1. Goal of HSX

Demonstrate the potential benefits of quasisymmetry.

- HSX has a helical axis of symmetry in $|B|$ and a resulting predicted very low level of microclassical transport, $q_0 \sim 0$.
- For experimental flexibility, the quasi-helical symmetry can be broken by adding a mirror field.

2. Evidence for Improved Single Particle Confinement

Energetic electrons produced by 2nd harmonic ECH are well confined with quasisymmetry and lead to immense heat-scape signals.

3. Energetic Particles Drive MHD

- Plasma is more thermal as density is increased.
- "Fish-bone" like discharges are observed in low density QHS operation.
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4. Particle Transport

- QHS edge density variation for QHS and mirror.
- Density profiles measured with ECE.
- HXR signal in mirror at $n_e \sim 4 \times 10^{11} \text{cm}^{-3}$.
- Mirror, measured thermal diffusion driven below profiles.
- Edge turbulence characteristics similar in QHS and mirror.

5. Thermal Transport

- Increasing range of effective ripple: By varying the current in modular coil type 3 of 0.6 period, a broad range of effective ripples can be achieved with well-formed magnetic surfaces.
- Increasing range of effective ripple: By varying the current in modular coil type 3 of 0.6 period, a broad range of effective ripples can be achieved with well-formed magnetic surfaces.
- High density, high power operation:
  - Increase operating field to $B=1.4$ T.
  - Q-mode operation at 1 T gives factor of 2 in $k_T$ and reduction of total population.
  - Reduction in anomalous transport
  - Presently installing upgraded ECH transmission line to bring system up to full power (200kW).
  - Implement a 2nd 28 GHz gyrotron.
  - Available power increased from 200 to 400 kW.

6. Future Directions

- New diagnostic initiatives
  - Implementing a CHERS system for measurement of radial electric field.
  - Diagnostic neutral beam ready to be installed on HSX.
  - Diagnostic neutral beam on loan to HSX from the MST Program.
  - Upgrade ECE system to 16 channels to measure the whole profile including central values for $k_T(\omega T)$.
  - Thermal conductivity with heat pulse propagation technique.
  - Diagnostic neutral beam ready to be installed on HSX.

Energetic Particles Drive MHD

- Correlation lengths ($L_r \approx k^{-1}$) and times are similar over a range of densities (see poster by Lechte).
- Turbulent diffusion ($D_T(n_e) \sim 0.8 \times 10^{-6}$) at high density - on the order of global transport analysis at the edge.

Overview of Recent Results from HSX and the Planned Experimental Program


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15th International Stellarator Workshop, Madrid, Spain, October, 3-7, 2005