

Progress and Plans - NCSX Coil Group

February 23-24 1999 Meeting

ORNL

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Plans for NCSX Coil Group (1999)

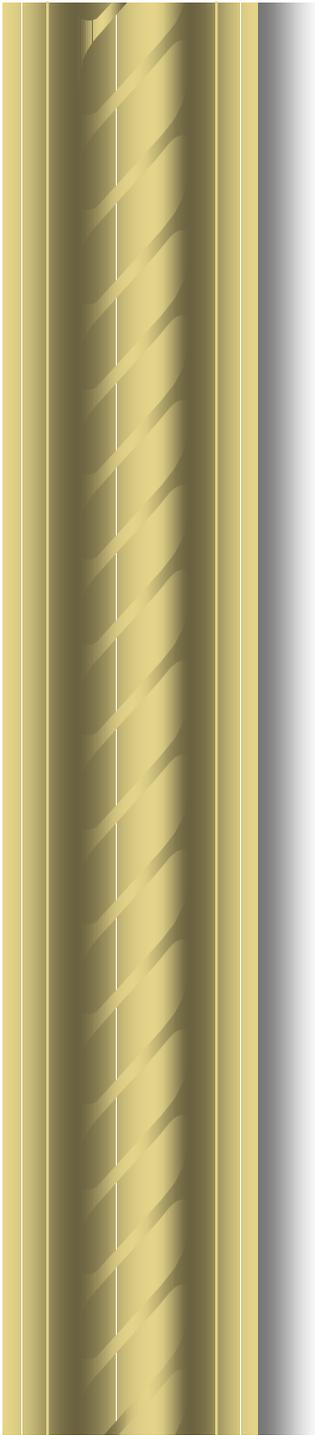
- Goal: obtain coils for NCSX:
 - low peak current densities and fewer coils/period (increased experimental relevance). Application to C82 is highest short term priority.
 - can be readily engineered (not too complex or “kinky”)
 - reconstruct magnetic surfaces well enough to preserve physics criteria

Plans (continued)

- Demonstrate reactor relevance
 - assessment of NCSX modular coils
 - necessary for SNOWMASS

Improved coil cutting algorithm (Pomphrey, Miner)

- Fewer coils/period have been realized for C10 at finite beta
 - Translates into lower current density at same B error level
 - Correlation with reconstruction underway
- Application to C82 imminent
- Use of genetic algorithm to improve scheme, locate global minima



Extend coil cutting algorithm (Valanju, Pomphrey)

- Target displacement in NESCOIL_CUT
- NESCOIL extension
 - Add $\text{grad}(|K|)$ penalty function: new current sheet starting point

Assess impact of finite coils (Brooks, Ku)

- Identify trends in current density, coil complexity with A , shear
- Reconstruction
 - Work with physics group to quantify “good” reconstruction
 - error tolerance needed to preserve physics
 - Sensitivity to resonant coil misalignments
 - PIES (Monticello) reduction of internal islands (Cary/Hanson at finite beta)

Additional coil enhancements

- Lower curvature, less complex coils
 - Extend ONSET collaboration (Drevlak, Brooks) to saddle coils for C82
 - way to reduce current density
 - Apply COILOPT (Miner) to C82. Add current density target.
- Extend NESCOIL to 3-D variations of the winding surface (Hirshman, Pomphrey)

Coupling to Physics Optimizer

- New optimizer framework available
- Various NESCOIL measures can now feedback to physics
- Reconstructions: need routine physics evaluation and feedback
 - Chi-sq (Brooks/Ku): impact on confinement and stability

Reactor-relevant modular coils (Valanju, Pomphrey)

- NESCOIL modified to compute B_{max}/B_0 from current sheet
 - Preliminary C10 result: larger by 70% than similar A tokamak
- Provide COE, Fusion power (A, separation) for NESCOIL (Lyon)
- Scan A to optimize COE, Fus. Pow.
- SVD: smoother coils at larger separations (in NESCOIL)

Benchmarking codes (EVERYONE!!!)

- **W7X coil evaluation has been done using our existing tools (Brooks).**
- **An illustrative exercise: apply advanced tools to reduce currents in W7X coils.**

Code conversions and integration (Miner).

- Continue conversion to F90 of NESCOIL modules
- Imbed codes into UNIX scripts for merging with optimizer