

Intercomparison of Mobility Particle Size Spectrometers

Project No.: *MPSS-2017-2-2*

Principal Investigator: David Picard

Home Institution: *CNRS-LaMP*

Participant: David Picard

Candidate: **FR-CNRS-LaMP**

Made by: home-made SMPS

Counter (SN): TSI CPC Model 3010, SN: 2257

Software: home-made

Location of the quality assurance: TROPOS Leipzig, lab 118

Comparison period: March 13, 2017 – March 17, 2017

Last Intercomparison (with Project No.):

Summary of Intercomparison:

Pre-Status:

The instrument arrived with participant. During the Pre-Status, the performance of the system showed a concentration 39% higher than the TROPOS Reference Instrument No.4. The PSL check showed a peak at 210 nm. There were several problems (hardware and software) encountered before we got the system running. Therefore, we got the first results on March 14. It was necessary to clean the whole instrument including the TSI-DMA. We changed

some o-rings and fittings to get the leak problem solved. The inversion was verified with the TROPOS inversion.

The candidate did not pass the quality standards of ACTRIS and GAW.

Final-Status:

During the Final-Status, the performance of the system showed a concentration 6% higher than the TROPOS Reference Instrument No.4. The candidate used the recalibrated TSI CPC model 3010 and a Kr85 source from TROPOS. The data evaluation was done by CNRS-LaMP and TROPOS inversion. TROPOS advises CNRS-LaMP to check there data logging and MPSS-software. The candidate changed regarding the ACTRIS workshop 2018 the data evaluation.

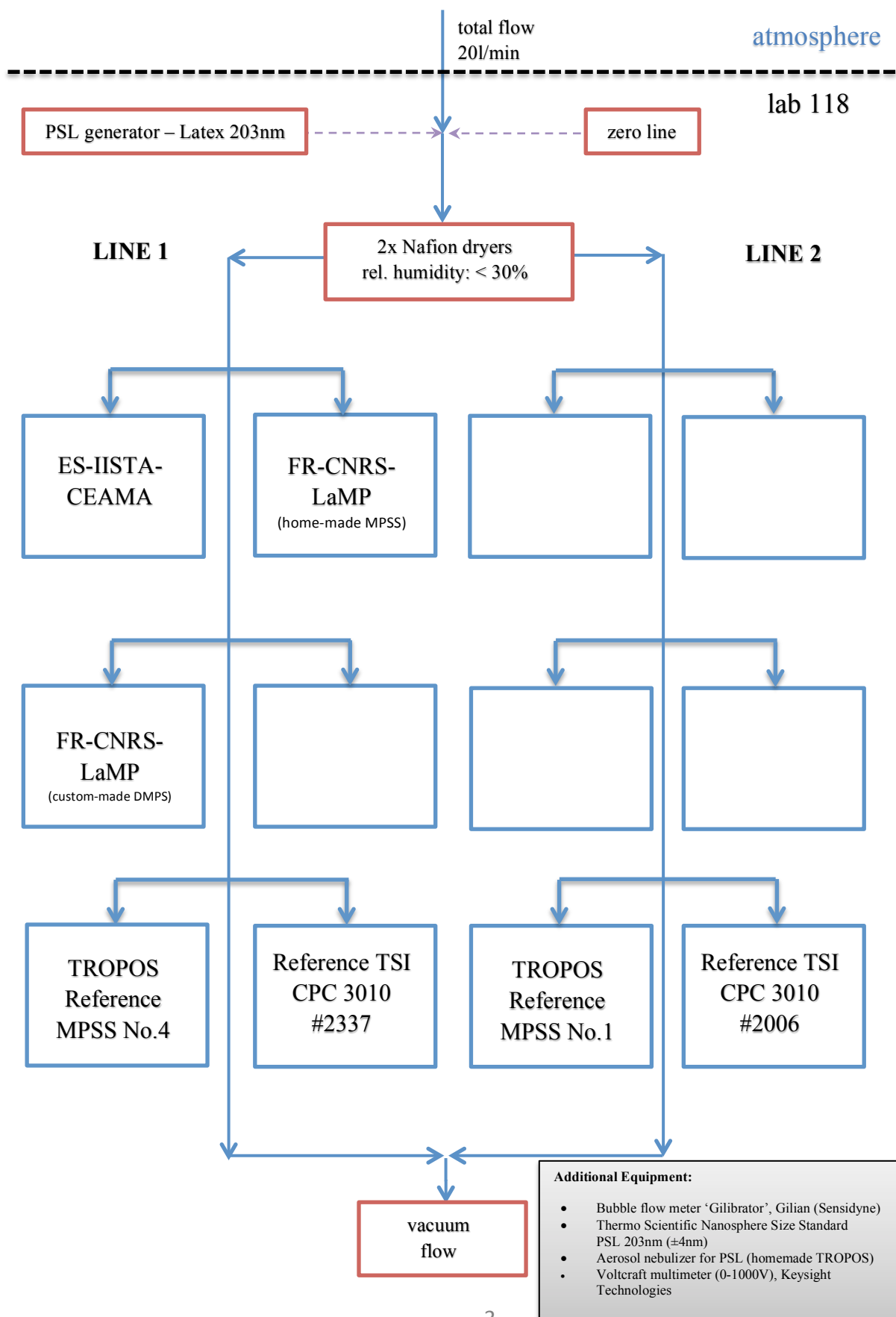
The candidate passed the quality standards of ACTRIS and GAW.

Information about the instruments:

Date of check: March 13, 2017

<i>List of Components</i>	TROPOS Reference MPSS No.1	TROPOS Reference MPSS No.4	Candidate
<i>Position</i>	Line 2	Line 1	Line 1
<i>Company</i>	TROPOS	TROPOS	Home made
<i>Software</i>	TROPOS	TROPOS	Home made
<i>CPC-MPSS</i>	TSI CPC, Model 3772	TSI CPC, Model 3772	TSI CPC, Model 3010
<i>CPC-total</i>	TSI CPC, Model 3010	TSI CPC, Model 3010	-
<i>flow ratio</i>	1.0 : 5.0	1.0 : 5.0	1.0 : 5.0
<i>source</i>	Kr85	Kr85	TROPOS Kr85
<i>HV power supply</i>	positive	positive	positive
<i>DMA</i>	Hauke medium	Hauke medium	TSI
<i>aerosol dryer</i>	✓	✓	
<i>aerosol RH- sensor</i>	✓	✓	
<i>aerosol T-sensor</i>	✓	✓	
<i>sheath RH-sensor</i>	✓	✓	
<i>sheath T-sensor</i>	✓	✓	
<i>Sheath dryer</i>	✓	✓	
<i>pressure sensor</i>	✓	✓	
<i>info</i>			

Laboratory setup:



Status of the instruments:

Date of check (Pre-Status): 13.03.2017

<i>CPC status</i>	MPSS		Total CPC	
<i>power/status</i>	LED green	-	-	-
<i>saturator temp</i>	-	°C	-	°C
<i>condenser temp</i>	-	°C	-	°C
<i>optics temp</i>	-	°C	-	°C
<i>cabinet temp</i>	-	°C	-	°C
<i>ambient pressure</i>	-	kPa	-	kPa
<i>orifice pressure</i>	-	kPa	-	kPa
<i>nozzle pressure</i>	-	kPa	-	kPa
<i>laser current</i>	-	mA	-	mA
<i>liquid level</i>	full	-	-	-

Date of check (Final-Status): 16.03.2017

<i>CPC status</i>	MPSS		Total CPC	
<i>power/status</i>	LED green	-	-	-
<i>saturator temp</i>	-	°C	-	°C
<i>condenser temp</i>	-	°C	-	°C
<i>optics temp</i>	-	°C	-	°C
<i>cabinet temp</i>	-	°C	-	°C
<i>ambient pressure</i>	-	kPa	-	kPa
<i>orifice pressure</i>	-	kPa	-	kPa
<i>nozzle pressure</i>	-	kPa	-	kPa
<i>laser current</i>	-	mA	-	mA
<i>liquid level</i>	full	-	-	-

Date of system checks:

<i>date</i>	13.03.2017	14.03.2017	15.03.2017	16.03.2017	unit
<i>total CPC flow</i>	-	-	-	-	l/min
<i>aerosol flow (DMA)</i>	-	-	-	-	l/min
<i>aerosol flow (UDMA)</i>	-	-	-	-	l/min
<i>aerosol flow (total)</i>	1044	-	1006	-	l/min
<i>Zero MPSS</i>	100	-	0	-	#/cm ³
<i>Zero total CPC</i>	-	-	-	-	#/cm ³
<i>PSL 203 nm</i>		-	210.66	-	nm
<i>HV – 0 V</i>	-	-	checked	-	V
<i>HV – 5 V</i>	-	-	checked	-	V
<i>HV – 100 V</i>	-	-	checked	-	V
<i>HV – 1000 V</i>	-	-	checked	-	V

Special Information regarding the Candidate:

<i>Was it necessary to:</i>	yes/no (date)	old part (ID/SN)	new part (ID/SN)	information
<i>clean the aerosol inlet</i>	yes			
<i>change aerosol Nafion dryer</i>	no			
<i>change sheath Nafion dryer</i>	no			
<i>check source</i>	yes			We used Kr85 from TROPOS.
<i>change HV power supply</i>	no			
<i>clean/change DMA</i>	yes			Cleaning was necessary
<i>change aerosol RH/T-sensor</i>	no			
<i>change sheath RH/T-sensor</i>	no			
<i>change pressure sensor</i>	no			

Instrument lengths: 1m radioactive source, 83 cm, 13 cm, 7.1 m DMA, 10 cm

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

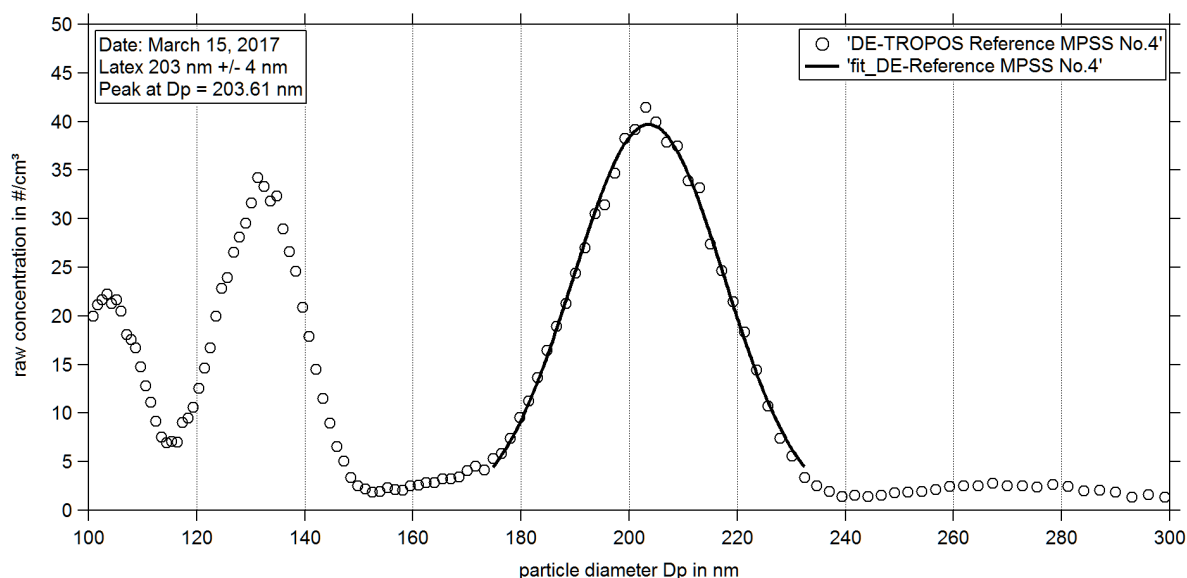


Figure 01: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on March 15th, 2017.

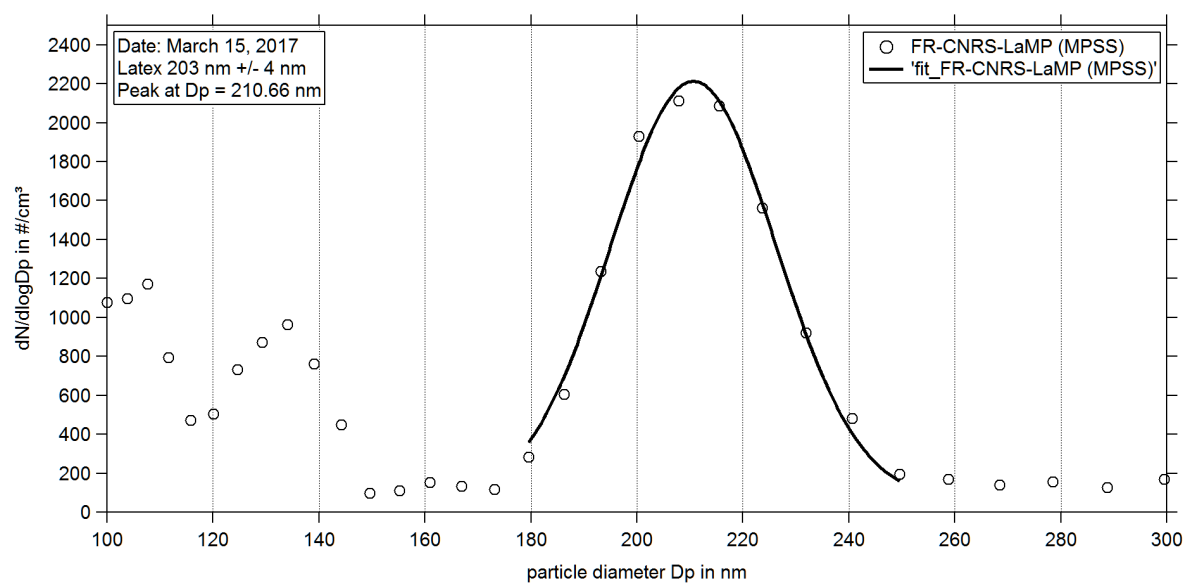


Figure 02: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on March 15th, 2017.

Status of the TROPOS Reference MPSS: Time Series

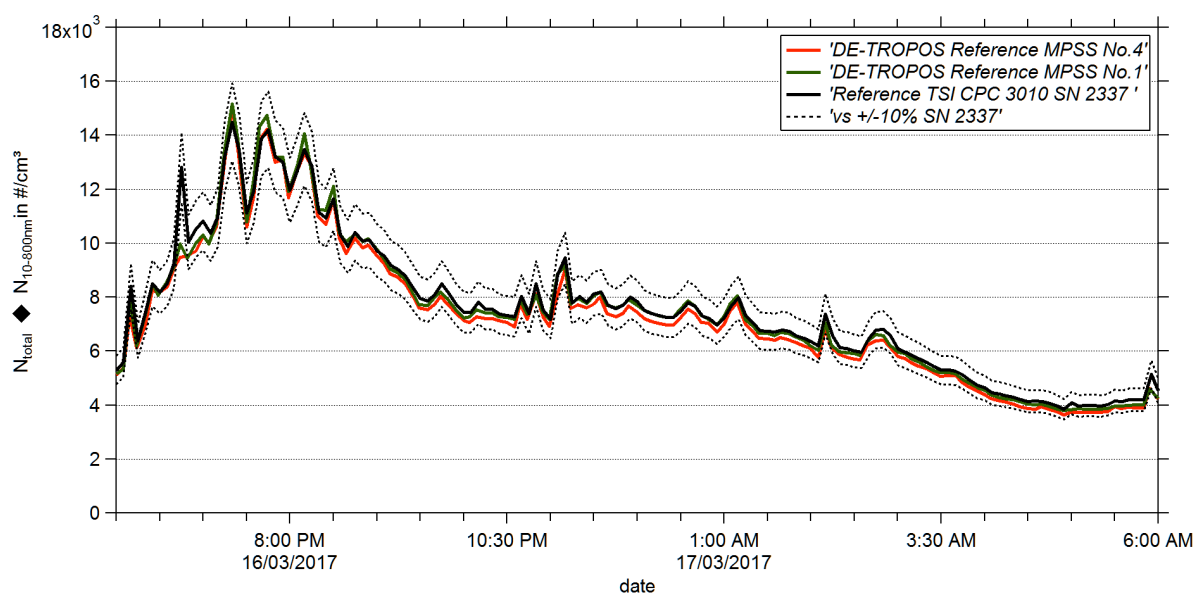


Figure 03: Time series (March 16, 2017 06:00 PM – March 17, 2017 06:00 AM) of the integrated particle number concentration ($N_{10-800nm}$) of the TROPOS Reference MPSS and total number concentration (N_{total}) of the Reference TSI CPC 3010. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Pre-Status of the Candidate: Particle Number Size Distribution

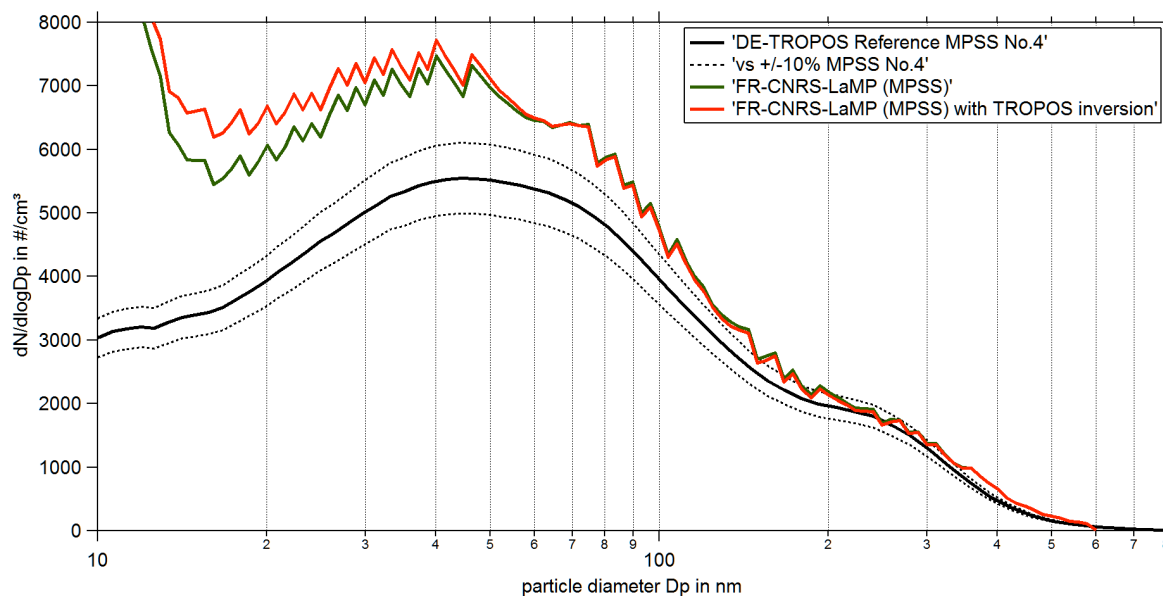


Figure 04: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.4 against FR-CNRS-LaMP from March 14, 2017 06:00 PM – March 15, 2017 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Pre-Status of the Candidate: Time Series

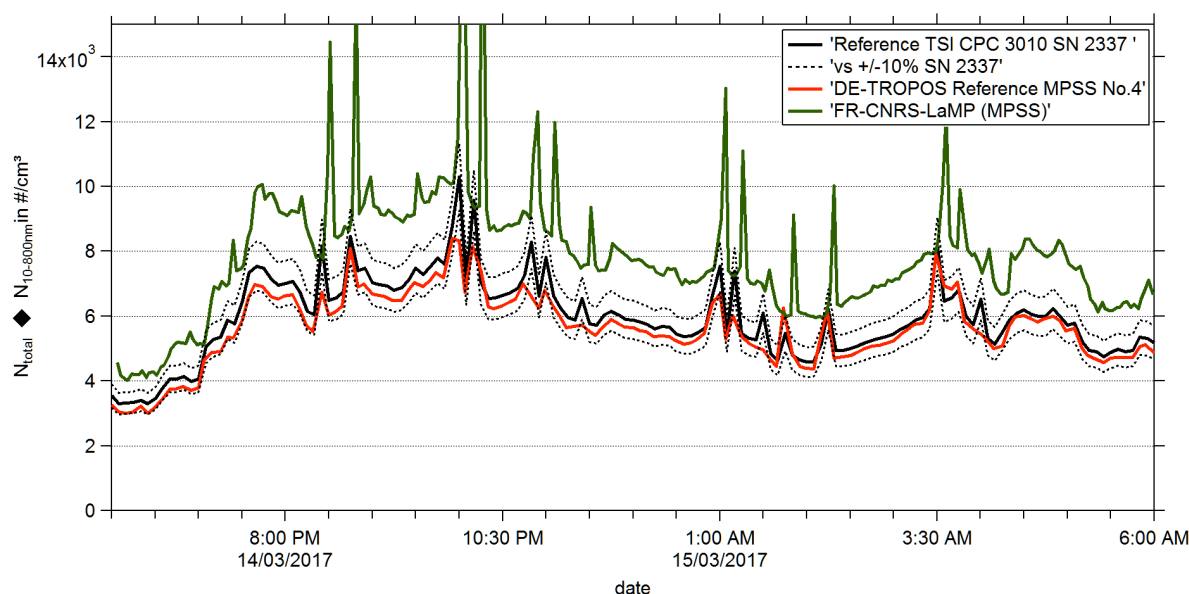


Figure 05: Time series (March 14, 2017 06:00 PM – March 15, 2017 06:00 AM) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. The inversion for the candidate was performed using TSI software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Pre-Status of the Candidate: Correlation

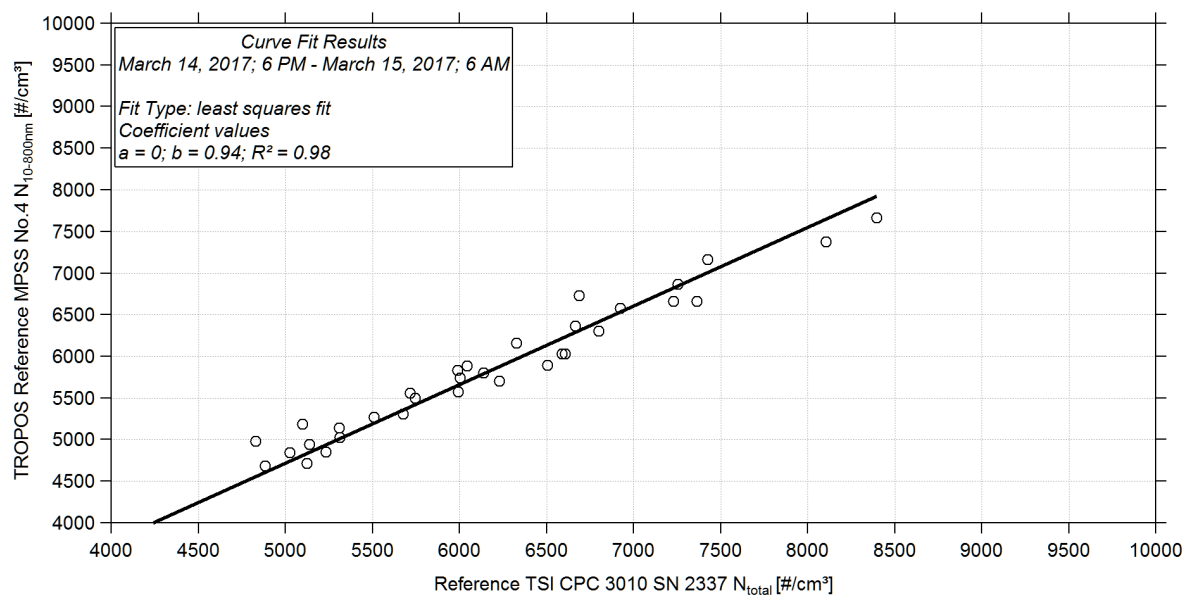


Figure 06: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and TROPOS Reference MPSS No.4. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

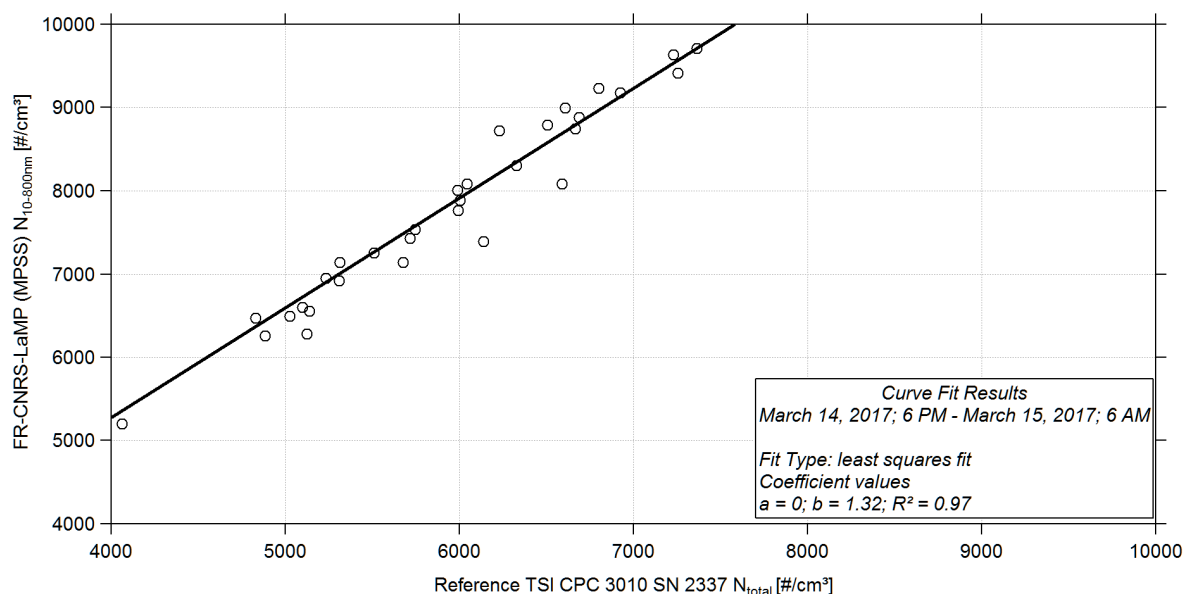


Figure 07: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and FR-CNRS-LaMP. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

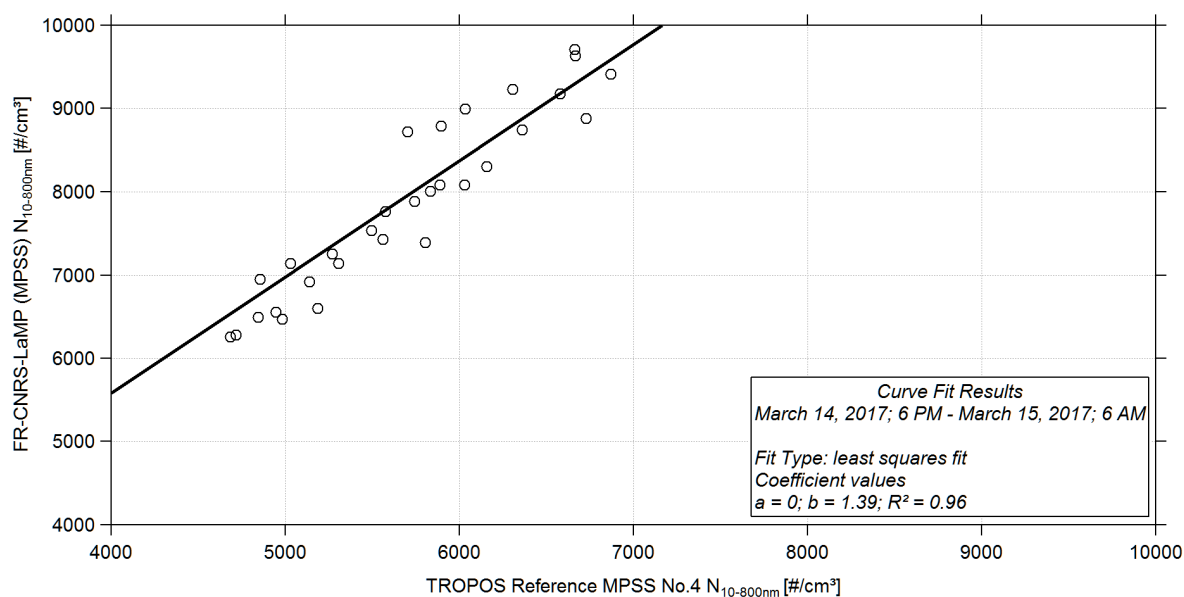


Figure 08: Linear regression between the number concentrations of the TROPOS Reference MPSS No.4 and FR-CNRS-LaMP. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Final-Status of the Candidate: Particle Number Size Distribution

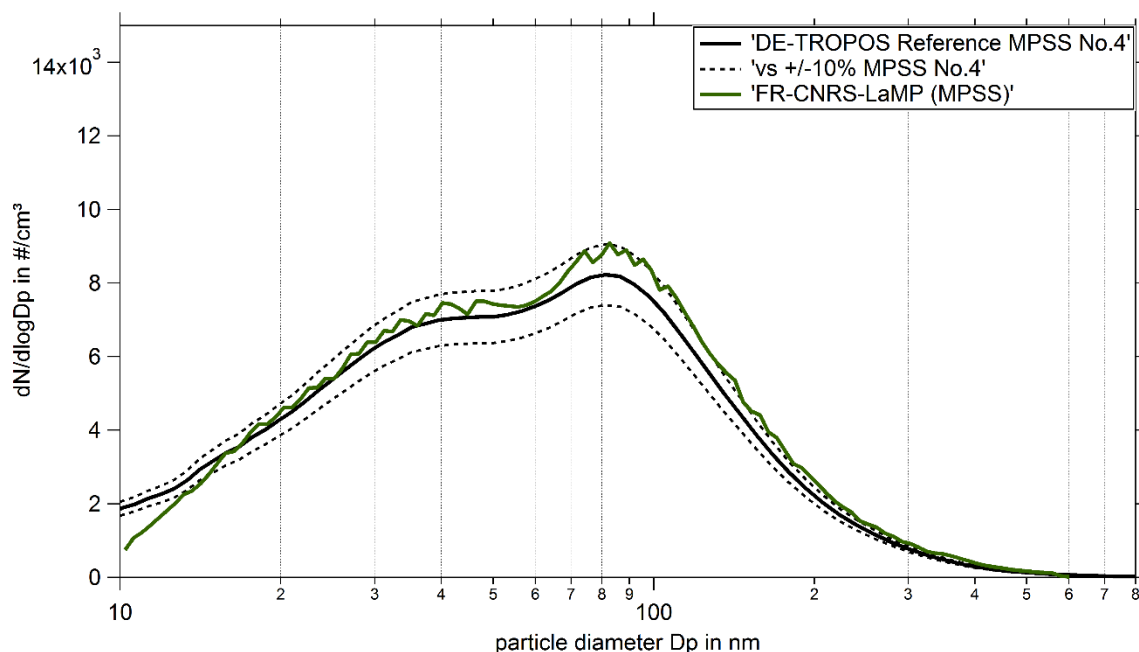


Figure 09: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.4 against FR-CNRS-LaMP from March 16, 2017 06:00 PM – March 17, 2017 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

Final-Status of the Candidate: Time Series

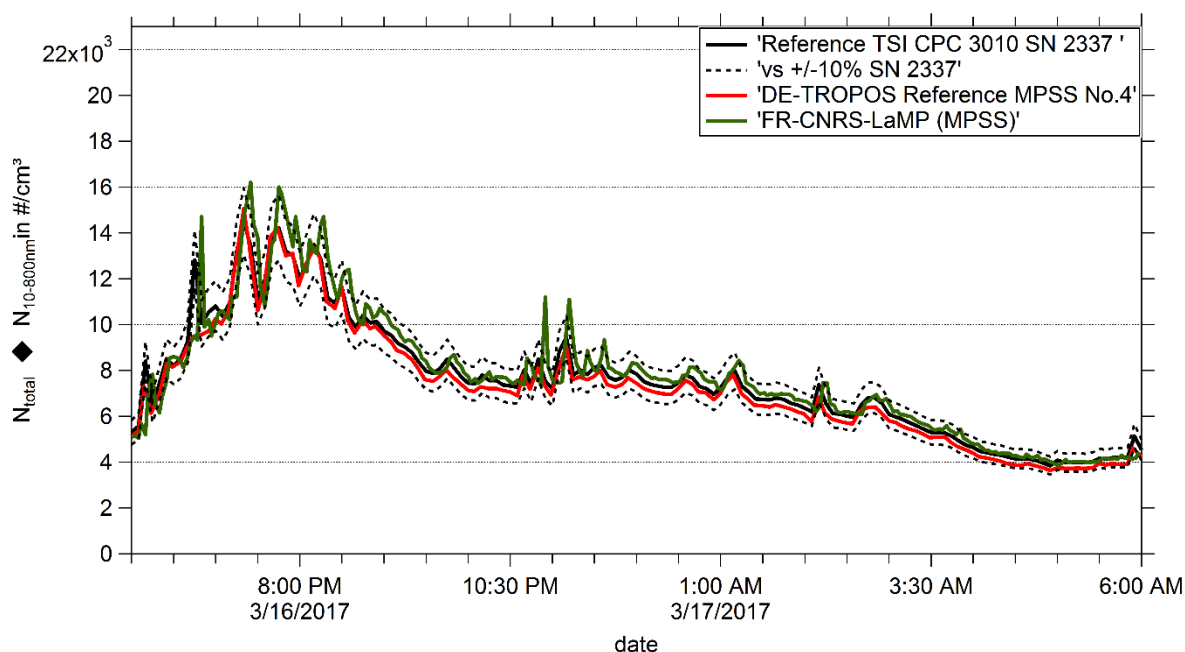


Figure 10: Time series (March 16, 2017 06:00 PM – March 17, 2017 06:00 AM) of the integrated particle number concentration ($N_{10-800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. The inversion for the candidate was performed using home made and TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Final-Status of the Candidate: Correlation

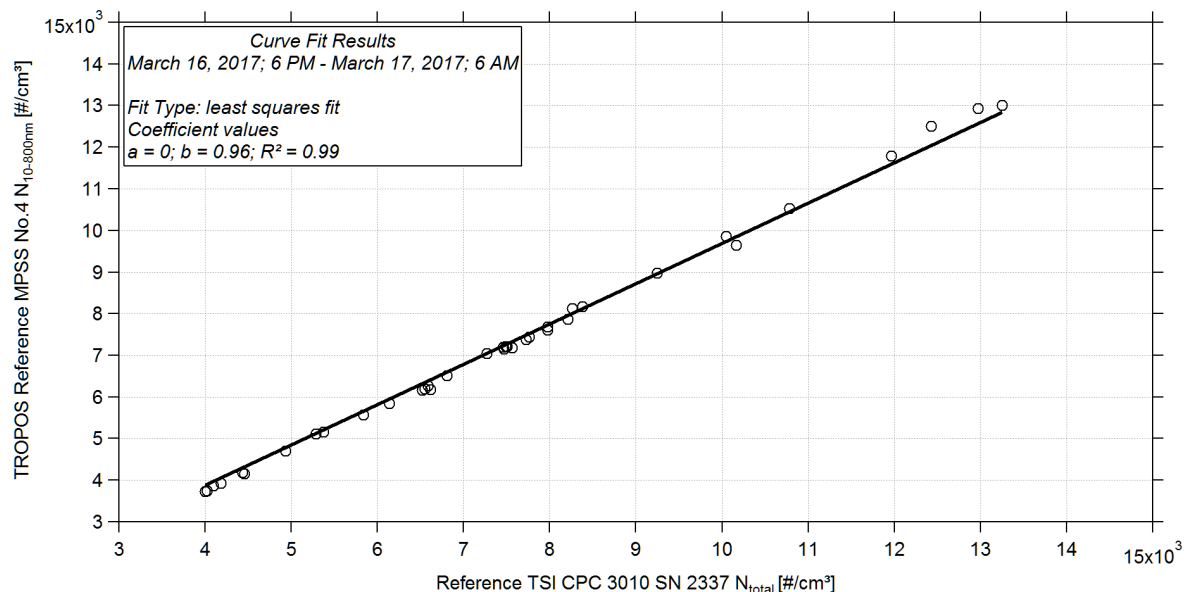


Figure 11: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and TROPOS Reference MPSS No.4. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

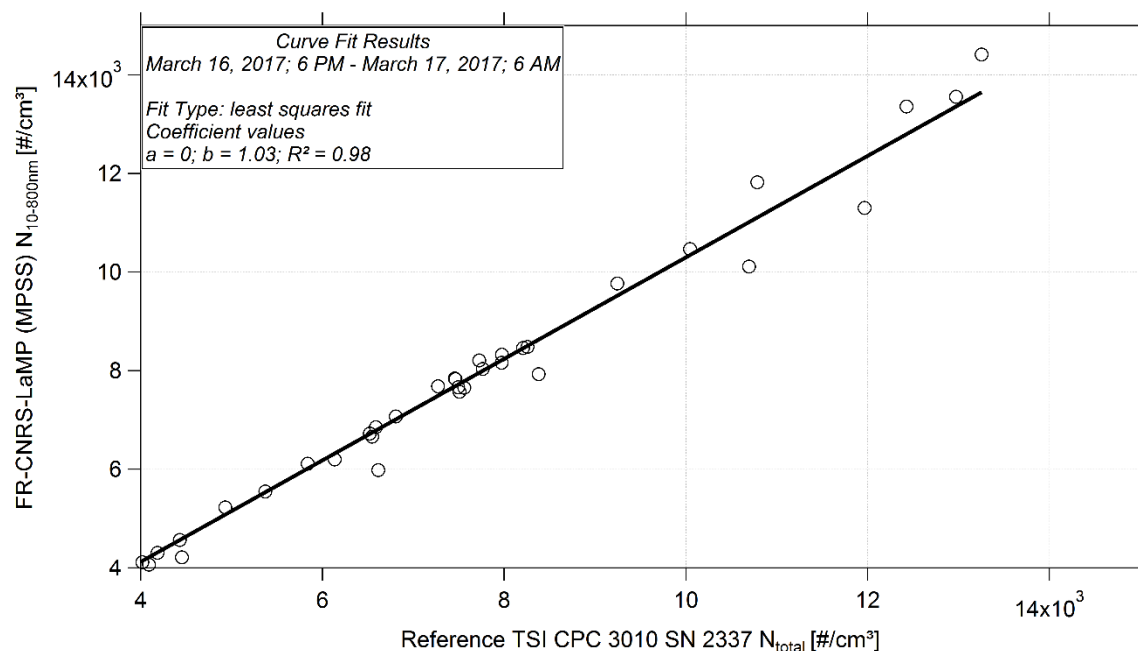


Figure 12: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and FR-CNRS-LaMP. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

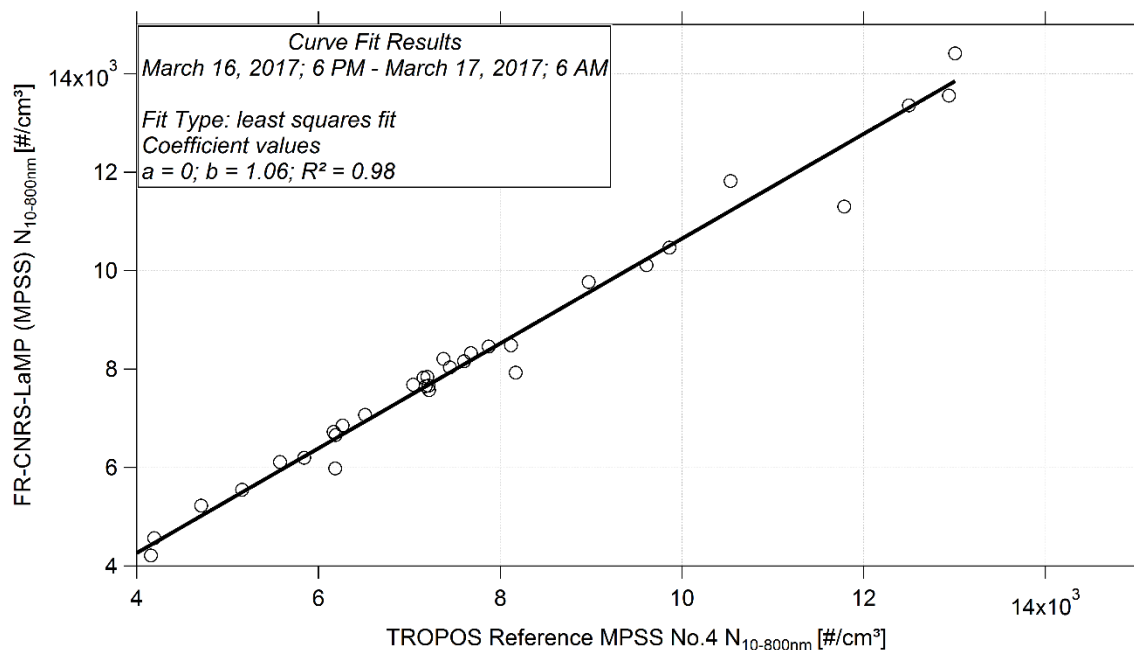


Figure 13: Linear regression between the number concentrations of the TROPOS Reference MPSS No.4 and FR-CNRS-LaMP. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.