SoLID Heavy Gas Cherenkov Update

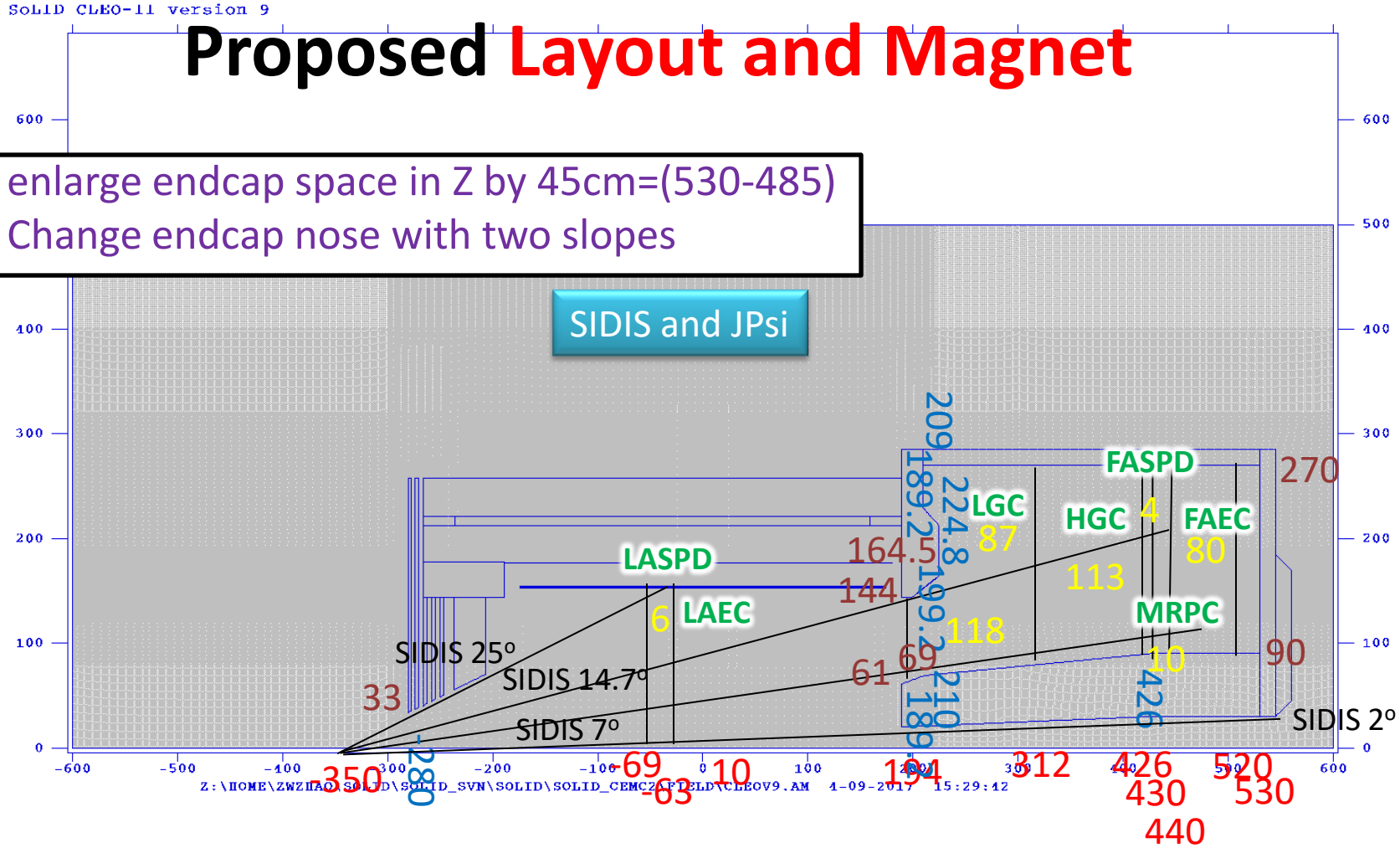
Zhiwen Zhao

for HGC group

SoLID Collaboration Meeting. June 29, 2017

Proposed Layout and Magnet

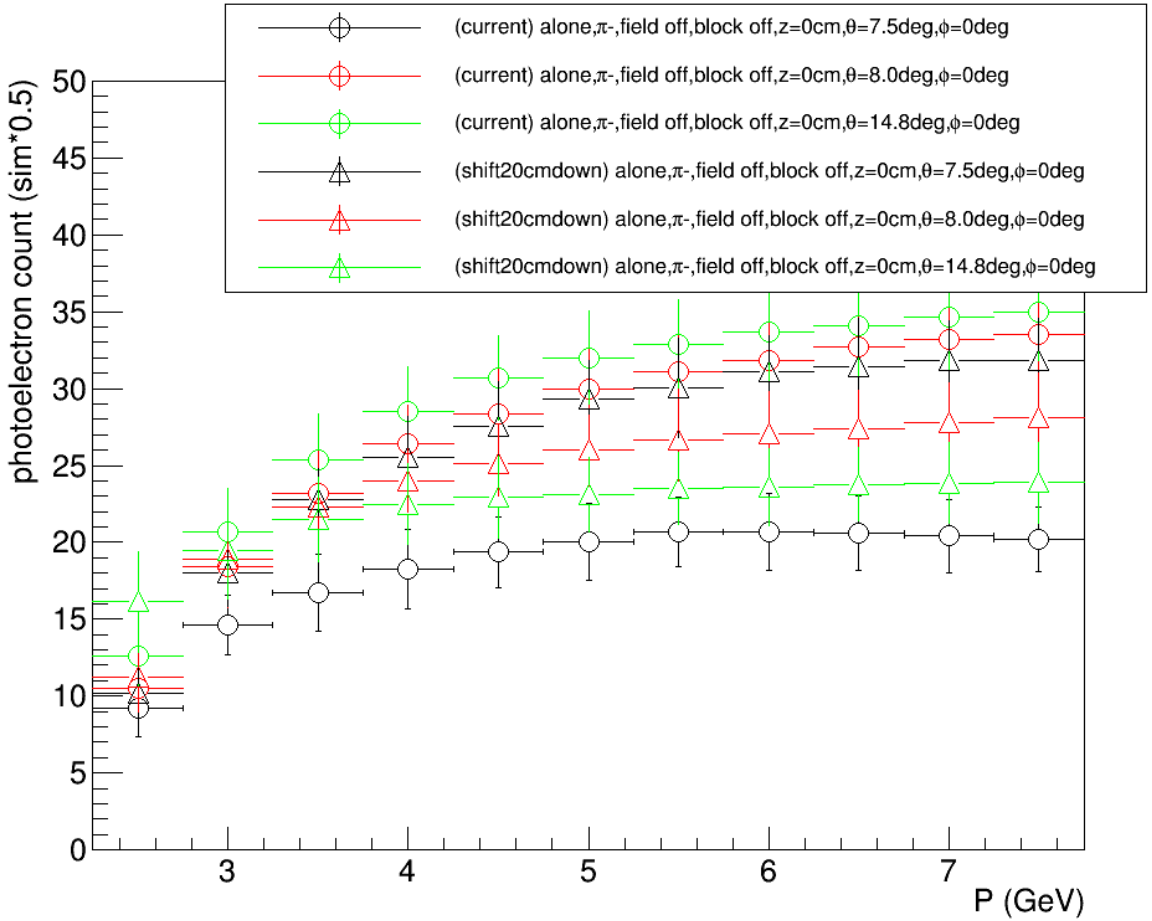
enlarge endcap space in Z by 45cm=(530-485)
Change endcap nose with two slopes



HGC is expected to move 20cm downstream
It's optics needs to be tuned for the new location

First attempt at 20cm downstream

- No field, pions from at target center
- Optimize for 7.5 degree
- Obtain similar performance, need more tuning
- Only He3 case here, need to check NH3 case



Tuning engineering design

- 3D print of one sector at 1/10 scale, the structure seems sound
- More tuning after updating design at new location

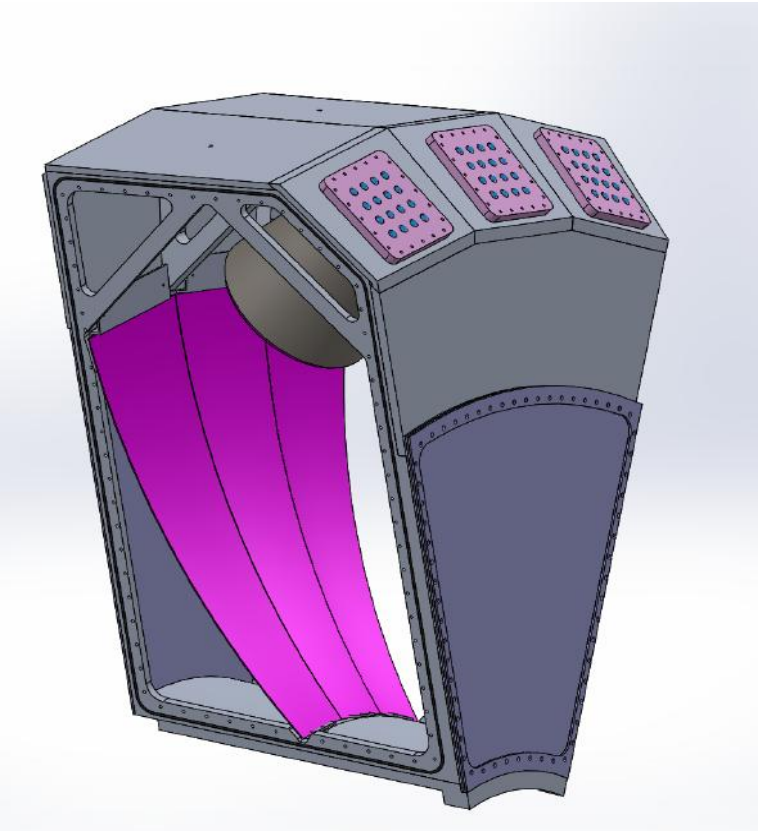
Gary Swift, Duke

HGC Prototyping Update

C$100k grants allow the U.Regina group to construct one SoLID HGC module for testing.

Questions to be addressed:

- Enclosure deformation at 1.5 atm operating pressure (investigate design and metal alloy options).
- Performance of the O-ring seals against adjacent units.
- Performance of thin entrance window in terms of light and gas tightness (test several options).



Conceptual design by Gary Swift, Duke U.

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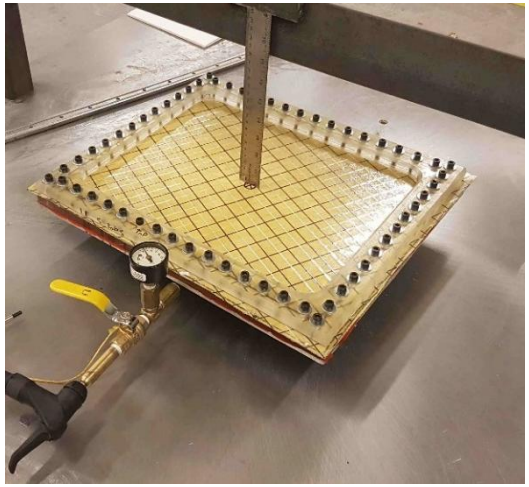
Progress since March 2017 meeting

HGC Entrance Window Pressure Tests

- **We purchased rolls of 5mil mylar and 12mil kevlar from Challenge Sailcloth, recommended to us by Dave Meekins.**

Photo of 2nd test setup with epoxy around circumference, which gave better performance.

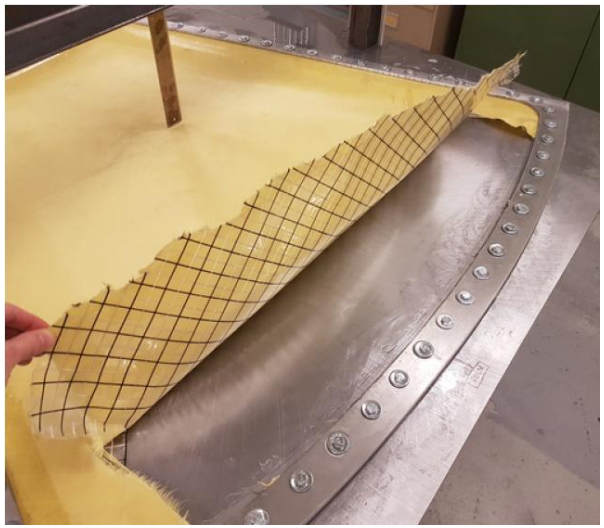


3rd test setup with two layers of kevlar-mylar bonded with epoxy.

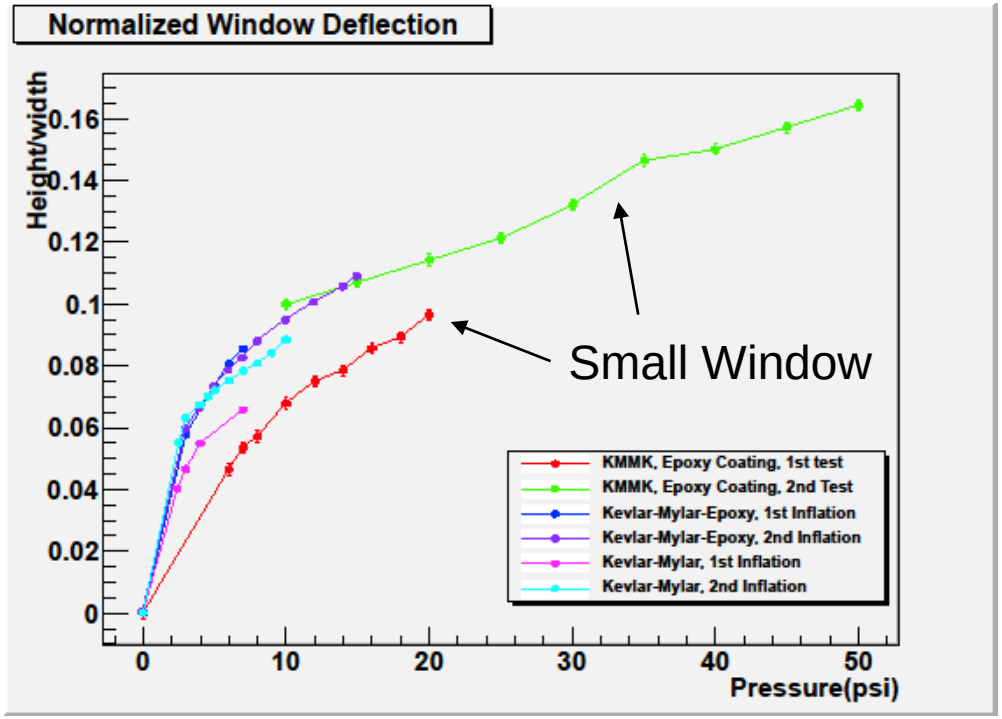
- Based on promising results with Kevlar-mylar sailcloth, and use of epoxy, we designed a scaled down window to save material on further testing.
- We estimate that this window requires ~4x pressure to match material tension (tension = pressure * radius of curvature).

HGC Entrance Window Test

Photo showing how window material failed in 2nd test.



- Use of epoxy shows significant improvements.
- Maximum pressure of 3.4 atm (overpressure) on small window.



- Deflection normalized to frame width for comparison.
- Large initial slope suggests we might try pre-stretching the material.

radiation testing in hall

Rory Evans
Ryan Ambrose Samip Basnet Derek Gervais Garth Huber
Geremy Lague Wenliang Li Dilli Paudyal Lorenz Weber

University of Regina

Ongoing Testing

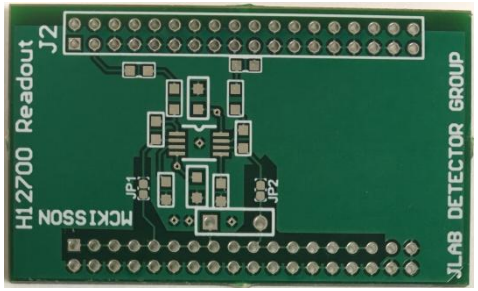
- ❑ Pre-stretching of window material to reduce deflection.

- ❑ Sturdier frame to address flexing.

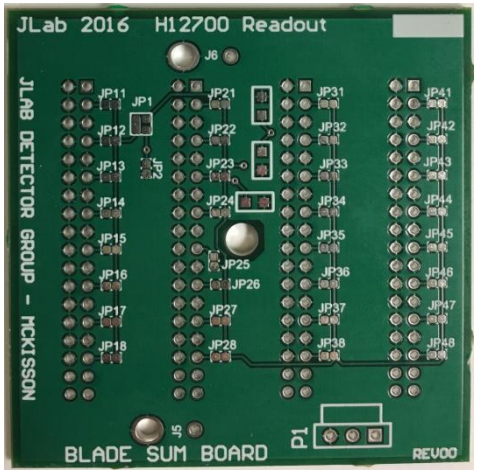
- ❑ New clamp arrangement to address material slipping.

Readout System

- Blade sum board designed by Jack McKisson
  - Jack has finished some prototype of the blade sum board prototype
  - Rebuilding and testing a DAQ system with these blade sum boards for the PMT and shielding study
- MAROC readout system
  - Hall B test platform for CLAS12 RICH has been updated to MAROC readout system
  - After they finish their test by September, we will borrow the platform to do some test with our MAPMTs



Blade board
(with three different sum configuration: 2, 4, 8 channels)



Sum board

Gas and gas system

- Gas is expensive

  ~$200/kg for large amount

  ~$400/kg for small amount (10kg for test)

- Need a lot
  - HGC needs 20m3*15kg/m3=300kg fill once at 1.5atm
  - BigBite RICH needs ~2m3*10kg/m3=20kg at 1atm
- Gas system
  - BigBite RICH may have a recycling system with no fancy filtering. But 5% CO_2 mixed
  - How expensive is fancy filtering?
  - For HGC, CO_2 goes to very top of two-halves, extraction?
  - pressure > 1.5atm to compensate impurity?

Ongoing discussion

Mirror coating update

- received all equipment for evaporating the samples: the electron-gun with all equipment and the ion gun with all equipment. We are in the process to install it in the evaporator.
- do not yet have a full-size frame and device that rotates the frame within the evaporator. We are waiting to receive the monies for our grants.

Summary and Outlook

- We are making progress on different aspects.
- Tuning design for the new location is a high priority
- Put window in hall for radiation testing
- Working with LHC to prepare testing prototype
  - Order small amount of C4F10, ready to change from LGC gas
  - DAQ solution?
  - Installation and testing this fall?