Results of 2D Hg Jet Simulation and Experimental Data

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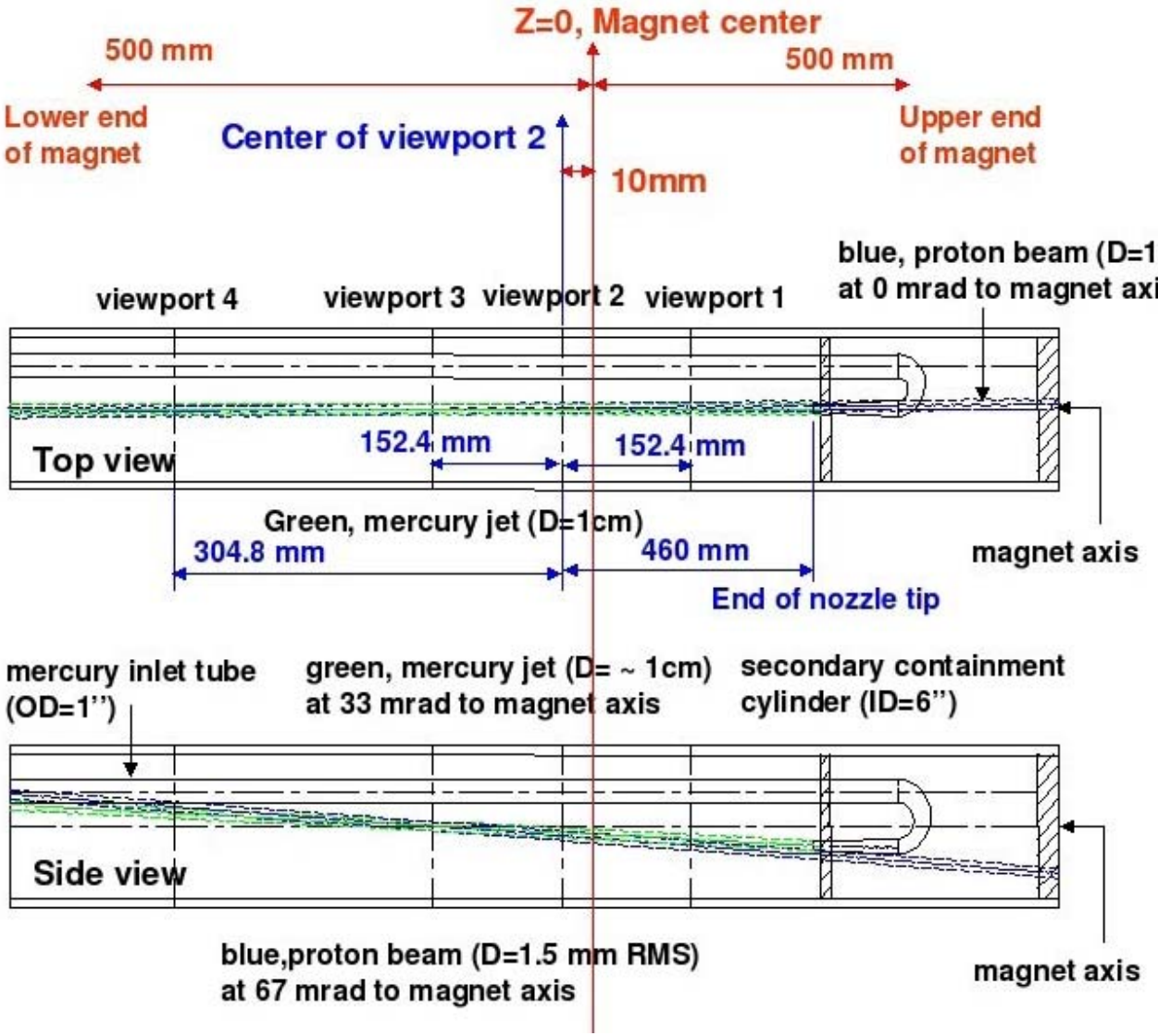
Problem Description

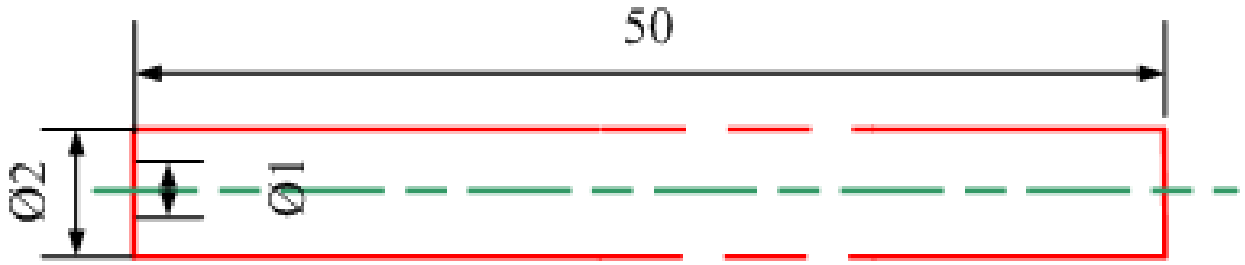


Viewport 1: 30cm away from nozzle exit;
Viewport 2: 45cm away from nozzle exit;
Viewport 3: 60cm away from nozzle exit;
Viewport 4: 90cm away from nozzle exit;

Sketch of the mercury free jet with MHD and energy deposition for the MERIT experiment

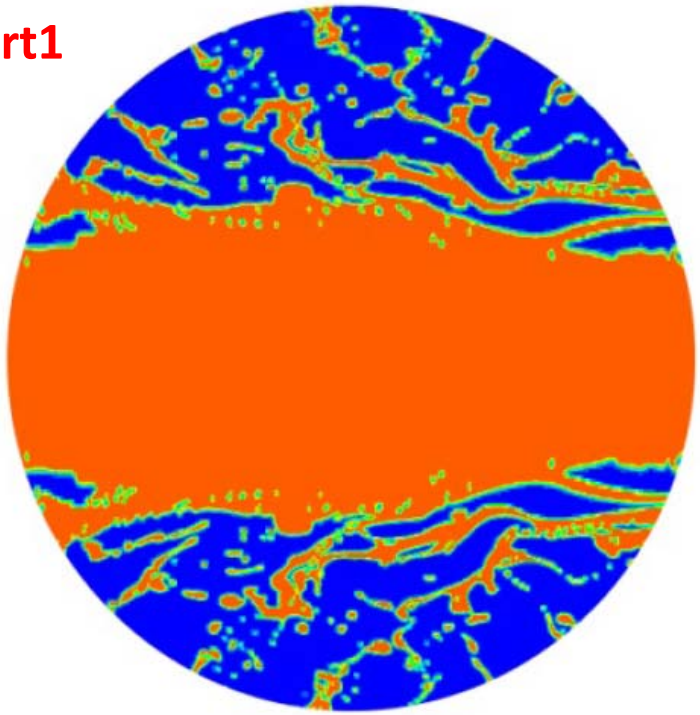
Simulation Results (t = 0.037s)

Simplified Model For Preliminary Simulation

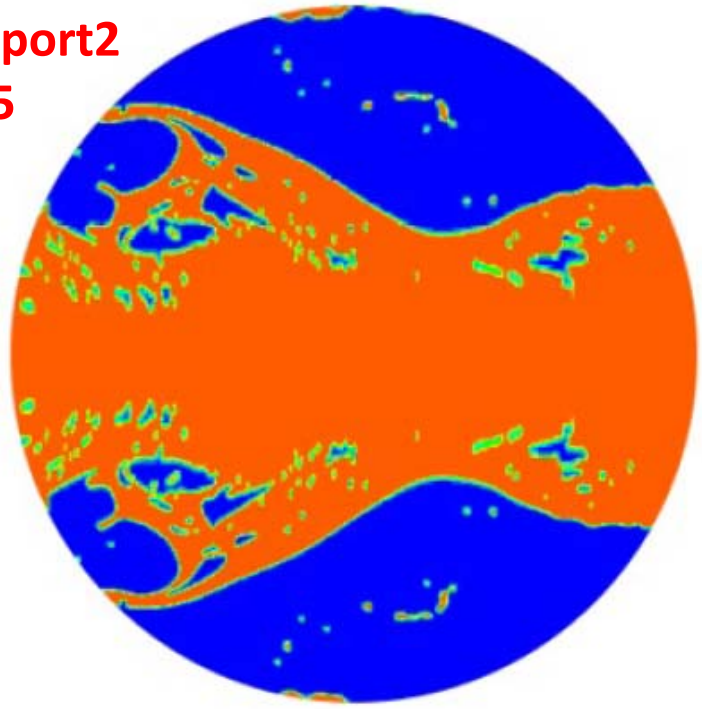


Grid number for halved model is 1,976,968 (width = 172, length = 11,494, Δx ≈ 4.437e-5 m).
One flow-through = 0.0255 s.

Viewport1
z = 30



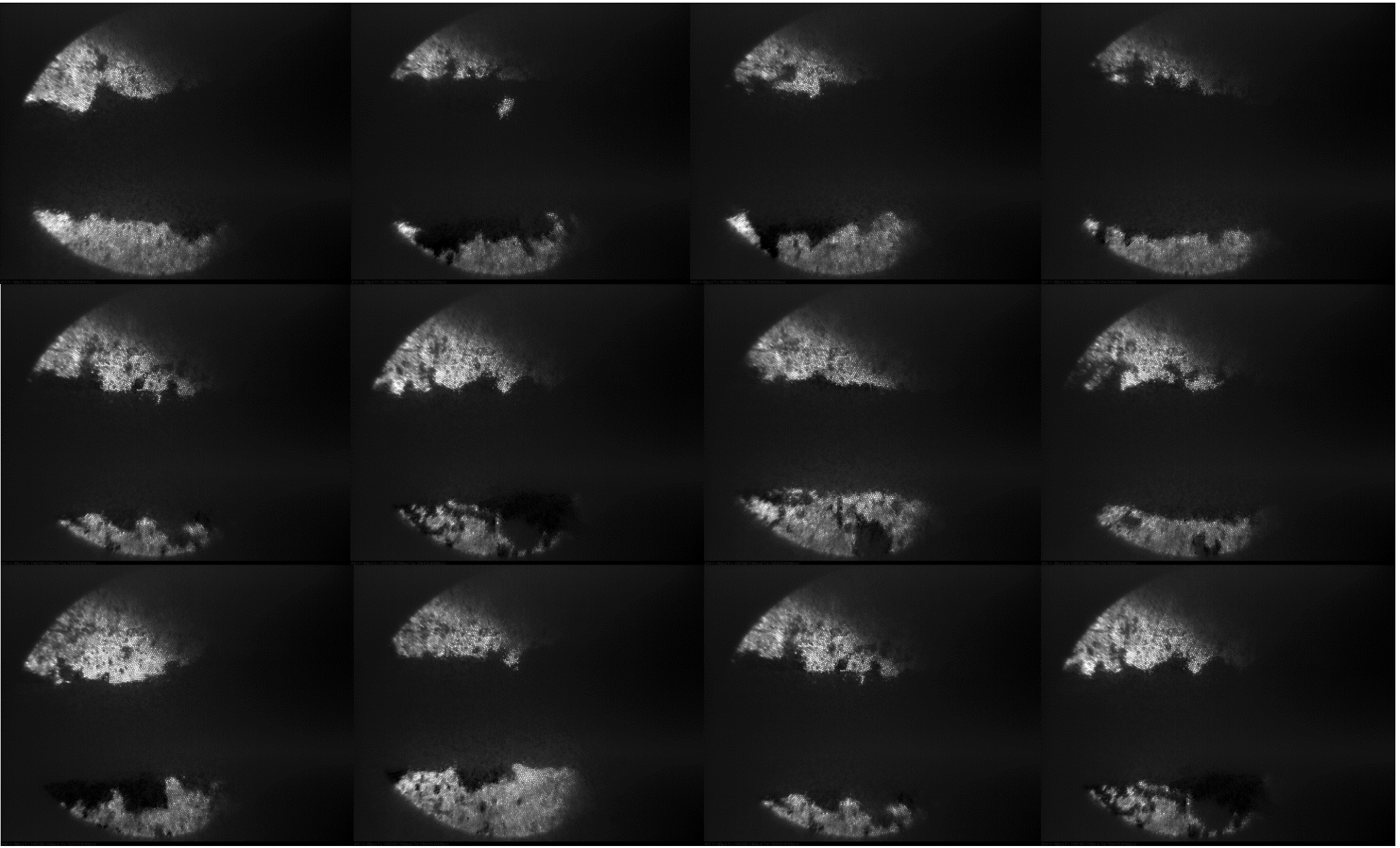
Viewport2
z = 45



	yan's simulation	Heejin's experiment
inlet velocity	bulk velocity of 20m/s	bulk velocity of 20m/s
mercury properties	density:13529 kg/m^3	density:13456 kg/m^3
	kinematic viscosity:1.12573e-7 m^2/s	kinematic viscosity:1.145e-7 m^2/s
	surface tension: 0.4855 N/m°C	surface tension: 0.4855 N/m°C
Reynolds number at the jet exit	1.776625e6	1.746725e6
transverse depth of the layer	computation domain with a reduced depth which is 0.02 m	0.1524 m
location of viewport 1	0.3 m away from the nozzle	0.3 m away from the nozzle
location of viewport 2	0.45 m away from the nozzle	0.45 m away from the nozzle

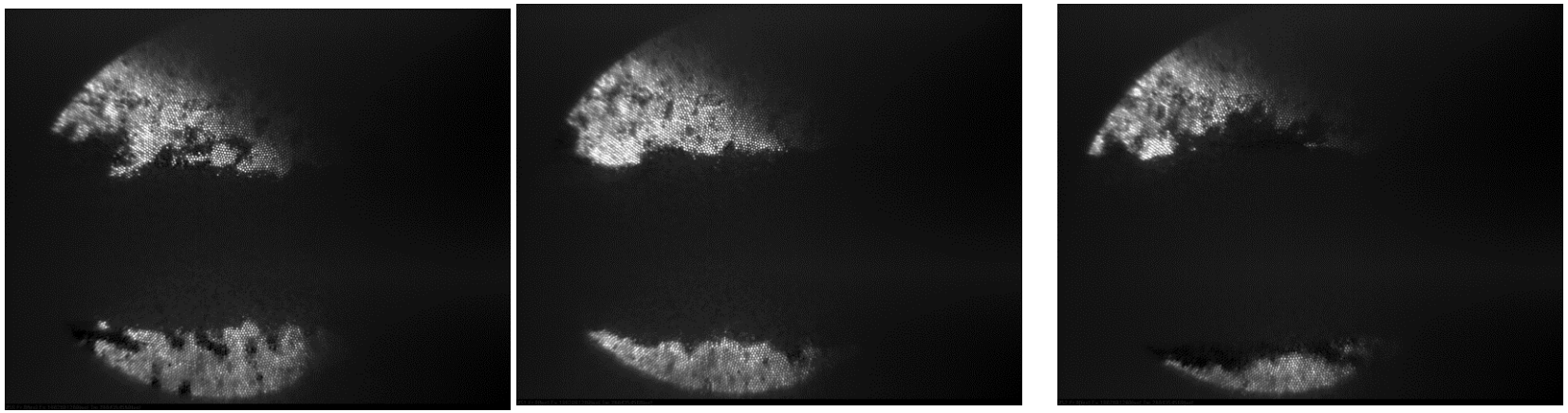
Experiment Results (20 m/s)

- Viewport 1



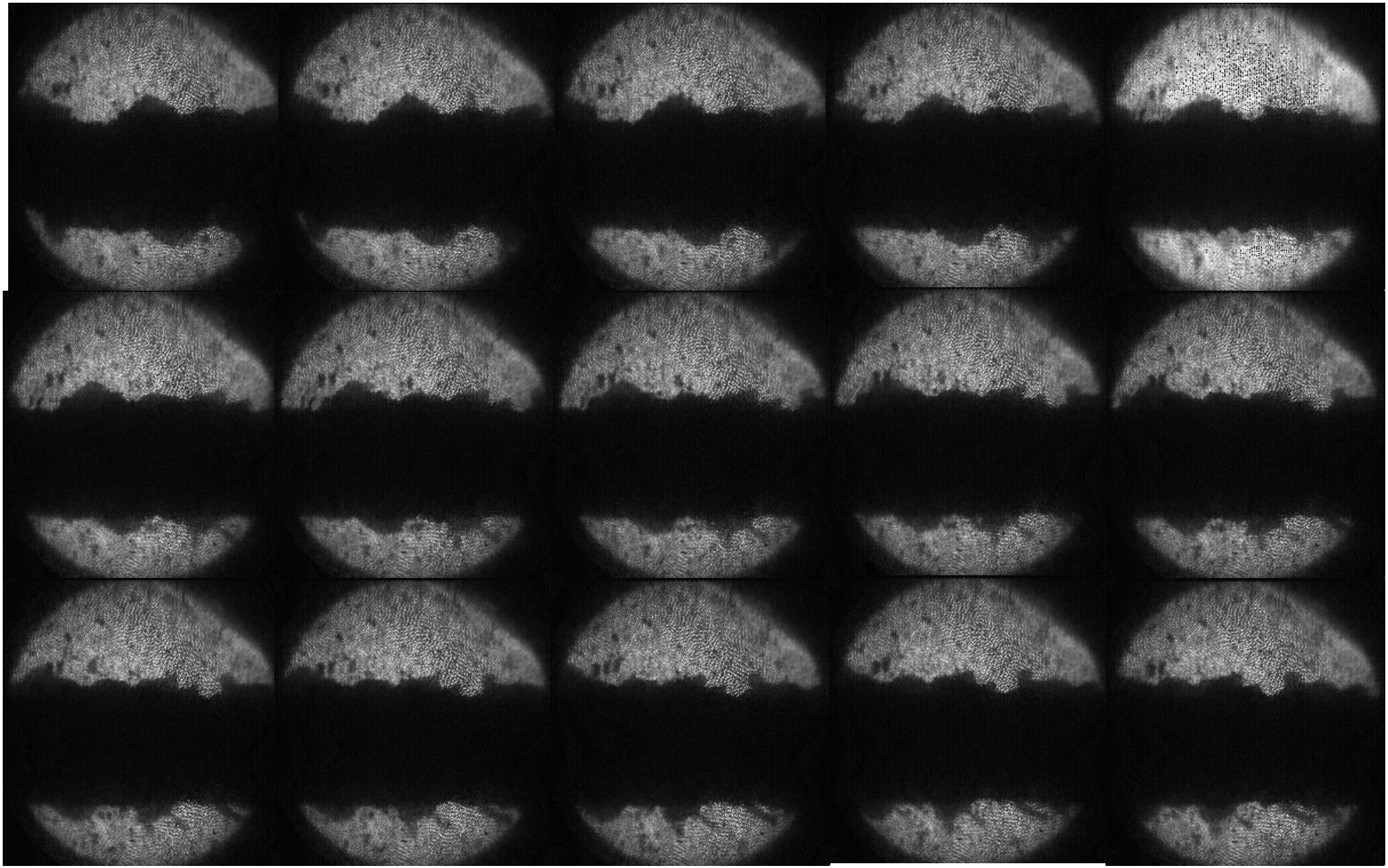
Experiment Results (20 m/s)

- Viewport 1

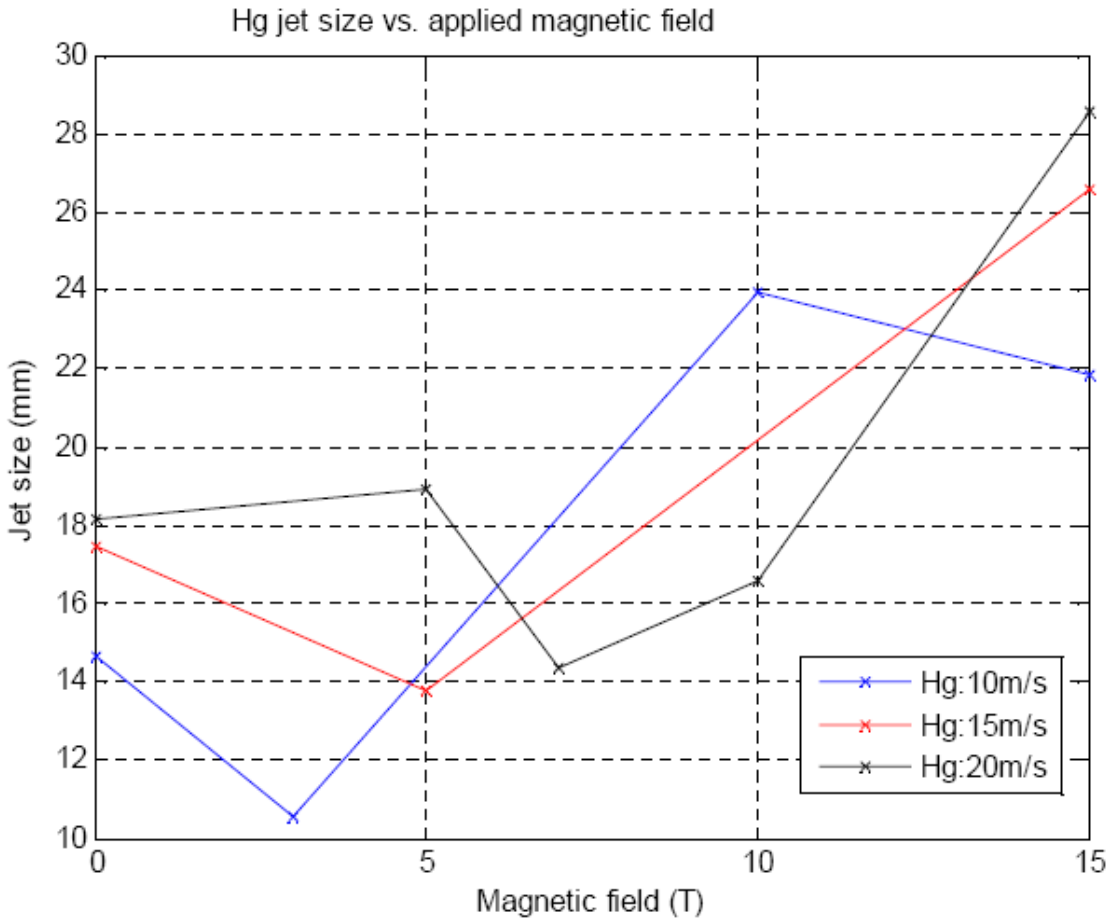


Experiment Results (20 m/s)

- Viewport 2



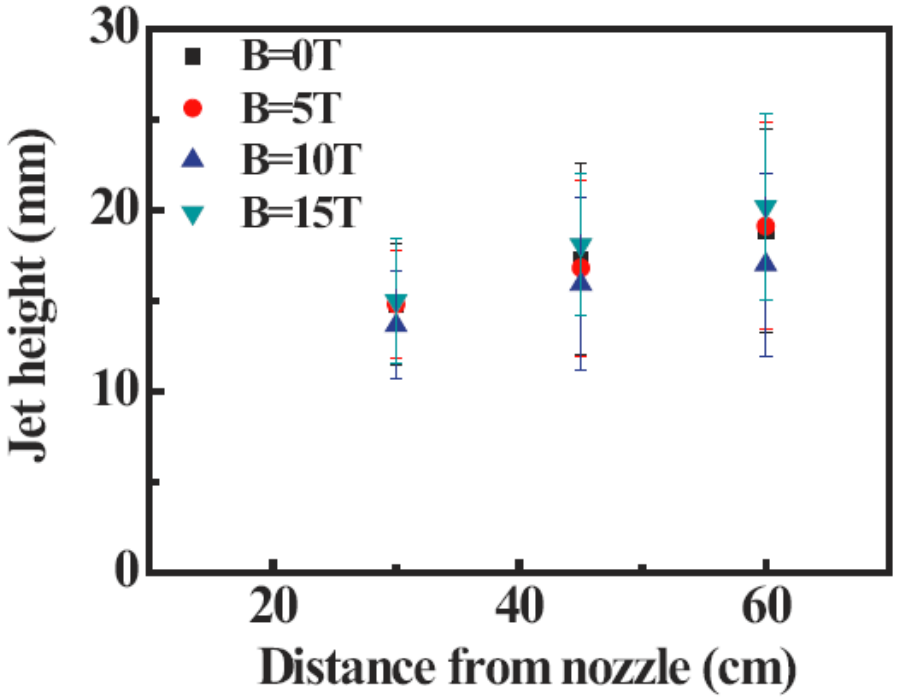
Jet Size At Viewport 2



Heejin Park, Optical Diagnostics, Experiment at MIT, March2~March3,2007

When T = 0, jet size at viewport2 is 18.2mm (Hg:20m/s) and 17.3mm (Hg:15m/s)

Jet Size For 15 m/s Hg Jet



Hg:15m/s

	0T	error	5T	error	10T	error	15T	error
30 (vp 1)	**14.83464**	**3.34655**	14.79571	2.99139	13.64166	2.9666	15.00912	3.39786
45 (vp 2)	**17.29619**	**5.29605**	16.79944	4.83743	15.90382	4.7509	18.10419	3.91201
60 (vp 3)	**18.83415**	**5.61034**	19.11242	5.68621	16.99188	5.01408	20.18525	5.10874

Discussion

- Mercury jet reaches the wall
- Size of viewport is 5cm according to Heejin
- Jet Size is more than 2cm when velocity is 20 m/s

✓ **Need larger width for the computational domain**