NSTX

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Dependence of P_{LH} on X-point Radius

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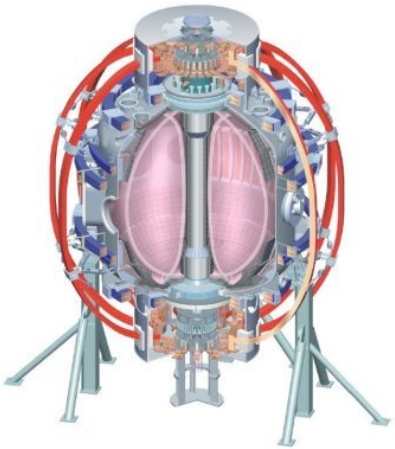
NSTX XP review
Princeton, NJ
Feb. 6, 2009



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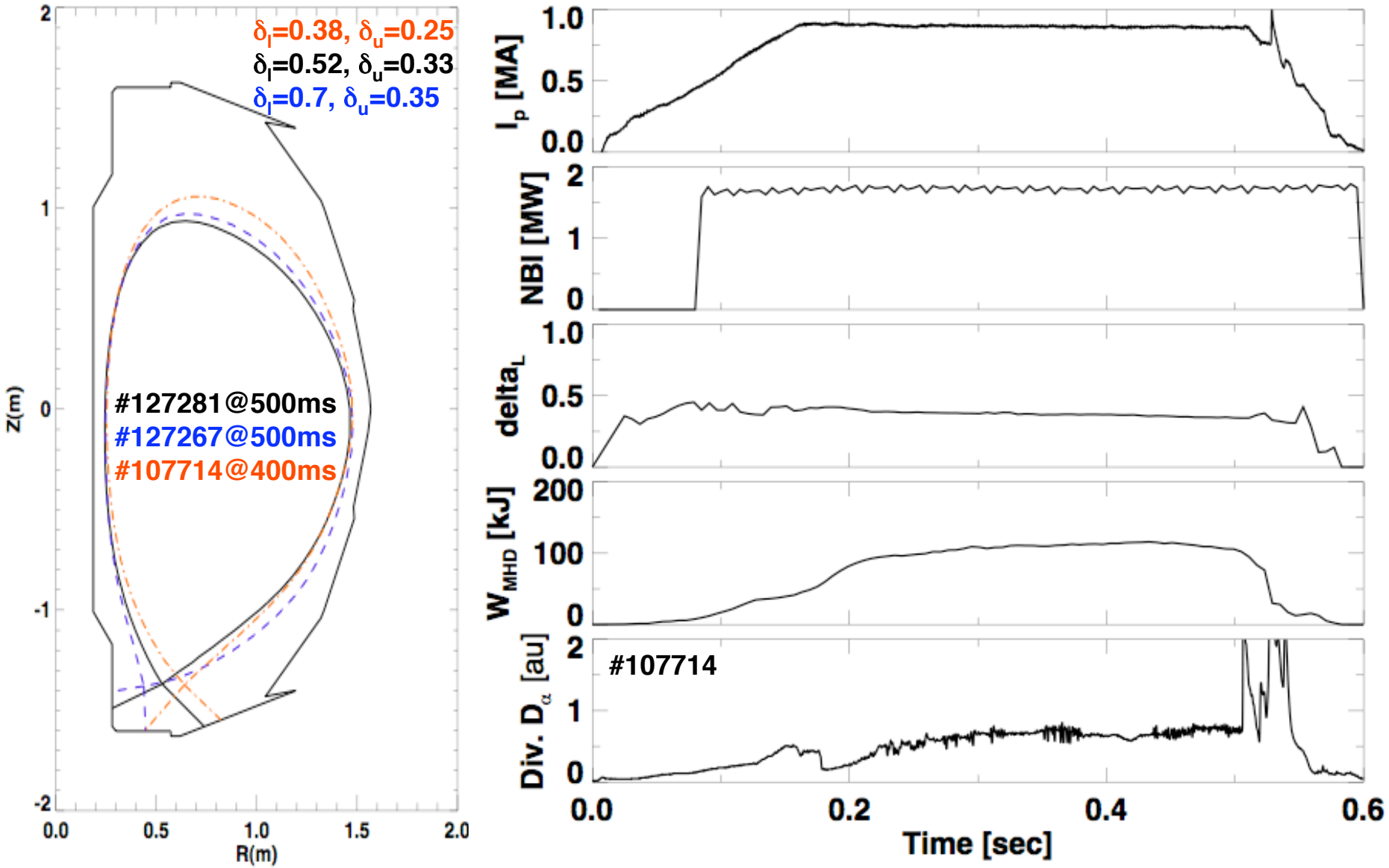
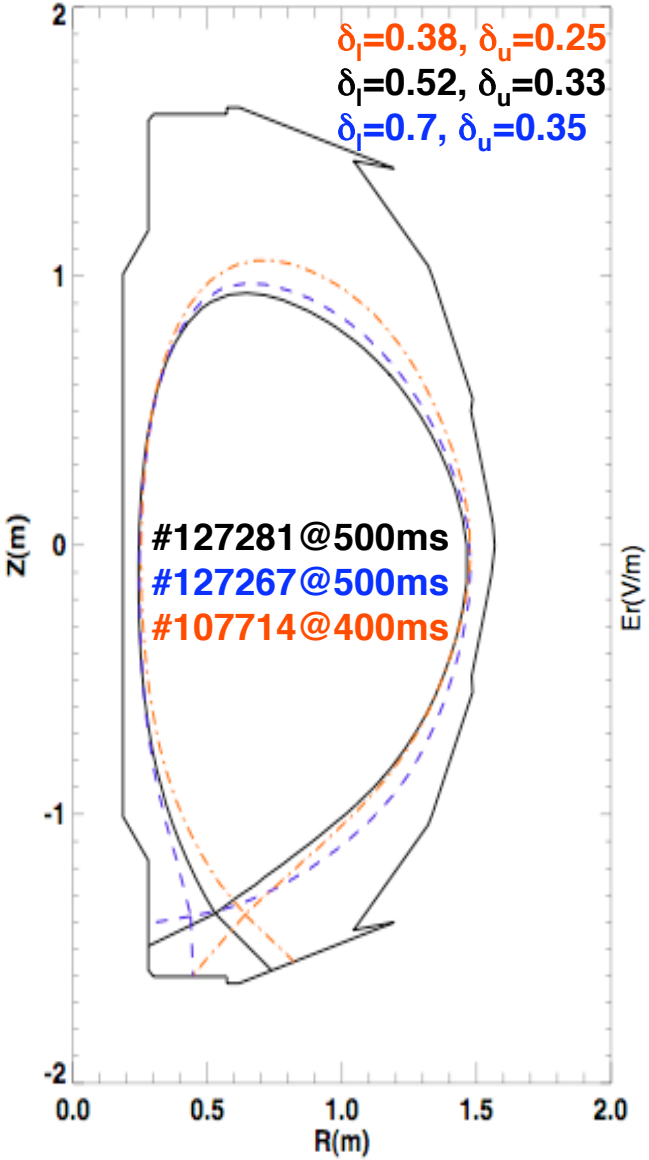
Dependence of the L-H power threshold on X-point radius

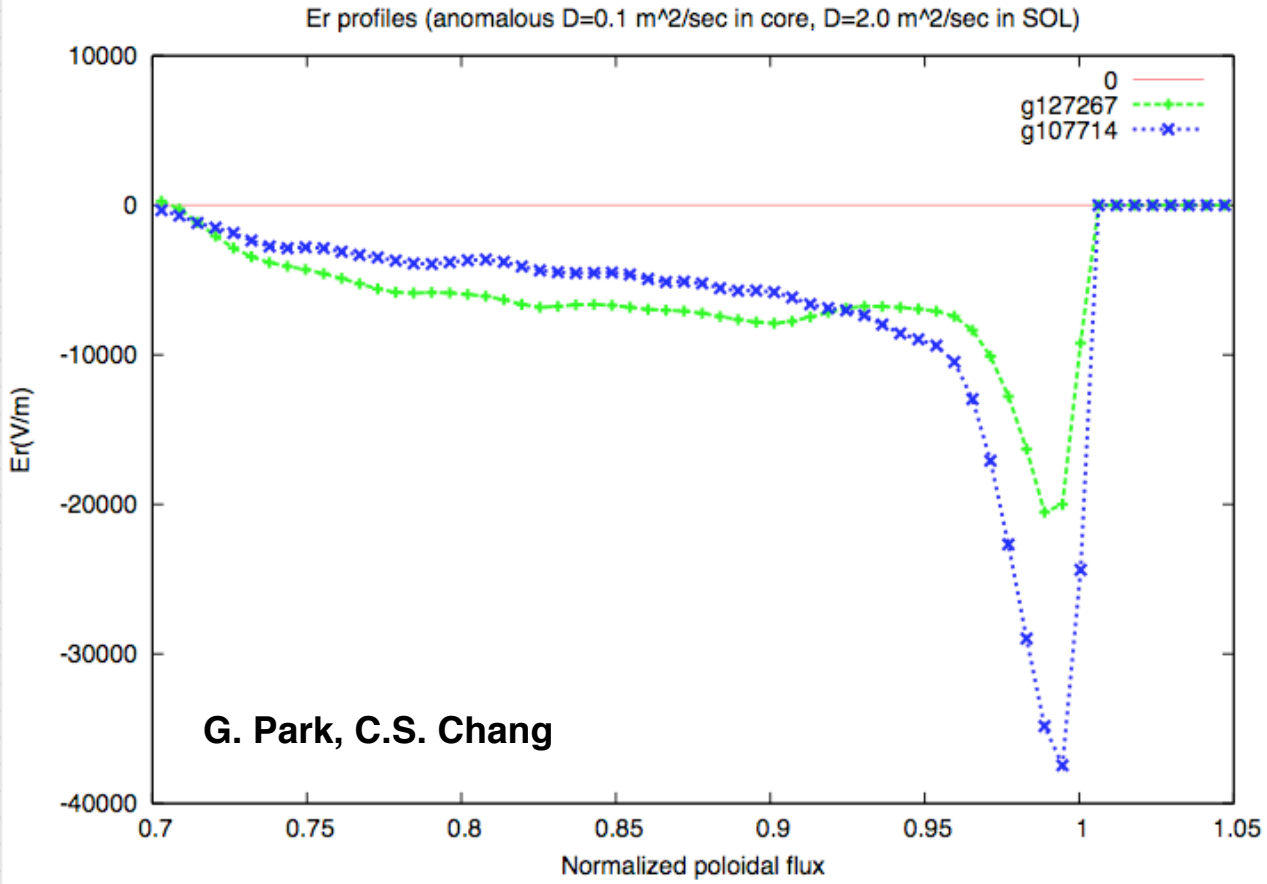
- In NSTX, DIII-D, JET (and probably other machines), an observation that P_{LH} decreases with triangularity (radius of X-point) has been noted but not documented
  - Could have an impact on future operational scenarios, using low δ to get H-mode and higher δ for improved stability, confinement
- CS Chang proposed in ~ 2003 that the ion loss near the X-point increased with increasing R (calcs. confirmed recently)
  - This would set-up a pre-transition E_r more easily and could translate to a lower P_{LH}
- *Goal: document the dependence of P_{LH} on triangularity (X-point radius) at fixed κ, δ_r^{sep}*
  - Target δ=0.4, 0.6, 0.8 (in LSN configuration)
  - Need XGC modeling/analysis to document results

Existence proof - we used to make lower δ shots routinely a long time ago (2002)



Recent XGC-0 calculation confirms larger X-point thermal loss and E_r/E_r' at large R_x





Shot list

- NBI scan at three different R_x (δ_L) to document E_r and P_{LH}
  - I_p=0.7-0.9 MA, B_t=0.45 T, κ ~ 2, δ_r^{sep} ~ -1.5 cm, X-point height ~ 20 cm, outer gap ~ 10 cm
- Measure P_{LH} in δ_L ~ 0.4 discharge (rtEFIT: 119838) [10]
  - Decision point: 0.7, 0.8, or 0.9 MA? (ohmic I_p ramp, 'high' P_{LH} desired)
  - Preliminary development in 'XP 900' will inform this part
  - Reduce NBI voltage as needed: C as low as possible, B~65, A~80-90
  - Pulse-width modulation if needed
- Measure P_{LH} in δ_L ~ 0.7 discharge (rtEFIT: 127267) [8]
  - Make sure to get comparison at same P_{LH} as for δ_L ~ 0.4
- Measure P_{LH} in δ_L ~ 0.5 discharge (rtEFIT: 127281) [8]
  - Make sure to get comparison at same P_{LH} as for δ_L ~ 0.4 and 0.7