

Disdrometer Imaging System (DIS)

Droplet and Particle Imaging

Droplet size, morphology, and concentration measurements

Droplet velocity measurements

Large field of view

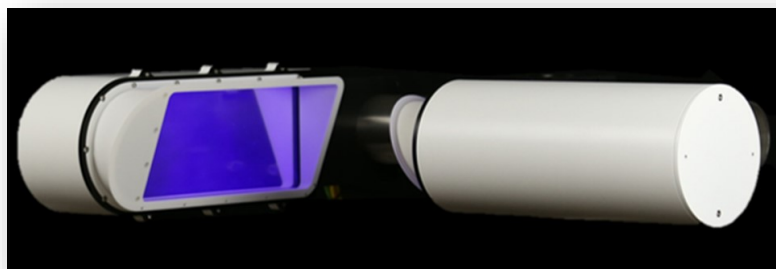
Pulsed illumination

Water-tight enclosure

Disdrometer Imaging

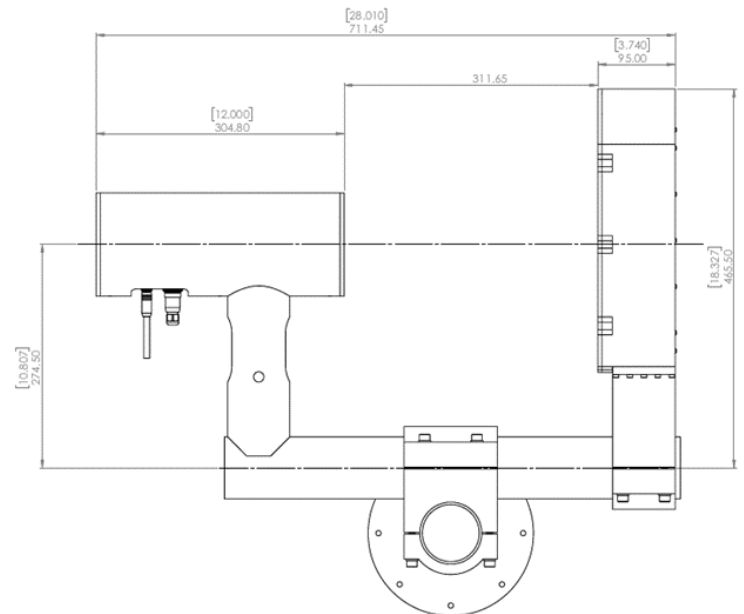
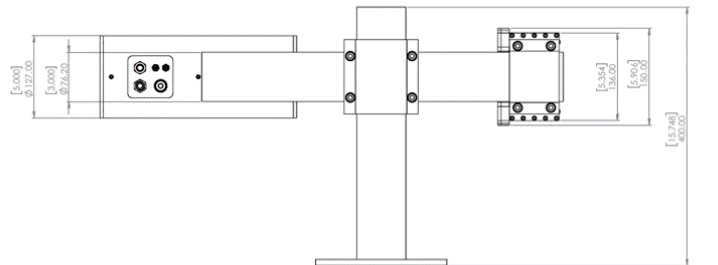
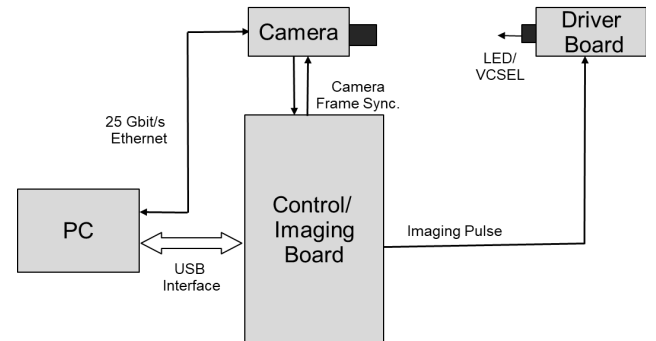
Measuring precipitation-simulated rain fields, snow fall, and hail are of significant importance in meteorology. Additionally, developers of hypersonic flight systems have urgent requirements for assessing the suitability of various aerospace materials that can withstand exposure to rain and other atmospheric conditions while these systems travel through the atmosphere. Under rain (or snow) conditions, there is a need to understand the reaction to the materials as a result of impacts with the mass, size, and quality of raindrops and how these impacts damage the vehicle materials.

Artium Technologies has developed Disdrometer Imaging Systems (DIS) to measure droplet and particle size, morphology, and concentration, as well as velocity using Particle Tracking Velocimetry (PTV). The Disdrometer is rugged and can withstand rough handling, shocks, and vibrations. Image illumination has enhanced uniformity and homogeneity which minimizes sensitivity of image processing methods to variations in background light intensity. The image capture area has a 2 to 1 aspect ratio with an overall field of view of approximately 140 x 70 mm (9,800 mm²) to maximize the data rate and limit window contamination.

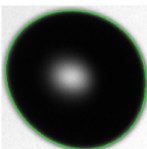
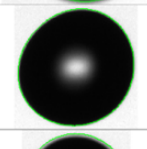
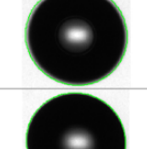
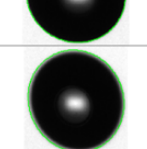




Technical Specifications













Disdrometer Imaging System	
Physical Specs	<15 kg; watertight; window shielding and hydrophobic coating
Camera	Emergent EVT HB-12000M; CMOS, 8-bit amplitude quantization
Lens	FL: 35mm f/#: 1.8
Sensor	Pixel size: 5.50µm Sensor size: 4096W x 2048H pix
Working distance	220mm
Magnification ratio	0.159
Eff. optical FL	35.0 mm
Camera sensor size	22.53W x 11.26H mm
Field of view	141.6W x 70.8H mm Area: 10026 mm ²
Depth of field	4.9 mm
Image resolution	28.9 pix/mm
Lens eff. Diameter	19.4 mm
Collection angle	5.1 deg
Software	Automated system setup, self-test methods; advanced image processing algorithms
	Image Sorting: Perimeter, circularity, image area, mean diameter, etc.
	Velocity: Drop velocity measurements, size-velocity correlations



Data Examples

Index	ROI	Frame #	Time	Area	Perimeter	Mean Diameter	Circularity	Mean Intensity	X	Y	Gradient Mean	Aspect Ratio	Intensity SD	Rel. Int.	Solidity	
15956		26170		131.10	549788	2635	836.1	0.995	18.0	99	97	157.832	1.095	28.0	135.00	0.99
27239		44598		223.29	381034	2198	696.2	0.991	19.0	82	83	482.126	1.076	32.0	201.00	0.99
16077		26380		132.15	284907	1906	602.0	0.985	29.0	72	71	211.040	1.015	45.0	204.00	0.99
66757		110491		553.08	274215	1849	591.1	1.000	18.0	71	69	557.517	1.015	33.0	206.00	0.99
30896		50806		254.37	274762	1879	590.9	0.978	27.0	69	72	207.752	1.092	42.0	200.00	0.99
44908		73868		369.80	269507	1837	585.8	1.000	18.0	70	69	260.310	1.016	32.0	164.00	0.99

Deformed large droplets acquired in wind tunnel tests. The Disdrometer system is capable of capturing this effect and the software enables the user to measure the characteristics of these droplets.

Index	ROI	Frame #	Time	Area	Perimeter	Mean Diameter	Circularity	Mean Intensity	X	Y	Gradient Mean	Aspect Ratio	Intensity SD	Rel. Int.	Solidity	
795		2218		11.33	52528	813	258.8	0.998	22.0	34	33	430.862	1.000	26.0	178.00	0.99
41990		117641		589.52	52194	818	258.2	0.979	21.0	34	33	258.143	1.037	27.0	149.00	0.98
33051		92509		463.71	52134	806	257.7	1.000	19.0	34	32	352.276	1.056	24.0	155.00	0.99
12328		34001		170.68	52063	800	257.5	1.000	21.0	34	33	341.602	1.000	28.0	168.00	0.99
6541		17962		90.41	51962	810	257.4	0.996	24.0	34	33	218.639	1.036	22.0	146.00	0.99
28256		79044		396.28	51698	809	257.0	0.993	20.0	33	32	446.556	1.055	27.0	176.00	0.99
33838		94734		474.84	51293	807	255.9	0.989	20.0	34	32	406.986	1.073	25.0	168.00	0.98
28053		78471		393.42	50706	798	254.8	1.000	21.0	34	32	346.730	1.093	28.0	164.00	0.99
37437		105051		526.50	50564	797	254.4	1.000	19.0	34	32	329.234	1.025	23.0	153.00	0.98
17288		48103		241.31	50564	805	254.0	0.980	21.0	33	32	312.046	1.036	27.0	158.00	0.99
34970		97863		490.51	50473	805	253.4	0.980	31.0	34	32	169.286	1.093	25.0	128.00	0.98
712		1977		10.12	50129	796	253.2	0.994	22.0	32	32	550.138	1.018	29.0	189.00	0.99

Droplet images achieved with the Disdrometer system, ~250 µm drops.

Key Features:

OPTICS

- Rugged optics mounts, support methods, bolted frames—can withstand rough handling, shocks, and vibrations
- Image area has 2-to-1 aspect ratio to maximize data rate and limit window contamination
- LED illumination panel enhances intensity distribution
- Engineered diffusers provide illumination uniformity
- High-resolution camera and optics for the receiver
- Minimized sensitivity of image processing methods to variations in background light intensity

SOFTWARE/IMAGE PROCESSING

- Automated system setup; self-test methods
- Advanced image processing algorithms
- Drop velocity measurements and size-velocity correlations
- Drop size measurements minimally dependent on image quality and background illumination
- Ability to sort images by various criteria such as perimeter, circularity, image area, mean diameter, etc.
- Optimized data storage



Ice Crystals

Our offices, research facilities, and manufacturing plant are located in Sunnyvale, California, where we serve our North American customers. Our distributor partners provide valuable services to our customers in other parts of the world.

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