SGP TDMA

Don Collins

SGP tandem differential mobility analyzer

- Installed in the AOS trailer ~ 10/1/05
- Continuous operation since
- First version of automated data processing and file creation software completed
- During CLASIC IOP in June:
  - Aircraft version of TDMA flown on Twin Otter
  - Additional ground version used for chamber studies in GIF

SGP tandem differential mobility analyzer

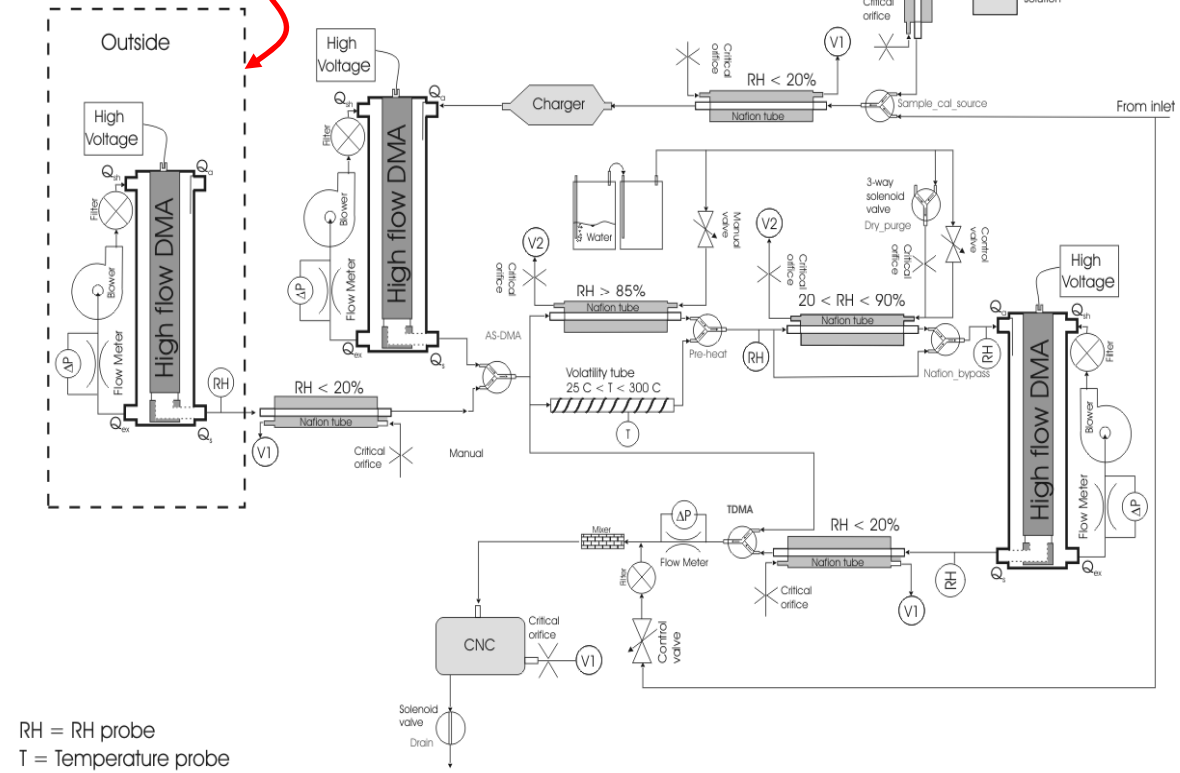
Instrument overview

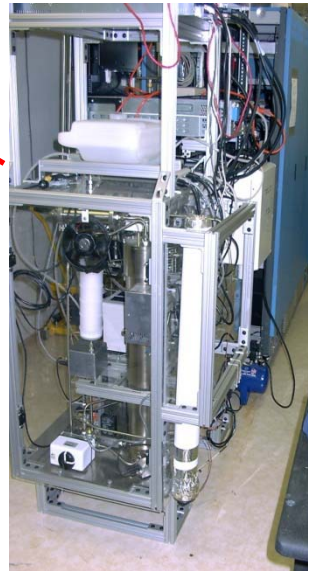
Measurement sequence

APS addition

Coupling to CCNc

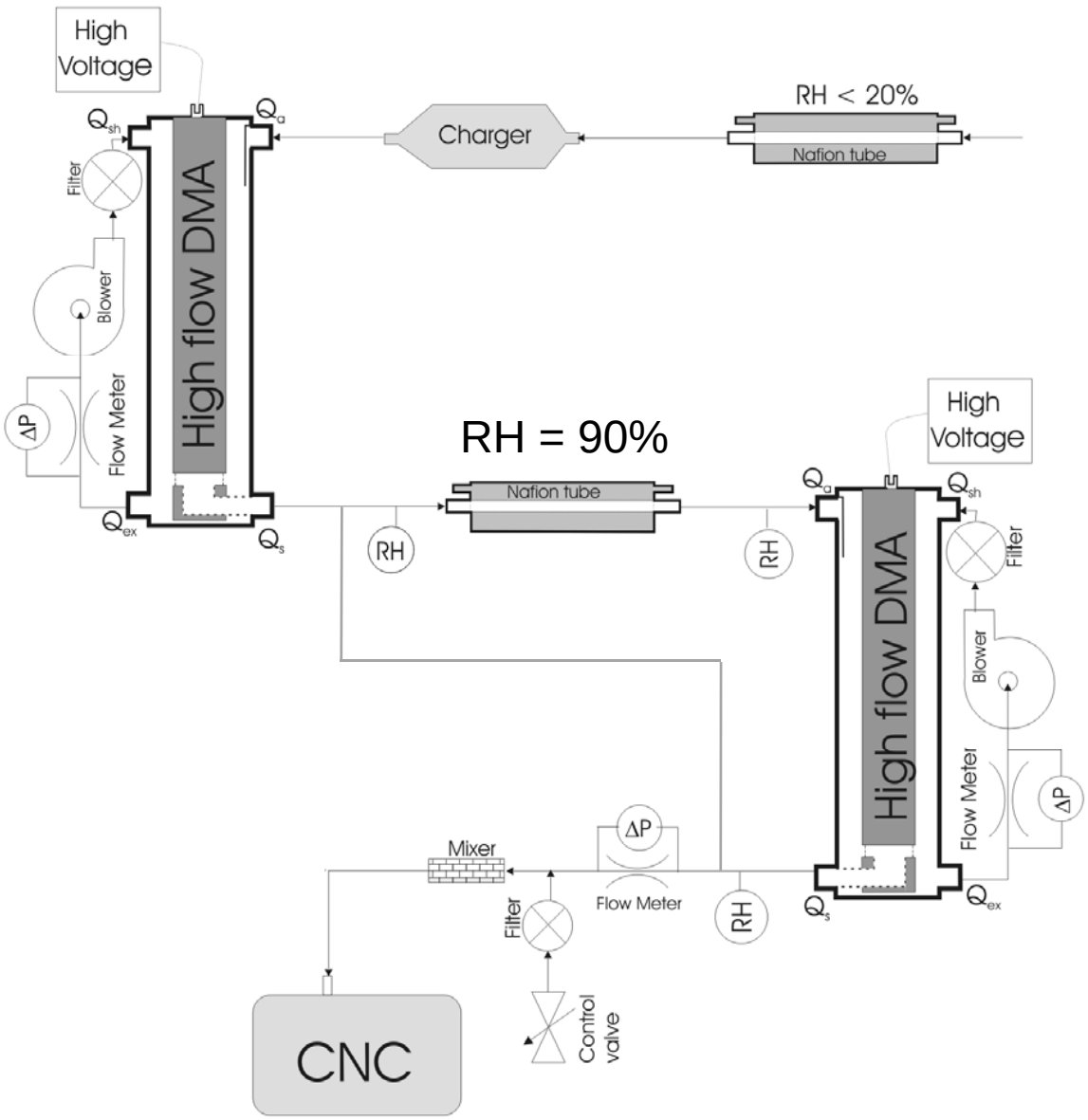
Data processing automation



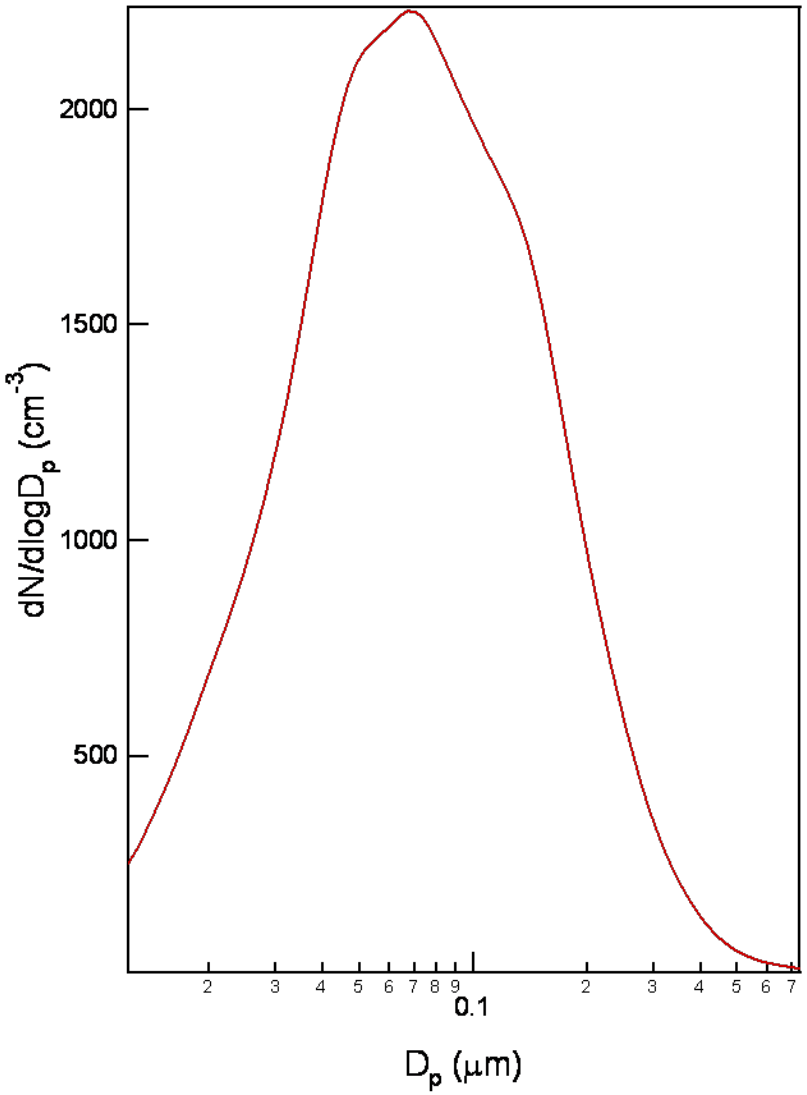


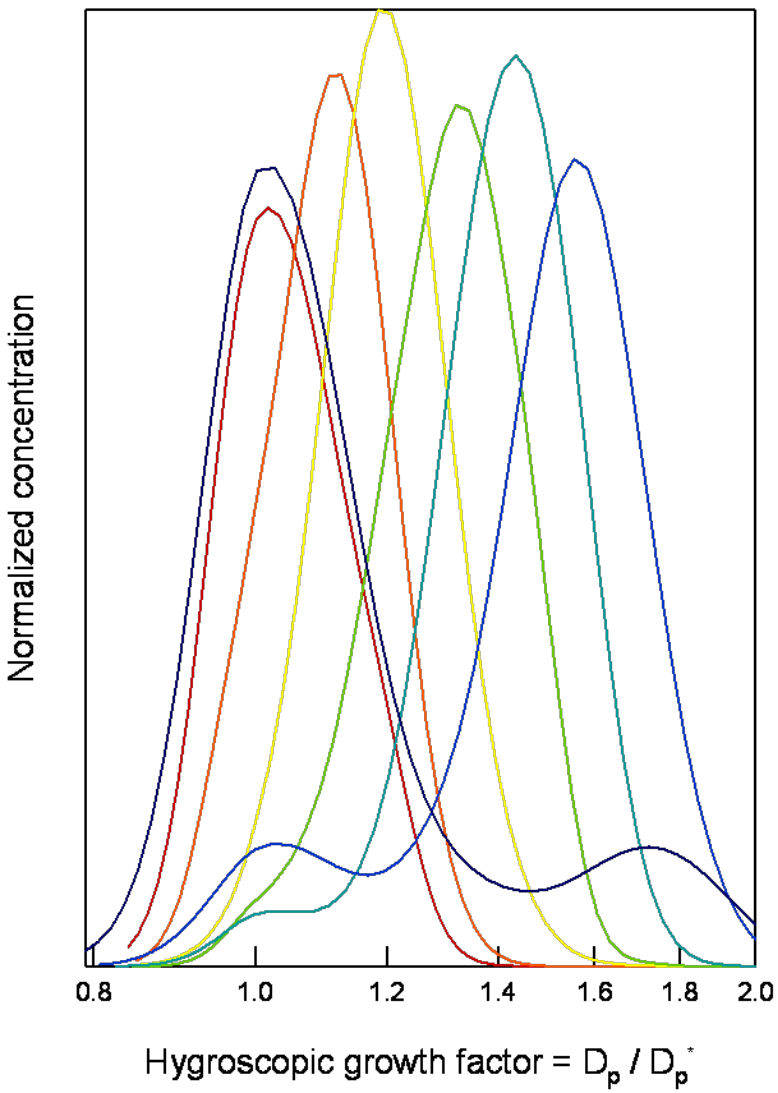
RH = RH probe
T = Temperature probe
V = Vacuum

Simplified schematic of indoor component



Example size and hygroscopicity distributions





Typical measurement sequence

Measurement name	Quantity measured	Size resolution / range	Time	Frequency
DMA	Dry aerosol size distribution	75 bins between 0.01 and 0.75 µm D_p	5 min	~ 25 times daily
TDMA	Size-resolved hygroscopic growth at fixed RH (90%)	7 bins between 0.013 and 0.6 µm dry D_p	40 min	~ 25 times daily
RH scan	Size-resolved hygroscopic growth over wide RH range (30 – 90% RH)	Limited to 0.05 and 0.2 µm dry D_p	2 hr	once daily
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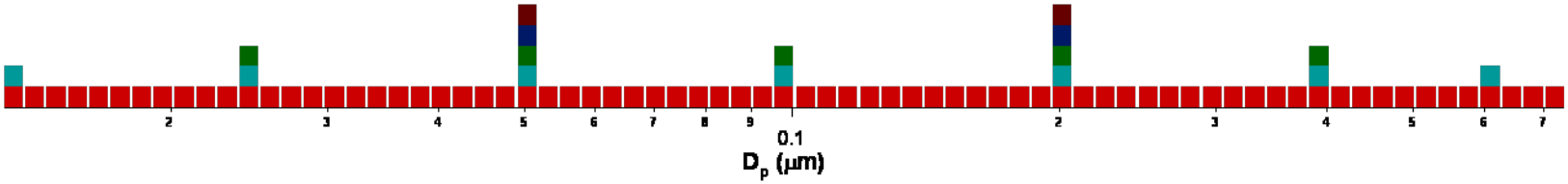
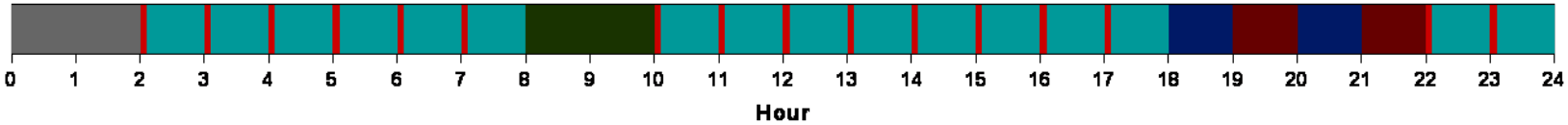
AS TDMA	Size-resolved ambient hydration state o Generally suitable only when ambient RH is between 40 and 80%	5 bins between 0.025 and 0.4 µm D_p	2 hr	≤ once daily
Auto-calibration	o Growth of NaCl particles at low (~10%) and high (90%) RH o False count rate		2 hr	once daily





Possible additions / changes

1. Replace AOS optical particle counter (OPC) with aerodynamic particle sizer (APS)

2. Couple TDMA to cloud condensation nuclei counter (CCNc)

TSI 3321 Aerodynamic Particle Sizer (APS)

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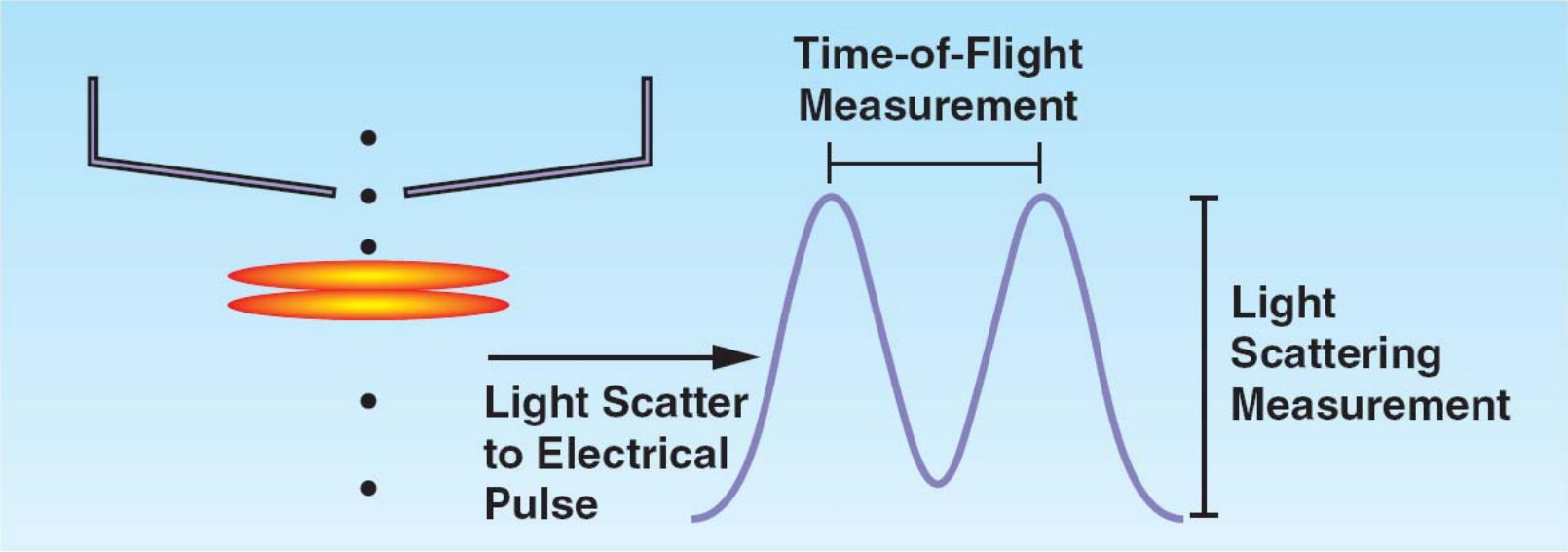
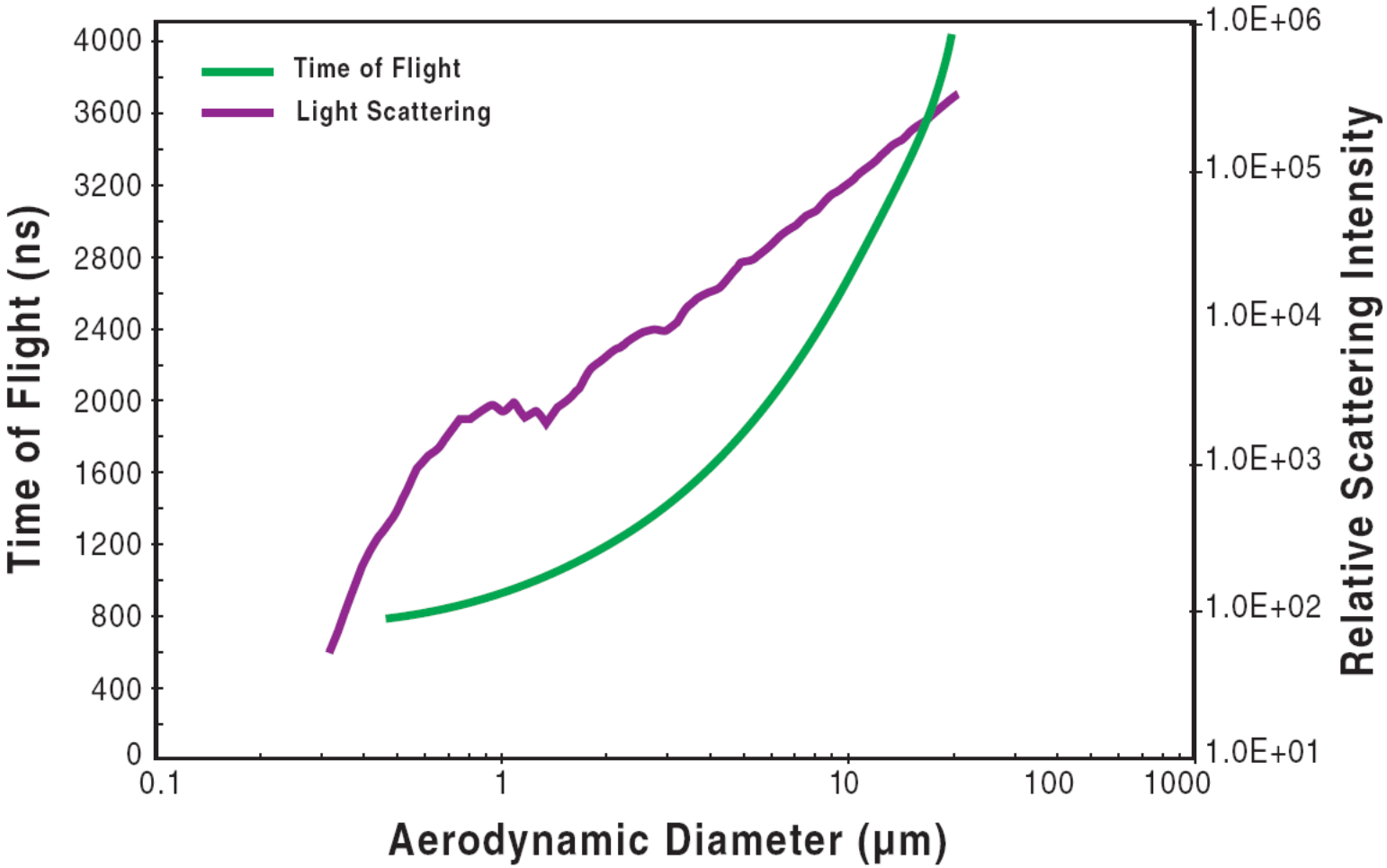
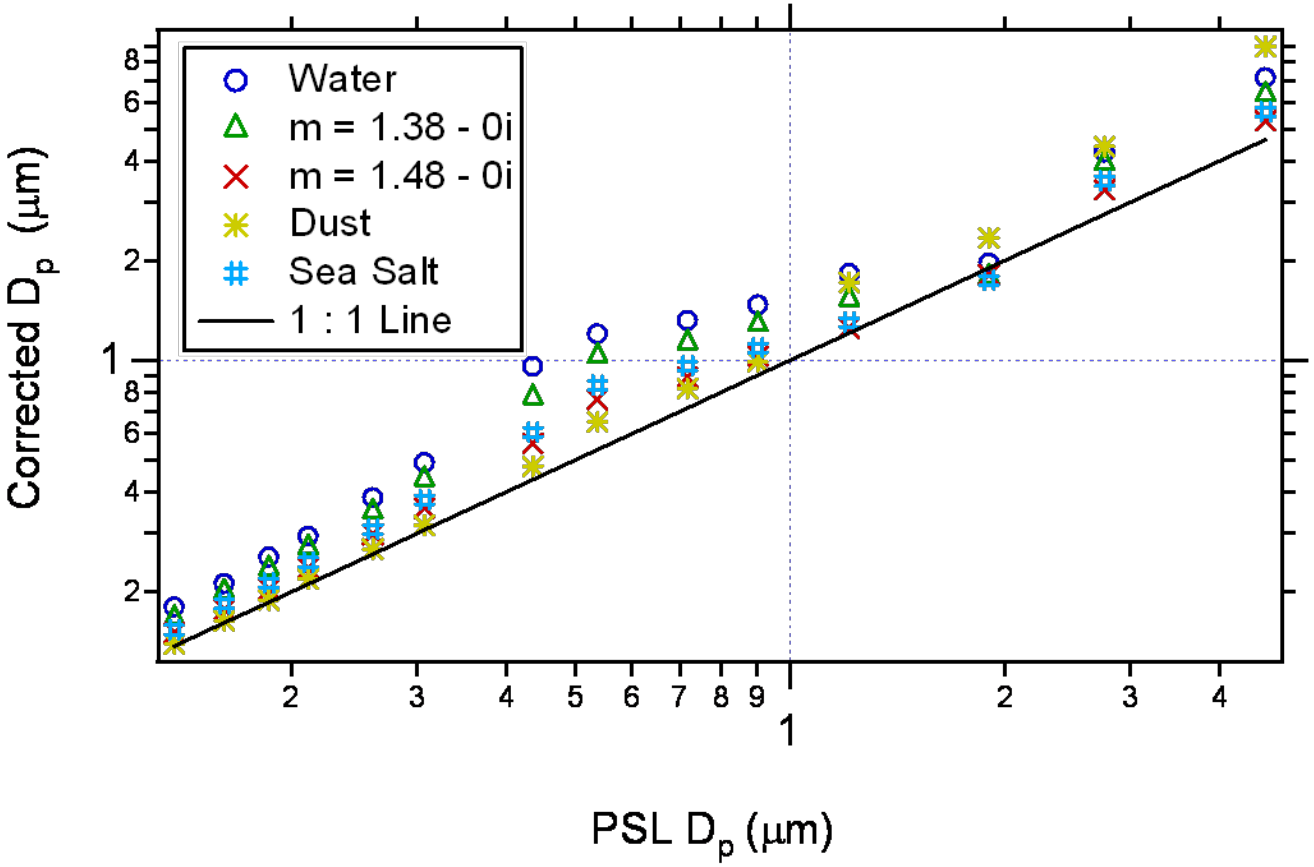


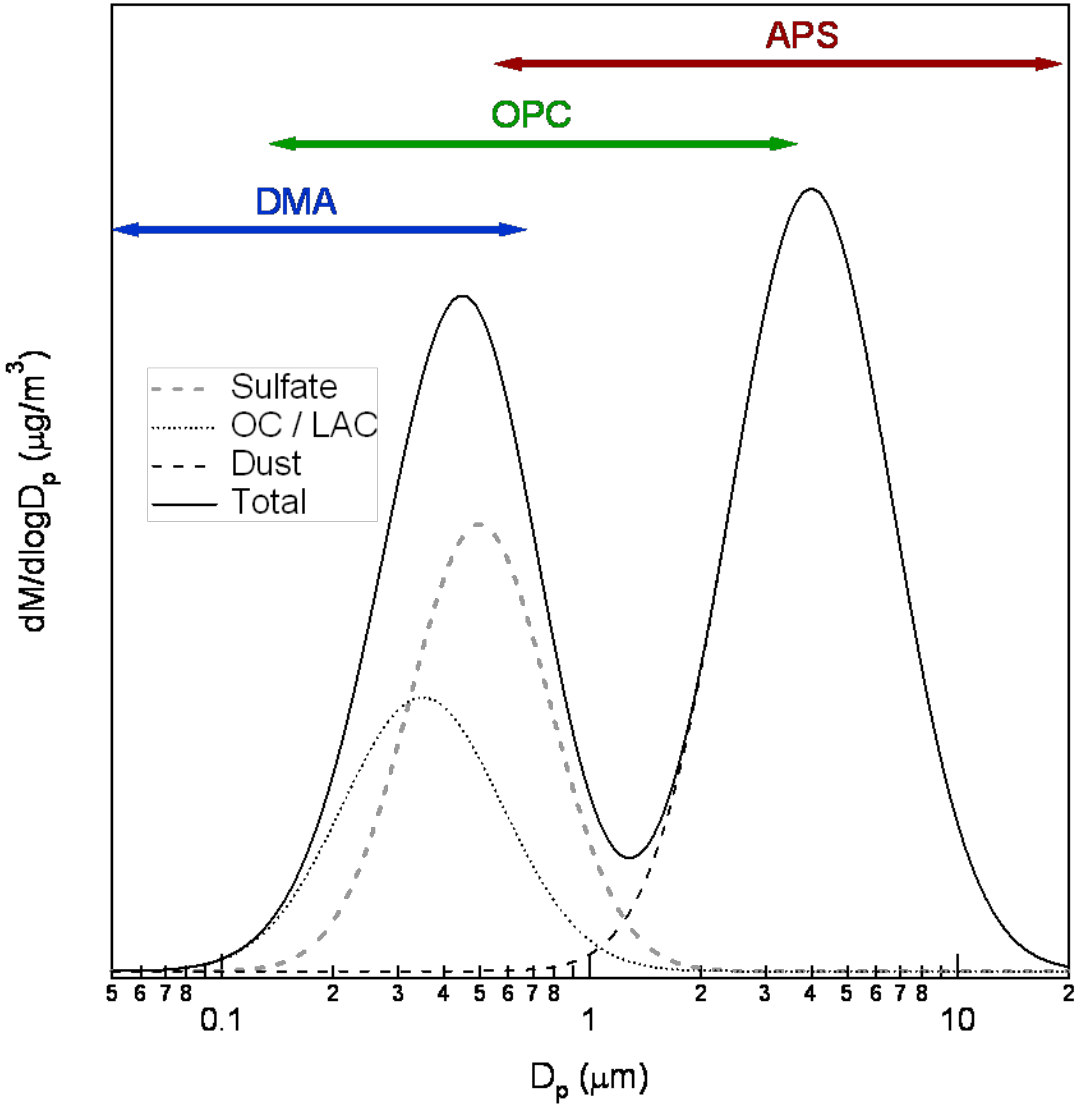
APS TOF vs. D_p


Time of Flight
Light Scattering
Time of Flight (ns)
4000
3600
3200
2800
2400
2000
1600
1200
800
400
0
0.1
1
10
100
1000
Aerodynamic Diameter (µm)
1.0E+06
1.0E+05
1.0E+04
1.0E+03
1.0E+02
1.0E+01
Relative Scattering Intensity

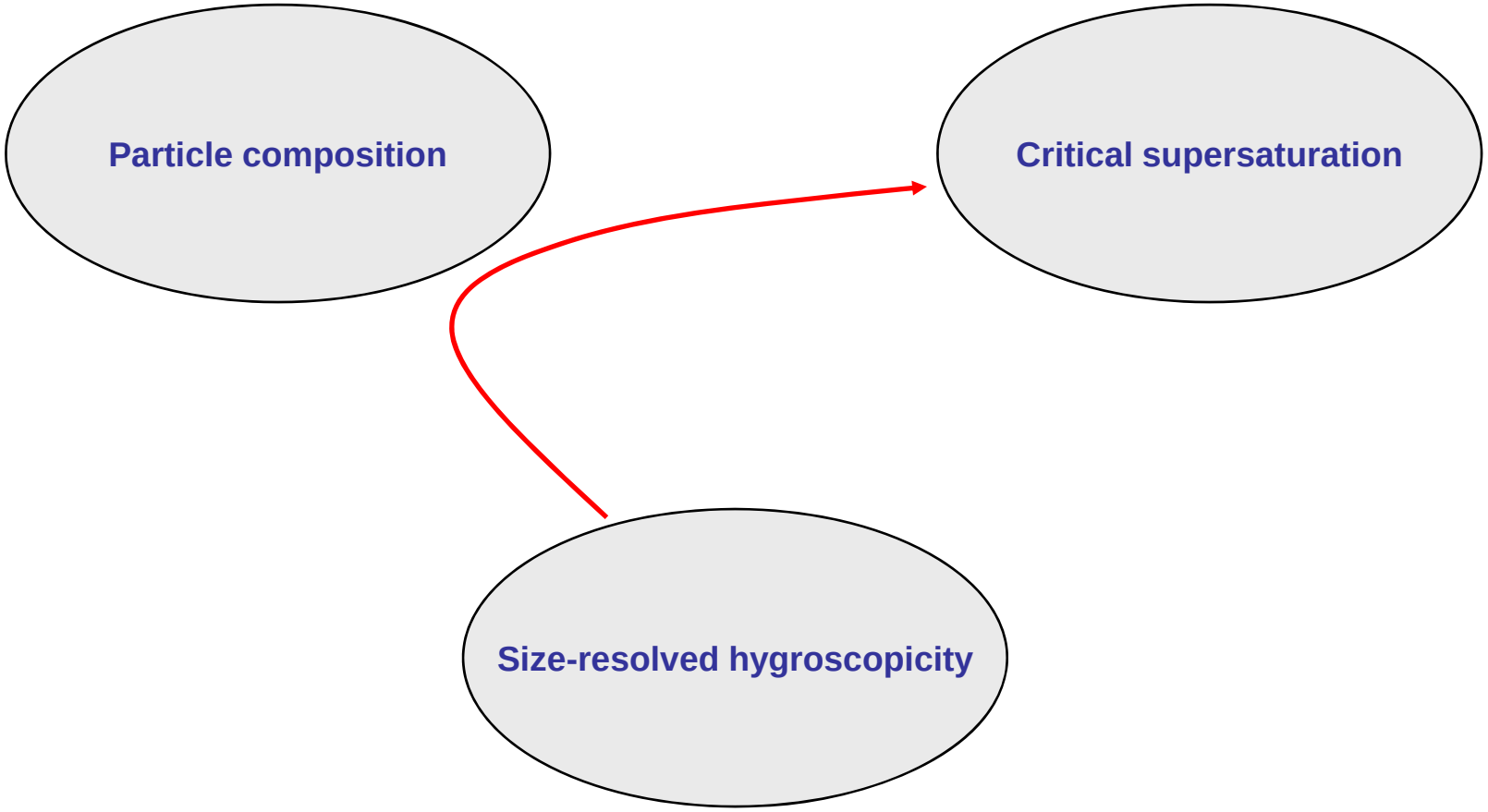
OPC sizing sensitivity to composition



Complementary DMA and APS size ranges

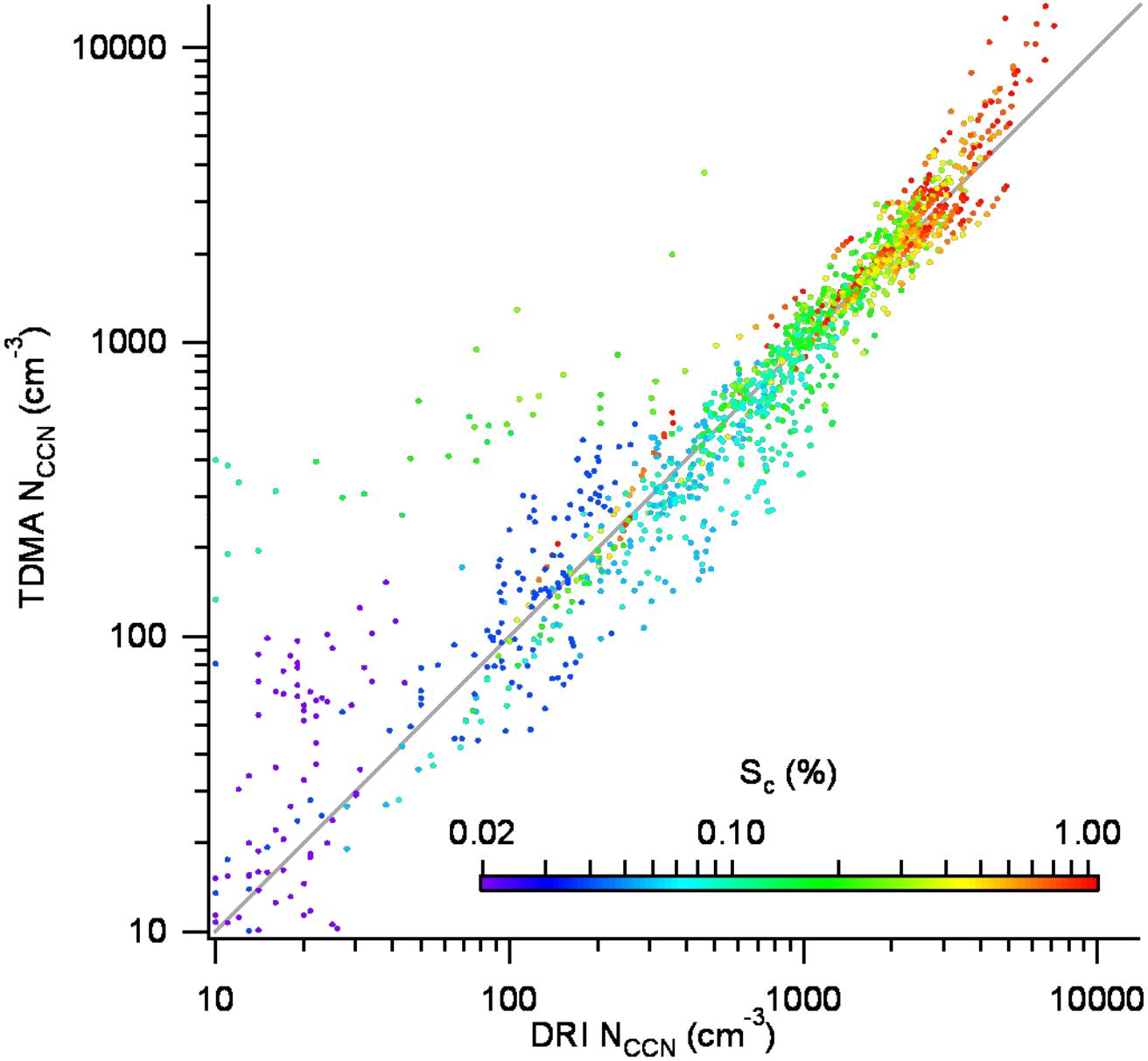


DMA + TDMA data → CCN spectra

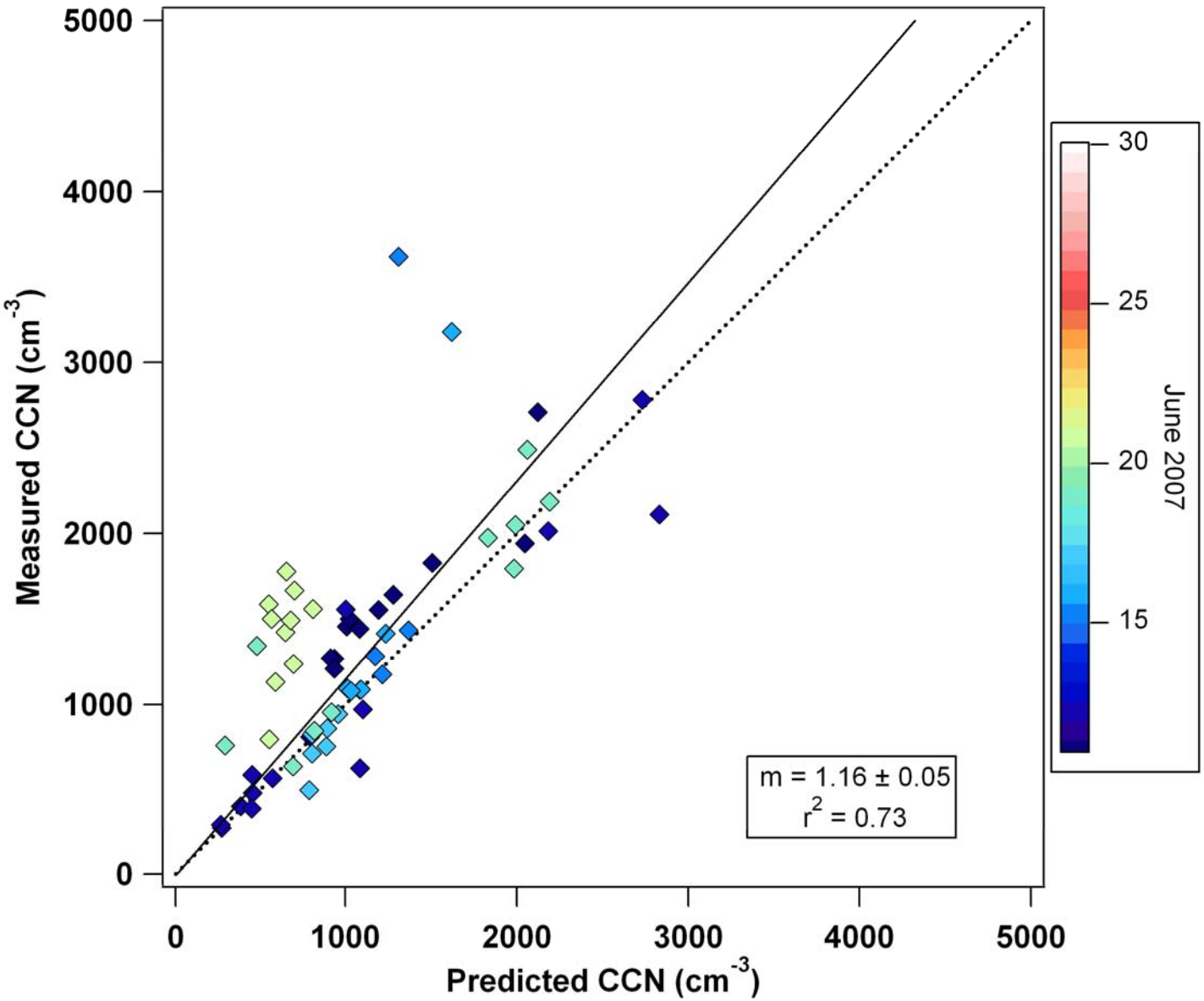


Files containing differential and cumulative spectra created

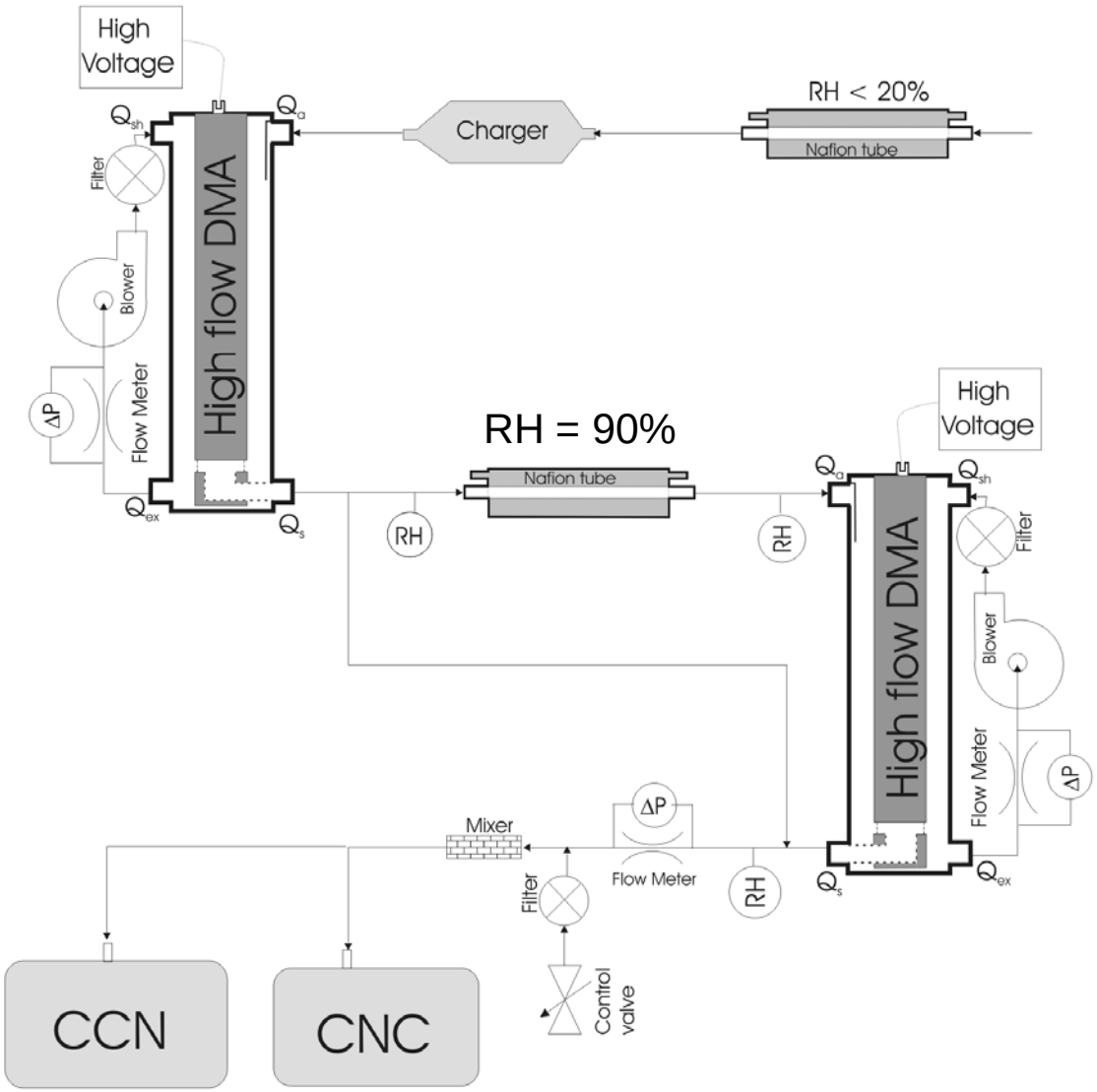
Comparison with direct CCN measurements



Comparison with direct CCN measurements



Near-future TDMA – CCNc combination



Objective # 1: CCNc calibration

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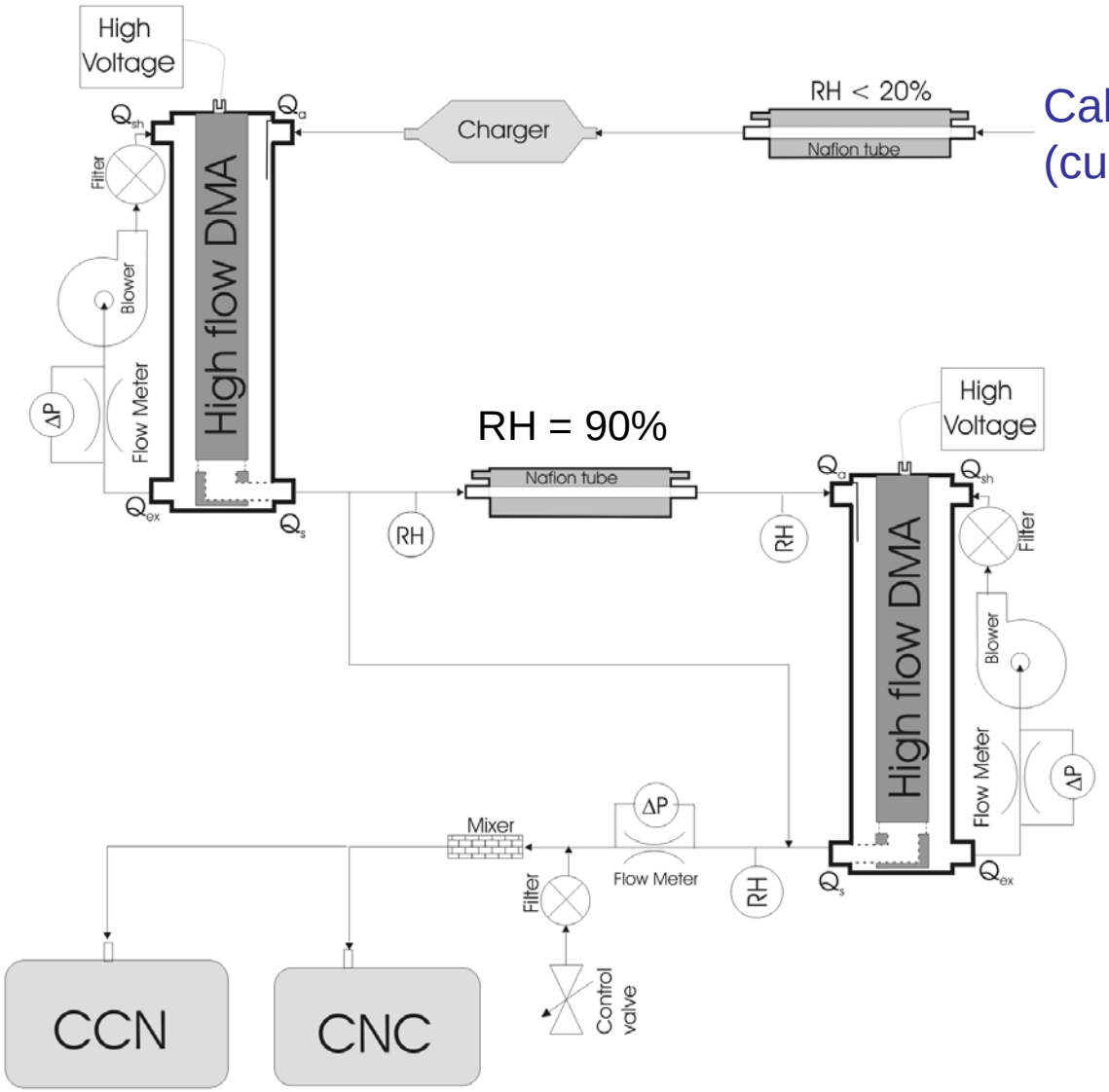
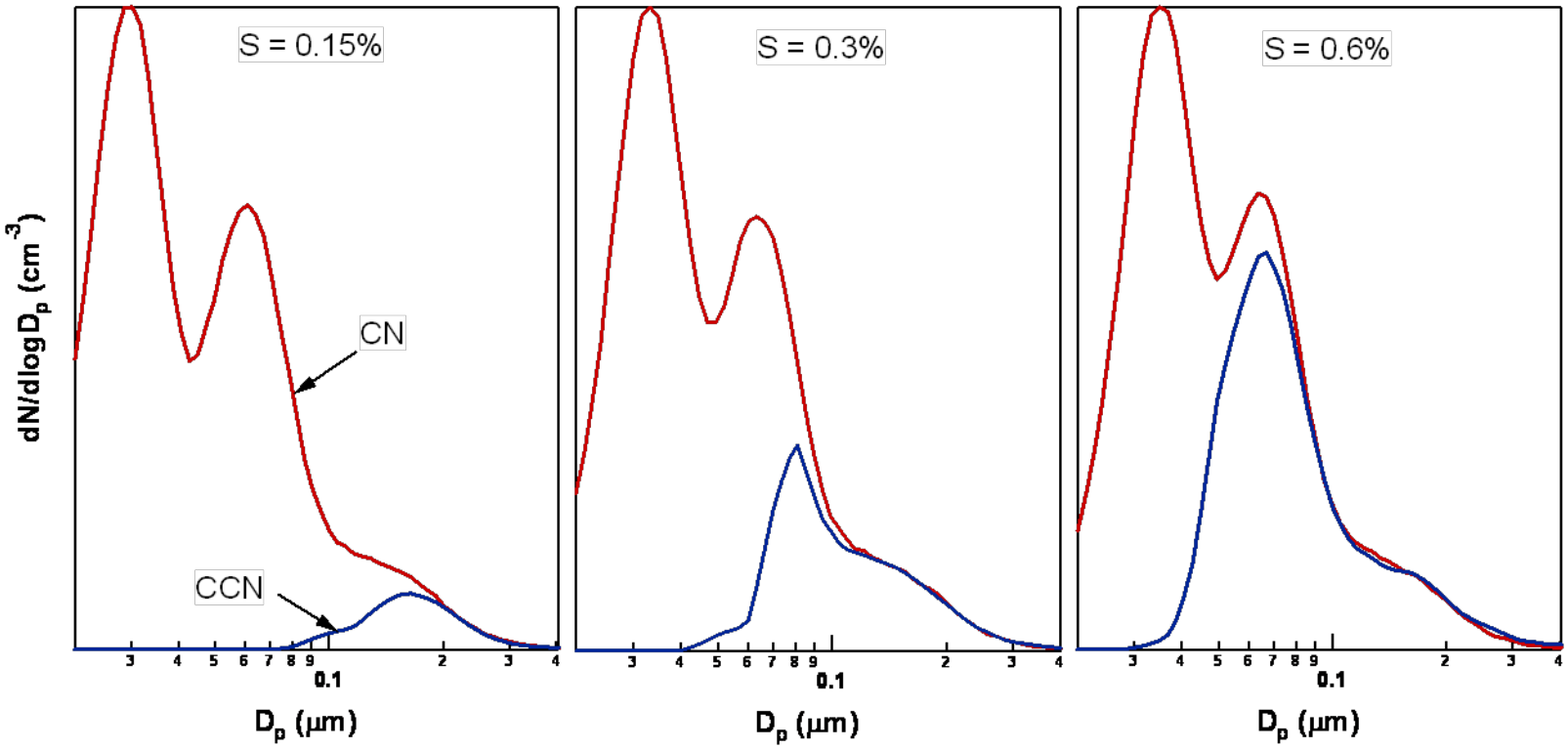


Calibration aerosol (currently NaCl)

(possible) Objective # 2: $S_c = f(D_p, GF)$



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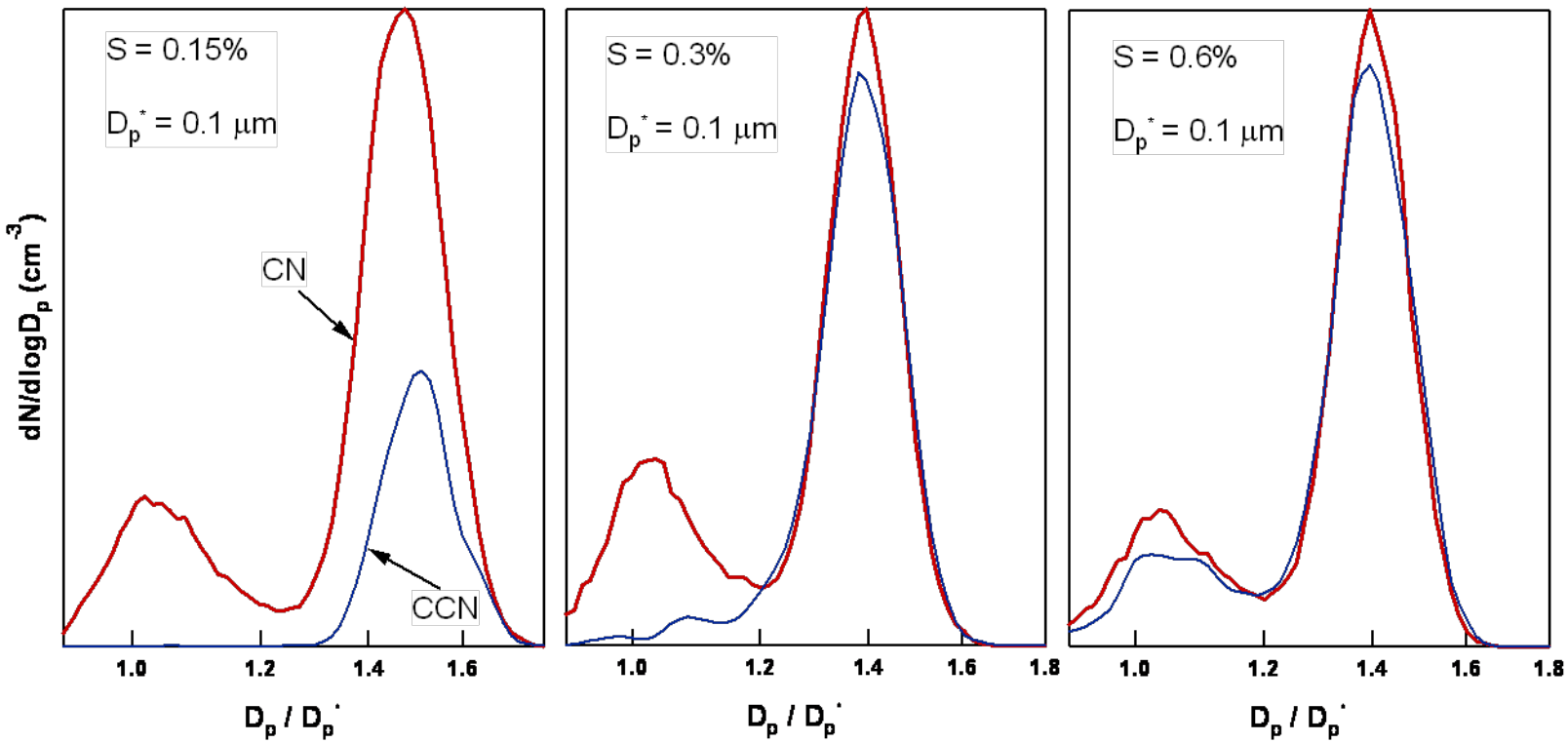

Lognormal fits of all distributions

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Σ ~ 600 distributions daily