

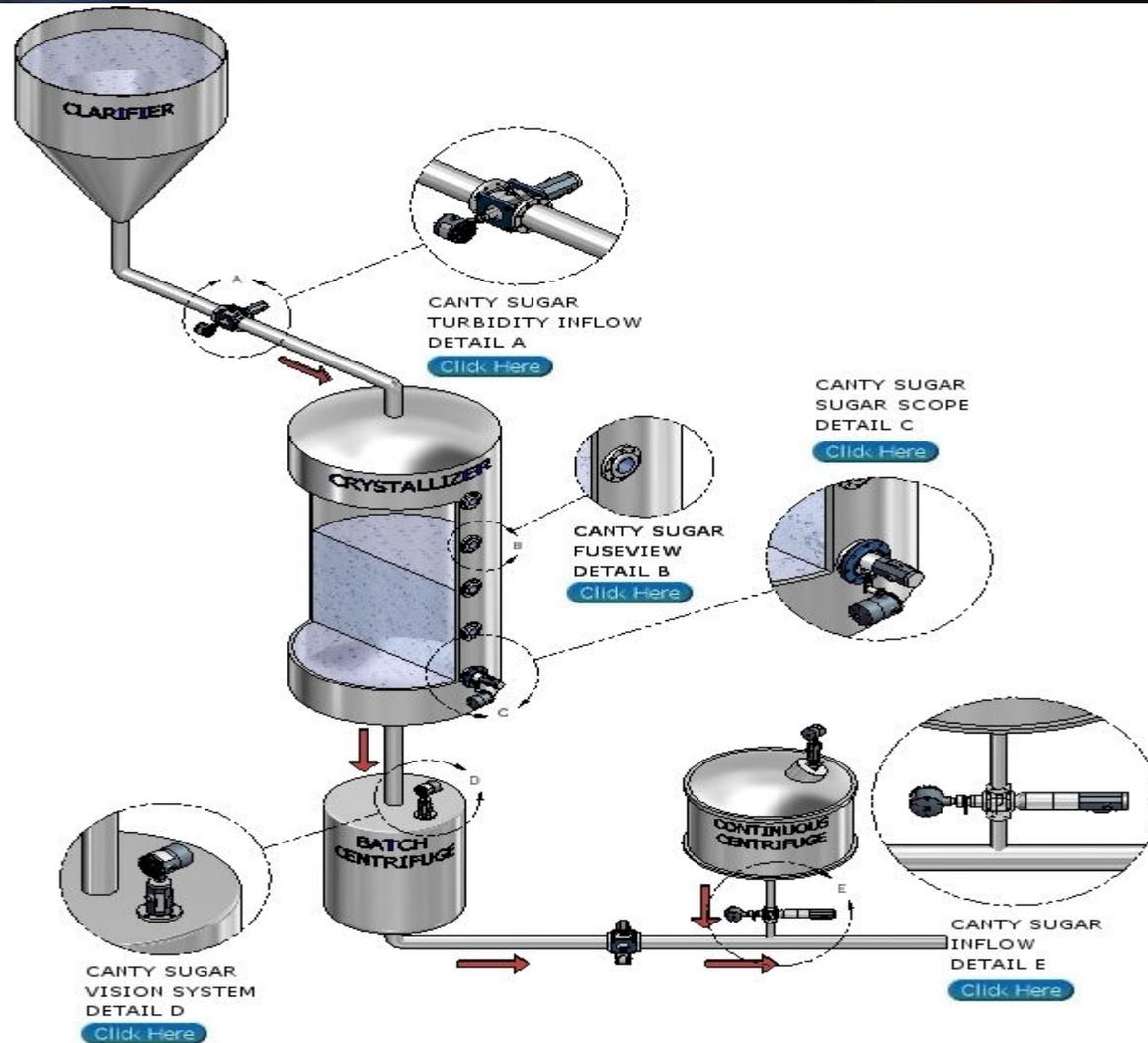
# Vision System Applications in the Sugar Industry

# CANTY

PROCESS TECHNOLOGY

VISION WITHOUT LIMITS

[www.jmcanty.com](http://www.jmcanty.com)



## **Introduction**

Vision Based Applications for the Sugar Industry from Seeding the Vacuum Pan to Measuring the Whiteness and Size of the Finished Product .

### 3 Keys to Process imaging

- 1) Lighting
- 2) Lighting
- 3) Lighting

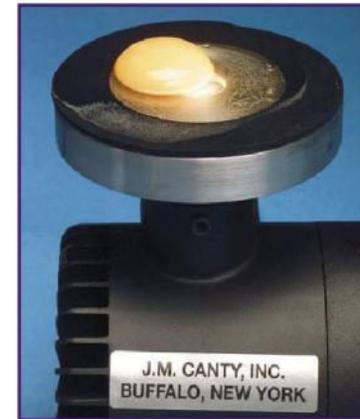
## Flexible Fiber Optic Light



- Flexible Bundle Option
- Cold Light, NO "Bake-on"
- EXP/FP or Weather Proof
- Multiple Bundles
- Full Range Dimmer
- Fused Glass (Standard)
- 40 through 250 Watts

- 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



## **Applications**

- Fuseviews on the Vacuum Pan
- Sugarscope on the Vacuum Pan for Crystal Size
- Camera Light Combination for Centrifuge Control
- In-Line Turbidity/Colorimeter Measurement
- Whiteness Measurement On-Line or in the Lab
- Particle Size On-Line or in the Lab

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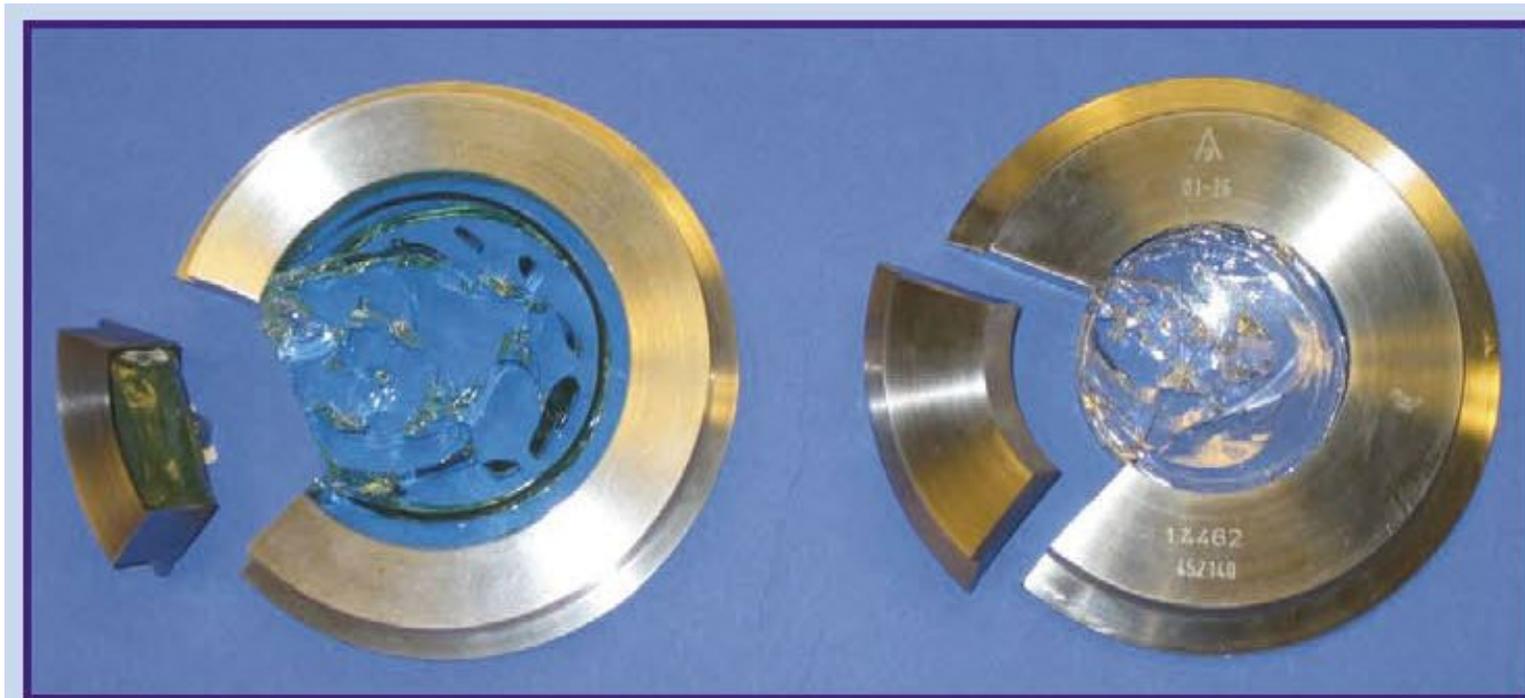
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## *What is a Fuseview™ ?*

It is a safety sight glass, which incorporates a fused glass metal seal. Glass is very good in compression, but weak in tension and shear. Fusing the glass to metal puts uniform radial stress on the glass, which pre-stresses the glass. This is done by heating the glass and metal to the molten point of the glass. The glass flows to the wall of the metal and fuses or bonds to the metal creating a hermetic seal. The unit is then cooled slowly. The glass will solidify and the metal ring will compress onto the glass because it has a higher coefficient of expansion. This is the same concept as done in concrete. It is pre-stressed in compression in order to take bending.

## Canty's Fused Glass Technology

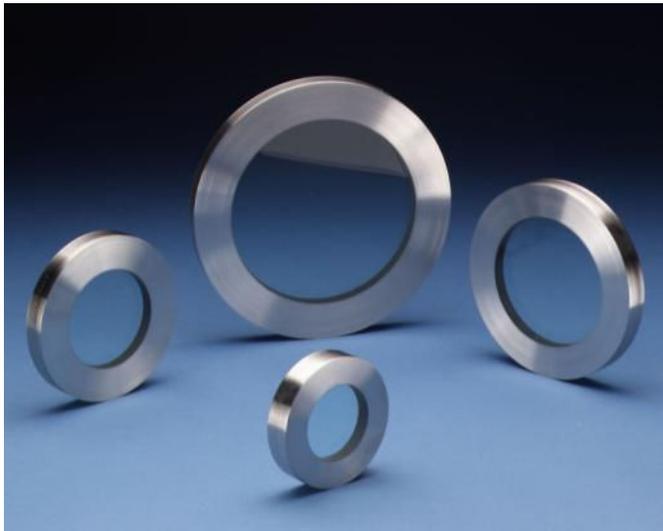
- Fusion of glass to metal – one piece construction
- Critical to our vision based technique
- Pressures to 10,000 PSI, Temp -450 to 800°F



## *Fused Glass vs. Tempered Glass*

- Scratches do NOT affect Fuseviews™
- Fuseviews™ CAN be removed for Cleaning
- Fuseviews™ CAN be certified
- Fuseviews™ can NOT be damaged from bolts being over torqued.
- Spray Rings CAN be used with Fuseviews™

## Fuseviews for the Vacuum Pan



- Fused Glass to Metal
- Boroplus Glass
- Various Metals
- Full Vacuum to 300 PSI Std.
- Std. Temperatures to 650°F
- Thermal Shock Resistant
- High Impact Resistance
- Retrofits for Inferior Tempered Glass Discs

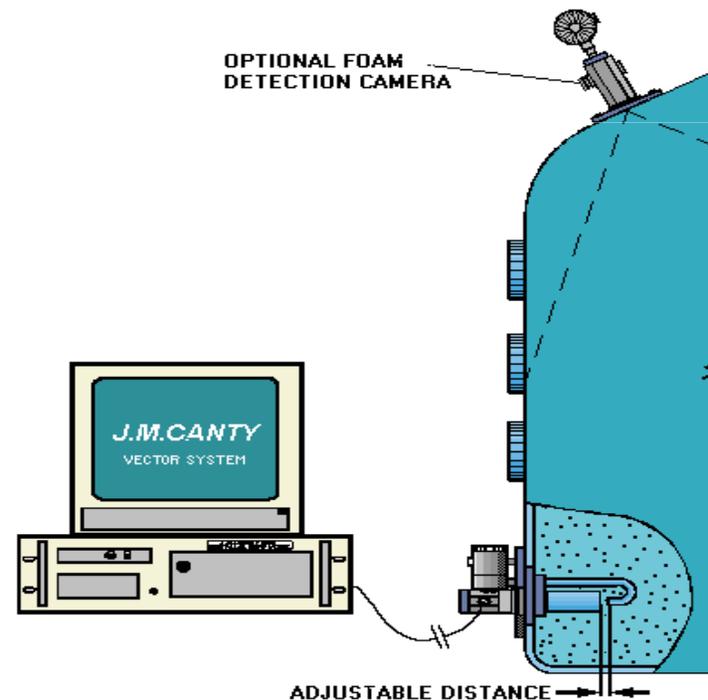
## Fused Glass in Pan applications

- Sightglasses account for the major leak of air and resulting loss of vacuum
- Fusedglass allows the operator to tighten his sightglasses without fear of being fired or causing a breakage any loss of an entire batch and cleanup cost
- Saftey improvement and reduced down time.
- Leaking glass also adds to poor sugar quality
- Energy savings allow for a quick payback in weeks when you calculate the cost to boil each gallon at x degrees higher x BTU required .

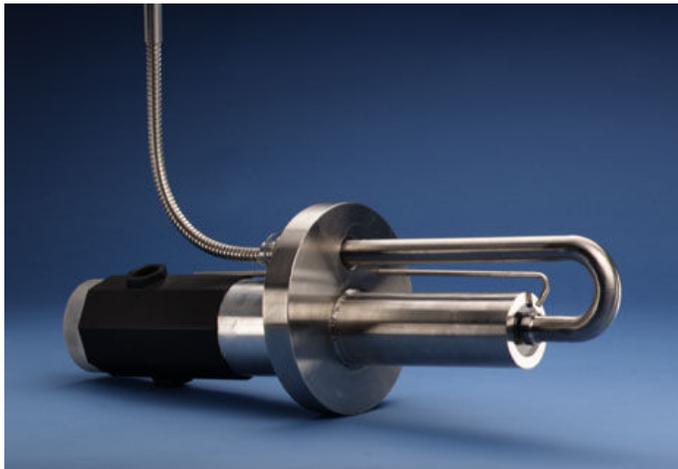
## CANTY Process Microscopy

The technology is based on in line microscopy which has been developed and used in Pharmaceutical ,Chemical , Mining, Food and other industries

## Typical Vacuum Pan with Sugarscope and Camera / Light



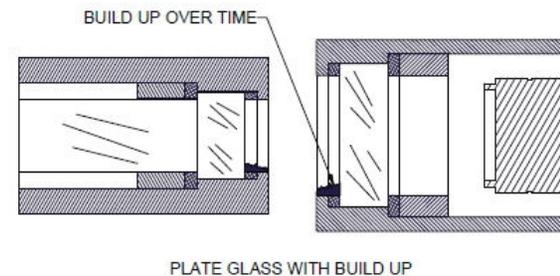
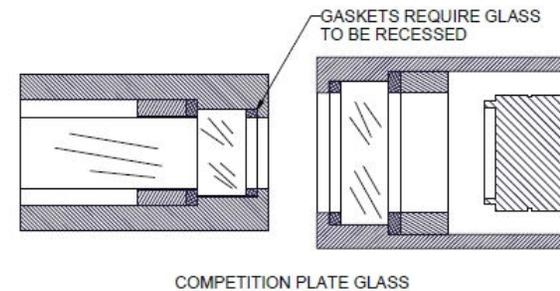
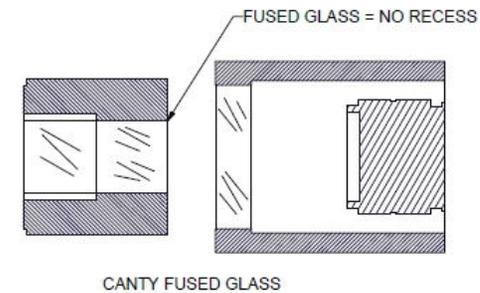
## Sugarscope



- Black & White
- Weather Proof
- Fused Glass (Standard)
- One Connection
- Spray Tube
- Adjustable Magnification
- Fiber Optic Lighting
- Cold Light NO "Bake-on"
- Remote Light

## 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



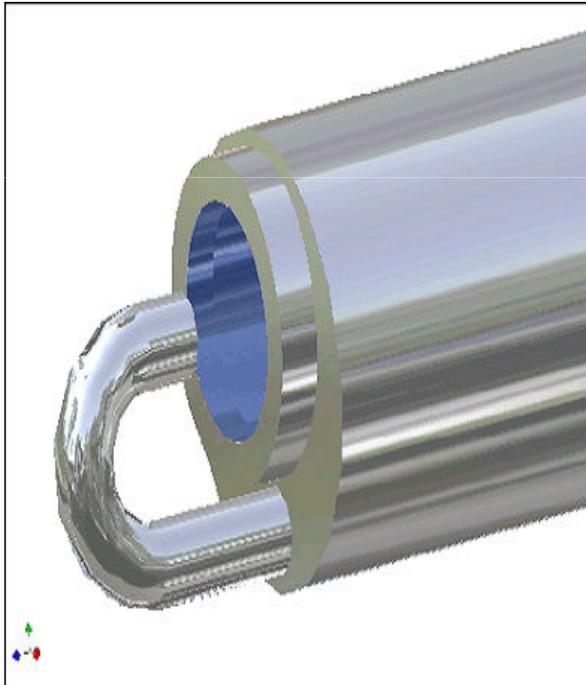
## *Crystal Size in the Vacuum Pan*

A Sugarscope is a microzoom camera which is back lit with a spray tube for cleaning (no one has needed to use the spray tube ). The system requires no maintenance other than changing a light bulb due. This is do to a nema 4 enclosure designed for offshore use along with fused glass process conditions.

The digital image is transmitted from the ethernet camera via gigabyte network or wireless transmission.

The signal is then analzed with the Canty Vector Image analysis software where the ppm level of seeds is provided along with partical distribution via 4-20ma control or OPC

## IMAGE ANALYSIS SYSTEM - Vessel Camera Calibration



- Sealed Camera/Lens unit retracted from insertion tube.
- Camera/Lens placed on Bench and recalibrated by adjusting Zoom and Focus.
- Optical Calibration against standard grid
- Unit replaced into insertion.
- Images focused on Wetted side of Fused glass.

# Imaging Detection and Monitoring of seed point

- You can view down to .7 micron with front or back lighting
- The software will detect and count number of particles (particle image density)
- The software will monitor size growth to avoid unwanted agglomerations or fines

## Why Seed/Nucleation Control

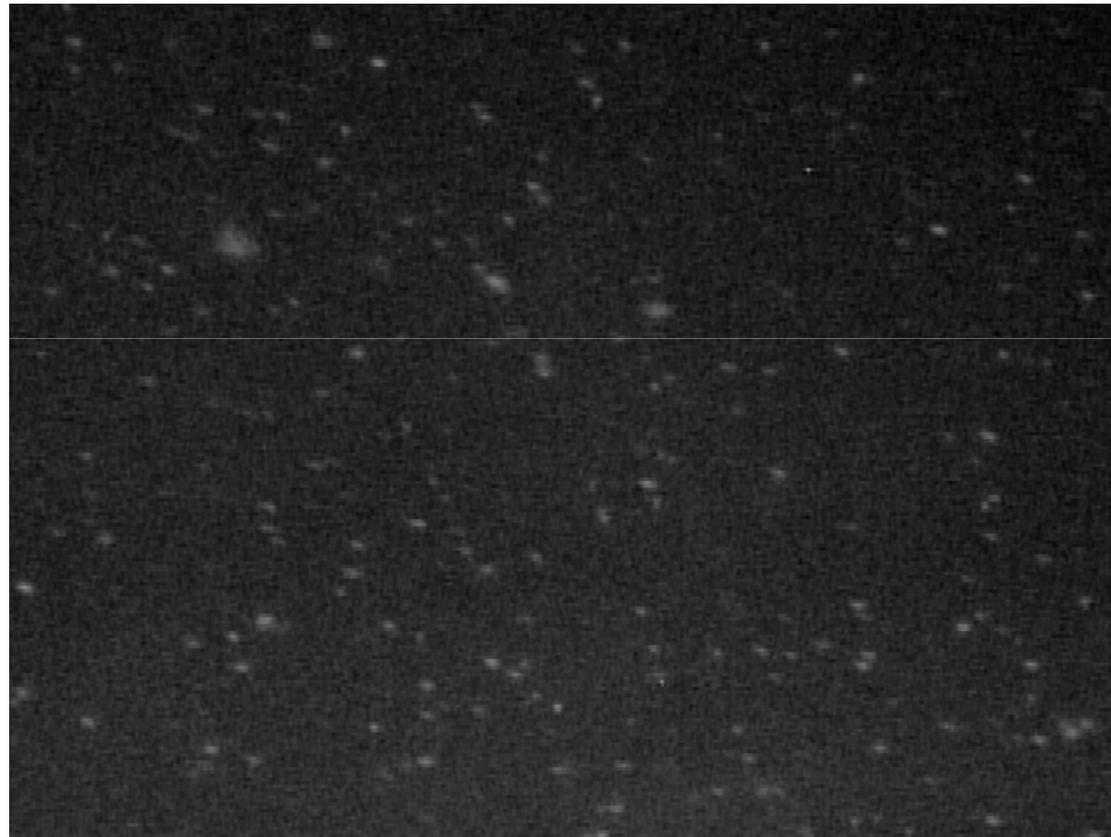
- The control of seeding is the most fundamental core control aspect of crystallization. Every other parameter tries to correct for improper seeding
- It is getting the train on the tracks to run and go in the right direction

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## Over Seeding

- Over seeding causes too many nucleation sites and creates small particles (too many fines) but a high yield. The problem becomes at filtration the product will plug and become unusable or impossible to wash

## Under seeding

- Under seeding reduces the nucleation sites creating a lower yield in addition the liquor can super saturate and create secondary fines causing filtration problems.

## Pay Back

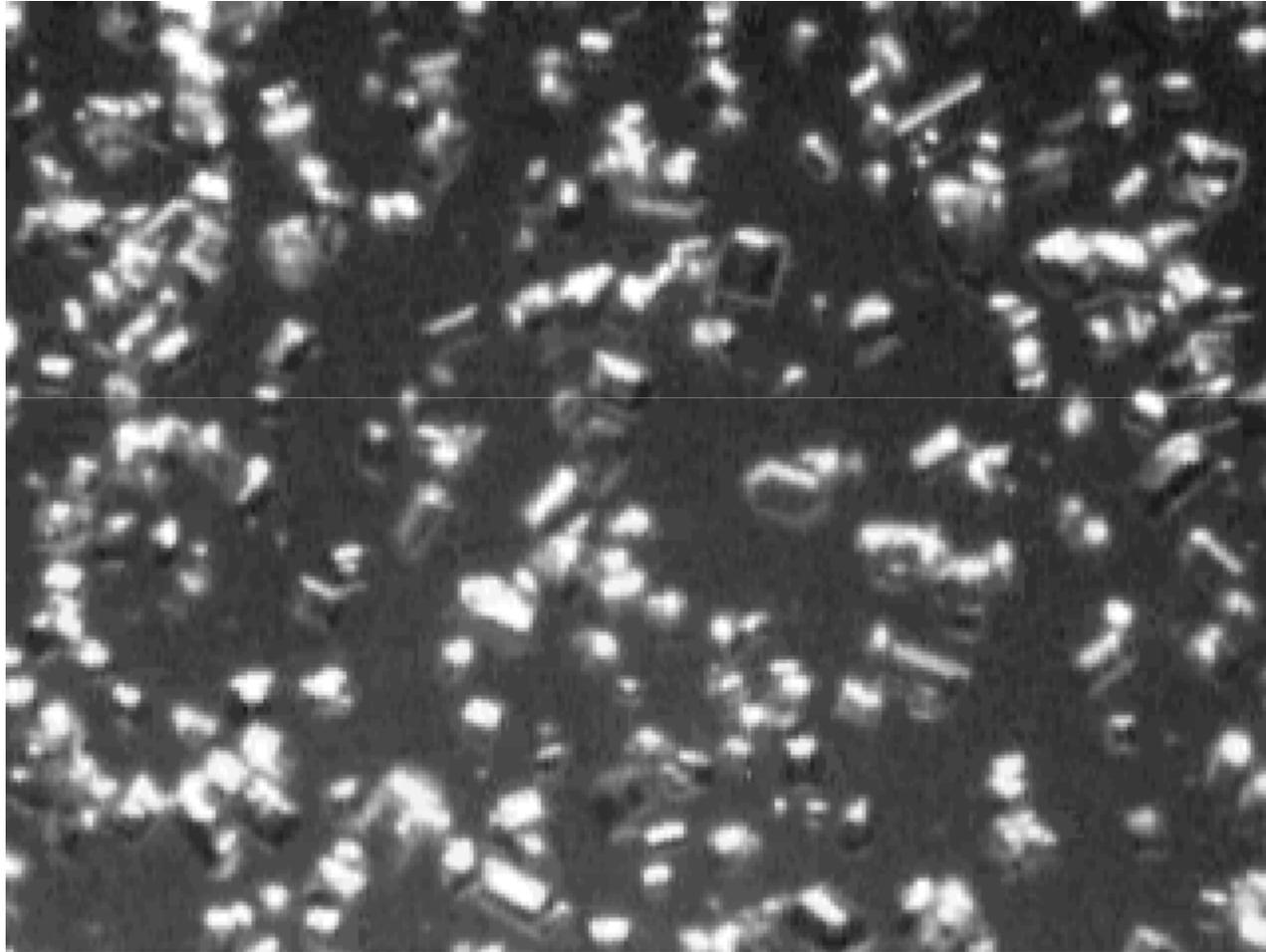
- Controlling seeding controls yield
- Mentoring crystal growth lets you detect secondary nucleation and agglomeration
- Any problem in the early stages can be corrected by remelting the crystals and restarting the seeding process.

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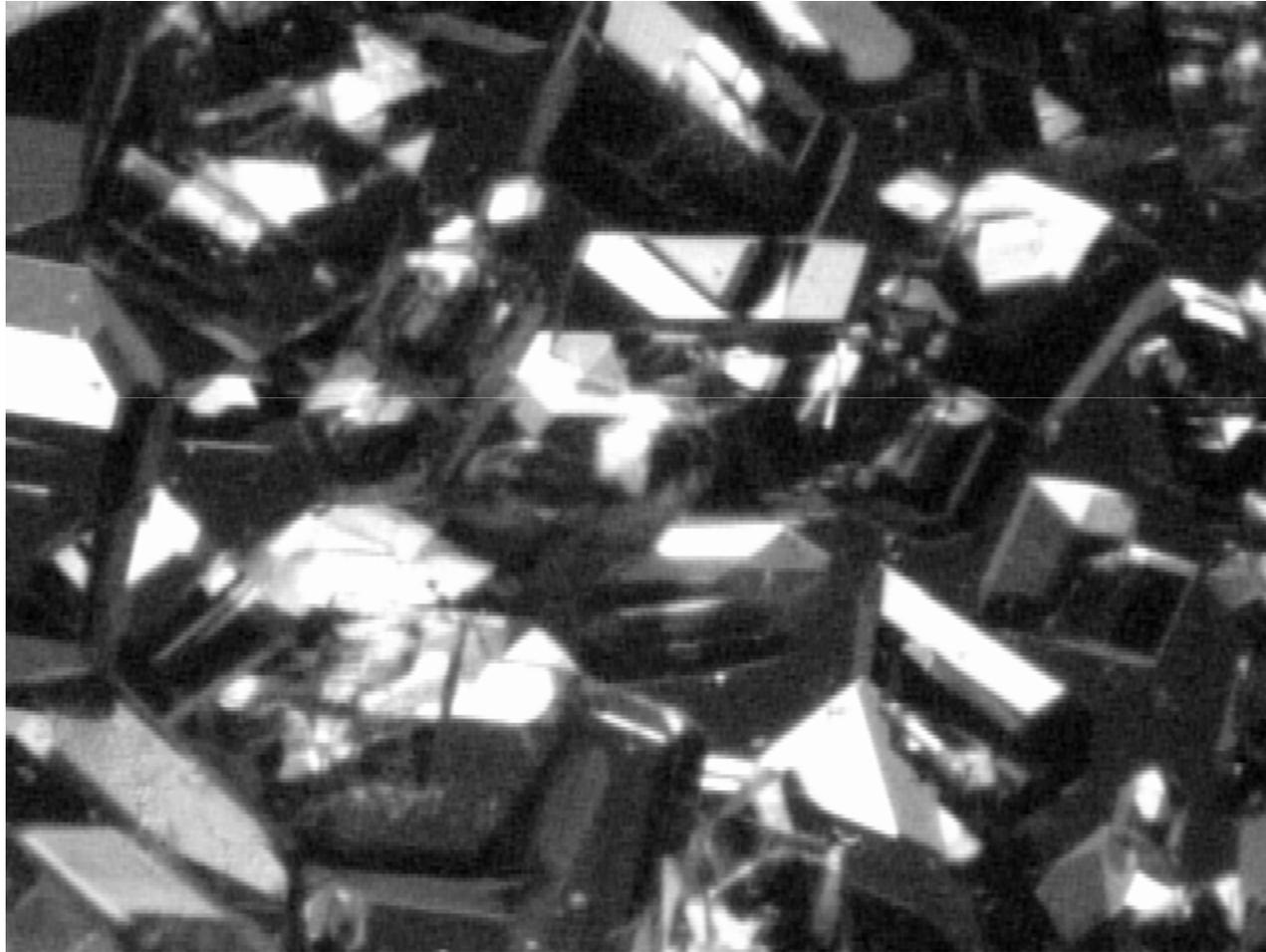


# CANTY

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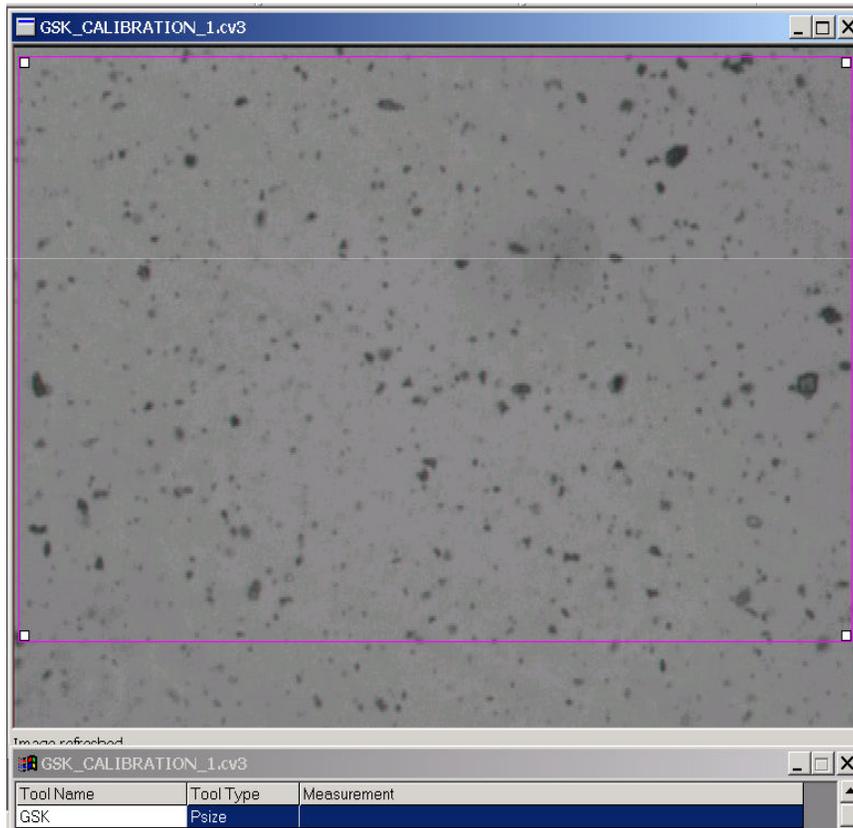
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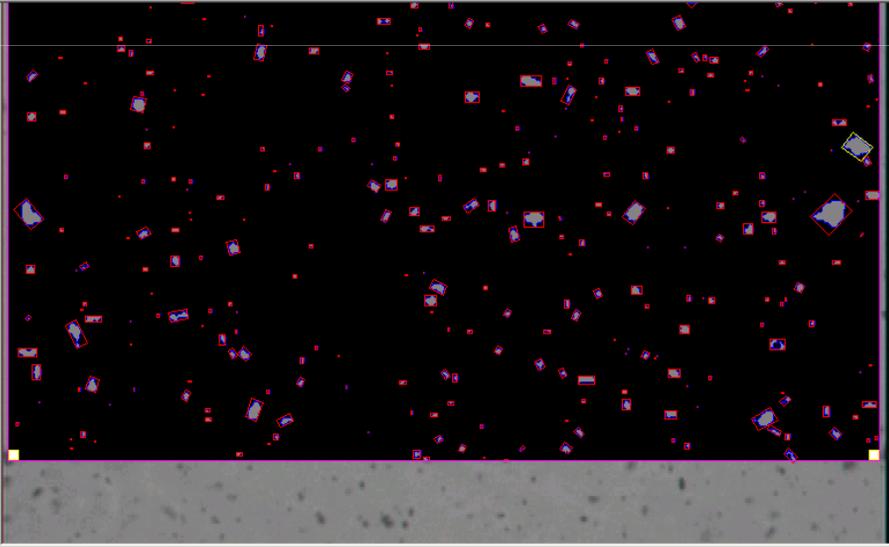
## IMAGE ANALYSIS SYSTEM - Image Processing Grab



- Image of particle taken.
- Sharp image of Small fast moving particles
- Frame rate: 25 frames per second
- Shutter speed: up to 1/100,000second

# IMAGE ANALYSIS SYSTEM - Calculating Size

Particle #	Area	Perimeter	Major Axis	Minor Axis	R	G	B	Y	U	V
96	55.3073	21.1658	9.4070	7.0553	101.6000	100.800	100.800	101.039	-0.1168	0.4936
97	22.1229	9.4070	4.7035	4.7035	109.0000	109.000	109.000	109.000	0.0000	-0.0000
98	143.7989	39.9798	16.0319	13.9365	99.0769	101.153	102.000	100.629	0.6705	-1.3661
99	165.9219	44.6833	16.4623	14.1105	98.6000	98.7333	98.6000	98.6783	-0.0384	-0.0689

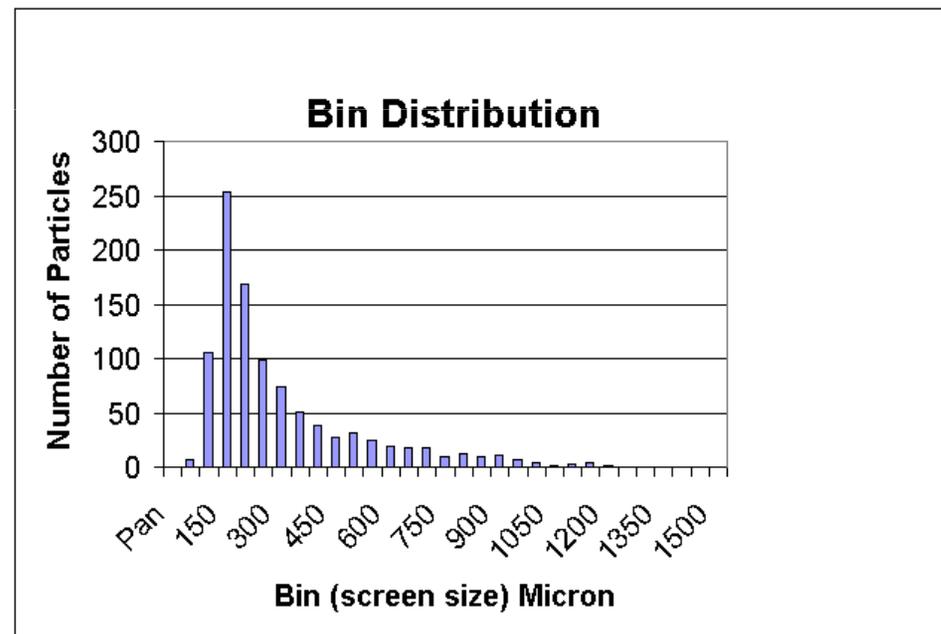
Tool Name	Tool Type	Measurement
GSK	Psize	Area=1471, Perimeter=155.2, Major=52.65, Minor=39.07

- Image Digitized
- Each particle sized
  - Area
  - Perimeter
  - Length
  - Width
  - Color Information
  - Particle Count
- Data outputted to file and Excel spreadsheet
- User Defined Output data sample size

# IMAGE ANALYSIS SYSTEM

## - Output Data/Process Control

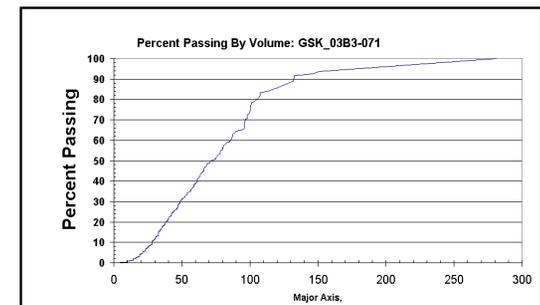
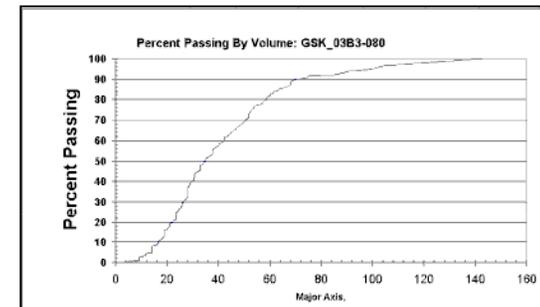
- Displays
  - [Graphs](#)
  - [Bin Analysis](#)
  - [Tables](#)
- Output Signals
  - 4-20mA
  - Digital
- ...ETHERNET



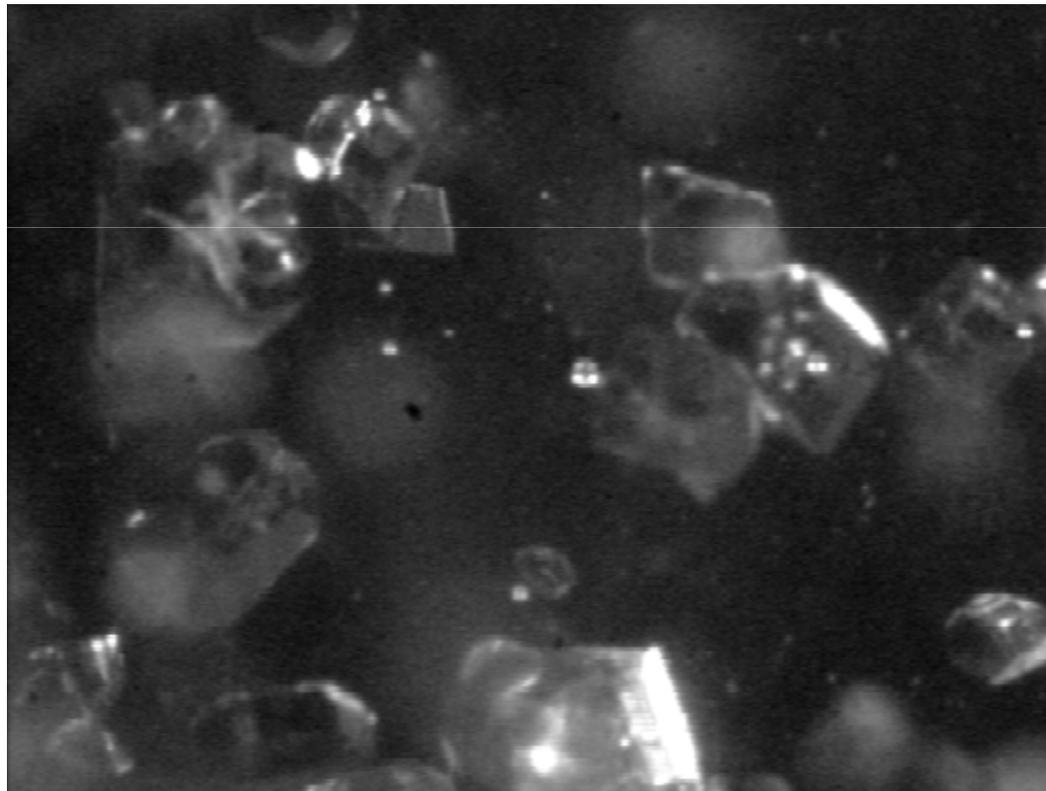
## IMAGE ANALYSIS SYSTEM

### - Output Data: Excel Graphs

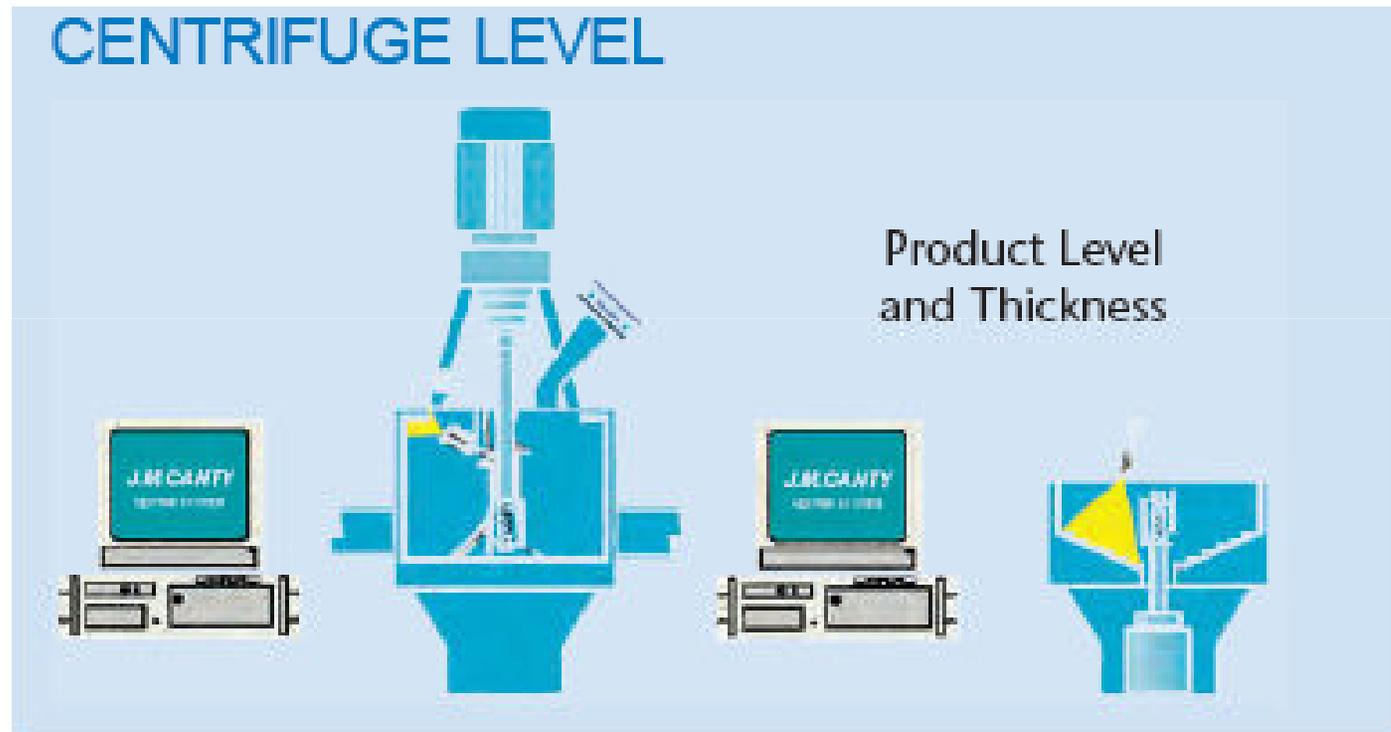
- Graphs: Automatically generated.
- Attached graphs calculated automatically with Percent passing by Volume.
- Volume calculated using Length-Width dimensions and Cylinder model.
- Various shape models possible (Sphere, Cube etc)



## *Typical Sugarscope Image*



## CENTRIFUGE LEVEL

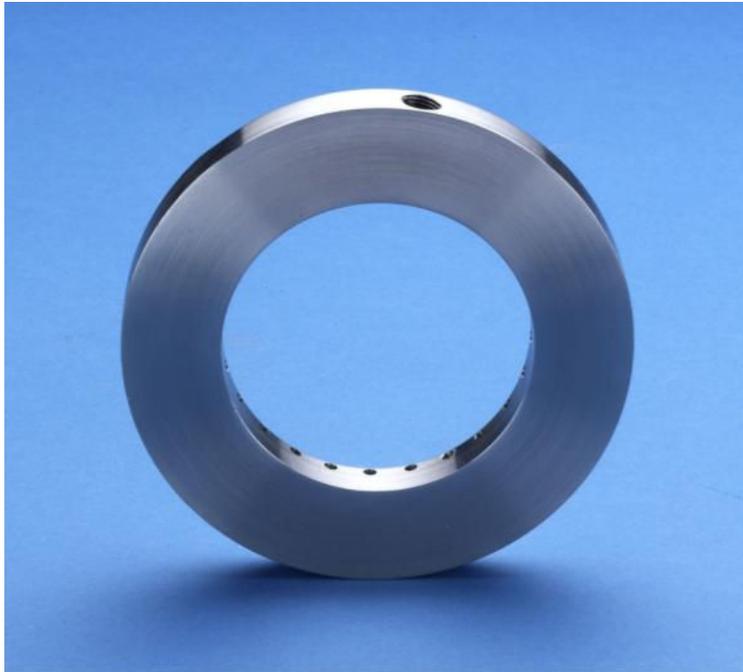


## Centrifuge Camera/Light



- Ethernet camera
- Weather Proof
- Fused Glass (Standard)
- One Connection
- Spray Ring Option
- Various View Angles
- Fiber Optic Lighting
- Cold Light NO "Bake-on"
- Remote Light Option

## Spray Ring

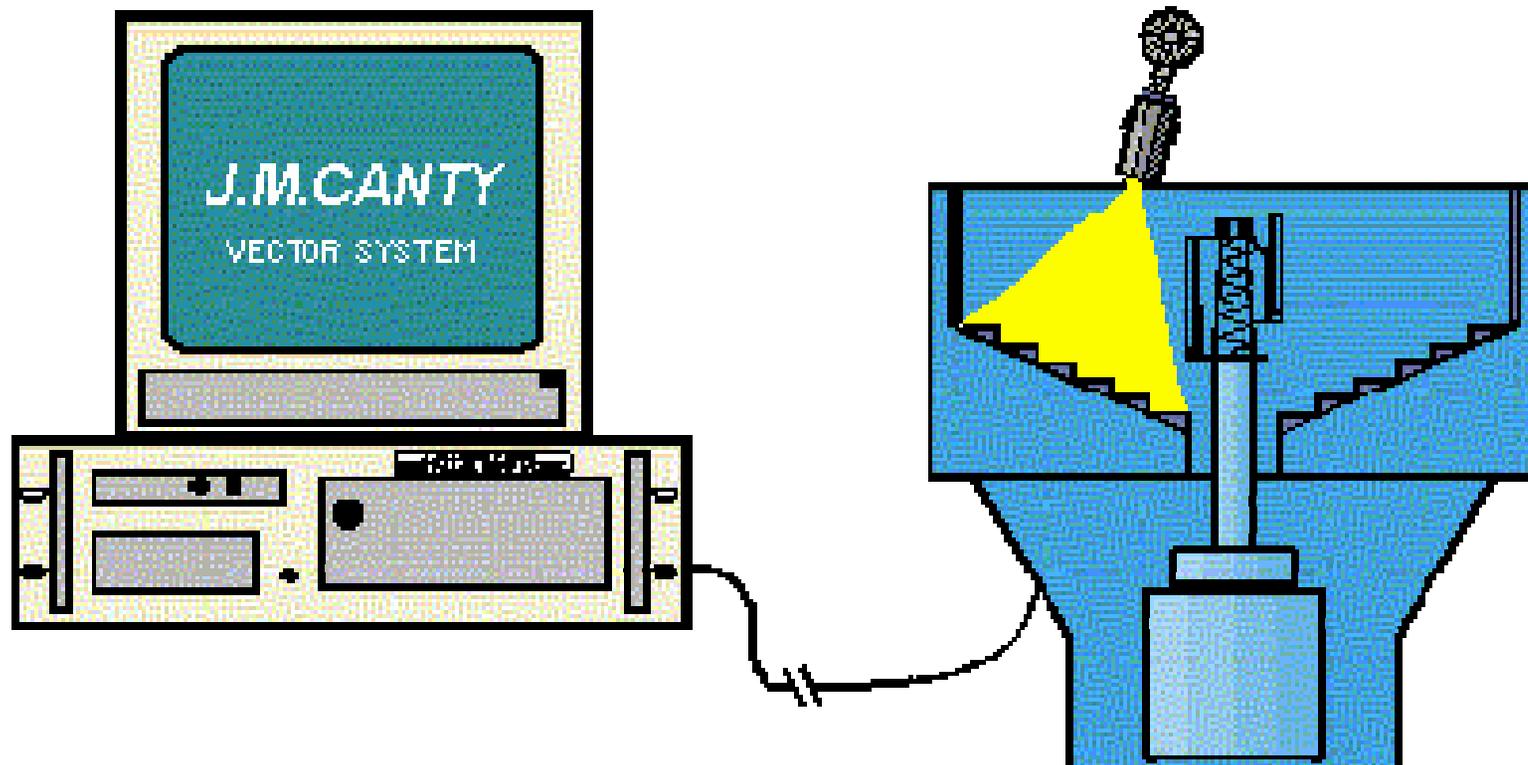


- Any Fluid
- Vortex Cleaning Action
- Insertion or Flush Mount
- Standard to 2500 PSI
- Various Materials
- Various Mounting Connections

## Batch Centrifuge

- Measure fill level in centrifuge (problem area currently )
- Measure slurry level and detect cake to start proper wash
- Color of surface –current R&D project
- [Visual Verification](#)

## Typical Continuous Centrifuge



## *Continuous Centrifuge Control by Image Analysis*

Canty uses a process camera light combination and Vector image processor to measure the position of the color line in a continuous centrifuge when washing the sugar crystals. The position of the line is determined by the vector and an output signal is then sent to the control system to automate the centrifuge. This allows the amount of water and speed of the centrifuge to be controlled to ensure a quality wash yielding the maximum amount of product.

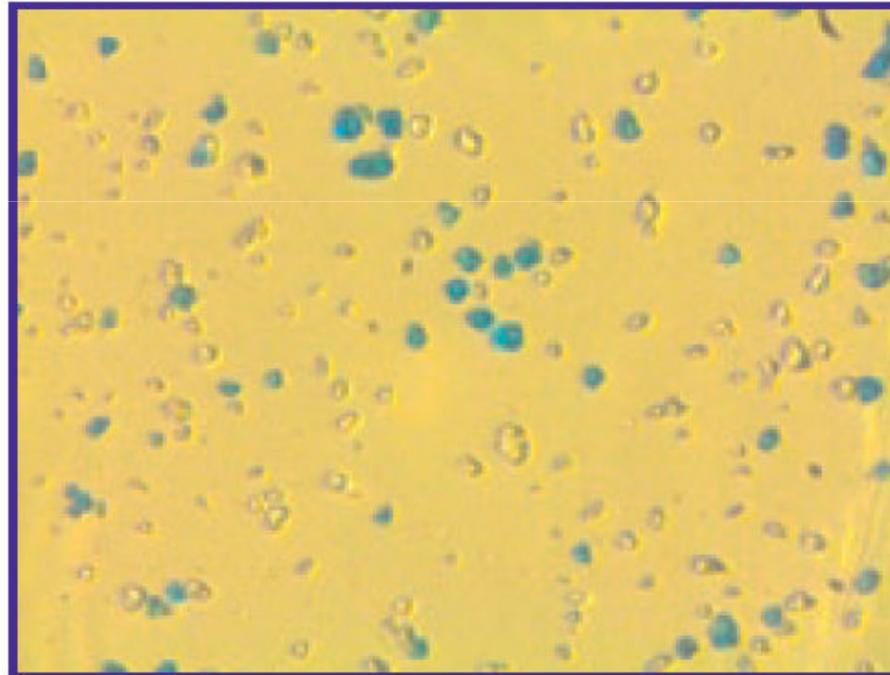
## Turbidity and Color Don't have to be a bad words

- To date lab and online turbidity and colorimeters couldn't deal with a mixture of changing liquid color ,solids and bubbles in the process line or lab sample. The technology has been based on a photo cell and light wave detector. This causes a real problem with solids are present as in samples Charlie Richard was mentioning yesterday.

## Imaging Based Process vision

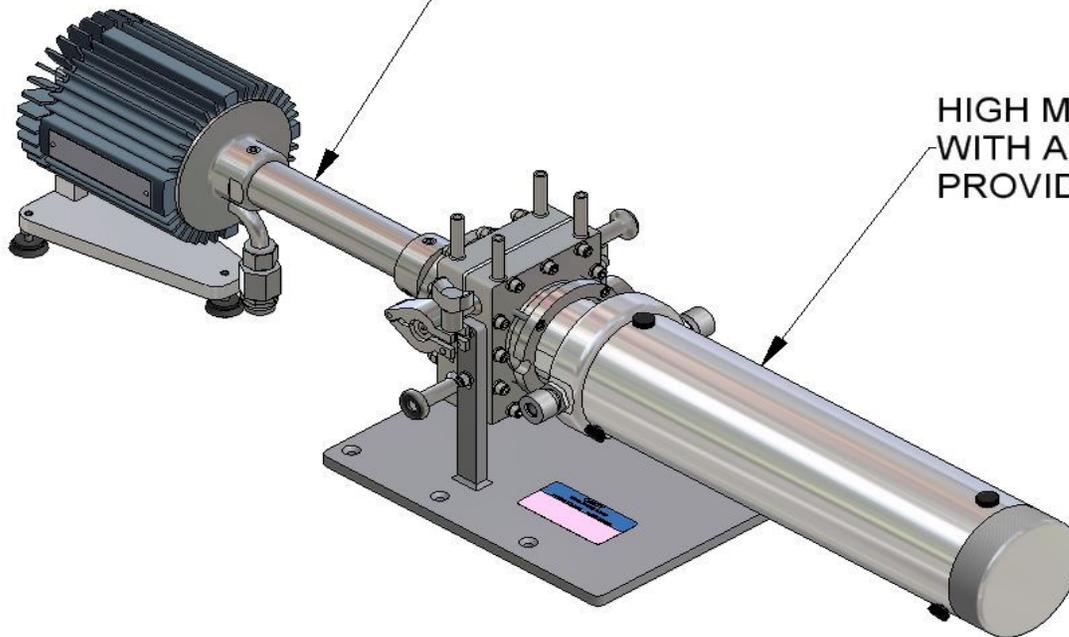
- Turbidity
- % Solids
- Color
- Particle Analysis

# Particle Sizing-Size, Shape & Color



## Lab based Systems

DIFFUSED HIGH INTENSITY  
COLLIMATED BACKLIGHTING



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

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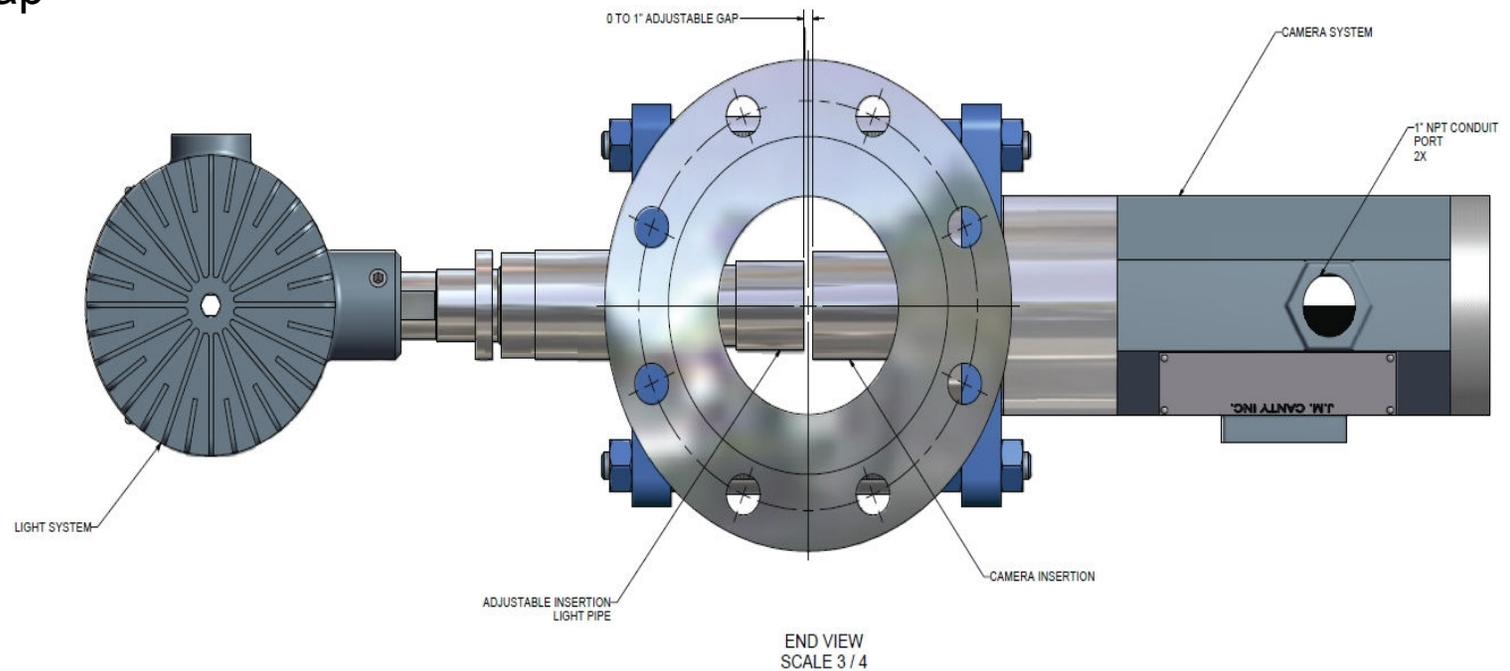


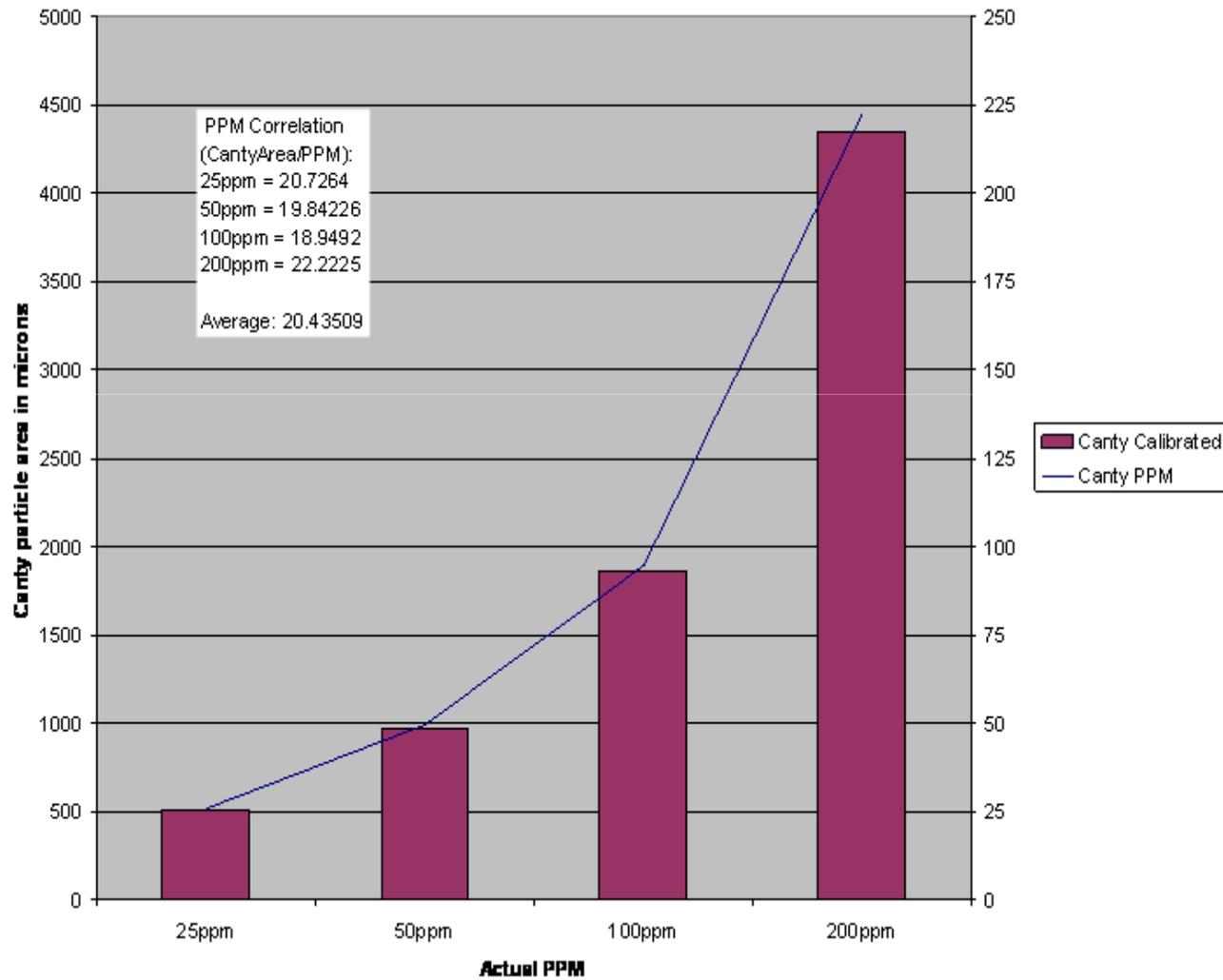
## Inline Analysis



The Inflow works on the same principle as the Microflow

- Lighting
- Camera
- Flow Gap





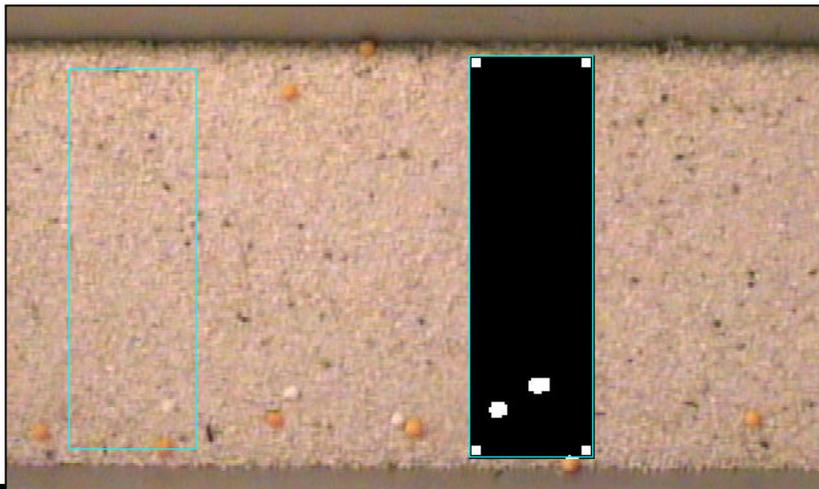
# Grain and Powder Particle Size ,Color and Black Spec

LAB based and at Line

## Color Analysis

### Solids

The LAB SOLIDSIZER™ WITH COLOR ANALYSIS builds upon the LAB SOLIDSIZER™ framework by integrating an additional color vision system module to provide continuous, color analysis and speck detection as well as particle characterization on the sample.



## Particle Size Analyzer



- On-Line or in Lab
- Stainless Steel Construction
- 20 through 6000 microns
- Various Lighting Options
- Easy Calibration
- Not Operator Dependent
- Results in 1 to 2 minutes
- Various Inlet / Outlet Ports

## High Temperature Insertion CCD Camera



- Color Ethernet Camera
- NO Cooling Required under 2500°F
- Quartz Lens Assembly
- Quartz Dust Shield
- Air Jet Spray Ring

Technical Specification: Example Installation

## Insertion HT Cameras



## Sugar Industry Applications

### Surveillance:

- Flame Monitoring
- Visually Verify Flame Presence

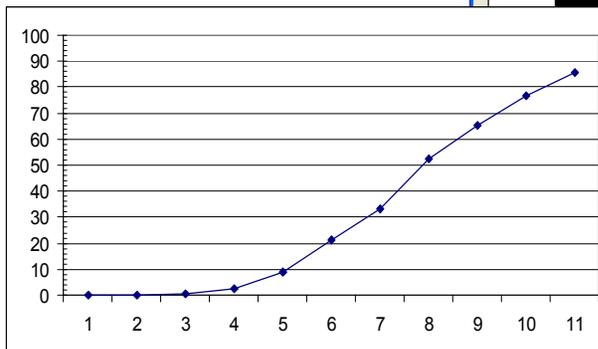
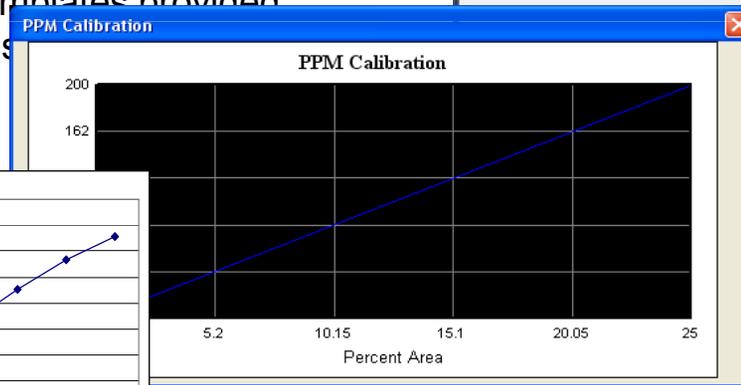
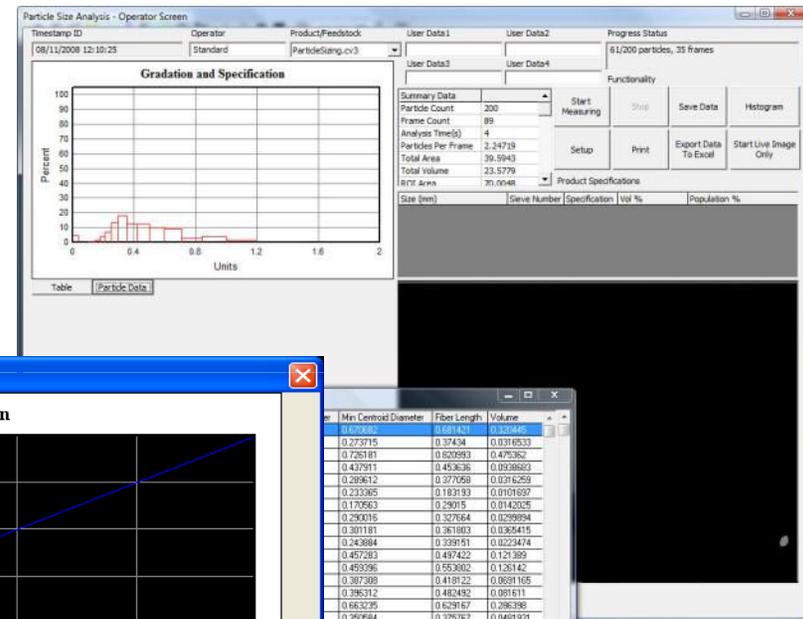
### Using Cantyvision Software:

- Temperature Measurement
- Begas Burning
- Smoke minimization



## 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 spreadsheets and formulas



10	0.357109	2.47989	0.709187	0.655439	0.719282	0.765862	0.674304	0.627947	0.568933	0.234063
19	0.0880575	1.225	0.432057	0.25449	0.379495	0.493624	0.334841	0.240719	0.366726	0.524798
20	0.229538	2.03887	0.789146	0.475726	0.607487	0.762794	0.538231	0.374414	0.536278	0.690981
21	0.627369	4.20745	1.257	1.00456	1.14426	1.2626	1.02637	0.867834	0.830727	
22	0.0260223	0.621987	0.22003	0.186138	0.19768	0.222567	0.182024	0.15526	0.167496	0.043223
23	0.0618029	1.02943	0.299612	0.274237	0.281267	0.273895	0.280917	0.252623	0.247488	0.0169248
24	0.307247	2.28434	0.691495	0.618829	0.642403	0.688404	0.617945	0.483802	0.617907	0.184481

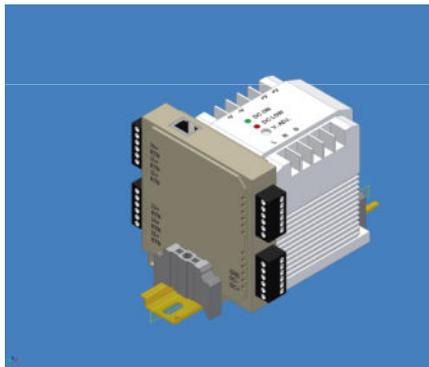
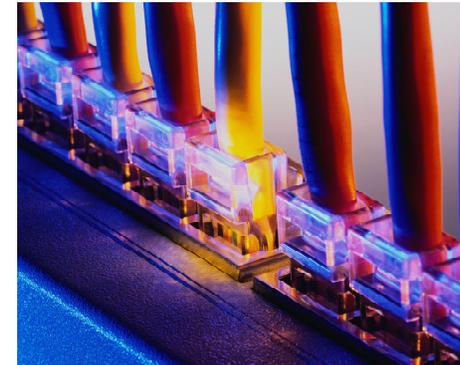
- Several Plot Types: Differential, Cumulative Retained & Passing
- Plot Data By: Minor Axis or a major, Average Cord, Area, Perimeter, Aspect Ratio many more

## OUTPUT OPTIONS

### OPC - Open Connectivity for Process Control

Canty provides both an OPC client and server to connect CANTYVISIONCLIENT™ Software to our customers' digital control systems.

This comes standard with CANTYVISIONCLIENT™!



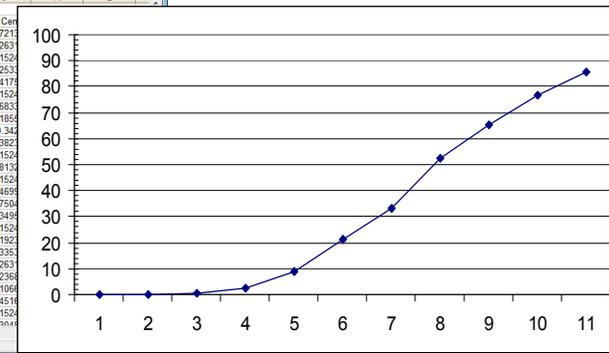
### 4-20mA Output - Ethernet Output Module

Canty also offers an Ethernet 4-20mA current loop CANTYVISIONCLIENT™ across a network, and convert it to a 4-20mA current loop signal. This is a separate DIN rail mounted module that can be purchased

### MS Excel Output

PPM, PPB, major diameter, minor diameter, area and perimeter are measured and logged into an Excel spreadsheet for each particle detected

Time (h.m.s. ms)	Area (mm <sup>2</sup> )	Perimeter (μ)	Major Axis (μ)	Minor Axis (μ)	Average Ch	Max Axis (μ)	Equivalent (μ)
12:40:10	268	0.772072	3.78371	1.21738	0.830512	1.10109	1.28433
12:40:10	314	0.10223	1.33968	0.467542	0.290329	0.393371	0.472011
12:40:10	374	0.002323	0.0678699	0.0152428	0.0152428	0.0152428	0.0171996
12:40:10	374	0.0915427	1.225	0.458111	0.275337	0.376336	0.458331
12:40:10	374	0.152881	1.56725	0.484576	0.435554	0.471595	0.506096
12:40:10	374	0.002323	0.0678699	0.0152428	0.0152428	0.0152428	0.0171996
12:40:10	426	0.905204	4.24005	1.47377	0.817534	1.22397	1.51257
12:40:10	426	0.062174	1.09462	0.367127	0.242807	0.322069	0.370762
12:40:10	426	0.200743	2.00728	0.754318	0.390059	0.585139	0.754623
12:40:10	426	0.142389	1.56725	0.521821	0.414038	0.462972	0.524679
12:40:10	426	0.002323	0.0678699	0.0152428	0.0152428	0.0152428	0.0171996
12:40:10	484	0.884525	4.17486	1.28374	1.01306	1.15118	1.28622
12:40:10	484	0.002323	0.0678699	0.0152428	0.0152428	0.0152428	0.0171996
12:40:10	484	0.206087	1.8769	0.548739	0.503011	0.554042	0.586552
12:40:10	484	0.50604	2.78956	0.834395	0.769794	0.83399	0.889914
12:40:10	547	0.116171	1.35538	0.432931	0.37385	0.405791	0.444739
12:40:10	597	0.0230018	0.605689	0.213399	0.152428	0.187238	0.218607
12:40:10	597	0.12695	1.61614	0.620412	0.275437	0.485302	0.622257
12:40:10	697	0.197865	1.94209	0.735941	0.396354	0.581676	0.737458
12:40:10	648	0.0717936	1.09462	0.433794	0.260628	0.338152	0.433794
12:40:10	697	0.0534386	0.947938	0.300702	0.260658	0.280793	0.302843
12:40:10	697	0.0151022	0.475309	0.182913	0.108699	0.152897	0.18566
12:40:10	724	0.50604	2.78956	0.834395	0.769794	0.83399	0.889914
12:40:10	747	0.002323	0.0678699	0.0152428	0.0152428	0.0152428	0.0171996



## *Visual Verification*

- Key Advantage
  - Operators View Process in Real Time
  - Cross-hairs / Inverted Image
- R&D
  - Recording Files
  - Images

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Thank for your time . I would be happy to answer any questions .