Poloidal Gap system is fully operational

System can correct all measured poloidal modes...

Field errors cause problems

- Magnetic fluctuations may lock to gap errors
- Locked mode amplitudes grow, degrade confinement
- Field errors at gap cause increased wall interaction, impurity influx

Poloidal Feedback System Uses Analog Signal Processing, Switching Amplifiers

- Analog system is simple, fast, but flexibility is limited
- Weighting coefficients programmed with plug-in resistor boards
- System can drive radial field to zero or to programmed waveform
- Spatial Fourier Transform approach allows selecting individual modes
- Individual modes can be excited separately
- Individual modes can be allowed to grow

Poloidal Gap has 32 sense coils, 38 drive coils

- Main poloidal field
  - 38 drive coils each
  - 30 turns (power)
  - One drive coil crosses both poloidal, toroidal gap

System can drive selected spatial modes

- 32 sense coils (yellow) inside vacuum vessel

... or allow selected modes to grow

Fiber-optic links control High-power amplifier stage

Pulse-Width Modulators have synchronized clocks, selectable phases

- 38 switching amplifiers, each +/- 100 A, ±450 V
- Small plug-in boards set weighting coefficients

System can correct all measured poloidal modes with no correction

Field errors correction presents challenges

- Toroidal gap has only small holes, so feedback must be direct
- Feedback from poloidal coils must be accurately timed
- Toroidal system monitors poloidal gap, but errors at toroidal gap propagate to poloidal

Design of Programmable Power Supply for main toroidal, poloidal fields underway

- Goal: arbitrary programmed and feedback voltage / current for main toroidal and poloidal fields
- Can program for Oscillating non-invasive drive
- Toroidal supply: 1 MA, ±20 kV (single-turn secondary)
- Poloidal supply: 100 kA, ±100 V (single-turn secondary)
- Build toroidal system first since it's smaller, lower power

Each module: IGERT H-bridge, 0.3 J 1 kV capacitor bank

Planned toroidal system uses multiple IGERT H-bridge in series and parallel

- Initial single-machine system in daily operation for one year
- Spatial Fourier Transform system in operation for two weeks
- System is fully automatic, requires no operator intervention
- System can fully correct errors for plasma currents < 450 kA, partially correct for higher plasma currents

What is effect on plasma? See poster 37, this session