Diagnostic Applications of Neutral Transport  
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Objectives
- Quantitative analysis of Gas Puff Imaging experiments,
- Accurate determination of tokamak midplane neutral density profiles.

Accomplishments
A decade of DEGAS 2 simulations of Gas Puff Imaging experiments has provided:
- Efficient and nearly automated techniques for setting up & executing simulations,
- Validation of DEGAS 2’s molecular deuterium penetration model.

Led to a new DEGAS 2 based forward analysis technique for inferring atom densities over a wider spatial range than direct inversion; also yields molecular density.

Impact
Application to several 2010 NSTX discharges yielded ranges:
- $D_2$: $2 \rightarrow 8\times10^{17} \text{ m}^{-3}$
- $D$: $1 \rightarrow 7\times10^{16} \text{ m}^{-3}$
- Can be used to quantify charge exchange loss of beam ions & resultant wall sputtering,
- & to assist in interpretation of other diagnostics.

(a) Simulated (color contours) & observed GPI camera images.  (b) Radial profiles from vertical summation provide one measure of agreement.

Midplane atomic & molecular density profiles for two NSTX discharges.