Characterization of Fast Ion Power Absorption of HHFW in NSTX

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NSTX Results Review

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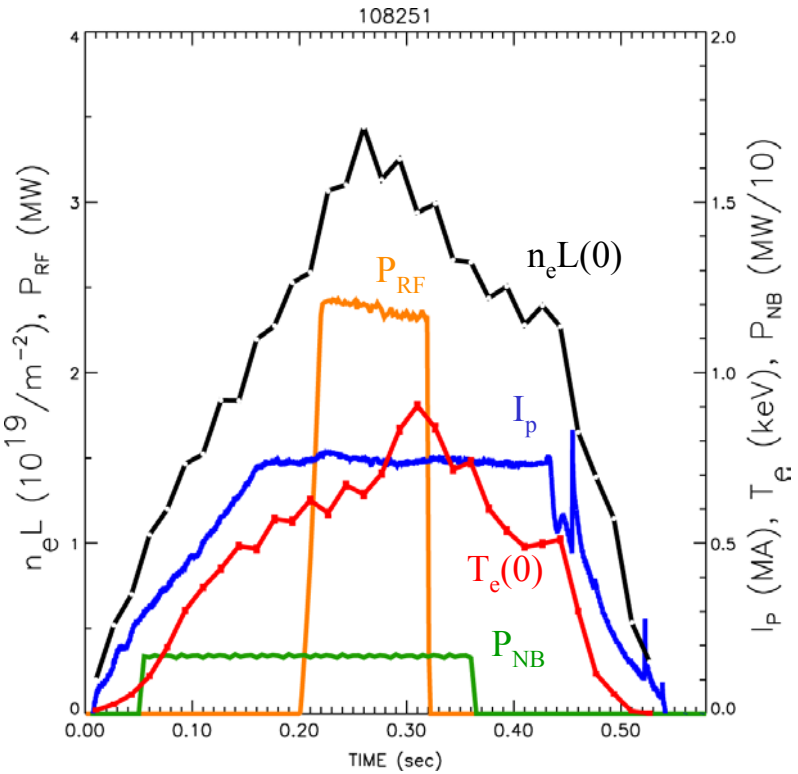
Review of XP-214

- Scan $B_T(0)$ to examine prediction of off-axis shift in absorption profiles
- Vary $k_{||}$ between similar shots to test prediction of greater ion absorption for lower $k_{||}$
- Scan beam energy maintaining constant beam power to observe non-Maxwellian effect
- Vary I_p
- Scan NPA with identical conditions to examine radial dependence of fast ion absorption

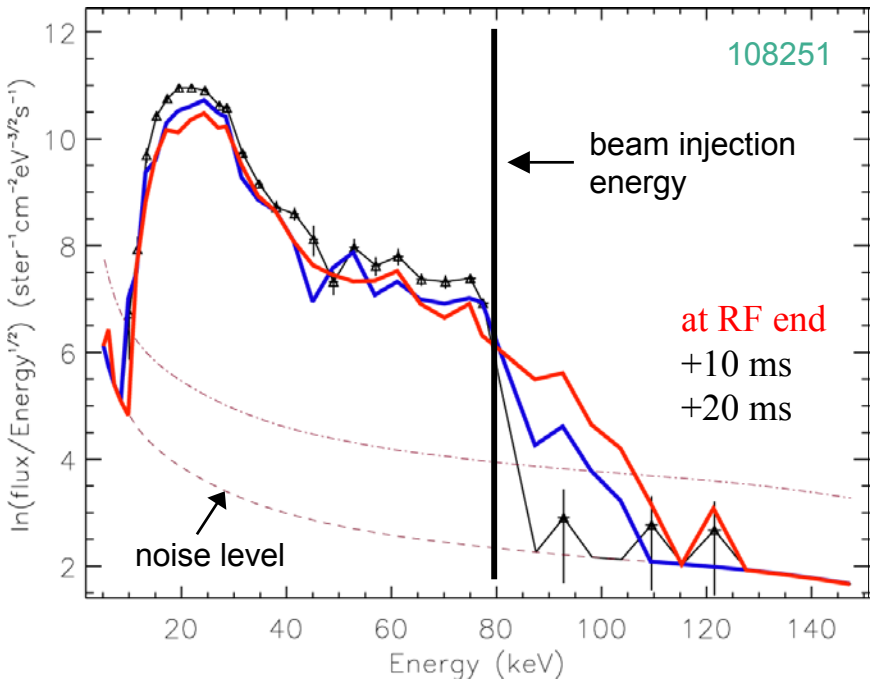
NPA shows fast ion tail build-up and decay

- HHFW turns off at t=320ms
- NBI Source A on throughout



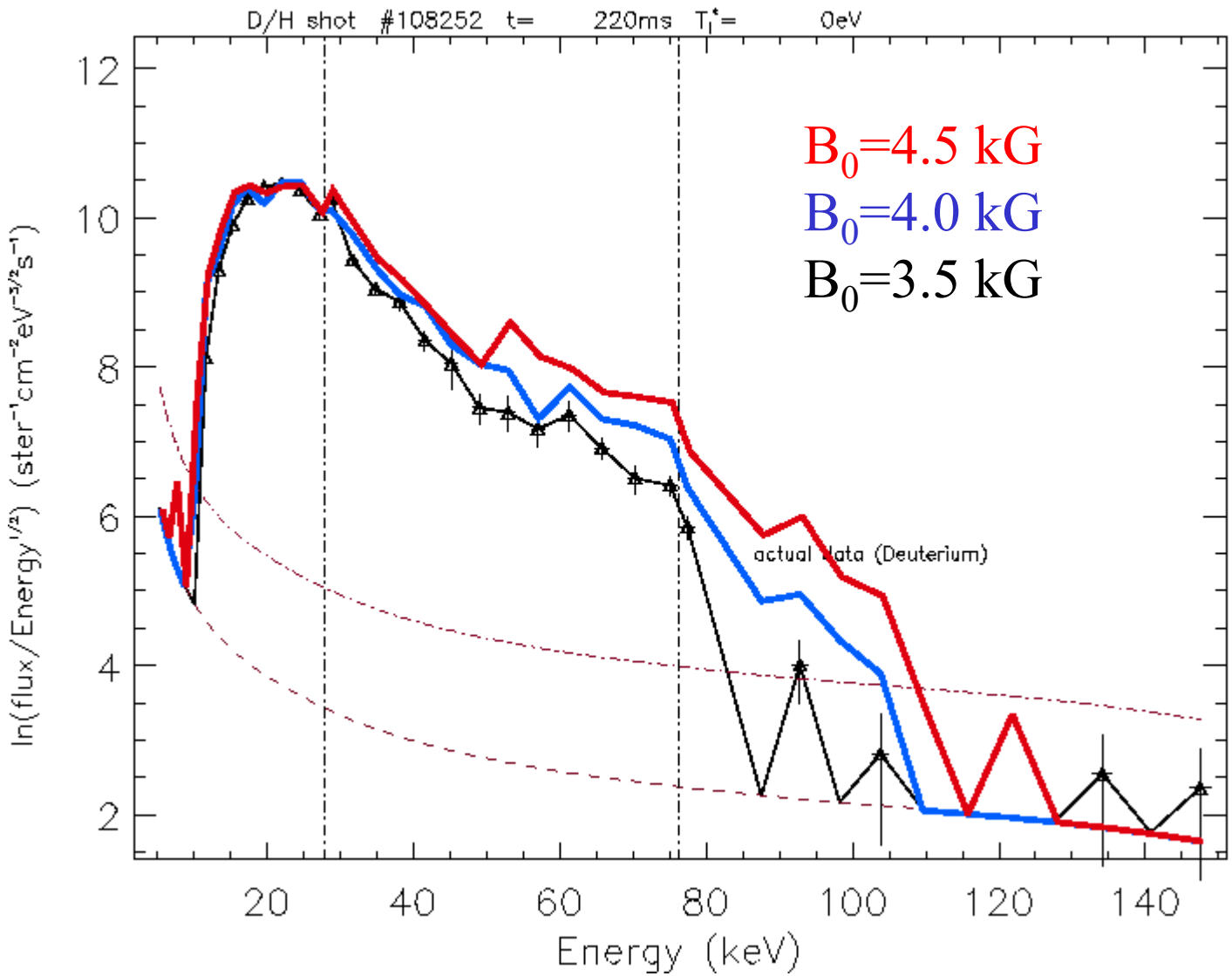
- typical shot traces in 1082xx series

- D^+ tail extends to 130 keV
- Tail saturates in time during HHFW

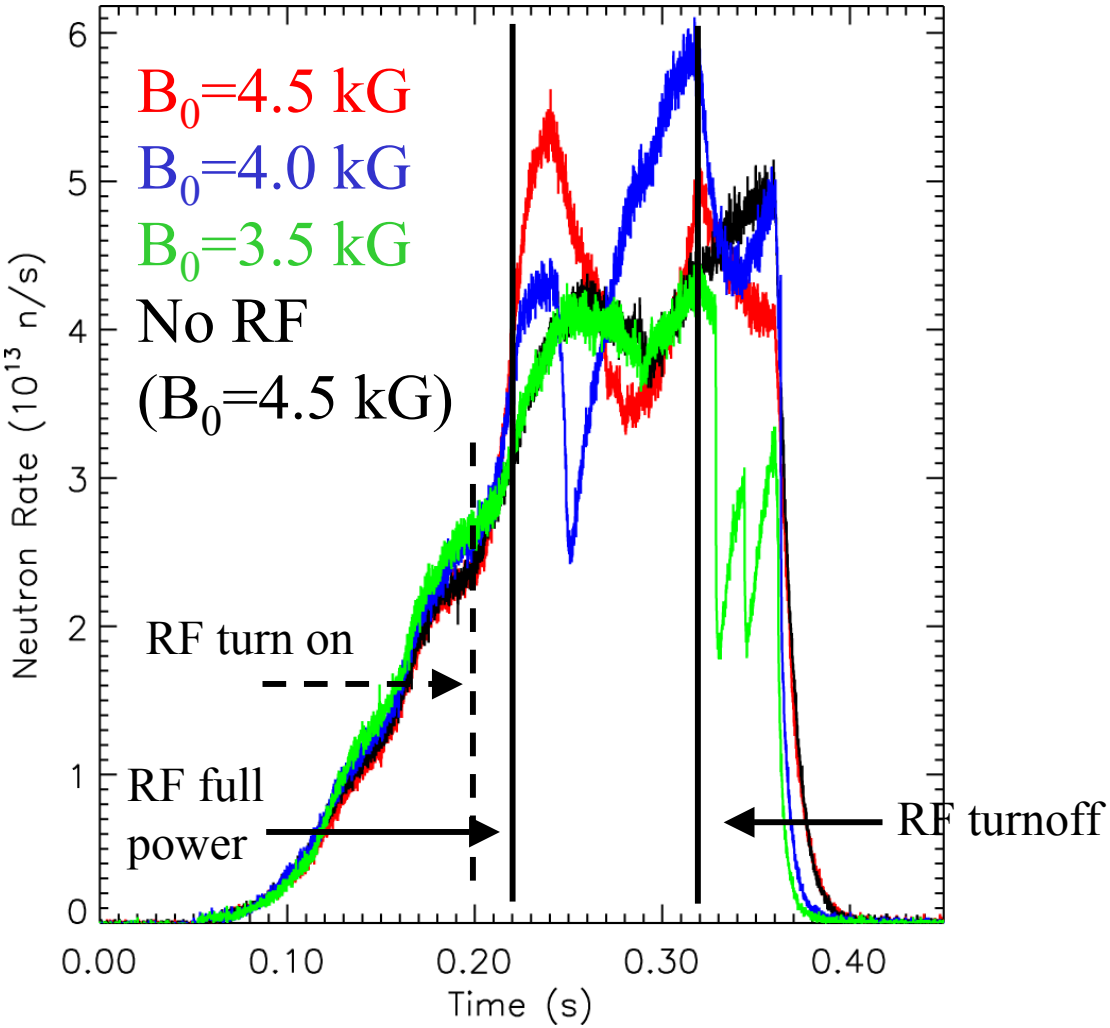


- Tail decays on collisional time scale

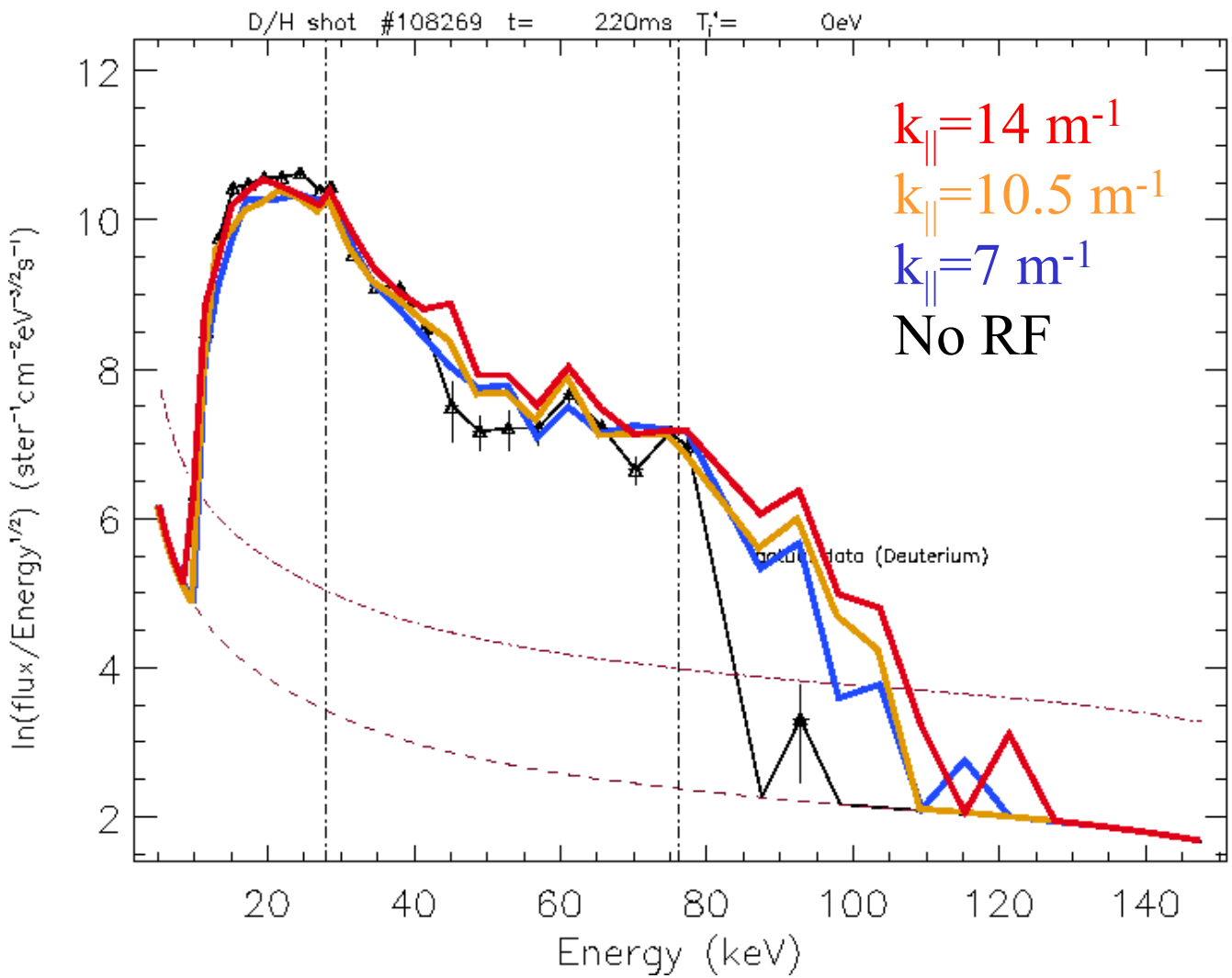
B-field scan, NPA data



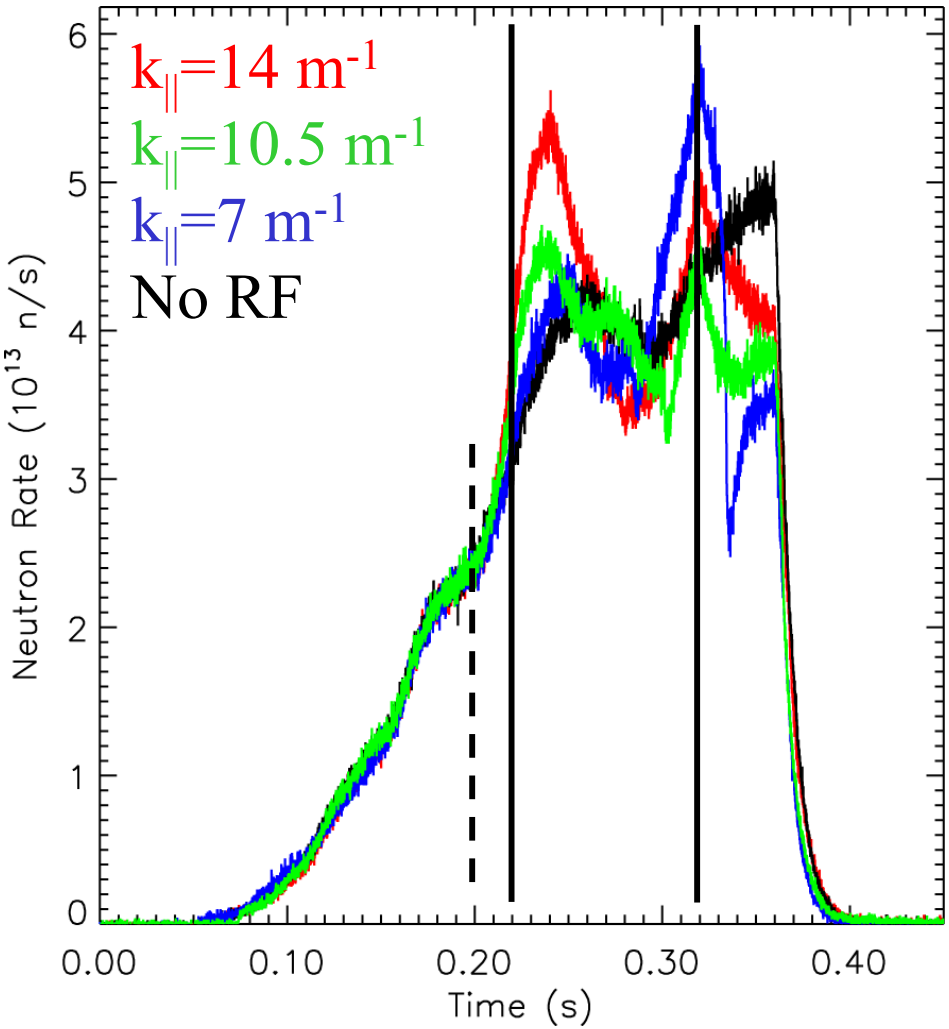
B-field scan, neutron rate comparison



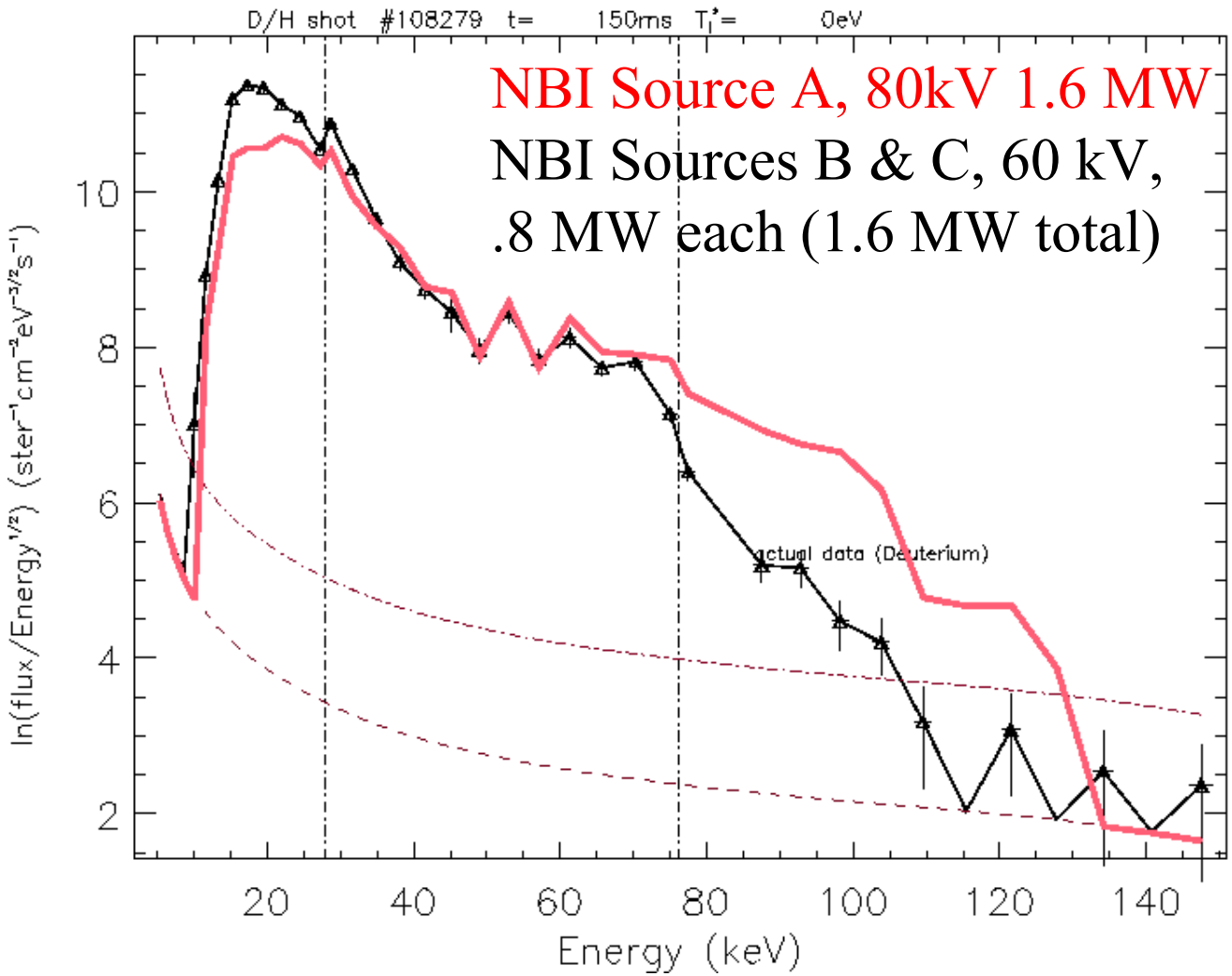
$k_{||}$ scan


D/H shot #108269 t= 220ms T_i'= 0eV
$k_{||}$=14 m^{-1}
$k_{||}$=10.5 m^{-1}
$k_{||}$=7 m^{-1}
No RF
Actual data (Deuterium)
ln(flux/Energy$^{1/2}$) (ster^{-1}cm^{-2}eV$^{-3/2}$s^{-1})
Energy (keV)
2
4
6
8
10
12
20
40
60
80
100
120
140

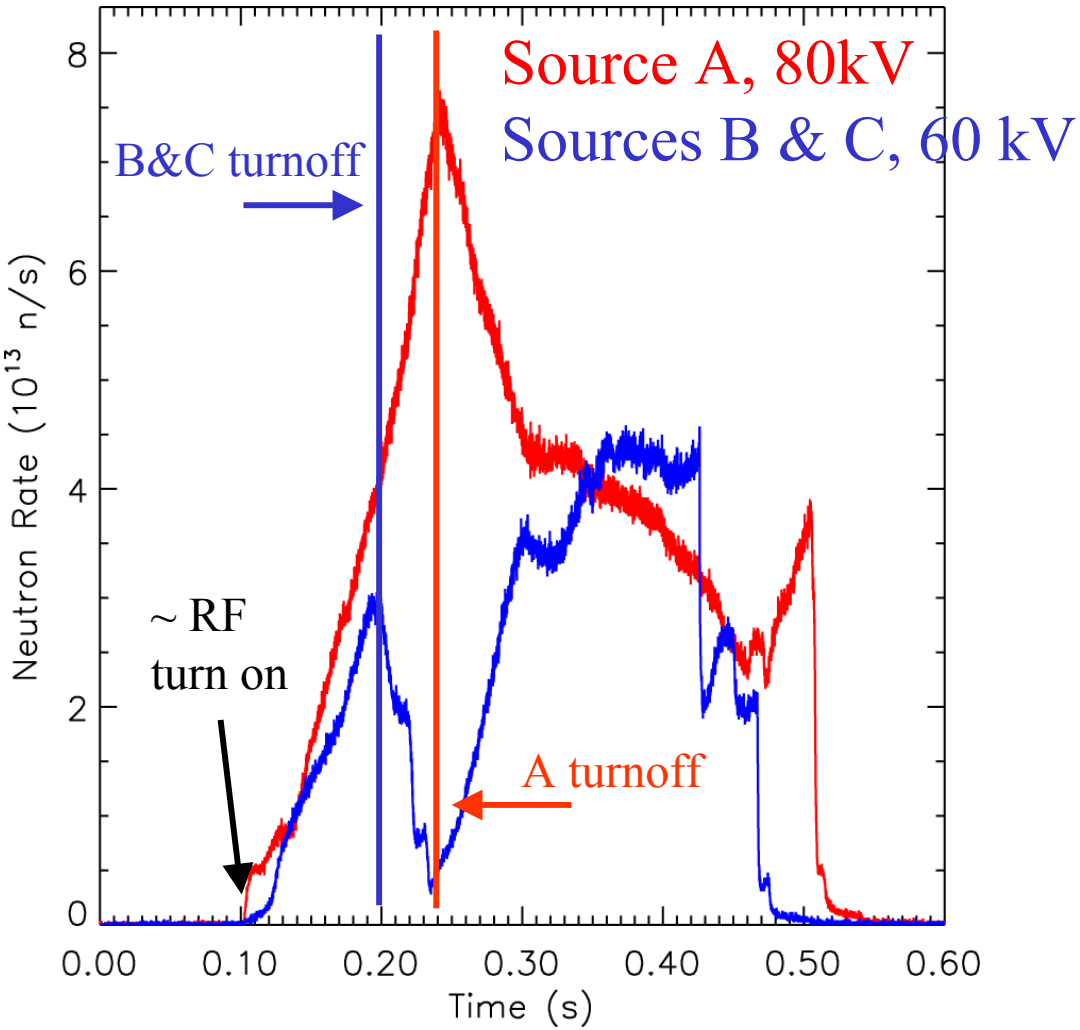
$k_{||}$ scan


$k_{||}$=14 m^{-1}
$k_{||}$=10.5 m^{-1}
$k_{||}$=7 m^{-1}
No RF
Neutron Rate (10^{13} n/s)
Time (s)
0
1
2
3
4
5
6
0.00
0.10
0.20
0.30
0.40

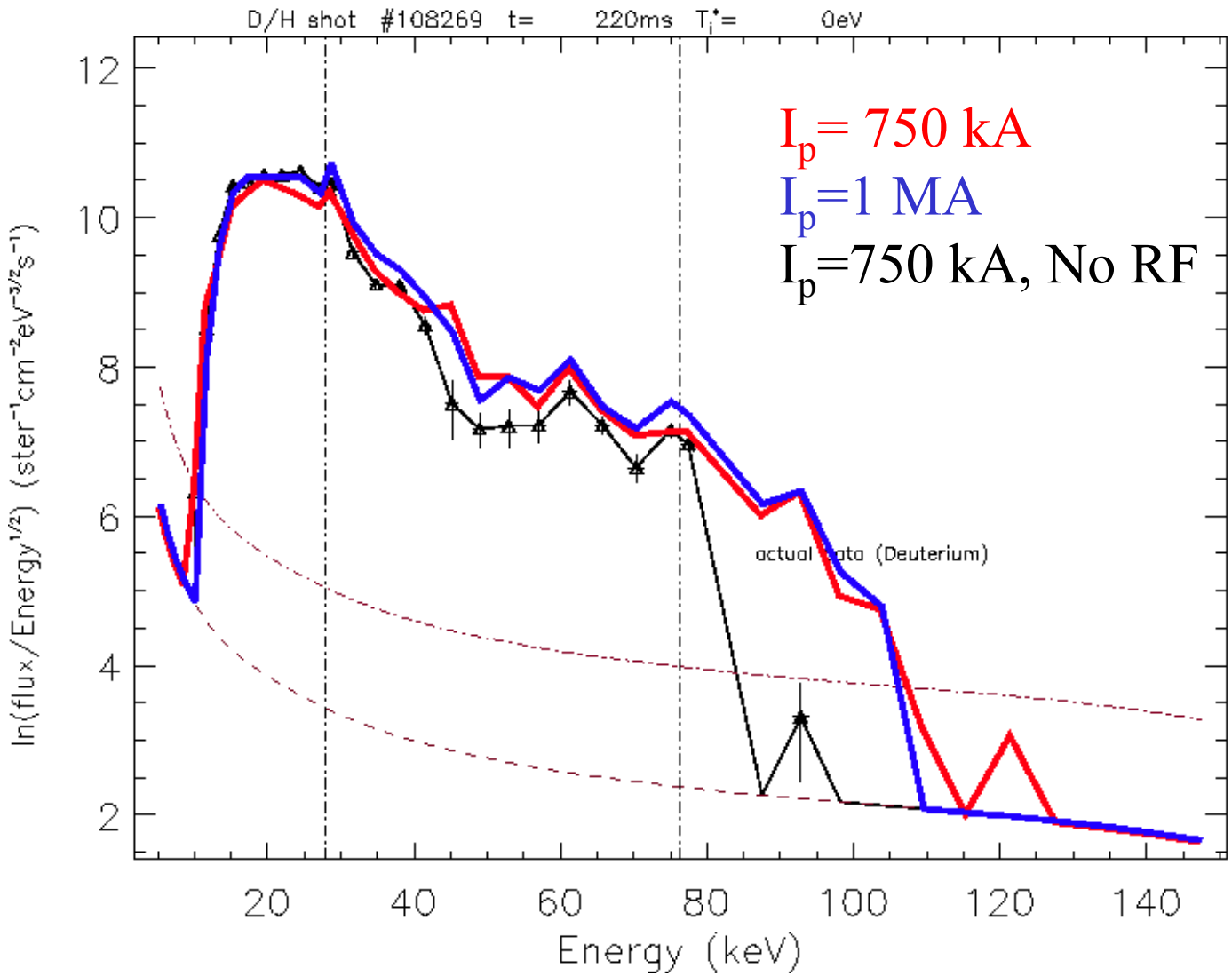
Beam energy scan



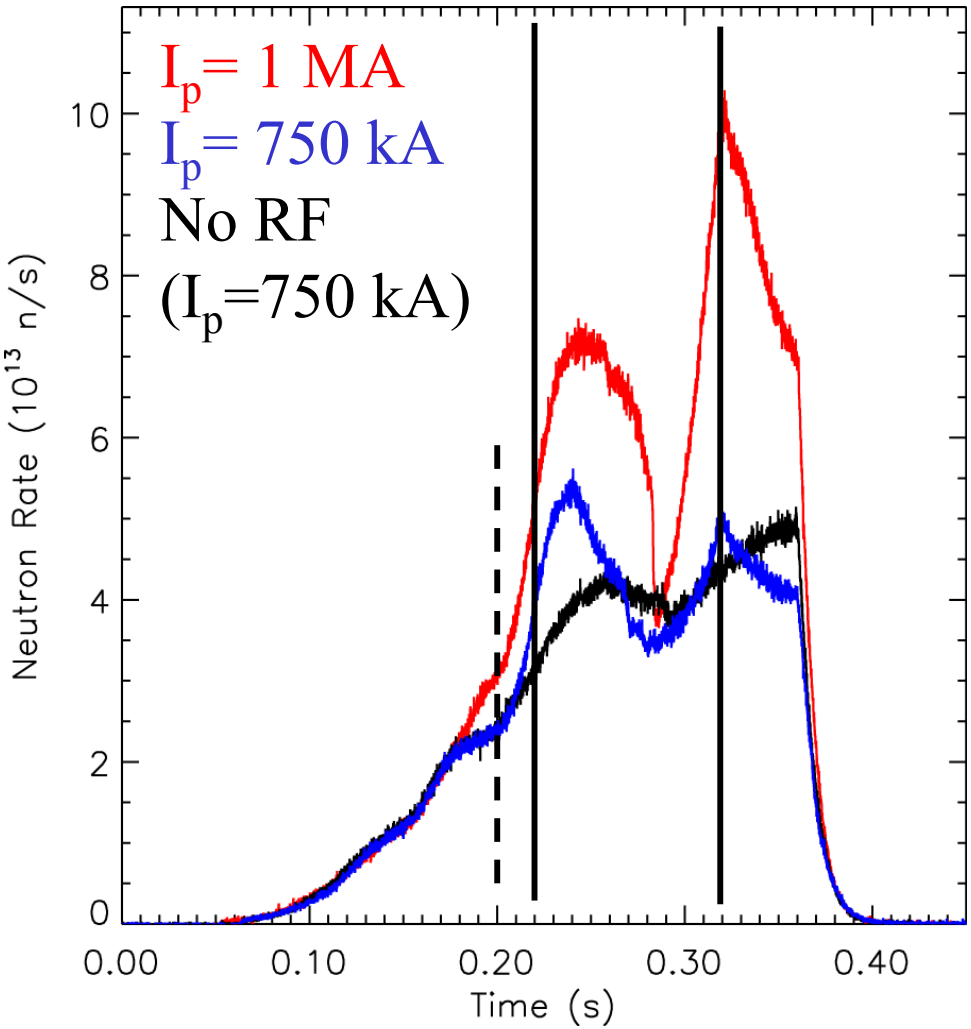
Beam energy scan



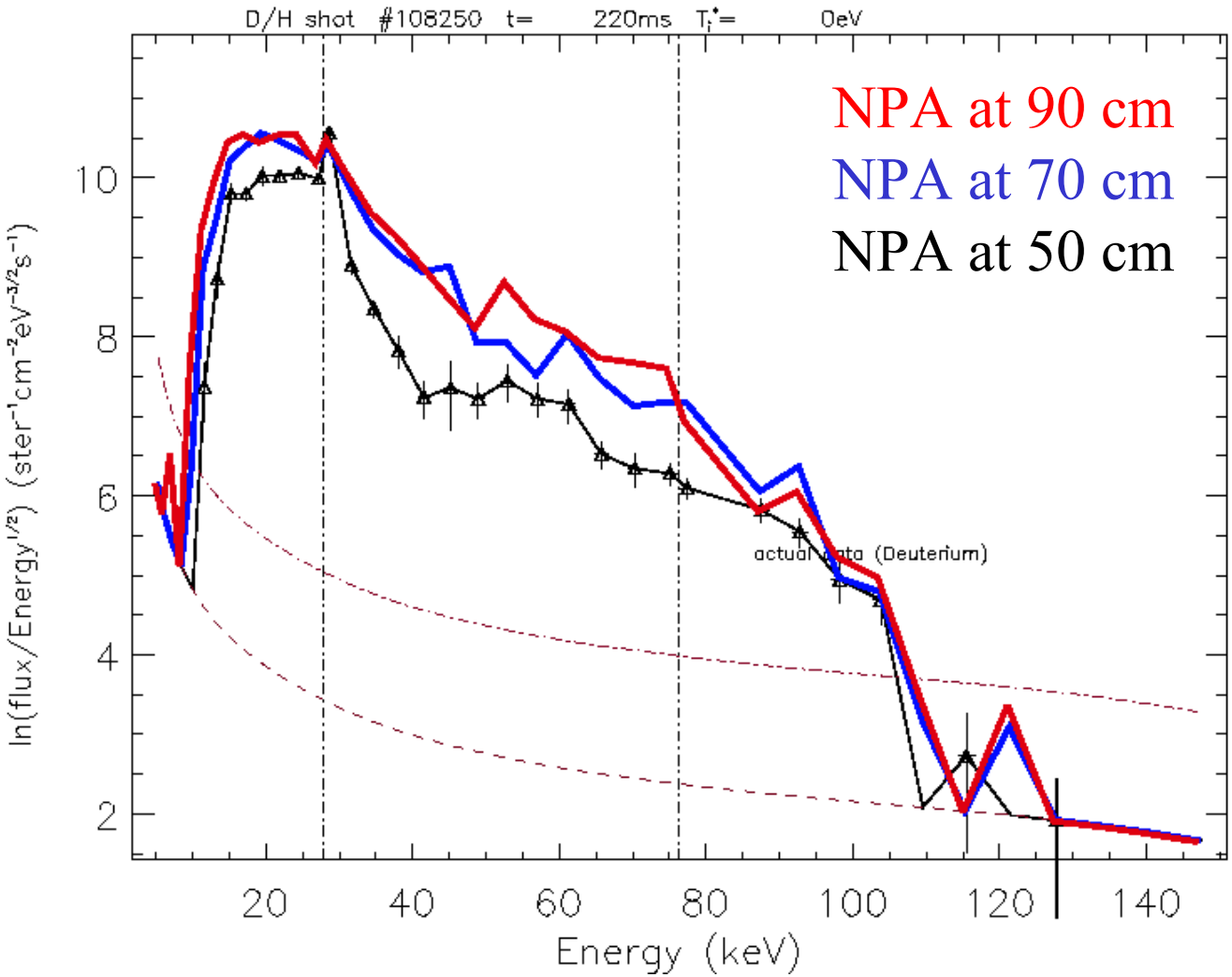
I_p scan


D/H shot #108269 t= 220ms T_i^*= 0eV
I_p= 750 kA
I_p=1 MA
I_p=750 kA, No RF
actual data (Deuterium)
ln(flux/Energy$^{1/2}$) (ster^{-1}cm^{-2}eV$^{-3/2}$s^{-1})
Energy (keV)
2
4
6
8
10
12
20
40
60
80
100
120
140

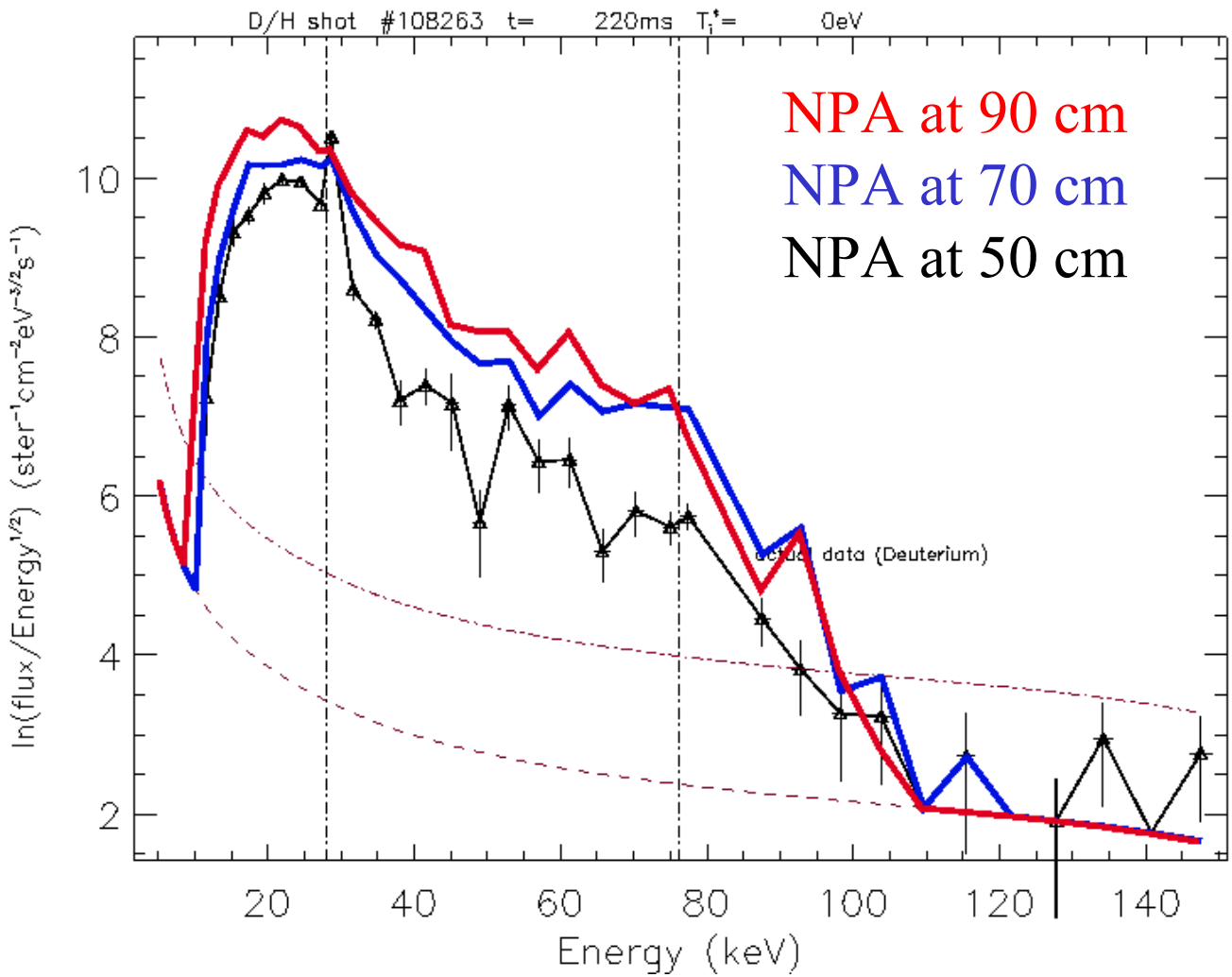
I_p scan


I_p= 1 MA
I_p= 750 kA
No RF
(I_p=750 kA)
Neutron Rate (10^{13} n/s)
0
2
4
6
8
10
0.00
0.10
0.20
0.30
0.40
Time (s)

NPA scan, $k_{||}$= 14 m^{-1}, B_0=4.5 kG



NPA scan, $k_{||}$= 7 m^{-1}, B_0=4.5 kG



Analysis Status and Plans

- Currently in the process of interfacing HPRT ray-tracer with the METS full wave code
  - Remi Dumont has added capability for METS to compute absorption with arbitrary distribution function
  - HPRT will compute ray paths, pass relevant parameters along paths to METS
  - Fast ion dist. fcn. will be pulled from TRANSP and converted to the appropriate form for METS
  - Allows better absorption profile comparisons between a 2D ray-tracer and a 1D full wave code

- CHERS data to be examined for trends and input into analysis codes