

Yet another attempt to tune / evaluate ATHENA forward (d)RICH geometry & performance

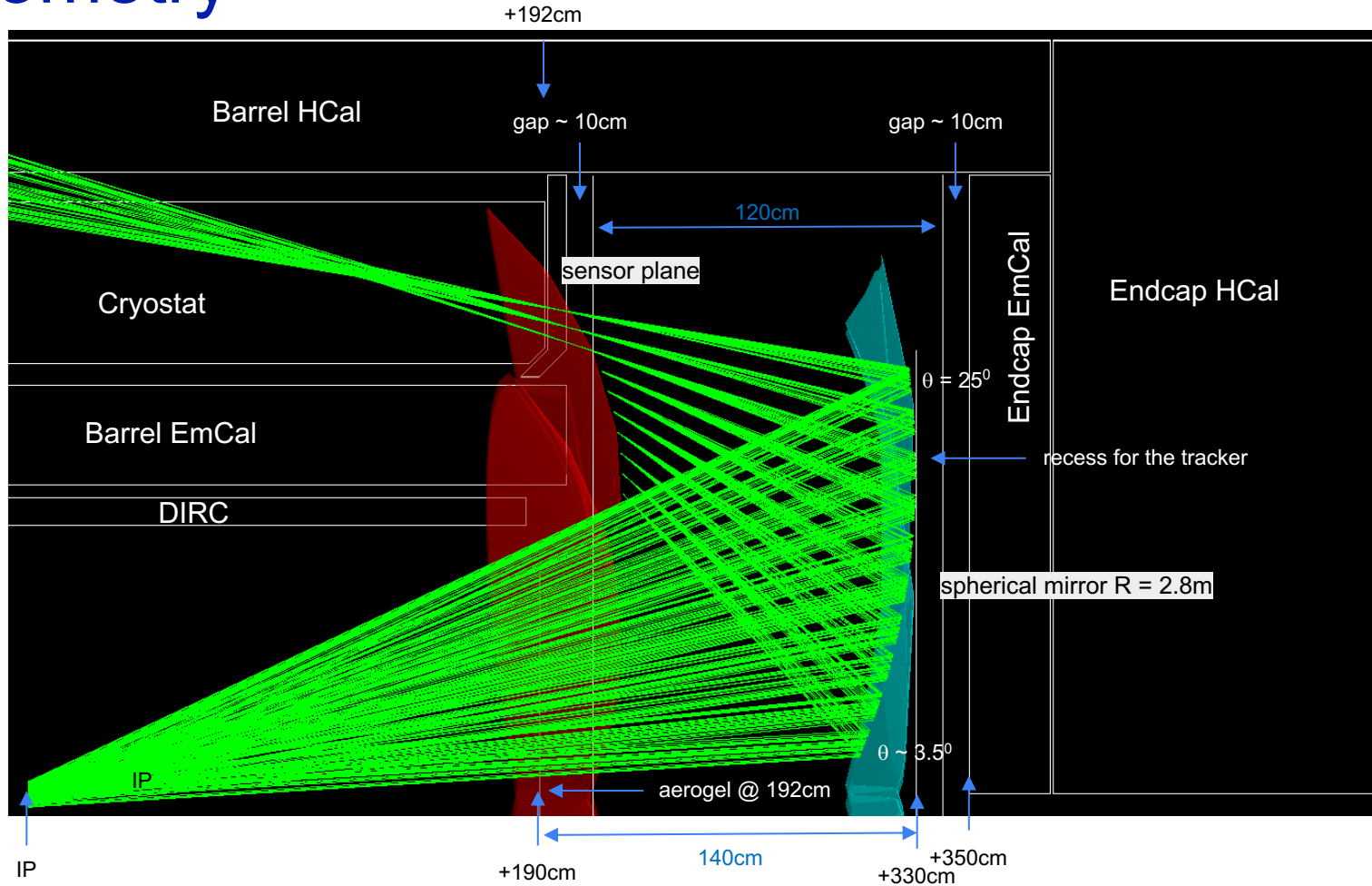
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Machinery

- Standalone GEANT sandbox
 - Mirror properties as implemented by Evaristo (can just use 90% reflectivity)
 - C_2F_6 properties (and later aerogel) from the same source; no attenuation
 - SiPMs (S13361-3050AE-08 8x8 panels)
 - 3.4 mm pitch
 - QE as given by Hamamatsu
 - 87% geometric fill factor
- Custom event dump in ROOT format
- IRT as implemented by Alessio del Dotto (Roberto's code gives the same)
- Application to a multi-mirror system + reflection accounting, etc.

Geometry

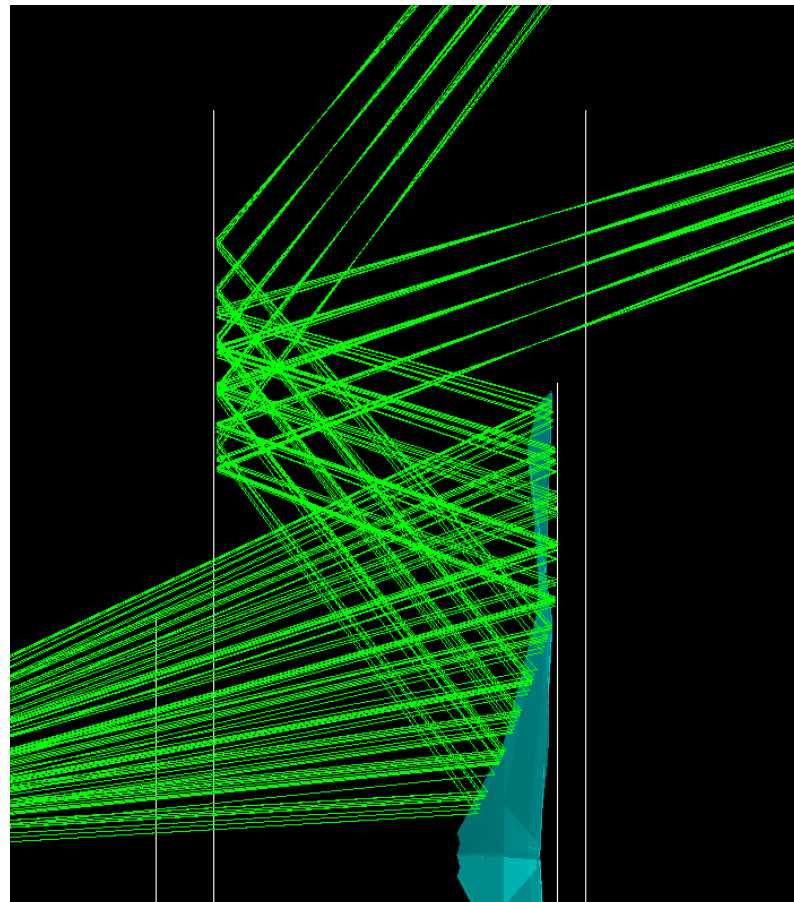


This configuration

- Pretty suboptimal optics, distortions up to a couple of mrad ...
- ... yet it kind of works:
 - At least ~ 120 cm of path in gas, and consequently ~ 30 p.e. per ring
 - $\sim 1.0 - 1.2$ mrad single photon RMS at large η
 - Consequently 4+ sigma π/K separation at ~ 50 GeV/c and $\eta = 4$
- Can comfortably reach $\eta = 4$ for both gas and aerogel
- Field orientation is unfortunate, no chance to use MCP-PMTs
- Field-inflicted distortions: had no time to check them yet

Other optical layouts tried so far

- Second reflection by a flat mirror a la LHCb
 - Kind of works, but has implications [remember, LHCb has $\theta_{\max} \sim 15^\circ$]
- Second reflection by a spherical mirror (to compress the focal area)
- Segmented spherical mirror
- Stereo-focusing between 60-degree sectors
- Cross-focusing through the beam pipe area (sounds weird, but actually almost works)
- Combinations of the above



Our options & questions

- Quantify this geometry (it is what it is) and freeze it
- Request ~20-30cm shortening of the cryostat (now?)
 - ... and grab the sweet spot located presently inside the barrel EmCal
- How much space is needed behind the sensors, actually?
- Can one reduce the θ_{\max} coverage to $\eta \sim 1.6 - 1.7$?
- Can one claim larger radius area (up to $R \sim 260\text{cm}$)?
- To what extent the **size** of the focal zone is important?
- What is the correct value of the attenuation length in C_2F_6 ?