

Intercomparison of Mobility Particle Size Spectrometers

Project No.: MPSS-2016-1-1

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
Jean-Philippe Putaud	JRC	Sebastiao Martins dos Santos	Homemade MPSS TSI CPC Model 3010 #2405

Summary of Intercomparison:

Pre-status:

The Homemade MPSS IT-JRC Ispra was working fine but there were several things that have been checked.

Final status:

The Homemade MPSS IT-JRC Ispra 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

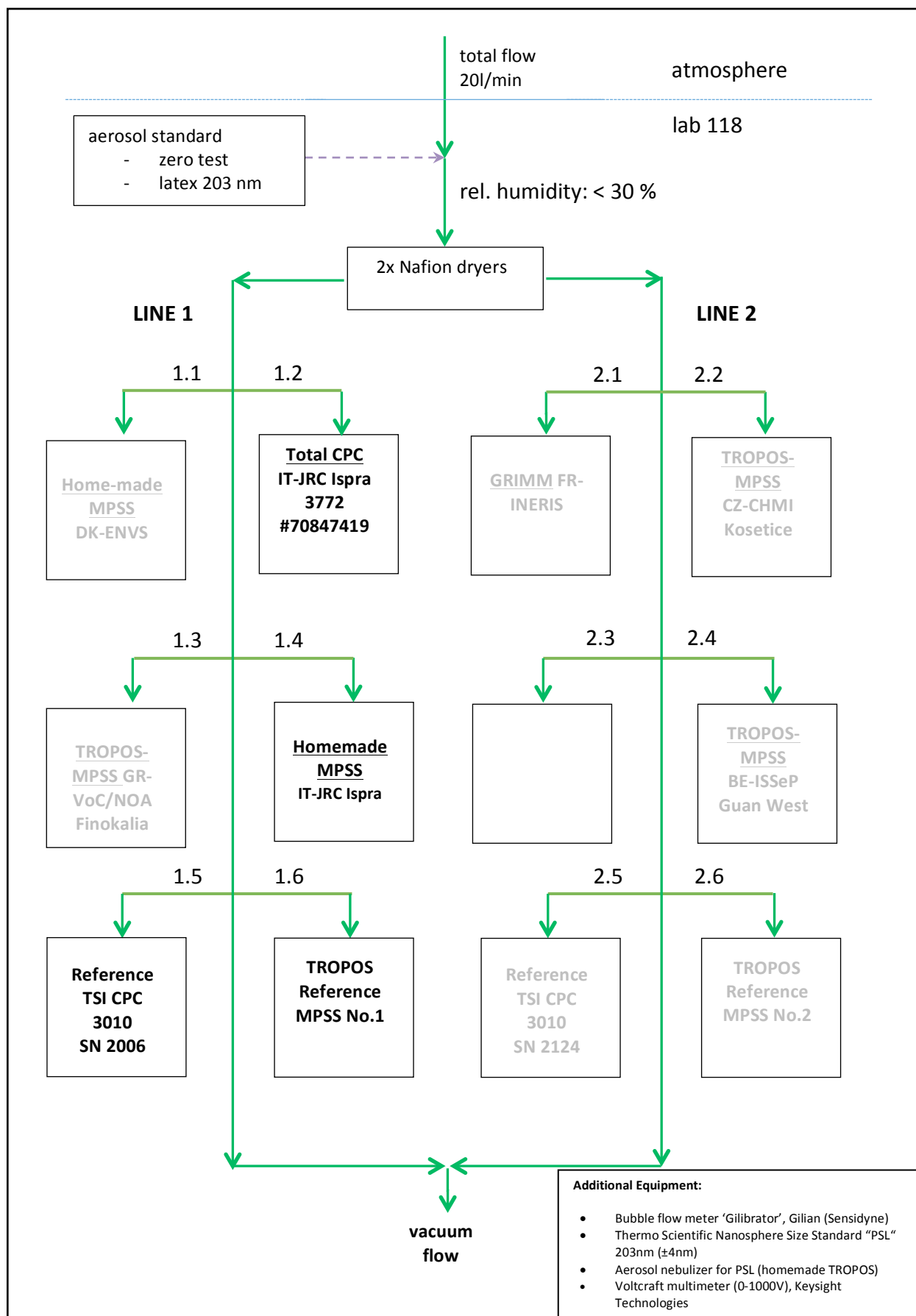
there are a lot of ultrafine particles that is the reason why the correlation to the TROPOS total CPC 3010 is sometimes out of the 10% range.

- 25.01.2016: setup IT-JRC Ispra in the lab 118 -> pre-status overnight run. The system is running with their own radioactive source Kr85.
- 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 because of wrong slit and scratches on the electrode. We changed the slit from 0.7 mm to 0.5 mm. Run without the nafion dryer. System is running with a DMA (161) from TROPOS. We checked the Kr85 source -> okay.
- 27.01.2016: DMA back in the MPSS after cleaning. Nafion dryer was checked by Andrea Haudek.
- 28.-29.01.2016: final status overnight run with ambient. All settings are the original like on the station.

List of Components

	Specification	Reference MPSS No.1	IT-JRC Ispra
Position (Line)		1.6	1.4
Company		TROPOS	Homemade
Software		TROPOS 5.7	Homemade
CPC		Model 3772 SN: 3772141701	Model 3772 SN: 3772133103
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

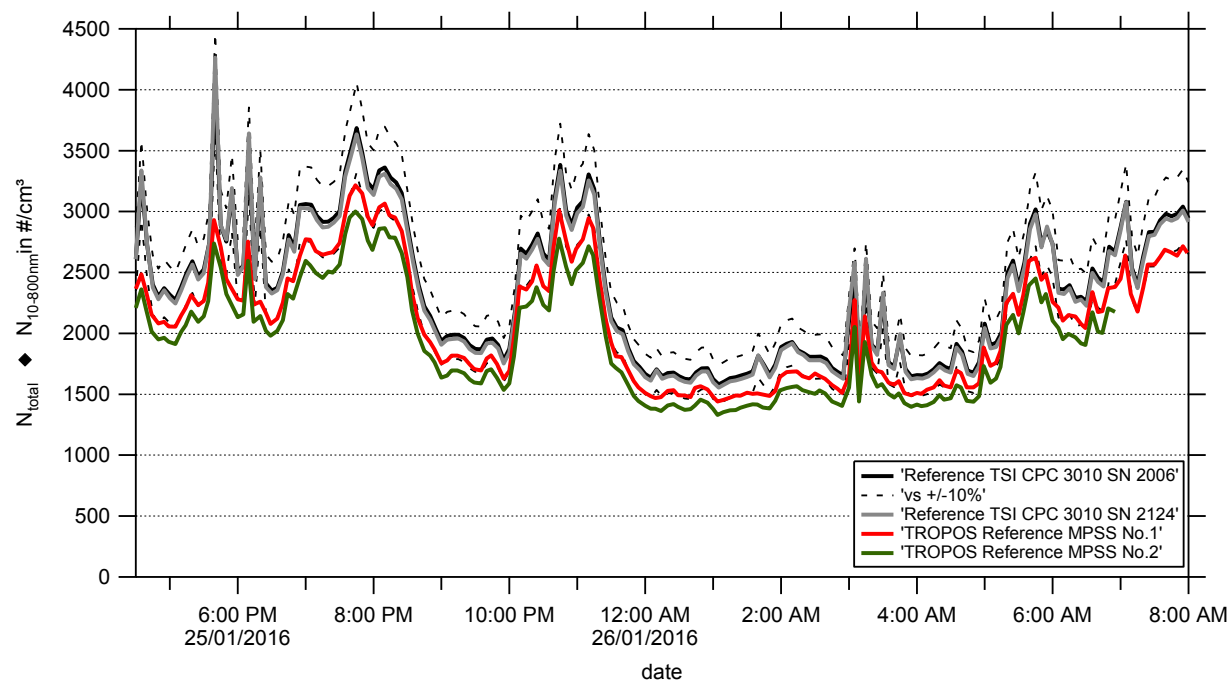


Figure 01: Time series (January 25, 2016 06:00 pm – January 26, 2016 08:00 am) of the integrated particle number concentration ($N_{10-800nm}$) of the two TROPOS Reference MPSS systems and total number concentration (N_{total}) of the two reference TSI-CPCs Model 3010. The inversion was performed using 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	Ref1	MPSS	3772 SN 3772141701	1.6	1.026	l/min	1	# cm ⁻³
TROPOS		Total CPC	3010 SN 2006	1.5	1.025	l/min	0	# cm ⁻³
JRC	Ispra	Homemade-DMPS	3772 SN 3772133103	1.4	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.1	Pre-status	-	-	-	-
		final	0	5	100	1000
JRC	Ispra	Pre-status	-	-	-	-
		final	-	-	-	-

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

Institute	System		Latex 203 [nm]	slope
TROPOS	Reference MPSS No.1	Pre-status	201	-
		final	202.8	4.9
JRC	Ispra	Pre-status	-	-
		final	203.89	-

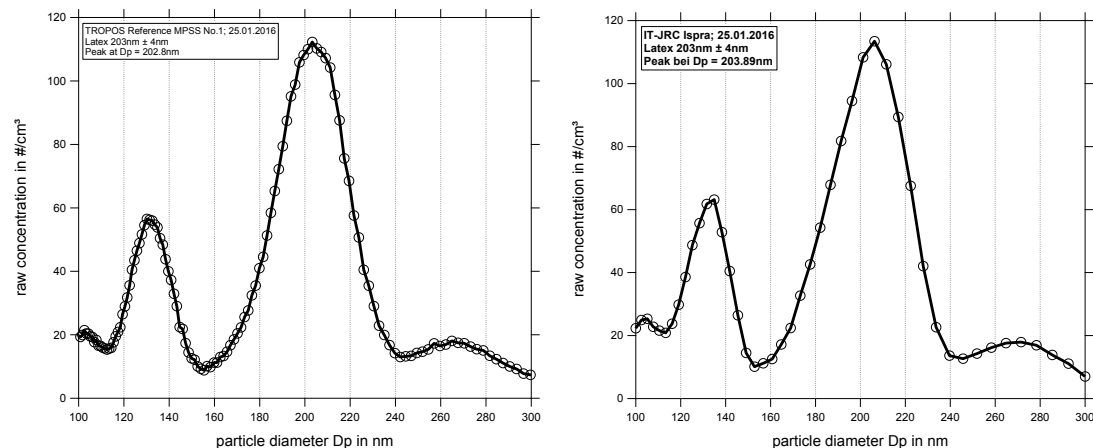


Figure 02: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on January 25th, 2016.

Time Series

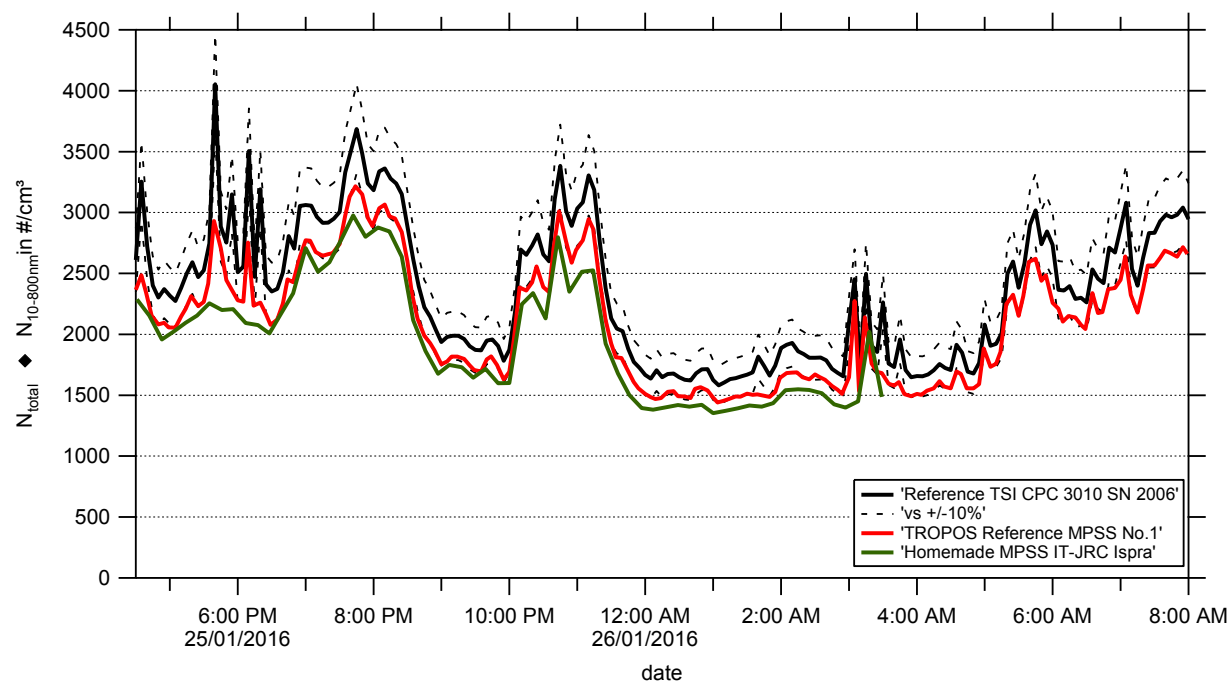


Figure 03: Time series (January 25, 2016 06:00 pm – January 26, 2016 08:00 am) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the reference TSI-CPC Model 3010. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Particle Number Size Distribution

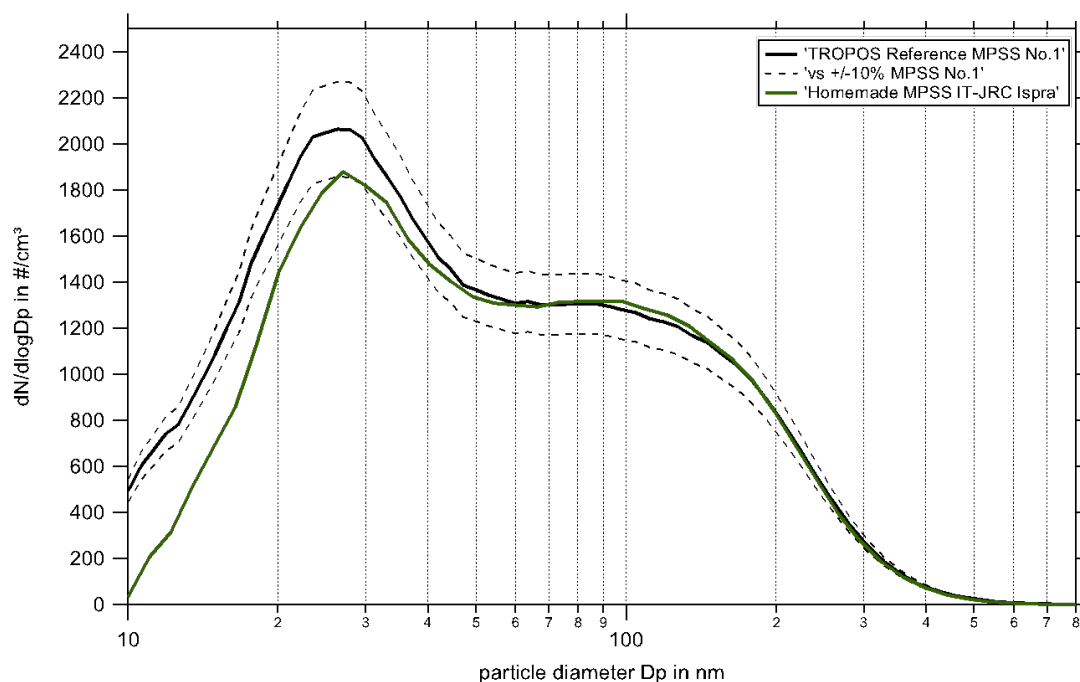


Figure 04: Comparison of mean particle number size distribution of IT-JRC Ispra and TROPOS Reference MPSS No.1 from January 26, 2016 06:00 pm until January 26, 2016 04:00 am. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Correlation

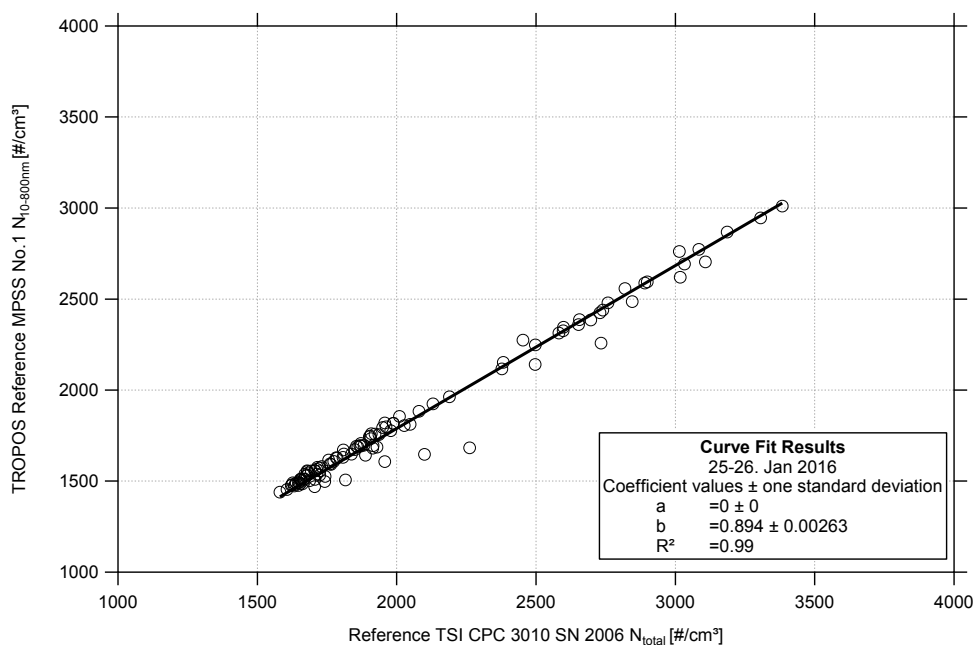


Figure 05: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and TROPOS Reference TSI CPC Model 3010 (SN 2006). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

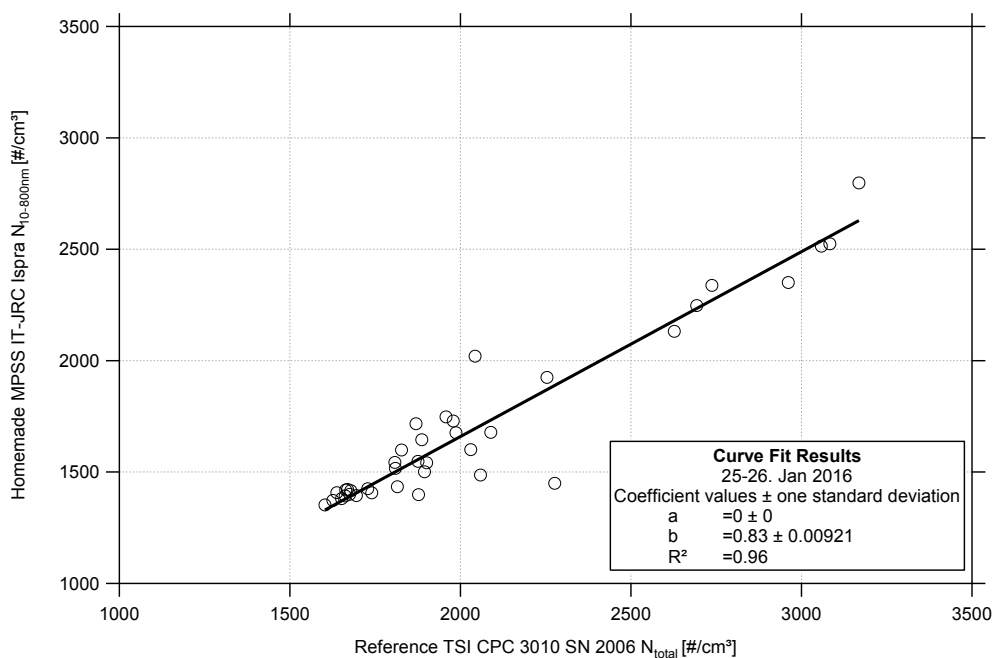


Figure 06: Linear regression between the number concentrations of the Homemade MPSS IT-JRC Ispra and TROPOS Reference TSI CPC Model 3010 (SN 2006). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

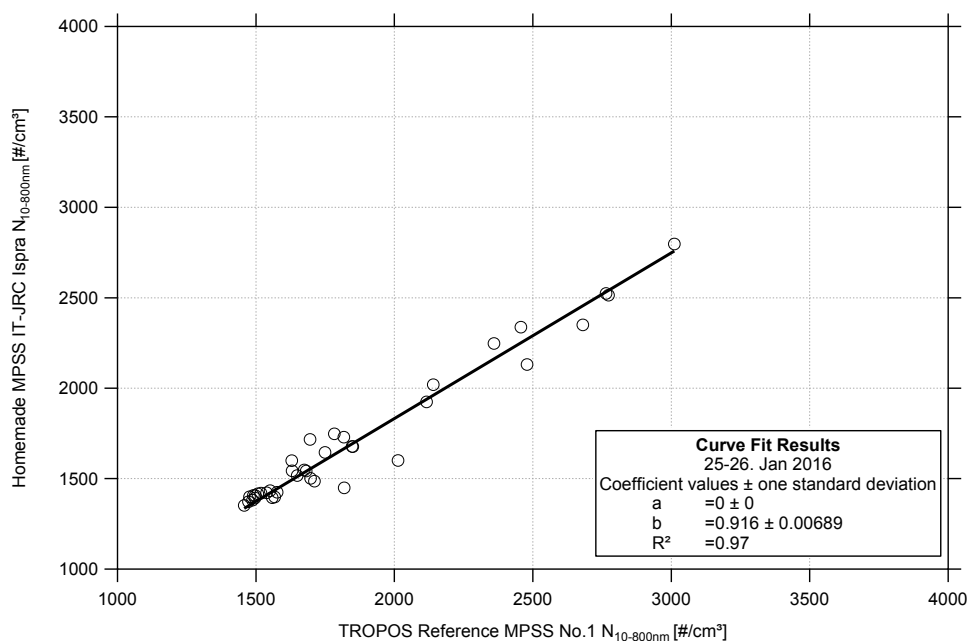


Figure 06: Linear regression between the number concentrations of the Homemade MPSS IT-JRC Ispra and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Final Status of the Candidate (January 28th)

Components and zero check

Institute	System	Components	CPC Model + Serial No.	Line	Flow		Zero	
TROPOS	Ref1	MPSS	3772 SN 3772141701	1.6	1.034	l/min	0	# cm ⁻³
TROPOS		Total CPC	3010 SN 2006	1.5	1.035	l/min	0	# cm ⁻³
JRC	Ispra	Homemade-DMPS	3772 SN 3772133103	1.4	1.040	l/min	0	# cm ⁻³

High voltage calibration

Institute	System	[V]	0 V	4 mV	80 mV	800 mV
TROPOS	Reference MPSS No.1	Pre-status	-	-	-	-
		final		4.9	100	1000
JRC	Ispra	Pre-status	-	-	-	-
		final				

Time Series

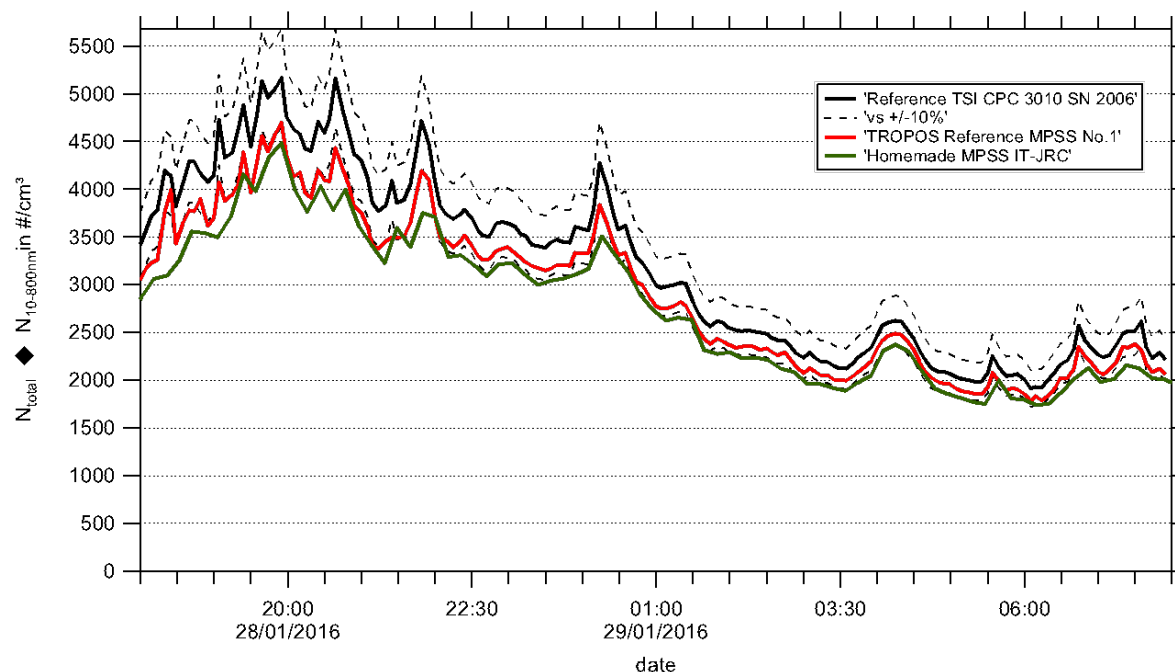


Figure 07: Time series (January 28, 2016 06:00 pm – January 29, 2016 06:00 am) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the reference TSI-CPC Model 3010. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Particle Number Size Distribution

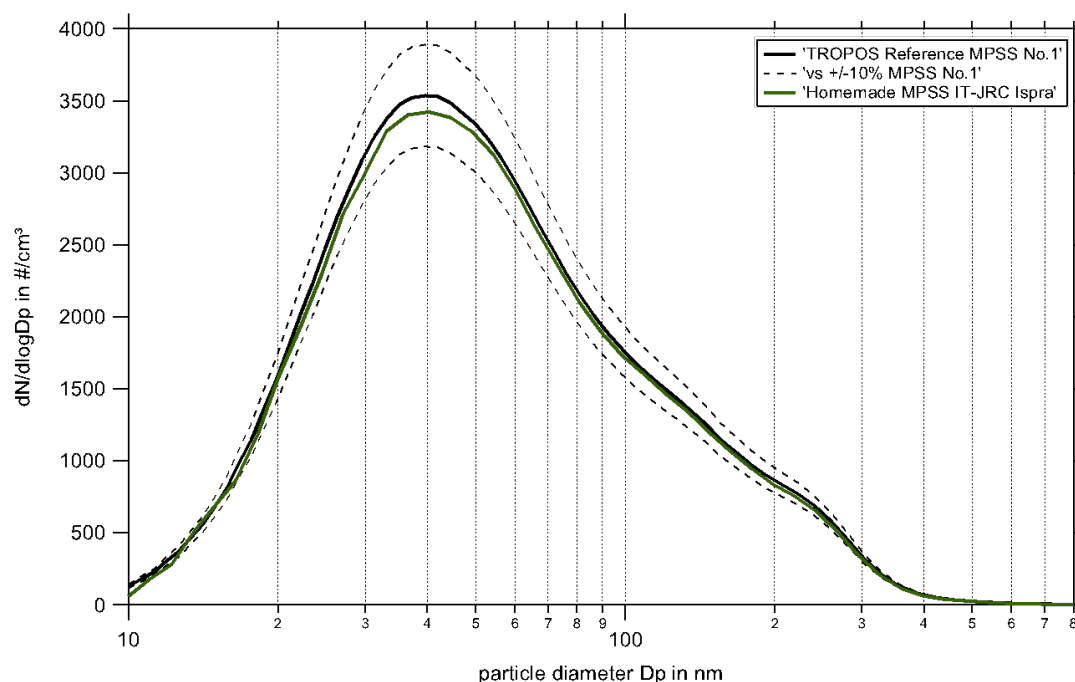


Figure 08: Comparison of mean particle number size distribution of Candidate MPSS and TROPOS reference MPSS No.1 from January 28, 2016 06:00 pm until January 29, 2016 06:00 am. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Correlation

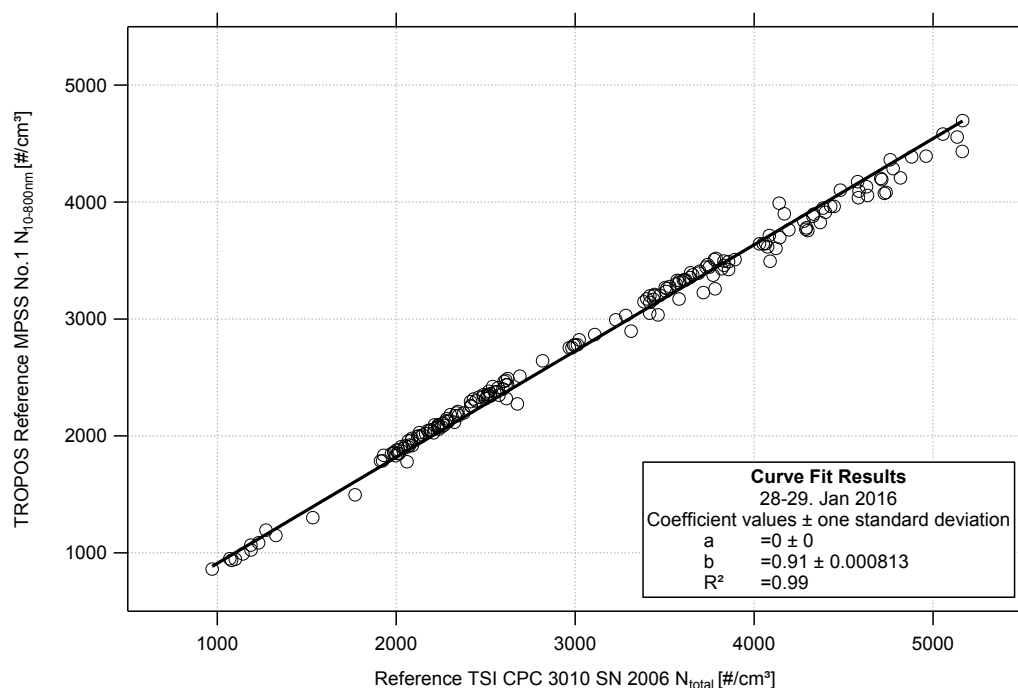


Figure 09: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and TROPOS Reference TSI CPC Model 3010 (SN 2006). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

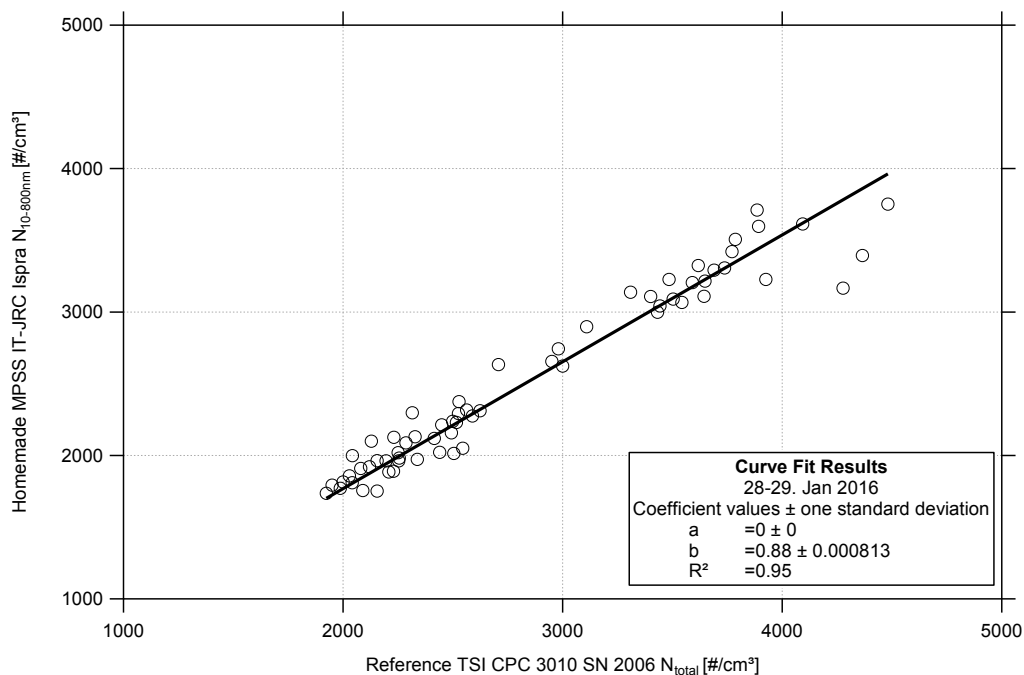


Figure 10: Linear regression between the number concentrations of the Homemade MPSS IT-JRC Ispra and TROPOS Reference TSI CPC Model 3010 (SN 2006). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

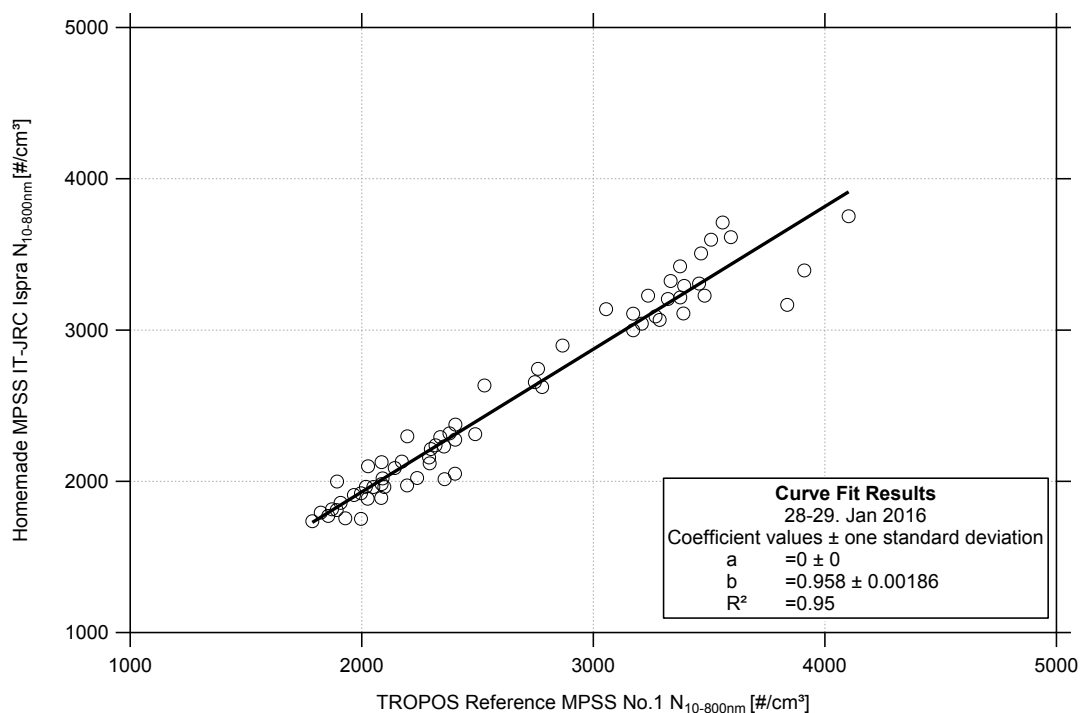


Figure 11: Linear regression between the number concentrations of the Homemade MPSS IT-JRC Ispra and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.