Dual-RICH simulations (Update)

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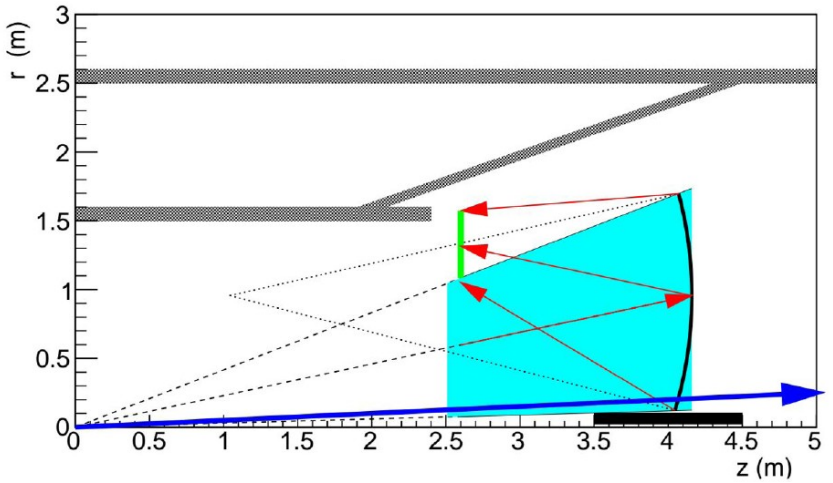
for the EIC PID RICH meeting
10-19-2015

Outline

Dual RICH mirror-lens configurations:

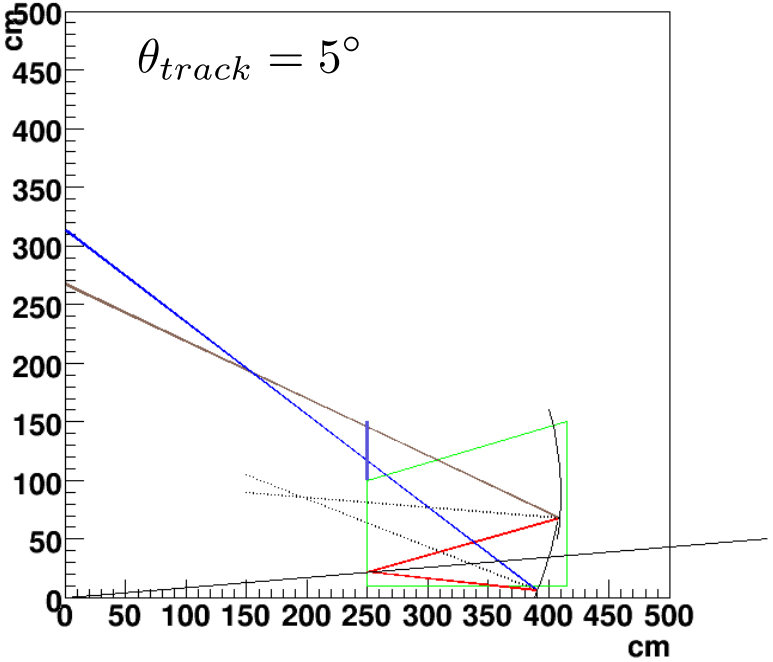
- Configuration with double spherical mirror (slides 4-6)
- Configuration with Spherical mirror + Fresnel lens (slides 5-12)

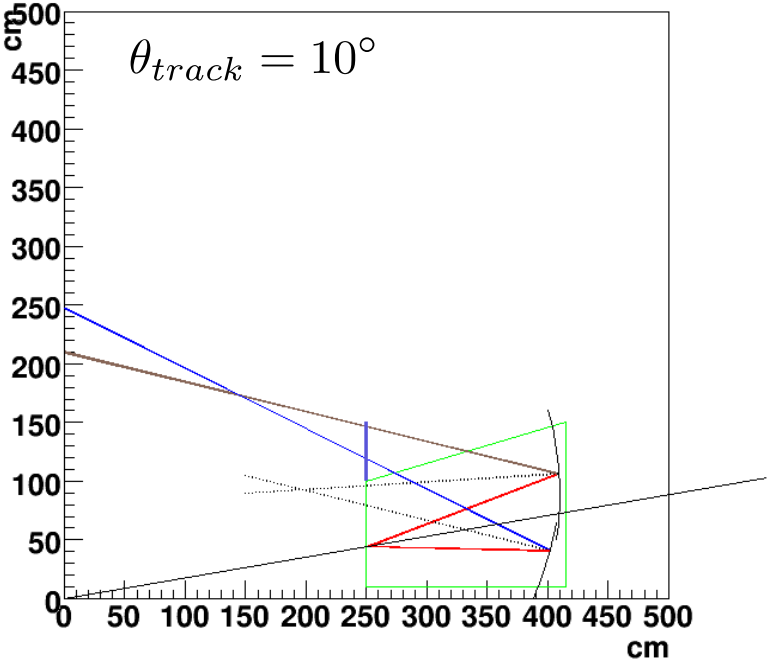
Towards a realistic mirror-lens configuration

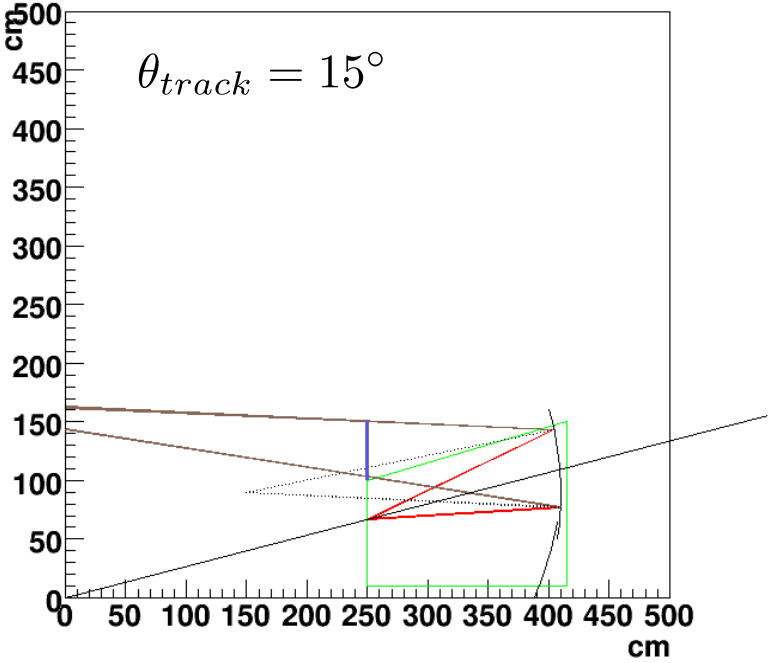


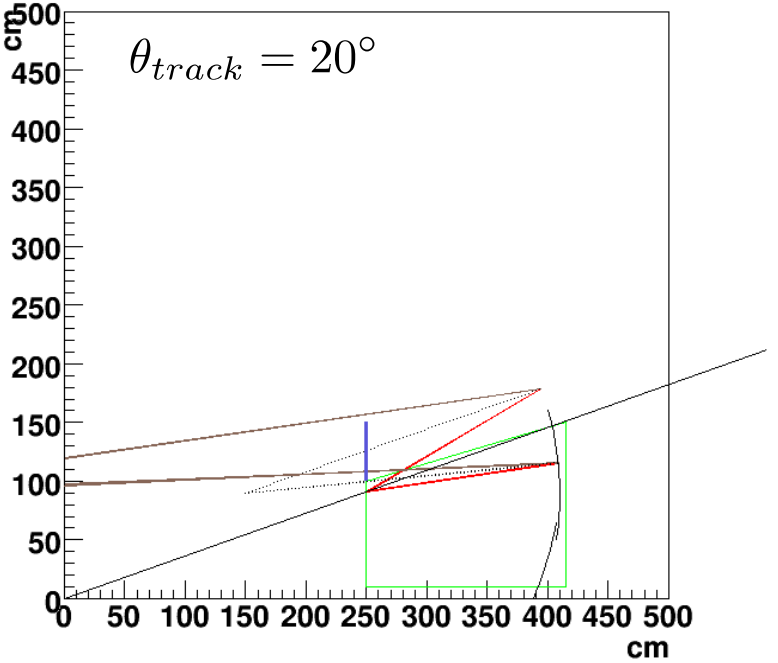
- A 2D optical ray tracing software has been developed (based on C++/Root)
- The reflection of the Cherenkov photons can be simulated for different radiators and different mirror configurations
- First approximation of a Fresnel lens has been added
- The photon-detector position can be studied in relation to the focal plane

Thickness of the Aerogel = 4 cm, 4+4 photons generated 1 each cm in the Aerogel



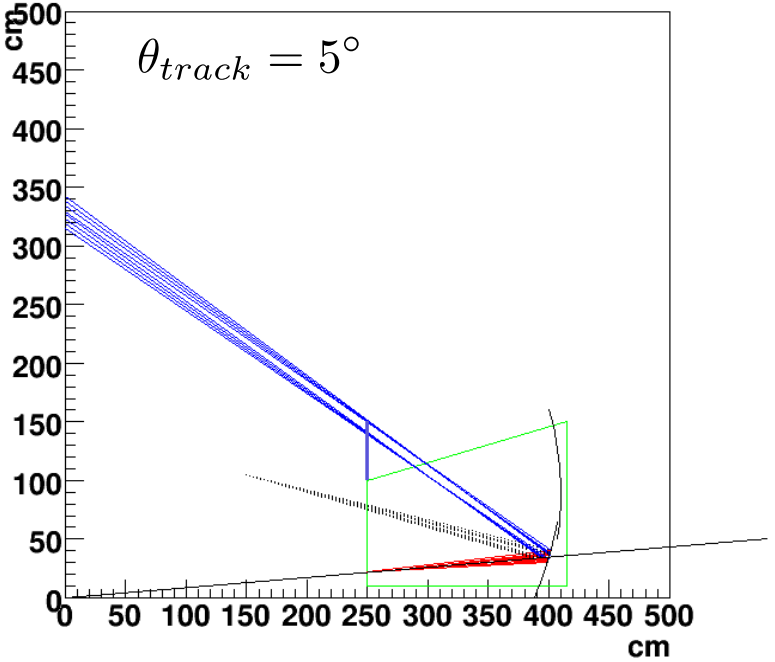


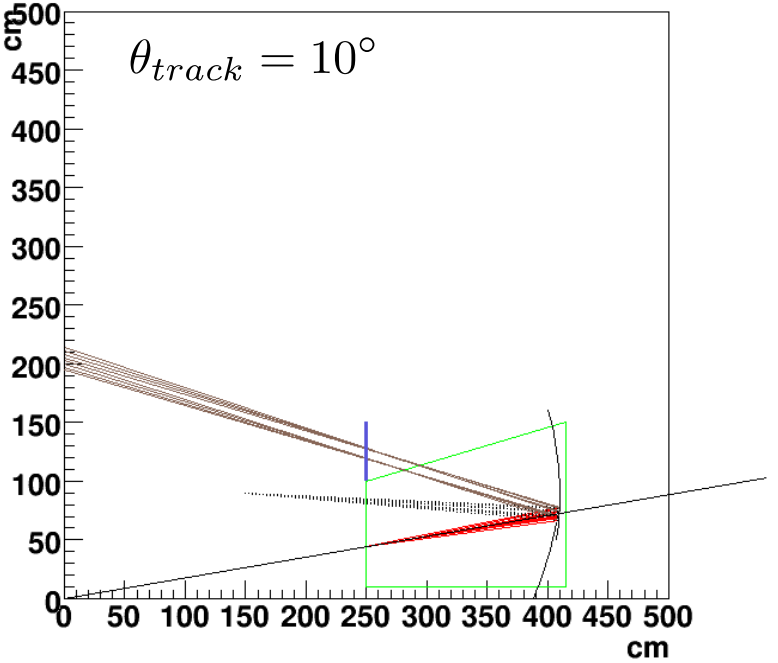


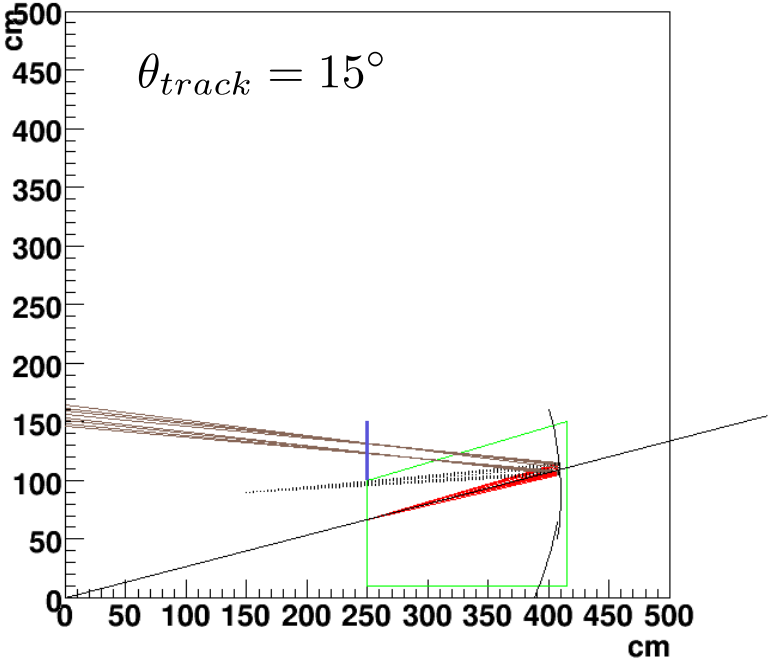


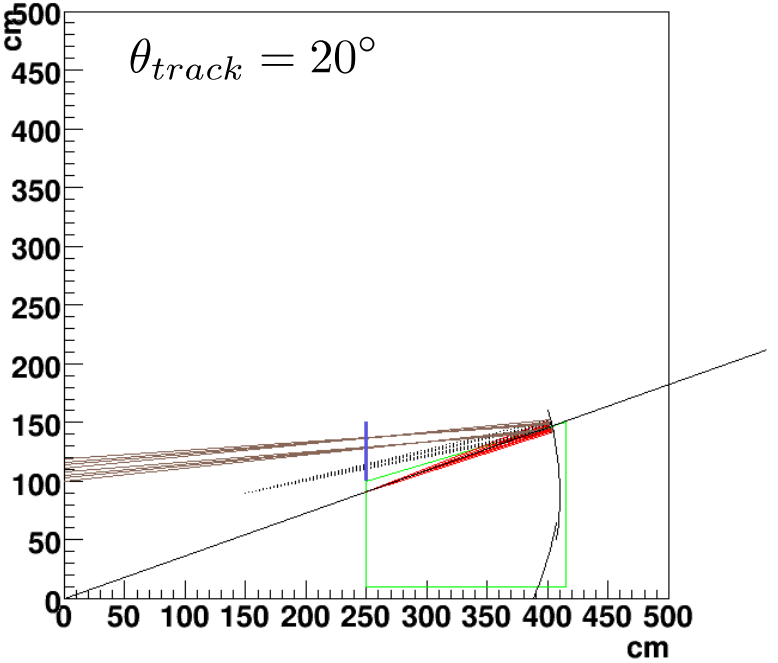
Good photons collection, some problem with the extremal angles

4+4 photons generated 1 each 35 cm in the CF_4 gas



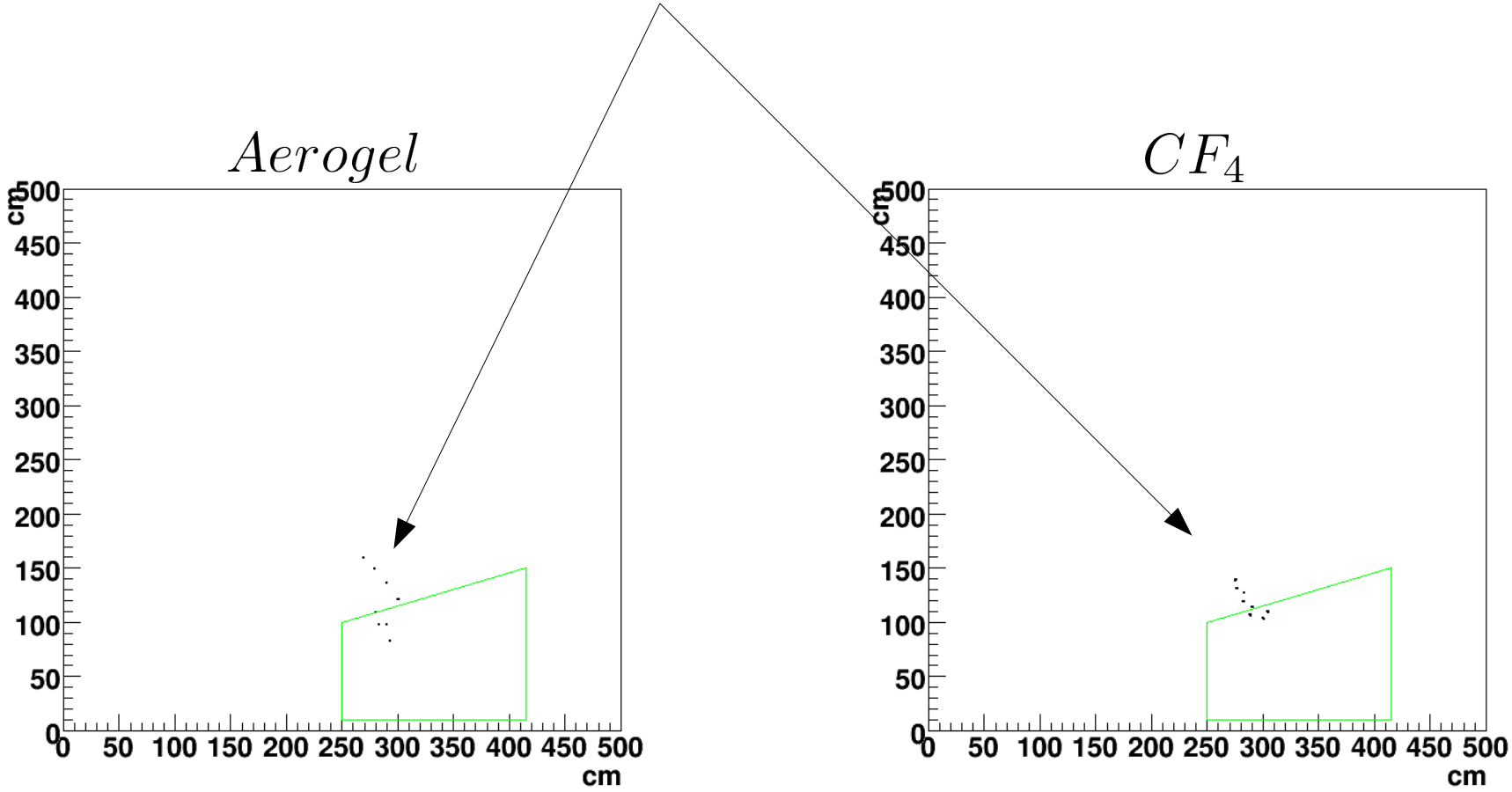






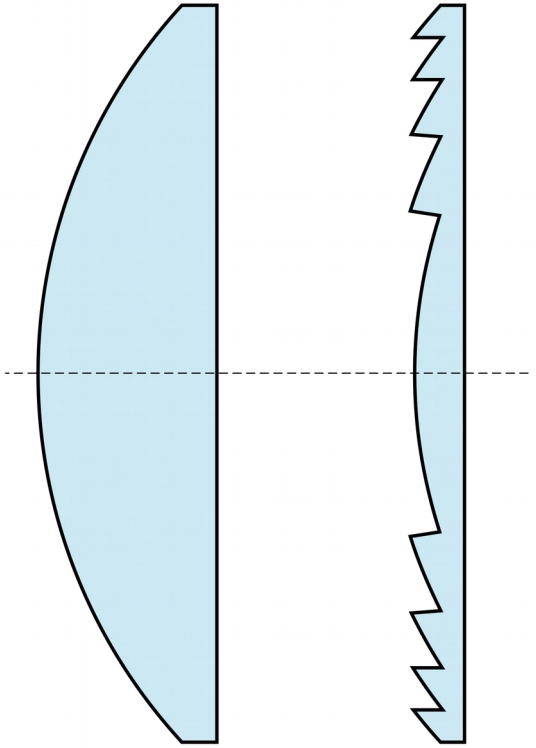
Good photons collection

Focal plane (curve in 2D) --> straight lines interception points

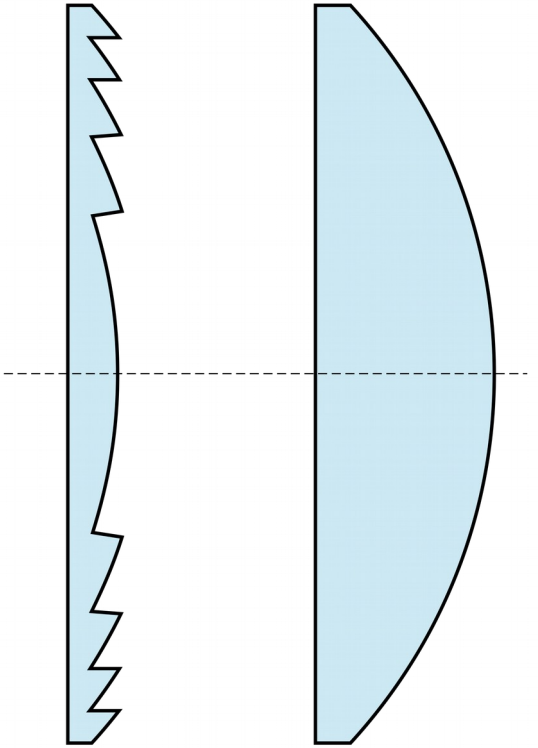


Fresnel lens – possible orientation

We can try to add a Fresnel lens after the Aerogel --> focusing of light and filtering of the UV light

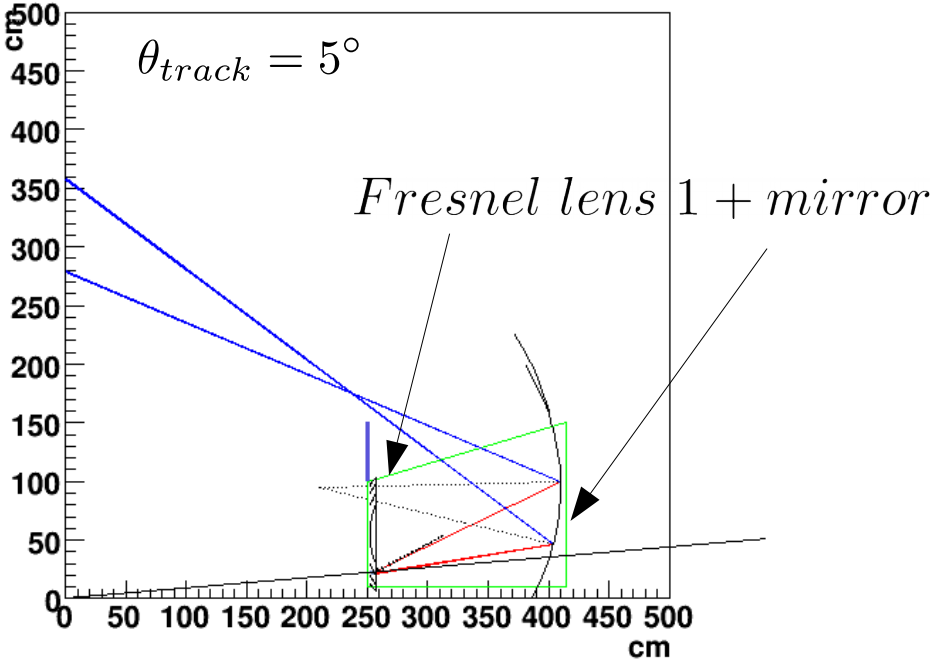


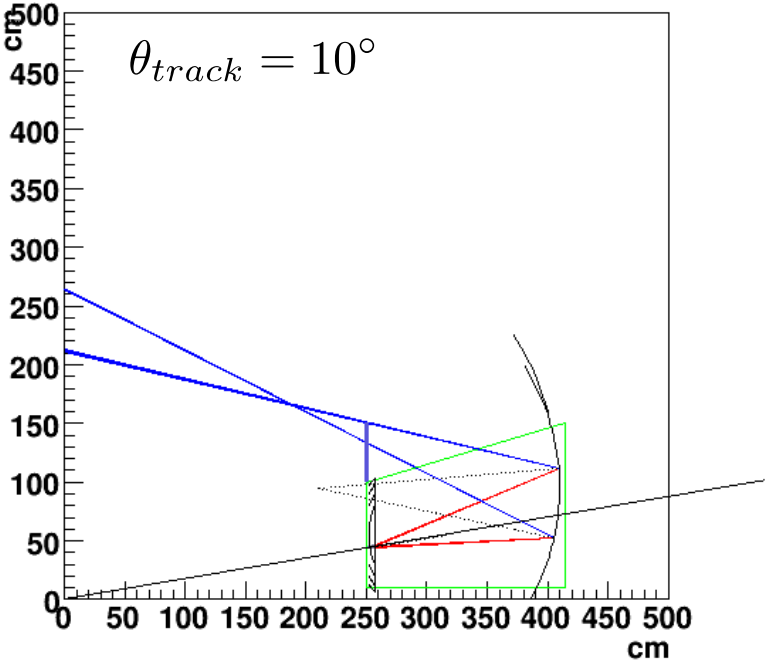
Fresnel lens --> orientation 1

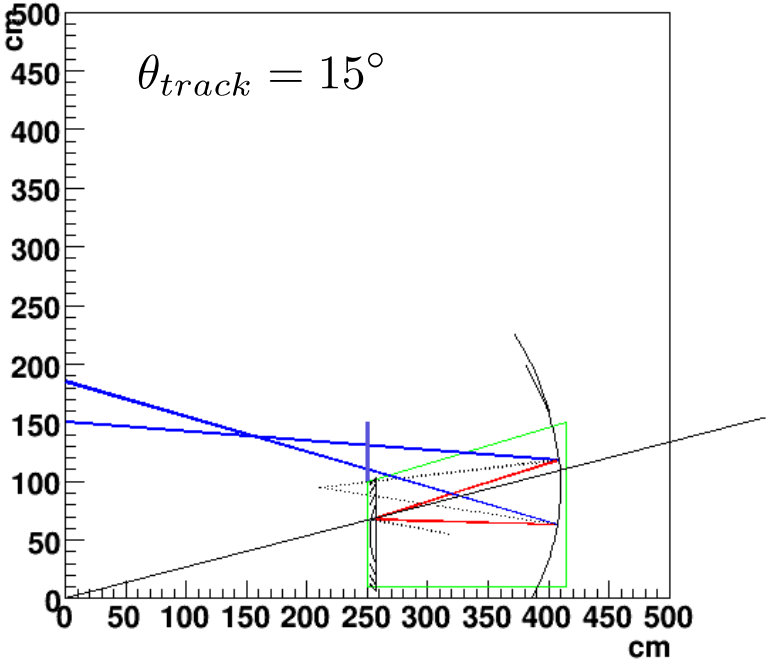


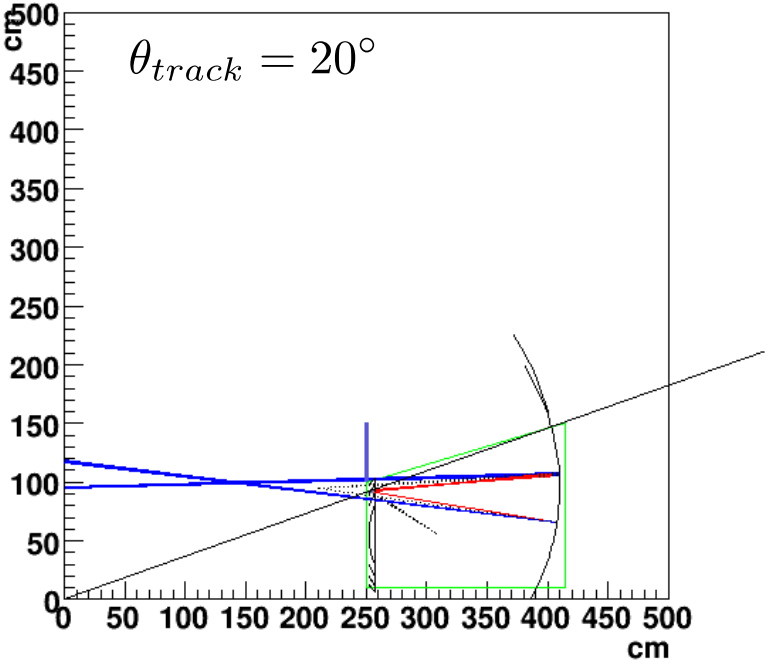
Fresnel lens --> orientation 2

Thickness of the Aerogel = 4 cm, 4+4 photons generated 1 each cm in the Aerogel









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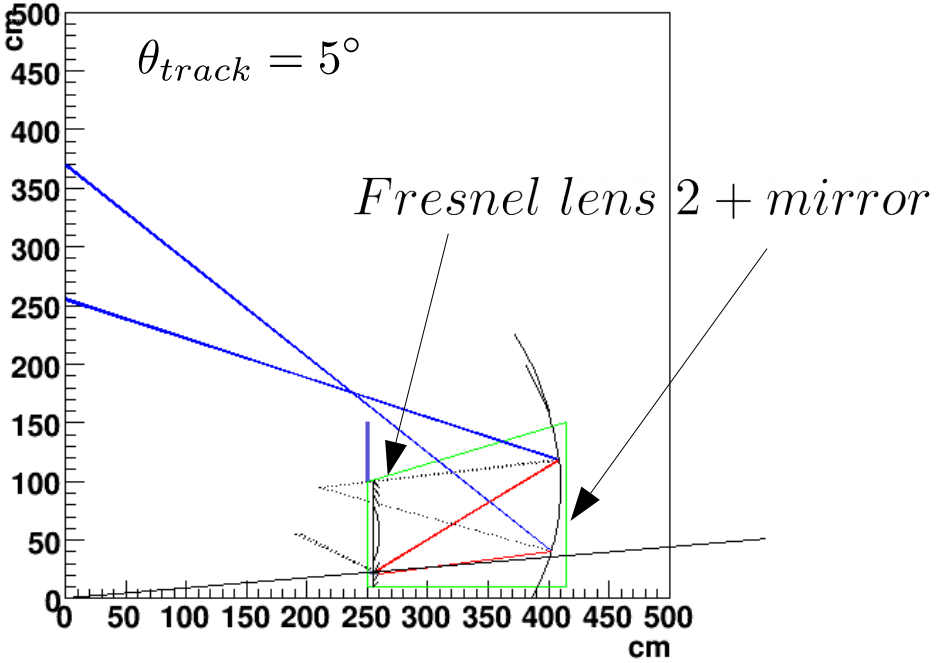
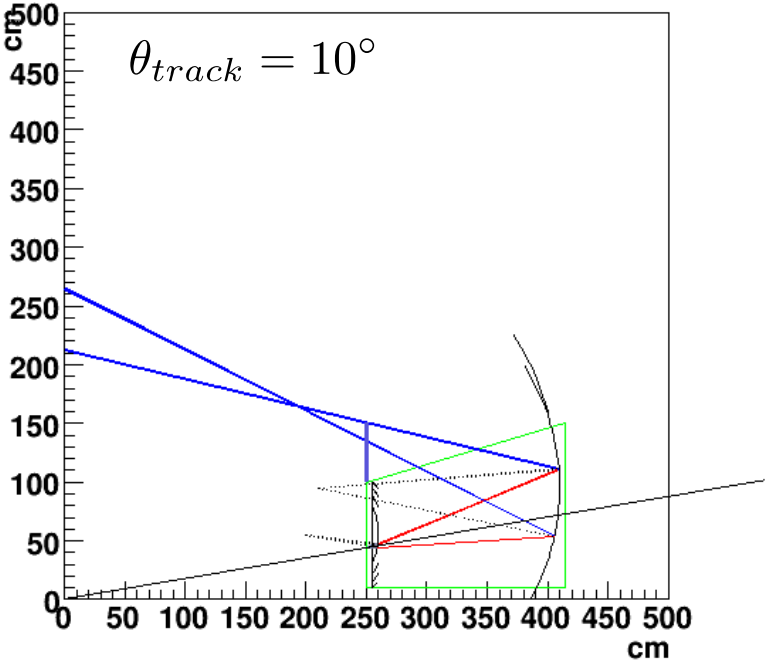
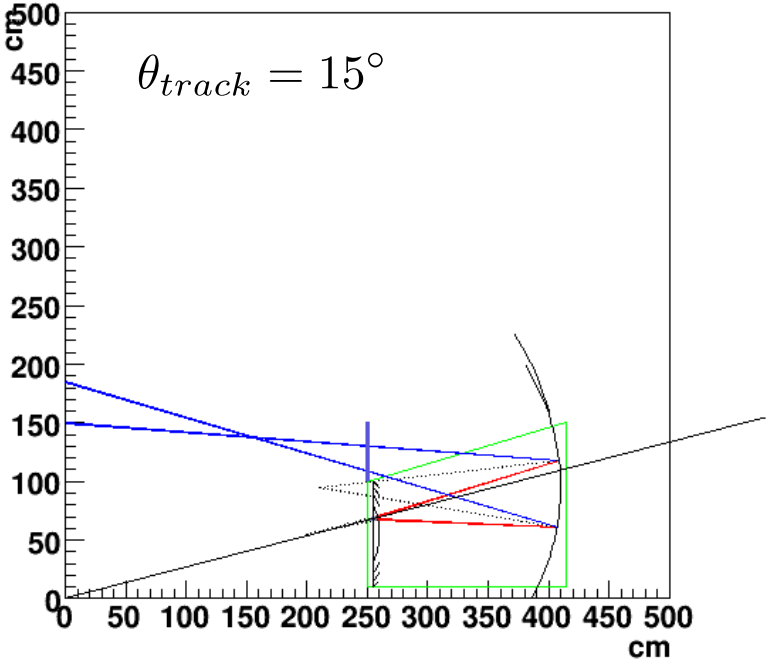
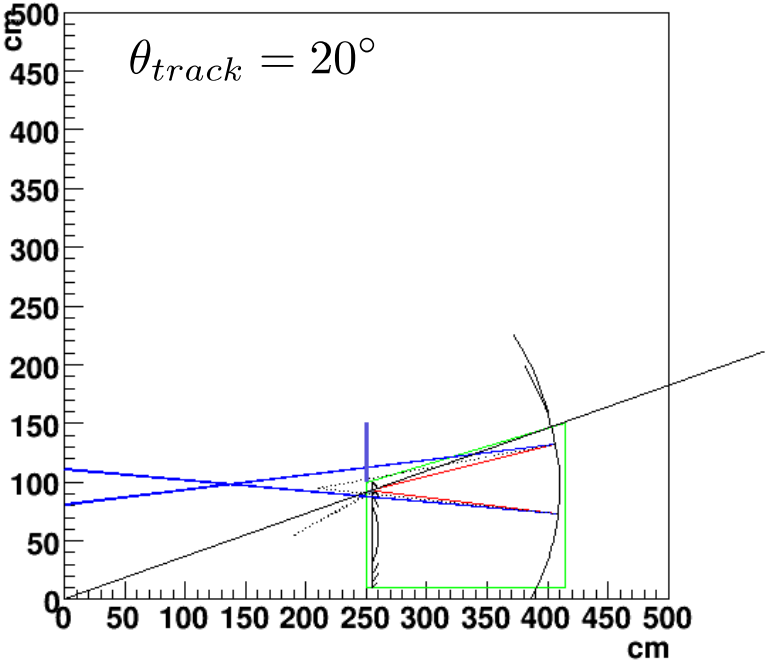
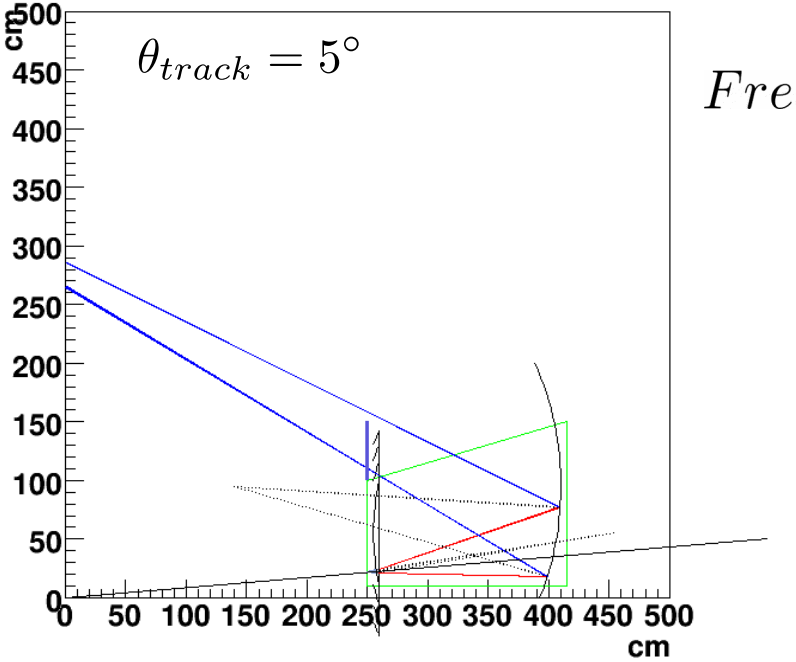




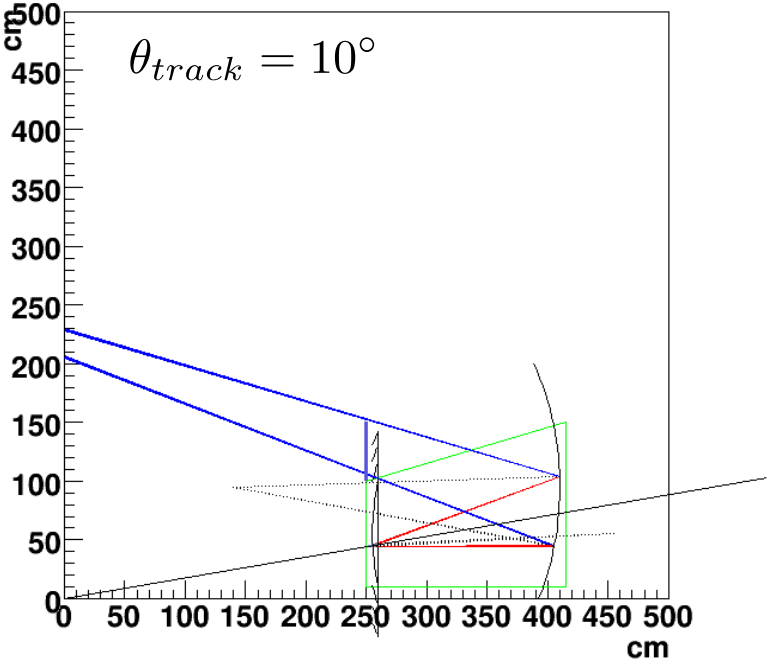


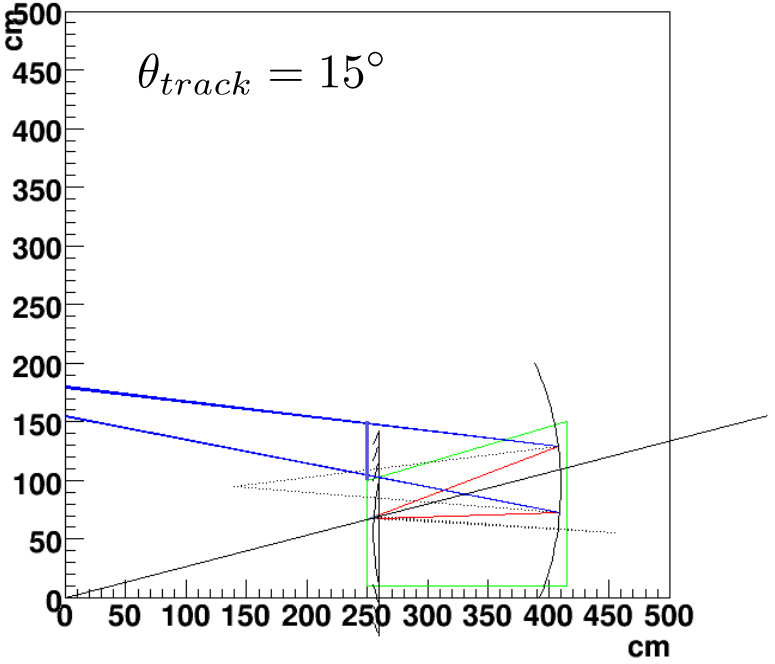


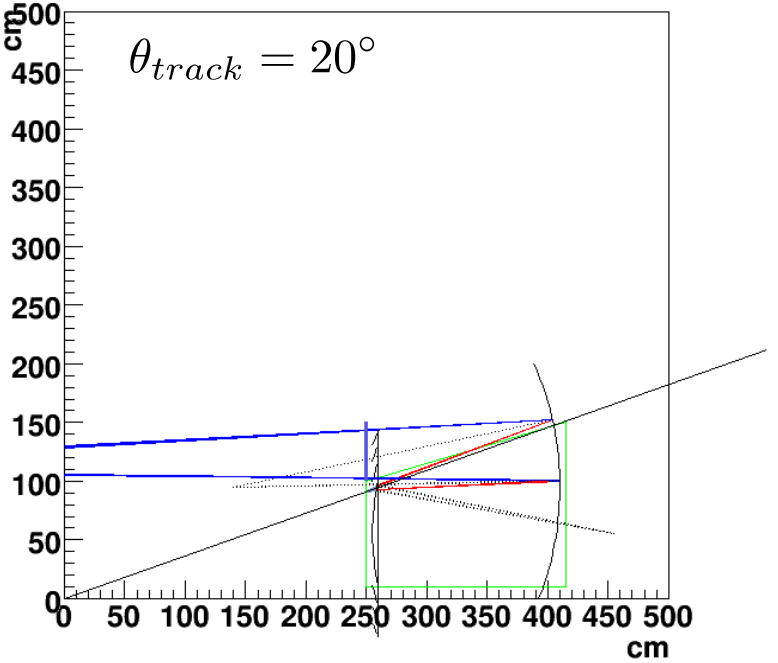
Lens with higher radius --> less curvature, probably a good direction to explore



$Fresnel\ lens\ 1$

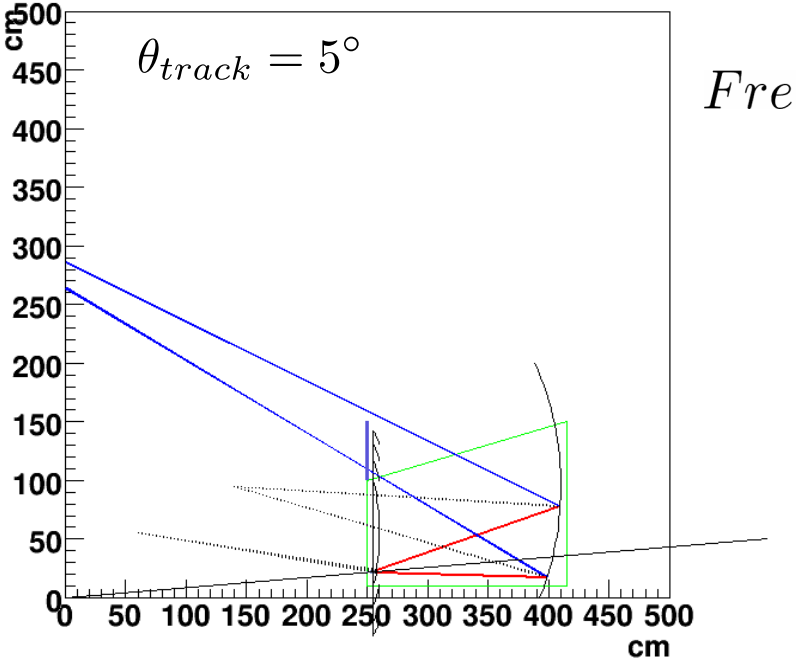




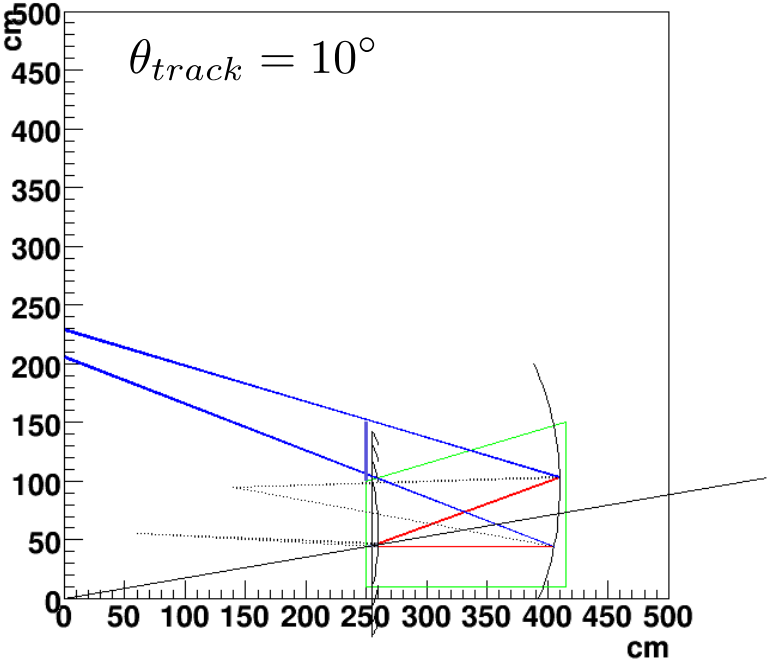


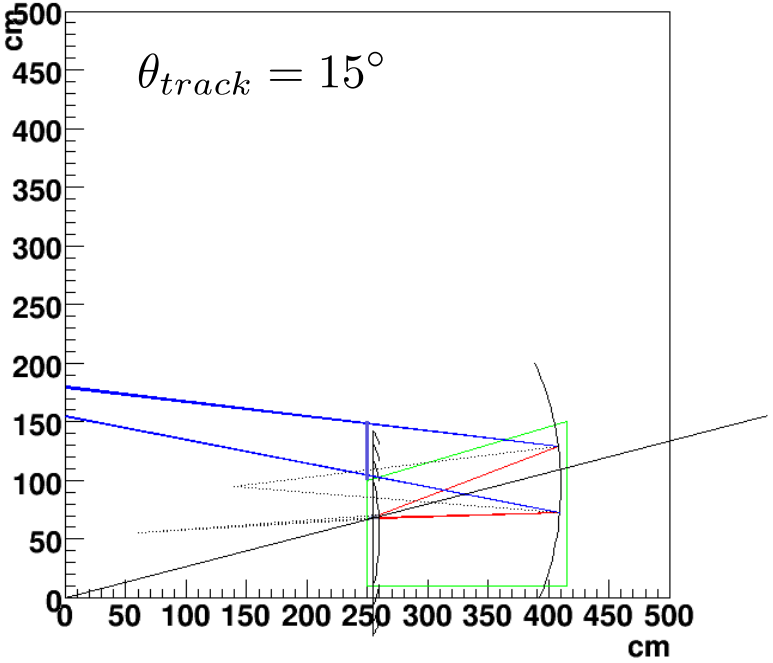
Good photons collection: loss minimized

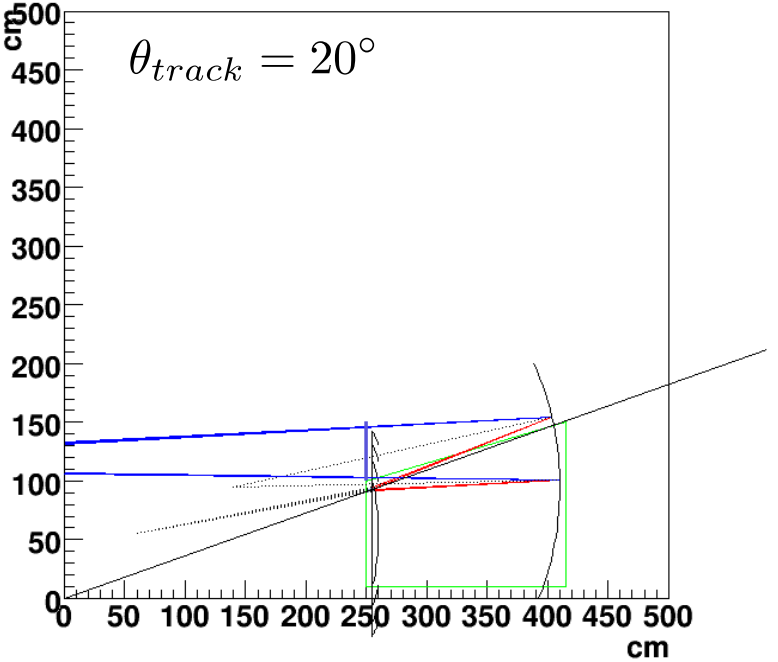
Lens with higher radius --> less curvature, probably a good direction to explore



Fresnel lens 2

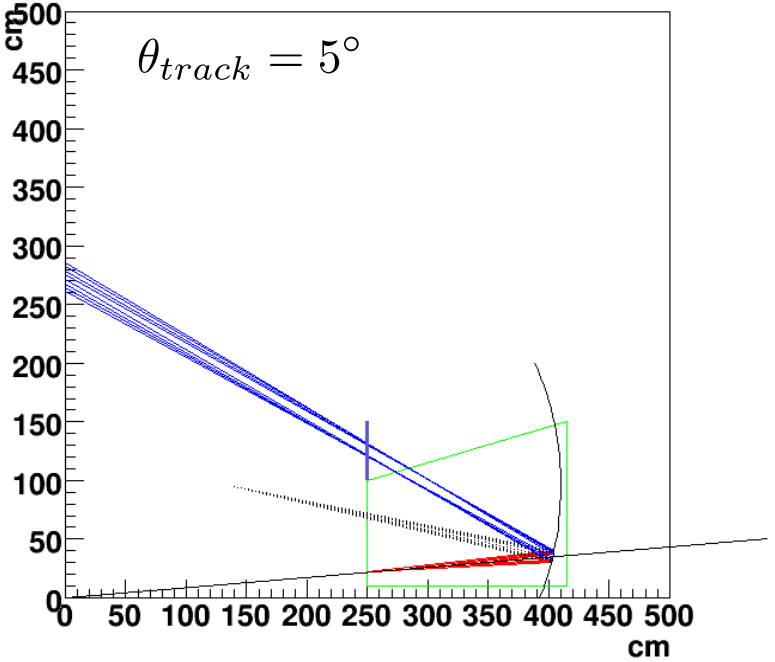


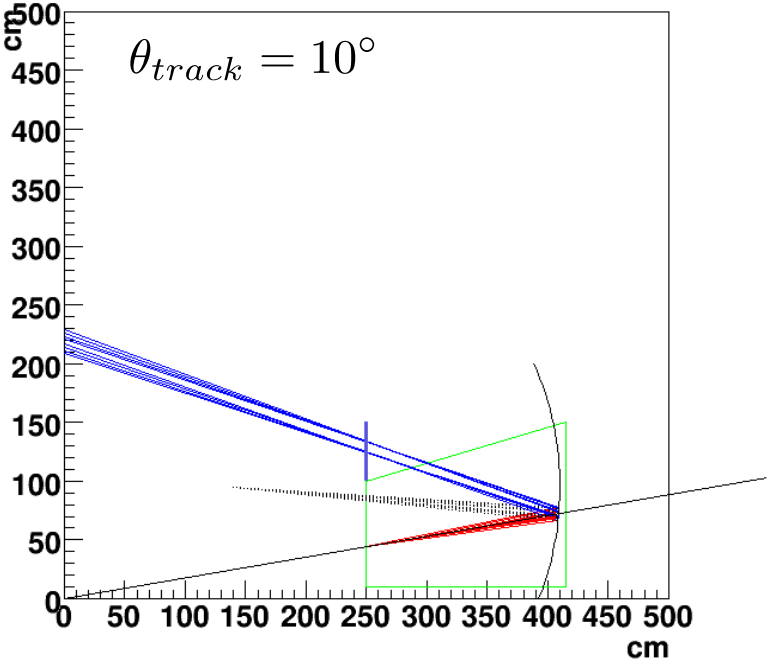


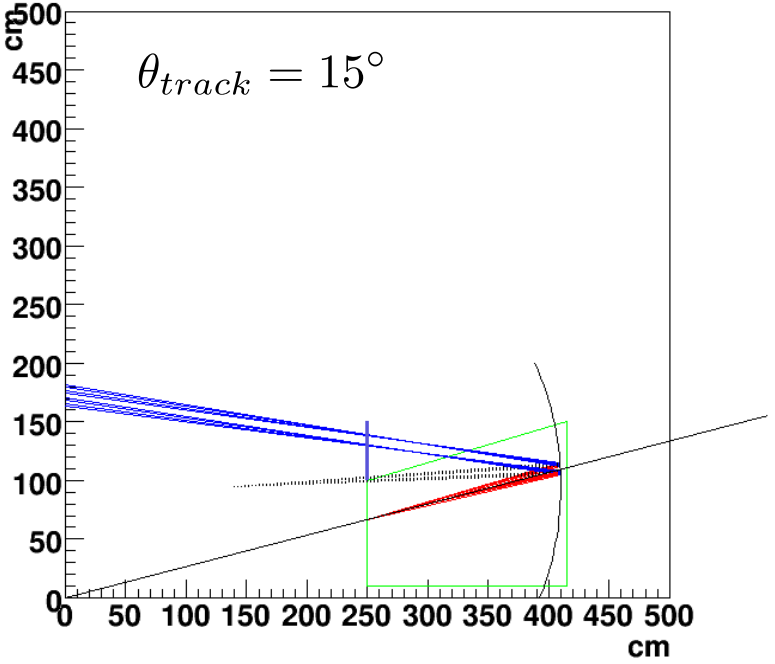


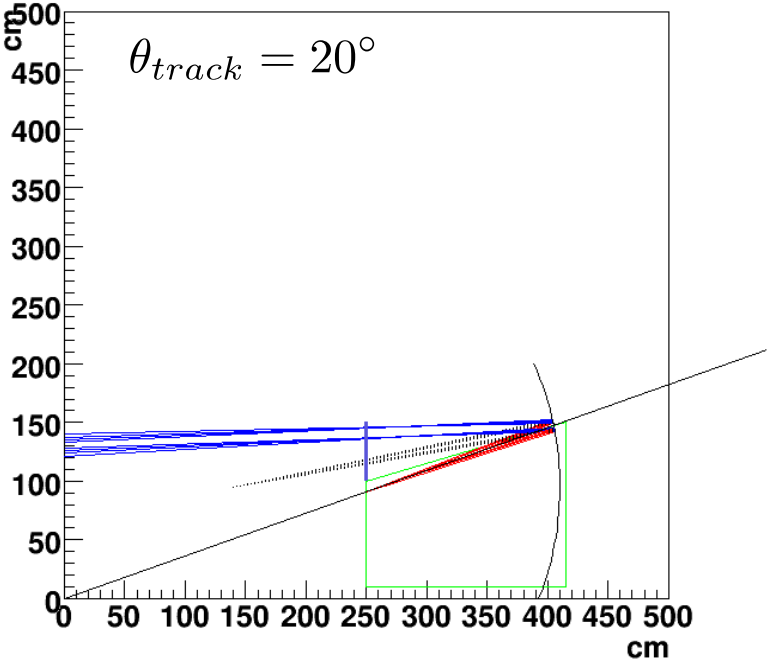
Good photons collection: loss minimized

No problem with the CF_4 gas after the Fresnel Lens









Comments and next developments

- Mirror + mirror configuration: promising solution → at extremal angles part of the Aerogel photons are lost, for the rest the photons can be collected in a detector plane.
- Fresnel lens + mirror configuration: promising solution → the problem with extremal photons is partially solved, almost all the photons can be collected. Additional complexity from the lens.

- Next steps:

  - Try to optimize again the geometry

  - A first estimation of the effective Npe → QE, reflectivity of the mirror, absorption coefficients (radiators, lens)