Intercomparison of Mobility Particle Size Spectrometers

Project No.:	*MPSS-2017-2-5*
Principal Investigator:	Dr. Angela Marinoni
Home Institution:	*ISAC - CNR* *Via Gobetti 101* *40129 Bologna* *Italy*
Participant:	-
Candidate:	**I-CNR Bologna**
Made by:	**TROPOS**
Counter (SN):	TSI CPC Model 3772, SN: 70902011
Software:	TROPOS
Location of the quality assurance:	TROPOS Leipzig, lab 118
Comparison period:	June 23, 2017 – June 26, 2017
Last Intercomparison (with Project No.):	

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Summary of Intercomparison:

Status:
The ISAC-CNR station Bologna is now operating with a TROPOS MPSS with the newest ACTRIS standards. During the night runs from June 23 to June 26, the performance of the system showed a concentration 1% lower than the TROPOS Reference Instrument No.1. The PSL check showed a correct peak at 203.65 nm. The candidate used the calibrated TSI CPC model 3772 and a Ni63 source from TROPOS. The candidate passed the quality standards of ACTRIS and GAW.

Information about the instruments: TROPOS MPSS

Date of check: June 23, 2017

List of Components	TROPOS Reference MPSS No.1	TROPOS Reference MPSS No.	Candidate
Position	Line 1	-	Line 1
Company	TROPOS	-	TROPOS
Software	TROPOS	-	TROPOS V6.68
CPC-MPSS	TSI CPC, Model 3772	-	TSI CPC, Model 3772
CPC-total	TSI CPC, Model 3010	-	-
flow ratio	1.0 : 5.0	-	1.0 : 5.0
source	Kr85	-	Ni63
HV power supply	Positive	-	positive
DMA	Hauke medium	-	Hauke medium
aerosol dryer	✓	-	✓
aerosol RH- sensor	✓	-	✓
aerosol T-sensor	✓	-	✓
sheath RH-sensor	✓	-	✓
sheath T-sensor	✓	-	✓
Sheath dryer	✓	-	✓
pressure sensor	✓	-	✓
info			new system

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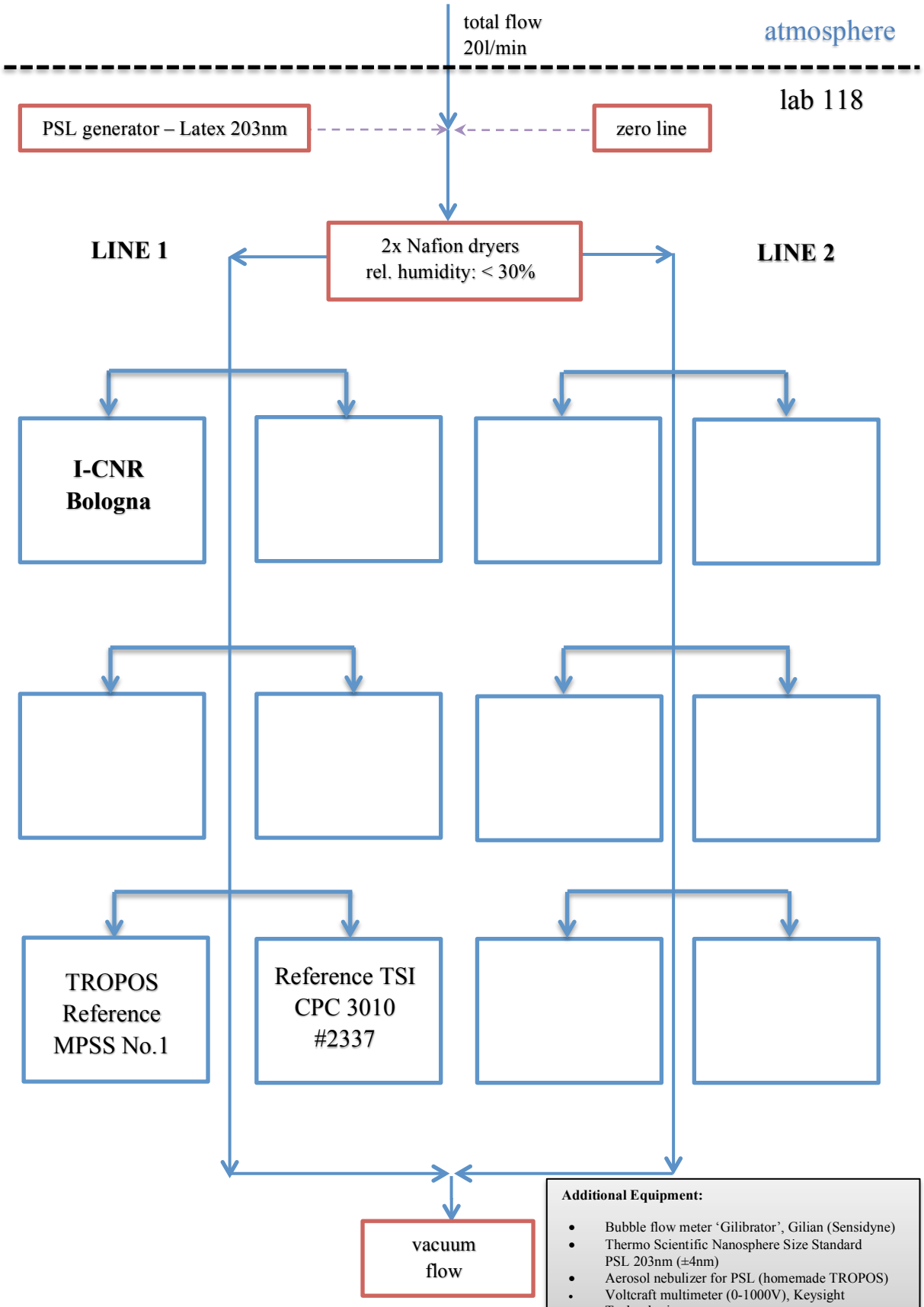
Laboratory setup:



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 check (Status): June 23, 2017

CPC status	MPSS		Total CPC	
power/status	LED green	-	-	-
saturator temp	39.0	°C	-	°C
condenser temp	22	°C	-	°C
optics temp	40.1	°C	-	°C
cabinet temp	28.8	°C	-	°C
ambient pressure	99.0	kPa	-	kPa
orifice pressure	72.6	kPa	-	kPa
nozzle pressure	2.8	kPa	-	kPa
laser current	42	mA	-	mA
liquid level	full	-	-	-

Date of system checks:

date	23.06.2017				unit
total CPC flow	-	-			l/min
aerosol flow (DMA)	-	-			l/min
aerosol flow (UDMA)	-	-			l/min
aerosol flow (total)	1.03	-			l/min
Zero MPSS	0	-			#/cm³
Zero total CPC	-	-			#/cm³
PSL 203 nm	203.65	-			nm
HV – 0 V	0.2	-			V
HV – 5 V	5.1	-			V
HV – 100 V	100.2	-			V
HV – 1000 V	1000.3	-			V

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Special Information regarding the Candidate: I-CNR Bologna is a new TROPOS MPSS

Was it necessary to:	yes/no (date)	old part (ID/SN)	new part (ID/SN)	information
clean the aerosol inlet	no	-	-	-
change aerosol Nafion dryer	no	-	-	-
change sheath Nafion dryer	no	-	-	-
check source	no	-	-	-
change HV power supply	no	-	-	-
clean/change DMA	no	-	-	-
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	no	-	-	-

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

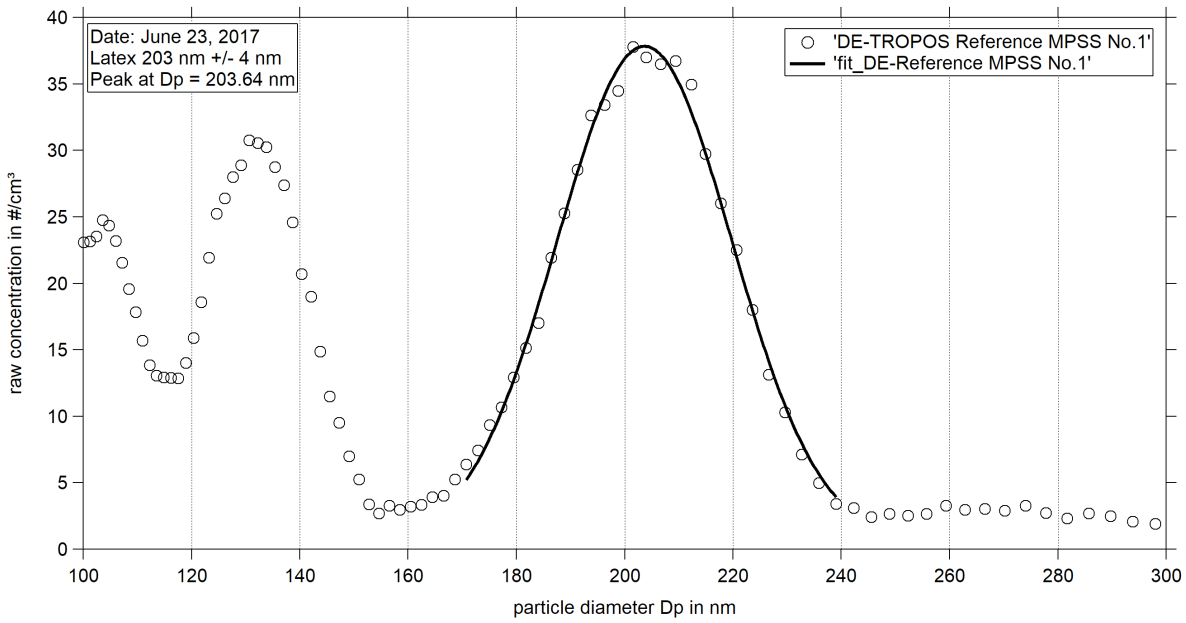

Figure 01: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on June 15rd, 2017.

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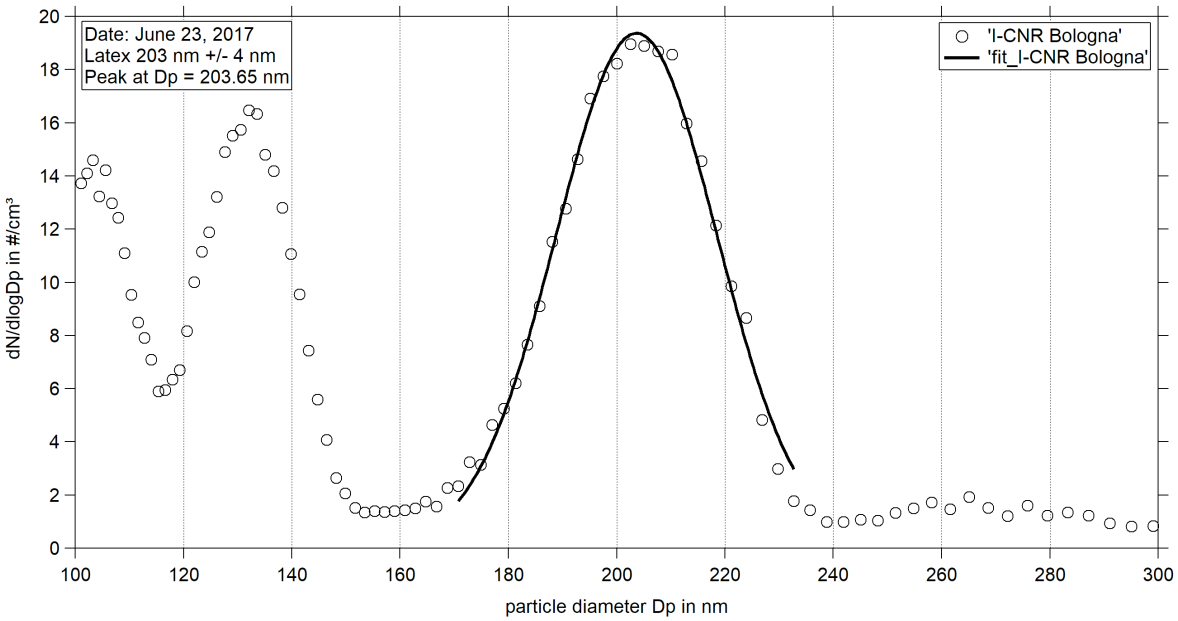

Figure 02: Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on June 15rd, 2017.

Status of the Candidate: Particle Number Size Distribution

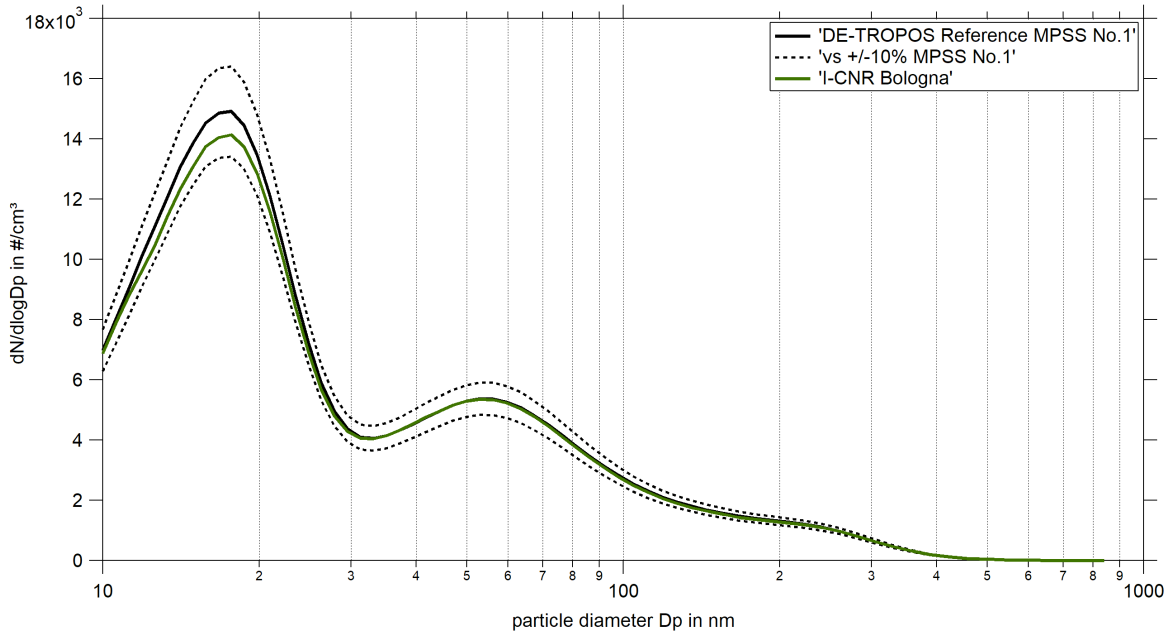

Figure 03: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against I-CNR Bologna from June 23, 2017 06:00 PM – June 26, 2017 06:00 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

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Status of the Candidate: Time Series

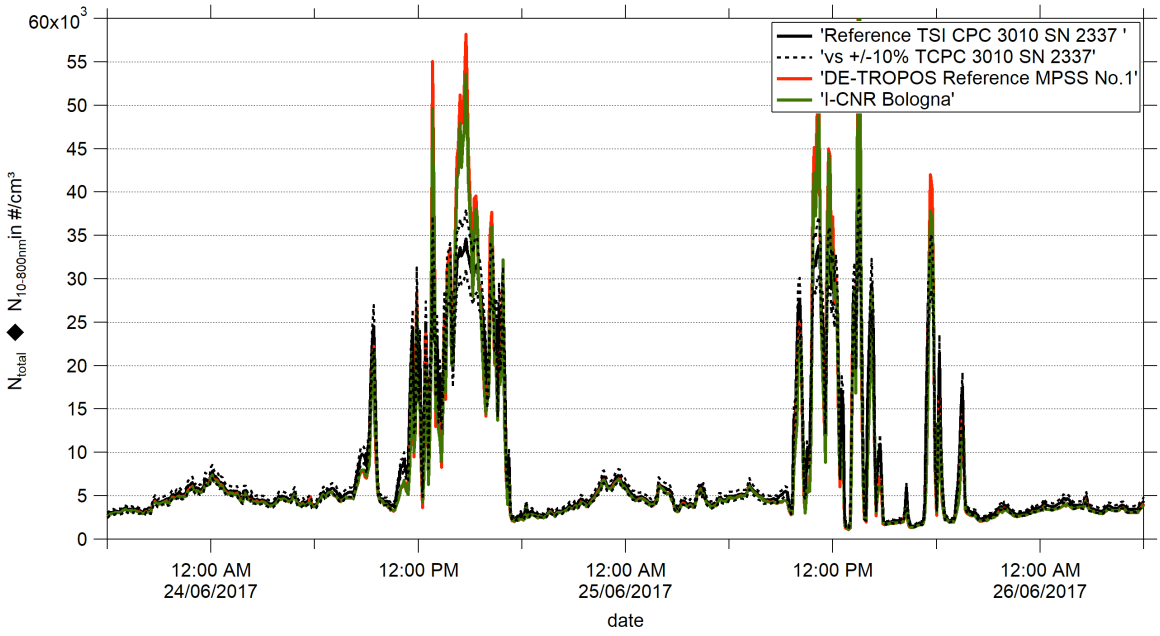

Figure 04: Time series (June 23, 2017 06:00 PM – June 26, 2017 06:00 AM) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3010. The inversion for the candidate was performed using TSI software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

Status of the Candidate: Correlation

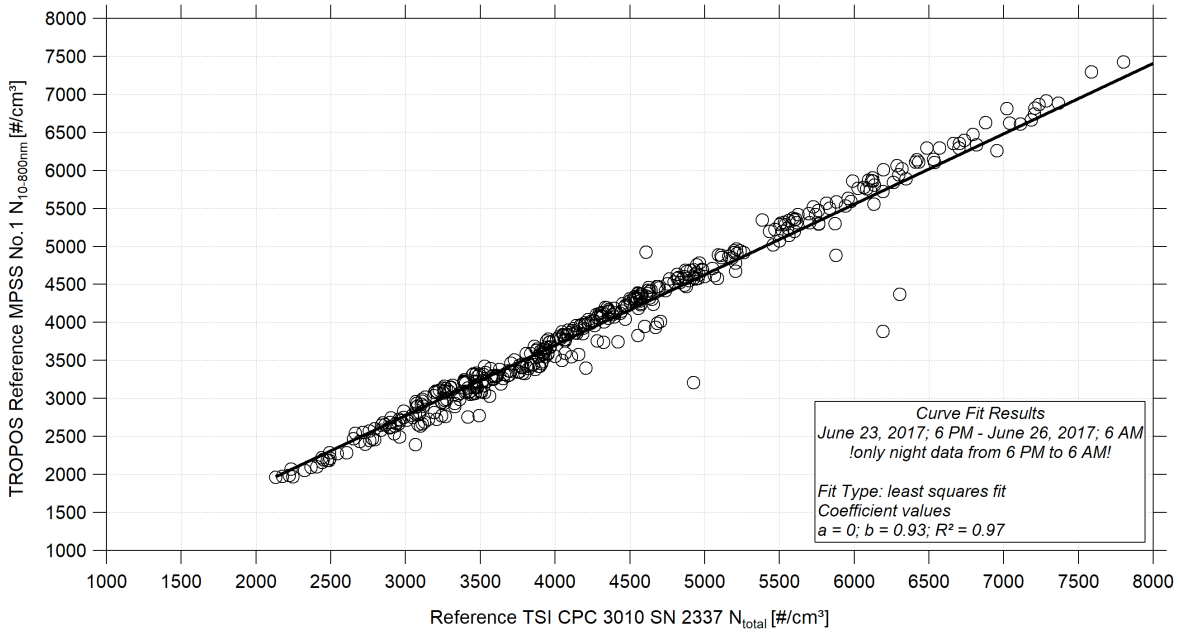

Figure 05: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and TROPOS Reference MPSS No.1 (Night data: June 23, 2017 06:00 PM – June 24, 2017 06:00 AM; June 24, 2017 06:00 PM – June 25, 2017 06:00 AM; June 25, 2017 06:00 PM – June 26, 2017 06:00 AM). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

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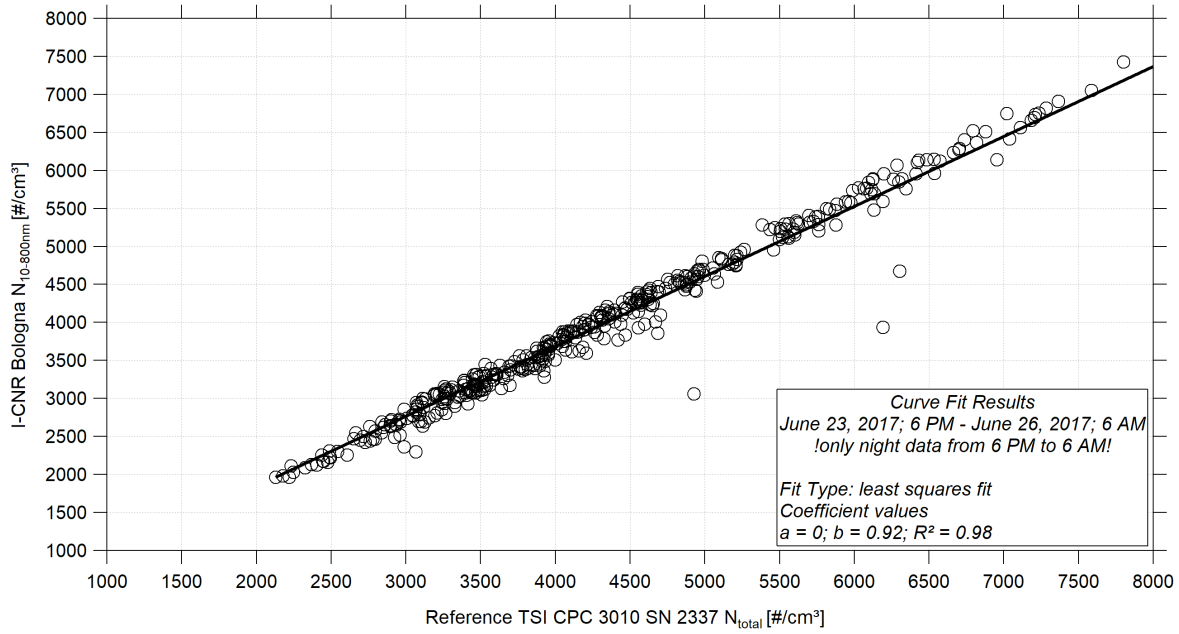

Figure 06: Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and I-CNR Bologna (Night data: June 23, 2017 06:00 PM – June 24, 2017 06:00 AM; June 24, 2017 06:00 PM – June 25, 2017 06:00 AM; June 25, 2017 06:00 PM – June 26, 2017 06:00 AM). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

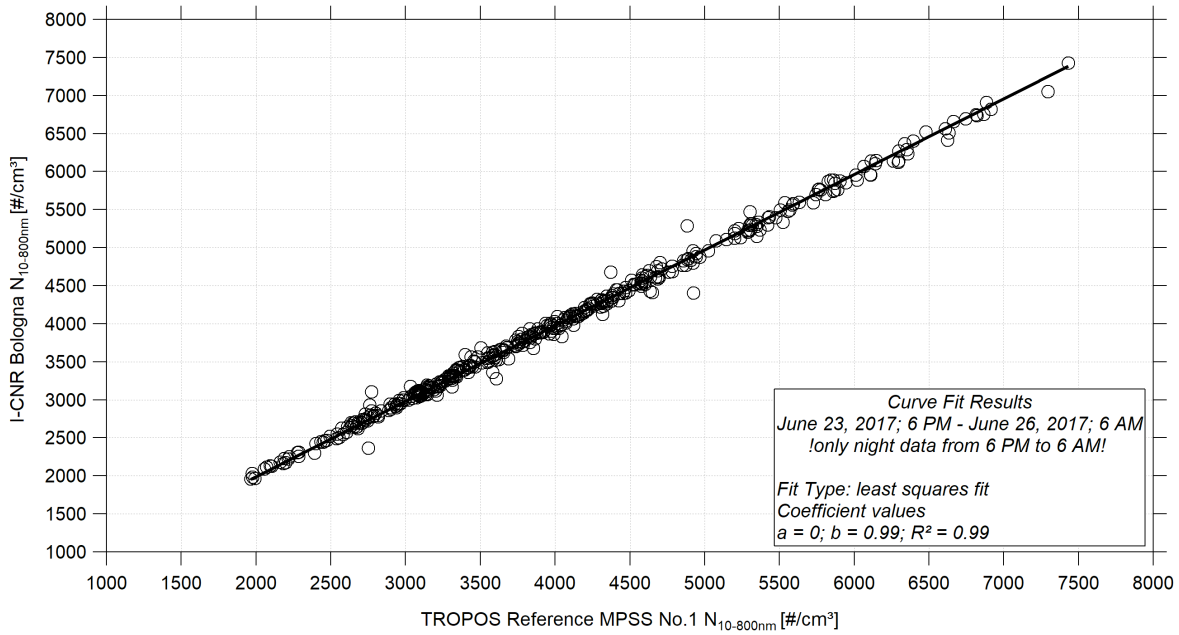

Figure 07: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and I-CNR Bologna (Night data: June 23, 2017 06:00 PM – June 24, 2017 06:00 AM; June 24, 2017 06:00 PM – June 25, 2017 06:00 AM; June 25, 2017 06:00 PM – June 26, 2017 06:00 AM). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

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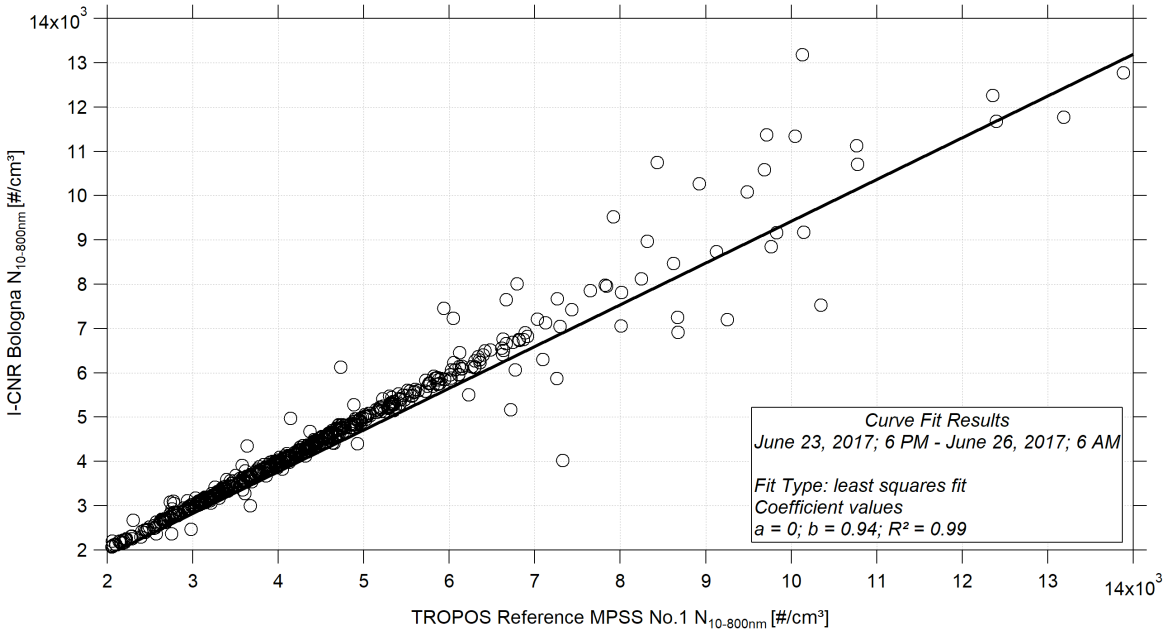

Figure 08: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and I-CNR Bologna (June 23, 2017 06:00 PM – June 26, 2017 06:00 AM). Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

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