Measurements of Dynamic Characteristics of Hg Jet Stream

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Purpose : To measure velocity and distortion of jet stream and verify the hydro-dynamic phenomenon experimentally

Condition

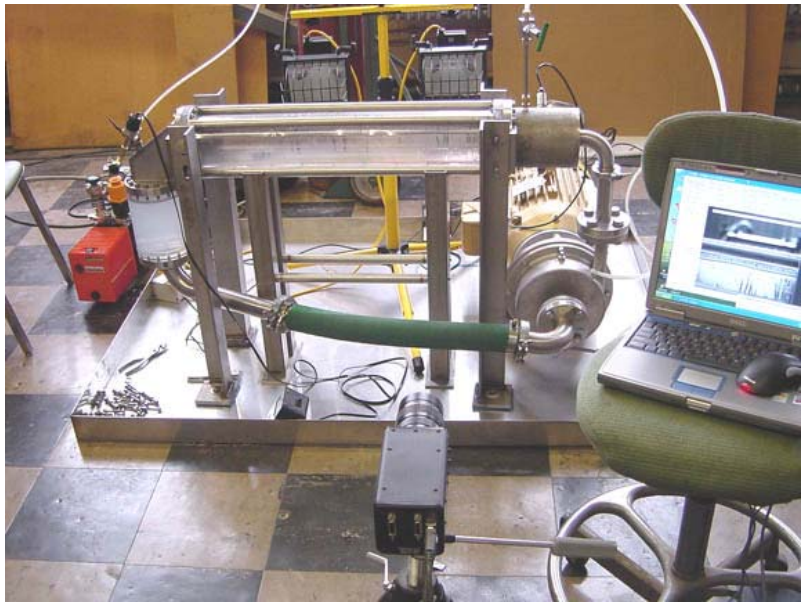
- Atmospheric
1.01295 x 105 Pa or N/m2
14.696 PSI or lb/in2
760 torr or mm Hg
- Vacuum
1/3 level of atmospheric condition

Test Plan

Condition	Atmospheric	Vacuum
Tapered brass nozzle (L=1 in)	Done	Done
Straight steel nozzle (L=6 in)	Done	Done
Tapered steel nozzle (L=0)	Done	No
Hole only (L=0.5 in)	Done	No

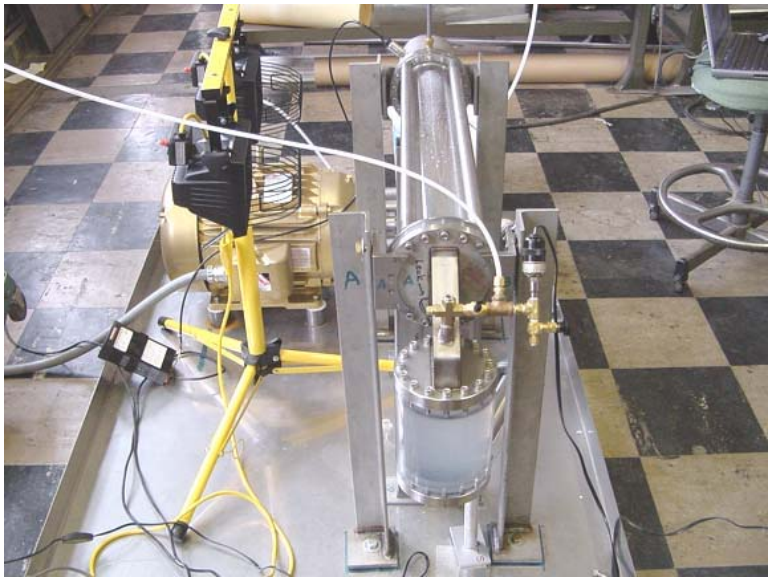
Experimental Setup

Front view



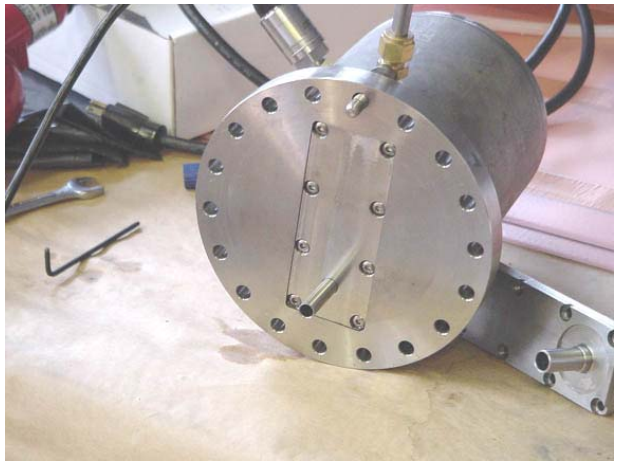
Left side view

Right side view



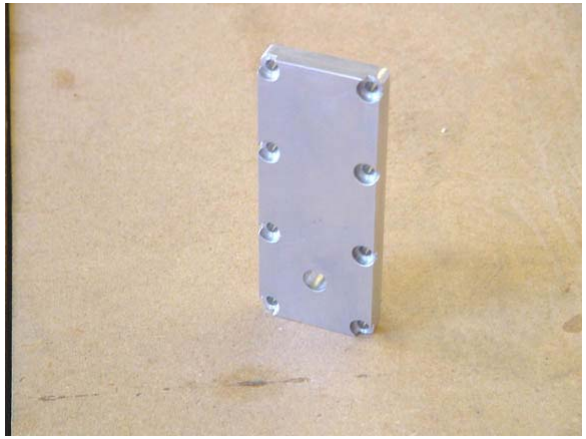
Nozzle Geometry

Straight steel nozzle



Tapered brass nozzle

Hole nozzle



Tapered steel nozzle

Configuration

High Speed Camera Setting

Frame Rate (fps)	2500
Exposure Time (μs)	200
Resolution	1280×200

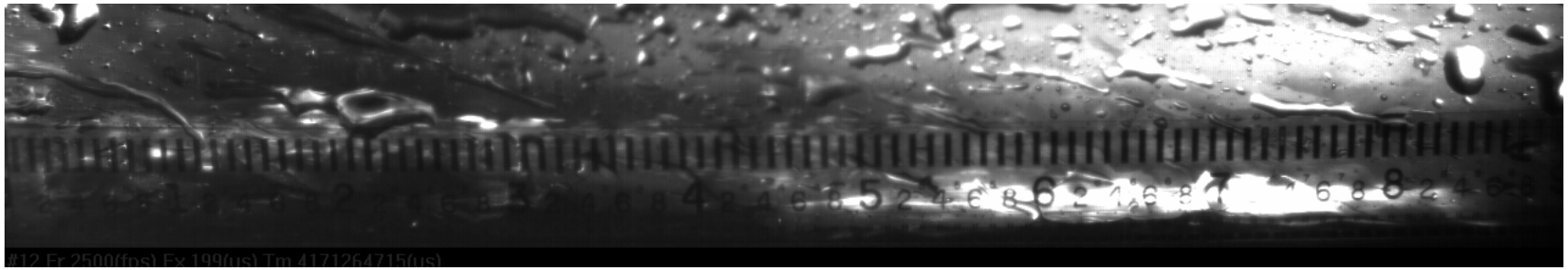
Distance Setting

	Distance from Nozzle	
	in	cm
front	4	10
center	15	37.5
rear	23	57.5
Total	27	67.5

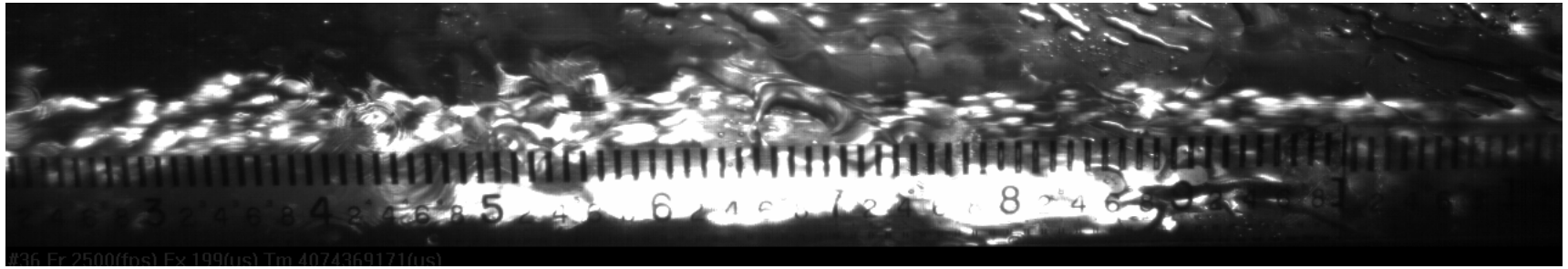
Captured Images

Brass Nozzle (atmospheric)

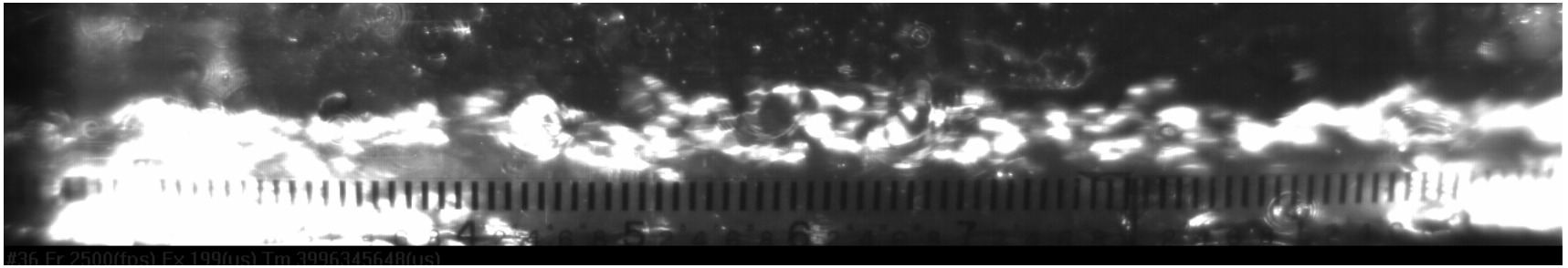
Front Region



Middle Region



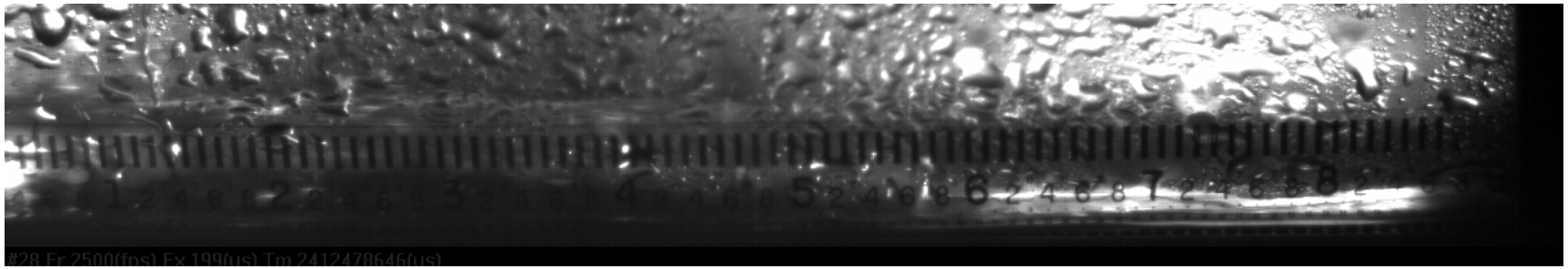
Rear Region



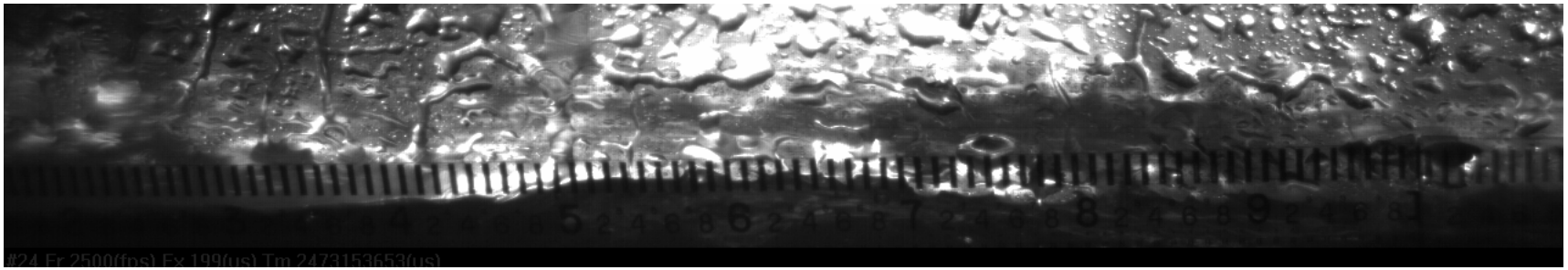
Captured Images

Brass Nozzle (vacuum)

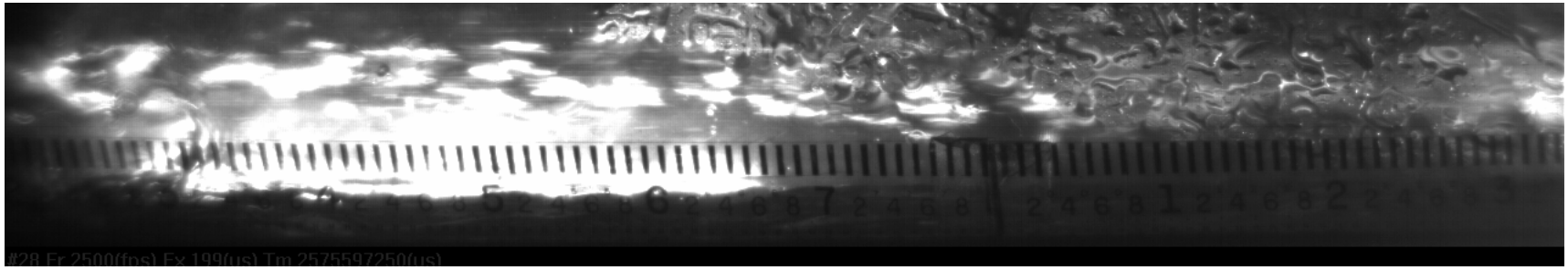
Front Region



Middle Region



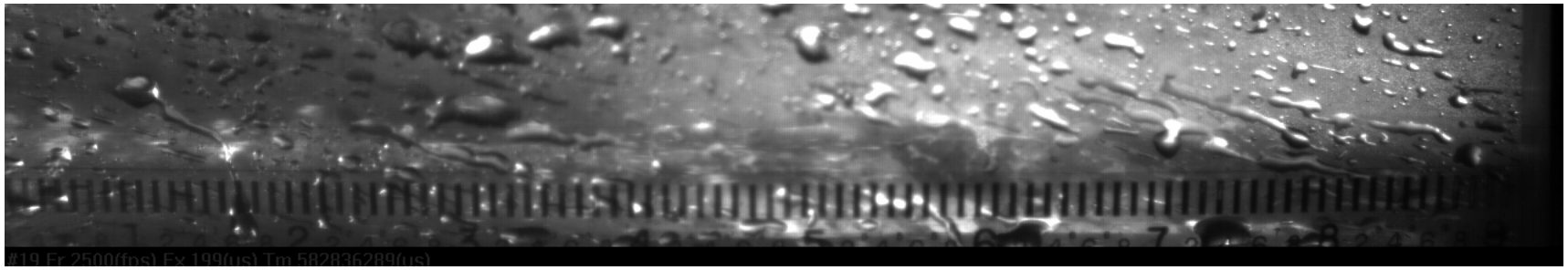
Rear Region



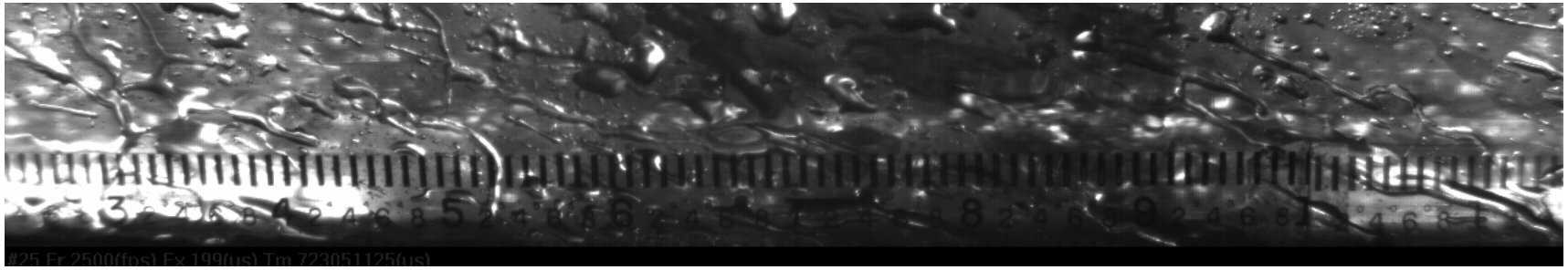
Captured Images

Straight Steel Nozzle (atmospheric)

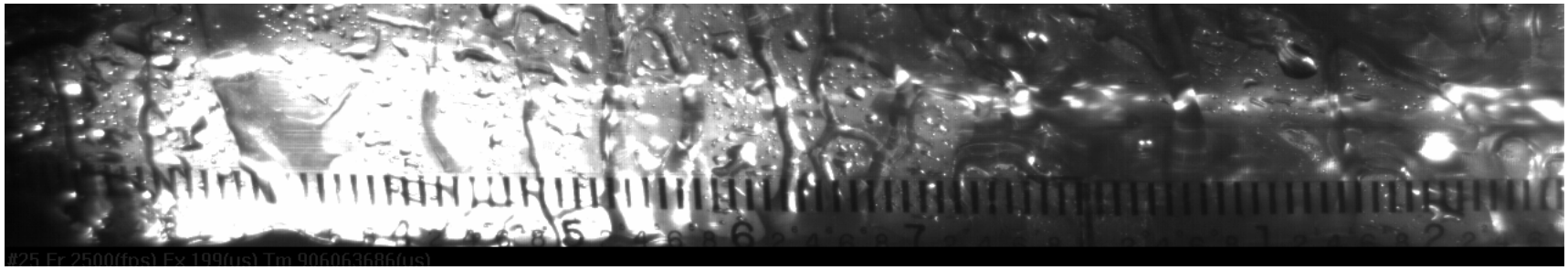
Front Region



Middle Region



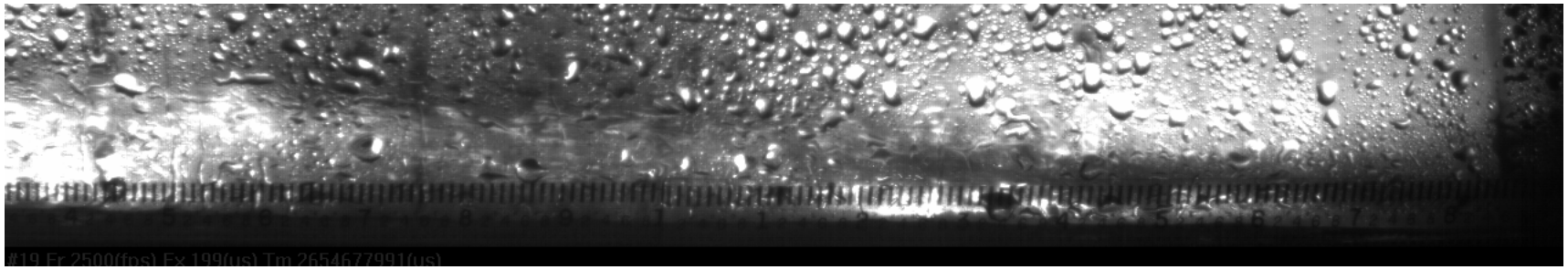
Rear Region



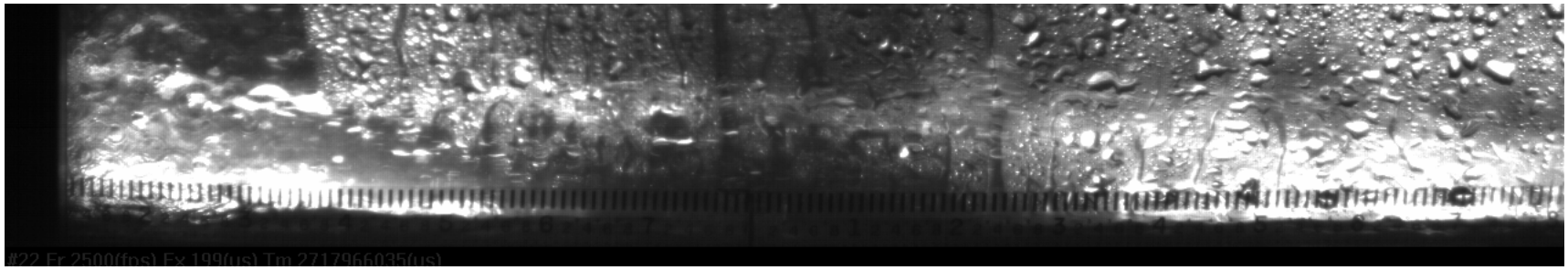
Captured Images

Straight Steel Nozzle (vacuum)

Front Region



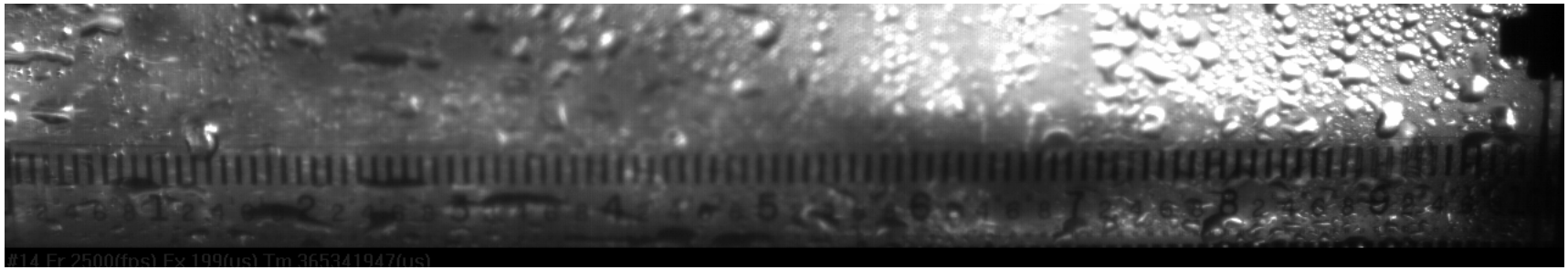
Rear Region



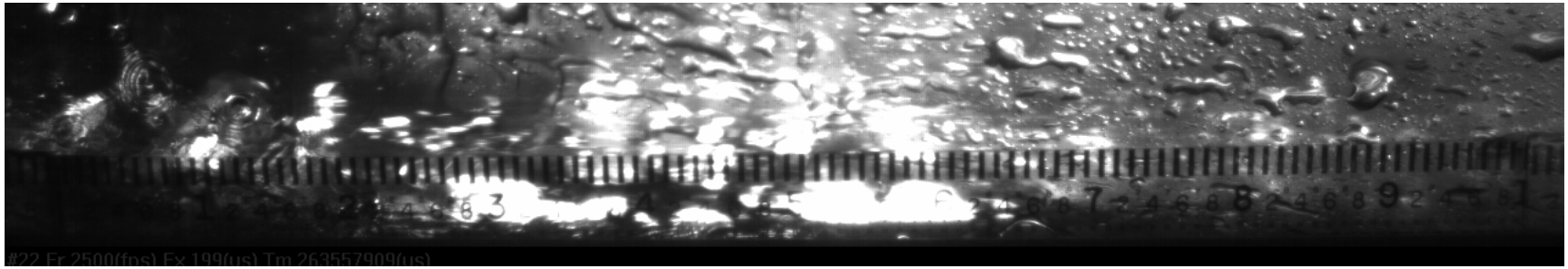
Captured Images

Tapered Steel Nozzle (atmospheric)

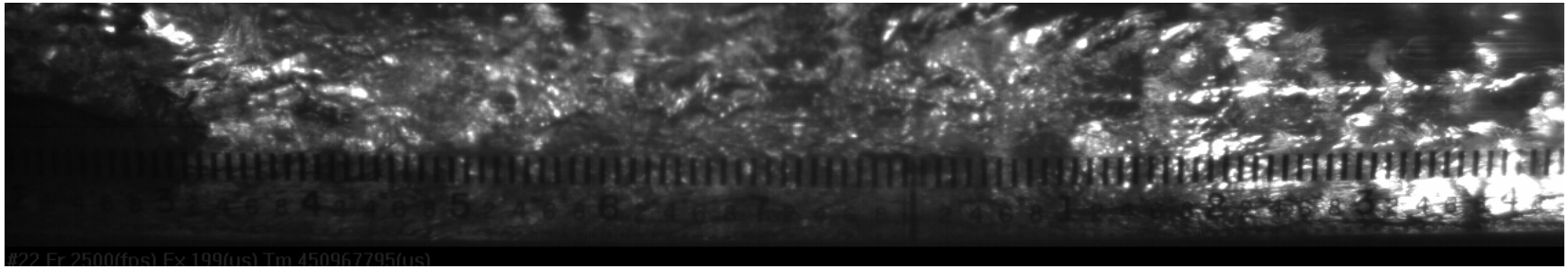
Front Region



Middle Region



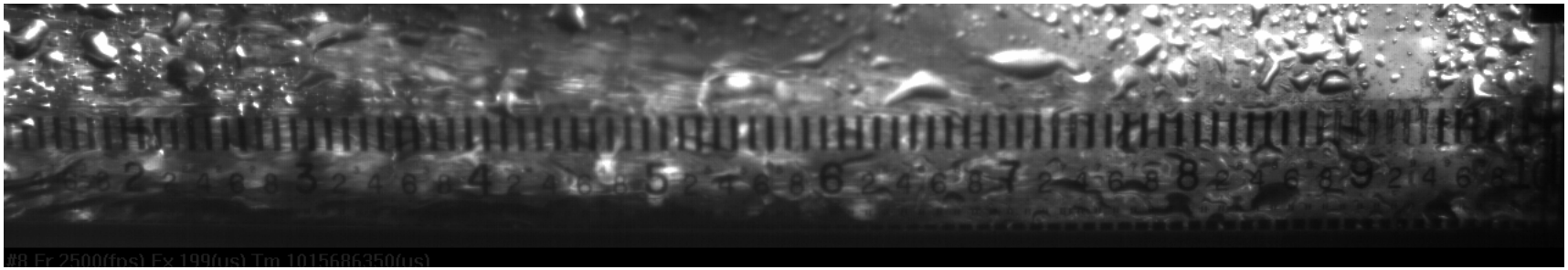
Rear Region



Captured Images

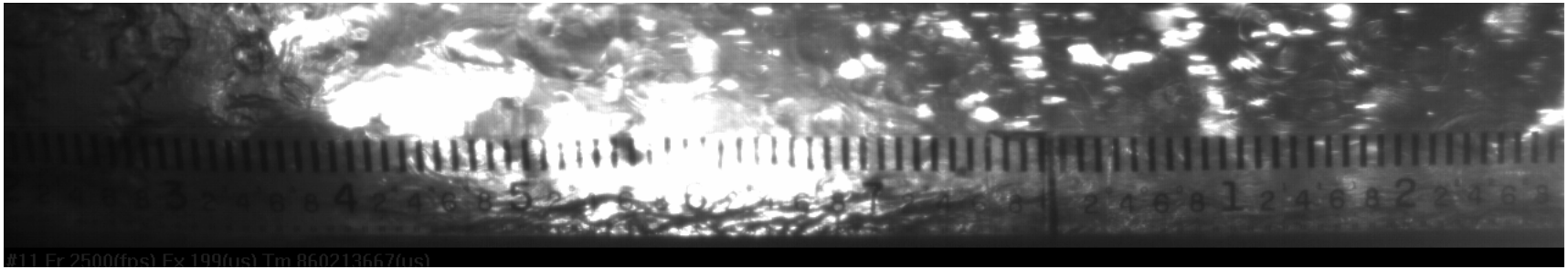
Hole Nozzle (atmospheric)

Front Region



Middle Region

Rear Region



Results

	Tapered Brass Nozzle (atmospheric)			Tapered Brass Nozzle (vacuum)		
	Front	Center	Rear	Front	Center	Rear
Distance (in)/Frame	0.2	0.2	0.2	0.25	0.25	0.25
Distance (m)/Frame	0.005	0.005	0.005	0.00625	0.00625	0.00625
Time (s)/Frame	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
Velocity (m/s)	12.5	12.5	12.5	15.625	15.625	15.625
Distortion	uniform	uniform	disperse	uniform	uniform	disperse

	Straight Steel Nozzle (atmospheric)			Straight Steel Nozzle (vacuum)		
	Front	Center	Rear	Front	Center	Rear
Distance (in)/Frame	0.3	0.2	0.2	0.3	0.25	0.25
Distance (m)/Frame	0.0075	0.005	0.005	0.0075	0.00625	0.00625
Time (s)/Frame	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
Velocity (m/s)	18.75	12.5	12.5	18.75	15.625	15.625
Distortion	uniform	disperse	disperse	uniform	disperse	disperse

Results

	Tapered Steel Nozzle (atmospheric)		
	Front	Center	Rear
Distance (in)/Frame	0.2	0.2	0.18
Distance (m)/Frame	0.005	0.005	0.0045
Time (s)/Frame	0.0004	0.0004	0.0004
Velocity (m/s)	12.5	12.5	11.25
Distortion	disperse	disperse	disperse

	Hole Nozzle (atmospheric)		
	Front	Center	Rear
Distance (in)/Frame	0.2	0.2	0.15
Distance (m)/Frame	0.005	0.005	0.00375
Time (s)/Frame	0.0004	0.0004	0.0004
Velocity (m/s)	12.5	12.5	9.375
Distortion	disperse	disperse	disperse

Reference

atmosphere	**bar**	**1.01295**
atmosphere	**dynes/cm^2**	**1.01295 x 10^6**
atmosphere	**in. Hg**	**29.9213**
atmosphere	**in. water**	**406.86**
atmosphere	**kg/cm^2**	**1.03325**
atmosphere	**mbar**	**1012.95**
atmosphere	**mtorr or micron Hg**	**7.6 x 10^5**
atmosphere	**Pa or N/m^2**	**1.01295 x 10^5**
atmosphere	**PSI or lb/in^2**	**14.696**
atmosphere	**torr or mm Hg**	**760**