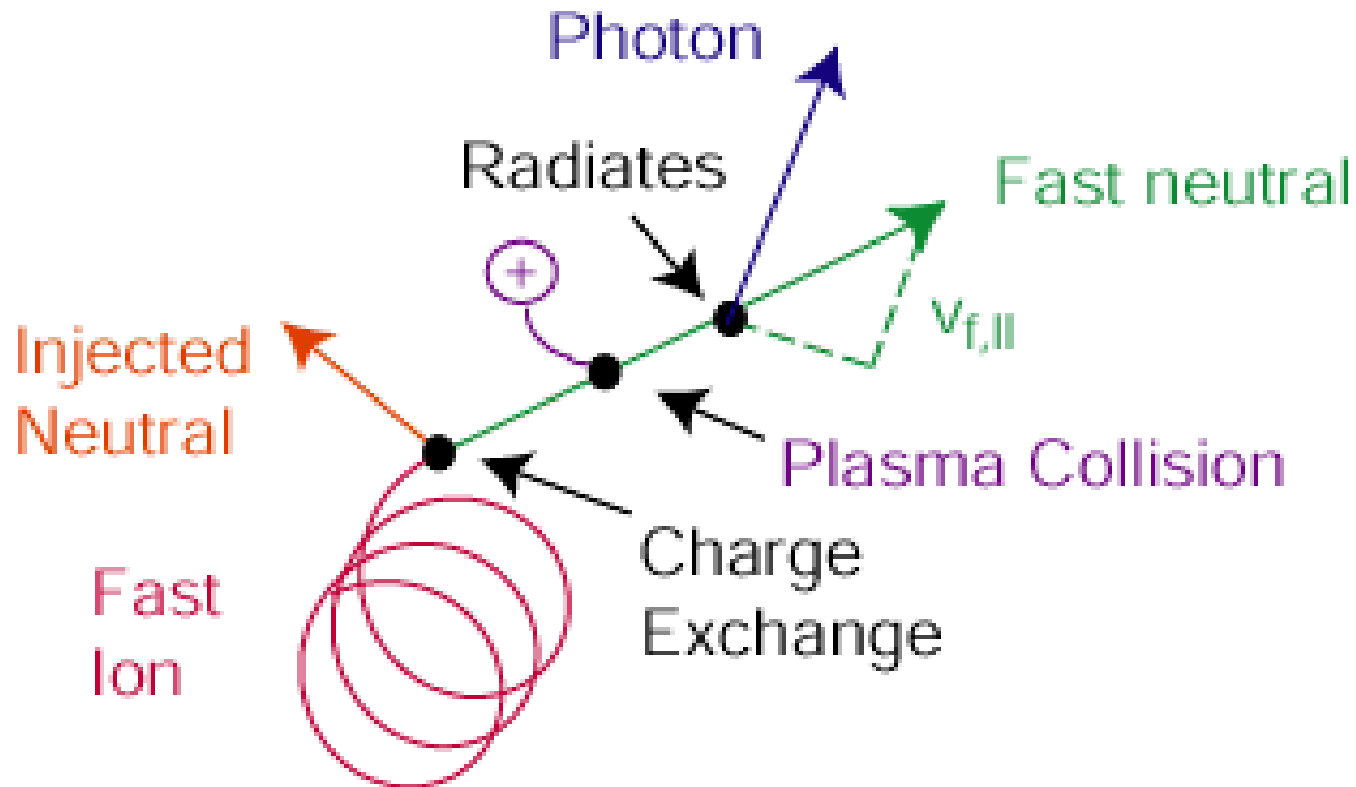


# First results from the Fast Ion D-Alpha prototype

M. Podestà, July 2007

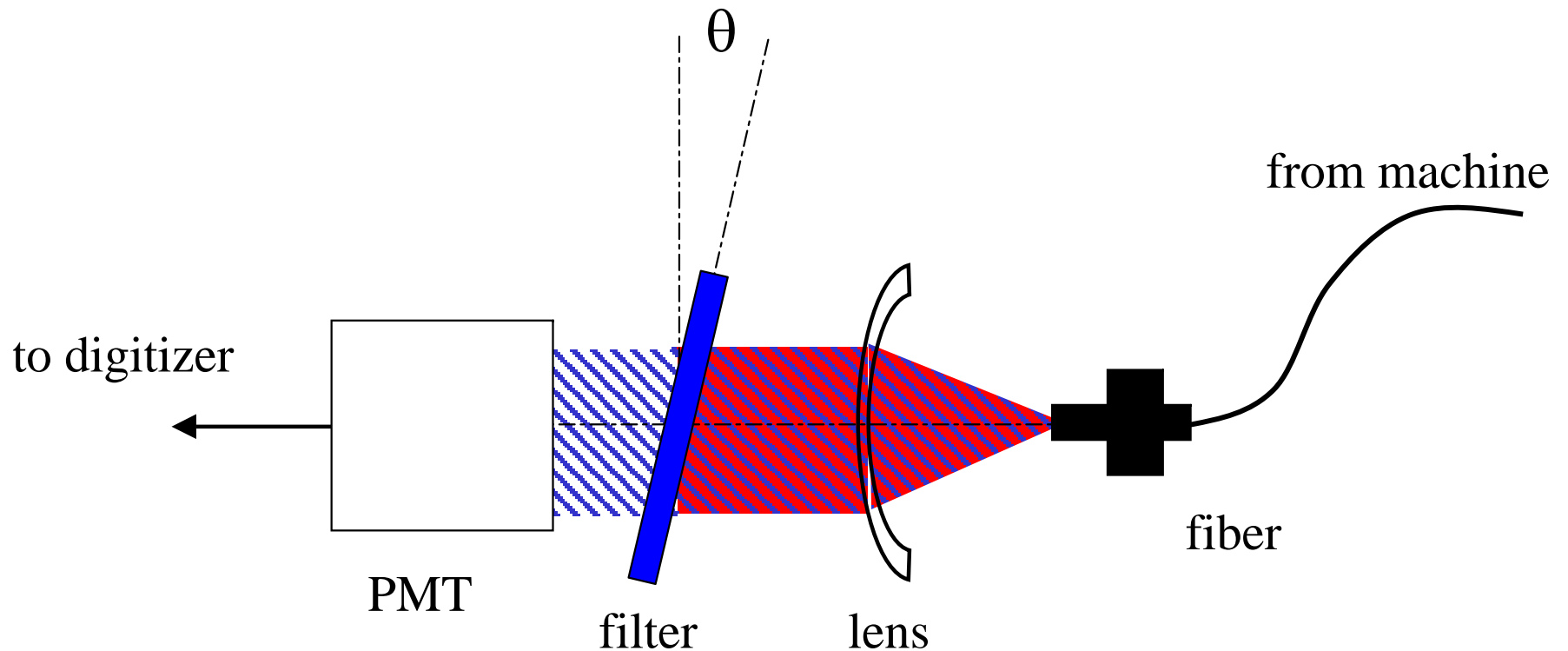
- Fast Ion D-Alpha diagnostic, UC Irvine-PPPL collaboration
  - Based on active charge exchange recombination spectroscopy
  - Exploit large Doppler shift of photons from re-neutralizing fast ions
    - Measure wings of  $D_\alpha$  line



# FIDA - results overview 2007

M. Podestà, July 2007

- 2007 run: 1 prototype channel, integrating over 20->80keV range
- 2 positions available: 100 or 120cm (shot-to-shot)
- Two vertical views/channel
  - Intercepting/missing the beam for direct background subtraction

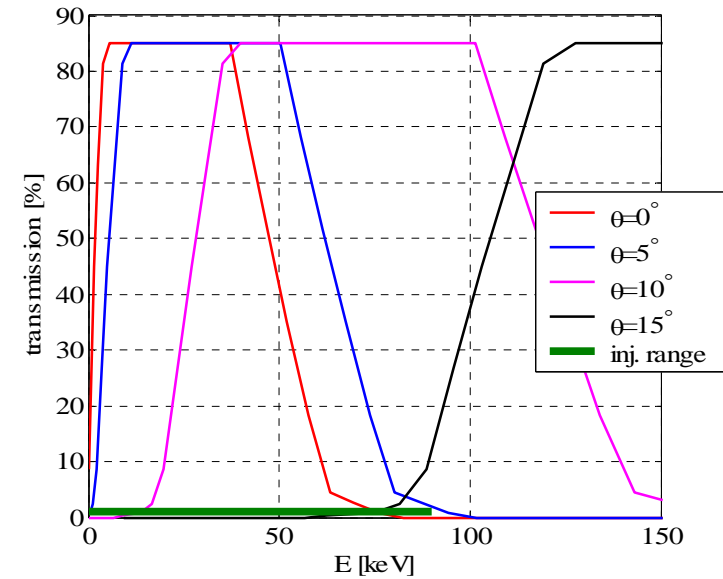
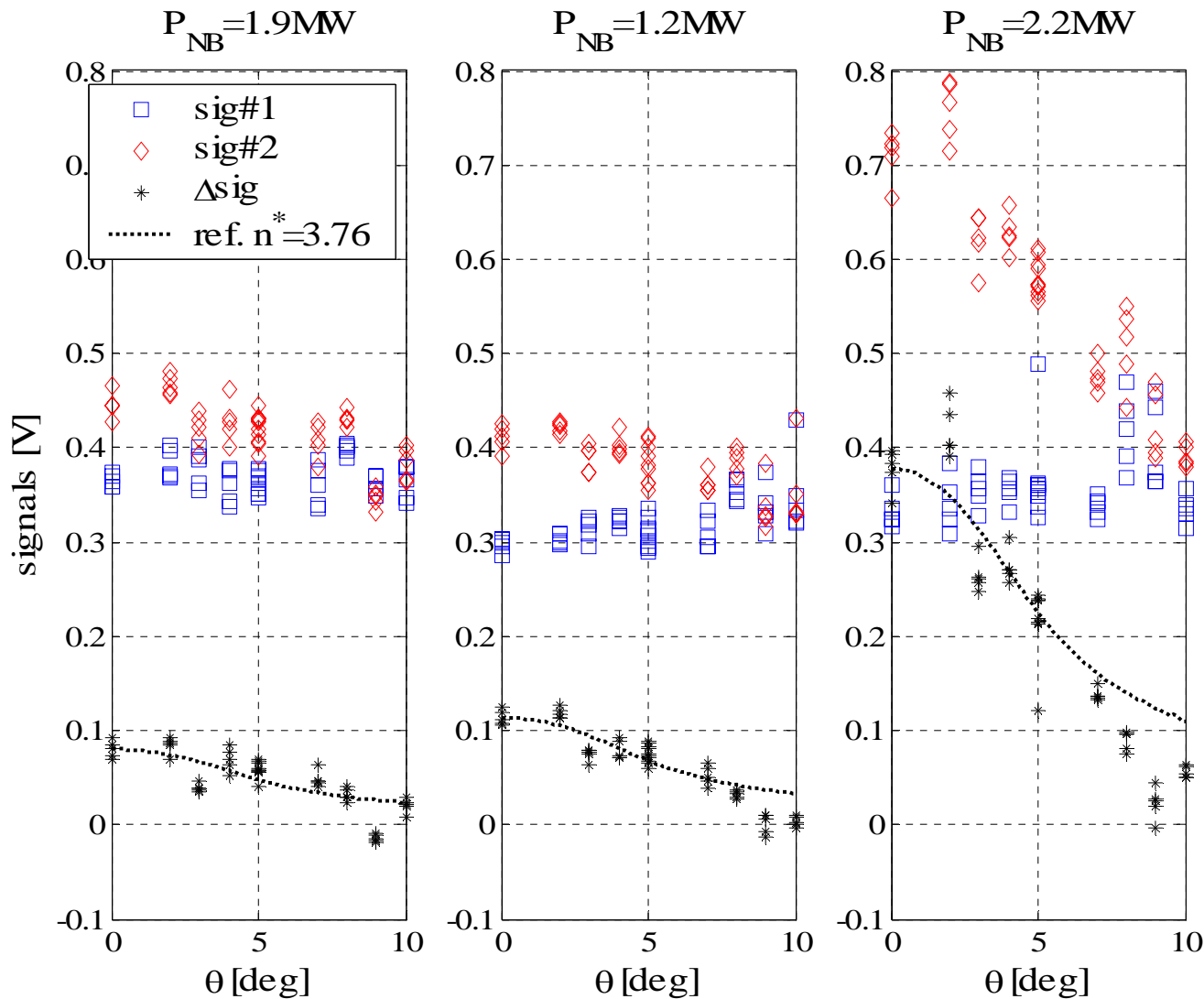


- Borrowed photomultipliers and digitizer
  - Low quantum efficiency, noisy signals

# FIDA - results overview 2007

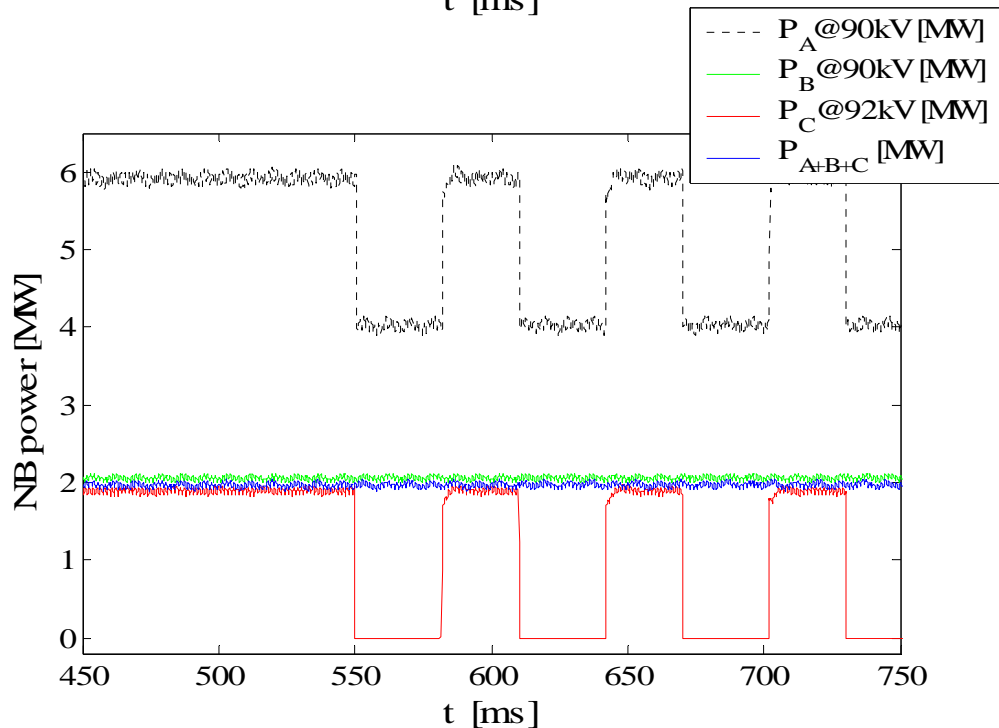
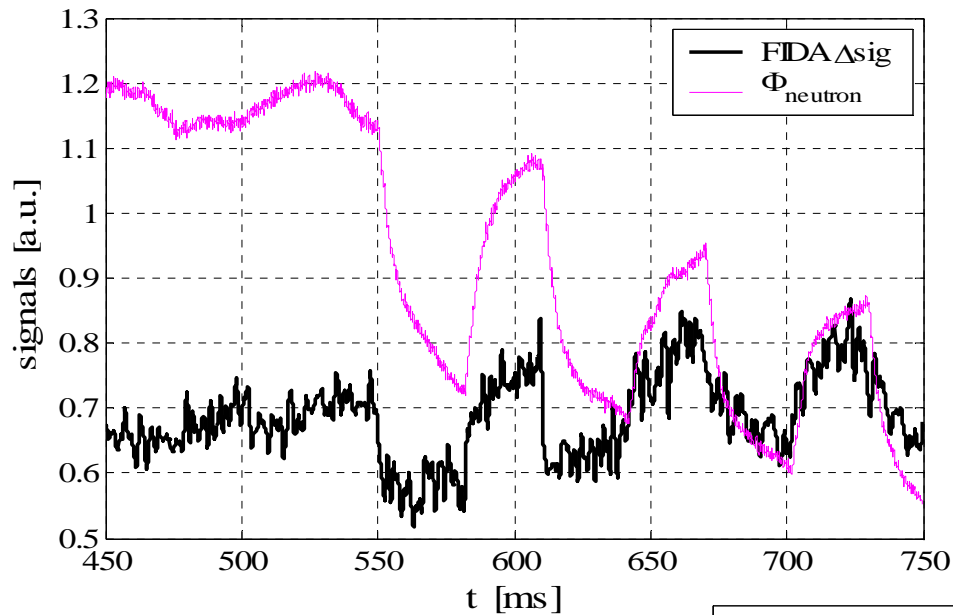
M. Podestà, July 2007

- FIDA signals  $V_s D_\alpha$  spectrum: correct dependence
  - Spectral scan by changing filter's angle



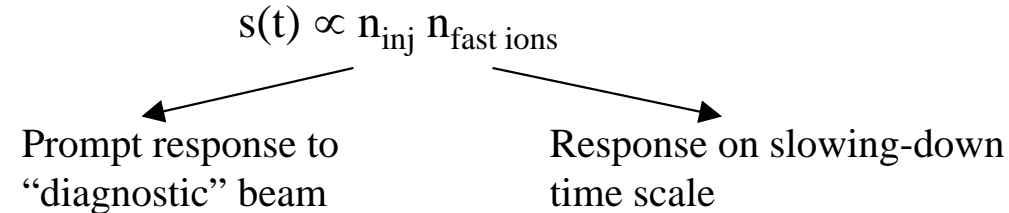
# FIDA - results overview 2007

M. Podestà, July 2007



- FIDA signals Vs neutron rate
- Clear response to beam modulation (not seen on NPA, see P.Ross review - why?)

- Consistent with neutron flux
- Roughly consistent with zero-th order interpretation:



- Need quantitative analysis

Example:

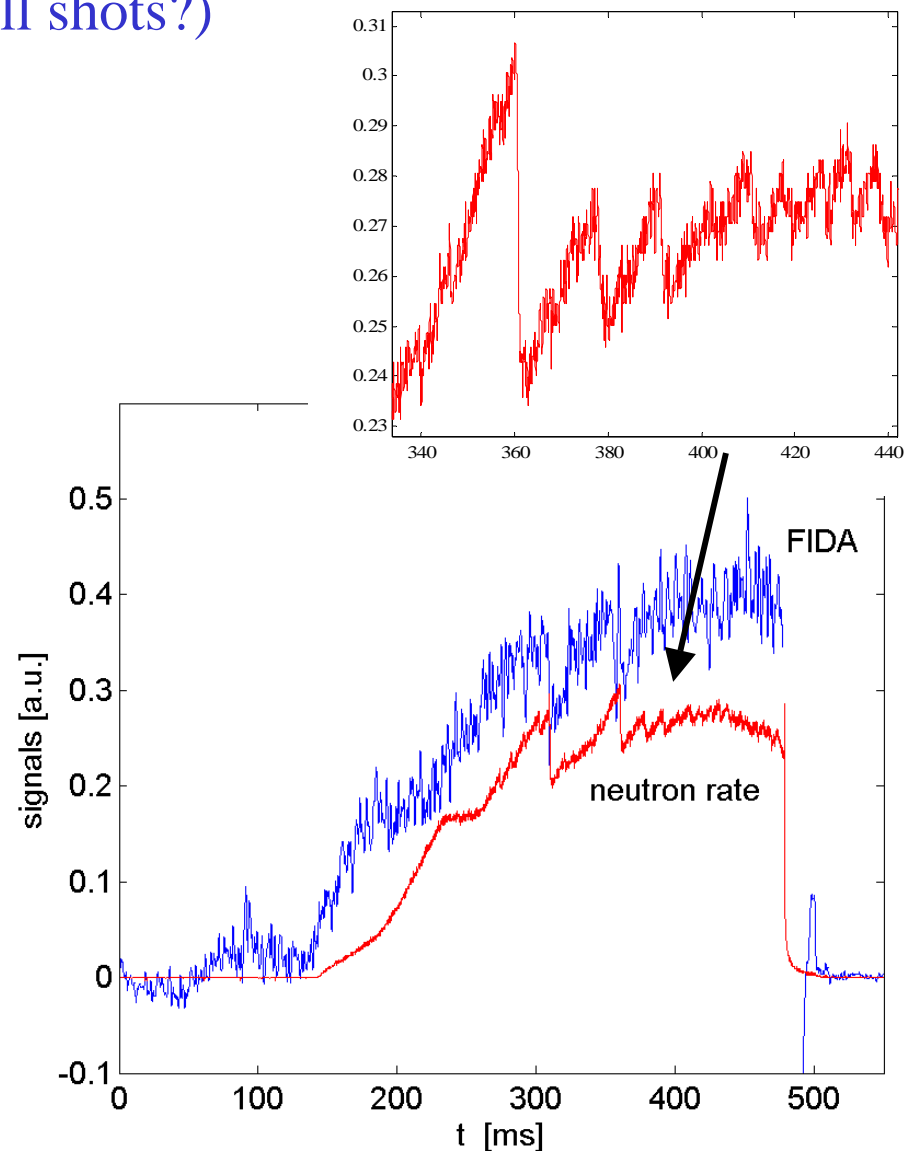
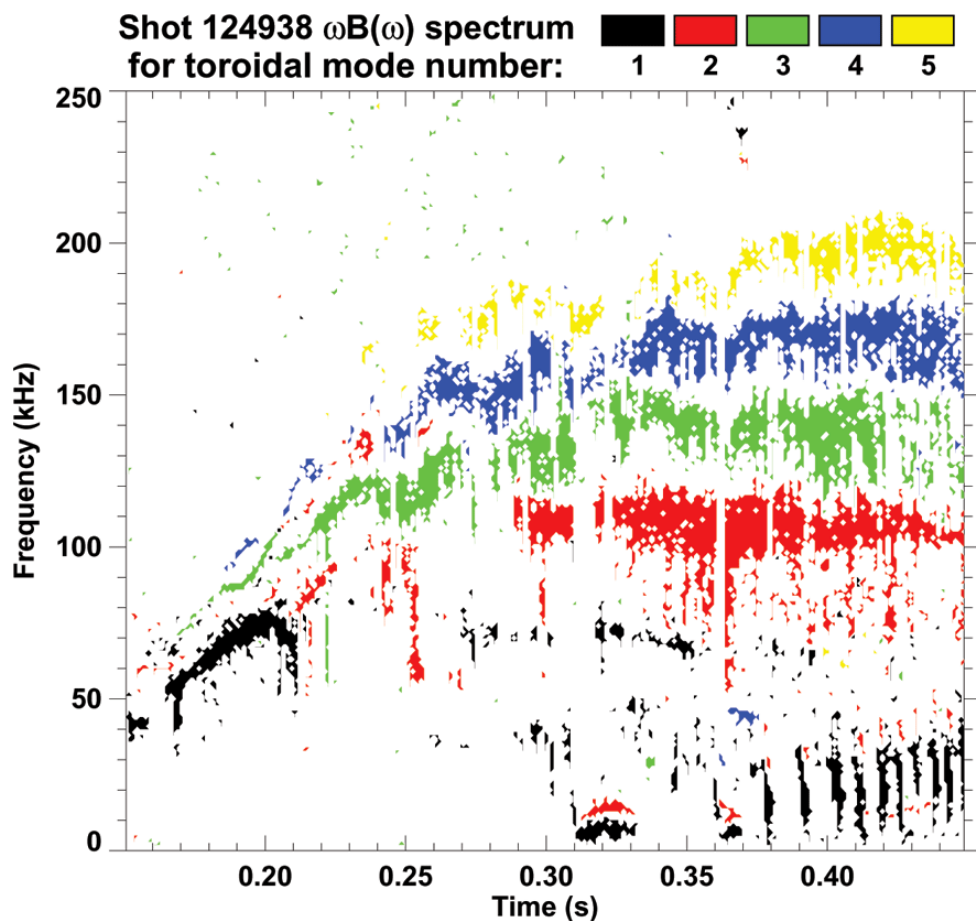
R=120cm

XP 737 - sh#124814,124819,124821,124822

# FIDA - results overview 2007

M. Podestà, July 2007

- Effects of instabilities - *scenario* (sh#124927 -> 124939, XP 735)
  - Low density  $n < 4 \times 10^{19} \text{m}^{-3}$
  - One NB source @ 90kV + RF (not for all shots?)
  - Strong Alfvén activity
  - Frequent drops of neutron rate



# FIDA - results overview 2007

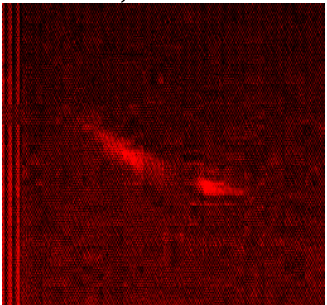
M. Podestà, July 2007

- Effects of instabilities: *ion losses*

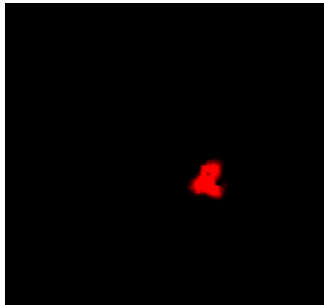
- Fast ions lost from core plasma on time scales  $\ll 1\text{ms}$

- FIDA, neutron rate, sFLIP, ...

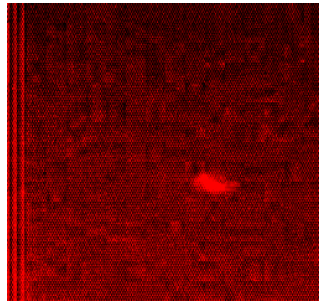
sFLIP,  $t=302\text{ms}$



$t=360\text{ms}$



$t=391\text{ms}$

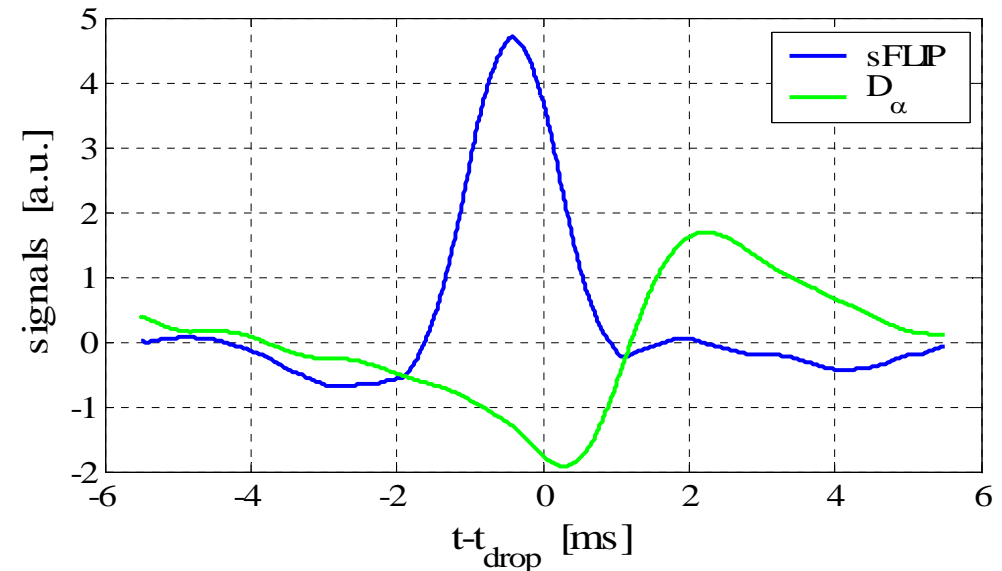
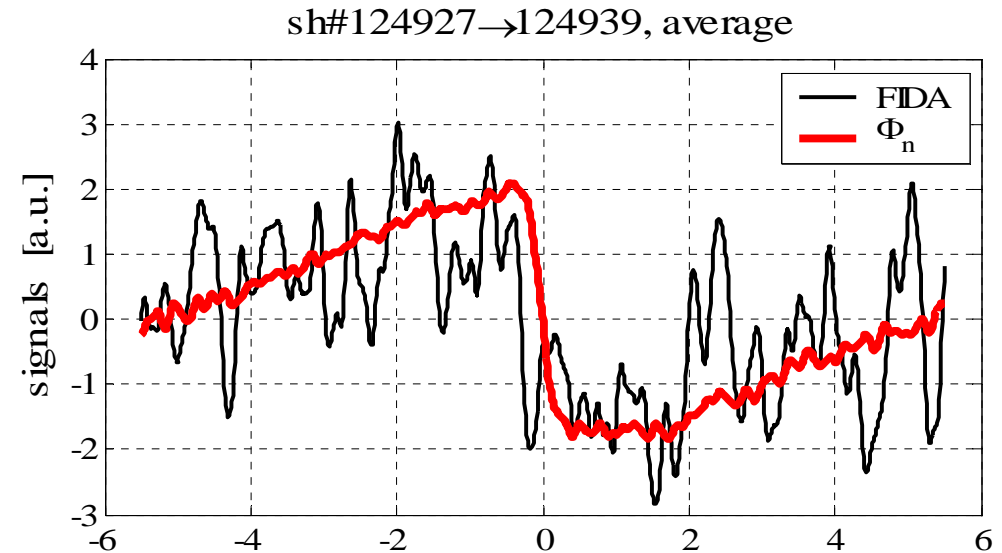


- RF seems to make no difference (within exp. uncertainties)

- Example:

- Average over 10 shots ( $\sim 50$  events)

- FIDA at  $r = 120\text{cm}$



# Summary

M. Podestà, July 2007

- Encouraging results from prototype setup
  - Thanks for many contributions from NSTX team
  - “Reasonable” data obtained for many XPs
  - Good consistency with other diagnostics (neutron rate, D-alpha emission, sFLIP, ...)
- Work in progress:
  - Calibration -> get quantitative information
  - Promising preliminary results (e.g. fast ion losses/redistribution) already obtained - much more to do!
- Install complete FIDA setup for 2008 Run