Jet Velocity Analysis

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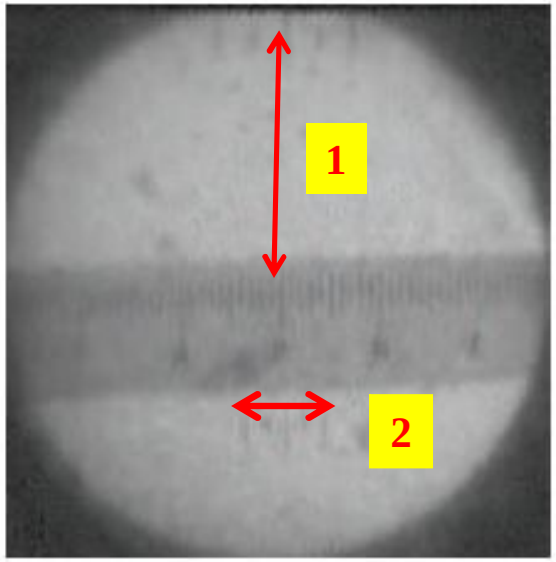
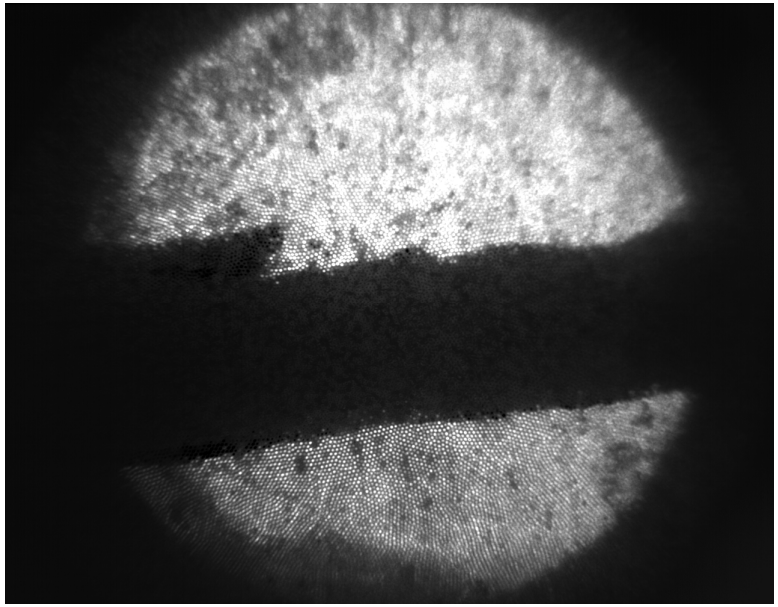
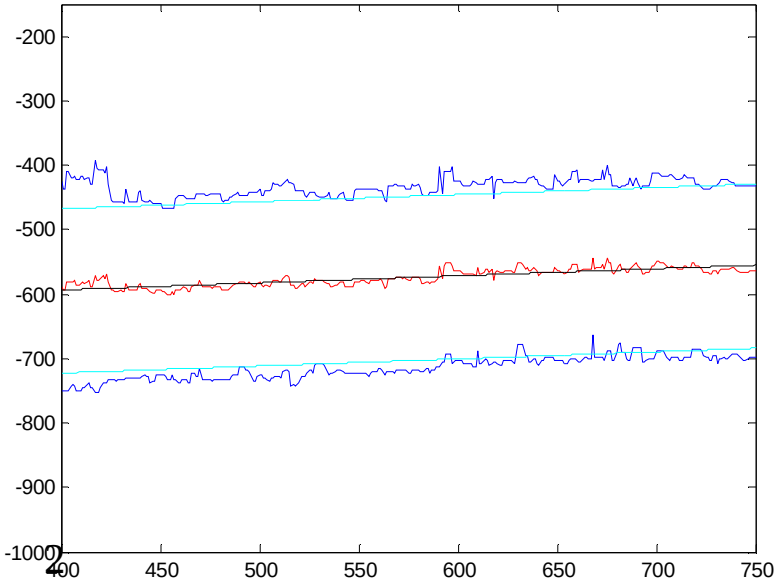
Image Processing Method For Data Analysis



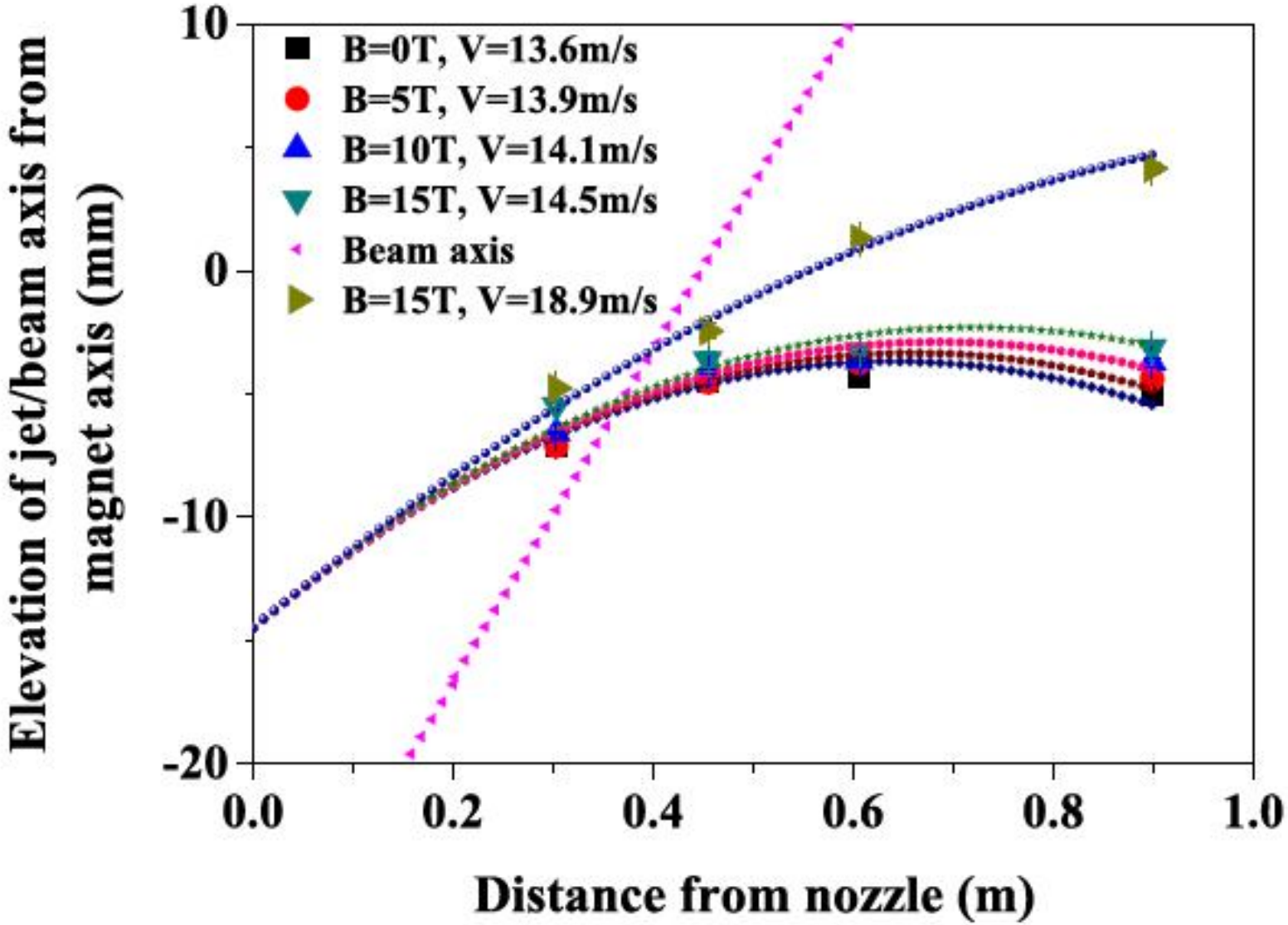
1. **Distance between fiducial center and cetner of window is 19 mm.**

2. **The fiducial length is 10 mm.**





Influence of Magnetic Field and Gravity on Jet Trajectory



Global Fitting of Jet Trajectory and Jet Parameters

Magnetic field (T)	Nozzle offset (mm)	Nozzle angle (milliradian)	Jet velocity (m/s)
0 T	-14.5 ± 1.0	33.8 ± 3.8	13.6 ± 0.9
5 T	-14.5 ± 1.0	33.8 ± 3.8	13.9 ± 0.9
10 T	-14.5 ± 1.0	33.8 ± 3.8	14.1 ± 1.0
15 T	-14.5 ± 1.0	33.8 ± 3.8	14.5 ± 1.0
15 T	-14.5 ± 1.0	33.8 ± 3.8	18.9 ± 2.3

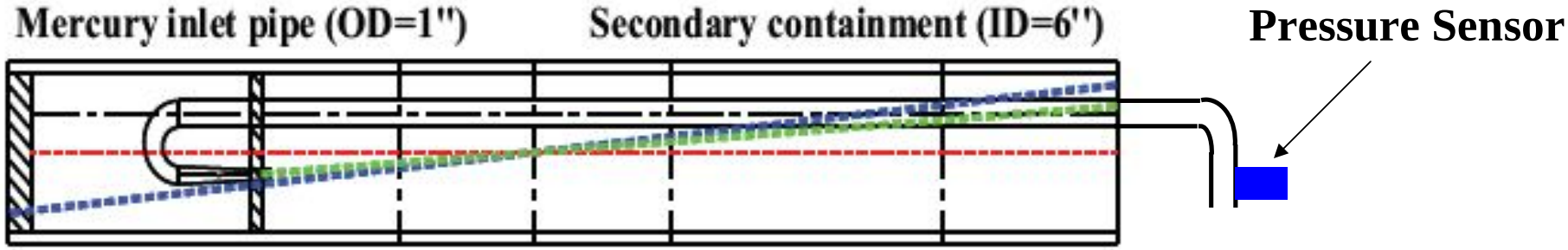
Designed Nozzle Parameters

Nozzle Position : -14.4 mm

Nozzle Angle : 2 degree (35 milliradian)

Jet Velocity : 15 m/s (20 m/s)

Geometry of Hg Deliverey Loop and Head Loss



Green, Mercury jet at 33 mrad to magnet axis Red, Magnet axis

Blue, Proton beam at 67 mrad to magnet axis

Geometry in pipe for mercury loop	Calculated pressure head loss	Percentage in total pressure head loss (%)
Friction by surface roughness	1.2212	26.9
Elbows in pipe bend (3 ×90°, 2 ×23°)	0.2265	5
Reducer, Contraction in nozzle	0.5645	12.5
Nozzle exit	2.5222	55.6

$$(h_{loss}) = K_1\frac{v_1^2}{2g} + K_2\frac{v_2^2}{2g} + \ldots + K_N\frac{v_N^2}{2g} ,$$

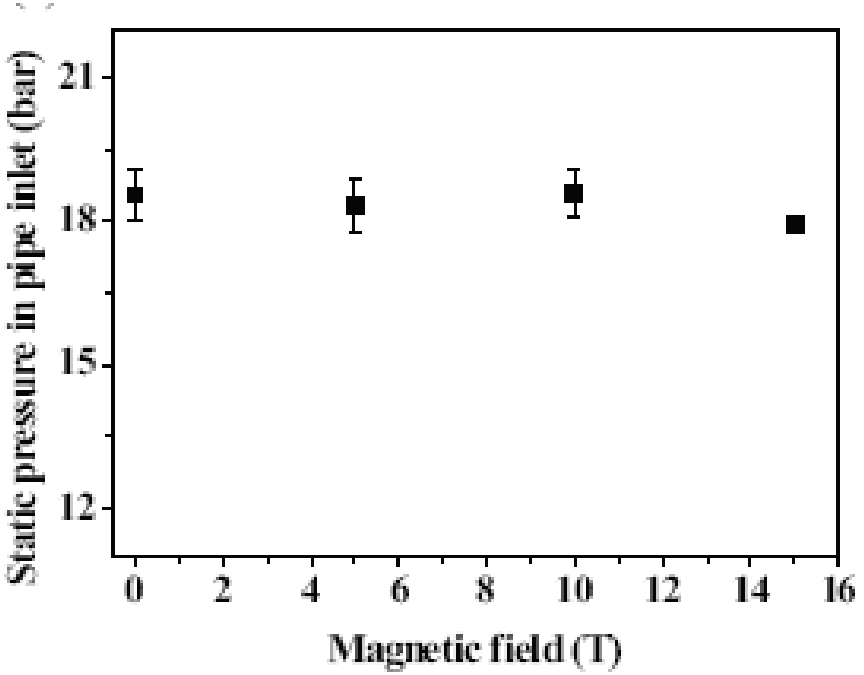
$$A_1v_1 = A_2v_2 = \ldots = A_Nv_N = A_Rv_R ,$$

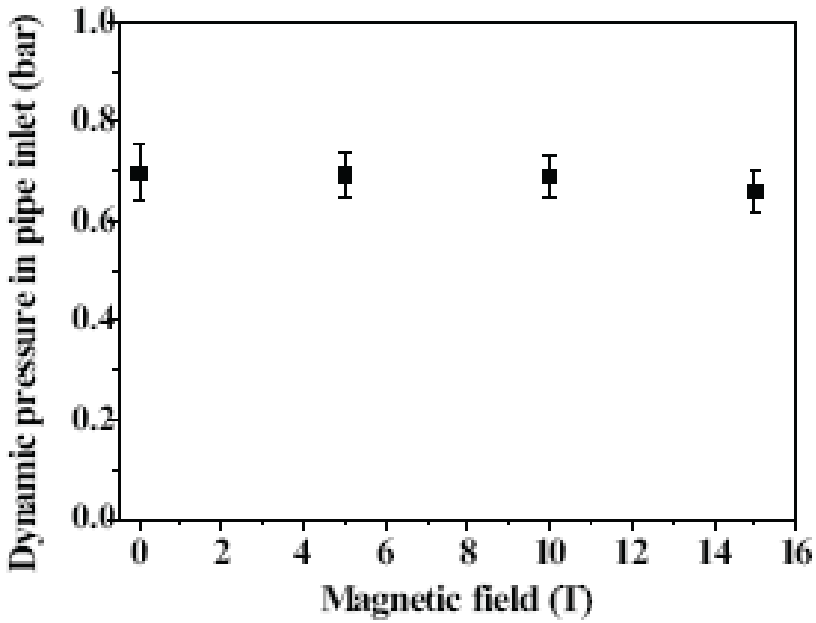
$$\int_1^2 \delta F = (h_{loss})_{1,2} = \frac{p_1 - p_2}{\rho g} + \frac{v_1^2 - v_2^2}{2g} + (z_1 - z_2) .$$

Jet Velocity after Nozzle Exit = 13.5 m/s

Jet Velocity before Nozzle Exit = 15.4 m/s

Pipe Inlet Pressure





Stagnation (Total) Pressure = Dynamic Pressure + Static Pressure

$$P_{\text{stagnation}} = \frac{1}{2}\rho v^2 + P_{\text{static}}$$

Jet Velocity in Magnetic Fields