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XP-903

Error Field Threshold Study in High-β_N Plasmas

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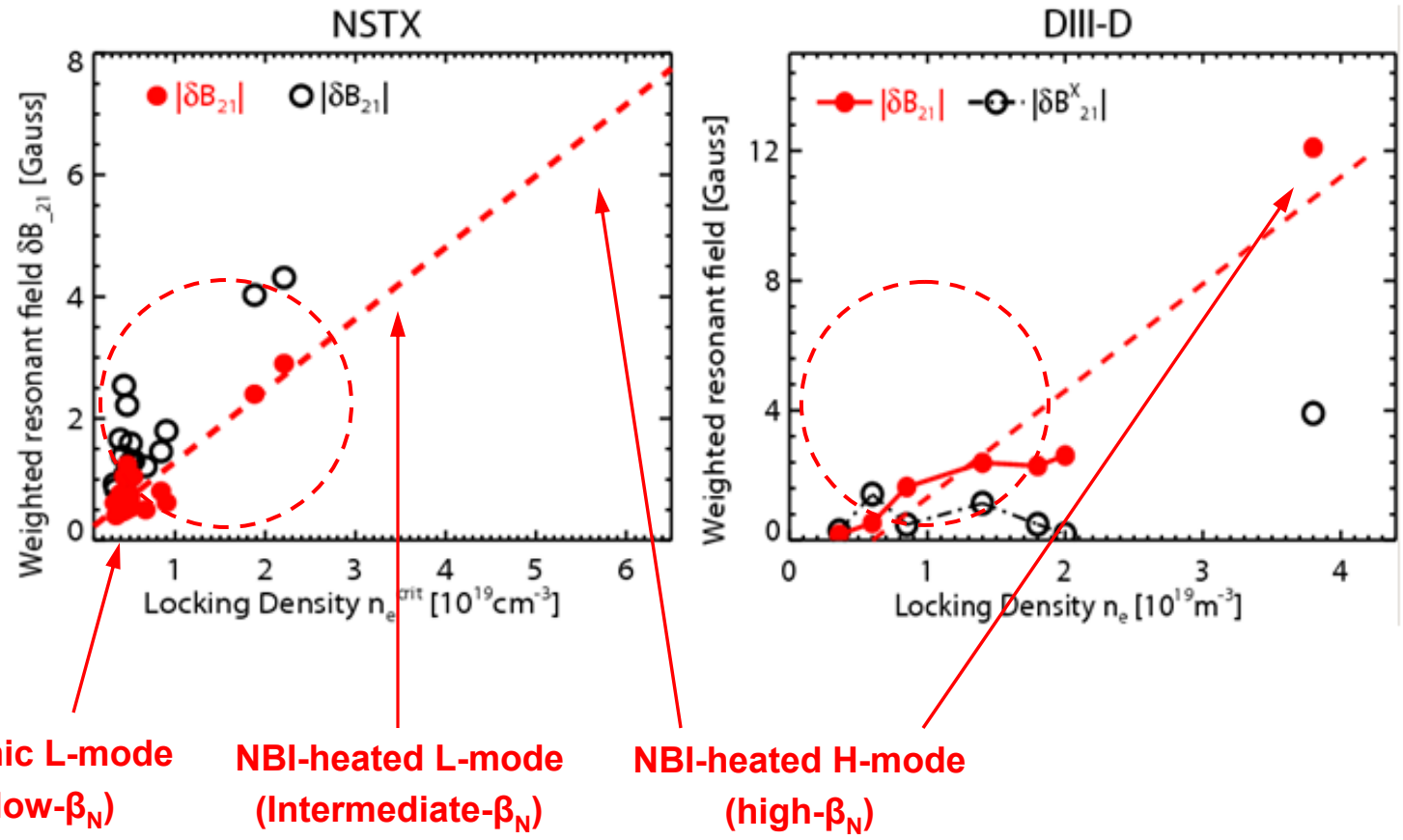
Experimental Goal

- Study static locking driven by 3D error field in high-β_N (density) plasmas, rather than Ohmic low-β_N plasmas
  - *Static locking : large opening of islands after error field penetration*
  - *Mode locking : locking to error field after slowing down of rotating tearing islands*
- Study the role of the plasma response in static locking
- Study the dynamics of islands and locking by using CHERS, MPTS, and MSE
- Obtain data for the error field threshold .VS. (density and β_N), and compare with IPEC expectation

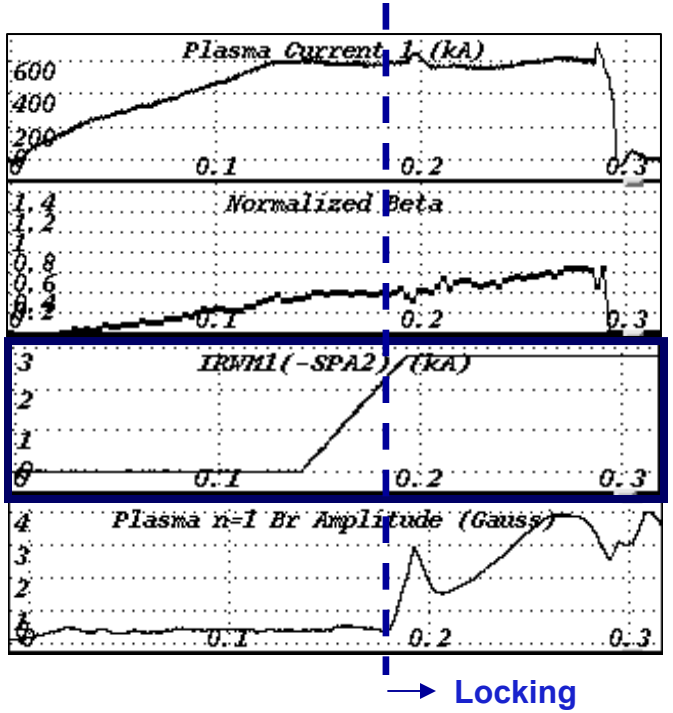
Low-β_N .vs. high-β_N static locking

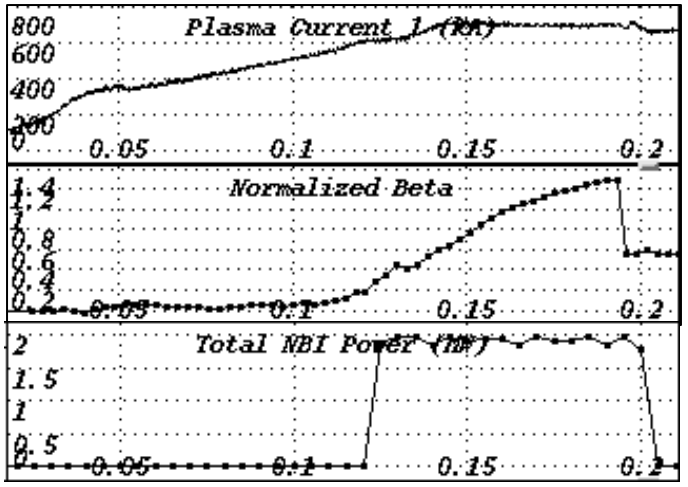
- Correlations between field threshold and density, etc, are unknown in high-β_N plasmas



Experimental procedure for Intermediate-β_N locking

- Start from Ohmic-L locking shots in XP703 (#122458)
  - Change gas puffing to obtain high density
- Add NBI source A to increase β_N and density
  - Change gas puffing and NBI timing to control density and β_N



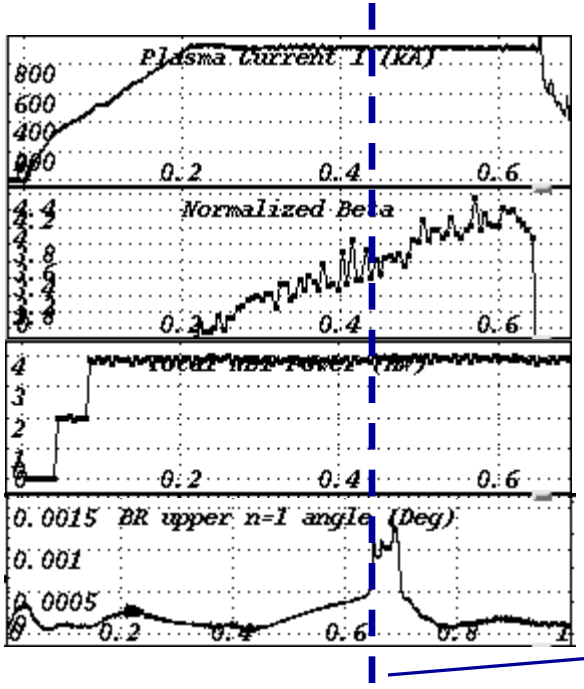


- Use the same n=1 SPA waveform from (0,0,0) to (3,-3,0)kA ramp-up during 50ms at different times

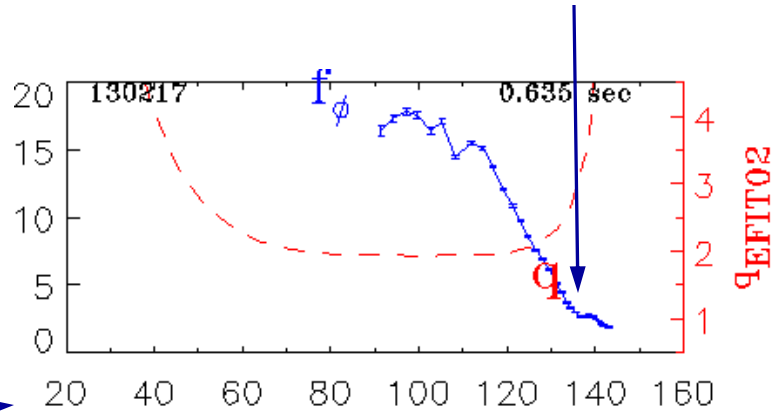
Experimental procedure for high-β_N locking

- Start from the developed targets and add NBI up to 4MW if the previous attempts with 2MW NBI were successful

- Otherwise, start from 4MW NBI-heated locking shots in XP810 (#130217)



– It is desired to have a tearing-free period (~250ms) with the sufficient β_N evolution, and make sure no RWM, but the static locking



Run Plan (I)

1. The error field threshold study in intermediate-β_N plasmas
   a. Reproduce the static locking in Ohmic L-mode plasmas in XP703
      i. Use the reference shot #122458 (I_P = 600kA~700kA, B_T = 0.45T), change gas puff (PZV2 flow rate > 100 TorrL/s) to achieve the density > $10^{19}m^{-3}$.
      {4 shots}
      (If this target is not achievable in 4 shots, go to the step 1.b.)
      ii. Apply SPA's at 150ms and increase the currents up to (3,-3,0) kA at 200ms.
      {2 shots}

   b. Test the static locking in NBI-heated L-mode plasmas
      i. Start with the developed Ohmic target and use NBI source A at 120~150ms to achieve higher density and β_N. Make sure the evolution of density and β_N, and no rotating mode .
      {4 shots}
      (If this target is not achievable in 4 shots, go to the step 2.b.)
      ii. Apply the same SPA waveforms at 150ms ~ 300ms with an interval ~50ms.
      {4 shots}
      iii. Change gas puffing to vary the density, and apply the same SPA waveforms.
      {4 shots}

Run Plan (II)

2. The error field threshold study in high-β_N plasmas
   a. **(Time permitting)** Study the static locking in NBI-heated H-mode plasmas from 1.b.
      i. Start with the developed NBI-heated L-mode target and increase NBI up to 4MW to achieve higher density and β_N. Make sure no rotating mode. {2 shots}

      (If this target is not achievable in 2 shots, go to the step 2.b.)
      ii. Apply the same SPA waveform at 300ms ~ 500ms with an interval ~50ms. {4 shots}
   b. **(If 1.b or 2.a failed)** Study the static locking in NBI-heated H-mode plasmas from XP810
      i. Use the reference shot #130217 (IP = 900kA, BT = 0.45T) and make sure no rotating mode {2 shots}
      ii. Apply the same SPA waveform at 300ms~500ms with an interval ~50ms. {4 shots}