

# **Experiments with supersonic gas injector on NSTX**

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**In collaboration with**

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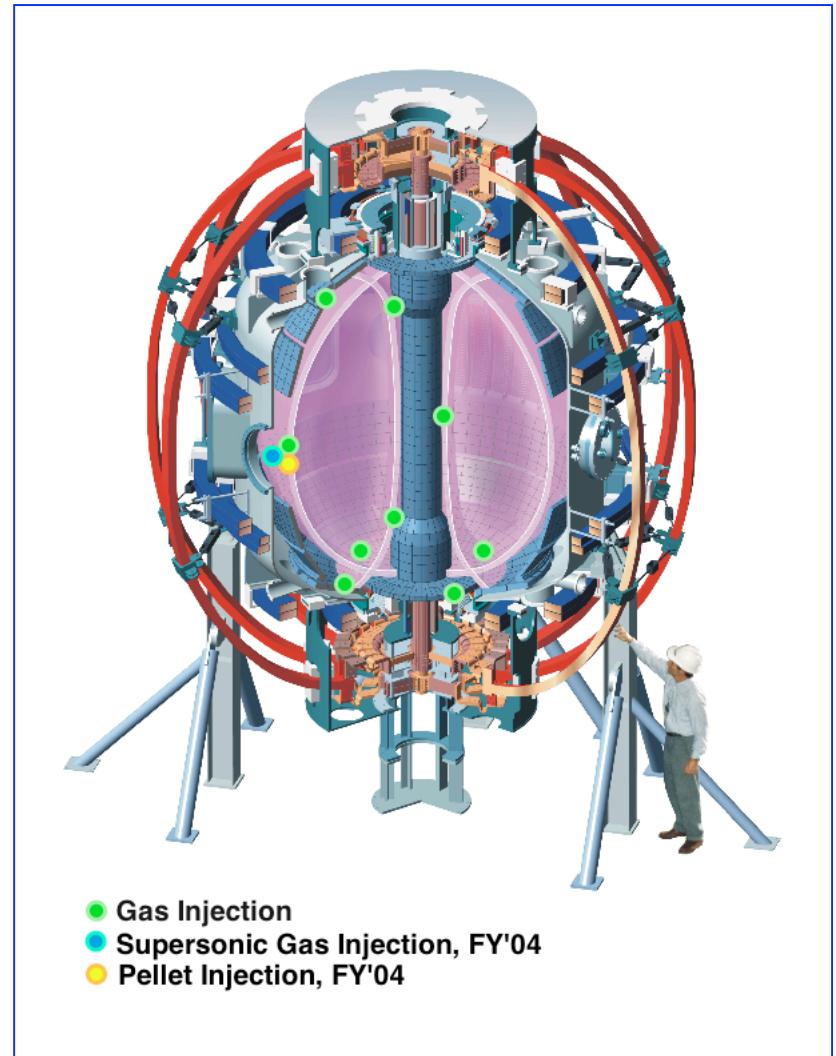
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## Supersonic gas injector on NSTX

- Concept first implemented in 1993 in China on HL-1 (L. H. Yao)
- Proposed for NSTX in 2001
- At present tried on HT-7, HL-1M, Tore Supra, W-7AS, ET, **CDX-U**
- Inject high pressure/density collimated gas jet into plasma
- NSTX can lead this effort in US
- International collaborations
- **Need XMP for comissioning, XP for fueling studies on NSTX**
- Can run early if SGI is ready

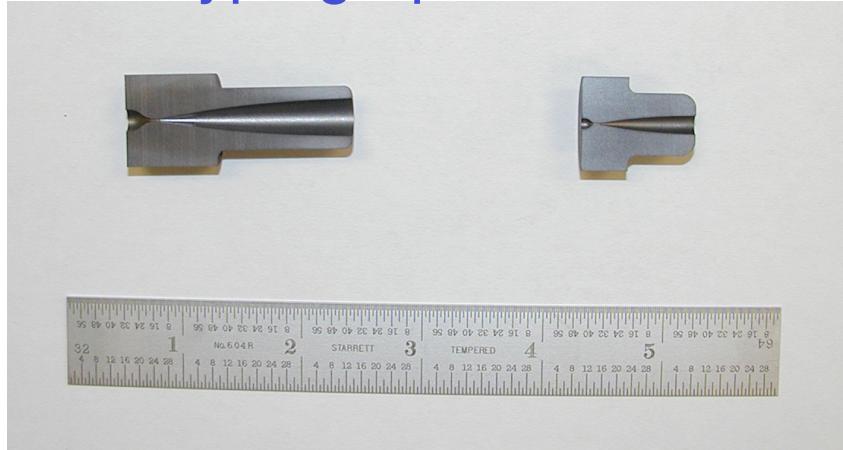


## Supersonic gas nozzle

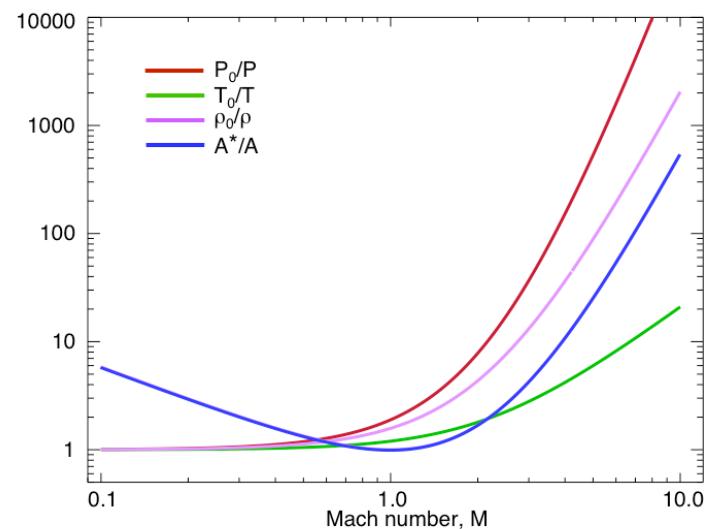
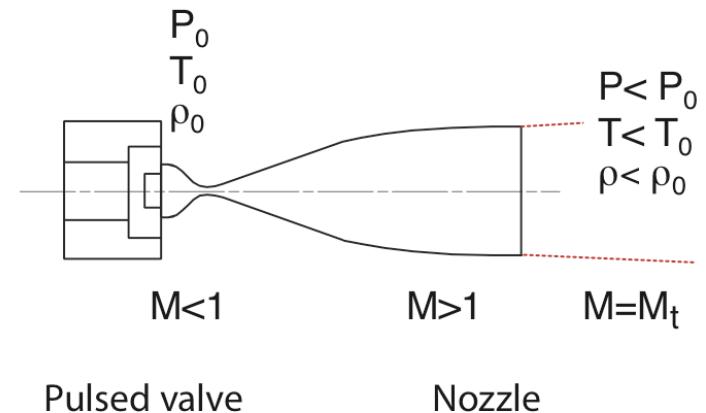
Technology is well developed - aerospace and molecular beam research and industry

- Molecular beam: simple convergent nozzle with skimmers
- High pressure gas jet: contoured nozzle (e.g. Laval)

### Prototype graphite Laval nozzle



Design courtesy of Baumgartner & Smits (Princeton U.)



# Fueling experiments with D<sub>2</sub>

## Ohmic L-mode plasmas

- Determine fueling rate and efficiency
- Determine change in edge plasma conditions ( $T_e$ ,  $n_e$ ,  $n_0$ , MHD modes, plasma rotation, impurities)
- Determine impact on core plasma performance ( $\langle \Psi_e \rangle$ ,  $\langle \Psi_b \rangle$ ,  $E_{stored}$ )
- Attempt to raise density quickly in t=0.0 - 0.1s for **target plasma formation**
- Monitor divertor detachment

## Aux. Heated L- and H-mode plasmas

- All from above +
- Determine **compatibility with H-mode operation**
- Determine **compatibility with HHFW heating**

# Diagnostic applications

- Impurity injection (He, N<sub>2</sub>, Ne)
- Electron transport studies using cold pulse propagation measurements
- Disruption mitigation (?)
- He line ratio spectroscopy for edge T<sub>e</sub>, n<sub>e</sub> profile measurements

(Keiser spectrometer & CCD - **available** from PPPL, He grating **available** from MIT)

- Measure helium line intensity radial profiles using imaging spectrometer
- Lines:  $\lambda_1 = 6678 \text{ nm}$ ,  $\lambda_2 = 7065 \text{ nm}$ ,  $\lambda_3 = 7281 \text{ nm}$   
 $I(\lambda_3)/I(\lambda_2) = f(T_e)$ ,  $I(\lambda_1)/I(\lambda_2) = f(n_e)$
- High quality atomic rates available
- Range of measurements:

$$10 < T_e < 100 \text{ eV}, 10^{12} < n_e < 10^{14}$$

