d/pfRICH in EICrecon Update

Brian Page – for d/pfRICH Teams

Reconstruction WG Meeting

March 10, 2025

d/pfRICH Near-Term Plans Recap

See Reco Meeting:
https://indico.bnl.gov/event/25540/

- ❑ Update pfRICH geometry in ePIC with necessary optical properties - Alexander
  - ➢ Continued maintenance of geometry handled by Bill Lee and Gabor (BNL)

- ❑ Validate existing IRT algorithm using pfRICH
  - ➢ Done after pfRICH geometry is updated
  - ➢ Ensure proper pfRICH information is being propagated to EICrecon
  - ➢ Can compare single particle results from EICrecon directly against the well understood standalone pfRICH model

- ❑ Implement and test IRT2 algorithm
  - ➢ Validate using both dRICH (simple reflection geometry) and pfRICH (complex reflection geometry)

- ❑ Catalogue needed changes to data model
  - ➢ While doing above, keep track of needed changes to the data model
  - ➢ Coordinate with S&C throughout this process

- ❑ Interface with S&C and Reconstruction groups on event reconstruction
  - ➢ Longer term goal
  - ➢ How do we integrate PID into holistic event reconstruction
  - ➢ Need POC from dRICH/pfRICH to interface with Reconstruction group – Brian will serve

- ➢ Other activities
  - ➢ GPU acceleration for optical photon tracing (Gabor)
  - ➢ Modeling of thin anti-reflective coating for sensor windows

Current Status – Focus on Simple QRICH Setup

- Generic adjustments / hacks for doing custom development are made
  - Let CMakeLists.txt files deal with locally installed include files and libraries
  - Let the codes compile against IRT 2.0 libraries (means that dRICH has to be disabled)
- IRT-2.0 branches created in EDM4eic, IRT, epic, EICrecon
  - Somehow cannot do this for reconstruction_benchmarks (Argonne GitLab server)
- All the essential ingredients on the machinery side are in principle available
  - A simplistic XML file and respective QRICH_geo.cpp in epic repository available
  - Npsim pass; simulated hit maps
  - Optical ROOT file export in QRICH_geo.cpp and import in EICrecon
  - Simulated hits and ACTS track parameterization import in EICrecon
  - Propagation of a dummy EDM4eic table from EICrecon to a benchmark code

Next Steps

- ❑ Emulate IRT 2.0 reconstruction factory input (tracks, photons, calibrations)
  - ➢ Step by step, using existing dRICH EICrecon codes as a further guidance
- ❑ Extract missing parts of the required machinery from dRICH codes
  - ➢ Simulated vs reconstructed track relations, sensitive volume cell indices, etc
- ❑ Port missing part of the standalone QRICH setup
  - ➢ Photosensor QE and aerogel property parameterizations in particular
- ❑ Have single track PID evaluation working
- ❑ Have multiple tracks PID evaluation working
- ❑ Populate some simplistic version of event-level data model
- ❑ Add pfRICH geometry complexity (mirrors, HRPPDs, multiple opt. paths)

Time-Line and Workforce

- Bullet points above deliberately left without completion dates
  - Current tasks being driven by Alexander – working as other responsibilities permit
  - Time-line should come into better focus this week

- Several relevant dates drive need to produce deliverables / milestones
  - Incremental Design and Safety Review – April 1 & 2
  - Detector Advisory Committee Review – June 11 – 13
  - Pre-TDR Completion – July

- As initial work concludes on above tasks, begin to engage wider workforce to carry on
  - Interested parties identified at BNL, Trieste, Yale, MSU

- Will restart regular pfRICH (also including dRICH) software meetings – tentatively planned for Thursdays at 8:30 am BNL time