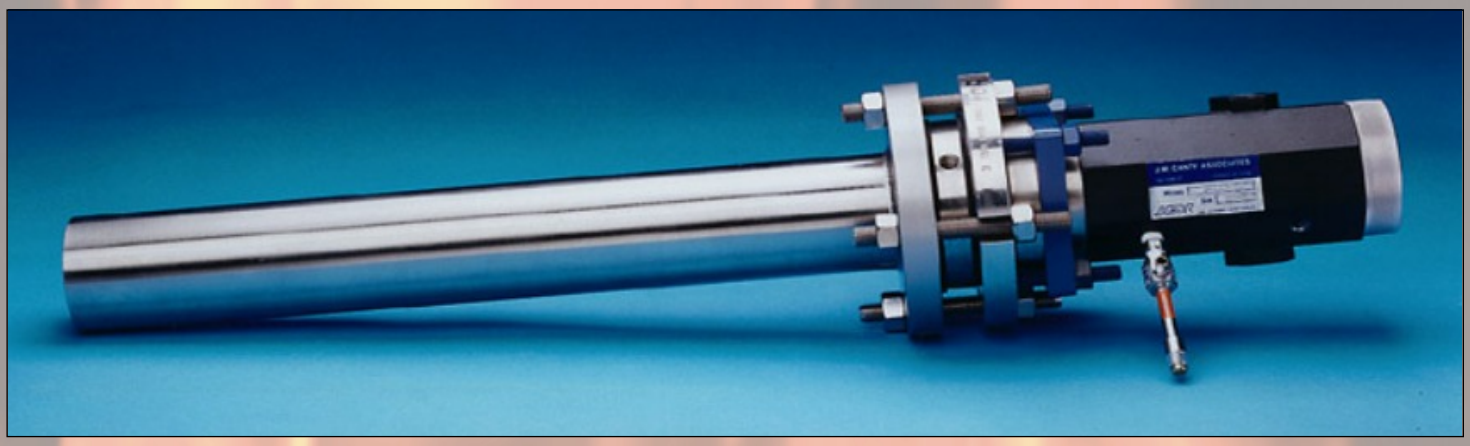

FIRED HEATERS
& FURNACES
vision
without
limits
▪ Ethylene Furnace
▪ Hydrogen Cracker
▪ VCM Cracker
▪ Reheat Boiler
CANTY
PROCESS TECHNOLOGY
BUFFALO
DUBLIN
THAILAND

TMT Measurement High Temperature Cameras

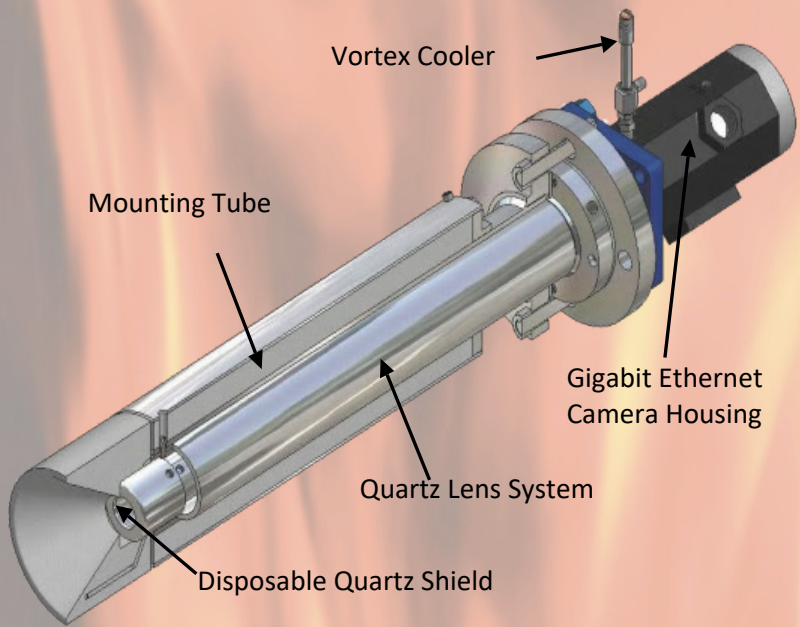
CANTY High Temperature Cameras are ideal for performing continuous real time TMT (Tube Metal Temperature) measurement within a cracking furnace. This measurement is critical to ensure the key temperature of the tubes is maintained, to maximize the efficiency of the cracking process. Above and below this key tube temperature, the yield of cracked gas is reduced, so accurate, continuous, real time measurement is of the utmost importance.

UltraTemp™ Insertion High Temperature Cameras



CANTY High Temperature Camera Systems feature a fused glass seal as standard equipment with every model. This unique seal provides an impenetrable safety barrier to protect the camera electronics from the harsh process environment, and prevents hazardous vapors from escaping into your plant. The electronics are cooled through the use of a vortex cooler, while a positive air flow over the lens through the cameras spray tube ensures the view remains clear at all times. A disposable and easily replaceable quartz shield protects the tip of the lens from any abrasion damage.

The high resolution Gigabit Ethernet camera captures the images from the process, and transmits them in the real time over a dedicated Ethernet connection to the control room Vector Control Module (VCM) running CANTY image analysis software.



Features

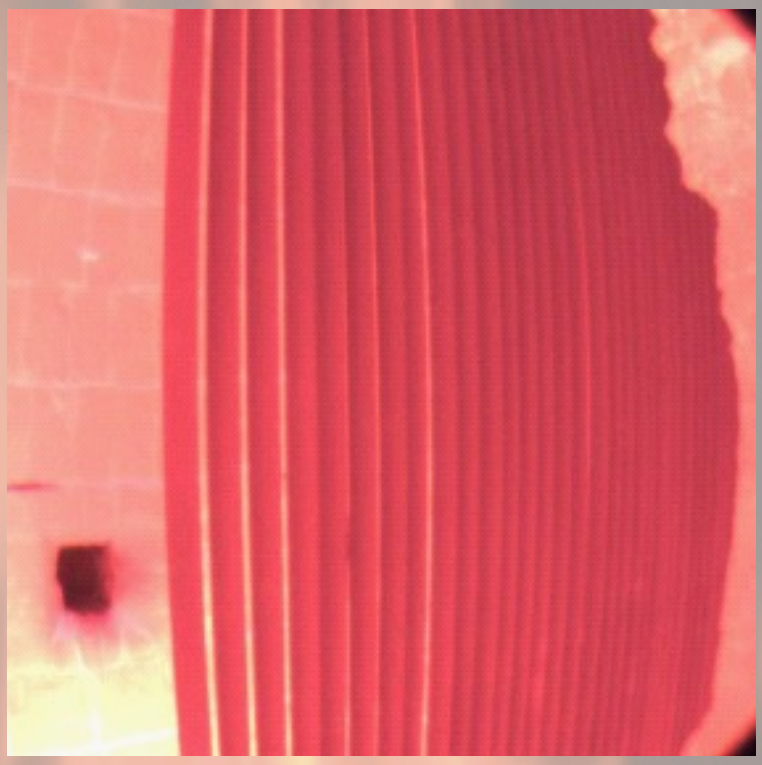
- Air is used for cleaning
- Can purge with any gas
- 2500ºF [1370ºC] models
- High temperature furnace package
- 12”-36” models available to insert through refractory wall
- High quality quartz optics
- Disposable, protective quartz shield
- Auto electronic iris
- Non-blooming CCD camera
- CCD temperature readout to prevent overheating

CANTY Vision Based Temperature Measurement

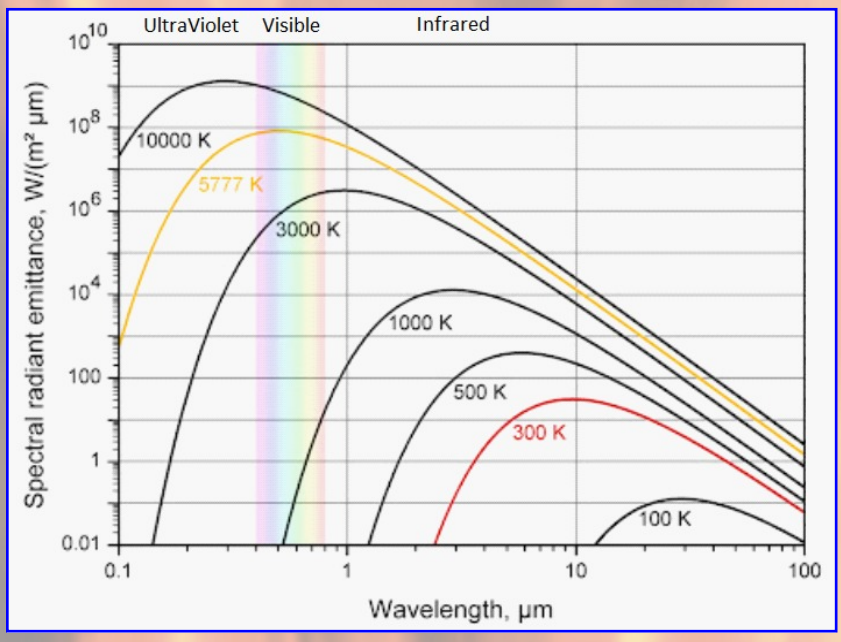
CANTY provide continuous Tube Metal Temperature (TMT) measurement by measuring the spectral radiance (intensity) of the furnace tubes, and correlating that to it's directly related real world temperature value.

This is performed is the **VISIBLE (VIS)** spectrum using multi-band wavelength imaging pyrometry. With the advancement of CCD technology, multiband measurement has several advantages over 2 color (2 wavelength) pyrometers:

- Product temperature measurement is integrated over a broader range of wavelengths, which minimizes variance due to changes in emissivity of the target.
- VIS (Visible spectrum) between .4 - .7 micron allows a wide range of materials to be measured without re-calibration or adjustment due to emissivity changes.



VIS vs IR Spectrum



Spectrum	Temperature Range
VIS	750ºF [400ºC] - 3630ºF [2000ºC]
NIR	570ºF [300ºC] - 1830ºF [1000ºC]
IR	32ºF [0ºC] - 750ºF [400ºC]

*For reference only

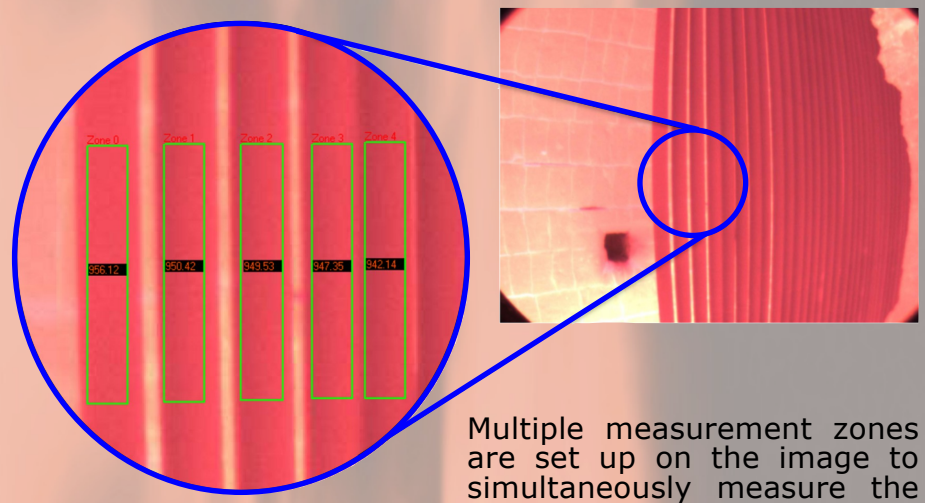
While it is true that IR and NIR based systems allow for measurement at lower temperatures than VIS spectrum based systems, the above table shows that VIS spectrum based instruments are suitable for the ranges required for TMT measurement. In fact, they are more suitable than IR and NIR based systems.

Whether using IR / NIR / VIS based technology, they are all based on correlating the emitted spectral radiance of the tubes, to a temperature value.

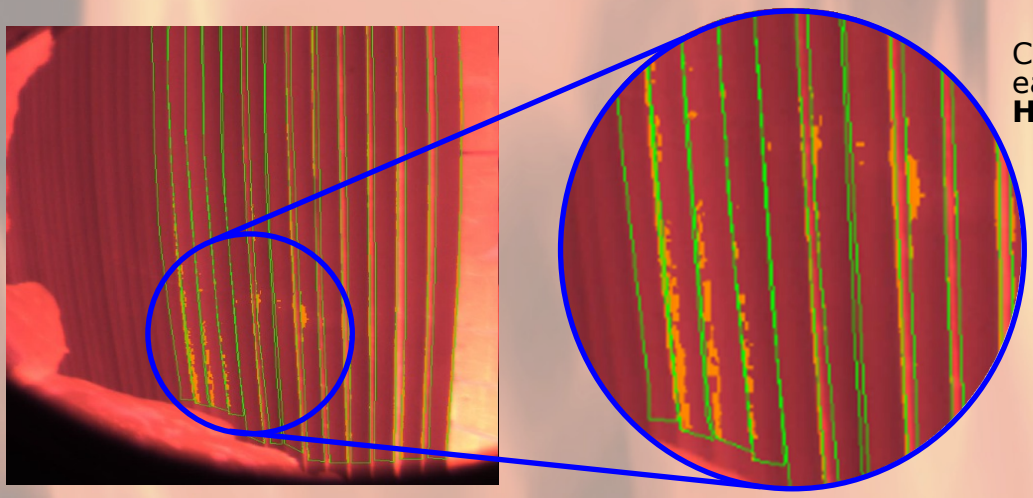
Planck's Law of Radiation as depicted in the graph above, shows that the difference in spectral radiance, is much greater in the visual spectrum, when considering temperatures above ~750K (475ºC / 890ºF). This in turn means that the sensitivity of measurement will be highest, when using VIS spectrum based instruments.

Smart Tube Software for TMT

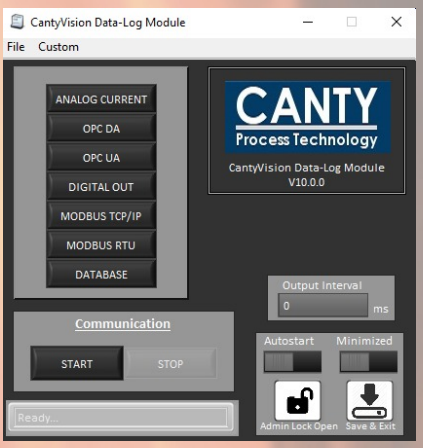
The Tube Metal Temperature (TMT) measurement is performed by CANTY's Smart Tube image analysis software. This software is pre-installed and configured on a CANTY Vector Control Module (VCM), which analyzes the live video feed from the high temperature camera in real time, to provide continuous TMT measurement. The measured value can be outputted directly from the VCM to the user's control system via OPC, Modbus (TCP/IP or RTU) or analog 4-20mA, to allow for automatic alarm triggering or automatic pre-defined actions to be taken in the case of a process upset such as an overheating tube.

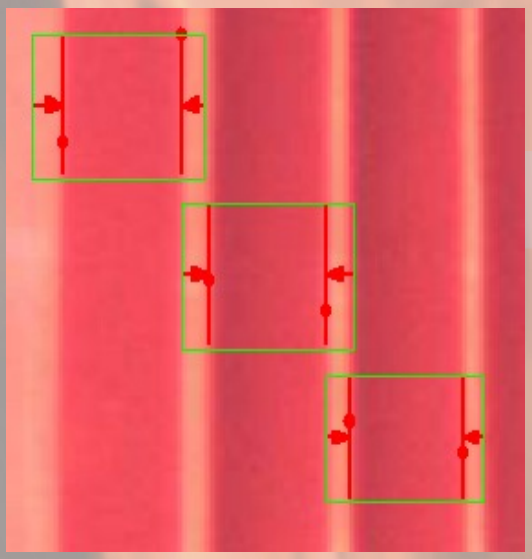


Multiple measurement zones are set up on the image to simultaneously measure the TMT of multiple tubes.



Color overlays allow for the easy visual identification of **HOT SPOTS** on individual tubes





Other Measurement Possibilities

The software can also be programmed to monitor the position of the tubes, which can be used to detect any tube movement or tube distortion which can lead to measurement inaccuracies, and also be an early warning sign of a larger tube issue.

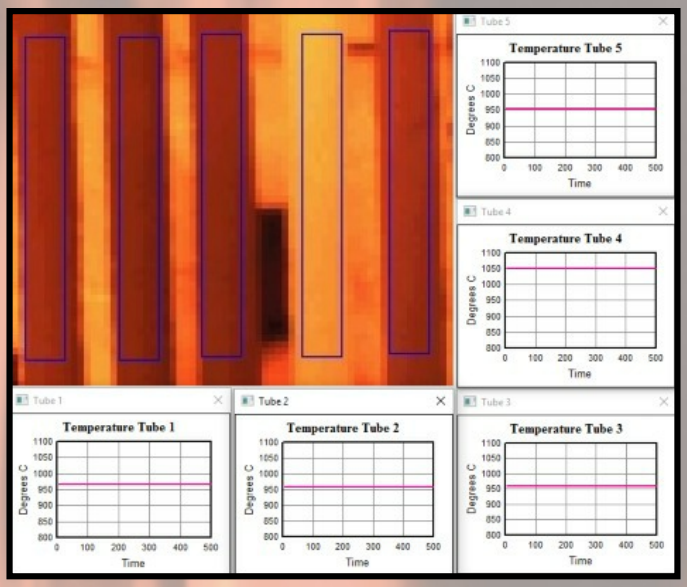
Depending on where the camera is mounted on the furnace, and the selected view angle of the system, it can also be used to provide surveillance of other features within the furnace eg. burners/flames. This allows the user to measure the flame size/shape, and also monitor for burner issues such as flame detachment, flame impingement on tubes, smoking burners etc. Monitoring for such issues allows the user to individually optimise each burner flame and therefore increase the process efficiency as a whole.

Field Study

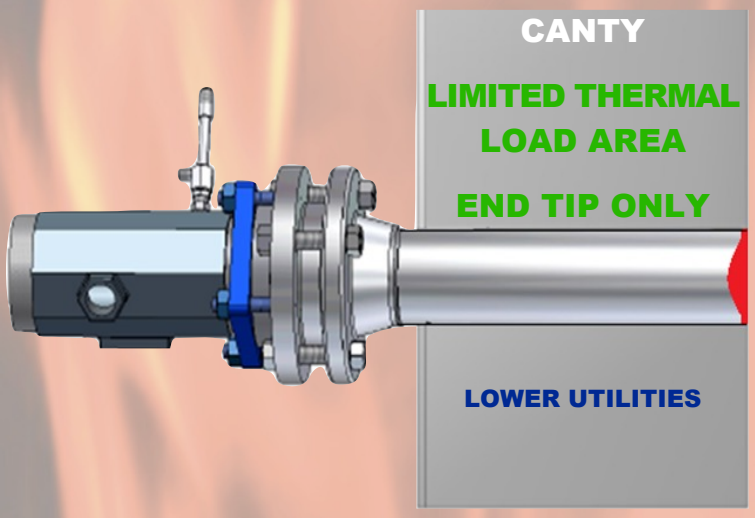
A CANTY high temperature camera was mounted to a cracking furnace, through the refractory wall, and positioned to monitor an array of tubes. Zones were set up on sections of the 5 t u b e s within the camera view and continuous real time scans were initiated.

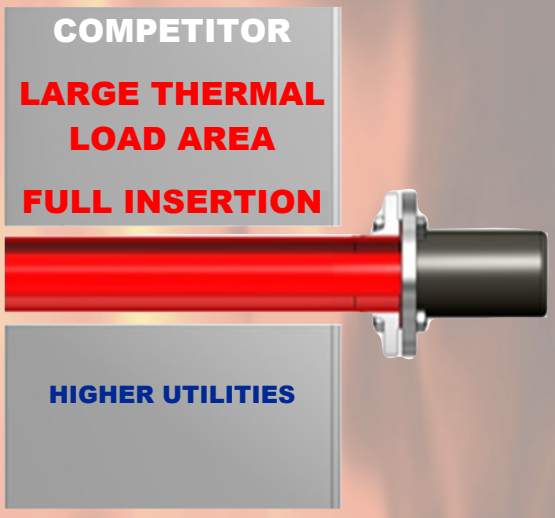
After a period of time, the reading for tube 4 increased significantly, which correlated to a temperature increase in the region of 100°C / 215°F. The increased temperature reading as measured and outputted to the DCS could be easily verified by looking at the camera image, where it is very clear to see that tube 4 is overheating.

The early detection of this temperature rise would allow to operator to de-coke with minimal disruption to the process, and get back to normal operating conditions as efficiently as possible.



CANTY Cameras vs Retractable Cameras



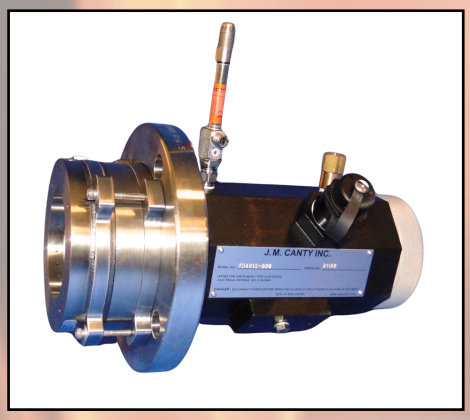


CANTY CAMERAS	RETRACTABLE CAMERAS
Small footprint. No retraction system required.	Large footprint due to the area required to retract the camera when cooling is lost.
No heat loss as camera is snugly mounted in place.	Heat loss from the process due to tolerances required for retraction of camera.
Virtually no maintenance costs. Replacement of the quartz shield. (Process dependent)	Expensive maintenance costs for automated retraction system.
No risk of instantaneous component failure.	Increased risk of instantaneous component failure.
Reduced cost due to camera only.	Increased cost due to purchase of camera, retraction & retraction system infrastructure.
No Risk	Potential to fail in dusty environments leading to camera failure

Flame Analysis

CANTY's High Temperature Camera Systems have been used for a variety of analysis on flames inside of different furnaces and reactors. Applications can range from simple to complex and include, but are not limited to:

- Presence/Absence Detection
- Smoke Detection/Quantification
- Flame Color Measurement
- Flame Detachment
- Flame Size



Some applications require a specific view of the flame or burner, so consult the factory for specific requirements on a particular application.

Vector Control Module

For all of CANTY's applications, the analysis software runs on a CANTY Vector Control Module (VCM) image processor. There are various options available as regards mounting (Wall or Panel mount, Rack Mount, Din Rail Mount), as well as options on the number of high temperature cameras it can support (1 / 4 / 6 cameras), and the type of signal output to the user's control system; OPC, Modbus (TCP/IP or RTU) or analog 4-20mA.

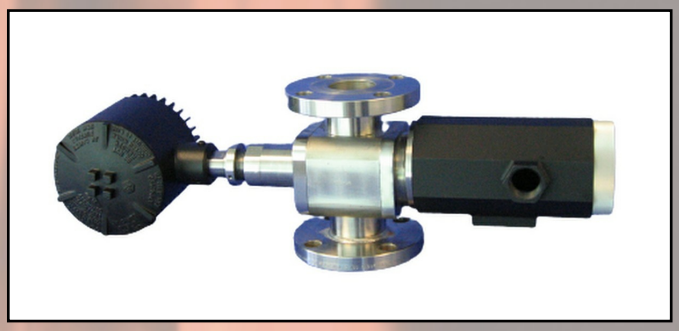
A network connection is required between each camera and the VCM, which connects to a control room monitor to provide the operator with a continuous live view, while the system performs the TMT measurement. This live video feed also allows for visual verification of any value, to give maximum confidence the measurements being provided.

The VCM is pre-configured with multi level user access, meaning that only administrator level users can change critical parameters, ensuring the integrity of the system, while it also features a remote support function in the unlikely event that urgent intervention by CANTY is required.

Quench Water in Oil / Oil in Water Detection

After cracking, when the gas is rapidly quenched, via oil and then water, there is a significant possibility of leakage of water into oil and / or oil into water. The CANTY InFlow™ can be used to detect and measure TSS and concentrations of water in oil and oil in water, even trace amounts as low as 1 ppm. It can also be deployed at the outlets of the oil / water separator to ensure that the fluids have been sufficiently treated to reach the quality levels required for reuse.

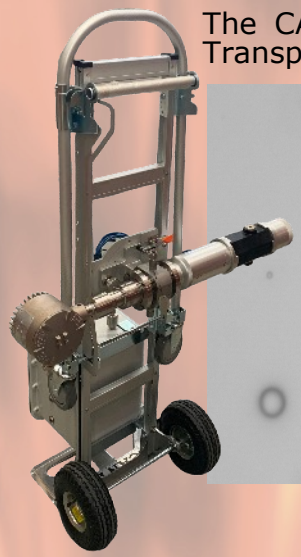
The INFLOW™ works on the principle of Dynamic Imaging. This technique works on the fundamental principle of flowing the oil or water stream through the analyser flow cell, where it passes between a high intensity LED light source and CCD camera fitted with microscopic optics, allowing for high resolution image capture and analysis.



The image analysis is performed in real time by CANTYVISION Intelligent Analysis™ (CVIA) software, which measures the suspended particulate (oil in water or water in oil, solids, gas bubbles) under a number of parameters to provide concentration and size data.

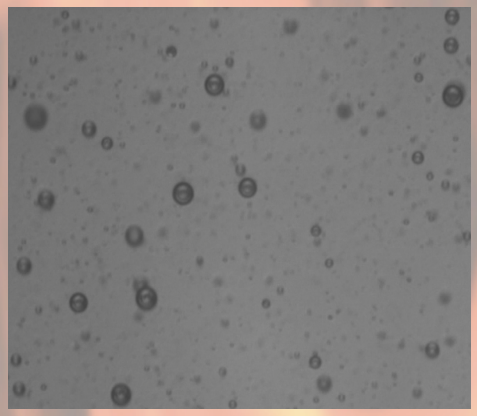
The software's AI applies a multi level classification to differentiate particle types, meaning oil in water or water in oil, solids, and gas bubbles are independently but simultaneously classified & analysed.

The operator interface displays graphical and numerical outputs of the measured parameters, which can be sent directly to the user's control system via OPC, Modbus (TCP/IP or RTU) or analog 4-20mA.



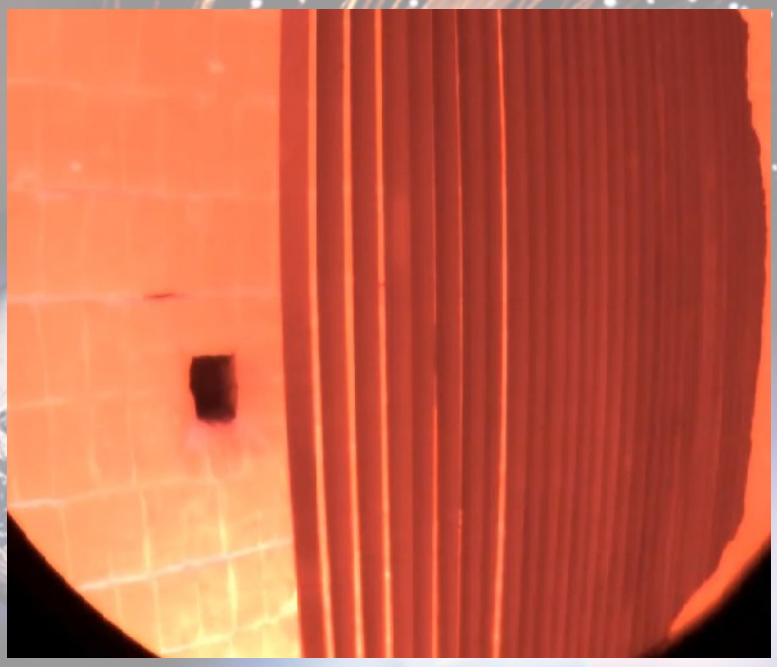
The CANTY InFlow™ can be supplied as Inline, At-Line and Transportable configurations, for maximum flexibility.

Water in Oil



Oil in Water

CANTY'S GOAL IS TO PROVIDE EQUIPMENT TO ENHANCE PROCESS CONTROL AND YIELD. WE ACCOMPLISH THIS BY DESIGNING, MANUFACTURING AND SERVICING THE FINEST EQUIPMENT IN THE WORLD



LET US HELP YOU OPTIMIZE YOUR ETHYLENE PRODUCTION PROCESS TODAY

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