POSSIBILITIES FOR PLASMA CONTROL

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Plasma control development for NSTX and DIII-D can take advantage of the similarities in requirements for the two experiments

- Thus far, capability already in use for DIII-D has successfully been applied to NSTX.
  - Plasma control system infrastructure software.
  - Real time equilibrium reconstruction (rtEFIT) and isoflux control.
- In the planned next steps, many developments will be new to both NSTX and DIII-D.
  - E.g. Model-based integrated controllers.
- Many of the ideas for new work are similar: pressure and current profile control, MHD control.
- This presents opportunities for plasma control improvements that simultaneously benefit both experiments.

The present plan for plasma control collaboration focuses on the model-based multiple input/multiple output controller for improved shape control

- First step leading to profile control.
  - Profile and shape control are coupled requiring an integrated, model-based controller.
- Improvement on empirical determination of gains for a PID controller.
  - Systematic design method for new plasma configurations.
  - Explicit means for trading off conflicting control demands (e.g. relative accuracy of gap and X point control).
  - Methods for dealing with hardware constraints (e.g. giving up control accuracy as coil currents approach 0 or the maximum level).
- This work is presently planned for the next 3-5 years.

Possibilities for new major efforts on plasma control for NSTX

- Add MSE data to rtEFIT for real time q profile reconstruction.
  - Necessary for current profile control.
  - Planned for DIII-D in 2003.
- Integrated controller for shape and current profile.
- Improved vertical position control to allow increased elongation.
- Add profile diagnostics (electron temperature and density, ion temperature, rotation) to PCS for pressure profile control.
  - Conceptual plan exists for DIII-D.
  - Requires concept for actuators that can modify pressure profile.
- MHD control: resistive wall modes, neoclassical tearing modes.
  - A significant opportunity for collaboration between NSTX and DIII-D.