Transient CHI Start-up (XP 531)
[On-going XP results update]

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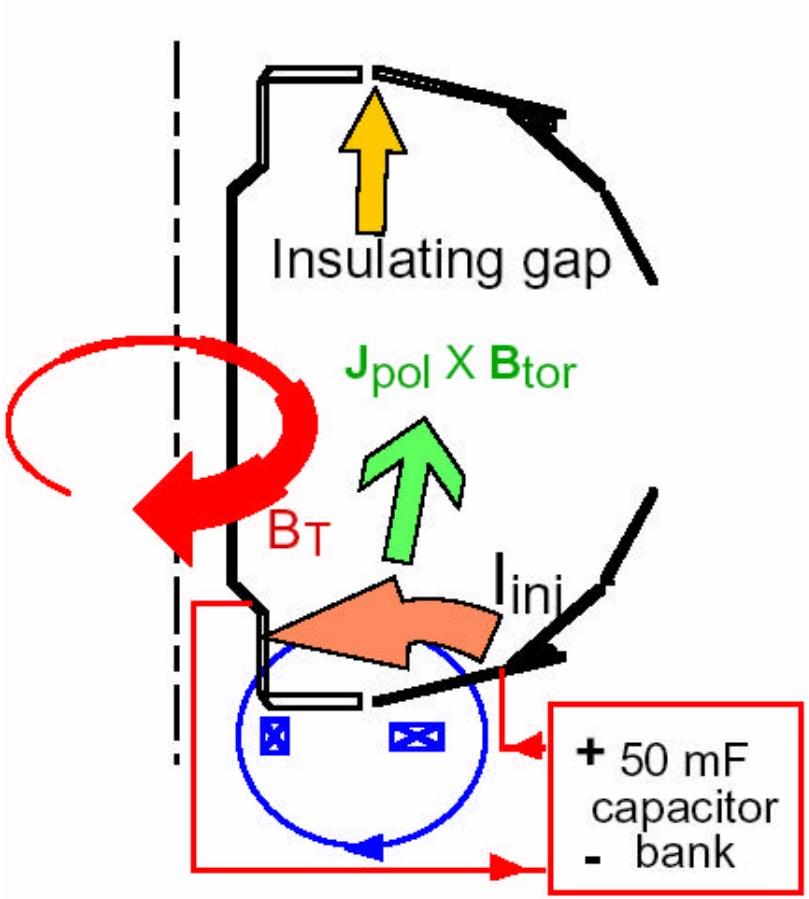
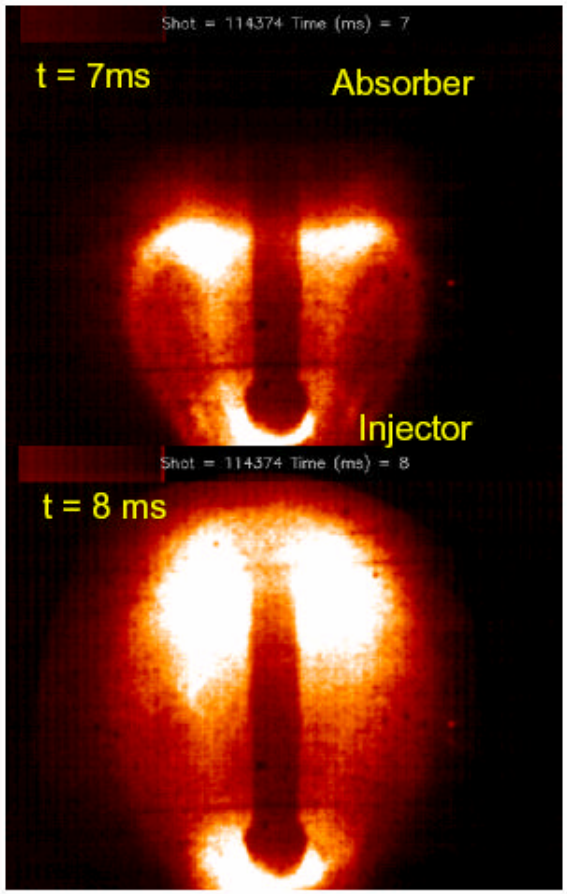
Implementation of Transient CHI





Expect axisymmetric reconnection at the injector to result in formation of closed flux surfaces

Fast camera: C. Bush (ORNL)

Capacitor bank used in Transient CHI Experiments

- Maximum rating:
  50 mF (10 caps), 2 kV
- Operated reliably at up to 1.3kV (5 caps)
- Produced reliable breakdown at ~5E-5Torr
  - ~60 Torr.L used in 2003
  - ~ 20 Torr.L used in 2004
  - 1.7 Torr.L used in present expts
  - Constant voltage application allowed more precise synchronization with gas injection
  - EC-Pi and gas injection below divertor used for Pre-ionization assist

This year we improved pre-ionization to a level that results in injected gas 10 times less than in 2004

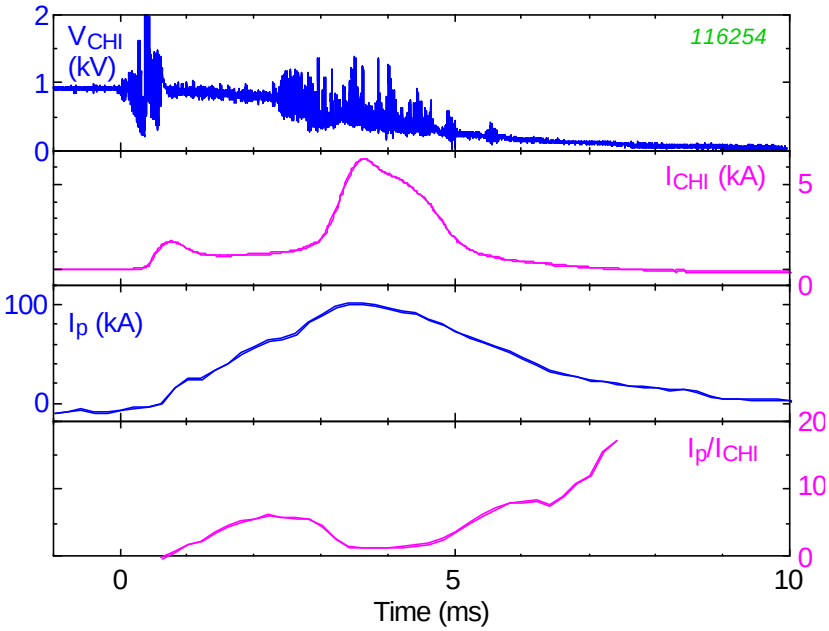
Novel pre-ionization system

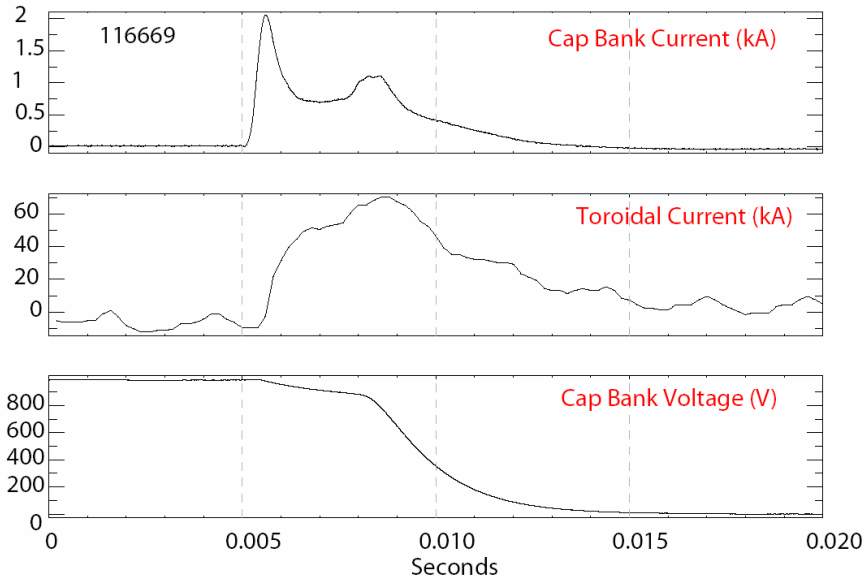
- Injects gas and 13 kW of 18GHz ECH in a cavity below the lower divertor gap
- Successfully tested, achieved discharge generation at injected gas amount of < 2 Torr.Liter

Fast Crowbar system

- Rapidly reduces the injector current after the CHI discharge has elongated into the vessel.
- Successfully used in on-going discharges

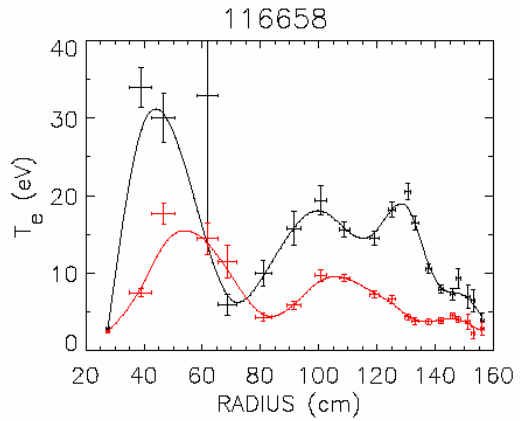
In initial transient CHI discharge in NSTX

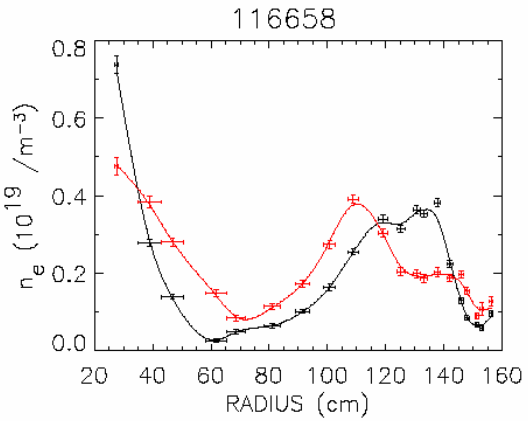


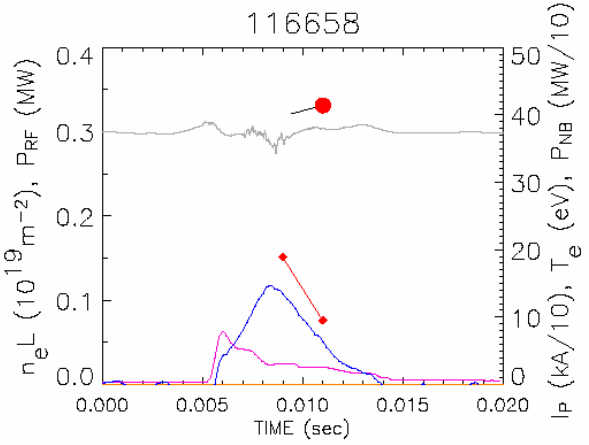


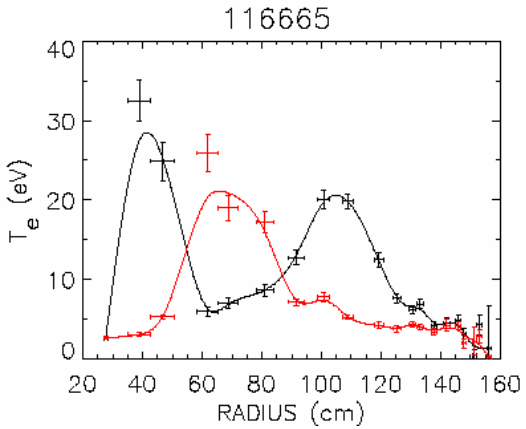
Current multiplication factors of over 170 observed.

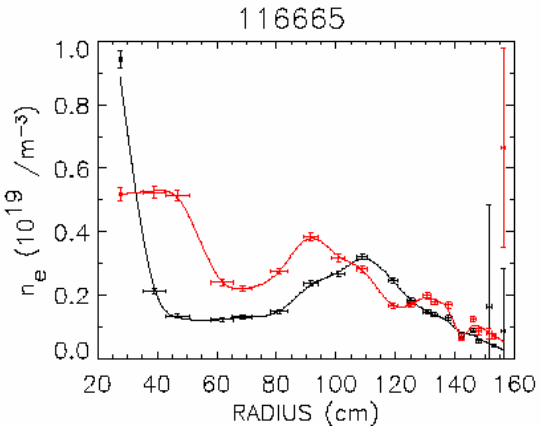
Te ~ 20-30eV measured in Yr 2005 discharges

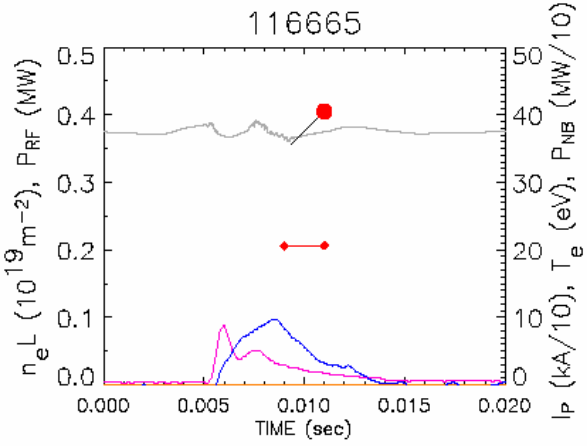










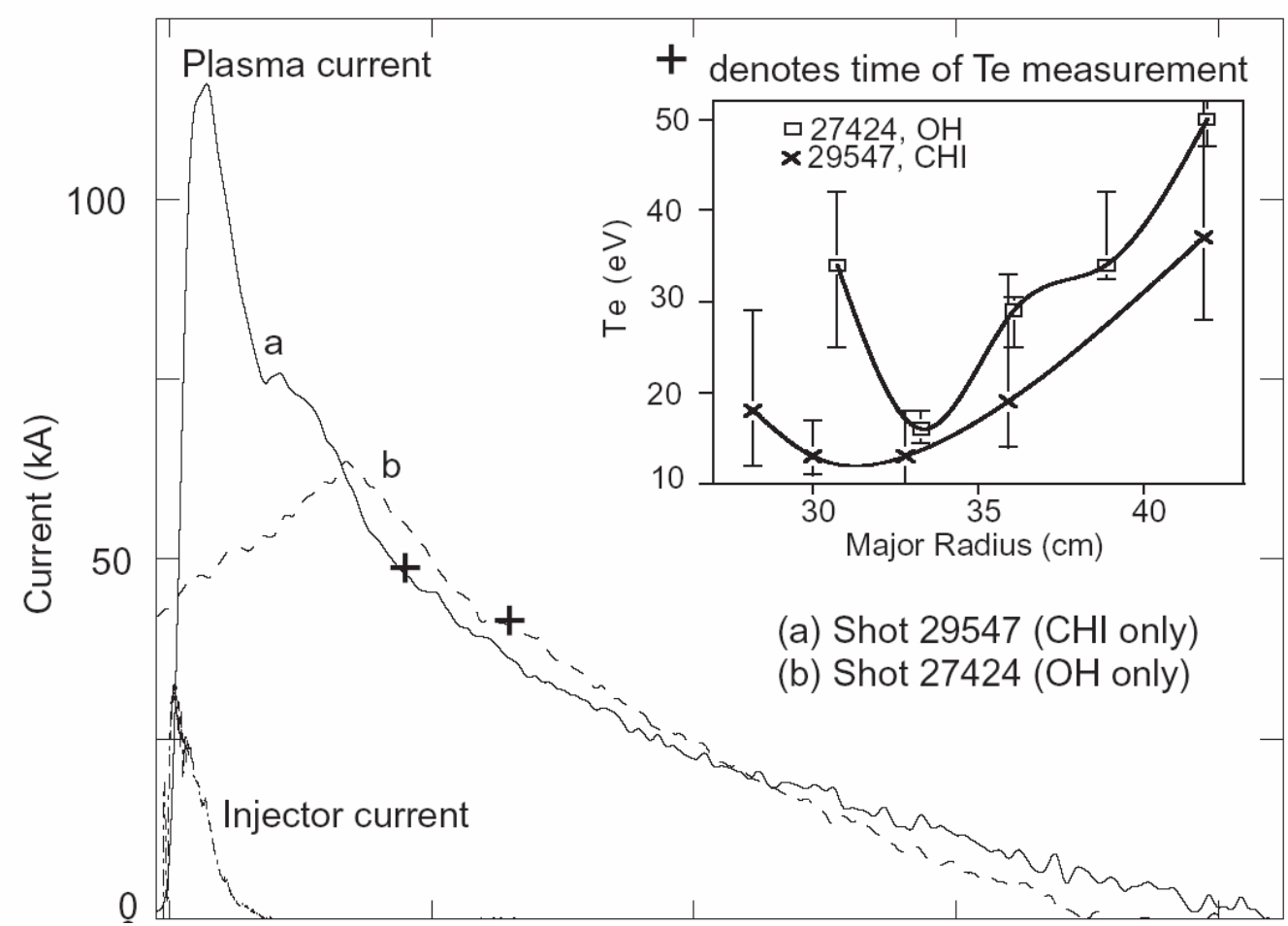


Te increases with reduction in fill pressure

Measured temperatures are now similar to those seen in HIT-II transient CHI discharges

Thomson: B. LeBlanc (PPPL)

Electron temperatures similar to Transient CHI plasma temperature in HIT-II



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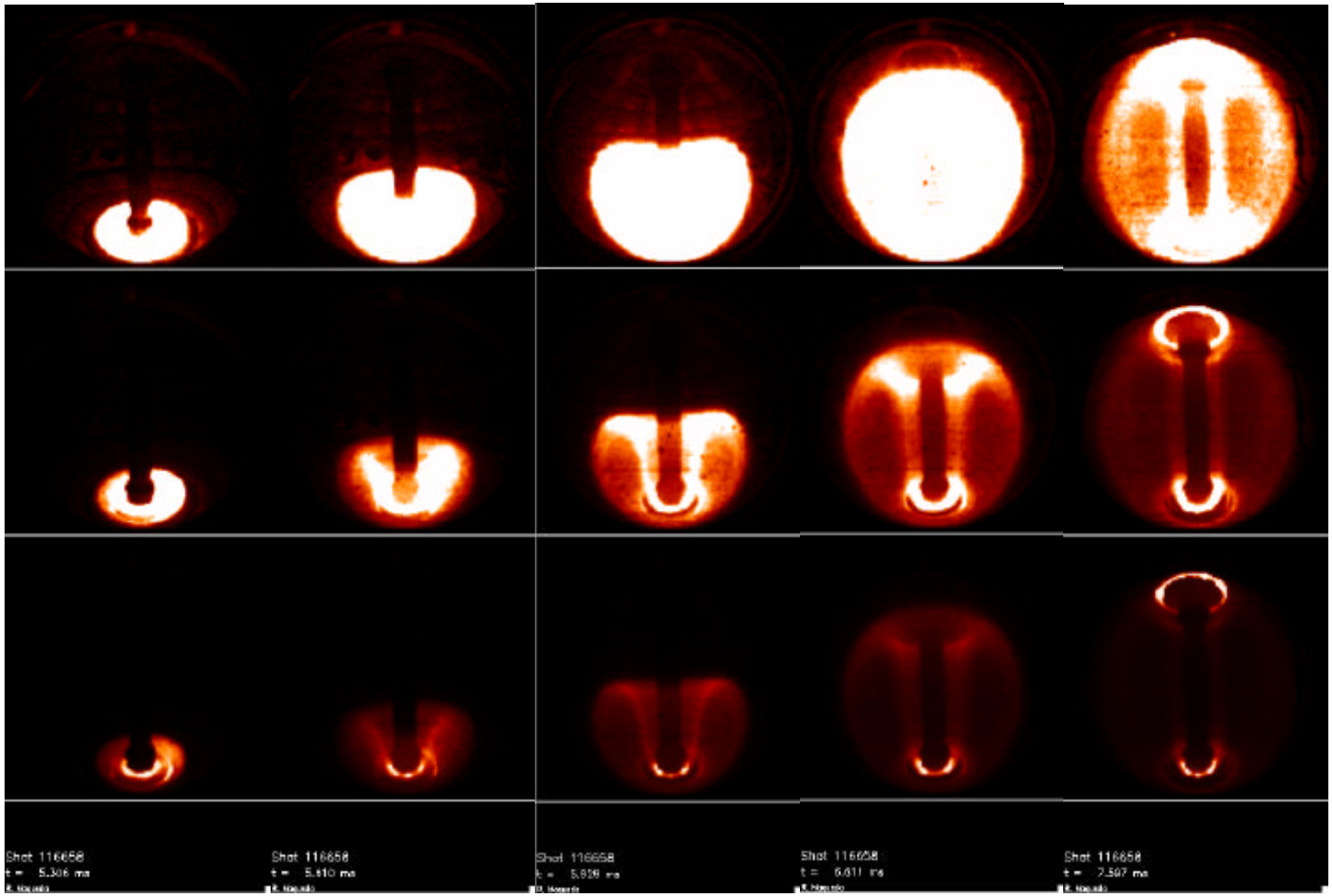
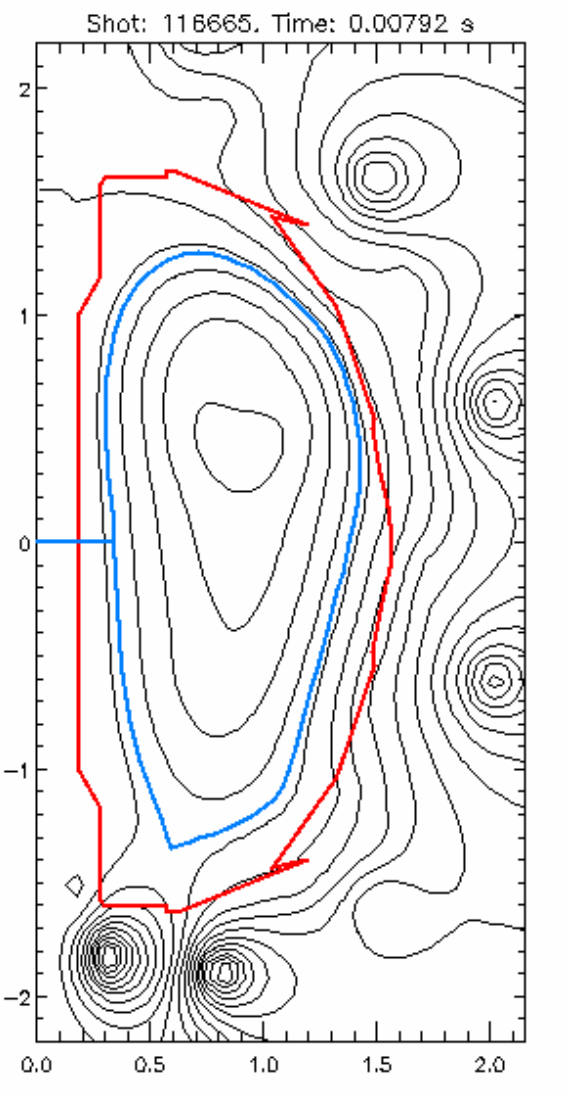
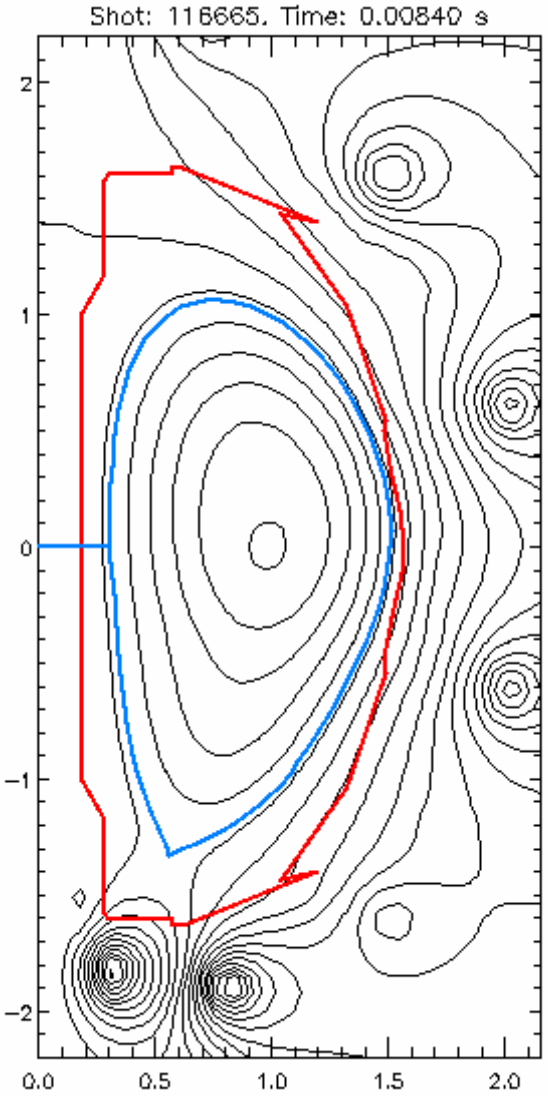
Fast camera images show discharge filling the vessel



Phantom camera data (R. Maqueda, Nova Photonics)

Preliminary Equilibrium reconstruction





CHI - produced currents need to be increased to obtain more robust EFITs.

Initial reconstructions are qualitatively consistent with Thomson scattering measurement and with the fast camera images.

EFIT (S. Sabbagh, Columbia)

Current persistence (July 29, 05)

To obtain current persistence the capacitor bank voltage was increased above 1kV (for the first time in NSTX experiments)

Discharges did not exhibit the usual $I_{inj} \propto V_{capacitor}$ scaling.

(a) First, the discharge switched to a high injector current mode

(b) As the voltage was further increased, it produced an initial negative I_p spike

Experiments were conducted to investigate the negative I_p spike by operating with only the PF1B coil. At higher voltages, these spikes returned, but the intensity of these spikes could be reduced by injecting more gas.

Further experiments are planned to reduce the injector flux and the TF to get to conditions where the discharges could be operated under conditions where the CHI produced plasma detaches from the injector flux.

Summary

Very important progress in key areas

Discharges have been successfully produced at gas pressures comparable to those used for conventional inductive startup

This has resulted in increased electron temperatures and Te profiles, similar to those seen in the HIT-II experiment

Very high current multiplication (I_p/I_{inj}) of about 170 has been observed during the current decay phase. This is a strong indicator of closed flux generation

The equilibrium reconstructions are encouraging and consistent with the Te profiles and the observed high current multiplication

The CHI produced plasma has not detached from the injector flux, therefore, current persistence has not yet been observed