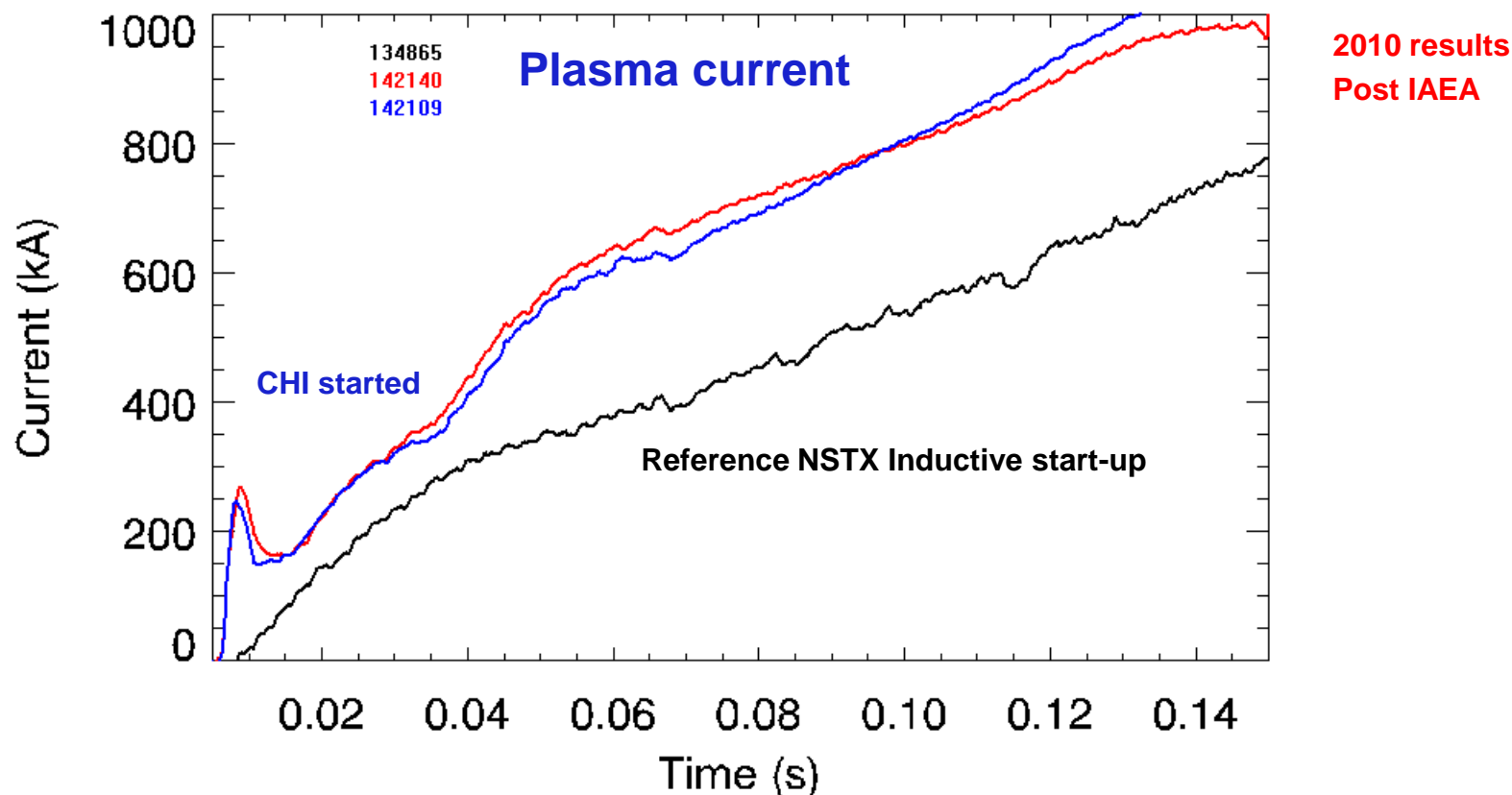


Inductive Flux Savings of Inductively-driven Transient CHI Plasmas

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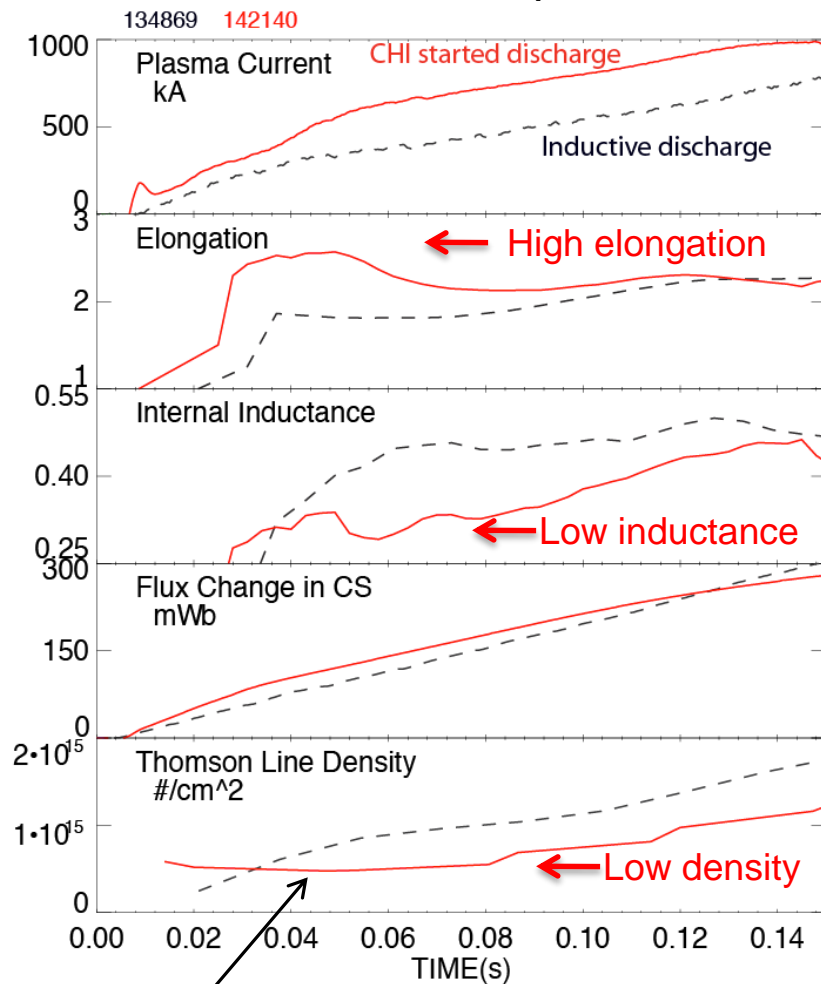
NSTX Demonstrated Inductive Flux Savings when OH was Coupled to CHI



- Reference Inductive discharge
 - Uses 396 mWb to get to 1 MA
- CHI started discharge
 - Uses 258 mWb to get to 1 MA (138 mWb less flux to get to 1 MA)

Plasma Discharge Ramping to 1 MA Required 35% Less Inductive Flux when Coaxial Helicity Injection (CHI) is Used

CHI assisted startup in NSTX



27 kJ of stored capacitor bank energy used for CHI plasma start-up

CHI produced plasma is clean
(Discharges have transitioned to H-mode after coupling to induction)

CHI generates plasmas with low n_e so that ECH could be used to heat these plasmas

Goals: Assess Inductive Flux Savings in NSTX-U & Compare to Results from NSTX

- Flux savings is a measure of the quality of the CHI-produced plasma
- Coupling to OH is the first step to determine if the CHI-produced plasma is compatible with standard inductive operations
- This prepares these plasmas for future coupling to NBI & RF
- Considerable improvements to the CHI system on NSTX should improve the CHI plasma quality and improve flux savings.
 - Full Li coating of divertor (and possibly the absorber)
 - Higher injector voltage and flux
 - Higher B_T

Experimental Plan

- After Transient CHI has shown significant current generation (200 kA), and good current persistence
- Assess the savings in inductive flux using methods developed on NSTX
- Apply a fast loop voltage ramp with the OH, initially at the maximum levels permitted (then later reduce through an optimization process)
- As the current ramps up increase the vertical field and adjust the PF3U/L coil currents to keep the plasma centered
- Inject gas as required using the mid-plane injector
- After the hand-off current reaches over 200 kA (TBD from NSTX-U operating experience) hand-off to the plasma control system as on NSTX for further current ramp-up

Experimental Plan and Run Time

- Ramp the current up to 1 MA, as on NSTX, for comparison to NSTX results
- Extend the pulse to the levels permitted by the solenoid flux
- After reproducible discharges have been obtained, improve the gas injection, and add NBI and RF to reduce the flux consumption
- Estimate 2 days required

Systems Required

- Li evaporator to fully coat the lower divertor tiles
- Li coating of the upper divertor (if available)
- Capacitor Bank
- Upgraded MOV capability
- ECH for pre-ionization
- Both CHI gas injections systems
- Multiple view fast cameras (Fish eye view & lower divertor view with optical filters)
- Thomson, and diagnostics used for CHI on NSTX