Mission & Vision

Better Particles with Best Instruments

1 nm to 10.000 µm

Sympatec makes a prominent contribution to the control of quality and production and the development of particulate systems of sustainable applications with innovative particle size analysis technologies

HST: M16 – Eagle Nebula

„Better Particles“ means

★ **Better** understanding of ...

... the behaviour of **Particles …**

★ ... the message and meaning of a **Particle-Size-Distribution (PSD)**

			Beg.	Adv.	Exp.	Pro.
☆	Mean diameter	x_{50}	✓			
☆	Finest particle	x_{min}	✓			
☆	Coarsest particle	x_{max}	✓			
☆	Specific surface	S_V, S_M		✓		
☆	Cumulative distribution	$Q_r(x)$		✓		
☆	Density distribution	$q_r(X)$			✓	
☆	Fine & coarse tail				✓	
☆	Statistic coefficients	$M_{k,r}$				✓

„Better Particles“

★ … the information about **Particle Shape**

☆ Shape factor definitions	Ψ	✓			
☆ Application fields		✓			
☆ Shape distributions	$Q(\Psi)$		✓		
☆ Size dependent diagrams	$\Psi(x)$		✓		
☆ Usage of shape filters			✓		
☆ Type of distributions	$Q_r(\Psi)$			✓	
☆ Out-of-focus particles				✓	
☆ Separation calculations					✓
		Beg.	**Adv.**	**Exp.**	**Pro.**

★ … the correlation with **Particle Stability**

„Better Particles“

★ ... the importance of Particles
and their description with PSD to characterise

properties and attributes of particulate matter:

☆ **Powders**	✳ Abrasion	✳ Colour
☆ **Suspensions**	✳ Absorption	✳ Combustibility
☆ **Aerosols**	✳ Agglomeration	✳ Compressibility
☆ **Sprays**	✳ Bulk density	✳ Consolidation
☆ **Emulsions**	✳ Classifiability	✳ Conveyability
☆ **Gels**	✳ Coarseness	✳ Crushability
☆ **Bubbles**	✳ Cohesiveness	✳ Crystallisation

„Better Particles“

... more properties and attributes of particulate matter

- Degree of Dispersion
- Deposition
- Diffraction
- Dispersibility
- Dissolubility
- Explosion Hazard
- Extinction
- Filling Capacity
- Fineness
- Flammability
- Floatability
- Flowability
- Fluidisation
- Formation
- Friability
- Fume
- Grade Efficiency
- Grading
- Granulation
- Grindability
- Handling
- Homogeneity
- Mesh Number
- Milling Progress
- Miscibility
- Nozzle Jet
- Oversize
- Packing
- Permeability
- Polydispersity
- Porosity
- Reactivity
- Reduction ratio
- Refinement
- Screenability
- Sedimentation
- Separation
- Settlement
- Shear-Strength
- Soil Mechanics
- Solubility
- Sortability
- Sphericity
- Spray Dryability
- Surface Area
- Trickling Capability
- Turbidity
- Undersize
- Wear strength
- .....

Particle Attributes

Properties of single Particles presented in…

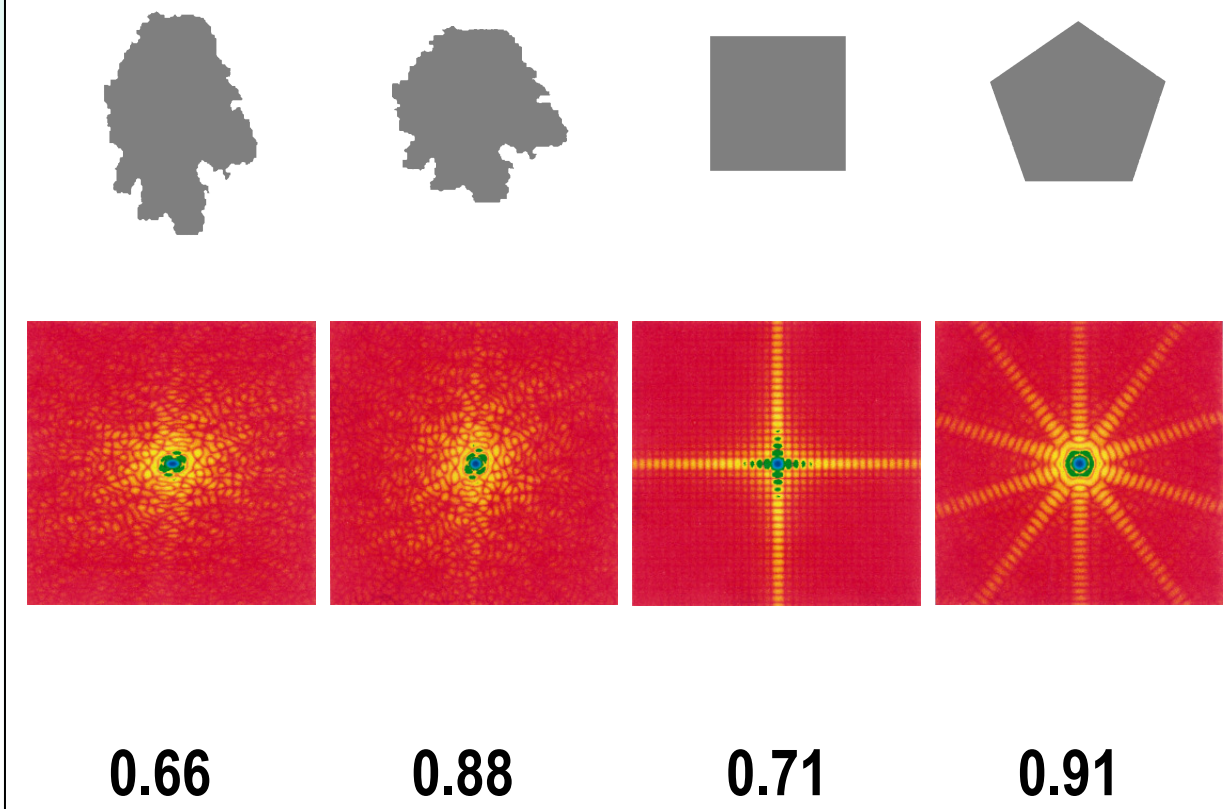
★ 2D-Projection

with reference to the…

★ Attribute “Diffraction”

and / or…

★ Aspect ratio



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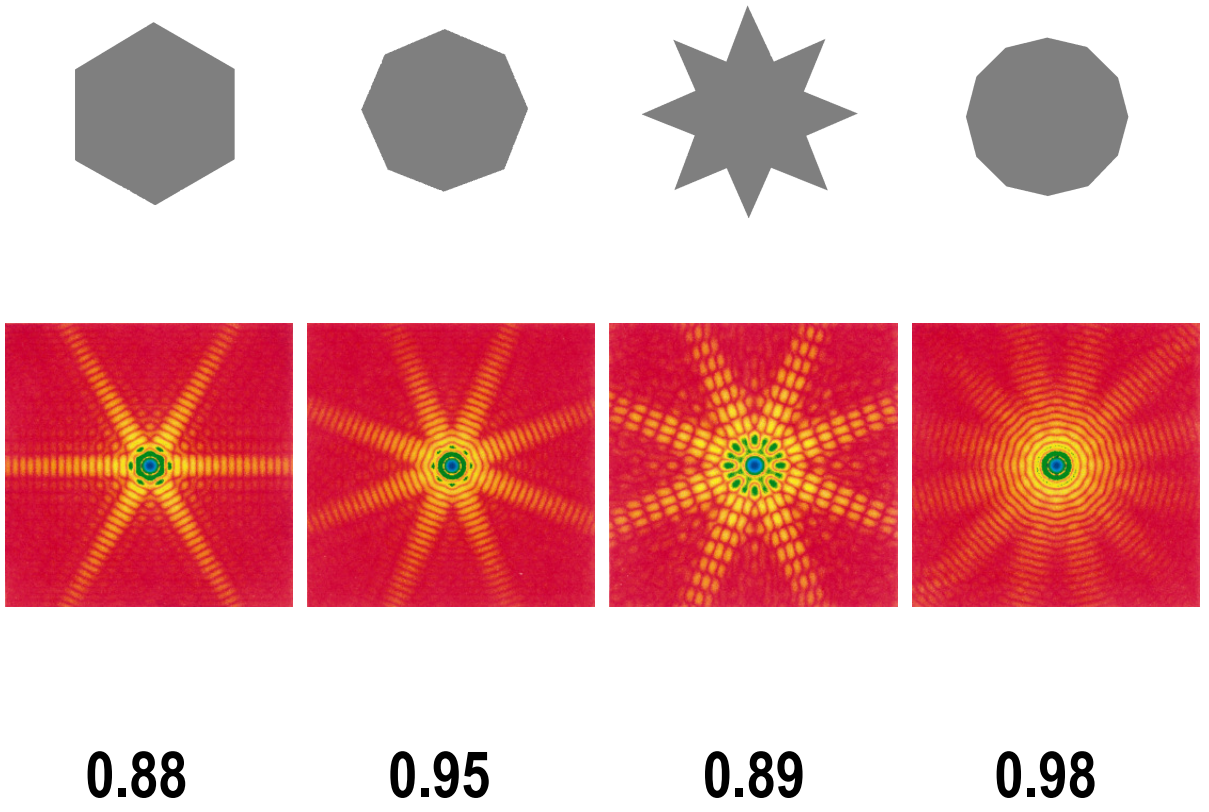

Sympatec Company Profile
SYsteM-PArticle-TEChnology

★	**Foundation**	**1984**	**Germany, Clausthal & Remlingen**
★	**Headquarter**	**2004**	**Pulverhaus, Clausthal**
★	**Subsidiaries**		**Basel (CH), Etten-Leur (NL), Paris (FR), Bury (UK), Stockholm (SE), Seoul (KR), Princeton (USA), Shanghai (CN), Teheran (IR)**
★	**Technology & Know-How**		**Powder Technology Departments TU Clausthal & University of Karlsruhe (TH) & Fraunhofer Institute Bremen**
★	**Awards**	**1985**	**RODOS dry dispersing technology** TT-Award, IHK-Braunschweig
		1986	**On-line particle size analysis** TT-Award, Federal Ministry of Science&Arts
		1992	**Opus Ultrasonic Extinction** Arnold-Euken-Award, GVC Düsseldorf
		2005	**System-Partikel-Technik** Honorary Doctorate-Award, TU Clausthal
★	**References**	**2006**	**more than 2000 installations**

★ **Mission**	**Better Particles**
★ **Vision**	**with Best Instruments** **from 1 nm to 10000 µm (Size-Range)**
★ **Strategy**	**Hidden Champion**
★ **Identity**	**Competence in Technology & Markets**
☆ Success positions	✳ **Laser Diffraction (LD) for dry powders from 0.1 µm** **- unique range: 0.1 µm – 8750 µm** ✳ **Development of dispersing systems** ✳ **Ultrasonic Extinction (UE): 0.01 µm – 3000 µm** ✳ **Image Analysis (IA): 1 µm - 20000 µm** ✳ **Photon Cross Correlation Spectroscopy: 1 nm – 10 µm** ✳ **off-, at-. on- & in-line in top down design**
☆ Innovation	**adaptation of sensors to the products to be analysed**
☆ Manufacturing	✳ **Lean production** ✳ **System integration** ✳ **High-tech-Instruments**
☆ Sales Force & Service in Industrial World	✳ **Direct sales & service** ✳ **Distributors** ✳ **Agencies**
★ **Employees**	**about 100 (2005)**

Technical Milestones (1)

1984	**RODOS**	adaptation of laser diffraction for dry powder analysis finer than 0.1 µm, with patented two-stage dispersing system
	HELOS	highly accurate sensor for auto-aligned 31 classes, combined with parameter-free Phillips-Twomey solution
1985	**QX**	programme package for universal processing of particle size distributions (psd)
1986	**ROPRON**	patented sample-coupler with two stage in-stream sample splitter (dry processes)
1987	**SUBMICRON**	pioneering application of Fraunhofer diffraction from 0.1 µm, with 11 points measured below 1 µm
1988	**REMO/PARA**	software modules for comparison of different psa-methods, for example, laser diffraction with sieve analysis
1989	**auto-RODOS**	automatic versions of dispersing systems, computer controlled, prepared for co-operation with robots
	auto-SUCELL	
1990	**auto-GRADIS**	
	TRIMO	dynamic trigger ignition
	SAFIR	Sampling Finger Robot (wet processes)
1991	**QT**	Quality-Time dependence monitor

Technical Milestones (2)

	SPRAY-SIZER	universal adapter for spray applications
	MAGIC	HELOS-sensor with auto-ranging
	OPUS/C	acoustic in-line psa using ultrasonic extinction, flow-through cuvette design
1992	**auto-RODOS- module**	integrated dry disperser with guaranteed long-term stability
1992	**TOPMICRON**	range extension with deflection amplifier up to 3500 µm
	MIE	evaluation mode for all complex refractive indices and absorption coefficients
1993	**auto-RODOS DSD/DTB/DRB**	automatic dry dosing modules
	GRACELL/HOTCELL SVA	specialised suspension applications for coarse and heavy particles, for heated suspensions and smallest liquid volumes
1994	**INCELL**	in-line dry measuring cell for laser diffraction
	INHALER- ADAPTER	universal adapter for dry powder inhalers
	DRYSUBMICRON	dry detection in the sub-micron range from 0.1 µm
	HRLD	high resolution laser diffraction evaluation

Technical Milestones (3)

1995	**WINDOX**	database, graphical operator interface
	Reference Material	test powders for certification of sensors and dispersing systems
	SQS & Validation	validation procedure in accordance with FDA/DIN-ISO/BS
	HELOS/F-Series	sensors with fibre optic light transmission and variable, automatic focal length adapted beam expansion
	VIBRI	universal precision feeder
1996	**MEGAMICRON**	range extension up to 8750 µm
	WINDOX/OS	sensor operation control under Windows™
	QUIXEL	automatic rapid operation suspension dispersing system (QUICK-SUCELL)
1997	**TWISTER**	representative in-line sampling for aerodispersions and suspensions
	MYTOS	in-line particle size analysis with laser diffraction and integrated dispersing device
	OPUS/F	acoustic probing in finger design
	QX/Windows	programme package for analytical evaluation of psa data and process optimisation

Technical Milestones (4)

1998	**HELOS/MAGIC**	optimisation of sensor sensitivity by automatic adaptation of measuring range
	WINDOX/NT	WINDOX software for the Windows NT™ operating system
	CUVETTE CHASSIS/SM/US	modular CUVETTE system with integral ultrasonic probe and for sub-micron ranges
	MEGAGRADIS	GRADIS optimised for cm particles
	HELOS/BF extension	BF-HELOS sensors with TOPMICRON technology up to 875 µm (R5)
	HELOS/KF extension	KF-HELOS sensors with MEGAMICRON technology up to 8750 µm (R8)
	TWIMY-Family	adaptation of in-line LD (TWISTER & MYTOS) to process and product specific requests
	OPUS/F-Pack	modular finger (probe) - design of different lengths and process – adapters
	WINDOX/OPUS	integration of OPUS/F operation control and data evaluation into WINDOX system
1999	**TWIMY-Family**	adaptation of in-line LD (R3, R5) to process and product specific requests

Technical Milestones (5)

	✰ MYTOS in-line	TWISTER 100 to 500 mm ∅
	✰ MYTOS on-line	TWISTER 100, 150, 200 mm ∅
	✰ MYTOS on-line GMP	TWISTER 150 mm ∅
	OPUS/F-Pack	modular Finger (probe) - design of different lengths and process – adapters ✰ length: 330 to 3500 mm ✰ process - adapters FT 10 – 25 DN BP 25/100 – 150/150 DN SB rack docking positioner & cleaner
2000	**HELOS**	laptop-support via USB interface
	QS	HELOS validation with IQ, OQ, PQ
	WINDOX 4.0	32-bit version of WINDOX with current user interface and extended performance
	RODOS/M	fully digital evolution of classical dry powder disperser RODOS
	VIBRI/RF	with rotary funnel allows for dosing of bulk materials, which tend to bridging
	SUCELL	LIM-Design

Technical Milestones (6)

	SPRAYER	adaptation of acknowledged SPRAY-SIZER to FDI requirements, incl. trajectory and force controlled actuators
	MYTOS&VIBRI/AMT	modular design for Polab® AMT for analysis of cement in automated labs or in process
	OPUS (G)	OPUS-fingerprobe in tempered design with improved chemical resistance, modularity in process and efficiency of service
2001	**OASIS**	dispersing system, combining RODOS /M and SUCELL/M for alternative use for dry or wet applications
	ASPIROS	encapsulated micro dosing system for use with RODOS and RODOS/M
	SUCELL/M	digital version of proven SUCELL
	INHALER	system for reception and evaluation of any kind of inhalers in modular
	KSigma	software for evaluation of extinction functions for OPUS
	NIMBUS	off-line ultrasonic extinction including calibration procedure (KSigma)
	WINDOX 4.1	"FDA rule 11" compatible
	TWIMY-Family	R2, R6 and TWISTER 600 mm Ø

Technical Milestones (7)

2002	**ASPIROS/Multi**	automated supply of sample tubes from a transport magazine including bar code reader for data transmission and functional control
	WINDOX 4.2	optimised control of dispersing systems, envelope curves and quality limit lines; French language integrated
	TWISTER 50	adaption of MYTOS & TWISTER family to small pipe diameters
2003	**NANOPHOX**	"Photon Cross Correlation Spectroscopy" 3D cross correlation for particle size and stability determination from 1 nm to 10000 nm for turbid suspensions and emulsions in high concentrations also
2004	**QICPIC**	particle size and shape analysis with image processing of highest order from 1 µm to 10.000 µm
	WINDOX 5	new structure based on Interbase™ data base server with integration of HELOS, QICPIC, OPUS, NIMBUS, NANOPHOX
2005	**Pulverhaus**	construction and move into new Sympatec premises at Clausthal-Zellerfeld, where all former operational units have been allocated under one roof
2006	**PICTOS**	on-line particle size and shape analysis