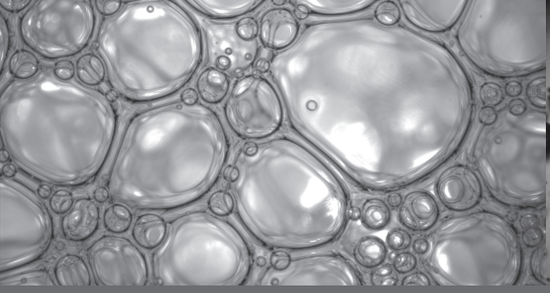
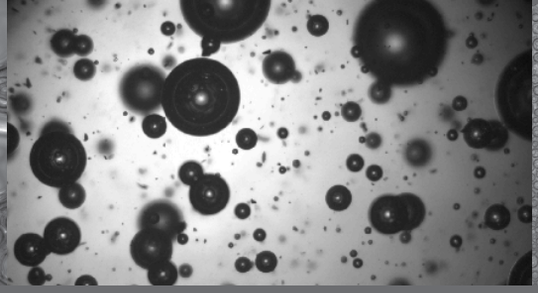
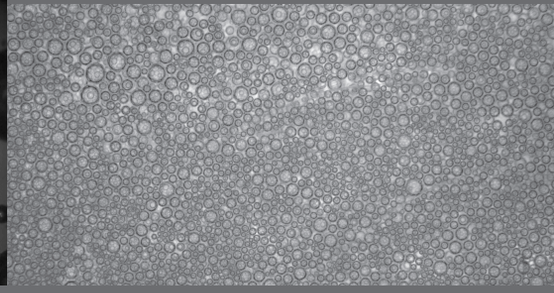




Pixact Bubble Monitoring

The Pixact Bubble Monitoring (PBM) technology is designed for the online analysis of bubble suspensions and foams in industrial processes.

The technology combines direct optical imaging with advanced image analysis techniques. As a result, the system provides a live camera view of the process and detailed measurement data on bubble characteristics, such as size distribution and concentration.

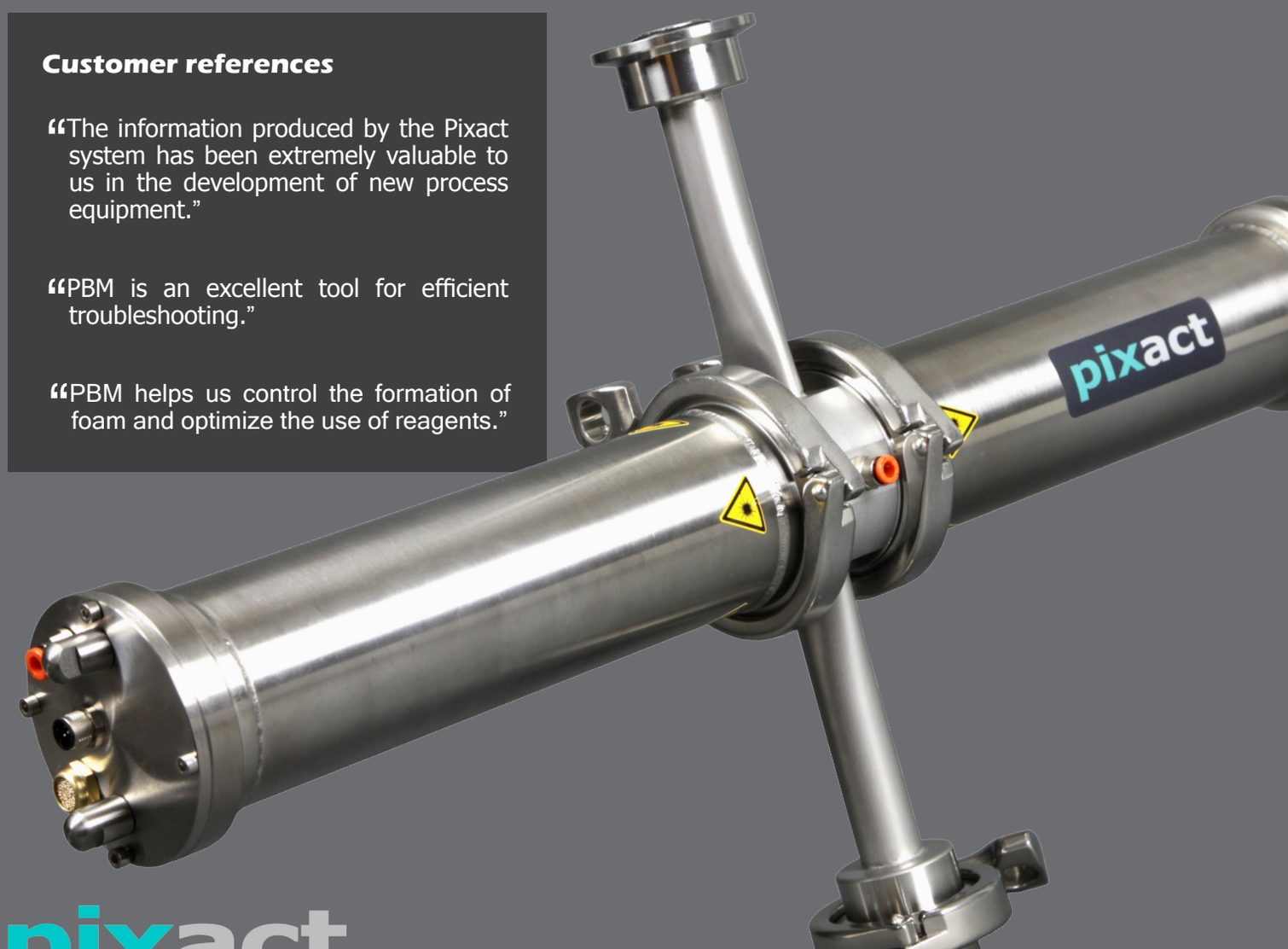
Two configuration options are available: the Pixcell flow-through cuvette for installation on process lines and dedicated sampling lines and the Pixscope probe for installation on reactors and tanks.

Customer references

"The information produced by the Pixact system has been extremely valuable to us in the development of new process equipment."

"PBM is an excellent tool for efficient troubleshooting."

"PBM helps us control the formation of foam and optimize the use of reagents."



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Results

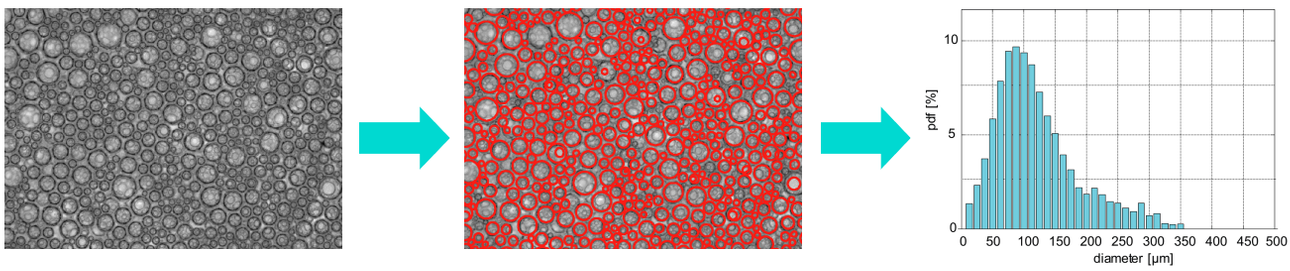
The PBM technology can be used for measuring both foams with high air content and bubble suspensions with lower air content.

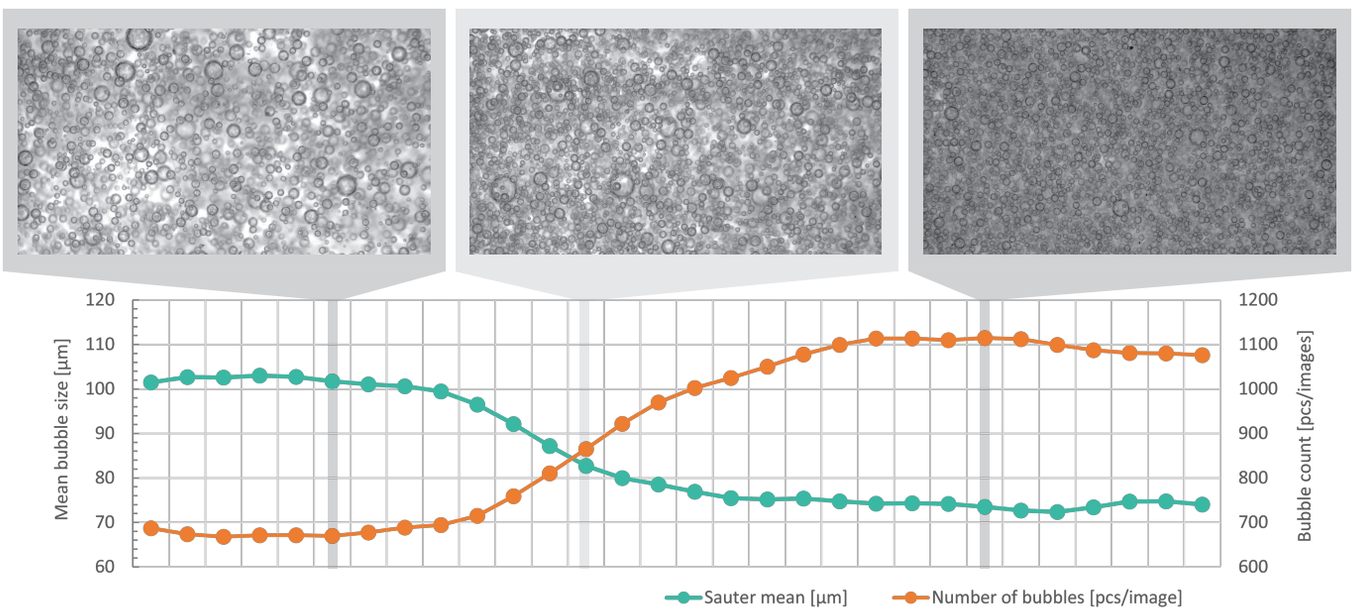
The foundation of PBM is optical imaging. The live camera view of the bubble suspension provides you with valuable visual information on your process.

Proprietary image analysis algorithms convert the image data into numerical results enabling real-time process diagnostics.

Measurement results produced by PBM include:

- Bubble size distribution and related statistics, such as arithmetic, Sauter and volumetric mean diameters and percentiles of size distribution (D10, D50, D90, etc.)
- Bubble count
- Bubble concentration
- Bubble flow velocity





Benefits

The measurement information on the size of the bubbles and suspension homogeneity helps you to optimize, control and troubleshoot your process. With PBM you can increase the yield and efficiency of your process and minimize quality variations in the final product.

For the operator, PBM provides tools for

- Visual examination of the process with a live camera view (featuring zoom, pause, etc.)
- Accurate process control and detection of disturbances on the basis of real-time statistics on suspension characteristics
- Documenting and reporting process states and changes with reports including complete statistics and example images

To increase productivity and promote Best Practice methods, PBM can be used for

- Benchmarking individual reactors, recipes and control schemes
- Comparing plants with each other
- Collecting a production database to help with troubleshooting in case of disturbances

In R&D, PBM supports

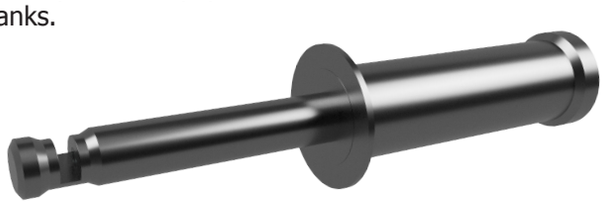
- Lab-scale work by providing new insights into process dynamics and related physical phenomena
- Scale-up work by using the same measurement equipment from the laboratory to the mill

PBM measurement hardware and software

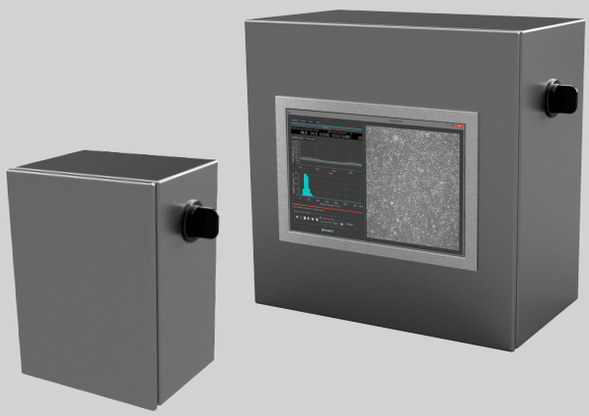
The PBM hardware consists of either a Pixcell cuvette or a Pixscope probe and a Pixstation main unit.

The Pixcell flow-through cuvette is ideal for installation on process lines and dedicated sampling lines.

The Pixscope probe can be fitted into both laboratory scale process equipment and mill scale reactors and tanks.

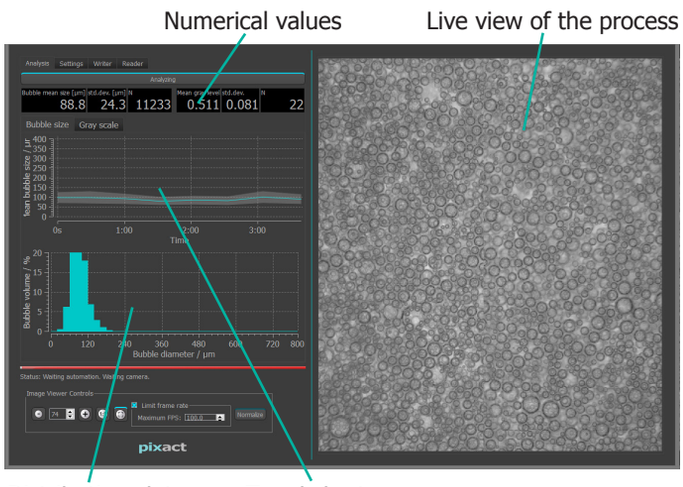


The Pixstation main unit includes a computational unit and an automation gateway. The main unit can be customized with optional features, such as a monitor for local operation or a complete selection of automation interfaces.



The PBM software is an all-in-one tool for analyzing and reporting measurement data.

The PBM software controls the measurement procedure from data acquisition to the reporting of results. You can use it as both a fully automated online measurement software or an effective R&D tool with access to all necessary settings as well as manually controlled data acquisition and analysis.



Key features of the software

User-friendly adjustment of imaging parameters

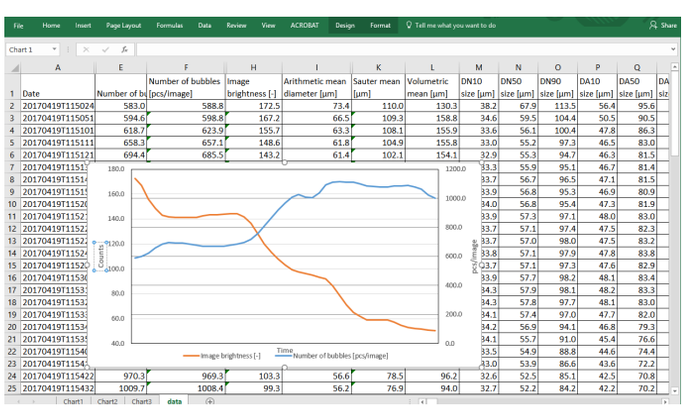
- Automatic camera controls
- Adjustable image refresh frequency
- Zoom and pause of the live view

Powerful analysis algorithms

- High-performance image analysis techniques that convert the image stream into real-time quantitative information
- Customized image analysis features on request

Flexible reporting tools

- Image data can be stored on an internal or external hard drive
- Internal database for the measurement results
- Results exported in Microsoft Excel® or CSV format



Date	Number of bubbles [pcs/image]	Image brightness [-]	Arithmetic mean diameter [µm]	Sauter mean [µm]	Volumetric mean [µm]	DN10 size [µm]	DN50 size [µm]	DN90 size [µm]	DA10 size [µm]	DA50 size [µm]
20170419T115024	588.8	172.5	73.4	110.0	130.3	38.2	67.9	113.5	56.4	95.6
20170419T115051	598.8	167.2	66.5	109.3	158.8	34.6	59.5	104.4	50.5	90.5
20170419T115101	623.9	155.7	63.3	108.1	155.9	33.6	56.1	100.4	47.8	86.3
20170419T115111	657.1	148.6	61.8	104.9	155.8	33.0	55.2	97.3	46.5	83.0
20170419T115121	685.5	143.2	61.4	102.1	154.1	32.9	55.3	94.7	46.3	81.5
20170419T1151						33.3	55.9	95.1	46.7	81.4
20170419T1151						33.7	56.7	96.5	47.1	81.5
20170419T1151						33.9	56.8	95.3	46.9	80.9
20170419T1152						34.0	56.8	95.4	47.3	81.9
20170419T1152						33.9	57.3	97.1	48.0	83.0
20170419T1152						33.7	57.1	97.4	47.5	82.3
20170419T1152						33.7	57.0	98.0	47.5	83.2
20170419T1152						33.8	57.1	97.9	47.8	83.8
20170419T1152						33.7	57.1	97.3	47.6	82.9
20170419T1153						33.9	57.7	98.2	48.1	83.4
20170419T1153						34.3	57.9	98.1	48.2	83.3
20170419T1153						34.3	57.8	97.7	48.1	83.0
20170419T1153						34.1	57.4	97.0	47.7	82.0
20170419T1153						34.2	56.9	94.1	46.8	79.3
20170419T1153						34.1	55.7	91.0	45.4	76.6
20170419T1154						33.5	54.9	88.8	44.6	74.4
20170419T1154						33.0	53.9	86.6	43.6	72.2
20170419T115422	969.3	103.3	56.6	78.5	96.2	32.6	52.5	85.1	42.5	70.8
20170419T115432	1008.4	99.3	56.2	76.9	94.0	32.7	52.2	84.2	42.2	70.2

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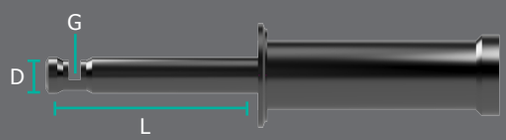
Technical specification

System description	Online mesurement system for the real-time analysis of bubble suspensions and foams		
Measurement principle	Direct optical imaging of the suspension combined with image analysis		
Config. options	Flow-through cuvette or probe		
Optical config. opt.	M=0.33	M=1	M=2
Image area [mm]	25.5 x 21.0	8.5 x 7.0	4.3 x 3.5
Image resolution	10.5µm/pix	3.5µm/pix	1.7µm/pix
Measurement range	from1.7µm	from1.7µm	from1.7µm
Power supply	All system components 24VDC, power supply unit 230VAC/50Hz		
Automation input / output	Profibus, Modbus, Analog (mA, V), Digital (5-24VDC)		
Protection	IP67, ATEX on request		
Operating temperature	Cuvette and probe: -20C to +120C Housing: -20C to +85C (cooling avail.)		
Operating pressure	Max. 30 bar, higher pressure on		
request Materials			
Cuvette and probe head	Stainless steel AISI316L (other materials on request)		
Optical windows	Sapphire or borosilicate		
Sealing options	NBR, PTFE, FPM, EPDM, silicone		

Pixcell flow-through cuvette	
Installation	Process or sampling lines
Standard models Flow inlet/outlet: • DN10 (3/8") • DN15 (1/2") • DN25 (1") • DN50 (2") Custom sizes available on request	
Options • Automatic washing cycle	
Pixscope probe	
Installation	Reactors, tanks and other equipment using DN25 or larger fittings
	
Probe dimensions	
Diameter (D)	Min. 19mm, standard 24mm
Length (L)	Max. 300mm, standard 100mm
Measurem. gap (G)	1-20mm (fixed, not adjustable)

Our services

We support our customers from the evaluation of the new measurement technology to the roll-out in mill scale. Our services help you to utilize new measurement data and reach your productivity and quality targets faster.

Our services include

- Measurement services in the customer's laboratory, pilot facilities or mill scale process
- Online measurement campaigns in pilot and mill scale
- Equipment rental
- Installation and commissioning of complete systems

We also provide comprehensive support and maintenance services for the Pixact measurement systems. The scope of the service can be adjusted to your needs.

Our support and maintenance services include

- Remote connection to the measurement system for support, system diagnostics and software updates
- Service visits to the site (regular or on-demand)
- Hardware maintenance program supporting the continuous operation of the system
- Training for the users of the system
- Further development of the software or hardware

More information

For more information on the PBM technology scan the QR code with your mobile device or visit pixact.fi/bubbles.

Interested in utilizing the Pixact measurement technology in another type of application? Read more about our solutions at pixact.fi/solutions or contact us directly.

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