

FRIB Nb_3Sn ECR ion source magnet: Schedule, Cost, and Progress monthly report

Tengming Shen for the Supercon team
Lawrence Berkeley National Laboratory
Feb 2025 report

2025/02/24

- FRIB: Yoonhyuck Choi, Junwei Guo, Xiaoji Du, Dalu Zhang, Ting Xu, Guillaume Machicoane, Tomofumi Maruta, Jie Wei
- LBNL: Tengming Shen, Ye Yang, Philip Mallon, Ray Hafalia, Lianrong Xi, Mariusz Juchno, Paolo Ferracin, Soren Prestemon

The Indico site where the meeting slides can be downloaded: <https://conferences.lbl.gov/event/2081/>

Access key: FRIB

Past meetings slides are available at <https://conferences.lbl.gov/category/109/>

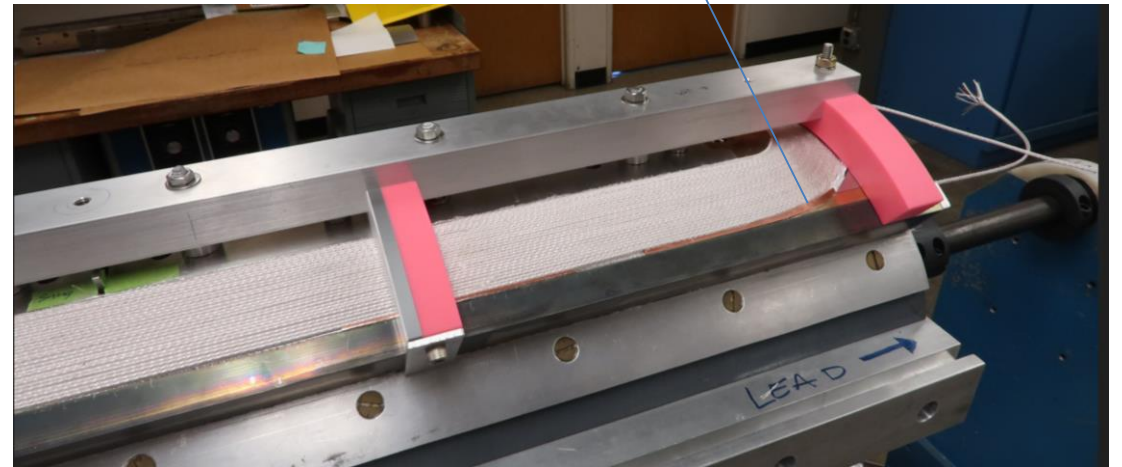
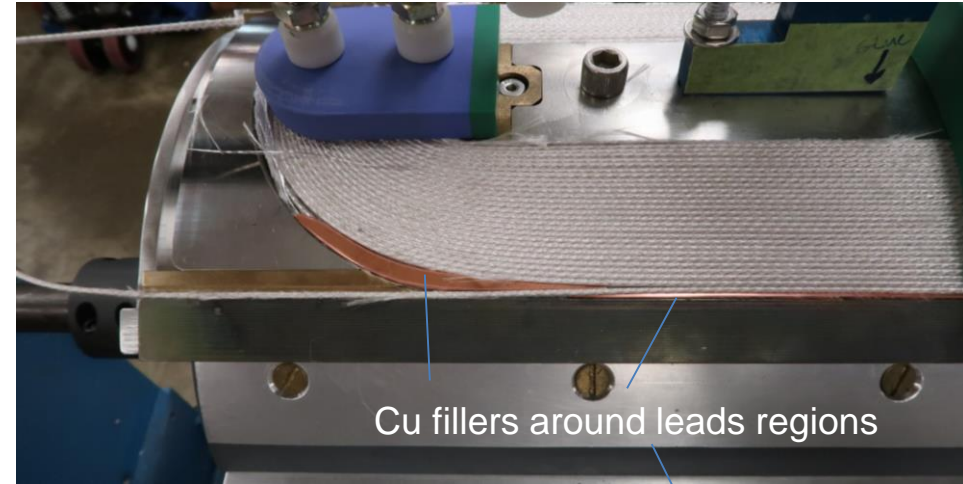
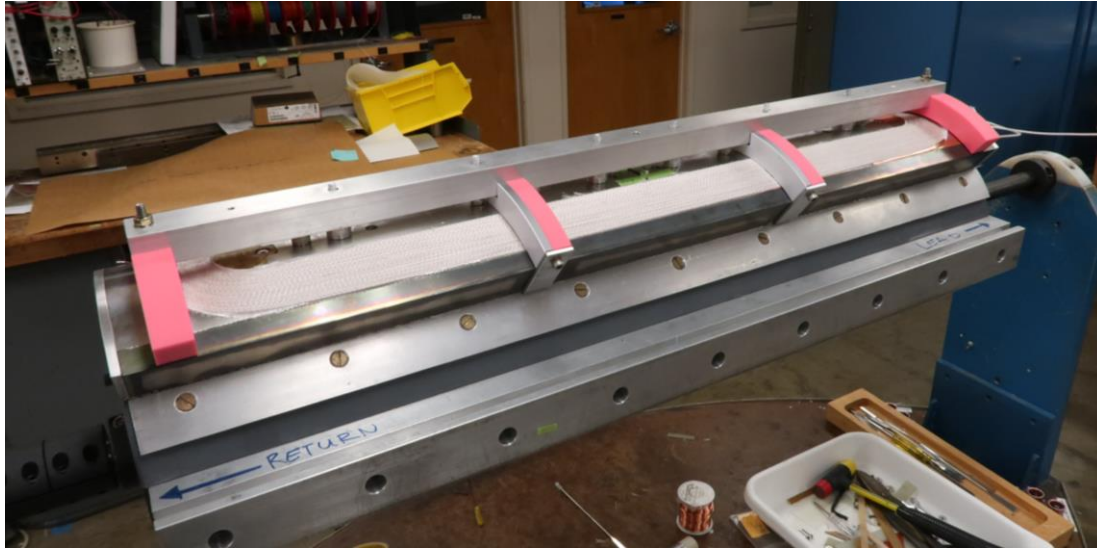


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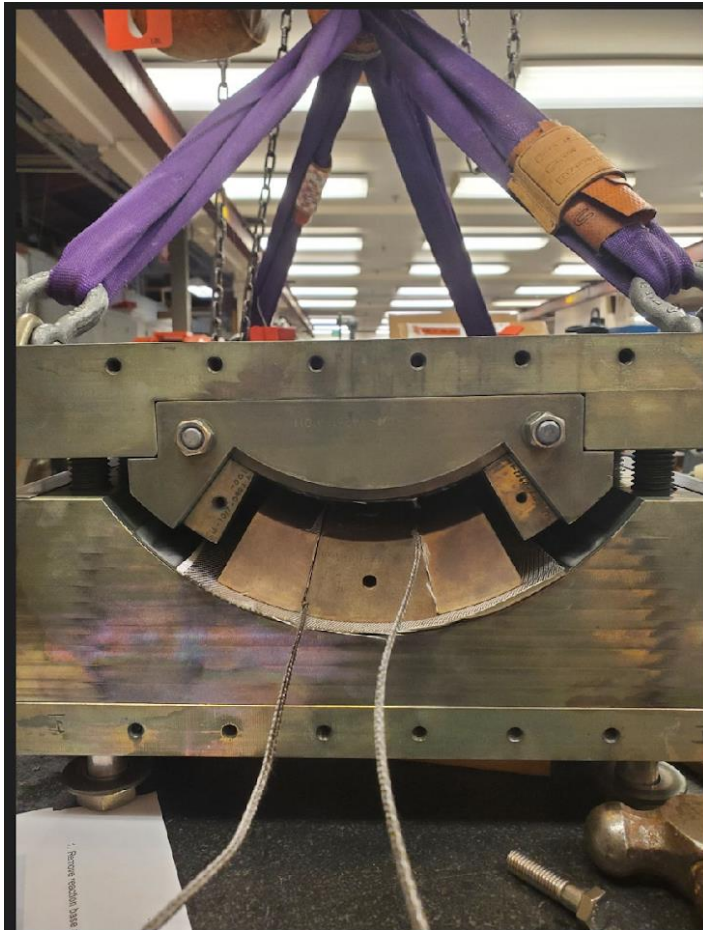
- **Complete preparation of prototype coil for heat treatment:**
- **Completed heat treatment of prototype coil – completed.**
- **Mirror magnet assembly component fabrication. Drawing released. All items received except the load pad, and the key and shim assemblies.**

Prototype coil winding completed on 11/21/2024.

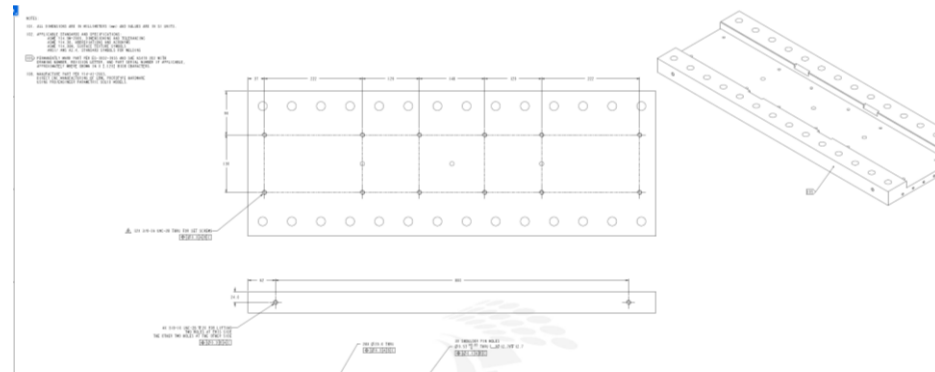




Apply lessons learned during the practice coil

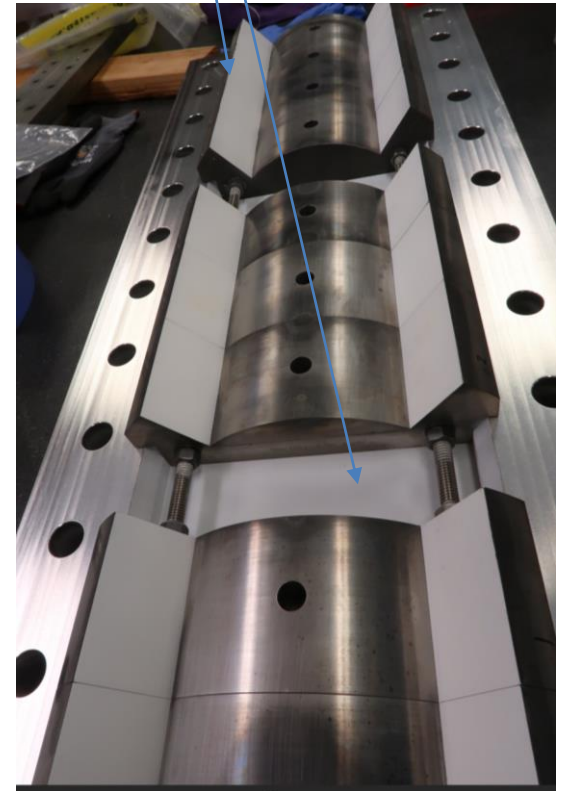


Reaction baseplate – add 12 setscrews holes.

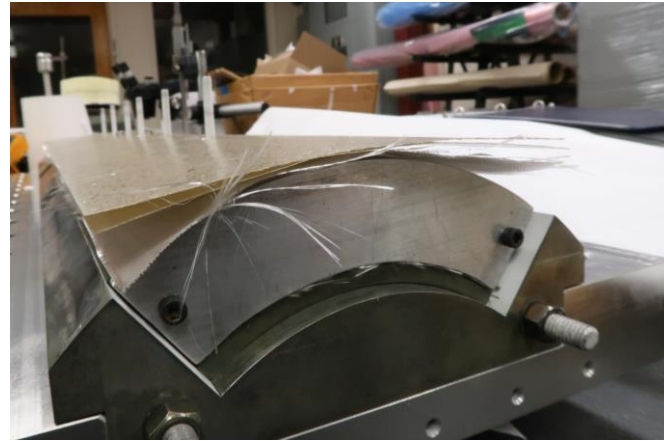
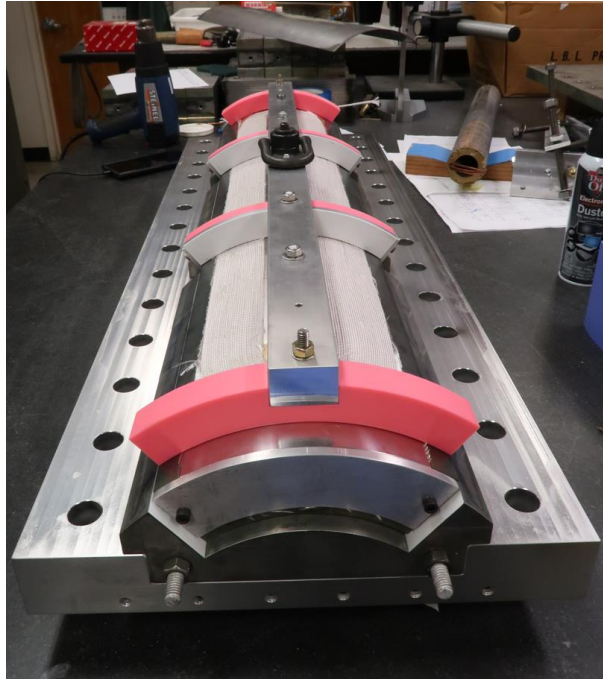


Reaction baseplate cavity width – enlarged by 0.010”.

Apply Boron Nitride



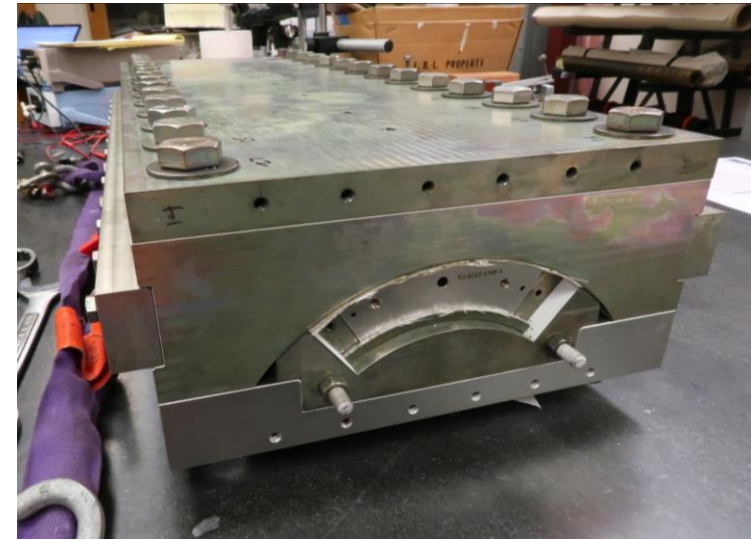
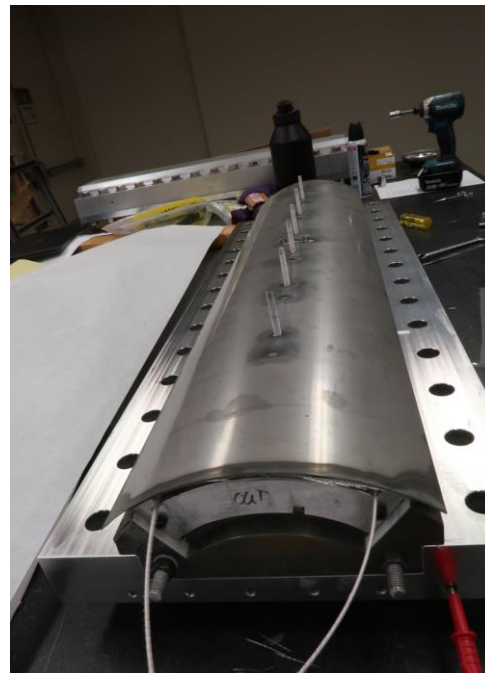
Preparation of prototype coil for heat treatment – leading into fixture and close the fixture



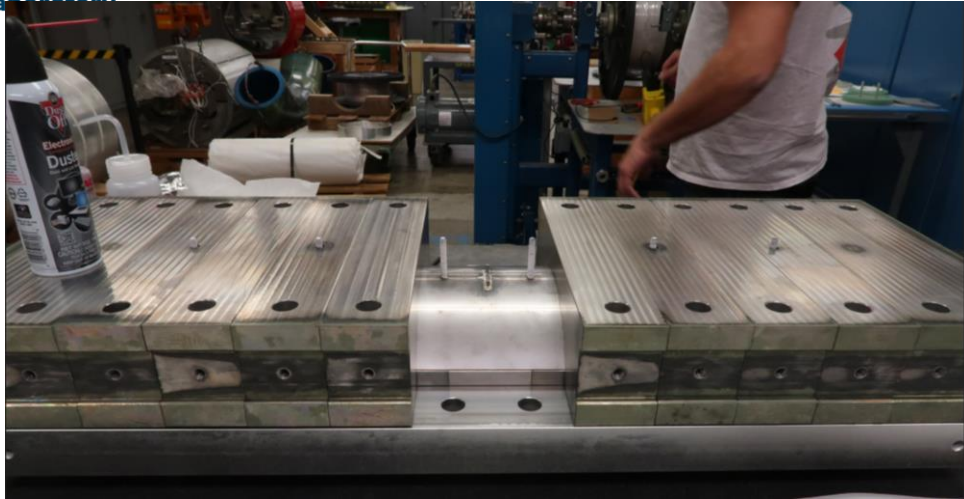
Fully closed.

Coil is electrically open to the fixture.

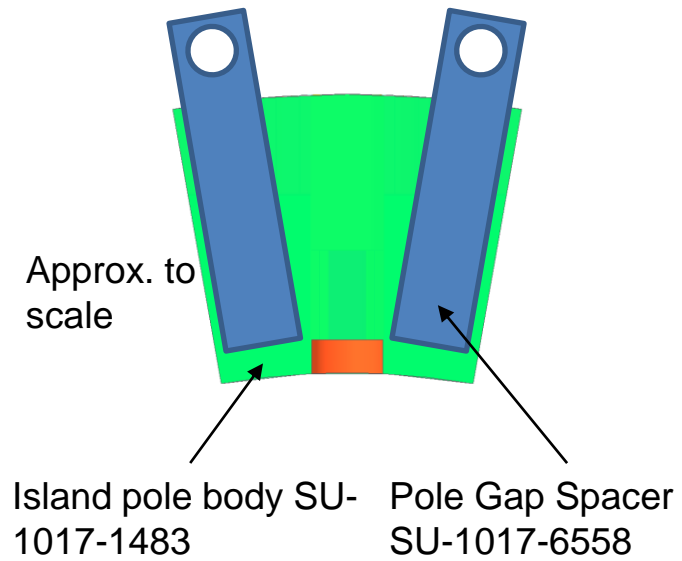
**Coil resistance unchanged before and after
closing the fixture.**

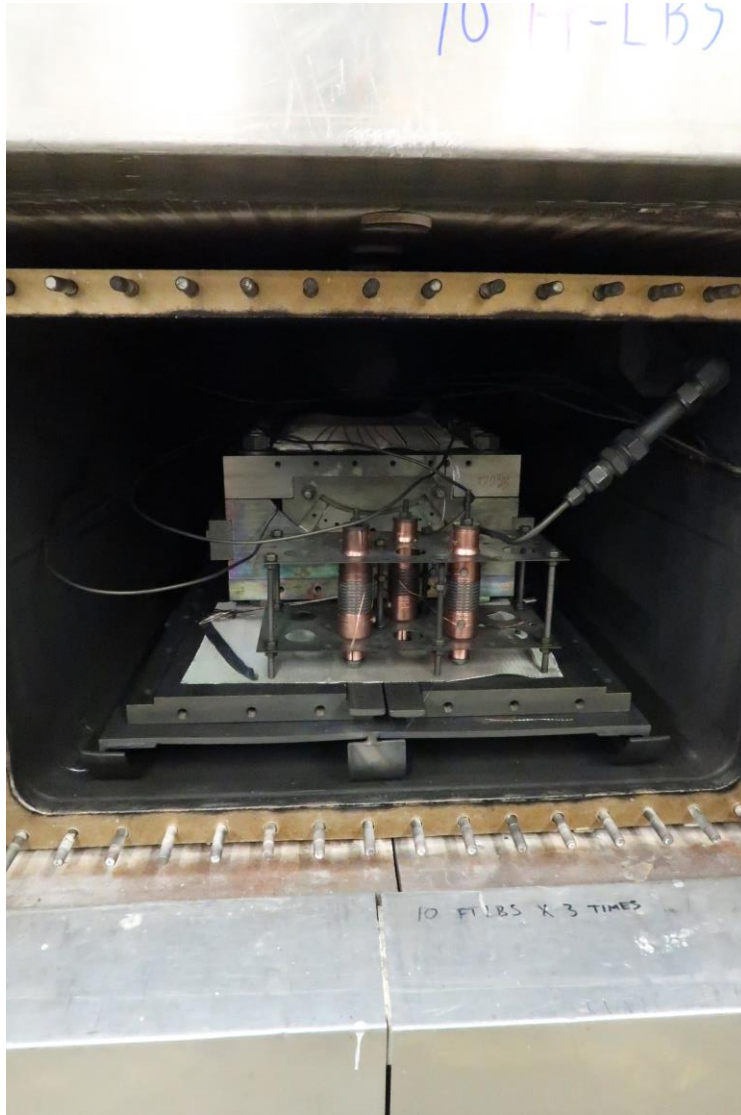


**A 0.002" gap between
Reaction liner and OD block.**

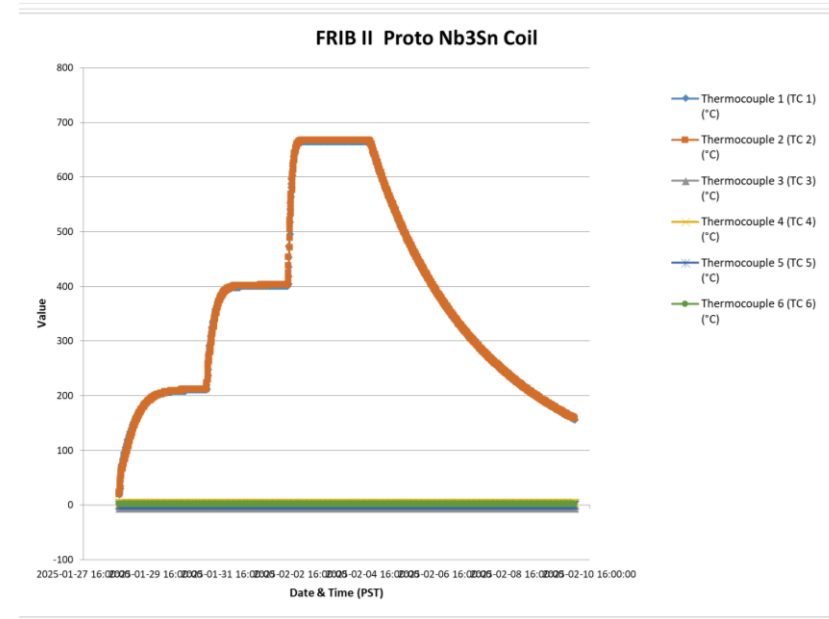


Difficult to remove the pole gap spacers.

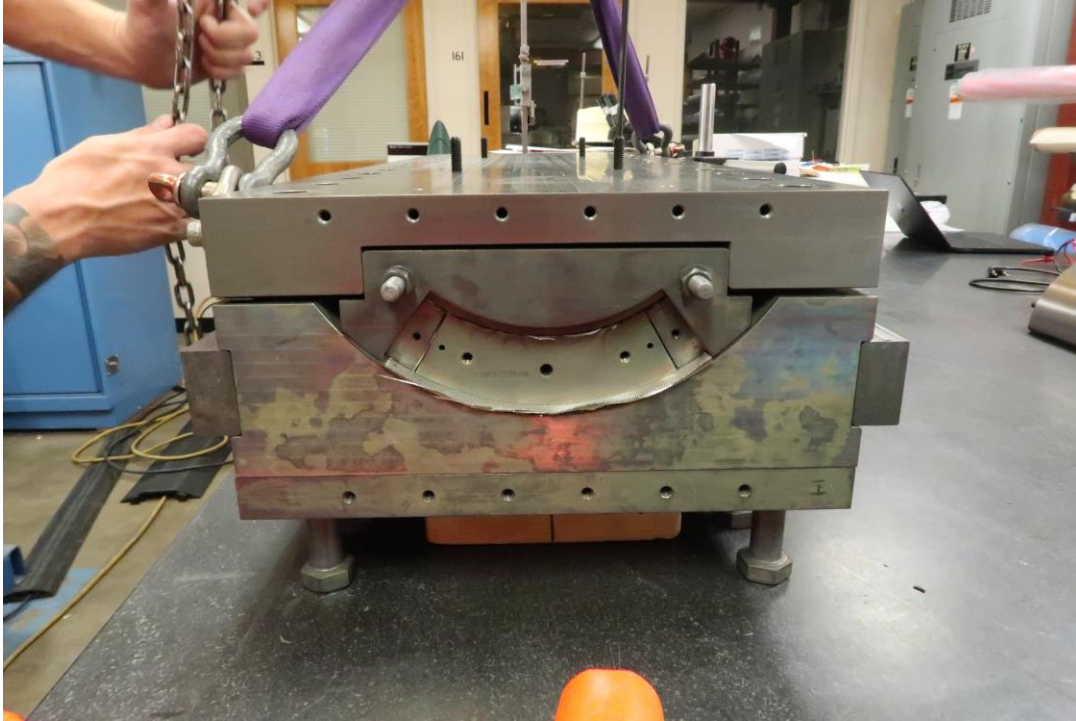




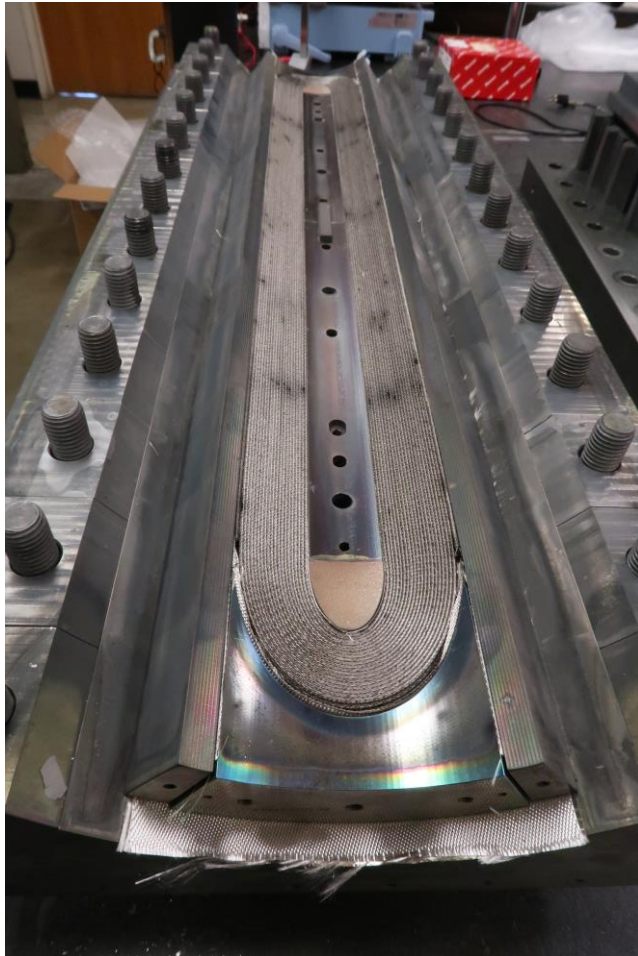
- Three barrel samples (round strands) for $I_c(B)$ measurements.
- Extracted strands for RRR measurements.



Removing baseplate was a smooth process with jackscrews and additional clearance.



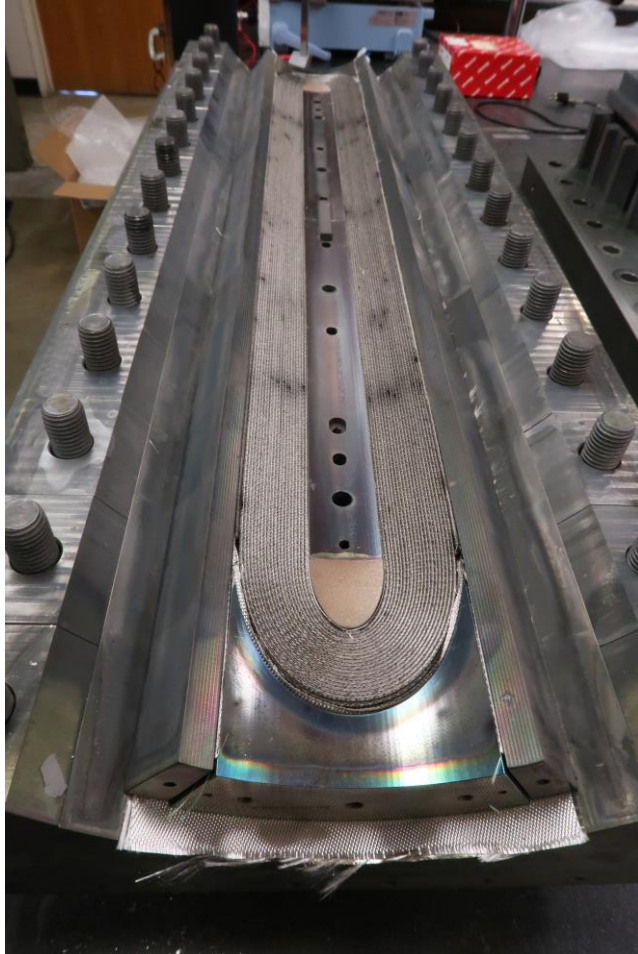
Observing the reacted prototype coil: Inner diameter wall and axial gap



Axial gap between two half poles reduced to 200 micron.

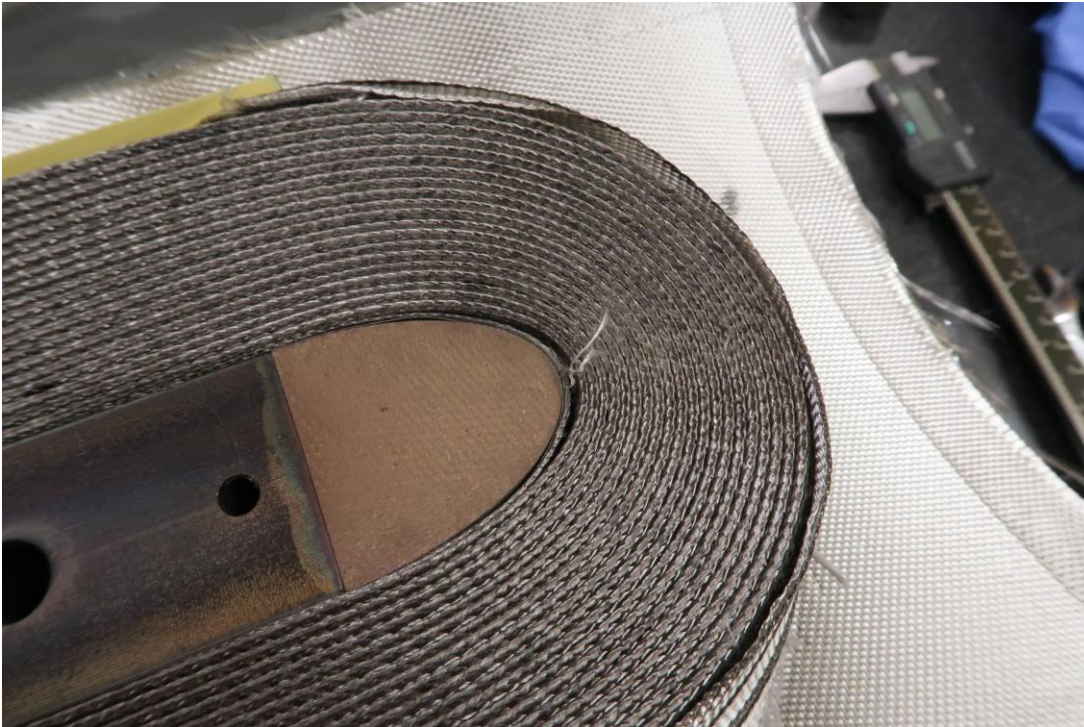


Observing the reacted prototype coil: Side wall

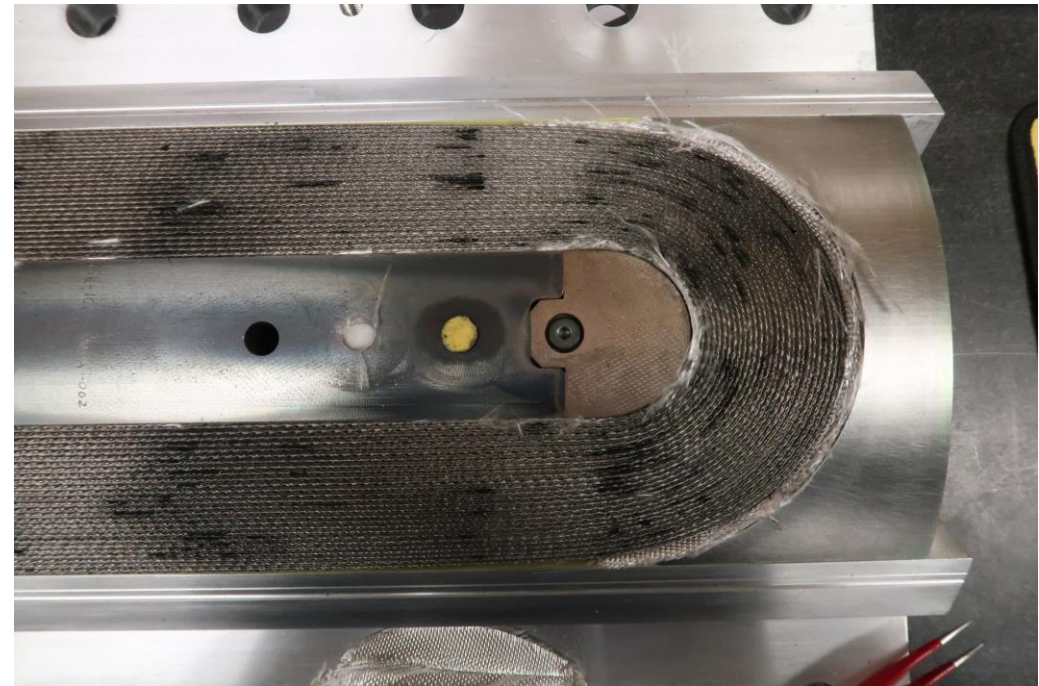


Gaps developed between coil and pole tips

Inner diameter side

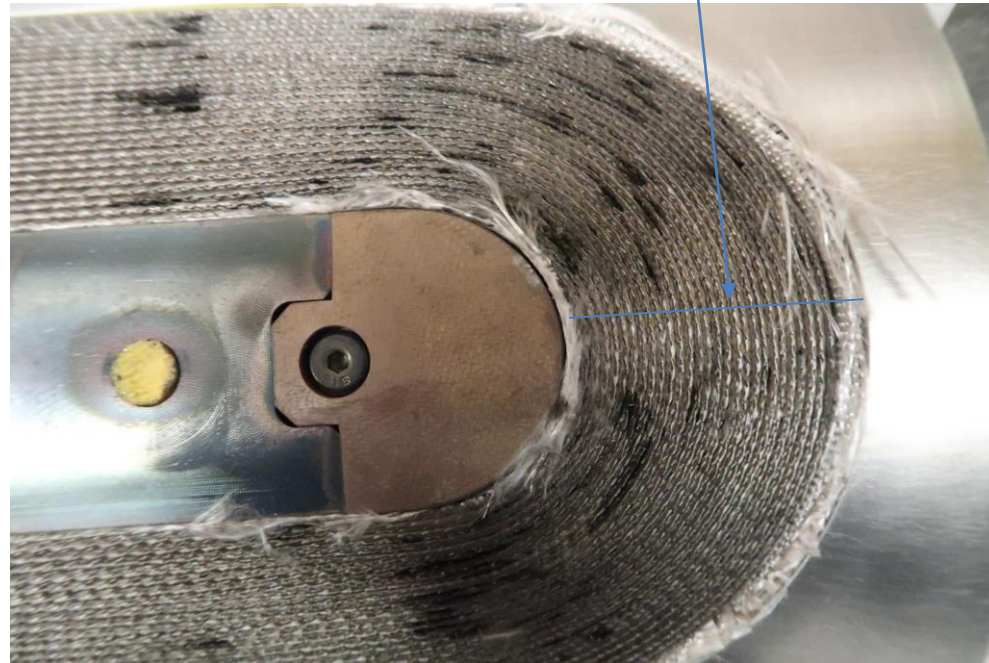


Outer diameter side





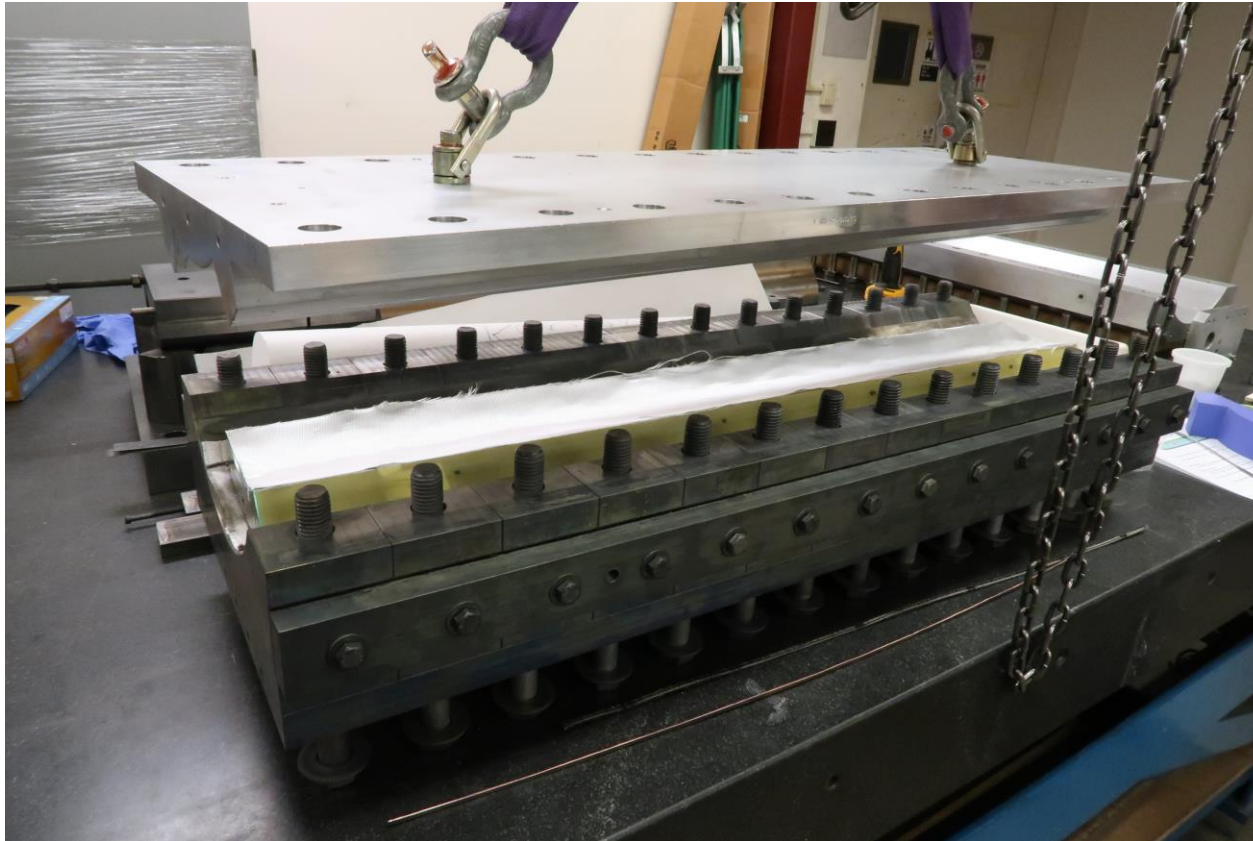
There is a slope here.



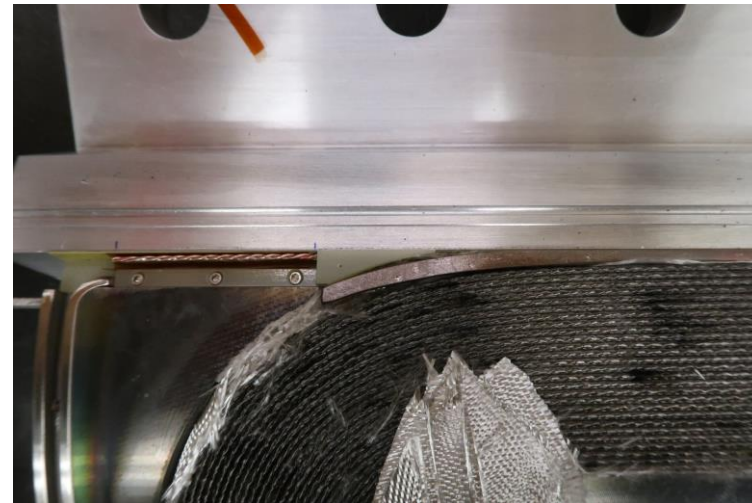
Preparing inner diameter side for impregnation



This step went well



Coil has been flipped and now being prepared for impregnation – at the critical step of splicing

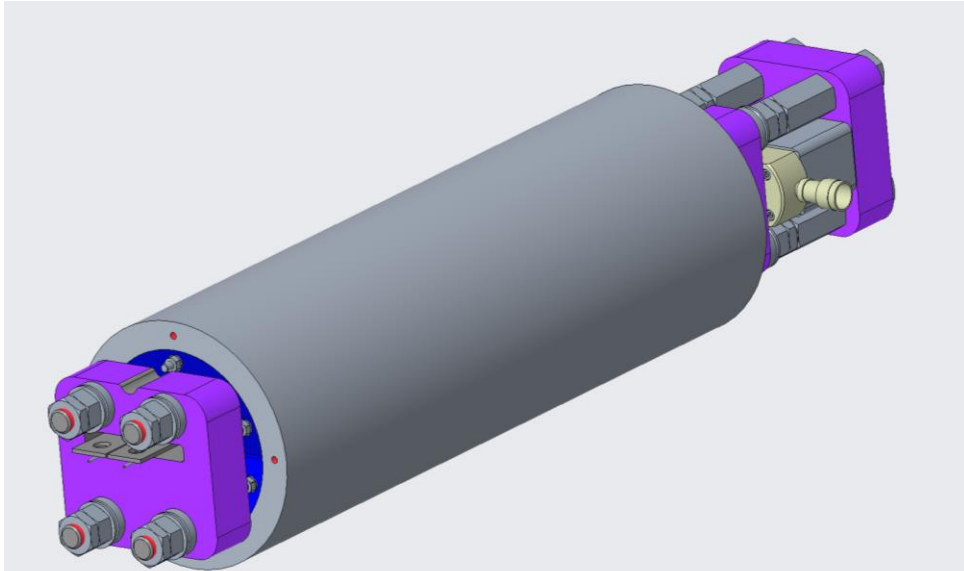


Coil electrical measurement after flipping

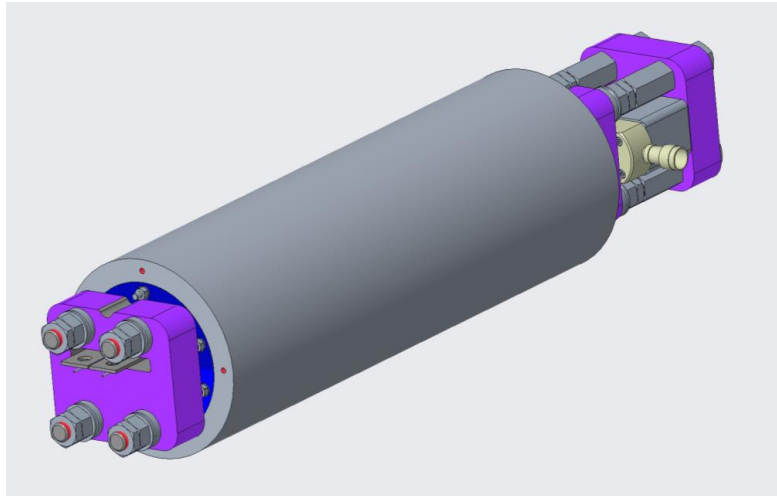
Coil resistance (ohm)	6.4
Coil to LE endshoe (k-ohm)	10
Coil to RE endshoe (k-ohm)	open
Coil to half pole island (LE) (M-ohm)	20
Coil to half pole island (RE) (M-ohm)	42

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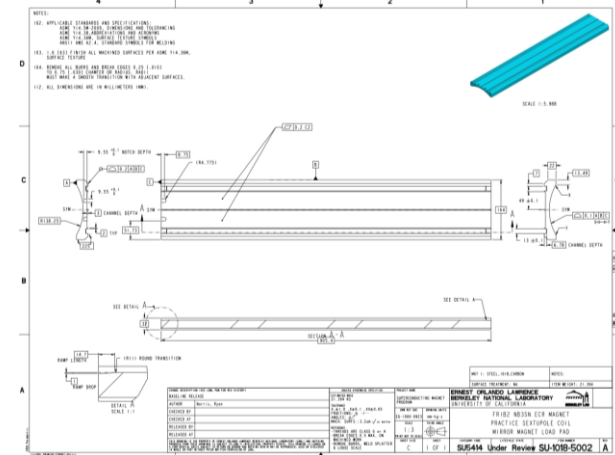
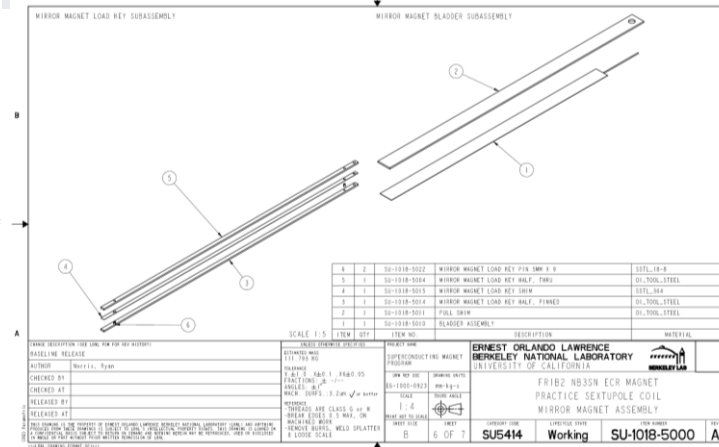
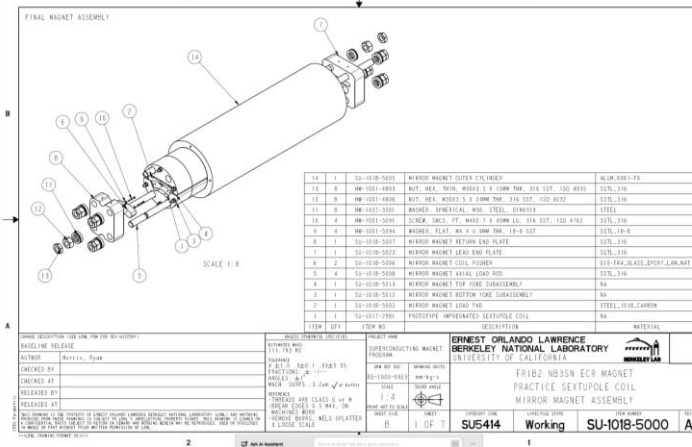
- Shell, upper yoke and bottom yoke received at LBNL.
- SS end plates, pushers, spacers are released for fabrication received at LBNL.



Philip Mallon, Ryan Norris, Lianrong Xu et al.



- Drawings released for fab: 1) load pad, 2) axial rods, 3) key and shim assemblies. Axial rods arrived.



- **Impregnate the prototype coil. Complete coil fabrication.**
- **Prepare mirror magnet assembly.**
- **Prepare mirror magnet cold testing.**

Info from Xiaoji.

We will communicate with our production team to ensure that this issue is prevented in the future.

Please let me know if you have any questions.

**14 unit pieces of (>650 m unit piece length) received.
9.1 km out of 39 km.**

SPL_ID	LENGTH	DIAM_POINTS	DIAM_AVG	DIAM_STDV
23541-1	668 m	8771	0.7001 mm	0.0003 mm
23541-2	1662 m	21825	0.7001 mm	0.0004 mm
23541-3	2925 m	38397	0.7001 mm	0.0003 mm
23541-4	2585 m	33938	0.7002 mm	0.0002 mm
23541-5	689 m	9045	0.6999 mm	0.0004 mm
23541-6	901 m	11827	0.6998 mm	0.0002 mm
23541-7	714 m	9375	0.6999 mm	0.0004 mm
23541-8	832 m	10921	0.7000 mm	0.0004 mm

WO#	Length	Round down	Diameter	Net Weight
23541-1	668m	650*1+18	0.84mm at inner terminal	2.5kg
23541-2	1662m	650*2+362	0.88mm at inner terminal	5.7kg
23541-3	2925m	650*4+325	0.7mm	10kg
23541-4	2585m	650*3+635	0.7mm	8.9kg
23541-5	689m	650*1+39	0.7mm	2.5kg
23541-6	901m	650*1+251	0.7mm	3.2kg
23541-7	714m	650*1+64	0.7mm	2.5kg
23541-8	832m	650*1+182	0.7mm	2.9kg
Total	10976m	9100+1876		

23541-1 laser micrometer results

Piece #	1	Good	Length	668.1 m	# Points	8771
Piece Statistics						
	Average	Deviation	Minimum	Maximum		
Diameter	0.70011 mm	0.00025 mm	0.69969 mm	0.70066 mm		

23541-2 laser micrometer results

Piece #	2	Good	Length	1662.3 m	# Points	21825
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