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NSTX

The dependence of the power threshold on drsep and X-point height

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NSTX XP Review
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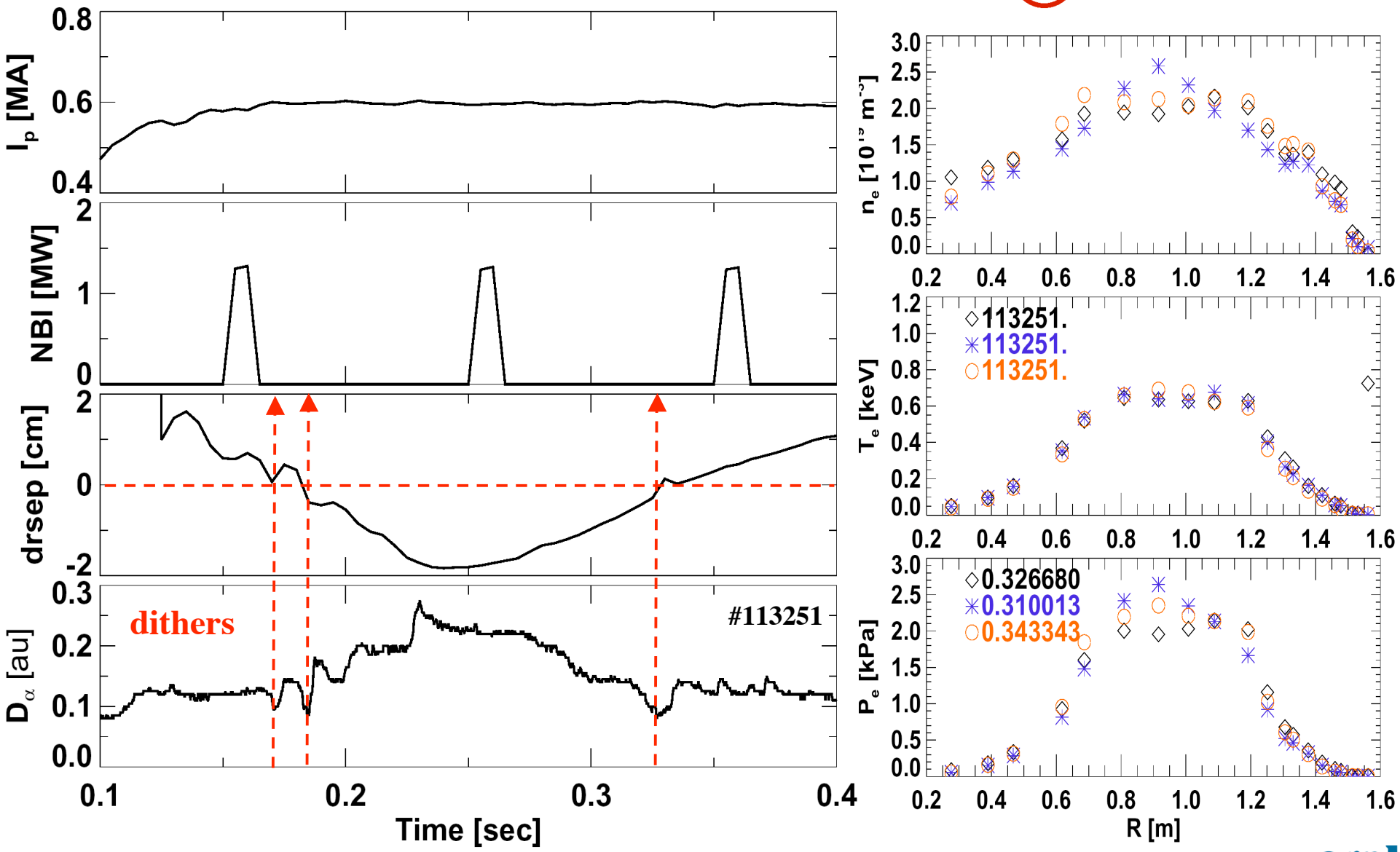
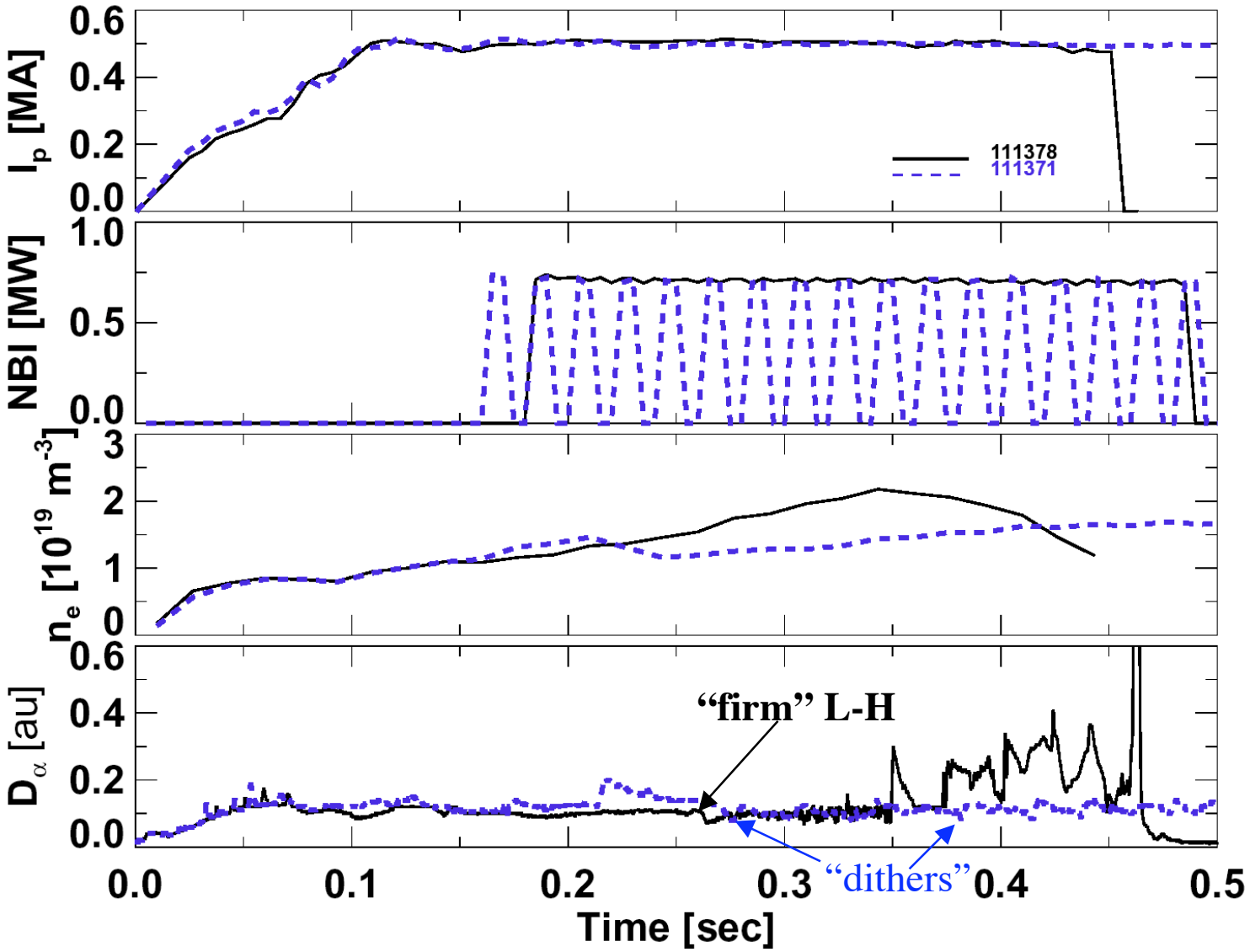
Is lack of H-mode access in lower-single null in previous NSTX XPs#418, #447 caused by high X-point?

- Could not get H-mode in anything but balanced DND with drsep scan with either NBI or RF heating in NSTX
- However we know that LSN gives the lowest power threshold with lower X-point/higher elongation
  - ohmic H-modes observed
- DIII-D and JET previously reported that low X-point reduced L-H power threshold
- Our early H-mode discharges with PF1b coil have very low X-points and really good H-mode access
  - What role does X-point height play in NSTX?

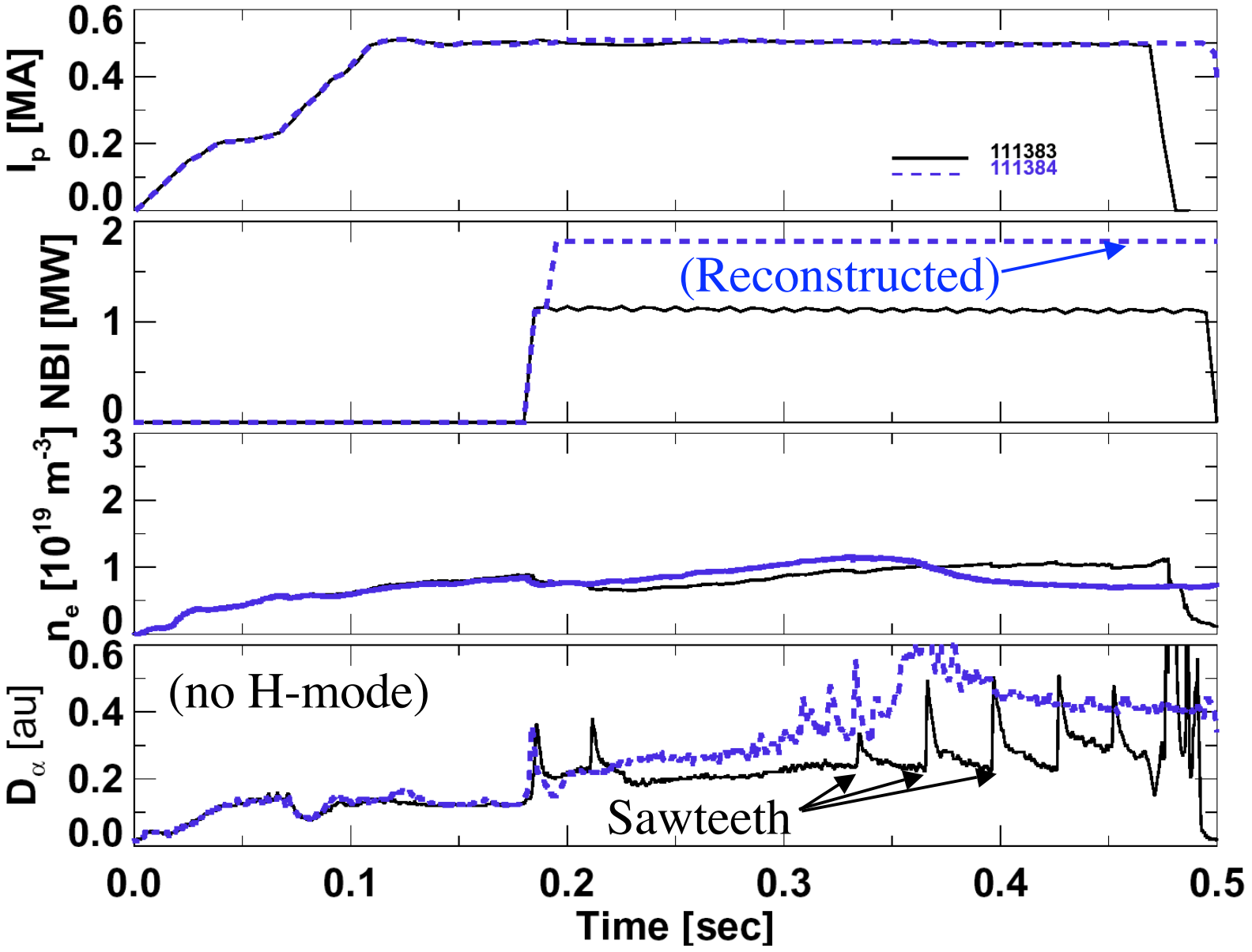
H-mode obtained with drsep ~ 0, and lost when drsep deviated in "high X-point shape"



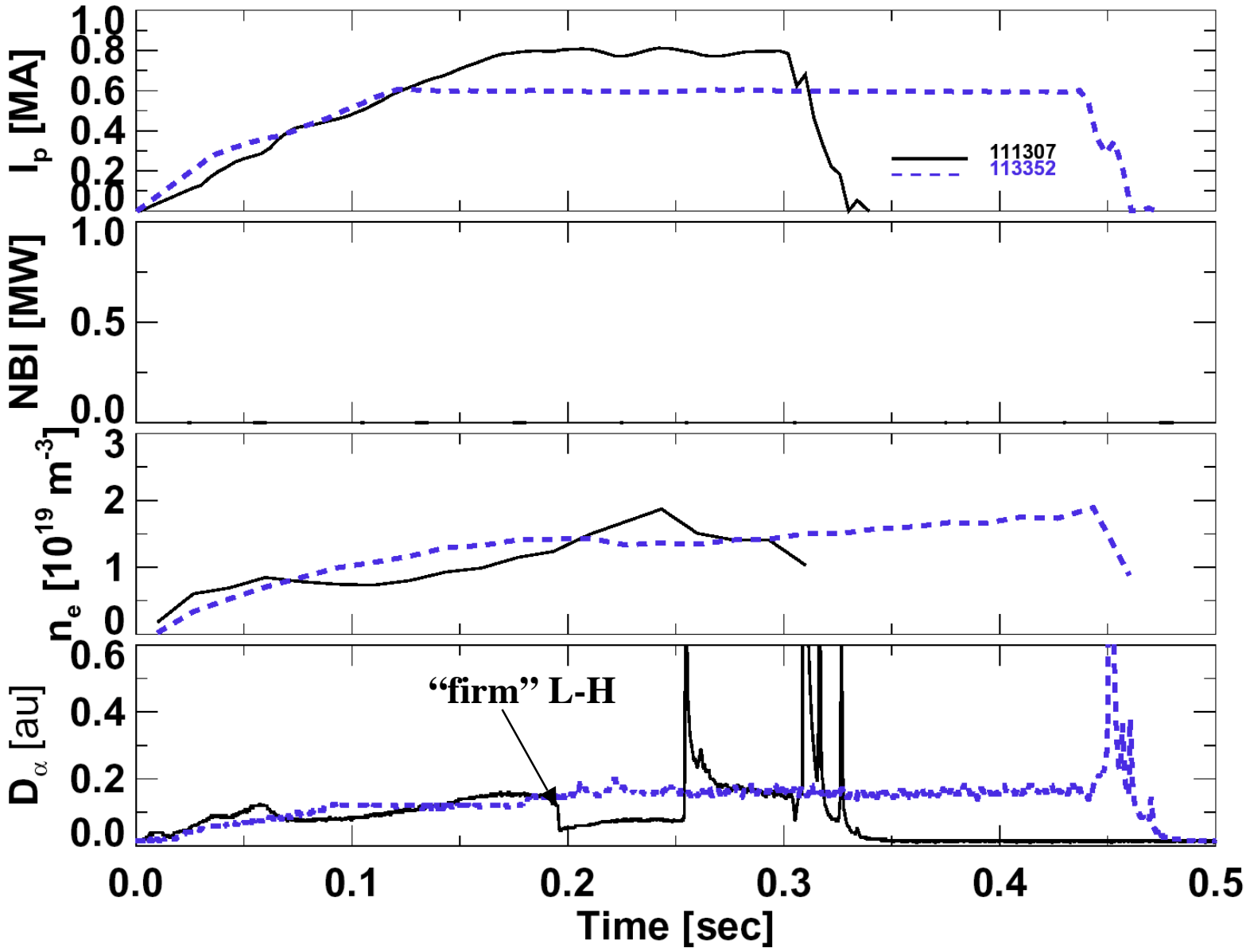
NSTX dithers observed in DN near P_{LH}



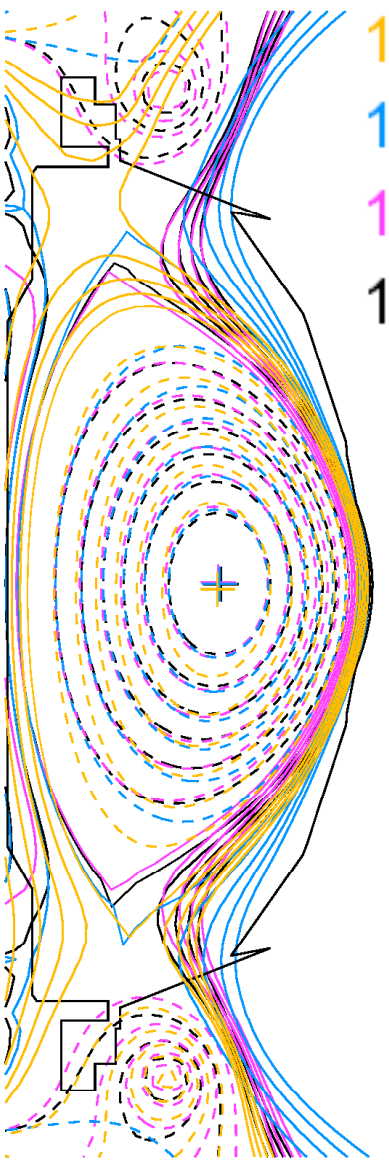
No transition observed in LDND in NSTX w/drsep=-1 cm for NBI heated (shown) or RF heated discharges



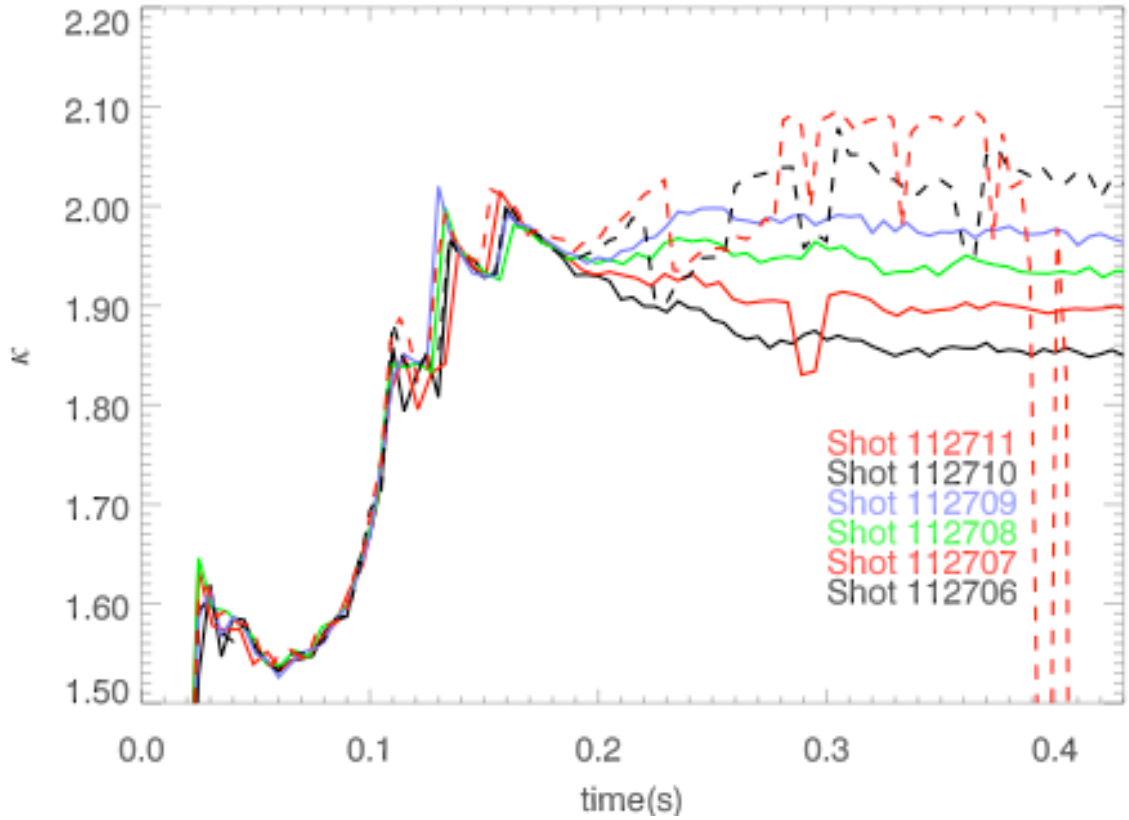
Ohmic H-mode obtained with low X-point and avoided previously by reducing I_p



rtEFIT isoflux feedback controlled shapes developed which connect high and low X-points



111307 0.250000
112711 0.301000
111378 0.301000
112706 0.300000



Run Plan to complete XP 418 (T&T) and XP 447(Boundary) 1.5 days requested

I. Restore #111307, and verify ohmic H-mode access in LSN – this is highest kappa. (2 shots)

II. Drop I_p to 0.5 MA as in MAST experiments and repeat. If still ohmic H-mode, decrease kappa to avoid ohmic H-mode, probably to 1.95-2.0 as in #112708-09. (3 shots)

III. Measure power threshold with NBI heating. (4 shots)

IV. Make DN out of LSN by using up/down symmetric coil currents, and measure power threshold with NBI. (4 shots)

V. Make USN out of LSN and measure power threshold with NBI, and then RF heating. Move on if H-mode inaccessible. (3 shots)

VI. Do a drsep ramp up and down (sawtooth) to +/- 1.5 cm as in #113251 to test power threshold levels at fixed NBI heating. (2 shots)

VII. Repeat steps III-VI for RF shots with smaller outer gap (9 shots)

VIII. Repeat step VI for old shape, i.e. #113378, and verify preferred access in DN with NBI, and then RF heating. (4 shots)

IX. Repeat steps II-VII for an intermediate kappa between steps VI and VII. (20 shots)

Run Plan to complete XP 418 (T&T) and XP 447(Boundary) 1.5 days requested (continued)

Listed below are some considerations:

A. Try to avoid disruptions during ramp-down to maintain wall conditions.

B. The drsep scan will be accomplished as in XP#418 and XP#447.

C. The minimum on/off time for modulation is 10 ms on/10 ms off. The on/off timing will be maintained in multiples of 10ms for CHERs and edge rotation data. The maximum off time will be 20ms, and a finer power scan will be done by reducing the voltage in small increments.

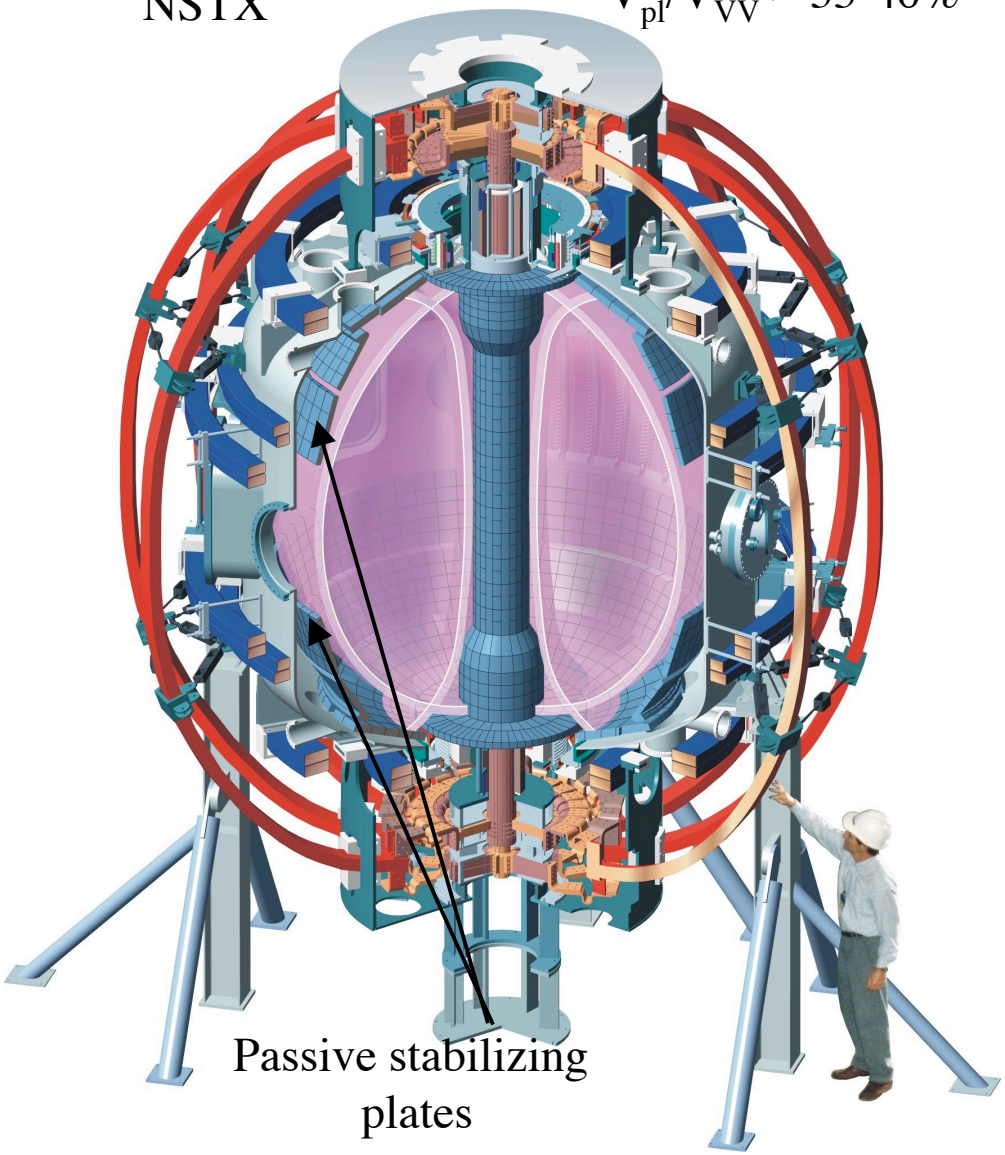
D. Add a 10 ms on-time NBI blip every 50ms during RF heating to document profiles.

Backup

NSTX and MAST save similar plasma size but MAST vacuum vessel larger and outer walls further away

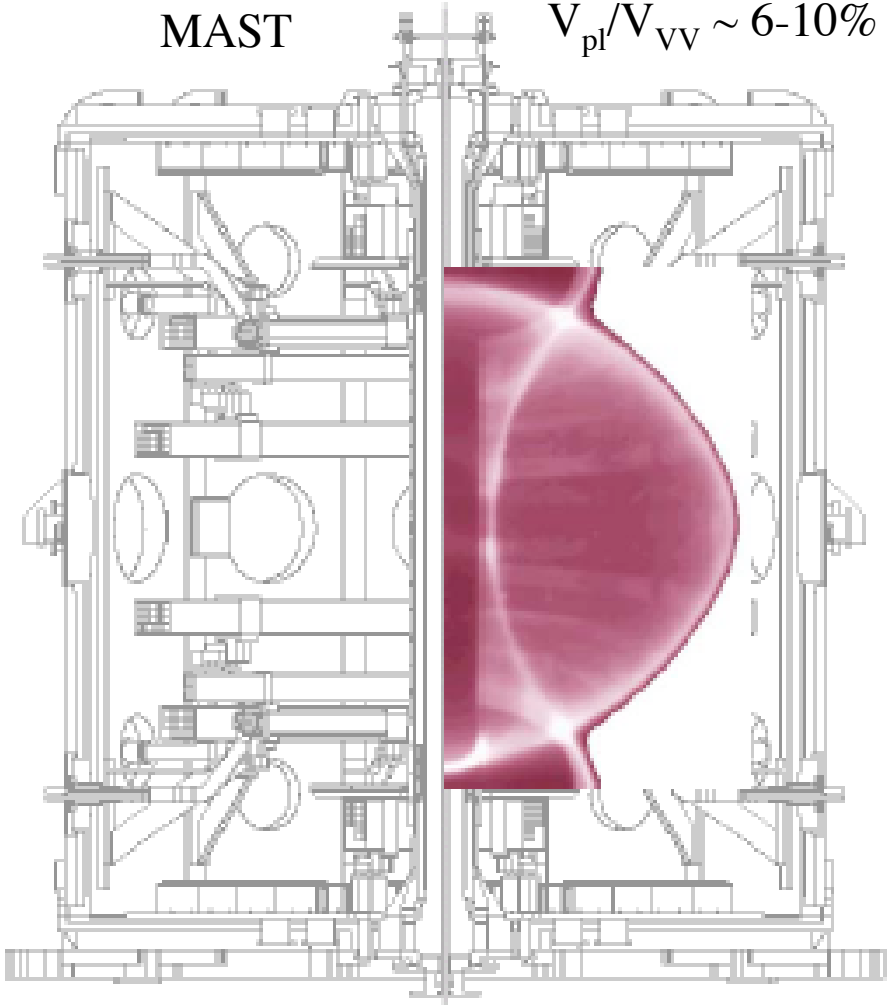
NSTX

$V_{pl}/V_{VV} \sim 35\text{-}40\%$

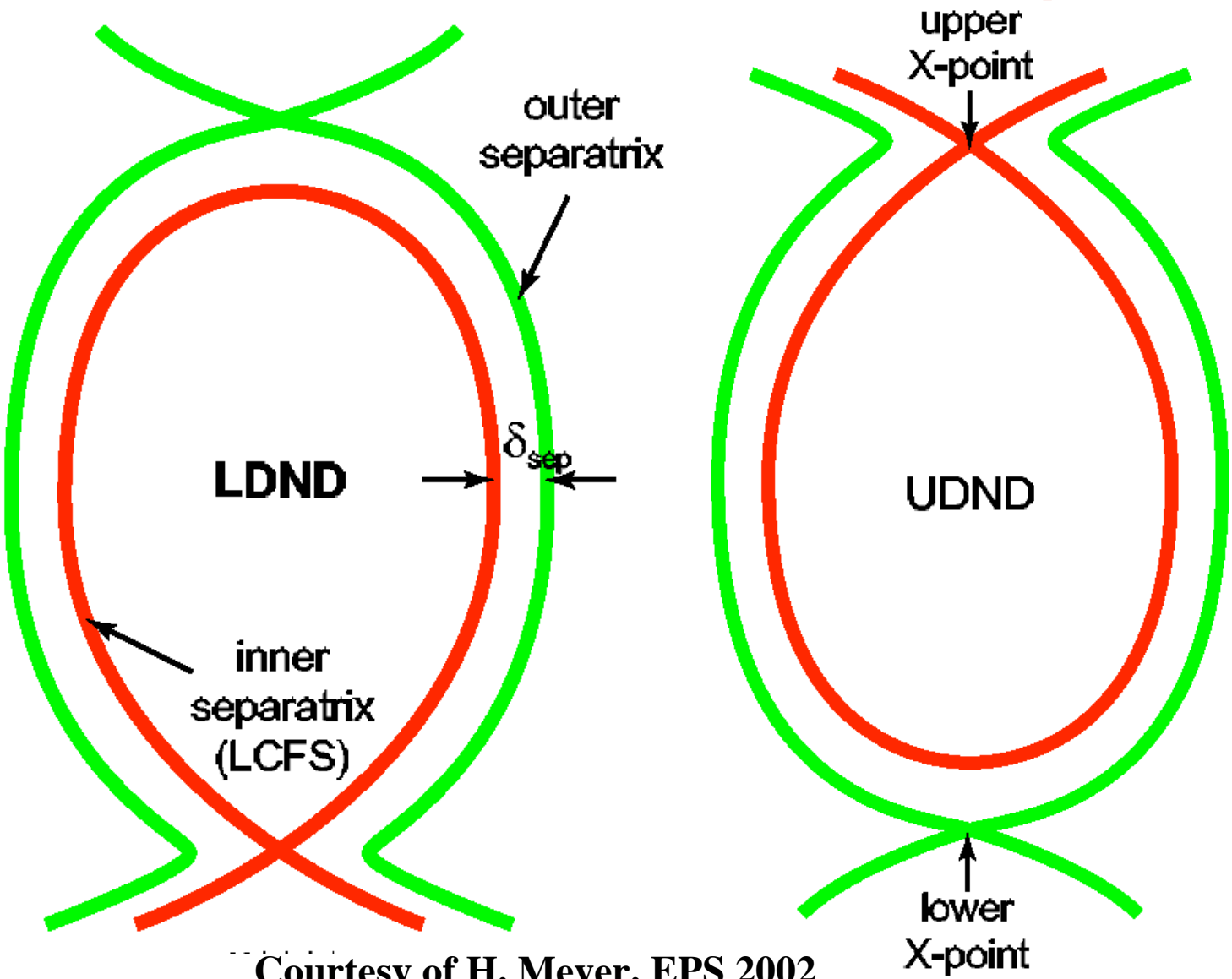


MAST

$V_{pl}/V_{VV} \sim 6\text{-}10\%$

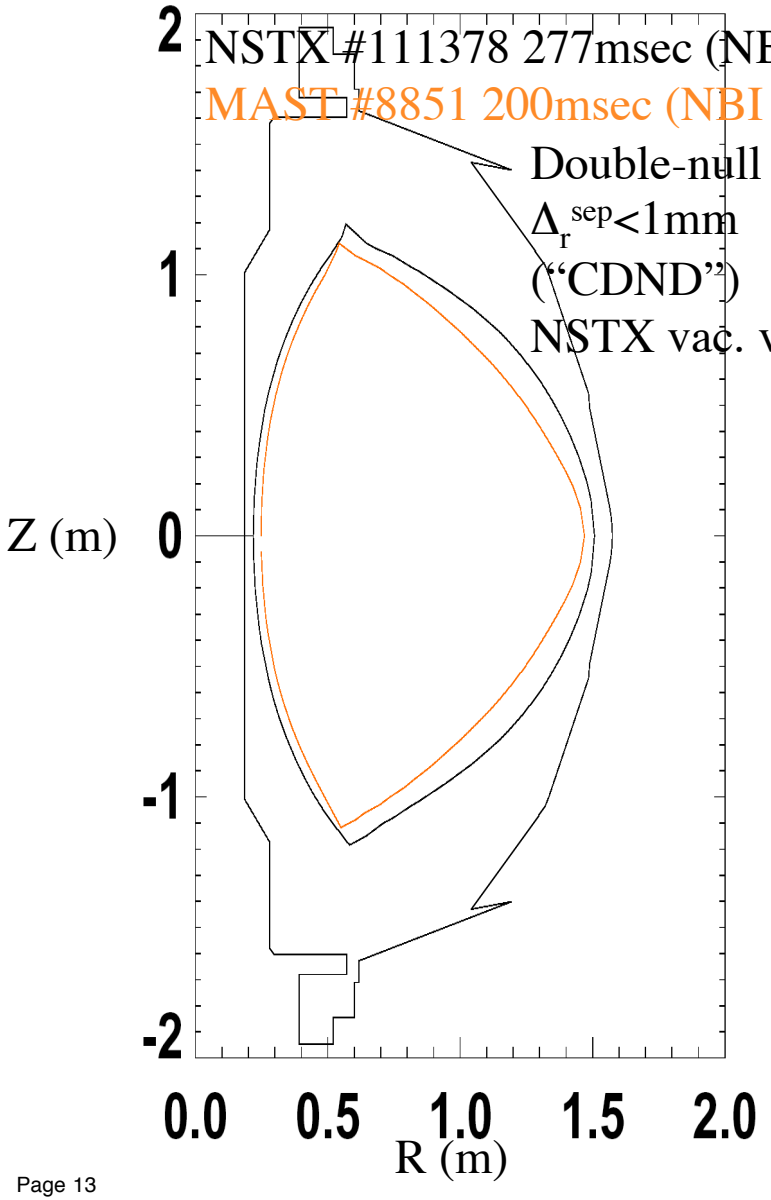


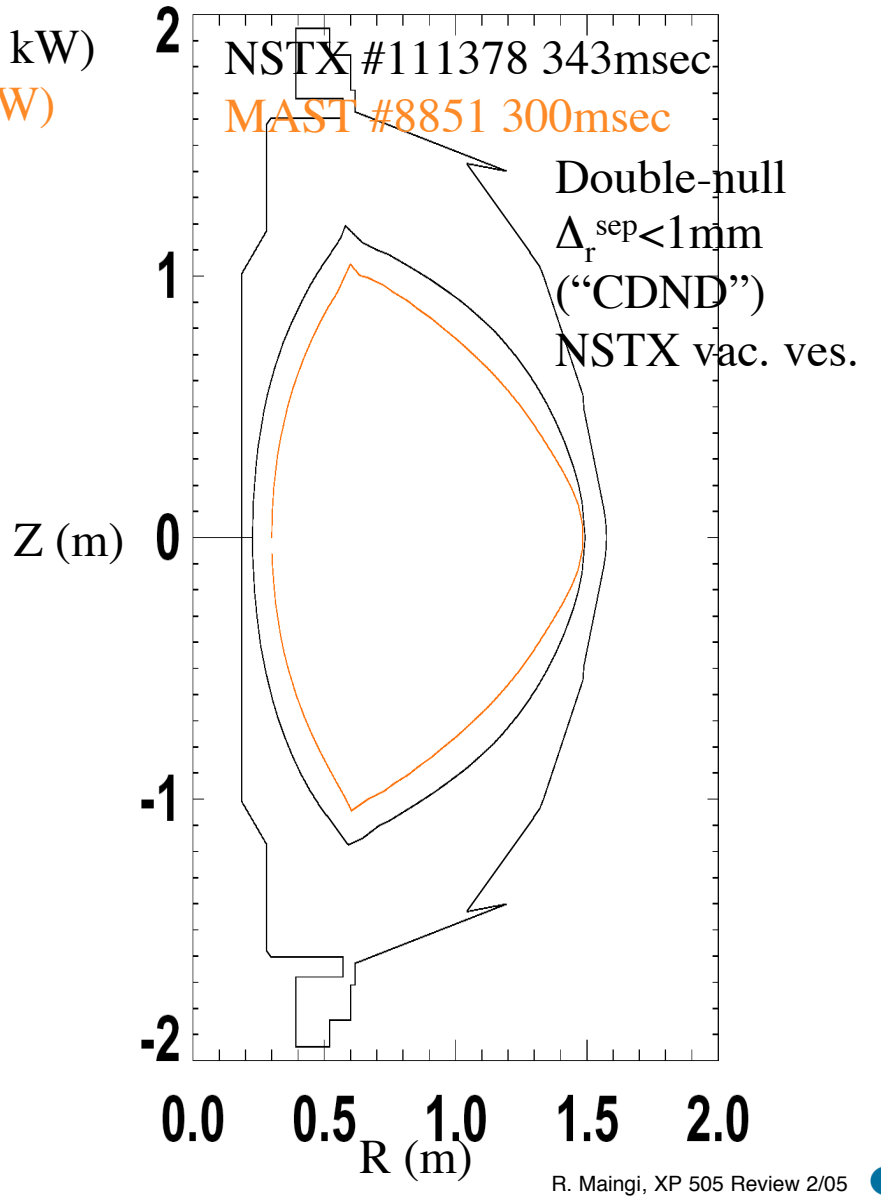
drsep or δsep defined as distance between separatrices mapped to outer midplane



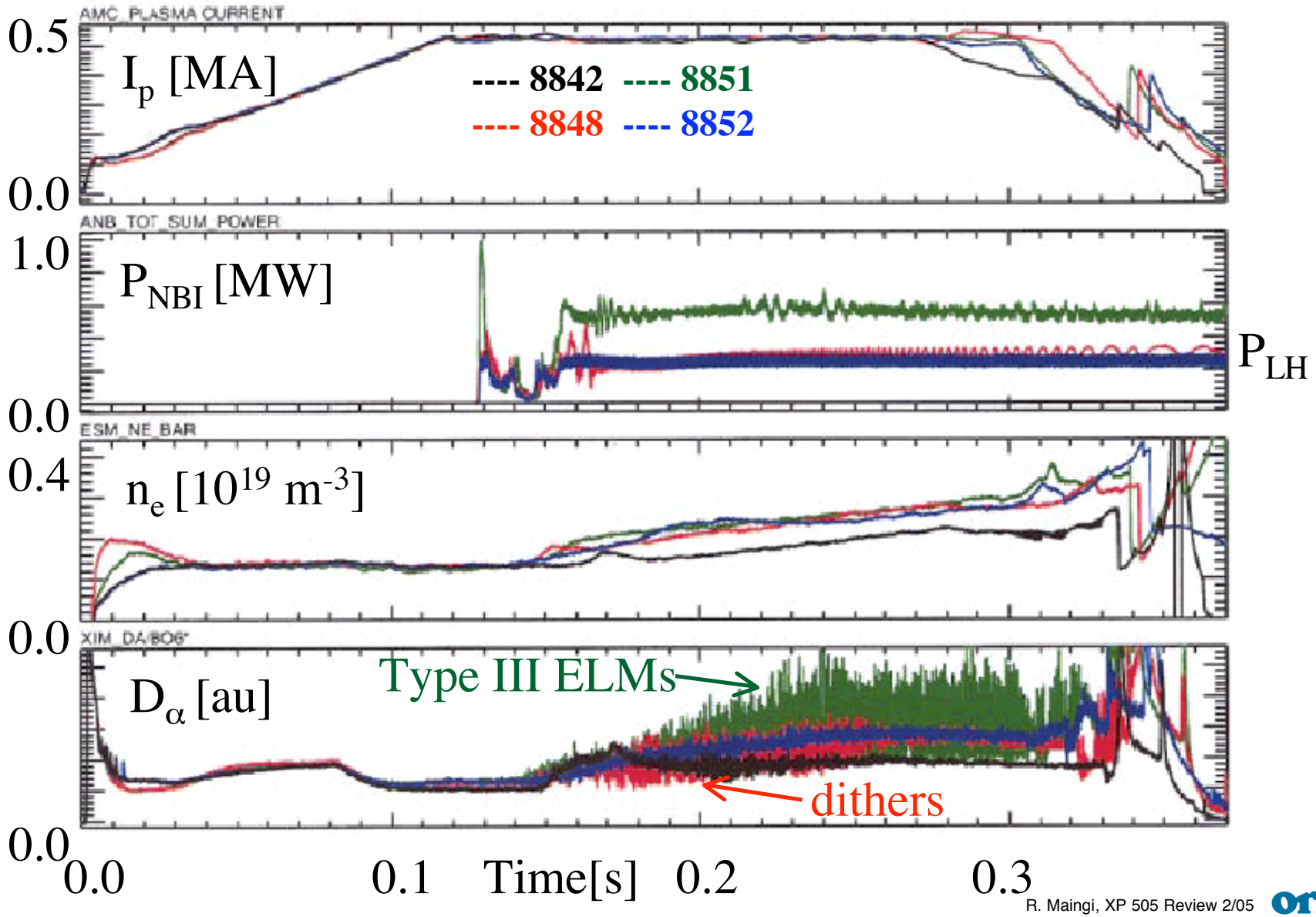
Courtesy of H. Meyer, EPS 2002

CDND Shapes were reasonably well matched, although NSTX shape (under rtEFIT) was a little larger

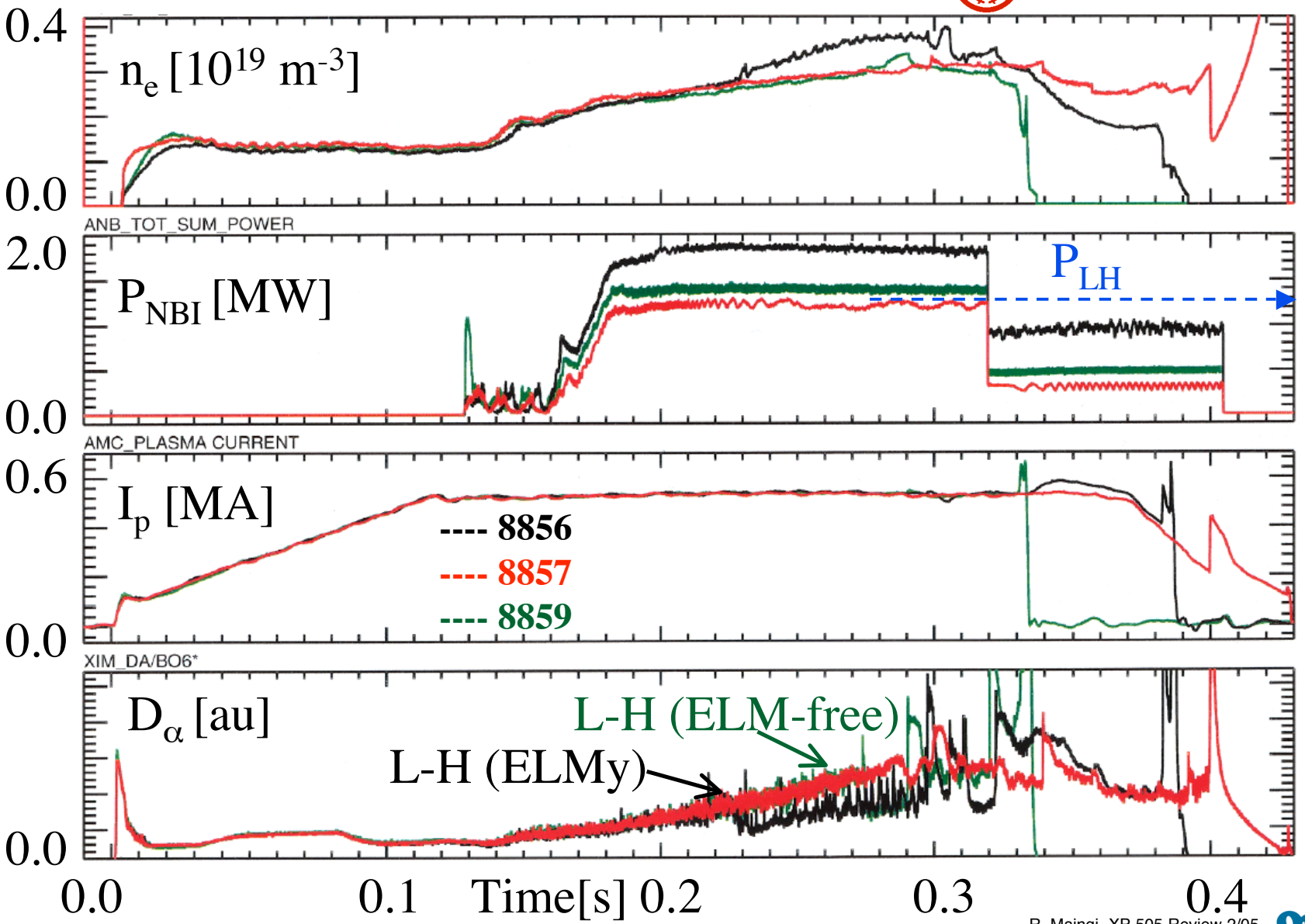




Dithery H-mode in CDND near P_{LH} in MAST



Clear H-mode Transition in LDND near P_{LH} in MAST



NSTX LDND shape a little larger than MAST
Magnetic balance (drsep) scan possible with rtEFIT