Intercomparison of Mobility Particle Size Spectrometers

Project No.:	*MPSS-2020-2-1*
Principal Investigator:	Maik Merkel
Home Institution:	*TROPOS* *Permoserstraße 15* *04318 Leipzig*
Participant:	Maik Merkel
Candidate:	**DE-TROPOS Chemie**
Made by:	**TROPOS**
Counter (SN):	TSI CPC Model 3010, SN: 2006
Software:	LabView version 6.66
Location of the quality assurance:	TROPOS Leipzig, lab 118
Comparison period:	Mar 03, 2020 – Mar 05, 2020
Last Intercomparison (with Project No.):	

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Summary of Intercomparison:

Final-Status:
During the final run, the performance of the system showed a concentration 4% higher in comparison to the TROPOS Reference Instrument No.1. The candidate used the TSI CPC model 3010 and their own Kr.85 source. The candidate passed the quality standards of ACTRIS and GAW.

Information about the instruments:

Date of check: Mar 03, 2020

List of Components	TROPOS Reference MPSS No.1	TROPOS Reference MPSS No.	Candidate
Position	Line 1	-	Line 1
Company	TROPOS	-	TROPOS
Software	TROPOS	-	TROPOS V6.66
CPC-MPSS	TSI CPC, Model 3772	-	TSI CPC, Model 3010
CPC-total	TSI CPC, Model 3772	-	-
flow ratio	1.0 : 5.0	-	1.0 : 5.0
source	Ni63	-	Kr85
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	✓	-	✓
info			

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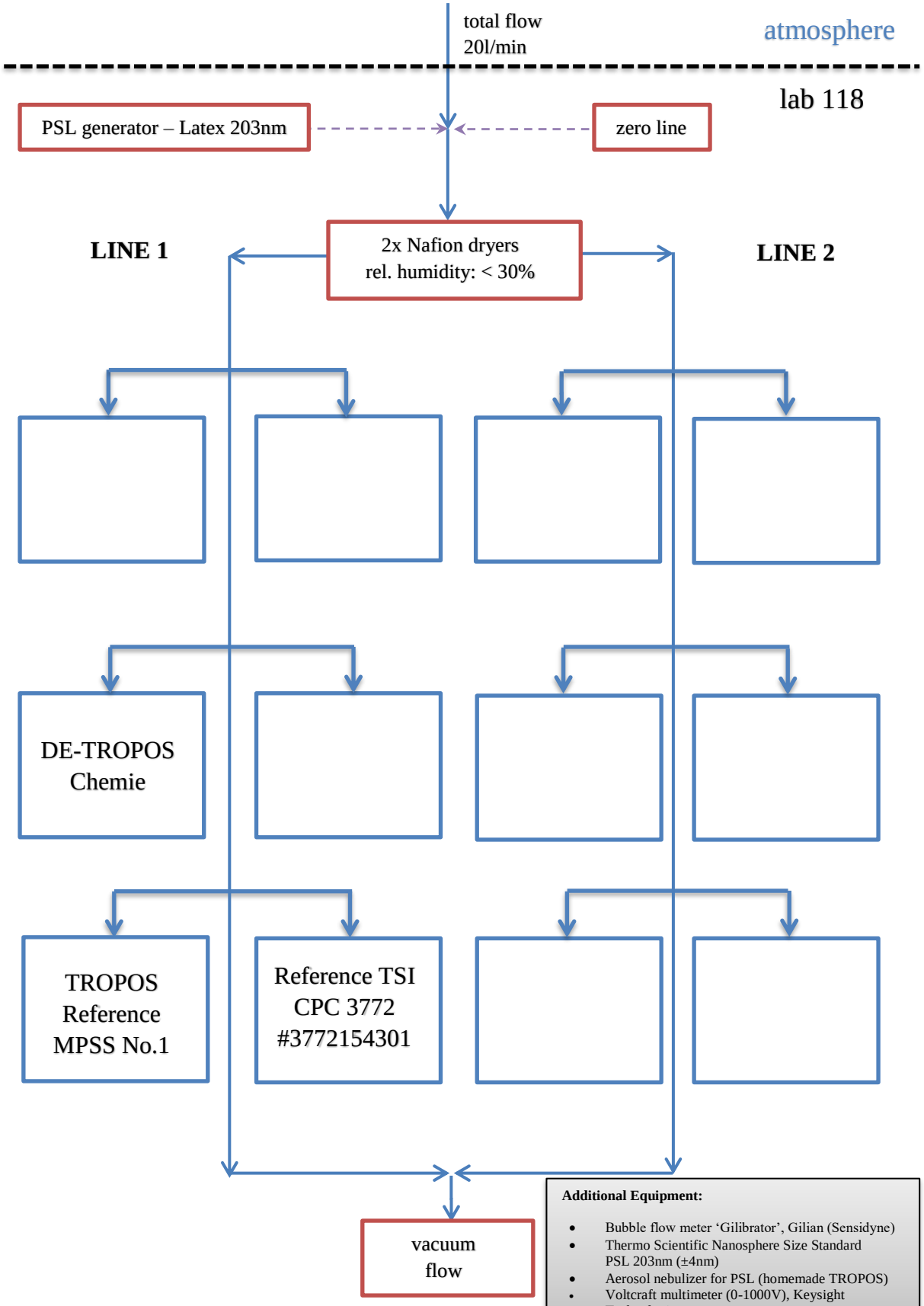
Laboratory setup:



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):

CPC status	MPSS		Total CPC	
power/status	-	-	-	-
saturator temp	-	°C	-	°C
condenser temp	-	°C	-	°C
optics temp	-	°C	-	°C
cabinet temp	-	°C	-	°C
ambient pressure	-	kPa	-	kPa
orifice pressure	-	kPa	-	kPa
nozzle pressure	-	kPa	-	kPa
laser current	-	mA	-	mA
liquid level	-	-	-	-

Date of check (Final-Status):

CPC status	MPSS Reference 1		Total CPC	
power/status	green	-	-	-
saturator temp	39.0	°C	-	°C
condenser temp	22.0	°C	-	°C
optics temp	40.1	°C	-	°C
cabinet temp	29.8	°C	-	°C
ambient pressure	99.1	kPa	-	kPa
orifice pressure	78.2	kPa	-	kPa
nozzle pressure	2.7	kPa	-	kPa
laser current	51	mA	-	mA
liquid level	full	-	-	-

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Date of system checks:

date	03.03.2020 Reference 1	03.03.2020 Chemie			unit
total CPC flow	1.031	-			l/min
aerosol flow (DMA)	-	-			l/min
aerosol flow (UDMA)	-	-			l/min
aerosol flow (total)	0.986	1.031			l/min
Zero MPSS	0	0			#/cm³
Zero total CPC	0	-			#/cm³
PSL 203 nm	202.70	202.22			nm
HV – 0 V	0.0	6.3 => 0.1			V
HV – 5 V	5.0	11.4 => 4.9			V
HV – 100 V	100.0	106.3 => 100.2			V
HV – 1000 V	1000.0	1007.1 => 1001.3			V

Special Information regarding the Candidate:

Was it necessary to:	yes/no (date)	old part (ID/SN)	new part (ID/SN)	information
clean the aerosol inlet	no			
change aerosol Nafion dryer	no	-	MT 112916-01-2	-
change sheath Nafion dryer	no	-	ND 0.7- 146d	-
check source	no	-	-	-
change HV power supply	no	-	-	-
clean/change DMA	no	-	-	-
change aerosol RH/T-sensor	no	-	-	-
change sheath RH/T-sensor	no	-	-	-
change pressure sensor	no	-	-	-
change inlet Nafion dryer	no	-	-	-
Total filter	no	-	-	-

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

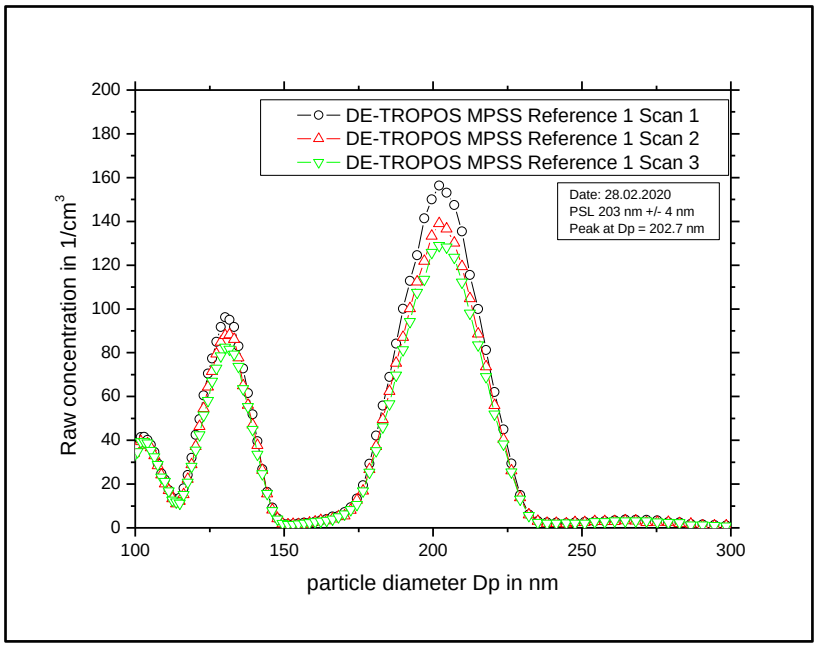

Figure 01: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on Feb 28th, 2020 for the MPSS Reference 1 instrument.

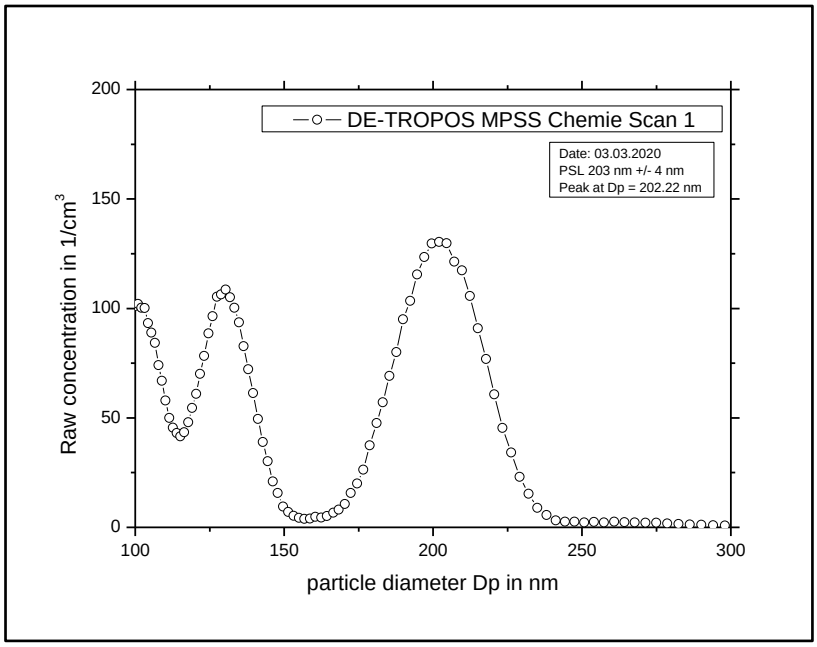

Figure 02: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on March 3rd, 2020 for the MPSS Chemie.

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Final Status of the Candidate: Particle Number Size Distribution

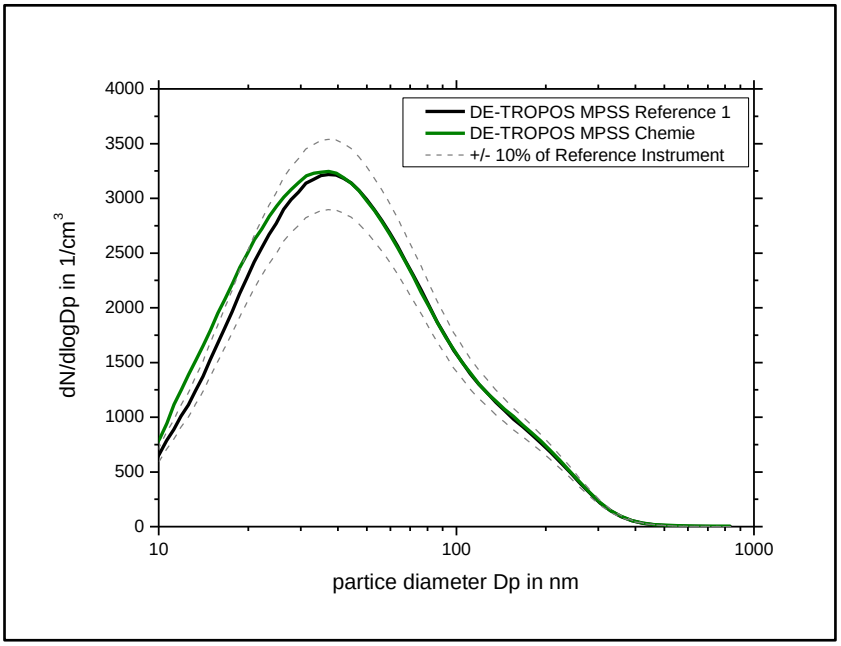

Figure 03: Comparison of mean particle number size distribution of TROPOS MPSS Chemie against DE-TROPOS MPSS Reference No.1 from Mar 03, 2020 4:00 PM – Mar 05, 2020 6:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Final Status of the Candidate: Time Series

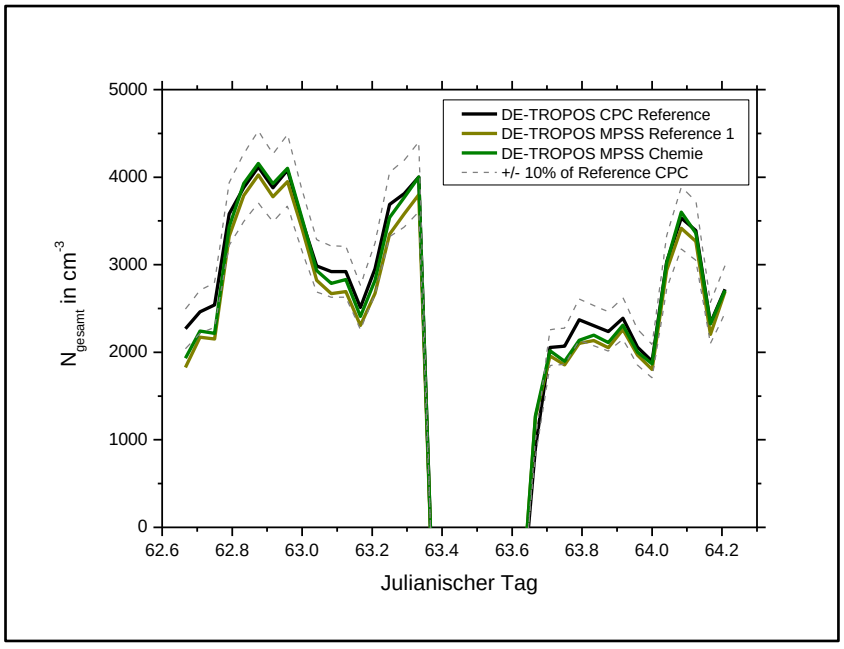

Figure 04: Time series (Mar 03, 2020 4:00 PM – Mar 05, 2020 6:00 AM) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3772. The inversion for the candidate was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

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Final Status of the Candidate: Correlation

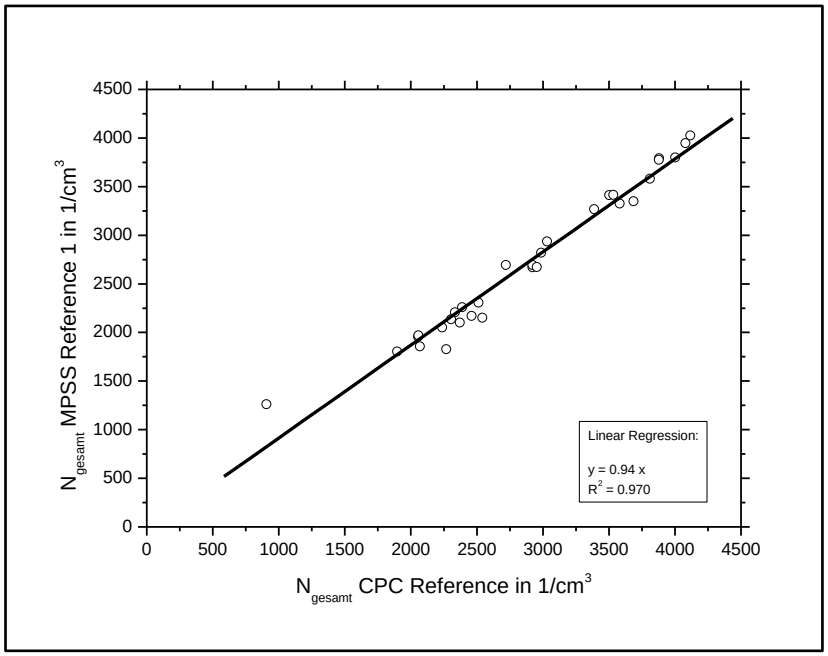

Figure 05: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3772 SN: 3772154301 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

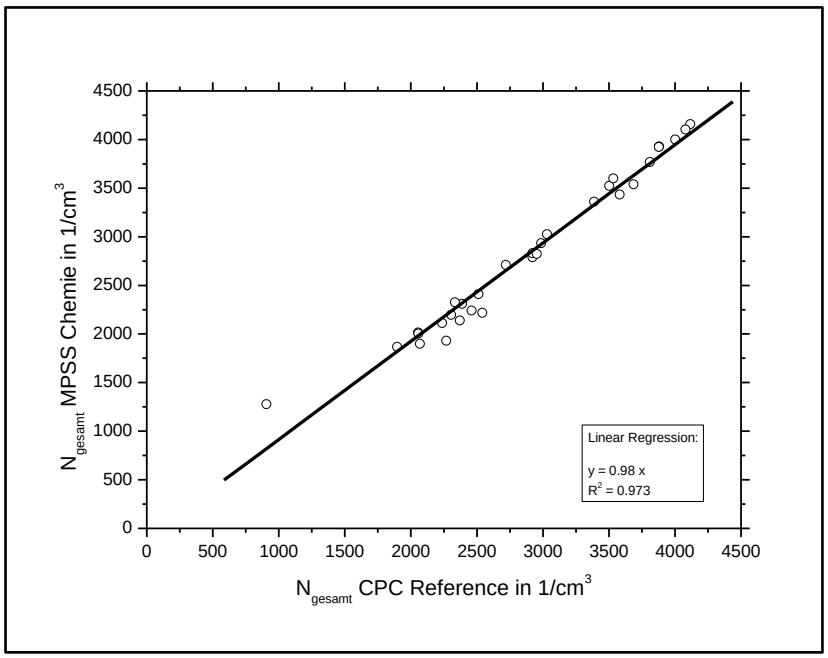

Figure 06: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3772 SN: 3772154301 and DE-TROPOS MPSS Chemie. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

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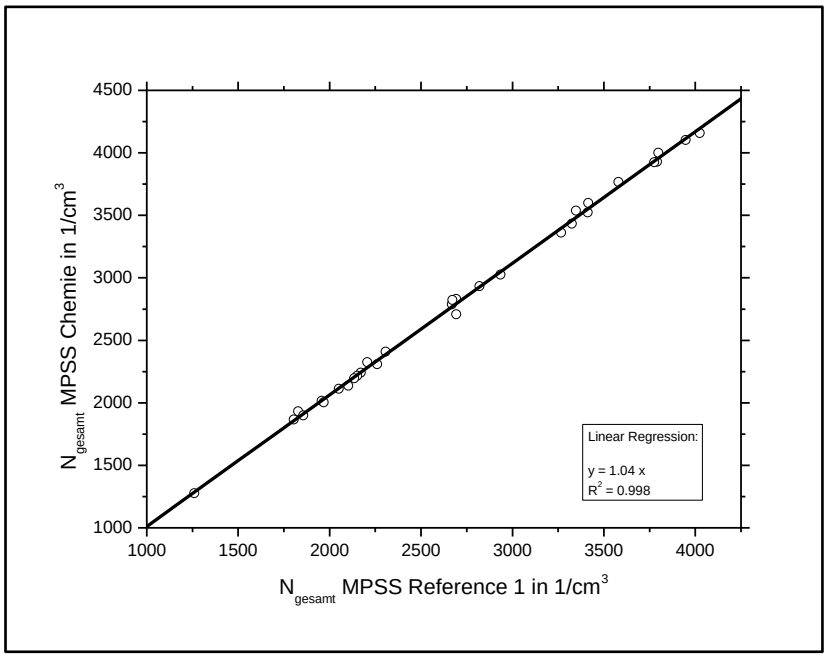

Figure 07: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and DE-TROPOS Chemie. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

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