ASIPP

First ICRF-Generated H-Mode Plasmas in EAST

Gary Taylor, Xinjun Zhang, Chengming Qin
and the EAST ICRF Group

NSTX Physics Meeting
June 25, 2012

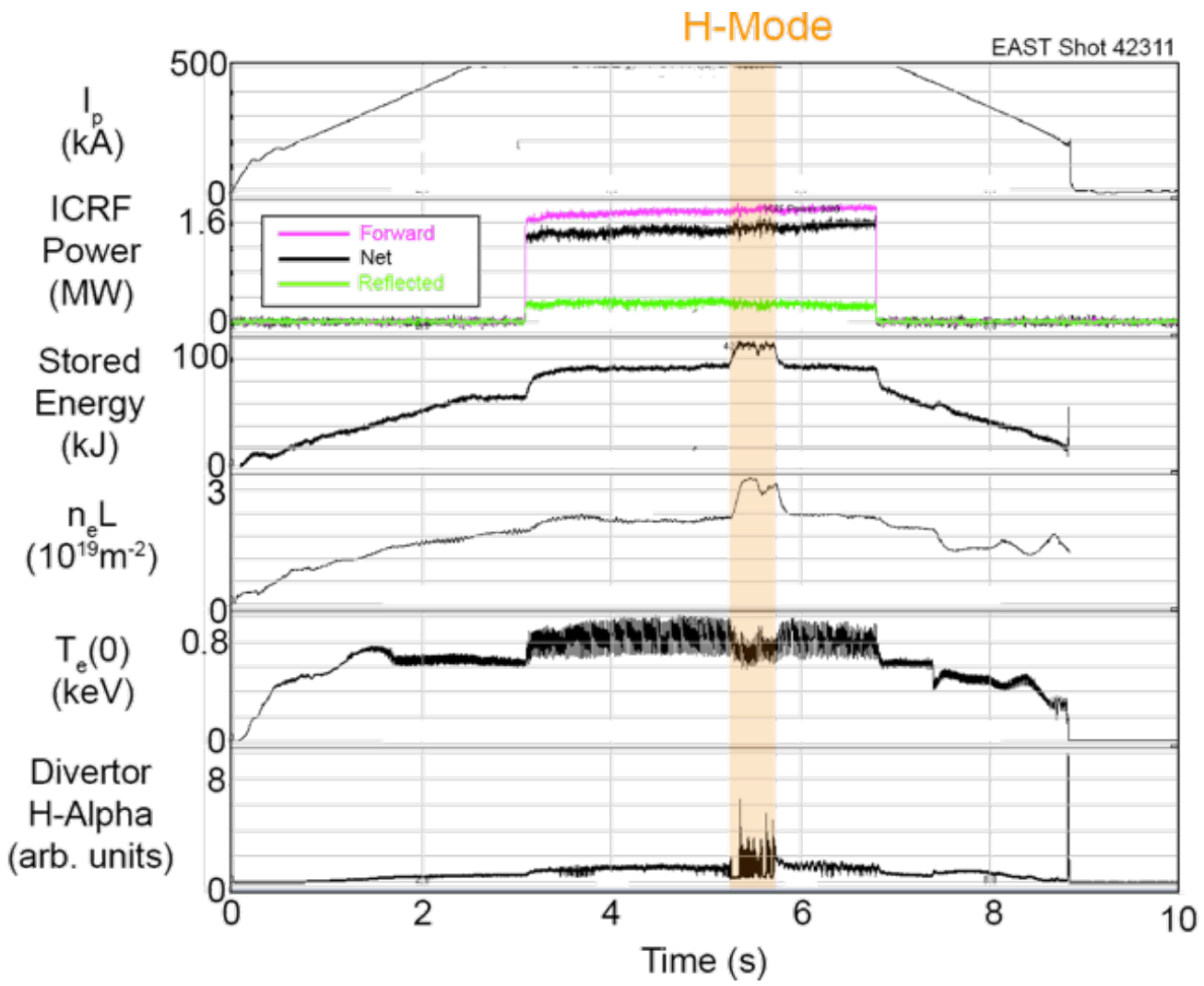
H-Mode Plasmas Generated by ICRH (Without Lower Hybrid Heating) Were Obtained Recently in EAST

ASIPP

- Previously only lower hybrid or lower hybrid + ICRH H-modes have been generated in EAST
- ICRH H-modes were obtained with only ~ 1.5 MW, even though earlier attempts with ~ 2 MW had failed
- Four 1.5 MW RF sources are currently available on EAST, but coupled power has been limited to ≤ 2 MW due to light antenna loading causing high reflected power and transmission line arcs
- Two ICRF sources are currently connected to the B-port two-strap antenna and two sources are connected to the I-port four-strap antenna

First ICRF-Generated H-Mode in EAST Were Obtained During Shot 42311 on June 12

ASIPP



- Transient H-modes were observed at I_p = 400 – 600 kA, $B_T(0)$ = 1.8 T and P_{RF} = 1.6 MW

Experiment Proposed Last Week to Extend the Duration of ICRF-Generated H-Mode Phase

ASIPP

Goals:

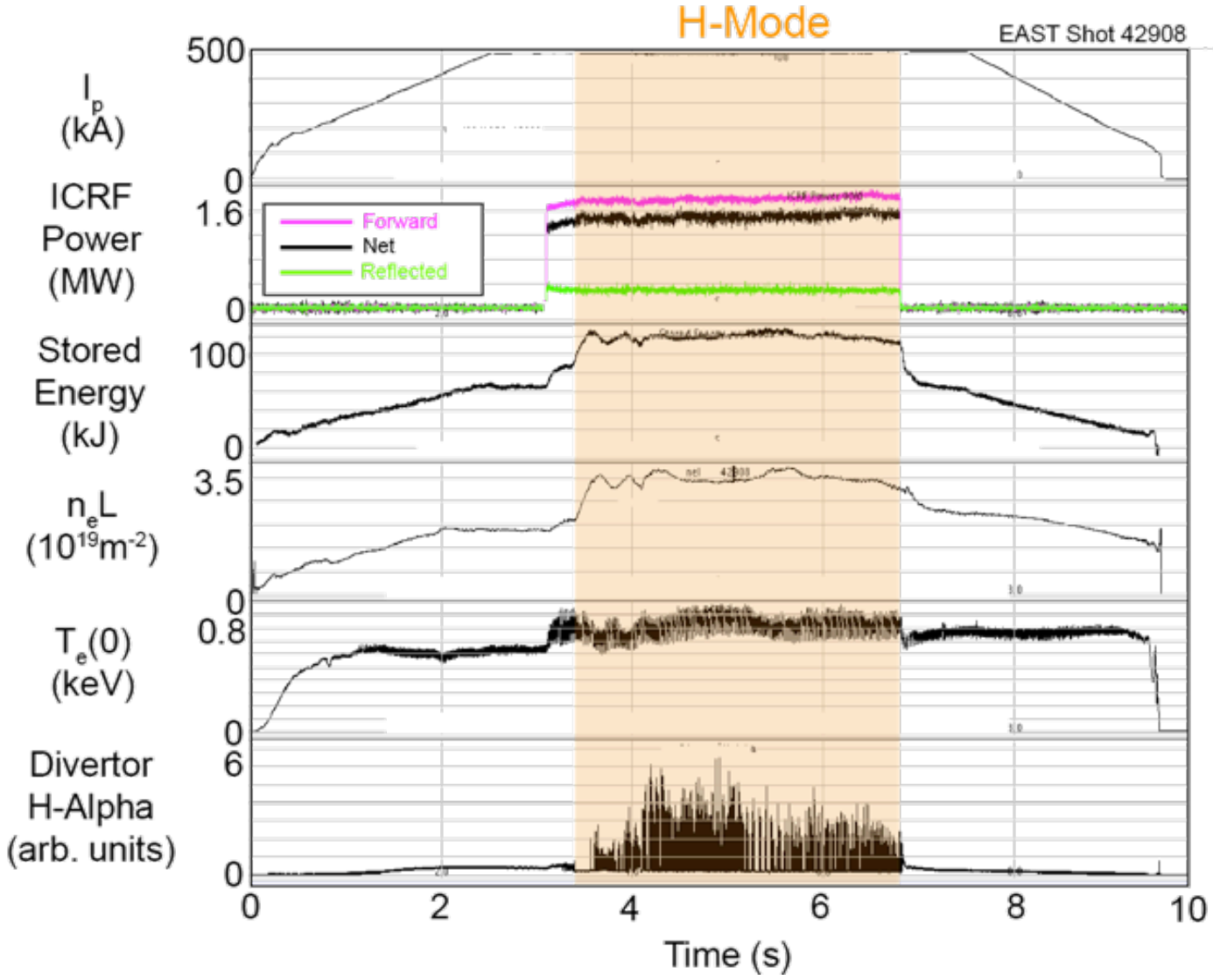
- Evaluate cause for late L→H transitions and early H→L back transitions
- Improve ICRF coupling by modifying the scrape off density profile
- Explore the dependence of the L→H threshold on I_p and n_e

Run Plan:

- Setup shot 42311, increase RF power to ~ 1.6 MW, look for L→H transition
- Measure scrape off density profile with microwave reflectometry
- Attempt to improve ICRF coupling efficiency by scanning the outer gap:
  - Start with 5 cm outer gap, then go to 6 cm, then 4 cm
- Attempt to modify the scrape off layer density by lithium pellet conditioning, in order to lower H-mode threshold and improve ICRF coupling:
  - if successful, repeat outer gap scan
- Explore the dependence of the L→ H threshold and H-mode duration on I_p (vary I_p between 400 and 600 kA) and n_e

Achieved 3.5 s Duration ICRF-Generated H-mode on June 20; Terminated Only When ICRF Turned Off

ASIPP



- 200 ms ELM-free period after L→H Transition
- Followed by "Grassy" ELMing until H→L back transition
- ELM frequency 150 - 500 Hz
- Measured core electron heating
- 30% increase in stored energy at L→H transition

Fresh 2 Hour Lithium Deposition Did Not Lower L→H Transition Power; Needed ~ 1.5 MW for H-Mode

ASIPP

- Earlier in the 2012 run campaign, ~ 2 MW of ICRF power was unable to generate L→H transitions in plasmas with similar parameters
- On June 20 L→H transitions and sustained H-mode phases were obtained with only ~ 1.5 MW
- L→H transition power was not lowered after a 2-hour lithium deposition on the morning of June 20
- Access to L→H transitions was apparently achieved as a result of long term conditioning
- ICRF power was limited to < 1.8 MW on June 20
- L→H transition was only achieved for a narrow range of target n_eL between 1.6×10^{19} m^{-2} and 2.8×10^{19} m^{-2}
- Reflectometry SOL density data were not available on June 20 → need to characterize the SOL conditions needed for ICRF H-modes
- Significant re-engineering of the I-port antenna needed to improve plasma loading after the run campaign; B-port will be removed and a second 4-strap antenna will be added for the next run campaign

ASIPP

谢谢!