CHI assisted plasma start-up and hand-off for inductive operation

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Requirements for successful plasma start-up

1. Produce a short pulse discharge in the narrow foot-print condition

2. Rapidly ramp-off the current in the CHI PF coils

3. Simultaneously reduce the CHI injector voltage

4. Apply OH induction during the CHI current ramp-down phase

5. After the OH drive couples to the CHI produced discharge, hand-off for OH feedback control operation at a new current level for feedback control operation.

Procedure:

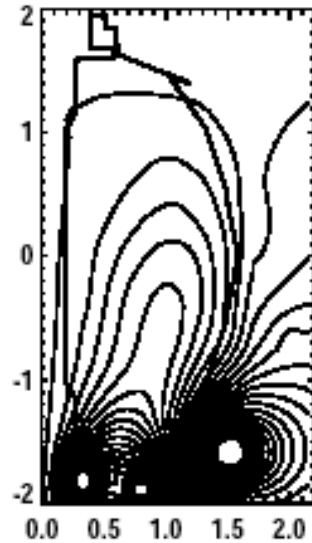1. Produce a 20 to 50ms discharge at a current level of 50 to 200kA.
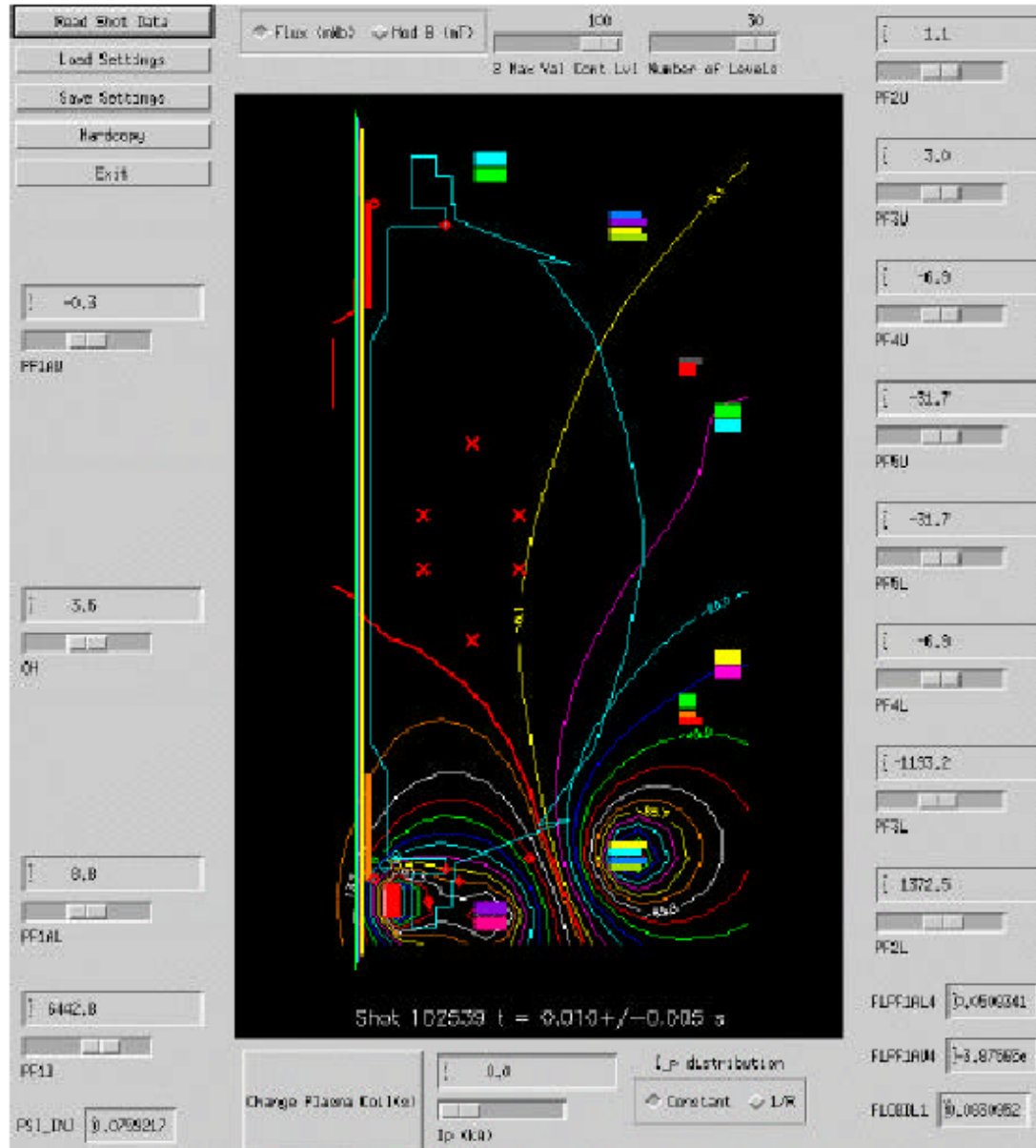
     Start with shot 102539 (from June 2000)
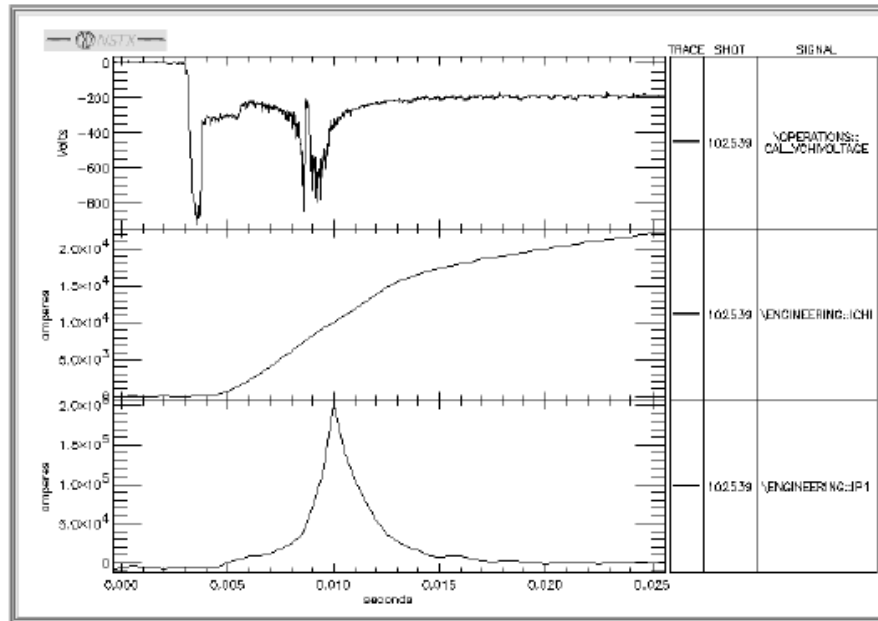
Shot 102539 at 10 ms   Shot 102539 at 12 ms

Vacuum flux plot for SN 102539
("narrow flux foot print case")

Repeat at two different levels of injector flux (one higher than 102539, the other lower)

Adjust the CHI gas pressure as needed (may need to go to a smaller plenum and increase the injector gas pressure)

If there is consistent difficulty with starting from a narrow-foot-print condition, switch to a recent wide-foot-print condition to narrow-foot-print case.

Initially use no current in any other coils. Then, if necessary use a buffer field using PF2U, 3U to keep the expanding CHI plasma from contacting the upper divertor region. Use the capability from the new absorber PF coils if this capability is available.

2. Rapidly ramp-off the current in the CHI PF coils

The objective is to reach a condition where the CHI injector flux decays faster than the toroidal current. Goal is to minimize the injector flux as much as possible before induction is applied.
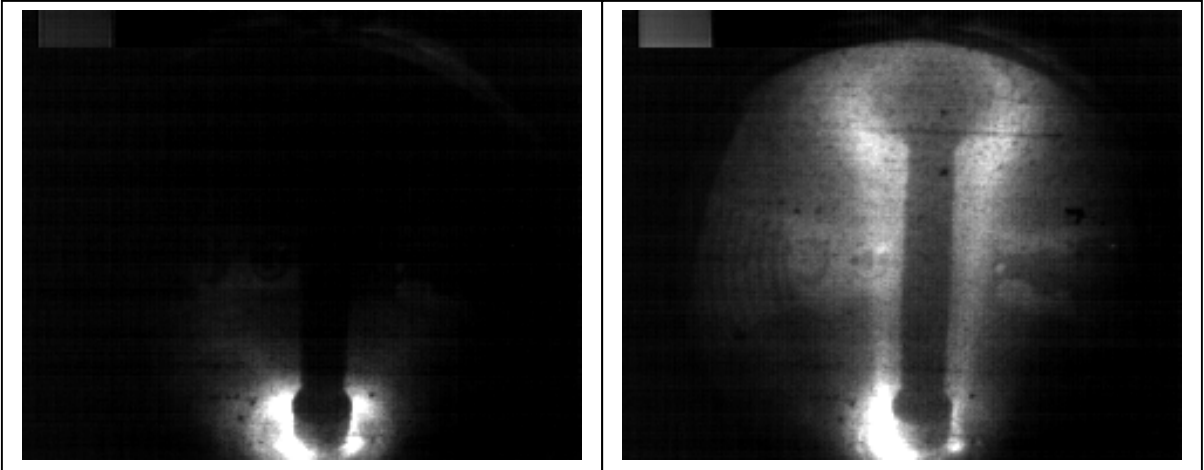
Reduce the CHI voltage, while avoiding an absorber arc.

Use simulations from TSC to optimize coil current and voltage ramp-down rates, but most likely real experimental data will be needed to optimize this.

3. During the toroidal current decay phase, apply inductive voltage corresponding to 6 volts, then decrease in steps to obtain good coupling at the lowest possible voltage.
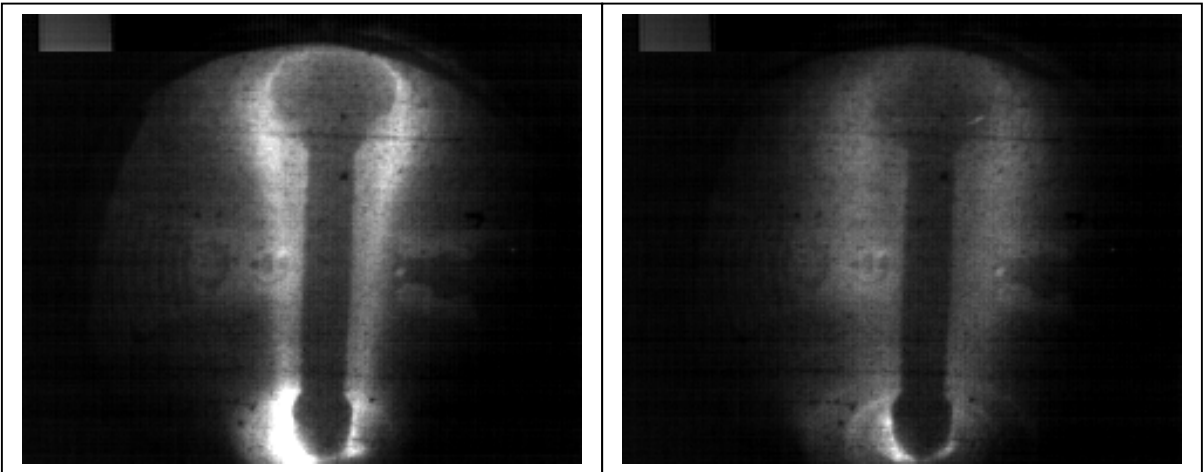
4. After the inductive drive couples to the CHI discharge and the plasma current begins its upward ramp, determine a new current level at which the discharge can be turned over to the feedback control system,
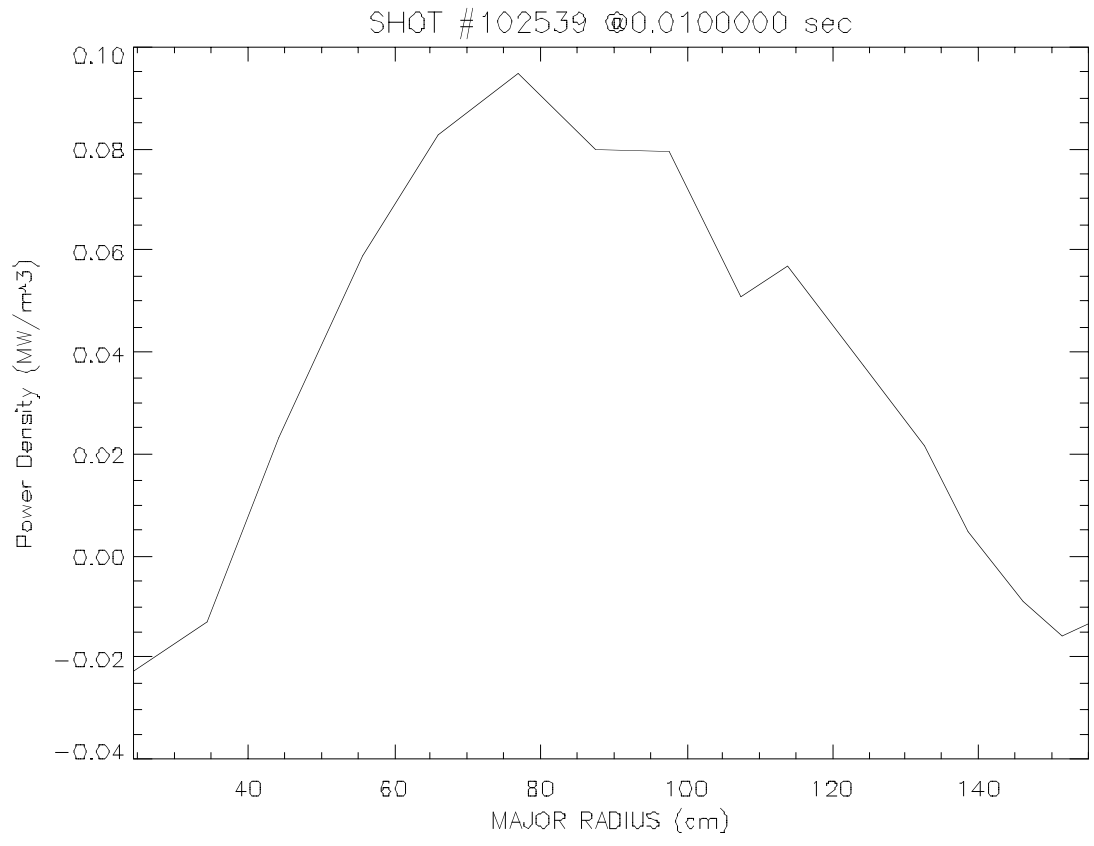
Fast camera images (102539)

T = 8ms   T = 10ms

T = 11ms
                                     T = 15ms

SHOT #102539 @0.0100000 sec

Bolometer trace at 10ms