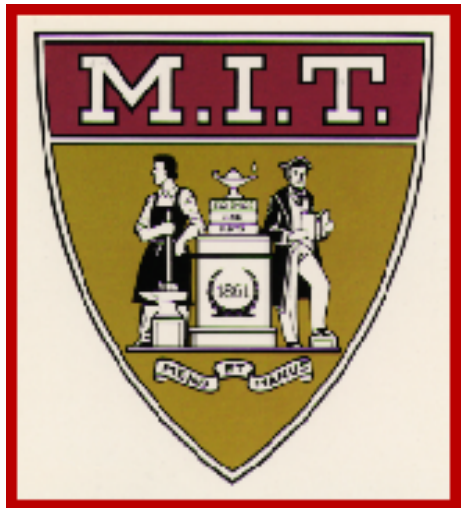


Disruption Neutral Point:

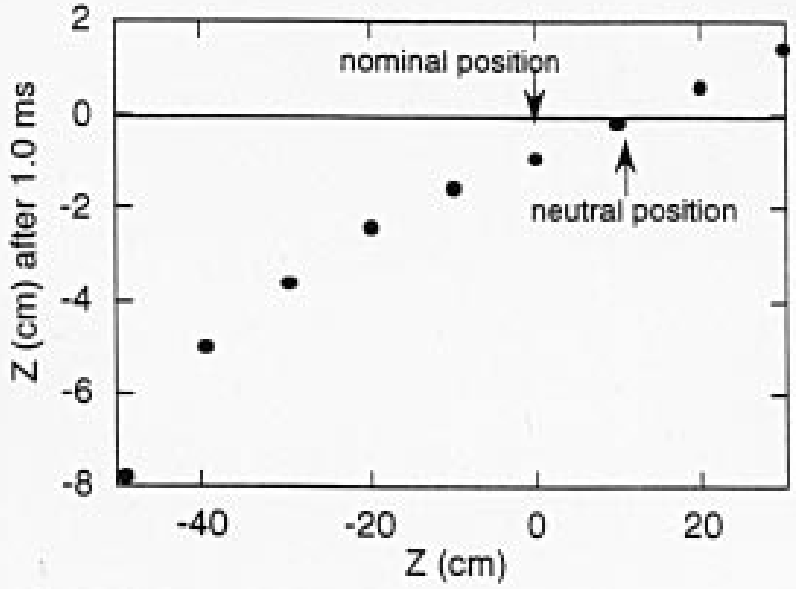
- Is it relevant for C-Mod ?
- Is it relevant for FIRE ?

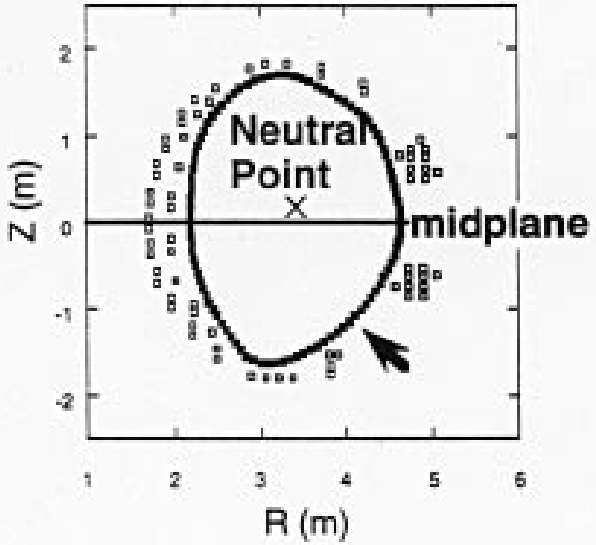
Disruption mitigation research on JT-60U includes studies of the 'neutral point' concept

TSC Prediction of Neutral Point

(Nucl. Fusion, Vol.36, No.5 (1996) 643.)

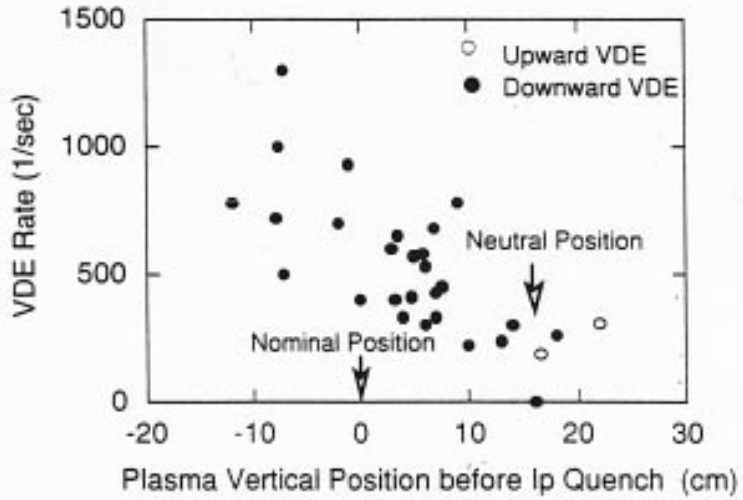
Up/down imbalance of attractive force arising from eddy current disappears at Neutral Point.





Disruption mitigation research on JT-60U includes studies of the 'neutral point' concept

● **Experimental Result** (Nucl. Fusion, Vol.36, No.3 (1996) 295.)



Ip-Quench Rate : 50 - 100 sec^{-1}

By positioning plasma at neutral point (~ 15 cm above midplane) before Ip-quench, avoidance of Ip-quench-induced VDE and suppression of halo current were established in JT-60U.

Comments about Neutral Point concept

- JT-60U typical plasma elongation is only 1.3
  - — inherently less unstable to begin with
- Alcator C-Mod typical plasma elongation is 1.65
  - — Much more stringent test of neutral point concept
- FIRE is up/down symmetric (vessel *and* plasma)
  - — Therefore nominal FIRE operation will *always* be at the neutral point.
  - — But FIRE's elongation is high, like C-Mod's.

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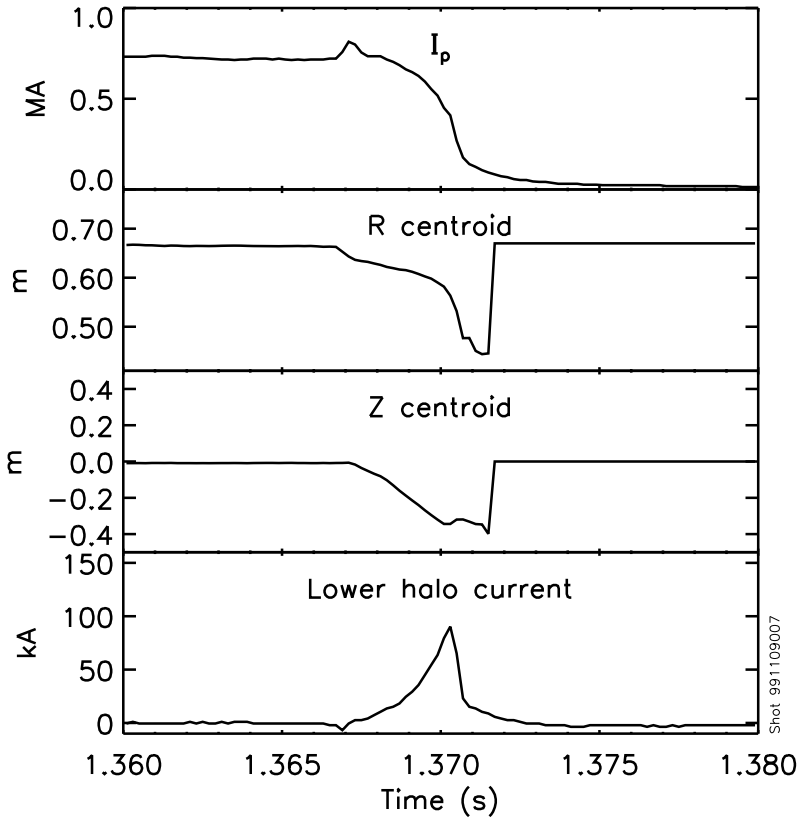
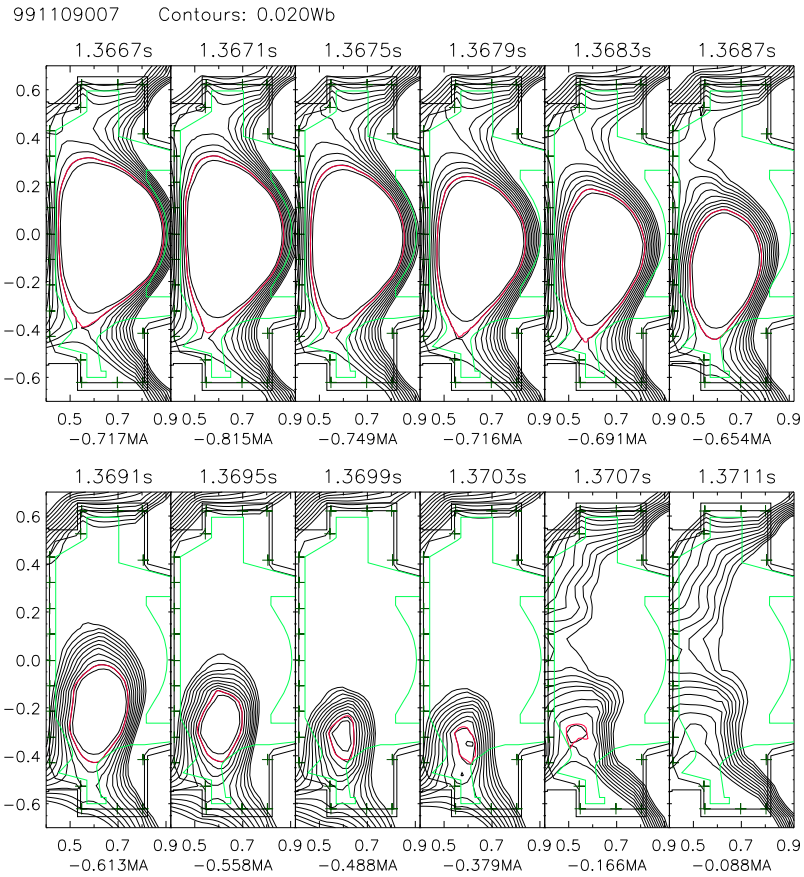
Typical vertical motion in C-Mod after thermal quench





- Plasma starts falling immediately after thermal quench.

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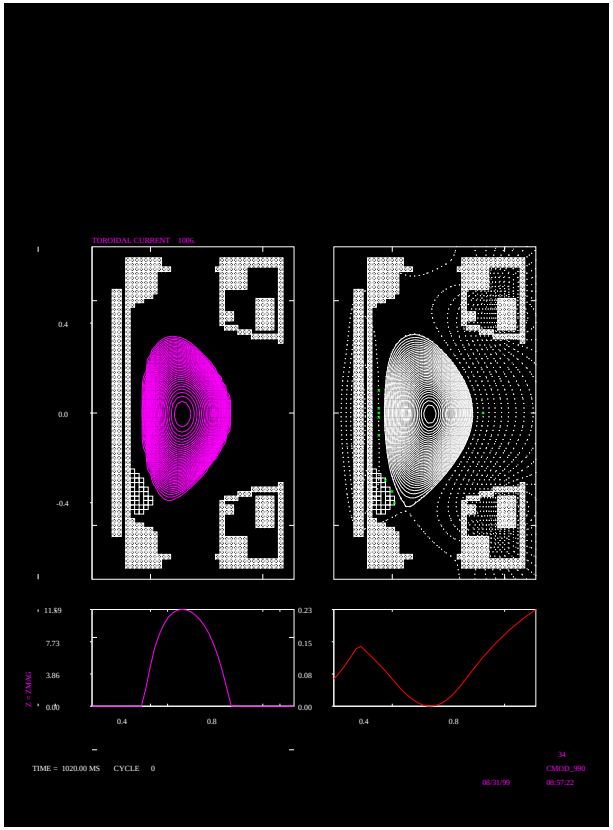
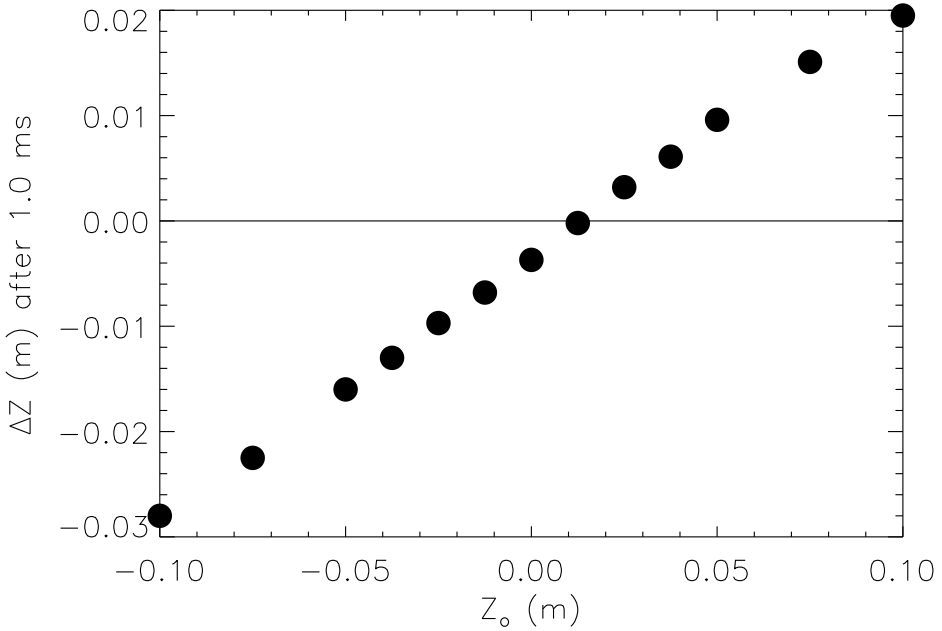
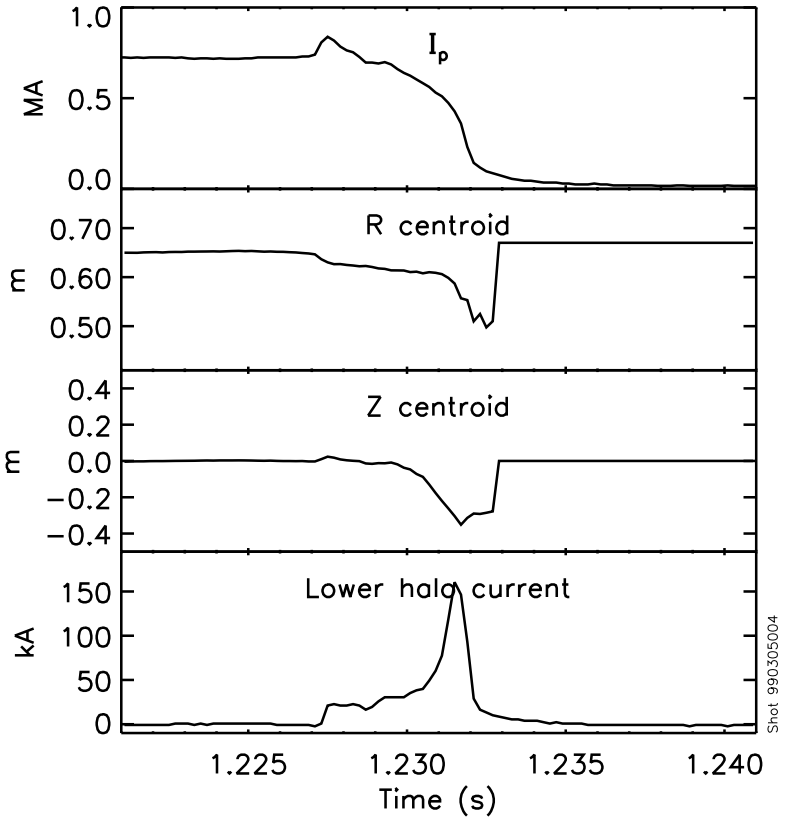
TSC Prediction of Neutral Point in Alcator C-Mod
(Y. Nakamura, *JAERI*)

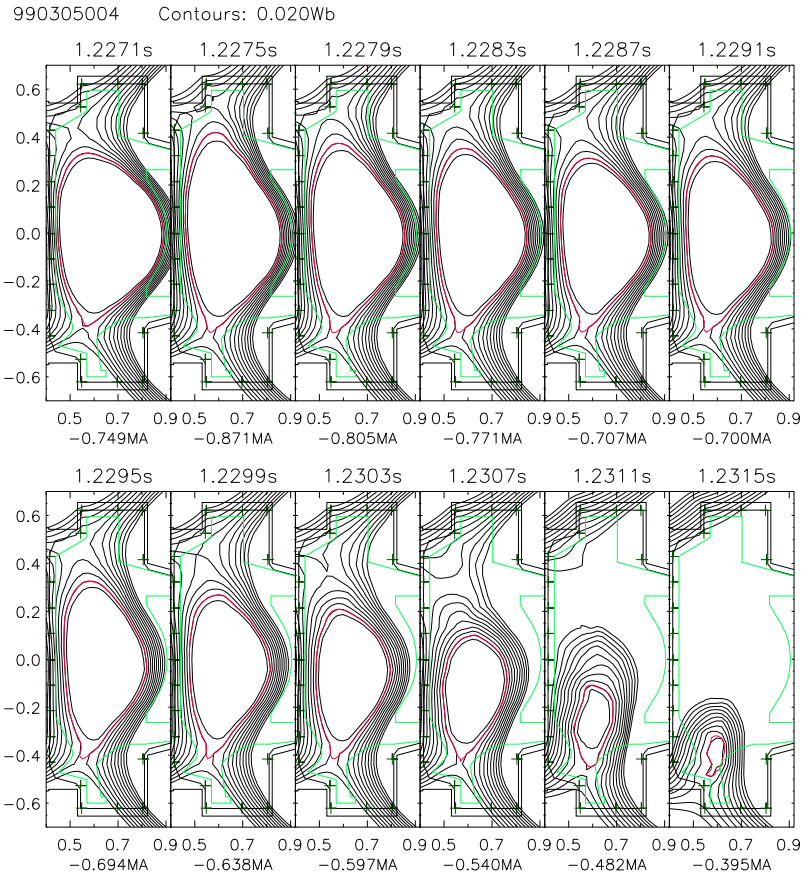




- Neutral Point lies at ∼1 cm above midplane.

Operating nearer to predicted neutral point: Less unstable vertical motion observed after thermal quench





- Plasma stays near midplane noticeably longer.

Disruption Program — Neutral Point Studies

We will do a controlled test of the neutral point issue in C-Mod.

— Check for neutral point location, duration of post-quench vertical stability, robustness to variation in plasma parameters, etc.

— Continue collaboration with JAERI. Dr. Nakamura will come to MIT again to participate in the execution of the neutral point run.

If robust neutral point operation is feasible, several scenarios might be possible to mitigate disruptions, depending on the duration of post-quench vertical stability:

- For long post-quench stability, can the PF supplies respond quickly enough and strongly enough to stabilize the quenching plasma at the midplane? Can the quench be reversed and the plasma rejuvenated?
- For increased, but still rather short, post-quench stability, is there time to kill the plasma on the midplane (which may be preferable to quenching in the divertor)?