Dynamic Image Analysis

Particle Counting , Water Concentration, color, haze Monitoring for Jet Fuels Inline,at line and Lab

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Buffalo, NY Dublin, Ireland

Outline

1. Applications of Canty Vision Based Systems Product Quality Control

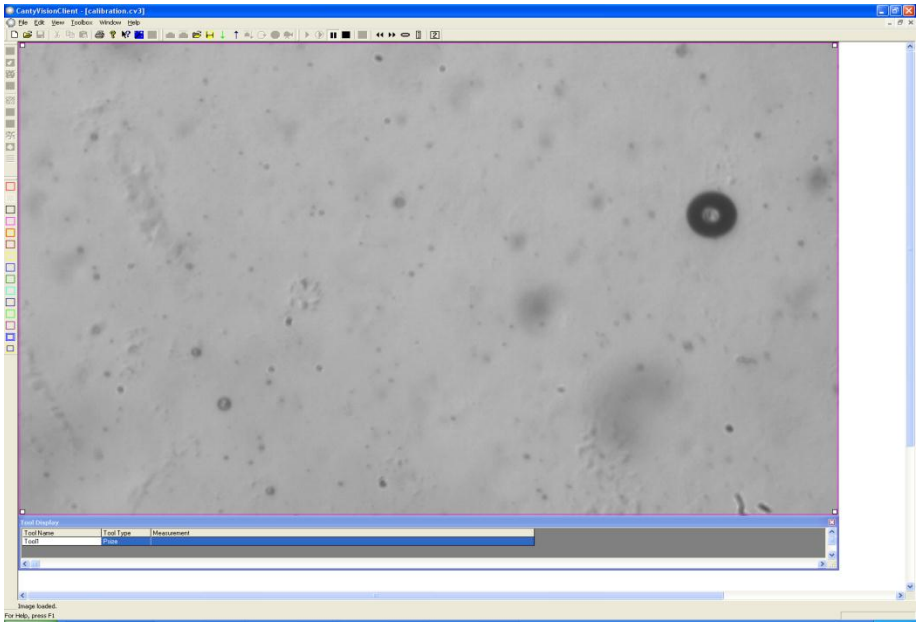
2. Explanation of How the Systems Work
   - Hardware
   - Software

3. Advantages and Reliability

4. Relevant Field Experience

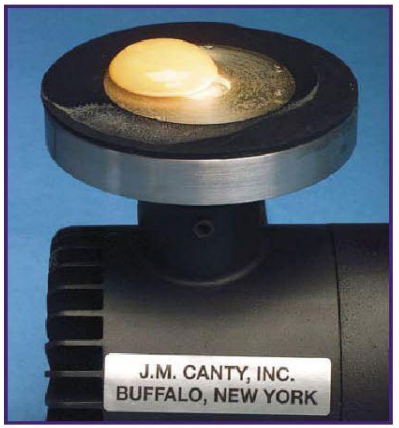
JM Canty's Vision Based Technique

- JM Canty's vision based technique combines the latest CCD Ethernet camera technology, Canty's trademark fused glass and lighting technology, and Cant vision Client software to provide real time measurement of oil in water
- Various systems depending on application retrieve live images from the process
  - Microflow
  - Inflow
  - Particle Probe



- Lighting is critical for any vision based system
- Canty have being doing process lighting for well over 30 years – part of our core business
- Would not be so confident in our vision based technique without our lighting expertise

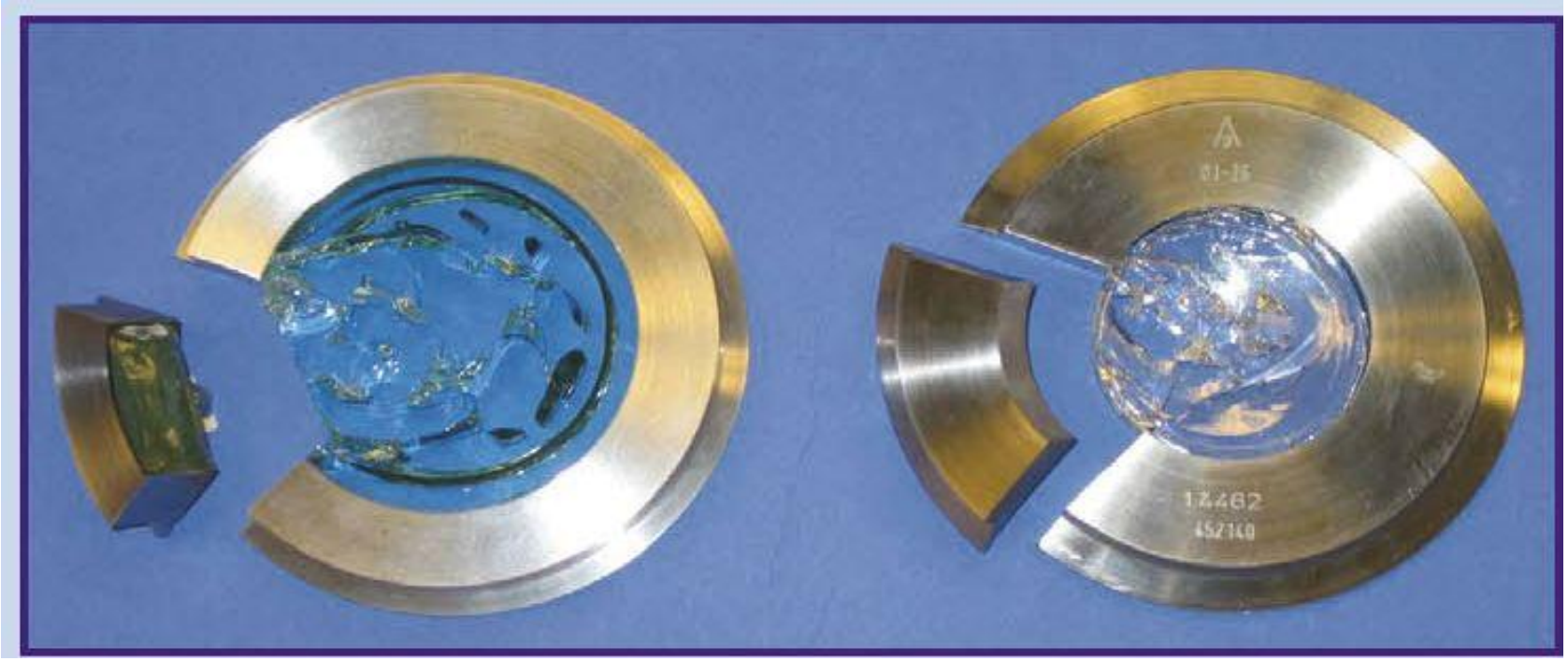
HOUR BAKE-ON TEST



CANTY COLD LIGHT

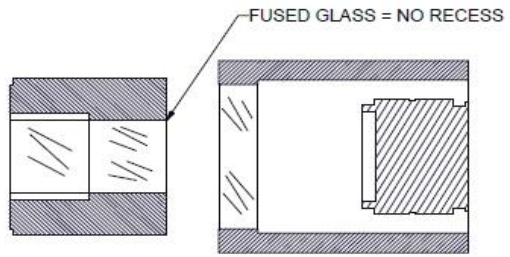
Canty's Fused Glass Technology

- Fusion of glass to metal – one piece construction
- Critical to our vision based technique
- Pressures to 10,000 PSI, Temp -450 to 800ºF

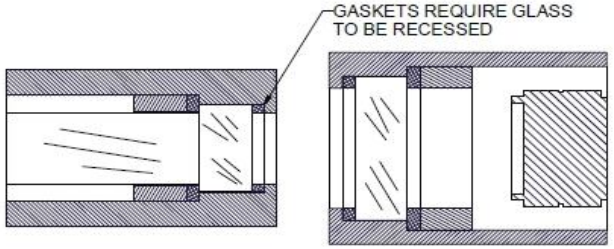


Importance of fused glass technology

- Hermetically sealed one piece construction means no recesses or gaps where product can adhere to and start to build up
- Self cleaning unit



CANTY FUSED GLASS



COMPETITION PLATE GLASS

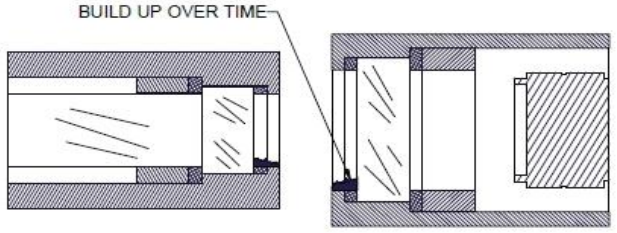


PLATE GLASS WITH BUILD UP

CANTY MICROFLOW
Portable / Lab System

"How it works"

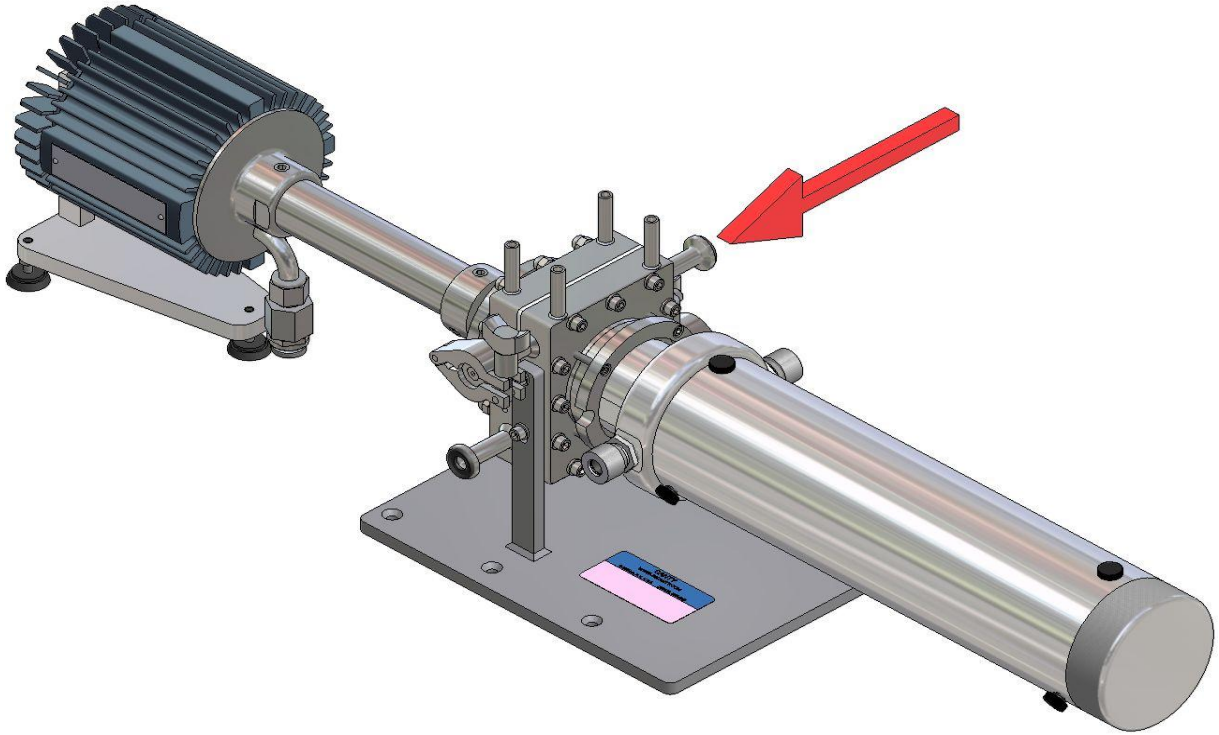
No sample preparation

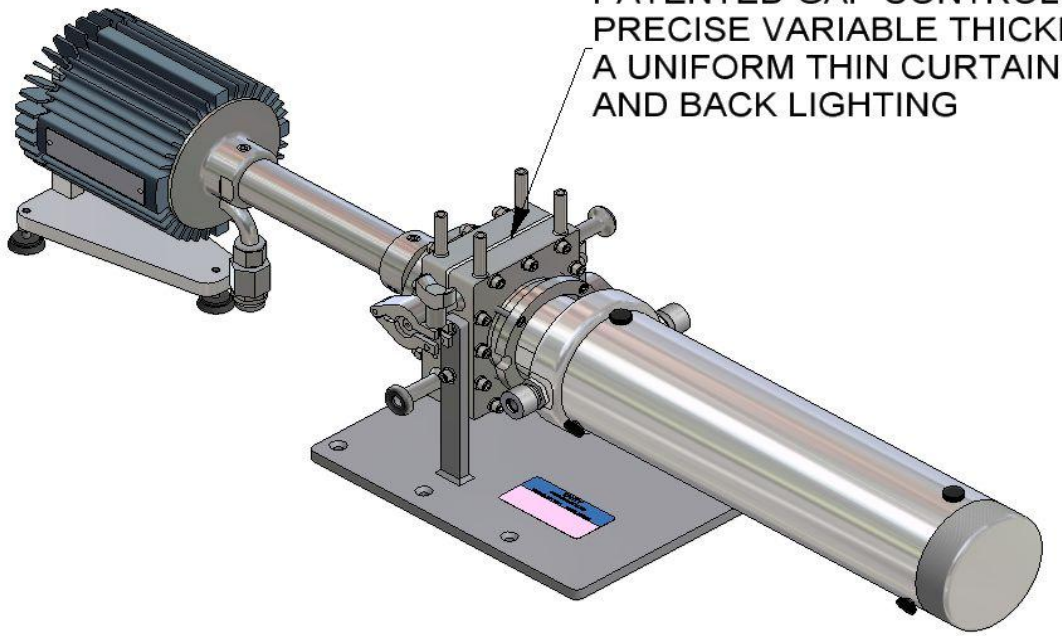
- The lab system lets you run the entire sample bottle.
- You can eliminate the sample bottle and run direct off the sample valve
- You can run in full pipeline and eliminate sampling altogether.

Bubbles are eliminated from measurement

- This means that the sample shaking is independent of the measurement
- No need to let the container to sit and have the particles settle out. This is a major variable in other particle counters as they can not distinguish between bubbles and other particles. Causing filter methods and APC not to correlate well

PRODUCT ENTERS THE MICROFLOW

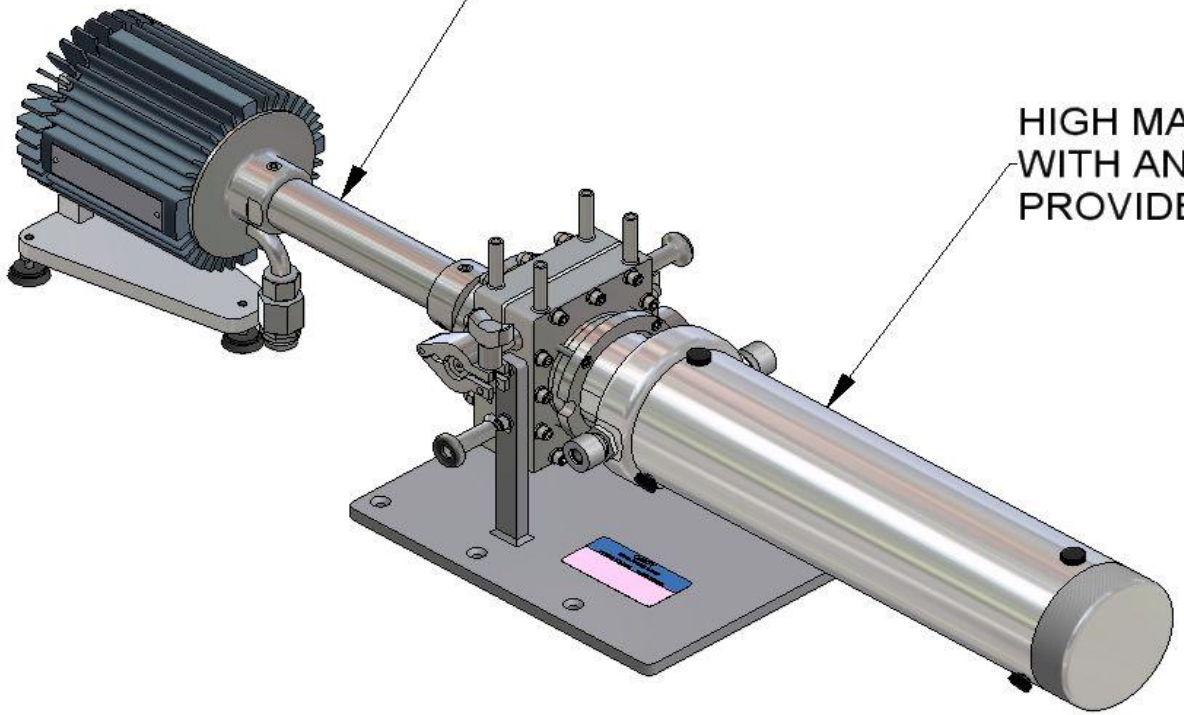


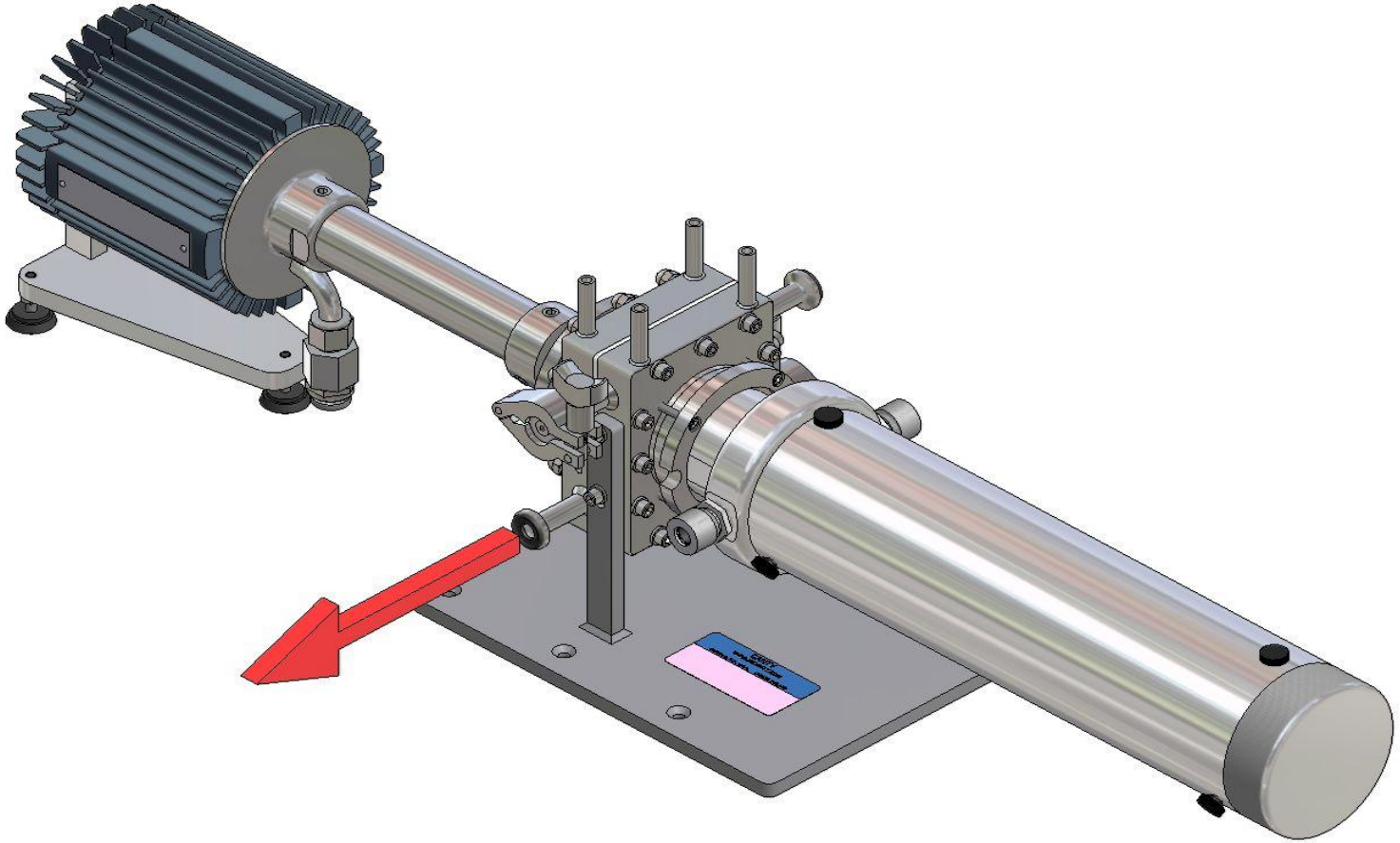


PATENTED GAP CONTROL IS ACCOMPLISHED BY USING PRECISE VARIABLE THICKNESS GASKETS PROVIDING A UNIFORM THIN CURTAIN OF PRODUCT TO THE OPTICS AND BACK LIGHTING

DIFFUSED HIGH INTENSITY
COLLIMATED BACKLIGHTING

HIGH MAGNIFICATION OPTICS COMBINED
WITH AN ETHERNET IMAGING SYSTEM,
PROVIDE SUPERIOR RESULTS





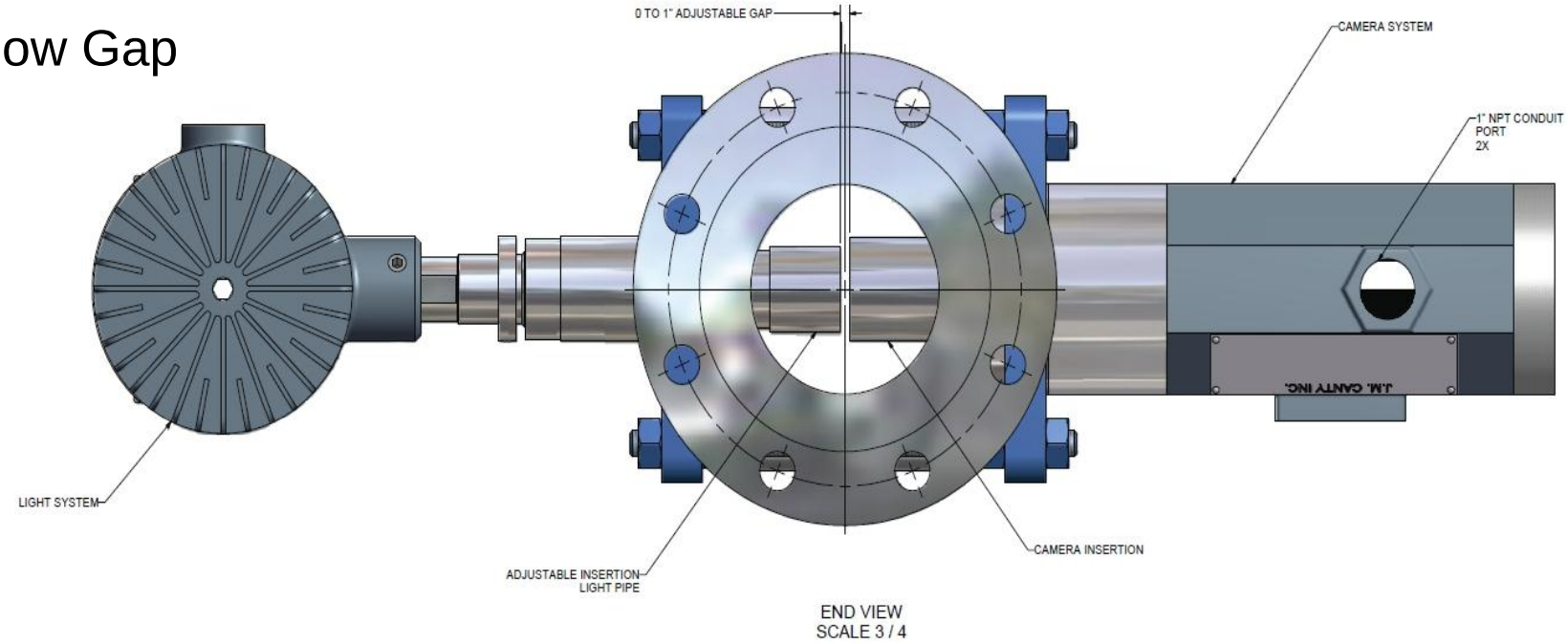
PRODUCT EXITS MICROFLOW

CANTY INFLOW
Inline System

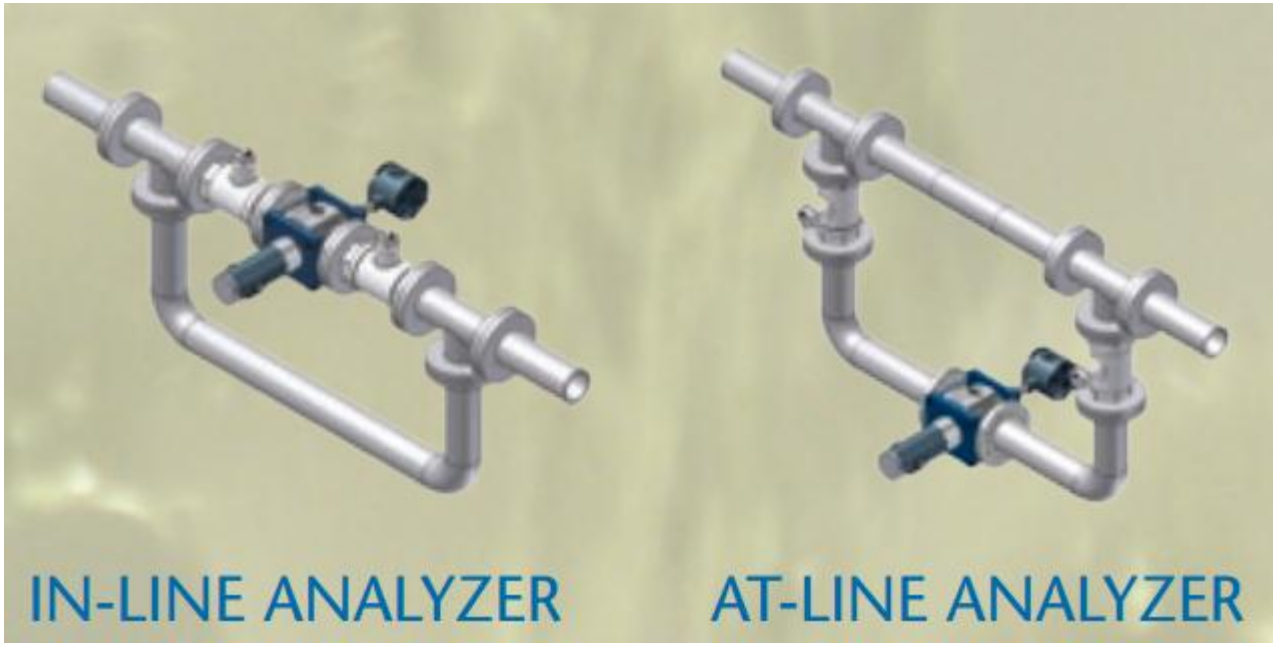
"How it works"

The Inflow works on the same principle as the Microflow

- Lighting
- Camera
- Flow Gap



The INFLOW can be configured to be directly inline or placed at-line depending on the application needs.



CANTY PARTICLE PROBE

"How it works"

Using an insertion camera, the analysis can be done within the larger sized pipelines, without the need to cut the entire line during installation.

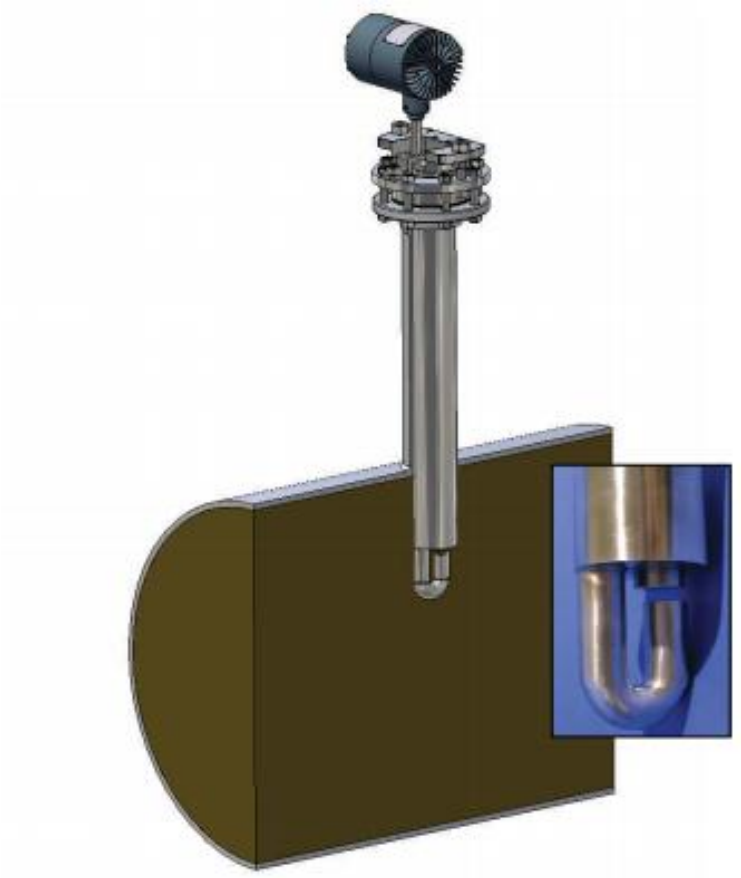
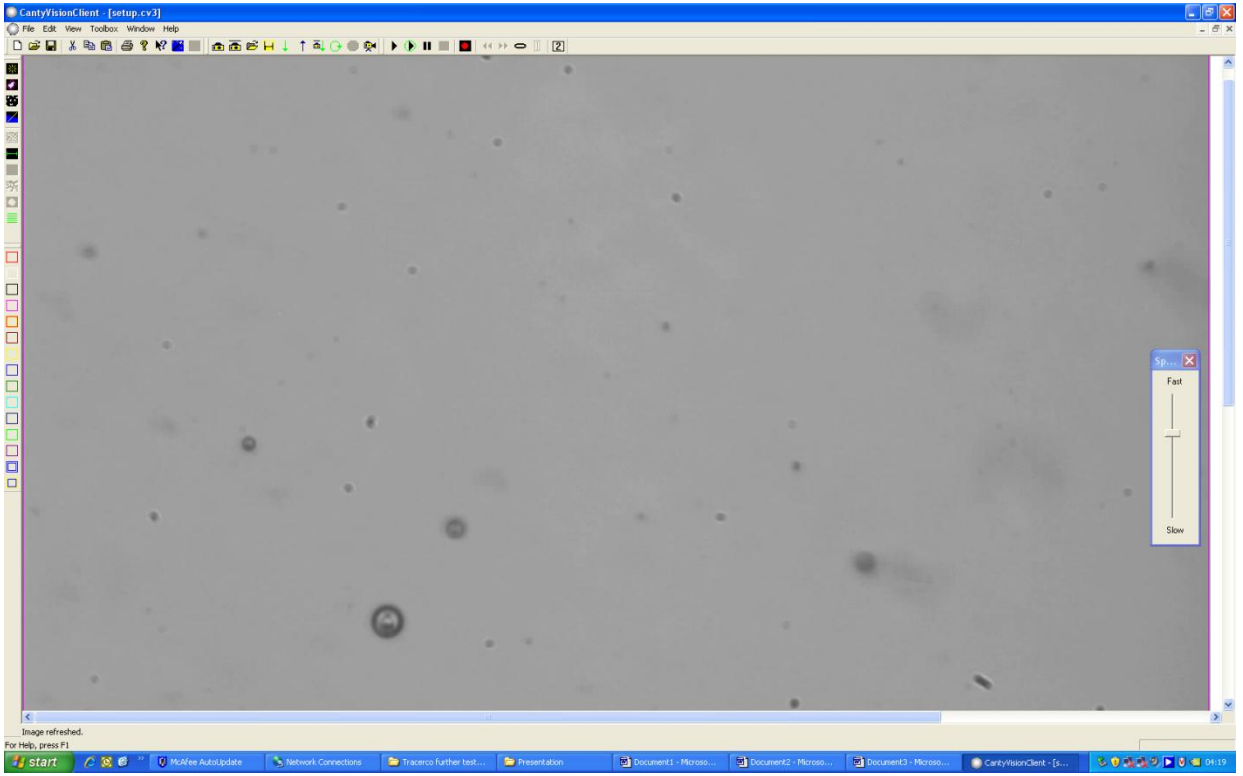


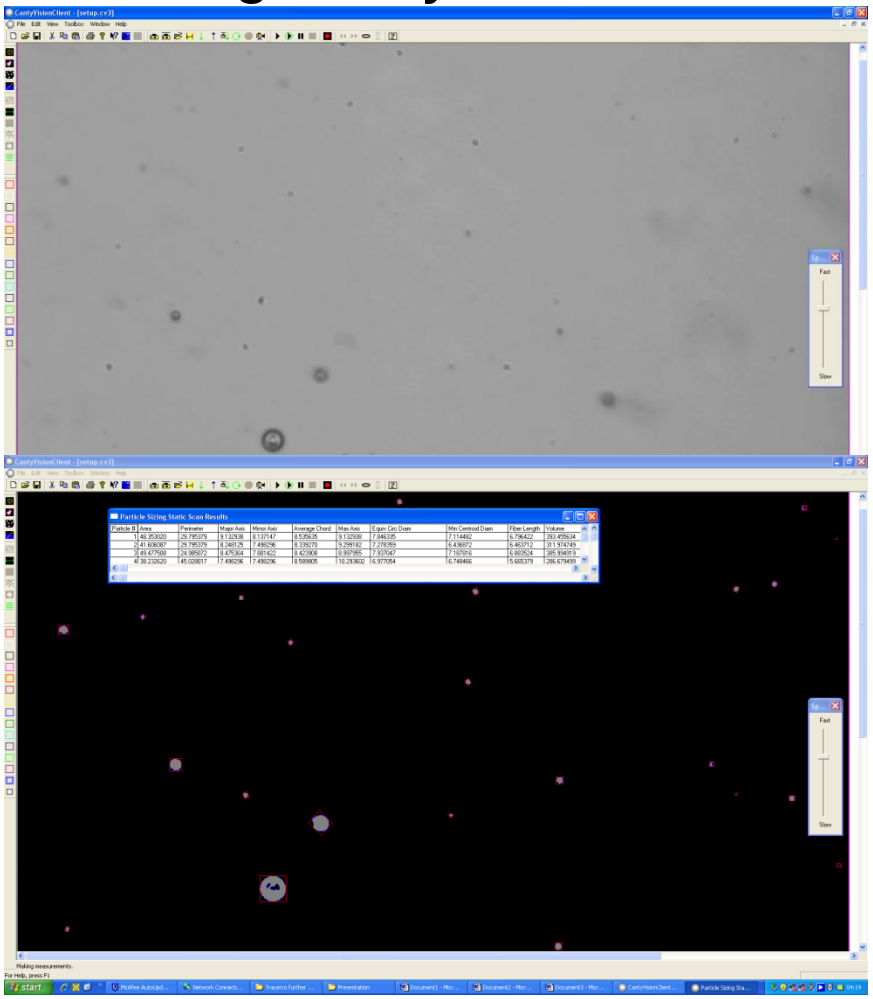
Image Analysis with Canty Vision Client

- Utilizing the latest Gigabit Ethernet camera technology available, users can see particles all the way down to 1 micron.
- The images retrieved from each of the 3 particles sizing systems are analyzed in real time by Cant vision Client Software



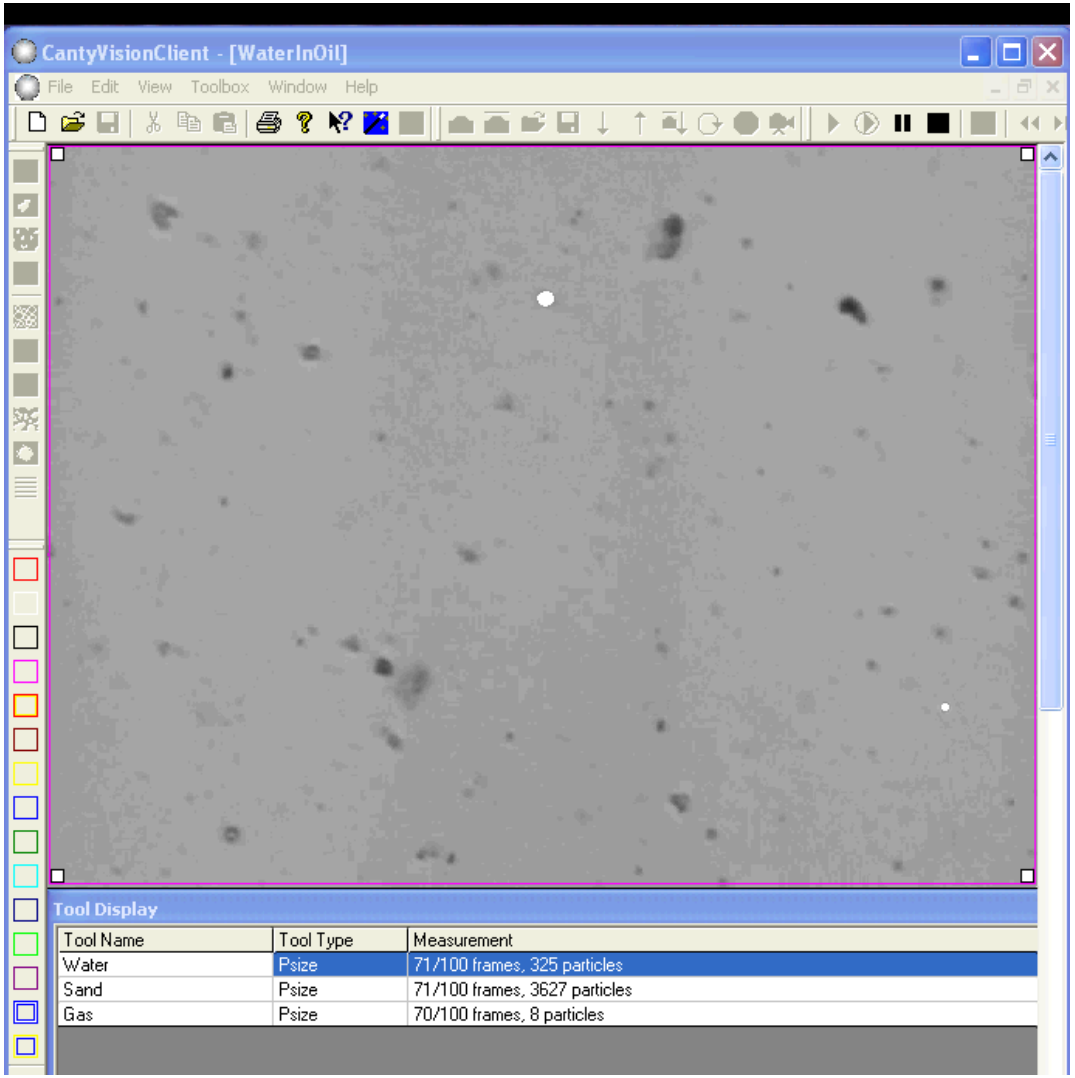
Solids and Water Detection using Canty Vision Client

- Each individual particle within the image is digitally mapped and analyzed.
- Visual verification of particles truly sets Canty apart from all other systems



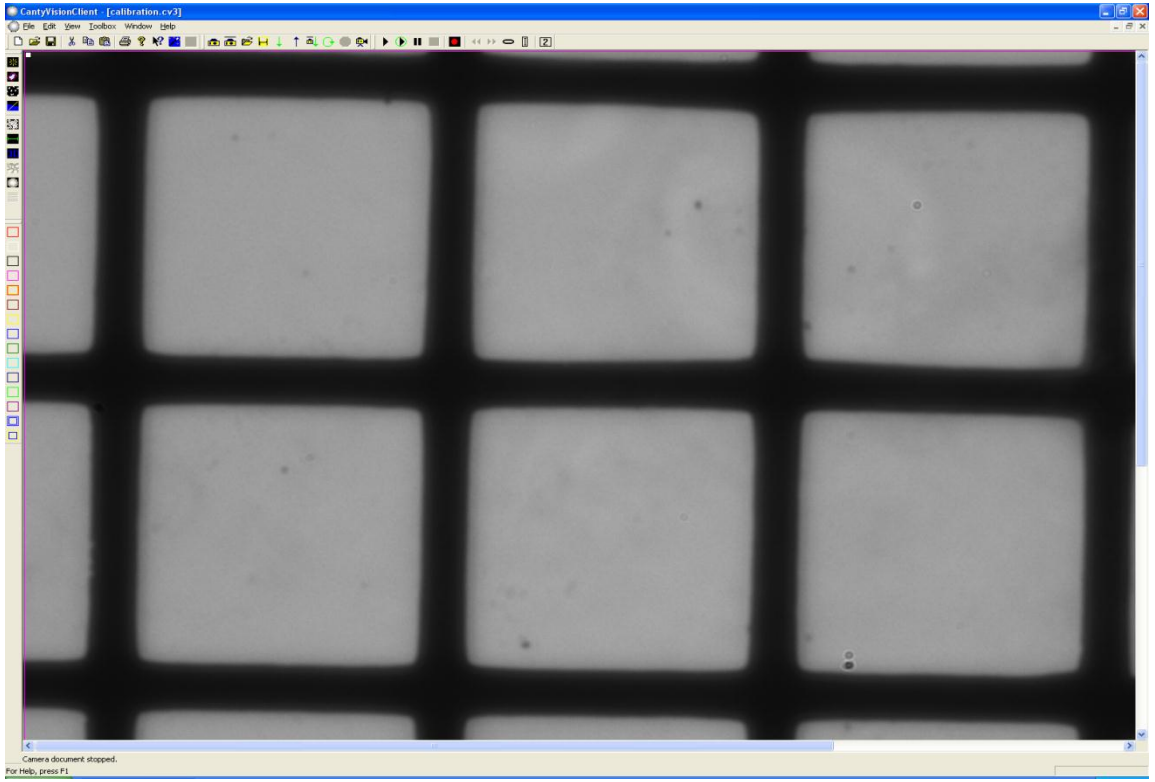
- There is no guessing with a Canty Particle Sizing System. Visual verification

- The imaging software can easliy distinguish between water,solids and gas bubbles or stuck partilces



System Setup / Calibration – Particle Size

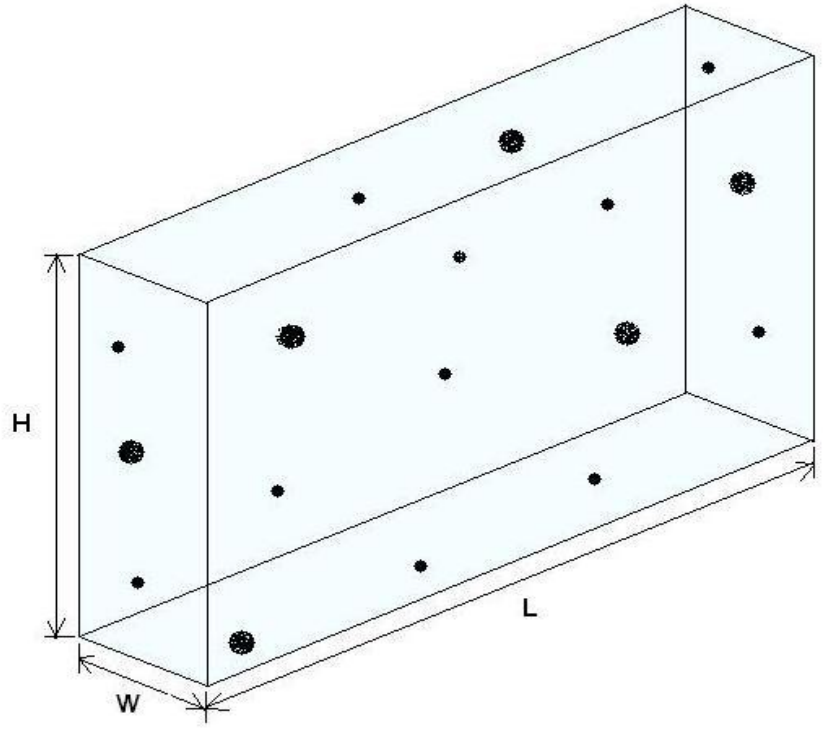
- The system is calibrated and programmed to correlate each pixel into a real world measurement value
- A NIST traceable reference or a simple reticule, such as the one shown here, will be correlated providing an accurate scale for particle size analysis.



System Setup / Calibration – Particle Concentration (Theory)

The percent oil in water can be calculated using the formula below:

% Oil in Water = (Volume of oil in water / Volume of water) x 100



System Setup / Calibration – Particle Concentration (Theory)

We can calculate the volume of the oil droplets using the formula:

$$4 / 3*\pi*r^3$$

Therefore we can calculate the concentration using the formula;

$$\text{Percent Oil in water} = \frac{\Sigma \text{ (volume of oil particles)}}{((W * L * H) * \text{number of images})} * 100\%$$

where

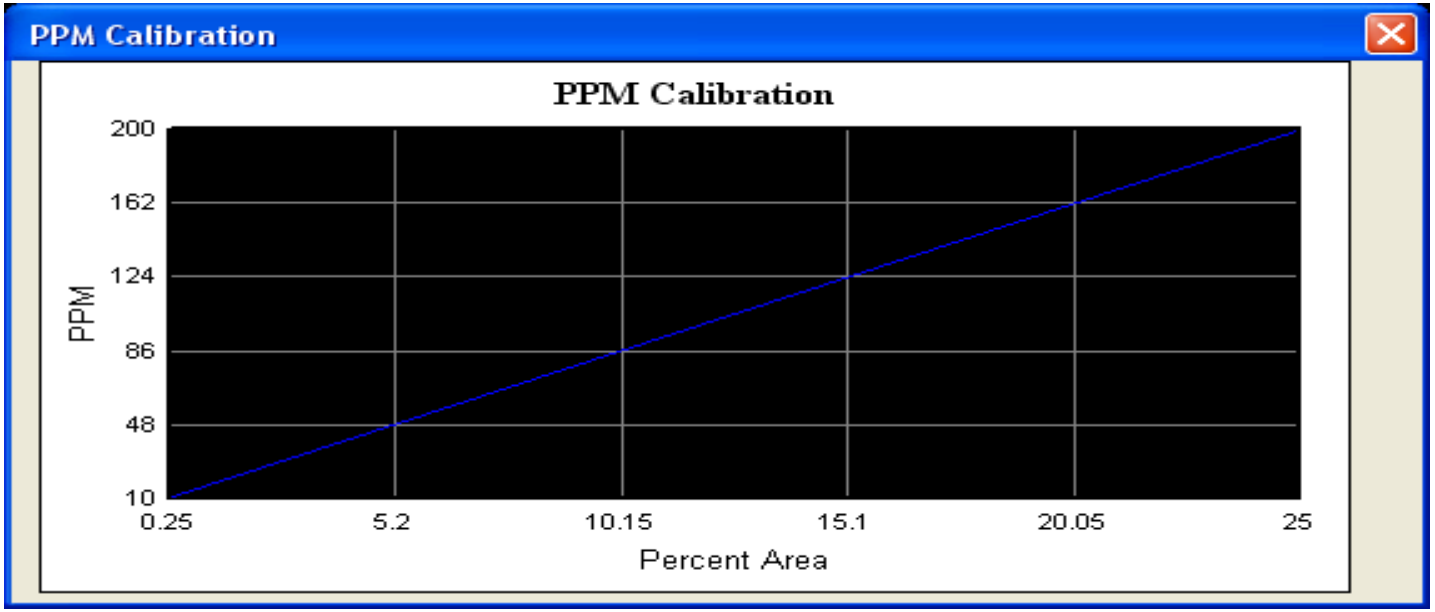
N = Number of oil particles

Oil volume = Σ volume of oil particles

Volume of water = W * L * H

System Setup / Calibration – Particle Concentration (Actual)

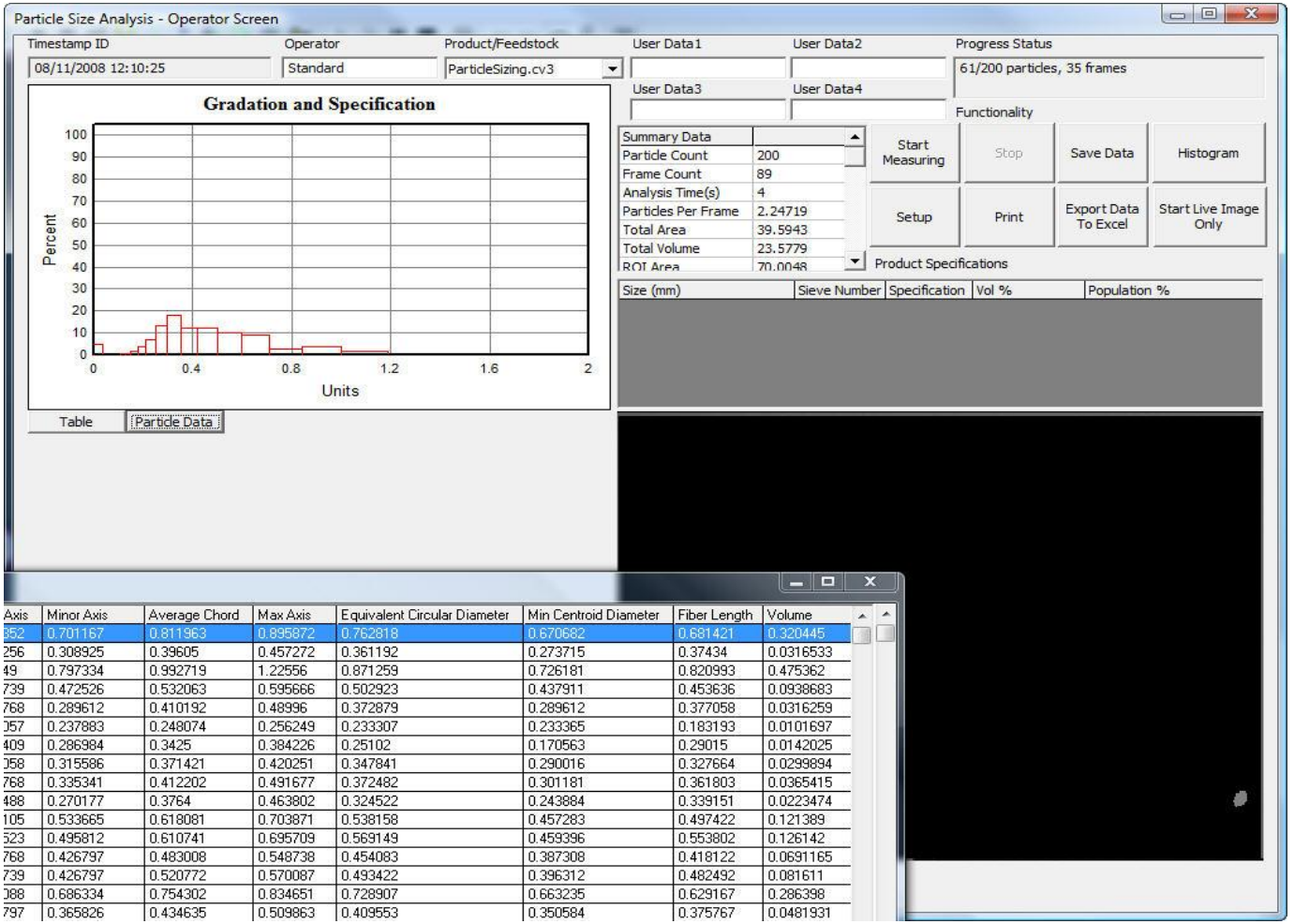
- Run a sample of known concentration through the unit
- Scan the sample through the unit using the Cant vision software
- Calibrate the output PPM value using the total area percent value, and the known PPM value in the Cant vision software.



Particle Size Analysis – Operator Screen

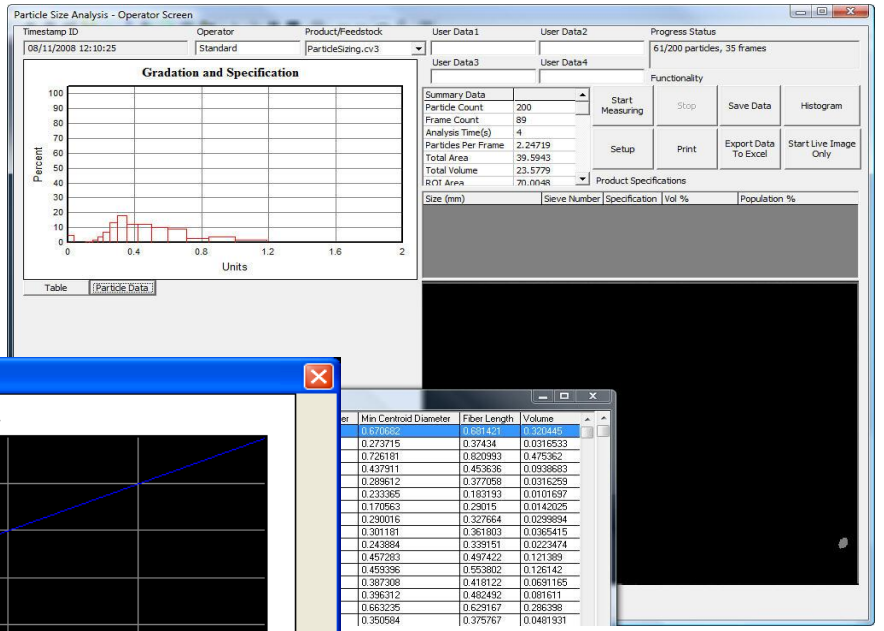
Puts information and configuration in an easy to read format fore ease of operator control

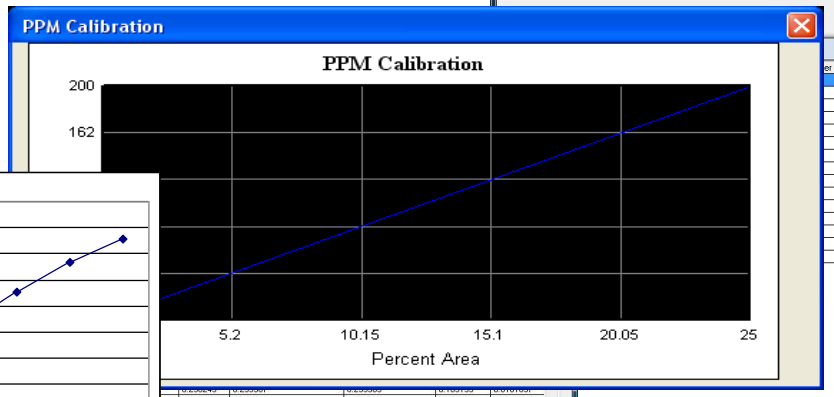
Configurable calculation for client specific products

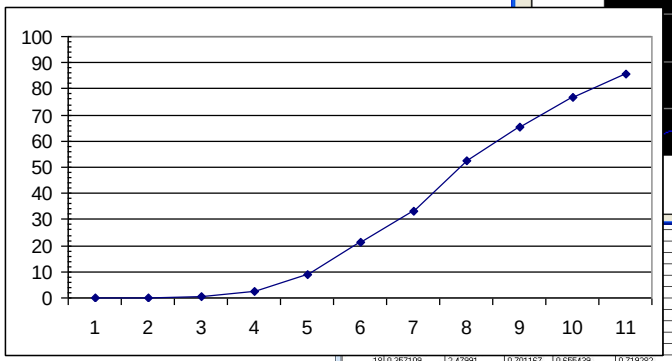


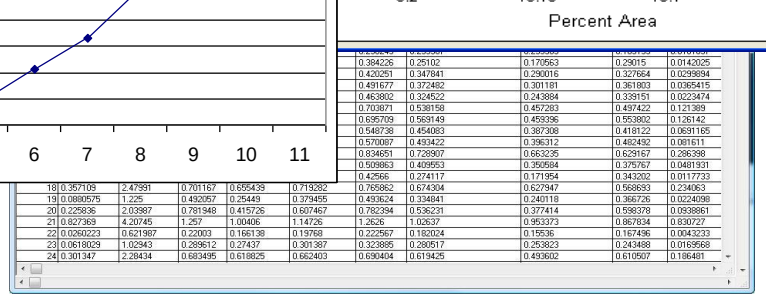
Data Analysis and Graphs

- Calibrated PPM and PPB outputs
- Replaces and correlates to screen analysis
- Particle distribution by major, minor diameter
- Particle area
- Particle perimeter
- Vision camera system establishes size range
- Various spreadsheet templates provided
- Custom analysis using spreadsheet formulas









- Several Plot Types: Differential, Cumulative Retained & Passing
- Plot Data By: Minor Axis or a major, Average Cord, Area, Perimeter, Aspect Ratio many more

Jet Fuel Testing
Onsite with NAVAIR

Objective

The goal of the testing was to determine if the Canty Vision system could categorize and quantify the detection of water and solid particles in jet fuel. Several samples were tested on site and the results are provided in this report.

Measurement Type

The software used was CantyVisionClient particle analysis. Vision is able to distinguish between solid and liquid contaminants based on the way light diffracts through and around them. This capability also allows the software to eliminate possible detection errors caused by air bubbles.

Sample Description

Seven (7) fuel samples were prepared by NAVAIR and processed through the Canty instrument. Each had varying water and solids content.

Jet Fuel Testing - Onsite with NAVAIR Data

	Free Water Readings	Sediment
Aquaglo	JFWA1	
PPM	PPM	mg/L
1	0.5	0
5.17	5.77	0.09
9.5	12.7	0.05
1	0.67	3.08
9.33	11.83	3.03
10	12.93	2.17
0.33	0.5	1.94
	Canty	
	Free Water	Sediment
Video #	Total Volume	Total Volume
Video 1	48,761	67.261
Video 3	369,034	14371.4
Video 4	730,991	6127.42
Video 5	80,240	61596
Video 6	615,544	97638.5
Video 7	712,929	84443.1
Video 8	64,432	38655.6

Preliminary Data

Jet Fuel Testing - Onsite with NAVAIR

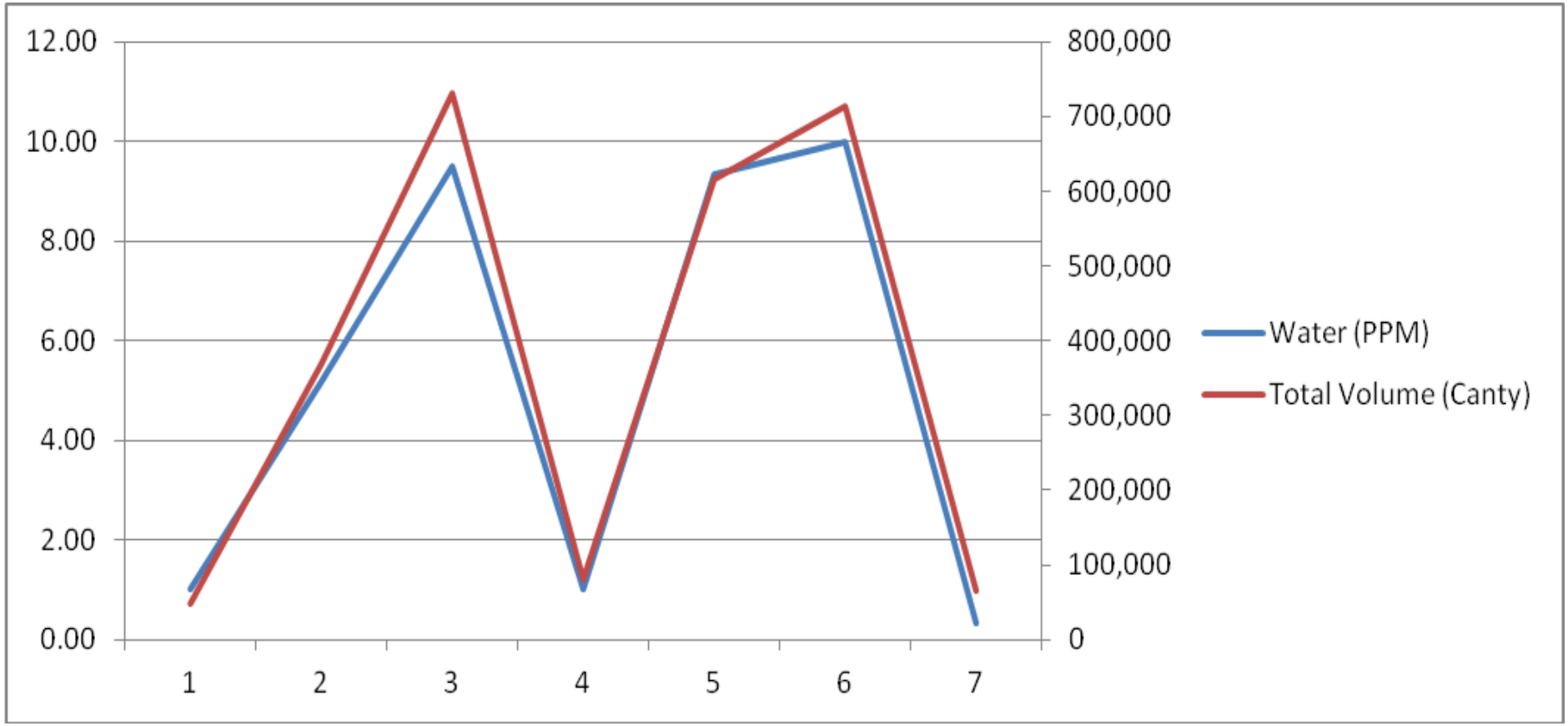


Figure 1 – Preliminary Data - Water Content - Expected PPM vs. Volume

Jet Fuel Testing - Onsite with NAVAIR

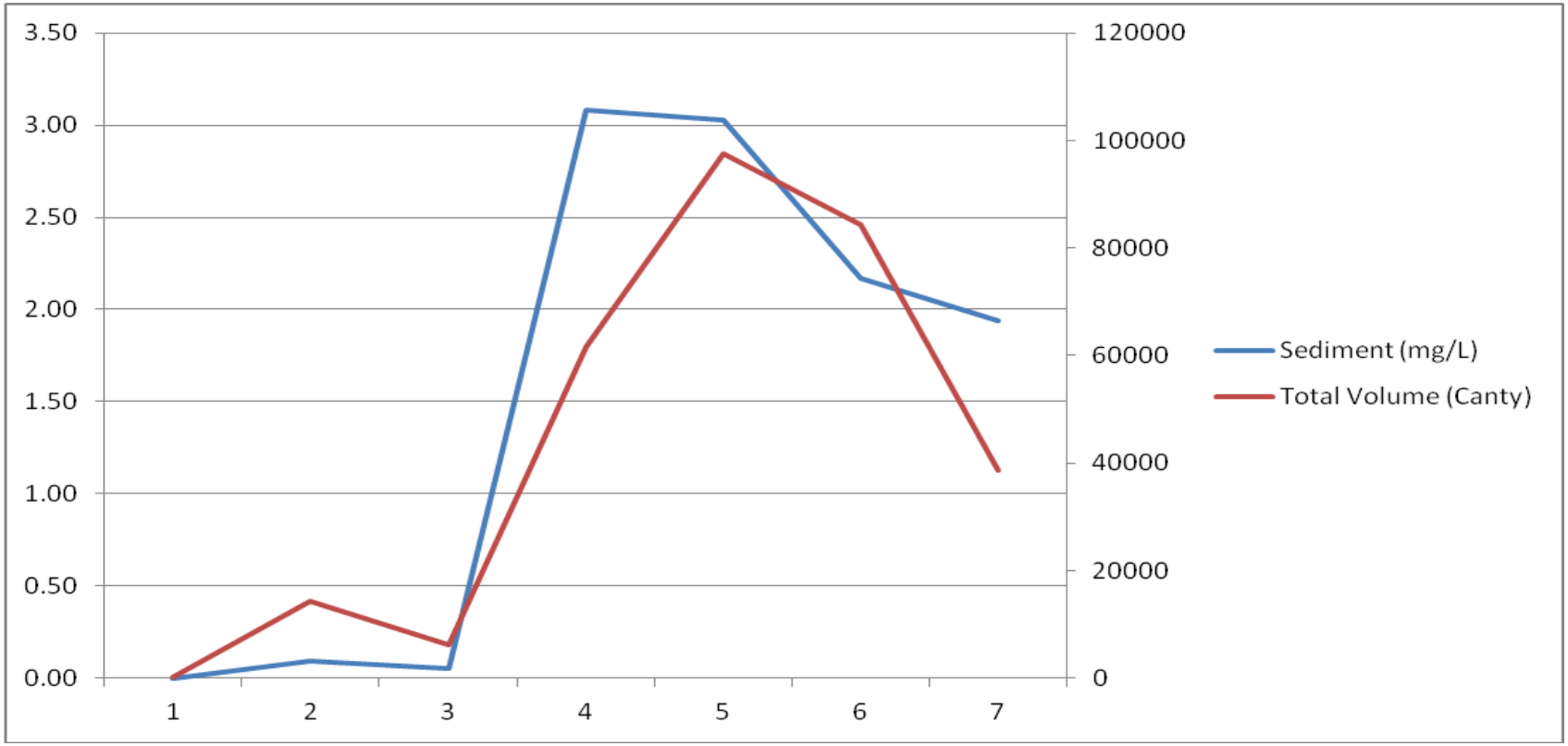
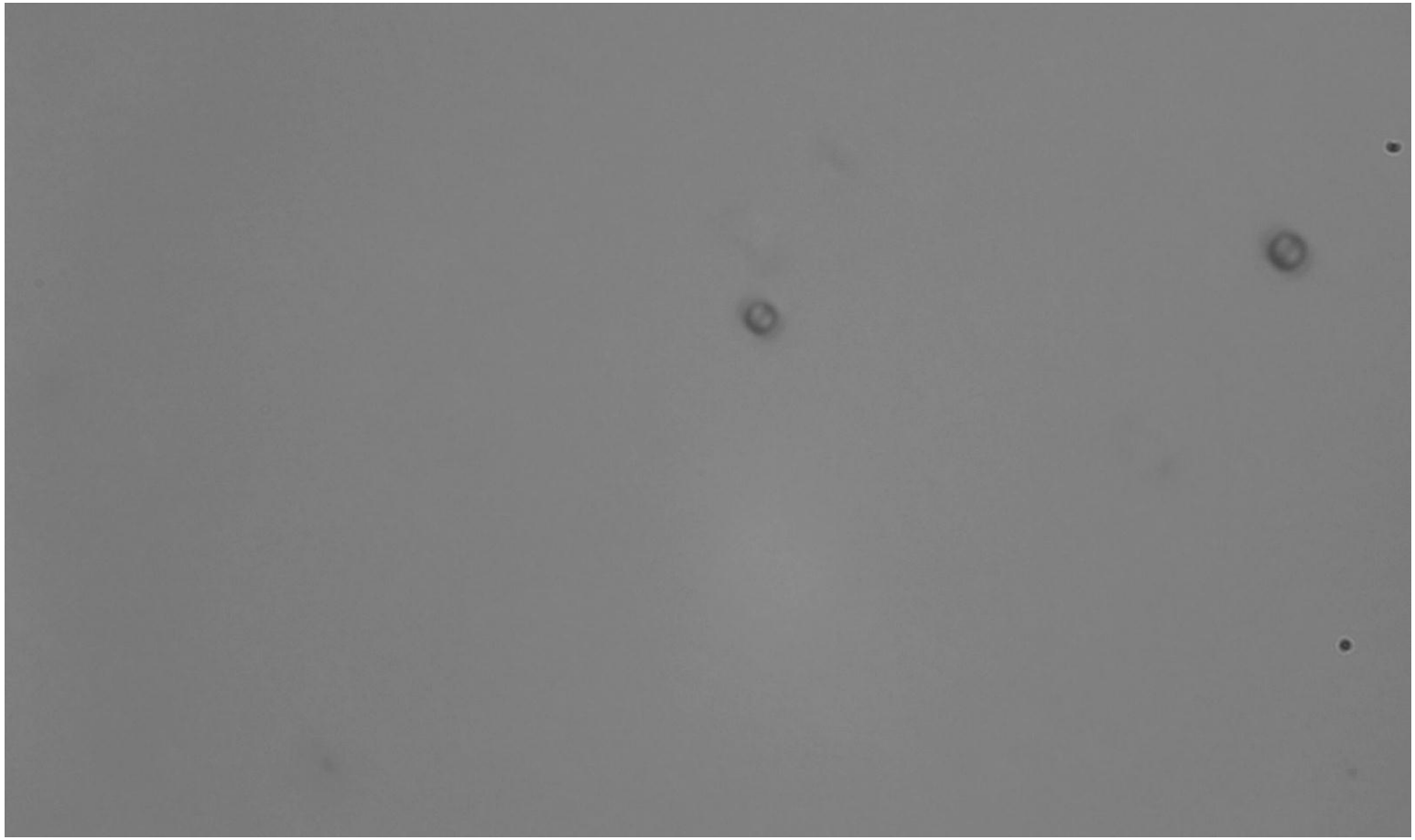


Figure 2 - Preliminary Data - Solid Content - Expected PPM vs Volume

Jet Fuel Testing - Onsite with NAVAIR



WK29485 Collaboration New Standard — Determining concentration .count and sizing distribution of Solid Particles, Water and gas in Fuel .

This concludes the Presentation!

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For Further Information on this

www.jmcanty.com.