

**Oil in Water Analysers  
Solids in Water Analysers  
Particle Size Analysers**

**Oilfield Water and Separation  
Consultancy with Field Service**



**Process Imagiπg**

## The Analyser Technology

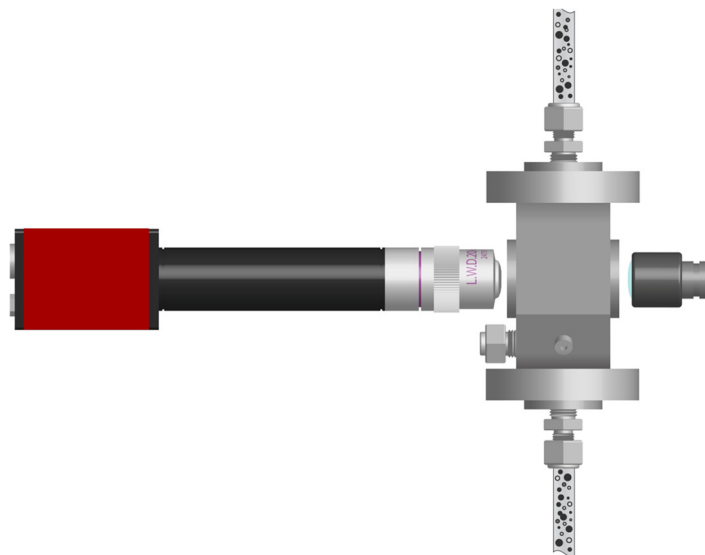
Process Imaging Limited is the owner of Jorin Limited, its technology, designs, patents and brands including ViPA and InVA. Benefiting from Jorin's 20+ years of product development and expertise, the Process Imaging LP100A safe area and benchtop analyser, and the Process Imaging MEx1A hazardous area Zone 1 rated analyser are powered by Jorin ViPA's state of the art image processing software. Our analysers combine advanced cameras and lighting modules to provide a live video image of a process fluid, and this combined with the intelligent Jorin ViPA software provides real time information on the dispersed and suspended particles in a fluid system. The software differentiates between species of objects in a fluid stream by utilising sophisticated morphological algorithms which allows for the characterisation of species such as oil droplets, solid particles, gas bubbles, etc and to distinguish them from each other. Therefore, being able to provide distinct and separate results for concentration (ppm) and particle size distribution (microns) for each species. This makes our analysers a key technology for produced water and injection water quality monitoring in the oil and gas production sectors.

The ability to monitor significant parameters throughout the oily water separation and disposal process allows previously unattainable levels of control, offering the opportunity to optimise performance, reduce operating costs and to avoid many current process problems in the future.

Process Imaging Limited provide a complete consultancy and project management service for exploration geochemistry, oil and gas fluid behaviour in the reservoir, during production, water injection, waste water treatment and produced water injection projects. These studies encompass all project stages, from initial reservoir studies through to conceptual and detailed design and to final plant commissioning and operation.

## Core Technology

The core technology uses a flow cell where the liquid sample passes between a video microscope and a light source. Using a specially developed strobe lighting unit coupled with a high speed camera, the analyser can work with liquid flow velocities up to  $5\text{ms}^{-1}$  when measuring on the micron scale and higher velocities when measuring larger objects.



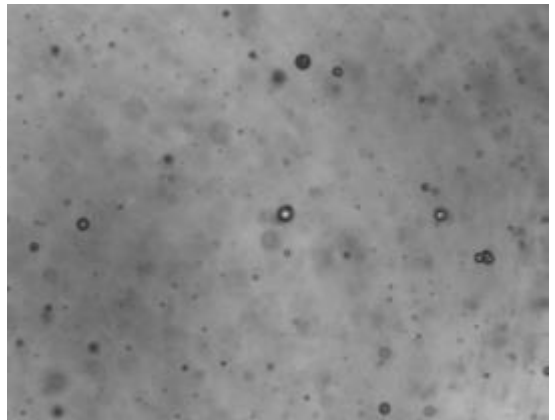
Schematic of the core technology, showing flow cell, camera, lenses and lighting unit

## The Image Analysis Software

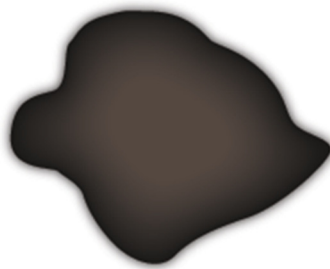
The Jorin ViPA software performs morphological and mathematical analyses on each particle detected, in standard form measuring and calculating 17 different parameters for each particle, and completely analyses 25 images per second for real-time data generation.

Typical parameters include Feret diameters, perimeter, size, aspect ratio, shape factor and optical density. These measurements can be used to create a mathematical description of a particle size for real-time particle identification.

Size distributions and volumetric concentrations are generated for each particle type assessed. For example, quartz sand has high aspect ratios, medium shape factors, low optical density and these parameters can be used to differentiate between quartz sand and silt.



Ferets: 10, 12, 12, 16  
Perimeter: 65  
Area: 252



Average Feret = Size

$50/4 = 12.5$  Microns

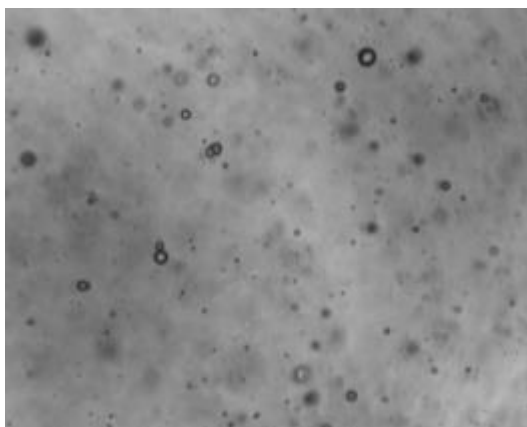
$\frac{\text{Minimum Feret } \varnothing}{\text{Maximum Feret } \varnothing} = \text{Aspect Ratio}$

$\frac{10}{16} = 0.63$

$\frac{4\pi \cdot \text{Area}}{(\text{Perimeter})^2} = \text{Shape Factor}$

$\frac{4\pi \cdot 252}{(65)^2} = 0.75$

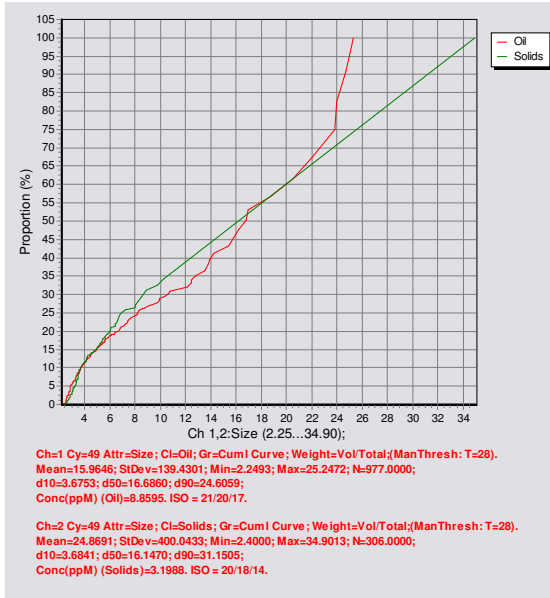
Sketch of a possible particle, showing some typical parameters measured and calculated



The company is owned, managed and run by engineers with extensive experience of making particle measurements in the most challenging environments and decades of experience in working with oilfield water. Working in the same environments as our customers and maintaining a genuine understanding of our customers' needs and applications is key to our success and to the on-going successful development of our hardware and software.

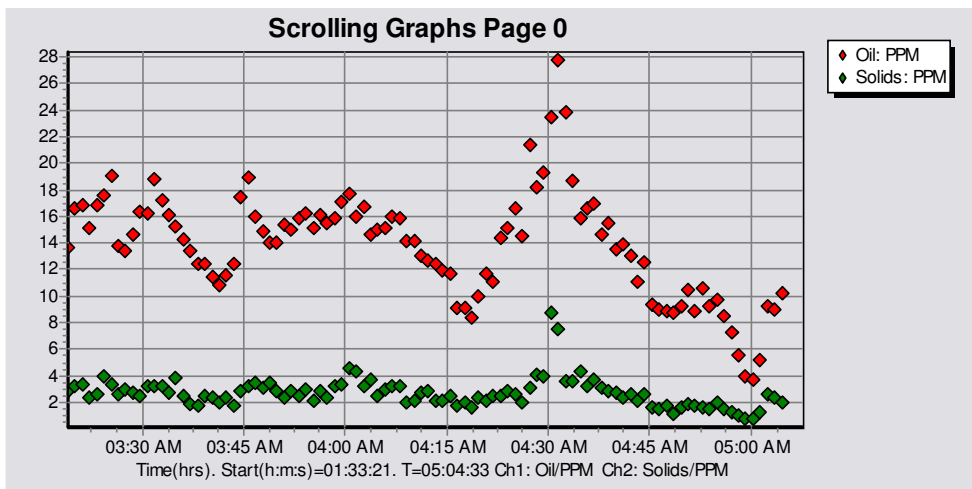
# Analyser Data

The analyser produces many different types of data for each particle observed, the most commonly used data are particle or droplet sizes and concentration information.



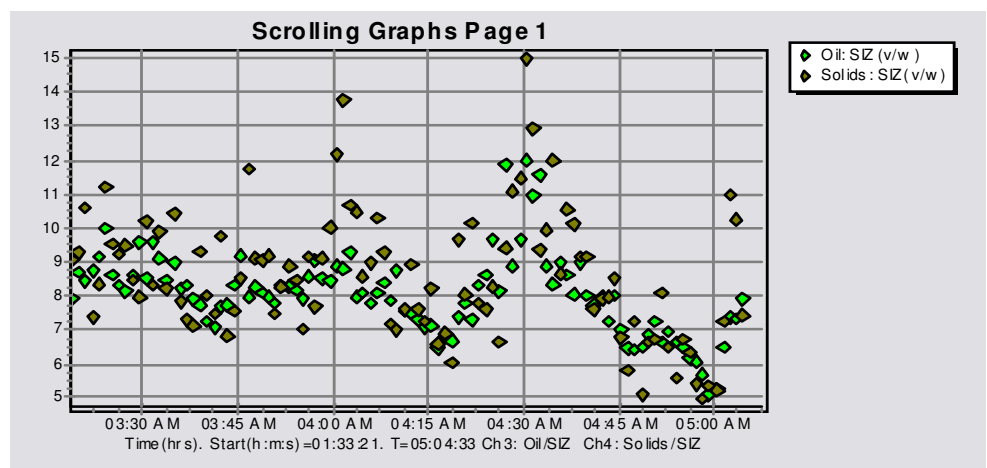
In the graph to the left, the particle size distribution for solid particles and the particle size distribution for oil droplets are each plotted separately; further statistical information and the concentration data are in the details below the curves.

When operating in continuous online mode then the analyser will provide data updates as frequently as every 10 seconds. Typical data outputs are oil concentration (red points) and solids concentration (green points) in the graph below to the left and oil droplet size (pale green) and solid particle size (olive green) in the graph below to the right.



These graphs reflect the data measured over a period of time, in this case 2 hours. This allows process condition and fluctuations to be monitored and the analyser software can also use trend analysis to monitor for future process upsets.

All the data provided in graphs, along with many analyser alarms can be provided as serial data over Modbus or through 4-20mA outputs and volt free contacts.



## Consultancy and Field Service

Often the most valuable data is the data received fastest and Process Imaging's consultancy and field services focuses on providing high quality data, quickly in the field. Using online and field portable tools, we provide a complete consultancy and field service for oil and gas fluid behaviour during production, sea water injection, waste water treatment and produced water injection projects. These studies encompass various project stages, from conceptual and detailed design to final plant commissioning and operation.

These services are provided by our employees and our partner companies employees who have experience of oil and gas production and water injection projects in the North Sea, North America and South America, the Middle East, Asia and Africa. This experience includes both offshore and onshore projects and covers heavy oil production, gas production and water injection in seawater, aquifer water, river water and produced water systems.

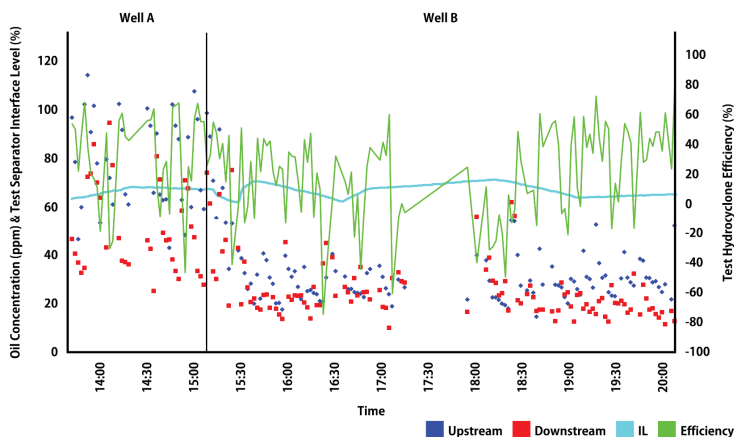


As we are independent of any chemical and separation equipment supply company, our services offers impartial advice on selection and implementation of chemical treatment programmes as well as separation equipment selection, troubleshooting and optimisation. In fact many chemical suppliers and separation equipment designers are among our customers. Our consultants have first hand experience in the selection, use and optimisation of production and water injection chemicals.

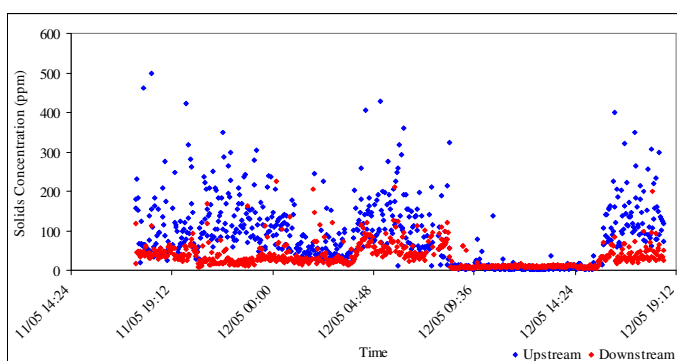
The production of data in real time allows the customer to react rapidly to process upsets, well changes, production chemistry effects and equipment malfunctions; often programmes that had been scheduled over weeks can be completed in days or even hours. The Process Imaging consultancy and field service provides cost effective on site optimisation and future field development plans to maximise revenue and minimise risk.

## FLUID CHARACTERISATION

Data can be obtained not only for new field developments but for any new fluids being introduced into an existing process, thus preventing or highlighting any incompatibility issues with existing system design and operation, materials of construction and process fluids. Use of the fluid data will help to avoid problems such as scale and emulsion formation, and provide a basis for prediction of performance for existing or intended process elements. For water injection systems, analysis should be carried out on both the potential injection water (source water) and on the formation water into which it may combine.



## CHEMICAL SELECTION



In many processes the cost of chemical treatment forms a significant part of the operating cost as well as having a major impact on process efficiency. The selection and effective use of chemicals is therefore of prime importance. Taking bottle samples of process fluids and sending them for laboratory analysis can provide useful data but is subject to time delay, and difficulty in reconciling analytical data with other process parameters.

Process Imaging's consultancy and field services utilises on line, real time analysis to give immediate quantification of the effect of process chemicals. This allows rapid and efficient assessment of changes in dosing regime or chemical type, together with instant and easy integration of analytical data with other process information. This approach gives speedy process optimisation and simple resolution of chemical treatment related process problems.

## CONCEPTUAL DESIGN STUDIES

Data is collected and evaluated to produce recommendations on fluid treatment to achieve the desired export and injection water qualities. Equipment Selection, Commissioning and Process De-bottlenecking Companies may choose to evaluate a number of different process technologies to identify the most appropriate or effective for dealing/handling their fluids, during any evaluation the collection of data on the performance does rely heavily on the quality of the input and output data, the means of collection and its relevance to the actual fluids or process being assessed. We have used data generated by our consultancy and field services work to collaborate with a number of operating companies, equipment suppliers and end users, both for the design and verification of process equipment and also in the assessment of actual field performance.

## ANALYTICAL AND PHYSICAL MEASUREMENTS

A complete and accurate characterisation of fluids is vital for the design and operation of the appropriate fluid treatment packages; where possible this should include analysis of each of the oil, water and gas phases. This data should ideally be obtained not only for new field developments, but for all new fluids being introduced into an existing process – thus preventing or highlighting any incompatibility issues with existing system design, operation,



metallurgy or with fluids i.e. emulsions, scaling etc. For injection water systems, analysis should not only be obtained on the potential injection water (source water) but also on the existing formation water into which it may combine.

The importance of obtaining reliable good quality data cannot be over-emphasised as the results will inform the basis for all subsequent decisions. Process Insight can analyse many different parameters for both oil and water characterisation.

### OIL CHARACTERISATION

- Wax Content/Wax Appearance Temperature/Pour Point
- Emulsion Tendency
- GC Analysis
- Foaming
- Calcium Napthenate /Asphaltene Content
- Total Acid Number (TAN)
- ARN acids (high molecular weight Naphthenic Acids)
- Water content
- BS&W
- Viscosity (Rheology)

### WATER CHARACTERISATION

- Full Ionic Characteristics
- Scaling Potential
- Corrosivity
- Heavy metals
- Total Suspended Solids (TSS)
- Solids concentration and particle size analysis
- Oil concentration and droplet size analysis
- Chemical and microscopic analysis of suspended solids
- Bacterial Nutrients, Volatile Fatty Acids (VFA), Sourin potential
- Chlorine demand
- Dissolved gases (oxygen, carbon dioxide and hydrogen sulphide)
- pH
- Temperature
- Specific gravity
- Viscosity
- Conductivity



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