

Neutral Particle Analyzer Measurements of Ion Behavior in NSTX

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NSTX Results Review
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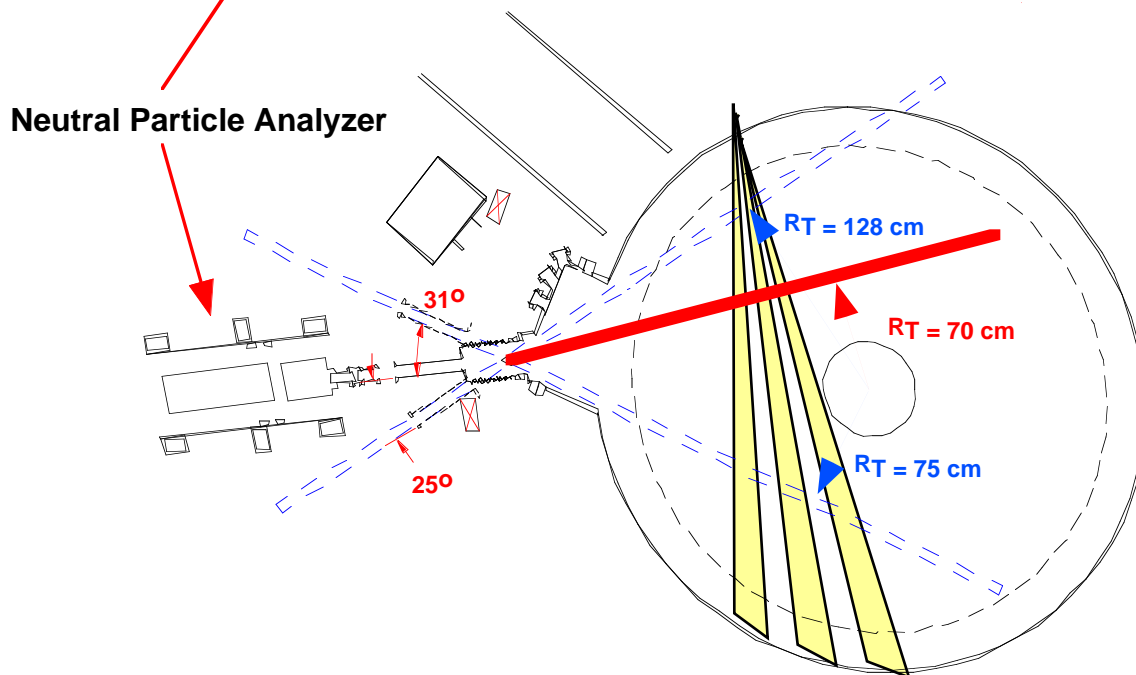
NSTX

NPA TOPICS

- **Suprathermal ions**
 - NBI Spectra
 - Effects of MHD Activity
 - Effects of Reconnection Events
 - HHFW Energetic Tail Formation

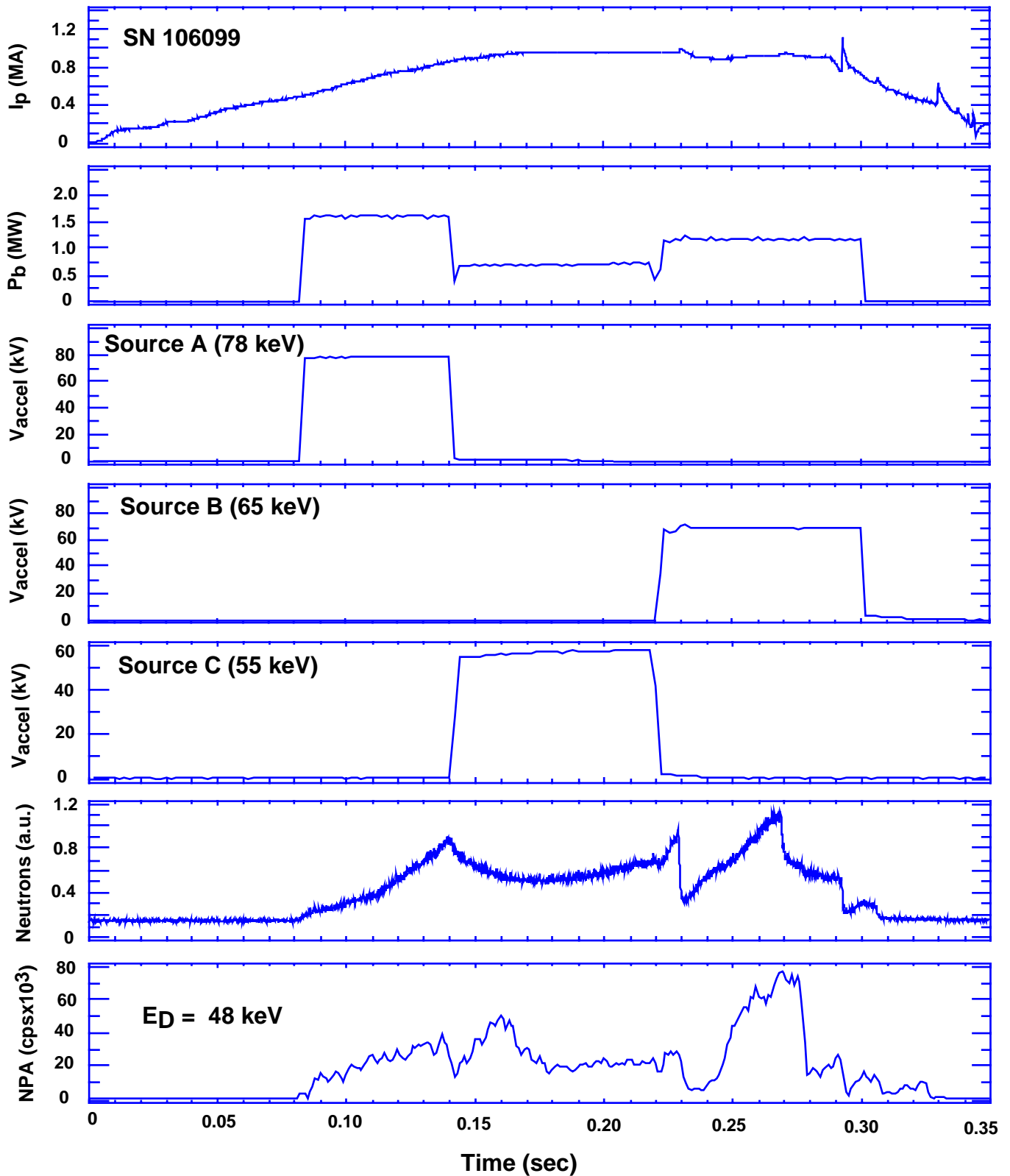
- **Thermal ions**
 - Ion temperature and CHERS
 - H-mode

NSTX NPA Installed with a Fixed Sightline ($R_T \sim 70$ cm) for Initial Operation

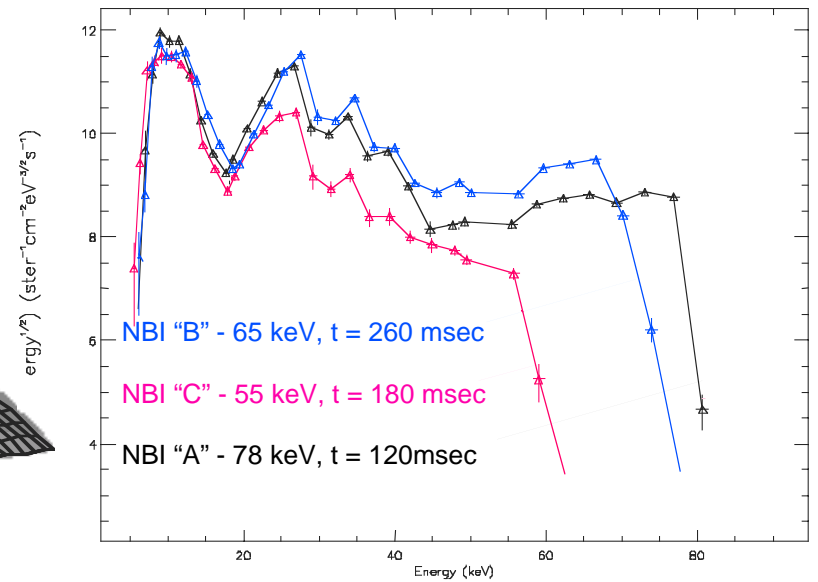
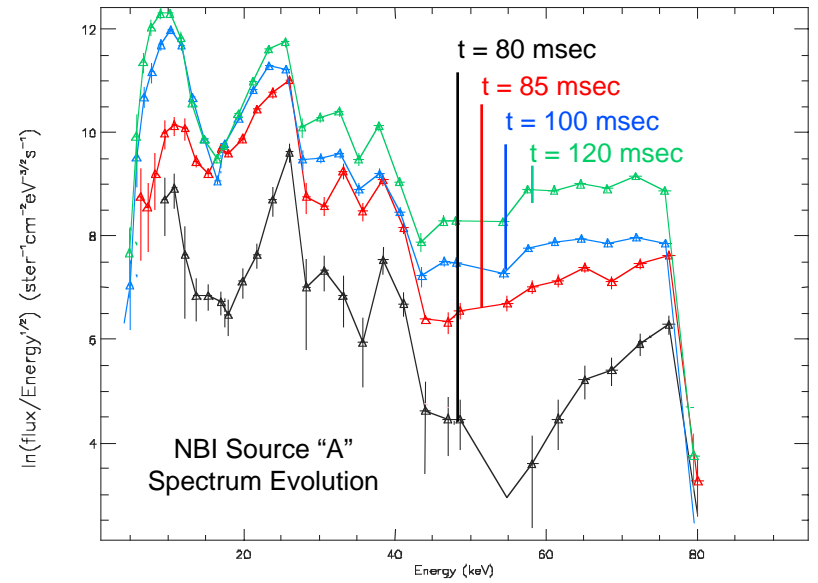
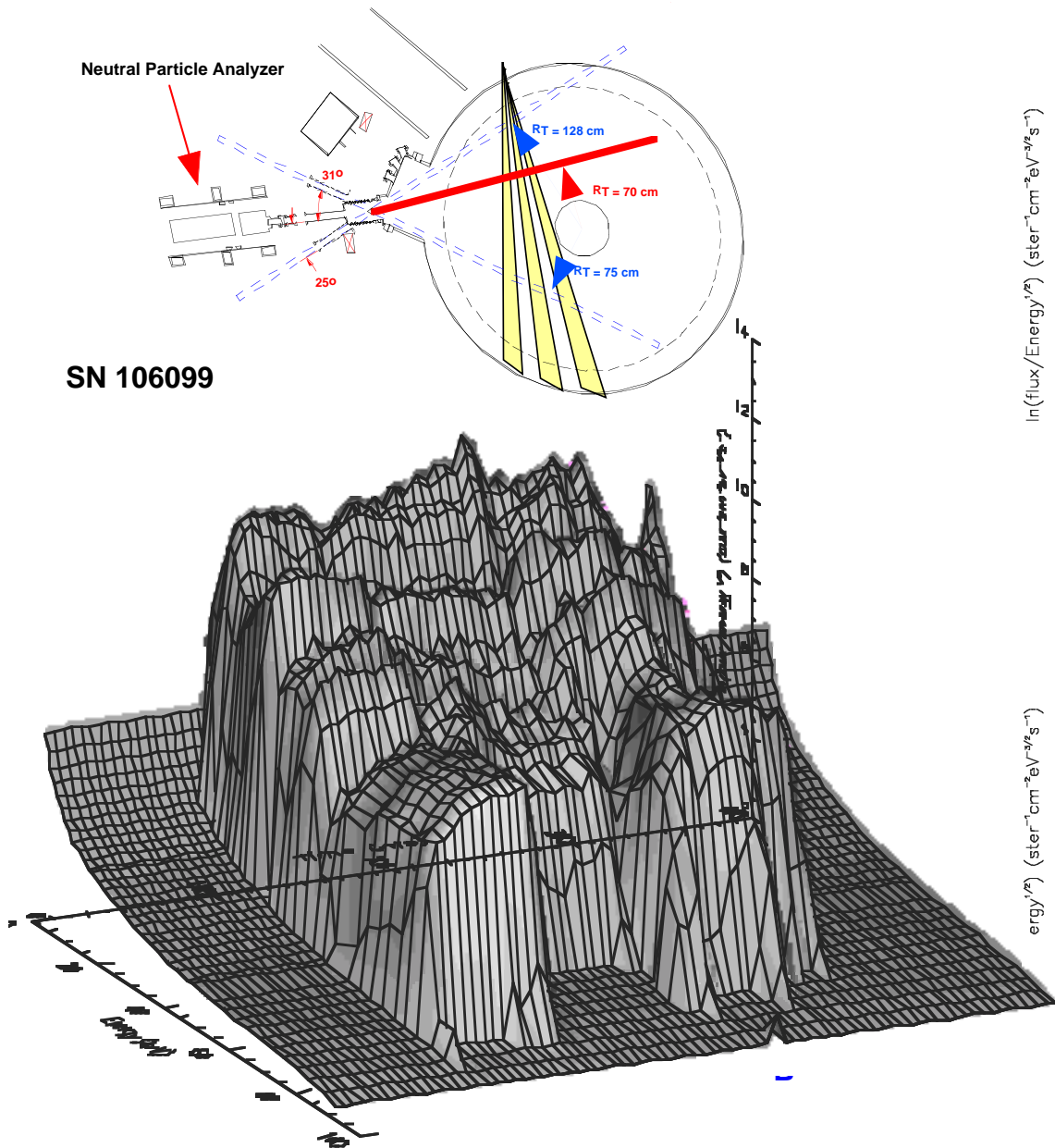


- The NPA sightline views across the NBI injection paths

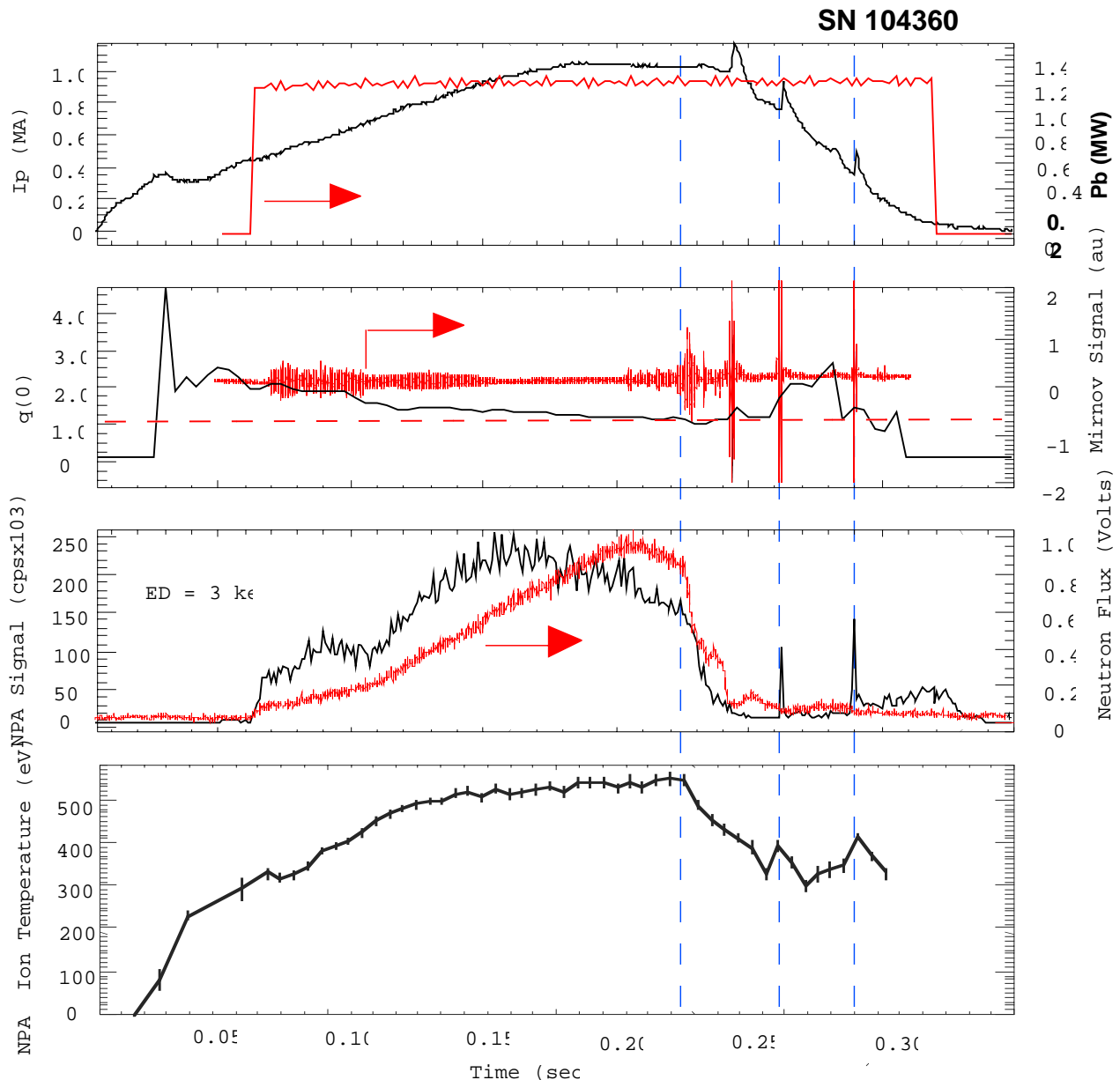
Multi-source NBI in NSTX with Variable Beam Energy



NPA Measurements of Deuterium Neutral Beam Ion Spectra in NSTX

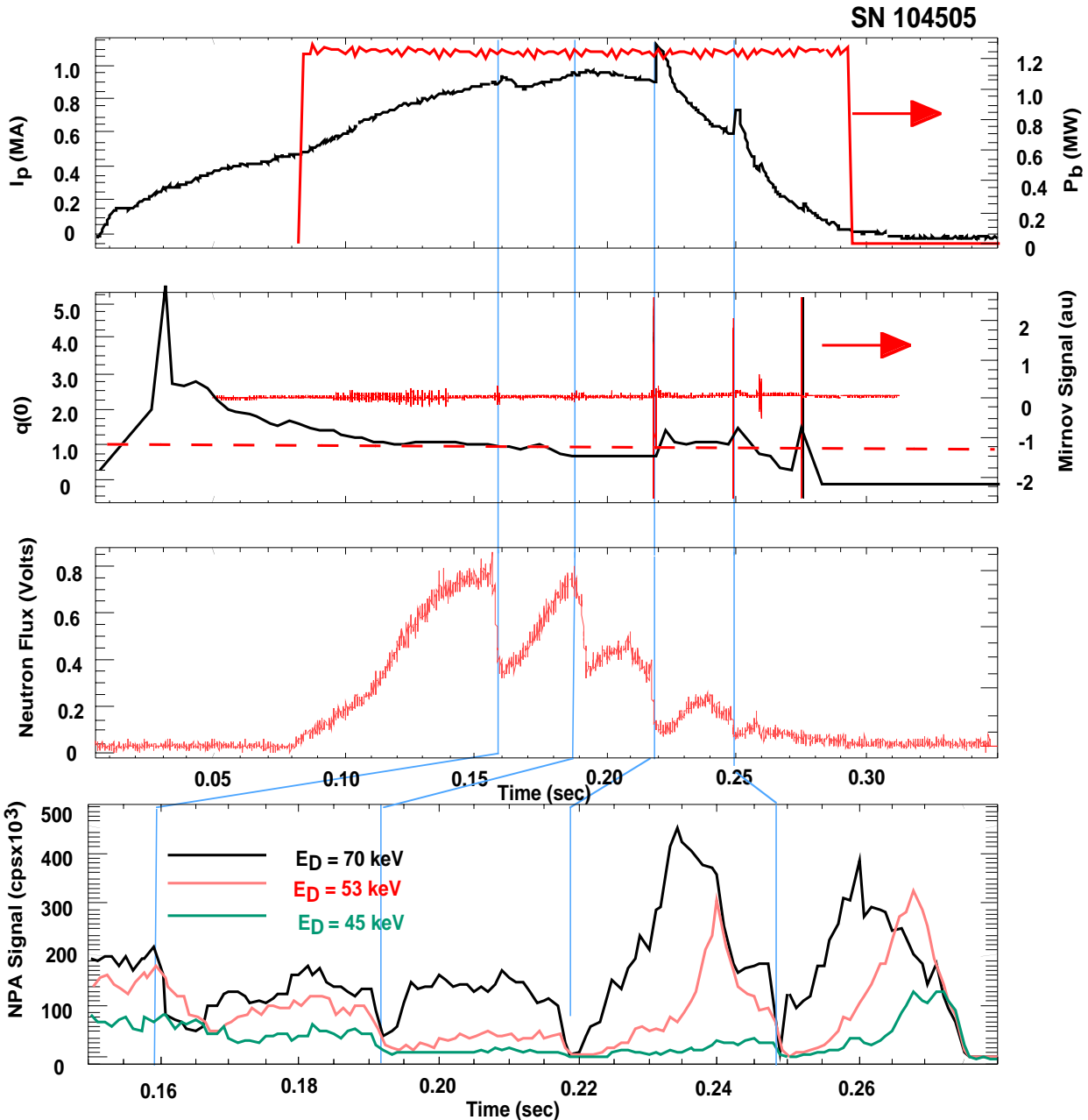


NPA Measurements in the “Thermal” Energy Range ($E_D \sim 0.5 - 5$ keV) during IRE Events



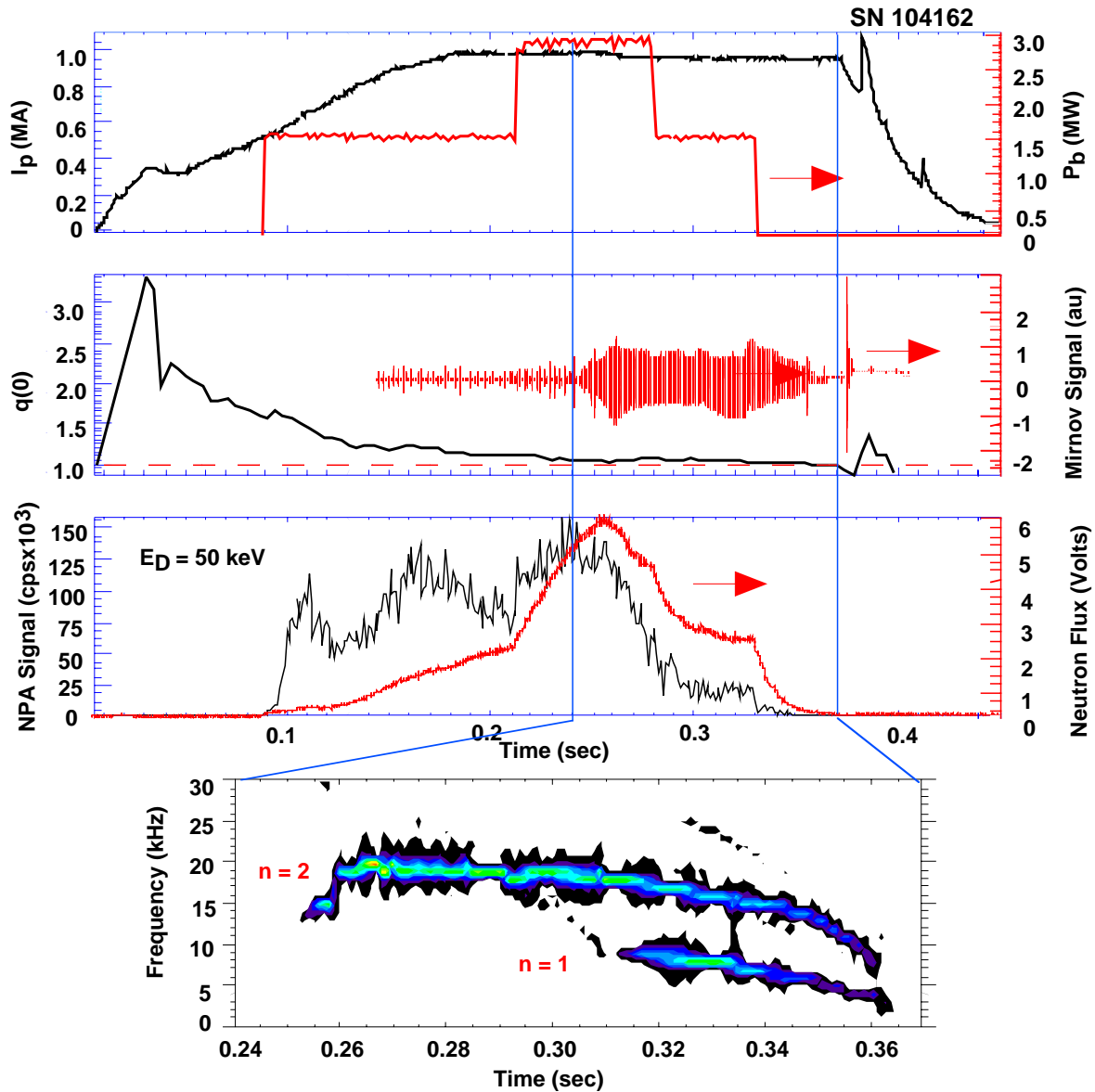
- IREs produce spikes in the NPA flux and T_i coincident with I_p upticks and bursts in Mirnov signals
- Thermal NPA measurements are consistent with “conventional” ion redistribution: IREs distribute core ions to the plasma periphery where the neutral density is higher, thus producing spikes in the NPA flux and measured T_i

NPA Measurements in the “Fast ion” Energy Range ($E_D \sim 5 - 85$ keV) during IRE Events



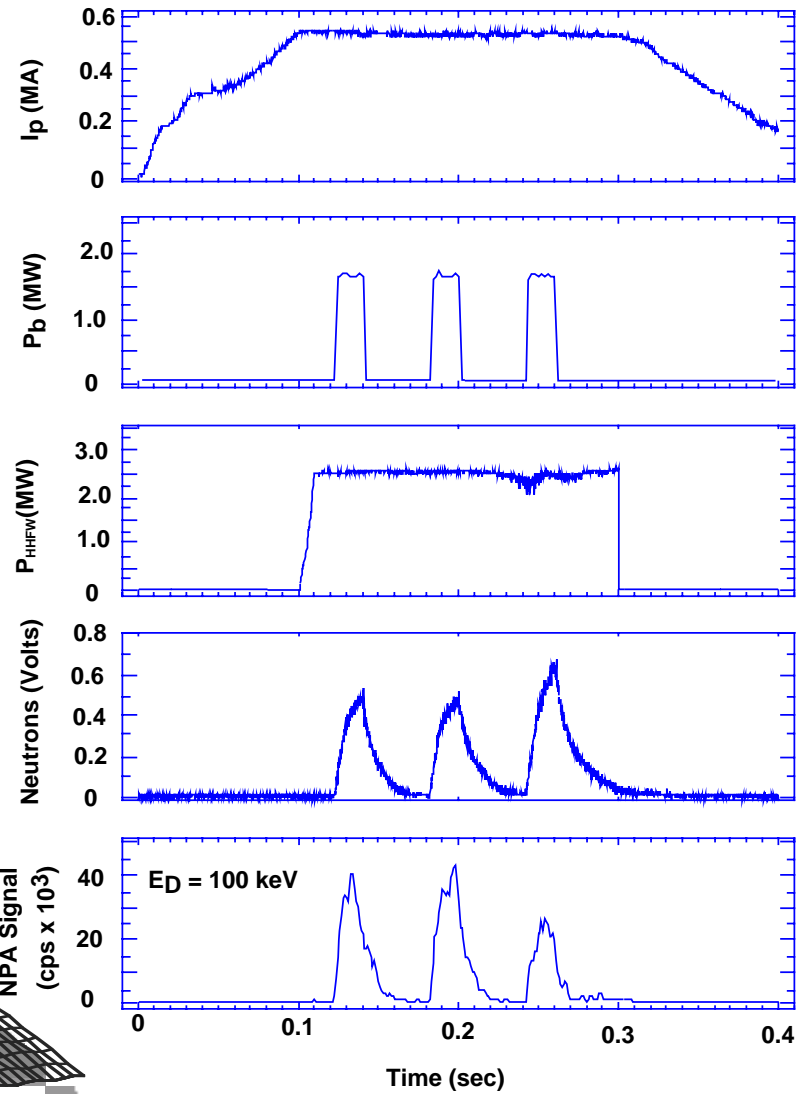
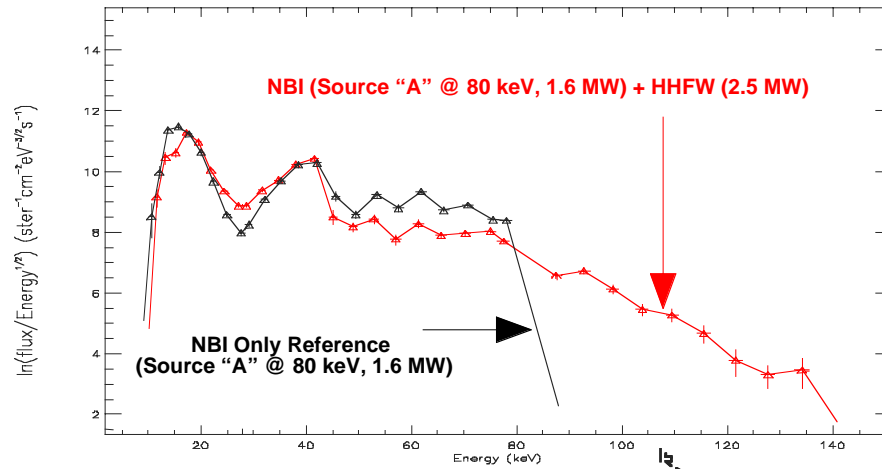
- NPA fast ion spectrum is promptly depleted during IREs and other MHD activity, without the redistribution signature seen in the thermal energy range

Effect of MHD on NPA Measurements in the “Fast ion” Energy Range ($E_D \sim 5 - 85$ keV)

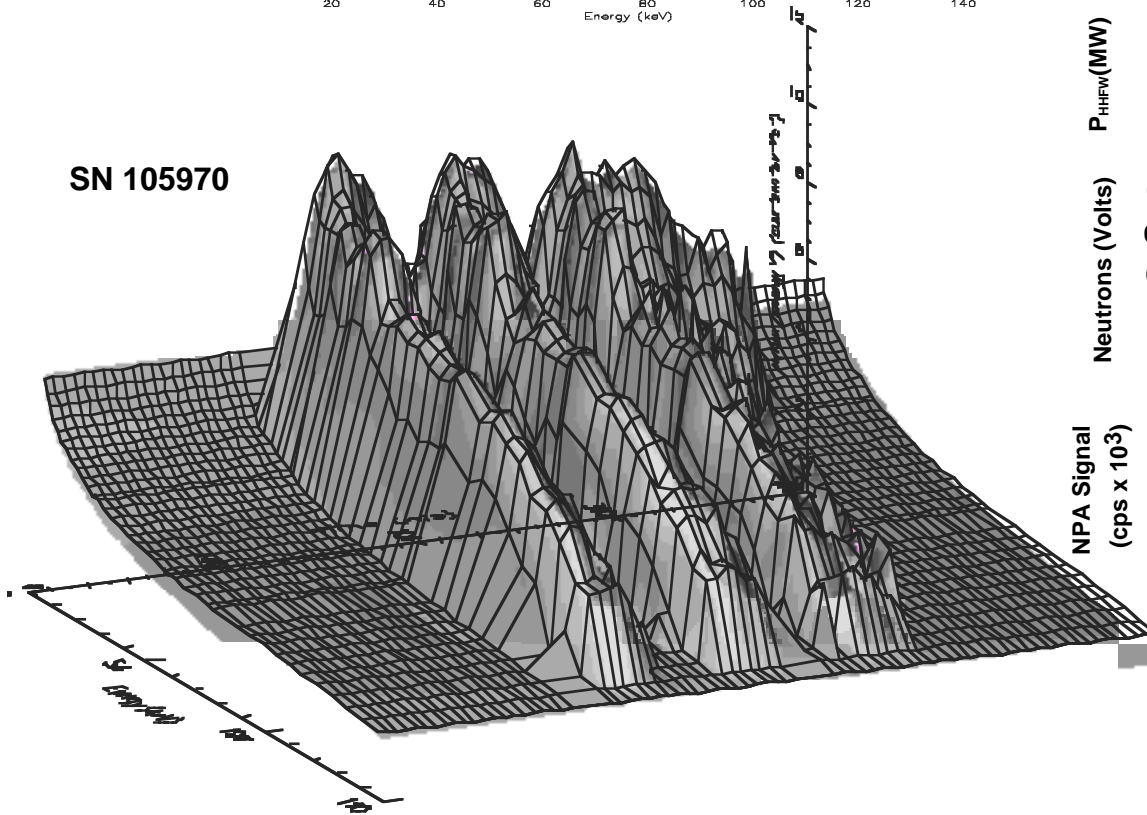


- Large $n=2$ mode @ 0.26 sec followed by $n=1$ @ 0.32 sec
- Neutron rollover and fast ion loss occurs at start of $n=2$ activity

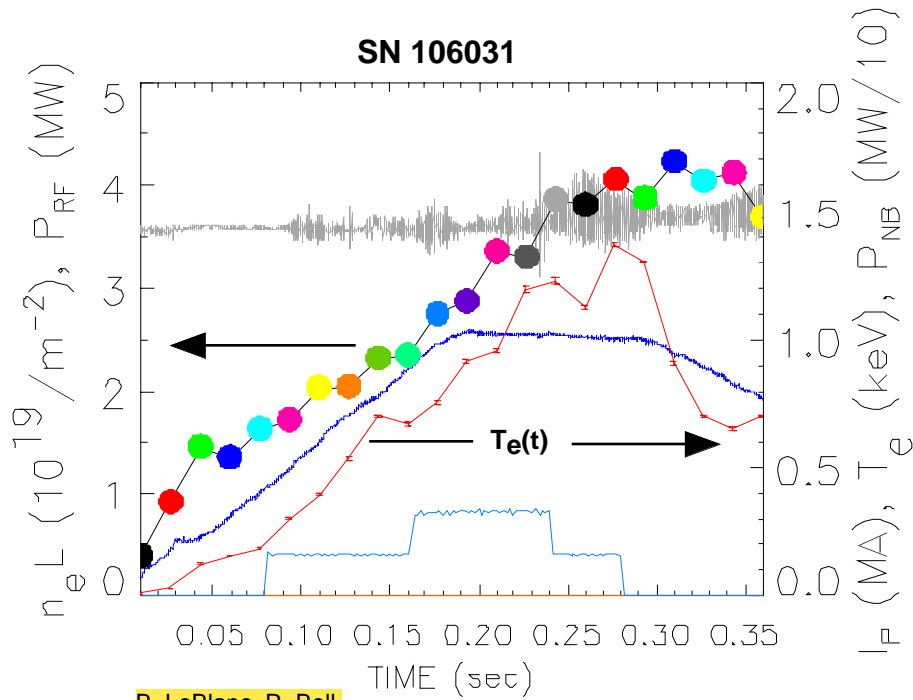
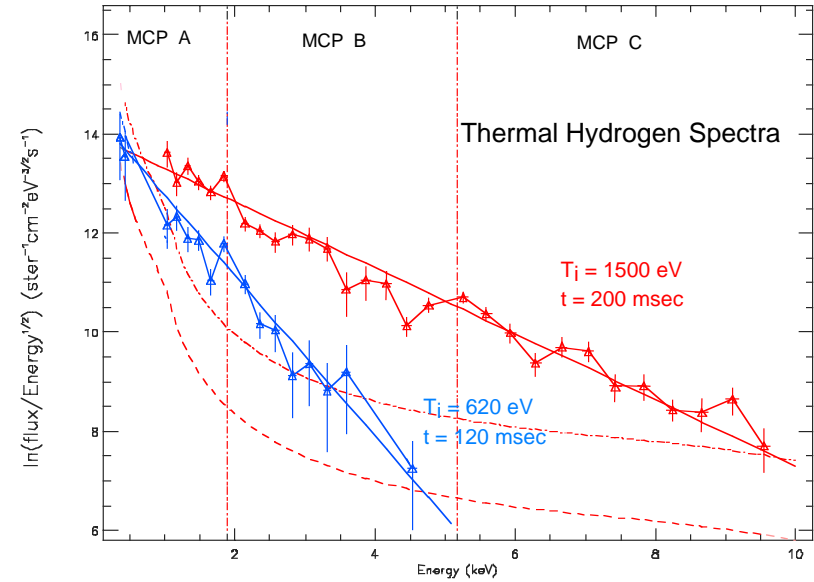
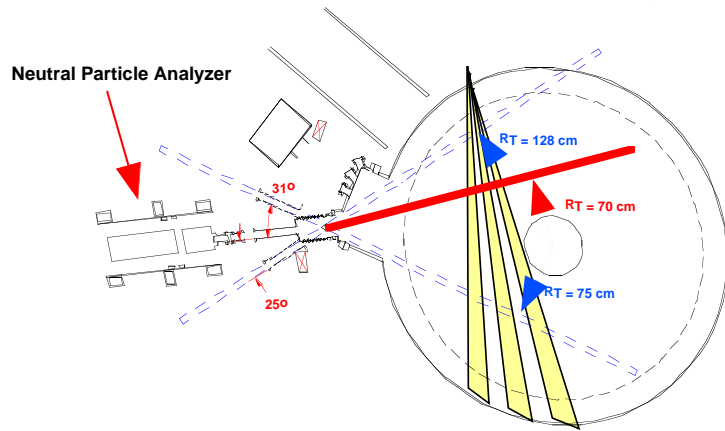
NPA Measurements of HHFW Energetic Tail Formation in NSTX



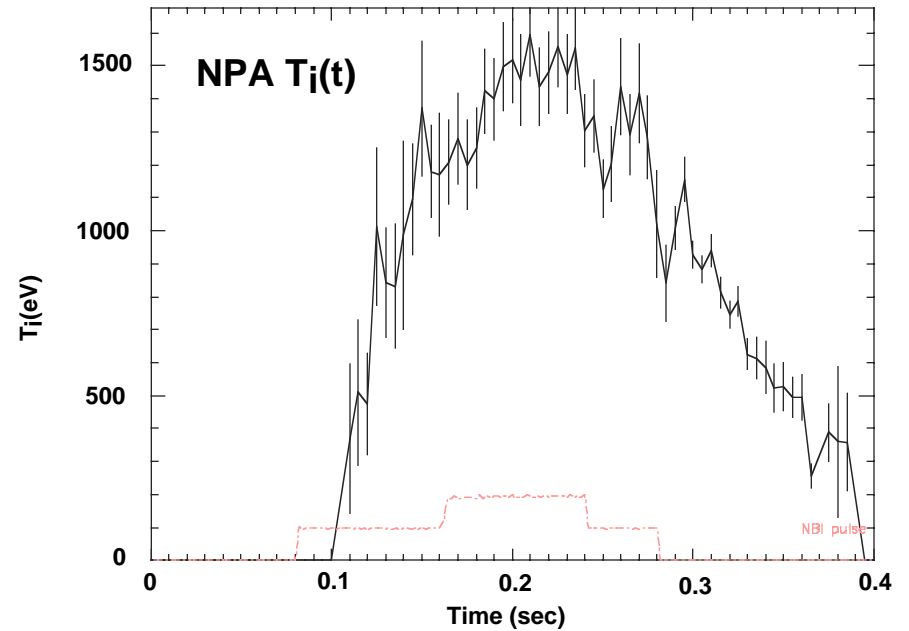
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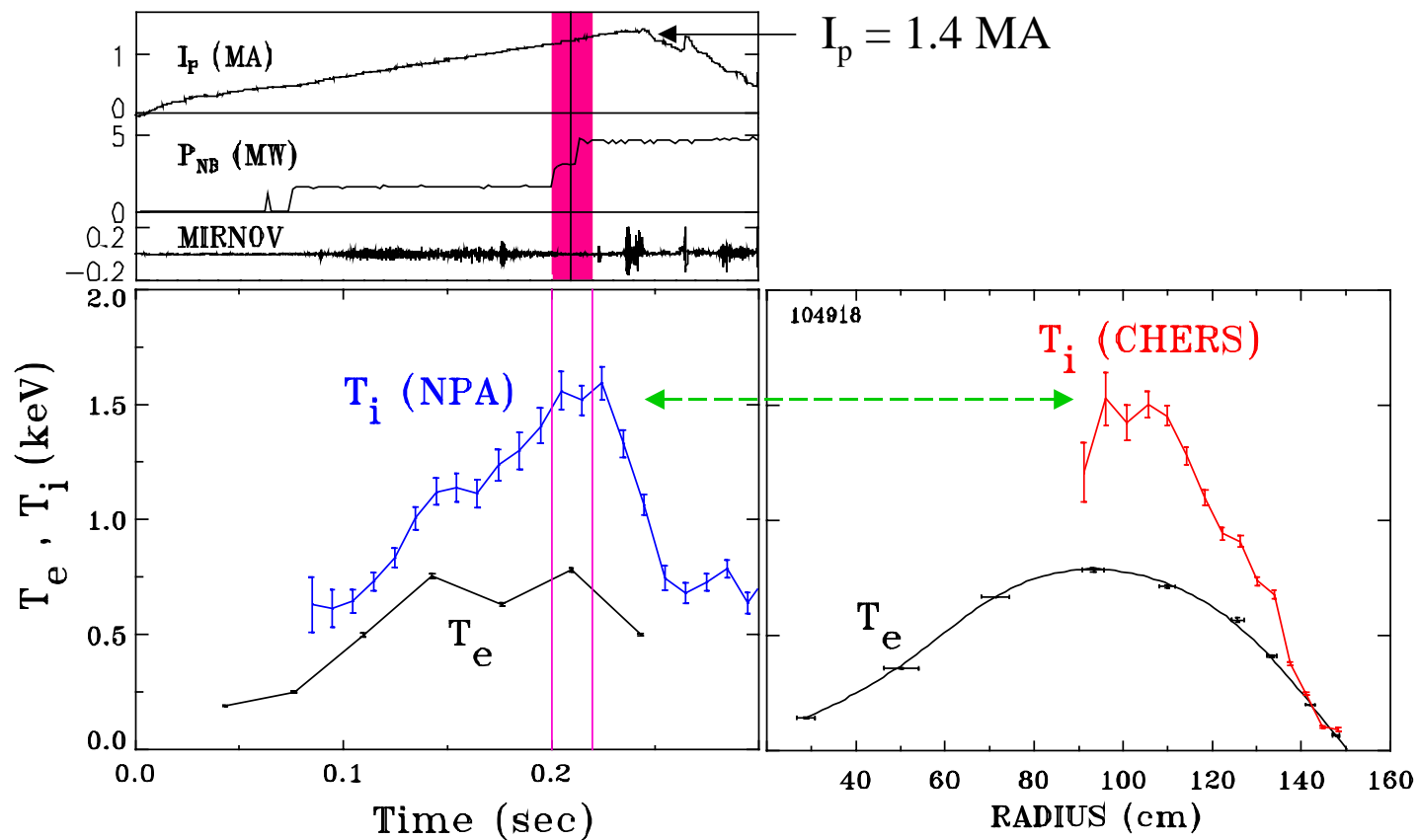
NPA Measurements of Hydrogenic Ion Temperature in NSTX



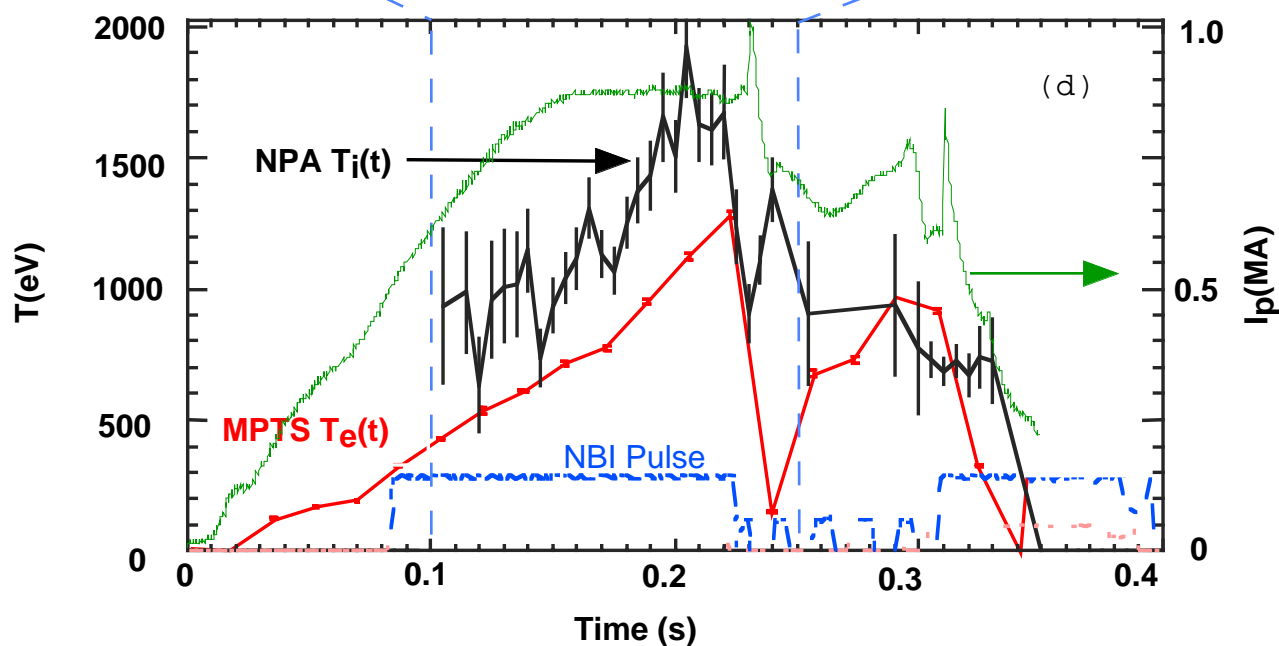
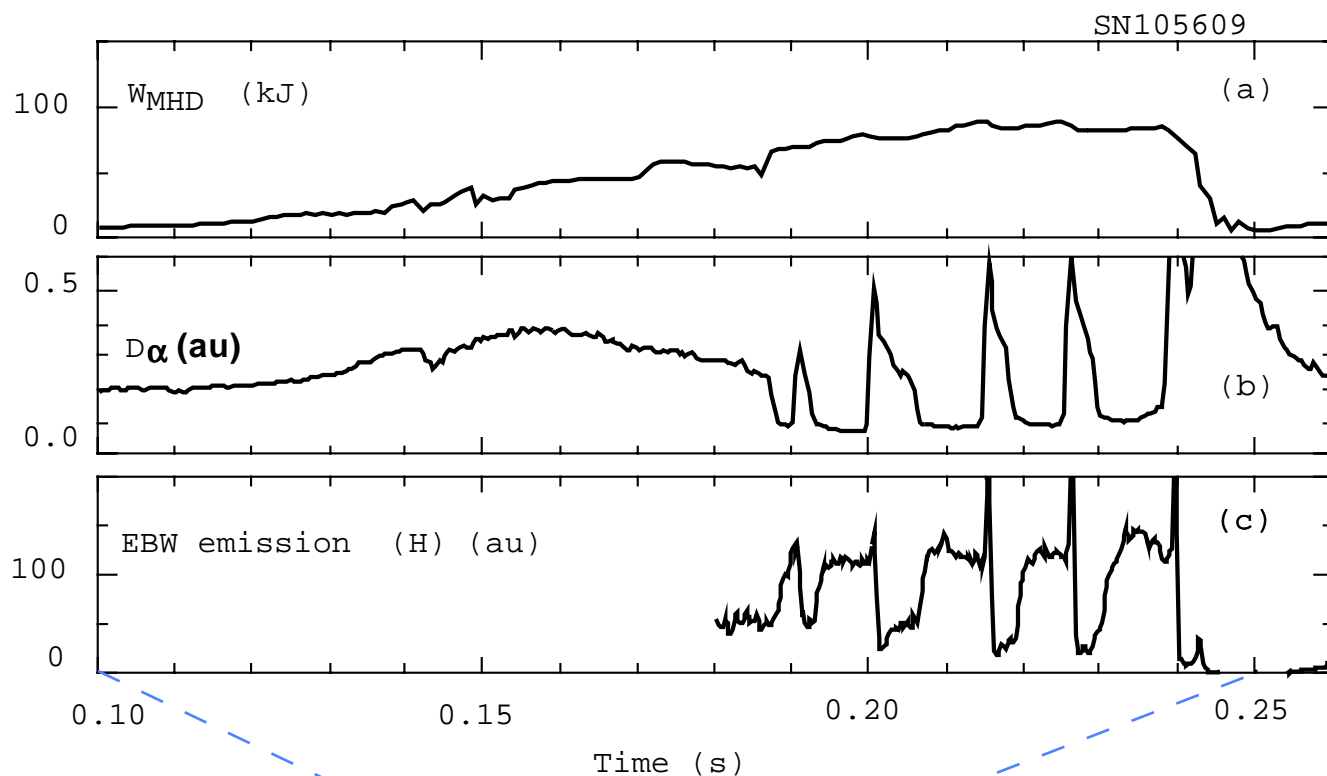
B. LeBlanc, R. Bell



T_i from NPA agrees with $T_i(0)$ from CHERS



NPA Measurement of Ion Temperature during H-mode



- Ion and electron temperatures increase during H-mode

NSTX

NPA FUTURE WORK

- **Hardware**
 - Complete horizontal/ vertical scanning upgrade
- **Run 2001 Data Analysis**
 - CAE stochastic ion heating?
 - NB blips in Ohmic and HHFW heated plasmas
 - NPA/CHERS T_i comparison
- **Code Analysis**
 - Power balance/ transport/ NPA simulation (TRANSP)
 - Implement LOCUST code from MAST