NCSX Project Overview

Hutch Neilson
NCSX Project Manager

NCSX Project Meeting
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NCSX Configuration Development

“PAC-3 design” (June, 1999):

- Reference QA plasma configuration (“C82”) stable at β=3.8%.
- Saddle coil designs optimized for C82 plasma and reference machine concept.
- Machine construction concept based on new stellarator core and re-use of PBX-M coils.

Post-PAC-3 Assessment (June, 1999)

- Made good progress toward full realization of NCSX design goals, but not enough to hold Physics Validation Review.
- Need further development to demonstrate additional qualities:
  - Good magnetic surfaces.
  - Coil set flexibility and robustness for startup and physics studies.
  - Adequate pulse length, access, enhanced confinement strategy.
  - More complete power plant vision for the QA concept.

NCSX Configuration & Design Development Plan

Approach for Going Beyond the PAC-3 Configuration

- Improve tools to fold additional requirements into design process.
- Explore alternatives (tools, design strategies, machine concepts) more broadly.

FY-2000 Program

Sub-Phase	Accomplishments	Completion Date
IIa	• Improved physics tools to implement new requirements. • Candidate machine topology options for subsequent evaluation.	3/1/2000
IIb	• Updated reference plasma configuration meeting all requirements. • Most attractive machine topology options identified using C82.	6/1/2000
IIc	• Updated stellarator configuration based on new reference plasma and best machine topology.	9/1/2000

Conceptual Design (Phase III) and Beyond

- Physics Validation Review, Dec. 1, 2000.
- Conceptual Design Review, March, 2001
- Construction Start, Oct. 1, 2002.

Deliverables for March 1 Milestone

Improved physics tools to implement new requirements. (Physics)

Physics Requirements

1. Startup, flexibility, and robustness requirements (plausible profile sets) defined, and snapshot transport/stability assessments complete. **(Zarnstorff)**
2. Access. Requirements for heating, diagnostic, and pumping access are defined. **(Zarnstorff)**
3. Documentation. Updated Physics Requirements document is issued. **(Zarnstorff, Reiersen)**

Equilibrium code upgrades.

4. Upgraded VMEC, with convergence and resolution issues resolved, completed and implemented in the configuration optimizer. **(Hirshman, Reiman)**
5. PIES code modifications to improve physics (implementation of neoclassical effects) and efficiency (speed, usability) and are implemented and tested. **(Monticello)**
6. PIES and VMEC consistent with each other. **(Hirshman, Monticello)**

Physics targeting.

7. At least one improved transport evaluator implemented/tested in plasma configuration optimizer. **(Reiman, Zarnstorff)**
8. Optimizer criteria for obtaining good magnetic surfaces implemented/tested in plasma configuration optimizer. **(Reiman, Zarnstorff)**

Deliverables for March 1 Milestone, cont'd.

Improved physics tools, cont'd.

Flexibility evaluation.

9. Methodology for evaluation of coil-set flexibility/startup/robustness is developed and tested. **(Zarnstorff)**

Coil configuration searching.

10. Improved methodology for finding the optimum conformal coil configuration for a given plasma and background coil set implemented/tested. **(Hirshman)**
11. Capability to handle alternative background and conformal coil topologies of interest is available. **(Hirshman)**

Reactor extrapolations

12. QA Reactor parameter sensitivities based on scoping using available QA plasma and modular-coil solutions and spreadsheet models complete. **(Lyon)**

Deliverables for March 1 Milestone, cont'd.

Candidate machine topology options for evaluation. (Engineering)

Access evaluation

13. Implications of access requirements set by Physics (space envelopes, constraints) are understood well enough to evaluate proposed machine concepts. **(Reiersen)**

Machine topology options definition.

14. Several machine topology options have been explored and are defined for comparative evaluation in the next phase. Background coil options currently envisioned to be studied are:
    - A) Straight vertical TF coils
    - B) Tilted, planar TF coils
    - C) Modular coils (tilted TFs with out-of-plane deformations)
    - D) Torsatron winding

    Conformal coils can be saddles, wavy PF's, modulars, or combinations thereof. **(Reiersen)**

Cabled conductor R&D

15. Cabled conductor design criteria are defined. **(Nelson)**

This Meeting (Seven Weeks to March 1)

- Discuss updated NCSX design plan and milestones. (HN, MZ talks)
- Assess progress toward project goals, including milestone deliverables due March 1. (19 talks)
- Refine plans as necessary. (Discussion periods in each session)

Session	Discussion Leader
NCSX Project Plans	Neilson
Physics Targeting/Flex.	Zarnstorff
3D Equilibrium	Reiman
Access	Reiersen
Coil Design	Hirshman

- Wrap-Up: Status deliverables and identify any open issues, possible changes in plan. (HN)

Calendar

NCSX Dates in Boxes

Feb. 22-24	ICC Workshop, Berkeley, CA. (Abstracts: Jan. 24)
Mar. 1	NCSX Phase IIa Milestone
mid-March	Next NCSX Project Meeting (tentative)
Mar. 27-29	Sherwood Meeting, Los Angeles, CA. (Abstracts: Feb. 2)
Apr. 4-6	DOE/OFES Budget Meeting, Germantown, MD.
June 1	NCSX Phase IIb Milestone
June 12-16	EPS Meeting, Budapest, Hungary. (Abstracts: Feb. 1)
June/July	Next NCSX PAC Meeting (tentative)
Sept. 1	NCSX Phase IIc Milestone
Oct. 4-10	IAEA Meeting, Sorrento, Italy. (Abstracts: Mar. 3)
Oct. 12-16	Varenna Alternates Conference, Varenna, Italy.
Oct. 23-27	APS-DPP Meeting, Quebec City, Canada.
Dec. 1	NCSX Physics Validation Review

Meeting Procedures

- Presentation material stored at NCSX web site: http://fileroom.pppl.gov/ncsx/ .

- Presenters submit electronic presentations to Autumn Percival (apercival@pppl.gov, 609-243-2653) for posting on web site. Allow decent lead time.

Compact Stellarator Publication List on Web:

- Follow Stellarator Publications link on NCSX web page.
- Provide corrections and updates to Autumn.