

Novel and Advanced AI Sensor for Measuring Volume Flow for Glass Coatings

87th GPC - Toledo, OH

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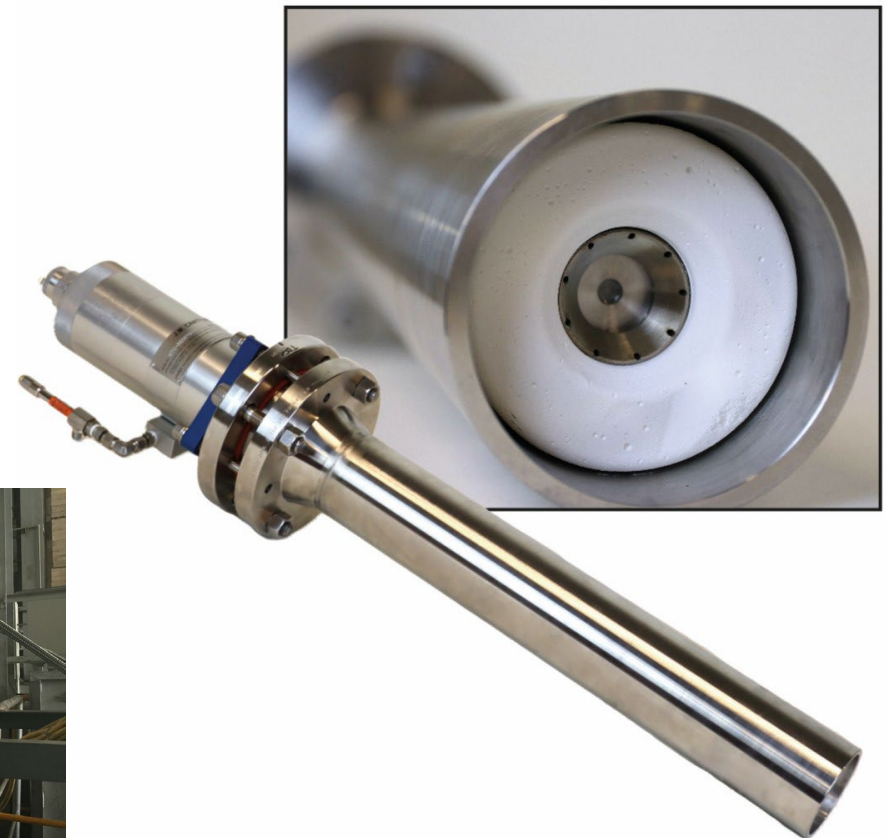
Matthew Spink – Canty

Agenda

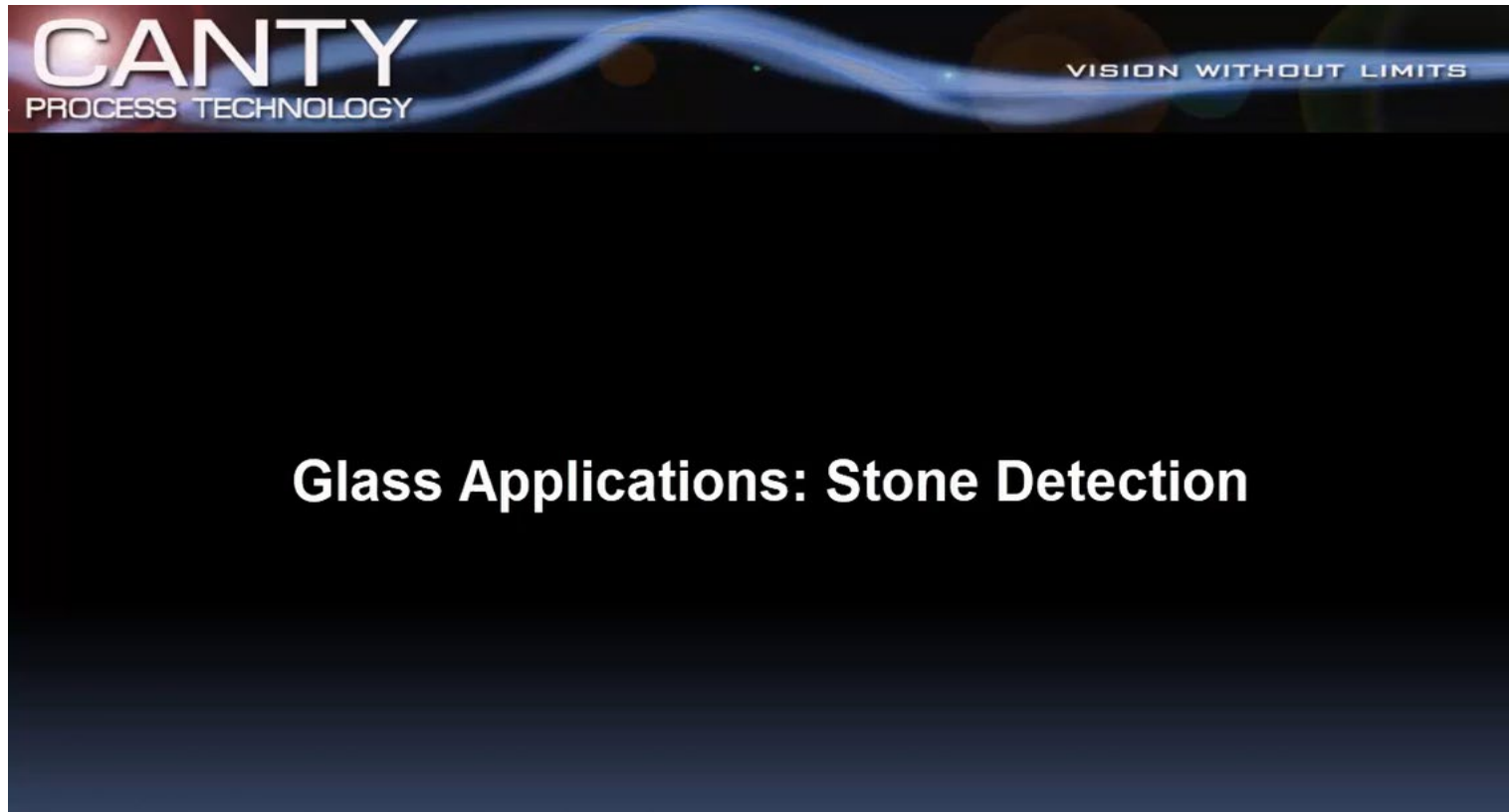
- Detection of stone size and shape in glass
- Dry coatings size and shape analysis
- Computing volume flow rate
- Case Study
- Conclusions

Stone Detection Hardware

- In float glass lines, cameras can be mounted looking into the process.
- In addition to providing a high-quality view and measurements such as glass level, the system can also detect the presence, size, and shape of stones.
- Detecting stones can improve downstream processing such as coatings.

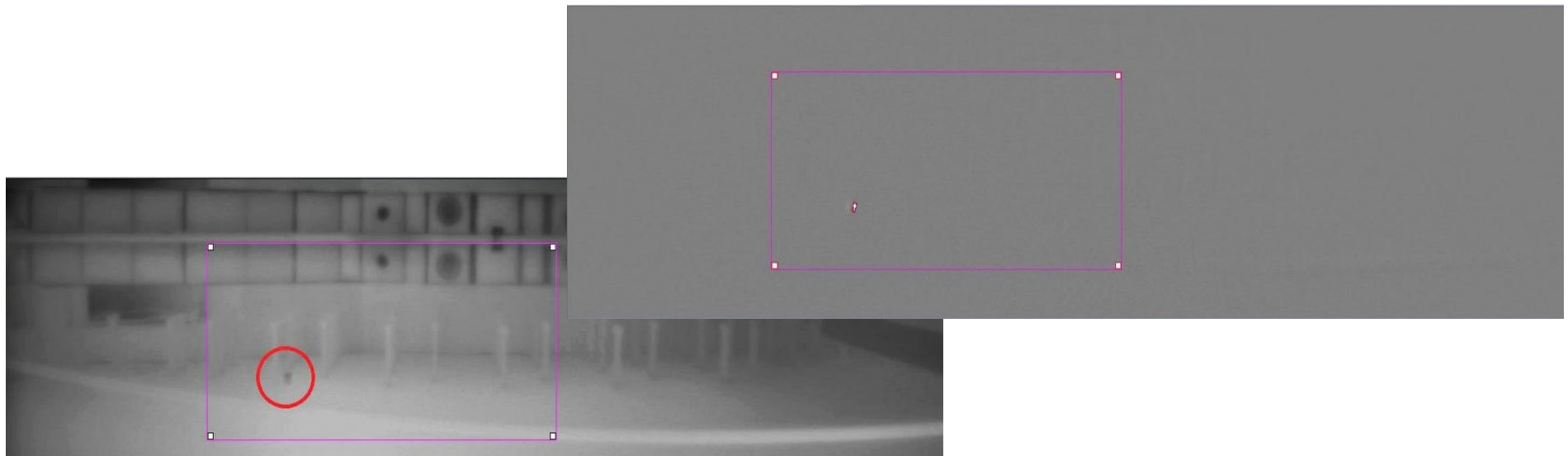


Typical Camera Feed



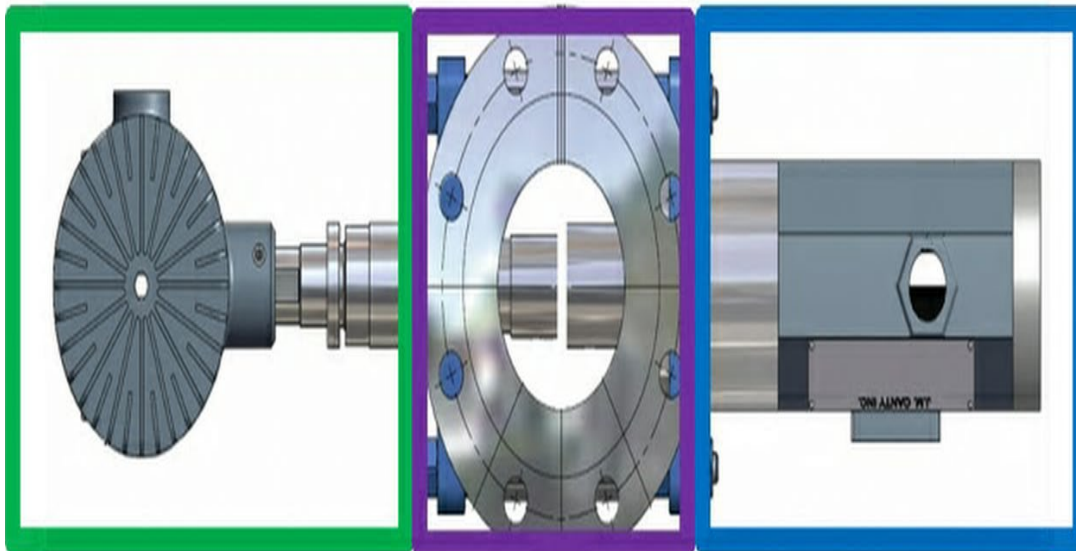
Stone Detection Measurements

- Using image analysis and AI, stones are detected in the camera images.
- Once detected, their size, shape, and concentration are measured.
- Alarms and process control are based on the measurements.



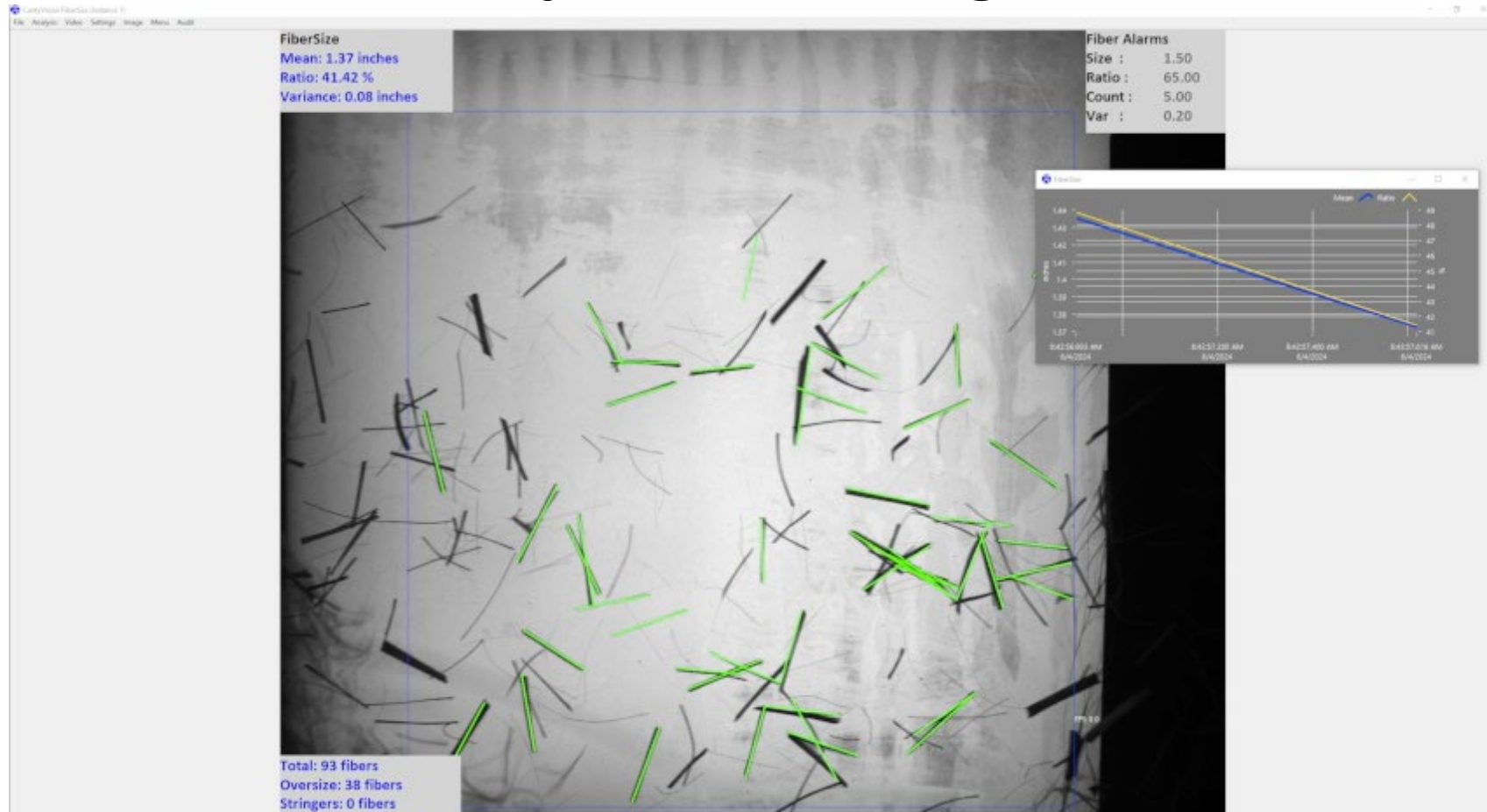
Dry Coating Image Analysis

- Similar image analysis and AI for stone detection can be applied to measure the size, shape, and concentration of particles in dry coatings.
- The powder used for the coating is passed in between a microscopic camera and high intensity light to measure the particles, size, and shape.

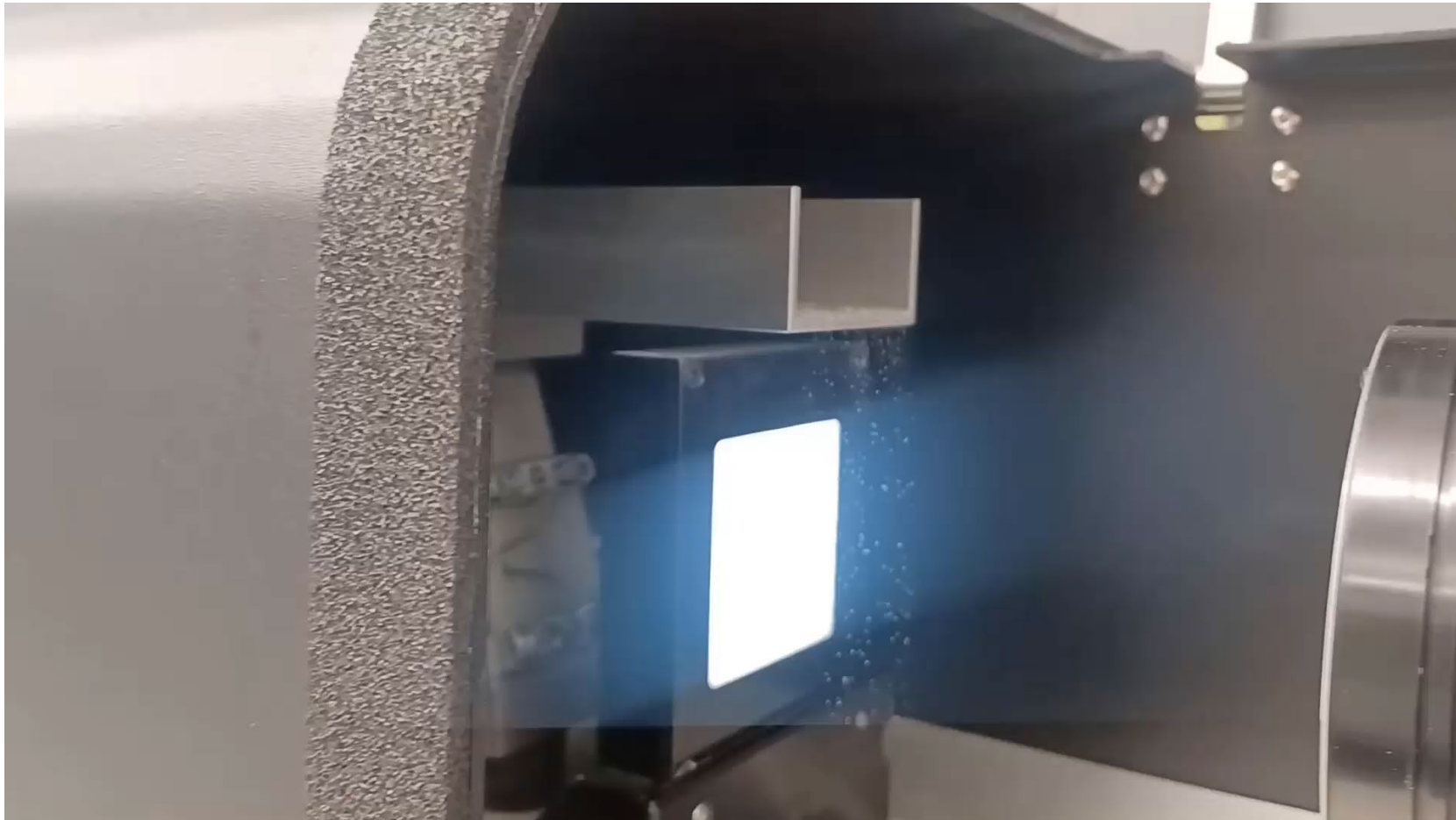


- Light
- Area where particle pass in between camera and light
- Camera

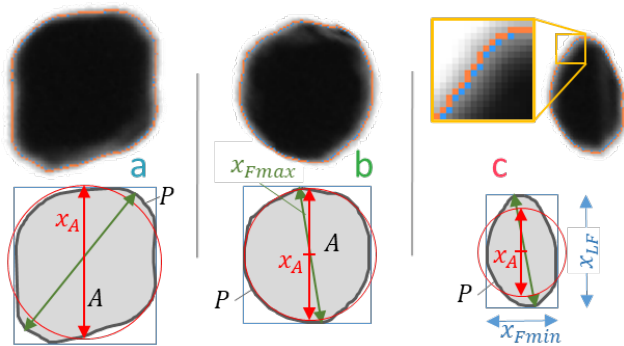
Typical Images



Images from Powder Feed

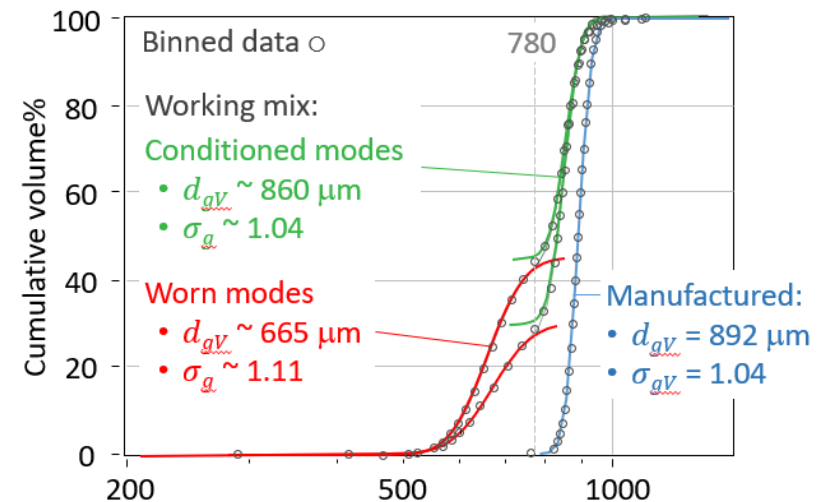


Size Analysis

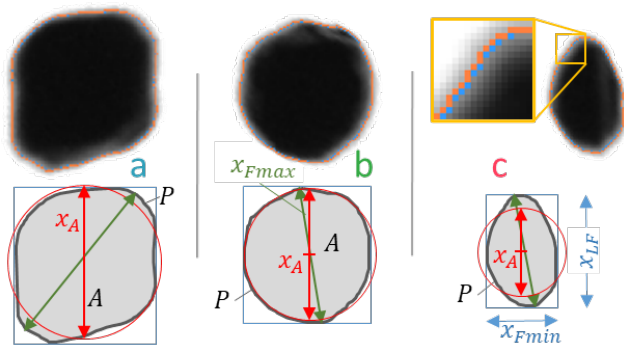


Analysis of images representing working mix (WM) modes: **a) sub-conditioned CW**; **b) conditioned CW**; **c) worn particles**.

- Orange pixels in grayscale images show thresholding.
- Bounding box shows minimum Feret length (~sieving);
- x_A is the area-equivalent diameter (~mass).

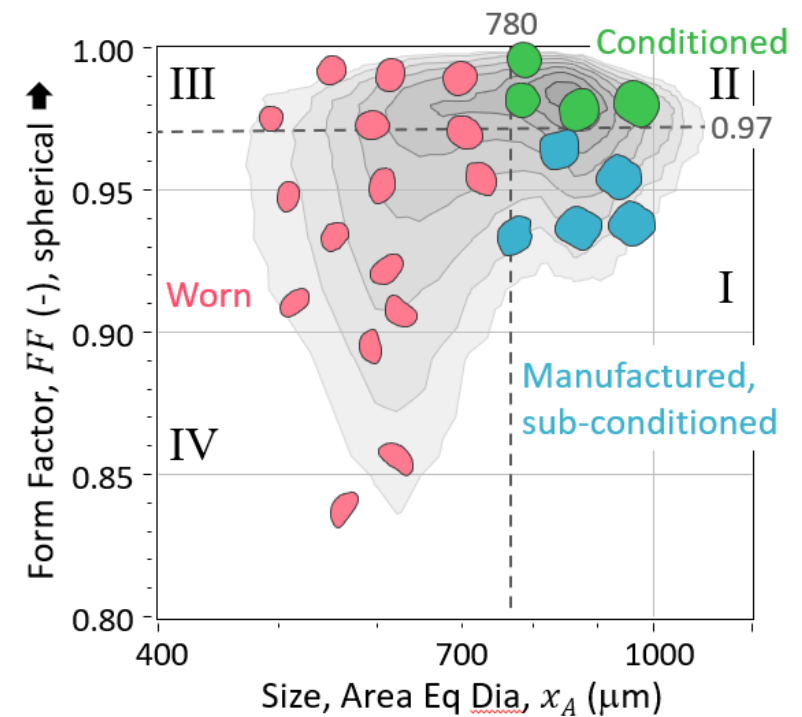


Shape Analysis



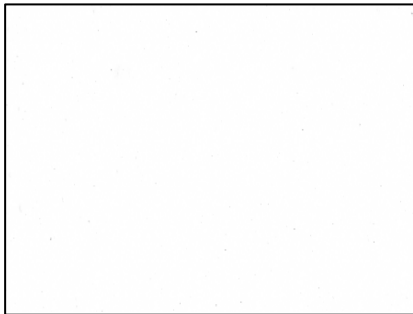
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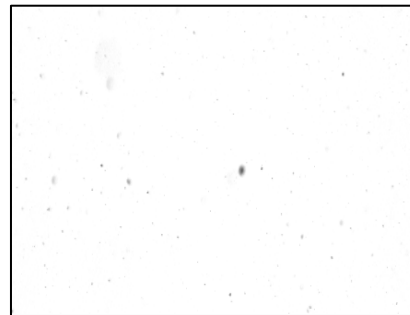


Volumetric Flowrate

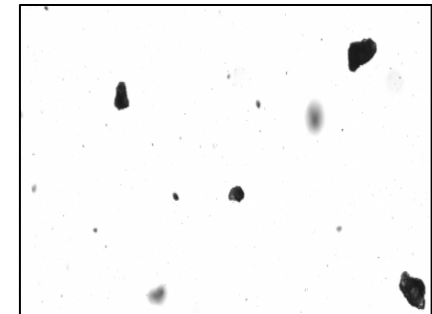
- The 2-D projections of the particles are measured as they fall in front of the camera.
- A volume model using AI calculates the volume of the particle.
- Summing the particle volume that passes within the depth of field of the camera in a given amount of time yields the volumetric flowrate.
- Visual verification of the different flowrates is also provided.



Low Flow



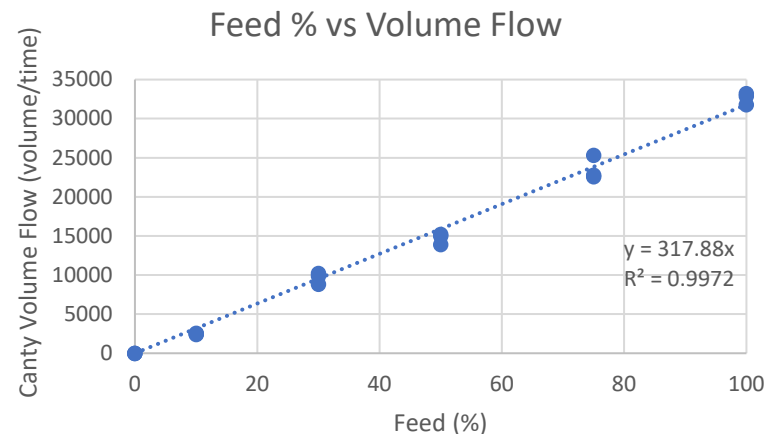
Medium Flow



High Flow

Case Study

- Before installing the analyzer online, an evaluation was performed on the instrument.
- Feed rates were changed and compared to the measured flowrate (shown below).
- Once validated, the instrument was able to be installed and the feed rate could be controlled online leading to optimal and consistent coating.



Conclusion

- Systems have existed for many years to detect stones in glass.
- Similar dynamic imaging technology coupled with advances in AI can allow the detection of volume flowrates for dry coatings.
- The technology can be installed in process to automate the feed rate of dry coatings in real time leading to optimal process control.