JM Canty International

Sand Management Monitoring through Dynamic Imaging Technology

Presentation Outline

Sand Management – Introduction

Dynamic Imaging Principle

Image Retrieval – Hardware

Image Analysis – Software

Data Outputs

Sample Case Study

Sand Management

As the market value of oil increases, production on less efficient, “sand prone” wells becomes more economically viable.

However, these less efficient wells generate more sand and therefore have increased sand issues

- Damage to valves / pipelines / separators
- Clogging of injection wells (WFI)

Lack of Sand Control
- Decreases Production Efficiency
- Costs Money!!!

Sand Management

There are a number of methods employed in an effort to manage the amount / effect of sand within the oil production process, for example;

- Gravel Packing
- Sand Screen Installation
- Well Formation Studies

The performance of this sand management system needs to be measured

Vision Based Particle Analysis Basic Principle

JM Canty's vision based technique works on the basic principle of presenting the fluid between a high intensity light source, and microscopic camera

The captured images are then sent to CantyVision Client Software for analysis, where the suspended particulate (sand, water, oil, gas bubbles etc.) is measured under a number of different parameters to provide size, shape and concentration data

Identical optics between the lab and inline system ensures consistent results

Image Retrieval - Hardware

- JM Canty's vision based systems are made up of 3 critical components;

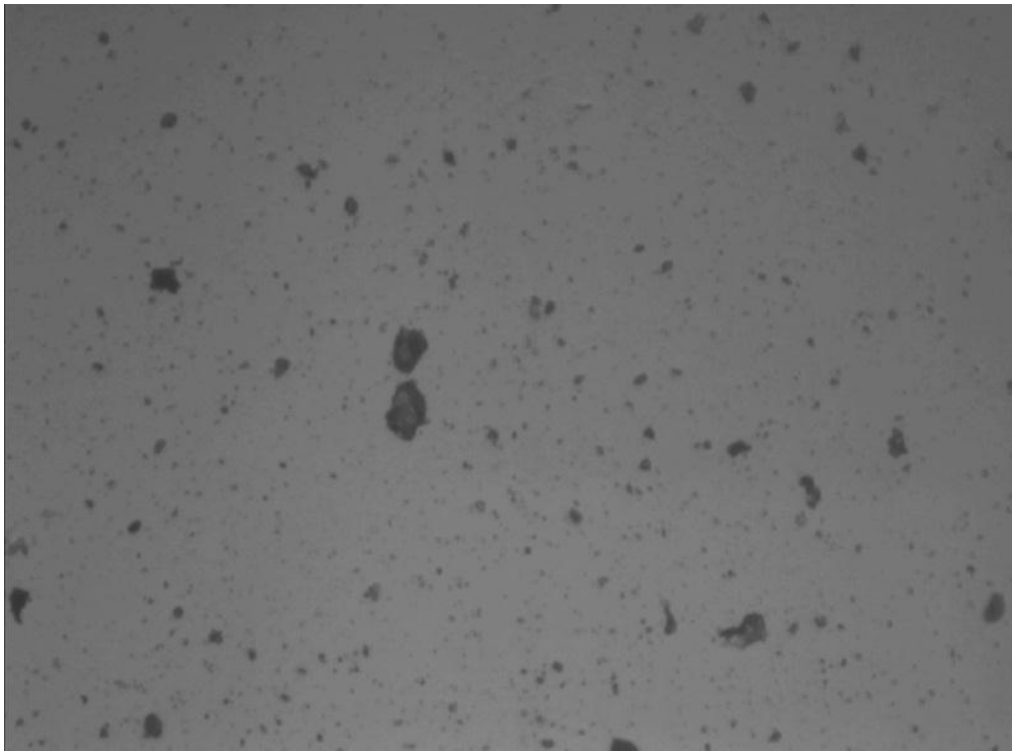
  - CCD Ethernet Camera
  - Flow Path between two Canty fused glass pieces
  - Canty High Intensity Light Source

Image Retrieval – Hardware – CCD Camera

Gigabit Ethernet technology for optimum image retrieval

Simple RJ45 Network Connection to Control PC

Possible to analyse as particulate as small as 0.7µm (dependent on magnification possible with light transmission through fluid)



Sand in Water

Image Retrieval – Hardware – Fused Glass Flow Path

- Fusion of glass to metal – one piece construction
- Critical to our vision based technique
- Pressures to 600 BAR, Temp -200 to 300ºC

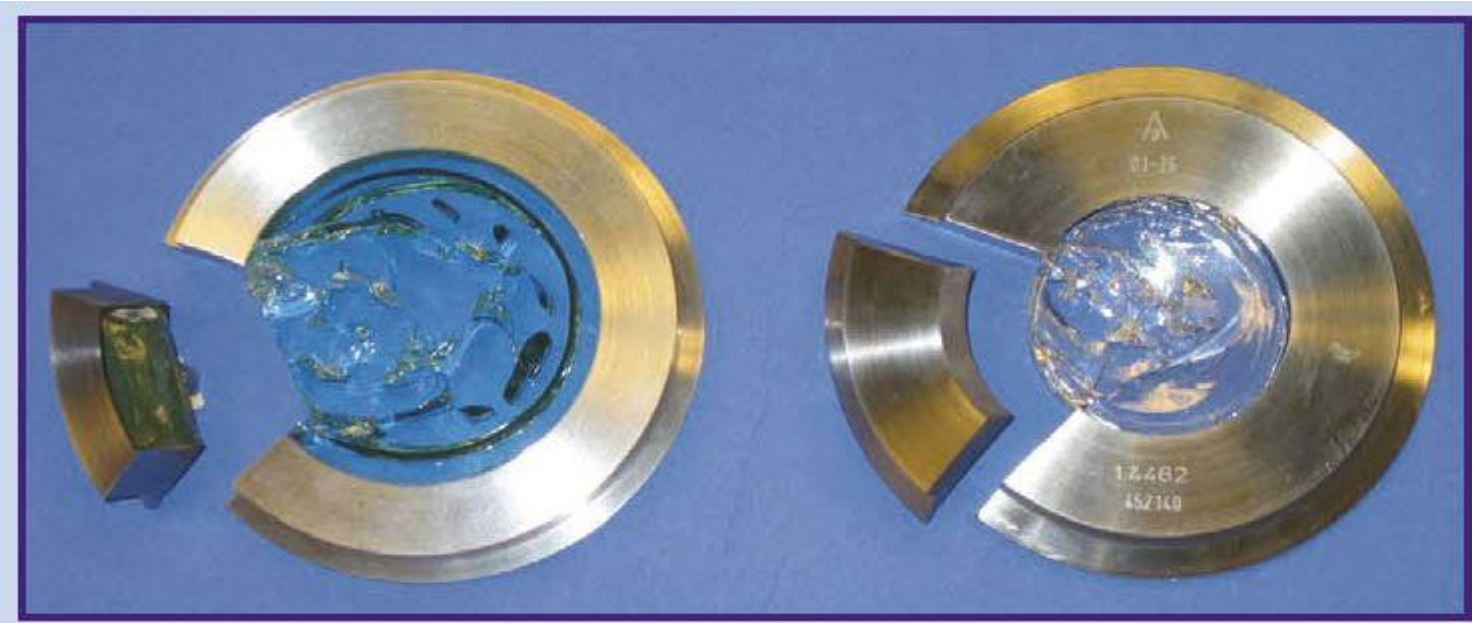
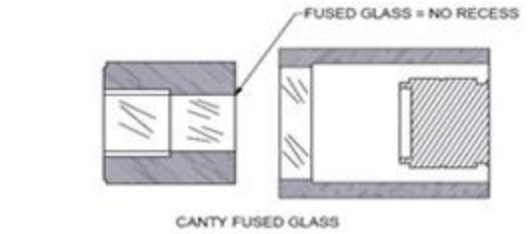
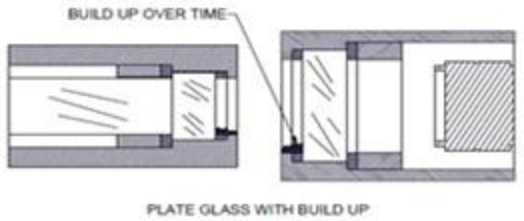


Image Retrieval – Hardware – Fused Glass Flow Path

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
- Spray Ring option included as standard
- Adjustable Gap Size dependent on sample present





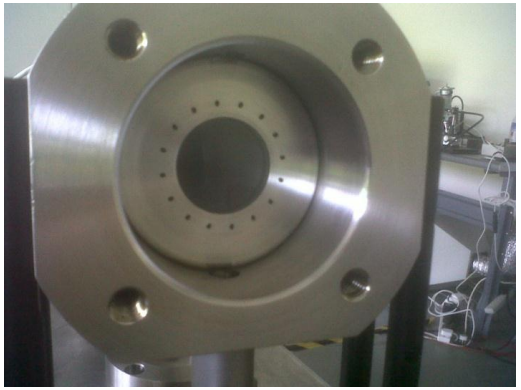
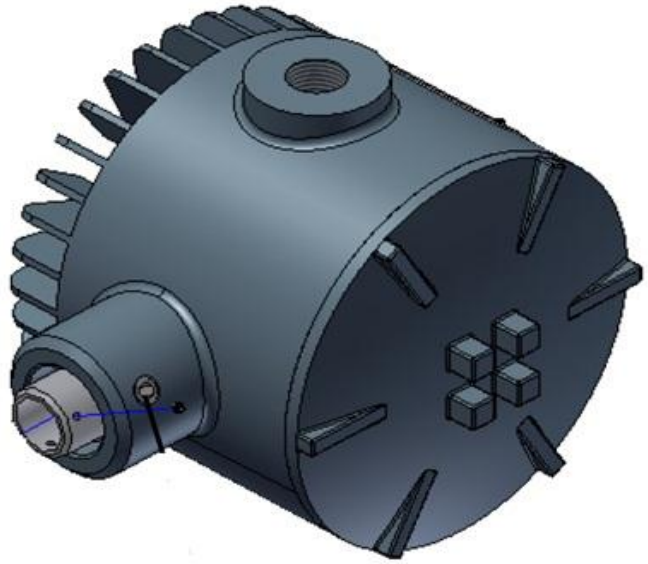


Image Retrieval – Hardware – Lighting System

High flow rates inline require an increased shutter speed and so an increased amount of light to capture particulate in “freeze frame” in order to perform software analysis

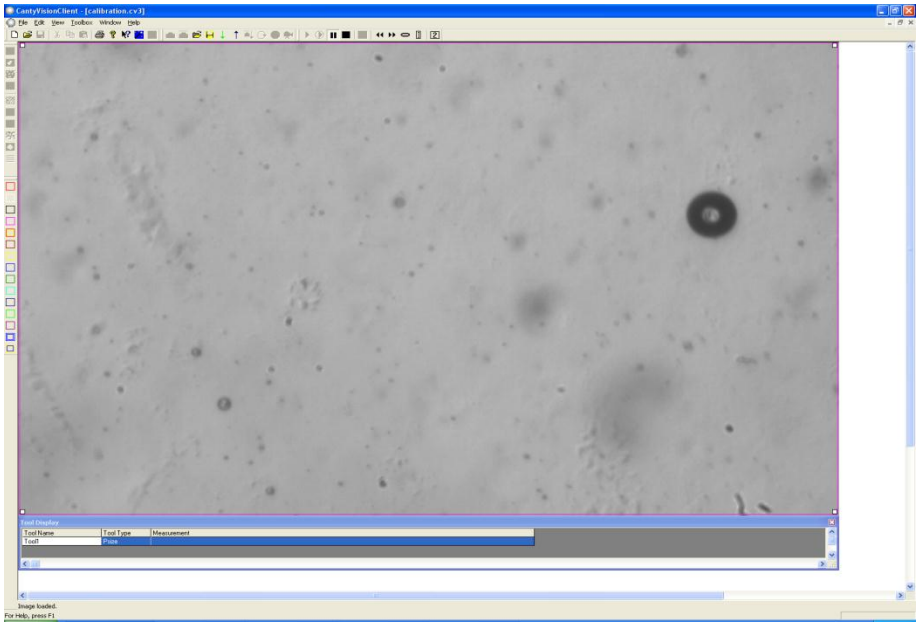
Flow speeds up to 2.75m/s (dependent on light transmission through fluid)

Pipe Line Size	Max Flow Rate
1"	83 l/m
2"	335 l/m
3"	750 l/m
4"	1340 l/m
6"	3000 l/m
8"	5300 l/m



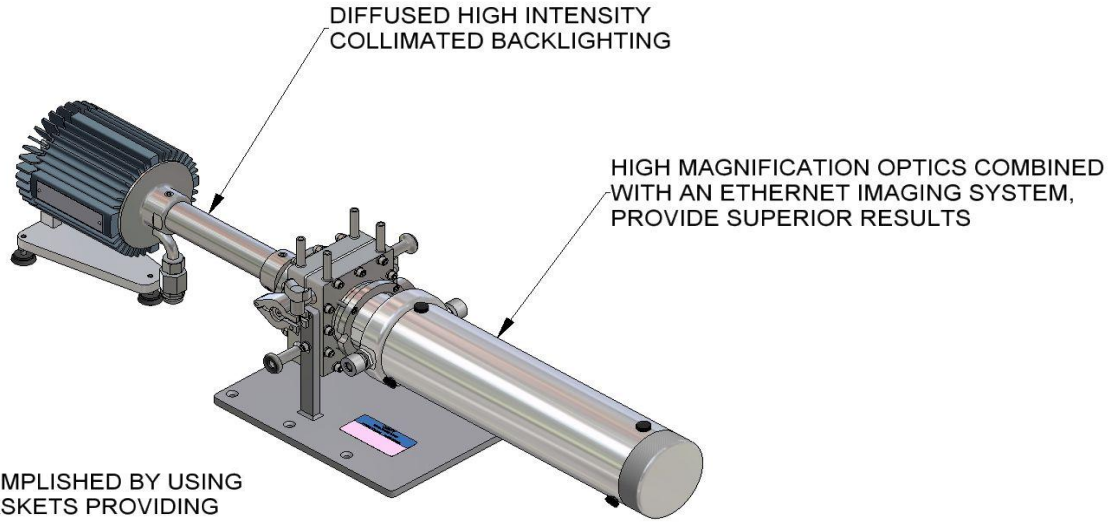
JM Canty's Vision Based Technique

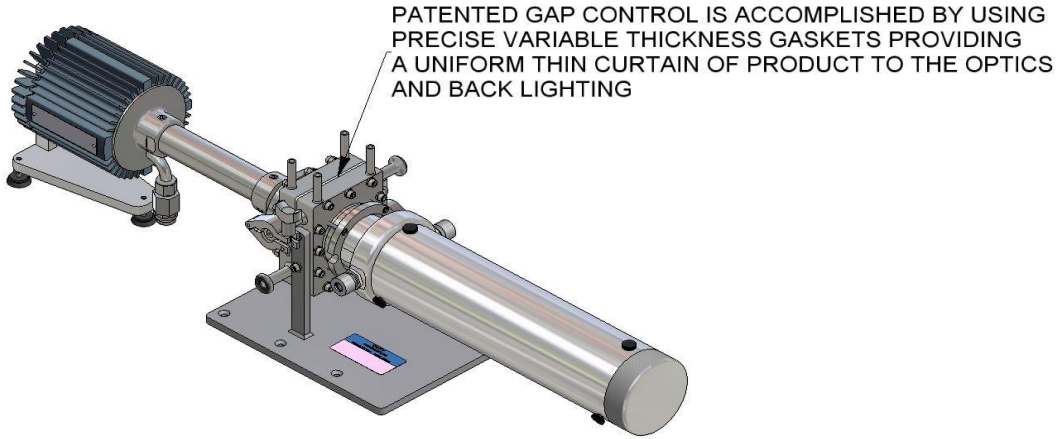
- Various systems depending on application retrieve live images from the process
  - Portable InFlow
  - Inflow (Inline)
  - Particle Probe



Portable / Lab System

- Lighting
- Camera
- Flow Gap



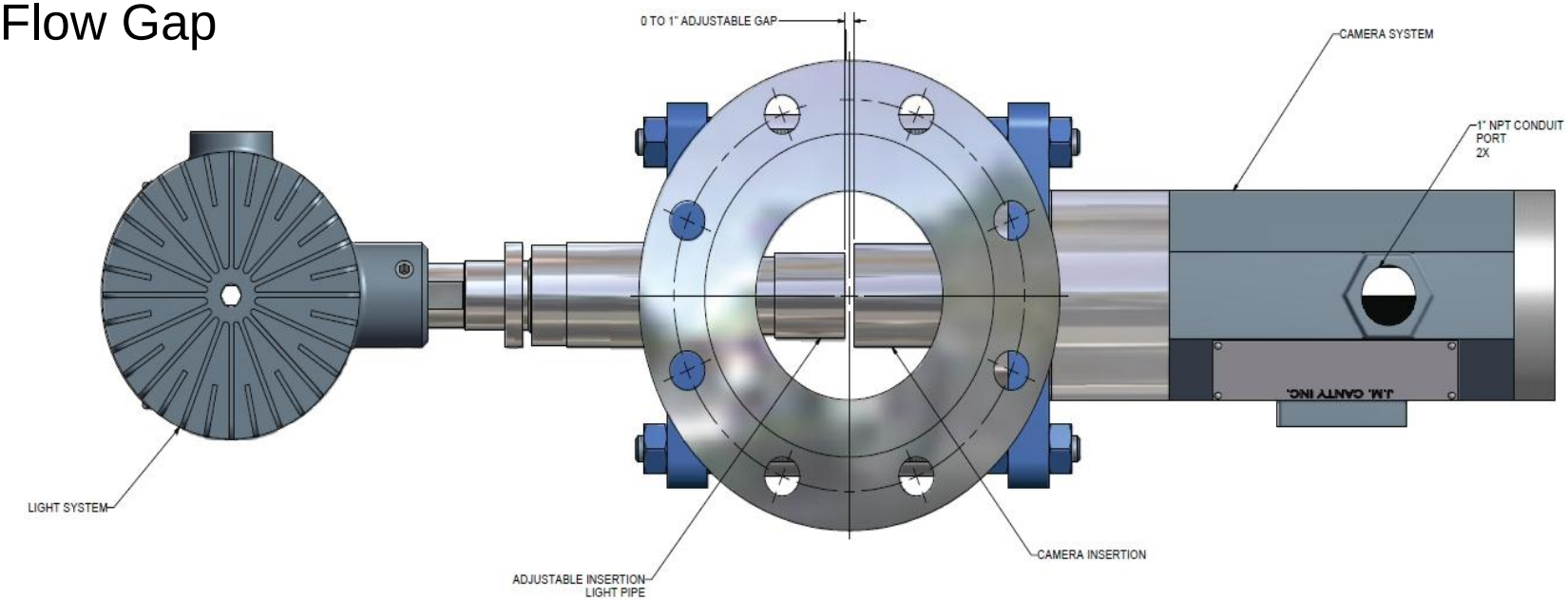


Portable / Lab System

Portable system that can be easily transported to different measurement points

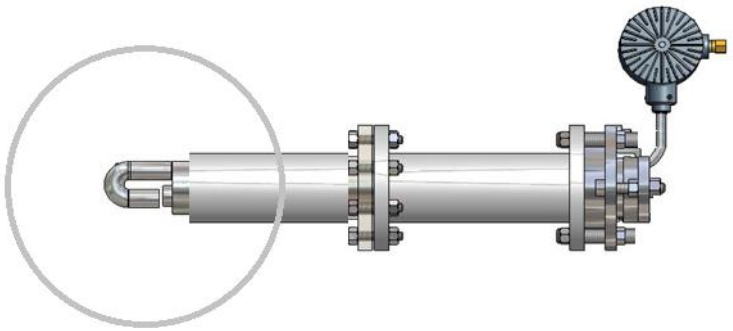
The Inflow (pipelines up to 22”) works on the same principle

- Lighting
- Camera
- Flow Gap



Particle Probe (pipelines 24”+)

- Lighting
- Camera
- Flow Gap



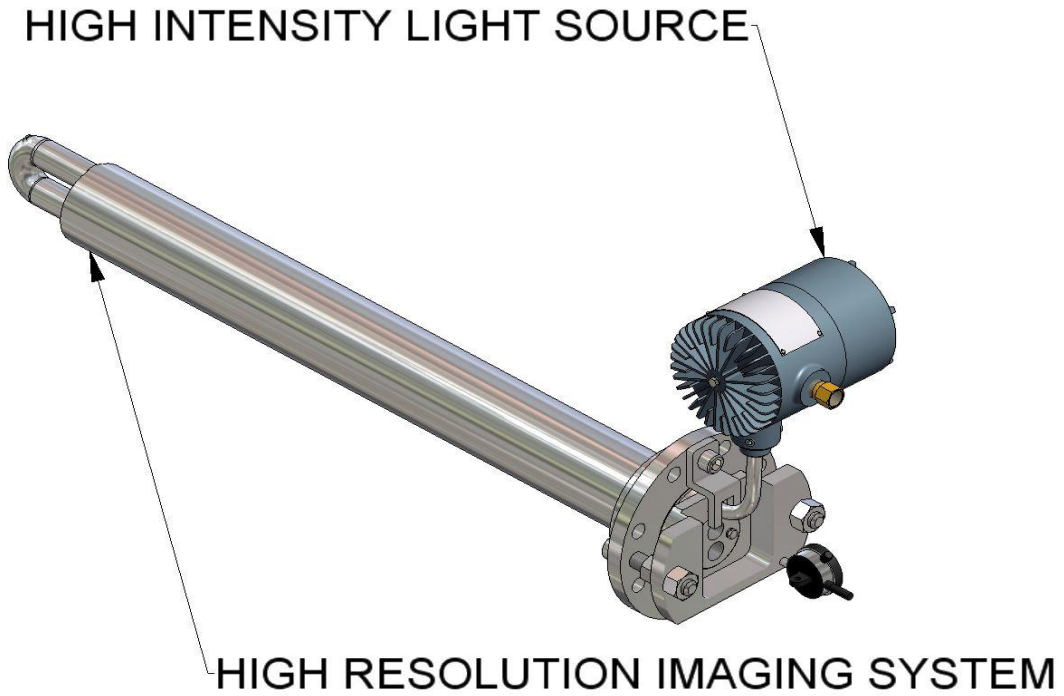


Image Analysis – Cantyvision Software

The retrieved images are analysed by the control PC running the Cantyvision Client Software

Each particle is analysed under a number of different parameters (major axis, minor axis, area, perimeter, circularity, aspect ratio….)

Water or oil droplets have a circularity value and an aspect ratio close 1, Solid particulate is randomly shaped

Air bubbles are larger and have a clear centre

Software filters (size / shape) can be applied so only particles with the characteristics of oil, water, solids, or air bubbles are individually analysed

Image Analysis with Canty Vision Client

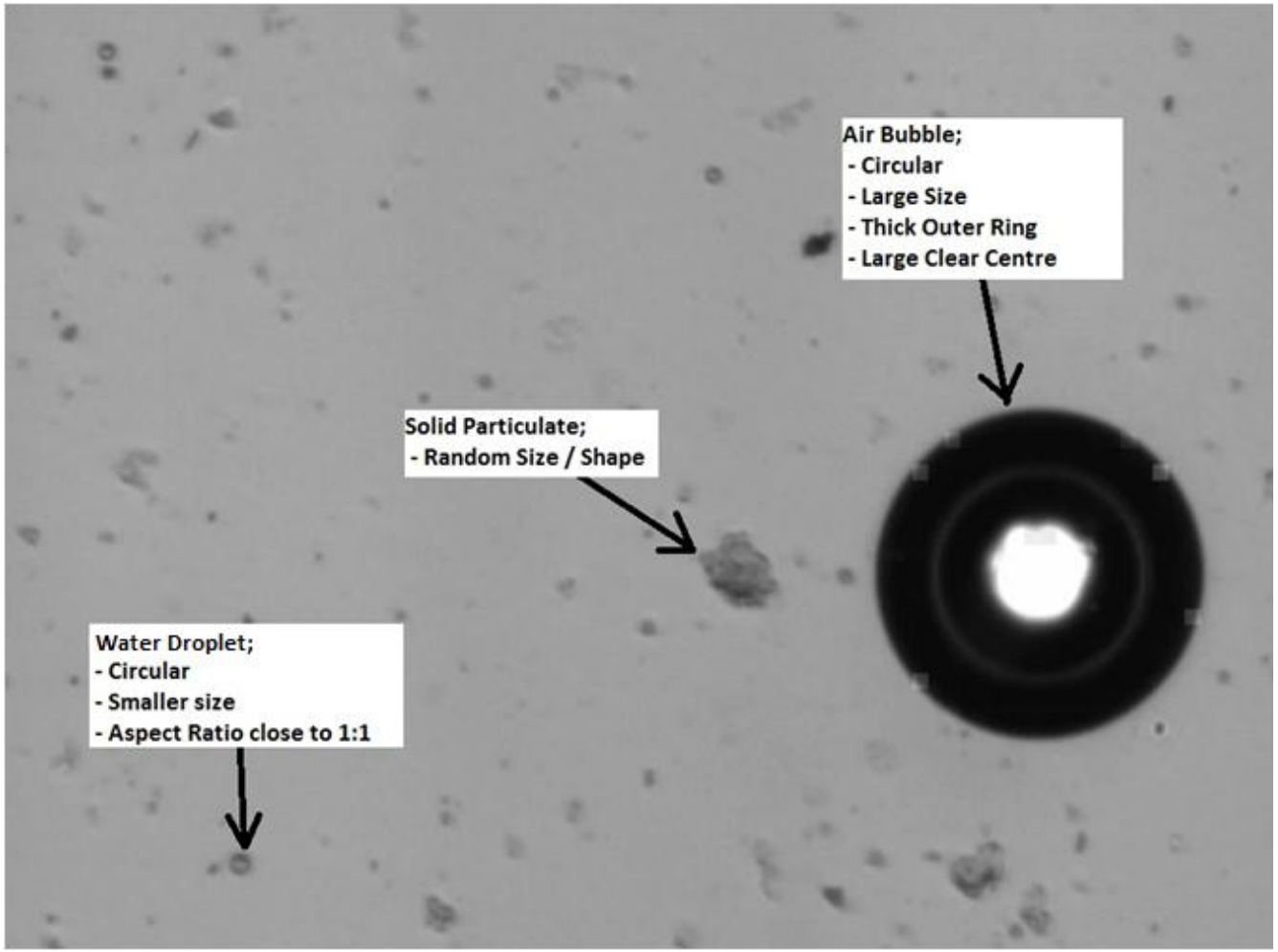
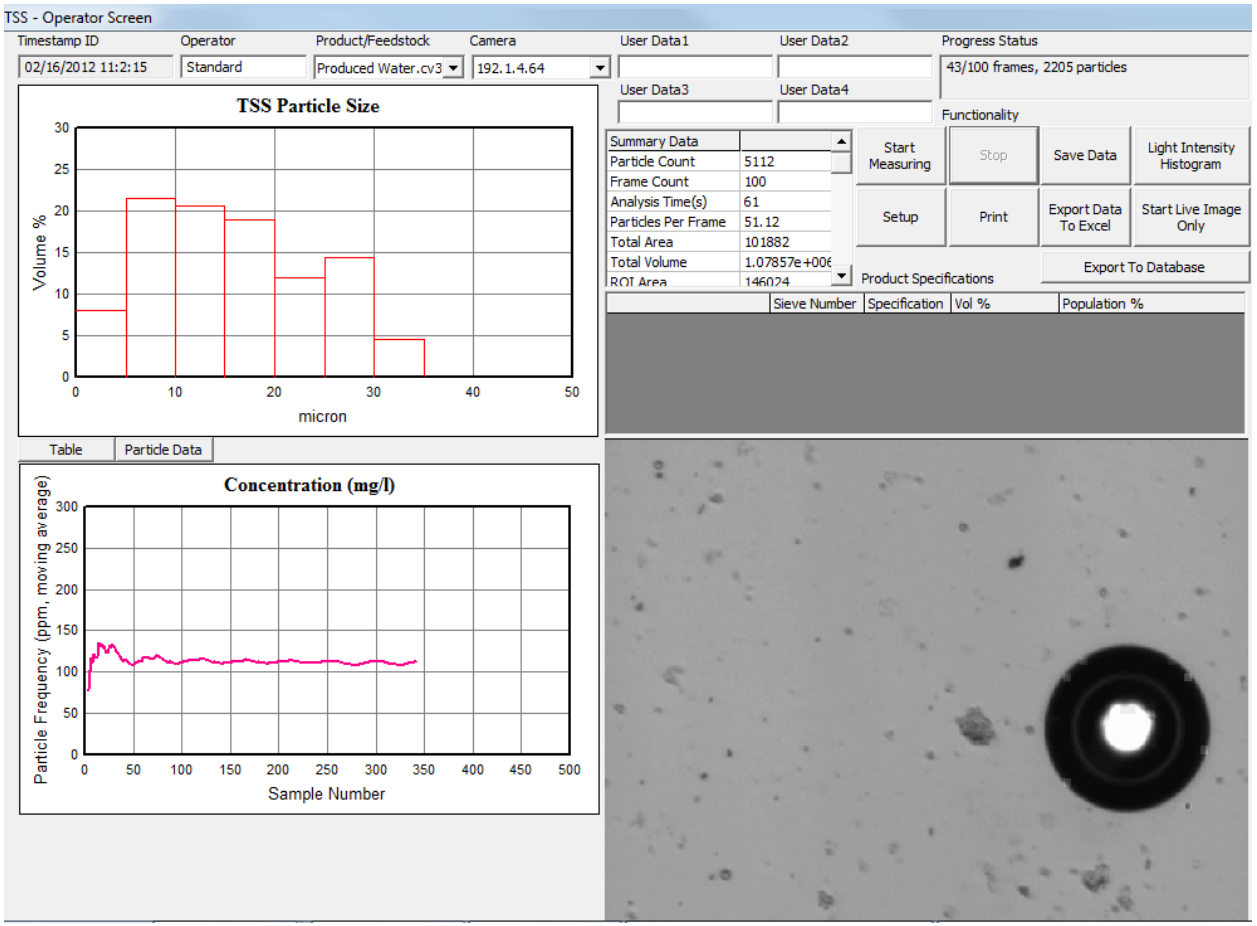


Image Analysis – Cantyvision Software – Operator Screen

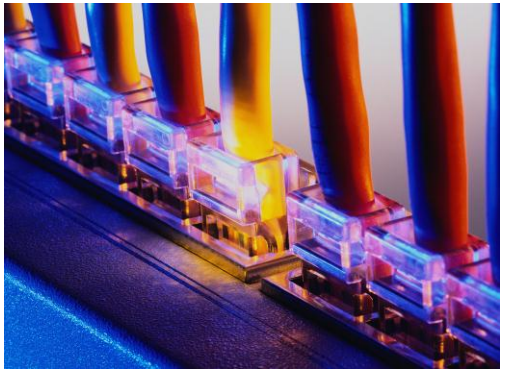
Puts information and configuration in an easy to read format fore ease of operator control

Graphical outputs of particle size distribution and concentration

Configurable calculation for client specific products

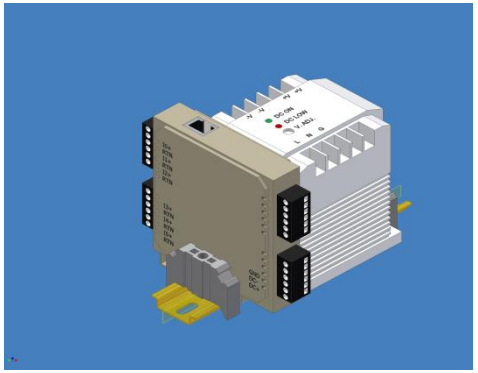


Output Options



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™!

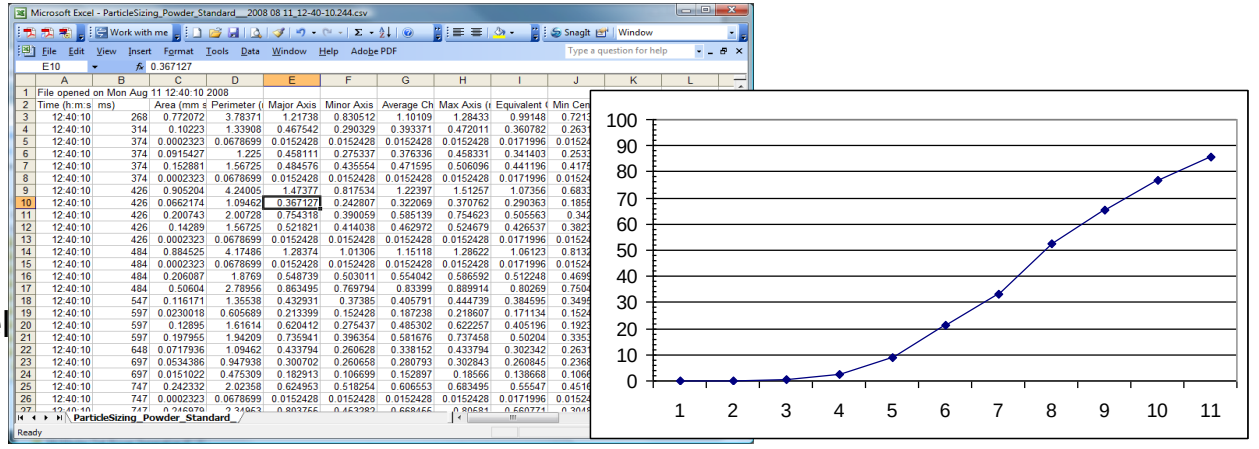


4-20mA Output - Ethernet Output Module

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 as an accessory.

MS Excel Output

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



Case Study: Dynamic Imaging Applied to Well Formation Studies

Overview

A cylindrical section of sandstone rock was placed under stress using a core flood cell, whilst flowing oil / brine through the sandstone.

Pressure was increased until sandstone rock failed catastrophically. The unit was connected to the core flood cell output for monitoring sand particle size

Case Study: Dynamic Imaging Applied to Well Formation Studies

Test 1: Sand in Oil

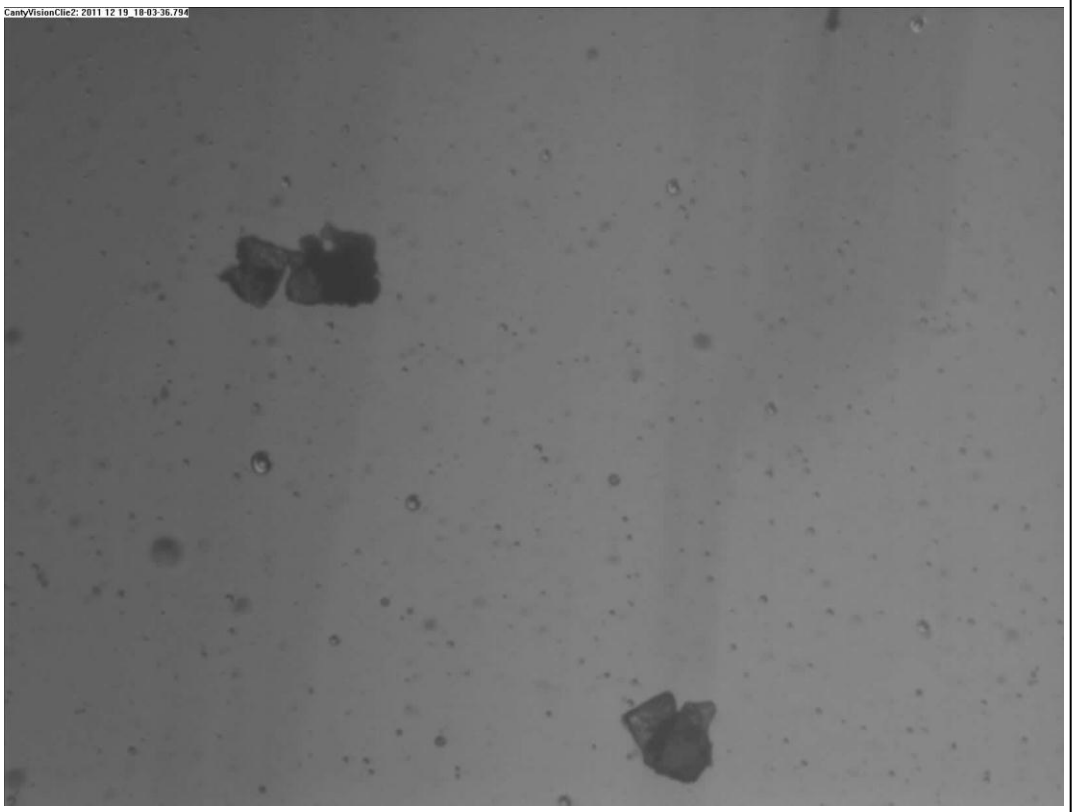
As the pressure to the sandstone rock was increased, water droplets became more evident at 3,500psi, which could be due to residual water within the sandstone being forced out

DV Values	Diameter (microns)
Dv 10	71.6471
Dv 20	91.2159
Dv 30	113.951
Dv 40	119.863
Dv 50	132.148
Dv 60	157.369
Dv 70	187.165
Dv 80	209.248
Dv 90	233.035
Dv 100	268.182

Case Study: Dynamic Imaging Applied to Well Formation Studies

Test 1: Sand in Oil

The first detection of sand was observed at a pressure of close to 5300psi. However, due to the oil, the sandstone rock did not fail in individual grains. Large clusters of grains were observed



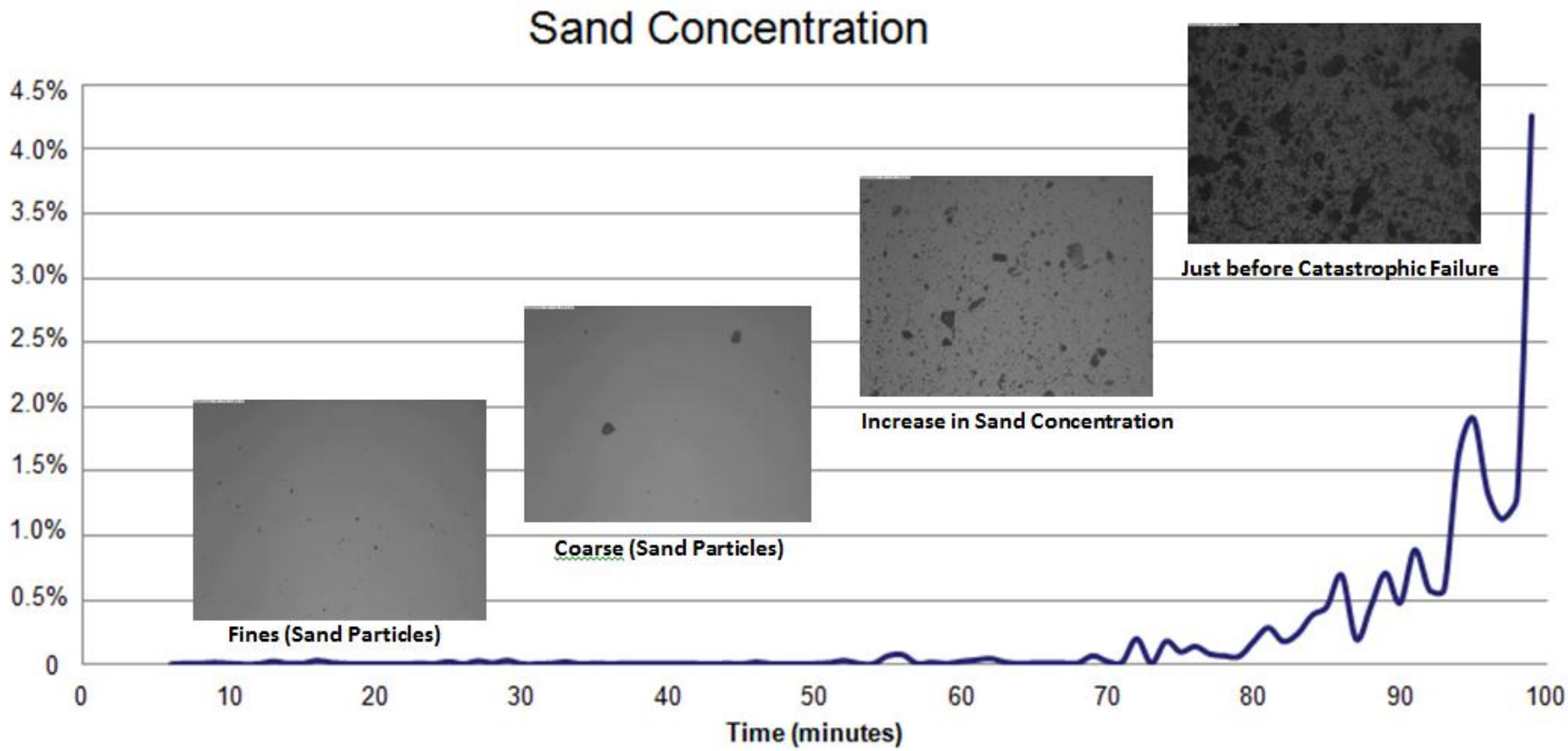
Case Study: Dynamic Imaging Applied to Well Formation Studies

Test 2: Sand in Brine

As the pressure was increased, the sandstone cylindrical section failed into individual grains due to the water dispersing the sand.

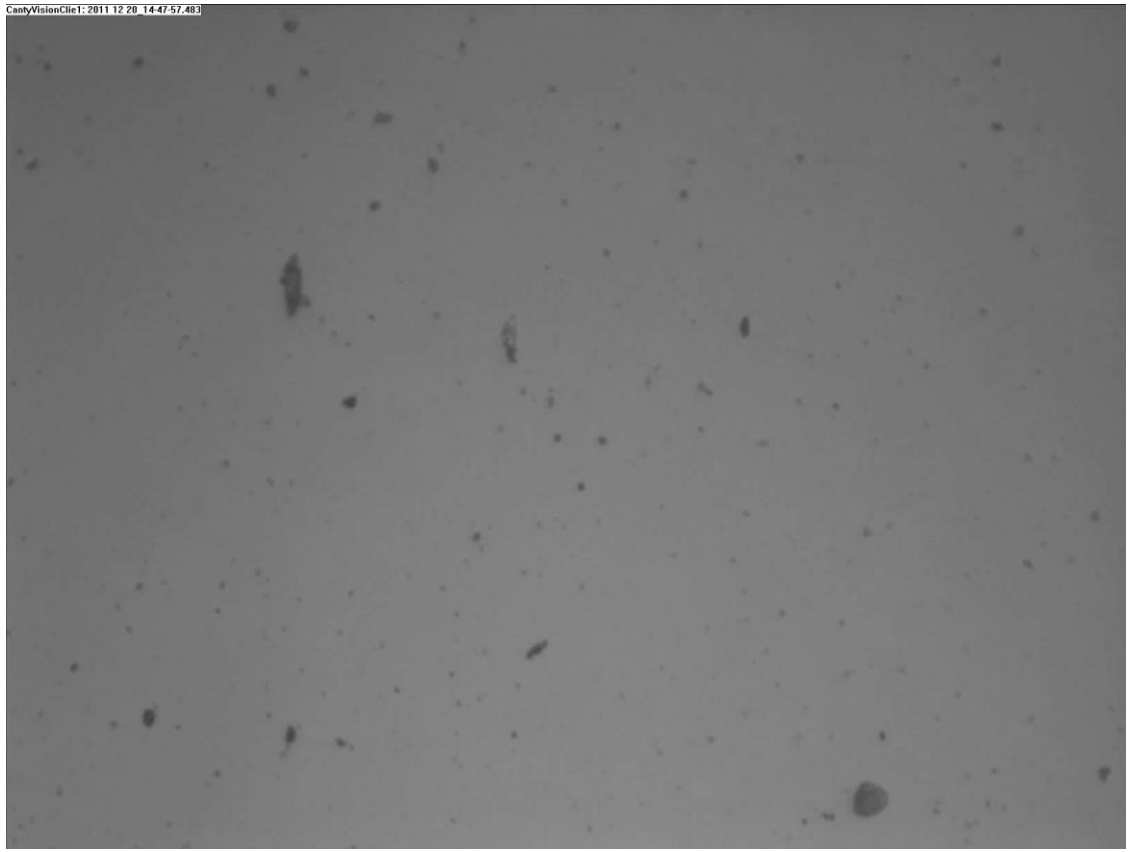
Sand particle size distribution & Concentration was recorded, in addition to observing the catastrophic failure of the sandstone core sample at approximately 5,280psi

DV Values	Minor Axis (microns)
Dv 10	42.8068
Dv 20	71.3619
Dv 30	108.203
Dv 40	125.69
Dv 50	135.123
Dv 60	145.013
Dv 70	165.965
Dv 80	198.231
Dv 90	237.742
Dv 100	351.44


Sand Concentration
4.5%
4.0%
3.5%
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0
0
10
20
30
40
50
60
70
80
90
100
Time (minutes)
Fines (Sand Particles)
Coarse (Sand Particles)
Increase in Sand Concentration
Just before Catastrophic Failure

Case Study: Dynamic Imaging Applied to Well Formation Studies

Test 2: Sand in Brine (Catastrophic Failure)



This Concludes the Presentation!

Thank You for Choosing CANTY!

For Further Information on this product please visit www.jmcanty.com.