CT Fueling for enhancement of NSTX discharges

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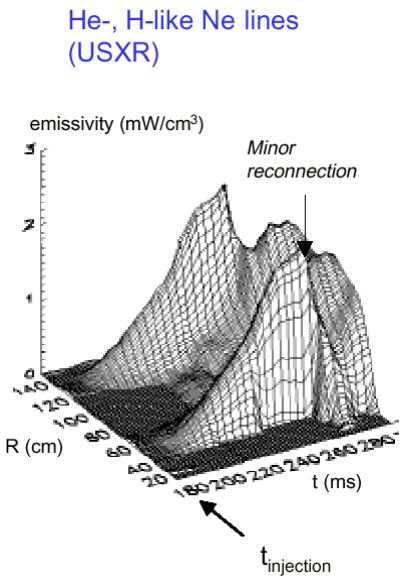
Motivation

• On NSTX, injection of neon resulted in a sharp build-up of neon at the edge with little or no penetration into the core [1], implying the possible presence of a edge barrier to neutrals.

[1] D. Stutman, APS 2001 and NSTX 2001 Research Review presentations.



• On DIII-D, inboard side injection of pellets has shown improved core fueling due to radial inward drift of a high beta cloud that forms around the pellet. On DIII-D, the velocity of this cloud is about 2 km/s, much more than the velocity of the injected pellet [2].

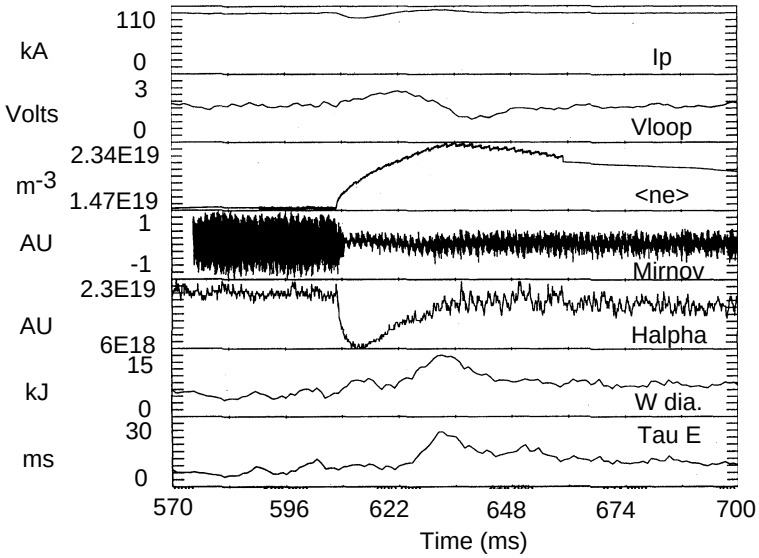
[2] T.C. Jernigan et al., "Pellet injection on DIII-D from multiple directions," IEA 45 Wrkshp. on density cntrl, PPPL, 30-31 October (2000).

• The velocity of the CT plasmoid can range form 50 km/s to more than 300 km/s >> than the inward drift velocity of the ablated pellet cloud, which should contribute to good core fueling on NSTX.

• This XP (FY 02) is to inject a puff of Neon from the inboard side of NSTX to see if there is enhanced penetration to the core. Measurement of the drift velocity of neon injected from the inboard side of NSTX is relevant to more advanced fueling methods.

The CT Fueling XPs have two primary goals.

1. Reliable initiation of H-modes and large surface area limited H-modes.



Low velocity CT injection into a limiter ohmic discharge on TdeV can cause a rapid reduction in the Mirnov coil fluctuation amplitude and a reduction in the H_α signal. This is possibly due to a rapid steepening of the edge density gradient [3]. Similar features are seen on limiter discharges on STOR-M [4].

[3] R. Raman, et al., "CT Fueling of TdeV," *Proc. 24th EPS*, Berchtesgaden, 9 - 13 June EAC Vol. **21A** 293 (1997).
[4] C. Xiao et al., " CT injection experiments on STOR-M," *Proc. 17th IAEA*, Yokohama, Japan, October (1998).

2. Develop localized core fueling tool to meet NSTX Steady State mission objectives.

Advanced Tokamak (AT) scenarios are essential for the viability of the ST concept. *Under this mode of operation, the fueling system must deposit small quantities of fuel at the desired location but more frequently without significantly altering the optimized density profile.* Present fueling methods, except NBI, have not demonstrated successful fueling of sustained AT type discharges. CT fueling has the potential to meet this need, but this technology is undeveloped.