

Lab Test Report

Sample Identity- Granular material described as:

SAM1	Pellet Sample 1
SAM2	Pellet Sample 2
SAM3	Pellet Sample 3

Purpose:

The dry granular particles were sized on a glass plate using a CantyVision Particle Size Analysis software. This report describes the measurement set up and presents measurement results.

Project Goals:

Particle size distribution with shape information (roundness, aspect ratio) with highest precision and accuracy.

Lab Setup:

The samples provided were analyzed for size and shape using a Canty 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 down 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 camera output for the free falling particles is a silhouette image of each particle in front of a lighted panel. The Canty Vector running the CantyVision Software processes these images. The Color measurements were made using the Color Speck Analysis System shown in Figure 2. The granular material enters the sensor at the hopper-funnel at the top right. An adjustable down tube deposits a thin layer of granules on a vibrating feeder tray. The granules travel along the tray and are observed by a color camera from above. Uniform white light is provided to illuminate the material traveling on a white tray.



Figure 1, SOLIDSIZER™ Industrial Solid Particle Analysis System sensor assembly includes light source and camera-lens

Calibration:

The SolidSizer sensor optical magnification can be adjusted over a wide range. For this application, magnification was adjusted to a magnification to permit detection of the 2 mm granular material. A pixel scale factor of 0.0273414 mm per pixel was used for all sample material. The resulting process image field of view (FOV) is 17.50 mm horizontal by 13.12 mm vertical and the solid particles appear dark with a bright background.

Results:

Figure 3 below shows a typical process image captured for SAM-1 in the SolidSizer. The test scan processing for the Figure 3 image is seen in Figure 4 illustrating how the Canty Software separates the particles from the background and measures the 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. The computer screen image in Figure 5 also contains a selected individual particle, which is identified by a yellow box surrounding it. The dimensions of this particular particle are shown on the first row of the table. This data (area, perimeter, major axis and minor axis) is written to a text file during each run time and evaluated using a Microsoft Excel template. 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.

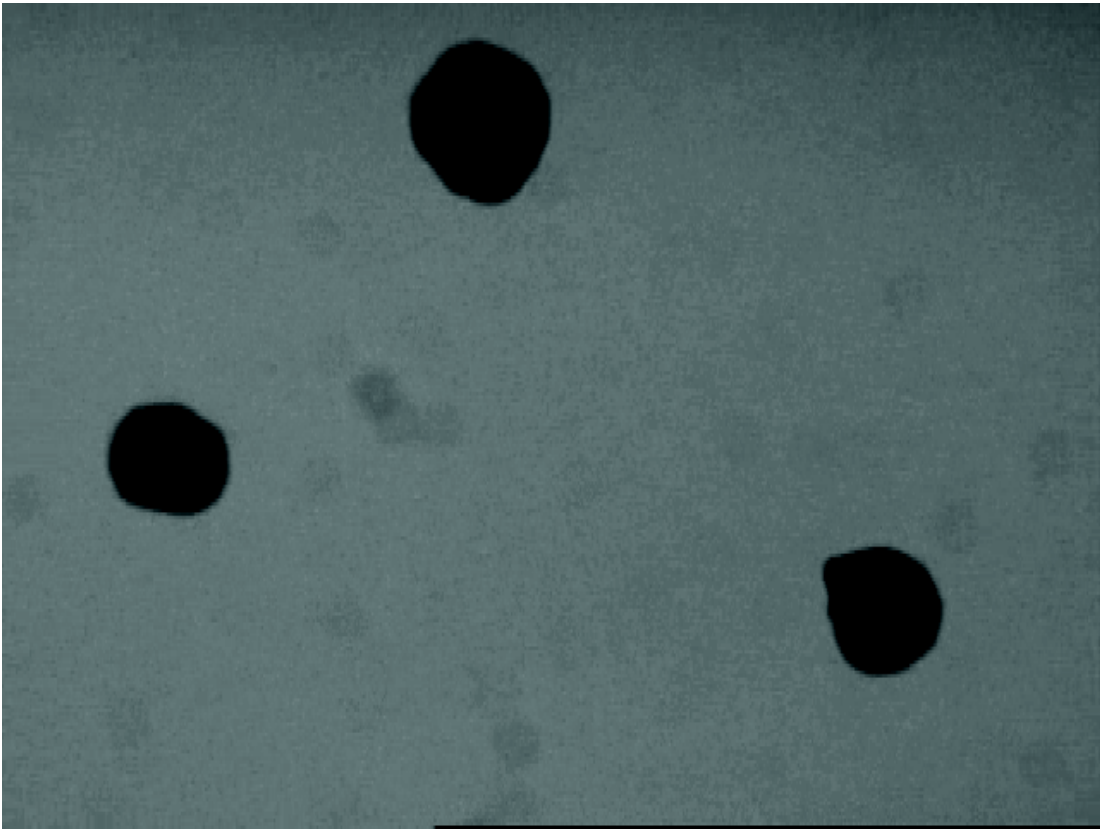


Figure 3, Typical Process Image of SAM1 Granules

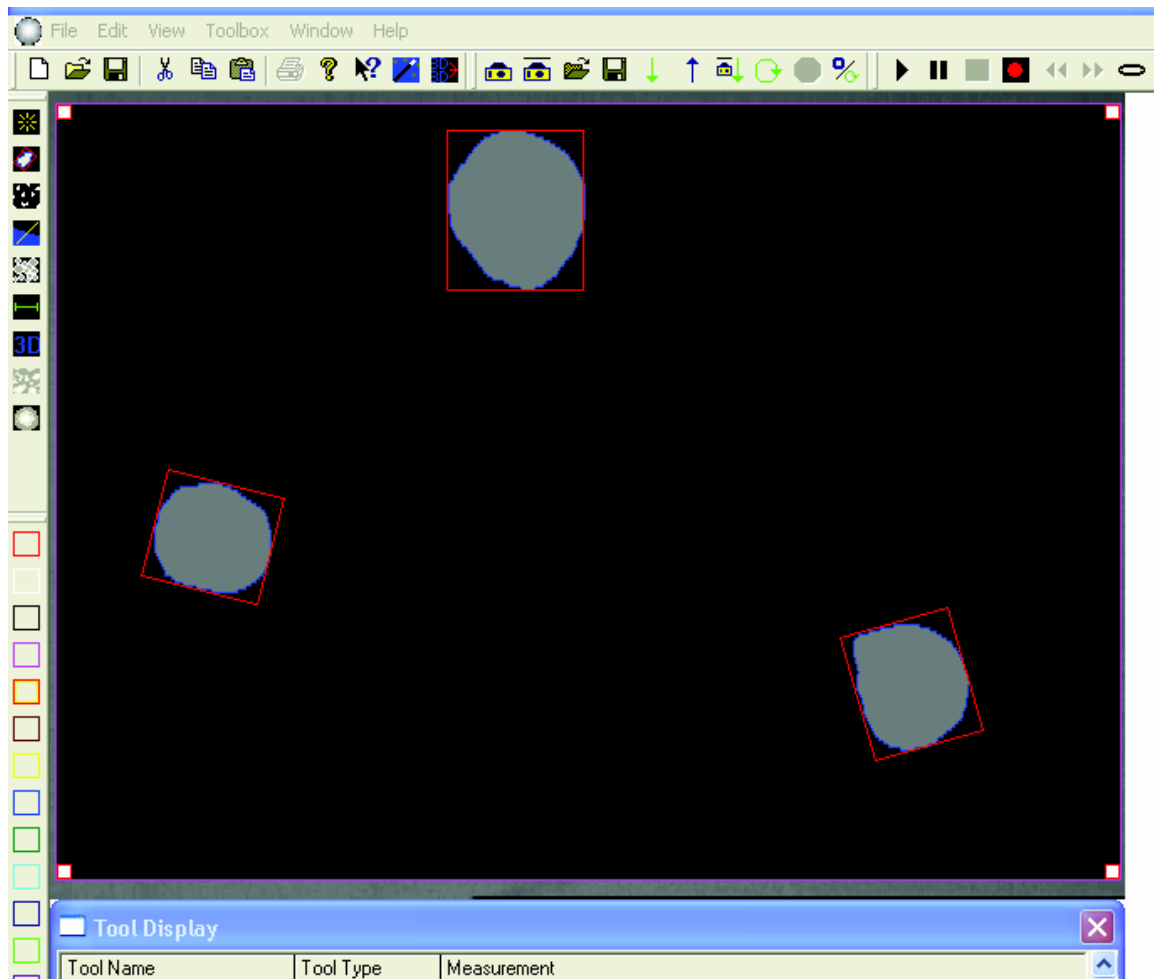


Figure 4, Test Scan of Figure 3 by Canty Vision Software detects three particles, report size in mm

The center particle was selected by clicking on the particle. The selected particle is moved to top of Results listing in Figure 5, and is highlighted blue to allow careful identification of each particle. When these visual verify functions seen in Figure 4 and 5 are satisfactory, a measurement data run of the sample is started to gather a full data set for about 2,000 particles.

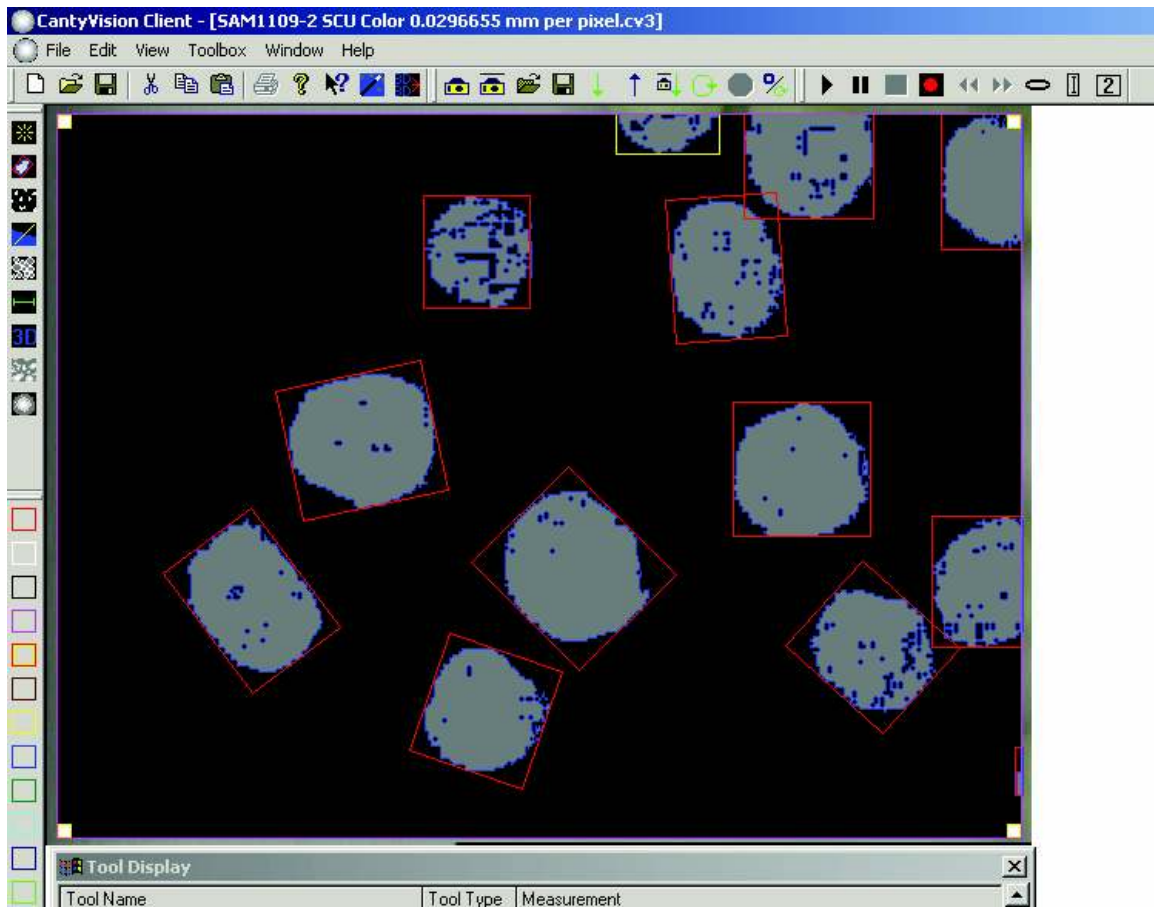


Figure 7, Test Scan of 13 particles, report size in mm

Particle #	Area	Perimeter	Major Axis	Minor Axis	R	G	B	Y	U	V	Aspect Ratio	F	Percent Fill
1	0.9575	8.4106	2.0173	0.8010	134.0542	139.3996	112.4952	134.7344	-10.8961	-0.6078	2.5185	0	59.26
2	4.0148	17.6406	2.5216	2.0469	135.1920	140.2481	112.1745	135.5361	-11.4458	-0.3123	1.2319	0	77.78
3	3.3125	10.7577	2.6402	1.5723	129.6336	134.1961	100.6182	129.0041	-13.9067	0.5428	1.6792	0	79.80
4	2.7739	26.7755	2.1952	2.0766	146.6155	151.7411	129.2335	147.6427	-9.0200	-0.9118	1.0571	0	60.85
5	4.2823	18.4653	2.7661	2.1790	139.4838	145.0941	115.9642	140.0956	-11.8233	-0.5486	1.2694	0	71.05
6	5.6921	13.0097	2.8861	2.5886	139.7715	144.5541	112.5575	139.4765	-13.1883	0.2488	1.1149	0	76.19
7	5.2116	13.2952	2.6699	2.6106	135.4384	140.4384	109.1604	135.3777	-12.8446	0.0428	1.0227	0	74.77
8	6.0107	13.8027	2.9664	2.6727	134.5912	139.0635	102.4155	133.5484	-15.2523	0.9054	1.1099	0	75.81
9	3.4286	16.9428	2.5512	1.7503	138.0585	142.7895	116.5667	138.3856	-10.6900	-0.2968	1.4576	0	76.78
10	4.9951	13.7393	2.9183	2.1241	138.9841	143.7625	114.3755	138.9836	-12.0564	-0.0095	1.3739	0	80.58
11	3.8880	21.1296	2.5368	2.2370	139.2734	144.6202	116.7144	139.8402	-11.3305	-0.5084	1.1340	0	68.51
12	4.0781	12.9146	2.4291	2.3206	138.1606	142.5835	111.3495	137.7004	-12.9098	0.3944	1.0468	0	72.35
13	0.0845	1.8132	0.9493	0.1483	128.7917	132.5417	110.8955	128.9525	-8.8468	-0.1492	6.4000	0	60.00

Figure 8, Scan Results Table of Figure 7 shows size and average color for detected particles

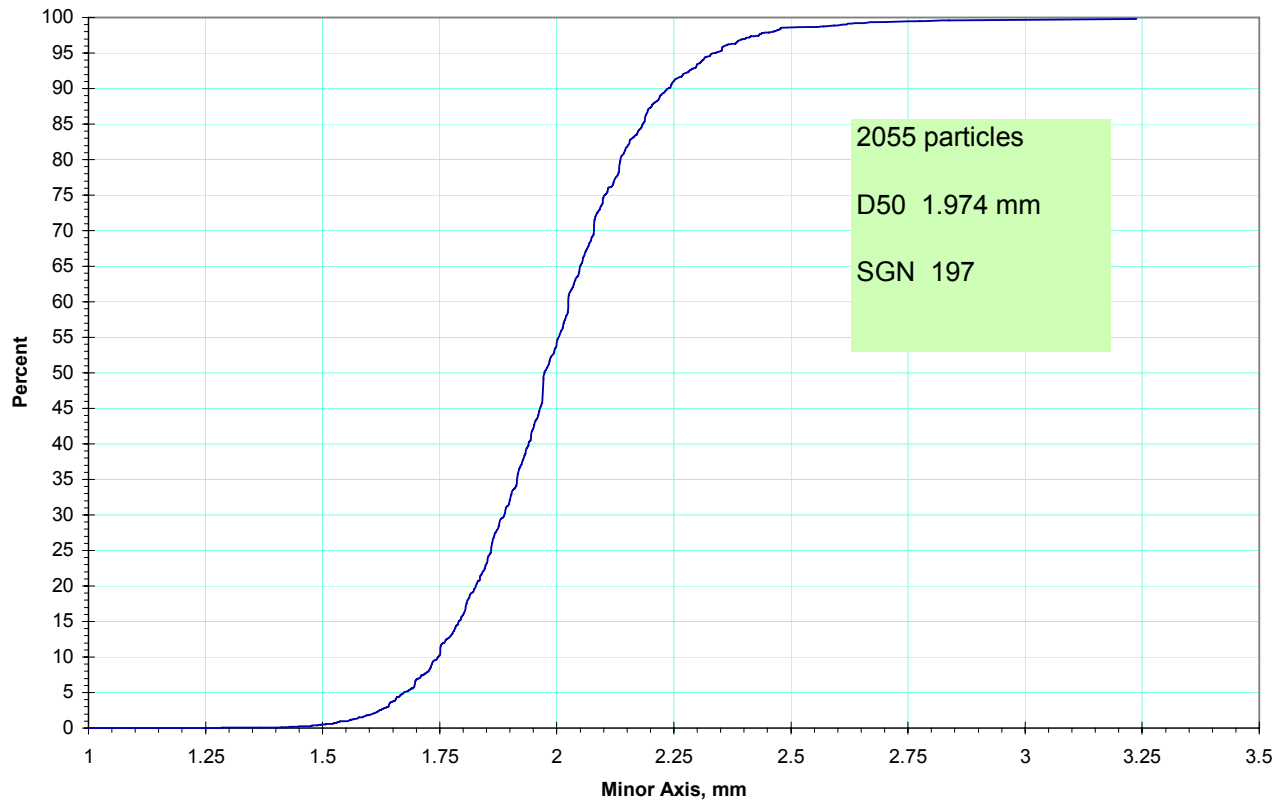


Figure 9, Volume Based Size distribution Results, SAM-1

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.

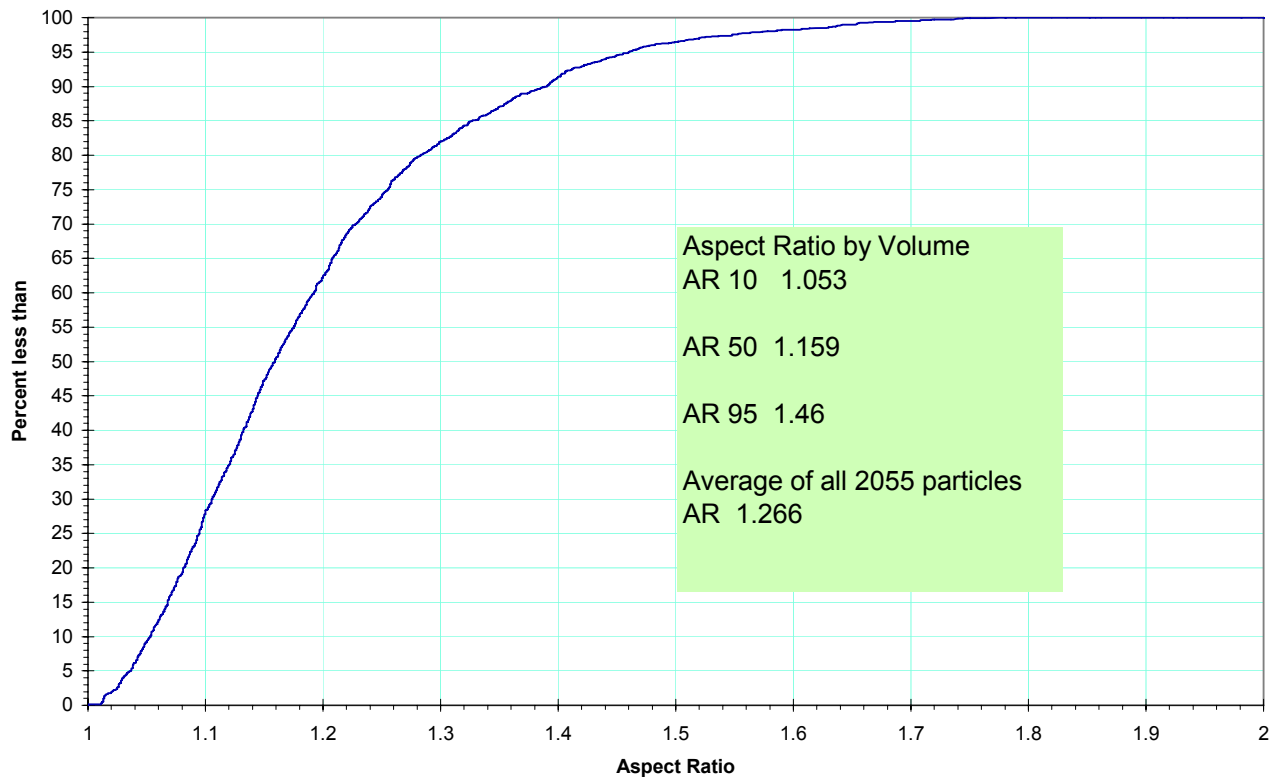


Figure 10, Aspect Ratio distribution Results, SAM-1

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.

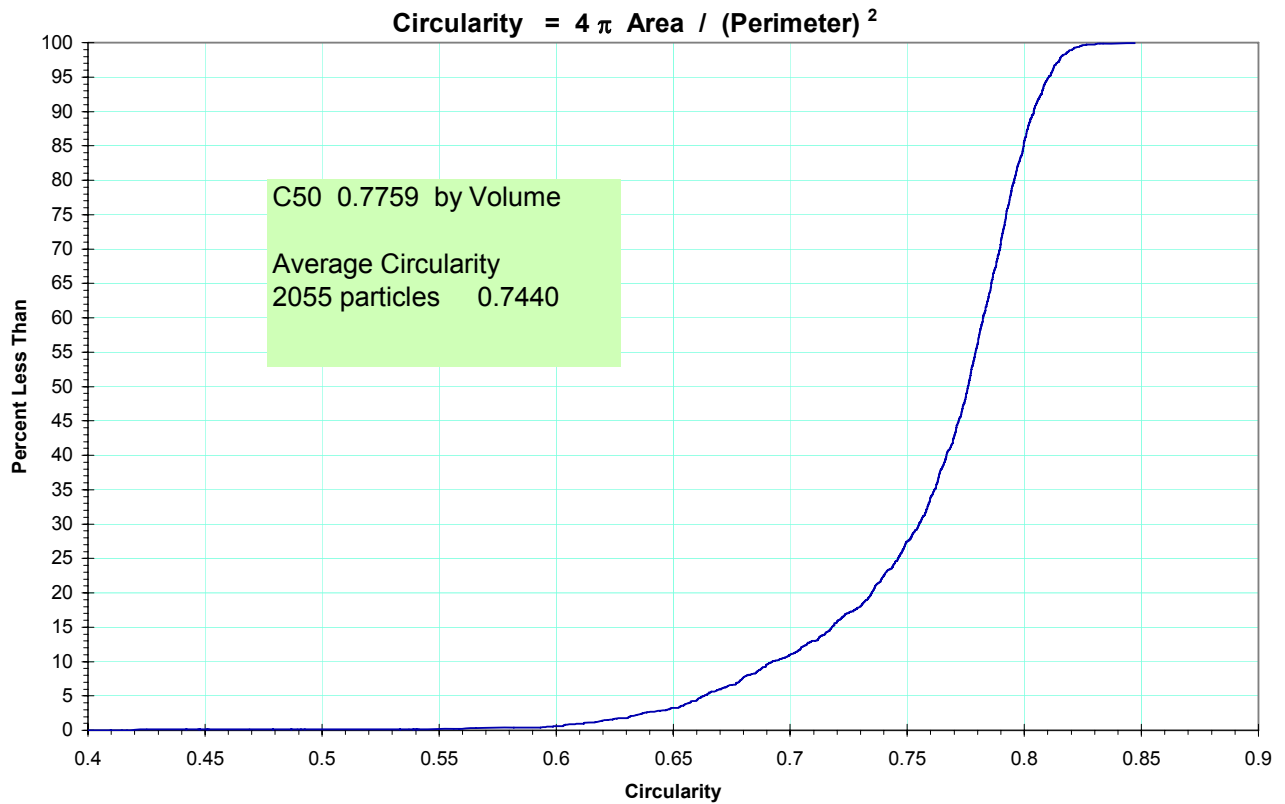


Figure 11, Circularity distribution Results, SAM-1

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.

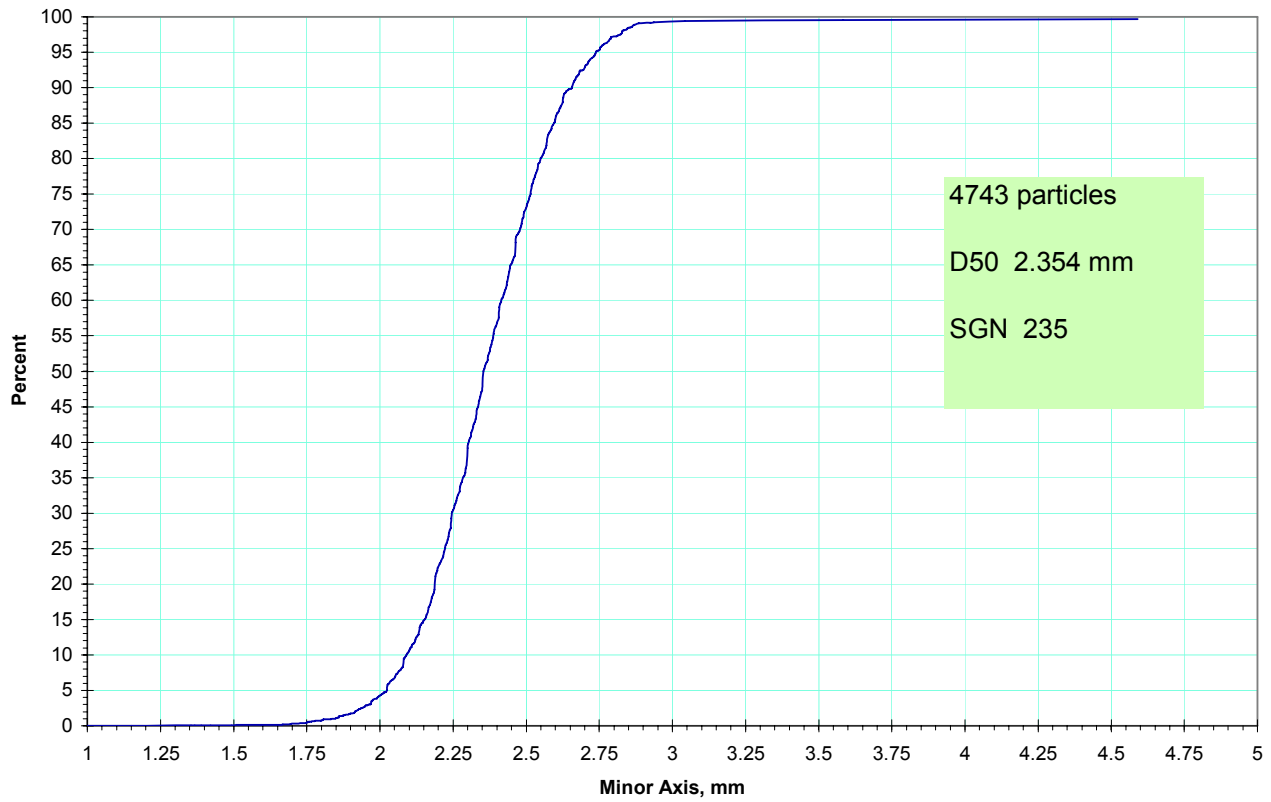


Figure 12, Volume Based Size distribution Results, SAM-2

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.

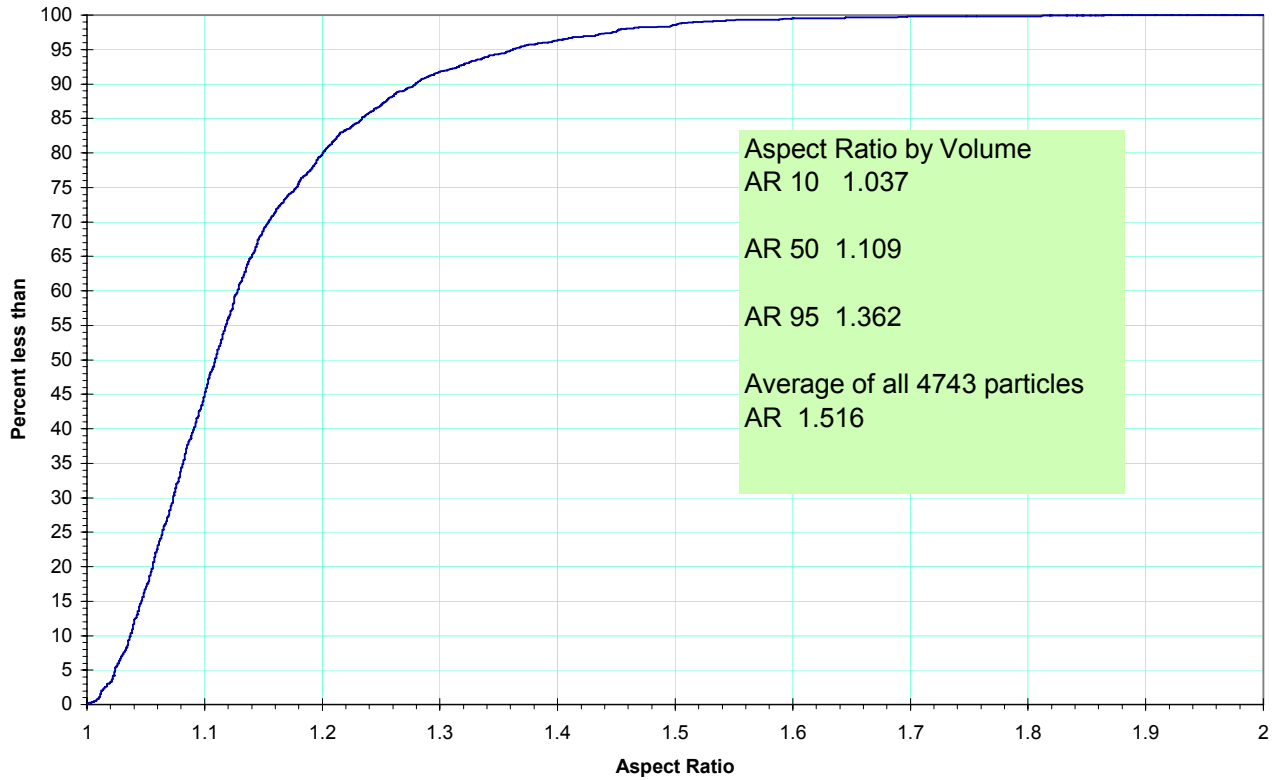


Figure 13, Aspect Ratio distribution Results, SAM-2

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.

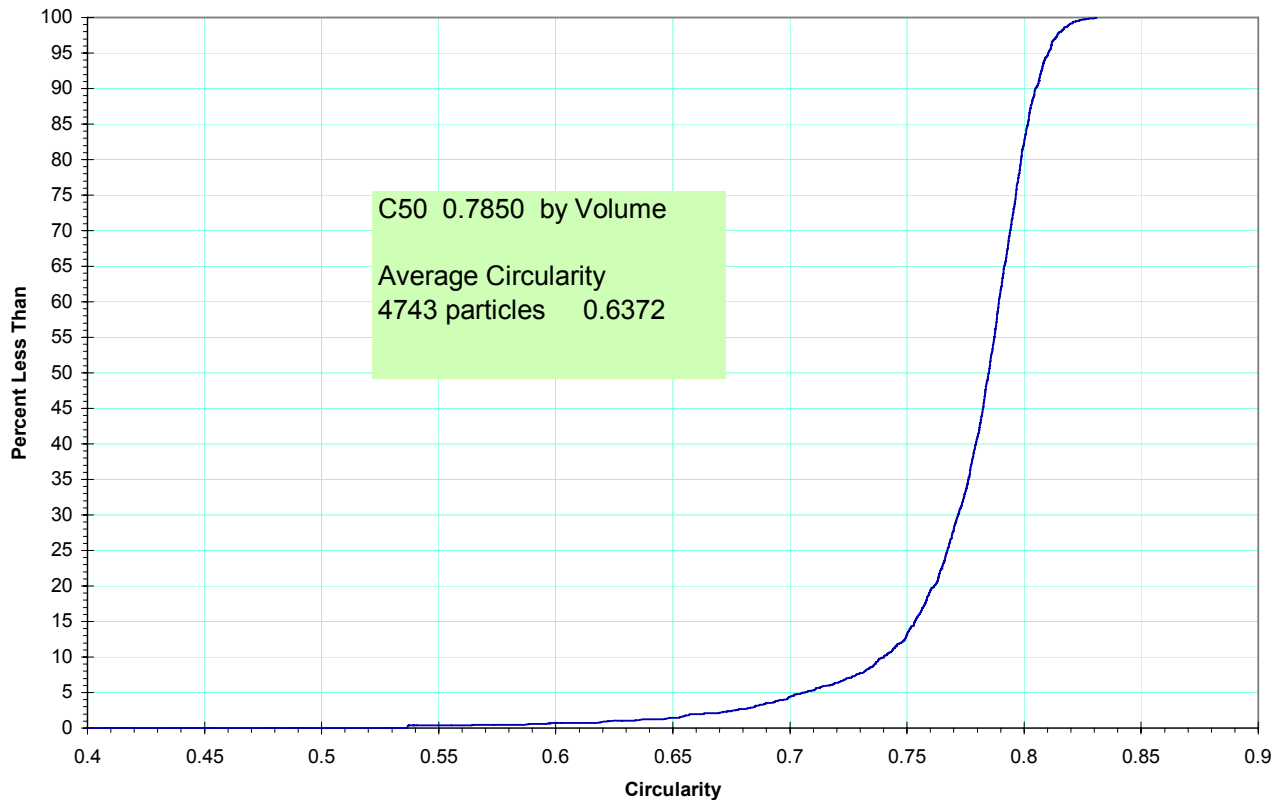


Figure 14, Circularity distribution Results, SAM-2

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.

Discussion:

SHAPE CHARACTERIZATION – Some particle processors and manufacturers need to characterize the particle shape after dividing the whole sample into a number of bins by size. There are varying specification limits for shape of particles in each size range. This more complex characterization output can be developed from the CantyVision measurement data and simply needs a Sort by Size function to group the particles to the desired bins before the shape calculation is done for each size bin. An Excel template could be developed if this level of shape characterization is needed.

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 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.

