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# Effect of Pitch Angle on MHD-induced Energetic Ion Redistribution or Loss by Neutral Particle Analyzer Vertical Scanning


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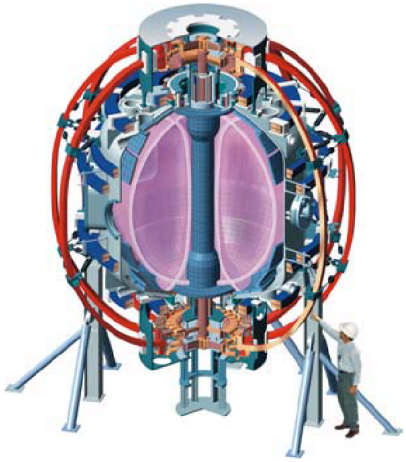

**NSTX 2008 XP Proposal 'Lite'**


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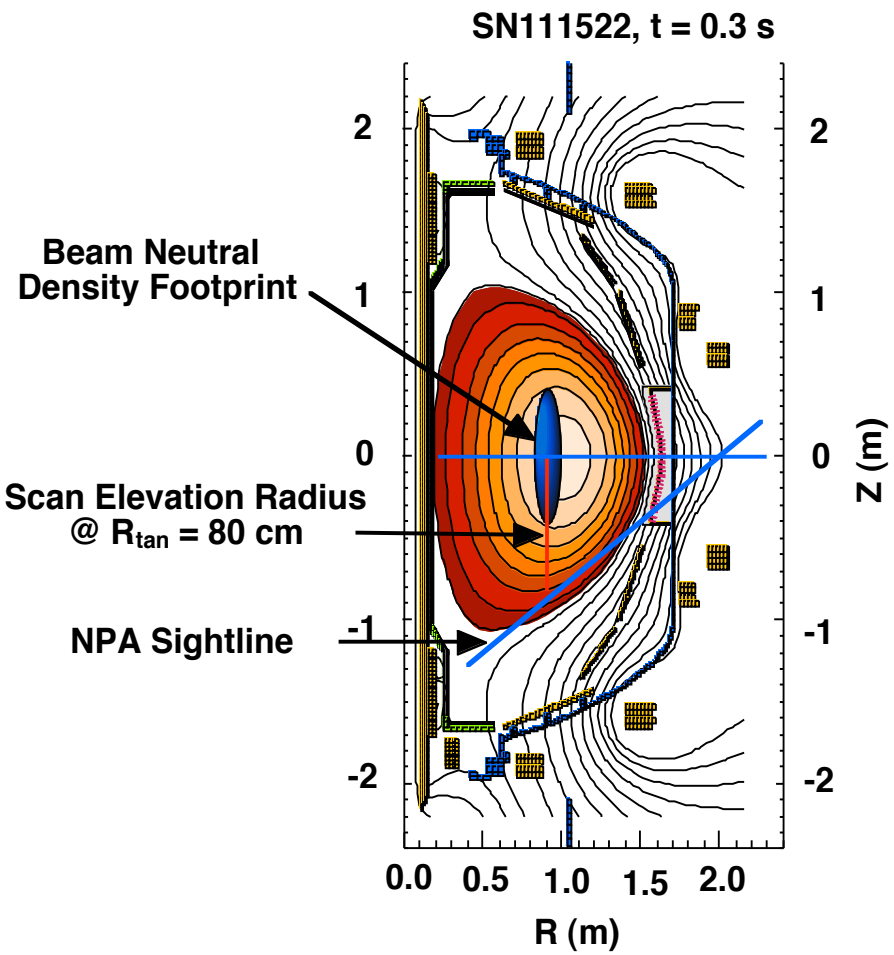
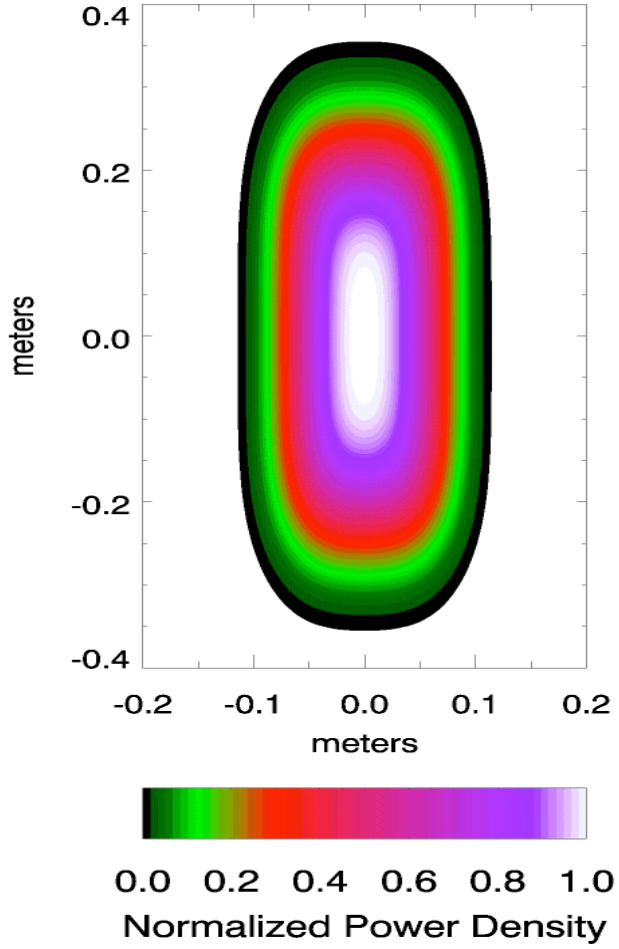
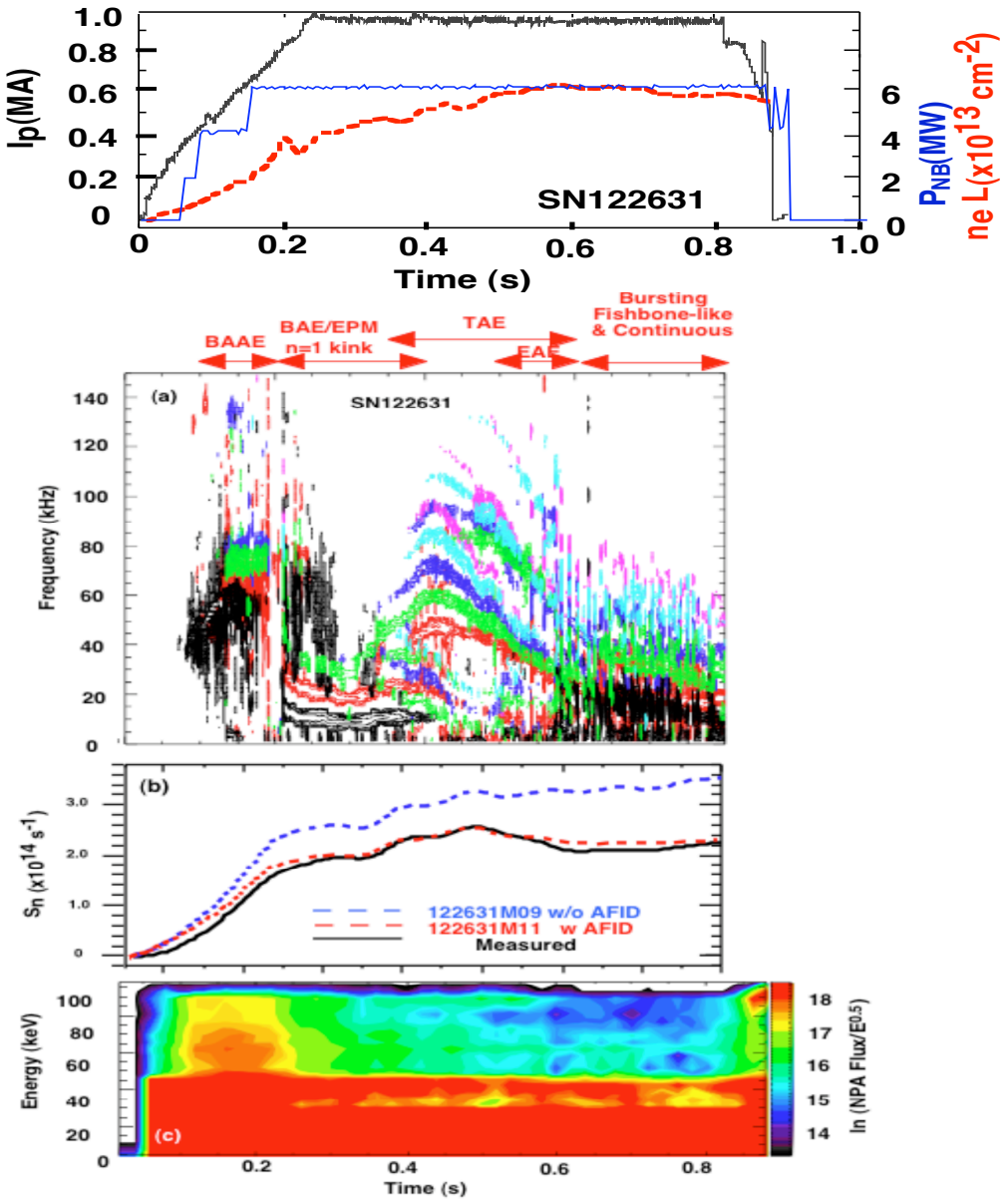
# The Neutral Particle Analyzer (NPA) on NSTX Scans Vertically Over a Wide Range of Angles on a Shot-to-Shot Basis



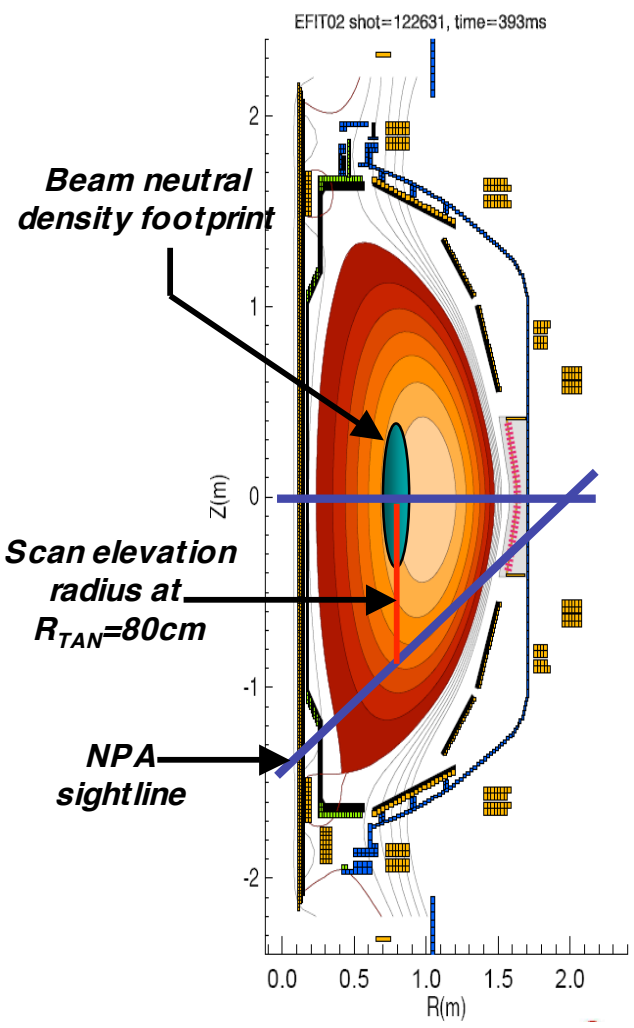

• The line-integrated NPA measurements (left panel) are 'localized' in pitch and space by intersection with the beam NB footprint (right panel). Radial resolution is ~ 20 cm due to footprint width.

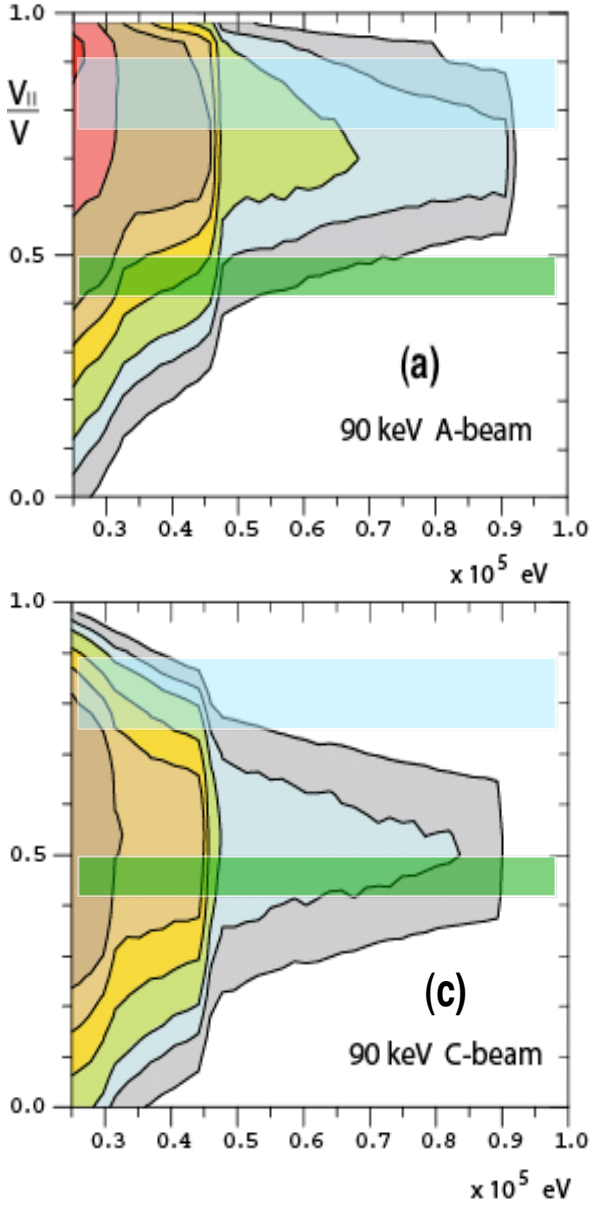
# XP-707 Vertical Scan Discharge Characteristics: 122631

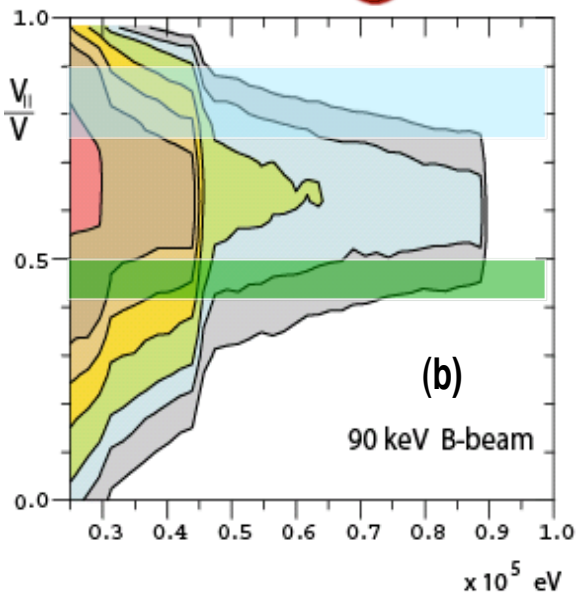


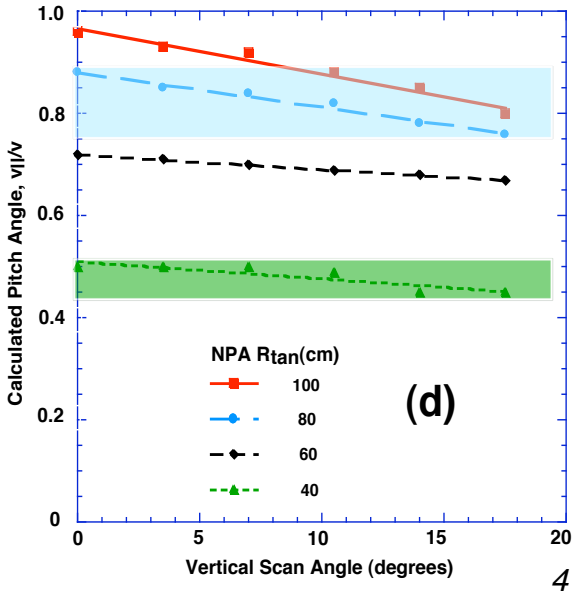

- H-mode with Ip = 1 MA, $B_T$ = 4.5 kG A, B, C @ 90 keV and $P_{NB}$ = 6 MW.
- TRANSP-calculated neutrons ~ 1.5x measured.
- Stable outer gap ~ 10 cm early in discharge and $n_e(r)$ 'flattop' at t > 0.5 s (i.e. no 'faux' depletion effects).
- Strong energetic ion depletion above E/2 after H-mode onset at t ~ 0.2 s.
- High f ~ 400-1000 kHz modes existed during the discharge but with $\delta B_{Low}/\delta B_{High}$ ~ 40.

# Proposed XP-8** Addresses NPA Vertically Scanning Measurement of MHD-induced Energetic Ion Redistribution at Reduced Field Pitch: $v_{||}/v \sim 0.47 \pm 0.03$.

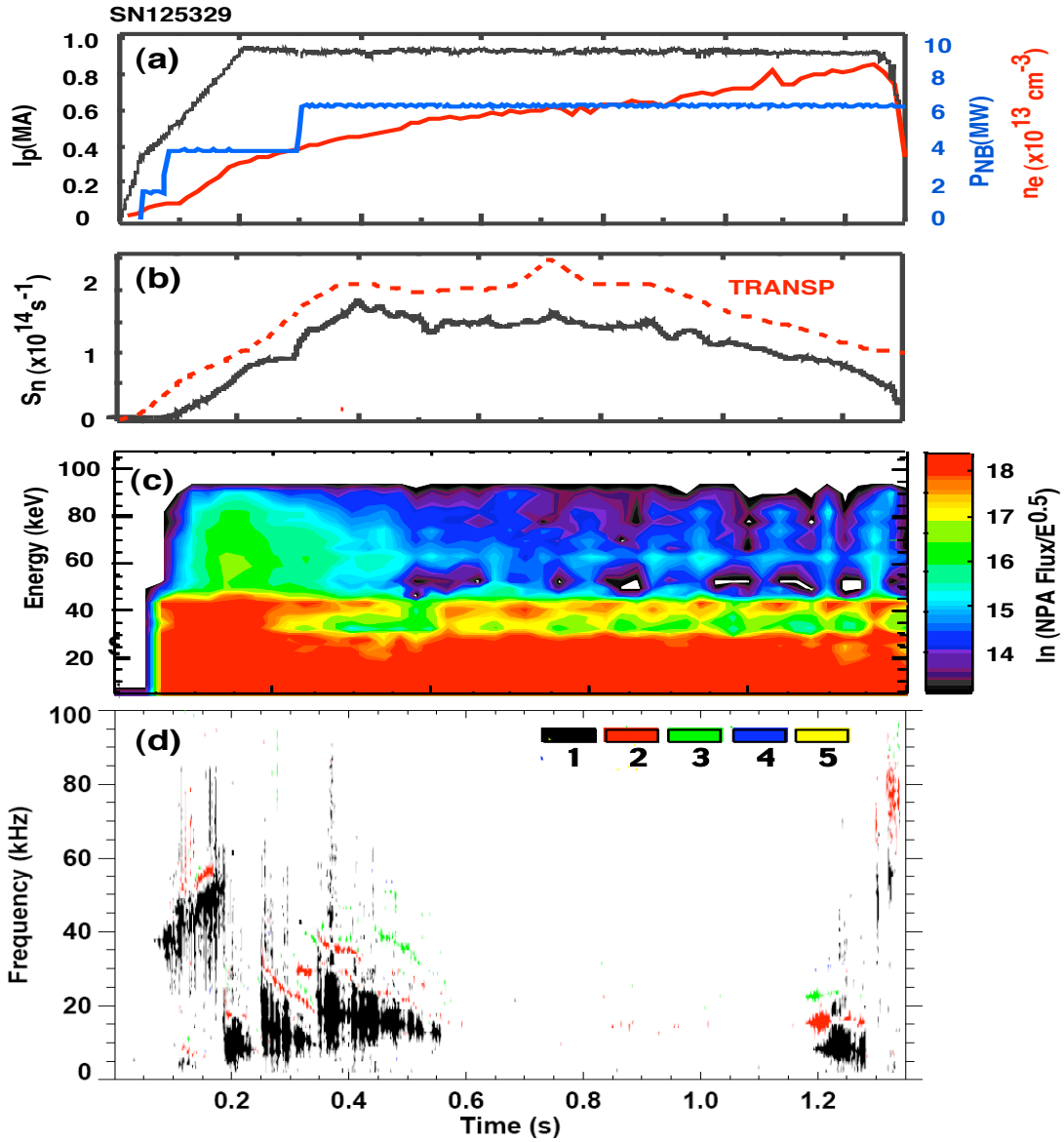


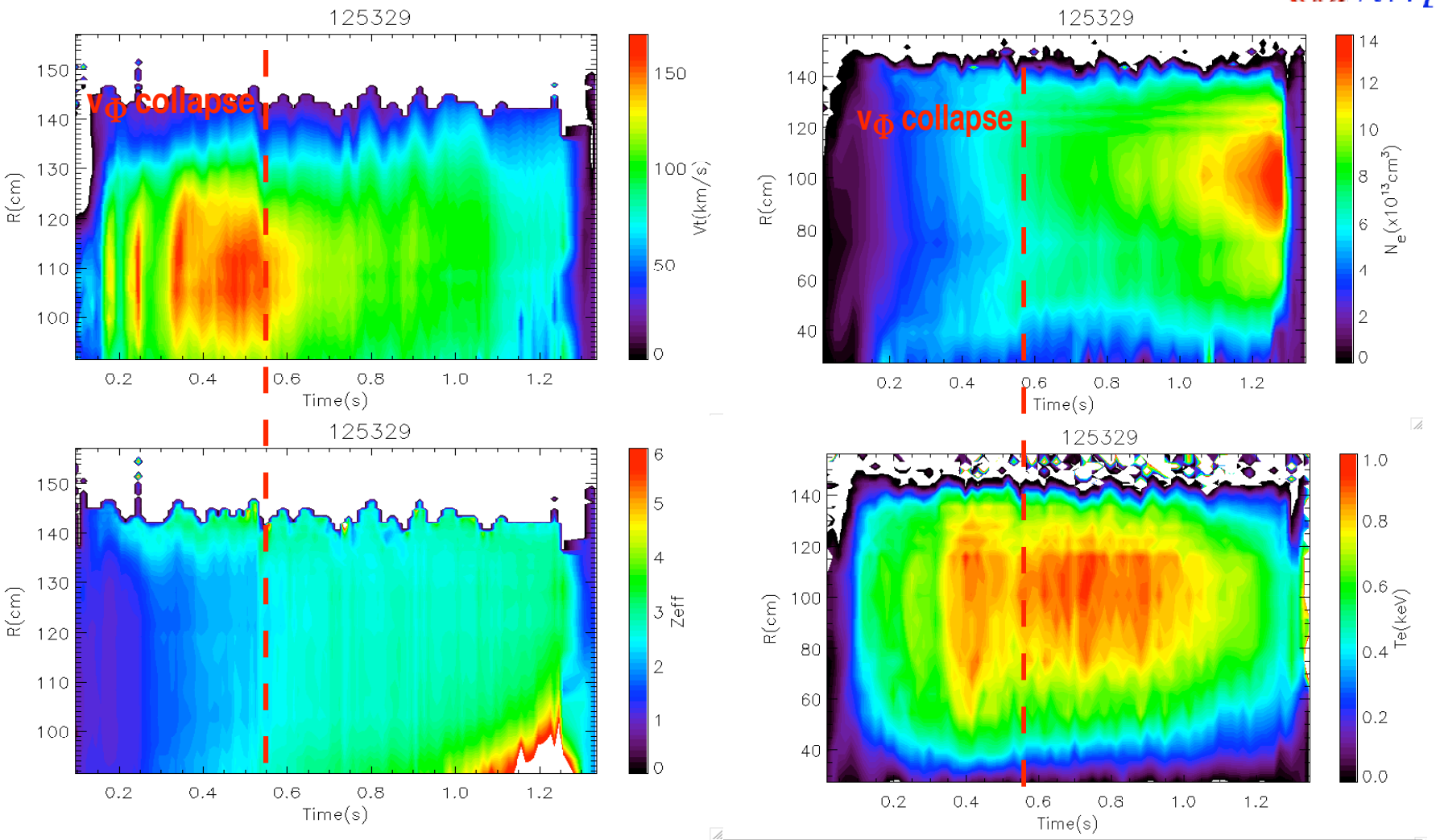



# Proposed XP-8** Also Addresses NPA Vertically Scanning Measurement of Energetic Ion Redistribution during MHD "Quiescent" Phase - e.g. SN125329.




- H-mode with Ip = 0.9 MA, $B_T$ = 4.5 kG A, B, C @ 90 keV and $P_{NB}$ = 6 MW.
- TRANSP neutrons ~ 1.25x measured.
- Stable outer gap ~ 10 cm early in discharge and density ramp-up to $n_e(r) = 8x10^{13}$ cm$^{-3}$.
- Energetic ion depletion above E/2 after H-mode onset at t ~ 0.1 s.
- Even during the 'Low - f Quiescent' phase, however, $\delta B_{Low}/\delta B_{High} \sim 4$.

# MPTS and CHERS Data for SN125329 - a Rare 'Low-f Quiescent' H-mode Discharge




- Collapse of $v_\Phi$ at t ~ 0.55 s coincides with ramp-up of carbon-dominated $Z_{eff}$ and $N_e$.
- Electron temperature profile is broad, $T_e(0) \sim T_i(0) \sim 1$ keV & $S_n \sim 1/Z_{eff}$ @ t > 0.55 s.

# Run Plan Details

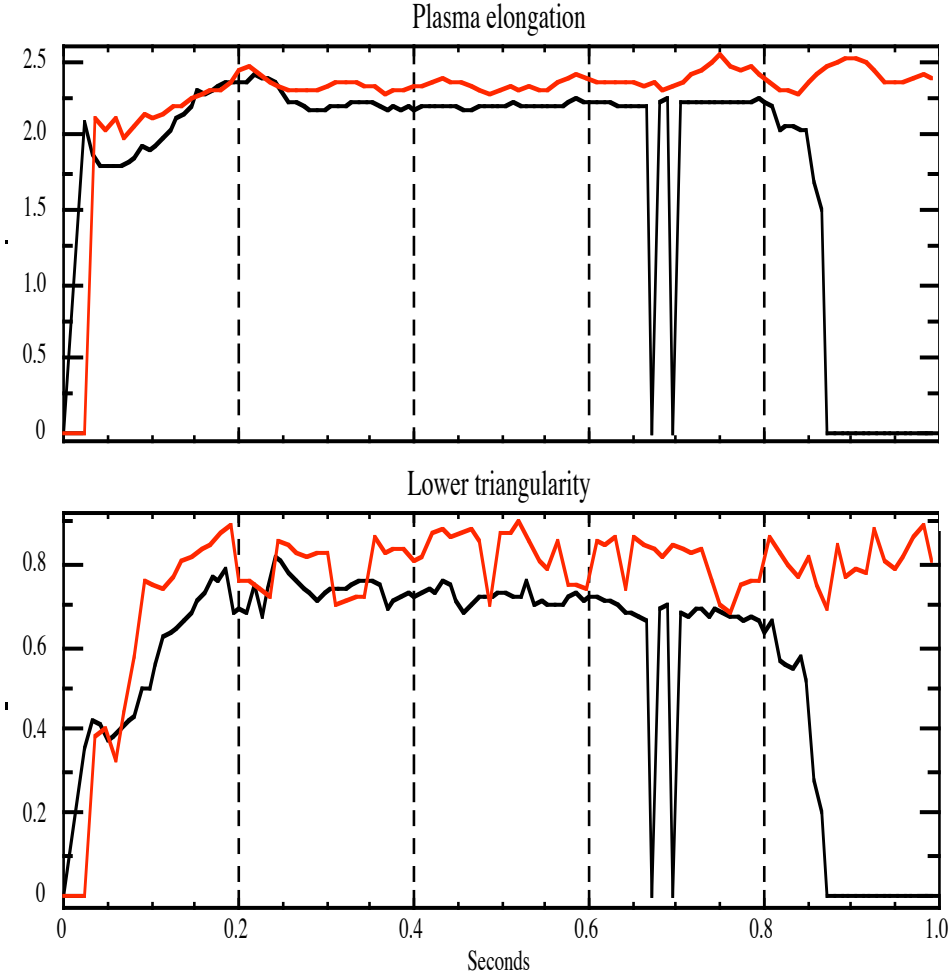
| Shot Number | Vertical Angle (degrees) | |
|---|---|---|
| 1 | 0 | ❒ |
| 2 | 3.0 | ❒ |
| 3 | 6.0 | ❒ |
| 4 | 9.0 | ❒ |
| 5 | 12.0 | ❒ |
| 6 | 15.0 | ❒ |
| 7 | 18.0 | ❒ |
| 8 | 20.0 | ❒ |
| 9 | 17.5 | ❒ |
| 10 | 13.5 | ❒ |
| 11 | 10.5 | ❒ |
| 12 | 7.5 | ❒ |
| 13 | 4.5 | ❒ |
| 14 | 1.5 | ❒ |

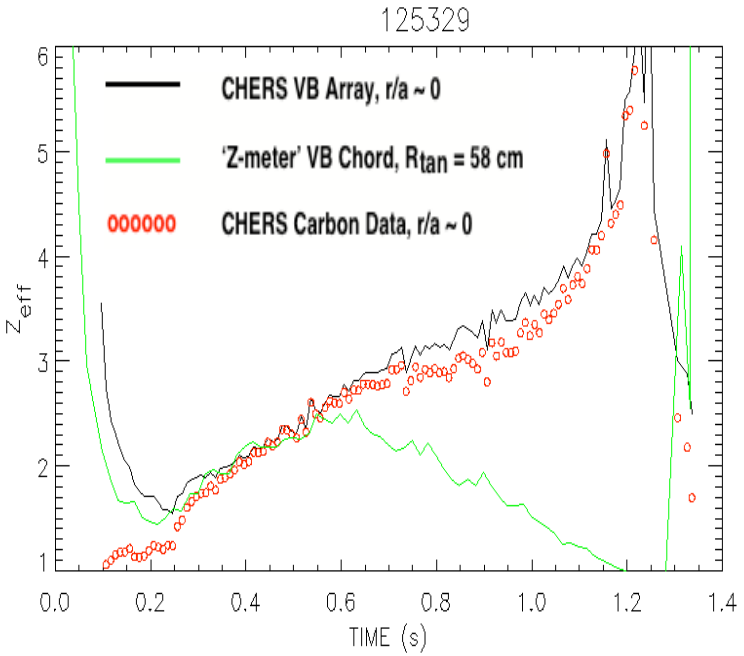
Machine: 4.5 kG, 1.0 MA, $n_e(0) \sim 6x10^{13}$ $cm^{-3}$**,** GDC between shots, **no Lithium contamination**
Beams: Sources A, B, C @ 90 keV deuterium
Diagnostics: Magnetics for EFIT equilibria, full kinetic diagnostics and **sFLIP data**.

# Run Plan Details: “Quiescent” Transition?

Shots:
122631
125329

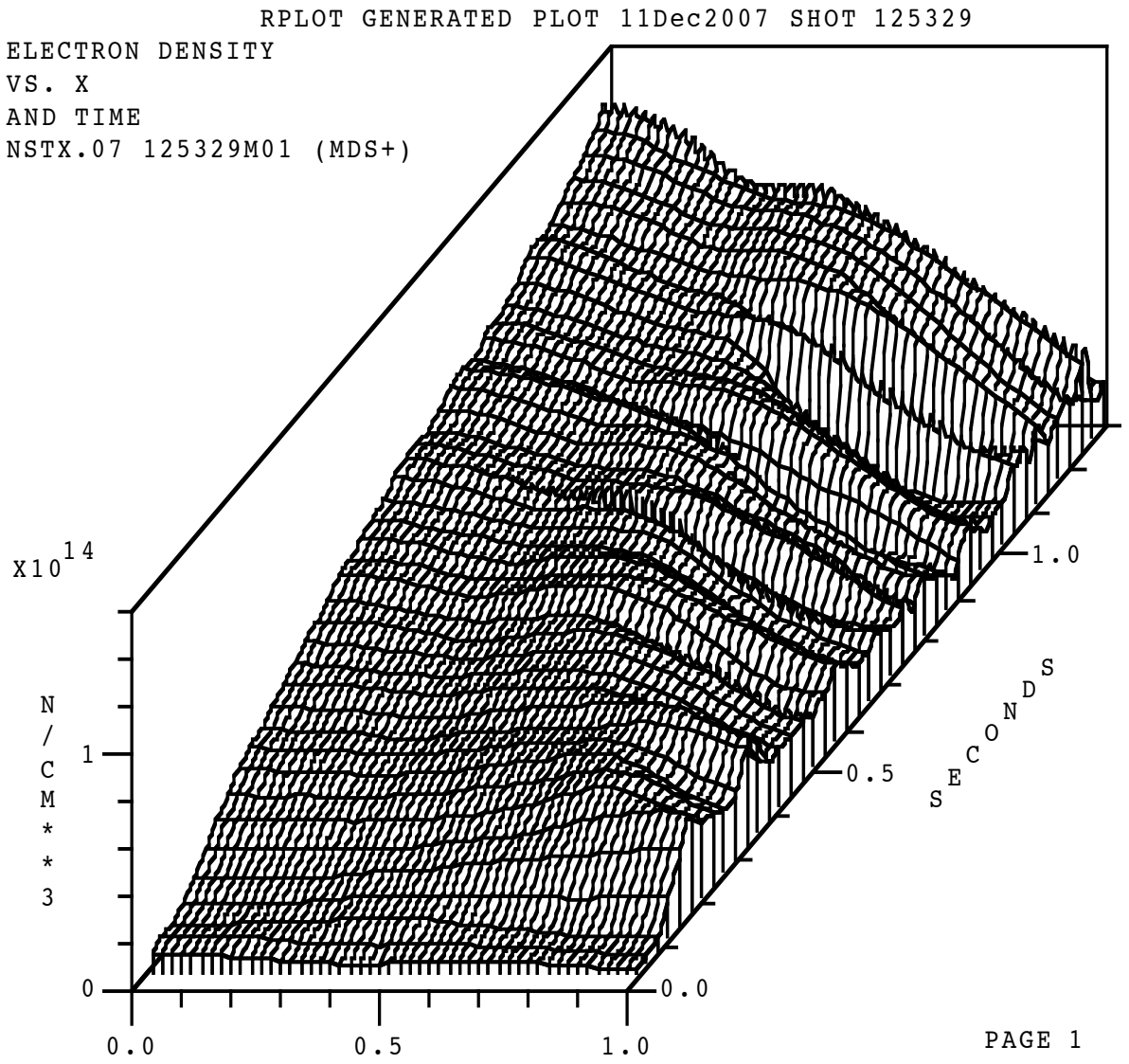
\efit01::kappa  \efit01::tribot




- What is the cause of the MHD “quiescent’ phase?
- Neutron yield doesn’t change at the ‘quiescent’ transition.

# SN125329 Exhibits Large Ne Fluctuations at r/a > 0.5

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