Comparison of NSTX Poloidal Velocity with Neoclassical Theory

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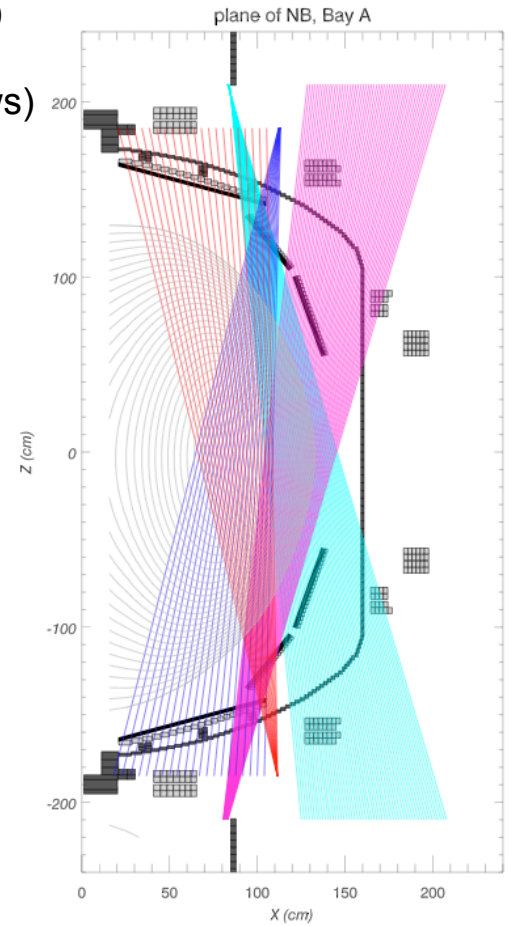
Poloidal Velocity Issues:

- uncertainty of atomic physics cross sections (especially at low energy)
- possible omission of some atomic physics processes contribute (e.g. halo neutrals, level mixing, etc.)
- gyro orbit finite lifetime effects (proportional to T_i and B_ϕ)
- excited beam neutrals (small fraction with very large CX cross sections)
- beam neutral density (beam attenuation)
- contributions from toroidal velocity flow in views (not perpendicular views)
- Typically, $V_\theta << V_\phi$
- Height of NB (non-local measurement)
- Contributions from non-CX emission (intrinsic background, plume)



NSTX poloidal CHERS:

- Unique Up/Down symmetric views
- Active and passive views
- NSTX is ST so low B_ϕ, T_i compared to TFTR, very small gyro orbit effects
- Line integrated, no atomic physics cross data required
- Inversion to give local velocity

Outline:

- Part A - NSTX poloidal velocity measurements
- Part B - Comparison to neoclassical velocity

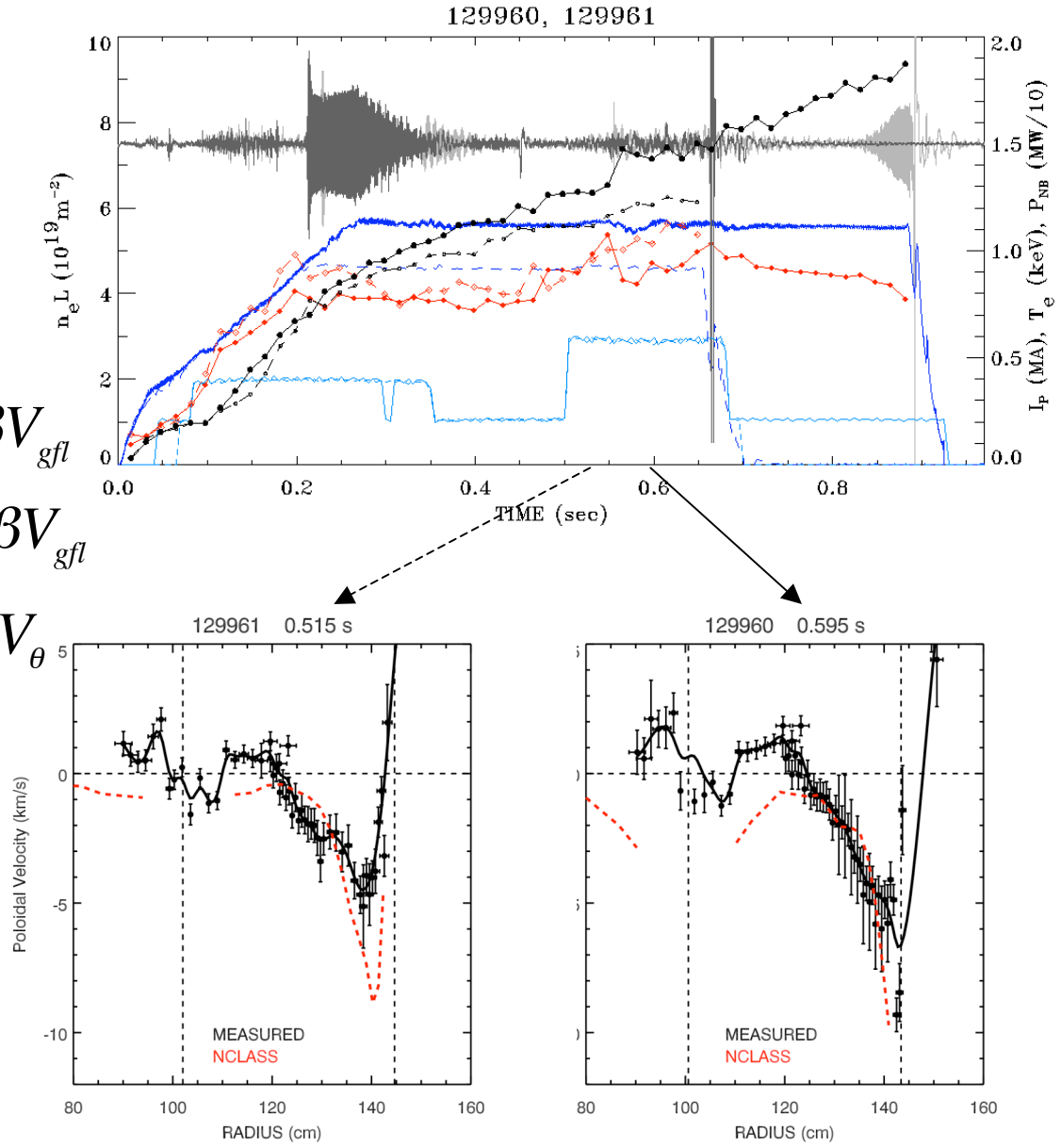
Preliminary Measurements

- Line-Integrated
- No Background Subtraction
- Apparent velocity difference between up/down views only
- No Atomic physics used!

$$V_{app}^{up} = V_\theta + \alpha_1 V_\phi + \alpha_2 V_{cx} + \beta V_{gfl}$$

$$V_{app}^{down} = -V_\theta + \alpha_1 V_\phi + \alpha_2 V_{cx} - \beta V_{gfl}$$

$$\frac{1}{2}\left(V_{app}^{up} - V_{app}^{down}\right) = V_\theta + \beta V_{gfl} \approx V_\theta$$



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