INPRINT MUNICH

Inkjet Optimization

Yair Kipman: President

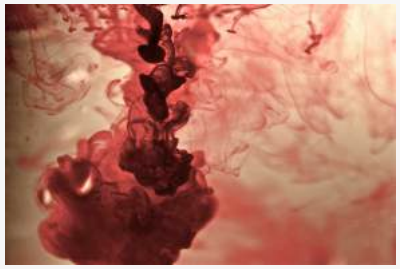
Outline

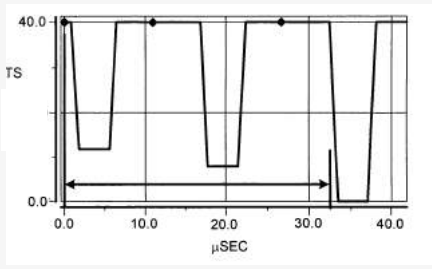
1. Key considerations and tools for inkjet development
   - Overview
   - Ink Development
   - Waveform Design
   - Overview of Development System

2. Inkjet analysis examples:
   - Drop formation
   - Drop measurement
   - Waveform optimization: pulse width, damping, and voltage
   - Inkjet performance testing: frequency, consistency, and sustainability
   - Print quality: Line/edge, bleed, text, dots, and skew/stretch
   - Missing jets
   - Nozzle inspection

3. Questions?

Key Considerations for Inkjet Development: Overview





Printhead

- Nozzle Geometry
- Fluid Compatibility
- Native Resolution
- Native Drop Size
- Max Firing Frequency
- Recirculating
- Greyscale
- Nozzle Coating

Substrate

- Application Requirements
- Colorfastness
- Required Durability
- Coating

Conditions

- Distance to Substrate
- Firing Frequency
- Idle Time
- Humidity
- Meniscus Pressure
- Ink Temperature

Ink Formulation

- Surface Tension
- Viscosity
- Rheology
- Particle Size
- Drying Speed
- Application Requirements

Waveform

- Voltage
- Pulse Width
- Pulse Spacing
- Rise/Fall Time
- Greyscale

Key Considerations for Inkjet Development: Printhead Selection

Key considerations for selecting a printhead:

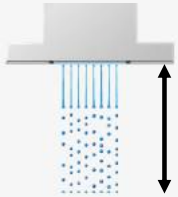
- Must be compatible with ink type to be used: UV, solvent, aqueous, or other (metal, etc).
- Must be able to achieve desired print resolution (using multiple printheads, if needed).
- Must be able to print at required frequency.
- Must be able to jet drops of the needed size and velocity.
- Depending on ink formulation and application, may need to be recirculating.

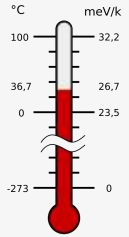
Key Considerations for Inkjet Development: Substrate Selection

Substrate selection is often primarily driven by the needs of the application, and is often not under the control of ink manufacturers. Nevertheless, substrate selection affects print quality. Key considerations:

- How will ink interact with this substrate? Common problems resulting from poor drop-substrate interaction include bleeding, mottle, pooling, strike through, and color-shifting.
- Could a coating improve the performance of the substrate?
- Does the printed substrate meet colorfastness and durability requirements?

Key Considerations for Inkjet Development: Jetting Conditions

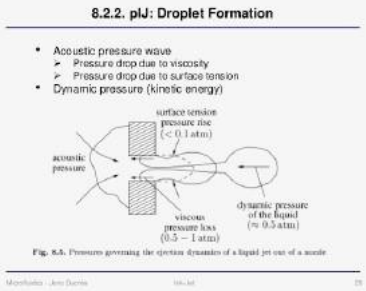




Some conditions may be under the control of the ink developer, and others are determined by the application. Many of these factors impact ink and waveform design. For example:

- A longer throw distance requires larger, faster drops.
- Long idle times require ink designs that limit latency/decap, by reducing solvent evaporation.
- Production conditions, including firing frequencies, should match test conditions.
- Ink temperature adjustments can be used to fine tune ink viscosity and surface tension.

Key Considerations for Inkjet Development: Ink Formulation



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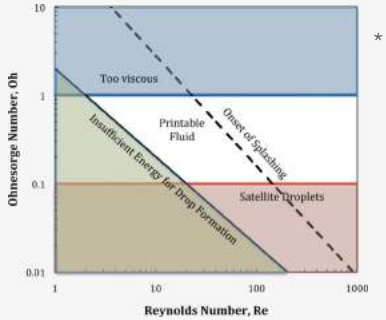

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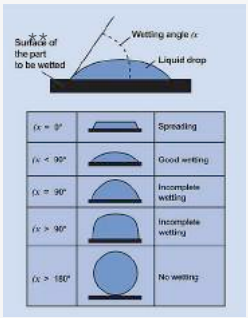

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Inkjet Ink must jet well, interact with the substrate well, and also meet the performance needs of the application. Key ink characteristics include:

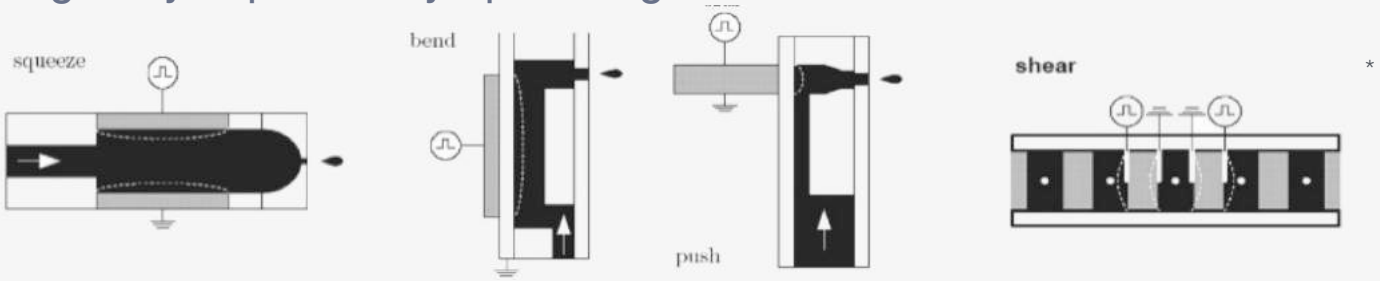
- Viscosity and surface tension (should be within proper range required for the printhead to be used, usually somewhere in the range of 10-30 cPs, and 20-70 dynes/cm).
- Solids content (pigment, dye, etc).
- Resistance to evaporation
- Substrate interaction
- Viscoelasticity, and other non-newtonian characteristics
- Application requirements, including longevity, durability, etc.

*Adapted from Wolfgang von Ohnesorge, McKinley & Renardy (2011) ** Adapted from Innovating Inkjet Technologies for Plastic Products, Sabreen & Taylor, 2013
*** Microfluidics - Jens Ducree

Key Considerations for Inkjet Development: Waveform Design

Waveforms are usually designed in conjunction with ink. Often, an ink's jetting performance can be greatly improved by optimizing the waveform.

Nozzle Types:



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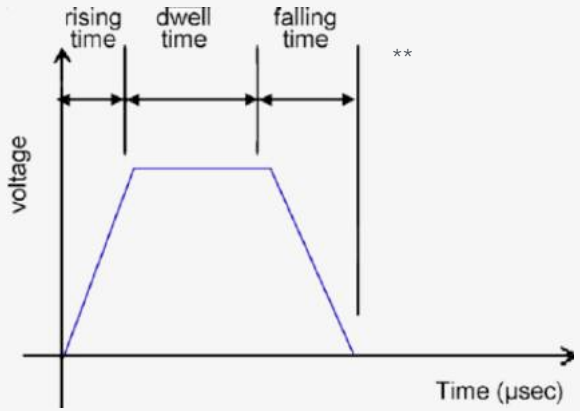
Basic Waveform:



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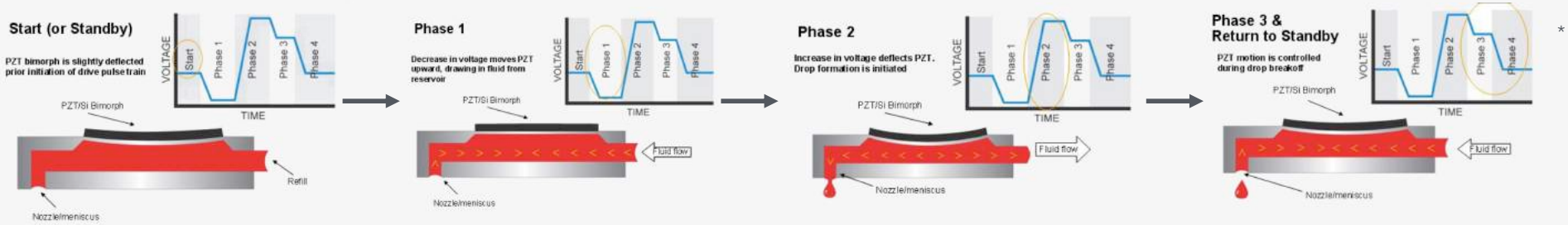
*Adapted from The Dynamics of the Piezo Inkjet Printhead Operation, Wijshoff (2010) **Adapted from Fundamentals of Inkjet printing: The Science of Inkjet and Droplets, SD Hoath(Ed) Wiley-VCH (2016)

Key Considerations for Inkjet Development: Waveform Design

How a Waveform Works:



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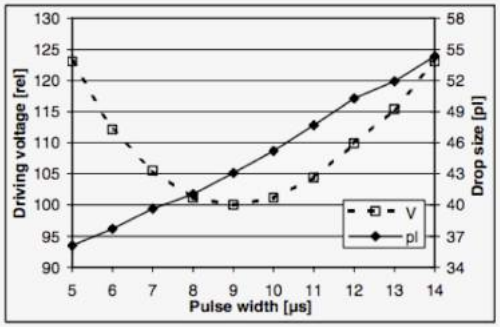
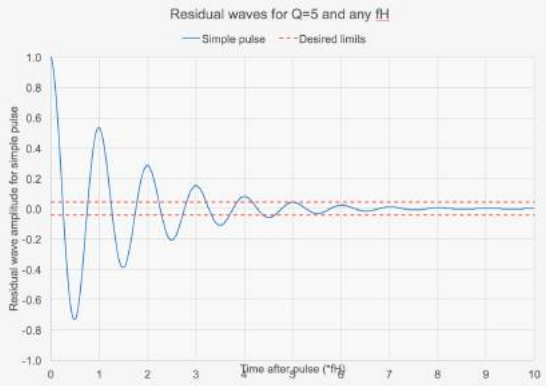
Optimization:





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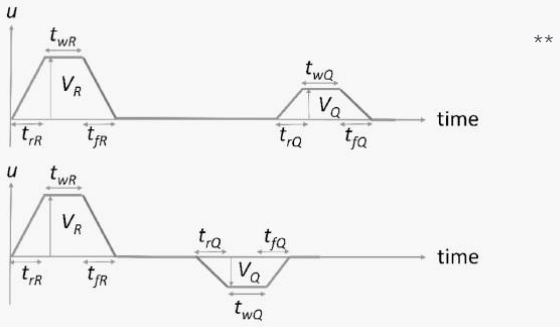

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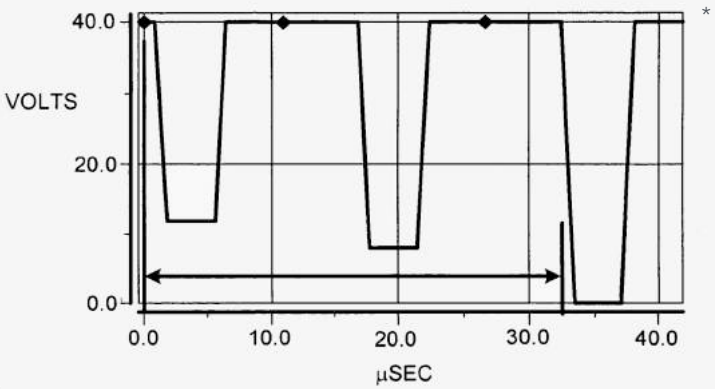
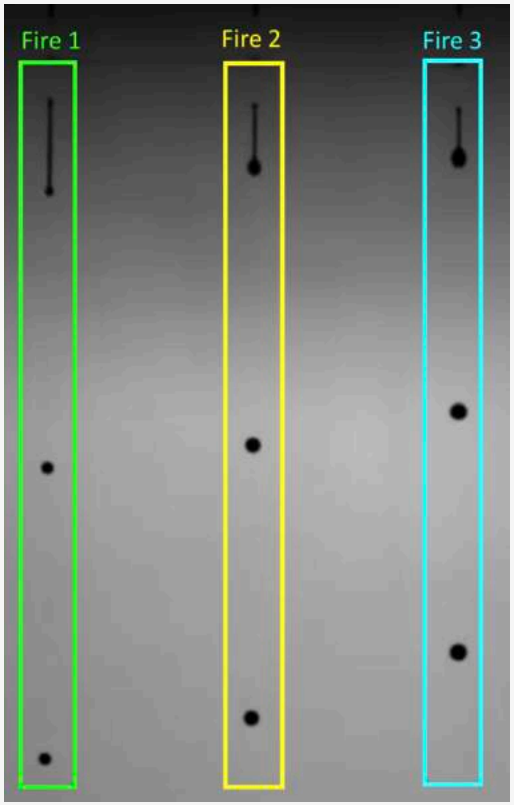
*Adapted from Inkjet printing of high molecular weight PVDF-TrFE for flexible electronics, Haque, Vie, Germainy & Boddaert (2015)

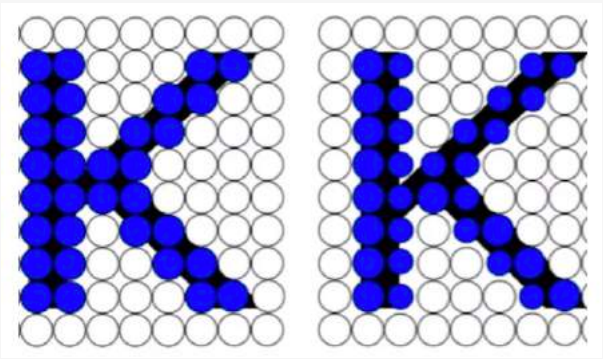
**Adapted from Fundamentals of Inkjet printing: The Science of Inkjet and Droplets, SD Hoath(Ed) Wiley-VCH (2016)

Key Considerations for Inkjet Development: Waveform Design

Greyscale:







*Patent Drawing

Testing Inkjet Performance
JetXpert Print Station

JetXpert drop measurement system

Variable print speed up to 2m/s

Vacuum-secured sample

Camera to inspect print quality

Available with a belt or linear stage

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JetXpert Print Station

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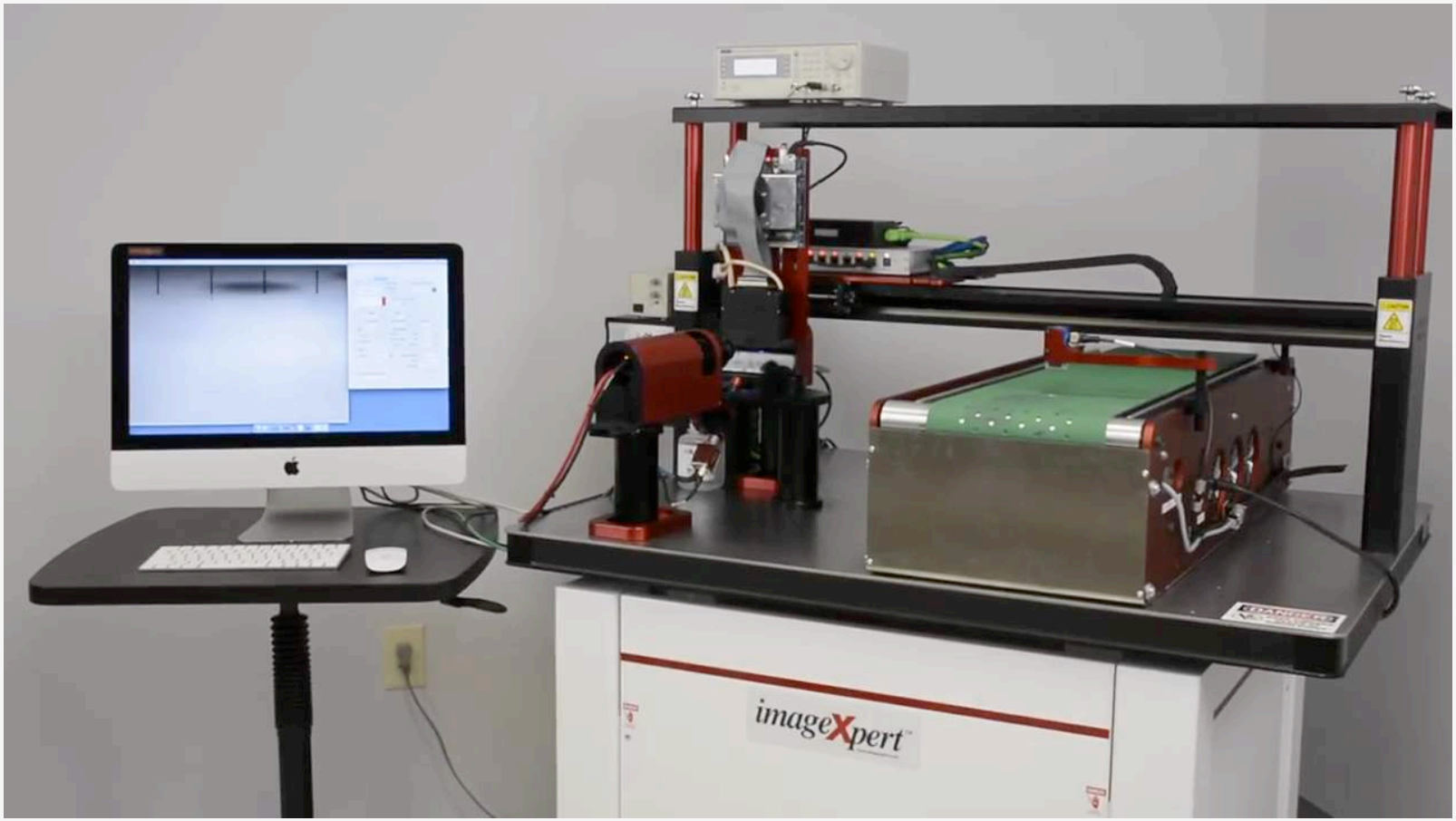
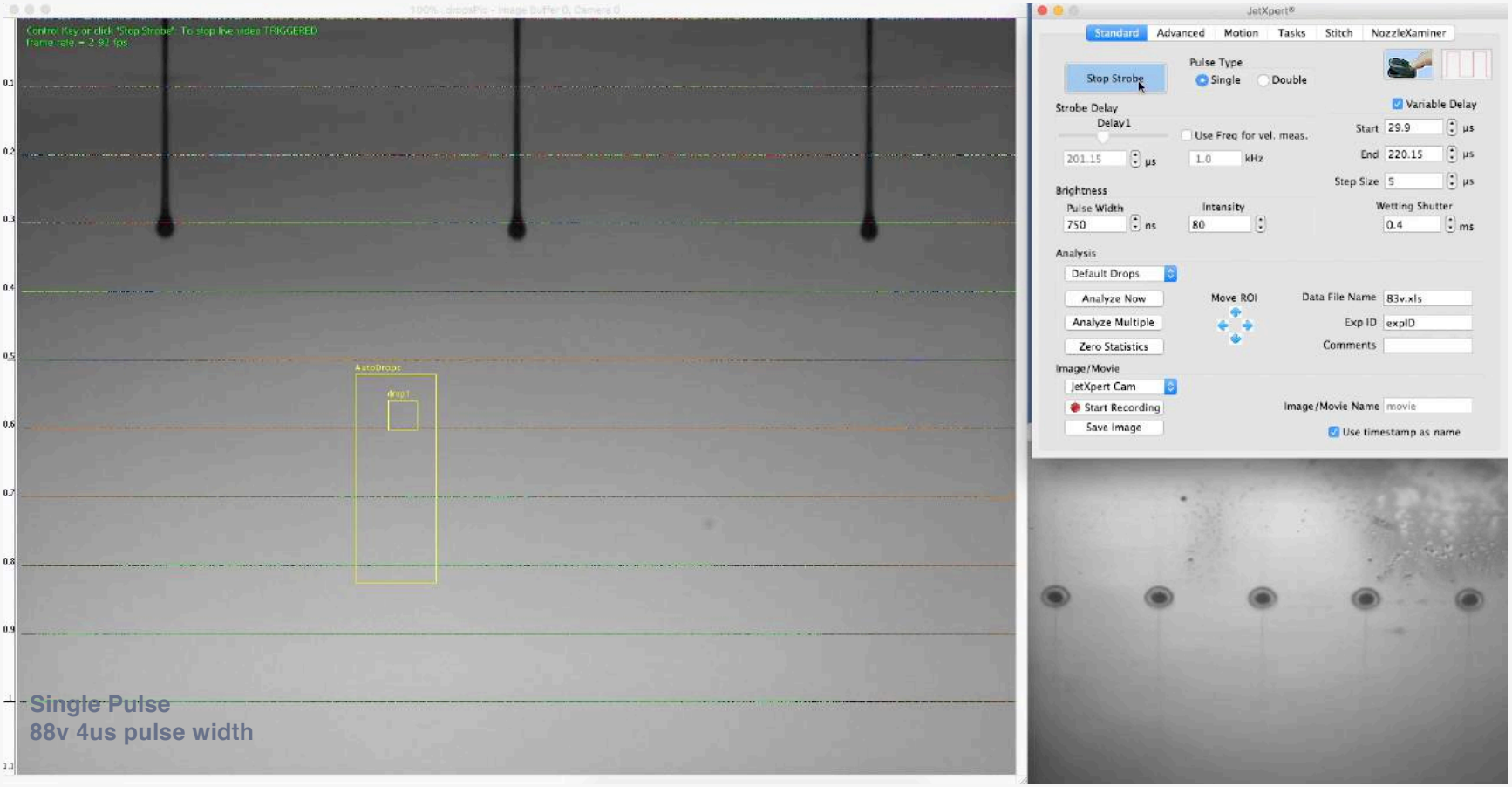
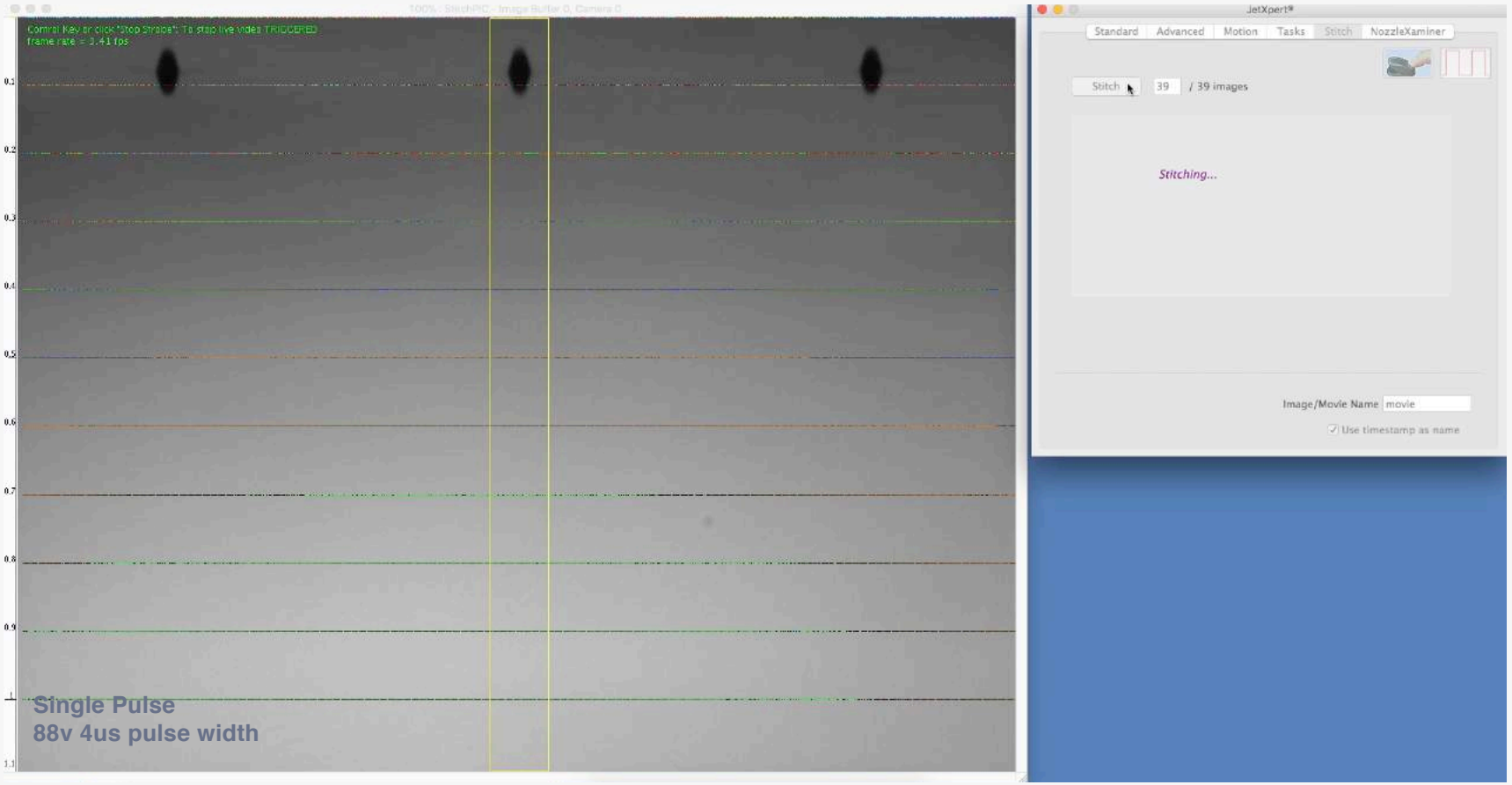
Testing Inkjet Performance
JetXpert Print Station



Testing Inkjet Performance: Drop Formation



Testing Inkjet Performance: Drop Formation

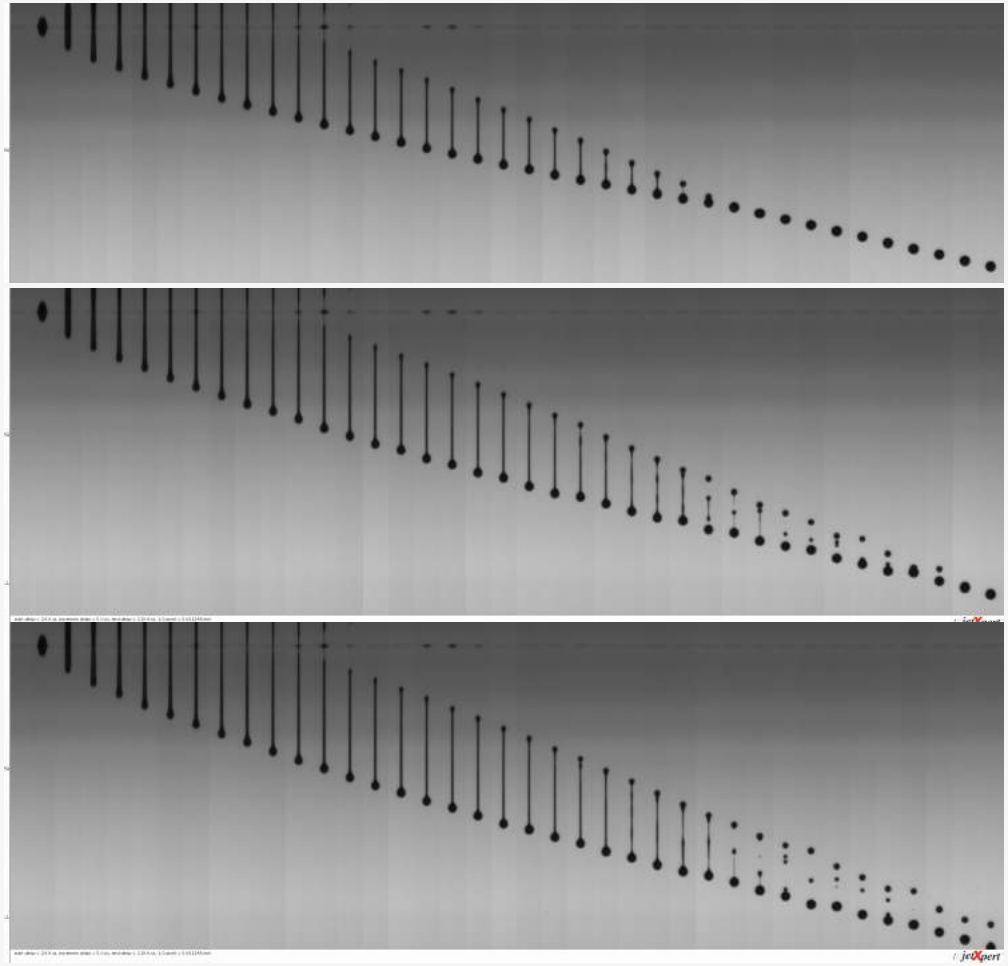


Testing Inkjet Performance:
Drop Formation: Stitch

83v

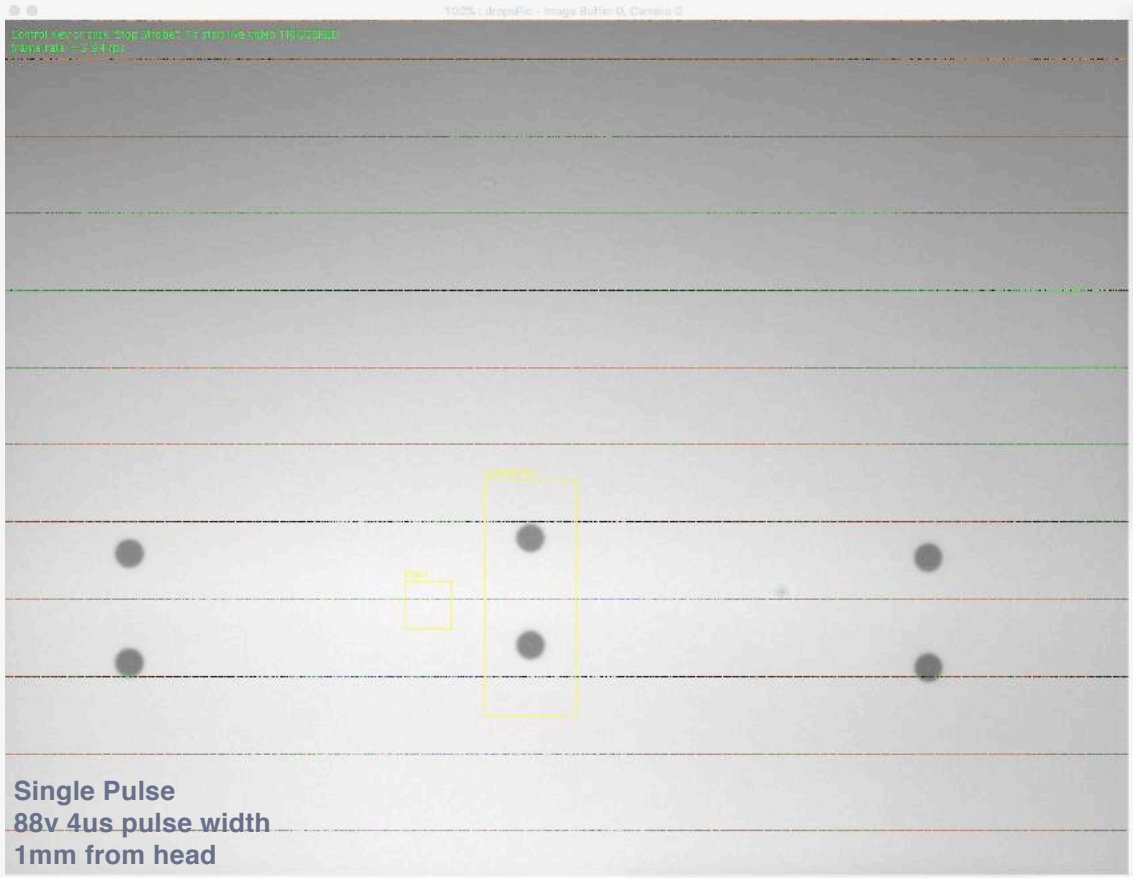
88v

93v

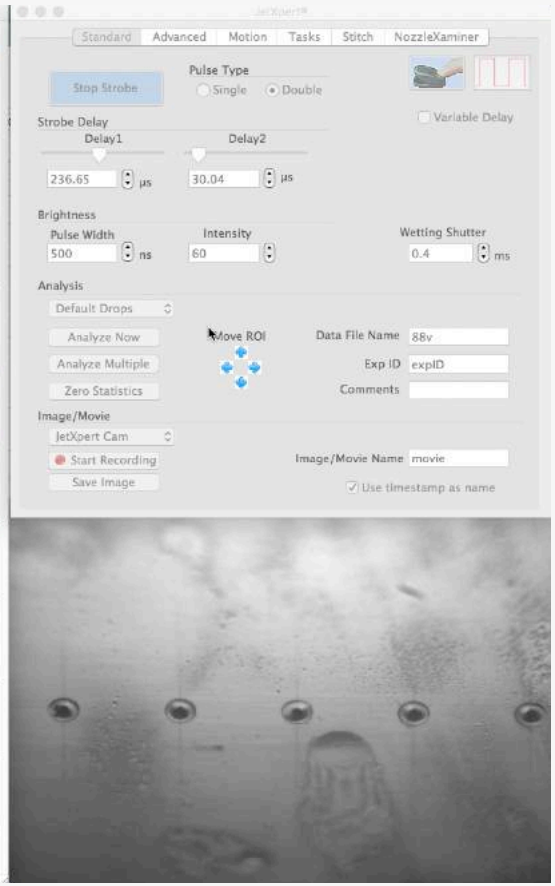


Single Pulse
4us pulse width

Testing Inkjet Performance:
Drop Measurement (Volume, Velocity, Trajectory)



Single Pulse
88v 4us pulse width
1mm from head



Testing Inkjet Performance:
Drop Measurement (Volume, Velocity, Trajectory)

Exp ID	drop1 radius	drop1 volum	trajectory	velocity (m/s	Comments
expID	1.78E-02	23.64679	89.70172	4.543411	
expID	1.77E-02	23.22714	89.97001	4.53003	
expID	1.77E-02	23.38563	89.99828	4.535925	
expID	1.77E-02	23.20437	89.73144	4.536961	
expID	1.77E-02	23.25911	89.98338	4.540887	
expID	1.77E-02	23.16405	90.0296	4.529499	
expID	1.77E-02	23.30307	89.73118	4.528831	
expID	1.77E-02	23.26943	89.972	4.544915	
expID	1.77E-02	23.14511	90.05304	4.53042	
expID	1.77E-02	23.11716	89.77731	4.520242	
expID	1.78E-02	23.73083	89.90238	4.534983	
expID	1.77E-02	23.41945	90.171	4.540323	
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expID	1.78E-02	23.61284	89.64214	4.534661	
expID	1.78E-02	23.49952	90.04241	4.524177	
expID	1.77E-02	23.24877	89.9324	4.54232	
expID	1.77E-02	23.14559	89.7114	4.524454	
expID	1.78E-02	23.55384	89.93995	4.542112	
expID	1.78E-02	23.49825	90.01518	4.530474	
expID	1.77E-02	23.35319	89.79762	4.522684	
expID	1.77E-02	23.42442	89.90449	4.547271	
expID	1.77E-02	23.21454	90.16875	4.531139	
expID	1.77E-02	23.2766	89.79346	4.533228	
expID	1.78E-02	23.45519	89.80906	4.532261	
expID	1.77E-02	23.1964	90.13292	4.539538	
expID	1.77E-02	23.40725	89.8188	4.536624	
expID	1.76E-02	22.92242	89.68328	4.536636	
expID	1.77E-02	23.15438	90.04935	4.534411	
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expID	1.77E-02	23.19534	89.66064	4.520061	
expID	1.78E-02	23.43251	89.98514	4.535129	
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expID	1.77E-02	23.21938	89.62259	4.52792	
expID	1.77E-02	23.05595	89.98764	4.53225	
expID	1.77E-02	23.23908	89.93388	4.540825	
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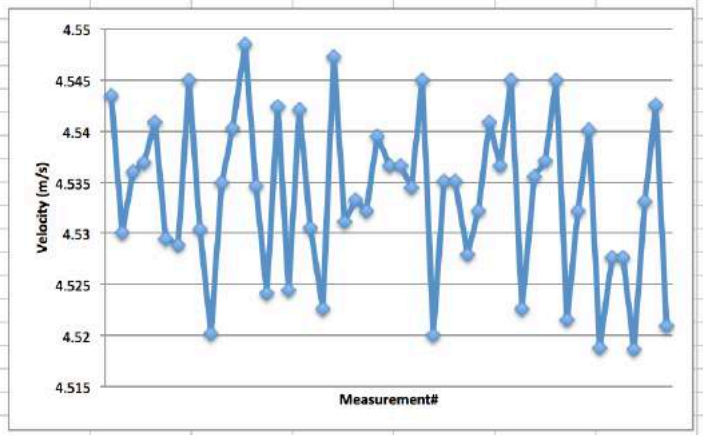
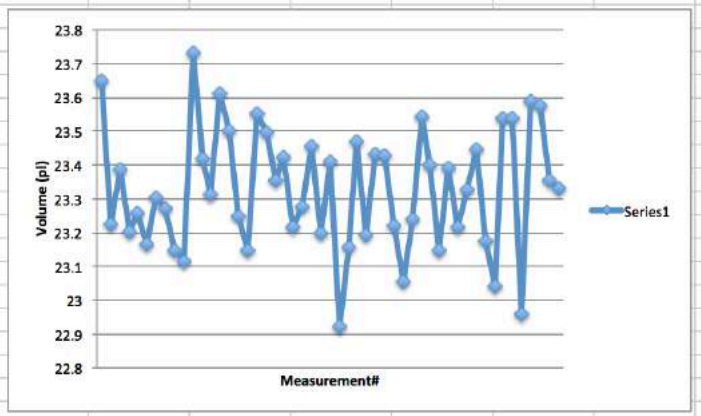
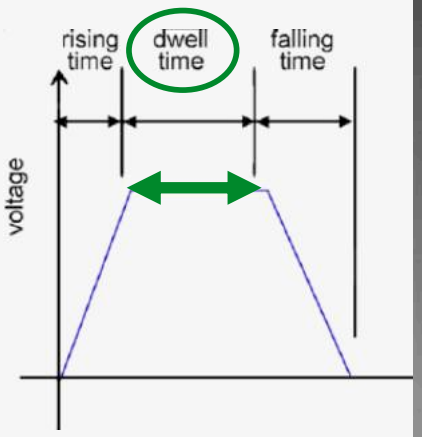
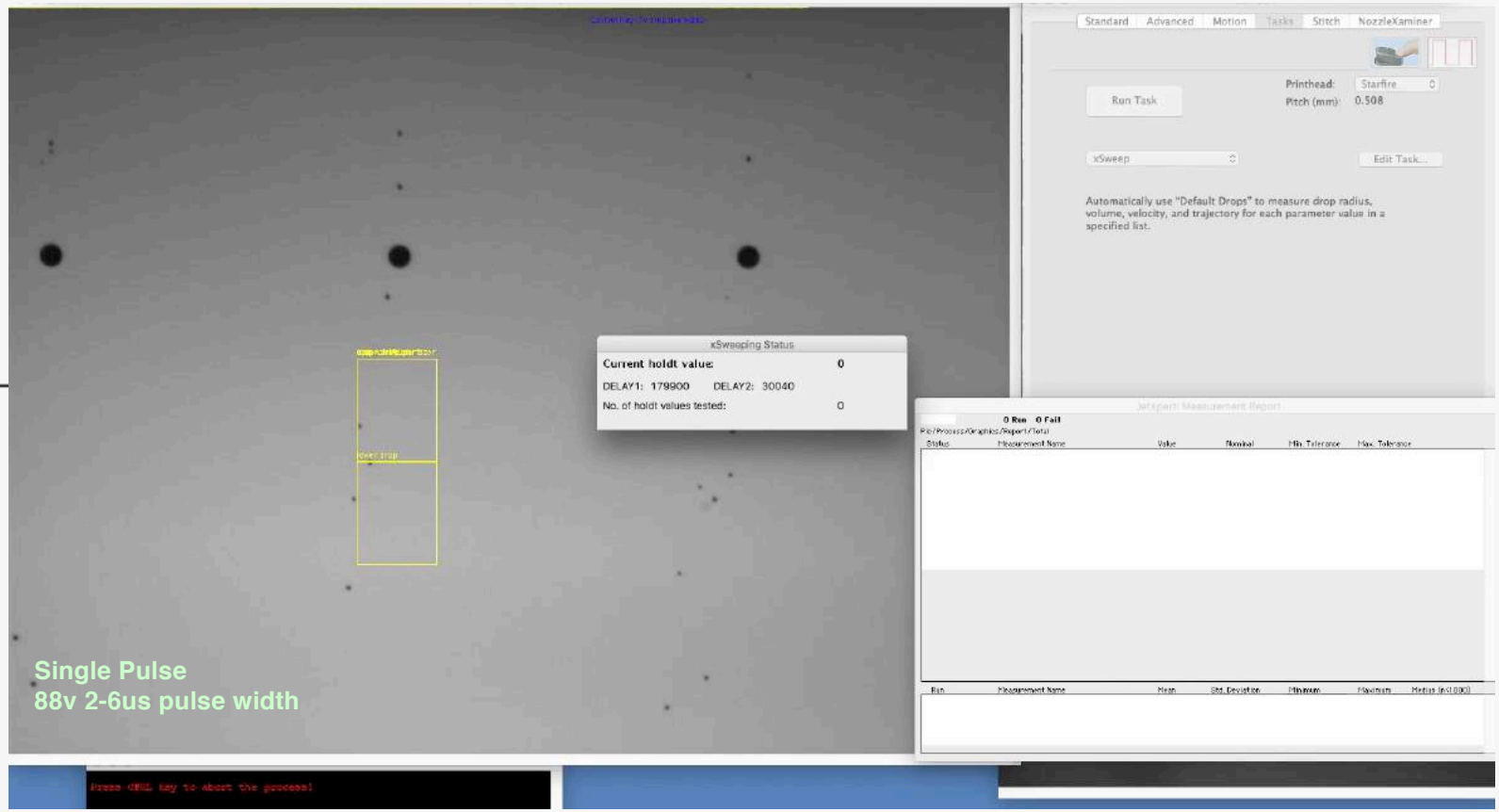




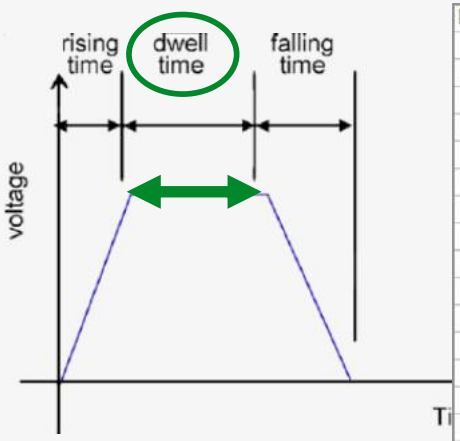
Single Pulse
88v 4us pulse width

Optimizing Inkjet Performance: Xsweep

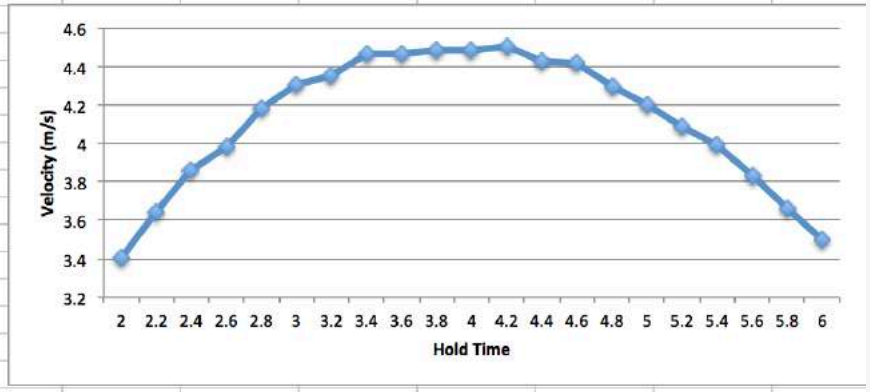


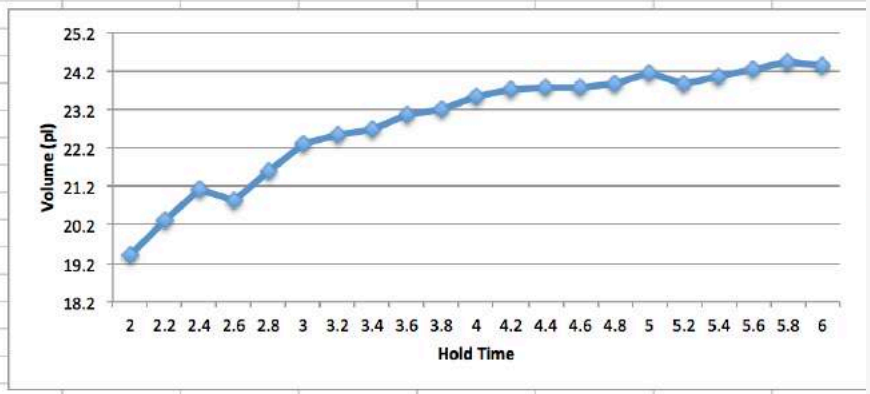


Optimizing Inkjet Performance: Pulse Width



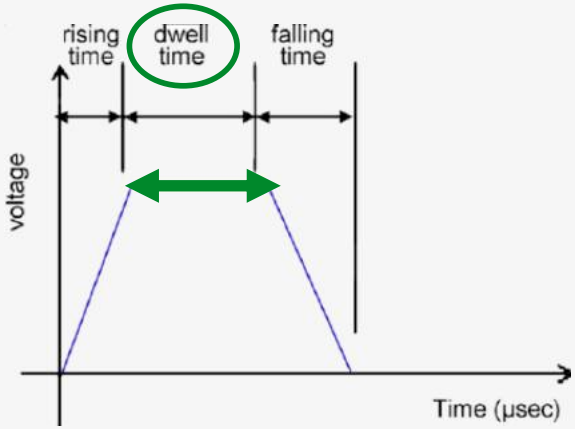
holdt	drop1 radius	drop1 volum	trajectory	velocity (m/s)
2	1.67E-02	19.4144	90.0023	3.404235
2.2	1.69E-02	20.31698	90.02568	3.644608
2.4	1.72E-02	21.13186	89.90416	3.860874
2.6	1.71E-02	20.83785	90.03738	3.980816
2.8	1.73E-02	21.5972	90.00366	4.181574
3	1.75E-02	22.29479	89.98841	4.304615
3.2	1.75E-02	22.56224	89.89004	4.35136
3.4	1.76E-02	22.70885	90.0424	4.470424
3.6	1.77E-02	23.0759	89.97984	4.470698
3.8	1.77E-02	23.20654	89.95087	4.483959
4	1.78E-02	23.51783	89.92339	4.48885
4.2	1.78E-02	23.71209	89.98703	4.508971
4.4	1.78E-02	23.78248	90.02592	4.42682
4.6	1.78E-02	23.79814	89.99418	4.416595
4.8	1.79E-02	23.85868	89.97408	4.293397
5	1.79E-02	24.14144	89.93959	4.203529
5.2	1.79E-02	23.89336	90.03404	4.089494
5.4	1.79E-02	24.0472	90.02541	3.991447
5.6	1.80E-02	24.25488	90.08328	3.832021
5.8	1.80E-02	24.42878	90.02531	3.661388
6	1.80E-02	24.35759	89.99642	3.501859

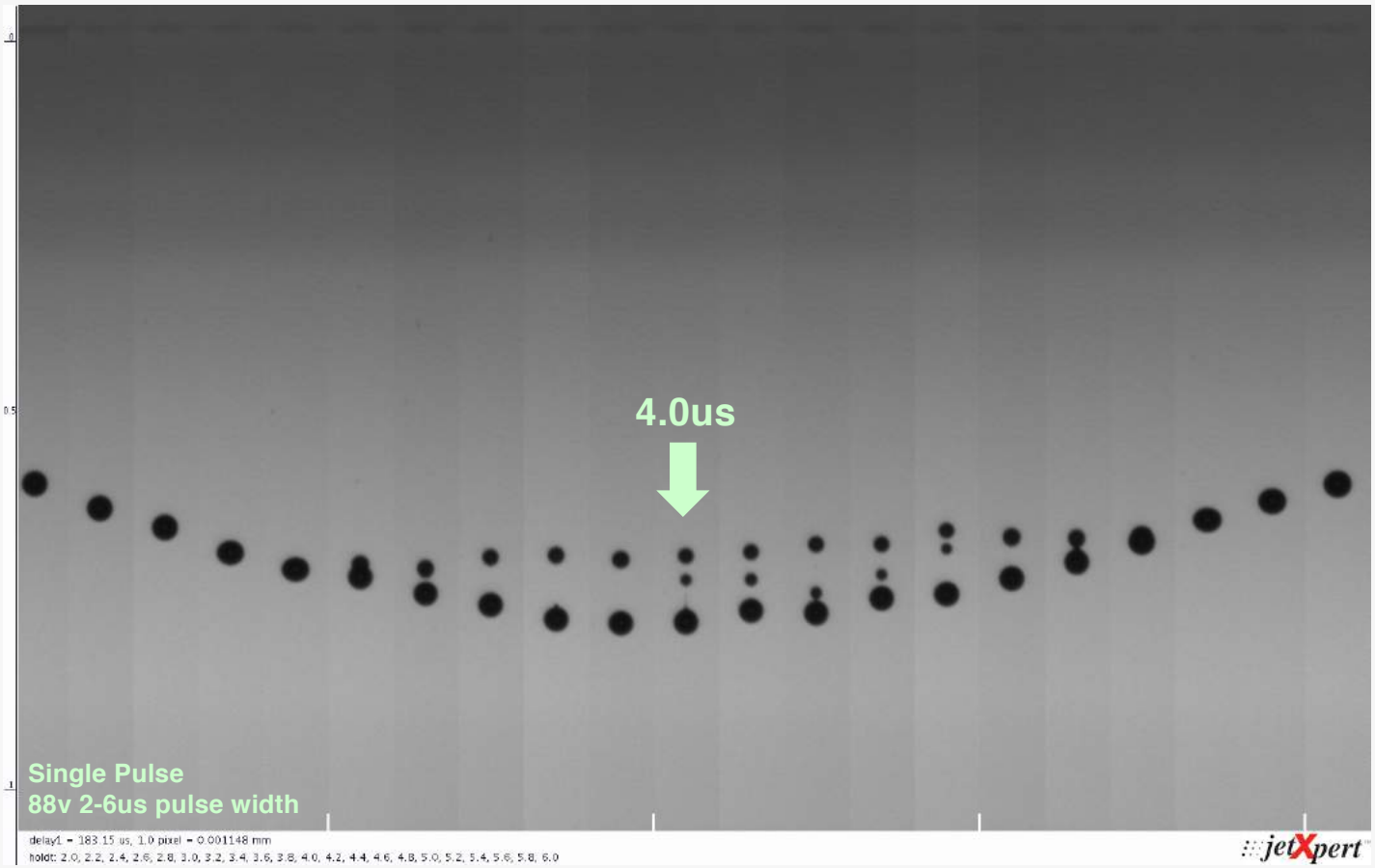




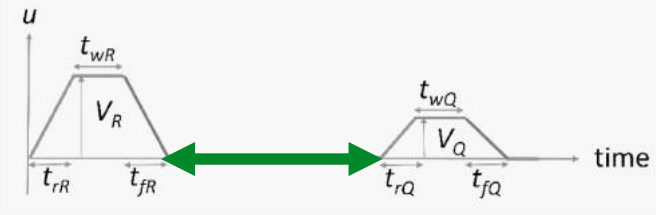
Single Pulse
88v 2-6us pulse width

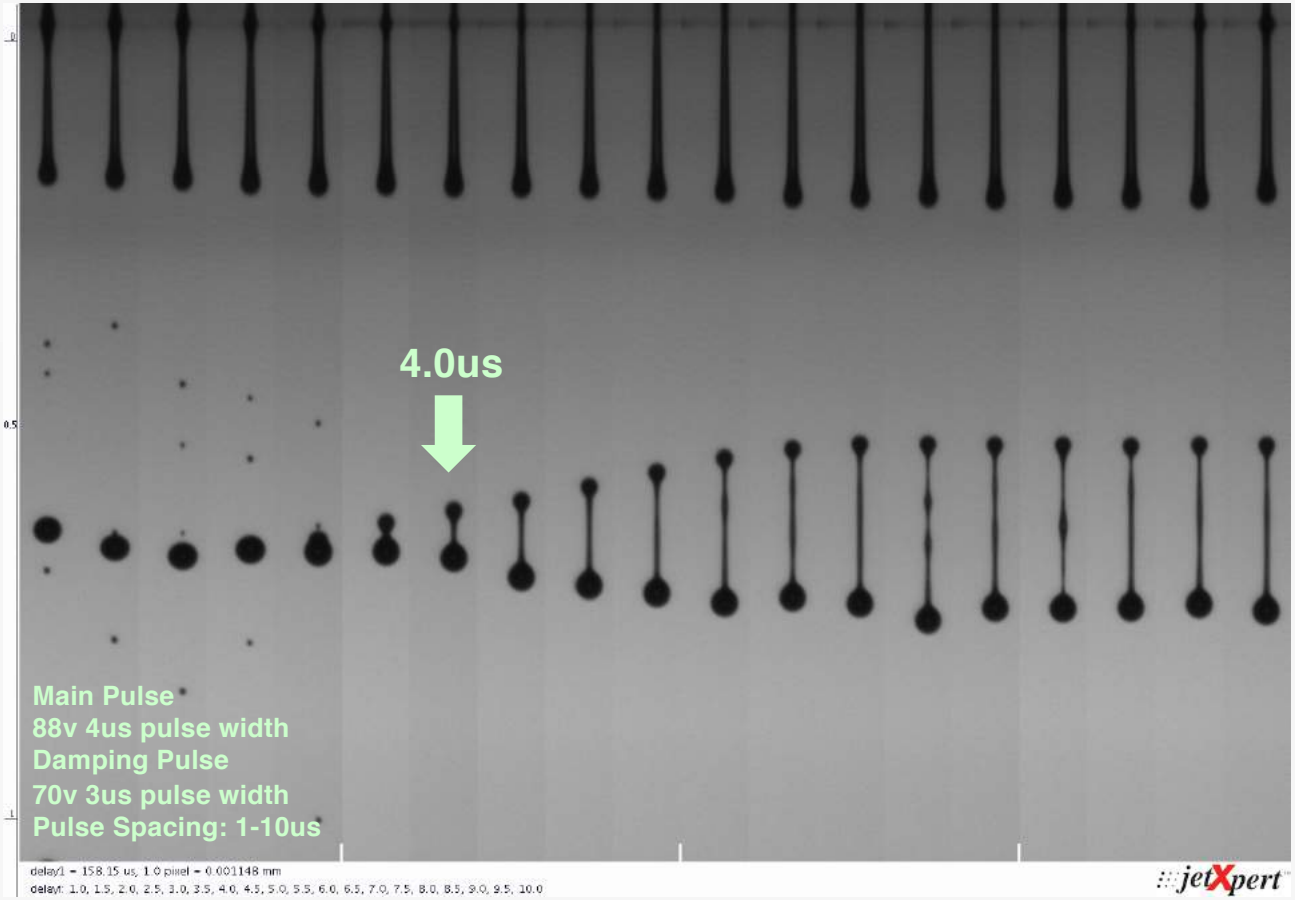
Optimizing Inkjet Performance
Pulse Width



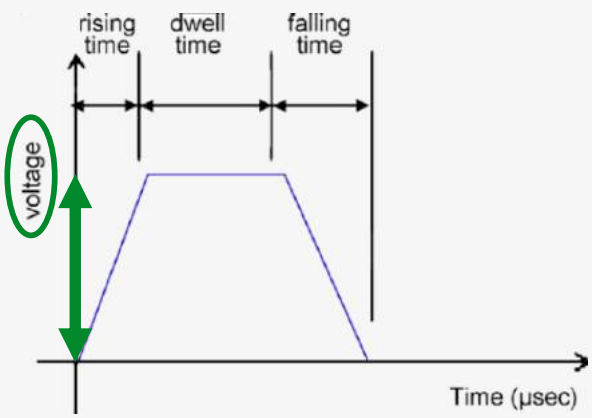


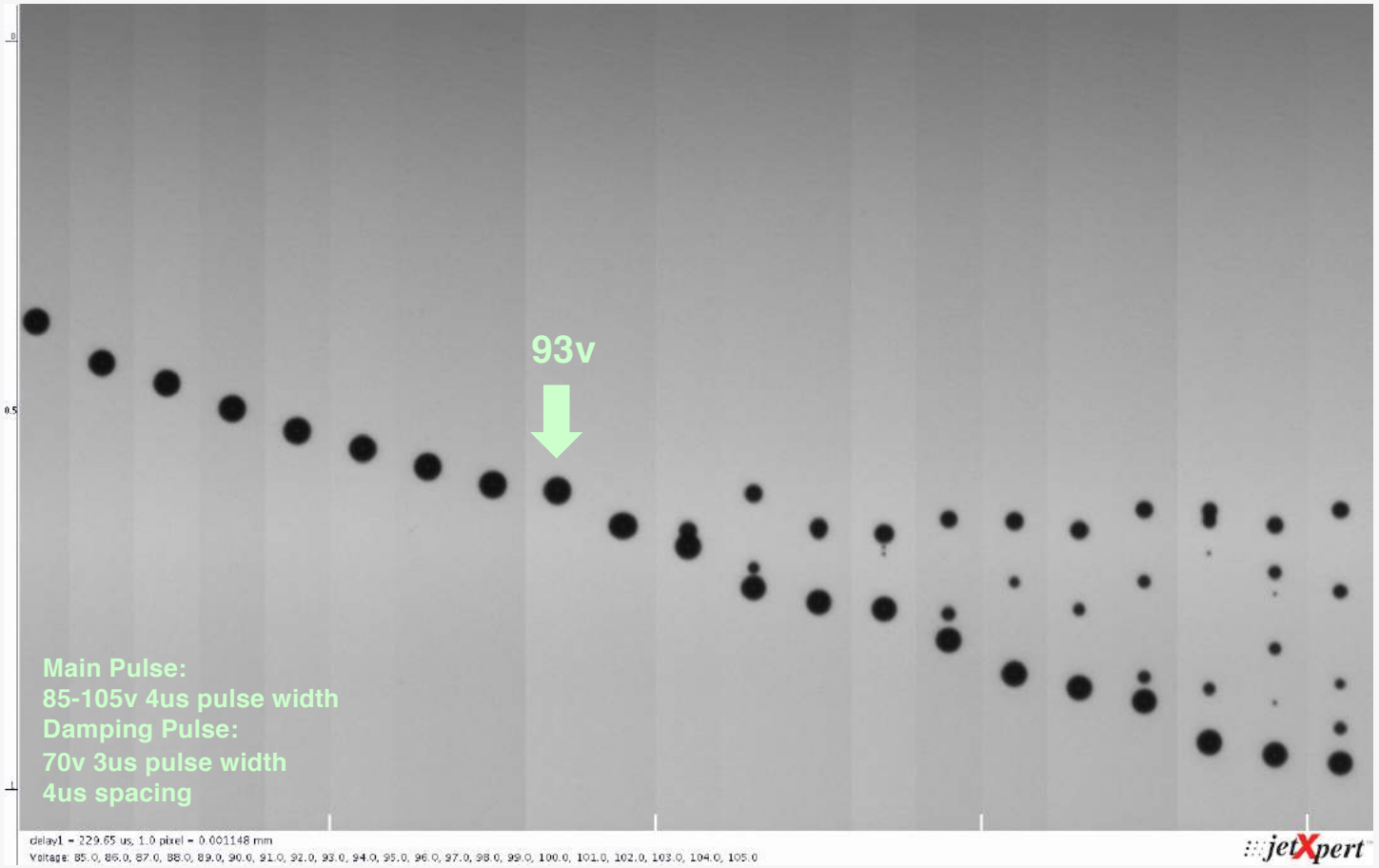
Optimizing Inkjet Performance: Damping Pulse Spacing



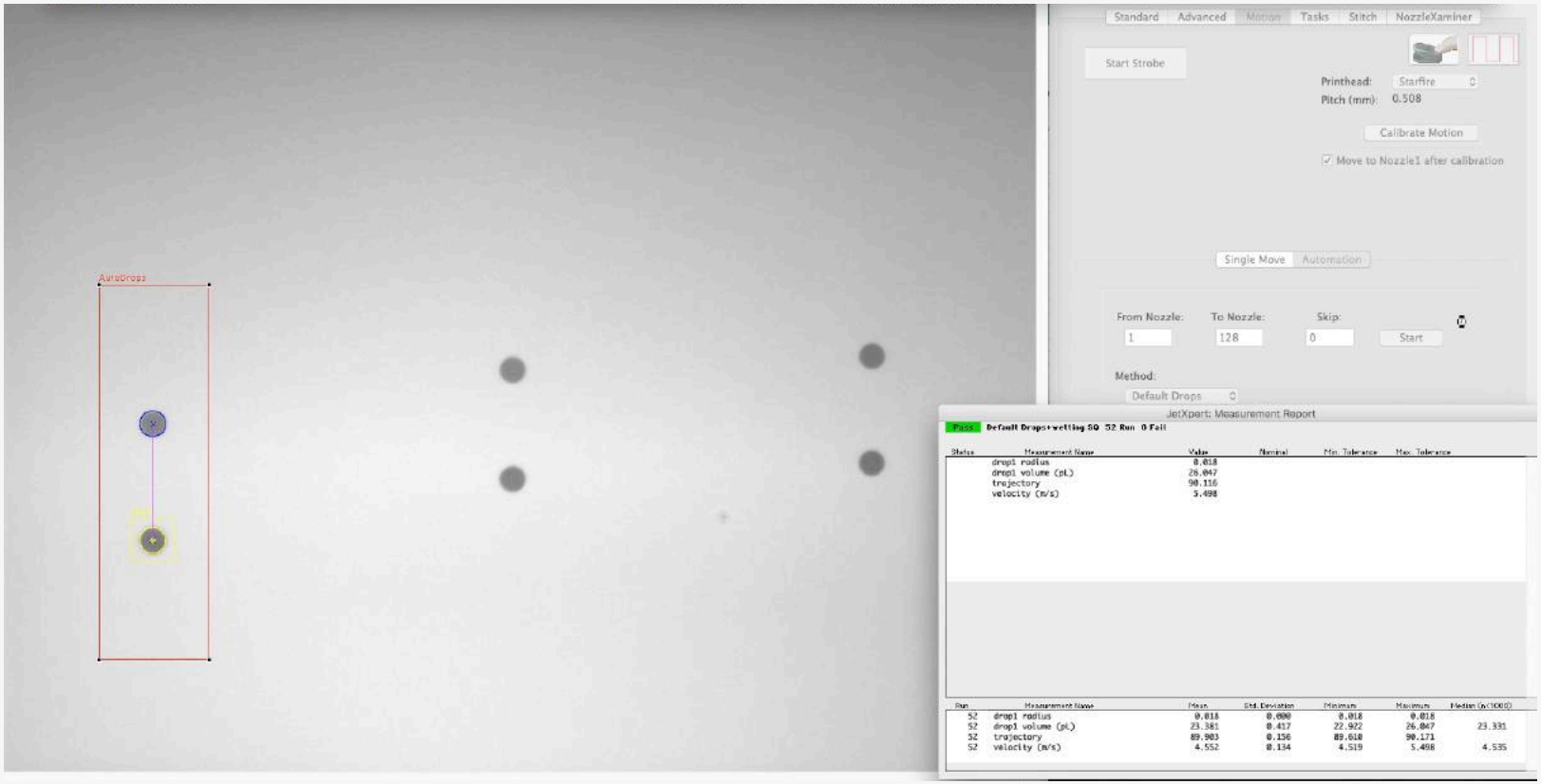


Optimizing Inkjet Performance: Voltage



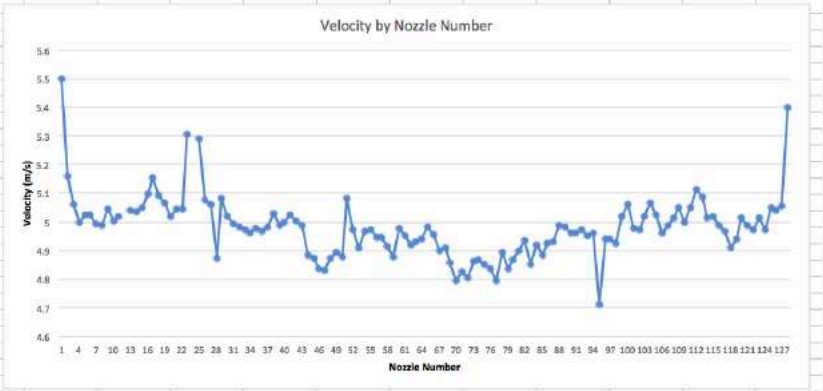


Testing Inkjet Performance:
Measuring Nozzles Across the Head

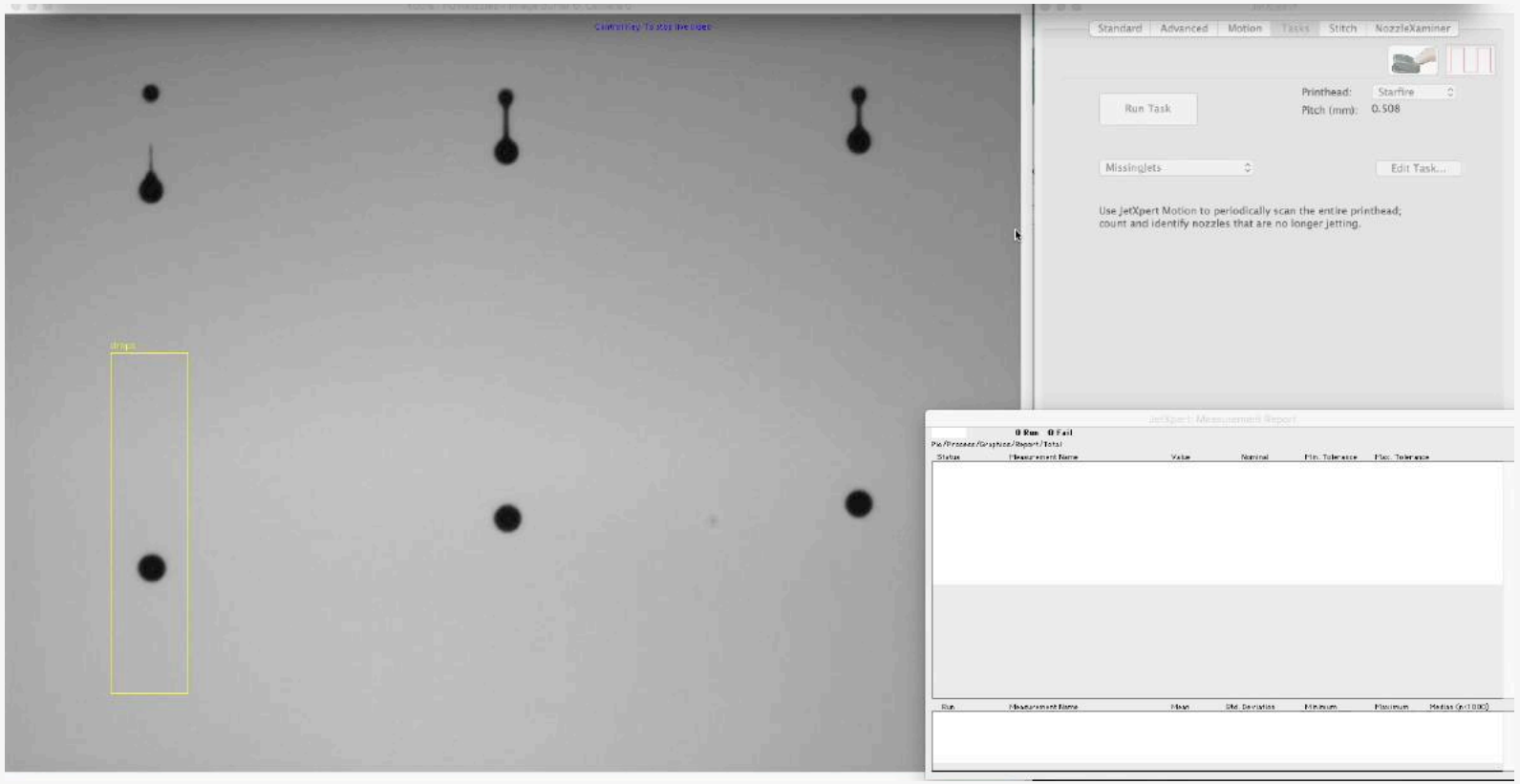


Testing Inkjet Performance: Measuring Nozzles Across the Head

Exp ID	drop1 radius	drop1 volum	trajectory	velocity (m/s	Comments
1	1.84E-02	26.04718	90.11611	5.49812	
2	1.81E-02	24.66727	89.93586	5.160513	
3	1.80E-02	24.39667	90.06785	5.060026	
4	1.80E-02	24.27732	89.94949	4.997071	
5	1.80E-02	24.4283	90.00678	5.023315	
6	1.81E-02	24.69008	90.01659	5.024307	
7	1.79E-02	23.90054	89.99226	4.994336	
8	1.79E-02	23.96581	89.96595	4.989107	
9	1.79E-02	24.05422	90.04739	5.043622	
10	1.80E-02	24.24961	90.00436	5.002392	
11	1.79E-02	23.95405	89.98158	5.018192	
12					
13	1.79E-02	23.9936	89.97467	5.041293	
14	1.79E-02	24.1829	89.98312	5.036355	
15	1.79E-02	24.11542	89.95038	5.049714	
16	1.80E-02	24.27157	90.024	5.095509	
17	1.80E-02	24.22691	90.06272	5.153436	
18	1.80E-02	24.49657	90.10282	5.089942	
19	1.80E-02	24.29265	89.98434	5.065942	
20	1.78E-02	23.81424	89.96819	5.020025	
21	1.79E-02	24.03958	89.99049	5.047489	
22	1.80E-02	24.23261	90.03884	5.047527	
23	1.82E-02	25.17817	90.03775	5.303641	
24					
25	1.80E-02	24.30346	90.01637	5.292051	
26	1.80E-02	24.34119	90.00596	5.075363	
27	1.79E-02	24.11695	89.95429	5.061609	
28	1.76E-02	22.6565	90.5867	4.8737	
29	1.80E-02	24.54394	90.11913	5.079146	
30	1.79E-02	24.047	89.97656	5.018638	
31	1.80E-02	24.29624	89.98008	4.993325	
32	1.79E-02	24.20475	90.04902	4.982627	
33	1.79E-02	24.06759	90.0404	4.974564	
34	1.79E-02	23.82466	89.95053	4.960391	
35	1.79E-02	24.08428	89.97804	4.979602	
36	1.79E-02	23.85902	90.09027	4.965972	
37	1.80E-02	24.24134	90.00222	4.981473	
38	1.79E-02	24.07425	89.93941	5.029032	
39	1.78E-02	23.55639	89.9679	4.989408	
40	1.79E-02	24.00422	89.90728	4.995642	
41	1.79E-02	24.02222	89.94918	5.023586	
42	1.80E-02	24.24306	89.97972	5.003099	
43	1.79E-02	23.92653	90.09837	4.985403	
44	1.79E-02	23.89834	89.98944	4.881387	
45	1.79E-02	23.9264	90.05838	4.875231	
46	1.78E-02	23.60505	89.9671	4.835505	
47	1.78E-02	23.71955	90.04577	4.831185	
48	1.79E-02	23.886	90.04436	4.875169	
49	1.78E-02	23.78389	90.09924	4.895747	
50	1.79E-02	24.02049	89.94218	4.877289	
51	1.79E-02	24.10302	89.75784	5.080554	
52	1.78E-02	23.77779	90.01118	4.971194	

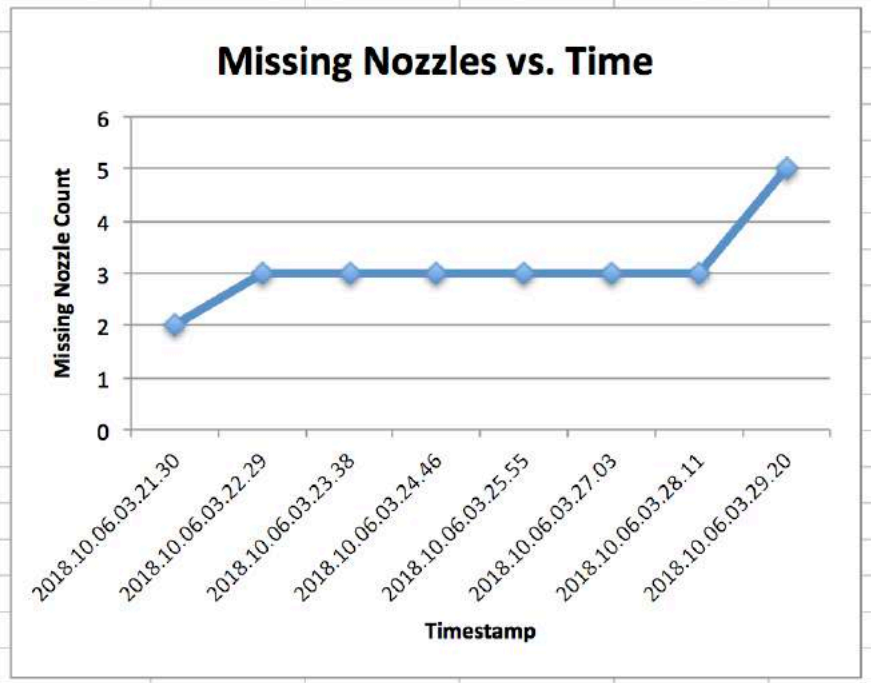


Testing Inkjet Performance: Sustainability

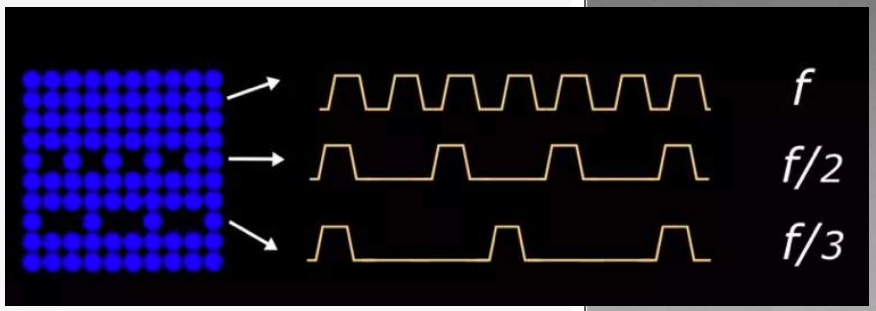


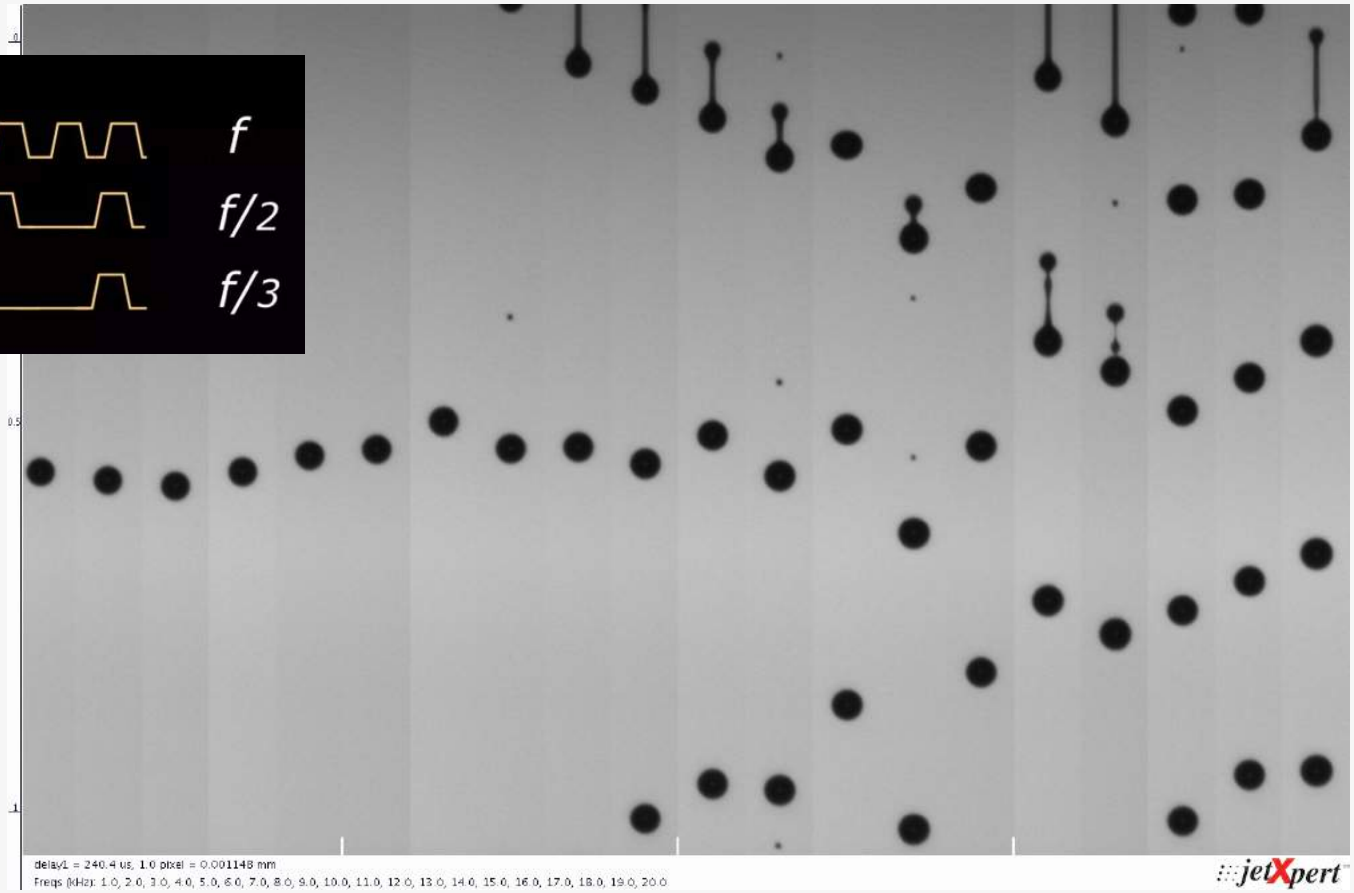
Testing Inkjet Performance: Sustainability

time	#FailedNozzles	#totalNozzles	#failed_list
2018.10.06.03.21.30	2	128	24, 95,
2018.10.06.03.22.29	3	128	24, 42, 95,
2018.10.06.03.23.38	3	128	24, 42, 95,
2018.10.06.03.24.46	3	128	24, 42, 95,
2018.10.06.03.25.55	3	128	24, 42, 95,
2018.10.06.03.27.03	3	128	24, 42, 95,
2018.10.06.03.28.11	3	128	24, 42, 95,
2018.10.06.03.29.20	5	128	24, 28, 42, 50, 95,



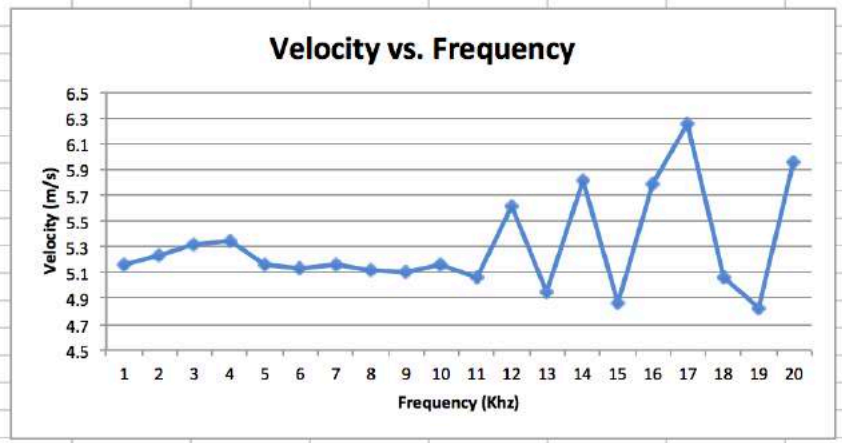
Testing Inkjet Performance: Frequency

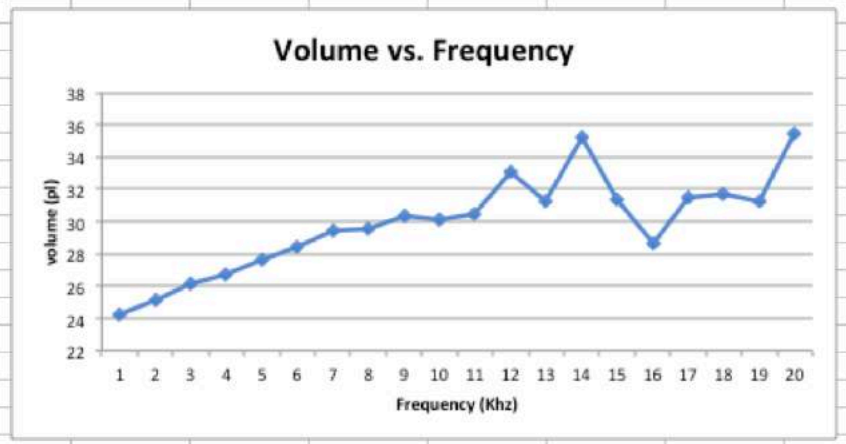




Testing Inkjet Performance: Frequency

Frequency (kHz)	drop1 radius	drop1 volume (pL)	trajectory	velocity (m/s)
1	1.80E-02	24.25241	89.97337	5.16386
2	1.82E-02	25.09501	89.99296	5.238451
3	1.84E-02	26.19967	90.07301	5.319919
4	1.85E-02	26.7219	89.97034	5.344988
5	1.88E-02	27.63136	90.02897	5.168274
6	1.89E-02	28.42394	90.07417	5.139957
7	1.92E-02	29.44158	89.99537	5.155534
8	1.92E-02	29.53142	89.96075	5.115504
9	1.94E-02	30.36416	89.97836	5.105206
10	1.93E-02	30.13937	89.94465	5.161822
11	1.94E-02	30.48748	89.92979	5.063175
12	1.99E-02	33.1057	89.93591	5.612579
13	1.95E-02	31.21084	89.91512	4.952079
14	2.03E-02	35.26918	89.88316	5.810924
15	1.96E-02	31.38365	89.82558	4.8679
16	1.90E-02	28.62666	89.9332	5.784729
17	1.96E-02	31.43763	89.97241	6.248661
18	1.96E-02	31.68546	89.96257	5.063194
19	1.95E-02	31.25376	89.95438	4.827392
20	2.04E-02	35.41389	89.96015	5.961308





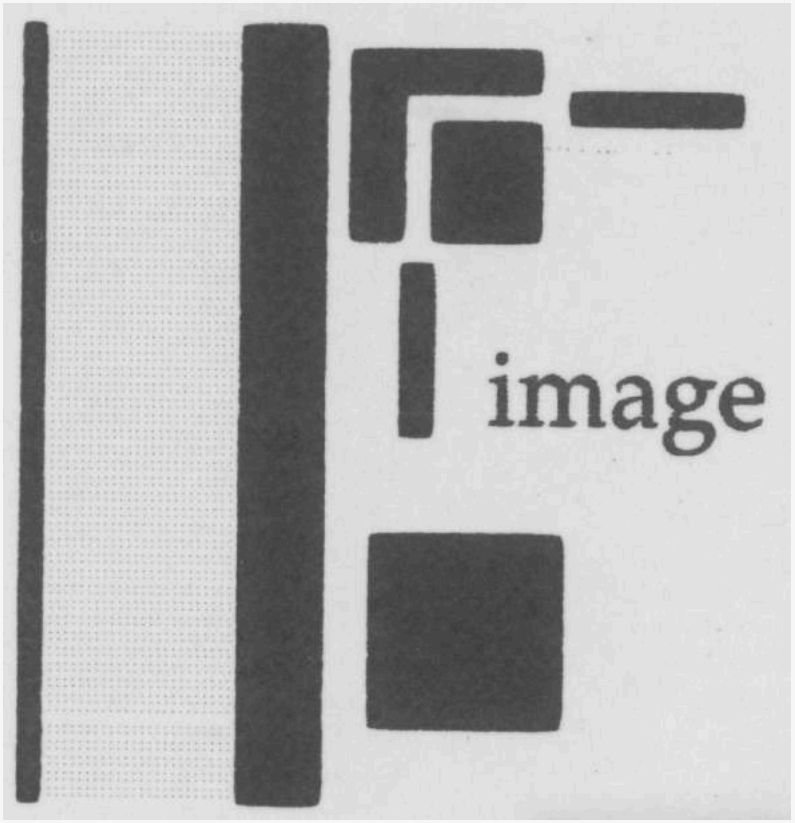
Print Quality Measurement

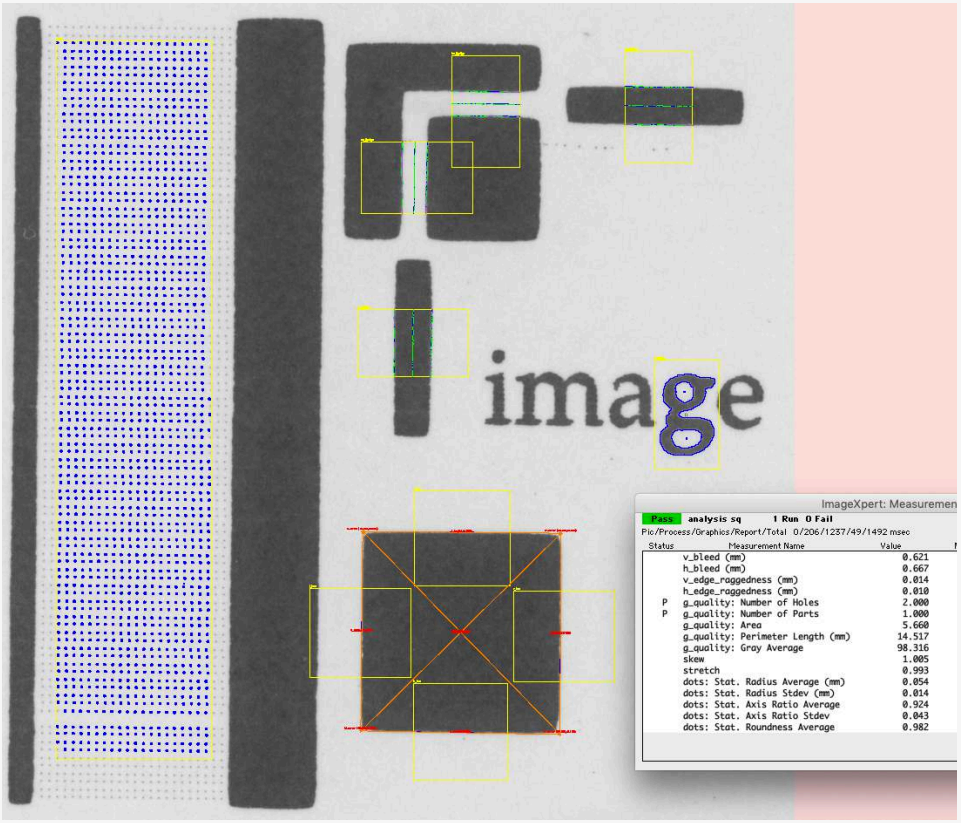
2400 DPI color

Up to size A3

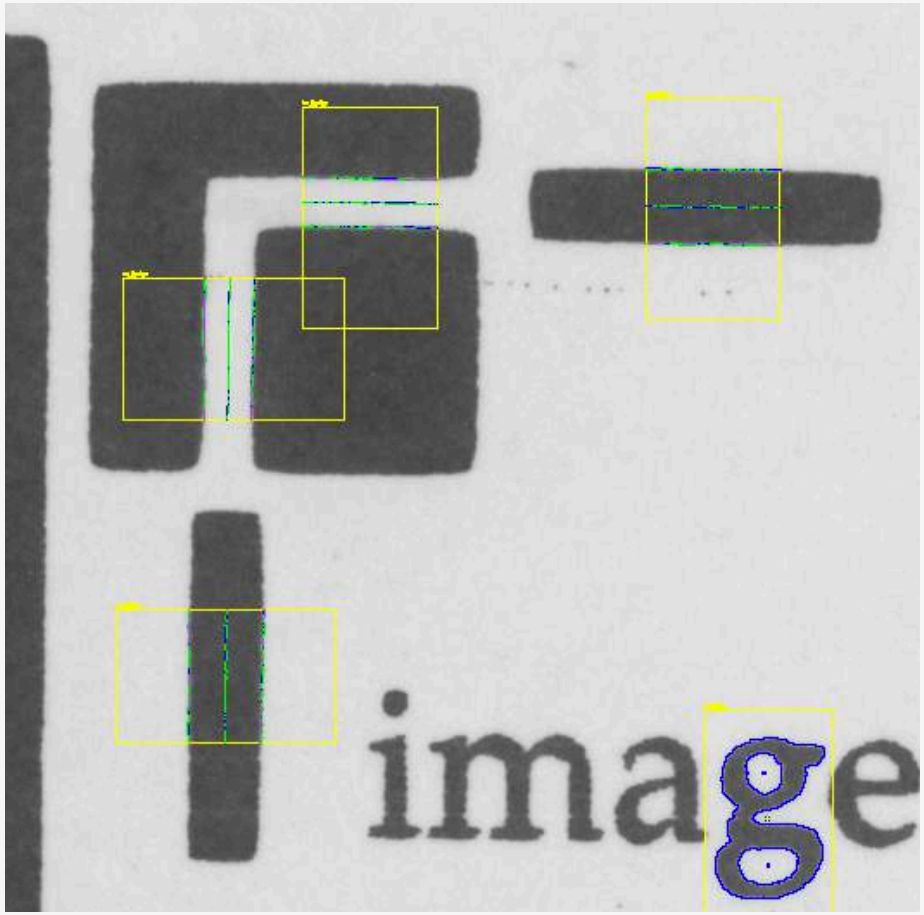
Transparency option

Analyzing Print Quality

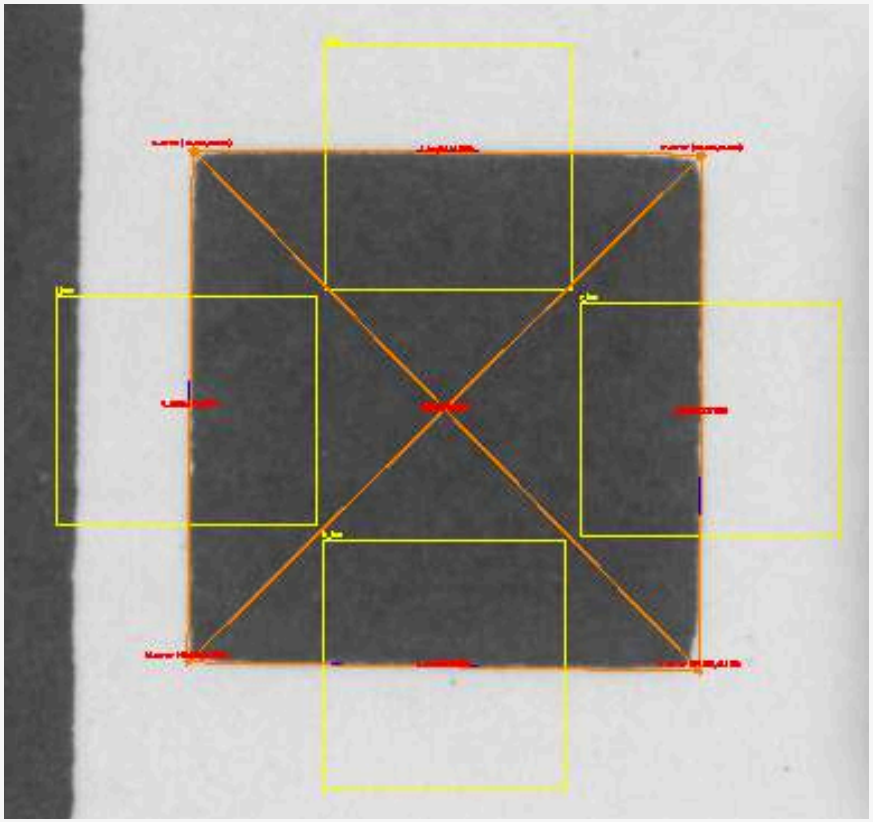




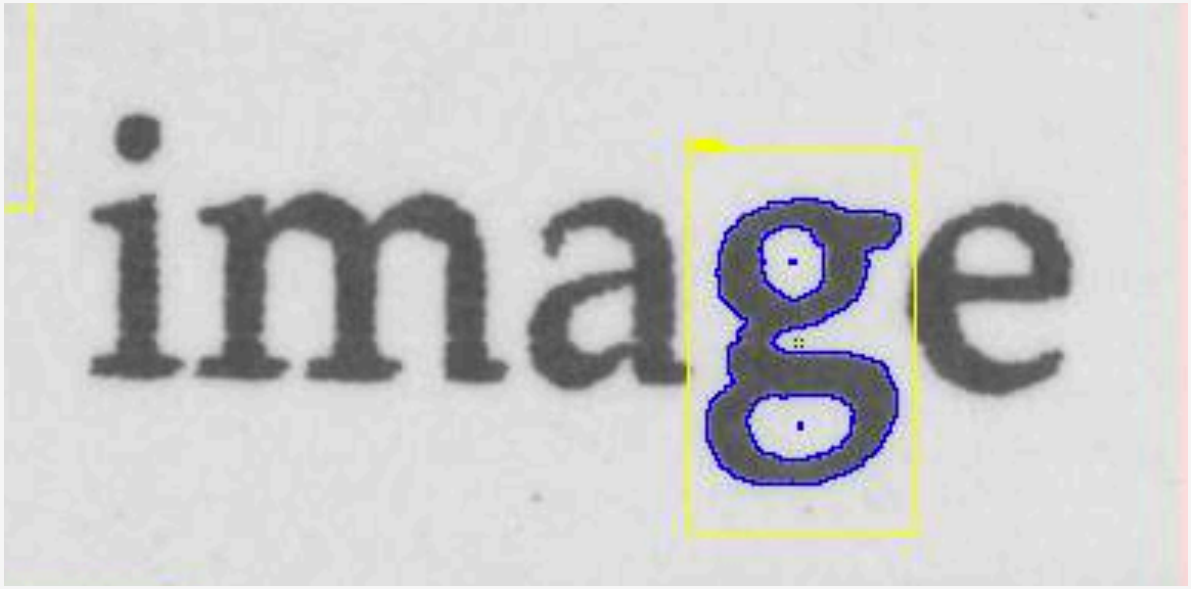
Print Quality Measurement:
Line Quality/Bleed



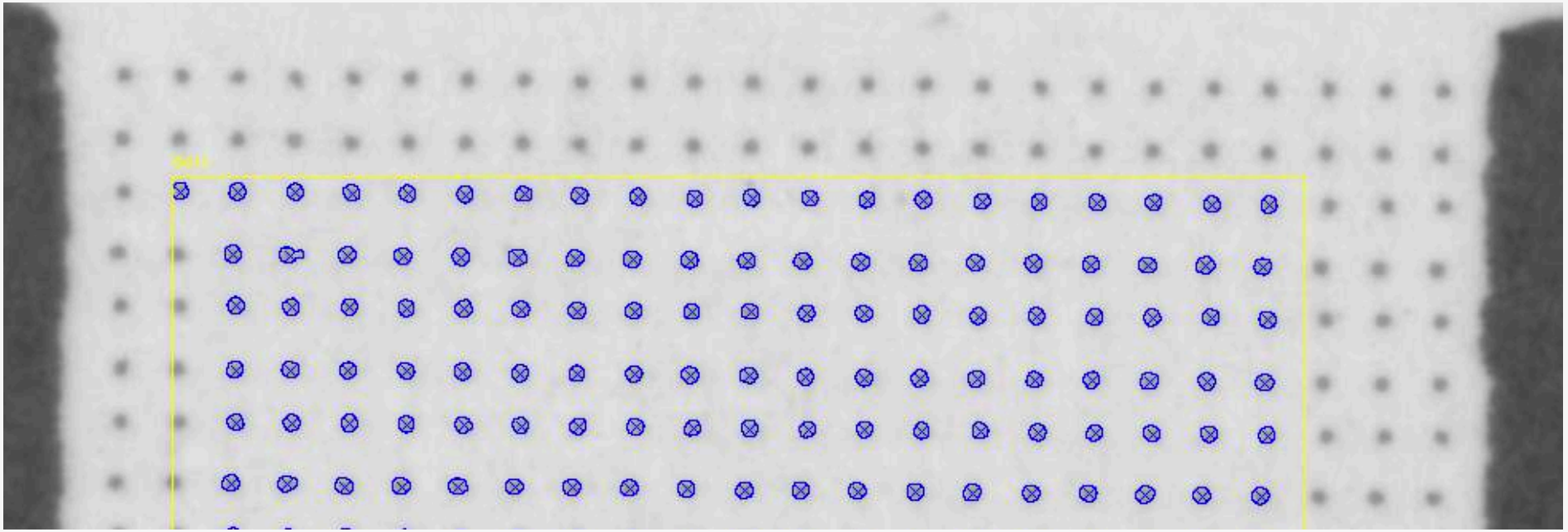
Print Quality Measurement: Skew/Stretch



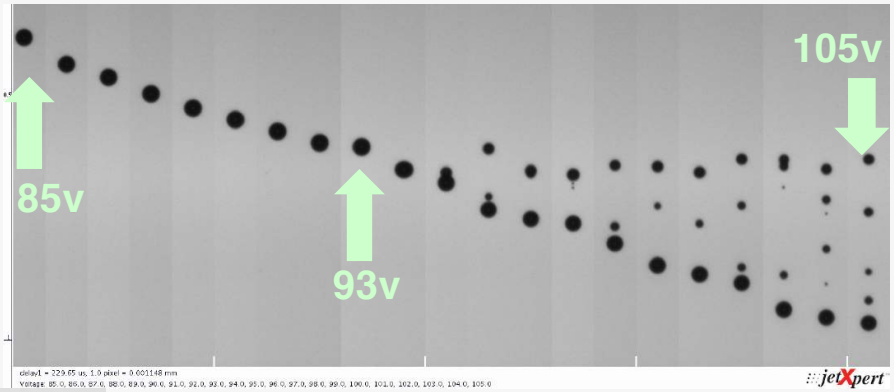
Print Quality Measurement: Text Quality

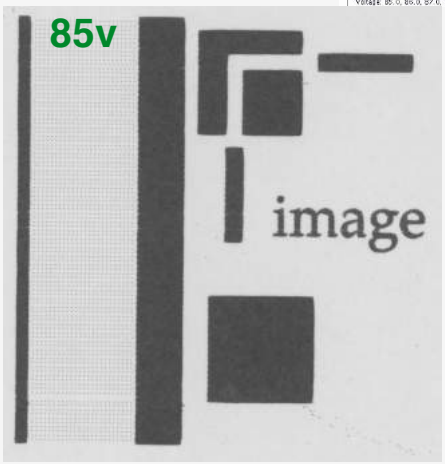


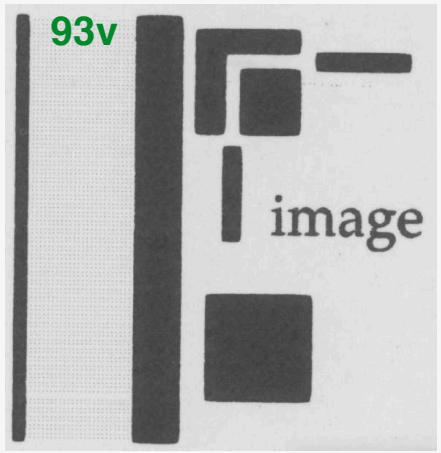
Print Quality Measurement: Dot Quality

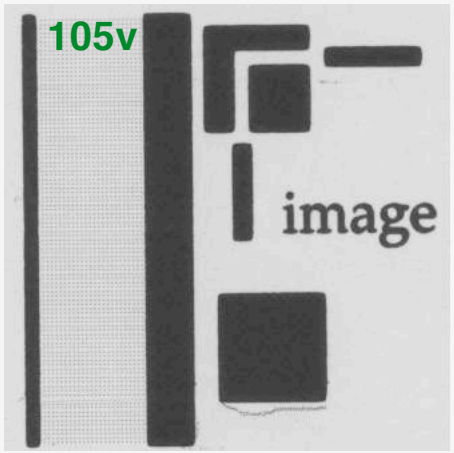


Analyzing Print Quality



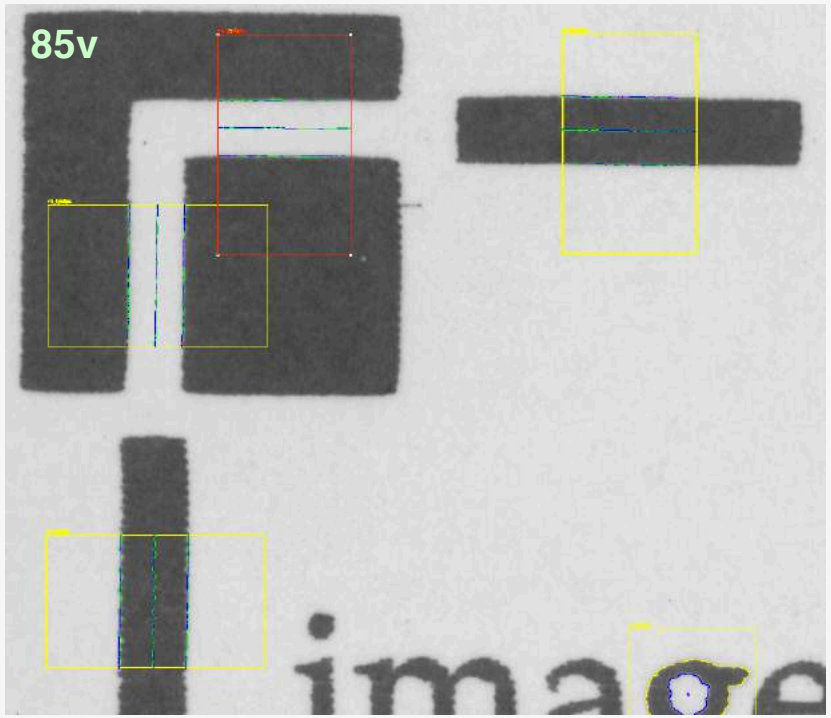


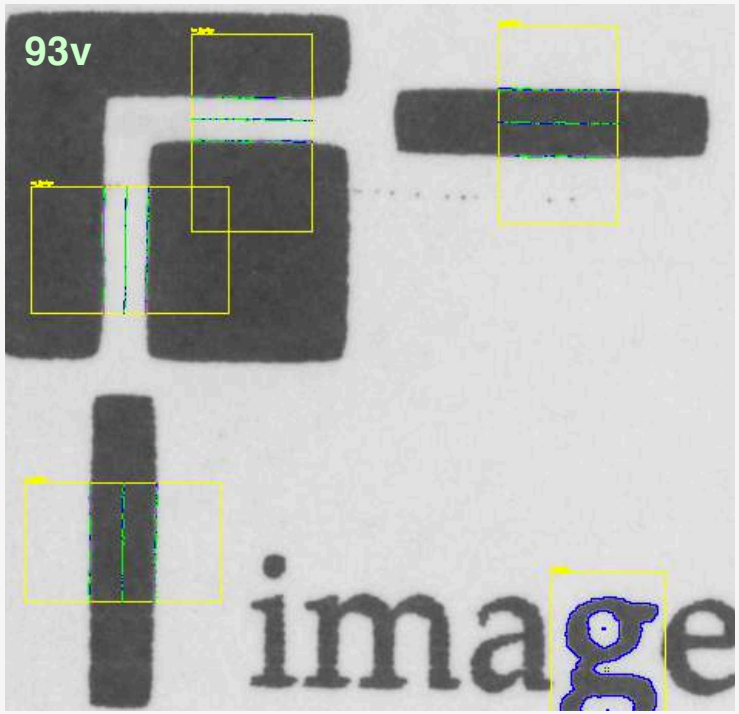




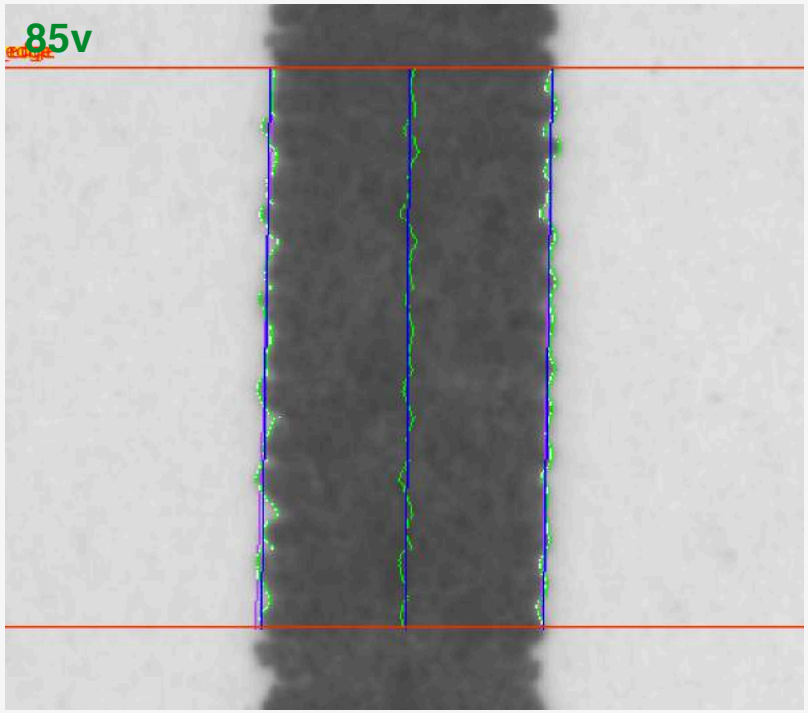
Sample ID	v_bleed (mm	h_bleed (mm	v_edge_ragg	h_edge_ragg	g_quality: Nu	g_quality: Nu	g_quality: Ar	g_quality: Pe	g_quality: Gr	skew	stretch	dots: Stat. Ra	dots: Stat. Ra	dots: Stat. Ax	dots: Stat. Ax	dots: Stat. Roundnes
85v	0.303	0.292	0.02	0.01	2	1	5.144	14.899	100.708	1.001	0.992	0.051	0.013	0.921	0.042	0.982
93v	0.621	0.668	0.014	0.01	2	1	5.66	14.517	98.316	1.005	0.993	0.054	0.014	0.925	0.043	0.982
105v	0.625	0.659	0.011	0.01	2	1	6.254	14.511	93.604	1	0.99	0.069	0.024	0.754	0.114	0.929

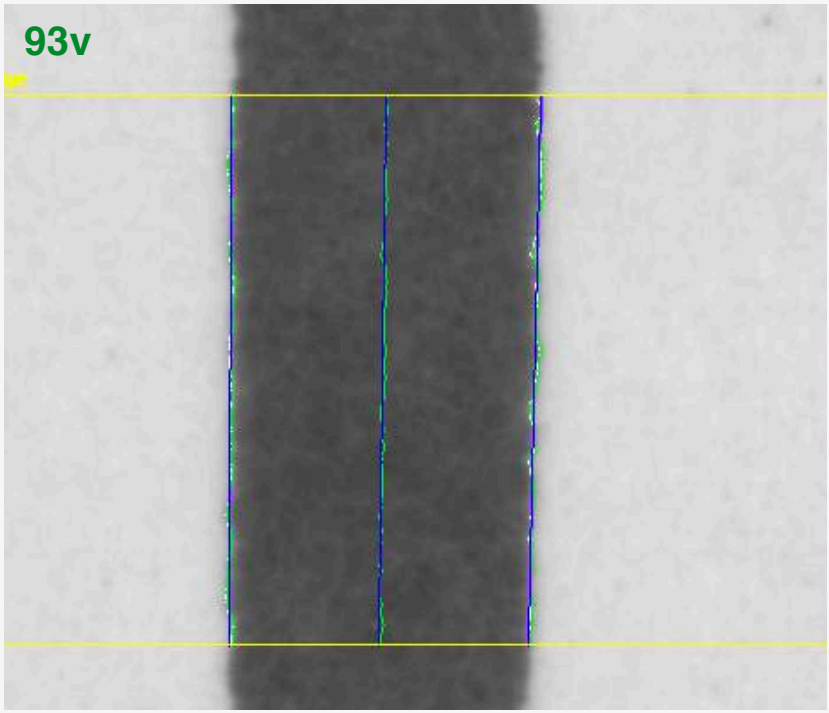
Print Quality Measurement: Bleed Comparison



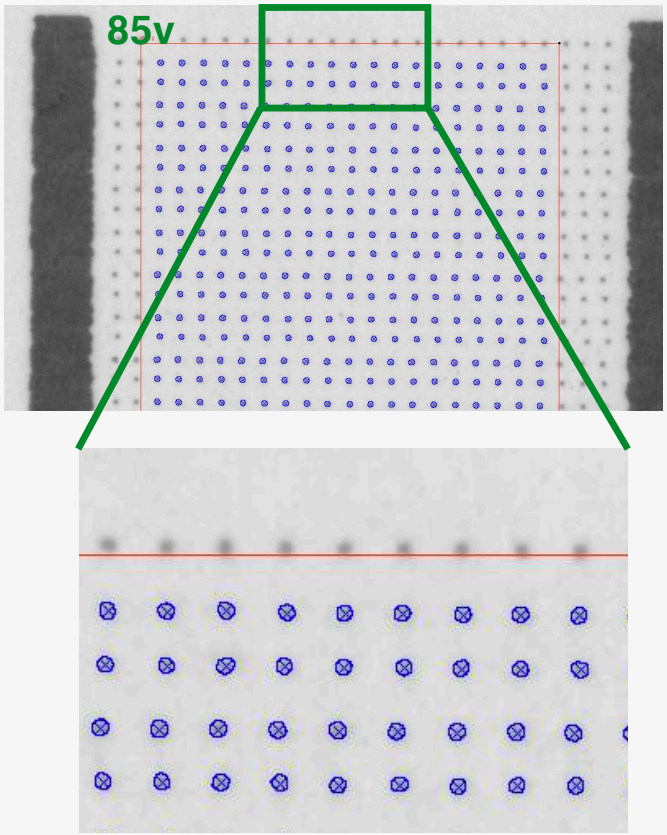


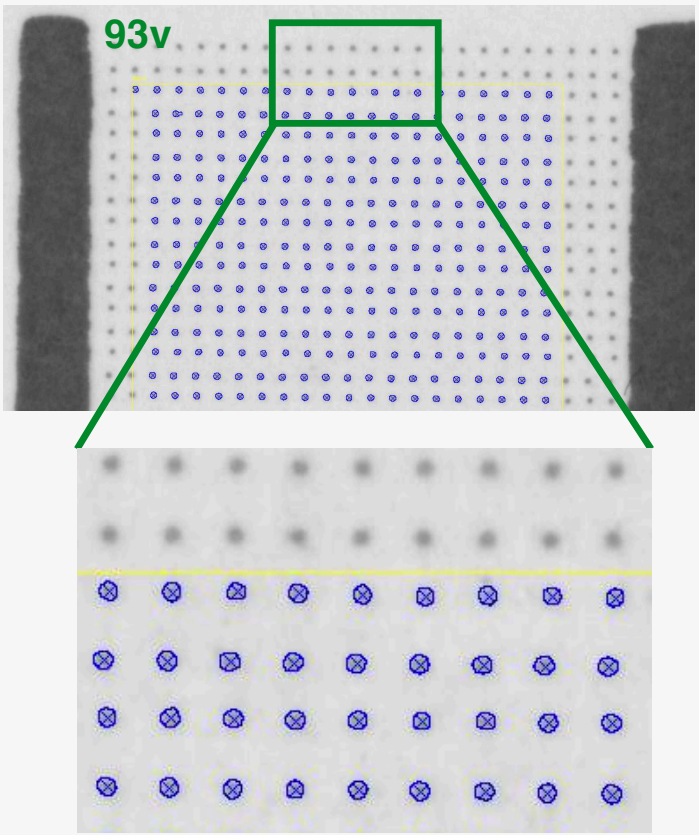
Print Quality Measurement: Edge Comparison

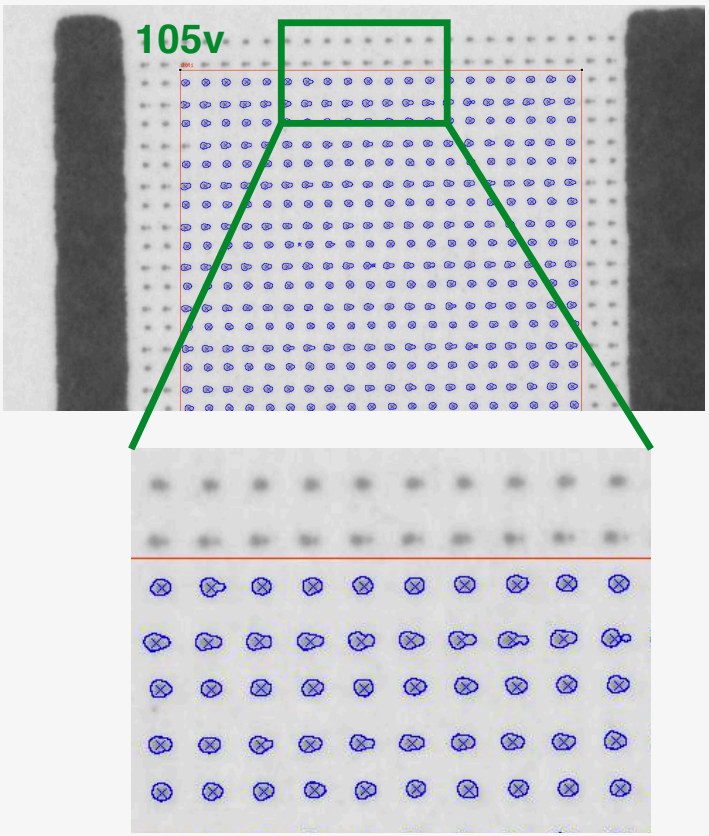




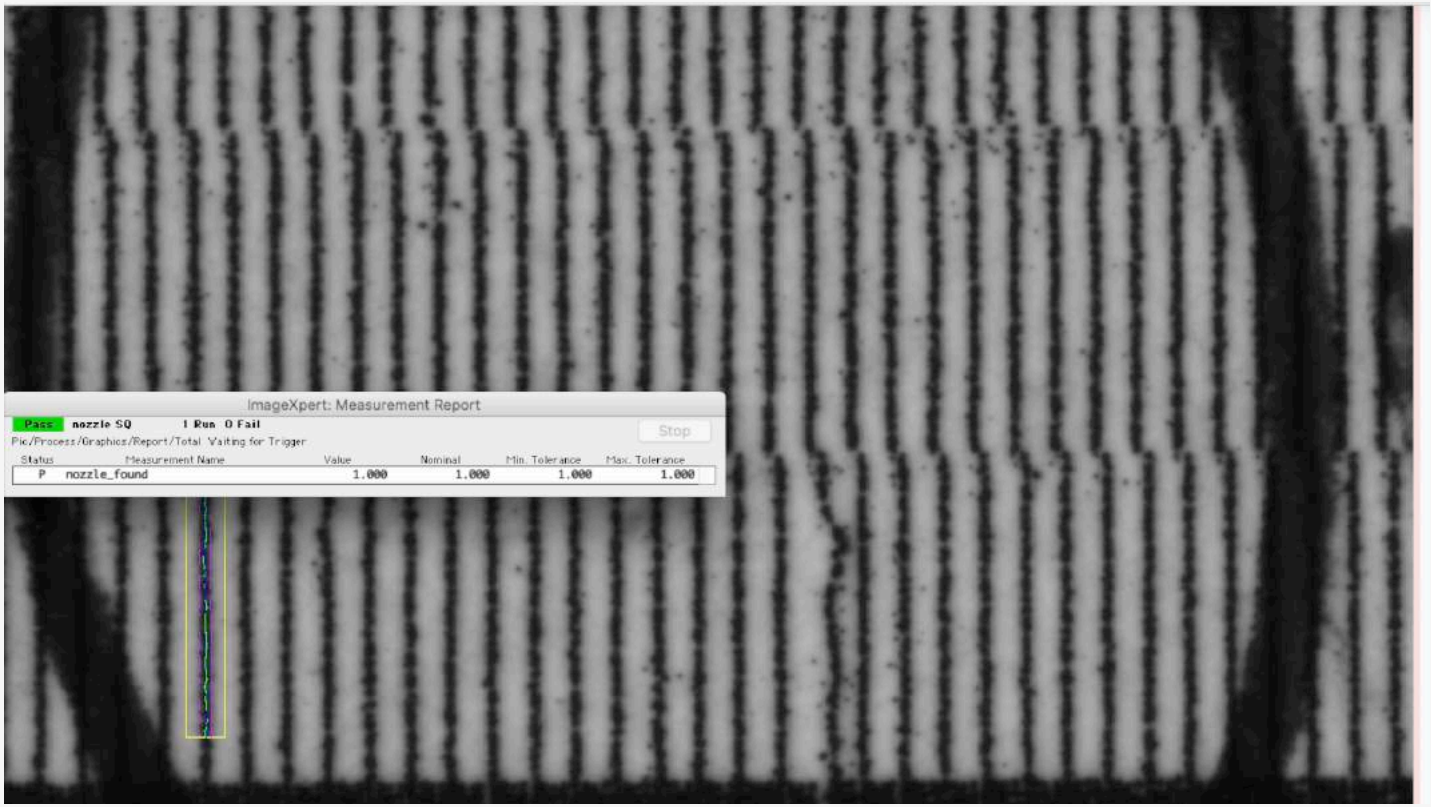
Print Quality Measurement: Dot Quality





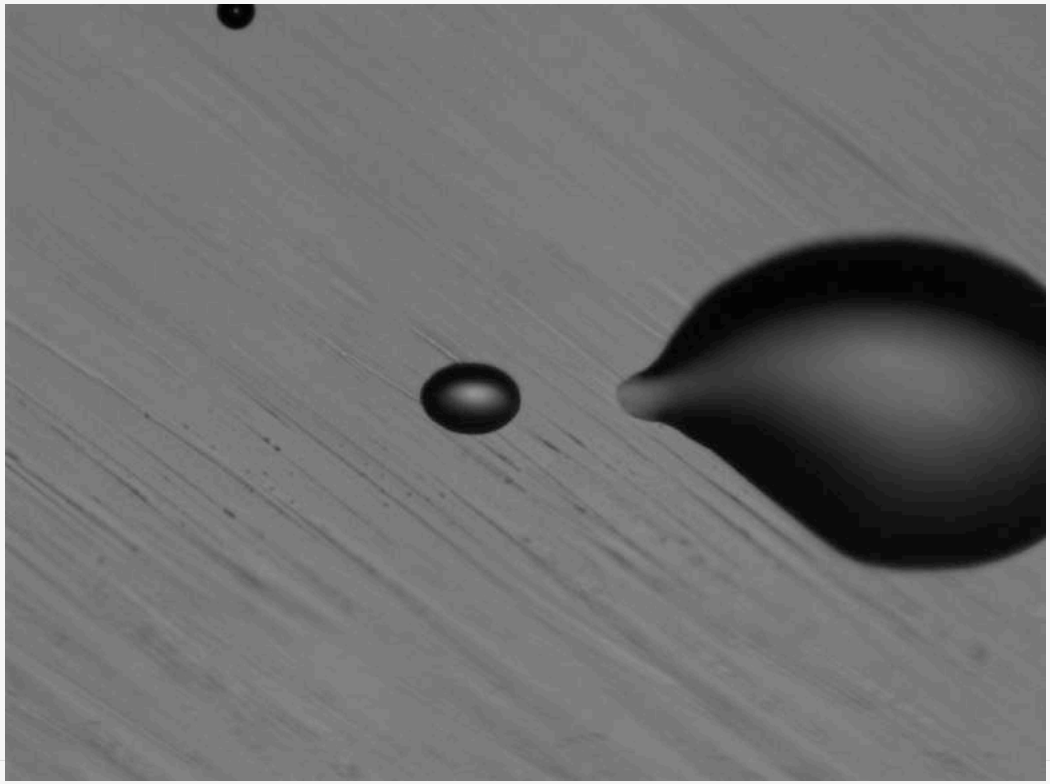


Other Analysis: Missing Jets

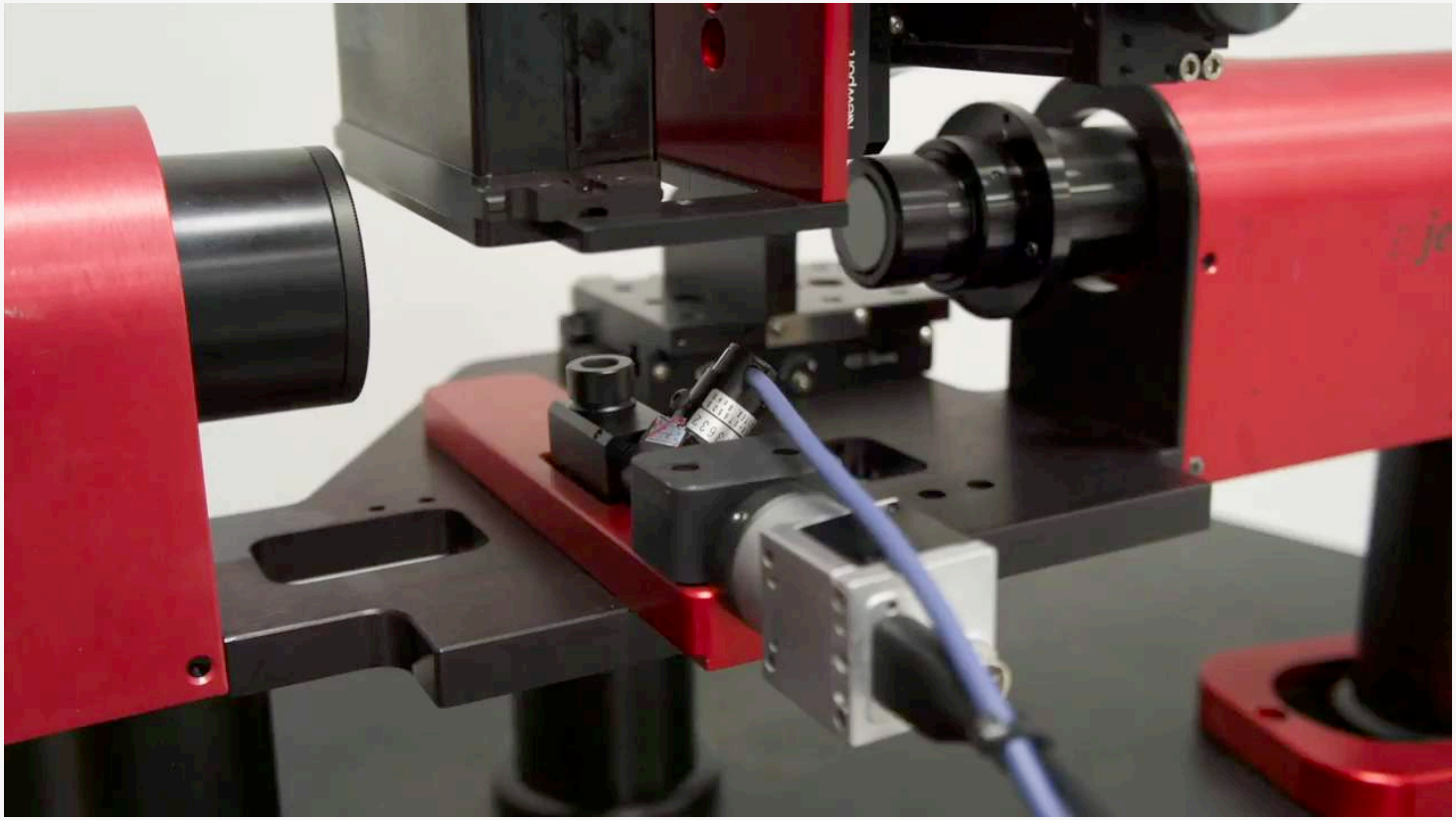


Option: Drop on surface

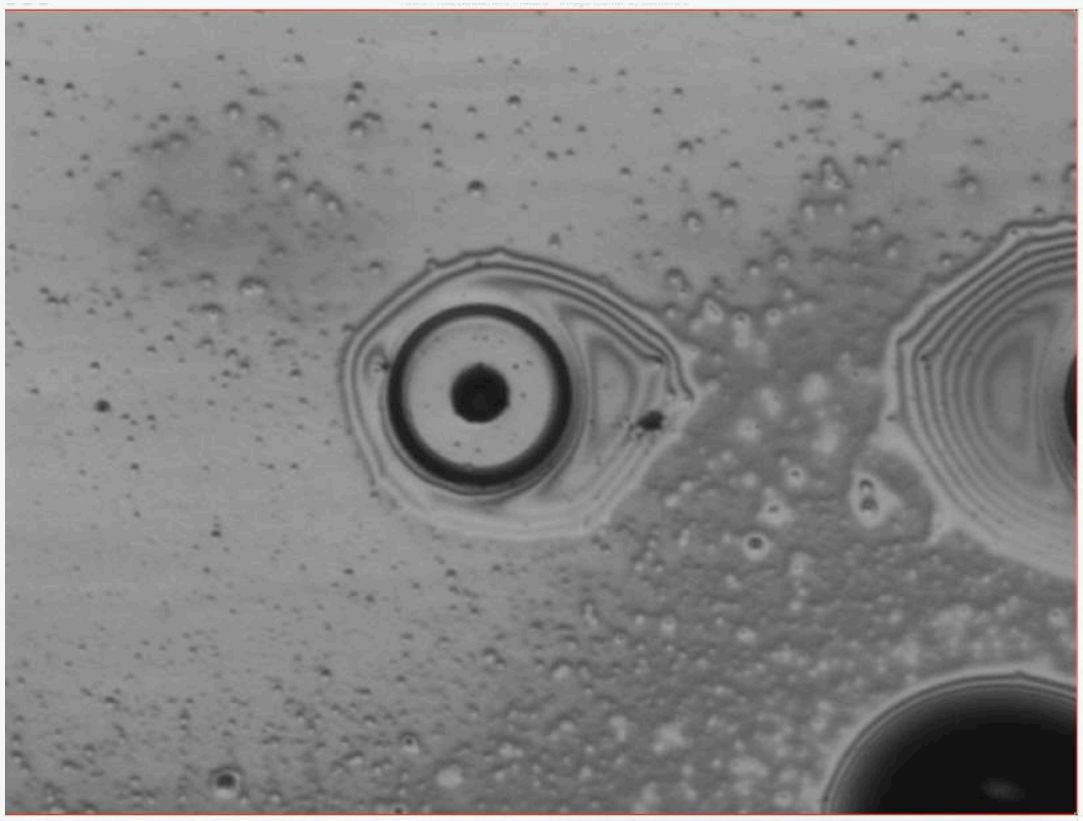
Kyocera head 30pl drops

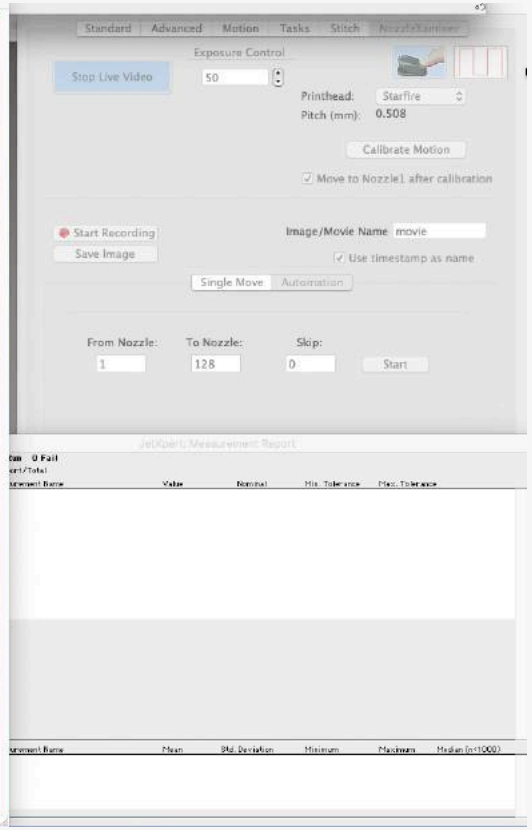


Other Analysis:
Nozzle Inspection

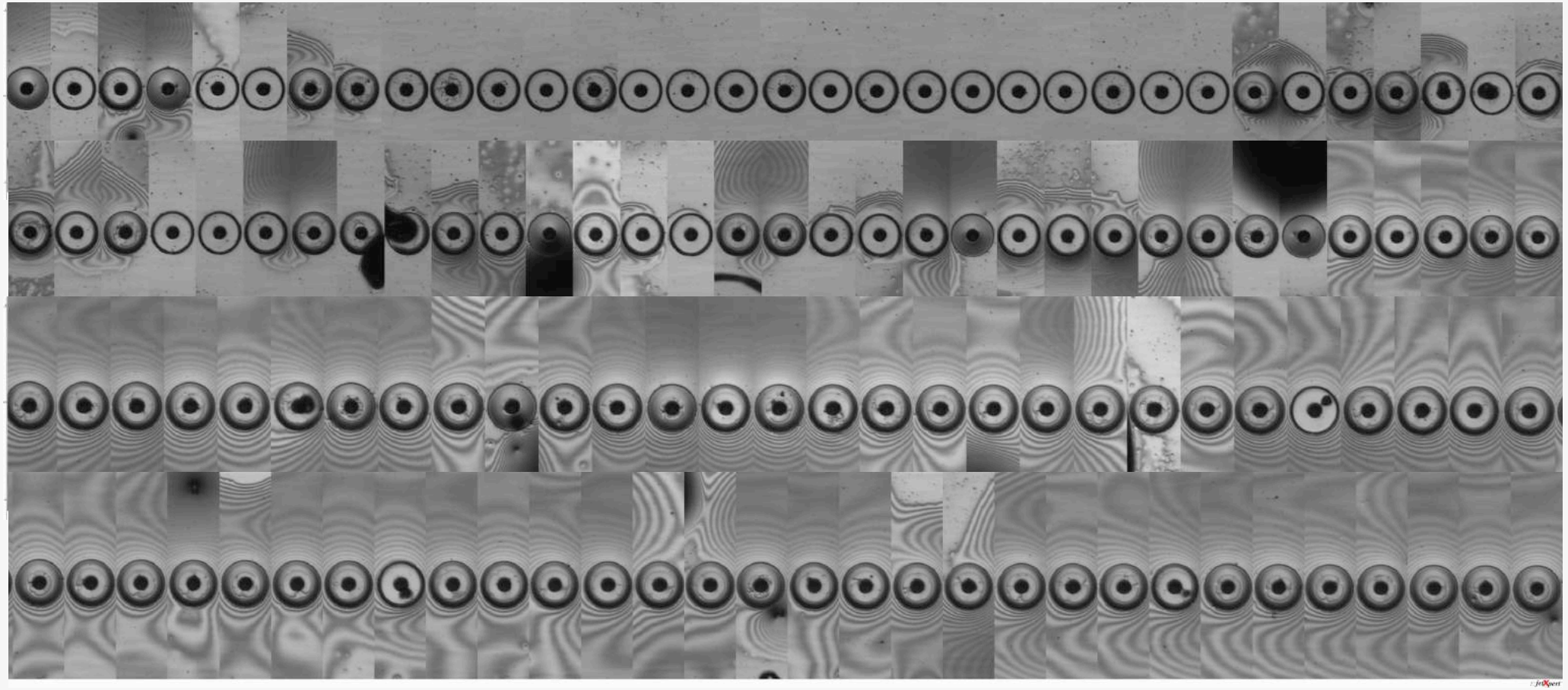


Other Analysis:
Nozzle Inspection





Other Analysis:
Nozzle Inspection



Thank You!

imageXpert®

Come visit us at booth 834

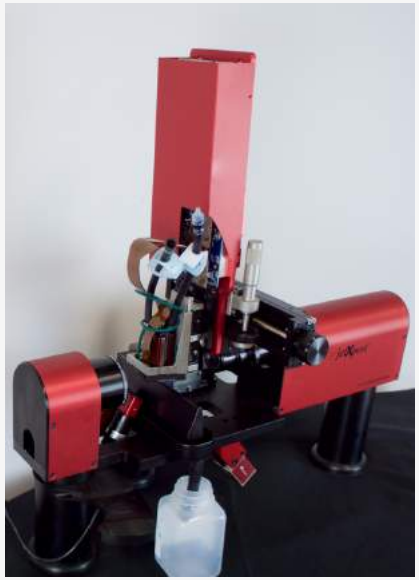
Thank You!

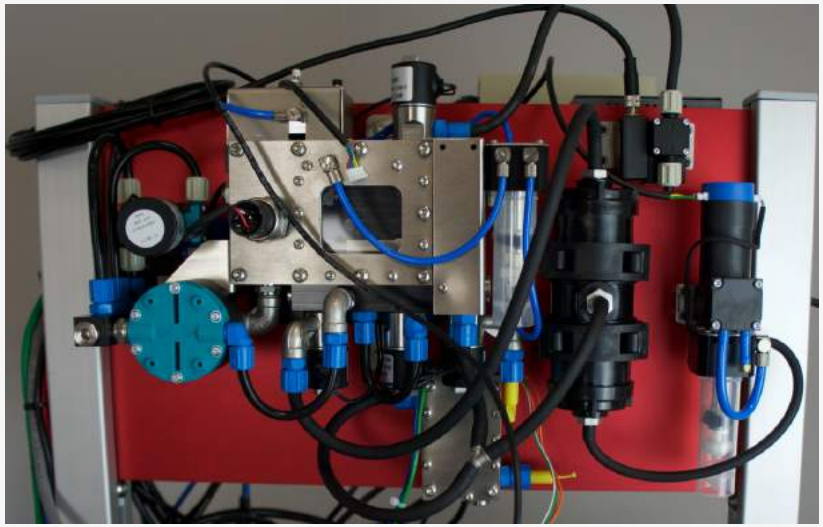
Questions?

Thank You!

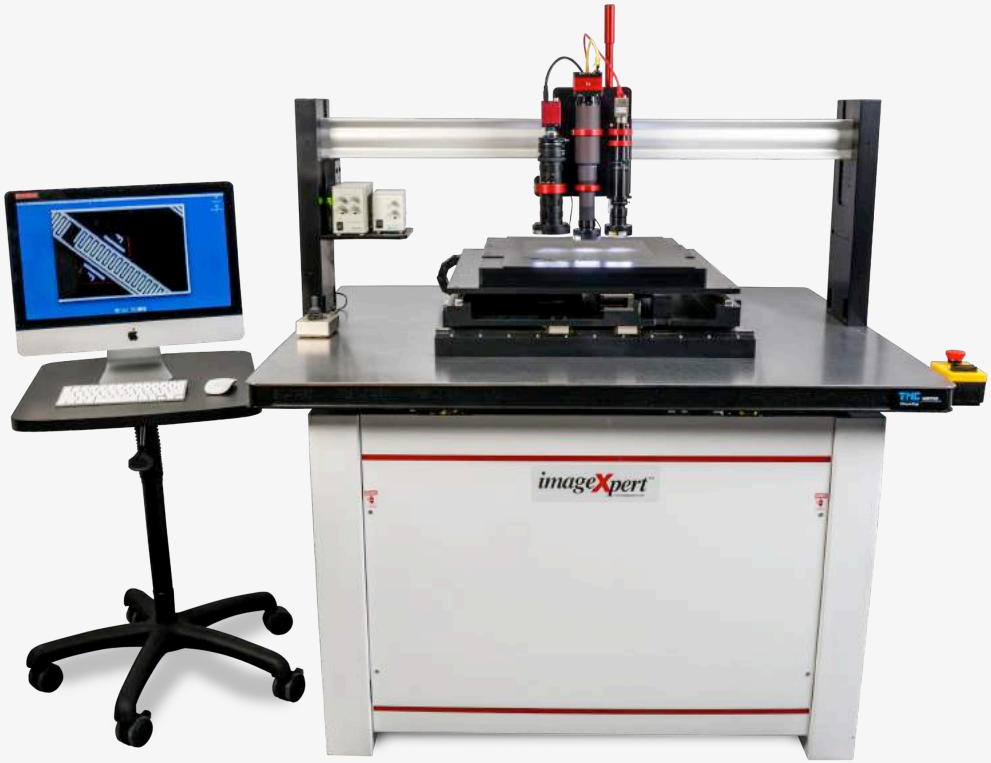
Extra Slides:

Testing Inkjet Performance: New: Integrated Control Electronics, Ink Supply





Print Quality Measurement



1 Micron/ pixel resolution

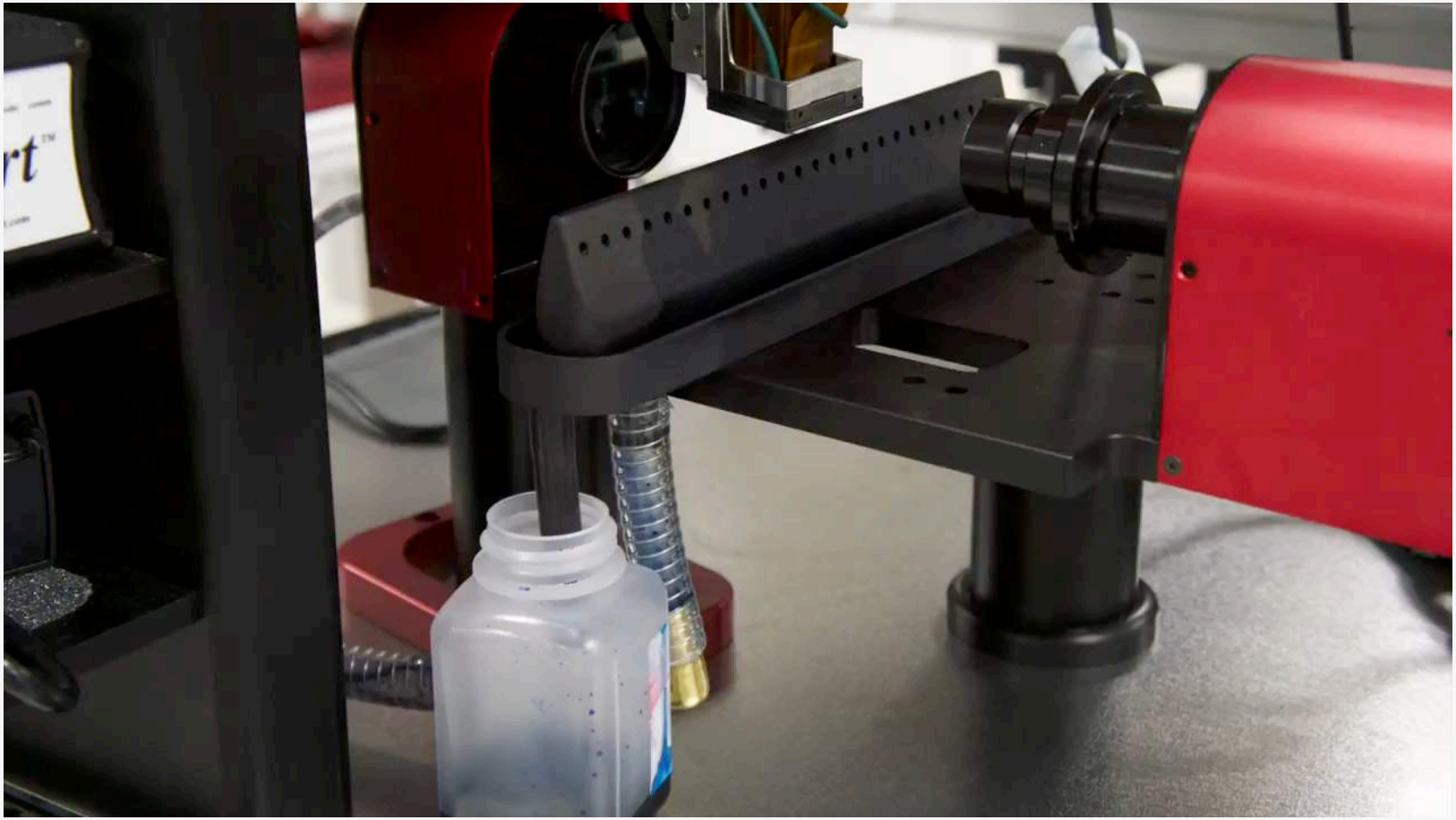
Multiple cameras

Spectrophotometer

Glossmeter

18"x18" XY travel

Testing Inkjet Performance
New: Vacuum Ink Collector



Option: JetXpert 3D

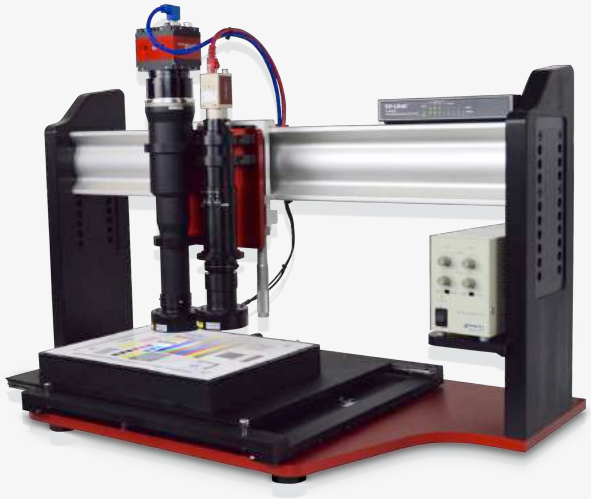
Measure drop trajectory in two planes simultaneously

Option: JetXpert OEM

In situ drop analysis

Camera-based system

High resolution measurements



1 Micron/pixel resolution

Multiple cameras

Testing Inkjet Performance
Drop Watching
JetXpert

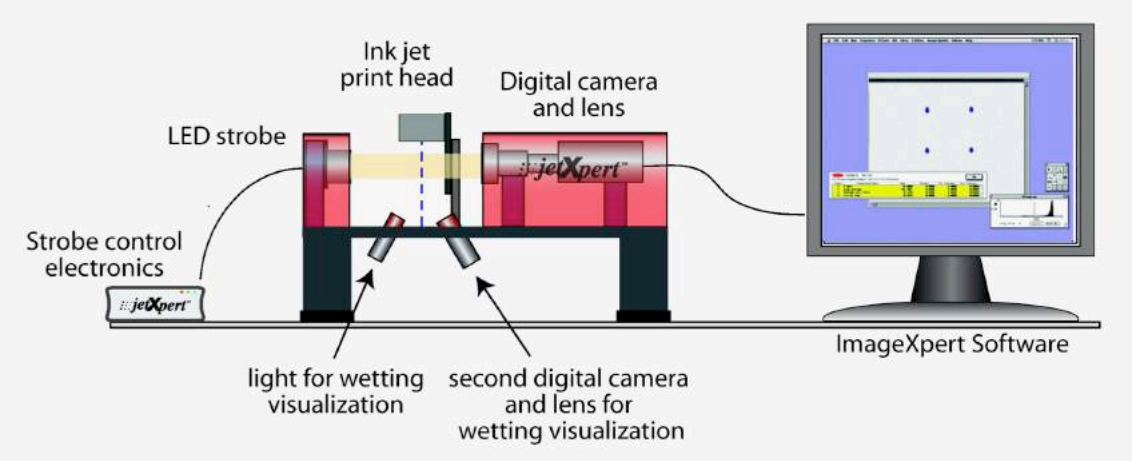
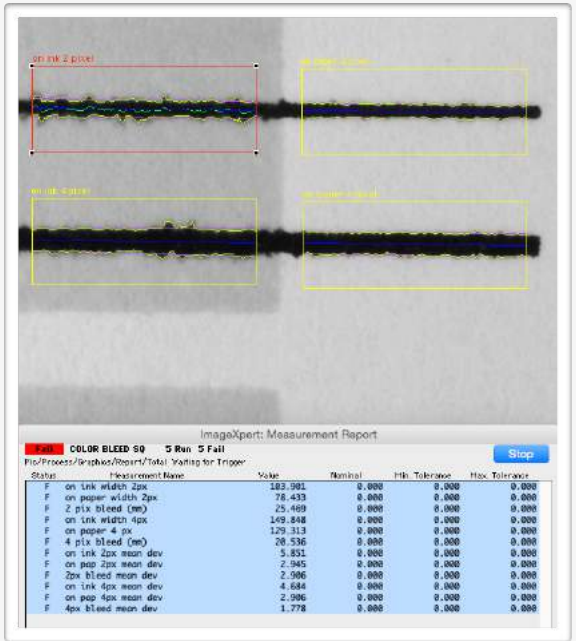
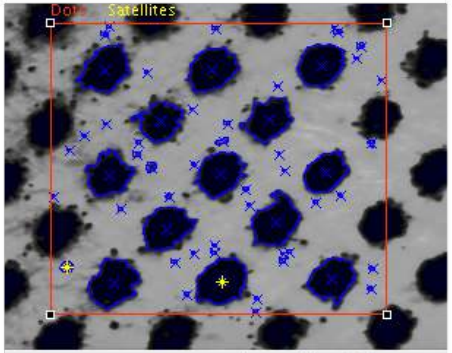


Image quality

Line quality and dot measurements





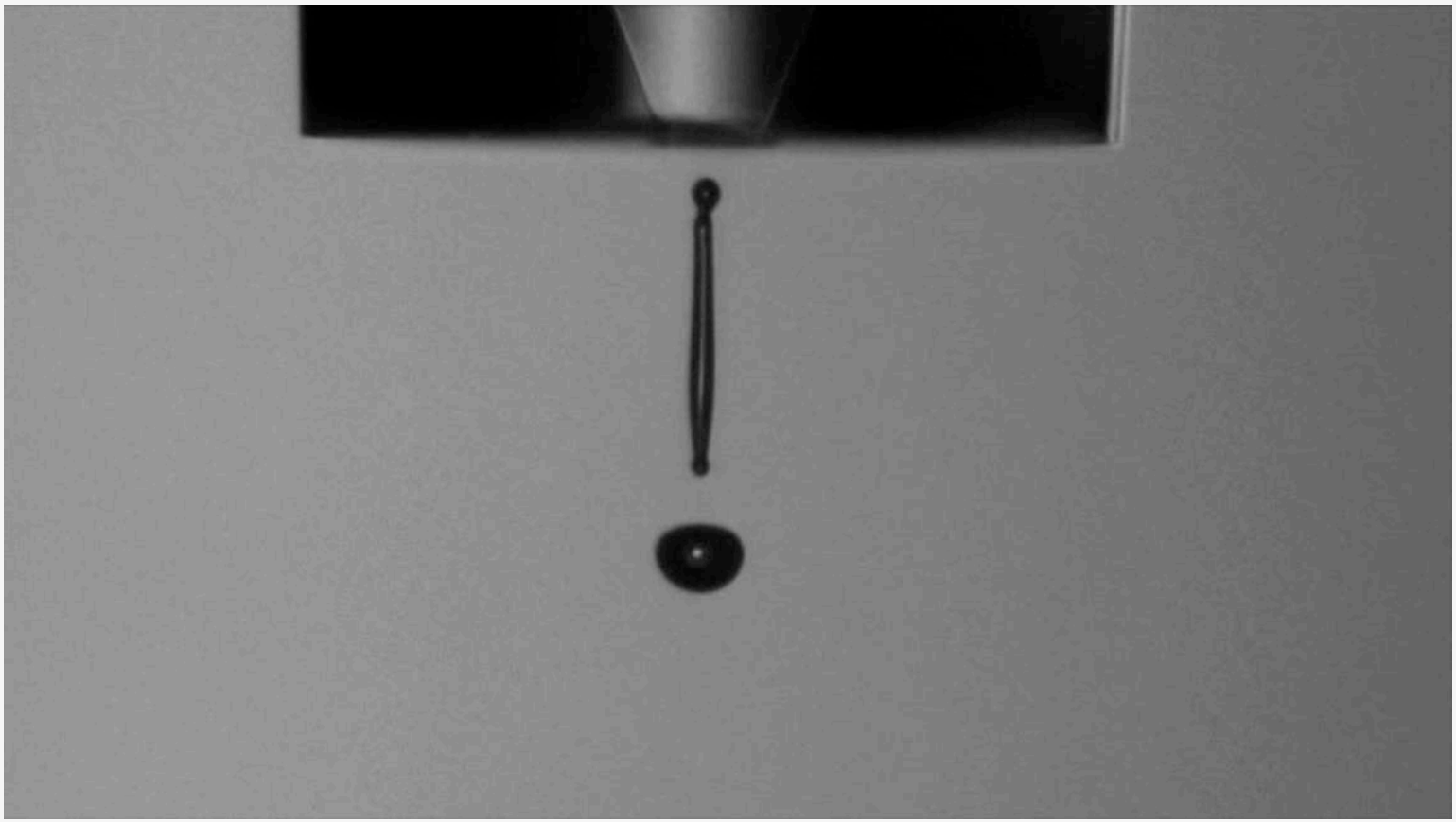
ImageXpert: Measurem

DOT QUALITY SQ 3 Run 3 Fail

ess/Graphics/Report/Total Waiting for Trigger

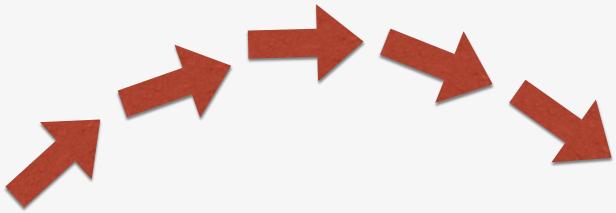
Measurement Name	Value
# of Dots	13.000
Dot Area Avg.	17211.400
Dot Area Stdev	1913.176
Dot Gray Avg.	6.325
Dot Gray Stdev	1.449
Axis Ratio Avg	18.763
Axis Ratio Stdev.	1.507
Roundness Avg.	0.728
Roundness Stdev.	0.093
# of Satellites	43.000
Satellite Avg. Area	211.714

Testing Inkjet Performance
Drop Watching
JetXpert



Testing Inkjet Performance
Why Testing Matters

- Ink Formulation
- Waveform
- Jetting Conditions
- Printhead



- Dot / Line / Text Quality
- Satellites / Overspray
- Color Bleed
- Banding

Testing Inkjet Performance: Why Testing Matters

- Ink Formulation
- Waveform
- Jetting Conditions
- Printhead

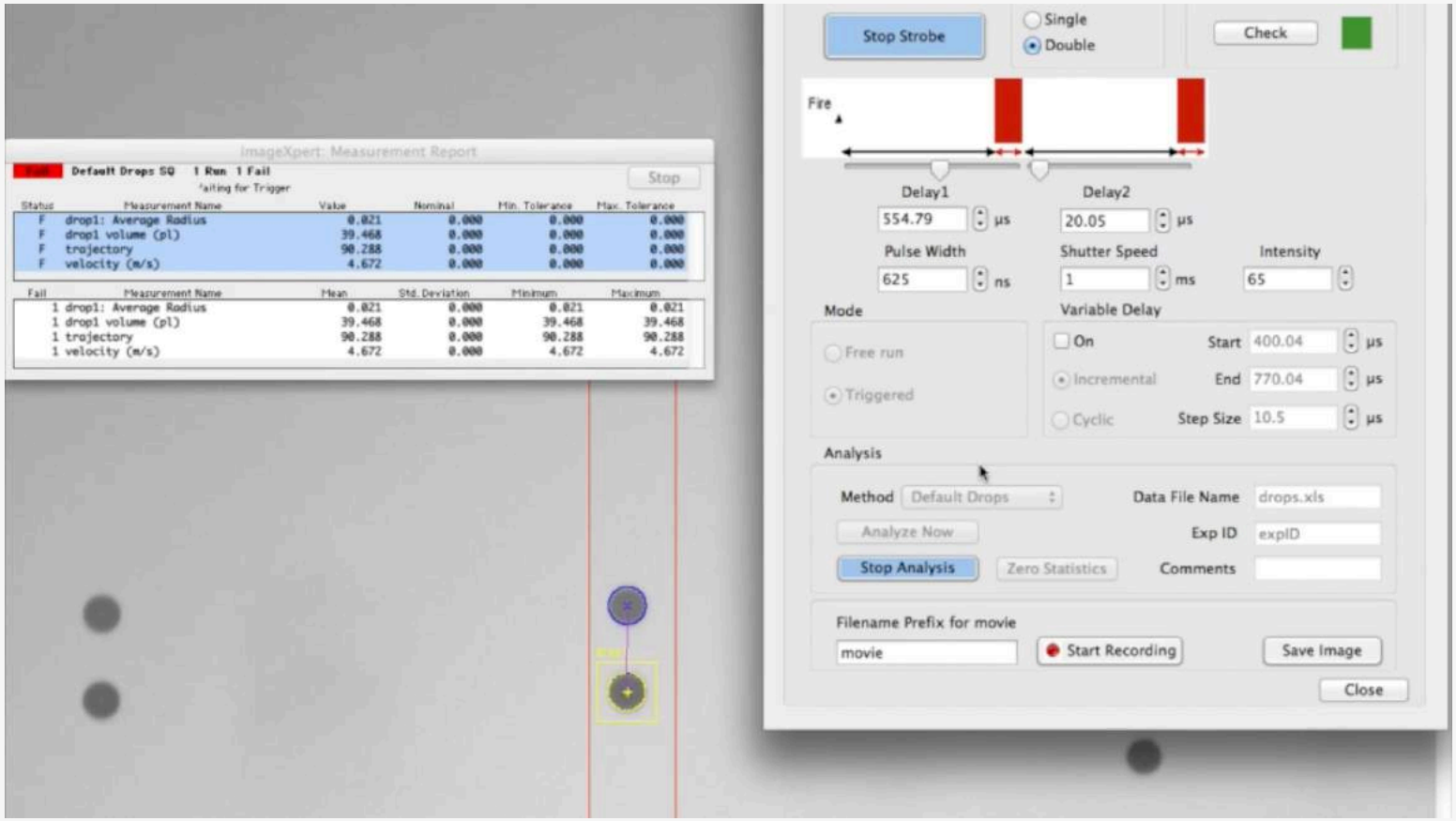
→

- Drop Volume
- Drop Velocity
- Drop Trajectory
- Satellites
- Sustainability
- Throw Distance

→

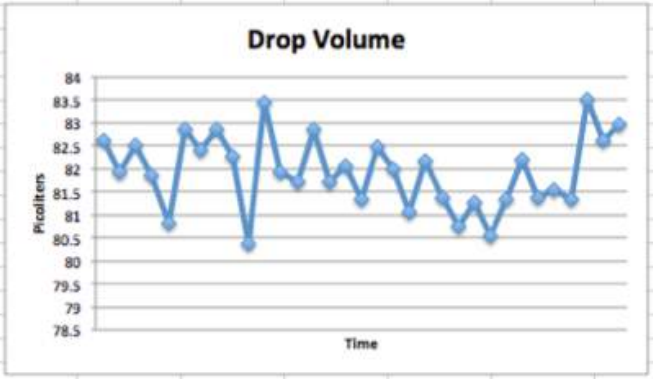
- Dot / Line / Text Quality
- Satellites / Overspray
- Color Bleed
- Banding

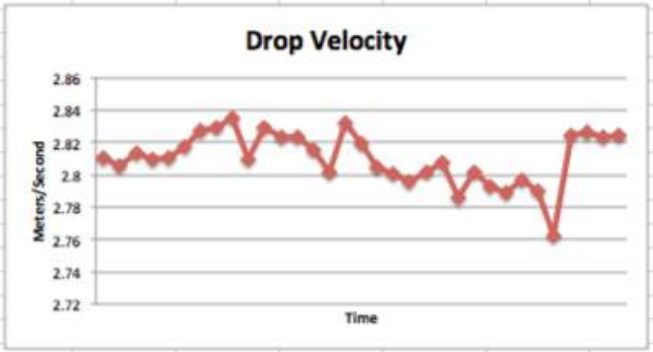
Testing Inkjet Performance
Drop Watching
JetXpert



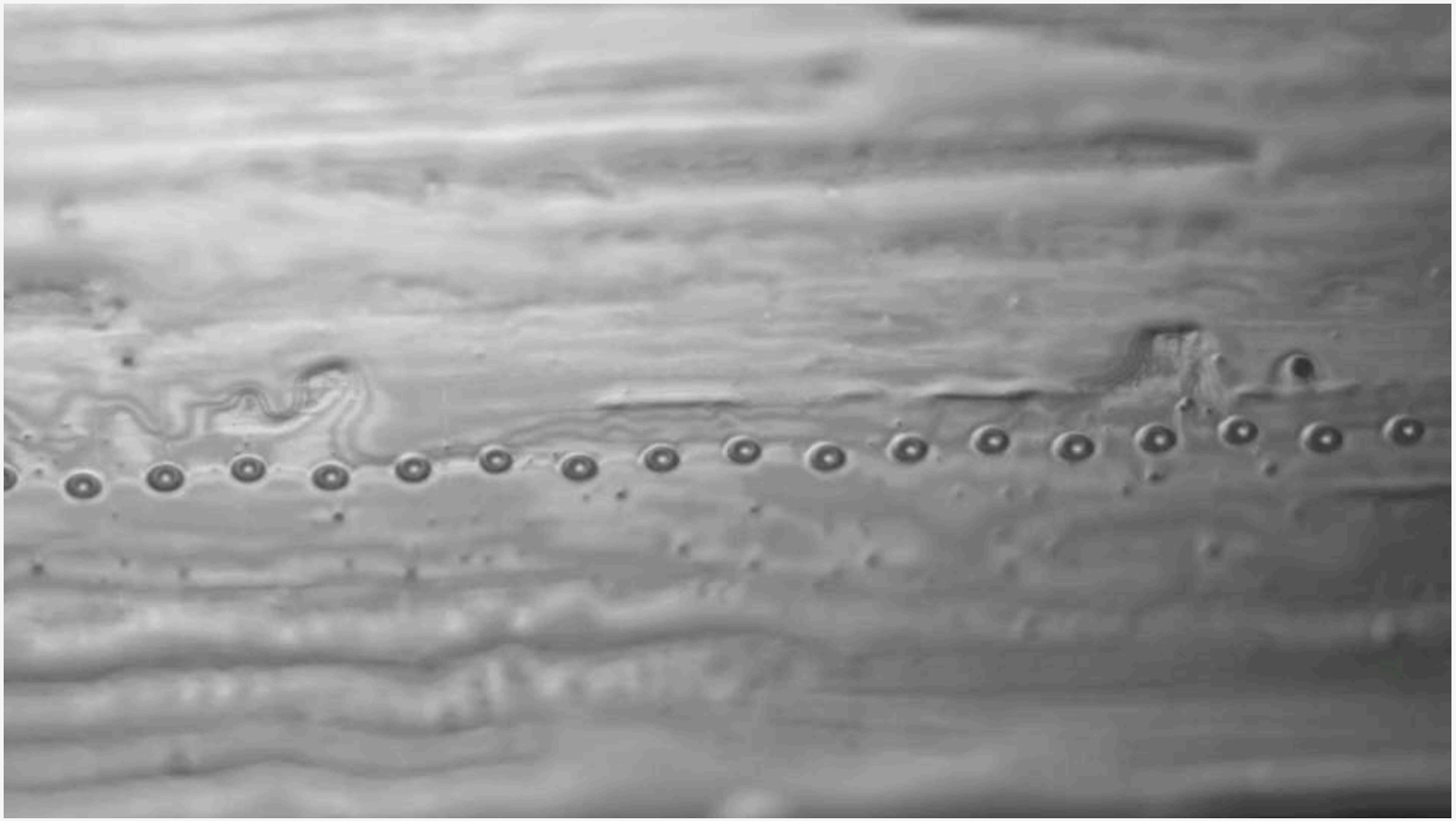
Testing Inkjet Performance
Drop Watching
JetXpert

	A	B	C	D	E	F
1	Exp ID	drop1: Average Radius	drop1 volume (pl)	trajectory	velocity (m/s)	Comments
2	expID	2.70E-02	82.59902	90.34734	2.810377	
3	expID	2.69E-02	81.92004	90.26538	2.805462	
4	expID	2.70E-02	82.51237	90.31779	2.813141	
5	expID	2.69E-02	81.86227	90.34512	2.809216	
6	expID	2.68E-02	80.82324	90.34123	2.810189	
7	expID	2.70E-02	82.84831	90.25301	2.817132	
8	expID	2.70E-02	82.39166	90.33254	2.827205	
9	expID	2.70E-02	82.85435	90.26772	2.829492	
10	expID	0.026978	82.24663	90.23643	2.83524	
11	expID	2.68E-02	80.35029	90.37906	2.80994	
12	expID	2.71E-02	83.42861	90.31487	2.828665	
13	expID	2.69E-02	81.90157	90.24297	2.823571	
14	expID	2.69E-02	81.70437	90.2906	2.823064	
15	expID	2.70E-02	82.83242	90.26447	2.815511	
16	expID	2.69E-02	81.72195	90.20704	2.801593	
17	expID	2.70E-02	82.0435	90.30197	2.831982	
18	expID	2.69E-02	81.33885	90.24323	2.819198	
19	expID	2.70E-02	82.47418	90.2083	2.804973	
20	expID	2.70E-02	81.99509	90.3025	2.800565	
21	expID	2.68E-02	81.04761	90.23068	2.795382	
22	expID	2.70E-02	82.15066	90.19217	2.802033	
23	expID	2.69E-02	81.35635	90.16116	2.807508	
24	expID	2.68E-02	80.75811	90.07607	2.785419	
25	expID	2.69E-02	81.26146	90.09369	2.801683	
26	expID	2.68E-02	80.53992	90.19228	2.792685	
27	expID	0.026878	81.3354	90.08604	2.789279	
28	expID	2.70E-02	82.18834	90.15737	2.796326	
29	expID	2.69E-02	81.35461	90.12866	2.789792	
30	expID	2.69E-02	81.53654	90.0044	2.762346	
31	expID	2.69E-02	81.33968	90.24271	2.824192	
32	expID	2.71E-02	83.51846	90.22217	2.825986	
33	expID	2.70E-02	82.59348	90.32095	2.82281	
34	expID	2.71E-02	82.96806	90.20089	2.824322	

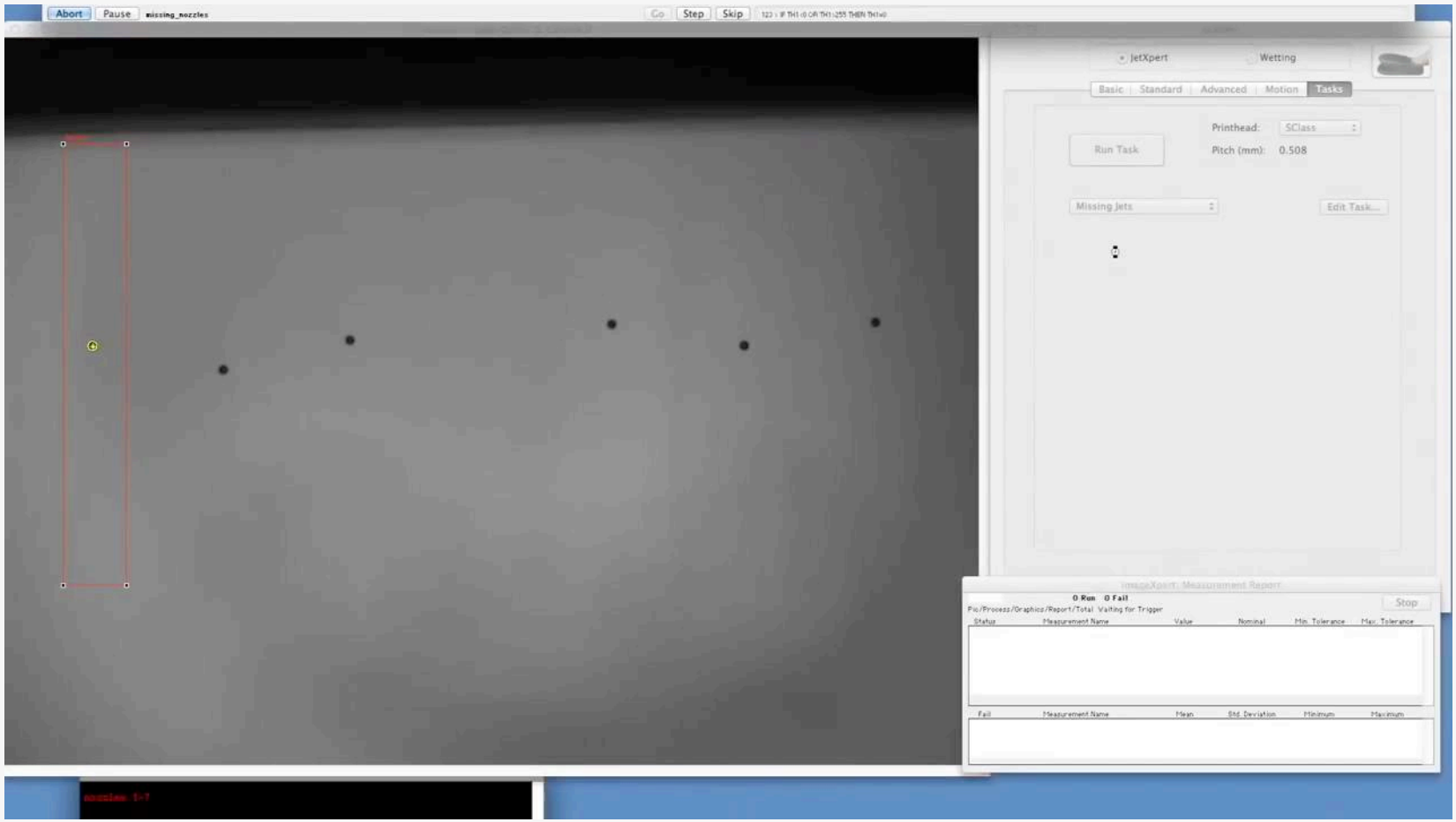




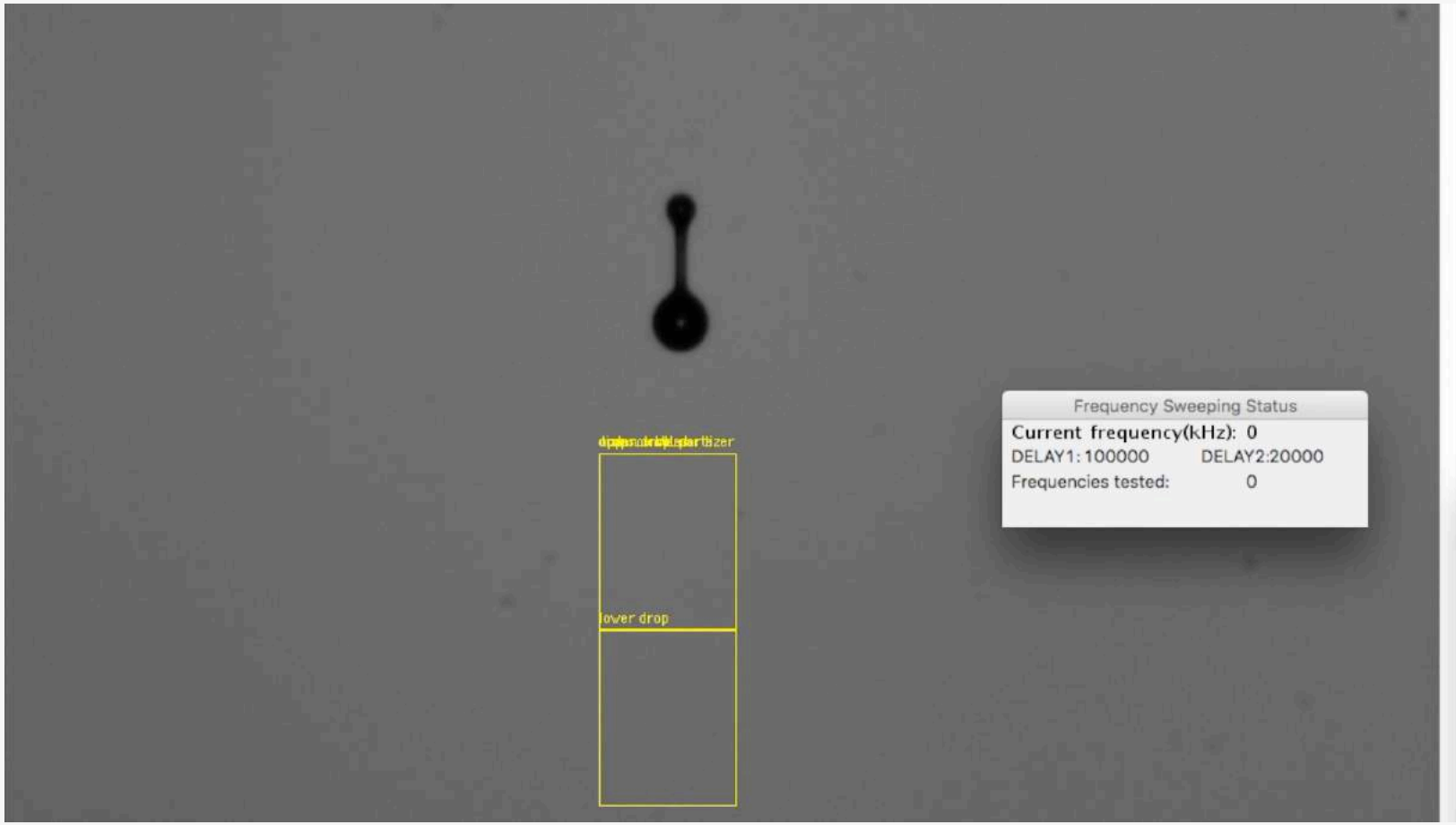
Testing Inkjet Performance
Wetting Camera



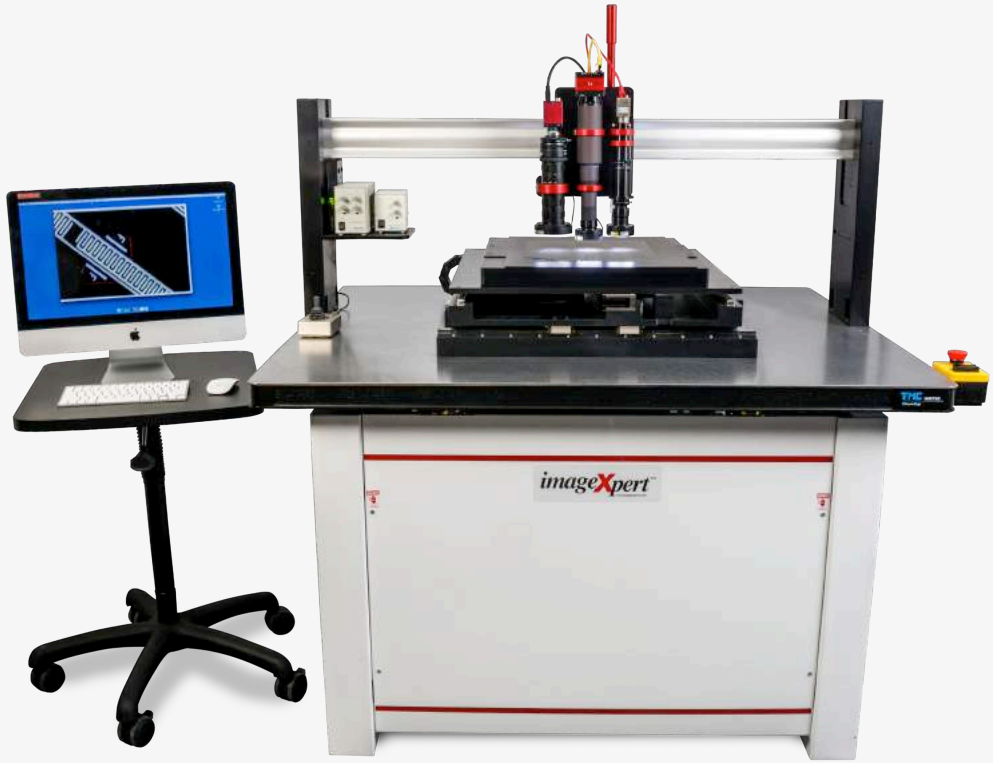
Testing Inkjet Performance Stage for Head Scanning



Testing Inkjet Performance
Scanning Frequencies



Testing Inkjet Performance
Print Quality Inspection



1 Micron/ pixel resolution

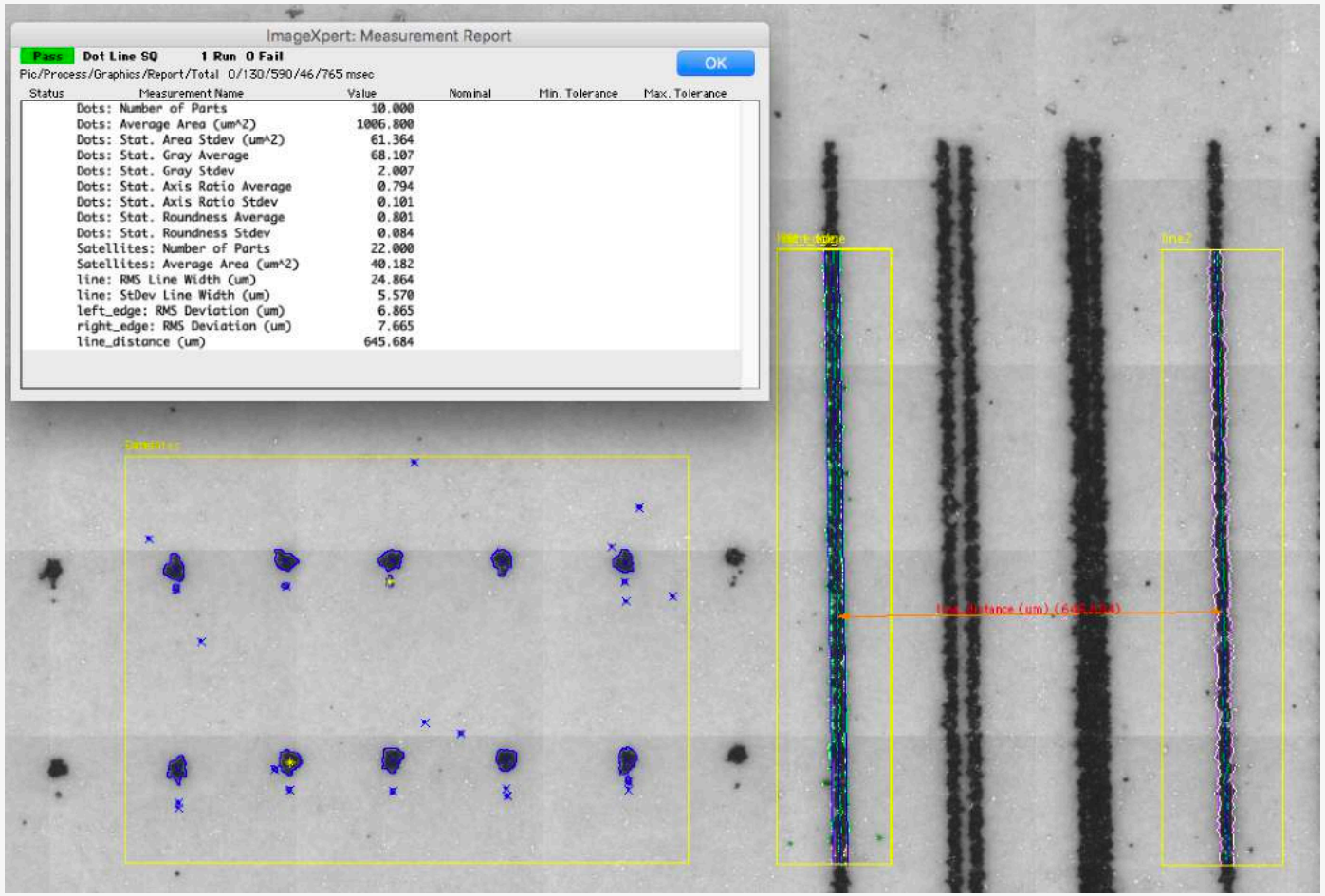
Multiple cameras

Spectrophotometer

Glossmeter

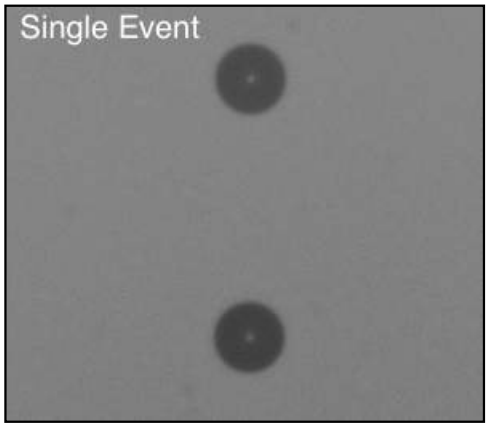
18"x18" XY travel

Testing Inkjet Performance
Print Quality Inspection

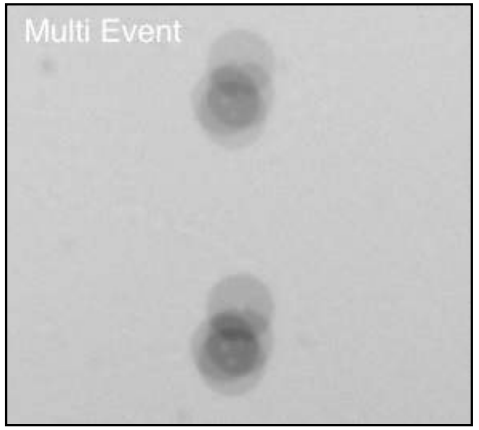


SINGLE EVENT IMAGING

Each image is of a single drop, rather than averaging or summing images of several drops.



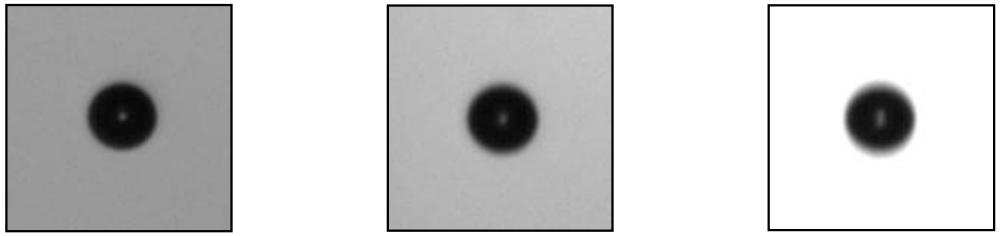
Single Event



5 Drop Aggregate

SHORT EXPOSURE TIME

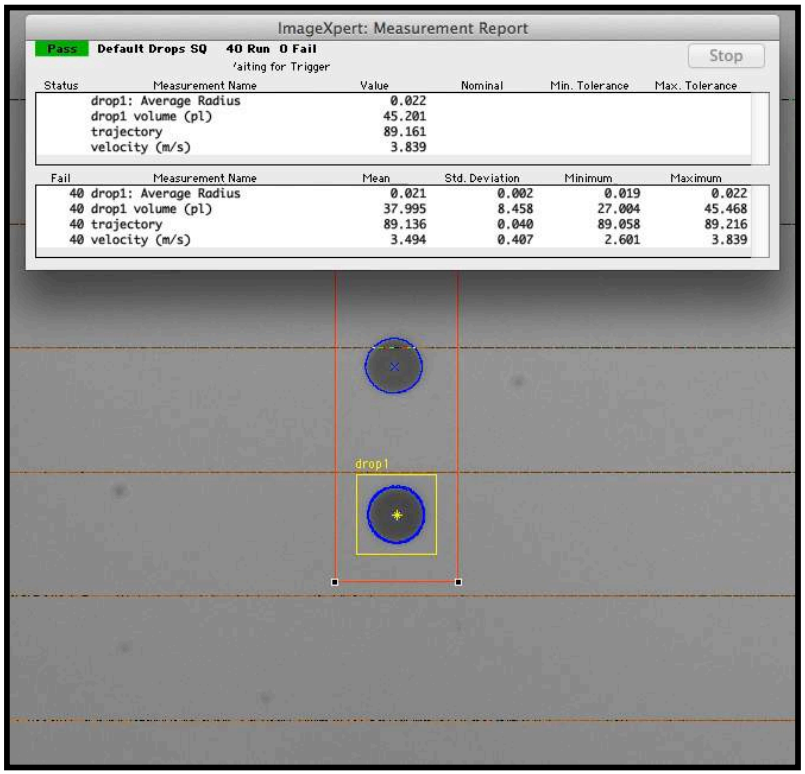
The further a drop travels while being imaged, the greater the blur.



750 ns 1750 ns 2750 ns

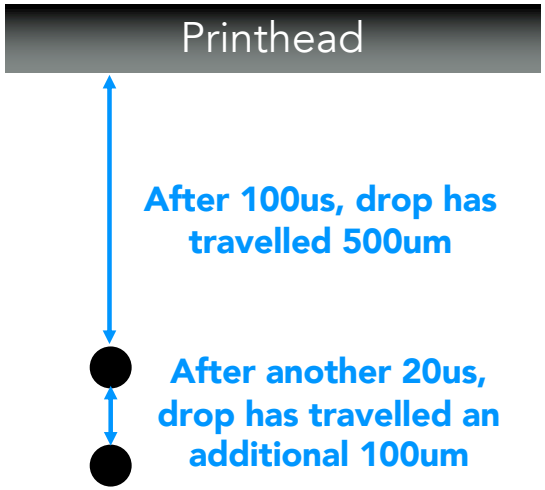
DOUBLE STROBE METHOD

The most accurate way to measure velocity of a single drop at a single moment in time.



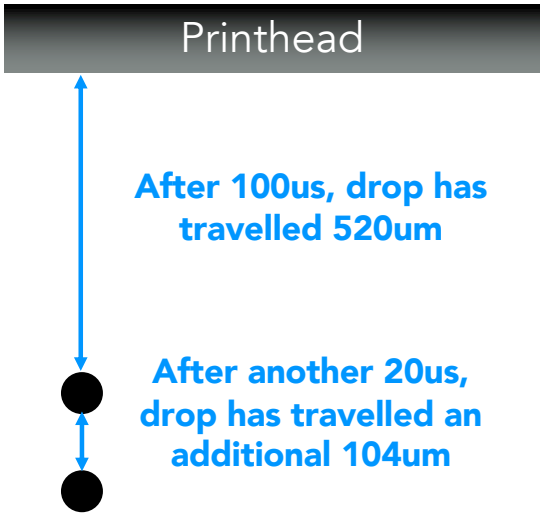
DOUBLE STROBE METHOD

First Drop Travels at 5 m/s



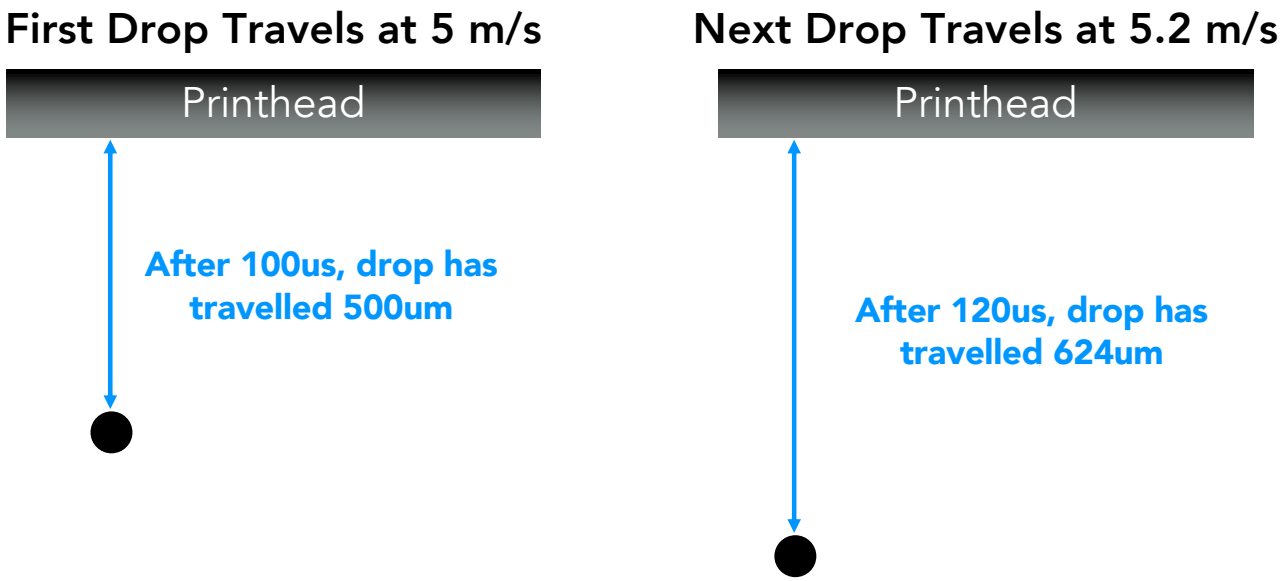
Double strobe method calculates the drop has travelled 100um in 20us and reports a velocity of 5m/s (correct)

Next Drop Travels at 5.2 m/s



Double strobe method calculates the drop has travelled 104um in 20us and reports a velocity of 5.2m/s (correct)

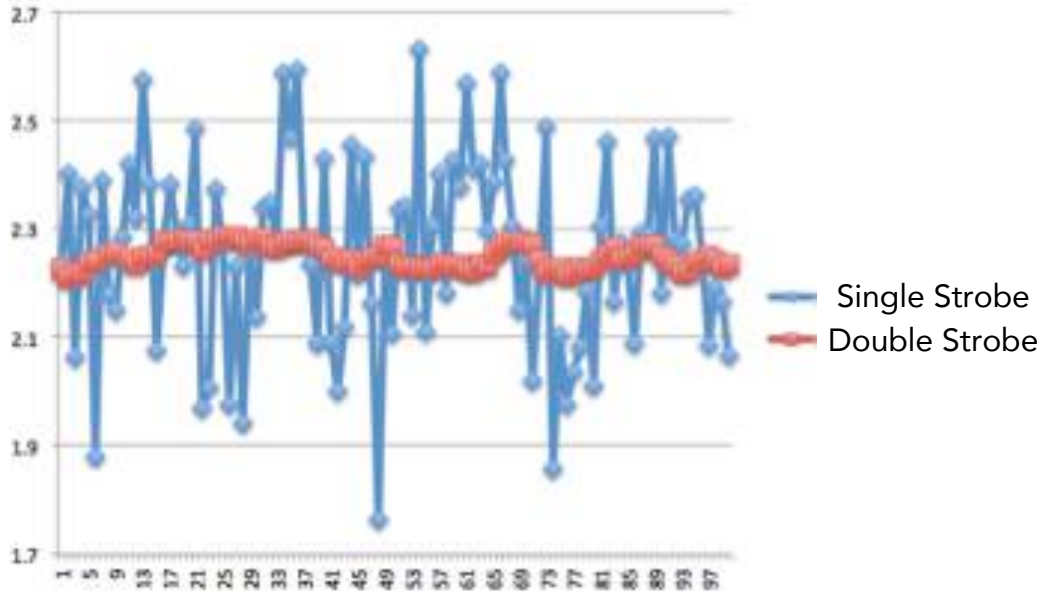
SINGLE STROBE METHOD



Single strobe method calculates that the drop has travelled 124um in 20us and reports a velocity of 6.2m/s (incorrect)

DOUBLE VS. SINGLE

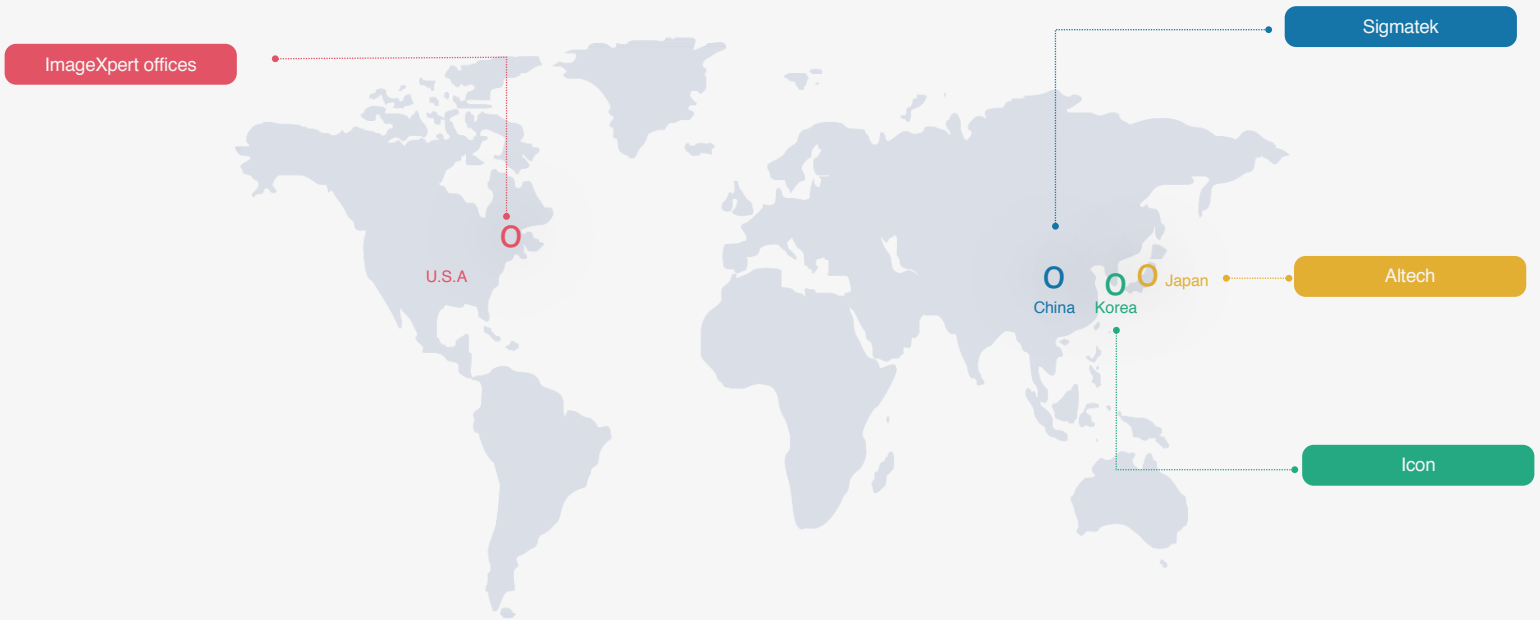
Comparison of Velocity Measurement Consistency



Data captured using a Dimatix S Class Printhead with XL50 Model Fluid

ImageXpert Inc.

Worldwide representation



Supported Inkjet Printheads

Integrated equipment for all printheads on the market

Drivers and software

Ink supply (gravity and recirculating)

Printhead mechanical mounts

Integration into JetXpert system

Xaar

Dimatix

Konica Minolta

Xerox

Ricoh

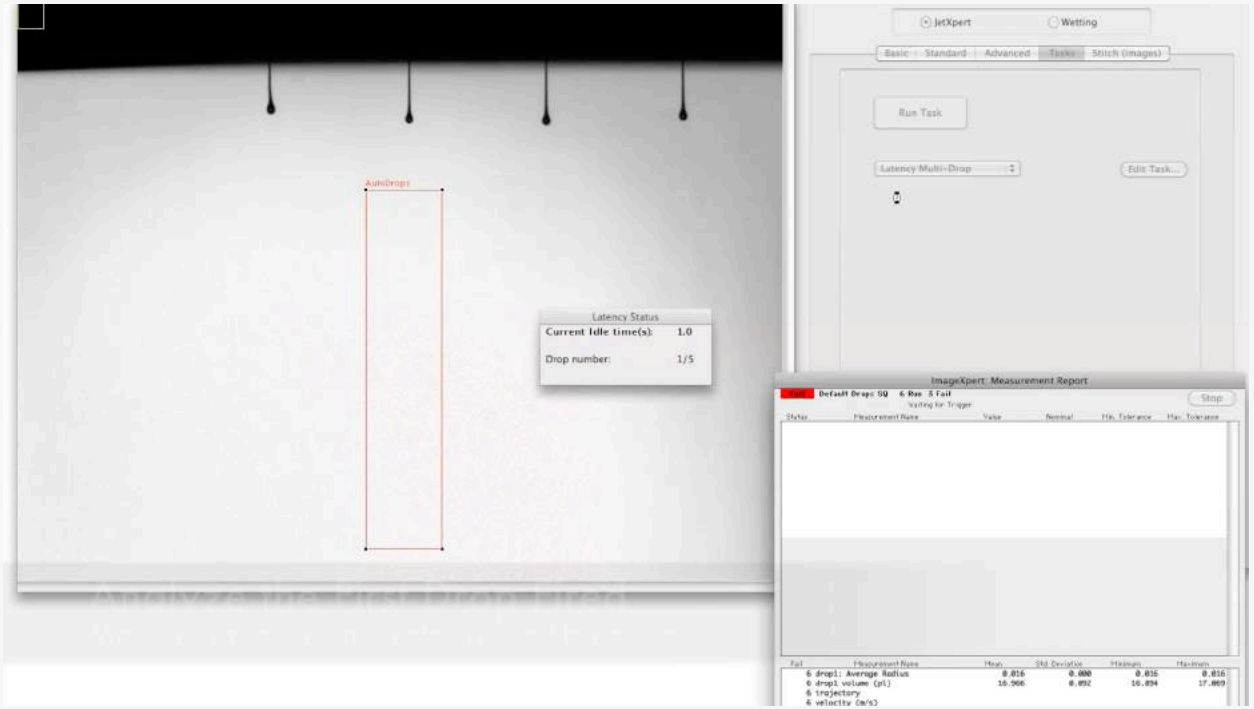
Kyocera

Seiko

Etc.

Option: Latency measurement

Study the effects of latency to maximize open time and minimize recovery time



Option: Stitch

Automatically capture drops at different delay settings in a single image

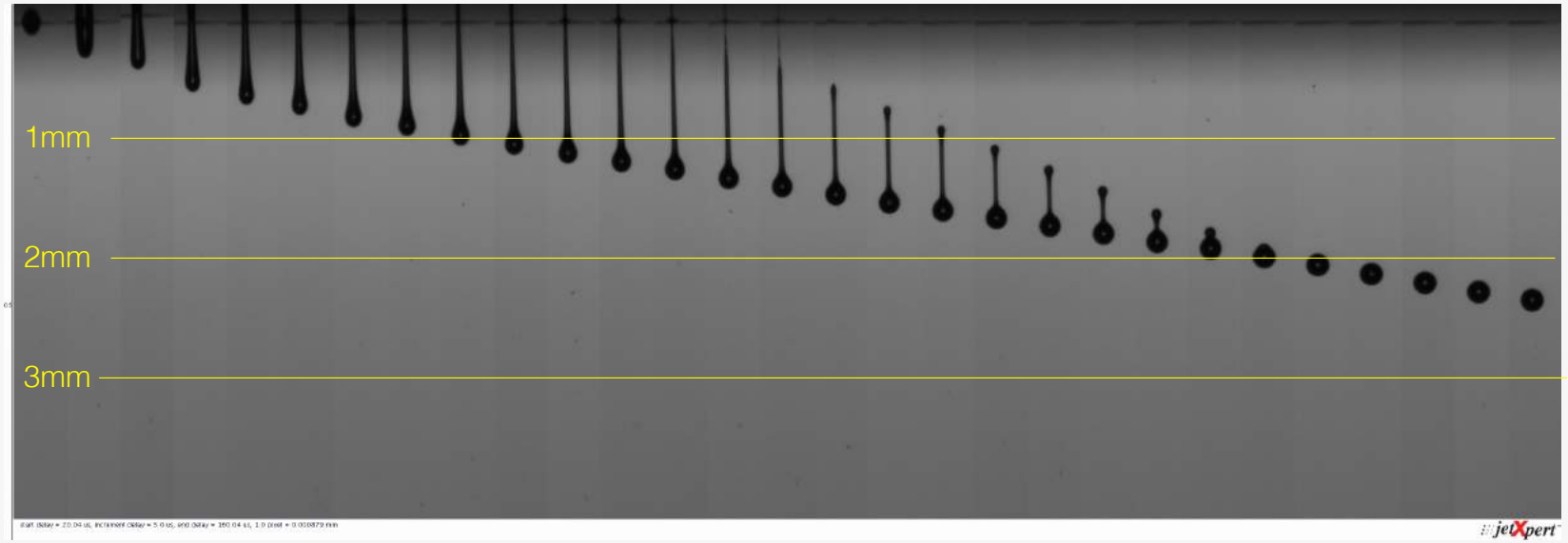


Image quality

Measure image quality attributes

Dot quality

Line quality

Mottle

Dimensions

Color

Text quality

Contact Us

Waiting to meet you in our office

- 460 Amherst St. Nashua NH 03063 USA
- 603-598-2500
- info@imagexpert.com
- www.jetxpert.com
- YouTube (ImageXpert Inc)