NSTX-U

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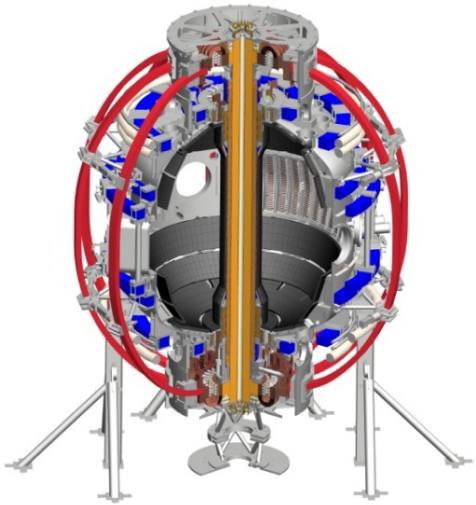
Research Operations Update

SPG

With input from B. Stratton, R. Kaita, J. Hosea

NSTX-U Team Meeting
B-318, PPPL
Oct. 4, 2013



Coll of Wm & Mary
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FOM Inst DIFFER
ENEA, Frascati
CEA, Cadarache
IPP, Jülich
IPP, Garching
ASCR, Czech Rep

Key Nearer Term Dates and Items

- Oct. 1-Dec. 13: Basic diagnostic interface installation, first calibrations.
- Dec. 16-Feb. 28: Test pumpdown, leak checking and repair.
- March 1-April 15: Finish diagnostic installations and calibration.
- May: CS Delivery to NTC
- May-Nov.: Prep for CD-4. NTC on critical path. Likely little tolerance for diagnostic considerations unrelated to CD-4.
- Nov. 2014: CD-4
  - 50 kA plasma
  - Three source of BL #2 injecting into armor.
  - These are separate events.

Important Dates		Start	Finish	Dur
NSTXU-1000	In-vessel installations End		30-Sep-13*	0
NSTXU-1010	Diagnostic checkouts and calibrations	01-Nov-13*	13-Dec-13	31
NSTXU-1020	Construction on the vessel ends		02-Dec-13*	0
NSTXU-1030	Close Up Vacuum Vessel	16-Dec-13*	17-Jan-14	25
NSTXU-1040	Pumpdown	20-Jan-14*	20-Jan-14	1
NSTXU-1050	Leak Check vessel and repair leaks	21-Jan-14*	28-Feb-14	29
NSTXU-1060	Complete diagnostic installation and calibrations	03-Mar-14*	15-Apr-14	32
NSTXU-1080	Pre-fit all buswork in NTC	03-Mar-14	12-May-14	51
NSTXU-1070	Prep Vessel for Centerstack Installation	16-Apr-14*	12-May-14	19

- Diagnostic systems that are unchanged will be installed as part of a generic procedure.
  - Be ready to help Joe W. and the machine tech when they ask.
- Diagnostic systems that are new or heavily modified will need dedicated installation procedures.
  - Includes everything on midplane bays E, J, I, and L.
  - Start working now.

Engineering and Diagnostic Development/Operations Supporting Numerous Diagnostic Upgrades

- Midplane Port Covers:
  - Bay E port cover is finished and ready for installation.
    - Supports suite of LLNL EUV instruments.
  - Bay J port cover is nearly finished…needs some modifications at vendor.
    - Supports LITER, Reflectometer & Polarimeter, RF Probe, various spectroscopy
  - Bay I port cover design is at the vendor…working out final details of their fabrication plan.
    - Supports SSNPA, TGIS, Bolometry,XICS, IR Cameras, QMB,…
- Numerous diagnostics under active development, including…
  - high-f and high-n Mirnov arrays
  - TAE antennas
  - sFLIP
  - GPI
  - New SSNPA (UC-Irvine)
  - Divertor SPRED (LLNL)
  - Divertor Imaging Radiometer (JHU)
  - Passive Plate Accelerometers
  - Visible and IR Cameras
  - Plasma Current Measurement
  - Divertor Tangential Imaging (R. Maqueda)
  - MAPP
  - BES (U. of Wisconsin)
  - EUV Spectroscopy (LLNL)
  - Midplane Bolometry
  - ME-USXR Arrays (JHU)
  - CS magnetics, TCs, and LPs
  - QMBs
  - Sample Coupons
  - LPs for the RF Program
  - Vacuum interface for FIReTIP
- Key near term task: get as many diagnostic vacuum interfaces as possible on machine by late November.

Most Center Stack Diagnostics Fabricated

- Manufacture of Mirnov coils and Rogowski coils complete
  - Includes extra Mirnov coils and “segmented” Rogowski coils for halo current measurements
- All copper and thermocouple wires procured
  - Satisfy specialized material and insulation requirements for installation under plasma-facing components
- Fabrication drawings for Langmuir probes complete
  - Awaiting delivery of center stack tiles to begin machining for probes
- Future plans include preparation of installation procedure and execution when center stack is ready

Plasma and Halo Current Rogowski coil requirements met

- Limited space on air side of center stack and underneath plasma-facing components constrained thickness

Plasma Current Rogowski Coil

- Turns needed to be non-overlapping and of correct number per unit length to insure proper gain (“nA”)

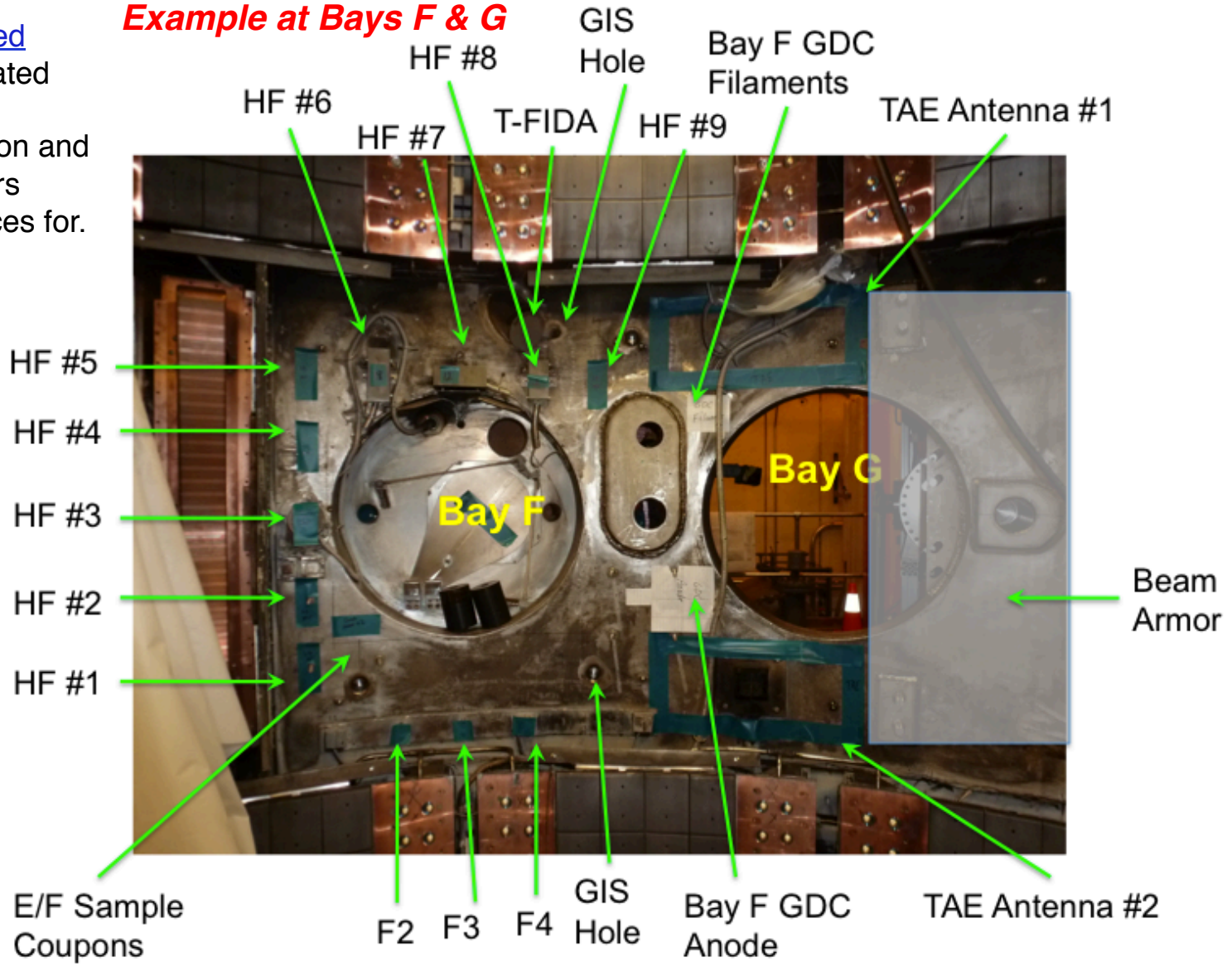
Halo Current Rogowski Coil

Plans For Resintalling Items on the NSTX-U Inner Vessel Wall Have Been Formed

Process Complicated
- J-K cap and associated stiffeners
- Larger Bay-L penetration and associated stiffeners
- More items to find places for.

Items Under Consideration
- High-f array
- High-n array
- TAE Antennas
- GDC Anodes (x2)
- GDC Filaments (x2)
- GPI Filaments
- Sample Coupon Holders (x4 locations)
- GPI Manifold

If you have a stake in this but haven't been consulted, please see me or Mike Kalish



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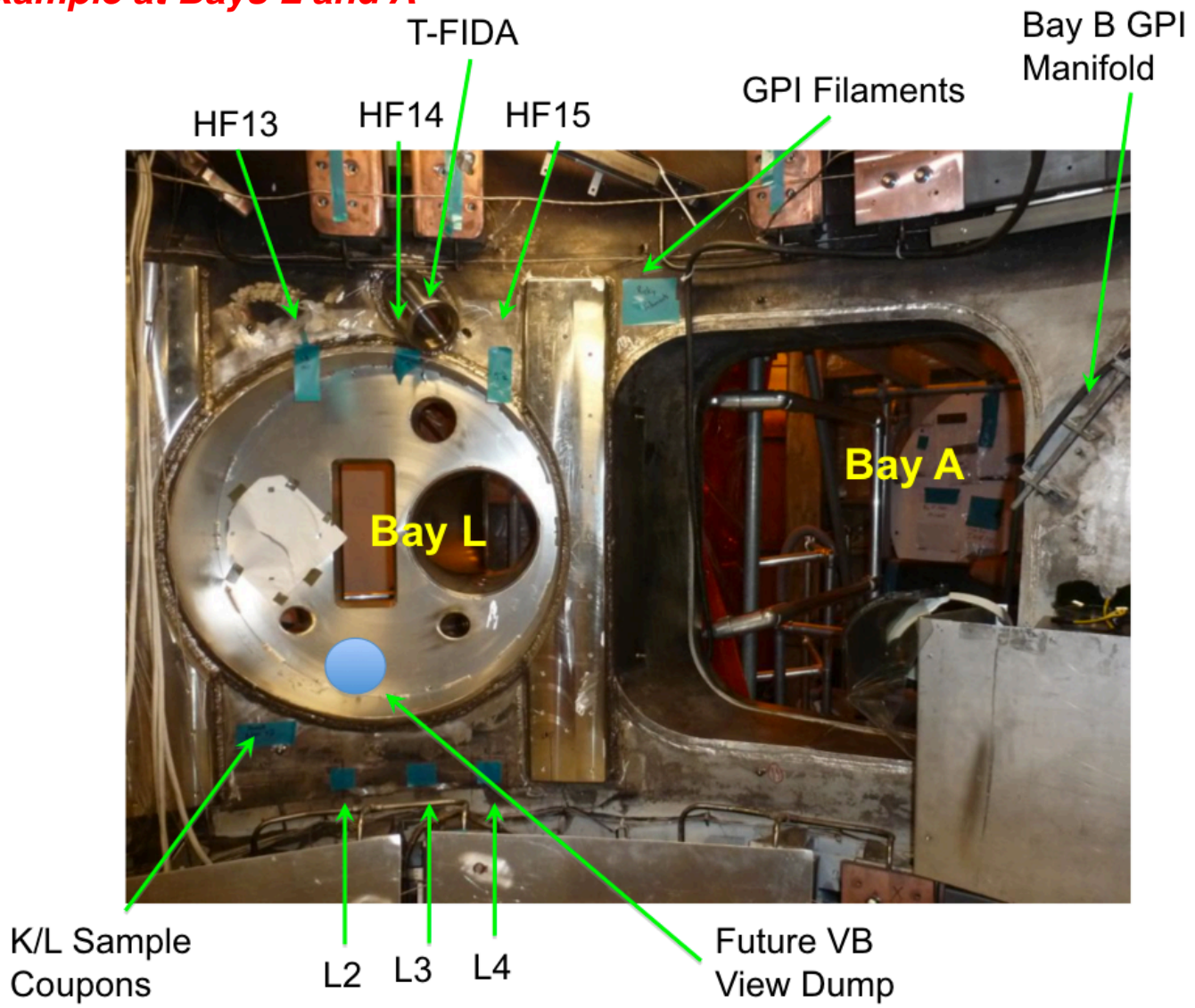
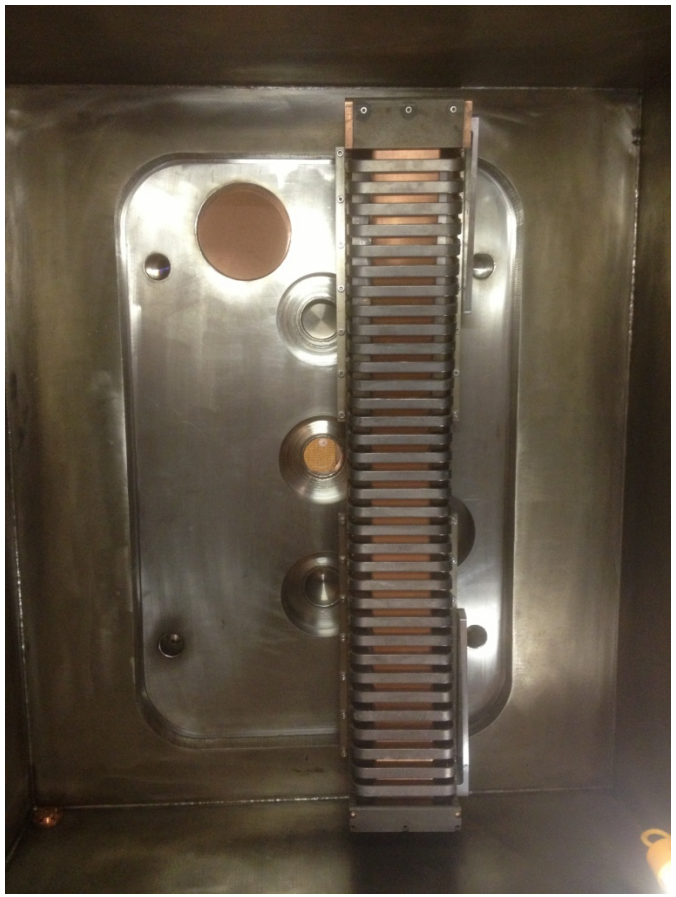
Example at Bays L and A



NSTX HHFW Progress
October 2013

HHFW antenna tests planned in RFTF

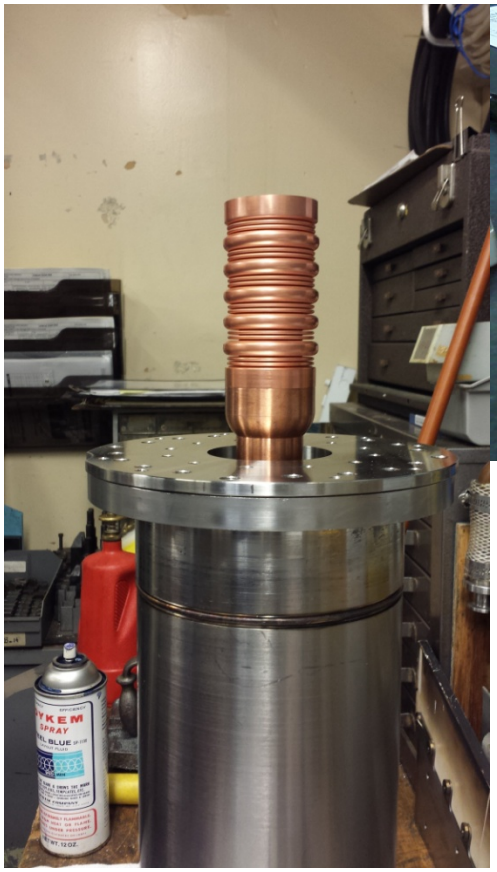
- Two antenna assemblies have been installed in the RF Test Stand. It is under vacuum, with a bakeout test scheduled for week of 9/30 – 10/4.
- Measurements of high voltage point outside of feedthrough are in progress.
- Assembly of resonant loops is in progress.
- Power has been transmitted from source into dummy load in RFTF room R-104. A stray radiation survey has been completed successfully.



Inside of RF Test Stand with one antenna assembly.

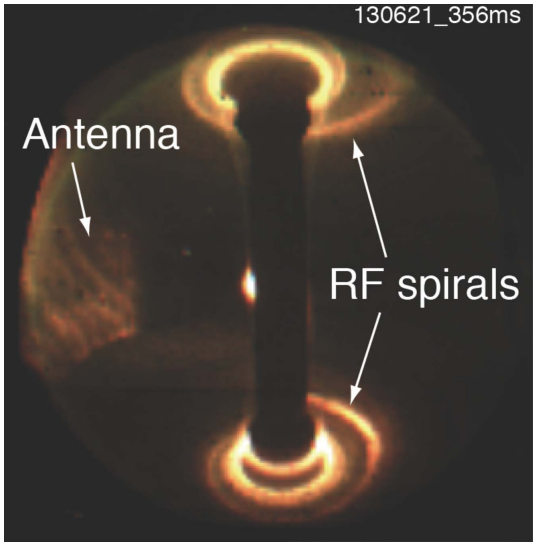
Prototype compliant center conductor received and to be tested on RFTF

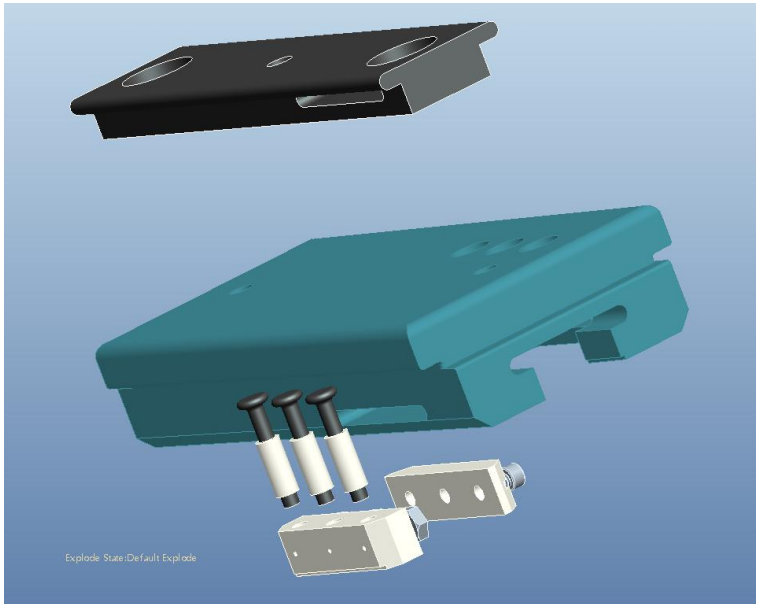
- The first set of three compliant conductor prototypes has arrived. Photo shows installation on feedthrough.
- Three compliant conductor prototypes from a second vendor have been ordered.



Coaxial Langmuir probes will be used to detect causes of HHFW power deposition on outer divertor

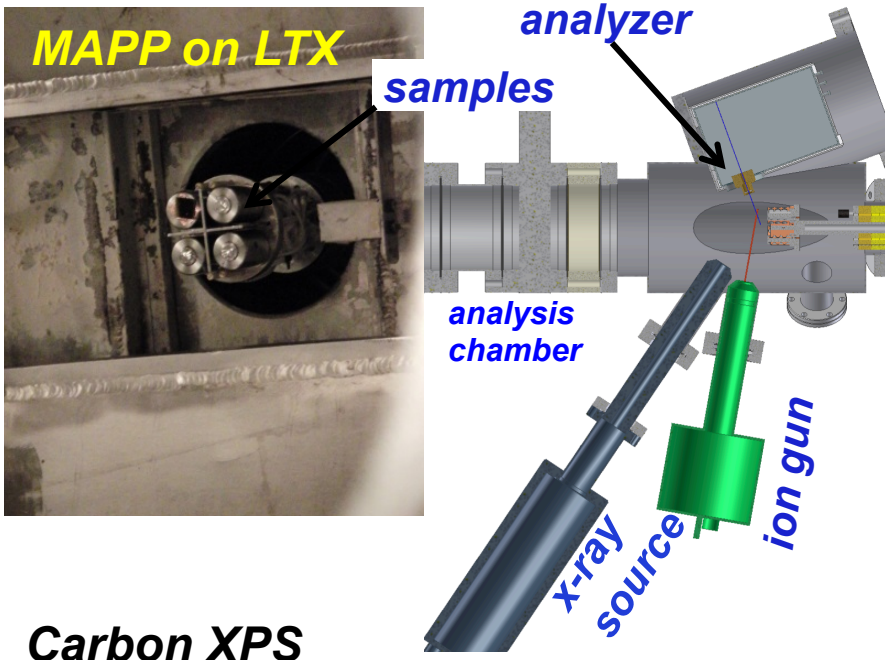
- Langmuir probes have been designed that can fit in tiles type 2 [narrower than 3 or 4] to permit installation in rows 2 – 5 for intercepting the “hot” RF spiral
- Probe design is based on LLD Biased Electron/Langmuir Probe tiles.
  - Macor mounting block assembly for probes.
  - Coaxial signal cables
  - Minimum bend radius .38”.
  - Graphite probes inside alumina insulating tubes.

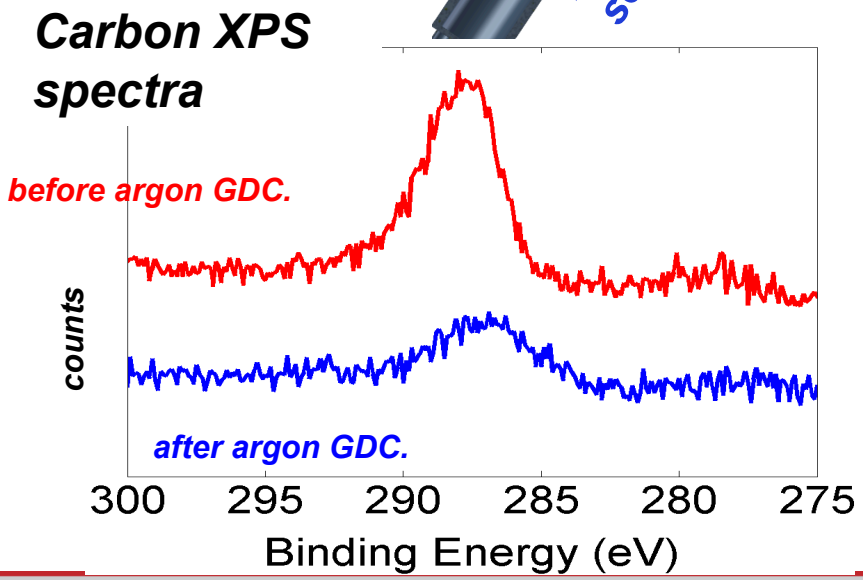




Measurements of tokamak surface after wall conditioning

- The Materials Analysis Particle Probe (MAPP) enables the prompt analysis of components exposed to tokamak plasmas.
- Lithium Tokamak Experiment is dedicated to the study of liquid lithium as a plasma-facing component (PFC).
- Argon Glow Discharge Cleaning (GDC) on LTX:
  - doubled the tokamak plasma current to > 20 kA
  - extended the duration to 25 – 30 ms.
- MAPP X-ray photo-electron spectroscopy showed reduction of surface carbon with GDC.
- Direct measurements of effect of GDC on surface of tokamak plasma-facing components.





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