

LGC update

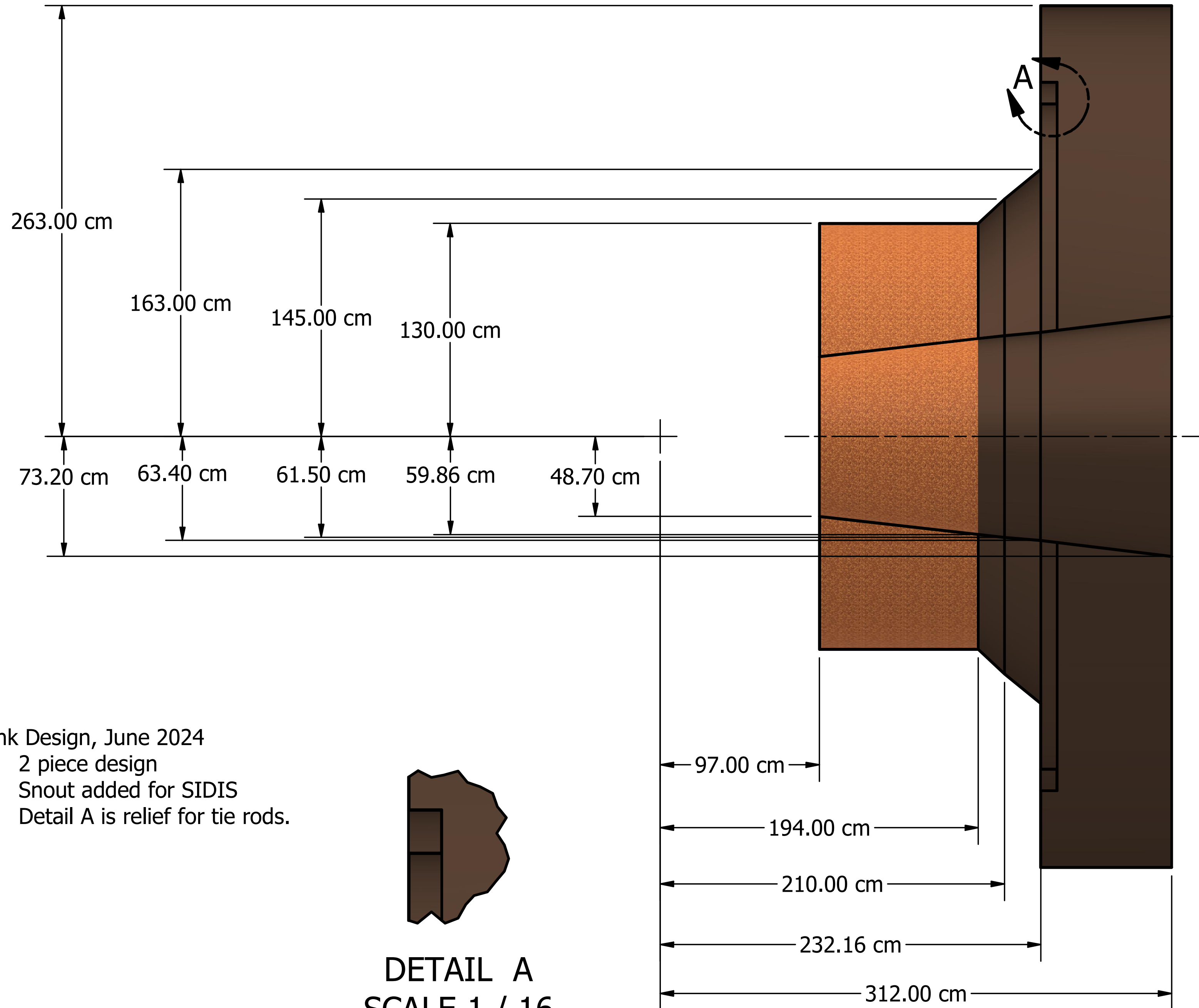
SoLID Collaboration Meeting, Argonne National Lab

Jun 21st, 2024

Michael Paolone (NMSU)

Engineering Design Updates

- Recent work at Argonne (Tom O'Connor, Kevin Bailey)
 - Conforms to simulation parameters:
 - 10cm downstream shift
 - 5cm wire bundle clearance.
- Still need some more exact specs for mounting parameters, and wire clearance.



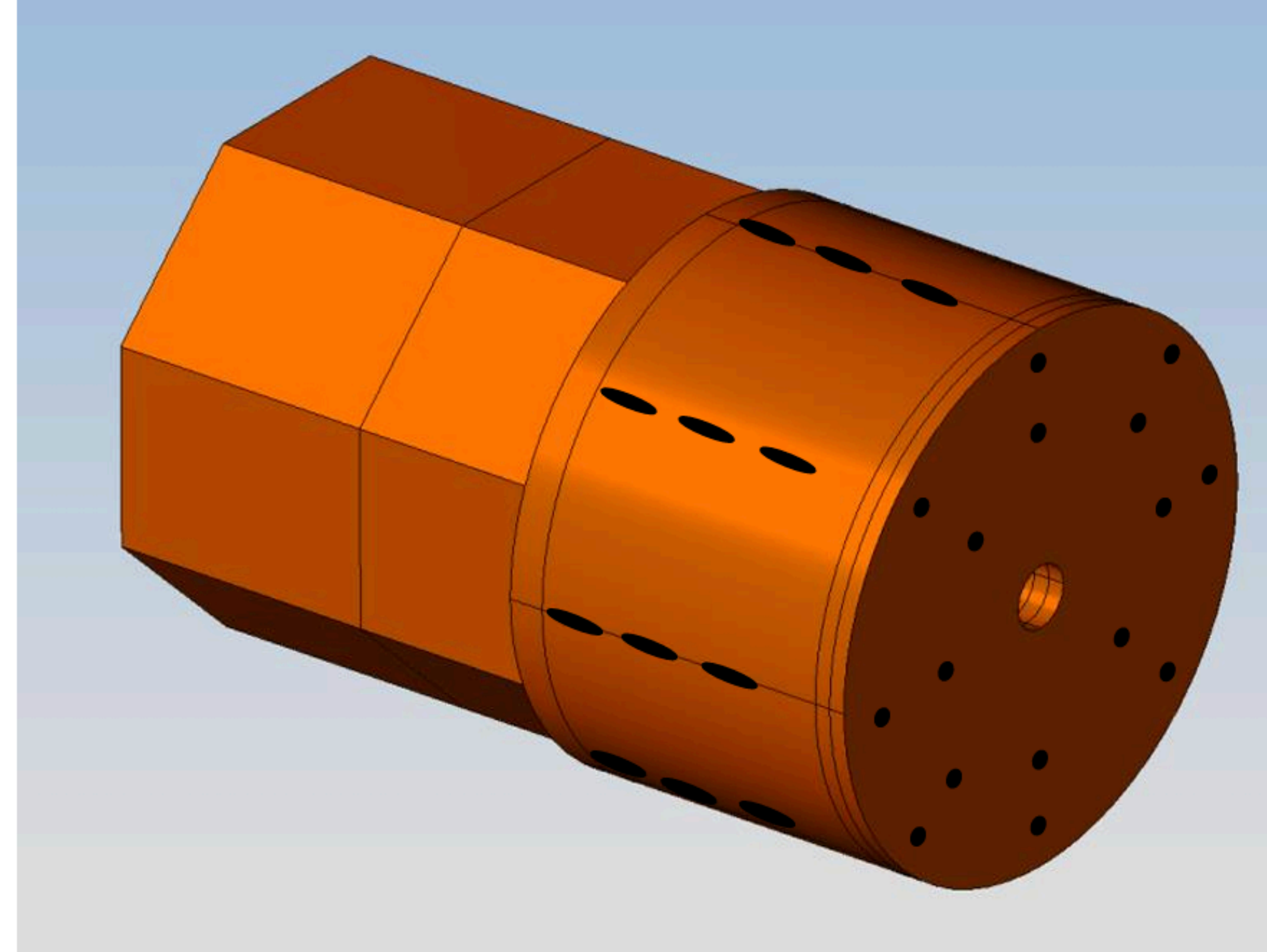
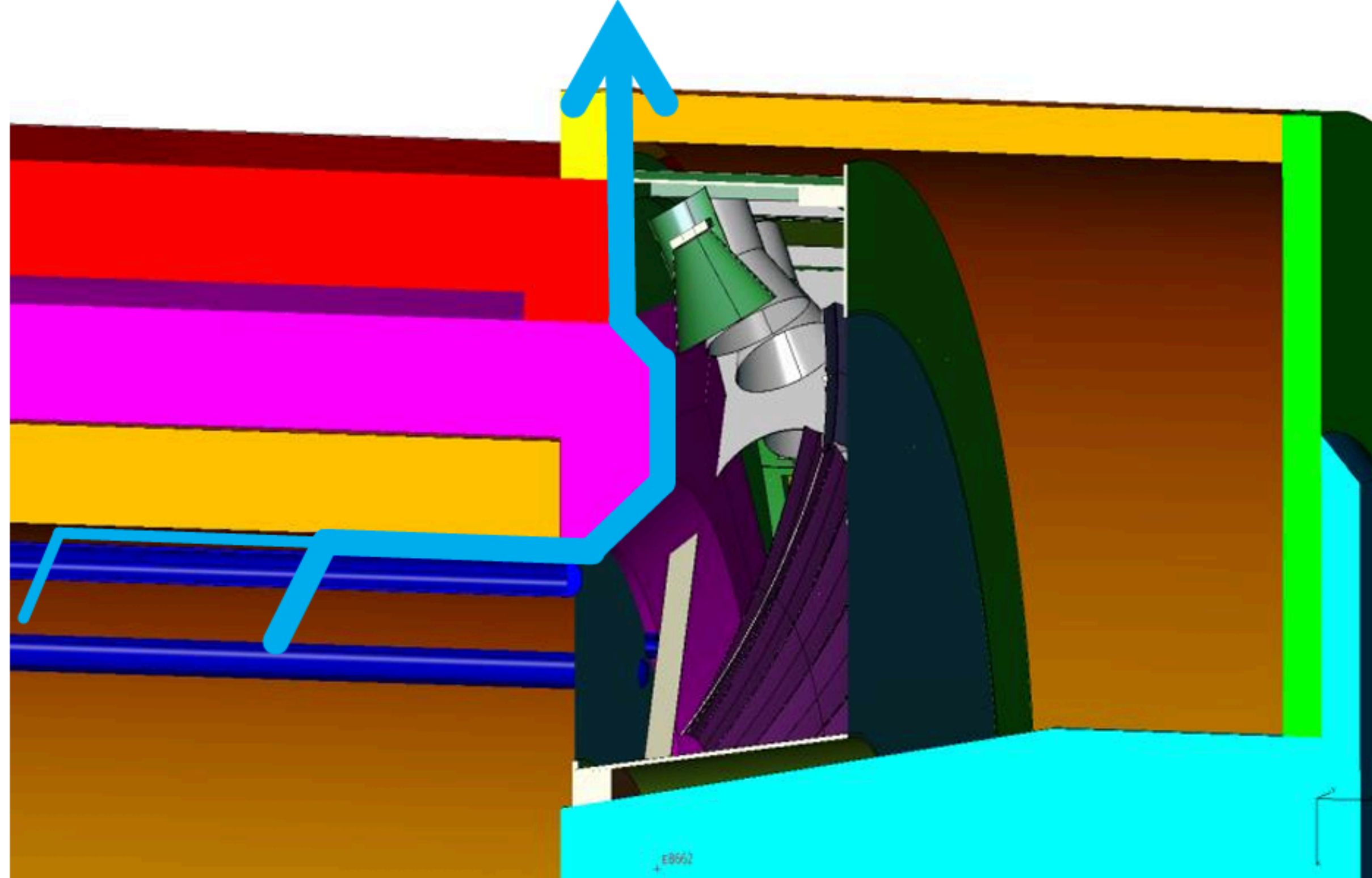
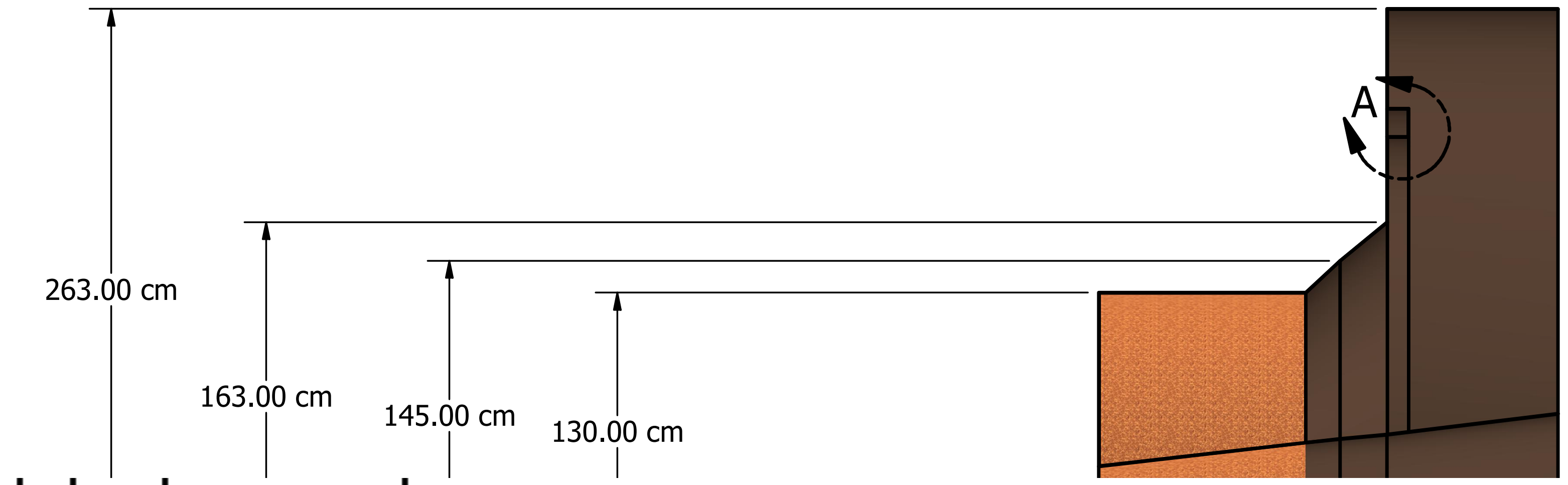
Tank Design, June 2024

- 2 piece design
- Snout added for SIDIS
- Detail A is relief for tie rods.

DETAIL A
SCALE 1 / 16

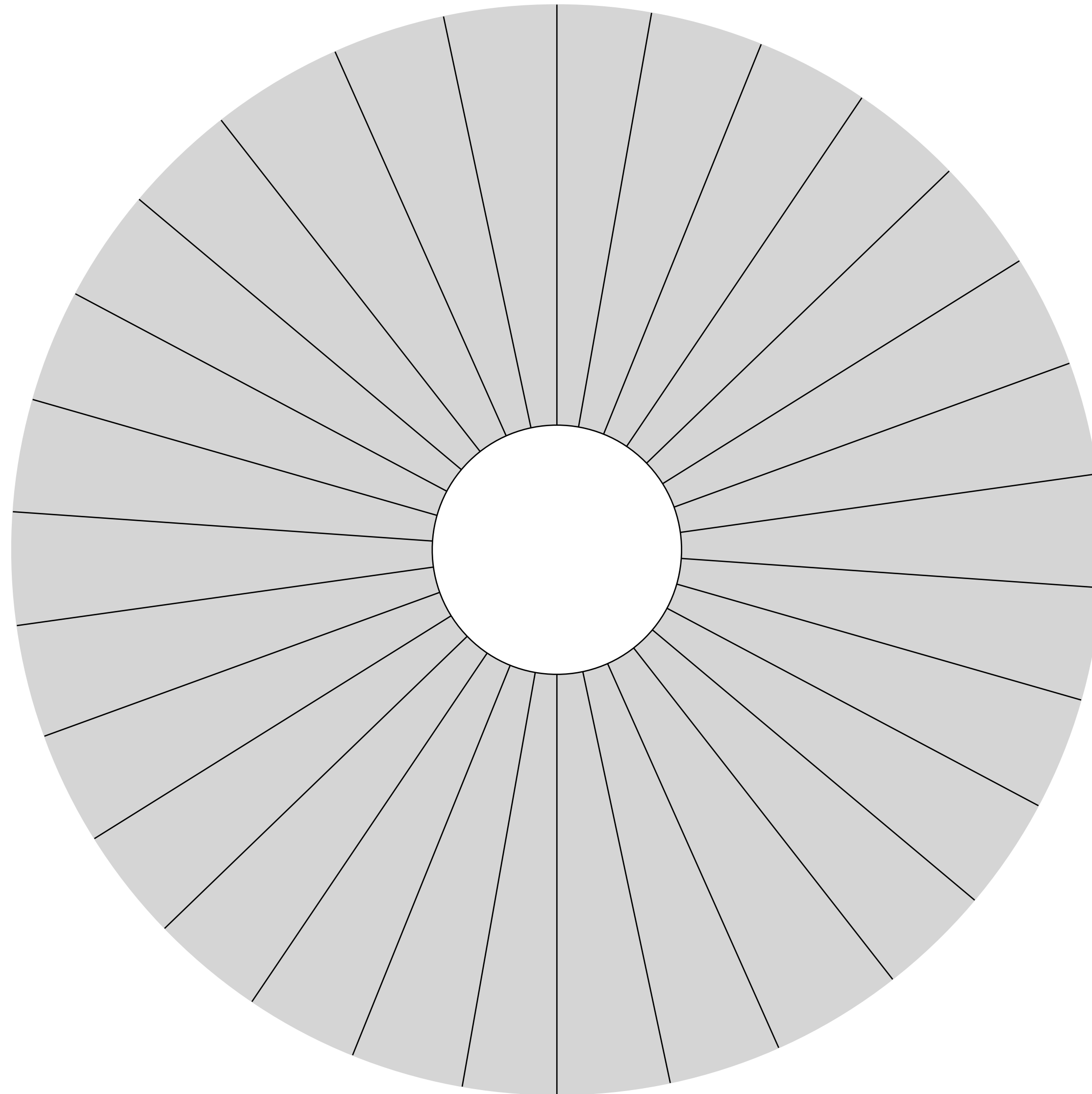
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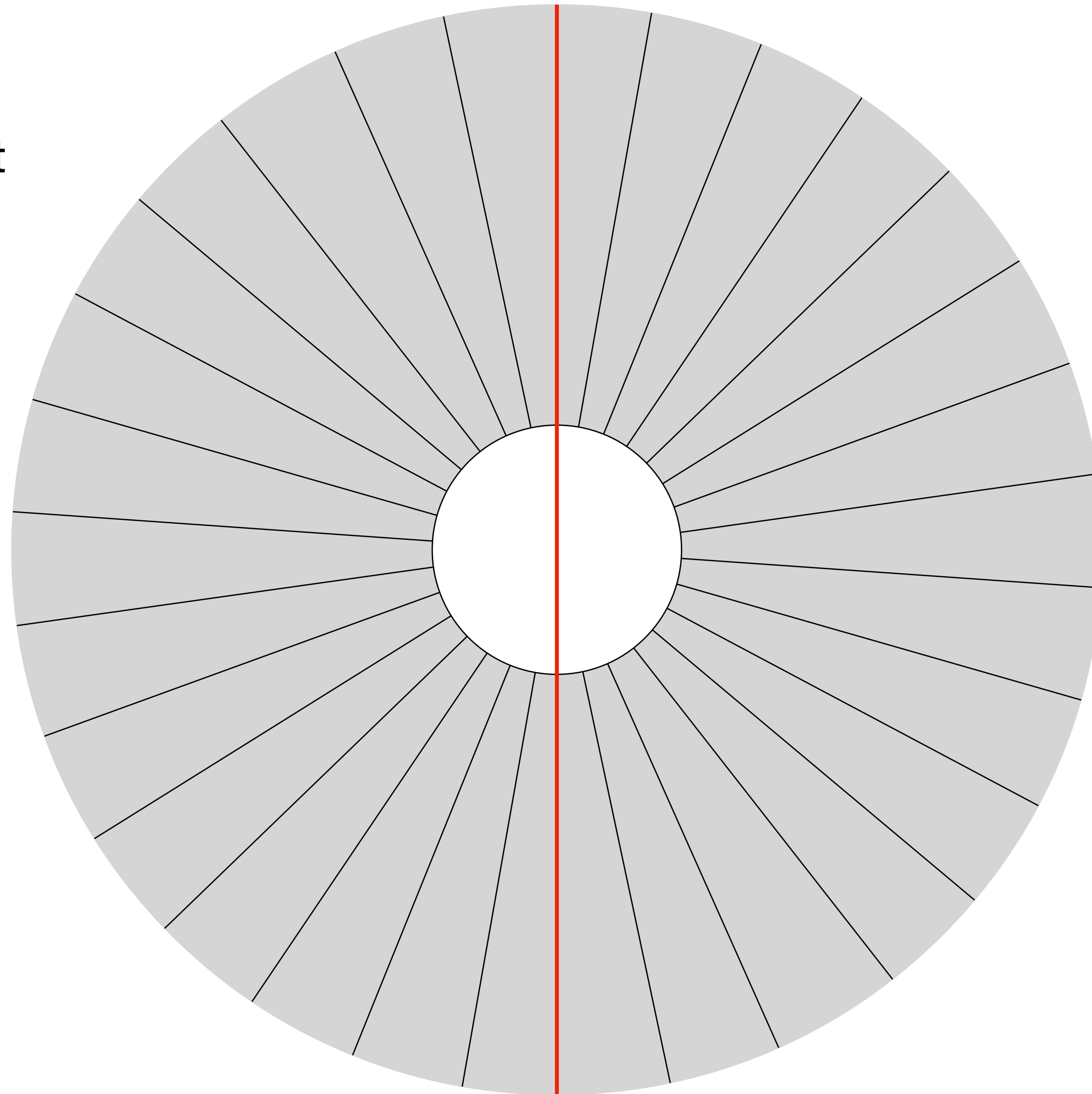
Engineering Design Updates

- Cartoon of 30 sector LGC



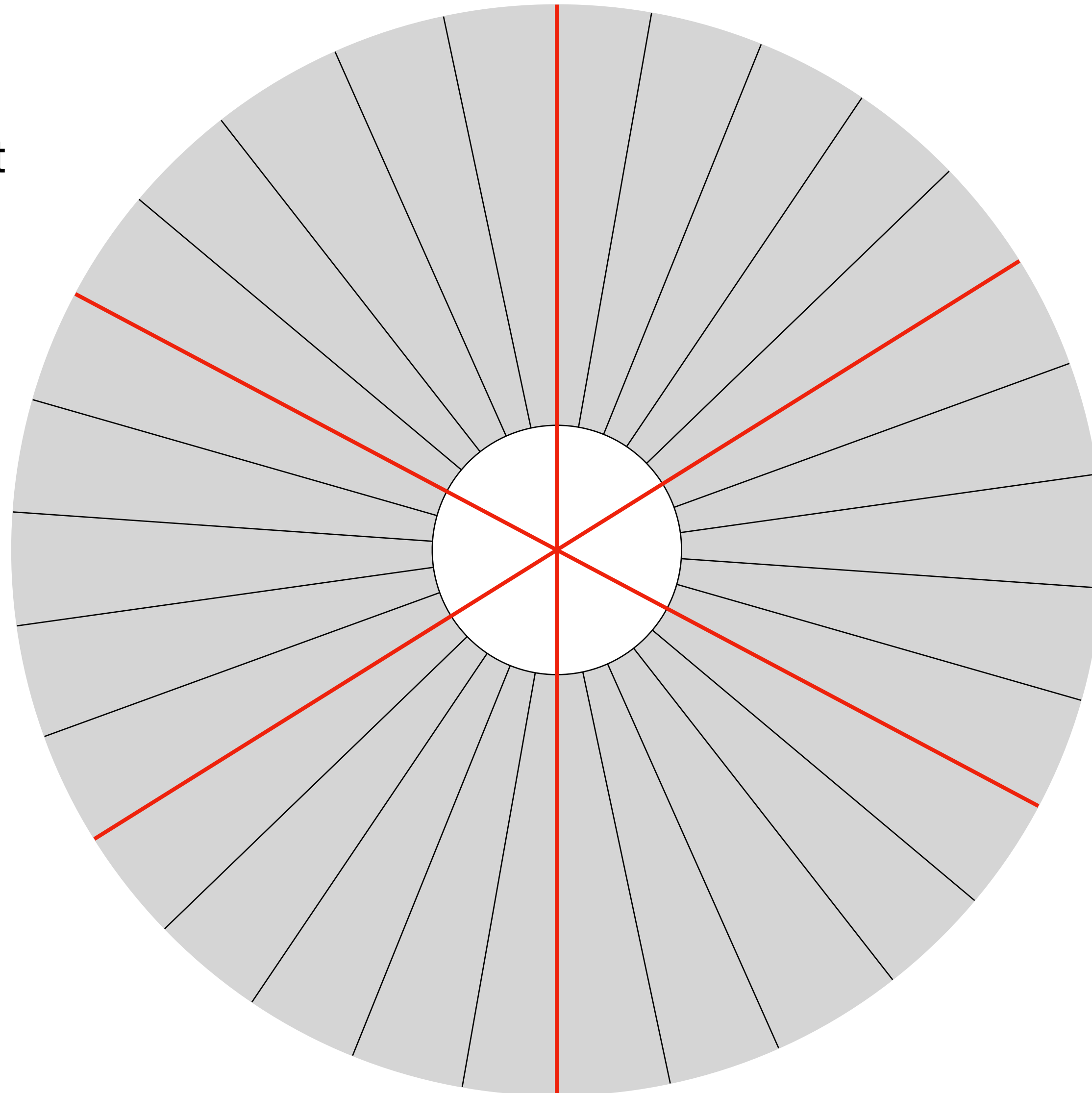
Engineering Design Updates

- Cartoon of 30 sector LGC:
 - From a construction viewpoint, it would be ideal to split the detector down the middle.



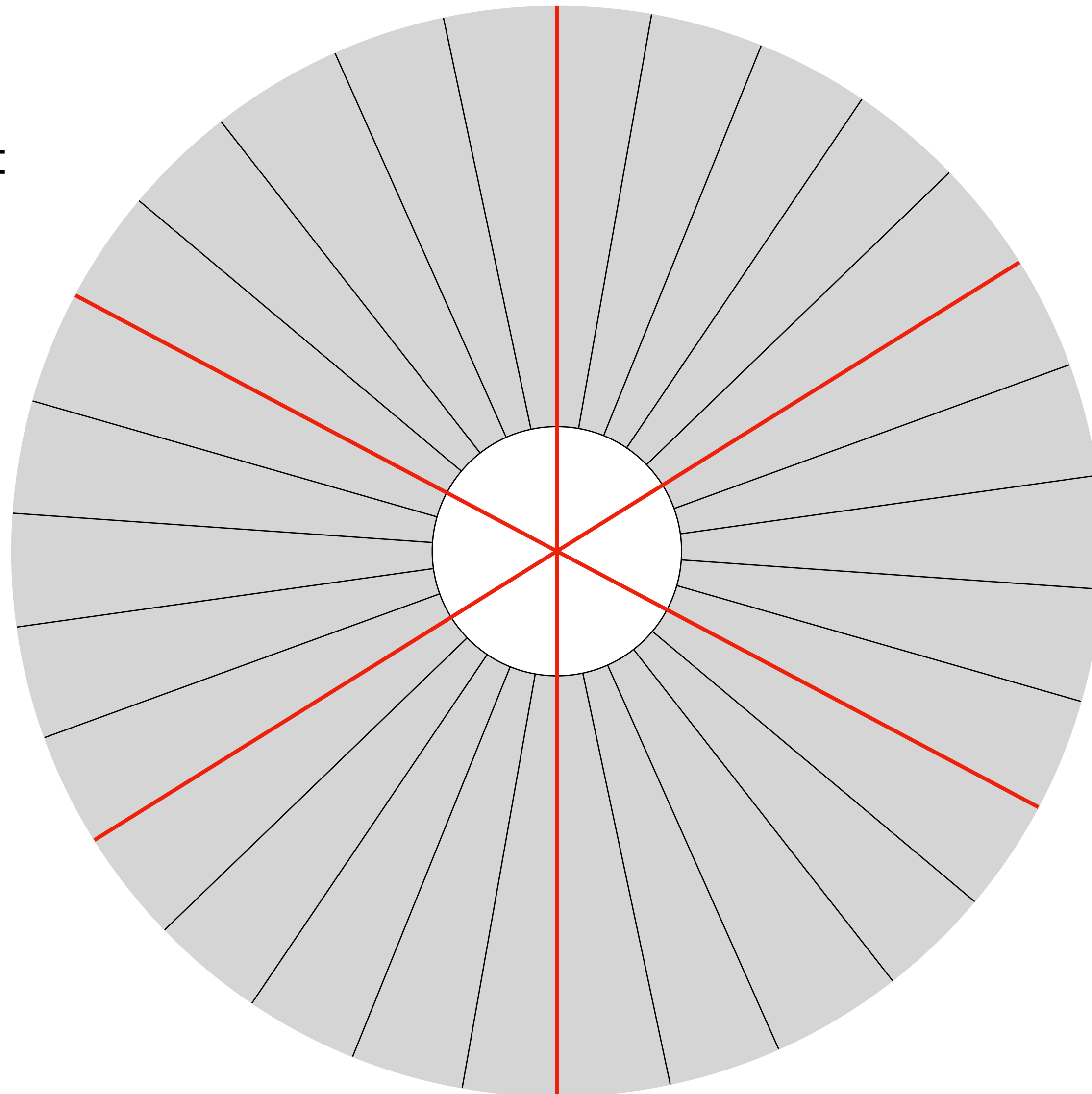
Engineering Design Updates

- Cartoon of 30 sector LGC:
 - From a construction viewpoint, it would be ideal to split the detector down the middle.
 - The minimum identical section splitting would include 5 subsections



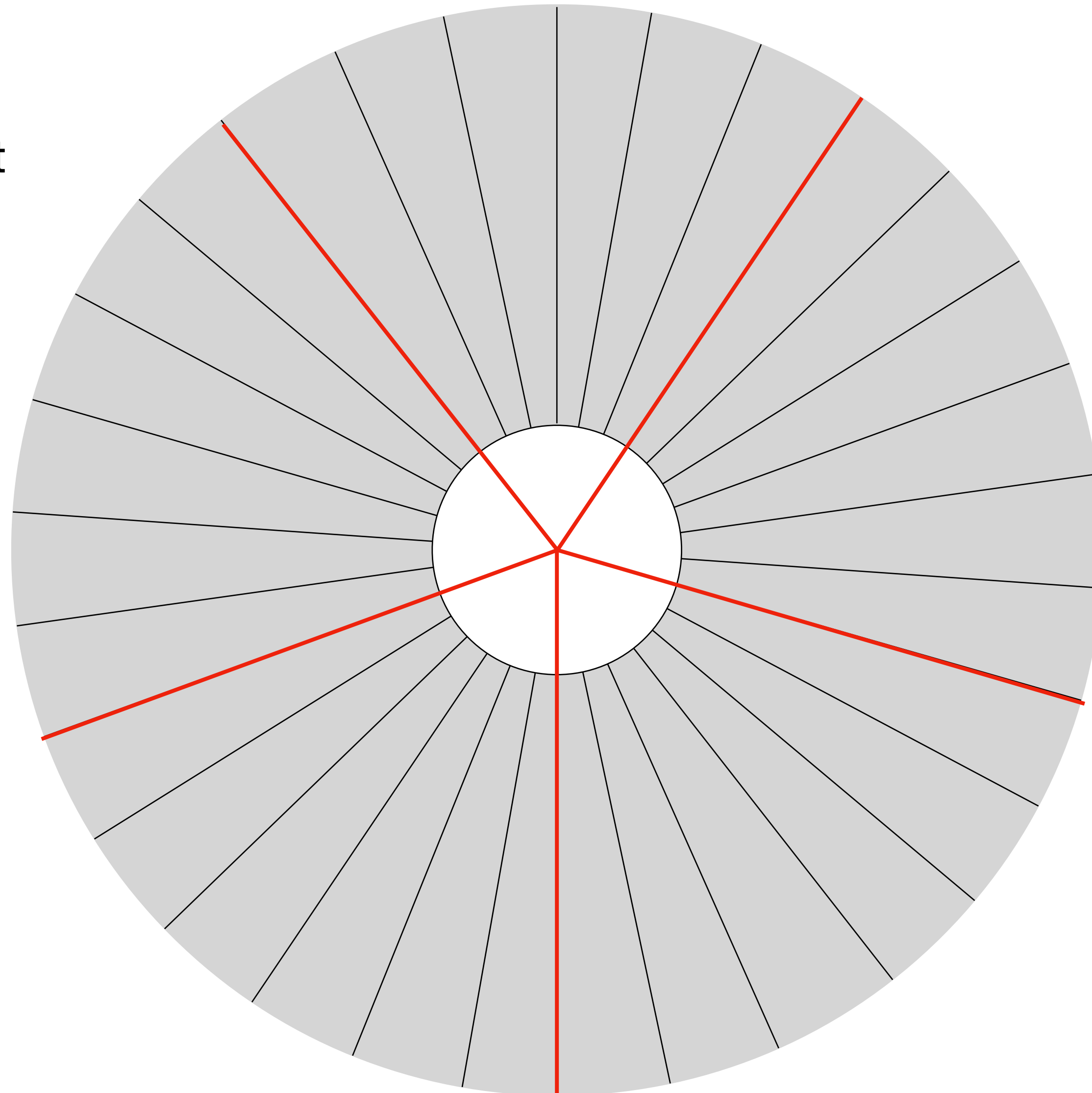
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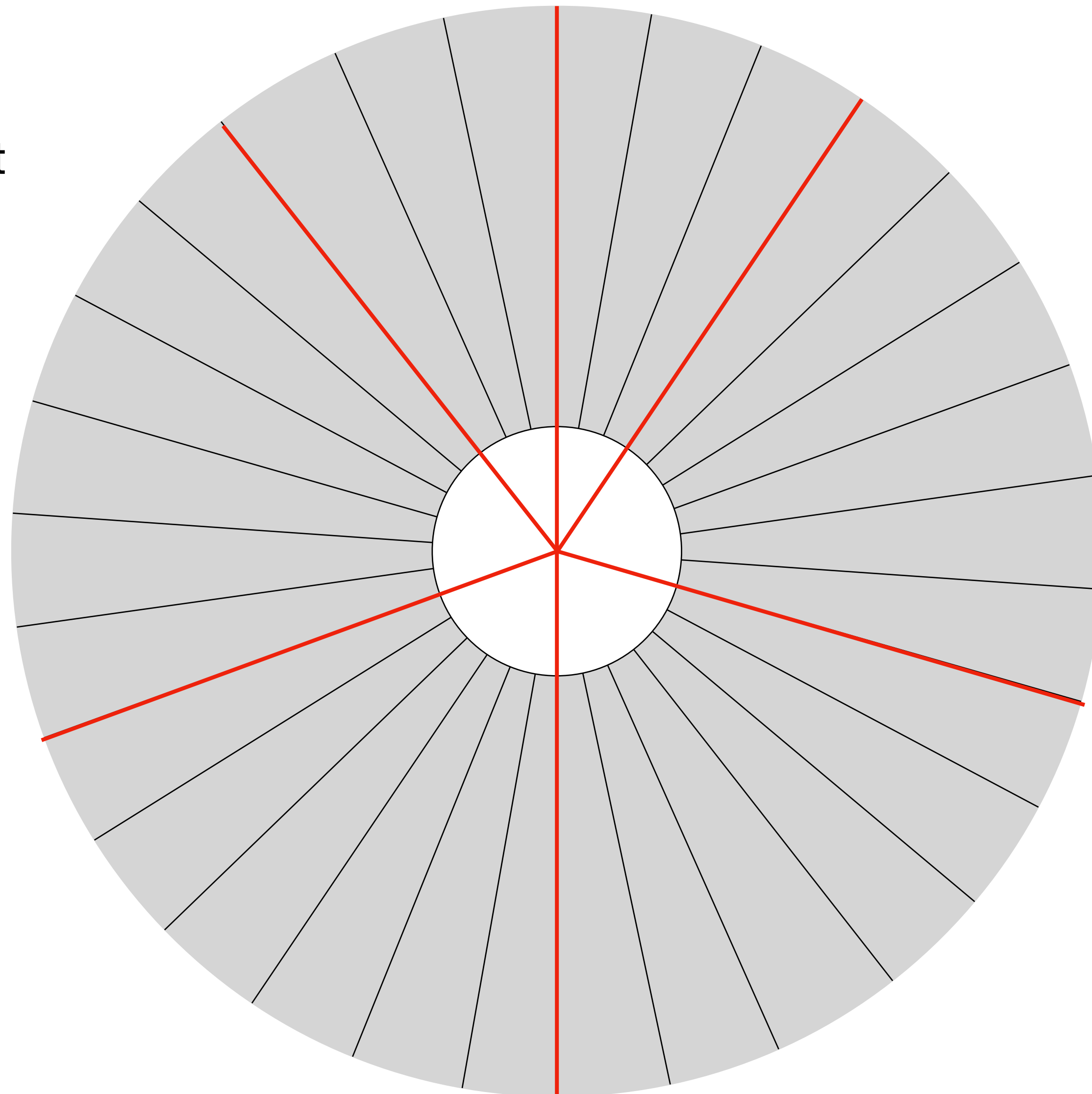
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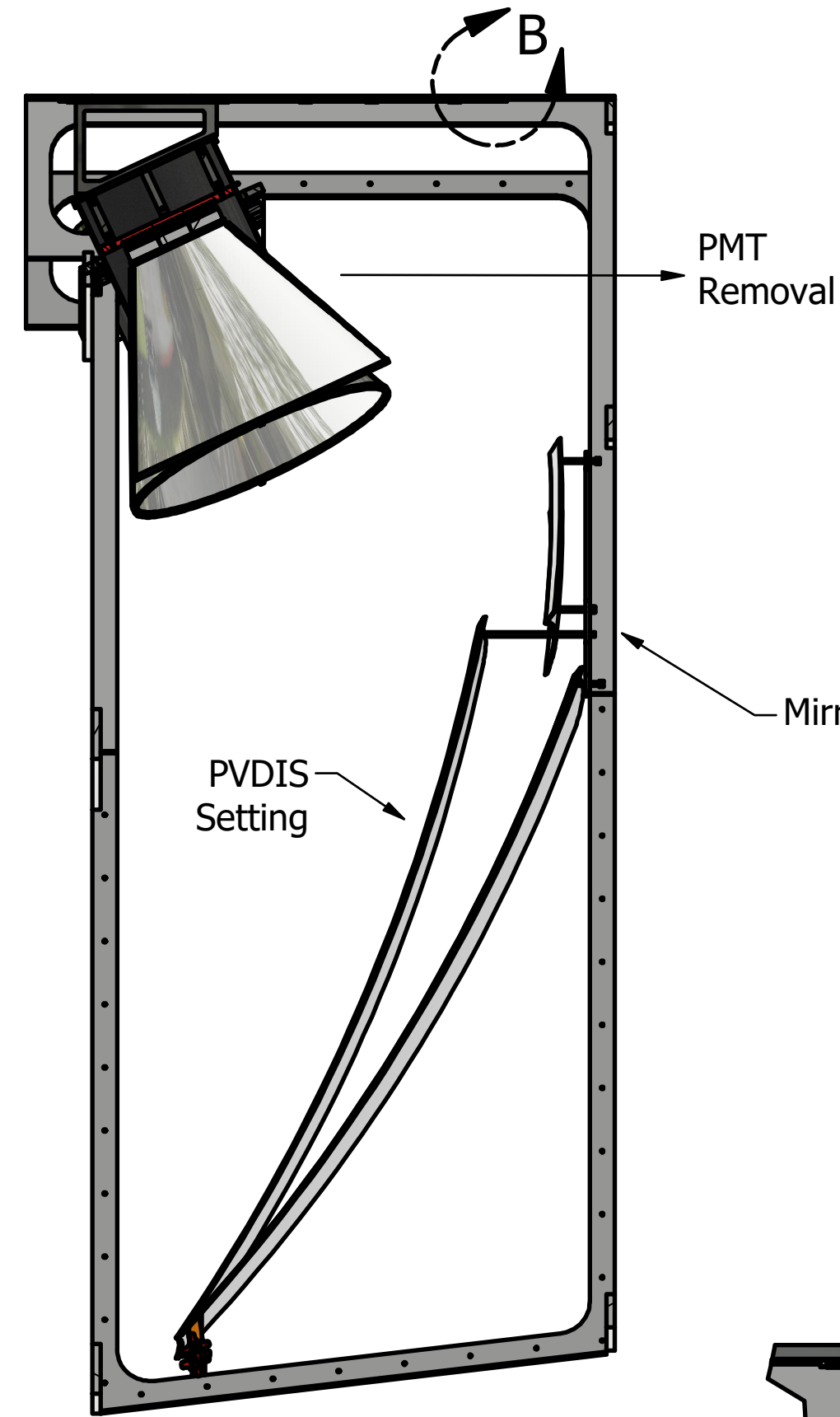
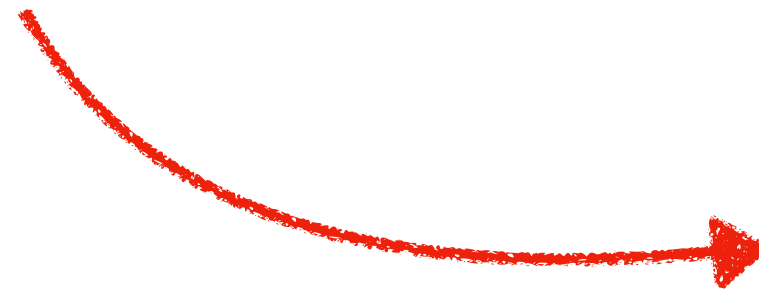
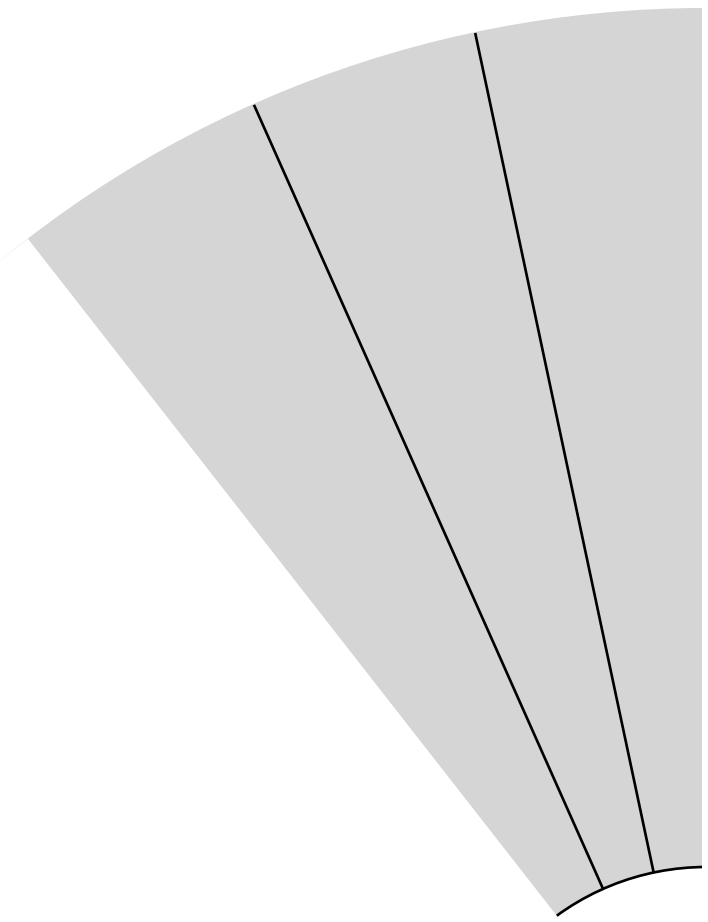
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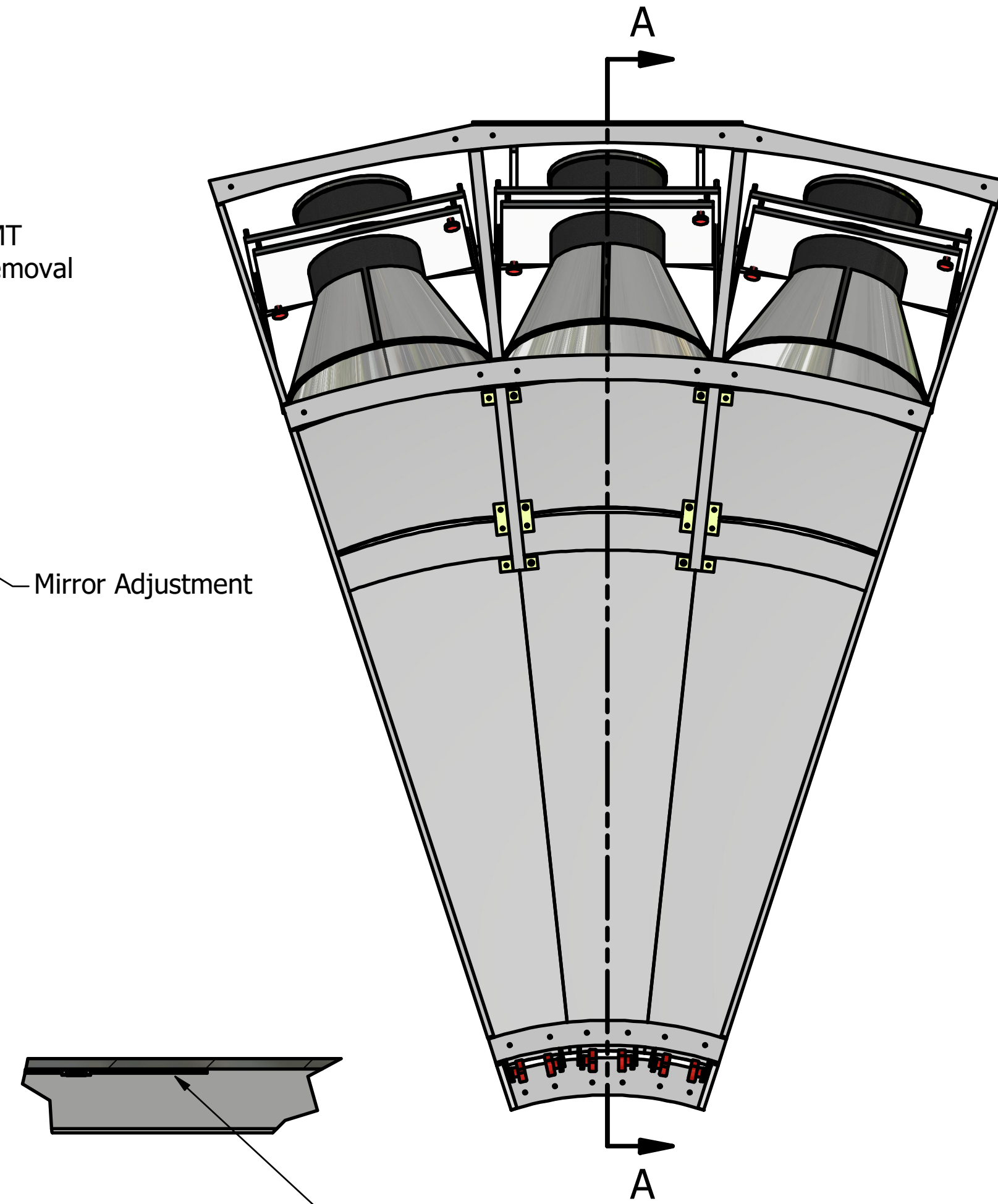


Engineering Design Updates

Protptype Sector
(3 mirrors, no snout)



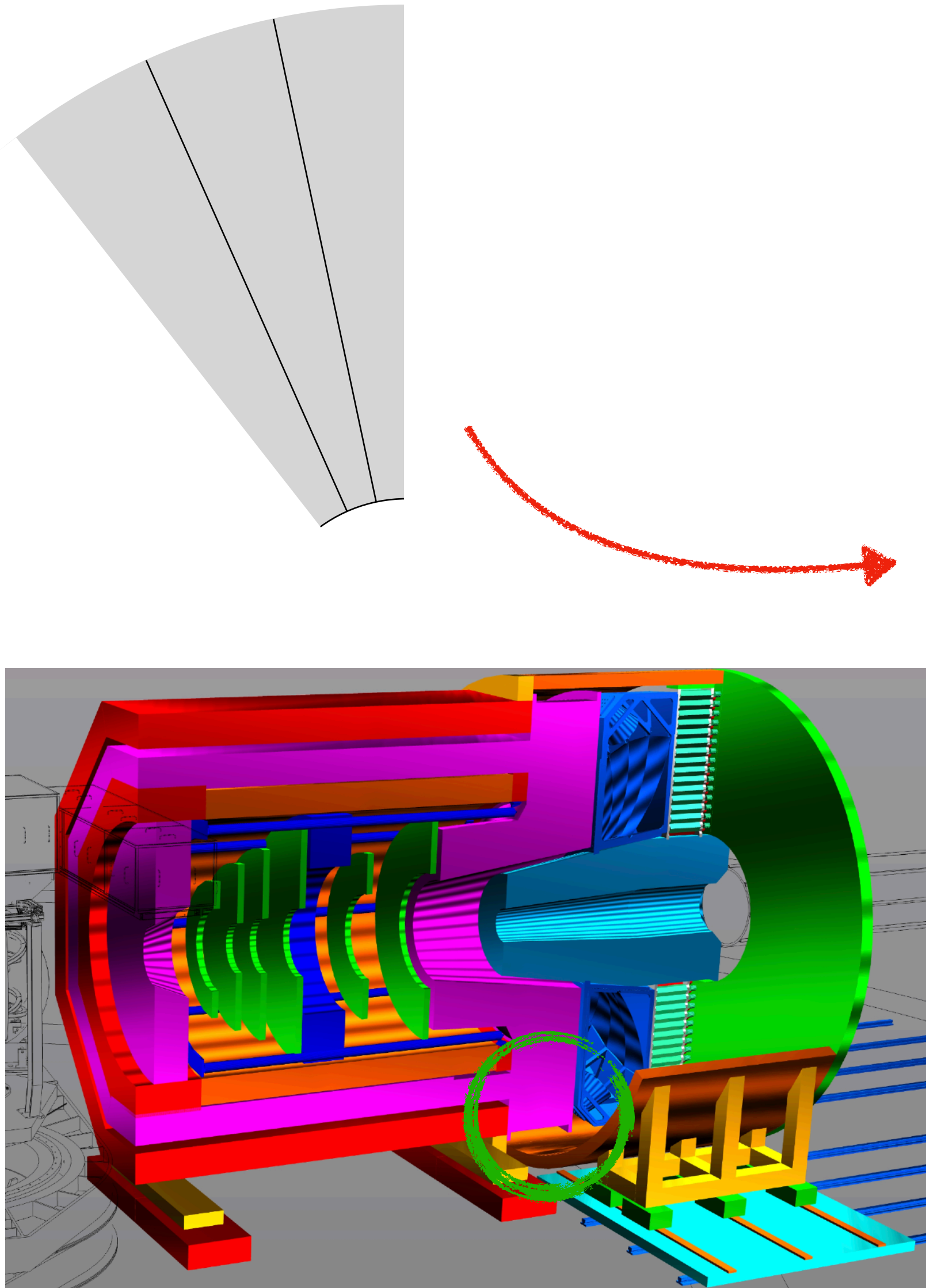
SECTION A-A
SCALE .075



DETAIL B
SCALE .25

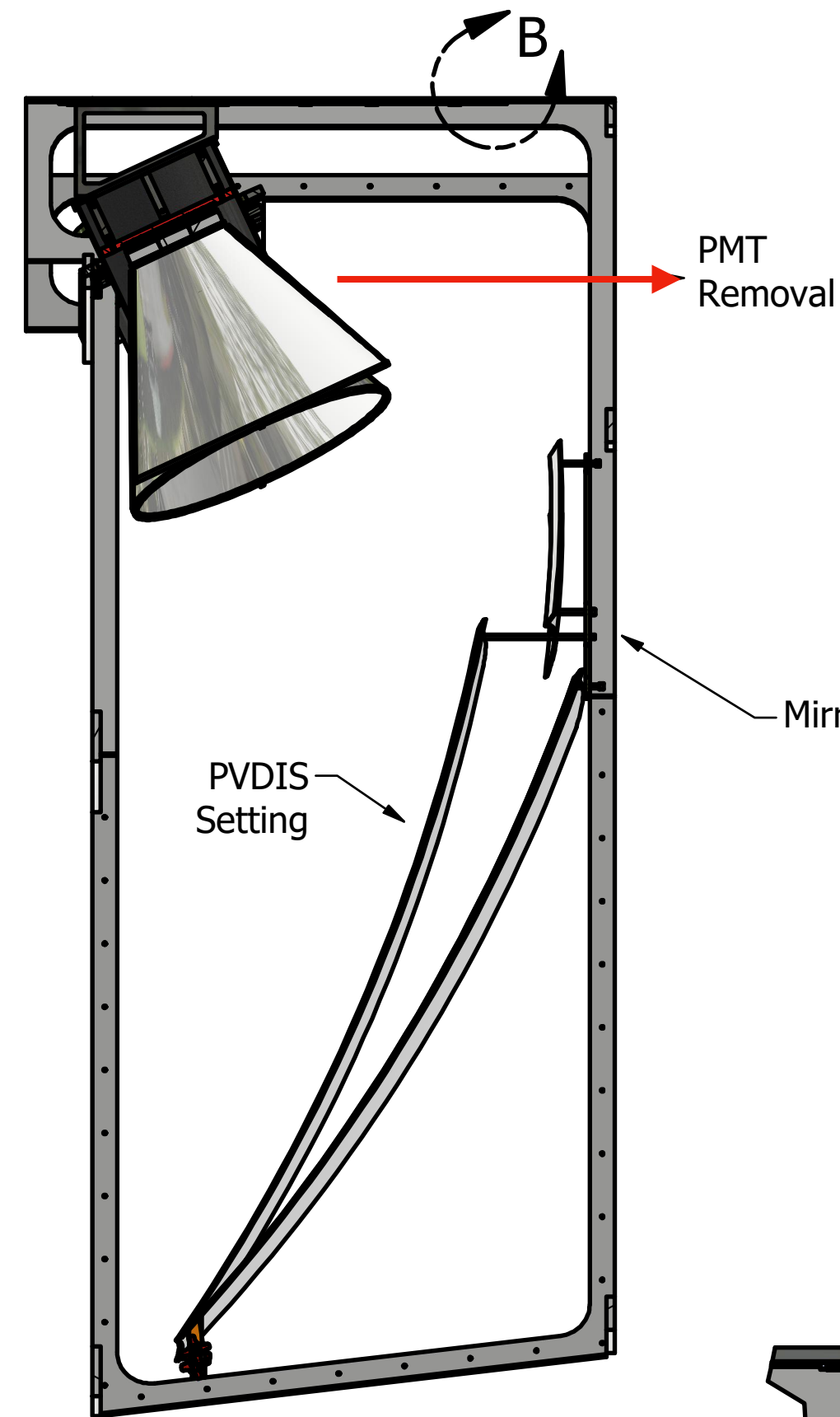
Rail/Carriage System

Engineering Design Updates

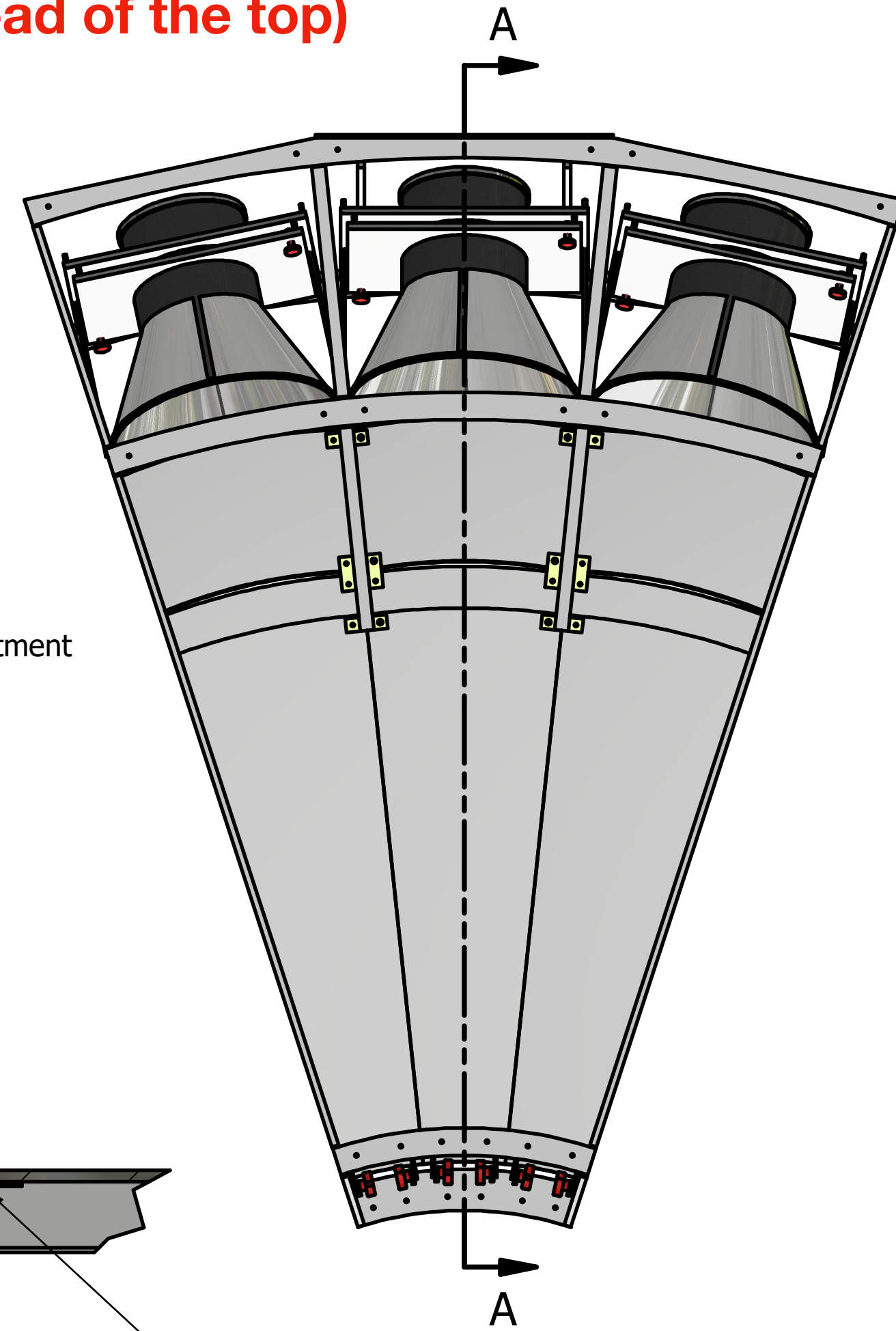


Prototype Sector
(3 mirrors, no snout)

**PMT assembly access from
the back (instead of the top)**



SECTION A-A
SCALE .075

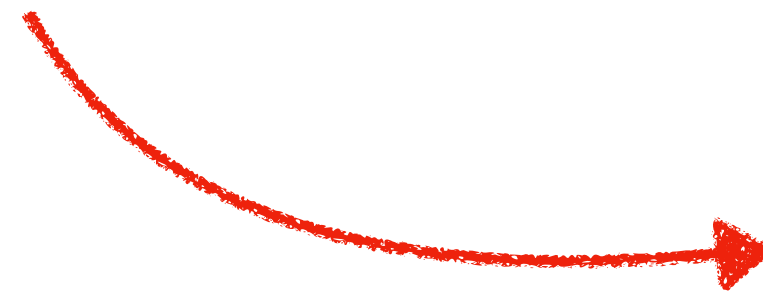
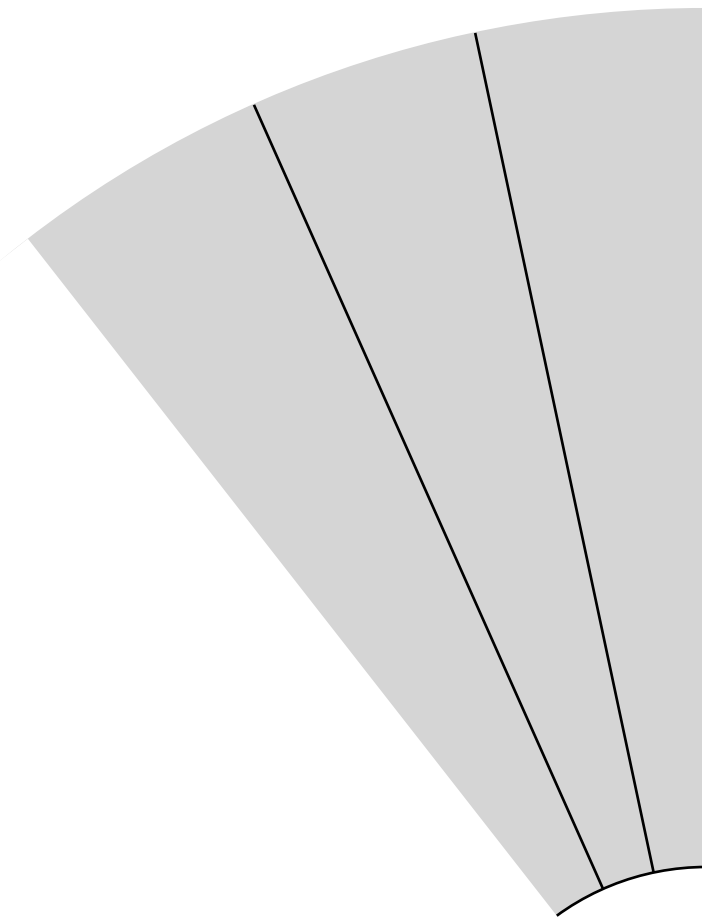


DETAIL B
SCALE .25

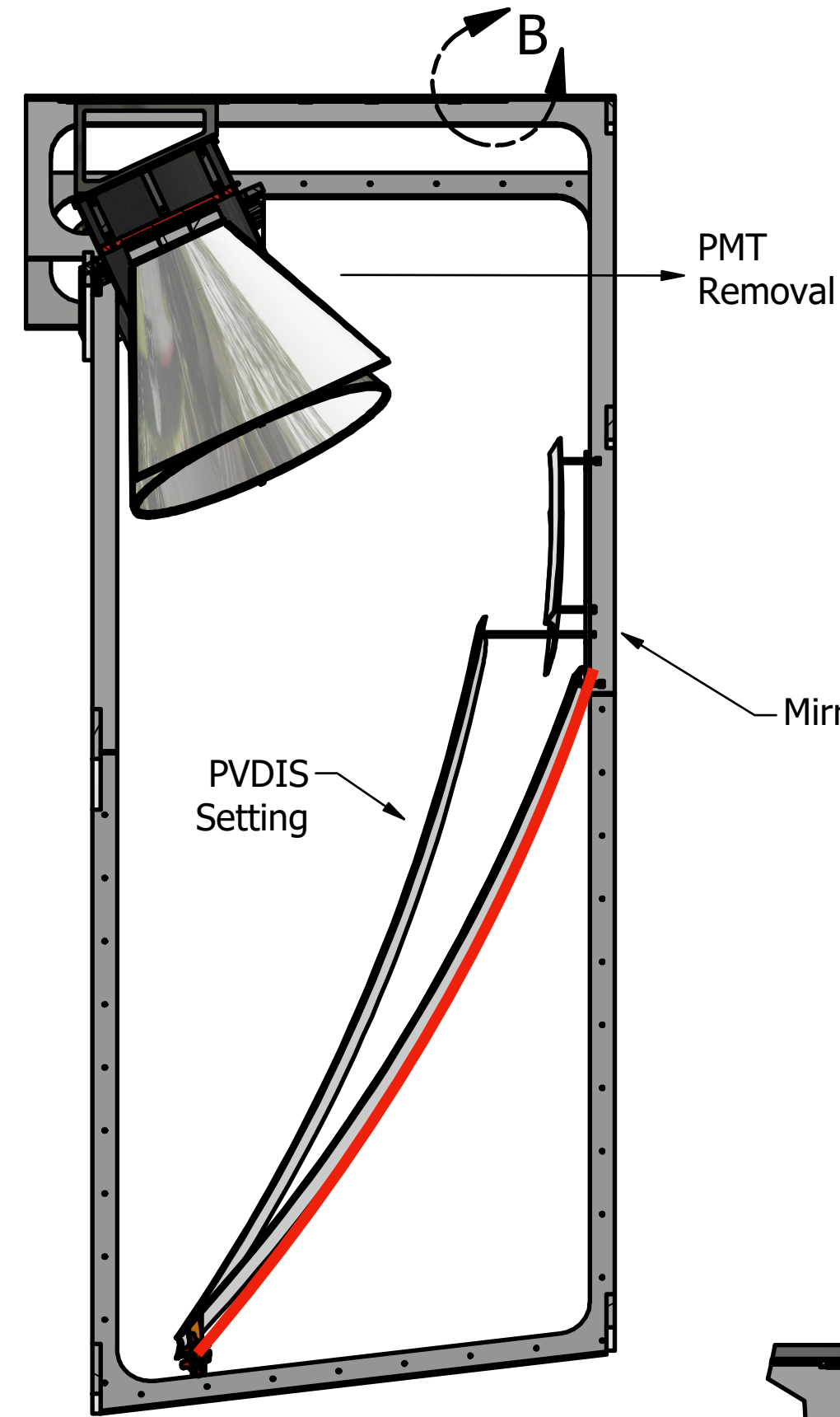
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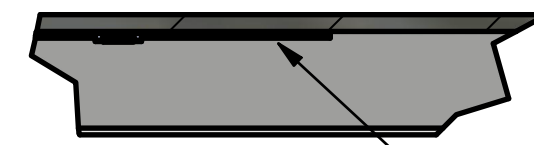
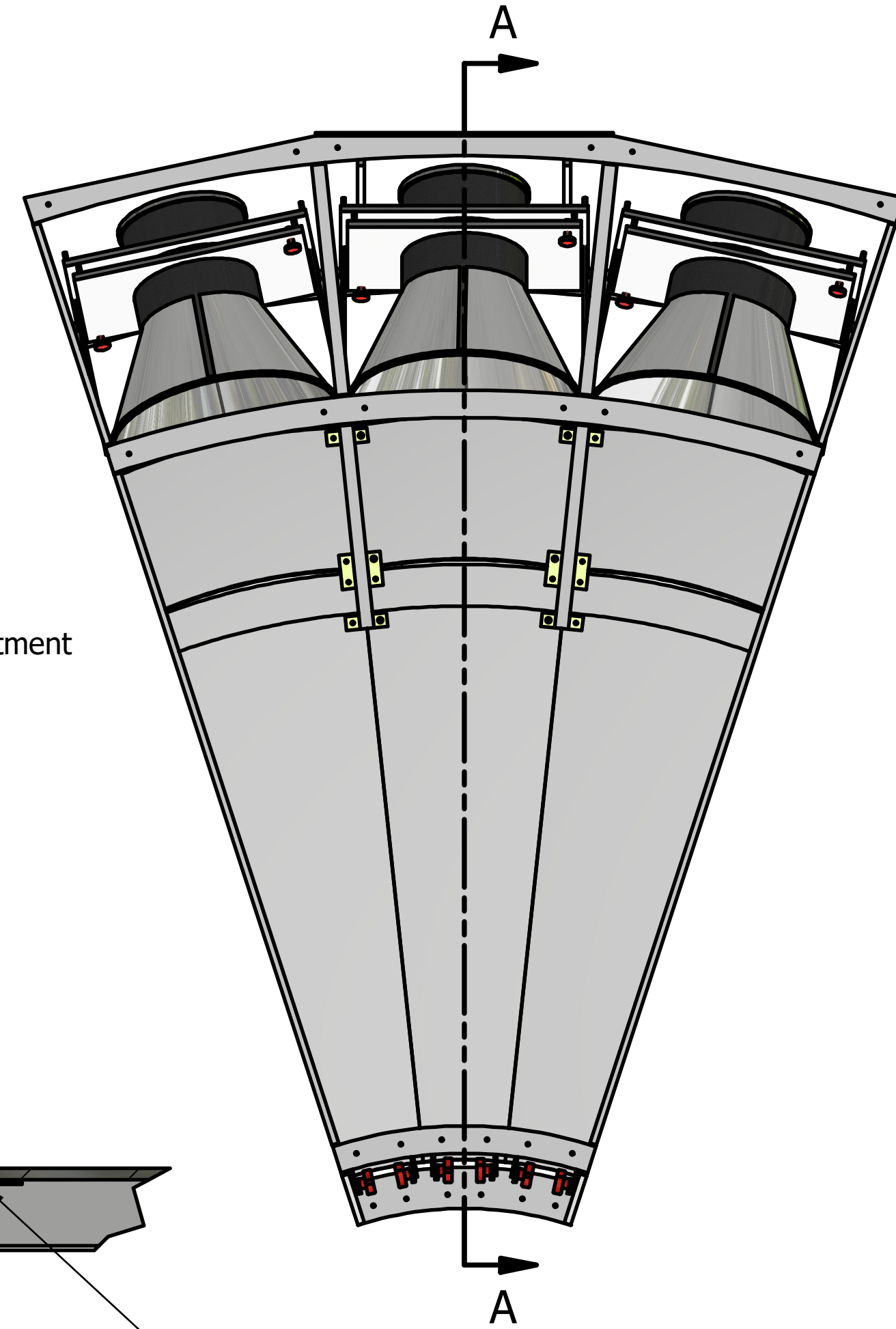
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SIDIS Mirror position



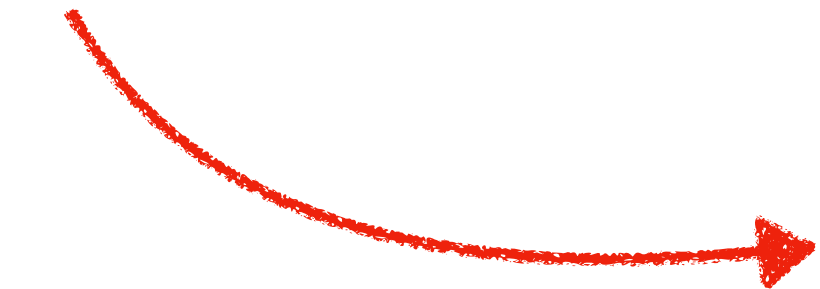
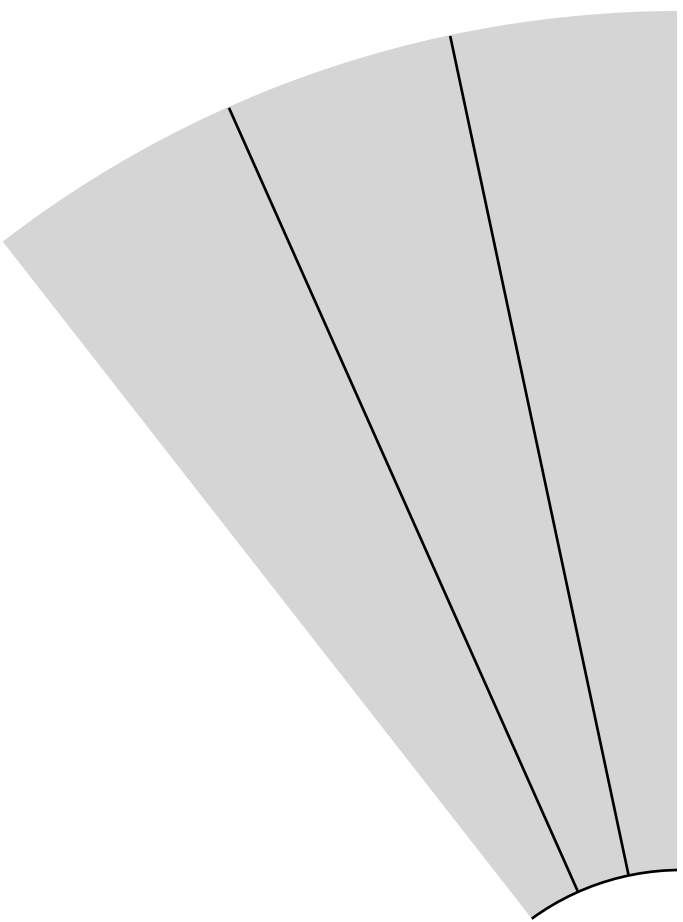
SECTION A-A
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DETAIL B
SCALE .25

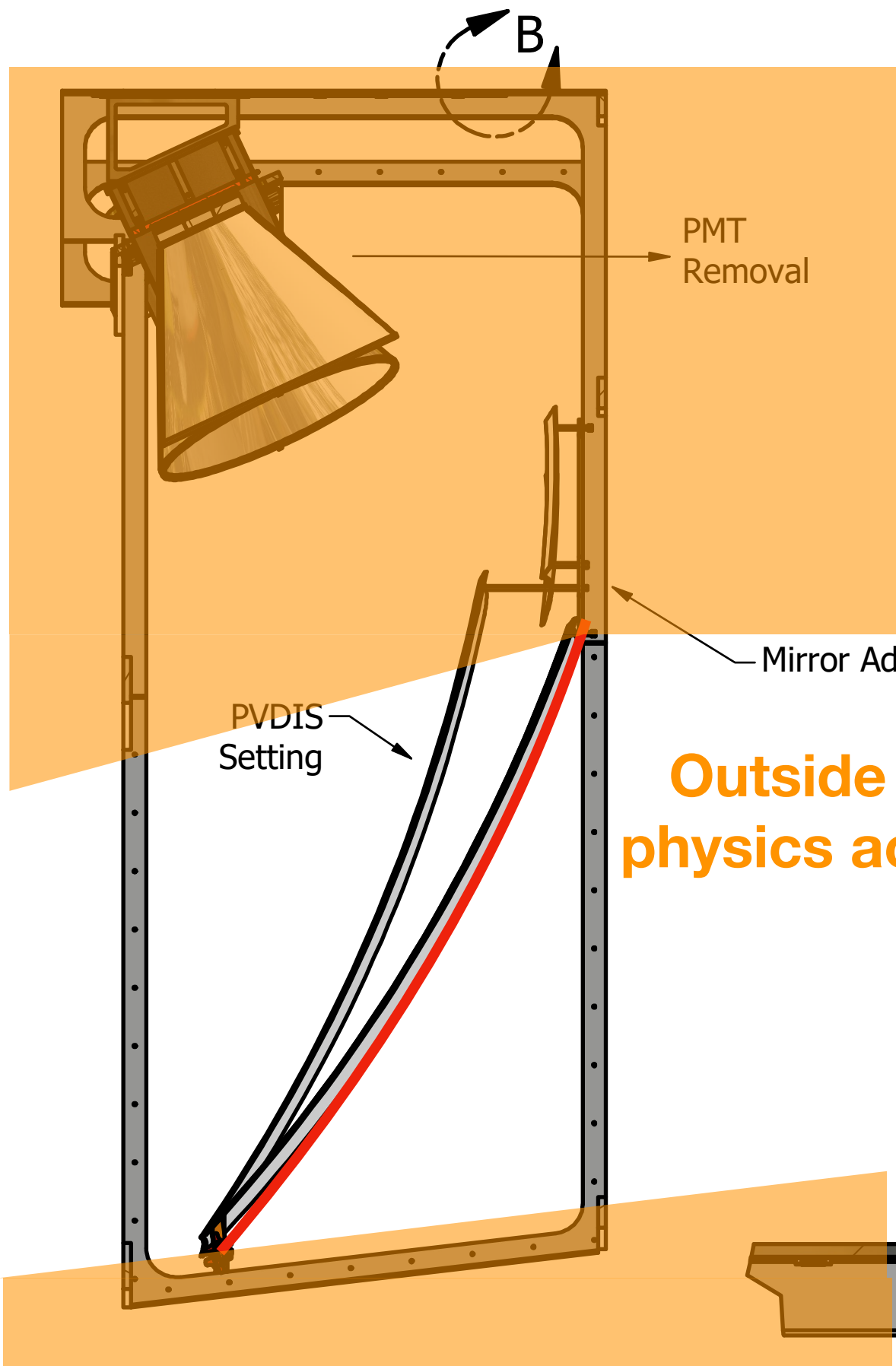
Rail/Carriage System

Engineering Design Updates



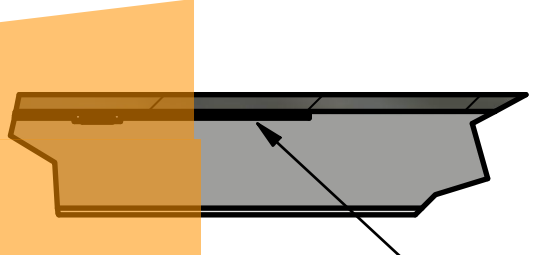
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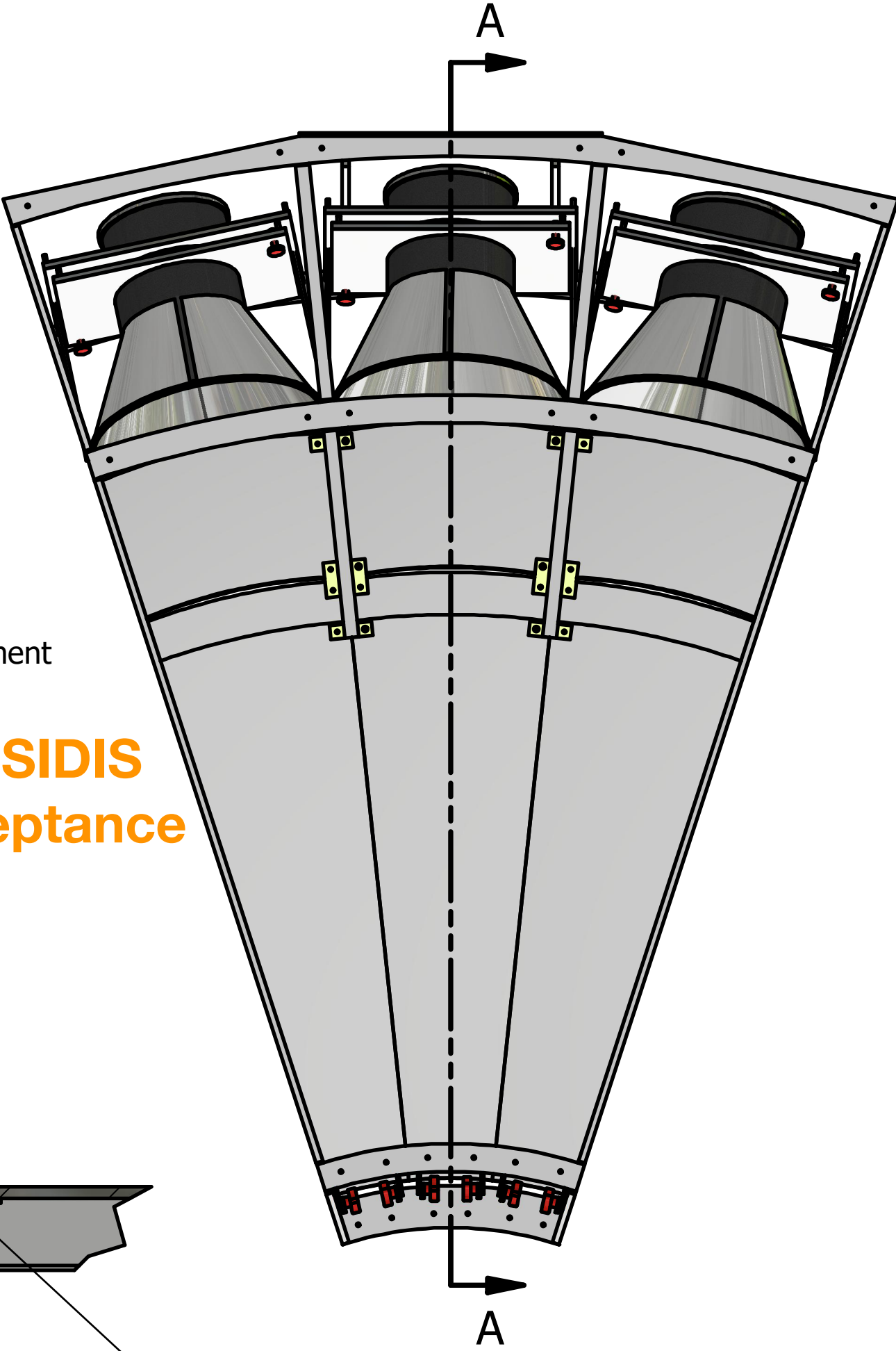
**Outside of SIDIS
physics acceptance**

SECTION A-A
SCALE .075

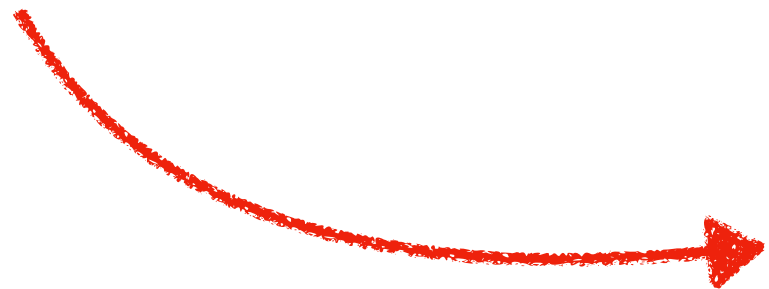
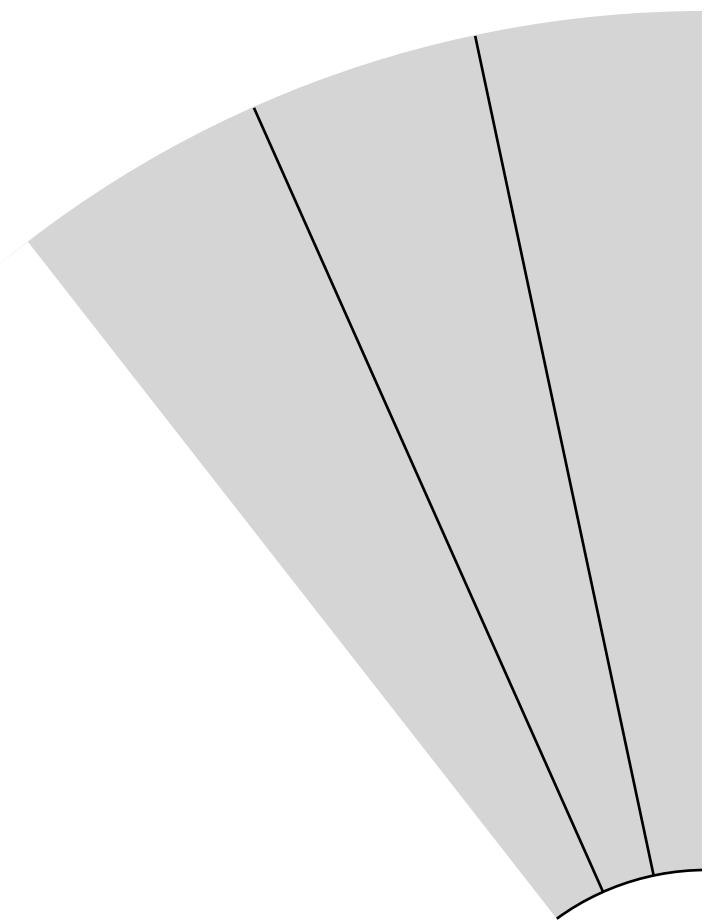


DETAIL B
SCALE .25

Rail/Carriage System

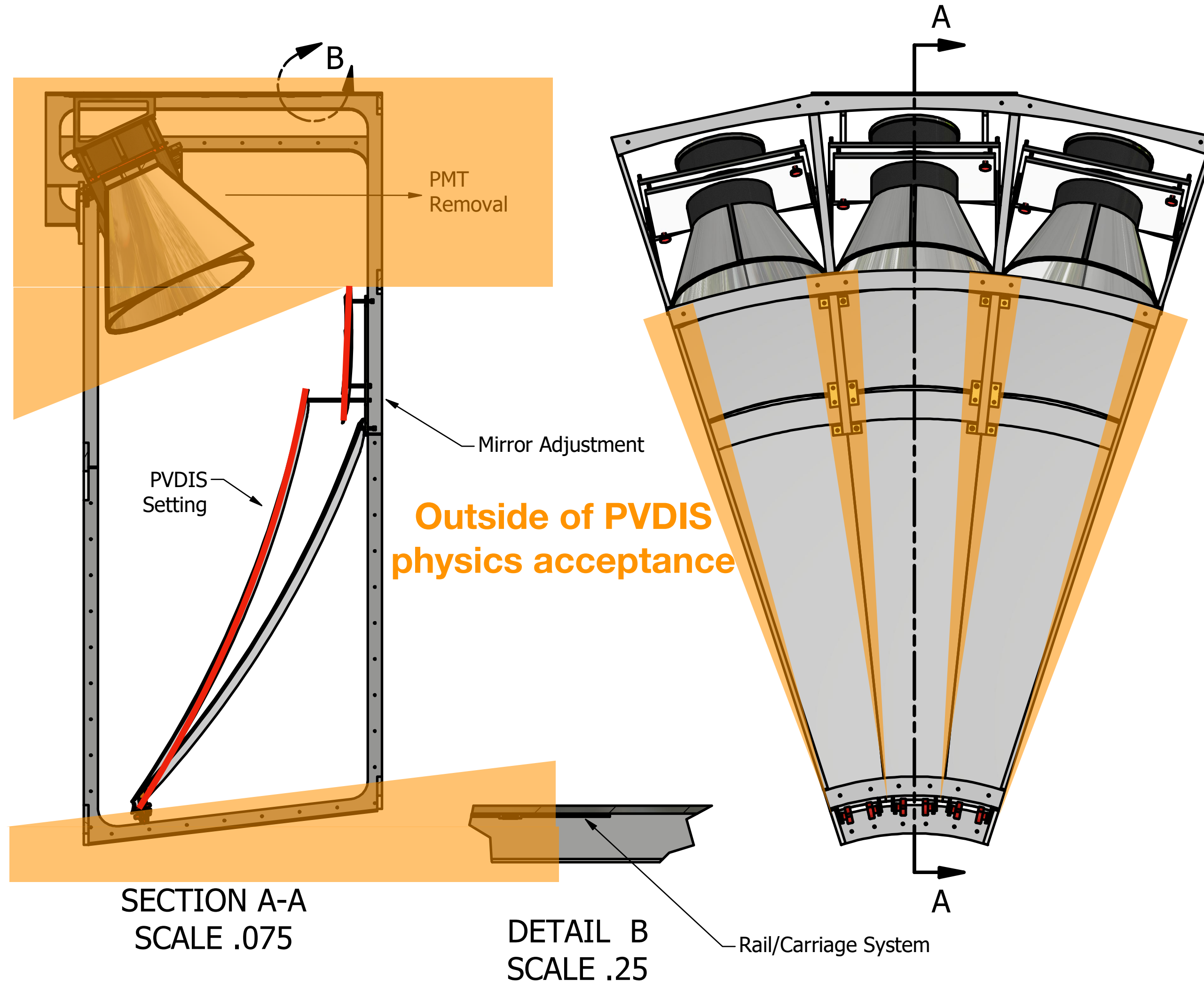


Engineering Design Updates



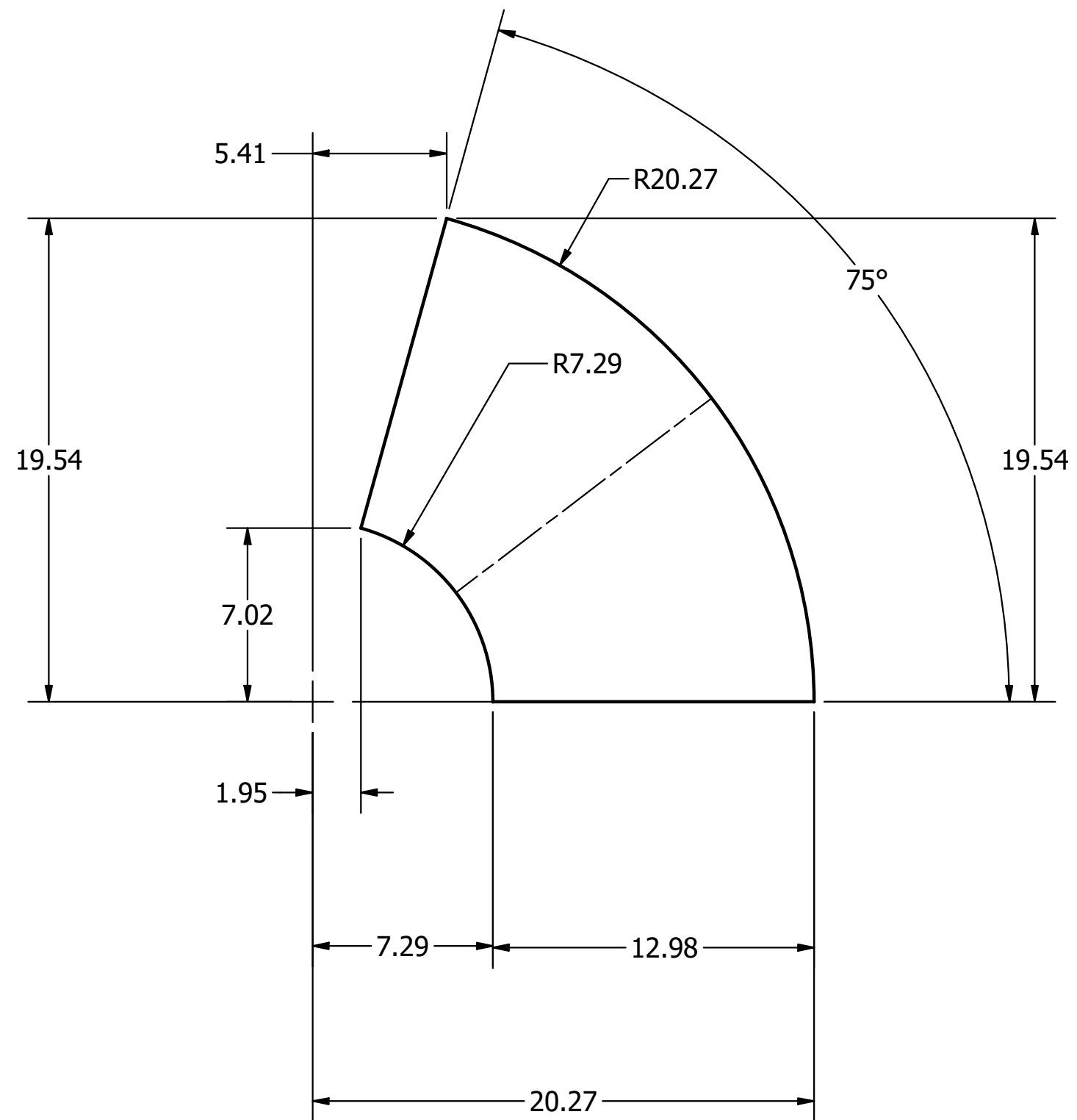
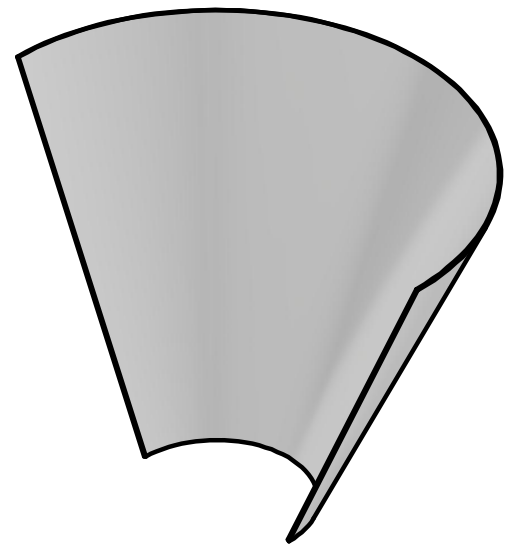
PVDIS Mirror position

Protptype Sector
(3 mirrors, no snout)

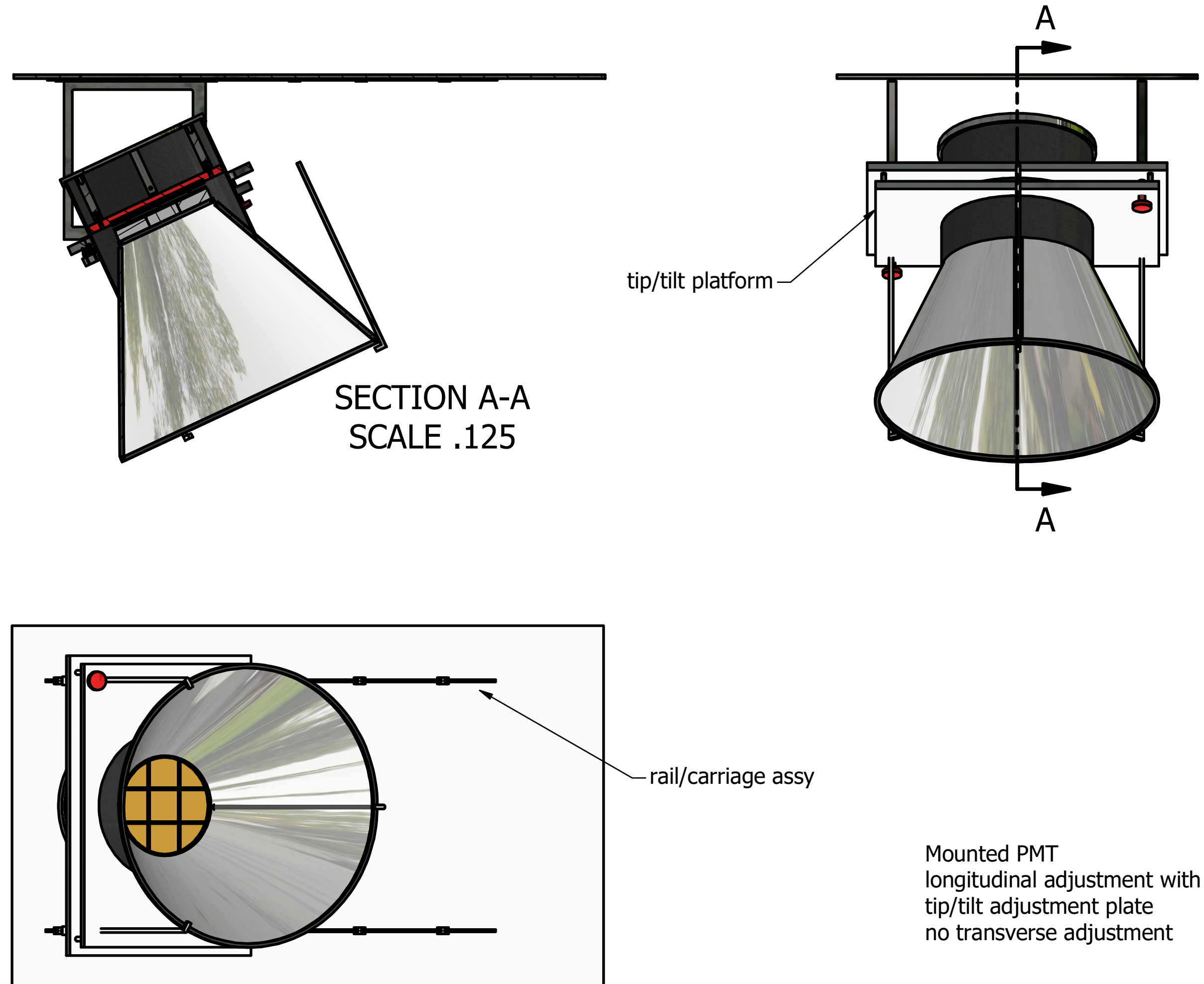


Engineering Design Updates

- Reflective cones:
 - Straight cones could be two “rolled” polycarbonate sections, with some additional shape support.

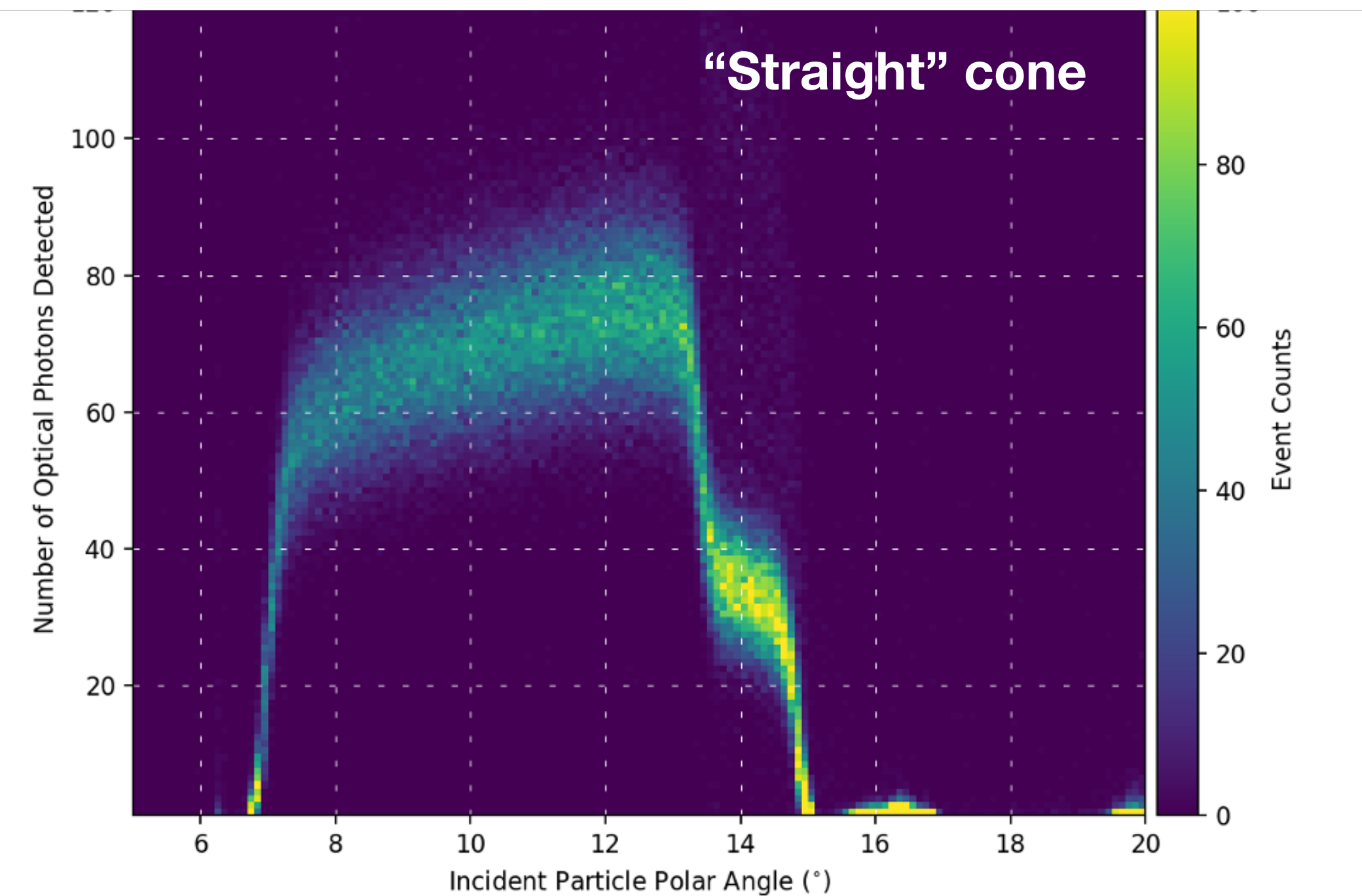
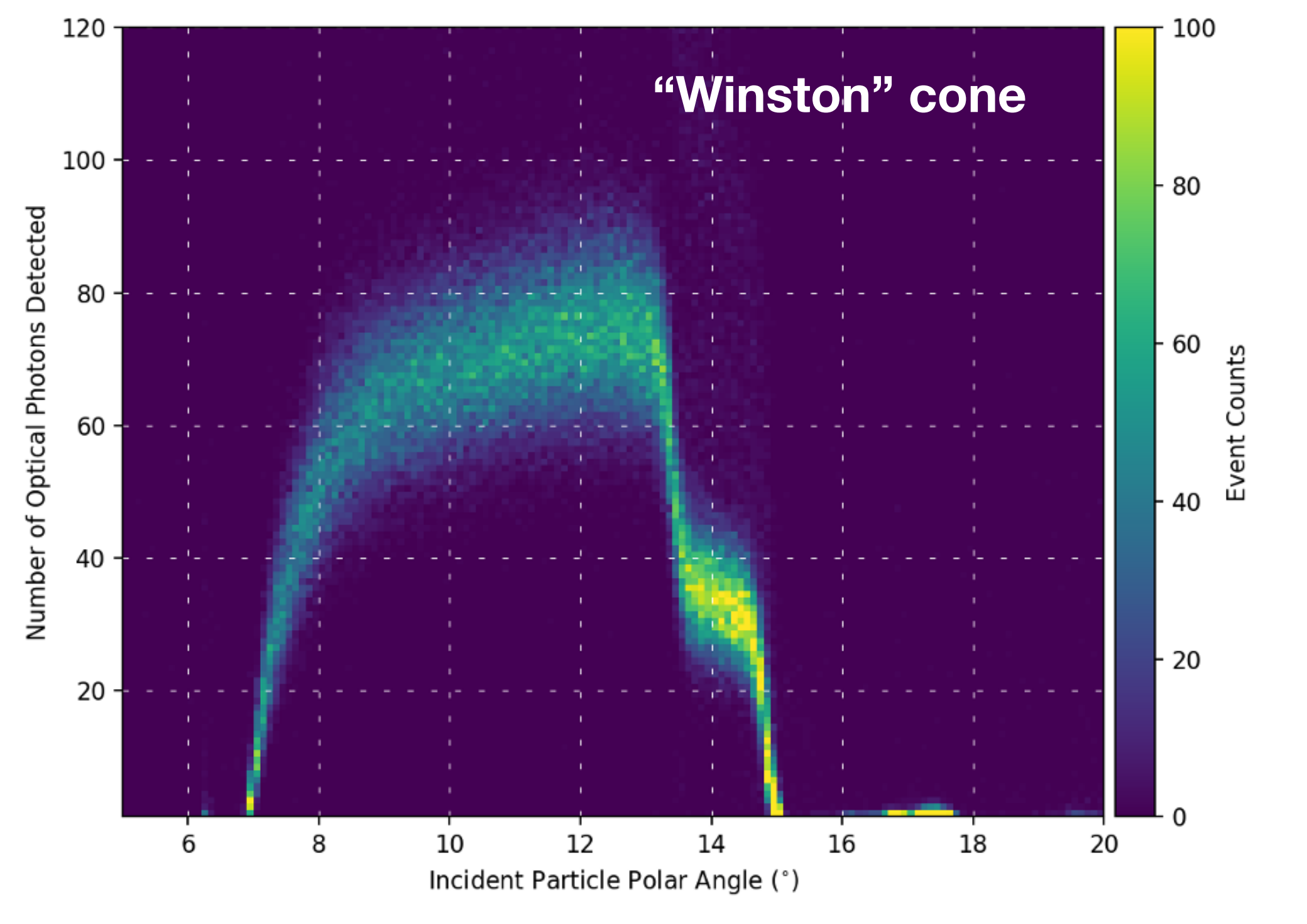
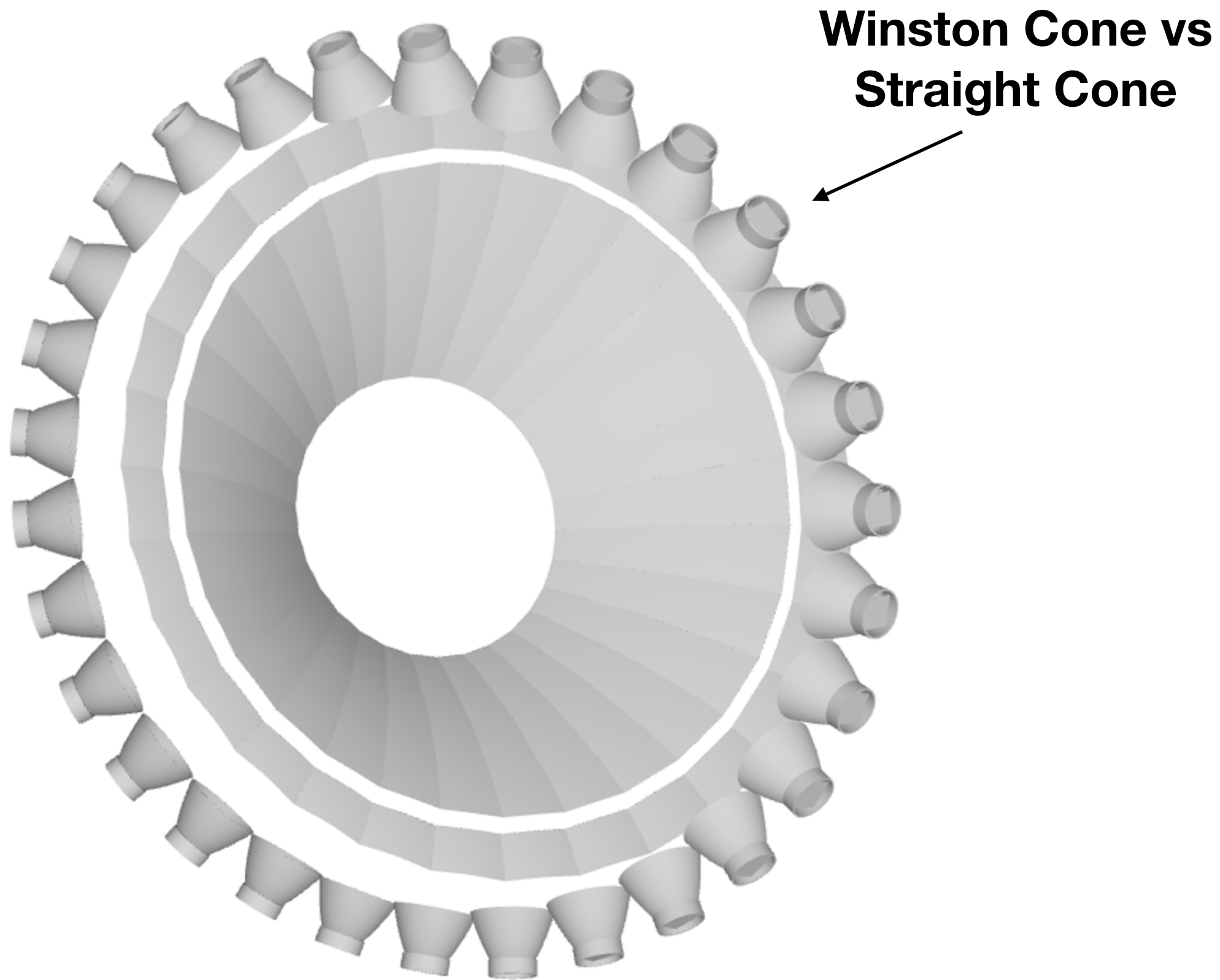


2-Piece Cone
Polycarbonate, $\frac{3}{64}$ " thick
Sheet Metal?



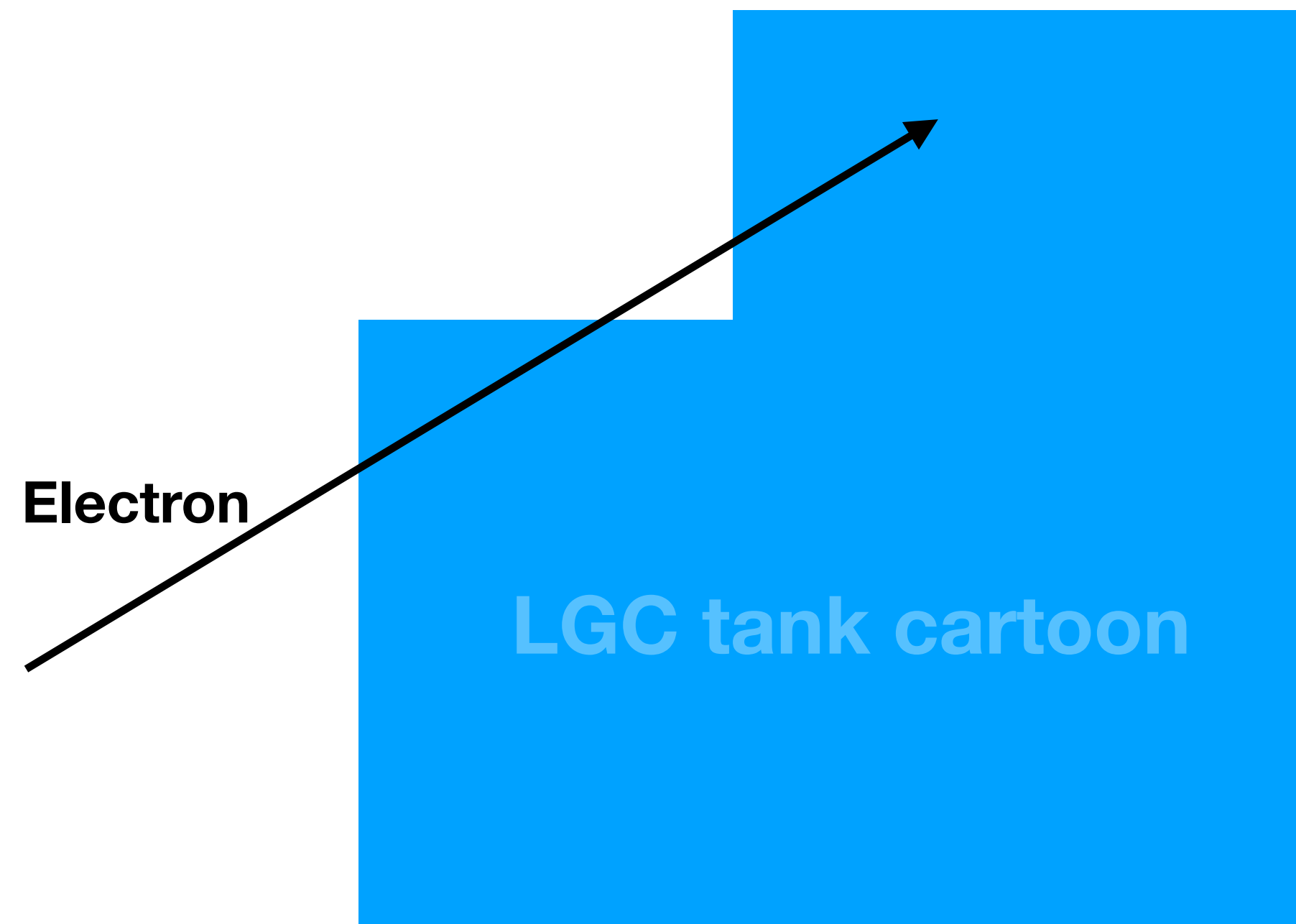
Simulation update

- We've begun simulation analysis with DD4HEP:
 - Current plots and analysis courtesy of Chao Peng, Argonne

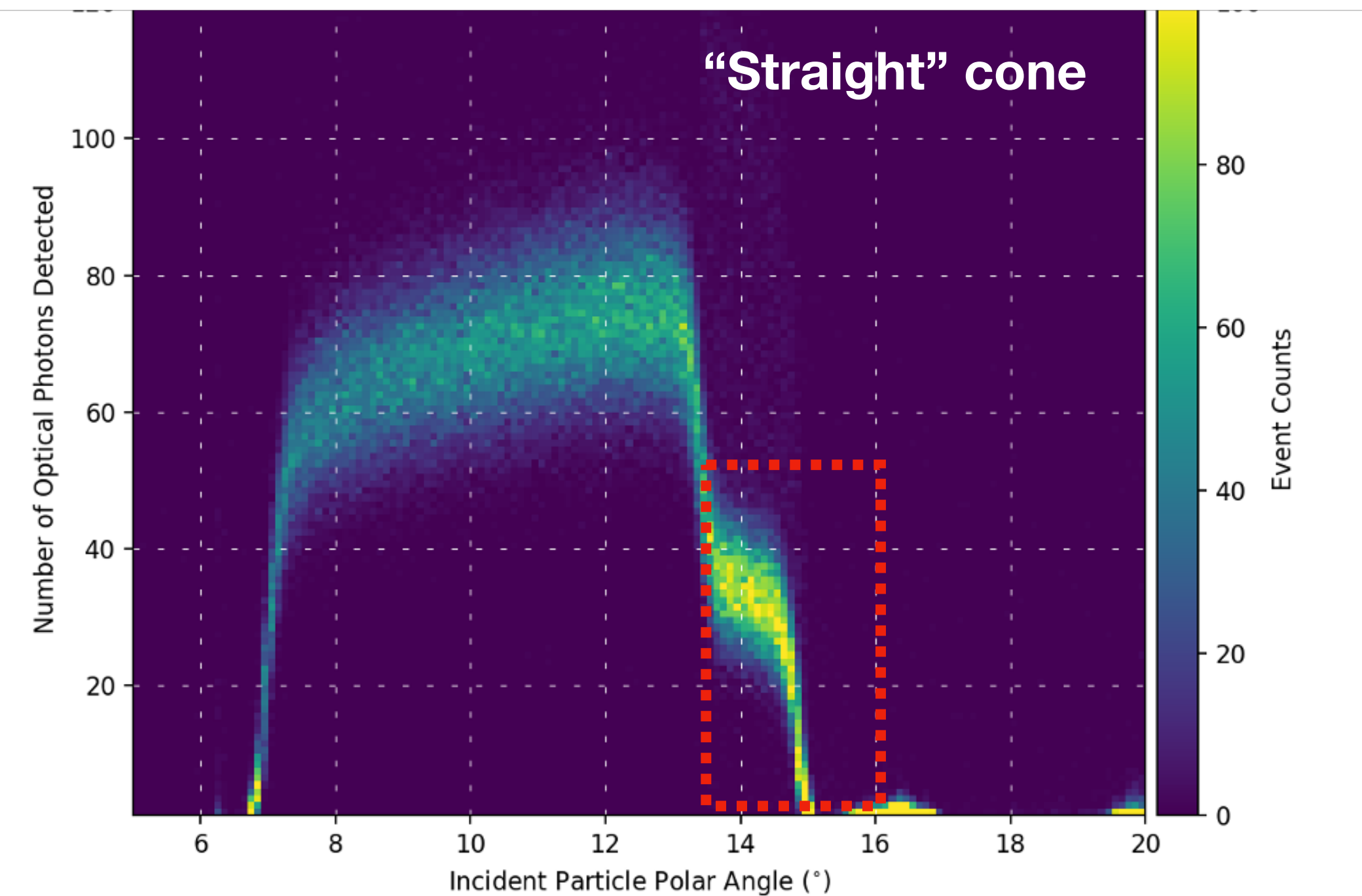
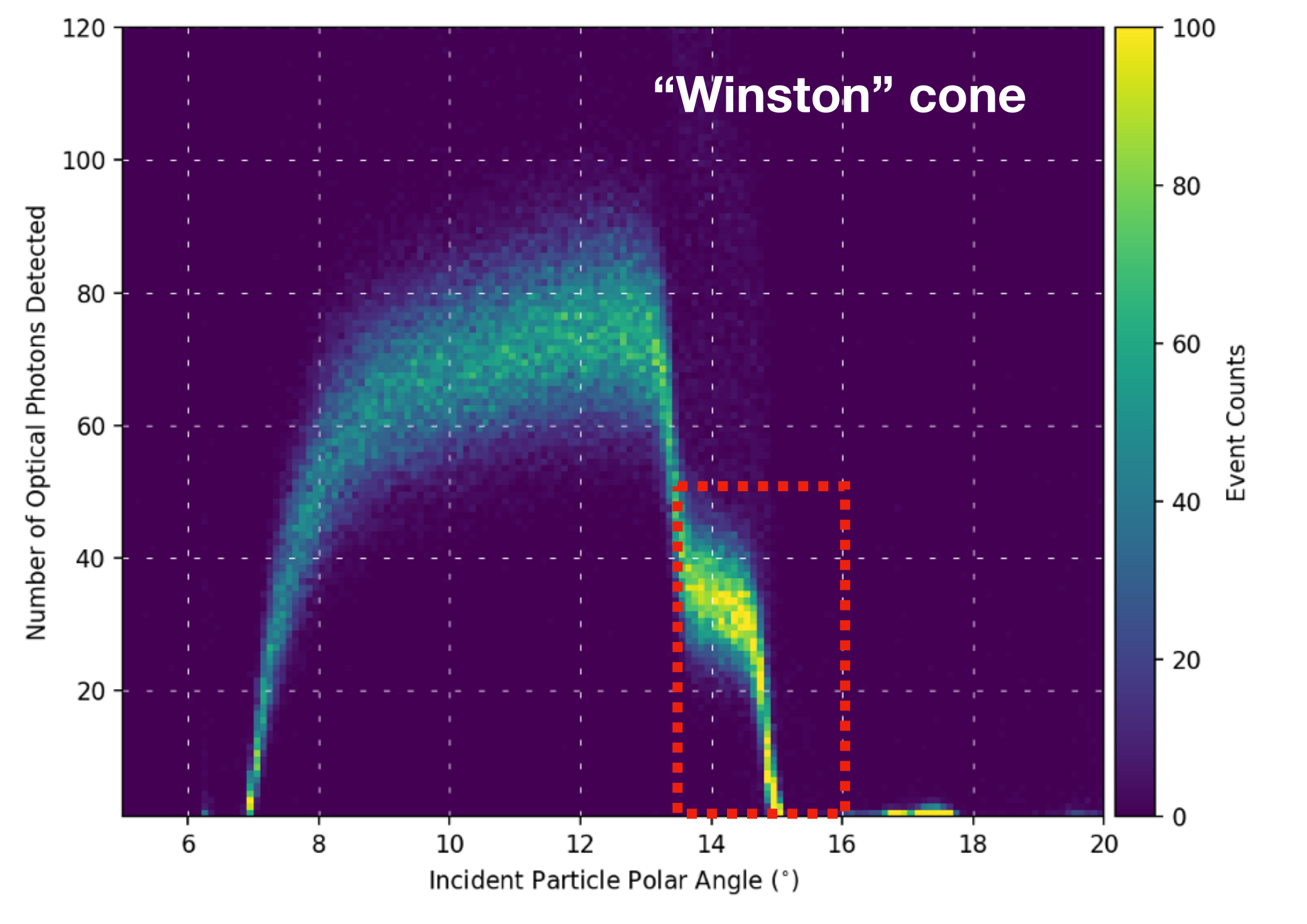


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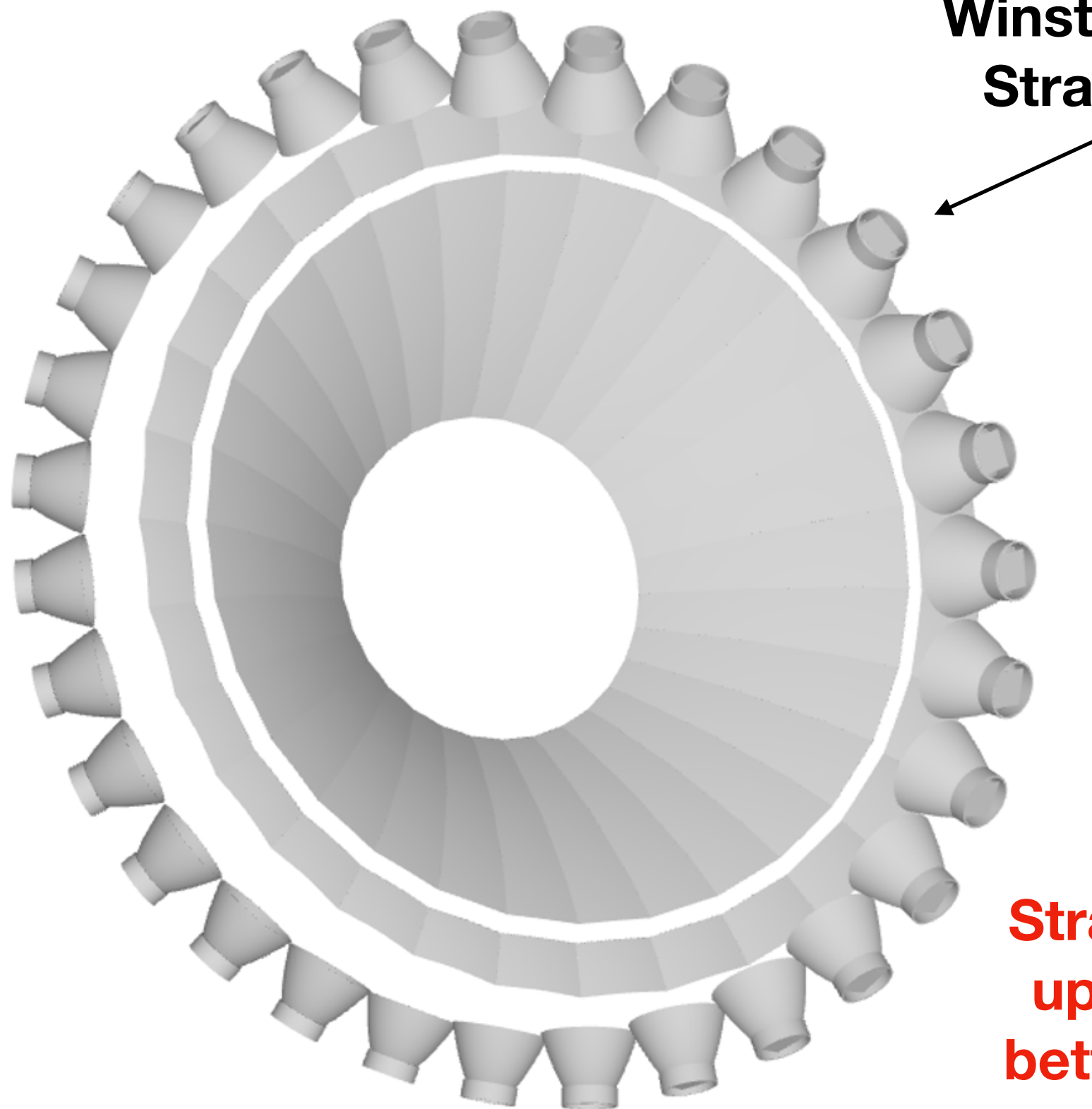


In "LGC only" simulation, magnet material doesn't stop an electron from re-entering tank



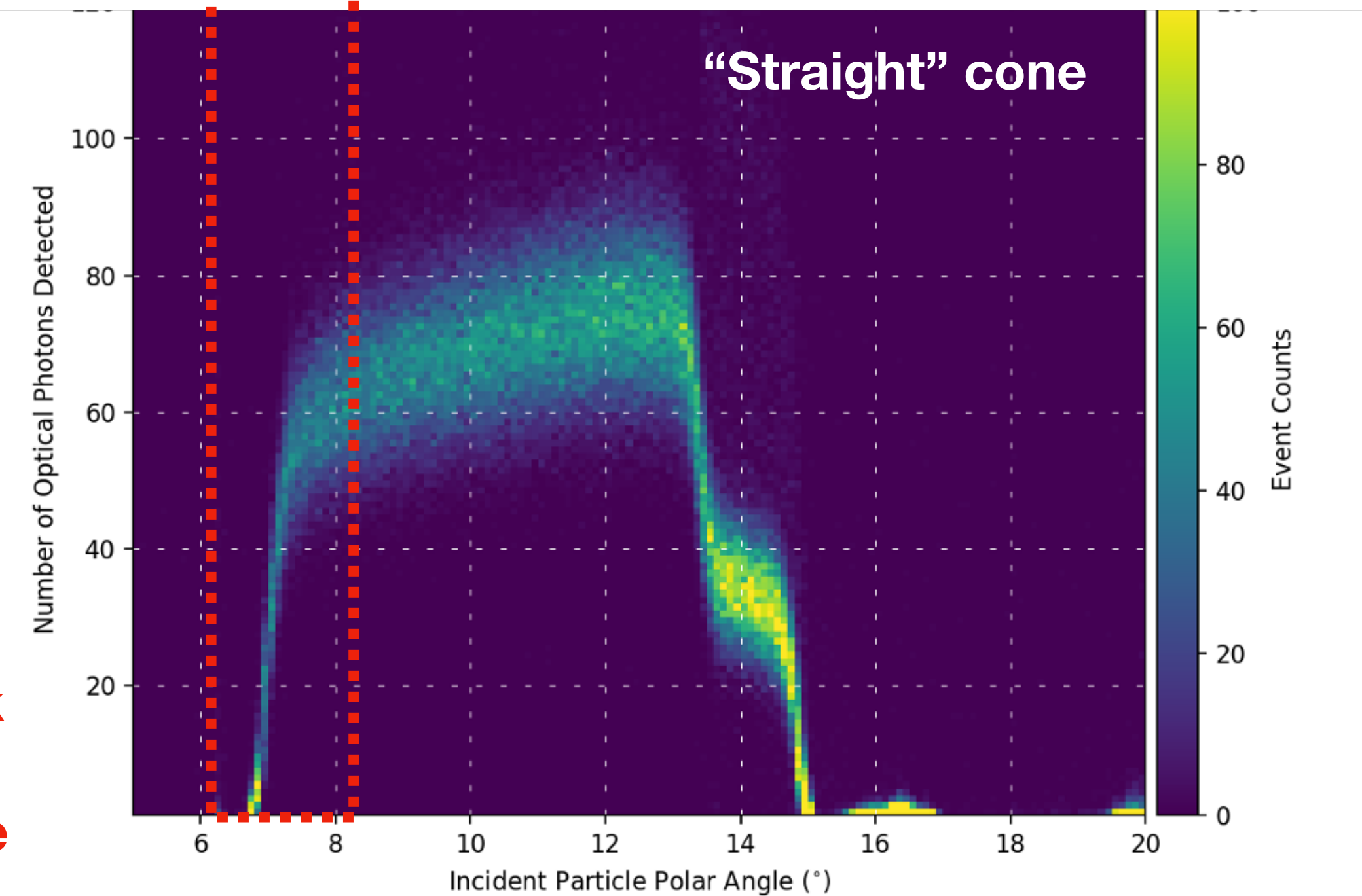
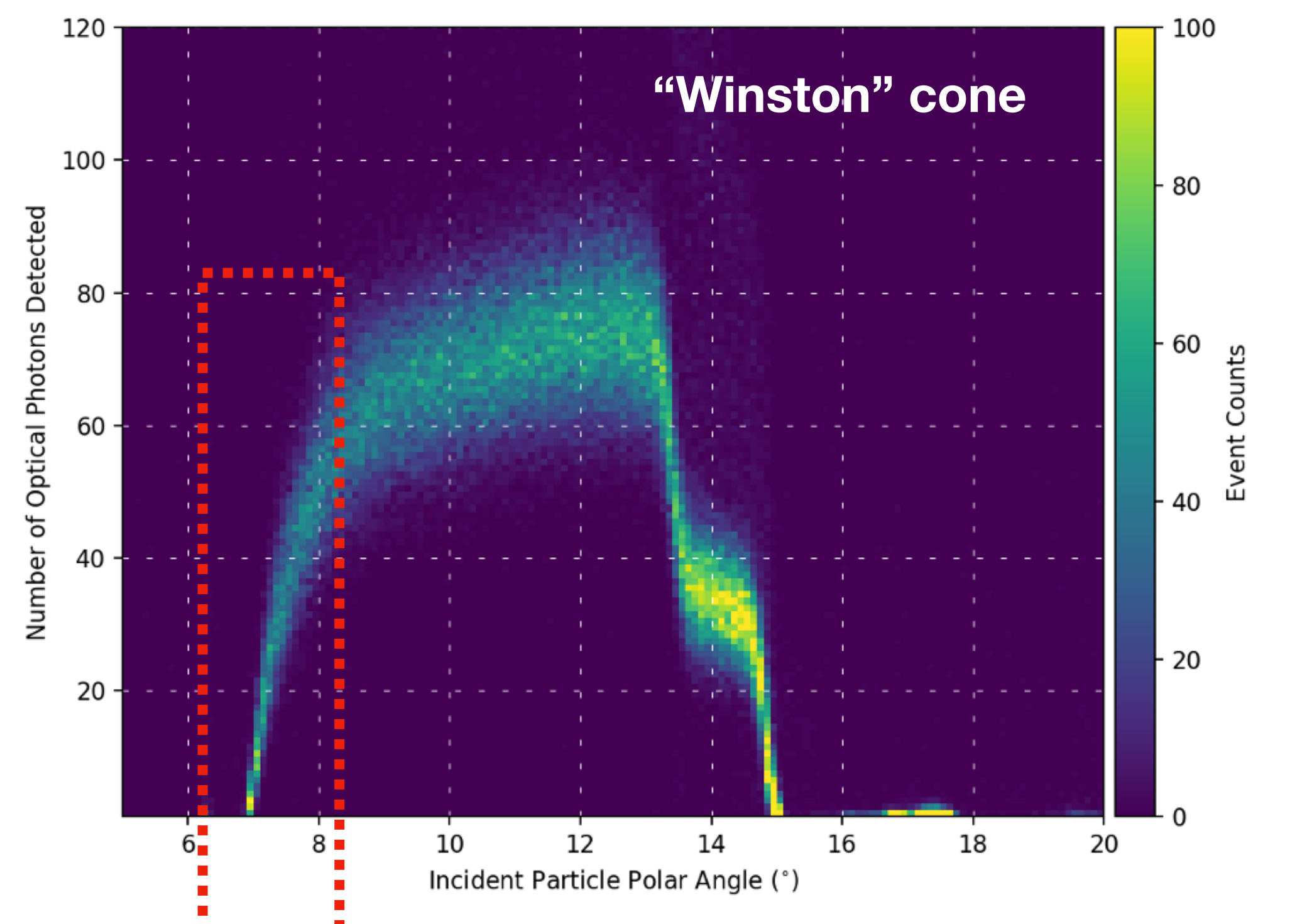
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Winston Cone vs
Straight Cone

Straight cone tends to pick up low angle SIDIS signal better than a Winston Cone



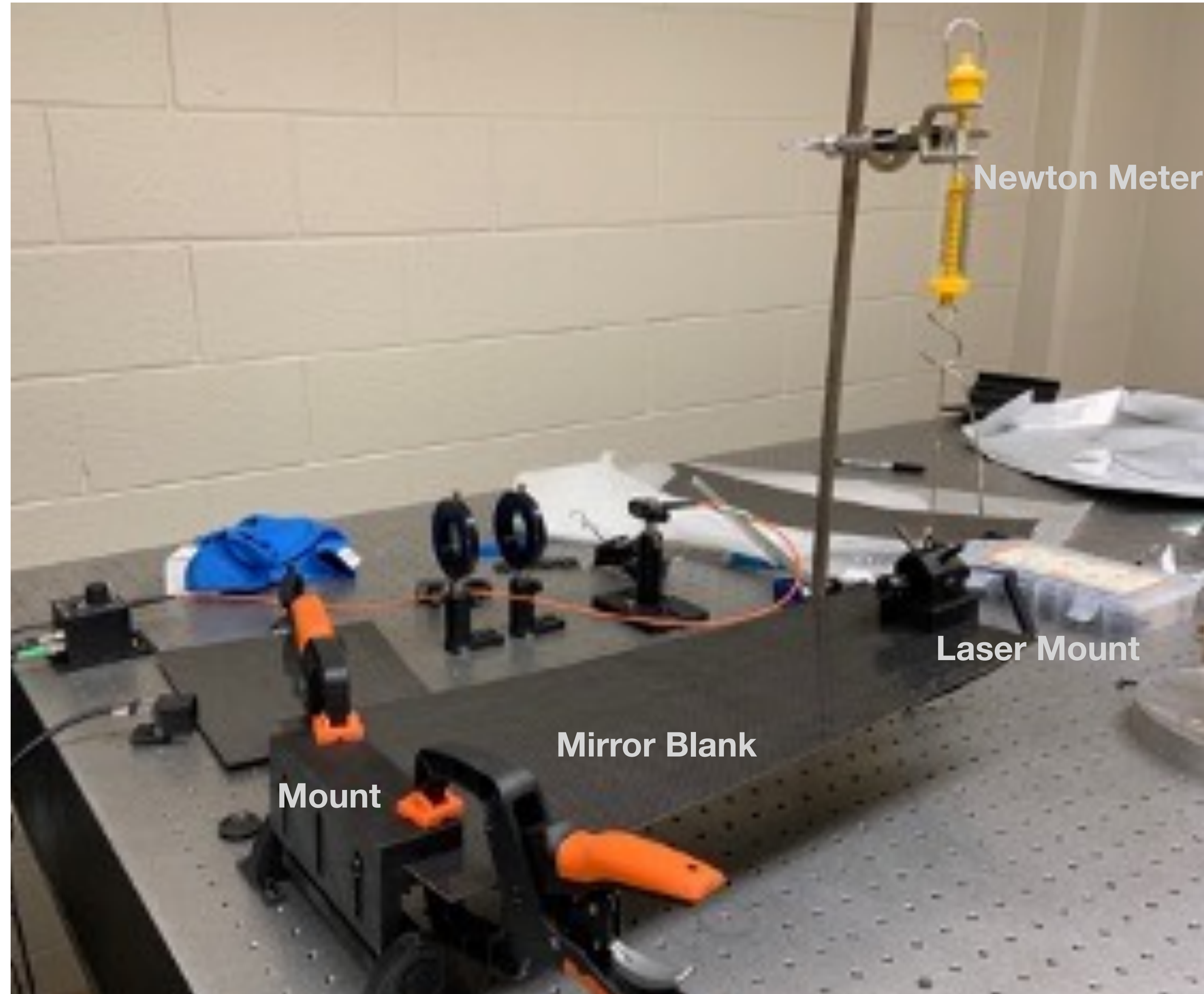
Mirror Fabrication Update

- Carbon Fiber blank segments have been received from Allred Inc:
 - 1/2 size Mirror-1 and Mirror-2 segments:
 - Comparison of infill: Depends on the material and orientation of fibers between layers.
 - Total thickness comes in at 1/2 of expected material budget!
 - **Tests of Radius of curvature:**
 - Using minimum spot-size calibrated versus known spherical mirror: about 1-3% deviation from design spec, depending on infill, all systematically large. Also slight aberration between “vertical” and “horizontal” focal length (~ 1%).
 - Relaxing after forming? Moisture drying? Maybe compensated with slightly larger mandrel.
 - Tests of mechanical deformation:
 - Laser deflection set-up:
 - Very small deflections at moderate force



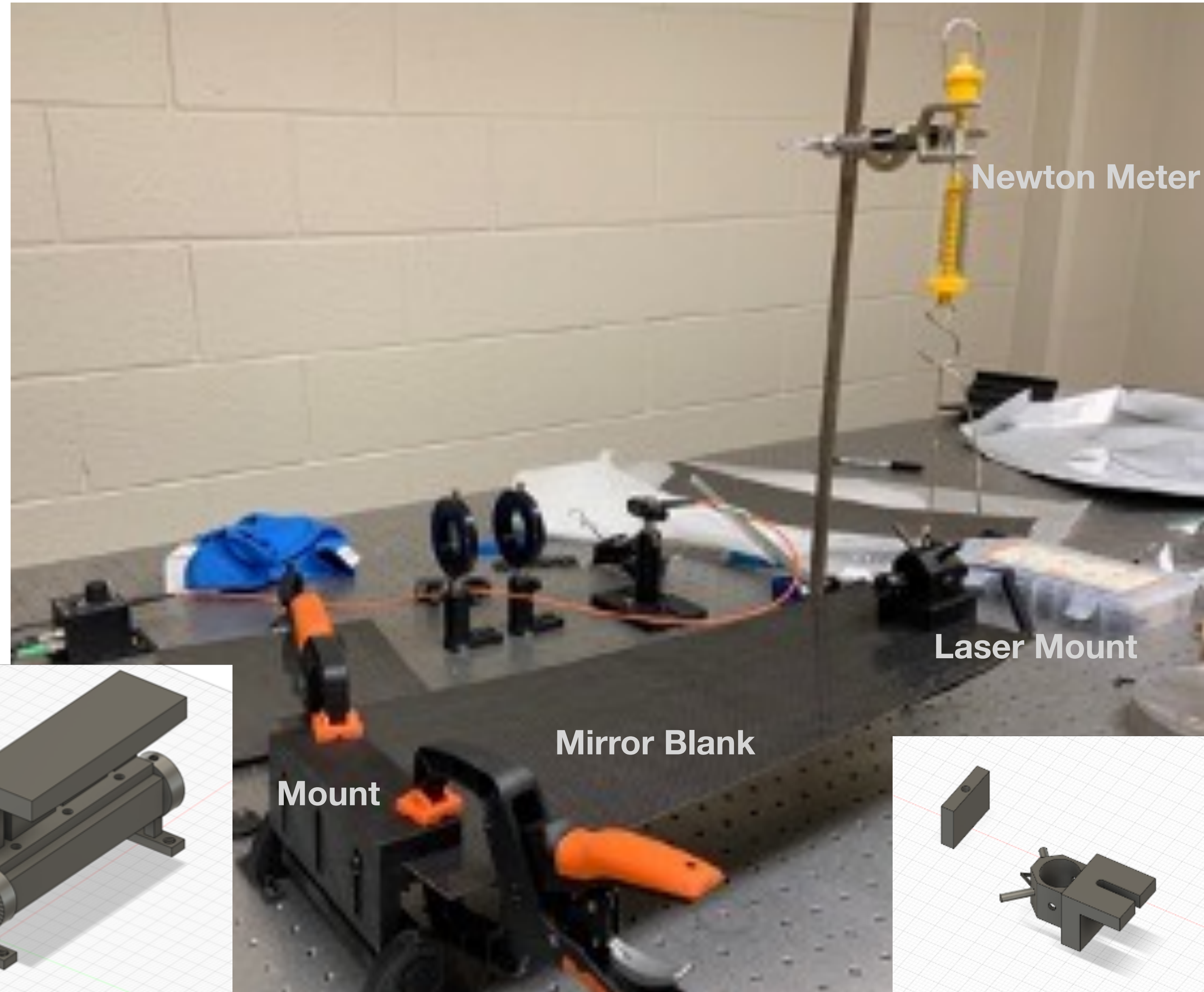
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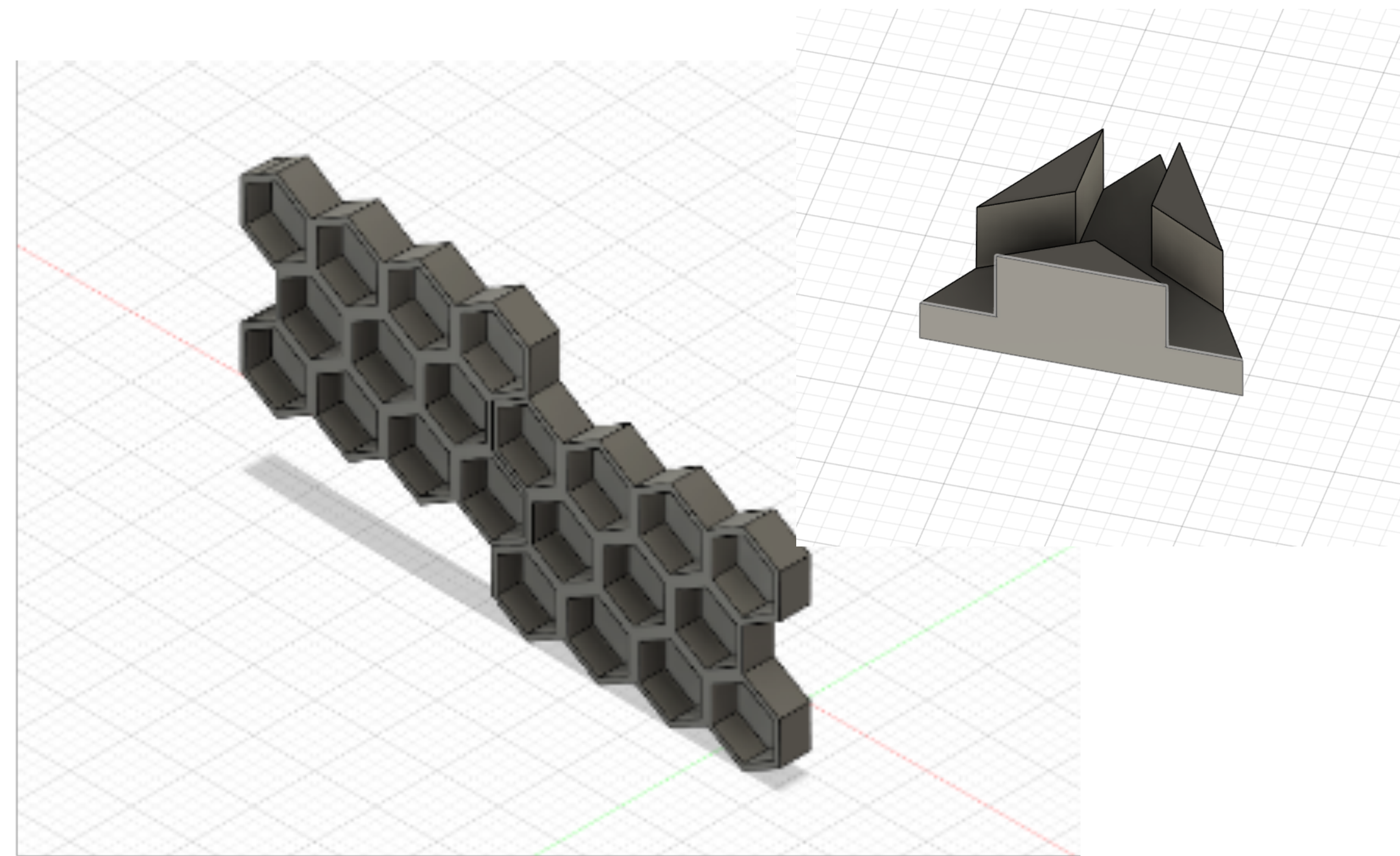
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Mirror Fabrication Update

- 3D printed solutions:
 - Use a modular hexagonal array, with interlocking back plate.
 - “Lego” build a curved array:
 - Still in design phase. Need to test mechanical stability along with material thickness optimization



Mirror Fabrication Update

- Pressure forming tests:
 - Temps up to 240 C, Pressure to 60 psi
 - Lexan (PC) needs high temps, high pressure, and extremely dry conditions.
 - Other plastics are more manageable:
 - PETG - good balance between temp and plasticity
 - Acrylic (PMMA) - Well known optical quality, less good plasticity.
- Reflectivity: See talk by Bill in a few minutes
 - Radiation hardness of reflectivity?



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