

Intercomparison of Mobility Particle Size Spectrometers

Project No.: MPSS-2017-3-4

Principal Investigator: M. Wallasch

Home Institution: UBA
Wörlitzer Platz 1
06844 Dessau-Roßlau

Participant: -

Candidate: DE-UBA Waldhof
Made by: TROPOS
Counter (SN): TSI CPC Model 3772, SN: 70835060
Software: TROPOS Software

Location of the quality assurance: TROPOS Leipzig, lab 118

Comparison period: May 16, 2017 – June 02, 2017

Last Intercomparison (with Project No.):

Summary of Intercomparison:

Pre-Status:

During the Pre-Status, the performance of the system showed a concentration 2% lower than the TROPOS Reference Instrument No.1. The PSL check showed a correct peak at 205.04 nm. The instrument showed problems with the TSI CPC 3772. There was an internal leak and counting problems. TROPOS is not able to repair it. TROPOS gave Andreas Schwerin the advice to send the CPC to TSI for maintenance. Meanwhile, we placed the additional total CPC TSI Model 3772 from Waldhof into the MPSS system. After getting the CPC back from

TSI, TROPOS will check the CPC efficiency and replace the CPC in the MPSS system. A second problem that came up was the radioactive source Kr85 from TSI. The radioactive source is made out of a cylinder including the Kr85 and two fittings with 1/4" tubes on both ends. Normally they are well connected, but during the check in TROPOS this source showed one loose ending. This is not hazardous, but during the zero check with a total CPC, pulling of the loose end, resulted in a concentration of more than 100 p/cm³. TROPOS recommends to send the source back to TSI.

Due to these technical issues, the candidate did not pass the quality standards of ACTRIS and GAW. Despite this, all data measured before the intercomparison at TROPOS can be used. The correlation and also the size distribution correspond to the ACTRIS and GAW standard.

Final-Status:

As already mentioned, the original TSI CPC and Kr.85 source should be replaced or repaired. To not lose data on the station, TROPOS replaced the original CPC with a total TSI CPC 3772 from UBA and temporarily placed another Kr85 source from TROPOS. During the Final-Status, the performance of the system showed a concentration 2% lower than the TROPOS Reference Instrument No.1. The PSL check showed a correct peak at 203.78 nm. The candidate passed the quality standards of ACTRIS and GAW.

Information about the instruments:

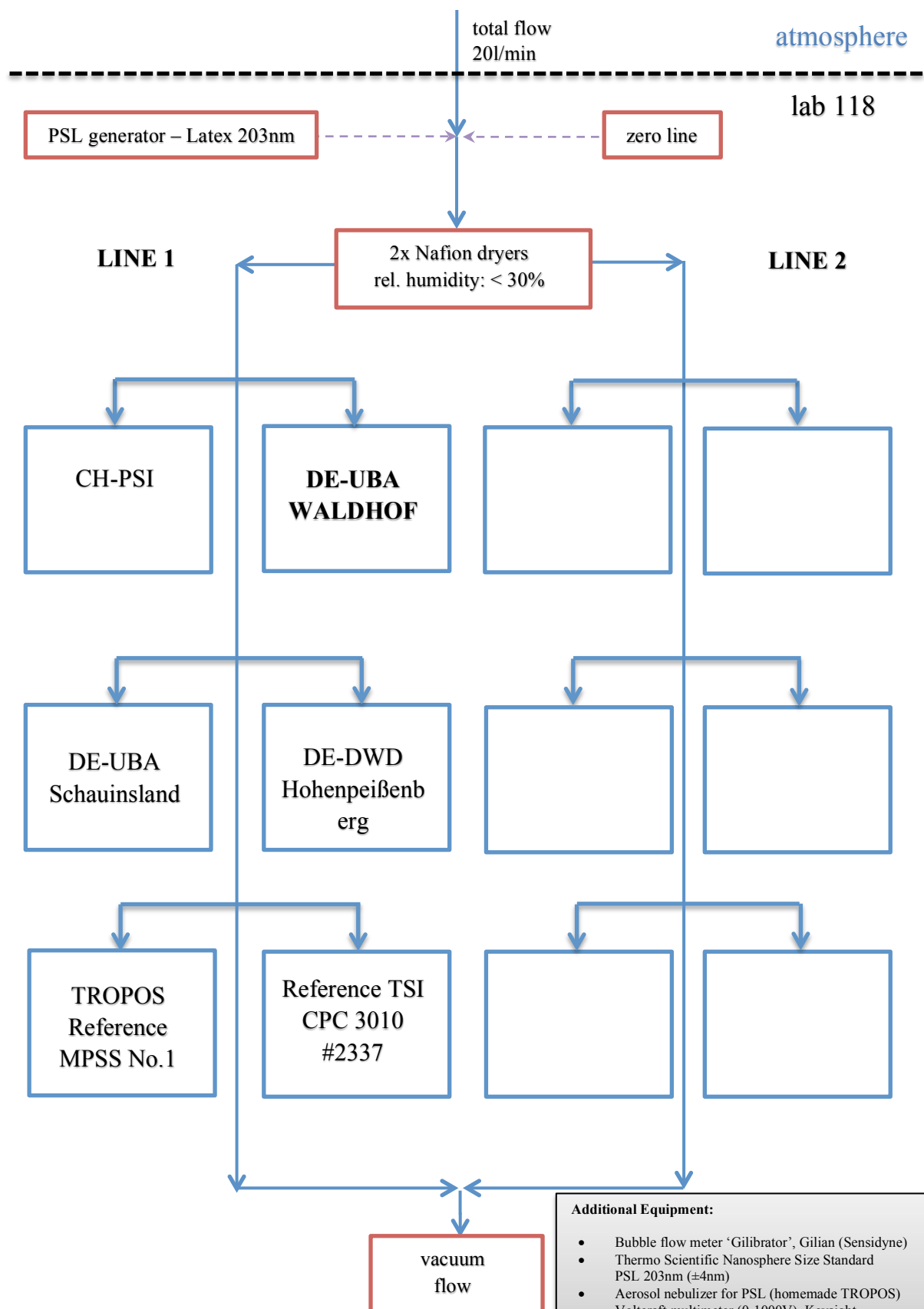
Date of check: May 15, 2017

<i>List of Components</i>	TROPOS Reference MPSS No.1	TROPOS Reference MPSS No.	Candidate
<i>Position</i>	Line 1	-	Line 1
<i>Company</i>	TROPOS	-	TROPOS
<i>Software</i>	TROPOS	-	TROPOS V6.66
<i>CPC-MPSS</i>	TSI CPC, Model 3772	-	TSI CPC, Model 3772 Used the total CPC
<i>CPC-total</i>	TSI CPC, Model 3010	-	-
<i>flow ratio</i>	1.0 : 5.0	-	1.0 : 5.0
<i>source</i>	Kr85	-	Kr85
<i>HV power supply</i>	positive	-	positive
<i>DMA</i>	Hauke medium	-	Hauke medium
<i>aerosol dryer</i>	✓	-	✓
<i>aerosol RH- sensor</i>	✓	-	✓
<i>aerosol T-sensor</i>	✓	-	✓
<i>sheath RH-sensor</i>	✓	-	✓
<i>sheath T-sensor</i>	✓	-	✓
<i>Sheath dryer</i>	✓	-	✓
<i>pressure sensor</i>	✓	-	✓

info

Software update

Laboratory setup:



Status of the instruments:

Date of check (Pre-Status): May 15, 2017

<i>CPC status</i>	MPSS		Total CPC	
<i>power/status</i>	LED green	-	-	-
<i>saturator temp</i>	39.1	°C	-	°C
<i>condenser temp</i>	22.0	°C	-	°C
<i>optics temp</i>	40.0	°C	-	°C
<i>cabinet temp</i>	35.8	°C	-	°C
<i>ambient pressure</i>	101.5	kPa	-	kPa
<i>orifice pressure</i>	79.5	kPa	-	kPa
<i>nozzle pressure</i>	2.4	kPa	-	kPa
<i>laser current</i>	43	mA	-	mA
<i>liquid level</i>	full	-	-	-

Date of check (Final-Status): June 01, 2017

<i>CPC status</i>	MPSS		Total CPC	
<i>power/status</i>	LED green	-	-	-
<i>saturator temp</i>	39.1	°C	-	°C
<i>condenser temp</i>	22.0	°C	-	°C
<i>optics temp</i>	40.0	°C	-	°C
<i>cabinet temp</i>	35.7	°C	-	°C
<i>ambient pressure</i>	101.5	kPa	-	kPa
<i>orifice pressure</i>	79.4	kPa	-	kPa
<i>nozzle pressure</i>	2.4	kPa	-	kPa
<i>laser current</i>	43	mA	-	mA
<i>liquid level</i>	full	-	-	-

Date of system checks:

<i>date</i>	15.05.2017	17.05.2017	01.06.2017		unit
<i>total CPC flow</i>	-	-	-		l/min
<i>aerosol flow (DMA)</i>	-	-	-		l/min
<i>aerosol flow (UDMA)</i>	-	-	-		l/min
<i>aerosol flow (total)</i>	0.994	1.031	1.029		l/min
<i>Zero MPSS</i>	0	0	0		#/cm ³
<i>Zero total CPC</i>	-	-	-		#/cm ³
<i>PSL 203 nm</i>	205.04	203.78	-		nm
<i>HV – 0 V</i>	0.3	0	-		V
<i>HV – 5 V</i>	5.2	5.1	-		V
<i>HV – 100 V</i>	100.0	100.1	-		V
<i>HV – 1000 V</i>	1000.4	1000.3	-		V

Special Information regarding the Candidate:

<i>Was it necessary to:</i>	yes/no (date)	old part (ID/SN)	new part (ID/SN)	information
<i>clean the aerosol inlet</i>	yes	-	-	-
<i>change aerosol Nafion dryer</i>	no	-	-	-
<i>change sheath Nafion dryer</i>	no	-	-	-
<i>check source</i>	yes	-	-	77A – 0290 44.0 nSv/h – okay Leak on the frame
<i>change HV power supply</i>	no	-	-	Checked; HV okay
<i>clean/change DMA</i>	yes	-	-	Cleaned; DMA okay
<i>change aerosol RH/T-sensor</i>	no	-	-	checked; sensor okay
<i>change sheath RH/T-sensor</i>	no	-	-	checked; sensor okay
<i>change pressure sensor</i>	no	-	-	checked; sensor okay
<i>change inlet Nafion dryer</i>	yes	-	ND0.7 - 206	New membrane
<i>Change Total filter</i>	no	-	-	-

PSL Scan and calibration: Latex 203 nm +/- 4 nm

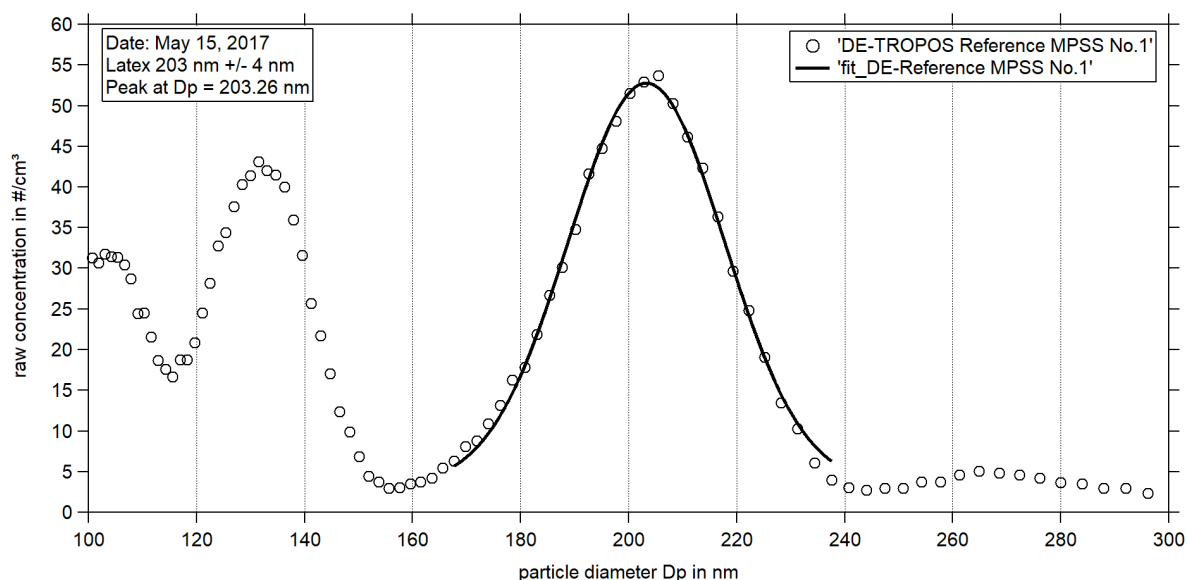


Figure 01: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on May 15rd, 2017.

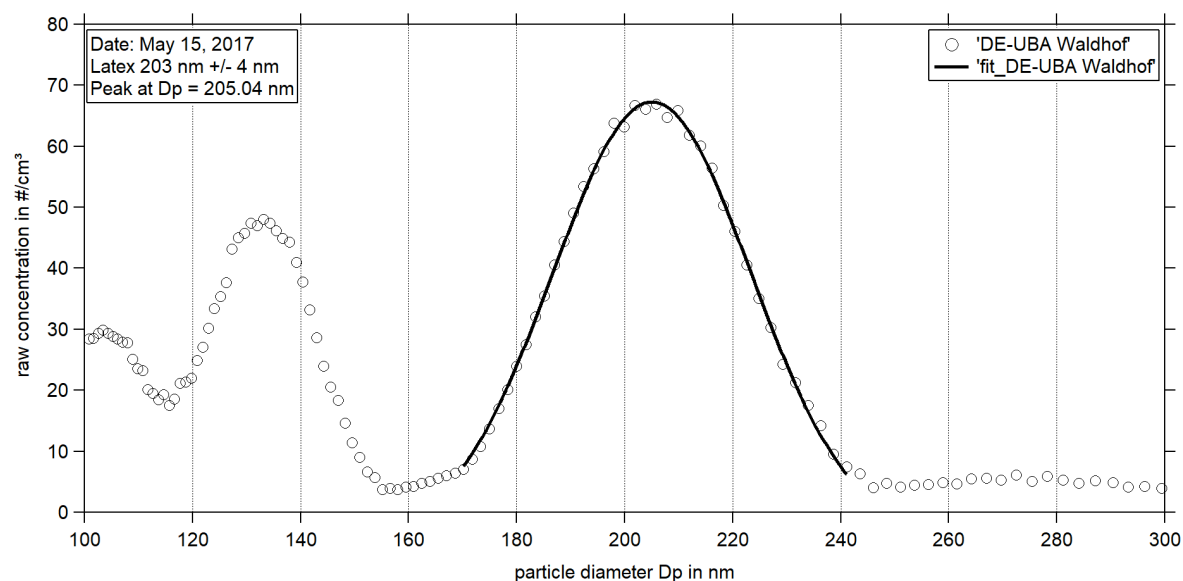


Figure 02: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on May 15rd, 2017.

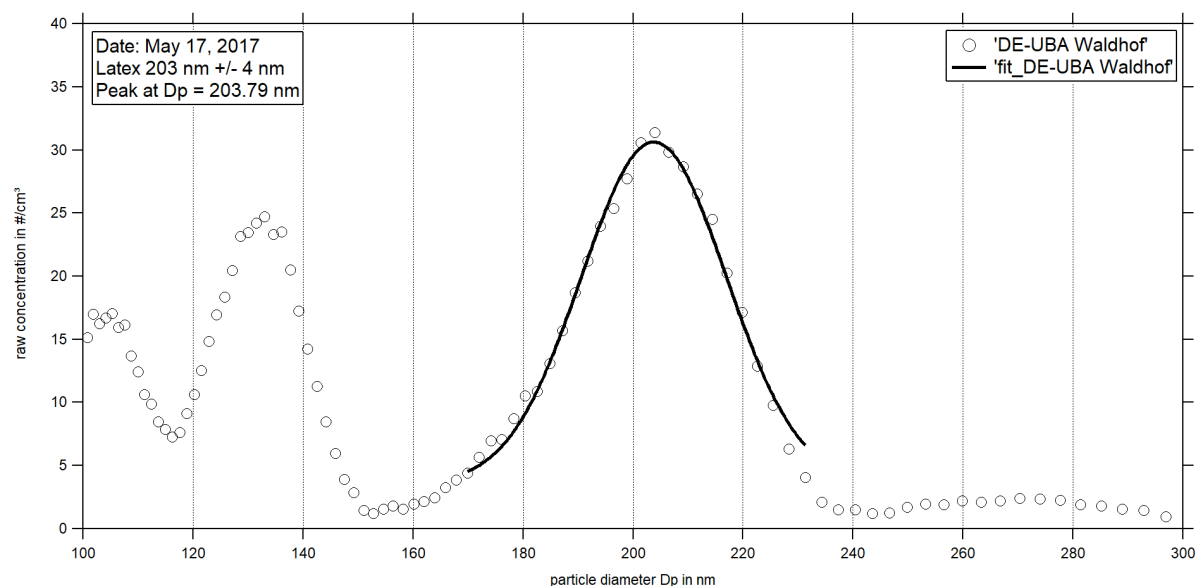


Figure 03: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on May 17th, 2017.

Pre-Status of the Candidate: Particle Number Size Distribution

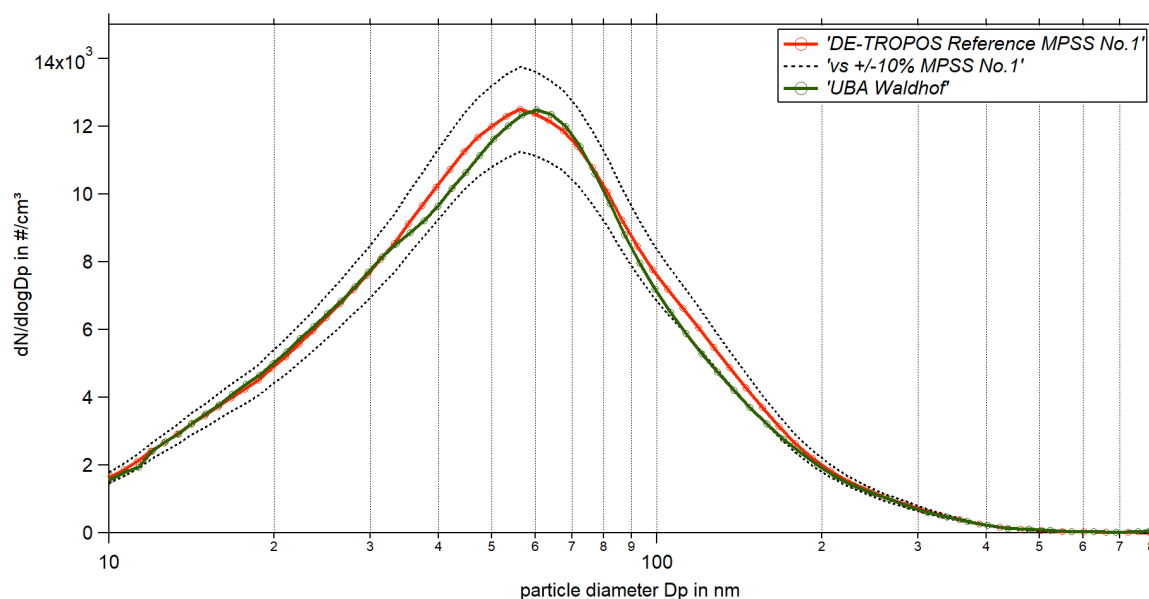


Figure 04: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against DE-UBA Waldhof from May 15, 2017 08:00 PM – May 16, 2017 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Pre-Status of the Candidate: Time Series

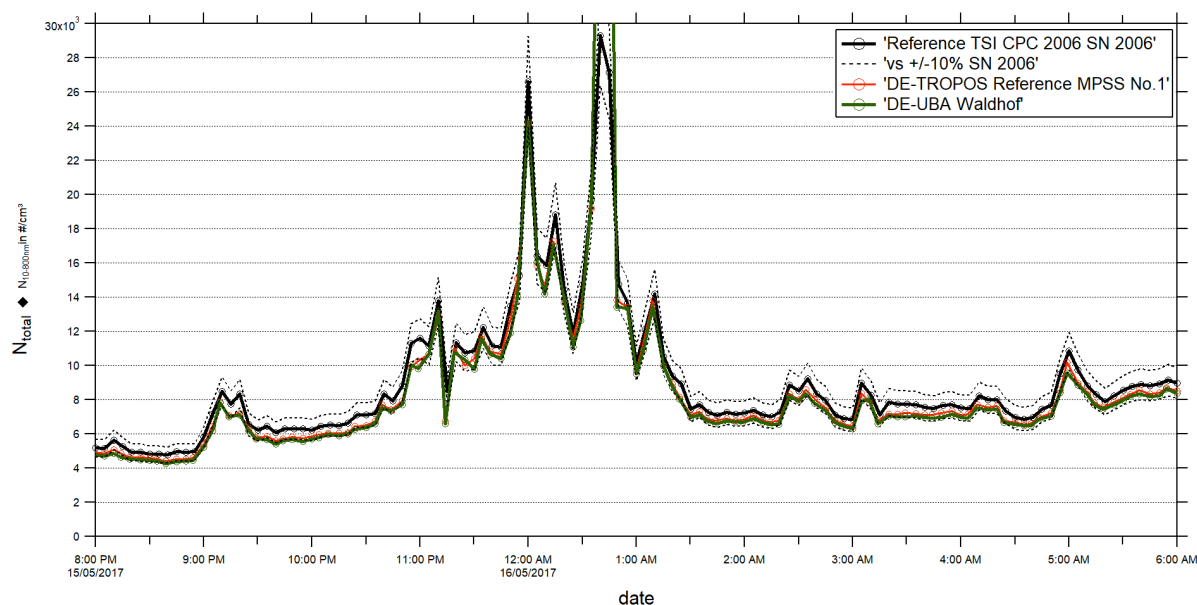


Figure 05: Time series (May 15, 2017 06:00 PM – May 16, 2017 06:00 AM) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Pre-Status of the Candidate: Correlation

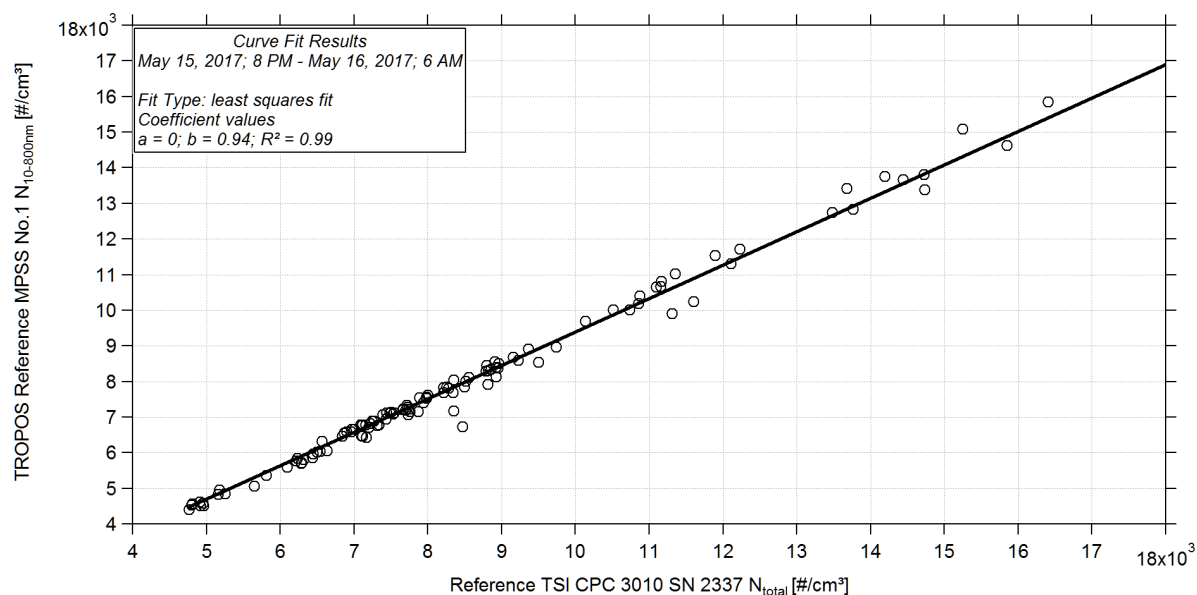


Figure 06: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

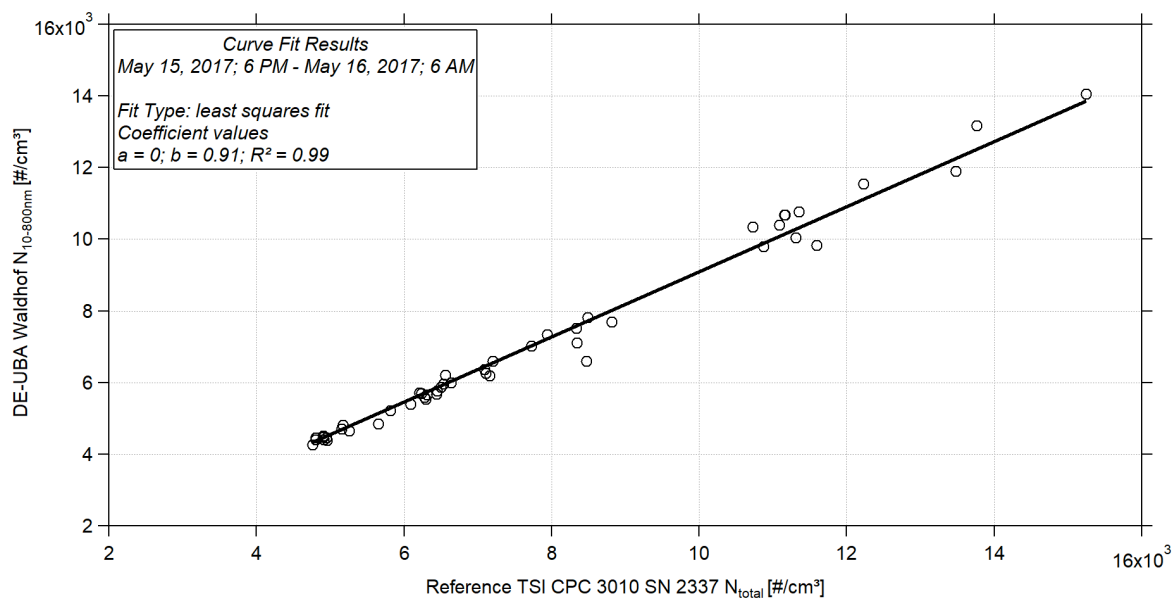


Figure 07: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and DE-UBA Waldhof. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

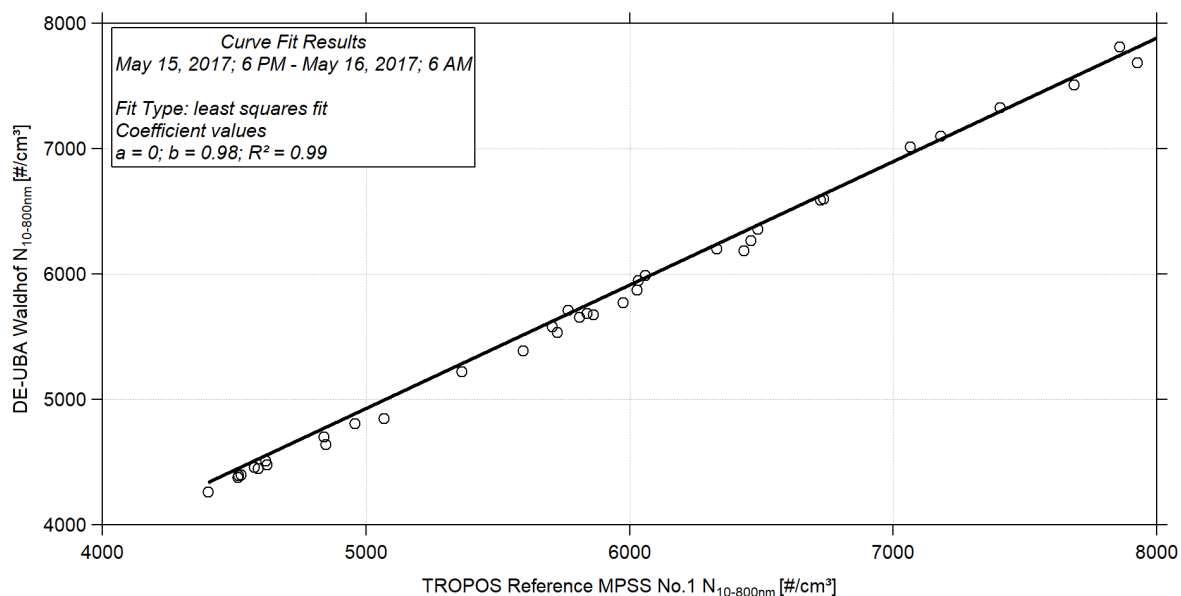


Figure 08: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and DE-UBA Waldhof. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Final-Status of the Candidate: Particle Number Size Distribution (not original settings)

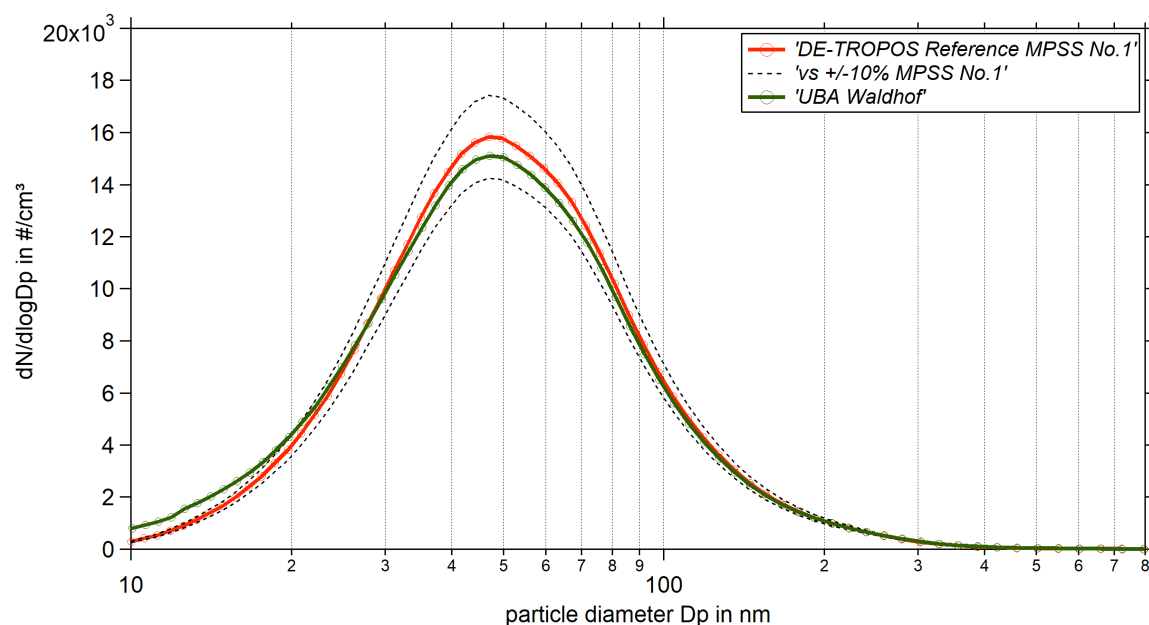


Figure 09: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against DE-UBA Waldhof from June 01, 2017 06:00 PM – June 02, 2017 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included. The system is running with the total TSI-CPC 3772 from Waldhof and a Kr.85 source from TROPOS.

Final-Status of the Candidate: Time Series (not original settings)

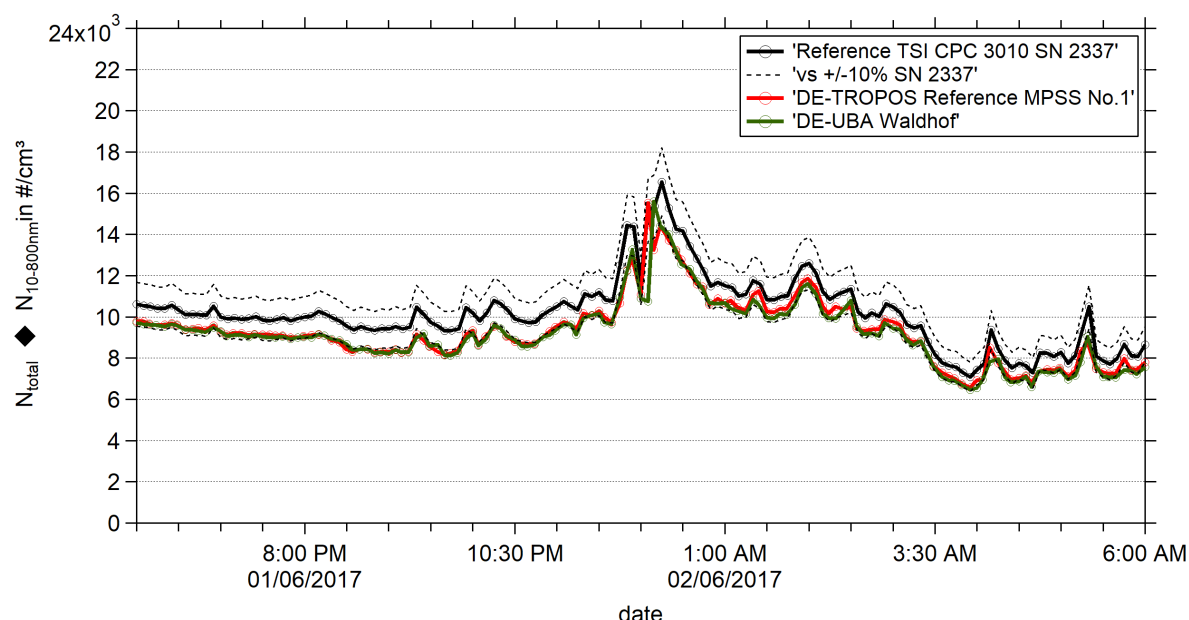


Figure 10: Time series (June 01, 2017 06:00 PM – June 02, 2017 06:00 AM) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included. The system is running with the total TSI-CPC 3772 from Waldhof and a Kr.85 source from TROPOS.

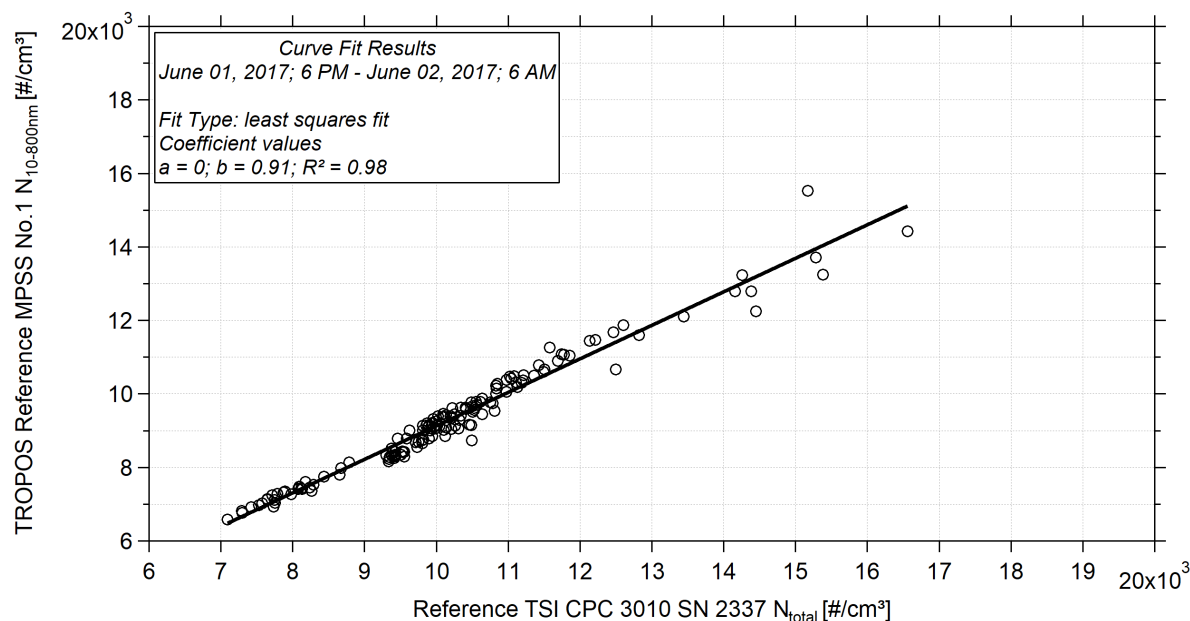
Final-Status of the Candidate: Correlation (not original settings)v

Figure 11: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and TROPOS Reference MPSS No.1 (June 01, 2017 06:00 PM – June 02, 2017 06:00 AM). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

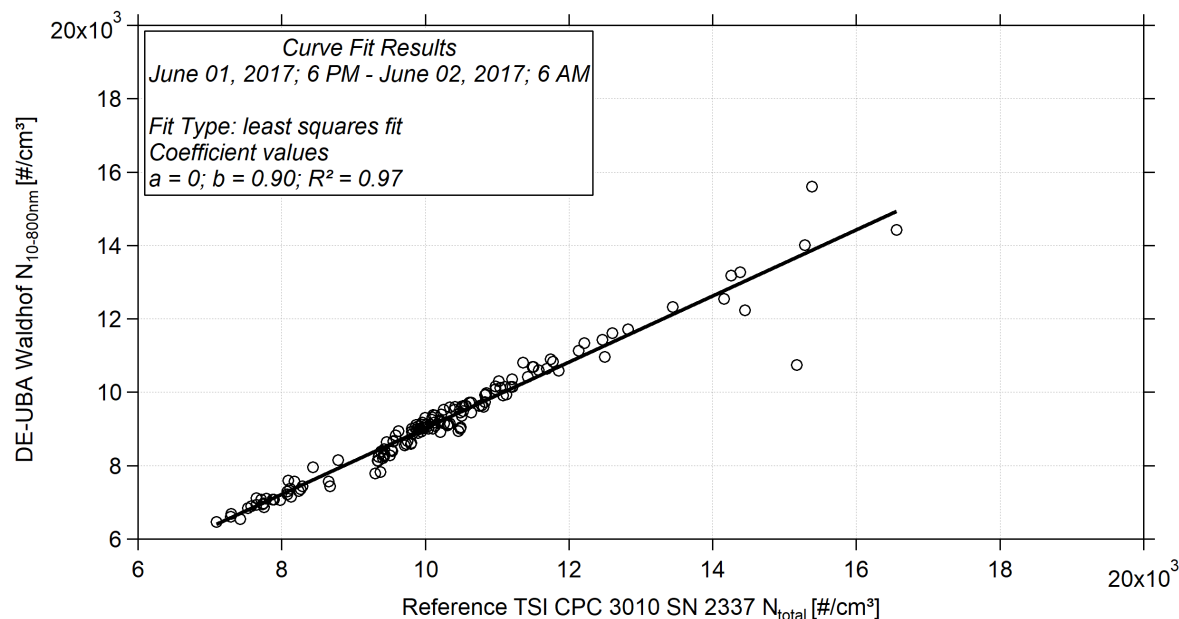


Figure 12: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and DE-UBA Waldhof (June 01, 2017 06:00 PM – June 02, 2017 06:00 AM). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

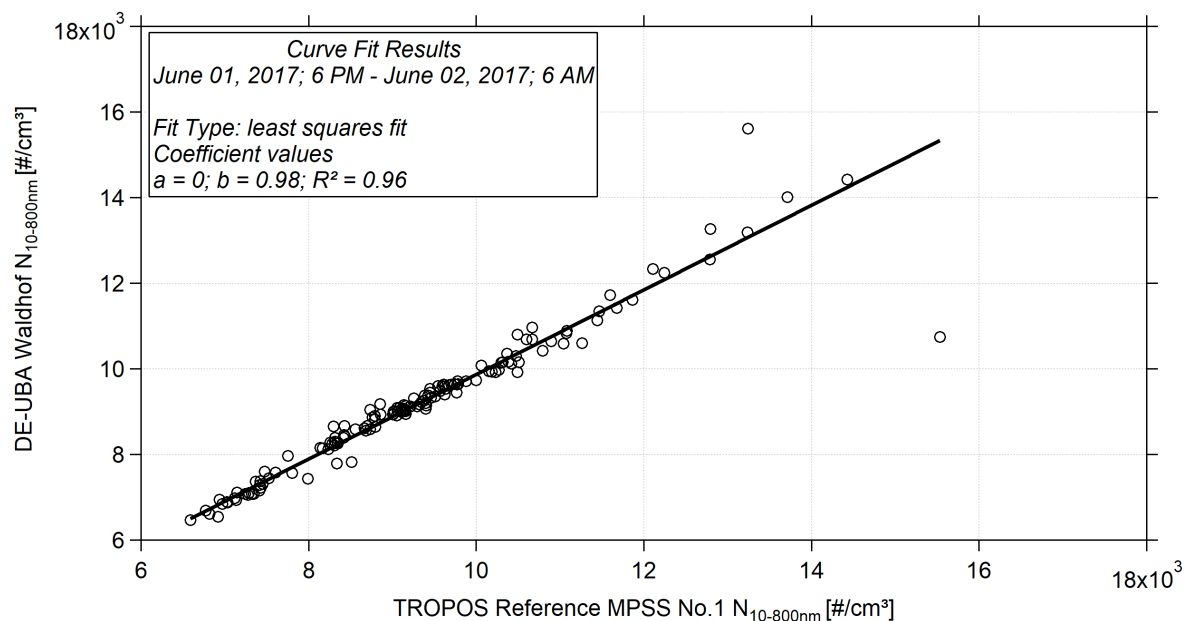


Figure 13: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and DE-UBA Waldhof (June 01, 2017 06:00 PM – June 02, 2017 06:00 AM). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.