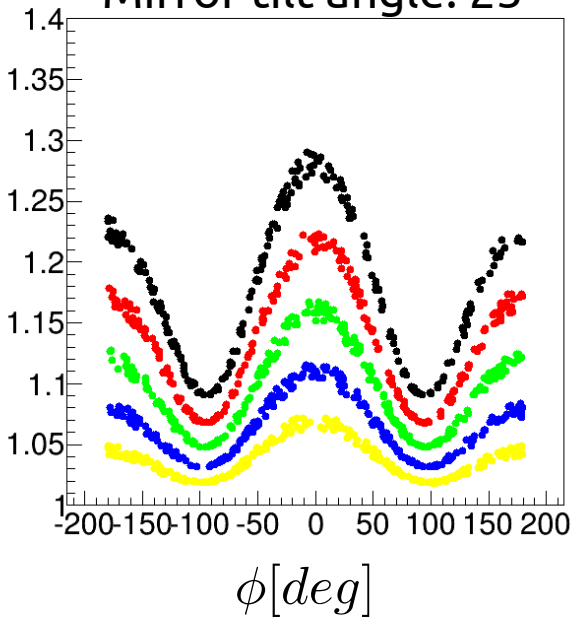
Track polar angle

θ = 5°
θ = 10°
θ = 15°
θ = 20°
θ = 25°

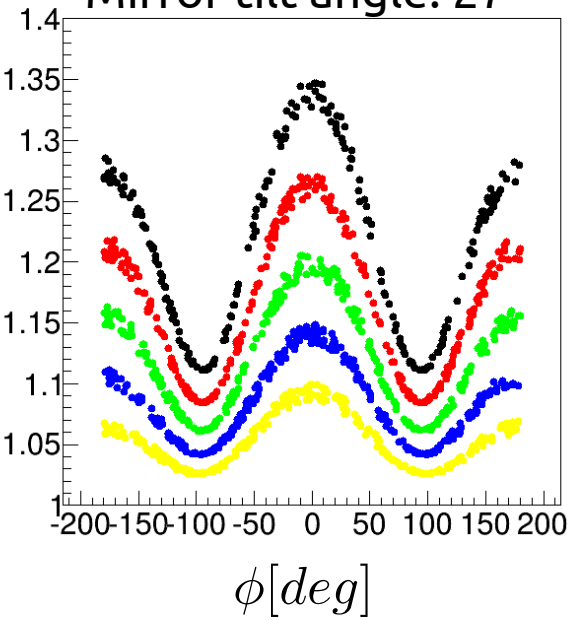
Mirror tilt angle: 23°



Mirror tilt angle: 25°



Mirror tilt angle: 27°



Azhimutal angle of the photons with respect to the track direction

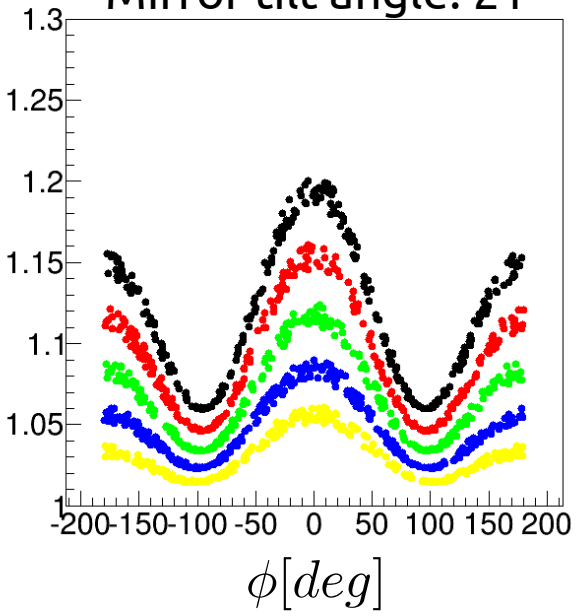
Position of the focal with respect to the “naive” sphere

$r_m = 300\ cm$

Track polar angle

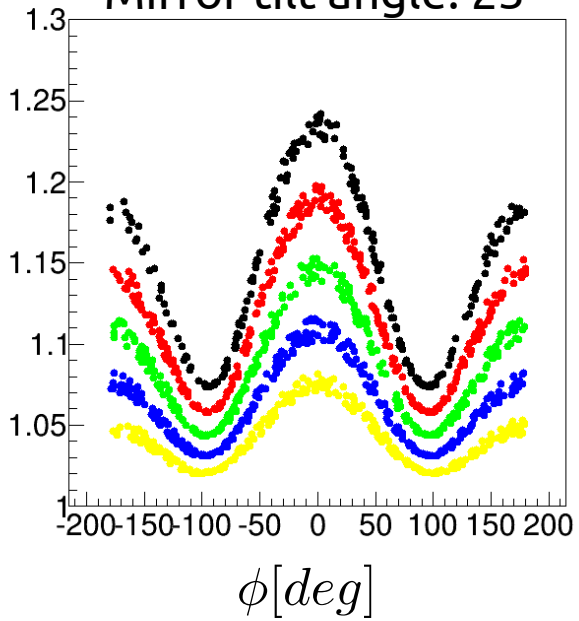
θ = 5°
θ = 10°
θ = 15°
θ = 20°
θ = 25°

Mirror tilt angle: 21°

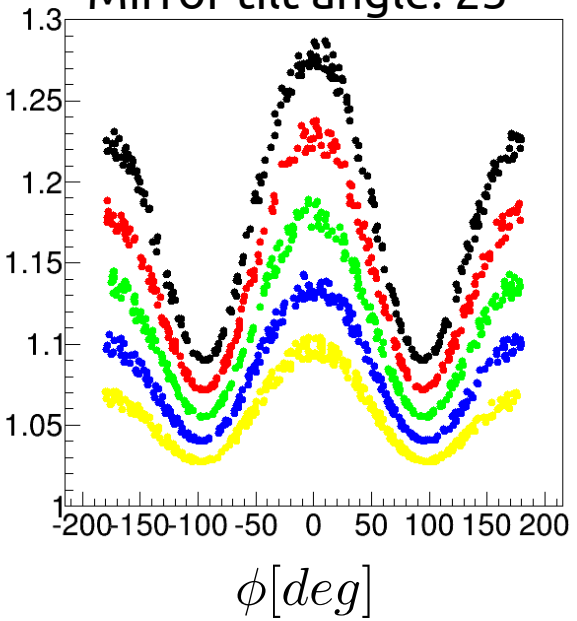


$\frac{r_f}{r_m/2}$

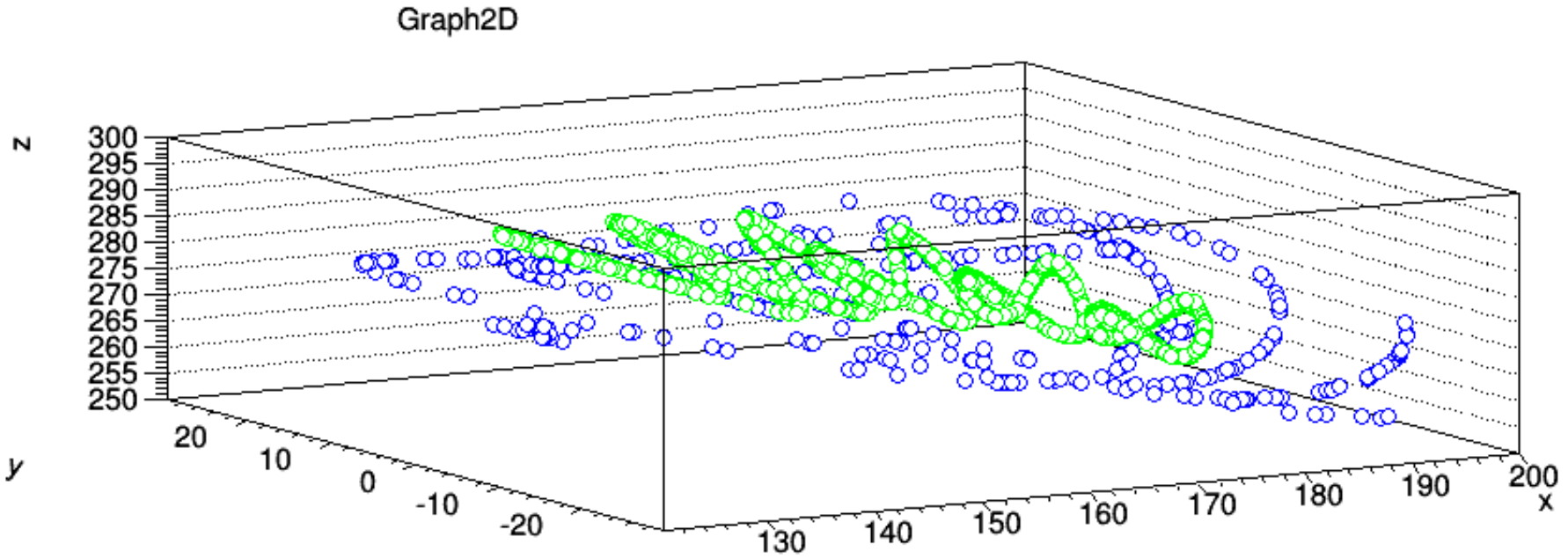
Mirror tilt angle: 23°



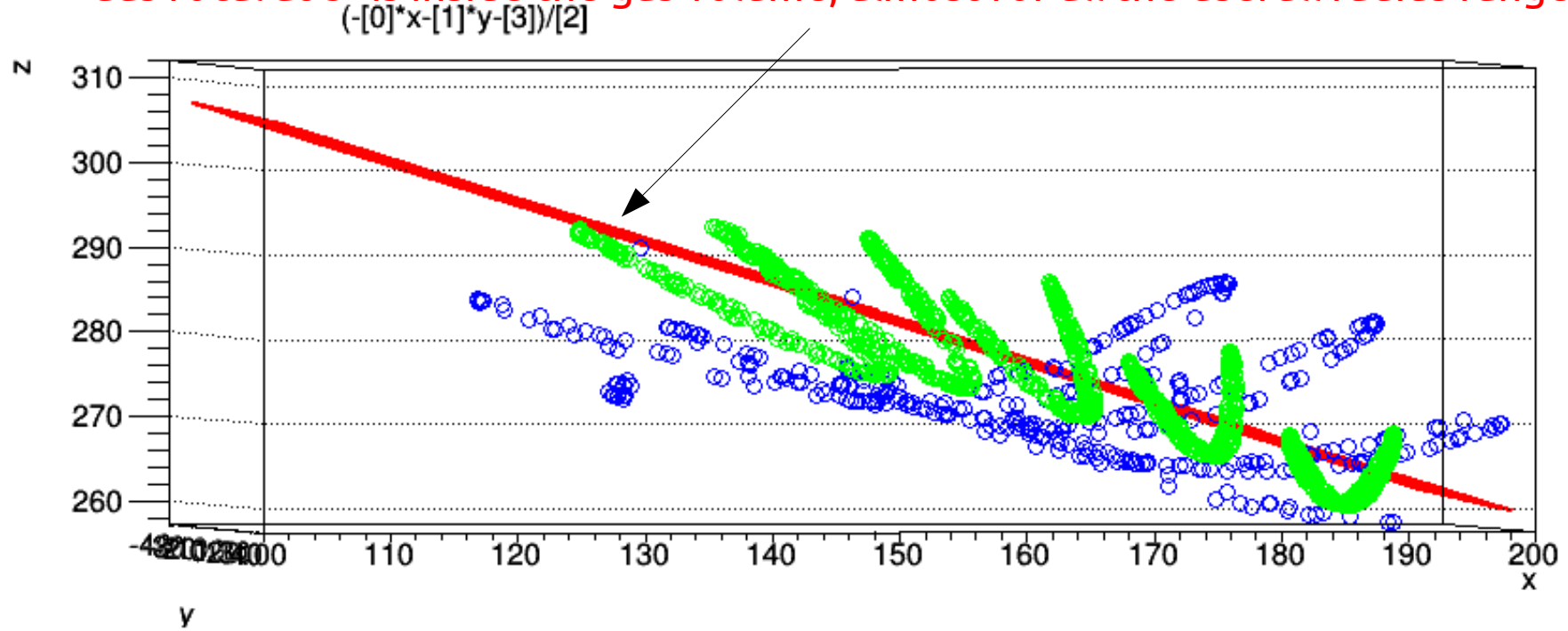
Mirror tilt angle: 25°

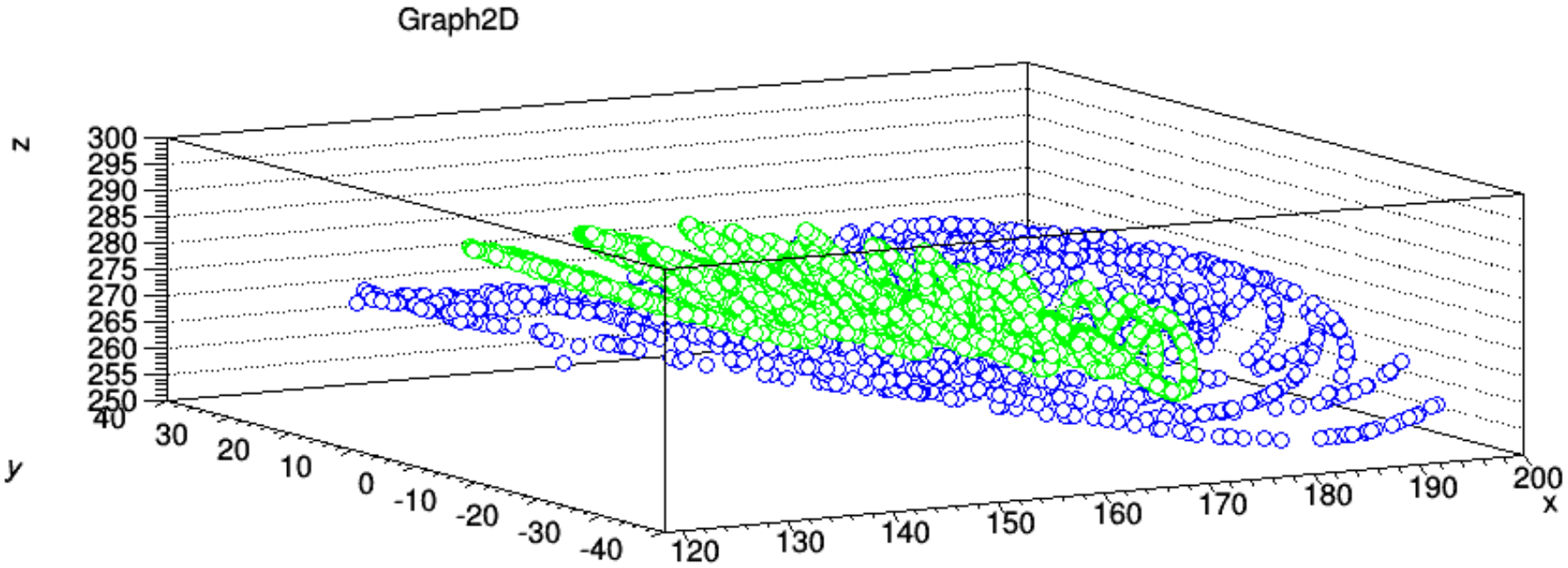


Azhimutal angle of the photons with respect to the track direction

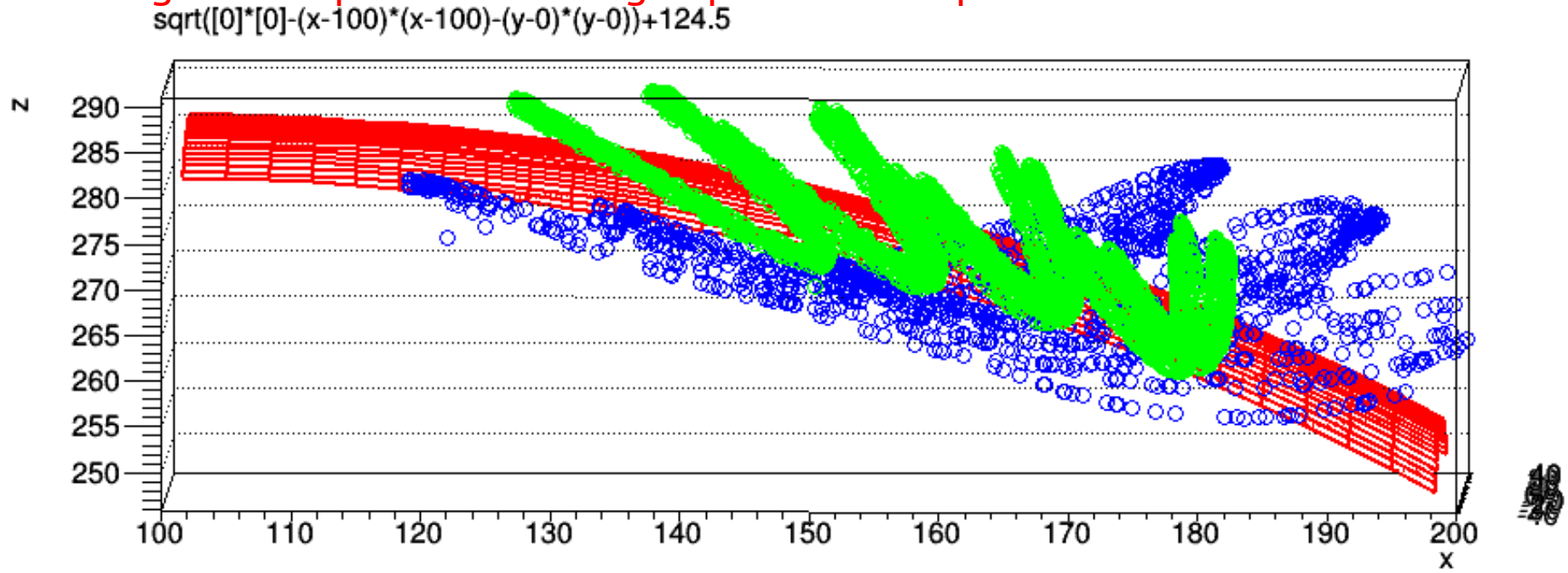


Gas focal at 5° is inside the gas volume, almost for all the usefull radius range!

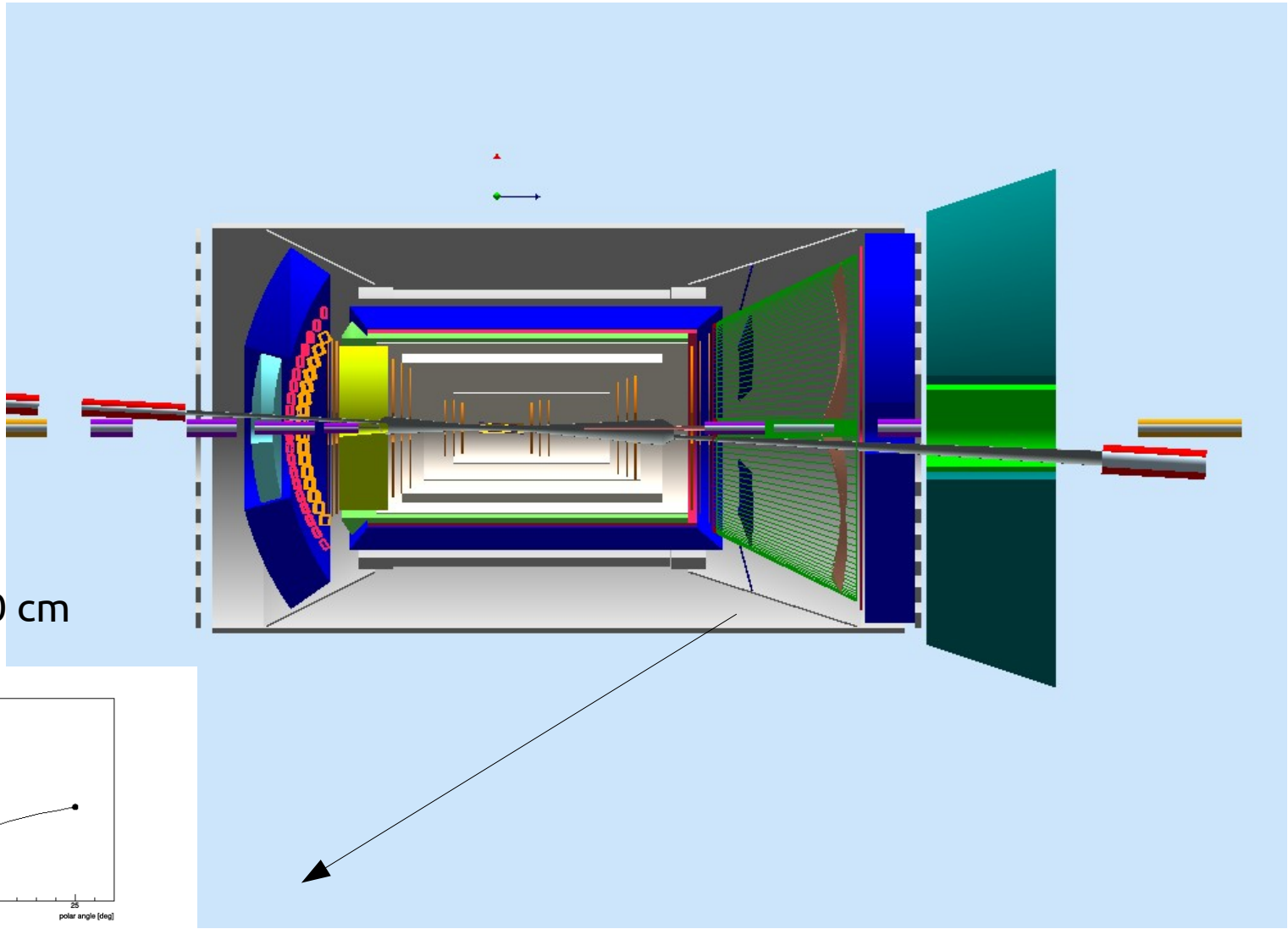




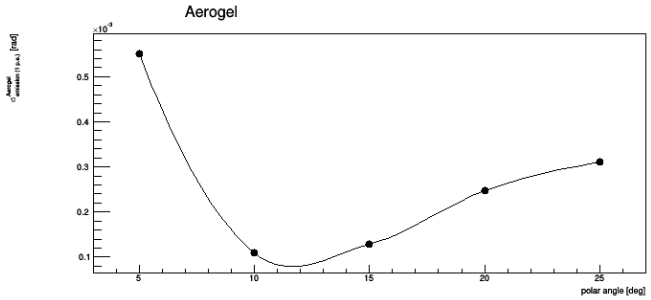
A good compromise is fitting a sphericalfocal plane with increased radius

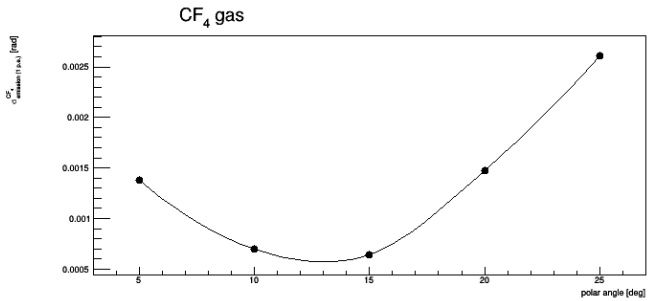


Avoilable space
for RICH in
The full detector

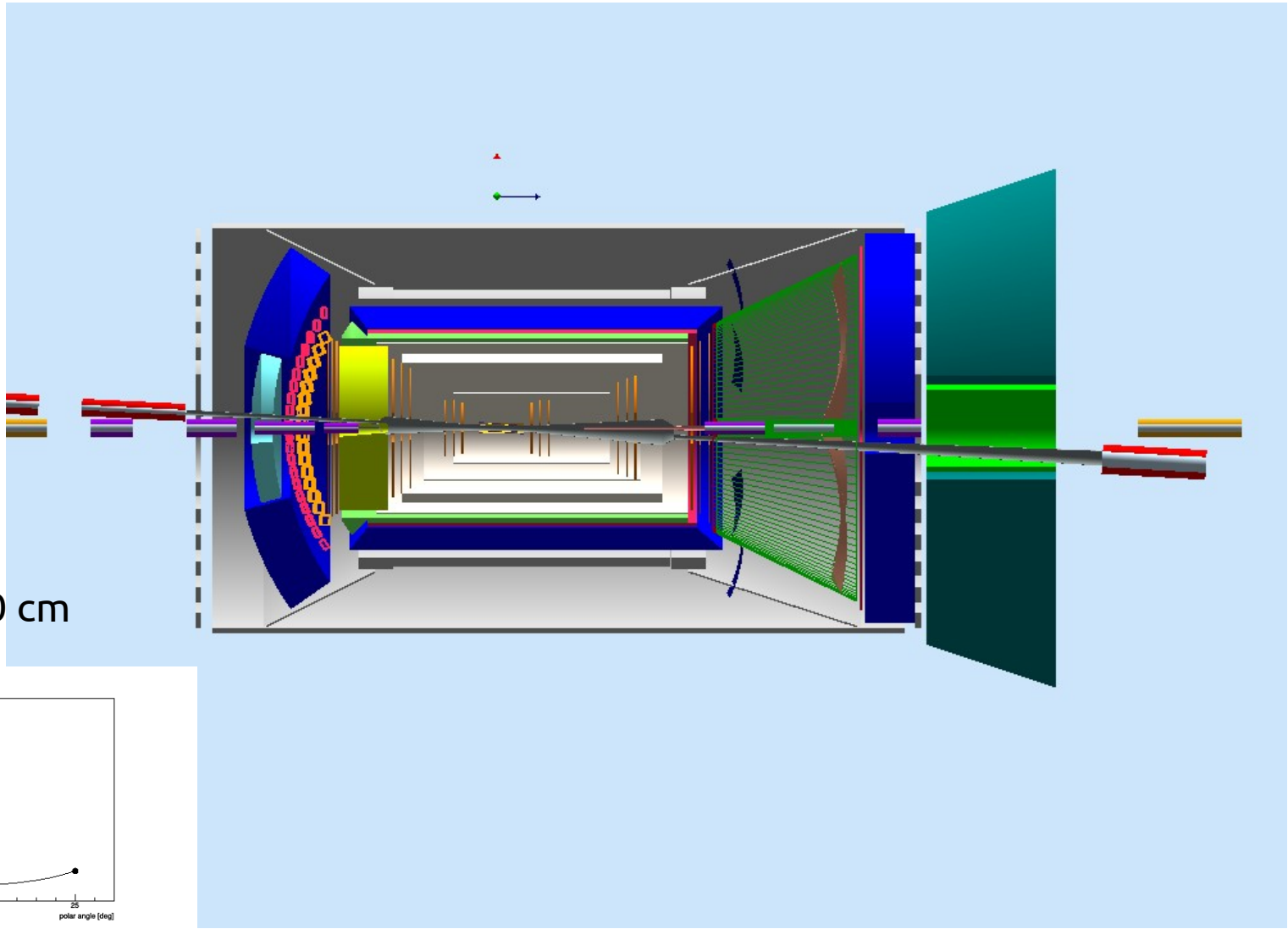


Mirror radius = 270 cm

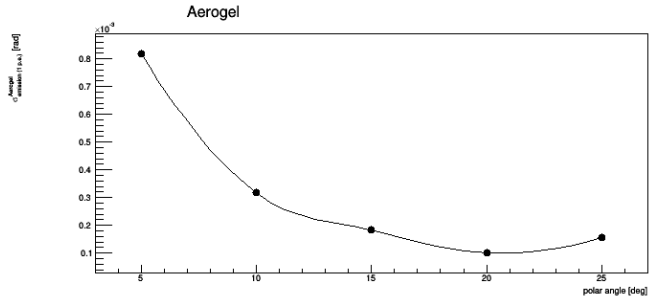


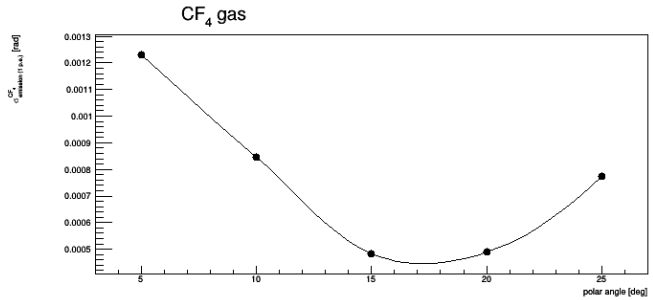


Flat focal plane in order to be in space!
That is in the opposit side with respect to
the focal of the mirror!



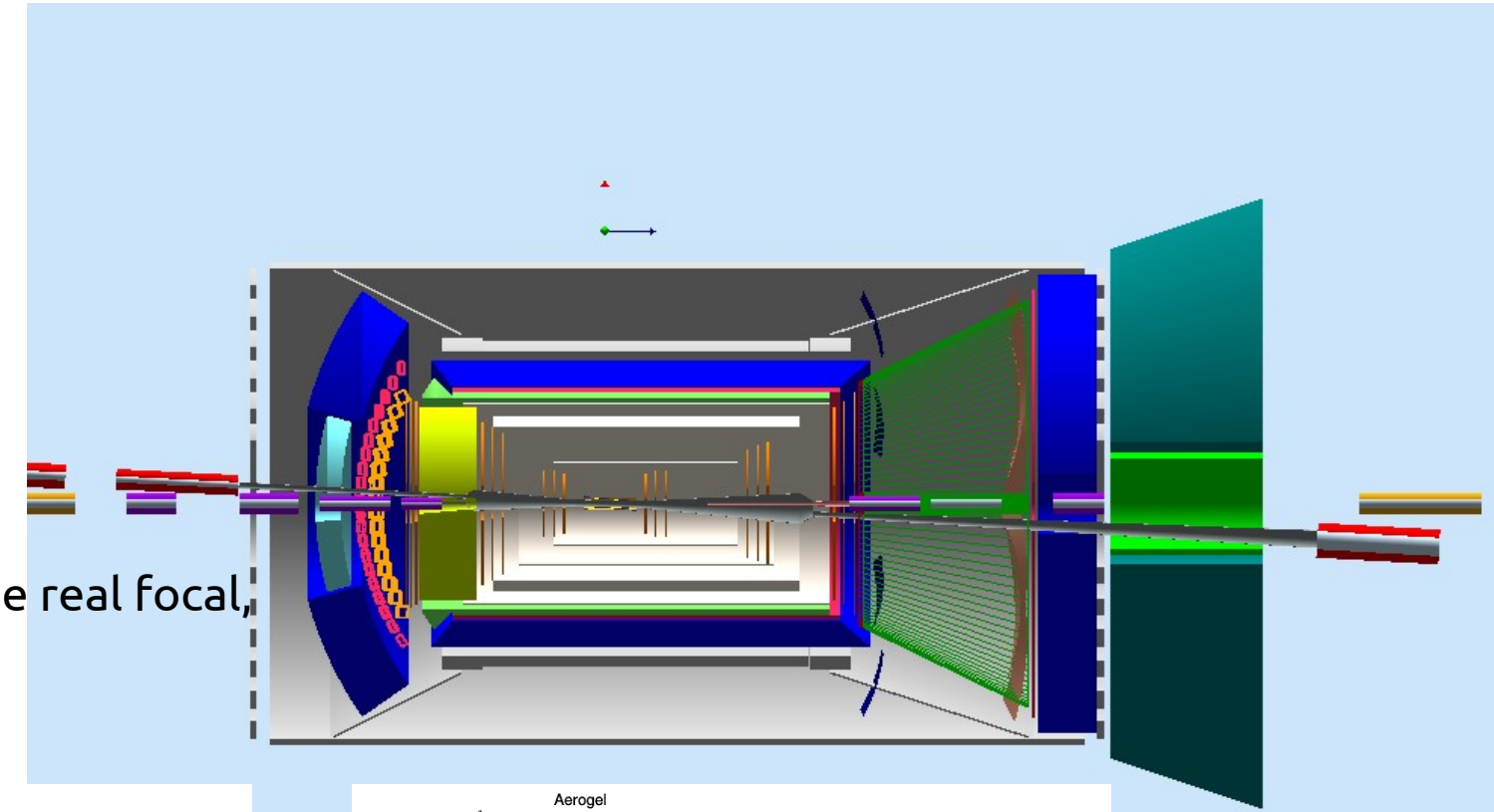
Mirror radius = 270 cm



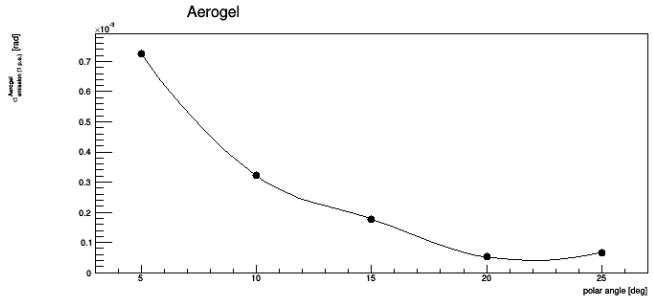


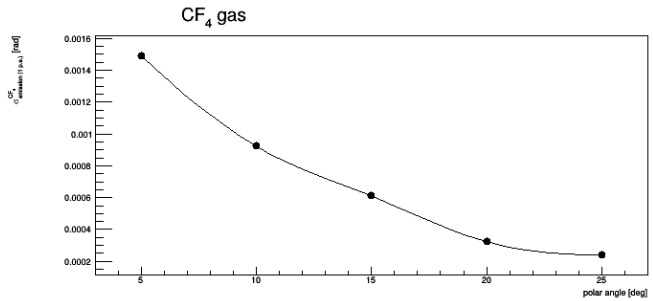
Focal plane nearest to the real focal, but out of space!

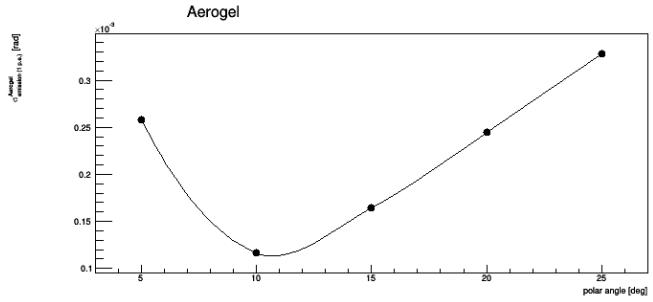
Mirror radius = 300 cm



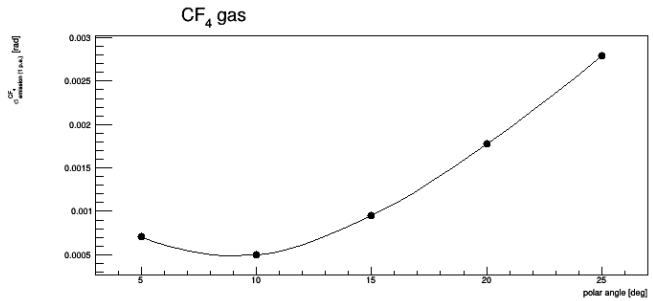
Focal plane nearest to the real focal, but out of space!





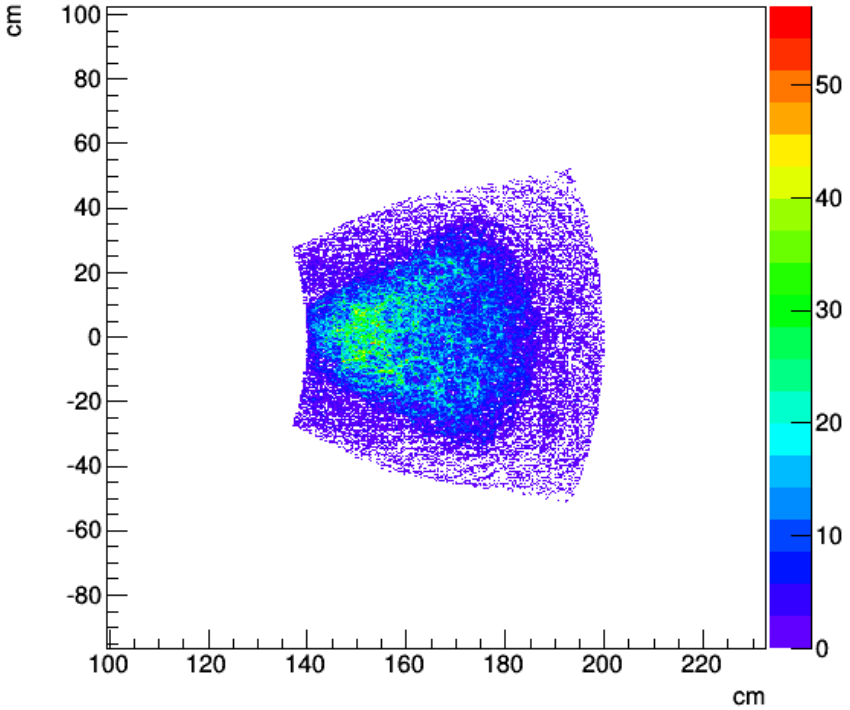


Flat plane
In space

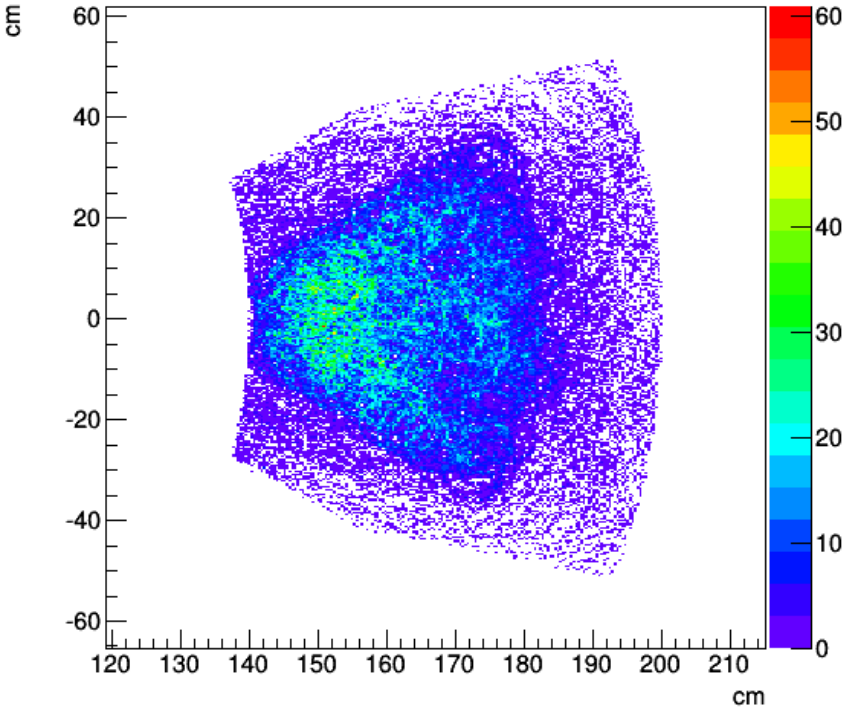


Detector plane effective size

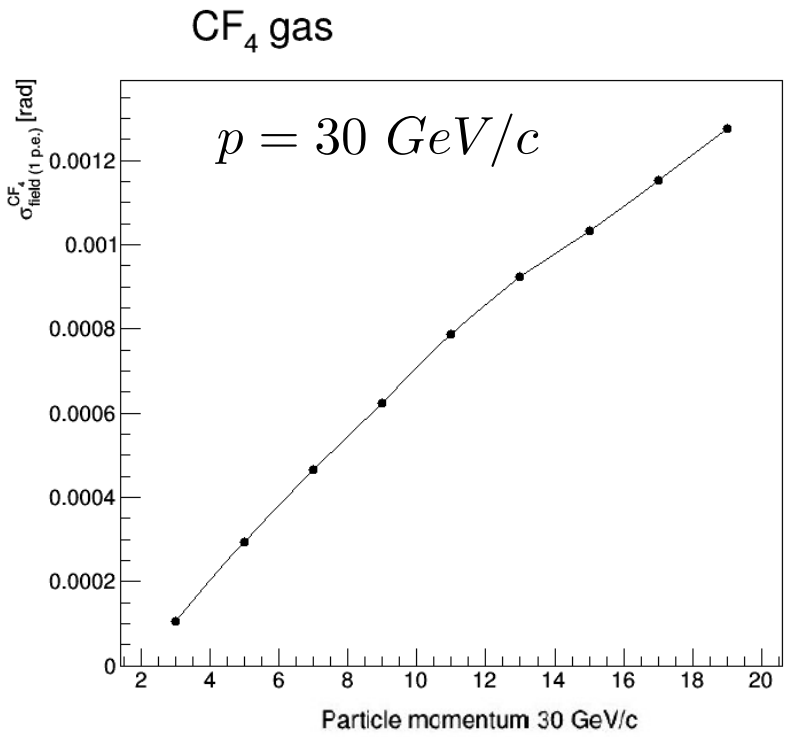
Mirror 3 m

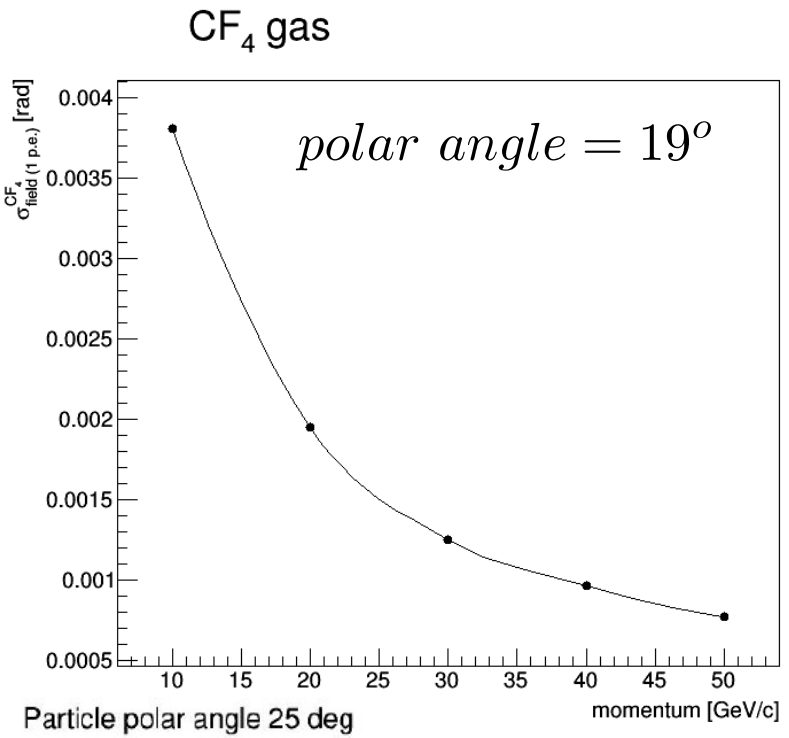


Mirror 2.7 m

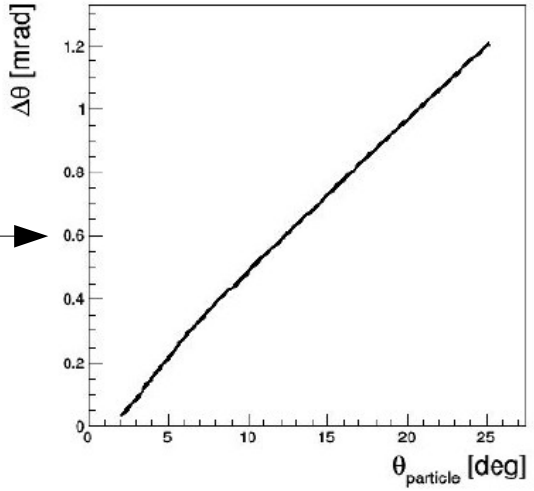


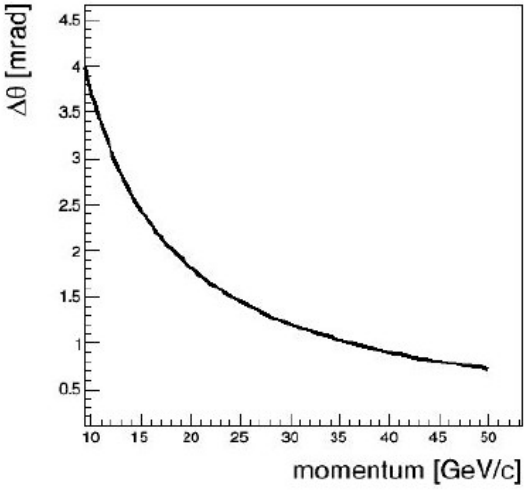
Field effects – gemc (the other main error)





Semi-analytic →





To do Next

- Find the optimum, geven the avoilable space

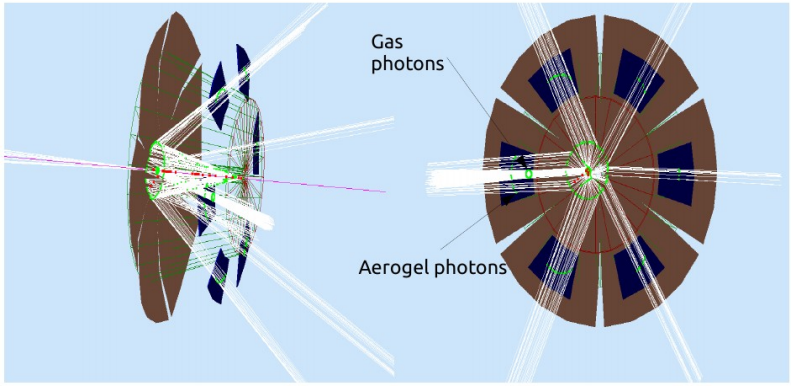
- Other mirror shape:

  - Elliptical mirror: it is suggested to use for threshold cherenckov, with the target in one of the focals. It does not converge parallel rays in the same ring.

  - Parabolic mirror: It reduces the spherical aberrations, but it does not solve the problem with the spece.

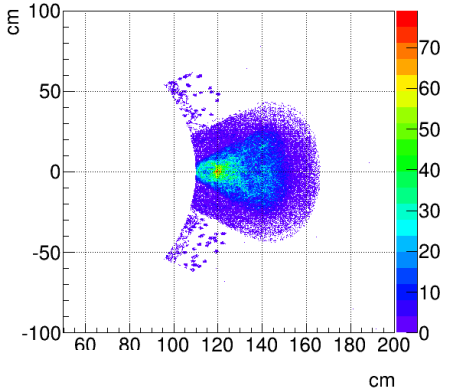
Dual-radiator RICH GEANT4/gemc simulation

Aerogel		CF_4 *gas*	
Errors on θc	mrad	Errors on θc	mrad
Chromatic	2.4	Chromatic	0.6
Emission	0.5 – 0.1	Emission	1.3 – 0.3
Pixel size (3 mm)	0.6	Pixel size (3 mm)	0.6
σtot	2.5	σtot	1.6
Npe	~ 10	Npe	~ 20



Two options of configuration under study:

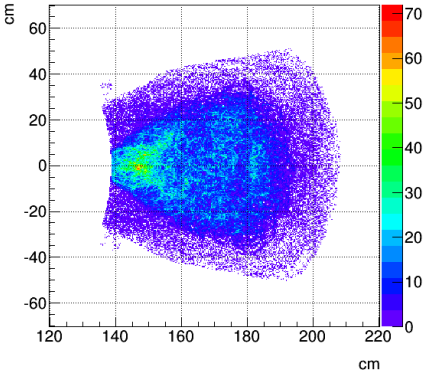
Polar angle coverage up to 21° -->smaller detector size



Momentum independent error contributions (1 p.e.), disentangled using the GEANT simulated data
In combination with the inverse ray tracing reconstruction algorithm developed and used for the HERMES experiment dual-radiator RICH

Magnetic field and track smearing to be added

The emission error contribution depends on the polar angle of the emitting track
and on the position/shape of the photodetector plane, namely it depends on the distance of the detector plane from the focus of the mirror at a given polar angle --> solutions to minimize the error range under study



Polar angle coverage up to 25° -->increased detector size