Brookhaven National Laboratory

U.S. DEPARTMENT OF ENERGY

CeC Time Meeting

CeC Experiment at RHIC

Jean Clifford Brutus

April 30th, 2024

@BrookhavenLab

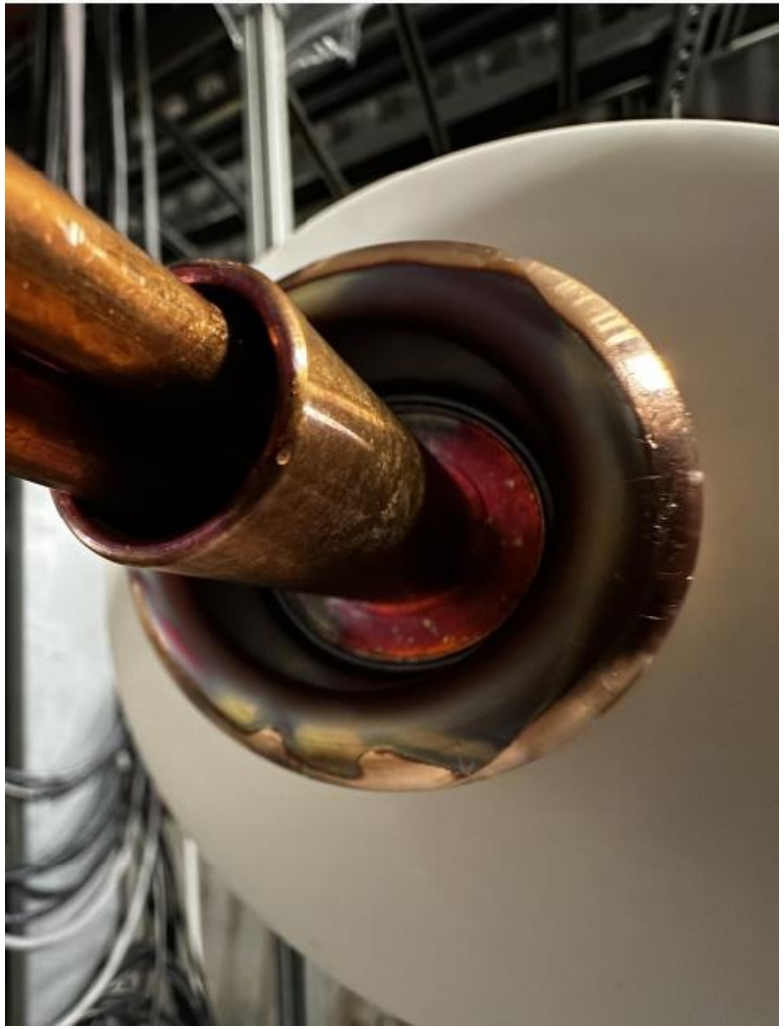
CeC work with off maintenance day access

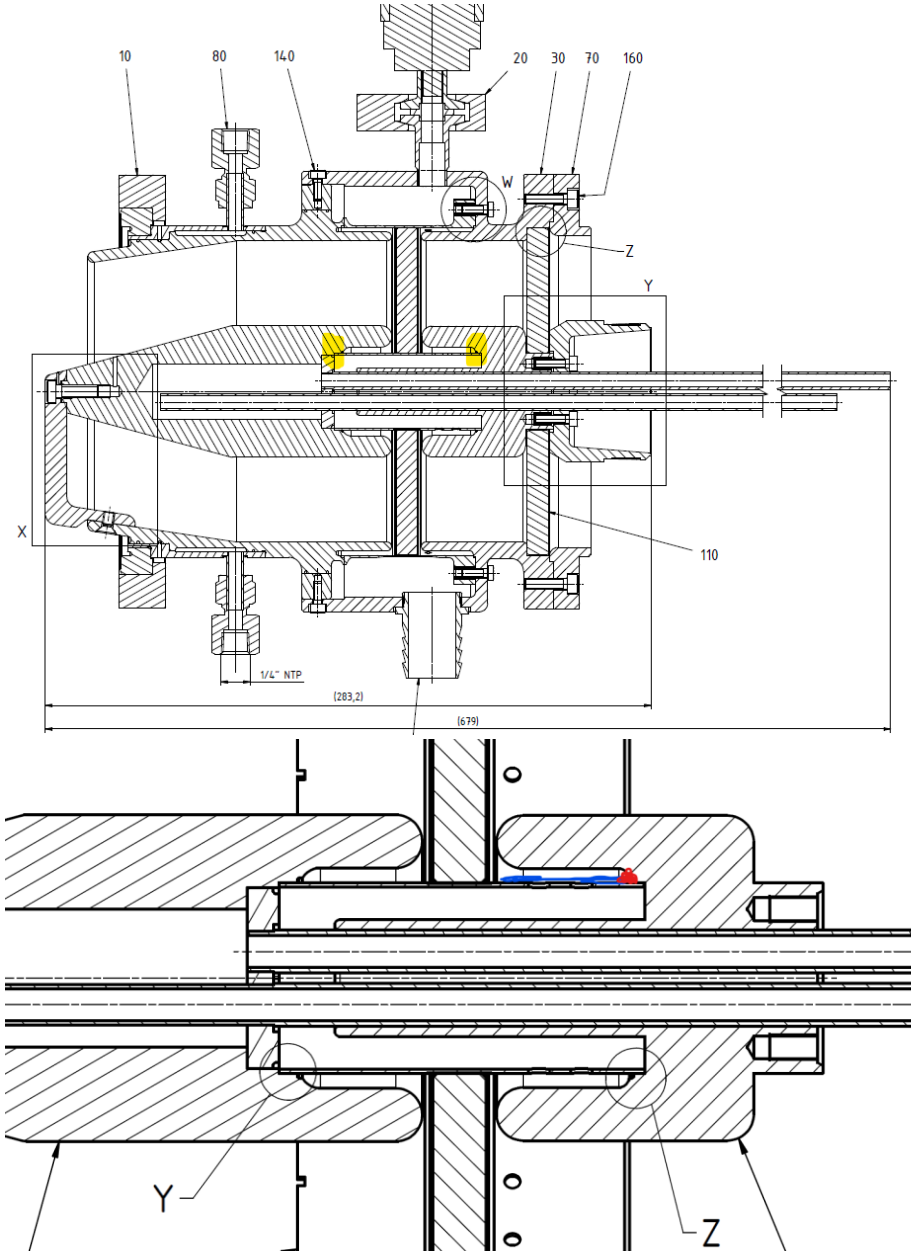
- FPC window dry air connections
- 500 MHz hybrid H dummy load leak diagnosis (still need to be repaired)
- Cavity water manifold connection
- Coax measurements and custom length pieces made
- FPC 2 repair
- FPC 1 coax installation
- H/V corrector installation and connection to PS
- Magnetometer installation

Maintenance Day April 29th

- Cryo repair
- FPC 2 coax installation
- Water manifold
- Inspection camera installation
- ~~Tuner cable connections and test?~~ Moved to Maintenance Day May 14th

500MHz – FPC 2 air side inner conductor





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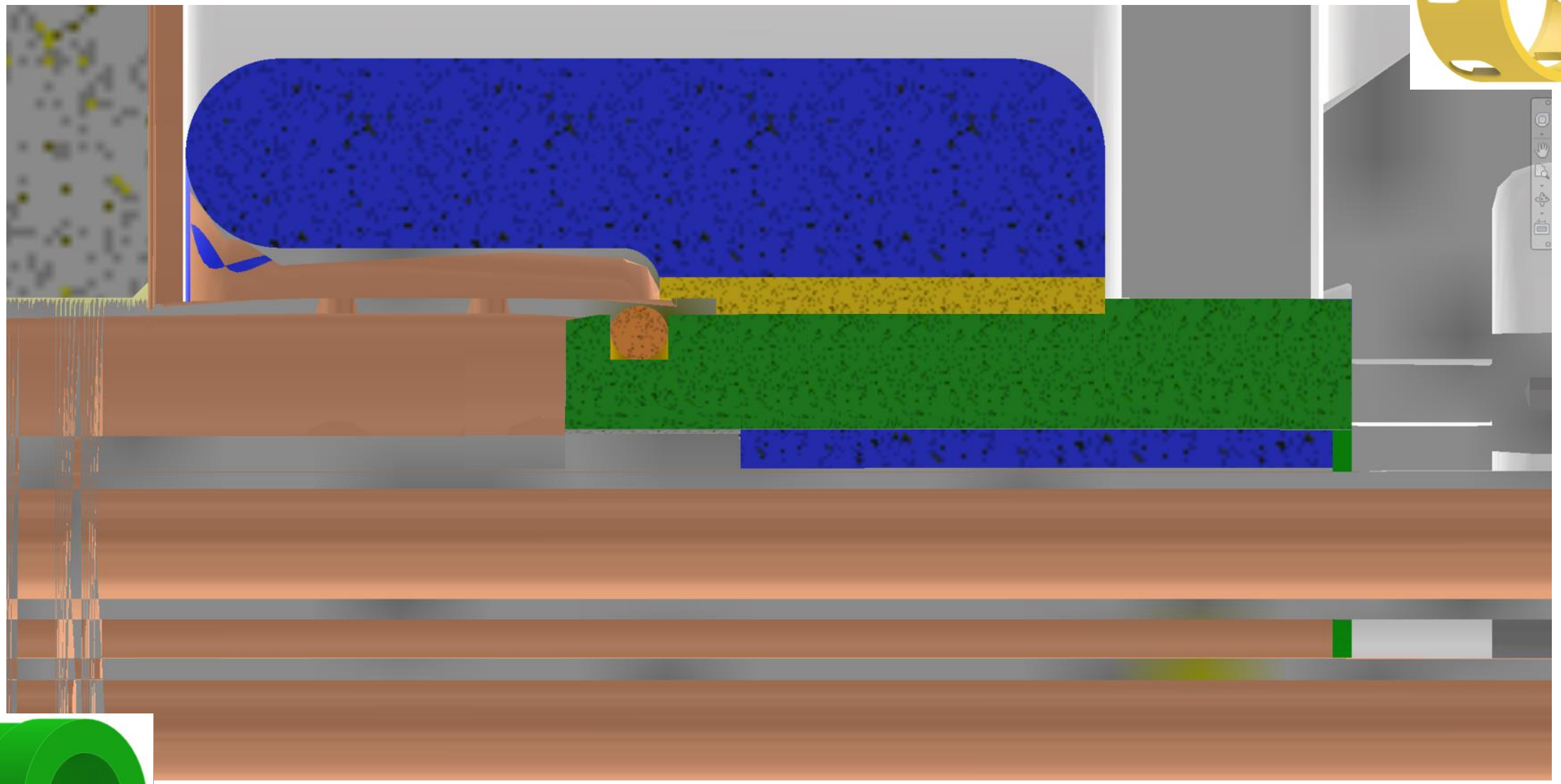
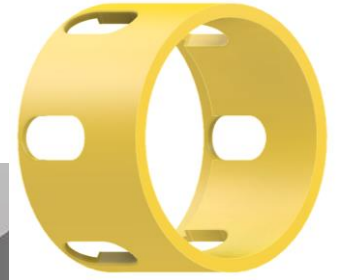
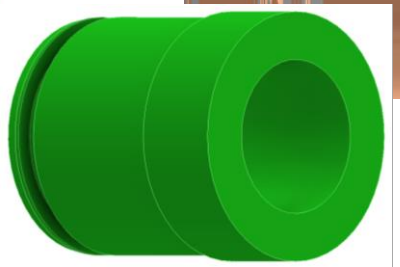
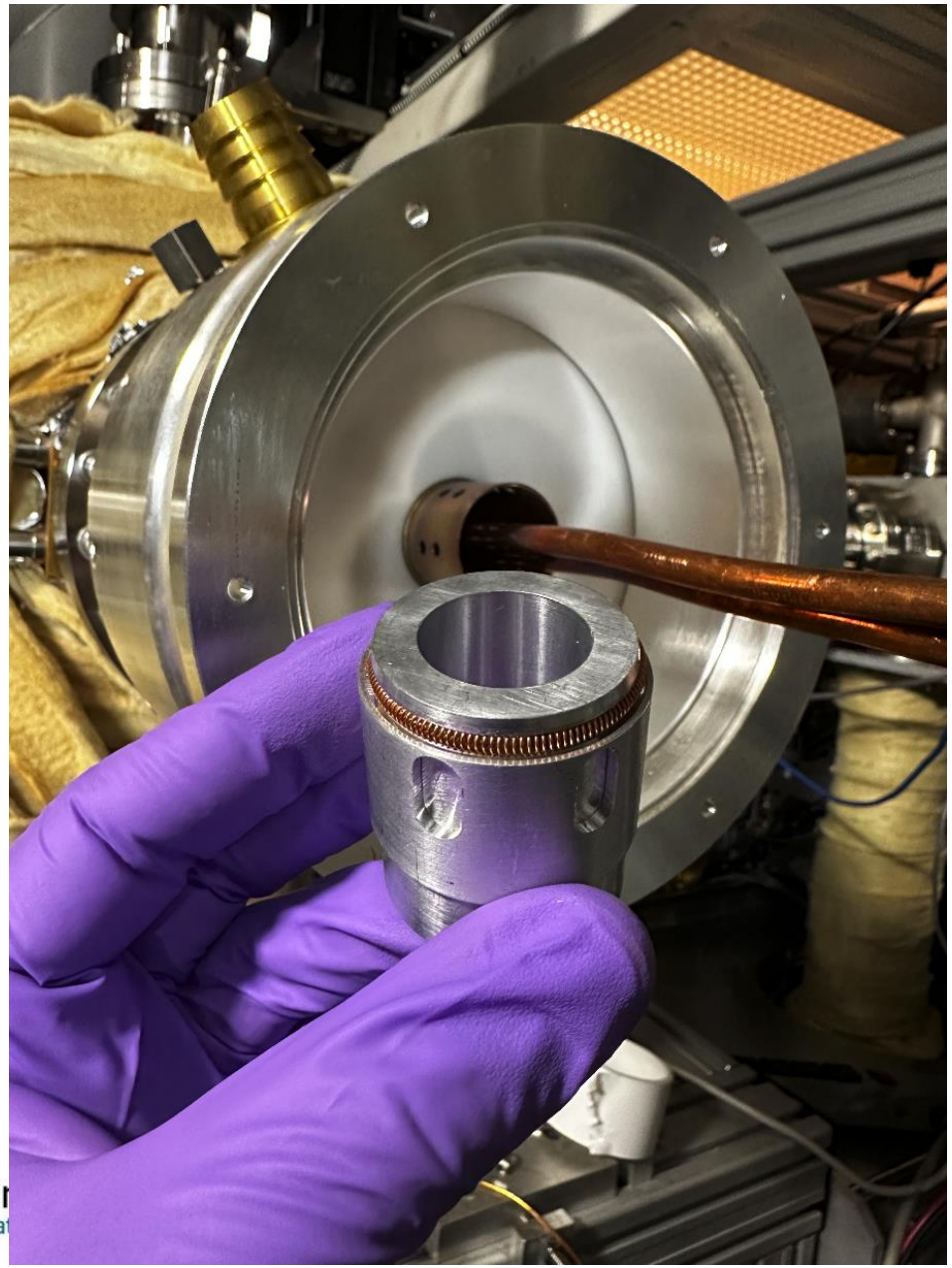
500MHz – FPC 2 Repair





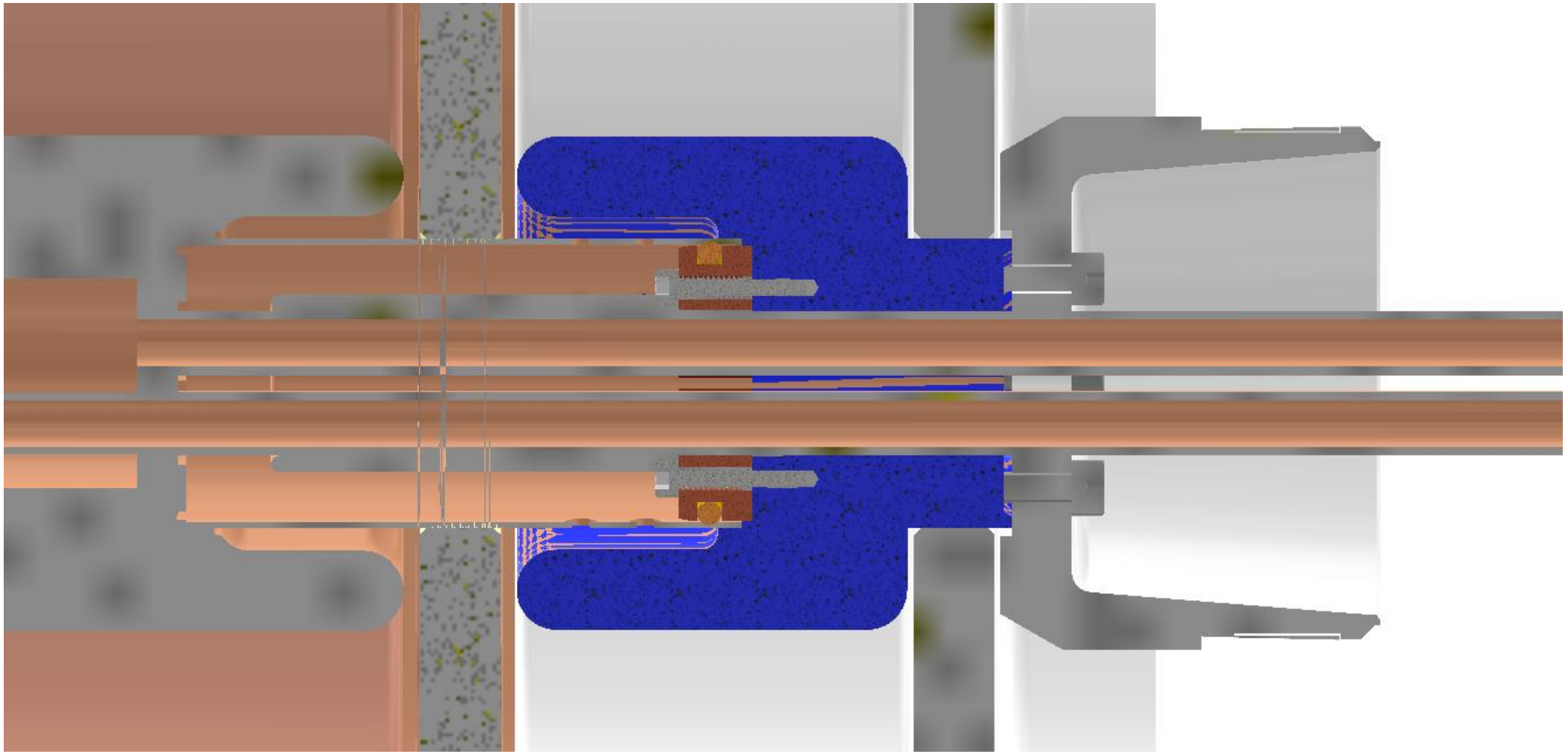


500MHz – FPC 2 Repair



500MHz – FPC 2 Repair

New Air Side IC Adapter



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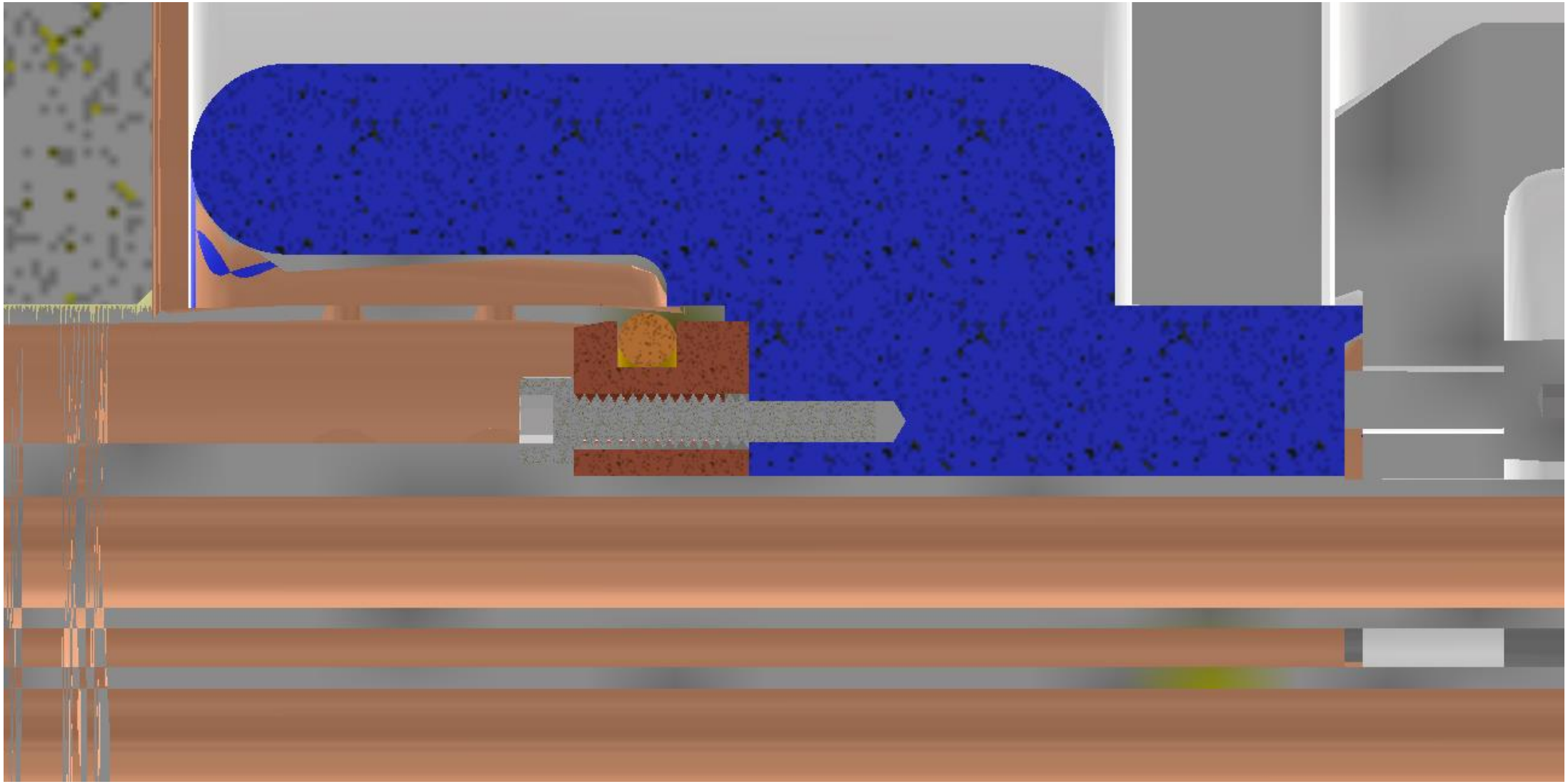
500MHz – FPC 2 Repair



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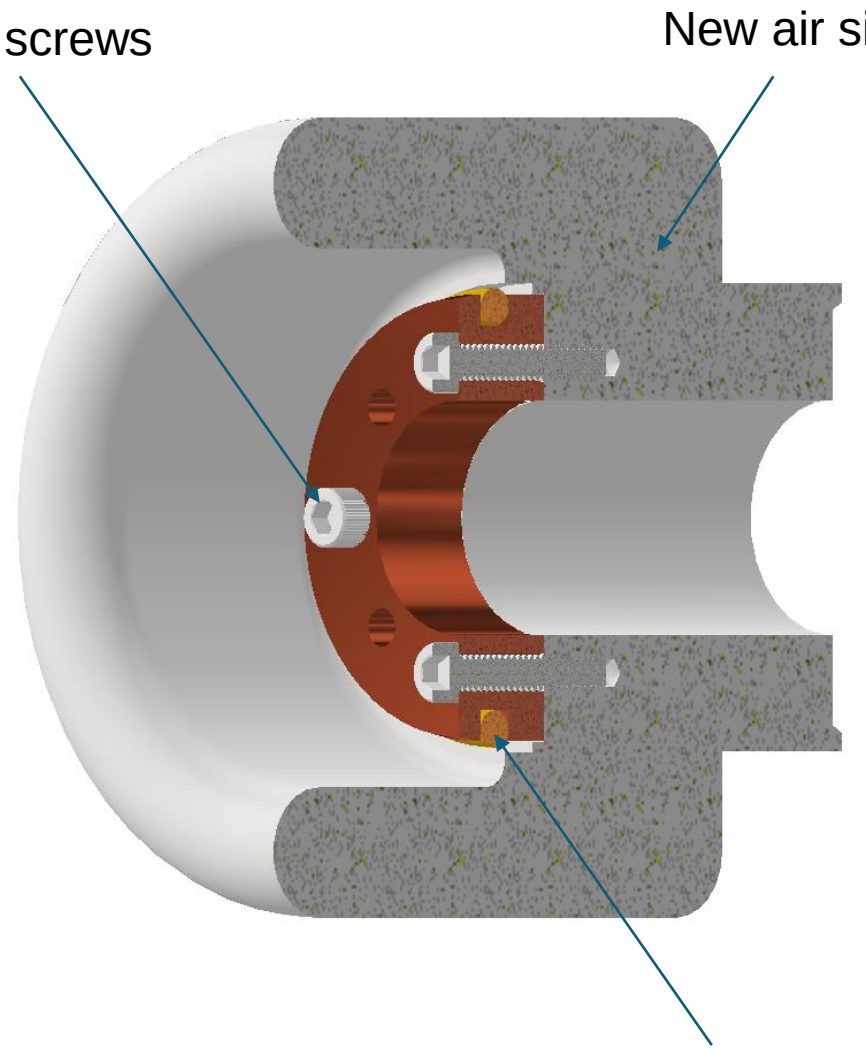
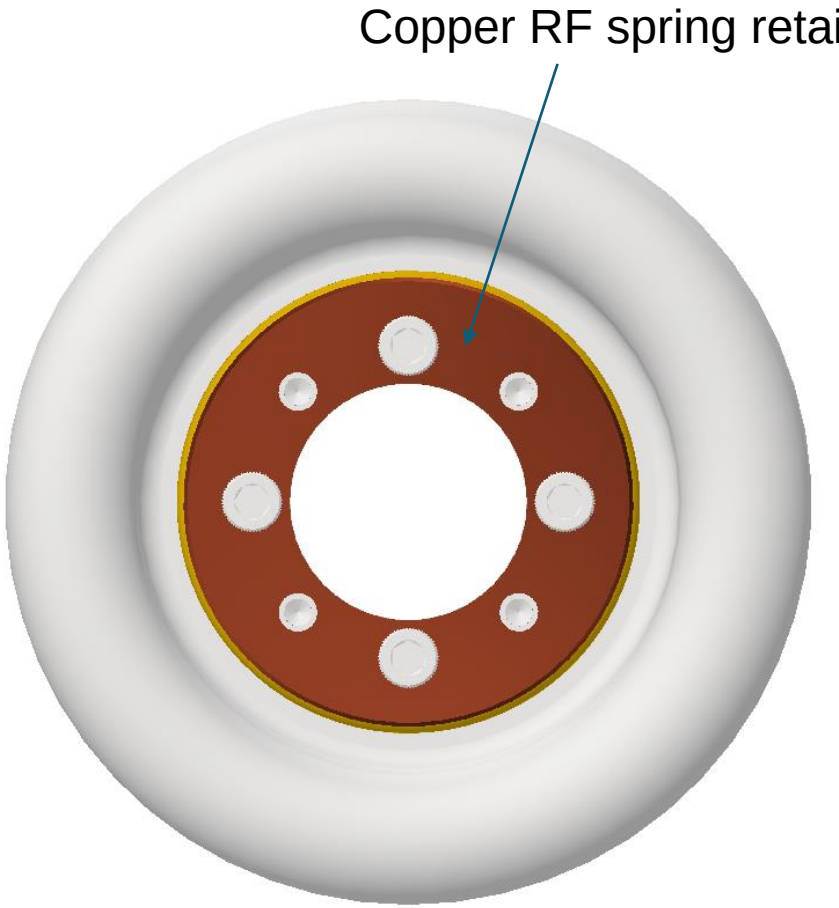
500MHz – FPC 2 Repair





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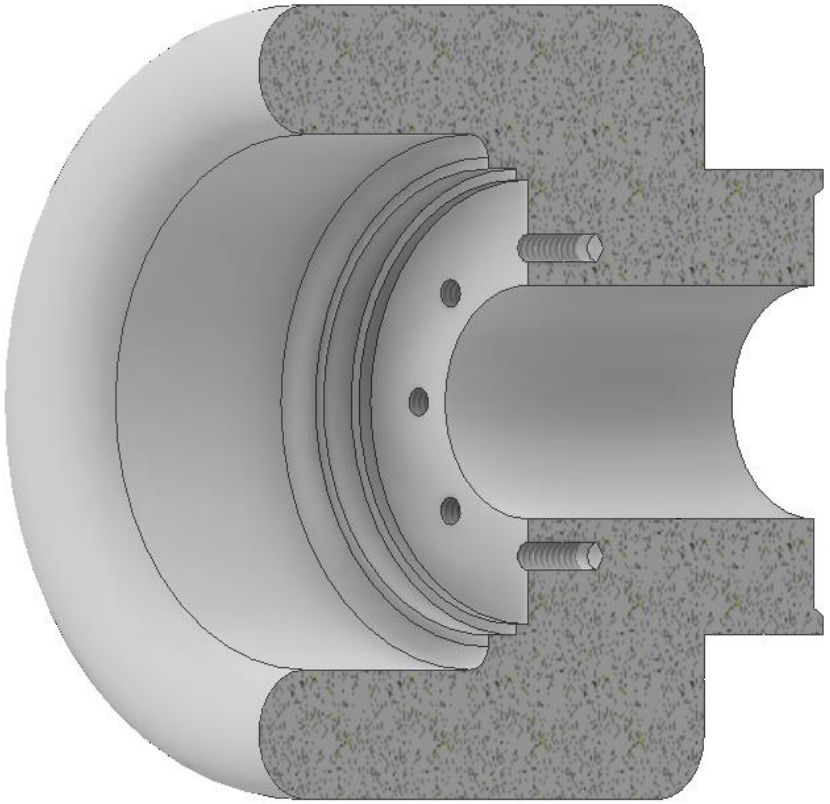
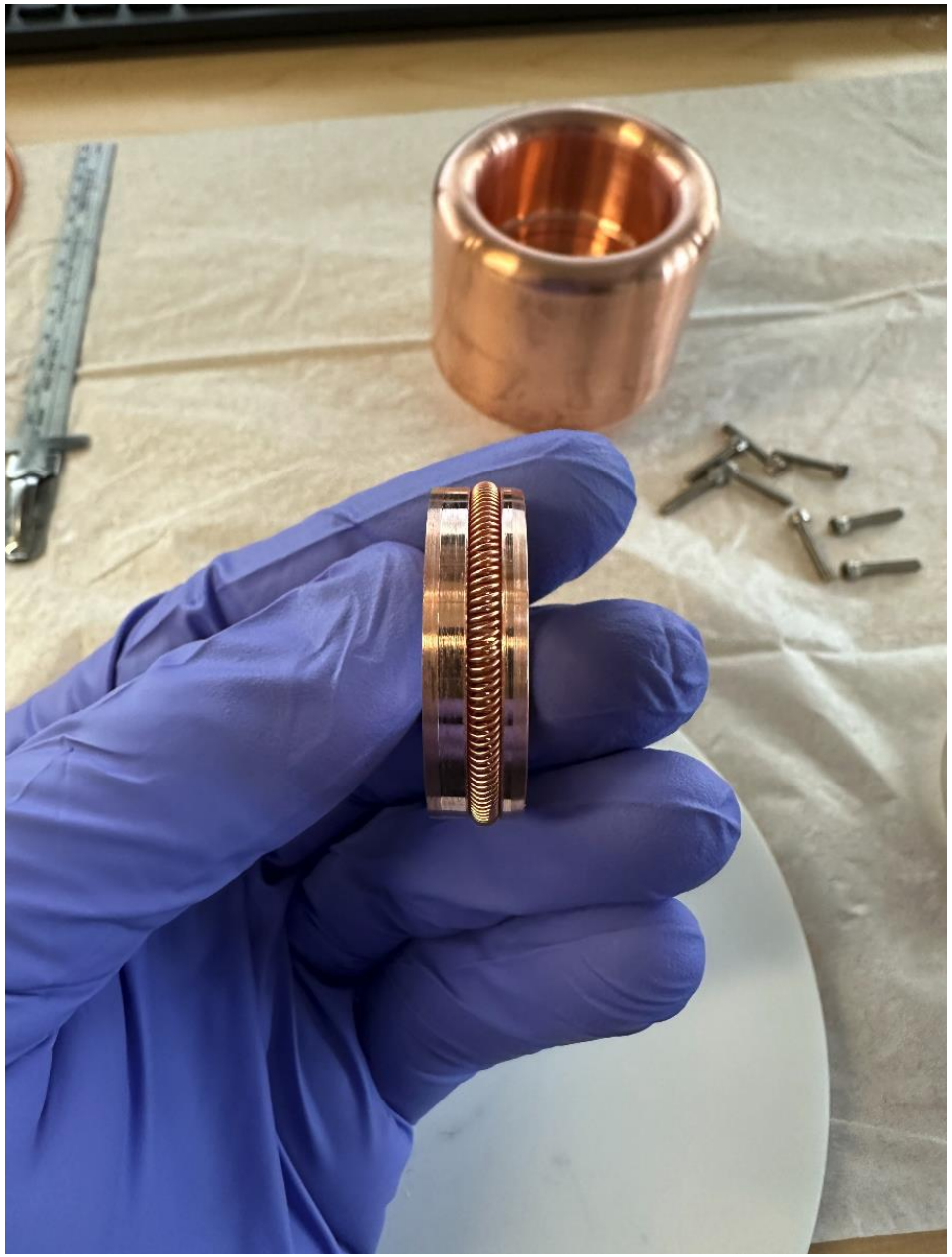
500MHz – FPC 2 Repair

Copper RF spring ring

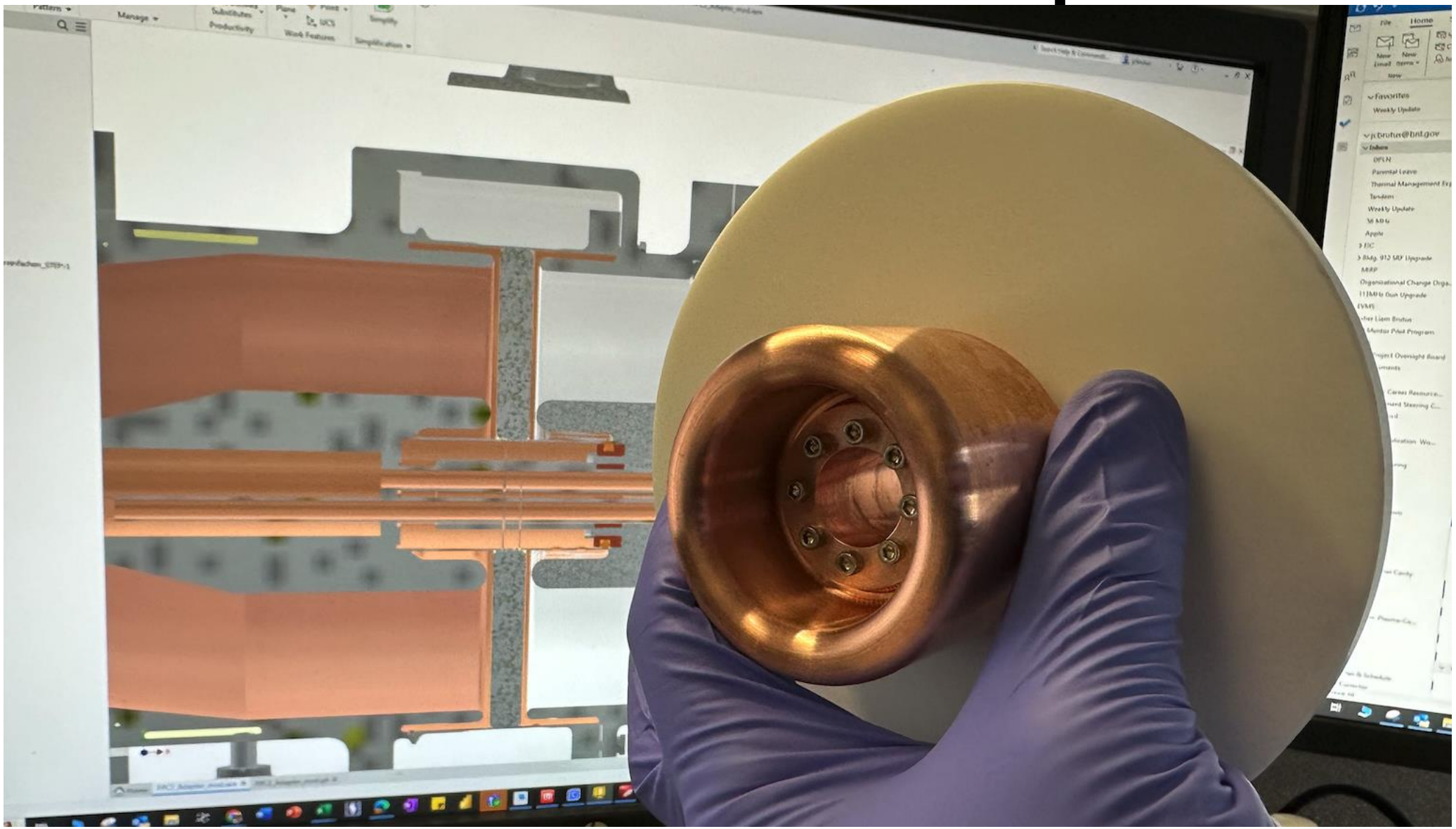


Machined air side IC

500MHz – FPC 2 Repair



500MHz – FPC 2 Repair



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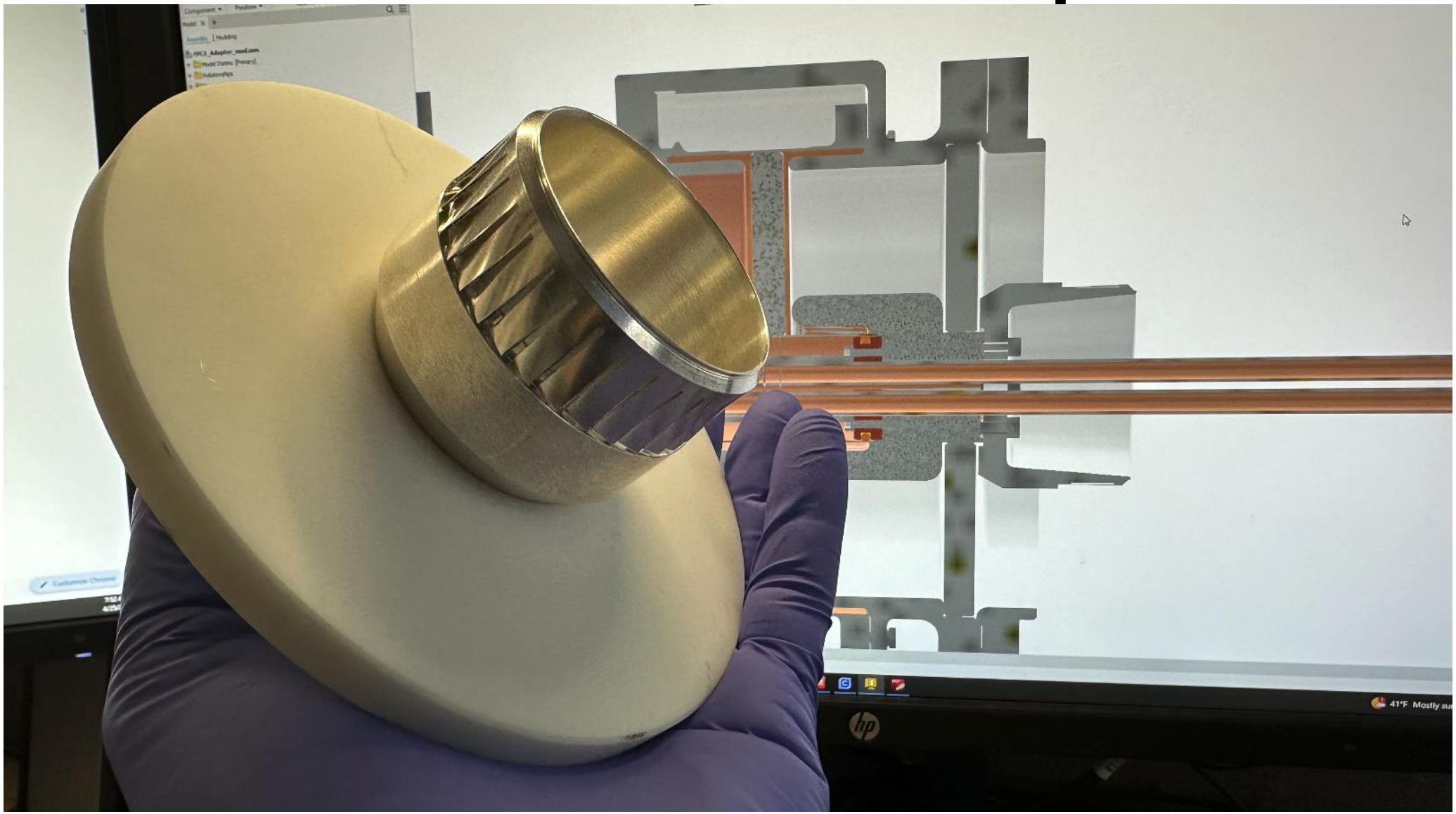
500MHz – FPC 2 Repair



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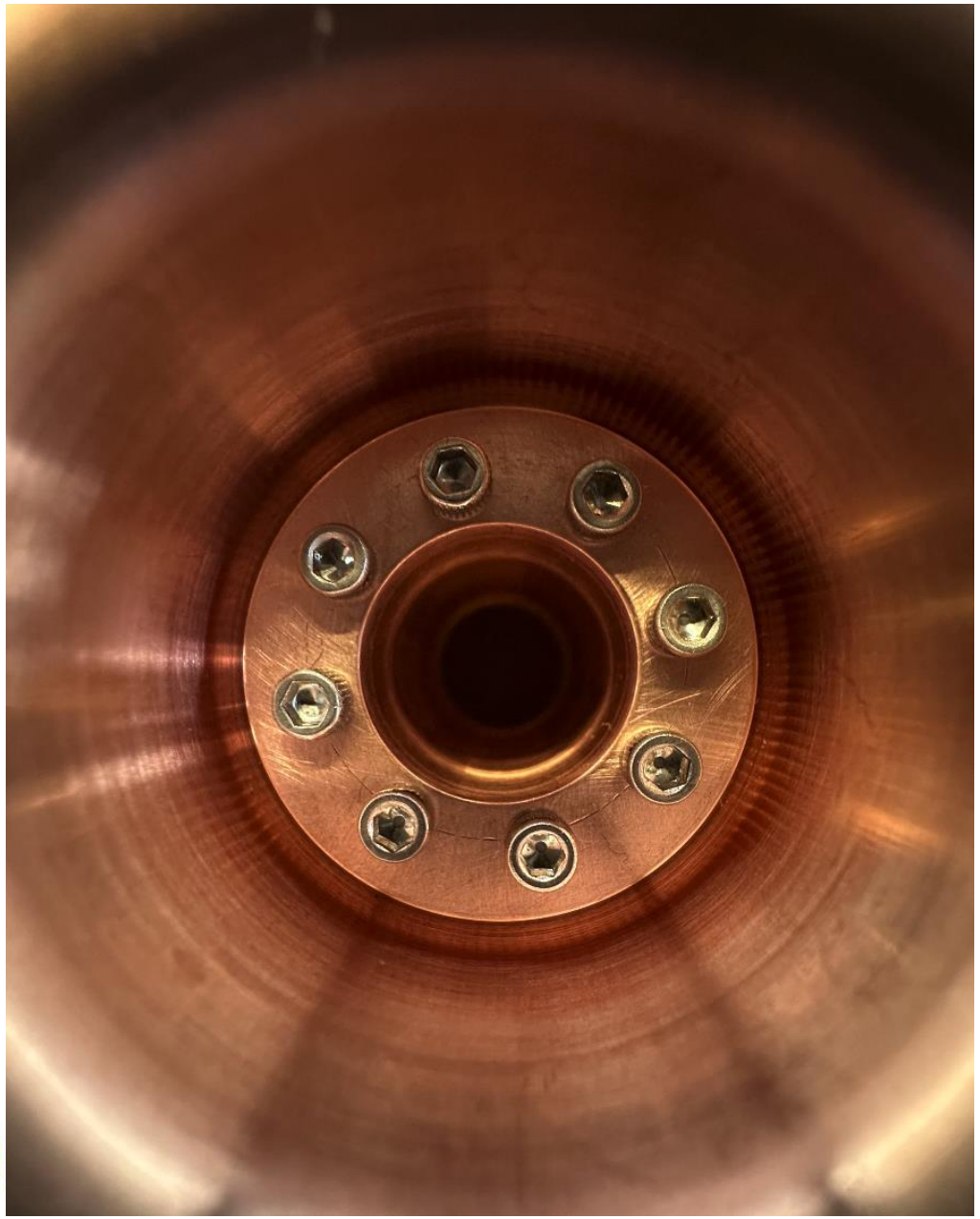
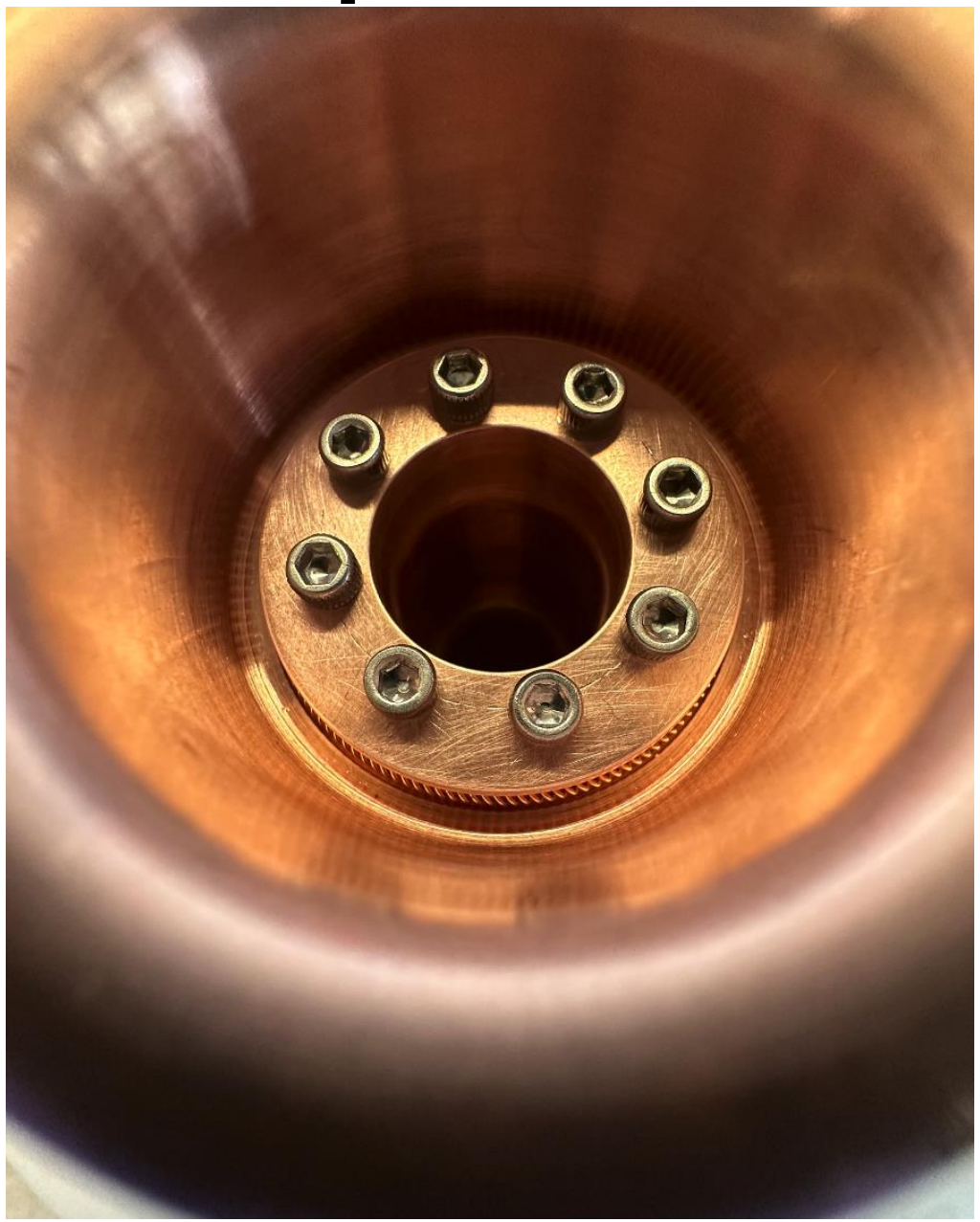
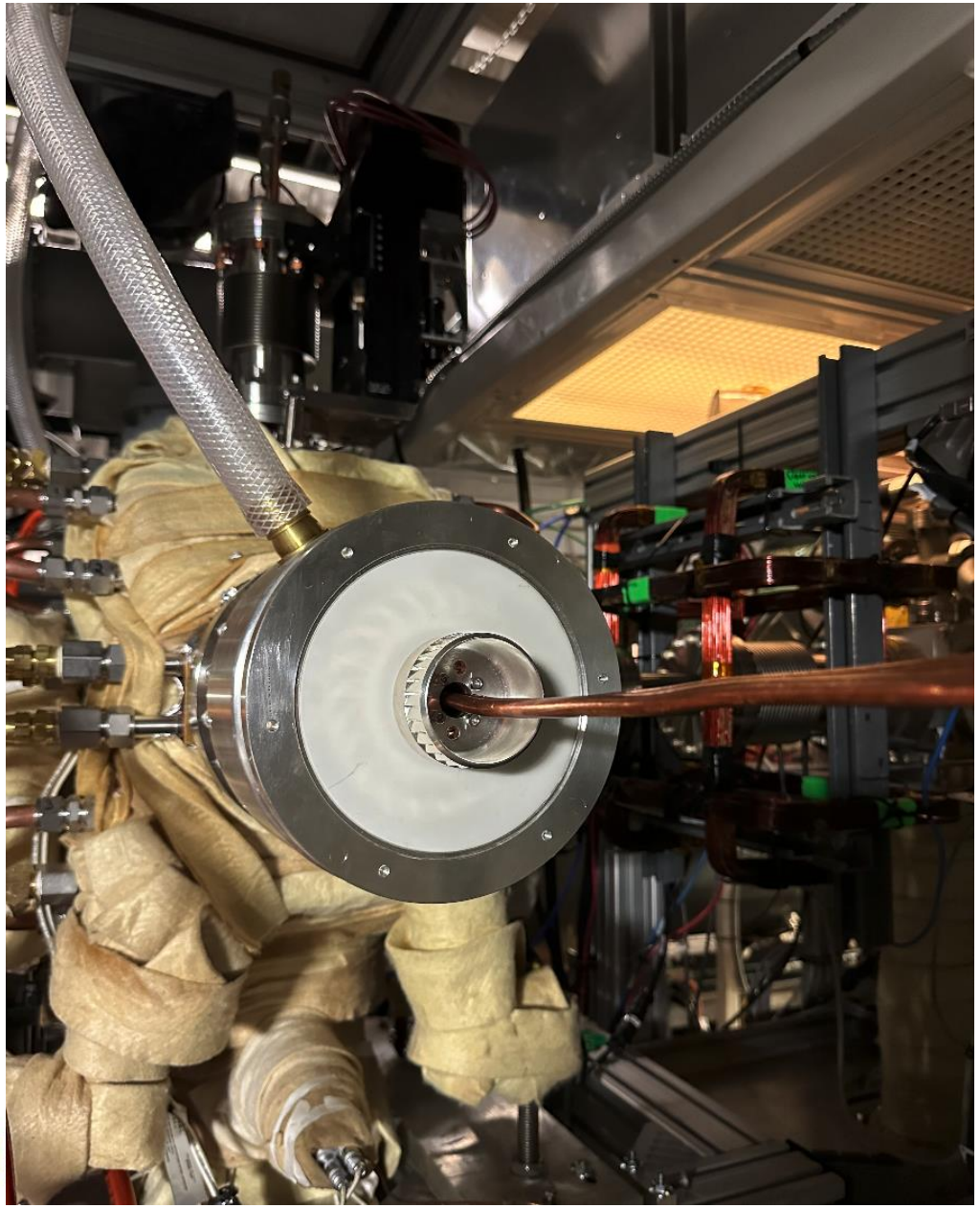
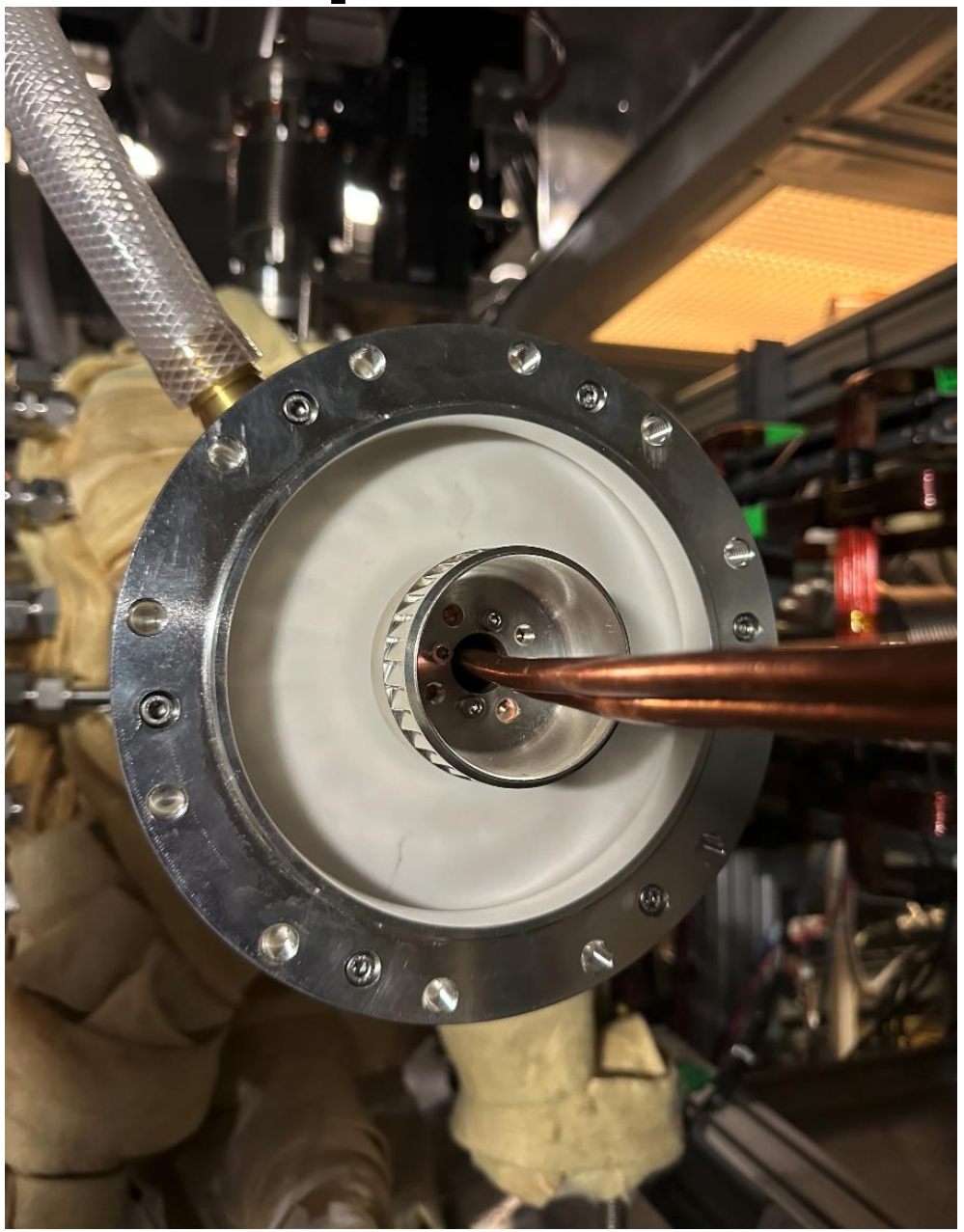
500MHz – FPC 2 Repair



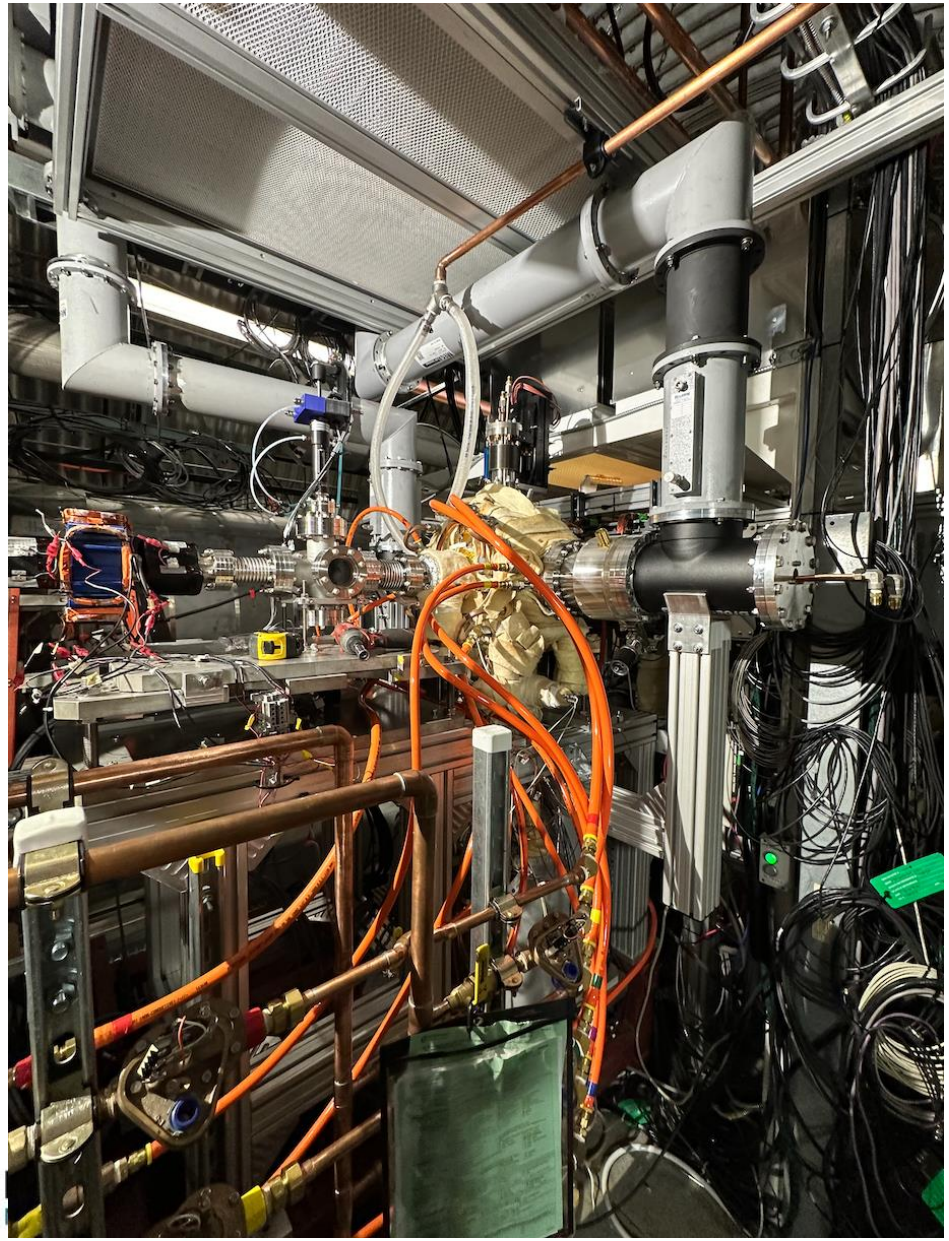


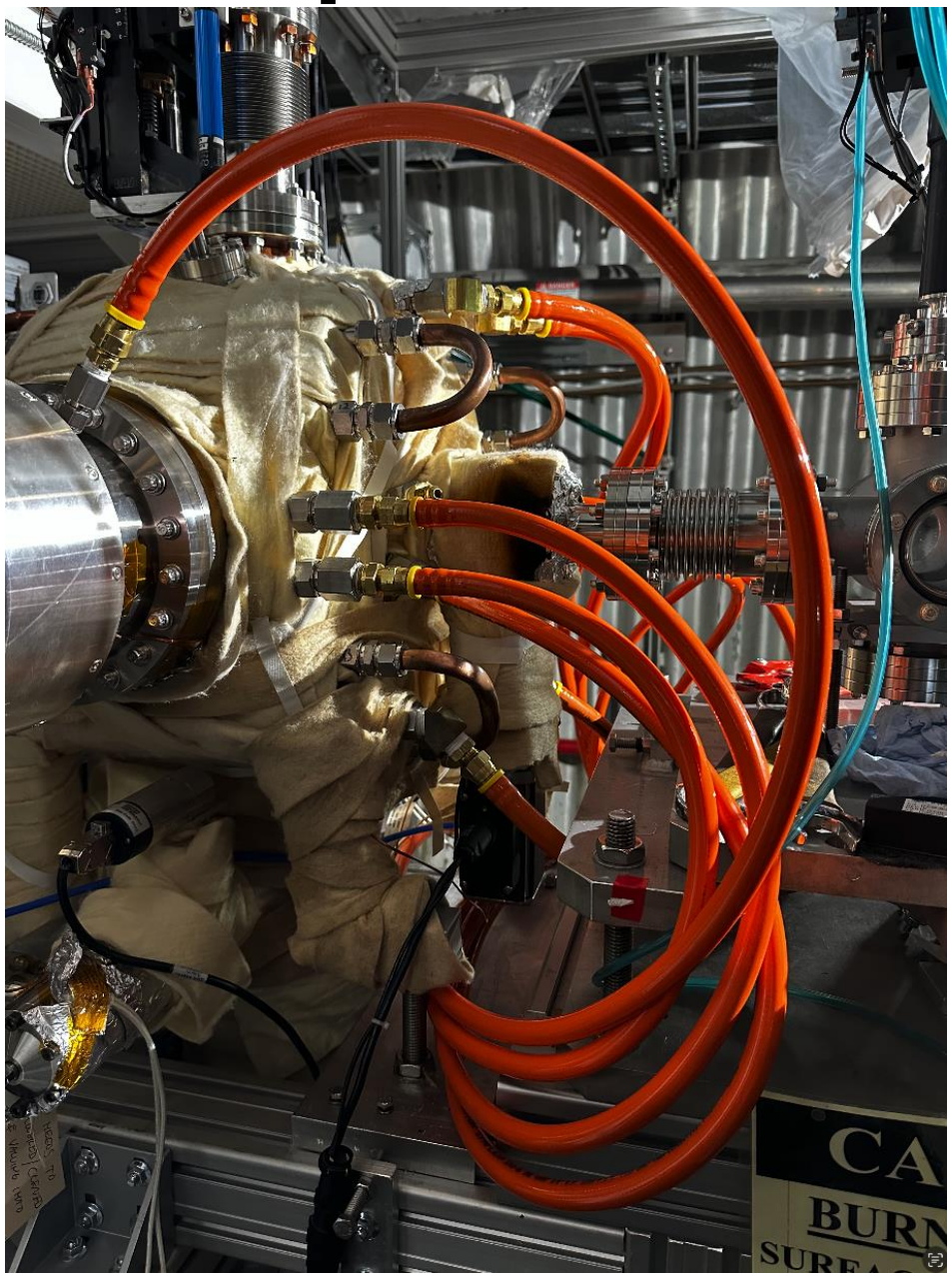
500MHz – FPC 2 Repair



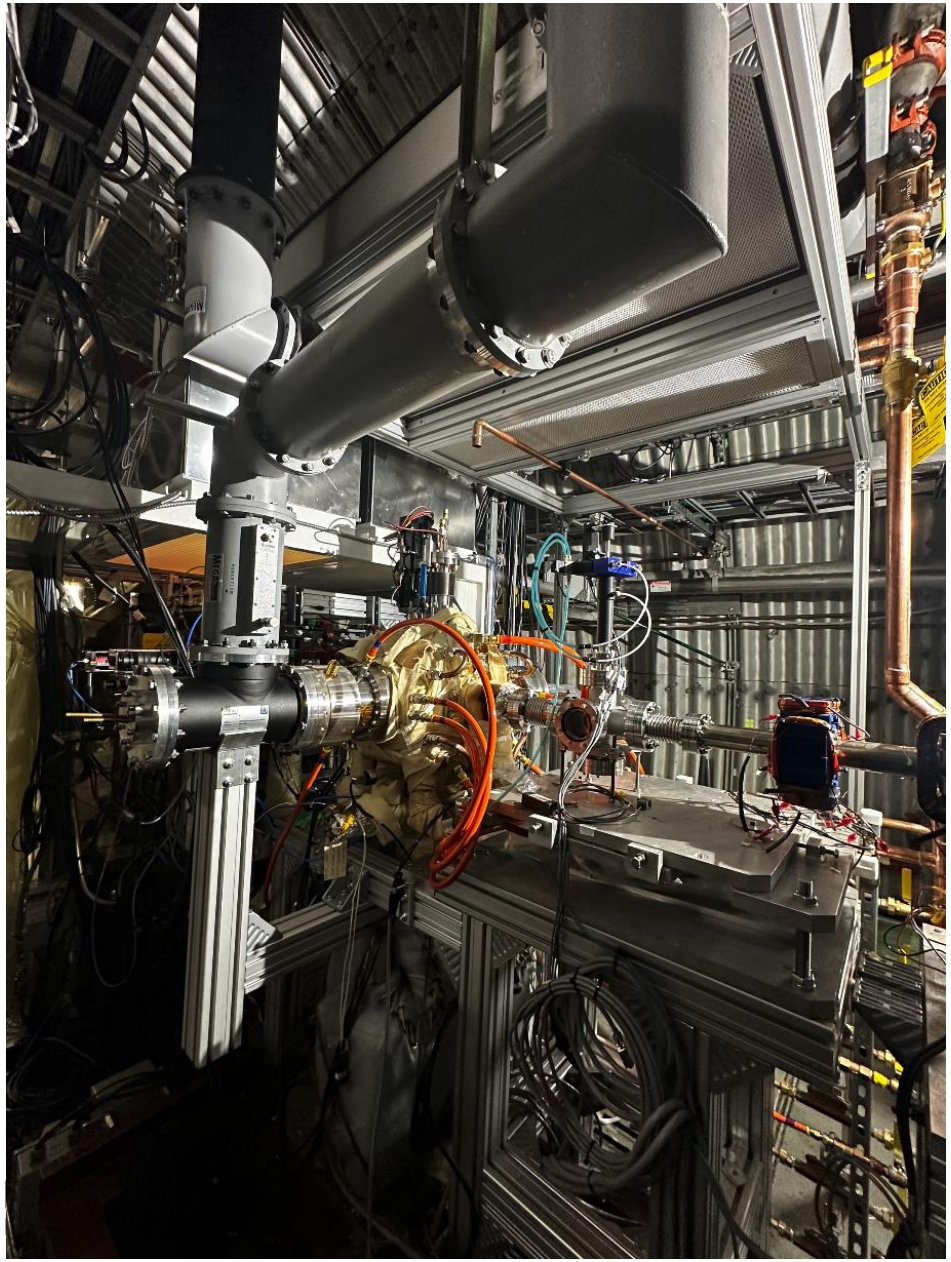


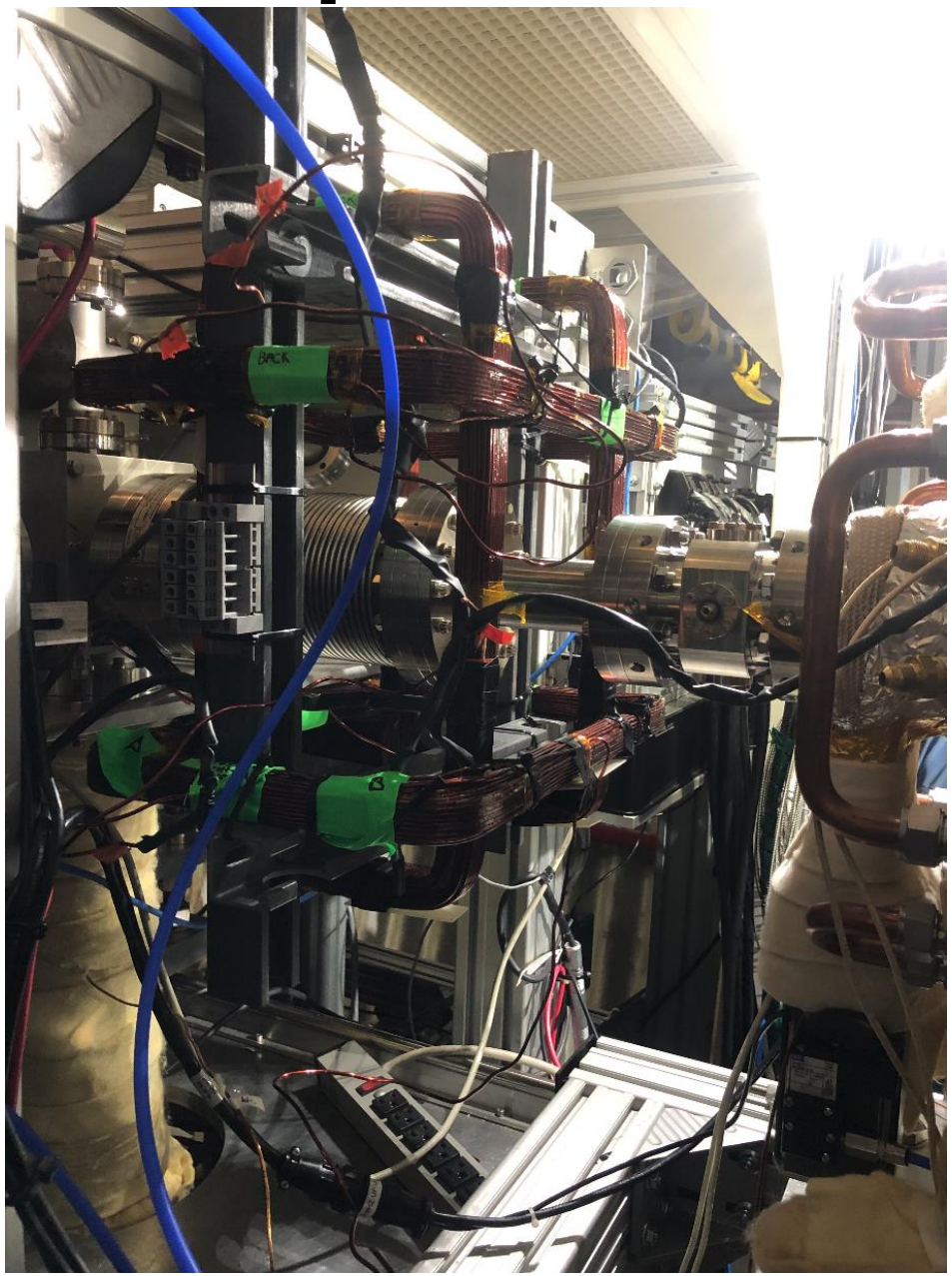
500MHz – FPC 2 Repair





500MHz – FPC 2 Repair





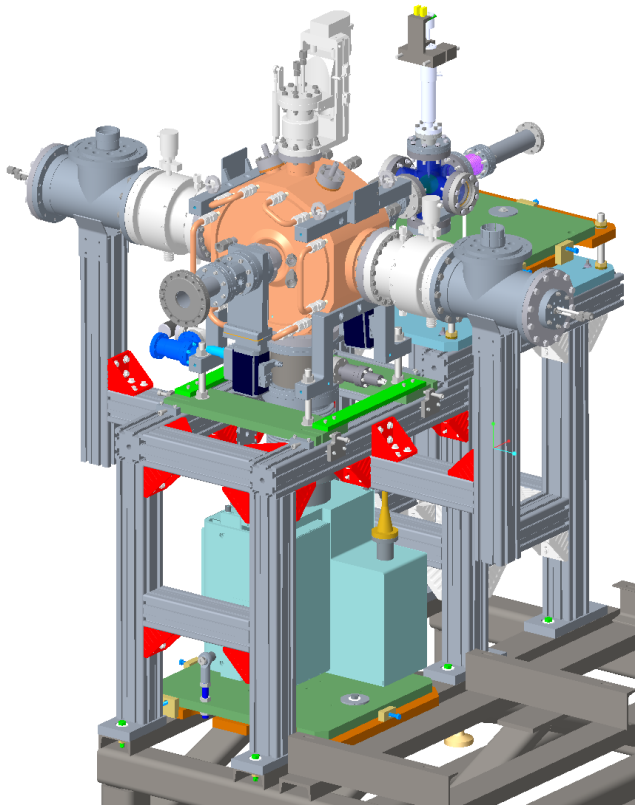
500MHz Cavity

Design and Tunnel Work prior to cavity arrival

- Design vacuum components
- Finalize beamline layout
- Order vacuum parts
- Design of coax layout
- Order coax needed
- Disconnect BPM
- Disconnect H/V Corrector
- Locate LEReC replacement BPM
- Transfer BPM to vacuum group for cleaning
- Remove H/V Corrector
- Disconnect and remove water manifold
- Submit drawings for mounting plates to shop
- Submit stand extension drawing to shop
- Lock/Out PA
- Disconnect and remove coax.
- Remove waveguide shorts
- Determine window requirement for dry-air (new line)?
- Determine flow requirements for flow switch
- Disconnect existing tuner (Find out connection/pin out for new tuner from RI)
- Prepare clean room
- Vent cavity and disconnect from beamline
- Blank and pump out vented sections
- Stand and support fabrication completed
- Remove cavity and ion pump
- Modify red base frame for new setup
- Modify ion pump base plate for new setup
- hybrid H test
- Reinstall hybrid H and coax connections as close as possible without interfering with installation
- Install new frame extension
- Reinstall ion pump on frame
- Reinstall clean room structure
- Run new dry air line from 1002 to tunnel 90% complete
- order all adapters from manifold to cavity systems

Cavity acceptance Work:

- Design and fabrication of clean room mobile stand Jan 15th-29th
- Cavity arrival Jan 29th -Feb 2nd
- Leak check of cavity and tuner Feb 5th-6th
- Survey group to pre-survey cavity Feb 7th-9th
- Tuner to Lenny D. for pre-wiring Feb 7th - Feb 9th
- Pressure test water line Feb 12th-16th
- **FPC 1 arrival at BNL March 18th**
- FPC 1 Leak check March 18th
- RF test with FPC 1 March 19th
- Cleaning of cavity and components March 19th - March 22nd
- pre-assemble cavity, tuner, pickup, valves and FPC 1 in clean room
- move cavity to tunnel and install on stand March 25th
- survey cavity on beam axis March 25th
- ~~Install FPC frame support extension Mach 18th~~
- Setup clean room March 25th – March 30th
- Connect to beamline, gauges, right angle valve and ion pump April 1st – April 5th
- **FPC 2 arrival at BNL, leak check, installation and RF test April 8th**
- pump out upstream and downstream beamlines and leak check April 5th– 7th
- Water Manifold pre-fit and valve installation April 8th
- Bakeout preparation and start bake out April 8th – 17th
- end bake out – April 18th
- Remove bake out equip & Install ¼ wavestub # 1 - April 18th
- reinstall H/V Corrector - April 19th
- Rewire H/V Corrector – April 19th
- Continue connect water to cavity – Maintenance Day 2 – April 29th
- FPC 2 Repair – Maintenance Day 2 – April 29th
- Coax installation – Maintenance Day 2 – April 29th
- Turn on water and check flow switches – Maintenance Day 3 – May 14th
- Connect and test tuner – Maintenance Day 3 – May 14th
- Arc detector and heliax cable connection, glue RTDs - Maintenance Day 3 May 14th
- Connect BPM, ICT, flow switches and connect RTDs Maintenance Day 3 May 14th
- Connect BPM, ICT, flow switches and connect RTDs Maintenance Day 4 – May 22nd
- AESRC Walkthrough Maintenance Day 5 – June 4th



April:

Sun	Mon	Tues	Weds	Thurs	Fri	Sat
21	22	23 0001 Yellow	24	25	26	27
28	29 Short Maintenance	30				

May:

Sun	Mon	Tues	Weds	Thurs	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14 Maintenance	15	16	17	18
19	20	21	22 Short Maintenance	23	24 Physics?	25
26	27	28	29	30	31	

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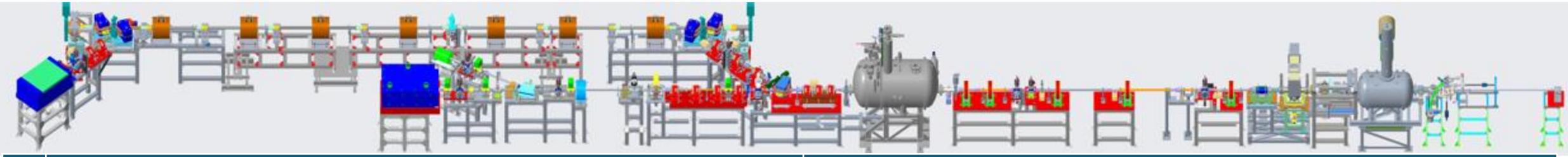
Summer 2023 Shutdown



#	Work	Note
1	Stabilize laser pulses (RMS below 1%)	Patrick I. – *waiting on quote for new board to fix pule shape. RMS 1.3% is the best at the moment.*
2	Bake-out of the HP dump in diagnostics beamline	Cliff - Instrumentation, vacuum water, RF and mechanical group
3	Add 3 additional PS for Solenoids 5,6 and 7 in. the CeC section – it will improve our abilities to check alignment of CeC solenoids	Anthony D. tunned all PS and able to control all of them thru Pet page.
4	Procedures	Cliff
5	Polarimeter	Cliff - Instrumentation, mechanical group
6	500 MHz Symmetric Cavity	Cliff - Next summer shutdown 2023 – PO pinned/ SOW and Specs approved
7	Low Power Dump Current monitor	Matt designed an amplifier circuit to connect directly to the new Faraday Cup to amplify and buffer the signals. There will be a fast output showing the pulses and a slower output showing the average current of a bunch train.
8	New Inspection Mirror	*Cliff / Lenny D. - Connected to MPS/ Add camera/ change ring light LDR2-50IR2-940*
9	Shunt resistor	*To measure high current – Igor and Vlad need to give clear direction*
10	Adjust laser power in individual beamlets to required levels at the gun laser table. Demonstrate that beam powers in all beamlets is proportionally controlled by main laser power control	*Patrick I.*
11	Optimize aperture for the laser beam transport from the gun table the cathode.	*Patrick I.*
12	Profile monitor gc2-amp.yag elimination does not work properly	Lenny D.
13	Iris at camera at the beam-dump YAG does not work	Lenny D.
14	Illumination of the SRF gun cathode should be fixed	Lenny D. - there is a huge bright “blobs” of reflected light from surrounding environment which obstruct observation for the cathode
15	BPM2 in LEBT has large offset	suspected feedthrough is fine and possible reason is poorly tightened connector
16	Consider options – and implement if possible - for improving vacuum in the laser cross, including possibility of cleaning it up during 500 MH z cavity installation	*Cliff & Vacuum Group*
17	Consider options – and implement if possible – for improving vacuum in the diagnostics beamline	*No change*
18	Laser Trailer AC Repair	*Completed*

Procedures

Active Procedures

Procedure No.	Title	Revision #	Status
22.2	OPERATIONS ORGANIZATION AND ADMINISTRATION		Section_Header
22.2.1	~~CeC PoP Experiment Operations Organization and Administration~~	1	Active
22.5	CeC PoP OPERATIONS		Section_Header
22.5.4	~~CeC PoP Operating Sequence~~	2	Active
22.5.5	~~Procedure for Configuration Control of CeC PoP Critical Magnets~~	2	Active
22.5.5.a	~~CeC PoP Magnetic Configuration Checklist~~	4	Active
22.8	SUBSYSTEMS: RF AND SRF, VACUUM, WATER, LASER & CONTROLS		Section_Header
22.8.1	RF		Section_Header
22.8.4	LASER		Section_Header
22.8.5	CONTROLS		Section_Header

Procedure No.	Title	Revision #	Status
24.2	OPERATIONS ORGANIZATION AND ADMINISTRATION		Section_Header
24.5	LEReC OPERATIONS		Section_Header
24.8	SUBSYSTEMS: DC GUN, RF AND SRF, VACUUM, WATER, LASER & CONTROLS		Section_Header
24.8.1	GUN		Section_Header
24.8.1.5	LEReC DC Multiplier Test Chamber SF6 Handling: Evacuating Air or Nitrogen Gas, Filling SF6 Gas, Suctioning SF6 and Storing SF6 Gas	0	Active
24.8.1.6	LEReC DC Gun Multiplier Test Chamber SF6 Pump Out Log Sheet	0	Active
24.8.1.7	LEReC DC Gun HV Conditioning	0	Active
24.8.2	VACUUM		Section_Header
24.8.4	LASER		Section_Header
24.8.4.7	Procedure for Access to 2zI During High Power Laser Alignment	2	Active
24.8.5	CONTROLS		Section_Header
24.8.6	RF		Section_Header
24.8.7	INSTRUMENTATION		Section_Header
24.8.7.1	Safe Work Practices for Diagnosing LEReC Faraday Cup Relay Chassis Problems	0	Active

Inactive Procedures

22.5.2	~~CeC PoP Low-Power Testing Sequence~~	cancel
22.5.3	~~CeC PoP Commissioning Sequence~~	cancel
22.8.1.2	~~Turning on the 112 MHz RF Amplifier~~	cancel
22.8.1.3	~~Turning on the 704MHz RF Amplifier~~	cancel
22.8.4.1	~~CeC PoP Laser System Operation~~	cancel
22.8.5.1	CeC PoP Machine Protection System (MPS) Test Procedure	w/ CAD procedures
23.2.1	Laser SOP OPPIS B930 (BNL# C-A-930-1)	
23.2.5	Polarized Helium 3 Laser System (BNL# C-A-930-5)	
23.2.7	LPM Laser Lab (BNL# C-A-930-7)	
23.4.1	Continuum Surelite II-10 Laser SOP (BNL# C-A-1008-1)	
23.6.1	~~Laser Profile Monitor for BLIP Beam Line (LPM) (BNL #CA-931-1)~~	
23.7.2	Building 1002, Power on Fiber, e-gun	w/ CAD procedures
23.7.3	~~Laser Alignments in the Coherent Electron Cooling Ring Location~~	cancel
23.8.2	Power on Fiber, e-gun @ SBU	
24.5.1	LEReC Magnetic Configuration Procedure	
24.5.1.a	LEReC Magnetic Configuration Checklist	
24.5.2	~~LEReC DC Gun Beam Testing Sequence~~	cancel
24.8.1.1	LEReC DC Gun SF6 Pressure Chamber Gas Handling: Evacuating Air or Nitrogen Gas, Filling SF6 Gas, Suctioning SF6 Gas and Storing SF6 Gas CJ	w/ CAD procedures
24.8.1.1.a	LEreC DC Gun Pressure Chamber Pumpout Log Sheet CJ	w/ CAD procedures
24.8.1.2	Extraction and Insertion Procedures for the LEReC DC Gun Molybdenum Puck with a Grown Bi-Alkali (K_2NaSb) Cathode	w/ CAD procedures
24.8.1.3	Turn On/Turn Off Instructions for LEReC DC Gun	
24.8.4.1	~~LEReC Laser System Operation~~	cancel
24.8.4.5	Building 1002F Laser Interlock System	w/ CAD procedures
24.8.4.6	~~LEReC and CeC IR2 Laser Enclosure Integrity Assurance~~	
24.8.5.2	~~MPS Configuration Management Procedure~~	
24.8.6.3	~~Booster SRF Amplifier Turn-On/Turn-Off Sequence~~	cancel
24.8.6.4	~~2.1 GHz RF Amplifier Turn-On/Turn-Off Sequence~~	cancel
24.8.6.5	~~9 MHz RF Amplifier Turn-On/Turn-Off Sequence~~	cancel
24.8.6.6	~~704 Warm MHz RF Amplifier Turn-On/Turn-Off Sequence~~	cancel
24.8.6.7	~~RF and electrostatic device RS LOTO Procedure~~	

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Procedures

Chapter	Procedure Num.	Revisio	Revision Date	Review Type	OPM Type	Title	Responsible Owner List	Current Status	Inactive/Cancelled Date	PPA?	NEW STATUS	PRIORITY	NEEDED AFTER RHIC	INITIAL REVIEW COMPLETED	
22	22.2.1	1	2/26/2019	5 yr.	Administrative	CeC PoP Experiment Operations Organization and Administration	Jing, Yichao	Active		No	Cancel - Need as Reference		No	YES	
22	22.5.4	2	9/22/2022	3 yr.	Procedure	CeC PoP Operating Sequence	Pinayev, Igor	Active		No	Cancel - Need as Reference		No	YES	
22	22.5.5	2	10/20/2022	3 yr.	Procedure	Procedure for Configuration Control of CeC PoP Critical Magnets	Pinayev, Igor	Active		No	Cancel - Need as Reference		No	YES	
22	22.5.5.a	4	11/22/2022	5 yr.	Checklist/Form	CeC PoP Magnetic Configuration Checklist	Pinayev, Igor	Active		No	Cancel - Need as Reference		No	YES	
22	22.8.5.1	1	6/14/2019	3 yr.	Procedure	CeC PoP Machine Protection System (MPS) Test Procedure	Bachek, Paul	Inactive	9/5/2023	No	Active	1	No	YES	
24	24.5.1	0	2/8/2017	3 yr.	Procedure	LEReC Magnetic Configuration Procedure	Hammons, Lee ; Kayran, Dmitry	Inactive	8/15/2023	No	Active		No		CANCELLED FOR CEC. DOES LEREC STILL NEED THIS?
24	24.5.1.a	1	1/19/2018	3 yr.	Procedure	LEReC Magnetic Configuration Checklist	Hammons, Lee ; Kayran, Dmitry	Inactive	8/15/2023	No	Active		No		CANCELLED FOR CEC. DOES LEREC STILL NEED THIS?
24	24.8.1.1	0	11/1/2016	3 yr.	Procedure	LEReC DC Gun SF6 Pressure Chamber Gas Handling: Evacuating Air or Nitrogen Gas, Filling SF6 Gas, Suctioning SF6 Gas and Storing SF6 Gas	Liaw, Chong-Jer	Inactive	8/15/2023	No	Active		No		
24	24.8.1.1.a	0	11/1/2016	5 yr.	Checklist/Form	LEreC DC Gun Pressure Chamber Pumpout Log Sheet	Liaw, Chong-Jer	Inactive	9/5/2023	No	Active		No		
24	24.8.1.2	1	9/19/2017	3 yr.	Procedure	Extraction and Insertion Procedures for the LEReC DC Gun Molybdenum Puck with a Grown Bi-Alkali (K2NaSb) Cathode	Liaw, Chong-Jer ; Wang, Erdong	Inactive	9/5/2023	No	Active		Yes		Authors should be Mengjia Gaowei & Robert D. Lehn. According to CJ it was recently updated by them. Requiered after RHIC. According the Erdong high current gun R&D will continue for EIC
24	24.8.1.5	0	1/14/2021	3 yr.	Procedure	LEReC DC Multiplier Test Chamber SF6 Handling: Evacuating Air or Nitrogen Gas, Filling SF6 Gas, Suctioning SF6 and Storing SF6 Gas	Liaw, Chong-Jer	InProgress		No	Active		No		should all DC gun procedures remain active for EIC R&D? if yes, we ned to talk to Ray regarding SAD for this test,
24	24.8.1.6	0	1/20/2021	3 yr.	Procedure	LEReC DC Gun Multiplier Test Chamber SF6 Pump Out Log Sheet	Liaw, Chong-Jer	InProgress		No	Cancel - Need as Reference		No		
24	24.8.1.7	0	11/29/2022	3 yr.	Procedure	LEReC DC Gun HV Conditioning	Gu, Xiaofeng ; Tustin, Gage	Active		Yes	Cancel - Need as Reference		No		
24	24.8.4.5	0	1/19/2018	3 yr.	Procedure	Building 1002F Laser Interlock System	Fliller, Raymond ; Inacker, Patrick	Inactive	9/5/2023	No	Cancel - Need as Reference		No		
24	24.8.4.7	2	12/9/2021	3 yr.	Procedure	Procedure for Access to 2zl During High Power Laser Alignment	Fliller, Raymond	Active		No	Cancel - Need as Reference		No		
24	24.8.7.1	0	5/16/2023	3 yr.	Procedure	Safe Work Practices for Diagnosing LEReC Faraday Cup Relay Chassis Problems	Tustin, Gage	Active		Yes	Cancel - Need as Reference		No		

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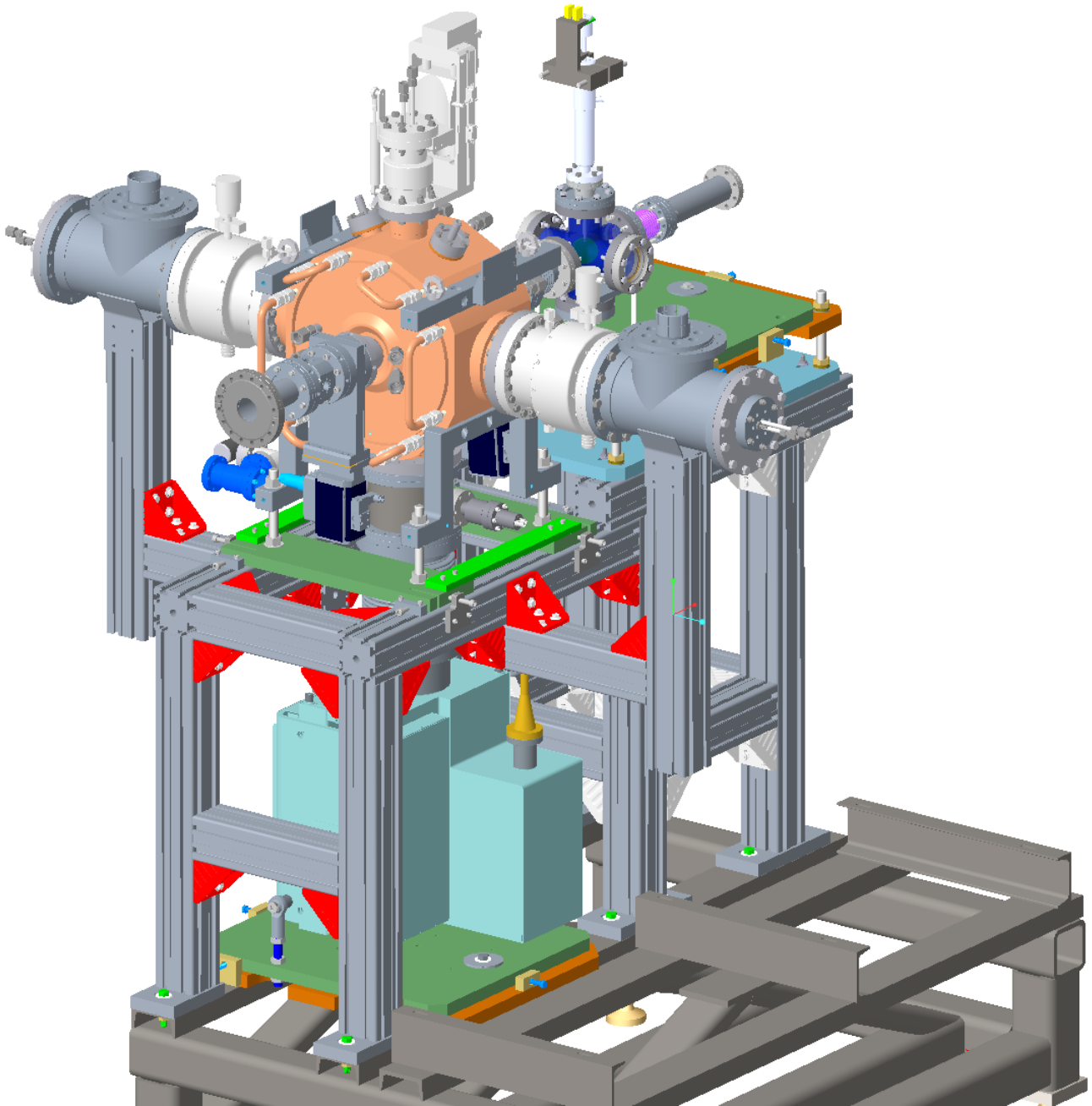
500MHz MPS

- FPC 1 Arc Detector: TTL [RF group]
- FPC 2 Arc Detector: TTL [RF group]

- Tuner RTD (Use RG58? cable from buncher that was removed) [Inst. Group]
- RF FPC 1 Window flow switch [Water group]
- RF FPC 2 Window flow switch [Water group]

- Cavity Left RTD (NO CHANGE) [Inst. Group]
- Cavity Right RTD (NO CHANGE [Inst. Group]
- PASS (NO CHANGE)
- RF Circ Arc Detector: TTL (NO CHANGE) [RF group]
- Vacuum Status (NO CHANGE) [Vacuum group]
- Water Status: (NO CHANGE) [Water group]



500MHz Cooling Requirement

Cooling Circuits	Description	Flow rate/ Circuit [GPM]
1	Coupler Port 1	2.1
2	Coupler Port 2	2.1
3	End disc 1	2.64
4	End disc 2	2.64
5	Nose Cone 1	1.05
6	Nose Cone 2	1.05
7	Tuner	0.8
8	FPC 1 Inner Conductor	.53
9	FPC 1 outer conductor	.53
10	FPC 2 Inner Conductor	.53
11	FPC 2 outer conductor	.53
12	Cavity half 1 (6 circuits reduced to 2)	5.55
13	Cavity half 2 (6 circuits reduced to 2)	5.55

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research instruments

3.3 Interfaces

The cavity interfaces are summarized in Table 3-2.

Table 3-2 Cavity Interfaces

Category	Name	Definition	Quantity
Electrical	RF input T-piece	EIA 6 1/8"	2
	Overpressure switch	Terminals	1
	PT100	4-Wire	1
	RF Probe	Type N	2
	Limit Switch Tuner	Terminals	2
Vacuum	Input Coupler Flange	DN160 CF	2
	Tuner Flange	DN63 CF	1
	Pickup Flange	DN40 CF	2
	Beam Tube Flange	DN63 CF	2
	Vacuum Pump Flange	DN160 CF	1
Water	Coupler Inner	SS-8M0-7-4	2 x 2
	Coupler Collar	SS-8M0-7-4	2 x 2
	Coupler Port	SS-16M0-7-8	2 x 2
	Tuner Head	SS-8M0-7-4	1 x 2
	Body	SS-16M0-7-8	12
	End Disc	SS-16M0-7-8	2 x 2
	Nose	SS-16M0-7-8	2 x 2
Air	Compressed Air inlet	Diameter 25mm Hose	1

All cooling channels and pipe work will be comprised out of stainless steel and copper only. On one side of the cavity every two channels are connected in series the body and U-turn tubes have 16mm outer diameter and are connected by twelve SS-16M0-6 fittings, that can be replaced easily by SS-16M0-7-8 in case needed.

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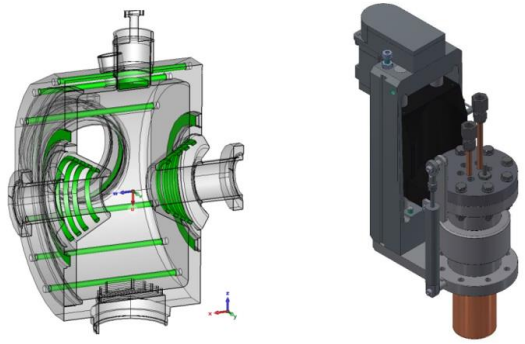

Figure 3-7 Frequency Tuner

Cooling Circuit	Heat transfer Coefficient / [W/(m² K)]	Flow rate per circuit [l/min]	GPM
Coupler Port (2 circuits)	5000	8	2.1
Enddisc (2 circuits)	5000	10	2.64
Nose (2 circuits)	5000	4	1.05
Plunger (1 circuit)	2000	3	0.8
Body (6 circuits)	6500	7	1.85
Total		**89**	

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Total: 23.5 GPM

Reply | Reply All | Forward

Tue 10/24/2023 10:57 AM

Kai did an "over the thumb" estimation of the air flow requirements. Since it was done analytically without a real 3D flow dynamic simulation we applied still some safety factor on the result. Out of the calculation comes that less than 10W are lost in the ceramics with 4kW input power. 3 to 5 m³/h are easily enough to provide cooling to the discs. Some flow should be applied so that the coupler can be monitored by the PT100 that is probing the out streaming air, if one would turn of the air flow completely this temperature interlock would be lost.

Can you provide this flow?

Best regards,
Björn

1.75 - 3 CFM

Figure 3-5 Power Coupler

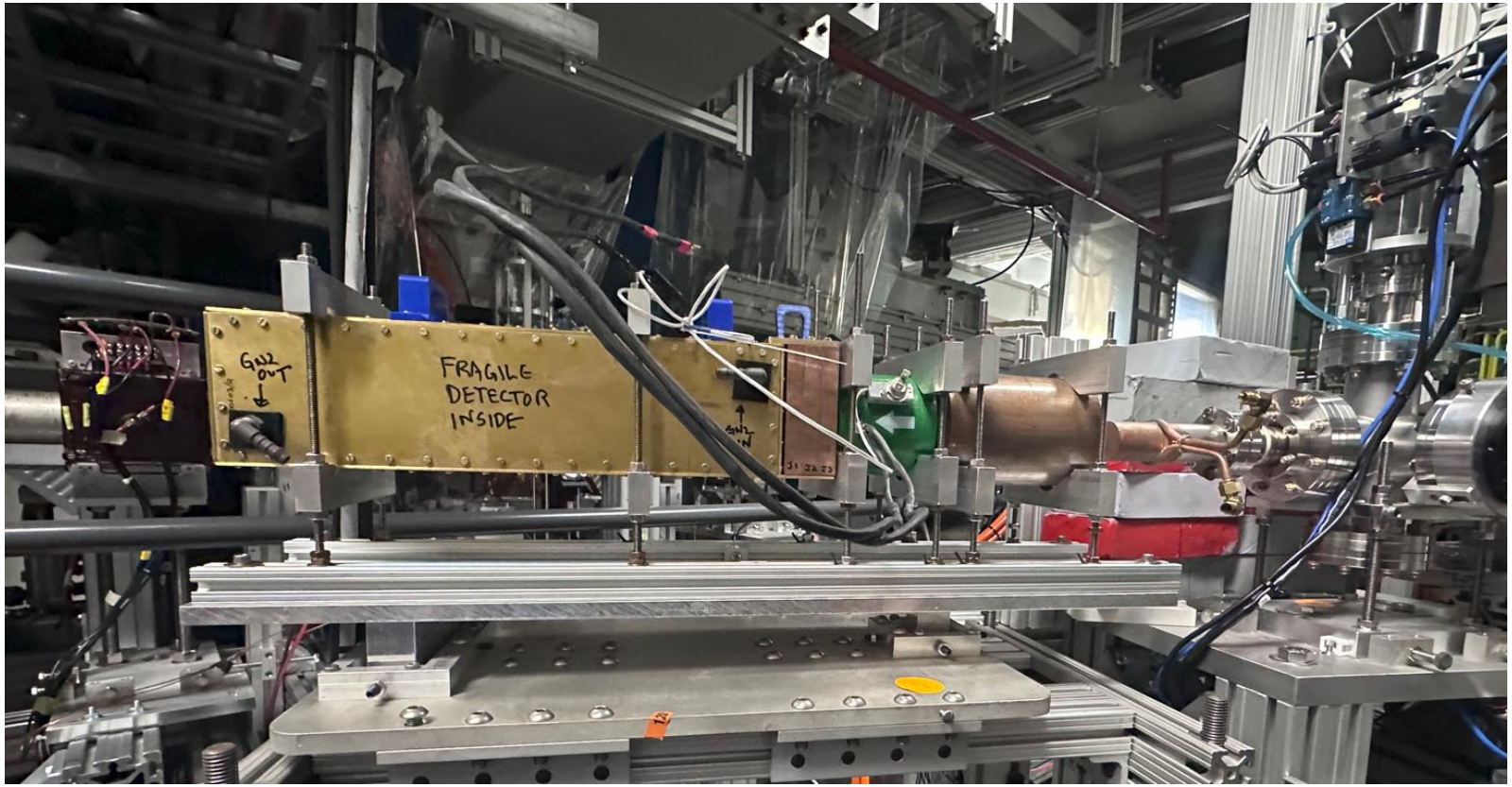
101.3 GPM
3.5 CFM

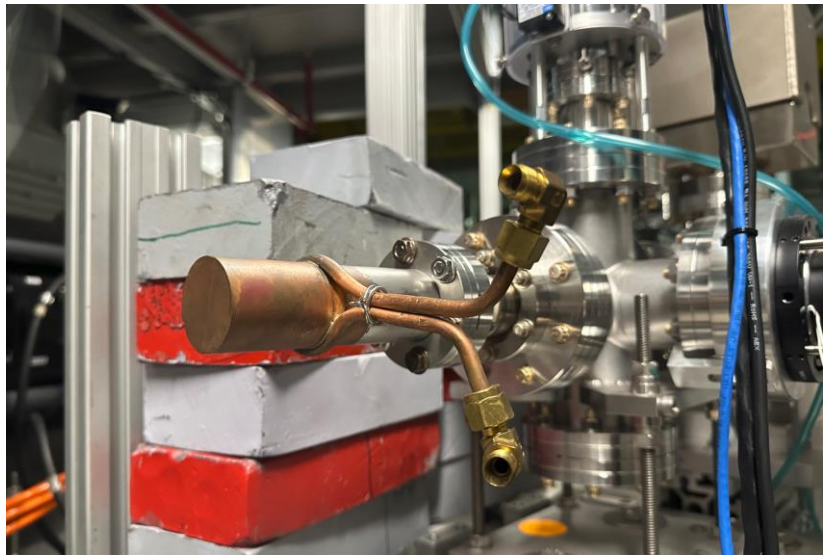
Outer Dimensions: 679 x 357 x 206mm
Weight:

The ceramic's atmosphere side is cooled by [illegible] l/hour are necessary to avoid too much temperature increase. The air flow through [illegible] overpressure in the coupler of above 10 mbar. The input air shall be dust free (filter [illegible] class filter) and the resulting overpressure [illegible] is monitored by an interlock switch [illegible] air temperature is measured by [illegible] 100 temperature probe.

The inner and outer conductors are water cooled (2 l/min @ P<120kW). The inlet tube is the shorter one that ends in front of the inner conductor cone (refer to Figure 3-5)

BNL/Jlab Compton Polarimeter





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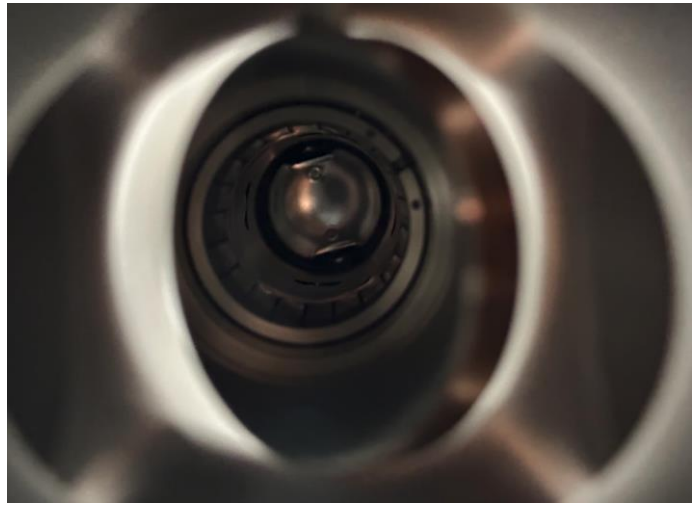
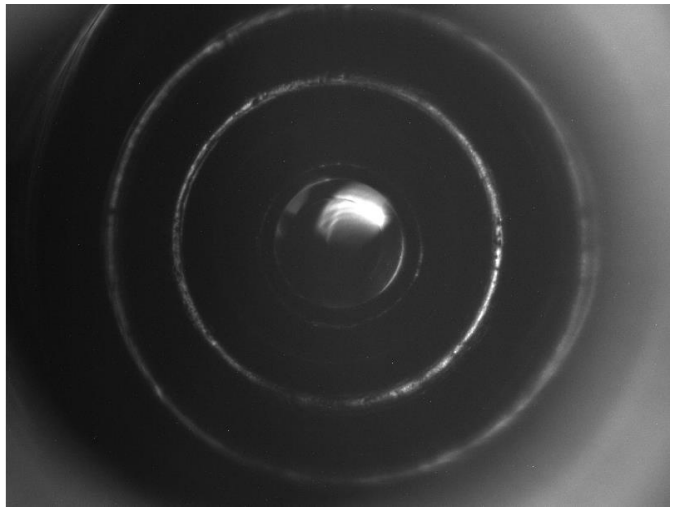
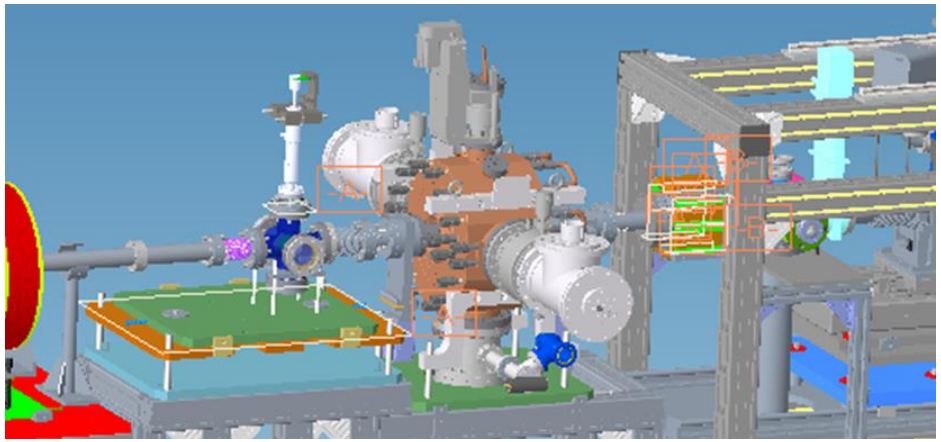
Inspection Camera

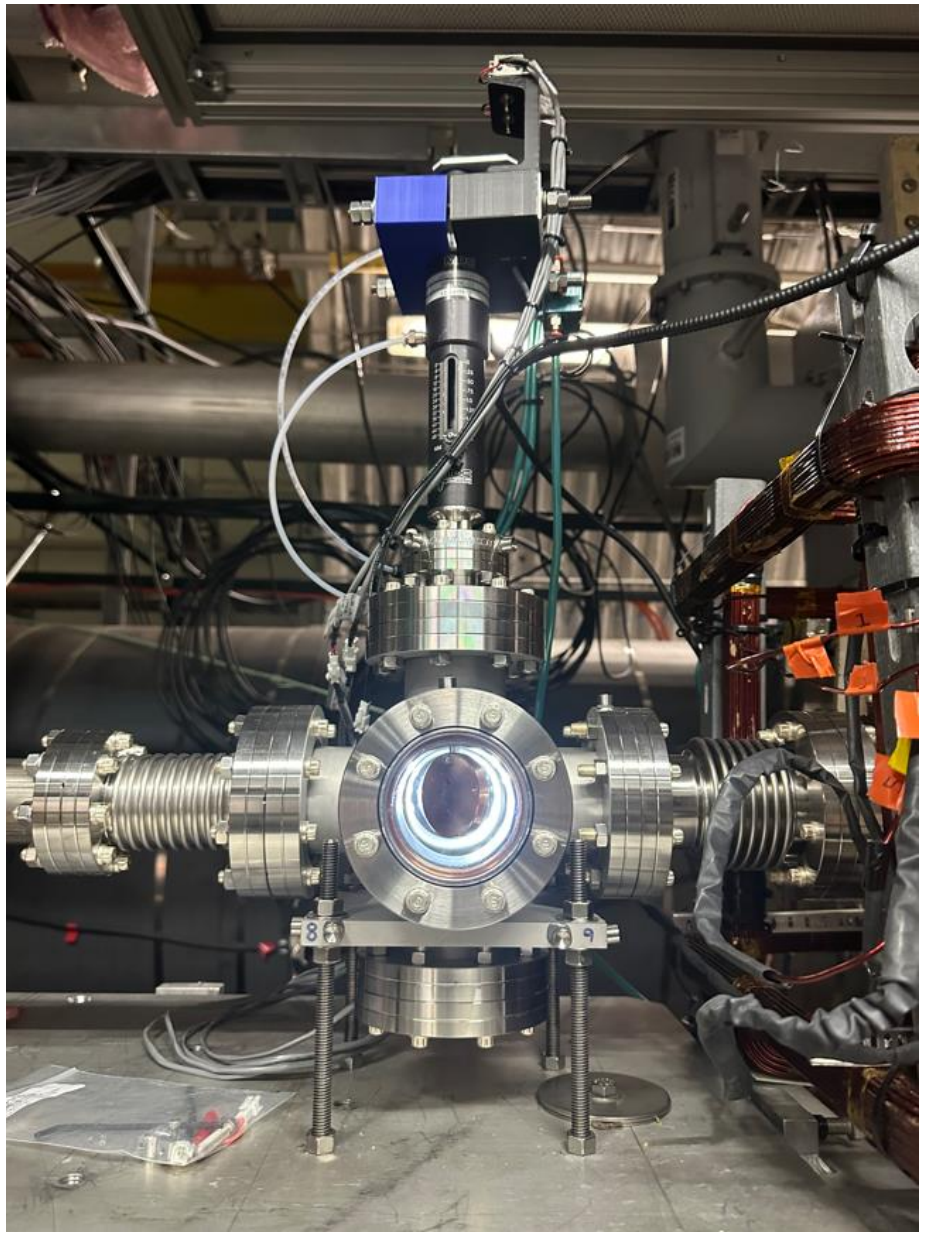
- Limit switches connected and added to MPS and checked.
- Successfully tested from Specialist Tool in PET
- Camera and 940nm illumination ring light connected
- PS and dimmer installed and final adjustment pending

RHIC/Systems/CeC/SpecialistTools/Instrumentation/SpecialistTools/2a-inst3/









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