Neue Methoden der Bildanalyse -

Teil 2

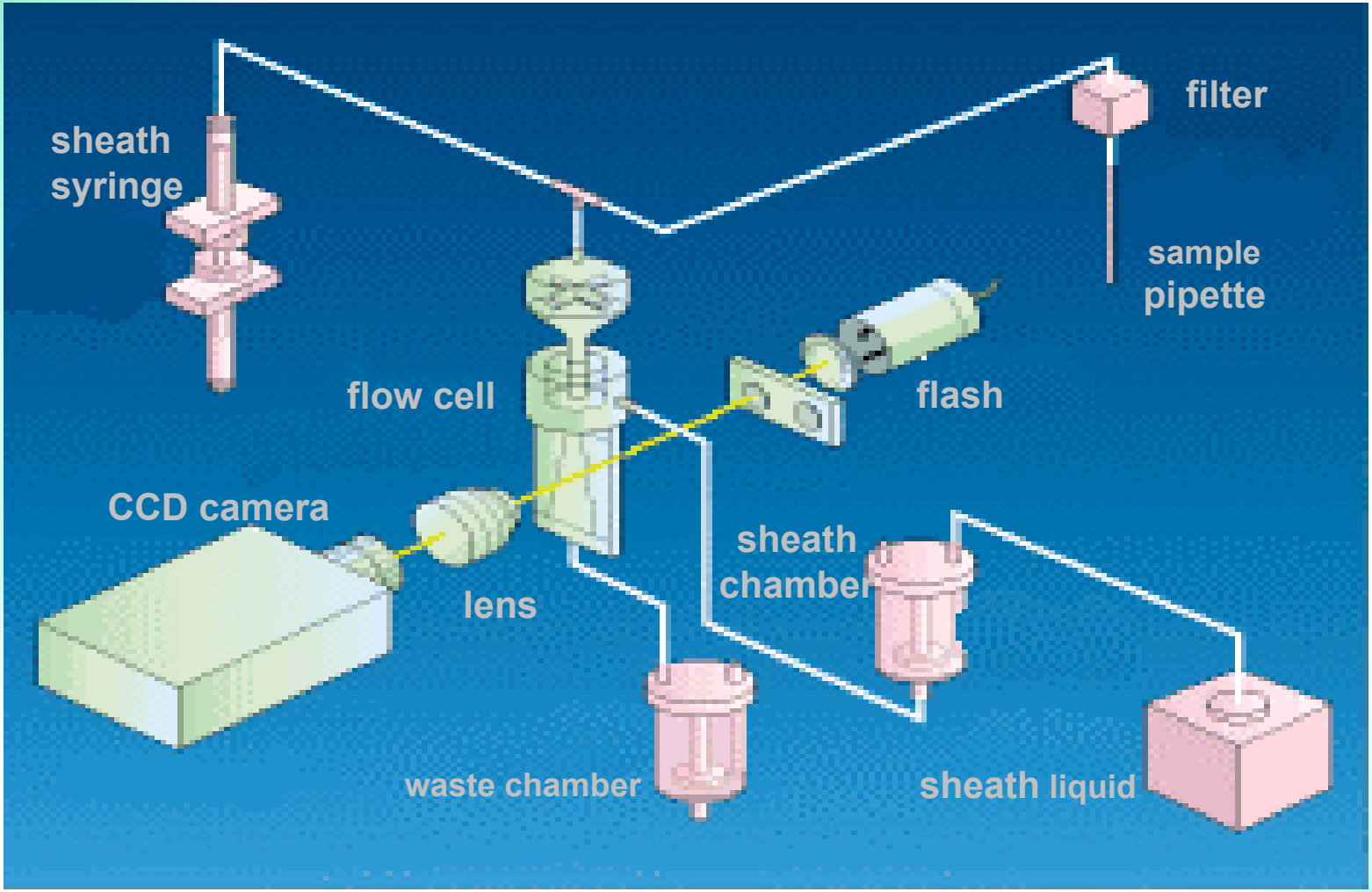
MALVERN
INSTRUMENTS

Automatisierte Partikelform- und größen Bestimmung mit dem FPIA 3000

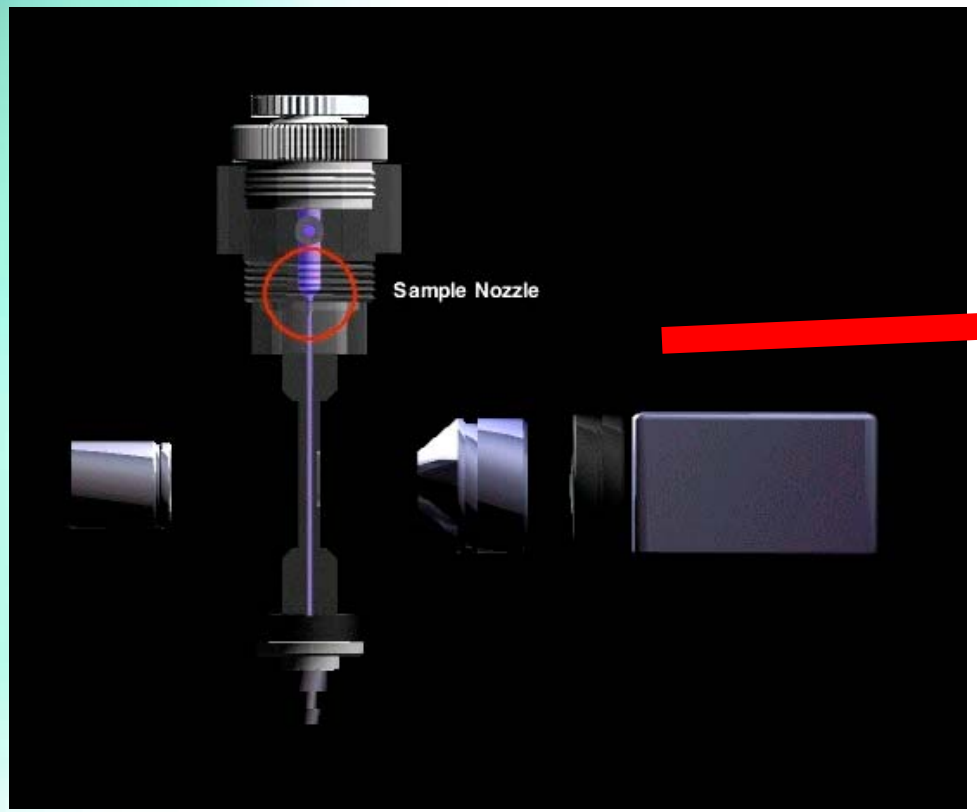
1) FPIA-3000 Produkt Übersicht

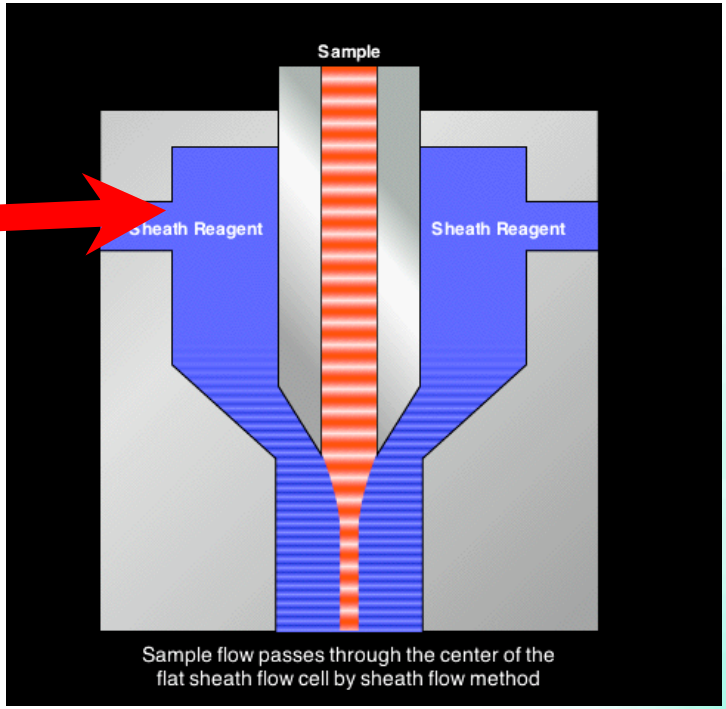
- Automatisches Bildanalysesystem für die Messung der Partikelgröße und Partikelform von Suspensionen und Emulsionen
- Größenbereich : 0.8 - 300 µm
- Bis zu 300 000 Partikel pro Messung (alle Bilder werden gespeichert)
- Mehr als 20 morphologische Parameter
- “Ein Knopf” Bedienung (SOP Konzept)
- 1 Meßzyklus (Analysenzeit + automatische Spülung) in 2 - 3 min

2) Messprinzip, schematischer Aufbau



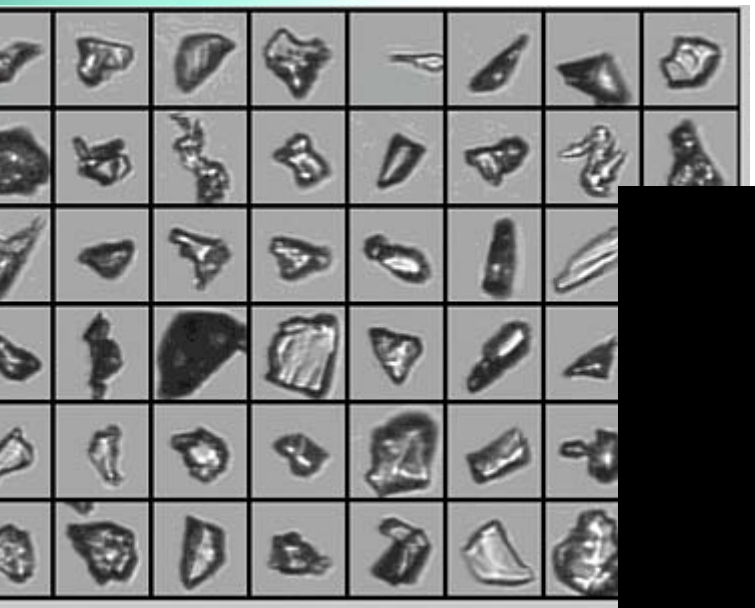
3) Mechanismus der Durchflussmesszelle



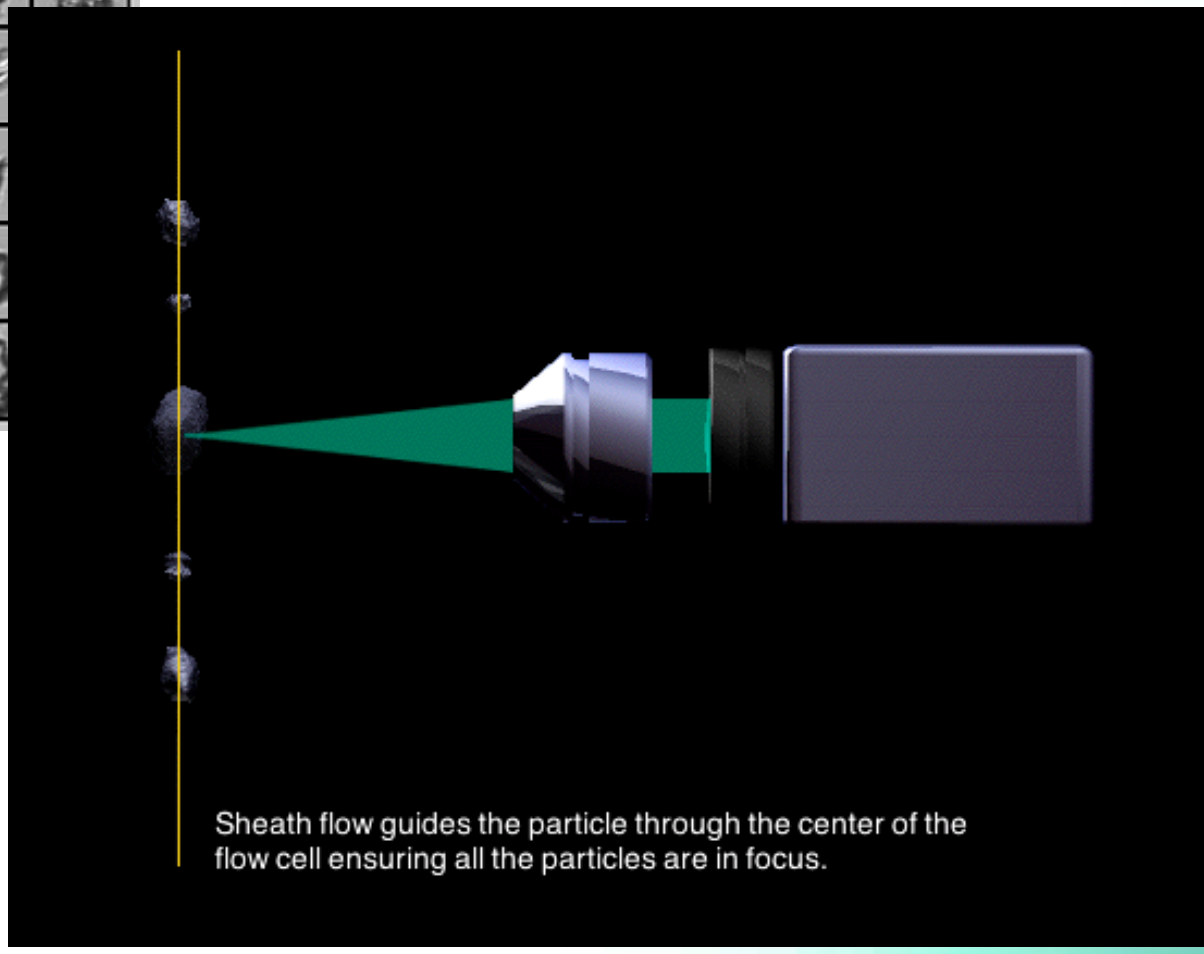


- Partikel werden vereinzelt und mit ihrer größten Fläche hin zur CCD Kamera orientiert und liegen im Fokus

4) Mechanismus der Durchflussmesszelle



- Gewährleistet, daß alle Partikel im Fokus liegen



5) Verwendbare Hüllstrom Flüssigkeiten

- **FPIA-3000** Standard Version
  - Wasser
  - Methanol
  - Ethanol
  - Isopropanol
  - Ethylen Glykol Lösung (25%)

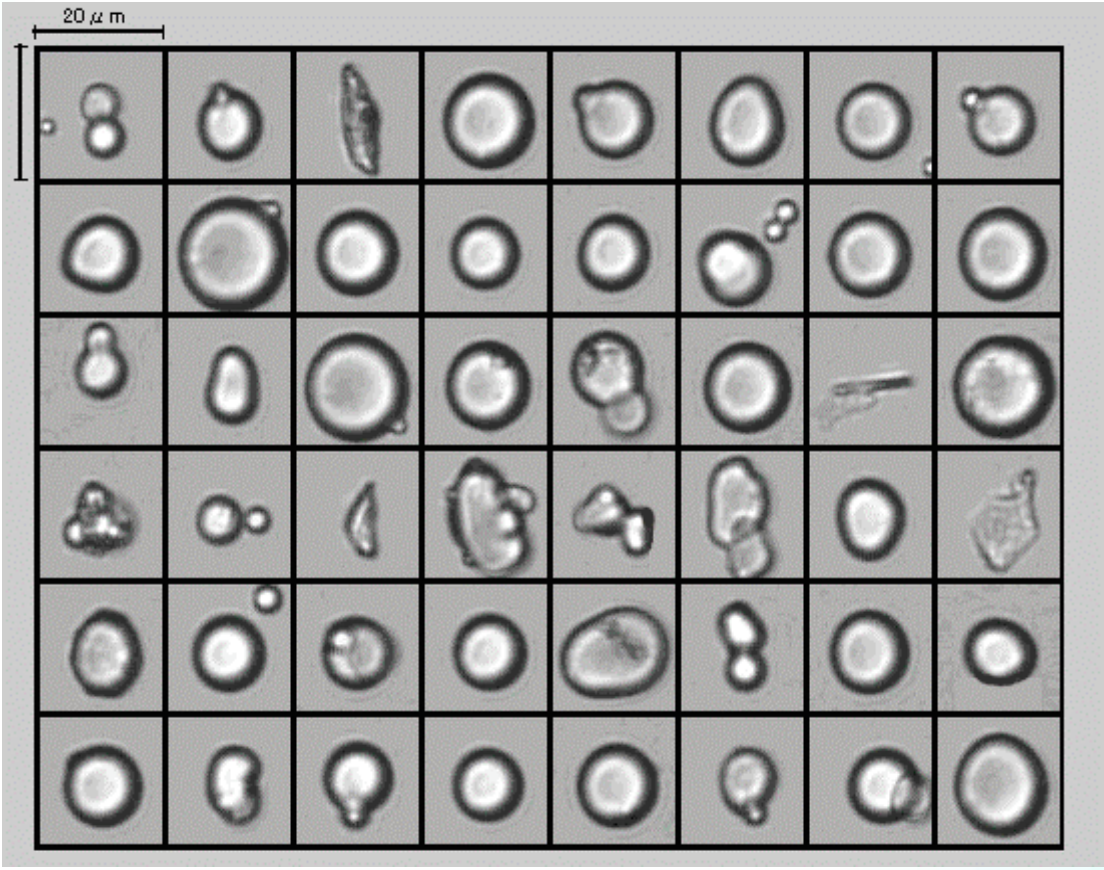
- **FPIA-3000S** lösemittelbeständige Version
  - alles von oben
  - Toluol
  - TCE
  - Azeton
  - Heptan
  - Hexan

6) Probenzugabe

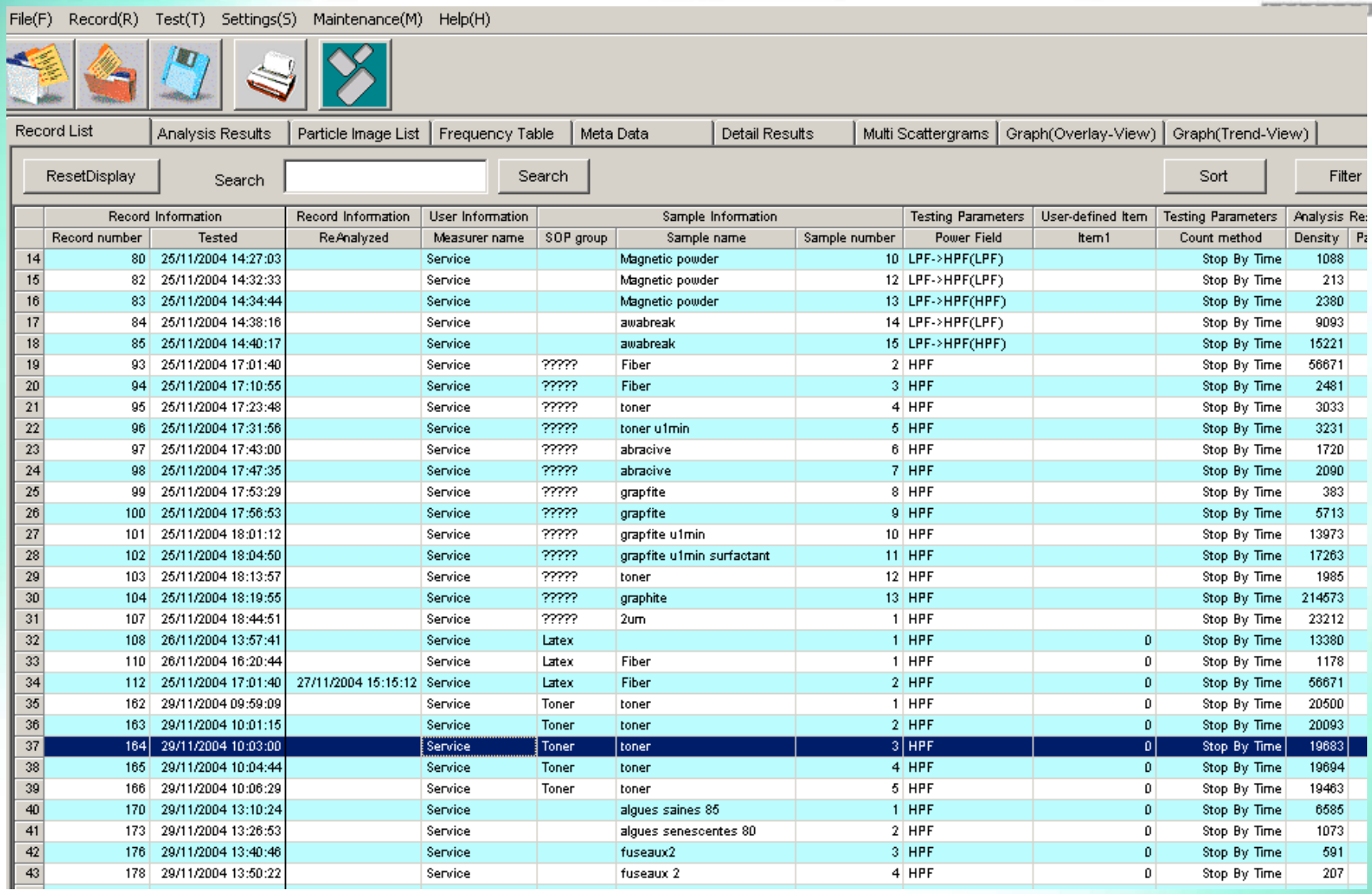
<u>Probemenge:</u>

1ml - 5ml (Standard)

7) Bilddatei



8) Ergebnisdarstellung 1



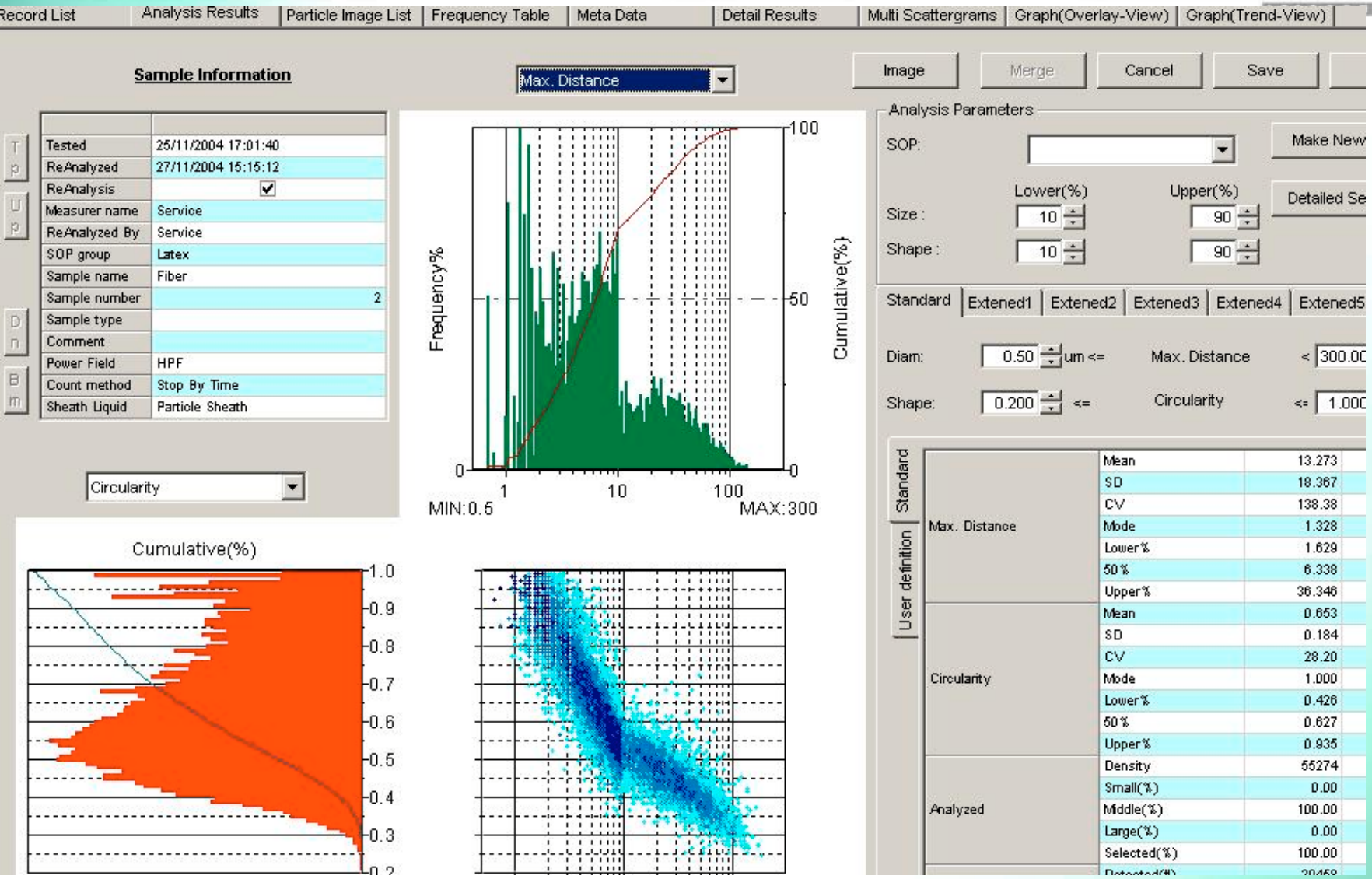
File(F) Record(R) Test(T) Settings(S) Maintenance(M) Help(H)

Record List | Analysis Results | Particle Image List | Frequency Table | Meta Data | Detail Results | Multi Scattergrams | Graph(Overlay-View) | Graph(Trend-View)

ResetDisplay Search Search Sort Filter

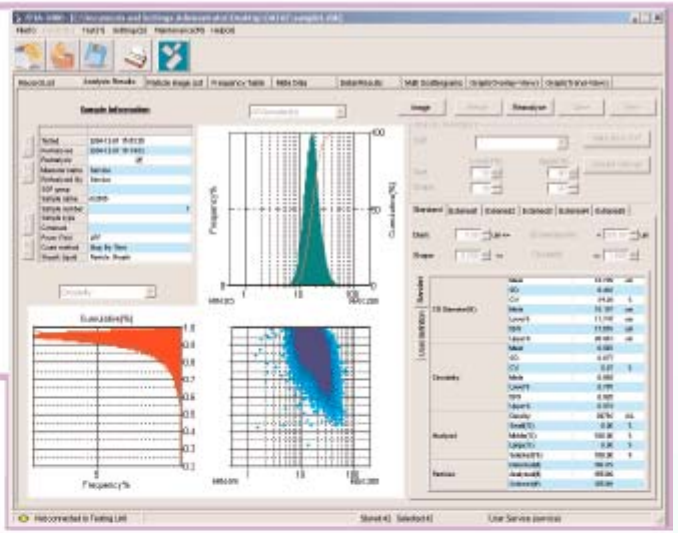
	Record Information		Record Information	User Information		Sample Information		Testing Parameters	User-defined Item	Testing Parameters	Analysis Re
	Record number	Tested	ReAnalyzed	Measurer name	SOP group	Sample name	Sample number	Power Field	Item1	Count method	Density
14	80	25/11/2004 14:27:03		Service		Magnetic powder	10	LPF->HPF(LPF)		Stop By Time	1088
15	82	25/11/2004 14:32:33		Service		Magnetic powder	12	LPF->HPF(LPF)		Stop By Time	213
16	83	25/11/2004 14:34:44		Service		Magnetic powder	13	LPF->HPF(HPF)		Stop By Time	2380
17	84	25/11/2004 14:38:16		Service		awabreak	14	LPF->HPF(LPF)		Stop By Time	9093
18	85	25/11/2004 14:40:17		Service		awabreak	15	LPF->HPF(HPF)		Stop By Time	15221
19	93	25/11/2004 17:01:40		Service	?????	Fiber	2	HPF		Stop By Time	56671
20	94	25/11/2004 17:10:55		Service	?????	Fiber	3	HPF		Stop By Time	2481
21	95	25/11/2004 17:23:48		Service	?????	toner	4	HPF		Stop By Time	3033
22	96	25/11/2004 17:31:56		Service	?????	toner u1min	5	HPF		Stop By Time	3231
23	97	25/11/2004 17:43:00		Service	?????	abracive	6	HPF		Stop By Time	1720
24	98	25/11/2004 17:47:35		Service	?????	abracive	7	HPF		Stop By Time	2090
25	99	25/11/2004 17:53:29		Service	?????	grapfite	8	HPF		Stop By Time	383
26	100	25/11/2004 17:56:53		Service	?????	grapfite	9	HPF		Stop By Time	5713
27	101	25/11/2004 18:01:12		Service	?????	grapfite u1min	10	HPF		Stop By Time	13973
28	102	25/11/2004 18:04:50		Service	?????	grapfite u1min surfactant	11	HPF		Stop By Time	17263
29	103	25/11/2004 18:13:57		Service	?????	toner	12	HPF		Stop By Time	1985
30	104	25/11/2004 18:19:55		Service	?????	graphite	13	HPF		Stop By Time	214573
31	107	25/11/2004 18:44:51		Service	?????	2um	1	HPF		Stop By Time	23212
32	108	26/11/2004 13:57:41		Service	Latex		1	HPF	0	Stop By Time	13380
33	110	26/11/2004 16:20:44		Service	Latex	Fiber	1	HPF	0	Stop By Time	1178
34	112	25/11/2004 17:01:40	27/11/2004 15:15:12	Service	Latex	Fiber	2	HPF	0	Stop By Time	56671
35	162	29/11/2004 09:59:09		Service	Toner	toner	1	HPF	0	Stop By Time	20500
36	163	29/11/2004 10:01:15		Service	Toner	toner	2	HPF	0	Stop By Time	20093
37	164	29/11/2004 10:03:00		Service	Toner	toner	3	HPF	0	Stop By Time	19683
38	165	29/11/2004 10:04:44		Service	Toner	toner	4	HPF	0	Stop By Time	19694
39	166	29/11/2004 10:06:29		Service	Toner	toner	5	HPF	0	Stop By Time	19463
40	170	29/11/2004 13:10:24		Service		algues saines 85	1	HPF	0	Stop By Time	6585
41	173	29/11/2004 13:26:53		Service		algues senescentes 80	2	HPF	0	Stop By Time	1073
42	176	29/11/2004 13:40:46		Service		fuseaux2	3	HPF	0	Stop By Time	591
43	178	29/11/2004 13:50:22		Service		fuseaux 2	4	HPF	0	Stop By Time	207

9) Ergebnisdarstellung 2



10) Ergebnisdarstellung 3

Results view: The results of a single analysis are represented in a 3 graph format – a particle size distribution (green), a particle shape distribution (red) and a scattergram plot of size against shape (blue). The statistical parameters associated with each distribution (mean, mode, lower, median and upper percentile values etc) are also displayed.



Particle view: Images of all particles are saved. These images can be viewed and manipulated through the particle viewer. The images can be magnified and sorted on any size or shape parameter allowing the operator to quickly and easily identify anomalies – perhaps agglomerates or the presence of unexpected foreign particles for example.

11) Verfügbare morphologische Parameter

Partikel Durchmesser

Diameter of an equivalent circular area
Diameter of a circle with equivalent circumference
Maximum length
Maximum vertical length
Major-axis diameter
Minor-axis diameter
Vertical Feret's diameter
Horizontal Feret's diameter
Vertical diameter of an equivalent area
Horizontal diameter of an equivalent area
Maximum vertical diameter
Maximum horizontal diameter
Particle circumference
Edge circumference
Particle area
Edge area
Mean luminosity
Luminosity distribution value

Partikel Form

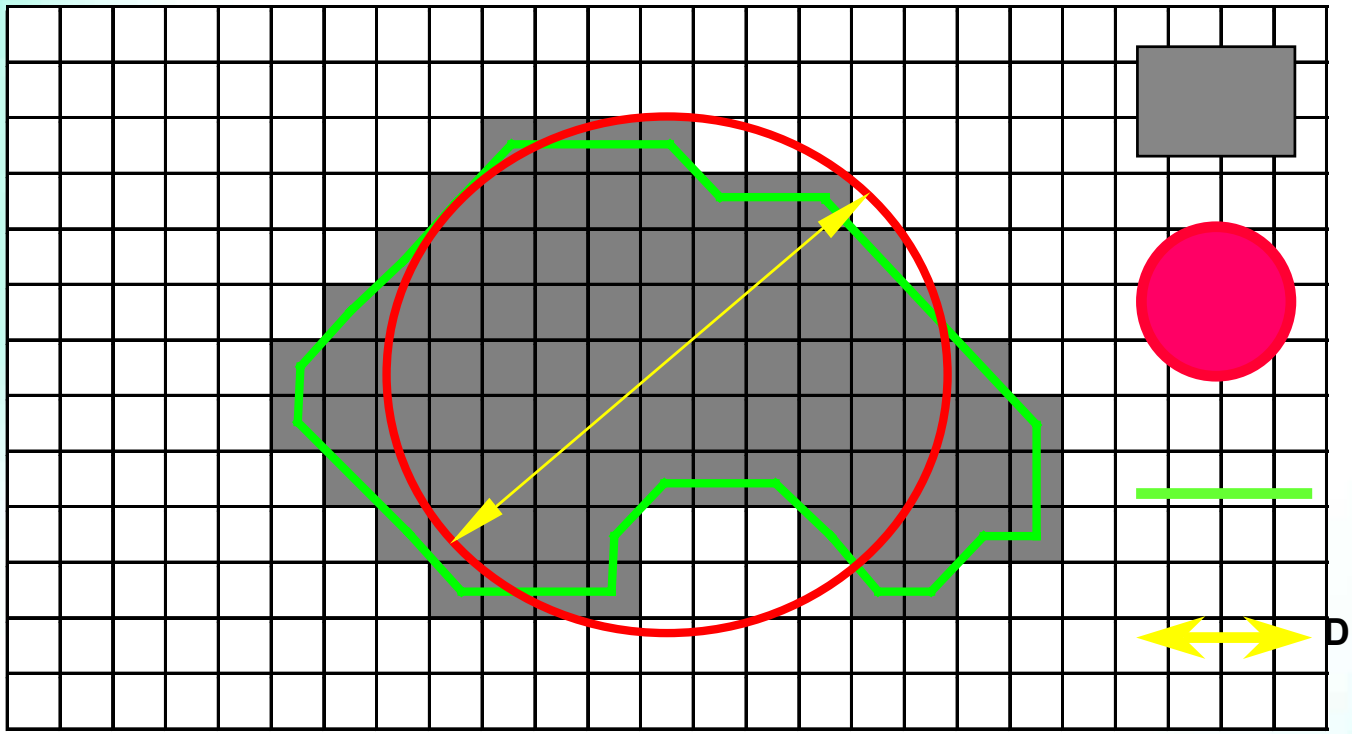
Circularity
Aspect ratio (width/length)
Circularity of edge (circumference)
Circularity of edge (encompassed area)
Horizontal circumscribing rectangle surface ratio
Vertical circumscribing rectangle surface ratio
Main axis circumscribing rectangle surface ratio

Statistische Parameter

Mean
Mode
SD
CV
50% value
Lower (may be set optionally in the 1-49% range)
Upper (may be set optionally in the 51-100% range)
Particle number restriction
Particle rate restriction
Large particle rate
Medium particle rate
Small particle rate

12) Zirkularität und Durchmesser

Zirkularität = Kreisumpfang / Partikelumpfang



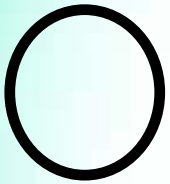
Fläche des Partikels

Kreis gleicher Partikelfläche

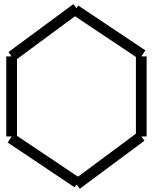
Partikelumpfang

Durchmesser des Kreise gleicher Partikelfläche

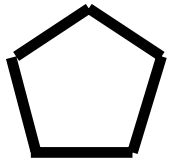
13) Zirkularität



1.00

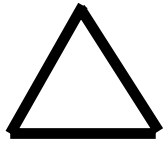


0.952



0.93

0.88



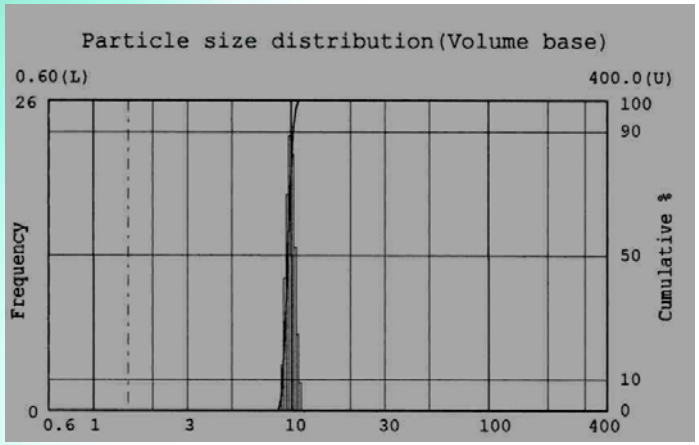
0.77

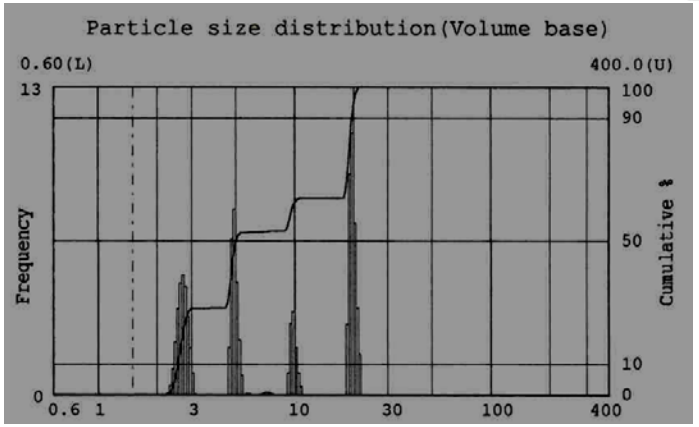
0.660

(1:5)

[Wadell's sphericity]

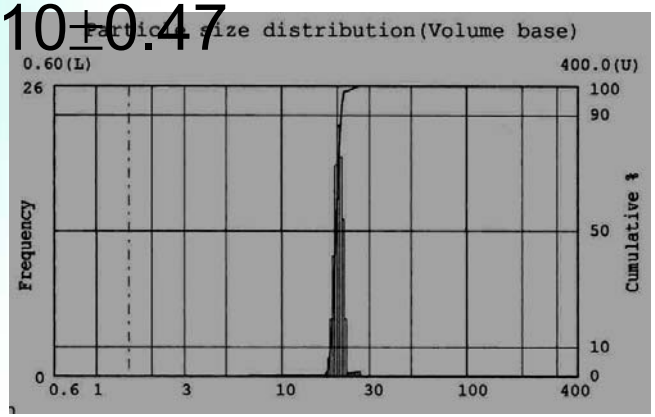
14) Messungen an Glaskugeln und Latex





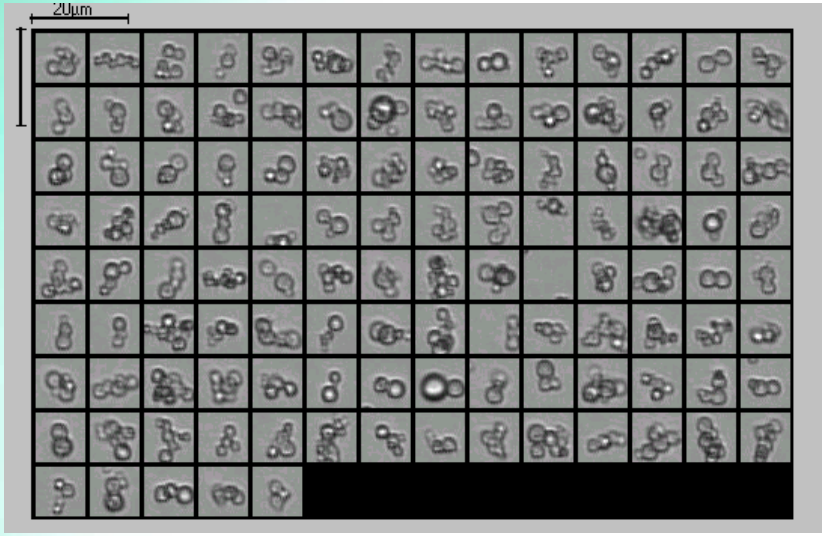
10μm gemessen:
10±0.47

2.5, 5,10 & 20 μm



20 μm gemessen:20.43 ±1.35

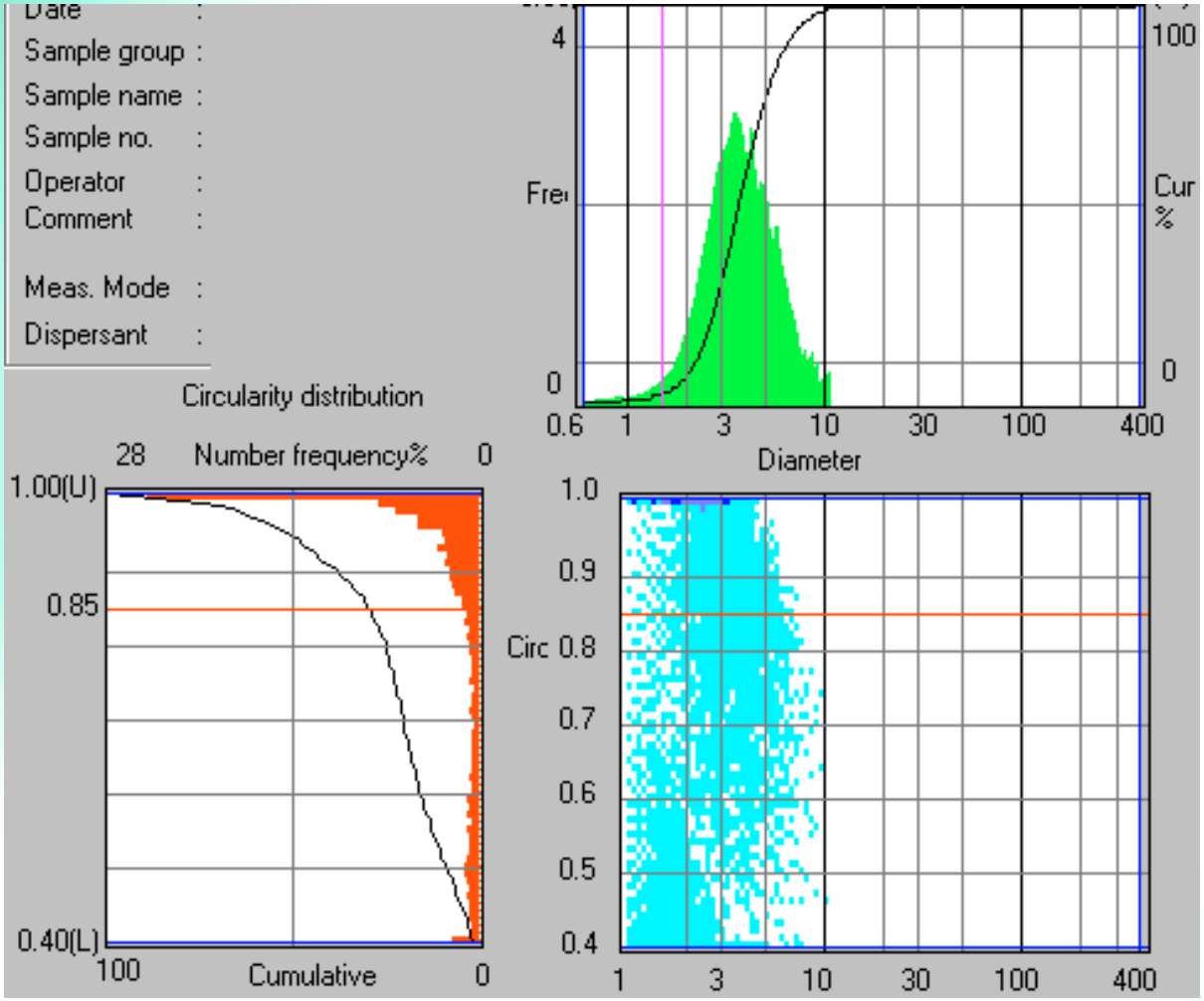
15) Pigmente - Vergleich der 10 - 20µm Anteile



Pigment A

Pigment B

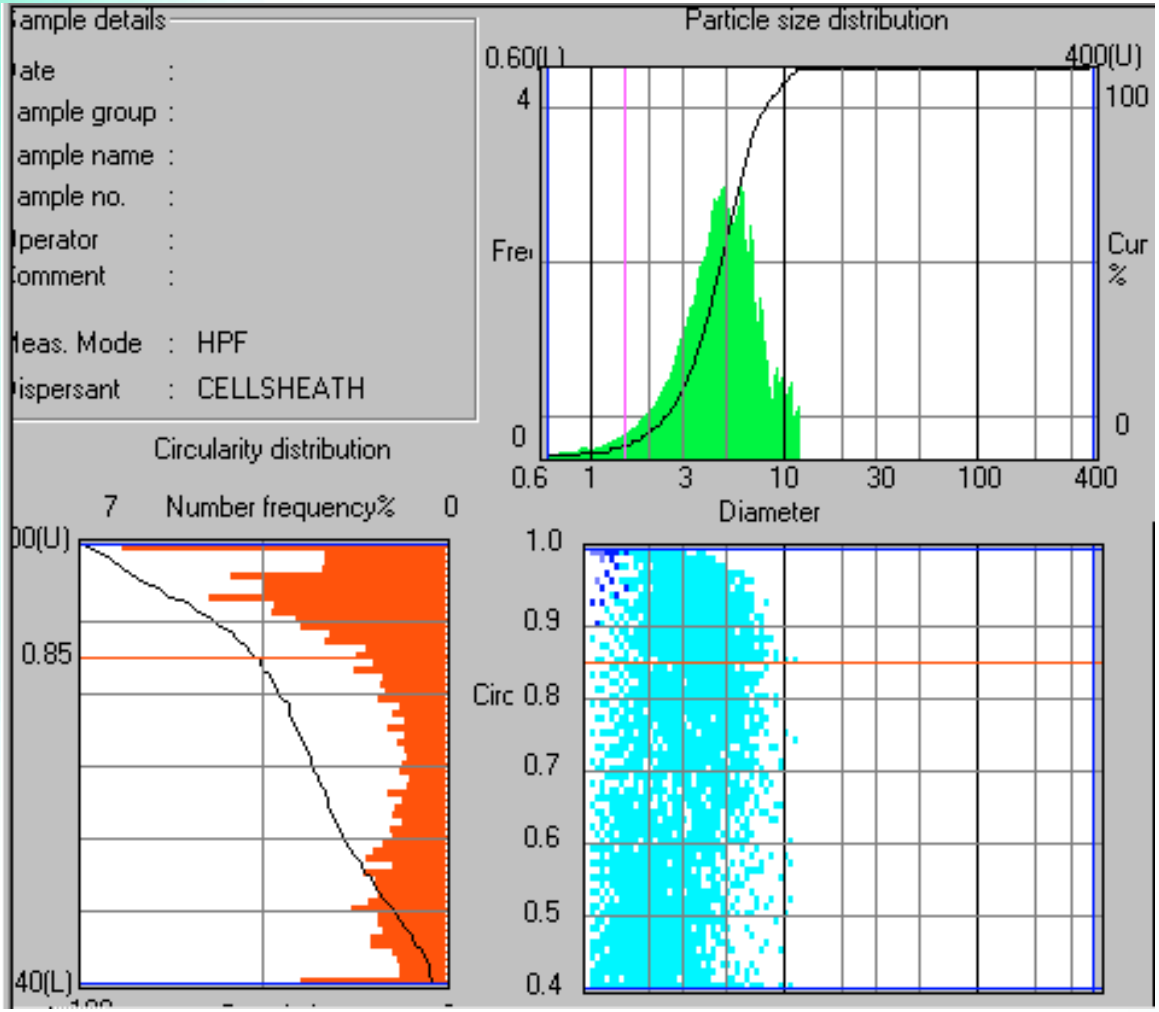
16) Pigment A



Anteil (Nr.)
Zirkularität
< 0,85

= 29%

17) Pigment B



Anteil (Nr.)
Zirkularität
< 0,85

= 51%

18) FPIA-3000 Anwendungsbereiche

- Toner (Rundheit als QC Werkzeug)
- Keramik
- Schmiergelmittel (z.B. Schleifpapierqualität)
- Pharma
- Biotechnik (z.B. Proteinkristalle, Wachstumshemmung von Algen)
- u.a

19) Zusammenfassung

❶ **Morphologi G2**

→ Automatisierte Partikelgrößen - und Form Bestimmung an **Pulvern**
→ Messbereich 0.5µm - 1000µm
→ bis 500.000 Partikel pro Messung
→ 10 morphologische Parameter
→ 1 Knopf Bedienung

❷ **FPIA 3000**

→ Automatisierte Partikelgrößen - und Form Bestimmung an **Partikeln in Flüssigkeit**
→ Messbereich 0.8µm - 300 µm
→ bis 300.000 Partikel pro Messung
→ über 20 morphologische Parameter
→ 1 Knopf Bedienung

Vielen Dank für Ihre Aufmerksamkeit !