

NCSX

**Stellarator Core
Design Progress and Status**

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NCSX Project Meeting

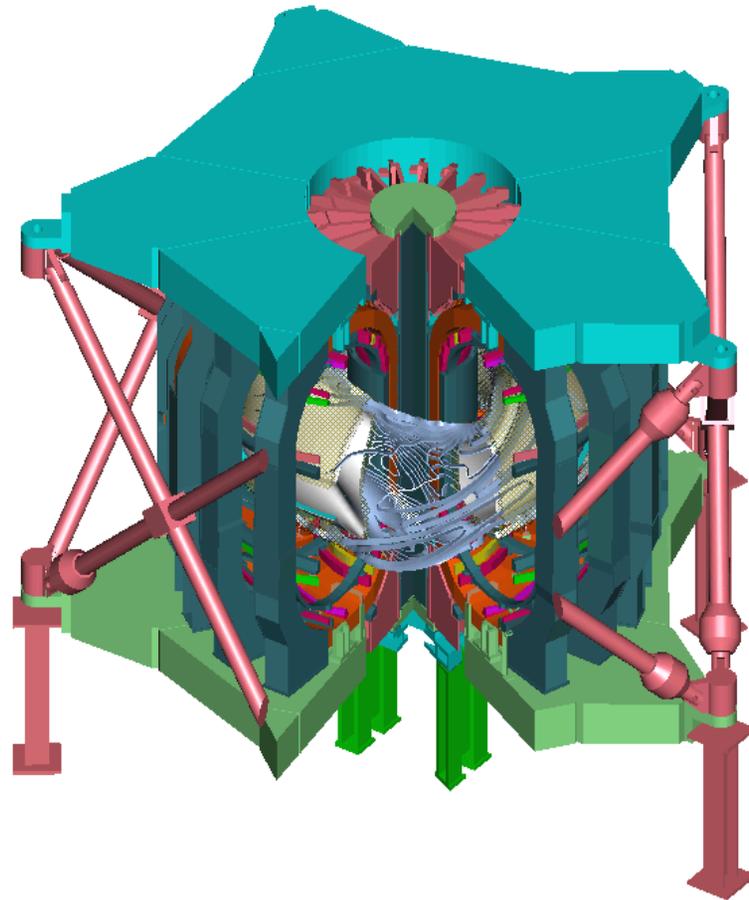
March 24, 2000

Outline of Presentations

- WBS 1 Overview and status Nelson
- Non-Axisymmetric Coil and Structure Design Williamson
- Design Criteria for cable conductor Nelson
- Vacuum Vessel and PFCs Goranson
- Design Integration / Access Cole

Focus of design effort has been PBX-M option

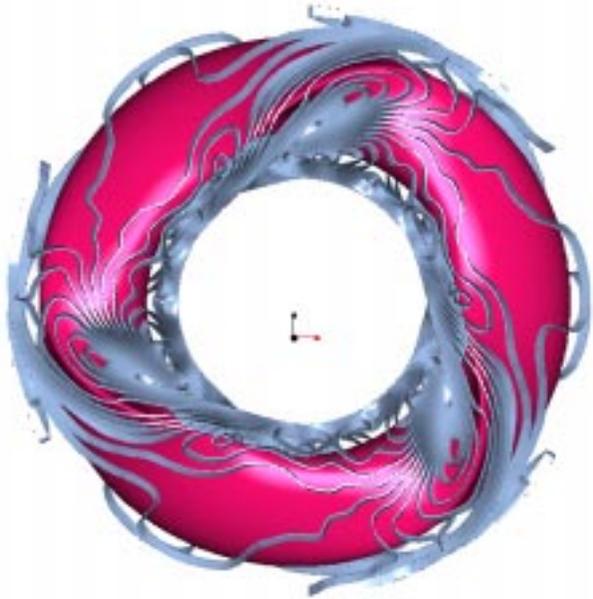
- Re-use PBX TF, PF coils and structure
- Add pre-assembled, “drop in “ stellarator core, consisting of
 - vacuum vessel,
 - saddle coils,
 - saddle coil structure
 - conformal cryostat



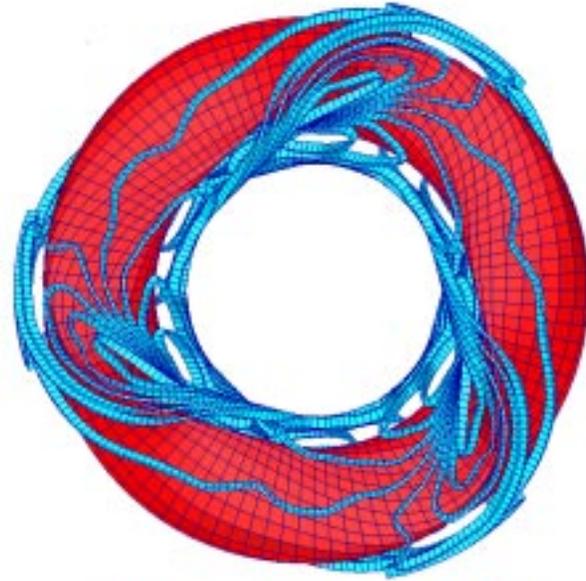
Saddle coil studies focused on C82, FS121-16.5 coil set

Parameter	C10, SAD18.5 16	C82, FD121 16	C82, 4064
Coils per period	26	26	10
Current for 2 Tesla	84 kA	91 kA	115 – 184
Plasma to coil center separation	18.5cm IB, 20.5 cm OB	18 cm IB, 18 cm OB	18 cm IB, 18 cm OB
Winding dimensions	16 x 70 mm	13 x 70 mm	(16-22) x 70 mm
Net current density	17500 A/cm ²	24600 A/cm ²	~27000 A/cm ² (7.7 mm web)
Temp at end of pulse (1.03s ESW)	139 K	184 K	273 K
Winding length	408 m x 10 turns	402 m x 10 turns	214 m x 10 turns

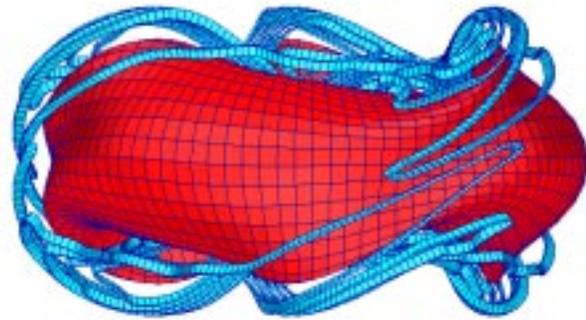
C82 saddle coil options



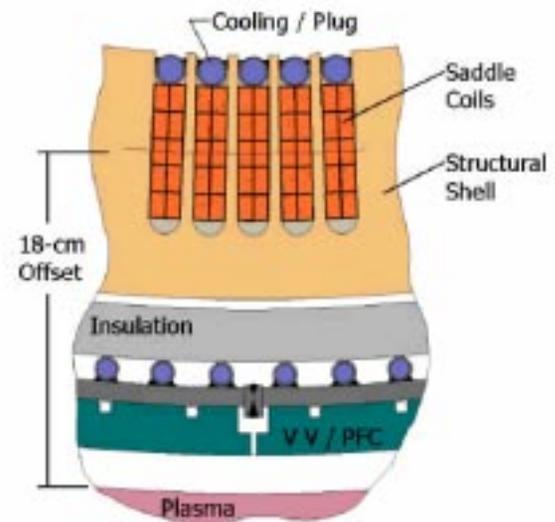
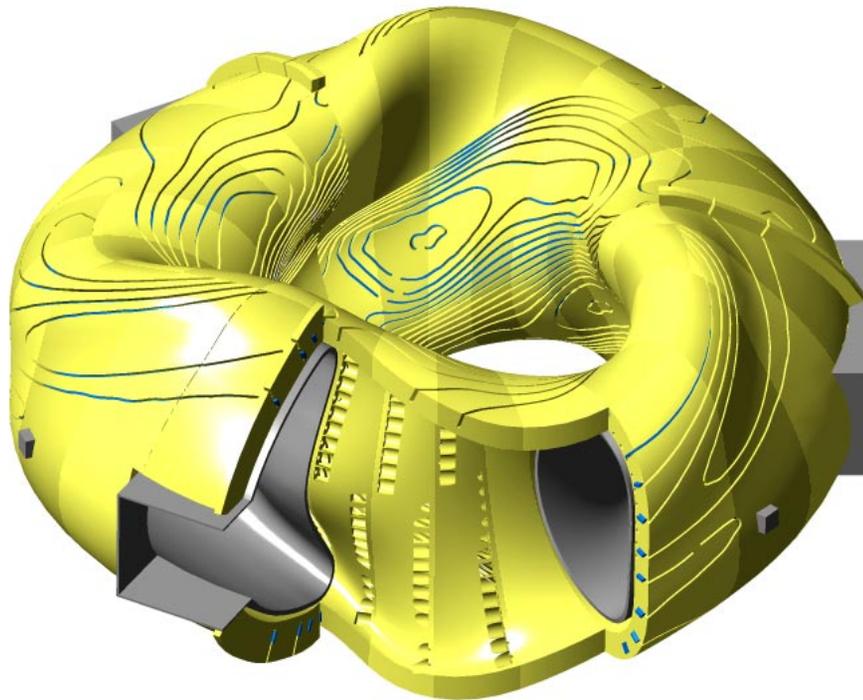
FD121_16



4064

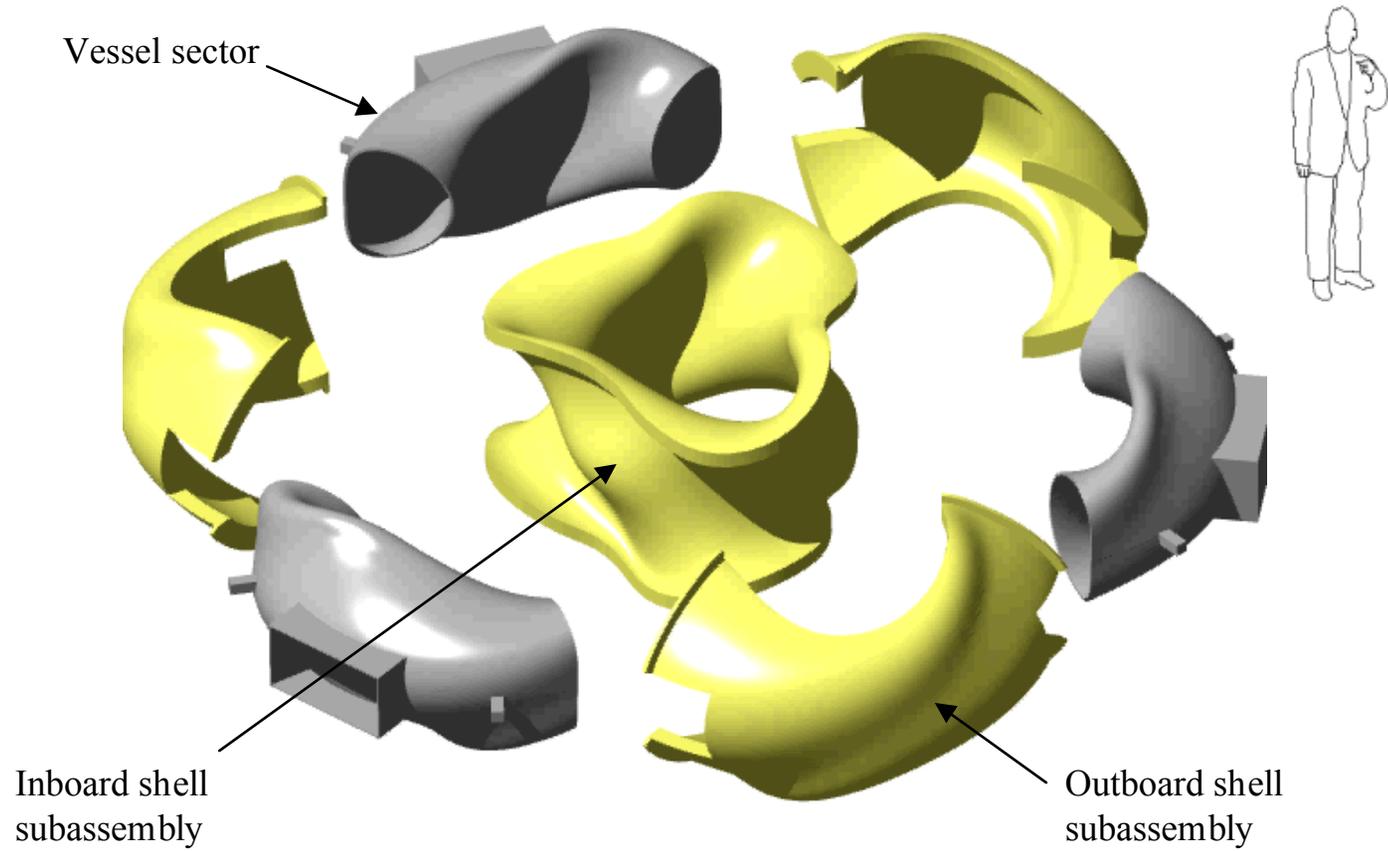


Saddle coils wound on segmented bronze shell

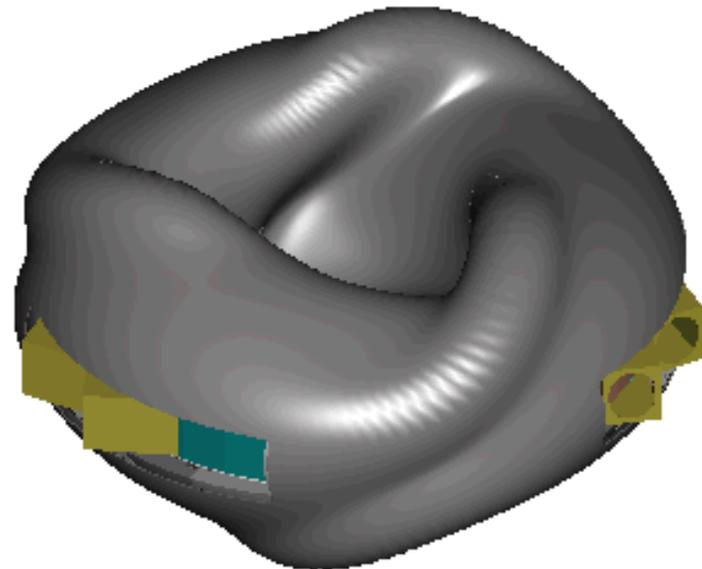
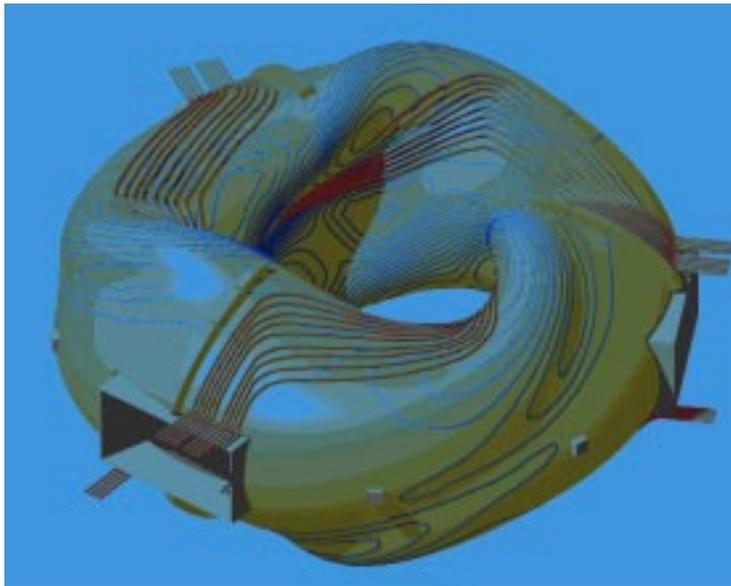


Typical Coil Cross-Section

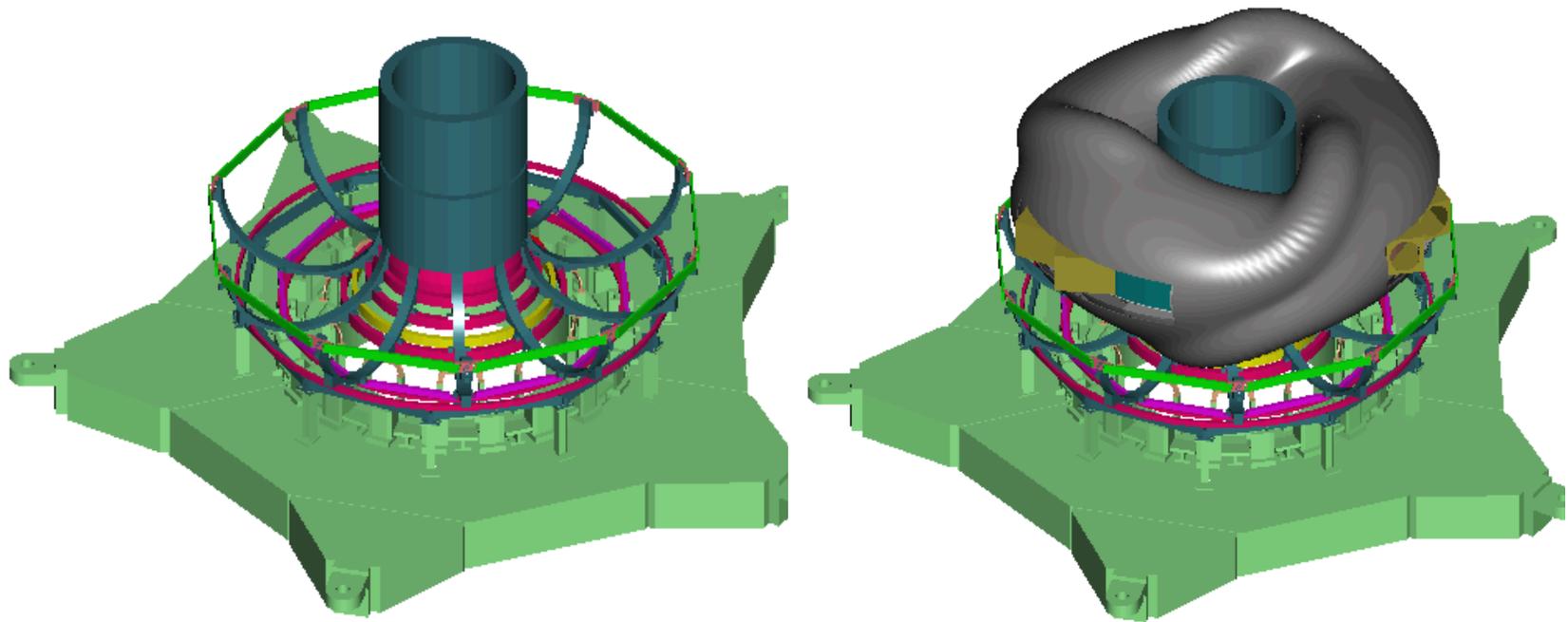
Vessel assembled around shell core, outer shell added



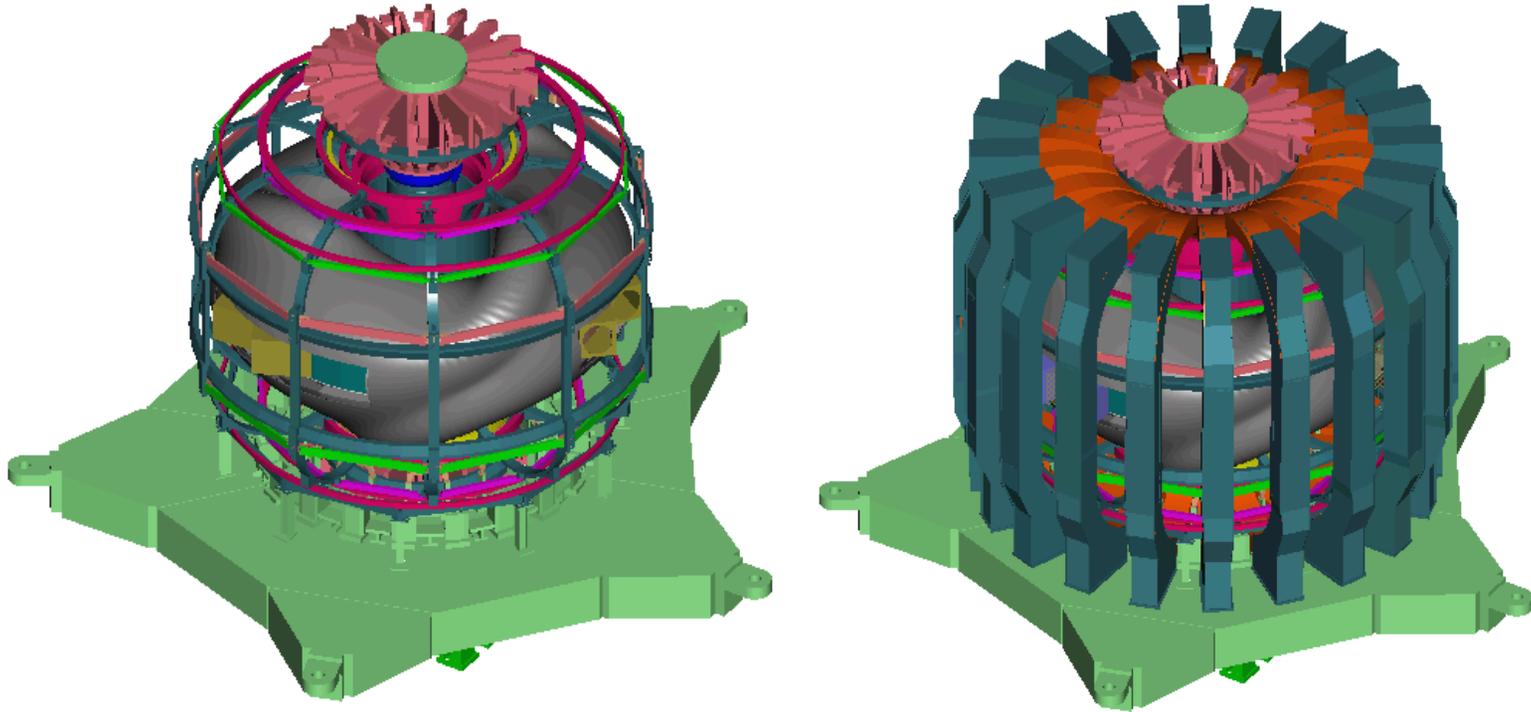
Leads are added and thermal insulation is sprayed on



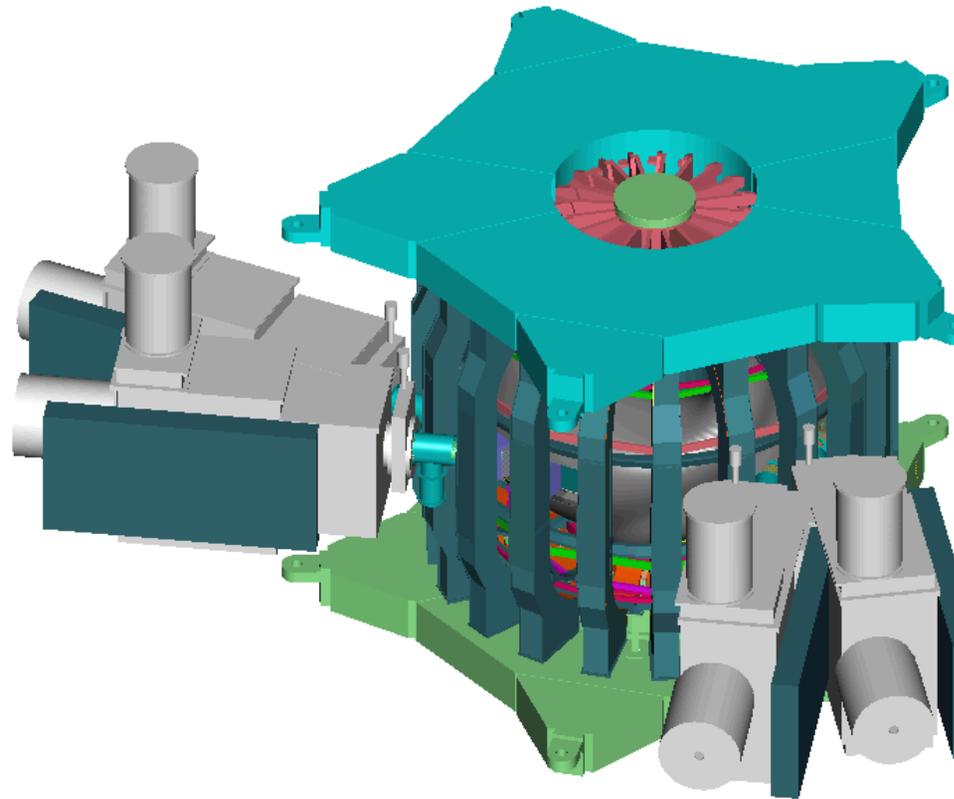
Core is placed on PBX lower structure and PF set



Upper PF coils are added, PBX TF coils are re-assembled



TF structure is added and NBI systems installed



Progress since last meeting

- **Design**

- Investigated access for C82 in PBX option
- Revised baseline radial build envelope, selected conformal cryostat option
- Investigated formed vessel as alternate to brake-bent vessel
- Performed various thermal, em load, and stress analyses
- Developed tools and began assessing non-PBX background coil options

- **R&D**

- completed cable compression tests
- designed small coil test form and sent to fabricator

- **Documentation Completed**

First draft of baseline stellarator core design description for PBX-M option
Access study memo, Cable design criteria memo, various analyses memos
Cable compression test R&D memo

Near term goals

- **Complete PBX-M option investigation**
- **Develop designs for alternate coil configurations to the point they can be compared with respect to:**
 - Feasibility / Design constraints
 - Access
 - Cost / Schedule
- **Develop lower cost PFC option**
- **Complete saddle winding R&D**

Near Term Plans / Milestones are aggressive

- Update and integrate cost algorithms into single spreadsheet 15-Apr-00
- Complete PBX option study based on C82 and revise cost est. 24-Apr-00
- Assess tilted TF coil option based on C82 08-May-00
- Assess L=3 option with conformal coils based on C82 29-May-00
- Complete small R&D coil winding 01-Jun-00
- Assess option w/o conformal coils based on C82 19-Jun-00
- Assess option based on PG2 10-Jul-00
- Complete testing of R&D winding w/o potting 31-Jul-00
- Provide low cost PFC concept 30-Sep-00