# dRICH Re-scaled in DD4hep

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dRICH Software Meeting

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# Available dRICH Software

🟧 Fun4all Standalone: https://github.com/cisbani/dRICh

- Geometry G4 text file: https://github.com/cisbani/dRICh/tree/main/share/config

    - Updated ECCE Versions: https://github.com/ECCE-EIC/calibrations/tree/main/dRICH/mapping

- Optics and Material Properties Generation: https://github.com/cisbani/dRICh/tree/main/share/source

🟧 ECCE in DD4hep: https://eicweb.phy.anl.gov/EIC/detectors/ecce      **UPDATE**

    - Compact XML file (constants): compact/drich.xml

    - Placement Algorithms: src/DRICH_geo.cpp

- Optical / Material Property Tables: compact/optical_materials.xml

- GDML Files available in CI artifacts

- IRT, documentation, and analysis: https://eicweb.phy.anl.gov/EIC/irt

- Development scripts + more documentation: https://github.com/c-dilks/drich-dev

🟧 GEMC: https://github.com/EIC-eRD11/dualRICH_inMEIC

C. Dilks                                                                                            2

## Rescaled dRICH to ECCE Geometry

Gitlab issue:https://eicweb.phy.anl.gov/EIC/detectors/ecce/-/issues/10
See linked <u>merge requests</u> and associated <u>branches</u>

ATHENA master branch dRICH version was copied to the new ECCE repository main branch

**The above MR does the following:**
- Re-scale and re-position dRICH to match ECCE G4 text file (v5)
  - Match optics
  - Re-parameterize sphere to support optical tuning
- Pull updates from ATHENA unmerged branch 144-irt-geometry:
  - Sensor size and pixel segmentation
  - Change material Silicon → AirOptical (temporary patch, to be updated)
  - Update sensor and mirror surfaces (something here caused a bug…)

# Assumed Envelope and Position

Sebastian's slides:
https://indico.bnl.gov/event/15567/contributions/62935/attachments/40804/68210/dRICH_geometry.pdf

G4 Text file:
https://github.com/ECCE-EIC/calibrations/blob/main/dRICH/mapping/drich-g4model_v5.txt

## Dimensions:
Units are cm, and positions are w.r.t. IP, given for the sector centered on the +x axis

- Occupies z from 180 – 280
- Outer radius = 180
- Snout parameters:
  - Length: 20  (note: testing a shorter option, with length = aerogel thickness)
  - Radii: projective to back-plane corner
  - Aerogel thickness = 4
- Mirror parameters:
  - Center (z,x) = (79.19, 125)
  - Radius = 200
- Sensor sphere parameters (extracted from spherical fit)
  - Center (z,x) = (71.93, 124,98)
  - Radius = 140

# Reparameterize Mirror → Focus Tuning

🔶 Mirror parameters:
- Center $(z,x)$ = (79.19, 125)
- Radius = 200

```
<mirror
    backplane     = "DRICH_window_thickness + 0.71*cm"
    focus_tune_x = "69.78*cm"
    focus_tune_z = "51.45*cm"
/>
```

While we could simply use the (center, radius) parameters, having the re-parameterized (backplane, focus_tunes) allows for the ability to "steer" the focal region:

- Mirror is parameterized such that the focus is aimed at $(z_s + \text{focus\_tune\_z}, x_s + \text{focus\_tune\_x})$

C. Dilks
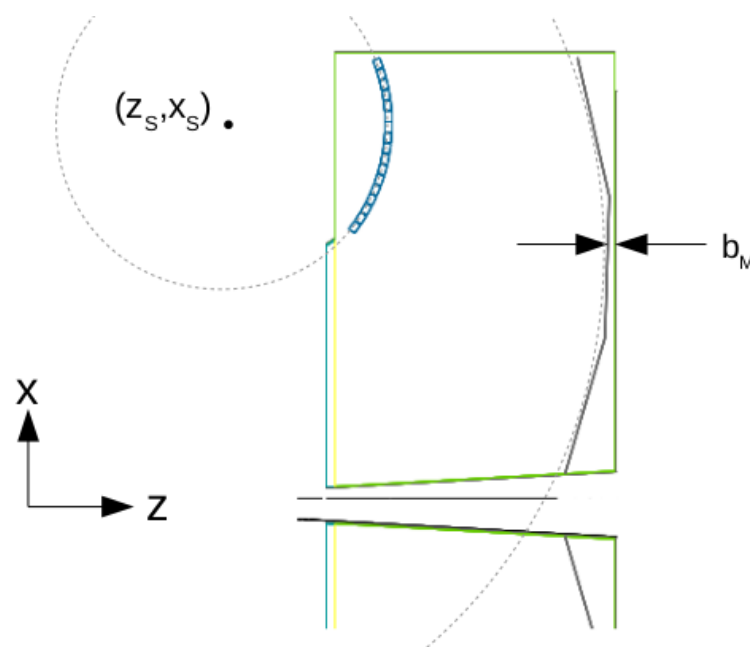
## Parallel-to-point Focal Regions

- 5, wide collimated photon beams
  - Emitted from IP
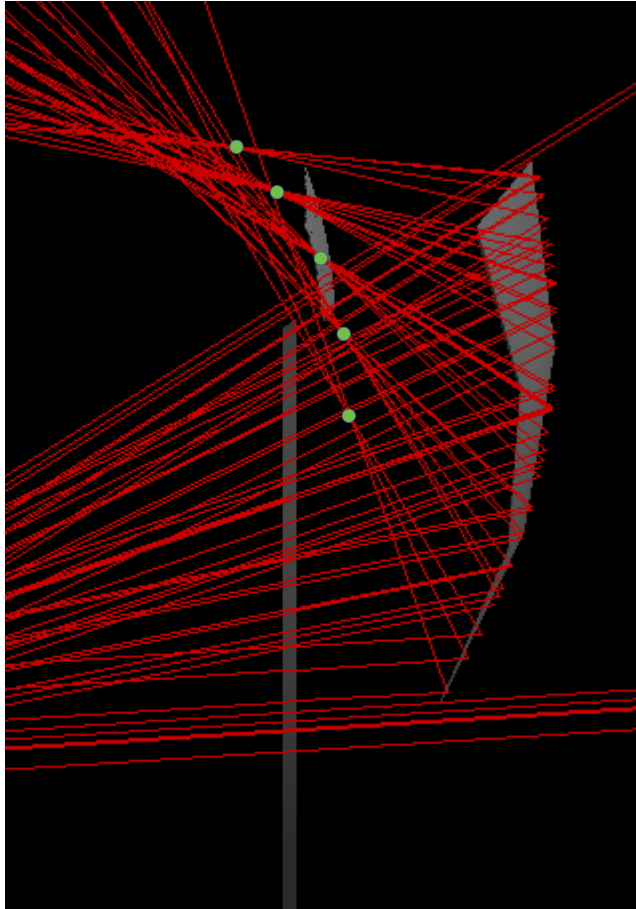  - Within full dRICH polar acceptance, evenly spaced
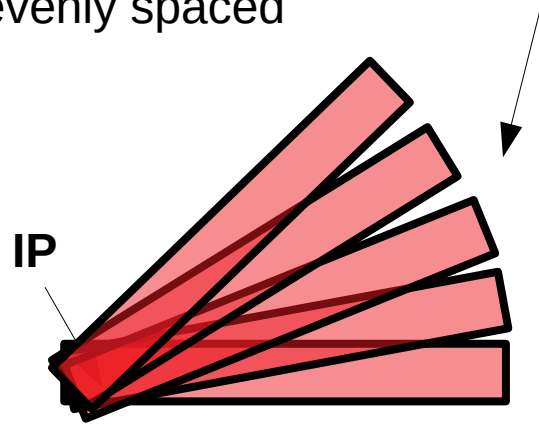


- Parallel-to-point focii indicated by green dots

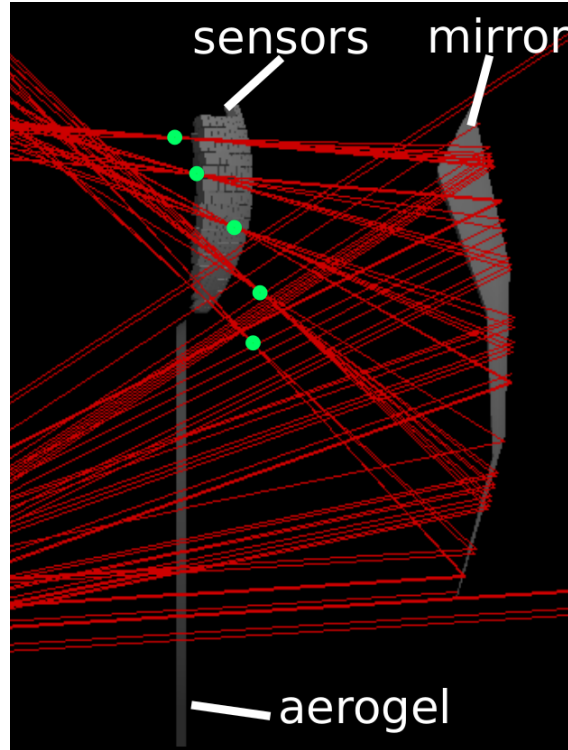- Outermost beams are not hitting the sensors

## New DD4hep ECCE version
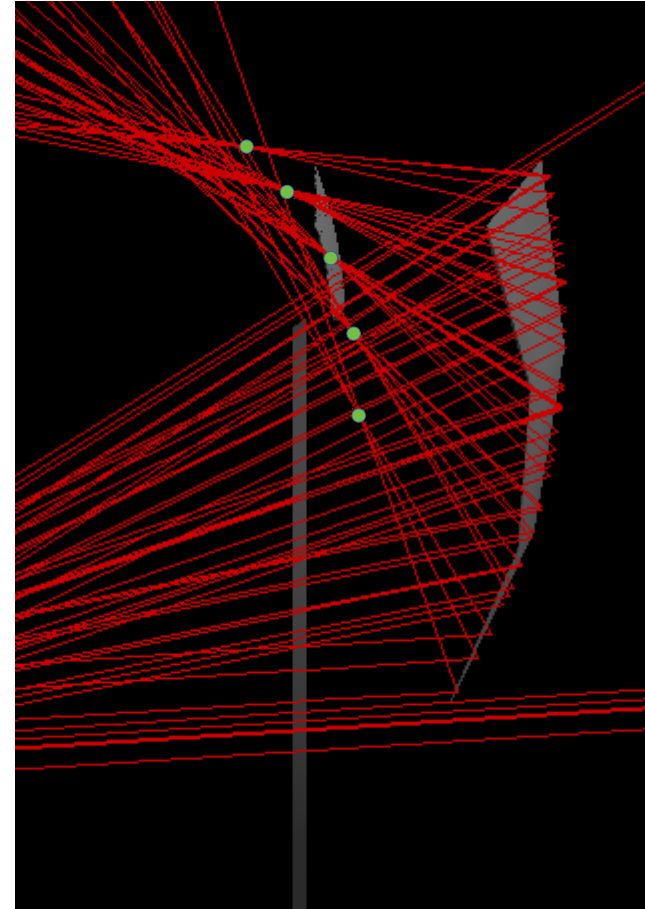
# Parallel-to-point Focal Regions
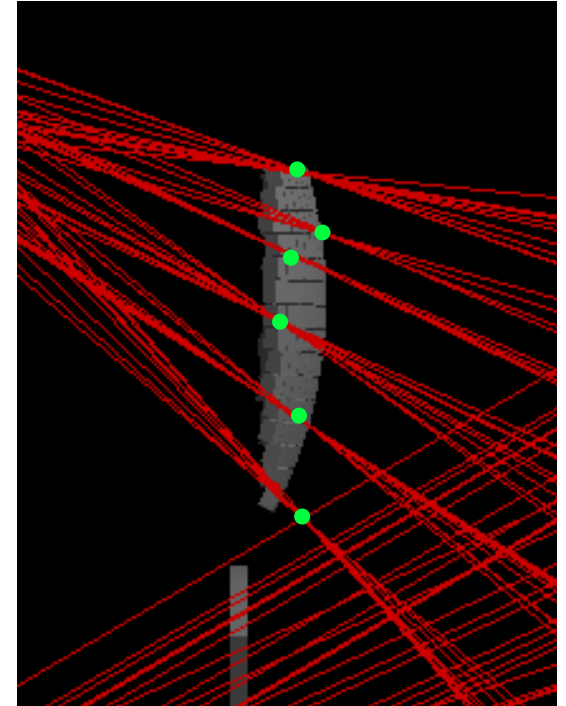
New DD4hep ECCE version

DD4hep ATHENA version

DD4hep ATHENA dual mirror test configuration
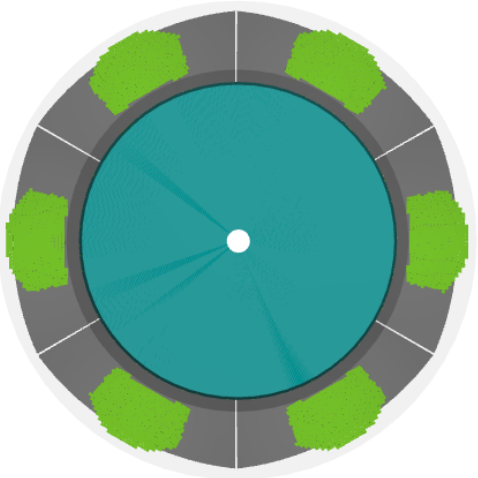
sensors    mirror

aerogel

tuned for maximum polar acceptance

*still plenty of room for improvement!!*

**Sensors tiled on a sphere may not be ideal...**

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# Pictures of Cherenkov Rings and Geometry

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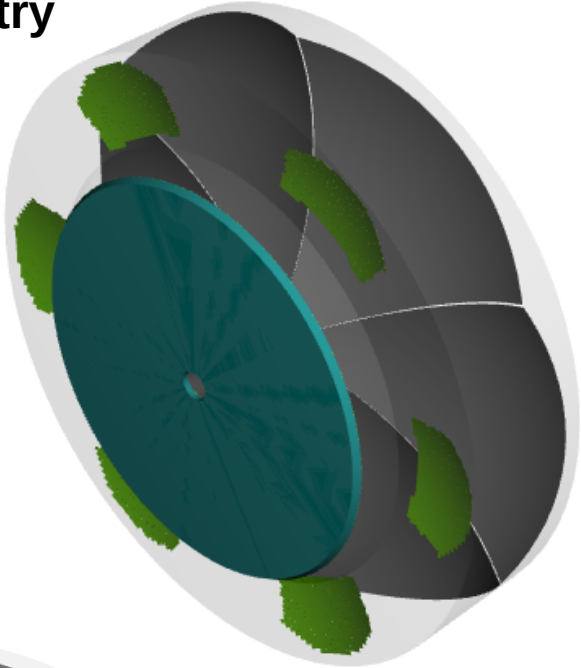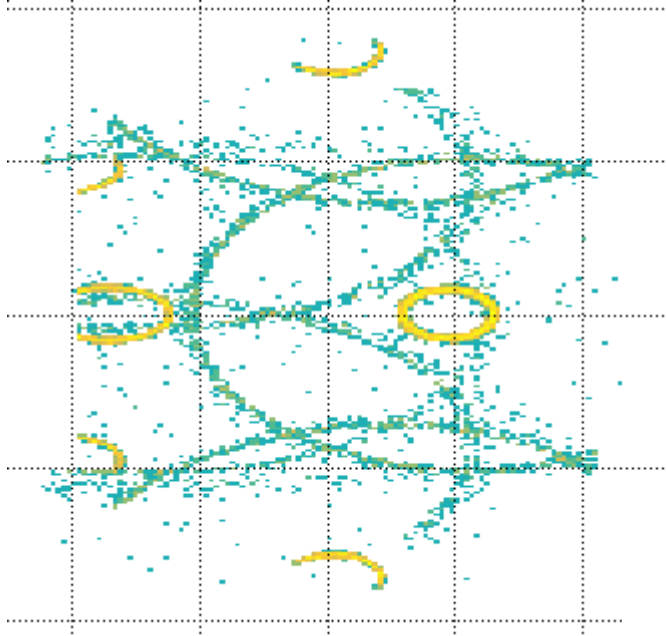
## Next Steps

- Export new GDML → import in Fun4all

- Review the MR ourselves, then request merging

- Need help with:

  - Synchronizing property tables with Fun4all

  - Optical tuning

  - …