Compare the benefits of off-axis NBI for advanced scenarios in low and medium aspect ratio devices

by

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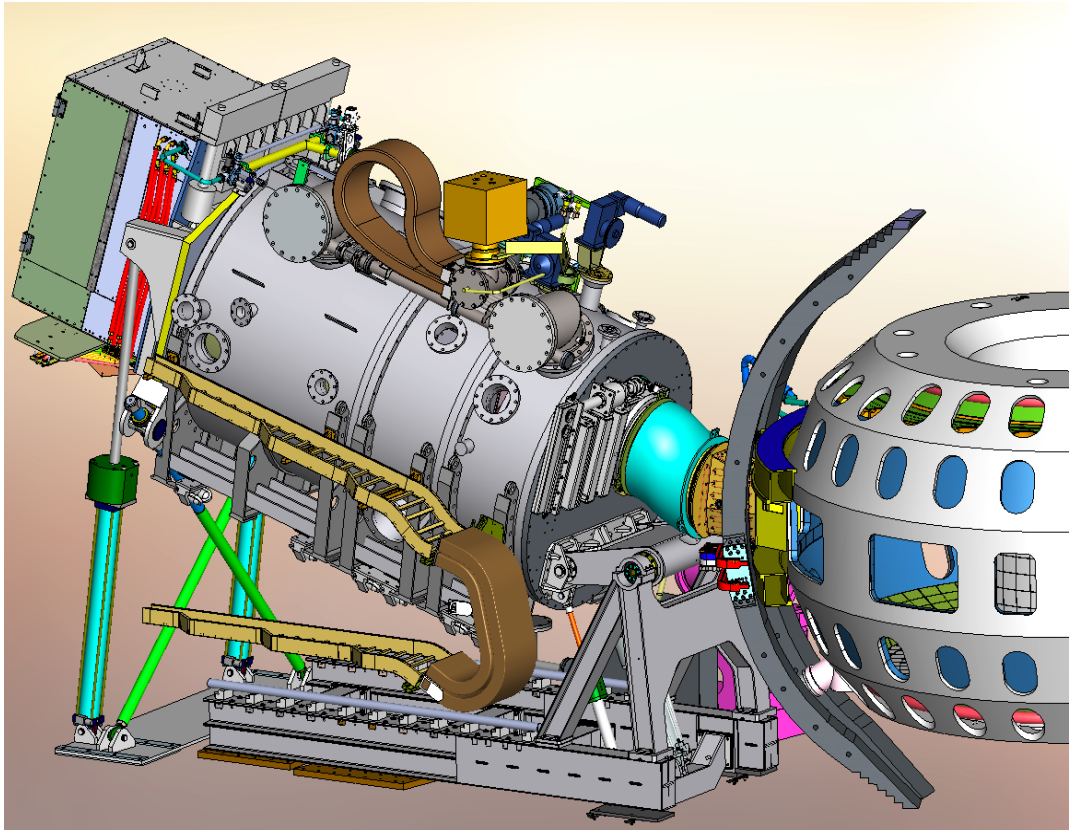
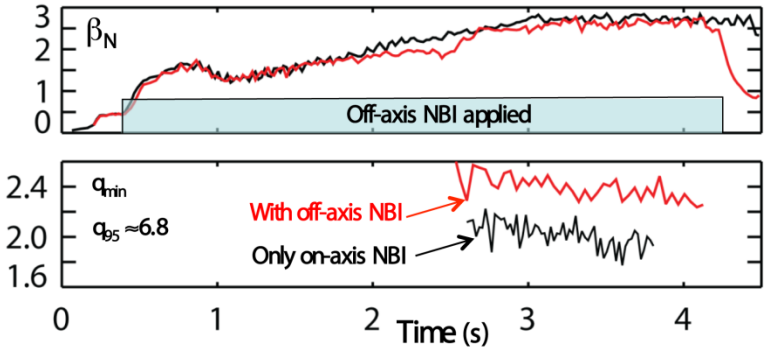


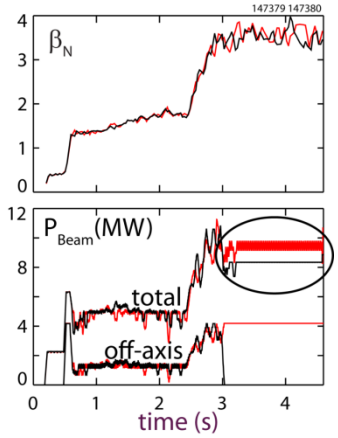
Goal: Compare off-Axis Beam Injection in NSTX-U and DIII-D

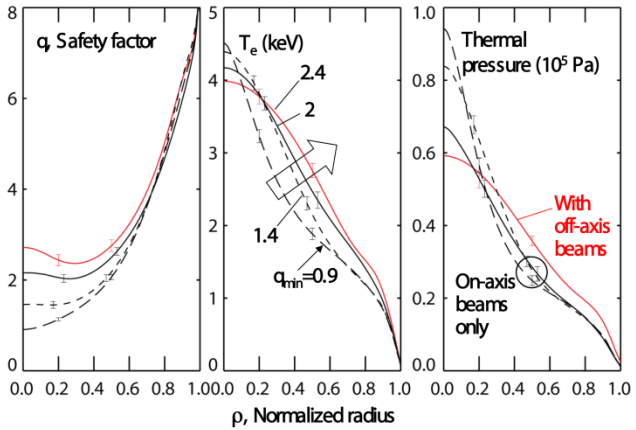
- **Examine the effect on the current, pressure, rotation profiles and the β_N limit.**
- **Perform experiments on NSTX-U that parallel those initially performed on DIII-D after the installation of off-axis injection capability (and those planned for 2015)**
  - Potential list of topics described here
  - The DIII-D results are documented in Ferron et al., Phys. of Plasmas 20, 092504 (2013) and Holcomb et al. Nuc. Fusion 54 093009 (2014).
- **Should yield aspect ratio scaling data**
- **Importance: Optimization of current and pressure profiles is the key to advanced tokamak operation**
- **The results of this experiment would be contributions to the Joint Research Target report for 2015.**
  - JRT addresses the effect of the current and pressure profiles on stability and confinement.

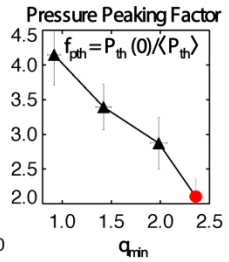
Access q_{min} >2 using off-axis neutral beam injection

- **Document accessible q_{min} vs choice of beam sources and n_e**
  - Use an early H-mode transition and heating during the I_p rampup to initially create a current profile with high q_{min}
- **Compare confinement with on or off-axis injection.**
- **Compare n_e and T profiles at constant injection power but different beam deposition profile**
- **Assess the pressure peaking factor as a function of q_{min} and injection location**



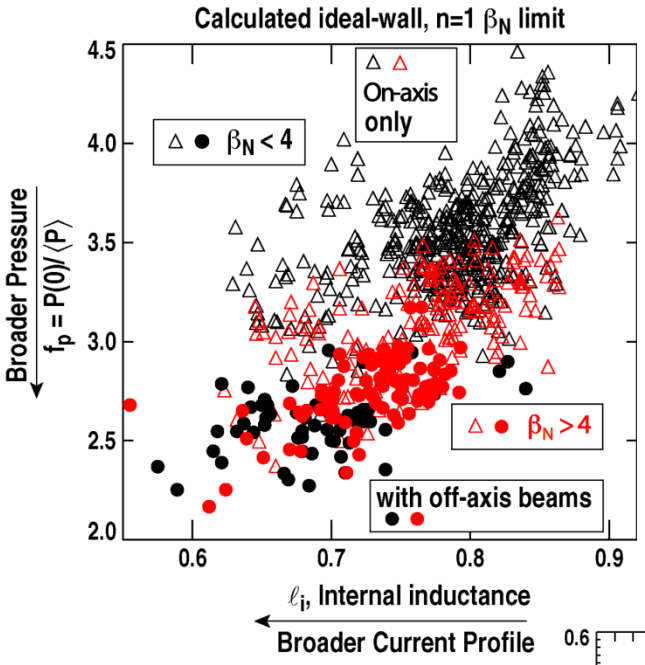


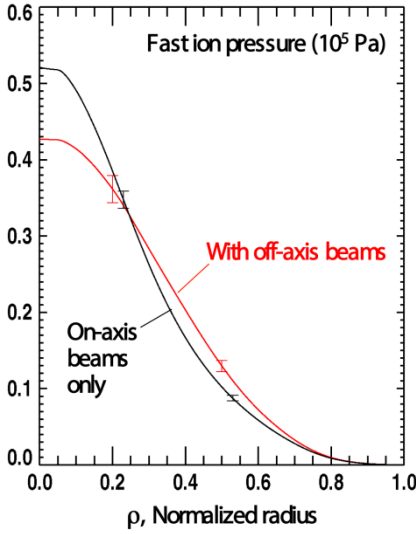




Map the calculated ideal MHD stability limit

- **As a function of q_{min} and ℓ_i using measured profiles.**
- **Effectiveness of off-axis injection in broadening the fast ion density profile in high β_N discharges.**
- **Assess the experimentally achievable β_N as a function of q_{min} and pressure profile width.**
  - Document the effect of increasing β_N on the pressure profile width.
  - Determine the maximum β_N that can be maintained for multiple τ_R





Look for anomalous fast ion loss that limits confinement and β_N

- **Especially at $q_{min} > 2$**
- **Assess the maximum achievable current profile width using large outer gap to increase the beam injection radius.**
  - Effect on the β_N limit
- **Aim for $f_{NI} = 1$**
  - Compare the measured current density profile evolution and f_{NI} at high β_N with transport code calculations