U.S. DEPARTMENT OF ENERGY | Office of Science

NSTX-U

-1aU and Machine History/Status Research Operations Update

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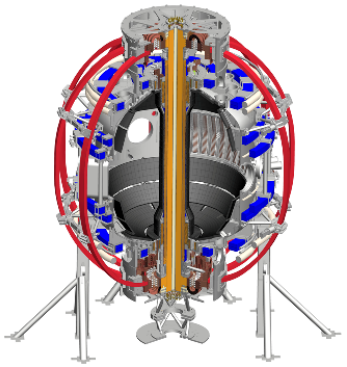
NSTX-U Team Meeting
B-318 PPPL
7/15/2016

PPPL



Slide title

- PF-1aU Status and Plans

- Other Research Operations

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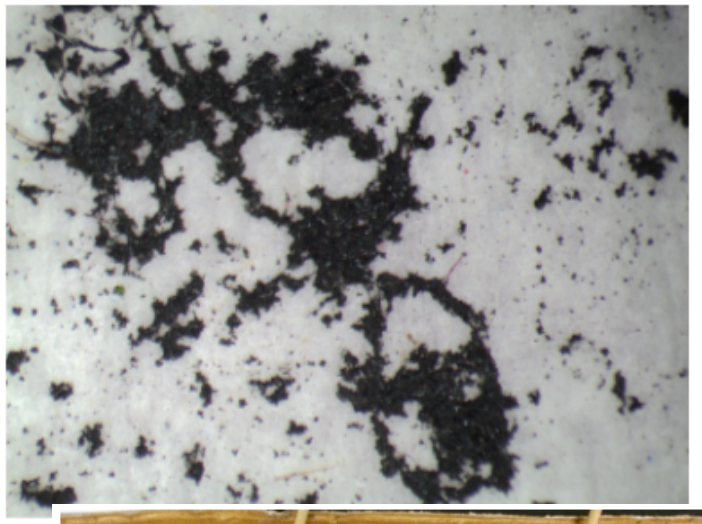
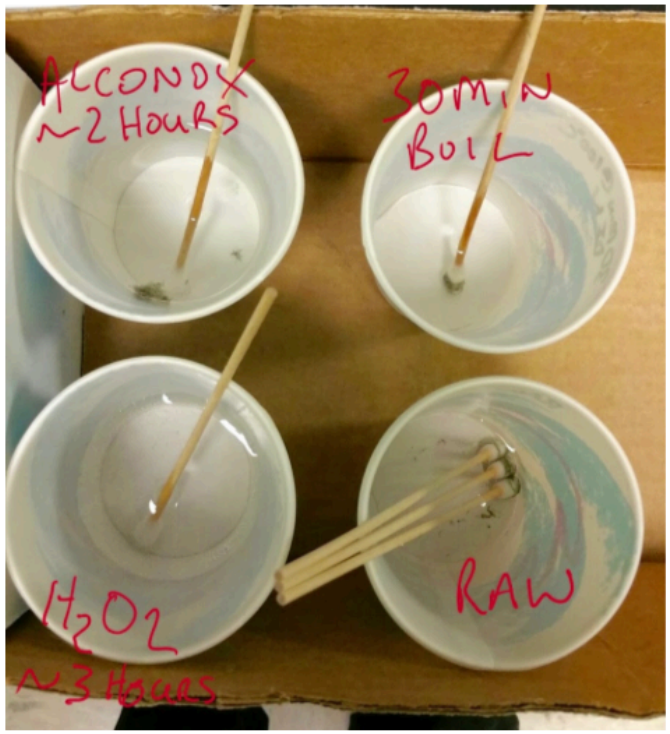
Chronology on PF-1aU Problems (I)

- Flow restriction noted via flow switch on final shot of Tuesday 6/28/2016.
  - Found to be a true flow restriction that evening.
- Wednesday 6/29-Friday 7/1 spend trying to understand and flush the flow blockage.
  - A component of the blockage material appeared like graphite, smelled “burnt”
  - A component of the blockage was likely determined to be biological.
  - Flush with water mixed with Dawn, Alconox
- Appeared to be making progress, but stopped for the long weekend.
  - Left coil filled with soapy water





Chronology on PF-1aU Problems (II)

- Tuesday 7/5/2016
  - Found a copper piece in a bucked that was used to collect water on 7/1/2016
  - While using DI water to push the apparent flow restriction out, a large water leak developed on the coil.
  - Water moved in the volume between the OH coil and CS, soaking the bottom of the machine.
- To dry machine, did a CS bake at ~90 C from Friday 7/8 to Monday 7/11
- TF and OH insulation resistance continued to be too low, so resumed inspections.
  - Found much more water in the vicinity of the lower TF and CS pedestal on Tuesday 7/12/16.
    - This area deliberately kept cool during bakeout
  - Cleaned that up and started circulating additional air in the lower part of the machine.

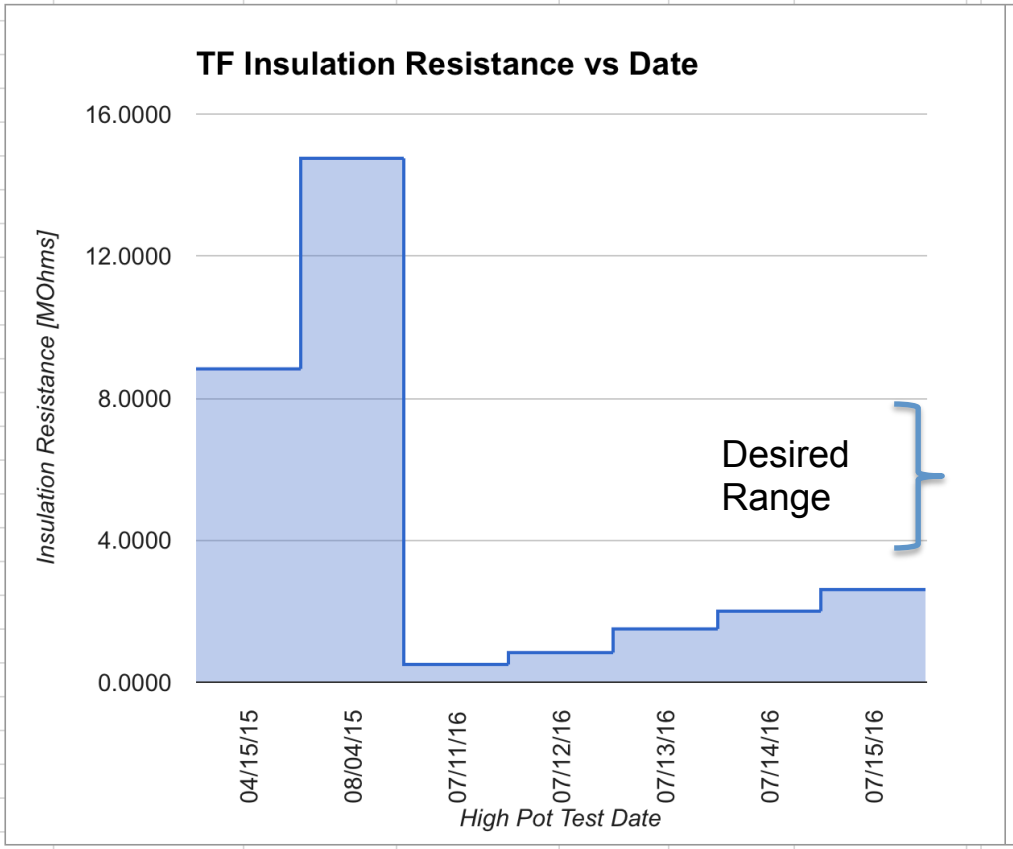
A Few Other Observations

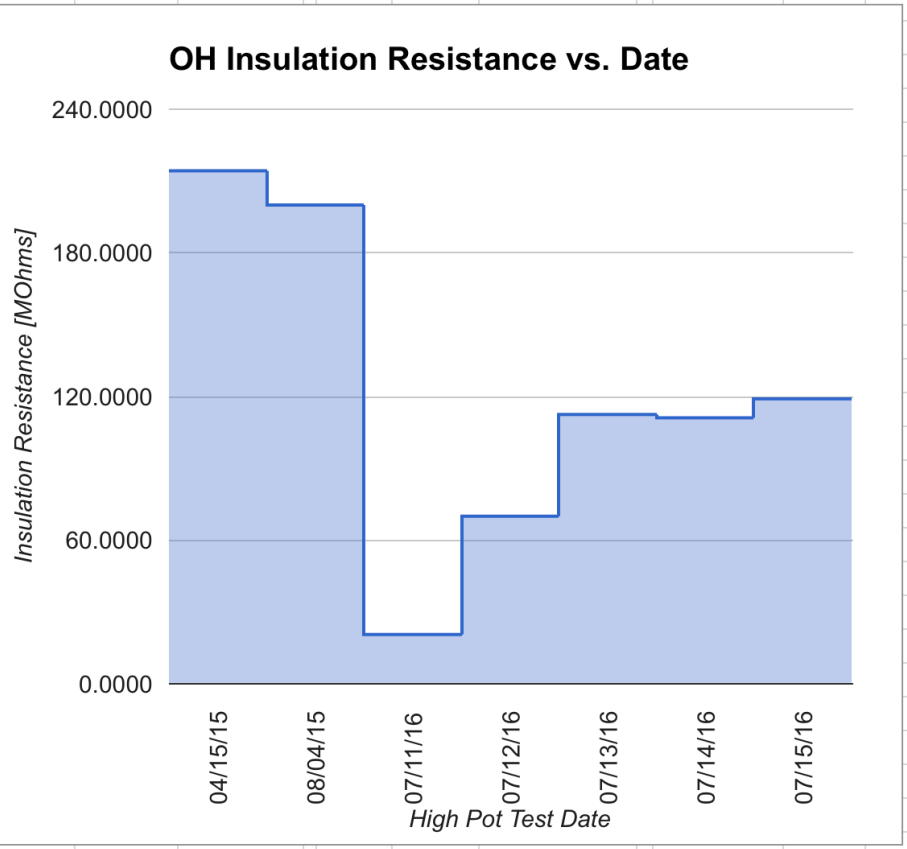
- There were no obvious electrical deviations in the coil:
  - On the test shot on 6/28, compared to previous test shots.
  - On the final plasma shots.
- There were no obvious deviations in the coil cooling water temperature until after the final shot.
- There were no signs of water leaks on the vessel GFM on 6/28
  - But large leak on 7/5 was easily observed by the GFM

Upshot: could not find any warning signs in the data that would lead us to stop operations.

Present Status: CS Coils

- TF insulation resistance is improving…targeting ~4-8 MOhms.
  - Endeavoring to improve the resistance by more targeted air flow.
- OH insulation resistance is back to previous values





Present Status: PF-1aU

- Working Hypothesis:
  - There is a breach in the cooling path of the coil itself, that opens at high(er) pressure.
- Status
  - Has 6 MOhm insulation resistance.
  - May still have water/soap in it
  - Will keep connected to FCPC ground-fault monitoring, but disable connection to any rectifier.
- Path forward
  - Have “budgetary guidance” quotes for both the mandrel fabrication and the winding.
  - Are assessing the most expedient path for each of these items/ steps…in house at PPPL vs outside vendors.
    - Would likely be willing to fabricate a mandrel before examining the existing coil. May not be comfortable with doing winding until after dissection.

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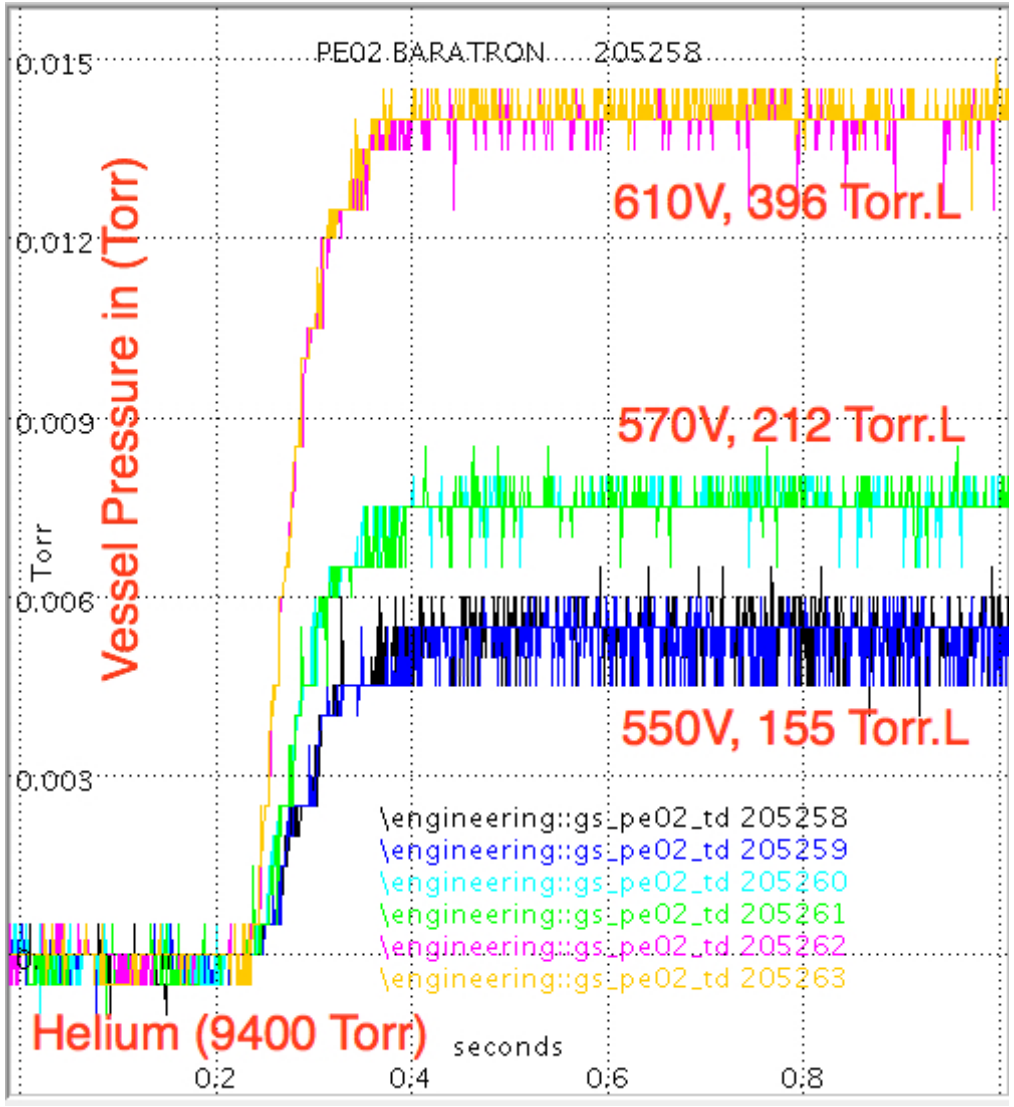
Operations Updates: RF Physics and Boundary Physics Operations

- RF:
  - Vacuum conditioning of sources 1 and 2 achieved 24/23 kV operation for 200 ms
  - Ready to do tuning into plasma at ~ 100 kW in piggyback mode.
  - Will then perform XMP-026 conditioning using dedicated discharges.
- Boundary Operations
  - LITER
    - Testing of motion control for LITERs completed with successful synchronization to shot clock
    - Bakeout completed for LITERs on Fill Stand in South High Bay and ready for lithium loading
    - Successful ACC review
  - MAPP
    - Remote position control being tested as final step in sample exposure and analysis capability during plasma operations

Operations Updates: Physics Ops.

- PCS largely uncharged as we wait to resume operations.
  - Biggest recent update was improved definition of boundary flux and successful inner gap control.
- Some evidence that the optimal error field correction early in the shot differs from that later.
  - Need to assess better to determine the optimal strategy.
- Mid-Plane and lower divertor MGI valves commissioned in nitrogen, helium, and neon at full operating pressure.
- Calibrations with TF on (XMP-136) to be followed by MGI gas injection into plasma
  - assess gains on diagnostics



Operations Resumption

- Operations will resume when the TF insulation resistance is deemed acceptable, and when there is no sign of water on the machine.
  - Will be w/o PF-1aU or either PF-1cU/L
    - Are working on the -1c flex bus restraints.
- First plasma activity will be XMP-155
  - "L-Mode Development w/o PF-1aU" (Battaglia et al.).
  - Should facilitate completing some unfinished tasks:
    - EFC
    - L-mode NB characterization
    - LGI commissioning
    - MGI commissioning.
  - Is a stepping stone to continued H-mode development.