Intercomparison of Mobility Particle Size Spectrometers

Project No.:	*MPSS-2017-5-6*
Principal Investigator:	Prof. A. Wiedensohler
Home Institution:	Leibniz Institute for Tropospheric Research
Participant:	-
Candidate:	**DE-TROPOS Reference MPSS No.1**
Made by:	TROPOS
Counter (SN):	TSI CPC Model 3772, SN: 3772141701
Software:	Labview TROPOS 6.66
Candidate:	**DE-TROPOS Reference MPSS No.4**
Made by:	TROPOS
Counter (SN):	TSI CPC Model 3772, SN: 71011009
Software:	Labview TROPOS 6.66
Location of the quality assurance:	TROPOS Leipzig, lab 118
Comparison period:	October 09, 2017 – October 13, 2017
Last Intercomparison (with Project No.):	

Leibniz-Institut für Troposphärenforschung e.V.
Telefon: +49 341 2717-7060
Telefax: +49 341 2717-99-7060
info@tropos.de
http://www.tropos.de

Commerzbank Leipzig
KTO 102 14 50
BLZ 860 400 00
IBAN: DE77 8604 0000 0102 1450 00
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Mitglied der Leibniz-Gemeinschaft

Summary of Intercomparison:

Pre-Status:
The candidate passed the quality standards of ACTRIS and GAW during the incoming checks. The system is within the range of +/-10% of the TROPOS Reference MPSS.

Final Status:
The candidate passed the quality standards of ACTRIS and GAW.

Information about the instruments:

Date of check: March 13, 2017

List of Components	TROPOS Reference MPSS No.1	TROPOS Reference MPSS No.4
Position	Line 2	Line 1
Company	TROPOS	TROPOS
Software	TROPOS	TROPOS
CPC-MPSS	TSI CPC, Model 3772	TSI CPC, Model 3772
CPC-total	TSI CPC, Model 3010	TSI CPC, Model 3010
flow ratio	1.0 : 5.0	1.0 : 5.0
source	Ni63	Ni63
HV power supply	positive	positive
DMA	Hauke medium	Hauke medium
aerosol dryer	✓	✓
aerosol RH- sensor	✓	✓
aerosol T-sensor	✓	✓
sheath RH-sensor	✓	✓
sheath T-sensor	✓	✓
Sheath dryer	✓	✓
pressure sensor	✓	✓

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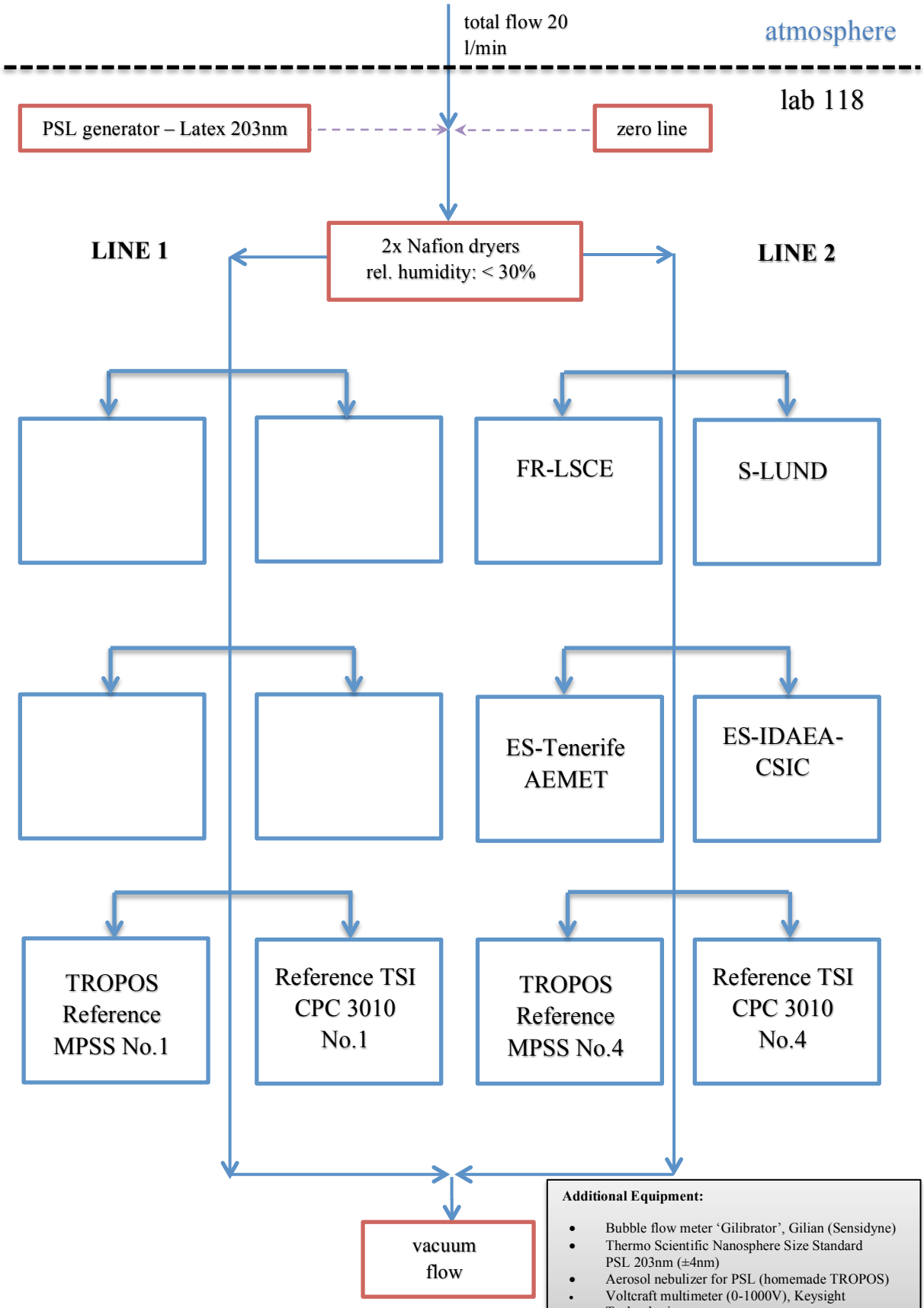
Laboratory setup:



Additional Equipment:

- Bubble flow meter 'Gilibrator', Gilian (Sensidyne)
- Thermo Scientific Nanosphere Size Standard PSL 203nm (±4nm)
- Aerosol nebulizer for PSL (homemade TROPOS)
- Voltcraft multimeter (0-1000V), Keysight Technologies

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Status of the instruments:

Date of check (Pre-Status): 09.10.2017

CPC status	TROPOS Reference MPSS No.4		TROPOS-total (line 1)	TROPOS Reference MPSS No.1		TROPOS-total (line 2)
power/status	LED green	-	LED green	LED green	-	LED green
saturator temp	39.0	°C	-	39.0	°C	-
condenser temp	22.0	°C	-	22.0	°C	-
optics temp	40.0	°C	-	40.0	°C	-
cabinet temp	34.4	°C	-	36.2	°C	-
ambient pressure	100.9	kPa	-	100.6	kPa	-
orifice pressure	75.4	kPa	-	84.0	kPa	-
nozzle pressure	2.8	kPa	-	2.8	kPa	-
laser current	46	mA	LED green	50	mA	LED green
liquid level	full	-	full	full	-	full

Date of check (Final-Status): 12.10.2017

CPC status	TROPOS Reference MPSS No.4		TROPOS-total (line 1)	TROPOS Reference MPSS No.1		TROPOS-total (line 2)
power/status	LED green	-	LED green	LED green	-	LED green
saturator temp	39.0	°C	-	39.0	°C	-
condenser temp	22.0	°C	-	22.0	°C	-
optics temp	40.0	°C	-	40.0	°C	-
cabinet temp	34.4	°C	-	36.2	°C	-
ambient pressure	100.7	kPa	-	100.7	kPa	-
orifice pressure	75.4	kPa	-	84.0	kPa	-
nozzle pressure	2.8	kPa	-	2.8	kPa	-
laser current	46	mA	LED green	50	mA	LED green
liquid level	full	-	full	full	-	full

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Instrument: TROPOS Reference MPSS No.1

date	09.10.2017	10.10.2017	11.10.2017	12.10.2017	unit
total CPC flow					l/min
aerosol flow (DMA)					l/min
aerosol flow (UDMA)					l/min
aerosol flow (total)	1023		1026	1022	l/min
Zero MPSS	0		0	0	#/cm³
Zero total CPC	0		0	0	#/cm³
PSL 203 nm			203		nm
HV – 0 V	0			0	V
HV – 4 mV	5.02			5.01	V
HV – 80 mV	100.02			100.2	V
HV – 800 mV	1000			1000	V

Instrument: TROPOS Reference MPSS No.4

date	09.10.2017	10.10.2017	11.10.2017	12.10.2017	unit
total CPC flow	1010		1011	1011	l/min
aerosol flow (DMA)					l/min
aerosol flow (UDMA)					l/min
aerosol flow (total)	1005		1004	1004	l/min
Zero MPSS	0		0	0	#/cm³
Zero total CPC	0		0	0	#/cm³
PSL 203 nm			204		nm
HV – 0 V	0			0	V
HV – 4 mV	4.99			5.01	V
HV – 80 mV	99.8			99.9	V
HV – 800 mV	1000			1000	V

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

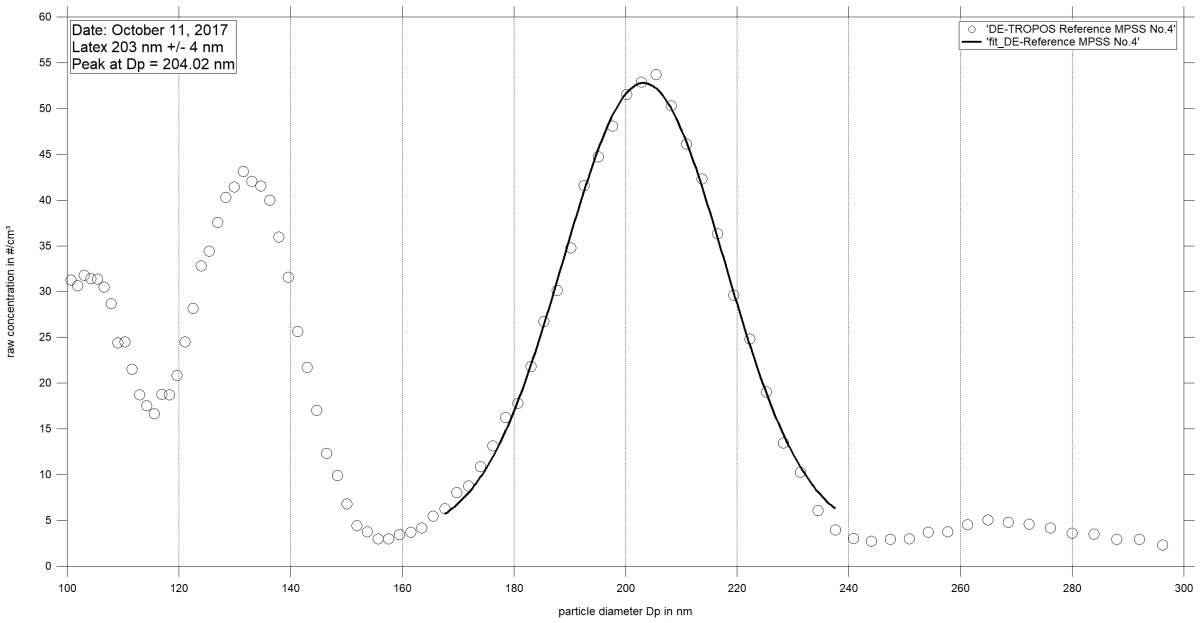

Figure 01: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on October 11rd, 2017.

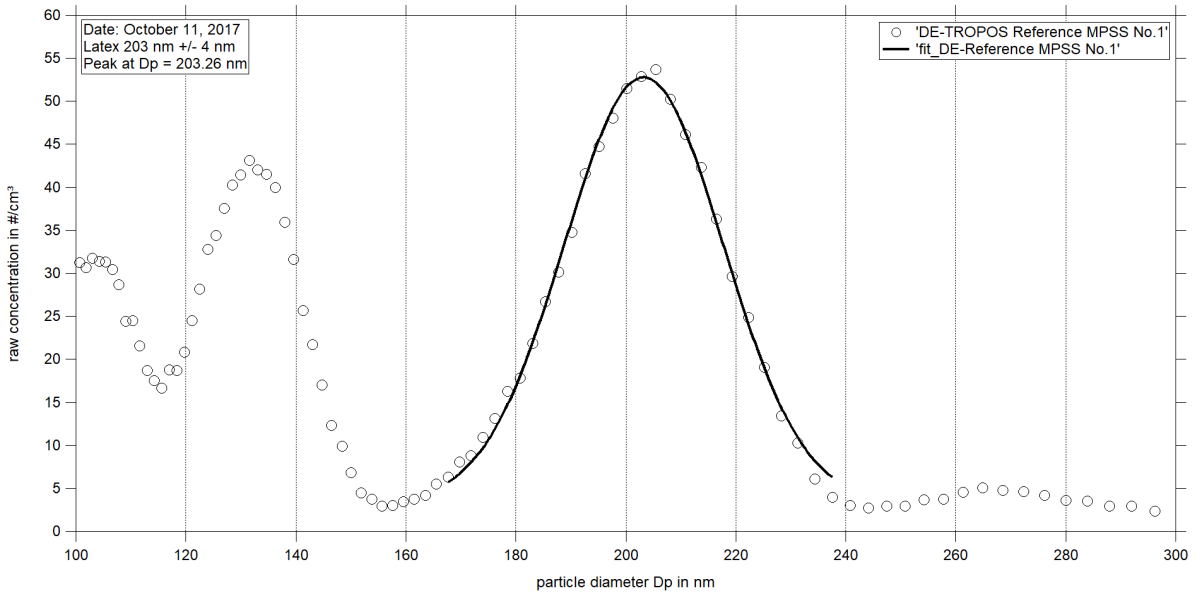

Figure 02: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on October 11rd, 2017.

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Status of the TROPOS Reference MPSS: Time Series

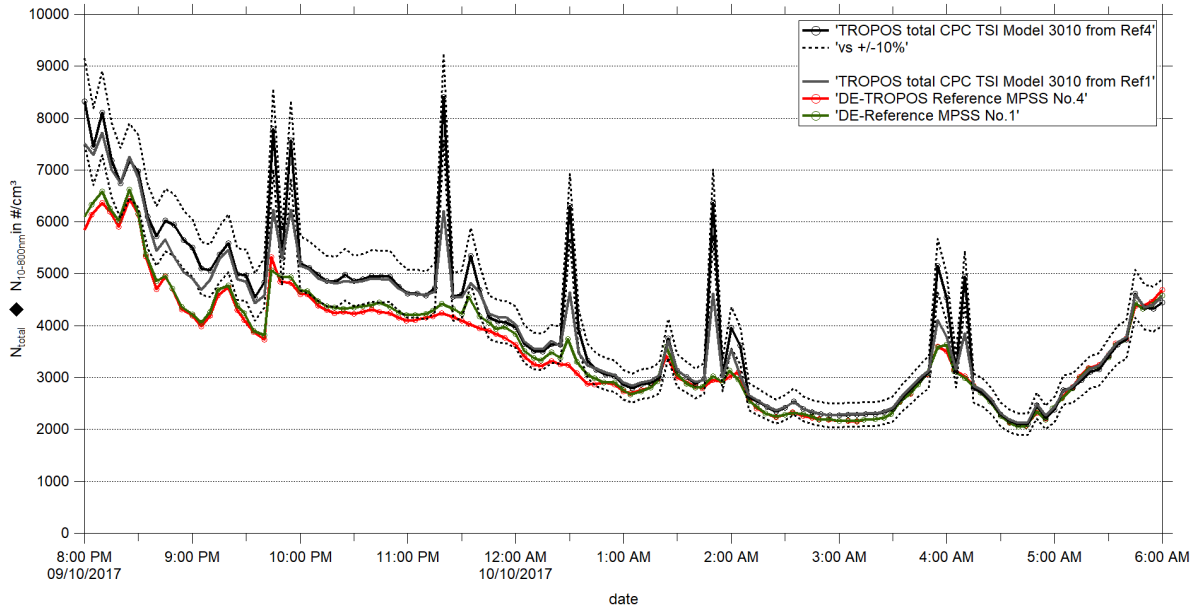

Figure 03: Time series (October 09, 2017 08:00 PM – October 10, 2017 06:00 AM) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the TROPOS Reference MPSS and total number concentration (N_{total}) of the Reference TSI CPC 3010. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Status of the TROPOS Reference MPSS: Particle Number Size Distribution

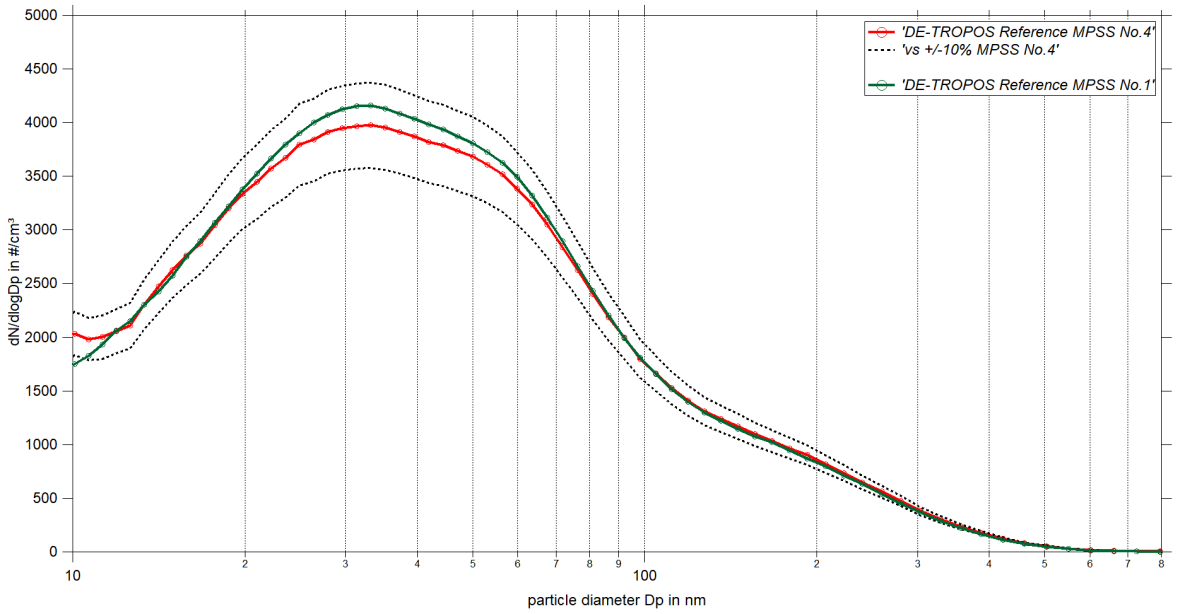

Figure 04: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 and No. 4 from October 09, 2017 08:00 PM – October 10, 2017 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included for both of the TROPOS Reference MPSS.

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Status of the TROPOS Reference Instruments Correlation

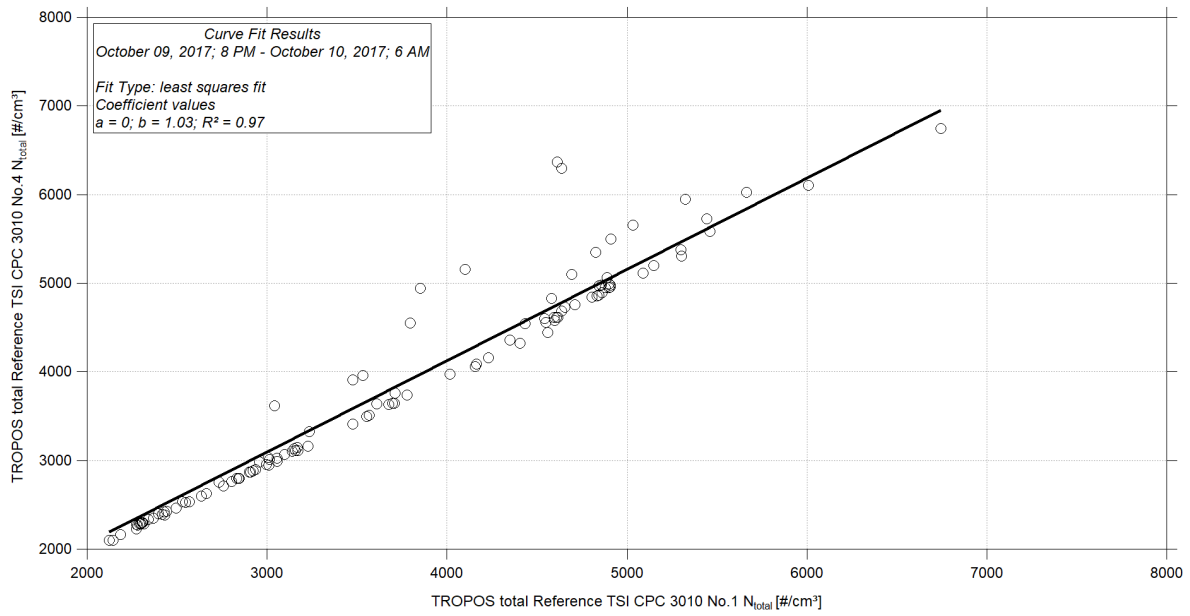

Figure 05: Linear regression between the number concentrations of the TROPOS total Reference TSI CPC Model 3010 No.1 and TROPOS total Reference TSI CPC Model 3010 No.4. Coincidence corrections and CPC flow corrections are included.

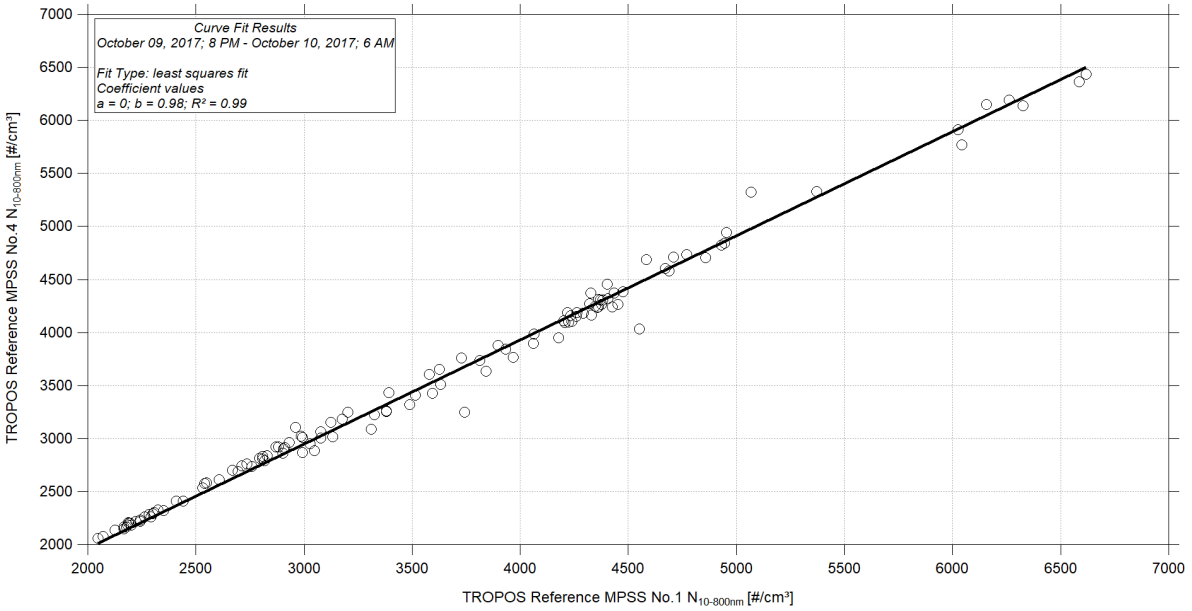

Figure 06: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and TROPOS Reference MPSS No.4. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

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