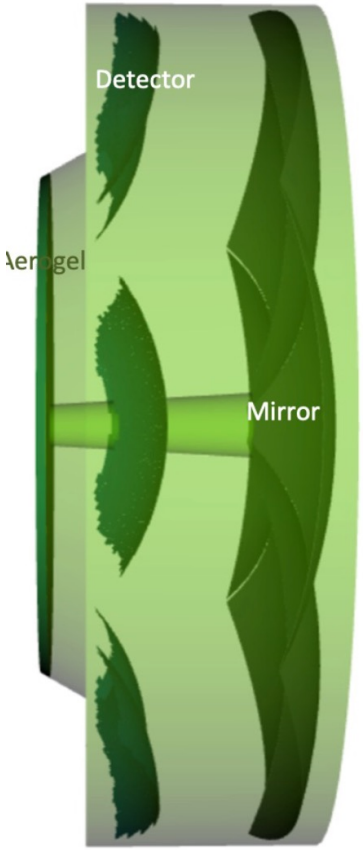
RICH Mirror Status

Anselm Vossen



Duke UNIVERSITY

Jefferson Lab

Requirements

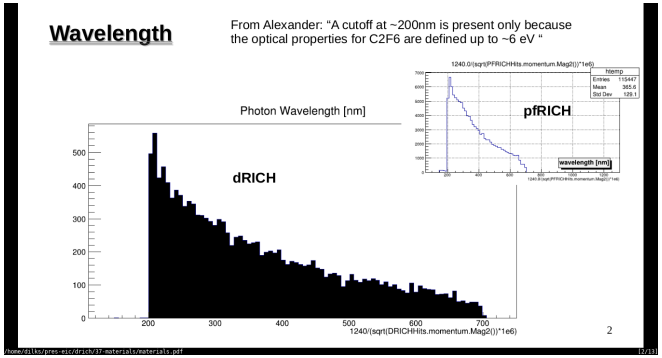
- Radius 2000 +/- 1%
- Reflectivity
  - $> 90\%$ in relevant wavelength region
  - $250 - 600nm$
- Roughness < 2 nm
- Precision of optical system
  - Needs to be better than other error sources
    - Chromatic aberration
    - Emission point
    - Tracking
  - Typical requirements better than $1 - 2\ mrad$
    (e.g. dRICH sensors pixel size corresponds to 0.7mrad)

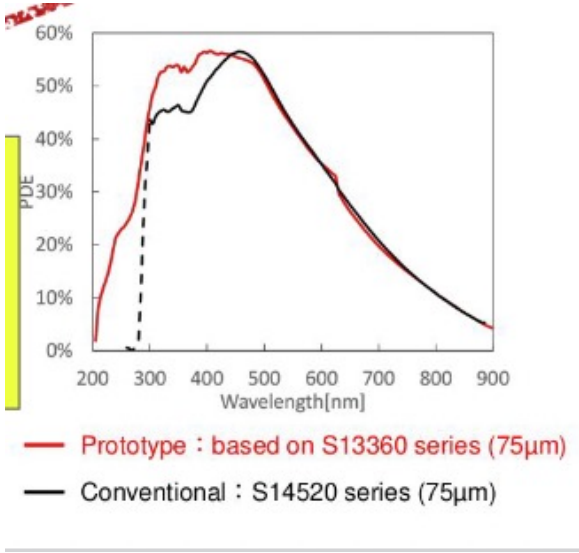
    ➔ $D0\ <\ 2.5\ mm$

    -
- Mechanical stability
  - CFRP skins + core demonstrated sufficient stiffness
- Chemical stability
  - Will be immersed in gas volume
  - compatibility with fluorocarbon gases

  ➔CFRP technology suitable (but still test)
- Material budget

  →weight < 6 kg/m2
- P6: Vendor production for first mirror start in late 2024





Roberto Preghenella, dRICH meeting 5/31

Default production CMA

- Successfully produced CLAS, LHCb mirrors
- Meeting with R. Romeo (CMA) on 11/10
- Existing spherical mandrel suitable for small – medium sized demonstrators
- New mandrel process planned
- **Planned procurements**
  - ≈ **10 small samples** to validate the substrate, characterization procedures, alternative coatings.
  - **1 small demonstrator**: a disk of ~140 mm diameter to serve our current basic prototype. (old mandrel, no reinforcement core) → test interactions with gas →1 month
  - 1 medium-size demonstrator: a shaped mirror with about a 50 cm diagonal, to serve a real-scale prototype. (final, ideal core) →2 months

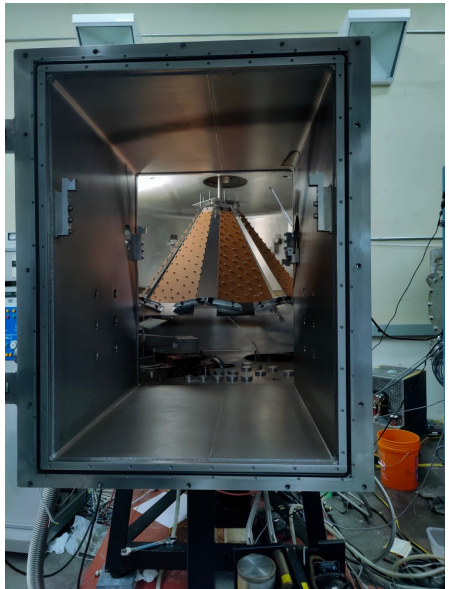
Coating

- Default: ECI (as has been done for CLAS)
  - Still need to be contacted, but no issue anticipated

- Plan on testing coating from SBU with small demonstrators

Coating at SBU

- SBU has coating station
- Have not produced optical quality components yet
  - Planned small improvements should make this possible
- Would be ‘free’
- Max size of mirrors $80cm$ (so about max we can get from CMA)
- Anticipate to be operational within weeks
  - Plan to test some of the small samples



Alternative developments at NMSU and Purdue aiming to reduce costs (~25%)

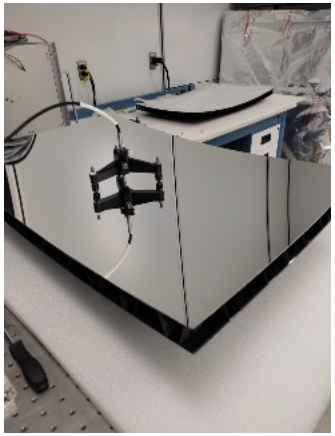
- Michael Paolone @ NMSU
  - 3D printing of mirrors for SoLID
  - Reflective surface: Al on Lexan film
  - Curved with radii between 1.6 – 3m
  - Polished Lexan, currently about 10nm roughness (polishing might be tricky for spherical surfaces)

- Andreas Jung @ Purdue
  - Carbon fiber on self-produced molds
  - Currently at ~300nm roughness, aiming at 20
  - Interested in seeing how far it can be pushed
  - Roughness currently

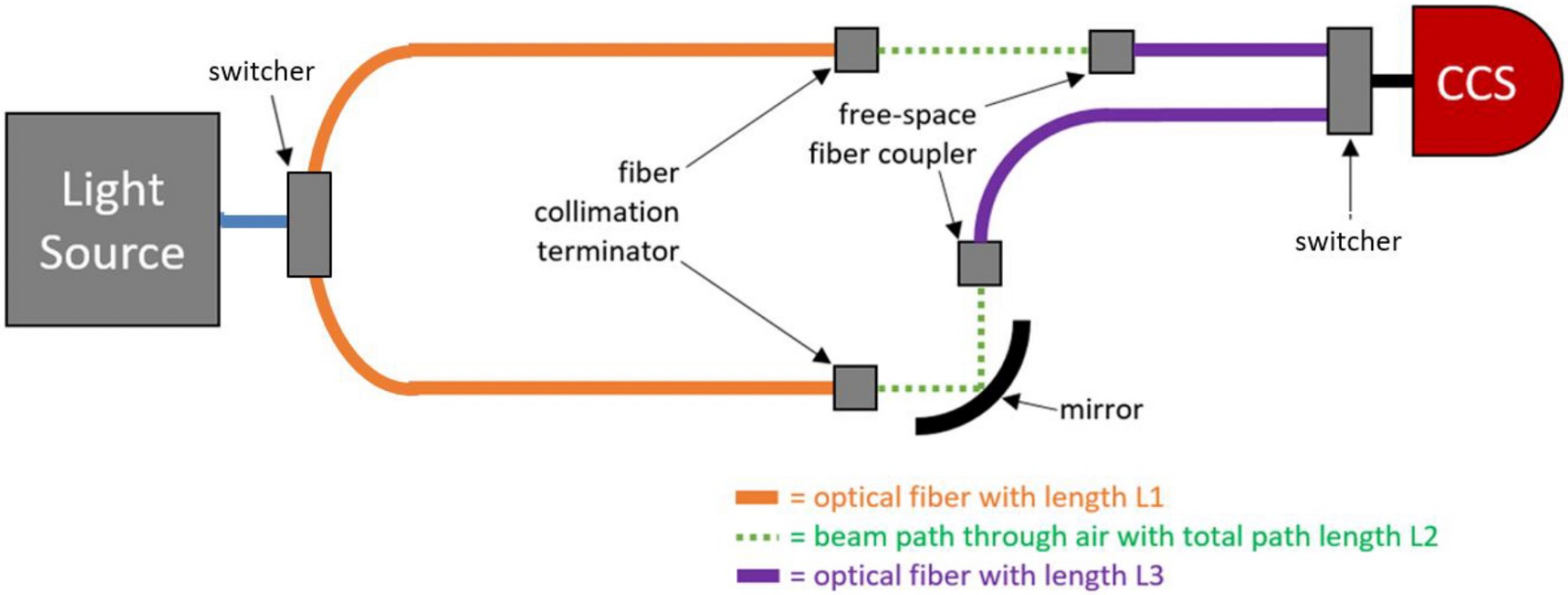
- Will meet with both to explore collaboration

Teststands

- Common effort with pfRICH and SOLID
- Mostly overlapping requirements
  - SoLID wants to go down to 200nm



Current test stand design

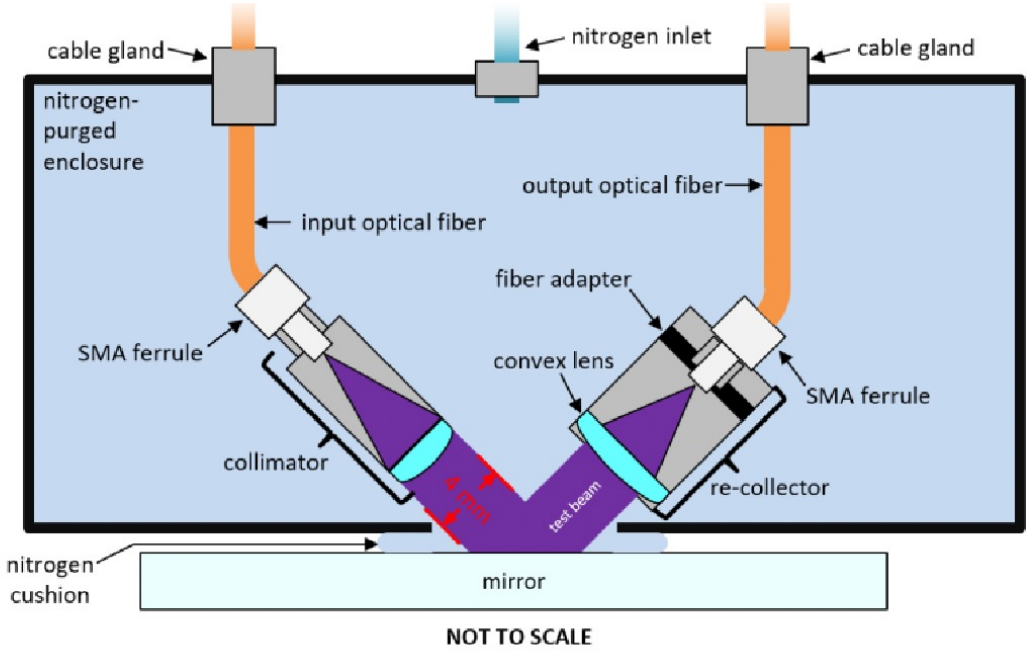


System diagram of proposed test station setup for a UV-Spectrum Reflectivity Test Station.

- Components off the shelf for > 250 nm
- Light source can be borrowed from SBU (still need a couple months to procure)

presentation at
https://www.jlab.org/sites/default/files/dsg/talks/dsg/UV%20reflectivity%20testing%20proposal%202023-10-10.pdf

Reflectivity test head



Next steps

- Order samples from CMA
- Order missing parts for testand
- …