Intercomparison of Mobility Particle Size Spectrometers

Project No.:	*MPSS-2018-2-4*
Principal Investigator:	Vladimir Zdimal
Home Institution:	ICPF, CAS
Participant:	
Candidate:	**CAS-Kosetice**
Made by:	**TROPOS**
Counter (SN):	TSI 3772; SN: 3772175003
Software:	TROPOS
Location of the quality assurance:	TROPOS Leipzig, lab 118
Comparison period:	March 12, 2018 – March 16, 2018
Last Intercomparison (with Project No.):	

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Summary of Intercomparison:

Pre-Status:
The instrument arrived with participant. The instrument is a home made MPSS from TROPOS and running with a TROPOS Software Version 6.66. During the Pre-Status, the candidate showed a concentration 10% lower than the TROPOS Reference MPSS No.6. Especially for the small particles, the system showed strong diffusion losses. The PSL check showed a peak at 203 nm. The instrument was completely cleaned and checked including polishing the DMA.

Final-Status:
During the Final-Status, the performance of the system was in the range of +/-10% of the TROPOS Reference Instrument No.6. The candidate used the recalibrated TSI CPC efficiency function and their own radioactive source. The candidate passed the quality standards of ACTRIS and GAW.

Information about the instruments:
Date of check: March 12, 2018

List of Components	TROPOS Reference MPSS No.6		Candidate
Position	Line 1		Line 1
Company	TROPOS		TROPOS
Software	TROPOS		TROPOS 6.66
CPC-MPSS	TSI CPC, Model 3772		TSI CPC 3772
CPC-total	TSI CPC, Model 3010		
flow ratio	1.0 : 5.0		1.0:5.0
source	Ni.63		Kr85 (10mCi)
HV power supply	Positive		Positiv
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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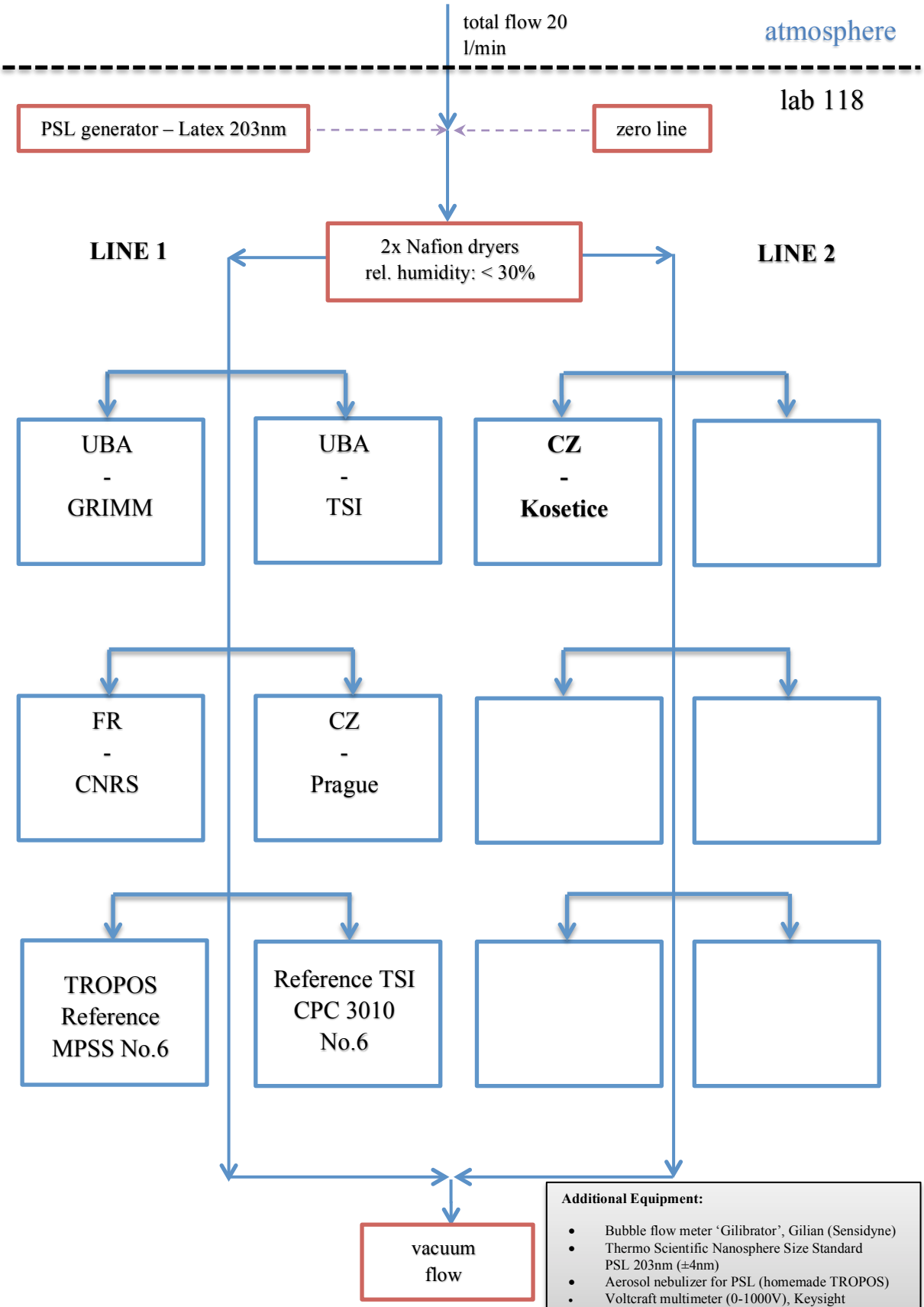
Laboratory setup:



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 system checks:

date	12.03.2018	13.03.2018	14.03.2018	15.03.2018	unit
total CPC flow	-	-	-	-	l/min
aerosol flow (DMA)	-	-	-	-	l/min
aerosol flow (UDMA)	-	-	-	-	l/min
aerosol flow (total)	1.019	1.009	1.014	-	l/min
Zero MPSS				-	#/cm³
Zero total CPC	✓	✓	✓		#/cm³
PSL 203 nm	✓		✓		nm
HV check	✓		✓		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	yes	-	-	checked
change aerosol Nafion dryer	yes	-	-	checked
change sheath Nafion dryer	yes	-	-	checked
check source	yes	-	-	checked
change HV power supply	yes	-	-	checked
clean/change DMA	yes	-	-	checked
change aerosol RH/T-sensor	yes	-	-	checked
change sheath RH/T-sensor	yes	-	-	checked
change pressure sensor	yes	-	-	checked
change inlet Nafion dryer (500)	No	-	-	checked
Change Total filter	No	-	-	checked
NI-card	No			checked

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

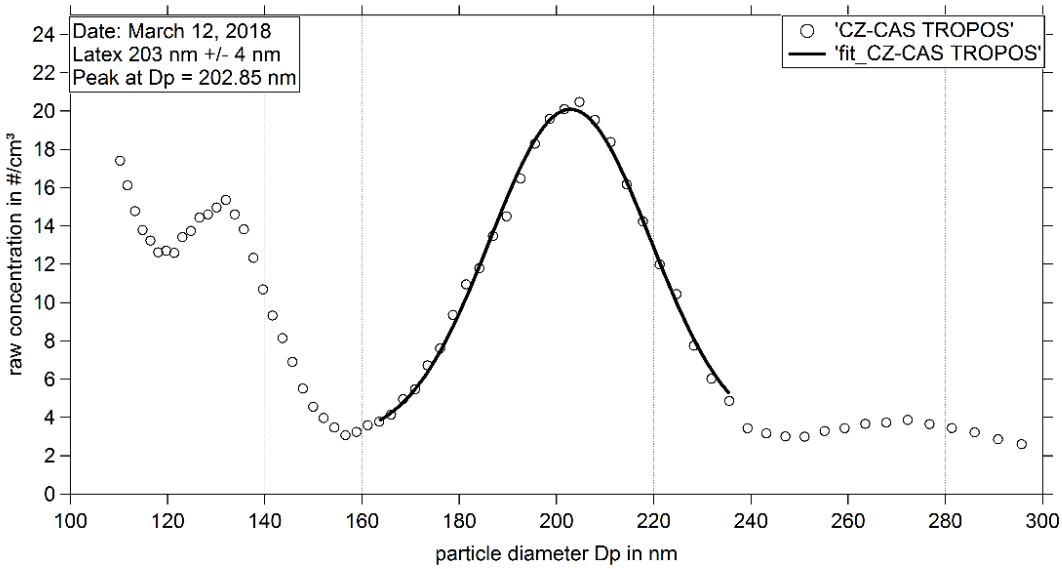

Figure 01: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on Mar 12, 2018.

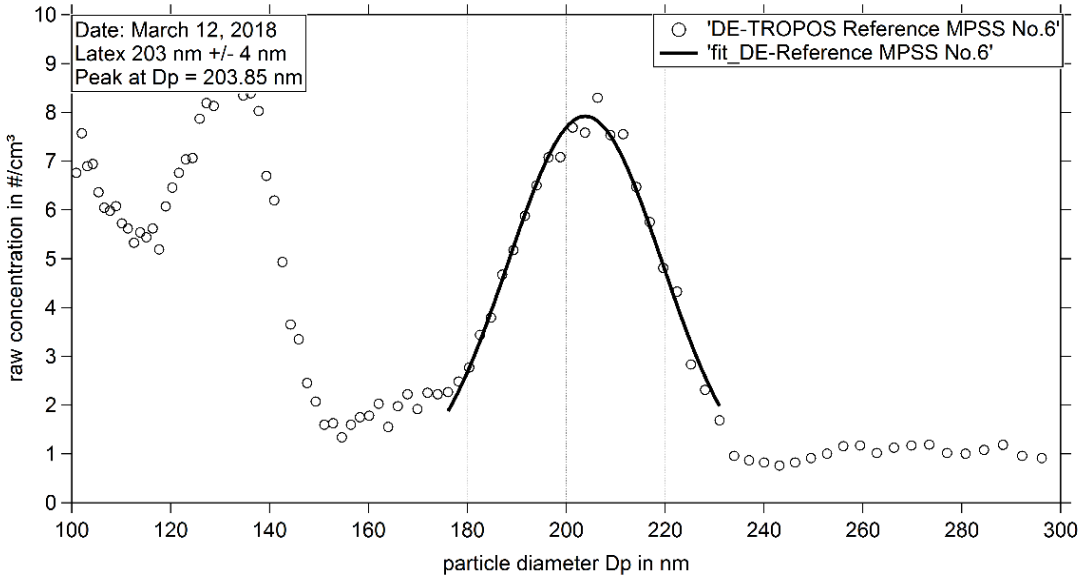

Figure 02: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on Mar 12, 2018.

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Status of the TROPOS Reference Instruments in February: Particle Number Size Distribution, Time Series and Correlation

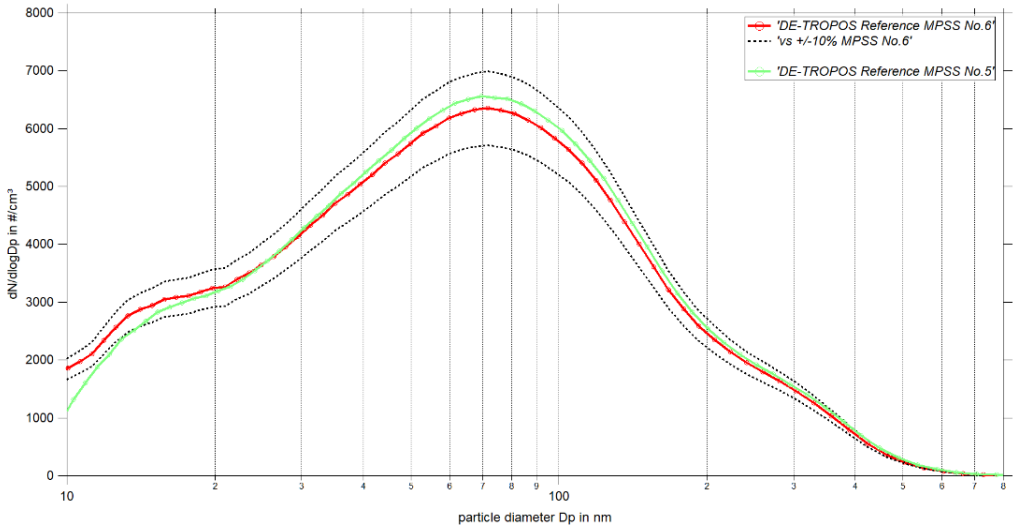

Figure 03: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.6 against TROPOS Reference MPSS No.5 from February 19, 2018 08:00 PM – February 20, 2018 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

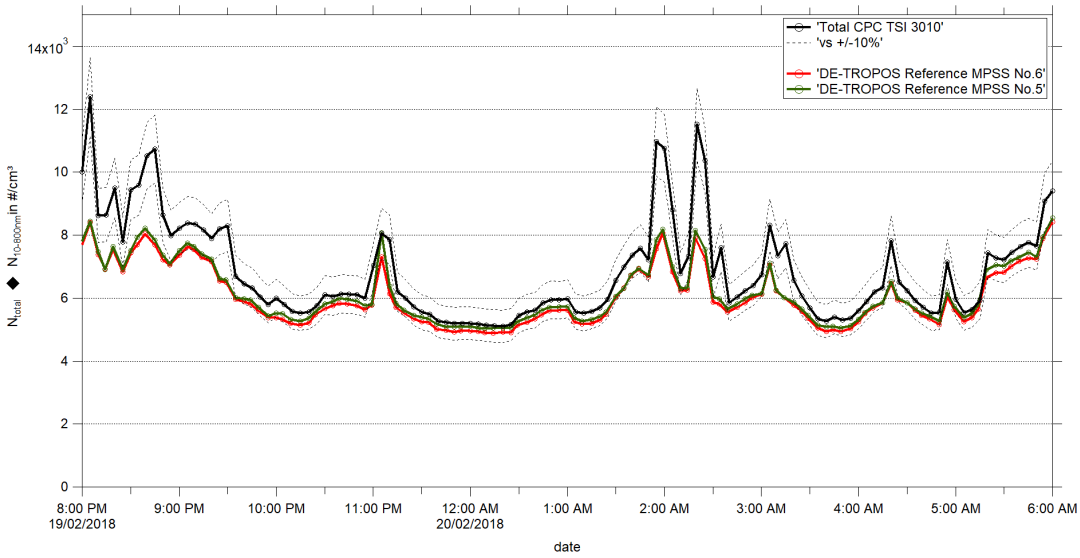

Figure 04: Time series (February 19, 2018 08:00 PM – February 20, 2018 06:00 AM) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. The inversion for the candidate was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

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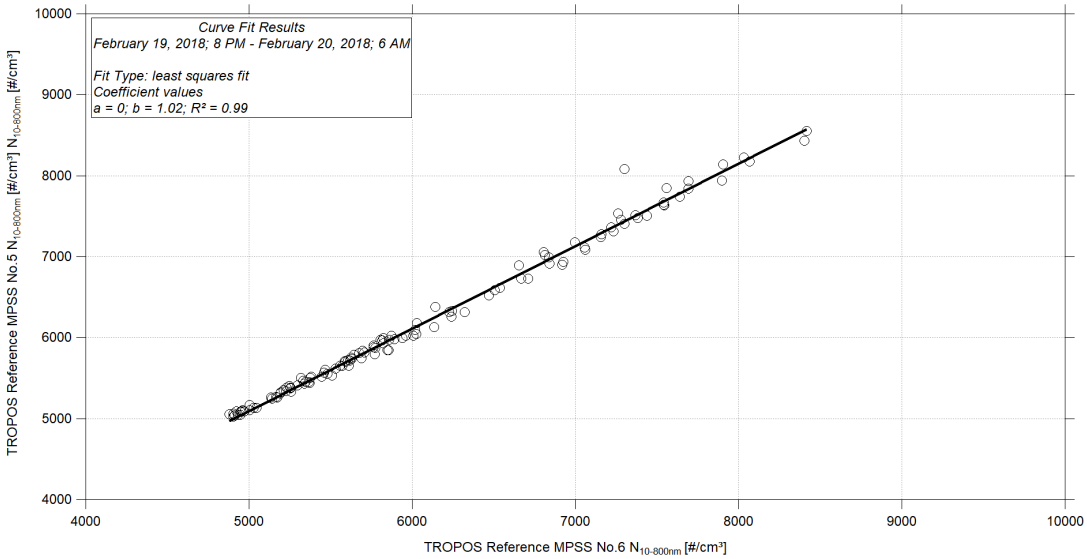

Figure 05: Linear regression between the number concentrations of the TROPOS Reference MPSS No.6 and TROPOS Reference MPSS No.5. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Status of the TROPOS Reference Instruments: Particle Number Size Distribution

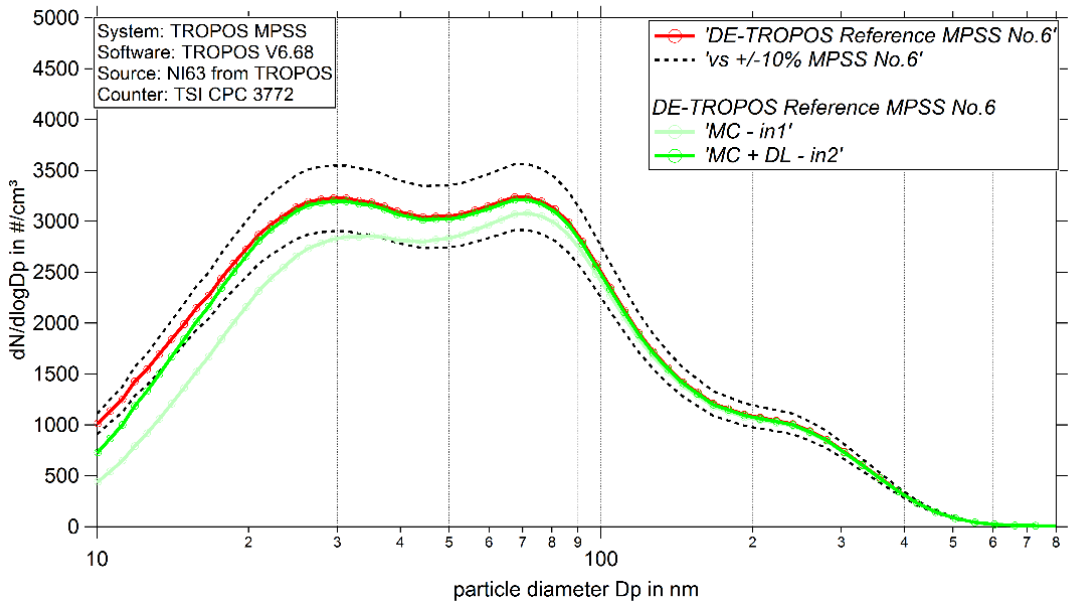

Figure 06: Comparison of mean particle number size distribution of TROPOS Reference TSI CPC Model 3010 Ref 6 against TROPOS Reference MPSS No.6 from March 12, 2018 08:00 PM – March 13, 2018 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

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Status of the TROPOS Reference Instruments: Time Series

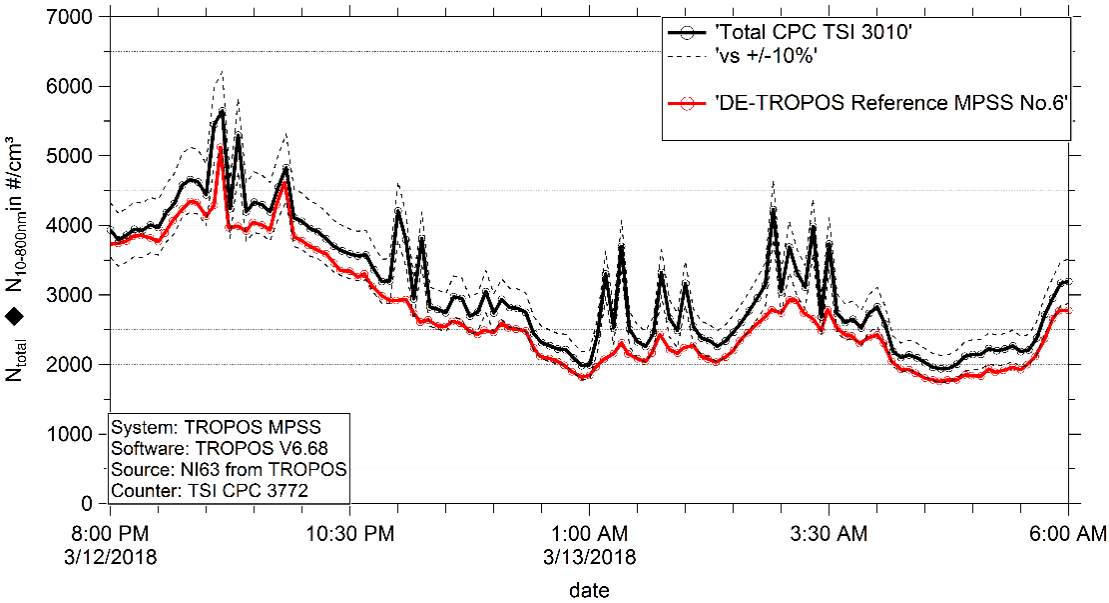

Figure 07: Time series (March 12, 2018 08:00 PM – March 13, 2018 06:00 AM) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. The inversion for the candidate was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Status of the TROPOS Reference Instruments: Correlation

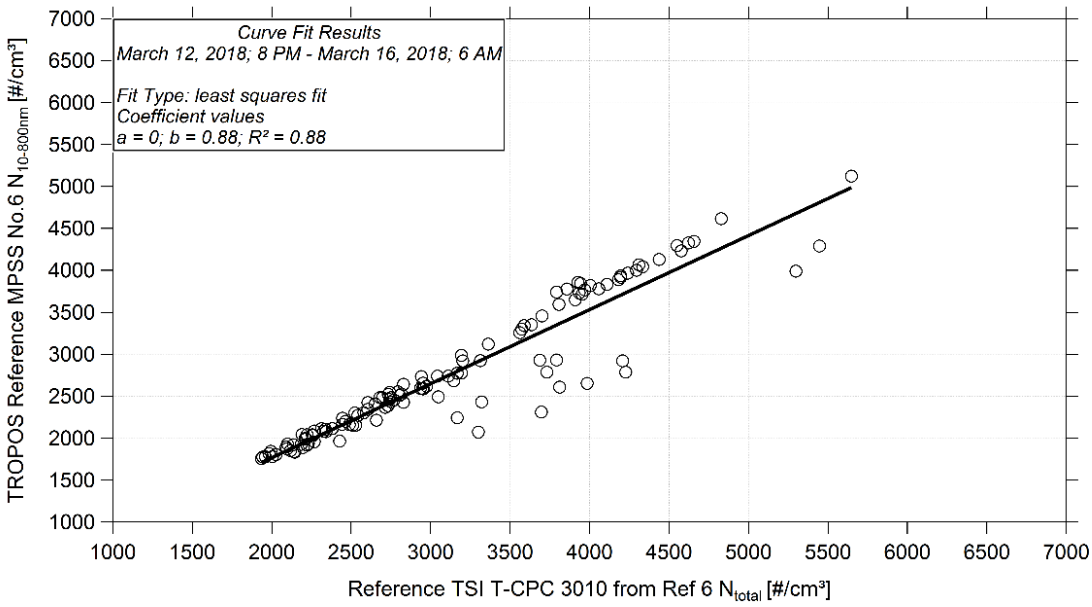

Figure 08: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 Ref 6 and TROPOS Reference MPSS No.6. Multiple charge correction, internal diffusion losses and CPC flow corrections are included

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Pre-Status of the Candidate: Particle Number Size Distribution

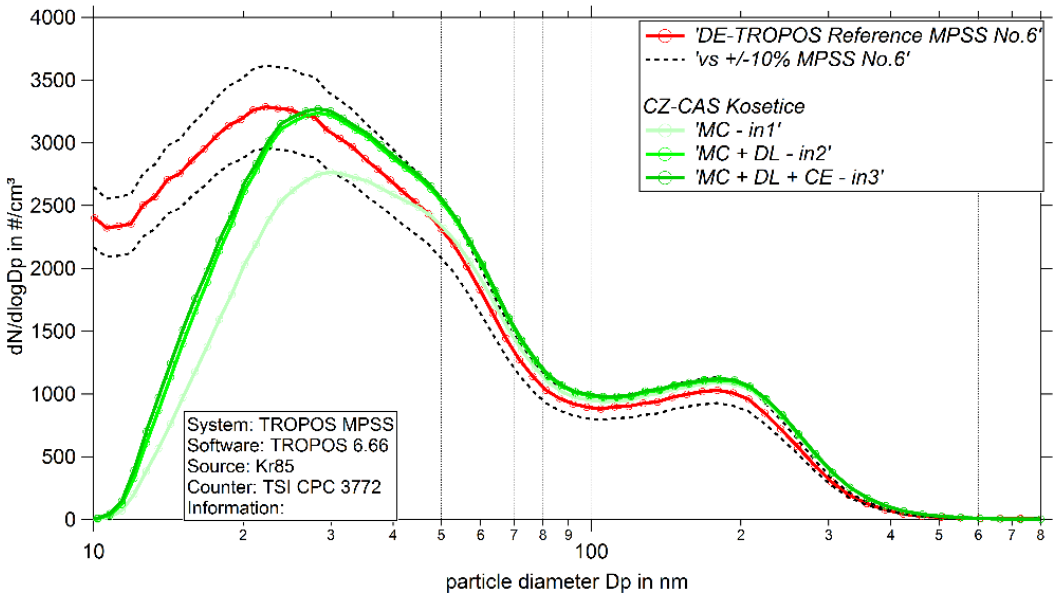

Figure 09: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.6 CZ-CAS Kosetice from March 12, 2018 08:00 PM – March 13, 2018 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Pre-Status of the Candidate: Time Series and Correlation

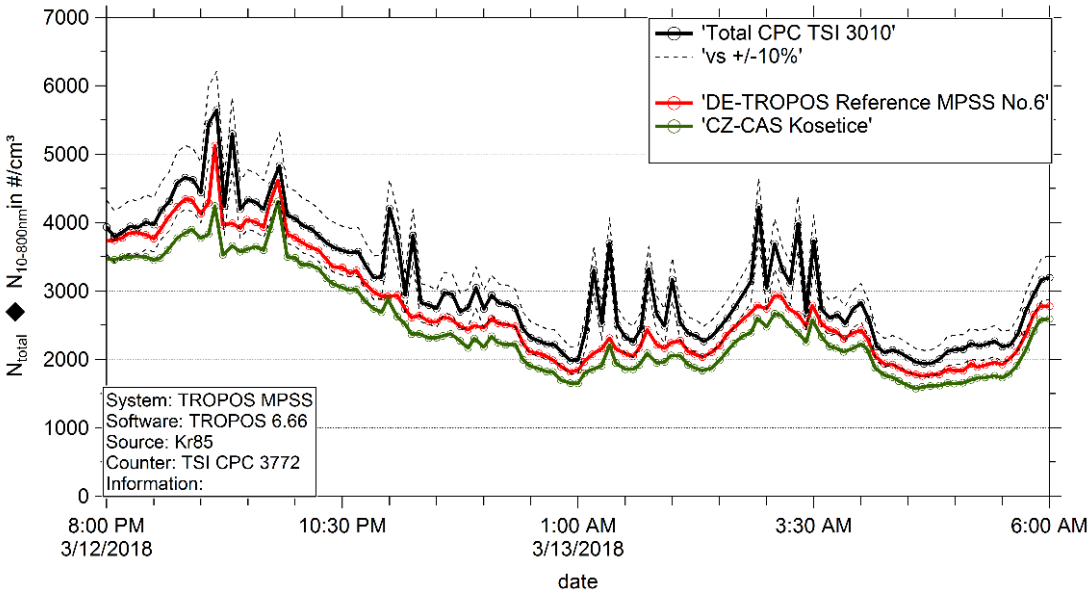

Figure 10: Time series (March 12, 2018 08:00 PM – March 13, 2018 06:00 AM) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. The inversion and corrections for the candidate was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

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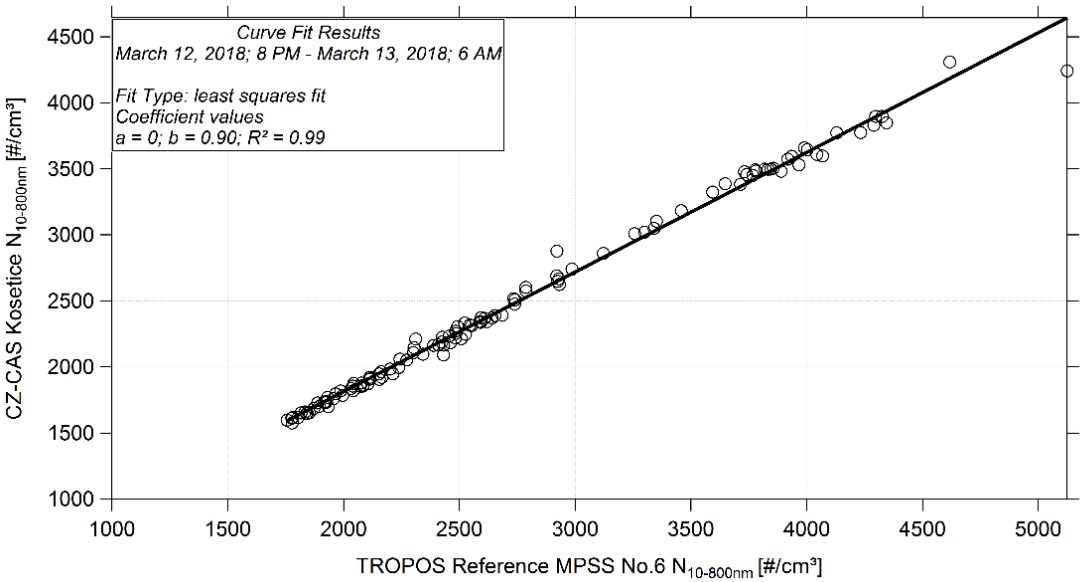

Figure 11: Linear regression between the number concentrations of the TROPOS Reference MPSS No. 6 and CZ-CAS Kosetice. The inversion and corrections for the candidate was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Final-Status of the Candidate: Particle Number Size Distribution

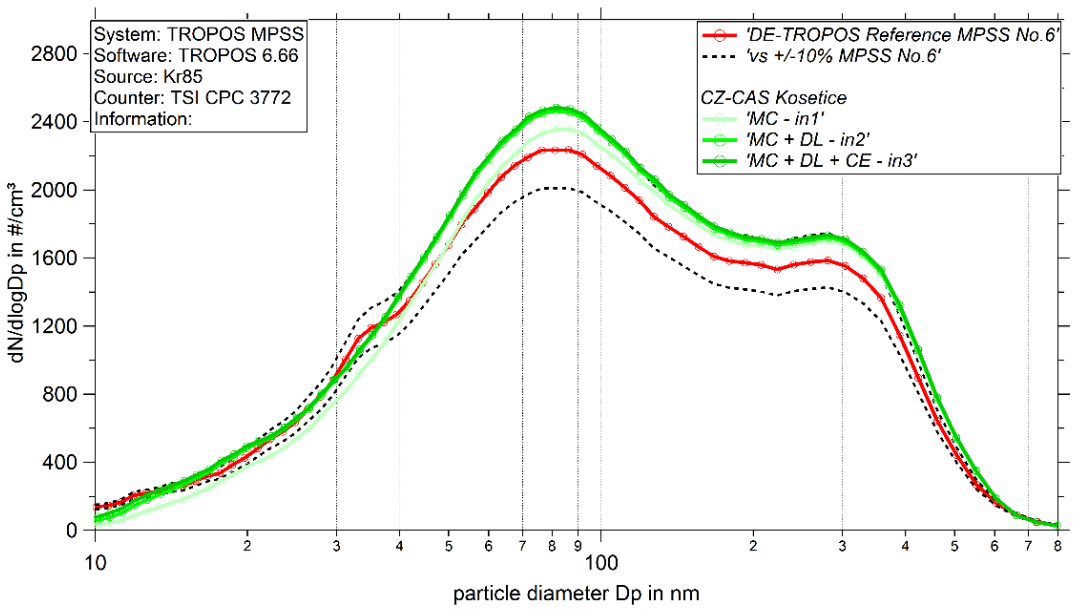

Figure 12: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.6 against CZ-CAS Kosetice from March 15, 2018 08:00 PM – March 16, 2018 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

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Final-Status of the Candidate: Time Series and Correlation

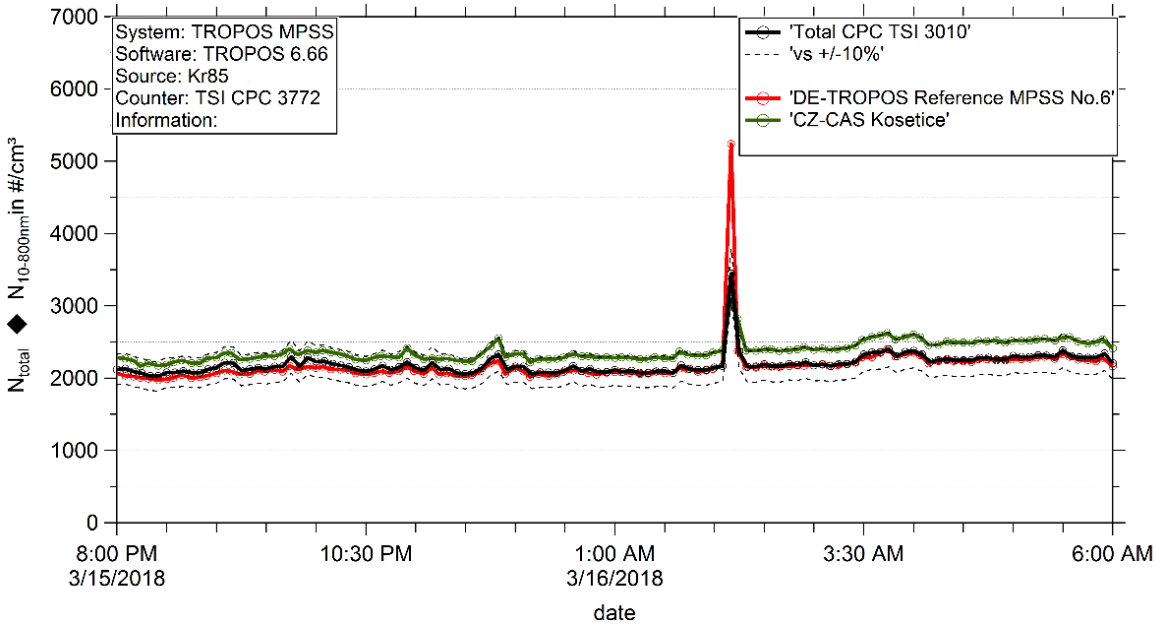

Figure 13: Time series (March 15, 2018 08:00 PM – March 16, 2018 06:00 AM) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. The inversion and correction for the candidate was performed using TROPOS software.

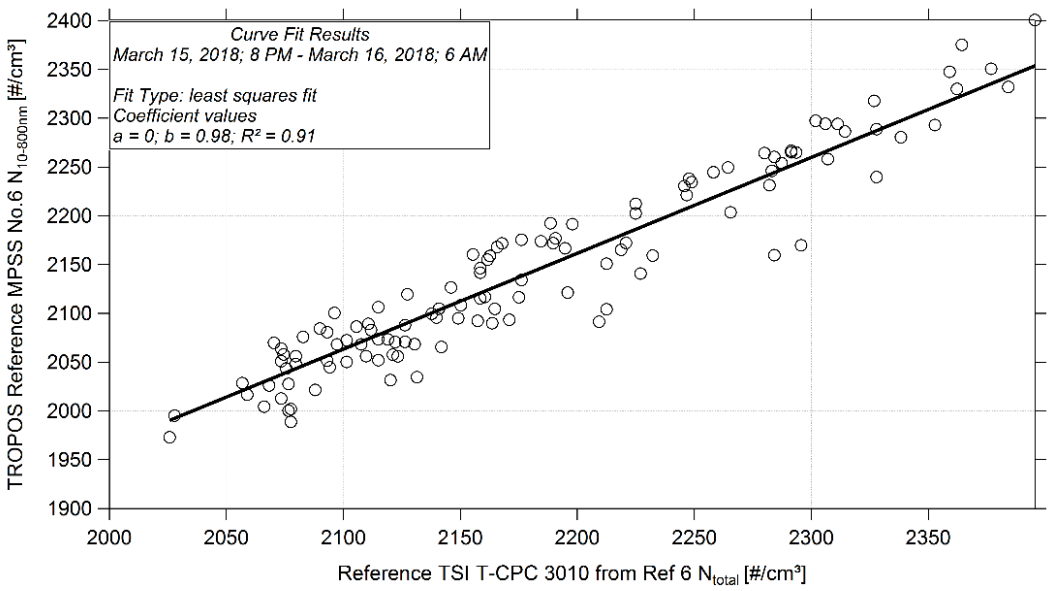

Figure 14: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 Ref 6 and TROPOS Reference MPSS Ref 6 (March 15, 2018 08:00 PM – March 16, 2018 06:00 AM). All corrections are included.

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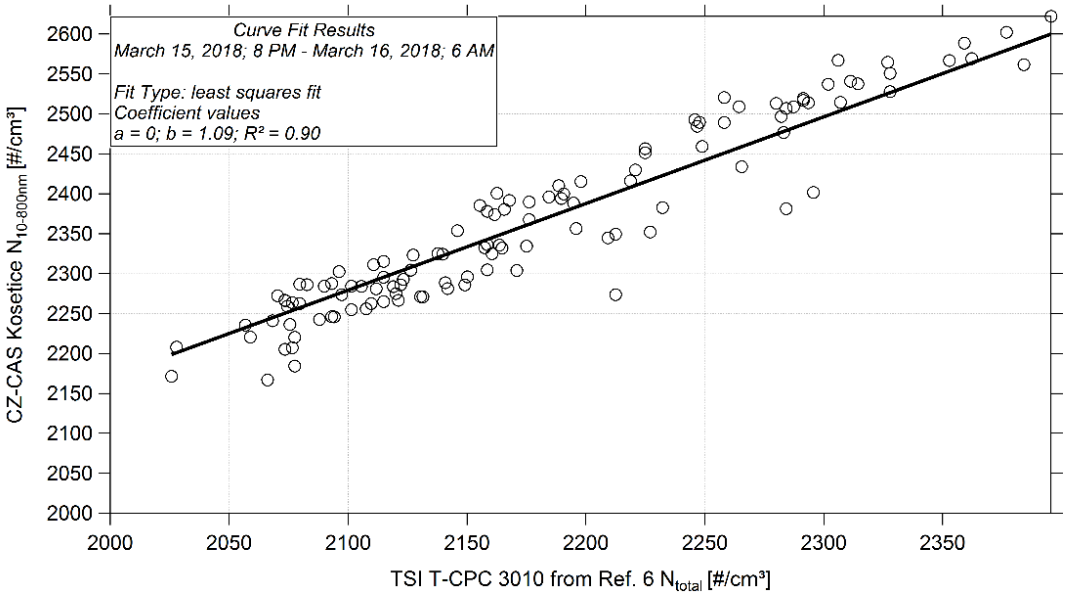

Figure 15: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 Ref 6 and CZ-CAS Kosetice (March 15, 2018 08:00 PM – March 16, 2018 06:00 AM). All corrections are included.

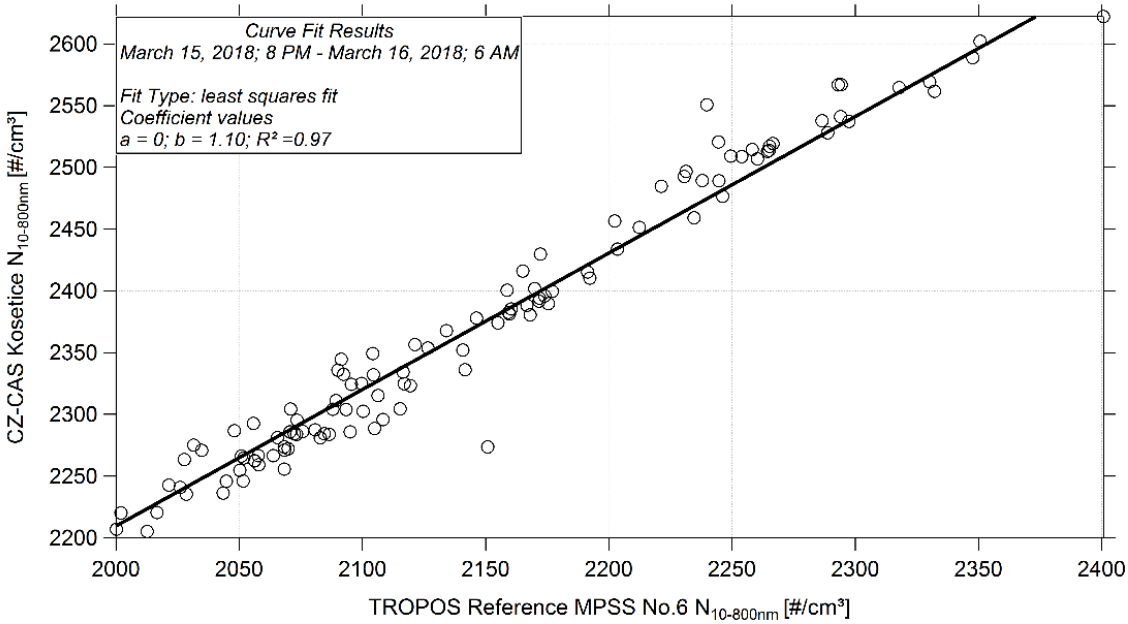

Figure 16: Linear regression between the number concentrations of the TROPOS Reference MPSS Ref 6 and CZ-CAS Kosetice (March 15, 2018 08:00 PM – March 16, 2018 06:00 AM). All corrections are included.

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