Highlights of the PID session at the ePIC meeting in Frascati

Alexander Kiselev (a personal view)

ePIC pfRICH DSC weekly meeting, 01/30/2025

Agenda

https://indico.bnl.gov/event/26095/

Synergies as seen by ePIC PID DSCs

9:00 AM → 9:15 AM **RICH - Developments of common interest: General**

Speaker: Alexander Kiselev (BNL)

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9:15 AM → 9:25 AM **RICH - Developments of common interest: Mirror QA**

Mirror QA setup @ Duke, aerogel testing facilities at INFN (?), etc

Speakers: Anselm Vossen (member@duke.edu;faculty@duke.edu), Marco Contalbrigo (INFN Ferrara)

dRICH_250124.pdf

9:25 AM → 9:35 AM **RICH - Developments of common interest: Mirror coating**

Stony Brook evaporator setup

Speakers: Preet Mann (Stony Brook), Zhoudunming Tu (BNL)

Mirror coating

9:35 AM → 9:45 AM **RICH - Developments of common interest: Aerogel**

Temple aerogel test setup

Speakers: Bernd Surrow (Temple University), Matt Posik (Temple University)

2025_01_24_posik_...

9:45 AM → 9:55 AM **hpDIRC - Developments of common interest: Topics and Needs**

Speaker: Grzegorz Kalicy (CUA)

10:00 AM → 10:10 AM **Status and Challenges of R&D (Project & Generic)**

Speaker: Thomas Ullrich (BNL)

PID_RD_Rome.pdf

A sub-session on R&D, including Prakhar's talk

Software-related session

11:30 AM → 11:45 AM **Status of PID in EIC Recon**

Perspective from Reconstruction Group

Speaker: Derek Anderson (Iowa State University)

Reco WG Perspectiv...

11:45 AM → 12:00 PM **dRICH - Status on Simulations and Reconstruction Software**

Speaker: Chandradoy Chatterjee (INFN Trieste)

Chatterjee_ePIC_dRI...

12:00 PM → 12:15 PM **Status and prospects of IRT 2.0 code adaptation to ePIC software stack**

Speaker: Alexander Kiselev (BNL)

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12:15 PM → 12:30 PM **hpDIRC - Status on Simulations and Reconstruction Software**

Speaker: Roman Dzhygadlo (GSI)

software_status_hp...

12:30 PM → 12:45 PM **ToF - Status on Simulations and Reconstruction Software**

Speaker: Kentaro Kawade (Shinshu University)

ePIC_ToF_Simulatio...

12:45 PM → 1:00 PM **Discussion - Status on Simulations and Reconstruction Software**

Speaker: All

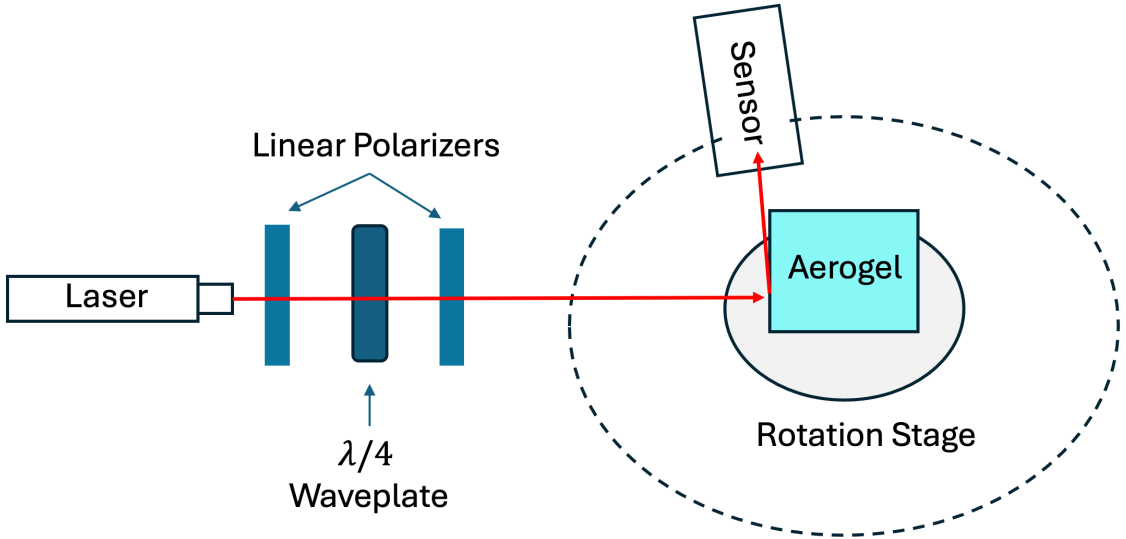
Activities / developments of common interest [for us]

- Aerogel: QA and characterization
  - Refractive index, forward scattering, transparency, etc
- Mirrors: coating (?) and QA; procedures & equipment
- Laser monitoring system
- Everything related to HRPPDs (and other MCP-PMTs)
  - Readout interface(s), QA & characterization; B-field & aging studied, timing, etc
- Reconstruction software

Aerogel: ellipsometry

by Bernd Surrow and Matt Posik (Temple)

- Local refractive index measurements
  - Measure change in light polarization to extract refractive index (via Brewster's angle or ellipsometry)
  - Equipment in hand as part of pfRICH PED
  - Main effort to start in summer 2025



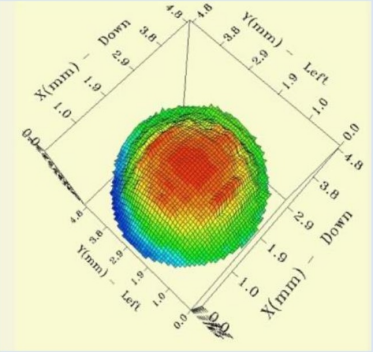
A new technique for a refractive index measurement (allows XY surface scans)

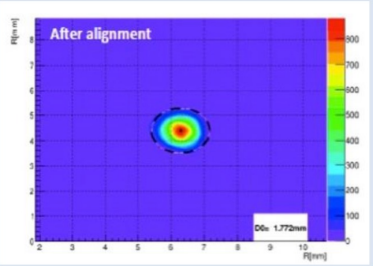
Mirrors & aerogel QA technique ideas

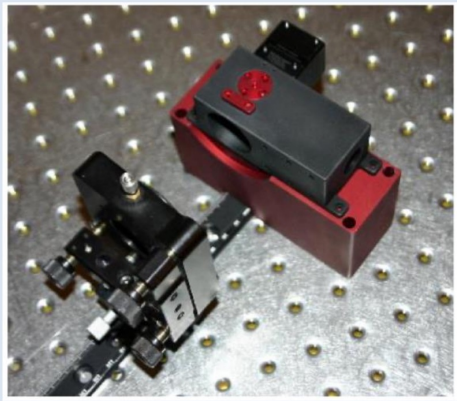
by Marco Contalbrigo (INFN)

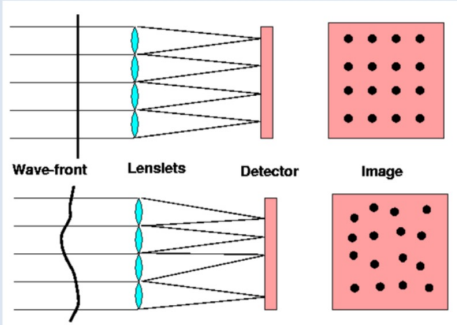
Shack-Hartmann sensor:
reflected waveform analysis

Surface mapping



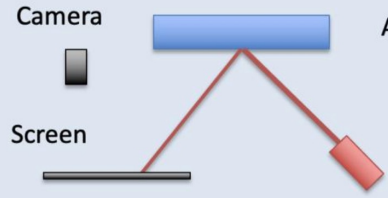


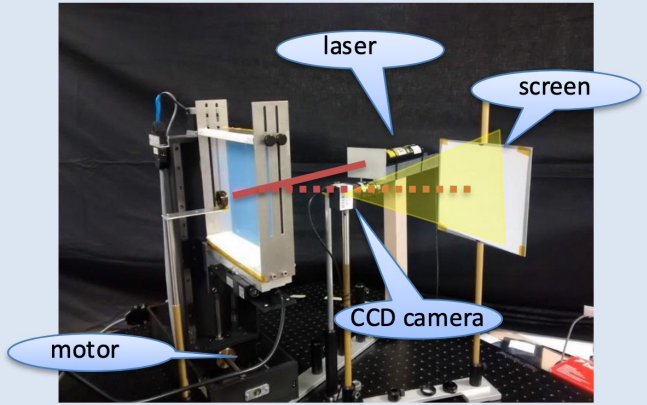




Under study: transfer to Duke

mirror surface quality control





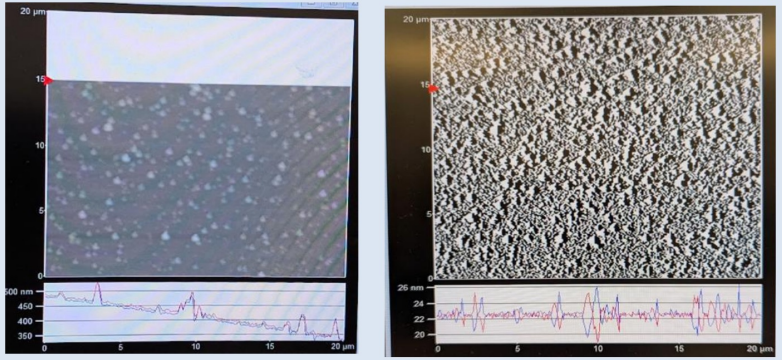
x-y axis movable table
CCD camera [ThorLabs DCU 224c]
- sensitive area [5.95-4.76 mm]
- resolution [1280-1024 pixels]
- pixel size 4.65 μm

aerogel 2D surface mapping

Other mirror-related topics

by A. Vossen (Duke)

- SMiF | SHARED MATERIALS INSTRUMENTATION FACILITY
  - Access to a variety of instruments for precision characterization of materials
  - Vossen's group members trained on Atomic Force Microscope, Spectrophotometer
- Variety of workshops and engineering facilities at Triangle Universities Nuclear Laboratory (TUNL) e.g. for 3D printing etc…



Screenshot of Atomic Force Microscope images of reflective surface coated at SBU showing roughness of $< 100\ nm$

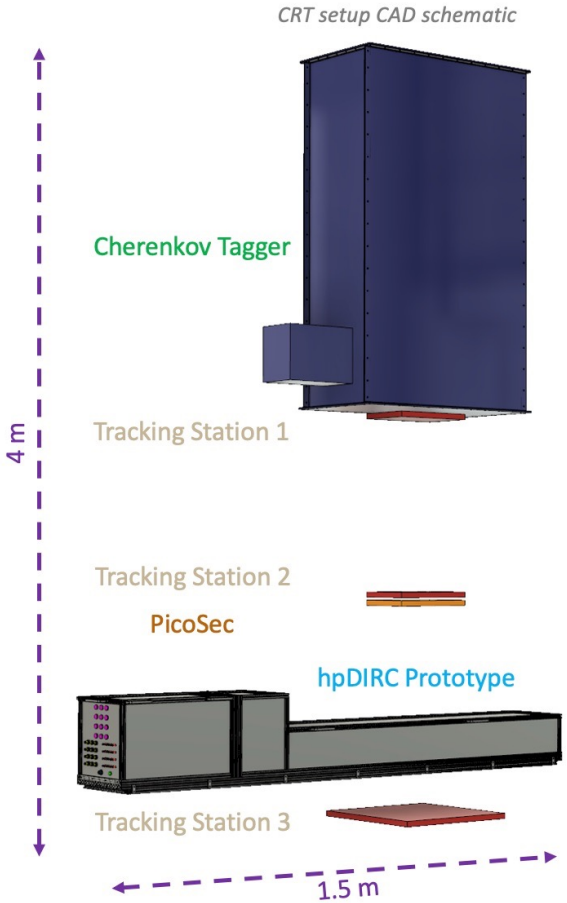
SEM and AFM equipment is also available at CFN (BNL)

- Can dRICH mirrors be coated at Stony Brook or they are just too big?
- Otherwise, does the synergy boil down to just sharing experience, technique, etc?

Synergies with hpDIRC

- Photosensor evaluation
- Front-end electronics

- Cosmic ray test stand usage @ SBU (?!)
  - Built-in muon ID (p > 3.5 GeV/c)
  - Possibility of using the same HRPPD(s) with the same ASIC electronics
  - Perhaps even try cross-calibration of the two subsystems (event selection)
- An alternative option: beam test at CERN PS with dRICH in Fall 2025
  - We will know more in mid February



Laser monitoring: unified across pfRICH/dRICH/hpDIRC ?

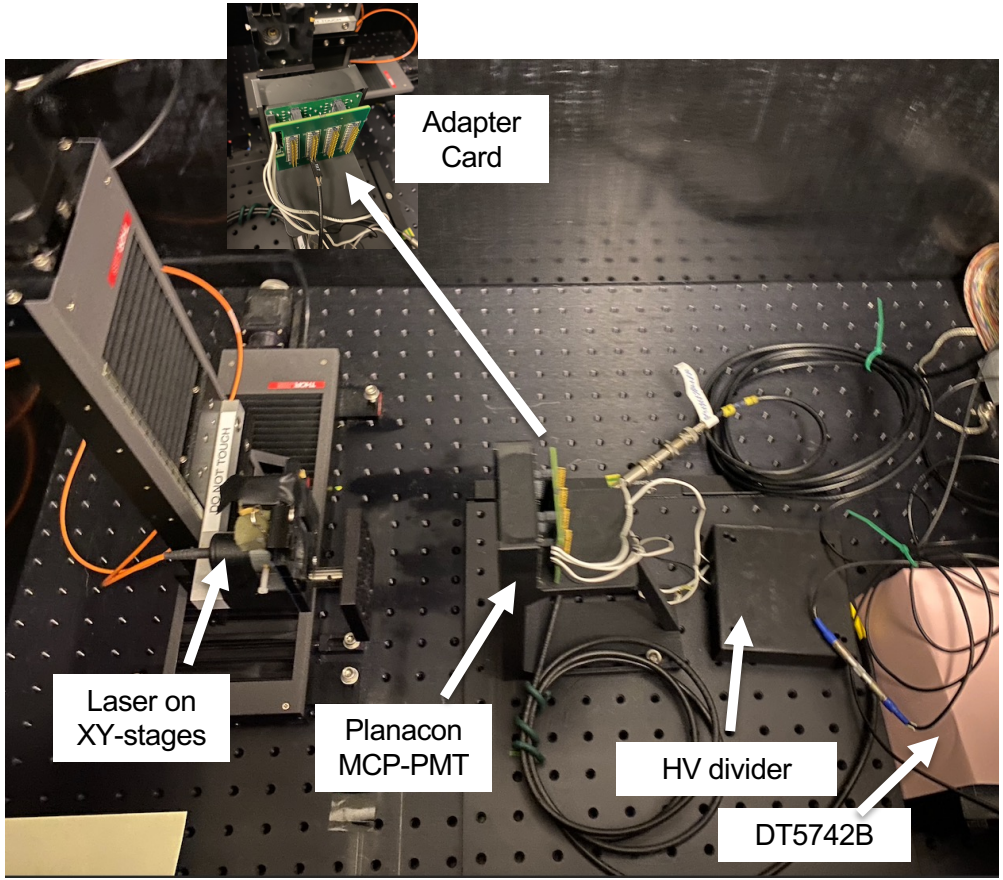
- **Similar DAQ and Slow Control implementations**

- **Same hardware components**
  - Common spare parts repository for expensive items, such as a PiLas laser system
  - Same type of fiber and diffusers
- **Design engineering considerations**
  - Timing resolution requirement
  - Laser signal diffused patterns: coverages and overlaps
  - Mounting themes and holders
- **Ongoing PED effort to answer common questions**
  - Small profile diffuser (~0.5mm diameter) with square pattern possible? (Integration)
  - Minimum bending radius and signal loss? (Engineering)
  - Validate and optimize the envelopes with Ray Trace program

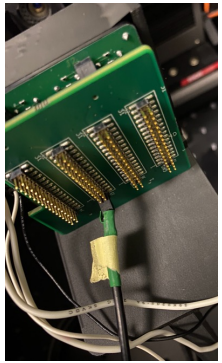
by Bill Li (MSU)

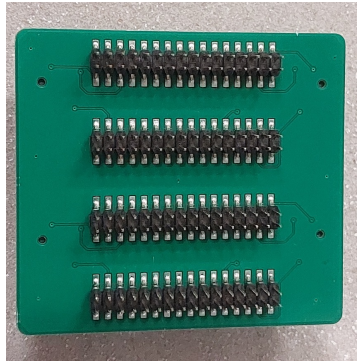
MCP-PMT test stand @ Glasgow

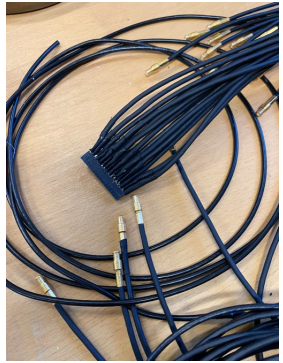
by Rachel Montgomery (UoG)



- Borrowed Planacon XP85112-S-BA MCP-PMT from GSI
  - This is the one which was thoroughly tested at Erlangen by A. Lehmann
- Photek Auratek MCP-PMT is supposed to be shipped to Glasgow by mid February
- Sending one of the EIC HRPPDs to Glasgow does not look hopeless either
  - Source of $8k TAX payment identified, etc

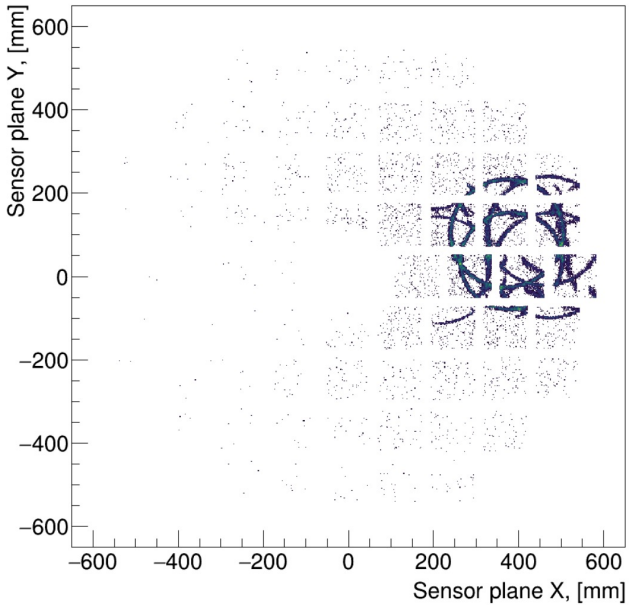




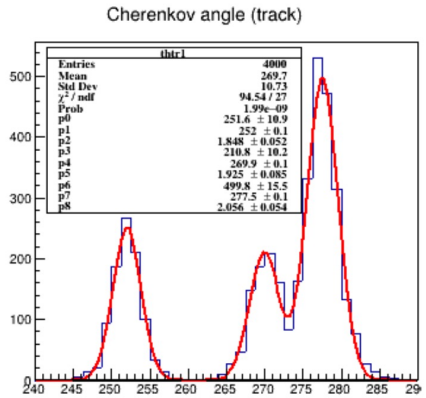


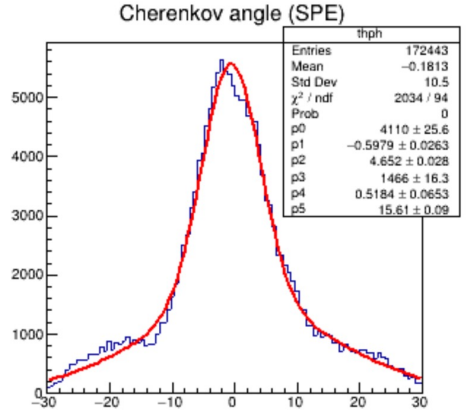
Software: IRT 1.0 -> 2.0 transition

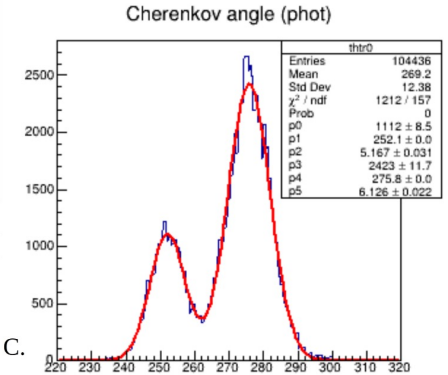
by Chandradoy Chatterjee (INFN)

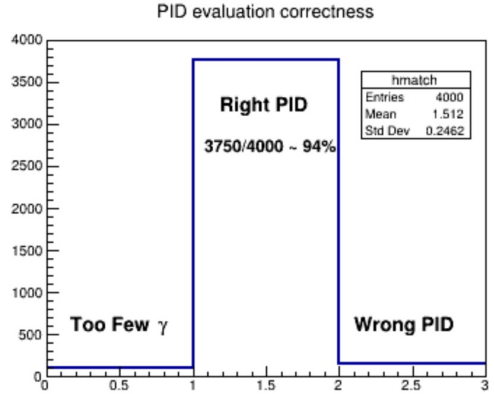


4 particles an event 4 GeV and 7 GeV pi/K mixture. Ensured overlapping









Standalone simulation results: IRT 2.0 is a substantial improvement over 1.0 and as such can be used as a new baseline in EICrecon (once ported there)