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Influence of Air on the Soot Particles in Co-Flow Diffusion Flame

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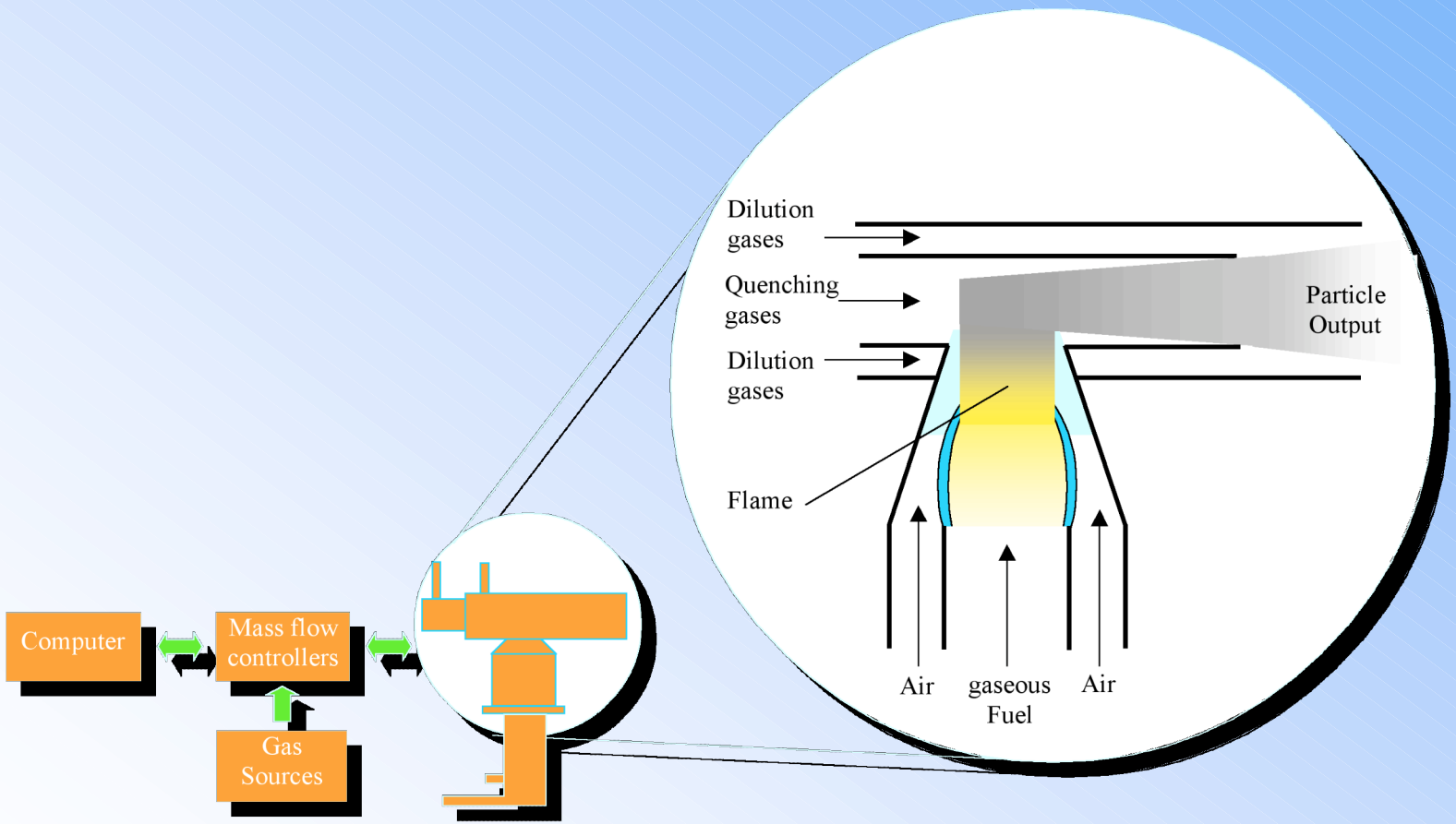
Principle of CAST



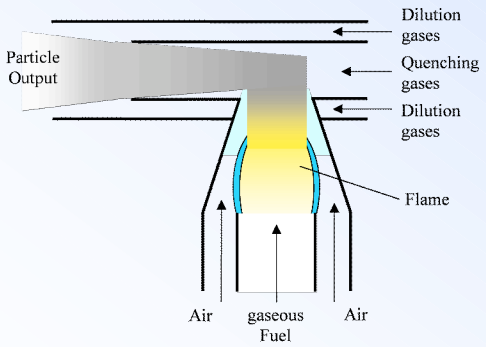
Relevant Parameters

constant:

- Quench gas
- Dilution air
- Fuel gas type

variable:

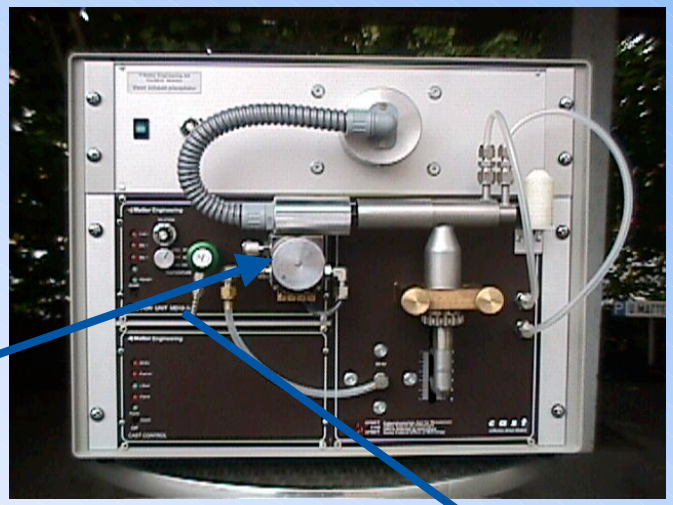
- Flow rates
  - ✓ fuel gas
  - ✓ oxidation air for flame
  - ✓ N_2 in fuel
- Quench position on diffusion flame



Objectives

- Learning the influences of the coating air on the soot within the diffusion flame
- Finding the optimal settings of air flow in order to work with minimal deviation of particle size and concentration.

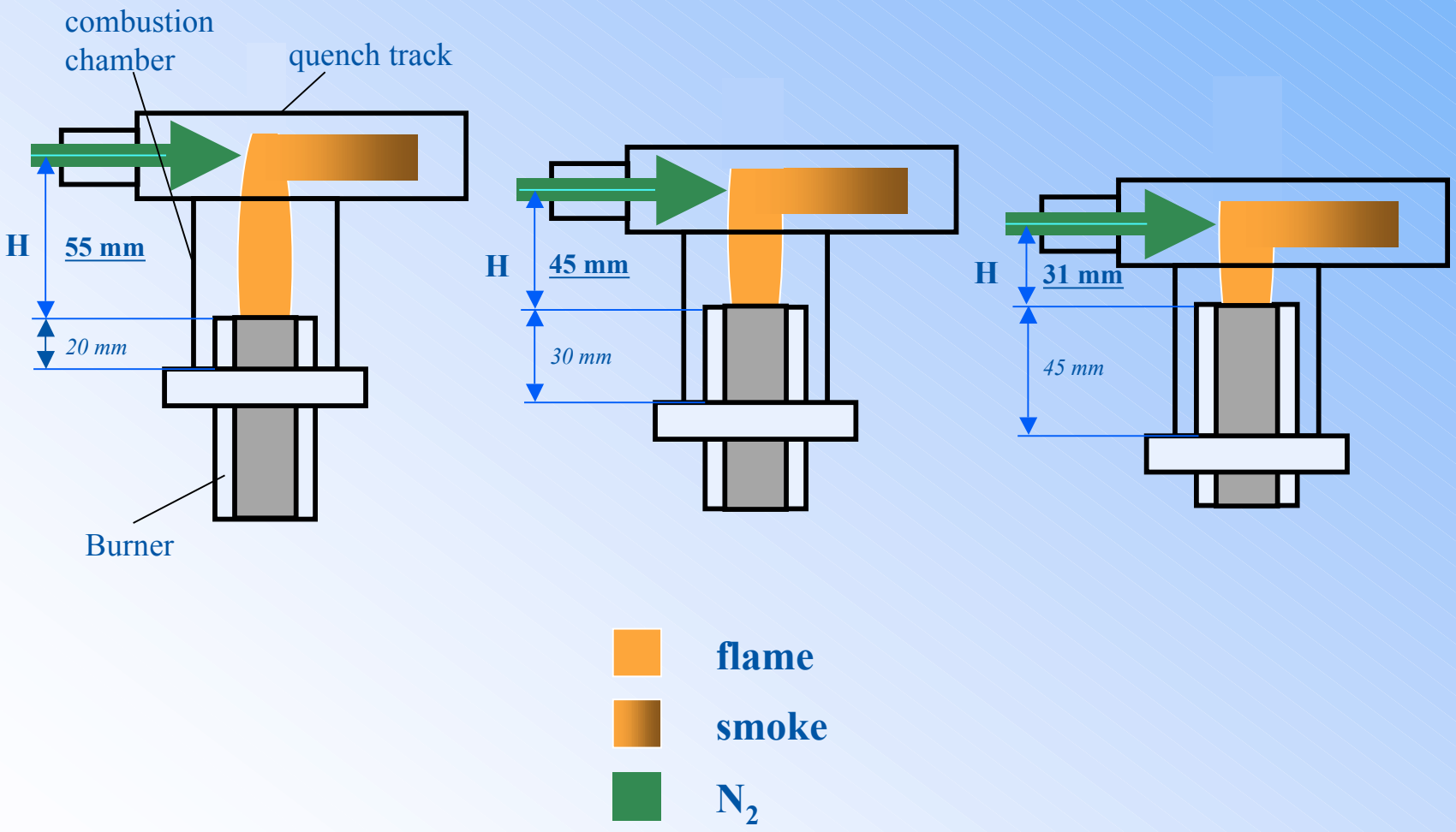
Setup



Dilution ration = 667

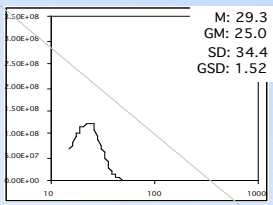
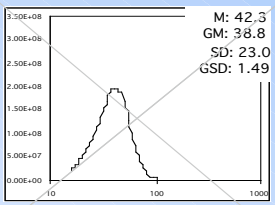
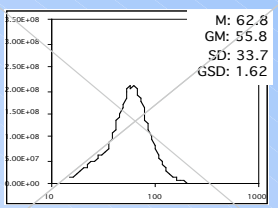
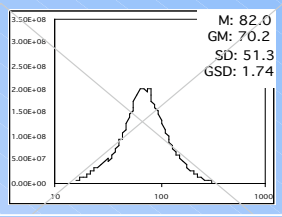
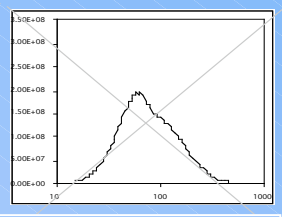
SMPS

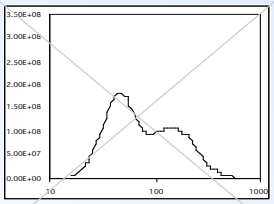
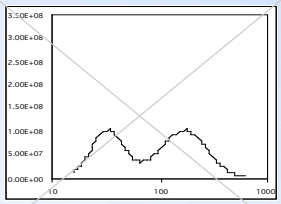
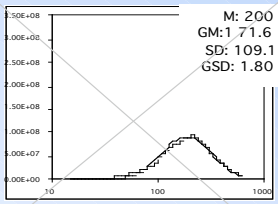
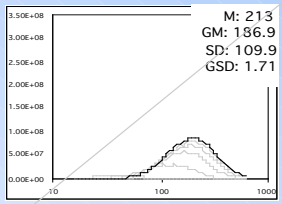
Quench positions H



Influences of the coating air

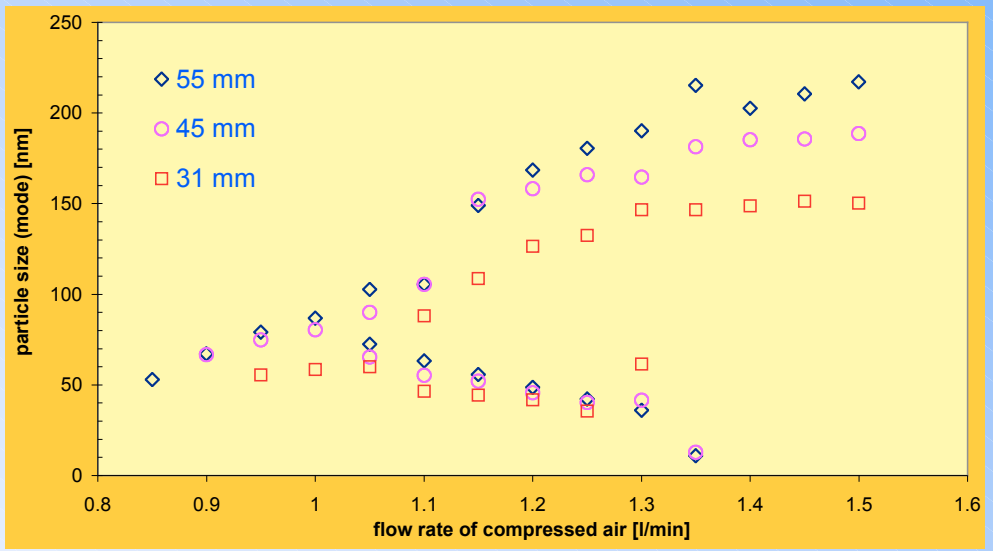
Propane C3H8 0.06 l/min

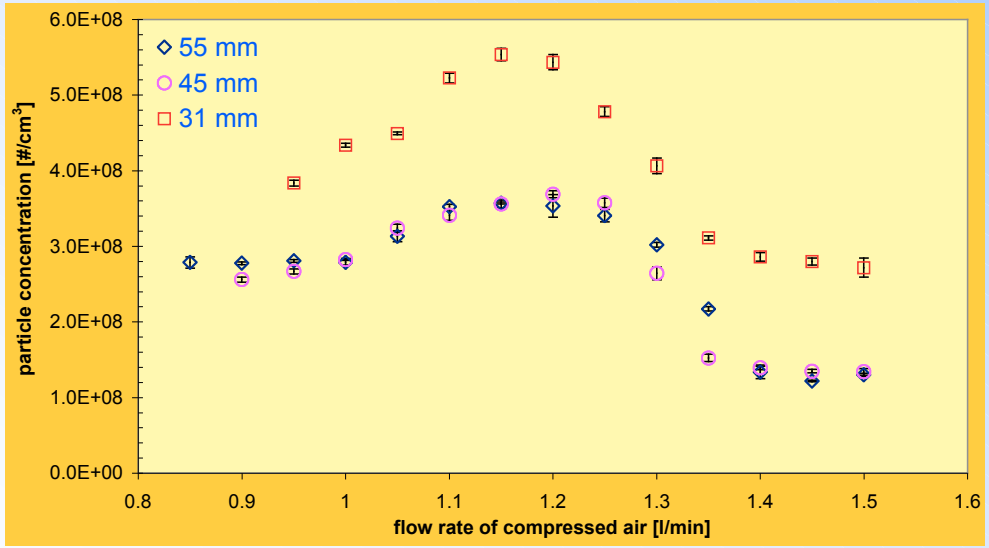
N_2 (l/min)	air Luft	0.7	0.8	0.9	1	1.1
		0.47	0.53	0.6	0.67	0.73
0						

1.2	1.3	1.4	1.5
0.8	0.87	0.93	1
			

Quench position = 55 mm

Air influences at different quench position

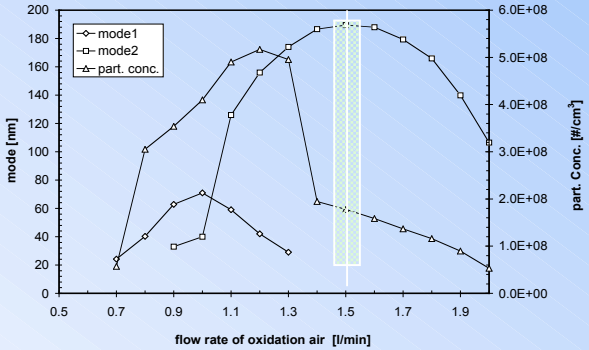




Air influences on the flame premixed with N_2

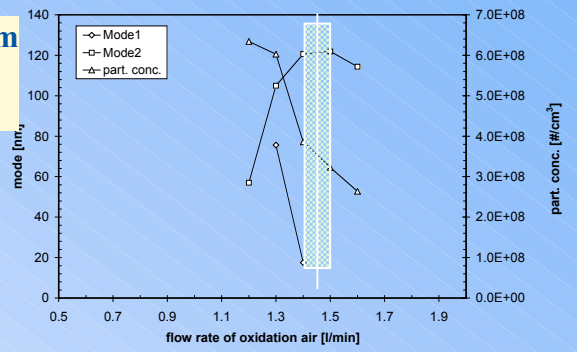
N_2 = 0 lpm

189 nm



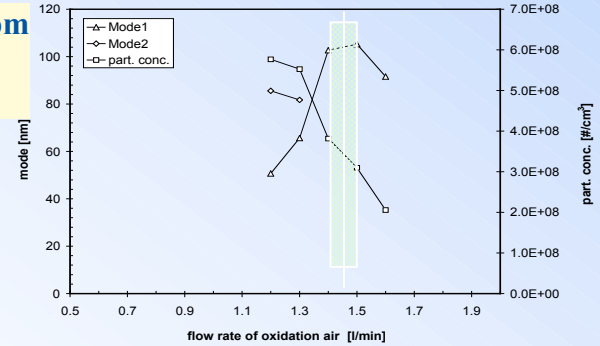
N_2 = 0.10 lpm

121 nm



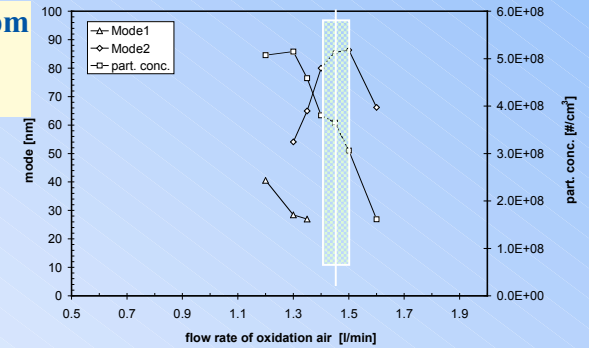
N_2 = 0.15 lpm

104 nm



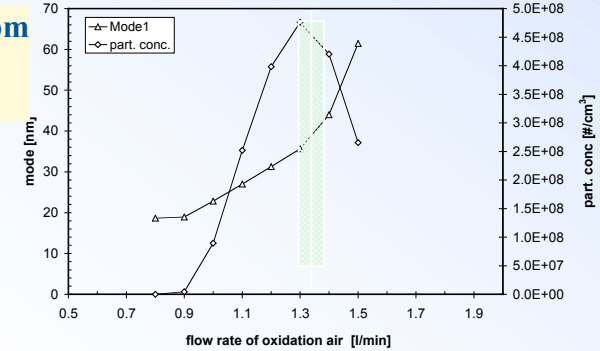
N_2 = 0.20 lpm

89 nm



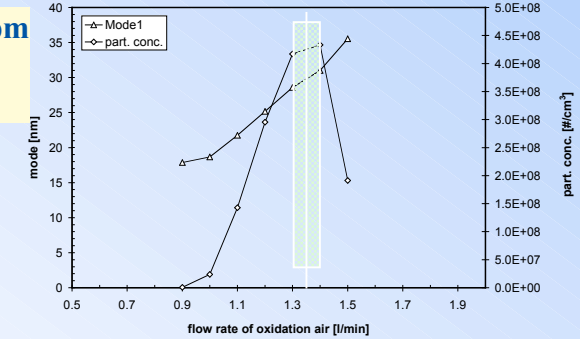
N_2 = 0.25 lpm

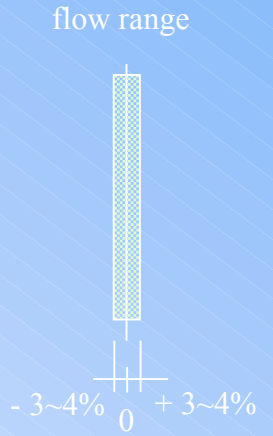
40 nm



N_2 = 0.30 lpm

30 nm

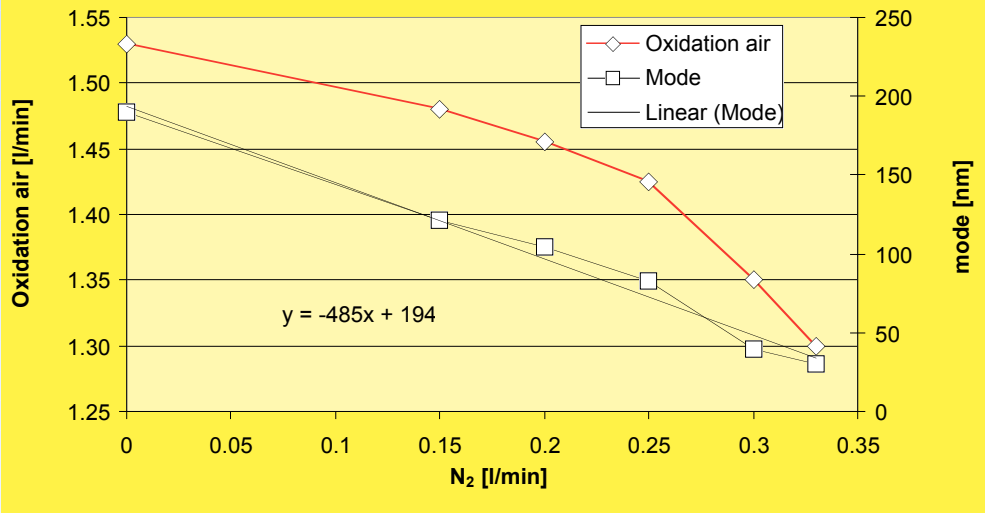


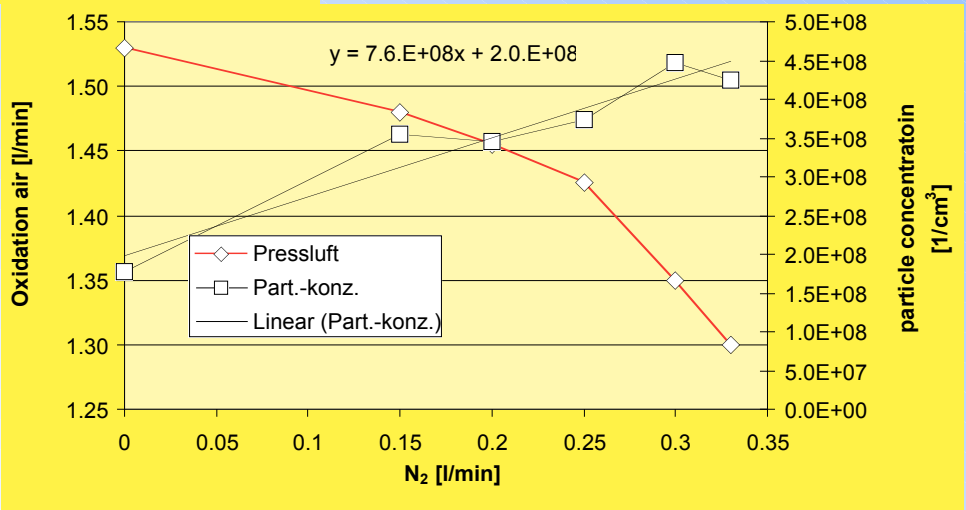


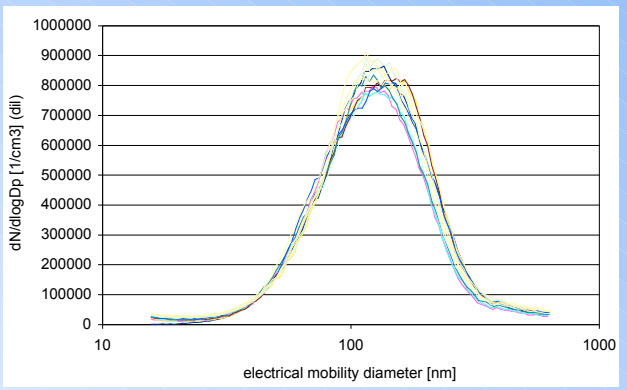
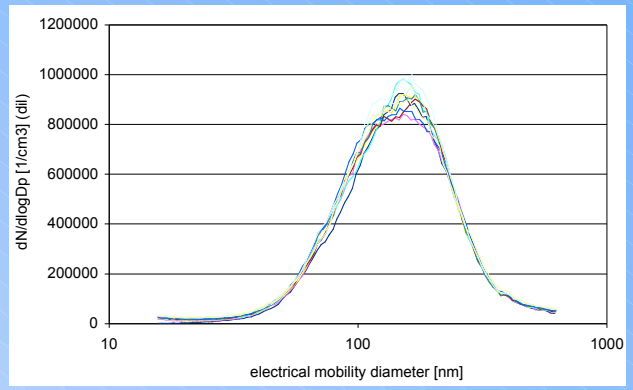
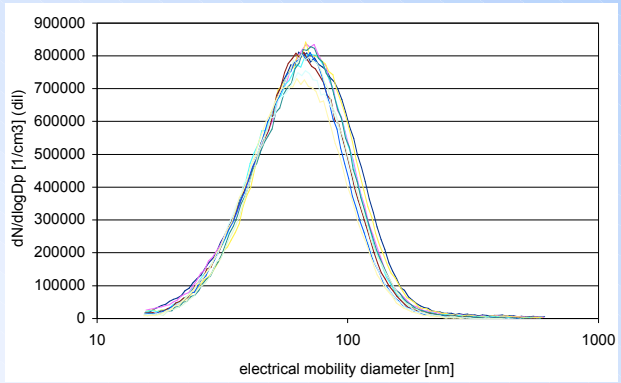
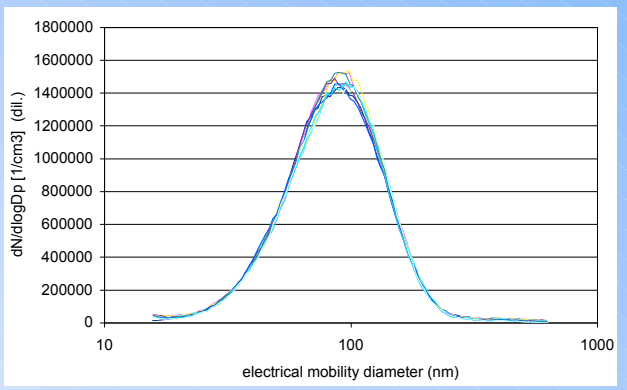
Deviations of particle size and number concentration

Operation points		flwo rate		±1% air flow deviation	
mode [nm]	*part. conc. [#/cm^3]*	*N_2 [l/min]*	*oxid. air [l/min]*	*mode*	*part. conc*
189	1.78E+08	0.00	1.50	± 0.2 %	± 1.6 %
121	3.54E+08	0.15	1.47	± 0.2 %	± 1.3 %
104	3.46E+08	0.20	1.45	± 0.4 %	± 3.0 %
83	3.73E+08	0.25	1.43	±1.9 %	± 1.2 %
40	4.48E+08	0.30	1.35	± 2.8 %	± 0.9 %
30	4.25E+08	0.33	1.30	± 1.1 %	± 0.3 %

Correlations between air flow and particulate parameters





	before	after
150 nm		
90 nm		
30 nm