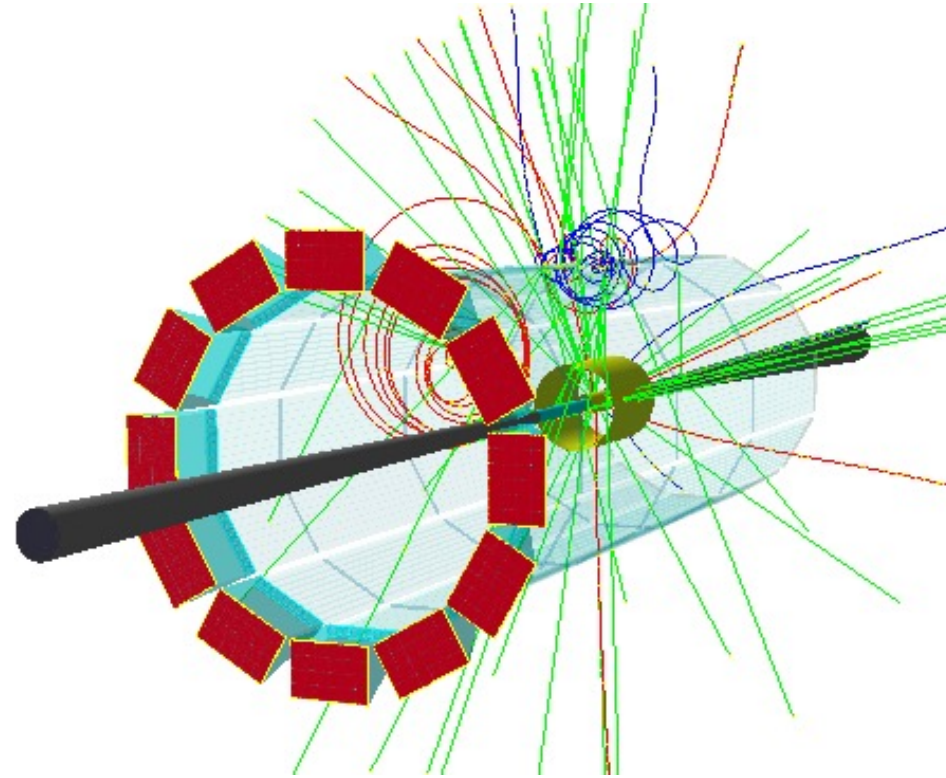


ePIC hpDIRC DSC Status



Greg Kalicy



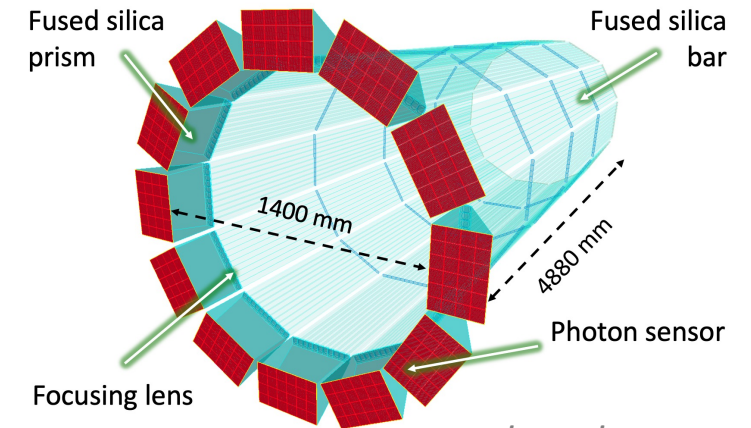
- DSC formed, DSL elected
- Moving forward
- Current R&D priorities

Bi-weekly meetings on Fridays at 8:30am

Slides and recordings available: <https://indico.bnl.gov/category/483/>

What is happening:

- Reviewing and adjusting path to **TDR readiness**, finalizing design
- Preparing for construction and installation
- 10 institutions represented at **hpDIRC DSL kick-off meeting**
- Preparing **work packages**, reviewing institutional interest
- Improving **communication** with other DSC/working groups
- Getting ready for **project PID review** in July
- DIRC@EIC **annual meeting** (hybrid) at JLab May 31st – June 4th
- Started work on mechanical design and integration with E&D engineer Avishay Mizrahi, MIT
- Moving forward with remaining R&D work, addressing technical risks



work package examples

Project Management

- Coordination hpDIRC efforts (DSL, deputy)
- ePIC liaisons (tracking, readout, software)
- TDR lead

Hardware

- Components R&D, purchase/production, and QA (optics, sensors, electronics)
- Mechanical Systems (design of housing and support structure; assuring integration, developing procedure for installation)
- Assembly of hpDIRC sections, installation, commissioning

Software

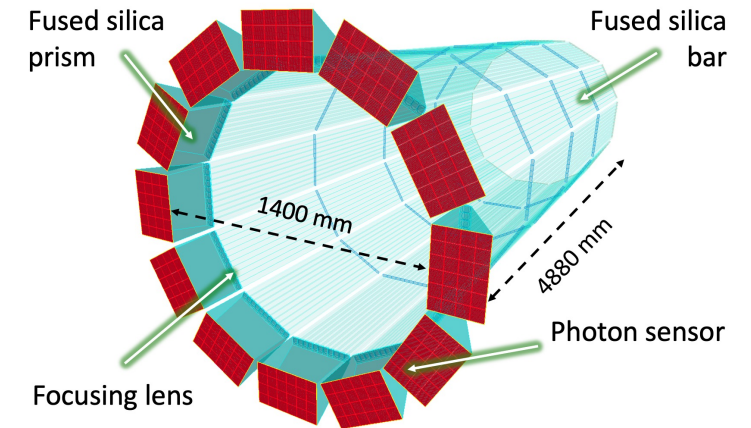
- Offline: simulations (DD4HEP, F4A, Standalone), reconstruction
- Online: FEE/DAQ, calibration, monitoring/slow control

Bi-weekly meetings on Fridays at 8:30am

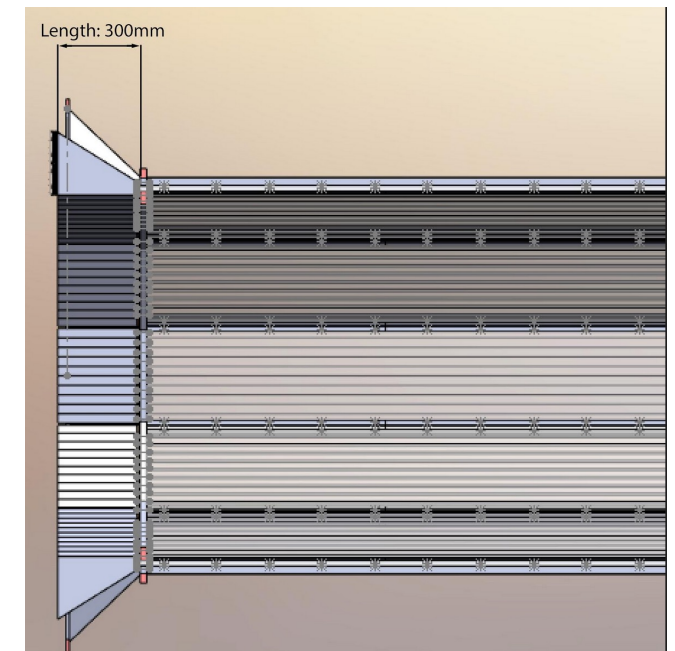
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Avishay Mizrahi



BaBar DIRC bar reuse

Potential reuse of BaBar DIRC bars for ePIC: highest priority hpDIRC R&D project

- Preparing BaBar bar box **transport** from SLAC to JLab (summer 2023)
- Developing plan for **disassembly** of the bars (fall 2023)
- **DIRC laser setup** at JLab close to ready: validate mechanical and optical bar quality

Strong support from Jlab management and DSG

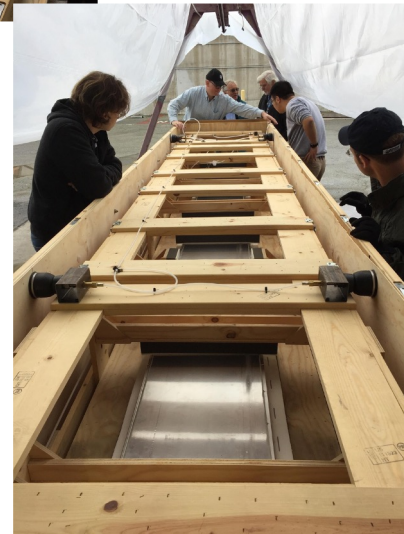
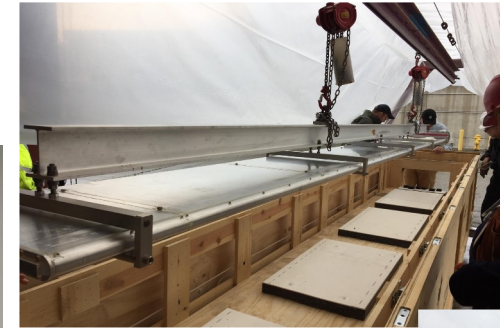
DIRC barboxes in SLAC



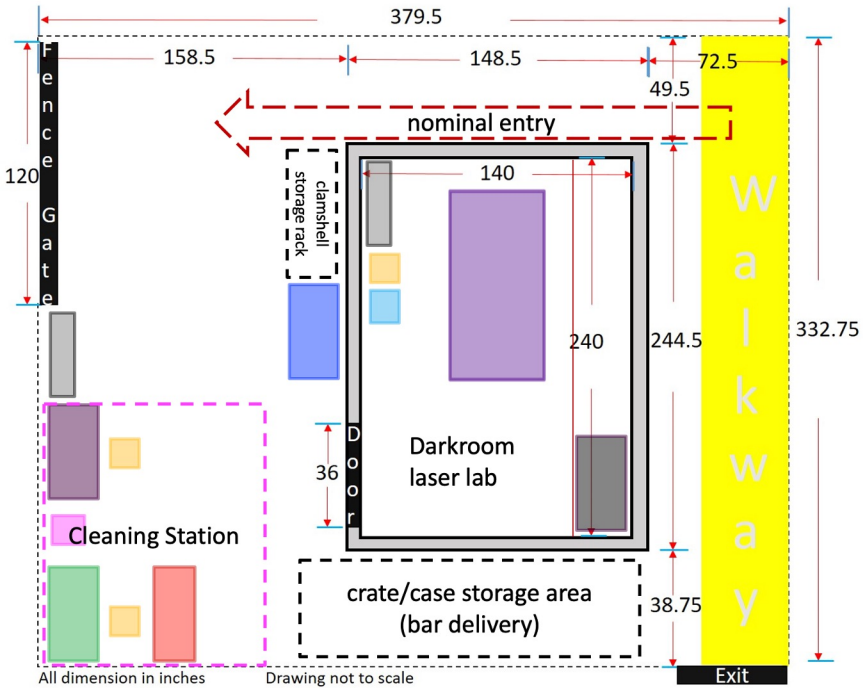
BaBar DIRC bars



BaBar DIRC bars transport for GlueX



QA Lab In JLab



HPDIRC PROTOTYPE IN CRT

Cosmic Ray Telescope (CRT) is under construction at SBU

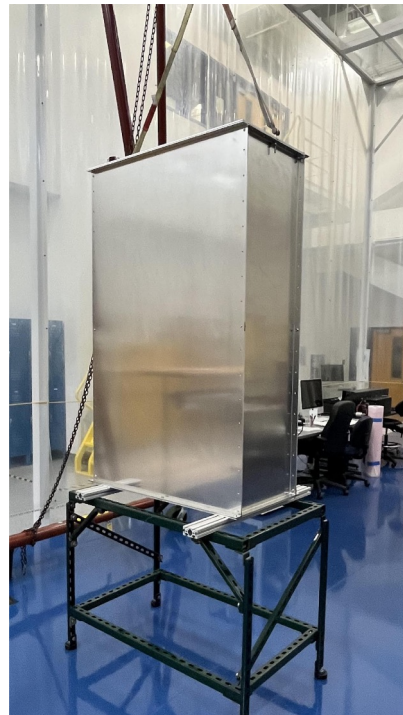
Facility to test incremental upgrades of prototype components, performance evaluation

- PANDA Barrel **DIRC prototype components** arrived in April, ready to be installed
- Advanced **design of mechanical support** (rotation and translation of prototype)
- **Simulation studies**: 3D tracking, optimum placement of tracking and timing detectors
- **Cherenkov tagger** construction at ODU

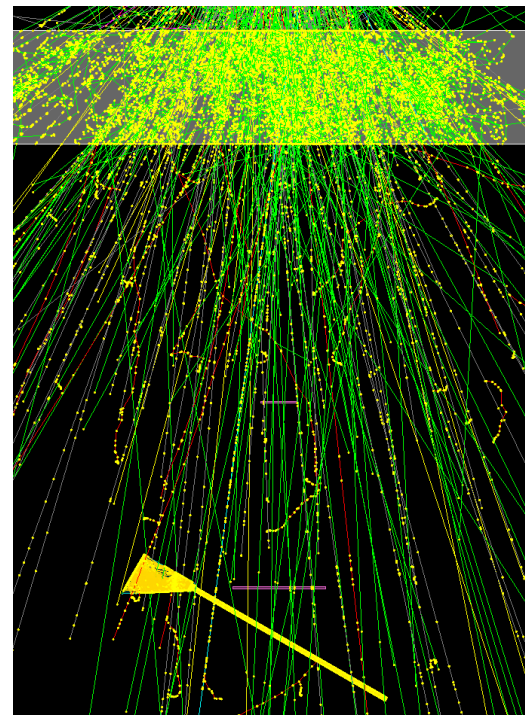
DIRC lab/CRT space at SBU



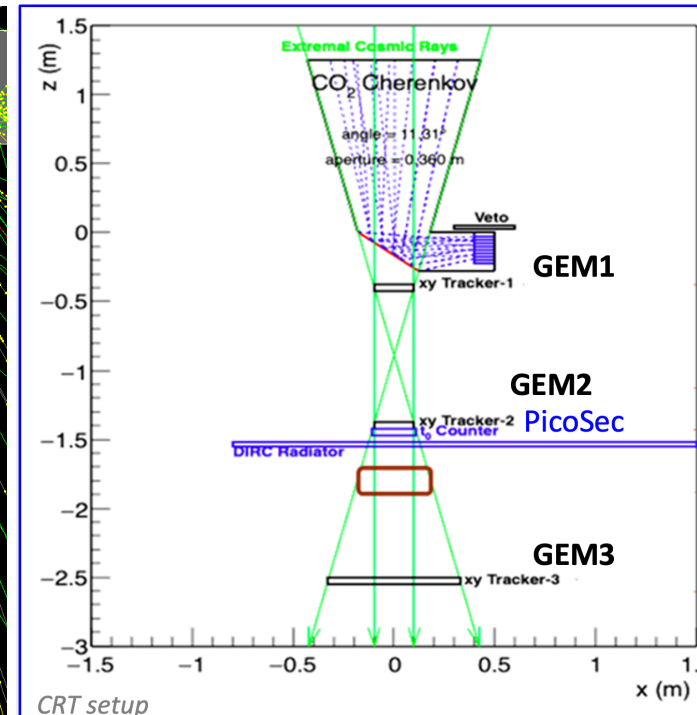
Cherenkov tagger under construction at ODU



Geant simulation



CRT setup schematic

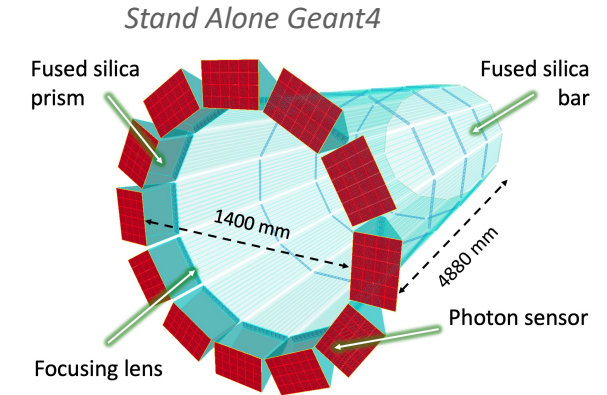


Prototype components from GSI at SBU



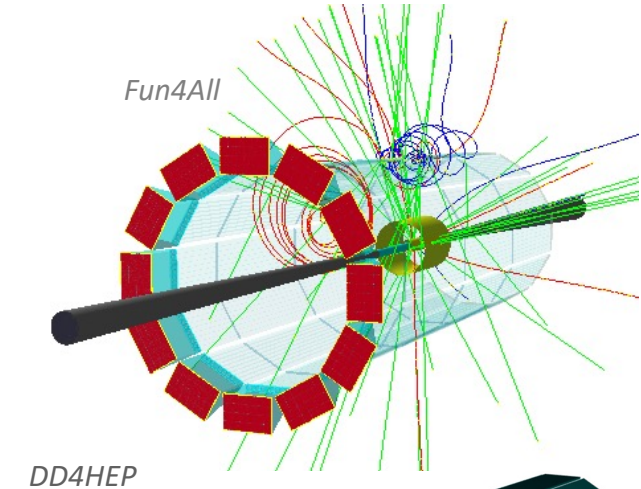
Stand-alone G4 Simulation

- Realistic optics geometry and material properties based on prototypes, with wavelength-dependent material properties and processes with all relevant resolution terms
- Validated with test beam data
- Used for design optimization studies and to test novel design options



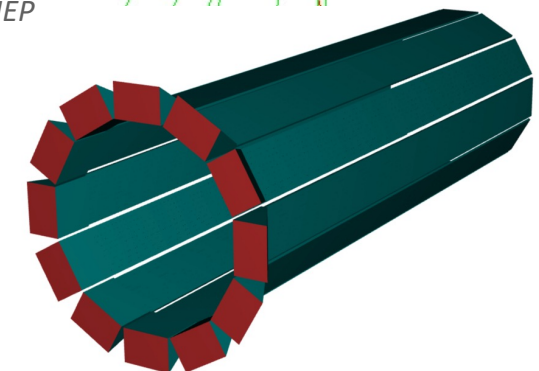
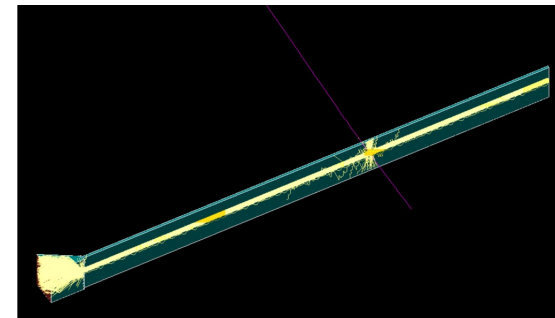
Fun4All:

- Imported and integrated Stand-alone package, performance in agreement
- Allows to study of the hpDIRC performance with background and magnetic field and using Pythia events



DD4HEP:

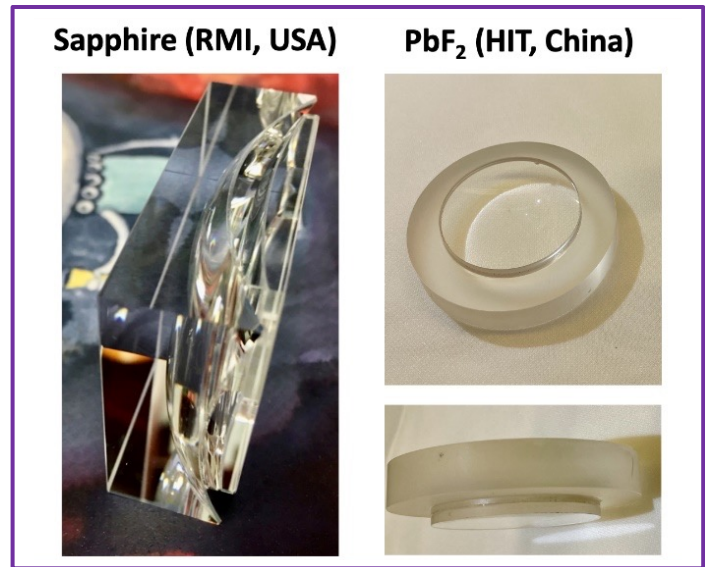
- Geometry fully implemented
- Work on digitization and reconstruction in progress



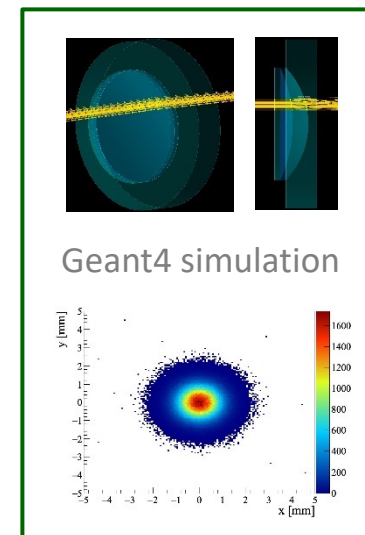
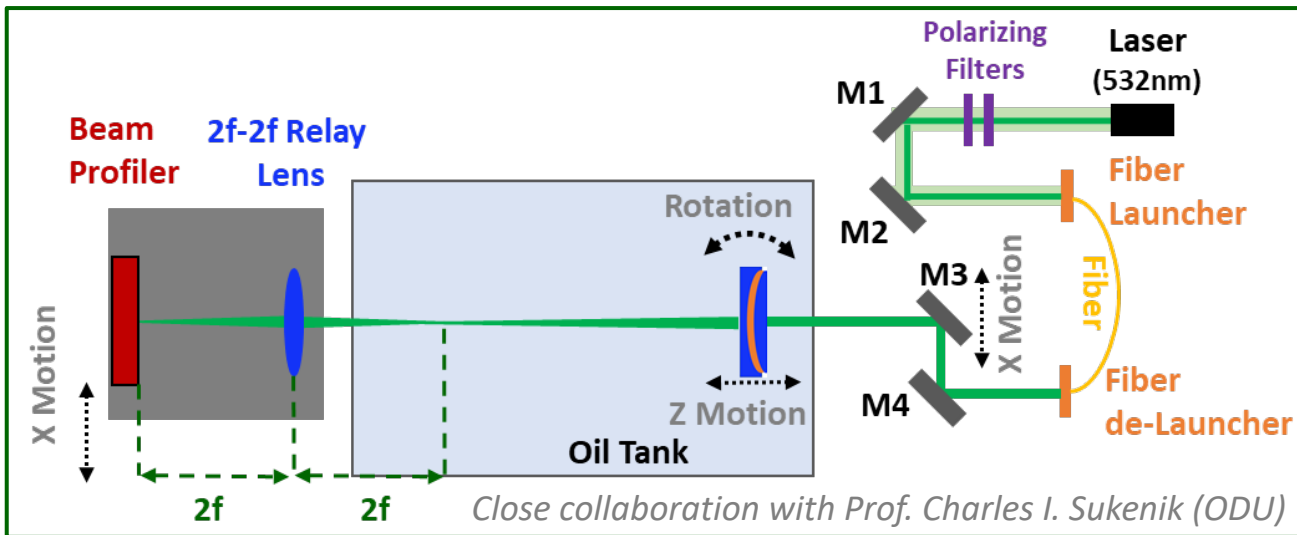
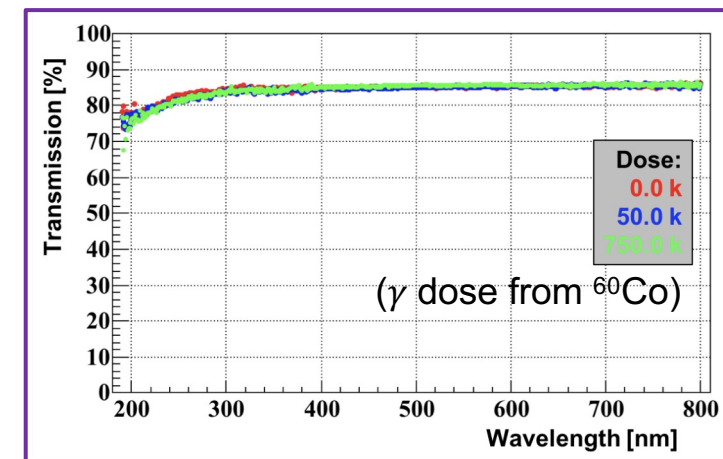
3-LAYER LENS

- Detailed scans of lens focusing properties with laser in optical lab at ODU
- Radiation hardness tests at BNL

Radiation-hard 3-layer lens prototypes



Radiation hardness of sapphire



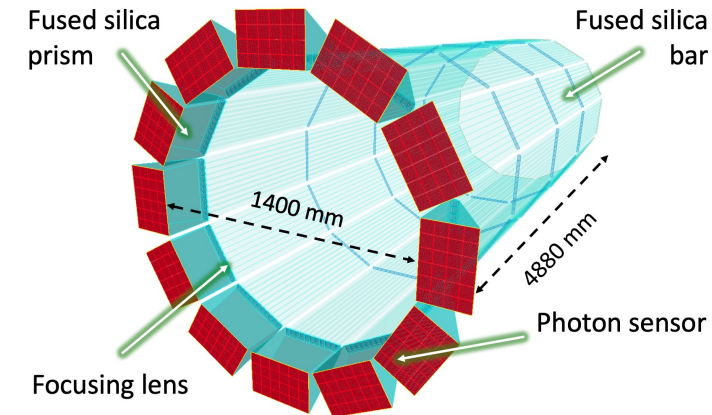
HPDIRC CONCEPT

hpDIRC R&D programs

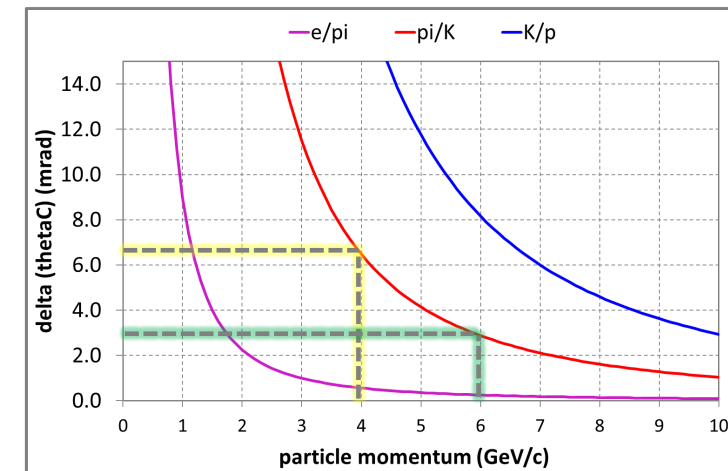
- Concept developed as part of previous **Generic R&D program (eRD14)**
- Finalizing design, validating components as part of **Project R&D (eRD103)**
- Future innovate optical DIRC configurations in **new Generic R&D program**

hpDIRC Concept:

- **Fast focusing DIRC**, utilizing **high-resolution 3D (x,y,t) reconstruction**
- Design based on BaBar DIRC, R&D for SuperB FDIRC, PANDA Barrel DIRC
- Radiator/light guide: **narrow fused silica bars** (radius/length flexible)
- **Innovative 3-layer spherical lenses**
- Compact **fused silica prisms** as expansion volumes
- **Fast photon detection**: small-pixel MCP-PMTs and high-density readout electronics
- Detailed Geant4 simulation: ≥ 3 s.d. π/K separation at 6 GeV/c,
 ≥ 3 s.d. e/π separation at 1.2 GeV/c

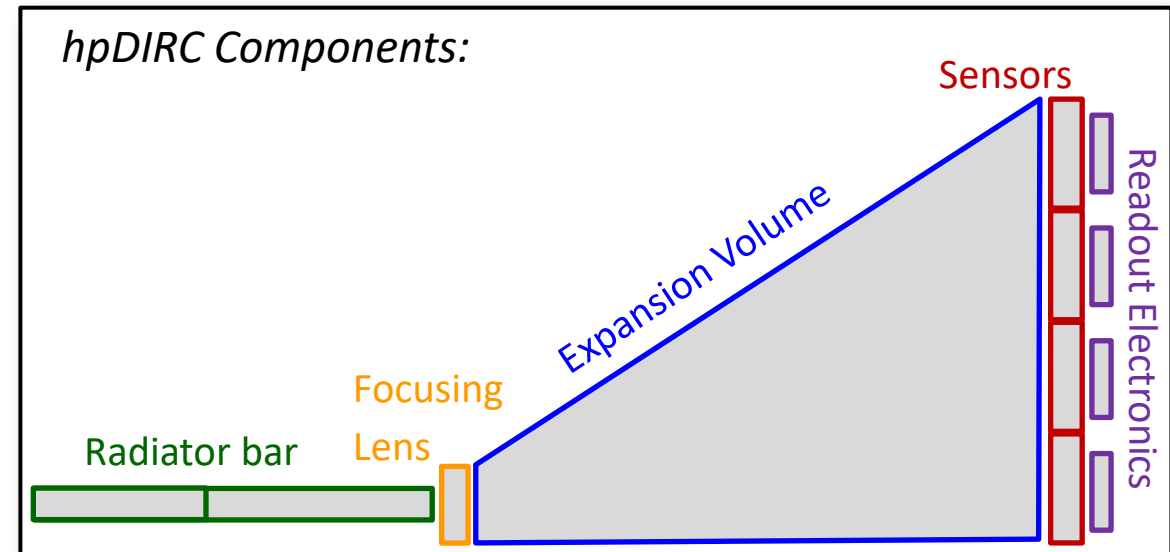
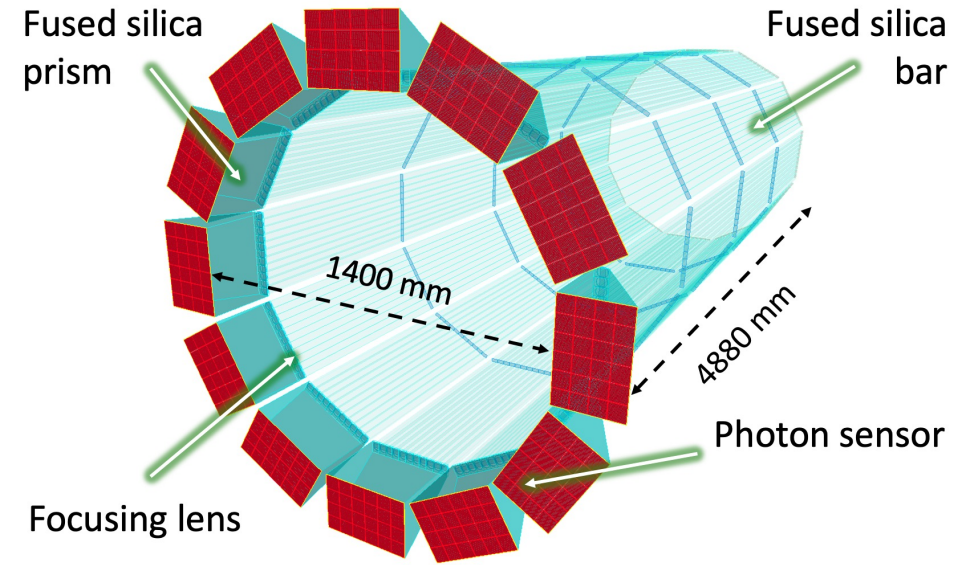


DIRC Cherenkov angle difference vs. momentum

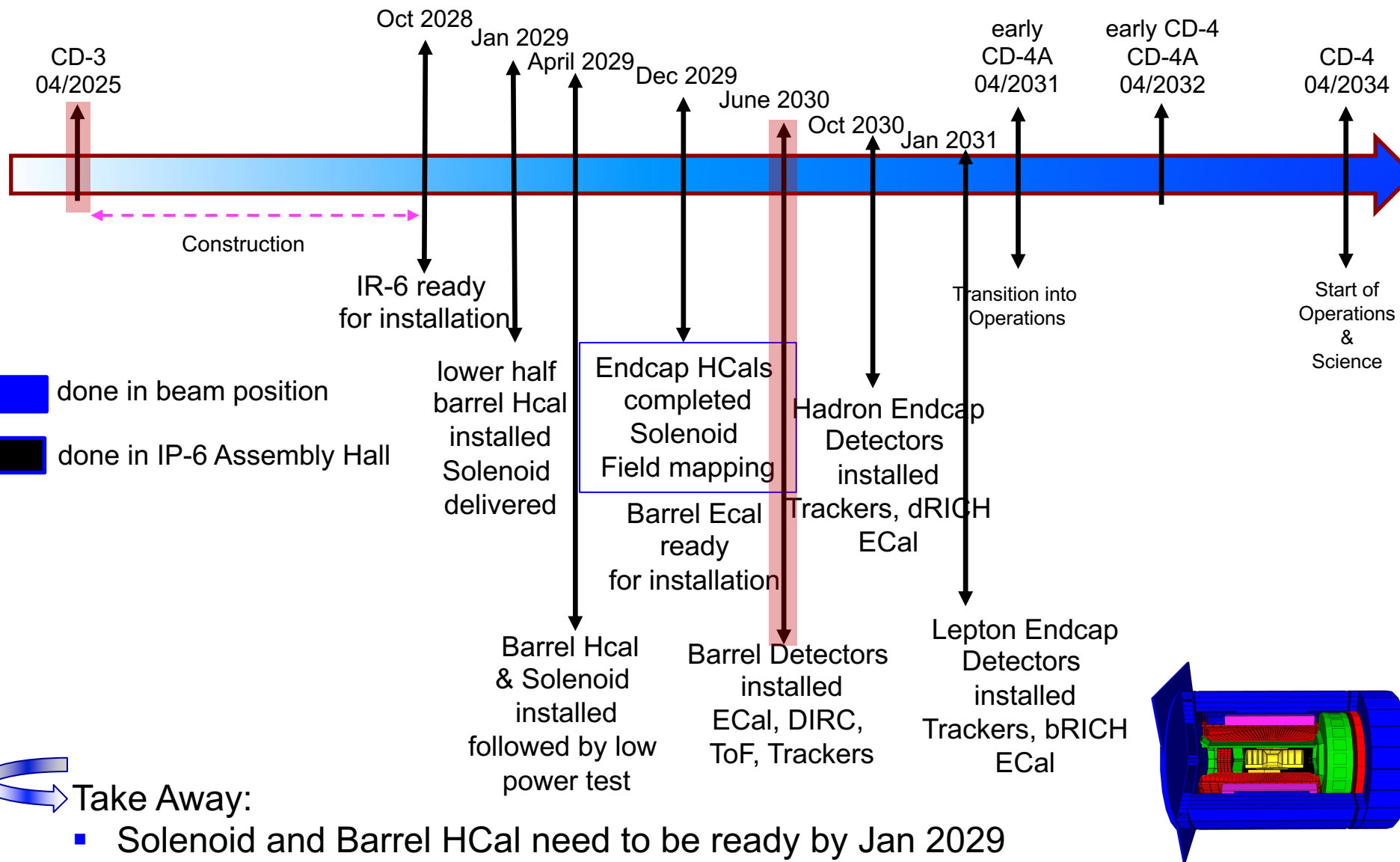


BASELINE HPDIRC DESIGN FOR EPIC

- **Radiator bars:**
 - Size: 4580mm x 35mm x 17mm (L x W x T)
 - Barrel: 715mm radius, 12 bar boxes, 10 long bars per bar box
long bar: 4 bars glued end-to-end, flat mirror on far end
baseline design: reuse of BaBar DIRC bars (R&D started)
- **Focusing optics:**
 - Radiation-hard 3-layer spherical lens (sapphire or PbF₂)
- **Expansion volume:**
 - Solid fused silica prism: 240 x 360 x 300 mm³ (H x W x L)
- **Readout system:**
 - MCP-PMT Sensors (e.g. Photek/Photonis/Incom)
 - ASIC-based Electronics (e.g. UH/Nalu Scientific, EICROC)
- Several core design aspects, as well as detailed Geant simulation, validated in PANDA Barrel DIRC beam tests (prototype tests in cosmic rays and test beams in preparation)



High Level Installation Schedule



Slide from Elke&Rolf
ePIC general meeting
April 14, 2023

done in beam position
done in IP-6 Assembly Hall

Take Away:

- Solenoid and Barrel HCal need to be ready by Jan 2029
- all other subdetectors need to be ready between 06/29 to 09/30 depending on their location in the detector

