



FOCUSING ON THE ESSENTIALS OF DYNAMIC IMAGE ANALYSIS WITH THE CAMSIZER S1

Context

Redefining routine measurement of bulk solids, the Microtrac CAMSIZER S1 is a compact and robust laboratory device that delivers high-resolution images for reliable quality control. This instrument is ideal for fast and accurate particle size and shape analysis of bulk solids ranging from 30 μm to 5 mm, catering to a variety of materials from many different industries. It is a particularly easy-to-use entry-level model for digital image analysis that delivers excellent results for many standard applications.

With its focus on the essentials of dynamic image analysis, the CAMSIZER S1 is purpose-built for basic quality control applications. This streamlined focus results in a system that is not only more efficient but also easier to use. Users can expect a seamless experience, from sample preparation through to final analysis, making the CAMSIZER S1 the most efficient choice for laboratories and production facilities seeking to enhance their quality control processes without the complexity of more advanced systems. The instrument excels in terms of repeatability and is especially suitable to replace traditional sieve analysis. Simultaneously it delivers basic particle shape information. In this article we will present a variety of application examples illustrating the capabilities of the CAMSIZER S1, focusing on repeatability and correlation to traditional sieve analysis. Finally, we will illustrate the differences between CAMSIZER 3D and CAMSIZER S1, two devices that look almost identical from the outside, but are suitable for different applications and levels of complexity. While the CAMSIZER S1 is a cost-effective entry-level device with a focus on quality control of standard applications, the CAMSIZER 3D is designed more for sophisticated shape analysis and applications in research and development.

Key Features of the CAMSIZER S1

- **High-Quality Imaging:** Equipped with a 12 Megapixel camera for detailed particle analysis.
- **Broad Particle Size Range:** Capable of analyzing particle sizes from 30 microns to 5 millimeters.
- **Fast Measurement:** High-speed analysis with a large field of view, providing results in just 2-5 minutes.
- **High Sample Throughput:** Achieve up to 30 measurements per hour thanks to quick operation and easy sample preparation.
- **Automated Measurements:** Standardized measurement routines ensure consistent quality control.
- **Highest Resolution:** Precise results with detailed images.
- **Ease of Use:** Simple connectivity with just two USB ports required; no dedicated PC or cumbersome hardware installation needed.
- **Efficiency:** Designed for standard requirements in the bulk solids laboratory without compromising on performance.
- **Over 25 Years of Expertise:** Microtrac's legacy of competence and innovation in dynamic image analysis.



Fig.1: CAMSIZER S1 (left) and CAMSIZER 3D (right). Hard to distinguish from the outside.

Sand Sample: Repeatability Test

Sand is one of the most important standard applications for dynamic image analysis. With a nominal size of 63 μm to 2000 μm , sand is exactly within the measuring range of the CAMSIZER S1. Both broad distributions and closely sieved fractions can be easily analyzed with the CAMSIZER S1 within a very short time, whereby the results are compatible with those of sieve analysis. Our measurement examples show 5 repeat measurements of a broadly distributed sand sample, including the expected range of sieving results for this product.

Sand is used in many industries, e.g. as a building material, as a filter material, as molding sand in foundries, or as an abrasive. Certain sizes and shapes of sand are particularly suitable for each application.

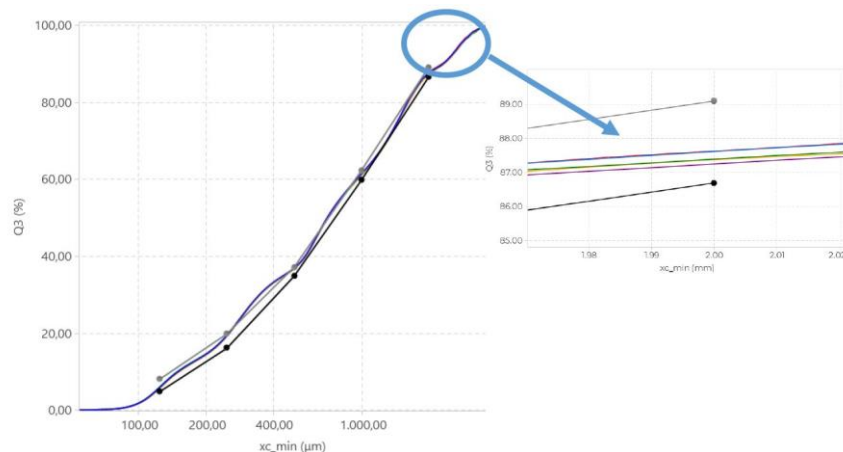


Fig. 2: Comparison of the five CAMSIZER S1 results of a mixed sand sample.

The results overlay perfectly. The grey and black reference curves indicate the expected sieve results. Note the perfect repeatability, even for coarse particles at 2 mm.

	Run 1	Run 2	Run 3	Run4	Run 5	Sieve min	Sive max
Q₃ (125 µm) [%]	6.06	5.89	6.00	5.96	5.92	5.00	8.1
Q₃ (250 µm) [%]	19.42	19.43	19.51	19.25	19.44	16.3	19.9
Q₃ (500 µm) [%]	36.69	36.88	36.85	36.75	36.91	35.0	37.2
Q₃ (1000 µm) [%]	60.95	60.30	61.21	61.13	61.45	59.9	62.3
Q₃ (2000 µm) [%]	87.38	87.63	87.40	87.26	87.62	86.7	89.1

Fertilizer

Fertilizer is one of the main applications for Dynamic Image Analysis. The biggest advantage is the fast measurement and high sample throughput, which means that fluctuations in product quality can be detected early, and the process can be adjusted immediately. This reduces the production of rejects and offers real cost savings. A well-adjusted image analysis system provides the complete size and shape distribution of a fertilizer sample within 2 minutes.

The fertilizer granulate in the measurement example was analyzed 5 times with the CAMSIZER S1. As expected, the results are an excellent match for analytical sieving. Note that the results are excellent even though the sample is at the upper end of the measuring range of the CAMSIZER S1. This sample represents the maximum size of standard fertilizer granules, so the CAMSIZER S1 can fully meet this requirement.

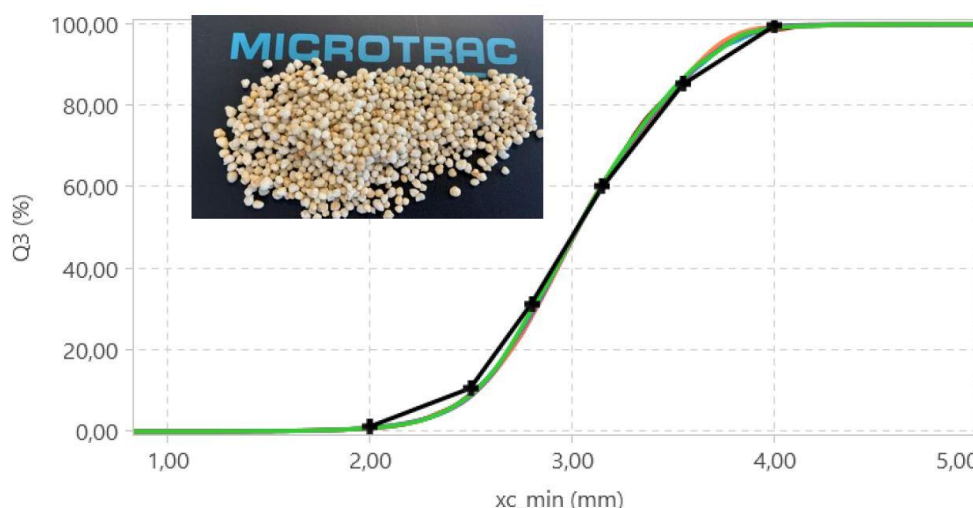


Fig.3: The coarse fertilizer granulates (photo) with a size range from 2-4 mm are a perfect application for the CAMSIZER S1. Five consecutive measurements and sieve analysis result in black.

	Run 1	Run 2	Run 3	Run4	Run 5	Sieve
Q₃ (2.00 mm) [%]	0.97	0.84	0.88	0.94	0.90	1.20
Q₃ (2.50 mm) [%]	8.91	9.15	8.70	8.62	9.04	10.70
Q₃ (2.80 mm) [%]	28.94	28.15	28.00	28.47	29.54	31.30
Q₃ (3.15 mm) [%]	60.11	60.55	60.56	59.98	60.48	60.00
Q₃ (3.55 mm) [%]	86.49	86.44	86.37	86.10	86.63	85.30
Q₃ (4.00 mm) [%]	99.25	98.73	99.35	99.45	99.12	99.60

Aggregates (Crushed Rock)

The CAMSIZER S1 can also be used for rapid quality control when analyzing aggregates. The device's ability to measure both broadly and narrowly distributed samples with excellent agreement for sieve analysis is impressive. The example shows two samples of crushed rock, one with a size range of 63 μm - 4 mm and one with a narrow grain size range of 710 μm - 1.25 mm.

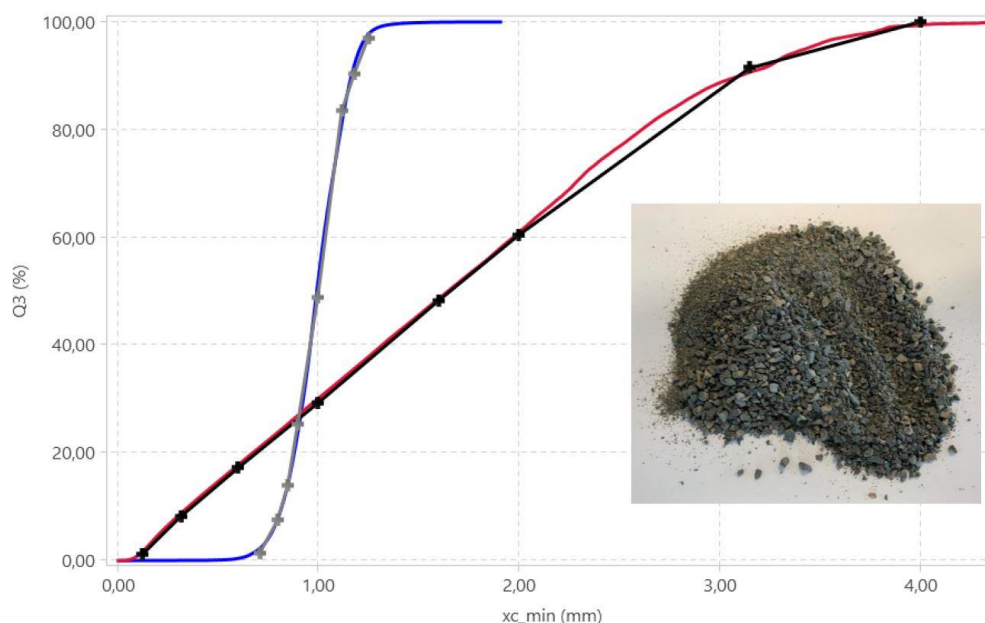


Fig.4: Aggregates sample, wide distribution (red) and narrow distribution, together with the corresponding sieve results (black / grey).

Narrow Sample			Broad Sample		
Size X [mm]	CAMSIZER Q3 (X) [%]	Sieve Q3 (X) [%]	Size X [mm]	CAMSIZER Q3 (X) [%]	Sieve Q3 (X) [%]
0.710	1.98	1.30	0.125	1.60	1.10
0.800	7.65	7.50	0.315	8.65	8.10
0.850	13.94	13.80	0.600	17.65	17.10
0.900	24.09	25.30	1.000	30.02	29.20
1.000	50.31	48.80	1.600	48.53	48.20
1.120	82.22	83.50	2.000	60.85	60.40
1.180	91.19	90.20	3.150	90.65	91.40
1.250	97.62	96.90	4.000	99.70	100

Sugar

Another important application for particle size analysis is sugar. Depending on further use, different size distributions must be produced, e.g. for beverages, baking mixes, confectionery, or household sugar. The CAMSIZER S1 is suitable for the rapid characterization of sugar, which is particularly advantageous during the beet harvest, when a lot of material is produced, as the time-consuming sieve analysis is no longer necessary.

The measurement example shows five measurements of a common sugar sample and the corresponding sieve analysis. Of course, all other free-flowing bulk materials, such as salts, can be measured just as well with the CAMSIZER S1.

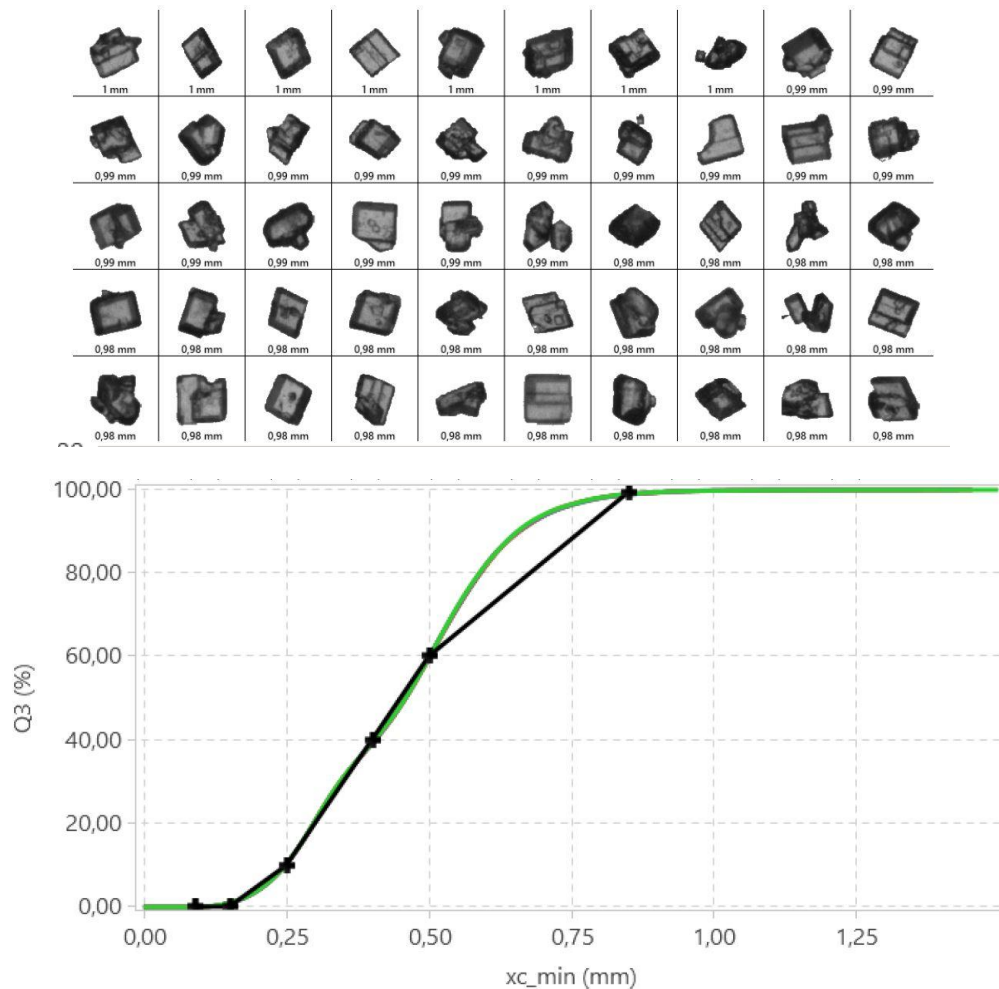


Fig.5: Comparison of the five CAMSIZER S1 results of a household sugar sample.

The results overlay perfectly. The black reference curve represents the sieve result. Note the perfect result quality, even for fine particles at 90 μm . The image analysis shows that the largest sugar crystals are 1 mm.

	Run 1	Run 2	Run 3	Run4	Run 5	Sieve
Q_3 (90 μm) [%]	0.03	0.04	0.04	0.04	0.04	0.10
Q_3 (150 μm) [%]	0.92	0.96	0.97	0.96	1.01	0.50
Q_3 (250 μm) [%]	10.22	10.20	10.28	10.27	10.33	10.00
Q_3 (400 μm) [%]	39.12	39.05	39.13	39.11	39.35	40.00
Q_3 (500 μm) [%]	59.68	59.53	59.42	59.64	59.69	60.10
Q_3 (850 μm) [%]	98.91	98.95	98.97	98.86	99.05	99.40

CAMSIZER S1 and CAMSIZER 3D

While both systems provide high-quality particle analysis, the choice between CAMSIZER S1 and CAMSIZER 3D depends on the specific needs of the user. The CAMSIZER S1 is ideal for laboratories requiring detailed particle analysis with efficient throughput, ease of use, and reliable sieve correlation. The CAMSIZER 3D does this just as well, but thanks to the use of 2 cameras over a wider measuring range from 20 μm to 30 mm.

Furthermore, the CAMSIZER 3D is suited for applications demanding comprehensive 3D shape analysis, and advanced image analysis features. The CAMSIZER 3D's unique 3D particle tracking technology offers a more in-depth and meaningful analysis of particle shapes and sizes, making it the first choice for advanced research and quality control in the characterization of dry, free-flowing bulk solids. The table shows an overview of the features and capabilities of the two measuring systems. The chart shows the comparison of CAMSIZER 3D and S1 results for a mixture of eight different sizes of glass beads.

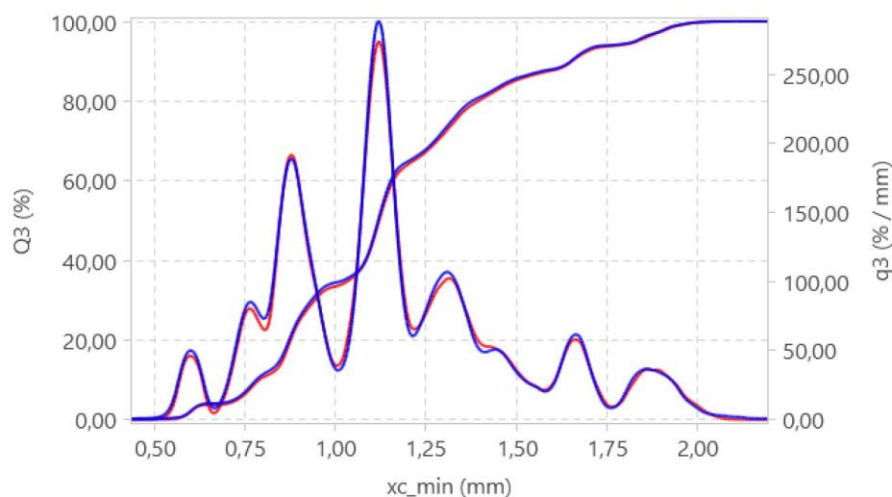


Fig.5: Comparison of the CAMSIZER S1 (blue) and CAMSIZER 3D (red) results of mixture of eight different sizes of glass beads. Within their specified size range, the two instruments deliver the same results.

Feature	CAMSIZER 3D	CAMSIZER S1
Dynamic Image Analysis acc. ISO 1322-2	YES	YES
Dual Camera Technology	YES	NO
Number of Cameras	2	1
Resolution	14 MPx (5 MPx + 9 MPx)	12.5 MPx
Size Range	20 μm - 30 mm	30 μm - 5 mm (recommended: 50 μm - 4.5 mm)
Measurement Time	2-5 minutes	2-5 minutes
Throughput	up to 30 samples / hour	up to 30 samples / hour
PC Requirements	Powerful Windows PC with special configuration	Windows Laptop or PC with 2 USB ports
Automatic Funnel Adjustment	YES	YES
Vacuum	YES	YES
AutoSampler	Optional	Optional
2D Analysis	YES	YES
3D Analysis	YES	NO
Size Definitions	All size characteristics	Basic 2D width, length, circle equivalent diameter
Shape definitions	Advanced 2D and 3D shape parameters	Basic 2D shape parameters
Automatic test of product specs	YES	YES
Single particle evaluation with "Particle Viewer"	YES	Optional
Recalculation of Results	YES	Optional
21CFR part 11	Optional	Optional
IQ-OQ-PQ Documentation	Optional	Optional
Volume based size & shape distribution	YES	YES
Area based size and shape distribution	YES	NO
Number based size & shape distribution	YES	YES