

CHI Relationship to IPPA Milestones

- Demonstrate on NSTX innovative techniques for starting up plasma currents in toroidal fusion devices that will allow these devices to be made simpler, run longer, and cost less to construct.
- Measure and analyze the effectiveness of using a combination of non-inductive techniques to assist in startup and sustainment of plasma pulse lengths up to 1 s.

2004-8 CHI Research Goals

Phase I:

- Extend full feedback control to CHI only discharges.
- Hand off a CHI discharge for operation using the central solenoid.

Phase II:

- Hand off a CHI discharge for operation using a non-inductive current drive system.
- Establish limits on CHI produced edge current drive in a lower single null ohmic discharge.

Near Term Objective: Supporting CHI Experiments

- Understand experimental operations with new Absorber.
- Investigate flux closure by generating a high current, long pulse discharge. Characterize the electron pressure.
- Initiate feedback control studies.
- Produce reference high current CHI discharges (similar toroidal current but different injector flux and toroidal flux) for benchmarking codes (TSC, ESC, EFIT, 3D-MHD).

Modeling and Diagnostics

- EFIT (Implement open field line currents and wall currents) - Schaffer, Lao (GA)
- 3D MHD simulations - Tang (LANL)
- ESC code reconstructions - Raman (UW), Zakharov (PPPL)
- TSC simulations for discharge development - Raman (UW), Jardin (PPPL)
- Dynamo probe - Ji (PPPL), Boedo (UCSD)
- MSE for current profile - Levinton (Nova Photonics)
- Edge rotation - Nagata (Himeji), Soukhanovskii & Bell (PPPL)
- Divertor heat flux and Langmuir probes - Maing & Busch (ORNL), Kugel (PPPL)
- Edge fluctuations - Maqueda (LANL), Zweben (PPPL)

Hardware Improvements

- 2kV Injector voltage capability.
- Increase tracking distance along external insulator surfaces.
- Investigate need for an auxiliary heating system to heat CHI plasma core. Implement if necessary.
- Investigate improvements to PF2, PF3 coil systems response time. Implement modifications if needed.
- Study improvements to CHI for CS upgrade.

Diagnosics Improvements

- Install an array of toroidal field measuring Mirnov coils for measurement of poloidal current path on vessel surfaces.
- Quantitative spectroscopy of a CHI plasma and correlation with divertor heat loading.
- Investigate the possibility of profile measurement along a vertical chord (top to bottom along machine axis).

Proposed CHI Research Plan 2003-8

2003:

Flux closure assessment.

Initiate feedback control studies.

Improve on adding CHI to OH and investigate methods to limit uncontrolled density rise during ELM free ohmic discharge. Investigate edge rotation of ohmic plasma.

Initial results from ESC, TSC and EFIT codes.

Initiate dynamo probe studies.

2004:

Implement full feedback control operation.

Establish edge current drive in an ohmic plasma.

2005:

Hand off a CHI discharge for ohmic operation.

2006:

Hand off a CHI discharge to a non-inductive current drive system.

2007:

Establish level of edge current drive for non-inductive operation.

2008:

Fully integrate CHI with other current drive methods.