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(XP-1161) Scoping XP: Density Modulation with SGI

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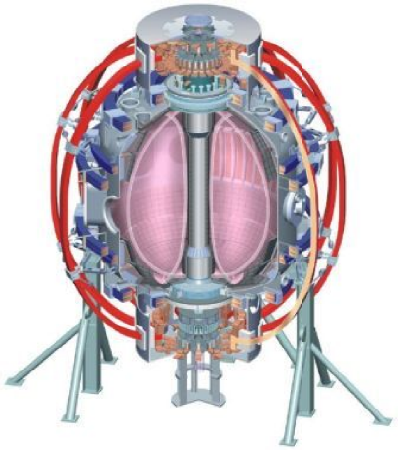
S. Kubota, V. Soukhanovskii,
S. Kaye, D. Clayton, et al.

T&T TSG XP Review
10:00 AM LSB-318
June 17, 2011



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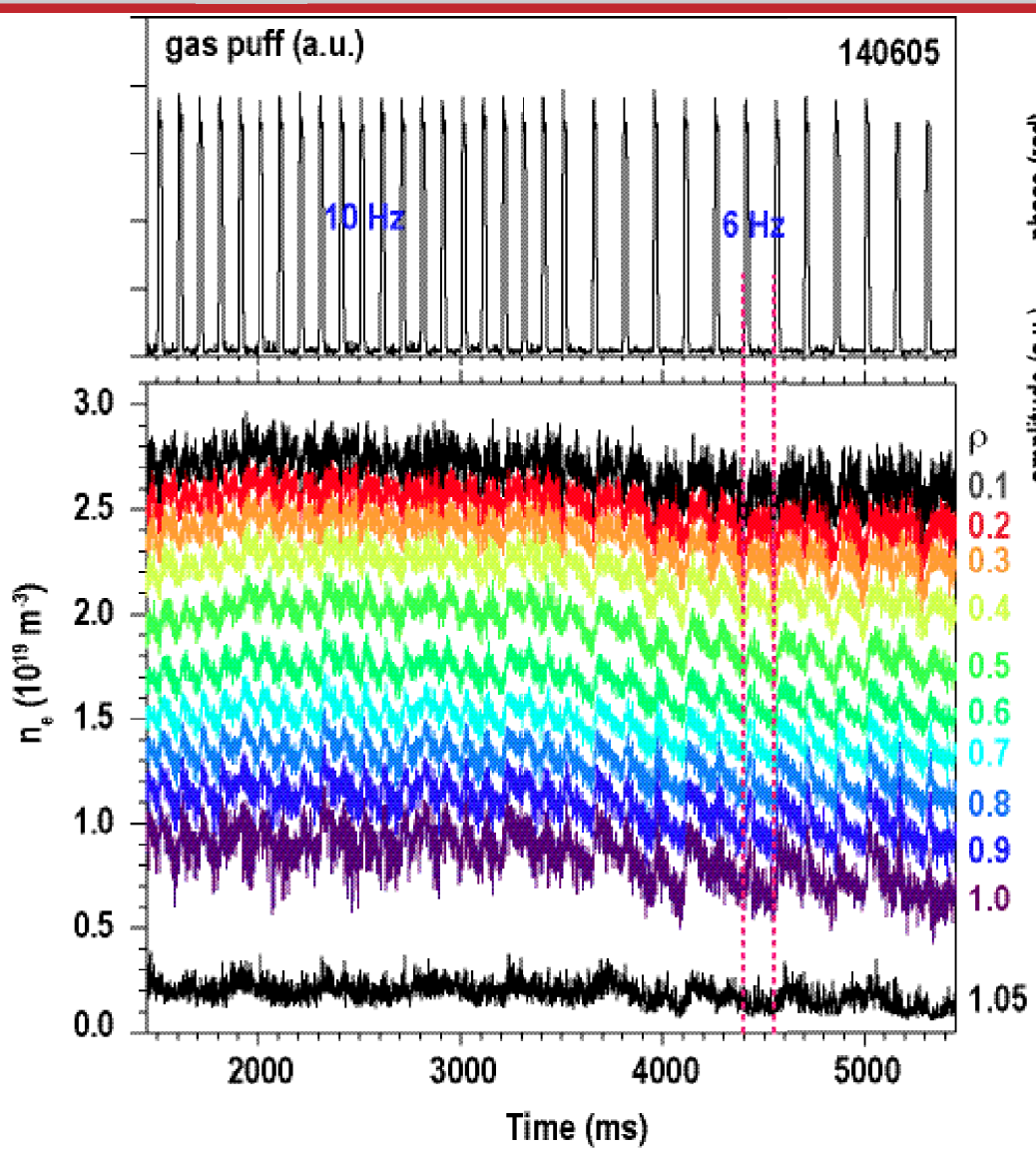
Particle Transport Using Modulated Gas Puff With SGI?

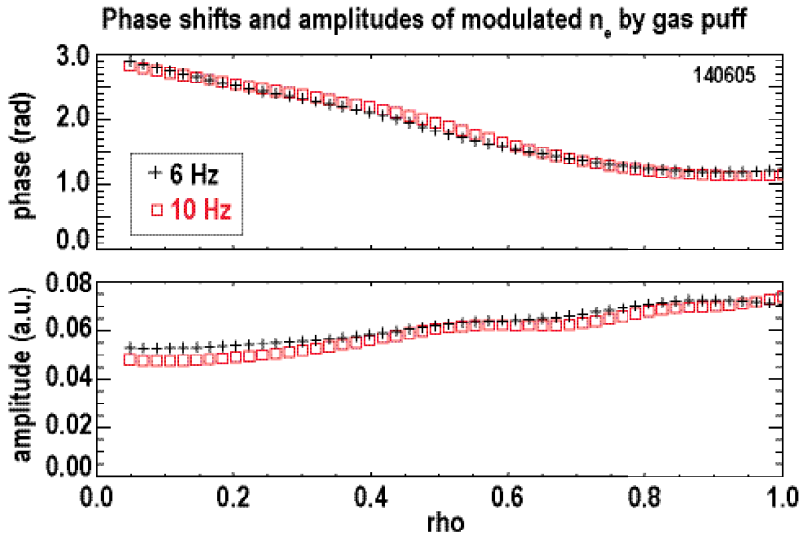
- **In support of FY2012 JRT Milestone**
  - Experimentally measure particle (electron & impurity) transport
  - Simultaneous measurements of core turbulence
  - Profile measurements (density, temperature, rotation, q, etc.)
  - Comparison gyrokinetics

- **Goals specific to this XP**
  - Can we use SGI with profile reflectometers for D and v estimates?
    - > L-mode target
    - > H-mode target
  - Reflectometers require targets with monotonic density profiles
  - Turbulence measurements require low MHD activity

- **Scenarios compatible with other diagnostics?**
  - NB requirements
    - > BES (2 MW), MSE (Src A), CHERs diagnostics
  - Ne injection
    - > SXR diagnostics
  - Density profile
    - > High-k, reflectometers

Modulated Gas Puff Technique and Analysis





Assume local perturbation: $\tilde{n} = A(r)\sin(\omega t - \phi(r))$

Assume cylindrical symmetry, modulated transport equations yield:

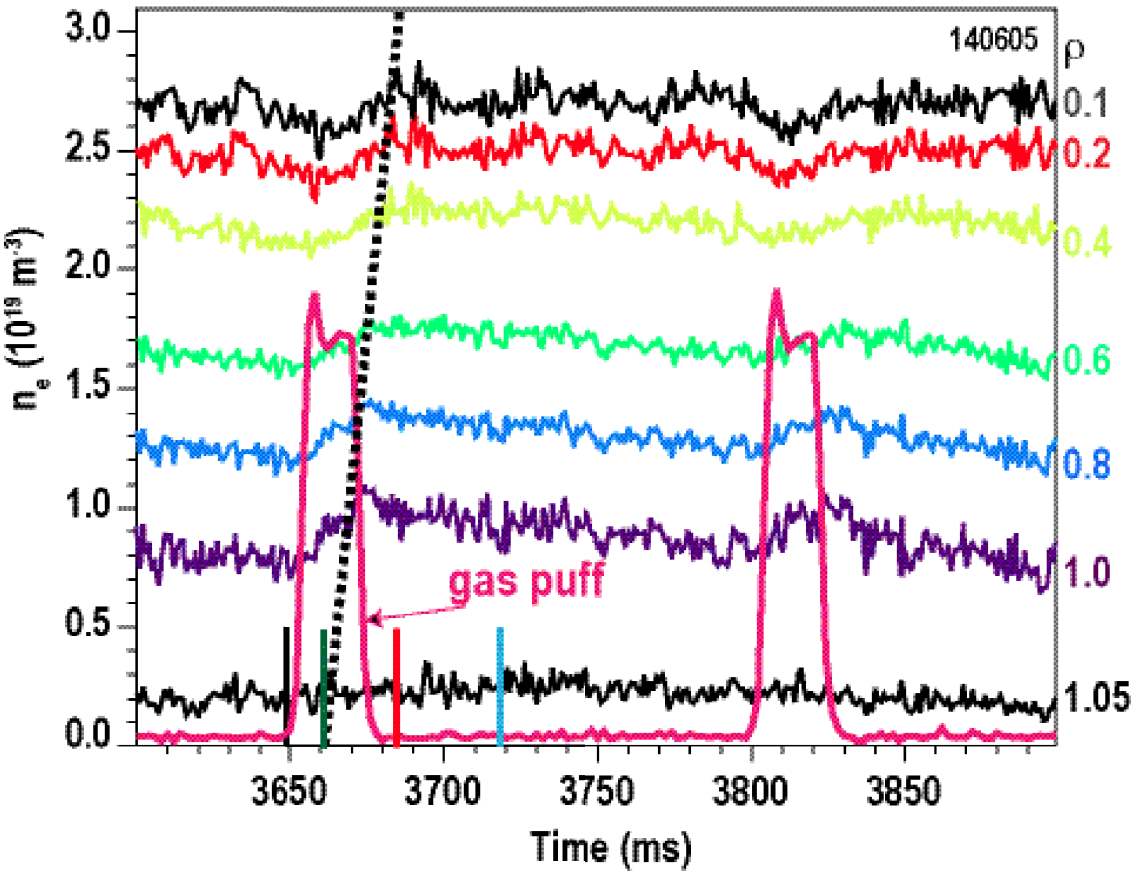
$$D = -\frac{\omega(X+Y)\sin(\phi)}{r\,\frac{\partial\phi}{\partial r}A}$$

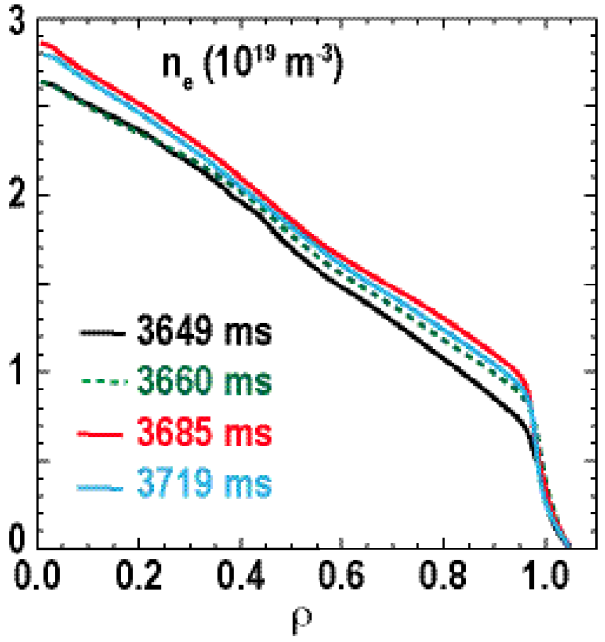
$$v = -\frac{\omega\left(\frac{\partial A}{\partial r}Y - \frac{\partial\phi}{\partial r}AX\right)\sin(\phi) + \left(\frac{\partial\phi}{\partial r}AY + \frac{\partial A}{\partial r}X\right)\cos(\phi)}{r\,\frac{\partial\phi}{\partial r}A^2}$$

$$X = \int_0^r r\,A\cos(\phi)dr$$

$$Y = \int_0^r r\,A\sin(\phi)dr$$

Measurements from DIII-D





Plan for 0.5 Day Scoping XP

- **Run Plan**
  - 13+ to19+ shots for L- and H-mode.
- **L-mode (8+ to14 shots):**
  - Start with XP-1015 target (141711): Deuterium, CS-limited, 5.5 kG, 900 kA, flattop 230 ms->
    - > Src A 90 kV, 90 ms->
    - > Adjust density to 3×10^{13} cm^{-3} at 300 ms or a bit higher (3 shots).
    - > If AE level acceptable, start SGI scan, Ne puff.
  - Otherwise, lower B_T to 4.5 kG.
    - > Adjust density to 3×10^{13} cm^{-3} at 300 ms or a bit higher (3 shots).
    - > If AE level acceptable, start SGI scan, Ne puff.
  - Otherwise, decide whether to proceed with B_T=4.5 or 5.5 kG
    - > Vary NB combination and power: A (90 kV): 90-230, 360->;
      B only, C only, B+C, 230-360 (8 shots).
    - > Concurrently with SGI scan, Ne puff.
- **SGI Scan and Ne Puff:**
  - Reference shot w/o SGI and Ne puff: 1 shot
  - SGI Scan (see next page): 4+ shots
  - Ne Puff Adjustments: on top of SGI scan

Plan for 0.5 Day Scoping XP Continued

- **H-mode (5+ shots):**
  - Fiducial-type shot with MHD quiescent period.
    - > SGI scan and Ne puff similar to L-mode.
- **SGI Scan:**
  - SGI positioned at R=157 cm
    - > 10 ms duration, adjust plenum pressure: 3000 Torr, 2000, 1000, 500, etc.
    - > For H-mode may want to start at maximum of 5000 Torr.
- **Impurity Injection:**
  - Ne, midplane puffer
    - > Adjust timing wrt SGI pulse. Check for perturbation on reflectometer signals.