

ePIC pfRICH preparations to the March 2023 review

Alexander Kiselev

ePIC GD/I meeting, January 30, 2023

Overview

- Current status presented at the Collaboration meeting three weeks ago: [link](#)
- Work plan discussed at the group meeting last Wednesday: [link](#)
 - (Re)assessed the status of various activities
 - Confirmed commitments for the coming five weeks
 - Requested draft planning from all active contributors (milestones, deadlines, up to the text incorporation into the Overleaf proposal document)
 - Internal deadline: March 5th

A Proximity-Focusing RICH for the ePIC Experiment
– Proposal –

(DRAFT)

Deb Sankar Bhattacharya⁵, Chandradoy Chatterjee⁵, Abhay Deshpande¹, Christopher Dilks^{2,3}, James Dunlop⁴, Alex Eslinger³, Tom Hemmick¹, Alexander Jentsch⁴, Alexander Kiselev⁴, Henry Klest¹, Samo Korpar⁶, Peter Križan⁶, Brian Page⁴, Rok Pestotnik⁶, Silvia Dalla Torre⁵, Zhoudunming Tu⁴, Thomas Ullrich⁴, Jan Vanek⁴, Anselm Vossen^{2,3}, Craig Woody⁴, and Zhengqiao Zhang⁴

³Jefferson Lab, Newport News, Virginia 23606, USA

¹Stony Brook University, Stony Brook, New York 11794, USA

⁴Brookhaven National Laboratory, Upton, New York 11973, USA

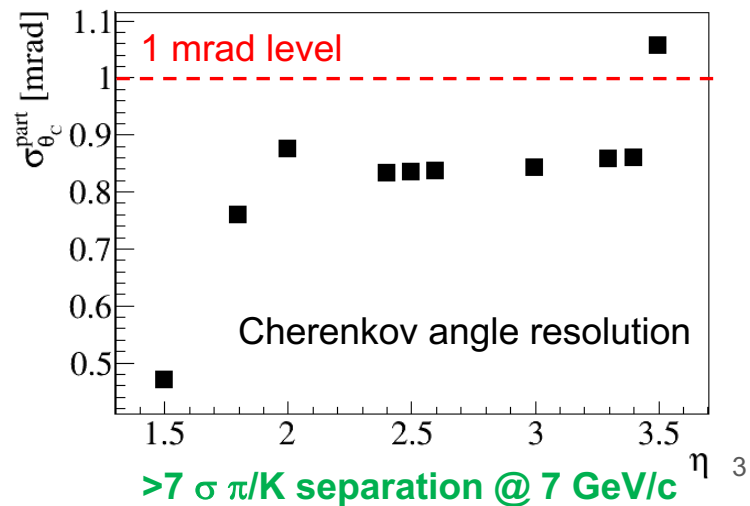
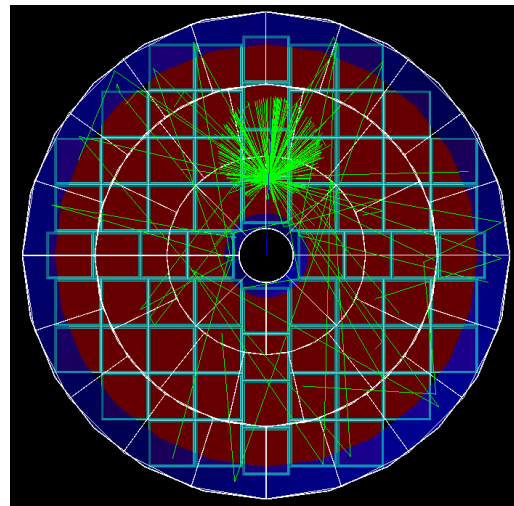
⁵INFN, Sezione di Trieste, Trieste, Italy

²Duke University, Durham, North Carolina 27708, USA

⁶Ljubljana University and J. Stefan Institute, Ljubljana, Slovenia

Detector-level modeling

- Pretty detailed standalone GEANT simulation exists already:
 - Segmented aerogel with Belle II parameterization
 - Detailed HRPPD description (window, photocathode layer, QE)
 - Complete description of the (partly optional) mirror system
 - IRT-based reconstruction: matches the mirror system complexity
- TODO list:
 - Incorporate magnetic field & timing information
 - Consider multi-particle configurations
 - Consider ring finding in presence of random noise
 - Consider photon-level modeling of the ToF performance
- Debugging & final optimization

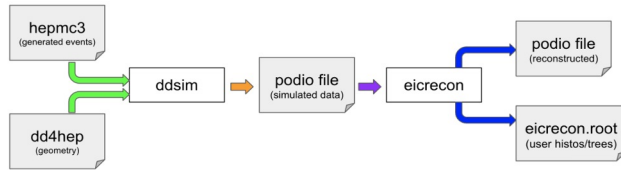


Physics modeling

Mixed EICRecon / Delphes-like environment

- First create Delphes-like PID smearing matrices using standalone GEANT4 detector-level modeling

- Then use EPIC official software stack

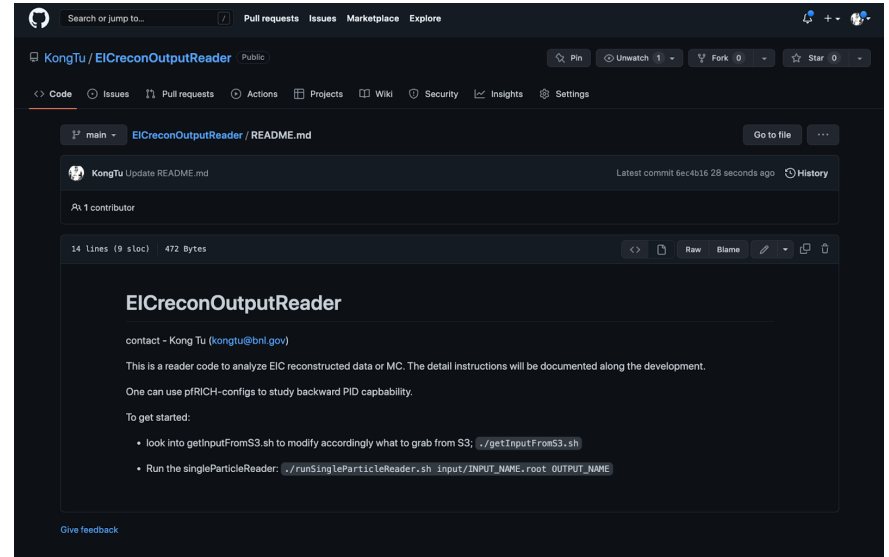


- With “eicrecon.root” & access to full reco'd tracks, apply pFRICH *delphes-like* parametrization for PID.

- We can make use of the official simulation campaign files (single particle, DIS, SIDIS, etc.)

- **TODO list:**

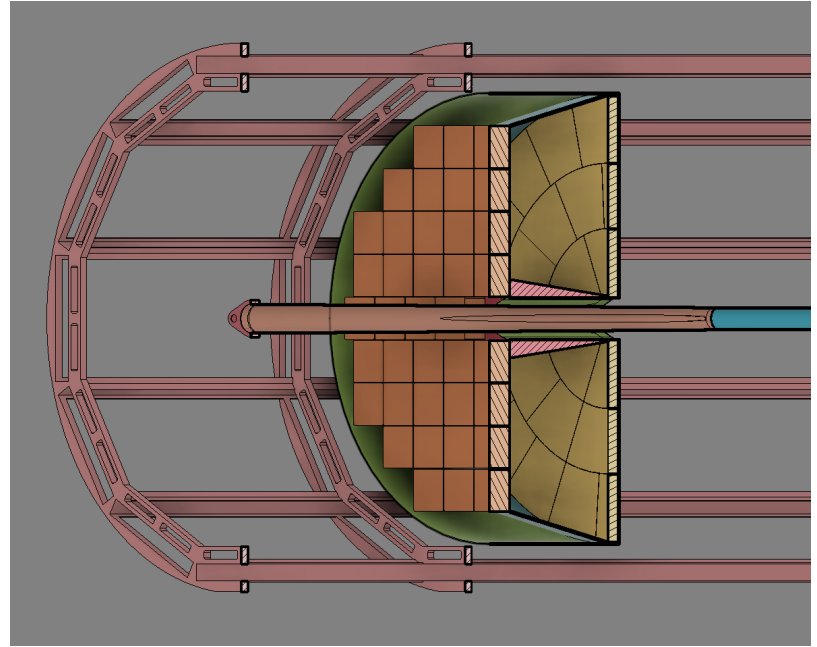
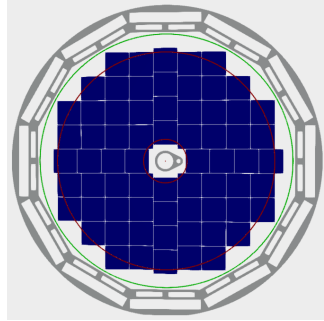
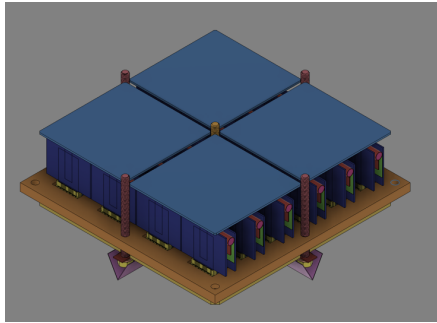
- Finalize e/π separation studies at low momenta
- See what can be done in terms of timing
- Pick up SIDIS channel(s) for pFRICH performance evaluation



<https://github.com/KongTu/EICreconOutputReader>

Integration model

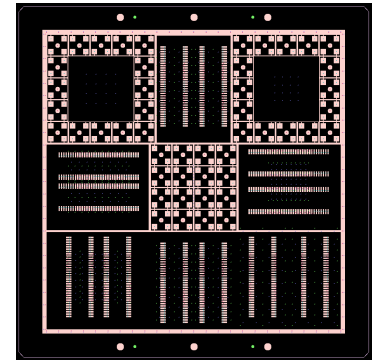
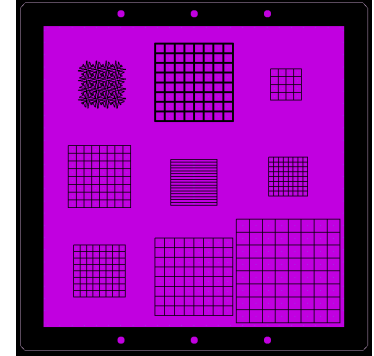
- Developed to quite some detail already:
 - Vessel, aerogel, mirrors, sensor plane



- TODO list:
 - Cooling system & services
 - Beam line area optimization (material)
 - Installation model / sequence
 - Interference with tracking and e/m calorimetry

Aerogel, photosensors, FEE

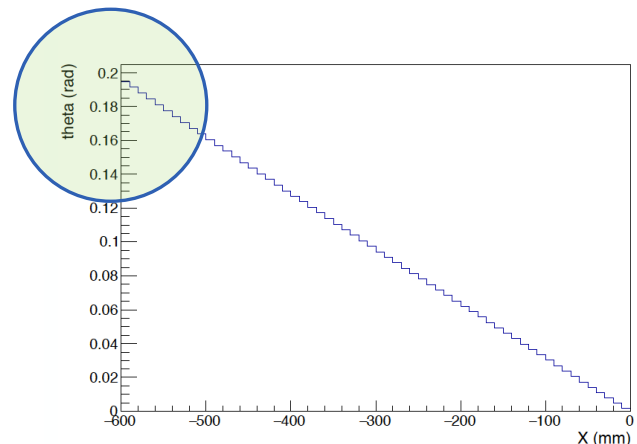
- Aerogel
 - Participate in the specs development & placing the order to Chiba
- Photosensors
 - Work in a close contact with Incom and other manufacturers (Techtra)
 - Facilitate setting up a contract between EIC and Incom (remaining R&D / PED, HRPPD adjustments for EIC, test samples order, etc)
- FE electronics
 - Setting up a meeting with eRD109, detector groups, ASIC developers and MCP-PMT / electronics experts to narrow down the “ASIC search list”



The outcome of these activities is equally applicable to pfRICH & mRICH

Test beam and lab test planning

- Have fully functional HRPPD / LAPPD test bench setups at BNL & INFN Trieste
 - In particular: HRPPD#6 will be sent to BNL for evaluation in March-April 2023
- Will assist in the LAPPD / HRPPD magnetic field tolerance measurements at Argonne in February 2023
 - Provide field strength / orientation of interest for pf(m)RICH
- May 2023 beam test at Fermilab is booked
 - Measurement program will depend on the progress on our side and Incom side in the coming few months
- Spring 2024 beam test at Fermilab
 - pfRICH prototype with Chiba aerogel & a 2x2 HRPPD sensor matrix: ring imaging and timing in one setup



pfRICH: field-to-sensor-normal angle

Other topics

- Need EIC project support to develop a cooling scheme
 - Strongly depends on the FEE solution
- Same is true for the electrical infrastructure in the hall