Status of and Progress on T_i and V_ϕ Analysis Issues

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NSTX Results Review
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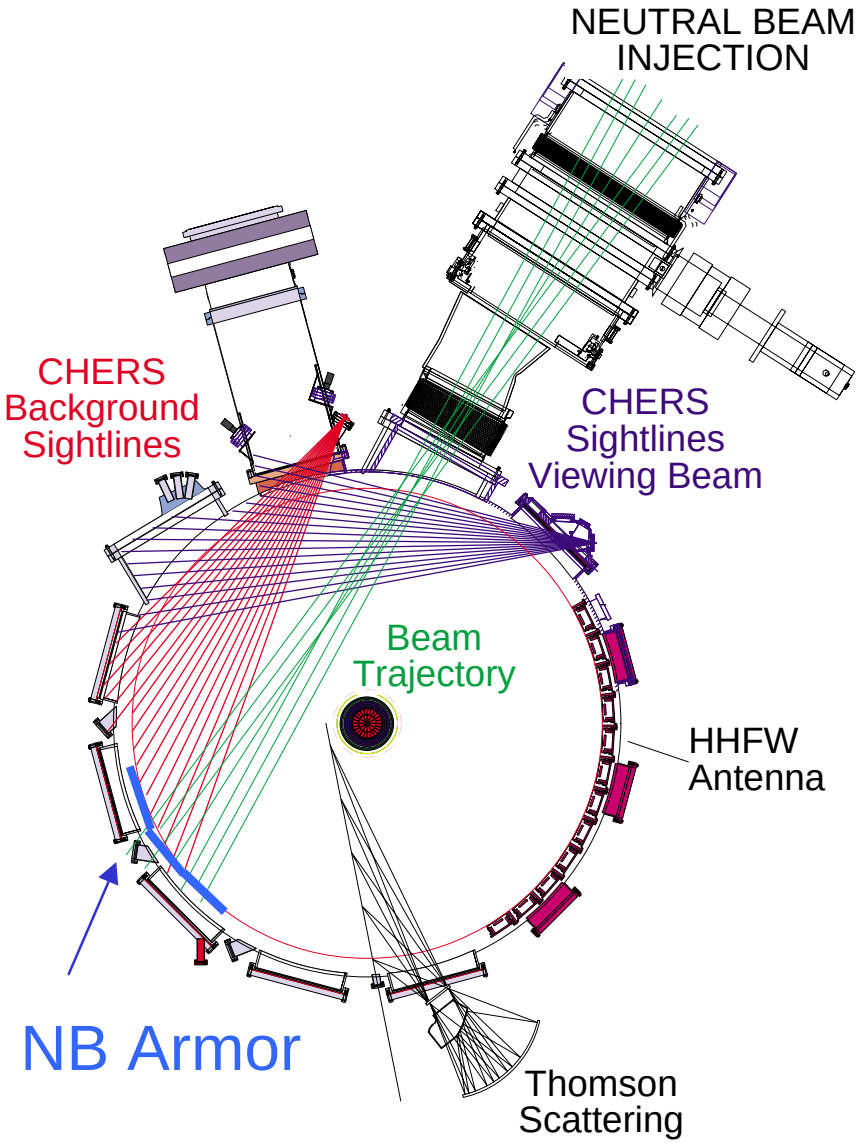
NSTX iCHERS Diagnostic

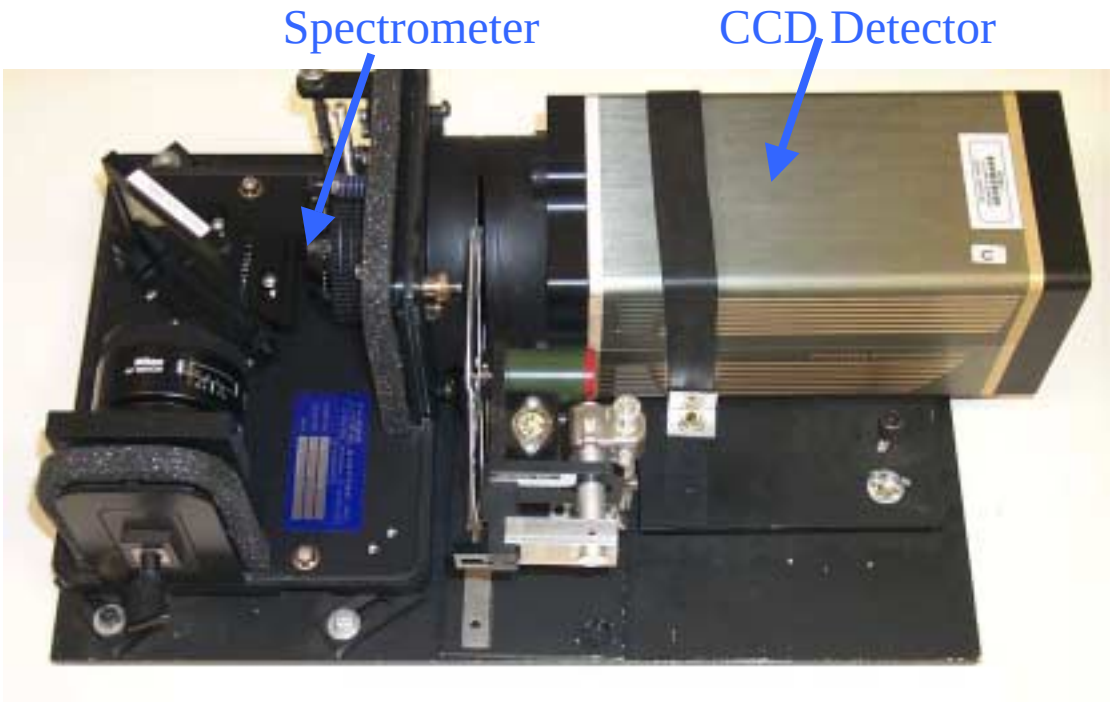


NSTX Interim CHERS:

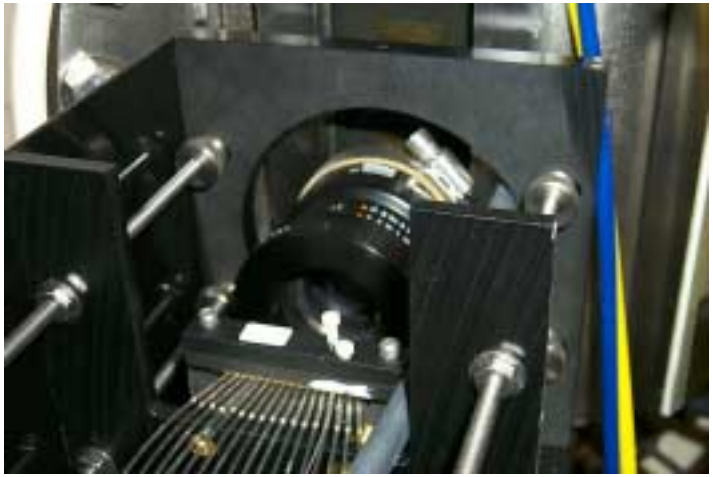
- 16 spatial channels, Bay B, viewing Neutral Beam
- 15 background channels, Bay L
- 20 ms integration time
- T_i (R), V_ϕ (R), N_{carbon} (R)
- C VI emission, 5290 Å

NSTX iCHERS Hardware

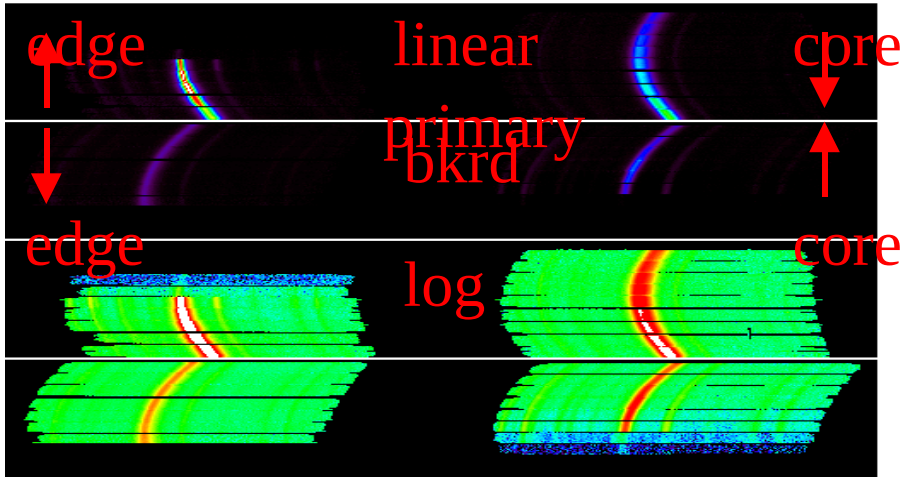
- Spectrometer, CCD detector and fiber optics reused from TFTR Poloidal Rotation Diagnostic
- Commercial camera lens used for collection optics



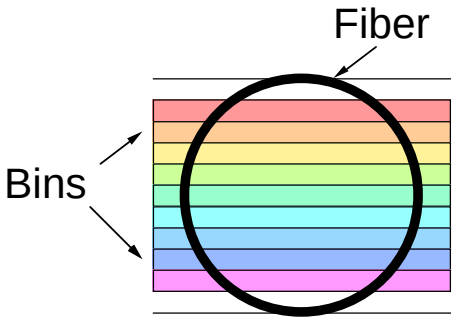
Viewing Optics and Fiber Array

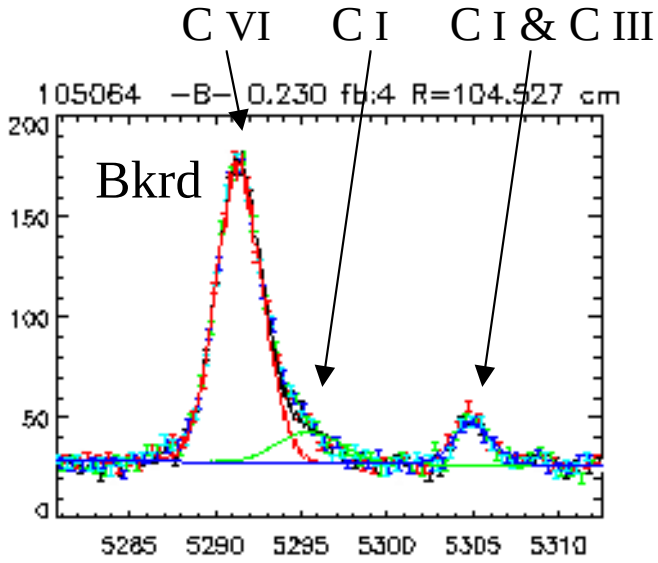


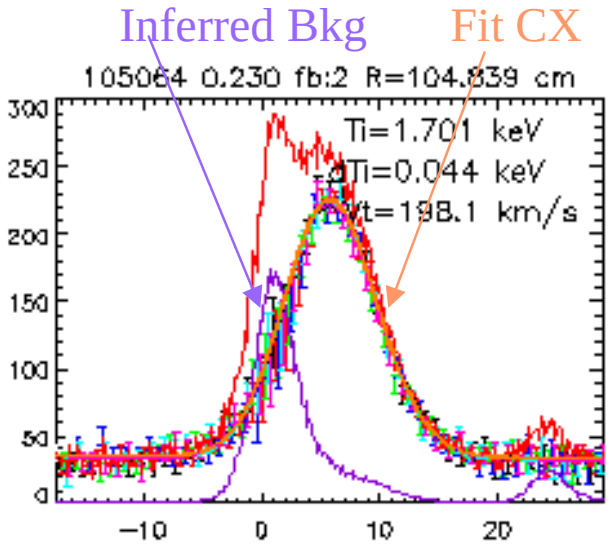
NSTX iCHERS Spectrum



- Curved images on CCD due to short focal length spectrometer
- Multiple bins for each fiber
- Spectra for all bins of fiber are restacked and fit
- Each bin is separately calibrated
- Spectra for fiber are fit as ensemble





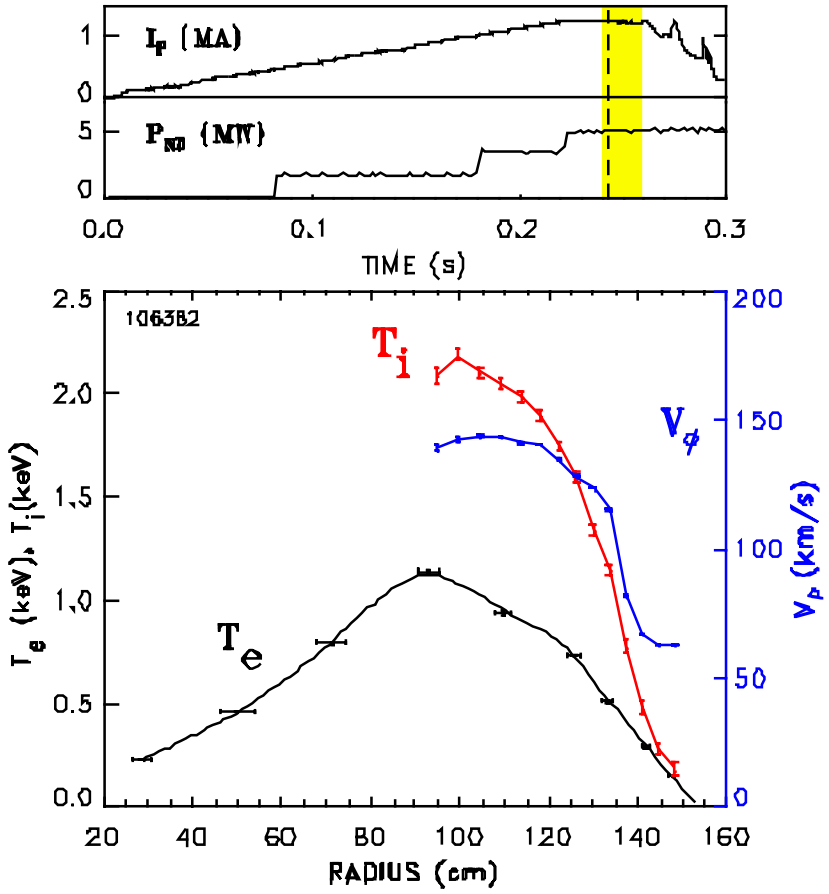


Interim CHERS Issues

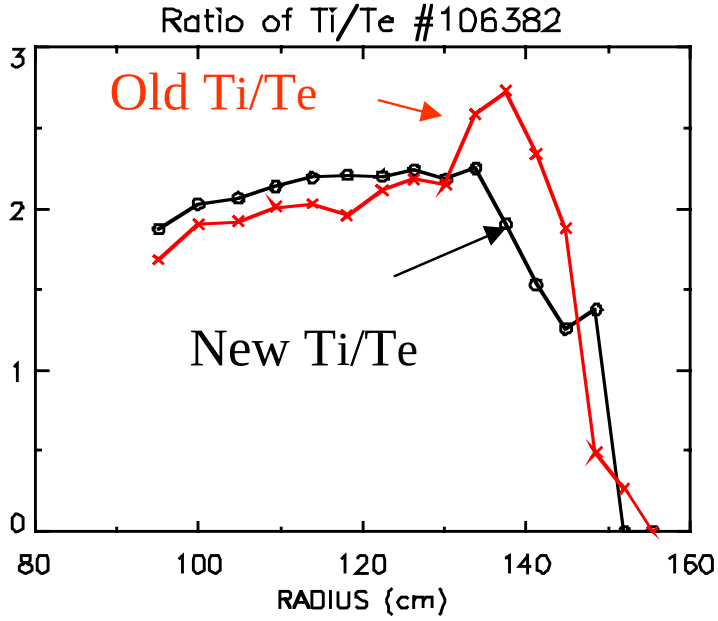
- High quality **cross calibration** needed between background array and main array.
  - → Instrumental function (in-vessel to fill optics properly)
  - → Wavelength
  - → Photometric (in-vessel)
  - → Spatial (in-vessel)
- Large **background emission** requires dual views of plasma and special analysis techniques
- **Reflections off NB Armor** contaminate background measurement
- Movement of collection optics during run
- Window coatings

In-vessel Instrumental Calibration

- New in-vessel calibration of instrumental function using neon glow
- Characterized by 3 gaussian fit
- Lower temperatures more sensitive to changes in instrumental function



- Ratio of Ti/Te is reduced near edge with new calibration
- May affect power balance calculation

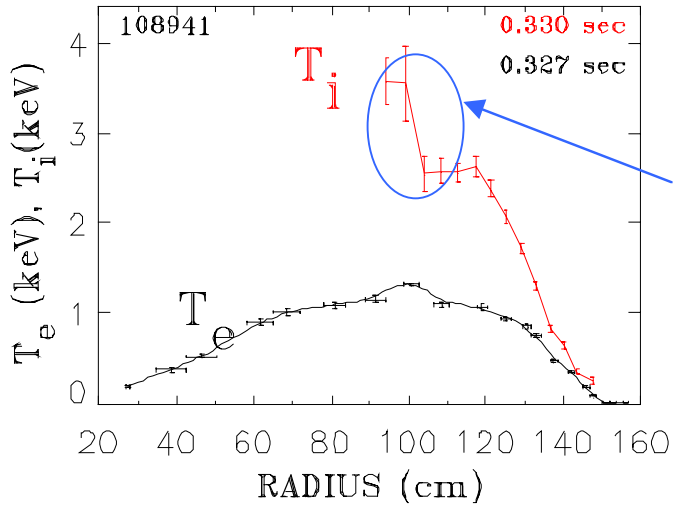


Latest Interim iCHERS Analysis Steps

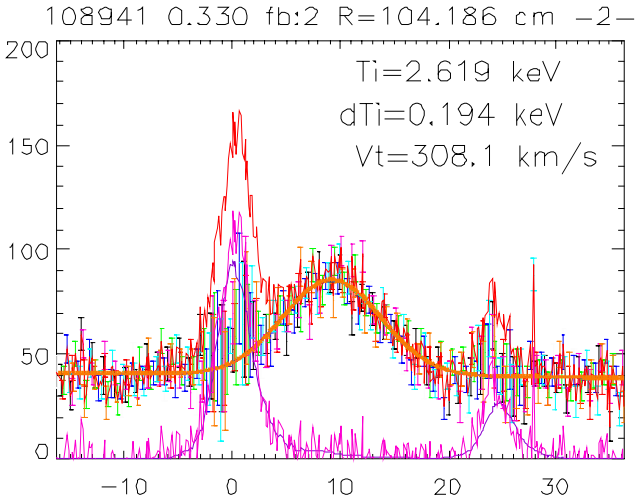
1) **Read data** and assemble calibration information
2) **Fit background** spectra for outer radii
3) Use fit coefficients to **reconstruct background** spectra at tangency radii and with instrumental function of main array
4) **Fit primary spectra** with background subtracted to get T_i and V_ϕ for outer radii
5) **Interpolate brightness profile** from background fit for outer radii
6) **Invert brightness profile** to get emissivity over C VI shell
7) **Reconstruct background spectra for all radii** by summing multiple gaussians using local values of T_i, V_ϕ , and emissivity for all lines in spectra
8) **Fit primary spectra** with background subtracted to get T_i and V_ϕ for ALL radii
9) Iterate once to step 7.
10) Repeat for all integration times

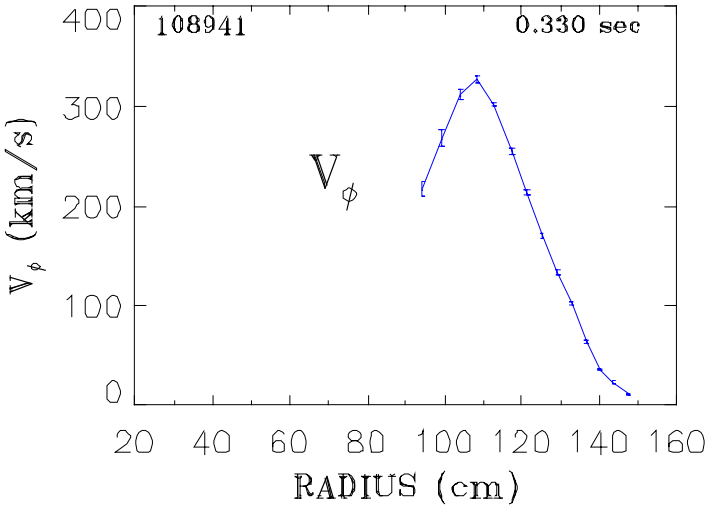
Crossing the S/N threshold

- Beam attenuation reduces CX signal in core

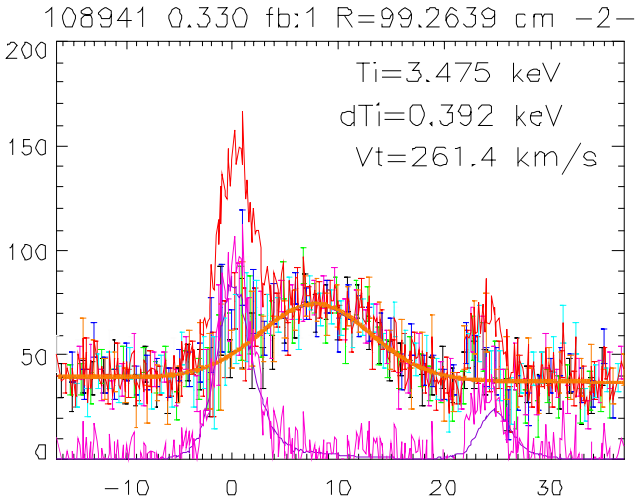


Step in T_i: near threshold of S/N?



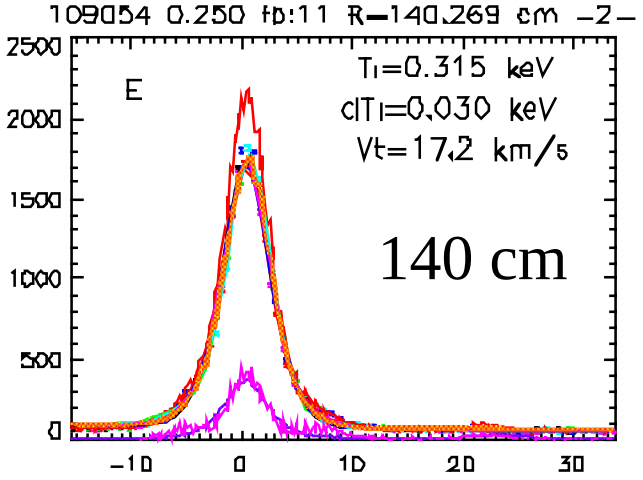


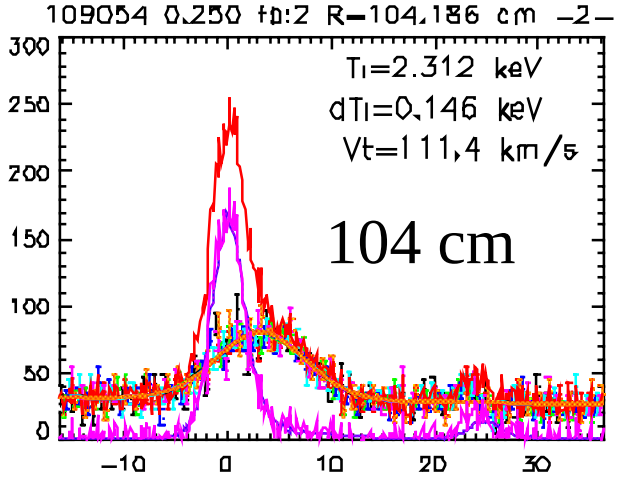
- High V_ϕ separates CX and background features
- Difference in FWHM ~ 1 pixel out of 10 pixels

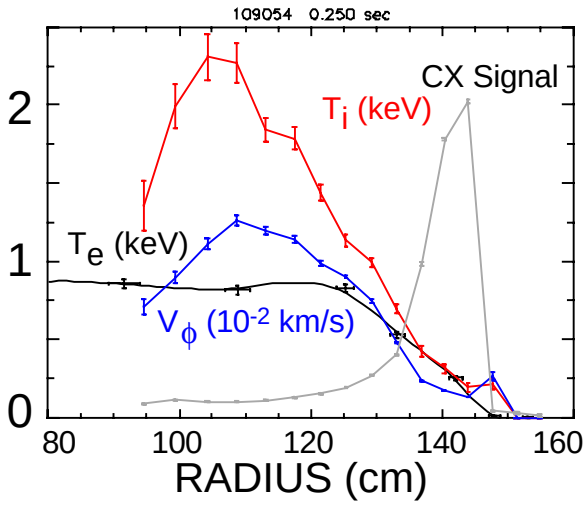


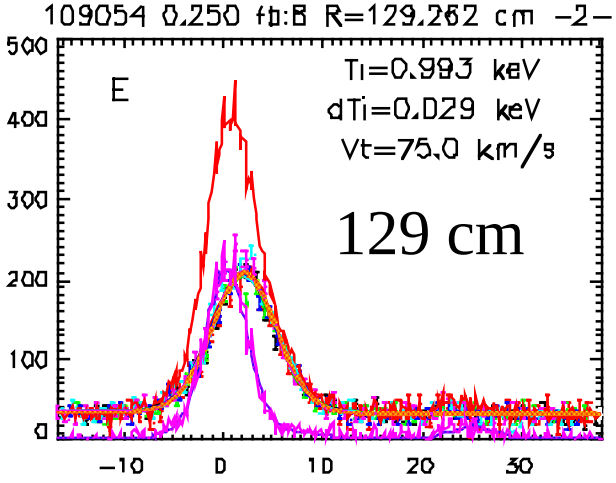
2 Source H-mode #109054

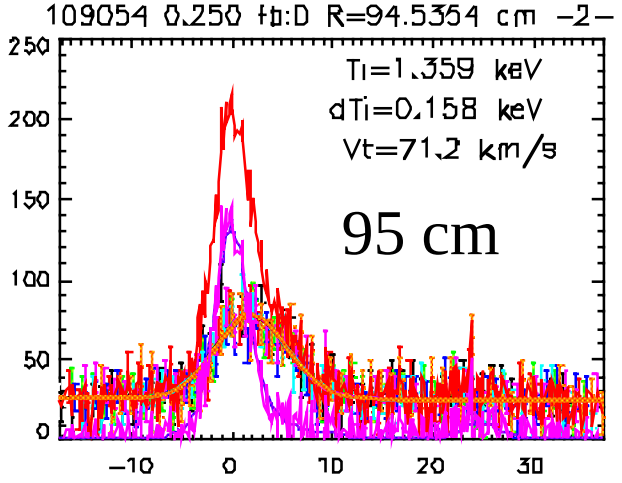
- Core CX signal weak, dominated by background emission
- Strong CX signal near edge
- Central temperature and velocity in question





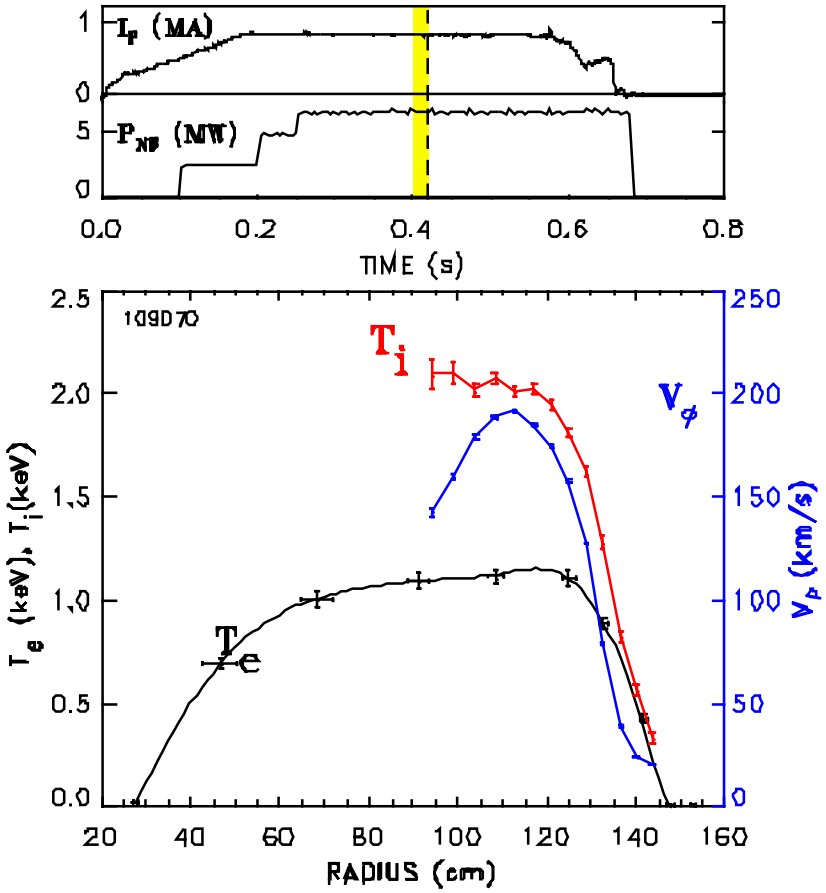


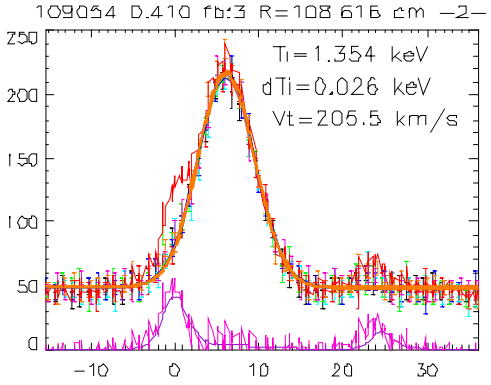


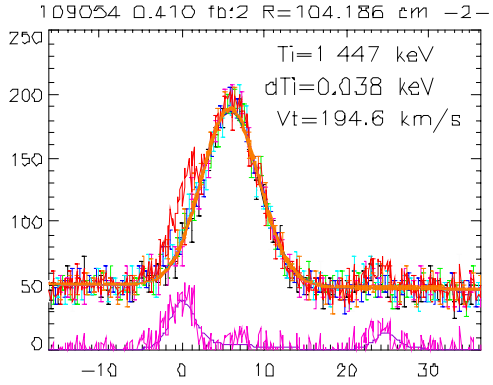


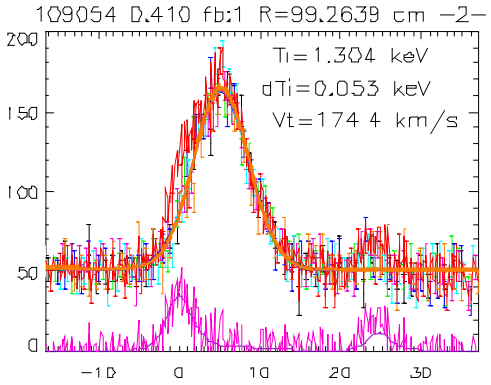
3 Source H-mode #109070

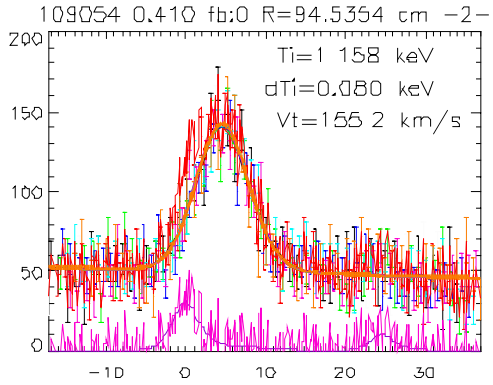
- Central sightlines show good S/N
- High PNB yields strong CX signal











STATUS of Analysis

- New instrumental calibration shows changes in Ti profile
- New method of modeling core background spectra required
- Testing will continue as shots are analyzed with improvements applied as needed
  - → Still some numerical instability
  - → Grid size for background reconstruction may be too large
  - → Desire to determine when S/N not adequate
- ANALYZED SHOTS will be generated starting this week, first IAEA requests, then APS requests
  - → May be some limitations for certain shot types or times