Heavy Gas Cherenkov Update

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SoLID Collaboration Meeting
July 7-8, 2025

Duke UNIVERSITY

University of Regina

STONY BROOK UNIVERSITY

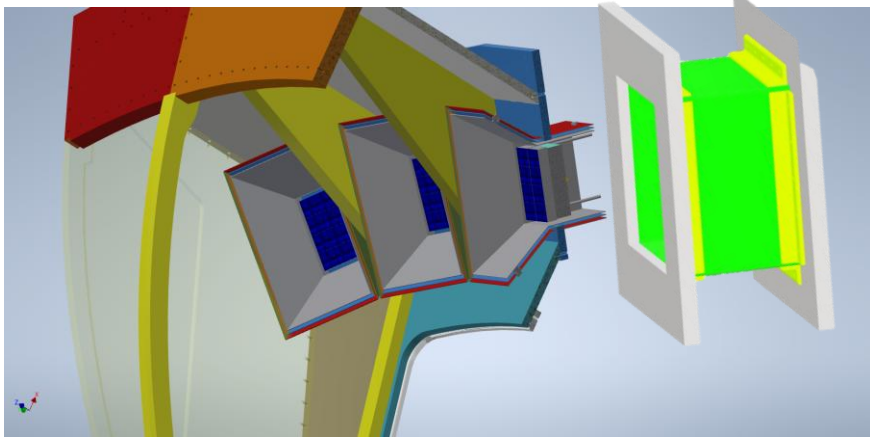
Outline

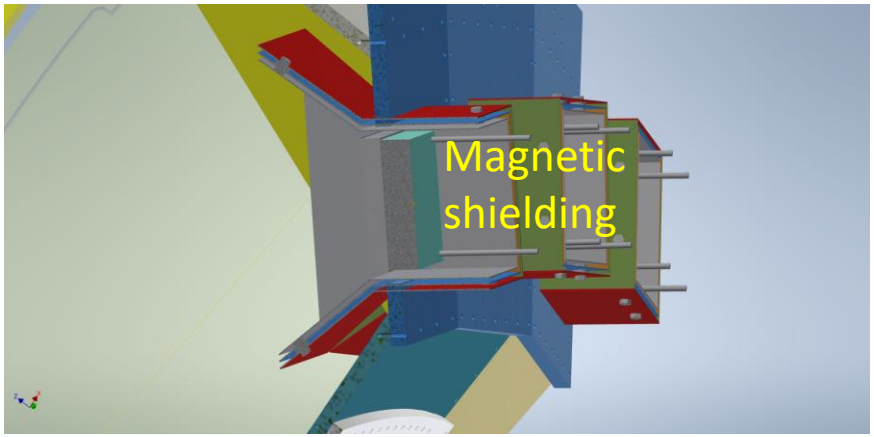
- Engineering and test update
  - Readout assembly housing
  - hermetic electrical connector
  - Readout board mounting structure
  - Mirror reflectivity test
- U of Regina funding update

Readout assembly housing

- Aluminum square housing
  - fix onto the blue plate by O-ring/gasket with epoxy and RTV
  - Magnetic shielding mounted on the housing
- Aluminum cap will mount electronic board with PMTs
  - use O-ring/gasket to connect to Aluminum square housing so it can open for installation and repair
  - Use high density hermetic connectors with protection covers as cable feedthrough

housing with cap



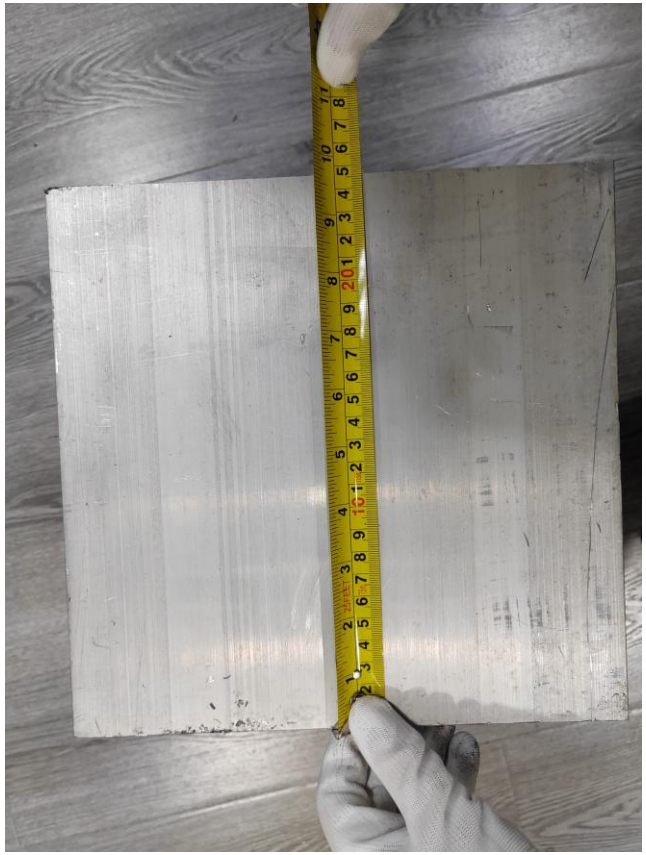


Make a small prototype and do standalone test first

Mark Emamian
(Duke Engineer)

Aluminum square housing

- Obtain extruded Al square tube (inner 9 inch), close to the require size (inner 10 inch) to avoid any gap



Mark Emamian and Duke machine shop

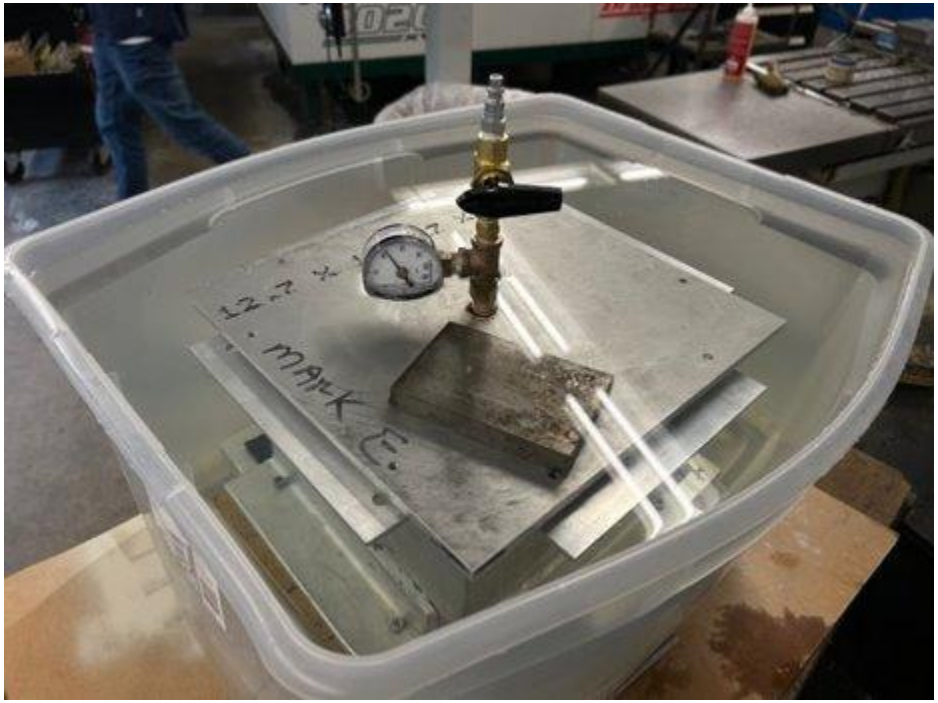
Gas Box Pressure test

- A gas box is made with the tube and two Al plates as caps
- Sealed with both gasket and O-ring at top and bottom
  - Gasket, easier to make, not always reuseable
  - O-ring, harder to make with groove and right size, more reuseable
- pressure tested at relative 22 psi (twice of required 11psi=0.7atm)
- Test with bubble leak finder first

Mark Emamian and Duke machine shop

Gas Box Pressure test

- water is also used to find leak
- Both Oring and gasket work without leak
- Ready to add hermetic electrical connectors to test, when available



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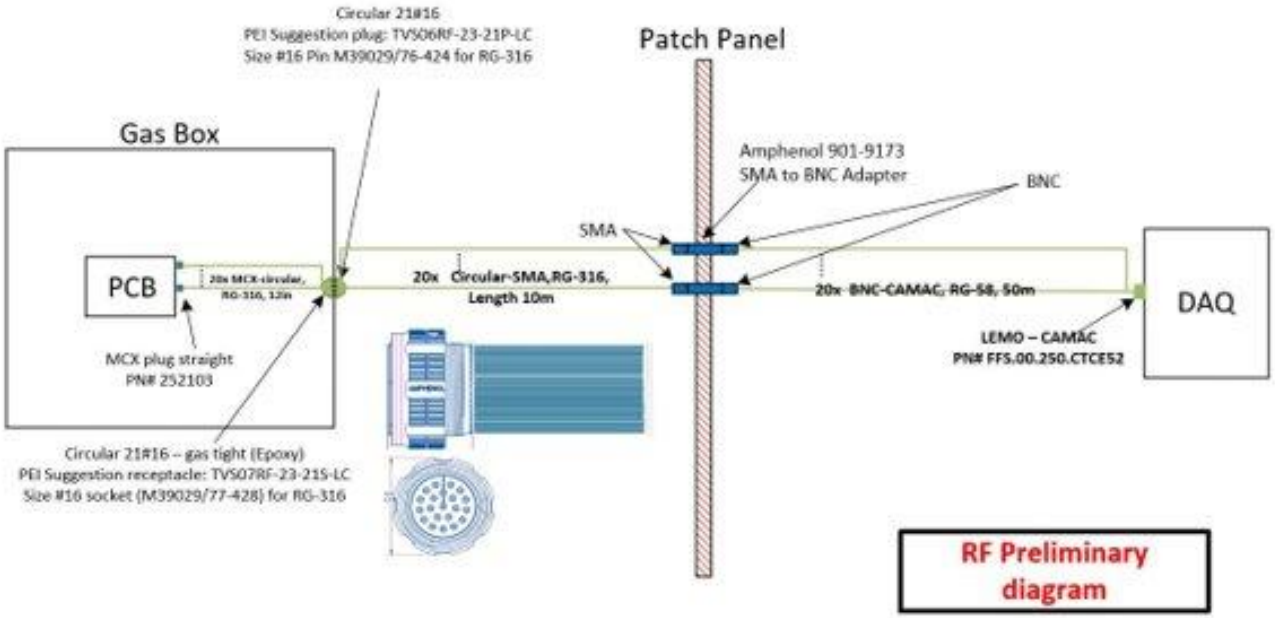
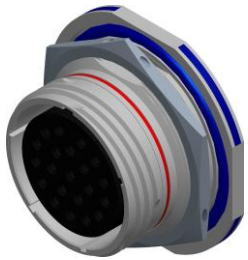
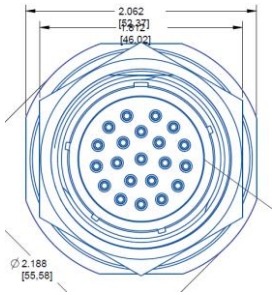
hermetic electrical connector

straight MCX plugs -> ~20cm RG316 cable -> gas tight connector -> ~10m RG316 cable -> patch panel (SMA-BNC) -> 30-50m RG58 cable -> DAQ crate (LEMO-CAMAC)



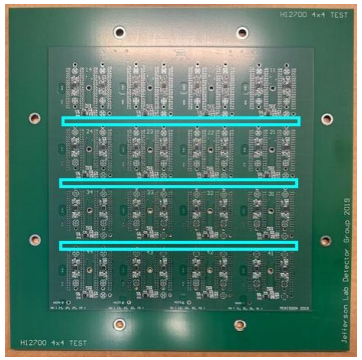


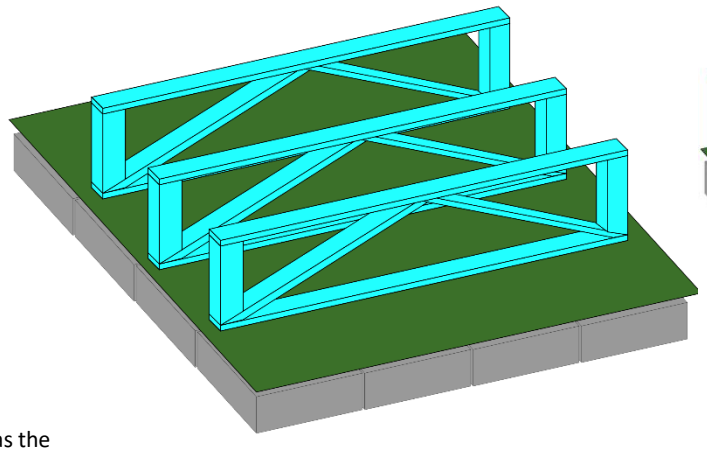


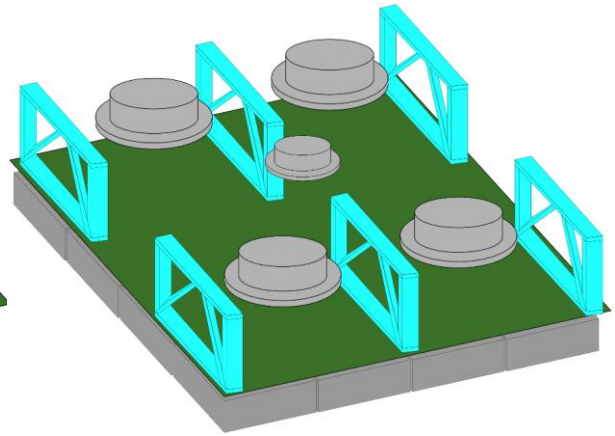
- With help from Jack McKisson from JLab
- talking to the company PEI-Genesis and Amphenol Aerospace and waiting for design and quote
- looking for alternatives

Readout board size and mounting structure

- MAPMT H12700 has size 53x53mm, so 4x4 tightly arranged array would be 213x213mm
- For future production board, we can assume 223x223mm size, as 10mm extra space is needed for HV connection. It would have 3.5mm all around clearance inside the magnetic shielding tube of 230x230mm
- We can use the sparse truss structure (two possible CAD drawings at middle and right) which can be mounted to an endcap and tilt at the 39deg angle in theta and all angle in phi
  - ~15cm long trusses can be customized made to fit. some posts/poles can be added if needed





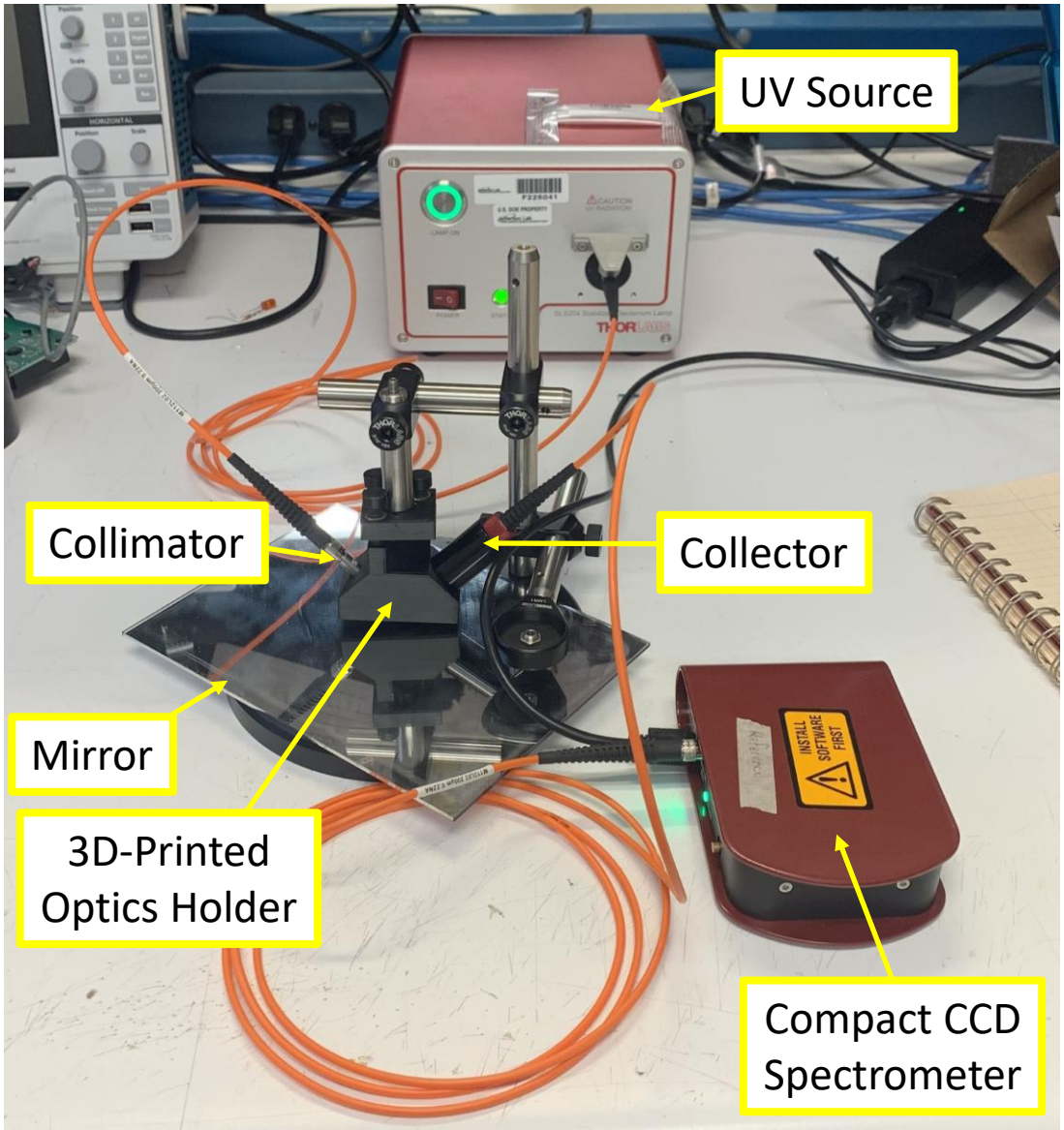


Prototype board (photo at left) has the darker area as the ground plane which has dimensions of 230x230mm and lighter area for mounting

Jack McKisson from JLab

Mirror reflectivity test at JLab (setup)

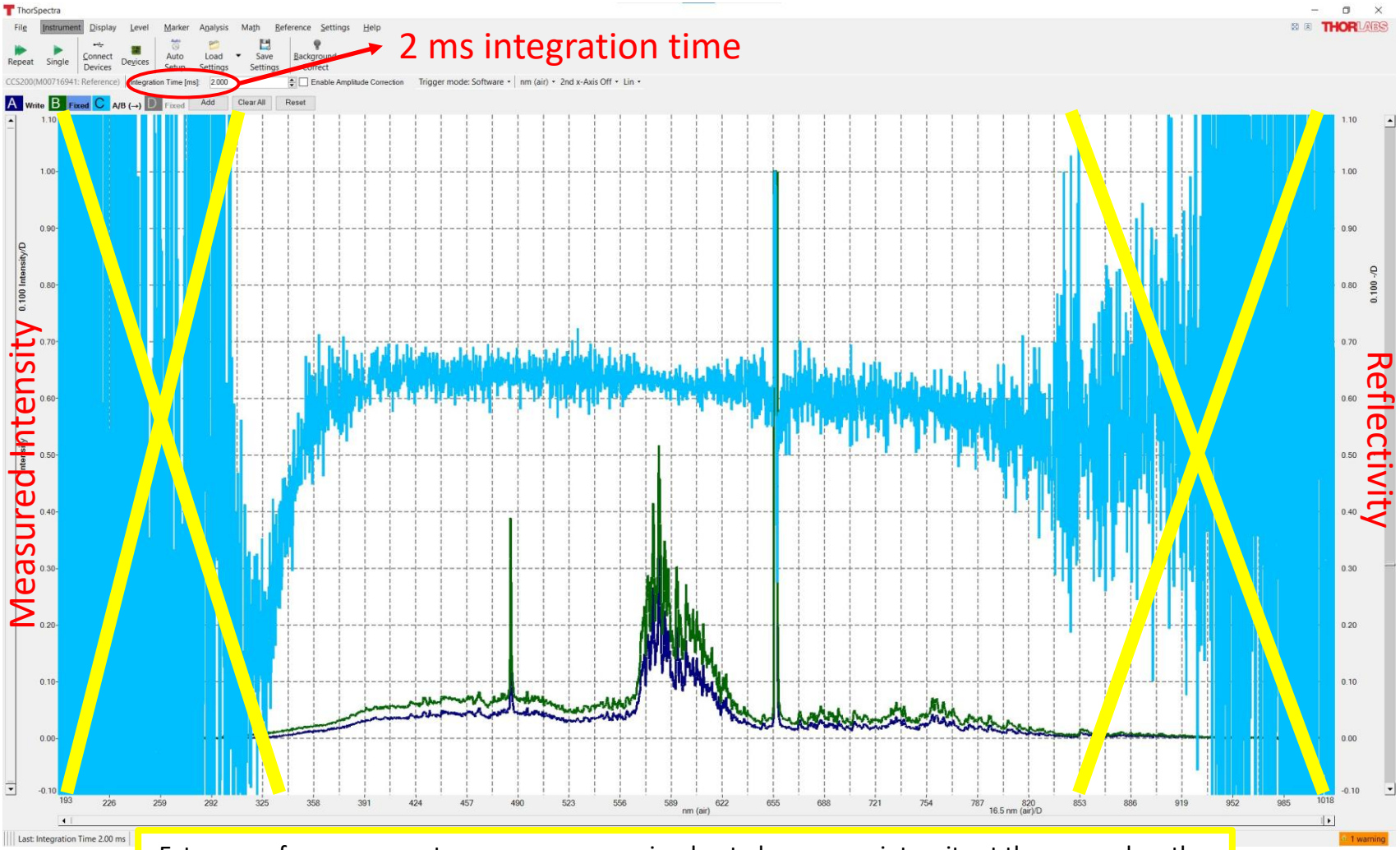
- Fiber based setup, simpler than previous monochromator based setup with a lot of optics
- Tyler Lemon from Jlab detector support group



Mirror reflectivity test at JLab (result)

- **The square mirror used in 2022 and 2018 HallC beamtest was tested with preliminary result of 60-70% above 300nm**
- **Somehow the setup has problem below 300nm (UV source? UV cable?)**

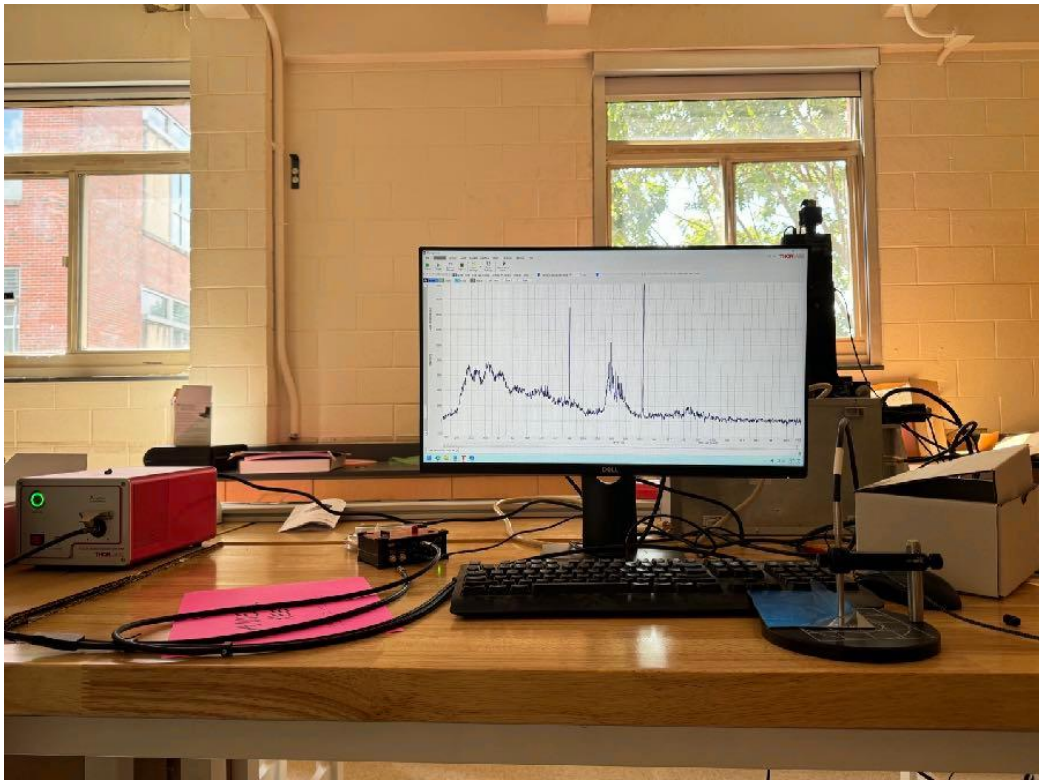
■ = Measurement ■ = Reference (no mirror) ■ = Reflectivity (Measurement ÷ Reference)



Extremes of measurement range very, very noisy due to low source intensity at those wavelengths. These wavelengths can be ignored in this screenshot.

Mirror reflectivity test at Duke

- Similar design to the JLab setup, but have all new parts
- Since last week, spectrum can be obtained for the entire range
- Starting with some sample mirrors
- Anselm Vossen group, joined effort with EPIC RICH mirror



Canadian Funds for SoLID HGC Vessel

- **Our grant application through CFI Innovation Fund (IF) 2023 competition was successful**
  - Canada Foundation for Innovation (CFI) is a Federal Agency that funds research infrastructure. There is a ~C$400 million IF competition every two years, covering all disciplines
  - CFI funds must be matched by other agencies to qualify for award, typically provincial or institutional funds
  - This can reduce pressure on funds provided by US–DOE

Funds Awarded (Canadian Dollars)	
INNOVATION.CA CANADA FOUNDATION FOR INNOVATION | FONDATION CANADIENNE POUR L'INNOVATION	$509.5k
innovation SASKATCHEWAN	$300k
University of Regina	$209.5k
TOTAL	**$1019k**

Status Update

1. **UofR and JLab have agreed on the wording of an International Cooperative Research and Development Agreement (ICRADA) covering:**

   a) Ownership and de facto control of infrastructure

   b) Reporting and audit requirements
      - e.g. documentation, if required, of in-kind contributions by JLab

   c) Intellectual property rights

- This agreement was sent for review and approval to USDOE and CFI. Once their agreement is obtained, the ICRADA can be signed by JLab and UofR
- CFI is in regular contact with US-DOE on a variety of projects and is trying to manage the recent uncertainty. As a result, as of June 2025, funds have been released by CFI to UofR without an ICRADA. However, the funds are being held in escrow by the UofR Research Office until the ICRADA is signed, and so they cannot yet be spent. This at least means that the funds cannot so easily be withdrawn by Ottawa
- Bottom line: we still need a signed ICRADA to move forward on the HGC vessel

Status Update

2.There is a deadline by which CFI funds must be spent

- **UofR has issued a Request for Tender (RFT) for SoLID HGC Vessel, to determine cost increases since 2022 application**
  - **Three detailed proposals were received. We reviewed all three, including site visits to the vendors and Q&A by email.**
  - **Dyna Industries (Regina, SK) was selected as the vendor, based on the best combination of technical merit, cost, and indigenization.**
  - **This is NOT the same vendor which made the HGC vessel prototype. That was Industrial Machine and Manufacturing (Saskatoon, SK), which was very similar technically but at significantly higher cost.**
  - **Dyna has been informed of our choice.**
- **According to the recently signed CFI-UofR award agreement, the project must be closed by Nov 30, 2030. We are fortunate that they were able to get the closing date to be pushed to the latest possible date. Annual progress reports on the project are required to be submitted effective immediately**