Tools for transient transport experiments on NSTX.

V. A. Soukhanovskii and NSTX Research Team
Princeton Plasma Physics Laboratory

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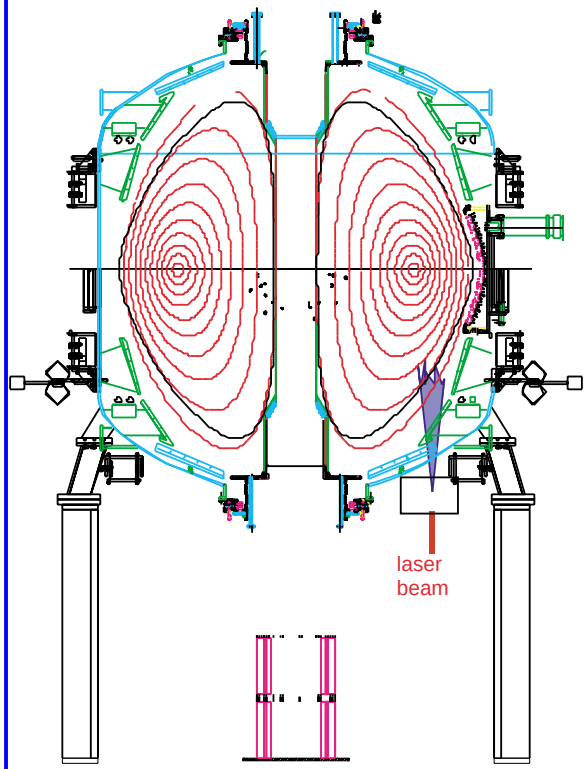
Impurity laser blow-off system has been proposed (2001)

LBO is a non-perturbative ablation of trace amount of impurity into plasma discharge



- Other impurity injection methods (gas puffs, erosion probes, powder injection, pellet injection)
- Non-perturbative to plasma:
  $\Delta n / n \sim 0.1$, $\Delta T / T \sim 0.1$,
  $\Delta V / V \sim 0.1$, $\Delta P / I V \sim 0.1$,
- Laser system: P ~ 50 J / cm^2
  $\therefore E \leq 3$ J, $\tau \sim 20$ ns
- LBO slide: film thickness 0.1 - 2 μm
  $\Rightarrow$ 10^16 - 10^18 atoms,
  Injected atoms: neutral, E ~ 2-3 eV
- Easy maintenance and control

Application to NSTX

Impurity transport

- Use existing plasma diagnostics: MPTS, probes, bolometry
- Spectroscopy: VUV spectrometers (GRITS, SPRED) $\Rightarrow \tau$
  SXR arrays: spatial and temporal evolution
- Injected impurities: low Z (lithium, carbon, fluorine),
  medium Z (aluminium, calcium)
- Multicomponent slides: for example, CaF_2 $\Rightarrow$ core and edge

MHD mode high contrast imaging

- Use multicomponent slides to "paint" core and edge modes

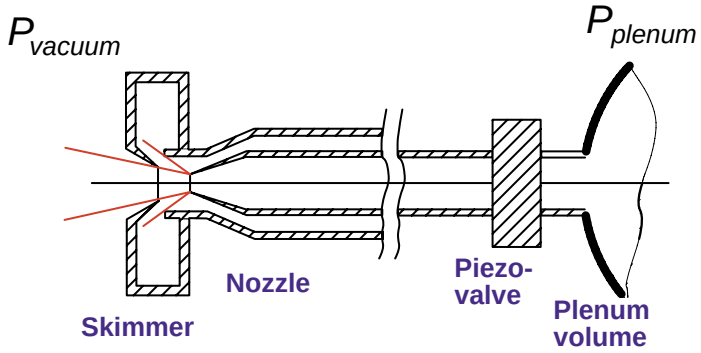
Perturbative transport studies

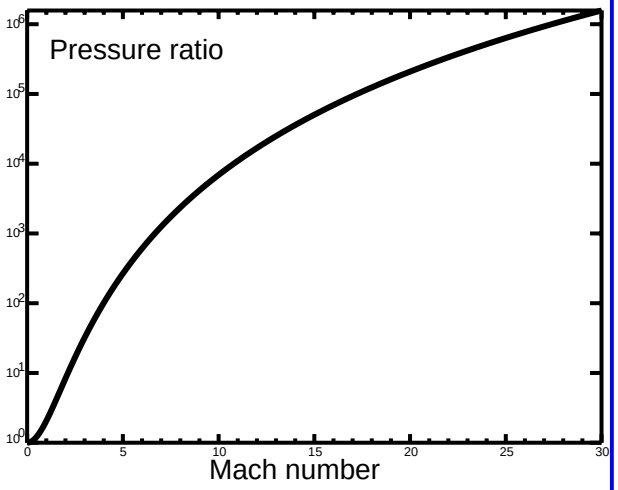
- Potential for "cold wave" propagation studies using EBW radiometer

Atomic physics studies in support of astrophysical mission needs

Supersonic gas injector has been proposed (2001)

Injector design and parameters





- Supersonic gas puff through nozzle : compressible flow of collimated beam of gas particles
- Estimated parameters: fueli ng rate 1 - 2 Torr l / s through mm nozzle (for pressure in plenum 2000 Torr) - Optimizations possible
- Similar desig ns have been used on TJ-1U torsatron (Madrid, Spain), HT-7, HL-1M tokamaks (China)

Applications

- Fueling and density control

  Main ionization source inside LCFS, collimated particle beam

- Particle transport studies

  - Impurity transport (inexpensive and simple alternative to laser blow-off system)
  - Cold pulse propagation experiments

  Delta function -like spatial and tempoal deposition profile

- SOL diagnostics: helium line intensity ratios for measuring electron temperature and density in the SOL (will work well with existing spectroscopy)