Engineering Update

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NCSX Project Meeting

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Topics

- Plans
- Progress
- Upcoming Milestones

December 20 Milestones

- ✓ Coil geometry fixed
- × Requirements (including reference scenario definition, flexibility, trim coils, and ancillary systems) in place
- ✓ Configuration-specific WBS developed
- ✓ Site selection finalized
- ✓ Option for providing power to coils selected
- ✓ Concepts for handling heat loads on plasma facing surfaces developed
- × Initial cost estimates and development plans presented

Coil Geometry Fixed

- The 1017 modular coils (with a supplemental TF set and a 5-coil PF set) was established as the reference engineering design for the PVR
- Coil data available on the Web

Requirements in Place

- **Three reference scenarios now mandated**
  - **2T, 0.2s flattop, 2MA/s**
  - **1T, 1.5s flattop, 2MA/s**
  - **Day One (1T, 0.2s flattop, 1.6MA/s)**
- **Waveforms for all 3 scenarios posted on Web**
- **Requirements documented for stellarator core (WBS 1) and auxiliary systems (WBS 2)**

Much Work on Requirements Remains

- **Requirements for flexibility needed**
  - **Coil currents and multipolar fields received from Pomphrey for iota flexibility at 2T, impacts to be assessed**
- **Requirements for trim coils needed**
  - **Brooks and Hatcher exploring different coil configurations, performance requirements are TBD**
- **Requirements for phased operation**
  - **Day One facility must support initial (Phase 1) experimental objectives (what exactly does this mean?)**
- **Requirements for diagnostics and supporting systems (power, utilities) need to be generated and documented**

Configuration Specific WBS Generated

- The WBS was revised (to the 2-digit level) to reflect the reference engineering design
  - Draft E is on the Web
- Input solicited from cognizant engineers to develop WBS to 3-digit level

Site Selection Finalized

- A study of D-site and C-site options was performed
- The combined PBX/PLT test cell was adopted as the reference site for the PVR
  - Clearing PBX/PLT test cell and bringing over DC power from D-site to C-site appears cheaper than moving 4 PBX beamlines to D-site

Option for Providing Power to Coils Selected

- 24 TFTR power supply sections (PSS) are presently unclaimed by NSTX
- DC power could be economically brought over with aluminum bus and cables
- These PSS appear adequate for powering NCSX at 1T with a slightly reduced plasma current ramp rate (1.6 MA/s v. 2 MA/s)
- Full performance capability would be achieved by either buying new power supplies for C-site or sharing power supplies at D-site with NSTX

Concepts for Handling Heat Loads

- Two concepts are being considered
  - Use large, formed panels for continuous plasma facing surface
  - Use discrete limiters and tiles
- Large panel option appears to be a simpler, more robust, and more flexible solution
- Key issues are fabricability and cost
  - ORNL is investigating, should have results by mid-January, down-selection to follow

Initial Cost Estimates and Development Plans

- High priority activity
- Meetings scheduled twice each week to review scopes of work, technical requirements, candidate design approaches, costing methodology, and cost algorithms and estimates for each WBS element
- Initial estimates should be available for the next project meeting

Excellent Progress in Configuration Development

- We think we have a workable machine configuration (a major milestone!)
- Near term focus on structural adequacy, fabricability, diagnostics integration, assembly, and cost
- Trim coils not yet incorporated
  - Design integration group will interface with Brooks and Hatcher to integrate trim coils

January 30 Milestones

- Physics and engineering ready to commit to PVR
  - 60 days notice to DOE
  - No showstoppers apparent (especially in design of stellarator core)
- PVR plans and documentation requirements established
- Requirements finalized
- Configuration of internal hardware set
- Trim coil geometry set ***NEW!***
- Port geometry and port allocations set
  - Diagnostics integration complete
- Initial cost and schedule estimates in place

Summary

- ***Generally tracking plan well but much work remains***
- ***Progress in next period will be critical***
  - ***Requirements***
  - ***Structural analysis of modular coils***
  - ***Diagnostics integration***
  - ***Trim coil integration***
  - ***Cost and schedule estimation***
- ***Need to have solid technical basis to commit to PVR by end of January***