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Inline Particle Sizing for Process Control of Fluid Bed and High Shear Mixing Processes

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WACHSTUMSKERNE UNTERNEHMEN REGION
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Presentation Outline

- Terms of On-Line, In-line, At-line etc.
- Destination and Requirements
- Presentation of Particle sizing results
- PARSUM's measurement principle
- Case Study Fluid Bed Processes
- Case Study High shear granulation processes
- Conclusion

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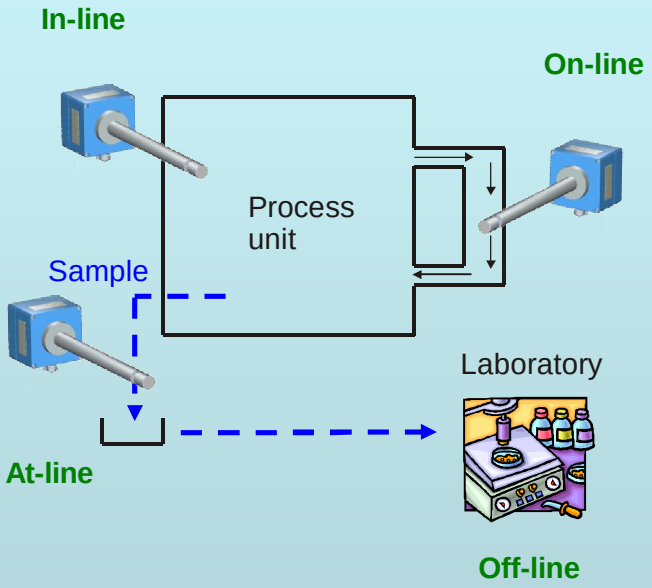
In-line Particle Size Analysis (PSD) Definition of Terms

- **On-line** – Measurement with "real time" output of the results (e.g. by continuous or quasi- continuous sampling or bypass)
- **In-line** – Measurement and analysis performed directly inside the process
- **AT-line** – Measurement of a sample near the process in production environment
- **Off-line** – All laboratory methods with sampling (analysis is separated from process in respect to time and space)



Why In-line Particle Size Analysis ?

- Monitors the particle size continuously
- Gives more representative results
- Increases efficiency and throughput.
- Gives higher quality by tighter control
- Reduces the potential product contact to operator
- Improves batch to batch consistency
- Gives better control to minimize wastage
- Reduces costs of production

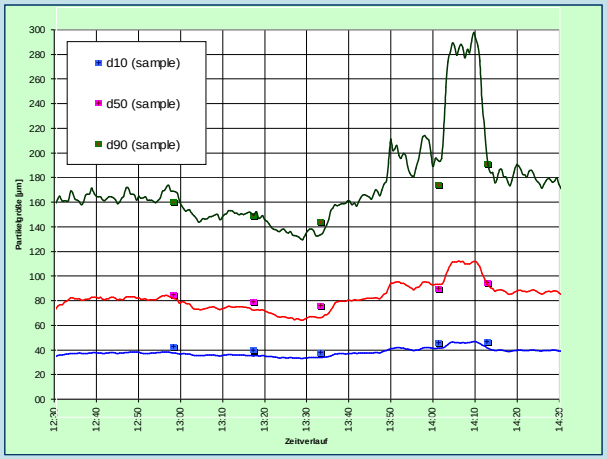
Requirements for use in Industry

- Low hardware efforts for installation
- Wide measuring range … µm – … mm
- True inline capability
- Robust industrial design
- Long term stability
- Independent of process conditions and product properties

Presentation of Particle Sizing Results

Off-line (process photo):

- PSD only at sample times
- No information about the progress of particle size



In-line (process movie):

- Progress of the PSD over the time
- Concentrated information for process control e.g. $X_{10,3}$; $X_{50,3}$ and $X_{90,3}$
- Dynamic of measurement is adjustable to process dynamic
- Averaged PSD at any interval

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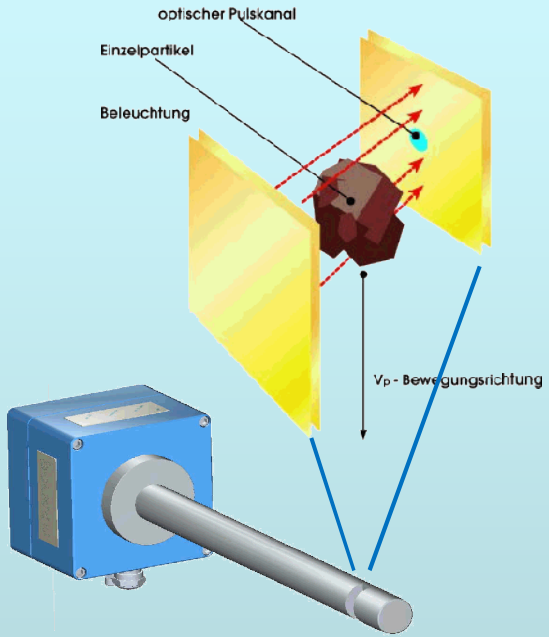
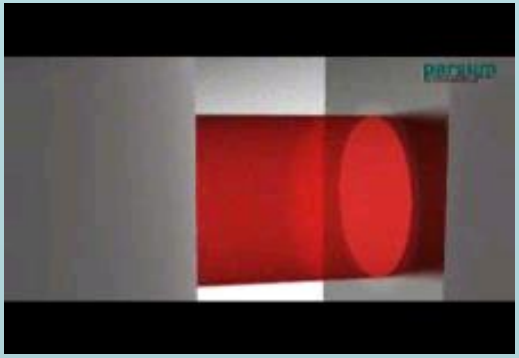
Parsum measuring principle



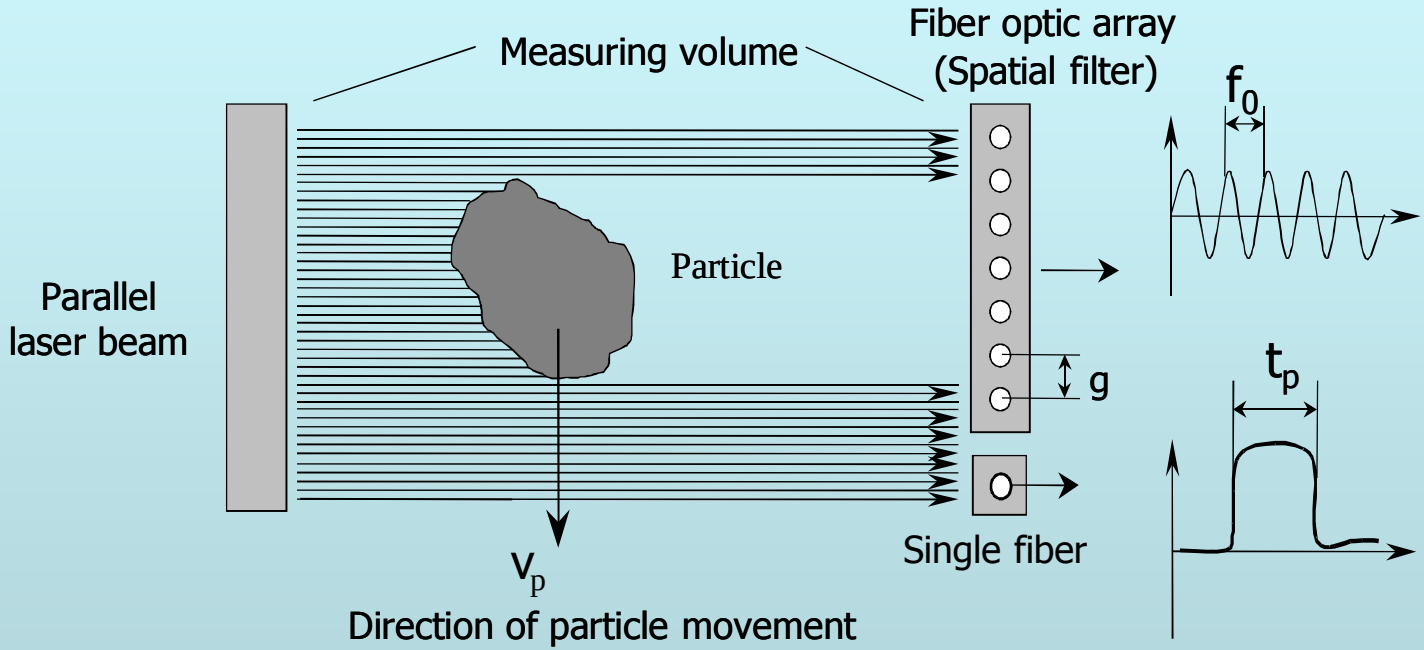


- Modified spatial filter method
- Measuring principle is based on evaluation of the shadows from moved particles in a parallel laser beam

Properties:

- Measuring range approx. 50µm to 6mm
- Velocity range up to 50 m/s
- Continuously recording of particle velocity and particle size
- Method especially for online use
- Chord length measurement
- Single particle measurement
- Probe with no moving parts

Modified Spatial Filter Method



Velocity: $\mathbf{v_p = f_o * g}$ Size: $\mathbf{x_p = t_p * v_p - d}$

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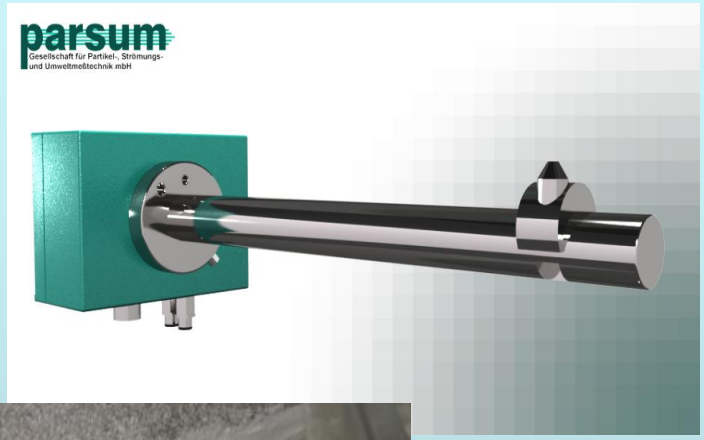
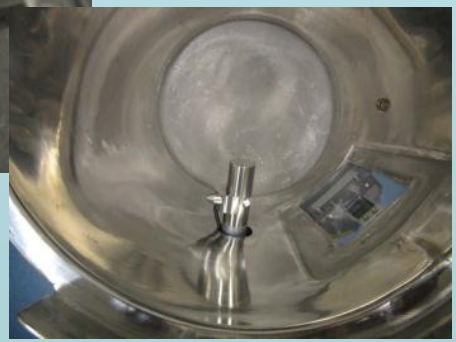
Process Interface – Inline Eductor D23



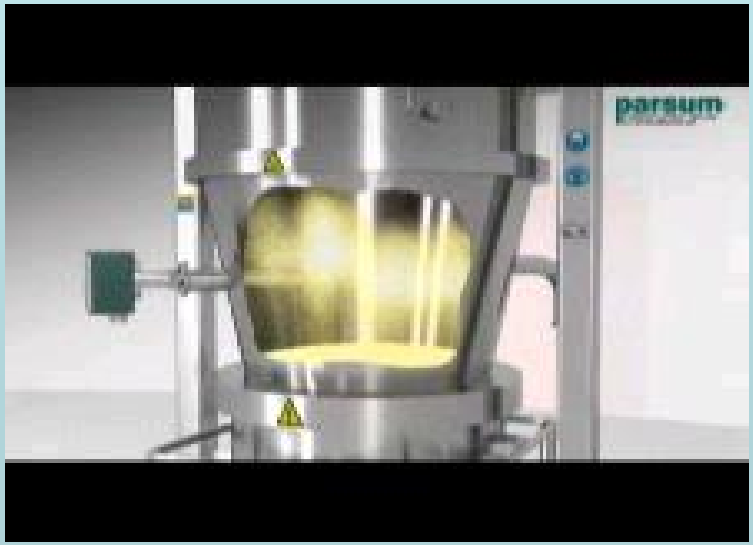


- For high loaded particle streams and for processes with irregular particle movement like Fluid Bed, High Shear Granulation
- Air purge to hold optics free
- Ring-nozzles to suck and accelerate particles
- Particles are moving on straight Lines
- separation effect is minimized
- Installation with Tri Clamp DN50
- Periodic back purge function with a separate internal nozzle

Fluid Bed Batch Granulation

Objective:

- To see trends in granulation,
- To find end-point of granulation,
- To see any defect (blocked nozzles, break down of fluidized bed ...) and
- To demo the usability of IPP-70 for direct measurement inside fluidized beds.



- ➢ Product: Lactose Powder,
- ➢ Equipment: 5 Kg lab scale FB Granulator, Top Spray
- ➢ Installation: IPP70-S with D23

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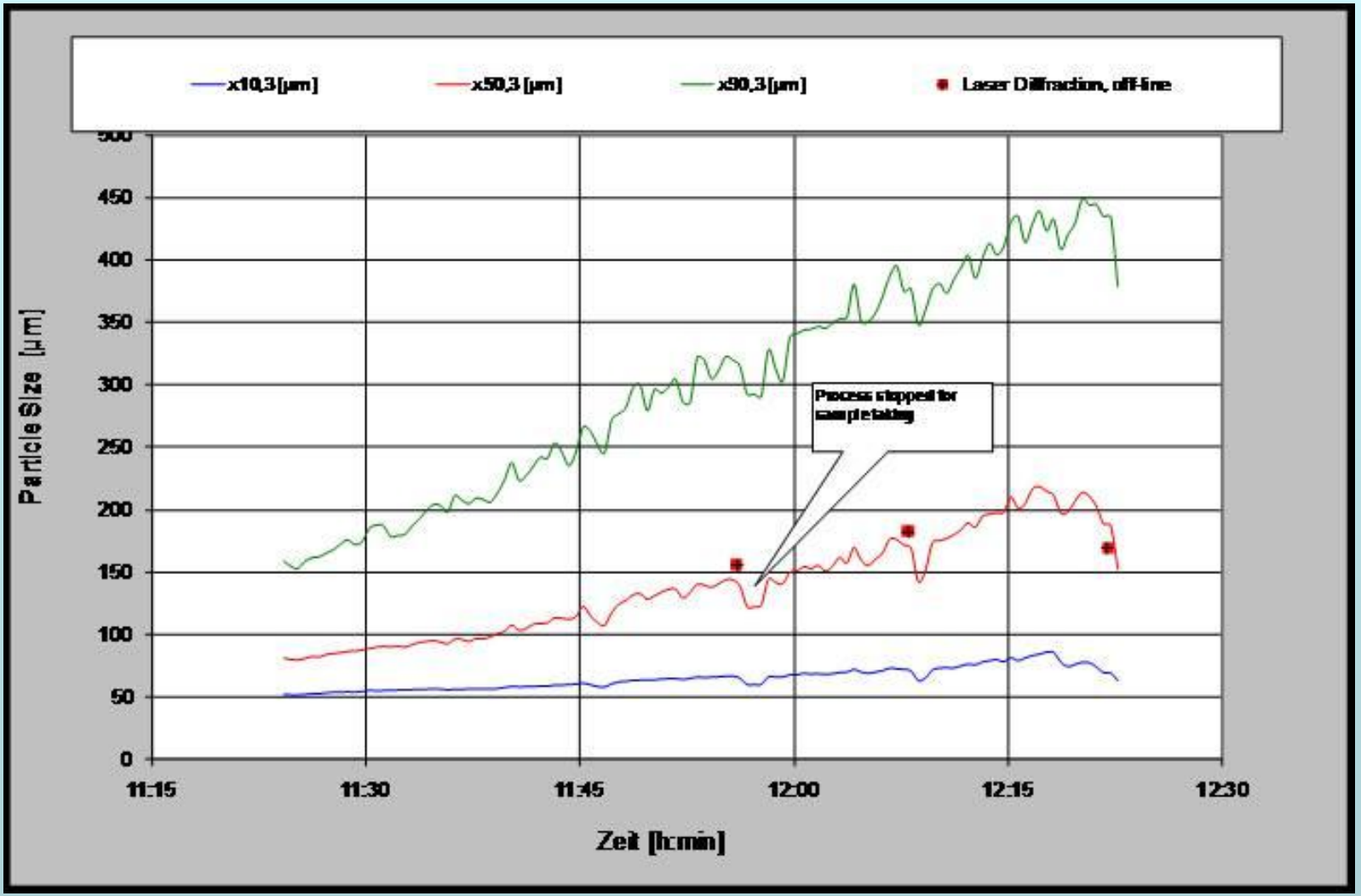
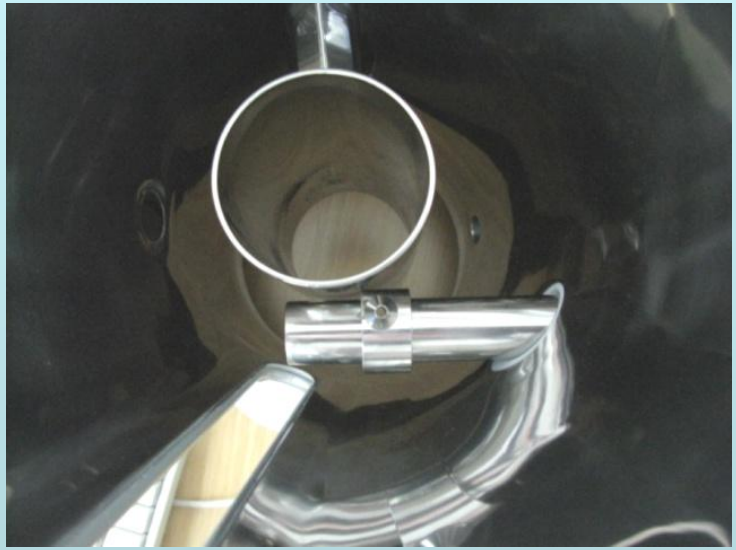
Fluid Bed Batch Granulation



Wurster Coating



Objective: Measurement of thickness of sprayed layer Detection of Agglomerates (Twins)

Product: Sugar pellets, spherical, 300µm,

Process-Equipment: Lab-scale FB-Granulator, 3Kg with Wurster-Tube and Bottom-Spray

Installation: IPP70-S with Inline-eductor D23

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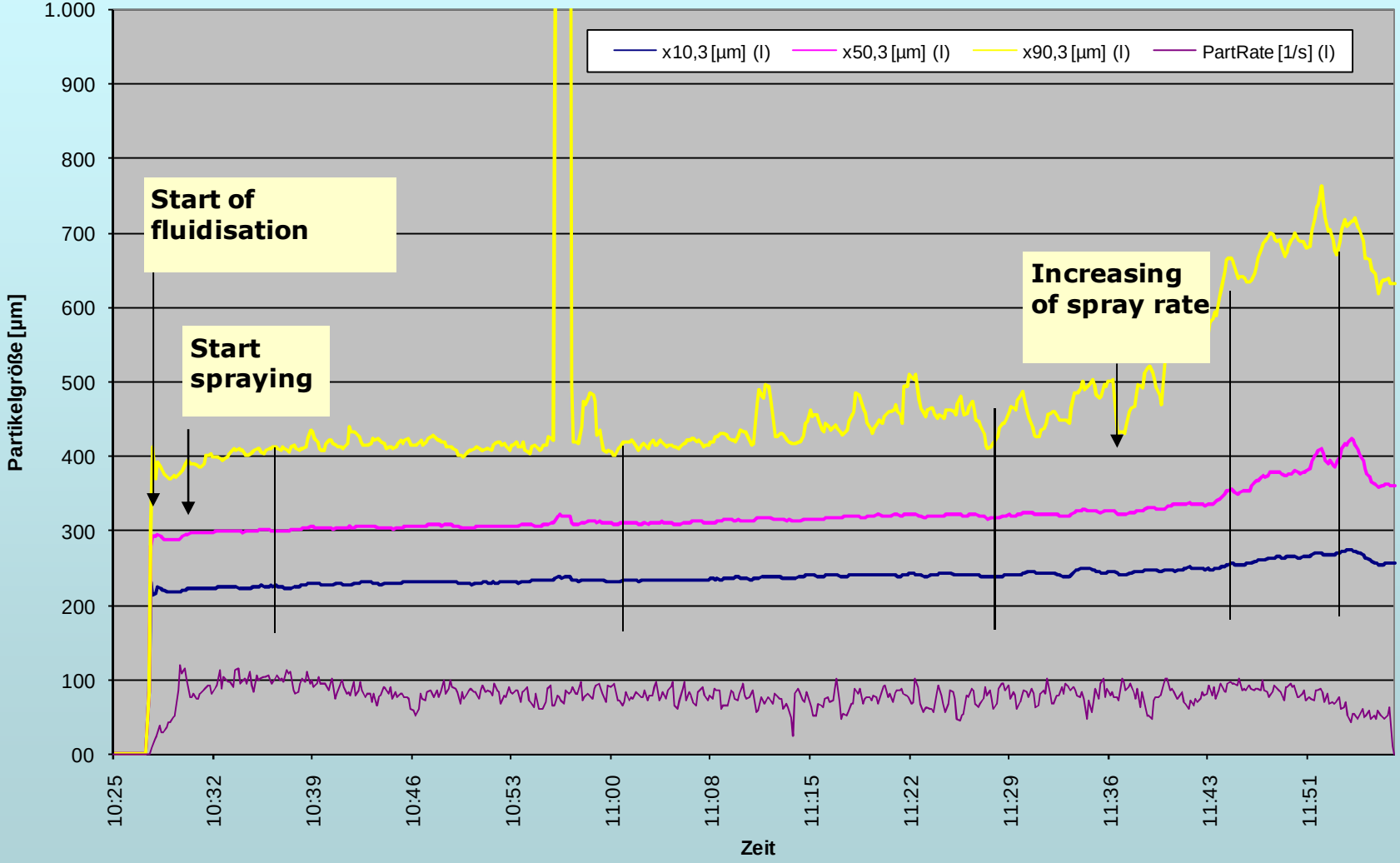
Wurster Coating



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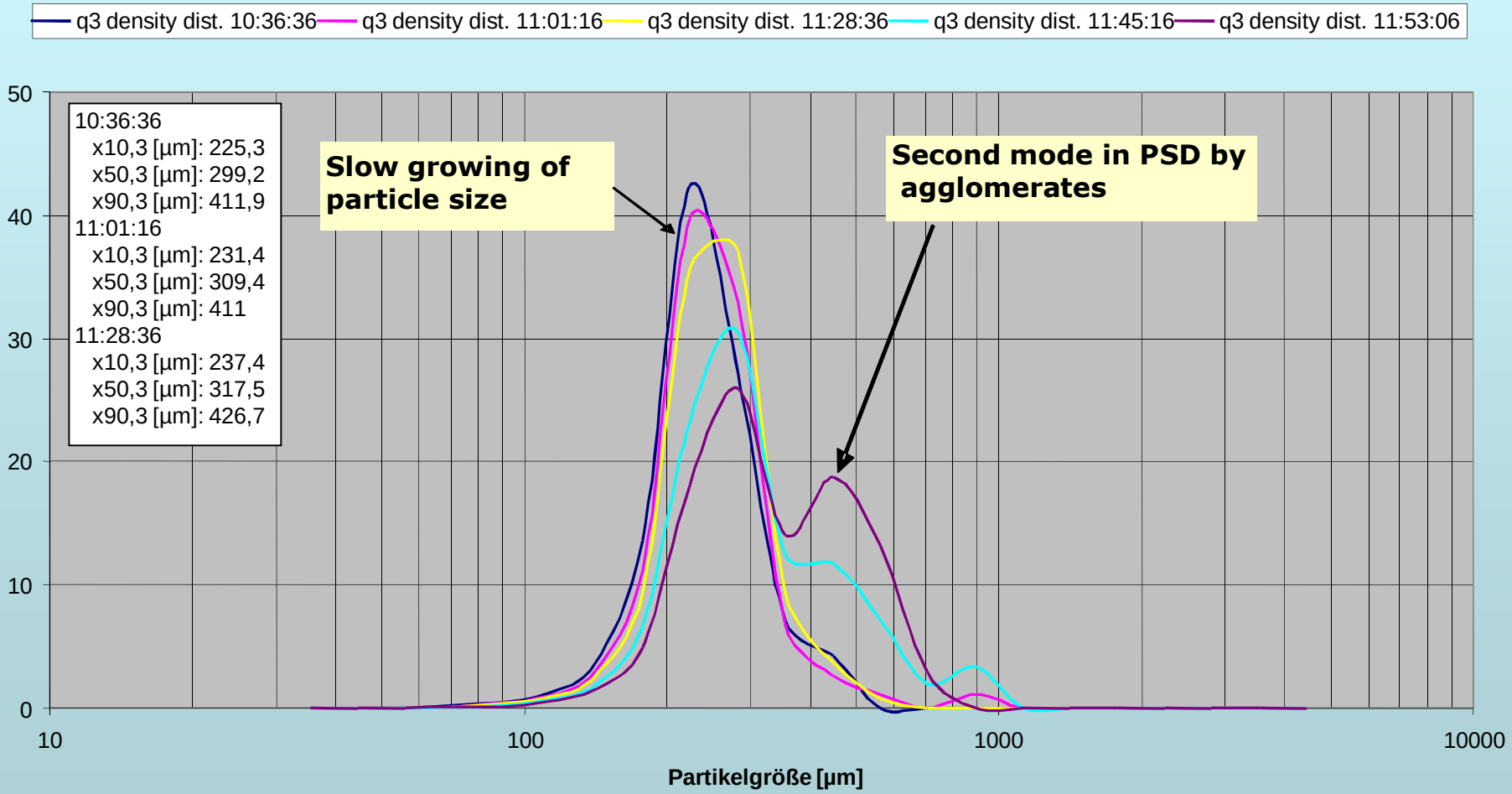


High Shear Granulation, production scale

Objective:

To demo useability of IPP 70-SL in larger mixers.

To follow fast particle size changing

flexible depth of probe

Product:

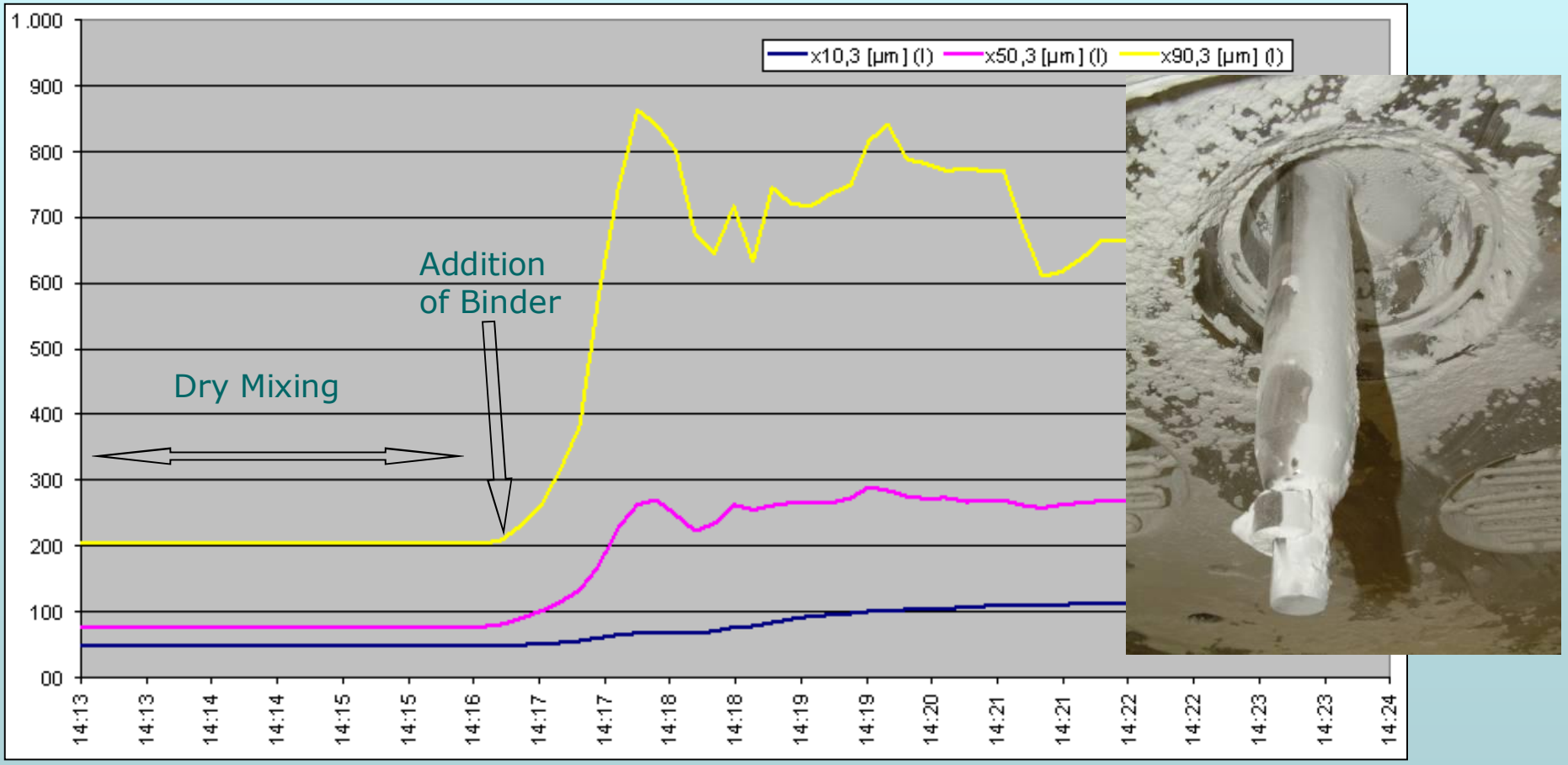
Lactose with API

Installation:

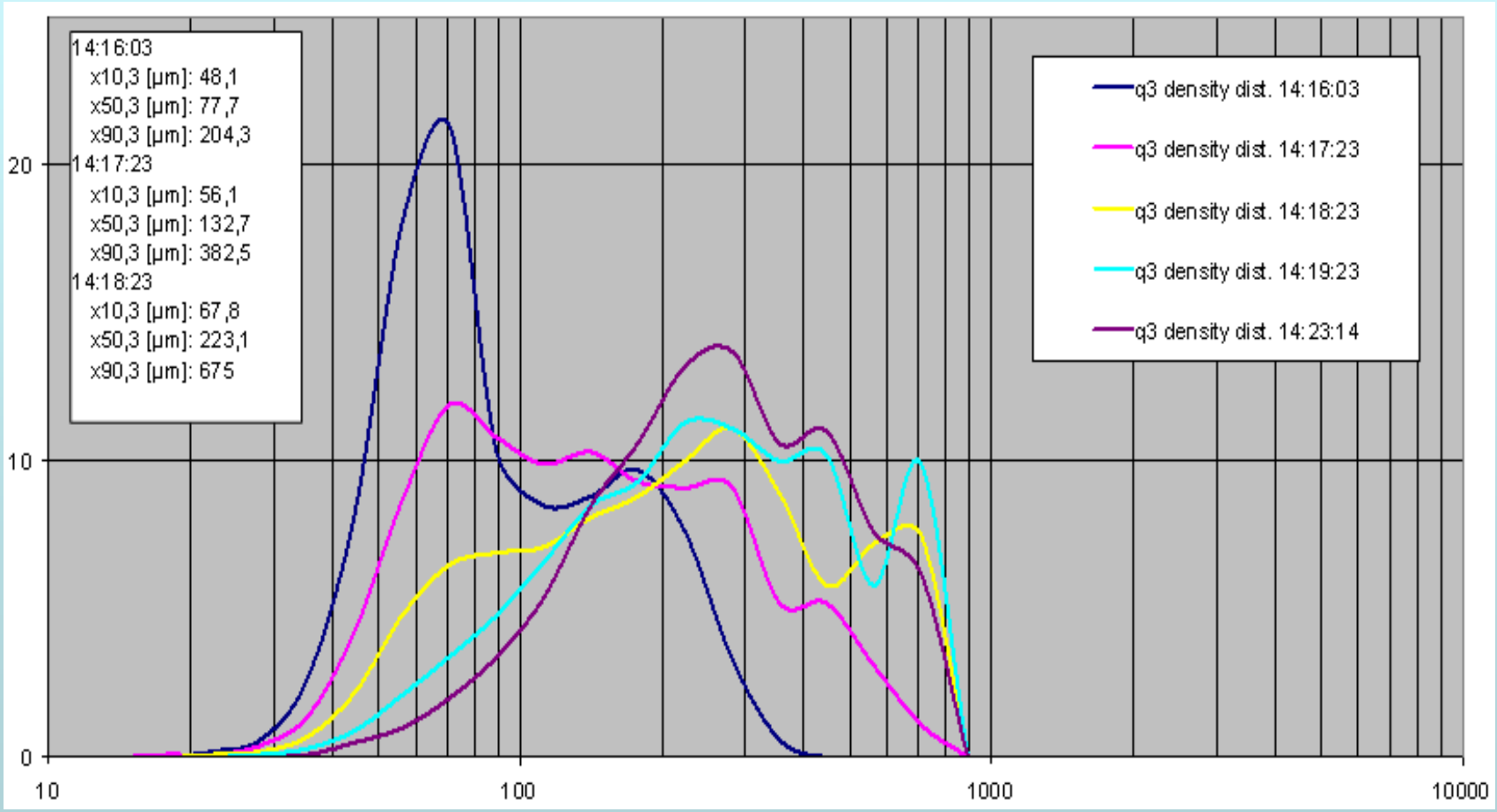
IPP 70-SL (60 cm)

with inline-eductor D23

High Shear Granulation, production scale



High Shear Granulation, production scale



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