Thermal EBW Conversion to O-mode at 8-40 GHz

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NSTX Results Review
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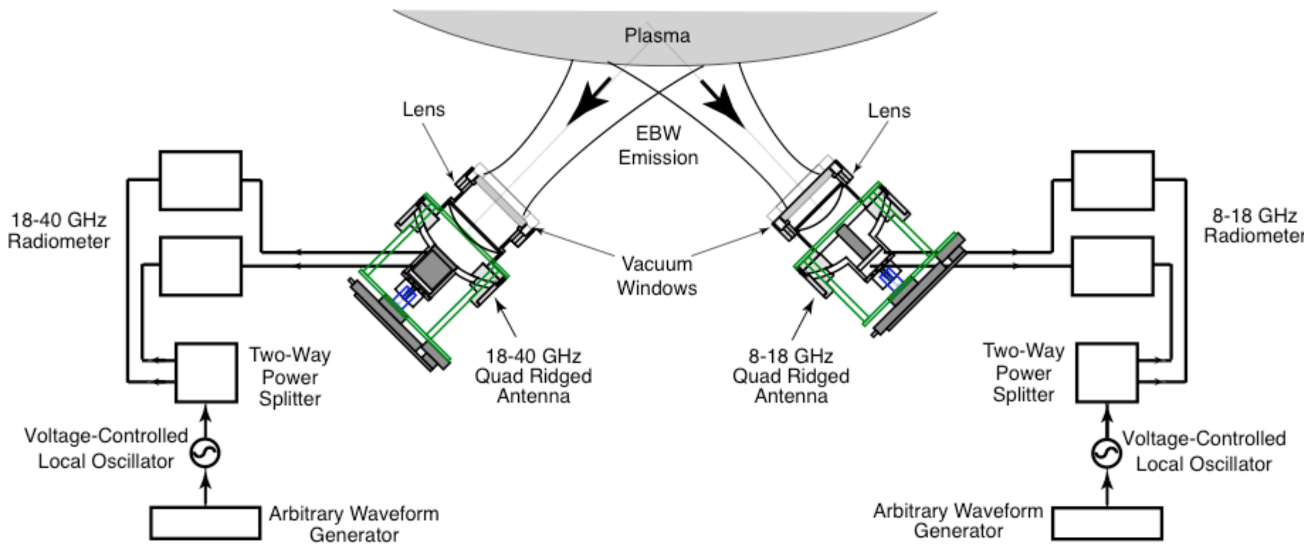
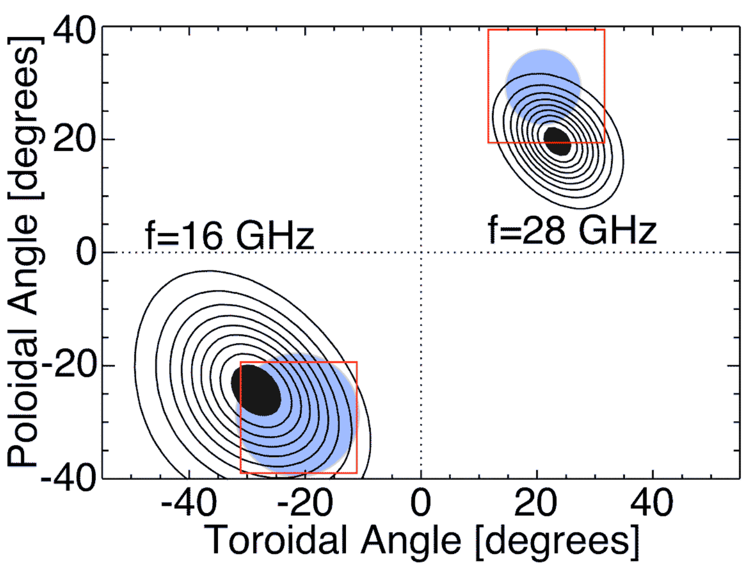
XP 625: B-X-O Mode Conversion Physics at 8-40 GHz

- Study 8-40 GHz EBW emission via oblique B-X-O coupling
- Use two remotely-steered, quad-ridge antennas and dual-channel radiometry at Bay G
- Study EBWs emitted from the fundamental, 2nd and 3rd harmonic emission from L-mode and H-mode plasmas
- Experiment had three objectives:
  – *Map coupling efficiency as a function of antenna pointing direction and compare to theory*
  – *Analyze emission polarization and compare to theory*
  – *Measure $T_e(R,t)$ using thermal EBW emission*

Upgraded EBW Antennas Allow Spatial Mapping of B-X-O Coupling "Window"



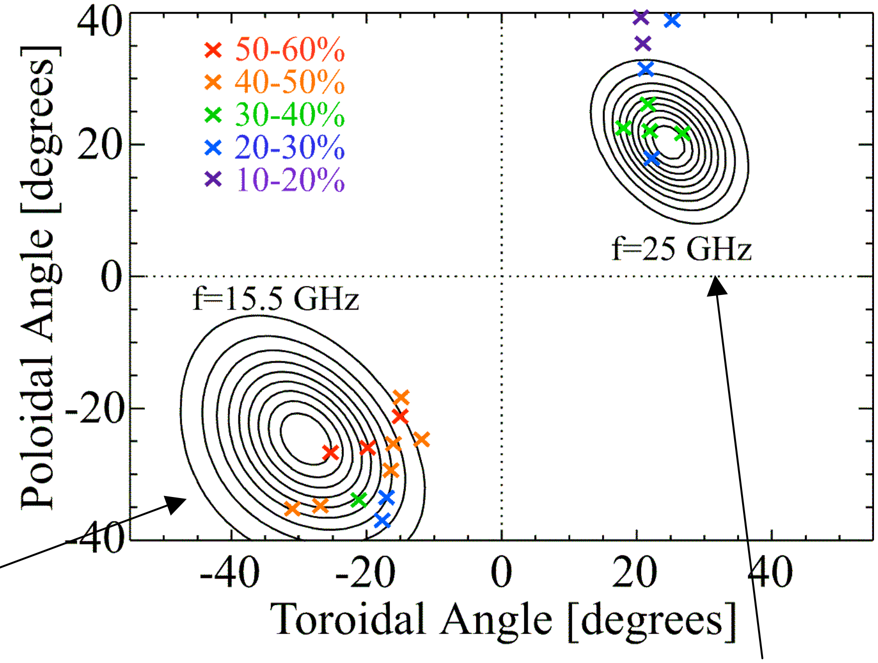
- Fundamental & 2nd harmonic: (8-18 GHz)
- 2nd & 3rd harmonic: (18-40 GHz)

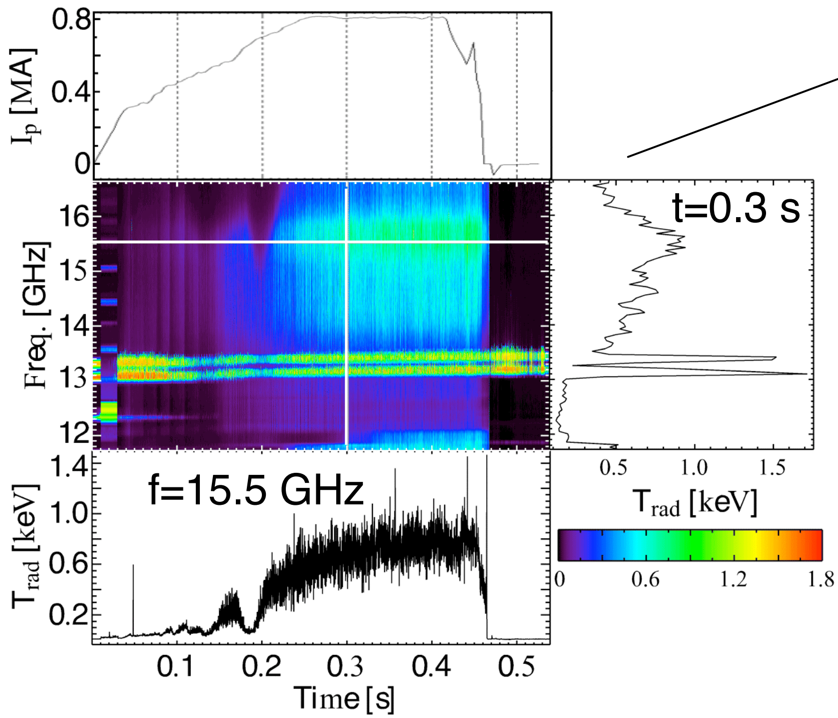


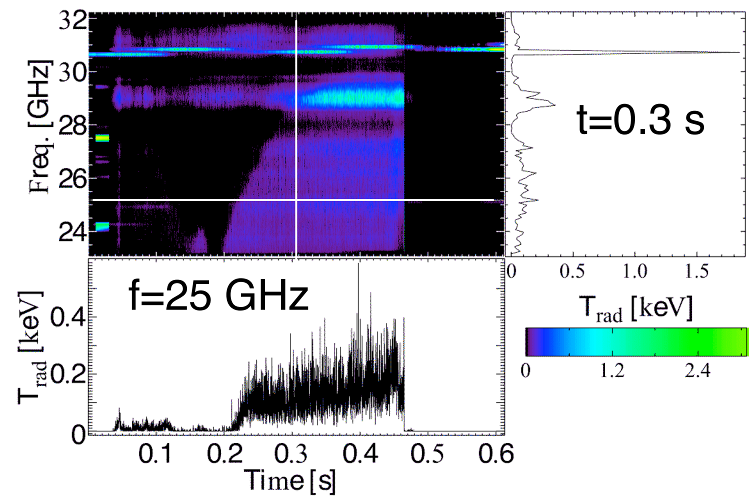
- ±10° steering in poloidal and toroidal directions
- Acceptance angle:
  For 8-18 GHz antenna ~ 22°
  For 18-40 GHz antenna ~ 14°

Angular Scan of L-mode B-X-O Window Shows Good Coupling at Fundamental

- 800 kA, helium L-mode
- $T_e(0)$~1.6 keV
- Post run calibration of radiometer sensitivities & vacuum window loss in progress

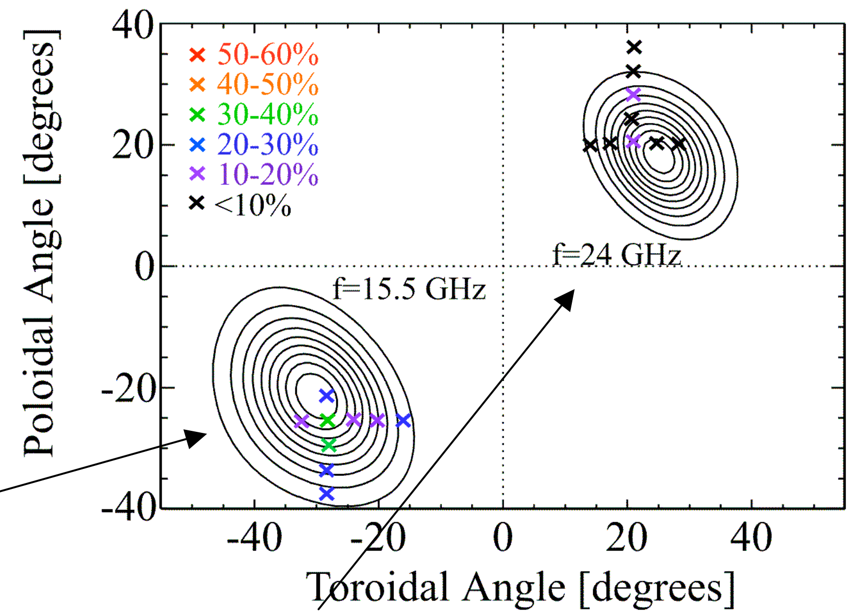


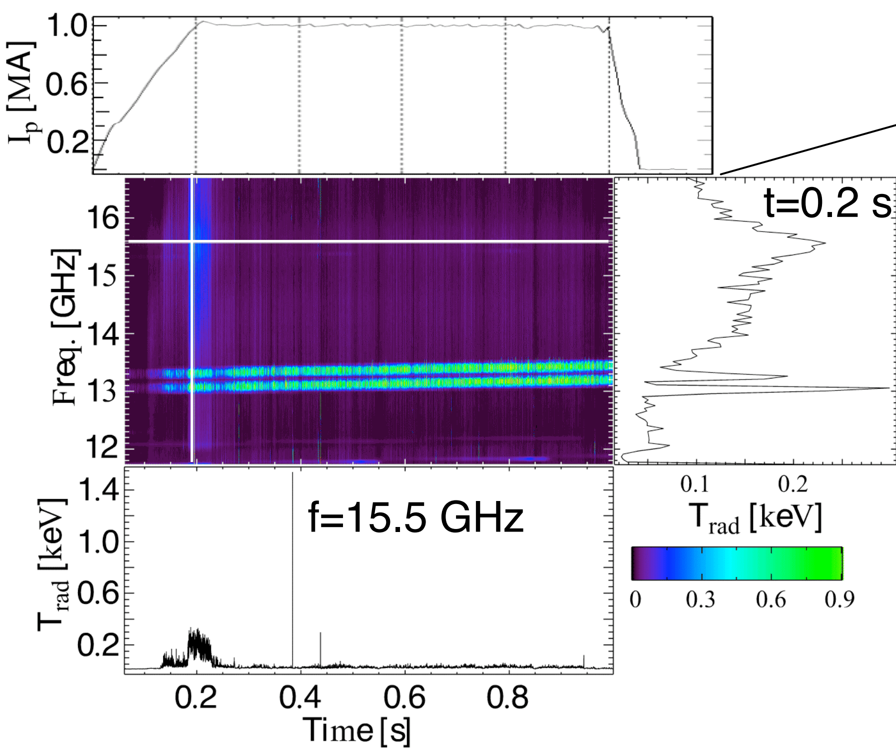


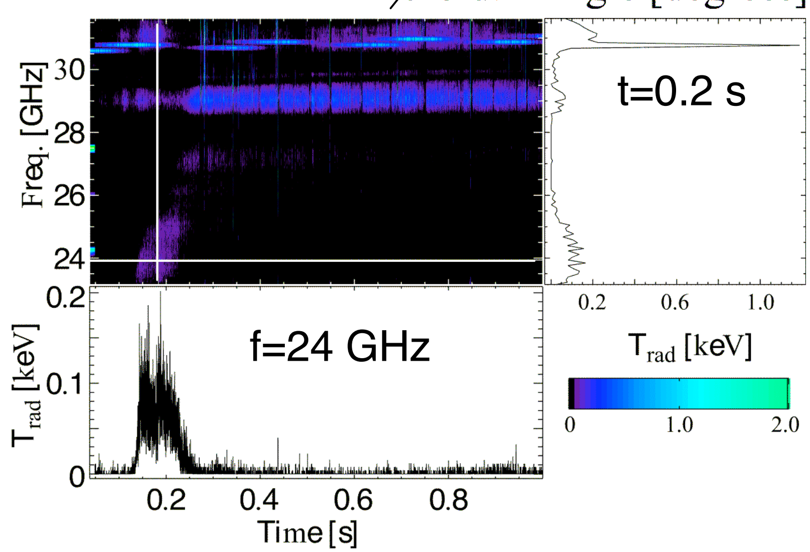


Angular Scan of H-mode B-X-O Window Indicates Very Low Emission Levels

- 1 MA H-mode
- $T_e(0)$~1.0 keV
- Reason for low emission currently not understood

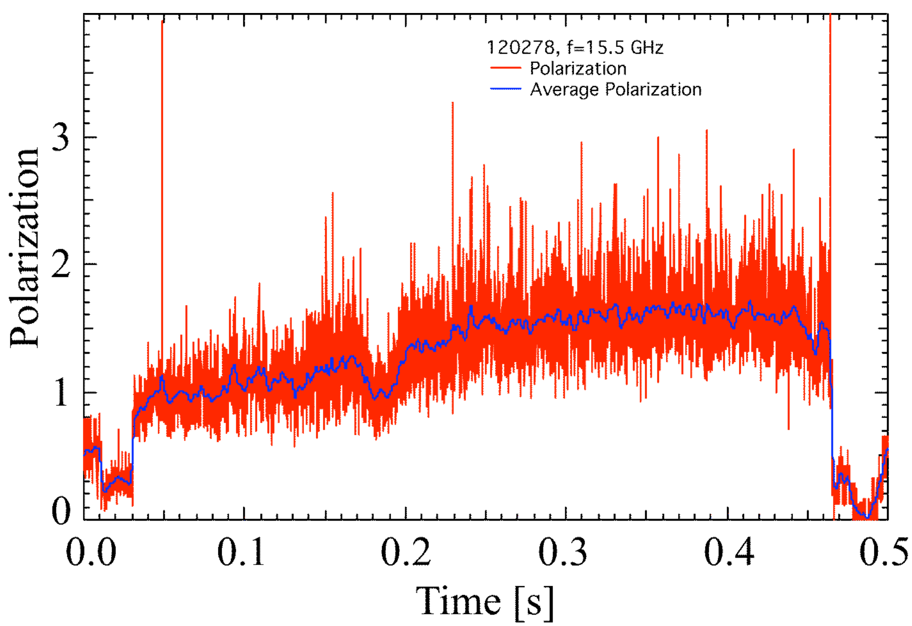


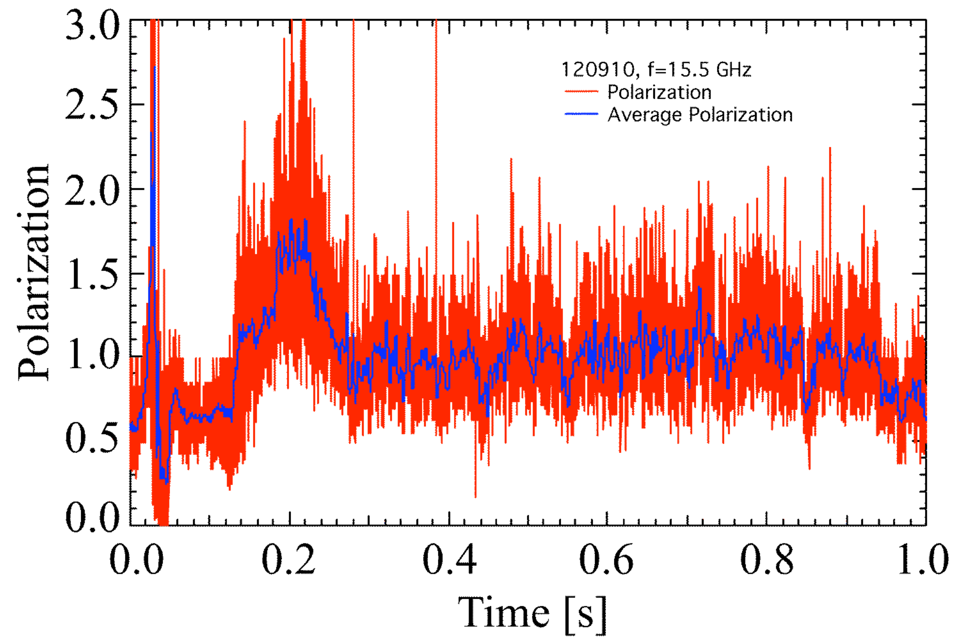




Emission Polarization Agrees Well with Prediction for B-X-O Coupling

- For L-mode:
  - EBW T_{para}/T_{perp} = 1.6-1.7 for peak emission angle
  - Expect ~ 1.6
- For H-mode:
  - T_{para}/T_{perp} ~ 1.7 at t ~ 0.2 s, then falls to < 1





More Work Needed to Understand EBW Mode Coupling Physics

- Complete calibrations (including vacuum window)
- More accurate mode conversion efficiency map
  - Previous ray-tracing relied on direct launching of EBW
  - B-X-O mode coupling and emission packages in GENRAY may provide more accurate results
  - Use J. Preinhaelter’s code to model H-mode emission
- Analysis of gas puffing experiments
- Analysis of TF ramping experiments
- Correlation analysis of L_n & emission fluctuation data
- Complete upgrades for 2007 run campaign
- XP for 2007 run to investigate low H-mode emission