

Diagnostics of Non-Ideal Plasma by High Energy Proton Microscopy

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Non-Ideal Plasma

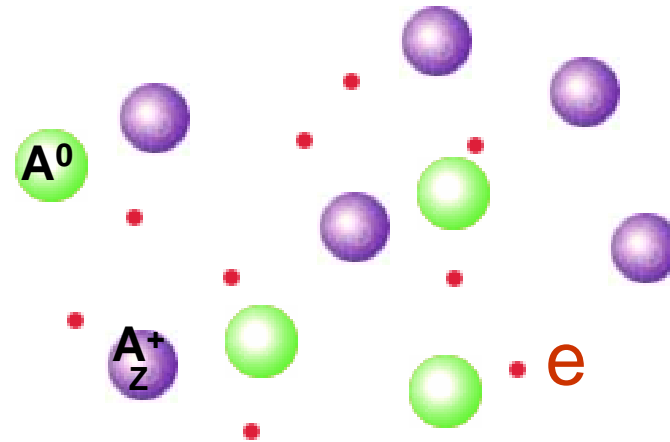
$\Gamma = W_c / W_{th}$ - parameter of Coulomb Coupling

W_{th} – kinetic energy

Coulomb interactions: $W_c \sim Z^2 e^2 n^{1/3}$

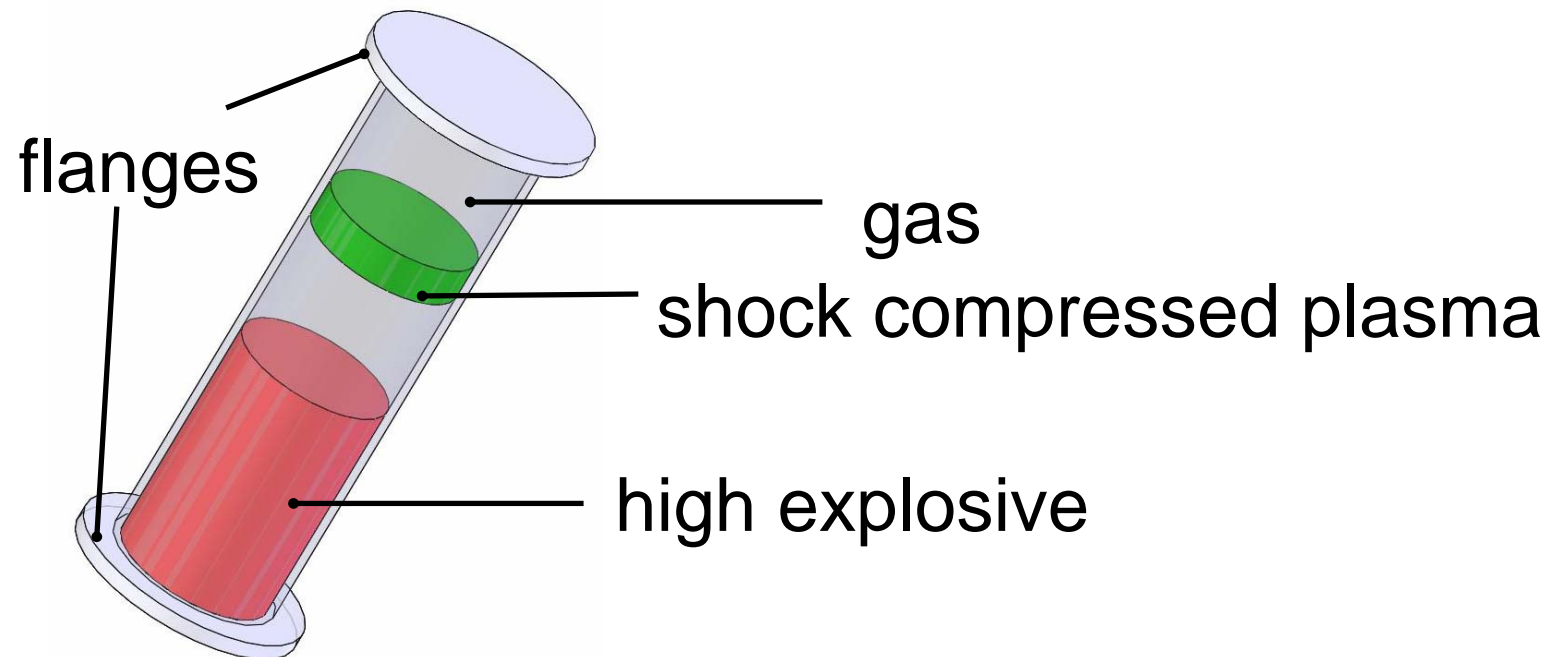
$\Gamma \ll 1$ – ideal plasma

$\Gamma > 1$ non-ideal plasma



Plasma Generation

shock compression of noble gases: Ar, Xe
in linear explosive generators



initial Pressure 1-5 Bar
shock wave velocities 4-6 km/s

Plasma Diagnostic

Global Task:

investigation of Equation of State

1. density distribution

2. shock wave front velocity

3. plasma velocity



+ temperature

Additional Task:

investigation of hydrodynamic effects

Typical Proton Radiography Setup at ITEP-TWAC Facility



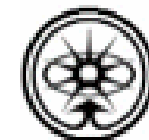
Explosive Chamber



Control Room



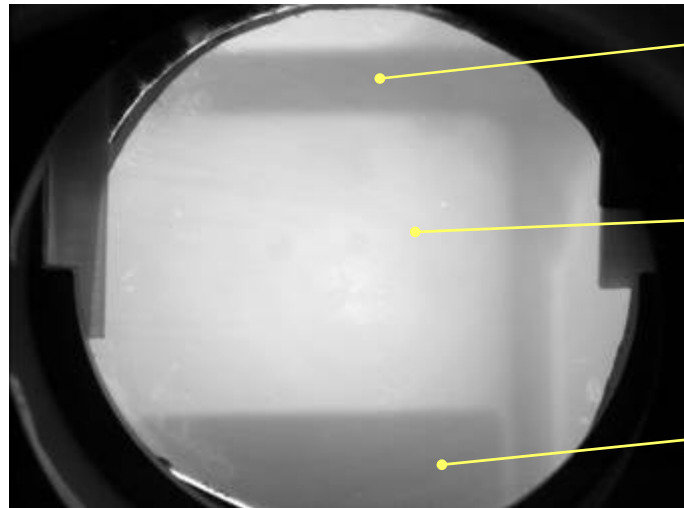
April 2010



ITEP

Typical Images

Before Experiment



20 mm

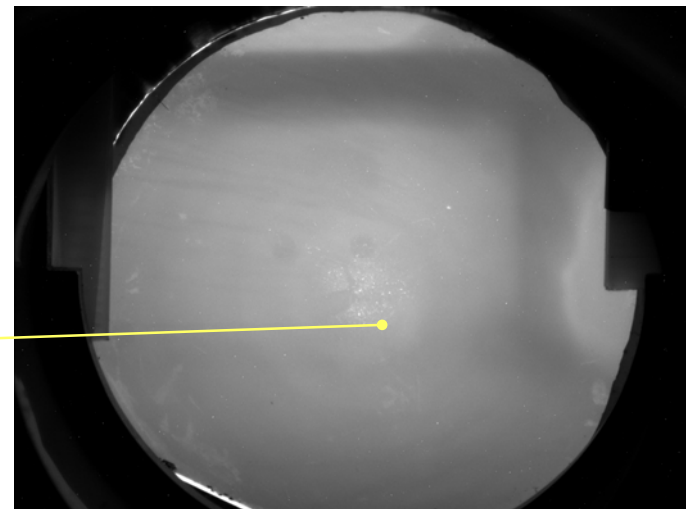
Flange

2.5 g/cm²

Argon $\sim 3 \times 10^{-3}$ g/cm² +
generator channel 0.4 g/cm²

TNT

Experiment



Expansion of
detonation products

Plans

1. Analyze experiments
2. New tests with increased initial linear gas density
(Ar->Xe, larger diameter of generator)

Thank You for Attention