Assess the affect of Alfvén Cascades on fast ion transport OP-XP-80-

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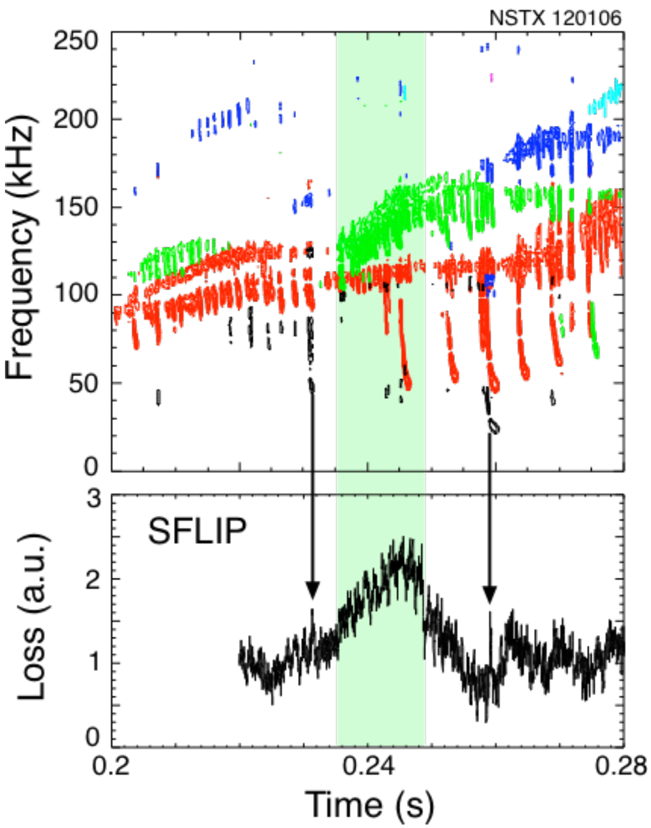
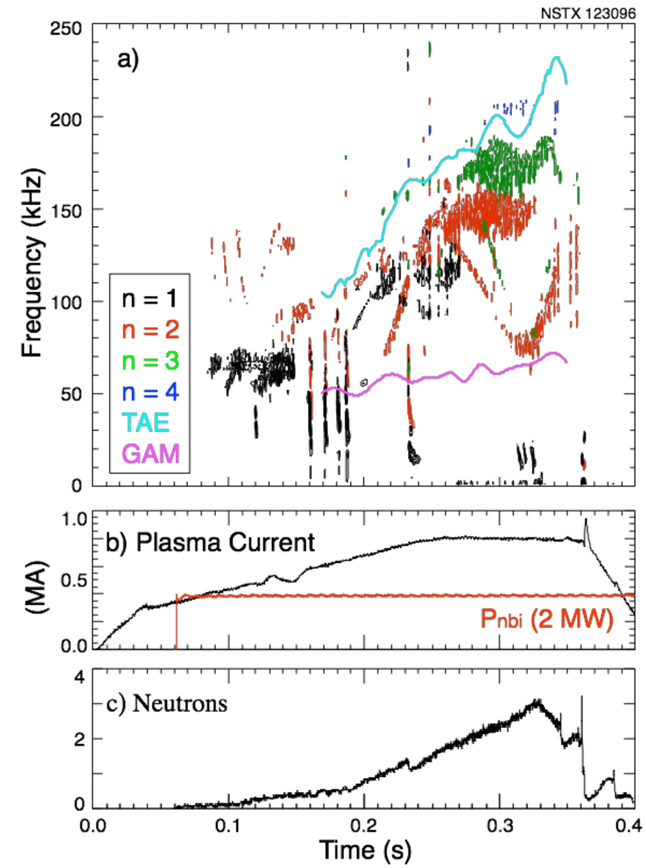
Alfvén Cascades Experimental Goals

1. Document fast ion losses.
   - NPA vertical scan, FIDA
2. Look for coupling to KAW
   - Radial scattering volume scan for high-k
3. Beam voltage/power scan



4. Toroidal field scan
5. Reflectometer data at higher density.
6. AC in H-modes
   - Sort out neutrons
   - Reduce β'
7. HHFW to heat electrons
   - Where are the higher-gap modes
8. N=3 non-resonant braking
   - Remove Doppler correction uncertainty
   - Remove rotation shear effect



Goal 1: Document/collect evidence for fast ion redistribution by AC modes.
Goal 2: Search for AC - KAW coupling

1. DO I=1,7

   Reproduce density, current, beams, neutron rate evolution for shot 120106

   IF (replication of AC spectrum, sFLIP measurement of losses) THEN GOTO 2.

   ENDDO

   GOTO 3.

2. Introduce source A to 150 ms to provide early measurement of q-profile

   IF (AC spectrum, fast ion losses NOT reproduced) THEN revert

   DO I=1,7

   Vertical NPA scan and radial High-k scattering scan (HHFW after 0.3s).

   ENDDO

   GOTO 3

c…Document fast ion redistribution, optimize FIDA, look for coupling to KAW

c…Introduce HHFW later in shot to be ready for Part 7

c…total 7 - 15 shots

Goal 3. Voltage/power scan
Goal 4. Toroidal field scan

3. DO I=1,3 (While AC present)

    Reduce beam voltage in 10 kV increments (from 90 kV to 60 kV)

c…Scan β_{fast} to determine scaling of AC minimum frequency (γ).

    ENDDO

    IF (AC modes become stabilized) THEN

        Increase beam voltage by 5 kV

    ENDIF

4. Increase toroidal field to 5.5 kV

    IF (AC modes stable) THEN

        Increase by 5 kV, look for AC return

    ELSE

        Decrease by 5 kV

    ENDIF

c…Higher field, lower beam power may increase density threshold for suppression.

c…5 shots for 3&4

Goal 5: Reflectometer data and β scaling.
Goal 6: Attempt AC in H-mode; reduces β'

5. DO I=1,3

    Density scan with good AC modes up to "β-suppressed" density.

    ENDDO

    DO I=1,2

    Move source A on time back to t1, t2 <300ms to be determined for q evolution.

    ENDDO

c…reflectometer data on AC mode structure, β scaling of f_{min} at low β_{fast}

6. DO I=1,3

    Replace He prefill and puffing with D prefill and puffing, maintain low density

    ENDDO

    IF(L-mode) THEN Add/extend source A

    DO I=1,2

    Move source A on time back to t1, t2 <300ms to be determined for q evolution.

    ENDDO

c…AC modes in H-mode plasma, reduced β' to determine role in minimum frequency

c…10 shots

Goal 7: Raise T_e (β_e), determine electron γ
Goal 8: First attempt to sort out rotational shear

6. Add as much HHFW as possible, optimum phase to heat electrons.

   DO I=1,2

   Move source A on time back to t1, t2 <300ms to be determined for q evolution.

   ENDDO

c…Increase electron β relative to other terms, sort out electron γ

7. Set n=3 non-resonant braking to 800A

   DO I=1,3

   Choose moderate density AC shot, increase n=3 braking in 150A increments

   ENDDO

c…Stop rotation to minimize rotational shear effects

c…6 shots

Desired Diagnostic/machine capabilities

- 5-channel reflectometers.
- 2 correlation channels in dwell.
- Mirnov HN/HF arrays
- High-k scattering
- FIDA operational
- Scanning NPA
- ssNPA
- sFLIP with PMT channels
- MSE
- Thomson scattering
- CHERS
- JHU Soft x-ray cameras
- Tangential fast SX camera
- Fast neutron detectors

- Source A at 90 kV
- Source C at 60-90 kV
- 4.5 and 5.5 kG operation
- 800 kA (120106/123096)
- Helium prefill/puffing
- D prefill/puffing
- N=3 nonresonant braking
- HHFW at 2 to 3 MW, best phasing for electron heating.

- Probably better before LITER, but may not matter.