U.S. DEPARTMENT OF ENERGY | Office of Science

NSTX-U

# Performance of FIDA diagnostics on NSTX-U

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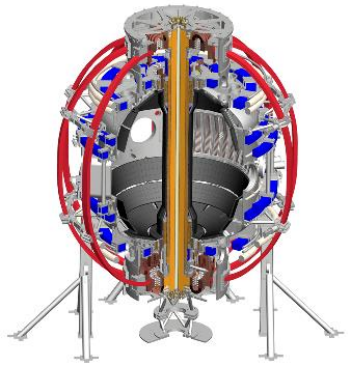
UCIrvine
University of California, Irvine

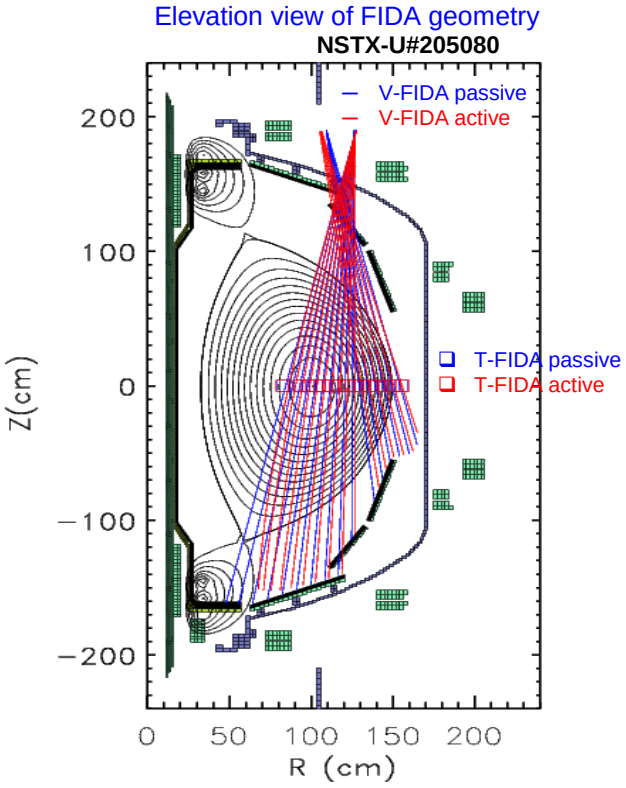
PPPL

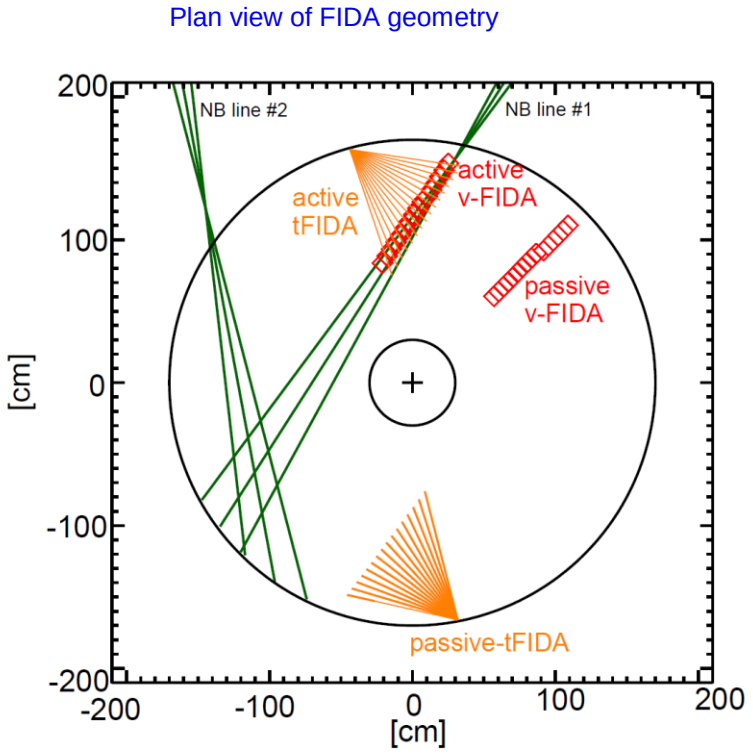


# Outline

- Sightline views of the FIDA geometry
- Performance of v-FIDA diagnostics
- Performance of t-FIDA diagnostics
  - Fast-ion Signals are observed on t-FIDA
  - Injected and Edge Neutrals Produce FIDA Signals
  - Some t-FIDA reference views are compromised
  - Beam-into-gas checks t-FIDA spatial calibration & species mix
- Summary

# FIDA Diagnostics are operational on NSTX-U

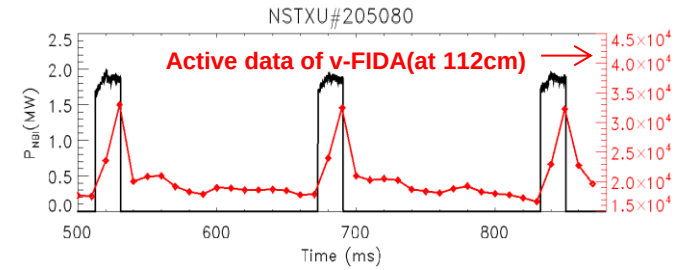


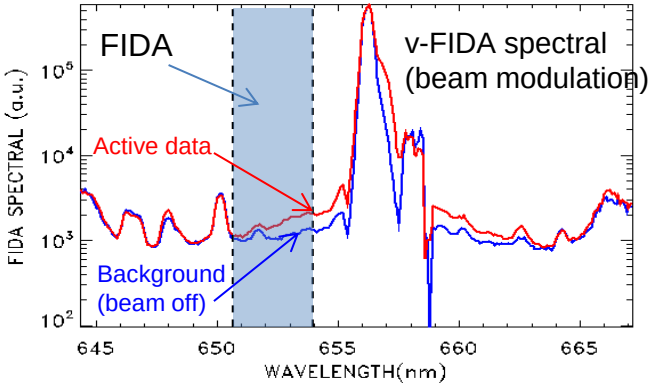



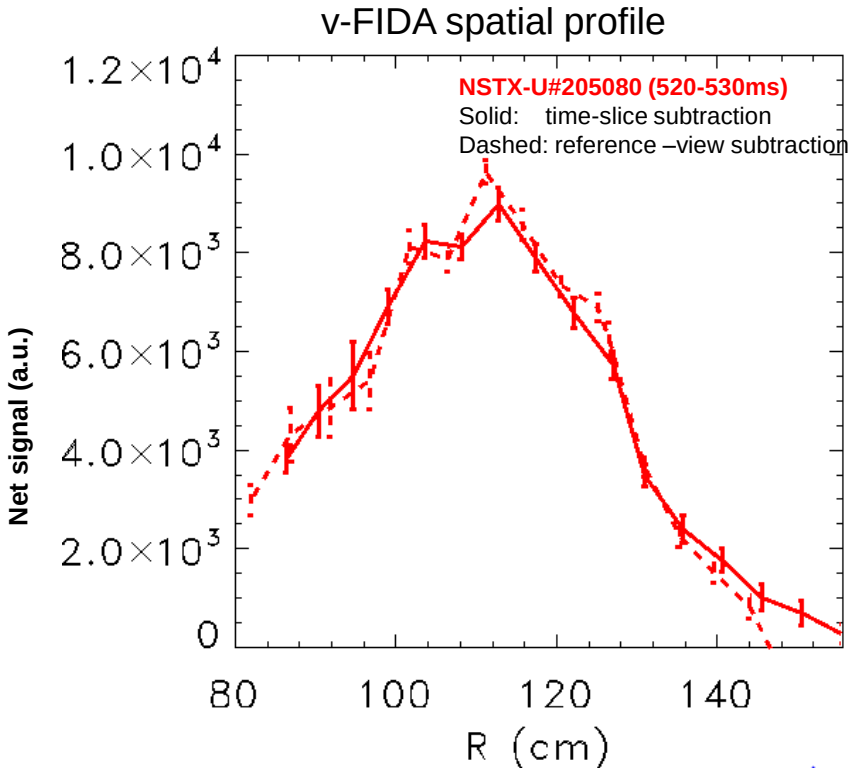

- FIDA covers 85~150cm region, with 5cm space resolution & 10ms/5ms temporal resolution for v/t-FIDA.

- The FIDA diagnostic was supposed to be beamline 1

# v-FIDA worked well during NSTX-U 2016 campaign

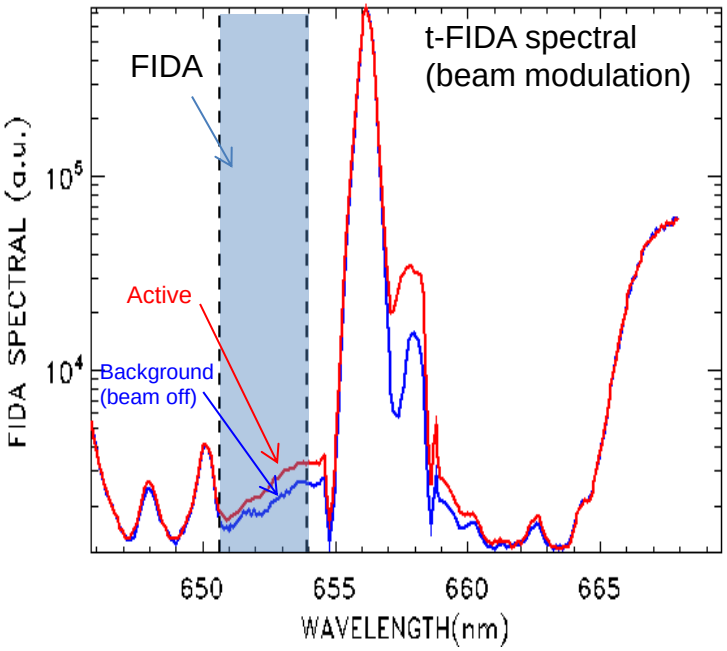


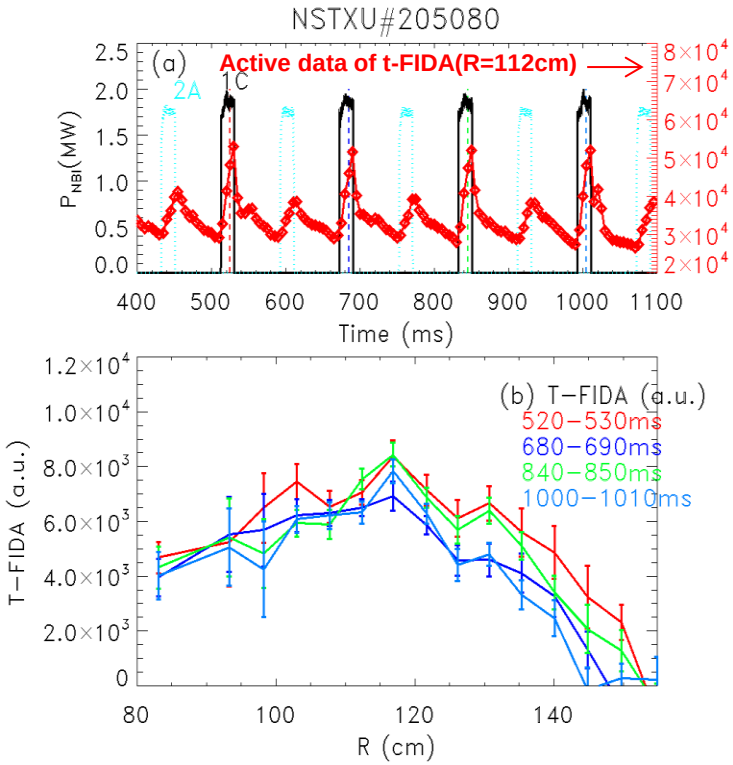




- v-FIDA has clear response to the beam source blips
- The good agreement between the signal profiles using time-slice subtraction and the reference-view subtraction identifies the good performance of v-FIDA diagnostic

# Fast-ion Signals are observed on t-FIDA

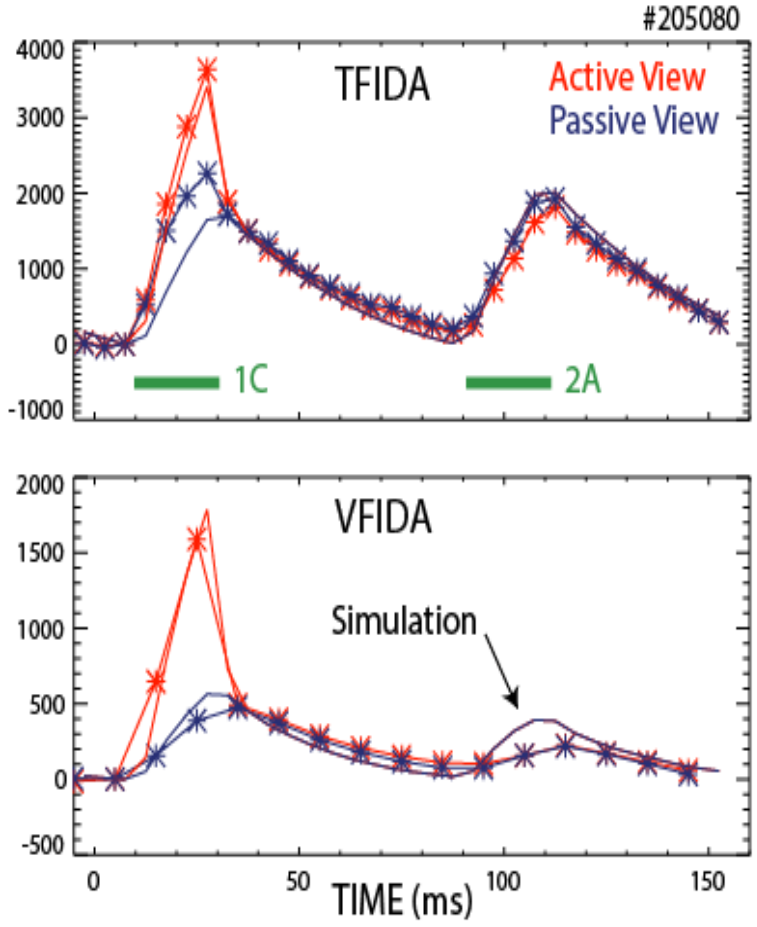



- t-FIDA has clear response to the beam source blip
- The signal profiles are reproducible on different time slices based on the time-slice subtraction

# Injected and Edge Neutrals Produce FIDA Signals

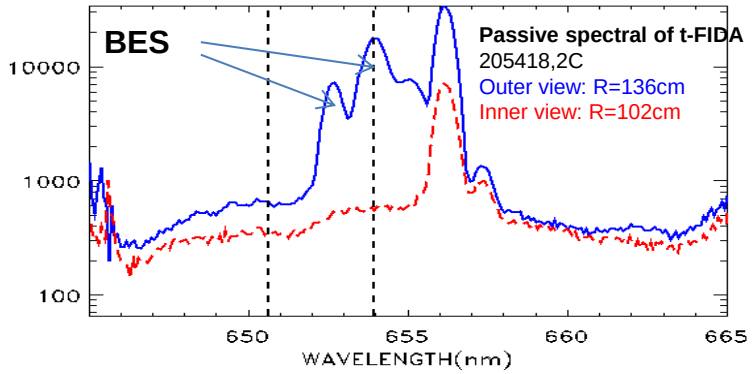
- The shown experiment data is based on 20 ms beam blips under steady L-mode conditions & Conditionally average 6 cycles
- t-FIDA: the active and passive signals are comparable in magnitude.
- Good agreement between data (v/t-FIDA) & FIDASIM for central channels
  - Simulate passive signals using edge neutrals from TRANSP
  - Simulate active signals using neutrals from 1C& edge neutrals
- As expected, 2A produces a small passive signal on v-FIDA

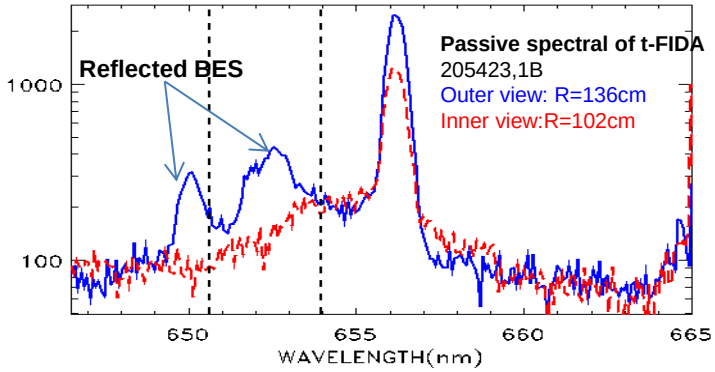


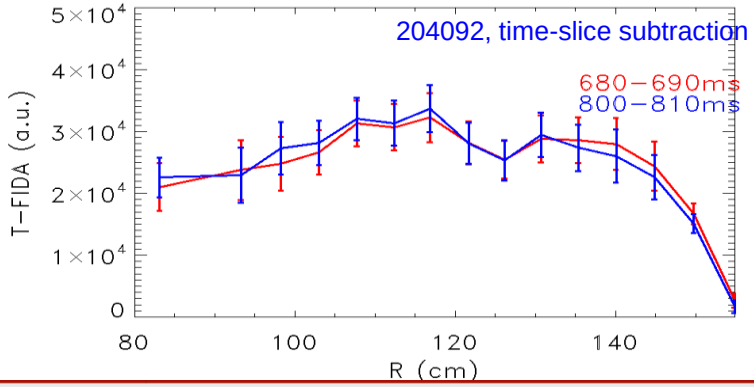

Note: Not all chords agree this well

# Some TFIDA reference views are compromised

- Beam-into-gas explained many troubling features
  - ➢ outer reference views see beam emission from beamline 2 → misalignment after bake-out
  - ➢ Some views see reflected beam emission from beamline 1 → from shiny objects in sightline?
  - ➢ Most channels see strong background light → from shiny objects in views?
- There is a bigger discrepancy between the time-slice subtraction and reference-view subtraction, since the light contamination on edge channels of passive view. The spatial profile of t-FIDA using time-slice subtraction is shown here.

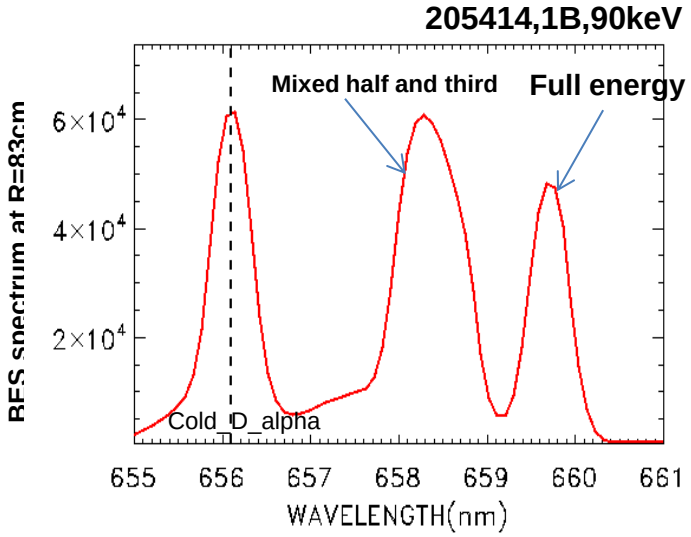


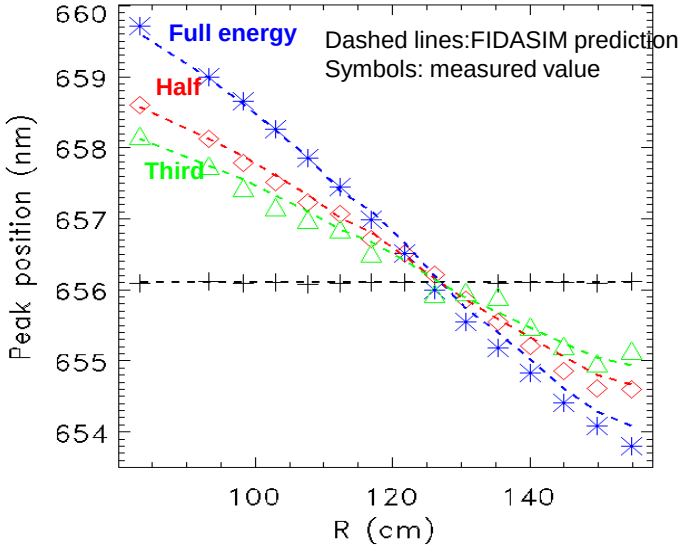



# Beam-into-gas checks t-FIDA spatial calibration & species mix

- The measured Doppler shifted wavelength of the full-energy beam emission is close to the FIDASIM prediction for most fibers → checks beam & sightline geometry




- The species mix is inferred from the beam emission



# Summary

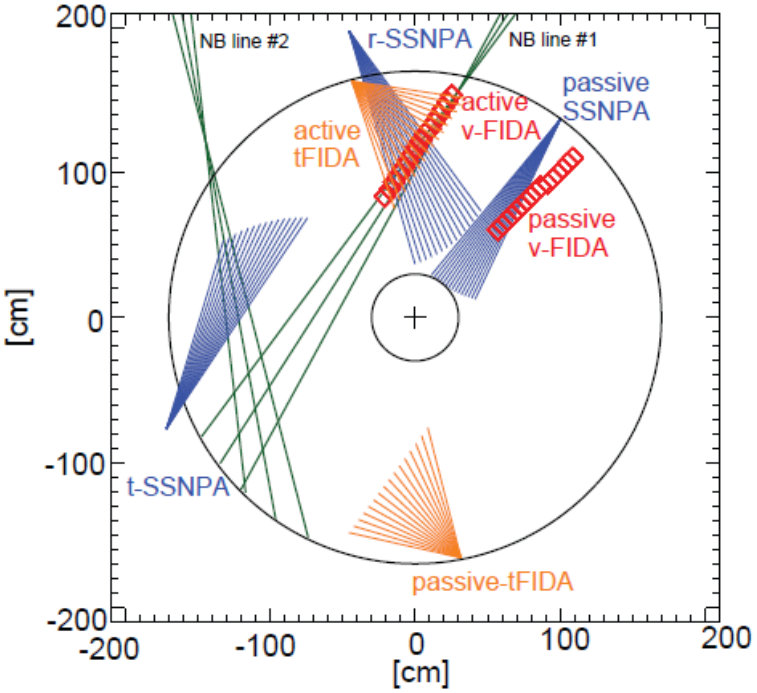
- V-FIDA works well during FY-16 campaign of NSTX-U

- Performance of T-FIDA diagnostics
  - T-FIDA signal has robust response to beam injection
  - Spatial profiles are available when beamline 1 is modulated
  - Reference views usable for selected channels

# Back up slides

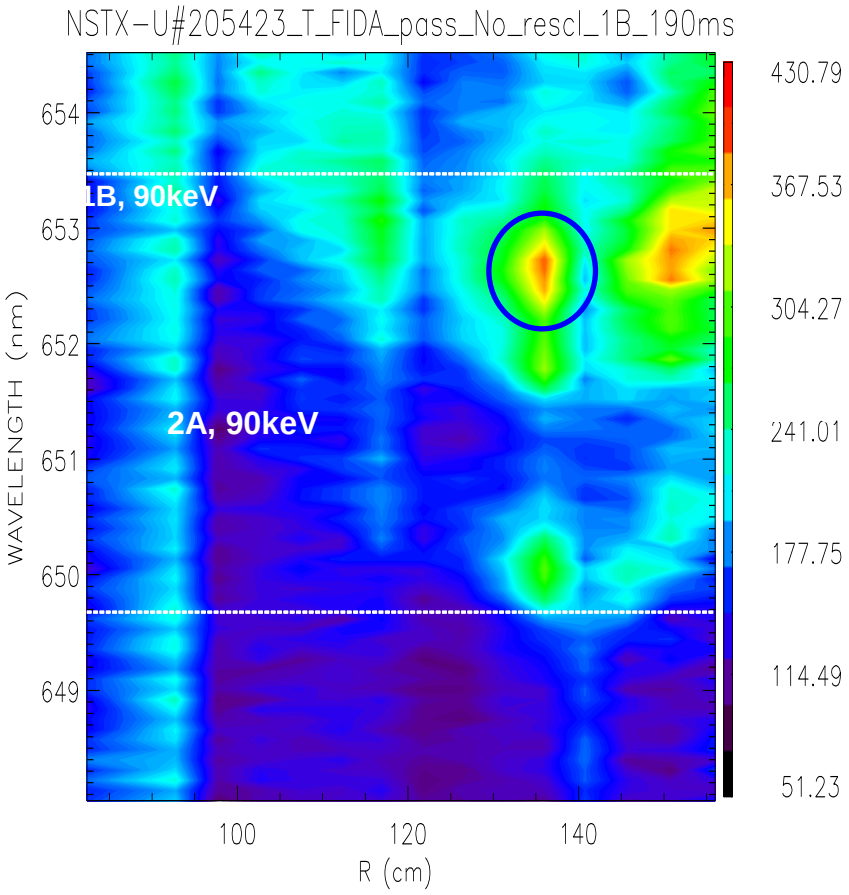
# FIDA & NPA Diagnostics are operational

- Podestà installed the vertical fast-ion D-alpha (v-FIDA) diagnostic that worked on NSTX
- Bortolon installed the tangential FIDA diagnostic on NSTX in 2011
- Deyong Liu installed new solid-state neutral particle analyzer (SSNPA) arrays for NSTX-U. It operates since March 2016

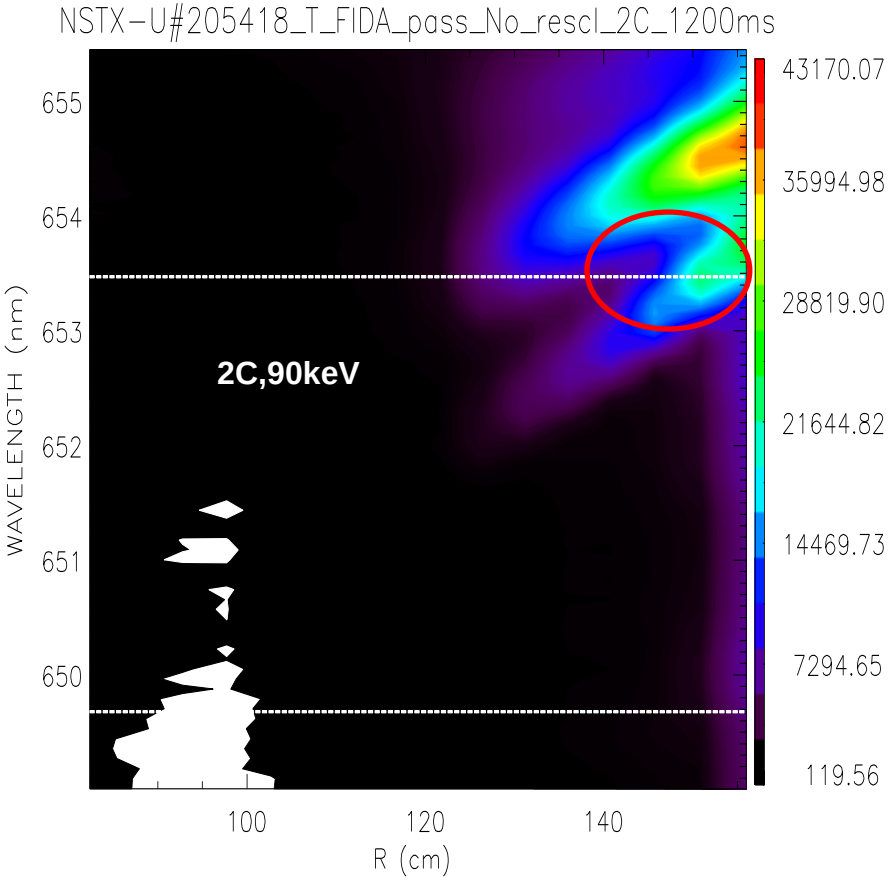


# Several passive view fibers of T-FIDA is contaminated

Reflection of Beam emission of beamline1

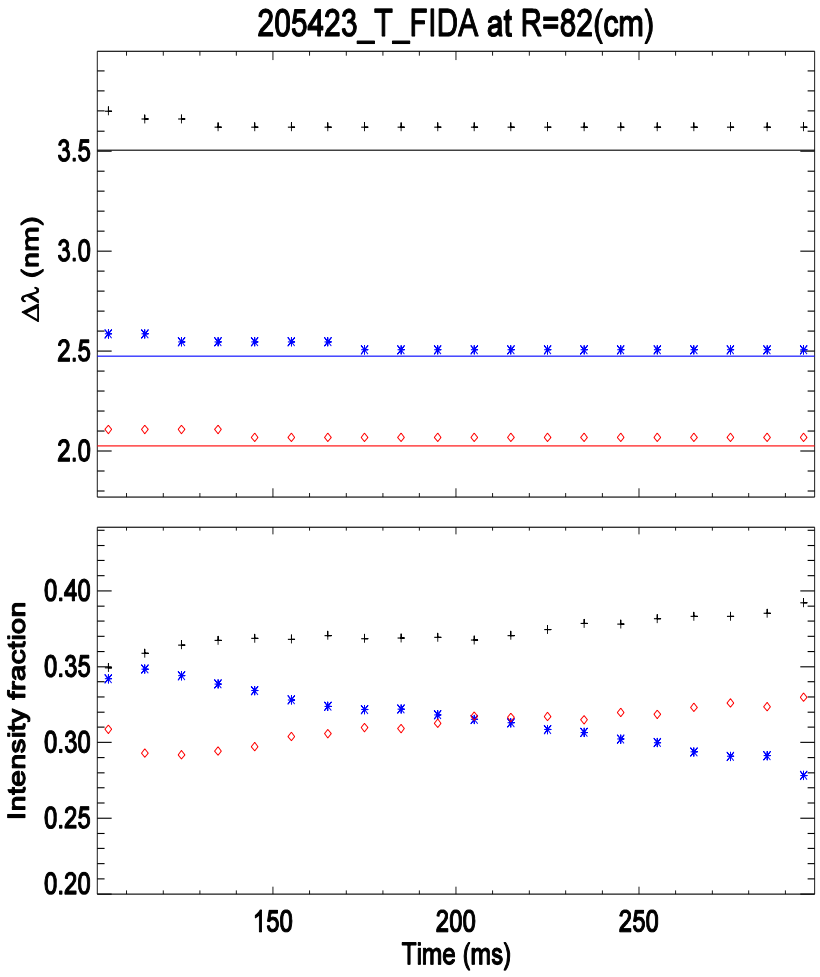



Beam emission from beamline 2

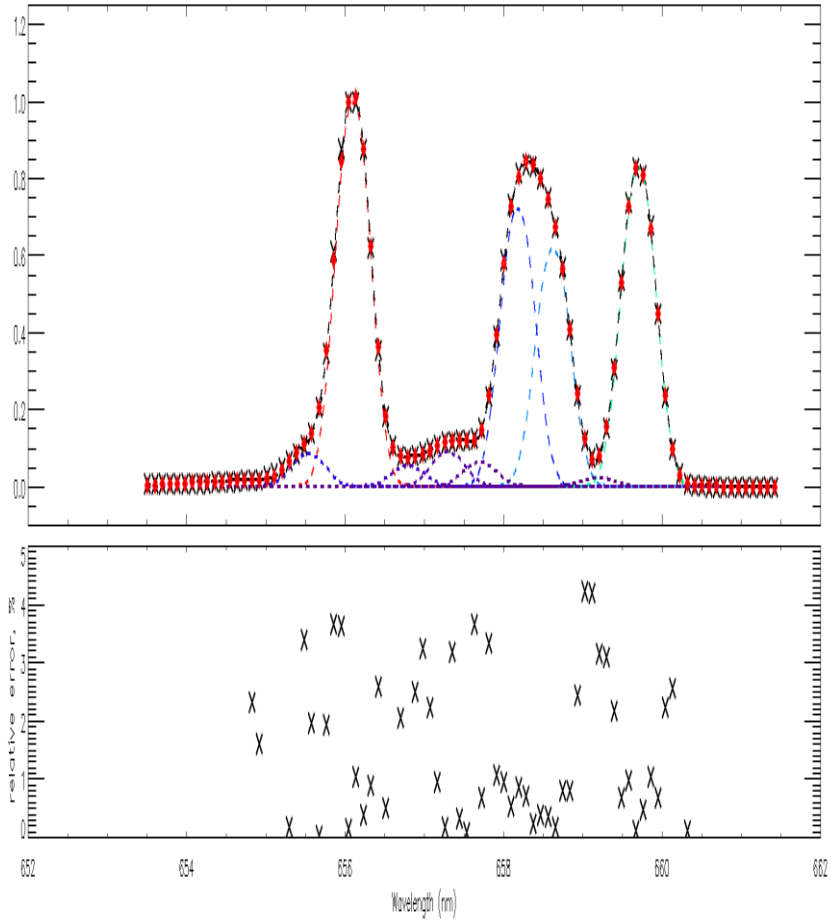


# Preliminary analysis of the beam species

Dashed lines:FIDASIM prediction
Symbols: measured value




205423,1B,@ R=82cm
Fitting error <~ 4%



# T_FIDA spectral: No-rescale, beam_modulation