XP 519: Thermal Electron Bernstein Wave Conversion to X-Mode

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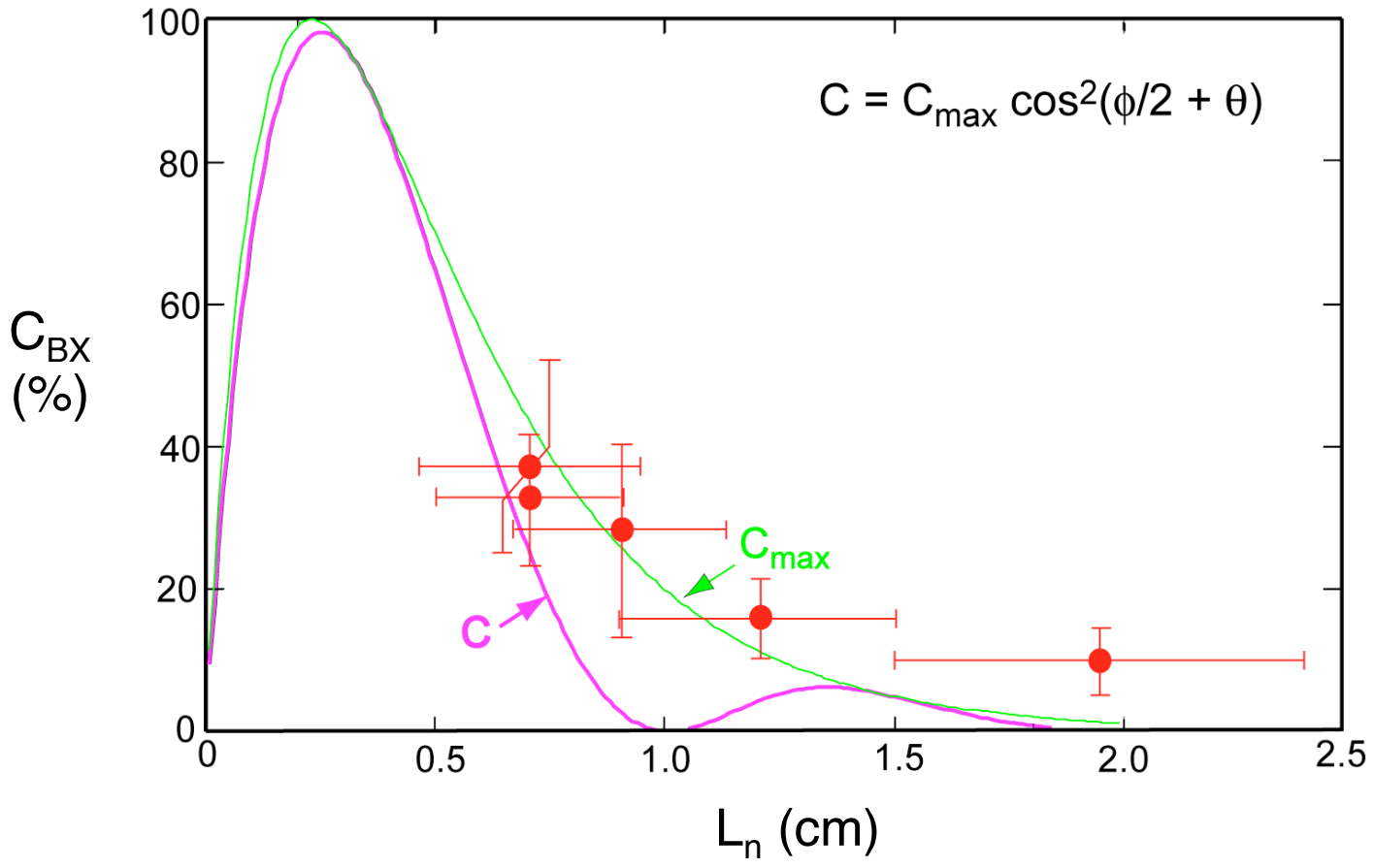
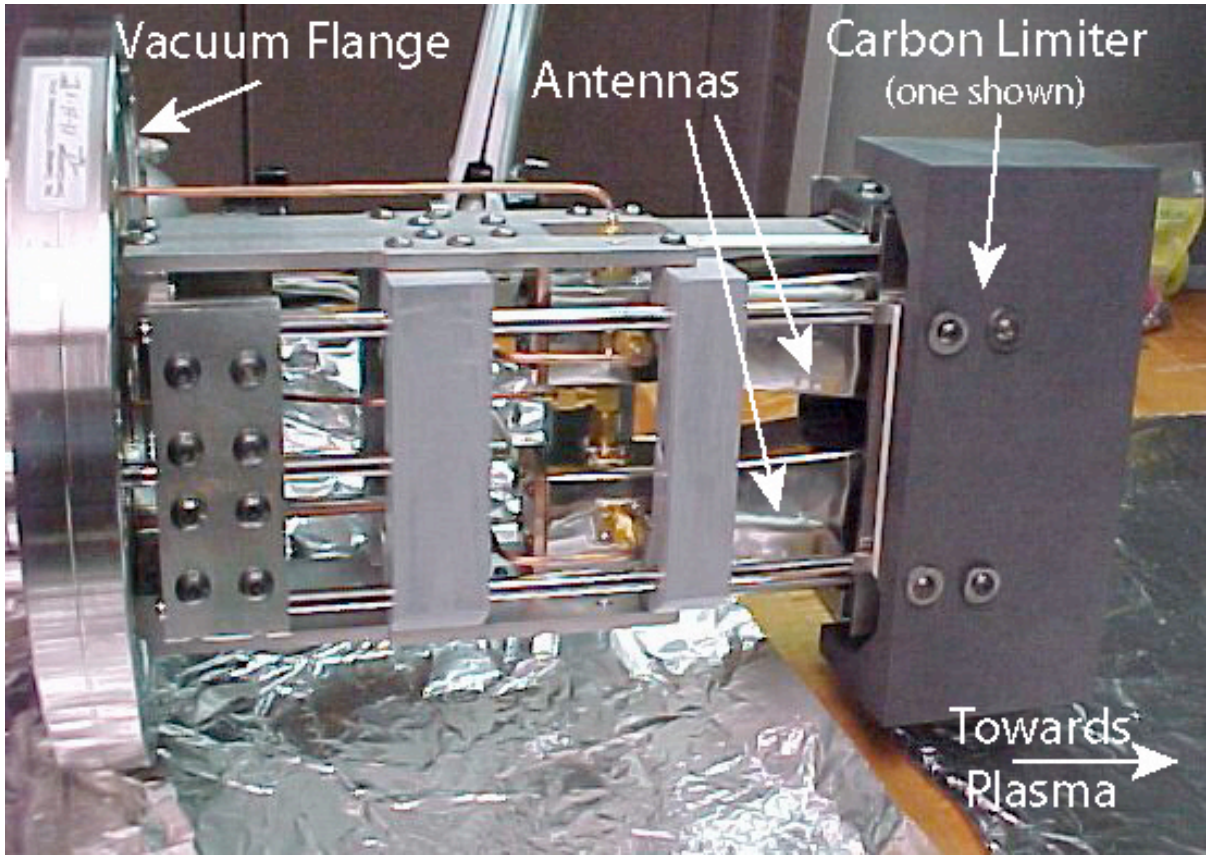
- EBW antenna with local, radially adjustable carbon limiter installed on NSTX
- Two goals for this experiment:
  - *Demonstrate measurement of T_e*
  - *Demonstrate B-X conversion ≥ 80%*
- Last years run of this experiment (XP404) showed that the local limiter was ineffective - insufficient electron density measured at antenna

EBW to X-Mode Conversion Efficiency (C_{BX}) Very Sensitive to L_n at Resonant Upper Hybrid Layer



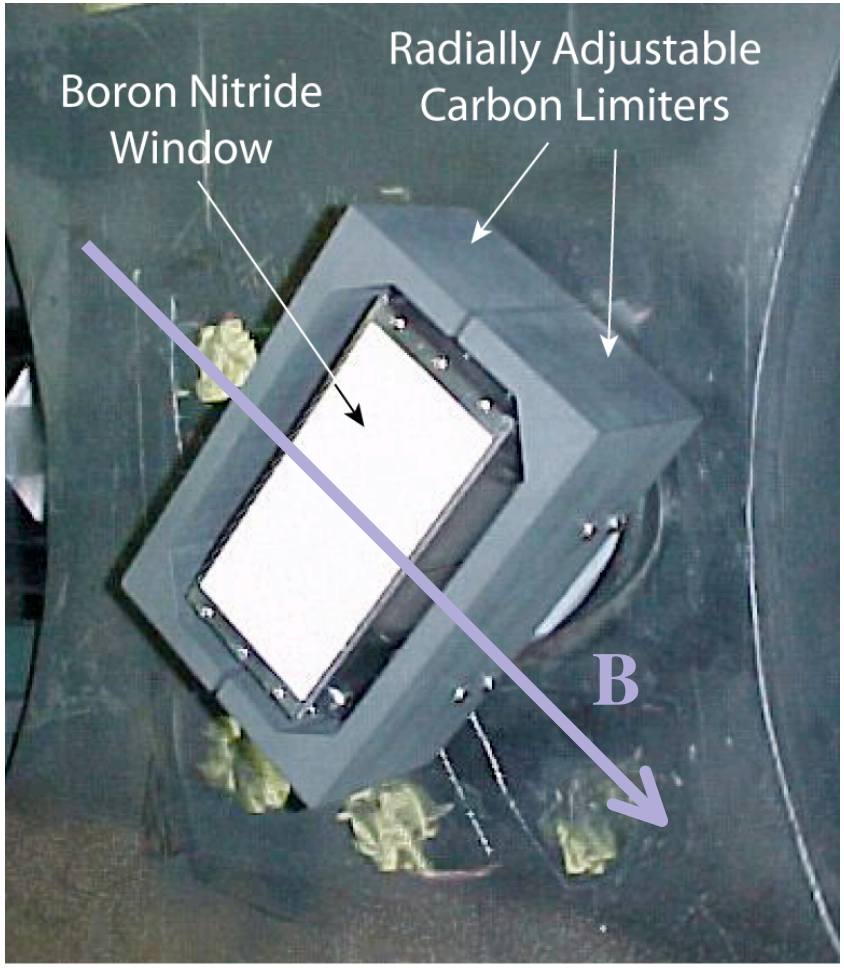
- Experiment on NSTX using HHFW antenna tiles shortened L_n and increased C_{BX} from ~ 10% to ~ 40%

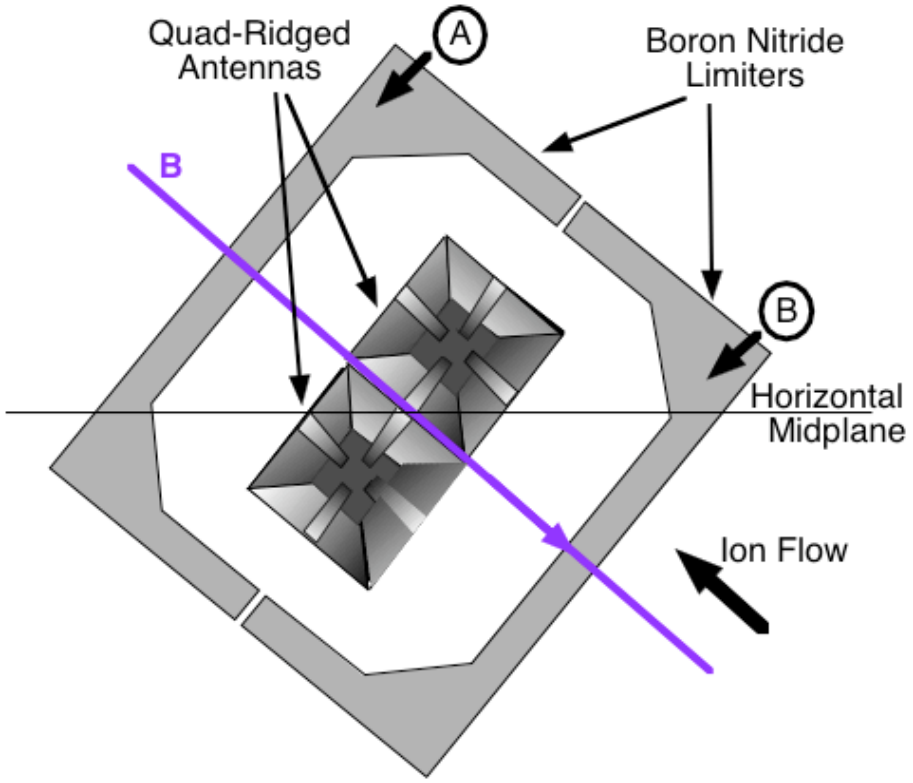
Two 8-18 GHz Quad-ridged Horn Antennas with Radially Adjustable Limiters Installed Near NSTX Bay I/J Midplane



- Antenna includes two carbon limiters to control L_n:
  - *Each limiter radially adjustable to be 0-3 cm in front of horns*
  - *Local gas feed to adjust density in front of horns*
  - *O-mode reflectometer to measure L_n in front of EBW antennas (UCLA)*

Antenna Tilted to Align Ridges for X-Mode and O-Mode





Looking outwards from NSTX center post

Run Plan

- Dedicated run time required only after gas injector at B-X EBW antenna has been fully commissioned:
  - *Need UCLA O-mode reflectometry to measure scrape off density profile routinely*
  - *Need remote operation of the radially adjustable carbon limiters*
- XP requires about 16-18 plasma shots

Run Plan - II

L_n scan for maximum B-X conversion, dwell EBW radiometer at frequency ~ 17 GHz (EBW from near axis):

- Establish OH plasma using setup from 113544 (I_p = 800 kA, B_o = 4.0 kG) [2-4 shots]:
  - *Need ~150 ms I_p flattop, no n_e glitches, well-controlled shape*
  - *Begin with both limiters A and B retracted (Δ_A & Δ_B = 0 cm)*
  - *Repeat until reproducible & without significant MHD*
  - *Acquire MPTS $T_e(R)$ and $n_e(R)$ profile data during I_p flattop*
  - *Measure L_n at the B-X conversion layer and EBW T_{rad}/T_e on separate shots*
- Move limiter B so that Δ_B = 1, 2 and 3 cm (6 shots):
  - *Two shots at each position*
  - *Limiter B should have the greatest influence on L_n since it is on the ion flow side*

Run Plan - III

L_n scan for maximum B-X conversion (cont.):

- Leave $\Delta_A = 3$, move limiter B so that $\Delta_B = 2$, 1 and 0 cm:
  - *Two shots at each position (6 shots)*

Run EBW radiometer in swept frequency mode (12-18 GHz) at maximum B-X conversion:

- Set Δ_A and Δ_B for maximum B-X conversion (2 shots)