XP 612

DEPENDENCE OF PERTURBED ELECTRON TRANSPORT
ON
HEAT FLUX, Q-PROFILE AND COLLISIONALITY IN NSTX

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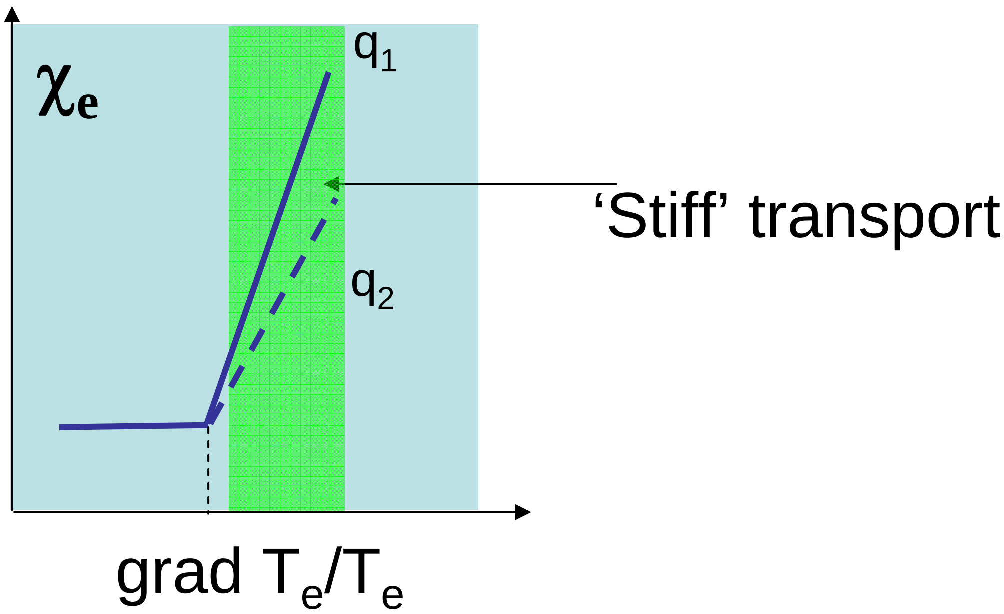
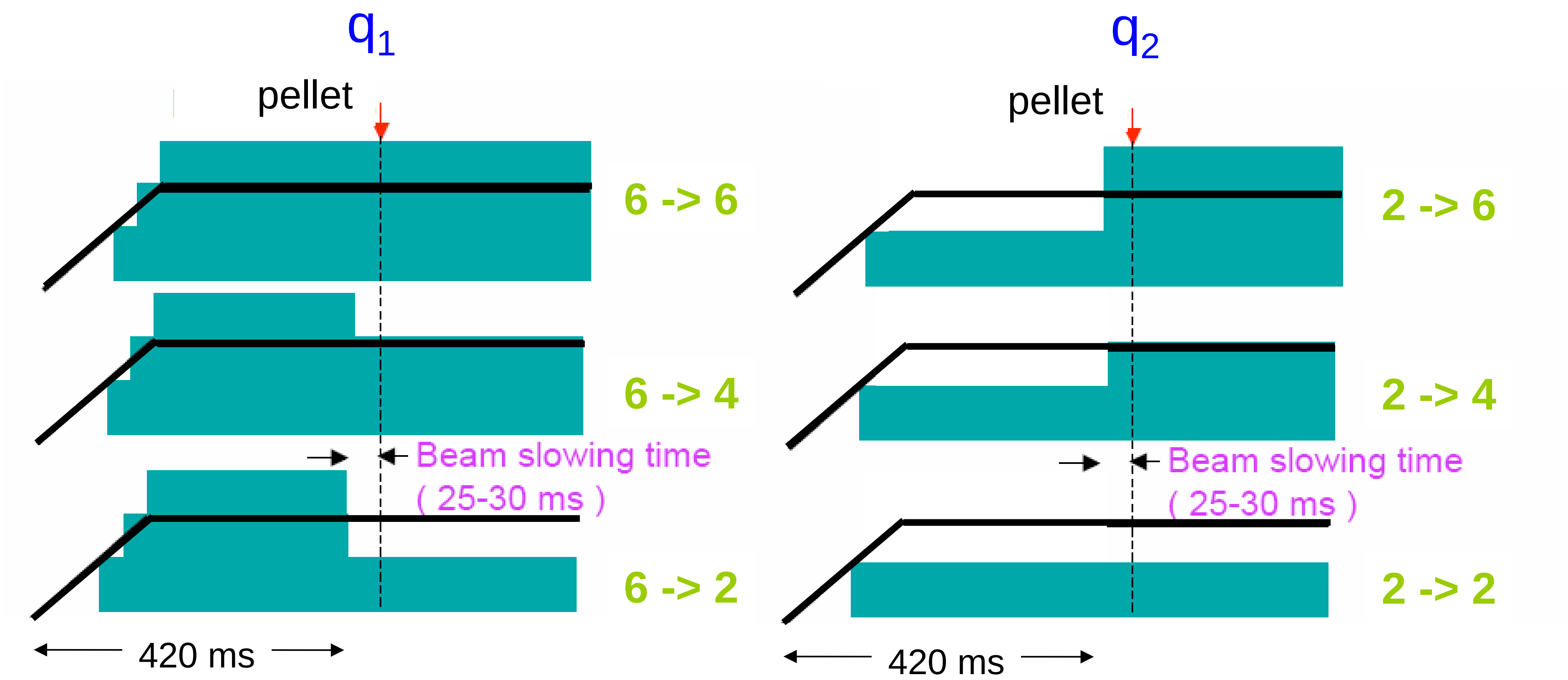
Motivation



- Expect faster cold pulse propagation at higher heat flux
- Expect q-profile/magnetic shear dependence from L-mode observations
- Compare perturbed electron and particle transport

Approach



- Preheat to ‘freeze-in’ q-profile -> change P_b -> perturb edge T_e with pellet
- Vary ‘frozen-in’ q-profile by changing preheat power
- Use as baseline high triangularity, small-ELM, 1 MA, DND H-mode

Summary of results

1. Small-ELM, high δ H-mode more resilient to perturbations

2. Cold pulse propagation slower with decreased heat flux

3. T_e peaking, confinement increase seen after pellet

4. Perturbed transport changes possibly also with preheat power/q-profile (equilibrium T_e profile clearly changes)

5. Vitreous C injection suggests particle diffusivity much less than electron diffusivity (see also L. Delgado XP)

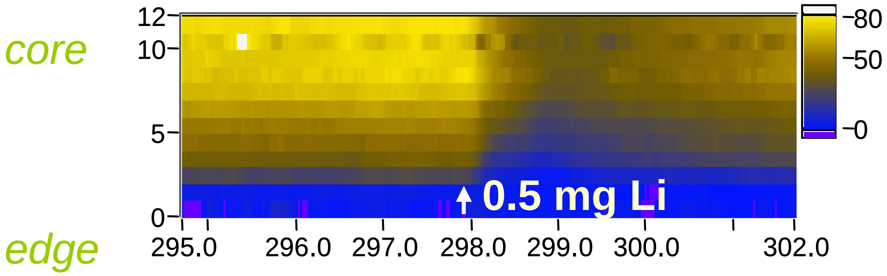
What did not work

- L-mode collisionality scan not executed (lack of time and suitable pellets)
- Injection of vitreous C did not make good T_e perturbation as before (but useful for particle transport)
- Injection of large (3 mg) Li pellet made T_e perturbation, but changed also magnetic equilibrium
- Few shots with MPTS before/after pellet, due to larger jitter in pellet arrival time

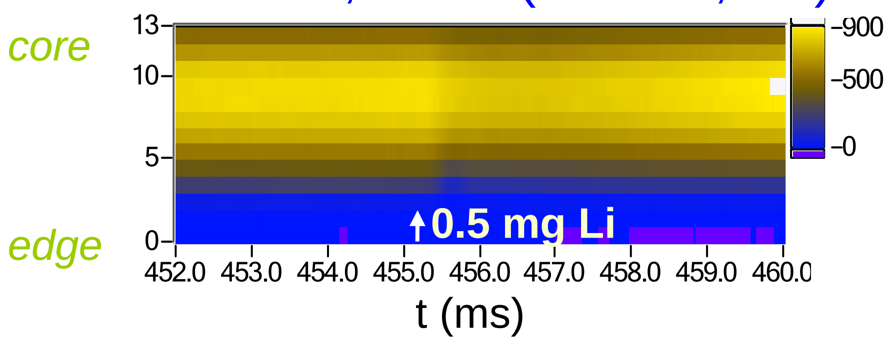
Result 1: Perturbed transport changed this run (high δ)

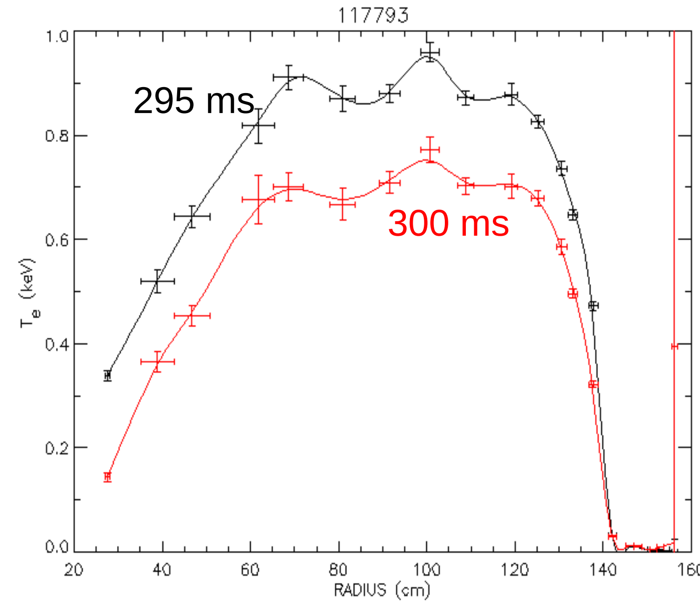
Top USXR, E > 1.4 keV

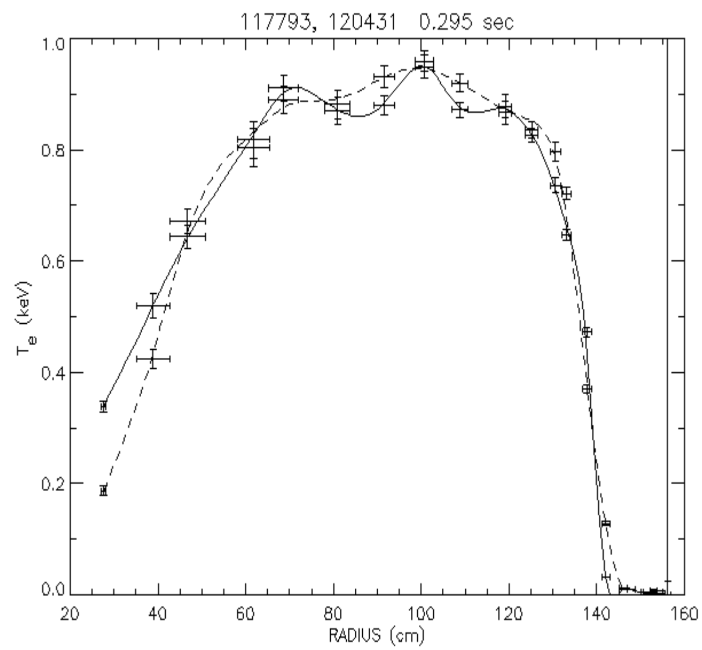
6 ->6, δ=0.65 (117793, '05)



6 ->6, δ=0.8 (120443, '06)





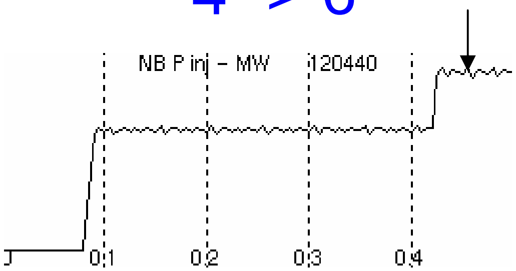


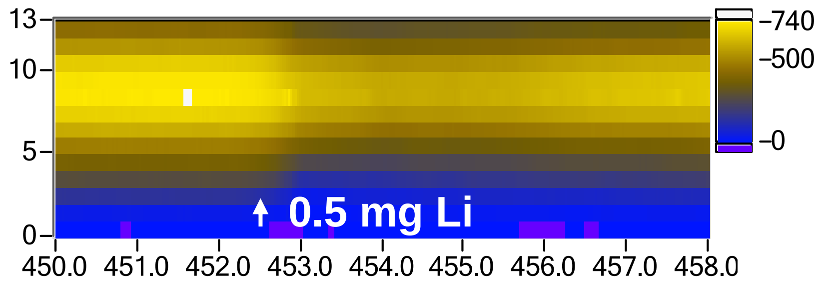
- Less perturbation in high δ, 6 -> 6 MW case
- Motivated 2nd half day (bigger pellets)
- Change in perturbed transport also reason for disappearance of large ELMs at high δ ?

Result 2: Cold pulse slows with decreased heat flux

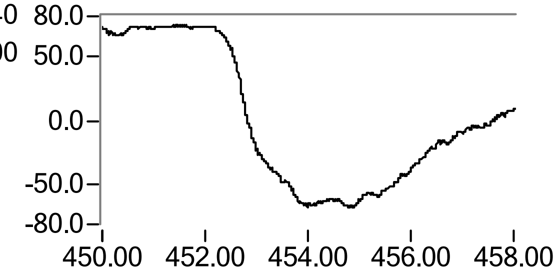
Top USXR, E > 1.4 keV

4 -> 6

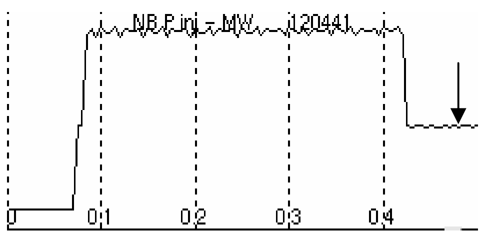


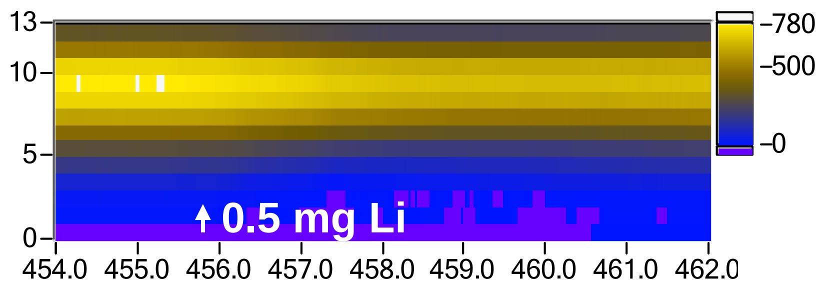


chord 9

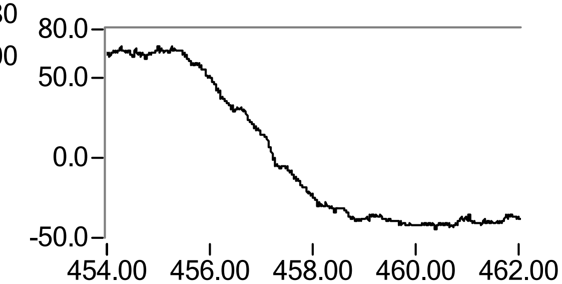


4 -> 2





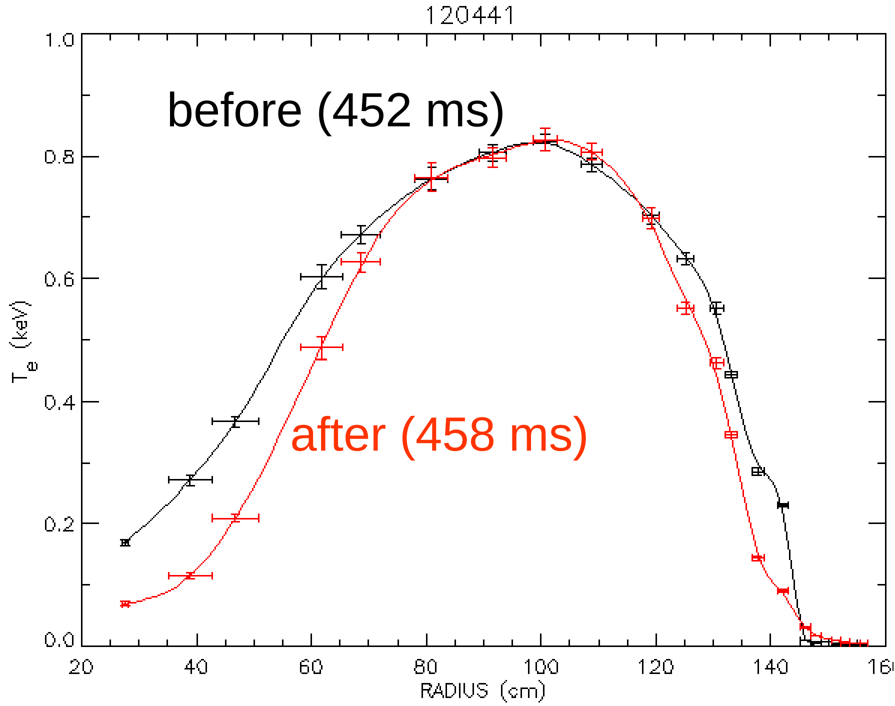
t (ms)

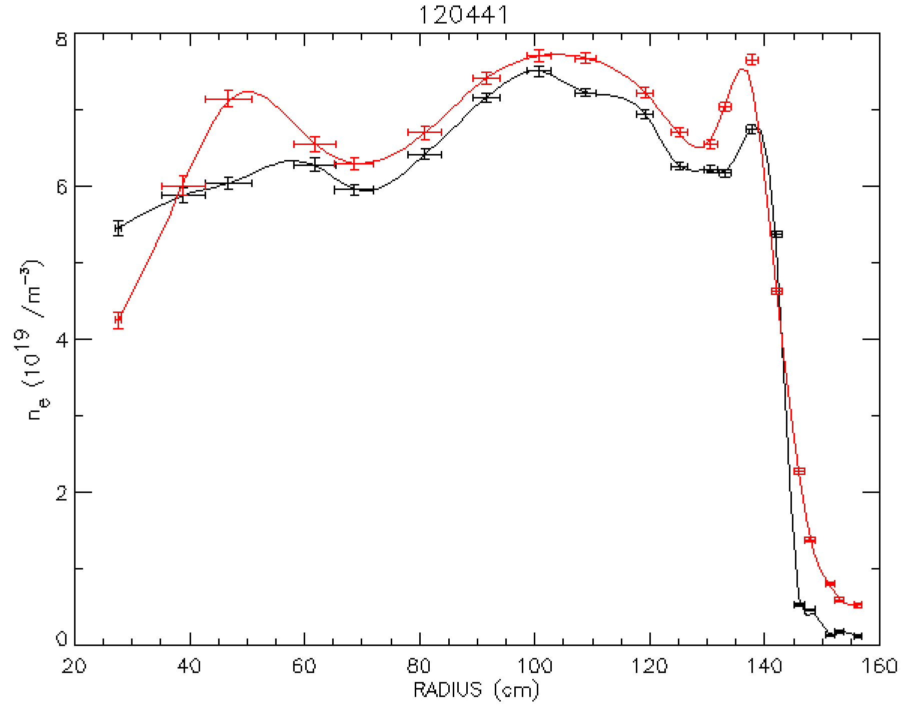


t (ms)

MPTS T_e less 'stiff' with reduced heat flux

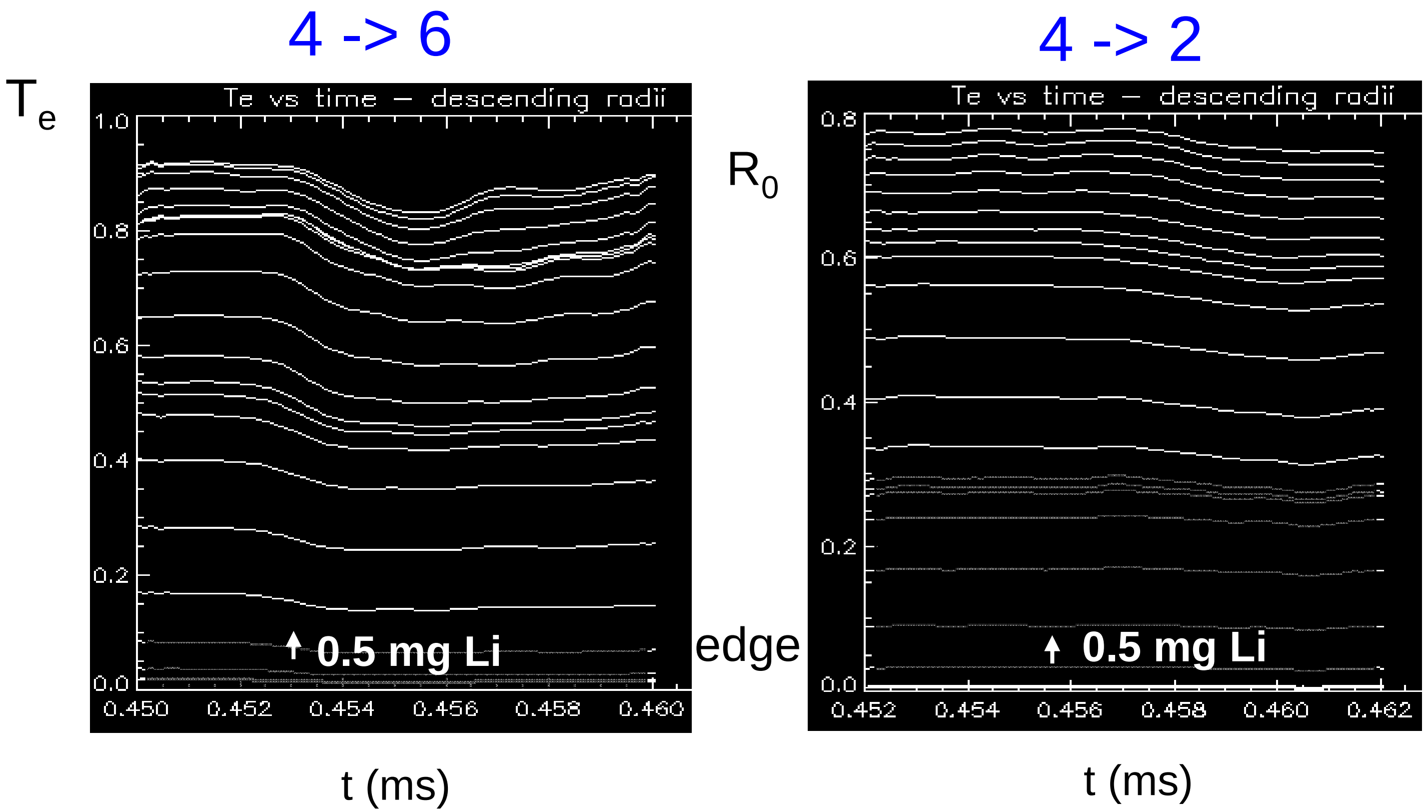
4 -> 2





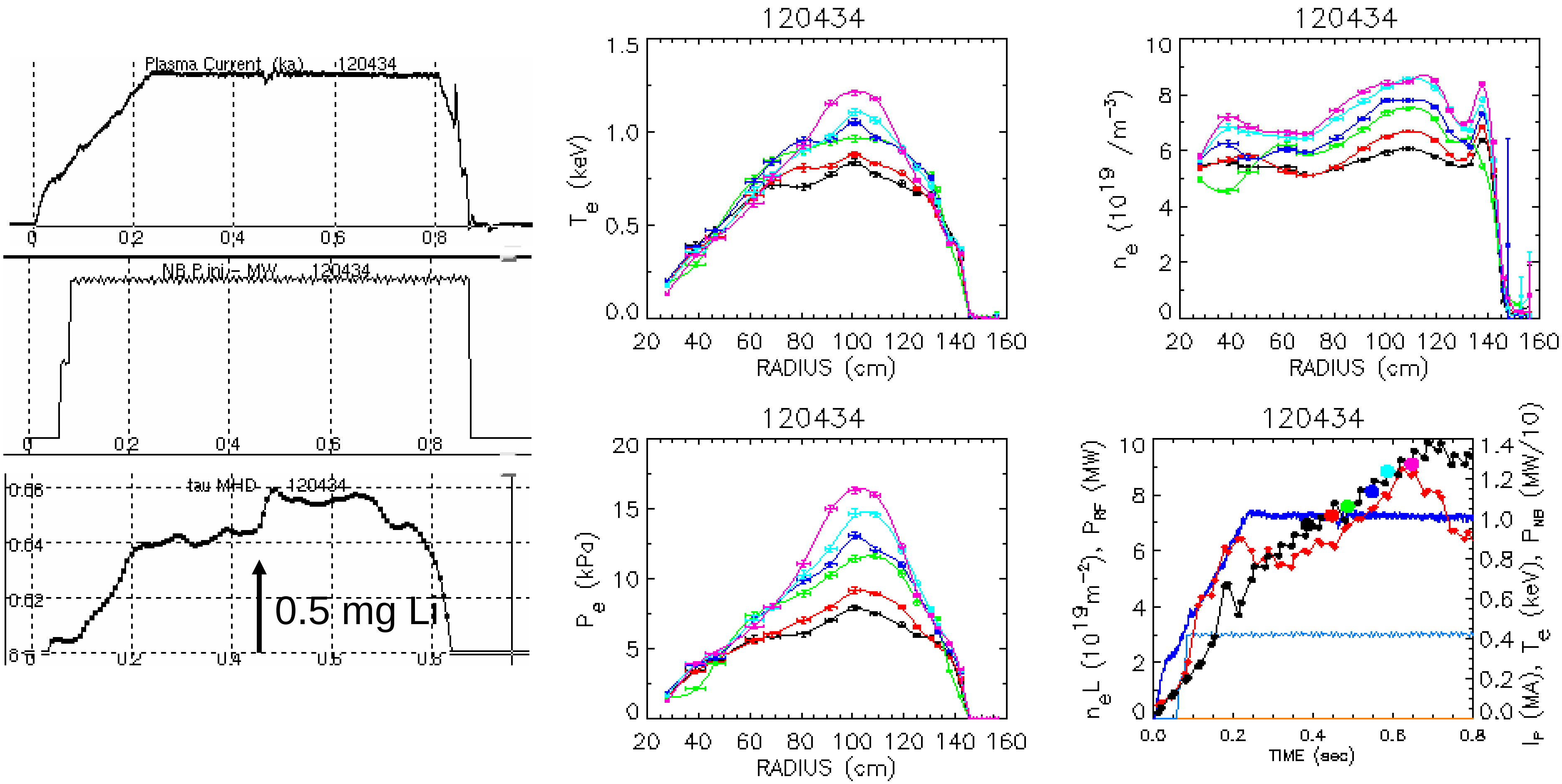
- Few shots with MPTS 'bracketing' due to large jitter in pellet arrival time

Preliminary modeling of OSXR array data



- Peripheral SNR affected by neutron background, tangential view
- Confirms slower cold pulse evolution at reduced power (center)
- OSXR + USXR modeling for improved peripheral profiles

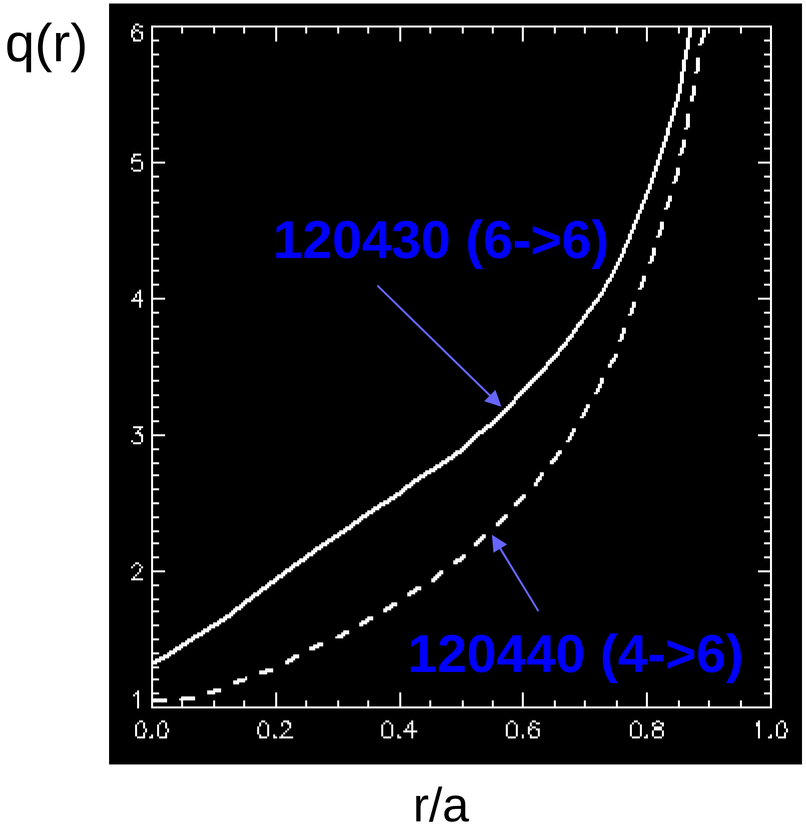
Result 3: T_e peaking and τ_e increase seen after pellet



- Apparently bifurcation in electron transport
- Due to change in q-profile induced by pellet ?

Result 4: Perturbed transport change some also with q

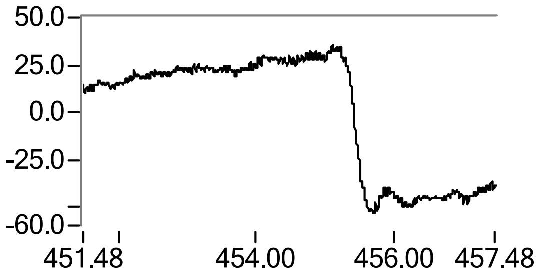
LRDFIT, t=0.45 s (K. Tritz)



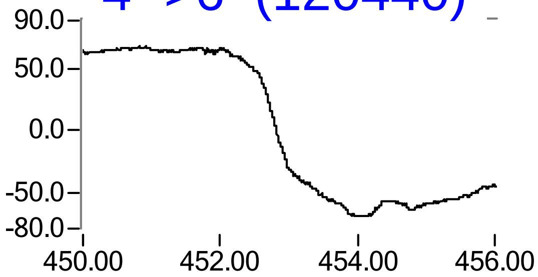
Top USXR, E > 1.4 keV

chord 6 (mid-radius)

6 ->6 (120443)



4 ->6 (120440)

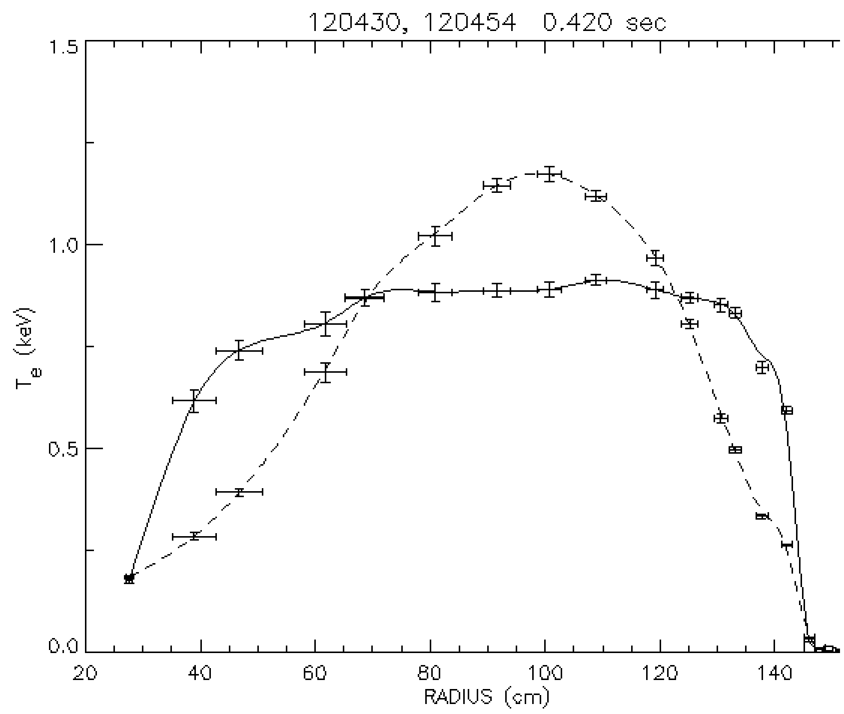


t (ms)

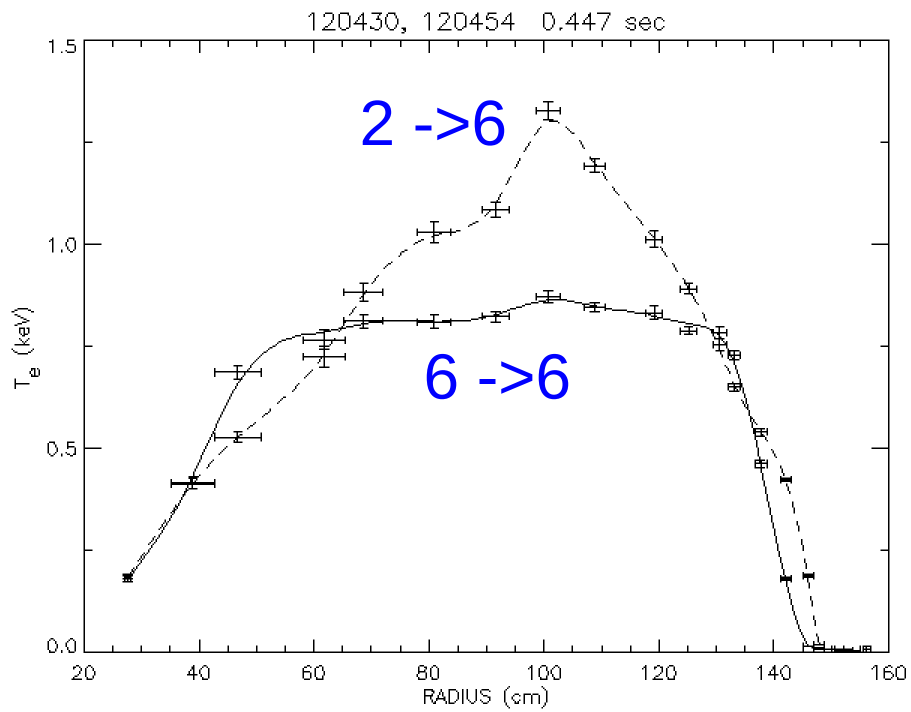
- LRDFIT confirms q-profile change with preheat, ‘frozen-in’ current
- Transport change less pronounced than with heat flux

Equilibrium T_e profiles change with preheat power

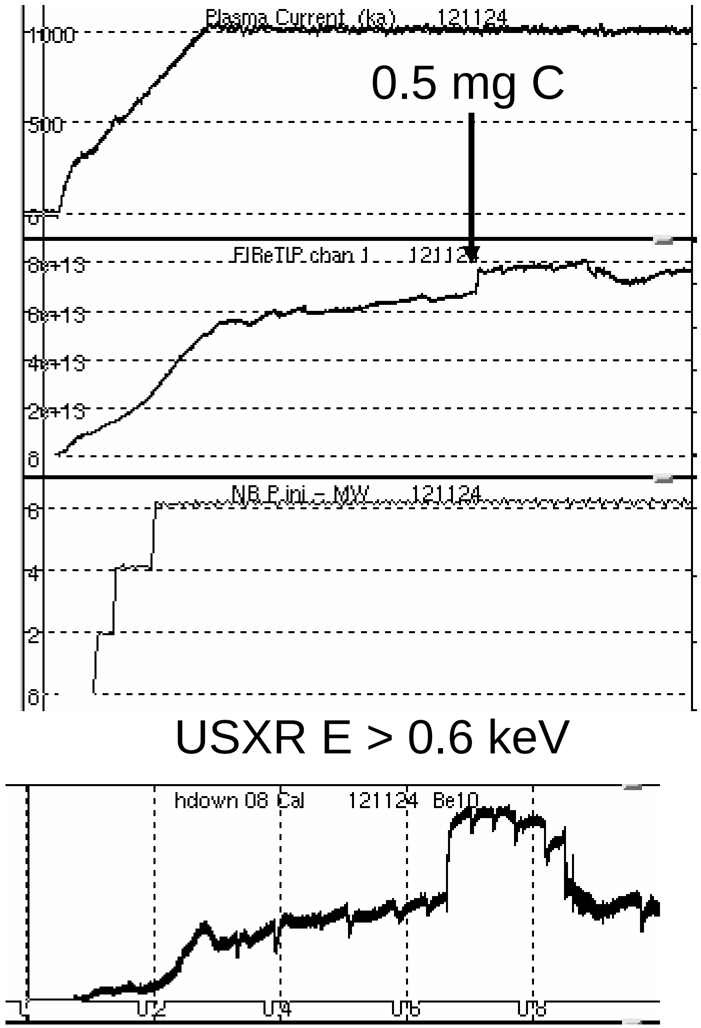
before P_b change



30 ms after (right before pellet)



Result 5: C pellet injection suggests low particle diffusion



- Vitreous C pellet ablates uniformly through the plasma
- Deposited C stays inside until expelled by MHD