Heavy Gas Cherenkov Update

Zhiwen Zhao and Garth Huber

SoLID Collaboration Meeting
Jan 9-10, 2025

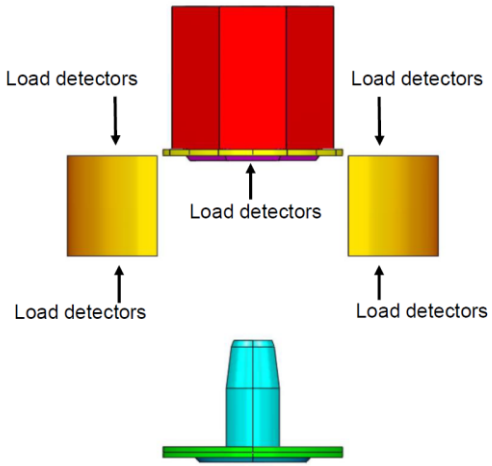
Outline

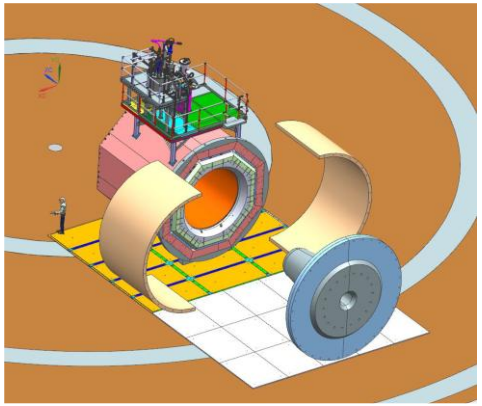
- Simulation and engineering
- U of Regina funding update

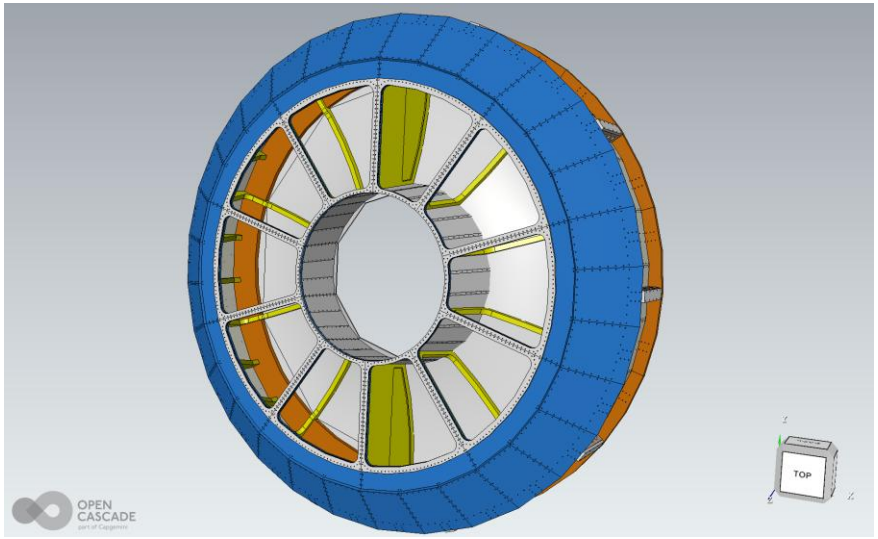
HGC block study

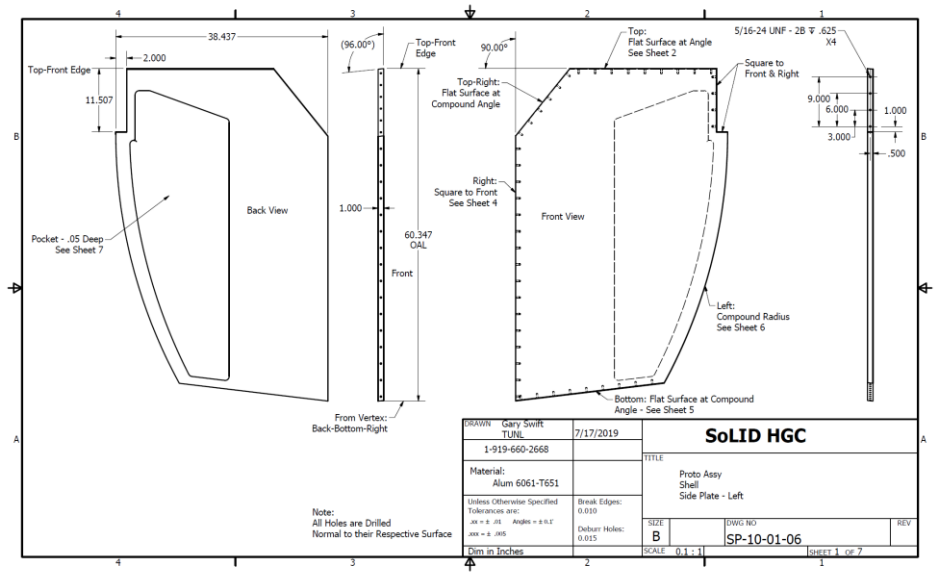
It is always better if block is not needed!

- Due to installation plan, HGC needs two C-shaped tanks separated vertically
- This means there are two “blocks” at phi=90,270deg
- Each block is 1-2inch thick and made of 2 Aluminum plates

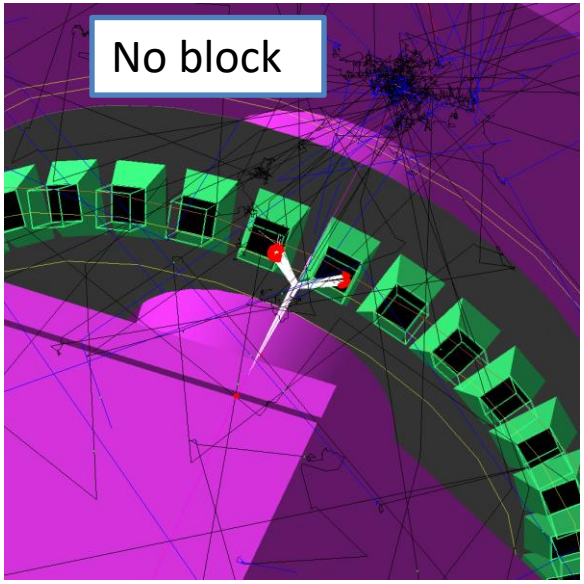


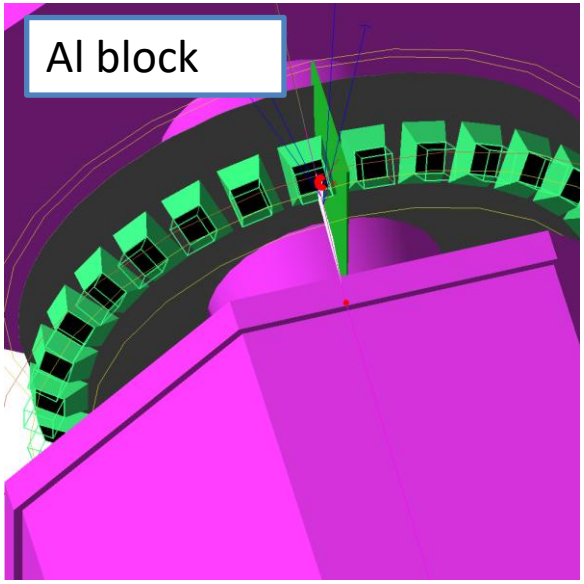


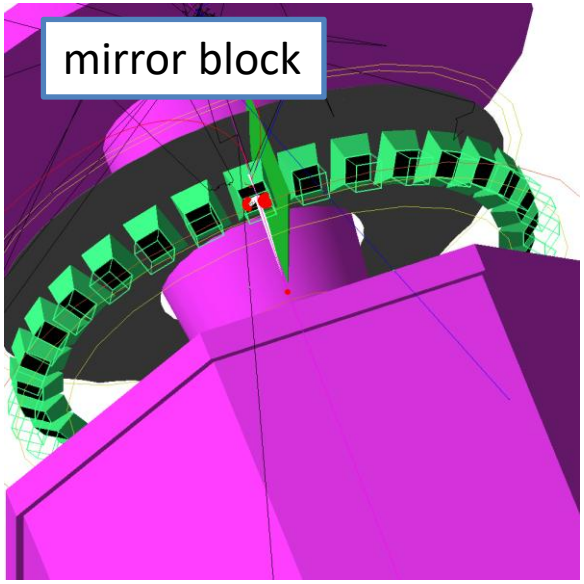




HGC block study

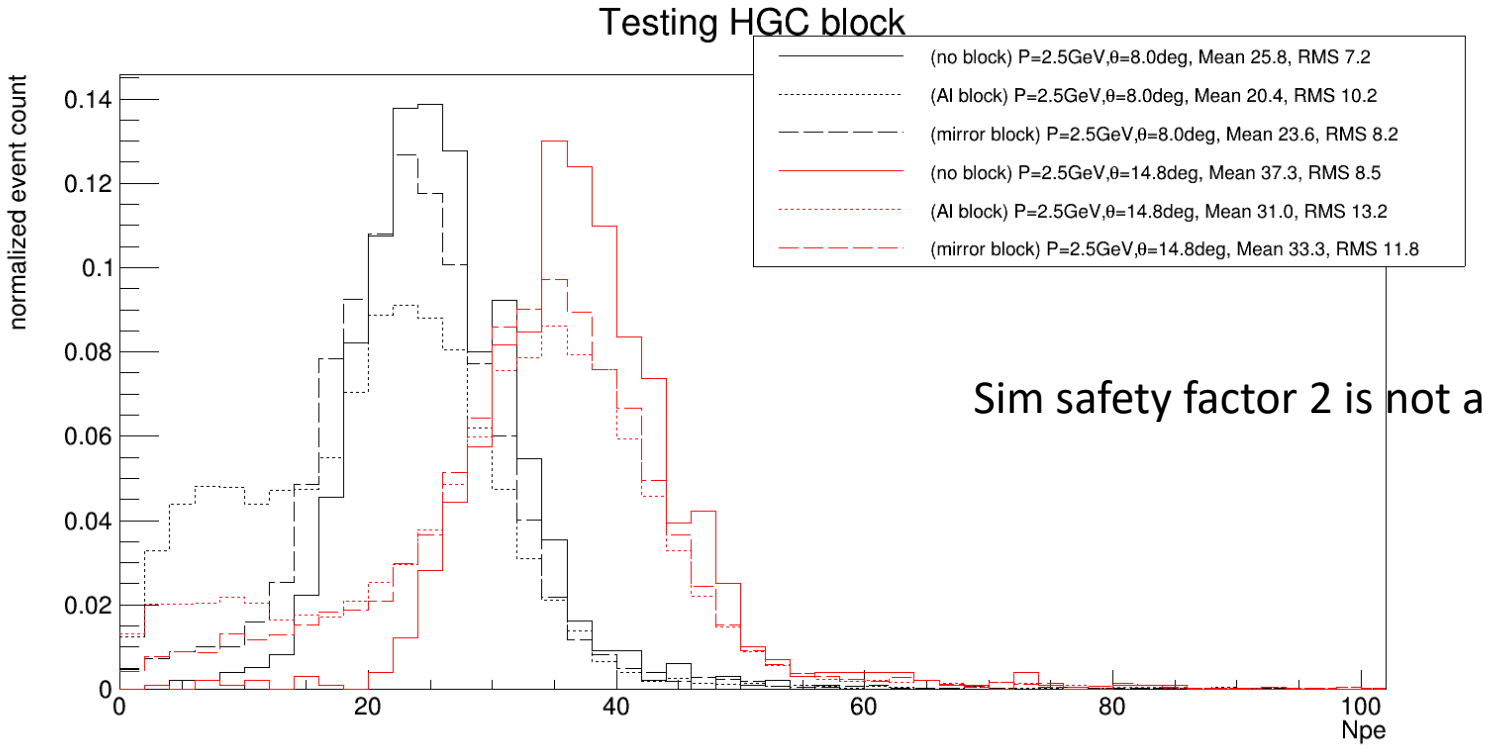






- For SIDIS_He3 setup, charged pions from target bent by solenoid field about 10-30deg in phi at the HGC entrance
- At certain angles, Cherenkov photons are collected by two neighboring mirrors
- Al blocks stop the photons going to the mirror in the other C tank
- Testing if mirrored block (with thin reflective films attached) can recover those photons

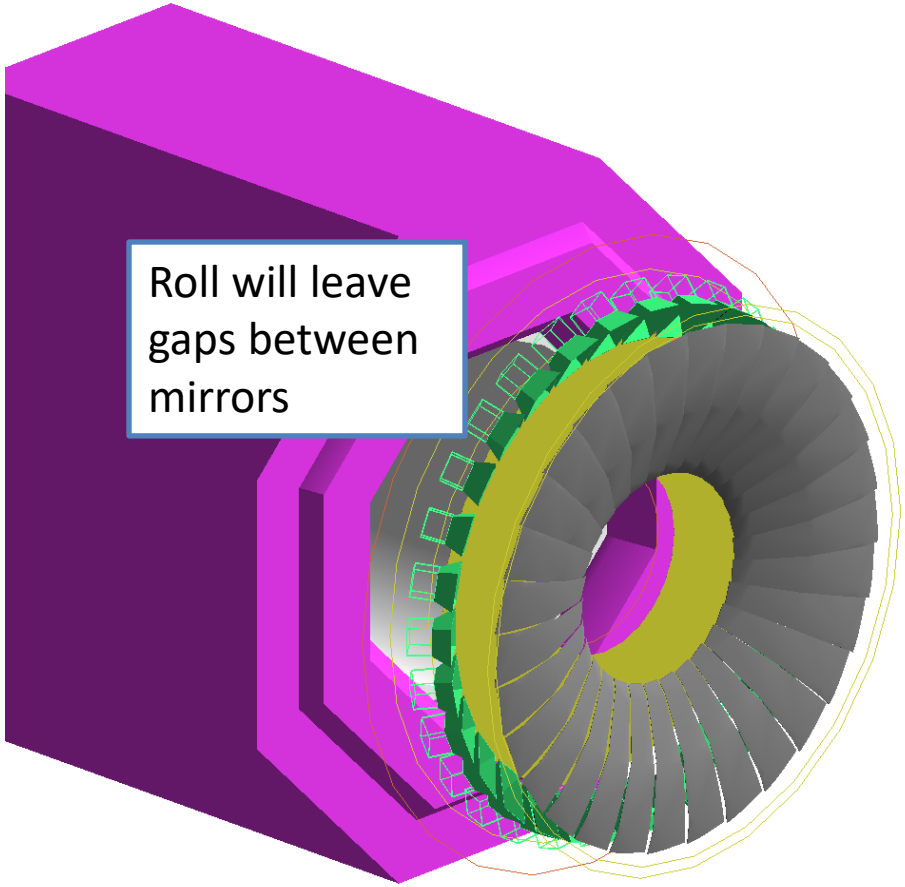
HGC block study



Sim safety factor 2 is not added

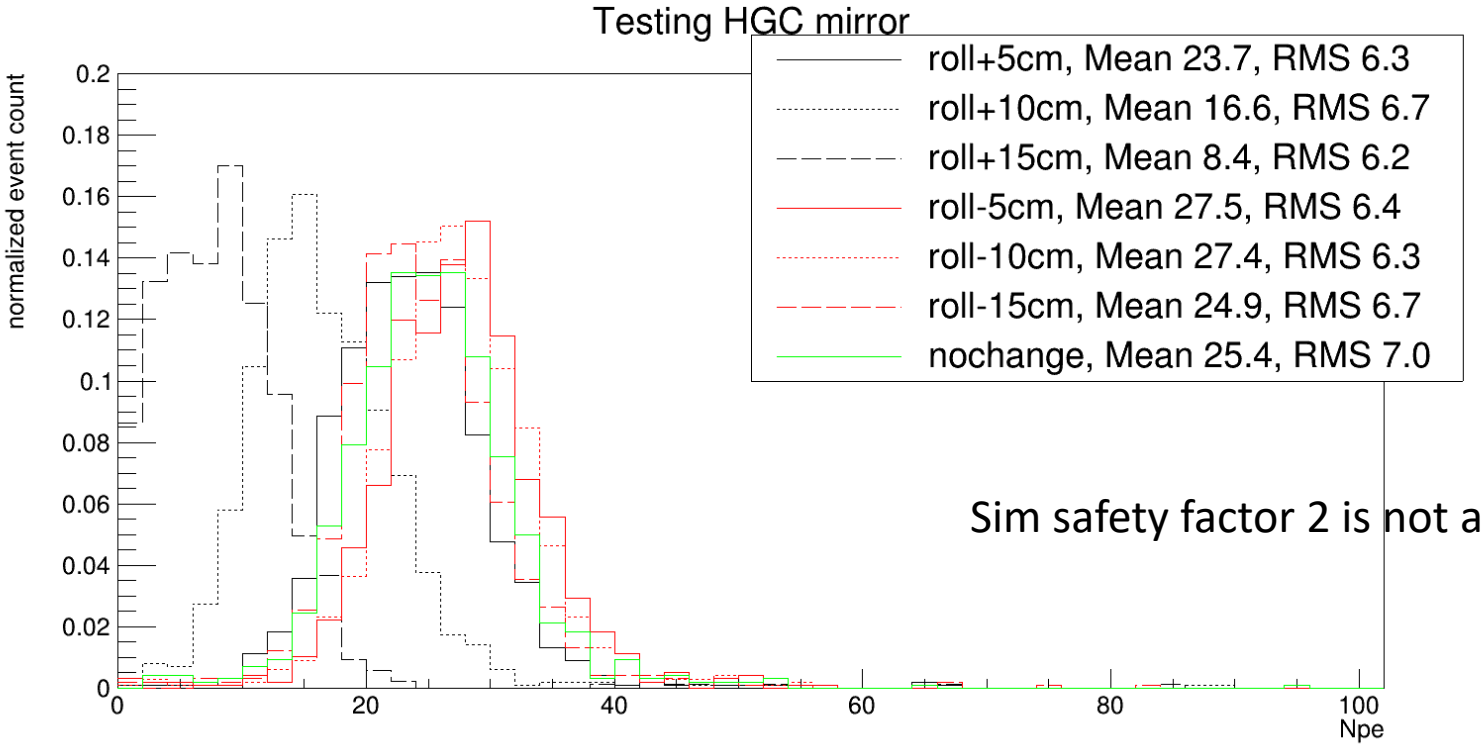
- Testing largest pion bending at P=2.5GeV, theta=8deg,phi=57-63deg,and P=2.5GeV, theta=14.8deg,phi=67-73deg
- Mirrored block can recover performance pretty well
- Next to test SIDIS_NH3 setup and how block affects detectors behind

HGC mirror study



- The goal is to understand mirror misalignment tolerance and further optimization
- For SIDIS_He3 setup, testing “roll” now.
- Do “yaw” and “pitch” later. Then SIDIS_NH3 setup

HGC mirror study



Sim safety factor 2 is not added

- One type of charged pions is sensitive to one direction of roll, but of course HGC needs to be careful with both
- More study needed

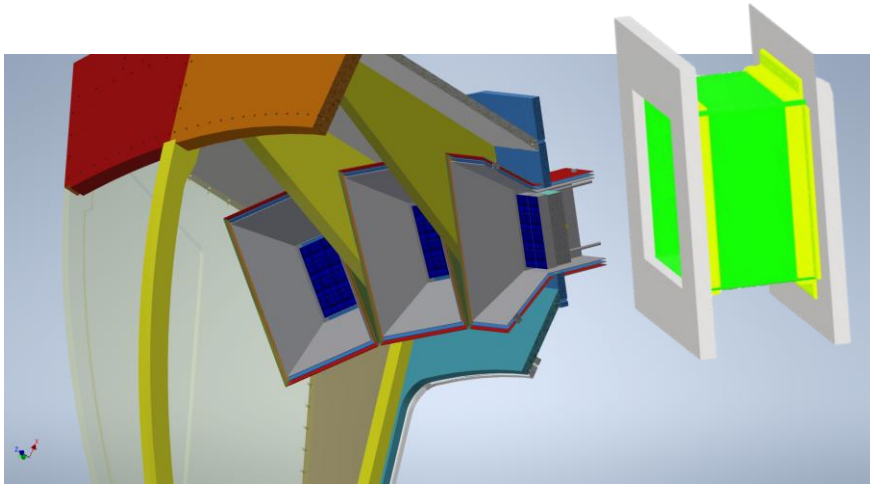
Engineering work

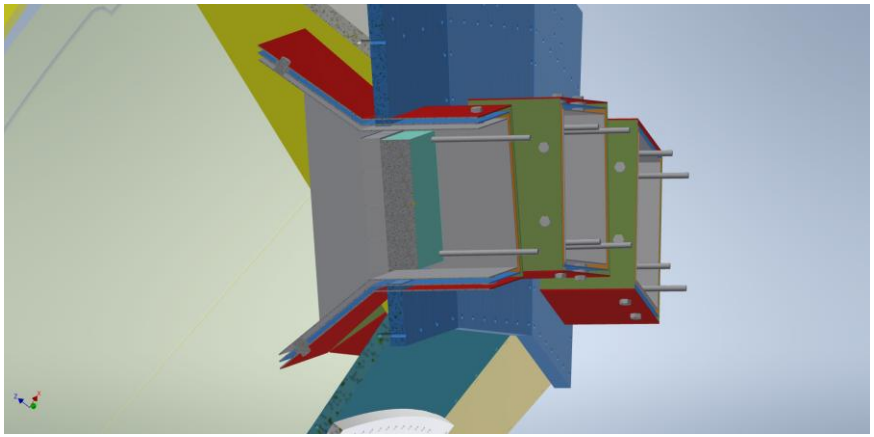
Monthly meetings between Duke and Regina to finalize parts of HGC design not incorporated in the prototype

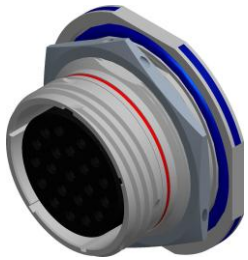
- Ongoing
  - readout assembly as pressure and light seal enclosures
  - Vessel materials list for bulk item order
- Next
  - Mirror mounting
  - Other small things

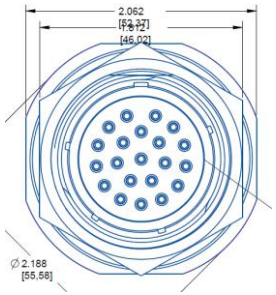
Design and test readout assembly

- Aluminum square housing
  - fix onto the blue plate by O-ring and/or epoxy
  - Magnetic shielding mounted on the housing
- Aluminum cap will mount electronic board with PMTs
  - use O-ring 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









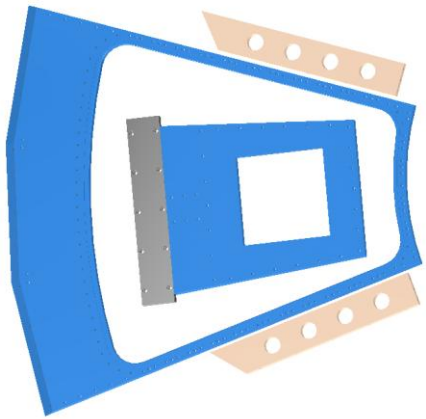
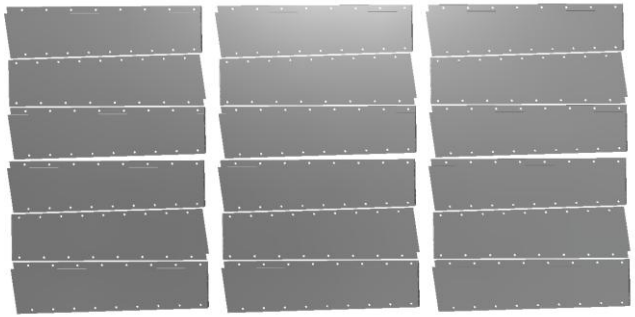
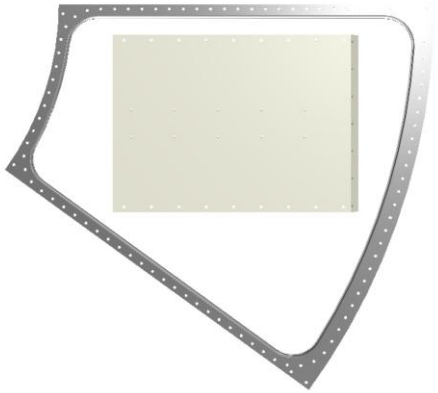
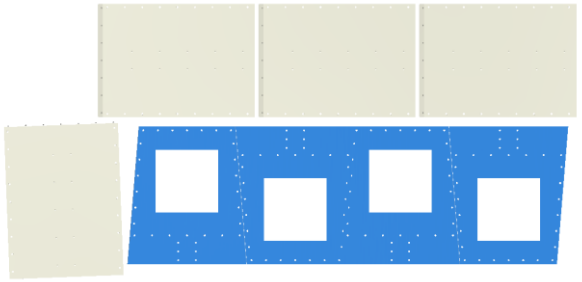
Make a small prototype and do standalone test first

Mark Emamian
(Duke Engineer)

Vessel materials list

- Fit parts into rectangle shaped Al plates to minimize waste

dimension	Quantity	mat
96x48x1	2	6061-T6
96x48x1	5	6061-T6
51x50x1	10	6061-T6
72x48x2	8	6061-T6
62x48x2	5	6061-T6
52x48x1	10	6061-T6
55x55x0.25	10	6061-T6
45x45x0.04	10	2024-T3

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

- As of mid-December, 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
- Funds will be released by CFI only after the ICRADA is in force

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, but we are waiting for funds to be transferred by CFI before proceeding further.
- RFT assumes we purchase bulk items (aluminum, nuts & bolts, etc) in 2025, with machining and pressure testing to occur 2026–27, delivery to JLab in 2027–28