Pellet Fueling Scoping Studies for NSTX

NSTX Research Forum 2002

L.R. Baylor, H.W. Kugel[#], R. Maingi, S.K. Combs, D.A. Rasmussen

Oak Ridge National Laboratory,
[#]Princeton Plasma Physics Laboratory

Pellet Fueling Rationale and Vision for NSTX

- A pellet injection system can provide the deep central fueling needed for an ST to optimize its performance.

- The vision of an optimized fueling system for NSTX is one that provides:
  - > Central fueling
  - > Minimized recycling
  - > Repetitive - 10 Hz with ~10% perturbations
  - > Reliable operation
  - > Alternative injection locations for optimized penetration
  - > Matched to NSTX high performance discharges

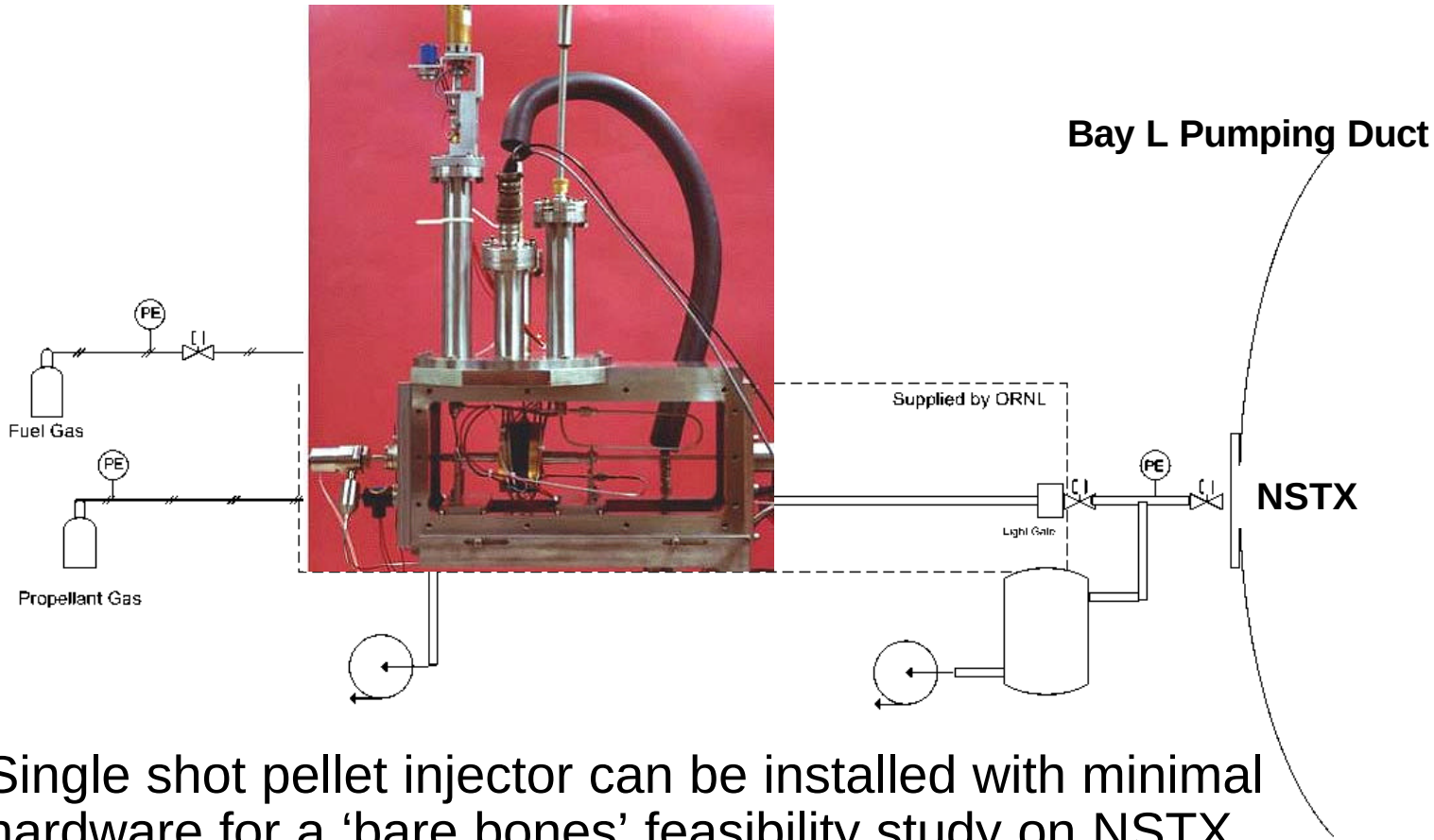
- A single-shot pellet injector could be the first step toward realization of these goals. A future step is the use of a simple multi-shot injector (pellet injector in a suitcase).

A Single Shot Pellet Injector is Available for Scoping Studies on NSTX in FY'03.

- A single shot pipe-gun pellet injector has returned from use on W7-AS, which recently shut down.
- The injector and associated electronics are available for use on other confinement experiments – e.g. NSTX.
- Minimal effort is necessary to install the injector on Bay L for initial scoping studies of pellet fueling during FY'03.
- Such an injector can be used as a prototype for a more extensive multi-pellet injection system to be installed in the future.

Single Shot Pellet Injector Installation on NSTX

ORNL Single Shot Pellet Injector



- Single shot pellet injector can be installed with minimal hardware for a ‘bare bones’ feasibility study on NSTX.

D_2 Pellet Fueling Experiments for NSTX in FY'03

- **Single pellets can be used to test feasibility of profile control for advanced confinement regimes**
  - Creation of peaked density profiles
  - Off-axis peaking of the bootstrap current and shear reversal, **PEP-mode ITB** with $T_e \sim T_i$ (JET, TFTR, DIII-D, C-MOD)
- **Core and edge particle transport studies**
  - **Density perturbations** of main species and impurity doped pellets for impurity studies (Ne, Ar, CH_4, …)
  - Tool for **L -> H mode transition** physics and pedestal control
- **Pellet injection can extend NSTX operating regime to high density -> high** b
  - A single 2.7mm D_2 pellet can more than double the maximum n_D achieved on NSTX
- **Also a diagnostic for q-profile determination**
  - Pellet cloud inclination leads to direct **measurement of q profile** for assessment of high β NSTX plasmas.