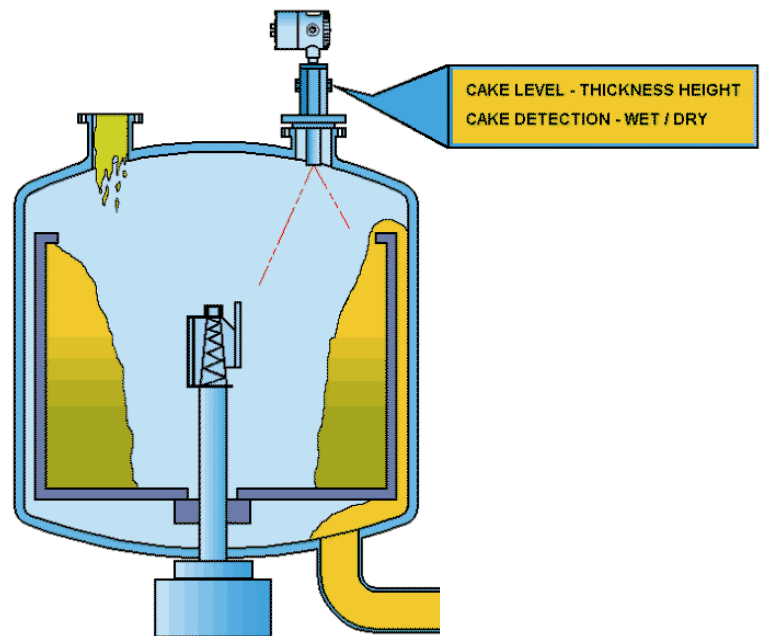
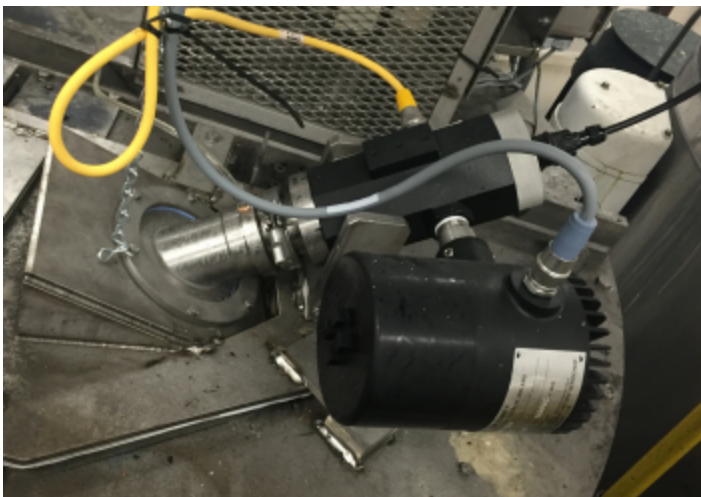


Centrifuge Measurement

This visual inspection system designed by JM Canty Inc. uses a high resolution GigE (gigabit Ethernet vision) cameras enclosed in an IP67 temperature/chemical resistant full metal/jacketed housing. Cameras are powered by PoE (power over Ethernet) through a direct connection back to a Vector Control Module (embedded image processing system) with variable outputs for system control (analog, modbus, OPC). Cameras have built in high intensity LED lighting that can be controlled through software via RJ45 Ethernet. Built in spray ring keeps camera lens clean throughout the process.

How it Works

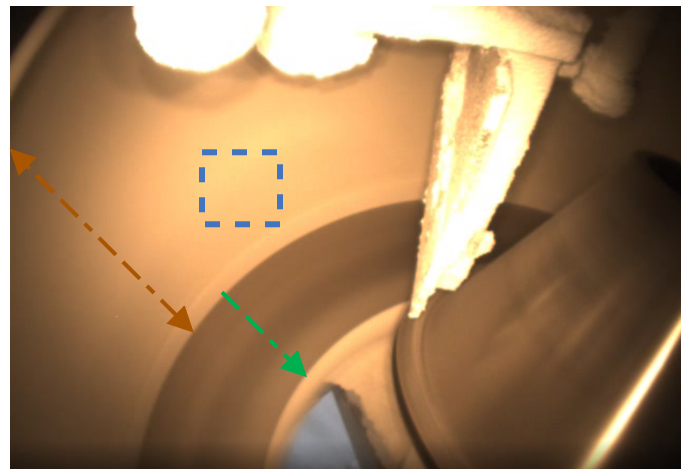
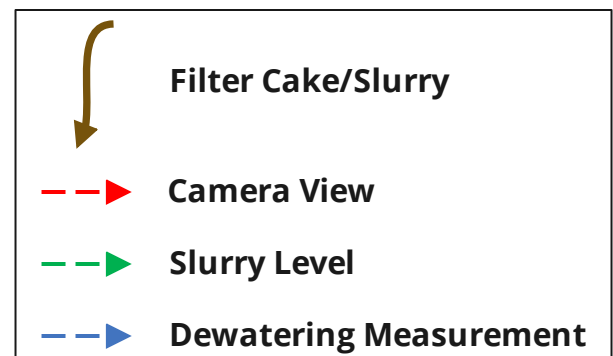
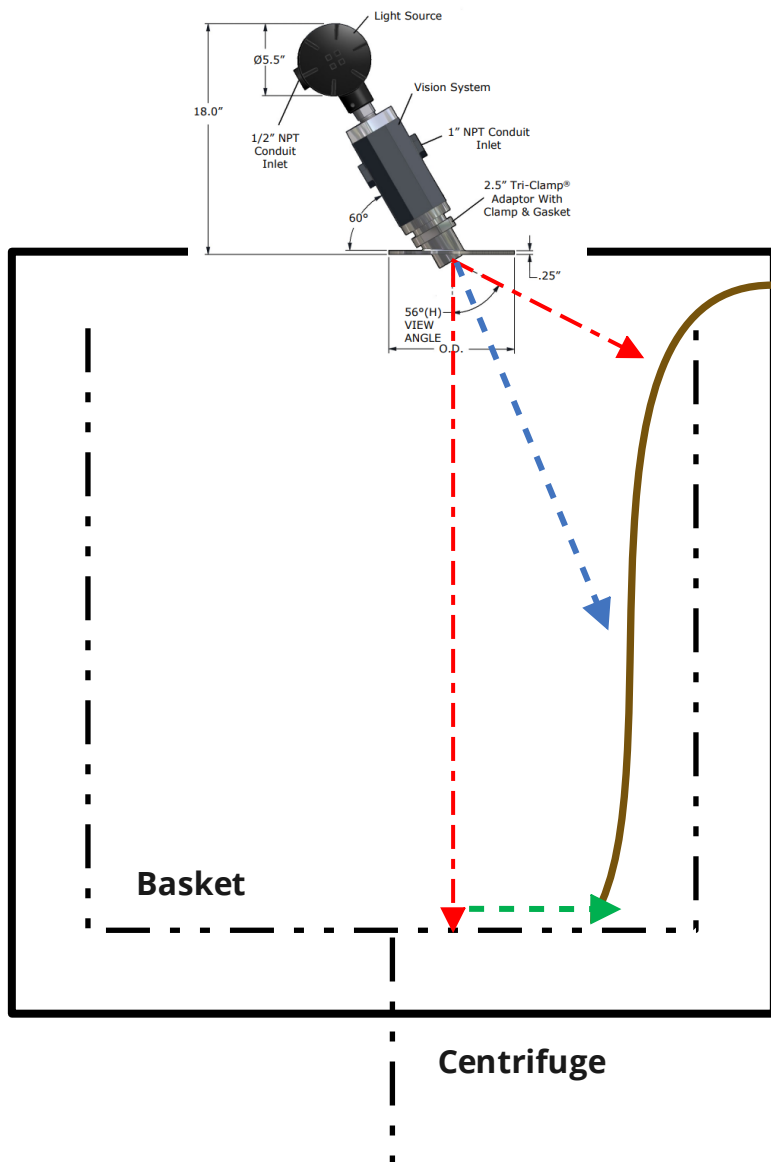
Camera system is mounted to centrifuge with a 2.5" Tri-Clamp adapter and gasket. Camera measures slurry fill level and when cake has been completely washed/dewatered. Measurement is preformed using an advanced image processing software package combined with a high resolution color camera images that can be viewed by an operator in real time. During centrifuge fill process the Canty Centrifuge Camera continually measures slurry fill levels. After cake is washed the Canty Centrifuge Camera system measures the dewatering process and provides real time measurements that prevent filter cake cracking and excess spin time.



Camera Installation - Proper Installation

Camera system should be mounted at an approximate 60° angle as shown in the image below. Camera should face sidewall of centrifuge but still have clear view of the bottom. It is important that the bottom be in view in order to accurately measure slurry fill levels. It is also very important to be sure that the cameras view is not obstructed by scrapers, spray nozzles or other items that may obstruct the cameras view of the areas of interest.

The images below show an optimal installation. The centrifuge wall is in clear view as well as the bottom plate. The bottom plate is used as a reference to measure the level/volume of the slurry. This is indicated by the green arrow. The blue box and arrow indicate the measurement position of the dewatering measurement. The brown arrow indicates the side wall and filter cake.



Camera Installation - Common Issues

When installing a centrifuge camera system be aware of the potential issues listed below.

Camera Mounting Angle

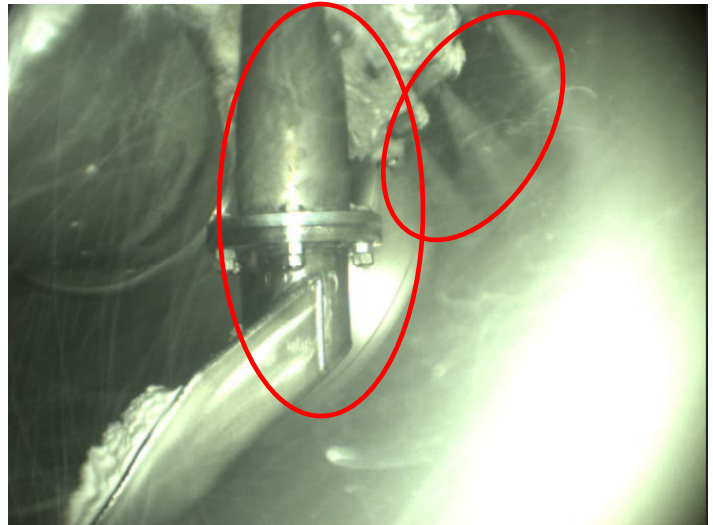
Typical camera mounting angle is around 60°. When a camera angle is too high then you can have trouble reading the dewatering measurement properly. If a camera angle is too shallow then you can have trouble with the slurry level measurement. It is important that the camera be optimized for both measurements in order to get the best readings. For most centrifuge systems this is around 60° (+/- 10°).



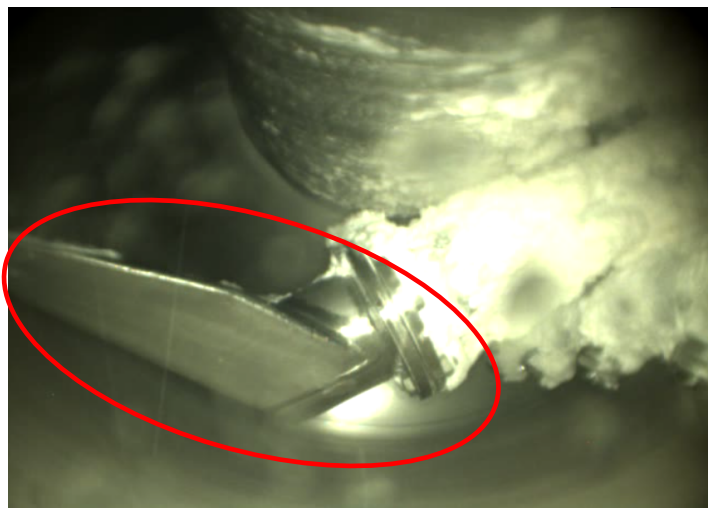
Camera View Obstructions

It is very important when installing a centrifuge camera system that the selected camera location is free of obstructions that might hinder the system measurement. Common obstructions that might be seen are scrapers, spray nozzles, fill ports, and piping.

The images to the right have multiple obstructions that hinder measurement quality. Camera system would optimally want to be positioned on the opposite side of the centrifuge to avoid these obstructions (circled in red).



The image below shows an optimal installation where both the bottom of the centrifuge and side wall can be easily seen and measured. Measurement areas are circled in green.



Centrifuge - Measurement

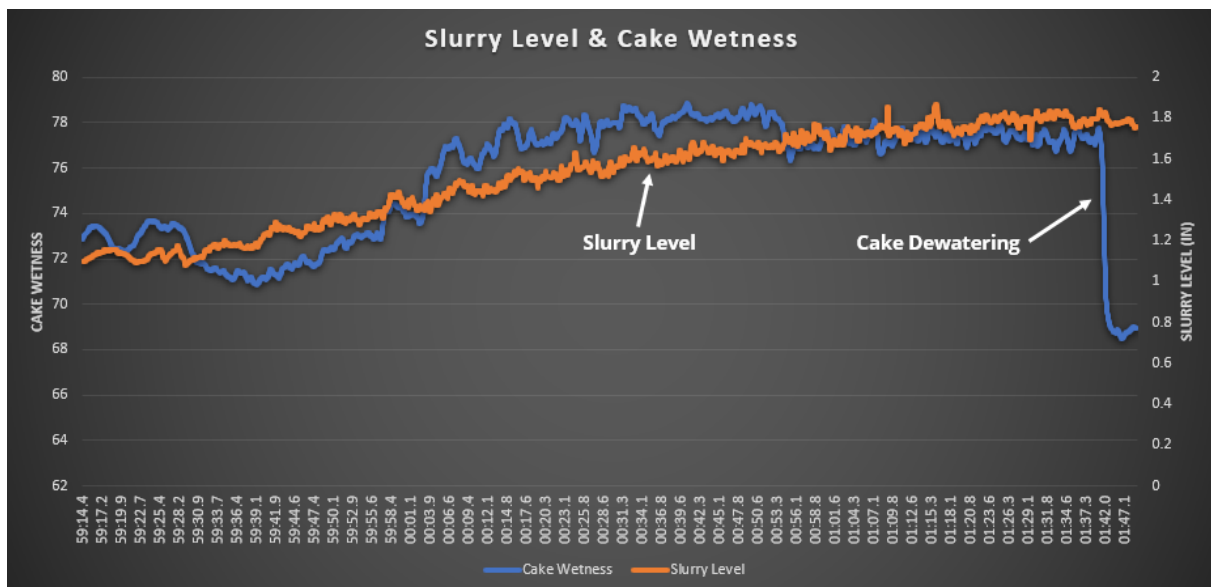
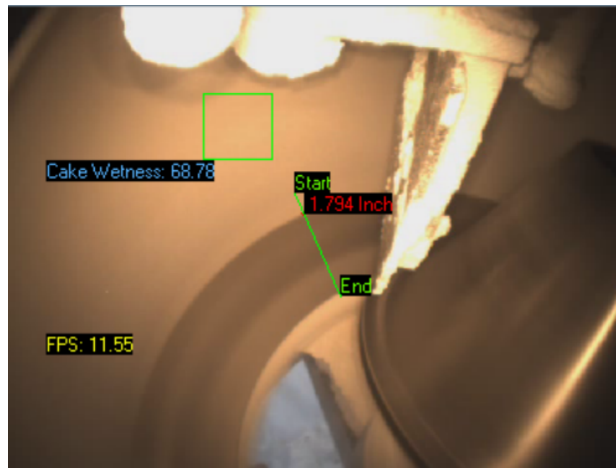
The Canty Centrifuge measurements are based on measuring two specific periods during the process.

Liquid Slurry (level)

Slurry is added to the centrifuge slowly to build the filter cake. During this period the Canty Centrifuge system will detect the slurry level along the bottom of the centrifuge. The graph below shows the level being tracked until a specific "fill" point is reached. The measurement helps the operator to determine this point to within a high degree of accuracy. Optionally an alarm can be sent to an automation system indicating optimal level is reached.

Cake De-Watering (wetness level)

Once the slurry level reaches a specific point the wash cycle typically begins. In sugar centrifuges like the one shown below there is no wash cycle. After wash, the cake is saturated with liquid. The Canty analysis will now read the level of water remaining within the filter cake. As water is removed the cake wetness level will decrease until an alarm can be triggered to notify the operator or automated system to begin the next step in the process. After material is removed from the centrifuge the canty system will automatically clean itself using its spray-ring in order to be ready for the next run.



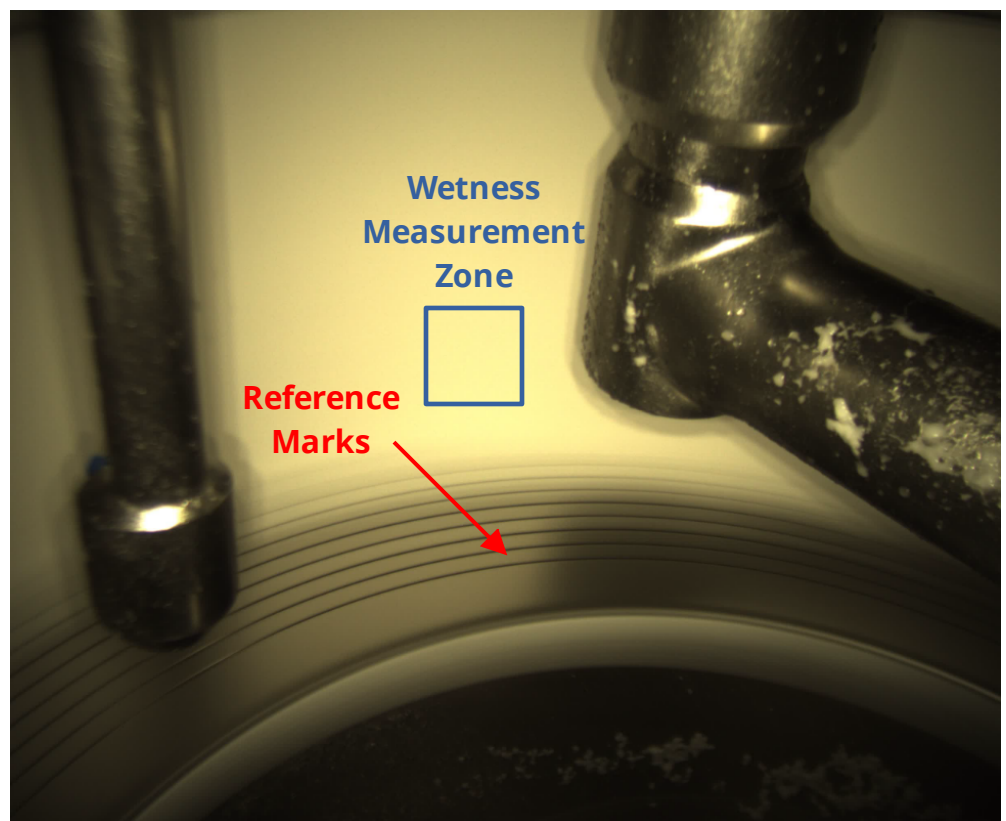
Centrifuge - Calibration

The Cauty Centrifuge can be calibrated when system is inactive or using known references along the bottom plate.

Liquid Slurry Level (calibration)

The measurement for the liquid slurry level can be output in a calibrated unit like mm or inches of thickness off the inner wall along the bottom plate. Calibration can be preformed by placing a reference measurement tool along the bottom of the Centrifuge when it is not running. A calibration can then be preformed within the software which will equate pixel units to a real world measurement. Another option is to use known reference marks engraved on the bottom plate of the centrifuge. Typically these marks will equate to a volume measurement that can then be referenced and placed into the software calibration table.

Reference marks are seen in the image to the right indicating varying levels in the centrifuge. These reference marks can be used to calibrate the slurry measurement.



Cake De-Watering (wetness level)

Cake dewatering typically does not need to be calibrated. However selecting an optimal measurement zone is critical. The zone typically wants to be in the area of the cake with the highest amount of reflection back to the camera. As water is removed from the cake the reflection decreases which is part of the measurement. It is important that the zone completely cover cake area and not part of the bottom plate, upper basket or any obstructions within the cameras view. Once an optimal placement zone is selected it is also critical that camera parameters and light settings be locked in order to get repeatable values for the wetness measurement. Use of the Ethernet controlled or manual LED dimmer can help with lighting optimization for this measurement.