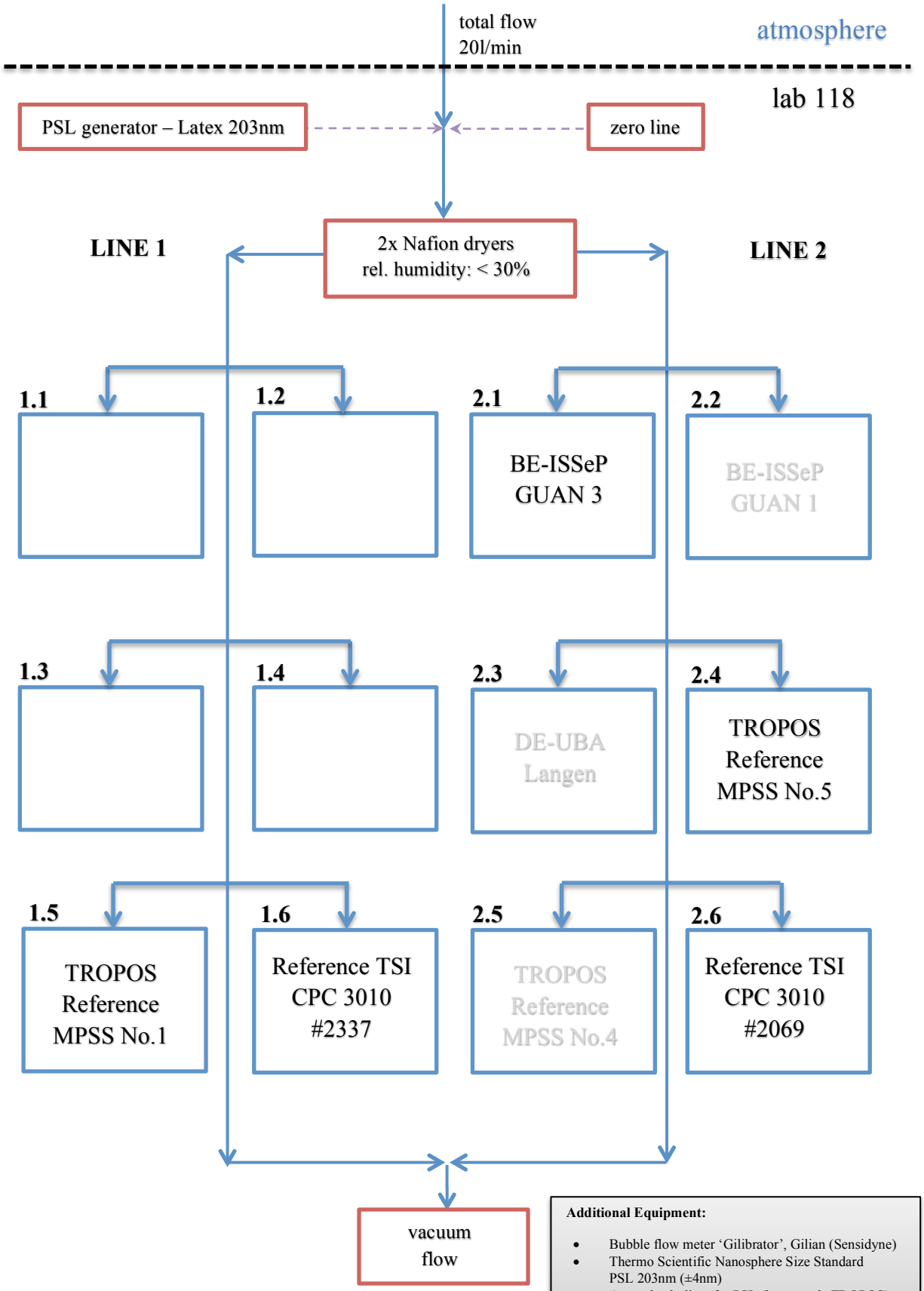
Intercomparison of Mobility Particle Size Spectrometers

Project No.:	*MPSS-2016-5-7*
Principal Investigator:	David Huygen
Home Institution:	Cellule Qualité de l'Air Technicien Réseau Mobile ISSeP
Participant:	-
Candidate:	**BE-ISSeP Guan3**
Made by:	TROPOS
Counter (SN):	TSI CPC Model 3772, SN: 71011105
Software:	Labview TROPOS 6.66
Location of the quality assurance:	TROPOS Leipzig, lab 118
Comparison period:	September 09, 2016 – September 12, 2016
Last Intercomparison (with Project No.):	

Summary of Intercomparison

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

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

Information about the instruments:

Date of check: 09.09.2016

List of Components	TROPOS Reference MPSS No.1	TROPOS Reference MPSS No.5	Candidate
Position	1.5	2.4	2.1
Company	TROPOS	TROPOS	TROPOS
Software	TROPOS	TROPOS	TROPOS
CPC-MPSS	TSI CPC, Model 3772	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	1.0 : 5.0
source	Kr85	Kr85	Kr85 - TROPOS
HV power supply	positive	positive	positive
DMA	Hauke medium	Hauke medium	Hauke medium
aerosol dryer	✓	✓	✓
aerosol RH- sensor	✓	✓	✓
aerosol T-sensor	✓	✓	✓
sheath RH-sensor	✓	✓	✓
sheath T-sensor	✓	✓	✓
Sheath dryer	✓	✓	✓
pressure sensor	✓	✓	✓

Date of check (Pre-Status): 09.09.2016

CPC status	TROPOS-MPSS	TROPOS-total	Candidate-MPSS	Candidate-total
power/status	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	32.3 °C	-	33.2 °C	-
ambient pressure	100.4 kPa	-	100.6 kPa	-
orifice pressure	74.3 kPa	-	80.7 kPa	-
nozzle pressure	2.9 kPa	-	2.6 kPa	-
laser current	46 mA	LED green	49 mA	-
liquid level	full	full	full	-

Instrument: TROPOS Reference MPSS

date	09.09.2016			
total CPC flow	1.008 l/min			
aerosol flow (DMA)	1.015 l/min			
aerosol flow (UDMA)	-			
aerosol flow (total)	-			
zero	0 #/cm³			
PSL 203 nm	203.85 nm			
HV – 0 V	0 V			
HV – 4 mV	4.6 V			
HV – 80 mV	99.3 V			
HV – 800 mV	999.9 V			

Instrument: Candidate

date	09.09.2016			
total CPC flow	-			
aerosol flow (DMA)	1.012 l/min			
aerosol flow (UDMA)	-			
aerosol flow (total)	-			
zero	0 #/cm³			
PSL 203 nm	203.31 nm			
HV – 0 V	0 V			
HV – 4 mV	4.95 V			
HV – 80 mV	100.1 V			
HV – 800 mV	1000.0 V			

Special Information regarding to the Candidate:

Was it necessary to:	yes/no	old part (ID/SN)	new part (ID/SN)	information
clean the aerosol inlet	yes	-	-	all parts are used again
change aerosol Nafion dryer	yes	2014	2016	membrane to old
change sheath Nafion dryer	no	-	-	-
check source	no	-	-	We used a Kr85 from TROPOS, because of shipping problems from Belgium.
change HV power supply	no	-	-	-
clean/change DMA	yes	-	-	-
change aerosol RH/T-sensor	no	-	-	-
change sheath RH/T-sensor	no	-	-	-
change pressure sensor	no	-	-	-
Software	yes	-	-	Update auf Version 6.66
Hardware	yes	-	-	New Laptop

TROPOS Reference Systems during the pre-status: Time Series

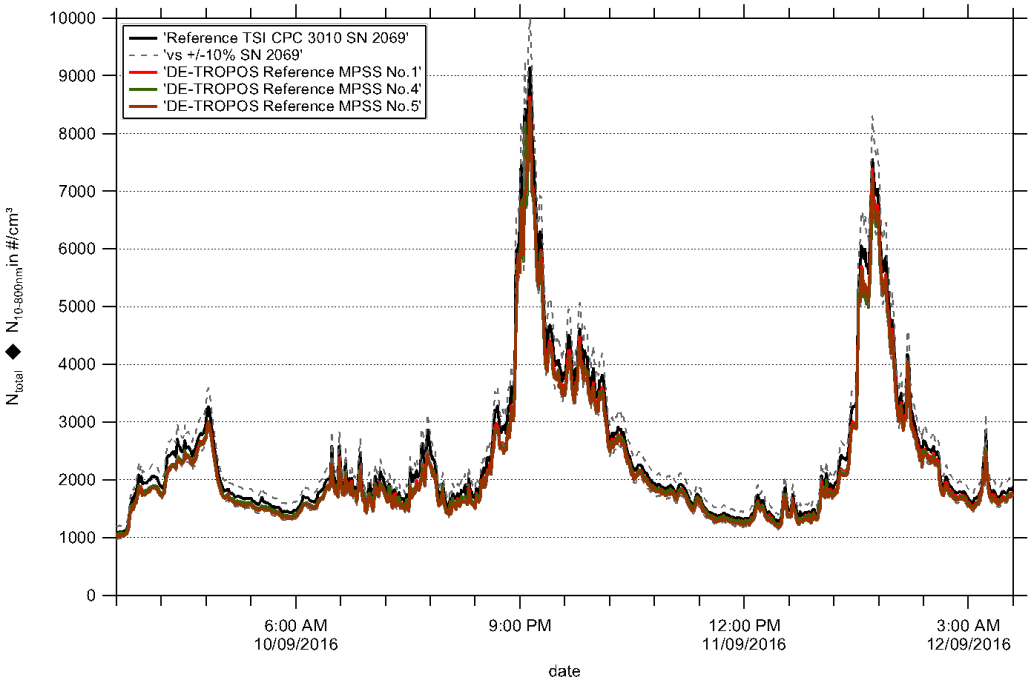


Figure 01: Time series (September 09, 2016 06:00 pm – Septmeber 12, 2016 06:00 am) of the integrated particle number concentration (N10-800nm) of the TROPOS Reference MPSS and total number concentration (Ntotal) of the Reference TSI CPC 3010. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

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

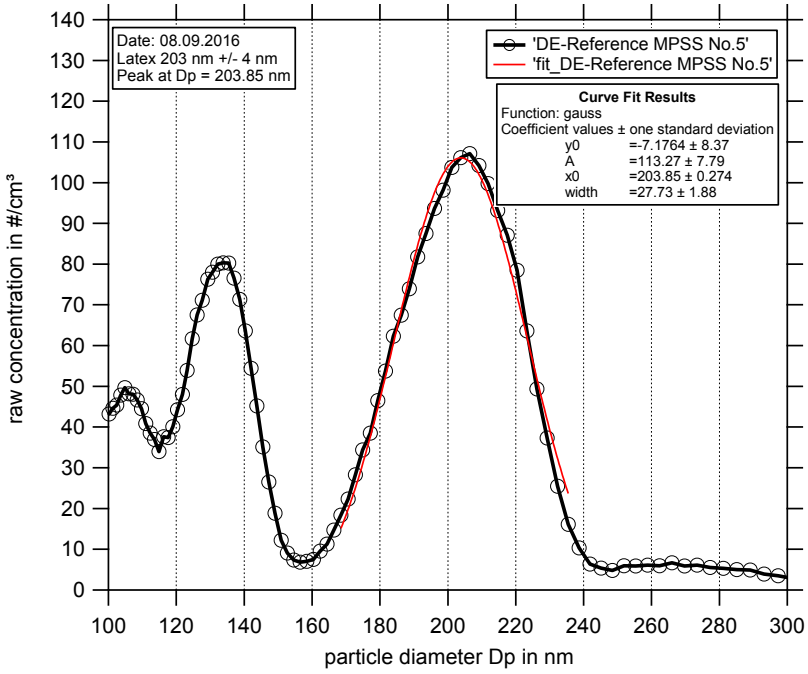


Figure 02: Measurement of latex 203 nm DE-TROPOS Reference MPSS No.5: Particle size distribution (raw concentration) for latex 203 nm on September 08th, 2016.

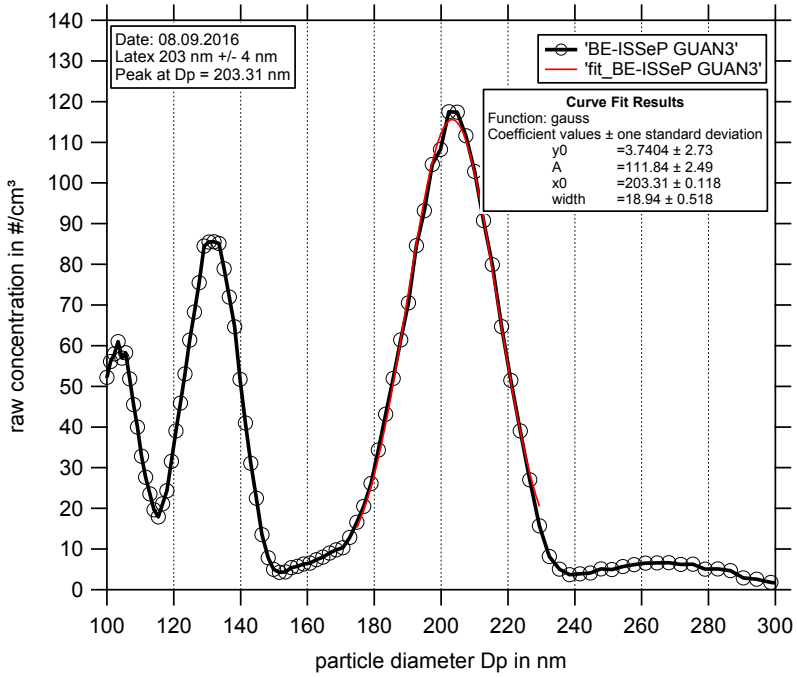


Figure 03: Measurement of latex 203 nm BE-ISSeP Guan3: Particle size distribution (raw concentration) for latex 203 nm on September 08th, 2016.

Status of the Candidate: Particle Number Size Distribution

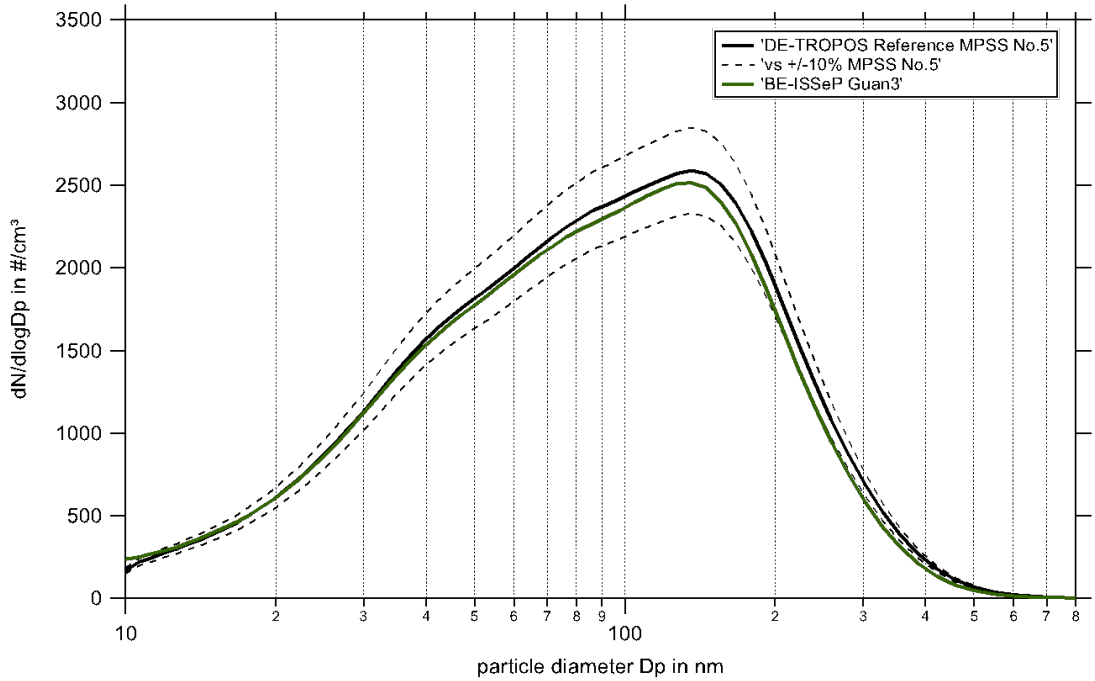


Figure 04: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.5 against BE-ISSeP Guan3 from September 09, 2016 06:00 pm until September 12, 2016 06:00 am. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Status of the Candidate: Time Series

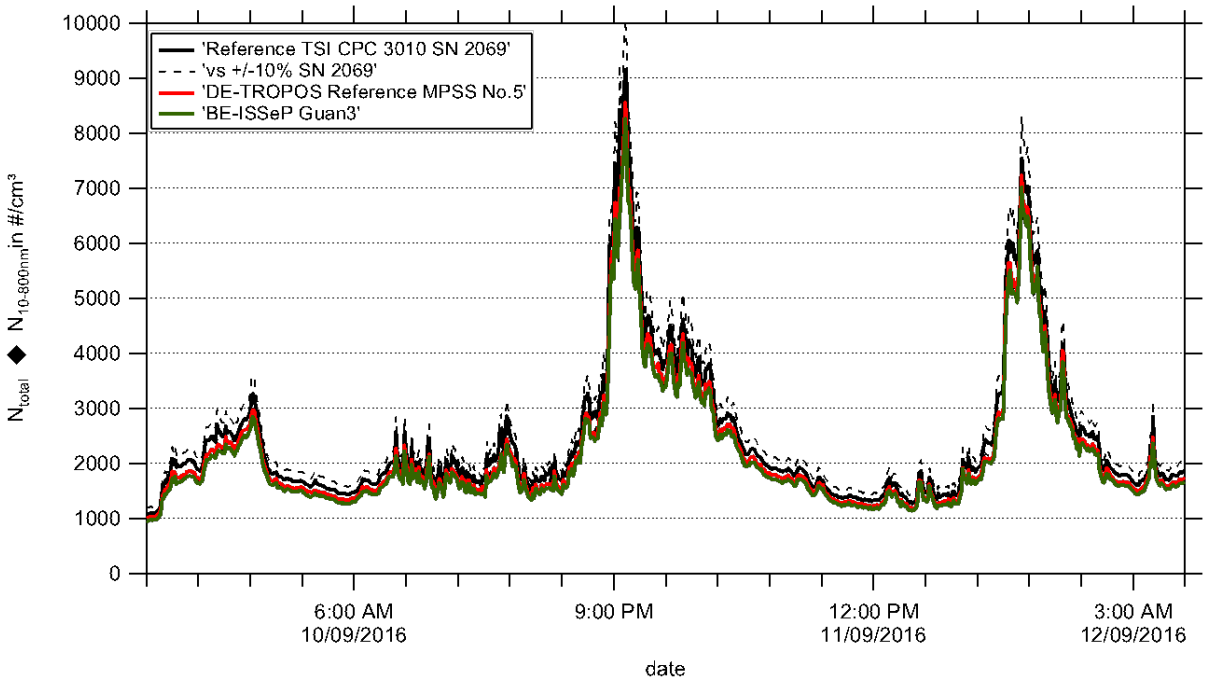


Figure 05: Time series (Septmeber 09, 2016 06:00 pm – September 12, 2016 06:00 am) of the integrated particle number concentration (N10-800nm) of the MPSS and total number concentration (Ntotal) of the reference TSI-CPC Model 3010. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Status of the Candidate: Correlation

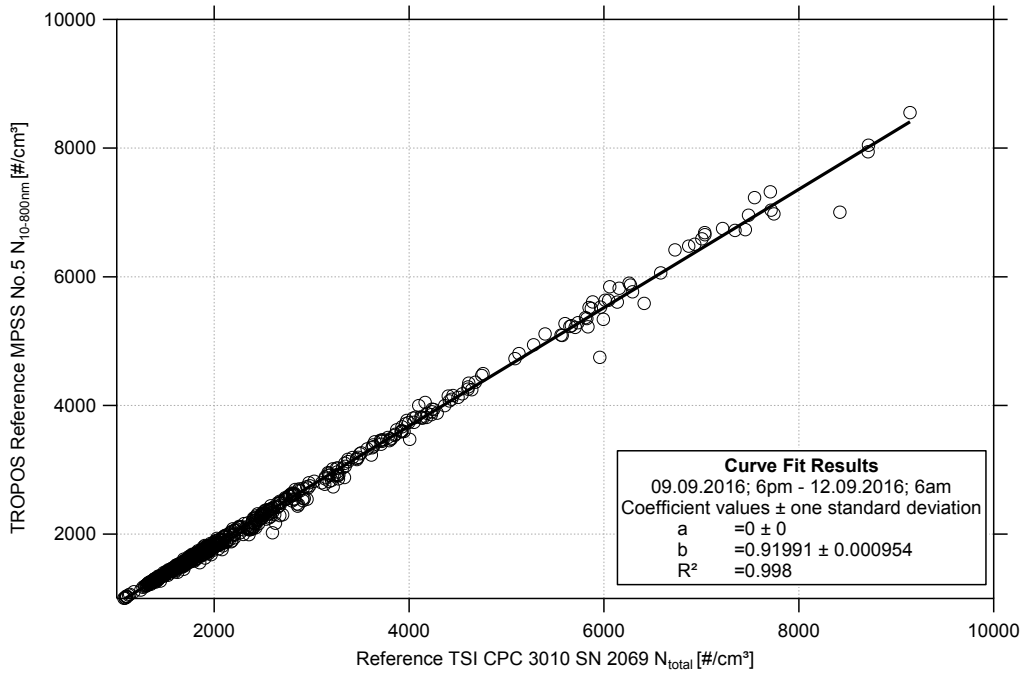


Figure 06: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2069 and TROPOS Reference MPSS No.5. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

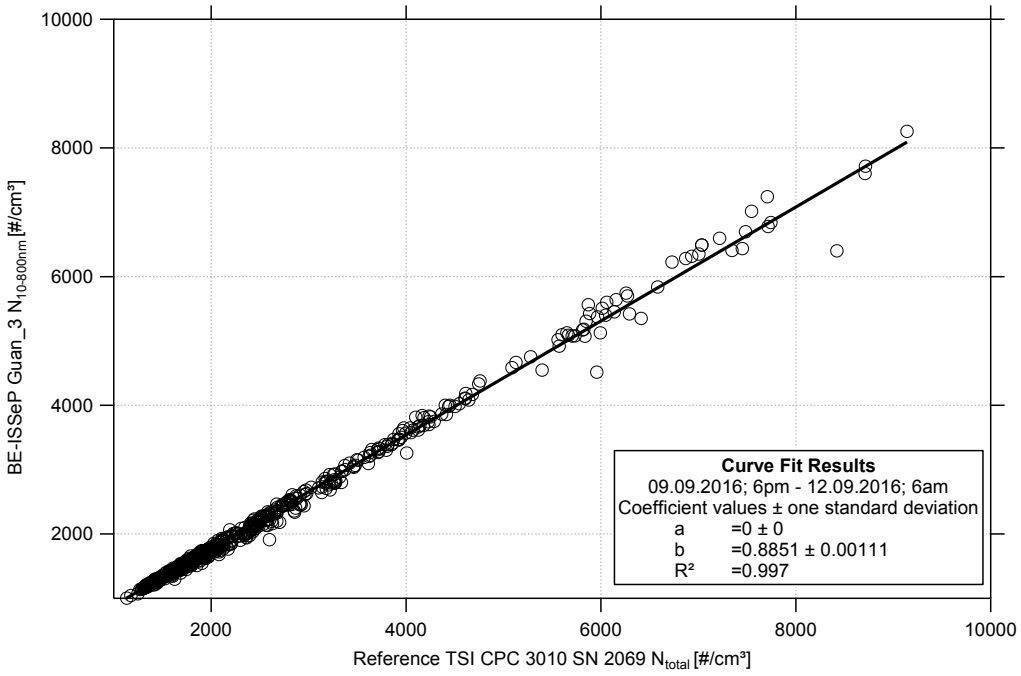


Figure 07: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2069 and BE-ISSeP Guan3. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

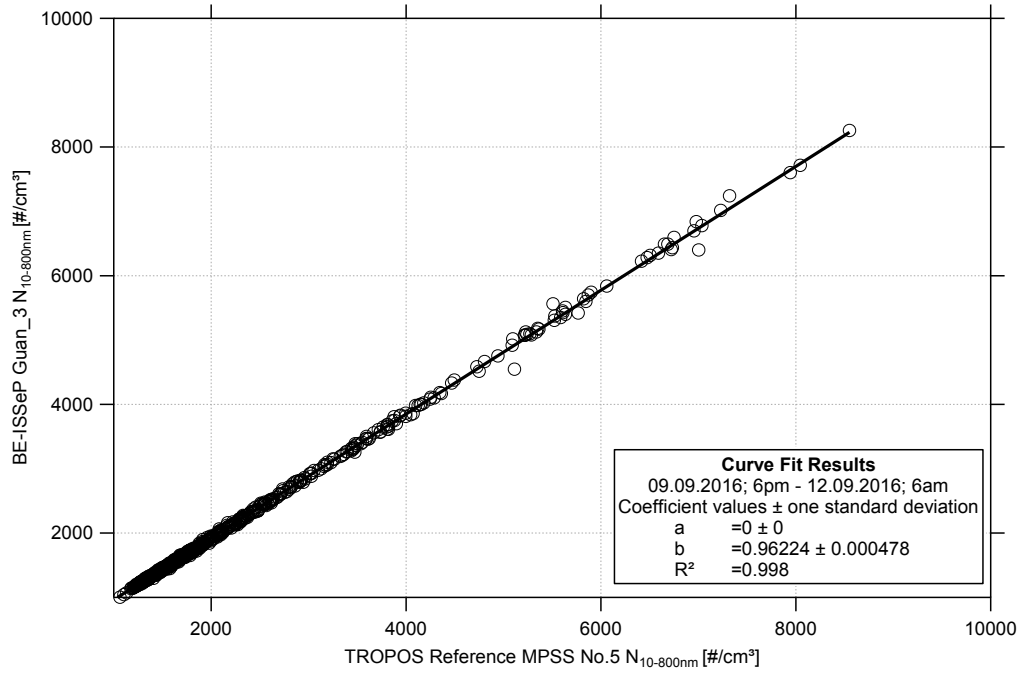


Figure 08: Linear regression between the number concentrations of the TROPOS Reference MPSS No.5 and BE-ISSeP Guan3. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.