NCSX Project Update and P

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Informal NCSX Program Advisory Committe
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NCSX Project's Design Goals

Goals Are As Presented at PAC-1

- Design a compelling experiment for the PoP mission.
- Minimize construction cost and time to first plasma.
- Conceptual Design Review in FY-1999.
- Ready to start construction in FY-2000.

The pace of the design process has been slower than projected. (
resolving remaining issues and uncertainties will be described at

The design uncertainties and open issues have narrowed substa
PAC-1.

The project's goals are achievable.

Review: NCSX Status at PAC-1

- Compact-stellarator opportunity was recognized. Community p principle program was being developed.
- Experimental goals and required capabilities were scoped in ge
- Potential physics properties for a range of NCSX plasma confic being explored.
- Coil design tools were just acquired and being adapted for hybr
- Adaptability of the PBX-M facility was being assessed.

Progress Since PAC-1

Experimental Goals and Requirements (M. Zarnstorff)

- NCSX research goals, outline plan were documented in PoP pr
- Physics design requirements have been quantified and docume working Physics Requirements Document.
- Performance-versus-cost tradeoffs are being evaluated. *What capabilities will optimize physics value for cost?*

Plasma Configurations (A. Reiman, H. Mynick)

- Can generate stable high-β QA plasma configurations with mor
- Candidate reference configuration compatible with PBX-M is be
- *Issue: adequacy of beam-orbit and energy confinement to acce with available heating power at PBX-constrained dimensions.*

Progress Since PAC-1, cont'd.

Coil Configurations (S. Hirshman, A. Brooks)

- Can generate reverse-engineered coil designs for QAS plasma
  or without auxiliary TF coils. Have demonstrated free-boundary
  reconstruction in sheet-current limit.
- Tools improvements to satisfy physics requirements with econo
  being developed. *What are the geometry requirements (numbe*
  separation, accuracy) for practical coils that successfully recon

Engineering Design (W. Reiersen, B. Nelson)

- Developed a preconceptual cost estimate based on an early pr
  coil configuration, re-use of PBX-M TF coils and vacuum vesse
  modifications to ancillary subsystems. Summarized in PoP prog
- Coil and first-wall solutions for in-PBX construction are being ev
  development of new-machine option has begun. *Which option p*
  value, considering physics capability, cost, schedule, and risk?

Program Reviews Have Influenced Projec

PAC-1 Report (March, 1998)

- Critical properties: compactness, high β, low recirculating powe disruptivity. *Incorporated in PoP proposal and design requirem research and experiment design. Reactor properties to be stud*

- Aim for 50% external transform as a central design point. *Cand configuration has >50% at edge.*

- Adopt reference configuration for costing. *Done for PoP progra external transform); in progress for NCSX machine proposal.*

- Investigate 3 construction options utilizing PBX assets: 1)minim disassembly, 2)remove top of vacuum vessel, 3)new machine. *1 & 3; 2 remains a backup.*

Reviews Have Influenced Project Directio

PAC-1 Report, cont'd.

- Provide additional resources for NCSX physics and engineerin
  expense of stellarator program breadth. *Additional $0.9M was*
  reprogrammed from other PPPL accounts, for a total of $2.7M i
  $4.1M provided in FY-99 for PPPL+ORNL+Collaborators.

- Technical issues: robustness, flexibility, disruption properties. *F*
  been made, more to be done.

PoP Program Review Panel Report (June, 1998)

- Reduce NCSX cost and construction time. *FY-99 work plans fo*
  requirements and performance-vs.-cost tradeoffs.

NCSX Plans for Remainder of FY·

Project approach: Parallel development of physics requiremen
design, and engineering design, with continuous feedback betwe
engineering efforts.

Schedule Goals

- Decide on plasma parameters and machine configuration– Feb
- Physics Validation Review, including details on cost– May-Jun
- Conceptual Design Review– September, 1999.

Project Issues and Design Challenges are Non-Trivial, bu

- An outstanding team is at work.
- Support of DOE, labs' management, and collaborators is excell
- An exciting research program provides incentive.
- Uncertainties have narrowed substantially this year.

The goals are achievable.

The NCSX Team

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