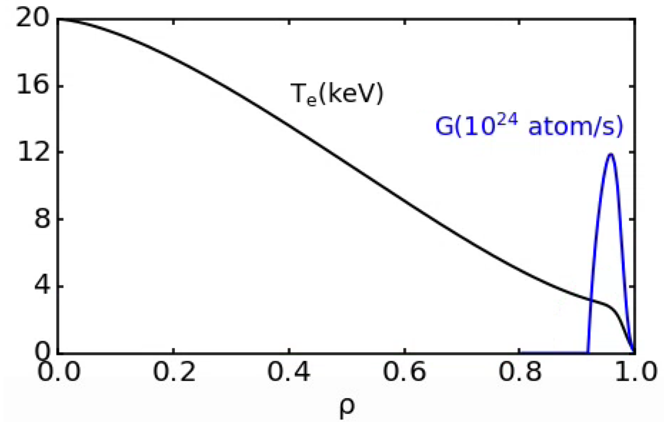
PAM has been developed for STEP transport modeling

- **Pellet ablation (G) rate based on previous formulation for homogeneous DT mixtures**

$$G = C\left(\frac{\langle W\rangle}{W_D}\right)^{2/3}\left(\frac{T_e}{2}\right)^{5/3}\left(\frac{r_p}{0.2}\right)^{4/3} n_{e14}^{1/3}$$

Parks et al. PoP, 1998
Parks et al., to be submitted

Typical ITER baseline LFS injection v_p=500 m/s, r_p=2.5 mm



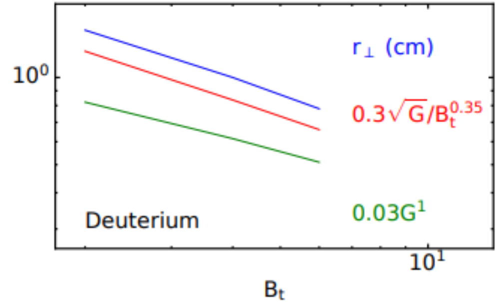
GENERAL ATOMICS

Parks et al. 2000 PoP equation rewritten in terms of G

$$\kappa_c = \frac{1.54 \times 10^4 T_{e\infty}^{1/6}}{(1-\mu_E)^{1/2} W^{1/6} (n_{e\infty} r_p \ln \Lambda_{\mathrm{en}})^{1/3}} (4\gamma T_* + \varepsilon_{\mathrm{ion}} + \varepsilon_{\mathrm{diss}})^{1/2}, \quad (12)$$

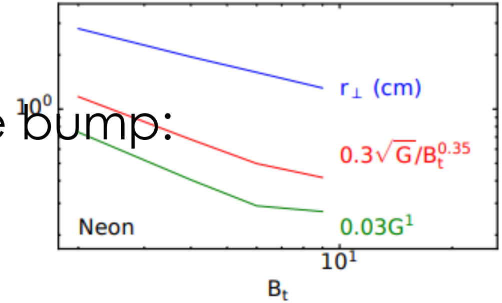
$$r_\perp \approx c_\perp \sqrt{\frac{G}{n_\infty T_\infty^{3/2}(1-\mu_E)}},$$

$$\mu_E \sim 1 - \mathrm{const}\ B^{0.7}$$



shift strong function of local pressure bump:

$$\frac{\beta_0}{\beta_\infty} = \frac{n_0 T_0}{n_\infty T_\infty} \propto n_e T_e^{3/2} B^{0.35}$$



PAM ∇B drift model derived from scaling formula accounting for magnetic field

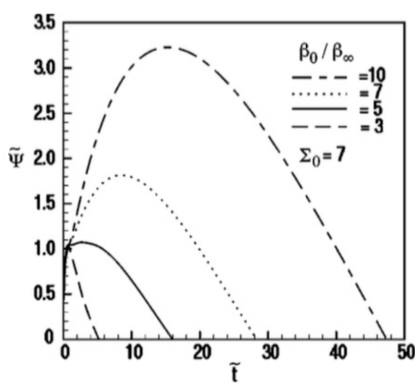
$$\Sigma_p \frac{dv_x}{dt} = -\frac{2B^2 v_x}{\mu_0 c_{A\infty}} + \frac{2}{R}\Psi(t).$$

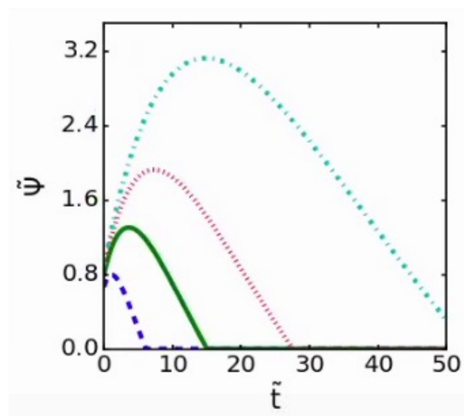
Parks et al., Phys. Plasmas, 2002

$$\Psi = a_1 \left[\exp\left(a_2 \left(L_c - L_{c0}\right)\left(\frac{p_\infty}{p_0}\right)^{a_3} \Sigma_0^{a_4}\right) - \frac{p_\infty}{p_0}\right] \frac{L_c}{L_{c0}} + (1 - a_1)\,(1 - \frac{p_\infty}{p_0})$$

- **Toroidal drive integral fitted to match scaling**

$$\langle\tilde{\Psi}\rangle = 0.036\Sigma_0^{1.1}\left(\frac{\beta_0}{\beta_\infty} - 1\right)^{2.64}$$





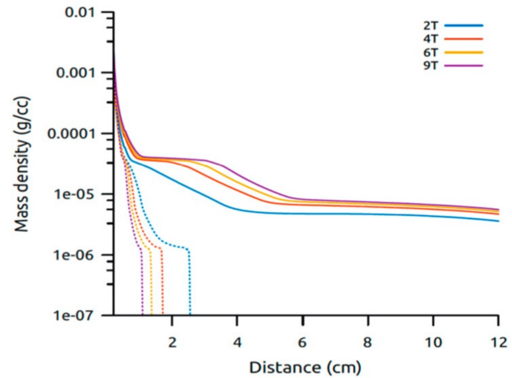
Tuned drift to match Bt-dependence 2D Eulerian modeling

- **Cloud width predicted to be reduce with B**

  Bosviel et al., NF, 2021
  Samulyak et al., NF, 2021

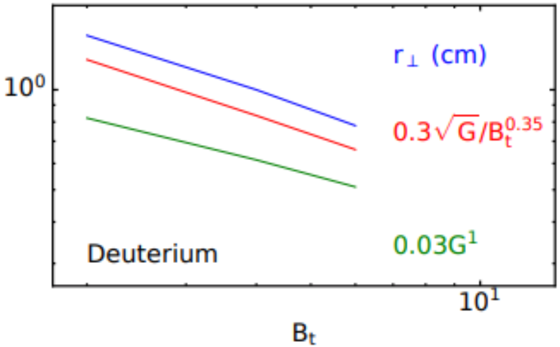
  – enhance ∇B drift effect

  – complicated by ablation also reduced by B



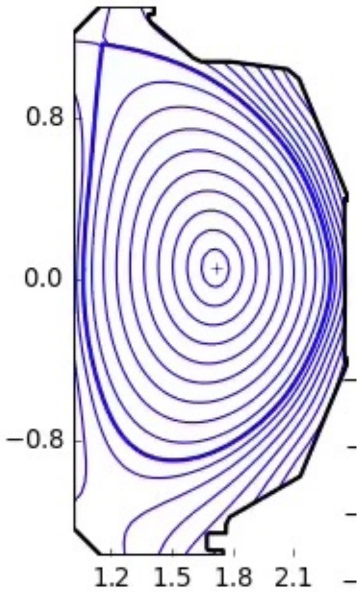
$$r_\perp \approx c_\perp \sqrt{\frac{G}{n_\infty T_\infty^{3/2}(1-\mu_E)}},$$

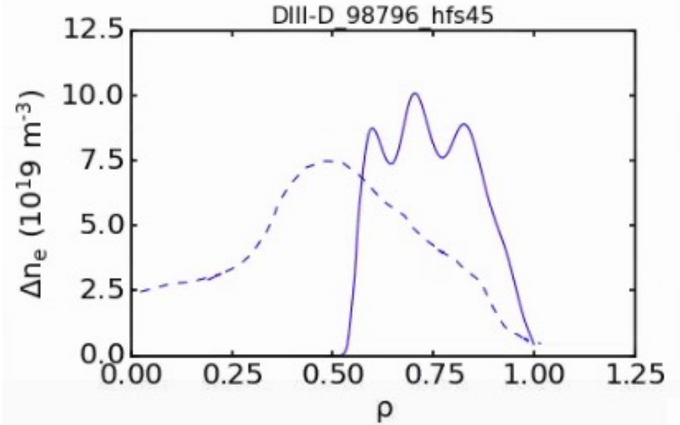
$$\mu_E \sim 1 - \text{const}\ B^{0.7}$$

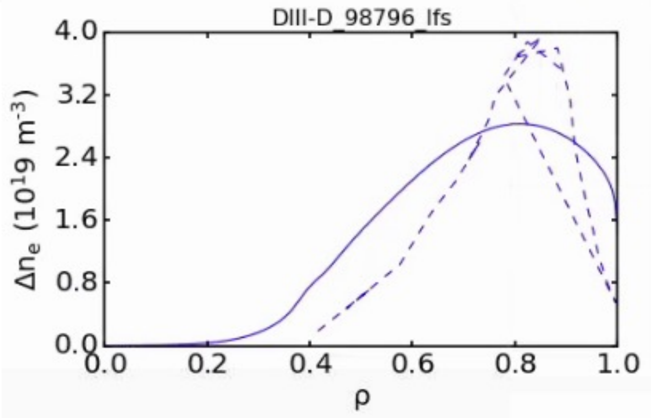


GENERAL ATOMICS

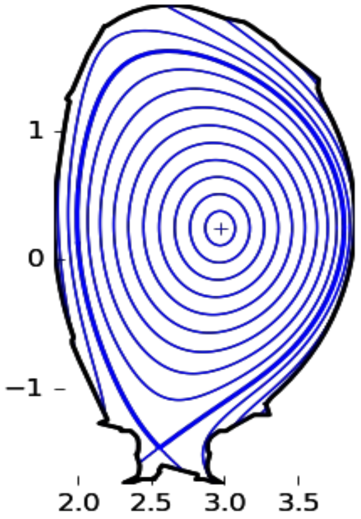
Experimental verification of this implementation is underway



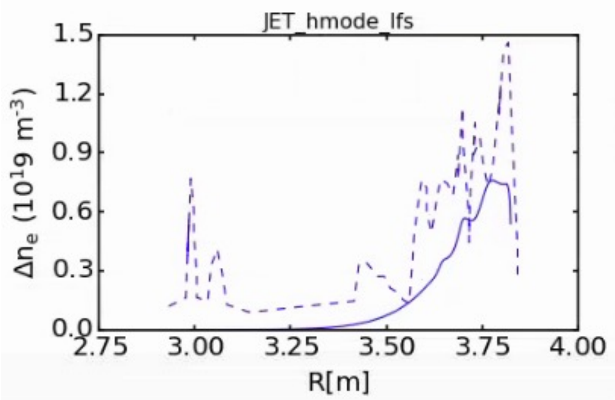


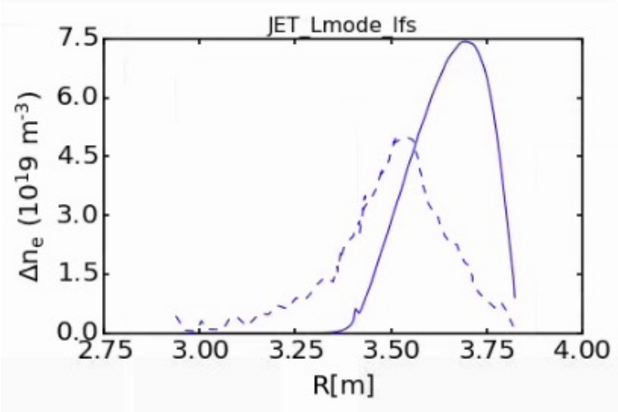


Experimental verification of this implementation is underway



JET Profiles/Equilibrium reproduced from Frigione et al. IAEA 2010





GENERAL ATOMICS