

CANTY

PROCESS TECHNOLOGY

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Sugar Crystallization Report

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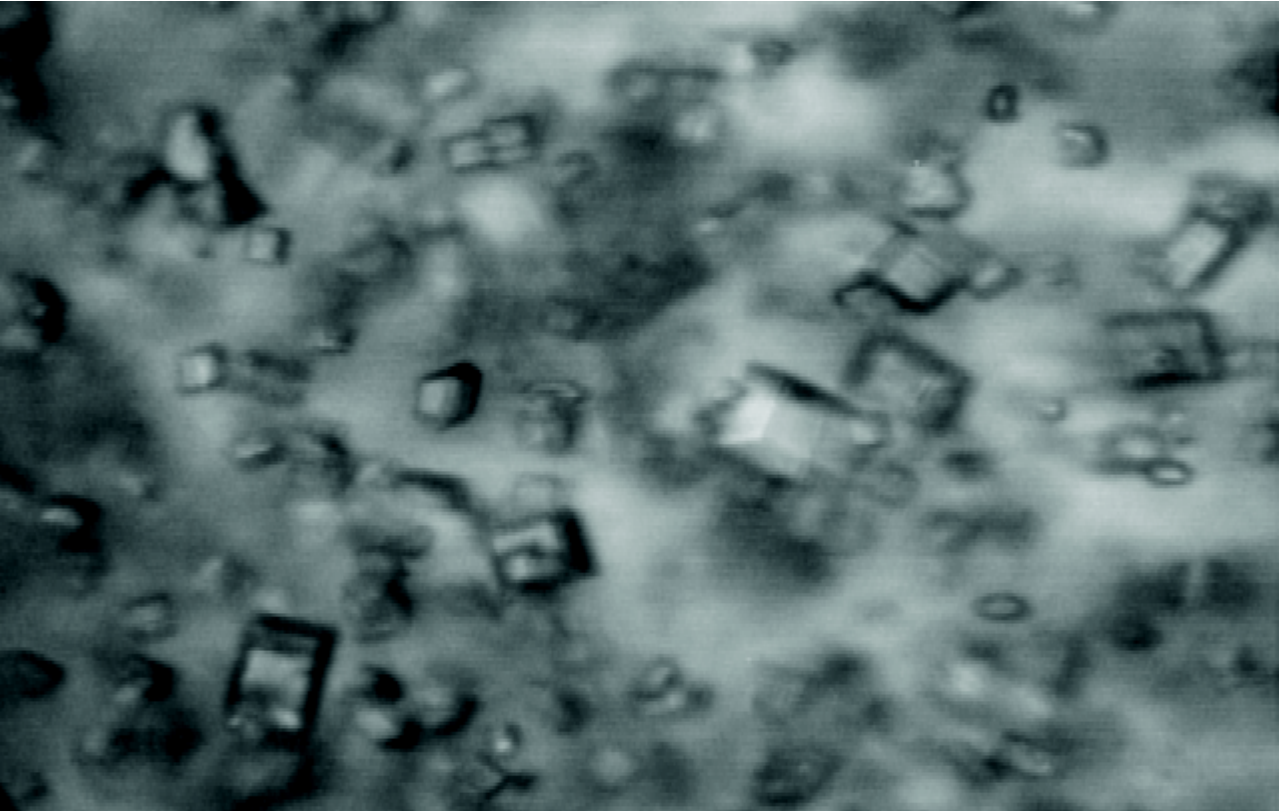
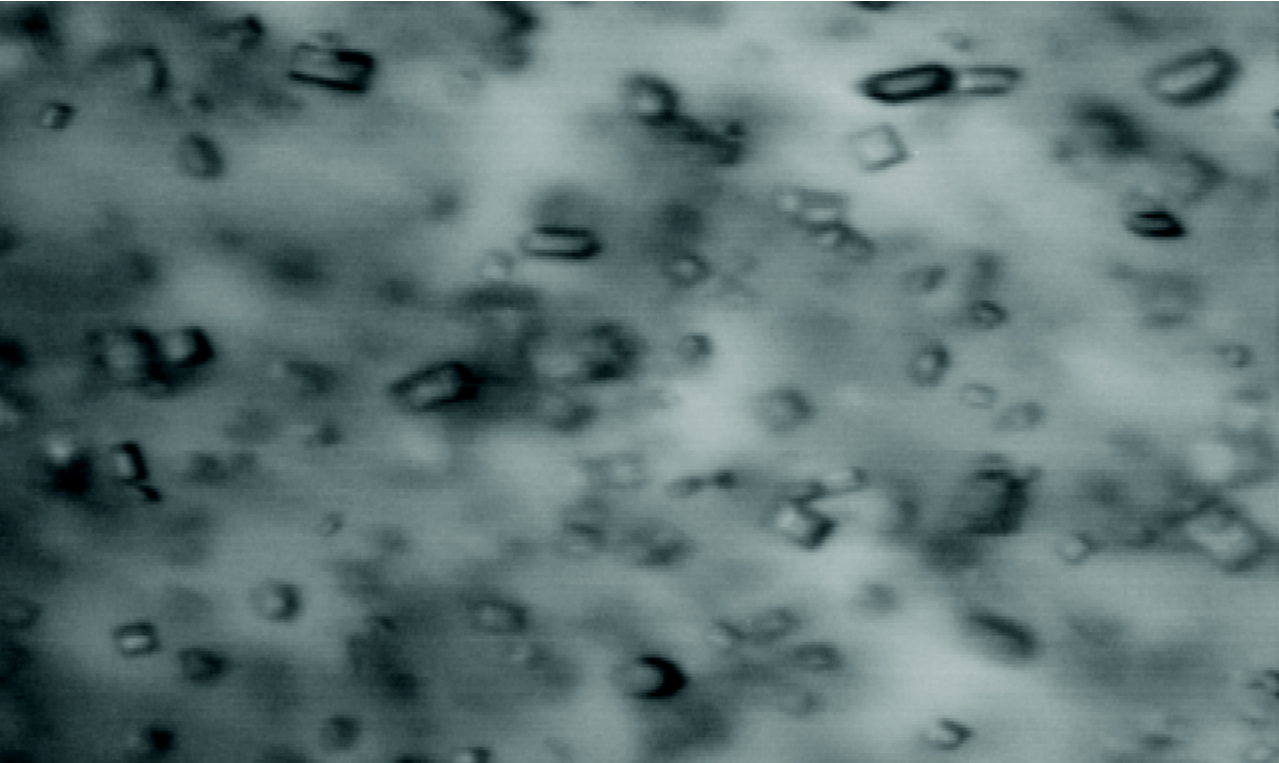
Equipment :

- Vector with 8 Channel current sink 4-20 mA
- B&W Crystal Camera with spray ring

Measurement Task: The camera and vector are installed to measure the sugar crystal growth in a vacuum vessel with agitation. The camera images crystals with 180 degree back light illumination, and the light alignment to the camera field of view achieves dark field illumination where crystal faces are bright white and background is black. The batch process is started with only a low level of hot syrup in the vessel. The top of liquid is slightly above the camera. Vacuum pulls off water until solids concentration reaches the desired level for seeding with small sugar crystals. After seeding, vacuum and agitation continue, and additional syrup is fed as sugar crystals grow. When larger crystals are seen at mid and late portion of the process, crystal motion from agitation is small compared to seeding time. When the vessel reaches the highest operating level, the batch is complete and the contents emptied to centrifuges for crystal extraction, washing, and drying. The liquid, and small crystals that escape the centrifuge, are processed in down stream units with similar function. After the last crystallizer, the remaining liquid is molasses. The desire is to use Canty measurements for process control to limit the percentage of crystal material that is so small that it passes the centrifuge and is carried to the next crystallizer or to the molasses by product.

The camera zoom setting is for minimum magnification, 2.46914 micron per pixel with image field of view of 1580 Micron H by 1185 micron V. This magnification is suited to see the larger crystal in the 450 to 500 micron range. The light dimmer dial is positioned to 60 and light is proper for the current shutter speed. Bulb life will be great at this low light output setting.

Typical Images Inside Pan



Results

A plot of the Vector size distribution measurement by volume for data recorded near the end of a batch is shown in Figure 1. From this chart the D10 minor axis size is read as 103 microns. Several more plots similar to figure 1 were made through out the batch and the trend of D10 for this batch is shown in Figure 2. These plots demonstrate the Vector measurement capability for the sugar crystals.

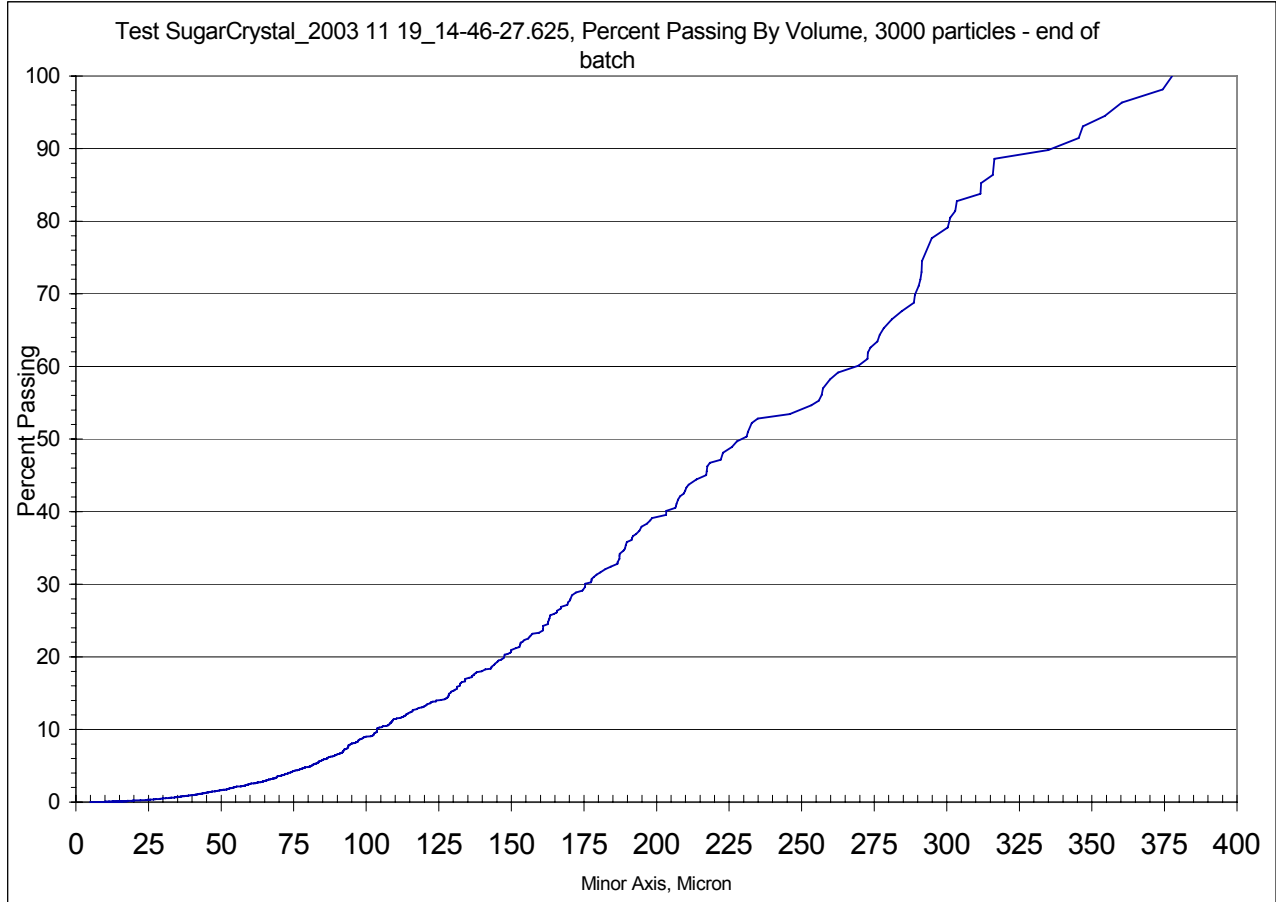


Figure 1, Crystal Size distribution, percent passing by volume near end of batch

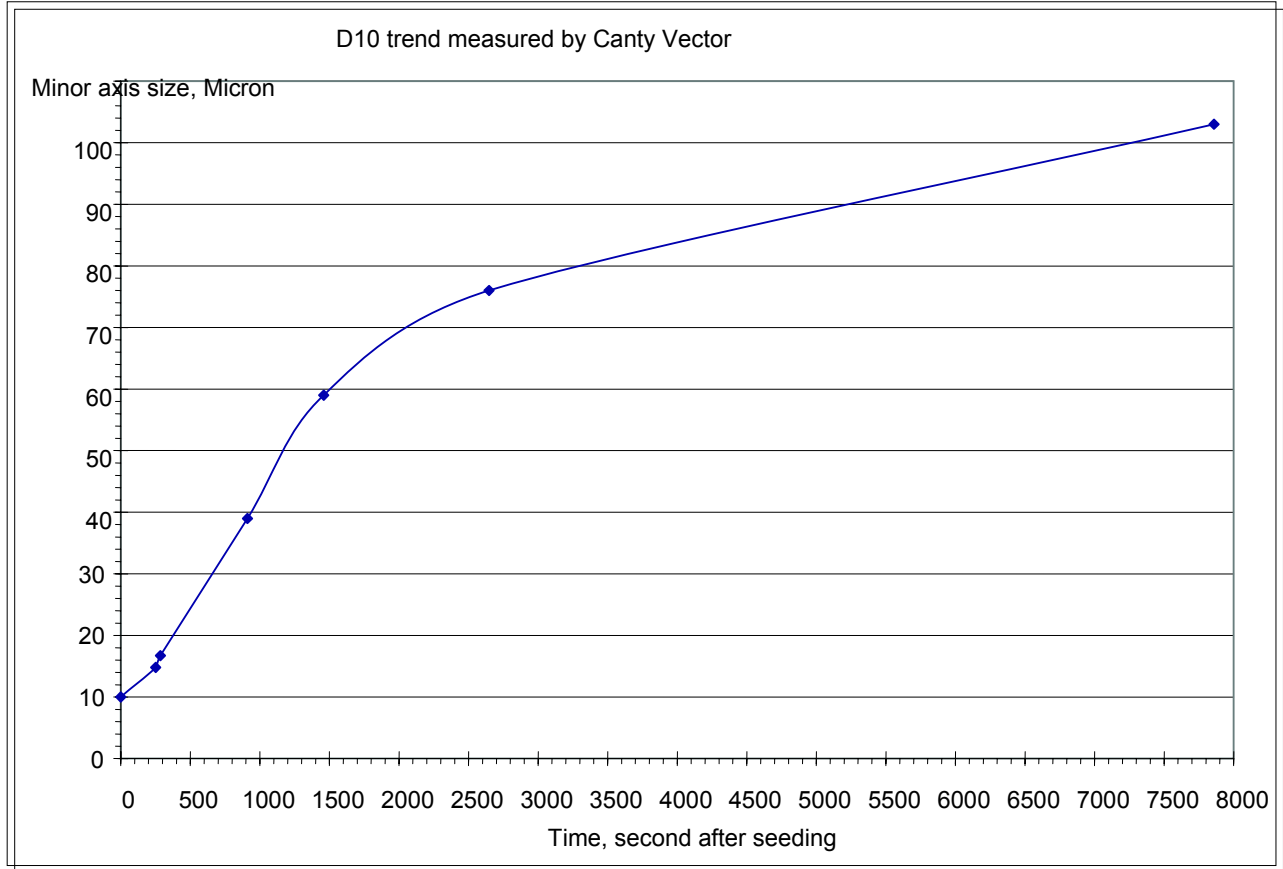


Figure 2, D10 growth trend during 8000 second (2-1/4 hour) crystallization batch

The D10 growth rate is used in this case to determine when the low end is large enough to allow further processing. The full distribution, Fig 1, is used to monitor the entire batch growth and the information generated by that curve allows for process control to arrive at an optimum output of mean size, span and low end.

Particle Count Output

The particle count after seeding and for the early portion (maybe 1/5 to 1/3 of batch process) has been used at other sugar crystallizers to characterize and control process parameters. Figure 3 shows a setup that reports the particles per image as a 4-20 signal covering a span of 0 to 500.

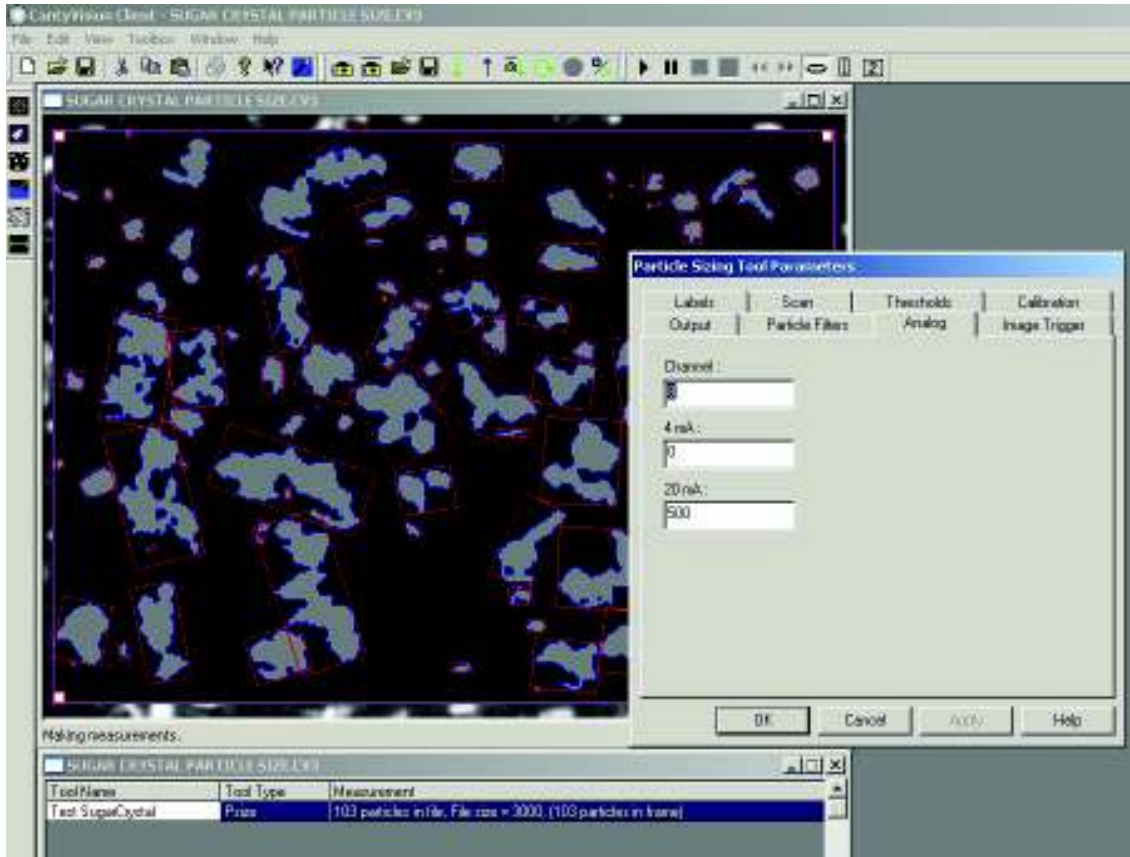


Figure 3, Analog Output Channel 8 configured to output 103 particle count as 4 to 20 in 0 to 500 count span.