Heat Flux Scaling Proposal

R. Maingi

Oak Ridge National Laboratory

K. Kugel, C.Lasnier, L. Roquemore, V. Soukhanovskii,
C. Bush, and the NSTX Team

NSTX Research Forum FY 2002

Princeton, NJ

Nov. 28-30, 2001

Heat flux scaling and power accountability is integral part of ST mission

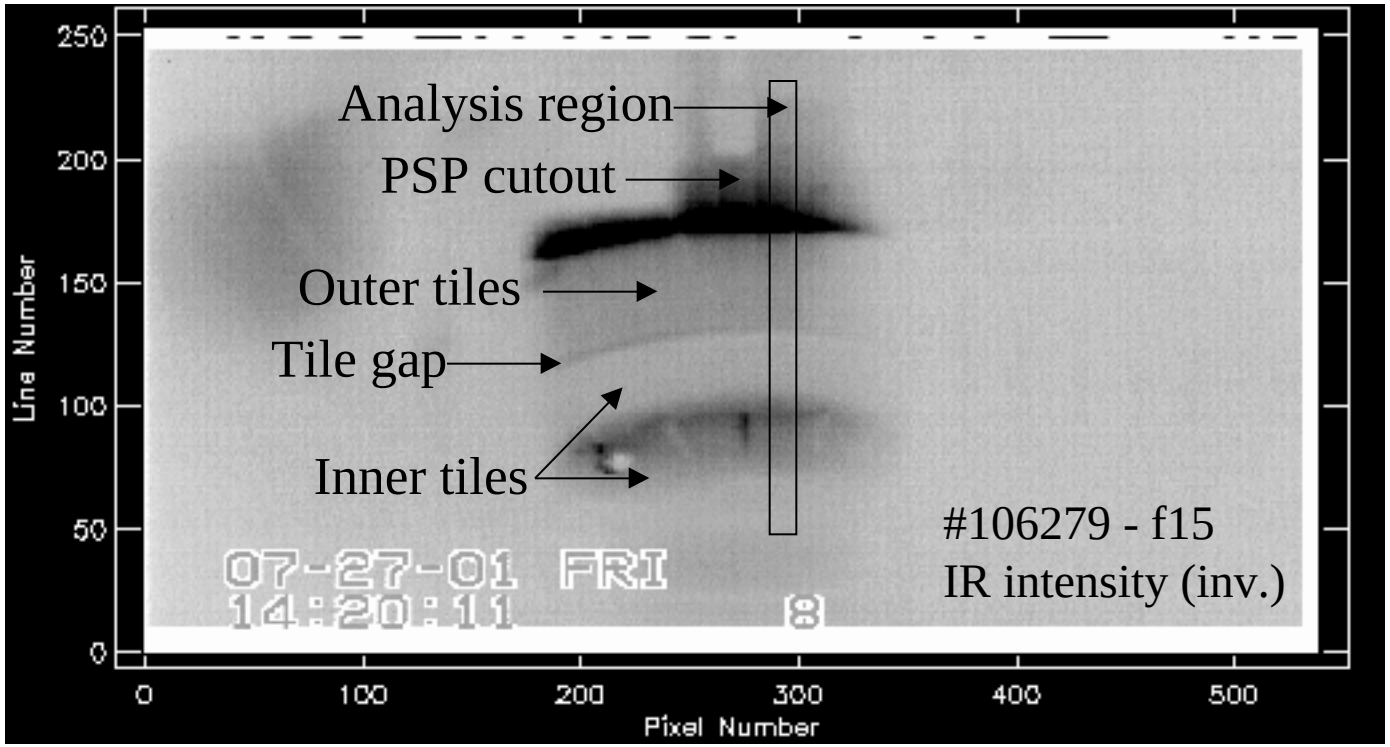
- Next step ST's designed for high power density operation
  - Higher heat loads on plasma facing components
- Milestone (in FY '03) for heat flux scaling and NSTX PFC needs for long pulse ~ 5s operation in '04-'06
- Proposal:
  - Measure heat flux vs. n_e, P_{heat}, and I_p
  - Compare profiles in L-mode and H-mode discharges
  - Measure power loss fraction to center stack
  - Measure in/out divertor heat flux ratios in single-null and double-null discharges

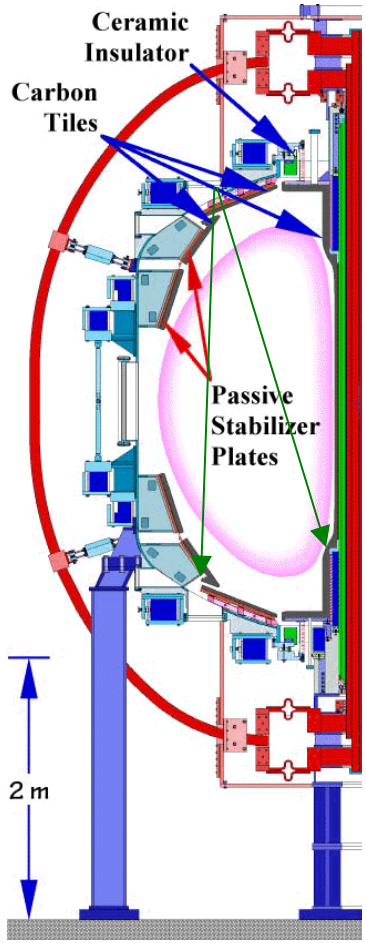
IR cameras upgraded during down time

- Second IR camera purchased to view center stack
  - Initiate power accountability study
- Digital interface units purchased
  - 12 bit resolution, compared with 8 bit video/analog
  - Obviates optimization of manual gains
- Narrow field-of view lens purchased
  - Improved spatial resolution
- Expect extension of pulse length in single-nulls due to anticipated error field reduction

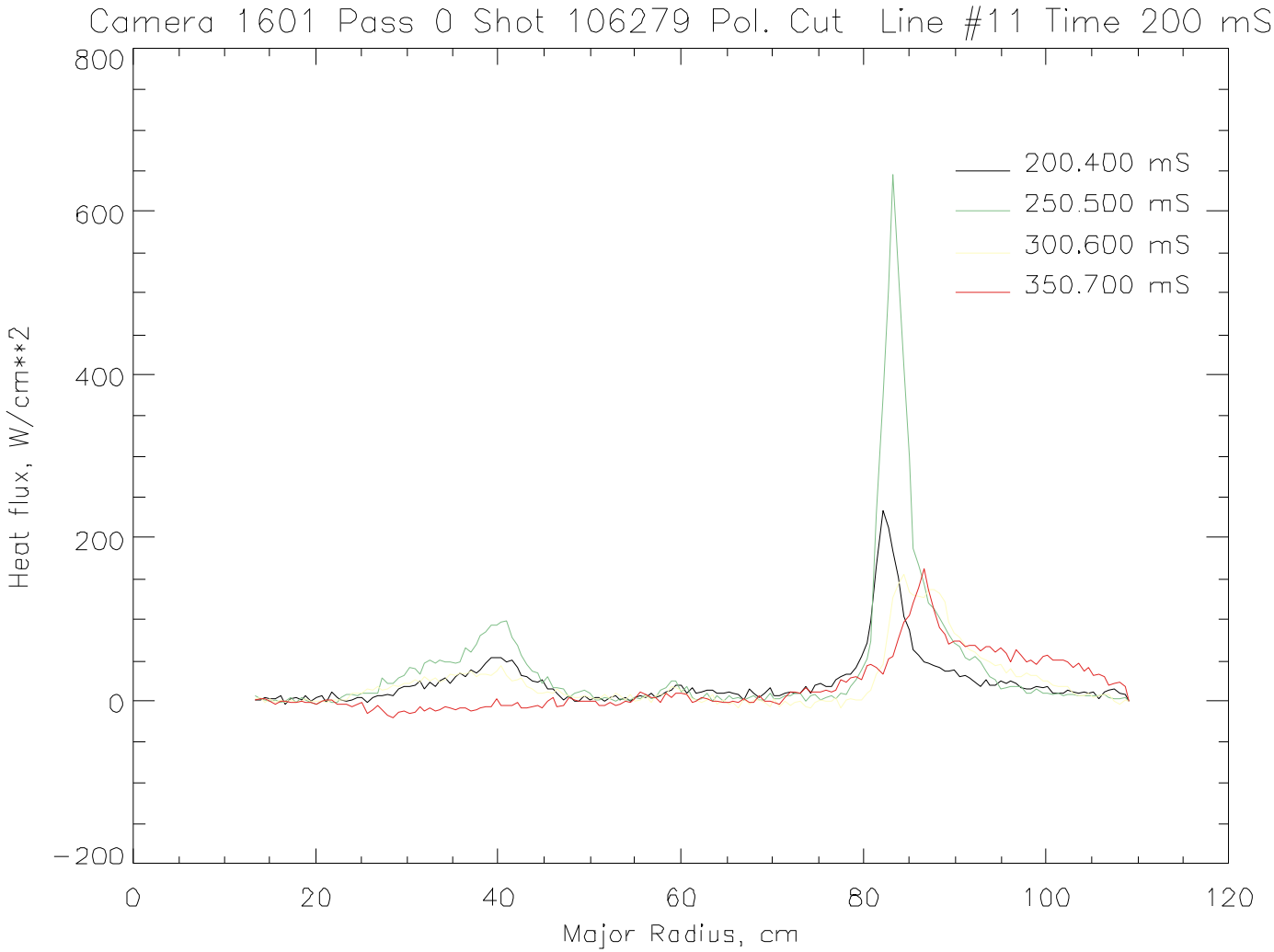
IR camera view allows radial profile measurements

IR camera: 7-13 μm range, 30 Hz, 25ms thermal e-folding time, spatial resolution ~ 1 cm with present optics

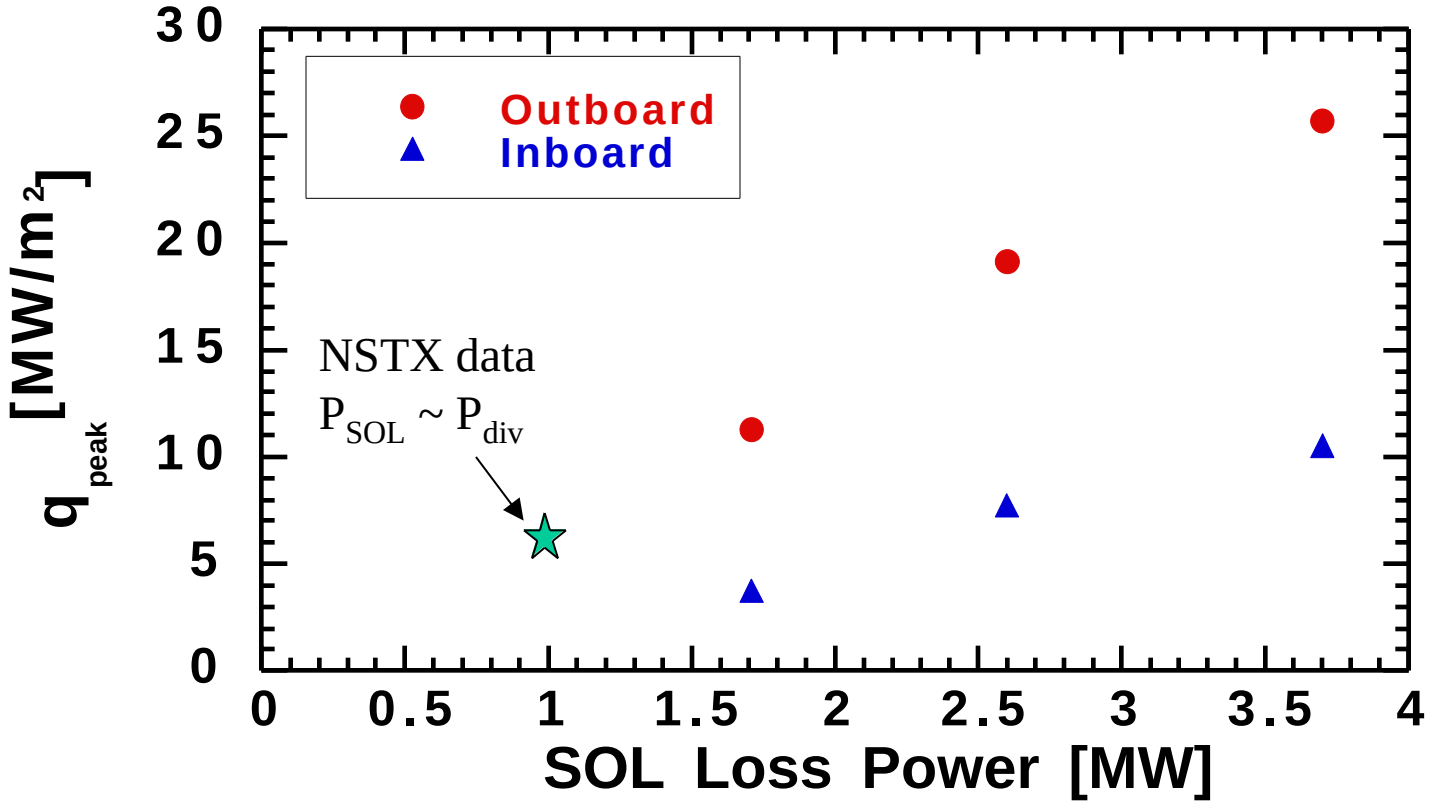




Heat Flux Profiles Peak Before Reconnection Event

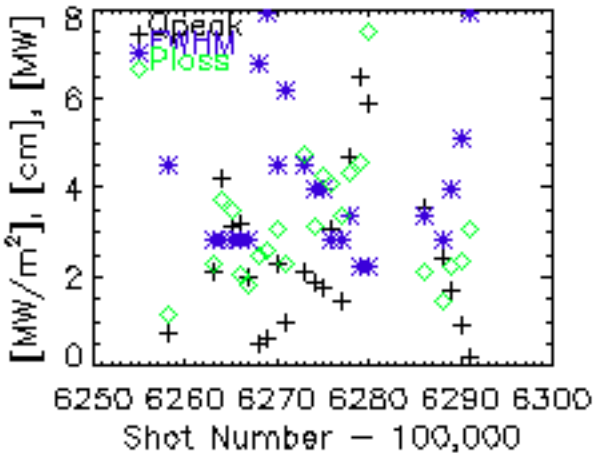


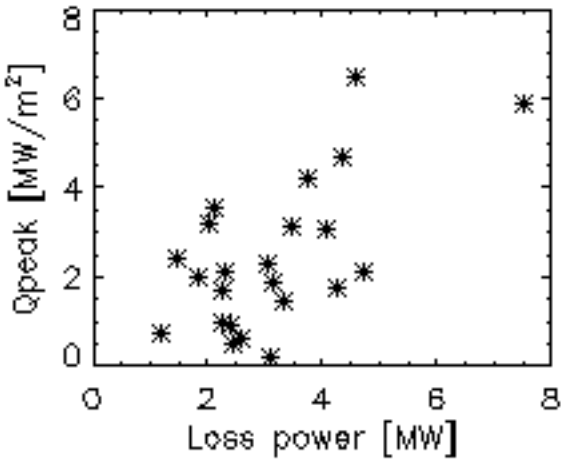
Peak heat flux in NSTX expected to increase with SOL loss power

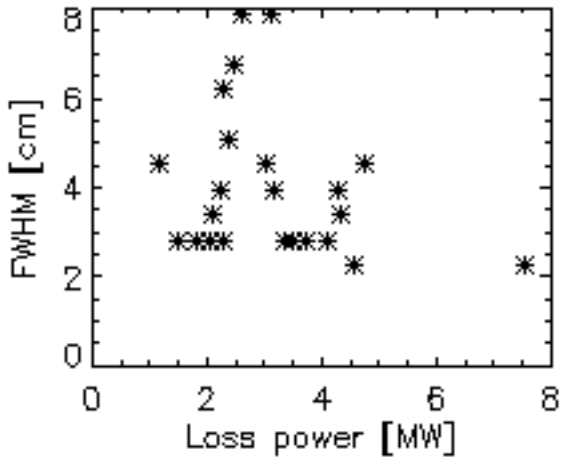


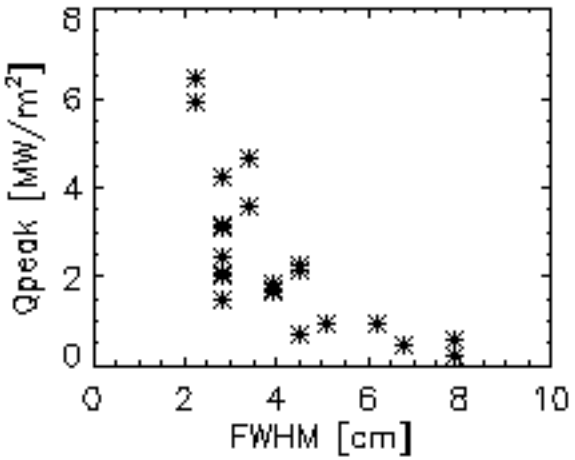
b2.5 code, 4 m^2/sec cross-field transport, deuterium radiation

Peak heat flux and profile peaking increase with heating power

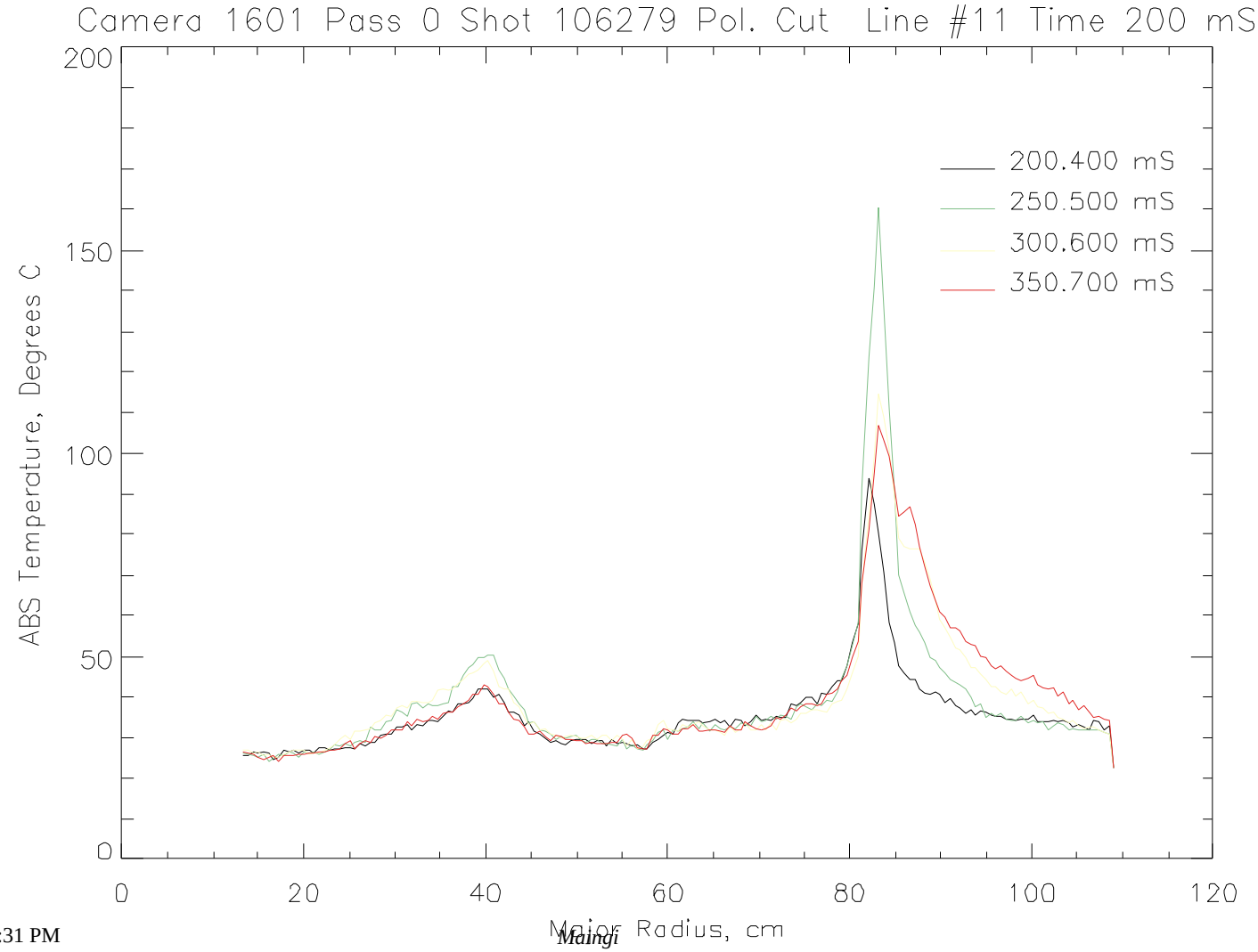




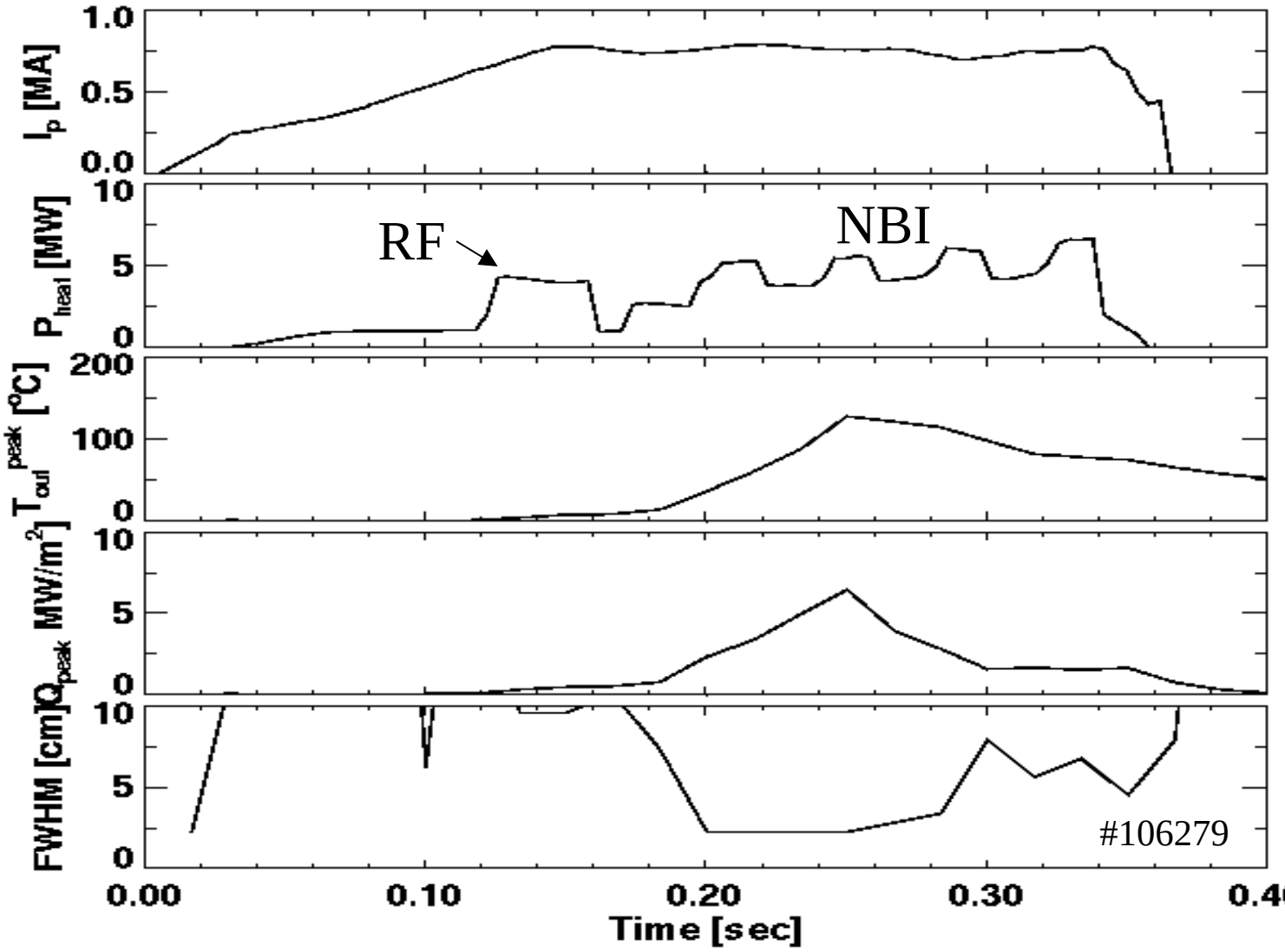




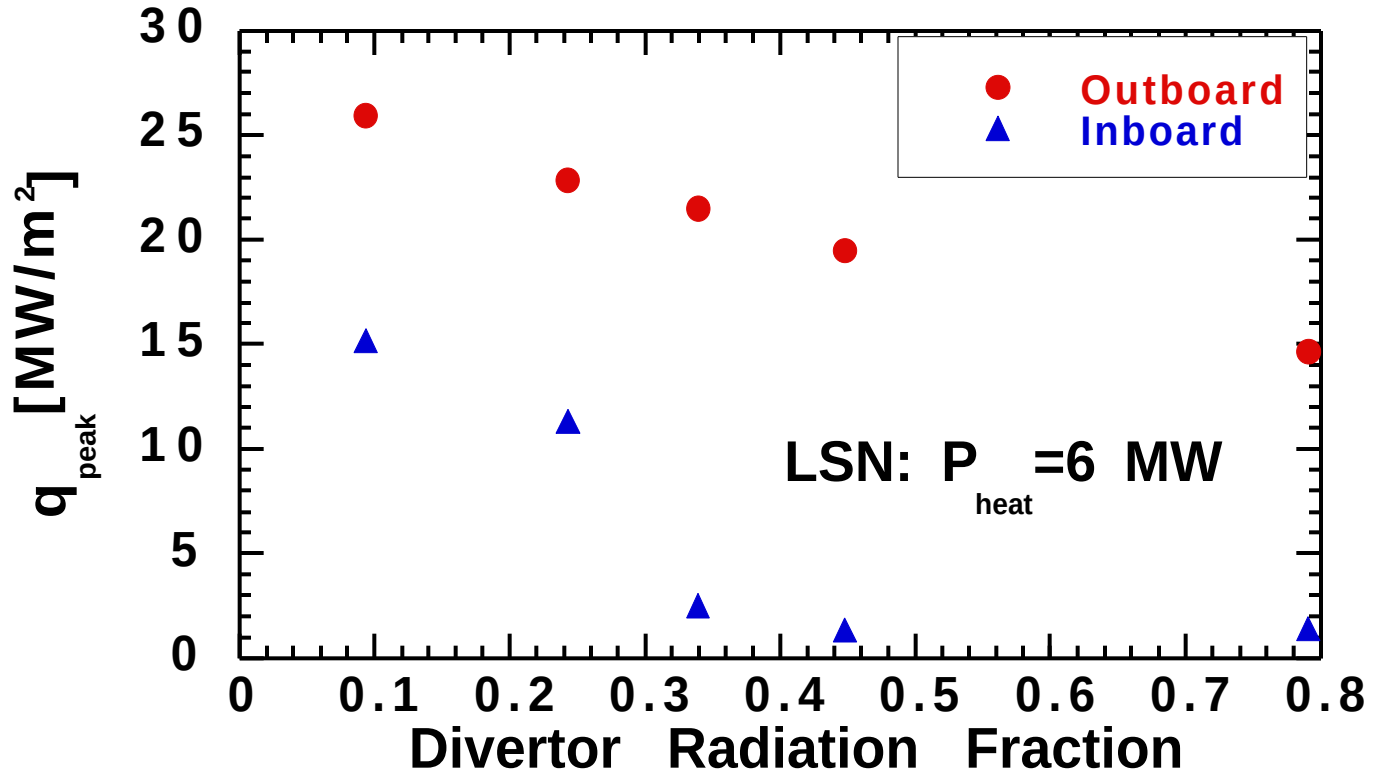
Temperature profiles show sharp peak during auxiliary heating



NBI heating lead to highest observed heat fluxes and sharpest profiles



Early 2-D model predictions showed decrease of peak heat flux with divertor radiation fraction



b2.5 code, 4 m^2/sec cross-field transport, deuterium enhanced radiation