National Spherical Torus eXperiment Upgrade

NSTX-U Team Meeting
TF/OH Update

NSTX-U Recovery Team
13 December 2021

Last Updated:
12/13/21, 11:16 PM

Biggest Picture Message on Bundle

The Project is actively pursuing the procurement of a new bundle.

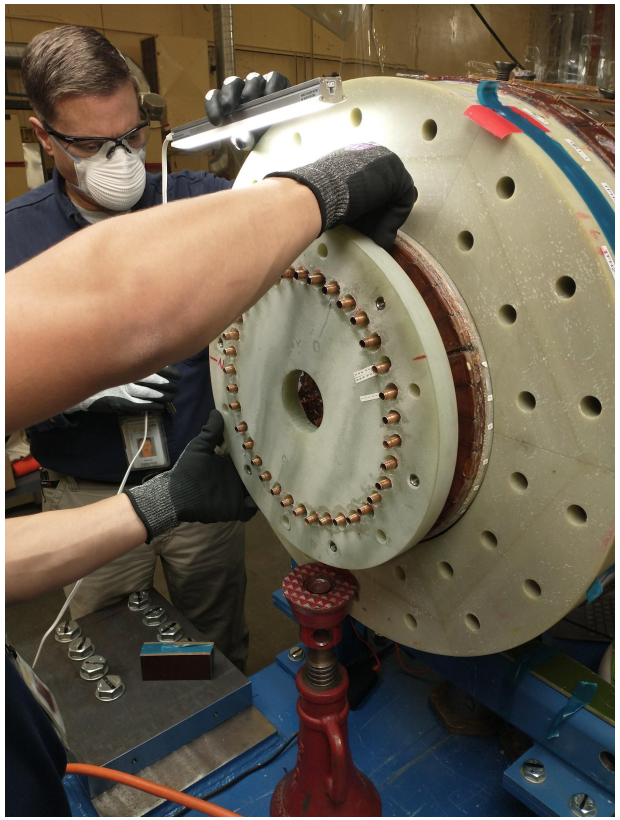
…in parallel…

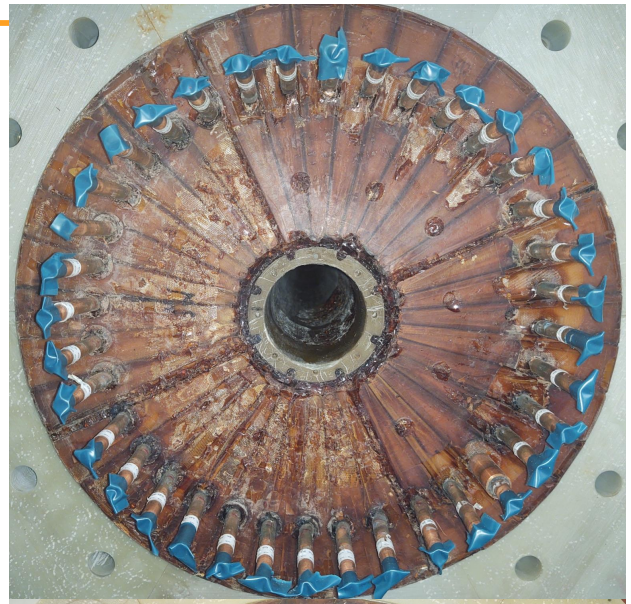
The Project continues to strive to return the existing bundle to service, including a TF-repair and OH rewind option.

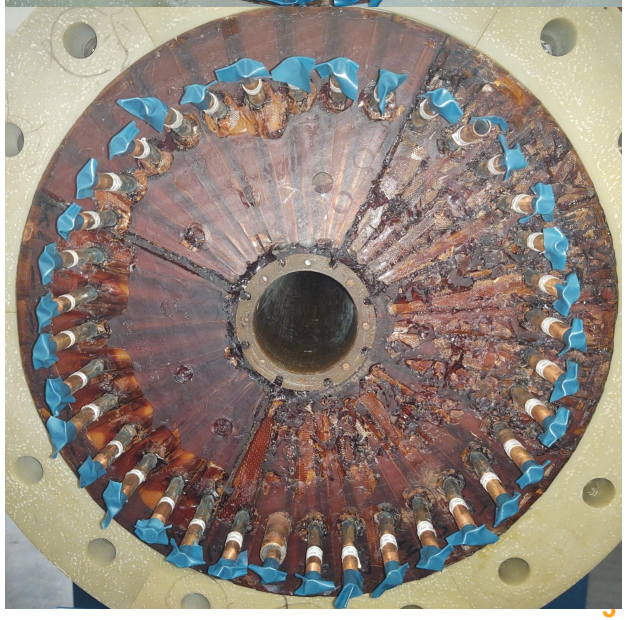
The latter path may not be possible, but that has not yet been demonstrated.

Existing TF Bundle - Recent Technical Activities Have Not Significantly Improved the Insulation Resistance

- Exposed the bundle ends amongst the water fittings



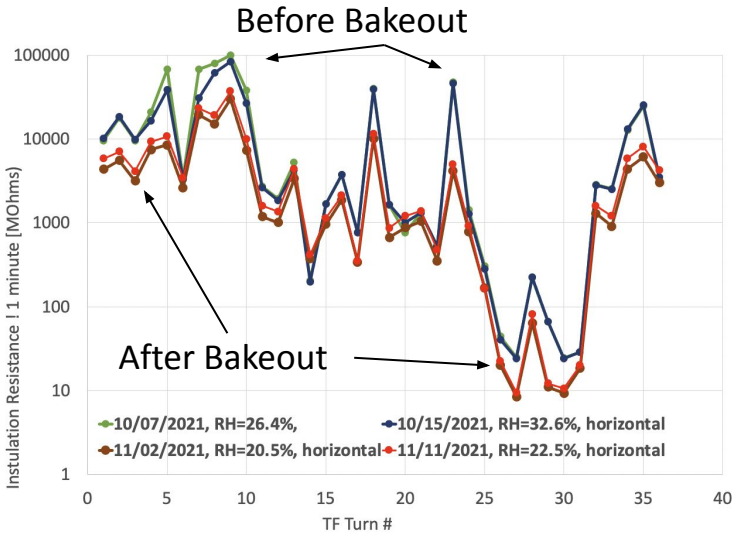




EExisting TF Bundle - Recent Technical Activities Have Not Significantly Improved the Insulation Resistance

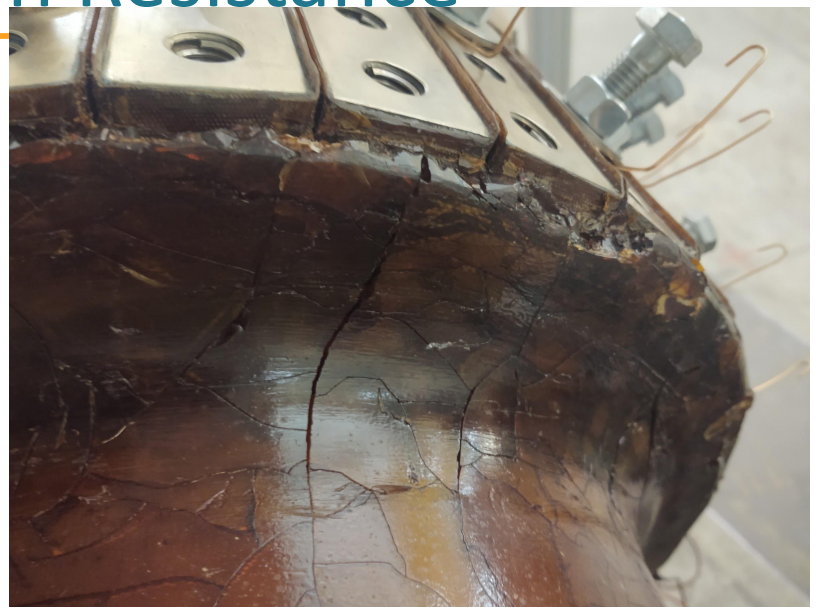
- Exposed the bundle ends amongst the water fittings

- Completed an atmospheric pressure bakeout



Existing TF Bundle - Recent Technical Activities Have Not Significantly Improved the Insulation Resistance

- Exposed the bundle ends amongst the water fittings
- Completed an atmospheric pressure bakeout
- Removed a large amount of cracked or loose resin on bundle ends



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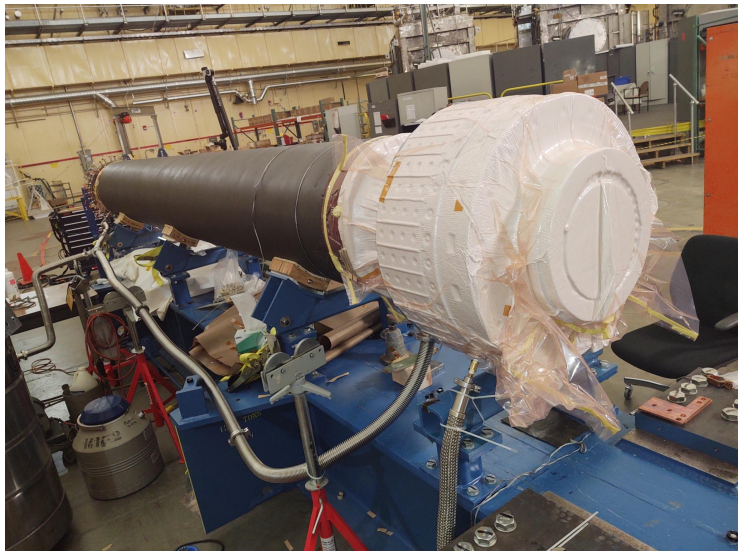
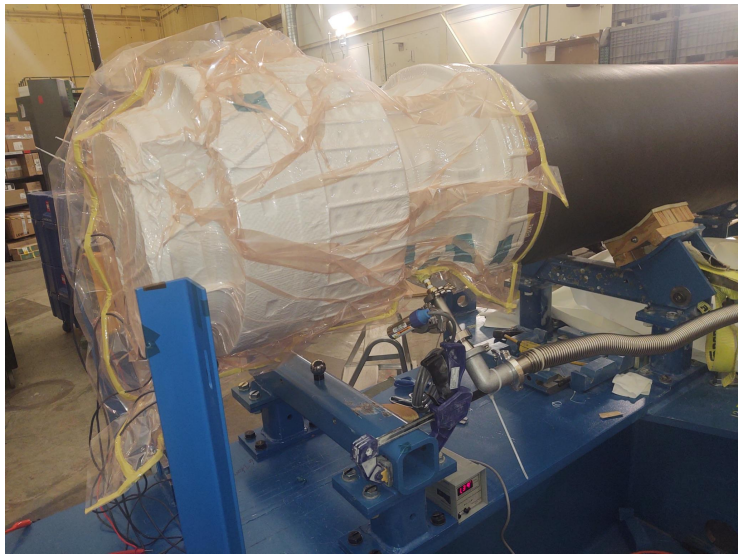
- Developed a method to locate the low-IR

Discussed in Upcoming Slide

Existing TF Bundle - Recent Technical Activities Have Not Significantly Improved the Insulation Resistance

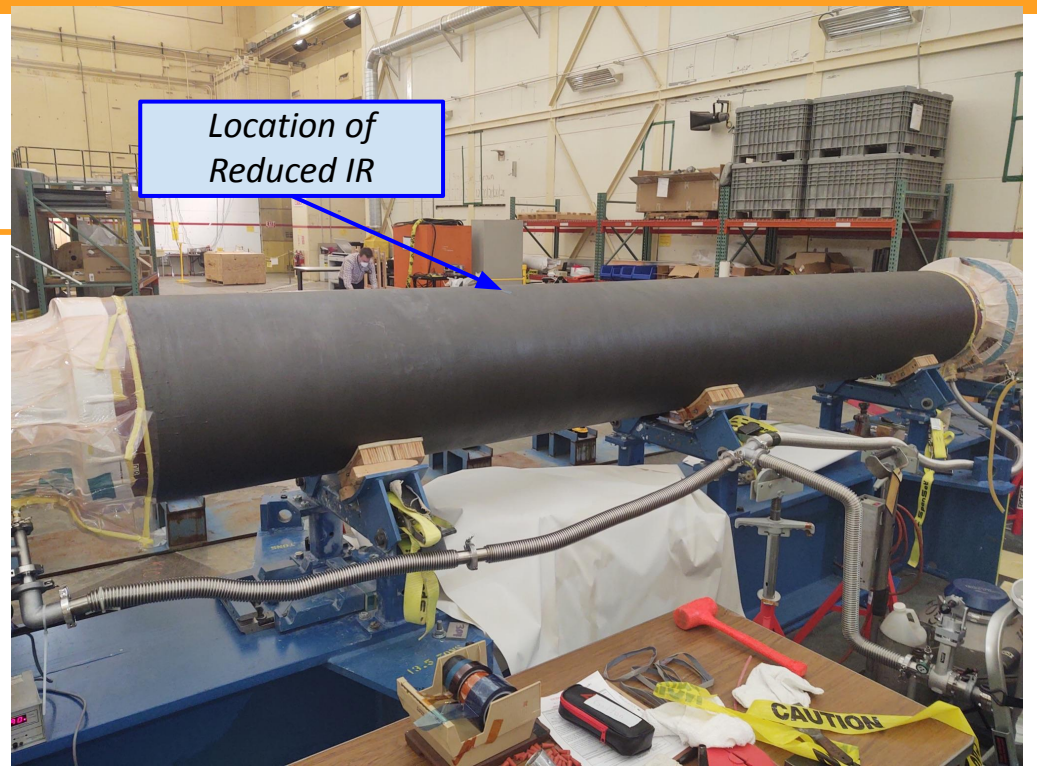
- Exposed the bundle ends amongst the water fittings
- Completed an atmospheric pressure bakeout
- Removed a large amount of cracked or loose resin on bundle ends
- Developed a method to locate the low-IR
- Did a vacuum test for 10 days

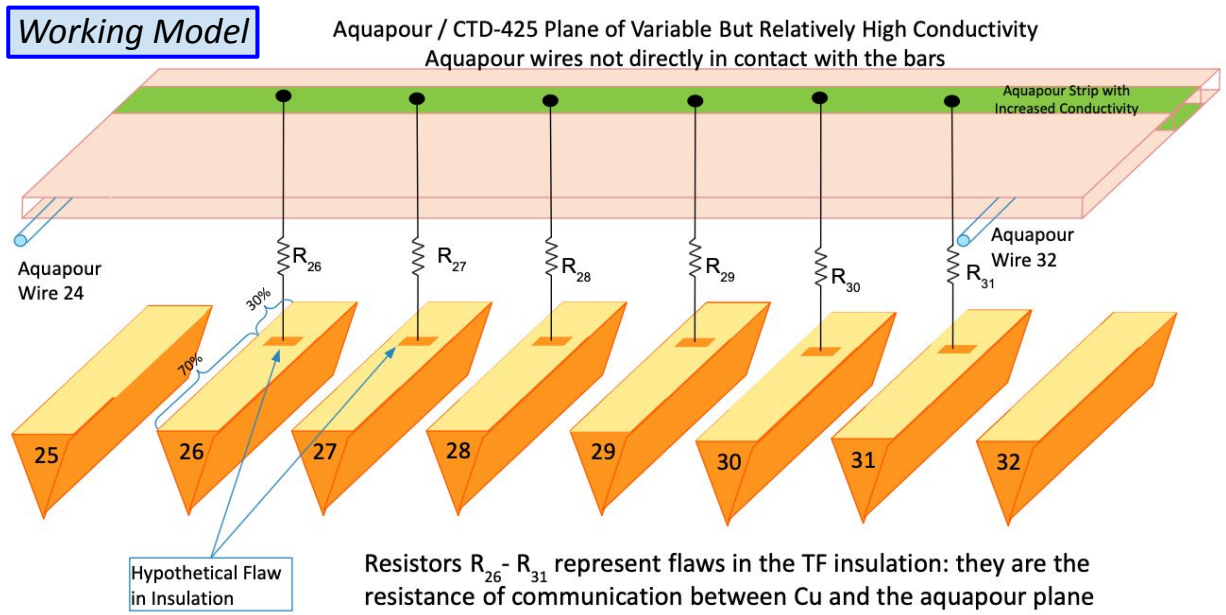




Issue Located - In the OH/TF Gap

- Measurement method developed to locate the flaw axially
  - Method underwent peer review w/ external participants
  - Localized the location of communication between turns to 70% up the bundle.
- Wires embedded in the aquapour found to electrically communicate with the TF Blades.
  - Point of communication is at 70% up the length of the blade.
- The wires appear to be probes, not the root cause.

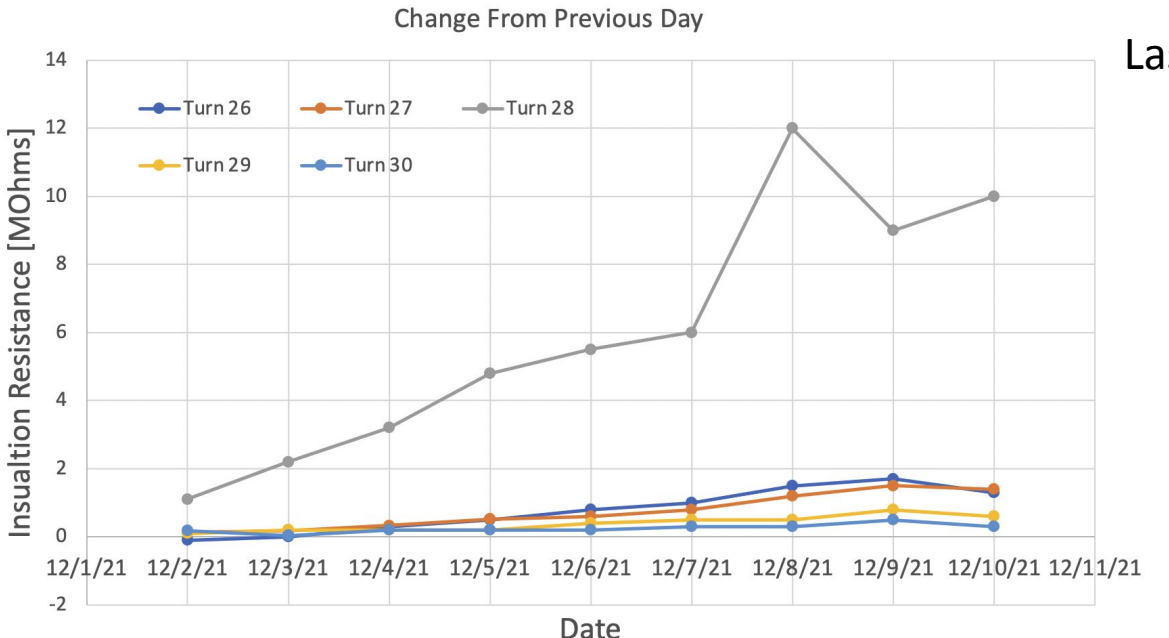




Turn Insulation Resistance Trends During Vacuum Pumping

Change From Previous Day					
	Turn 26	Turn 27	Turn 28	Turn 29	Turn 30
12/2/21	-0.1	0.14	1.1	0.1	0.18
12/3/21	0	0.17	2.2	0.2	0.04
12/4/21	0.3	0.33	3.2	0.2	0.2
12/5/21	0.5	0.52	4.8	0.2	0.2
12/6/21	0.8	0.6	5.5	0.4	0.2
12/7/21	1	0.8	6	0.5	0.3
12/8/21	1.5	1.2	12	0.5	0.3
12/9/21	1.7	1.5	9	0.8	0.5
12/10/21	1.3	1.4	10	0.6	0.3

Resistance Values (Floating Aquapour Wires)					
	Turn 26	Turn 27	Turn 28	Turn 29	Turn 30
12/1/21	19.6	9.34	83.2	11.3	9.78
12/2/21	19.5	9.48	84.3	11.4	9.96
12/3/21	19.5	9.65	86.5	11.6	10
12/4/21	19.8	9.98	89.7	11.8	10.2
12/5/21	20.3	10.5	94.5	12	10.4
12/6/21	21.1	11.1	100	12.4	10.6
12/7/21	22.1	11.9	106	12.9	10.9
12/8/21	23.6	13.1	118	13.4	11.2
12/9/21	25.3	14.6	127	14.2	11.7
12/10/21	26.6	16	137	14.8	12
12/10/21	27.7	17	143	17.4	14.5



Last row after venting

- Isolation of the aquapour wires increased a lot
- Assessing if this gives us any route to retaining the existing OH
- Preparing the means and methods for removal of the OH coil, repair to the damaged TF, and rewind of the OH.
- Developing the procurement strategy for rewinding

Targeting Having the Backup Bundle Fabricator On-Board for IPR in February or March

- We are pursuing a three-phase contract model
  - Phase 1: Design support
  - Phase 2: Long-lead tooling and setup
  - Phase 3: Build the bundle - 1 year fabrication time challenge to vendors
- Phase 1 source selection involves criteria relevant to delivery of Phases 2 & 3
- SoW approved, SSP approved, RFP finalized
- Industry day held on Wednesday 12/1- nine domestic and international firms participated
- Modest design changes being implemented to follow up from recommendations from recent external reviews.
  - Eliminating aquapour is front and central
- Finalizing a collaboration with FNAL magnet engineers to support design, cost estimates, vendor selection, etc.
- Market surveys for long-lead components (conductor materials and sub-assemblies)