

5/25/16 Gun to Booster Transport Line Meeting Minutes: A. Fedotov, D. Kayran, S. Bellavia, M. Mapes, T. Rao, B. Sheehy, J. Tuozzolo, Z. Zhao, B. Sheehy, J. Halinski, T. Arno, J.C. Brutus, K. Hamdi, J. Fite, D. Gassner, L. Hammons, W. Fischer

Status of component drawings was reviewed:

- All the chamber drawings have been checked by Sumanta. John and Sumanta will work on getting them approved. They have been given to KJL for quotation.
- Solenoid magnets drawings complete and approved.
- Corrector magnets complete. Being checked (Tony)
- Mirror system drawings complete. Being checked (Sumanta)
- Vibration Isolators are incorporated to the beam line brackets including the solenoid magnets.
- Design of the positioning mounts are complete (x and y positioning transverse to beam and skew on both x and y axis)
- Layout for profile monitor-camera assembly has started.

It was agreed to proceed with YAG crystal mounting design shown in the slide with 3° angle.

Extended discussion on laser mirrors stainless steel and copper. The following was agreed to:

- Fabricate 3 stainless steel 440C mirrors that will be polished by Cabot Microelectronics. Sumanta is checking where protective silver coating would be done, Cabot/LT-ULTRA.
- Fabricate 3 copper mirrors that will be polished and silver coated by LT-ULTRA

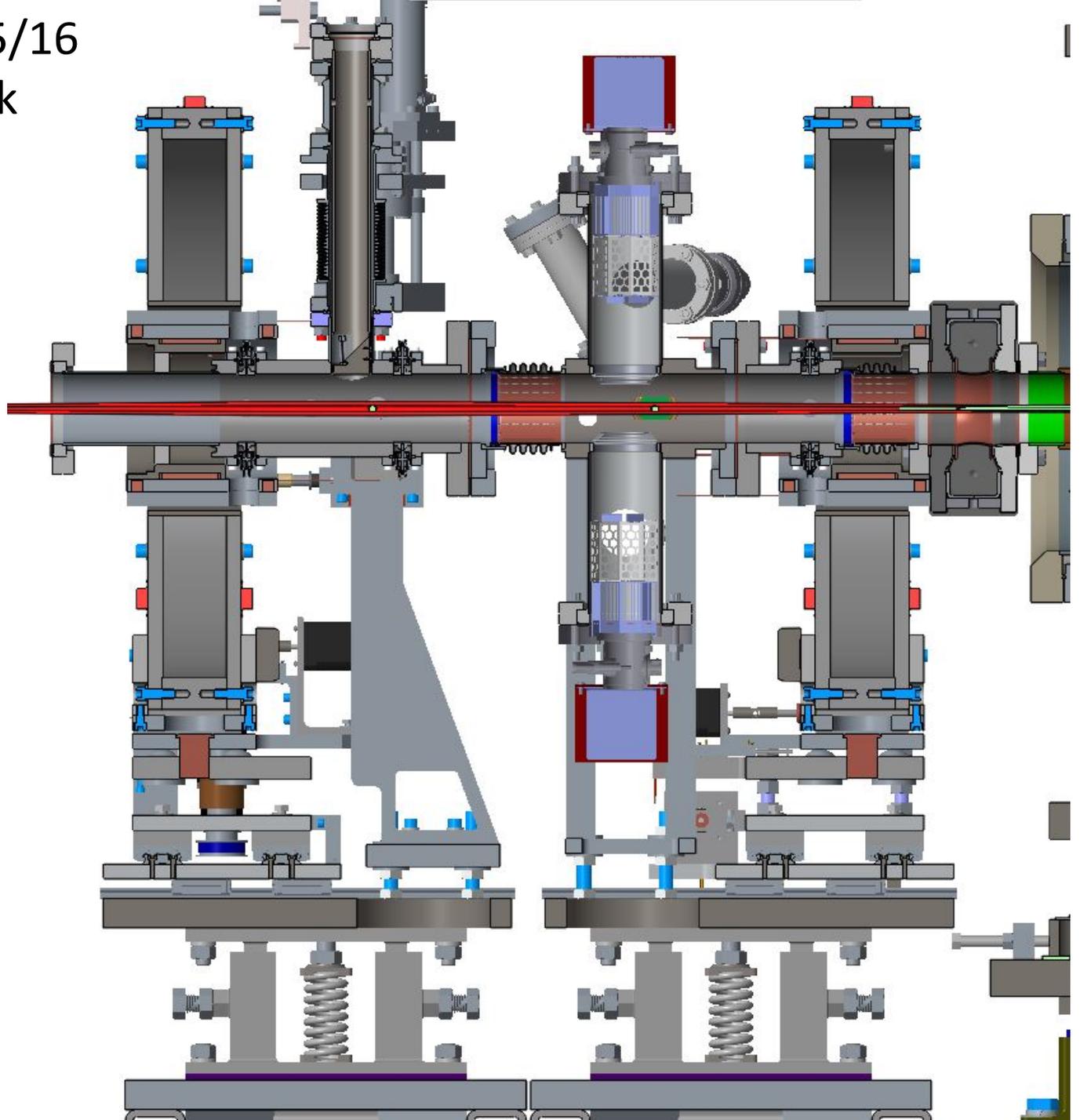
Cabot Microelectronics is also making profile monitor mirror with the specification same as the laser mirror w/o any coating. There was agreement in the meeting that if the bakeout is done without incident that the copper mirror should not be damaged. There is time in the schedule to do some bakeout testing.

Discussion on the view ports. Zhi stated that the vendor needs to be aware of the laser intensity and Zhi will provide specifications for that will transit through the window. As far as clear aperture is concerned, Spectrum Thin Films quotation works fine. Zhi wants to check the following with the vendor.

1. what's the highest bake temperature?
2. what could be the best tolerance of vacuum level?
3. what's the average and peak power damage threshold?
4. AR coating specification for s- and p- light?

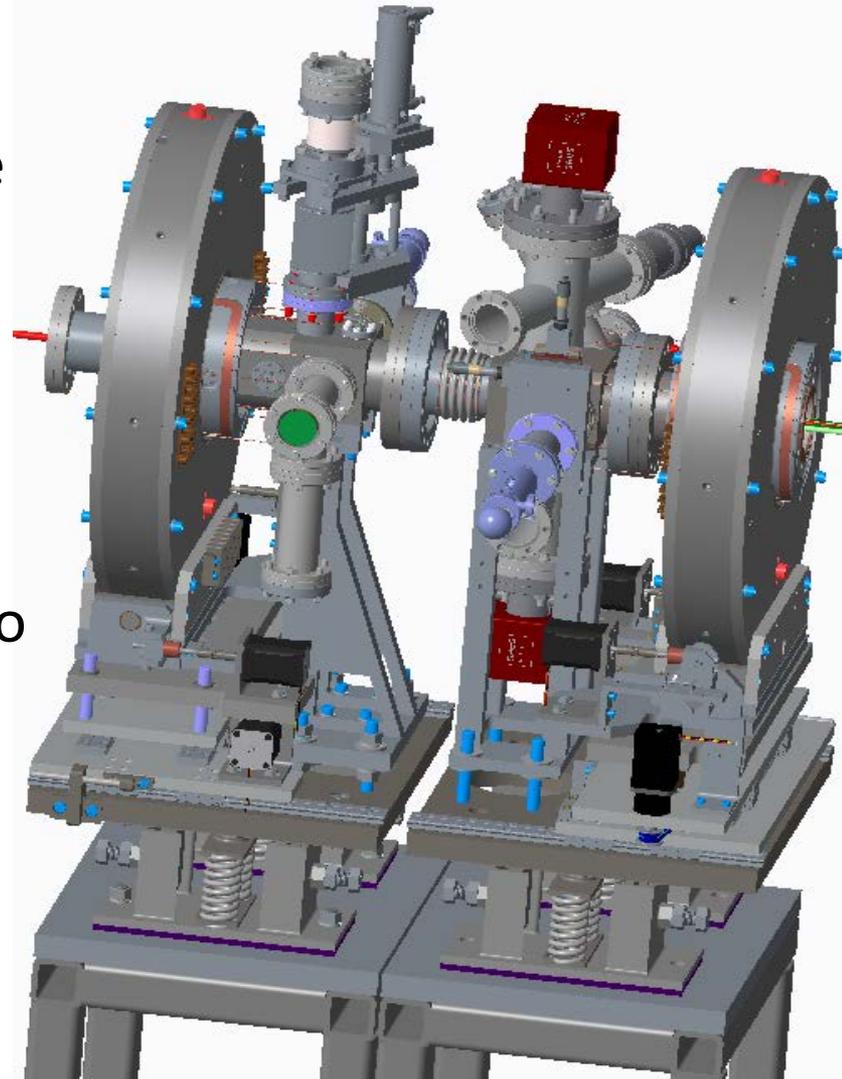
Additional discussion on the windows and mirrors for the laser transport (under rough vacuum) from the laser building to the tunnel optics table. Zhi stated that the requirements for those windows are less stringent. Steve noted that the commercially available vacuum mirror mounts were designed for 1" mirrors. It was agreed that 2" mirrors provide easier alignment and they should be used for the transport system. Steve will contact the vendor to find out the cost for mounting the larger mirrors in larger chambers.

GtB beamline 5/25/16
J. Halinski, S. Nayak



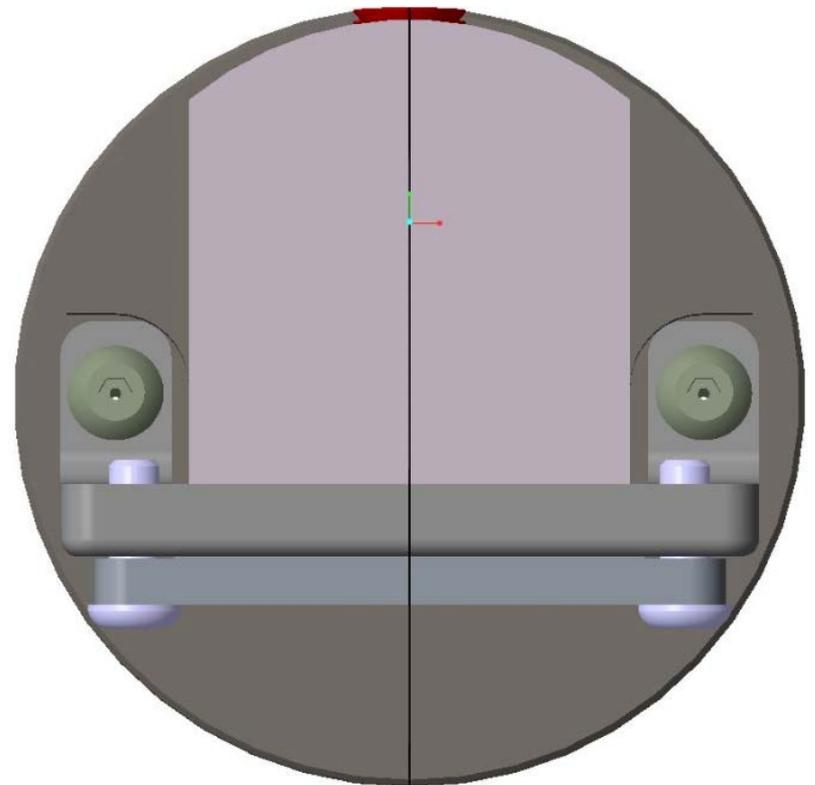
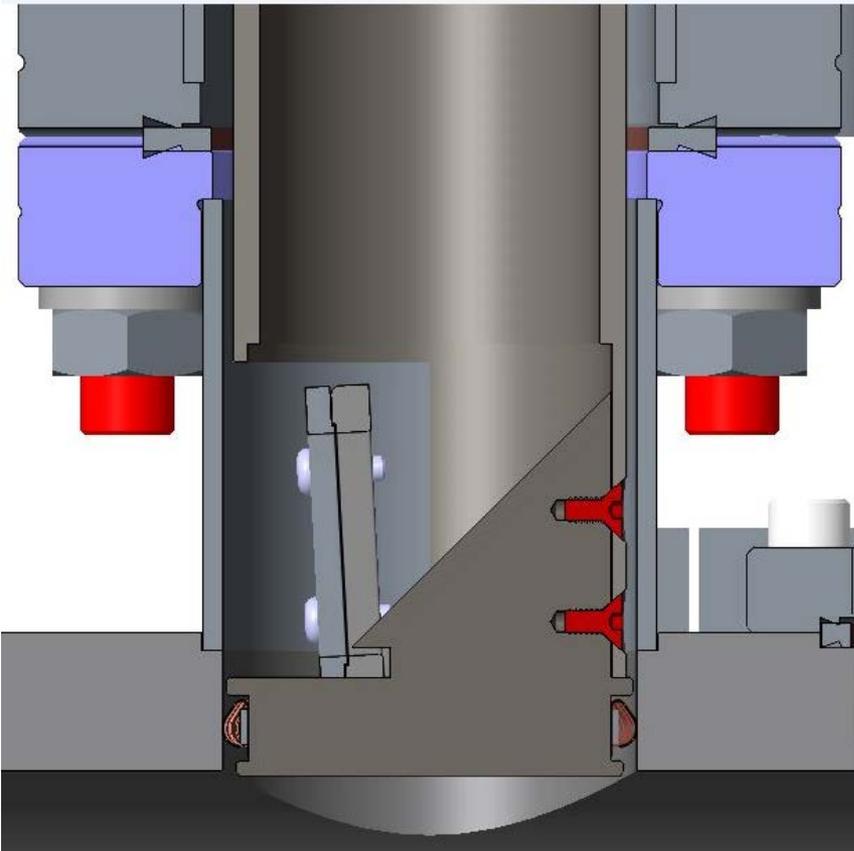
DC Gun to Booster Transport Line Status

- All the chamber drawings are checked (approved?) and submitted to KJL for quotation.
- Solenoid magnets drawings complete and approved.
- Corrector magnets complete. Checked and approved?
- Mirror system drawings complete? Checked?
- Vibration Isolators are incorporated to the supports
- Layout for profile monitor-camera assembly has been looked upon.



DC Gun to Booster Transport Line Status

- YAG crystal is tilted by 3° outward w.r.t vertical plane



DC Gun to Booster Transport Line Status

Profile monitor mirrors (Vendor: Cabot Microelectronics Polishing Corp)

Material: SS 440C 55-60 RC

Flatness: $\frac{1}{3}$ wave @ 532 nm (0.000007")

Average Roughness (Ra): 2 nm (20 angstroms)

Scratch/Dig: 10/5 (per mil spec MIL-O-13830)

Laser Mirrors

Original Specification:

Material: Cross forged SS 304L

Optical Finish: $\frac{1}{8}$ Wavelength @ 500nm

- SS 304L is the first choice of material, but the recommended vendor LT-ULTRA declined to make so.

“Unfortunately we cannot machine steel like 304L with our diamond tools. One possibility would be to cover the mirror with a 100 micron Nickel layer. On this Nickel layer a diamond machining would be possible” – LT-ULTRA

DC Gun to Booster Transport Line Status

Laser Mirrors

LT-ULTRA quoted for copper mirrors as follows:

Pos	Item Description	Qty	Unit	Price EUR	Value EUR
1	120343 Tilted Flat Mirror ø 19,05mm, Ch = 47,44mm , 92° OFHC-Copper coated with Protected Silver surface accuracy <0,3µm roughness <5nm Ra Drawing No. 3070M0086 Index A Delivery time: 7-8 working weeks after receipt of order	3	PCS	445,00 (*)	1.335,00

The SS mirror made by Cabot Microelectronics is better than the copper made by LT-ULTRA

DC Gun to Booster Transport Line Status

Laser Mirrors

LT-ULTRA quoted for Cornell:

<u>Item</u>	<u>Qty.</u>	<u>Article</u>	<u>US\$/pc.</u>
01	2	Tilted Flat Mirror out of OFHC-copper (complete manufacturing) <ul style="list-style-type: none">- 0.75" x 0.6" x 1.325" / 47°- flatness $\leq 0,3\mu\text{m}$- roughness $\leq 5\text{nm Ra}$- coated with protected silver *)- according drawing 7108-104	752,--
02	2	Tilted Flat Mirror out of steel (1.4429) (only polishing) <ul style="list-style-type: none">- 0.75" x 0.6" x 1.325" / 47°- flatness $\leq 0,3\mu\text{m}$ over a elliptical aperture and a border of about 0,5mm- roughness $\leq 3\text{nm Ra}$- coated with protected silver *)- raw blanks provided by you- according drawing 7108-104	595,--
*) Protected Silver			
• $R \geq 96\% @ \lambda = 520\text{nm} / \text{AOI}=43^\circ$			

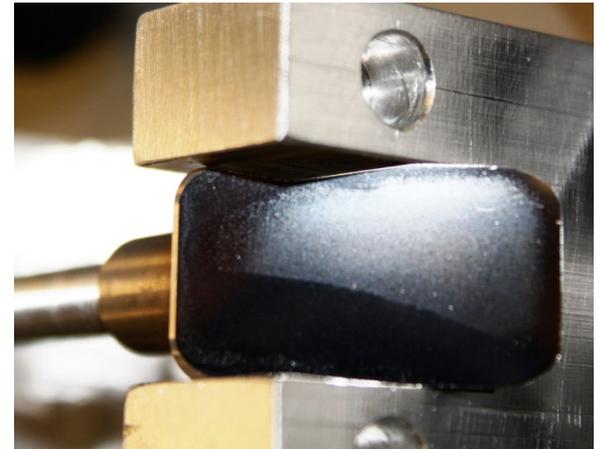
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Laser Mirrors

“Importantly, though, the copper mirrors that we purchased were damaged by a 200C bake (see attached photo), and we had to send them back to be re-polished. The stainless steel ones that we purchased were fine after the same bake, so if you have a choice of material, I would choose that. On the other hand, after re-polishing, I believe the copper ones were fine after a lower temperature bake, but I don't remember the details”- Adam

Summary from other emails from Adam:

- Cornell is using all SS mirrors, it seems copper mirrors are kept as spares.
- Cornell stopped using copper mirrors as it could not withstand 200C bake out.
- No beam testing is done on copper mirrors, but the expectation is that mirror would be fine if they survive the bake-out.



DC Gun to Booster Transport Line Status

Laser Mirrors

*“If you do find another company to machine the steel mirror substrates, **I would still recommend having LT Ultra polish and coat the mirrors.** A collaborator at DESY had many mirrors made by many different companies, and found that LT Ultra was the best choice.*

See the slide 2 on the attached Power Point for what happened when we originally used another vendor to polish the SS mirrors. Laser is totally wrecked! But, after LT Ultra re-polished that mirror, it was indistinguishable from the standard dielectric mirror. So, we trust that company!”- Adam

Conclusion:

- SS mirror is the best choice, but unfortunately LT-ULTRA, who makes most reliable mirrors, declined to make those mirrors.
- As Toby suggested, lets have both SS mirrors made by Cabot Micro Electronics and the Copper mirrors made by LT-ULTRA.
- May be, Copper mirrors would withstand 150⁰ bake out, if it doesn't work then we can use SS mirrors

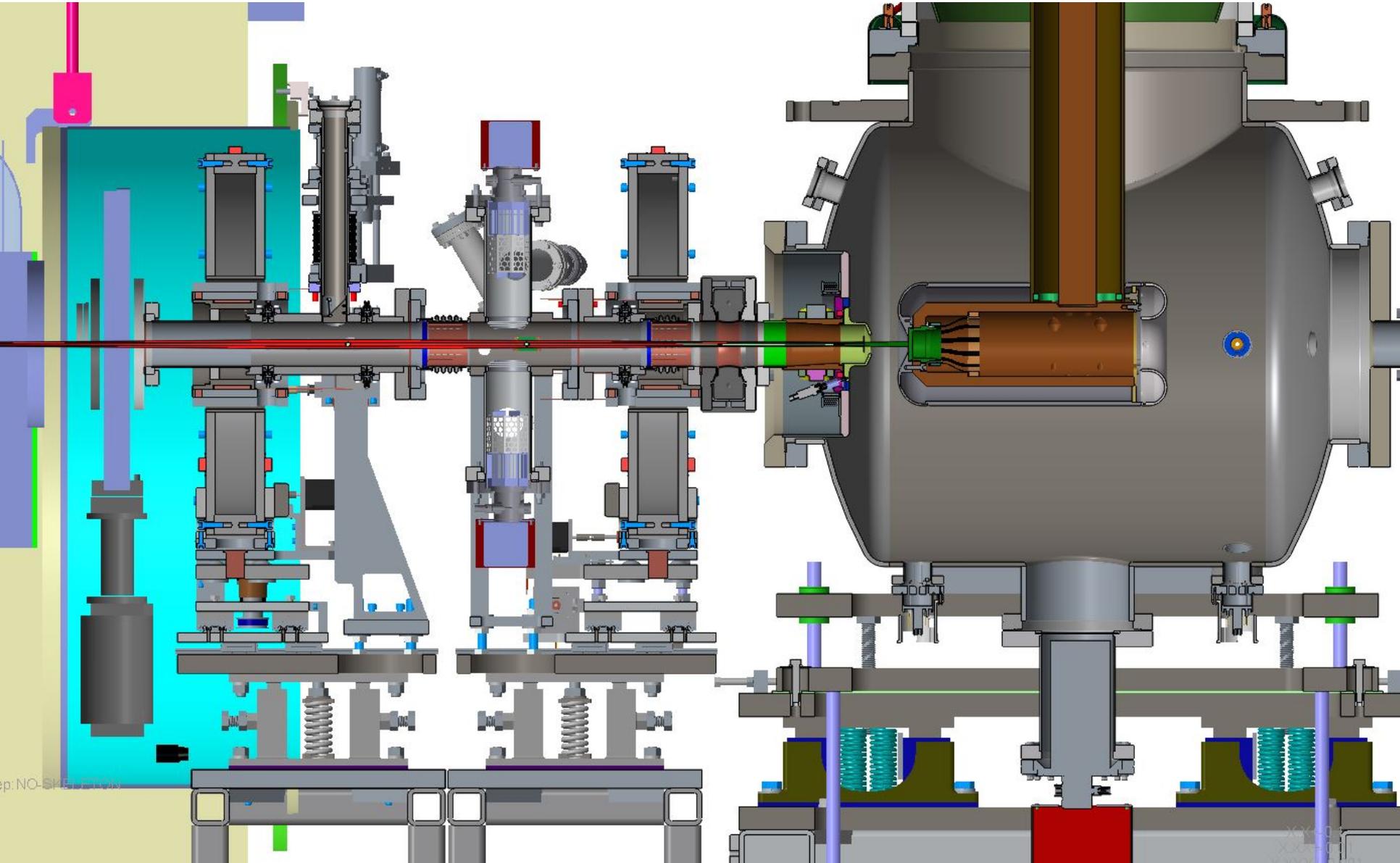
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Laser Viewports

- 2.75" CF has view port diameter 1.13", after AR hard coating by Optosigma, the clear aperture (CA) will be 0.56" which is not acceptable to us.
- Spectrum Thin Films, can provide 90% CA of viewing diameter, I have asked for a plot %R vs wavelength.
- I will try another vendor, Laseroptex.com

Quotation from Spectrum Thin films:

Coating Description	Delivery	Qty	Price Each	# Per Run	Total
CFM: FS Viewport Dimensions: 2.720" dia CA: 90% Coating Both Surfaces: R<0.25% @ 520nm AOI: 0° High Power Coating Lot Charge Qty: 3 pieces	1 week ARM	1	1,000.00		1,000.00



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