

Ancillary Systems

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and the NSTX Upgrade Team**

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Ancillary Systems

- Coil and Vacuum Vessel Support Structures
- Power
- Diagnostics
- I&C
- Passive Plate Mods
- DCPS- will be presented this afternoon at a breakout session by Hatcher / Erickson

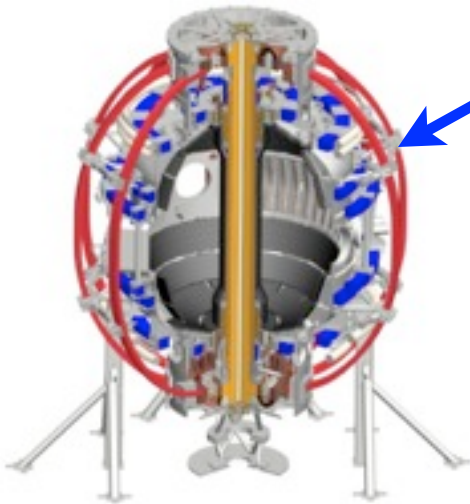
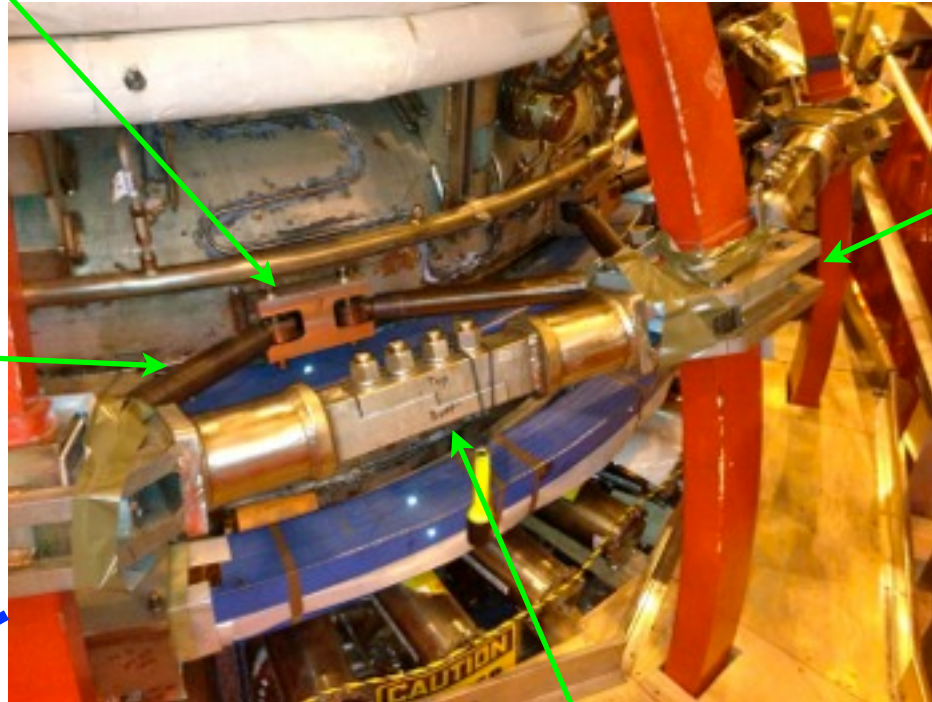
Vacuum Vessel and Coil Support Structures (Smith)

New Clevis Supports

New Links and Rod Ends

OTF Weldments

OTF Outer Ring / Links

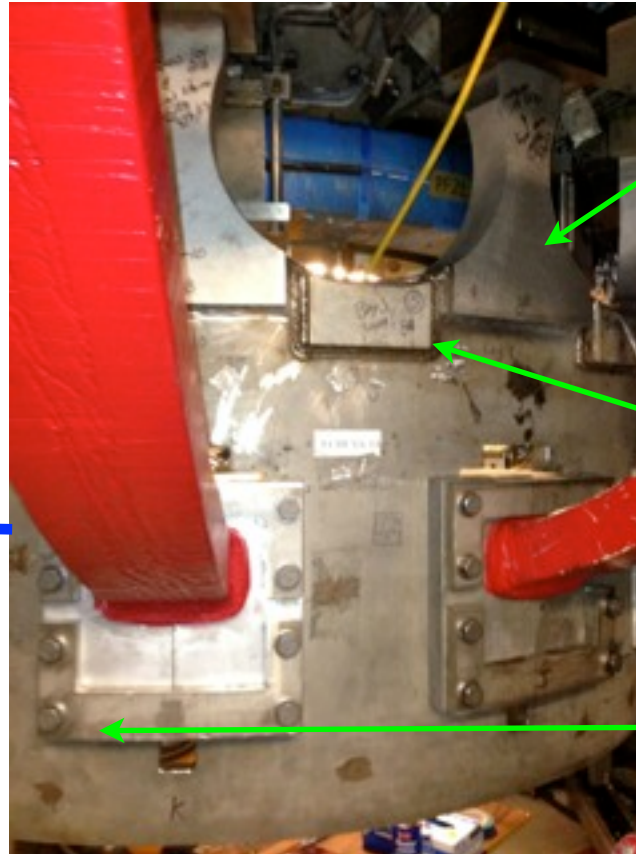
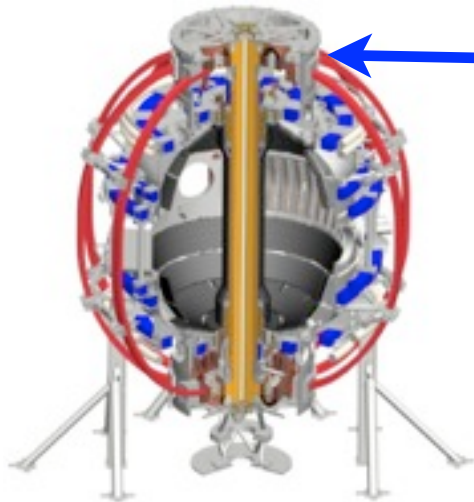


Umbrella External Reinforcements



Reinforcement of dome rib welds with gusseting

New Stronger Sliding Foot



New Umbrella Legs

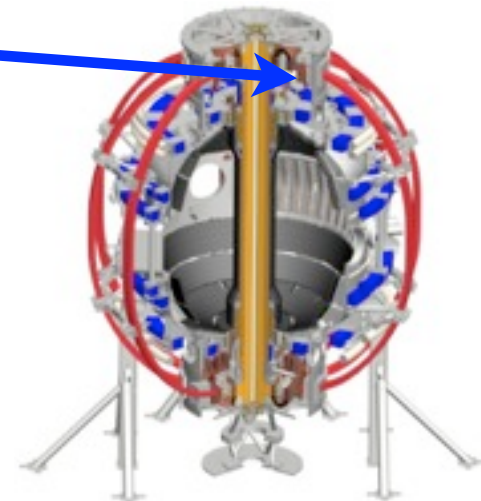
New Umbrella Reinforcement

New Aluminum block reinforcements

Internal Umbrella Reinforcements



New Internal Umbrella Reinforcement



Electrical Power System (Ramakrishnan)

- Upgrade Requirements
 - TF : 129.8 kA, 1kV, ESW 7.08 sec @ 2400 sec (7.05kA rms) ;
 - OH : 24kA, ESW 1.474 sec @ 2400 sec ; 6kV
 - PF1a: Eliminate Ripple reduction reactors
- Design is complete, Installation spec. has been written and work is in progress.
 - About 80% of work completed in FCPC Building
 - Power Cabling changes from Transition Area to NSTX Test Cell completed and tested
- One fiber-optic DCCT (+/-0 to 150kA) has been procured and installed to measure the TF current. Another one procured and installation procedure has been prepared



Fiber Optic DCCT for TF Current

Electrical Power Systems (Contd)

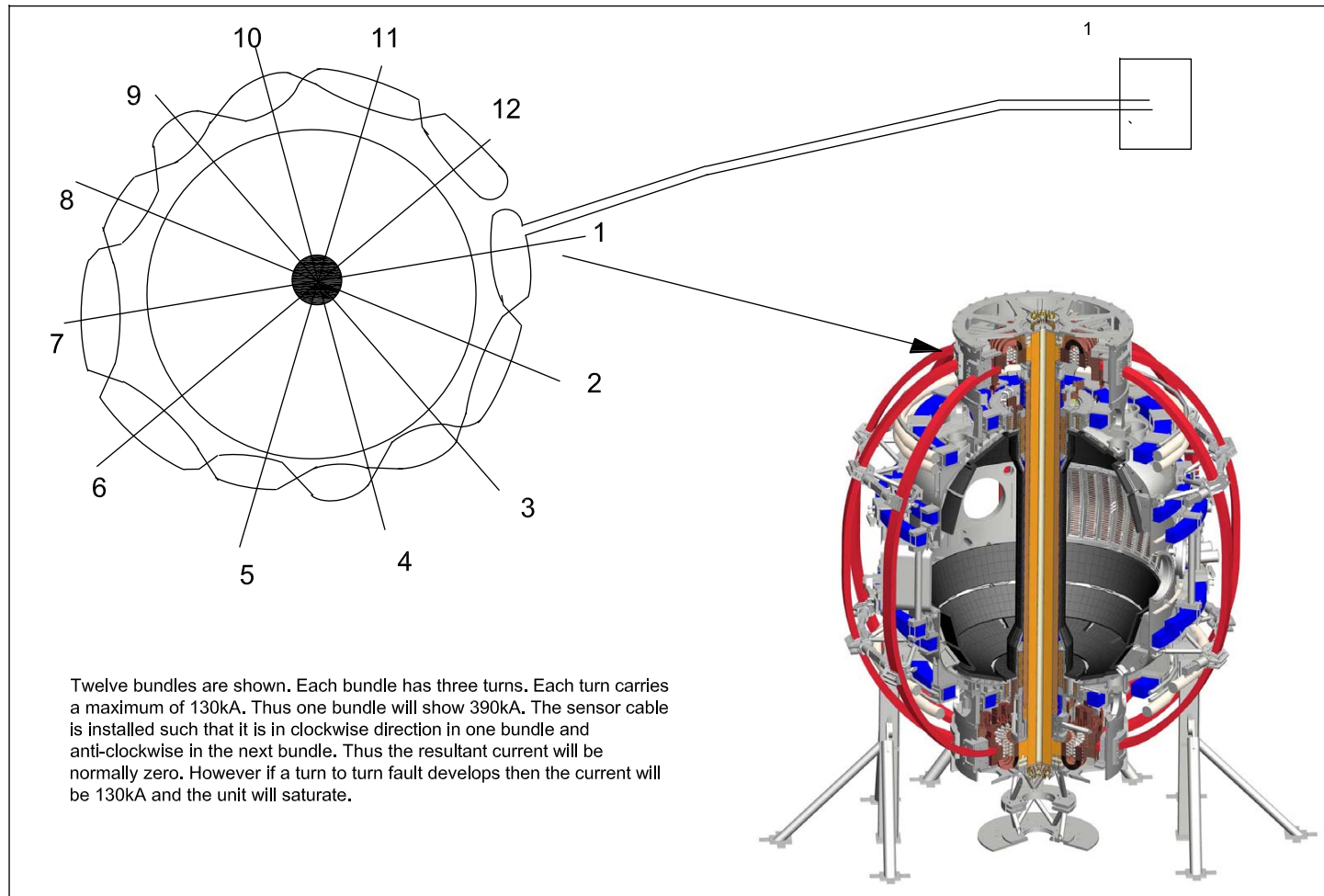
- For OH system, the old PLT TF coils have been installed in the OH circuit as the DC Current Limiting Reactors.
 - About 400k\$ saved by using these.
 - PTP is yet to be conducted
- Hardwired Controls
 - FDR completed to change part of the system to PLC.

*Surplus PLT TF Coils
installed for use as DC
CLR for upgrade*



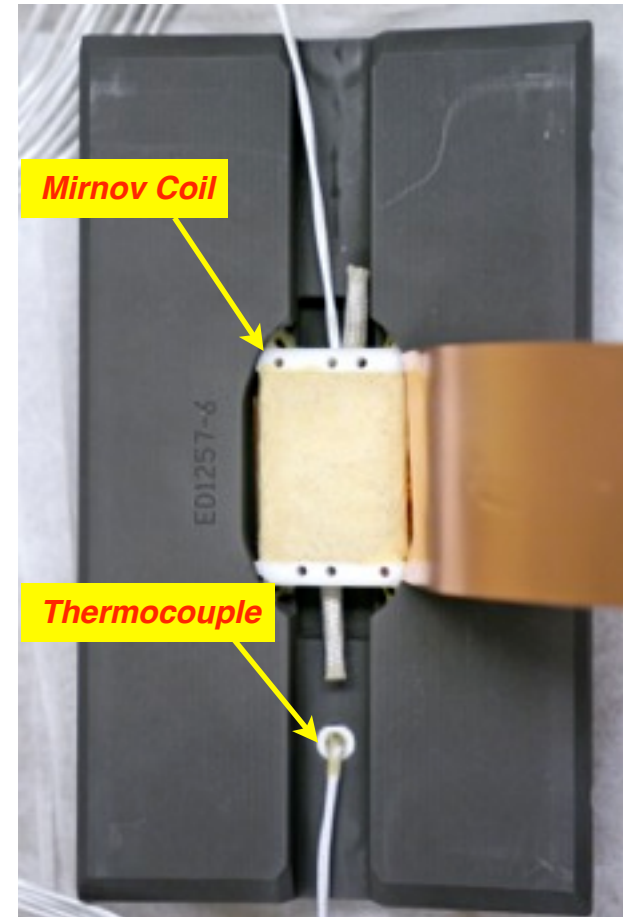
Electrical Power Systems (Contd)

- TF Turn to Turn Fault Detection
 - New TF Turn to turn fault detection designed & order placed for sensor.



Most Center Stack Diagnostics Fabricated (Kaita)

- 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”)

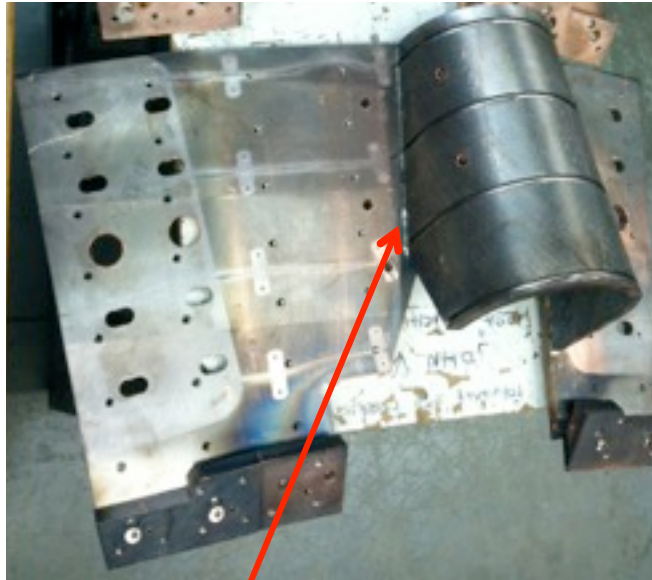


*Halo
Current
Rogowski
Coil*

Central I&C (6100, Sichta)

- The ~4x longer pulse length drives upgrades for data acquisition, networking, and real-time controls.
- Job is 36% complete. Remaining scope: \$250k M&S, 1000 hrs programming, 900 hrs installation, 600 hrs testing. Ready to support ISTP Aug 21, 2014.
- Majority of procurements have been deferred into FY14; low-risk off the shelf data acquisition equipment.
- Network upgrades have been deferred to FY14. \$80k external to NSTX-U project scope needed.
- Real-time Plasma Control algorithms for NSTX-U are in good shape. Software requirements document up to revision 6.
- Postponement of (Transrex rectifier) *Fault Detector* project will add minor scope change to 6100; additional CAMAC will (now) remain in service so more CAMAC memory upgrades are needed to accommodate longer pulse.

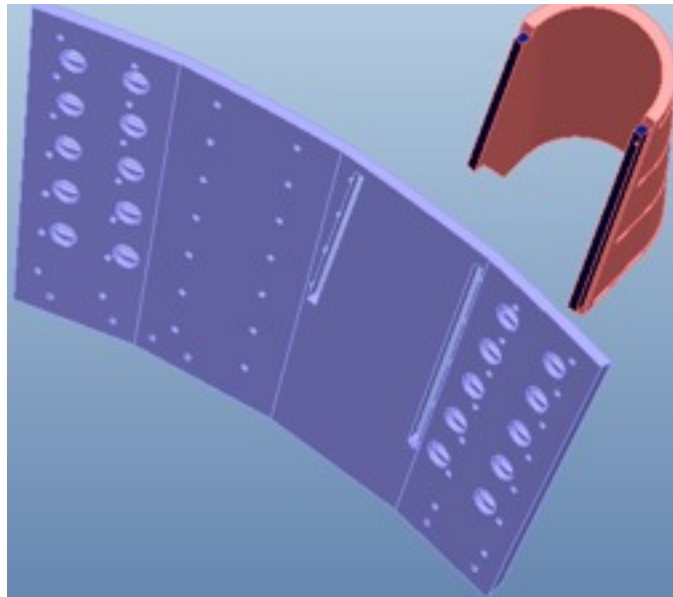
Secondary Passive Plates Upgrade



Brazed Joint

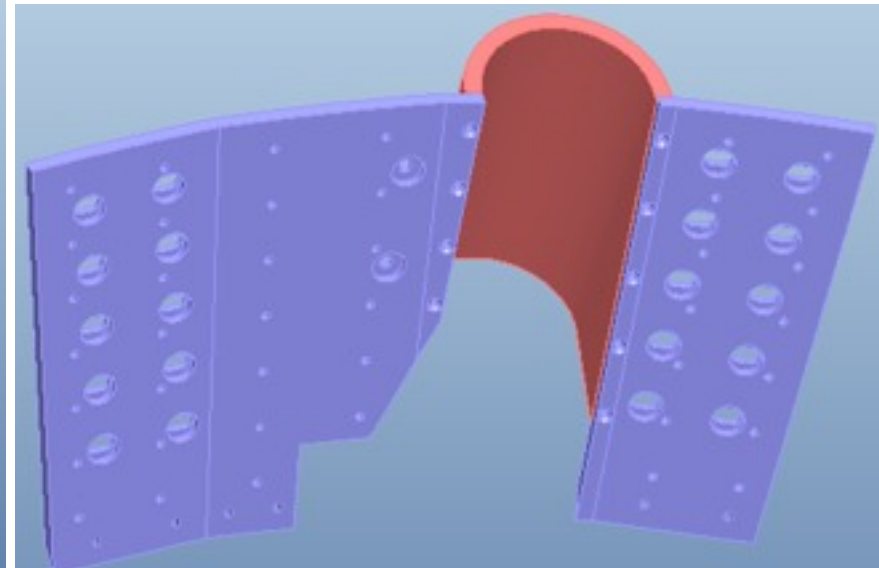
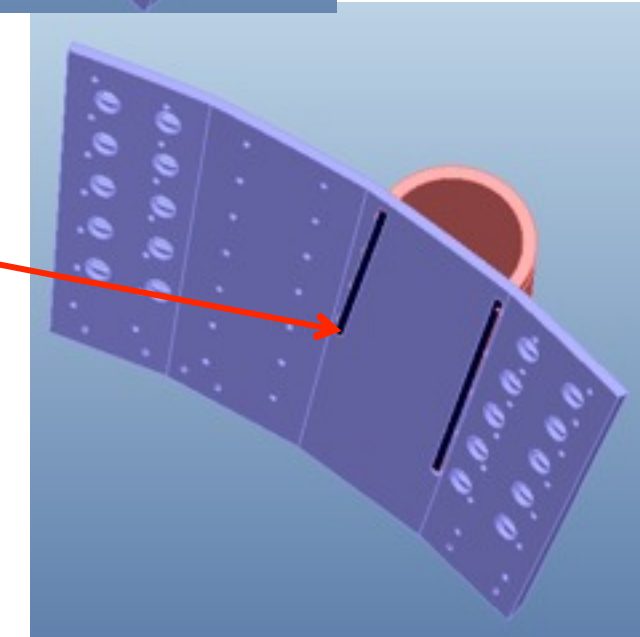
- Challenge: The existing secondary plates in the Bay A/L were weakened by the thermal cycle during brazing.
- Hardness and tensile test results confirmed that these plates are significantly weaker than the standard plates.
 - Standard (unbraze) plates = 57 ksi (tensile strength)
 - PCHERS Passive Plate braze joint = 7 ksi
 - Electron beam weld joint = 40 ksi
 - E-beam Heat affected area = 57 ksi
- A new design will use E-Beam welding to join the passive plates to the jumper plates.

Development of Secondary Passive Plates



- First, the passive plates and jumper plates will be fabricated.
- Second, the two plates will be joined using E-Beam welding.
- Last, the “throat” of the CHERS viewing channel will be machined open
- Key Milestones:
 - Peer Review in 10/14/2013
 - Final Design Review in 02/04/2014
 - Fabricated Parts Delivered to PPPL by 06/23/2014
 - Installation complete by 07/22/2014, Total budget:
 - Total Budget: \$333.5K

E-Beam Welded Joint



Conclusions

- Significant progress has been made in the ancillary system work over the last six months.
- Installation work is well underway
- Work is on track to support the scheduled startup of the upgrade