

# XP Proposal 1: Particle Transport Using Modulated Gas Puff and Non-Axisymmetric 3-D Fields

- **Measure particle diffusion coefficient (D) and pinch velocity (v)**
  - Modulate edge particle source term with gas puffs using SSGI (deuterium)
    - > **With and without RMP**
  - Modulated edge fields with RMP
  - Target plasmas: L-mode and low density H-modes
- **Diagnostics**
  - Utilizes ultrafast profile reflectometers (0.2-3.5x10 cm<sup>-3</sup> range, 4 μs resolution).
    - > **Fast density profiles,  $k_r$ , backscattering and turbulence radial correlations**
  - BES, high-k, GPI, etc.
- **Examples of analysis**
  - Early 1990's on JT-60U, H. Takenaga
  - 2010 on DIII-D, L. Zeng et al.
- **DIII-D results**
  - Gas puff modulation in L- and H-mode
    - > **Both D and -v (inward pinch) increase with radius**
    - > **Both D and -v increase with collisionality  $\nu^*$**
  - Add RMP with steady I-coil current (n=3, even parity)
    - > **D increases while -v decreases (increased particle transport)**
    - > **Both L- and H-mode**
- **Physics impact**
  - Direct comparison can be made to standard aspect ratio tokamak
    - > **Difference in ELM response to RMP**
  - Direct comparison between particle transport and turbulence
    - > **Same diagnostic will be used for both measurements**

# XP Proposal 2: Doppler Backscattering or Search for GAMs

- **Background**
  - Doppler reflectometry is uniquely suited for looking at GAMs
    - > Poloidal velocity via backscattering from intermediate- $k$  turbulence
    - > Arguably the most sensitive measurement for GAM detection
  - Doppler reflectometry on NSTX
    - > Usually not possible with existing antennas due to elongated plasma shape
    - > May be possible using strongly off-centered plasma shapes
- **Plan**
  - Utilize shapes developed for XP-1030
    - > Axis shifted strongly downward
    - > Beam launched from top antennas can make oblique incidence at cutoff
    - > Will sample plasma off-axis near maximum amplitude of GAMs
  - Investigate dependence on  $v^*$ ,  $B$ , etc.
- **Diagnostics**
  - Dual-channel tunable correlation reflectometer
    - > Radial correlation at top location
    - > Sample dual poloidal locations, one near top of machine and another closer to the midplane (expect GAMs to be 90 degrees out of phase here)
- **Examples**
  - Many machines
- **Significance for NSTX-U**
  - Measurements will provide valuable information for a dedicated Doppler reflectometry system to be proposed for NSTX-U