NSTX

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NSTX CSU Upgrade Overview

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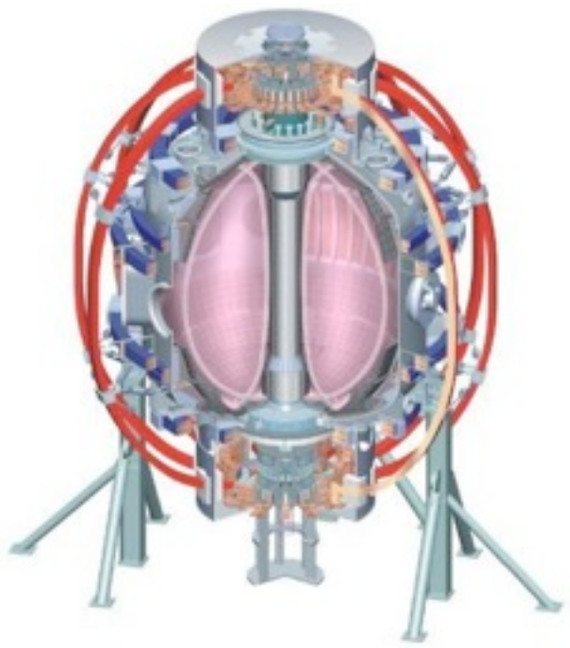
NSTX Center Stack Upgrade Peer Review
LSB B-318
May 18, 2011



College W&M
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CompX
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Nova Photonics
New York U
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IPP, Garching
ASCR, Czech Rep
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Purpose of this Review

- A technical checkpoint for the preliminary designs to be presented at the FDR in June
- To prepare for the cost estimates in preparation for the FDR and the CD-3 Approval for Construction
- To have peers review the progress to date and critique the status of the Final Design
- Chits are available to collect input from reviewers (E. Perry chairman). Once the presentations are completed chits will be collected, reviewed and dispositioned.
- What is not covered in this review
  - Detailed Cost and Schedule
  - Final assembly sequence of the upgrade

Charge to the Reviewers

- Are ES&H issues being properly addressed for the fabrication, assembly and testing?
- Does the final design meet the requirements for the NSTX Upgrade Project as delineated in the General Requirements Documents (attached)?
- Does the Final Design Review satisfy the objectives of PPPL Procedure ENG-033, "Design Verification", Attachments 4 and 6, "Design Review Objectives and Input Documentation" and "Human Performance Improvement/Factors Considerations in Design Reviews" (attached)?
- Have previous recommendations from previous reviews been adequately addressed?
- Have risks been appropriately identified? Are project plans adequate to address/retire the identified risks? Are there any "show stoppers" to starting fabrication and assembly?
- Have the cost and schedule estimates been updated? Do they reasonably reflect the cost, schedule, and resource efforts required to complete the project?

General Requirement Document

- The new center stack will provide a toroidal magnetic field at the major radius R0 of 1 Tesla (T) compared to 0.6T in the
- original NSTX device, and will enable operation at plasma current Ip up to 2 Mega-Amp (MA)
- compared to the 1MA rating of the original device.

CS Upgrade Scope
Machine Core / Coils

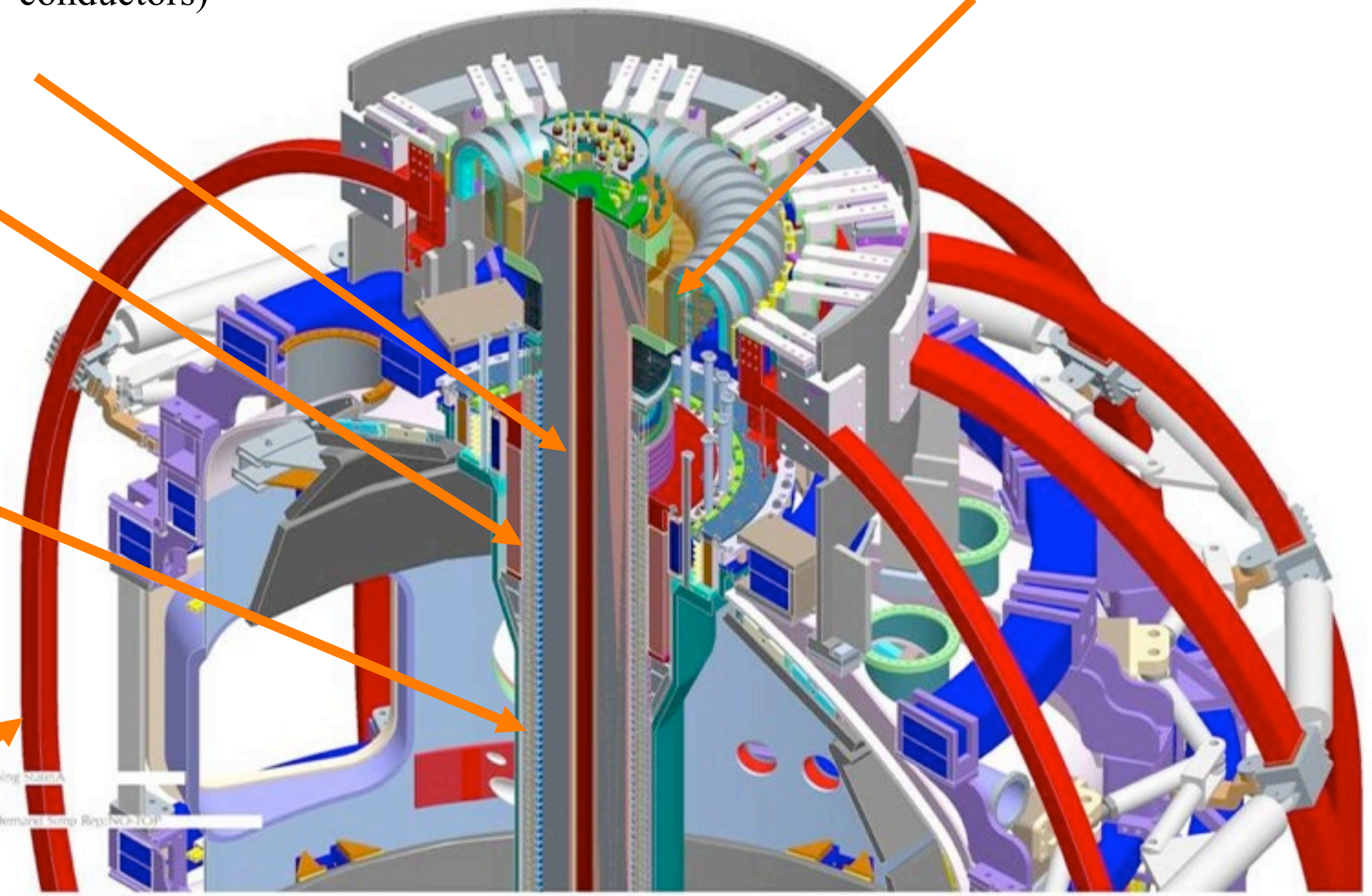
Simpler Inner TF design
(single layer of TF conductors)

Improved Joint Design

OH coil wound
on TF

New
Centerstack
Casing and Tiles

Existing outer
TF WITH water
cooling



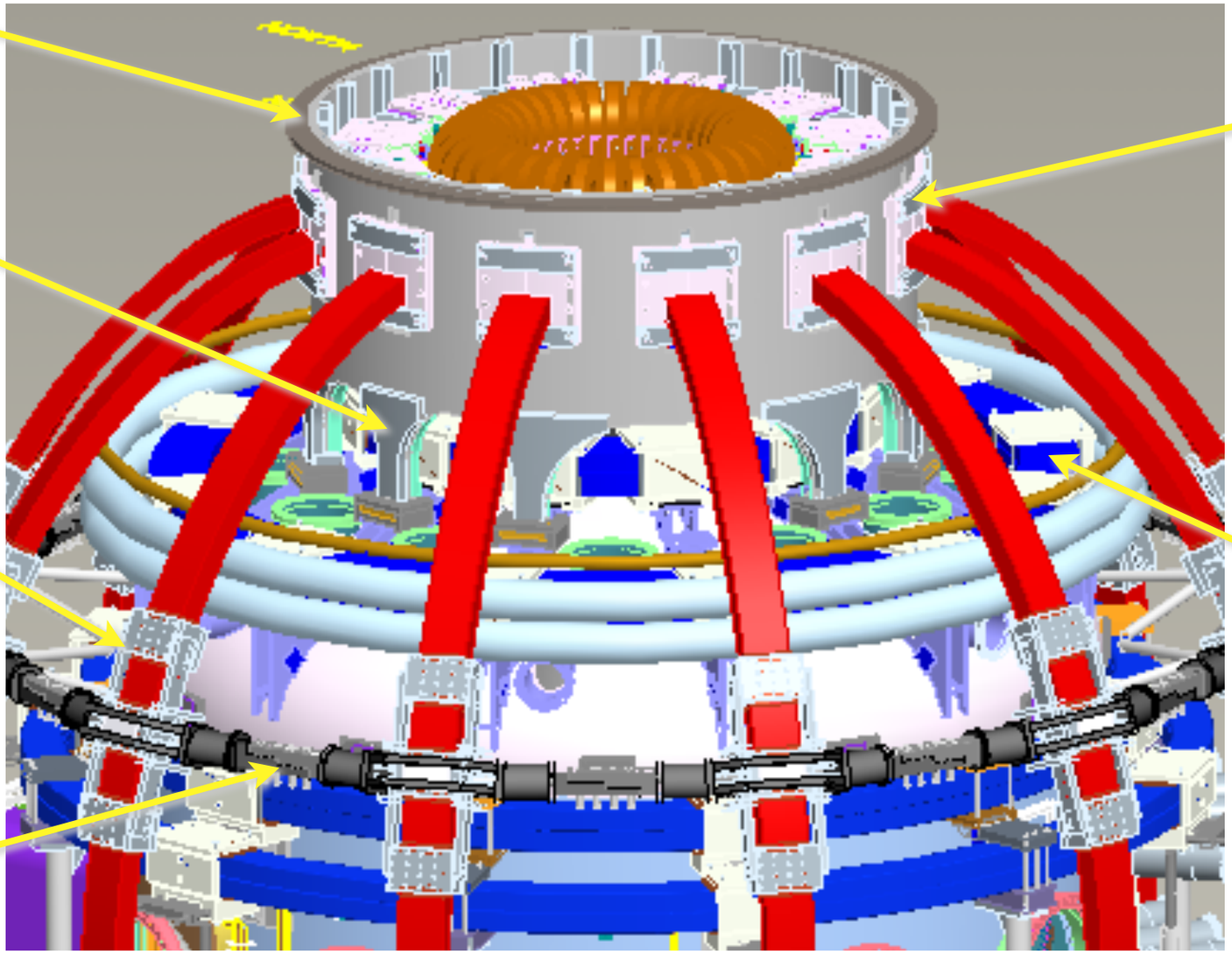
Structural Reinforcements

New Umbrella Lid (Not Shown)

Umbrella Reinforcements

Additional TFO Leg Clamps

New TFO Leg Support Ring



Umbrella Reinforcements

Additional PF2 Clamps, New Hardware on PF2&3, & Weld Reinforcement

Structural Support Modifications

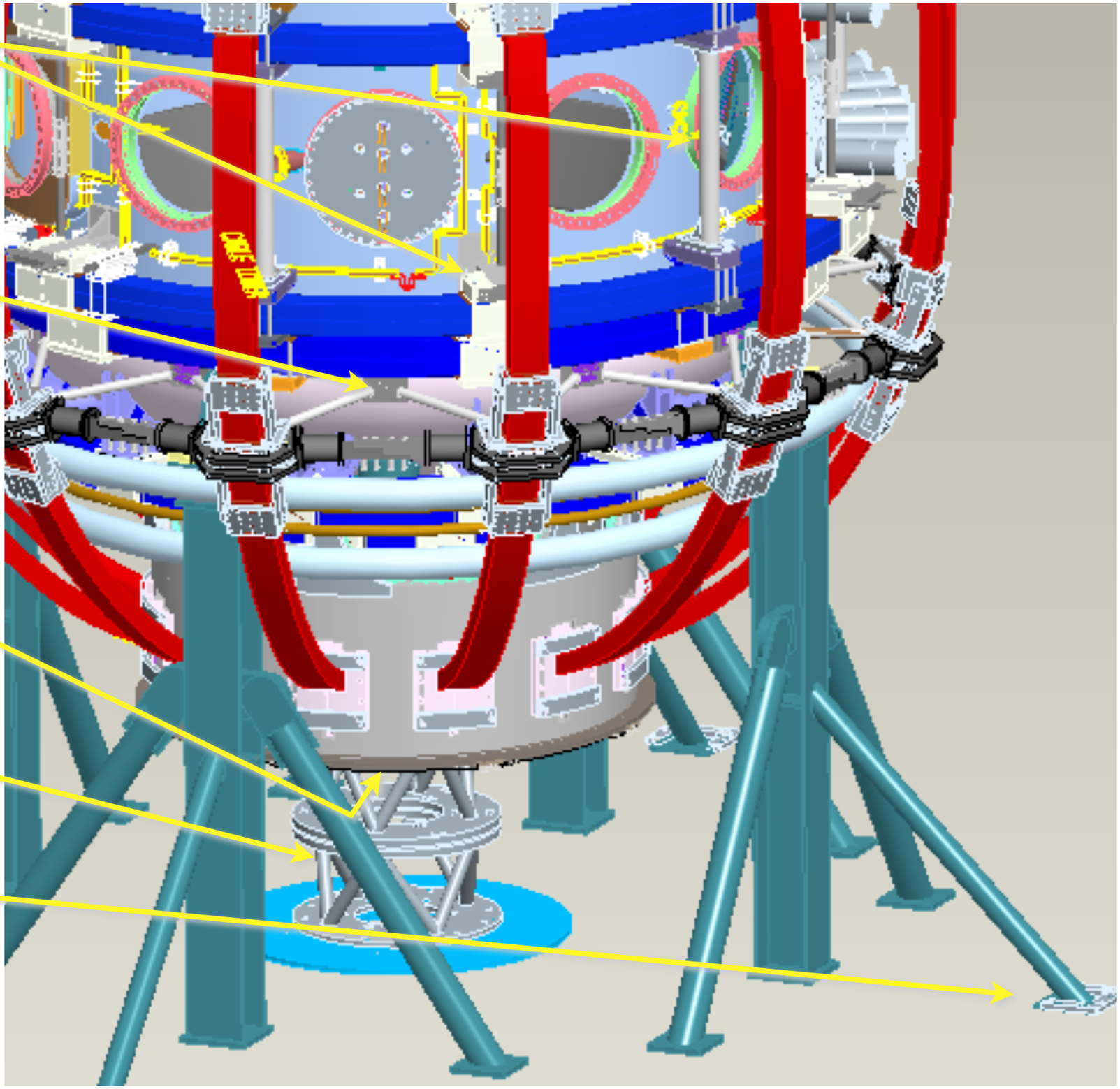
Additional PF4/5 supports & Reinforcement to existing

New Clevis and Connecting Rods

New Lower Umbrella Lid

New Pedestal

New leg foot reinforcement



CS Upgrade Scope
Electrical Tasks(part 3 of 3)

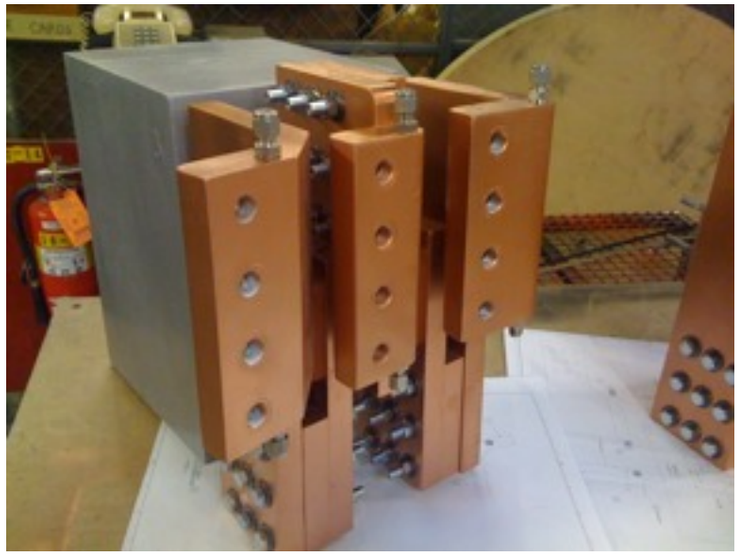
- Power Feed Upgrades (Raki)
  - Upgrade TF power supply to support full field capability of ~1T. (At ~1T, ~2.5s flattop every 20 min and up to ~5 s every 40 min)
  - Increase in PF 5 current to 34kA to meet new design point requirement.
- Controls (Sichta)
- Diagnostics (Kaita, Labik)
  - Relocation of Centerstack Magnetic diagnostics to new home
  - Relocation of MPTS to account for eclipsed view of new CS *(new)*
- Digital Coil Protection System (Hatcher)
  - New since last Peer Review
  - Requirements document produced
- Analysis (Titus)
  - Supports the design
  - Based on Operational Limits

Center Stack Progress to Date

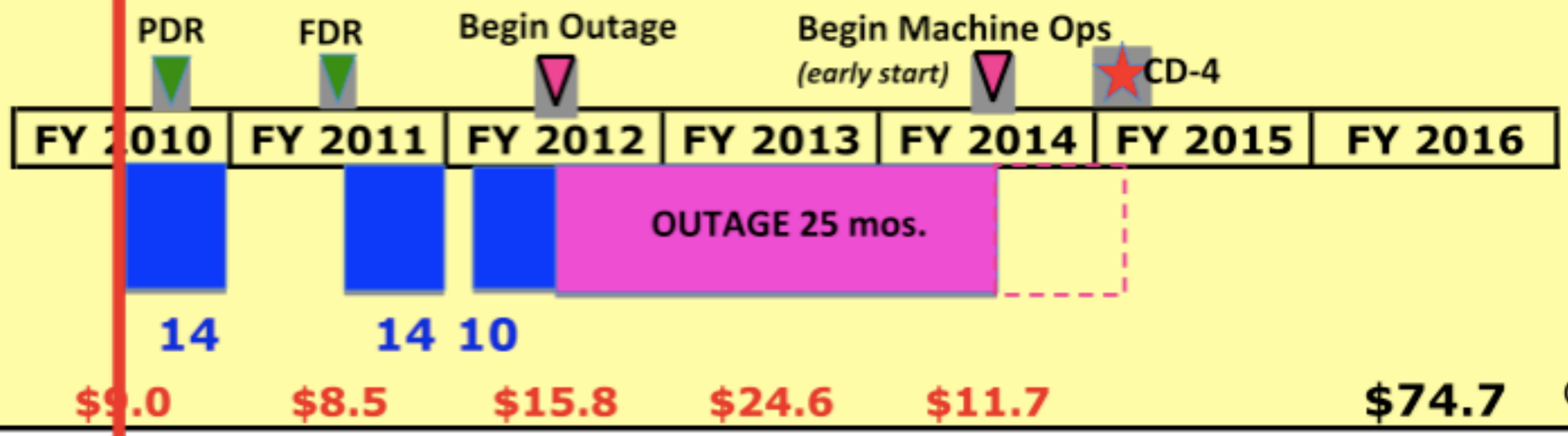
- CD-0 Approved February 2009
- Successful technical conceptual peer review in August 2009
- Successful Independent CDR October 28-29th
- OFES (Lehman) Review December 15th–16th 2009
- CD-1 was signed in April 2010
- Peer review April 2010
- PDR June 2010
- OFES Review August 2010
- CD-2 was signed

Plans for 2010

- Complete Final Design
- Complete R&D Activities (joint test, OH braze testing & flex joint mockup)
- Update estimates for FDR
- Project comprehensive FDR June 22nd – 24th
  - Outside reviewers
  - All WBS elements included
- Office of science review October
- Apply for and receive approval for CD-3
- Receive TF Conductor (Early Procurement)
- Place procurement for TF Conductor Machining

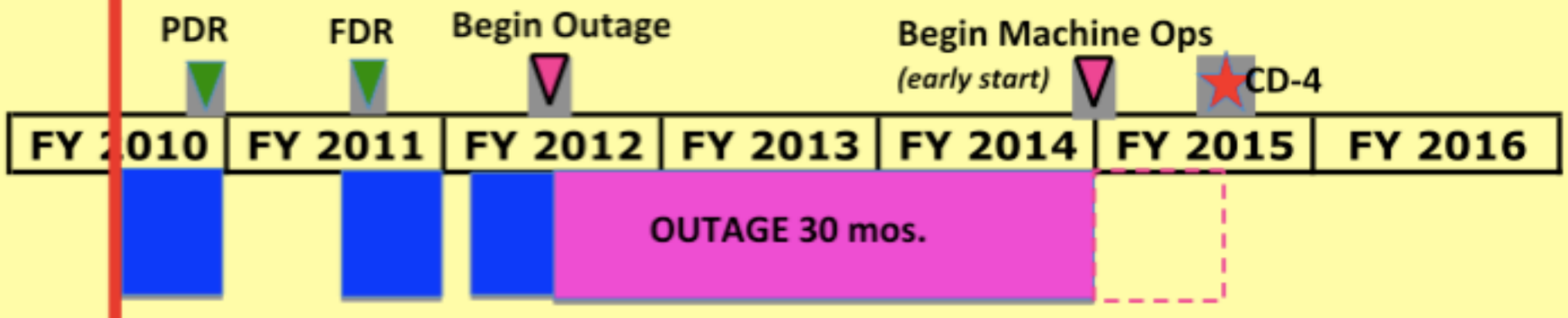


LOW Range



Operations							
Run Weeks	14	14	10				
Project Cost	$9.0	$8.5	$15.8	$24.6	$11.7	$74.7	(2)

HIGH Range



Operations								
Run Weeks	14	14	10					
Project Cost	$9.0	$8.5	$15.8	$27.2	$25.5	$1.9	$92.9	(2)