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SolidSizer TS Lab Test Report

Company:

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Sample Identity- Granular material described as:

Sam 1	Coated Fertilzer #1
Sam 2	Coated Fertilizer #2

I. Purpose:

The dry granular particles were analyzed with a Canty Classic SolidSizer unit with Color Speck Detection option in order to determine the size distribution of the samples as well as the color of the sample particles. The particle size is classified by minor diameter which is a standard measurement that closely reflects a sieve measurement. The color data is listed in terms of average Y,u,v standards and the standard deviations of these three color components are graphed so the user gains an understanding of the consistency of the color coating across the entire particle surface.

II. Lab Setup:

The samples provided were analyzed for size and shape using a Canty Classic SolidSizer sensor, shown in Figure 1. The granular material enters the sensor at the flange fitting seen at the top left in the illustration. An adjustable tube deposits a thin layer of granules on a vibrating feeder tray. The granules travel along the tray and drop in a thin curtain at the discharge end of the tray. A camera observes the falling curtain of particles. The CantyVision Software processes these images. The Color measurements were made using the same instrument. While the particles are traveling down the tray, the camera (black housing shown on top of the unit) views the particles before they fall off the tray end. The images are analyzed for color over the entire surface area seen by the camera.

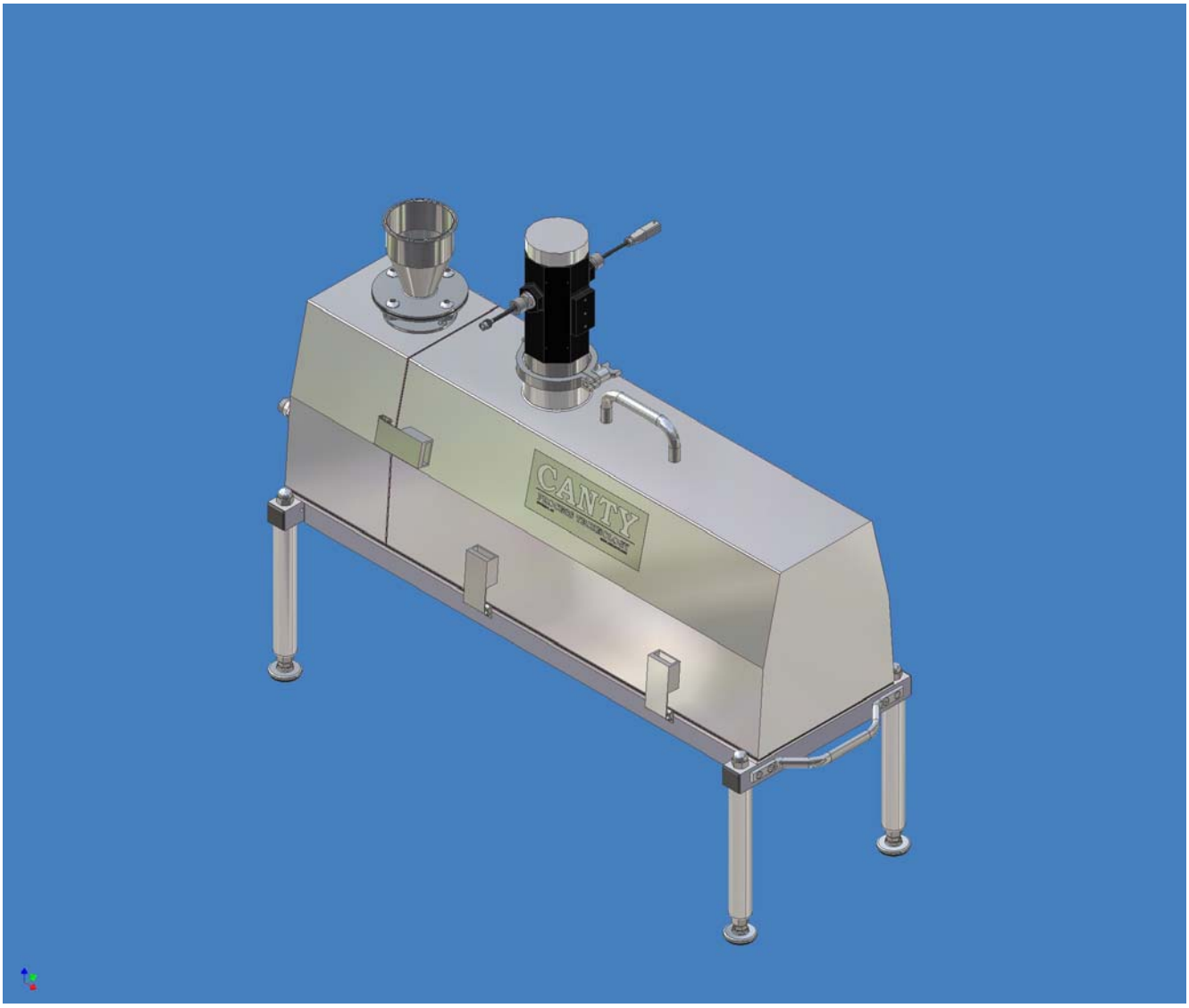


Figure 1, Classic SolidSizer™ with Color Speck option

III. Calibration:

Particle Size Analysis:

System calibration is critical for obtaining accurate and repeatable results. Once the system is calibrated it does not drift which is unique to vision systems. The only way for a vision system to change the results it sees for a given particle sample is for the relative distance between the camera and the particles to change. As long as that remains fixed, the data produced by the system will be repeatable.

The SolidSizer sensor optical magnification can be adjusted over a wide range. For this application, magnification was adjusted to permit detection of the 1.75 mm granular material which is the largest particle of interest. A pixel scale factor of 0.0269 mm per pixel was used for all sample material. The resulting process image field of view (FOV) is 17.01 mm horizontal 13.84 mm vertical and the solid particles appear dark with a bright background.

Color Speck Analysis:
Color Speck Analysis System sensor maintained the same settings as for particle size.

IV. Results:

Particle Size

Figure 3 below shows a typical process image captured for SAM1109-1. The raw image (Figure 2) is then digitized (figure 3) and then analyzed for features including Area, Perimeter, Major Axis, and Minor Axis for each detected particle. The table included in this screen image lists the dimensions, in mm, of the particles imaged in the figure. This data (area, perimeter, major axis and minor axis) is written to a text file during each analysis run and evaluated using a Microsoft Excel template. Other data features can be computed such as aspect ratio, perimeter to area ratio or as many other data combinations that are useful to classify the particles. From these data measurements, plots can be created using either major or minor axis as a size basis. For comparison to sieve screen data, minor axis has been selected for reporting here.

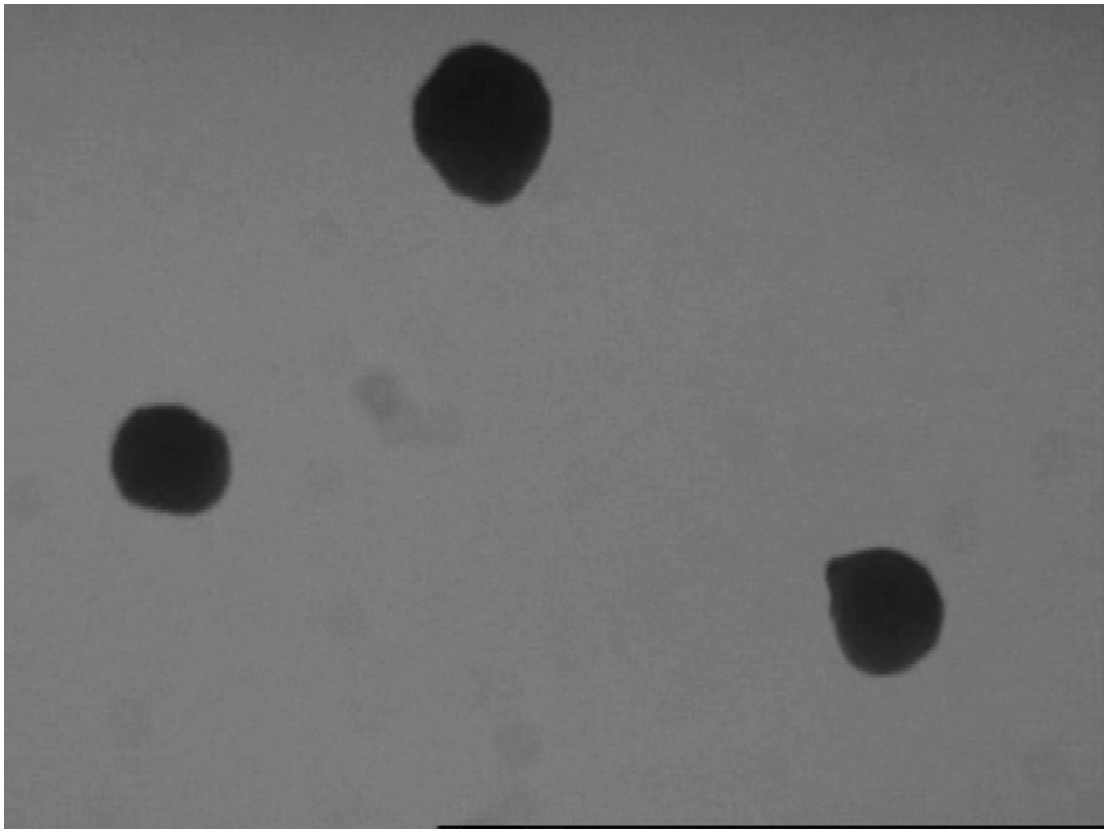


Figure 2, Typical Process Image of SAM 1 Coated Granules

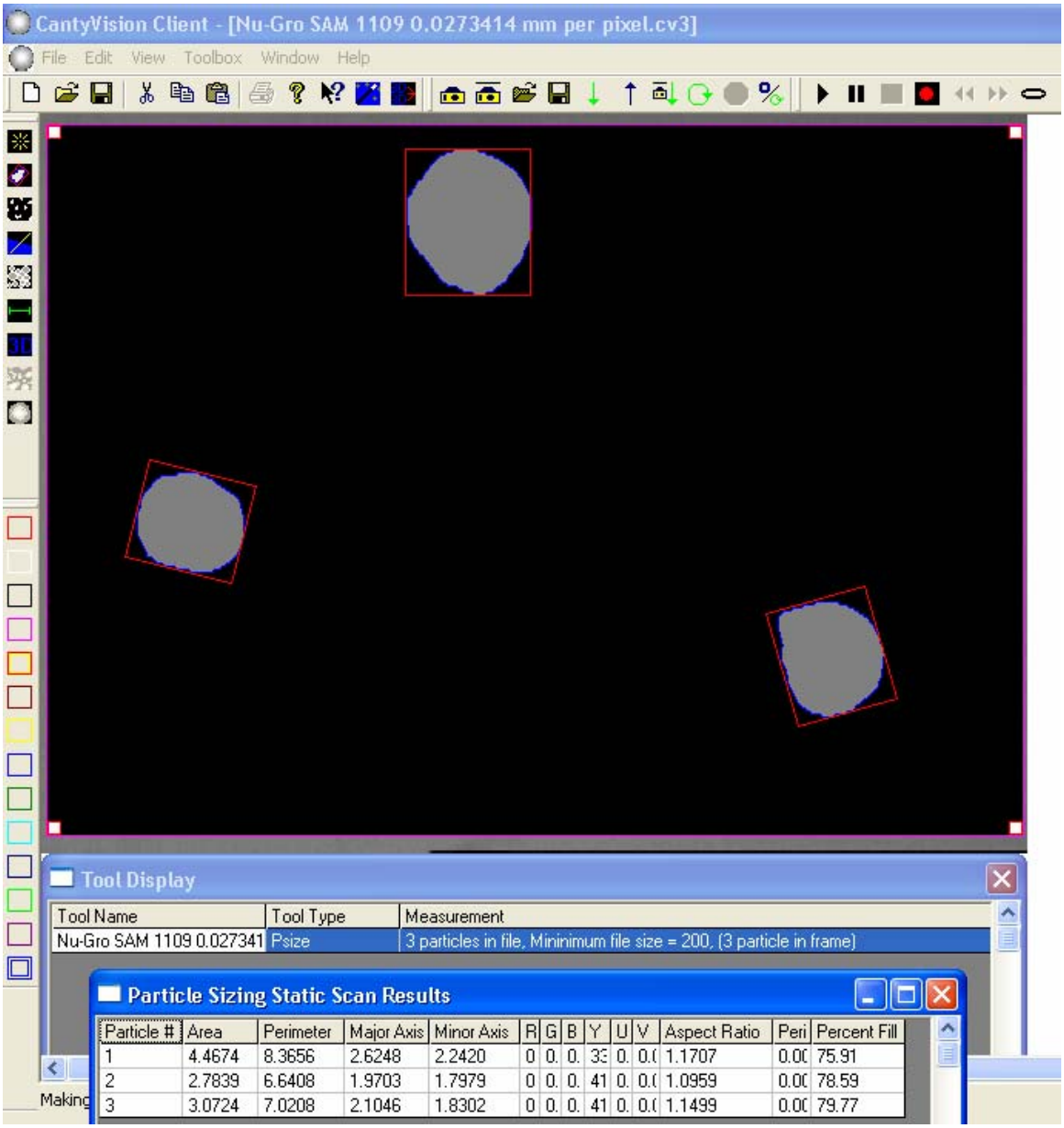


Figure 3, Digitized image with analysis chart

Color Speck Analysis:
Figure 4 shows an image of the colored particles on the feed tray. The software analyzes the particles for R,G,B and Y, u, v values. Other data are available as is helpful such as percent color which indicates what percentage of the particle surface is a selected color value. The same Psize software tool is used here, but the color threshold parameters are used to isolate particles from the background and the average color for each particle is reported.

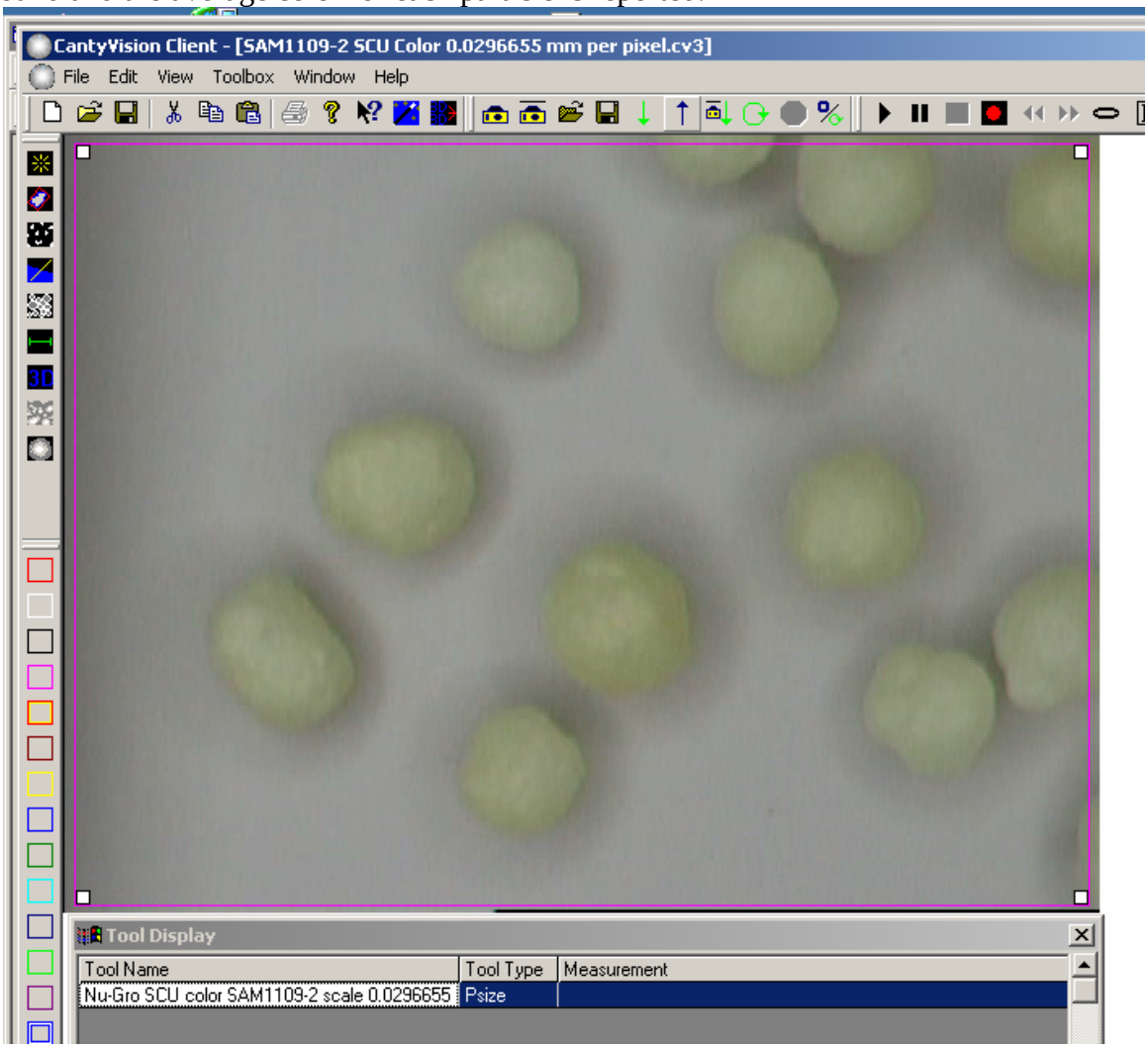


Figure 4, Live Color Image

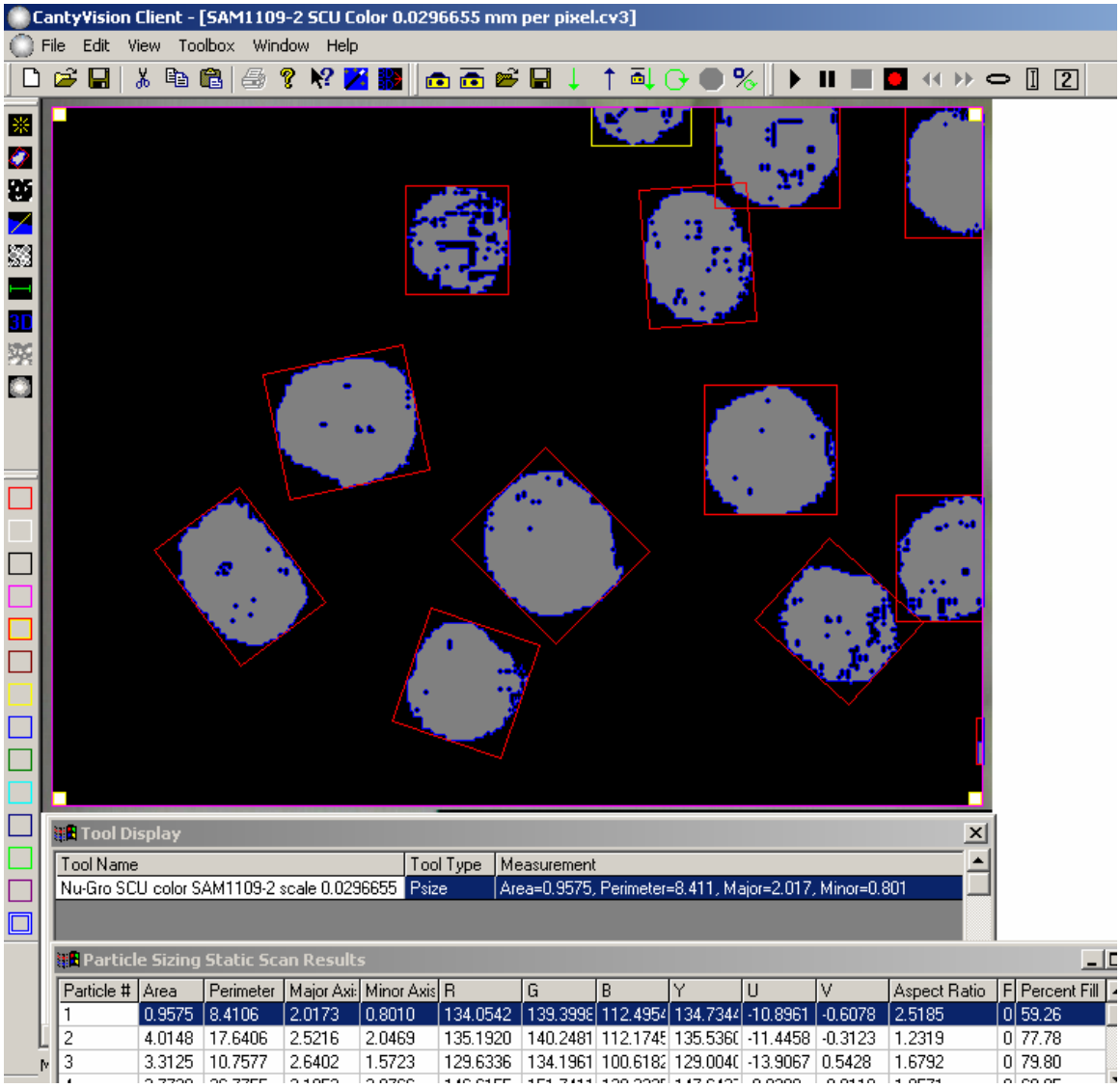


Figure 5, Digitized image with analysis chart

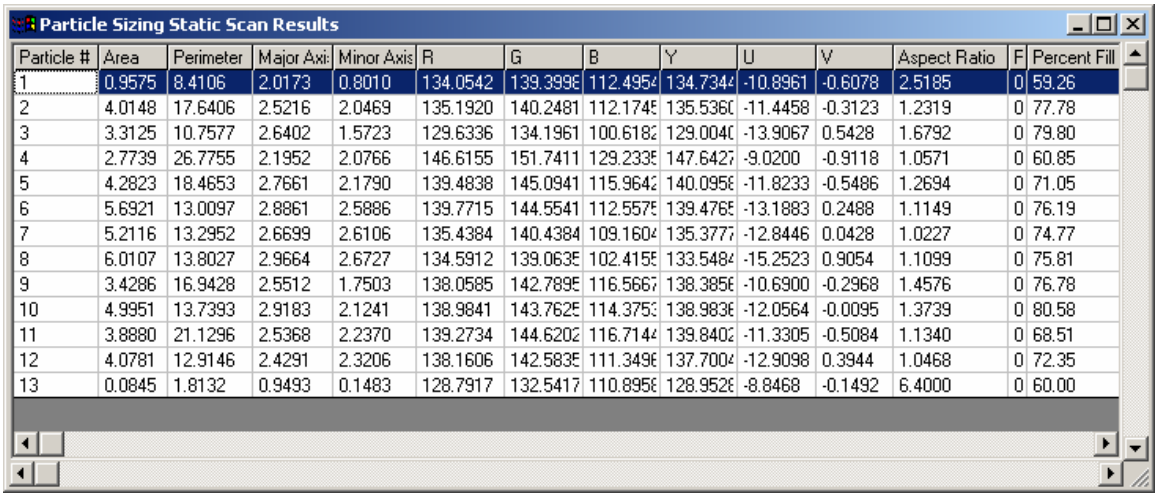


Figure 6, Scan Results Table of Figure 7 shows size and average color for detected particles

Color is reported in both [R G B] and [Y u v] coordinates.

Graphical Presentation – Particle Size and Shape:

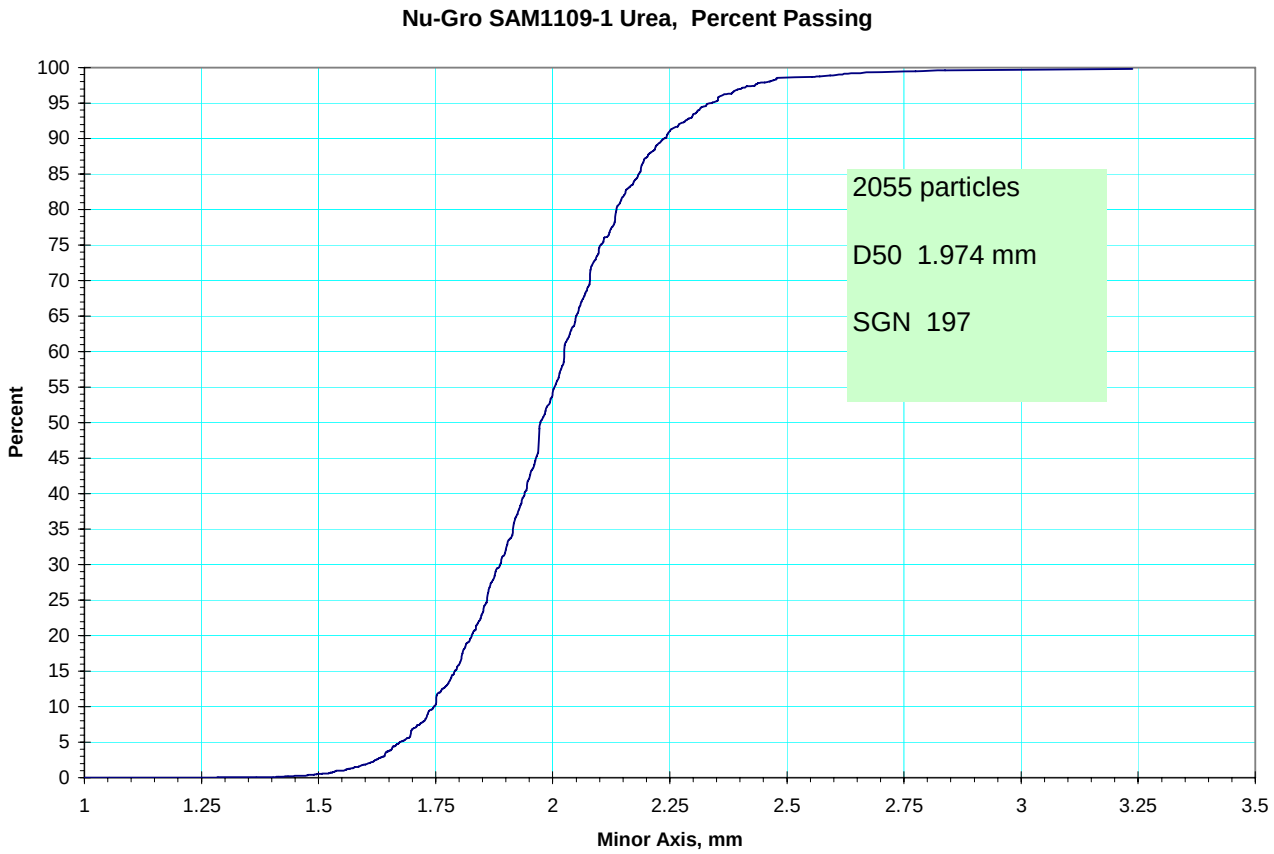


Figure 7, Volume Based Size distribution Results, SAM 1

The Percent Passing plot is computed from the volume of each particle and the D50 minor axis size is where 50 percent of particles are larger and 50 percent are smaller.

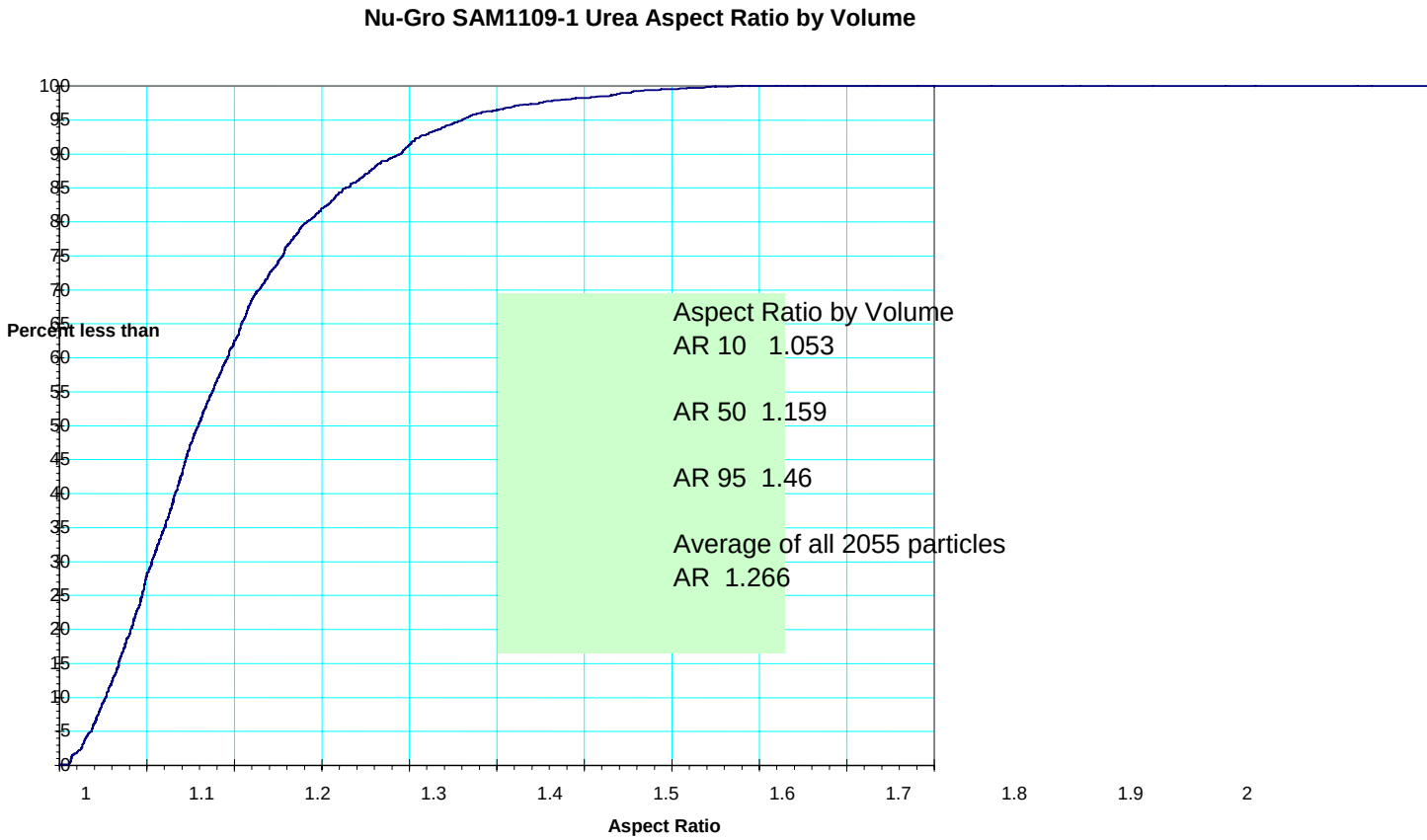


Figure 8, Aspect Ratio distribution Results, SAM 1

The Percent Passing plot is computed from the volume of each particle and the AR50 Aspect Ratio is where 50 percent of particles are larger and 50 percent are smaller. The AR 10, AR 50, and AR 95 are presented to characterize the shape or sharpness of the distribution curve. The volume based AR50 value of 1.159 is compared to the count based average Aspect Ratio of 1.266 and implies that the smaller particles have a higher aspect ratio.

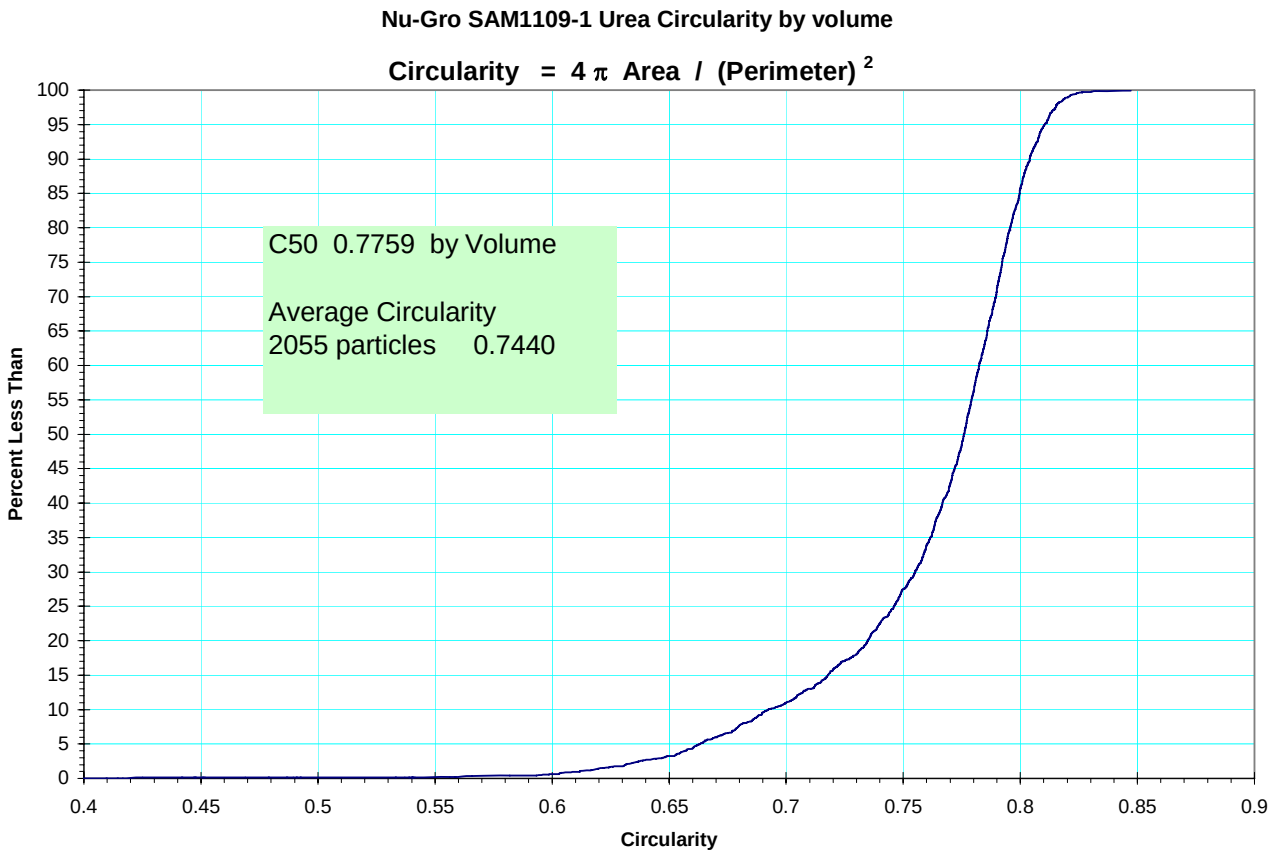


Figure 9, Circularity distribution Results, SAM 1

The Circularity by volume plot is computed from the volume of each particle and the C50 Circularity is where 50 percent of particles have higher circularity and 50 percent have smaller. The volume based C50 value of 0.7759 is compared to the count based average Circularity of 0.7440 and implies that the smaller particles have a lower Circularity. This is expected from the Aspect Ratio characterization for the smaller particles.

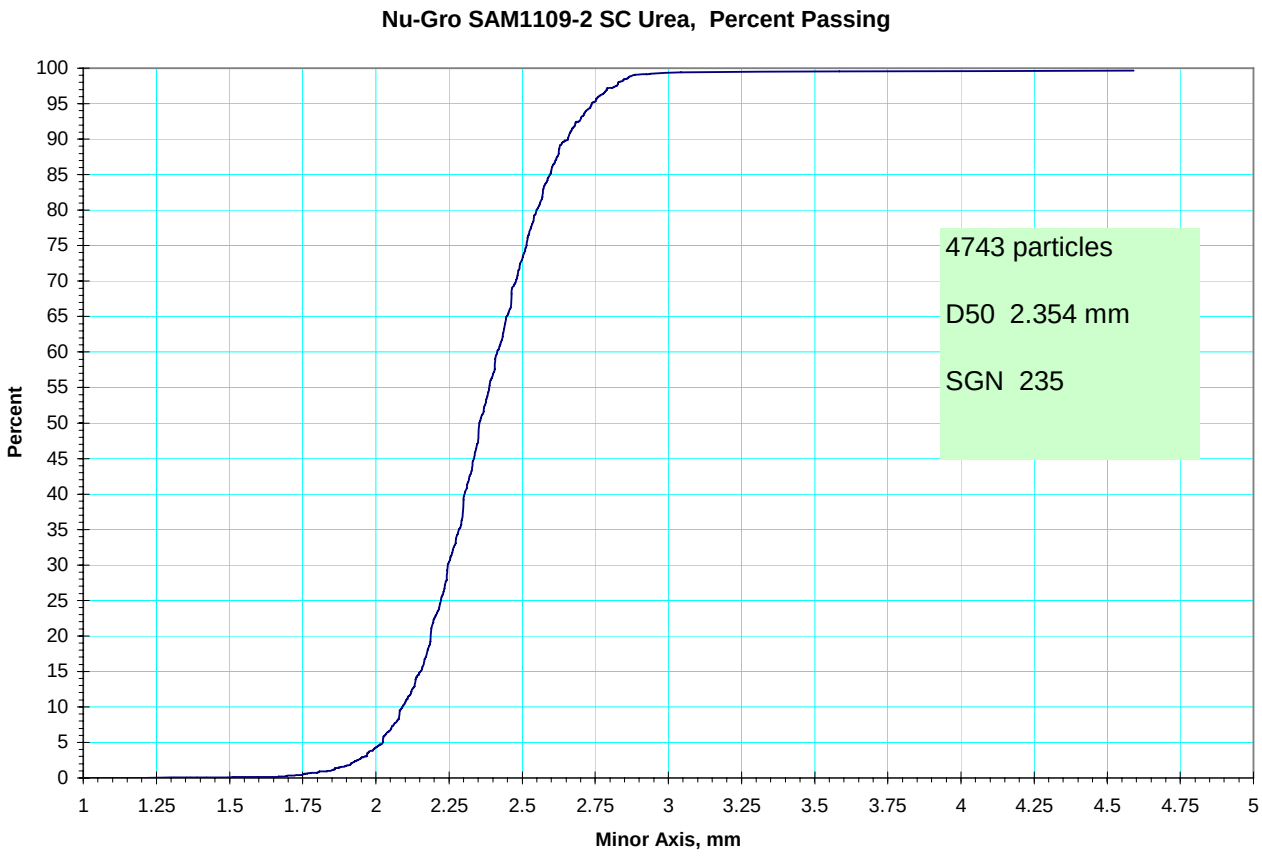


Figure 10, Volume Based Size distribution Results, SAM 2

The Percent Passing plot is computed from the volume of each particle and the D50 minor axis size is where 50 percent of particles are larger and 50 percent are smaller.

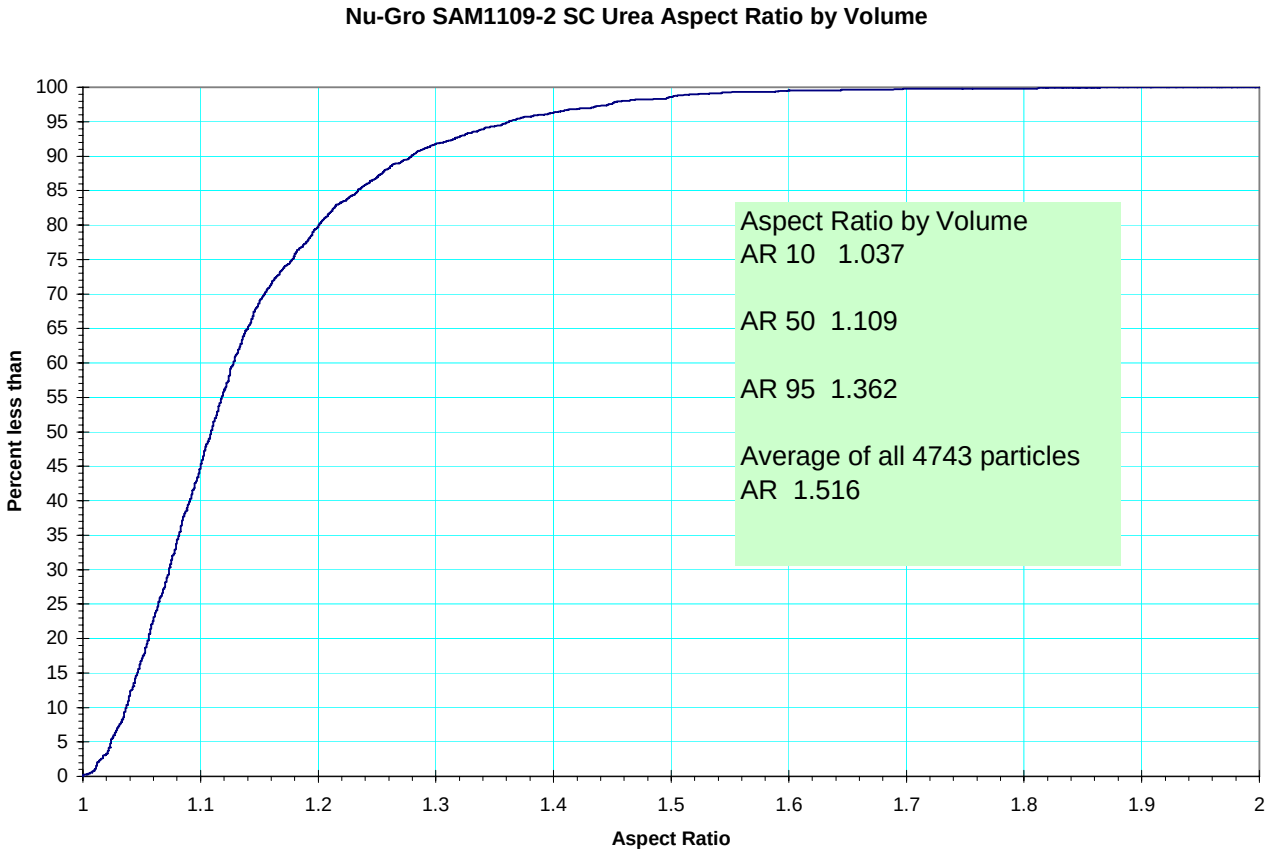


Figure 11, Aspect Ratio distribution Results, SAM 2

The Percent Passing plot is computed from the volume of each particle and the AR50 Aspect Ratio is where 50 percent of particles are larger and 50 percent are smaller. The AR 10, AR 50, and AR 95 are presented to characterize the shape or sharpness of the distribution curve. The volume based AR50 value of 1.109 is compared to the count based average Aspect Ratio of 1.516 and implies that the smaller particles have a higher aspect ratio.

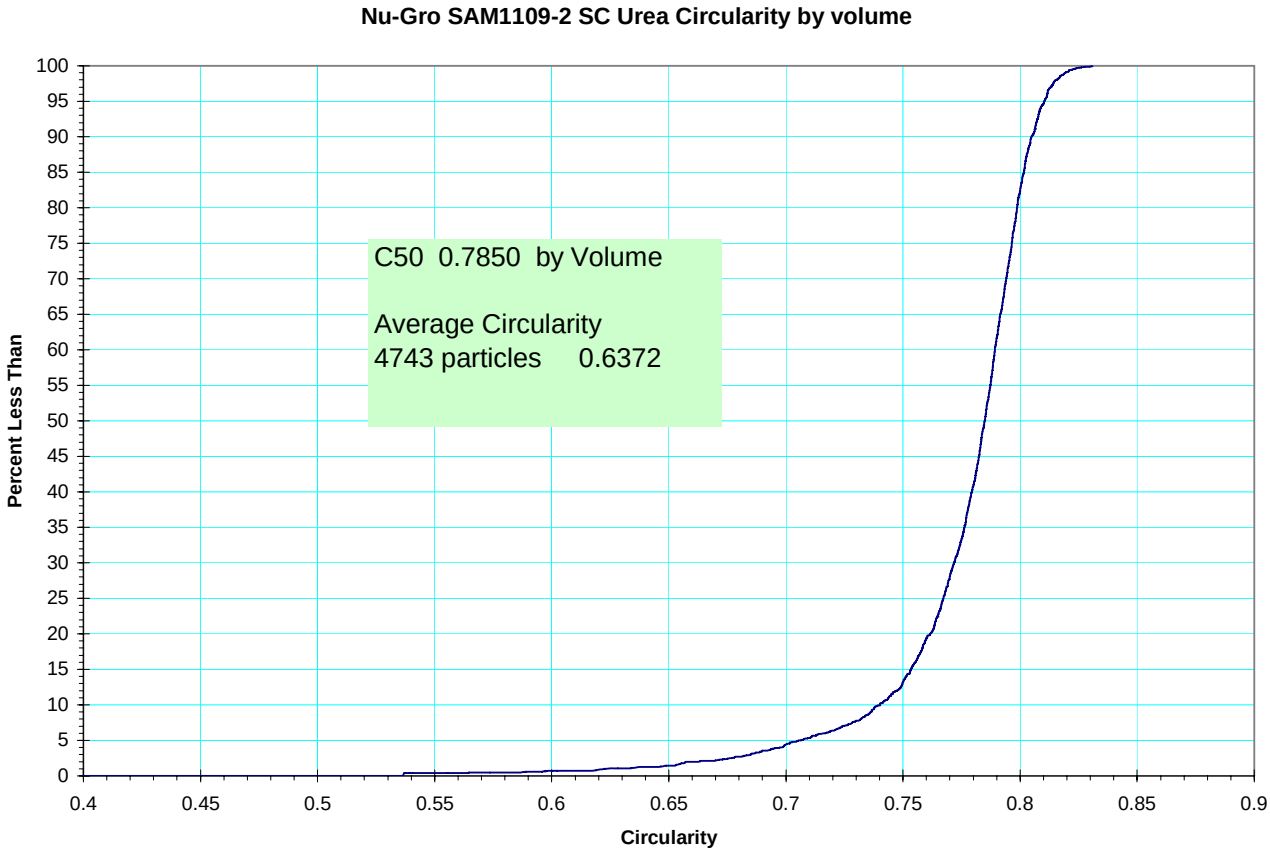
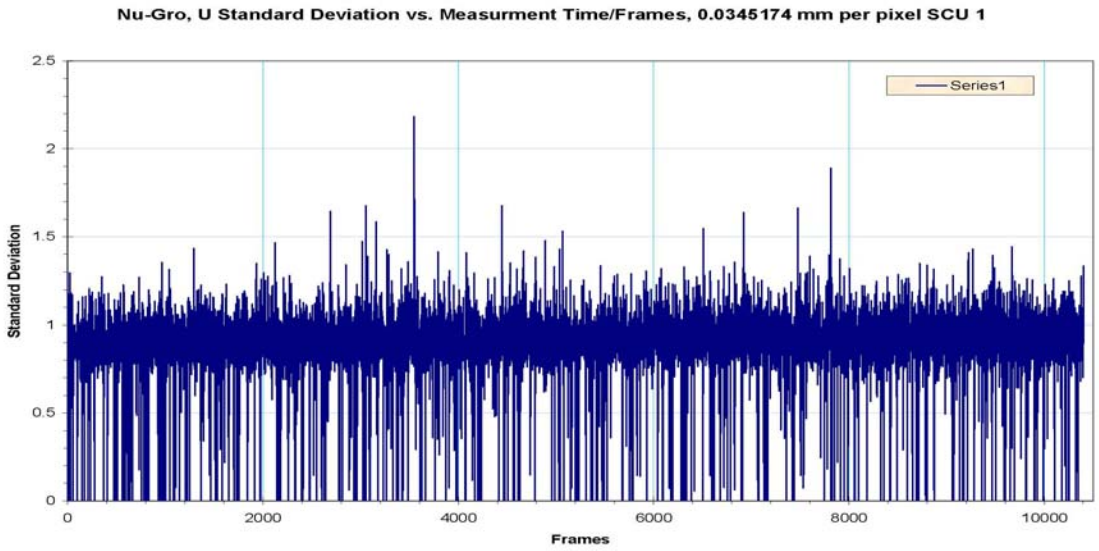


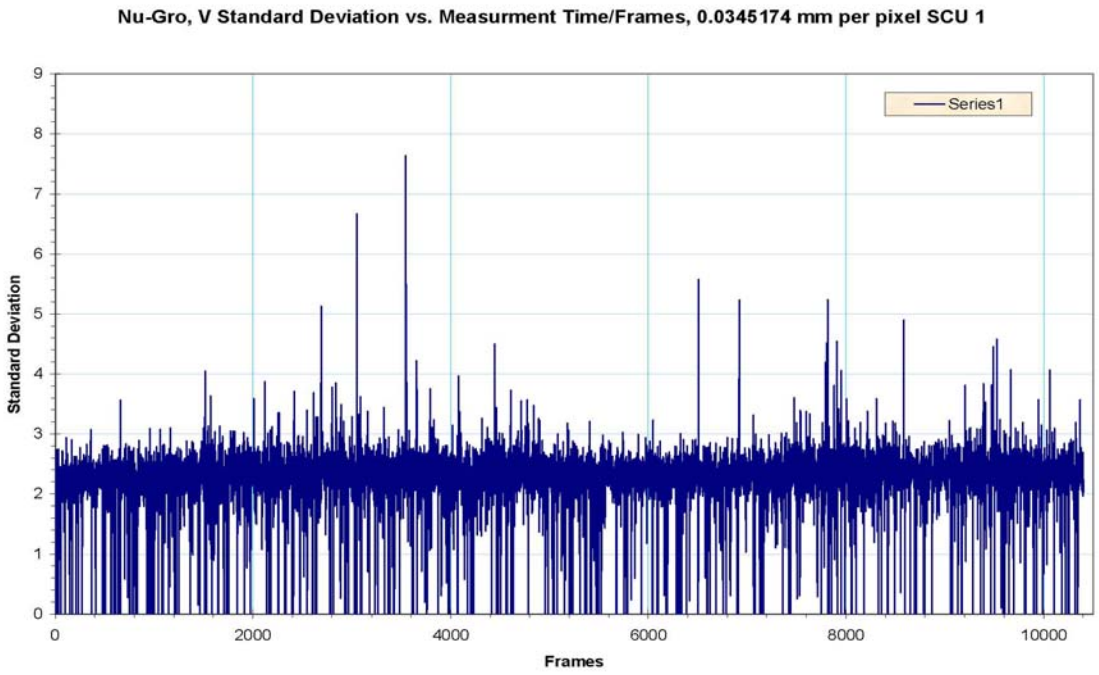
Figure 12, Circularity distribution Results, SAM 2

The Circularity by volume plot is computed from the volume of each particle and the C50 Circularity is where 50 percent of particles have higher circularity and 50 percent have smaller. The volume based C50 value of 0.7850 is compared to the count based average Circularity of 0.6372 and implies that the smaller particles have a lower Circularity. This is expected from the Aspect Ratio characterization for the smaller particles.

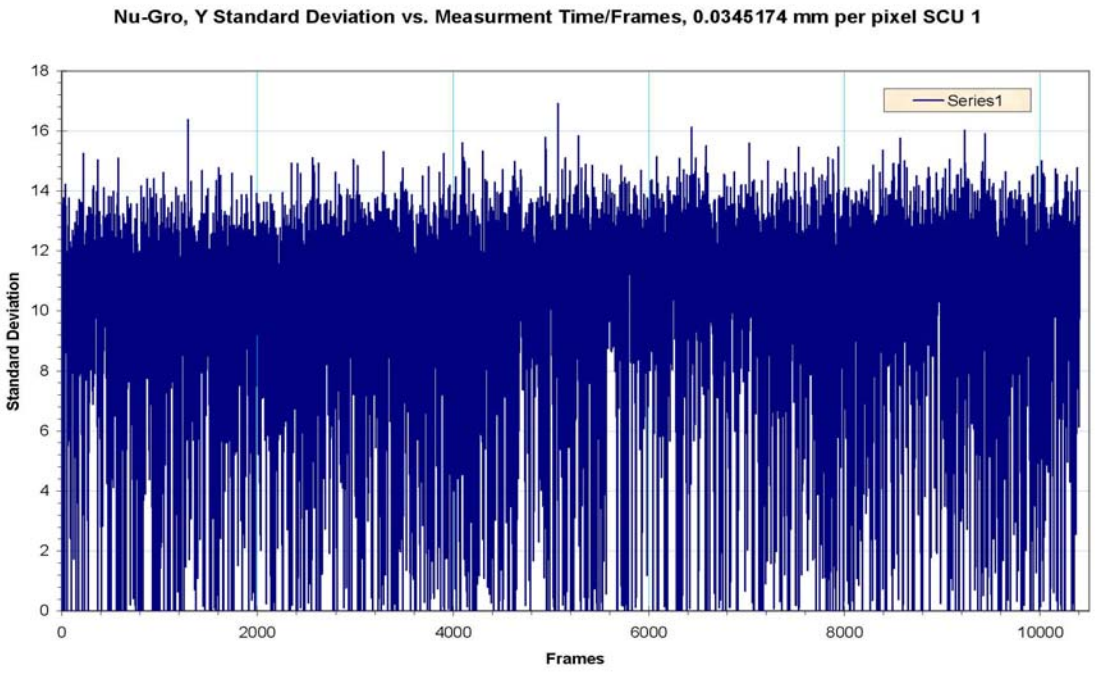
Graphical Presentation – Particle Color:



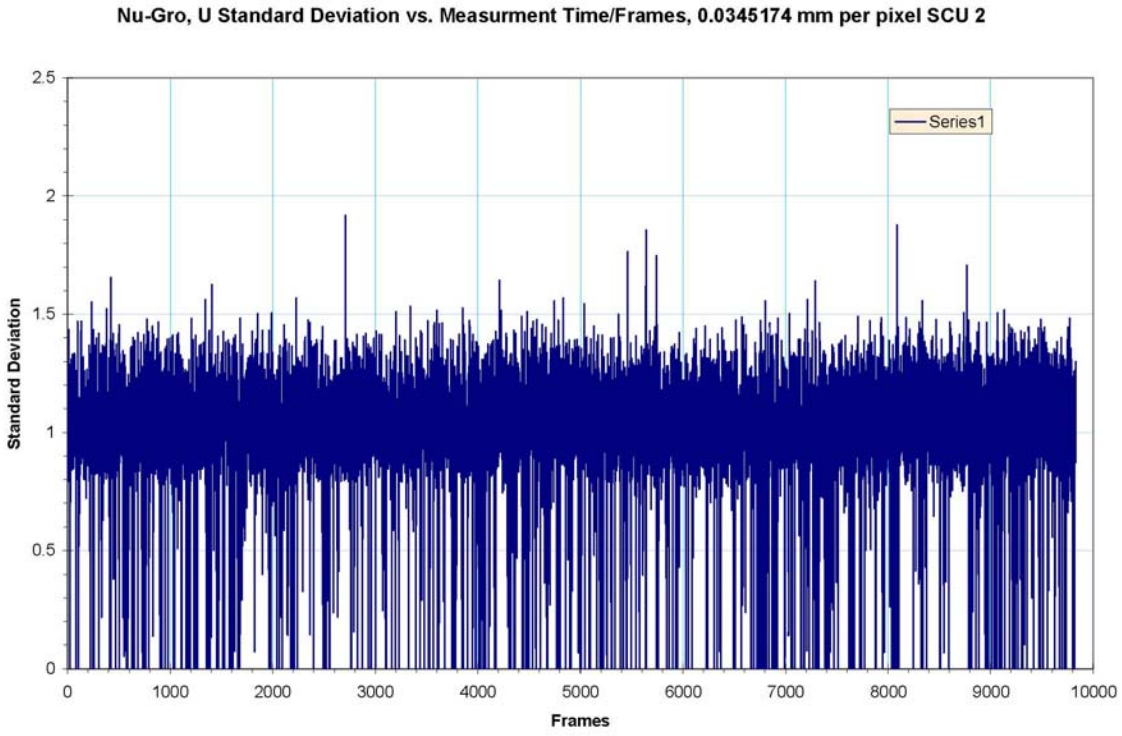
Above shows Standard Deviation of color across each particle, u component. Sam 1



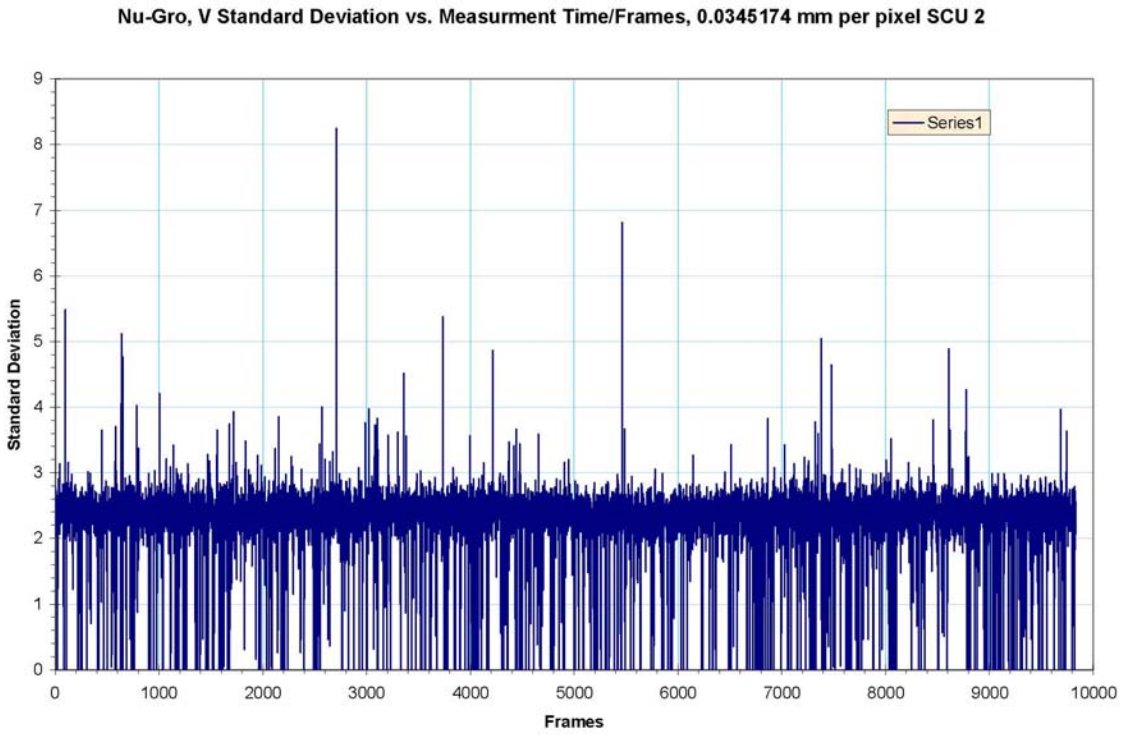
Graph shows Standard Deviation of color across each particle, y component Sam 1



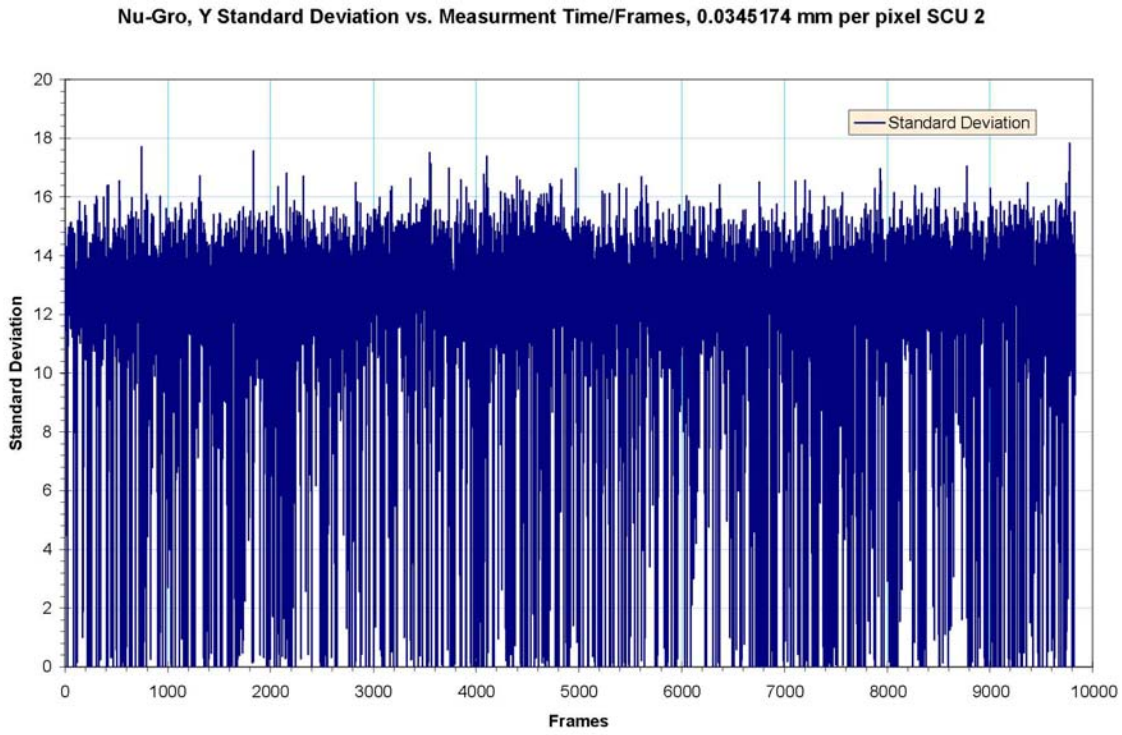
Graph shows Standard Deviation of Y intensity across each particle.
Sam 1



Above shows Standard Deviation of color across each particle, u component. Sam 2



Above shows Standard Deviation of color across each particle, y component. Sam 2



Graph shows Standard Deviation of Y intensity across each particle.
Sam 2

Discussion:

PARTICLE CHARACTERIZATION – The information in this report is just a sample of the data the system can provide. Canty Vision supplies the user with the basic particle features that are available only to a vision system, but also provides the user with the capability to customize the system with filters to assist in achieving the most meaningful information with respect to the product or process. The particular data presented here shows how the system is able to do particle shape and size as well as average color and color deviation across single particles, which in this case, may indicate to the user how efficient the coating process is functioning.

This instrument can function in several capacities;

1. Process Control
2. Quality Control
3. Process repair or improvement

It is usual for an instrument to provide a measure of process control, however with visual assessment of the product available on line and the many product characteristics that can be measured by a single image, it is also possible to do quality control and assess process deficiencies from the captured process images or video.

Conclusions:

The Canty Vision Technology using the SolidSizer sensor and the Vector vision processor provides a Particle Size Distribution that characterizes the size granular materials by minor axis. This volume based size characterization can be directly compared to weight based size measurement methods such as sieve screening. The particle shape characterization available with this vision-based system provides information that is not available from sieve methods. The Color Speck Analysis System provides a measure of both color and particle coating uniformity for fertilizer products. The CANTY equipment provides excellent images for particle observation and shape analysis and can be used to characterize particles equally well in either online or lab environment.