

Update on the ATHENA forward dRICH geometry & reconstruction

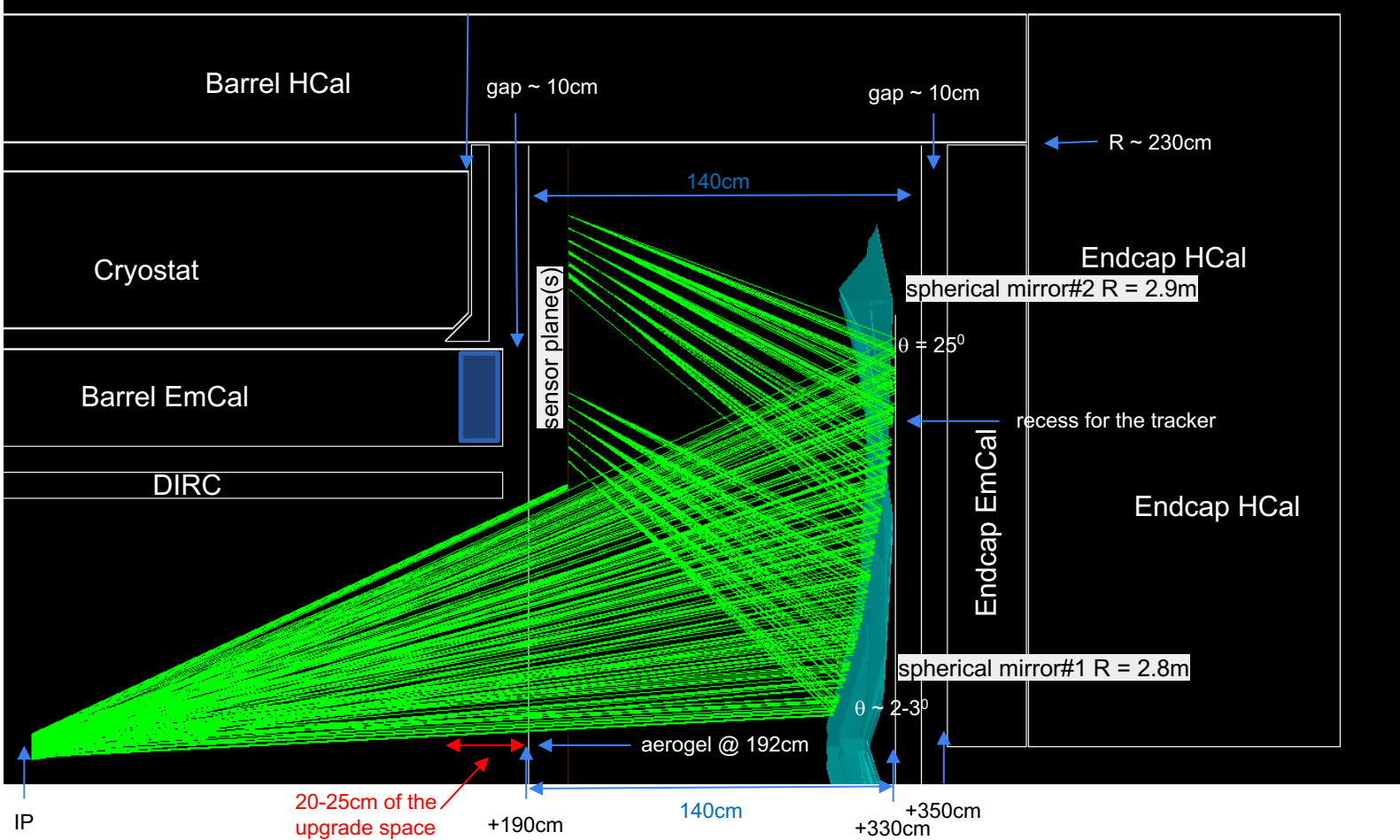
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ATHENA PID WG meeting September 20th, 2021

Machinery

- Standalone GEANT sandbox
 - Mirror properties as implemented by Evaristo (alternatively can use ~90% reflectivity)
 - C_2F_6 properties from the same source; **10m absorbtion length**
 - Aerogel: model#3 (CLAS12 data), 4cm thick @ density 110mg/cm^3 ($n \sim 1.02$ @ 400nm)
 - Acrylic: 5mm thick, “cutoff” set @ 350nm (is it right?)
 - SiPMs (S13361-3050AE-08 8x8 panels)
 - 3.4 mm pitch (not used in digitization for plots on slide 5, by mistake)
 - QE as given by Hamamatsu
 - 87% geometric fill factor
- Custom event dump in ROOT format (full history of every photon)
- IRT as implemented by Alessio del Dotto, with some modifications
- Truth level reconstruction, no magnetic field (yet), no momentum smearing

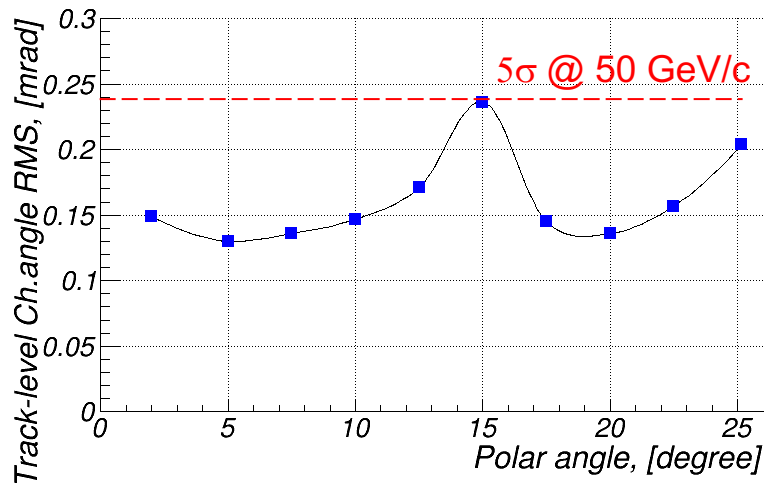
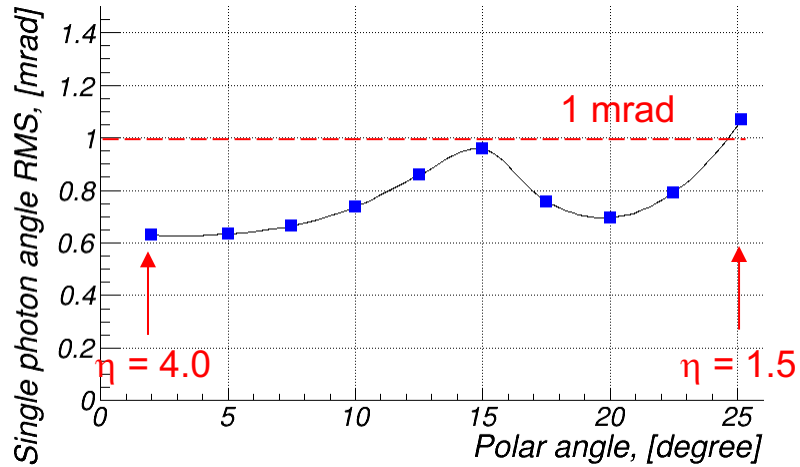
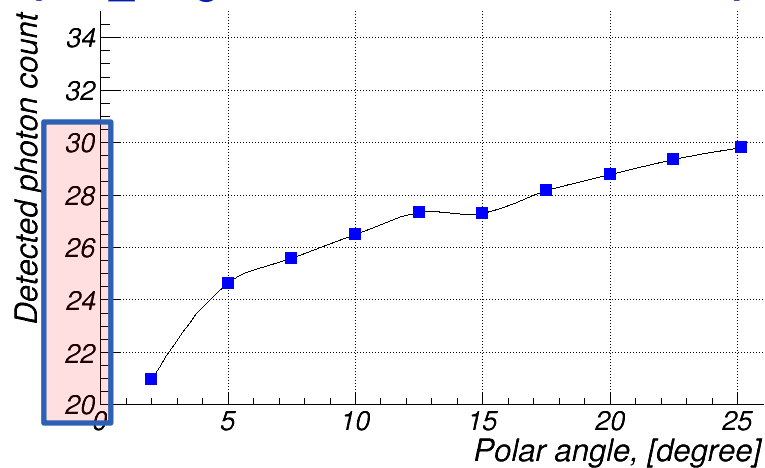
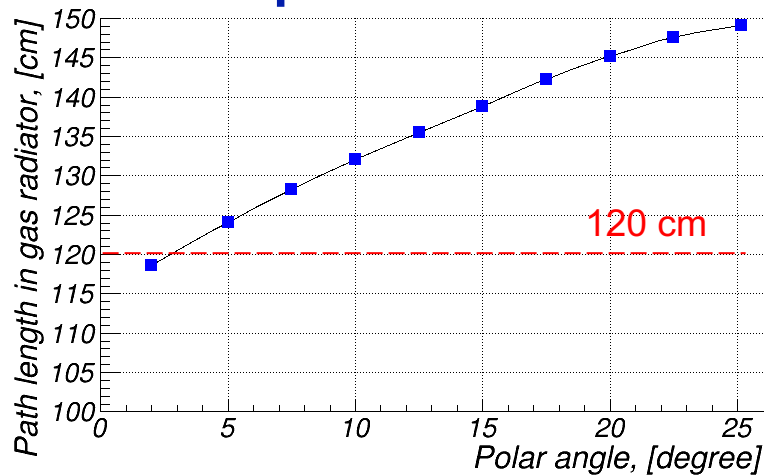
dRICH geometry as of 09-15-2021



Details

- Two spherical mirrors per 60-degree sector
- 15cm gap between the flat vertical sensor plane and the vessel wall
- Angular coverage $\sim [1.5 \dots 4.0]$ in η
- “Upgrade space” of 20-25cm upstream of the vessel
 - dRICH snout, 7-th forward silicon disk, TRD, ToF, ...
- Reasonable optics & performance:
 - Single photon Cherenkov angle RMS ~ 1 mrad or less
 - Path length in the gas radiator ~ 120 cm and more
 - Typically, more than 25 p.e.
 - Track azimuthal angle dependency is rather small

Some performance plots (C_2F_6 , 50 GeV/c π^+)



This week

aerogel and gas rings split across 2x2 mirrors

- Finalize aerogel performance evaluation (requires iterative wrapper for IRT code)
- Verify performance in the magnetic field
- Replace truth information by ring-finder-like one where possible; merge aerogel and gas measurements in a single σ count
- Factorize reconstruction part out and see how it would work on the flat trees, to start with
- Assist Chris with implementing dd4hep geometry
- Look into e-endcap case

