

Boundary Physics Overview

Heat Flux Scaling Experiment

R. Maingi

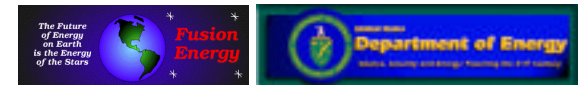
Oak Ridge National Laboratory

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

NSTX Results Review

Princeton, NJ

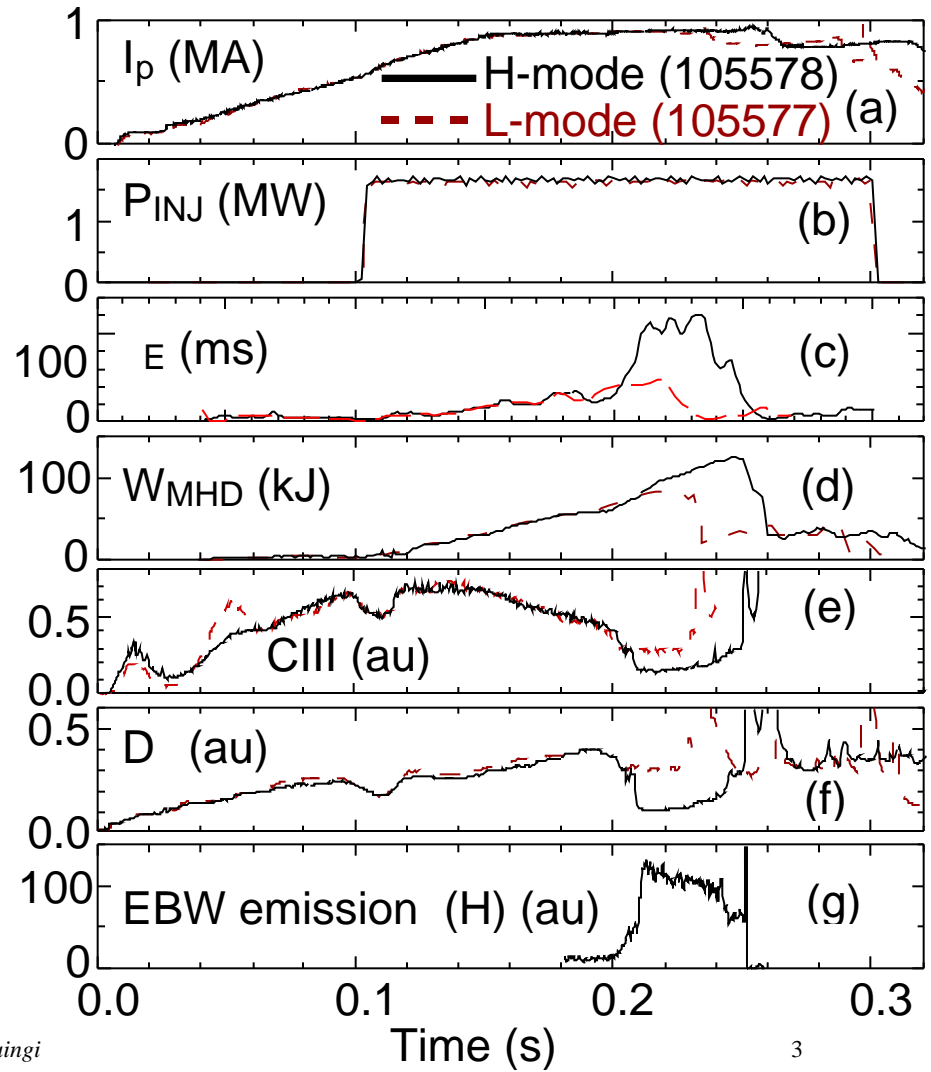
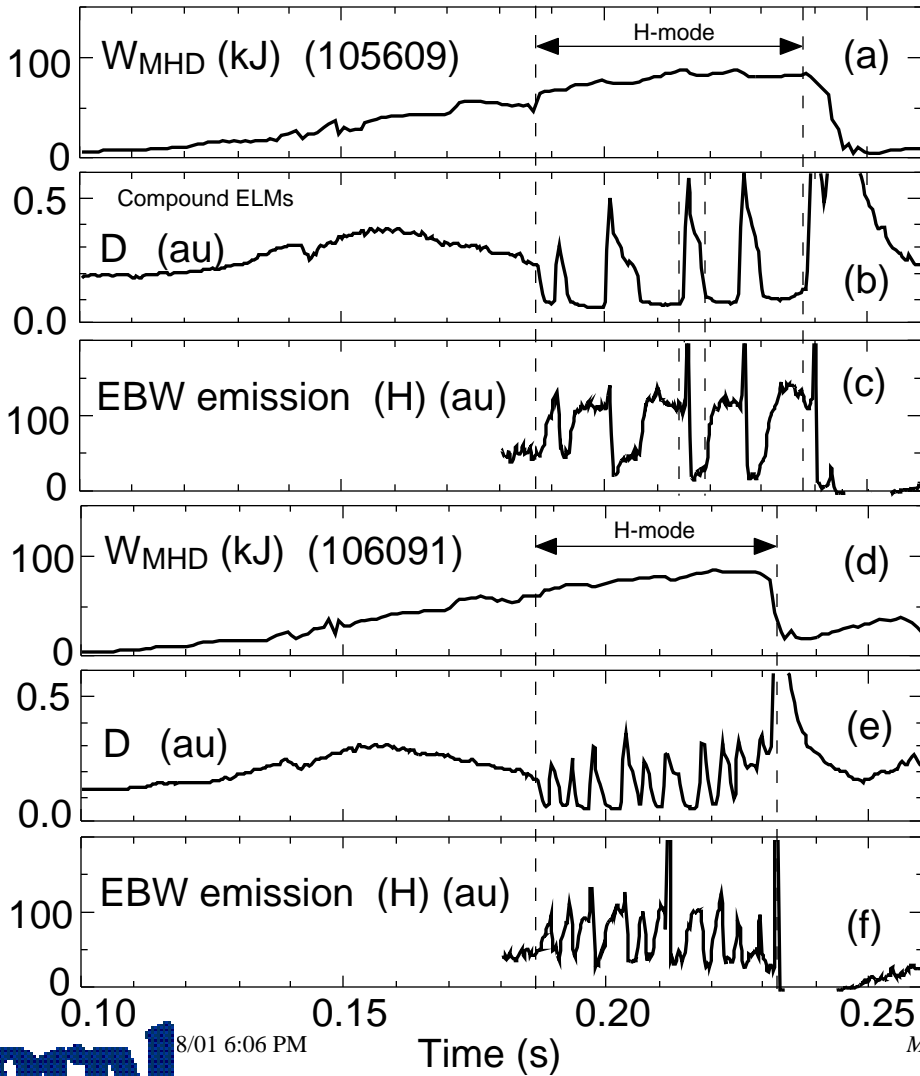
Sept. 19-20, 2001



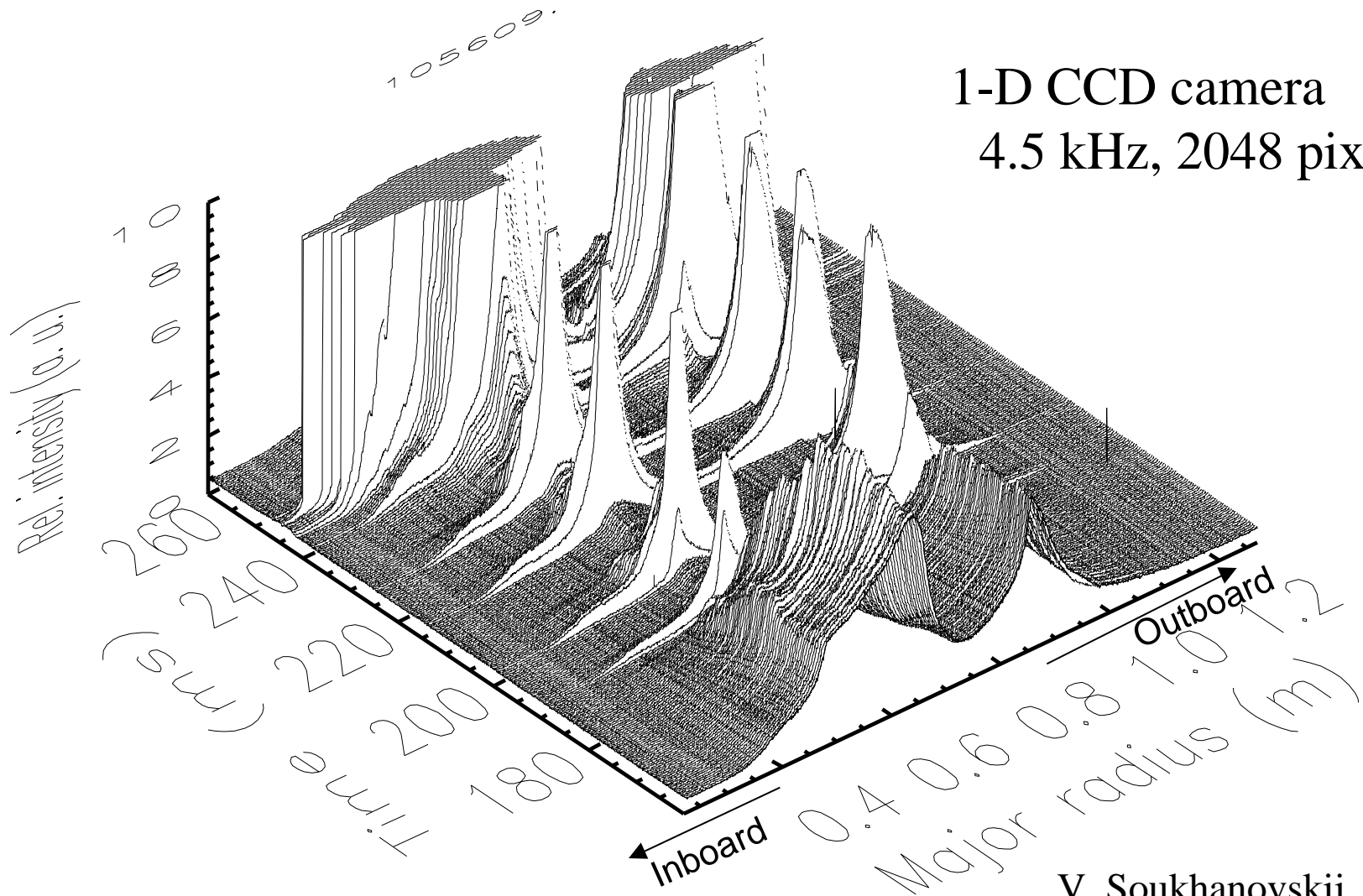
Boundary Physics experiments conducted in several areas

- H-mode experiments w/ T & T (Bush, Kaye, LeBlanc, Maingi)
- Heat Flux Scaling Experiment (Maingi)
- Analysis of standard boronization (Na)
- Plasma boronization experiment (Kugel)
- Preparation for particle balance analysis (Soukhanovskii)
- Prototyped/debugged divertor Langmuir probes (Nishino)

Both ELM-free and ELMy -modes have been observed in NSTX

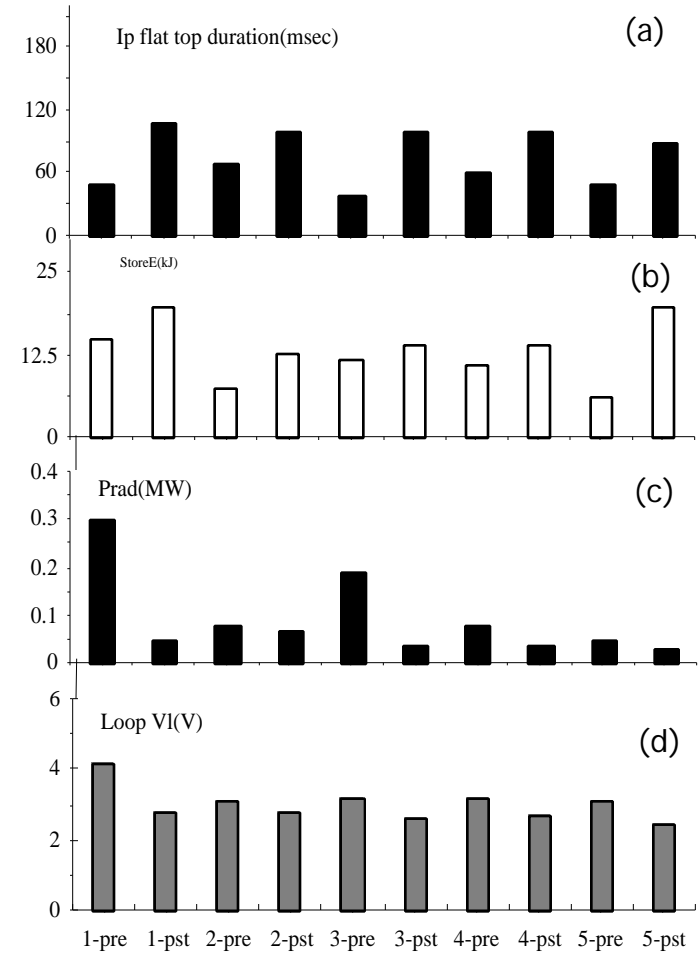
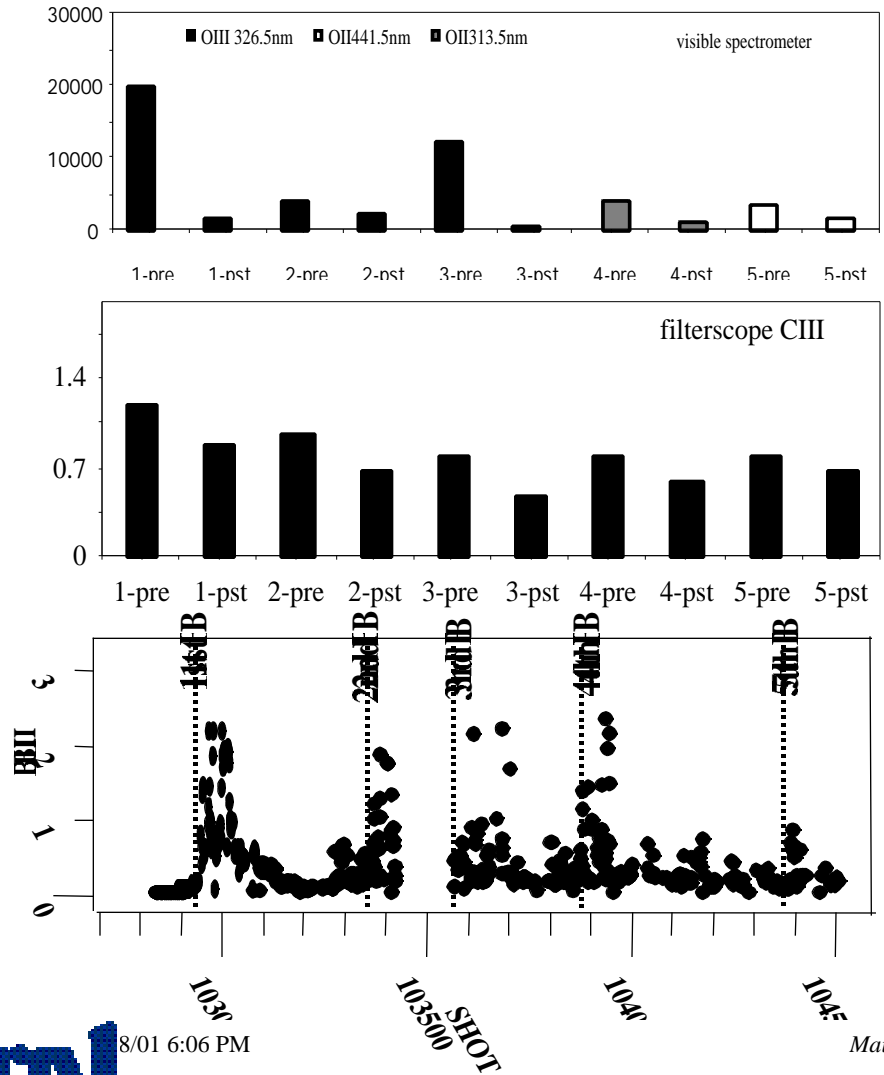


D Emission From lower divertor will be used in particle balance and core fueling studies



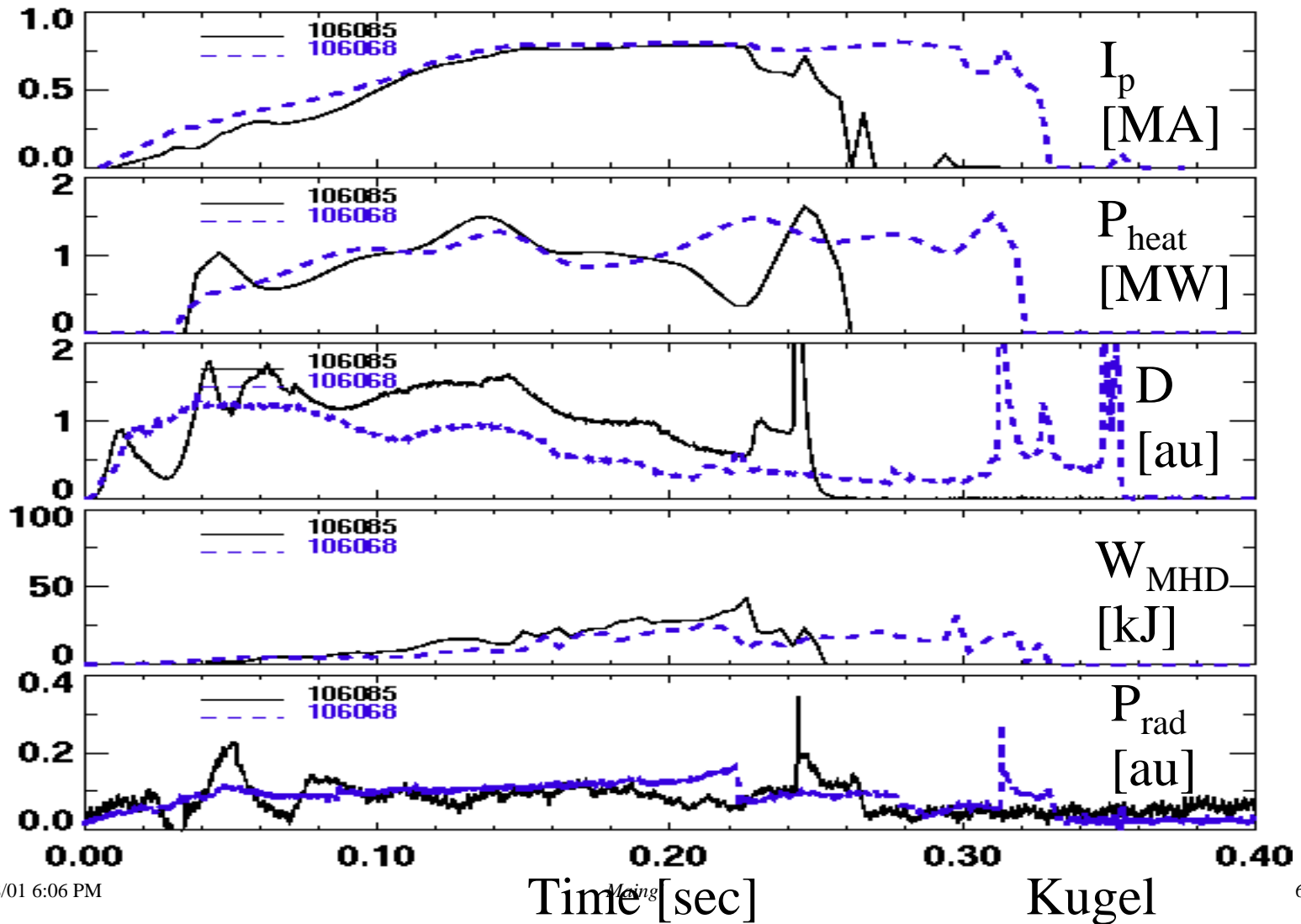
1-D CCD camera
4.5 kHz, 2048 pixels

Glow Discharge Boronization Consistently Reduced Oxygen and Improved Ohmic Performance



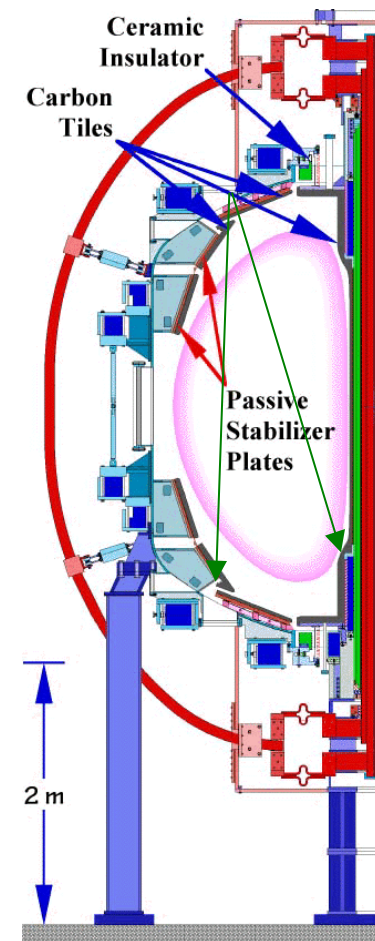
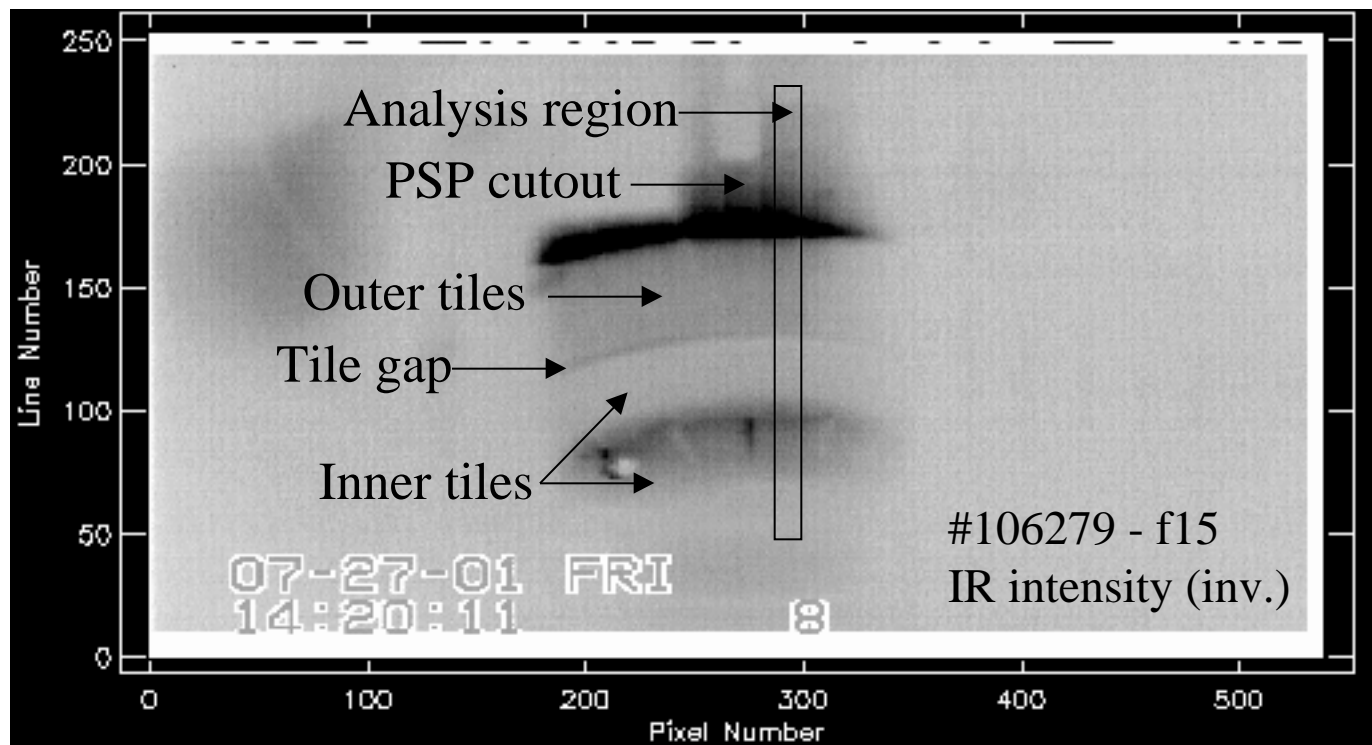
H. Na

Plasma Boronization (black) lead to lower radiated power and better ohmic performance



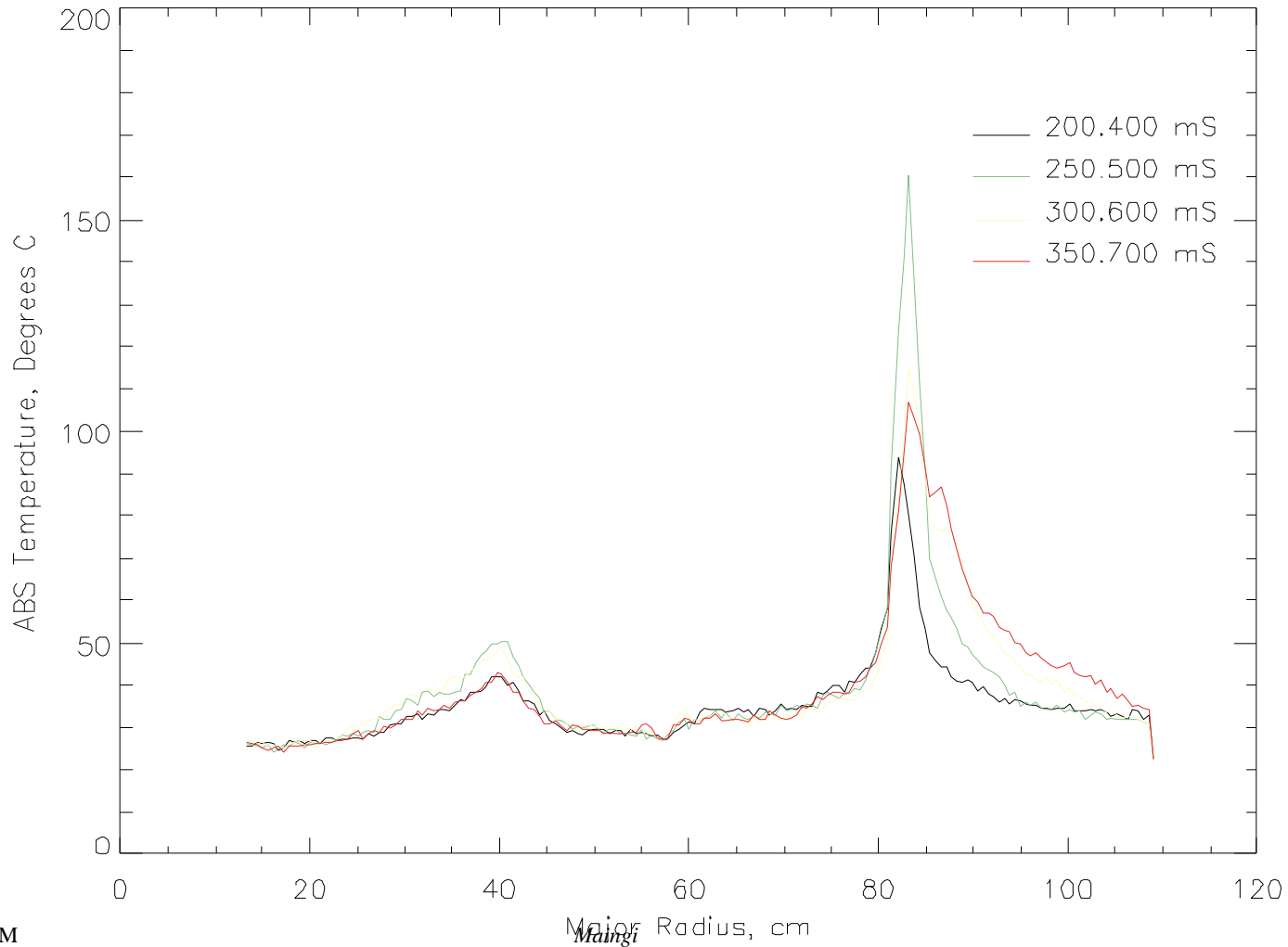
IR camera view allows radial profile measurements

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

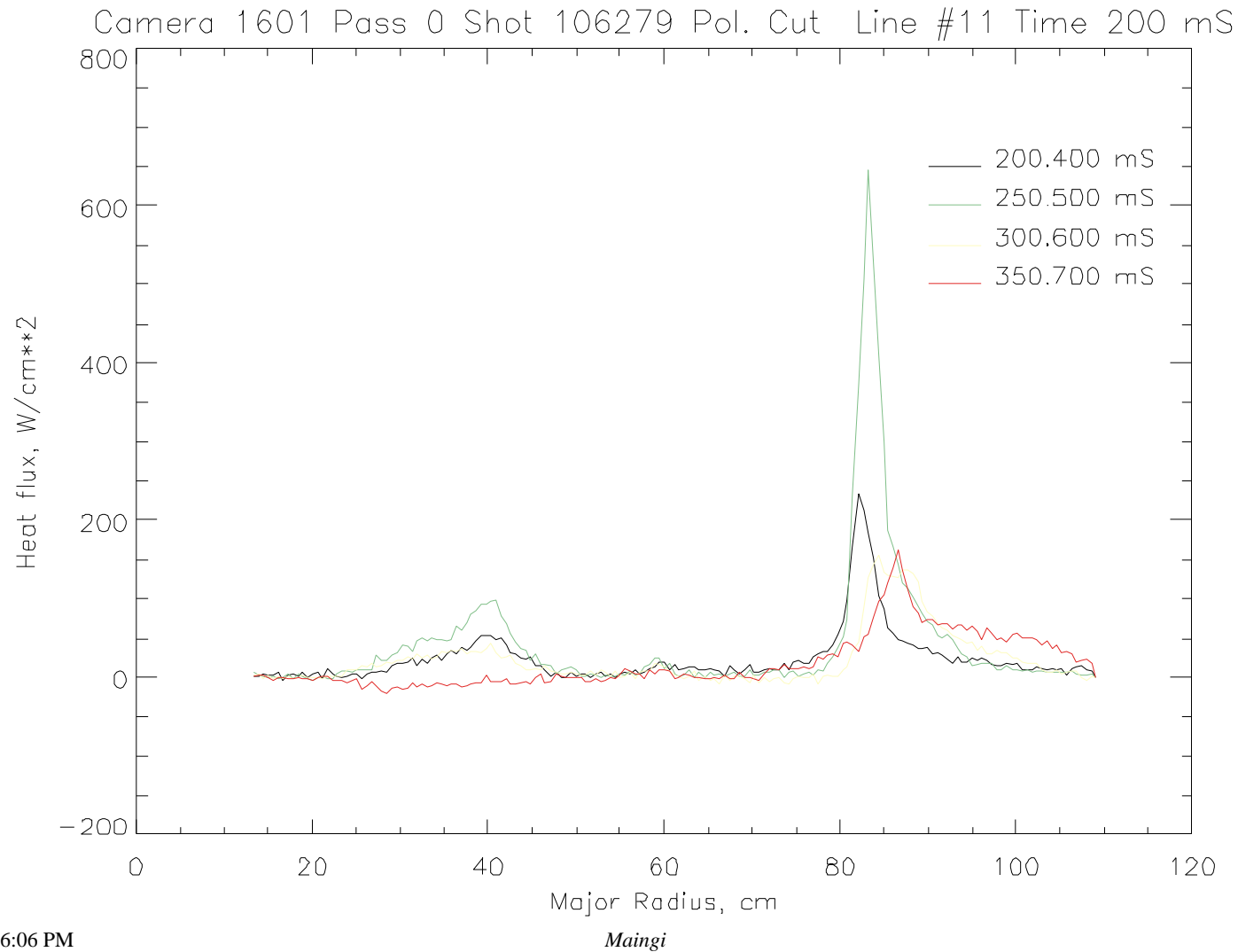


Temperature profiles show sharp peak during auxiliary heating

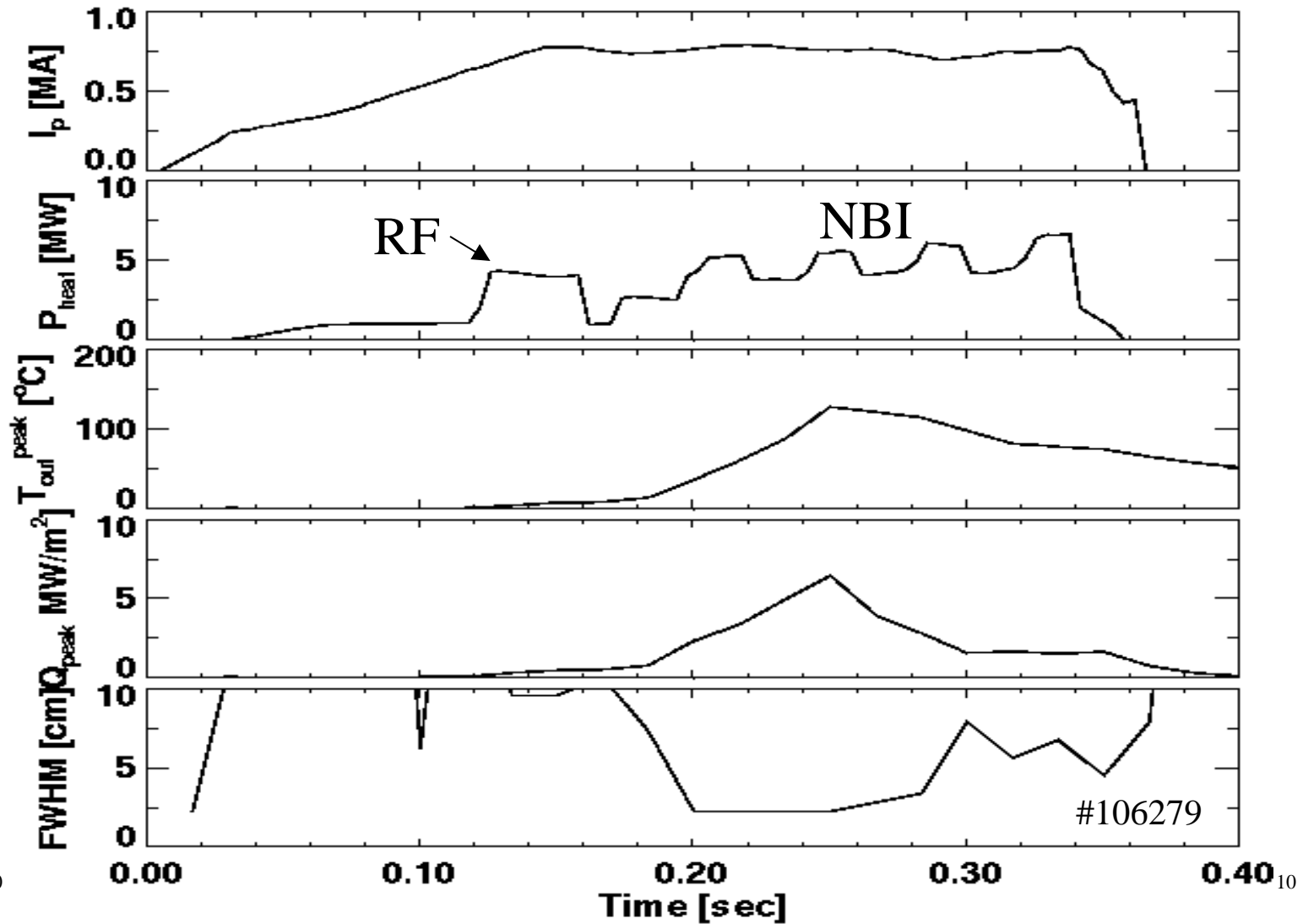
Camera 1601 Pass 0 Shot 106279 Pol. Cut Line #11 Time 200 mS



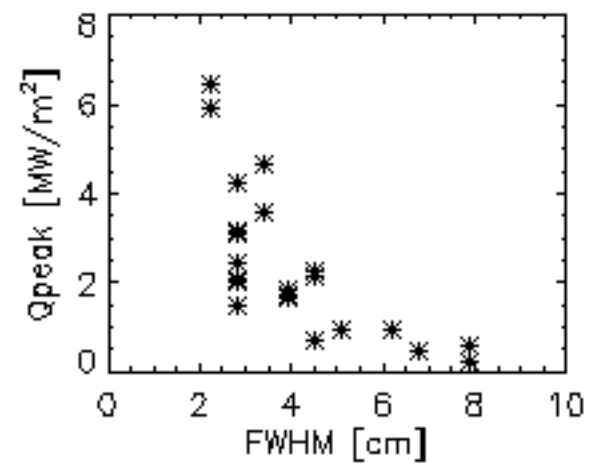
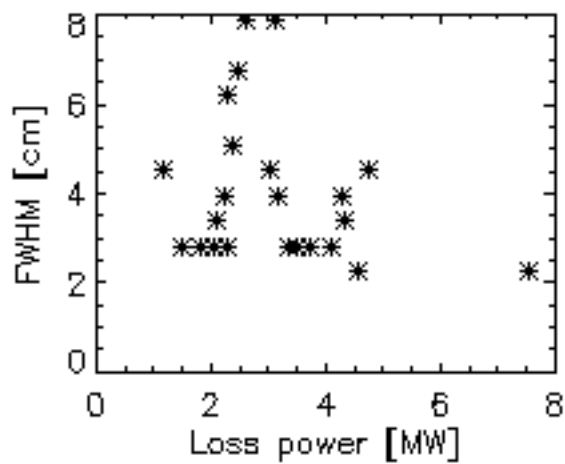
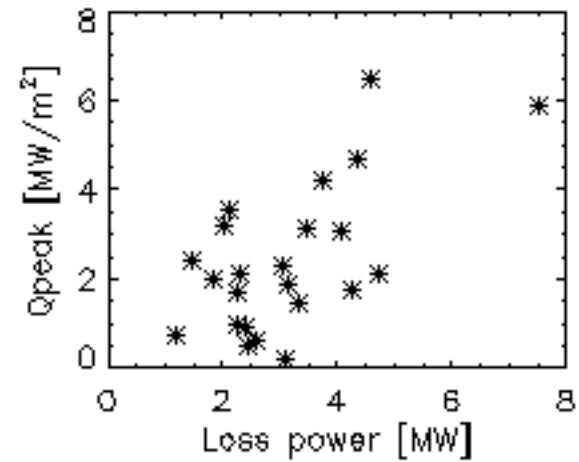
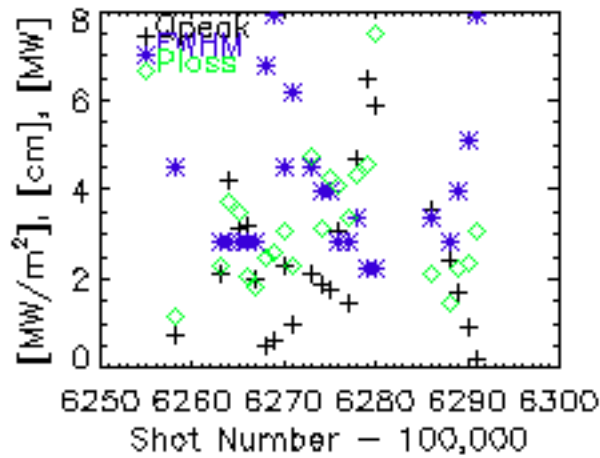
Heat Flux Profiles Peak Before Reconnection Event



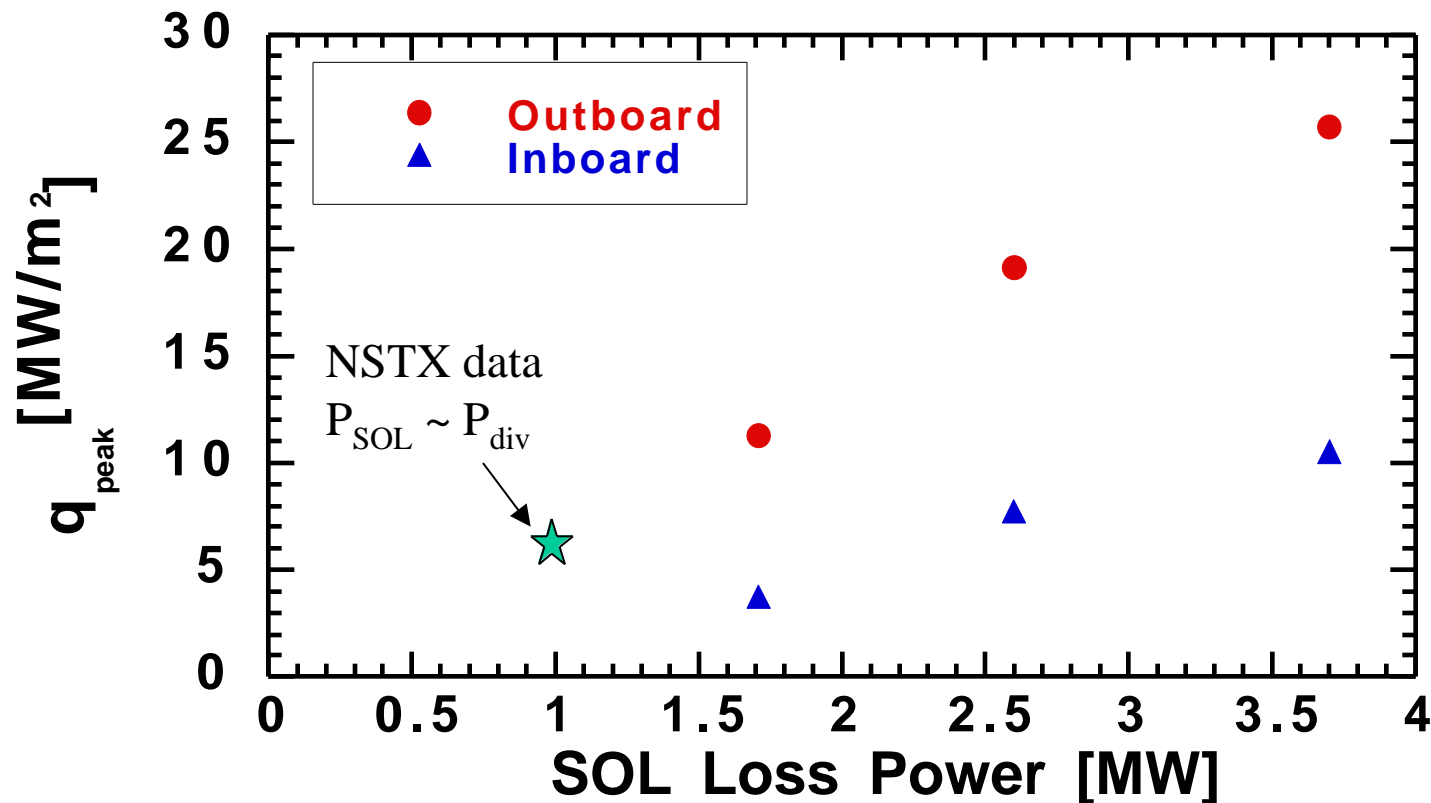
**NBI heating lead to highest observed heat fluxes
and sharpest profiles**



Peak heat flux and profile peaking increase with heating power

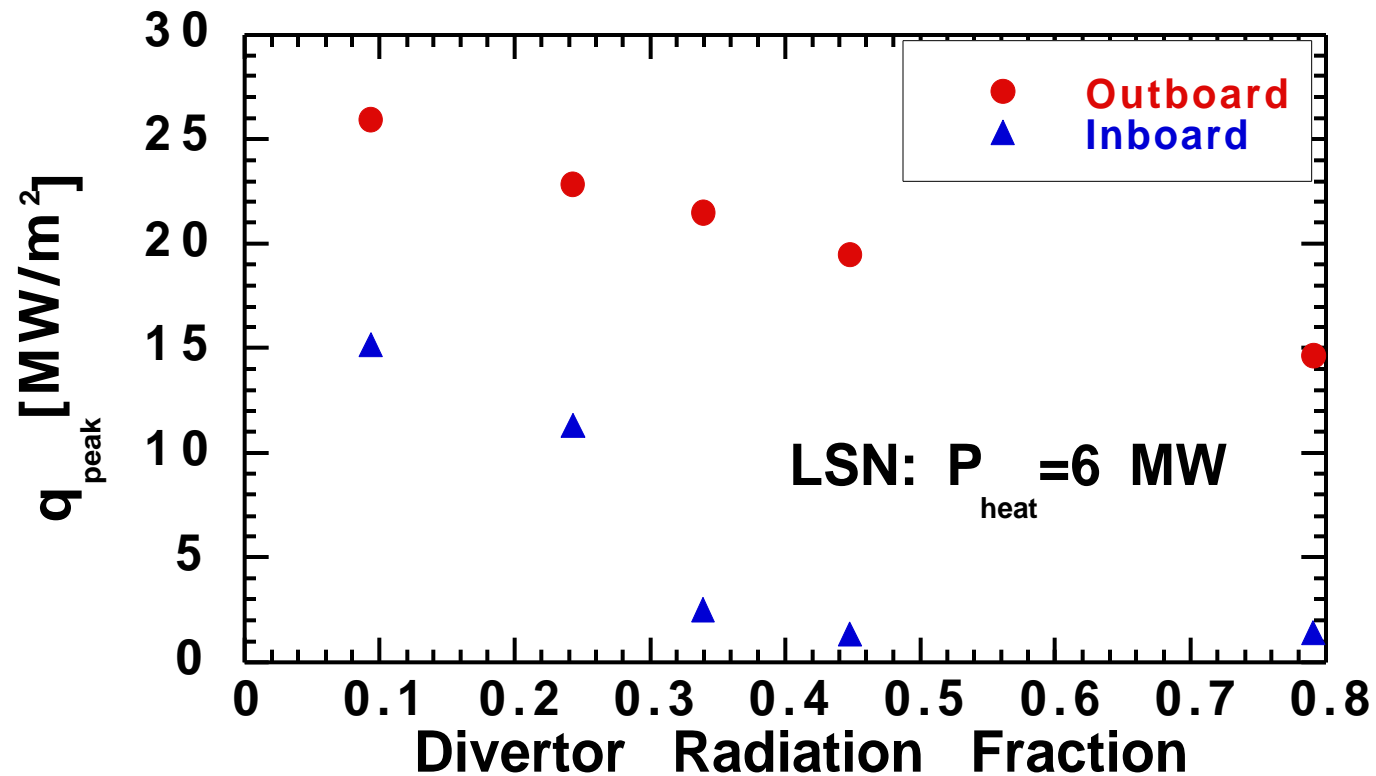


Early 2-D model predictions showed ~ linear increase of peak heat flux with SOL loss power



b2.5 code, 4 m²/sec cross-field transport, deuterium radiation

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

Summary and Future work

- H-modes obtained reliably
 - need to extend duration of ELM-free ones for higher
- Divertor D camera producing high resolution profiles
 - commencing UEDGE and DEGAS analysis for core fueling
- Glow discharge boronization consistently reduced oxygen
 - ohmic performance enhanced
 - few dozen shots required for Boron light level to equilibrate
- Plasma boronization reduced radiated power
 - proof-of-principle execution, needs dedicated XP
- Outer divertor heat flux increased with heating power
 - Profile width reduced at higher heating power
 - Divertor received low fraction (~ 20%) of total SOL loss power
 - Need to improve spatial resolution to see H-mode profiles