

Intercomparison of Mobility Particle Size Spectrometers

Project No.: MPSS-2016-1-3

Basic information:

Location of the quality assurance:	TROPOS, lab: 118
Delivery date:	January 25, 2016
Setup in the laboratory:	January 25, 2016
Comparison period:	January 25, 2016 – January 29, 2016

Principal Investigator	Home Institution	Participant	Instrument
Vladimir Zdimal	Institute of Chemical Process Fundamentals, CAS	Adéla Holubová Smejkalová	TROPOS-MPSS: homemade TSI CPC Model 3772 SN 70729281

Summary of Intercomparison:

Pre-status:

The TROPOS-MPSS CZ-CHMI was in good condition, but a cleaning was necessary.

Final status:

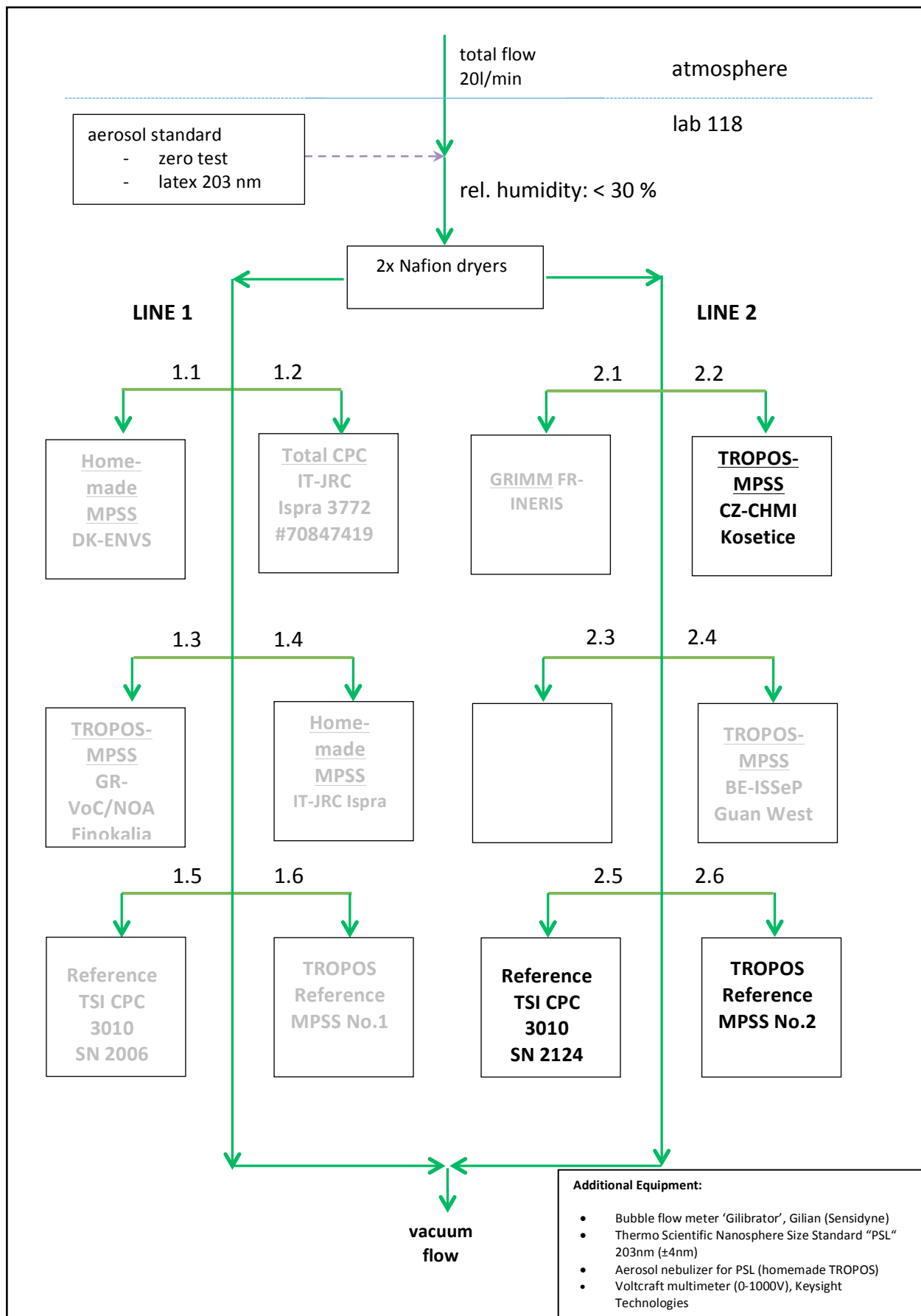
The TROPOS-MPSS CZ-CHMI passed the quality standards of ACTRIS and GAW. The system is within the 10% range of the TROPOS Reference MPSS No.2. During this week there are a lot of ultrafine particles that is the reason why the correlation to the TROPOS total CPC 3010 is sometimes out of the 10% range.

- 25.01.2016: setup TROPOS-MPSS CZ-CHMI in lab 118 -> pre-status overnight run
- 26.01.2016: CPC Workshop in lab 130.
- 26.01.2016: Check and cleaning of the MPSS -> it was necessary to bring the DMA to the mechanical workshop. We changed the slit from 0.45 mm to 0.5 mm. Run without the nafion dryer. It was also necessary to clean the CPC -> CZ-CHMI is running overnight with TROPOS CPC 3772.
- 27.01.2016: DMA back in the MPSS after cleaning. Nafion dryer was checked by Andrea Haudek.
- 28.01.2016: CPC goes back to the MPSS CZ-CHMI after repair. Flow is 1.080 l/min.
- 28.-29.01.2016: final status -> overnight run with ambient

List of Components

	Specification	Reference MPSS No.2	CZ-CHMI Kosetice
Position (Line)		2.6	2.2
Company		TROPOS	TROPOS
Software		TROPOS 6.1	TROPOS 4.7.2
CPC		Model 3772 SN : 70835059	Model 3772 SN : 70729281
Flow ratio		1.0 : 5.0	1.0 : 5.0
Source		Kr85	Kr85
HV cassette		positive	positive
DMA		Hauke medium	Hauke medium
Flow meas.	Aerosol	✓	✓
Dryer			✓
RH sensor	Inlet	✓	✓
T sensor		✓	✓
RH sensor	Sheath air	✓	✓
T sensor		✓	✓
Dryer			✓
p sensor		✓	✓

Laboratory Setup



TROPOS Reference Systems during the pre-status night measurement

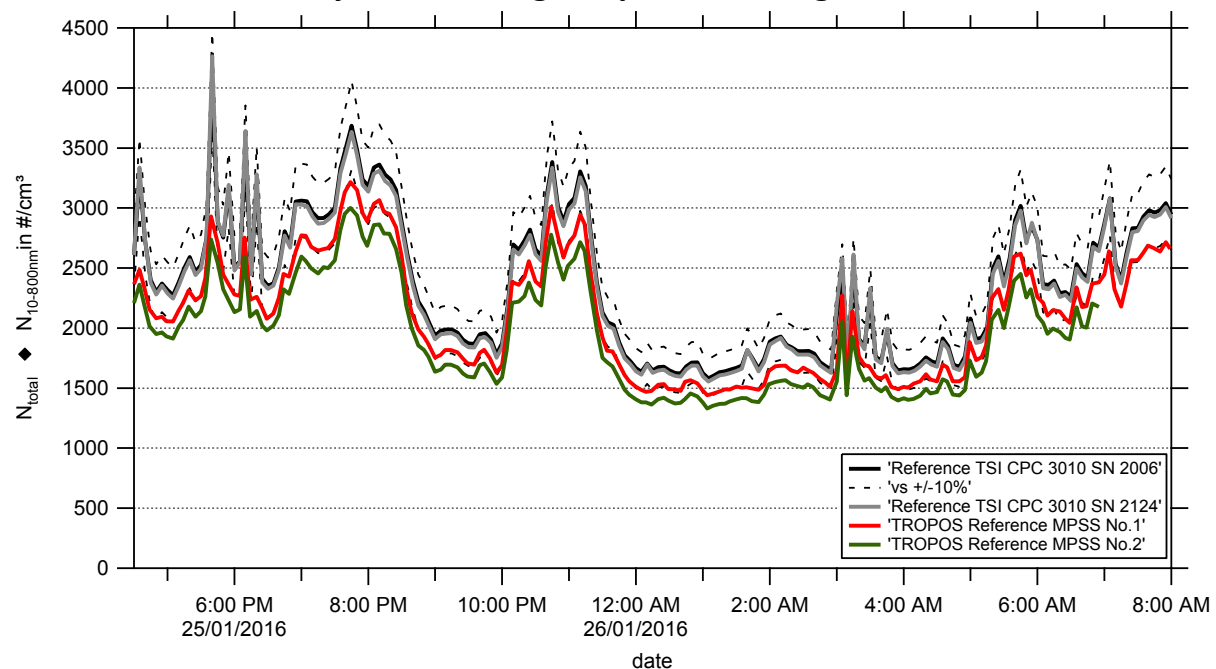


Figure 01: Time series (January 25, 2016 06:00 pm – January 26, 2016 08:00 am) of the integrated particle number concentration ($N_{10-800nm}$) of the two TROPOS Reference MPSS systems and total number concentration (N_{total}) of the two reference TSI-CPCs Model 3010. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Pre-status of the Candidate (January 25th)

Components and zero check

Institute	System	Components	CPC Model + Serial No.	Line	Flow		Zero	
TROPOS	Ref2	MPSS	3772 SN 70835059	2.6	1.003	l/min	0	# cm ⁻³
TROPOS		Total CPC	3010 SN 2124	2.5	1.020	l/min	0	# cm ⁻³
CHMI	CZ-CHMI Kosetice	TROPOS-MPSS	3772 SN 70729281	2.2	1.025	l/min	0	# cm ⁻³

High voltage calibration

Institute	System	[V]	0 V	4 mV	80 mV	800 mV
TROPOS	Reference MPSS No.2	Pre-status	-	-	-	-
		final	0.15	5.15	100	1000
CHMI	CZ-CHMI Kosetice	Pre-status	0	4	99.5	1008.5
		final	0	4.9	100	1000.5

Latex 203nm \pm 4nm (pressure 1009 hPa, 23.0°C)

Institute	System		Latex 203 [nm]	slope
TROPOS	Reference MPSS No.2	Pre-status	201	-
		final	203.65	4.82
CHMI	CZ-CHMI Kosetice	Pre-status	200	2.7
		final	205	2.6

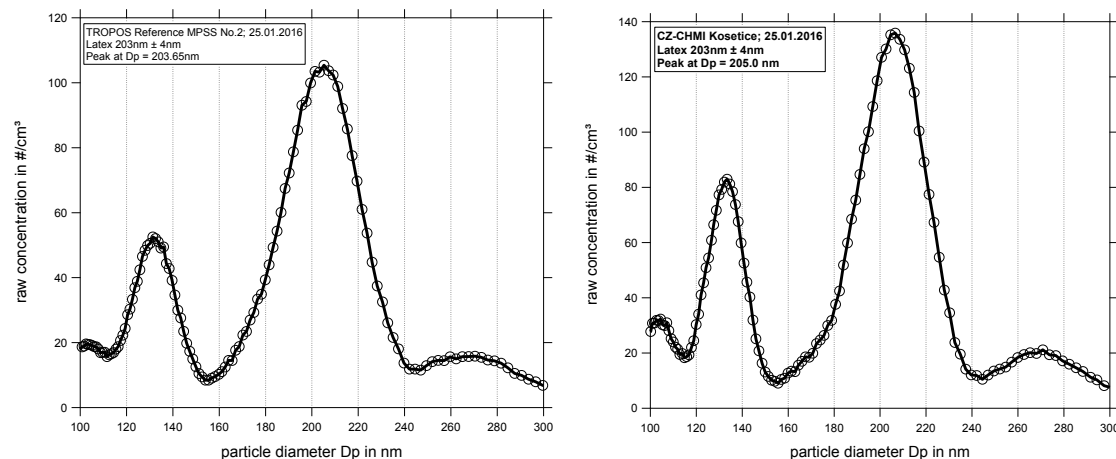


Figure 02: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on January 25th, 2016.

Time Series

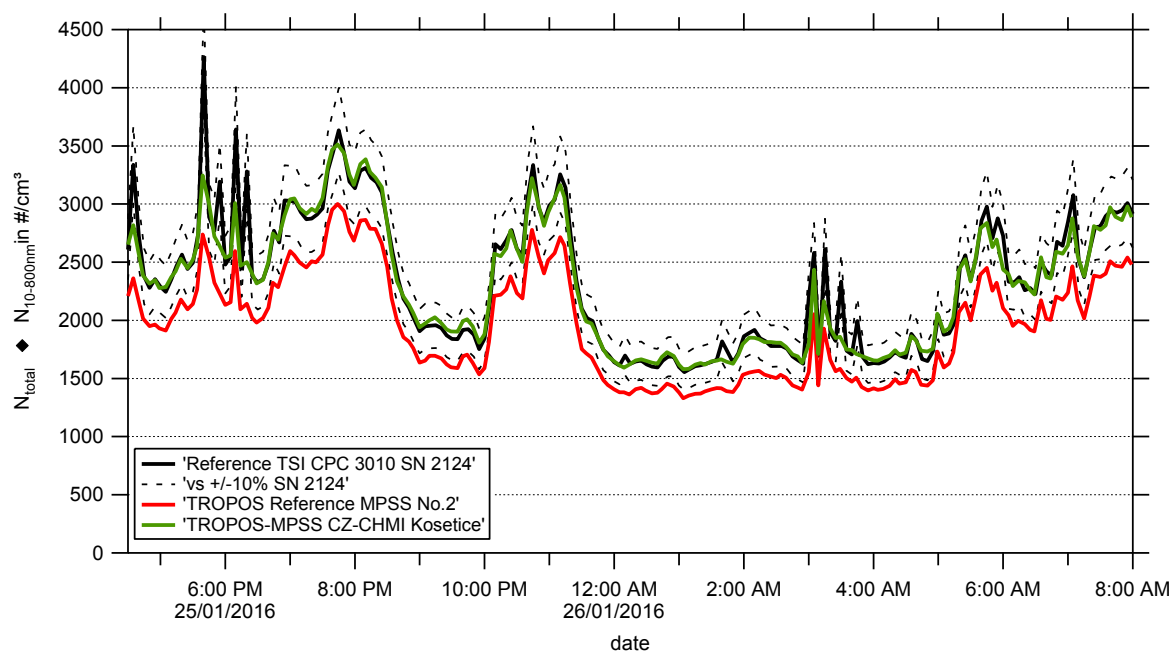


Figure 03: Time series (January 25, 2016 04:00 pm – January 26, 2016 08:00 am) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the reference TSI-CPC Model 3010. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Particle Number Size Distribution

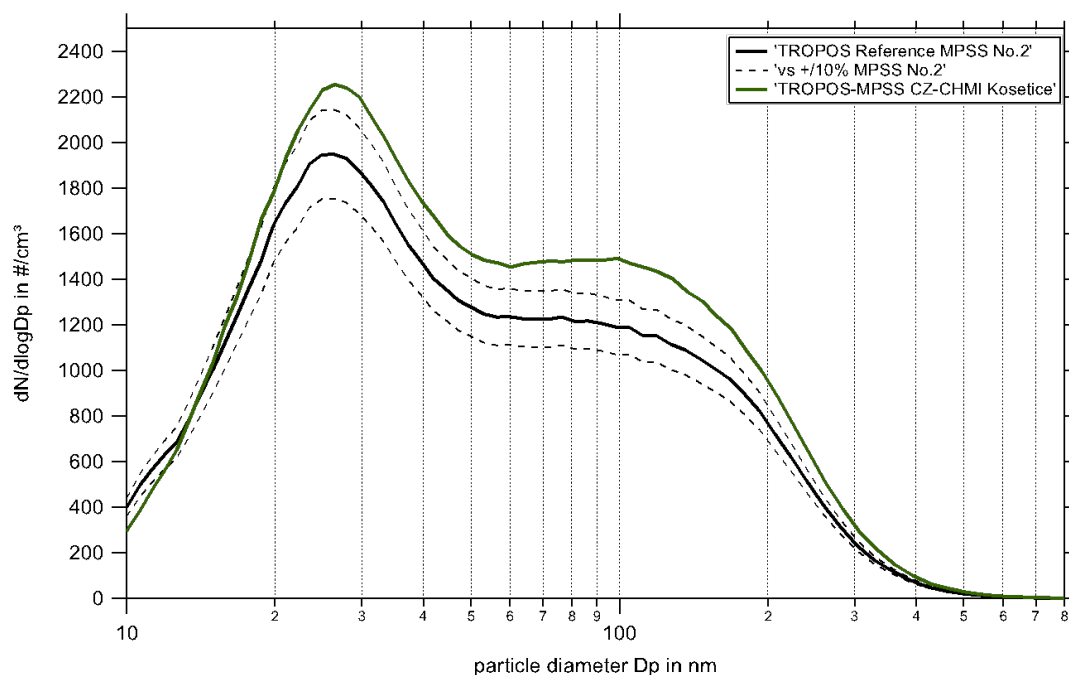


Figure 04: Comparison of mean particle number size distribution of TROPOS-MPSS CZ-CHMI Kosetice and TROPOS Reference MPSS No.2 from January 25, 2016 10:00 pm until January 26, 2016 04:00 am. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Correlation

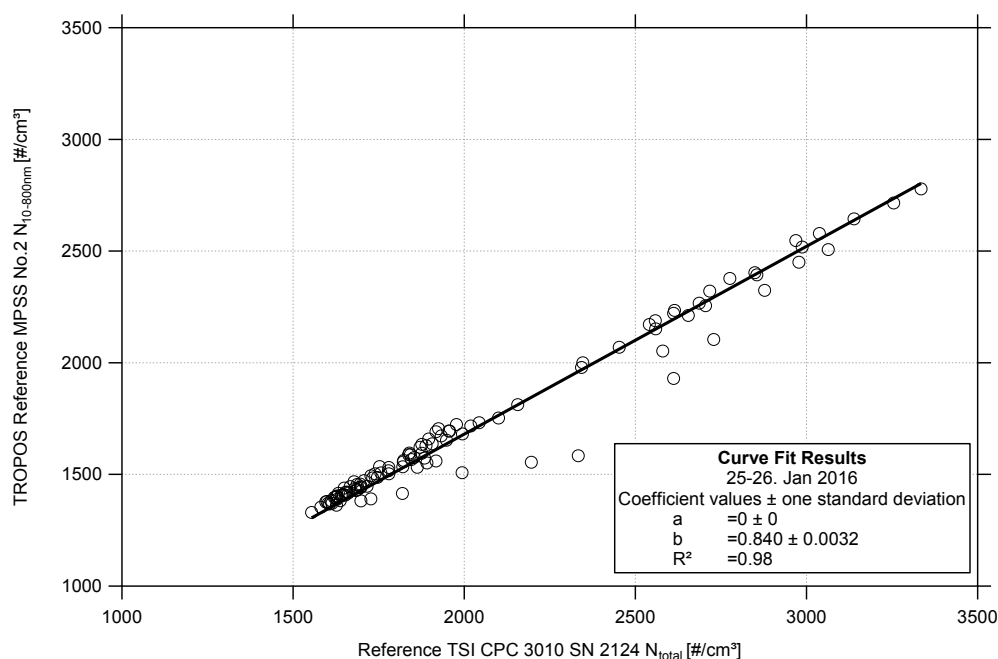


Figure 05: Linear regression between the number concentrations of the TROPOS Reference MPSS No.2 and TROPOS Reference TSI CPC Model 3010 (SN 2124). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

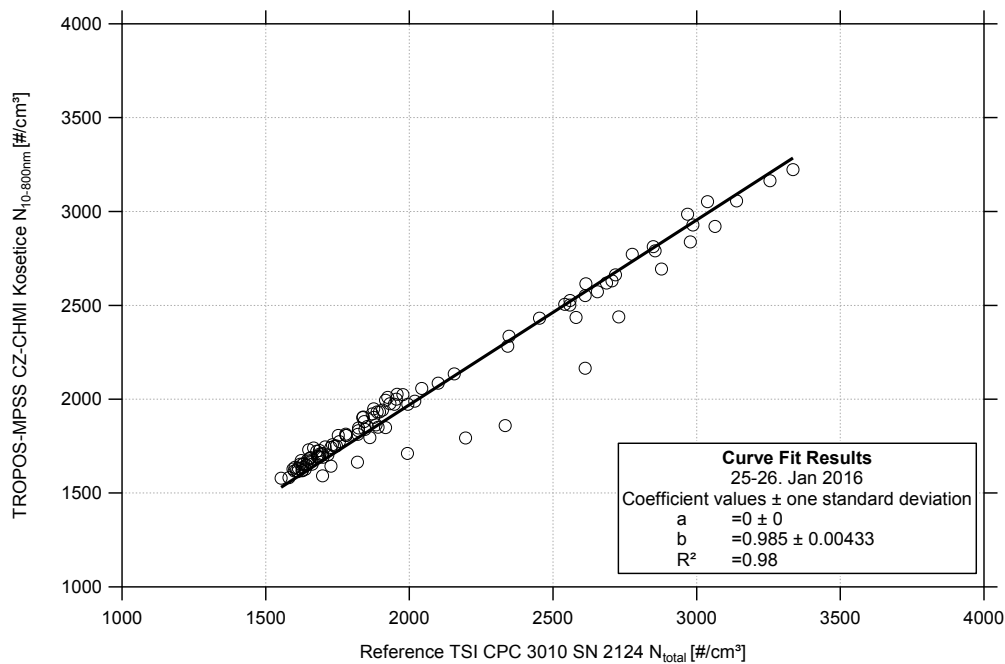


Figure 06: Linear regression between the number concentrations of the TROPOS-MPSS CZ-CHMI Kosetice and Reference TSI CPC Model 3010 (SN 2124). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

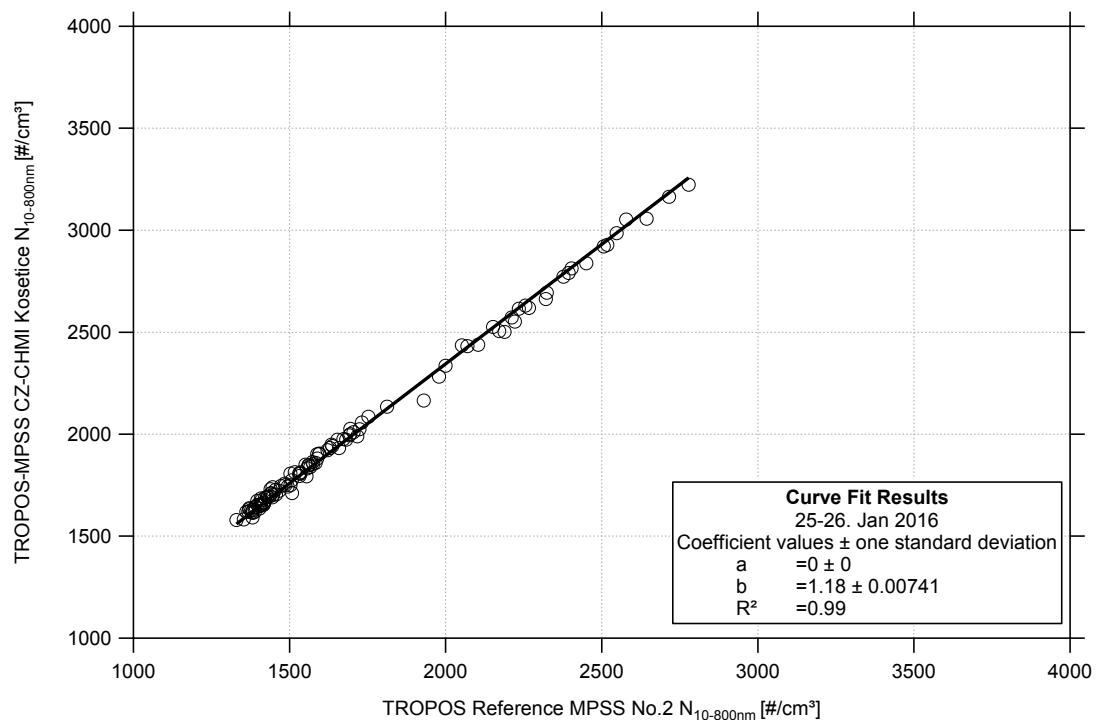


Figure 07: Linear regression between the number concentrations of the TROPOS-MPSS CZ-CHMI Kosetice and TROPOS Reference MPSS No.2. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Final Status of the Candidate (January 28th)

Components and zero check

Institute	System	Components	CPC Model + Serial No.	Line	Flow		Zero	
TROPOS	Ref2	MPSS	3772 SN 70835059	2.6	1.017	l/min	0	# cm ⁻³
TROPOS		Total CPC	3010 SN 2124	2.5	1.038	l/min	0	# cm ⁻³
CHMI	CZ-CHMI Kosetice	TROPOS-MPSS	3772 SN 70729281	2.2	1.028	l/min	0	# cm ⁻³

High voltage calibration

Institute	System	[V]	0 V	4 mV	80 mV	800 mV
TROPOS	Reference MPSS No.2	Pre-status	-	-	-	-
		final		5.1		1000
CHMI	CZ-CHMI Kosetice	Pre-status	-	-	-	-
		final		4.9		1000.5

Latex 203nm ±4nm (pressure 1007 hPa, 23.0°C)

Institute	System		Latex 203 [nm]	Slope
TROPOS	Reference MPSS No.2	Pre-status	-	-
		final	203	4.86
CHMI	CZ-CHMI Kosetice	Pre-status	-	-
		final	205	2.68

Time Series

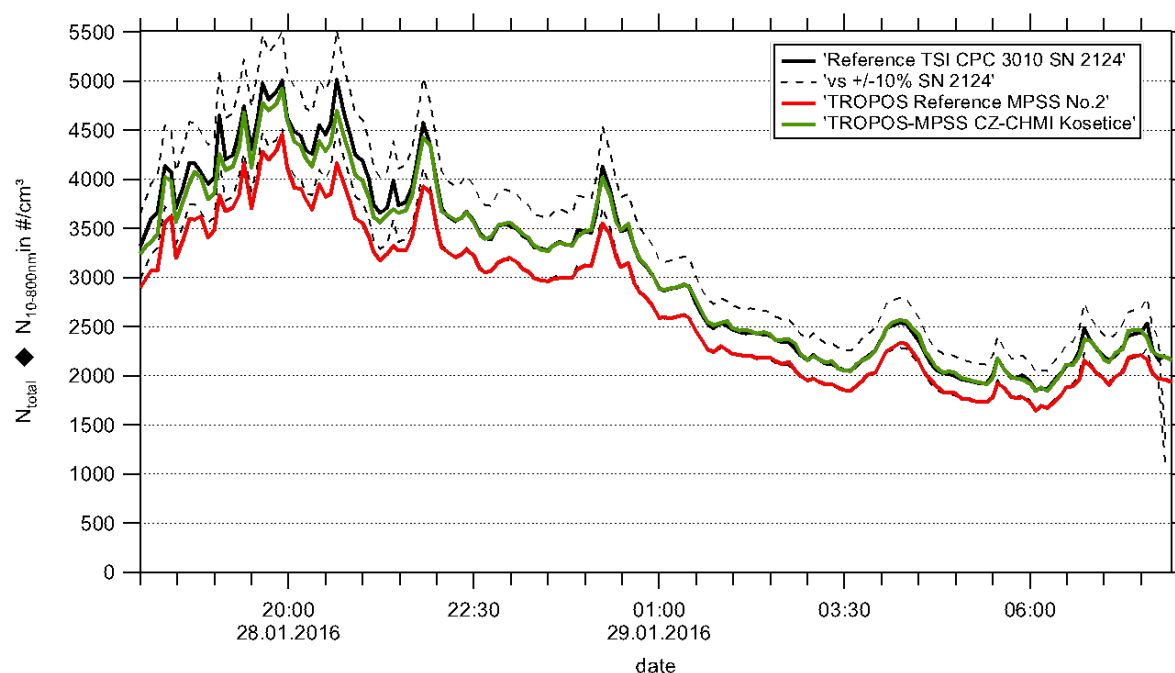


Figure 08: Time series (January 28, 2016 18:00 pm – January 29, 2016 08:00 am) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the reference TSI-CPC Model 3010. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Particle Number Size Distribution

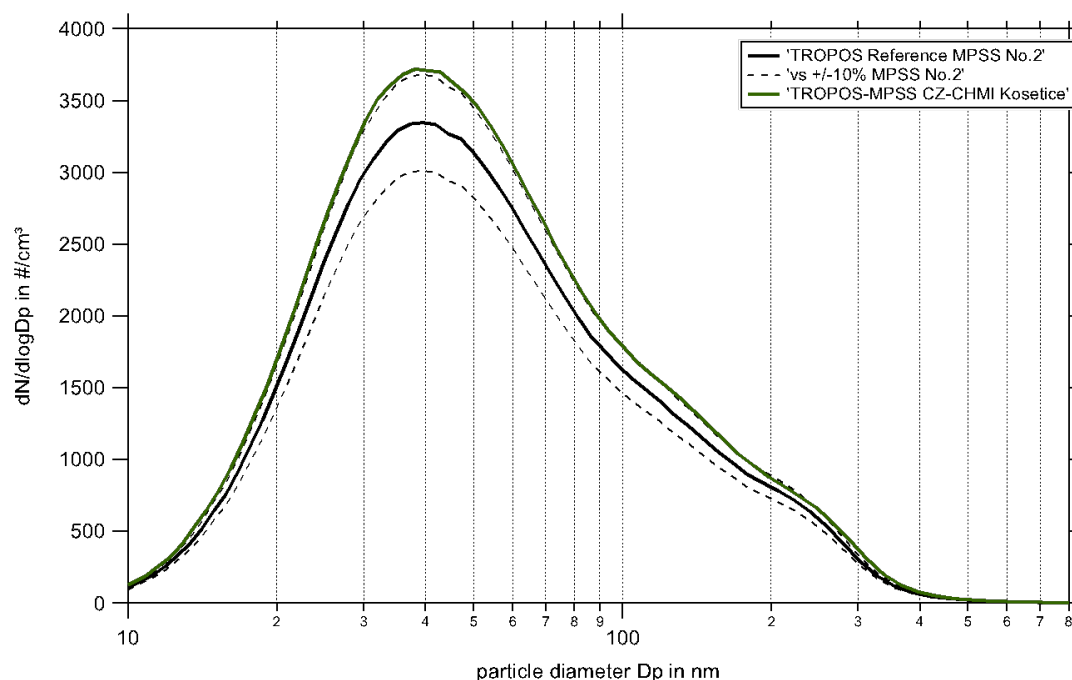


Figure 09: Comparison of mean particle number size distribution of Candidate MPSS and TROPOS reference MPSS No.2 from January 28, 2016 18:00 pm until January 29, 2016 06:00 am. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Correlation

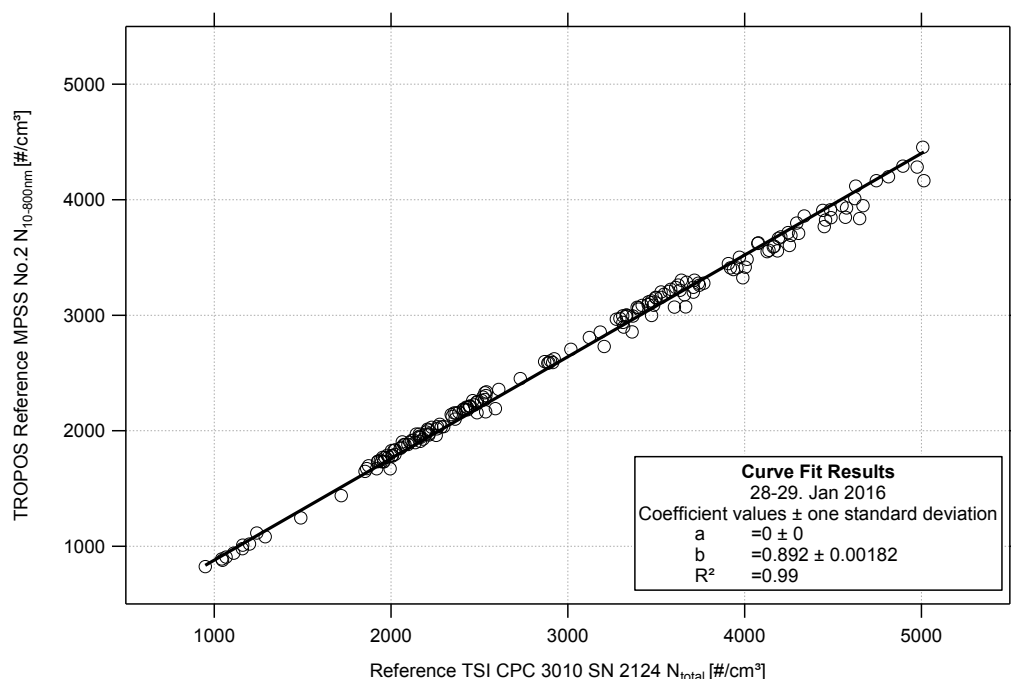


Figure 10: Linear regression between the number concentrations of the TROPOS Reference MPSS No.2 and TROPOS Reference TSI CPC Model 3010 (SN 2124). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

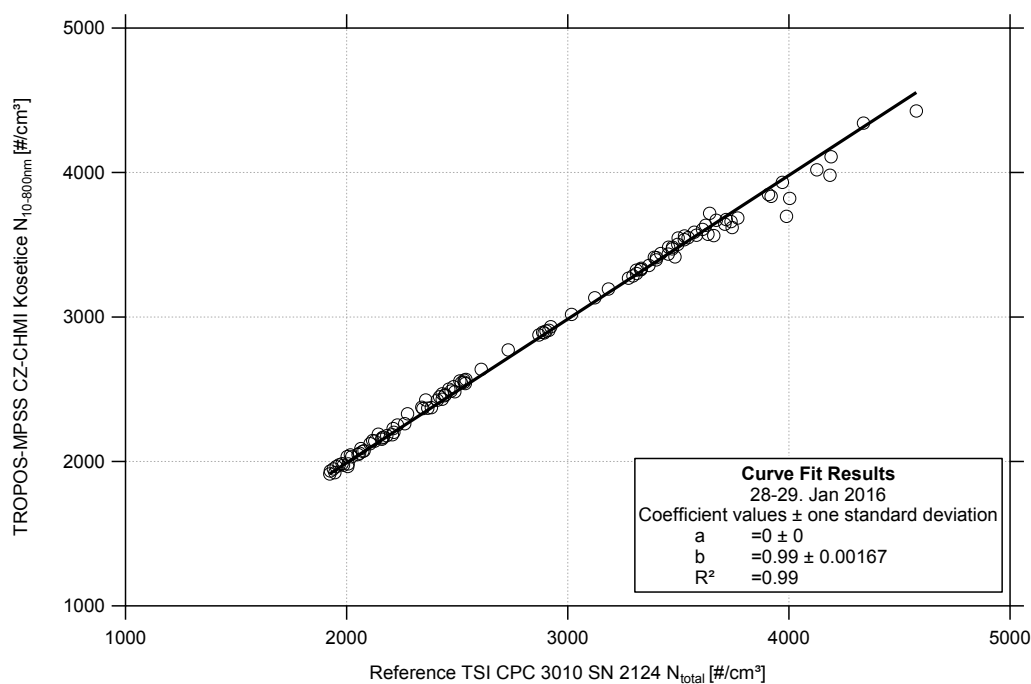


Figure 11: Linear regression between the number concentrations of the TROPOS-MPSS CZ-CHMI Kosetice and Reference TSI CPC Model 3010 (SN 2124). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

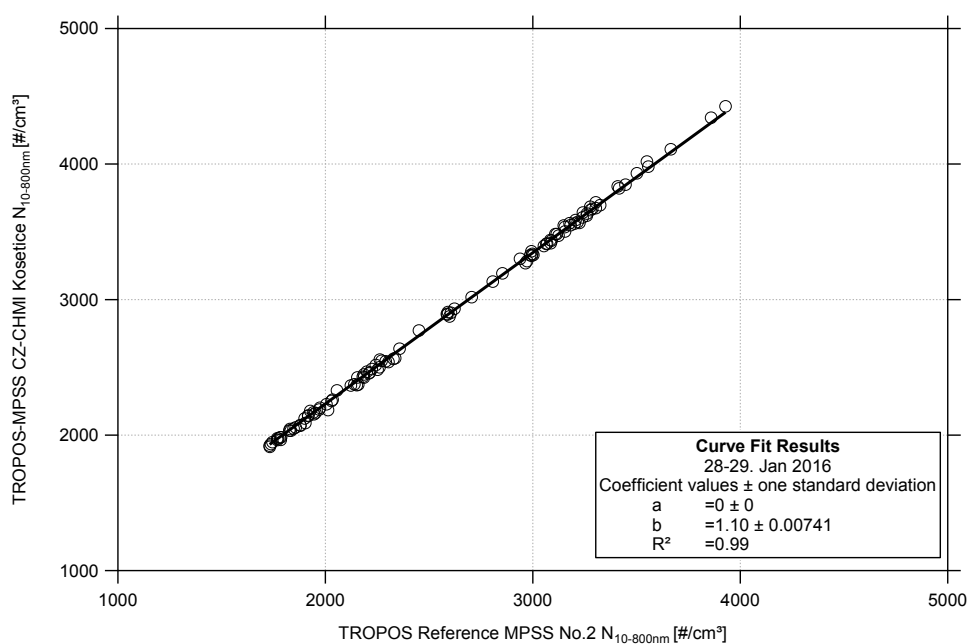


Figure 12: Linear regression between the number concentrations of the TROPOS-MPSS CZ-CHMI Kosetice and TROPOS Reference MPSS No.2. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.