Intercomparison of Mobility Particle Size Spectrometers

Project No.: MPSS-2018-5-2

Principal Investigator: Juan Andrés Casquero Vera

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18006 Granada (Spain)

Participant: Juan Andrés Casquero Vera

Candidate: **IISTA-CEAMA**
Made by: **TROPOS**
Counter (SN): **TSI 3772 SN: 3772153703**
TSI 3082 SN: 3082001532001
Software: **TSI Software V10.2**

Location of the quality assurance: TROPOS Leipzig, lab 118

Comparison period: June 18, 2018 – June 22, 2018

Last Intercomparison (with Project No.):

Summary of Intercomparison:

Pre-Status:
The instrument arrived with the participant. The instrument was running with TSI Software, version 10.2, having x-ray as the radioactive source. During the Pre-Status, the candidate showed a concentration of 11% above the TROPOS Reference MPSS No.1. The PSL check showed a peak at 203.78 nm.
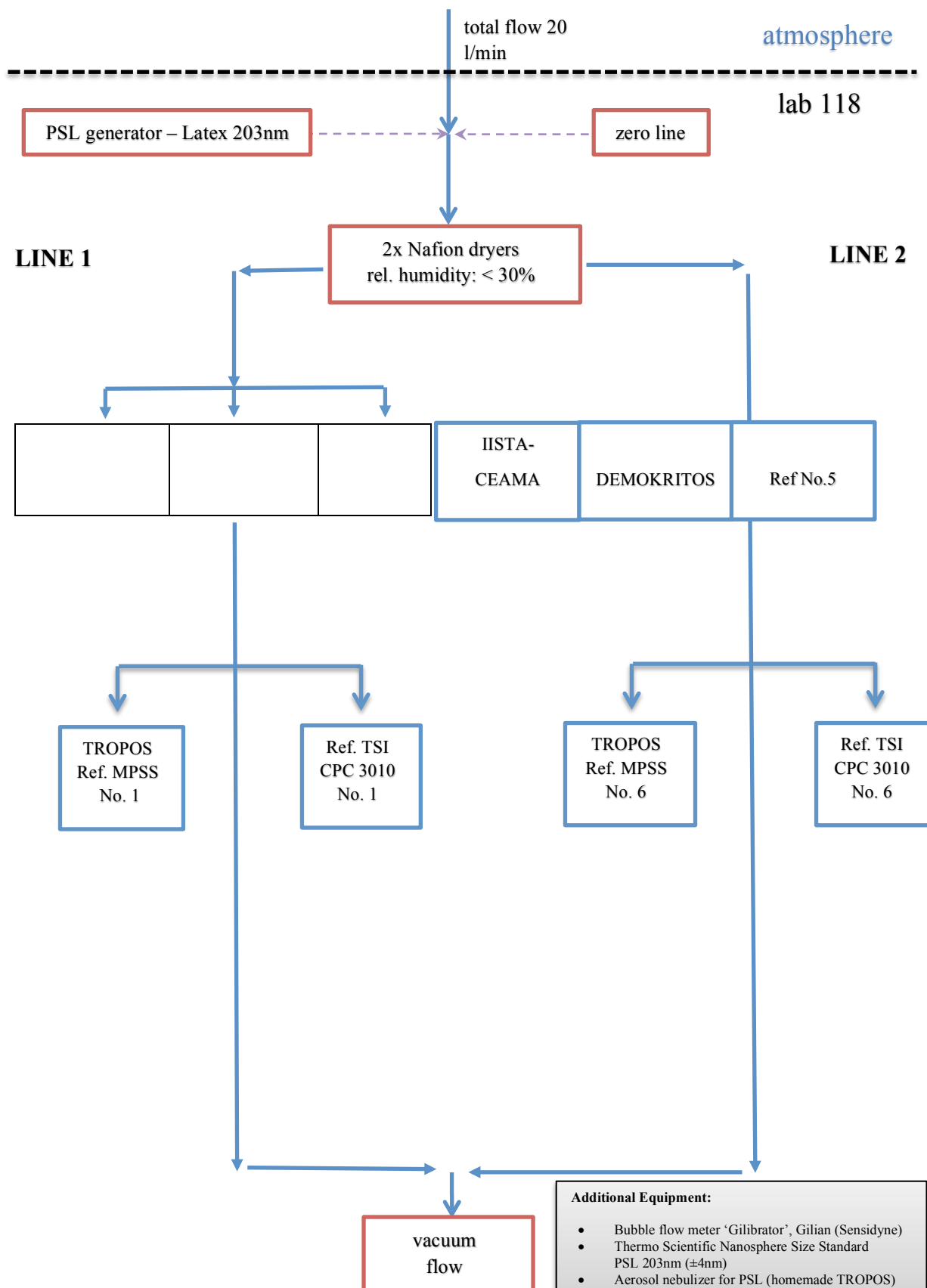
Final-Status:
During the Final-Status, the performance of the system showed a concentration of 4% below the TROPOS Reference Instrument No.1. The radioactive source was changed to Ni-63 and the CPC efficiency curve measured during the workshop was used. Additionally the DMA was cleaned and also other important parts making up the MPSS were checked as described below.

The candidate passed the quality standards of ACTRIS and GAW.

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

List of Components	TROPOS Reference MPSS No.6	TROPOS Reference MPSS No.1	Candidate
Position	Line 2.1	Line 1.2	Line 1.1
Company	TROPOS	TROPOS	TROPOS
Software	TROPOS V6.68	TROPOS V6.68	TSI V10.2
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	Ni.63	Kr.85	x-ray/Ni.63(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	✓	✓	✓
info			

Laboratory setup:

total flow 20
l/min

atmosphere

lab 118

| PSL generator – Latex 203nm | | zero line |

LINE 1

2x Nafion dryers
rel. humidity: < 30%

LINE 2

| | | | IISTA-CEAMA | DEMOKRITOS | Ref No.5 |

| TROPOS Ref. MPSS No. 1 | | Ref. TSI CPC 3010 No. 1 |

| TROPOS Ref. MPSS No. 6 | | Ref. TSI CPC 3010 No. 6 |

vacuum
flow

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

Status of the instruments:

Date of system checks:

date	18.06.2018	19.06.2018	unit
total CPC flow	-	-	l/min
aerosol flow (DMA)	1.038	1.025	l/min
aerosol flow (UDMA)	-	-	l/min
aerosol flow (total)	1.038	1.025	l/min
Zero MPSS	0	0	#/cm³
Zero total CPC	-	-	#/cm³
PSL 203 nm	203.78	205.27	nm

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	No	-	-	No dryer
change sheath Nafion dryer	No			No dryer
check source	Yes	-	-	Additional Ni.63 from TROPOS
change HV power supply	No	-	-	checked
clean/change DMA	Yes	-	-	checked and cleaned
change aerosol RH/T-sensor	No	-	-	-
change sheath RH/T-sensor	No	-	-	-
change pressure sensor	No	-	-	-
change inlet Nafion dryer (500)	No	-	-	-

Change Total filter	-	-	-	-
NI-card	-	-	-	-

PSL Scan and calibration: Latex 203 nm +/- 4 nm
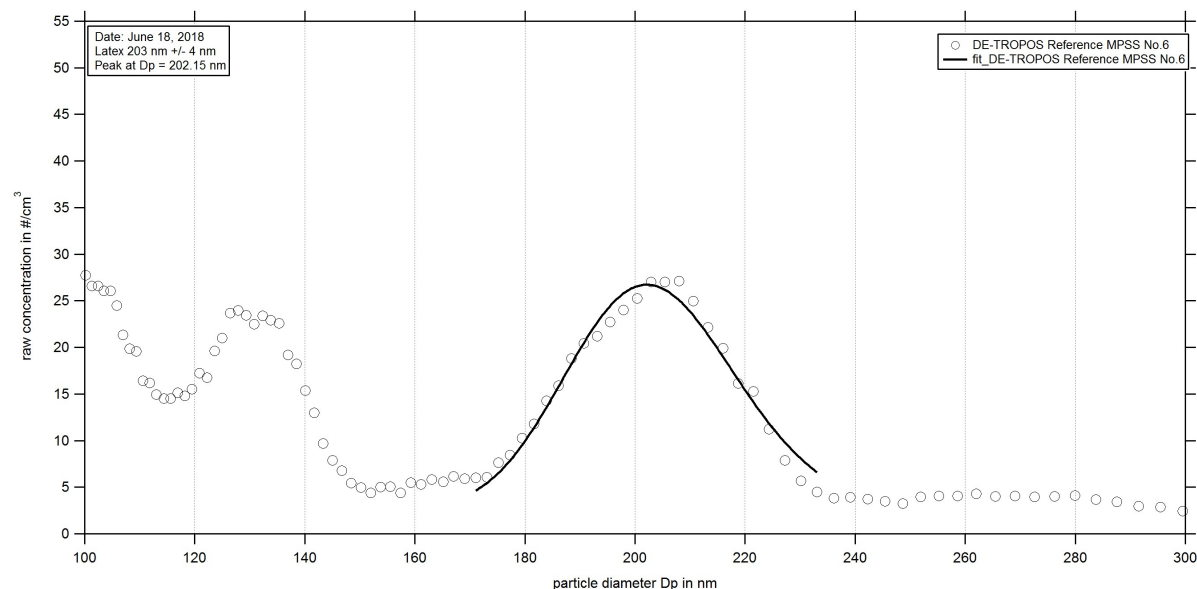
Figure 01: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on June 18th, 2018.
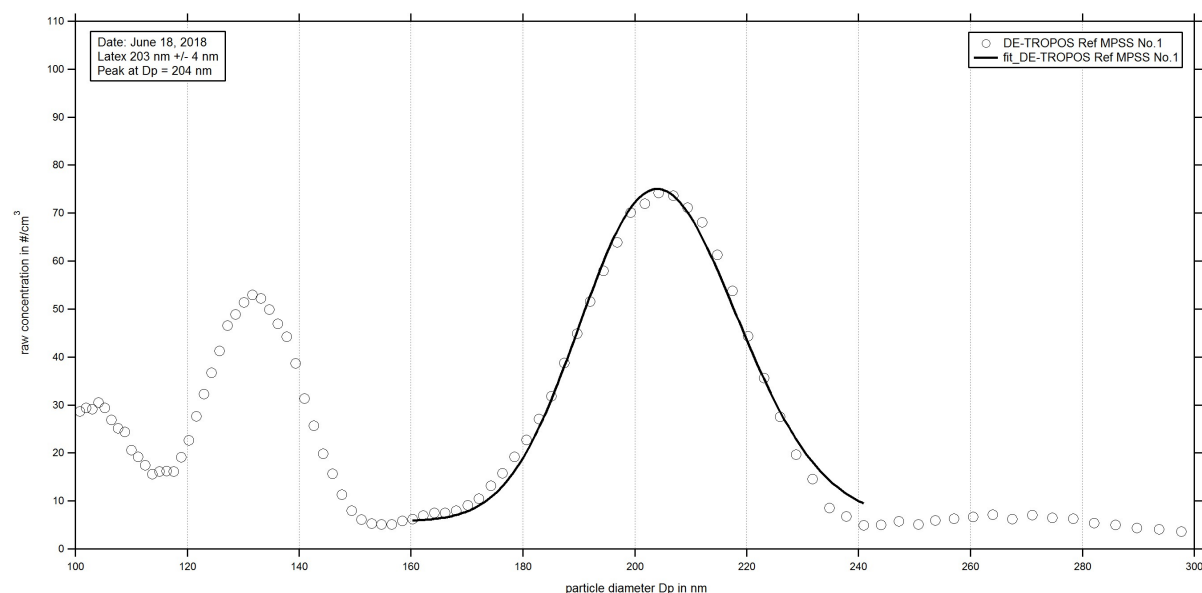

Figure 02: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on June 18th, 2018.
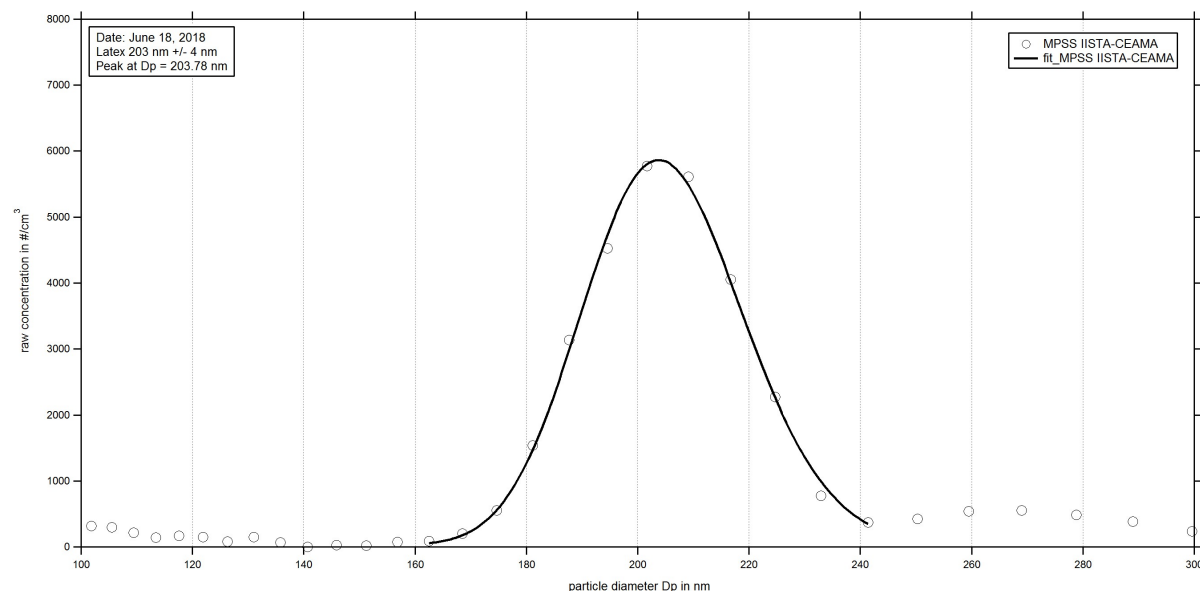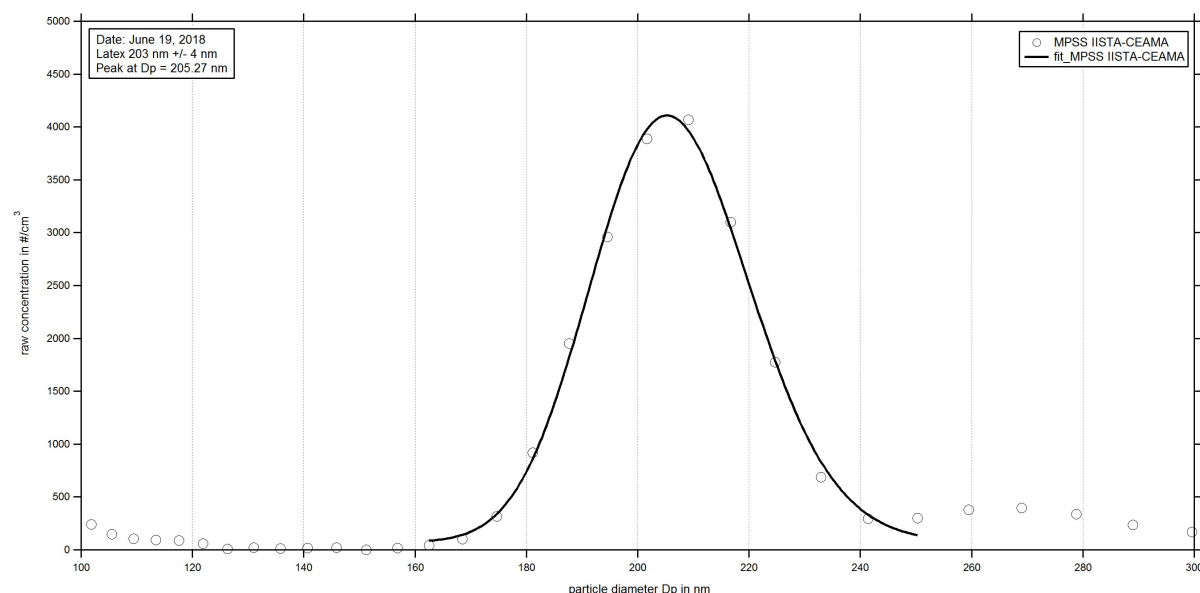
Figure 03: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on June 18th, 2018.

Figure 04: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on June 19th, 2018.

TROPOS Reference Instruments: Time Series, Correlation and Particle Number Size Distribution
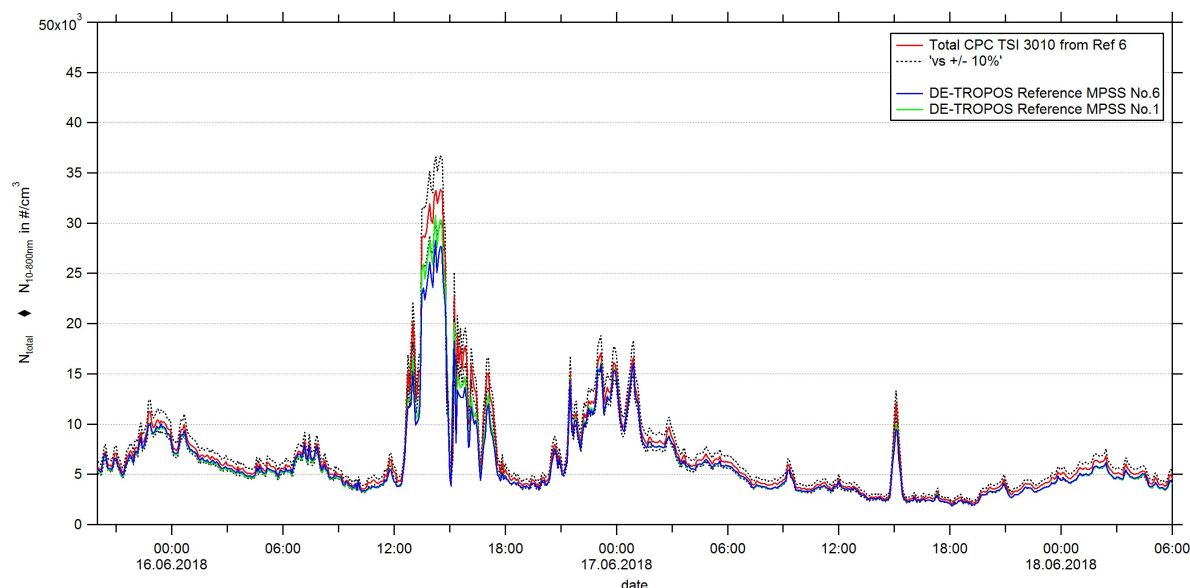
Figure 05: Time series (June 15, 2018 20:00 – June 18, 2018 06:00) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.
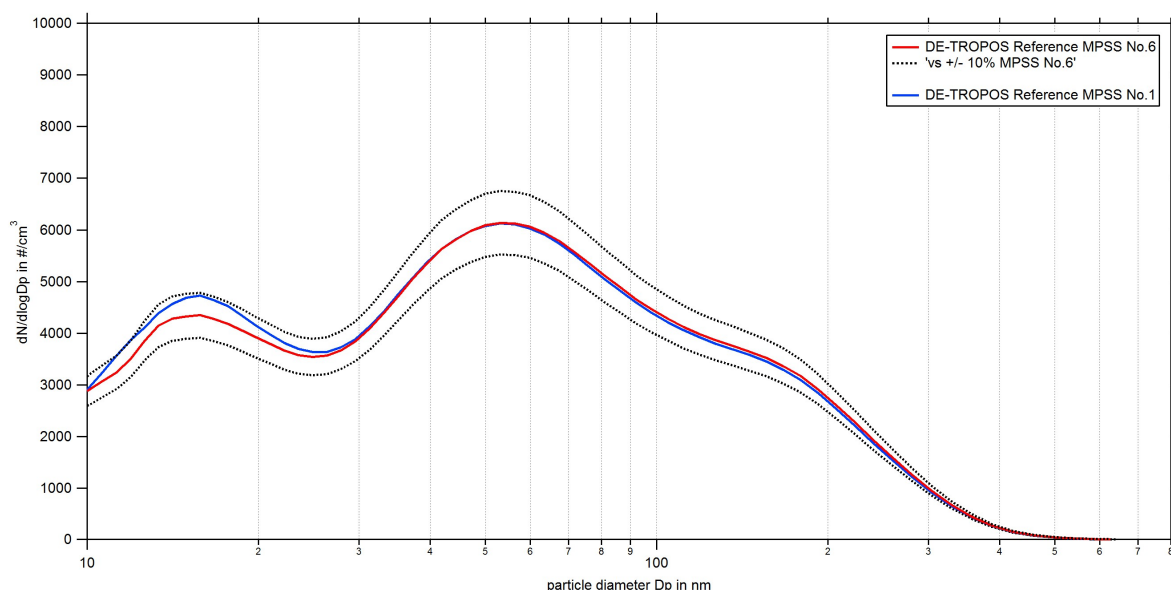
Figure 06: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.6 against TROPOS Reference MPSS No.1 from June 15, 2018 20:00 – June 18, 2018 06:00. Multiple charge correction, internal diffusion losses and CPC efficiency are included.
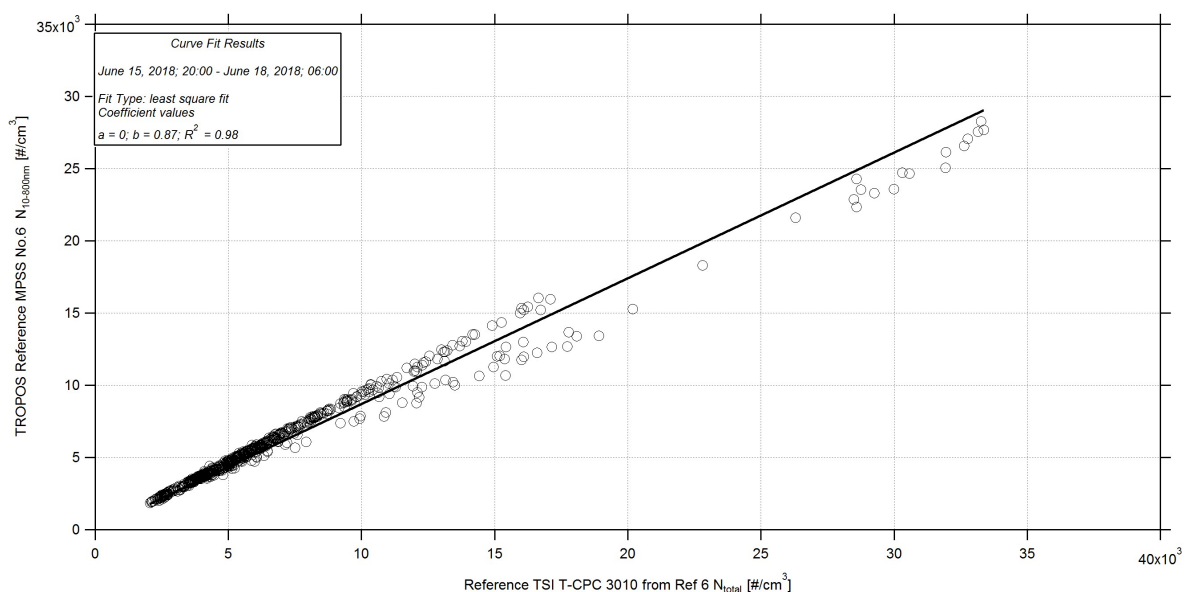
Figure 07: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 Ref 6 and TROPOS Reference MPSS No.6. Multiple charge correction, internal diffusion losses and CPC efficiency are included.
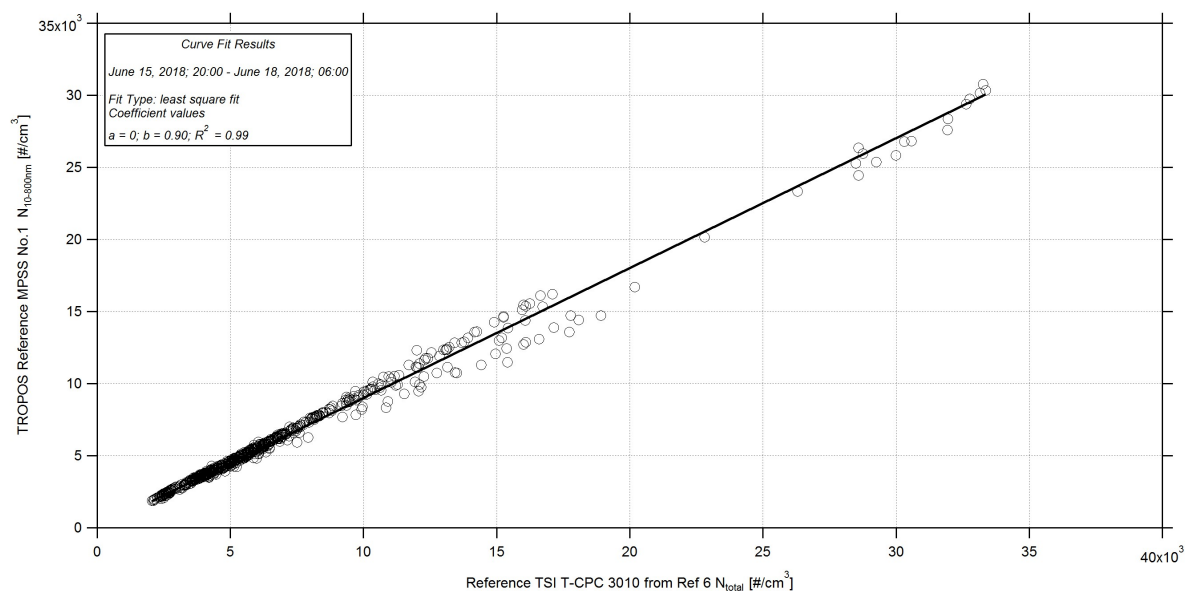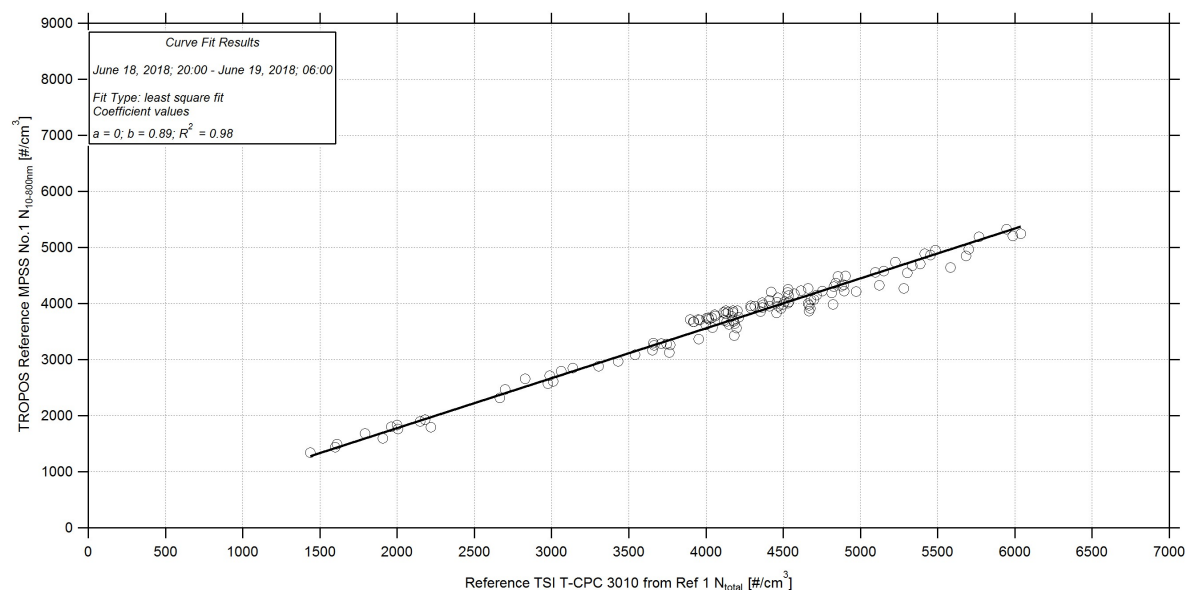

Figure 08: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 Ref 6 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

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Figure 09: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 Ref 1 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC efficiency are included.
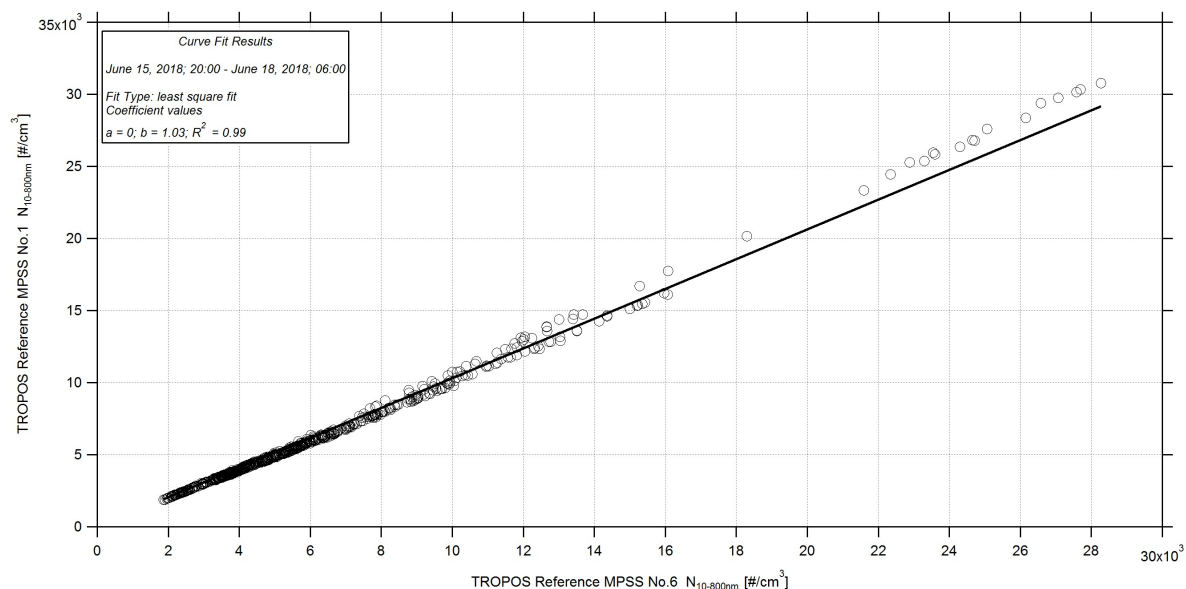

Figure 10: Linear regression between the number concentrations of the TROPOS Reference MPSS No.6 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Pre-Status of the Candidate: Particle Number Size Distribution
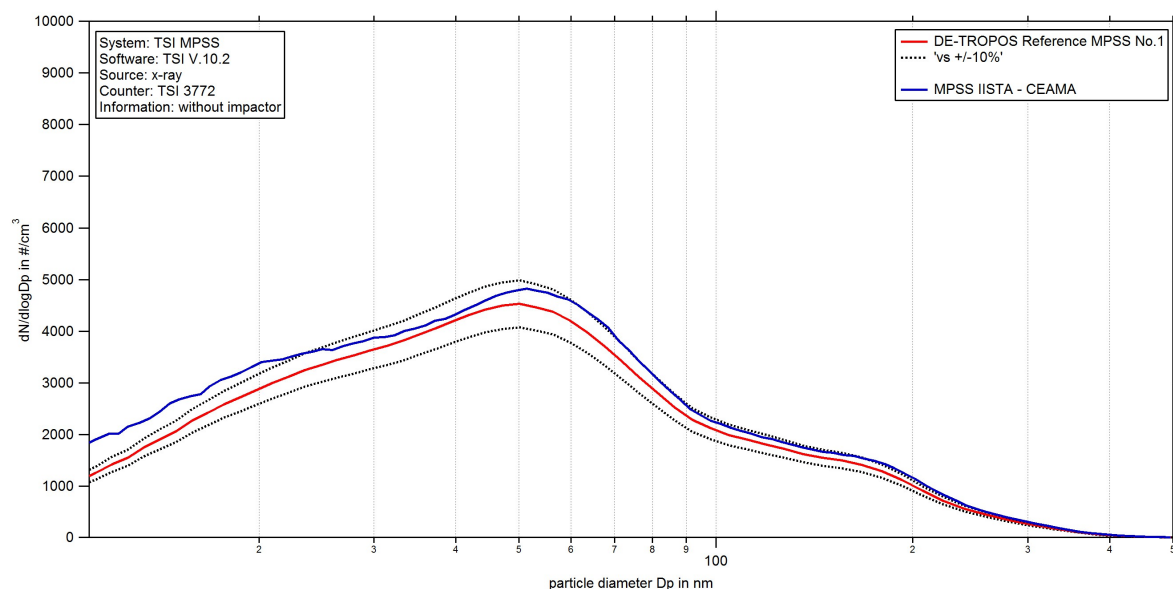
Figure 11: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against MPSS IISTA - CEAMA from June 18, 2018 20:00 – June 19, 2018 06:00. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

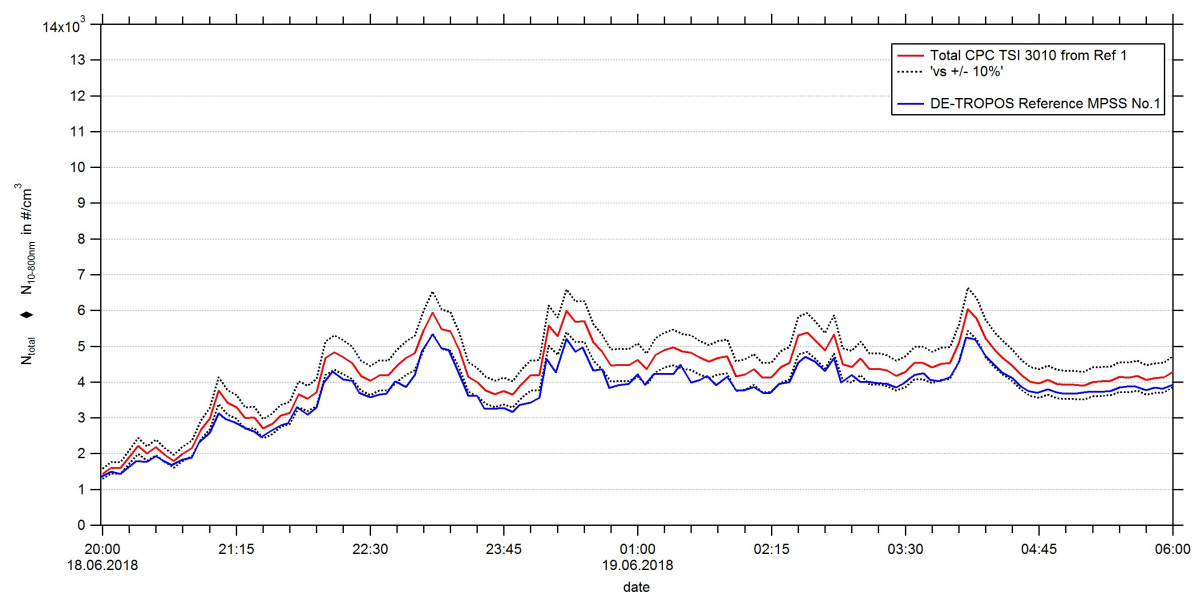## Pre-Status of the Candidate: Time Series and Correlation

Figure 12: Time series (June 18, 2018 20:00 – June 19, 2018 06:00) 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. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.
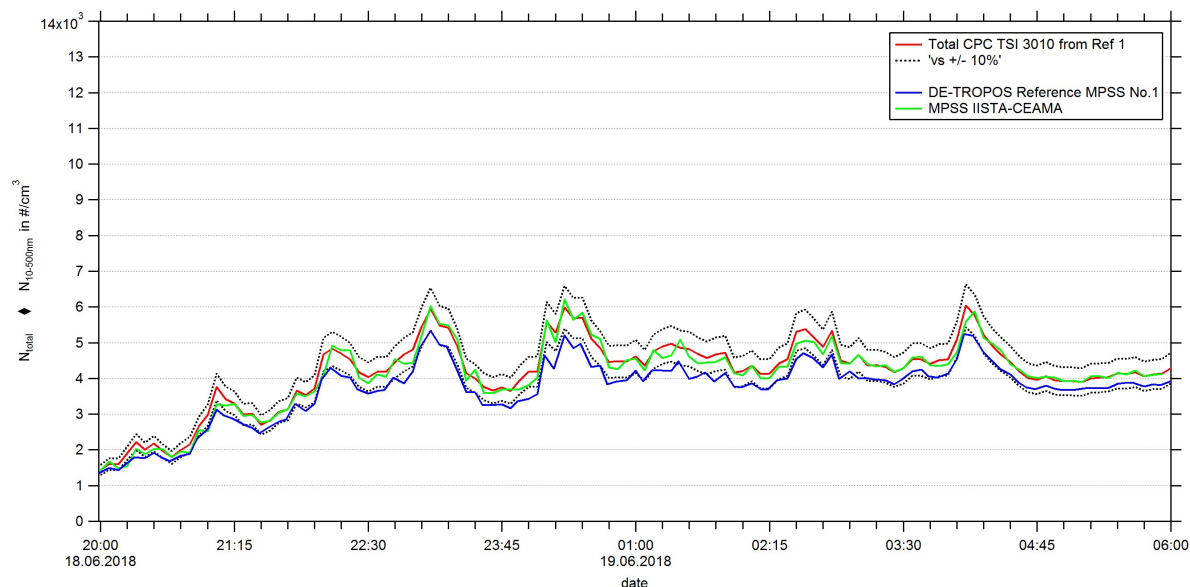
Figure 13: Time series (June 18, 2018 20:00 – June 19, 2018 06:00) of the integrated particle number concentration ($N_{10-500nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. The inversion and corrections for the candidate were performed using TSI software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.
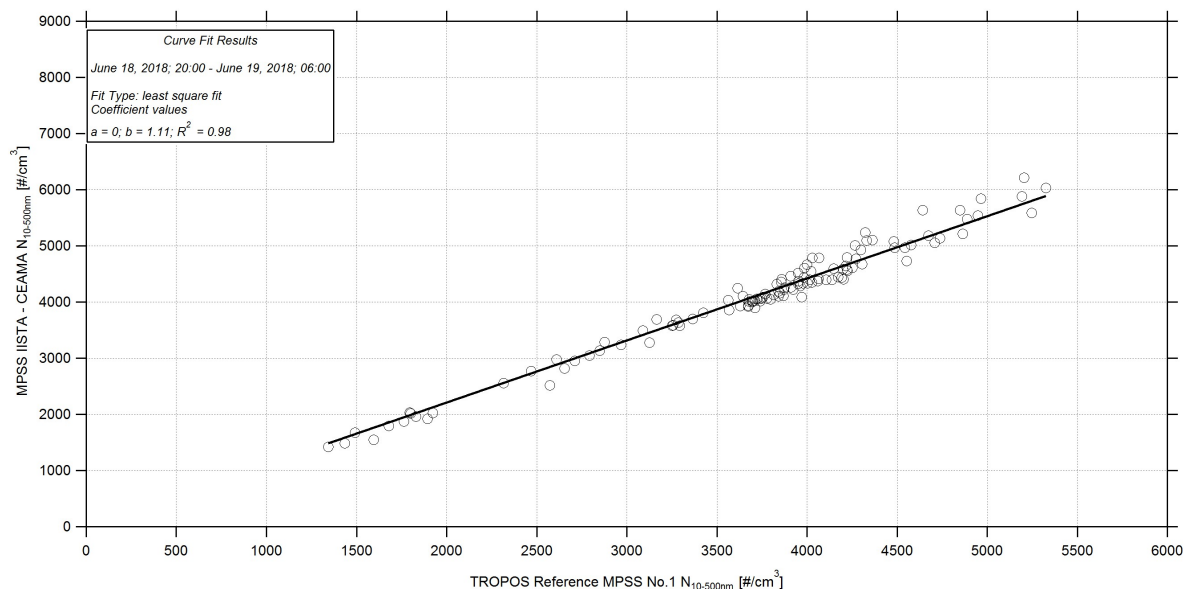

Figure 14: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and MPSS IISTA - CEAMA. The inversion and corrections for the candidate were performed using TSI software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

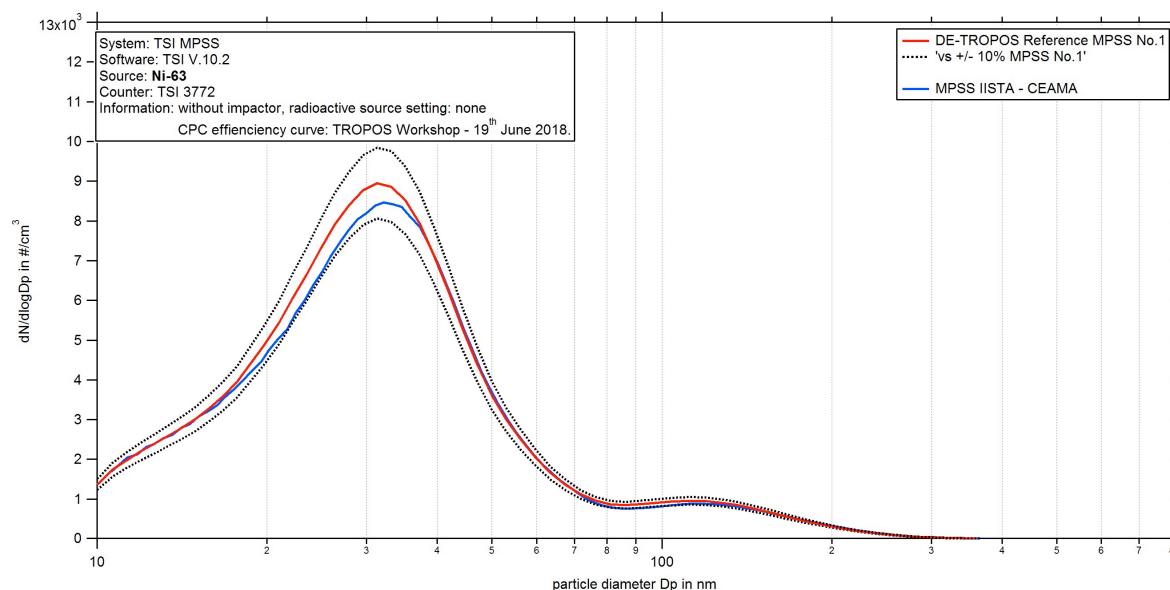## Final-Status of the Candidate: Particle Number Size Distribution

Figure 15: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against MPSS IISTA-CEAMA from June 21, 2018 20:00 – June 22, 2018 06:00. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

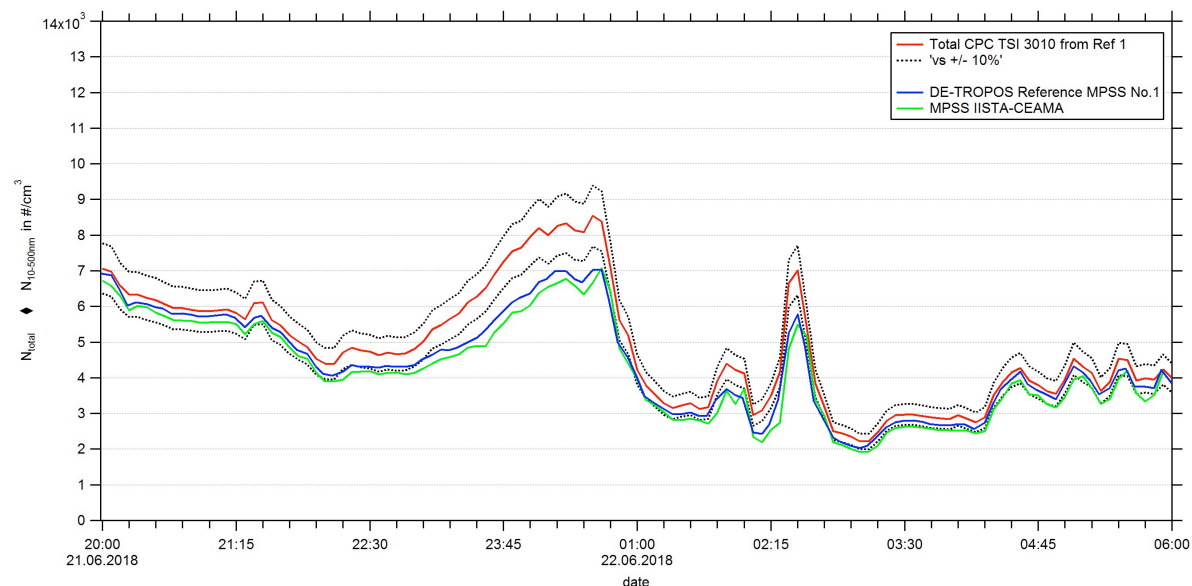## Final-Status of the Candidate: Time Series and Correlation

Figure 16: Time series (June 21, 2018 20:00 – June 22, 2018 06:00) of the integrated particle number concentration ($N_{10-500nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. The inversion and

correction for the candidate were performed using TSI software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.
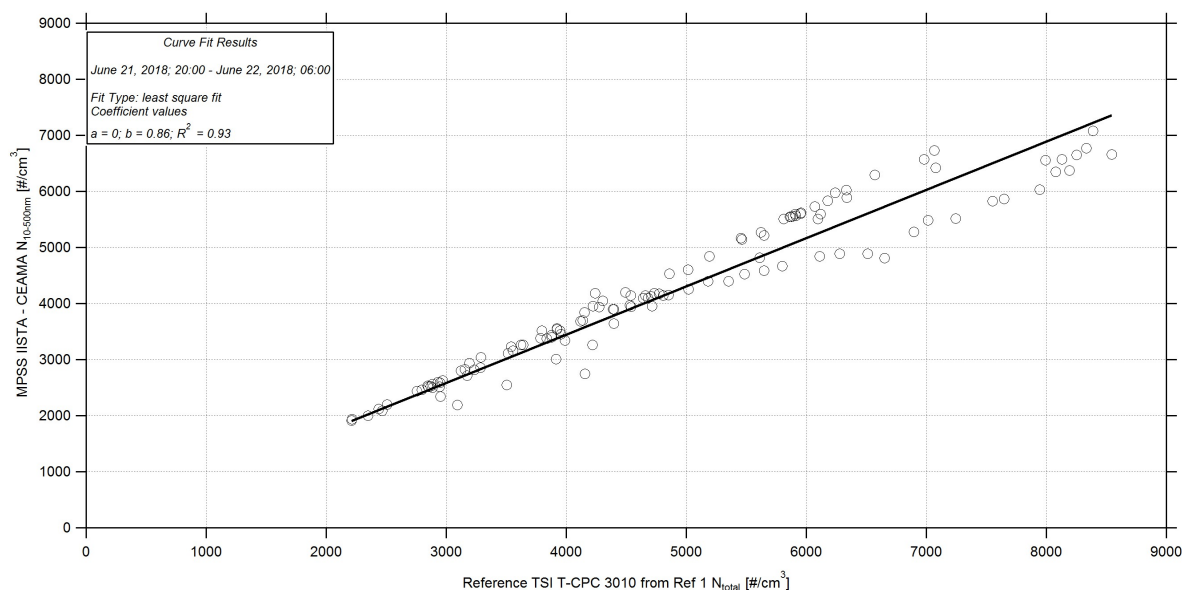

Figure 17: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 Ref 1 and MPSS IISTA-CEAMA (June 21, 2018 20:00 – June 22, 2018 06:00). All corrections are included.
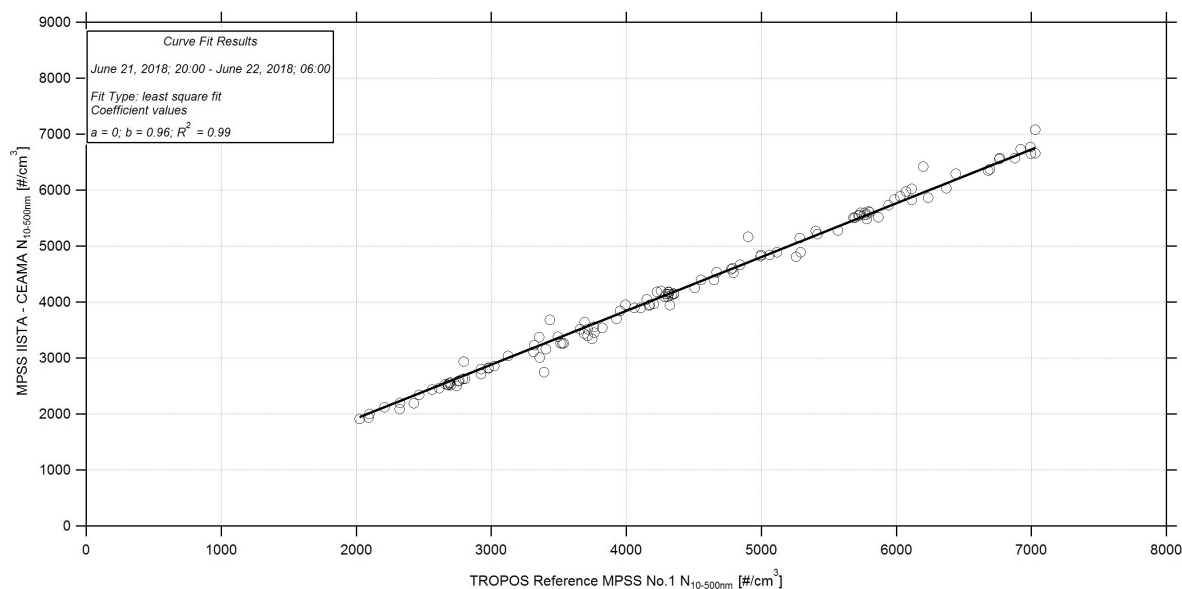

Figure 18: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and MPSS IISTA-CEAMA (June 21, 2018 20:00 – June 22, 2018 06:00). All corrections are included.

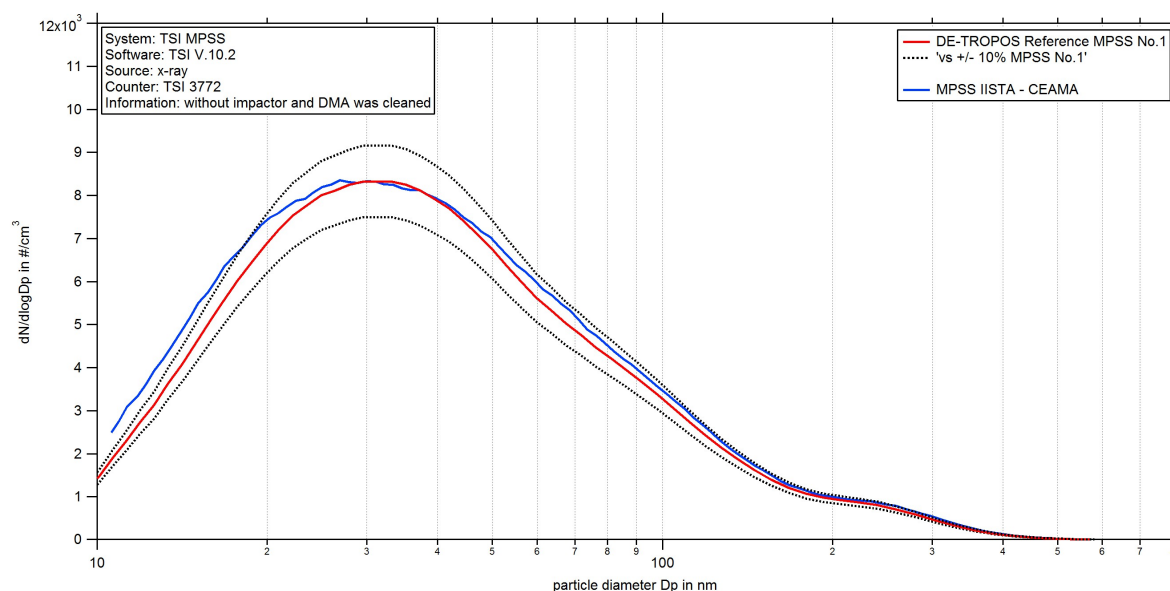## Additional information: Particle Number Size Distributions

Figure 19: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against MPSS IISTA-CEAMA from June 19, 2018 20:00 – June 20, 2018 06:00. Multiple charge correction, internal diffusion losses and CPC efficiency are included.
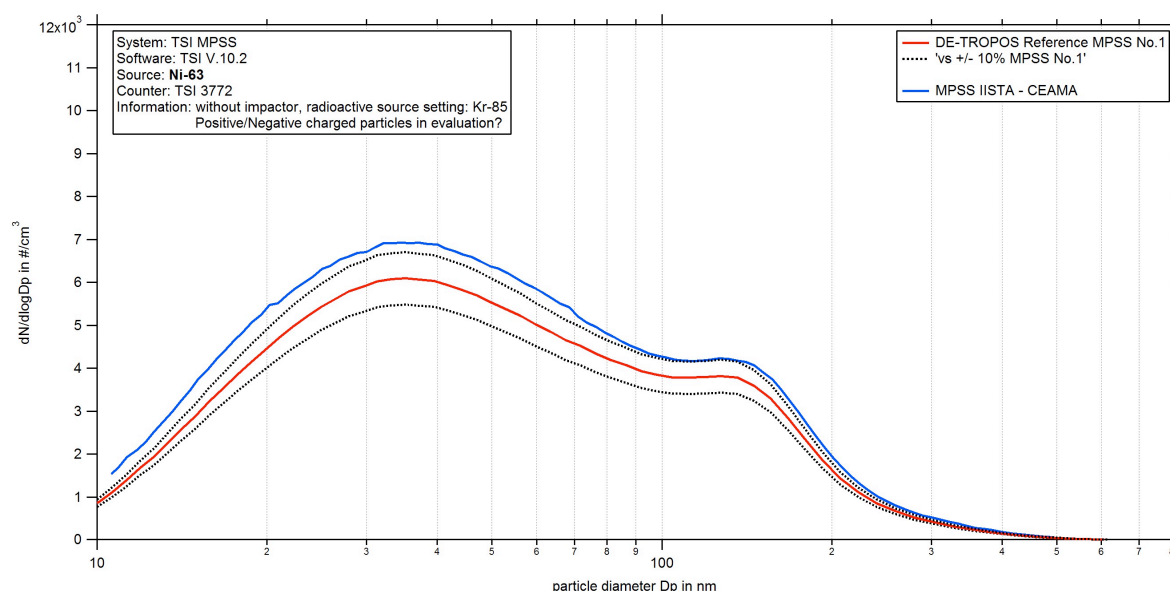

Figure 20: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against MPSS IISTA-CEAMA from June 20, 2018 20:00 – June 21, 2018 06:00. Multiple charge correction, internal diffusion losses and CPC efficiency are included.
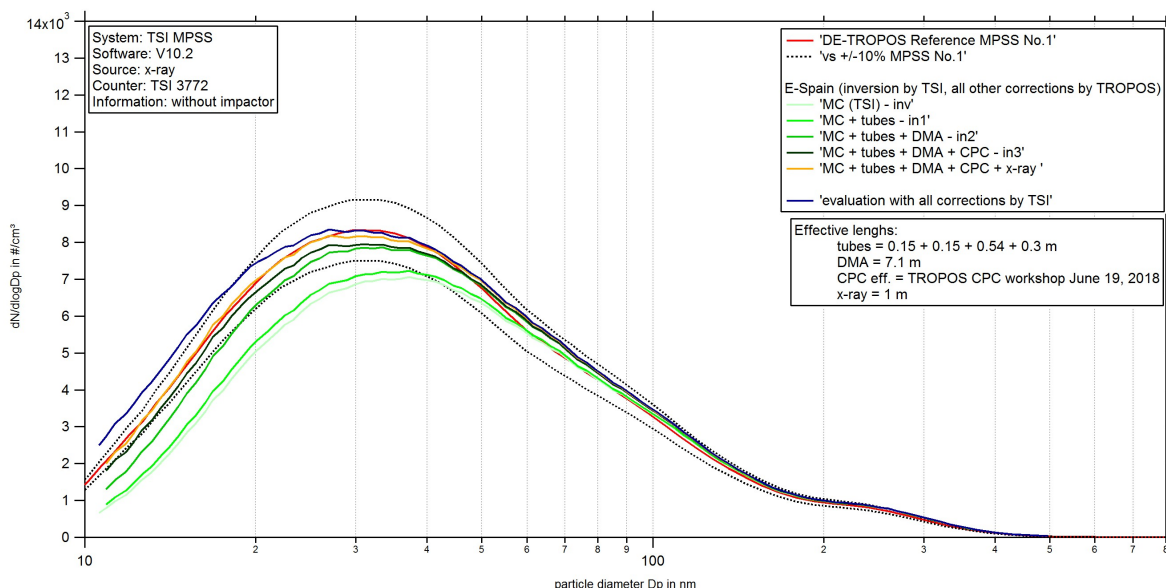
Figure 20: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against MPSS IISTA-CEAMA from June 18, 2018 20:00 – June 22, 2018 06:00. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Figure 21: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against MPSS IISTA-CEAMA from June 18, 2018 20:00 – June 22, 2018 06:00. Multiple charge correction, internal diffusion losses and CPC efficiency are included.
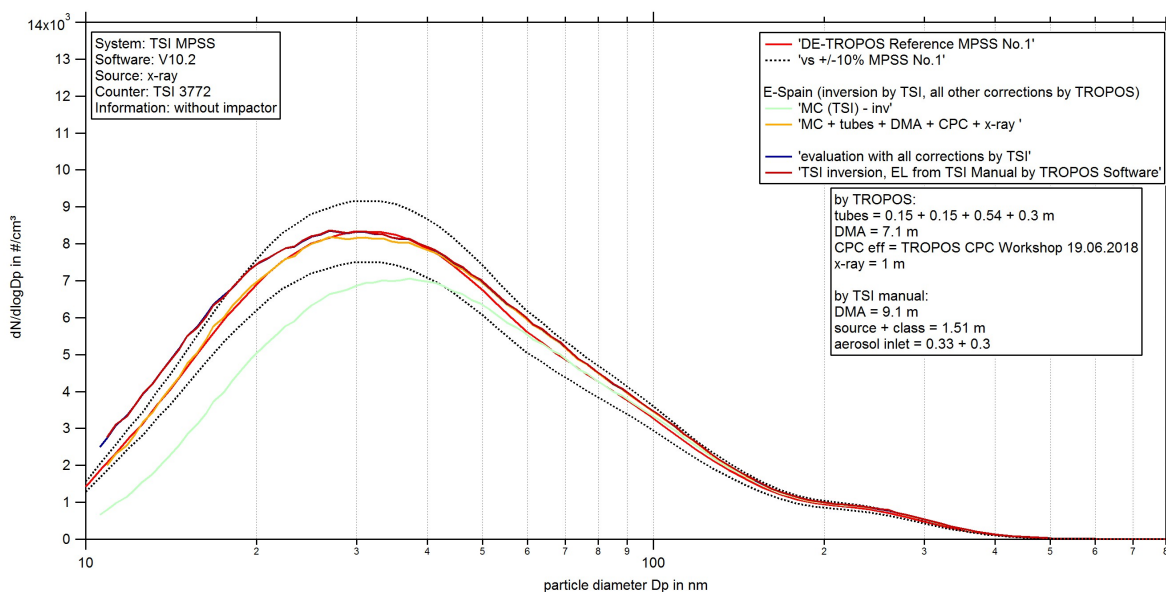
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