Benchmarking and Validation Initiative for Three-Dimensional Equilibrium Calculations
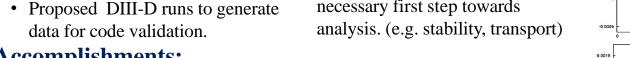
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Objectives

- cross-benchmarking and validation of 3D equilibrium calculations
- Compare full range of stellarator and tokamak equilibrium codes
- Codes with differing physics models provide insight into the physics
- Proposed DIII-D runs to generate data for code validation.

Significance.

- ELMs must be suppressed or amplitude reduced by order of magnitude for ITER to achieve goals.
- ITER will have nonaxisymmetric coils for purpose of suppressing ELMs by small magnetic perturbations (RMPs).
- Numerical predictive capability desired to guide use of 3D coils.
- Generally, equilibrium calculations necessary first step towards analysis. (e.g. stability, transport)

Accomplishments:

- Double-null shot from DIII-D ELM suppression experiments allows application of full range of stellarator and tokamak 3D equilibrium codes.
- Participation of 8 codes with differing physics models and computational methods.
- Finding significant differences in solutions for radial flux surface displacement on inboard side of tokamak from VMEC stellarator code and tokamak perturbed equilibrium codes. (See figure.)
- Disagreement traced to difficulty VMEC has in handling localized currents near rational surfaces.
- Two half-days of DIII-D run time in May devoted to generating data that allows validation simultaneously with benchmarking.
- Comparisons with experimental data are being pursued.