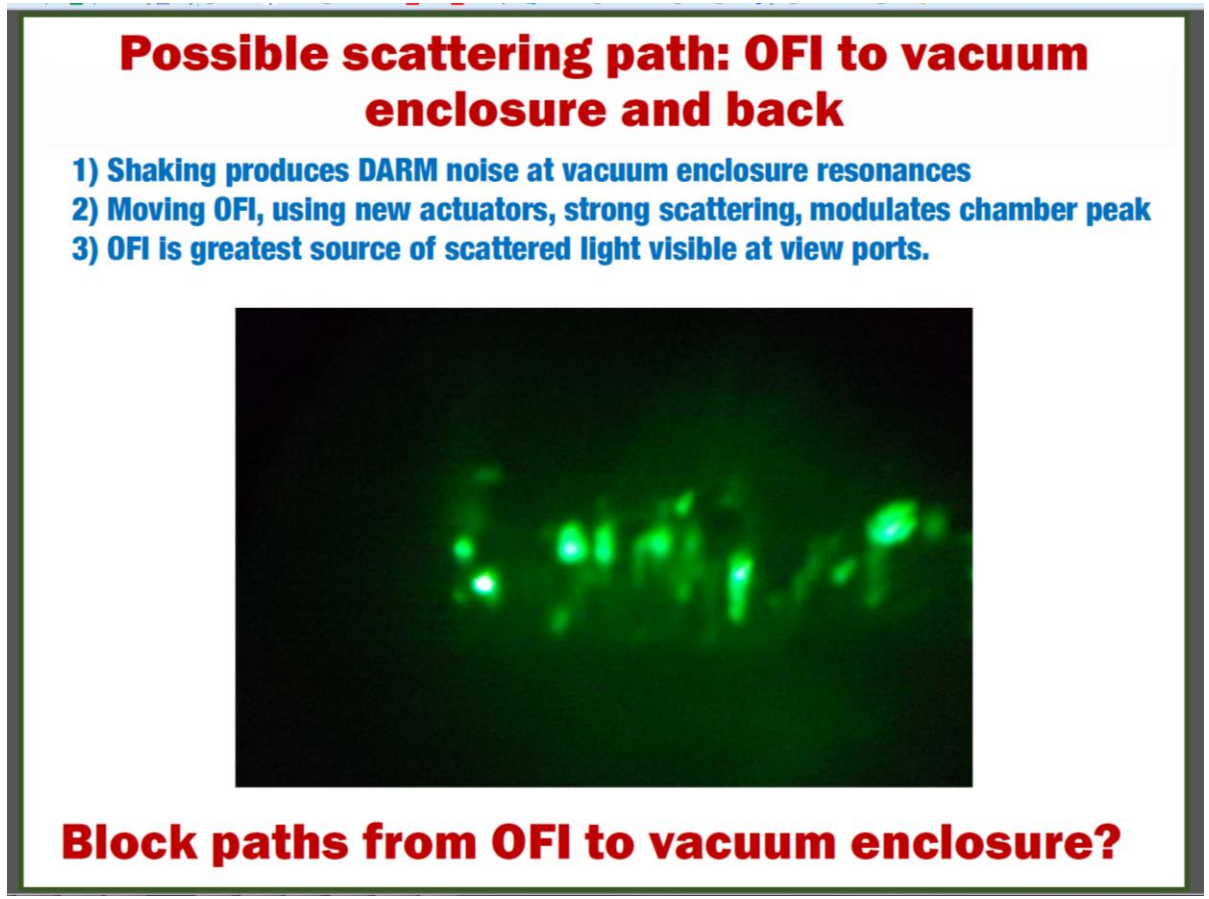
OFI shroud design review

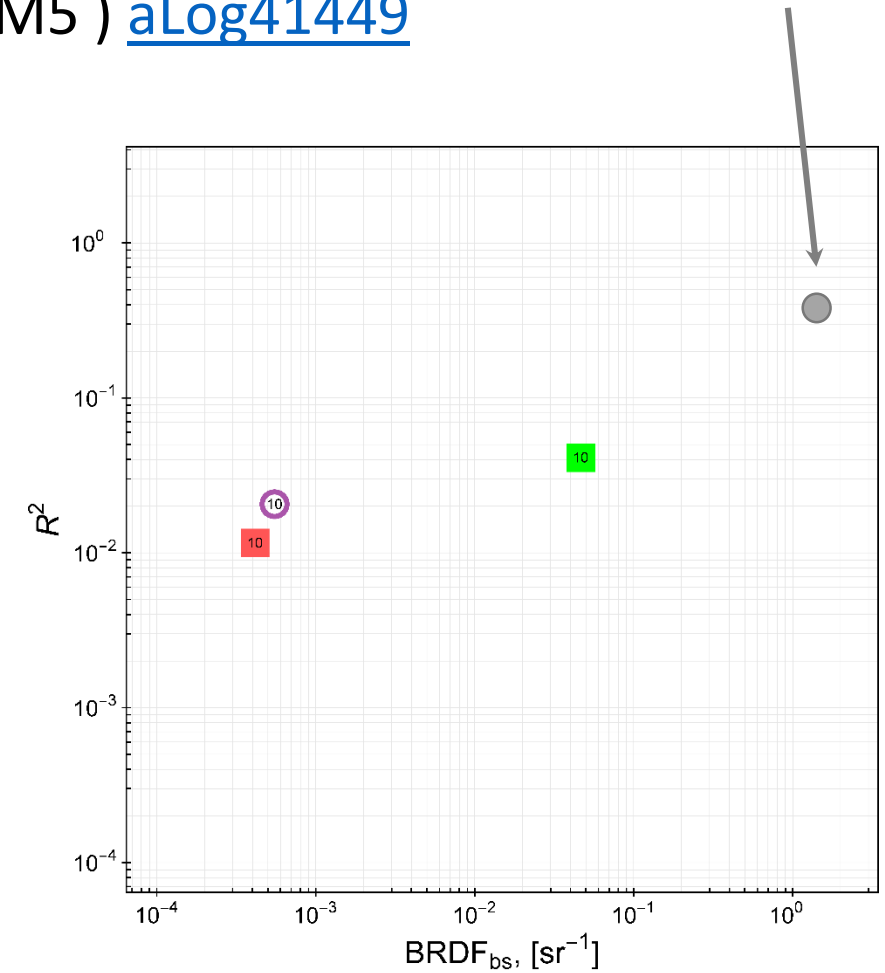
Alena A., Calum T., Corey A., Eddie S., Stephen A.

Scatter from OFI during operation



Robert Schofield LIGO-G1800717

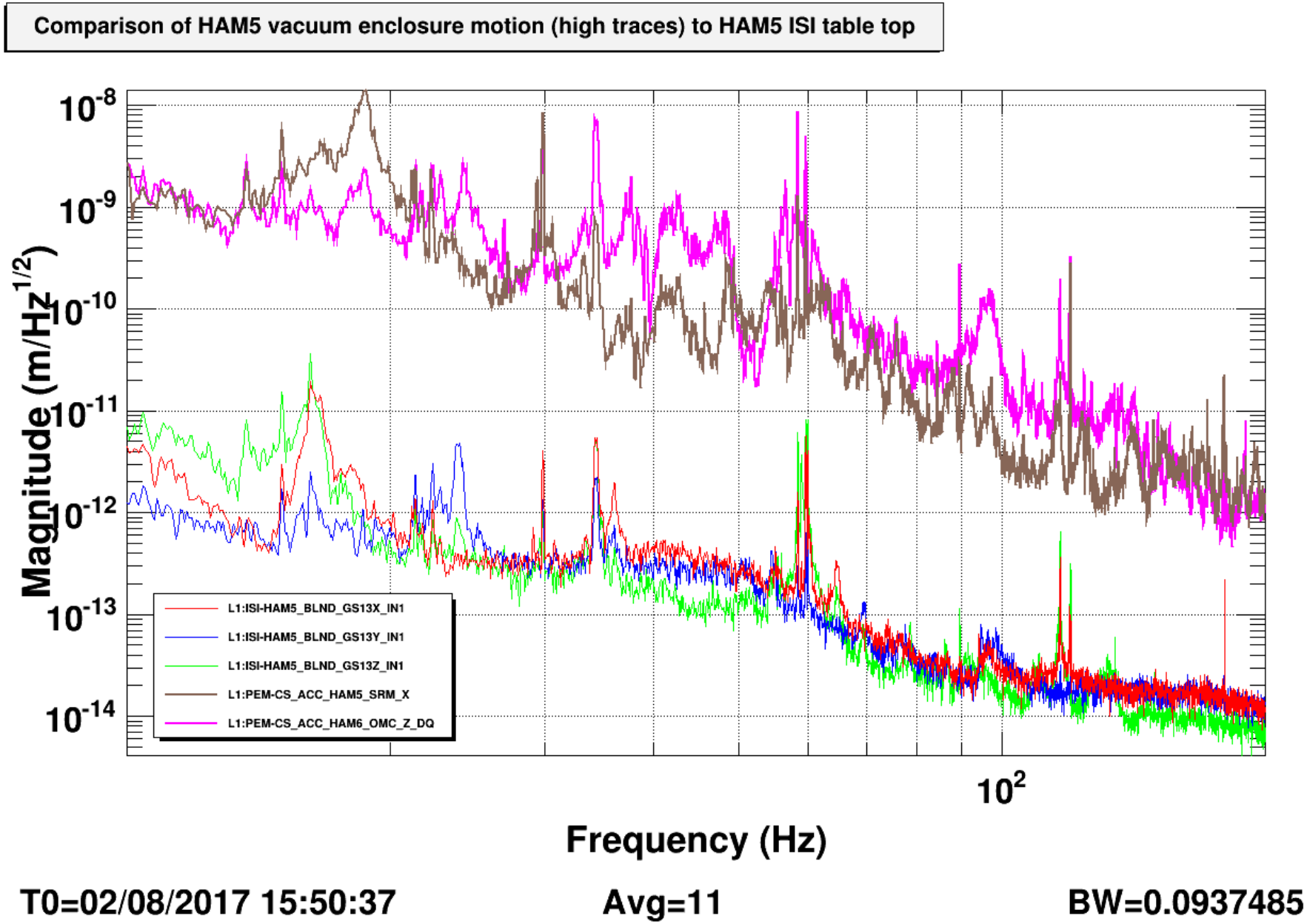
Scatter from a moving vacuum enclosure wall (HAM5) aLog41449



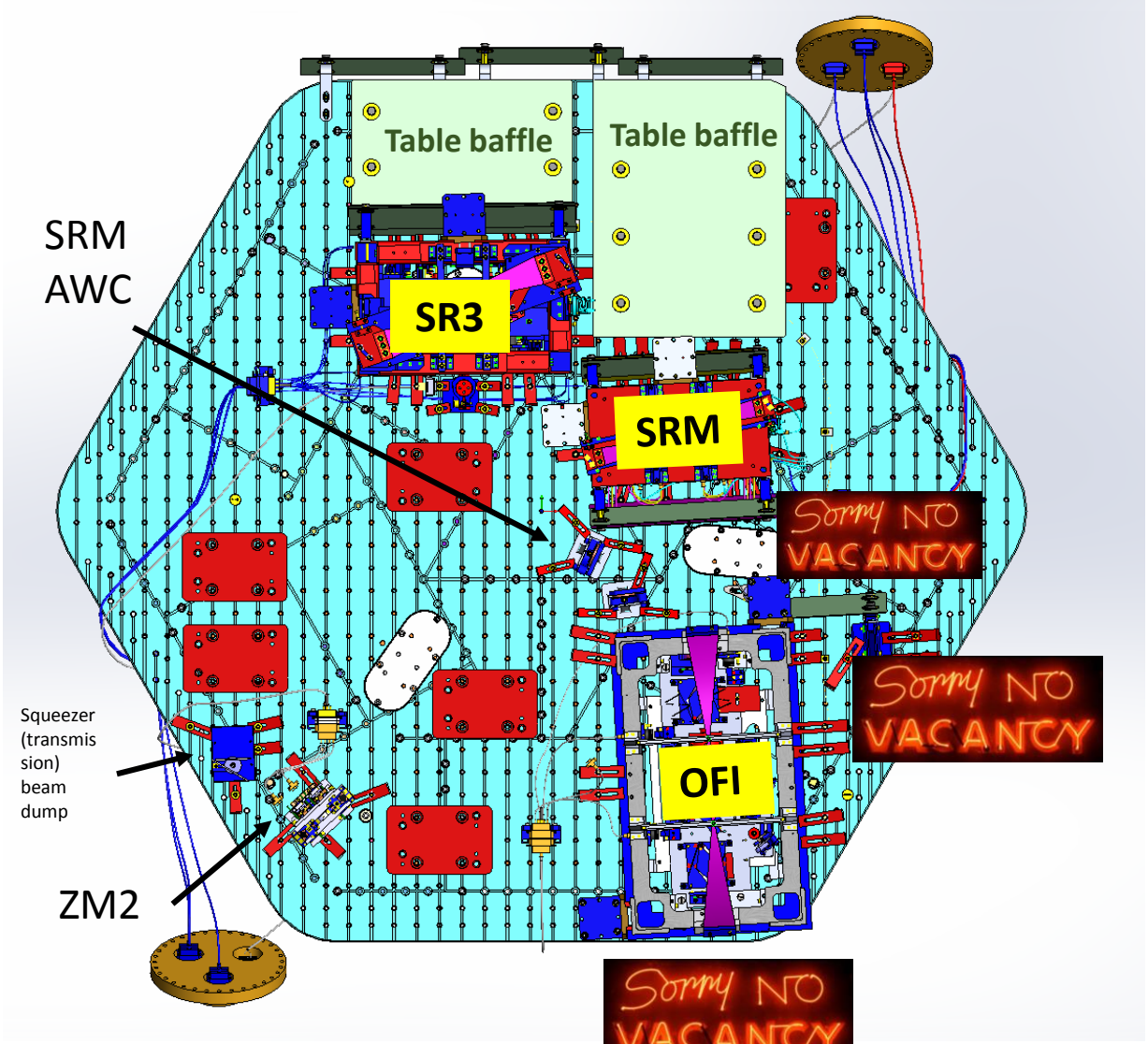
- Vacuum enclosure wall – speculated numbers
- Black Nickel on stainless steel super #8 (Anoplate)
- DLC on stainless steel Super#8 (Duralar)
- DLC on stainless steel Super#8 (Richter)

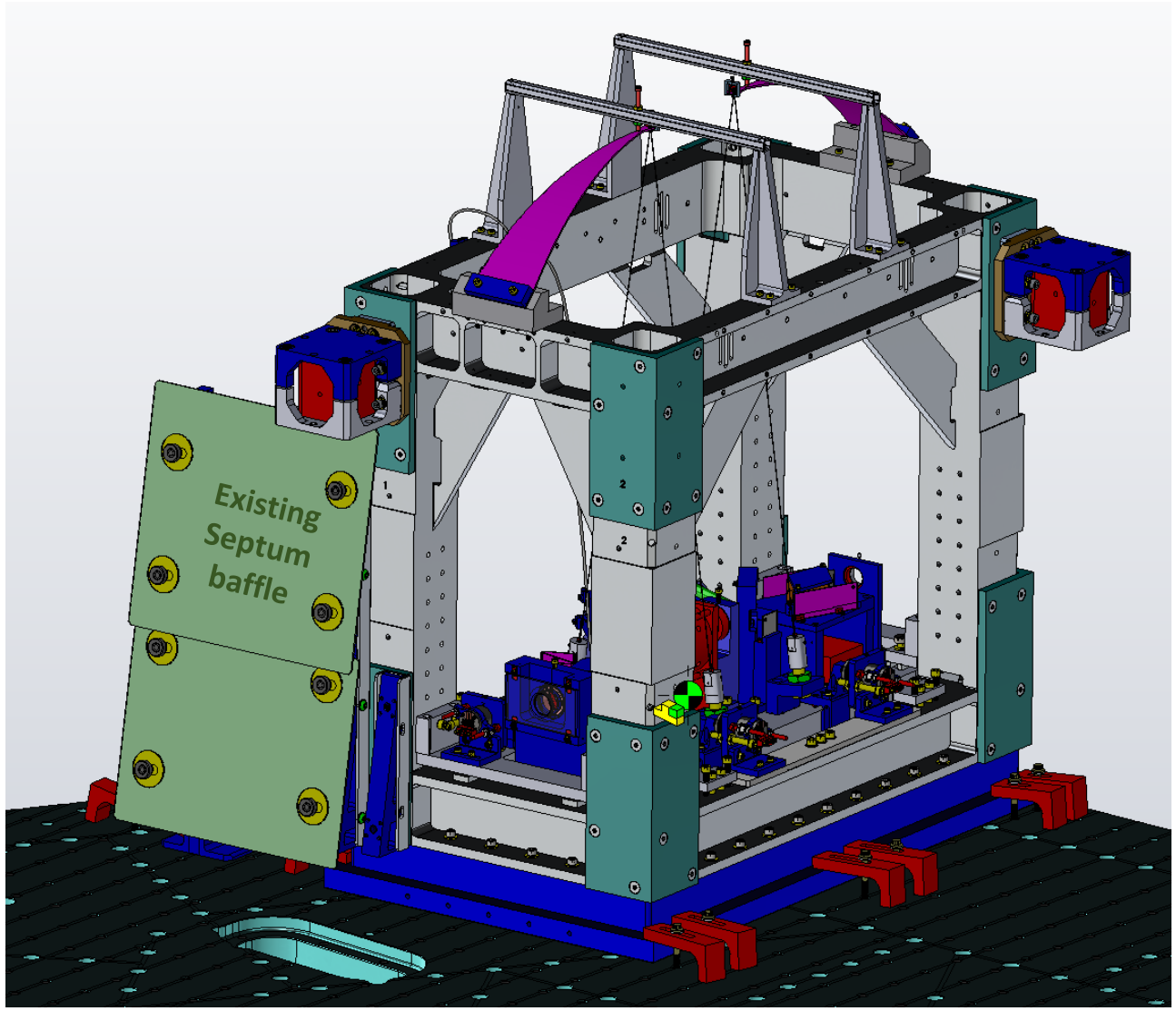
https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=41449

As a quick check, the attached figure shows that the vacuum enclosure walls of LLO HAM5 move between about 10^2 and 10^3 times more than the table top in the 10-100 Hz band. Thus, even if baffles that were mounted on the table top were as good at back-scattering light as the HAM5 doors (unlikely), and they were only 10 cm away from an OFI scattering site, a linear estimate suggests they would cause less noise than reflections off of the more distant door. Of course, for the same geometric attenuation reason, the further the baffles are from the OFI, the better.



HAM 5 post SLiC part A install (LLO) – Existing as of 4/18/2018





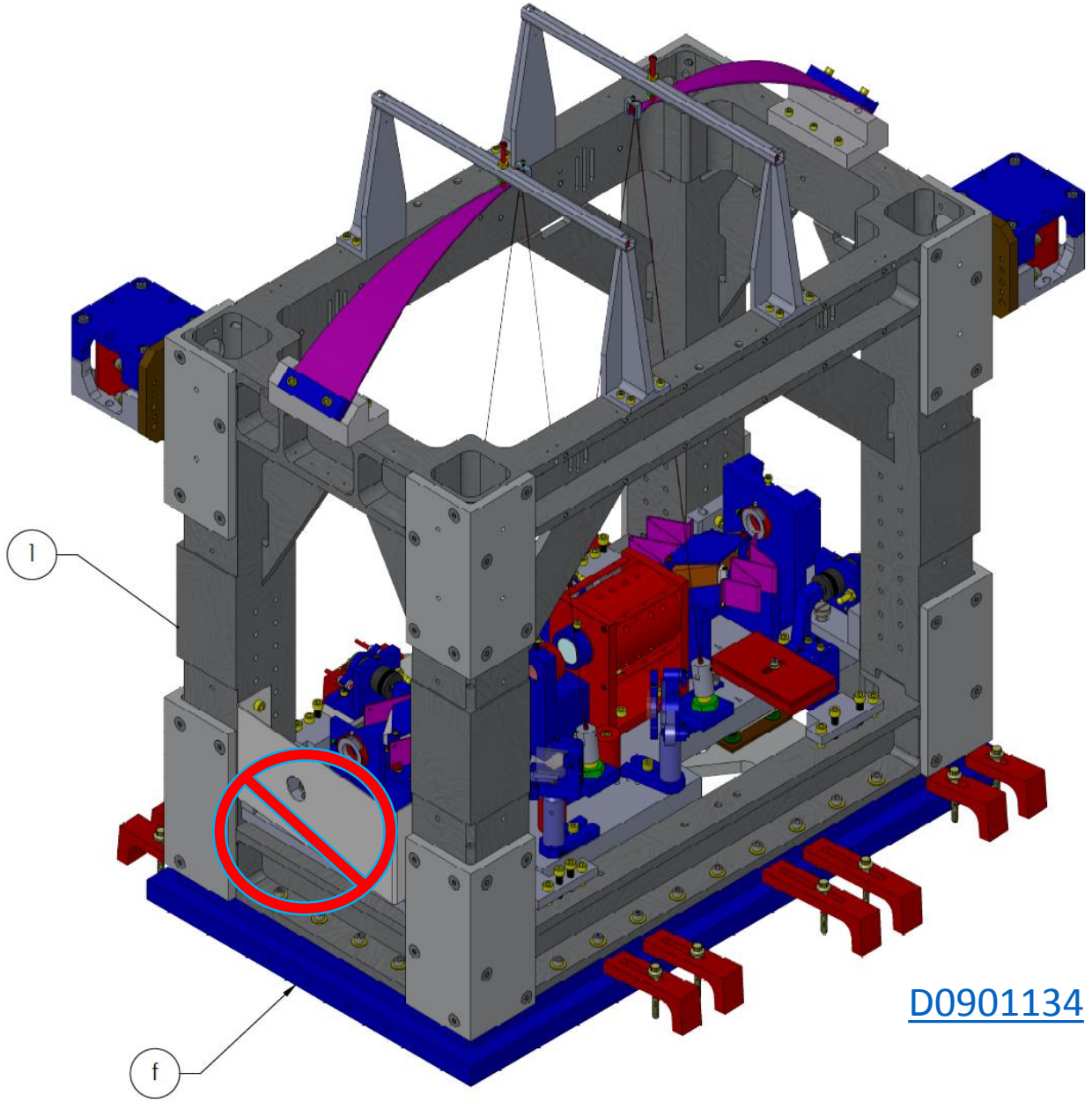
https://dcc.ligo.org/LIGO-D0900456

Faraday Isolator Refl Baffle removal

A ghost beam from septum window was found hitting the reflection baffle (uncoated) and going back to the window

FRS 9647
ECR E1700425

Already removed at LLO
Pending at LHO (function handled by shroud)



D0901134

Refl baffle in NOT part of the new shroud!

Purpose of the shroud:

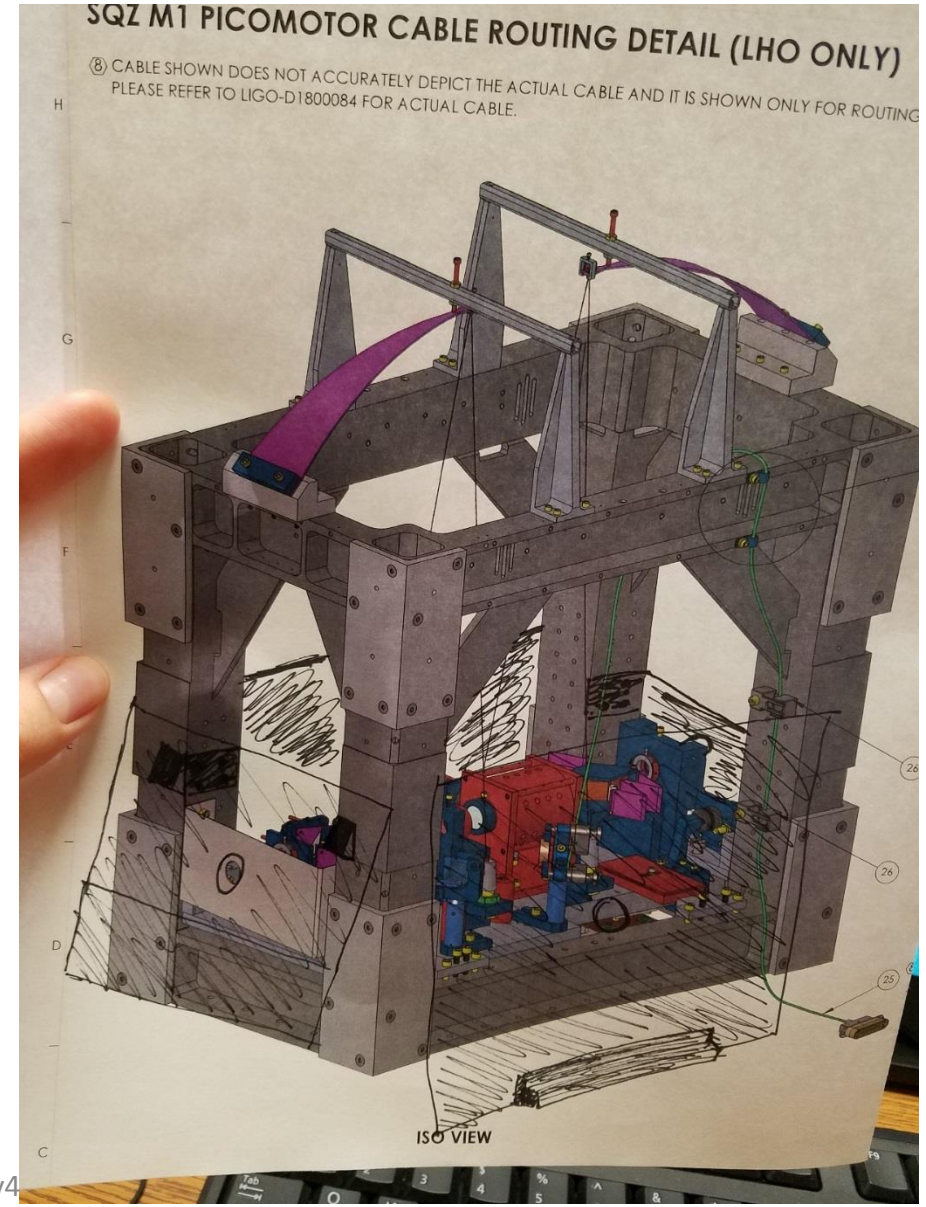
1) Block scatter paths from OFI to vacuum enclosure and absorb the scatter with minimum bounces (Super #8 * side of panels should face the inside of the shroud)
2) Minimize new stray light scatter from added panels with apertures (Super #8 * side of panels should face the laser input)
3) Septum window ghost beam dumping

** Super #8 is only finished on one side, the other side is ~ mill finish*

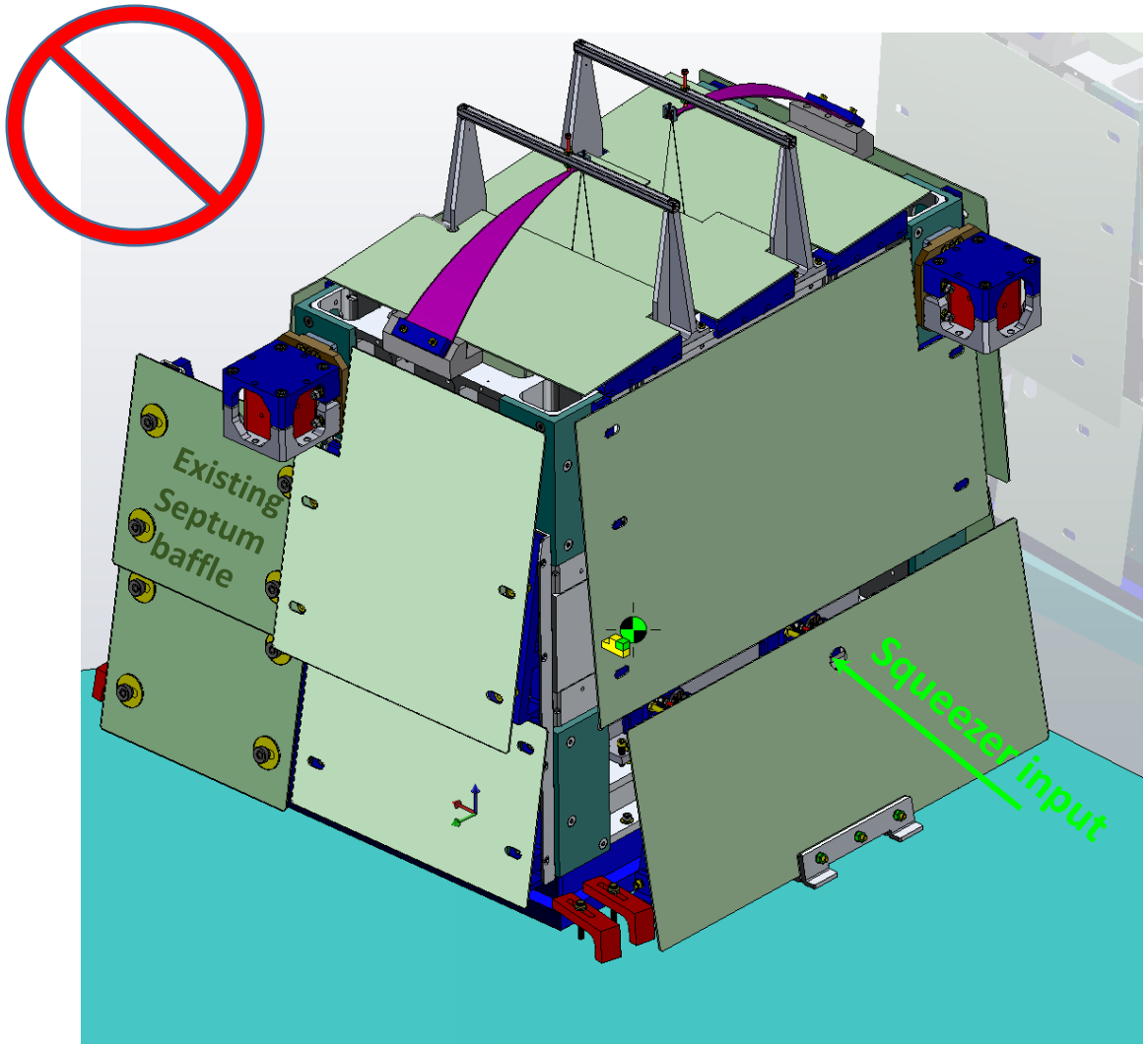
Inspiration:
excising structure, angled walls, apertures

Bar / restaurant in Seattle, WA

Every house needs a roof!

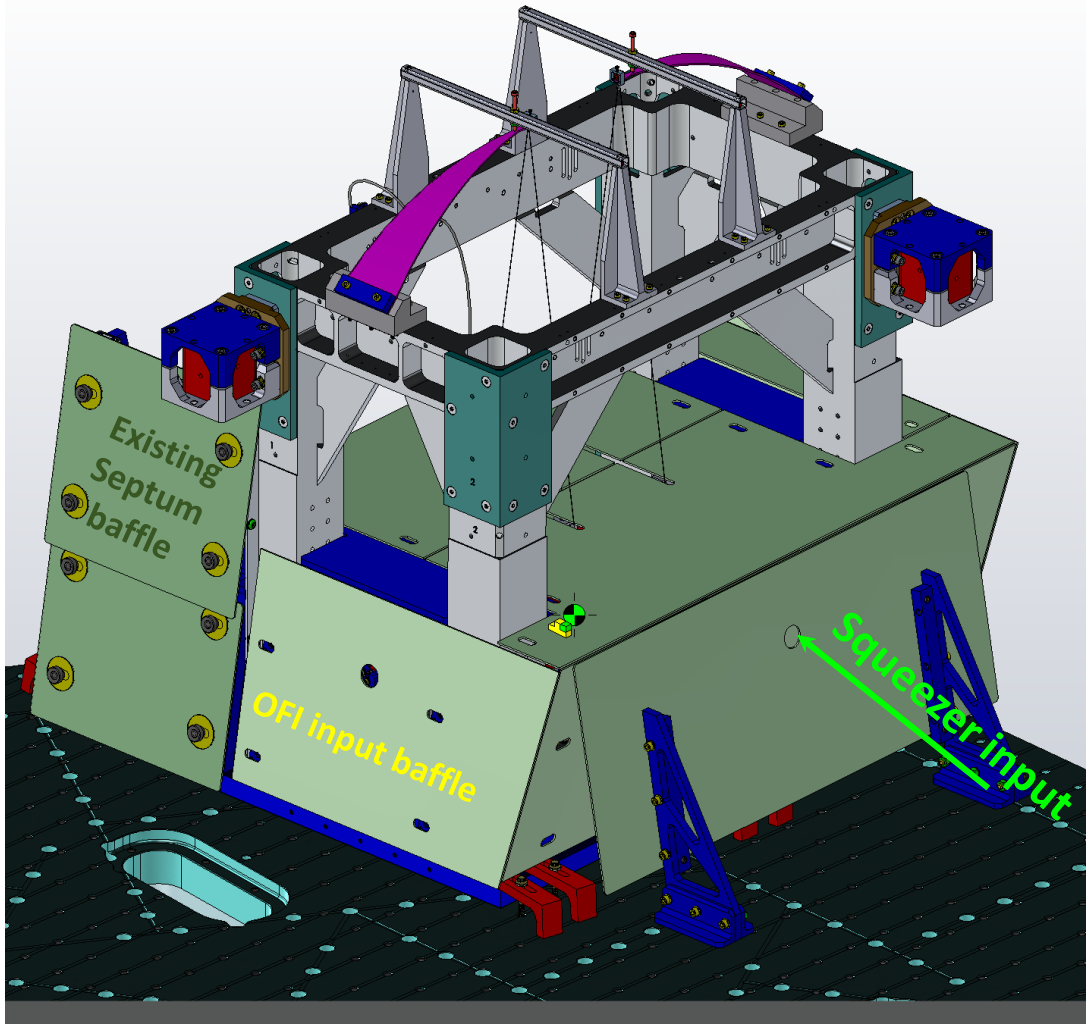


#1 High roof concept



- 13 panels!

#2 Low roof concept

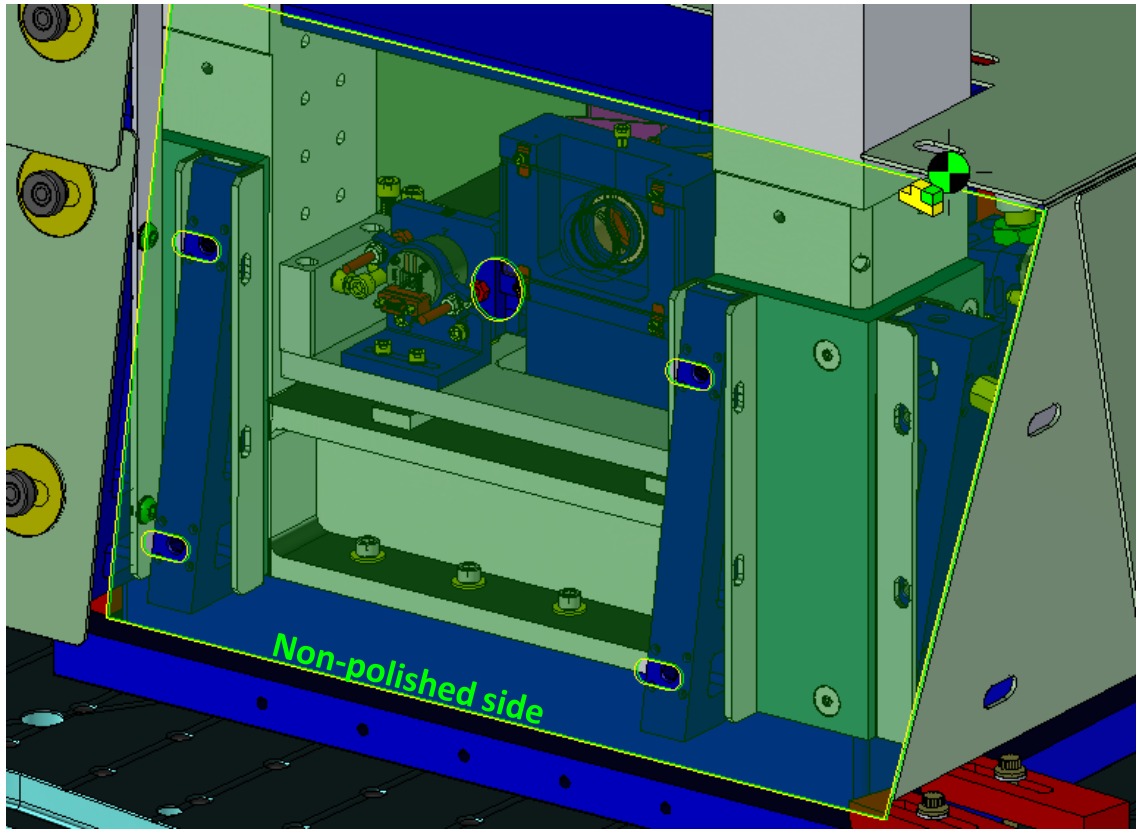


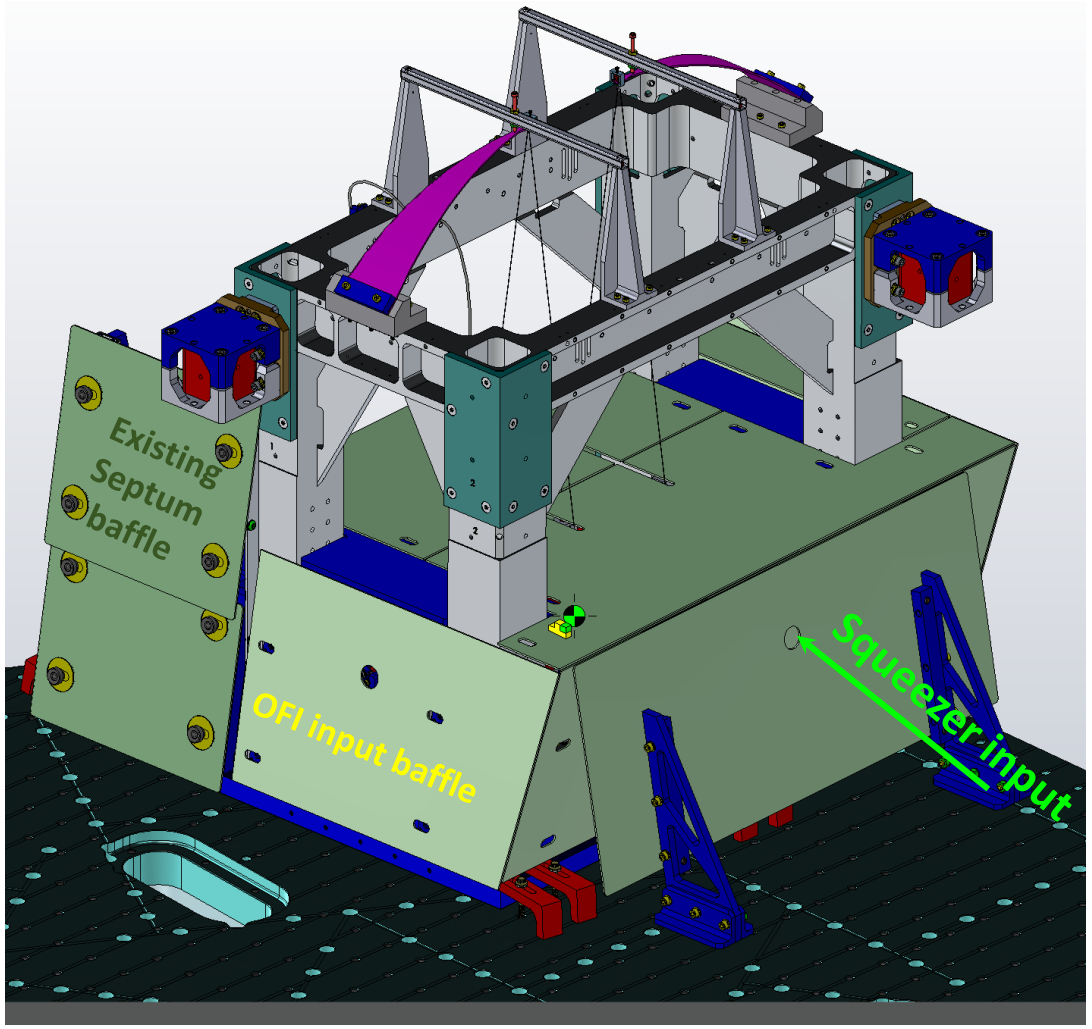
- 8 panels
  - Minimizes uncoated surfaces inside the shroud

OFI input side (panels are not yet detailed)

Aperture:
- same as output side baffle and old reflection baffle D0902845
- additional vertical and horizontal adjustment

Same bracketry as SLiC part A



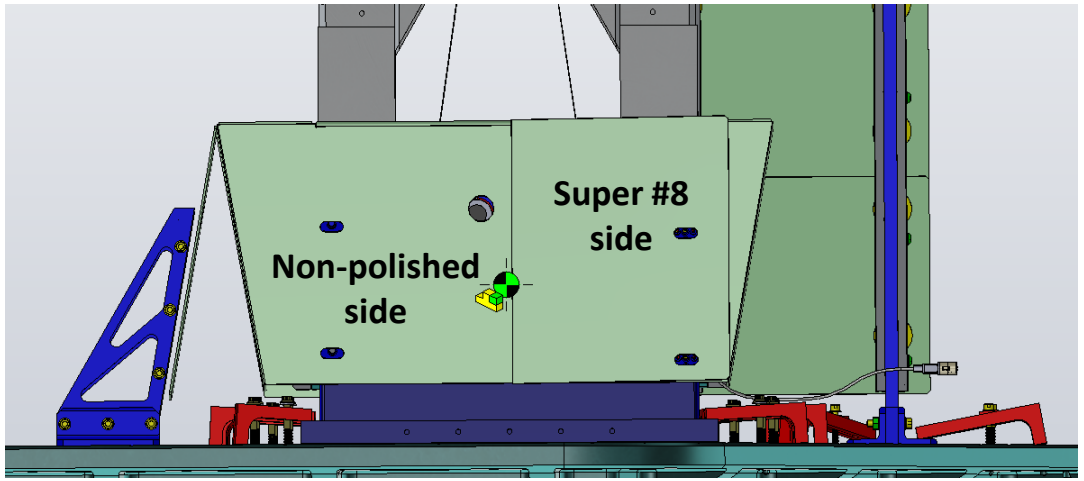


- Trapezoidal panel pitched 10°
- Polish – on the inside of the shroud
- Stray light on the outside – dumping on SRM baffle

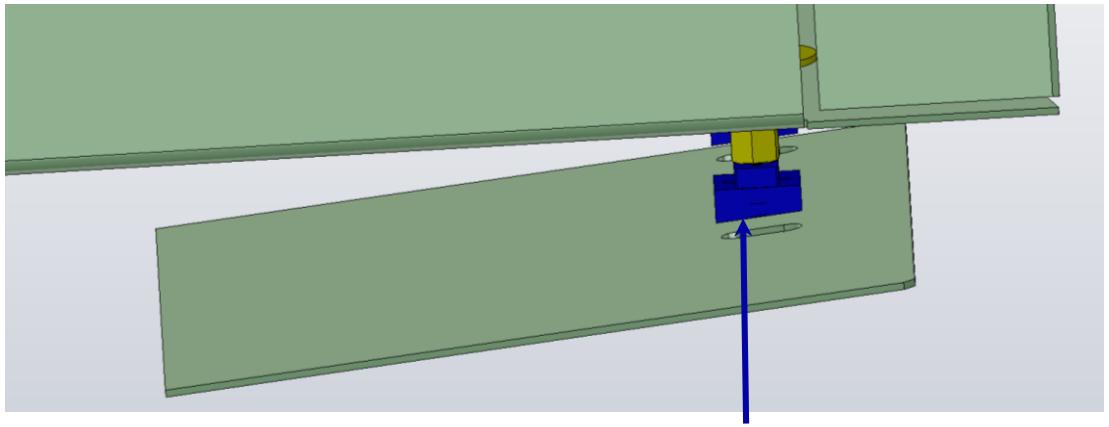
OFI output side (panels are not yet detailed)

Two panels:

1) OFI output baffle
2) Septum window ghost beam baffle



OFI output trapezoidal baffle is pinched 10°

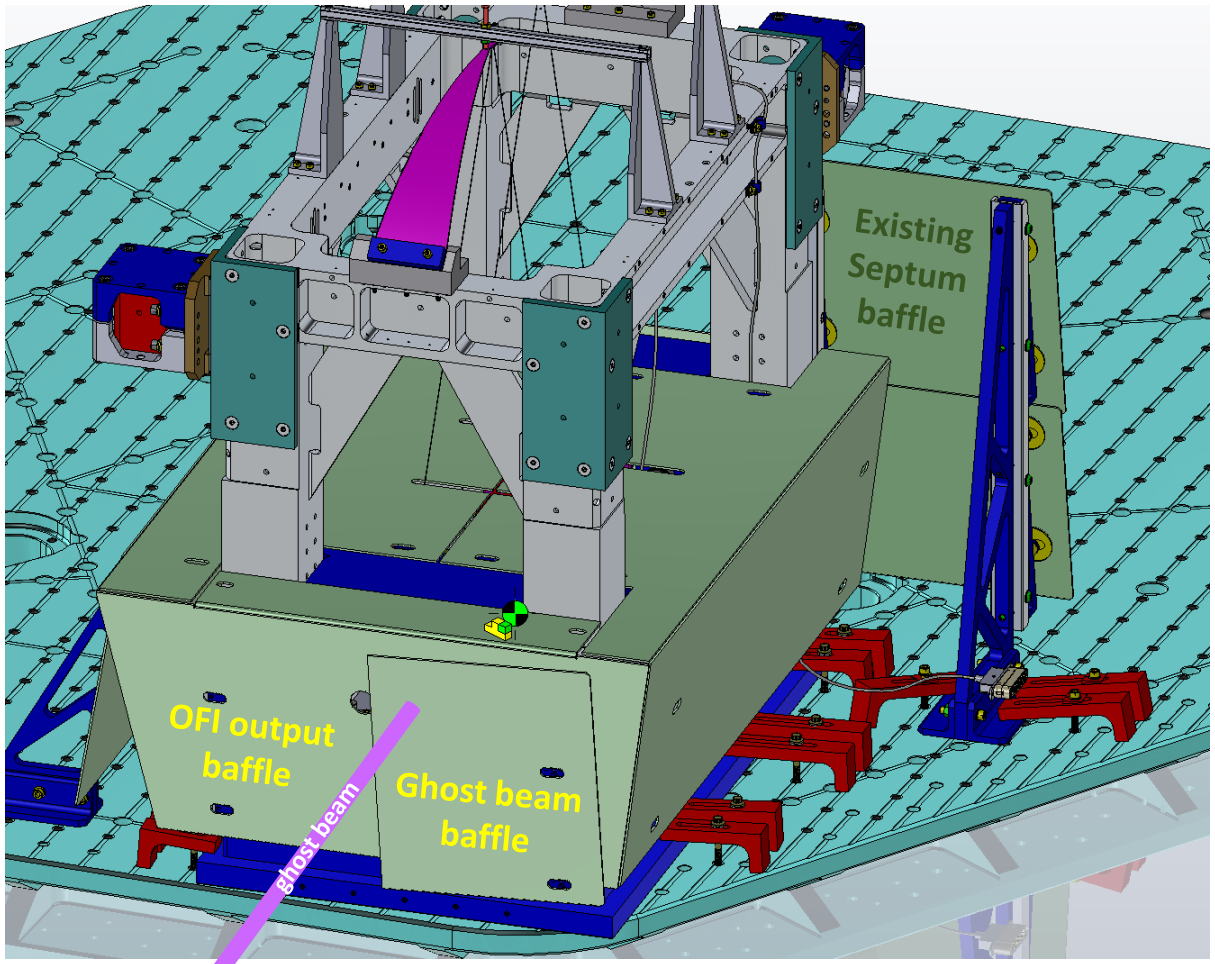


Ghost beam baffle pitched 10° and optionally yawed with a 5° wedge

Aperture:

- same as input side baffle and old reflection baffle D0902845
- additional vertical and horizontal adjustment

Same bracketry as SLiC part A

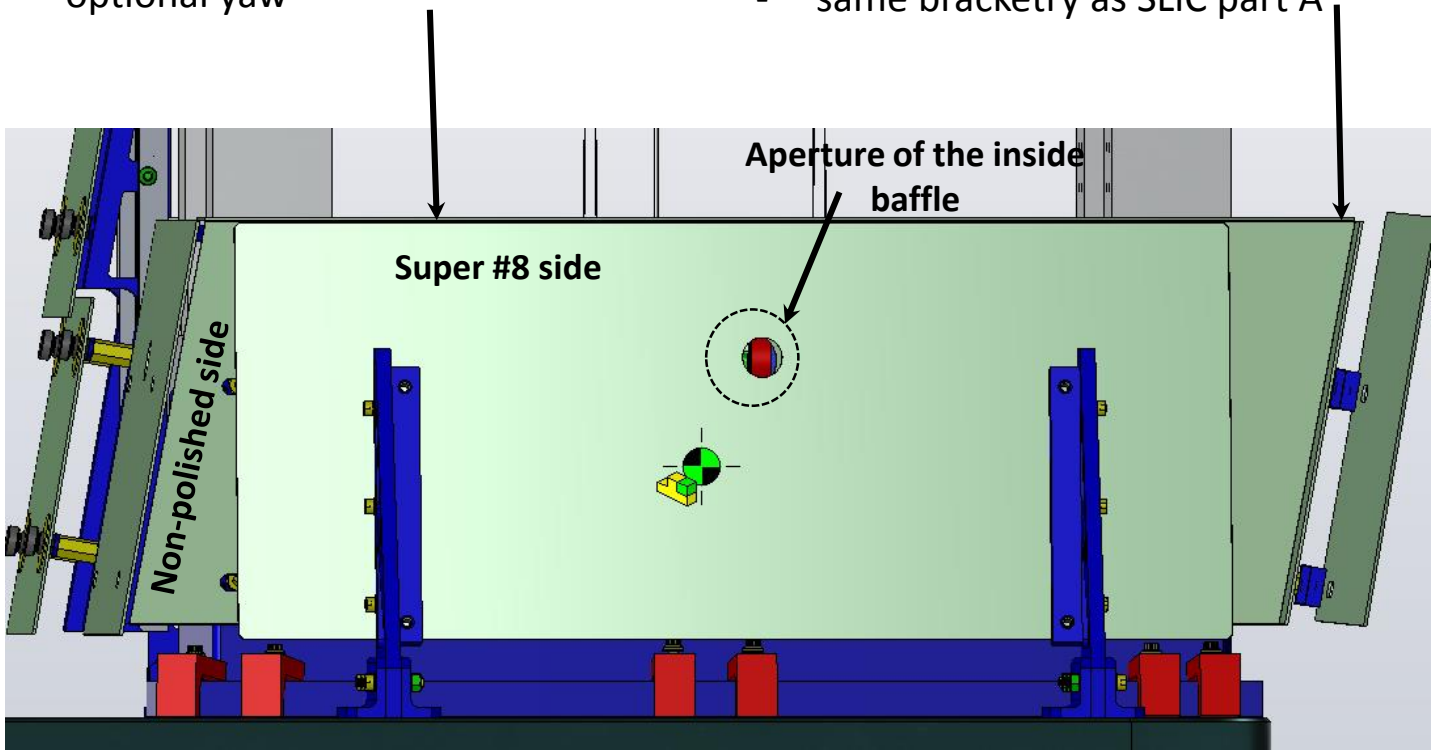


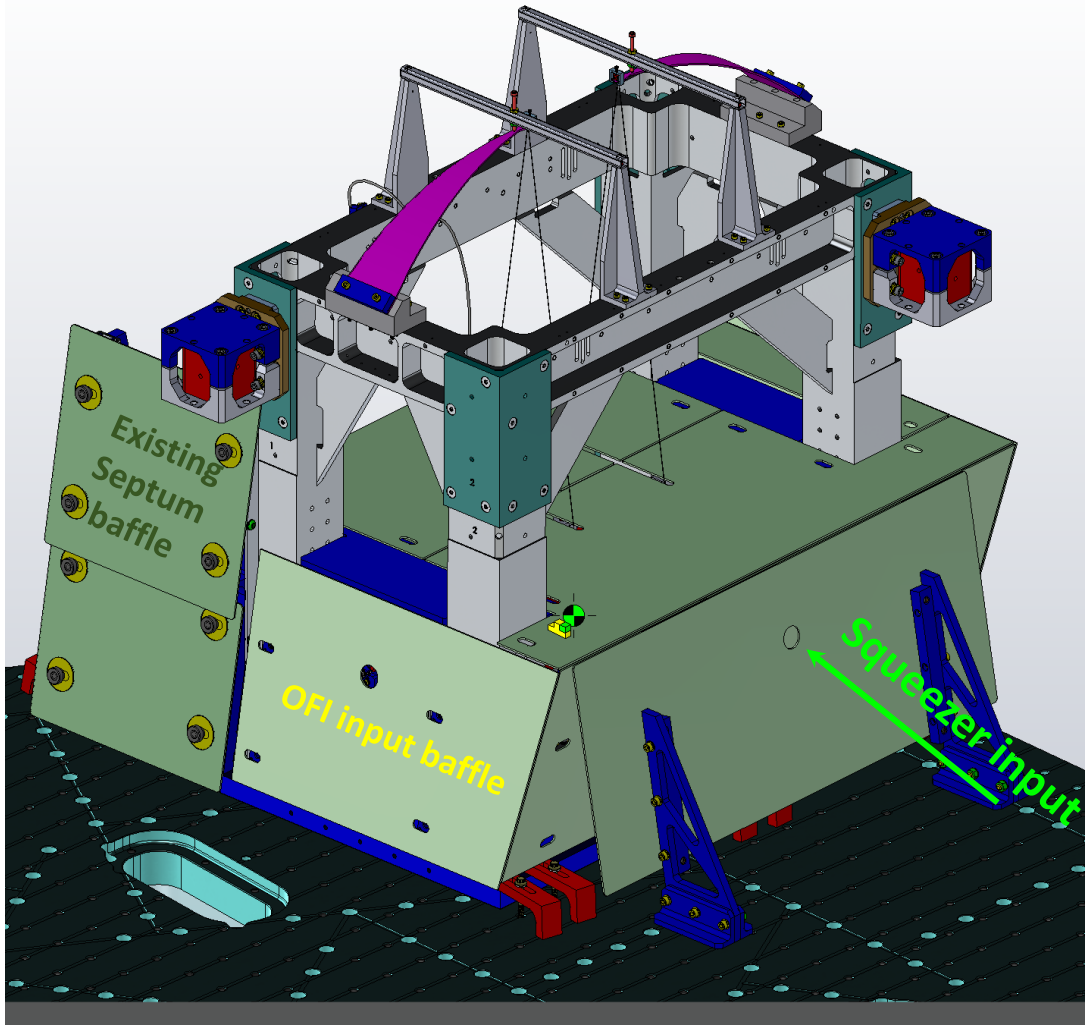
Squeezer input side (panels are not yet detailed)

Two panels on squeezer input side:

1) Table baffle (stop stray light purpose)
- 10° pitched rectangle
- polished side facing the input
- small aperture
- optional yaw

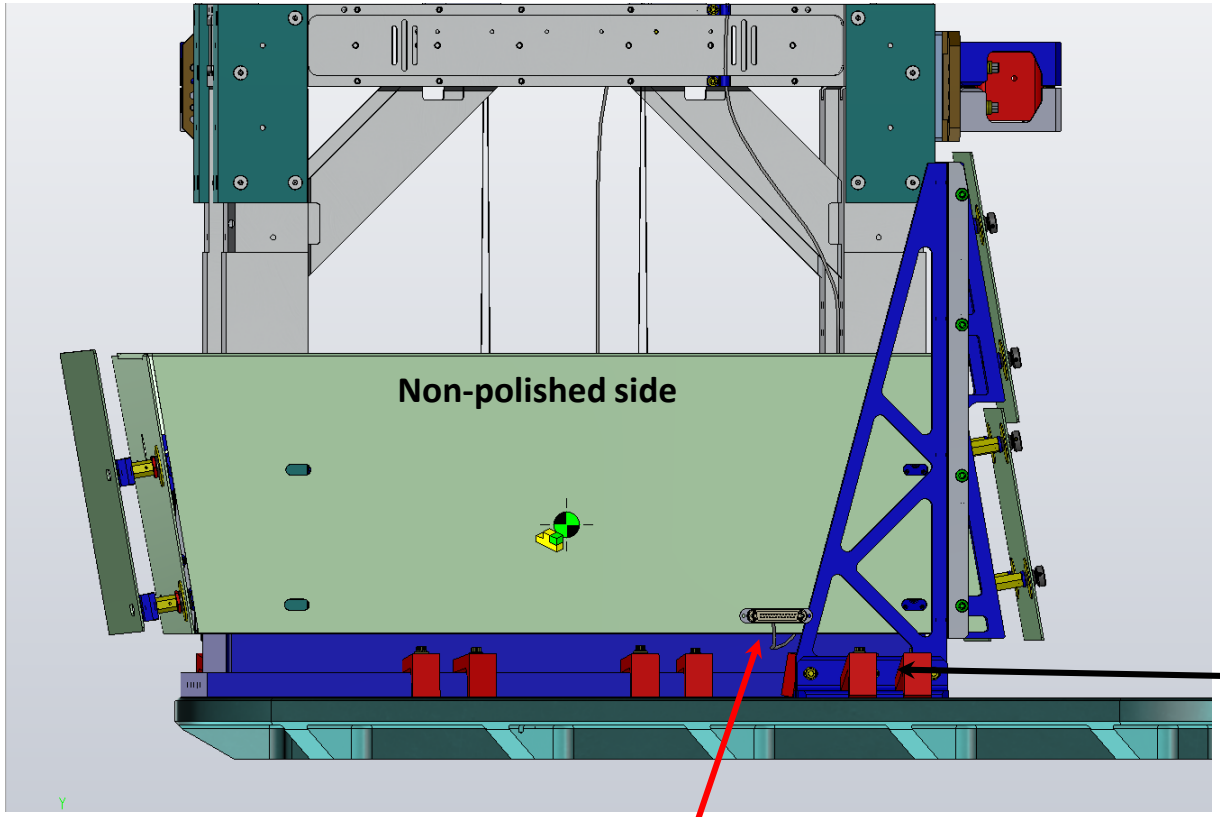
2) Inside baffle (stop scatter purpose)
- 10° pitched parallelogram
- polished side inside
- large aperture
- same bracketry as SLiC part A

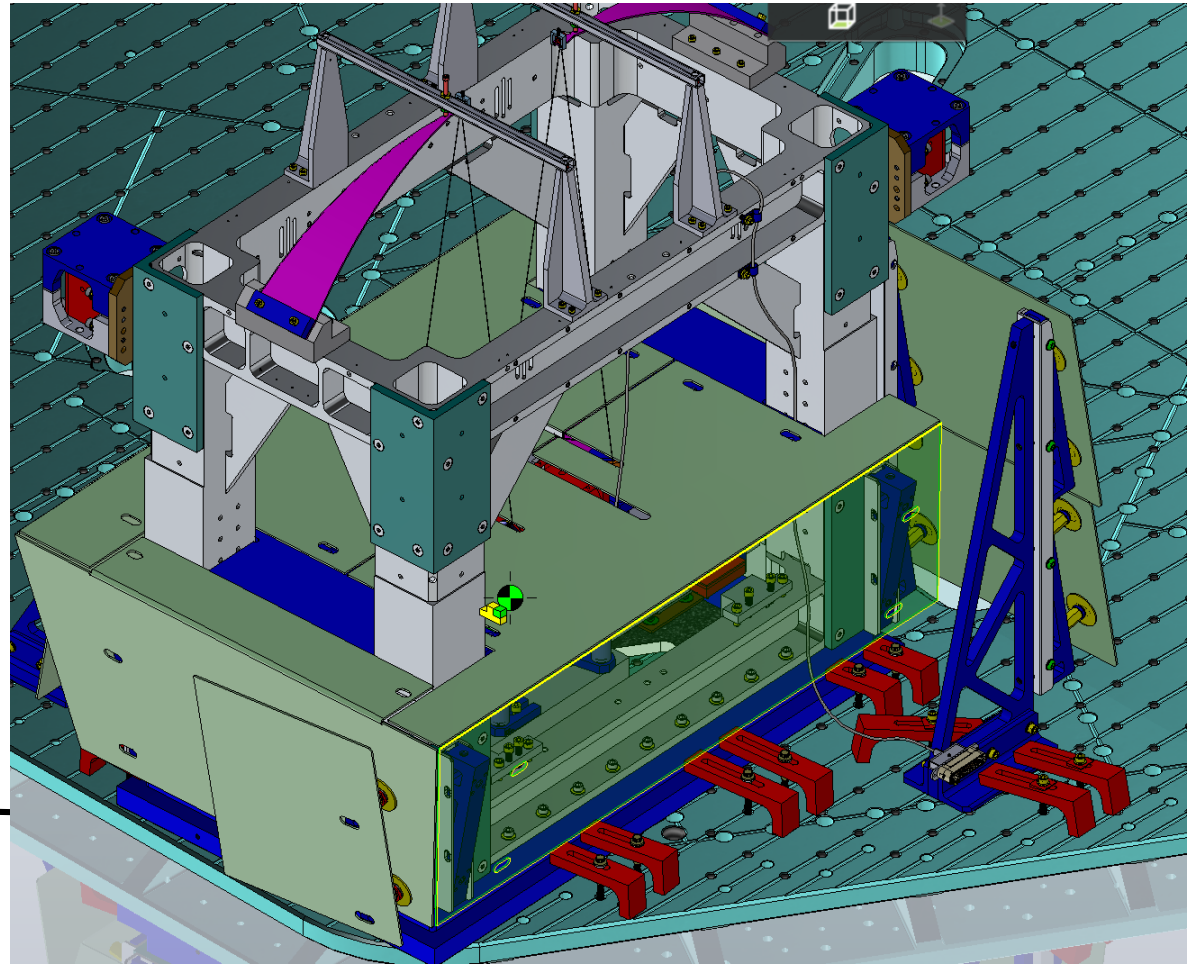




Panel opposite to squeezer input

- 10° pitched parallelogram
- polished side inside
- same bracketry as SLiC part A

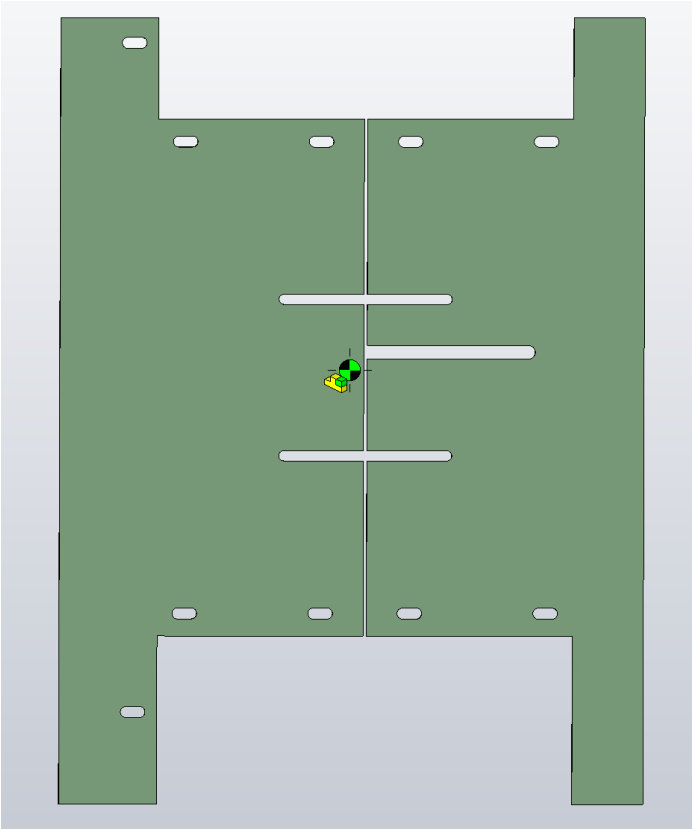




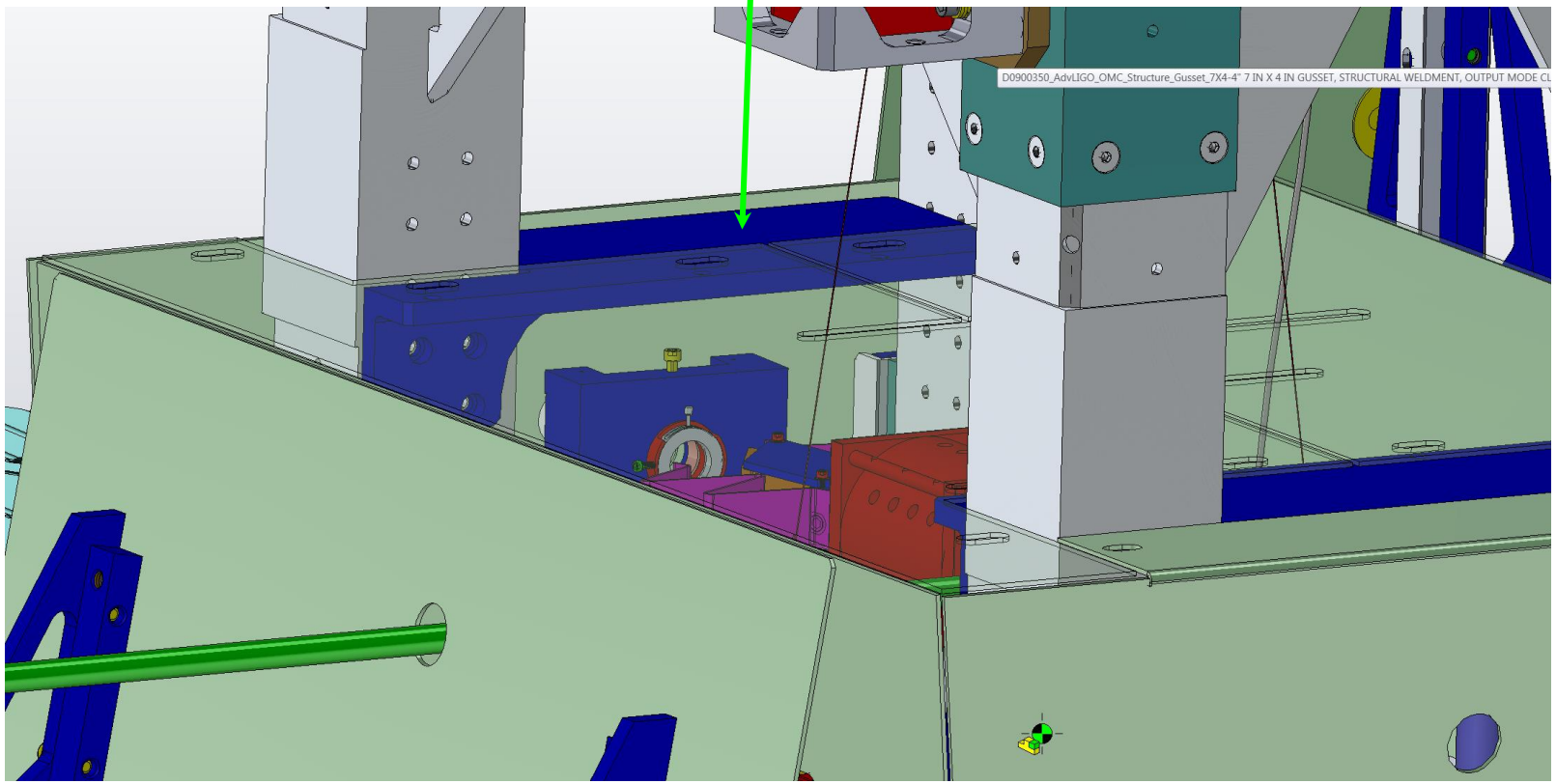
clearance for the cable

The roof

- Roof extends outside the OFI for better coverage
- Wide slots
- Polished side on inside
- No pitch required



Extended coated bracket for better coverage



OFI TFP Beam Dump

Alena A., Calum T., Corey A., Eddie S., Stephen A.

How much scattered power in SQZ path?

Sheila's power @ OMC : 5.5 mW
Koji's transmission : ÷ 0.967
Gives (going into OFI) : 5.7 mW
Koji's TFP AR reflection : × 0.00089
Gives (into SQZ path) : 5.1 µW
Sheila measured (SQZ path) : 3.4 µW

Koji's Optics Lab Measurements (LHO #39436)

	LHO OFI 2017/11/13 After the adjustment [LHO ALOG 39418]	LHO OFI 2017/11/14 PD measurement	LHO OFI 2017/11/14 Power meter measurement	LHO OFI 2017/11/14 In-situ measurement
Temperature of the faraday rotator body	N/A	N/A	73degF = 22.8degC	76degF = 24.4degC
Transmission From the input port to the output port	0.967 +/- 0.002 (3.3% loss)	---	---	---
Back-scatter isolation S-pol From the input port to the squeezer port	1300 +/- 10 ppm	---		
TFP AR reflection From the input port to the squeezer port	890 +/- 10 ppm	---		
Isolation From the output port to the input port	52 +/- 13 ppm (= 43 +/- 1 dB isolation)	48.4 +/- 0.7 ppm (= 43.15 +/- 0.05 dB isolation)	42 +/- 2 ppm (= 43.7 +/- 0.3 dB isolation)	34.5 +/- 0.4 ppm (= 44.6 +/- 0.5 dB isolation)
Back-scattering From the input port to the input port	3.0 +/- 0.5 ppm	0.5 +/- 0.2 ppm	2 +/- 3 ppm	---
Squeezer transmission From the squeezer port to the input port	0.978 +/- 0.002 (2.2% loss)	---	---	---

Where does this beam go?

sheila.dwyer@LIGO.ORG - 11:54, Friday 30 March 2018 (41229) Link

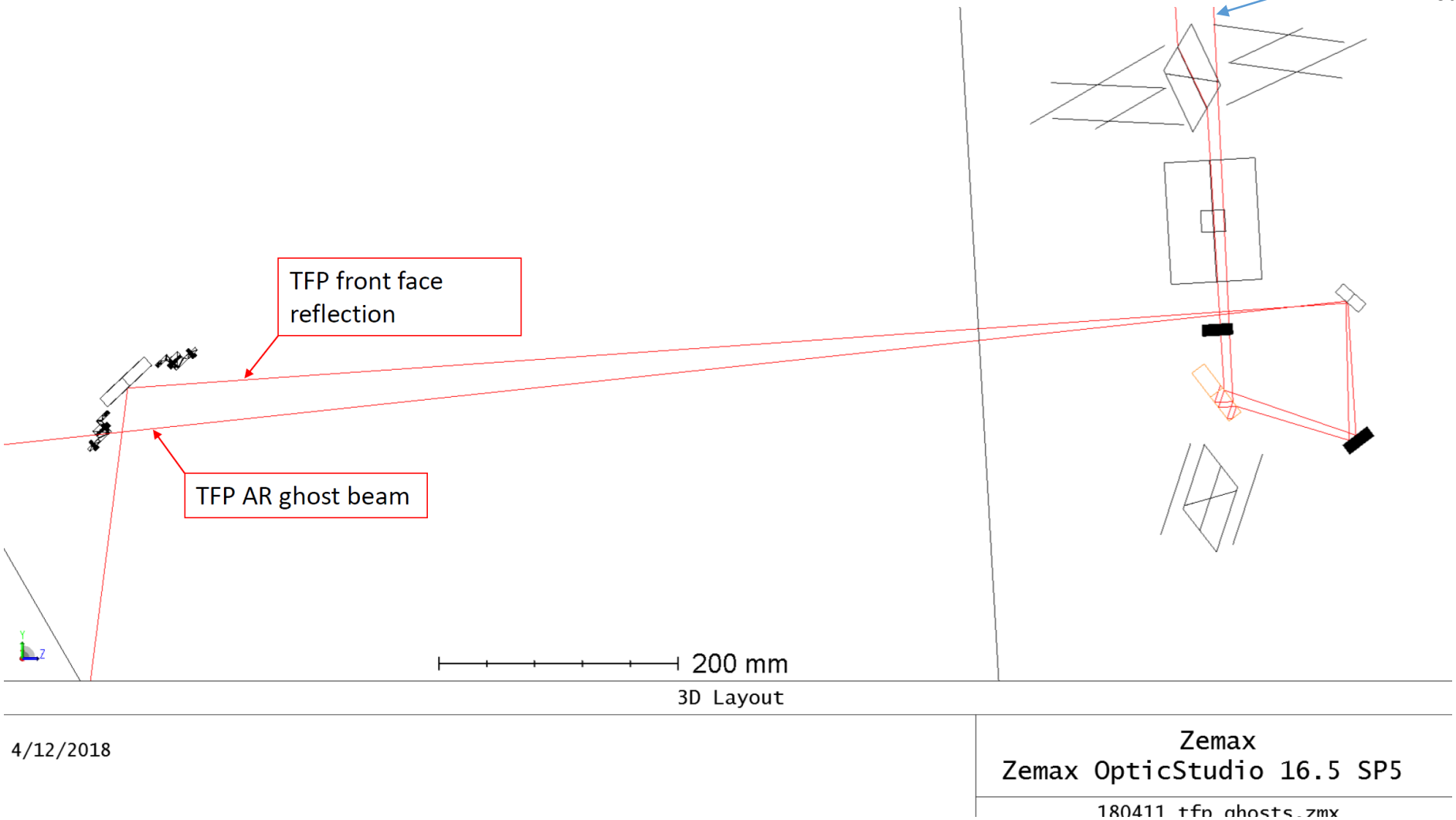
We measured 5.5mW of light arriving in HAM6 heading towards the OMC in single bounce, and 3.4+/-0.1 uW arriving in HAM6 in the squeezer path, so the rejection ratio of the thin film polarizer at the output of the OFI is about 1600:1.

After the exercise that Daniel described above, we let SR3 pit at 600 on the slider (cage servo off), and 490 yaw, SR2 at -240.8 urad pitch, 3705 yaw, and zeroed the offsets on ZM2. Terry and I attempted to align the squeezer to this beam, to see if we can get in some measurements of the mode matching from the squeezer to the OMC before the HAM5 vent next week. In the end we didn't find the beam, but we have left ZM1 pitched with the adjustment screw most of the way in. We will undo this soon, so there is no need to re-center osems or worry about rubbing.

Sheila's Single Bounce Measurements (LHO #41229)

OFI TFP AR Ghost Beam – adding V-shaped beam dump

This beam is an artifact of Zemax model – not real



https://dcc.ligo.org/LIGO-G1800771

H1 SQZ (SQZ) Link

nutsinee.kijbunchoo@LIGO.ORG - posted 13:51, Thursday 12 April 2018 - last comment - 14:41, Thursday 12 April 2018(41407)

Double-beam hunting

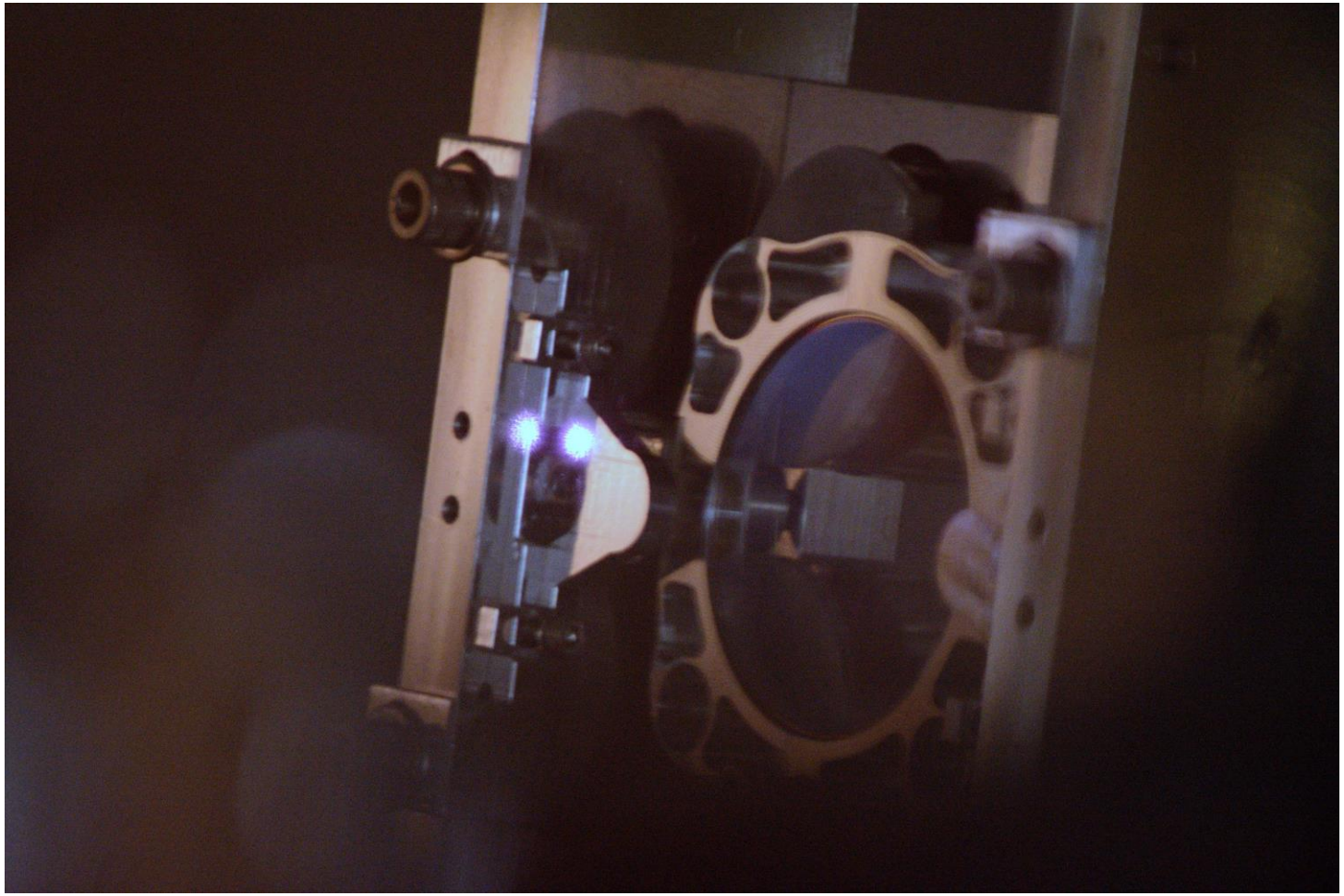
Robert, Sheila, Nutsinee

Today we removed a view port cover on HAM5 north door (faraday side) to look for the IFO beam reflected off AR side of the thin film polarizer. Attached a couple photos we took with our IR camera (Nikon D7100 with IR filter removed)-- We found the beam hitting the HAM6 side of the ZM2 cage. The beam moved towards HAM4 when we did positive yaw on SR2 and moved up when we did negative pitch. This is consistent with how the rejected polarization beam moved in HAM6.

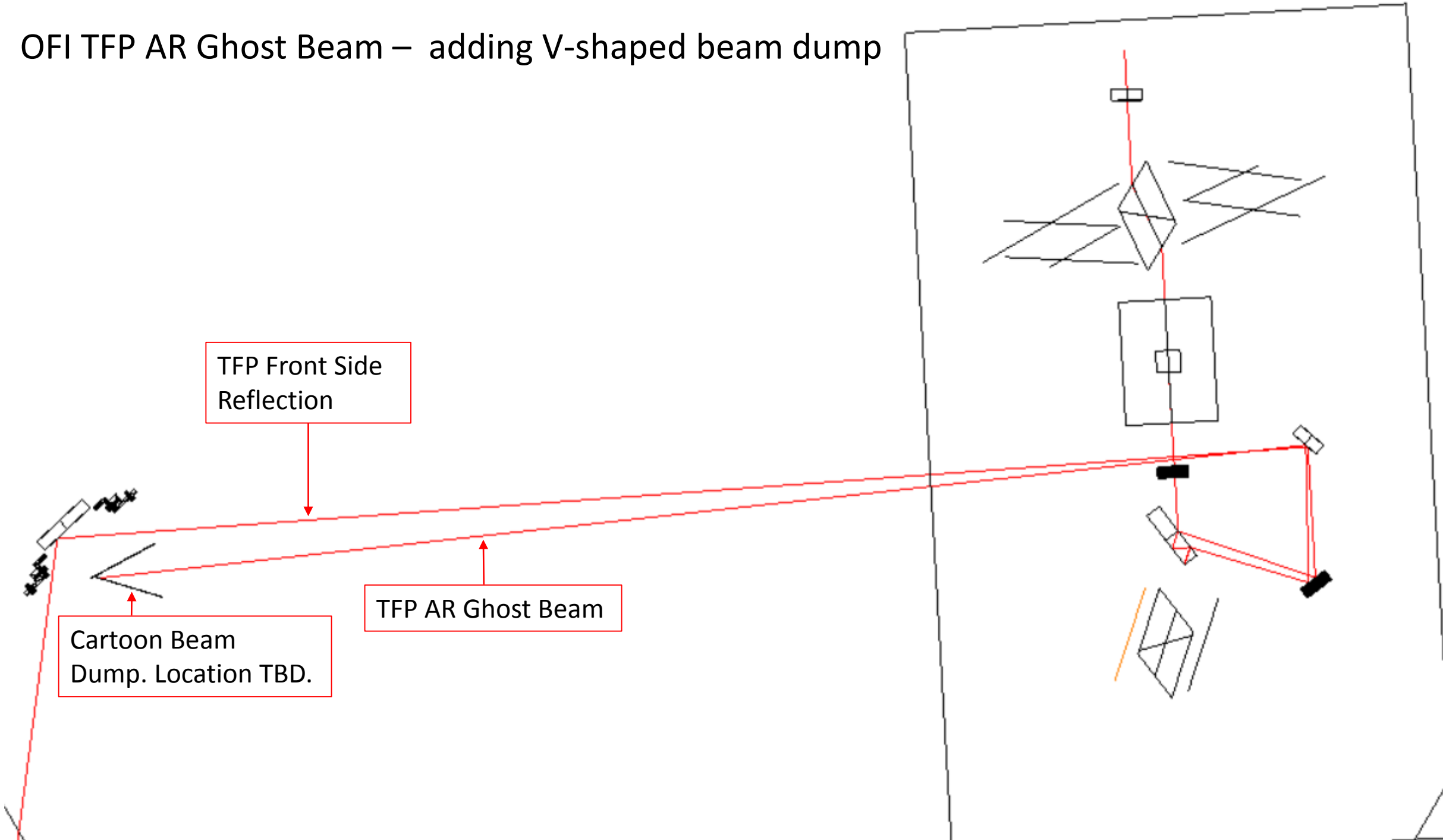
According to Koji's calculation and Corey Austin's response to our alog last night (alog41403) we suspect that our wedge is in the opposite direction.

Images attached to this report

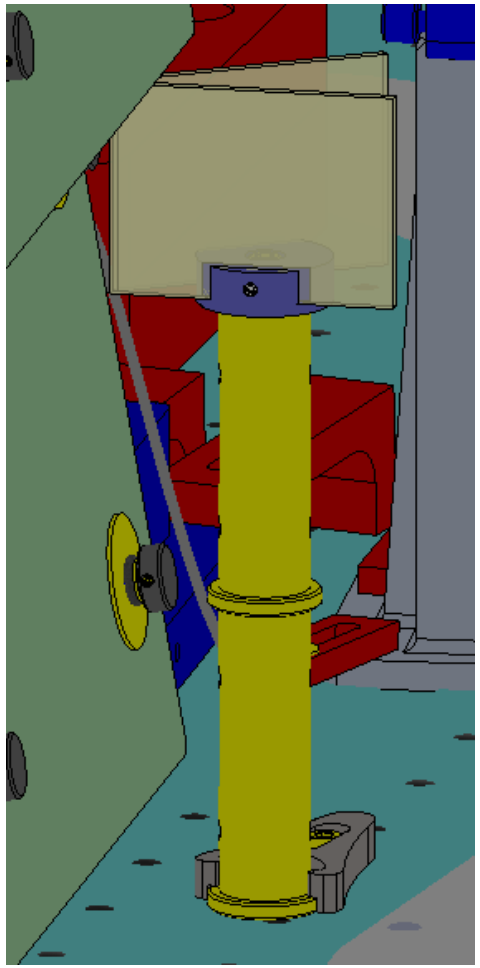
No Preview Available



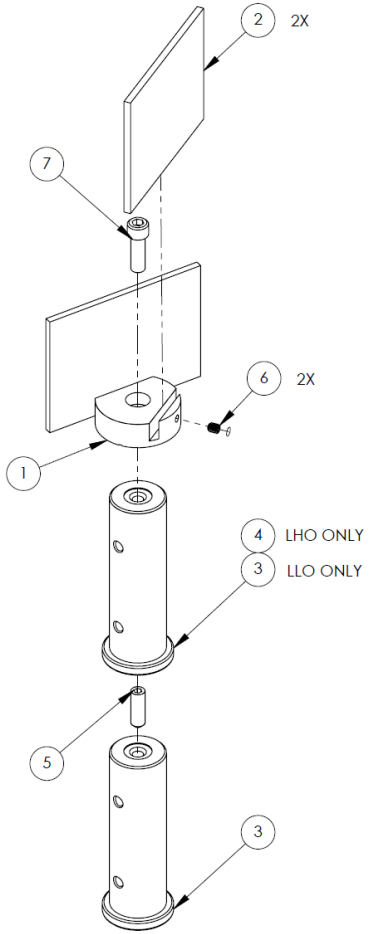
OFI TFP AR Ghost Beam – adding V-shaped beam dump



OFI TFP AR Ghost Beam – adding V-shaped beam dump



Representation of design, not in final location.



- SYS black glass beam dump
  - Based on D1400222
- For HAM5 beam heights
  - L1 (9.11”)
  - H1 (8.35”)
- Flexible positioning in front of ZM2
- All dirty parts will be in CIT’s hands by end of this week

- Related to **Ticket 10407**

<u>Pending:</u> FEA on beam dump and possibility of adding damping (viton)