Magnetic Error Field Workshop
Albuquerque, Oct. 31 – Nov. 1, 2003

Summary by Ted Strait
at MHD Mode Control workshp
(Austin, Nov. 3-5)

~ 30 participants

12 talks = 8 experimental + 4 theory and modeling

lots of lively discussion!

Error field effects

- Locked modes (C-Mod, JET, DIII-D)
- Toroidal flow damping (JET, DIII-D)
  - Viscosity (Boozer)
  - Neoclassical effects (Callen)
- Global equilibrium changes (small effect: Callen)
- Uncertainty of equilibrium reconstruction (DIII-D)
  - Significant effects on local measurements (Lao)
- Stochastic edge layer (DIII-D)
  - ELM control tool

Sources of error fields

- Coil misalignments
- Coil feeds
- Eddy currents
- Stable MHD modes
  - ("error field amplification")
- Scrape-off layer currents
  - (source or effect?)

Correction of error fields

- Robust coil design (NCSX)
- Correction coils
  - Need enough degrees of freedom to control modes of interest, but not necessarily perfect matching to mode structure (Boozer)

New experimental tools

- JET: 4 external coils – 2004
- NSTX: 6 external coils – 2004
- C-Mod: 2x4 external coils ("A-coils") – first results
- DIII-D: 2x6 internal coils ("I-coils") – first results

Measurements of error fields

- Direct (local B-fields)
- Inferred (optimum correction field)
  - Maximize rotation
  - Minimize locked modes
  - Feedback control of delta-B

  – optimization methods are self-consistent, though results vary with beta (DIII-D)

Inconsistencies? (DIII-D)

External vs. internal coil
Direct vs. inferred
– Toroidal phase is consistent, but amplitude is not consistent
  - Correction coil sidebands?
  - Unmeasured sources of error field?
  - "Unconventional" plasma response?

New C-Mod results:

Critical error field for locked modes in ohmic plasma is slightly less than predicted from JET/DIII-D scaling.
 Supports more optimistic size scaling to ITER

Key issues

- Modeling of plasma response to non-axisymmetric fields. (3-D equilibrium)
- Physics of toroidal flow damping predictive capability
- Consistency of optimized error correction vs. measured error fields.
- Scaling of plasma rotation and critical error fields to future devices.
- Possible role of scrape-off layer currents.