

SoLID Heavy Gas Cherenkov Update

Zhiwen Zhao

for HGC group

SoLID Collaboration Meeting. May 8, 2023

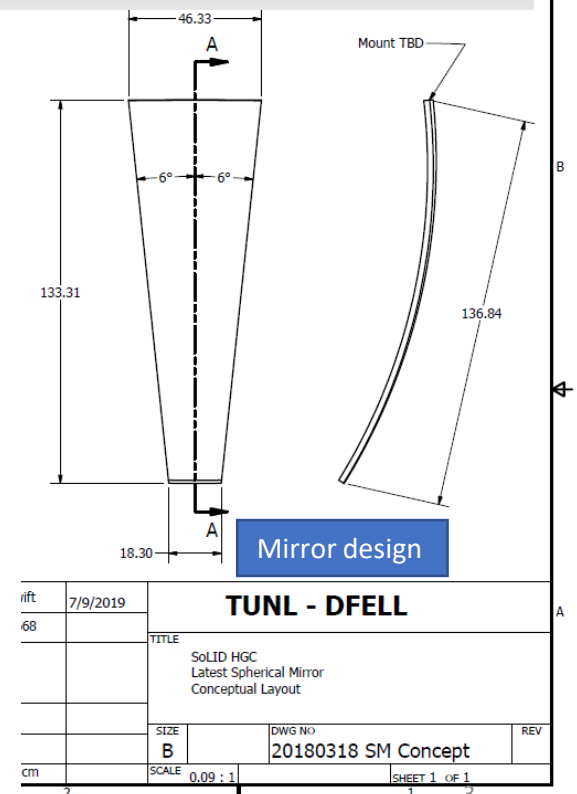
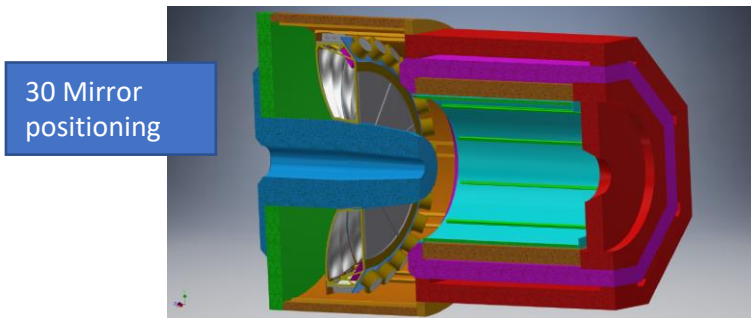
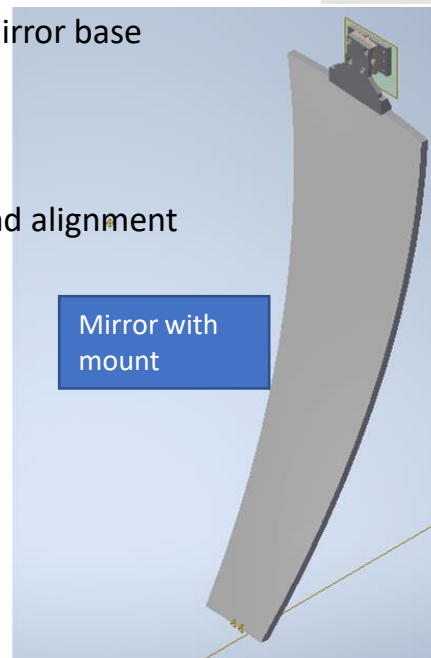
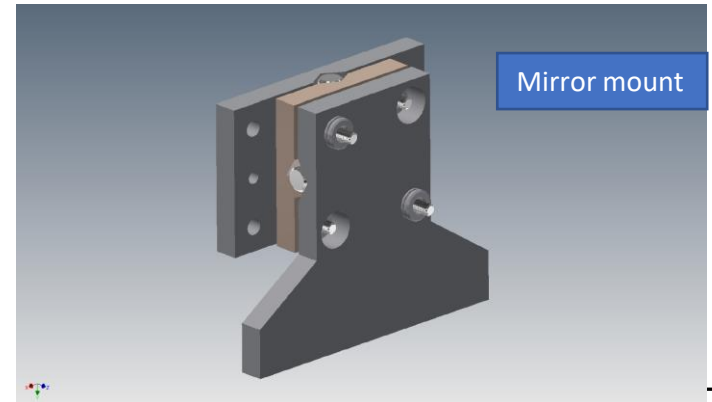


Outline

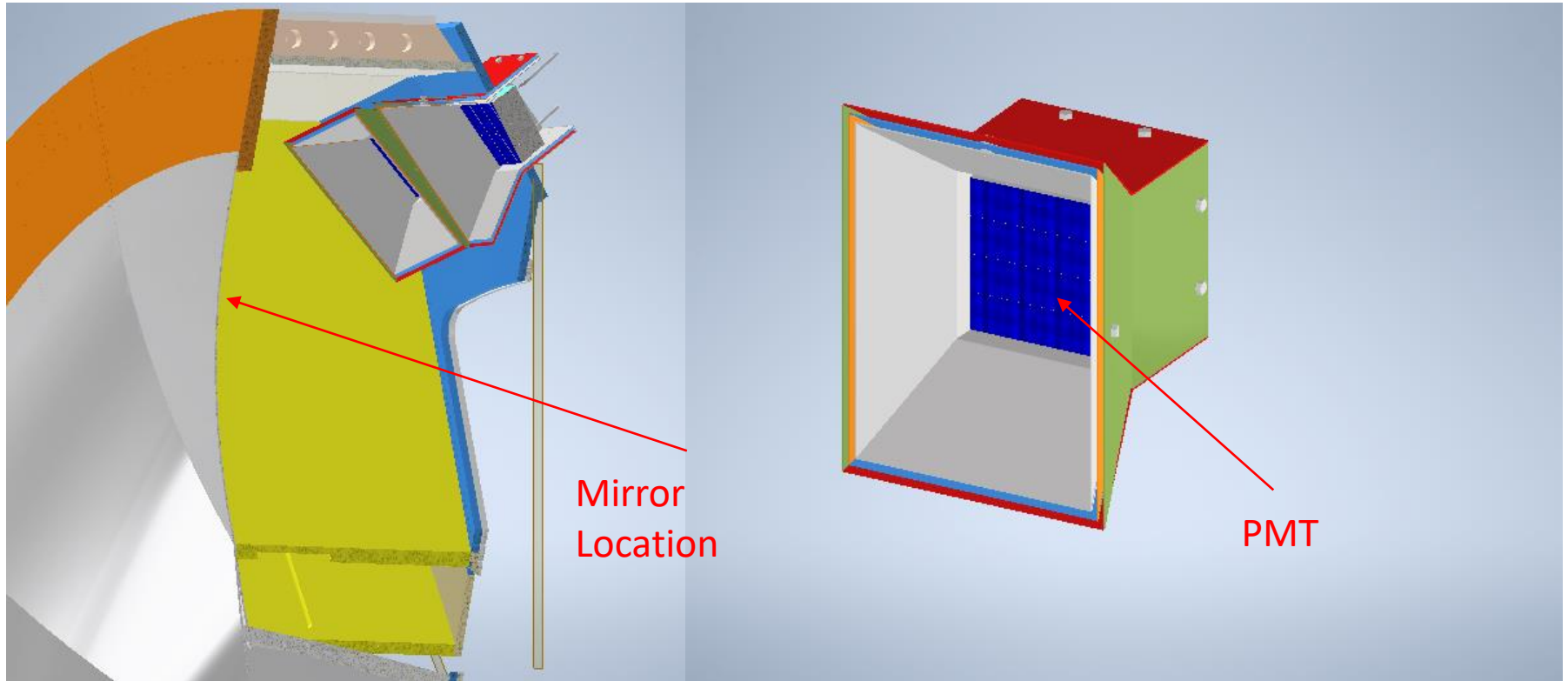
- HGC mirror mount
- Maroc sum test
- SBU mirror coating status

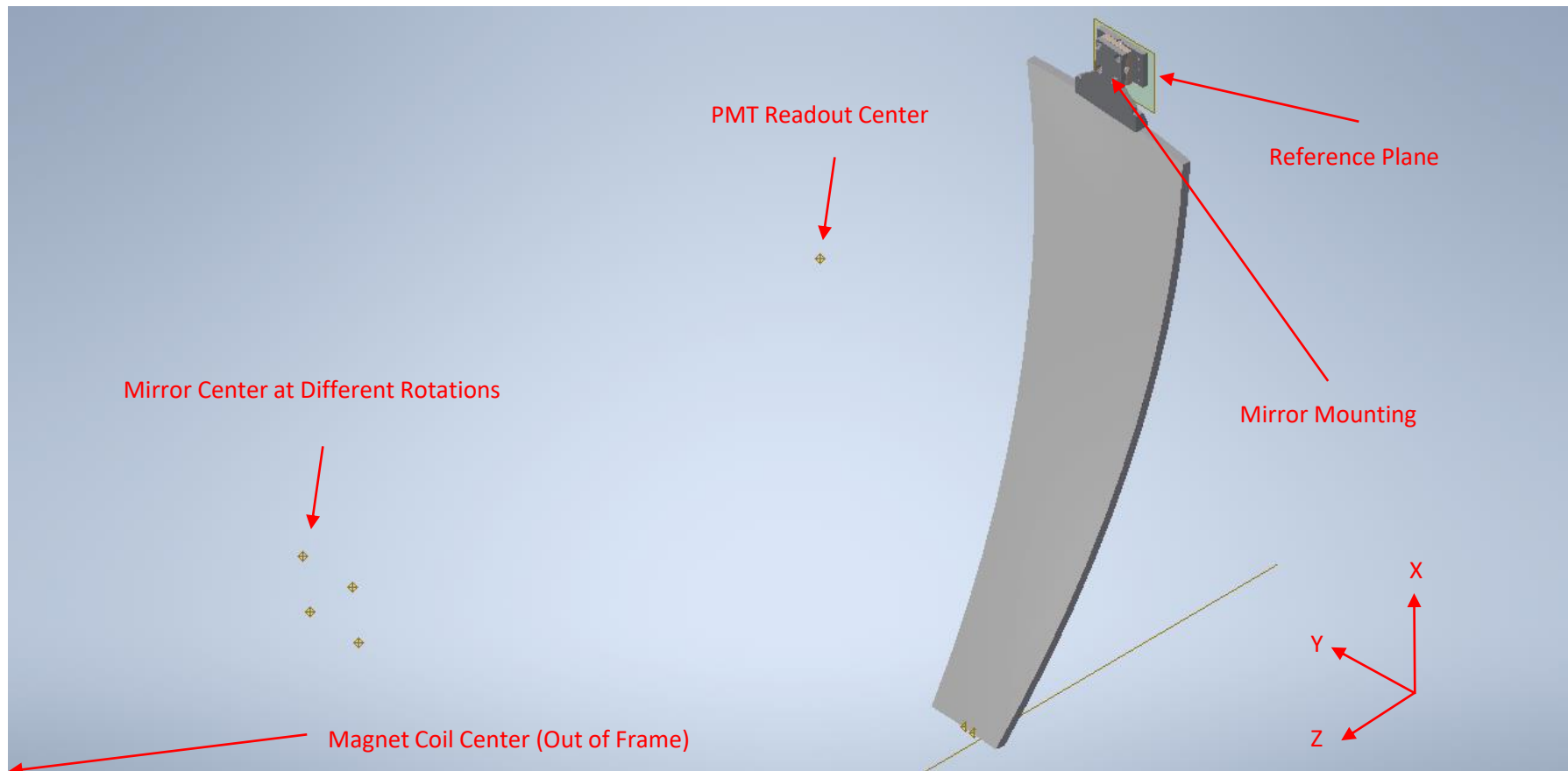
SoLID HGC mirror mount

- HGC mirror has large size 133x46cm and 0.45m²
- Mount from the mirror outer radius end only and leave inner radius end free to avoid stress
- Mount needs to hold mirror stable for all 30 positioning
- Readout fixed and mirror mount does all optical alignment
- Prototyping plan:
 - Obtain a mockup mirror base (synergy with mirror base study, could be just a flat piece)
 - Build a mirror mount
 - Build a testing stand
 - Mount the mirror base and test its stability and alignment using a laser pointing system



Updated Cone Shield Design

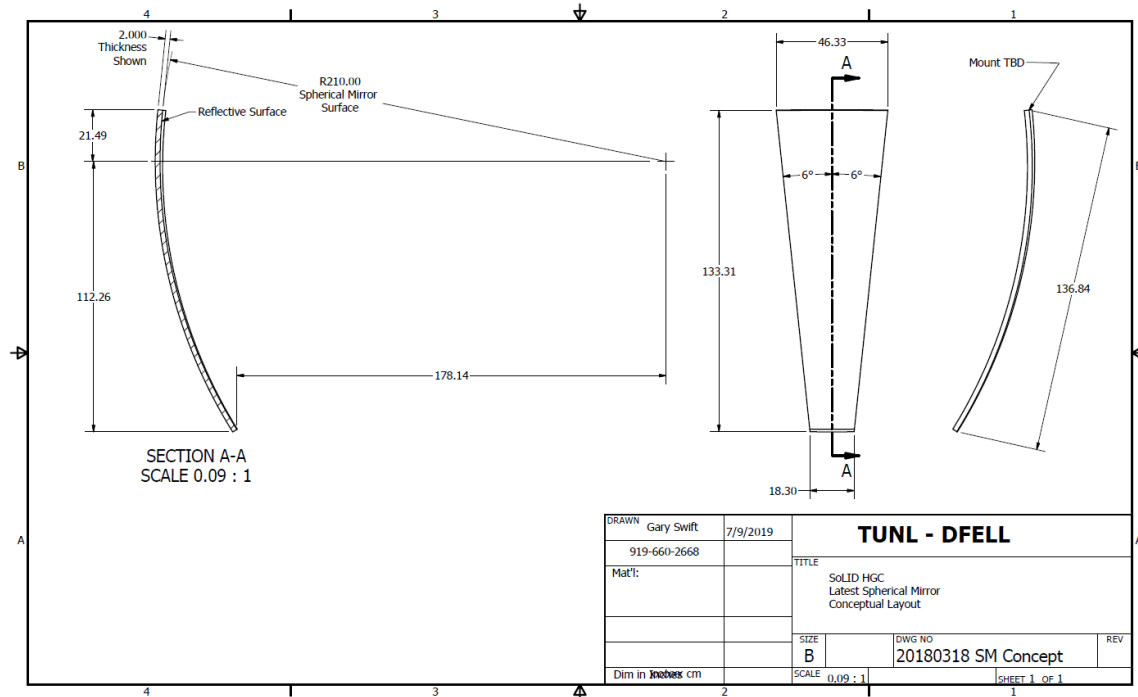




HGC mirror CAD

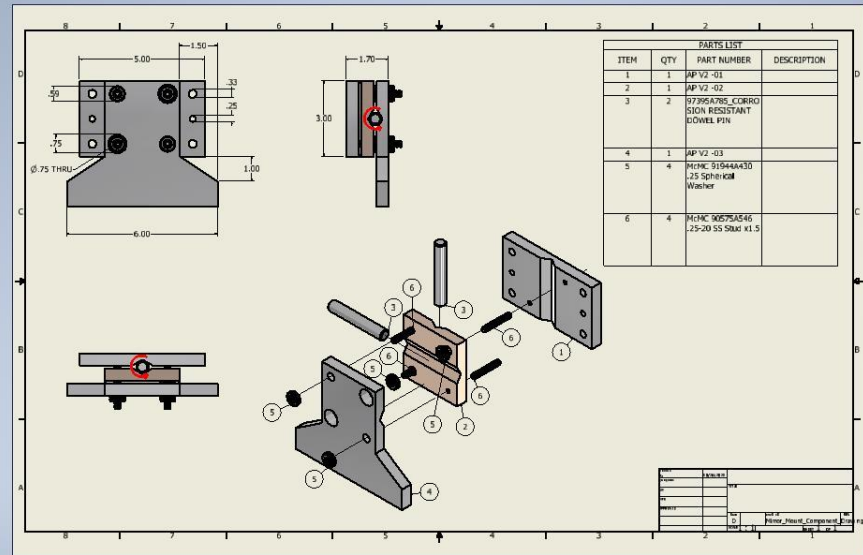
Mockup Carbon Fiber Plate

- <https://www.rockwestcomposites.com/4xx-plate-series>
- 0.052 lbs / in³ OR 1.45 grams / cm³
- 24" x 48" x 0.115" \$450



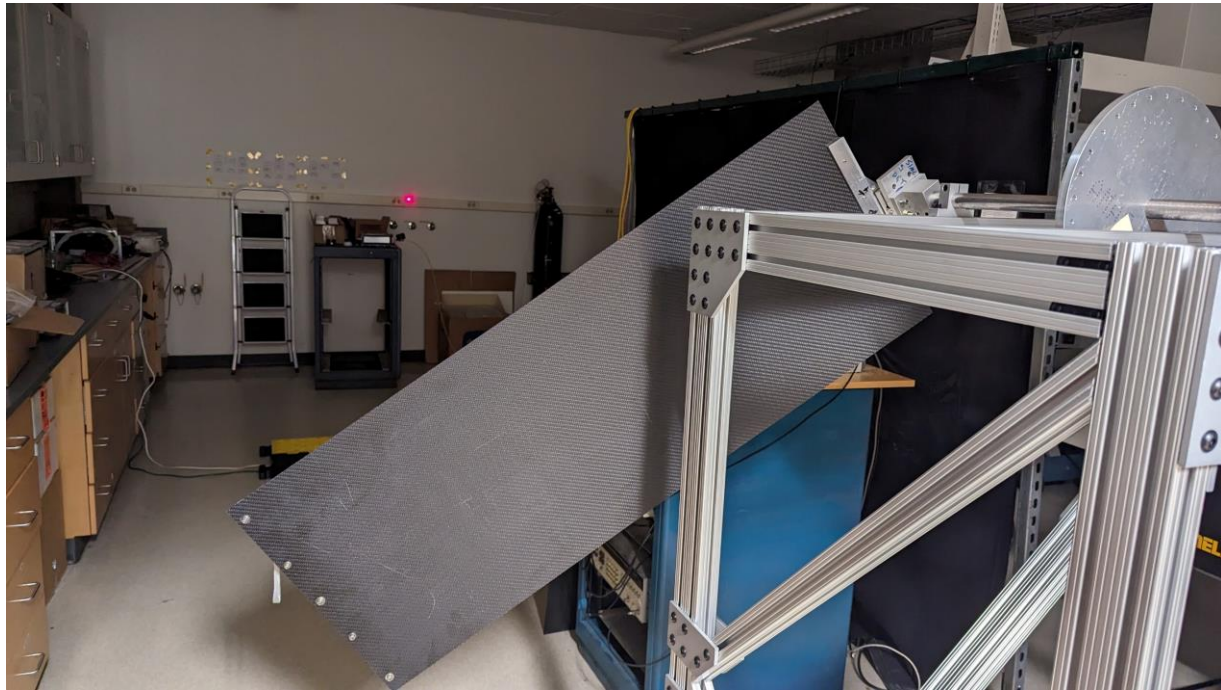
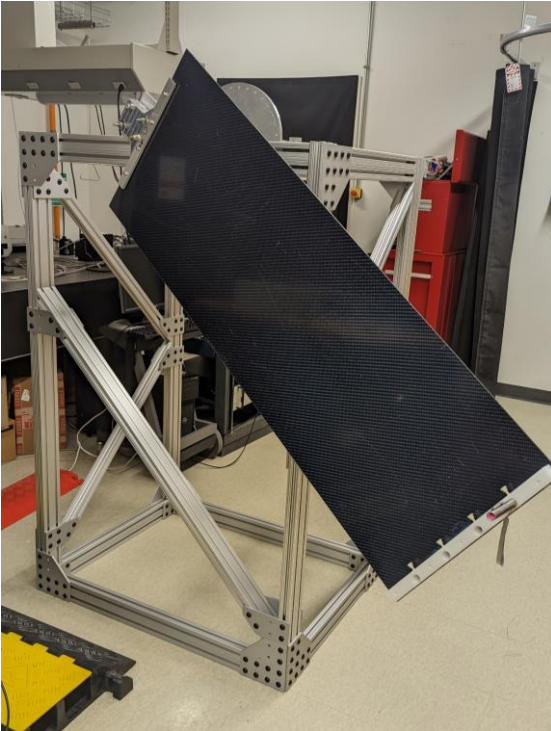
Mirror mount

- 2 direction lever systems in both X and Y
- tilting controlled by adjusting 4 screws

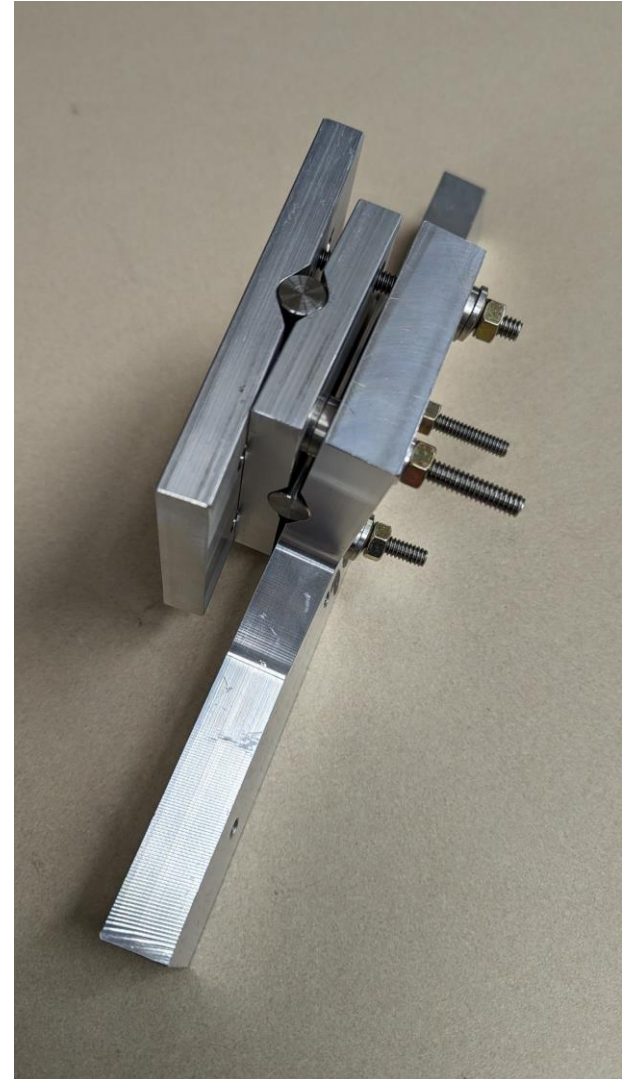
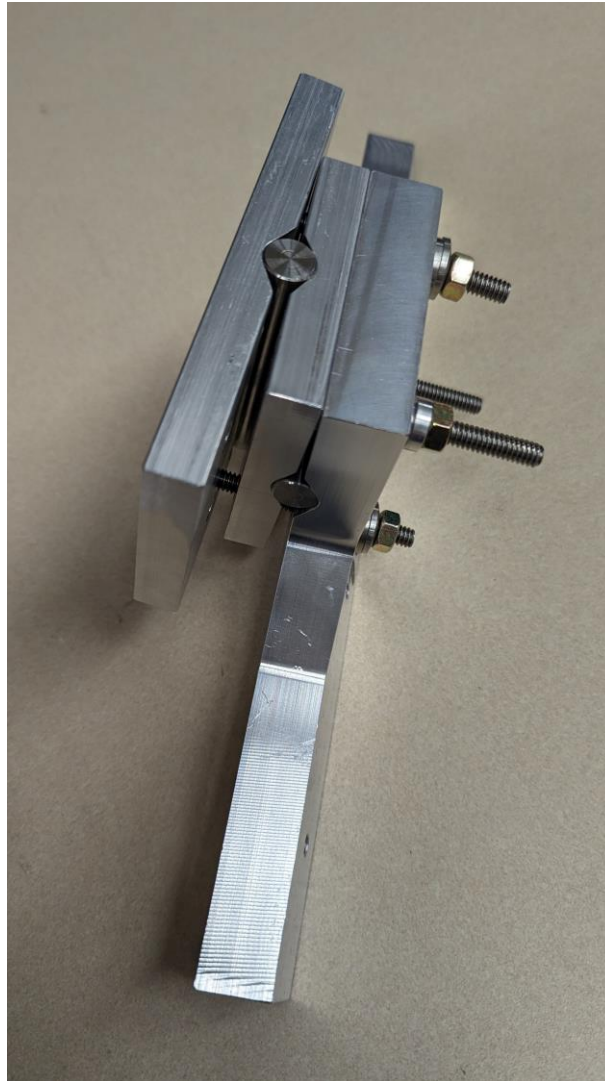


Mirror mount test

- Use a laser pen and attach it directly to the mirror base
- Observe the laser point on far away wall to determine stability and alignment

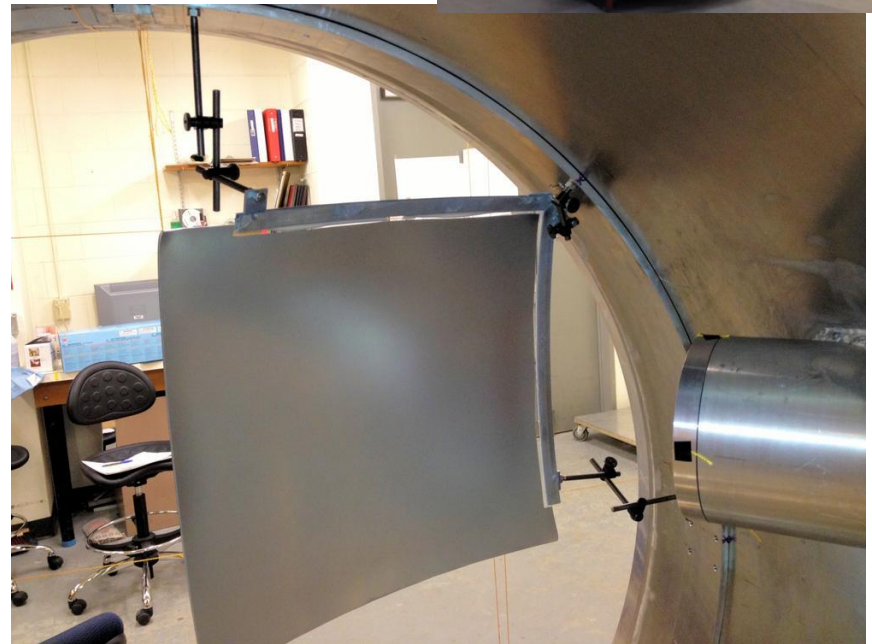
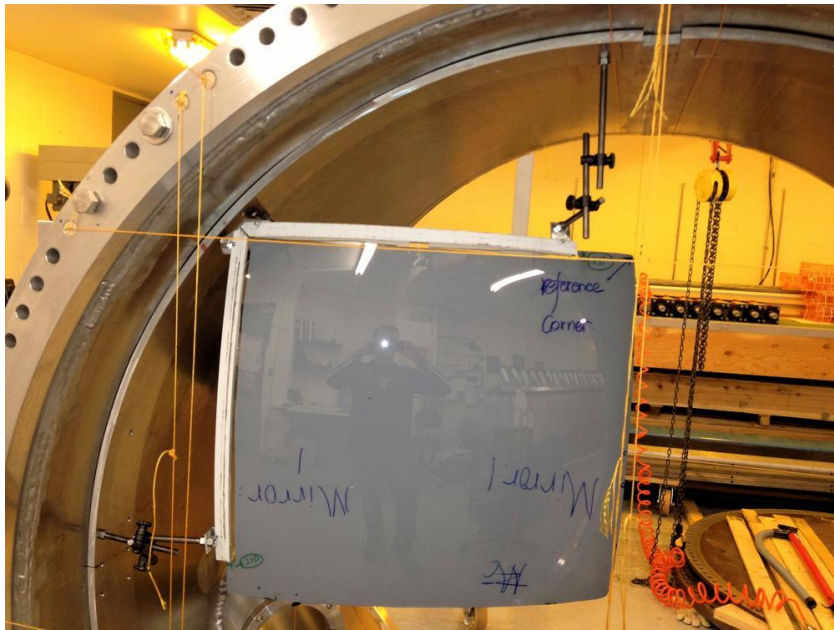
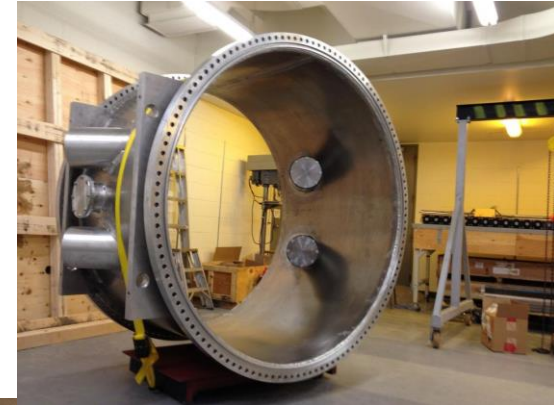


At two extreme positions



SHMS HGC mirror mount

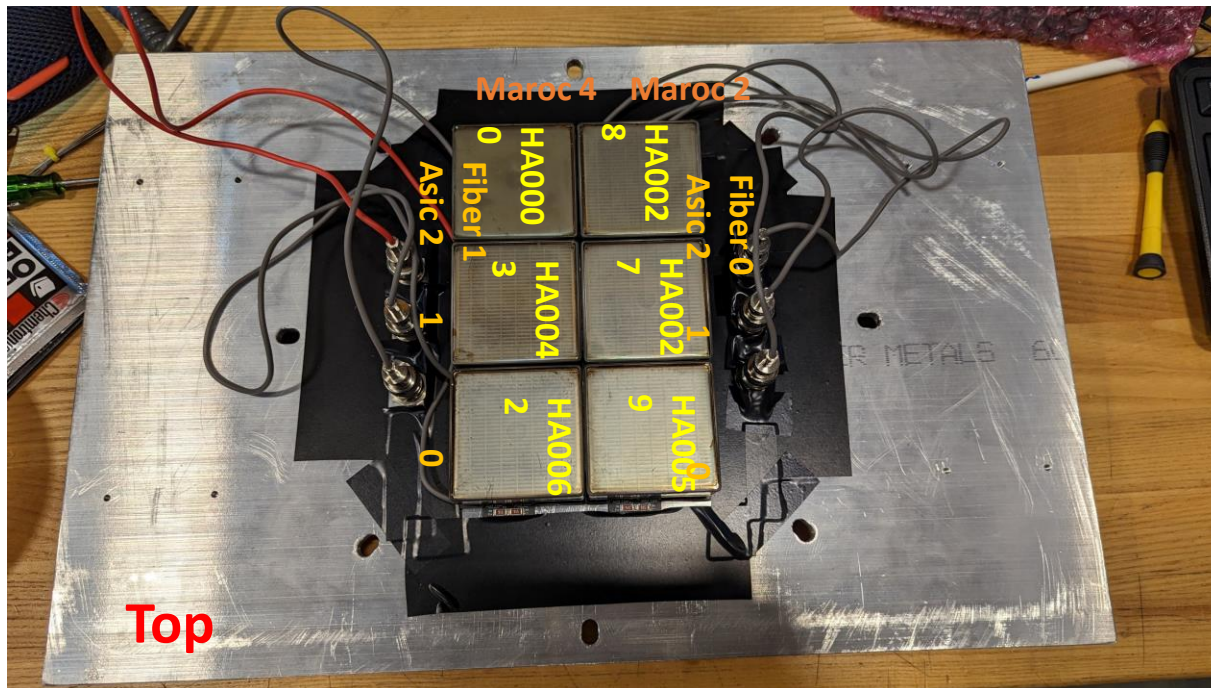
- Made from lab stands re-purposed to make precision mounts, instead of using difficult to control bolts, etc. Can easily be pivoted along multiple axes and locked securely into place.



MAROC sum readout for 2022 hallc beamtest

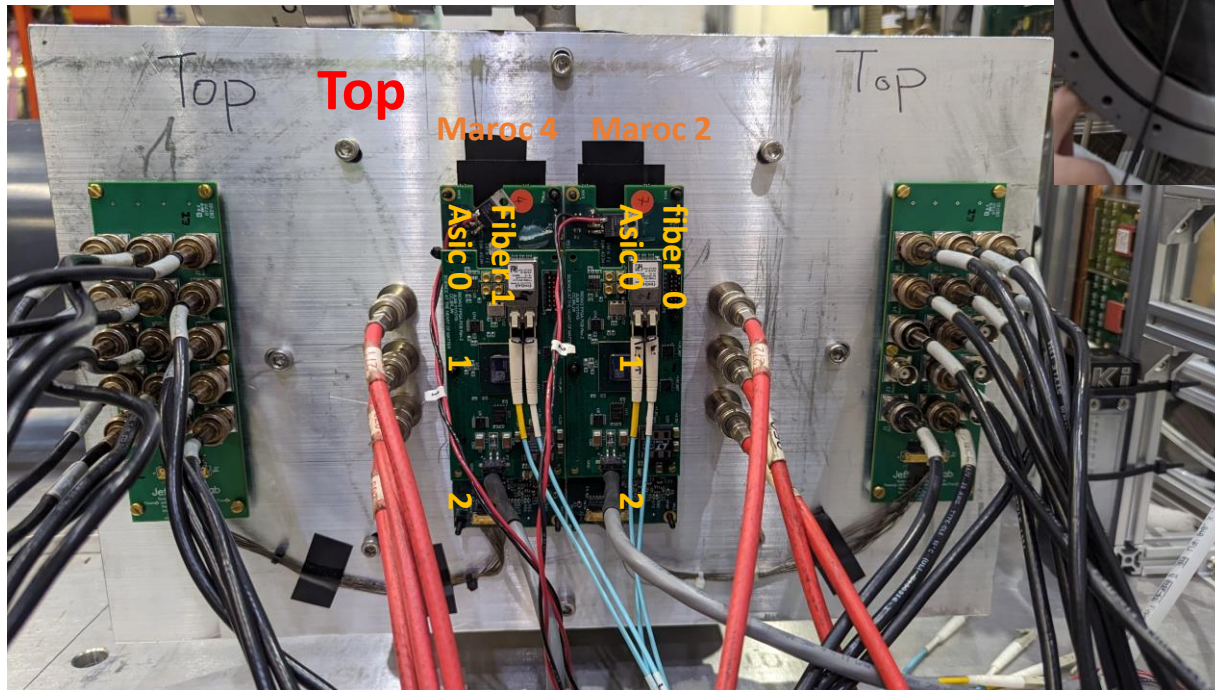
Inner view

HV connector is near PMT
(except HA0028 and HA0027
swapped HV connectors)



MAROC sum readout for 2022 hallc beamtest

Outer view and front view



MAROC sum readout for 2022 hallc beamtest

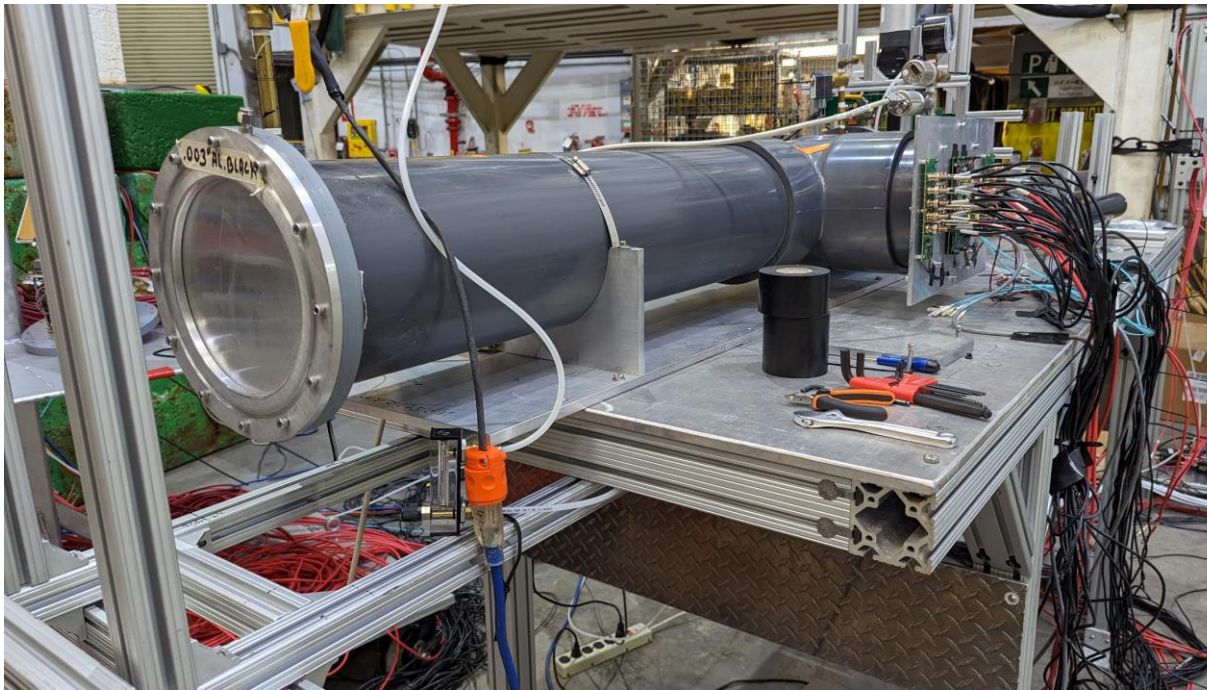
LED test setup:

one 275nm LED placed inside tank and near front tank window, facing the mirror. It's powered and controlled by a function generator

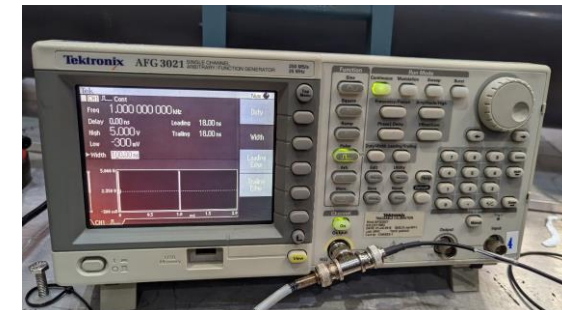
We know NPE by maroc pixel readout hit counting:

LED pulse mode has the condition of each pmt has about 10 NPE (each quad has about 2.5 NPE) per event 1khz LED trigger

LED DC mode has the condition of each pmt has about 1 NPE (each quad has about 1 NPE) per event with 4khz random trigger



LED DC mode: generator in burst mode to mimic DC power, only key parameter is low amplitude, typical at 2.056v or 2.085v

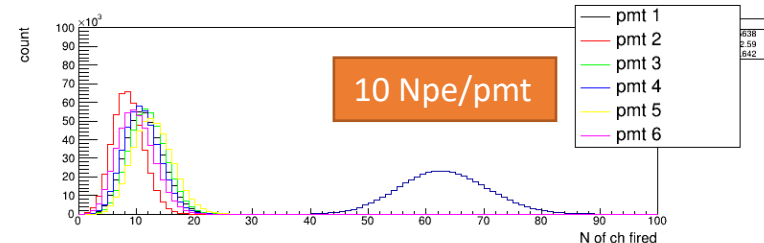
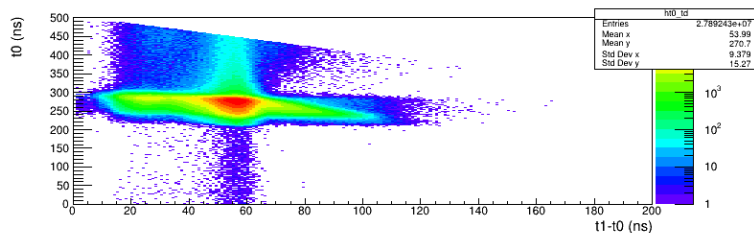
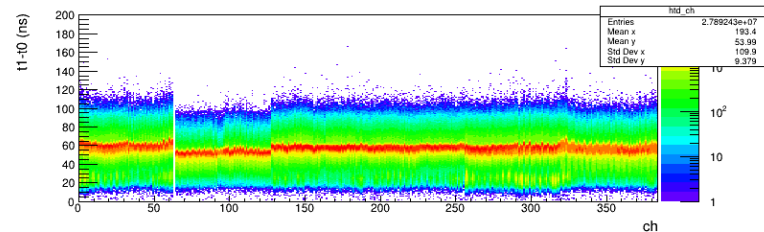
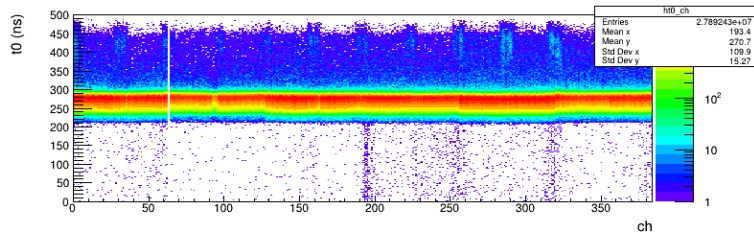
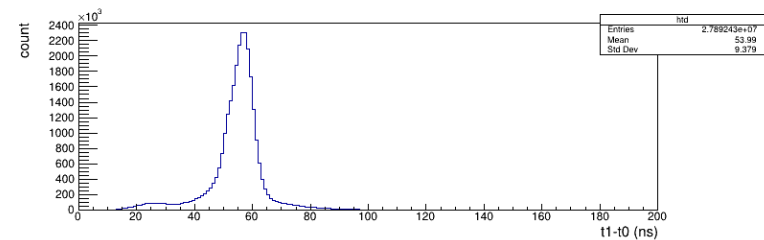
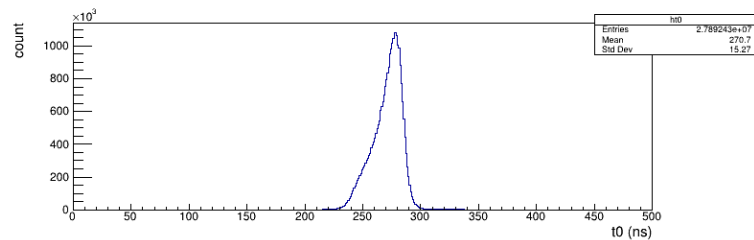


LED pulse mode: generator in pulse mode. Typical setting is 1kHz, 5V and varying wide like 100ns

MAROC sum readout for 2022 hallc beamtest

LED pulse mode

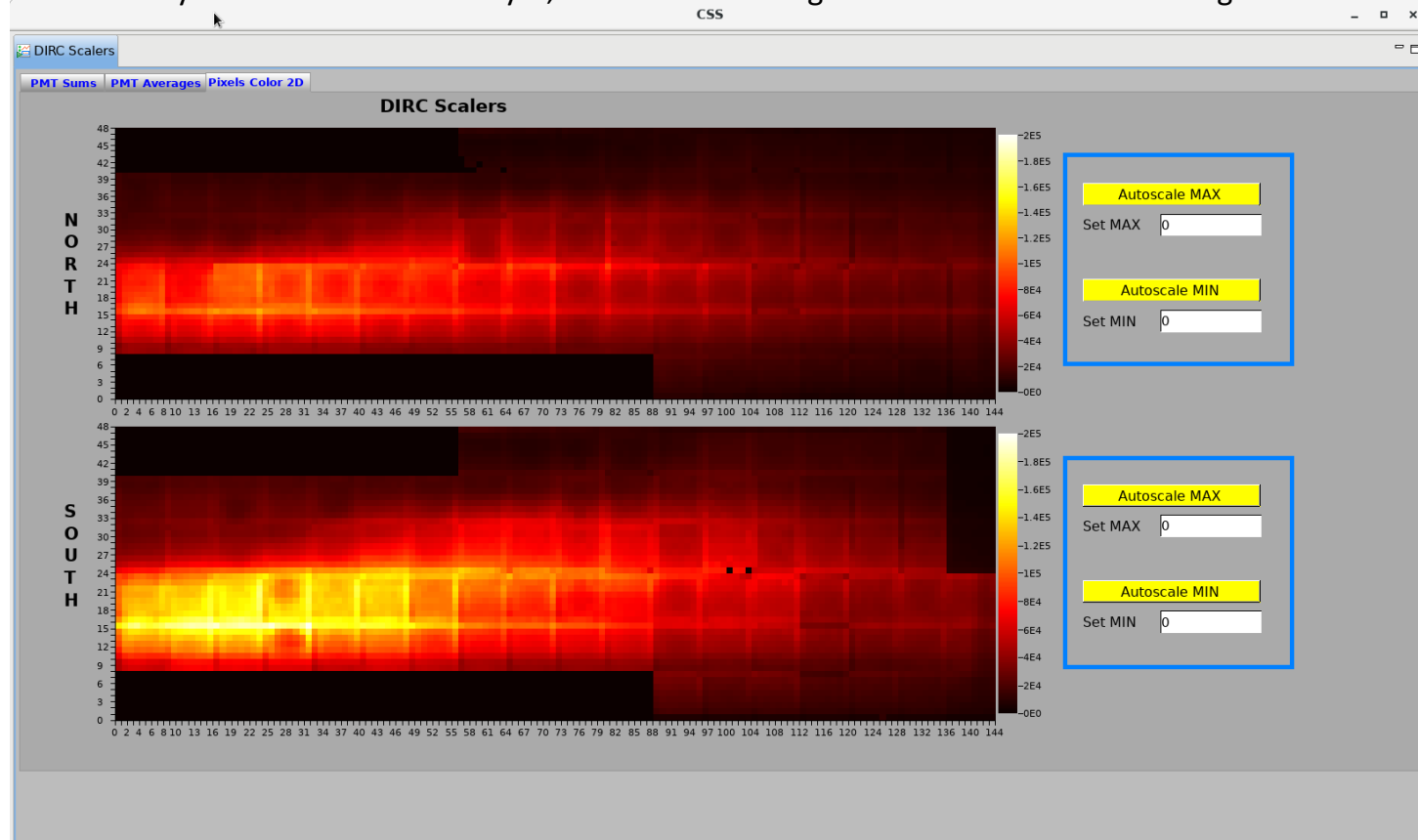
maroc_LED100ns_HV1000v_run3814



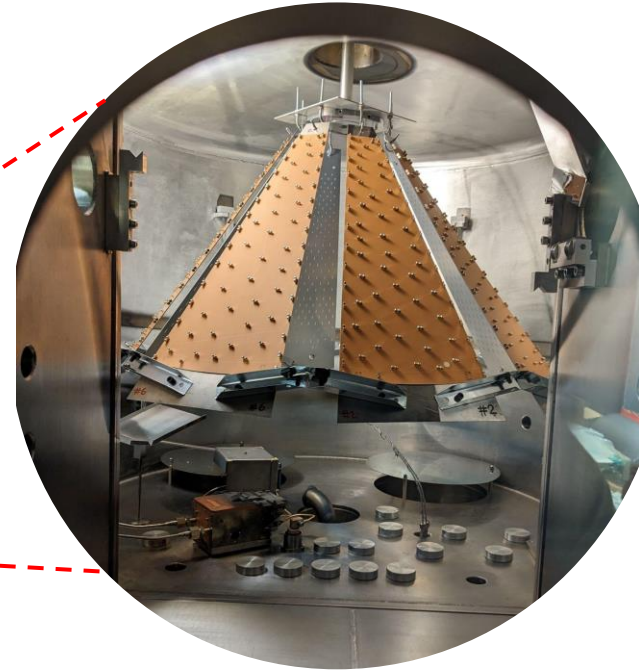
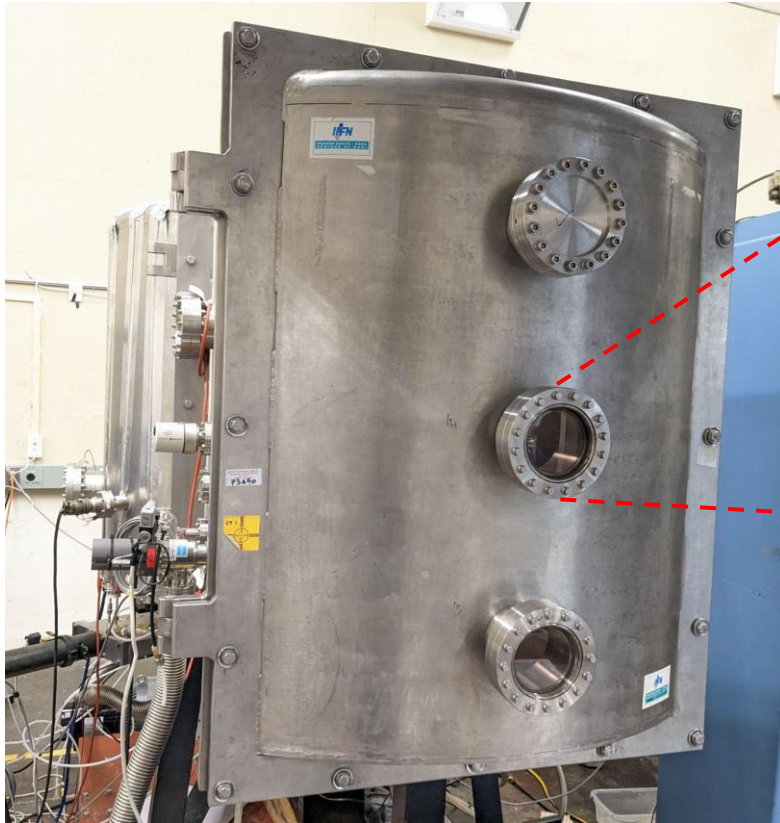
It works well at bench using LED

Even though we didn't get hallc beamtest due to tight schedule, halld maroc high rate test reached 200khz/pixel similar to what we need

- screenshot of the DIRC scaler GUI where you can see the rates go up to 200kHz/pixel on the z-axis for the highest occupancy channels.
- run stably in this mode for several hours with the nominal 1000V and DAC settings that we use in typical running conditions with 3x lower beam current.
- Not much analysis done with the data yet, but the online diagnostics seemed to show things worked reasonably.

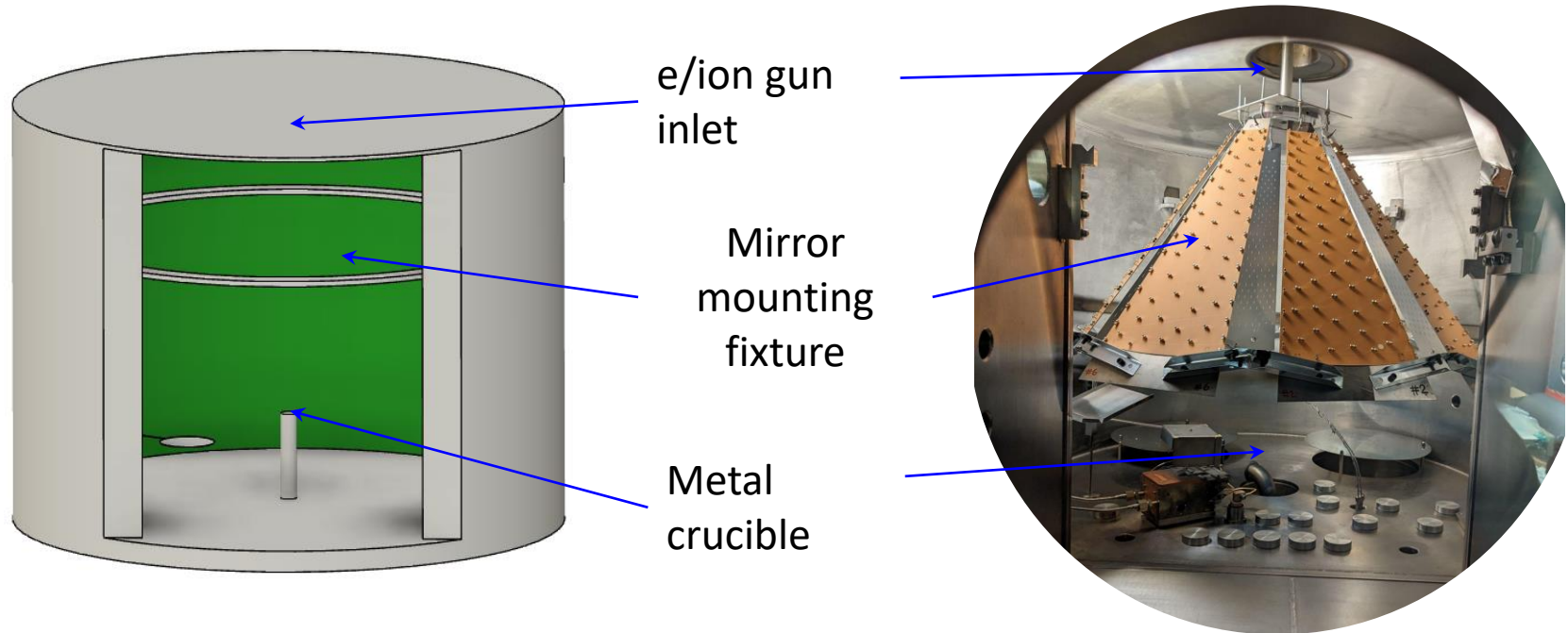


Evaporator at SBU



The SPhinex TPC Cathode paddles 60cm long
Longer HGC or LGC mirrors needs to be
segmented to top and bottom half for
evaporation

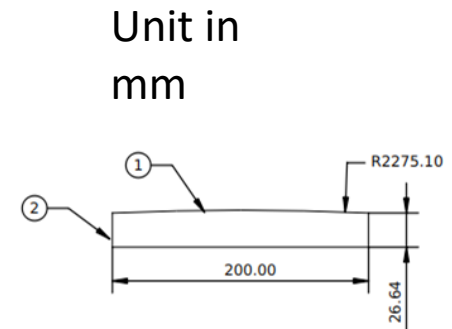
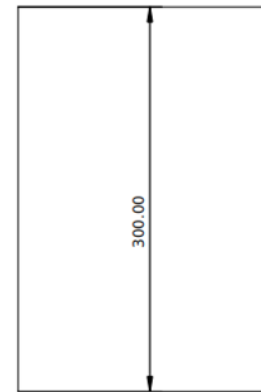
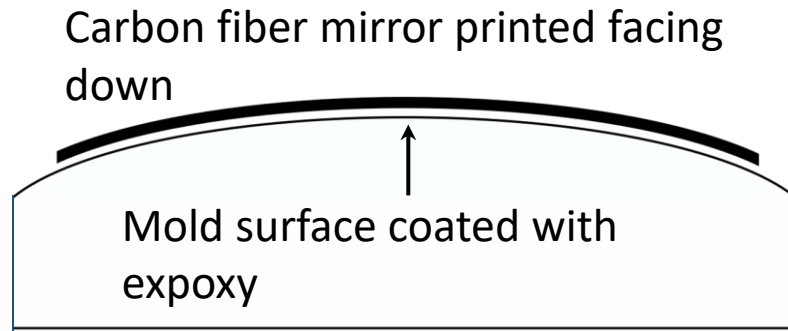
Evaporator at SBU



Goal: challenge the relectivity (on CarbonFiber base/3D print/Lexan film) at FUV (~150 nm)

- synergy with EIC RICH mirrors
- close to coat small sample of CarbonFiber base from CMA (same as RICH mirror base)
- start to explore some mirror quality test options

SBU help with Convex 3D printing (Proposed by Michael)



- **A precision mode will be made for the LGC proto-typing**
 - Quote from SBU machine shop: \$600-\$1000
 - SBU CFNS agreed to pay to the mold production cost

