

Onsite Fabrication Overview

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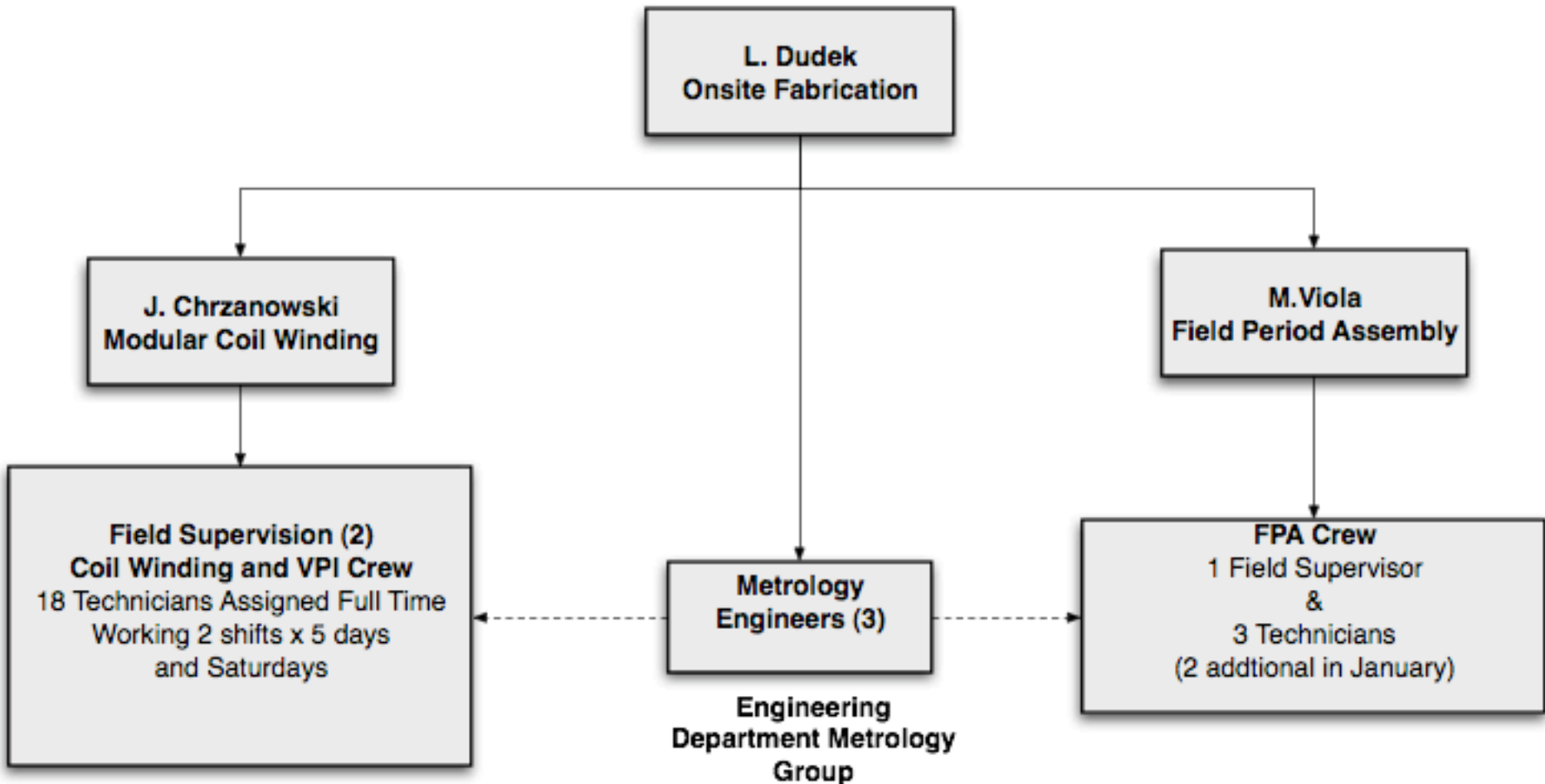
Princeton Plasma Physics Laboratory

**Office of Science Project Review
Princeton Plasma Physics Laboratory
Princeton, NJ
December 19-20, 2006**

Outline

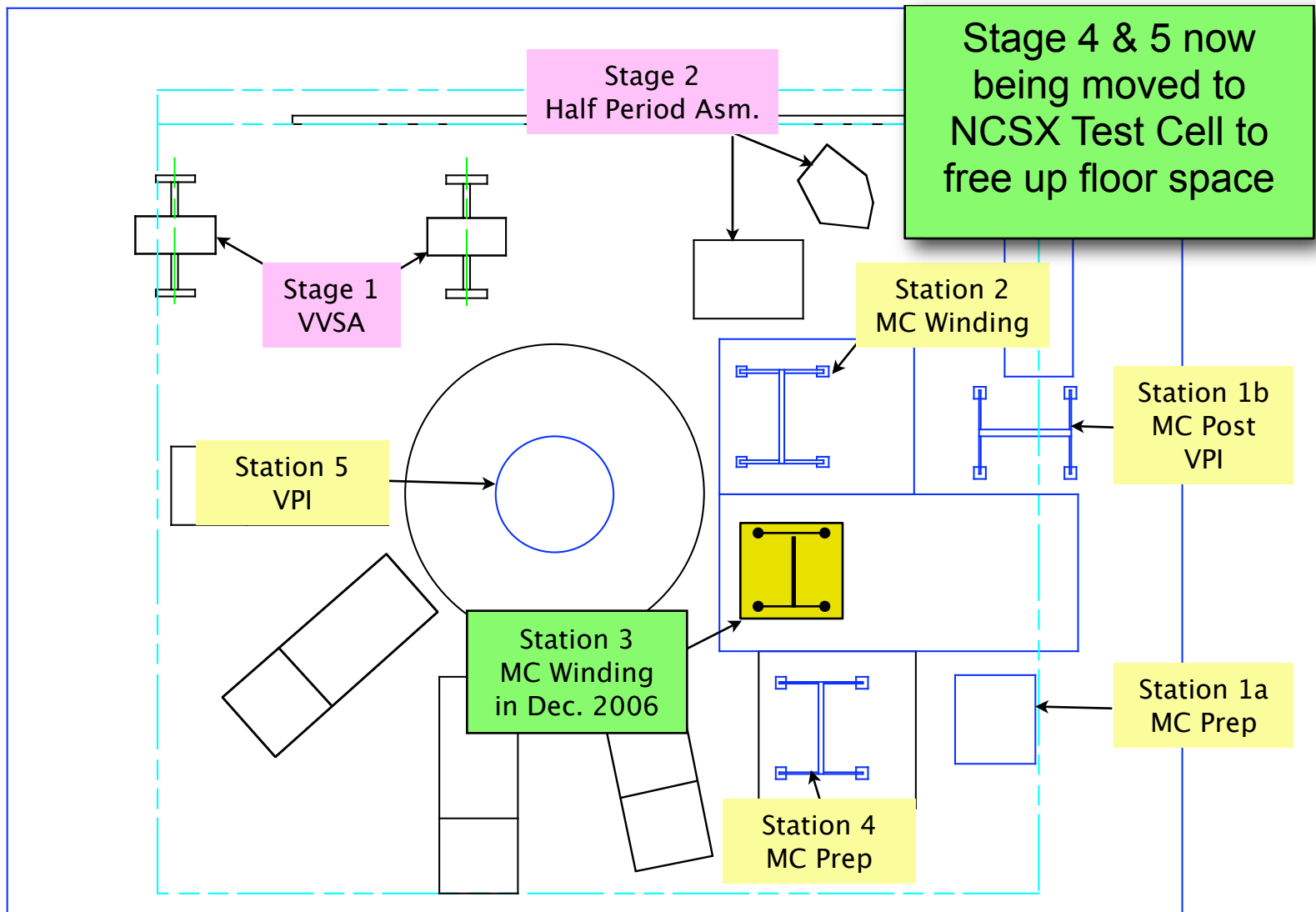
- Organization and Facility
- Modular Coil and FPA Process Improvement
- Field Period Assembly
- Quality
- Safety
- Summary

Fabrication Organization



Was 14 Technicians in May 2006

A Master Plan with Sufficient Space



Modular Coil / FPA Process Improvement



- Project level schedules are broken down to daily work schedules with detailed work assignments
 - Work schedule issued for 1 week period, tuned further on a weekly / daily basis
 - Two shift / 5 day operations + Saturdays one shift
 - Extended shifts and / or added weekend shifts are used as required to meet project needs
- Actual hours spent on coil winding are tracked on a daily basis using a Daily Report
- Hours are tracked for 50 different activities which account for the work needed to turn a raw casting into a completed coil
- Hours are entered into a database to collect and summarize data

Modular Coil / FPA Process Improvement

- Feedback
 - Production data collected is assembled in graphical form to feedback to technicians
 - Technicians have become motivated in besting previous winding times and identifying areas for improvement
- Value Improvement Proposals (VIP)
 - Almost 40 proposals have been identified and implemented to date
 - Team members are encouraged to submit suggestions for process improvement
 - Examples include:
 - * Two color silicone tape to improve visibility of layers
 - * Added third fixture to add flexibility
 - * Two (2) shift operations on fixture 1B
 - * Cleaning of manifolds by outside contractor
 - Improvements to Safety, Quality, Cost, Risk & Schedule

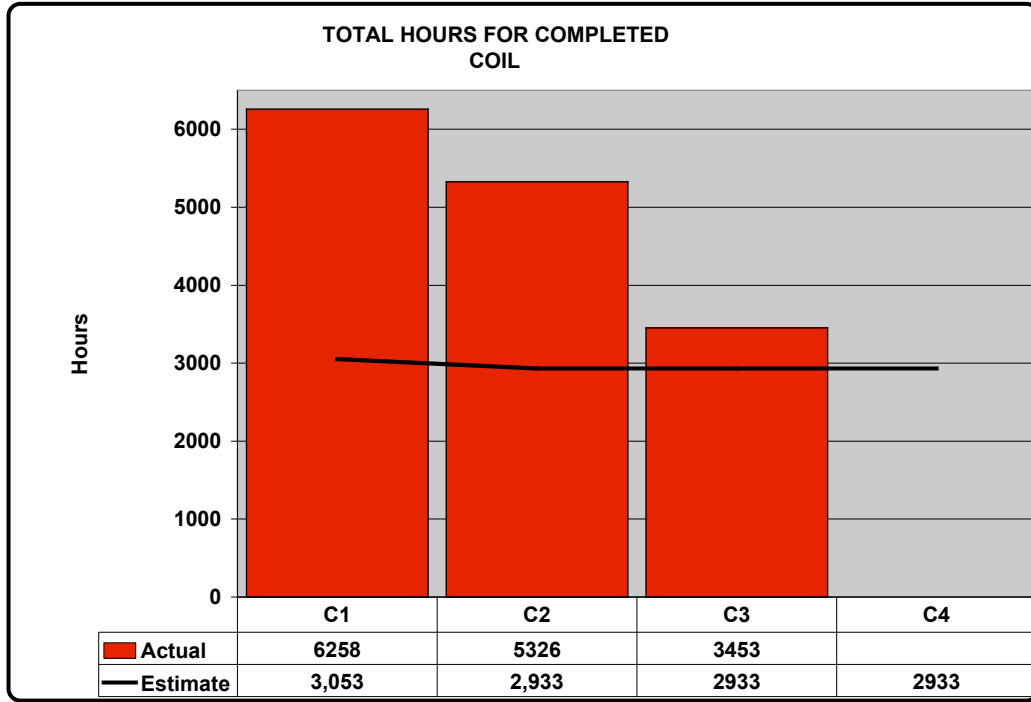


VIP's Implemented

Almost 40 Value Improvement Proposals identified in the Coil Winding and FPA area

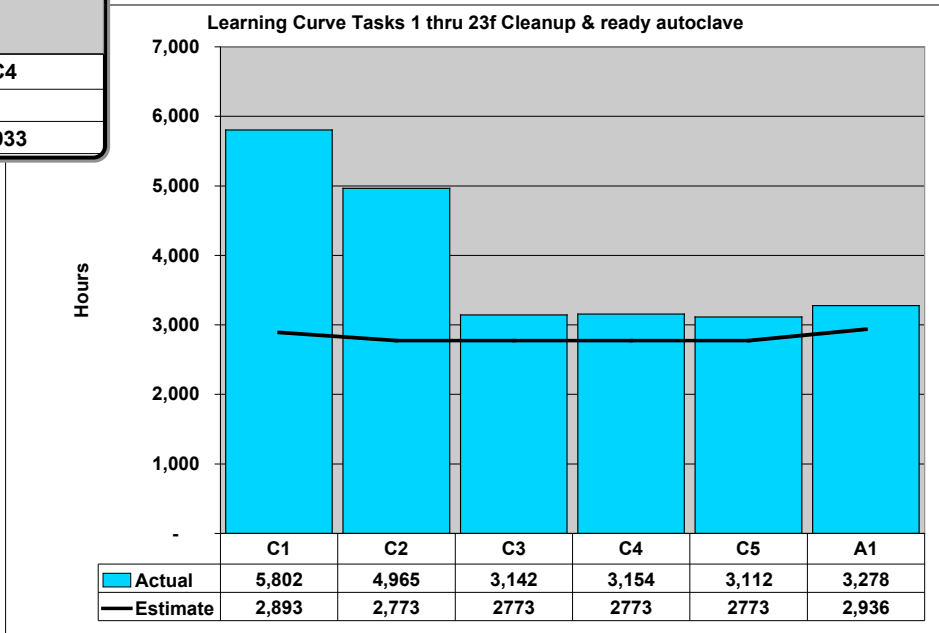
Area	Identified / Implemented
Tool Changes	25/25
Design Changes	4/3
Process Changes	4/1
Autoclave Change	1/1
Labor	1/1
Vendor	1/1
Requirements Change	2/1

NCSX Modular Coil Winding Hours



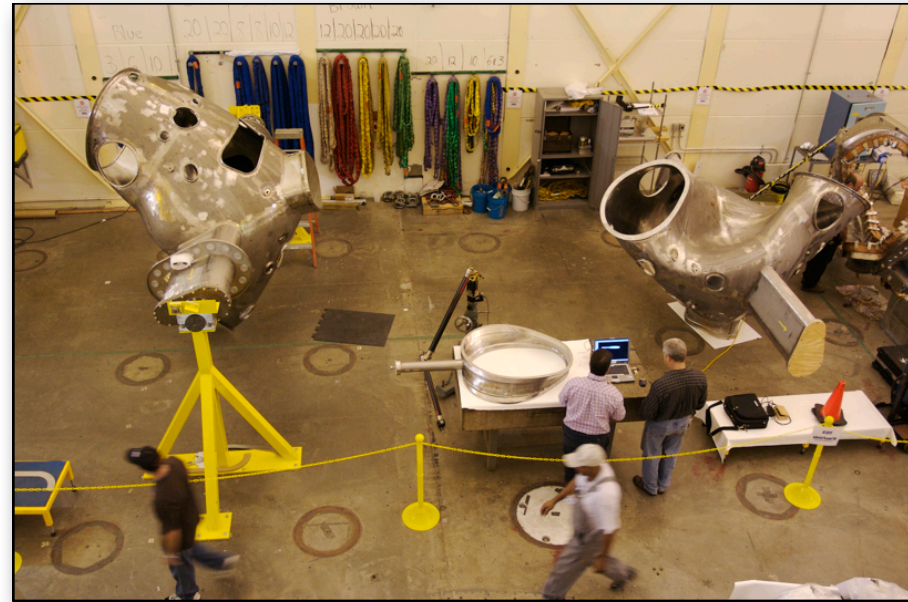
Completed Coils

Coils through
potting, and post VPI
cleanup



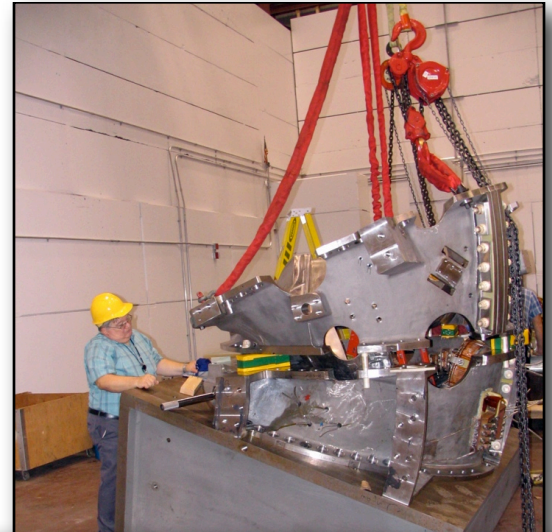
FPA Fixture Schedule Supports Assembly Plan

- Two (2) Stage I fixtures have been installed, VV sections have been mounted
- Stage 2 fixture design was completed, however in a cost saving measure the machining fixtures from the coil manufacturers are being substituted
- Stage 3 fixture design is nearing completion, by end of December



Assembly Risks are Being Retired

- Trying to fit as many different parts as possible to identify problems early
 - A pair of type C coils and B&C were assembled to assess clearance
 - Heating Cooling tubes were trial assembled
 - Trials are planned for
 - * Coil to coil inflatable wing shims
 - * Coil to coil bolting
 - * Coil to coil shim adjustments



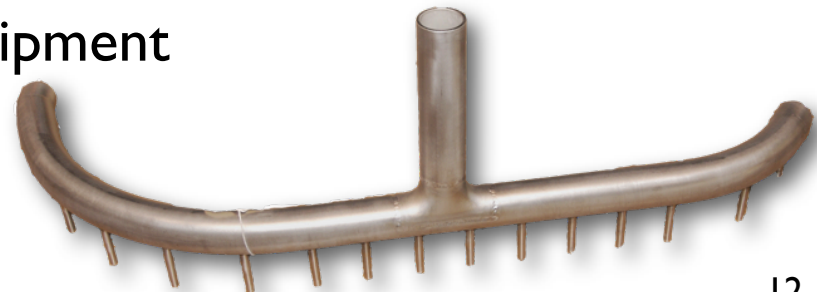
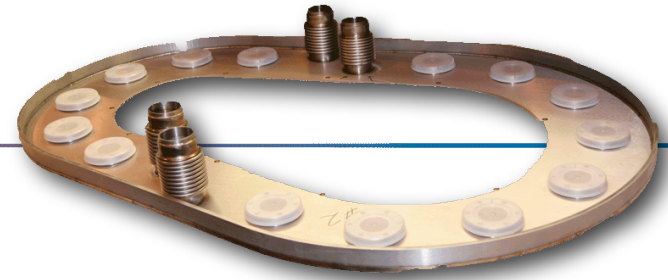
Progress on FPA in FY06

- Field Period Assembly:
 - All 3 VV segments have arrived
 - The crew has been trained and has been working well
 - Station I VV assembly Fixtures have been completed and installed
 - Most of the small parts have arrived
 - Layout of magnetics, TC's and H/C lines is complete on 2 of 3 segments.
 - Assembly of the cryostat flanges has been completed on 1,2 & 3.
 - Assembly of heater tapes, diagnostic loops and H/C hose has begun on segment 1.



Metrology

- Analysis has shown that there is an overload on the metrology equipment and personnel
- The reliance on sophisticated measuring instruments at the lab has highlighted the need for a central metrology resource
- As a result a Metrology group, consisting of 3 engineers, has been formed within the Engineering Department to add depth to the experienced personnel at the lab
- A new laser tracker has been approved for purchase this year to alleviate the equipment shortage



FPA Plans and Procedures Support Fabrication



Field Period Assembly Plans and Procedures		
NCSX-MIT/QA-185-01-00-dB	Field Period Assembly Manufacturing, Inspection, Test , and Quality Assurance Plan	Approved
NCSX-PLAN-FPA-00-dA	Field Period Assembly Plan	Approved
NCSX-PLAN-FPA1SEQ-00	Station 1 Field Period Assembly Sequence Plan	Approved
NCSX-PLAN-FPA1DC-00	Field Period Assembly Station 1 Dimensional Control Plan	Approved
NCSX-PHA-142-01-01	NCSX Manufacturing Facility Project Hazard Analysis	Approved
D-NCSX-FPA-QA1-00	Field Period Assembly Component Receipt Inspection	Approved
D-NCSX-FPA-001	Field Period Assembly Station One	Approved

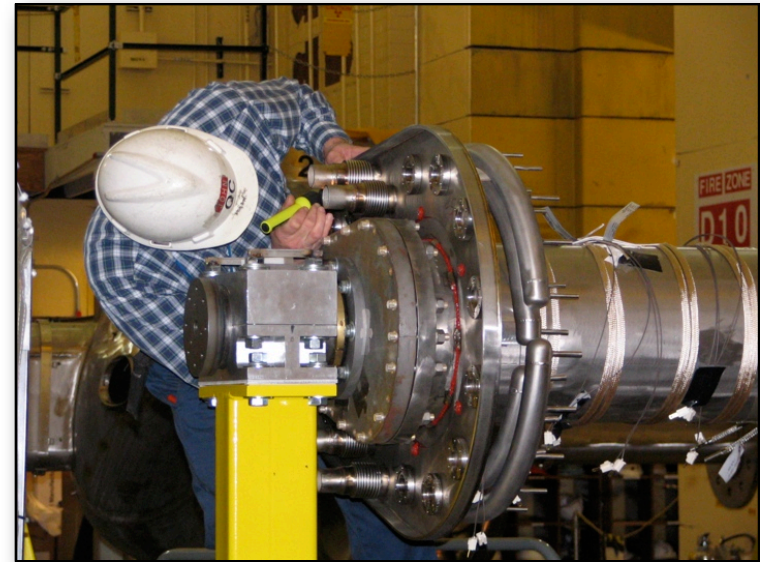
Safety

- All activities are performed **Safely, Safely, Safely**
- Safety is an integral part of **every activity** performed in the area
 - Toolbox safety meetings are held every couple weeks to review timely topics (e.g. lifting, ladder safety, PPE etc)
 - Job Hazard Analysis are performed for all new activities
 - Regular safety inspections by NCSX, PPPL & DOE management
 - Daily Walkthrus by Industrial Hygiene and line management
 - Prejob / Post Job Briefs
- **Safety Performance:** There have been no time loss accidents associated with the Modular coil production (14 months) or FPA activities



Quality

- Quality Control
 - Procured parts are inspected using a sampling plan
 - * Dimensional Inspect
 - * Magnetic Permeability
 - * Other Inspections as required
 - Internal welding operations are 100% inspected
 - Electrical breaks are inspected for isolation
 - Electrical components are tested for continuity, resistance and insulation quality
 - Critical fasteners are torqued and witnessed by QC.
 - Cooling tubes receive a pressure and flow test.
 - Critical lifts require special procedures and 100% QC review



Summary

- The NCSX Winding Facility is up and running and aggressively improving performance and costs
- The NCSX FPA Facility is gaining momentum rapidly
- Planning and process improvement are being used to constantly improve safety and quality