

MOLLER Shower-max Ring Engineering

Aug 24, 2020

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(Idaho State University)

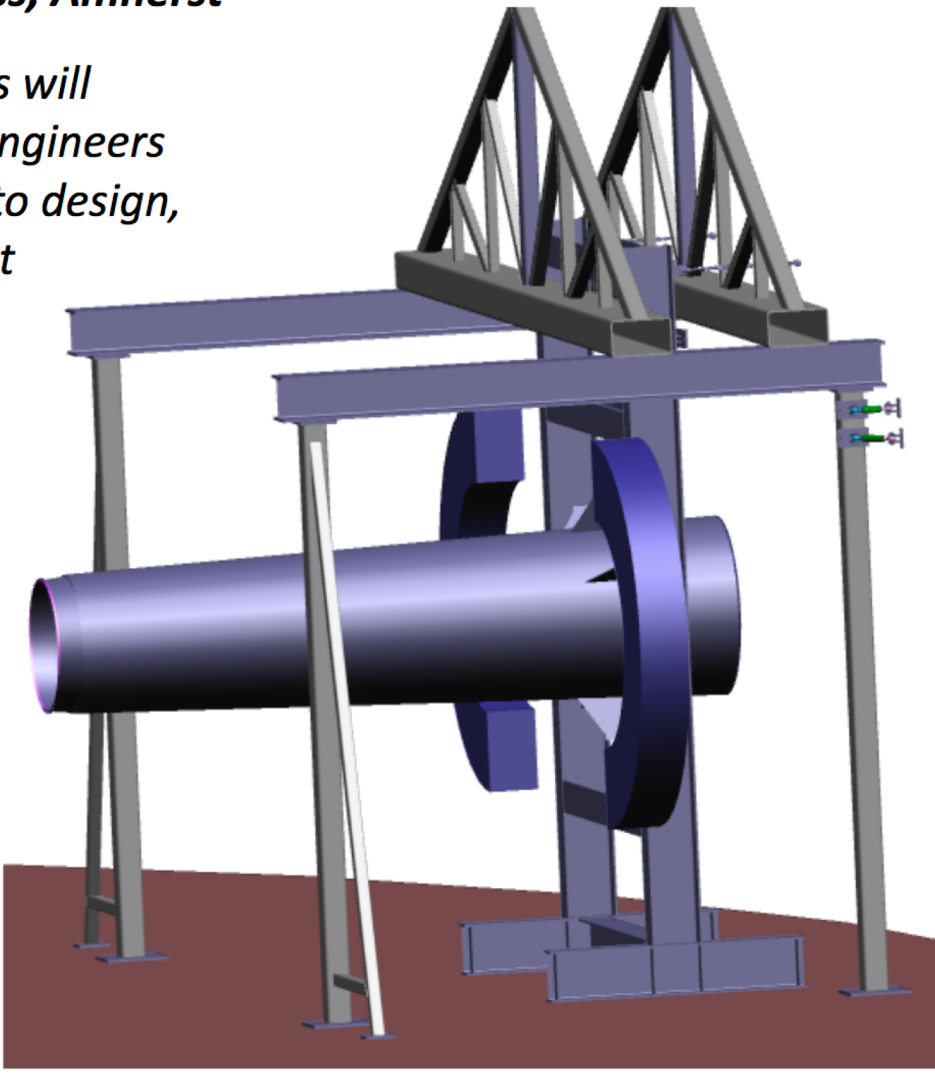
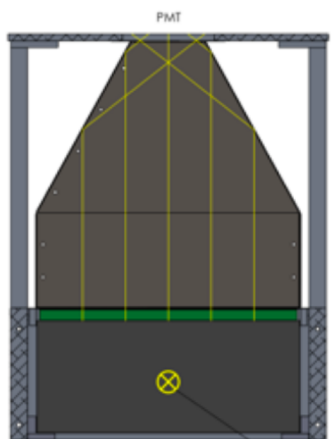
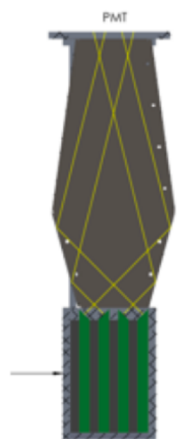
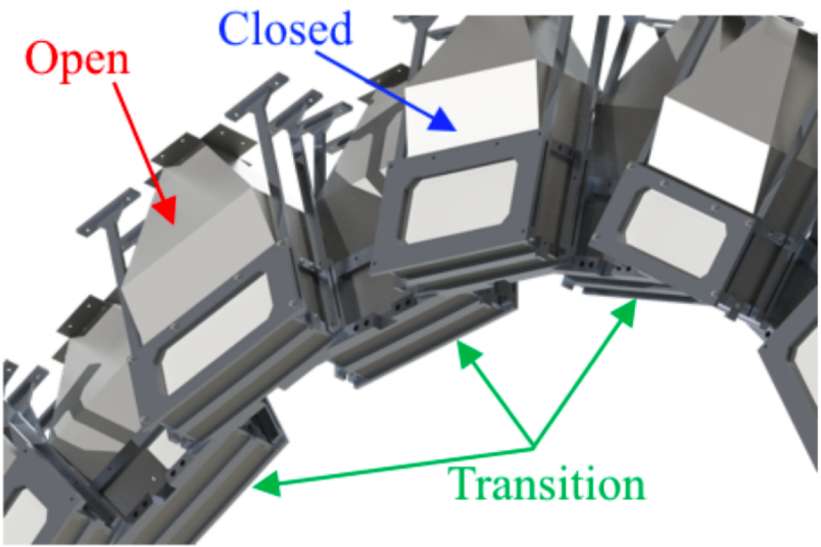
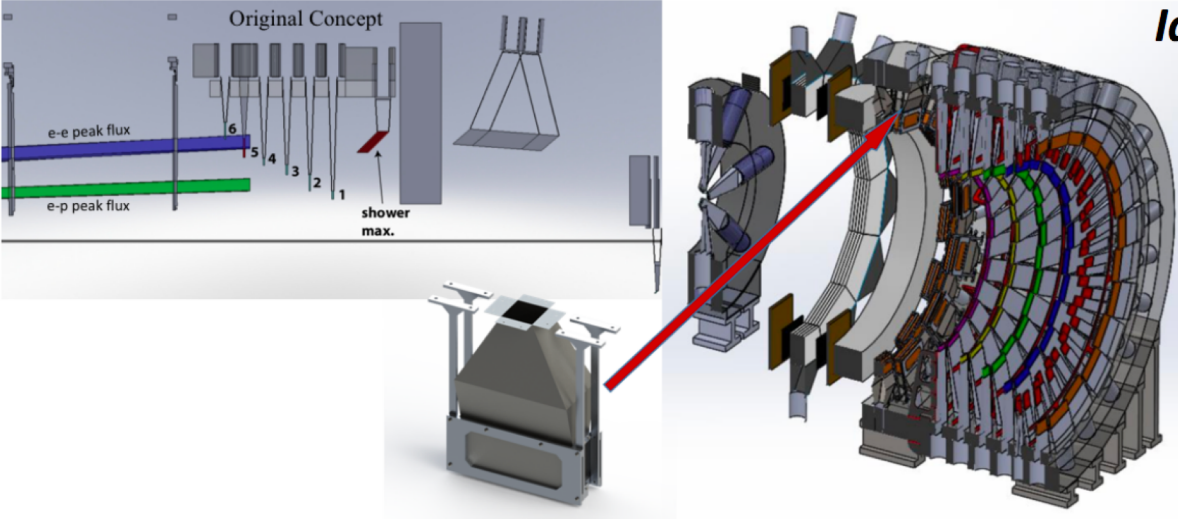
Outline

- Shower-max overview
- Prototype assembly
- Prototype/baseline design
 - Lightguide
 - Chassis/stack support
- Ring layout and dimensions
- Ring support system idea

Shower Max Assembly

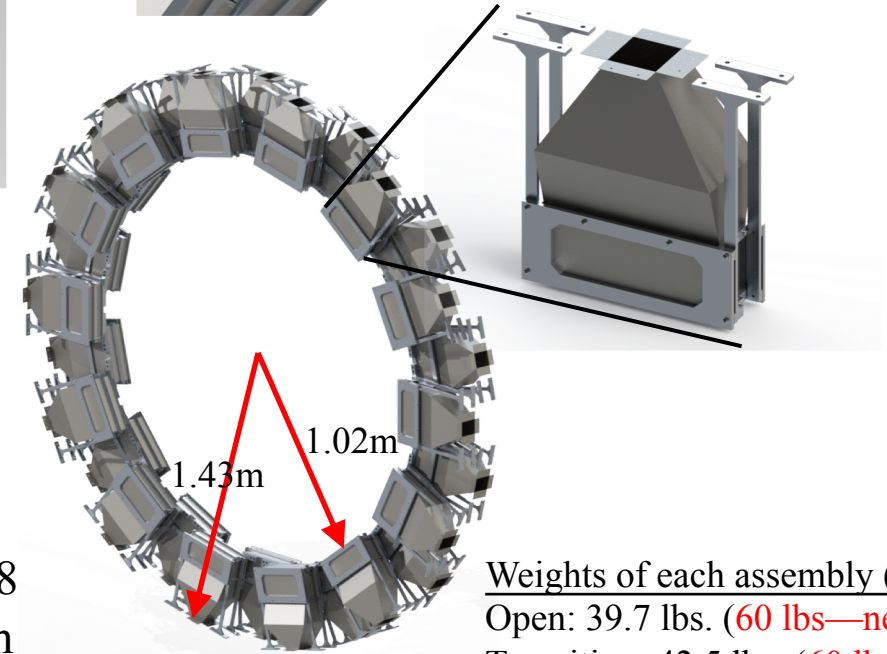
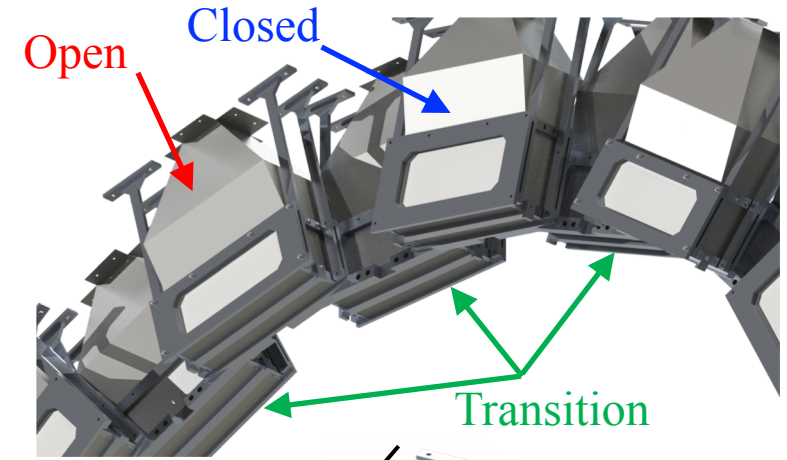
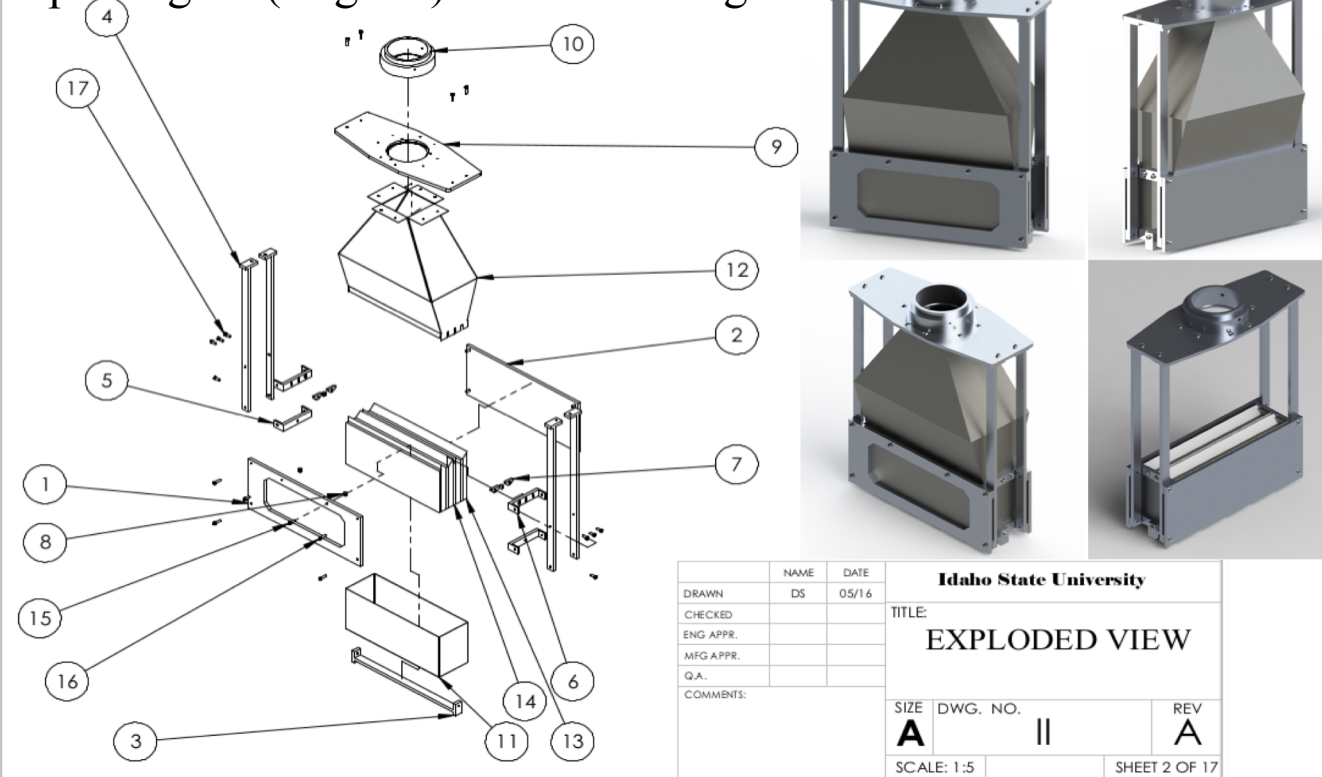
Idaho State and UMass, Amherst

University groups will work with JLab engineers and make plans to design, fabricate and test subassemblies



Baseline Shower-max Design and Ring Concept

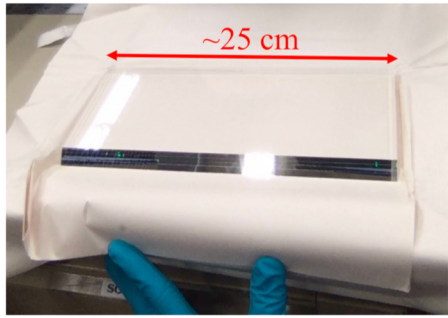
Open region (original) Baseline Design



- Engineered shop drawings for full-scale prototypes in hand
- ***PLANS***: Finalized prototype Stack designs in fall 2017, ordered prototype quartz in Nov 2017, constructed in spring/summer 2018 and tested in Dec 2018 using 2 - 10 GeV electron SLAC testbeam
- Shower-max ring design concept: staggered in \hat{z} with reinforced struts and brackets. 28 detectors in ring: 7 Open, 7 Closed, and 14 Transition

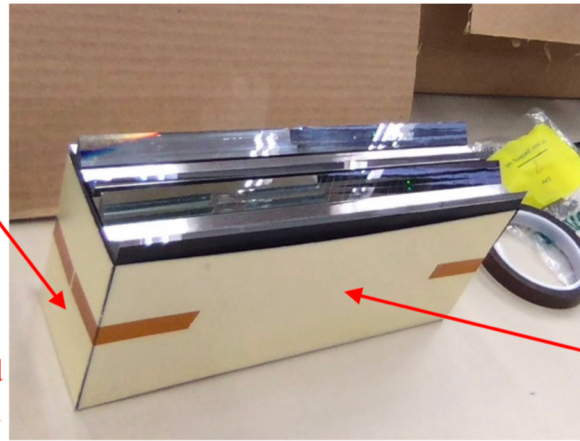
Weights of each assembly (old):
 Open: 39.7 lbs. (**60 lbs—new size**)
 Transition: 42.5 lbs. (**60 lbs**)
 Closed: 50.8 lbs. (**60 lbs**)
 ring weight: 1230 lbs. (**1700 lbs**)

Prototype Assembly



~25 cm

Aluminum sheet coffin



Quartz wrapped in black Kapton

Fully assembled stack weighs ~40 lbs

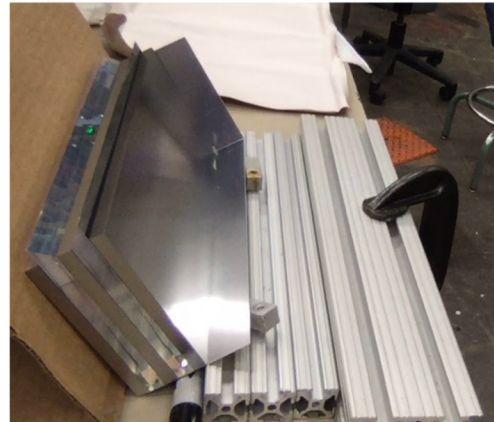


8 mm thick 99.95% pure tungsten plates

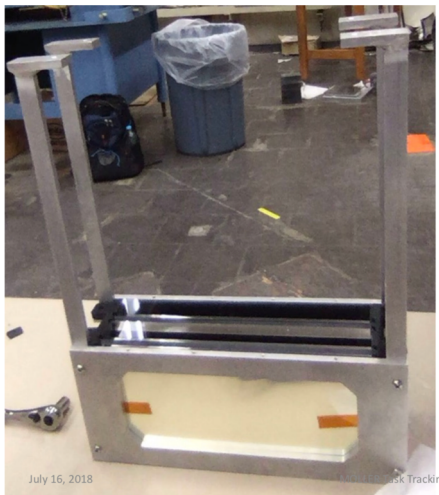
July 16, 2018



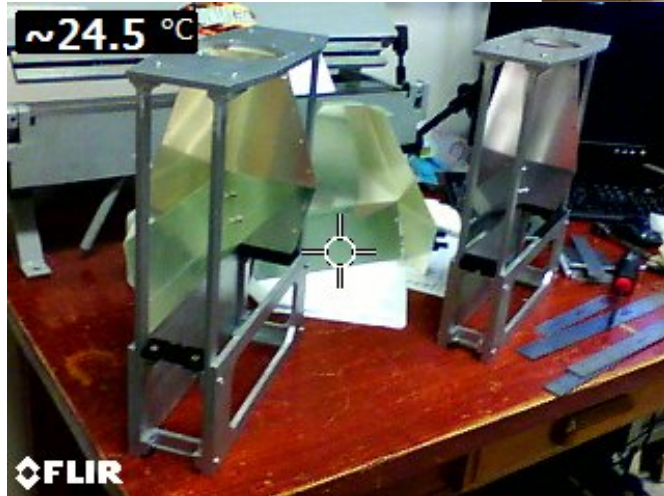
MOLLER Task Tracking Bluejeans Meeting



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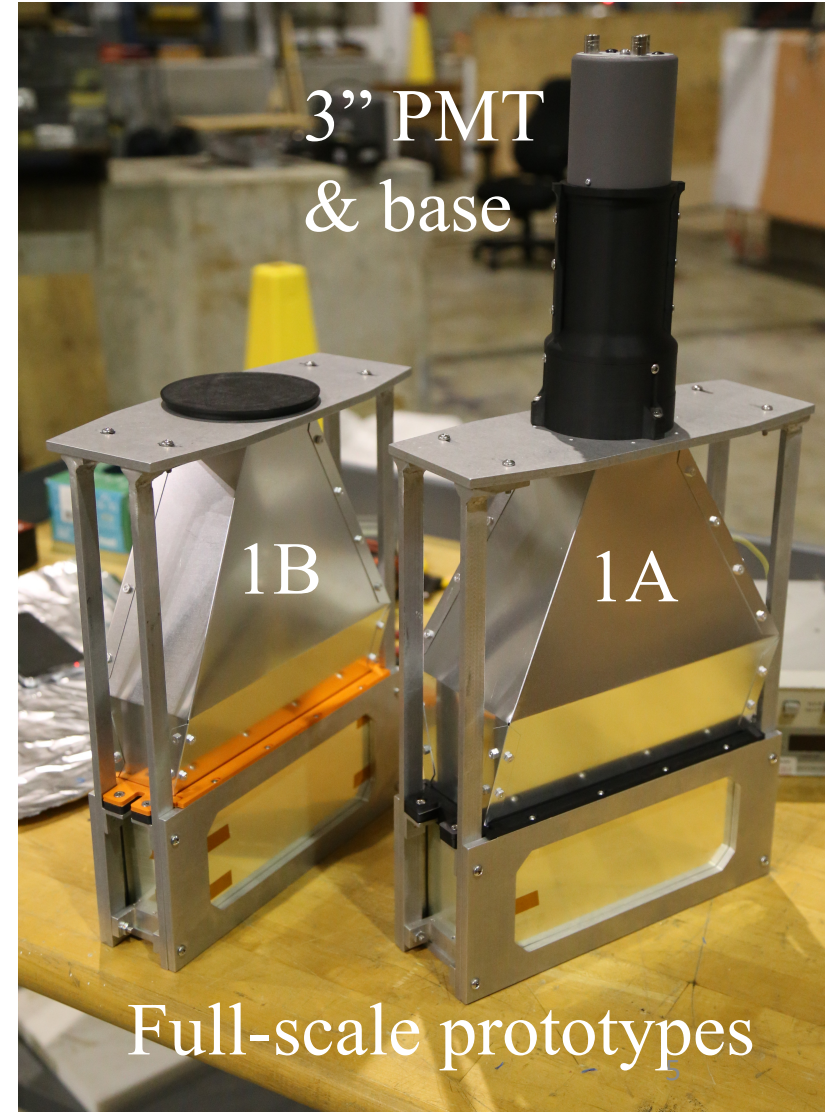


July 16, 2018



FLIR

All aluminum chassis and light guide. Stainless 316 and aluminum screws and nuts



3" PMT & base

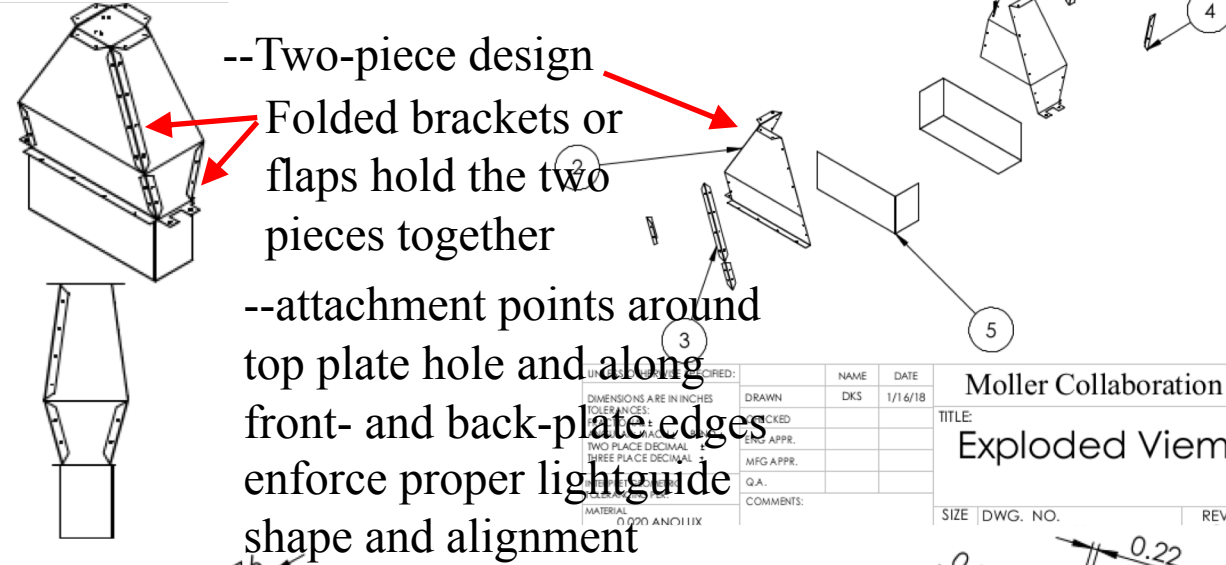
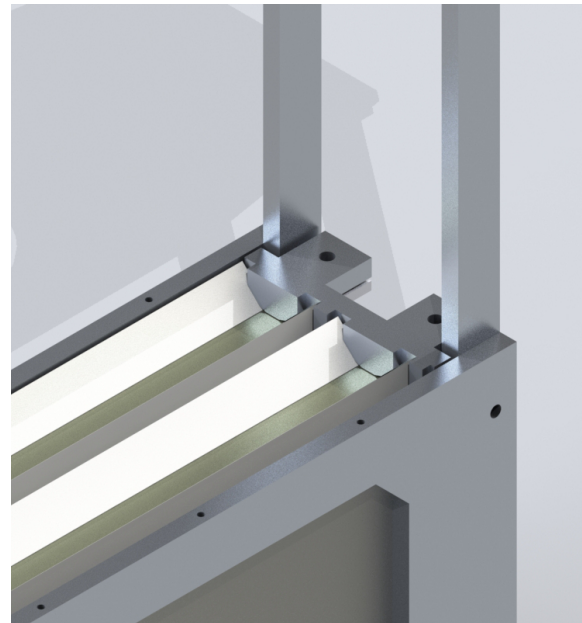
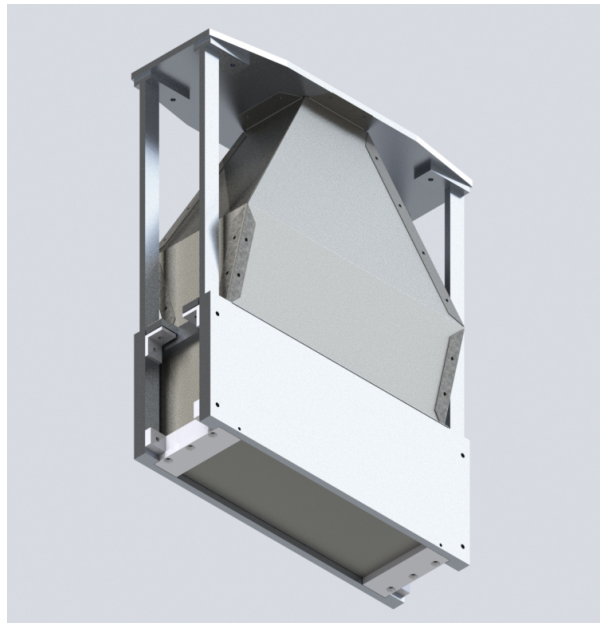
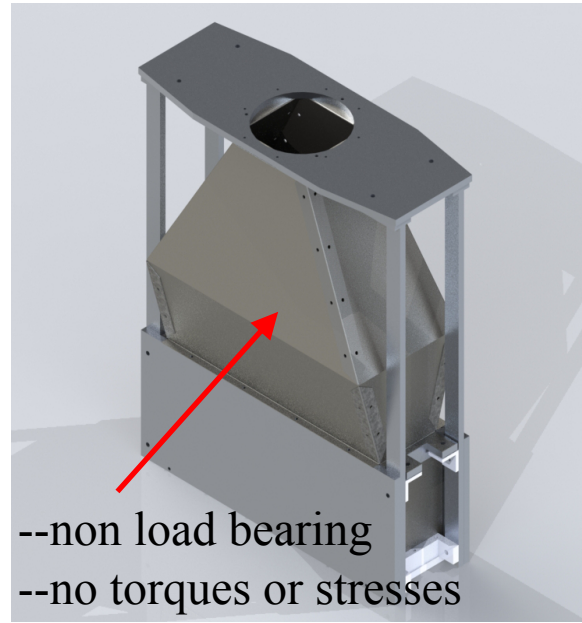
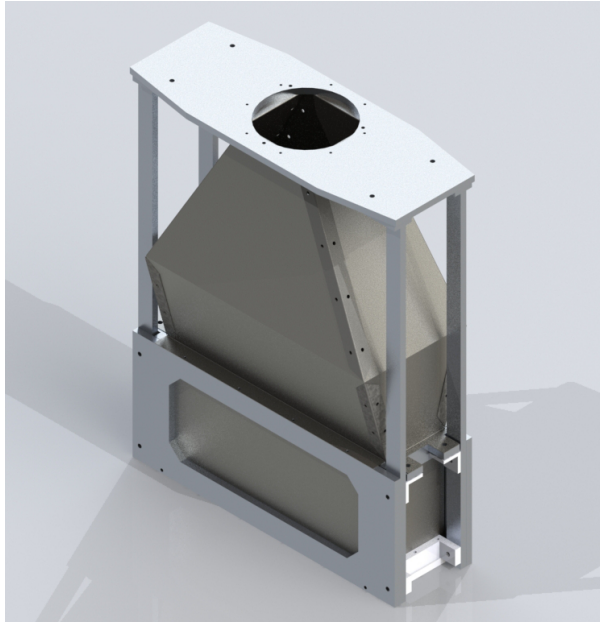
1B

1A

Full-scale prototypes

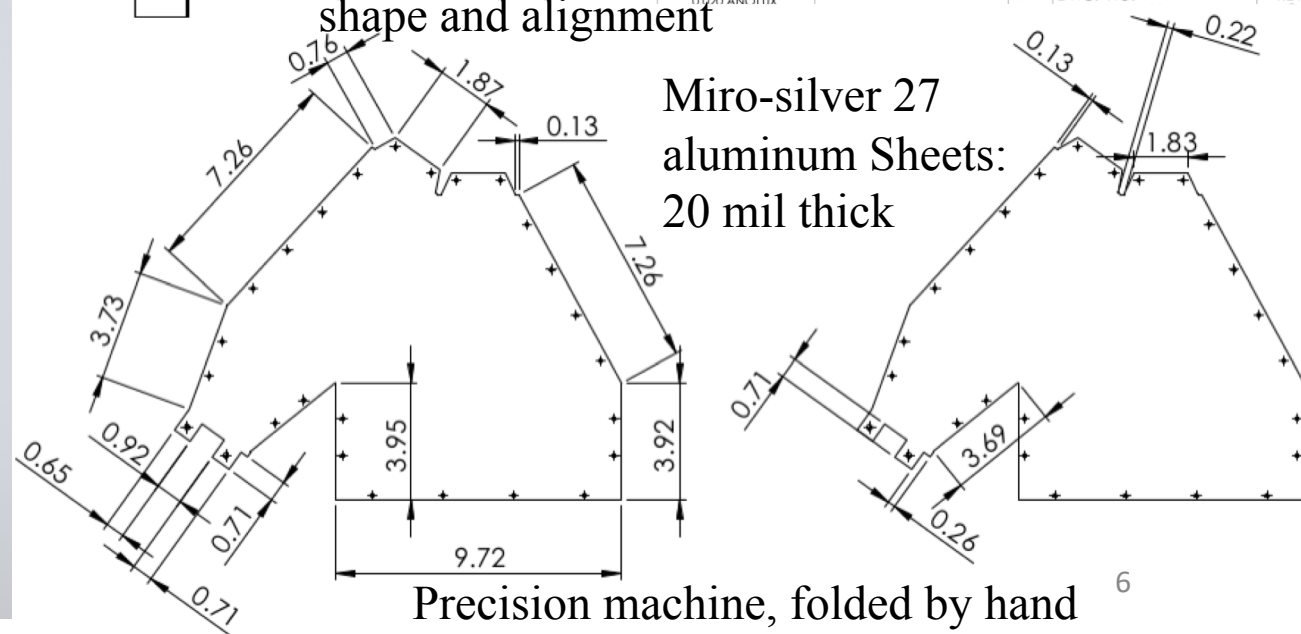
Shower-max light guide

ITEM NO.	PART	MATERIAL	QTY.
1	Light Guide - Back	0.020 ANOLUX MIRO-SILVER REFLECTIVE ALUMINIUM SHEET	1
2	Light Guide - Front	0.020 ANOLUX MIRO-SILVER REFLECTIVE ALUMINIUM SHEET	1
3	Long Flap	0.020 ANOLUX MIRO-SILVER REFLECTIVE ALUMINIUM SHEET	2
4	Short Flap	0.020 ANOLUX MIRO-SILVER REFLECTIVE ALUMINIUM SHEET	4
5	Suitcase	0.020 ANOLUX MIRO-SILVER REFLECTIVE ALUMINIUM SHEET	2

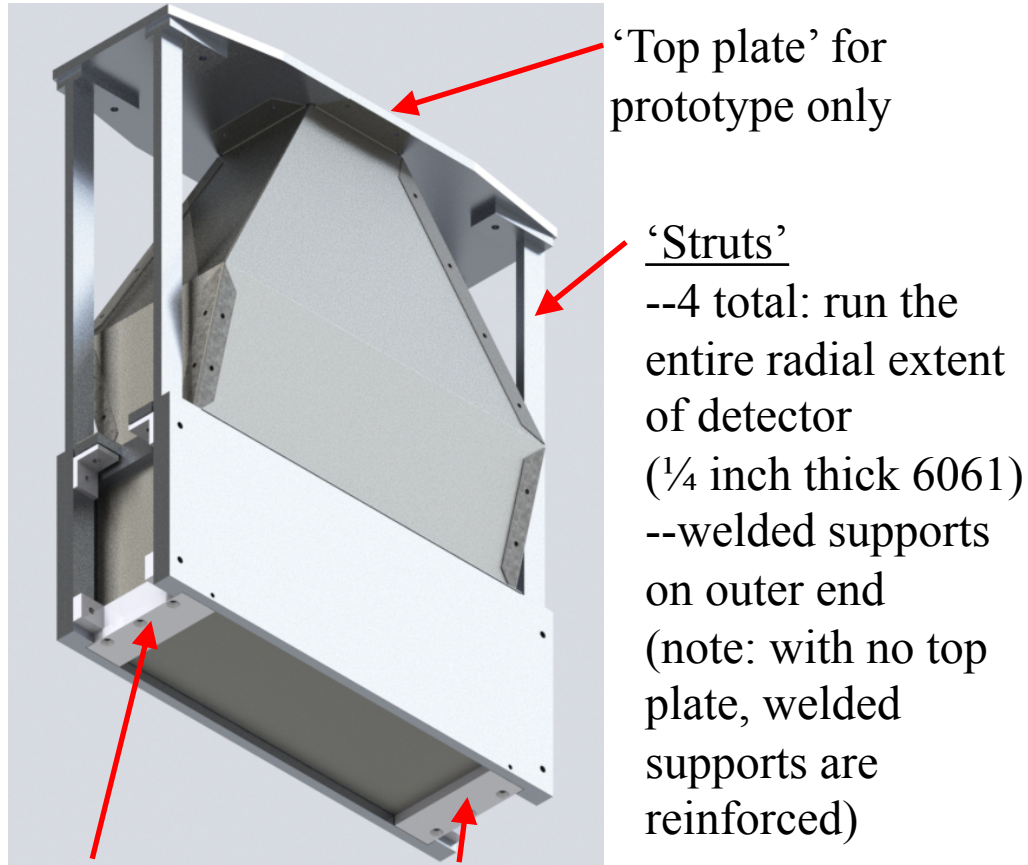


DATE	NAME	DATE	NAME
1/16/18	DKS		

Moller Collaboration
TITLE: Exploded View
SIZE DWG. NO. REV



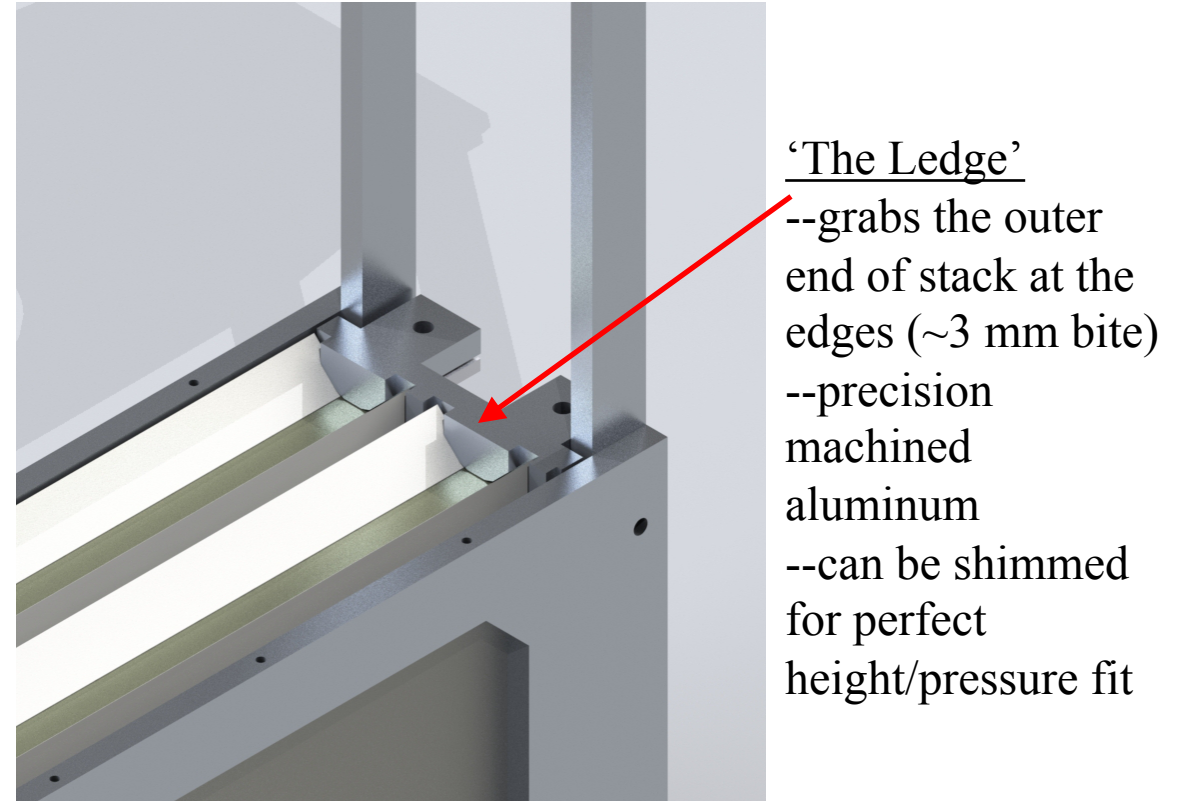
360° Stack supports



'The Floor': supports inner end of stack at edges

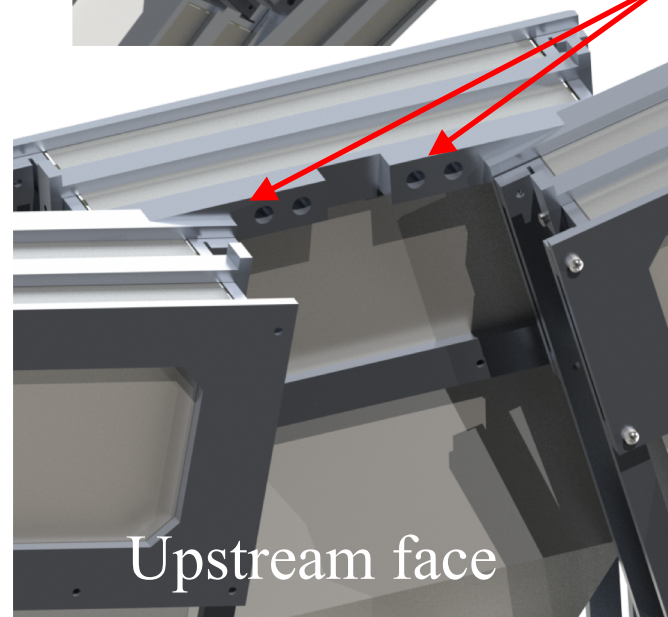
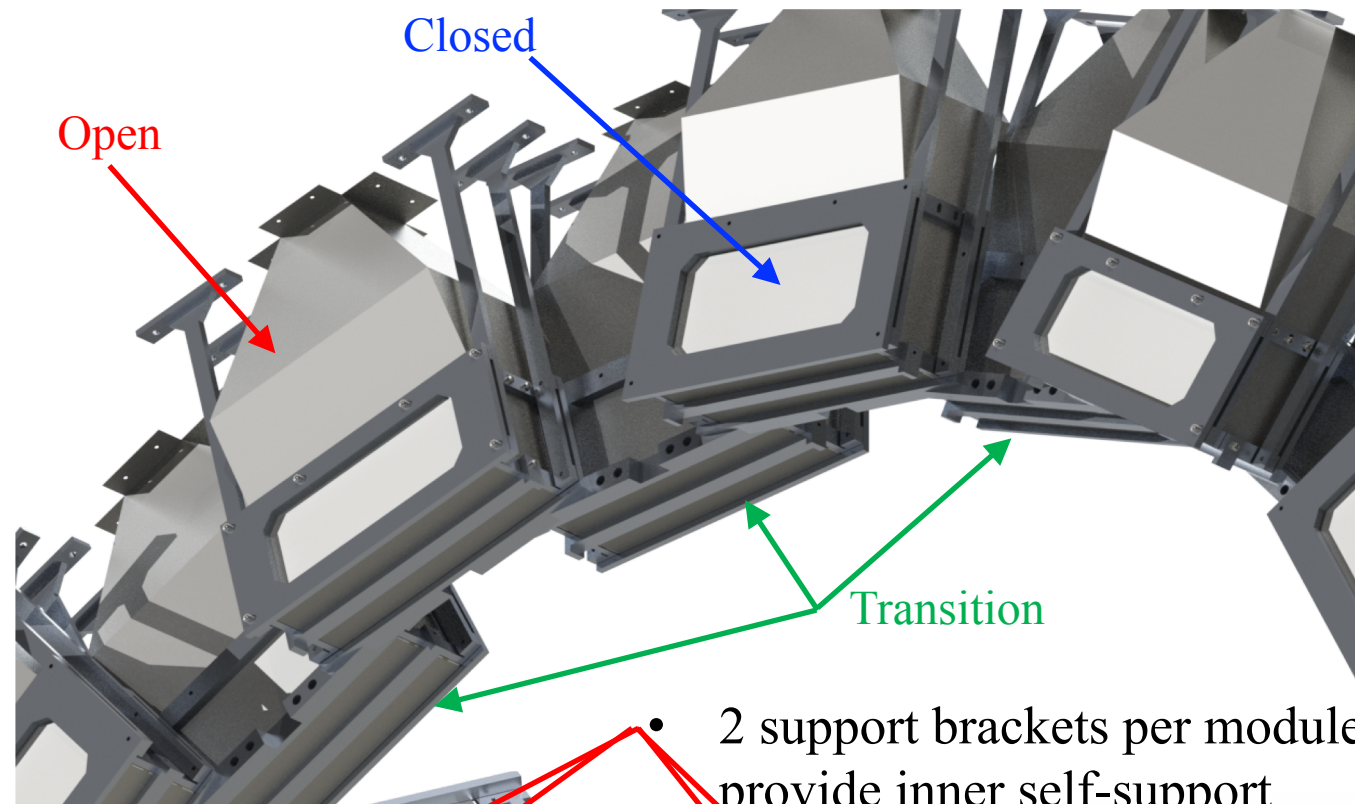
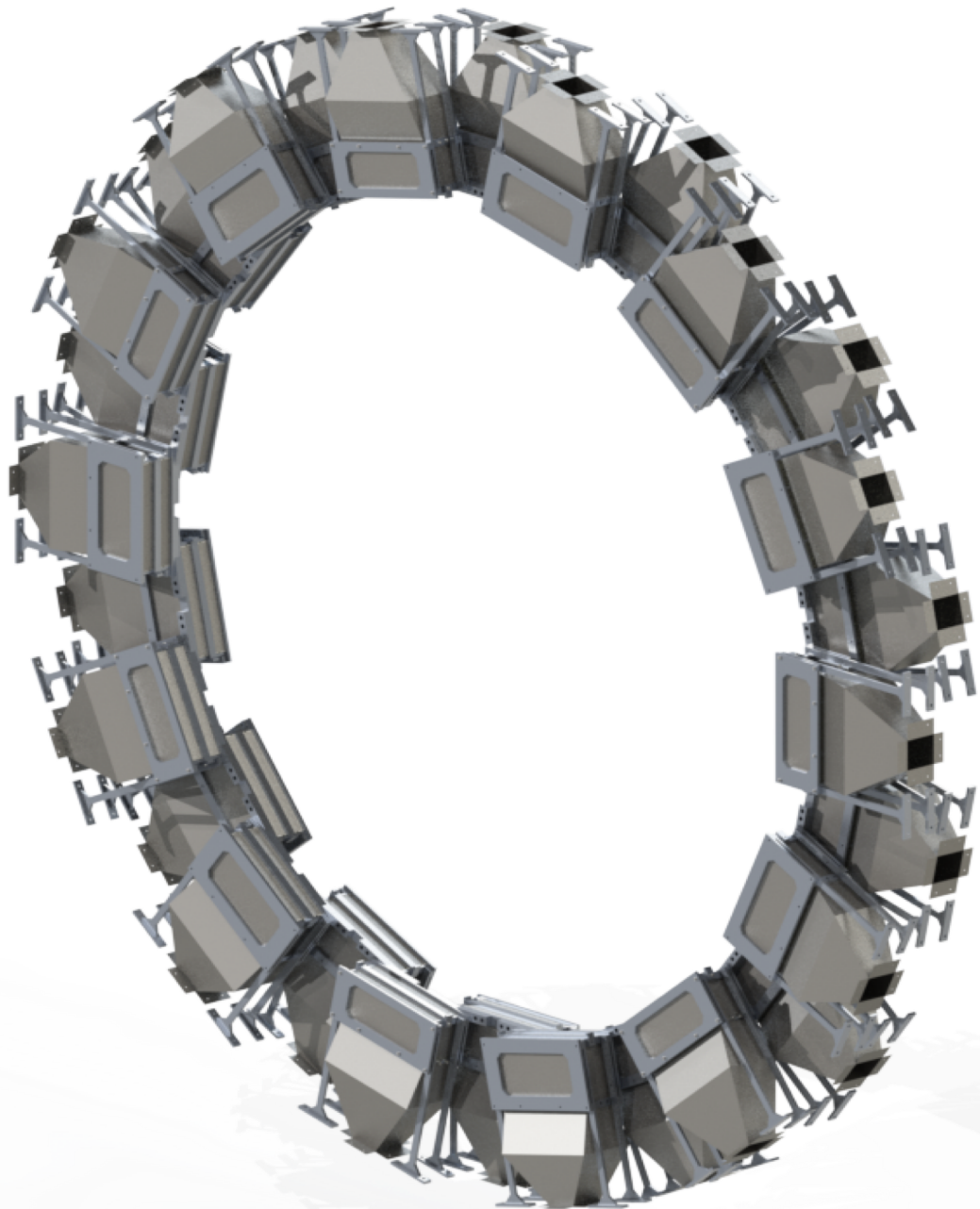
Each consists of two aluminum parts:

- 1/4 inch thick 6061 plate (3 counter sunk through holes)
- 1/4 inch thick 6061 U-channel (3 taped holes, 2 through holes)
- U-channel with floor plate attach to struts and front and back plates

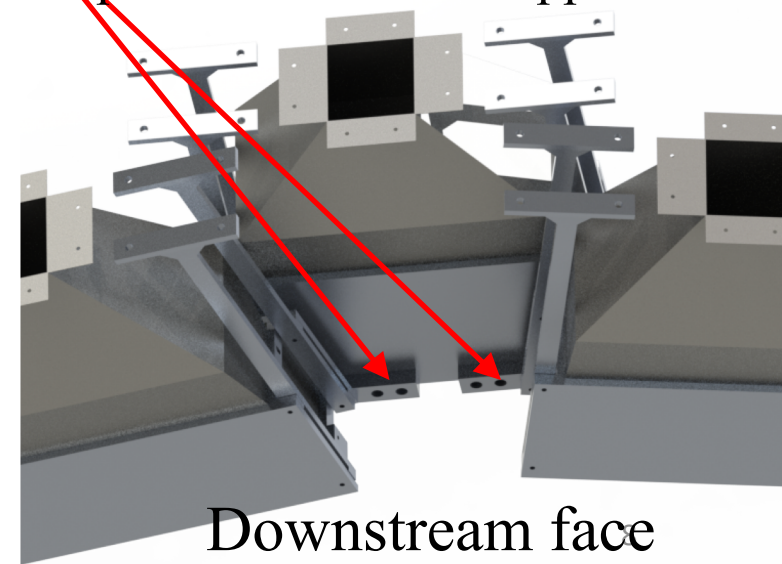


- Lateral or phi-direction stack support relies on precision fit of stack coffin into aluminum chassis

Ring Design



Upstream face



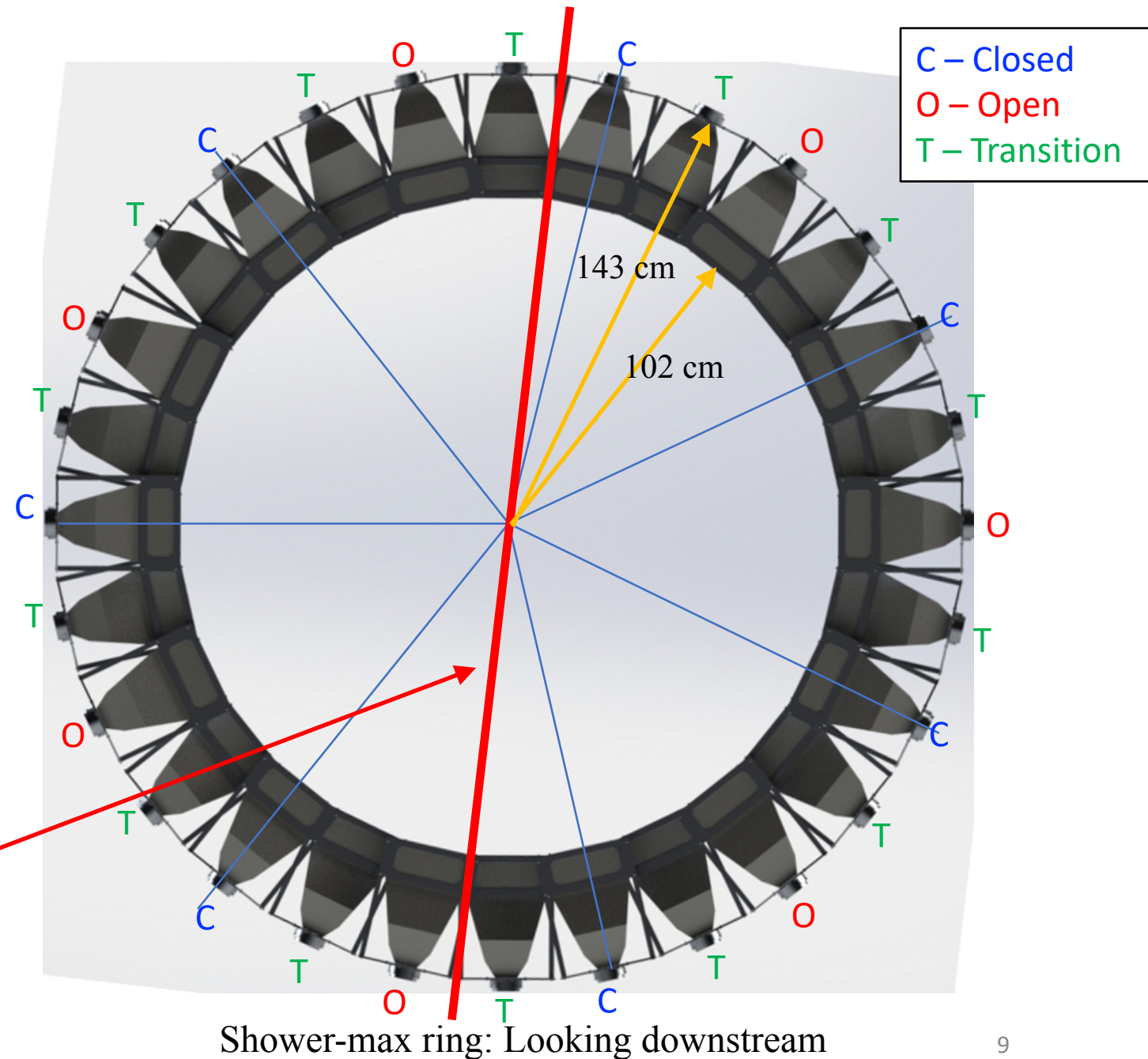
Downstream face

• 2 support brackets per module provide inner self-support

Ring Layout and Size

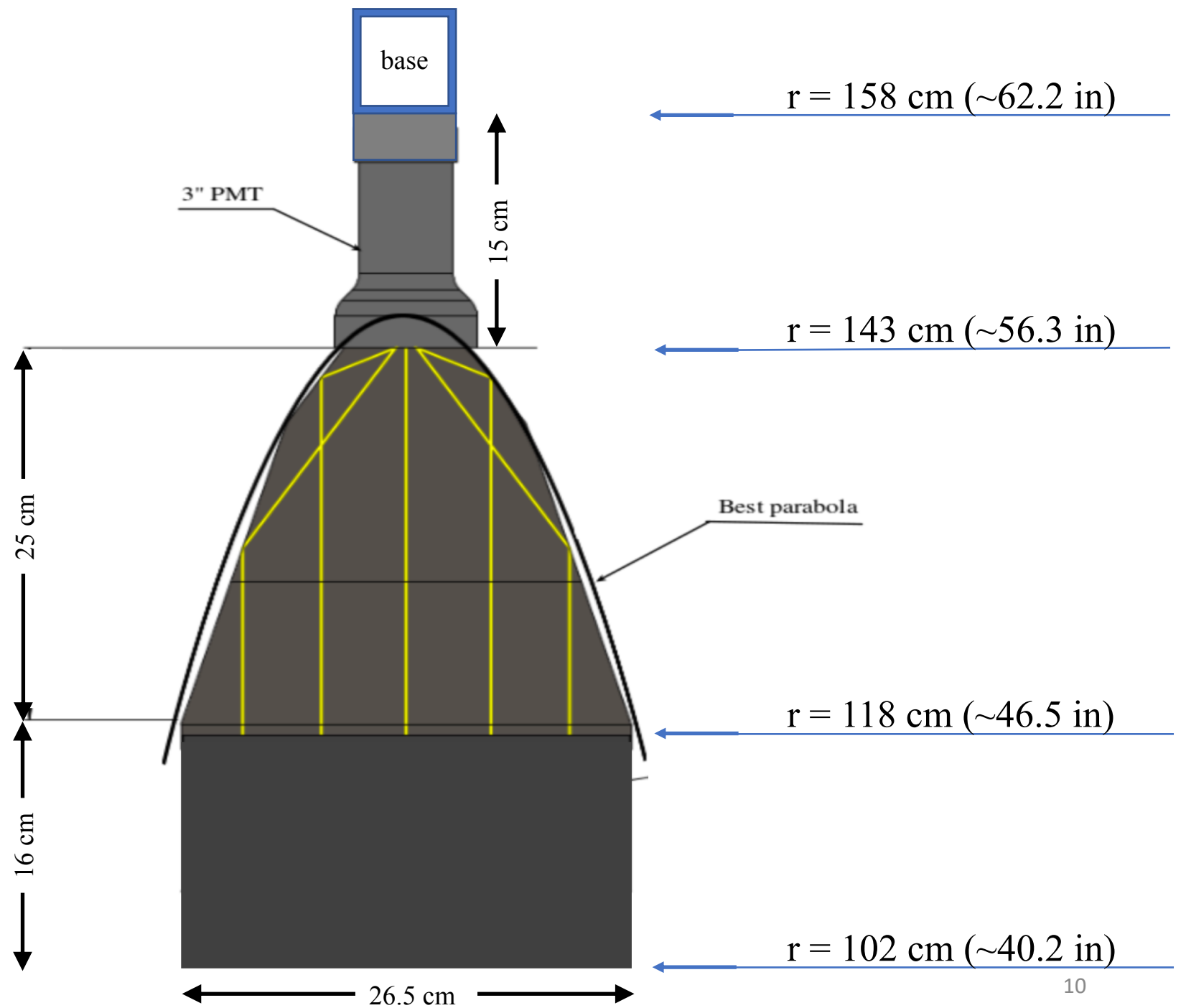
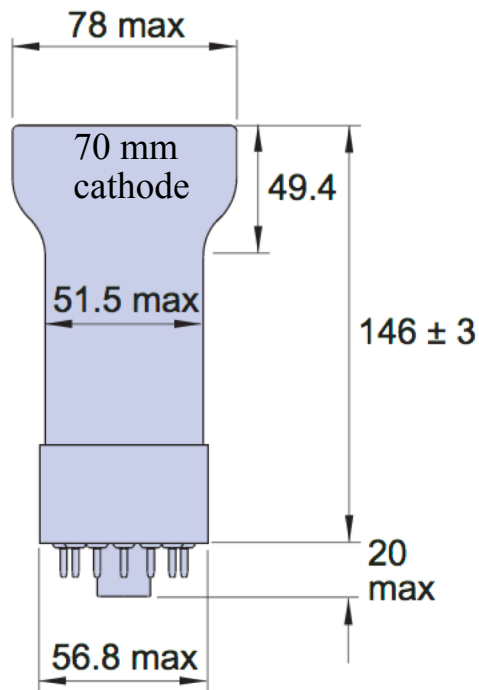
- Shower-max is located at $z = \sim 29$ m from target center (~ 24.5 m from hall center)
- Active detector area ranges from $r = 102$ cm to $r = 118$ cm (16 cm span to match Ring-5)
- To cover full azimuth with 28 stacks with no gaps at $r = 118$ requires ~ 26.5 cm wide (azimuthal direction) stack
- Baseline/prototype lightguide is 25 cm long (radially); could possibly reduce to 20 cm if needed

Possible 'clam-shell' partition



Module Size and radial locations

ET 9305QKB
pmt size (mm)



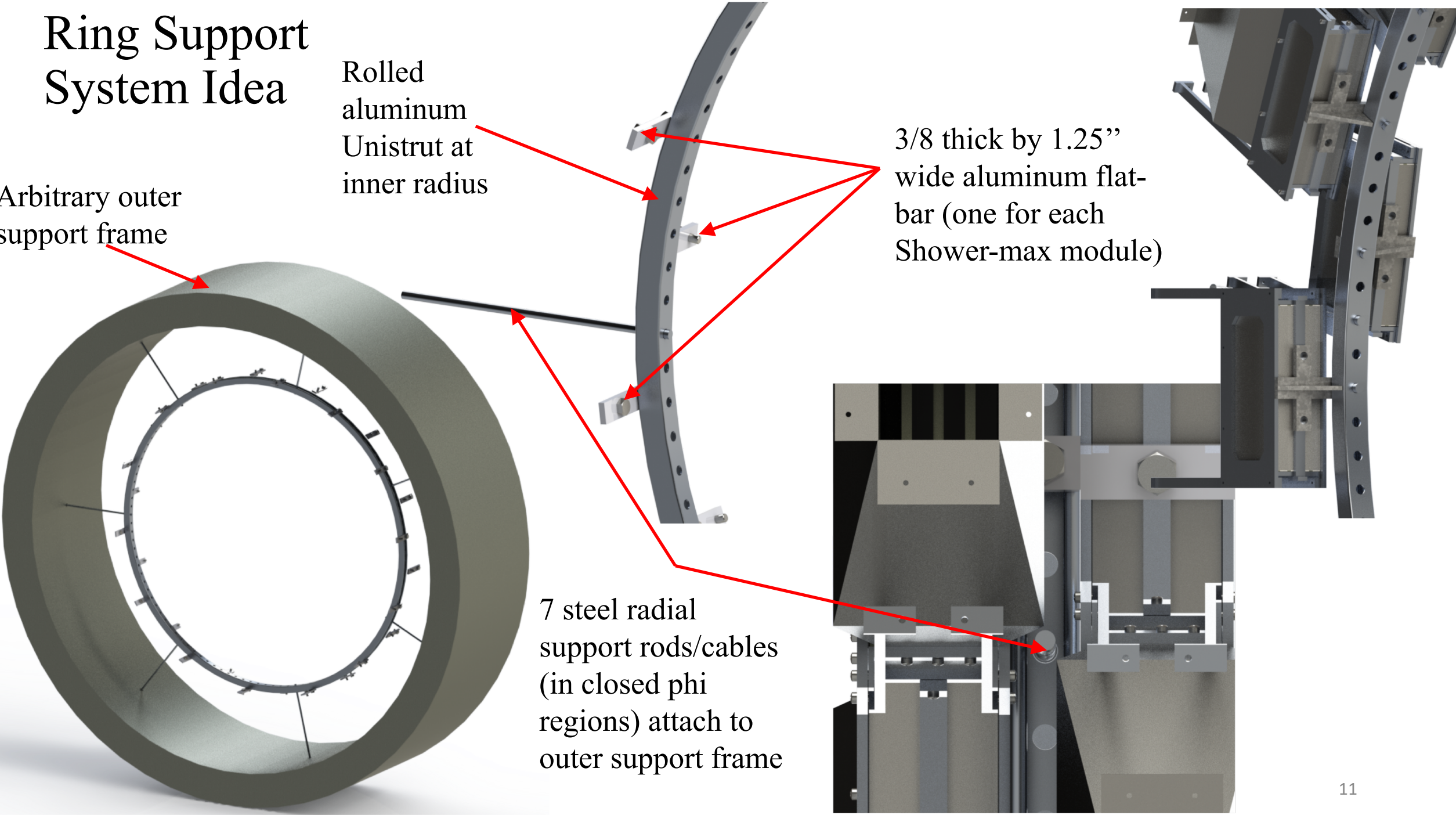
Ring Support System Idea

Arbitrary outer support frame

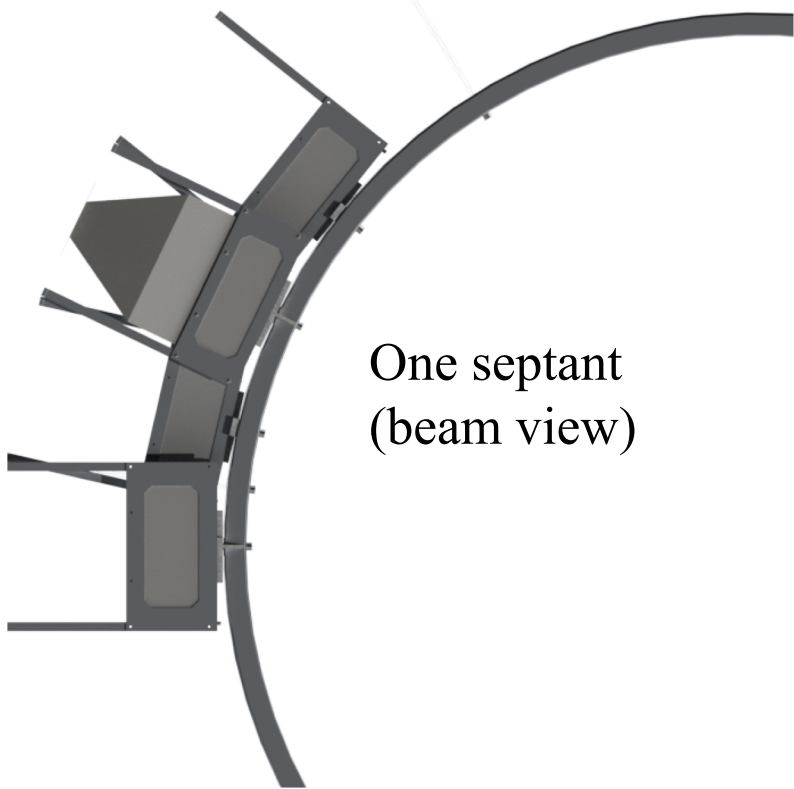
Rolled aluminum Unistrut at inner radius

3/8 thick by 1.25" wide aluminum flat-bar (one for each Shower-max module)

7 steel radial support rods/cables (in closed phi regions) attach to outer support frame



Inner ring and cable support system



One septant
(beam view)

