

1st ACTRIS intercomparison workshop for mobility particle size spectrometers and condensation particle counters

The intercomparison workshop for mobility particle size spectrometers was conducted from Sept. 16 to Oct. 4, 2013.

In the following, the participating ACTRIS partner and associate partner institutes as well as the individual participants are listed. Separate reports for each instrument are given as well. ACTRIS partners and associate partner who did not participate with their instrument in the workshop in 2013 are invited for a second workshop from May 12 to 16, 2014. Additionally, those instruments, which did not perform well, should participate again in the second intercomparison workshop after an improvement.

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Participant list

ACTRIS intercomparison workshop: Condensation Particle Counters and Mobility Particle Size Spectrometers		
Participant list ACTRIS WP3 workshop		
Sept. 16 - Oct 04, 2013, TROPOS, Leipzig		
First name	Family Name	Institution
Pasi	Aalto	University Helsinki (UHEL)
Todar	Arsov	BEO Moussala, Basic Environmental Observatory (INRNE)
Laureline	Bourcier	Institute of Atmospheric Sciences and Climate (ISAC) of the Italian National Research Council (CNR)
Björn	Briel	UBA, GAW Station Schneefernerhaus, Garmisch-Partenkirchen
Vicent	Crenn	Laboratoire des sciences du climat et de l'environnement (LSCE)
Markus	Fiebig	Norwegian Institute for Air Research (NILU)
Francisco Javier	Gomez	Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT)
Frank	Göran	Lund University (ULUND)
Angela	Marinoni	Institute of Atmospheric Sciences and Climate (ISAC) of the Italian National Research Council (CNR)
Sebastiao	Martins dos Santos	Joint Research Centre (JRC)
Modris	Matisans	Stockholm University (SU- ITM)
Dietrich	Muck	Institut scientifique de service public (ISSeP)
Noemi	Perez	Institute of Environmental Assessment and Water Research
David	Picard	Observatoire de Physique du Globe de Clermont-Ferrand (OPGC)-Laboratoire de Météorologie Physique (LaMP)
Ludwig	Ries	UBA, GAW Station Schneefernerhaus, Garmisch-Partenkirchen
Ralf	Sohmer	UBA, GAW Station Schneefernerhaus, Garmisch-Partenkirchen

Mar	Sorribas	Instituto Nacional de Técnica Aeroespacial - INTA
Iosonas	Starroulas	Environmental Chemical Processes Laboratory, University of Crete (ECPL)
Nadezda	Zikova	Institute of Chemical Process Fundamentals (ICPF)
Alfred	Wiedensohler	Leibniz Institute for Tropospheric Research (TROPOS)
Kay	Weinhold	Leibniz Institute for Tropospheric Research (TROPOS)
Thomas	Tuch	Leibniz Institute for Tropospheric Research (TROPOS)
Anja	Schmidt	Leibniz Institute for Tropospheric Research (TROPOS)
Wolfram	Birmili	Leibniz Institute for Tropospheric Research (TROPOS)
Maik	Merkel	Leibniz Institute for Tropospheric Research (TROPOS)
Zhibin	Wang	Leibniz Institute for Tropospheric Research (TROPOS)
Simonas	Kecorius	Leibniz Institute for Tropospheric Research (TROPOS)

Overview of individual reports:

<p>first week</p>	<p>Birkenes Nilu DMPS Finokalia SMPS TROPOS Hohenpeissenberg TROPOS SMPS ISSeP TROPOS SMPS Kositice TROPOS SMPS Montseny TROPOS SMPS Moussala TROPOS SMPS Prag TSI SMPS TROPOS</p>
<p>second week</p>	<p>CIEMAT UPC Madrid TSI INTA TSI SMPS SU reference DMPS TNO TSI SMPS TROPOS Zugspitze TSI SMPS TROPOS</p>
<p>third week</p>	<p>ISPRA JRC SMPS K-Putsta UHEL DMPS Monte Cimone CNR DMPS Puy de Dome CNRS SMPS Sirta GRIMM SMPS Vavihill ULUND DMPS</p>

First Week:

Intercomparison of Birkenes NILU DMPS

Basic information

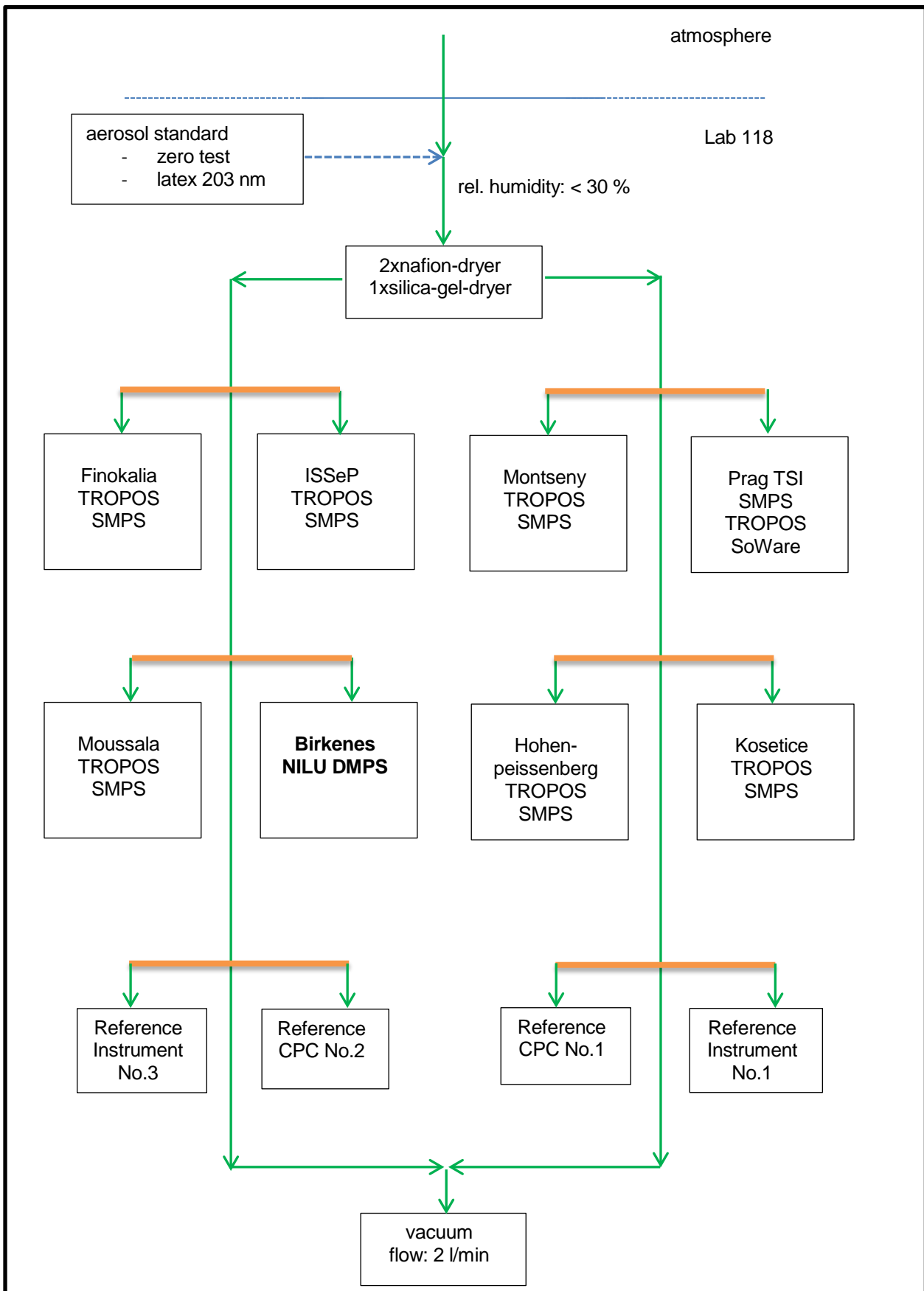
Location of the quality assurance:	TROPOS, lab: 118
Delivery date:	Sep. 16, 2013
Setup in the laboratory:	Sep. 16, 2013
Comparison period:	Sep. 16, 2013 – Sep. 20, 2013
Instrument:	Birkenes NILU DMPS
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	Markus Fiebig (fiebig@nilu.no)

Summary:

From Sep. 16, 2013 to Sep. 20, 2013, the Birkenes NILU DMPS participated successfully the TROPOS ACTRIS Workshop. The workshop consisted of an entrance test and a final run. In addition to the overnight ambient measurements, we had numerous high voltage checks, zero- and PSL- measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that, we show for each run the time series of the particle number concentration, the particle number size distribution, and correlation plots. If anything was written in the log book, so we added this also in this report. As reference standards, we used CPCs model TSI 3772 for total particle number concentration and two TROPOS mobility particle size spectrometer. The particle counters have been calibrated against a calibrated TSI electrometer 3068 B with the serial number 70838596.

For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. The Birkenes NILU DMPS showed in the PSL-measurements a particle diameter of 202.0 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. If we look at the final ambient measurement run, the Birkenes NILU DMPS is within the uncertainty range of +/- 10 %. The Birkenes NILU DMPS passed the ACTRIS Workshop. There is no re-examination required.

Laboratory setup



A: First run

Latex 203 nm

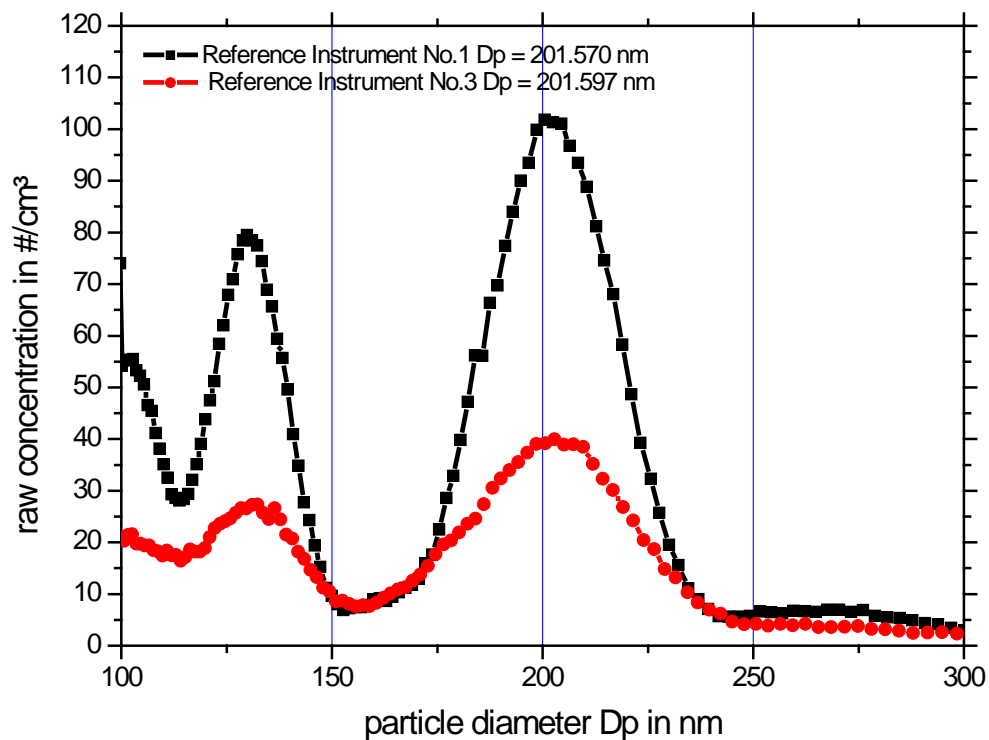


Fig.1. Measurement of latex 203 nm for TROPOS reference instrument No.1 and No.3: Particle size distribution (raw concentration) for latex on Sep. 16, 2013 between 01:20 pm and 01:45 pm (UTC time).

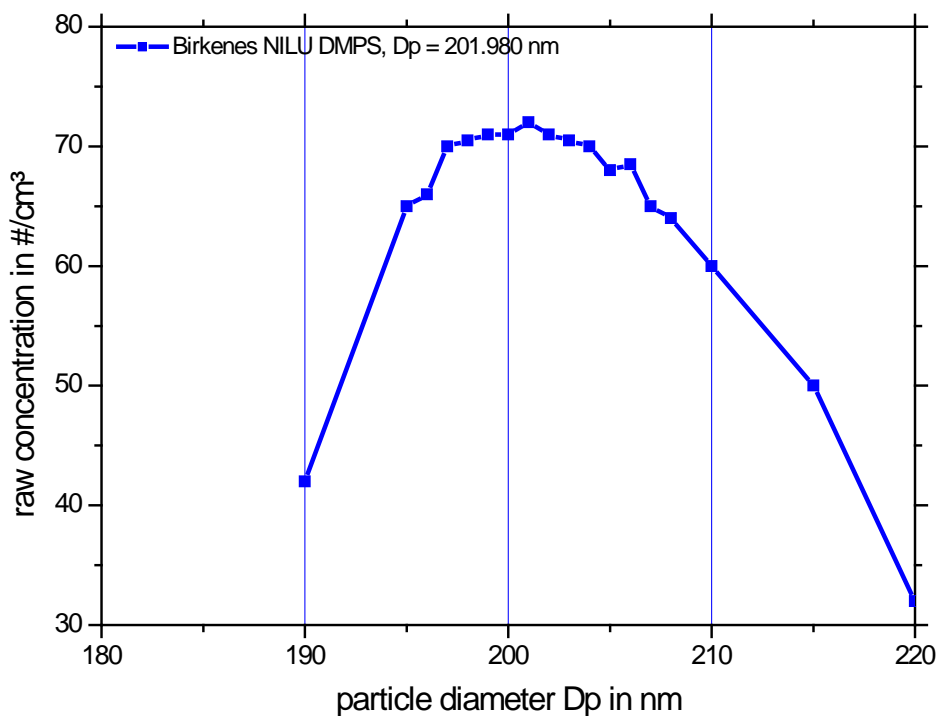


Fig.2. Measurement of latex 203 nm for instrument Birkenes NILU DMPS: Particle size distribution (raw concentration) for latex 2013 on Sep. 16, 2013 between 01:20 pm and 01:45 pm (UTC time).

CPC efficiency

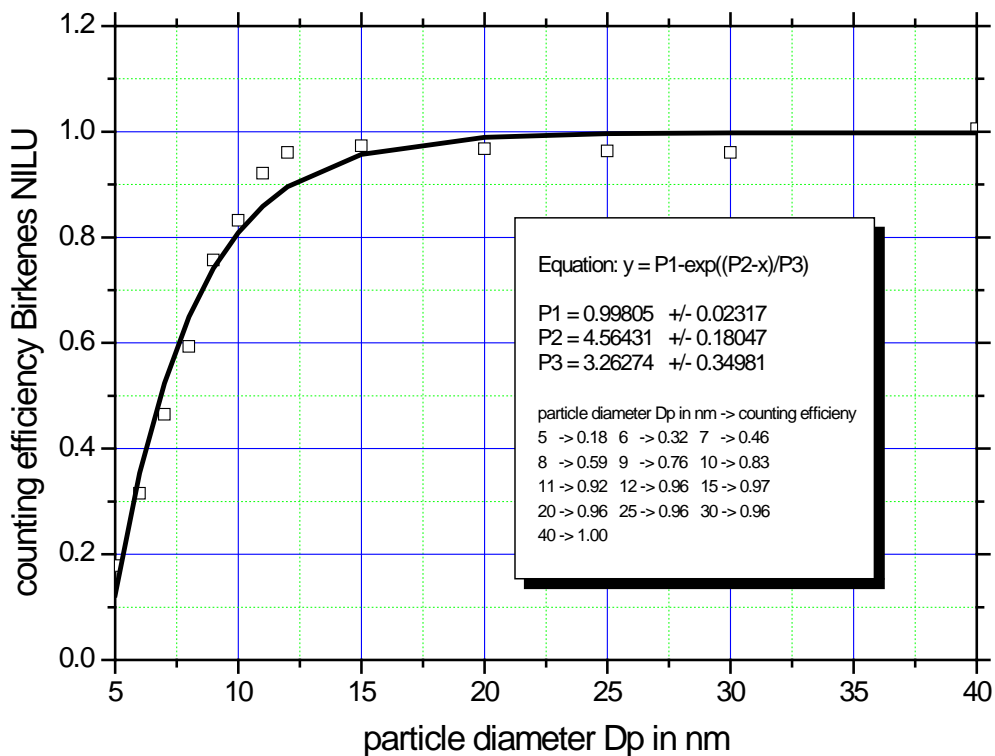


Fig.3. CPC efficiency curve. Based on Electrometer TSI 3068B. Serial number: 70838596

1. Time Series

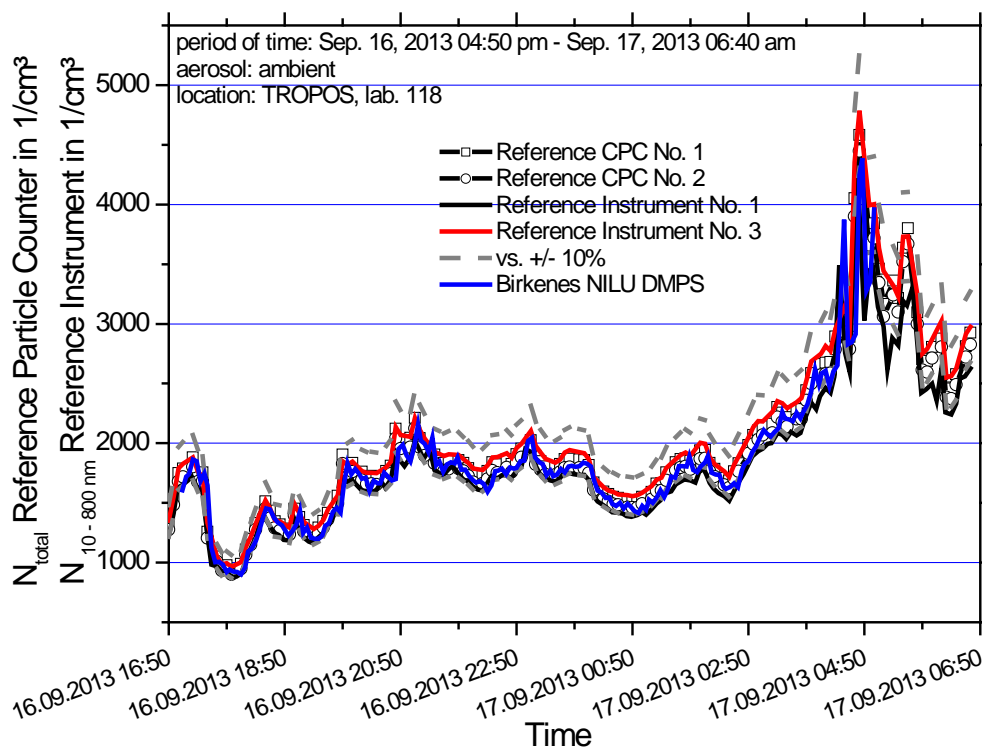


Fig.4. Time series (Sep. 16, 2013 04:50 pm - Sep. 17, 2013 06:40 am) of the integrated particle number concentration ($N_{10-800\text{nm}}$). Flow corrections are included.

2. Correlation

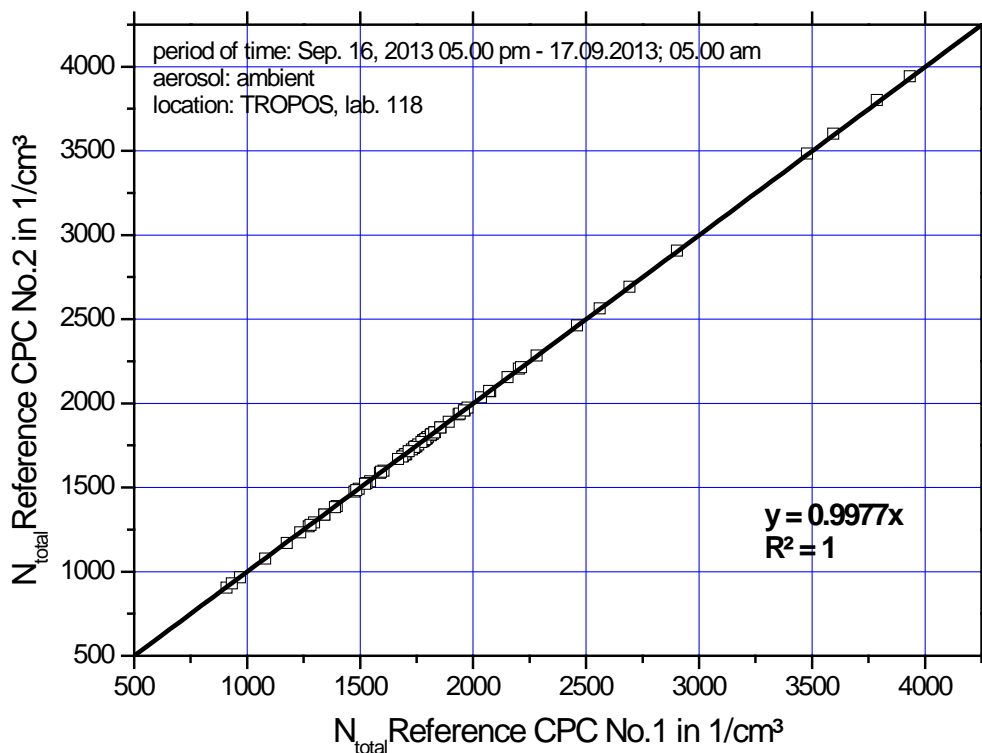


Fig.5. Linear regression between two TROPOS CPCs (Model 3772). Flow corrections are included.

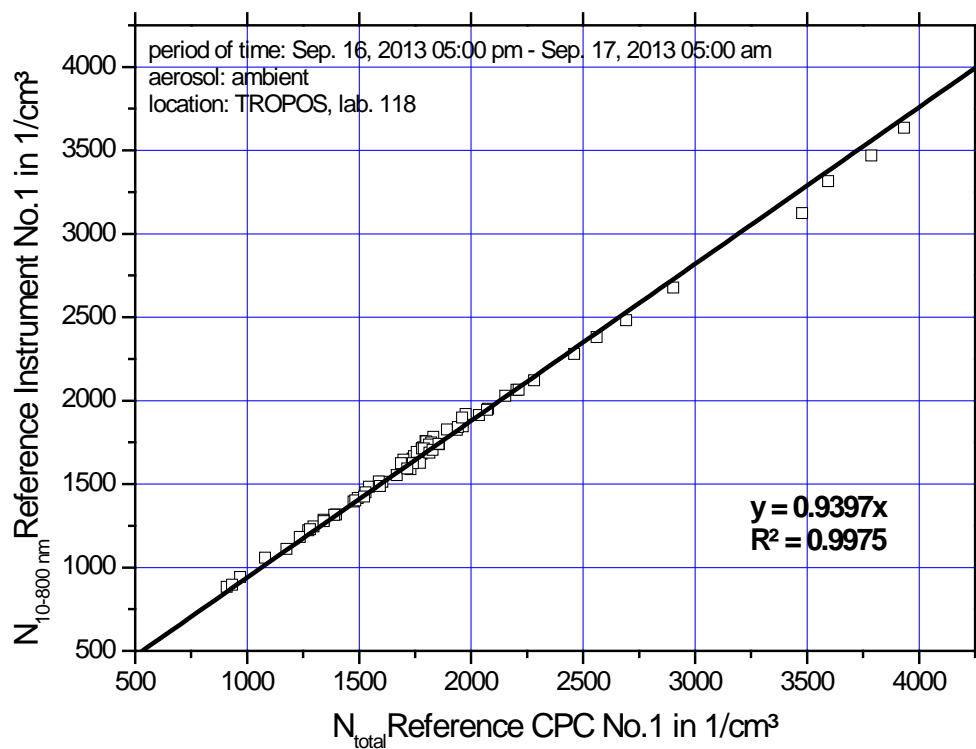


Fig.6. Linear regression between the particle number concentrations of TROPOS reference CPC No.1 and TROPOS reference instrument No.1. Internal diffusion losses and flow corrections are included.

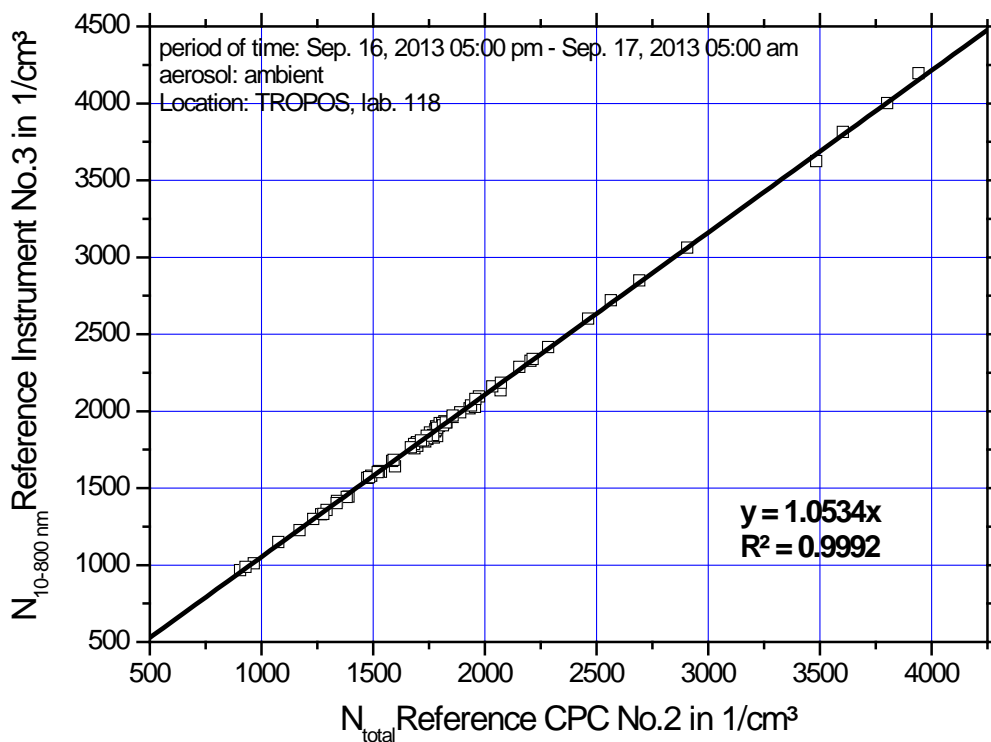


Fig.7. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.3. Internal diffusion losses and flow corrections are included.

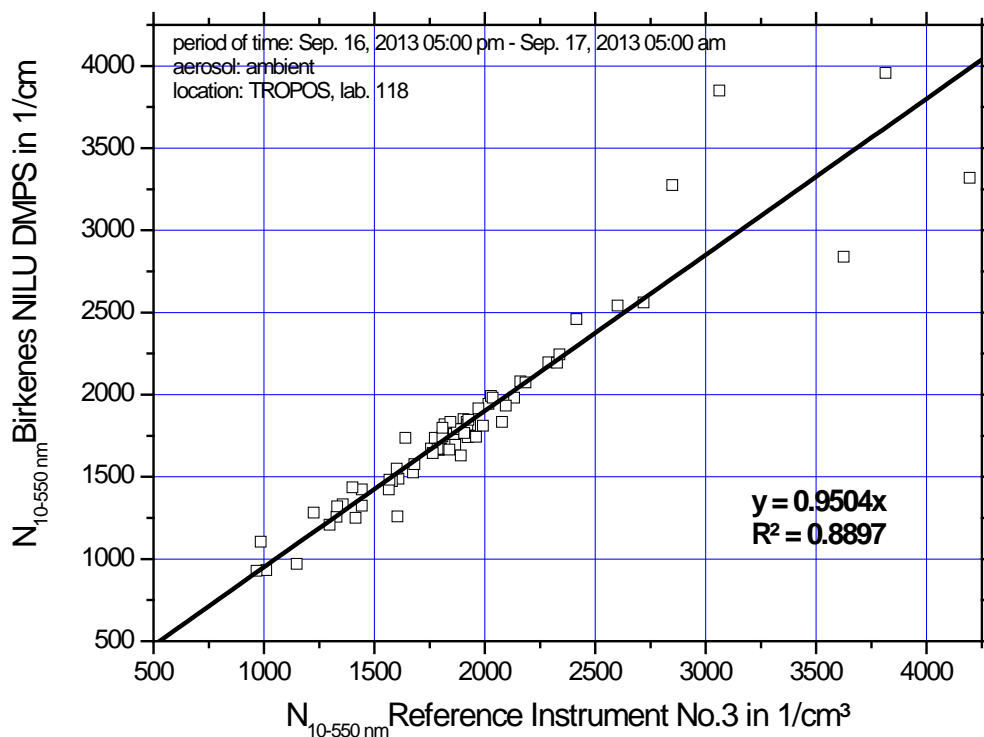


Fig.8. Linear regression between the particle number concentrations of TROPOS reference instrument No.3 and Birkenes NILU DMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

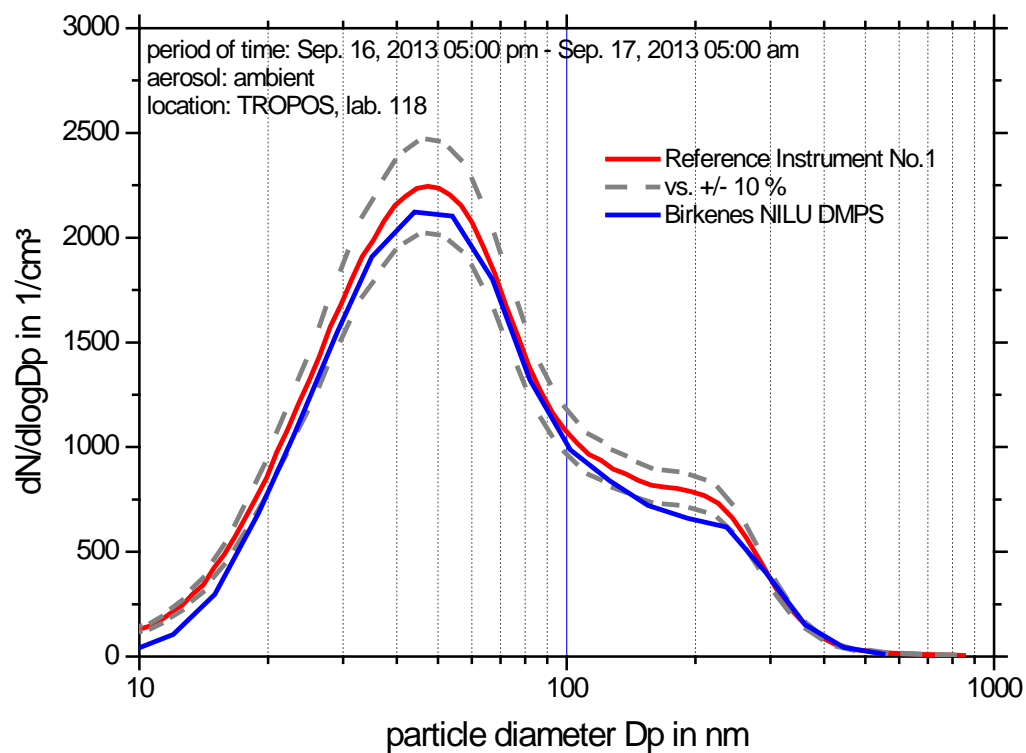


Fig.9. Comparison of mean particle number size distribution between Sep. 16, 2013 05:00 pm and Sep. 17, 2013 05:00 pm. Internal diffusion losses and CPC efficiency are included.

B. Final run

Latex 203 nm

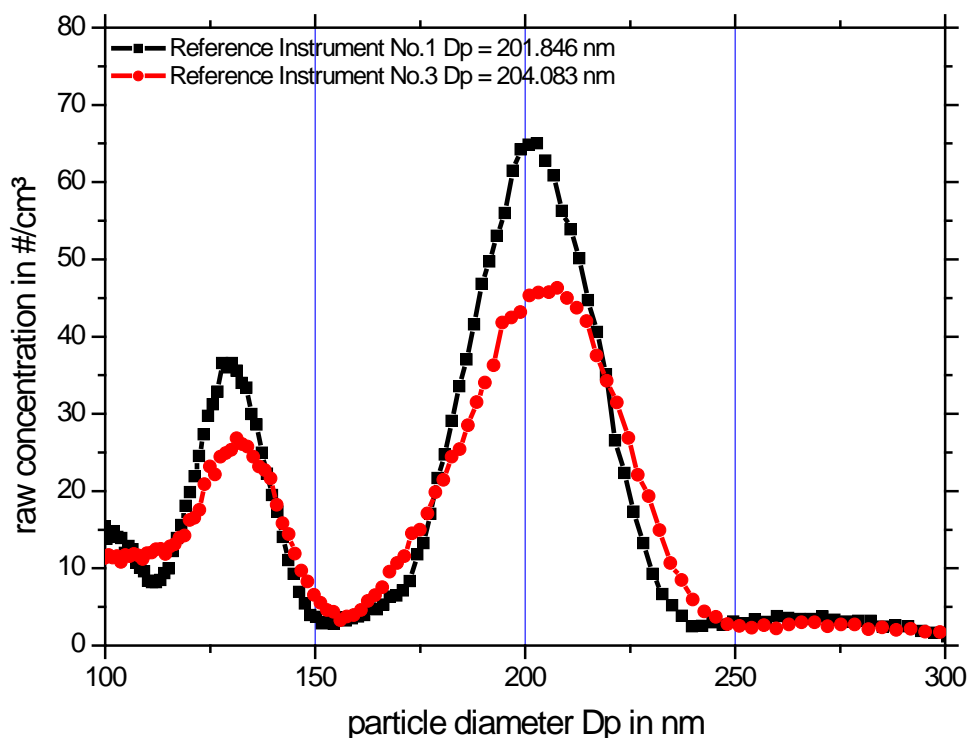


Fig.10. Measurement of latex 203 nm for TROPOS reference instrument No.1 and No.3: Particle size distribution (raw concentration) for latex on Sep. 18, 2013 between 04:00 pm and 04:15 pm (UTC time).

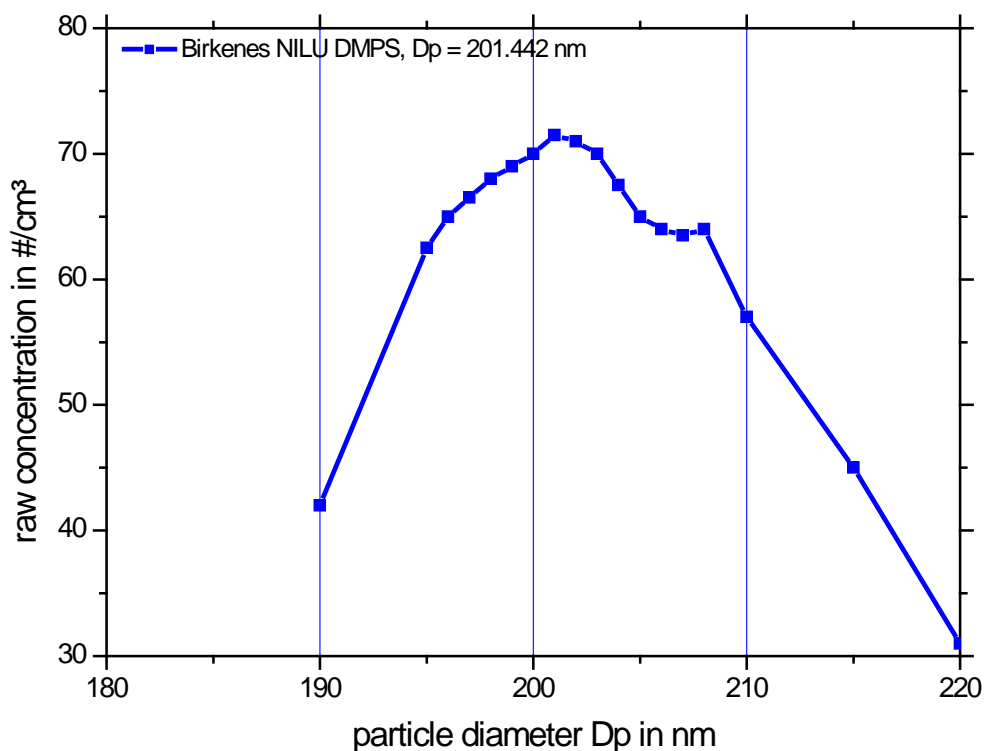


Fig.11. Measurement of latex 203 nm for instrument Birkenes NILU DMPS: Particle size distribution (raw concentration) for latex 2013 on Sep. 18, 2013 between 04:00 pm and 04:15 pm (UTC time).

1. Time series

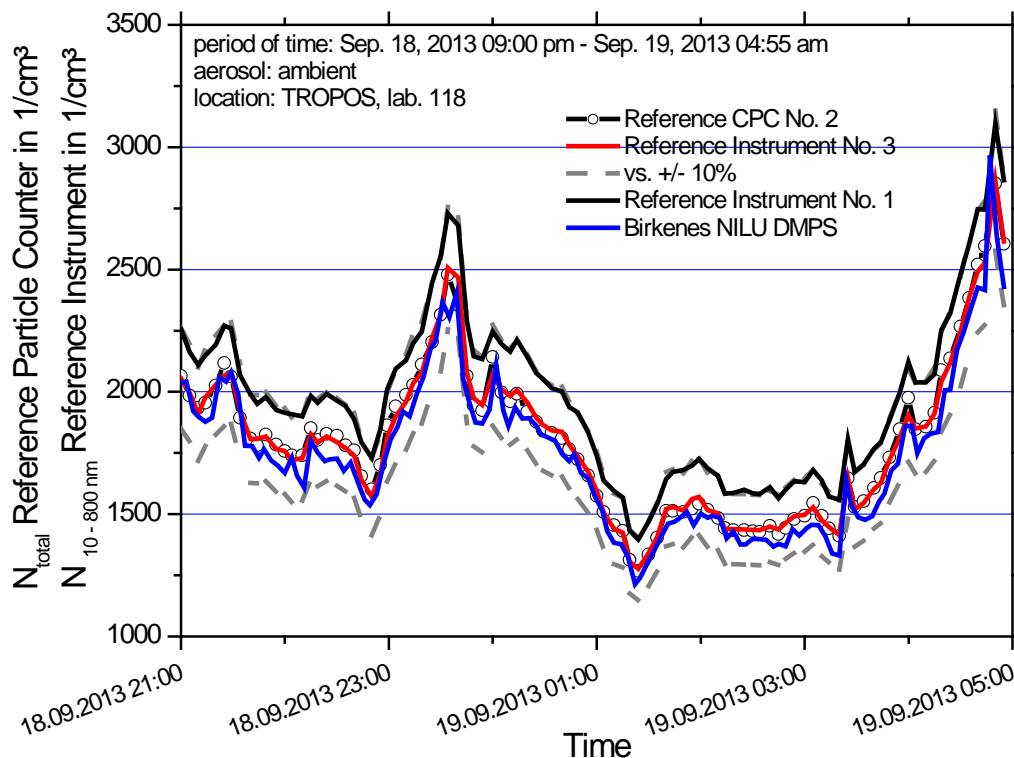


Fig.12. Time series (Sep. 18, 2013 09:00 pm - Sep. 19, 2013 05:00 am) of the integrated particle number concentration ($N_{10-800nm}$). Flow corrections are included

2. Correlation

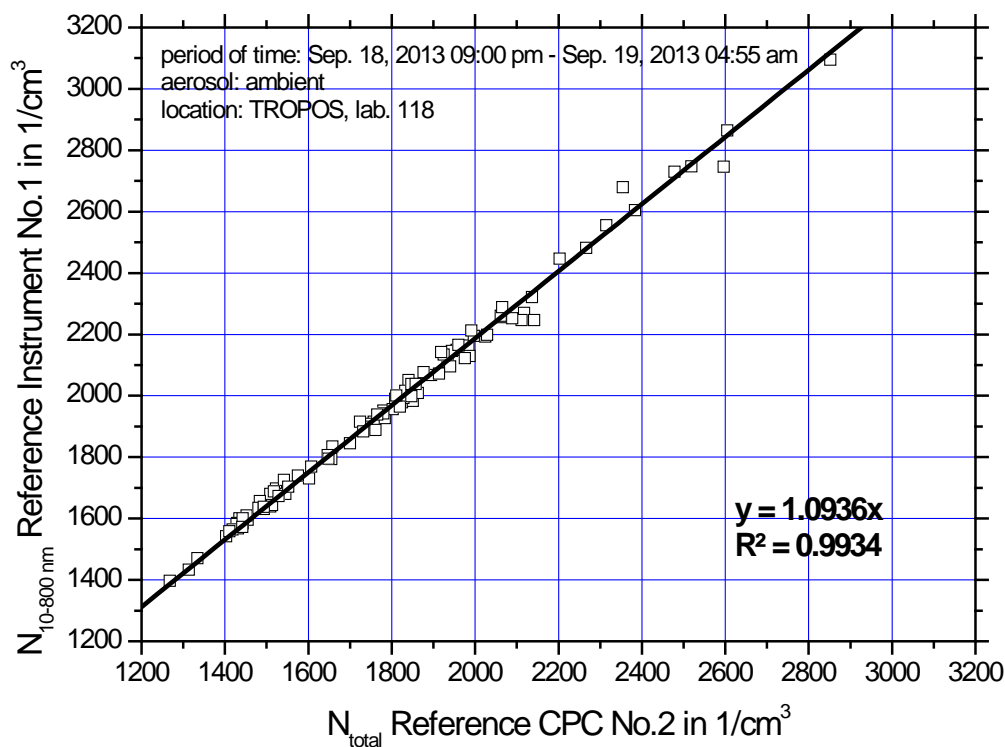


Fig.13. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.1. Internal diffusion losses and flow corrections are included.

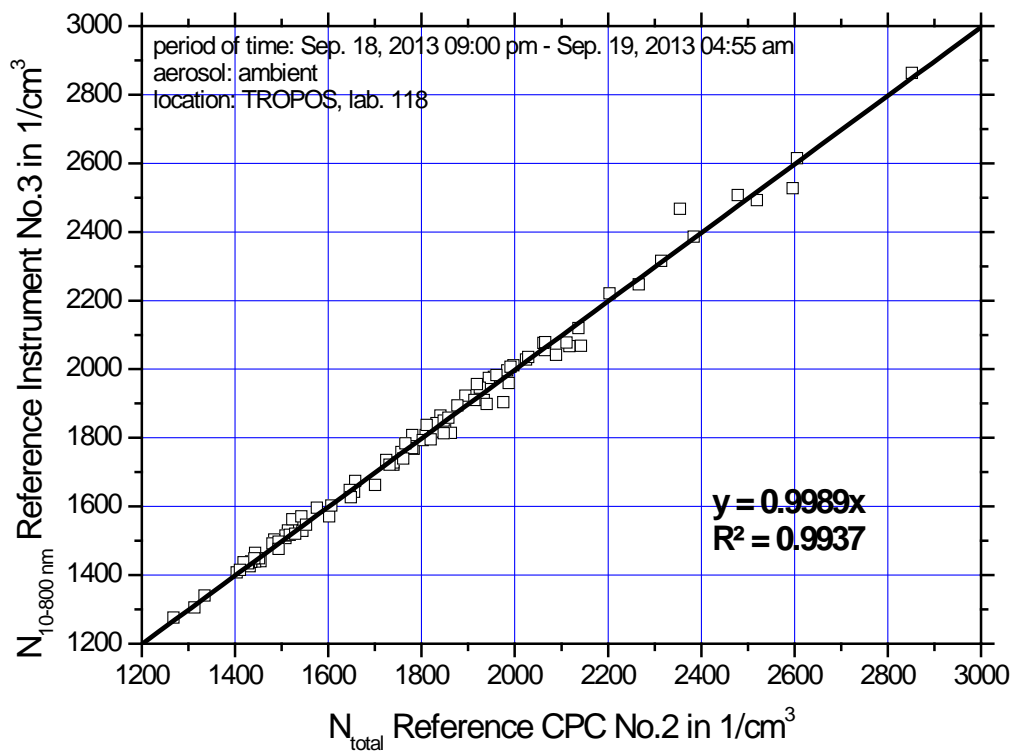


Fig.14. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.3. Internal diffusion losses and flow corrections are included.

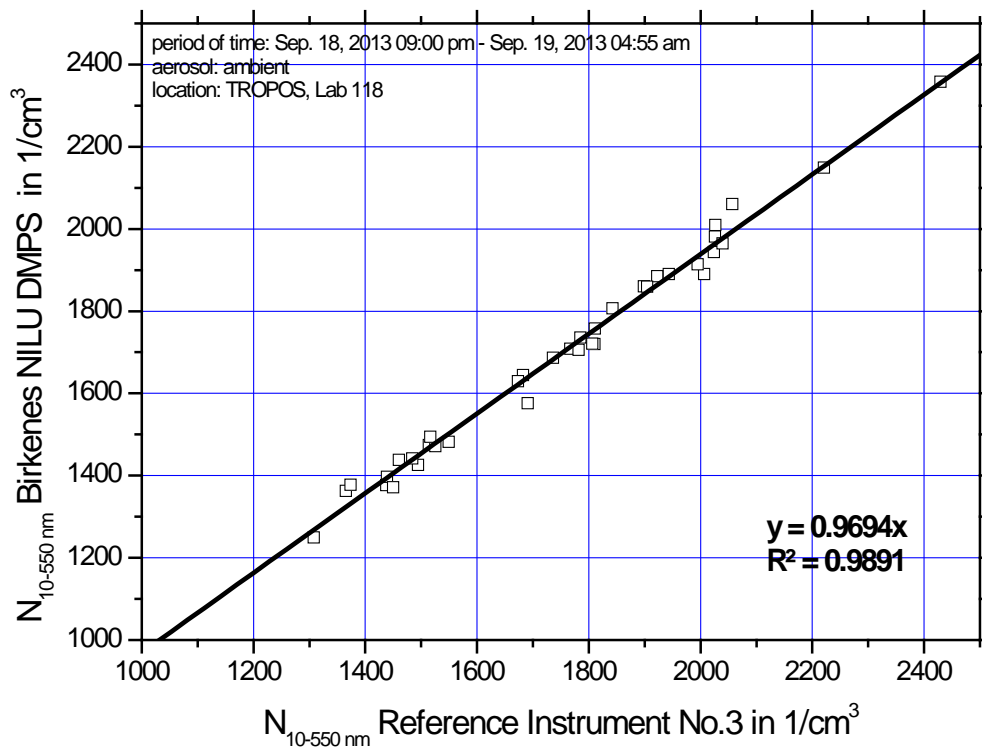


Fig. 13. Linear regression between the particle number concentrations of TROPOS reference instrument No.3 and Birkenes NILU DMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

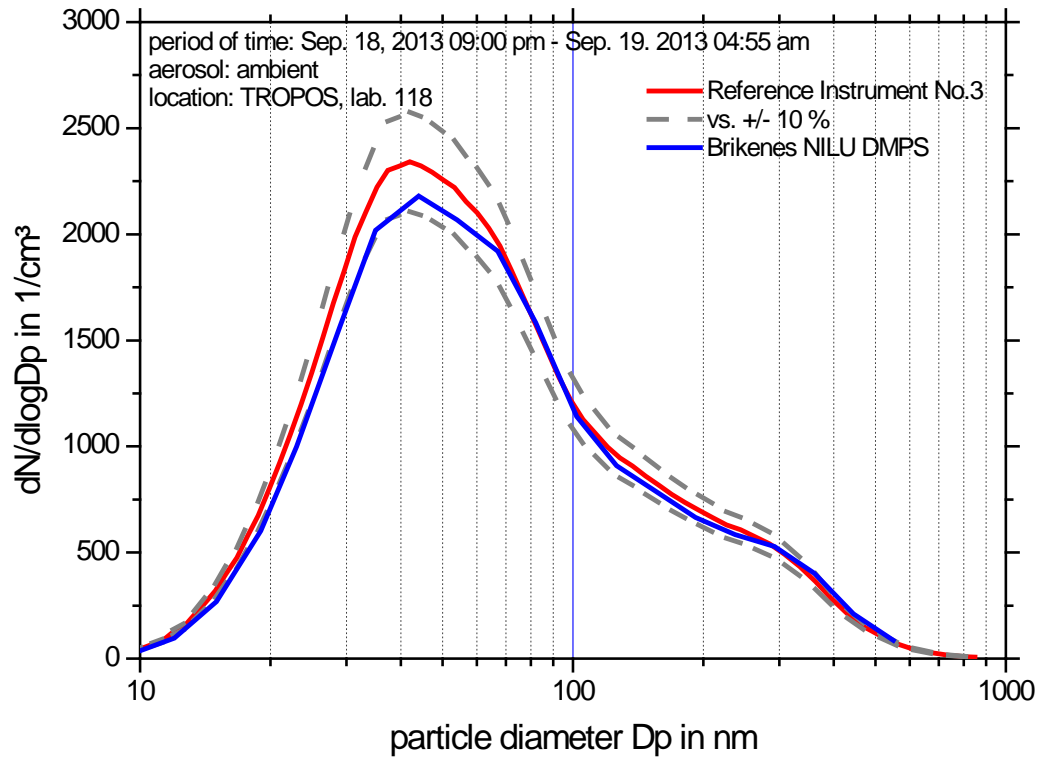


Fig. 14. Comparison of mean particle number size distribution between Sep. 18, 2013 09:00 pm and Sep. 19, 2013 04:55 am. Internal diffusion losses and CPC efficiency are included.

Intercomparison of Finokalia TROPOS SMPS

Basic information

Location of the quality assurance:	TROPOS, lab: 118
Delivery date:	Sep. 17, 2013
Setup in the laboratory:	Sep. 17, 2013
Comparison period:	Sep. 16, 2013 – Sep. 20, 2013
Instrument:	Finokalia TROPOS SMPS
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	Nikos Kalivitis (nkalivitis@chemistry.uoc.gr)

Summary:

From Sep. 16, 2013 to Sep. 20, 2013, the Finokalia TROPOS SMPS participated successfully the TROPOS ACTRIS Workshop. The workshop consisted of an entrance test and a final run. In addition to the overnight ambient measurements, we had numerous high voltage checks, zero- and PSL- measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that, we show for each run the time series of the particle number concentration, the particle number size distribution, and correlation plots. If anything was written in the log book, so we added this also in this report. As reference standards, we used CPCs model TSI 3772 for total particle number concentration and two TROPOS mobility particle size spectrometer. The particle counters have been calibrated against a calibrated TSI electrometer 3068 B with the serial number 70838596.

For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. The Finokalia TROPOS SMPS showed in the PSL-measurements a particle diameter of 202.0 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. If we look at the final ambient measurement run the Finokalia TROPOS SMPS is within the uncertainty range of +/- 10 %. The Finokalia TROPOS SMPS passed the ACTRIS Workshop. There is no re-examination required.

Log book:

Sep. 16, 2013

-> instrument not present

Sep. 17, 2013

09:00 – 10:00 -> setup of Finokalia TROPOS SMPS

-> $Q_{CPC} = 1.019$ l/min, $Q_{line} = 1.014$ l/min

-> high-voltage calibration

-> zero check ok

-> latex calibration

10:45 -> start ambient measurement

18:00 -> zero check ok

20:00 -> start ambient measurement

Sep. 18, 2013

09:50 -> restart ambient measurement after deinstalling nafion

10:00 -> high-voltage calibration ok

-> start ambient measurement still without nafion

12:25 -> zero check ok

12:40-15:10 -> ambient measurement

15:40 -> zero check not ok, noise at high channels -> butanol in DMA

16:00 – 16:30 -> PSL test and zero check ok

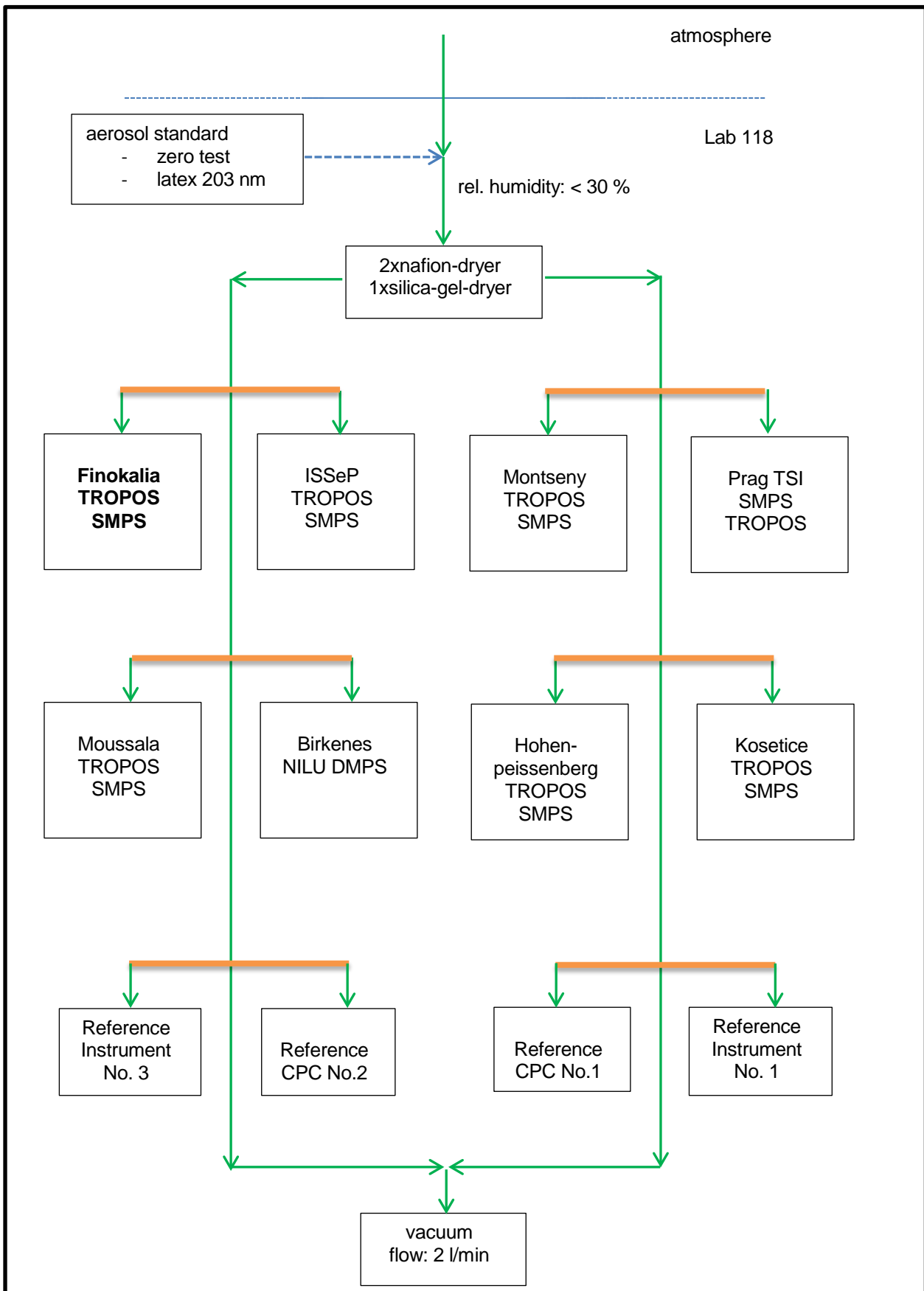
16:40 -> start ambient measurement

Sep. 19, 2013

07:00 -> without diffusion

09:45 -> ambient measurement

Laboratory setup



A: First run

Latex 203 nm

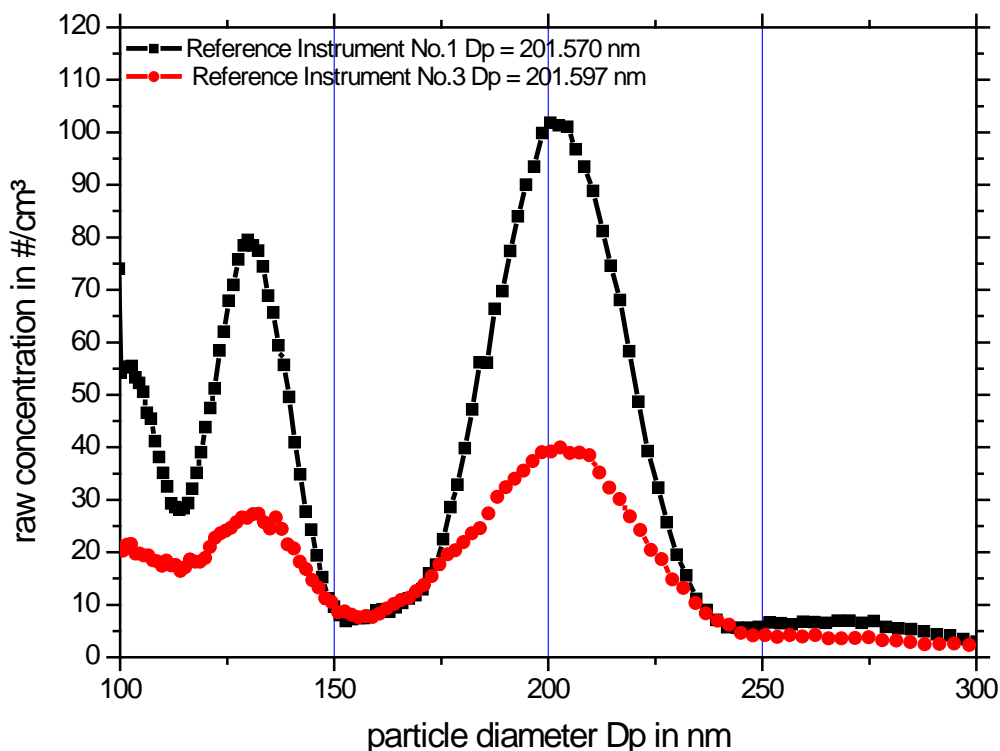


Fig.1. Measurement of latex 203 nm for TROPOS reference instrument No.1 and No.3: Particle size distribution (raw concentration) for latex on Sep. 17, 2013 between 07:35 pm and 07:50 pm (UTC time).

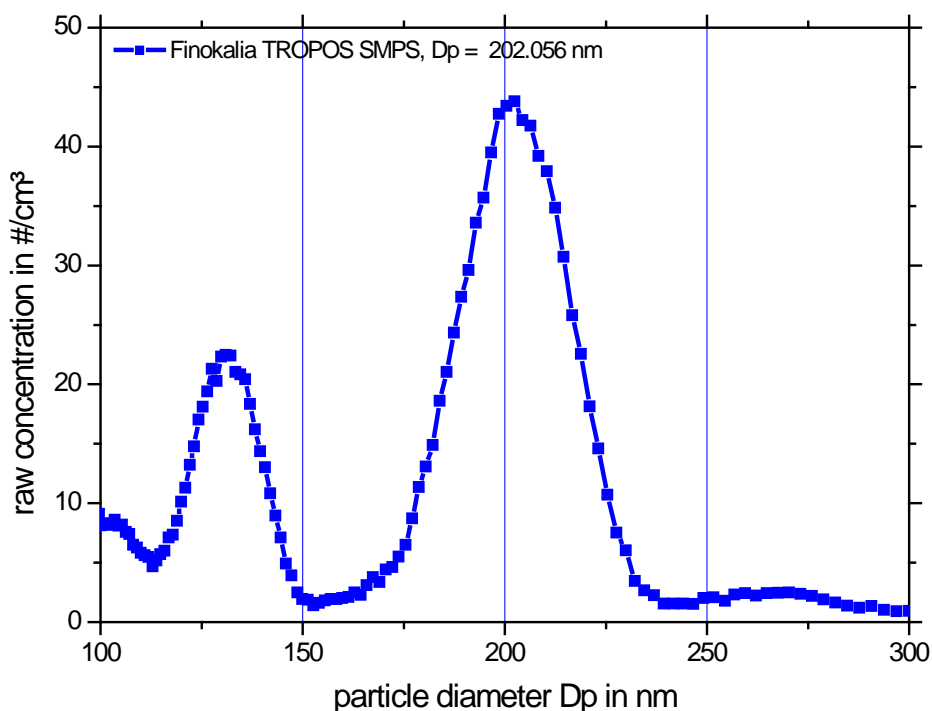


Fig.2. Measurement of latex 203 nm for instrument Finokalia TROPOS SMPS: Particle size distribution (raw concentration) for latex 2013 on Sep. 17, 2013 between 07:35 pm and 07:50 pm (UTC time).

CPC efficiency

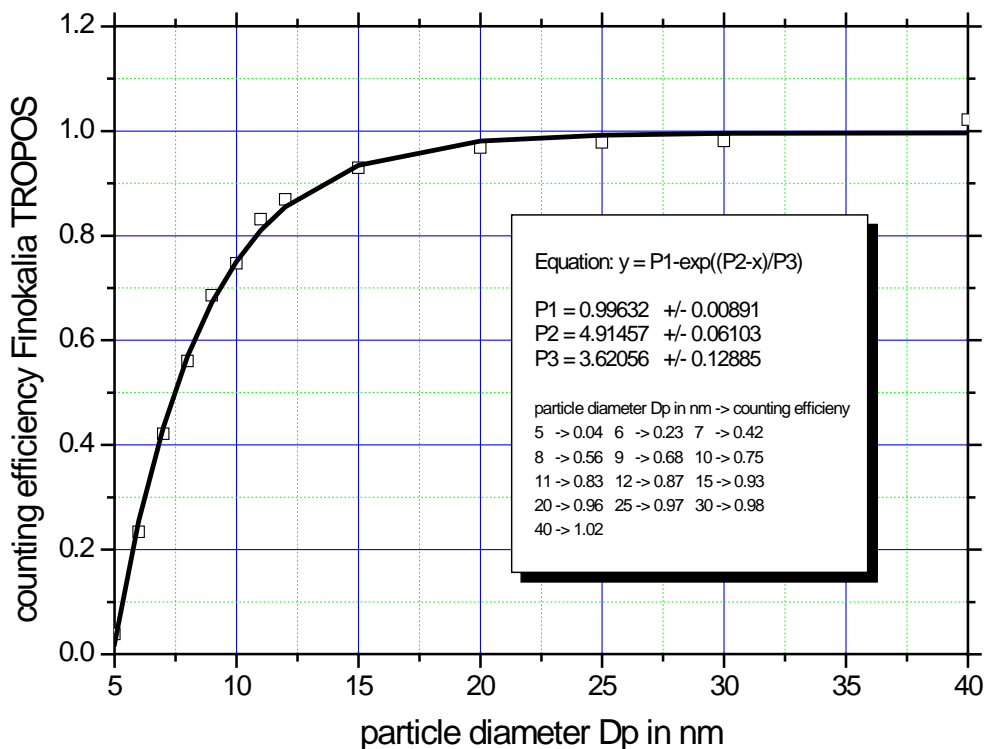


Fig.3. CPC efficiency curve. Based on Electrometer TSI 3068B. Serial number: 70838596.

1. Time series

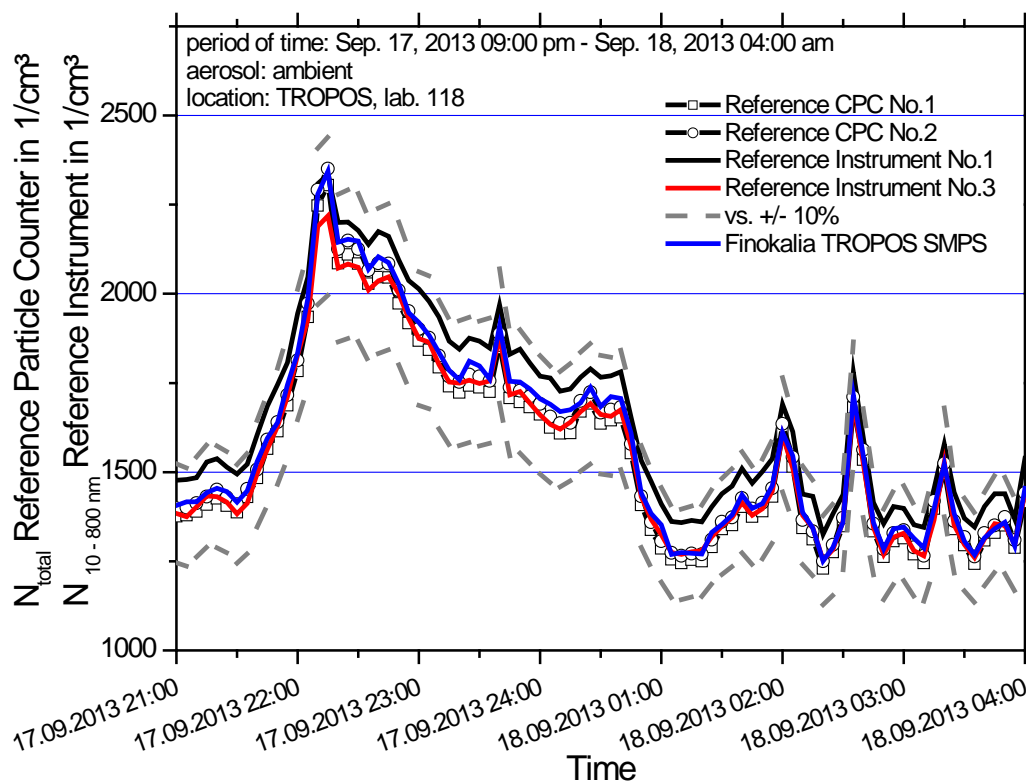


Fig.4. Time series (Sep. 17, 2013 09:00 pm - Sep. 18, 2013 04:00 am) of the integrated particle number concentration ($N_{10-800nm}$). Flow corrections are included.

2. Correlation

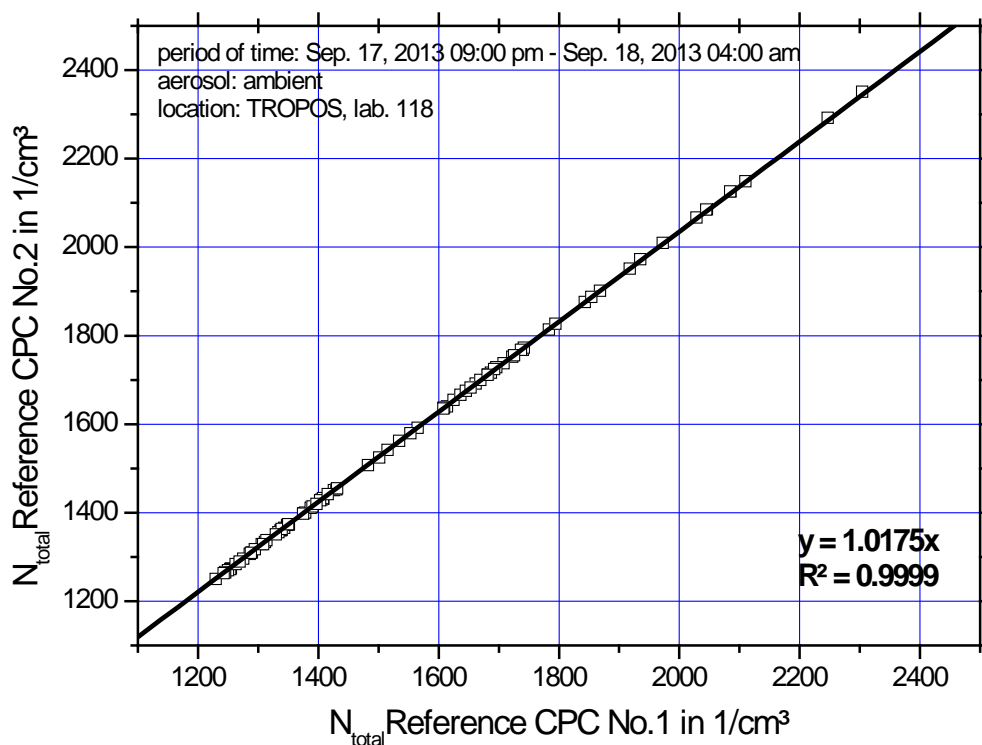


Fig.5. Linear regression between two TROPOS CPCs (Model 3772). Flow corrections are included.

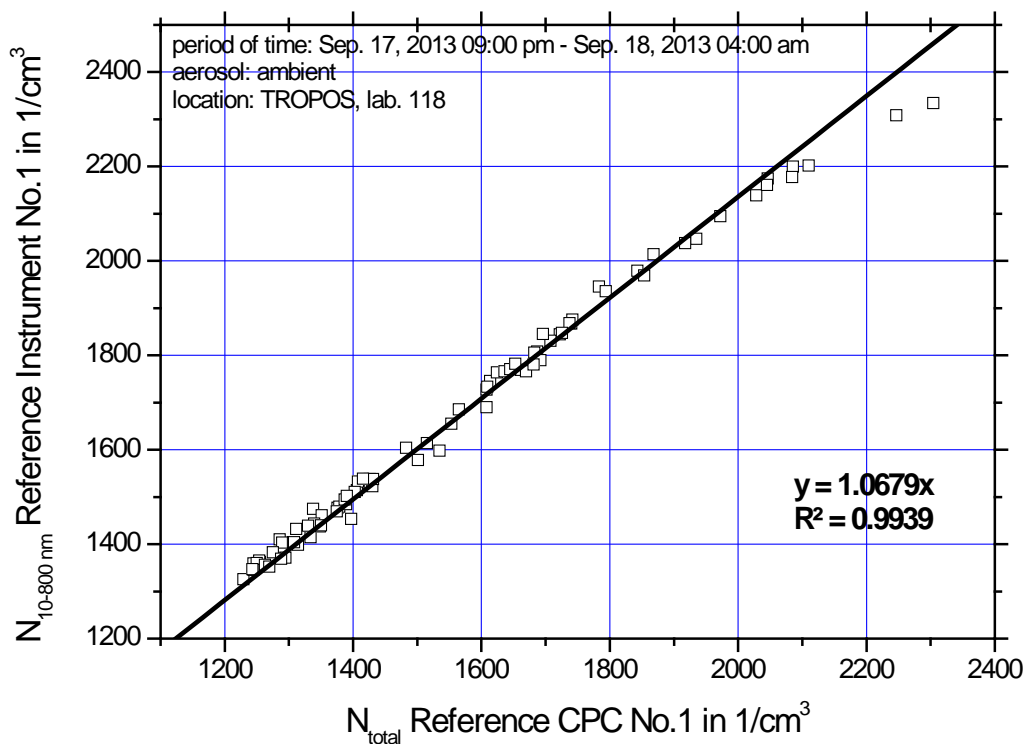


Fig.6. Linear regression between the particle number concentrations of TROPOS reference CPC No.1 and TROPOS reference instrument No.1. Internal diffusion losses and flow corrections are included.

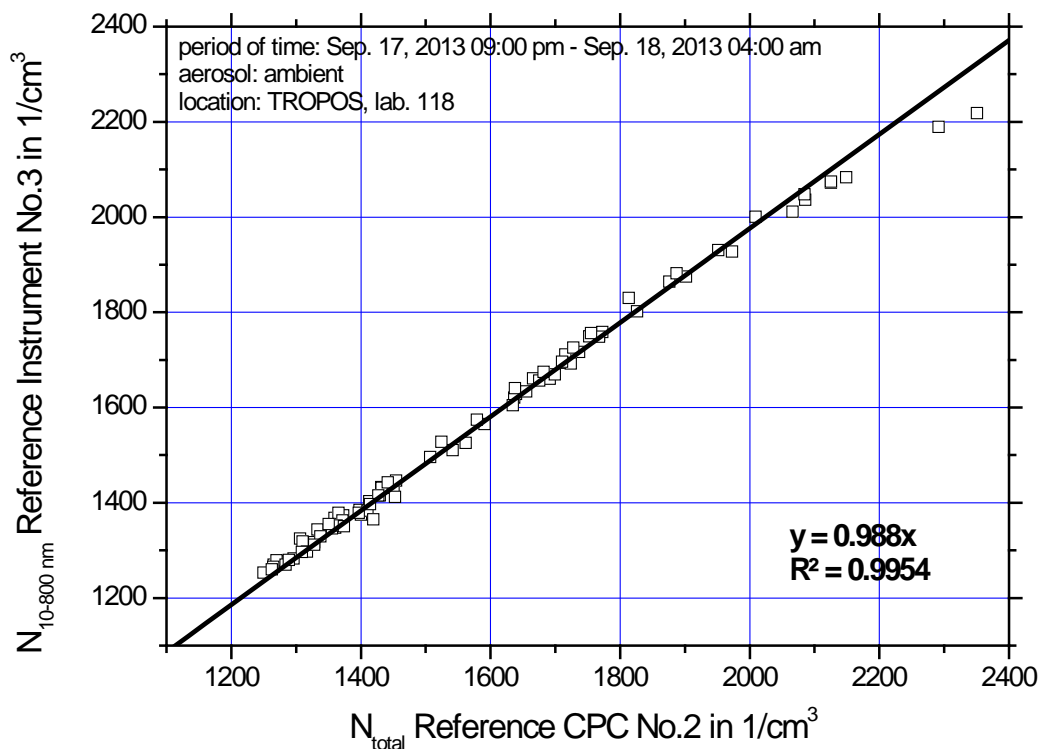


Fig.7. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.3. Internal diffusion losses and flow corrections are included.

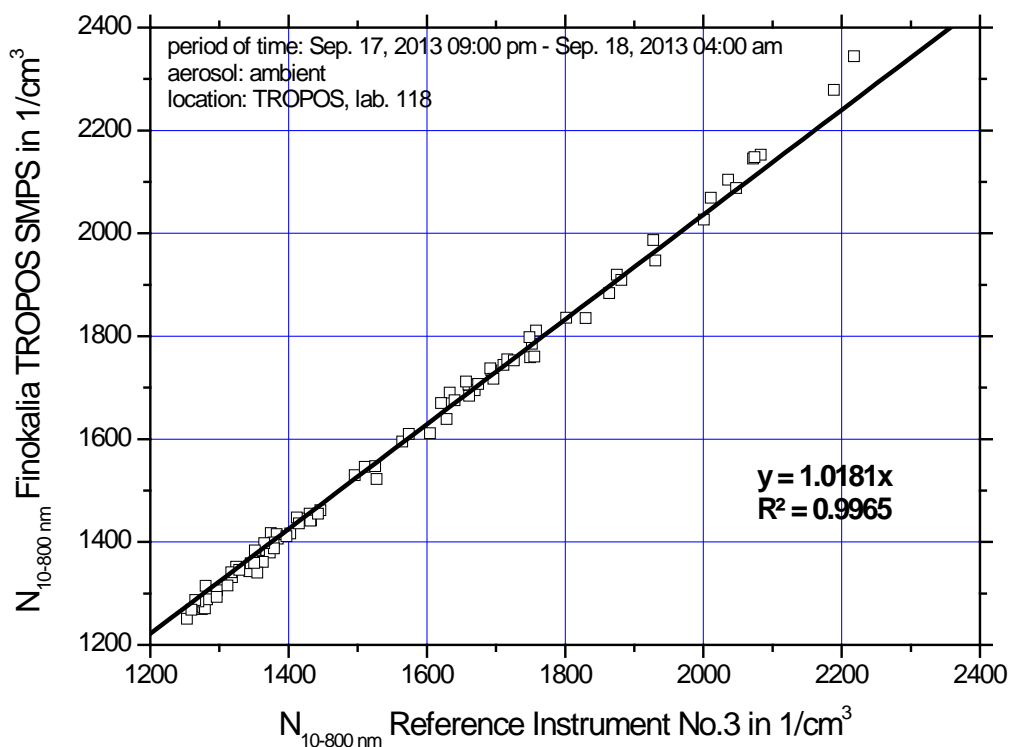


Fig.8. Linear regression between the particle number concentrations of TROPOS reference instrument No.3 and Finokalia TROPOS SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

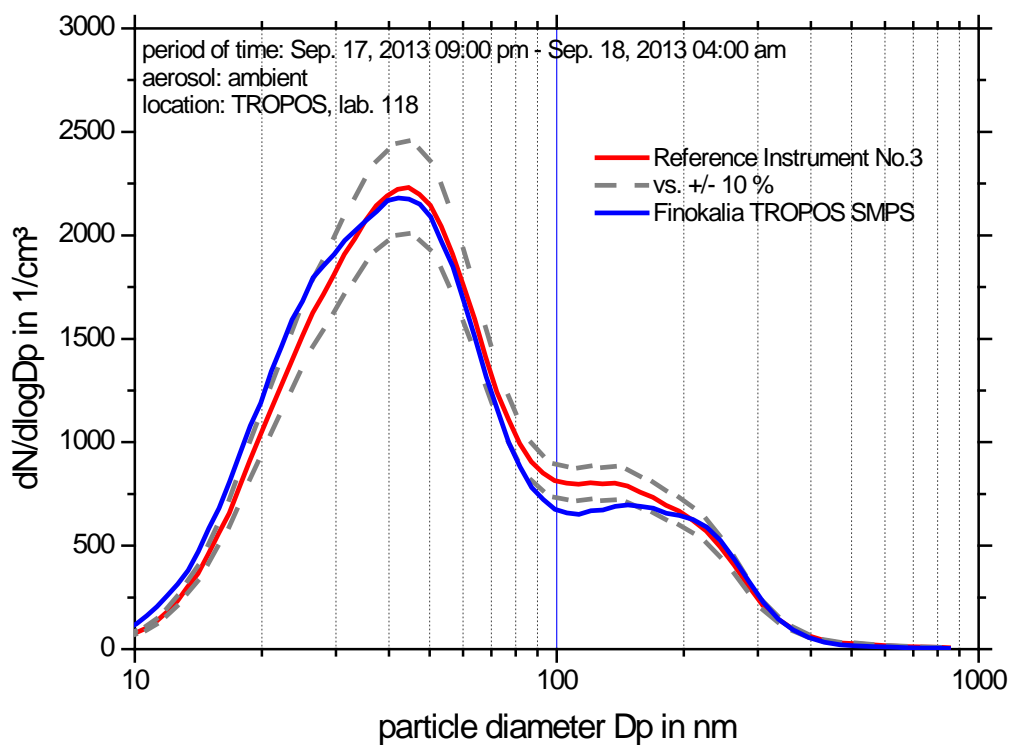


Fig.9. Comparison of mean particle number size distribution between Sep. 17, 2013 09:00 pm and Sep. 18, 2013 04:00 am. Internal diffusion losses and CPC efficiency are included.

B: Final run

Latex 203 nm

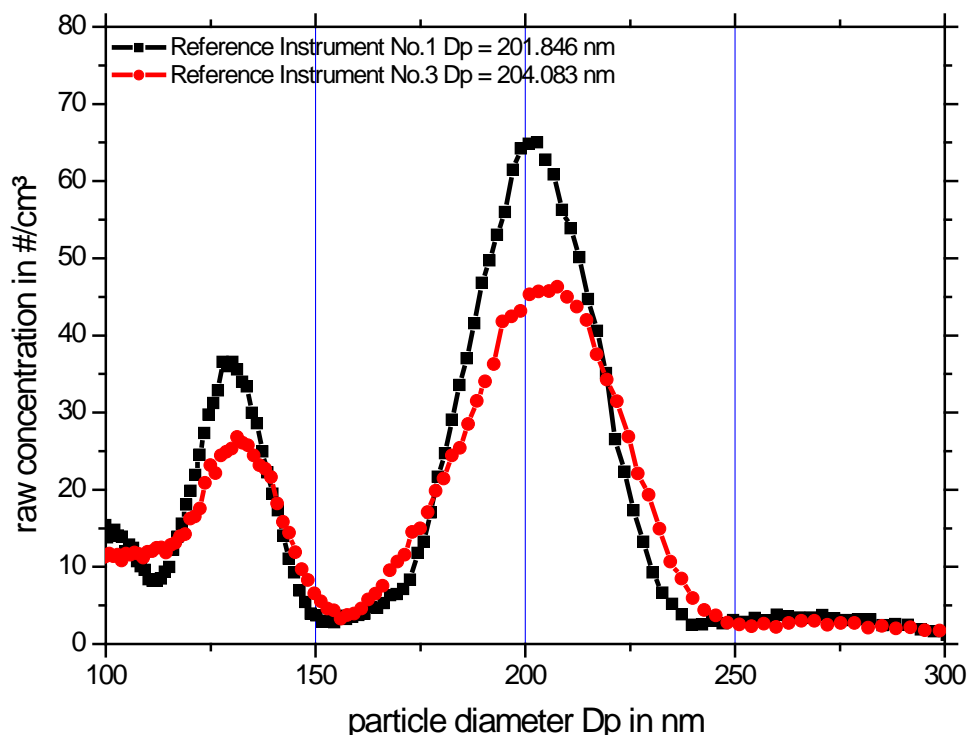


Fig.10. Measurement of latex 203 nm for TROPOS reference instrument No.1 and No.3: Particle size distribution (raw concentration) for latex on Sep. 18, 2013 04:00 pm and 04:15 pm (UTC time).

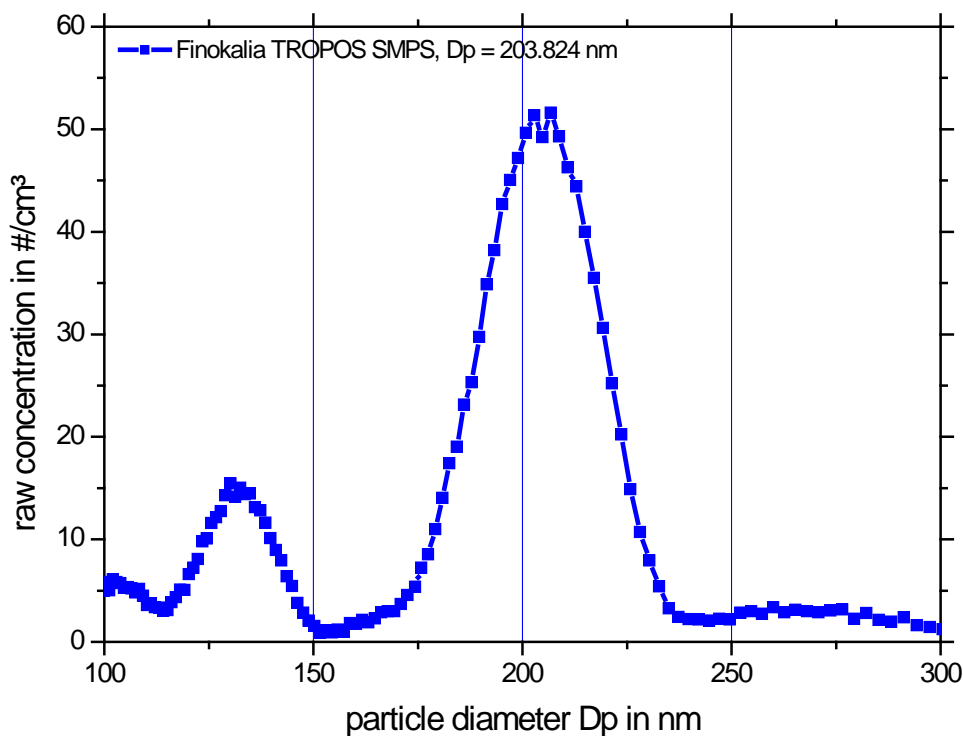


Fig.11. Measurement of latex 203 nm for instrument Finokalia TROPOS SMPS: Particle size distribution (raw concentration) for latex 2013 on Sep. 18, 2013 between 03:55 pm and 04:10 pm (UTC time).

1. Time series

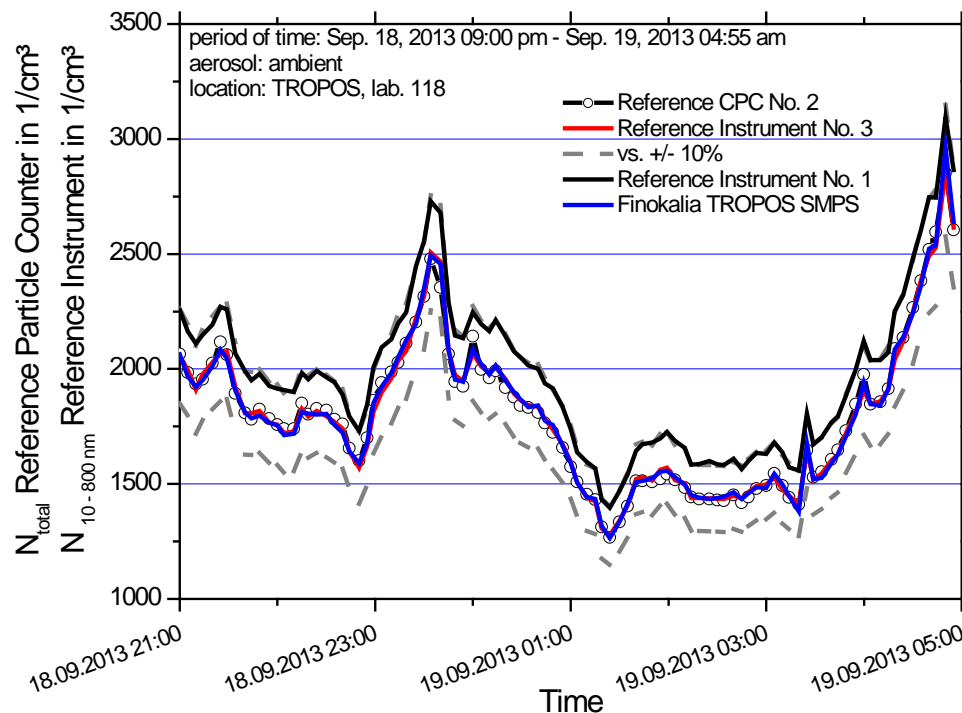


Fig.12. Time series (Sep. 18, 2013 09:00 pm - Sep. 19, 2013 04:55 am) of the integrated particle number concentration ($N_{10-800nm}$). Flow corrections are included.

2. Correlation

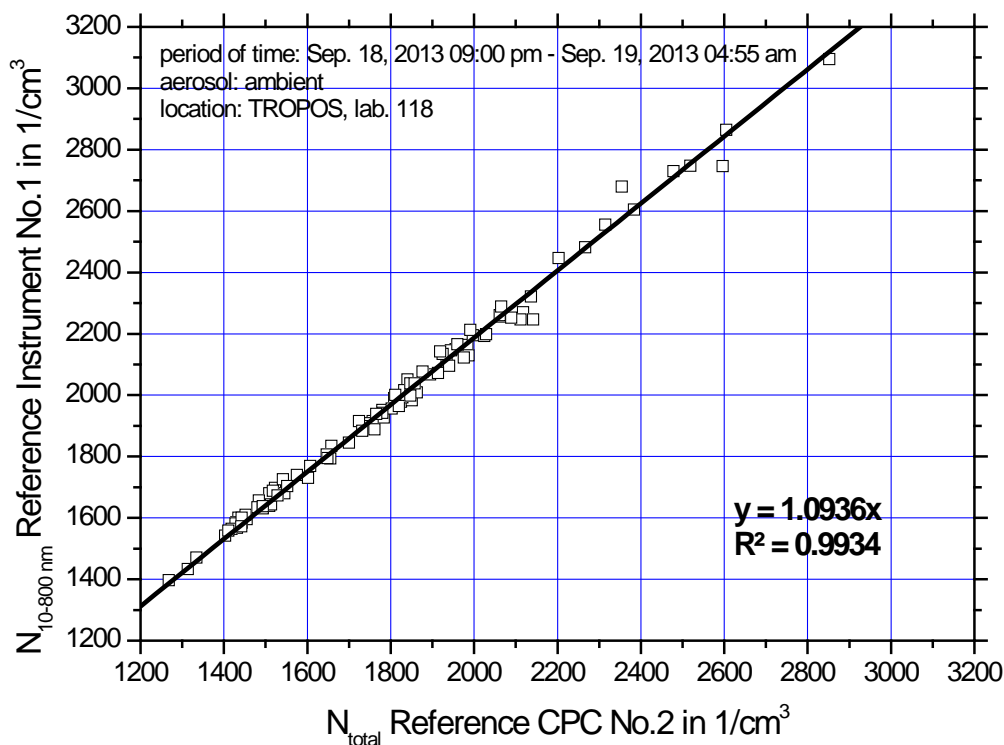


Fig.13. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.3. Internal diffusion losses and flow corrections are included.

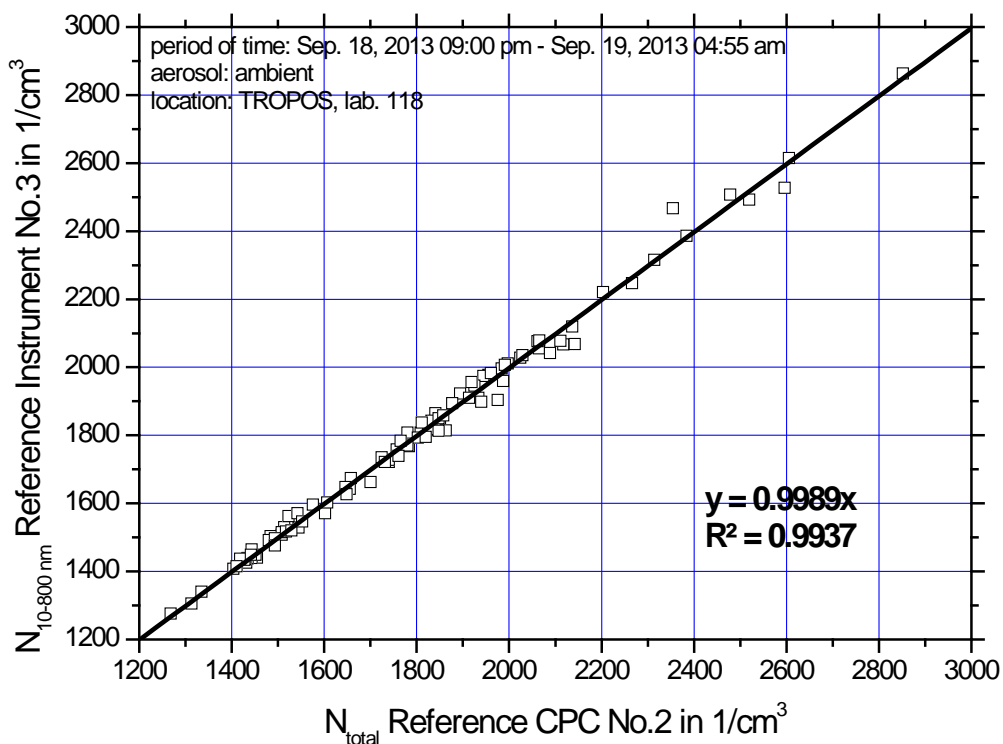


Fig.14. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.3. Internal diffusion losses and flow corrections are included.

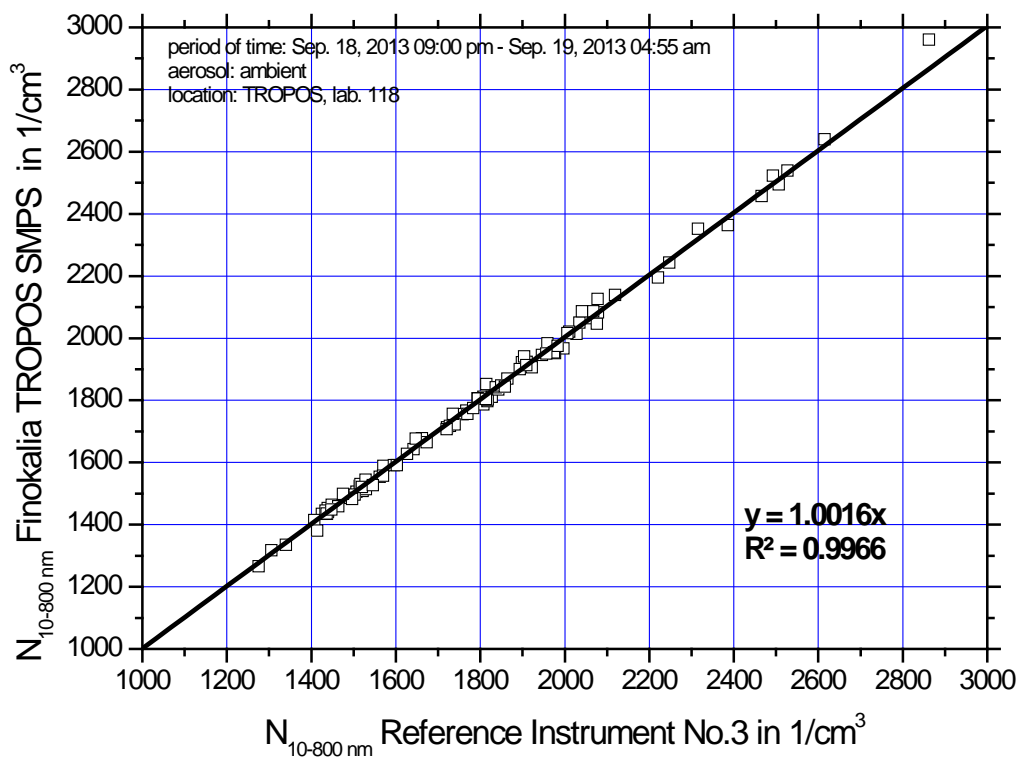


Fig.15. Linear regression between the particle number concentrations of TROPOS reference instrument No.3 and Finokalia TROPOS SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

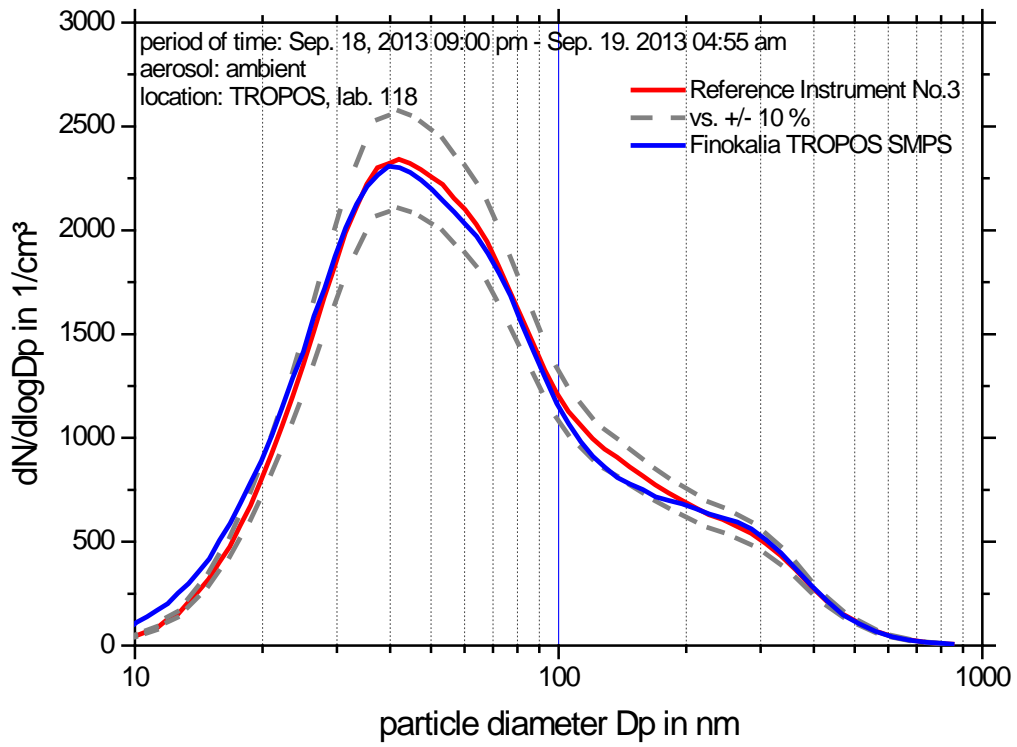


Fig.16. Comparison of mean particle number size distribution between Sep. 18, 2013 09:00 pm and Sep. 19, 2013 04:55 am. Internal diffusion losses and CPC efficiency are included.

Intercomparison of Hohenpeissenberg TROPOS SMPS

Basic information

Location of the quality assurance:	TROPOS, lab: 118
Delivery date:	Sep. 16, 2013
Setup in the laboratory:	Sep. 16, 2013
Comparison period:	Sep. 16, 2013 – Sep. 20, 2013
Instrument:	Hohenpeissenberg TROPOS SMPS
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	Harald Flentje (Harald.Flentje@dwd.de)

Summary:

From Sep. 16, 2013 to Sep. 20, 2013 the Hohenpeissenberg TROPOS SMPS participated successfully the TROPOS ACTRIS Workshop. The workshop consisted of an entrance test and a final run. In addition to the overnight ambient measurements, we had numerous high voltage checks, zero- and PSL- measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that, we show for each run the time series of the particle number concentration, the particle number size distribution, and correlation plots. If anything was written in the log book, so we added this also in this report. As reference standards, we used CPCs model TSI 3772 for total particle number concentration and two TROPOS mobility particle size spectrometer. The particle counters have been calibrated against a calibrated TSI electrometer 3068 B with the serial number 70838596.

For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. The Hohenpeissenberg TROPOS SMPS DMPS showed in the PSL-measurements a particle diameter of 205.5 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. If we look at the final ambient measurement run the Hohenpeissenberg TROPOS SMPS is within the uncertainty range of +/- 10 %. The Hohenpeissenberg TROPOS SMPS passed the ACTRIS Workshop. There is no re-examination required.

Log book:

Sep. 16, 2013

- 08:00-13:00 -> setup of Hohenpeissenberg TROPOS SMPS in laboratory 118
- > $Q_{CPC} = 0.977$ l/min
- 13:20-14:30 -> zero check
- 14:30 -> HV calibration (no change in settings)
- 16:30-16:40 -> latex mode 203 nm

Sep. 17, 2013

- 04:30-07:25 -> ambient measurements
- 09:03 -> new CPC, $Q_{CPC} = 1.057$ l/min
- 09:20 -> zero check
- 09:38 -> blackout
- 09:40 -> zero check
- 09:45-09:58 -> ambient measurements, stop for software update
- 11:14 -> CPC remove
- 17:10 -> zero check with problems???
- 17:40 -> $Q_{CPC} = 1.031$ l/min
- 18:00-18:10 -> zero check 0 \#/cm^3
- 18:12-20:00 -> latex ok, no correction
- 19:30-19:40 -> zero check for all???

Sep. 18, 2013

- 12:25 -> zero check
- 12:40-15:00 -> ambient measurement
- 15:18 -> new nafion dryer
- 15:40-15:55 -> zero check with new nafion dryer
- 16:00-16:20 -> latex, zero check
- 16:40 -> ambient measurement

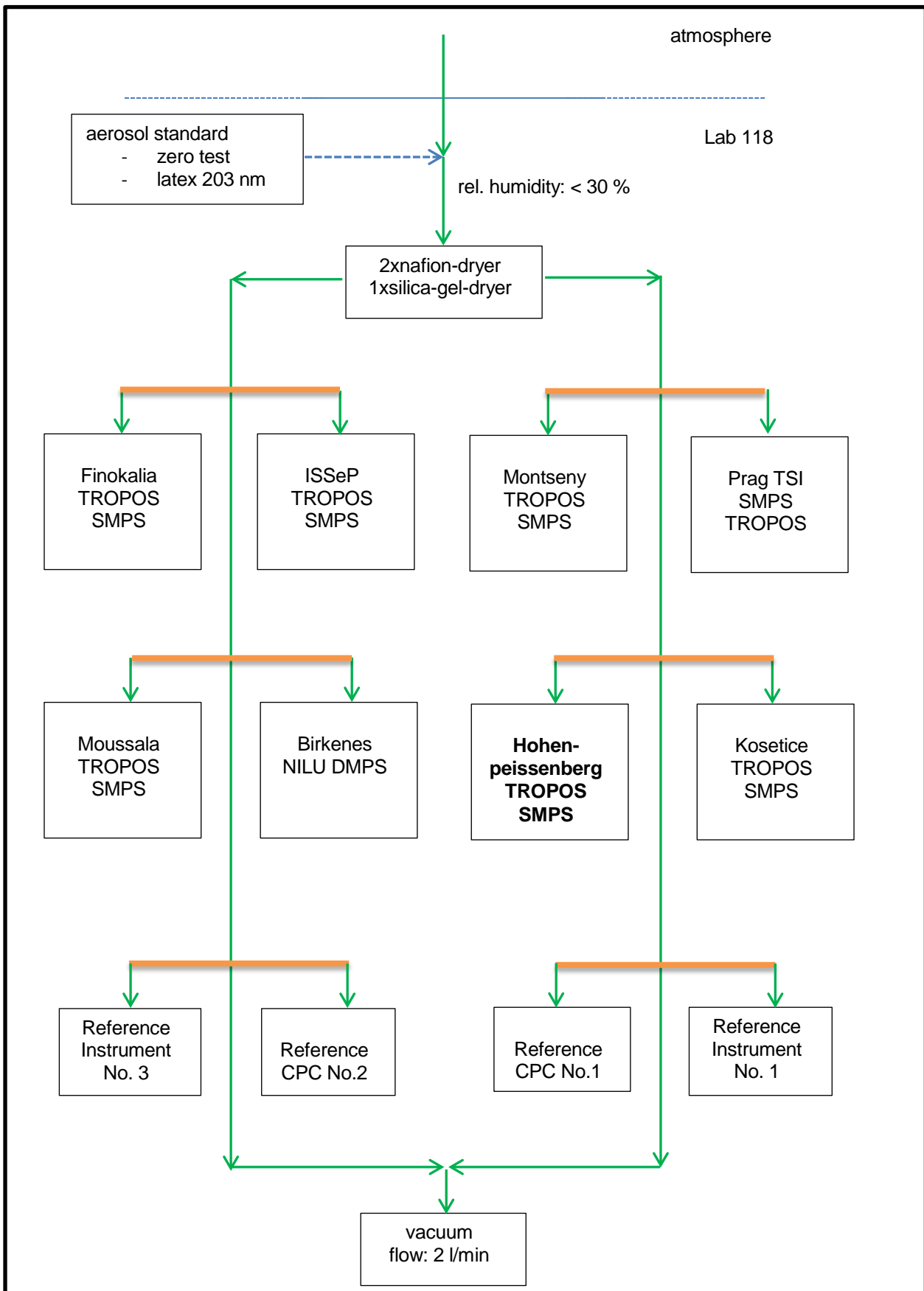
Sep. 19, 2013

- 07:00 -> change to without diffusion
- 09:30-9:40 -> zero check

Sep. 20, 2013

- 05:45 -> ambient measurement

Laboratory setup



A: First run

Latex 203 nm

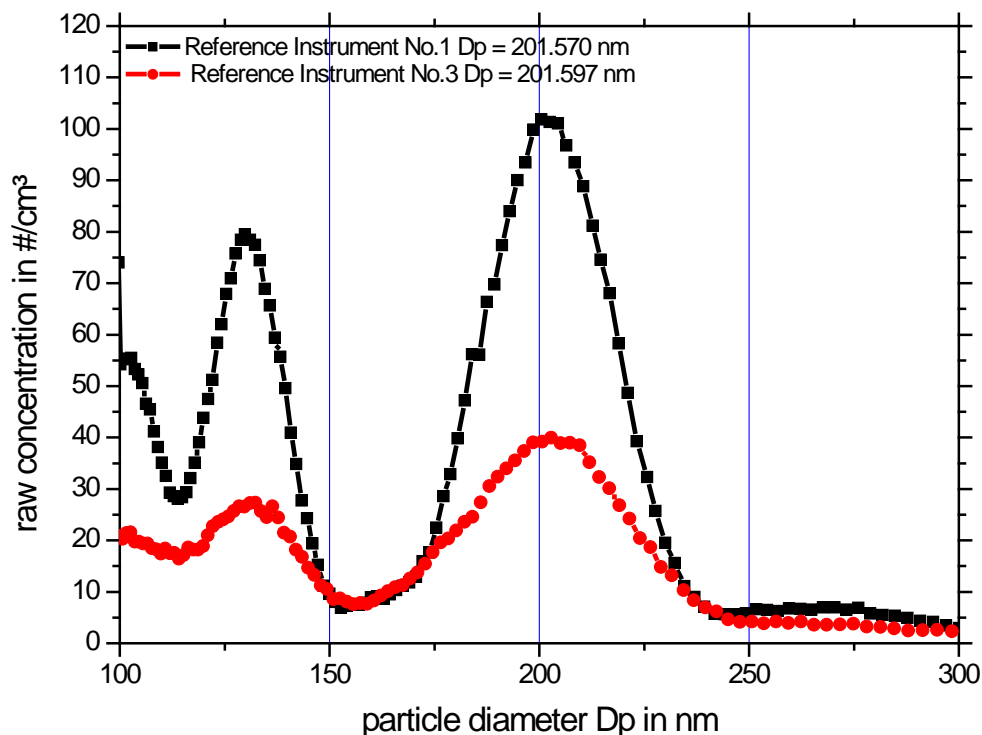


Fig.1. Measurement of latex 203 nm for TROPOS reference instrument No.1 and No.3: Particle size distribution (raw concentration) for latex on Sep. 16, 2013 between 01:20 pm and 01:45 pm (UTC time).

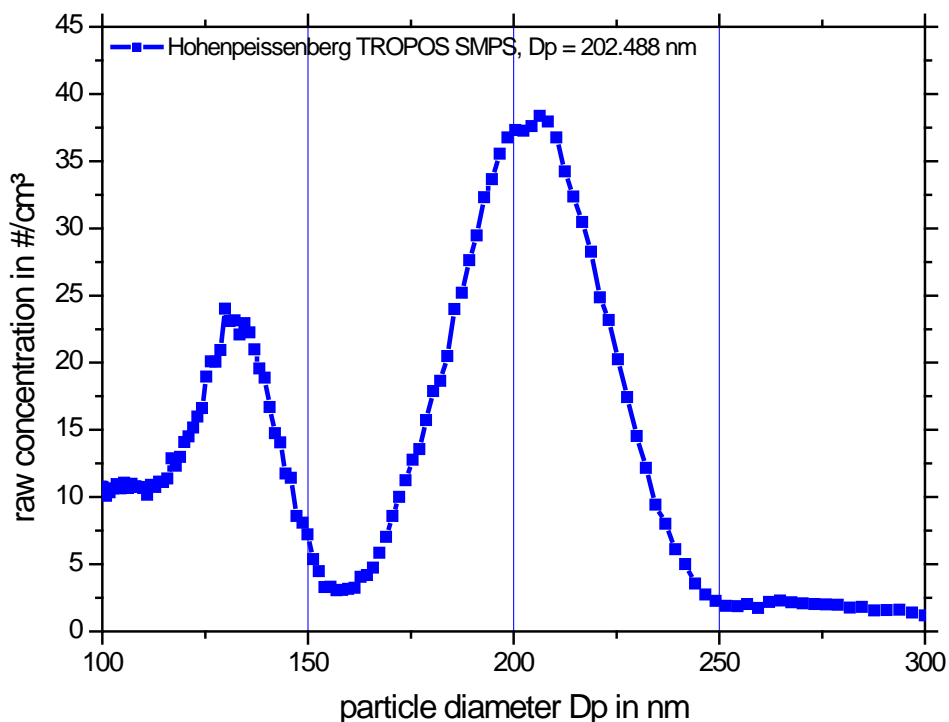


Fig.2. Measurement of latex 203 nm for instrument Hohenpeissenberg TROPOS SMPS: Particle size distribution (raw concentration) for latex 2013 on Sep. 16, 2013 between 02:25 pm and 02:35 pm (UTC time).

CPC efficiency

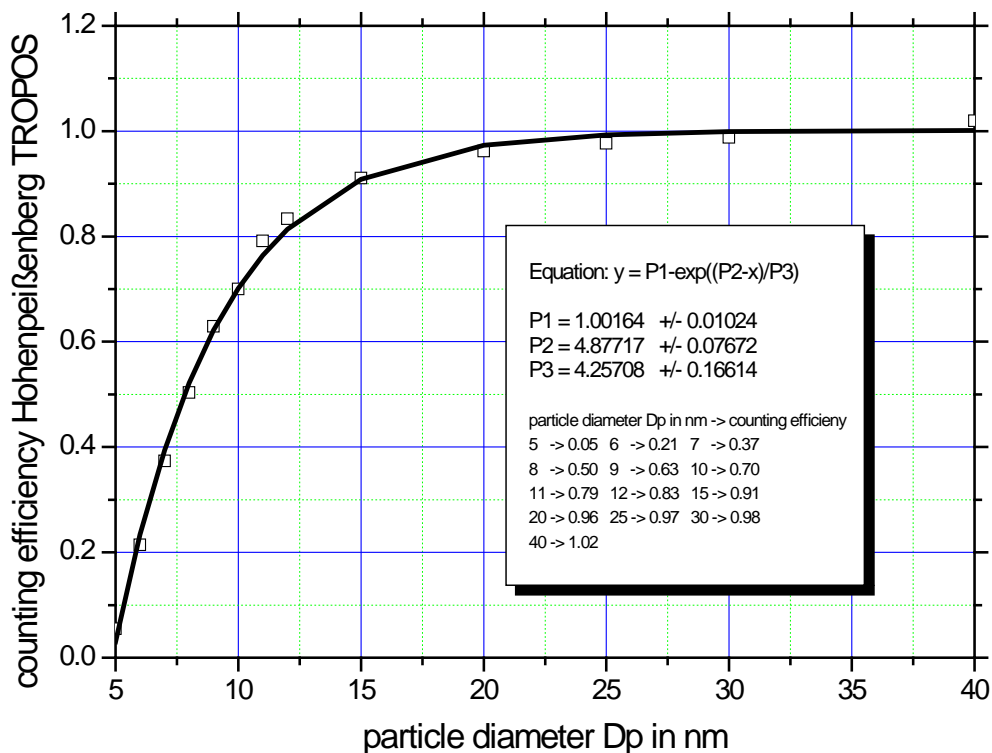


Fig.3. CPC efficiency curve. Based on Electrometer TSI 3068B. Serial number: 70838596

1. Time series

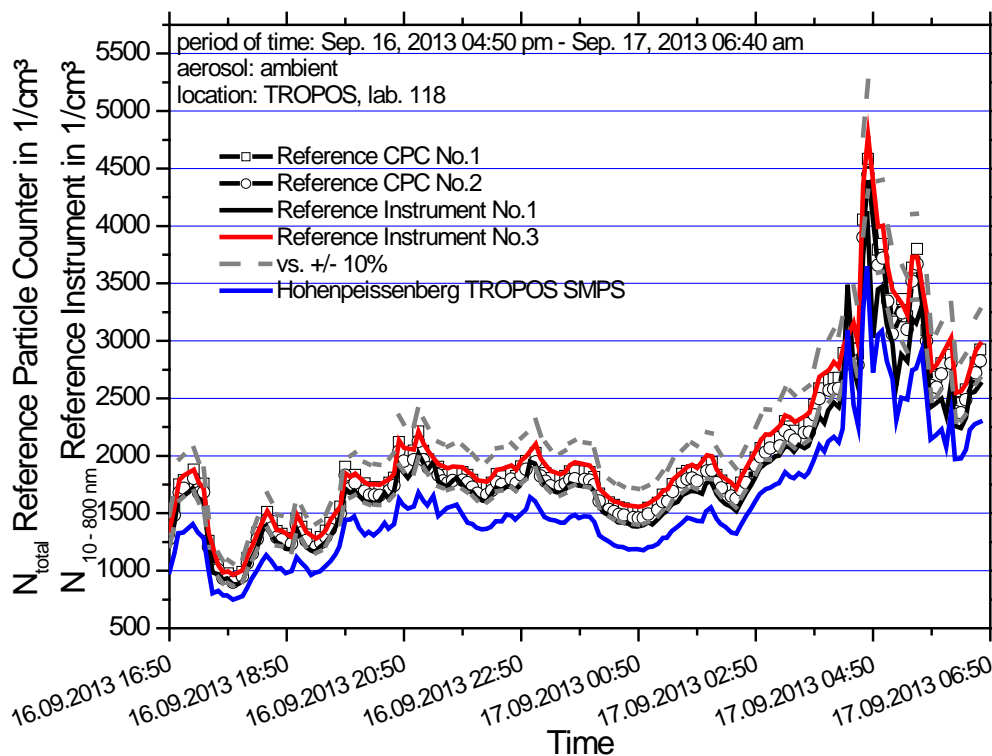


Fig.4. Time series (Sep. 16, 2013 04:50 pm - Sep. 17, 2013 06:40 am) of the integrated particle number concentration ($N_{10-800nm}$). Flow corrections are included.

2. Correlation

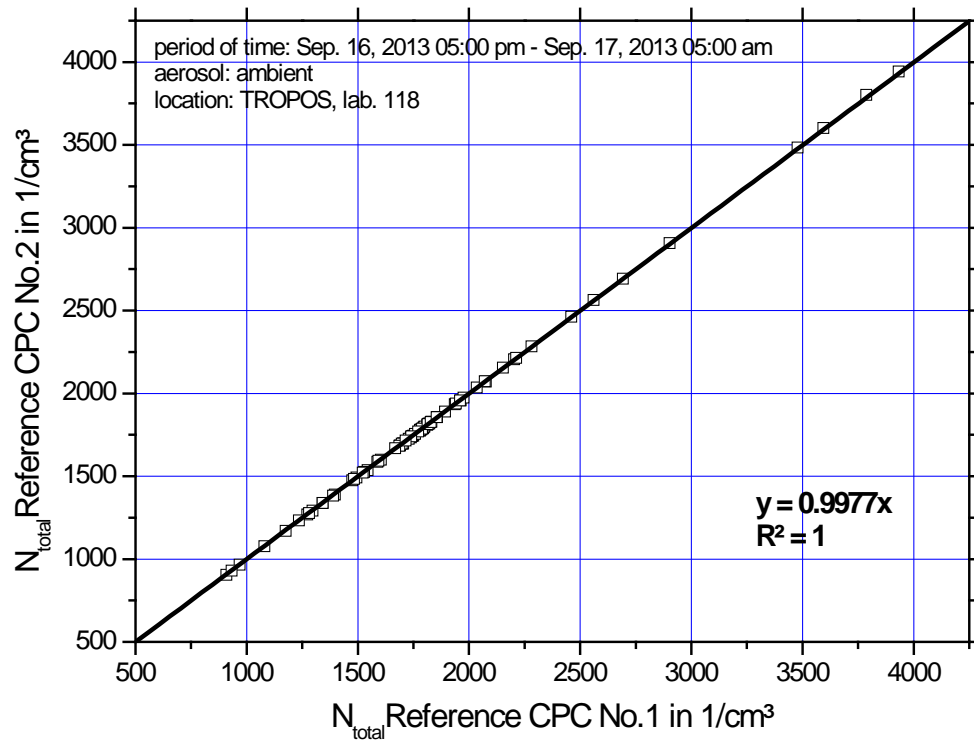


Fig.5. Linear regression between two TROPOS CPCs (Model 3772). Flow corrections are included.

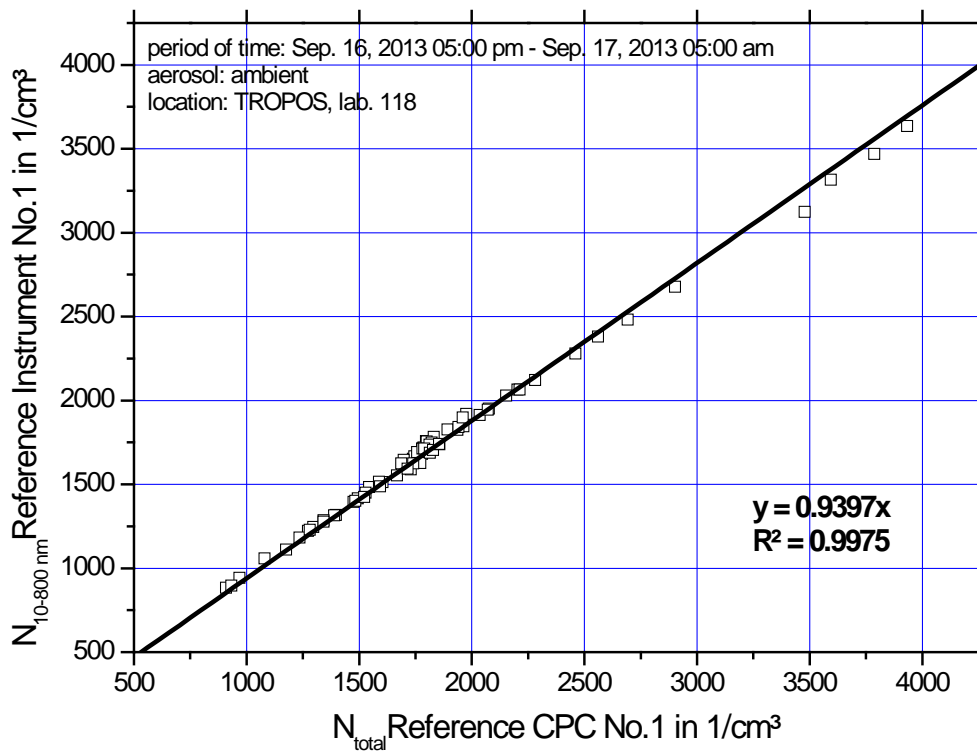


Fig.6. Linear regression between the particle number concentrations of TROPOS reference CPC No.1 and TROPOS reference instrument No.1. Internal diffusion losses and flow corrections are included.

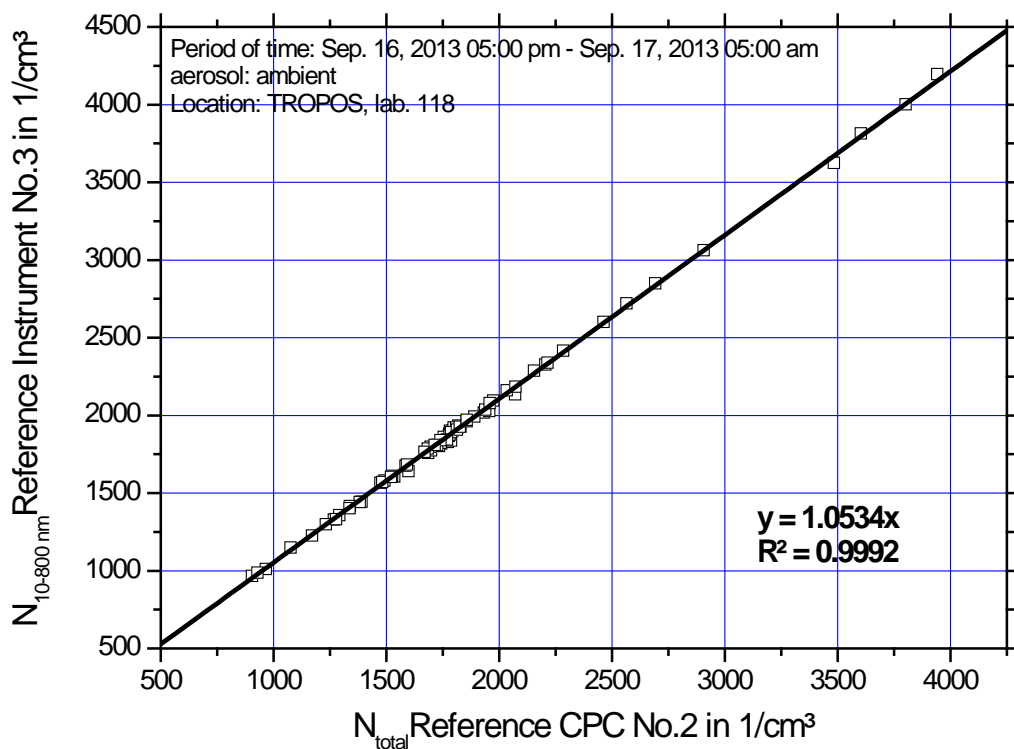


Fig.7. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.3. Internal diffusion losses and flow corrections are included.

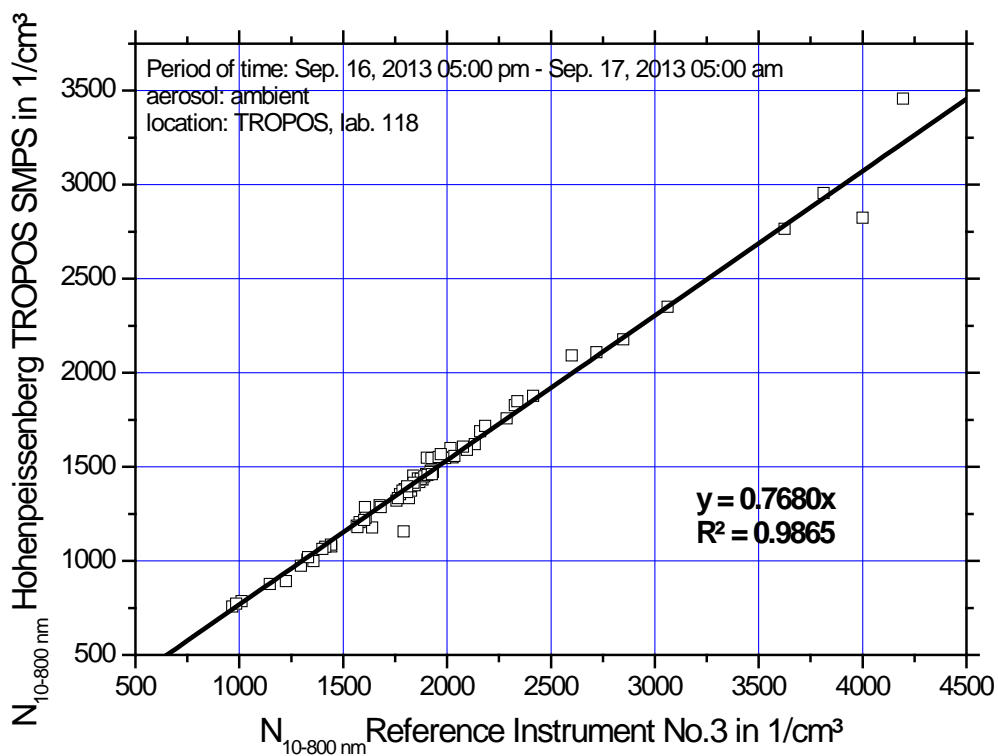


Fig.8. Linear regression between the particle number concentrations of TROPOS reference instrument No.3 and Hohenpeissenberg TROPOS SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

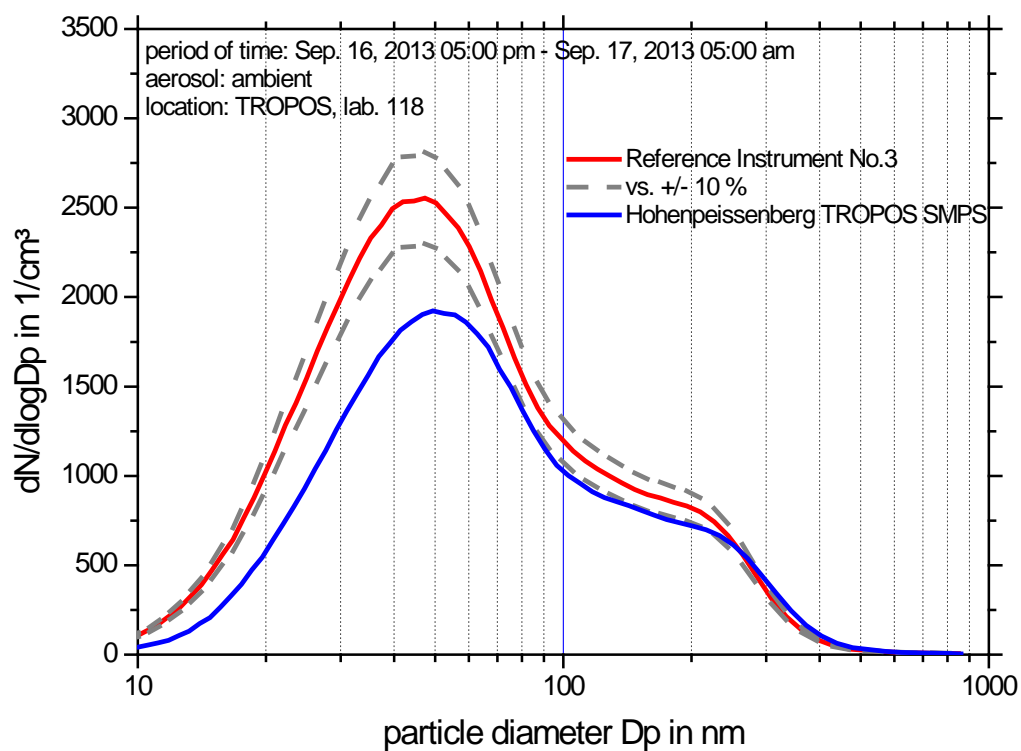


Fig.9. Comparison of mean particle number size distribution between Sep. 16, 2013 05:00 pm and Sep. 17, 2013 05:00 am. Internal diffusion losses and CPC efficiency are included.

B: Final run

Latex 203 nm

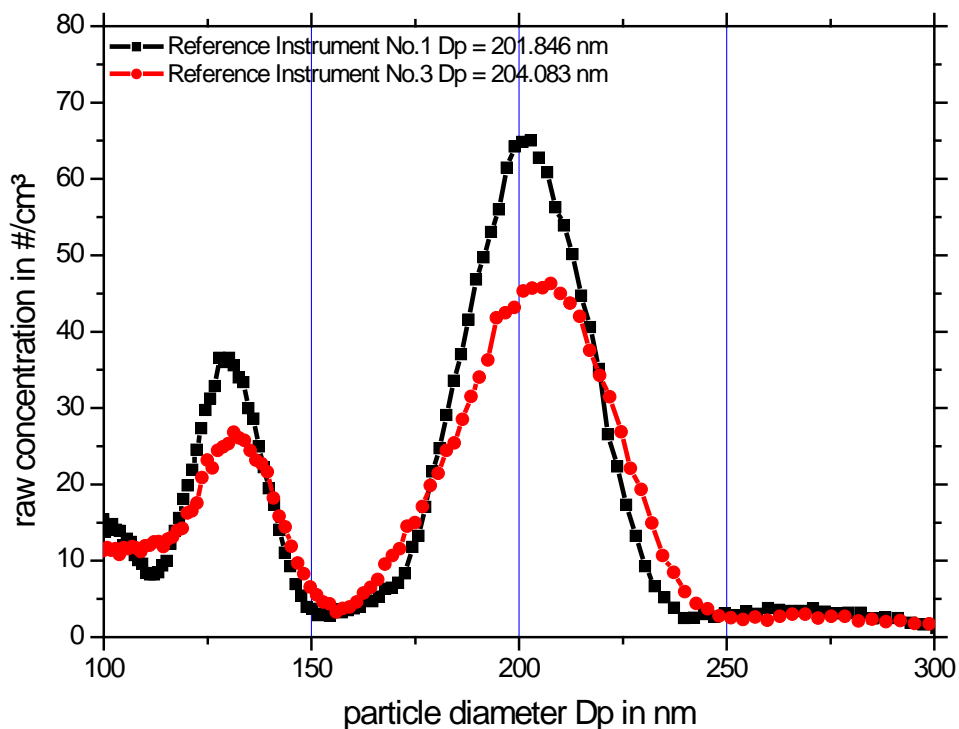


Fig.10. Measurement of latex 203 nm for TROPOS reference instrument No.1 and No.3: Particle size distribution (raw concentration) for latex on Sep. 18, 2013 03:55 pm and 04:05 pm (UTC time).

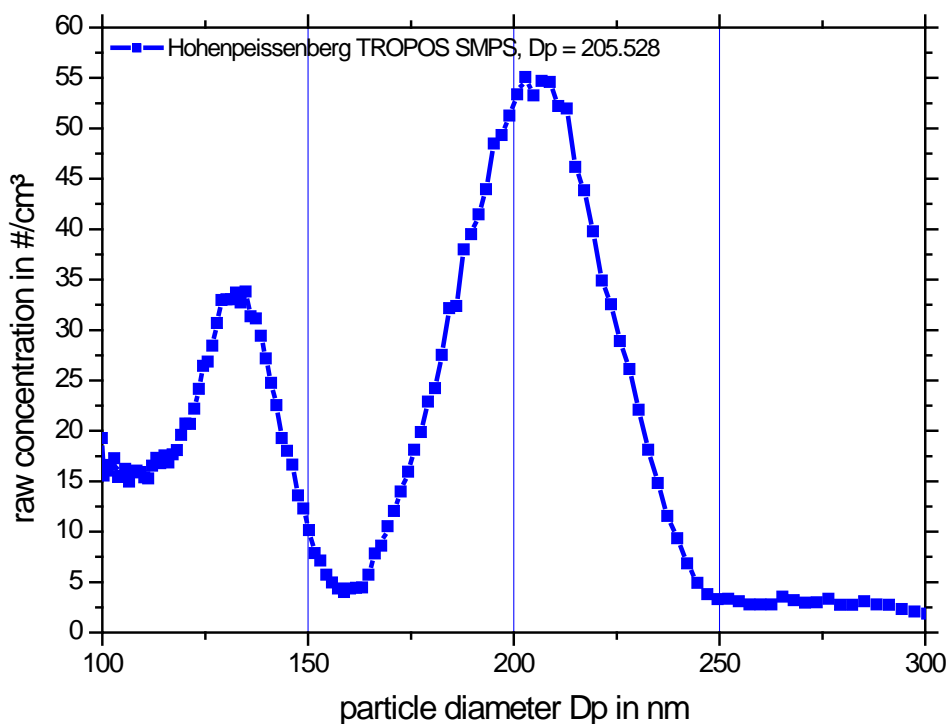


Fig.11. Measurement of latex 203 nm for instrument Hohenpeissenberg TROPOS SMPS: Particle size distribution (raw concentration) for latex 2013 on Sep. 18, 2013 between 03:55 pm and 04:05 pm (UTC time).

1. Time series

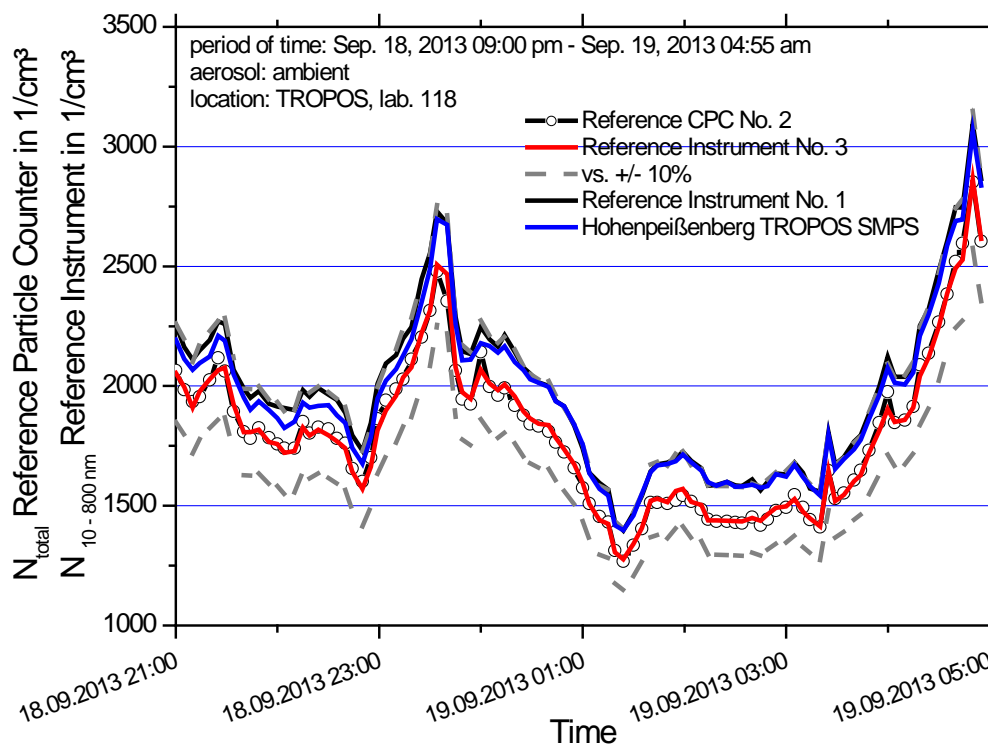


Fig.12. Time series (Sep. 18, 2013 09:00 pm - Sep. 19, 2013 04:55 am) of the integrated particle number concentration ($N_{10-800\text{nm}}$). Flow corrections are included.

2. Correlation

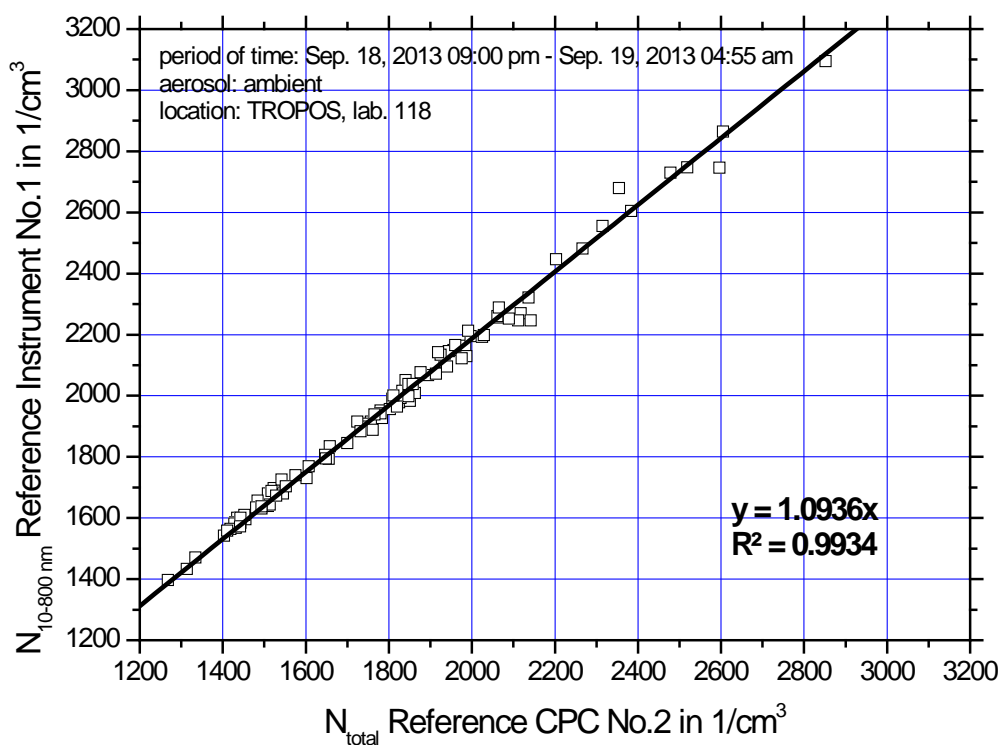


Fig.13. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.1. Internal diffusion losses and flow corrections are included.

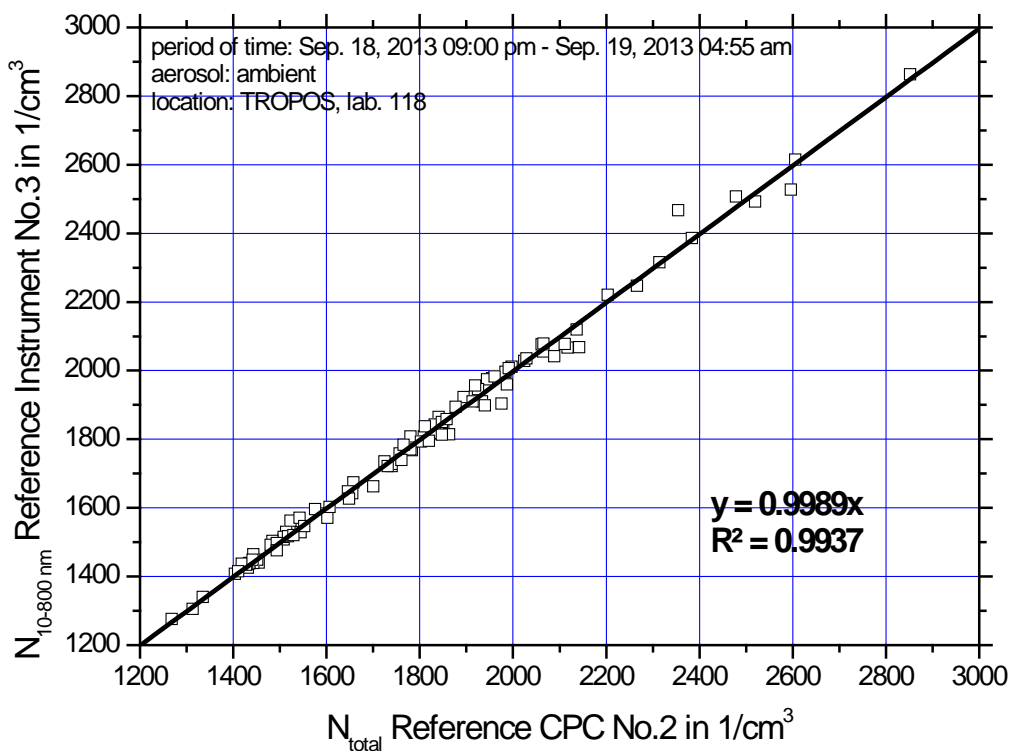


Fig.14. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.3. Internal diffusion losses and flow corrections are included.

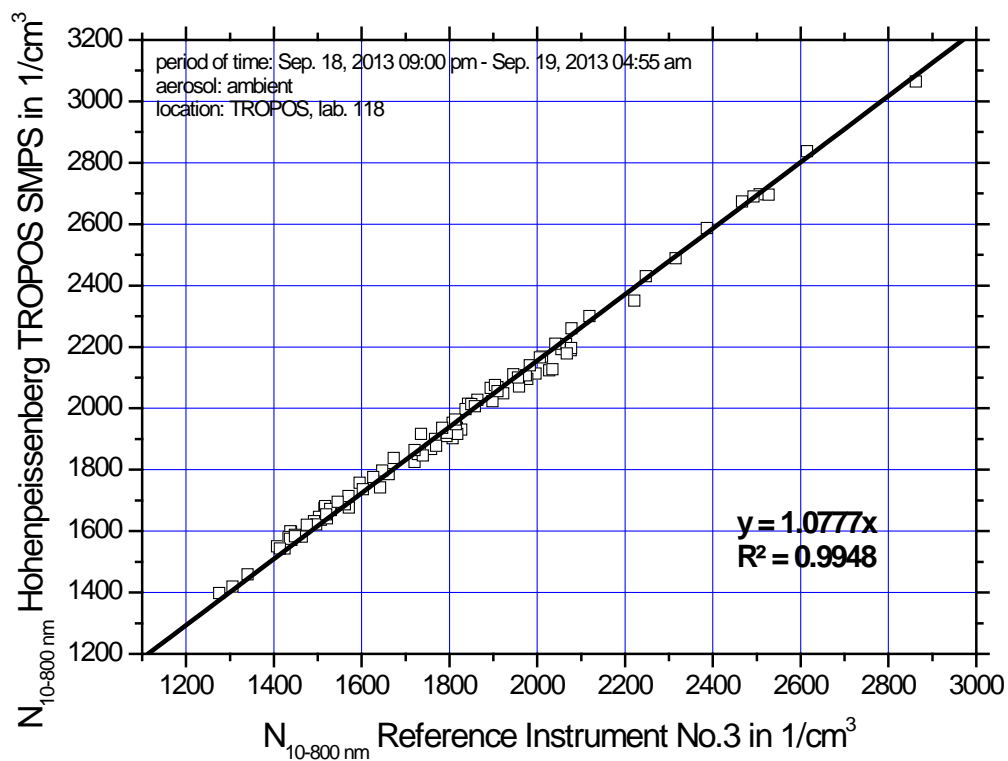


Fig.15. Linear regression between the particle number concentrations of TROPOS reference instrument No.3 and Hohenpeissenberg TROPOS SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

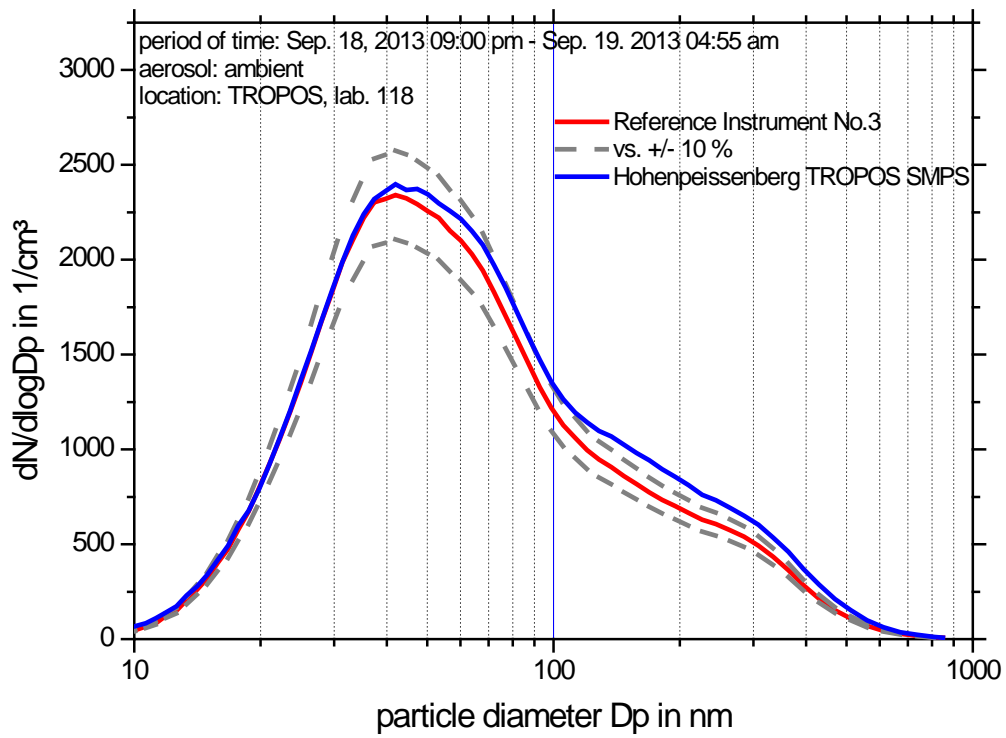


Fig.16. Comparison of mean particle number size distribution between Sep. 18, 2013 09:00 pm and Sep. 19, 2013 04:55 am. Internal diffusion losses and CPC efficiency are included.

Intercomparison of ISSeP TROPOS SMPS

Basic information

Location of the quality assurance:	TROPOS, lab: 118
Delivery date:	Sep. 16, 2013
Setup in the laboratory:	Sep. 16, 2013
Comparison period:	Sep. 16, 2013 - Sep. 20, 2013
Instrument:	ISSeP TROPOS SMPS
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	Benjamin Bergmans (b.bergmans@issep.be)

Summary:

From Sep. 16, 2013 to Sep. 20, 2013 the ISSeP TROPOS SMPS participated successfully the TROPOS ACTRIS Workshop. The workshop consisted of an entrance test and a final run. In addition to the overnight ambient measurements, we had numerous high voltage checks, zero- and PSL- measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that, we show for each run the time series of the particle number concentration, the particle number size distribution, and correlation plots. If anything was written in the log book, so we added this also in this report. As reference standards, we used CPCs model TSI 3772 for total particle number concentration and two TROPOS mobility particle size spectrometer. The particle counters have been calibrated against a calibrated TSI electrometer 3068 B with the serial number 70838596.

For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. The ISSeP TROPOS SMPS showed in the PSL-measurements a particle diameter of 204.8 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. If we look at the final ambient measurement run, the ISSeP TROPOS SMPS is within the uncertainty range of +/- 10 %. The ISSeP TROPOS SMPS passed the ACTRIS Workshop. There is no re-examination required.

Log book:

Sep. 16, 2013

08:00-11:00 -> setup of ISSeP TROPOS SMPS in laboratory 118
-> $Q_{CPC} = 1.031$ l/min, $Q_{line} = 1.027$ l/min
-> zero check 0 #/cm³, HV calibration
11:38-12:33 -> latex mode; 208 nm
16:30 -> ambient measurements

Sep. 17, 2013

19:00 -> start with CPC China III, ambient
19:30 -> 2 runs with Latex
17:07 -> scan started
20:00 -> ambient measurement

Sep. 18, 2013

10:14 -> high voltage DMA
12:25 -> zero check
12:40 -> ambient measurements
12:59 -> change Kr-source
13:04 -> Ni source
13:13 -> changed DMA
15:25 -> new nafion
15:40 -> zero check
16:00-16:18 -> latex check
16:20 -> zero check
16:40 -> ambient measurement

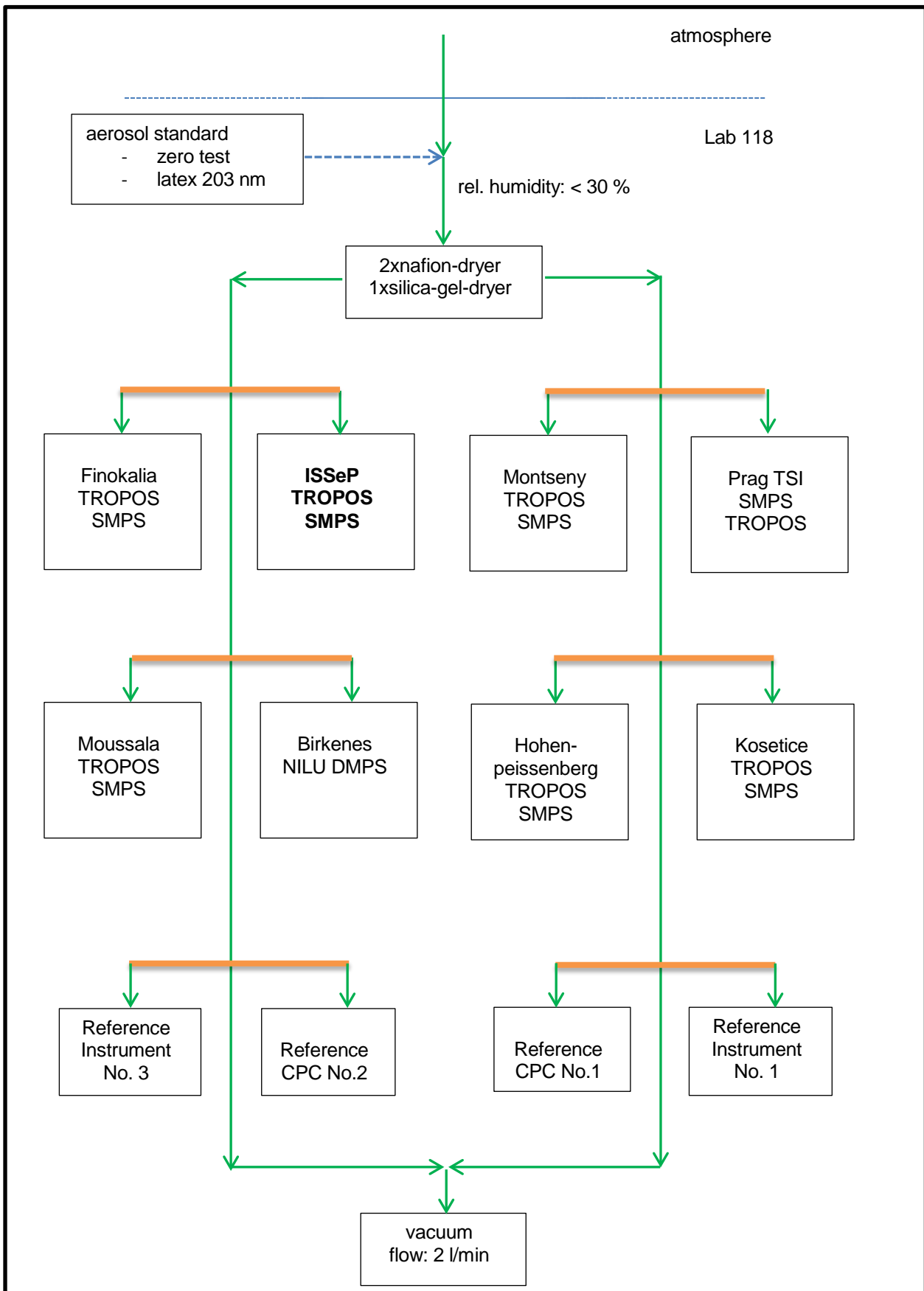
Sep. 19, 2013

07:00 -> no diffusion
09:30 -> zero check
09:45 -> ambient measurement
17:00 -> ambient with total CPC

Sep. 20, 2013

05:25 -> stop measurements for CPC calibration

Laboratory setup



A: First run

Latex 203 nm

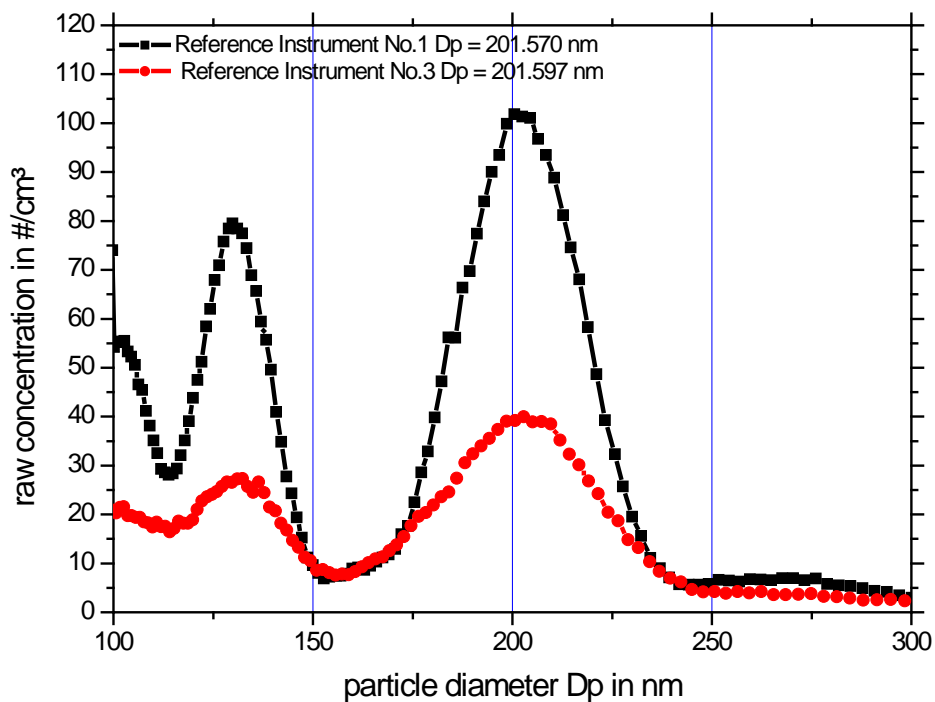


Fig.1. Measurement of latex 203 nm for TROPOS reference instrument No.1 and No.3: Particle size distribution (raw concentration) for latex on Sep. 16, 2013 between 01:40 pm and 02:00 pm (UTC time).

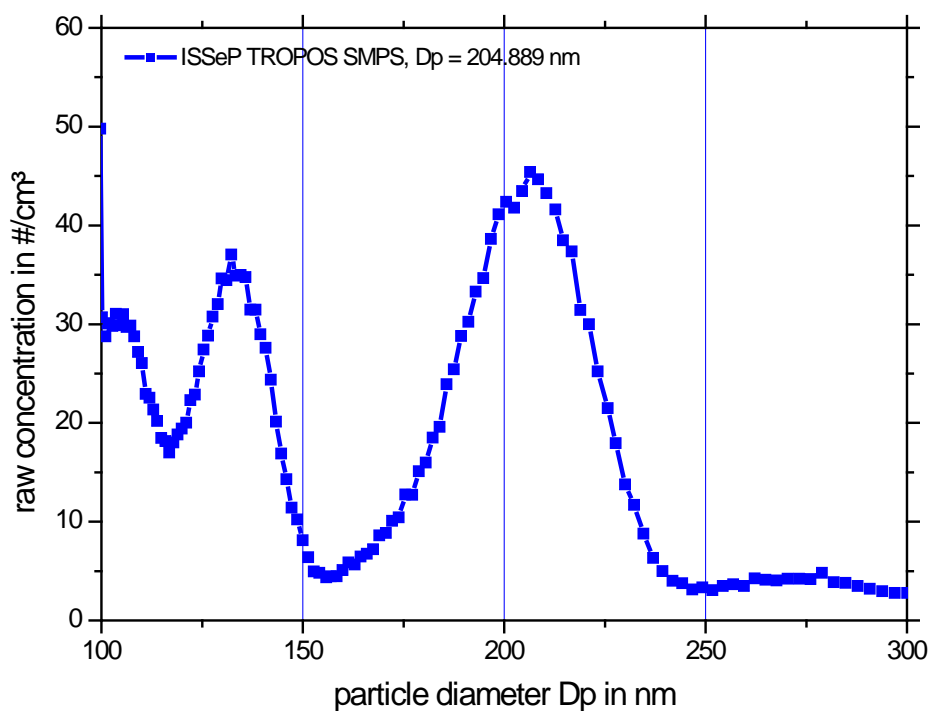


Fig.2. Measurement of latex 203 nm for instrument ISSeP TROPOS SMPS: Particle size distribution (raw concentration) for latex 2013 on Sep. 16, 2013 between 03:40 pm and 03:50 pm (UTC time).

CPC efficiency

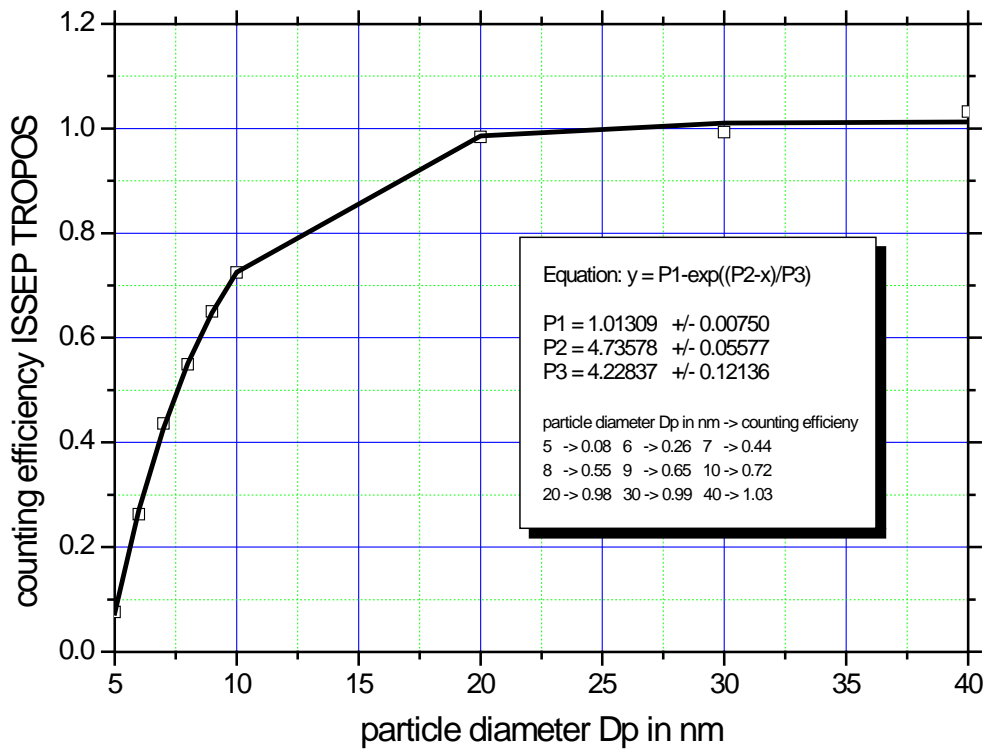


Fig.3. CPC efficiency curve. Based on Electrometer TSI 3068B. Serial number: 70838596

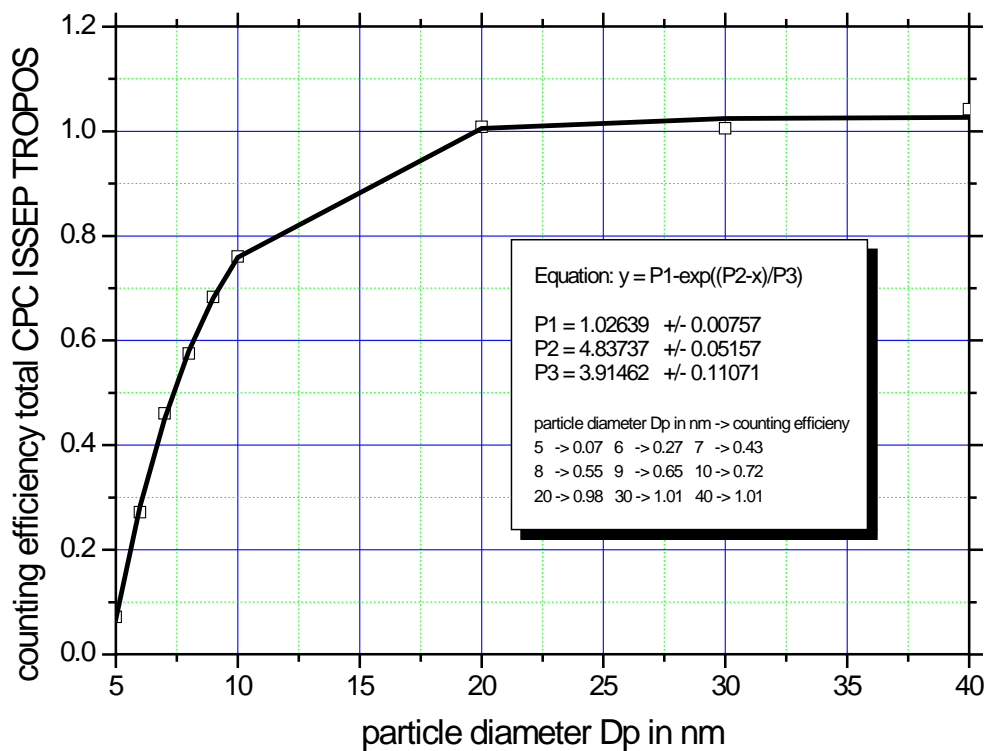


Fig.4. CPC (total CPC) efficiency curve. Based on Electrometer TSI 3068B. Serial number: 70838596

1. Time series

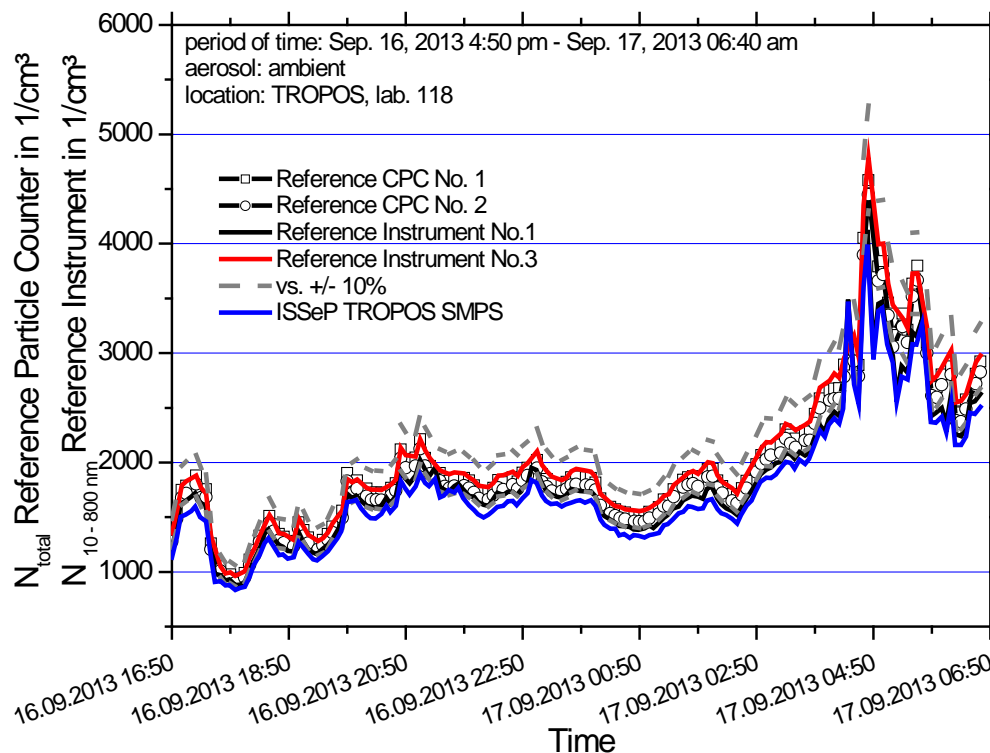


Fig.5. Time series (Sep. 16, 2013 04:50 pm - Sep. 17, 2013 06:40 am) of the integrated particle number concentration ($N_{10-800\text{nm}}$). Flow corrections are included

2. Correlation

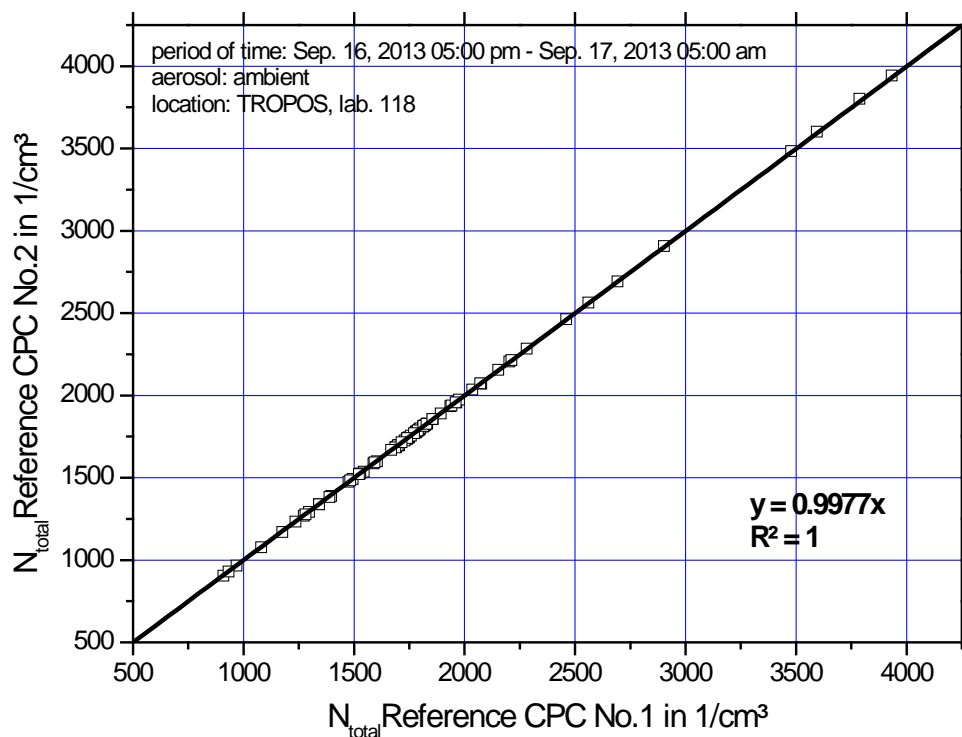


Fig.6. Linear regression between two TROPOS CPCs (Model 3772). Flow corrections are included.

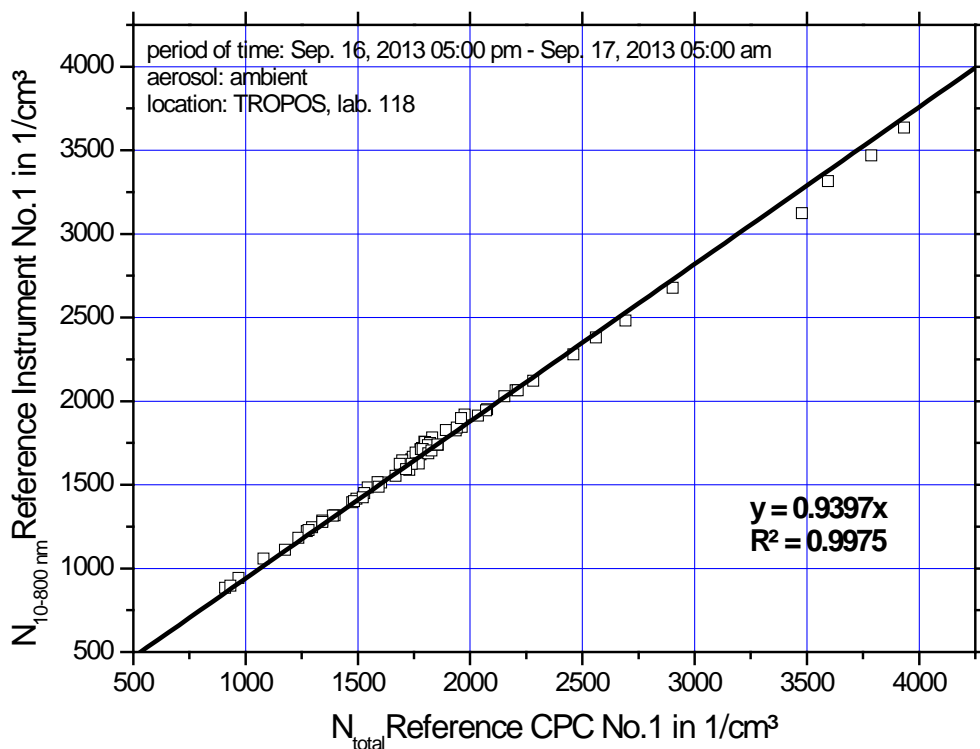


Fig.7. Linear regression between the particle number concentrations of TROPOS reference CPC No.1 and TROPOS reference instrument No.1. Internal diffusion losses and flow corrections are included.

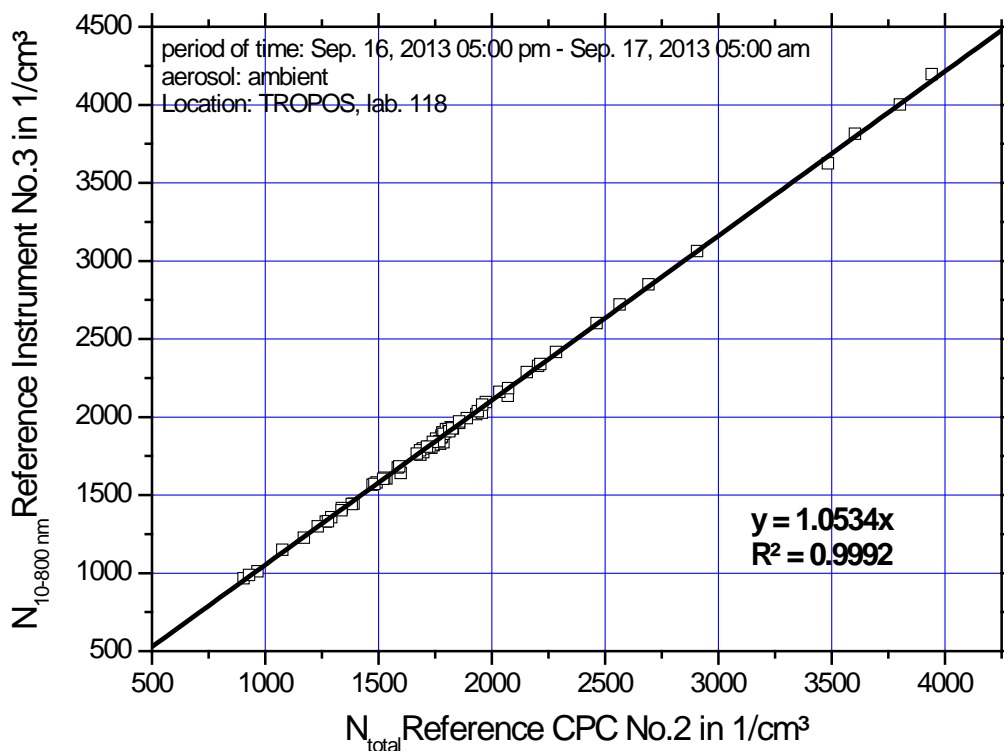


Fig.8. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.3. Internal diffusion losses and flow corrections are included.

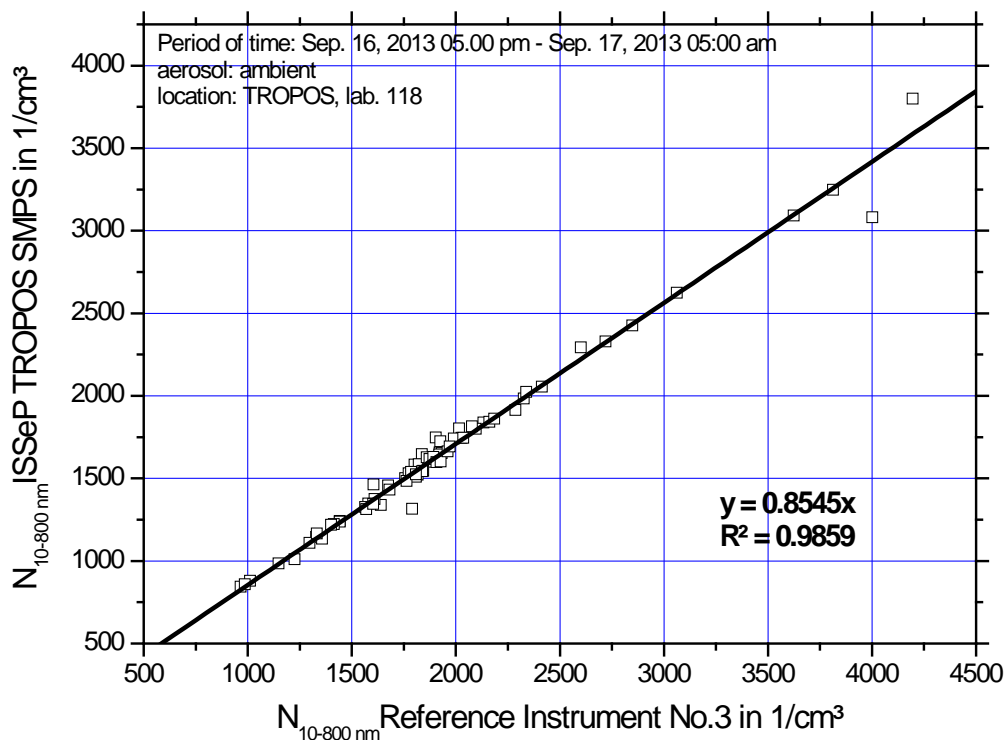


Fig.9. Linear regression between the particle number concentrations of TROPOS reference instrument No.3 and ISSeP TROPOS SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

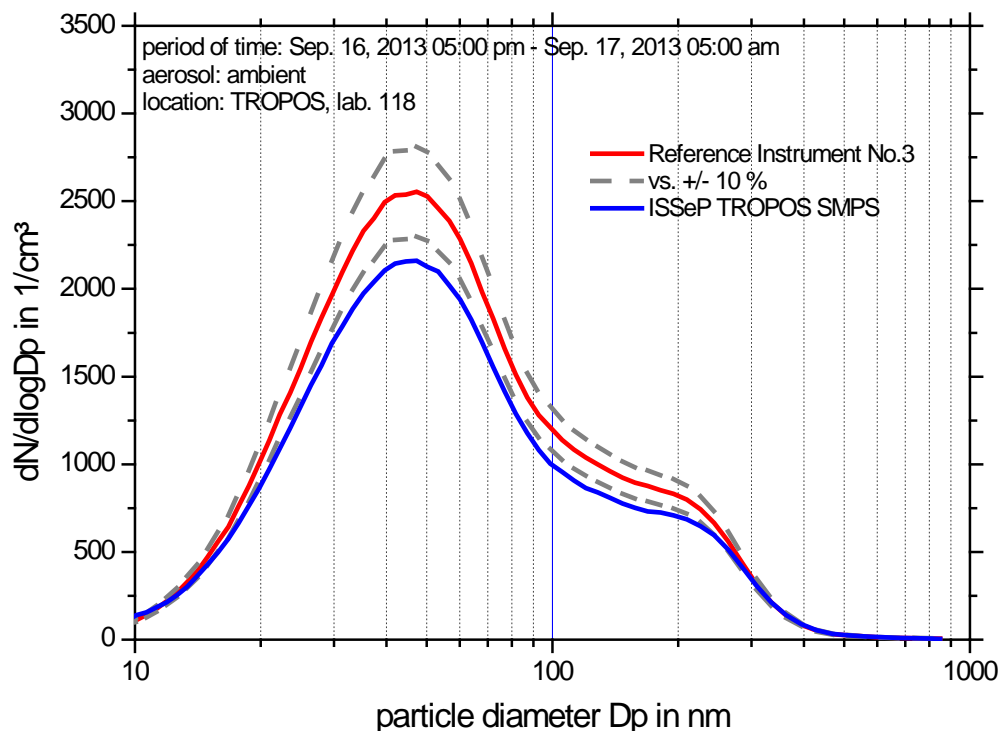


Fig.10. Comparison of mean particle number size distribution between Sep. 16, 2013 05:00 pm and Sep. 17, 2013 05:00 am. Internal diffusion losses and CPC efficiency are included.

B: Final run

Latex 203 nm

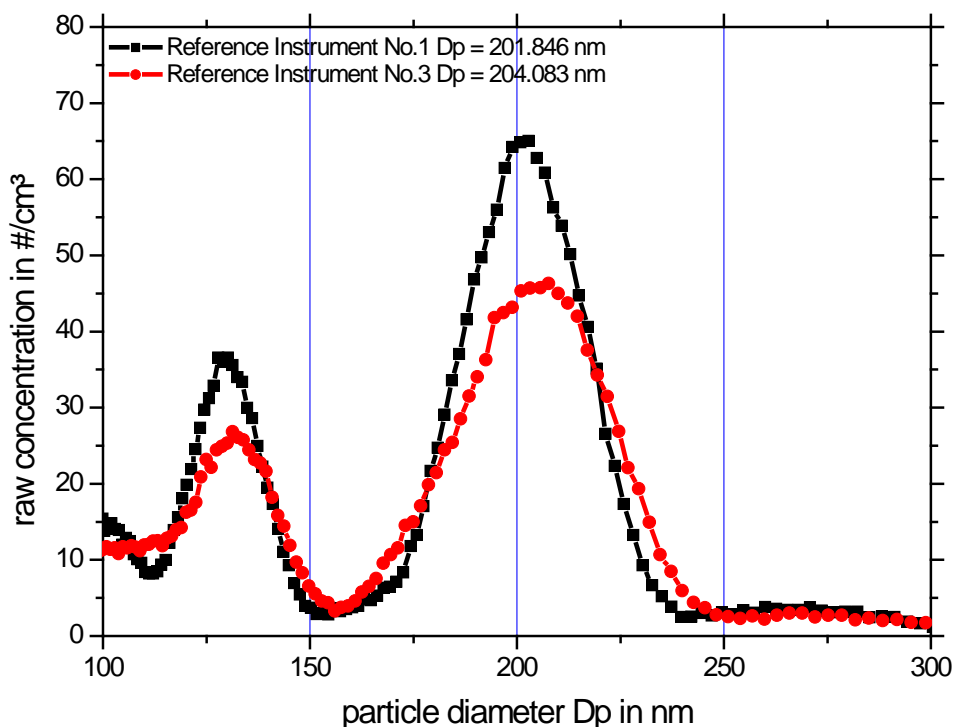


Fig.11. Measurement of latex 203 nm for TROPOS reference instrument No.1 and No.3: Particle size distribution (raw concentration) for latex on Sep. 18, 2013 04:00 pm and 04:15 pm (UTC time).

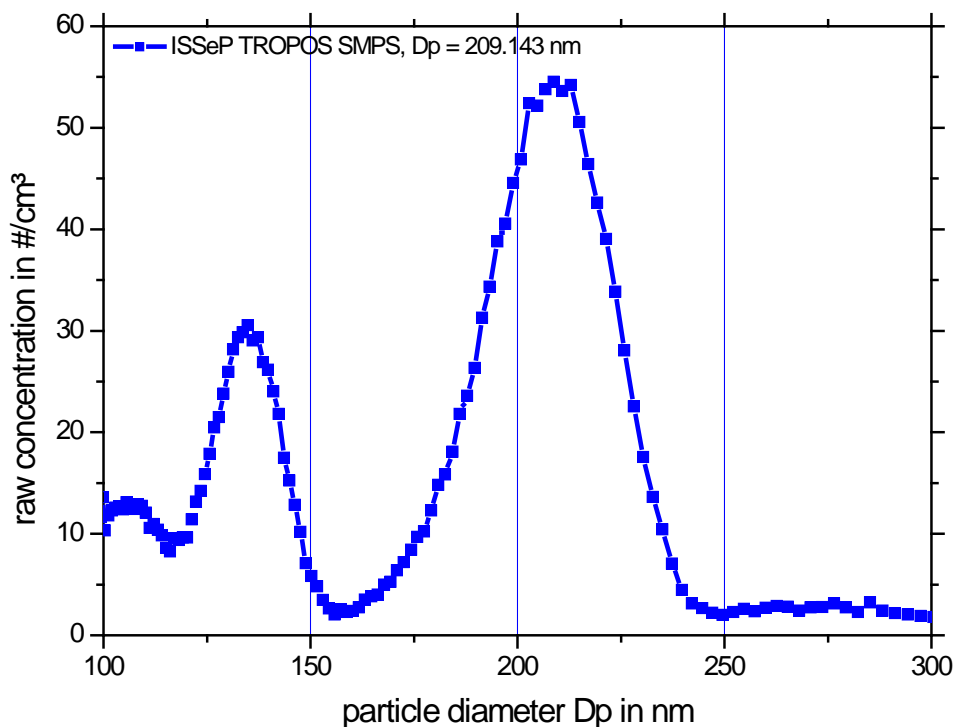


Fig.12. Measurement of latex 203 nm for instrument ISSeP TROPOS SMPS: Particle size distribution (raw concentration) for latex 2013 on Sep. 18, 2013 between 03:55 pm and 04:05 pm (UTC time).

1. Time series

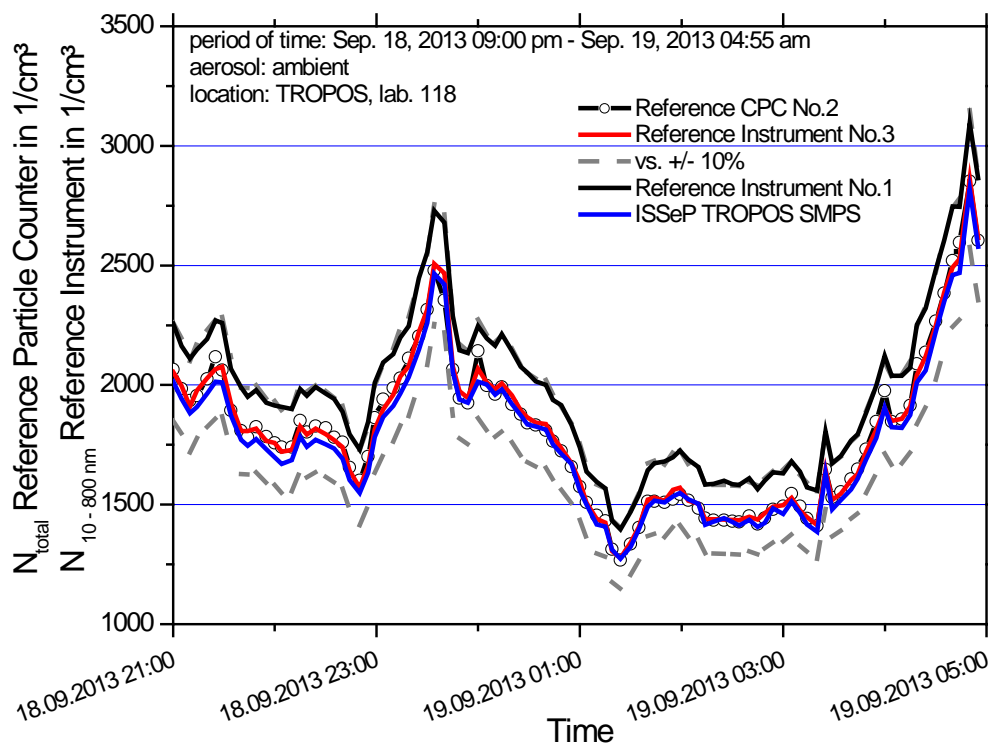


Fig.13. Time series (Sep. 18, 2013 09:00 pm - Sep. 19, 2013 04:55 am) of the integrated particle number concentration ($N_{10-800nm}$). Flow corrections are included.

2. Correlation

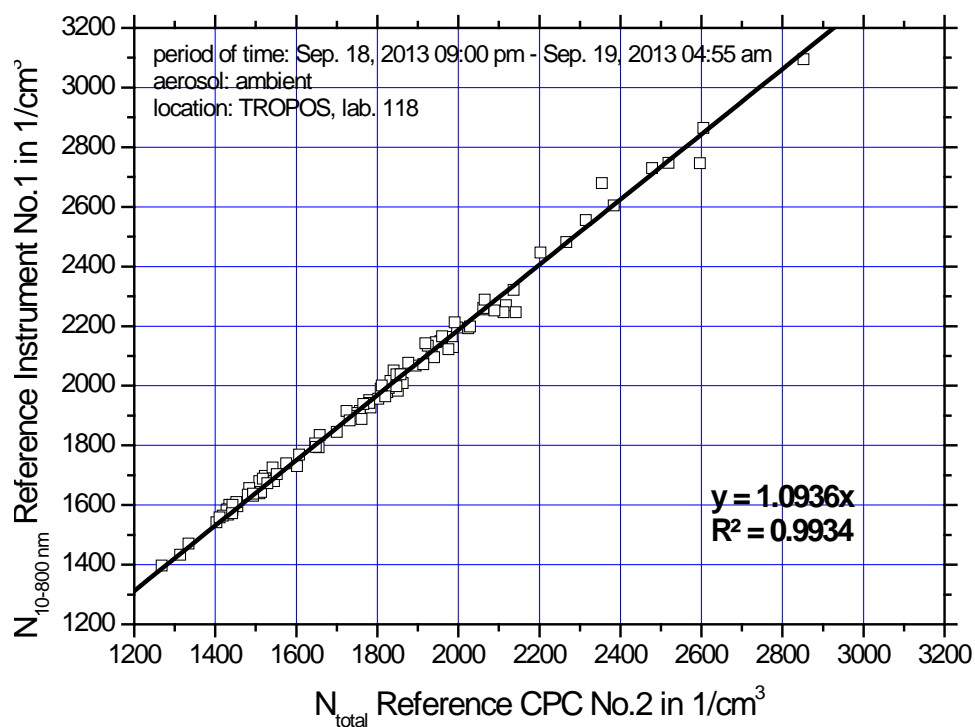


Fig.14. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.1. Internal diffusion losses and flow corrections are included.

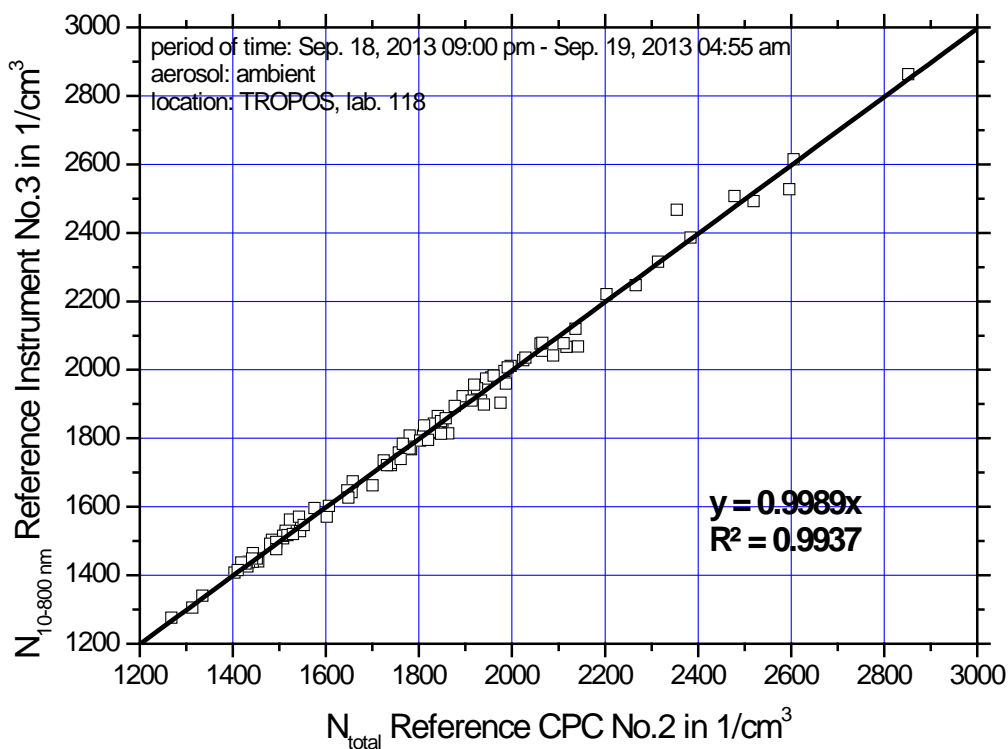


Fig.15. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.3. Internal diffusion losses and flow corrections are included.

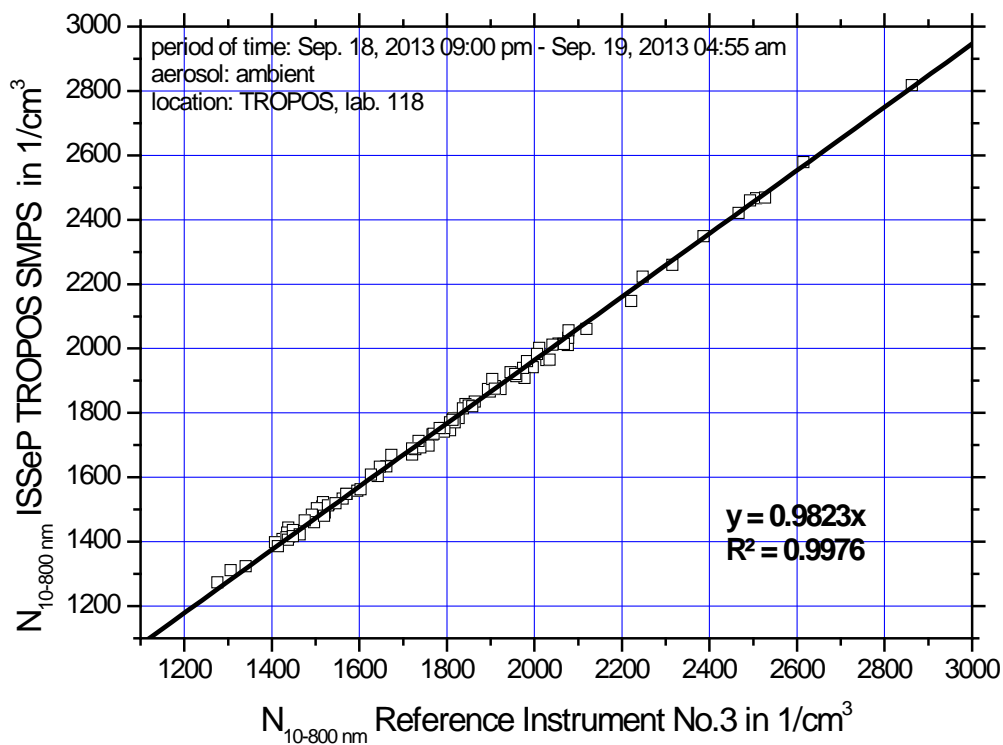


Fig.16. Linear regression between the particle number concentrations of TROPOS reference instrument No.3 and ISSeP TROPOS SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

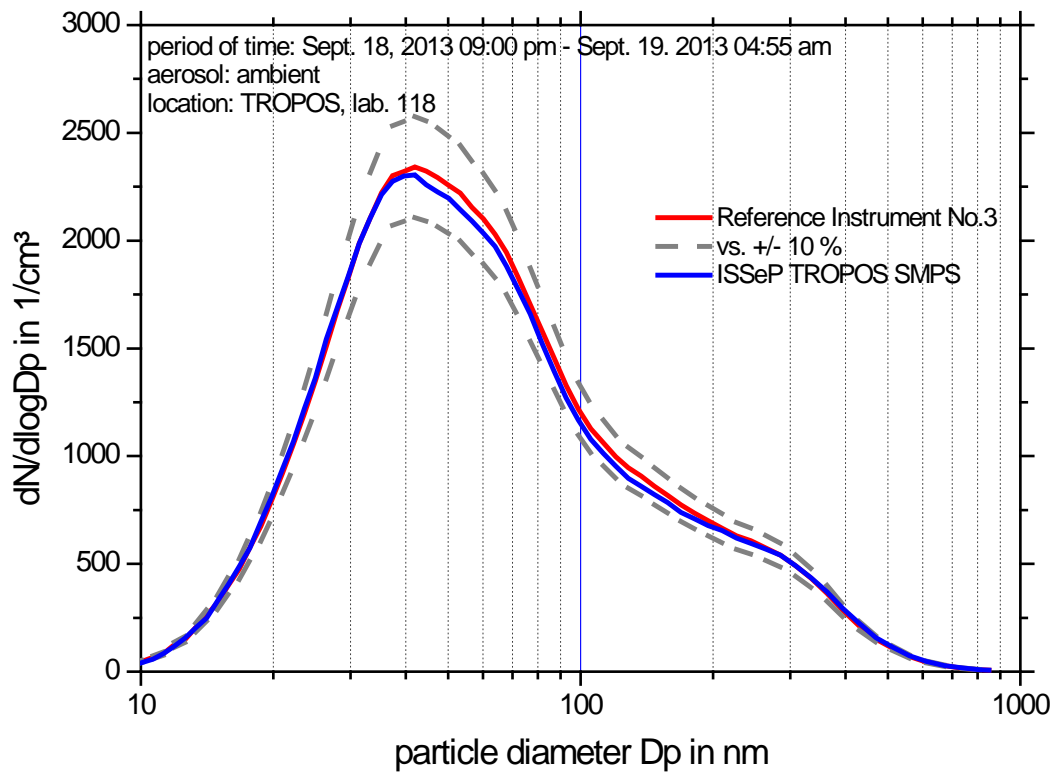


Fig.17. Comparison of mean particle number size distribution between Sep. 18, 2013 09:00 pm and Sep. 19, 2013 04:55 am. Internal diffusion losses and CPC efficiency are included.

Intercomparison of Kosetice TROPOS SMPS

Basic information

Location of the quality assurance:	TROPOS, lab: 118
Delivery date:	Sep. 16, 2013
Setup in the laboratory:	Sep. 16, 2013
Comparison period:	Sep. 16, 2013 – Sep. 20, 2013
Instrument:	Kosetice TROPOS SMPS
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	Nadia Zikova(zikova@icpf.cas.cz)

Summary:

From Sep. 16, 2013 to Sep. 20, 2013 the Kosetice TROPOS SMPS participated the TROPOS ACTRIS Workshop. The workshop consisted of an entrance test and a final run. In addition to the overnight ambient measurements, we had numerous high voltage checks, zero- and PSL- measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that, we show for each run the time series of the particle number concentration, the particle number size distribution, and correlation plots. If anything was written in the log book, so we added this also in this report. As reference standards, we used CPCs model TSI 3772 for total particle number concentration and two TROPOS mobility particle size spectrometer. The particle counters have been calibrated against a calibrated TSI electrometer 3068 B with the serial number 70838596.

For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. The Kositice TROPOS SMPS showed in the PSL-measurements a particle diameter of 201.4 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. If we

look at the final ambient measurement run, the Kosetice TROPOS SMPS is out of the 10%.
The Kosetice TROPOS SMPS didn't pass the ACTRIS Workshop.

Log book:

Sep. 16, 2013

08:00-11:00 -> setup of Kosetice TROPOS SMPS in laboratory 118
-> $Q_{CPC} = 1.026$ l/min, $Q_{line} = 1.022$ l/min
11:13-12:39 -> change to Latex mode (11:36 started), 203 nm ok
12:45 -> ambient measurement
14:41 -> sampling from manifold
16:30 -> start ambient measurement

Sep. 17, 2013

06:50 -> CPC change to Kosetice after cleaning, $Q_{CPC} = 1.022$ l/min
16:00 -> CPC back from intercomparison, measurement stopped, HV check
17:07 -> scan started
17:43 -> flow rate 1.028 l/min
18:00-18:10 -> zero check 0 #/cm³
19:25 -> 2 latex scans (203 nm, 203 nm)
20:00 -> stop, ambient

Sep. 18, 2013

10:00 -> nafion checked ok, nafion bypassed
-> HV check with new software, new HV calibration
12:16 -> DMA change for TROPOS
12:17 -> ambient measurement without nafion
15:40 -> zero check with new nafion dryer
15:55-16:25 -> latex, zero check

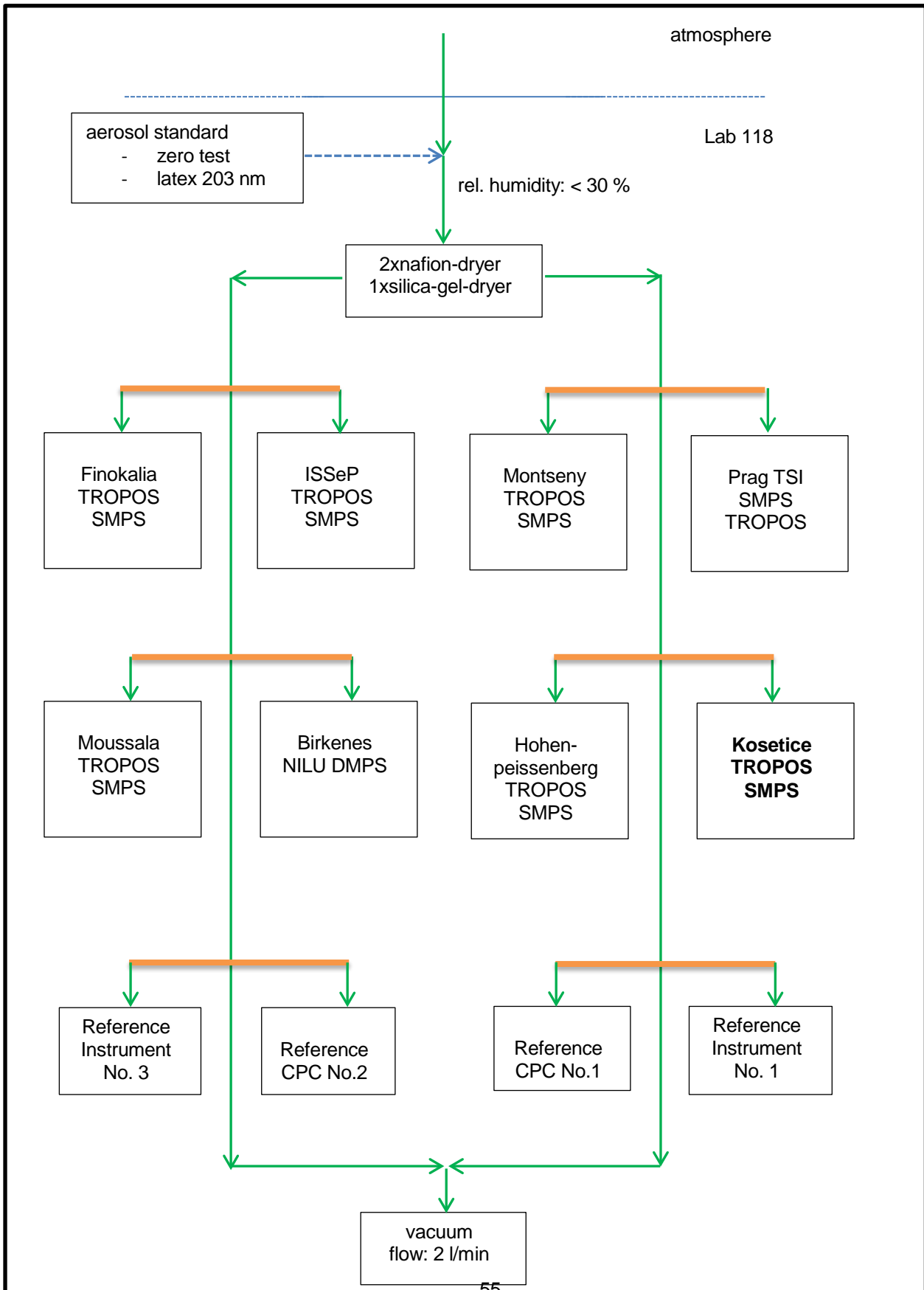
Sep. 19, 2013

07:00 -> diffusion screens added
07:50 -> stop ambient, software update
09:45 -> ambient

Sep. 20, 2013

07:12 -> stop measurements

Laboratory setup



A: First run

Latex 203 nm

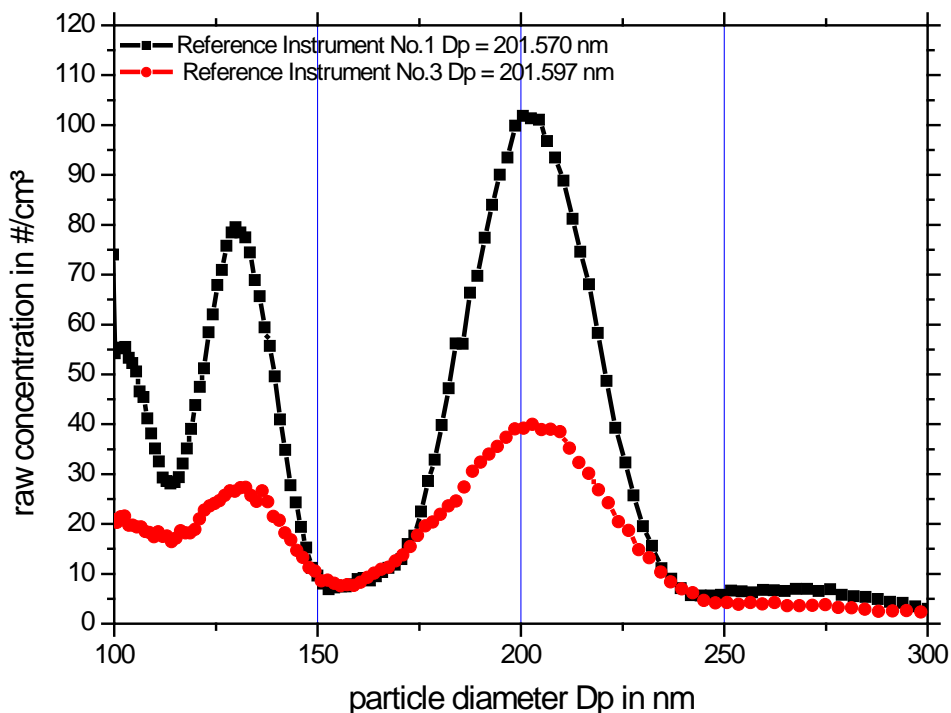


Fig.1. Measurement of latex 203 nm for TROPOS reference instrument No.1 and No.3: Particle size distribution (raw concentration) for latex on Sep. 16, 2013 between 01:20 pm and 01:45 pm (UTC time).

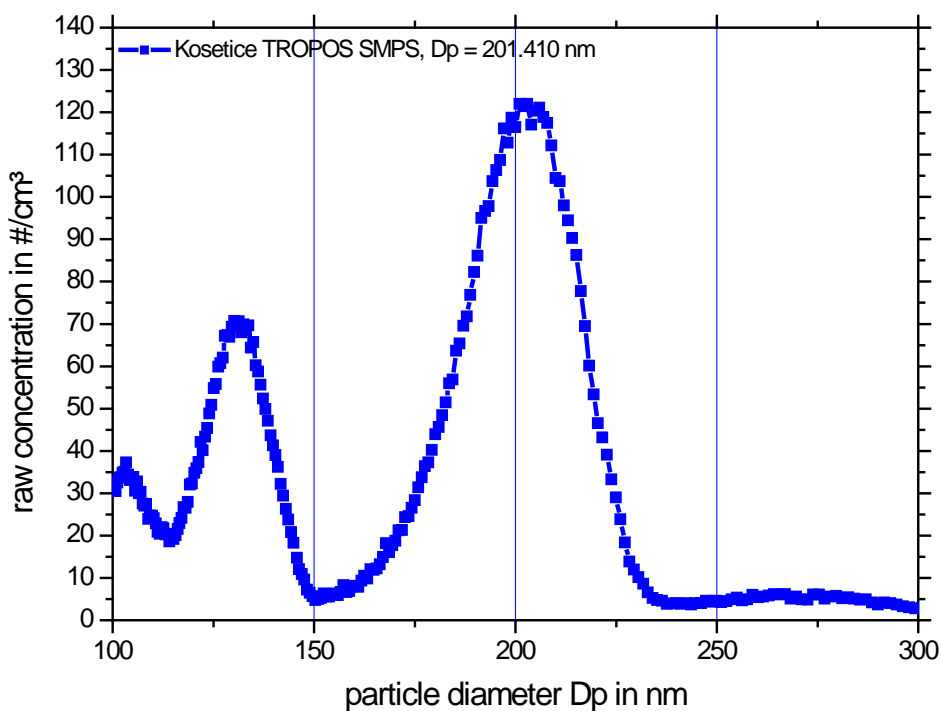


Fig.2. Measurement of latex 203 nm for instrument Kosetice TROPOS SMPS: Particle size distribution (raw concentration) for latex 2013 on Sep. 16, 2013 between 12:10 pm and 12:25 pm (UTC time).

CPC efficiency

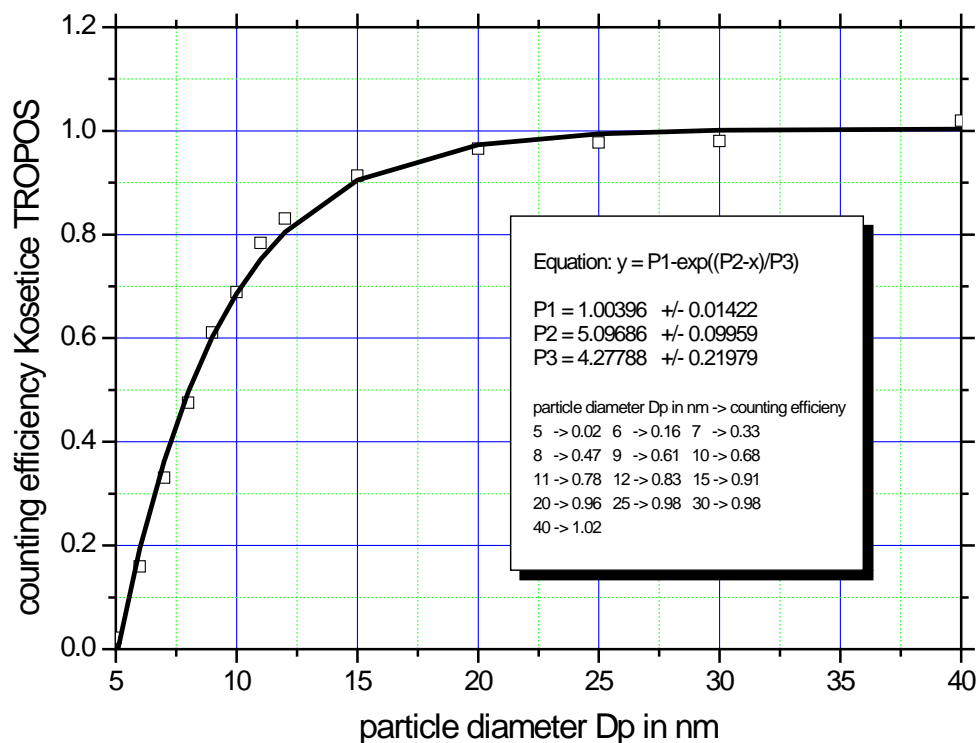


Fig.3. CPC efficiency curve. Based on Electrometer TSI 3068B. Serial number: 70838596.

1. Time series

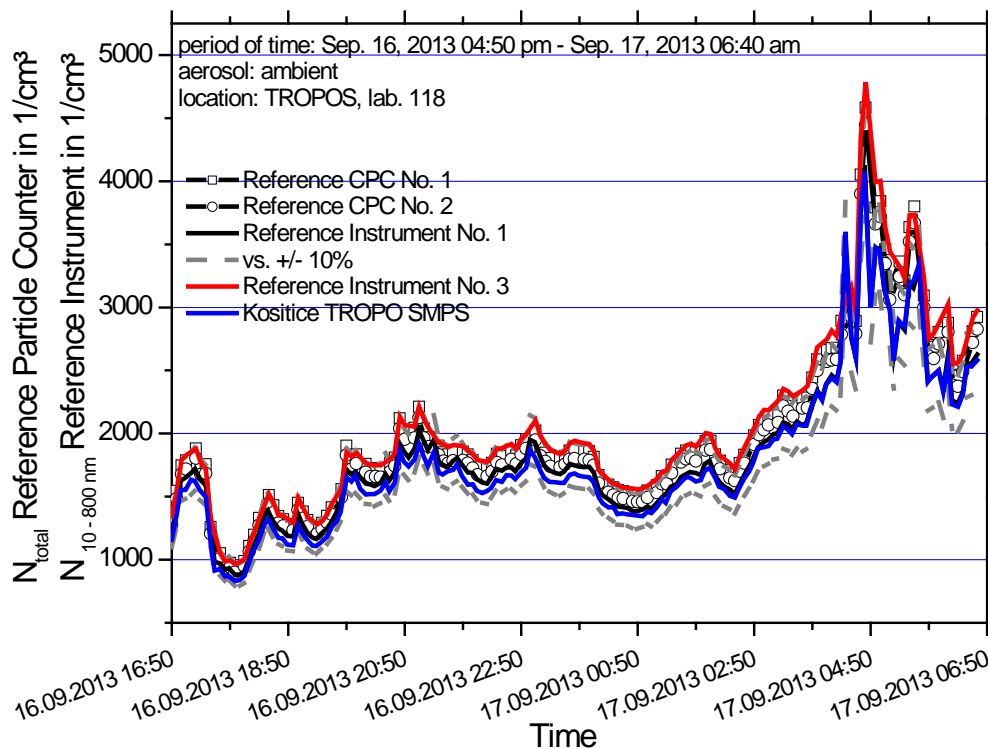


Fig.4. Time series (Sep. 16, 2013 04:50 pm - Sep. 17, 2013 06:40 am) of the integrated particle number concentration (N10-800nm). Flow corrections are included

2. Correlation

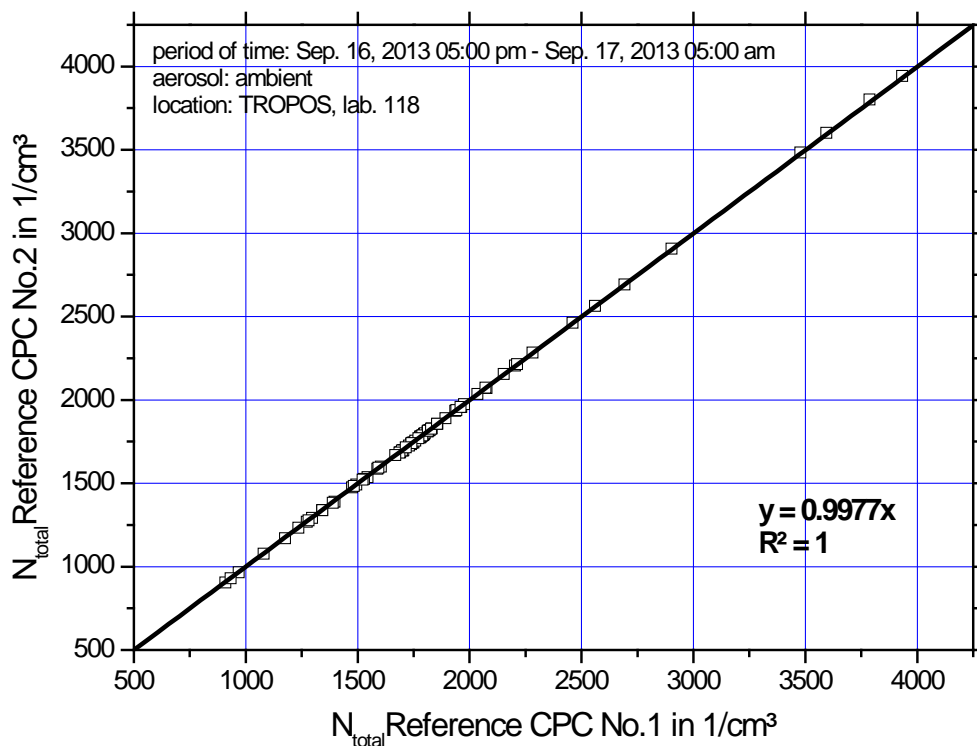


Fig.5. Linear regression between two TROPOS CPCs (Model 3772). Flow corrections are included.

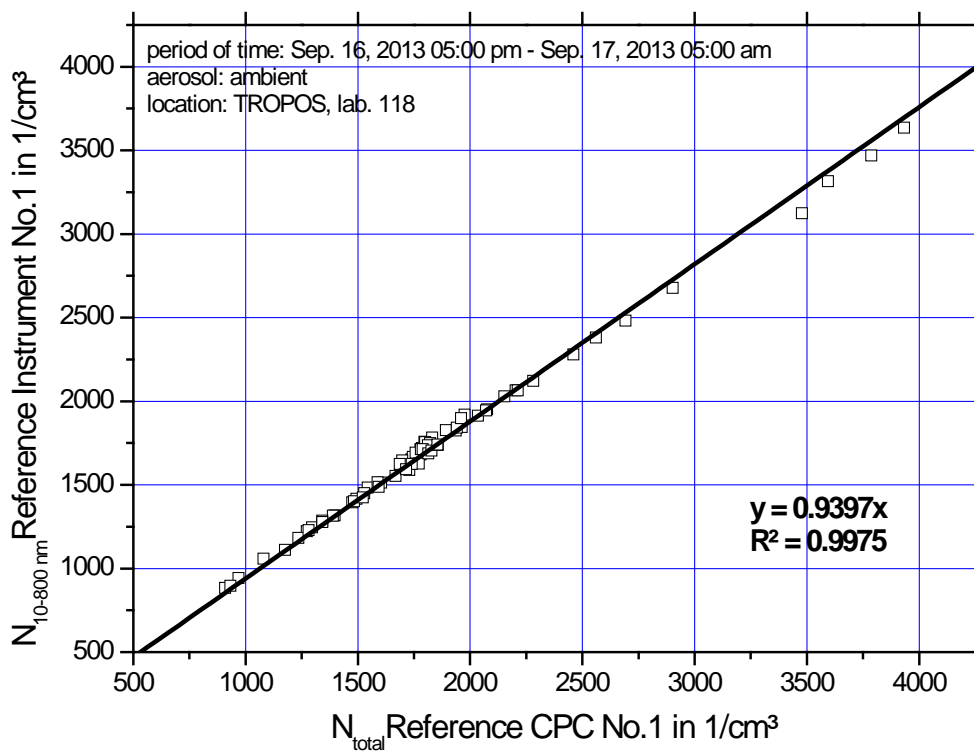


Fig.6. Linear regression between the particle number concentrations of TROPOS reference CPC No.1 and TROPOS reference instrument No.1. Internal diffusion losses and flow corrections are included.

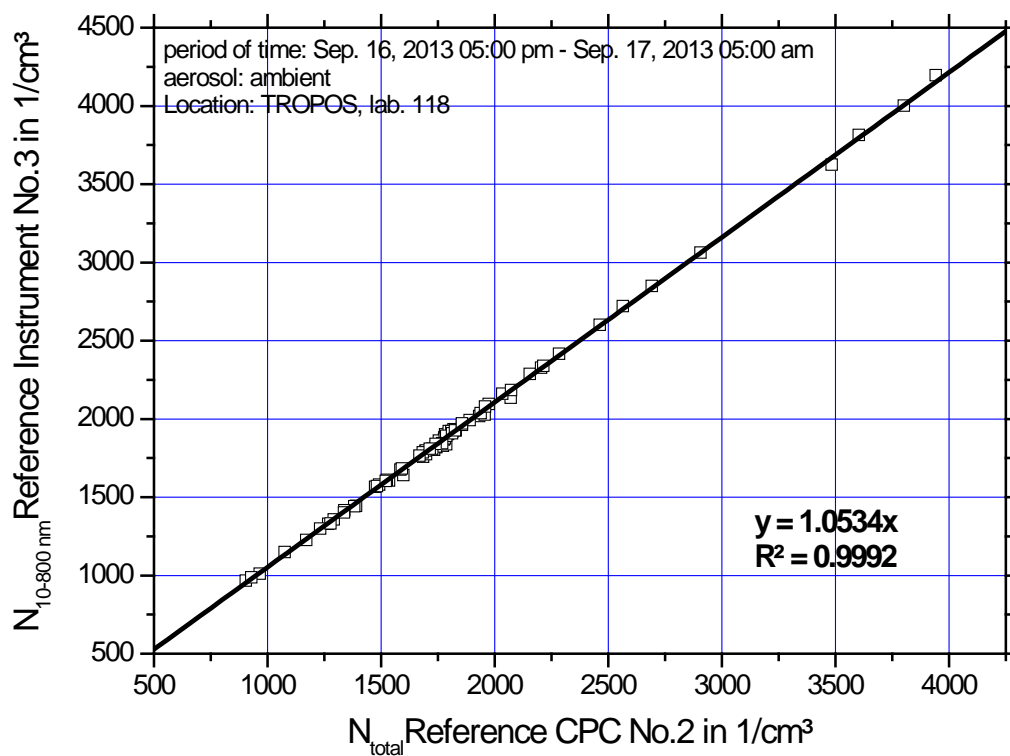


Fig.7. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.3. Internal diffusion losses and flow corrections are included.

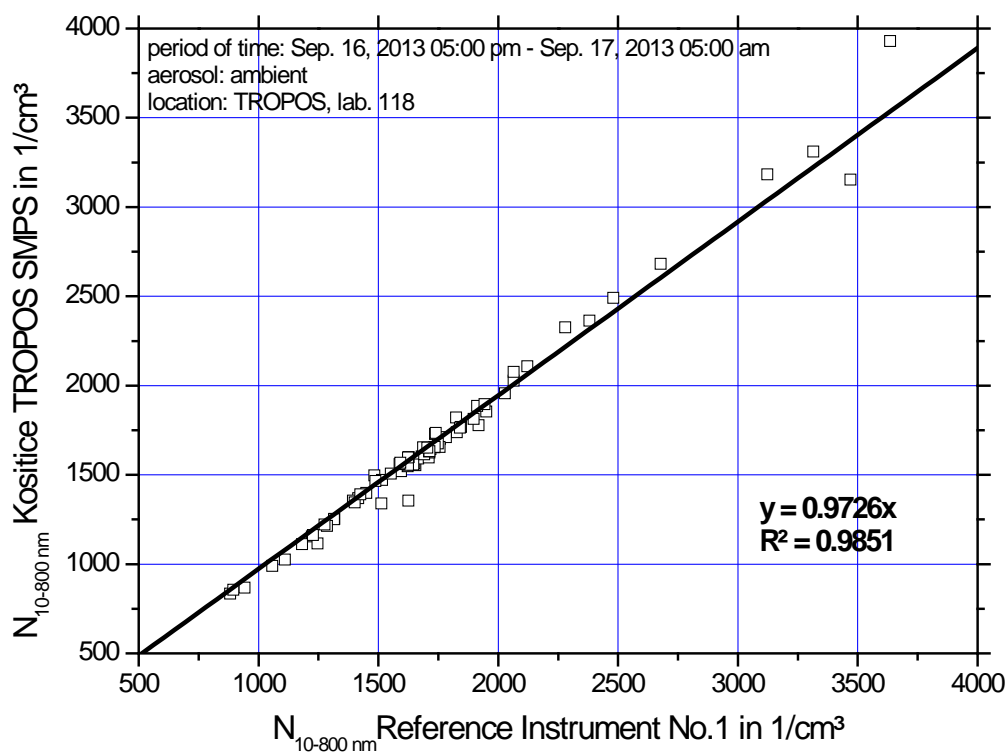


Fig.8. Linear regression between the particle number concentrations of TROPOS reference instrument No.1 and Kositice TROPOS SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

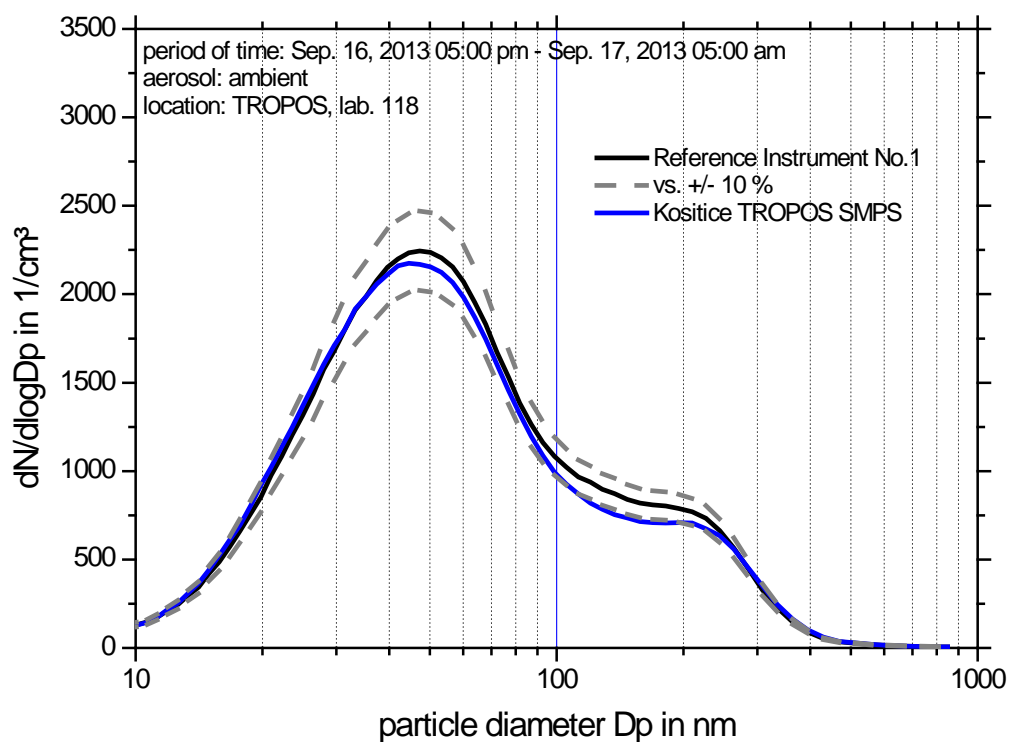


Fig.9. Comparison of mean particle number size distribution between Sep. 16, 2013 05:00 pm and Sep. 17, 2013 05:00 am. Internal diffusion losses and CPC efficiency are included.

B: Final run

Latex 203 nm

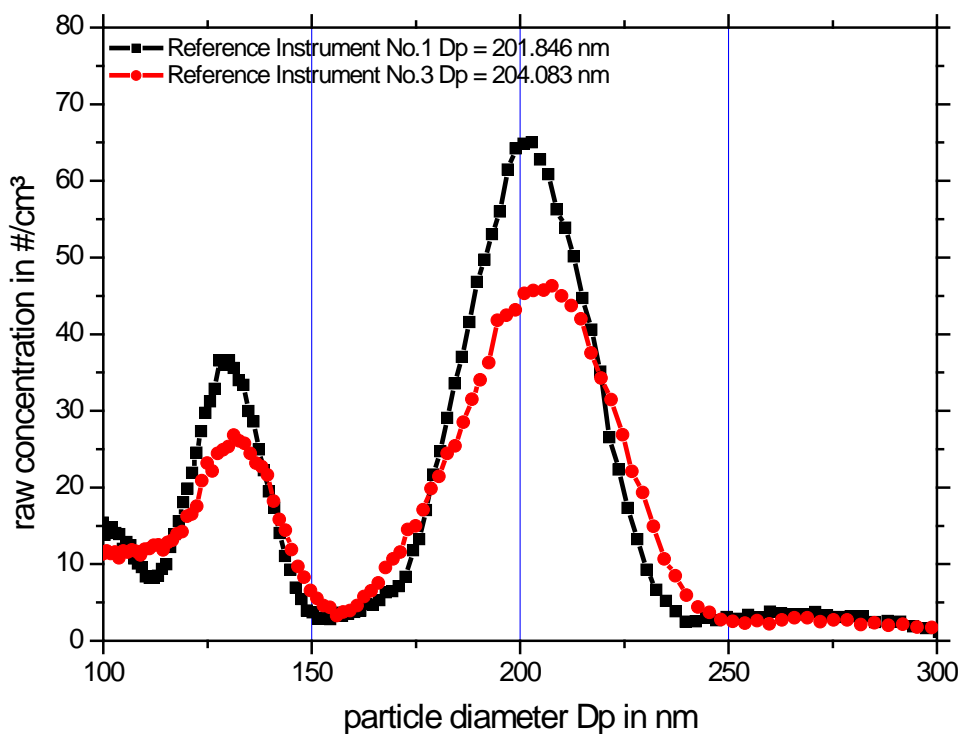


Fig.10. Measurement of latex 203 nm for TROPOS reference instrument No.1 and No.3: Particle size distribution (raw concentration) for latex on Sep. 18, 2013 03:55 pm and 04:10 pm (UTC time).

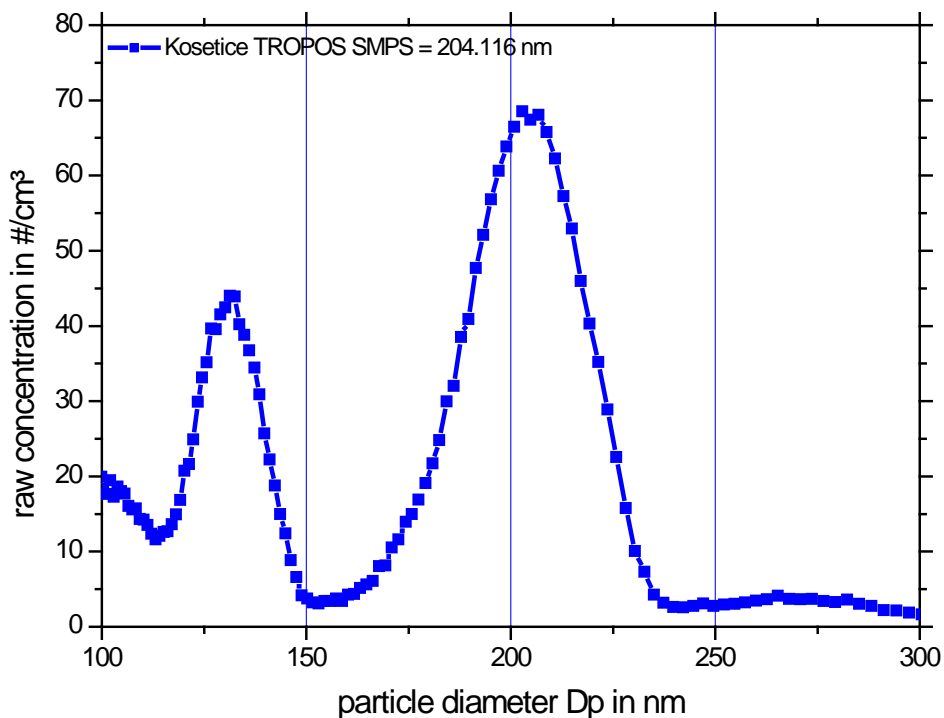


Fig.11. Measurement of latex 203 nm for instrument Kositice TROPOS SMPS: Particle size distribution (raw concentration) for latex 2013 on Sep. 18, 2013 between 03:55 pm and 04:05 pm (UTC time).

1. Time series

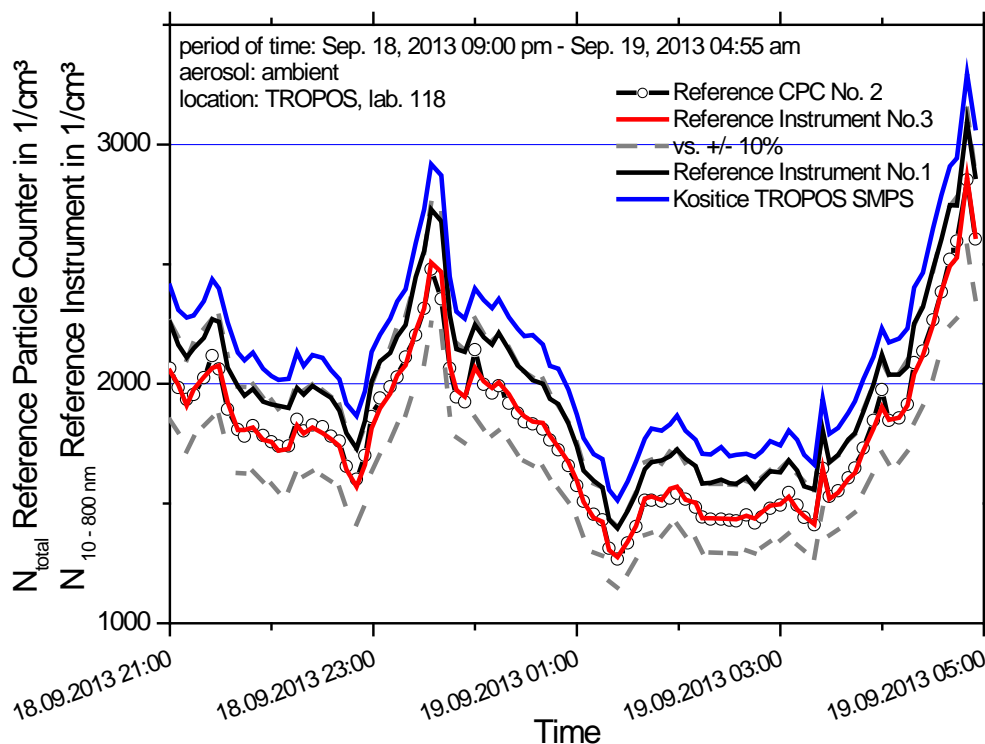


Fig.12. Time series (Sep. 18, 2013 09:00 pm - Sep. 19, 2013 04:55 am) of the integrated particle number concentration ($N_{10-800nm}$). Flow corrections are included.

2. Correlation

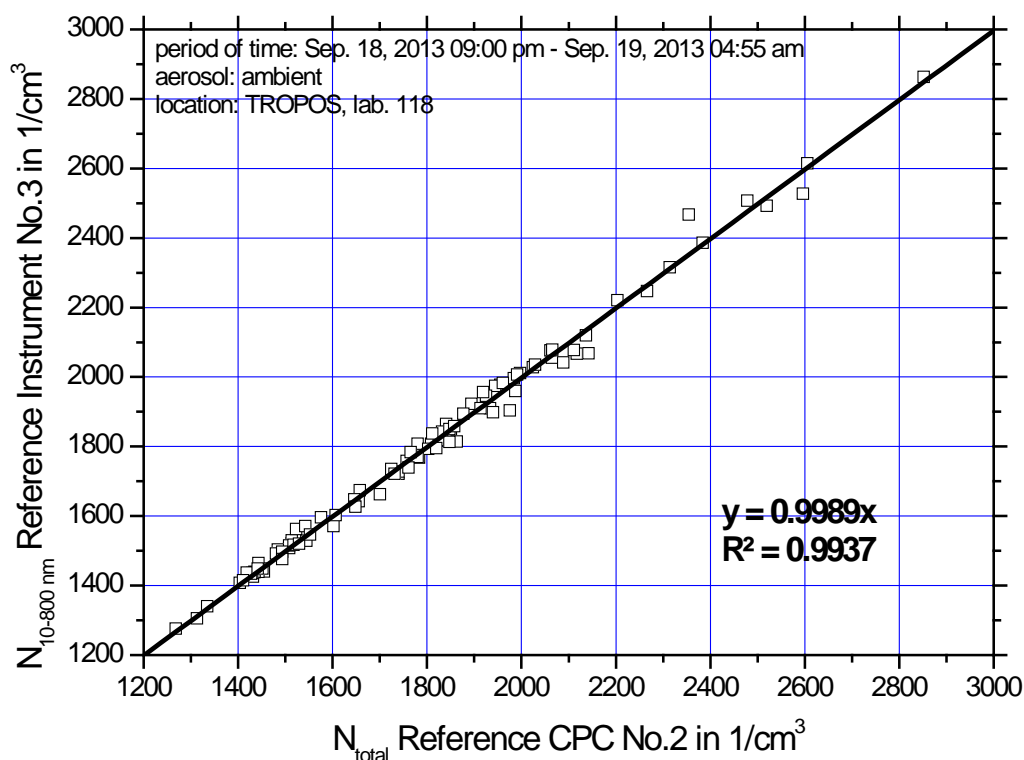


Fig.13. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.3. Internal diffusion losses and flow corrections are included.

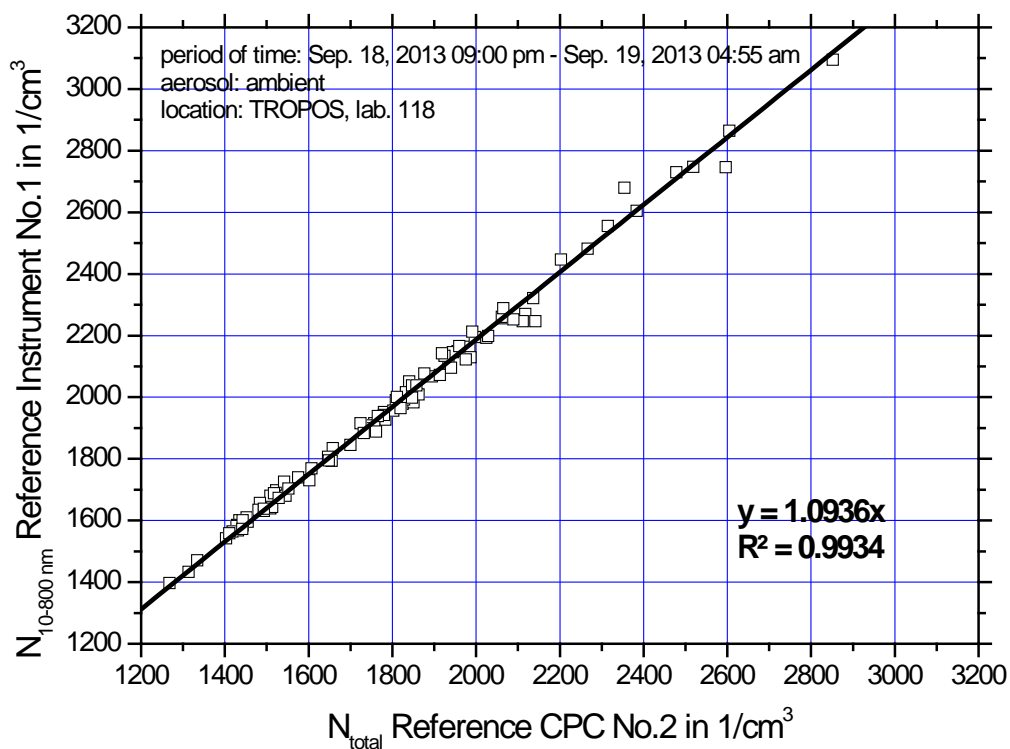


Fig.14. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.1. Internal diffusion losses and flow corrections are included.

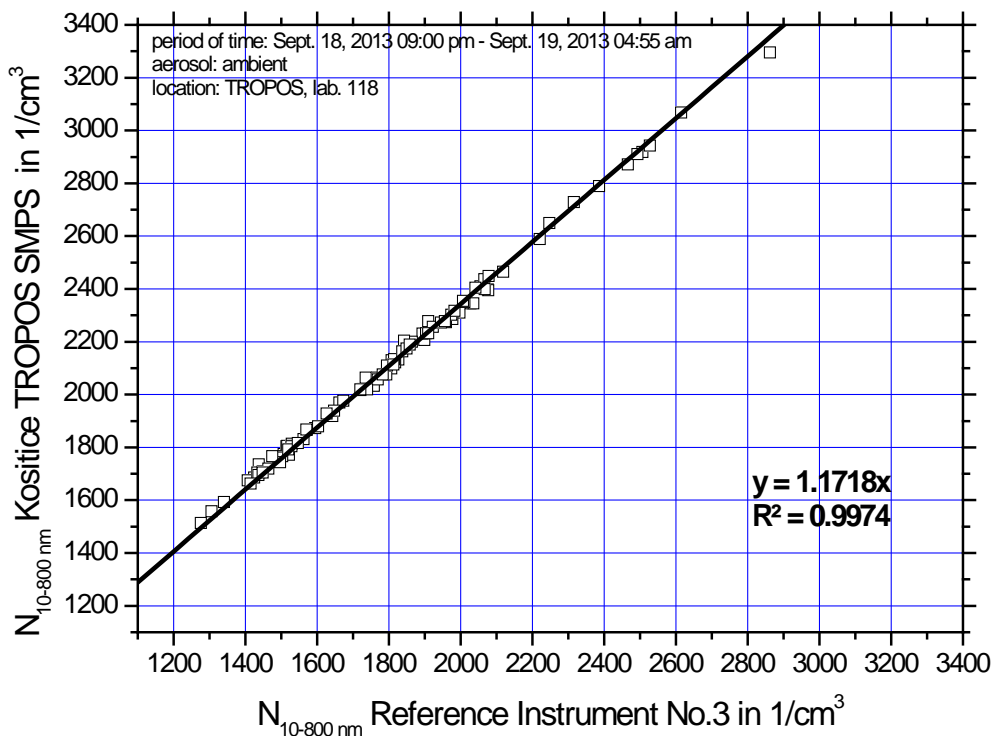


Fig.15. Linear regression between the particle number concentrations of TROPOS reference instrument No.3 and Kositice TROPOS SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

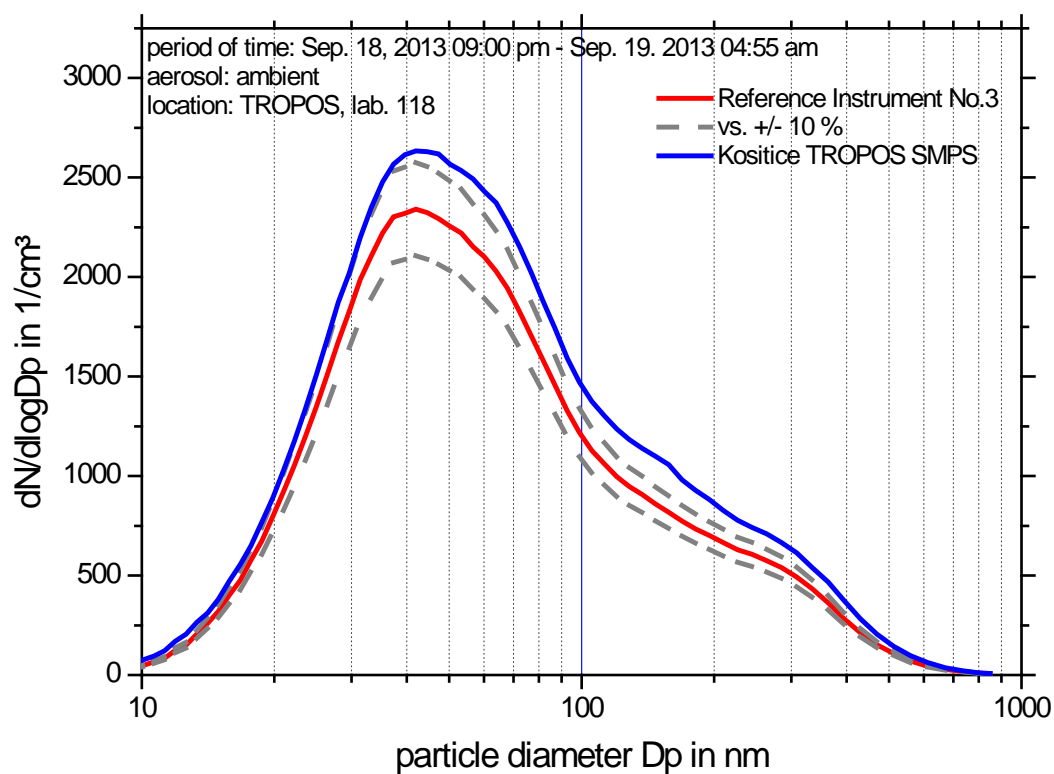


Fig.16. Comparison of mean particle number size distribution between Sep. 18, 2013 09:00 pm and Sep. 19, 2013 04:55 am. Internal diffusion losses and CPC efficiency are included.

Intercomparison of Montseny TROPOS SMPS

Basic information

Location of the quality assurance:	TROPOS, lab: 118
Delivery date:	Sep. 16, 2013
Setup in the laboratory:	Sep. 16, 2013
Comparison period:	Sep. 16, 2013 - Sep. 20, 2013
Instrument:	Montseny TROPOS SMPS
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	Noemí Pérez (noemi.perez@idaea.csic.es)

Summary:

From Sep. 16, 2013 to Sep. 20, 2013, the Montseny TROPOS SMPS participated successfully the TROPOS ACTRIS Workshop. The workshop consisted of an entrance test and a final run. In addition to the overnight ambient measurements, we had numerous high voltage checks, zero- and PSL- measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that, we show for each run the time series of the particle number concentration, the particle number size distribution, and correlation plots. If anything was written in the log book, so we added this also in this report. As reference standards, we used CPCs model TSI 3772 for total particle number concentration and two TROPOS mobility particle size spectrometer. The particle counters have been calibrated against a calibrated TSI electrometer 3068 B with the serial number 70838596.

In 2013 the Montseny TROPOS SMPS had problems with the hardware. It was necessary to repair the system before the ACTRIS Workshop. We changed the blower and fixed problems with the electronic and HV power supply. The first runs during the ACTRIS Workshop showed that the Montseny TROPOS SMPS is higher than the Reference CPC 3772. We found out, that the pulse output of the internal CPC 3772 get wrong values. We solved the problem after the regular workshop. For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. The Montseny TROPOS SMPS showed in the PSL-measurements a particle diameter of 202.9 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. If

we look at the final ambient measurement run, the Montseny TROPOS SMPS is within the uncertainty range of +/- 10 %. The Montseny TROPOS SMPS passed the ACTRIS Workshop. There is no re-examination required.

Log book:

Sep. 16, 2013

09:20 -> setup of SMPS System SCIC
-> start measurements with TROPOS CPC 3772

09:53 -> set time to local time
-> create new folder for Workshop D:\Actris workshop2013

10:55 -> $Q_{cpc} = 0.984$ l/min; $Q_{line} = 0.977$ l/min
-> zero check -> 0 counts
-> set time to UTC

09:25 -> end time zero check -> 0 counts

09:30 -> voltage check -> modification of zero and 0.8 values; ok
-> latex sizing check (203 nm); change measurement mode.exe,
ambient
conditions: $p = 875$, $T = 20^\circ\text{C}$

11:27 -> change CPC for CPC 3772 from MSY which has been cleaned by
TROPOS

11:37 -> start latex check
-> peak at ~ 209 nm -> should be 203 ± 5 nm
-> change scale at DMA loop flow from 2.48 to 2.55

12:30 -> take out the rad. source from the latex particle generator
-> slope from 2.55 to 2.58

12:40 -> slope from 2.58 to 2.65
-> close scan and restart

12:50 -> slope from 2.65 to 2.63 -> 203 nm: ok
-> black tube 70 cm
-> stop latex check

14:42 -> turn to ambient measurement

16:10 -> change the DMA, as it is measuring higher than other systems
-> still measuring higher than other systems (problem with CPC?)

Sep. 17, 2013

-> data files in C:\Documents and
Settings\Montseny\Desktop\barcelona_ACTRIS2012

09:30 -> latex check

10:00 -> ambient measurements

14:30 -> CPC intercomparison

17:00 -> voltage check ok

17:05 -> zero check

18:00-18:10 -> zero check
-> set latex config.mode

18:15-19:53 -> latex scans

20:00 -> start ambient measurement

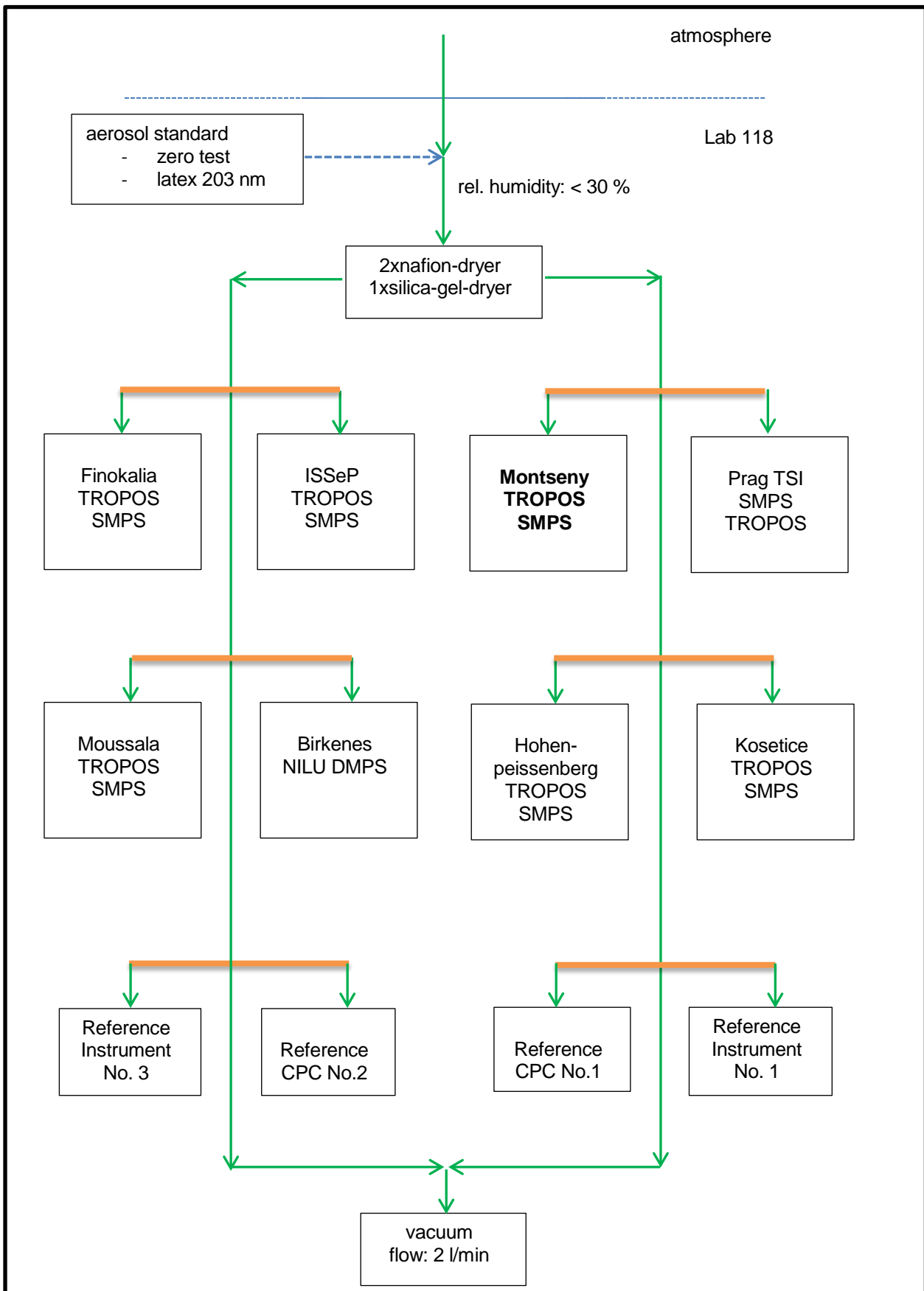
Sep. 18, 2013

-> CPC higher than other systems
-> size distr. higher for all size ranges
-> scan with no cable to CPC -> 0 counts
-> scan with HV off -> 0 counts
10:20 -> change of CPC to China II TROPOS CPC (SIN 3772114801)
12:25 -> zero check
12:40 -> ambient measurements
13:40 -> zero check: ok
16:00 -> latex check
16:25 -> zero check
16:40 -> ambient measurements

Sep. 19, 2013

07:00 -> we continue ambient measurements without smapp particles until
we see
data
07:30 -> change SPS TROPOS for CPC Barcelona
08:30 -> stop instrument

Laboratory setup



A: First run

Latex 203 nm

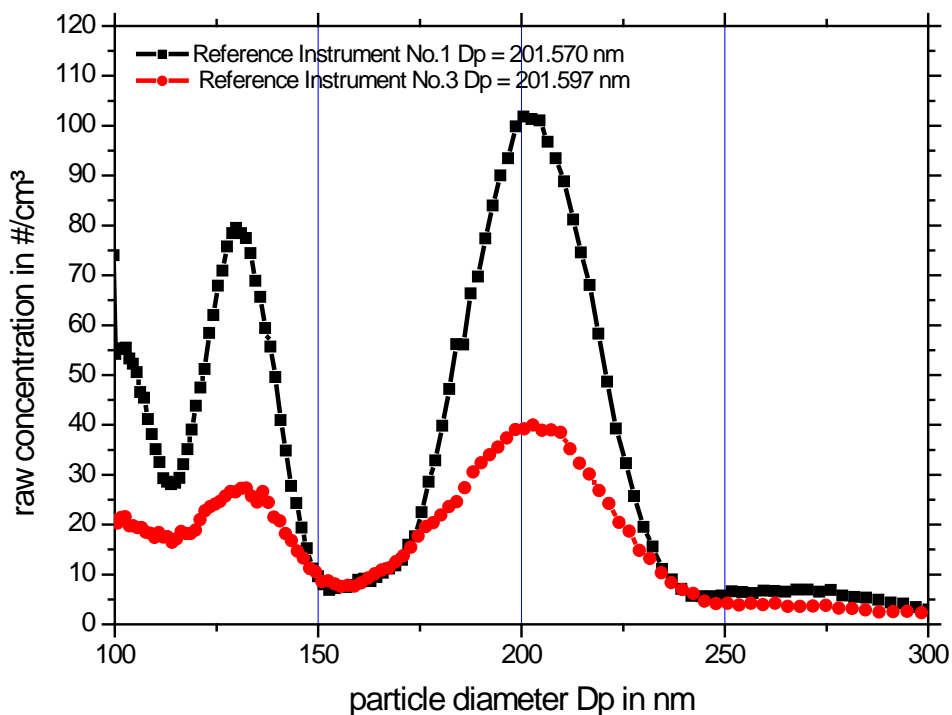


Fig.1. Measurement of latex 203 nm for TROPOS reference instrument No.1 and No.3: Particle size distribution (raw concentration) for latex on Sep. 16, 2013 between 11:37 pm and 12:50 pm (UTC time).

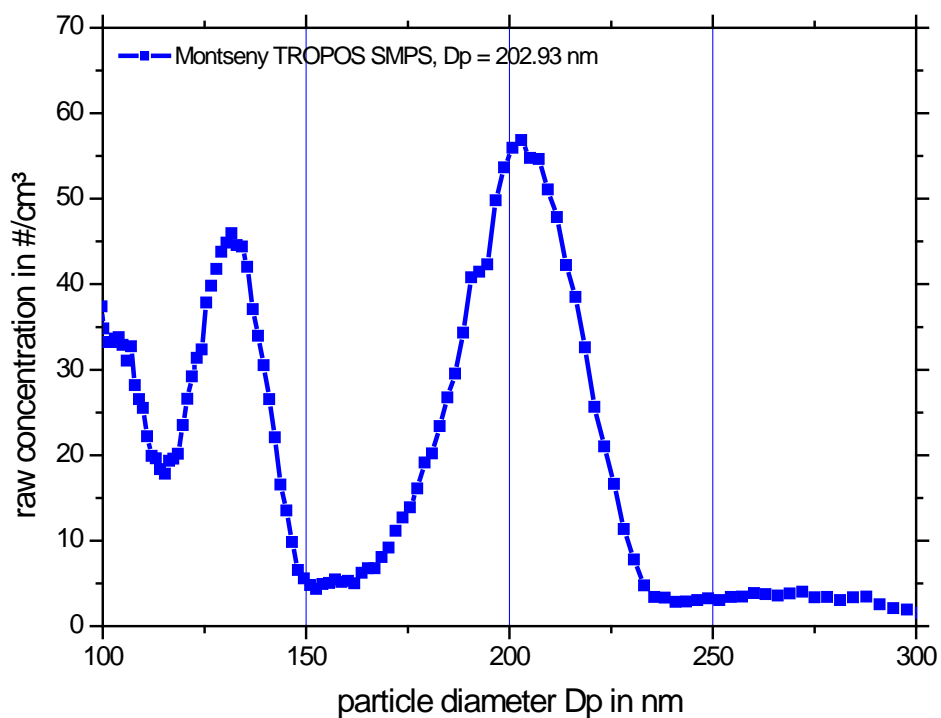


Fig.2. Measurement of latex 203 nm for instrument Montseny TROPOS SMPS: Particle size distribution (raw concentration) for latex 2013 on Sep. 16, 2013 between 11:37 pm and 12:50 pm (UTC time).

CPC efficiency

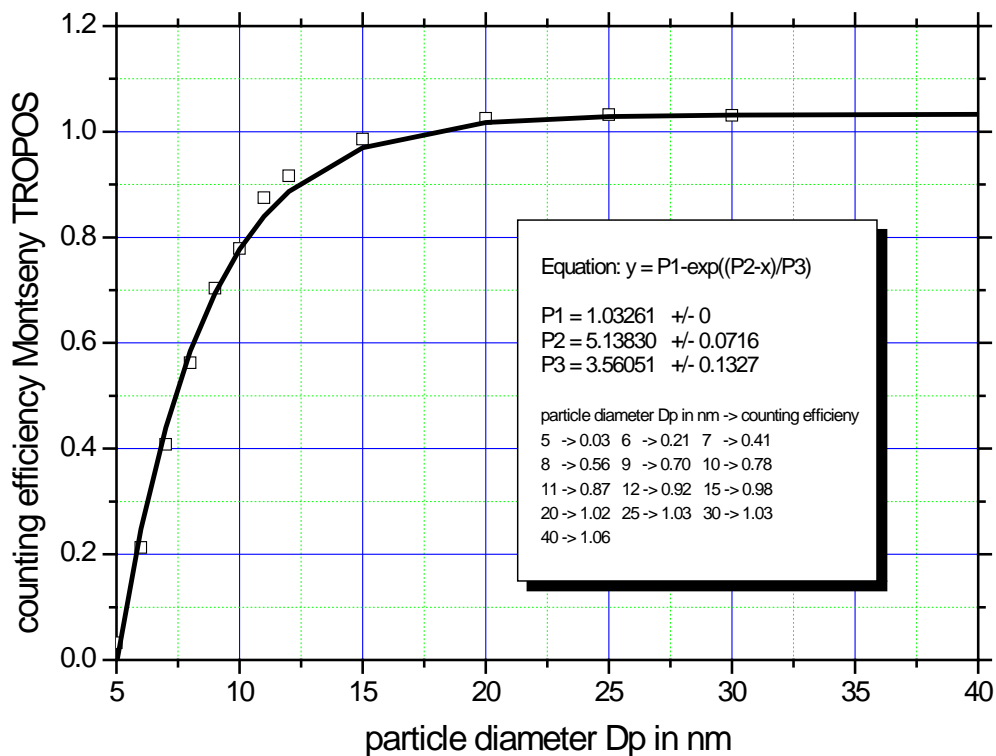


Fig.3. CPC efficiency curve. Based on Electrometer TSI 3068B. Serial number: 70838596.

1. Time series

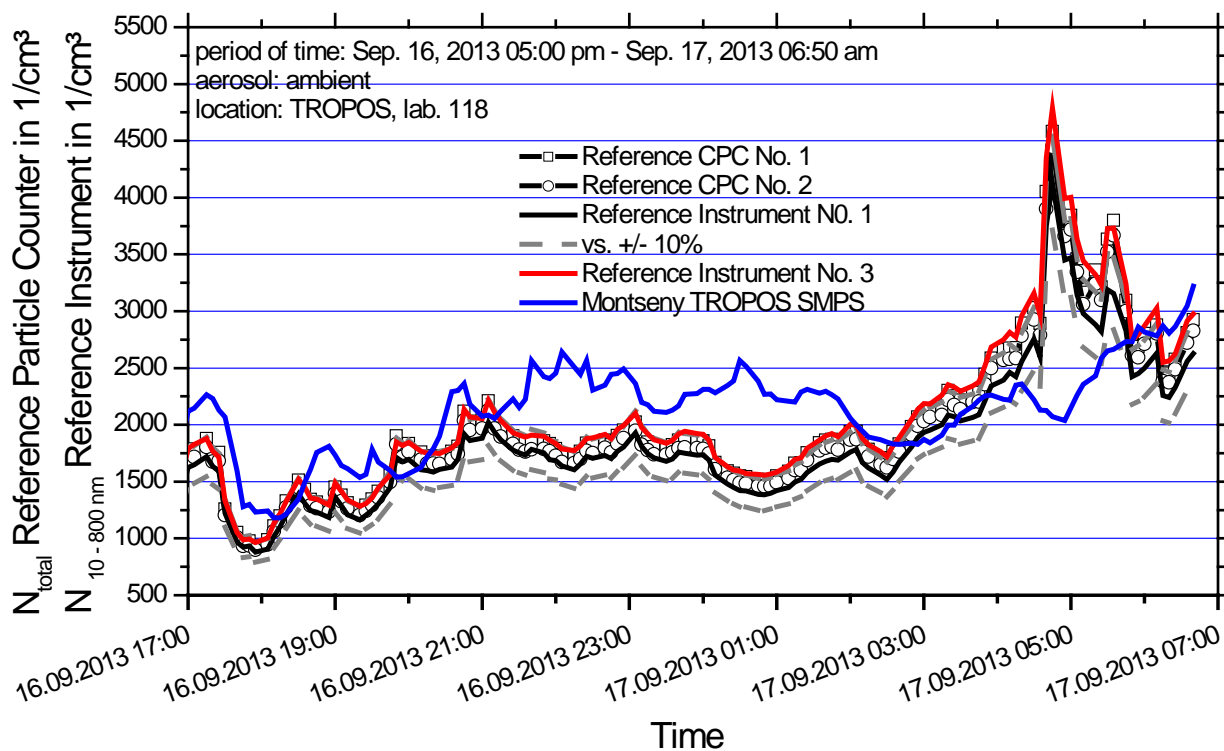


Fig.4. Time series (Sep. 16, 2013 05:00 pm - Sep. 17, 2013 06:50 am) of the integrated particle number concentration (N10-800nm). Flow corrections are included.

2. Correlation

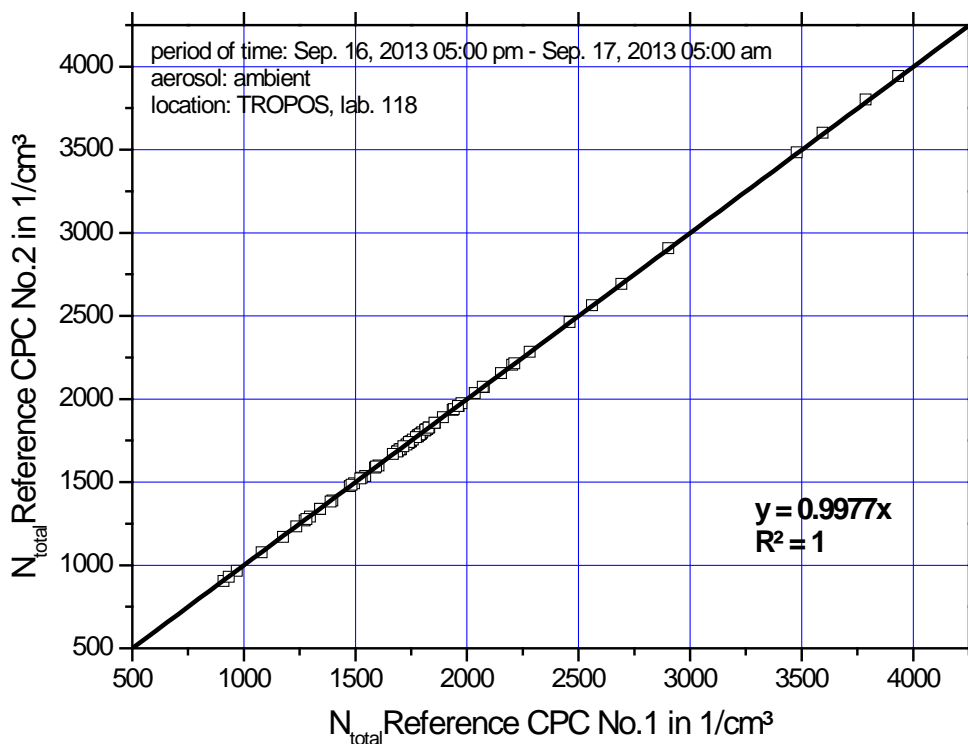


Fig.5. Linear regression between two TROPOS CPCs (Model 3772). Flow corrections are included.

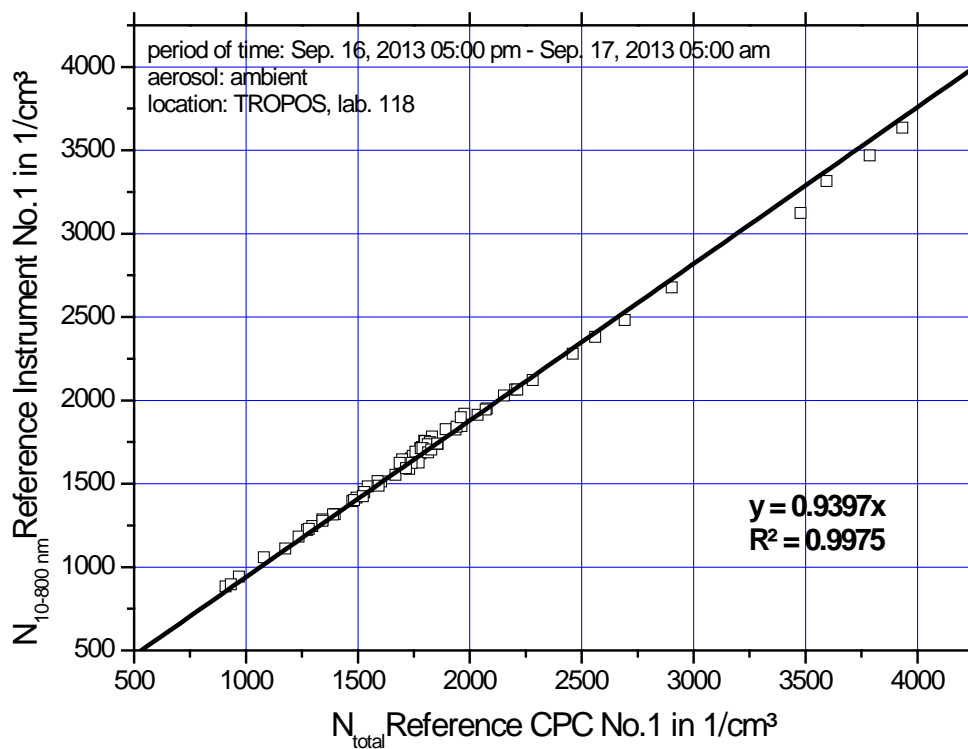


Fig.6. Linear regression between the particle number concentrations of TROPOS reference CPC No.1 and TROPOS reference instrument No.1. Internal diffusion losses and flow corrections are included.

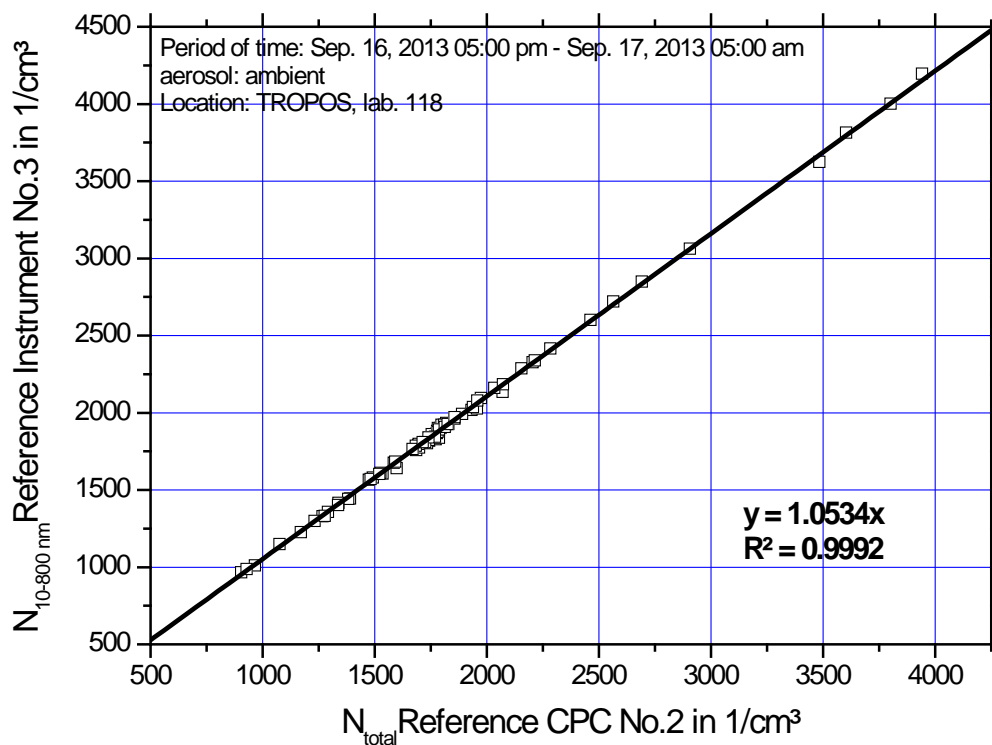


Fig.7. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.3. Internal diffusion losses and flow corrections are included.

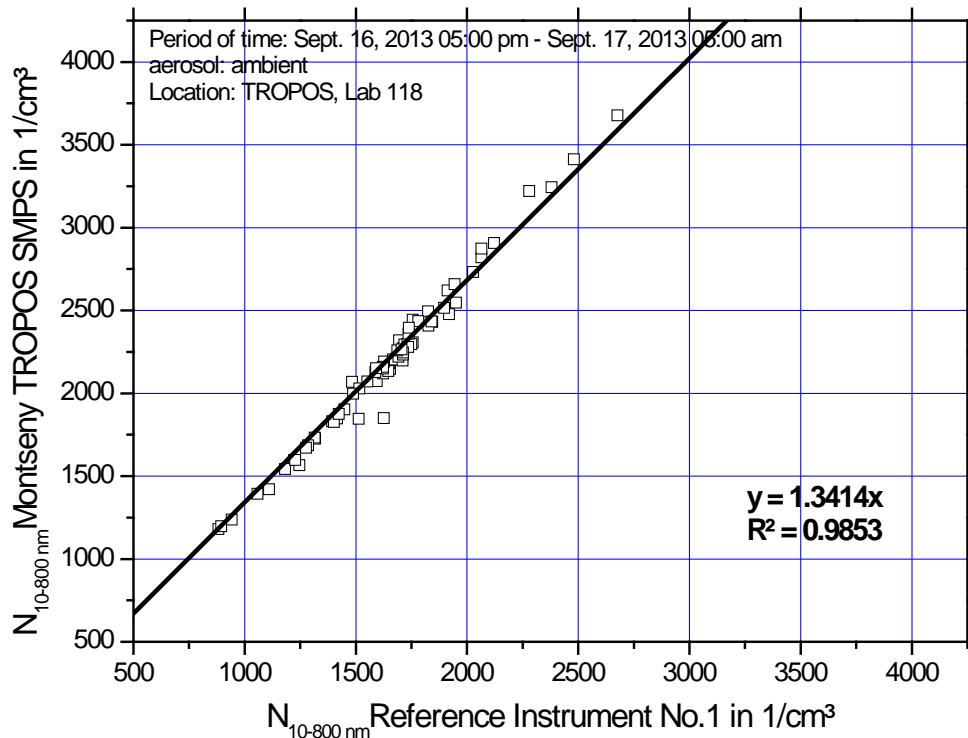


Fig.8. Linear regression between the particle number concentrations of TROPOS reference instrument No.1 and Montseny TROPOS SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

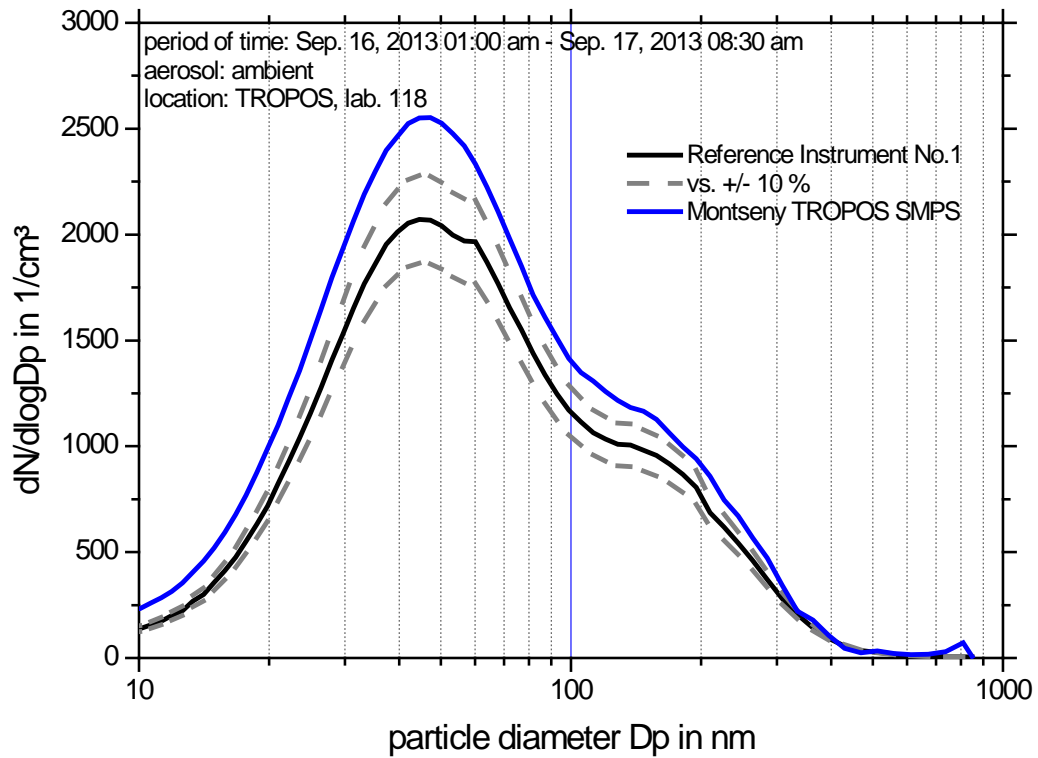


Fig.9. Comparison of mean particle number size distribution between Sep. 16, 2013 01:00 pm and Sep. 17, 2013 08:30 am. Internal diffusion losses and CPC efficiency are included.

B: Final run

Latex 203 nm

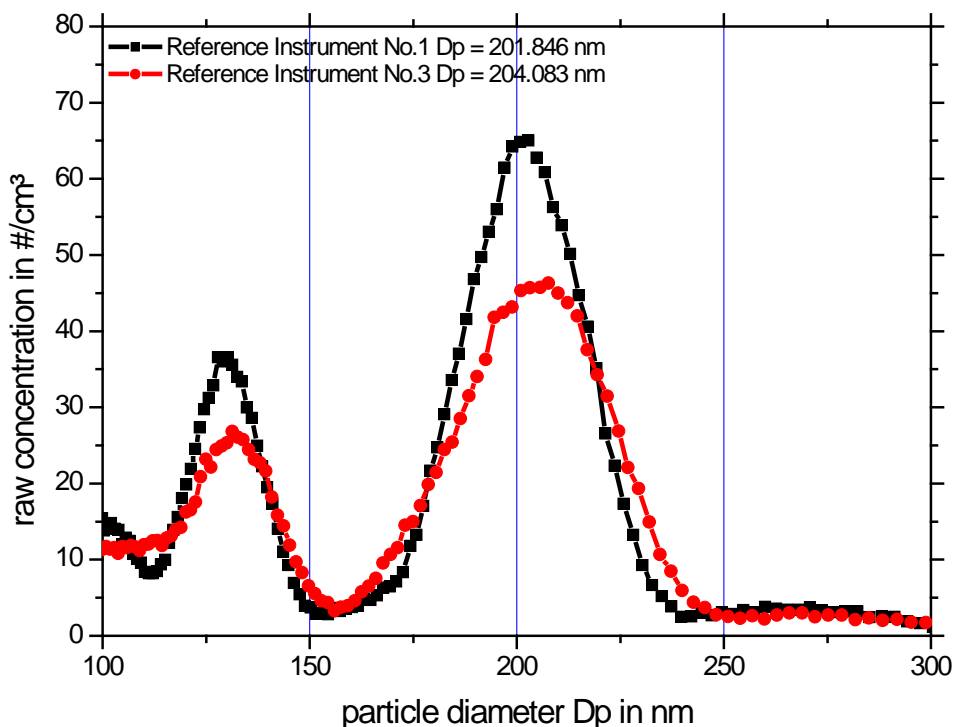


Fig.10. Measurement of latex 203 nm for TROPOS reference instrument No.1 and No.3: Particle size distribution (raw concentration) for latex on Oct. 22, 2013 01:00 pm and 01:10 pm (UTC time).

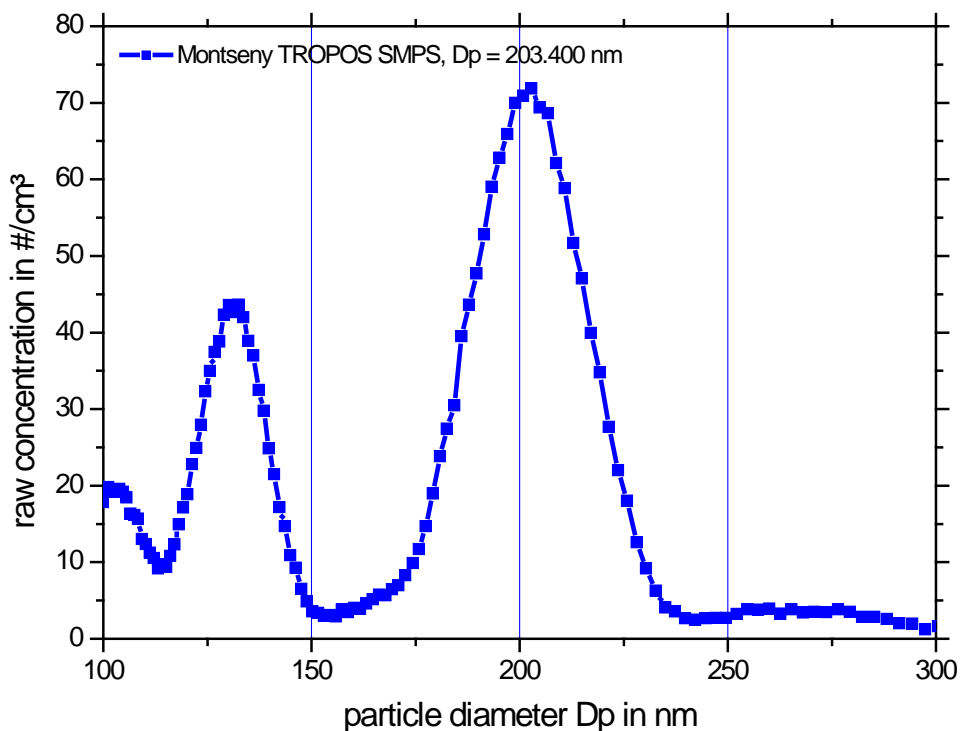


Fig.11. Measurement of latex 203 nm for instrument Montseny TROPOS SMPS: Particle size distribution (raw concentration) for latex 2013 on Oct. 21, 2013 between 05:25 pm and 05:45 pm (UTC time).

1. Time series

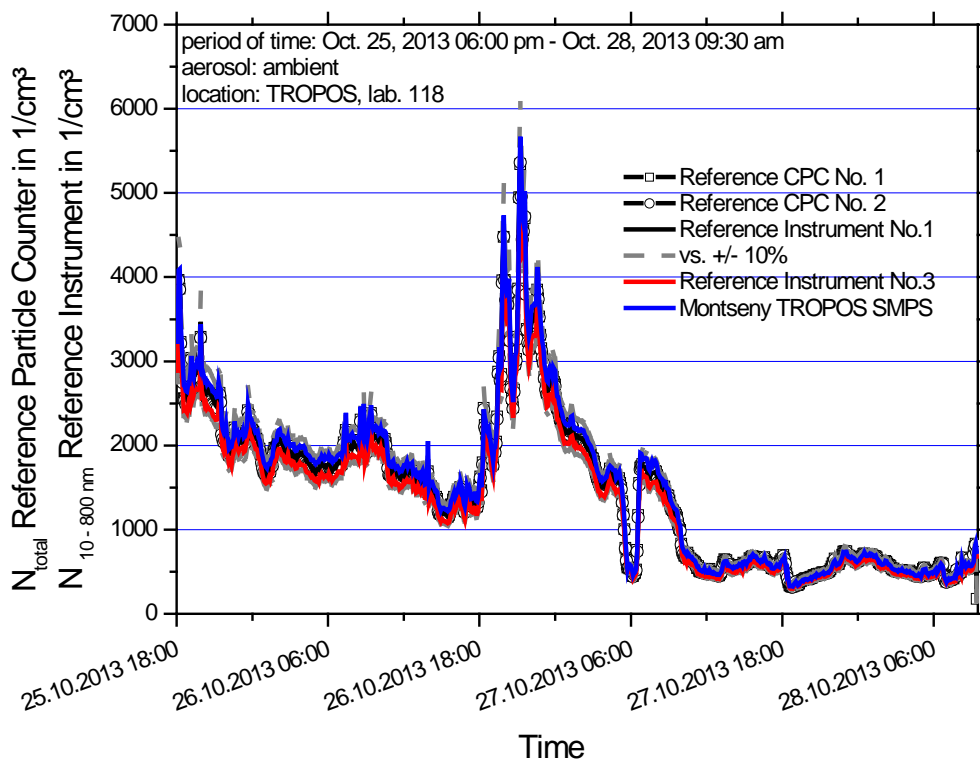


Fig.12. Time series (Oct. 25, 2013 06:00 pm – Oct. 28, 2013 09:30 am) of the integrated particle number concentration ($N_{10-800nm}$). Flow corrections are included.

2. Correlation

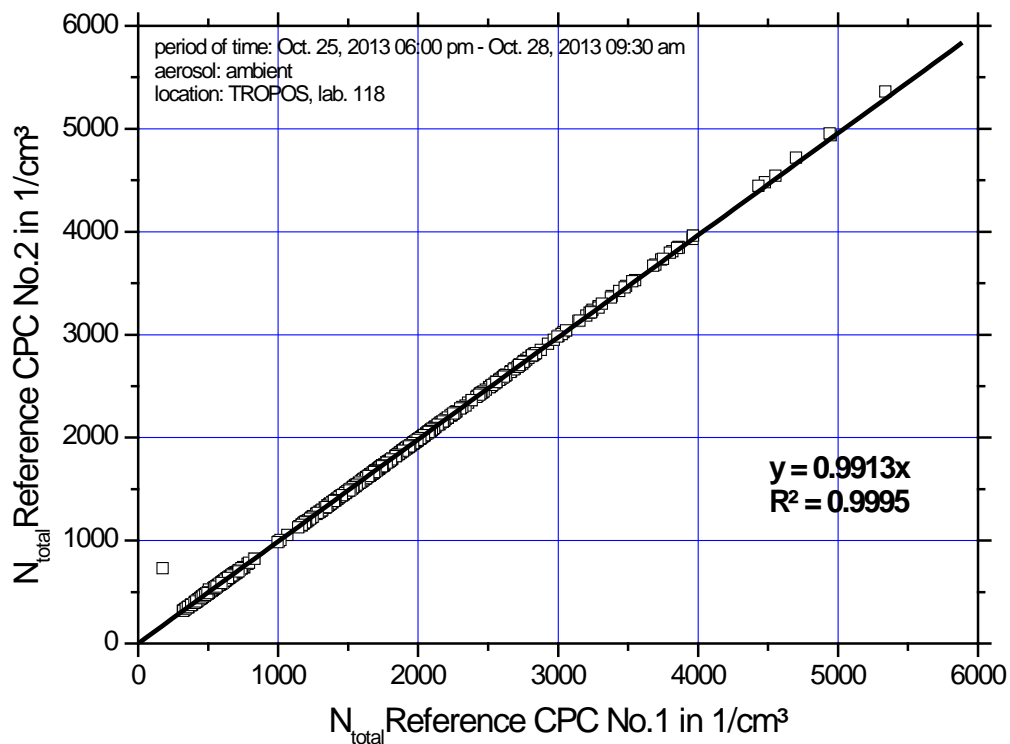


Fig.13. Linear regression between two TROPOS CPCs (Model 3772). Flow corrections are included.

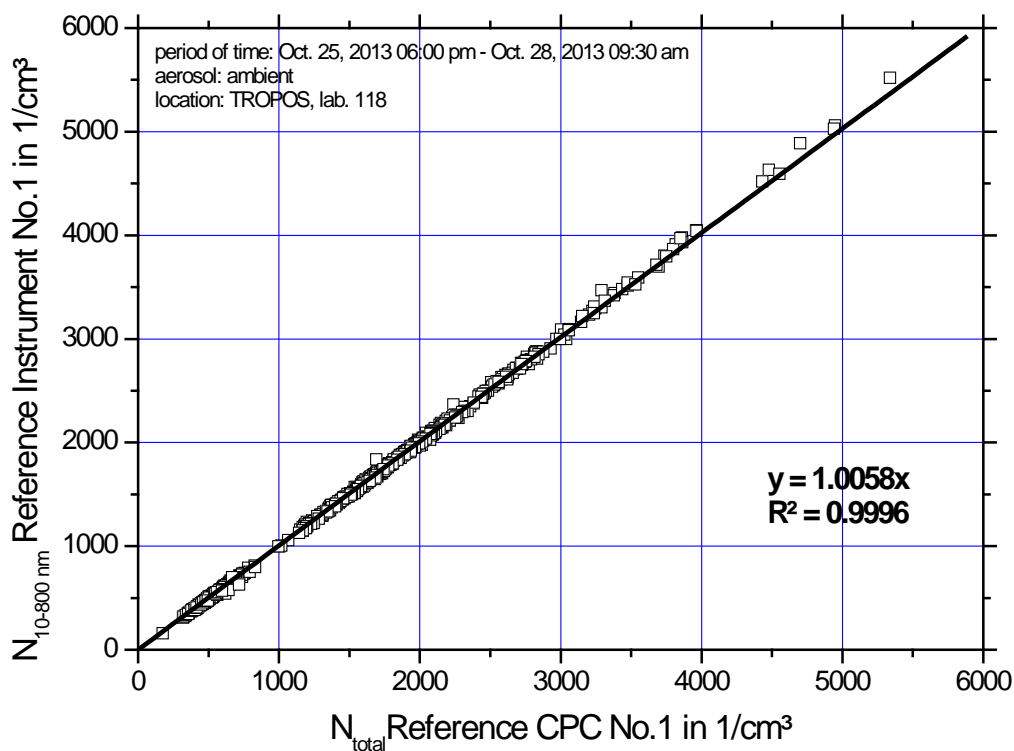


Fig.14. Linear regression between the particle number concentrations of TROPOS reference CPC No.1 and TROPOS reference instrument No.1. Internal diffusion losses and flow corrections are included.

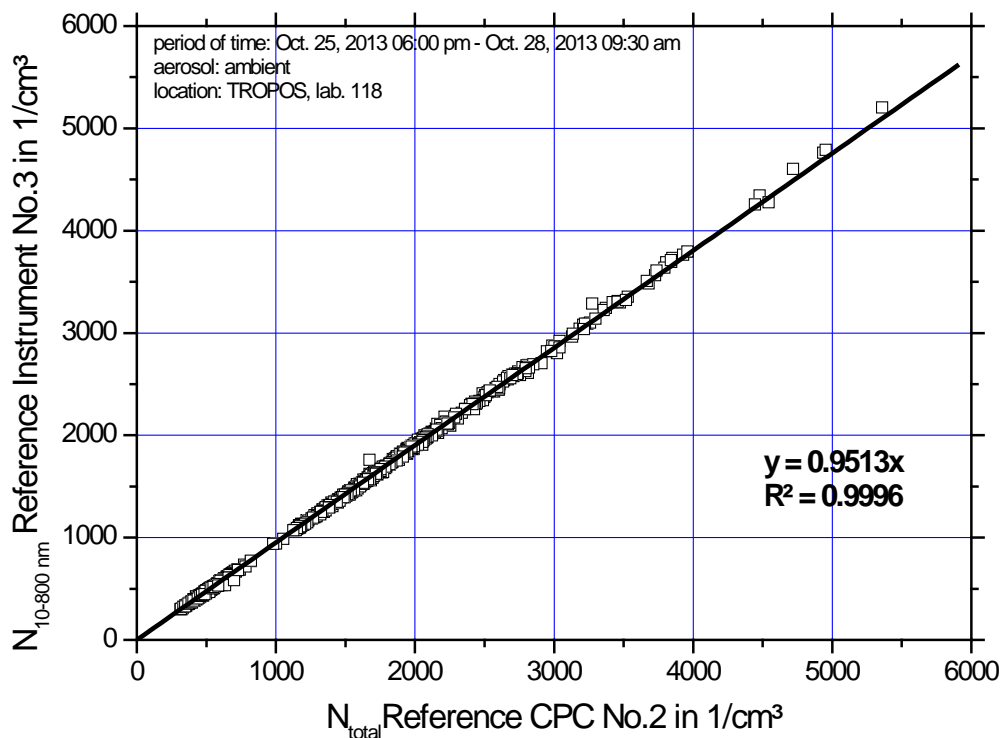


Fig.15. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.3. Internal diffusion losses and flow corrections are included.

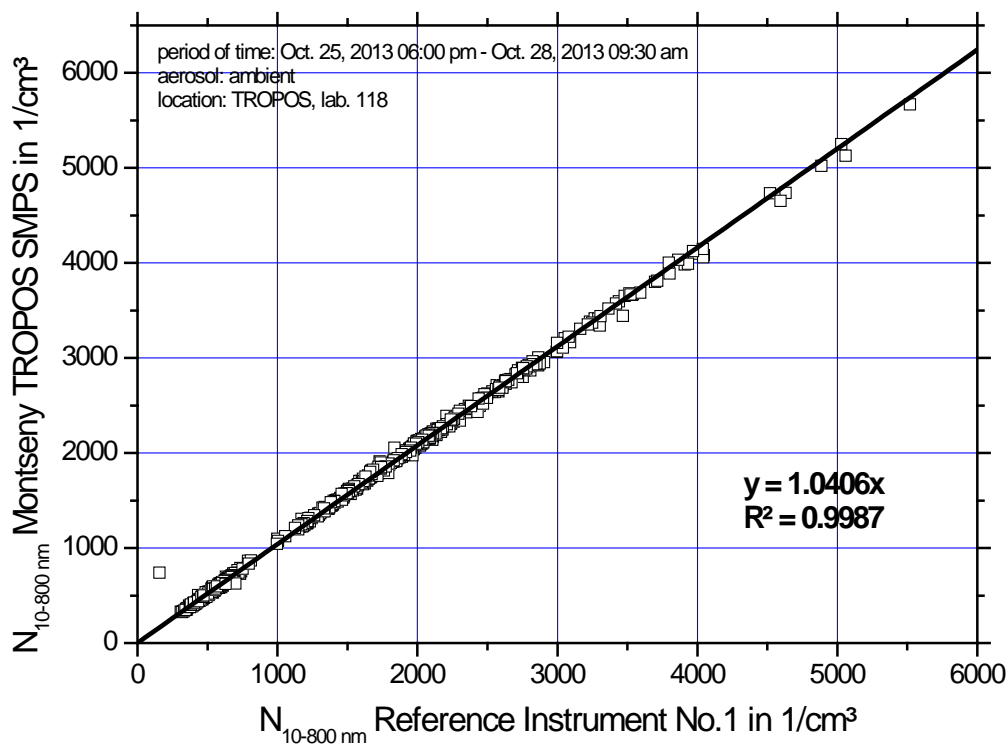


Fig.16. Linear regression between the particle number concentrations of TROPOS reference instrument No.1 and Montseny TROPOS SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

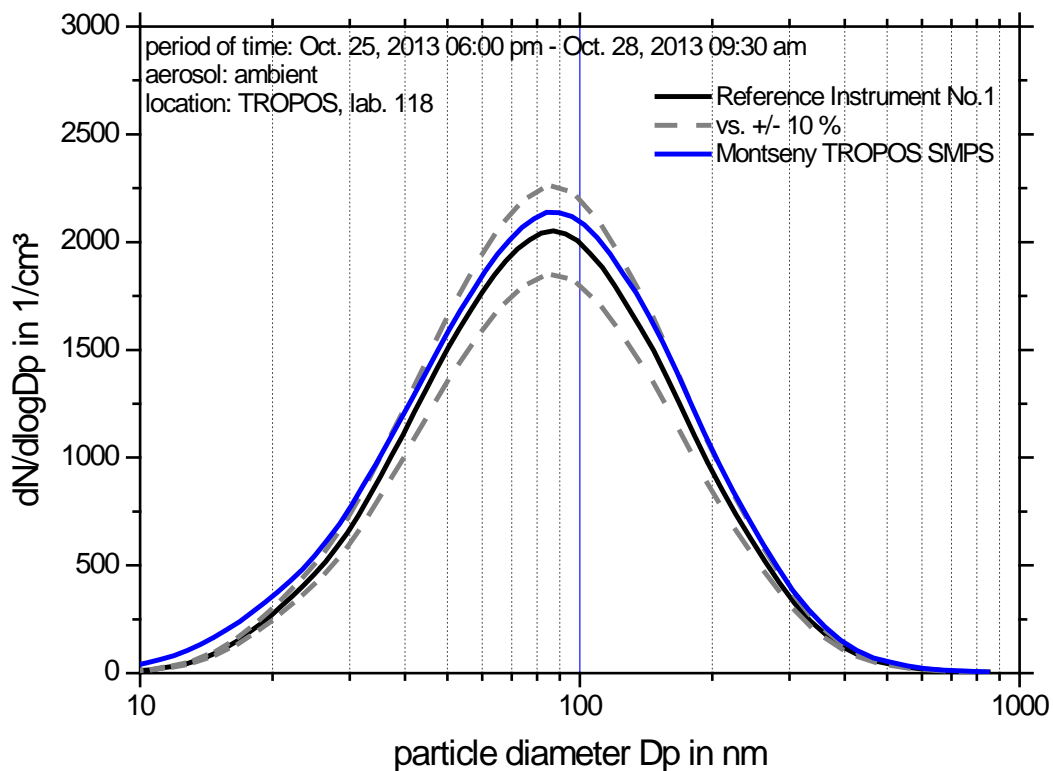


Fig.17. Comparison of mean particle number size distribution between Oct. 25, 2013 06:00 pm and Oct. 28, 2013 09:30 am. Internal diffusion losses and CPC efficiency are included.

Intercomparison of Moussala TROPOS SMPS

Basic information

Location of the quality assurance:	TROPOS, lab: 118
Delivery date:	Sep. 16, 2013
Setup in the laboratory:	Sep. 16, 2013
Comparison period:	Sep. 16, 2013 - Sep. 20, 2013
Instrument:	Moussala TROPOS SMPS
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	Todar Arsov (arsoff@inrn.bas.bg)

Summary:

From Sep. 16, 2013 to Sep. 20, 2013, the Moussala TROPOS SMPS participated successfully the TROPOS ACTRIS Workshop. The workshop consisted of an entrance test and a final run. In addition to the overnight ambient measurements, we had numerous high voltage checks, zero- and PSL- measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that, we show for each run the time series of the particle number concentration, the particle number size distribution, and correlation plots. If anything was written in the log book, so we added this also in this report. As reference standards, we used CPCs model TSI 3772 for total particle number concentration and two TROPOS mobility particle size spectrometer. The particle counters have been calibrated against a calibrated TSI electrometer 3068 B with the serial number 70838596.

For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. The Moussala TROPOS SMPS showed in the PSL-measurements a particle diameter of 202.4 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. If we look at the final ambient measurement run, the The Moussala TROPOS SMPS is within the uncertainty range of +/- 10 %. The Moussala TROPOS SMPS passed the ACTRIS Workshop. There is no re-examination required.

Log book:

Sep. 17, 2013

09:14-09:24 -> voltage calibration
4mV 5.72V 0.0054
0 -0.00025
0.80 +0.007
800mV 10V
-> Total volume 0.9824 l/min
09:40 – 09:50 -> zero check: ok
10:00 -> Latex check, slope 2.5, 206 nm
10:05 -> change slope from 2.5 to 2.6; latex peak: 202 nm
10:45 -> Restart ambient
17:06 -> start zero
17:36 -> flow rate

Sep. 18, 2013

10:00 -> latex check ok: 203 nm
15:24 -> check HV
15:40 -> zero check with original nafion dryer
16:00 -> PSL 203 nm with p = 980 hPa
-> first scan -> peak ~ 204 nm
16:25 -> zero check
16:40 -> ambient

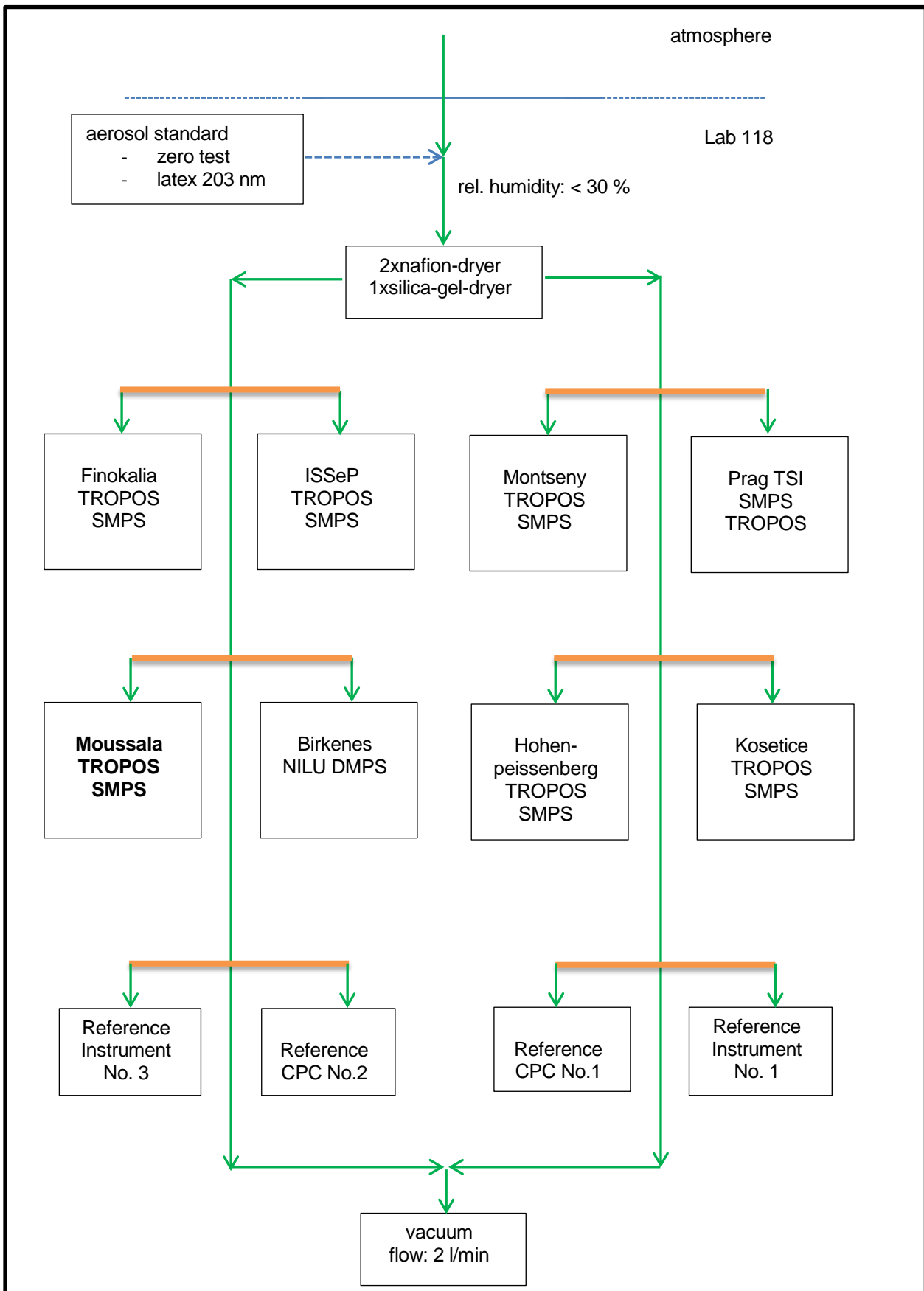
Sep. 19, 2013

10:14 -> high voltage DMA
12:25 -> zero check
12:40 -> ambient measurements
12:59 -> change Kr-source
13:04 -> Ni source
13:13 -> changed DMA
15:25 -> new nafion
15:40 -> zero check
16:00-16:18 -> latex check
16:20 -> zero check
16:40 -> ambient measurement

Sep. 20, 2013

07:00 -> without diffusion
09:05 -> liquid level empty
09:10 -> level filled
09:45 -> ambient

Laboratory setup



A: First run

Latex 203 nm

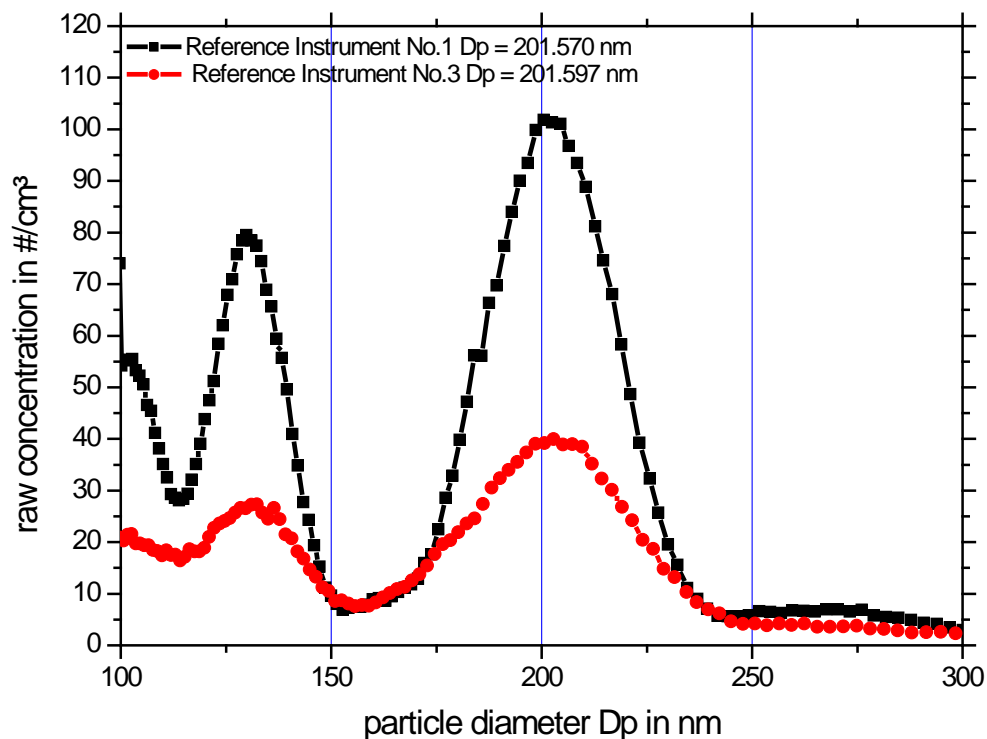


Fig.1. Measurement of latex 203 nm for TROPOS reference instrument No.1 and No.3: Particle size distribution (raw concentration) for latex on Sep. 16, 2013 between 01:20 pm and 01:45 pm (UTC time).

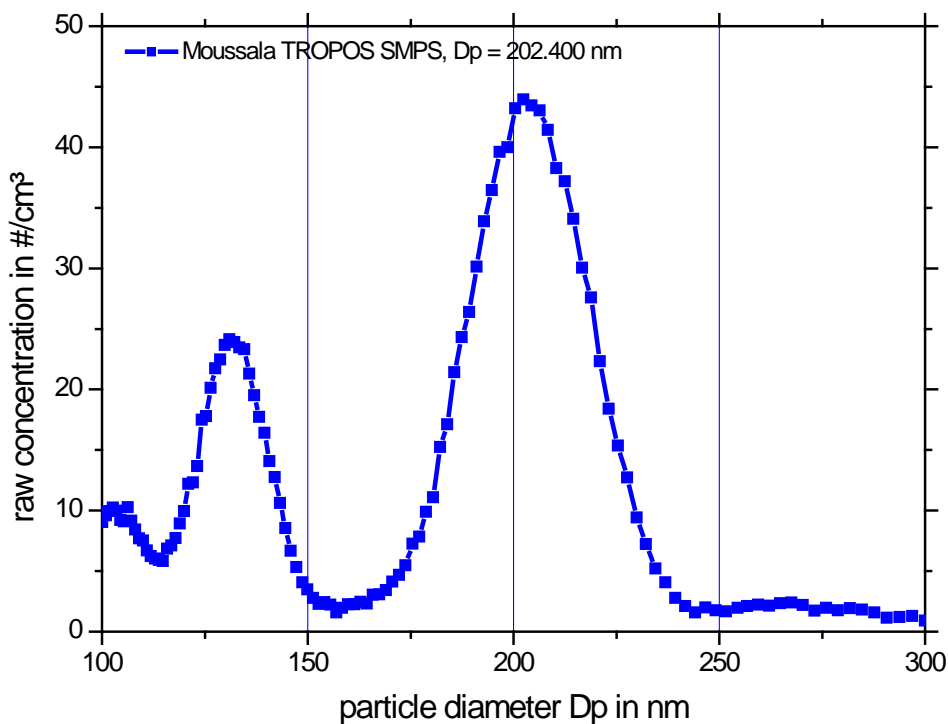


Fig.2. Measurement of latex 203 nm for instrument Moussala TROPOS SMPS: Particle size distribution (raw concentration) for latex 2013 on Sep. 16, 2013 between 01:20 pm and 01:45 pm (UTC time).

CPC efficiency

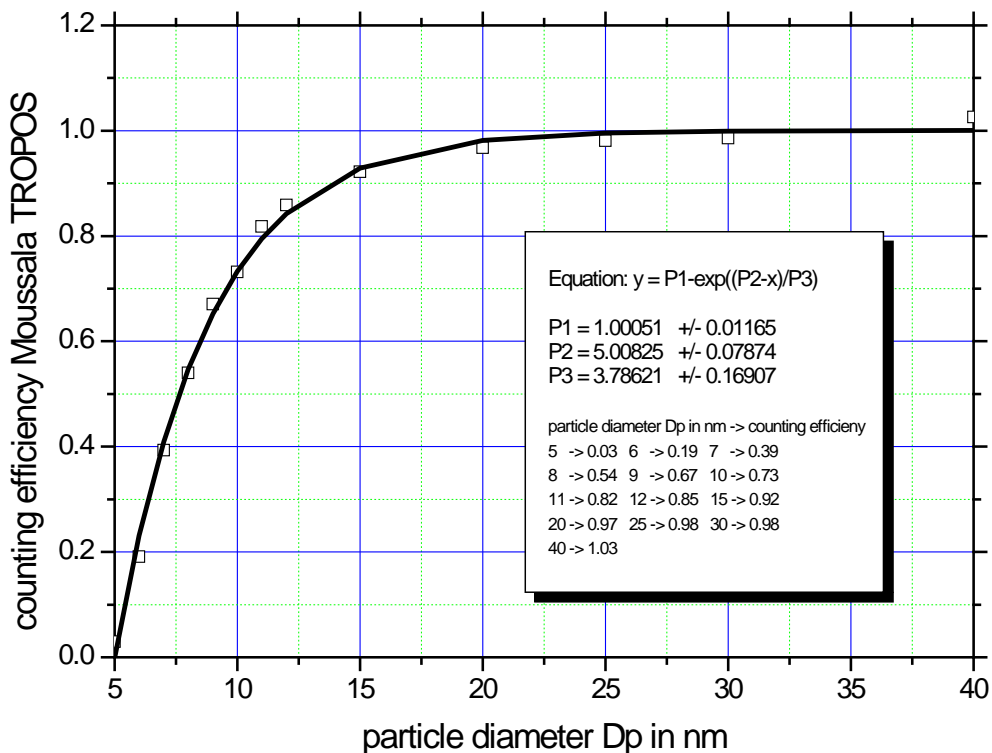


Fig.3. CPC efficiency curve. Based on Electrometer TSI 3068B. Serial number: 70838596

1. Time series

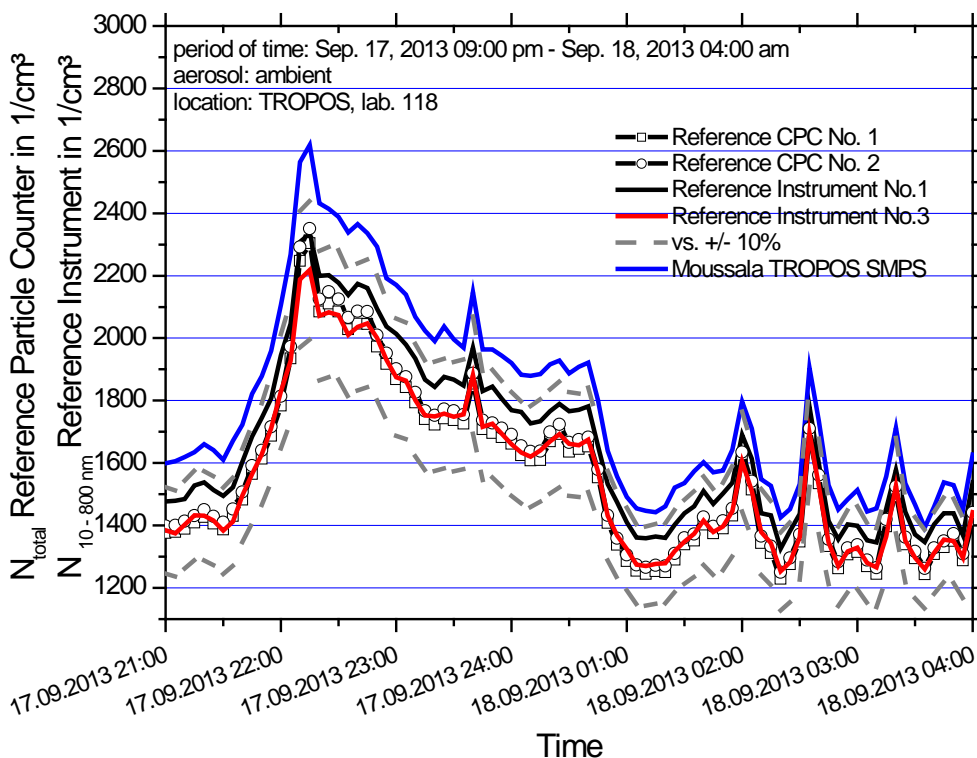


Fig.4. Time series (Sep. 17, 2013 09:00 pm - Sep. 18, 2013 04:00 am) of the integrated particle number concentration (N10-800nm). Flow corrections are included.

2. Correlation

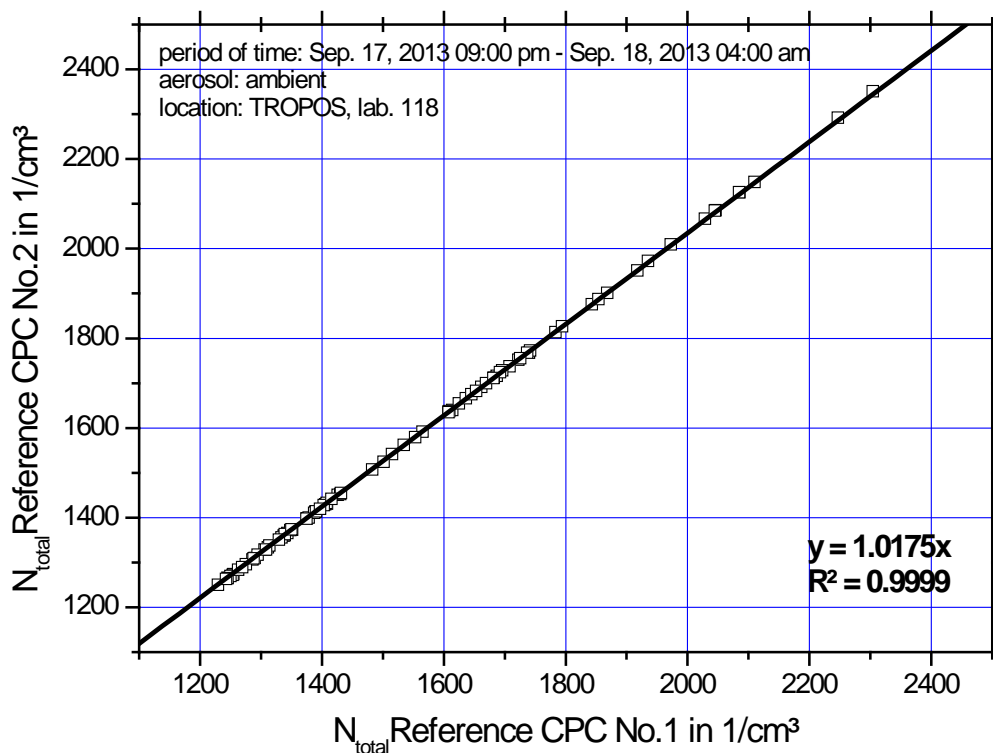


Fig.5. Linear regression between two TROPOS CPCs (Model 3772). Flow corrections are included.

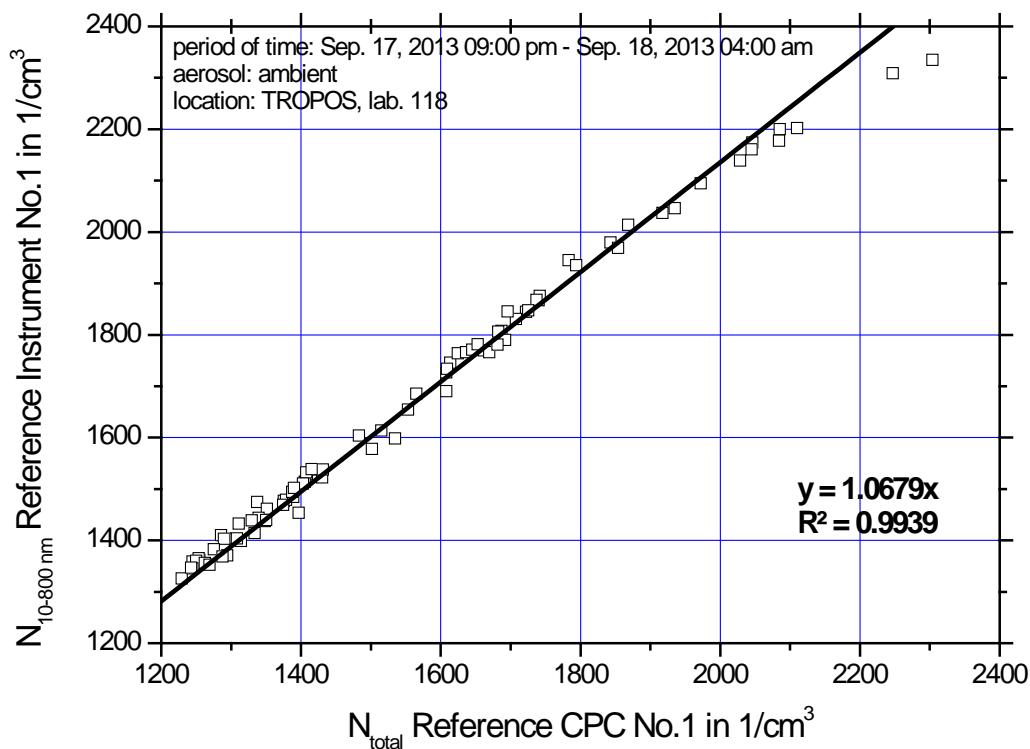


Fig.6. Linear regression between the particle number concentrations of TROPOS reference CPC No.1 and TROPOS reference instrument No.1. Internal diffusion losses and flow corrections are included.

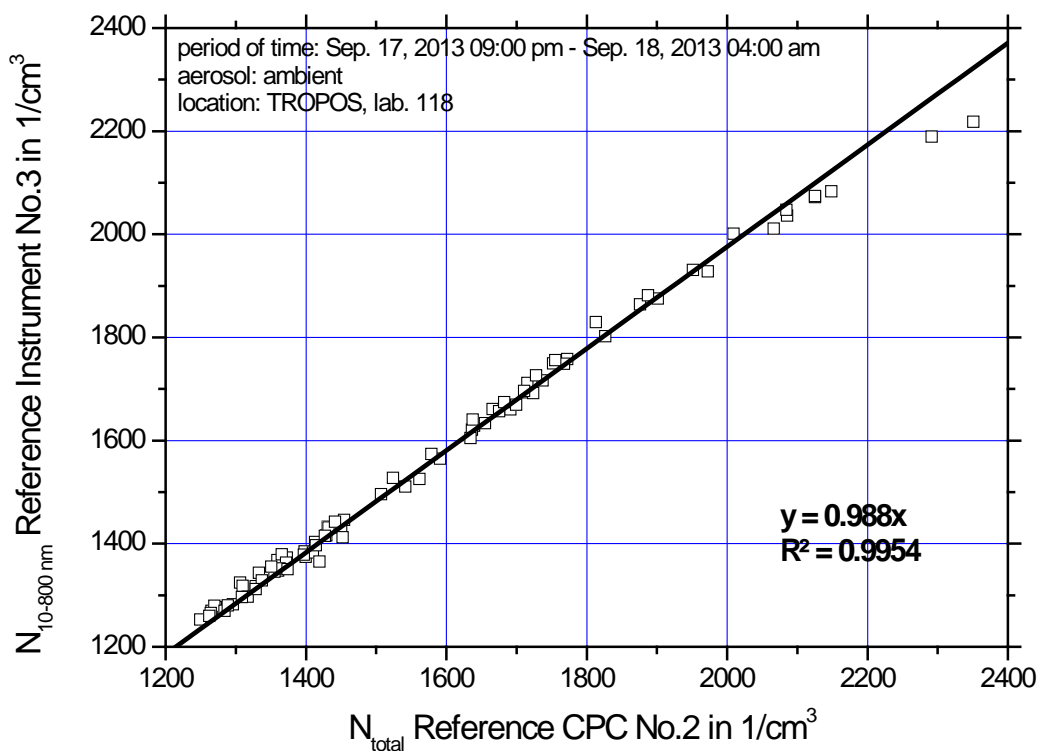


Fig.7. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.3. Internal diffusion losses and flow corrections are included.

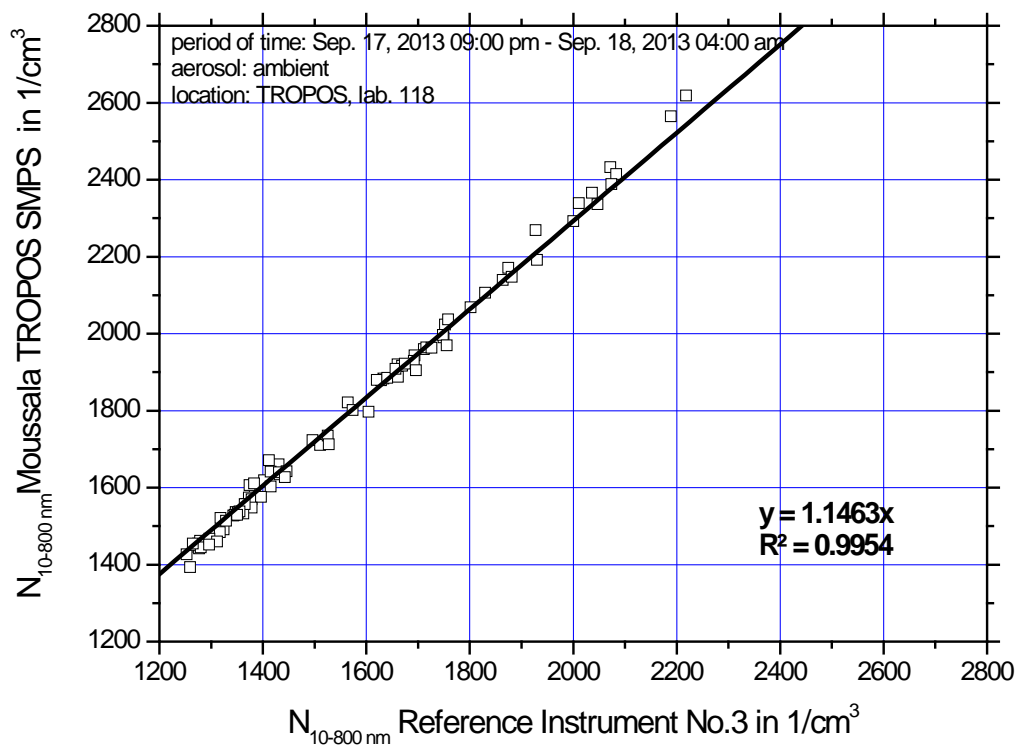


Fig.8. Linear regression between the particle number concentrations of TROPOS reference instrument No.3 and Moussala TROPOS SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

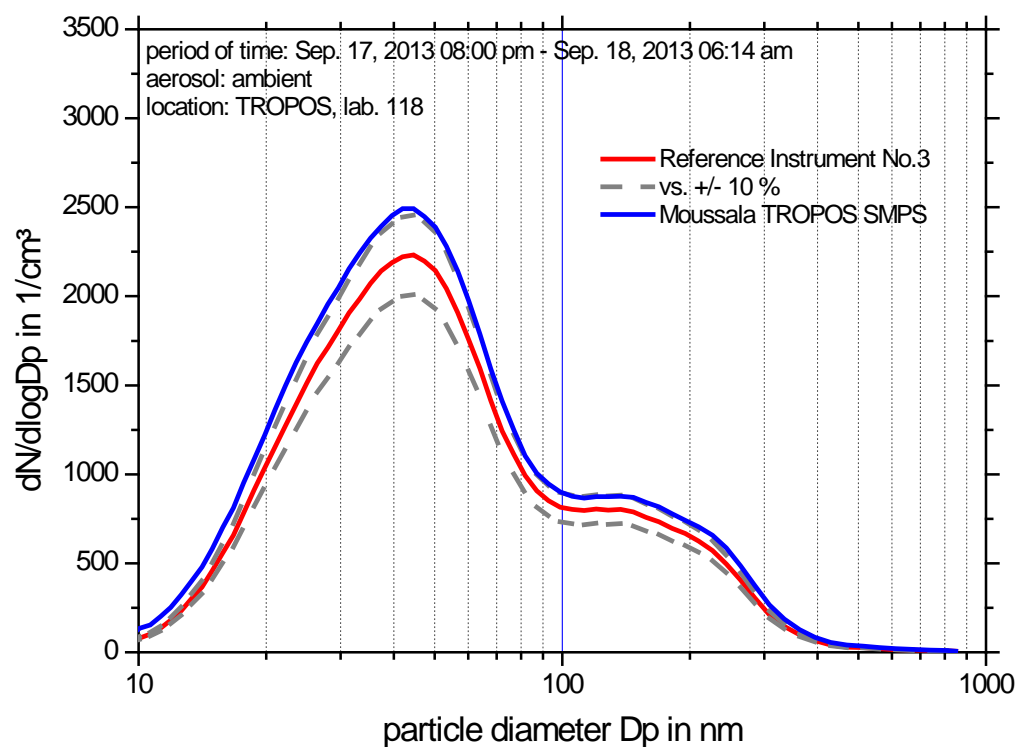


Fig.9. Comparison of mean particle number size distribution between Sep. 17, 2013 08:00 pm and Sep. 18, 2013 06:14 am. Internal diffusion losses and CPC efficiency are included.

B: Final run

Latex 203 nm

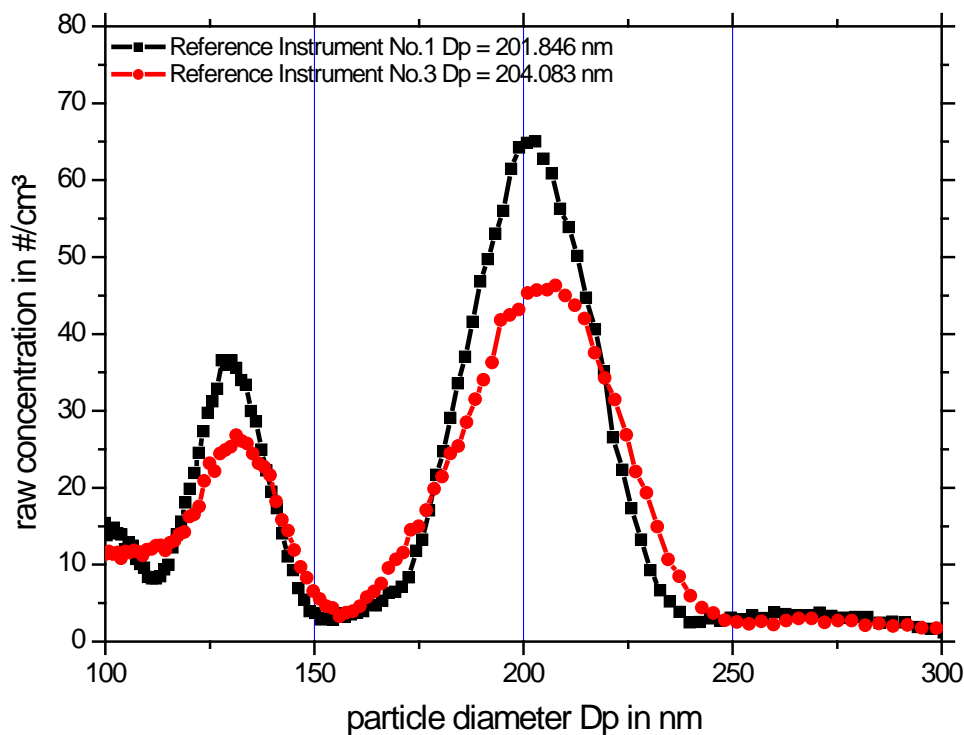


Fig.10. Measurement of latex 203 nm for TROPOS reference instrument No.1 and No.3: Particle size distribution (raw concentration) for latex on Sep. 18, 2013 between 04:00 pm and 04:15 pm (UTC time).

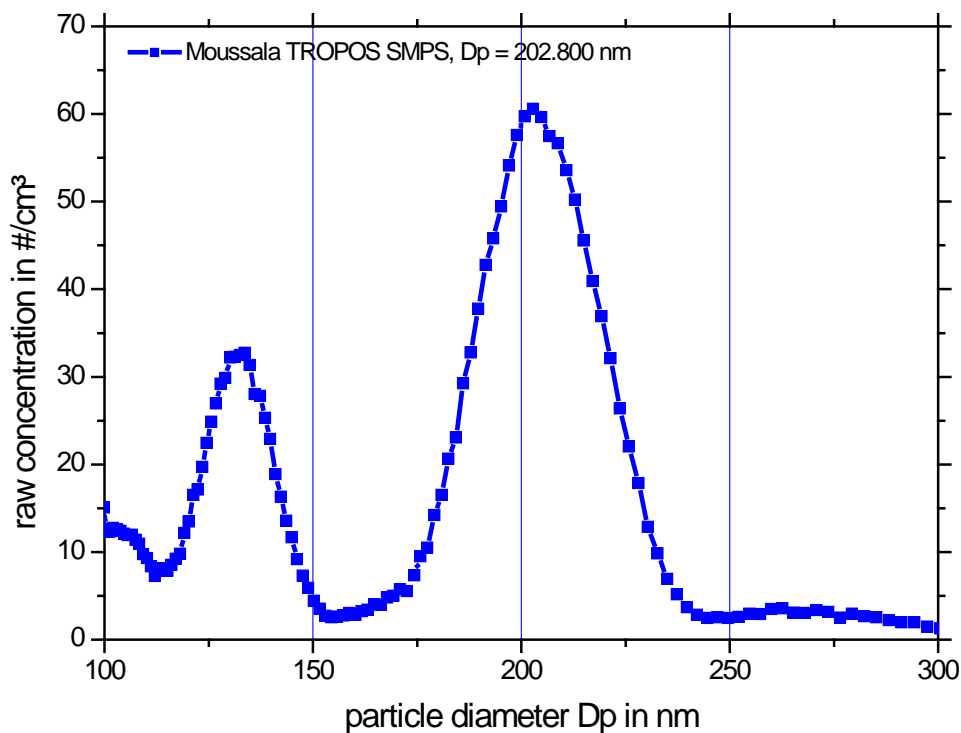


Fig.11. Measurement of latex 203 nm for instrument Moussala TROPOS SMPS: Particle size distribution (raw concentration) for latex 2013 on Sep. 18, 2013 between 03:55 pm and 04:05 pm (UTC time).

1. Time series

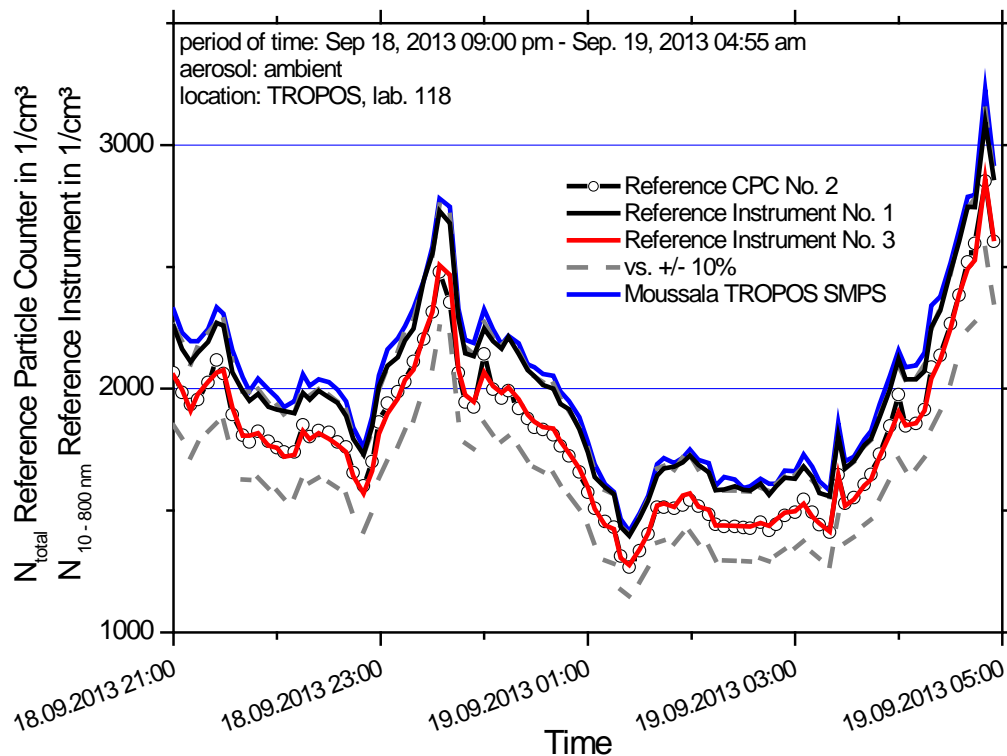


Fig.12. Time series (Sep. 18, 2013 09:00 pm - Sep. 19, 2013 04:55 am) of the integrated particle number concentration ($N_{10-800nm}$). Flow corrections are included.

2. Correlation

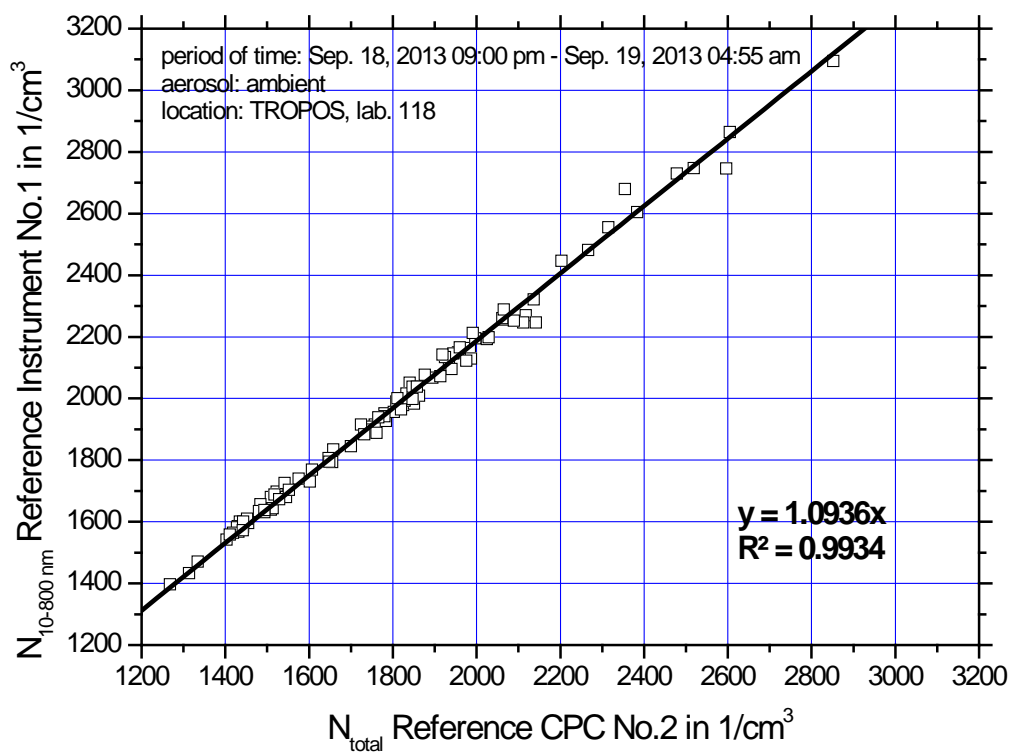


Fig.13. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.1. Internal diffusion losses and flow corrections are included.

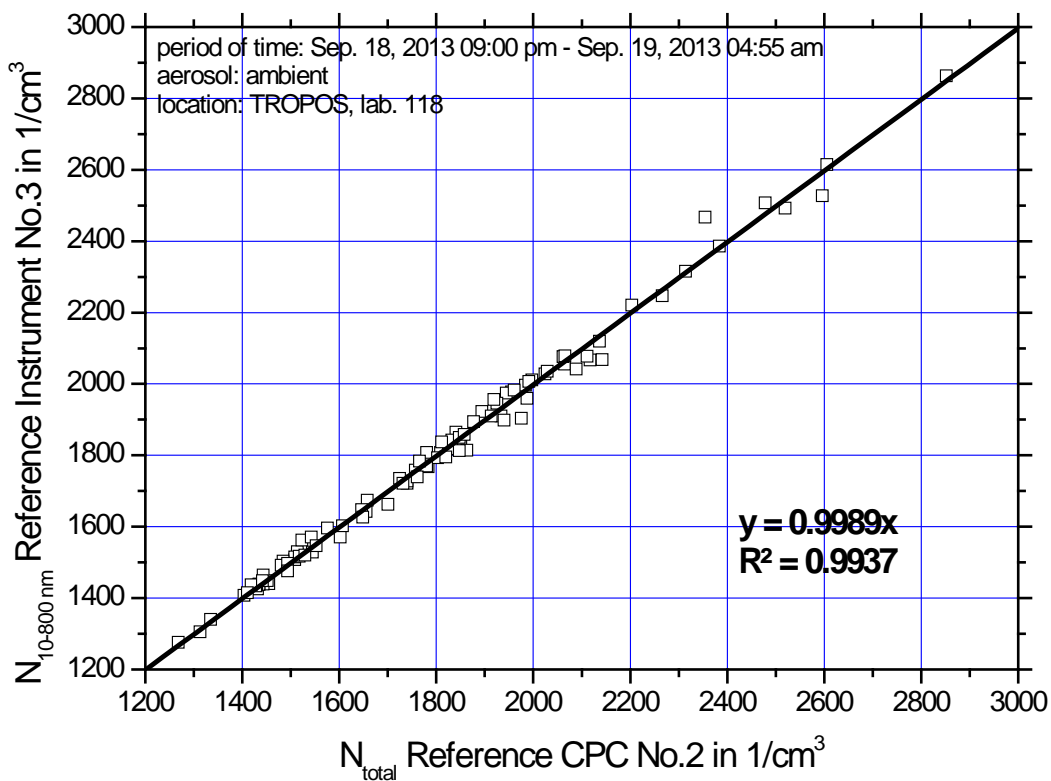


Fig.14. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.3. Internal diffusion losses and flow corrections are included.

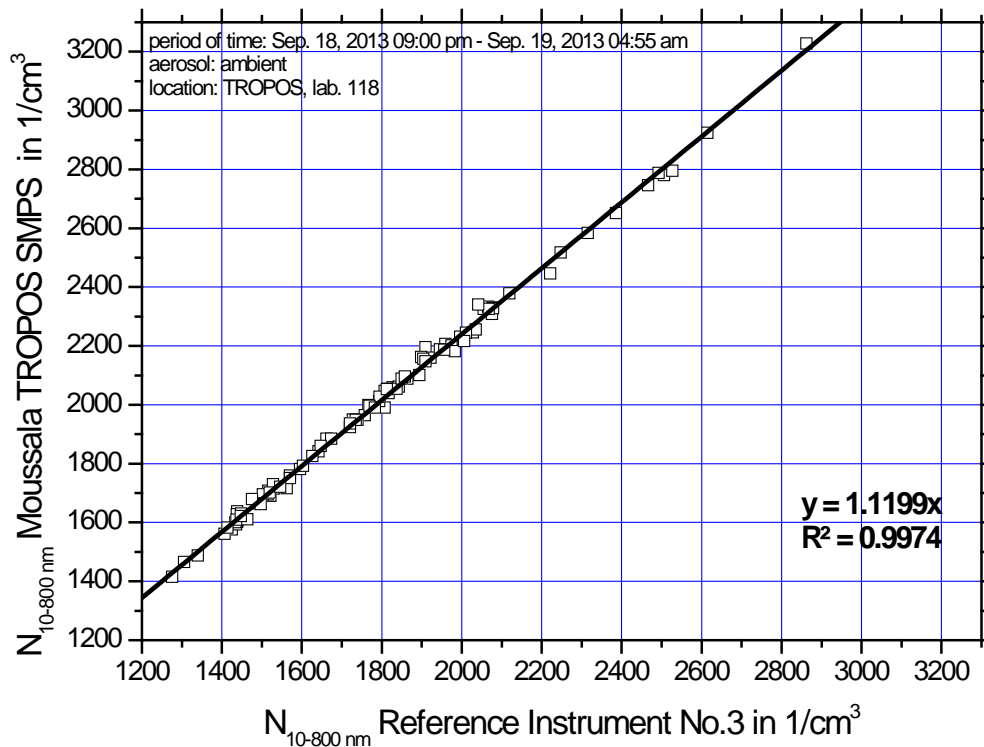


Fig.15. Linear regression between the particle number concentrations of TROPOS reference instrument No.3 and Moussala TROPOS SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

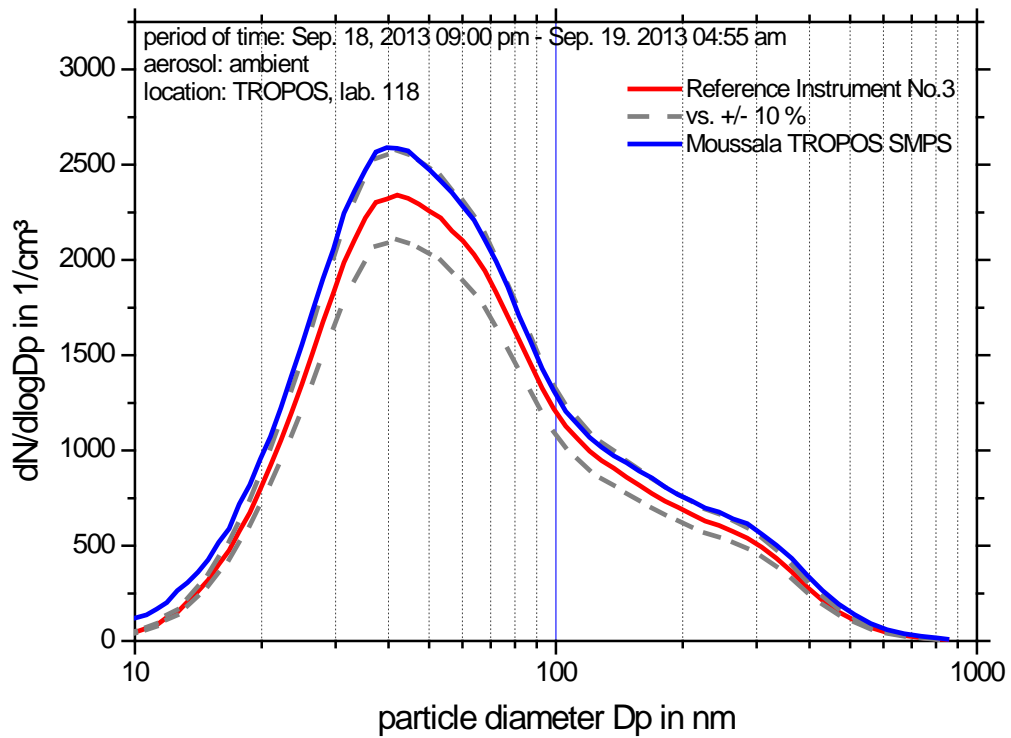


Fig.16. Comparison of mean particle number size distribution between Sep. 18, 2013 09:00 pm and Sep. 19, 2013 04:55 am. Internal diffusion losses and CPC efficiency are included.

Intercomparison of Prag TSI SMPS TROPOS

Basic information

Location of the quality assurance:	TROPOS, lab: 118
Delivery date:	Sep. 16, 2013
Setup in the laboratory:	Sep. 16, 2013
Comparison period:	Sep. 16, 2013 - Sep. 20, 2013
Instrument:	Prag TSI SMPS TROPOS SoWare
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	Vladimir Zdimal (zdimal@icpf.cas.cz)

Summary:

From Sep. 16, 2013 to Sep. 20, 2013, the Prag TSI SMPS TROPOS participated successfully the TROPOS ACTRIS Workshop. The workshop consisted of an entrance test and a final run. In addition to the overnight ambient measurements, we had numerous high voltage checks, zero- and PSL- measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that, we show for each run the time series of the particle number concentration, the particle number size distribution, and correlation plots. If anything was written in the log book, so we added this also in this report. As reference standards, we used CPCs model TSI 3772 for total particle number concentration and two TROPOS mobility particle size spectrometer. The particle counters have been calibrated against a calibrated TSI electrometer 3068 B with the serial number 70838596.

For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. The Prag TSI SMPS TROPOS showed in the PSL-measurements a particle diameter of 203.9 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. If we look at the final ambient measurement run, the Prag TSI SMPS TROPOS is out of the 10%. The Kosetice TROPOS SMPS didn't pass the ACTRIS Workshop.

Log book:

Sep. 16, 2013

08:00-11:00 -> setup of Prag TSI SMPS TROPOS SoWare in laboratory 118 (System 1)
-> $Q_{CPC} = 1.013$ l/min, $Q_{line} = 1.029$ l/min
-> zero check 0 #/cm³, HV calibration
11:14-12:47 -> latex mode; 203 nm Latex, 204 nm ok
12:50 -> ambient measurement
13:05 -> ambient scan
14:41 -> sampling from manifold
16:30 -> start ambient measurement

Sep. 17, 2013

16:00 -> measurement stopped, HV check
17:07 -> scan started
18:00-18:10 -> zero check 1 #/cm³
19:25 -> 2 latex scans (203 nm, 204 nm)
20:00 -> stop HV check

Sep. 18, 2013

15:40 -> nafion back, zero check ok
15:58 -> latex
16:20 -> zero check

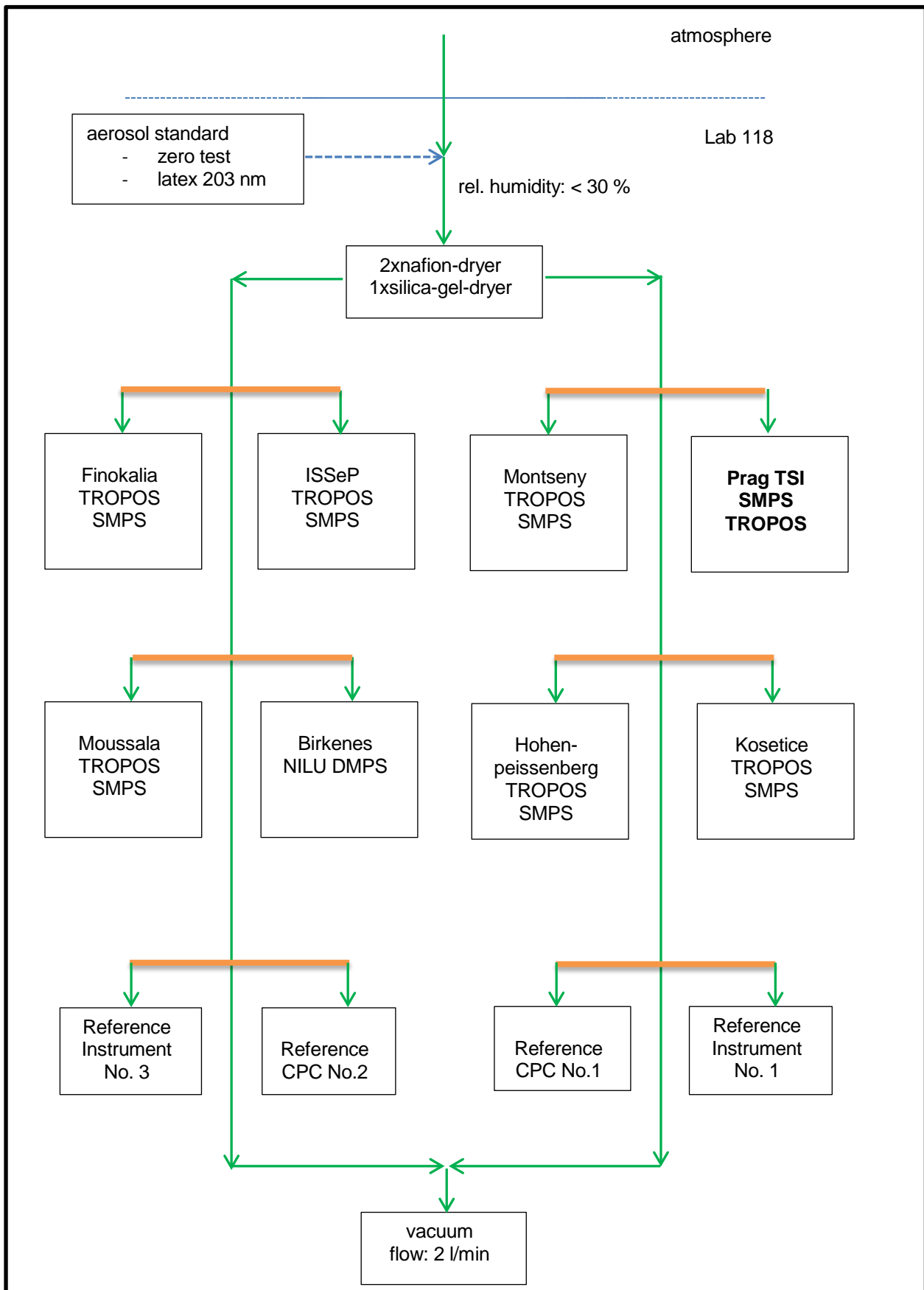
Sep. 19, 2013

07:05 -> additional radioactive source
09:45 -> new Kr-source instead ambient

Sep. 20, 2013

07:12 -> stop measurements

Laboratory setup



A: First run

Latex 203 nm

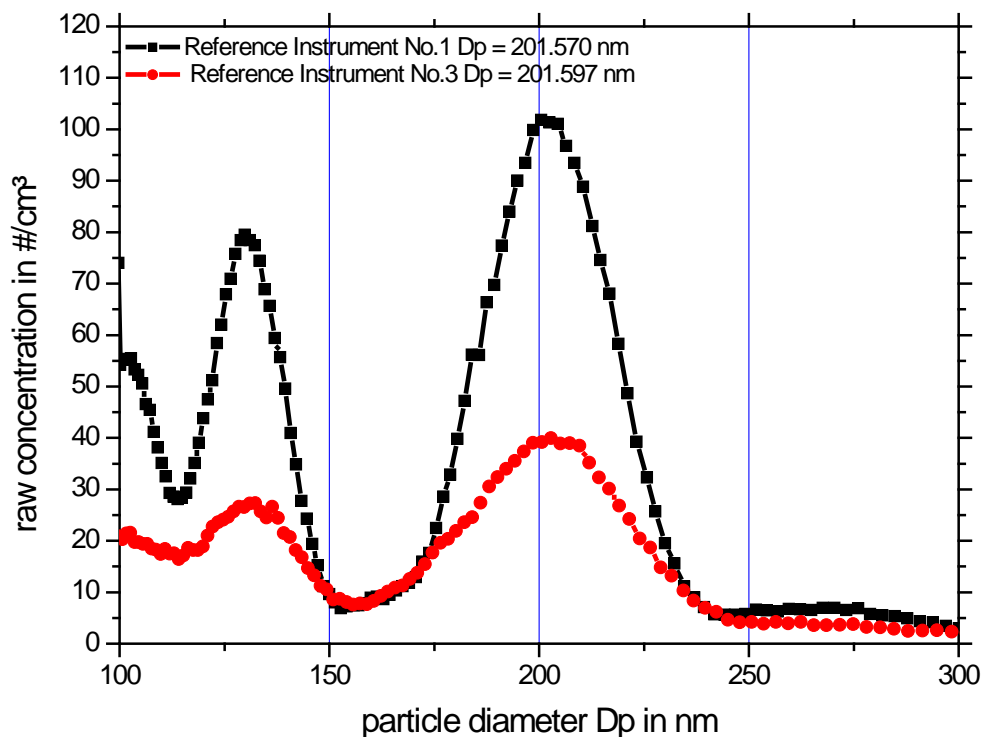


Fig.1. Measurement of latex 203 nm for TROPOS reference instrument No.1 and No.3: Particle size distribution (raw concentration) for latex on Sep. 16, 2013 between 01:20 pm and 01:45 pm (UTC time).

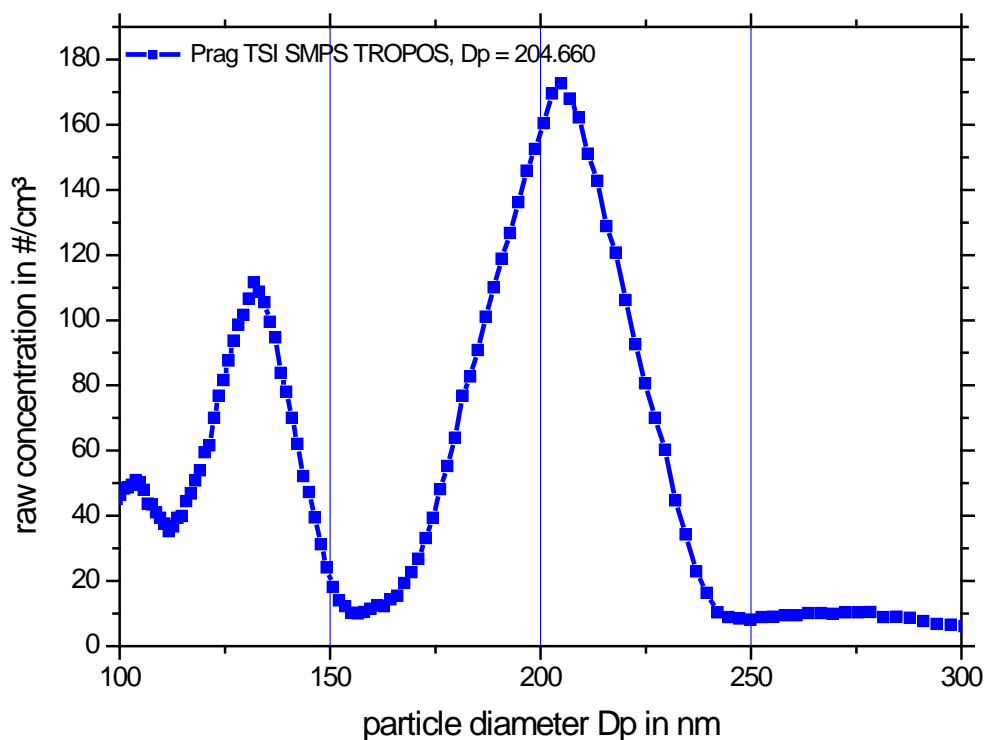


Fig.2. Measurement of latex 203 nm for instrument Prag TSI SMPS TROPOS: Particle size distribution (raw concentration) for latex 2013 on Sep. 16, 2013 between 12:25 pm and 12:35 pm (UTC time).

1. Time series

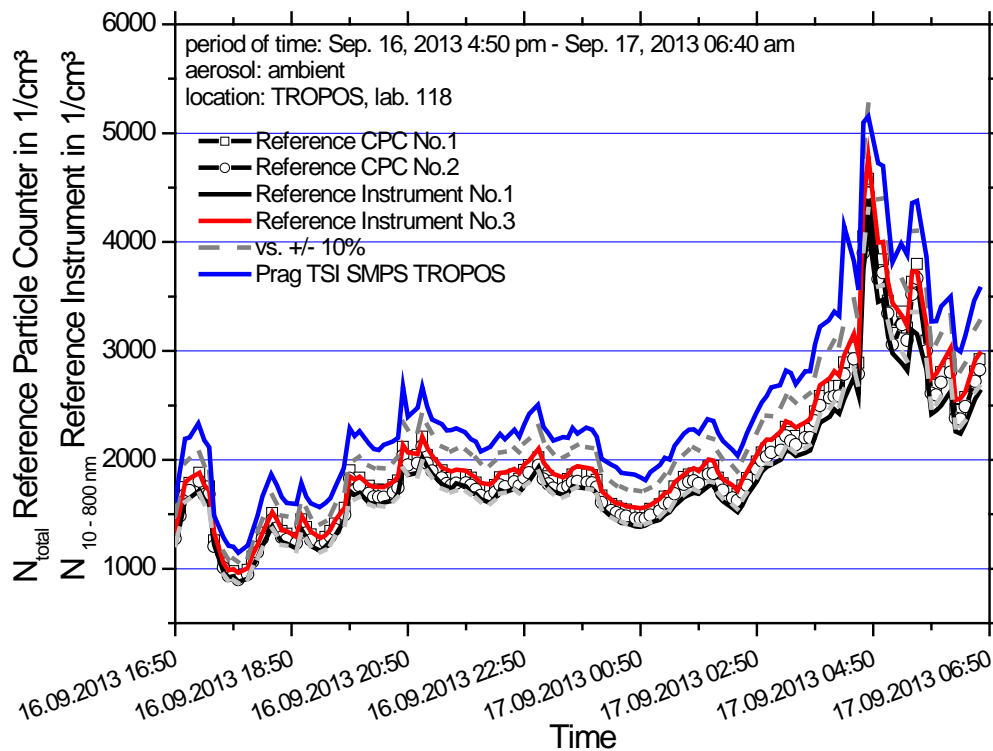


Fig.3. Time series (Sep. 16, 2013 04:50 pm - Sep. 17, 2013 06:40 am) of the integrated particle number concentration ($N_{10-800nm}$). Flow corrections are included.

2. Correlation

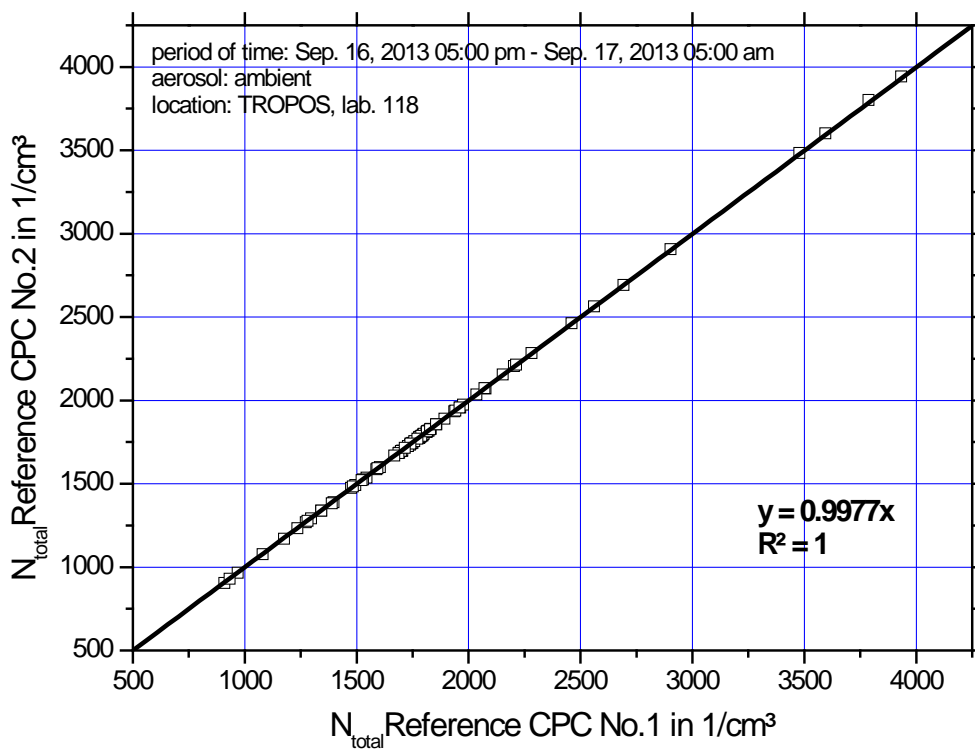


Fig.4. Linear regression between two TROPOS CPCs (Model 3772). Flow corrections are included.

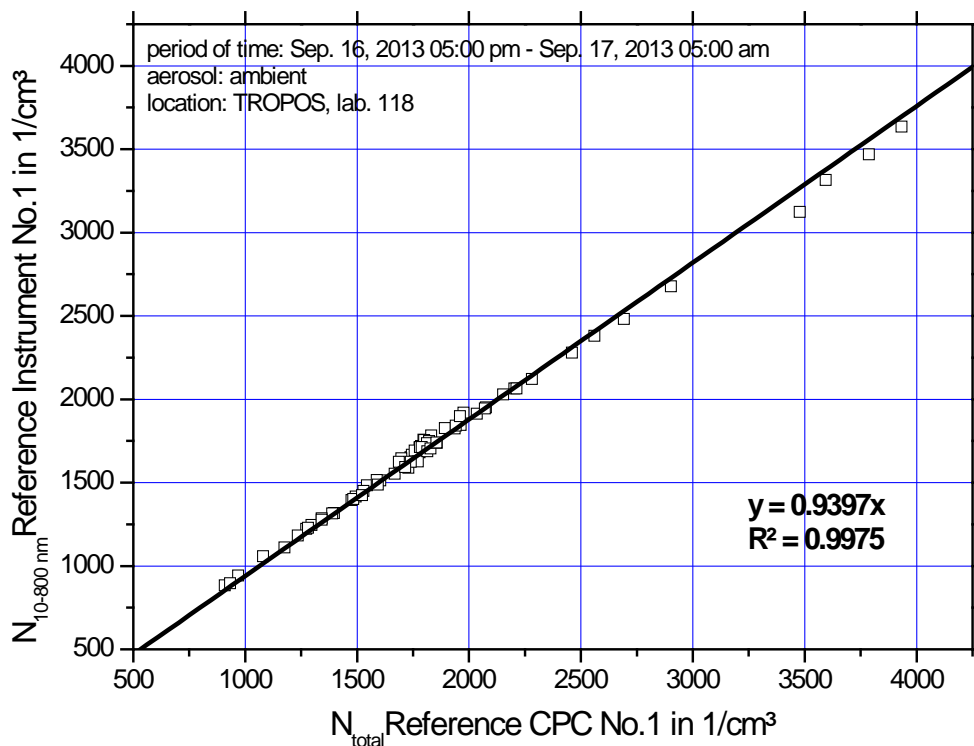


Fig.5. Linear regression between the particle number concentrations of TROPOS reference CPC No.1 and TROPOS reference instrument No.1. Internal diffusion losses and flow corrections are included.

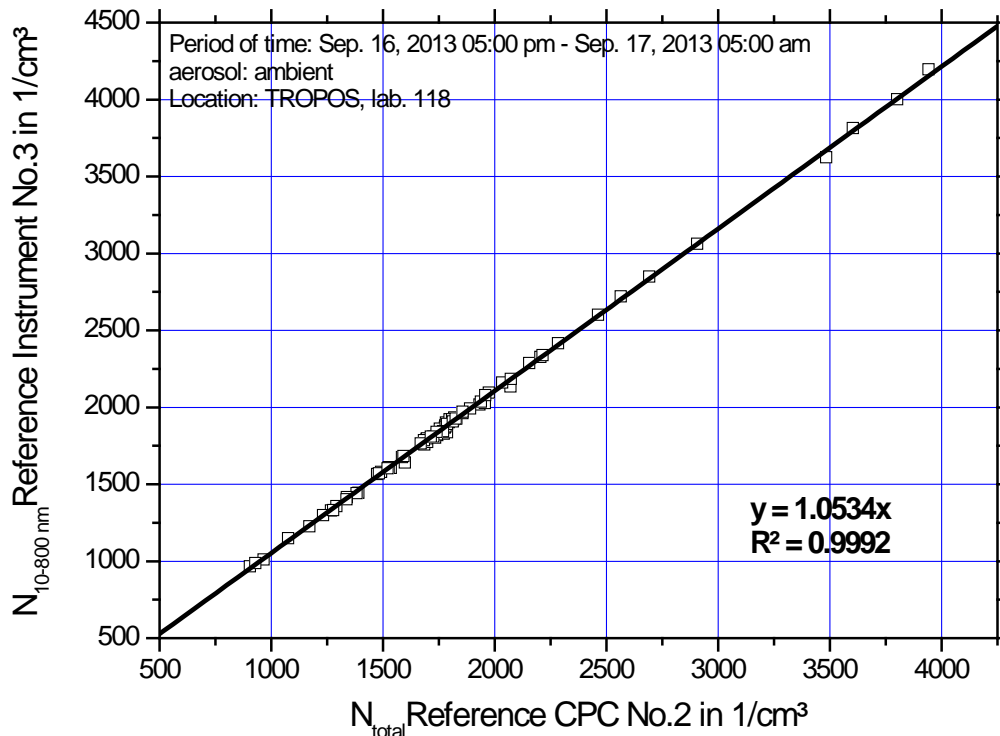


Fig.6. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.3. Internal diffusion losses and flow corrections are included.

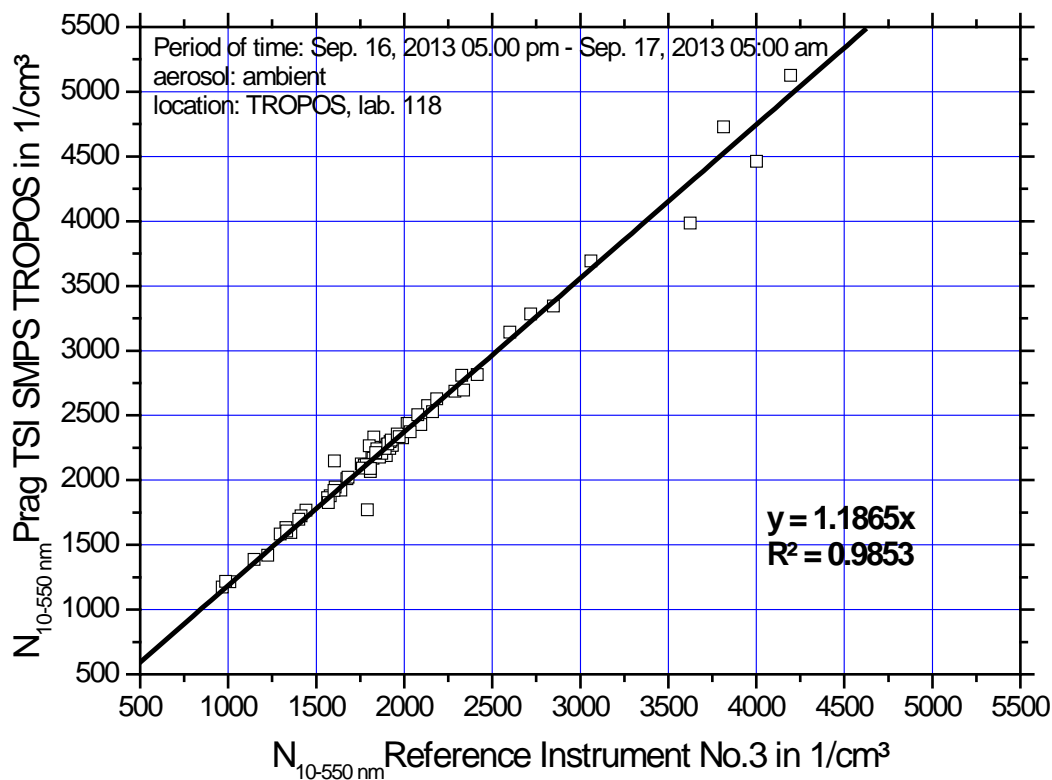


Fig.7. Linear regression between the particle number concentrations of TROPOS reference instrument No.1 and Prag TSI SMPS TROPOS. Internal diffusion losses and flow corrections are included.

3. Size distribution

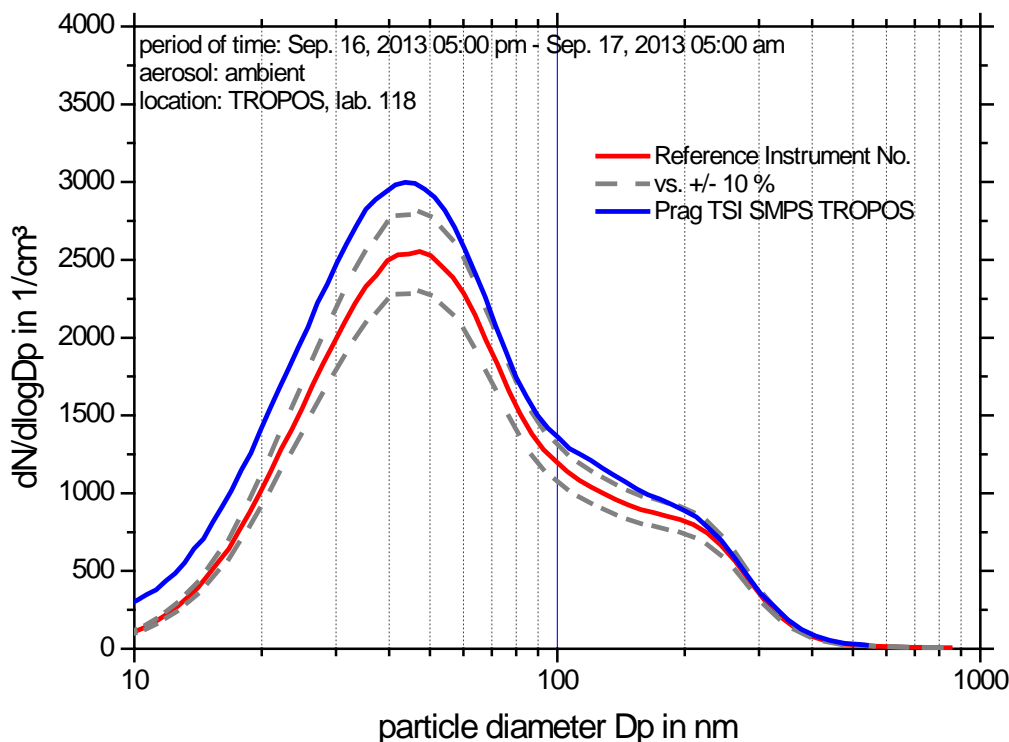


Fig.8. Comparison of mean particle number size distribution between Sep. 16, 2013 05:00 pm and Sep. 17, 2013 05:00 am. Internal diffusion losses and CPC efficiency are included.

B: Final run

Latex 203 nm

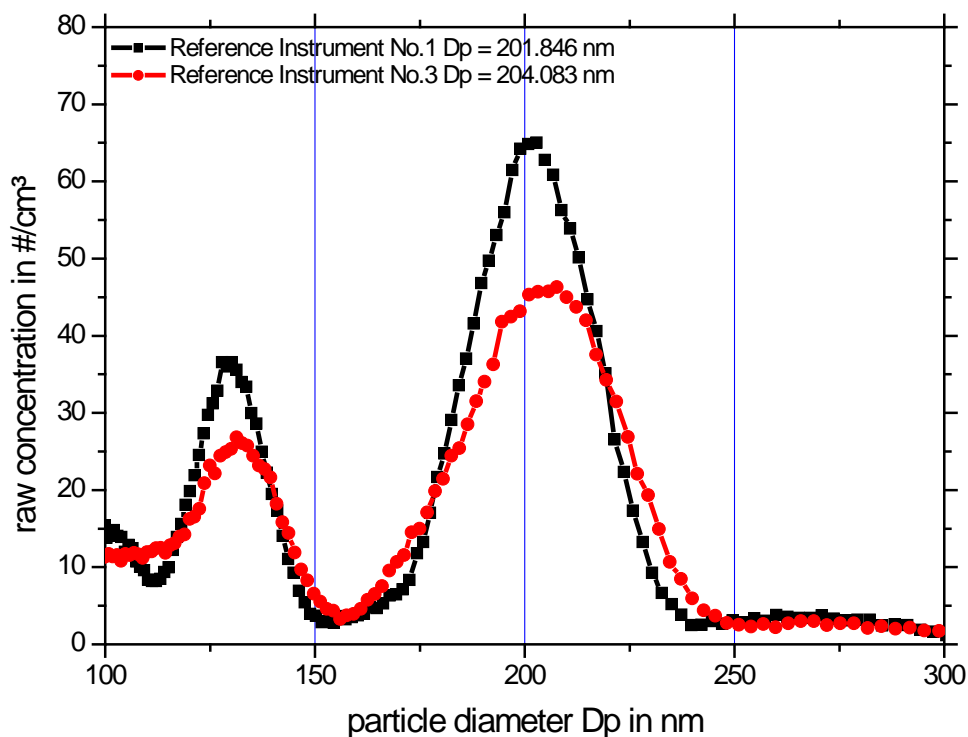


Fig.9. Measurement of latex 203 nm for TROPOS reference instrument No.1 and No.3: Particle size distribution (raw concentration) for latex on Sep. 18, 2013 03:55 pm and 04:10 pm (UTC time).

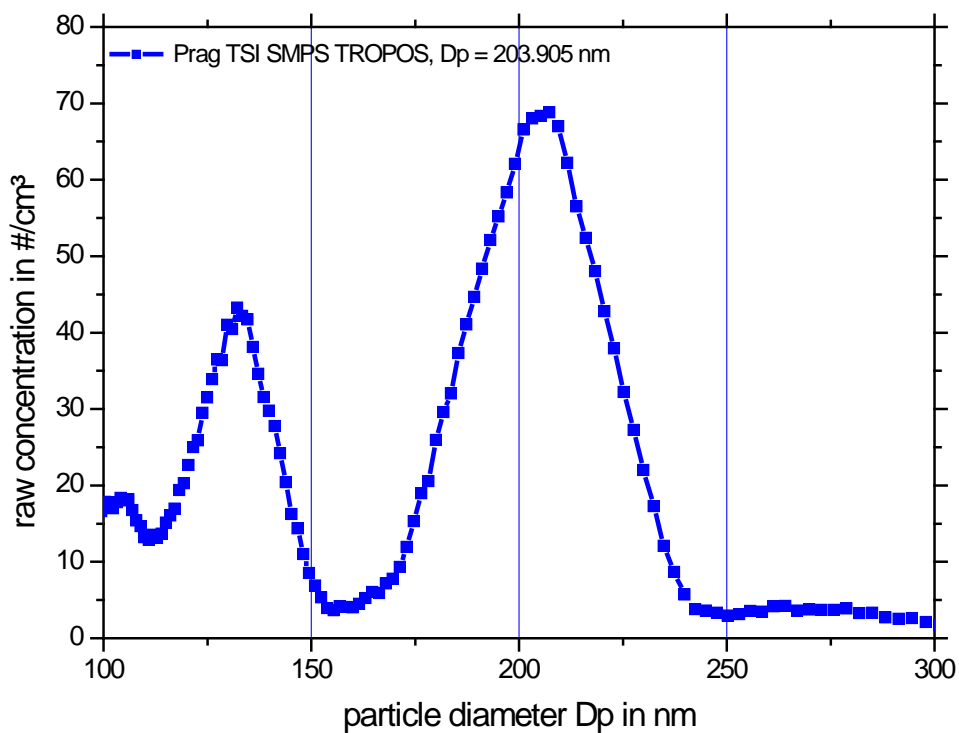


Fig.10. Measurement of latex 203 nm for instrument Prag TSI SMPS SMPS: Particle size distribution (raw concentration) for latex 2013 on Sep. 18, 2013 between 04:00 pm and 04:15 pm (UTC time).

1. Time series

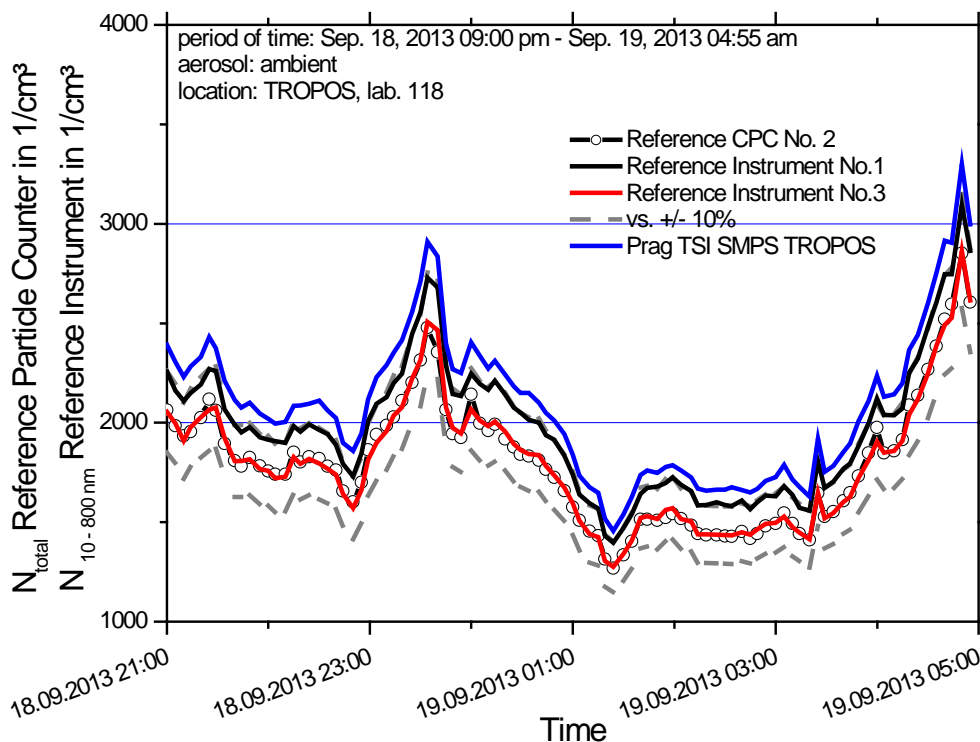


Fig.11. Time series (Sep. 18, 2013 09:00 pm - Sep. 19, 2013 04:55 am) of the integrated particle number concentration ($N_{10-800nm}$). Flow corrections are included.

2. Correlation

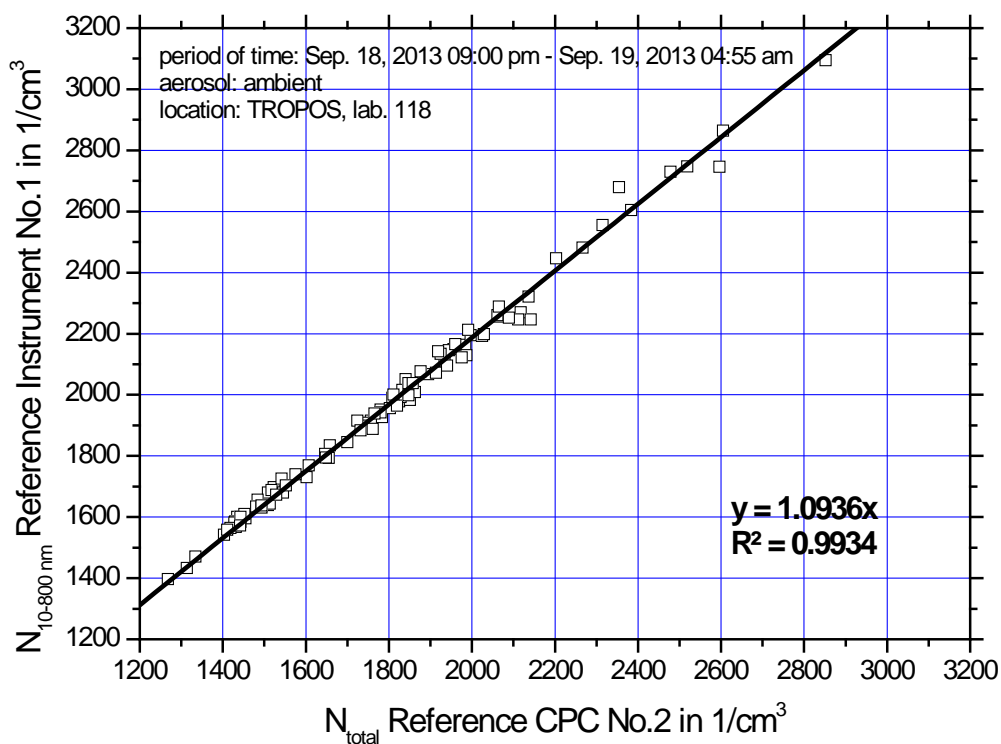


Fig.12. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.1. Internal diffusion losses and flow corrections are included.

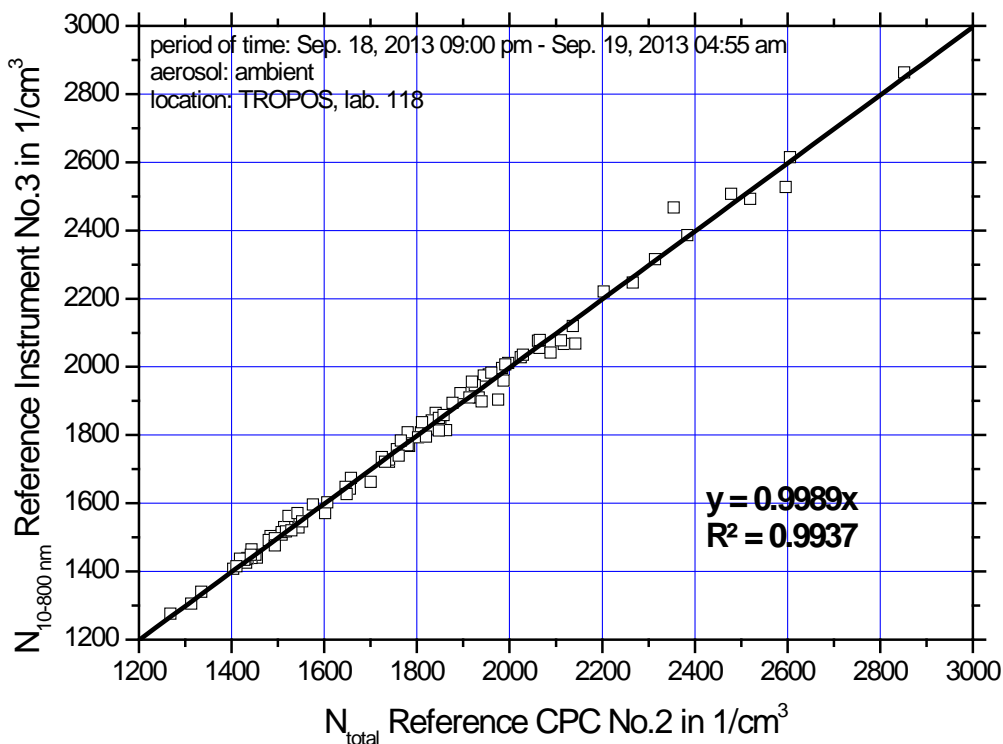


Fig.13. Linear regression between the particle number concentrations of TROPOS reference CPC No.2 and TROPOS reference instrument No.3. Internal diffusion losses and flow corrections are included.

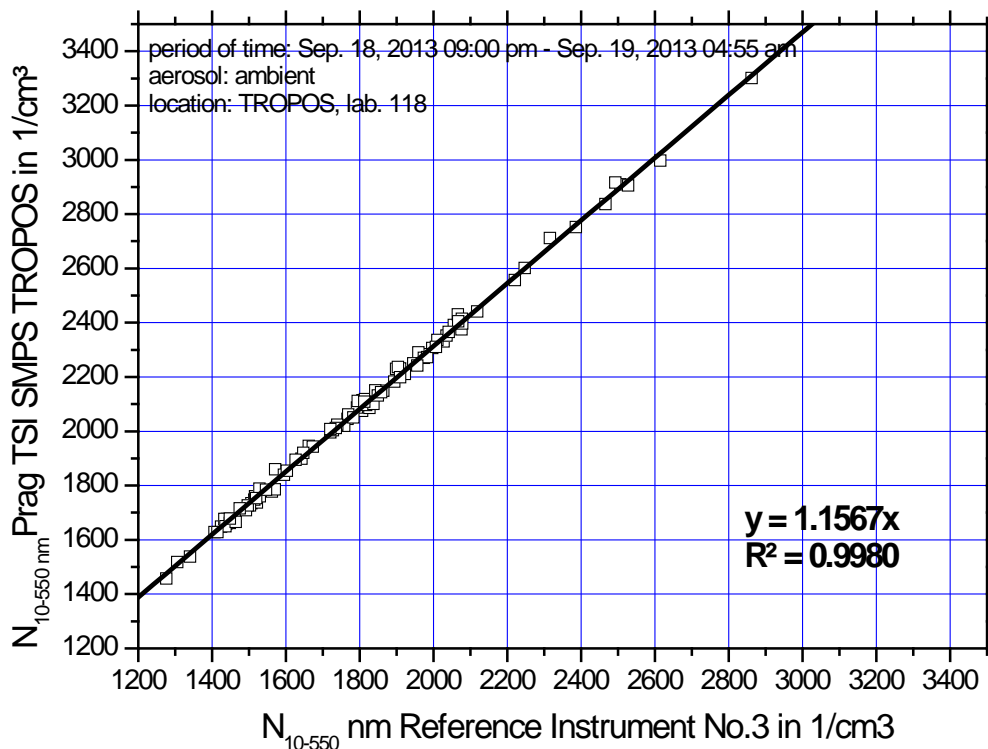


Fig.14. Linear regression between the particle number concentrations of TROPOS reference instrument No.3 and Prag TSI SMPS TROPOS. Internal diffusion losses and flow corrections are included.

3. Size distribution

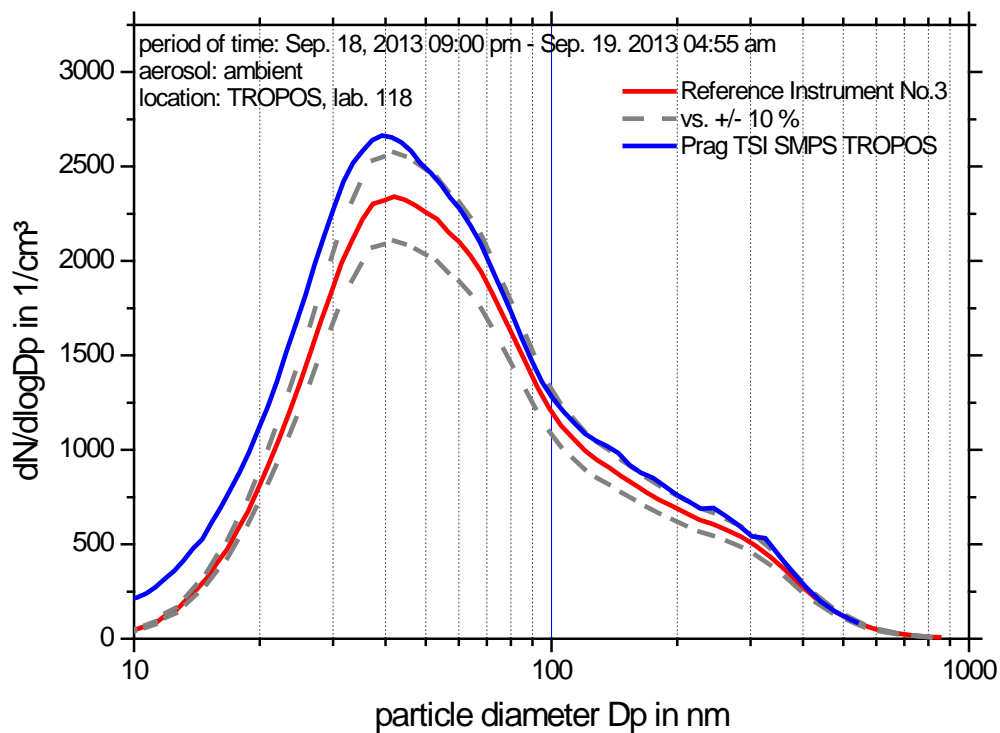


Fig.15. Comparison of mean particle number size distribution between Sep. 18, 2013 09:00 pm and Sep. 19, 2013 04:55 am. Internal diffusion losses and CPC efficiency are included.

Second week:

Intercomparison of CIEMAT TSI SMPS

Basic information

Location of the quality assurance:	TROPOS, lab: 118
Delivery date:	Sep. 23, 2013
Setup in the laboratory:	Sep. 23, 2013
Comparison period:	Sep. 23, 2013 – Sep. 26, 2013
Instrument:	CIEMAT TSI SMPS
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	F. J. Gomez-Moreno (fj.gomez@ciemat.es)

Summary:

From Sep. 23, 2013 to Sep. 26, 2013, the CIEMAT TSI SMPS participated successfully the TROPOS ACTRIS Workshop. The workshop consisted of an entrance test and a final run. In addition to the overnight ambient measurements, we had numerous high voltage checks, zero- and PSL- measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that, we show for each run the time series of the particle number concentration, the particle number size distribution, and correlation plots. If anything was written in the log book, so we added this also in this report. As reference standards, we used CPCs model TSI 3772 for total particle number concentration and two TROPOS mobility particle size spectrometer. The particle counters have been calibrated against a calibrated TSI electrometer 3068 B with the serial number 70838596.

For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. The CIEMAT TSI SMPS showed in the PSL-measurements a particle diameter of 204.0 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. When we look at the time series and particle number size distributions the system showed all the time a lower concentration than the Reference Instrument. Especially for particle smaller than 50 nm the system showed a permanent offset in the high voltage what means that the concentration

increases. The same effect you can see on the upper end. Because of this the calculated time series and the correlation is not in the range we accept. We run the system in different settings without Kr85, change DMA and modified the inlet. Nothing happened. Also the TROPOS inversion + diffusion correction can't solve the problem. In the final run the CIEMAT TSI SMPS is out of the 10%. The CIEMAT TSI SMPS didn't pass the ACTRIS Workshop. It is necessary to repeat the intercomparison workshop 2014.

Log book:

Sep. 23, 2013

15:15	-> zero check: $0.58 - 1.45 \text{ 1/cm}^3$
	-> multiple voltage calibration: $y=0.9848x+1.2021$; $R^2=1$
17:00-17:50	-> latex tests (203nm)

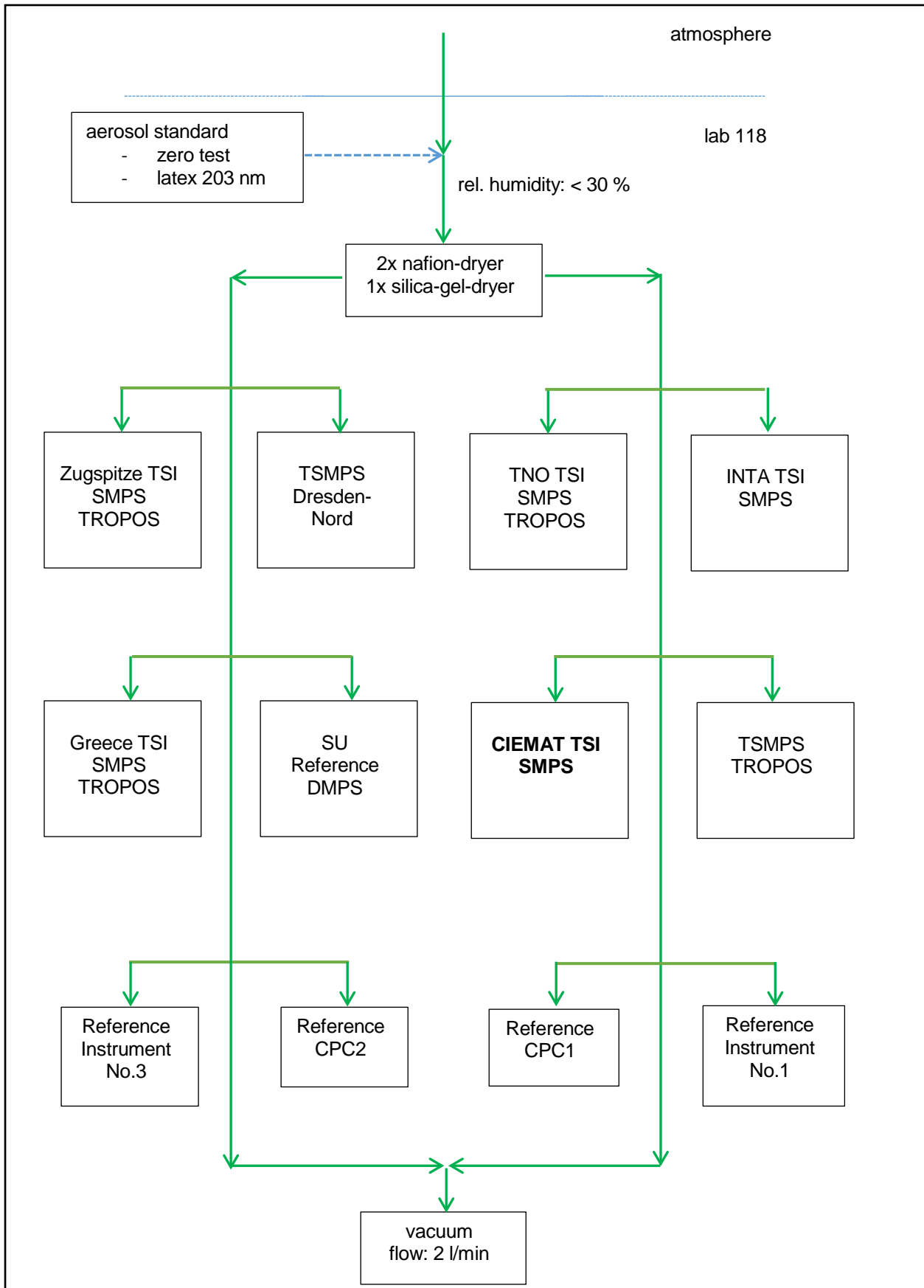
Sep. 24, 2013

	-> bad results after night. Kr-85 is changed. Two plugs installed to dryer in case of leak.
15:30-16:50	-> zero check
17:00-17:30	-> latex tests

Sep. 25, 2013

09:30	-> DMA interchange between CIEMAT and INTA Systems
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Laboratory setup



A: First run

Latex 203 nm

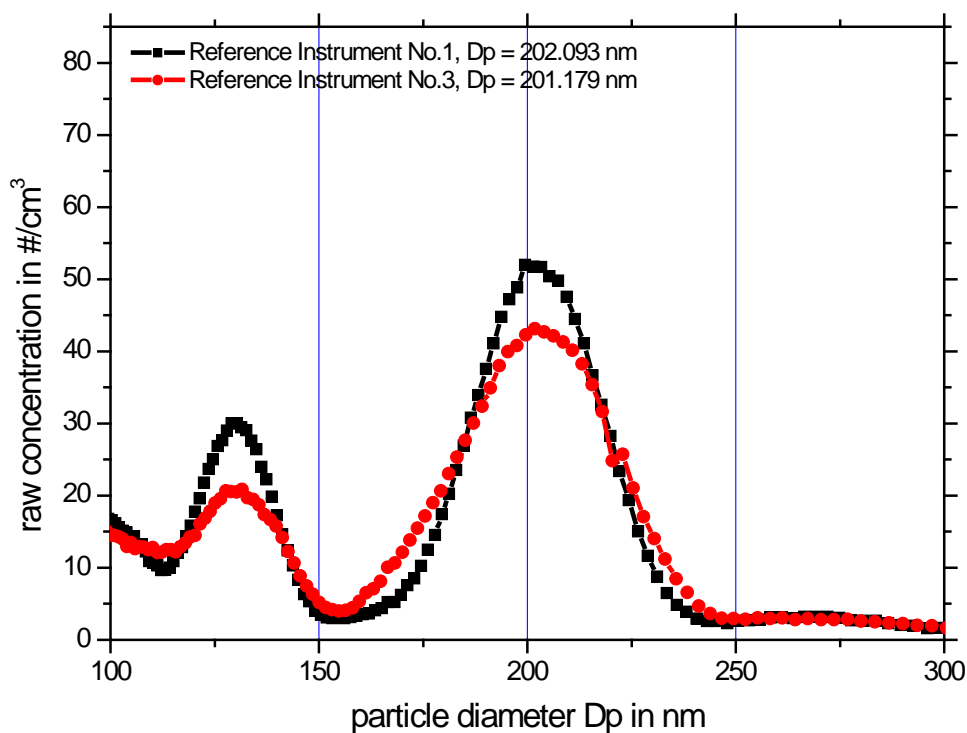


Fig.1. Measurement of latex 203 nm for TROPOS reference instruments: Particle size distribution (raw concentration) for latex 203 nm on Sep. 23, 2013 between 05:06 pm and 05:33 pm.

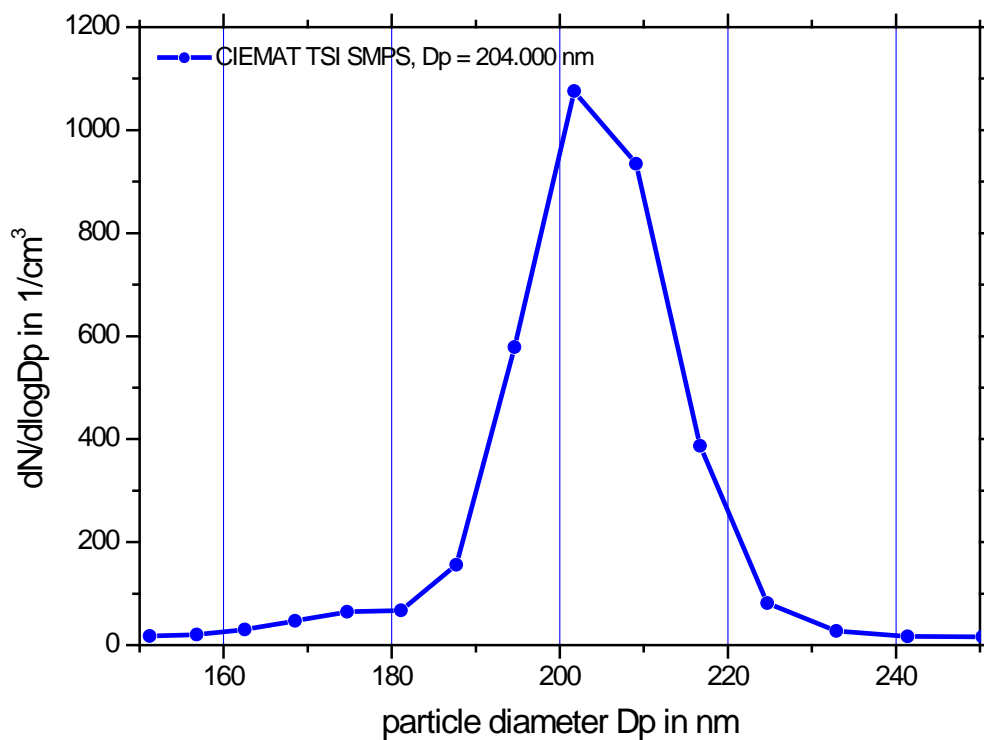


Fig.2. Measurement of latex 203 nm for instrument CIEMAT TSI SMPS: particle size distribution (raw concentration) for latex 203 nm.

CPC efficiency

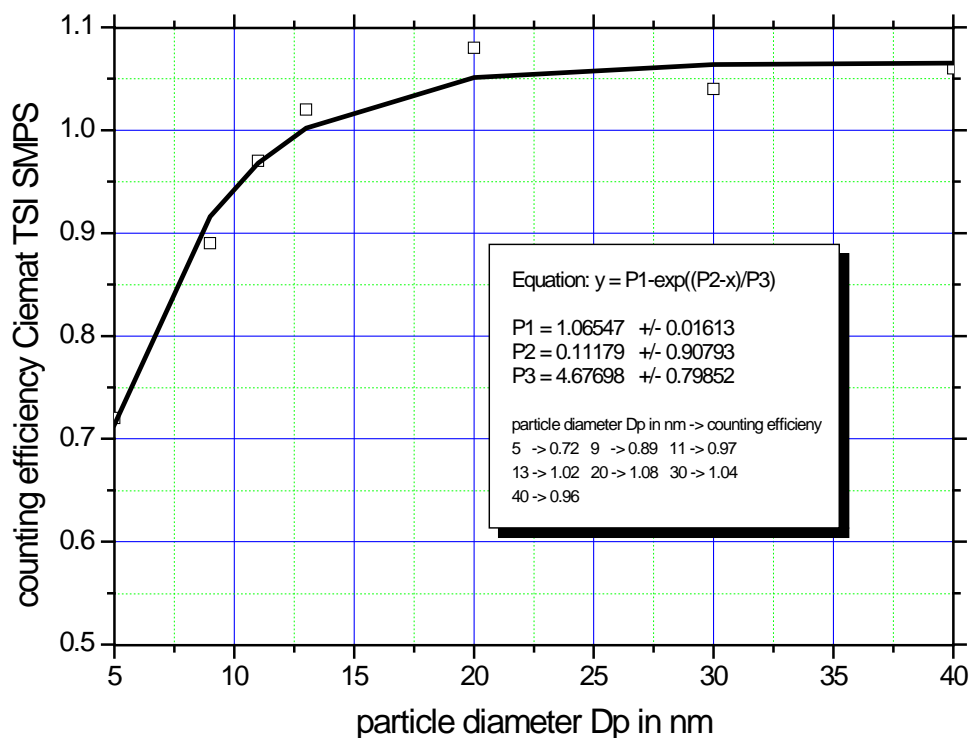


Fig.3. CPC efficiency curve. Based on Electrometer TSI 3068B. Serial number: 70838596.

1. Time series

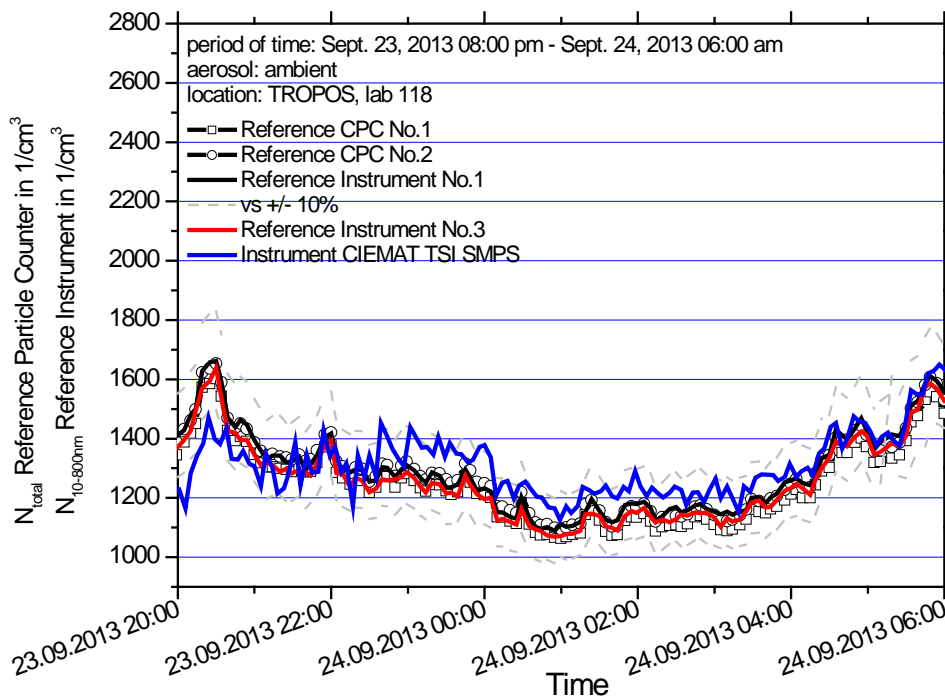


Fig.4. Time series (Sep. 23, 2013 08:00 pm – Sep. 24, 2013 06:00 am) of the integrated particle number concentration ($N_{10-800nm}$). Diffusion losses are included.

2. Correlation

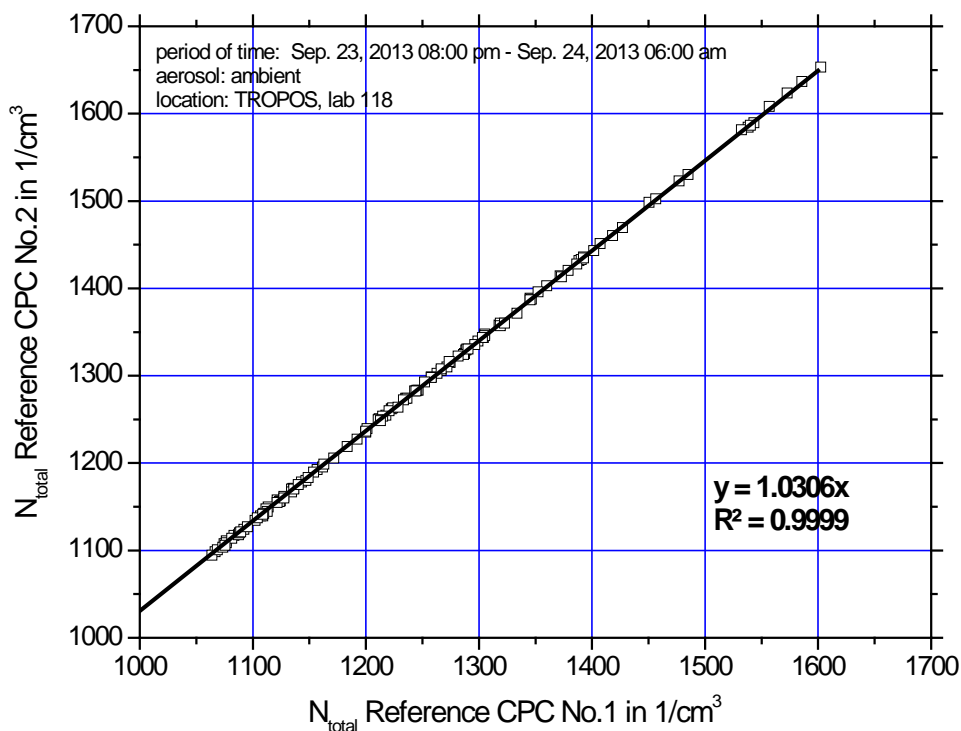


Fig.5. Linear regression between two TROPOS reference CPCs (Model 3772). Flow corrections are included.

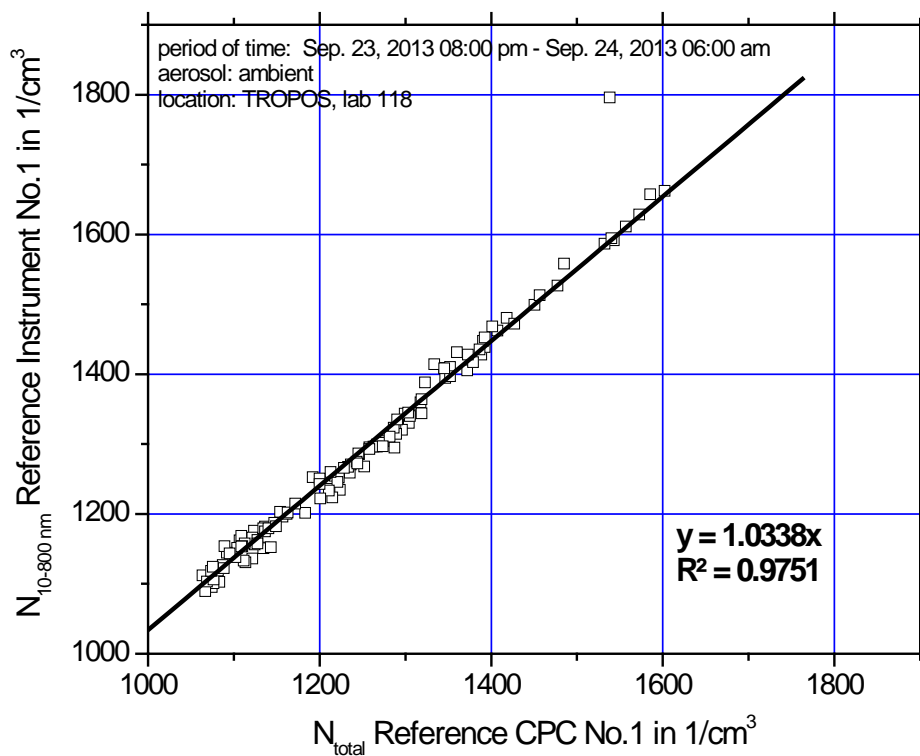


Fig.6. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No. 1. Internal diffusion losses and flow corrections are included.

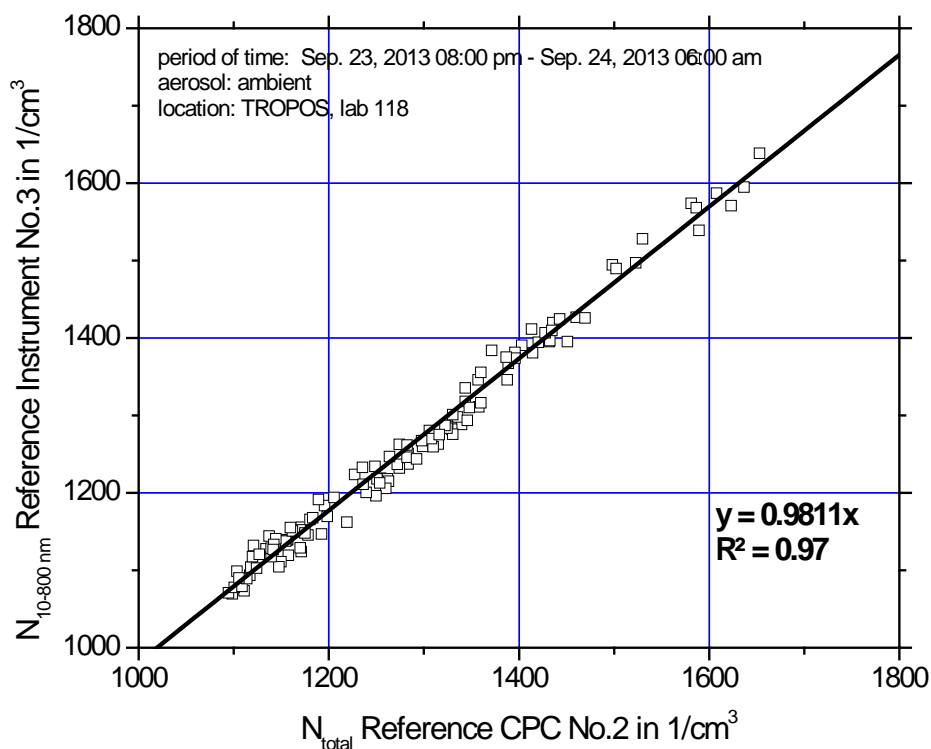


Fig.7. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusion losses and flow corrections are included.

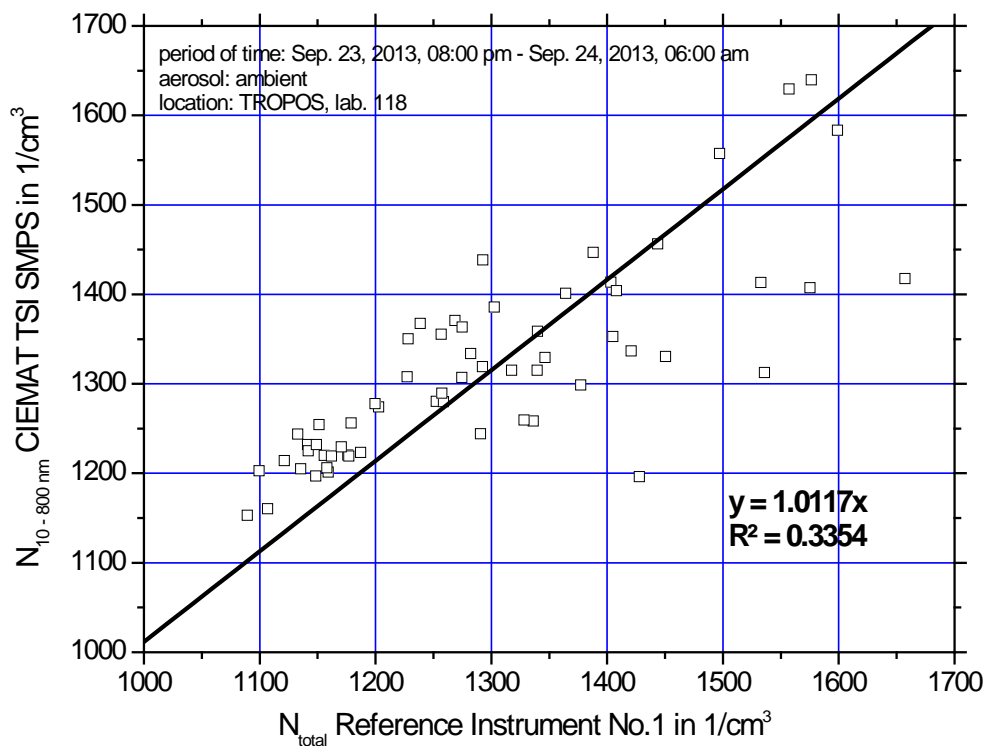


Fig.8. Linear regression between the number concentrations of the TROPOS reference instrument No. 1 and instrument CIEMAT TSI SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

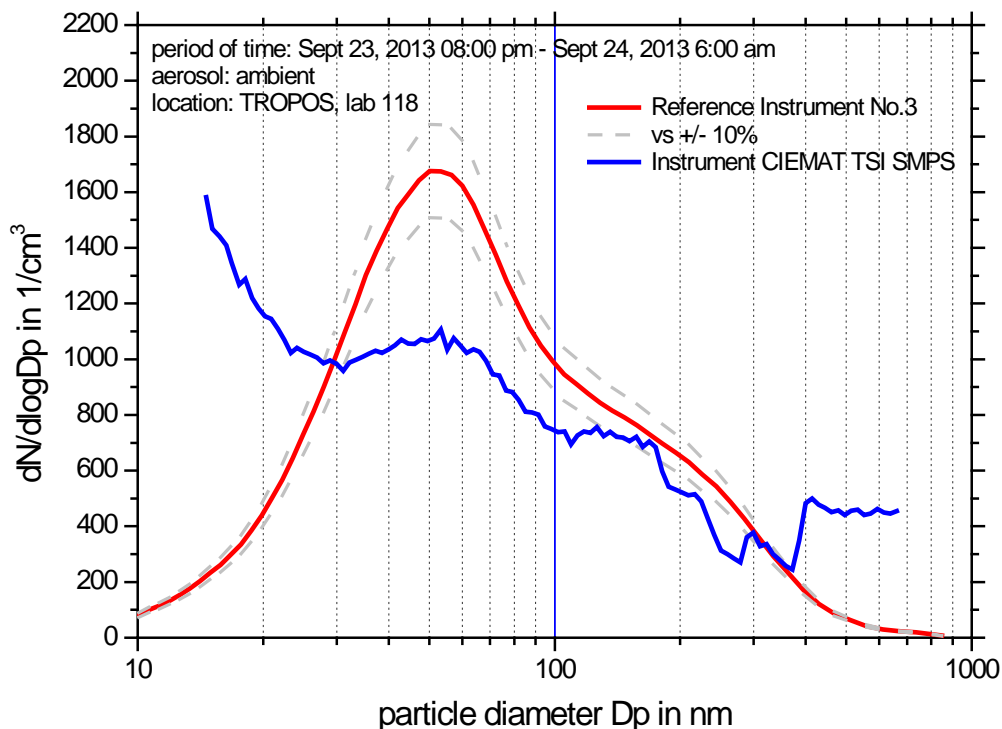


Fig.9. Comparison of mean particle number size distribution between Sep. 23, 2013 08:00 pm and Sep. 24, 2013 06:00 am. Internal diffusion losses and CPC efficiency are included.

B: Final run

1. Time series

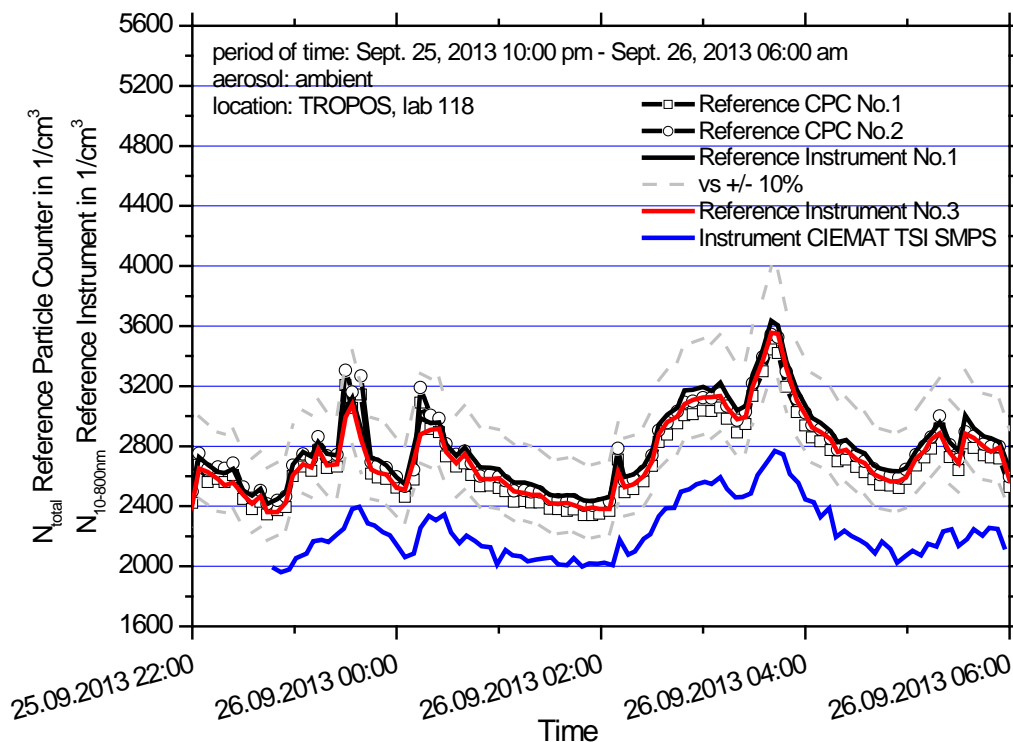


Fig.10. Time series (Sep. 25, 2013 09:45 pm – Sep. 26, 2013 06:00 am) of the integrated particle number concentration ($N_{10-800\text{nm}}$). Diffusion losses are included.

2. Correlation

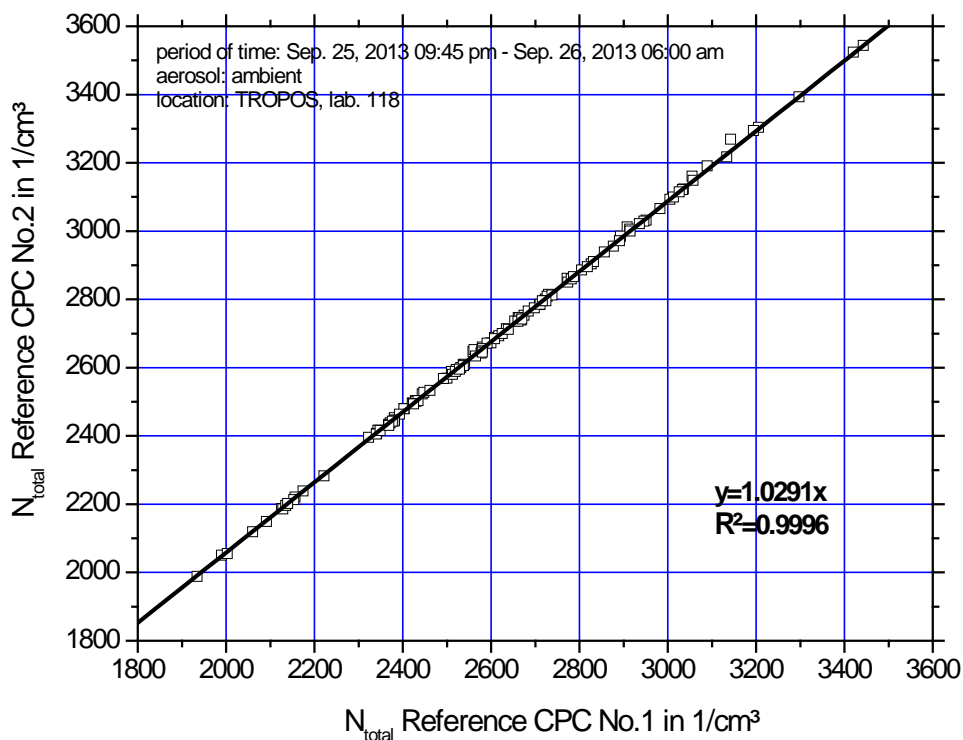


Fig.11. Linear regression between the number concentrations of two TROPOS reference CPCs (No. 1 and No. 2). Internal diffusion losses and flow corrections are included.

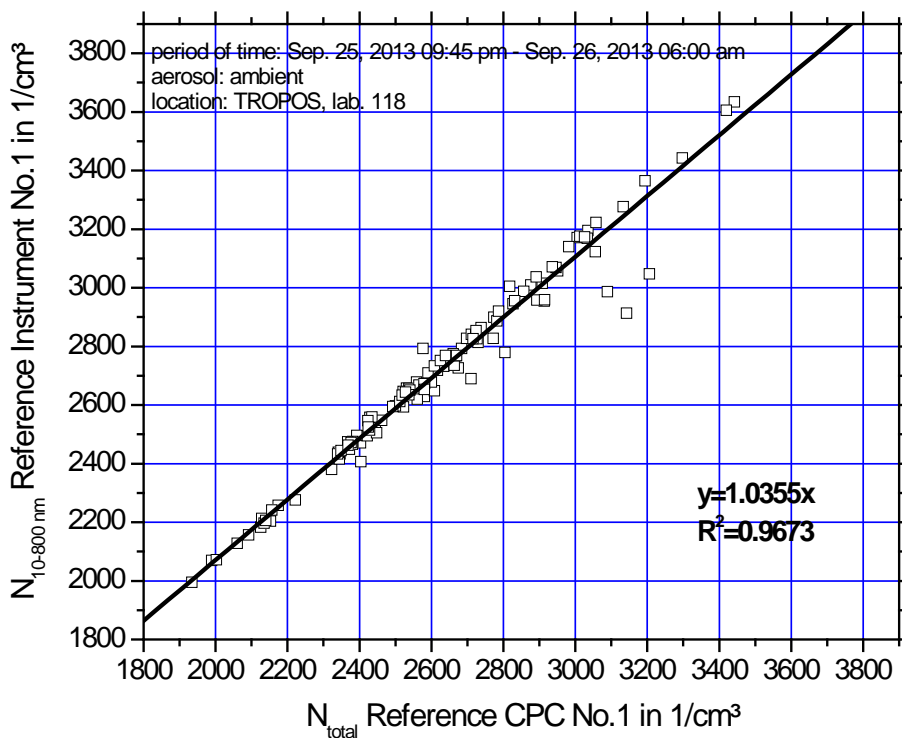


Fig.12. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No. 1. Internal diffusion losses and flow corrections are included.

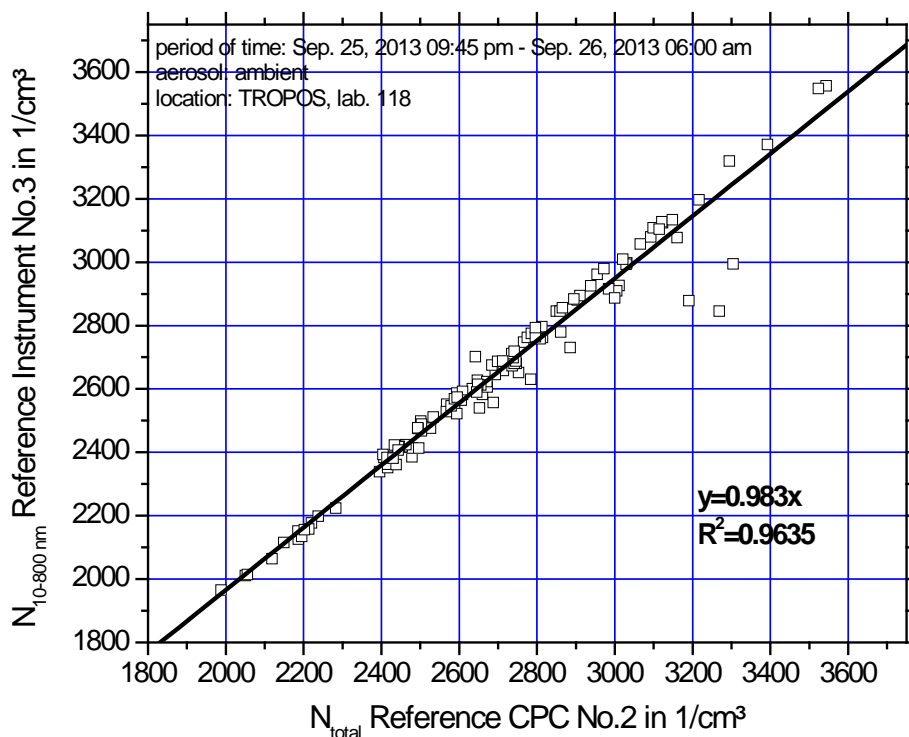


Fig.13. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusion losses and flow corrections are included.

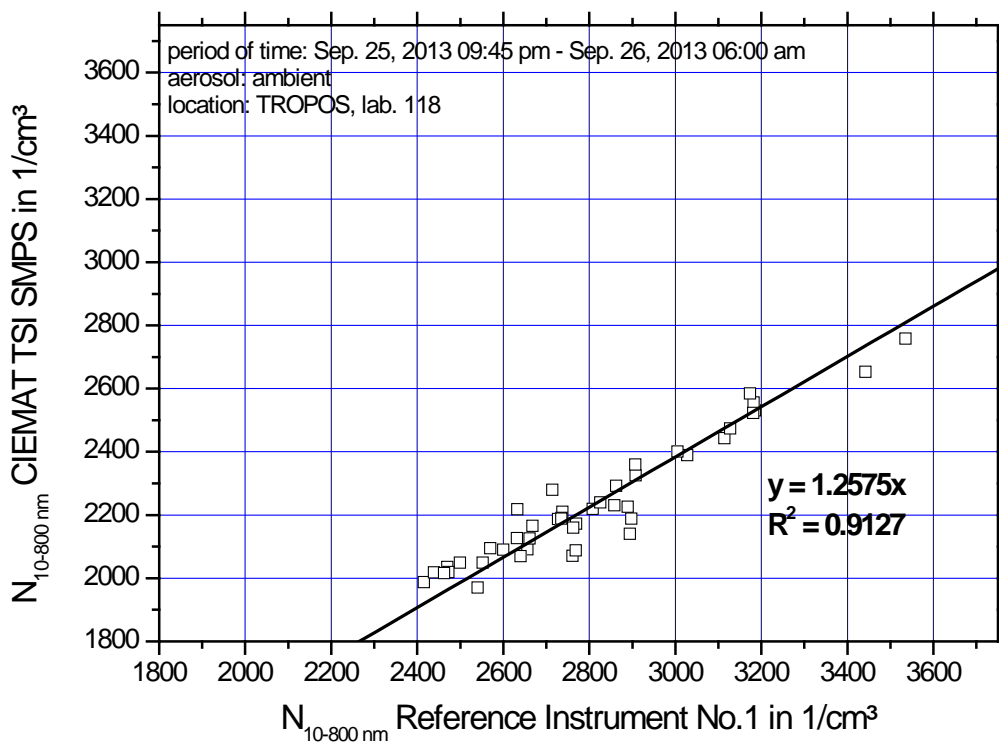


Fig.14. Linear regression between the number concentrations of TROPOS reference CPC No. 1 and instrument CIEMAT TSI SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

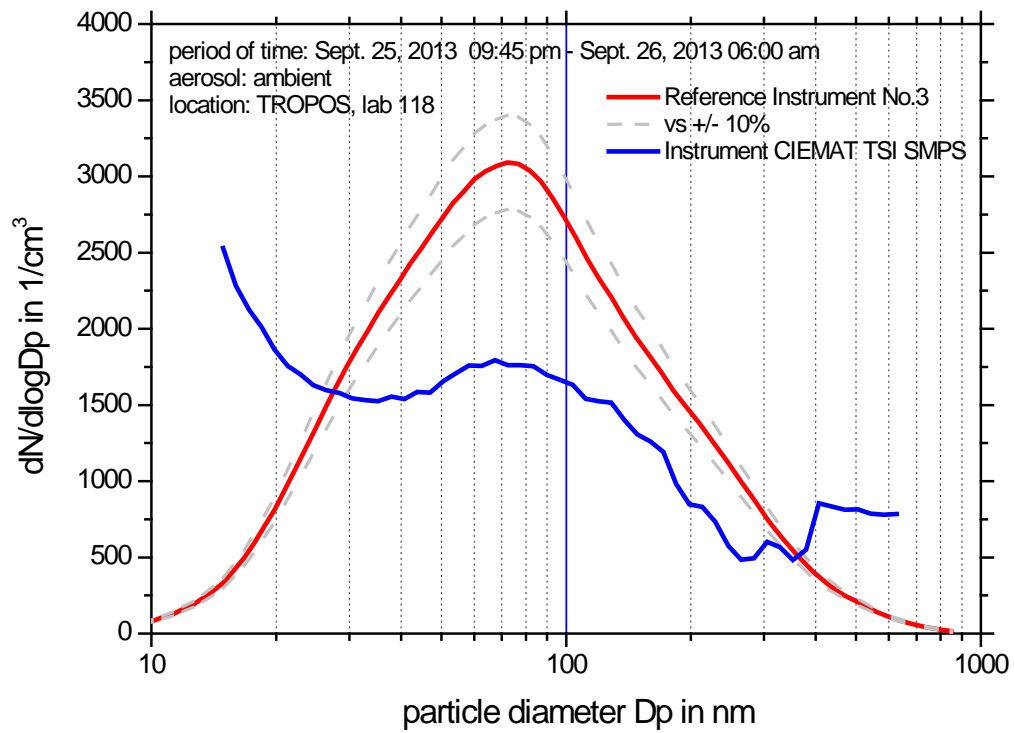


Fig.15. Comparison of mean particle number size distribution between Sep. 25, 2013 09:45 pm and Sep. 26, 2013 06:00 am. Internal diffusion losses and CPC efficiency are included.

Intercomparison of INTA TSI SMPS

Basic information

Location of the quality assurance:	TROPOS, lab: 118
Delivery date:	Sep. 23, 2013
Setup in the laboratory:	Sep. 23, 2013
Comparison period:	Sep. 23, 2013 – Sep. 27, 2013
Instrument:	INTA TSI SMPS
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	Mar Sorribas (sorribasmm.per_externo.inta.es)

Summary:

From Sep. 23, 2013 to Sep. 26, 2013, the INTA TSI SMPS participated successfully the TROPOS ACTRIS Workshop. The workshop consisted of an entrance test and a final run. In addition to the overnight ambient measurements, we had numerous high voltage checks, zero- and PSL-measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that, we show for each run the time series of the particle number concentration, the particle number size distribution, and correlation plots. If anything was written in the log book, so we added this also in this report. As reference standards, we used CPCs model TSI 3772 for total particle number concentration and two TROPOS mobility particle size spectrometer. The particle counters have been calibrated against a calibrated TSI electrometer 3068 B with the serial number 70838596.

For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. The INTA TSI SMPS showed in the PSL-measurements a particle diameter of 202.4 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. When we look at the time series and particle number size distributions the system showed all the time a lower concentration than the Reference Instrument. We changed the DMA, radioactive course. Nothing happened. Also the TROPOS inversion + diffusion correction can't solve the problem. In

the final run the INTA TSI SMPS is out of the 10%. The INTA TSI SMPS didn't pass the ACTRIS Workshop. It is necessary to repeat the intercomparison workshop 2014.

Log book:

Sep. 23, 2013

- > setup of INTA TSI SMPS in laboratory 118
- > start with a neutralizer of americium from TROPOS
- > flows: Aerosol : 0.3 l/min
 - Sheath: 3 l/min
 - Scan-up: 260 seg.
 - Scan-down: 20 seg.
- > aerosol flow from gilibrator = 0.3009 l/min
- 15:36 -> close valve of TROPOS inlet
- > problems with UCPC during zero check
- 17:00 -> open valve of TROPOS inlet

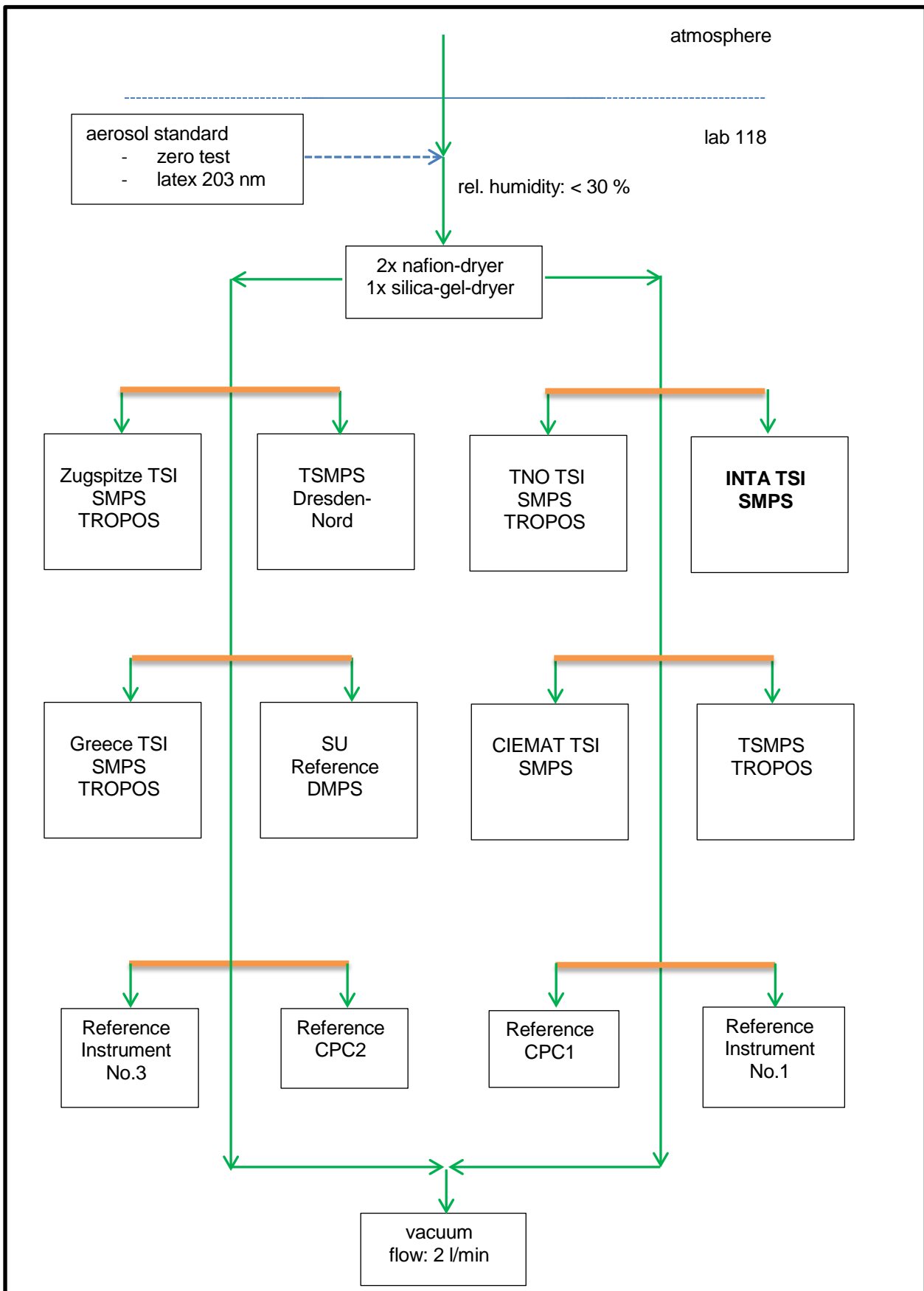
Sep. 24, 2013

- 09:21 -> stop intercomparison
- > start calibration or evaluation of UCPC efficiency
- > flow UCPC: 0.305 l/min
- 15:00 -> krypton source installed
- > zero test is ok
- > latex test is ok
- 17:40 -> start ambient air

Sep. 25, 2013

- 09:25 -> stop intercomparison
- > exchange DMA with DMA-CIEMAT
- > measure length of sampling tube: 11.35m
- > STEPS was running better with DMA of CIEMAT but conc. a little lower
- > open the DMA and little piece up the DMA maybe not ok. Close again.
- > measurements better now although with lower conc.
- > improvement with application of diffusion correction from TROPOS and corr. of intercomparison

Laboratory setup



A: First run

Latex 203 nm

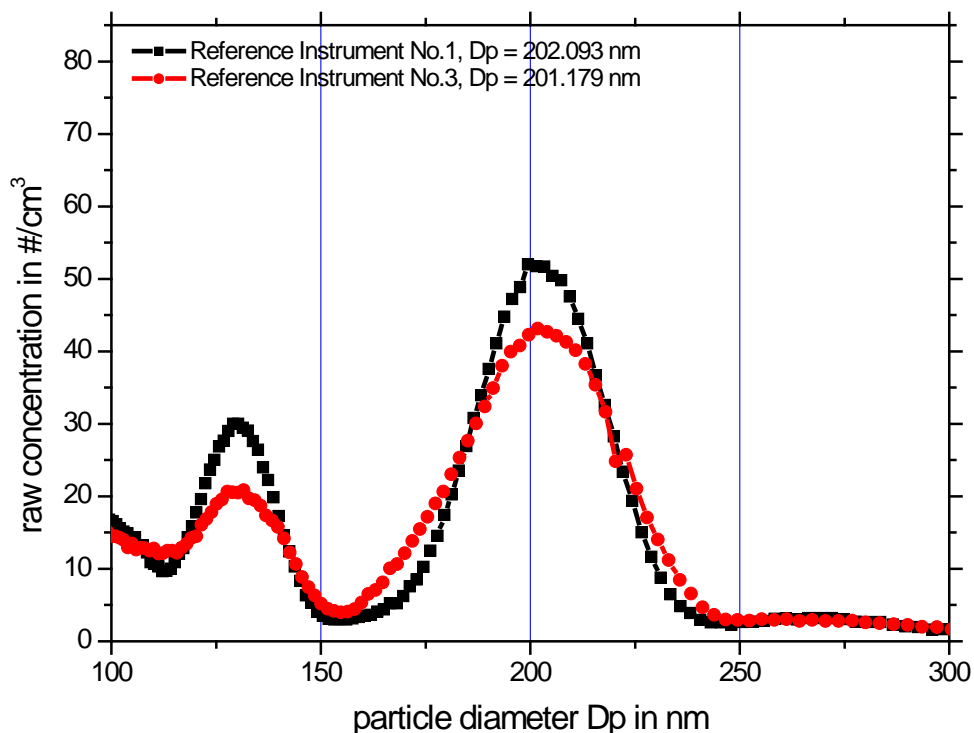


Fig.1. Measurement of latex 203 nm for TROPOS reference instruments No. 1 and No. 3: particle size distribution (raw concentration) for latex 203 nm on Sep. 23, 2013 between 05:06 pm and 05:33 pm.

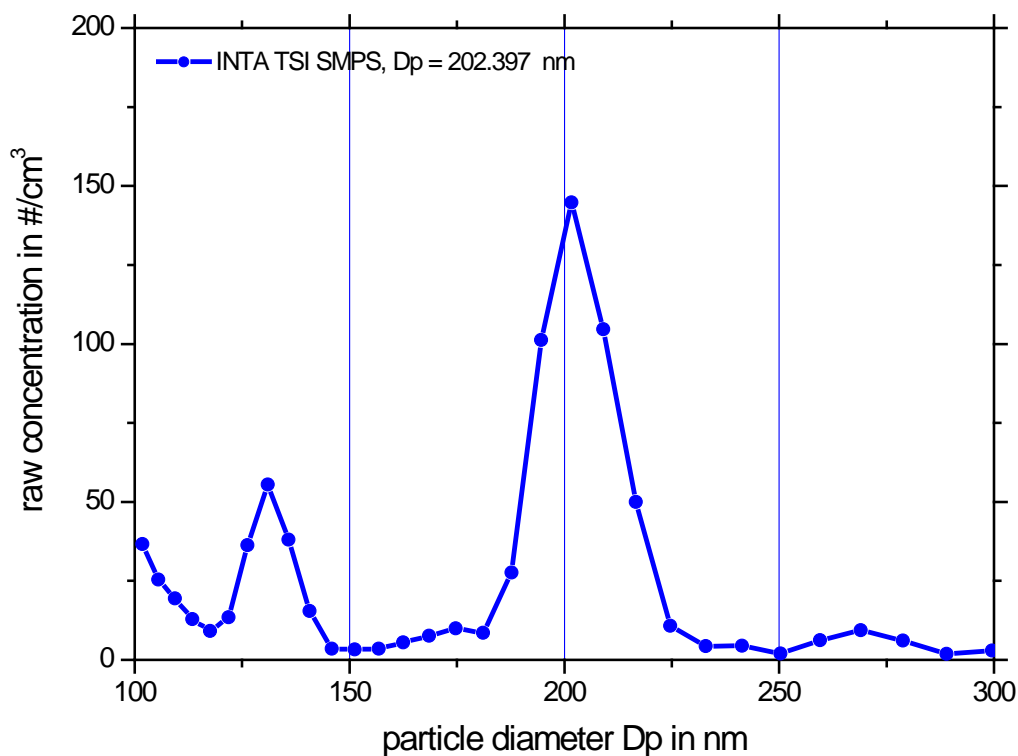


Fig.2. Measurement of latex 203 nm for instrument INTA TSI SMPS: particle size distribution (raw concentration) for latex 203 nm on Sep. 23, 2013

CPC efficiency

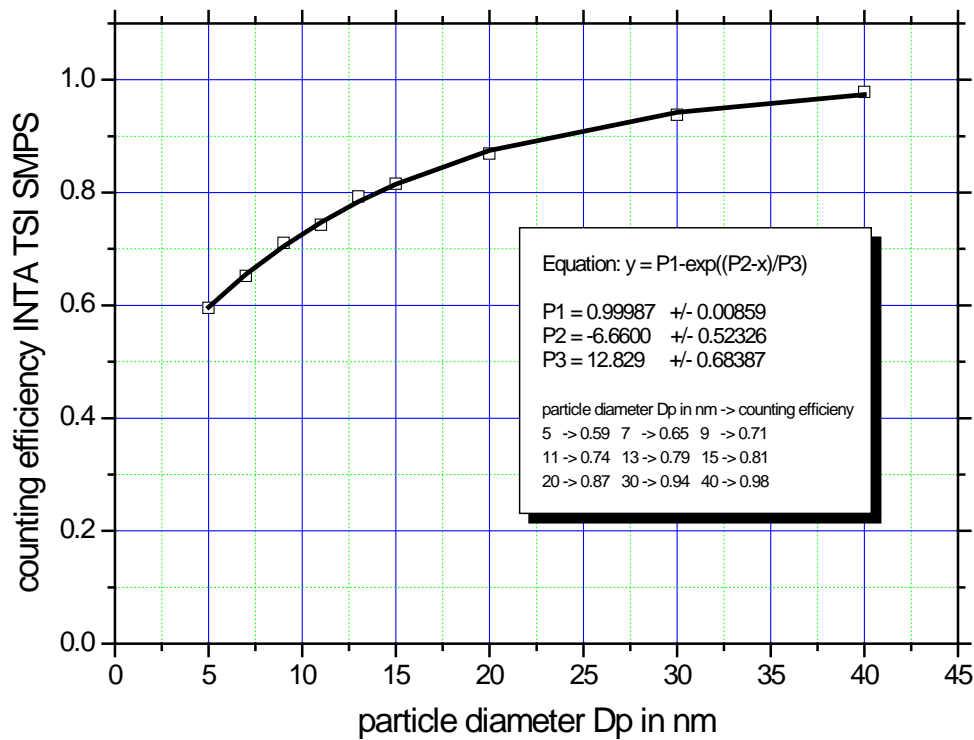


Fig.3. CPC efficiency curve. Based on Electrometer TSI 3068B. Serial number: 70838596.

1. Time series

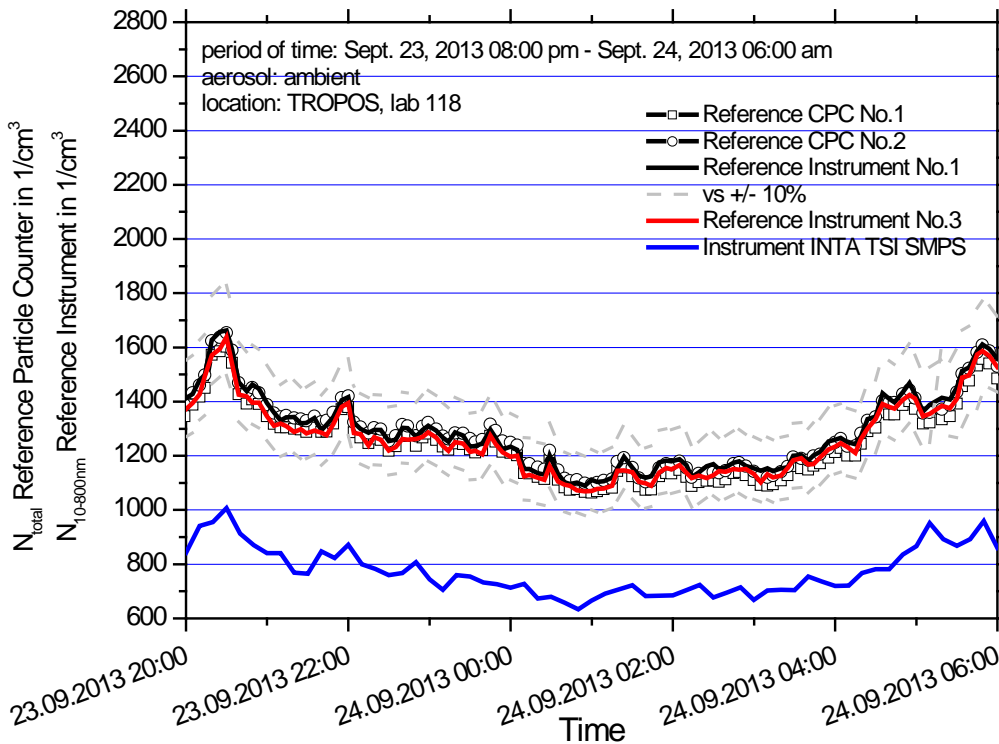


Fig.4. Time series (Sep. 23, 2013 08:00 pm – Sep. 24, 2013 6:00 am) of the integrated particle number concentration (N 10-800nm). Flow corrections are included.

2. Correlation

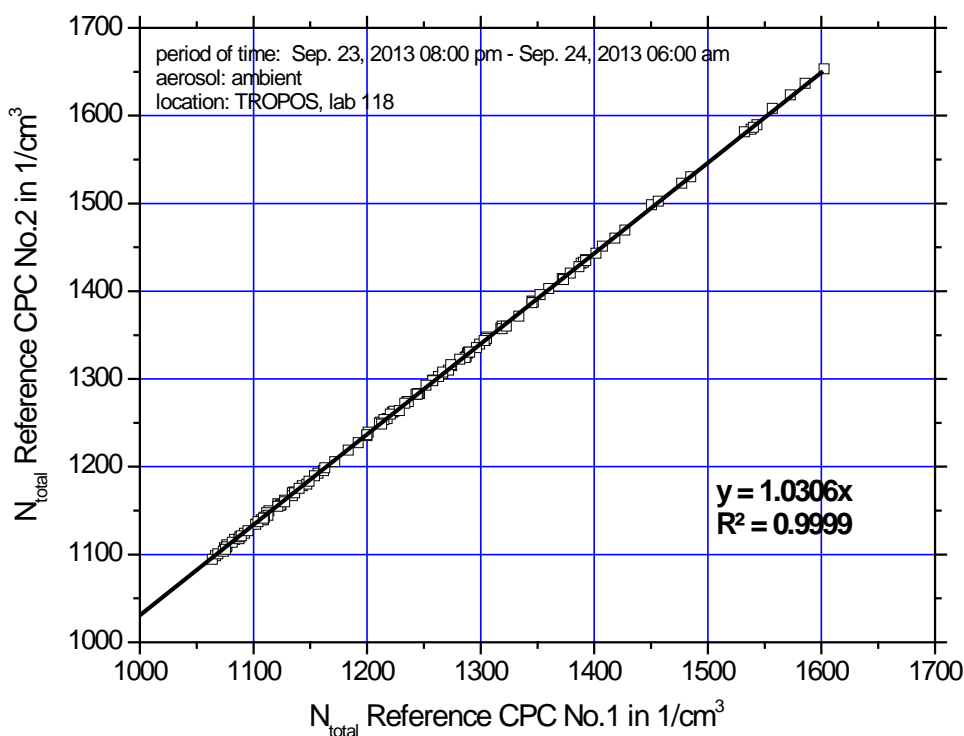


Fig.5. Linear regression between two TROPOS reference CPCs (Model 3772). Flow corrections are included.

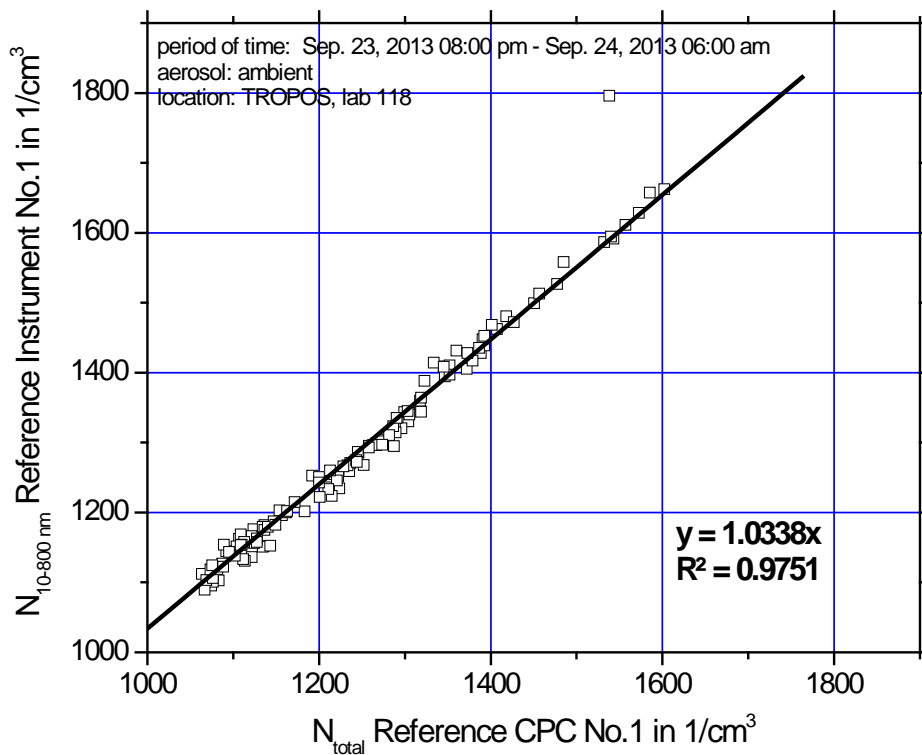


Fig.6. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No.1. Internal diffusion losses and flow corrections are included.

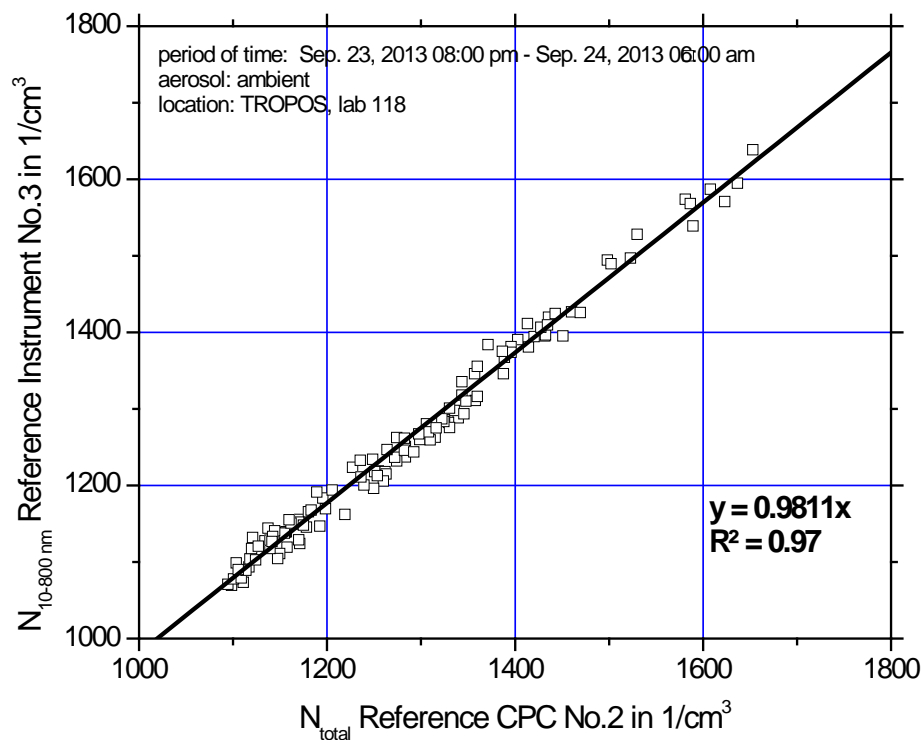


Fig.7. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusion losses and flow corrections are included.

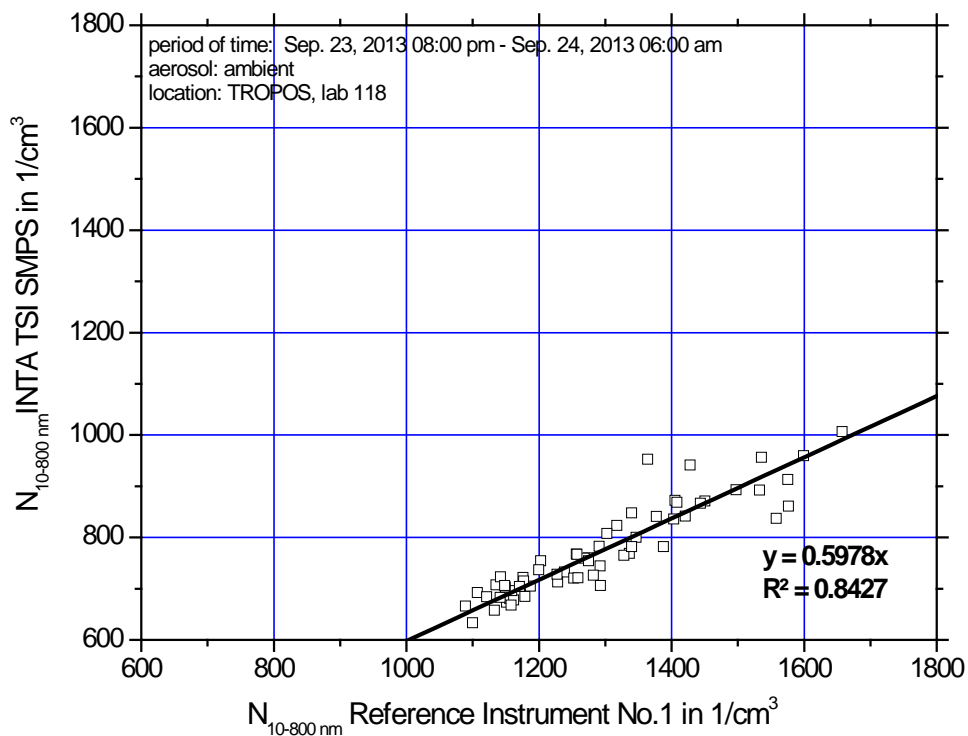


Fig.8. Linear regression between the number concentrations of the TROPOS reference instrument No. 1 and instrument INTA TSI SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

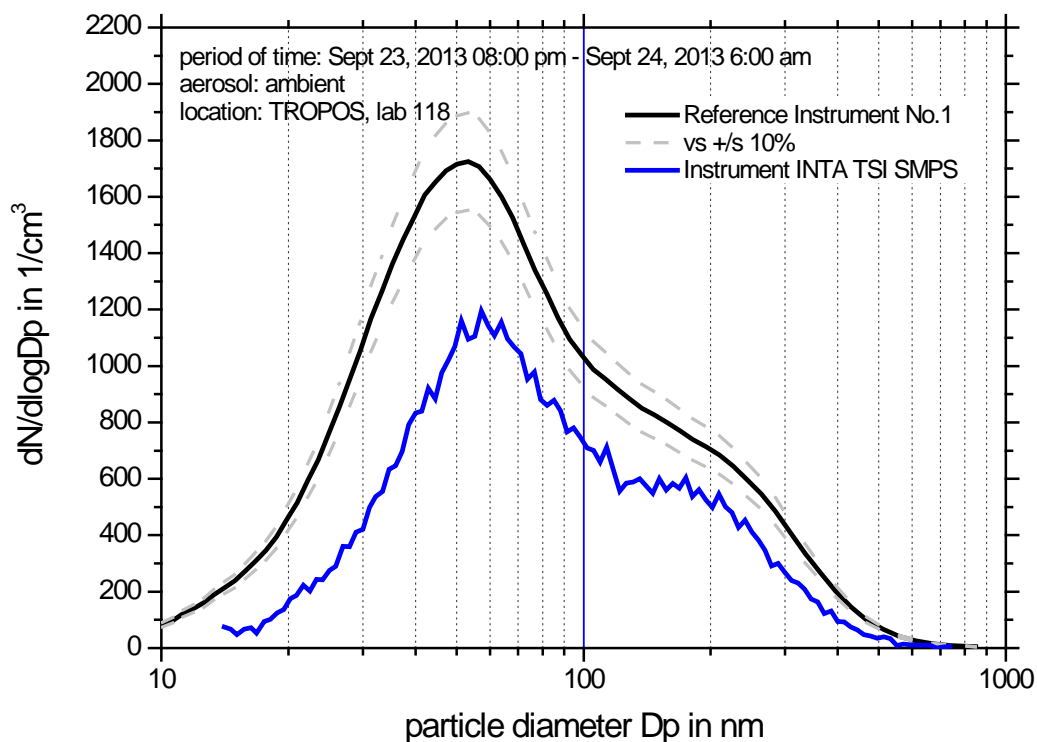


Fig.9. Comparison of mean particle number size distributions between Sep. 23, 2013 08:00 pm and Sep. 24, 2013 06:00 am. Internal diffusion losses and CPC efficiency are included.

B: Final run

1. Time series

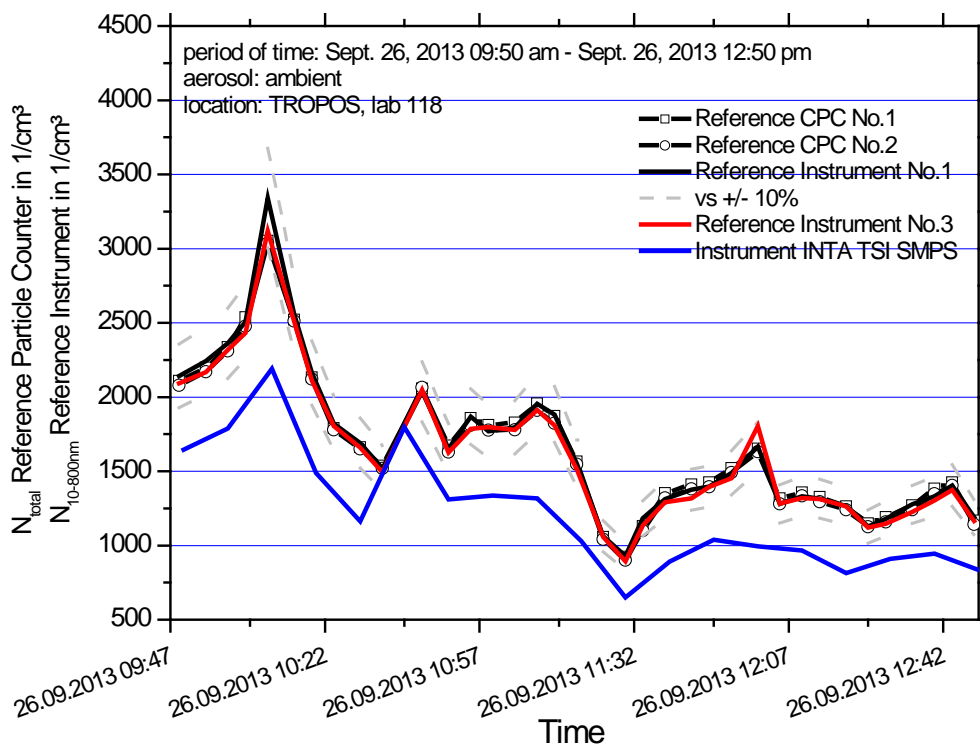


Fig.10. Time series (Sep. 26, 2013 09:50 am – 12:50 pm) of the integrated particle number concentration ($N_{10-800\text{nm}}$). Flow corrections are included.

2. Correlation

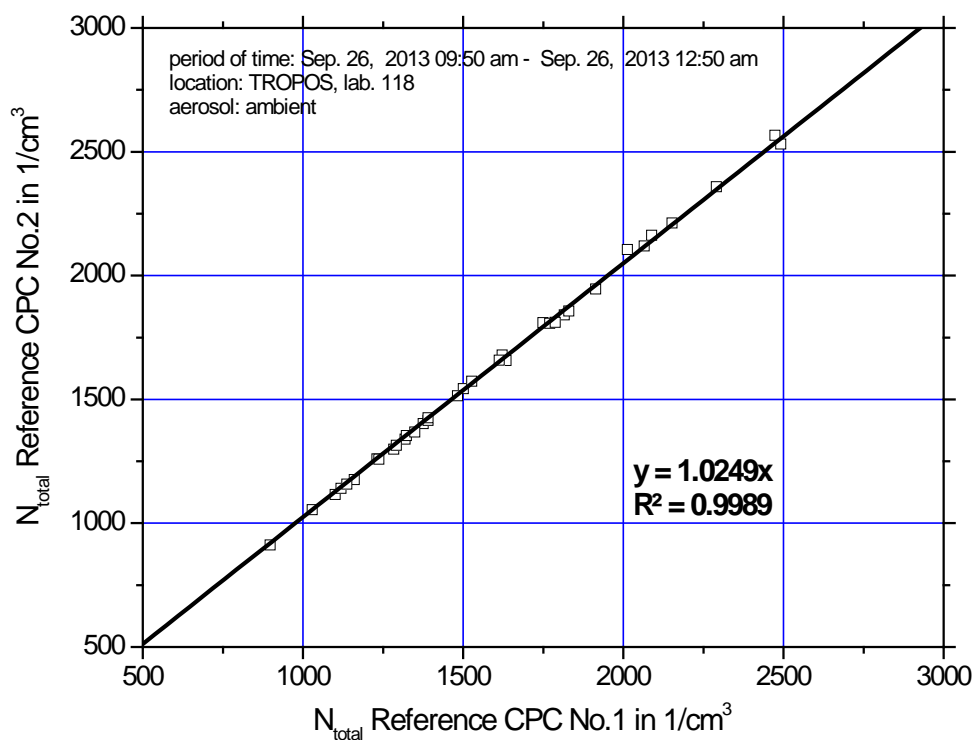


Fig.11. Linear regression between the number concentrations of two TROPOS reference CPCs No. 1 and No. 2. Internal diffusion losses and flow corrections are included.

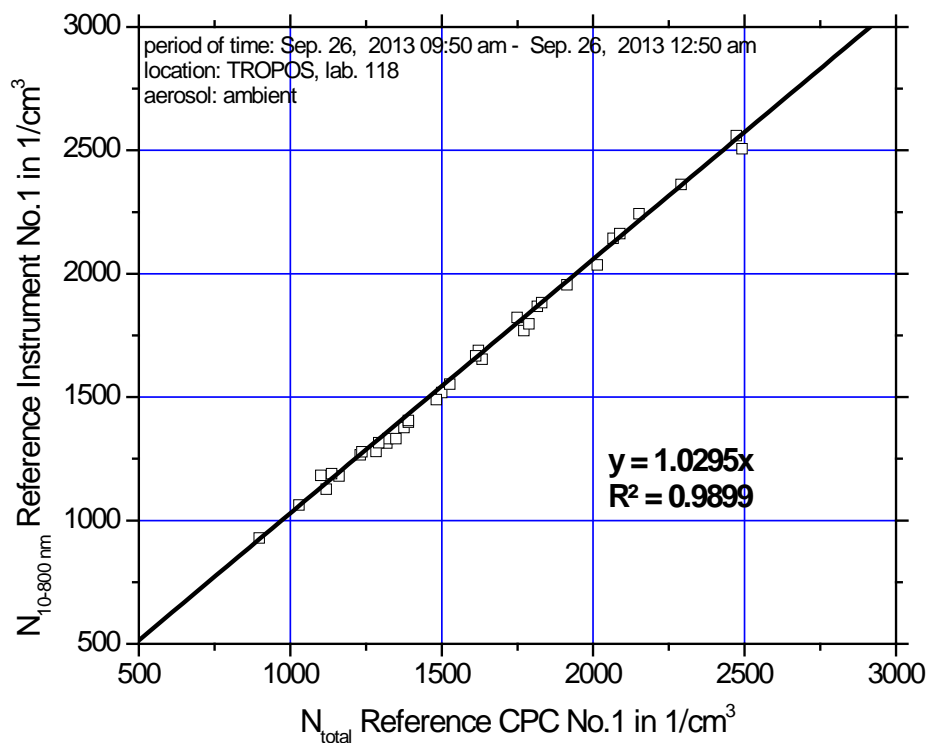


Fig.12. Linear regression between the number concentrations of the TROPOS reference instrument No. 1 and the TROPOS reference CPC No. 1. Internal diffusion losses and flow corrections are included.

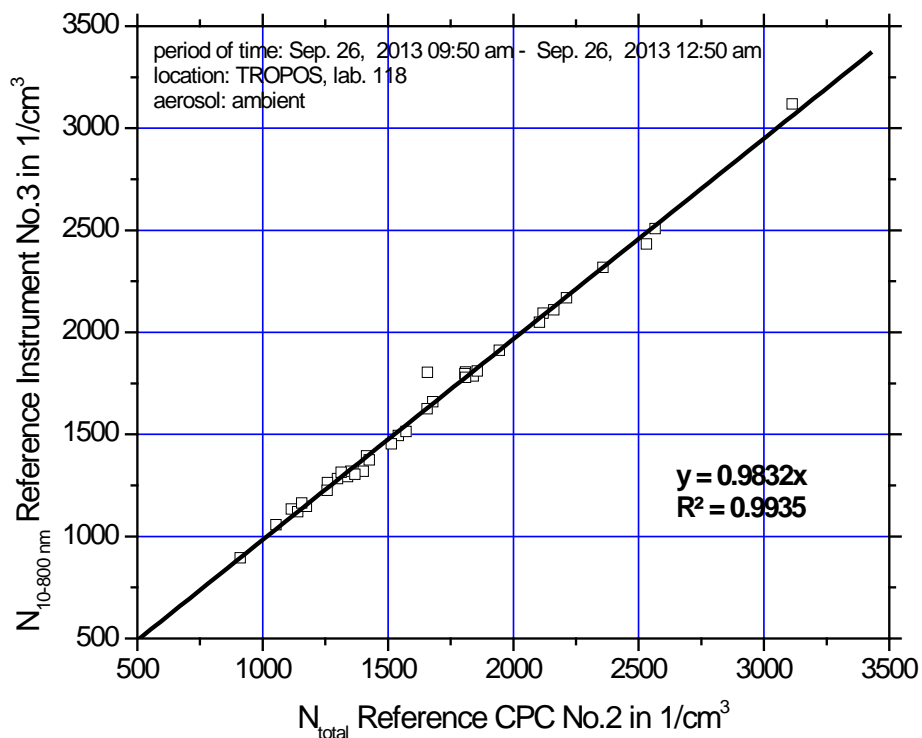


Fig.13. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusion losses and flow corrections are included.

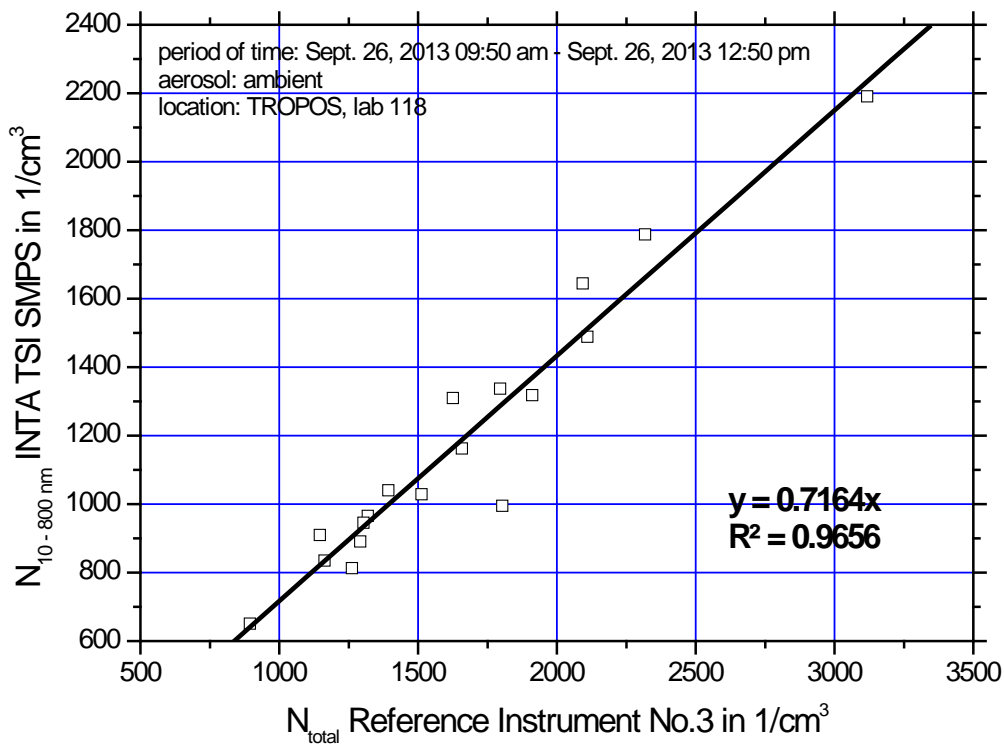


Fig.14. Linear regression between the number concentrations of the TROPOS reference instrument No. 1 and instrument INTA TSI SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

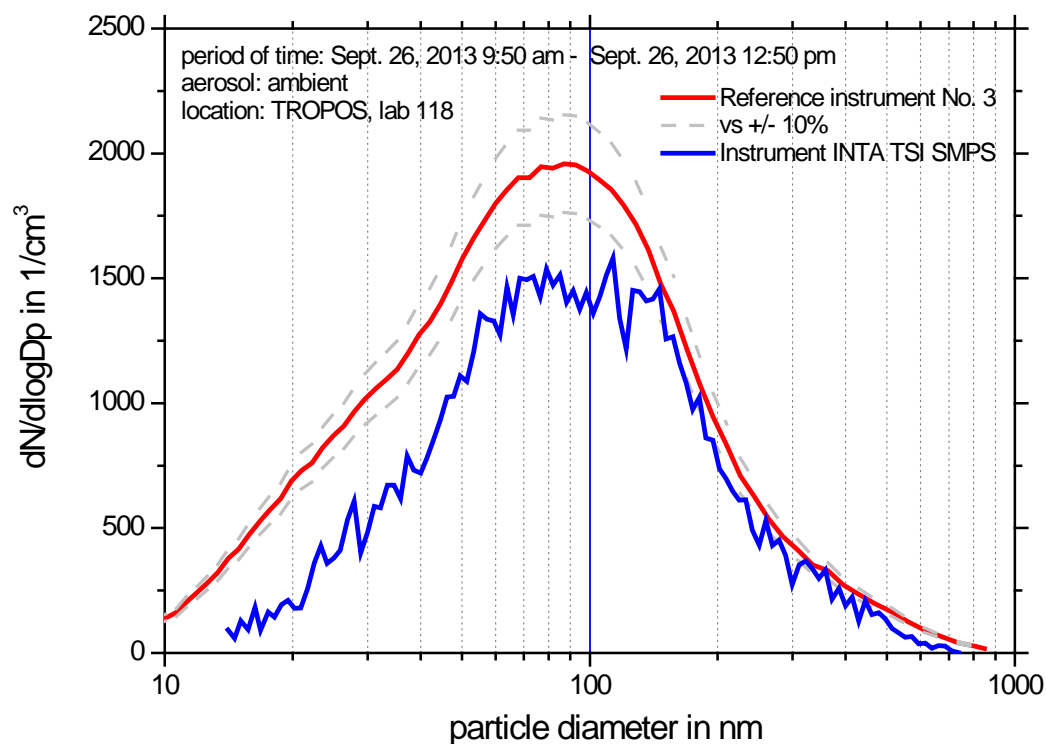


Fig.15. Comparison of mean particle number size distributions on Sep. 26, 2013 between 09:50 am and 12:50 pm . Internal diffusion losses and CPC efficiency are included.

Intercomparison of SU Reference DMPS

Basic information

Location of the quality assurance:	TROPOS, lab: 118
Delivery date:	Sep. 23, 2013
Setup in the laboratory:	Sep. 23, 2013
Comparison period:	Sep. 23, 2013 – Sep. 27, 2013
Instrument:	SU Reference DMPS
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	Radovan Krejci (radek@itm.su.se)

Summary:

From Sep. 23, 2013 to Sep. 27, 2013 the SU Reference DMPS participated successfully the TROPOS ACTRIS Workshop. The workshop consisted of an entrance test and a final run. In addition to the overnight ambient measurements, we had numerous high voltage checks, zero- and PSL- measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that, we show for each run the time series of the particle number concentration, the particle number size distribution, and correlation plots. If anything was written in the log book, so we added this also in this report. As reference standards, we used CPCs model TSI 3772 for total particle number concentration and two TROPOS mobility particle size spectrometer. The particle counters have been calibrated against a calibrated TSI electrometer 3068 B with the serial number 70838596.

For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. The SU Reference DMPS showed in the PSL-measurements a particle diameter of 204.3 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. If we look at the final ambient measurement run, the SU Reference DMPS showed all the time a higher concentration than the Reference Instrument. Because of this the calculated time series and the correlation is not in the range we accept. We run the system in different settings without Kr85 and modified

the inlet. Nothing happened. Also the TROPOS inversion + diffusion correction can't solve the problem. In the final run the SU Reference DMPS is out of the 10%. The SU Reference DMPS didn't pass the ACTRIS Workshop. It is necessary to repeat the intercomparison workshop 2014.

Log book:

Sep. 23, 2013

	-> conductive cable longer than others with 1 m length
14:10	-> start measurements; aerosol flow is 2.281 l/min
15:22	-> zero check
15:31	-> switch on scan
18:17	-> latex check, then ambient measurement
18:30	-> start overnight ambient measurement

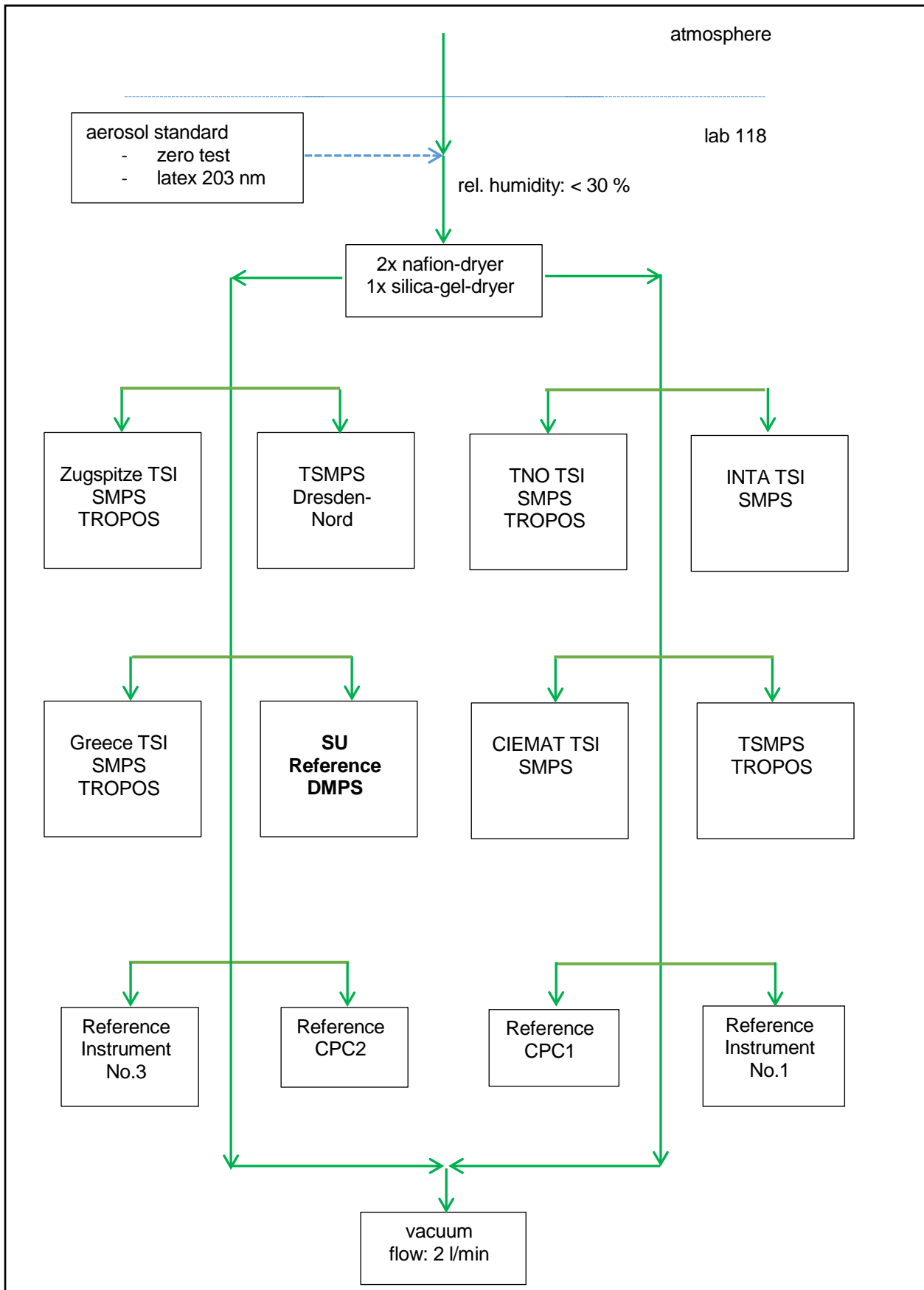
Sep. 24, 2013

09:15	-> stop ambient measurement
16:55	-> latex runs
17:25	-> 160 – 340 nm runs
18:00	-> start overnight ambient measurement
17:40	-> start ambient air

Sep. 25, 2013

	-> CPC has factor of three
12:30	-> ambient measurement

Laboratory setup



A: First run

Latex 203 nm

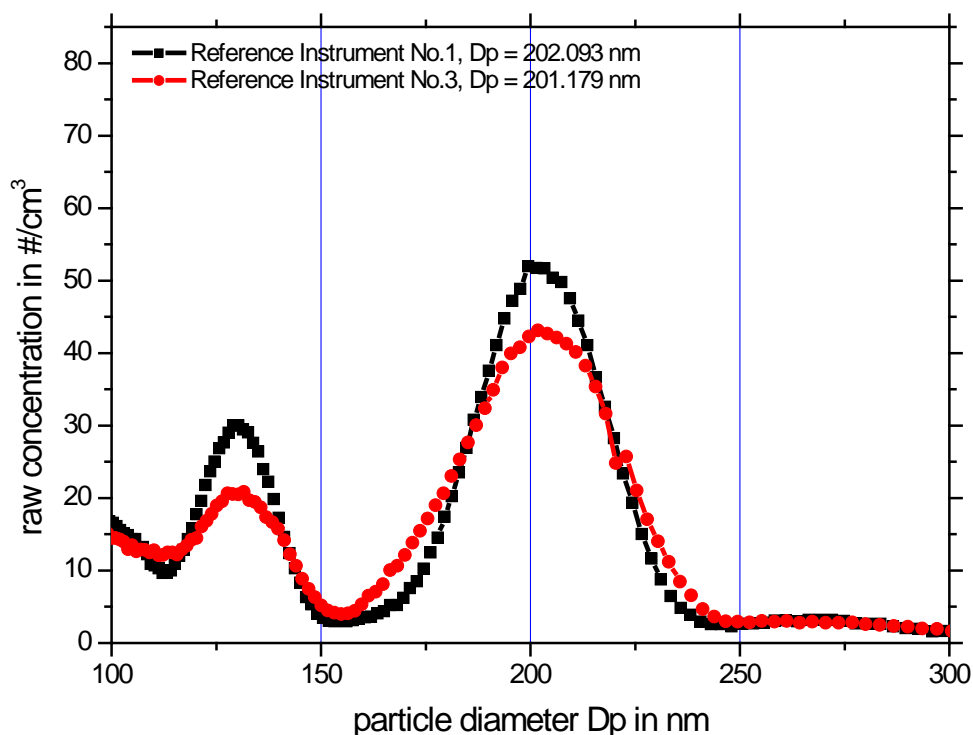


Fig.1. Measurement of latex 203 nm for TROPOS reference instruments No. 1 and No. 3: particle size distribution (raw concentration) for latex 203 nm on Sep. 23, 2013 between 05:06 pm and 05:33 pm.

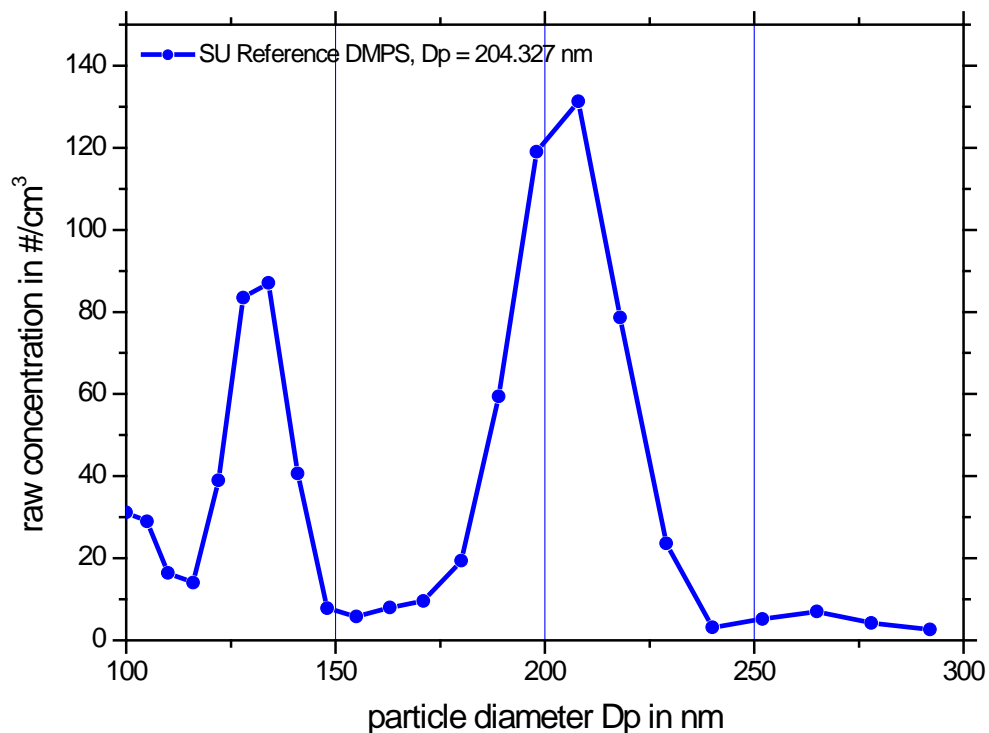


Fig.2. Measurement of latex 203 nm for instrument SU Reference DMPS: particle size distribution (raw concentration) for latex 203 nm on Sep. 24, 2013.

CPC efficiency

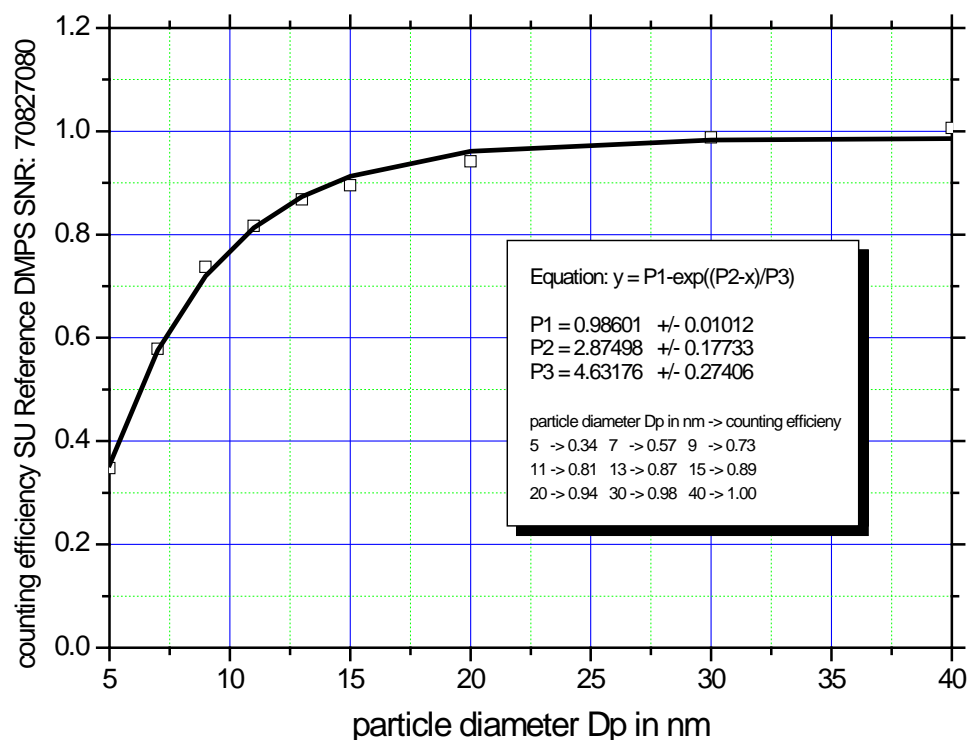


Fig.3. CPC efficiency curve. Based on Electrometer TSI 3068B. Serial number: 70838596.

1. Time series

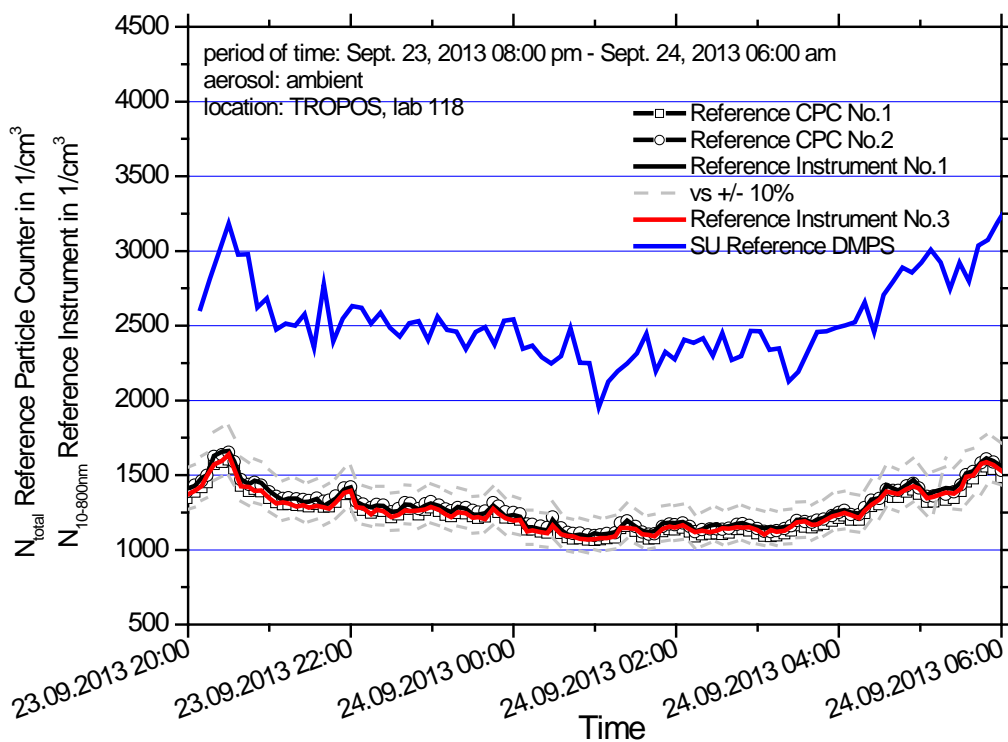


Fig.4. Time series (Sep. 23, 2013 08:00 pm – Sep. 24, 2013 06:00 am) of the integrated particle number concentration ($N_{10-500nm}$). Flow corrections are included.

2. Correlation

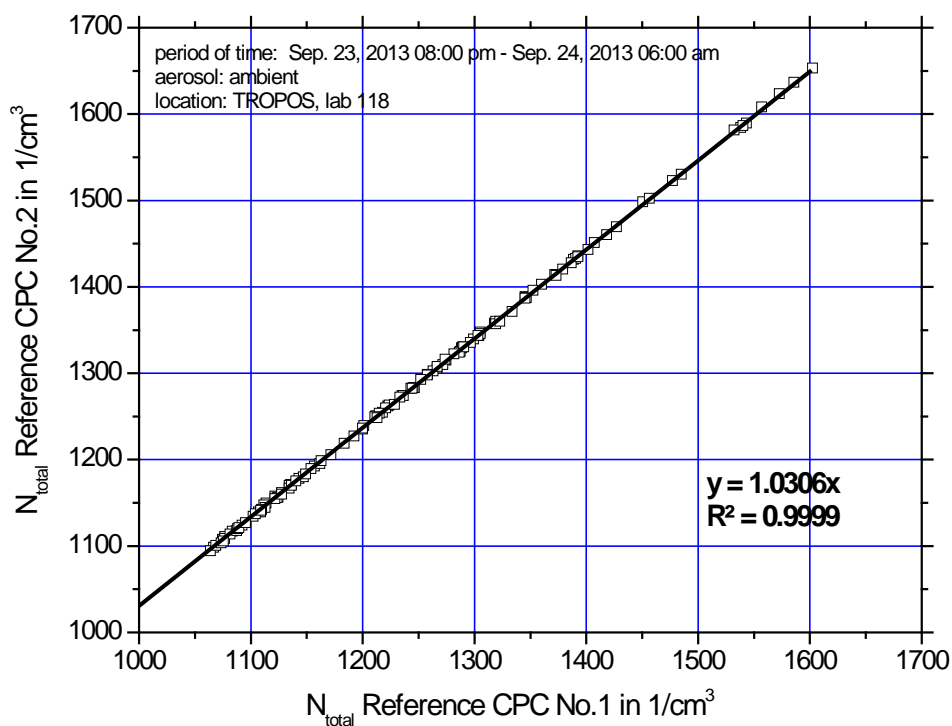


Fig.5. Linear regression between two TROPOS reference CPCs (Model 3772). Flow corrections are included.

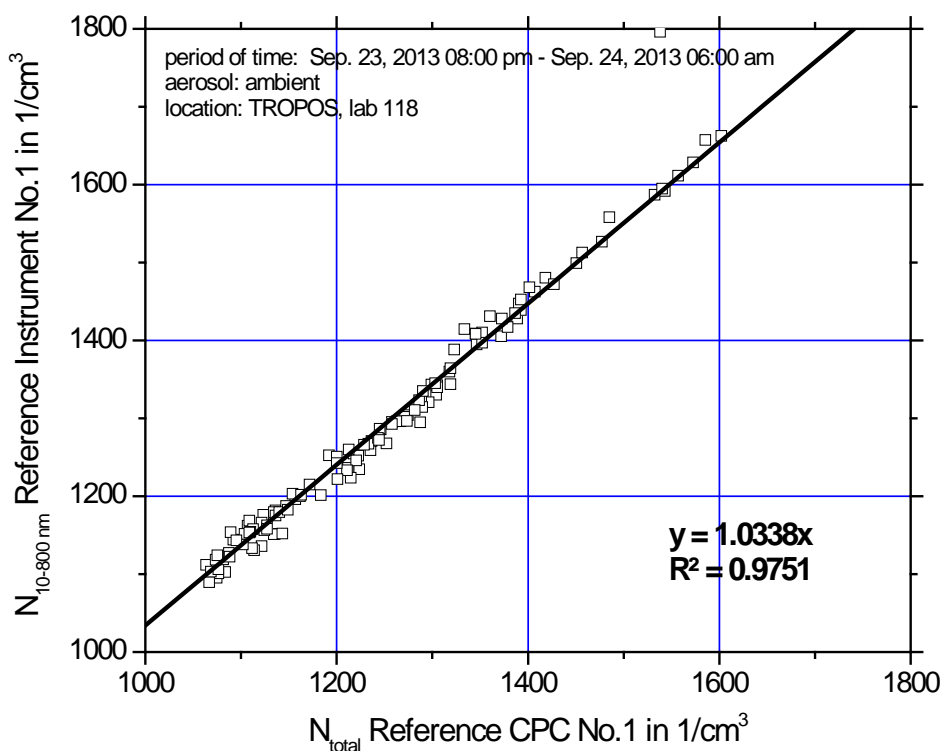


Fig.6. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No. 1. Internal diffusion losses and flow corrections are included.

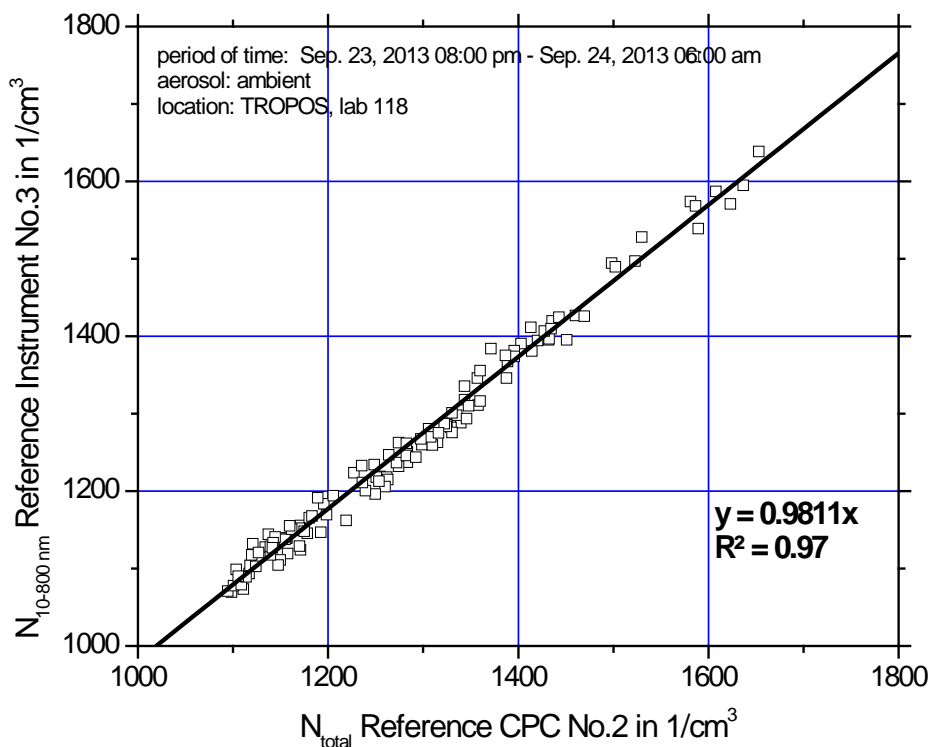


Fig.7. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and TROPOS reference instrument No. 3. Internal diffusion losses and flow corrections are included.

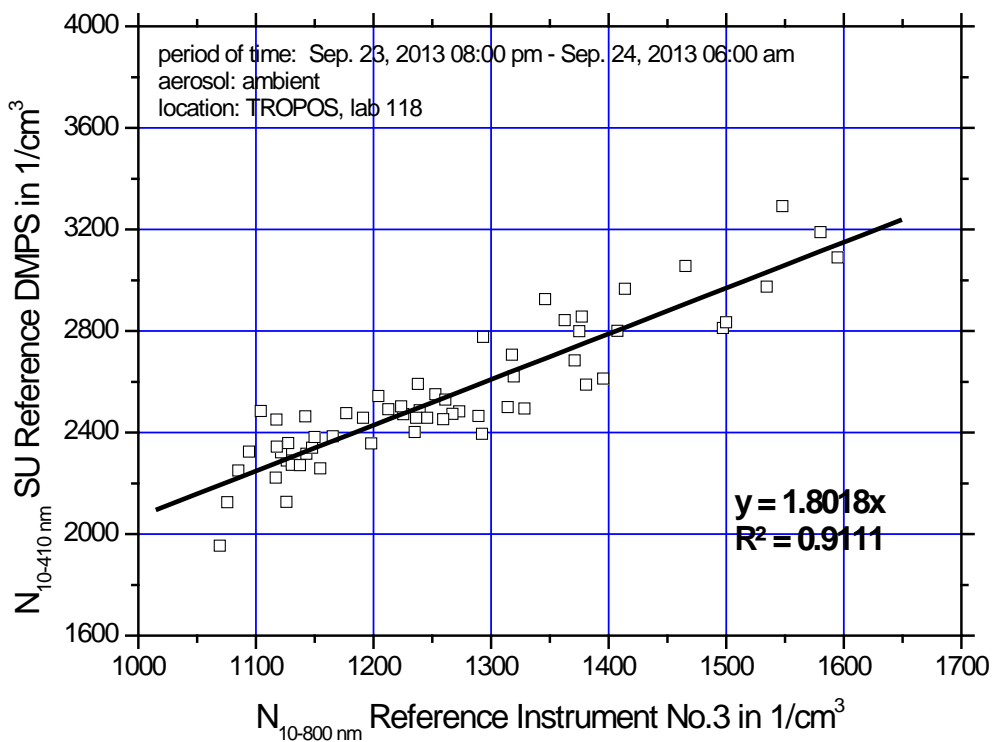


Fig.8. Linear regression between the number concentrations the TROPOS reference instrument No. 3 and instrument SU Reference DMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

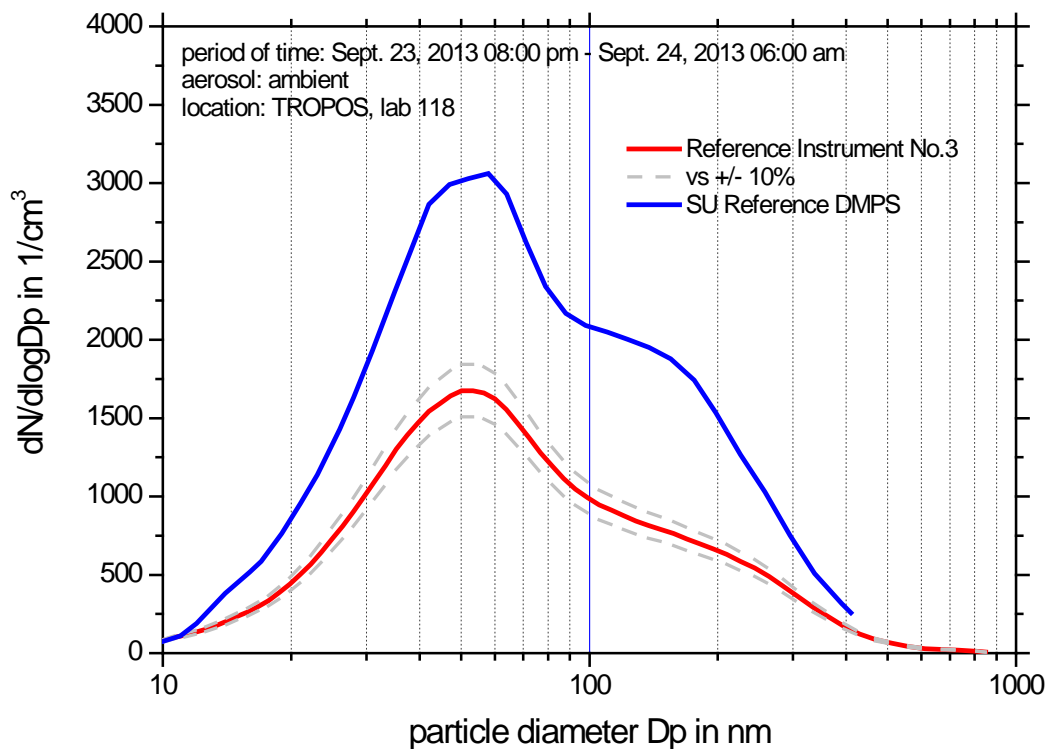


Fig. 9. Comparison of mean particle number size distributions between Sep. 23, 2013 08:00 pm and Sep. 24, 2013 06:00 am. Internal diffusion losses and CPC efficiency are included.

B: final run

1. Time series

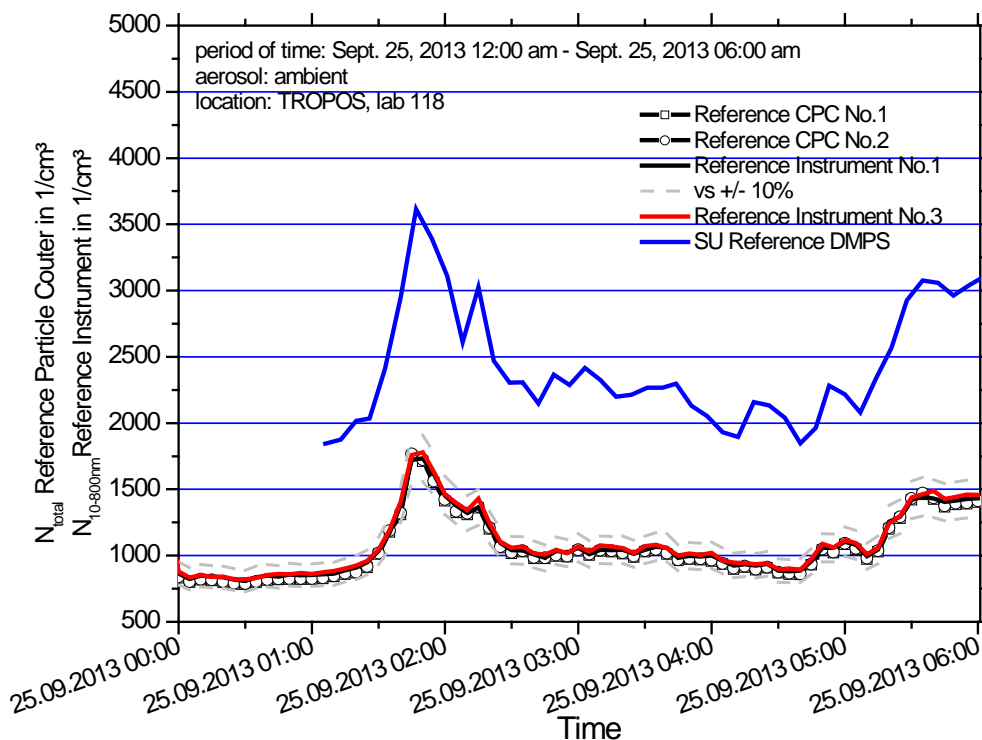


Fig.10. Time series (Sep. 25, 2013 12:00 am – Sep. 25, 2013 06:00 am) of the integrated particle number concentration ($N_{10-500\text{nm}}$). Flow corrections are included.

2. Correlation

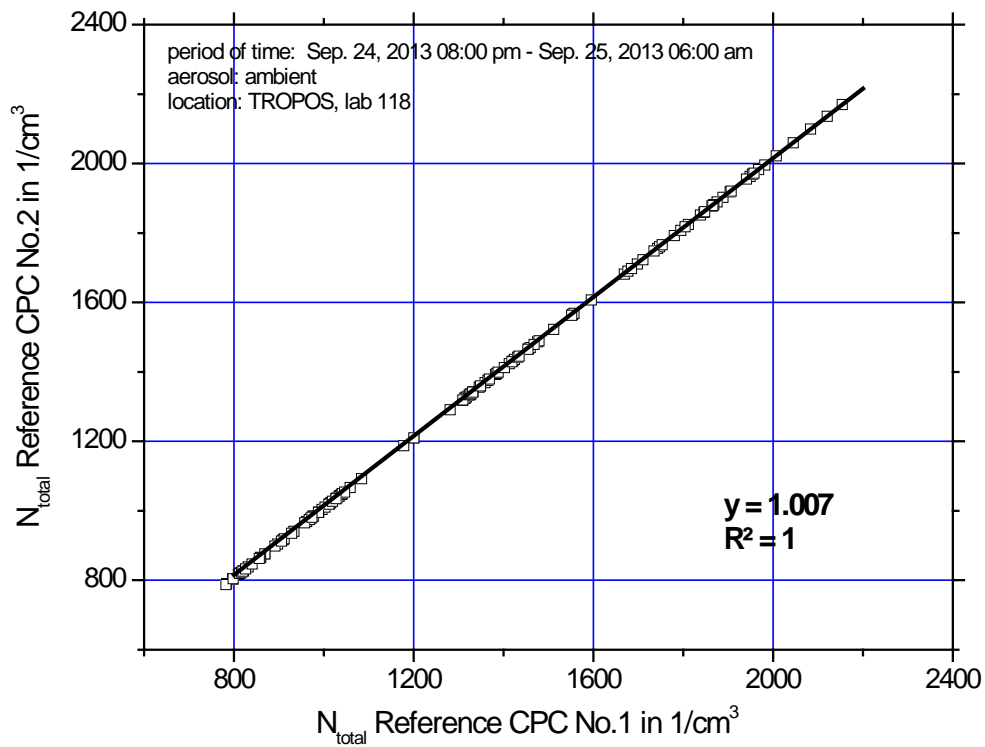


Fig.11. Linear regression between two TROPOS reference CPCs (Model 3772). Flow corrections are included.

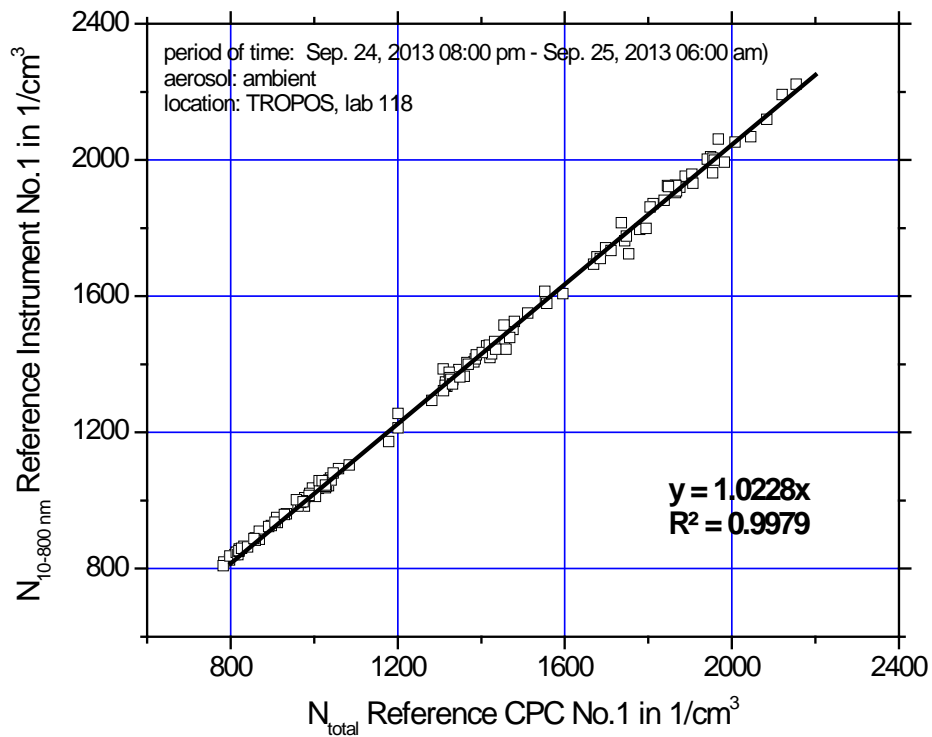


Fig.12. Linear regression between the number concentrations of the TROPOS reference instrument No. 1 and the TROPOS reference CPC No. 1. Internal diffusion losses and flow corrections are included.

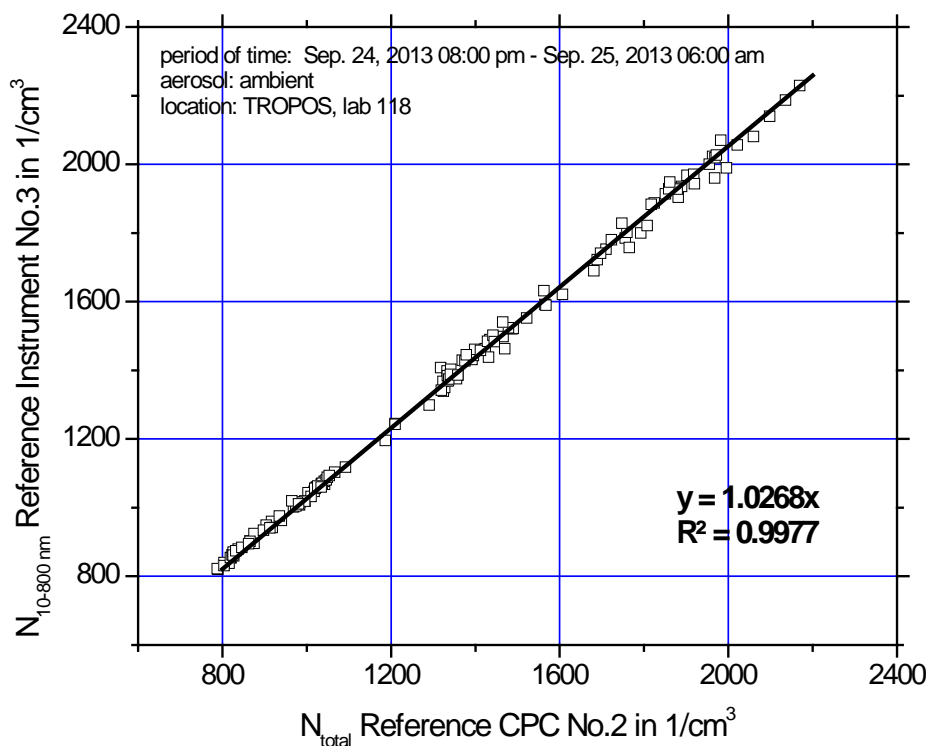


Fig. 13. Linear regression between the number concentrations of the TROPOS reference instrument No. 3 and the TROPOS reference CPC No. 2. Internal diffusion losses and flow corrections are included.

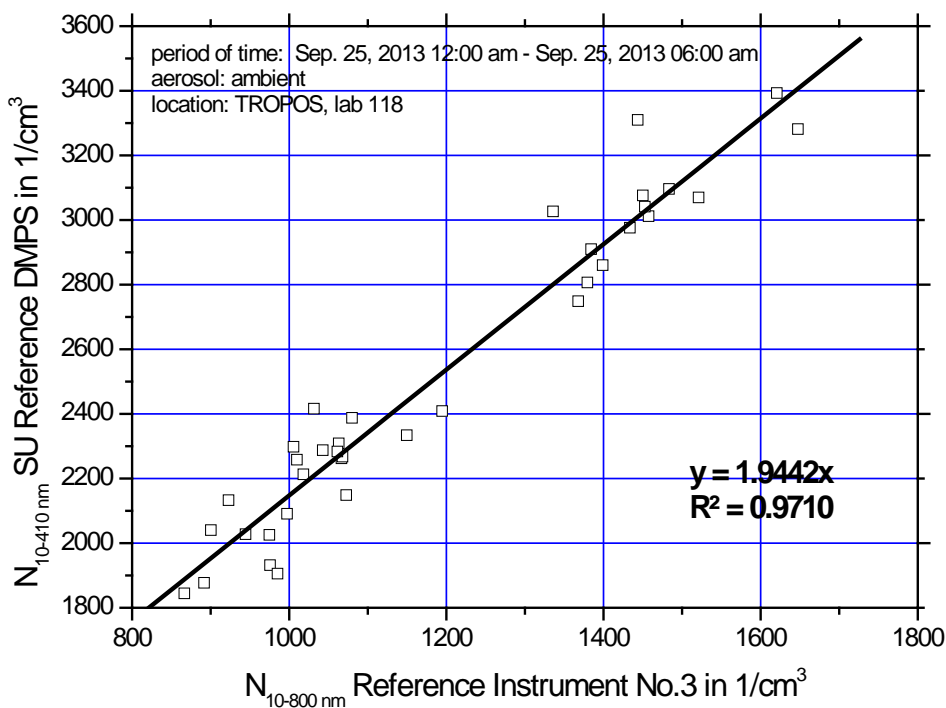


Fig.14. Linear regression between the number concentrations the TROPOS reference instrument No. 3 and instrument SU Reference DMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

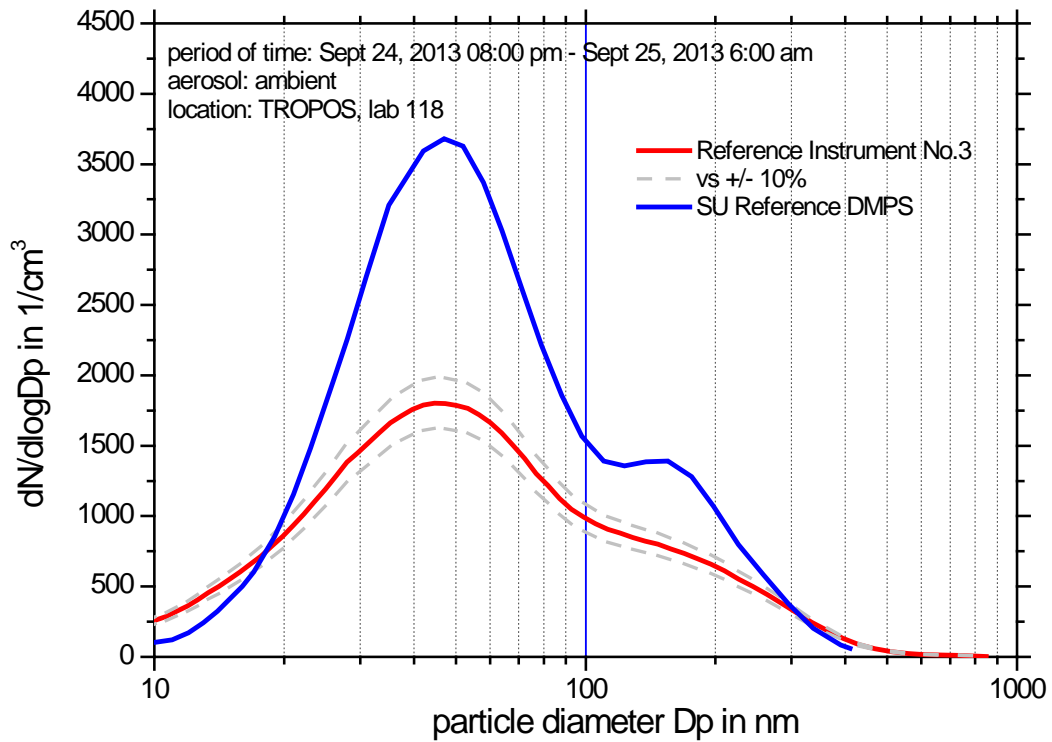


Fig.15. Comparison of mean particle number size distributions between from Sep. 24, 2013 08:00 pm to Sep. 25, 2013 06:00 am. Internal diffusion losses and CPC efficiency are included.

Intercomparison of TNO TSI SMPS TROPOS

Basic information

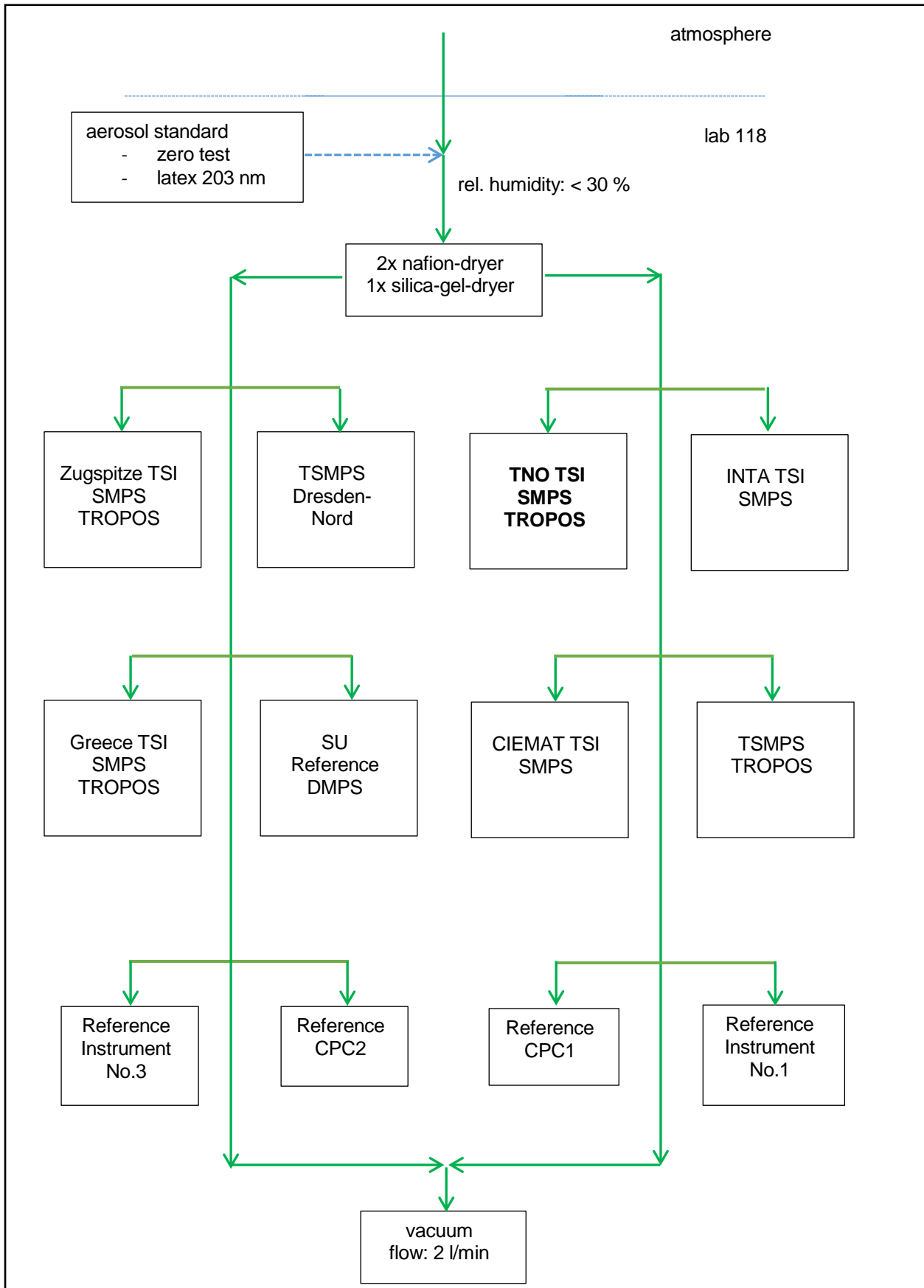
Location of the quality assurance:	TROPOS, lab: 118
Delivery date:	Sep. 23, 2013
Setup in the laboratory:	Sep. 23, 2013
Comparison period:	Sep. 23, 2013 – Sep. 27, 2013
Instrument:	TNO TSI SMPS TROPOS
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	J. S. Henzing (bas.henzing@tno.nl)

Summary:

From Sep. 23, 2013 to Sep. 27, 2013, the TNO TSI SMPS TROPOS participated successfully the TROPOS ACTRIS Workshop. The workshop consisted of an entrance test and a final run. In addition to the overnight ambient measurements, we had numerous high voltage checks, zero- and PSL- measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that, we show for each run the time series of the particle number concentration, the particle number size distribution, and correlation plots. If anything was written in the log book, so we added this also in this report. As reference standards, we used CPCs model TSI 3772 for total particle number concentration and two TROPOS mobility particle size spectrometer. The particle counters have been calibrated against a calibrated TSI electrometer 3068 B with the serial number 70838596.

For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. The TNO TSI SMPS TROPO showed in the PSL-measurements a particle diameter of 201.5 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. If we look at the final ambient measurement run, the TNO TSI SMPS TROPOS showed for particle smaller than 50 nm and higher than 300 nm lower concentration then the Reference Instrument No.1. We run the system in different settings without Kr85 and modified the inlet. Nothing happened. Also the TROPOS inversion + diffusion correction can't solve the problem. In the final run the TNO TSI SMPS TROPOS is in the correlation in the size range of 10% we accept but in the size distribution the TNO TSI SMPS TROPOS is out of the size range. The TNO TSI SMPS TROPOS didn't pass the ACTRIS Workshop. It is necessary to repeat the intercomparison workshop 2014.

Laboratory setup



Latex 203 nm

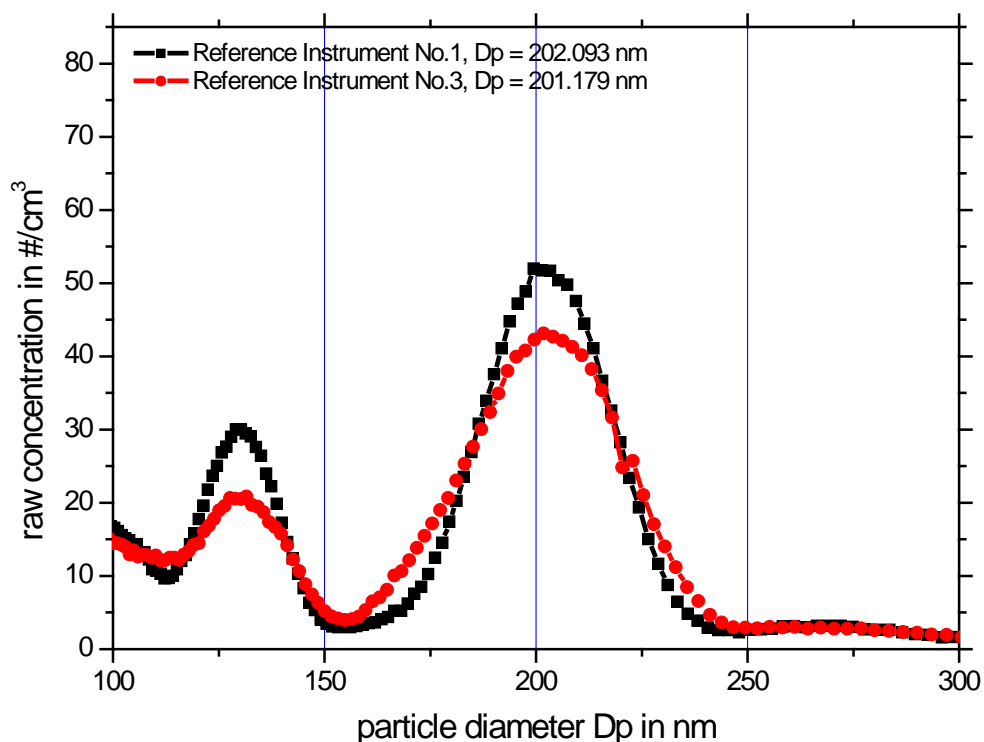


Fig.1. Measurement of latex 203 nm for TROPOS reference instruments: particle size distribution (raw concentration) for latex 203 nm on Sep. 23, 2013 between 05:06 pm and 05:33 pm.

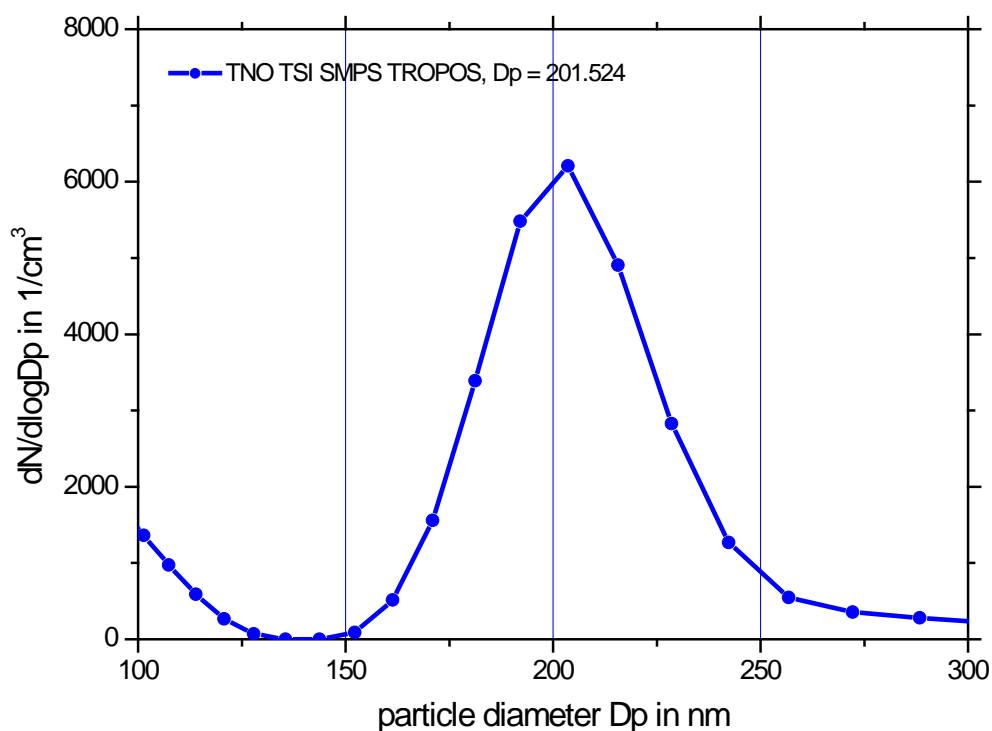


Fig.2. Measurement of latex 203 nm for instrument TNO TSI SMPS TROPOS: particle size distribution (raw concentration) for latex 203 nm on Sep. 25, 2013.

A: First run

1. Time series

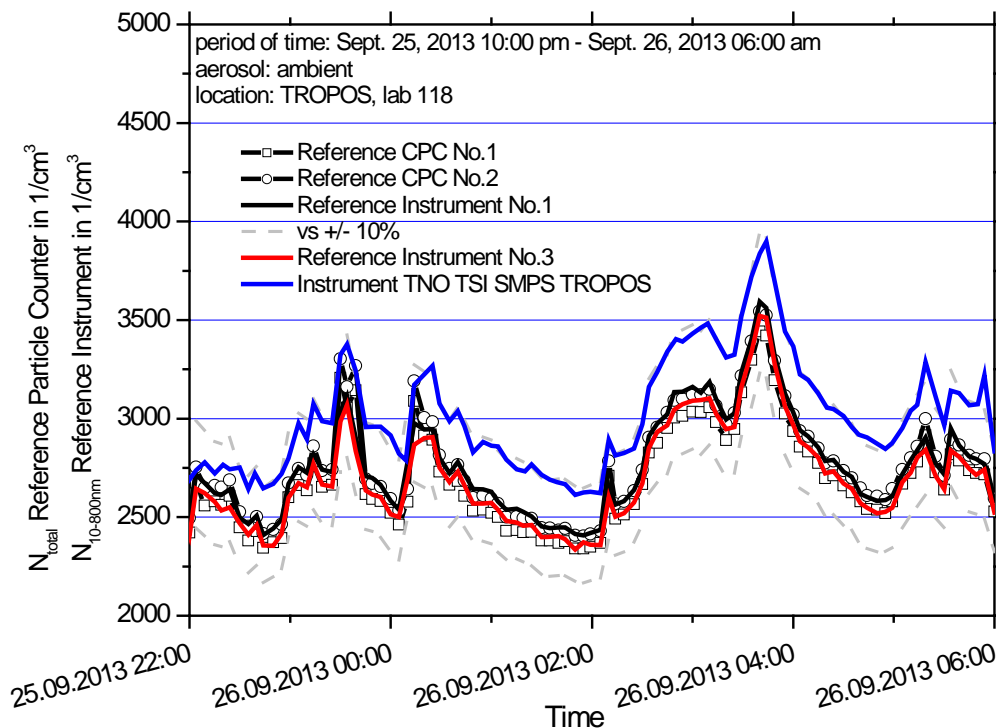


Fig.3. Time series (Sep. 25, 2013 10:00 pm – Sep. 26, 2013 06:00 am) of the integrated particle number concentration ($N_{10-800nm}$). Flow corrections are included.

2. Correlation

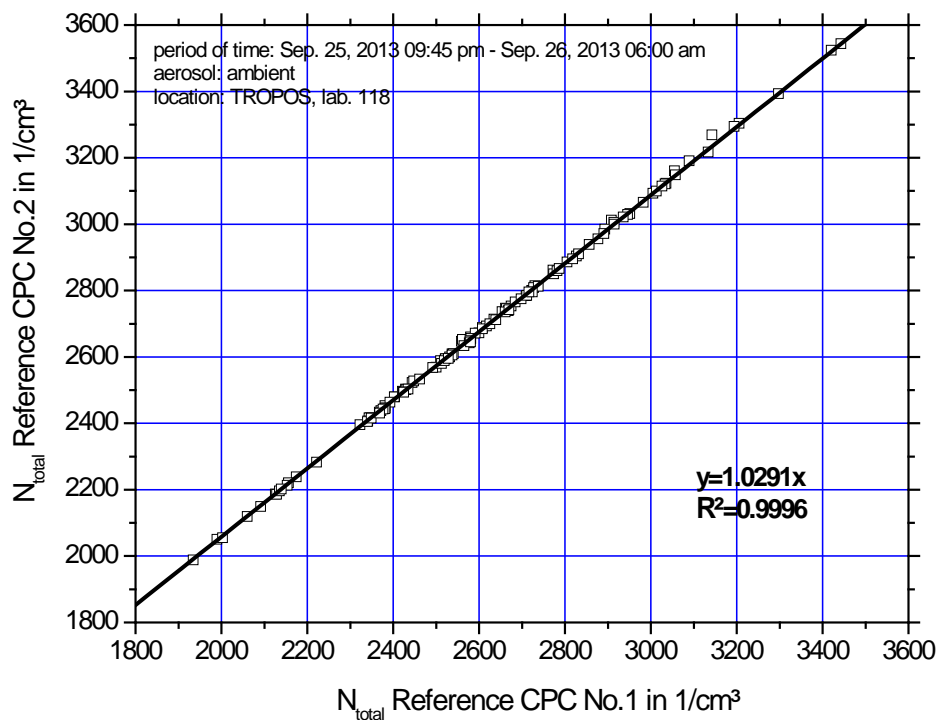


Fig.4. Linear regression between two TROPOS reference CPCs (Model 3772). Flow corrections are included.

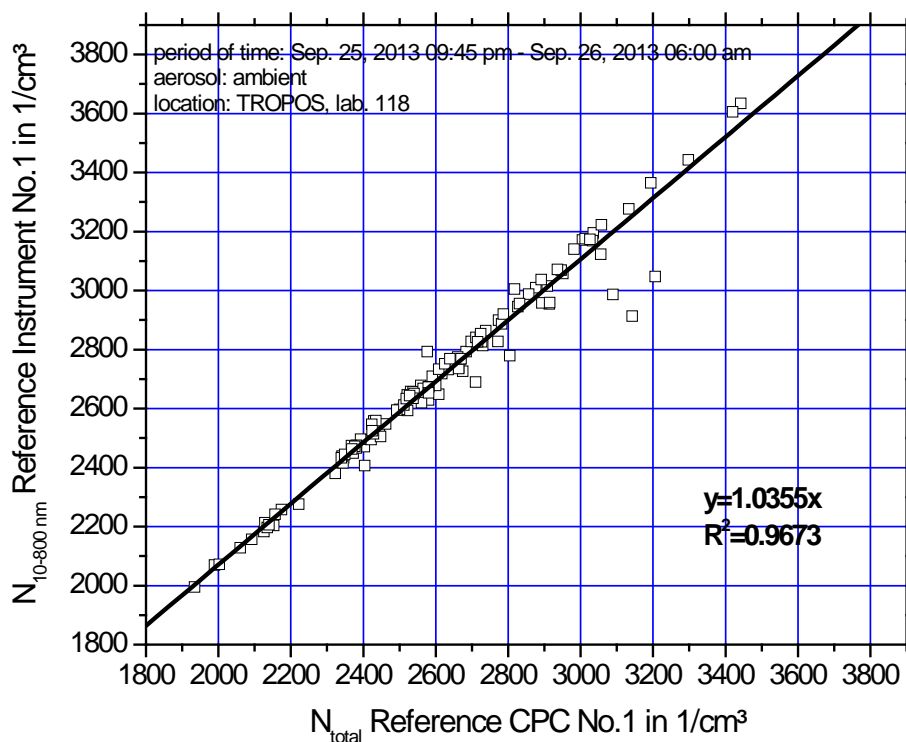


Fig.5. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No. 1. Internal diffusion losses and flow corrections are included.

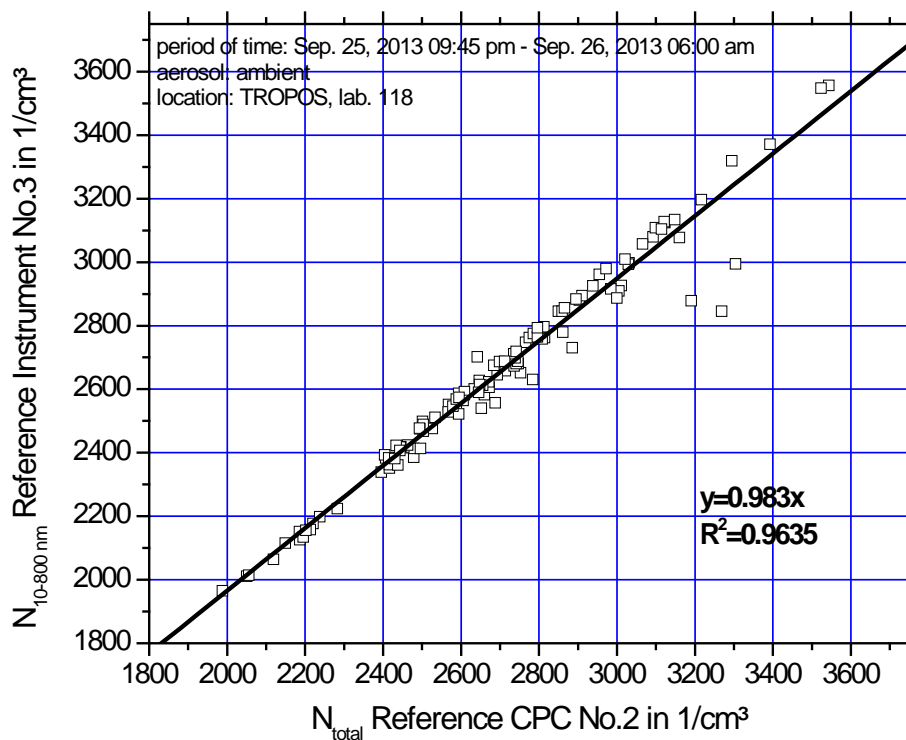


Fig.6. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusion losses and flow corrections are included.

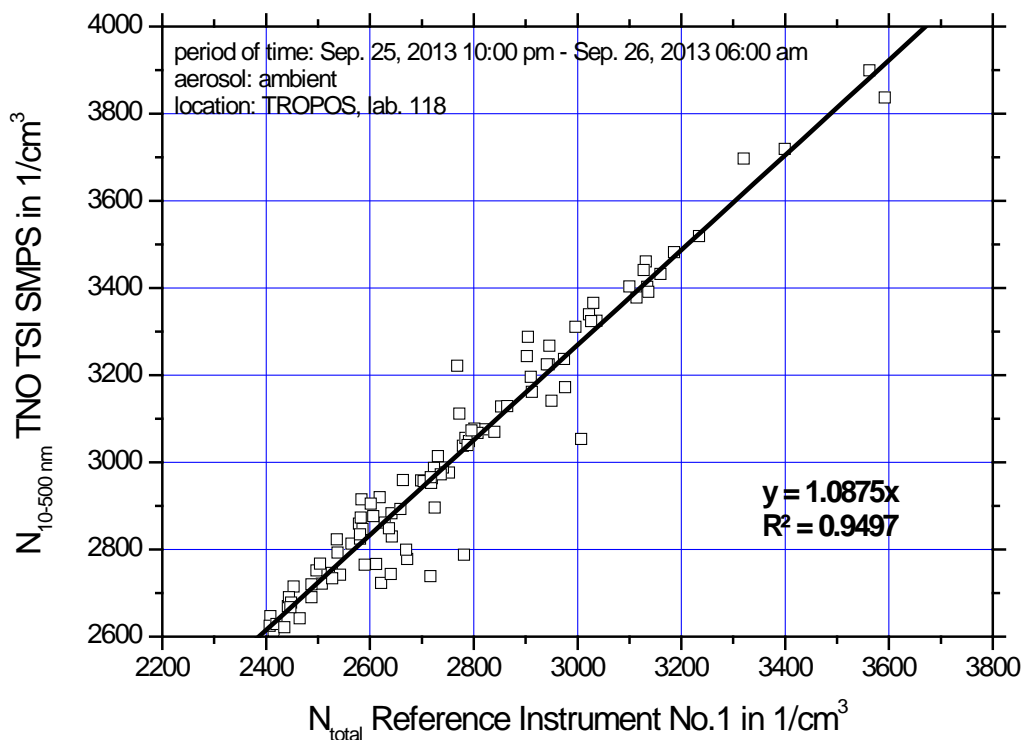


Fig.7. Linear regression between the number concentration of the TROPOS reference instrument No. 1 and instrument TNO TSI SMPS TROPOS. Internal diffusion losses and flow corrections are included.

3. Size distribution

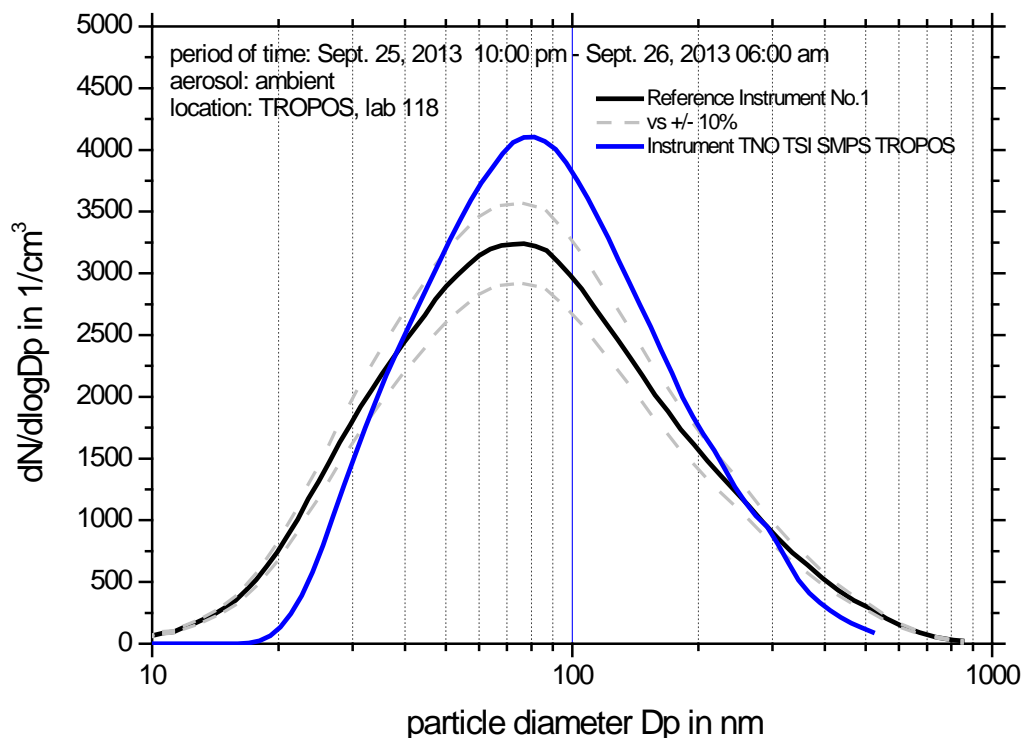


Fig.8. Comparison of mean particle number size distribution between Sep. 25, 2013 10:00 pm and Sep. 26, 2013 06:00 am. Internal diffusion losses and CPC efficiency are included

B: Final run

1. Time series

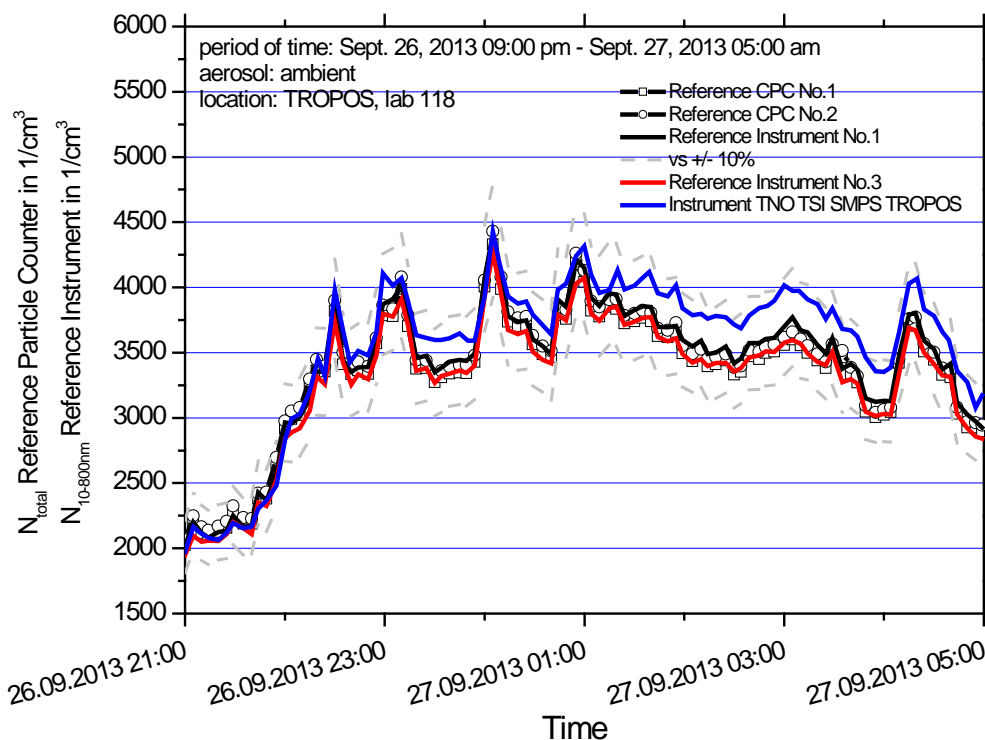


Fig.9. Time series (Sep. 26, 2013 09:00 pm – Sep. 27, 2013 05:00 am) of the integrated particle number concentration ($N_{10-800\text{nm}}$). Flow corrections are included.

2. Correlation

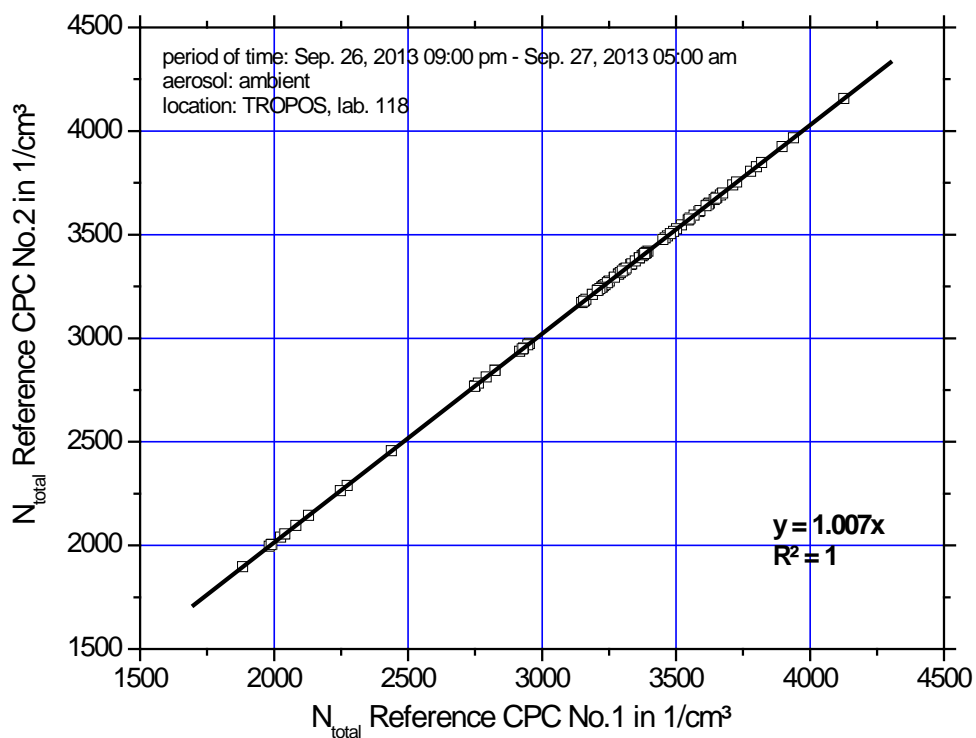


Fig.10. Linear regression between the number concentration of two TROPOS reference CPCs No. 1 and No. 2. Internal diffusion losses and flow corrections are included.

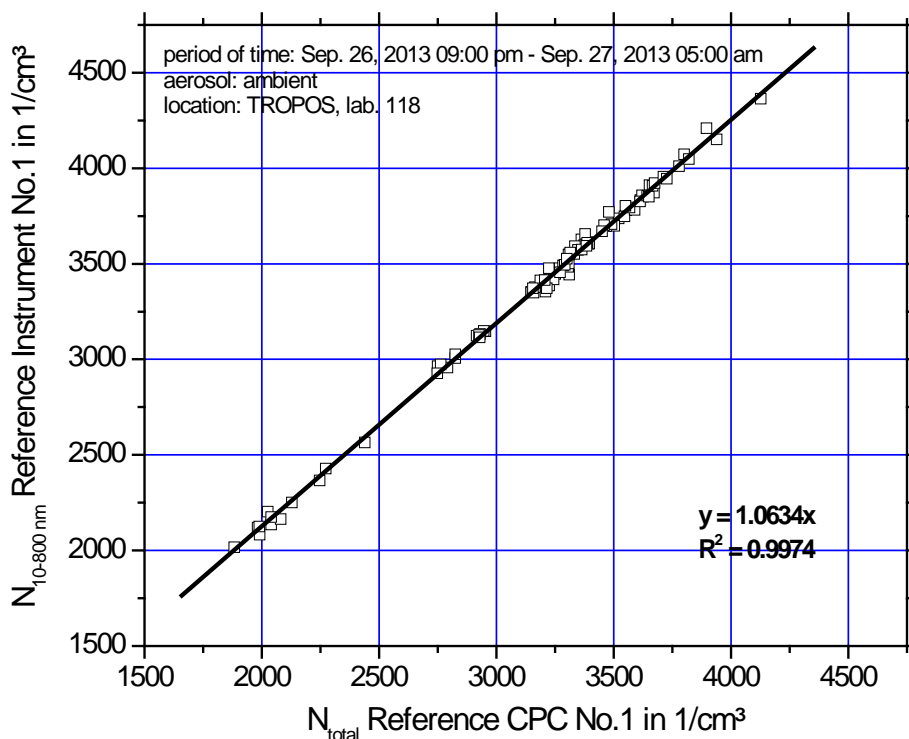


Fig.11. Linear regression between the number concentration of the TROPOS reference instrument No. 1 and the TROPOS reference CPC No. 1. Internal diffusion losses and flow corrections are included.

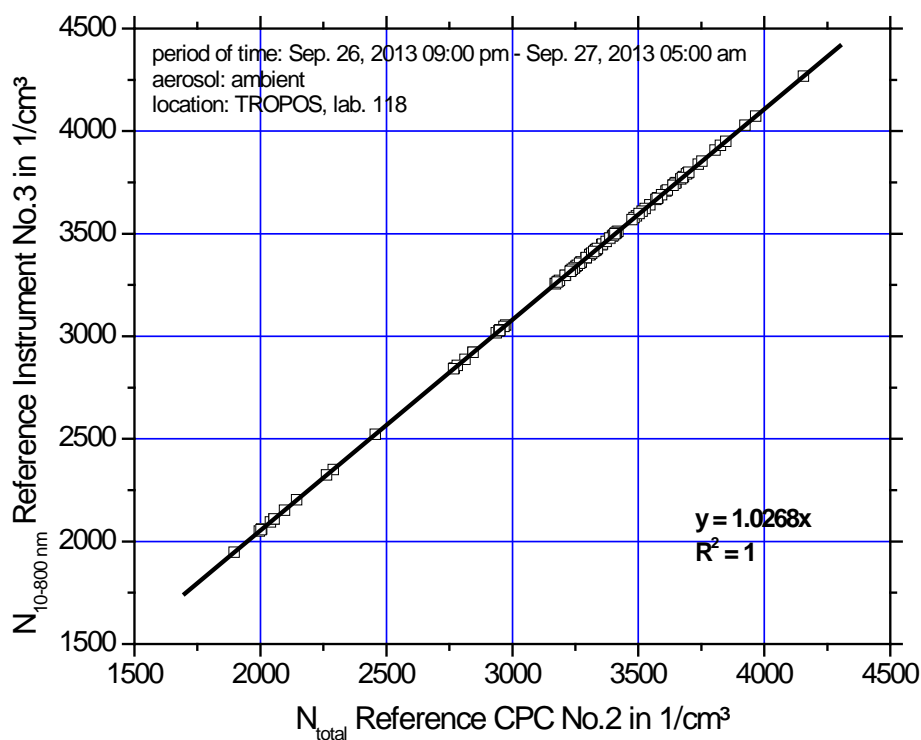


Fig.12. Linear regression between the number concentration of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusion losses and flow corrections are included.

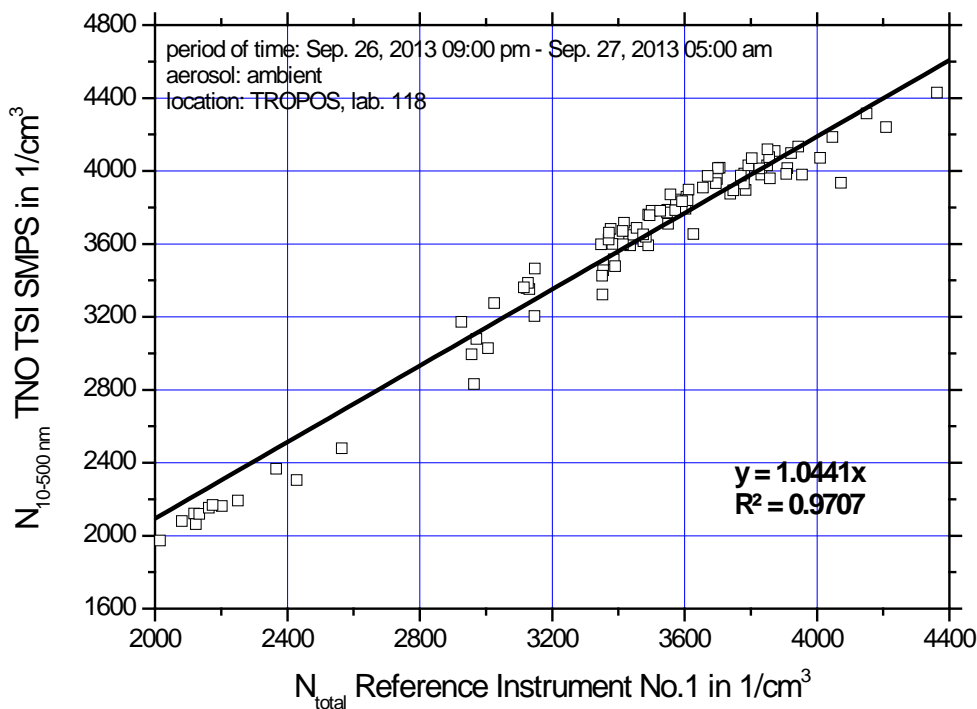


Fig.13. Linear regression between the number concentration of the TROPOS reference instrument No. 1 and instrument TNO TSI SMPS TROPOS. Internal diffusion losses and flow corrections are included.

3. Size distribution

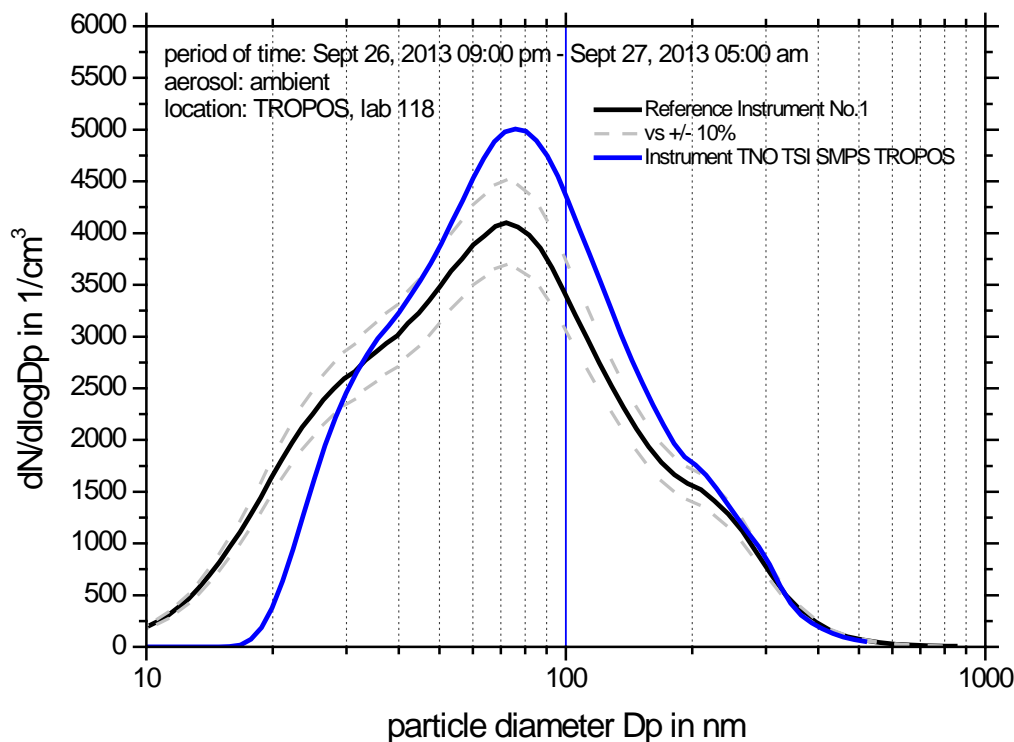


Fig.14. Comparison of mean particle number size distributions between 26.09.2013 09:00 pm and 27.09.2013 5:00 am. Internal diffusion losses and CPC efficiency are included.

Intercomparison of Zugspitze TSI SMPS TROPOS

Basic information

Location of the quality assurance:	TROPOS, lab. 118
Delivery date:	Sep. 23, 2013
Setup in the laboratory:	Sep. 23, 2013
Comparison period:	Sep. 23, 2013 – Sep. 27, 2013
Instrument:	Zugspitze TSI SMPS TROPOS
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	Ludwig Ries (ludwig.ries@uba.de)

Summary:

From Sep. 23, 2013 to Sep. 27, 2013 the Zugspitze TSI SMPS TROPOS participated successfully the TROPOS ACTRIS Workshop. The workshop consisted of an entrance test and a final run. In addition to the overnight ambient measurements, we had numerous high voltage checks, zero- and PSL- measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that, we show for each run the time series of the particle number concentration, the particle number size distribution, and correlation plots. If anything was written in the log book, so we added this also in this report. As reference standards, we used CPCs model TSI 3772 for total particle number concentration and two TROPOS mobility particle size spectrometer. The particle counters have been calibrated against a calibrated TSI electrometer 3068 B with the serial number 70838596.

For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. The Zugspitze TSI SMPS TROPOS showed in the PSL-measurements a particle diameter of 201.2 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. If we look at the final ambient measurement run, the Zugspitze TSI SMPS TROPOS is within the uncertainty

range of +/- 10 %. The Zugspitze TSI SMPS TROPOS passed the ACTRIS Workshop. There is no re-examination required.

Log book:

Sep. 23, 2013

09:30 – 12:00	-> setup as system 7 -> effective length of inlet tubes is 77 cm
13:20	-> system on, vacuum still off: CPC continuously shows 0
13:22	-> turn vacuum on -> restart laptop at 14:00 -> flowrate: 0.897 l/min -> latex measurement: adjustment : 800 V (DMA V_{\min}) – 4800 V (DMA V_{\max})
17:45	-> latex measurement takes place
18:45	-> ambient measurement

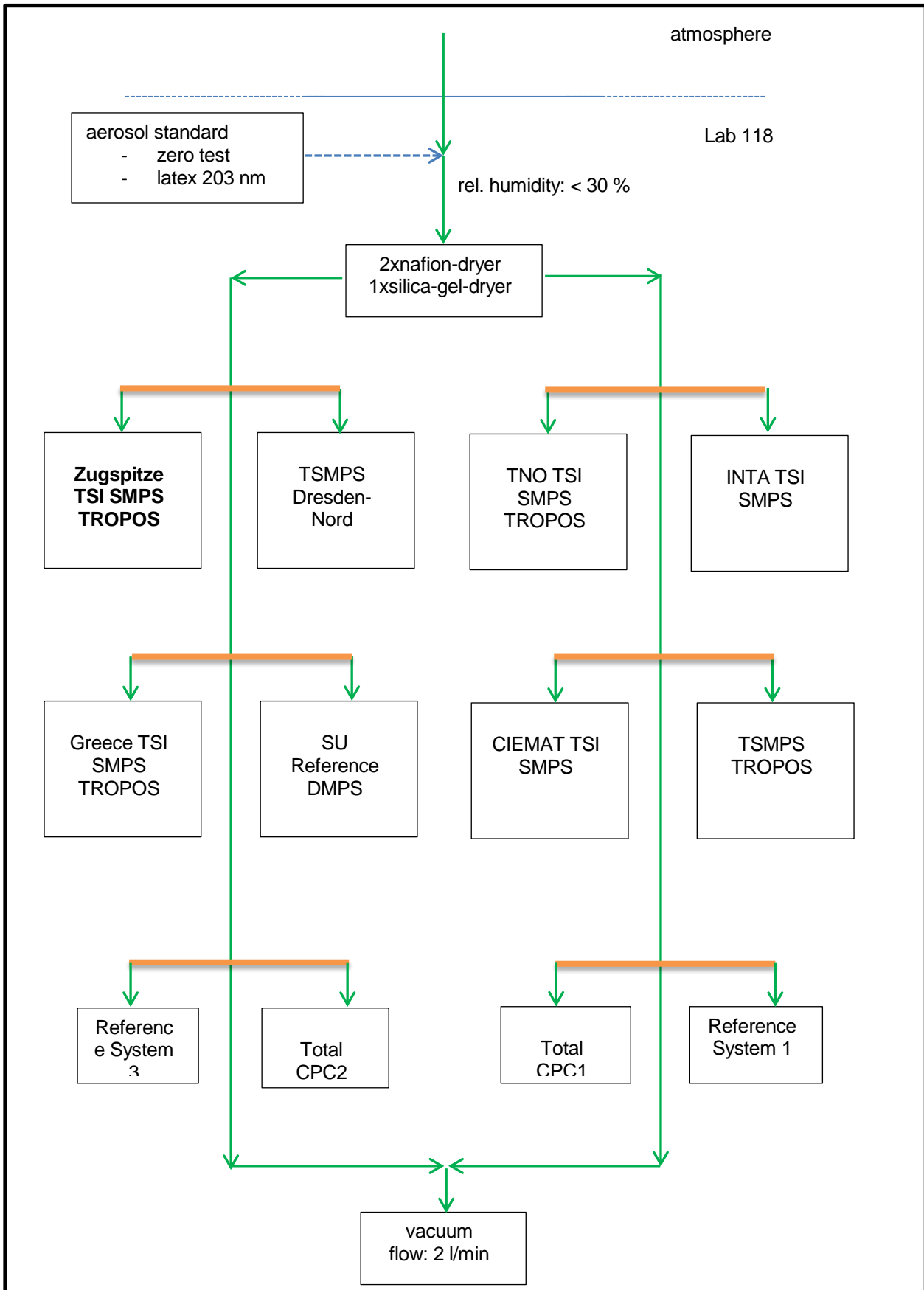
Sep. 24, 2013

	-> measure average flow through CPC at 0.9239 l
	-> setup of UBA: total length at 223 cm
15:00	-> CPC 3010 brought to cleaning

Sep. 25, 2013

-> second run with -3% flow correction

Laboratory setup



Latex 203 nm

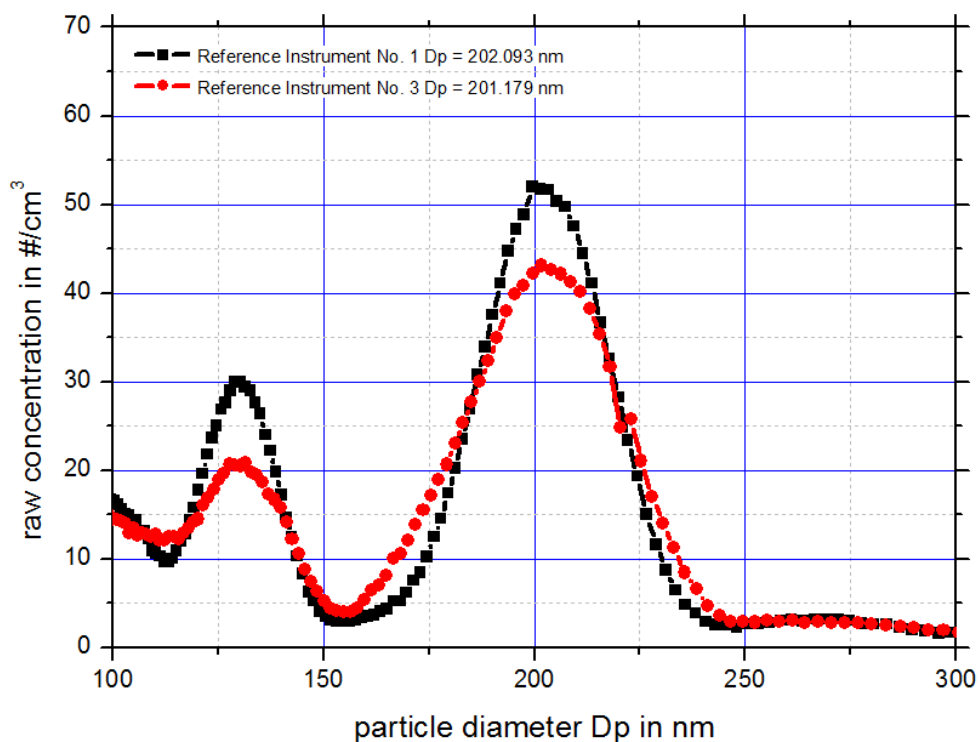


Fig.1. Measurement of latex 203 nm for the TROPOS reference instruments: Particle size distribution (raw concentration) for latex 203 nm on Sep. 23, 2013 between 05:06 pm and 05:33 pm.

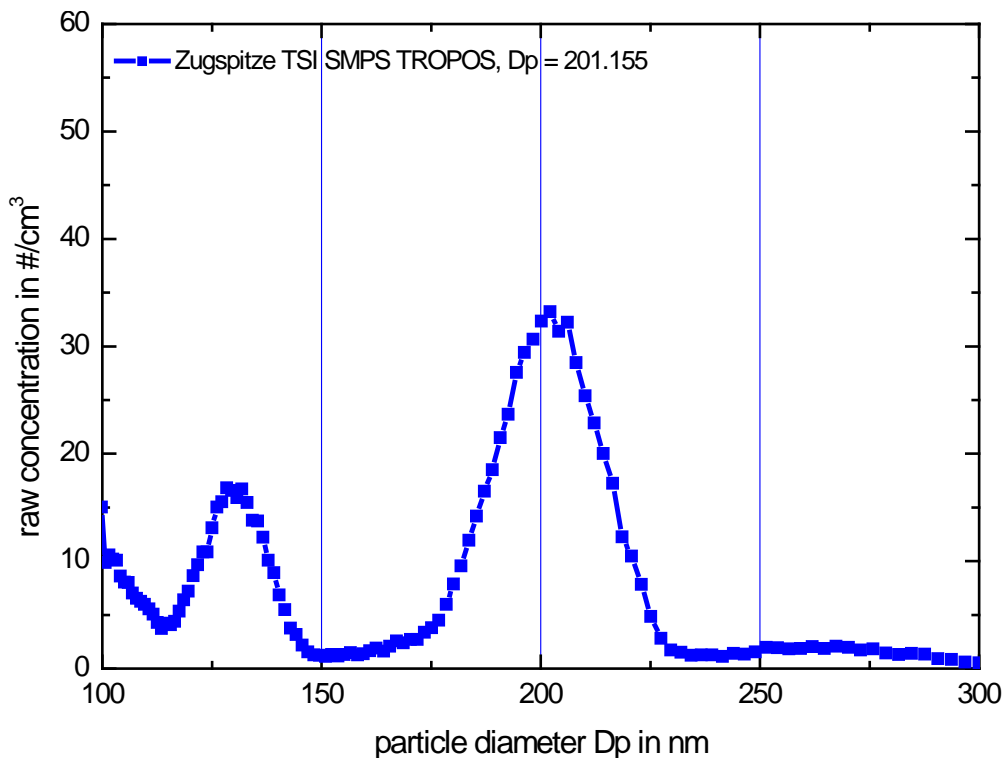


Fig.2. Measurement of latex 203 nm for Zugspitze TSI SMPS TROPOS: Particle size distribution (raw concentration) for latex 203 nm on Sep. 23, 2013 between 05:40 pm and 05:50 pm.

CPC efficiency

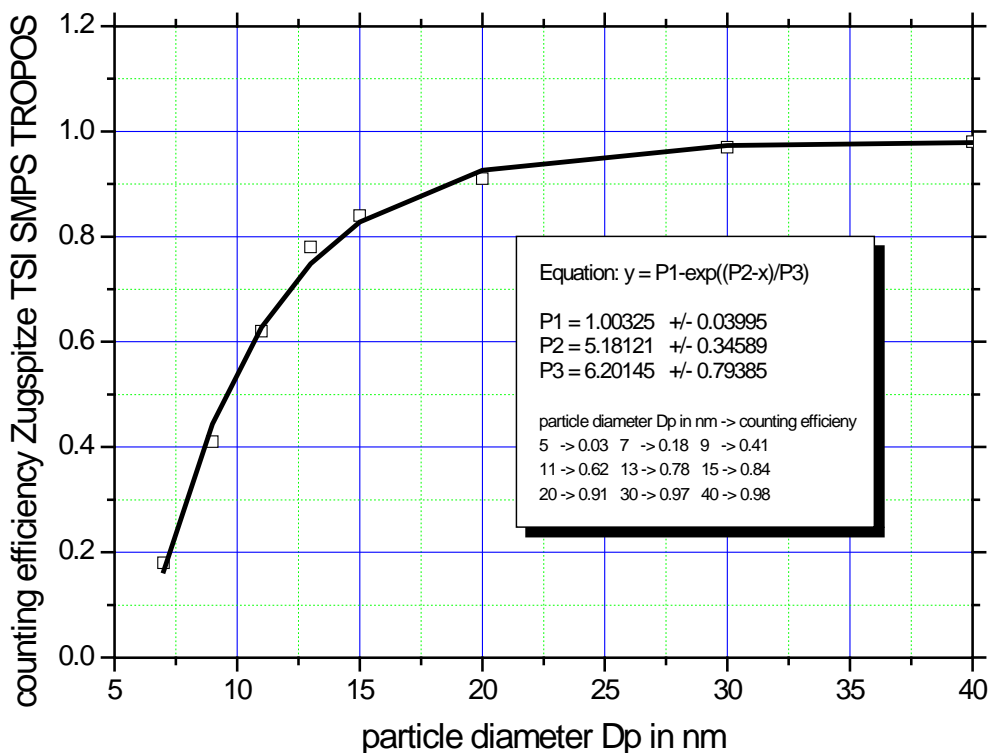


Fig.3. CPC efficiency curve. Based on TSI 3068B. Serial number: 70838596

A: First run

1. Time series

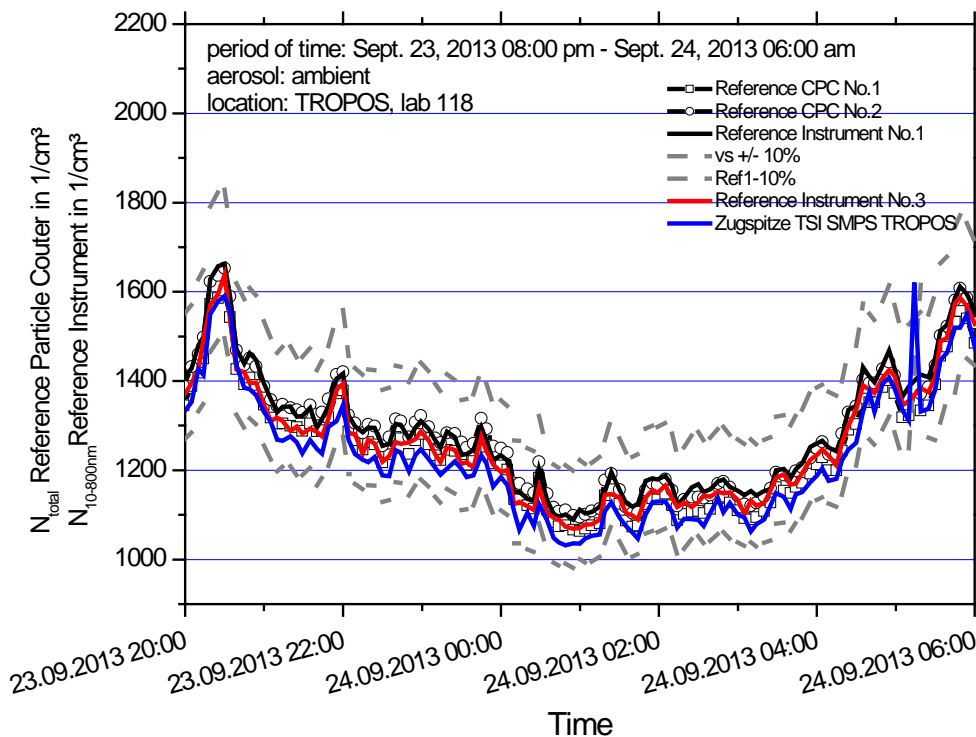


Fig.4. Time series (Sep. 23, 2013 08:00 pm – Sep. 24, 2013 06:00 am) of the integrated Particle Number Concentration ($N_{10-800\text{nm}}$). Flow corrections are included.

2. Correlation

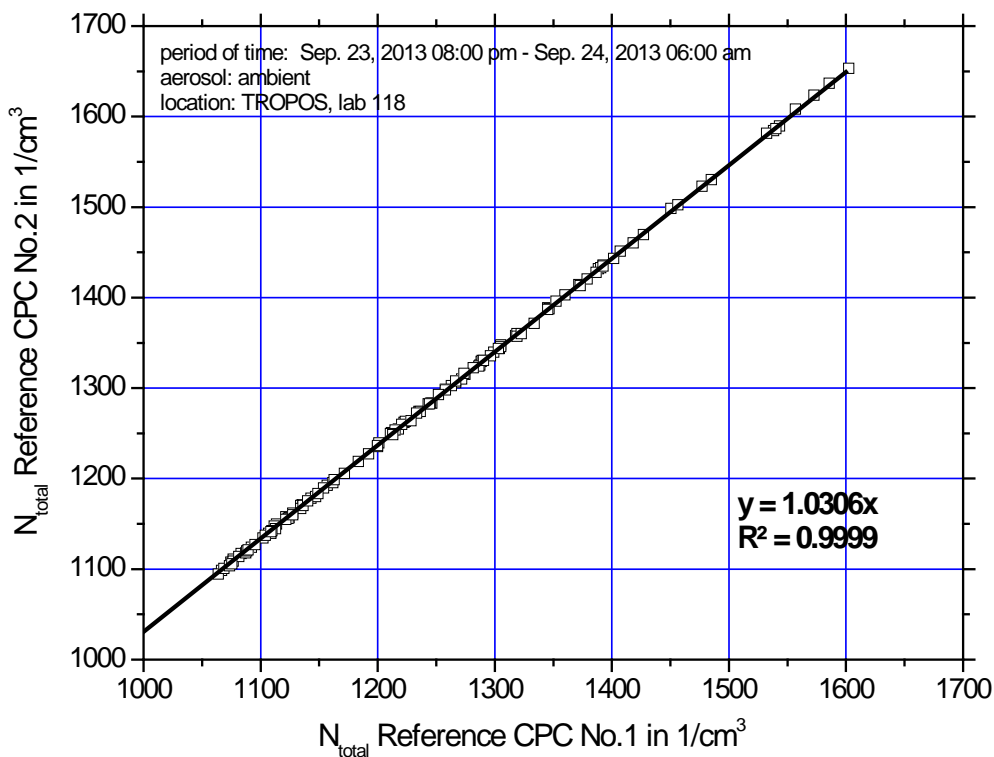


Fig.5. Linear regression between two TROPOS reference CPCs (Model 3772). Flow corrections are included.

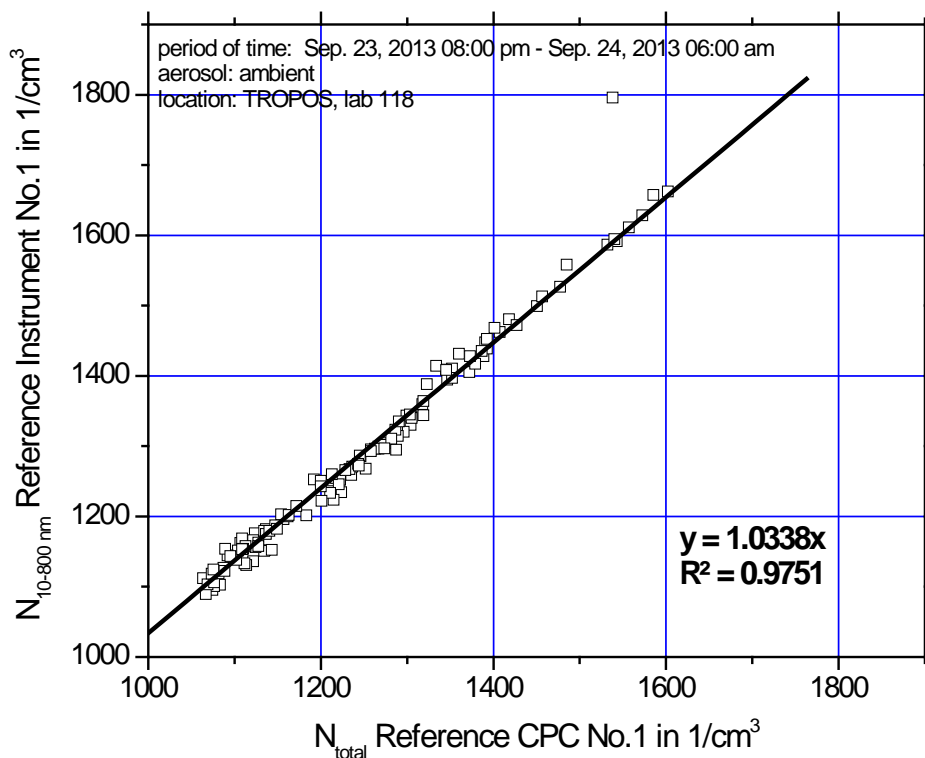


Fig.6. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No. 1. Internal diffusion losses and flow corrections are included.

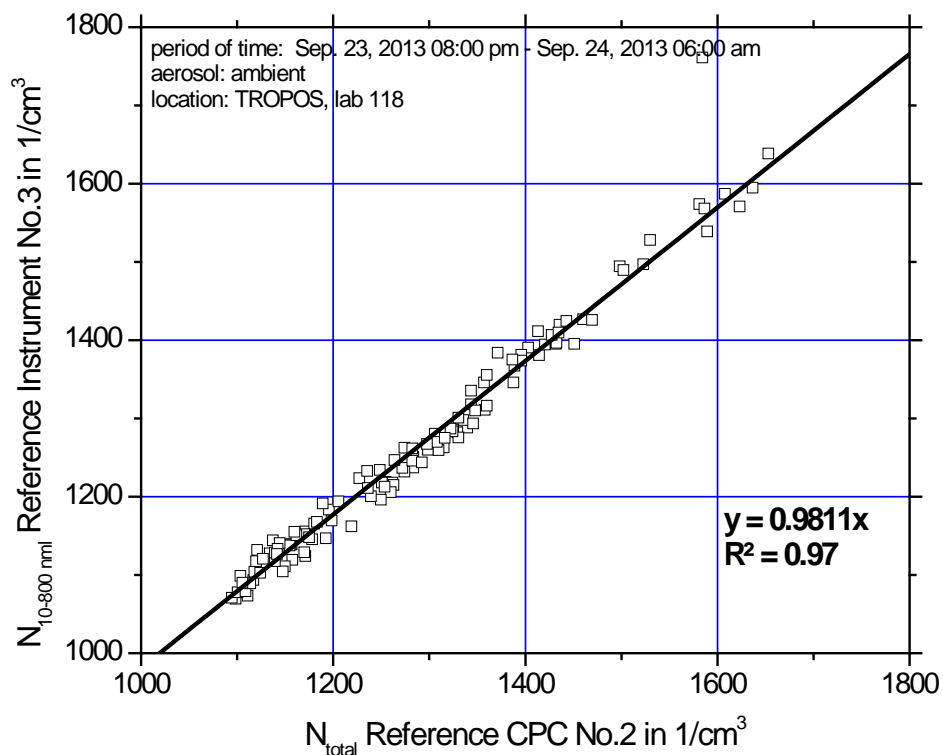


Fig.7. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusion losses and flow corrections are included.

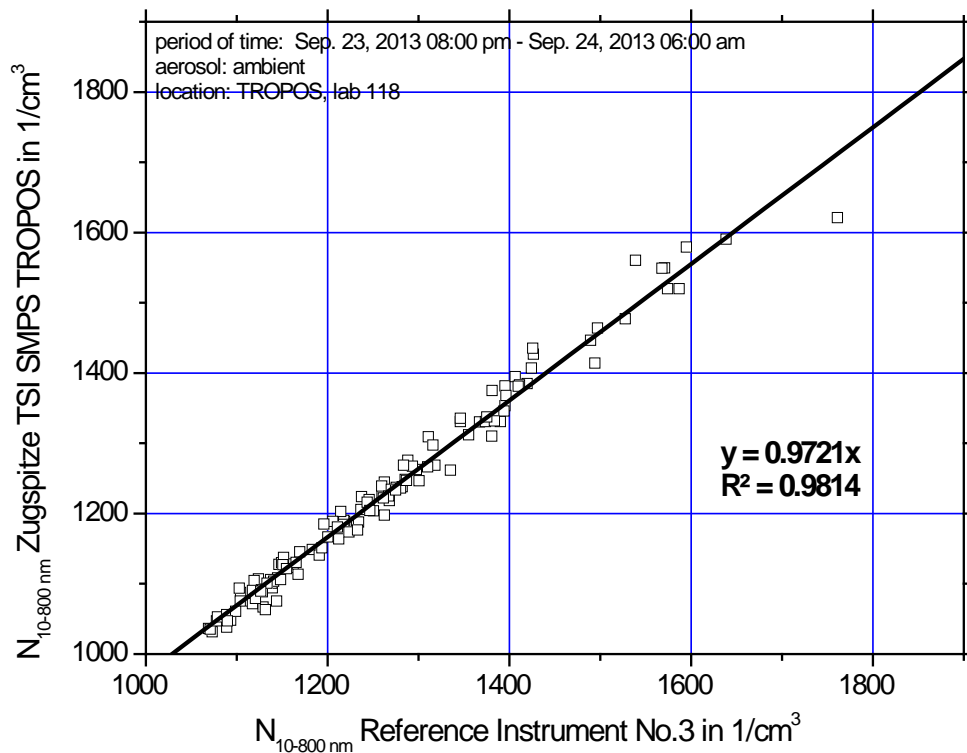


Fig.8. Linear regression between the number concentrations the TROPOS reference instrument No. 3 and Zugspitze TSI SMPS TROPOS. Internal diffusion losses and flow corrections are included.

3. Size distribution

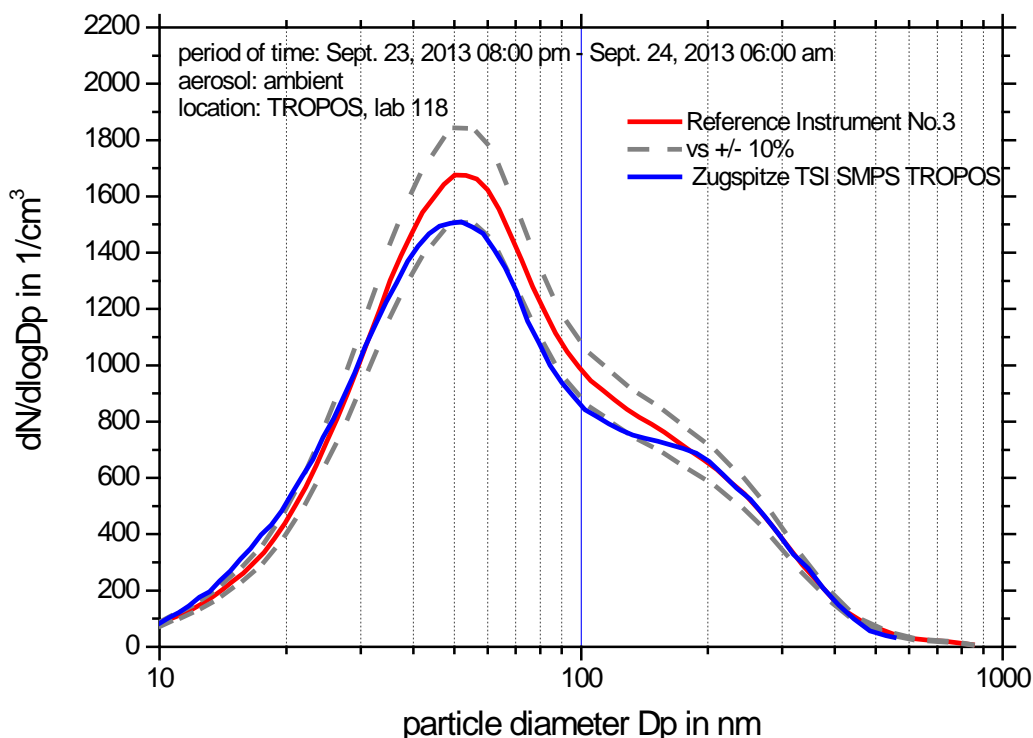


Fig.9. Comparison of the mean particle number size distributions between Sep. 23, 2013 08:00 pm and Sep. 24, 2013 06:00 am. Internal diffusion losses and CPC efficiency are included.

B: Final run

1. Time series

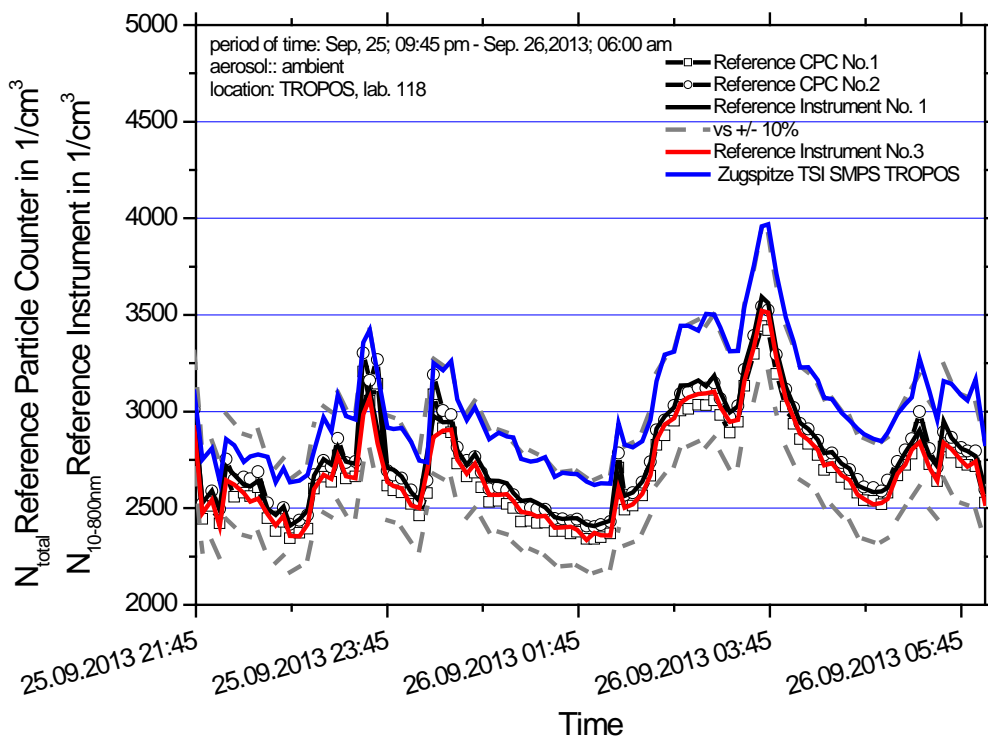


Fig.10. Time series (Sep. 25, 2013 09:45 pm – Sep. 26, 2013 06:00 am) of the integrated Particle Number Concentration ($N_{10-800\text{nm}}$). Flow corrections are included.

2. Correlation

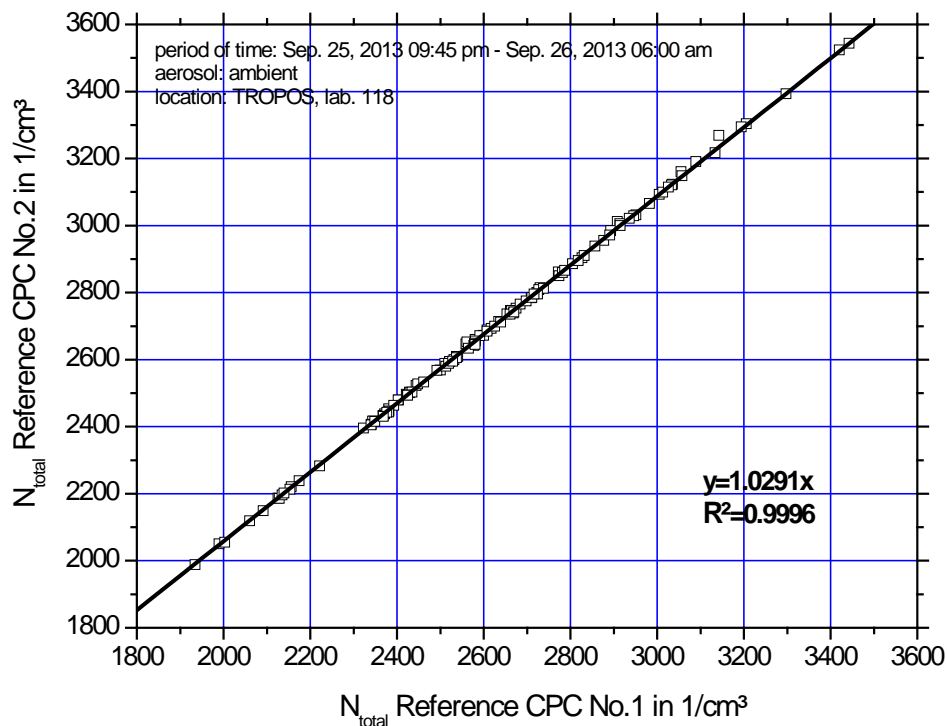


Fig.11. Linear regression between the number concentrations of two TROPOS reference CPCs. Internal diffusion losses and flow corrections are included.

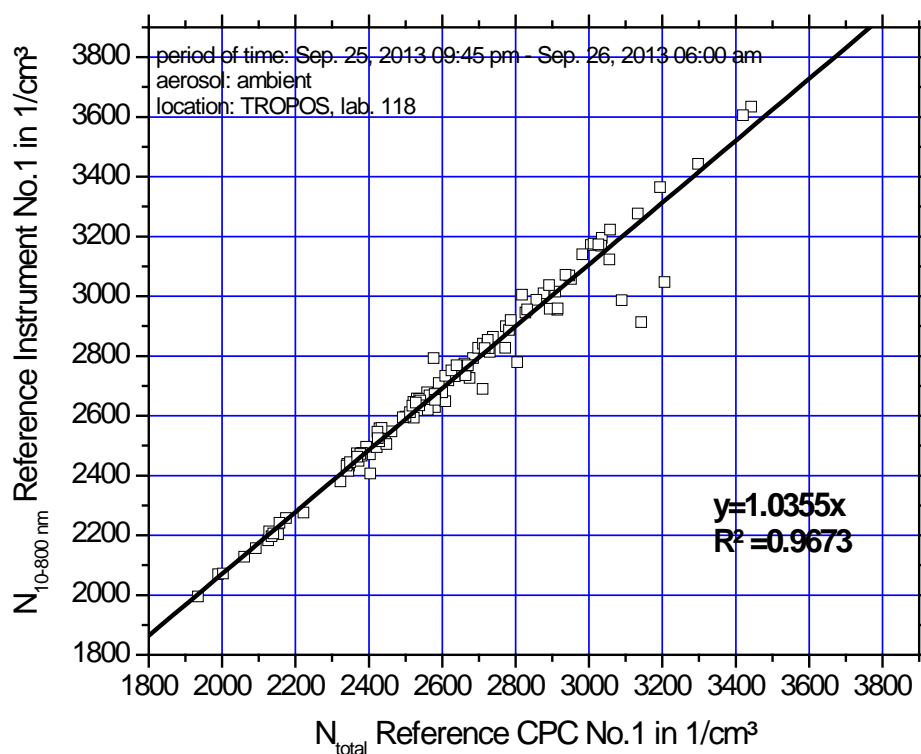


Fig.12. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No. 1. Internal diffusion losses and flow corrections are included.

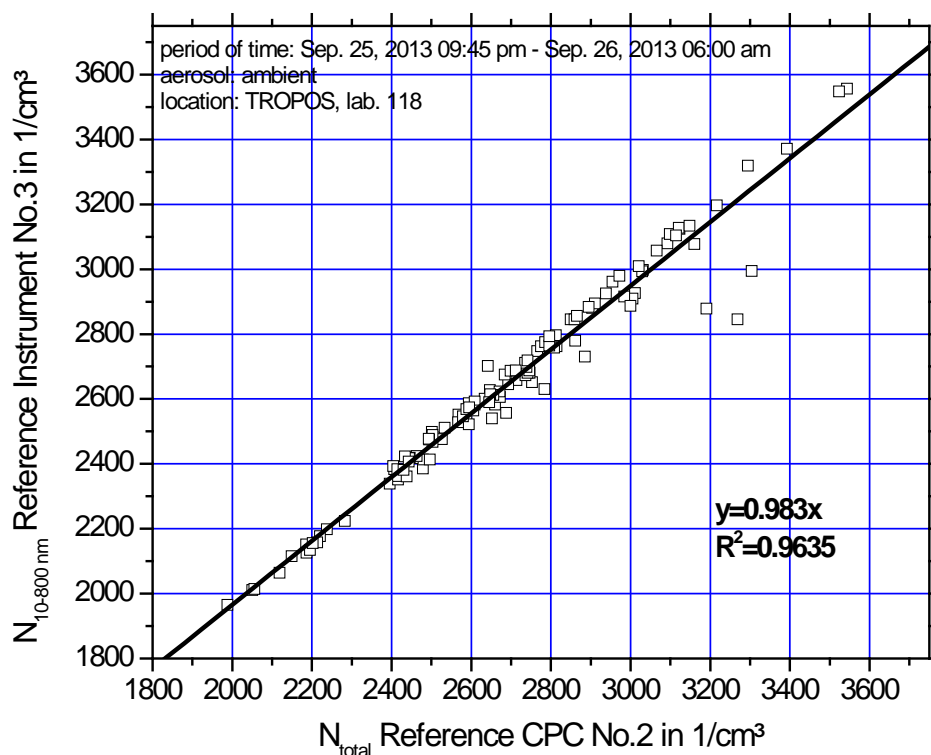


Fig.13. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusion losses and flow corrections are included.

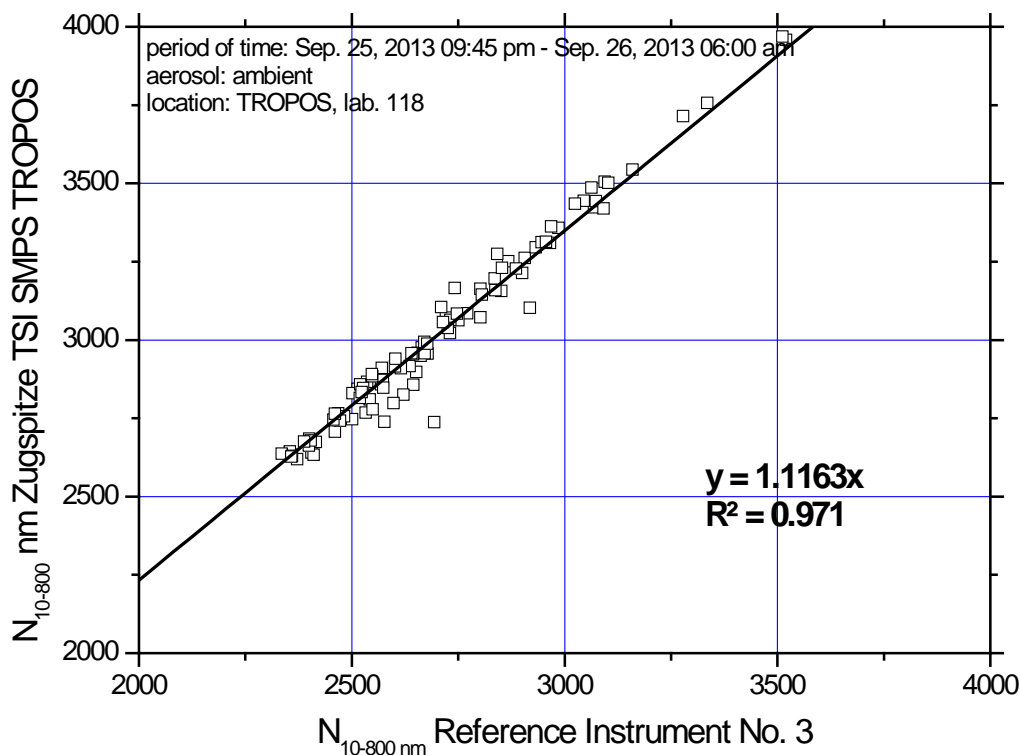


Fig.14. Linear regression between the number concentrations of the TROPOS reference instrument No. 3 and Zugspitze TSI SMPS TROPOS. Internal diffusion losses and flow corrections are included.

3. Size distribution

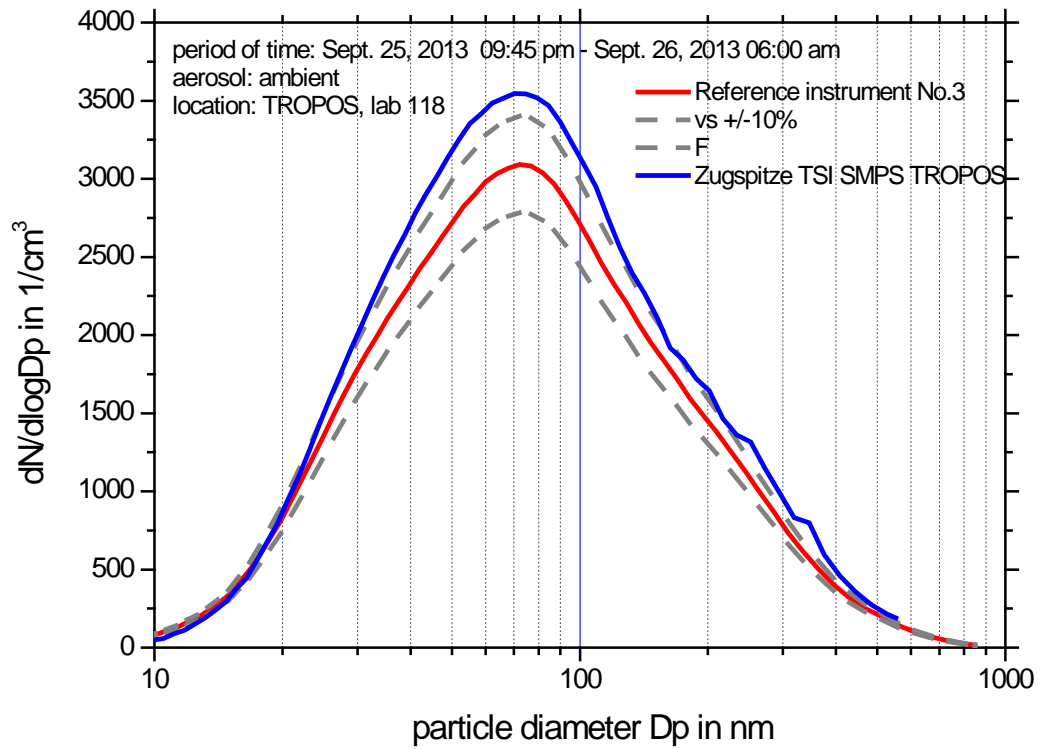


Fig.15. Comparison of the mean particle number size distributions between Sep. 25, 2013 09:45 pm and Sep. 26, 2013 06:00 am. Internal diffusion losses and CPC efficiency are included.

Third week:

Intercomparison of Ispra JRC SMPS

Basic information

Location of the quality assurance:	TROPOS, lab. 118
Delivery date:	Sep. 30, 2013
Setup in the laboratory:	Sep. 30, 2013
Comparison period:	Sep. 30, 2013 – Oct. 03, 2013
Instrument:	Ispra JRC SMPS
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	Sebastiao Martins dos Santos (sebastiao.santos@jrc.ec.europa.eu)

Summary:

From Sep. 30, 2013 to Oct. 03, 2013 the Ispra JRC SMPS participated successfully the TROPOS ACTRIS Workshop. The workshop consisted of an entrance test and a final run. In addition to the overnight ambient measurements, we had numerous high voltage checks, zero- and PSL-measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that, we show for each run the time series of the particle number concentration, the particle number size distribution, and correlation plots. If anything was written in the log book, so we added this also in this report. As reference standards, we used CPCs model TSI 3772 for total particle number concentration and two TROPOS mobility particle size spectrometer. The particle counters have been calibrated against a calibrated TSI electrometer 3068 B with the serial number 70838596.

For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. The Ispra JRC SMPS showed in the PSL-measurements a particle diameter of 203.6 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. If we look at the final ambient measurement run, the Ispra JRC SMPS is within the uncertainty range of +/- 10 %. The Ispra JRC SMPS passed the ACTRIS Workshop. There is no re-examination required.

Log book:

Sep. 30, 2013

10:00 -> setup of SMPS
-> check flows: sample flow = 0.976 l/min; display shows 0.98 l/min
13:18 -> start zero check, power off
14:05 -> restart measurements
14:35 -> voltage calibration
14:45 -> resume zero check
15:10 -> stop zero check, set scan range from 100 nm to 300 nm, number size bins 45
15:15 -> run sizing check
16:01 -> set scan range from 10 nm to 800 nm
16:10 -> ambient air measurement
-> check sample flow: sample flow = 0.986 l/min; display = 0.988 l/min

Oct. 01, 2013

09:15 -> stop ambient measurements, remove CPC for calibration
15:20 -> check sample flow: 0.986
15:25 -> resume measurements
15:58 -> zero check
17:18 -> sizing check, set scanning range from 100 nm to 300 nm
-> run sizing check
-> check flow: sample flow = 0.99 l/min; display shows 1.007 l/min
17:50 -> resume ambient measurements

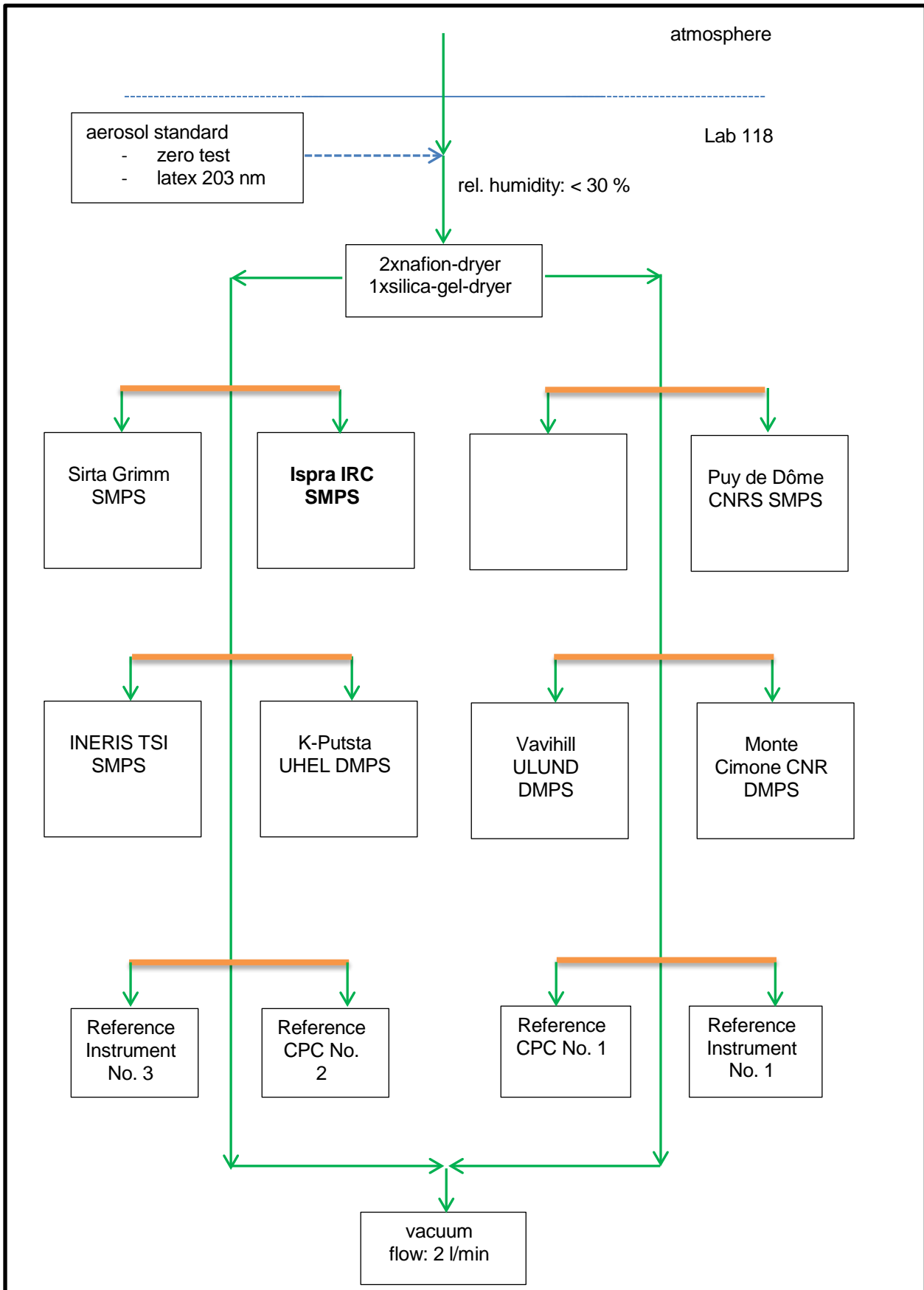
Oct. 02, 2013

09:30 -> running ambient air measurements
14:00 -> remove diffusion screen
14:05 -> start intercomparison for small diameters (below 20 nm)
16:20 -> stop DMPS and replace CPC 3772
16:35 -> sample flow = 1.027 l/min, resume measurements
17:06 -> insert diffusion screen
17:07 -> zero check
17:30 -> run overnight ambient air measurement

Oct. 03, 2013

09:09 -> ambient air
14:04 -> stop DMPS

Laboratory setup



Latex 203 nm

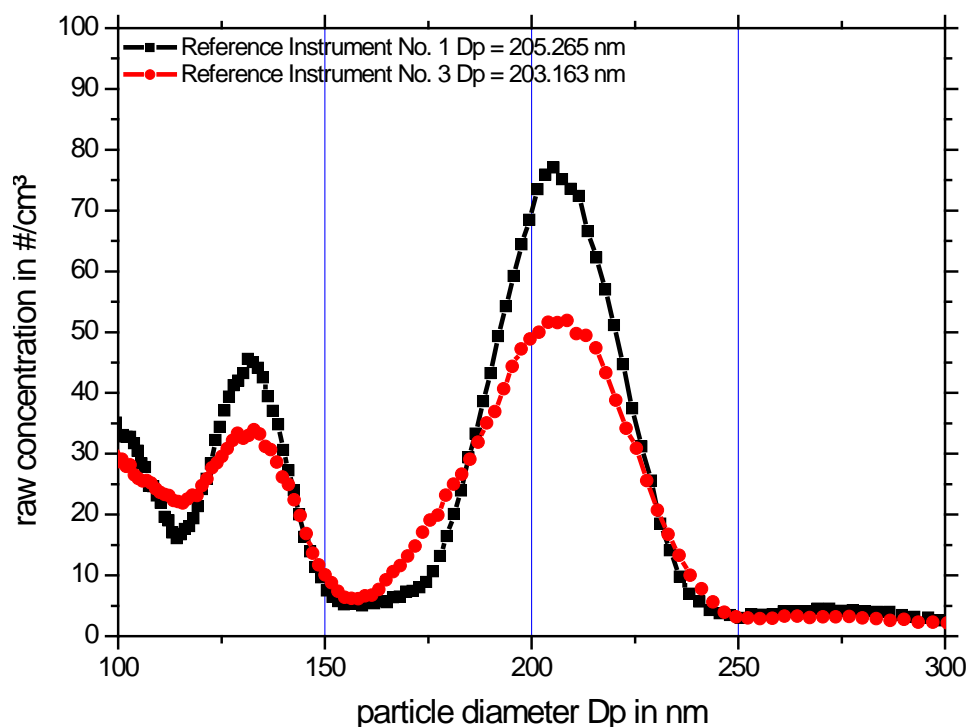


Fig.1. Measurement of latex 203 nm for reference instruments: Particle size distribution (raw concentration) for latex 203 nm on Sep. 30, 2013 between 15:19 and 15:28 (UTC time).

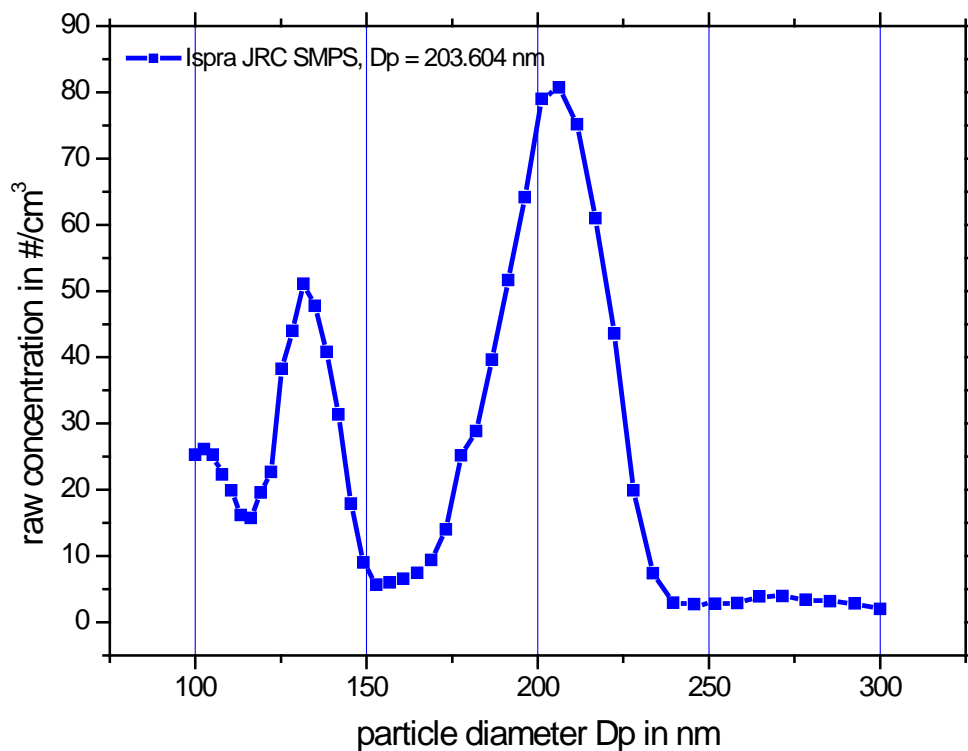


Fig.2. Measurement of latex 203 nm for Ispra JRC SMPS: Particle size distribution (raw concentration) for latex 203 nm on Sep. 30, 2013 between 15:20 and 15:30 (UTC time).

CPC efficiency

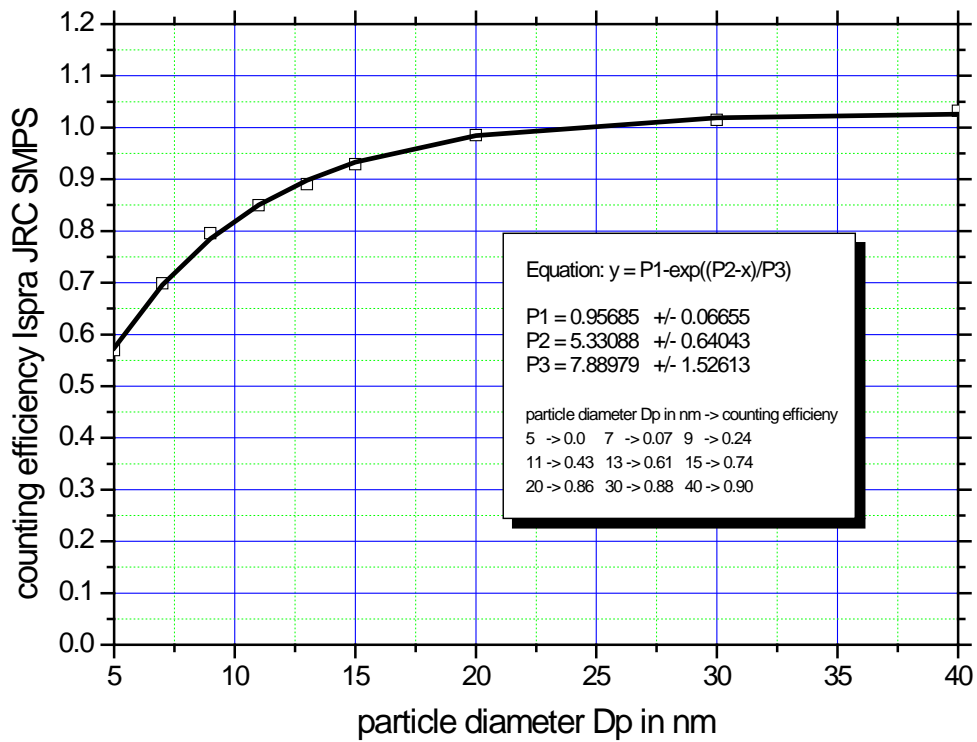


Fig.3. CPC efficiency curve. Based on TSI Electrometer 3068B. Serial number: 70838596.

A: Final run

1. Time series

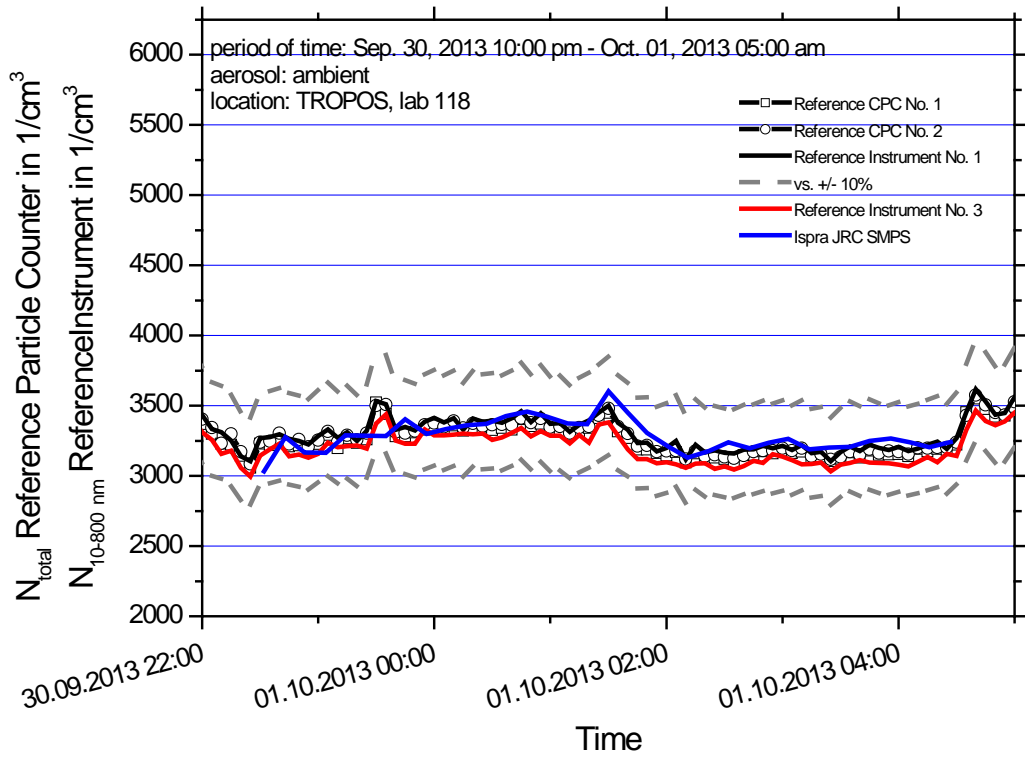


Fig.4. Time series (Sep. 30, 2013 10:00 pm - Oct. 01, 2013 05:00 am) of the integrated Particle Number Concentration (N 10-800 nm). Flow corrections are included.

2. Correlation

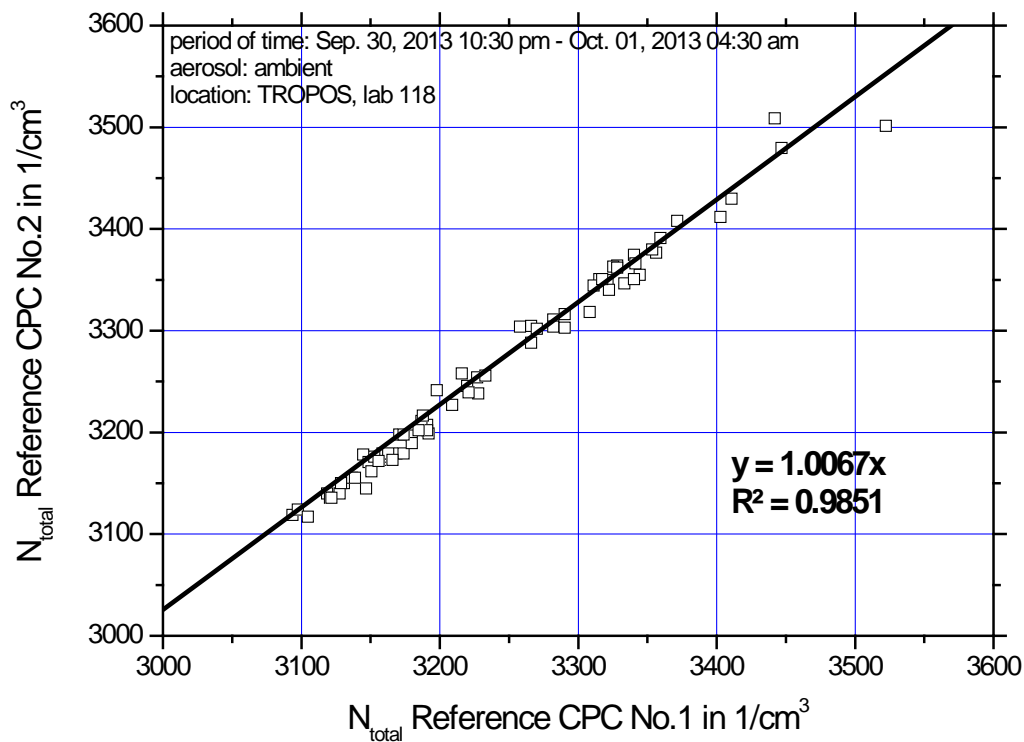


Fig.5. Linear regression between two Reference TROPOS CPCs (Model 3772). Flow corrections are included.

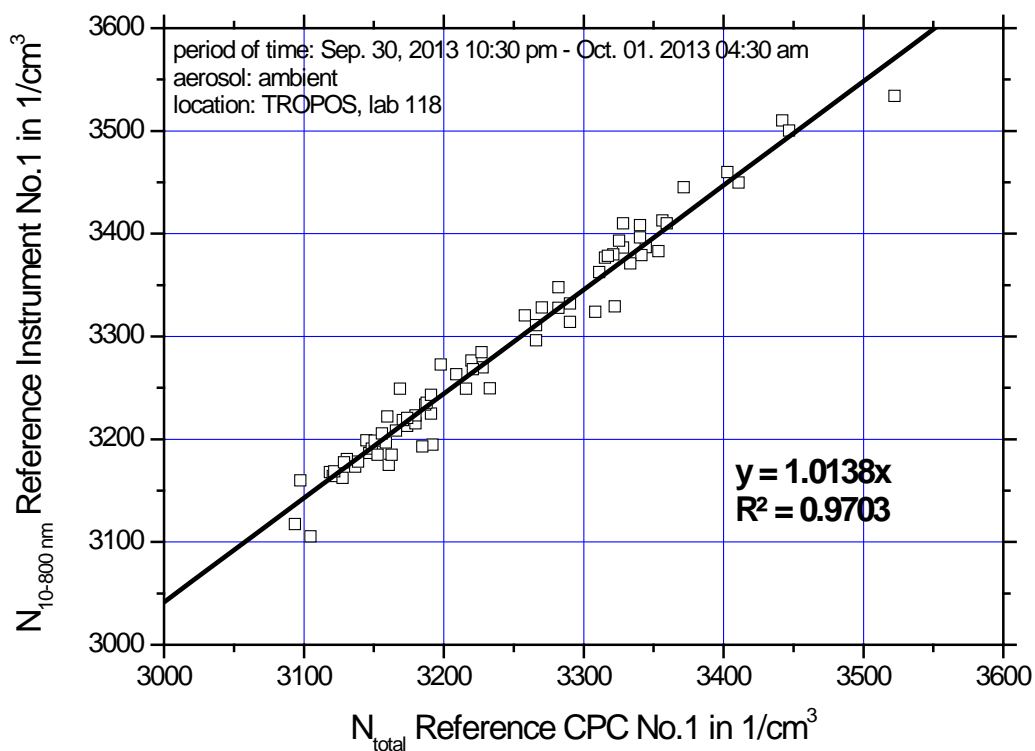


Fig.6. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No. 1. Internal diffusion losses and flow corrections are included.

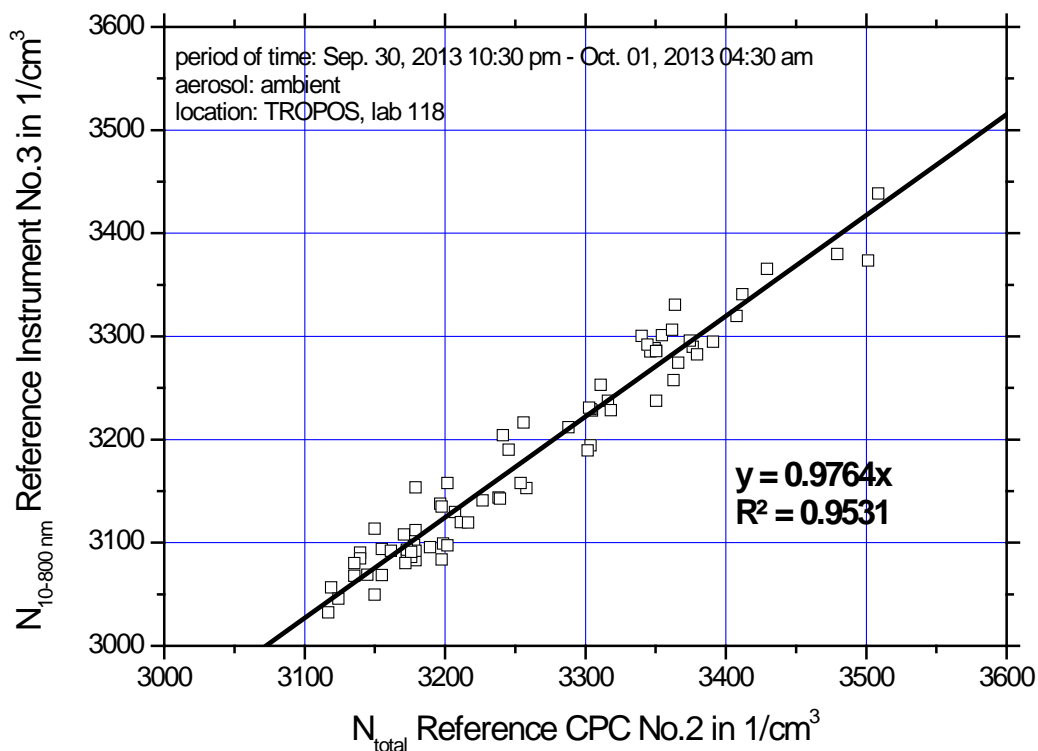


Fig.7. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusion losses and flow corrections are included.

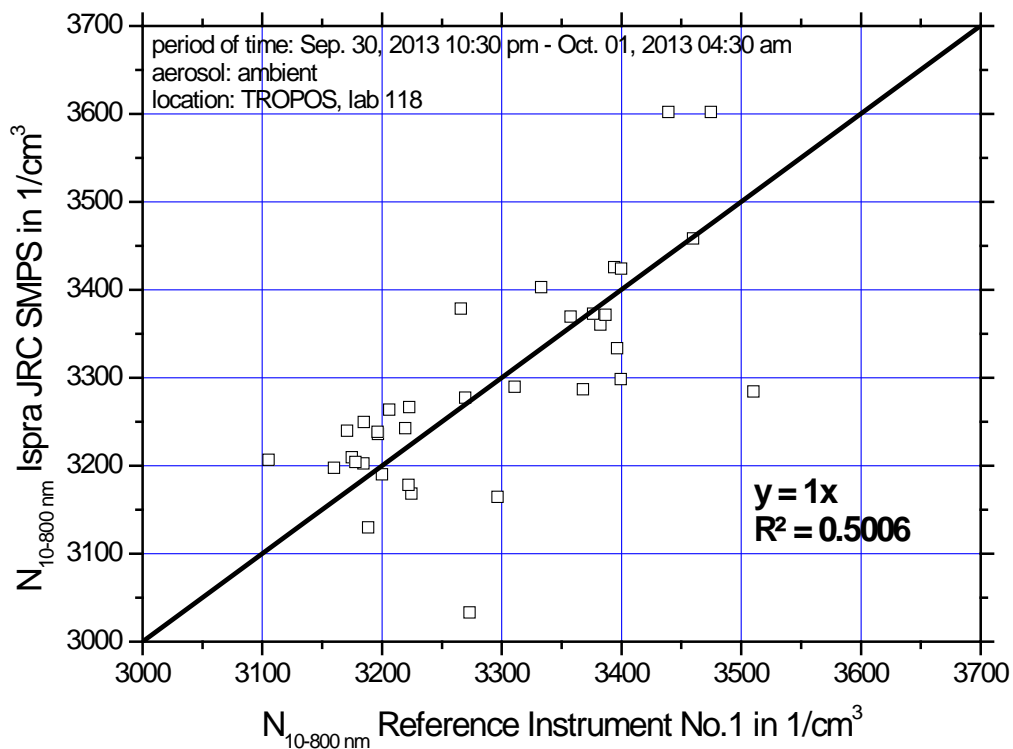


Fig.8. Linear regression between the number concentrations of Reference Instrument No. 1 and Ispra JRC SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

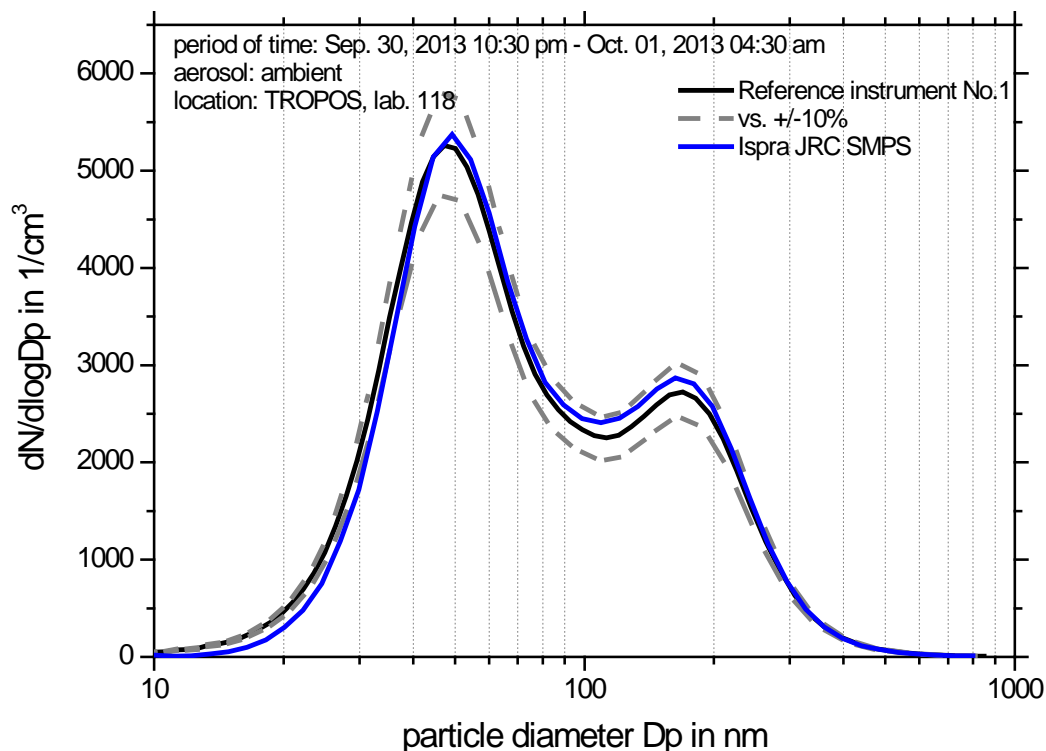


Fig.9. Comparison of mean particle number size distributions between Sep. 30, 2013 10:30 pm and Oct. 01, 2013 04:30 am. Internal diffusion losses and CPC efficiency are included.

B: Final run

1. Time series

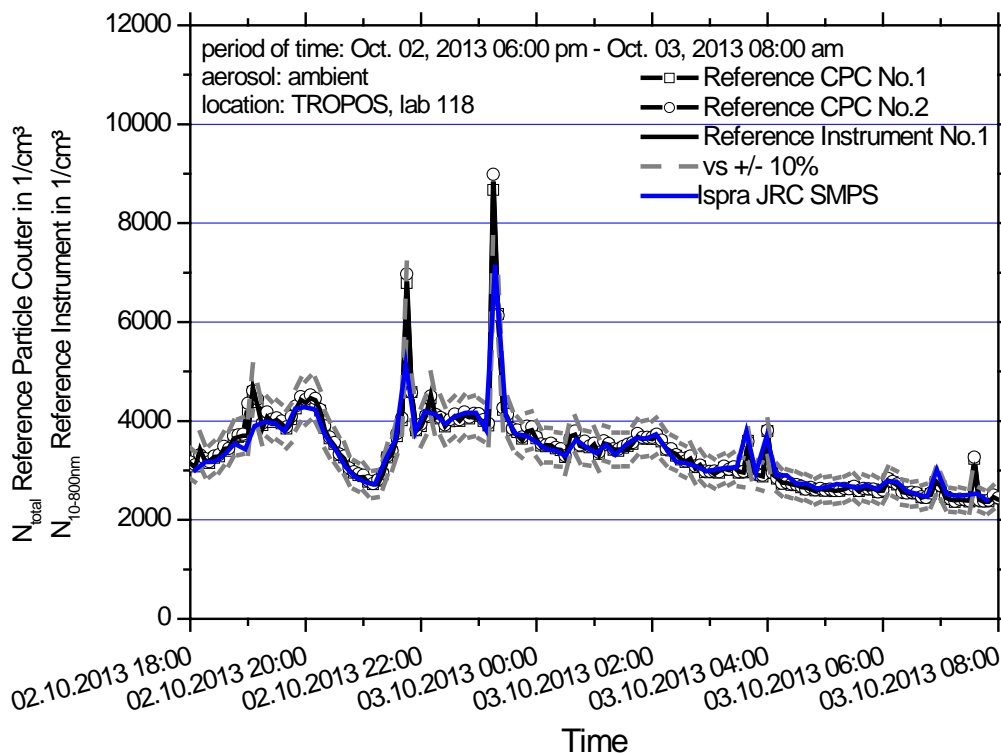


Fig.10. Time series (Oct. 02, 2013 06:00 pm – Oct. 03, 2013 08:00 am) of the integrated Particle Number Concentration ($N_{10-800\text{nm}}$). Flow corrections are included.

2. Correlation

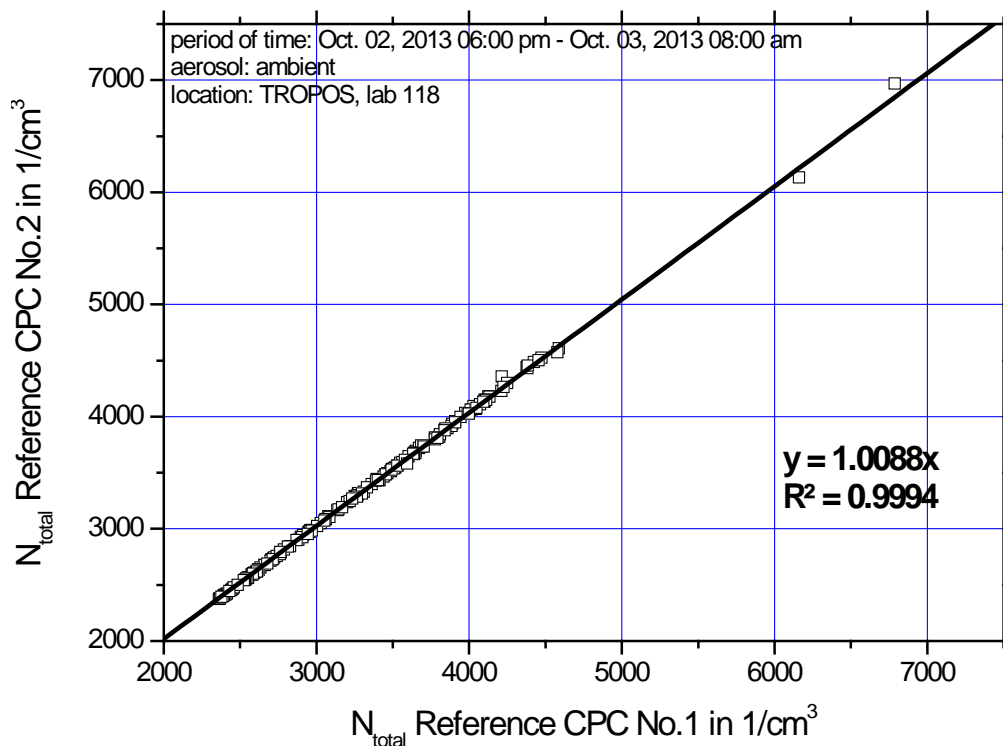


Fig.11. Linear regression between two Tropos' reference CPCs (Model 3772). Flow corrections are included.

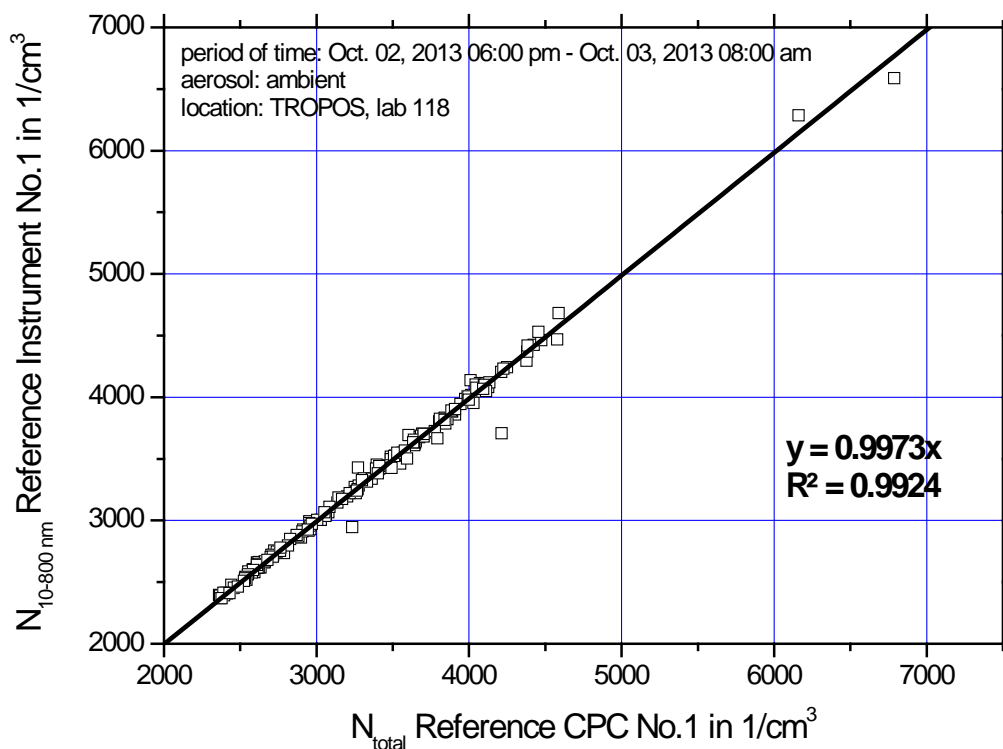


Fig.12. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No. 1. Internal diffusion losses and flow corrections are included.

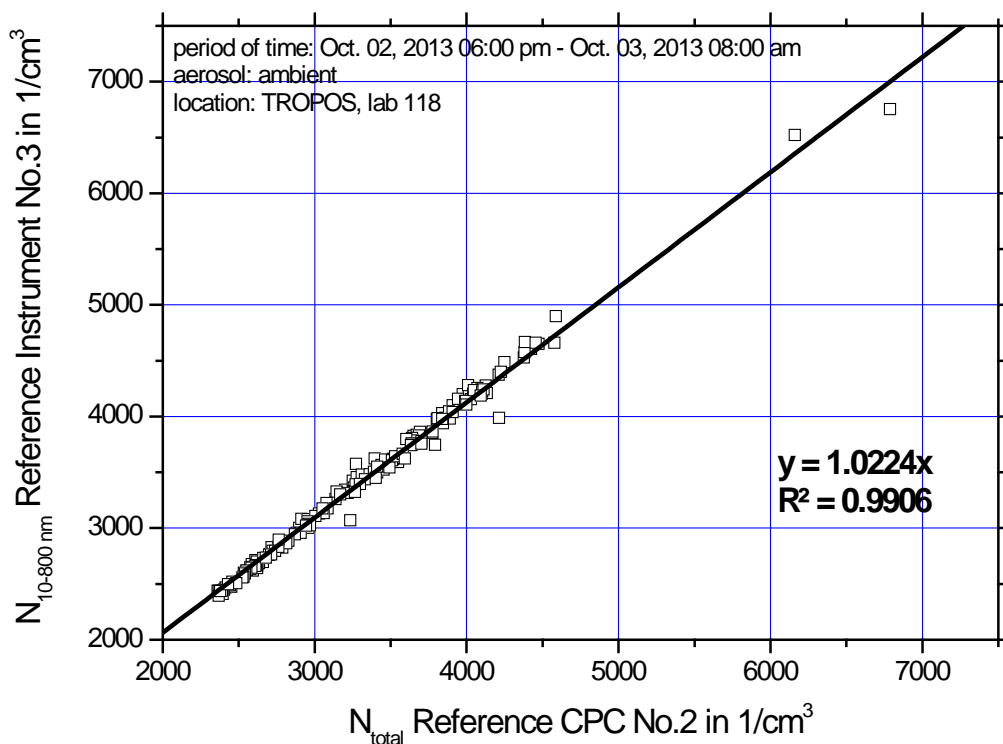


Fig.13. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusion losses and flow corrections are included.

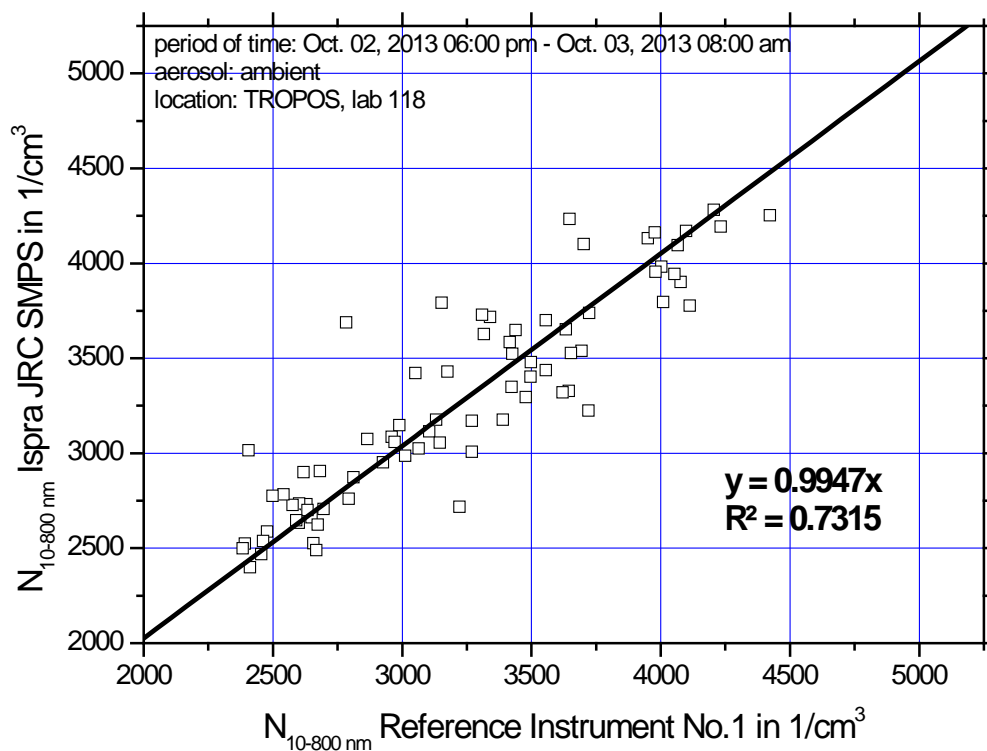


Fig.14. Linear regression between the number concentrations of the TROPOS reference instrument No.1 and Ispra JRC SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

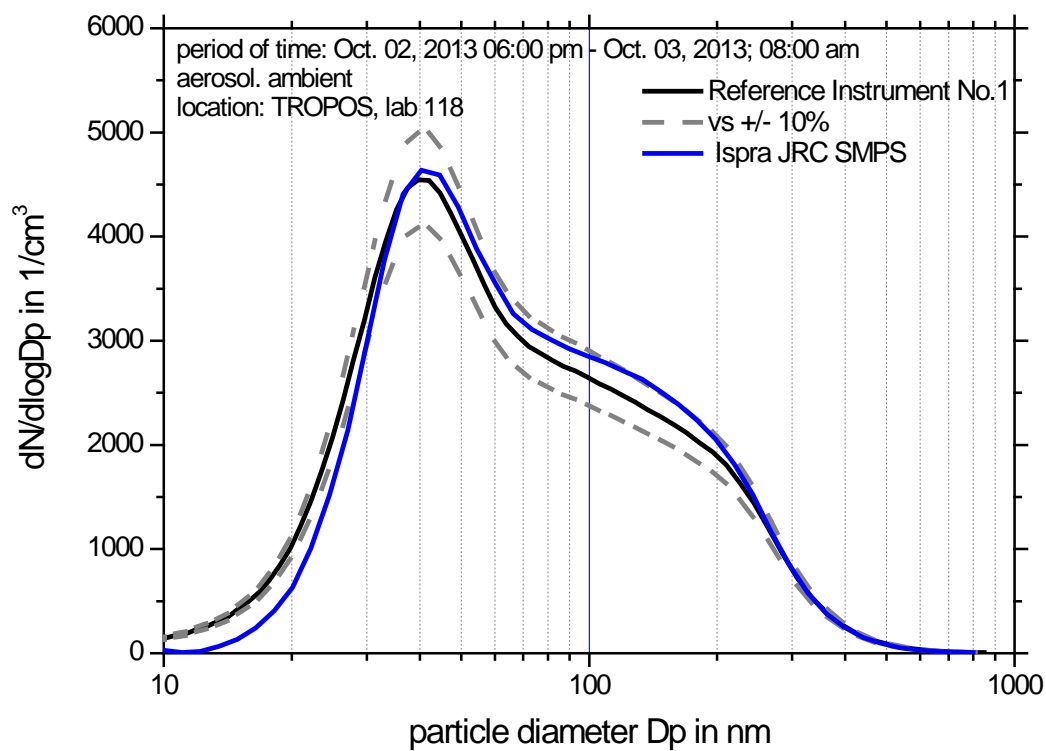


Fig.15. Comparison of mean particle number size distributions (Oct. 02, 2013 06:00 pm - Oct. 03, 2013 08:00 am). Internal diffusion losses and CPC efficiency are included.

Intercomparison of K-Putsta UHEL DMPS

Basic information

Location of the quality assurance:	TROPOS, lab. 118
Delivery date:	Sep. 30, 2013
Setup in the laboratory:	Sep. 30, 2013
Comparison period:	Sep. 30, 2013 – Oct. 03, 2013
Instrument:	K-Putsta UHEL DMPS
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	Pasi Aalto (pasi.p.aalto@helsinki.fi)

Summary:

From Sep. 30, 2013 to Oct. 03, 2013 the K-Putsta UHEL DMPS participated successfully the TROPOS ACTRIS Workshop. The workshop consisted of an incoming test and a final run. In addition to the ambient measurements overnight we had numerous high voltage checks, zero- and PSL- measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that we show for each run the time series, correlation plots and size distribution. Information from the log book were also added in the report. As a standard we used a total CPC 3772 and a TROPOS reference instrument which is calibrated against a TSI electrometer 3068 B with the serial number 70838596.

For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. The K-Putsta UHEL DMPS showed in the PSL-measurements a particle diameter of 196.98 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. If we look at the final ambient measurement run, the K-Putsta UHEL DMPS is within the uncertainty range of +/- 10 %. The K-Putsta UHEL DMPS passed the ACTRIS Workshop. There is no re-examination required.

Log book:

Sep. 30, 2013

13:35-15:10 -> zero check
15:22-15:55 -> 203 PSL
16:20 -> start ambient air measurements

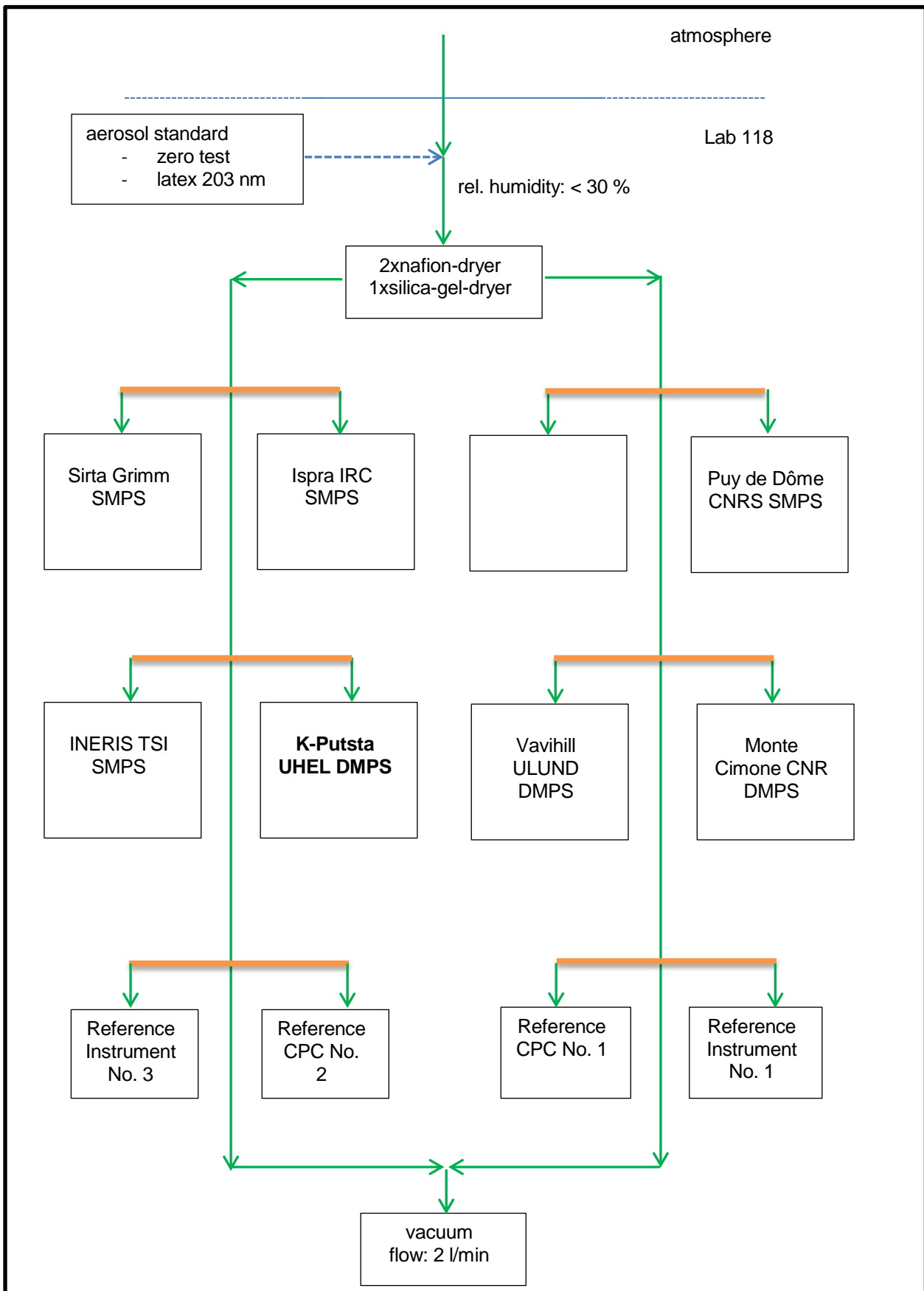
Oct. 01, 2013

09:40 -> flow check: high aerosol: 3.99 l/min -> 4.00 l/min
-> HV check: 10 was 10.8, 100 and 500 ok
-> zero check with V = 0 is ok
10:45 -> start ambient air measurements
16:57 -> start zero check
17:30 -> start PSI measurements
17:50 -> start ambient air measurements

Oct. 03, 2013

14:04 -> stop DMPS

Laboratory setup



Latex 203 nm

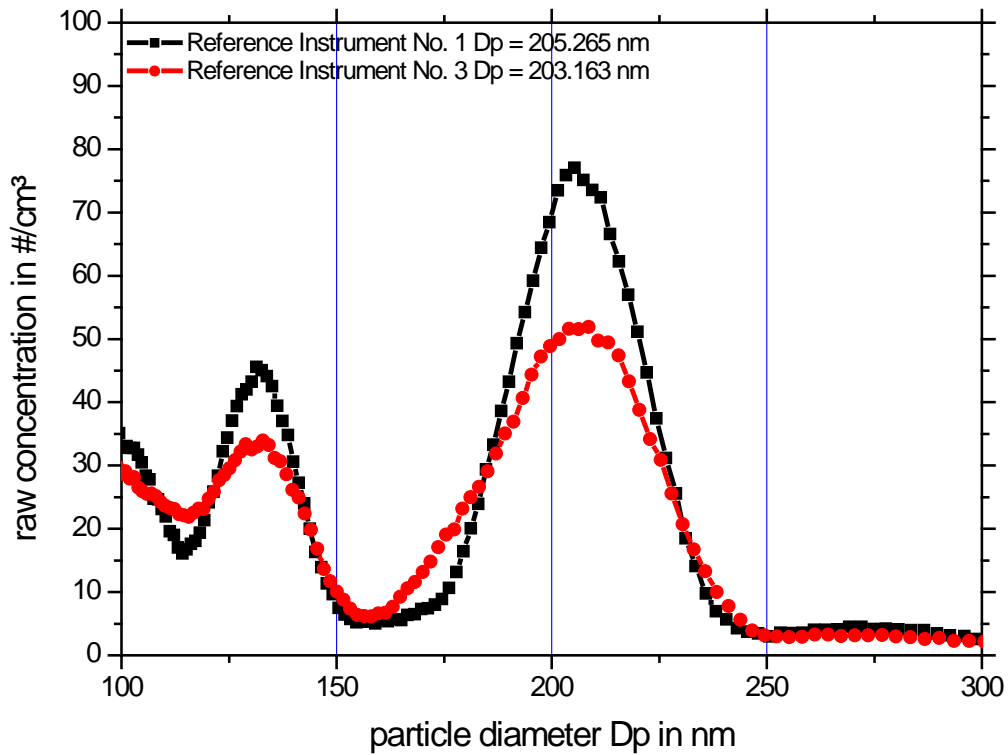


Fig.1. Measurement of latex 203 nm for reference instruments: Particle size distribution (raw concentration) for latex 203 nm on Sep. 30, 2013 between 15:19 and 15:28 (UTC time).

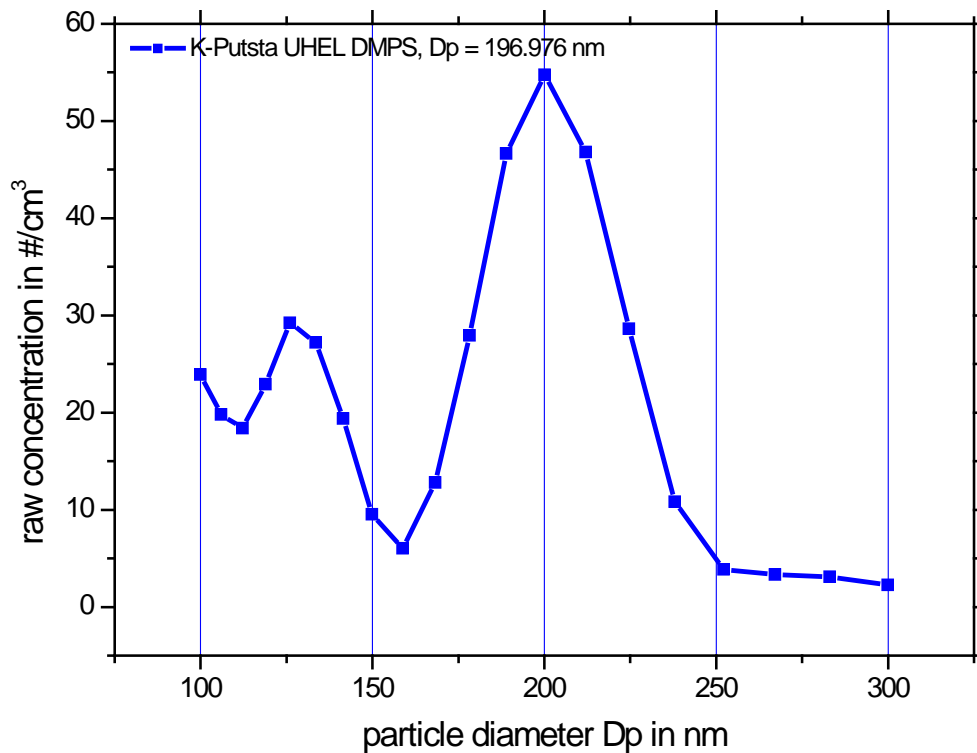


Fig.2. Measurement of latex 203 nm for K-Putsta UHEL DMPS: Particle size distribution (raw concentration) for latex 203 nm on Sep. 30, 2013 between 15:22 and 15:55 (UTC time).

CPC efficiency

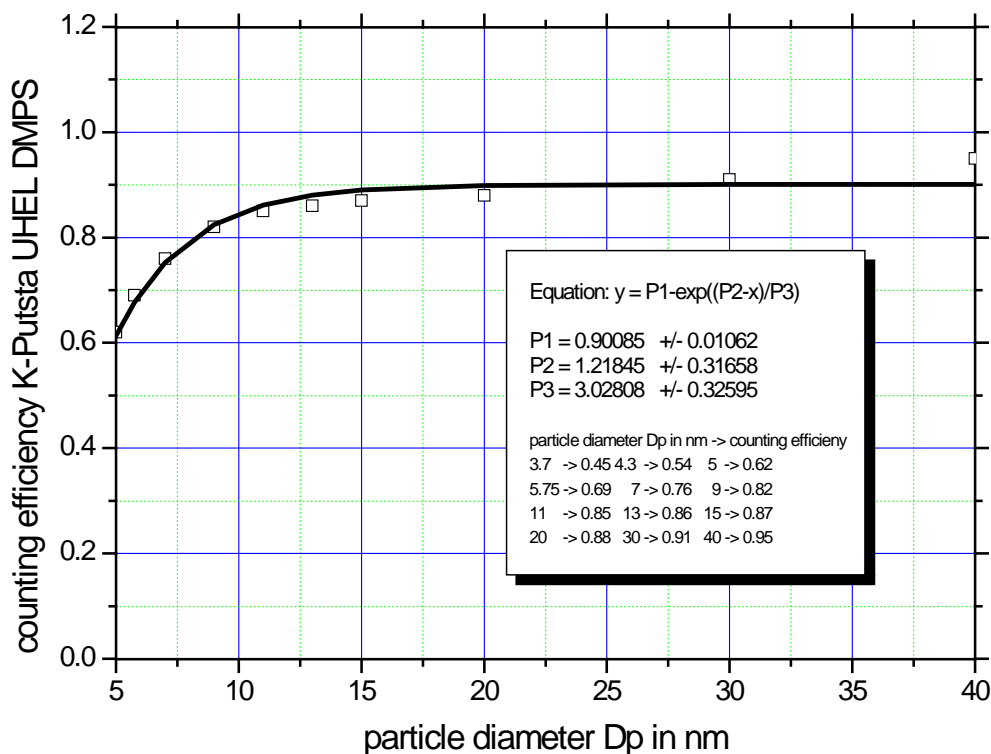


Fig.3. CPC efficiency curve. Based on TSI Electrometer 3068B. Serial number: 70838596.

A: First run

1. Time series

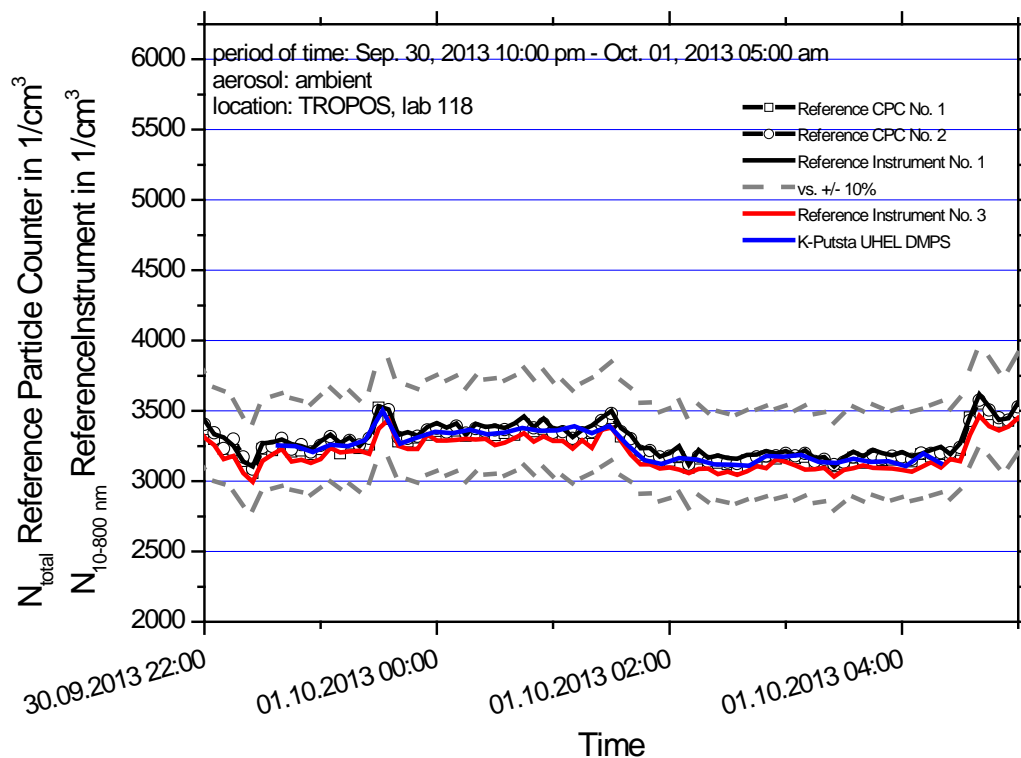


Fig.4. Time series (Sep. 30, 2013 10:00 pm – Oct. 01, 2013 05:00 am) of the integrated Particle Number Concentration ($N_{10-800\text{ nm}}$). Flow corrections were included.

2. Correlation

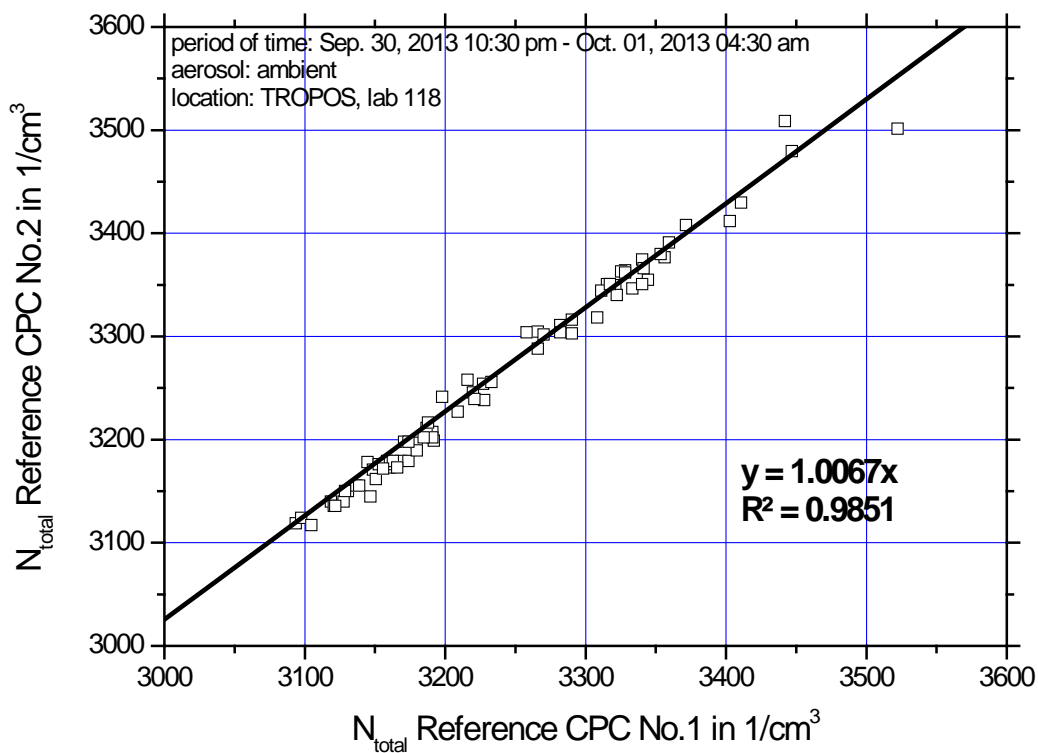


Fig.5. Linear regression between two Reference TROPOS CPCs (Model 3772). Flow corrections were included.

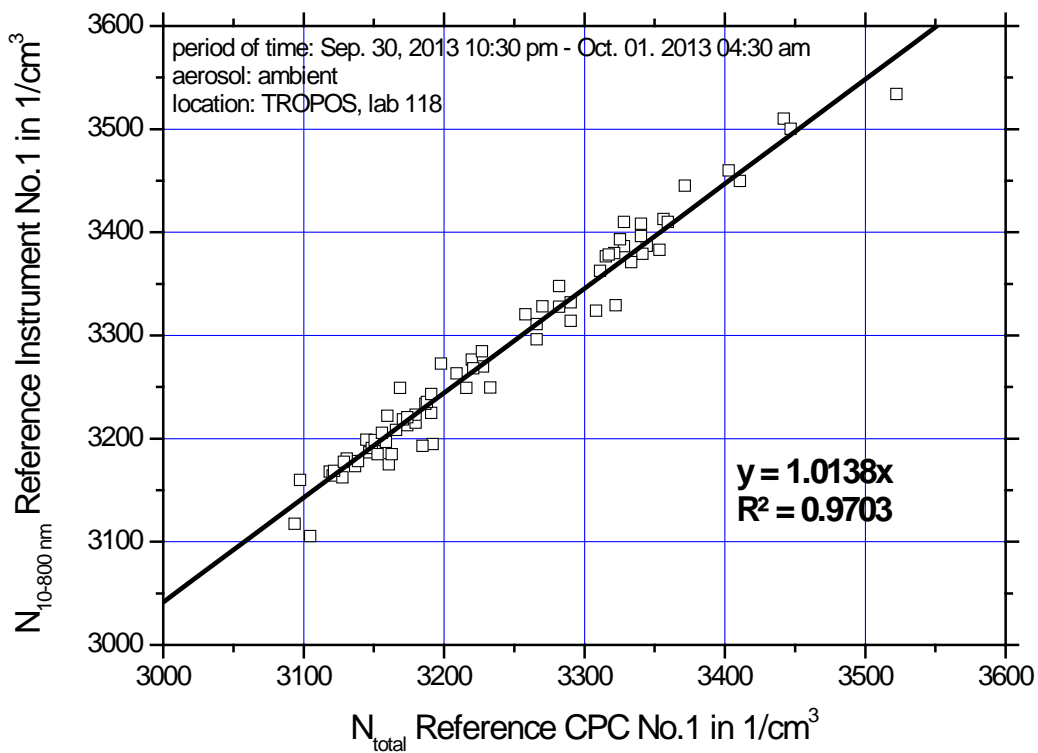


Fig.6. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No. 1. Internal diffusion losses and flow corrections are included.

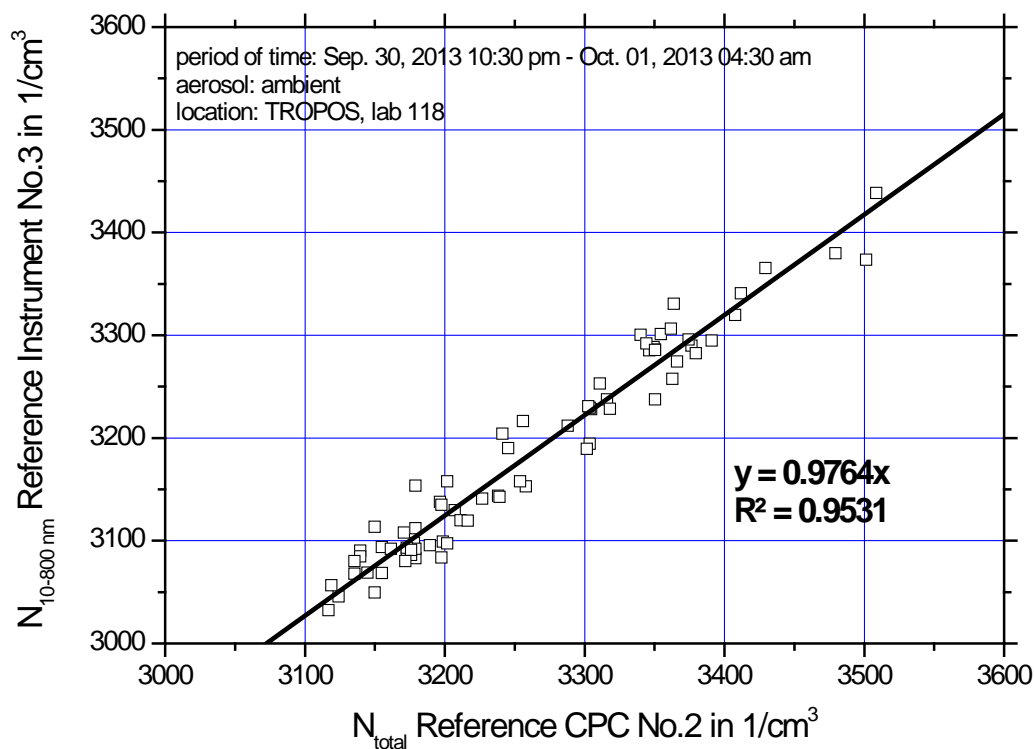


Fig.7. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusion losses and flow corrections are included.

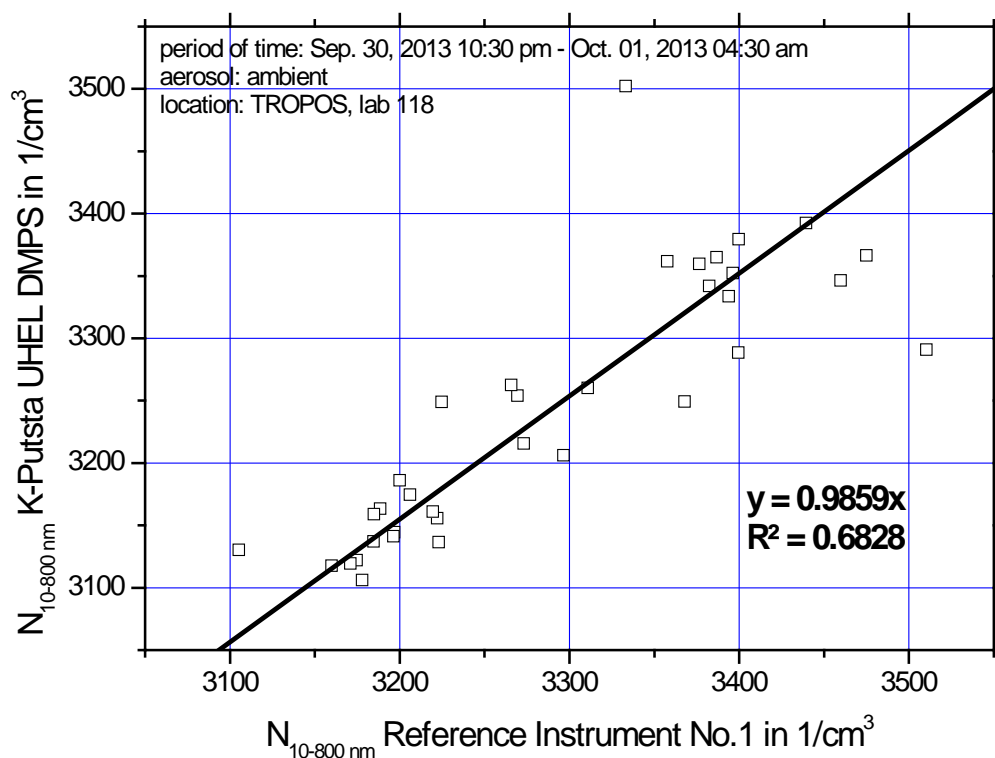


Fig.8. Linear regression between the number concentrations of the TROPOS reference instrument No. 1 and K-Putsta UHEL DMPS. Internal diffusion loss and flow corrections are included.

3. Size distribution

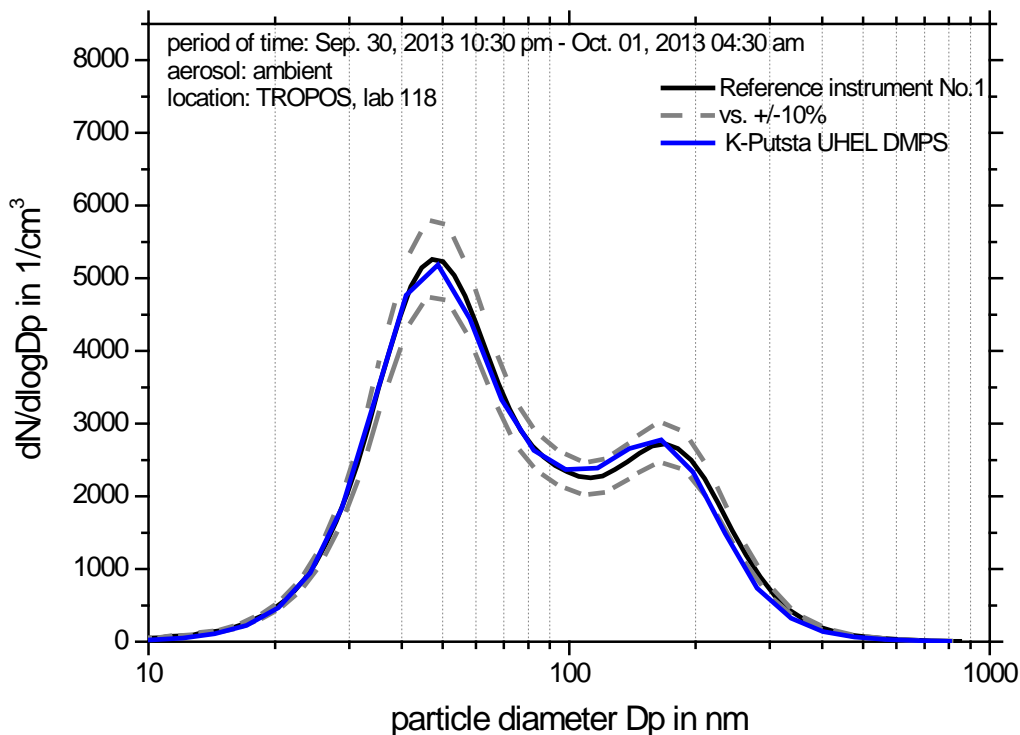


Fig.9. Comparison of mean particle number size distributions between Sep. 30, 2013 10:30 pm and Oct. 01, 2013 04:30 am. Internal diffusion losses and CPC efficiency are included.

B: Final run

1. Time series

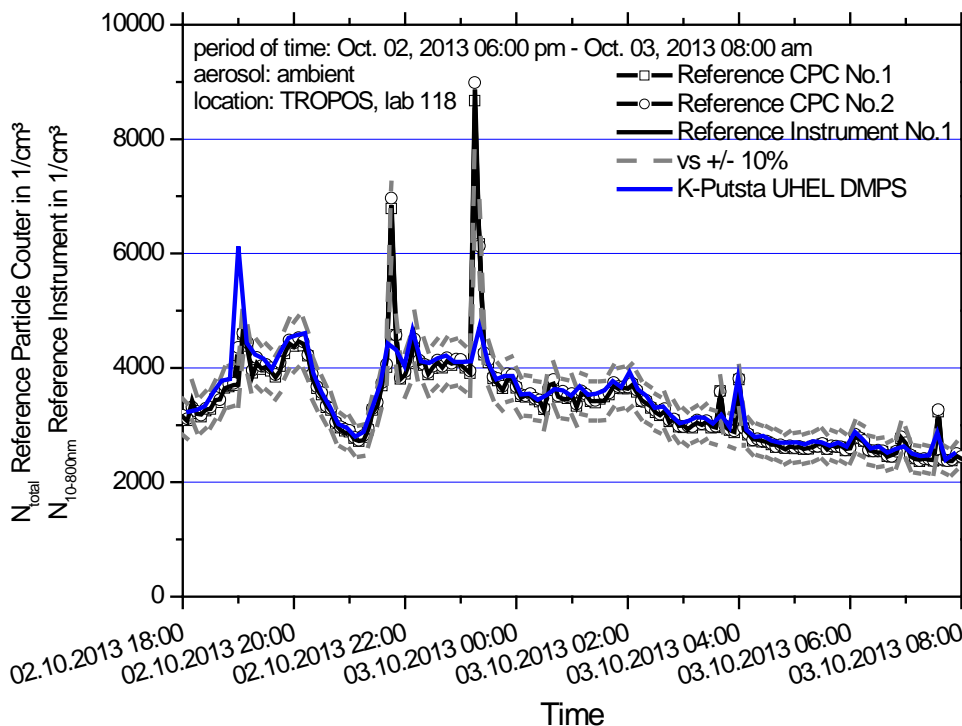


Fig.10. Time series (Oct. 02, 2013 06:00 pm – Oct. 03, 2013 08:00 am) of the integrated Particle Number Concentration ($N_{10-800\text{nm}}$). Flow corrections are included.

2. Correlation

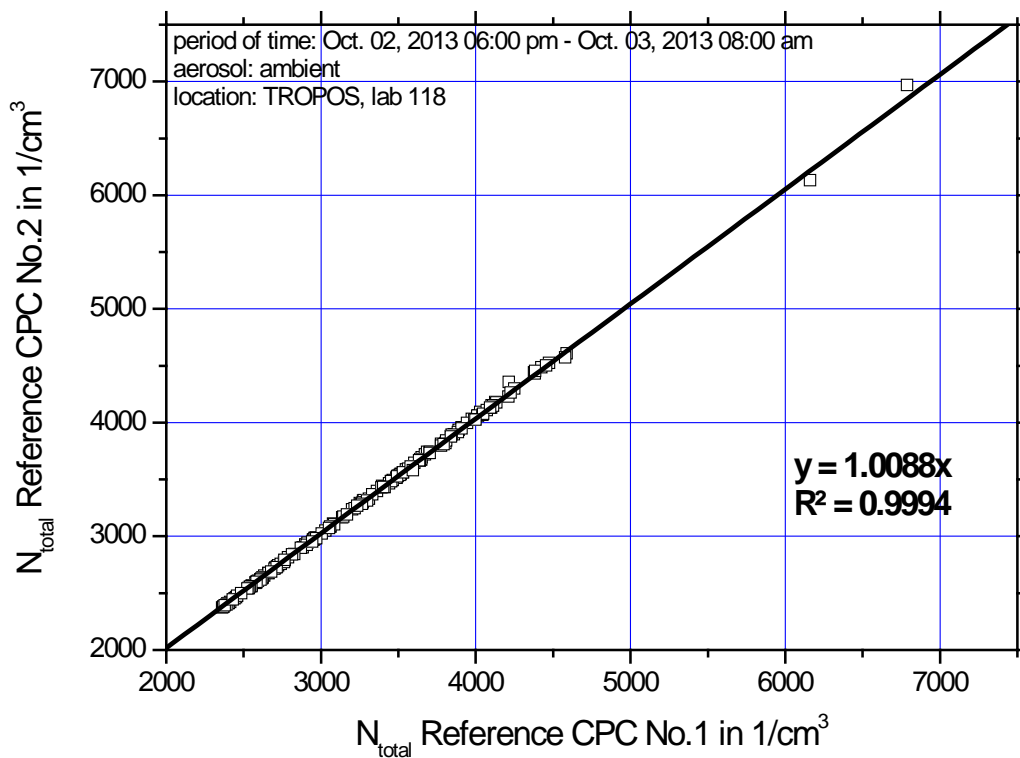


Fig.11. Linear regression between two Tropos' reference CPCs (Model 3772). Flow corrections are included.

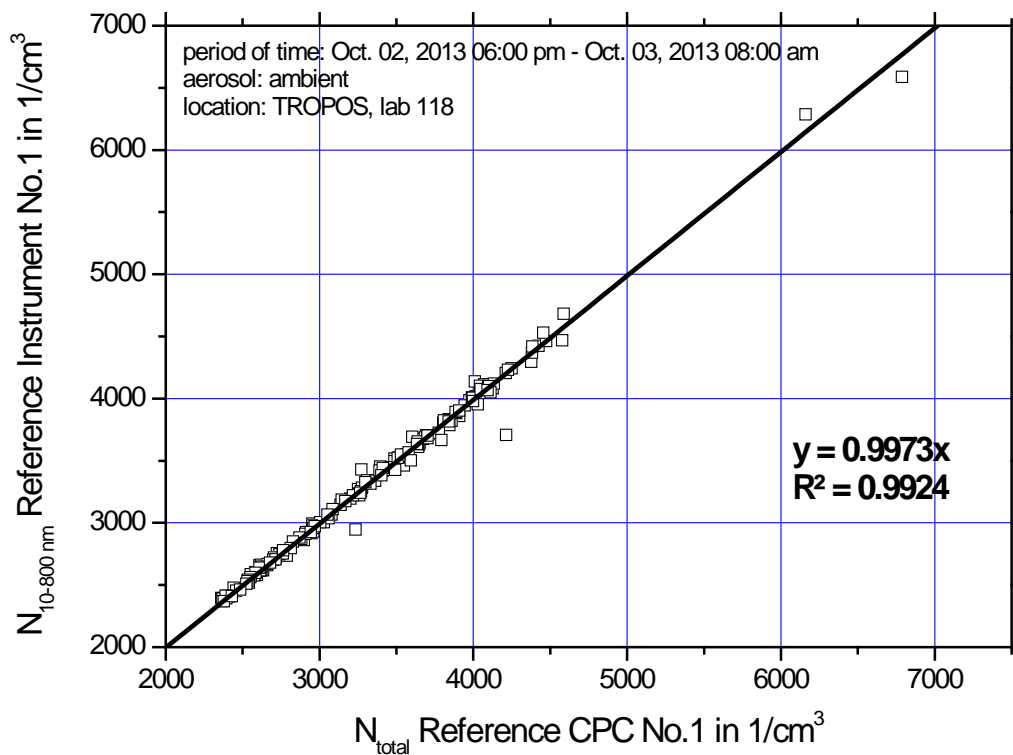


Fig.12. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No. 1. Internal diffusion losses and flow corrections are included.

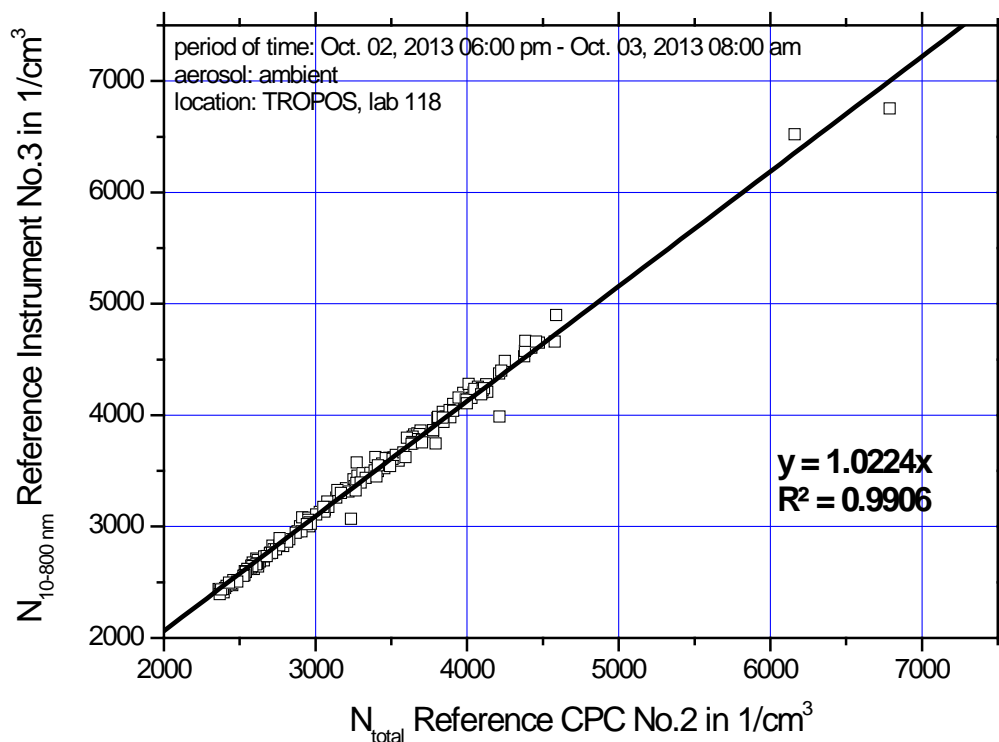


Fig.13. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusion losses and flow corrections are included.

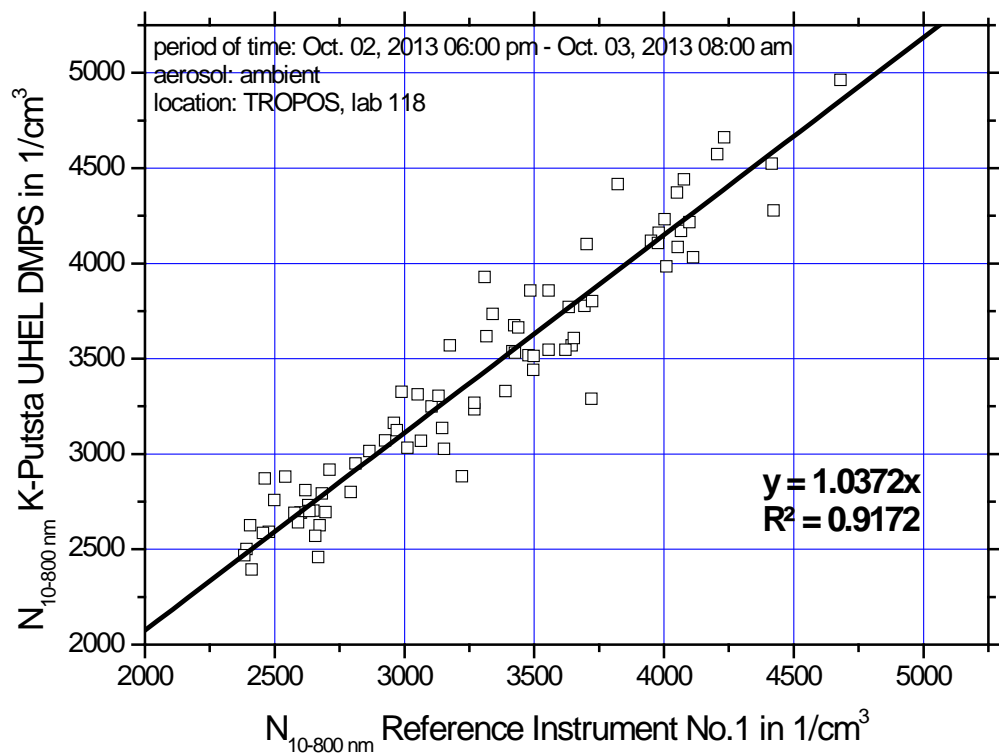


Fig.14. Linear regression between the number concentrations of Reference instrument No.1 and K-Putsta UHEL DMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

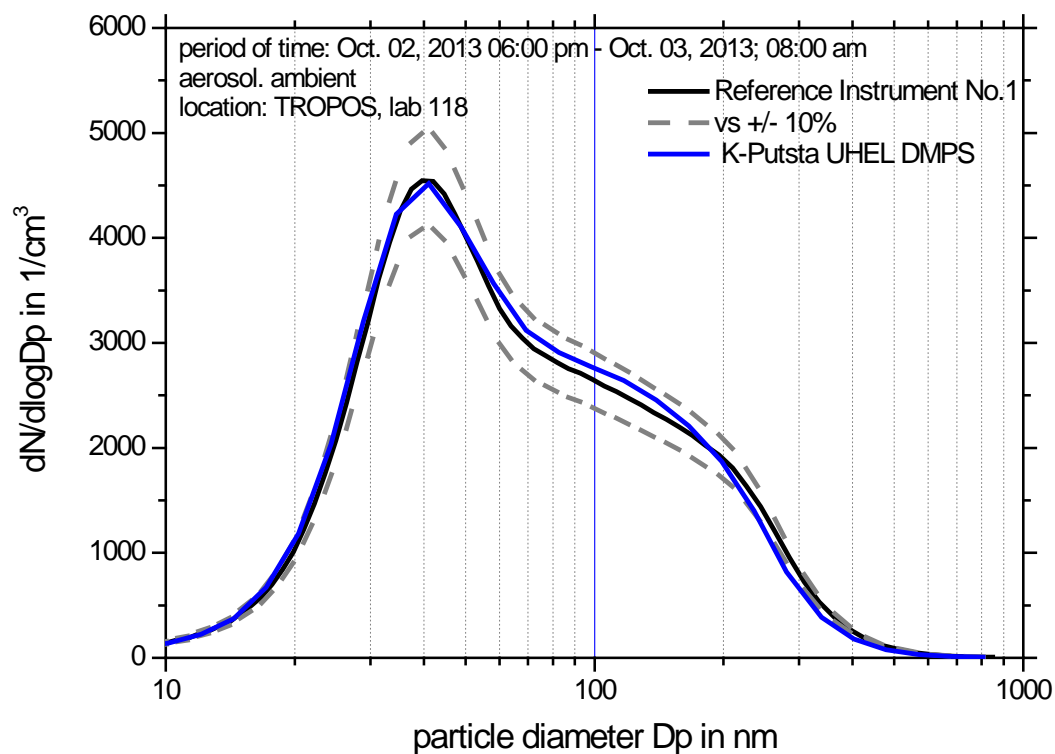


Fig.15. Comparison of mean particle number size distributions (Oct. 02, 2013 06:00 pm – Oct. 03, 2013 08:00 am). Internal diffusional losses and CPC efficiency were included.

Intercomparison of Monte Cimone CNR DMPS

Basic information

Location of the quality assurance:	TROPOS, lab. 118
Delivery date:	Sep. 30, 2013
Setup in the laboratory:	Sep. 30, 2013
Comparison period:	Sep. 30, 2013 – Oct. 03, 2013
Instrument:	Monte Cimone CNR DMPS
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	Angela Marinoni (A.Marinoni@isac.cnr.it)

Summary:

From Sep. 30, 2013 to Oct. 03, 2013 the Monte Cimone CNR DMPS participated the TROPOS ACTRIS Workshop. The workshop consisted of an entrance test and a final run. In addition to the overnight ambient measurements, we had numerous high voltage checks, zero- and PSL-measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that, we show for each run the time series of the particle number concentration, the particle number size distribution, and correlation plots. If anything was written in the log book, so we added this also in this report. As reference standards, we used CPCs model TSI 3772 for total particle number concentration and two TROPOS mobility particle size spectrometer. The particle counters have been calibrated against a calibrated TSI electrometer 3068 B with the serial number 70838596.

The incoming status of the Monte Cimone CNR DMPS showed many problems in hard- and software. First point: the PSL measurement was out of the range. It was necessary to calibrate the sheath air. But with the original setup there was no way to control the power of the blower. Because of this we used a power controlled blower from TROPOS. It is necessary that the operators change this. For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. The Monte Cimone CNR DMPS showed in the PSL-measurements a particle diameter of 200.0 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. We had leaks in the blower, inlet system and T/RH sensor. The T/RH sensor was also not

working. For the whole runs we use the TROPOS source Kr. 85 and the DMPS-program from Pasi Aalto. The evaluation is done by the TROPOS inversion algorithm.

If we look at the final ambient measurement the Monte Cimone CNR DMPS is within the uncertainty range of +/- 10 %. The DMPS Monte Cimone did not pass the ACTRIS Workshop. It is necessary to check the system again!

Log book:

Sep. 30, 2013

- 11:50 -> set up system; CPC flow: 0.989 l/min; aerosol flow: 0.996 l/min; sheath flow: 5.001 l/min
- 13:30 -> zero measurements show there is a leak
- 13:36 -> one run with 0 V (turn off HV) in DMA, run ok
- 13:47 -> filter in front of CPC is ok
- 13:55 -> zero air without Ni-36 source and RH-T sensor
- 14:35 -> zero air with Ni-36 and without RH-T sensor in aerosol flow
- 15:08 -> latex measurement

Oct. 01, 2013

- perform test for detecting leaks in sheath flow, CPC connected with whole circuit with $\approx 60 \text{ cc}^{-1}$; only blower with $\approx 100 \text{ cc}^{-1}$
- TRH rotronic repaired with 2-comp-glyce; tested with filter and CPC 0-0.01 p/cc
- ΔP on the inlet is tested with CPC: 0.00 p/cc
- DMA inlet and outlet are closed; put filter on the sheath inlet and CPC on the sheath outlet;
~ 0 p/cc
- blower us replaced, new blower is tested for leaks and shown to be ok
- external power regulator
- sheath flow measured by gilibrator with 5.0 l/min, TSI reads 4.8 l/min
- system reset
- aerosol flow is 1.07 l/min
- last sheath flow is 4.36 l/min as read by TSI
- 11:00 -> test with different voltages to blower with 200 nm PSL, correct flow read
on TSI flowmeter is 4.36 l/min
- 16:04 -> total filter in front of DMPS; test with P. Aalto's program LabView
2012,
without inversion of data
 - test with ambient aerosol ok
- 12:27 -> test with PSL ok, final sheath flow is 4.54 l/min
- 17:57 -> zero air measurement
- 18:50 -> ambient aerosol

Oct. 02, 2013

- 12:23 -> PSL 203 nm
- 12:49 -> PSL with program from P. Aalto (UPAC)
- 14:55 -> connect KR source and use P. Aalto's program along with TROPOS

Inversion

18:07 -> zero test with Kr source and P. Aalto's program
18:10 -> second scan (zero)
18:16 -> ambient aerosol measurement with Kr. 85 source and P. Aalto's
program

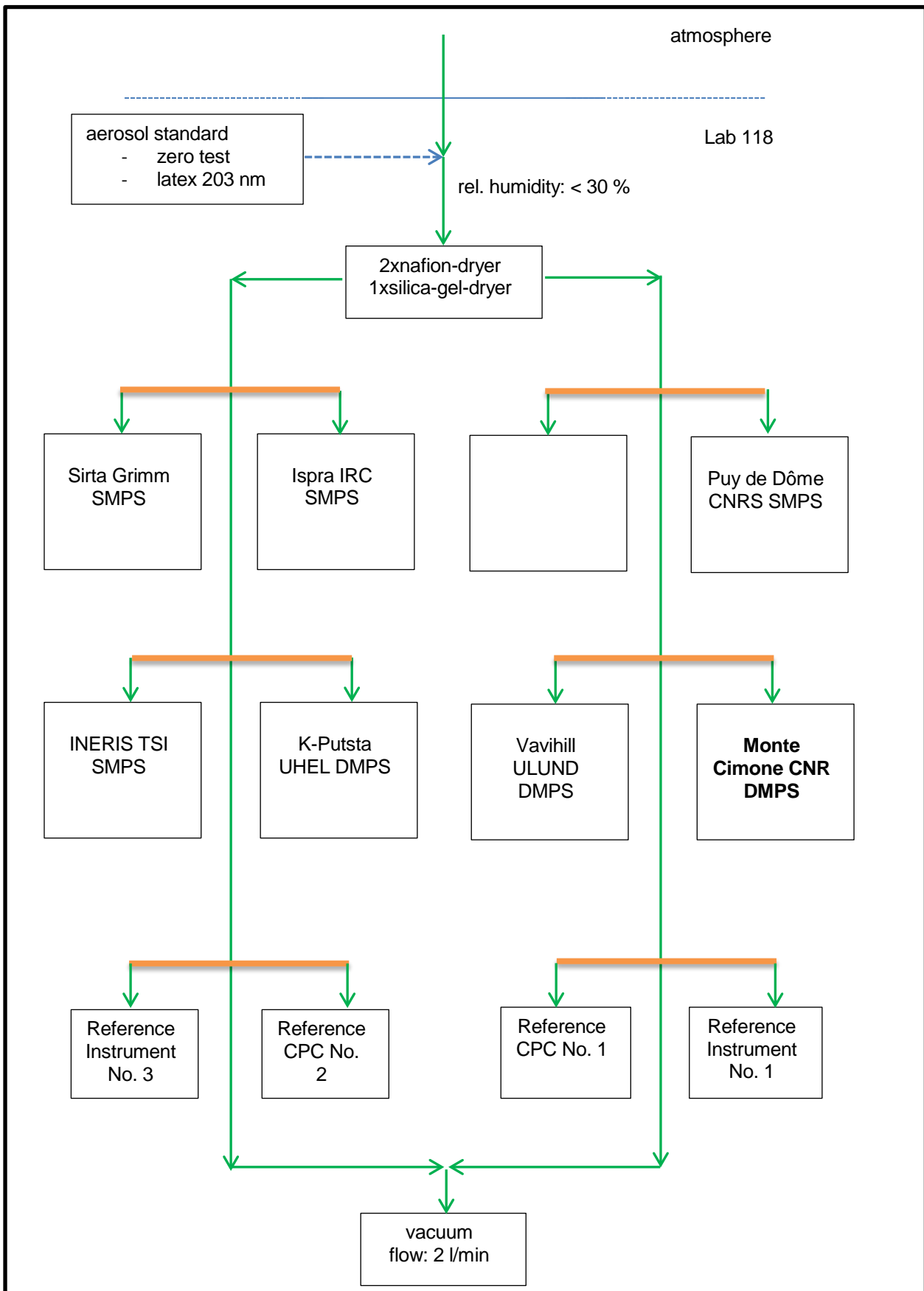
Oct. 03, 2013

12:48 -> scan ambient with CPC 3772 using TROPOS source and P. Aalto's
program

Oct. 04, 2013

10:08 -> end ambient measurement

Laboratory setup



Latex 203 nm

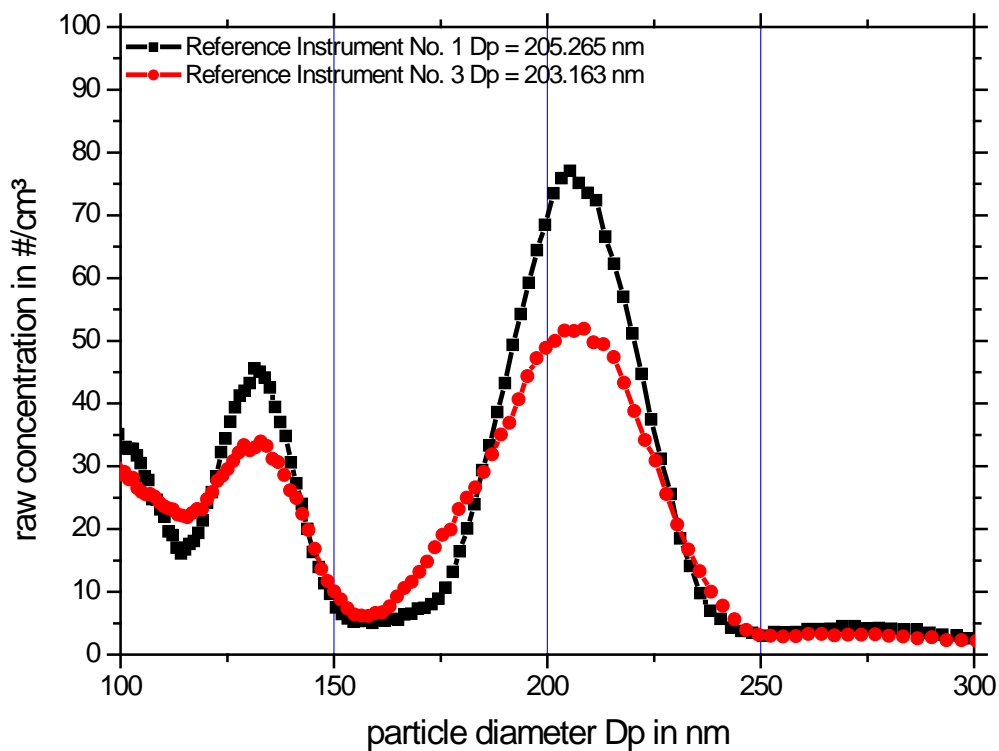


Fig.1. Measurement of latex 203 nm for reference instruments: Particle size distribution (raw concentration) for latex 203 nm on Sep. 30, 2013 between 15:19 and 15:28 (UTC time).

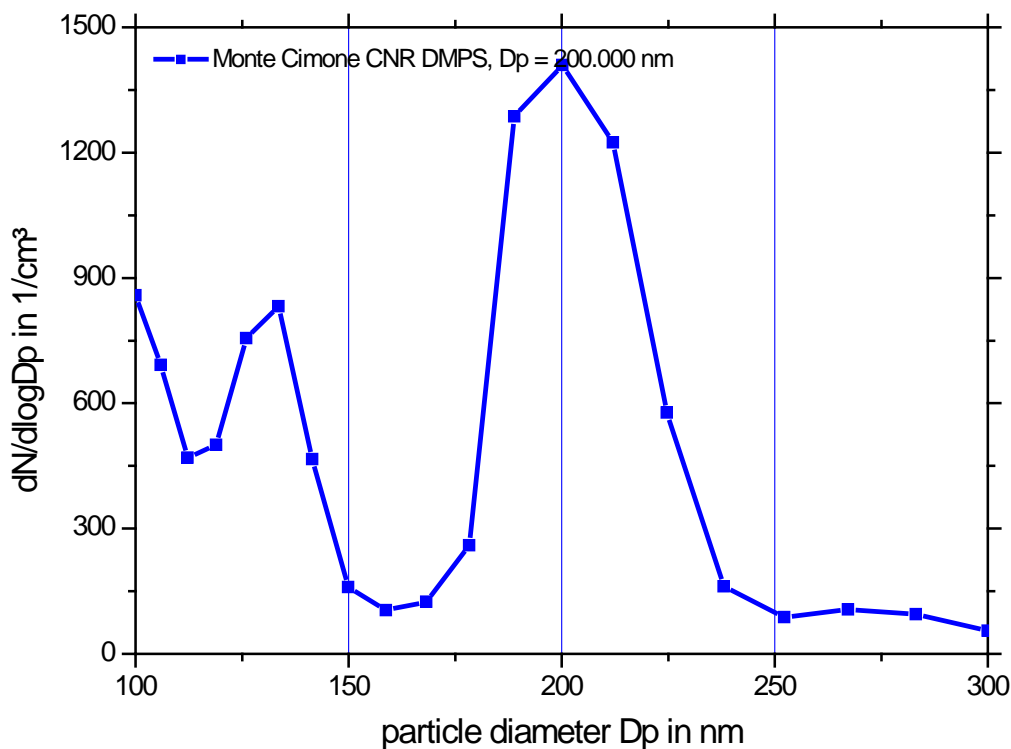


Fig.2. Measurement of latex 203 nm for Monte Cimone CNR DMPS: Particle size distribution ($dN/d\log D_p$) for latex 203 nm on Sep. 30, 2013 between 15:08 and 15:28 (UTC time).

CPC efficiency

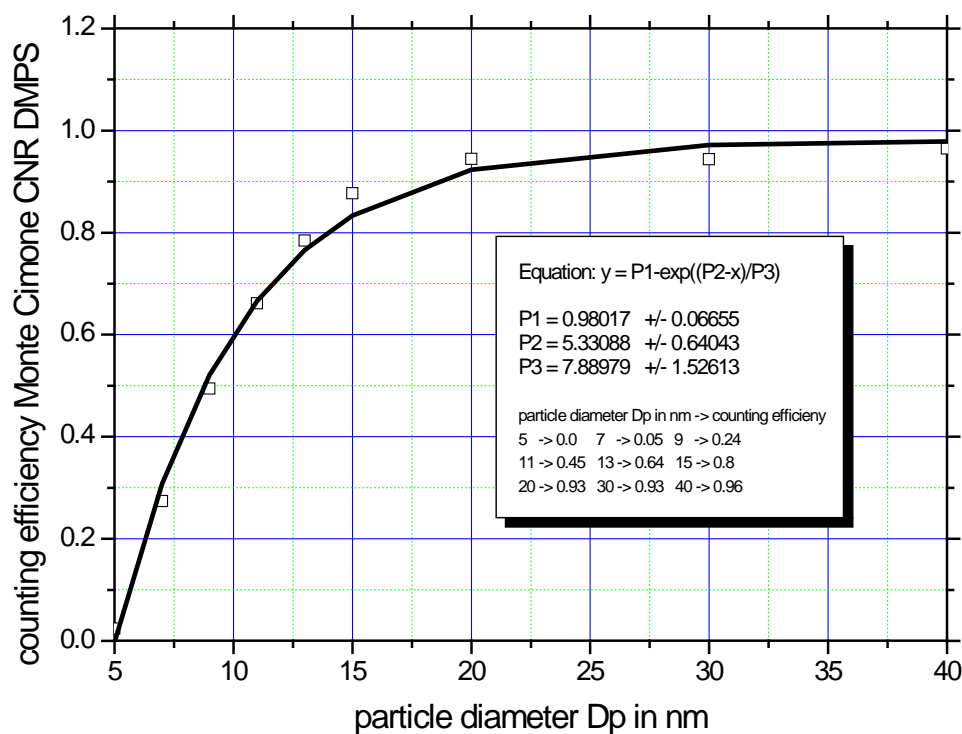


Fig.3. CPC efficiency curve. Based on TSI Electrometer 3068B. Serial number: 70838596.

A: First run

1. Time series

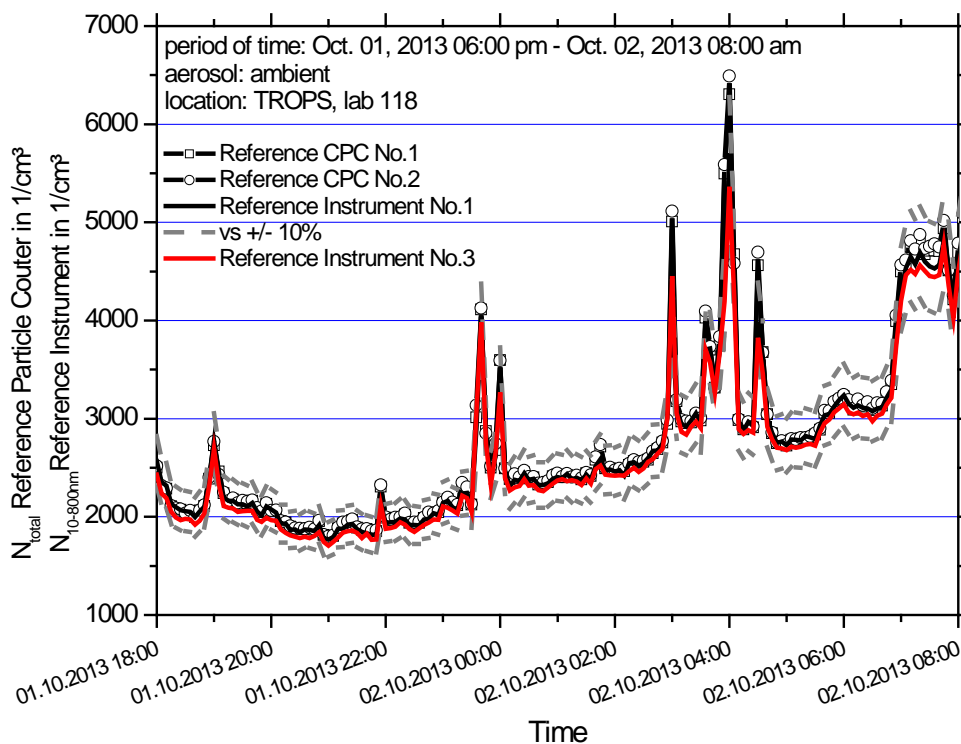


Fig.4. Time series (Oct. 01, 2013, 06:00 pm – Oct. 02, 2013 08:00 pm) of the integrated Particle Number Concentration ($N_{10-800\text{nm}}$). Flow corrections were included.

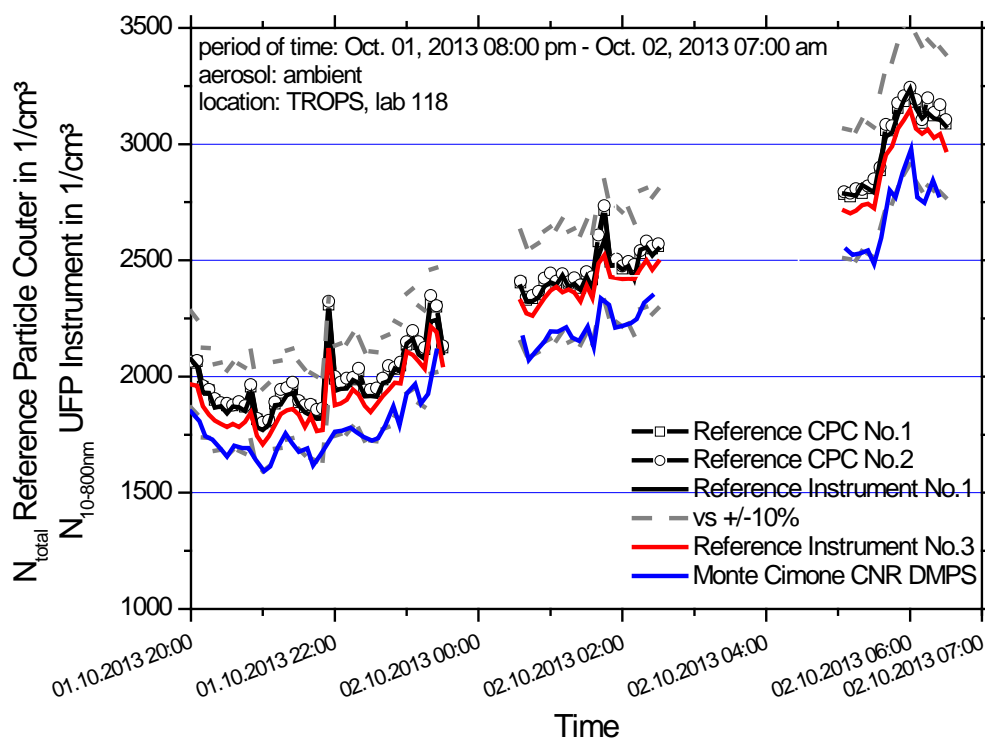


Fig.5. Time series (Oct. 01, 2013 08:00 pm – 11:30 pm and Oct. 02, 2013, 0:30 am – 2:30 am, 5:00 am – 06:30 am) of the integrated Particle Number Concentration ($N_{10-800\text{nm}}$). Flow corrections were included.

2. Correlation

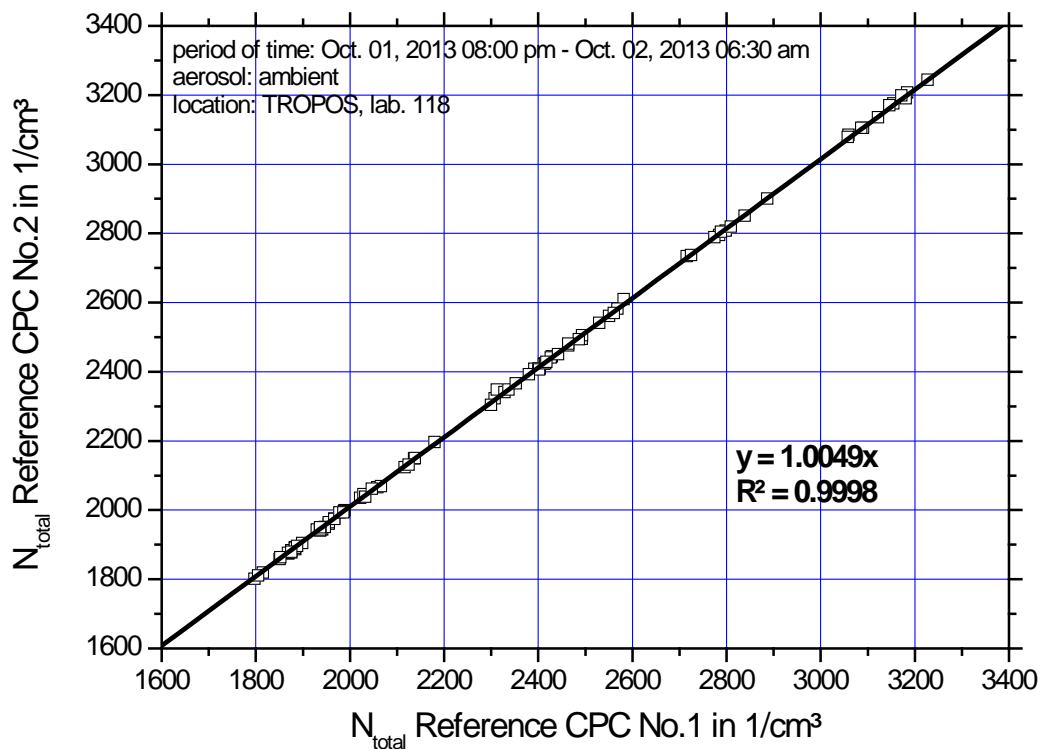


Fig.6. Linear regression between two Reference TROPOS CPCs (Model 3772). Flow corrections are included.

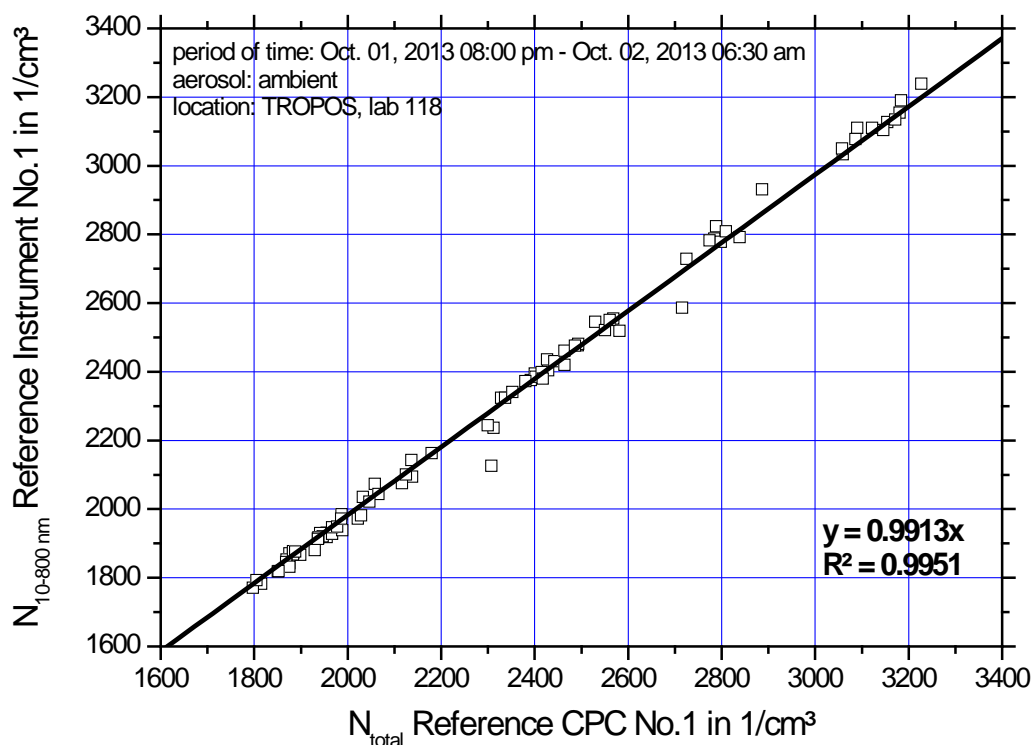


Fig.7. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No. 1. Internal diffusion losses and flow corrections are included.

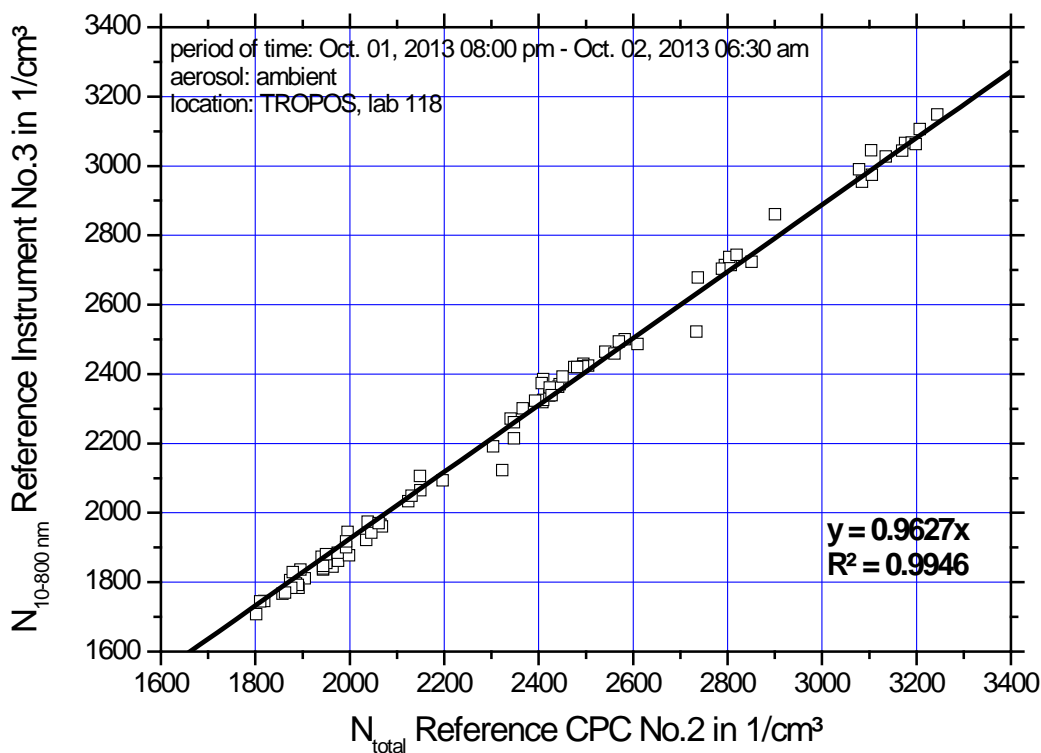


Fig.8. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusion losses and flow corrections are included.

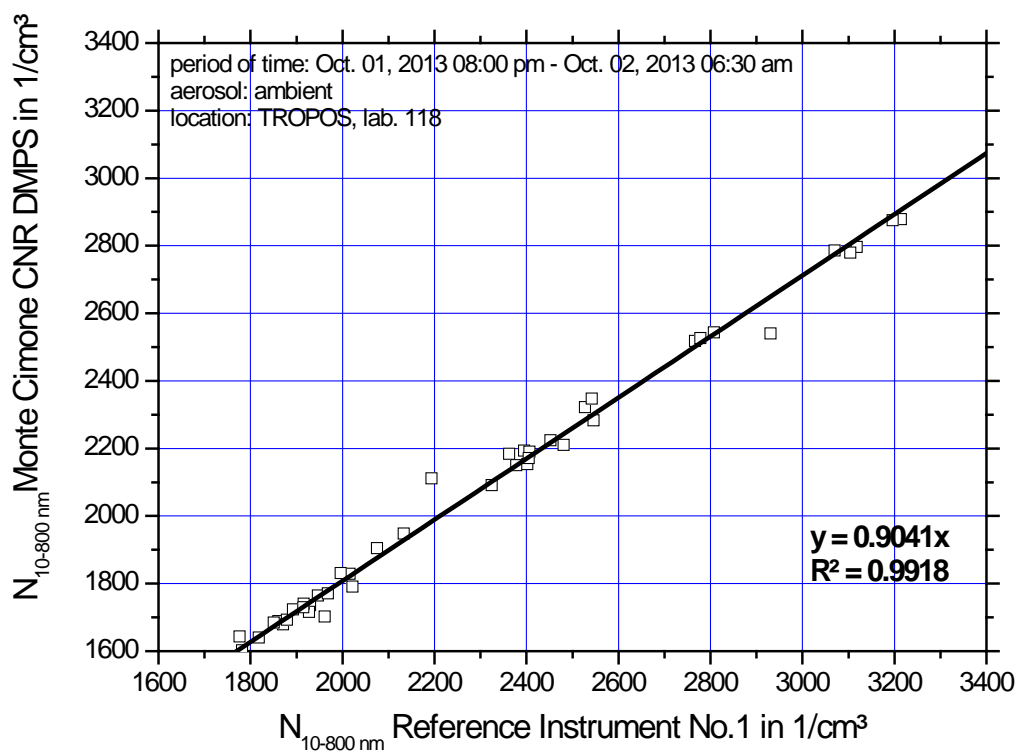


Fig.9. Linear regression between the number concentrations of Reference Instrument No. 1 and Monte Cimone CNR DMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

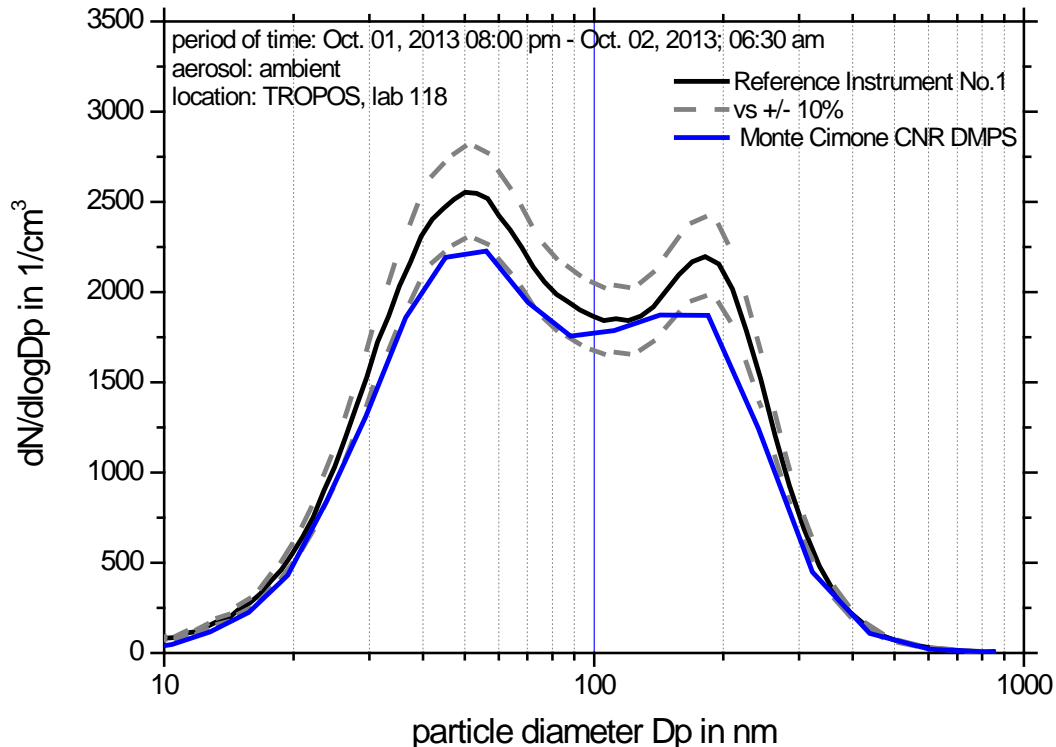


Fig.10. Comparison of mean particle number size distributions (Oct. 01, 2013 08:00 pm - 11:30 pm and Oct. 02, 2013 00:30 am – 02:30 am, 05:00 am – 06:30 am). Internal diffusion losses and CPC efficiency are included.

B:Final run

1. Time series

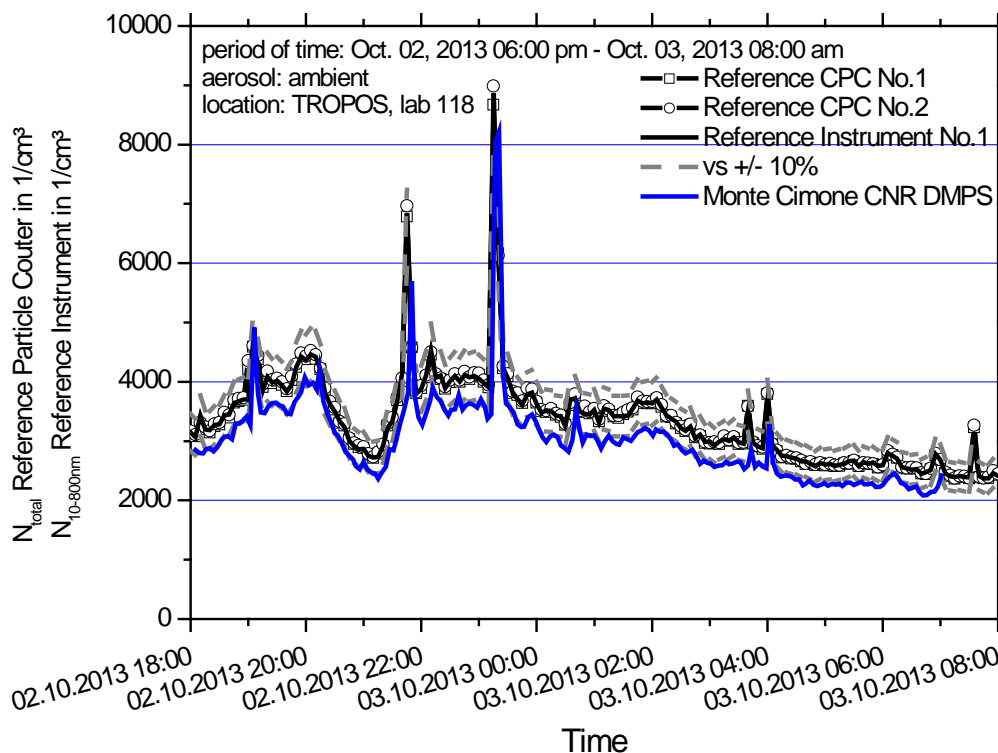


Fig.11. Time series (Oct. 02, 2013 06:00 pm – Oct. 03, 2013 08:00 am) of the integrated Particle Number Concentration ($N_{10-800\text{ nm}}$). Flow corrections were included.

2. Correlation

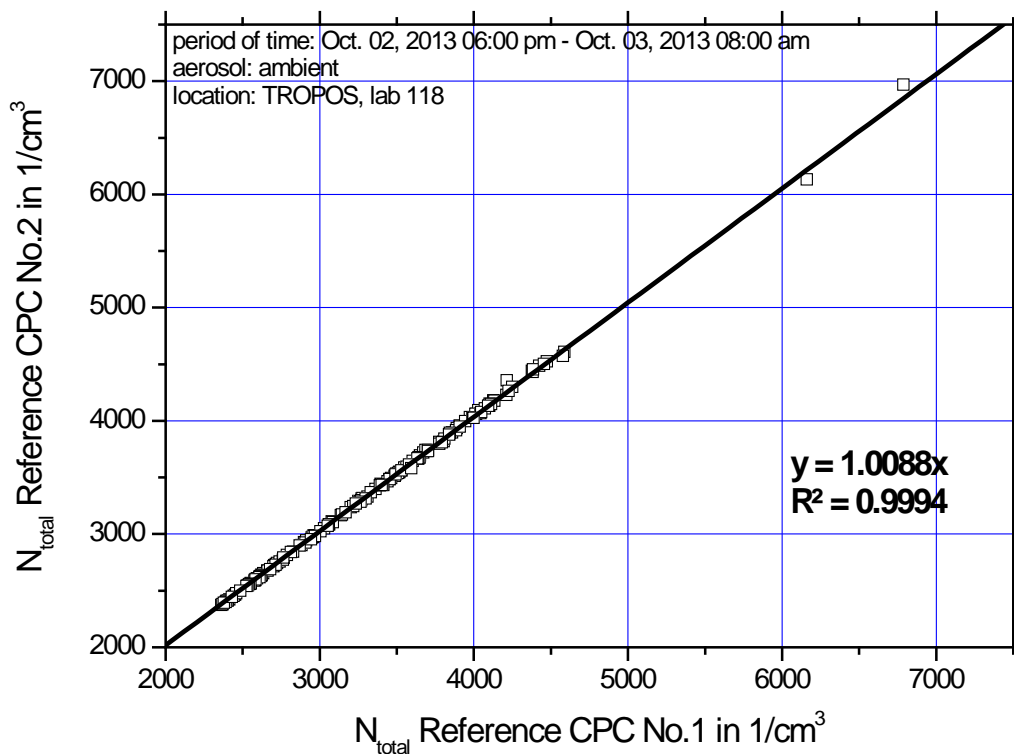


Fig.12. Linear regression between two TROPOS reference CPCs (Model 3772). Flow corrections are included.

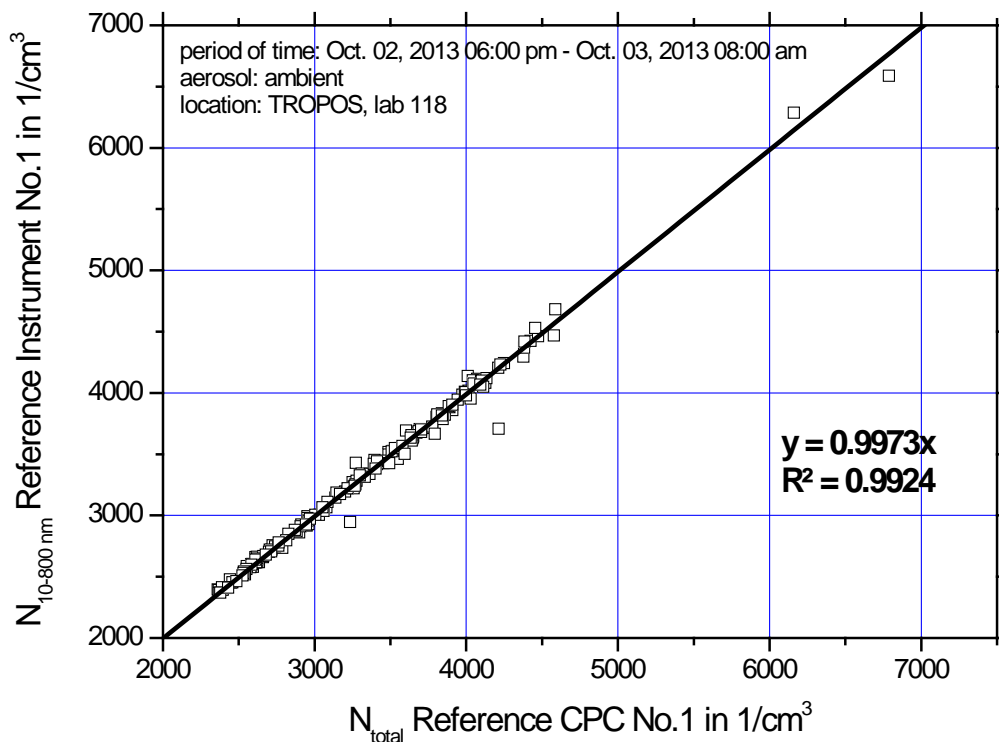


Fig.13. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No. 1. Internal diffusion losses and flow corrections are included.

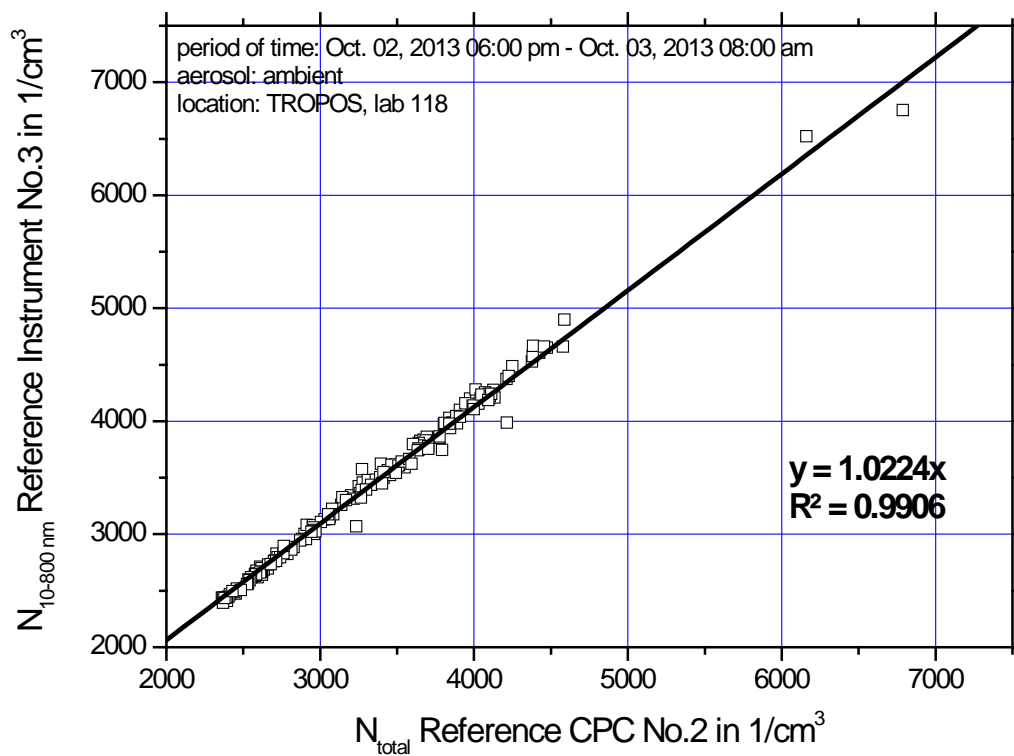


Fig.14. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusion losses and flow corrections are included.

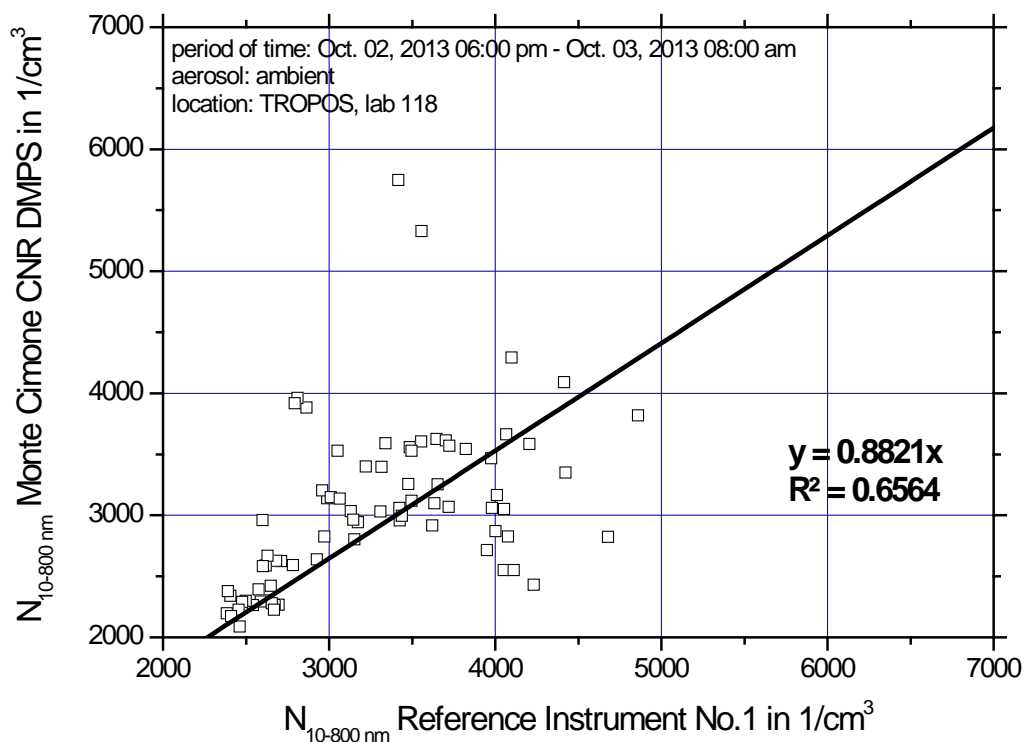


Fig.15. Linear regression between the number concentrations of Reference instrument No.1 and Monte Cimone CNR DMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

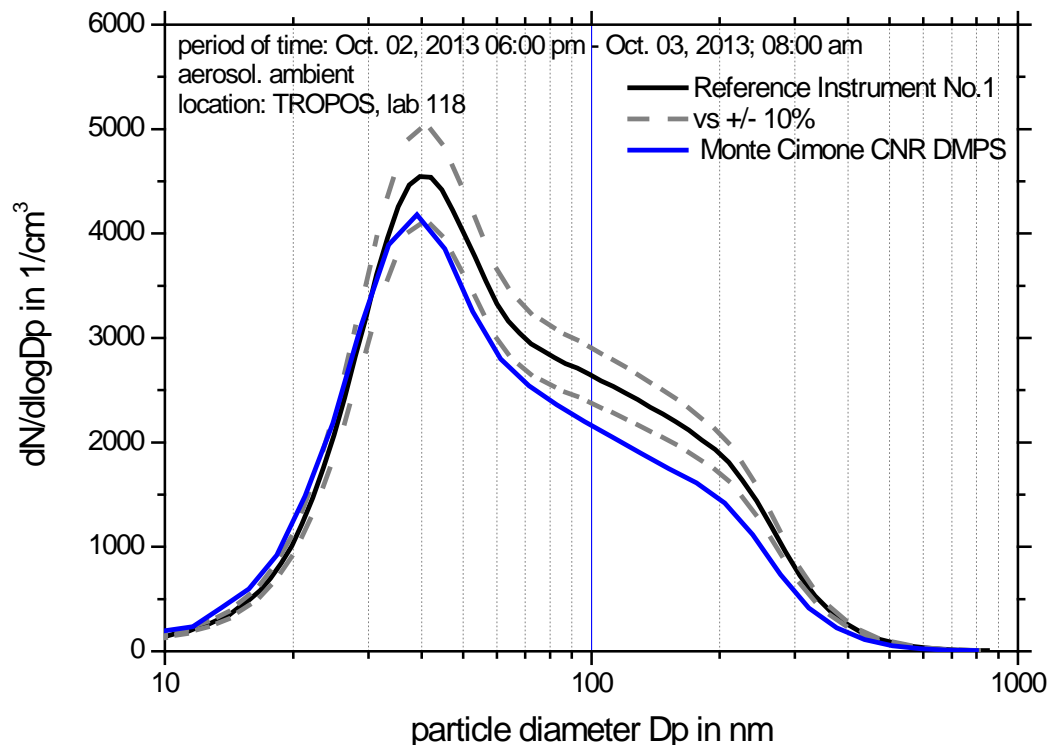


Fig.16. Comparison of mean particle number size distributions (Oct. 02, 2013 06:00 pm – Oct. 03, 2013 08:00 am). Internal diffusion losses and CPC efficiency are included.

Intercomparison of Puy de Dôme CNRS SMPS

Basic information

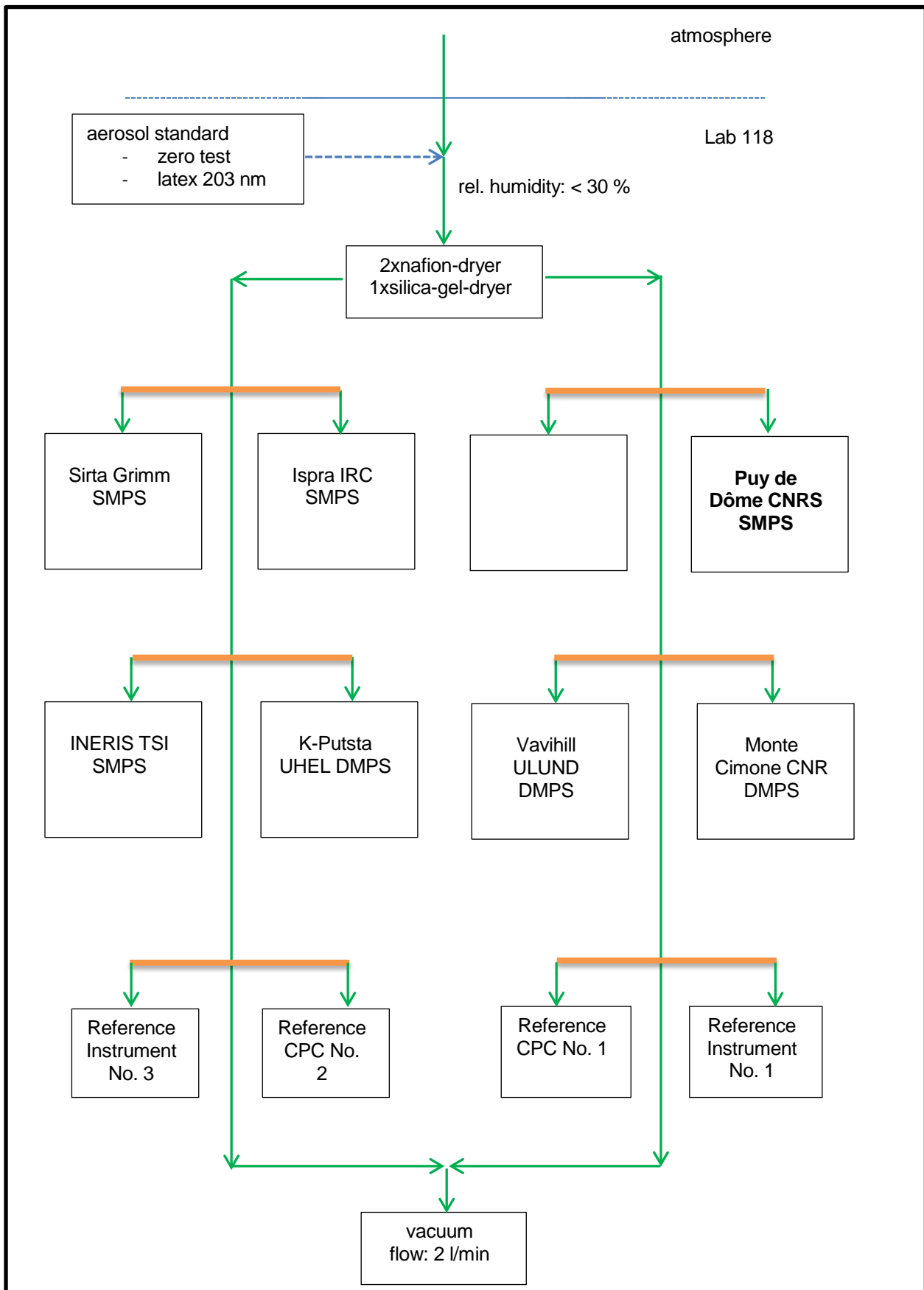
Location of the quality assurance:	TROPOS, lab. 118
Delivery date:	Sep. 30, 2013
Setup in the laboratory:	Sep. 30, 2013
Comparison period:	Sep. 30, 2013 – Oct. 03, 2013
Instrument:	Puy de Dôme CNRS SMPS
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	David Picard (d.picard@opgc.univ-bpclermont.fr)

Summary:

From Sep. 30, 2013 to Oct. 03, 2013 the Puy de Dôme CNRS DMPS participated successfully the TROPOS ACTRIS Workshop. The workshop consisted of an entrance test and a final run. In addition to the overnight ambient measurements, we had numerous high voltage checks, zero- and PSL- measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that, we show for each run the time series of the particle number concentration, the particle number size distribution, and correlation plots. If anything was written in the log book, so we added this also in this report. As reference standards, we used CPCs model TSI 3772 for total particle number concentration and two TROPOS mobility particle size spectrometer. The particle counters have been calibrated against a calibrated TSI electrometer 3068 B with the serial number 70838596

For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. The Birkenes NILU DMPS showed in the PSL-measurements a particle diameter of 205.4 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. If we look at the final ambient measurement run, the Puy de Dôme CNRS SMPS is within the uncertainty range of +/- 10 %. The Puy de Dôme CNRS SMPS passed the ACTRIS Workshop. There is no re-examination required.

Laboratory setup



Latex 203 nm

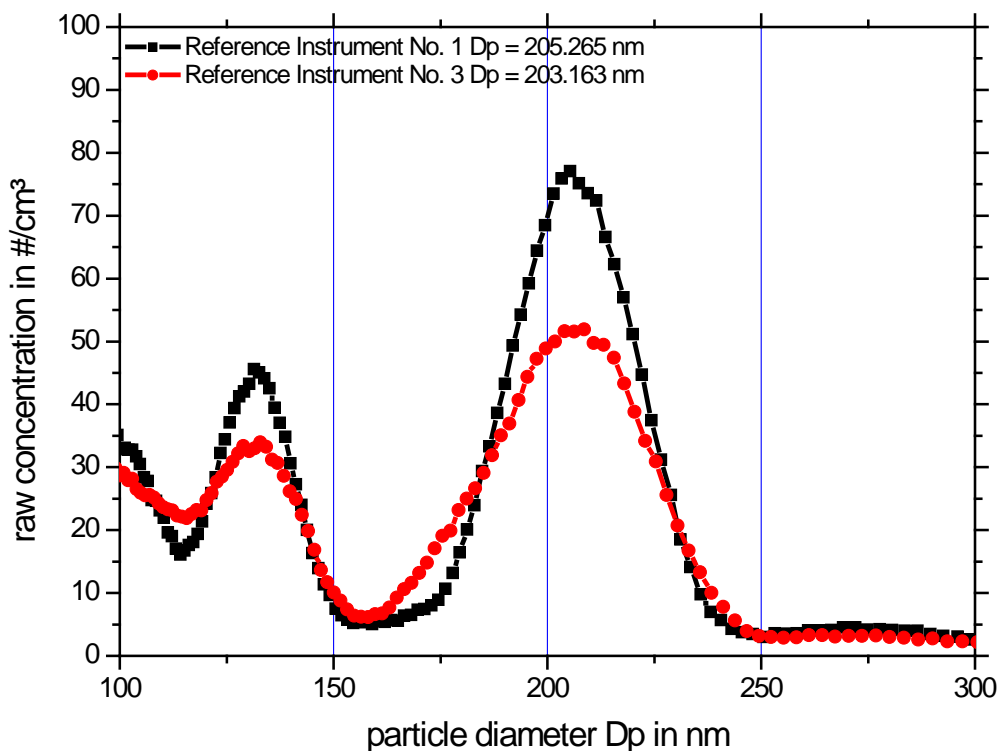


Fig.1. Measurement of latex 203 nm for reference instruments: Particle size distribution (raw concentration) for latex 203 nm on Sep. 30, 2013 between 15:19 and 15:28 (UTC time).

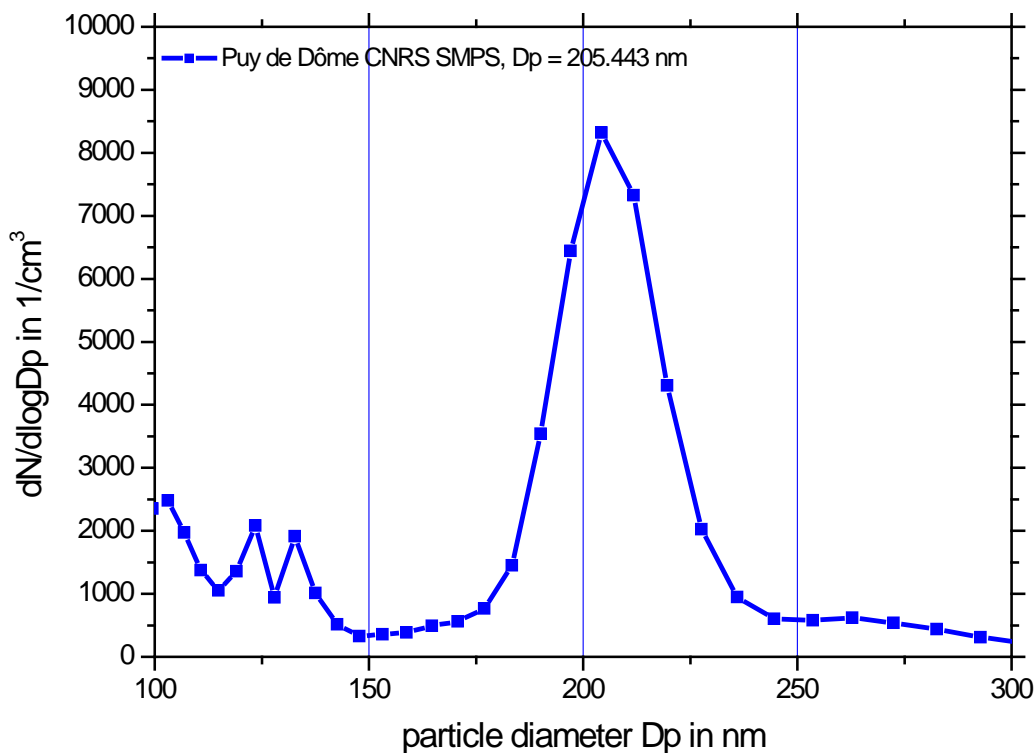


Fig.2. Measurement of latex 203 nm for Puy de Dôme CNRS SMPS: Particle size distribution (dN/dlogDp) for latex 203 nm on Sep. 30, 2013 between 15:20 and 15:30 (UTC time).

CPC efficiency

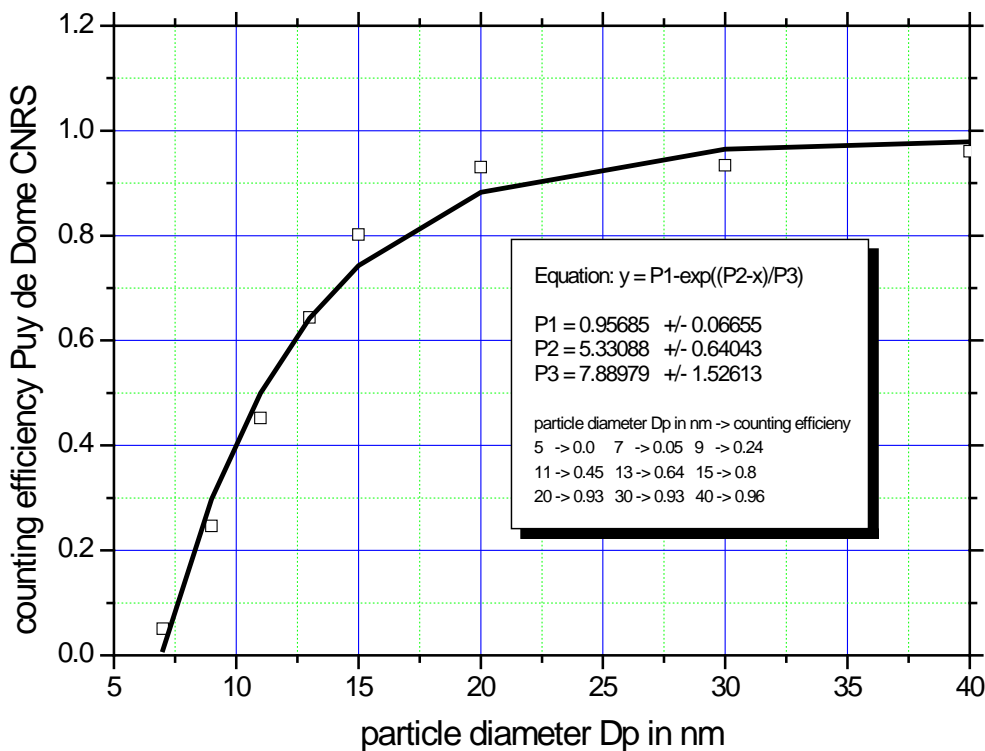


Fig.3. CPC efficiency curve. Based on TSI Electrometer 3068B. Serial number: 70838596.

A: First run

1. Time series

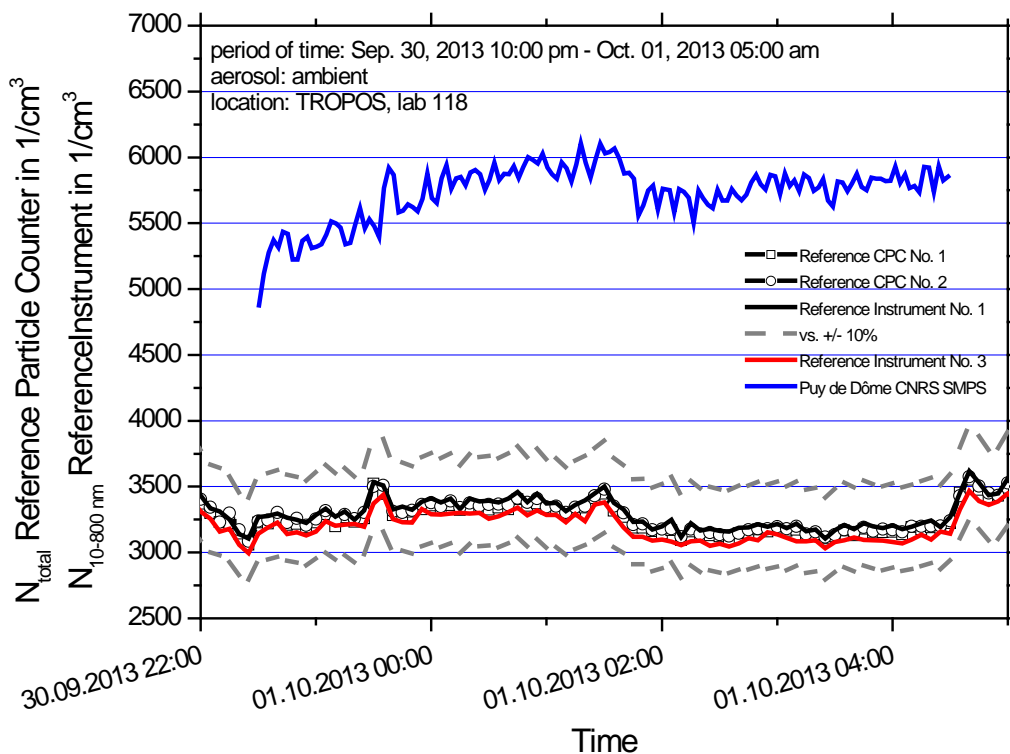


Fig.4. Time series (Sep. 30, 2013 10:00 pm – Oct. 01, 2013 05:00 am) of the integrated Particle Number Concentration ($N_{10-800 \text{ nm}}$). Flow corrections are included.

2. Correlation

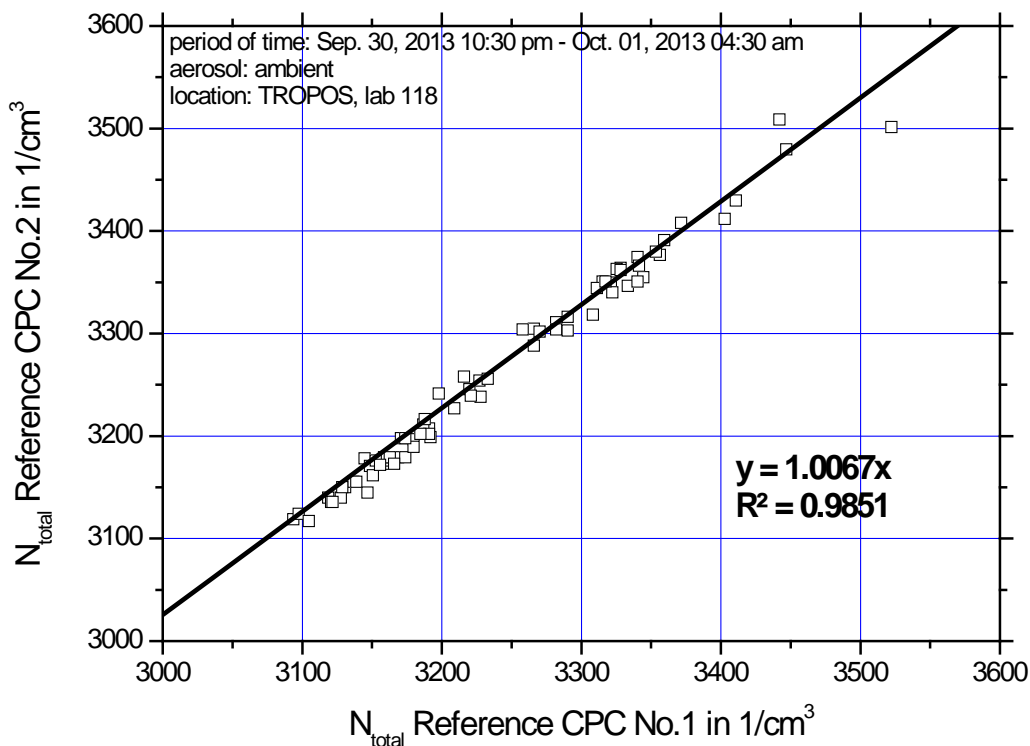


Fig.5. Linear regression between two Reference TROPOS CPCs (Model 3772). Flow corrections are included.

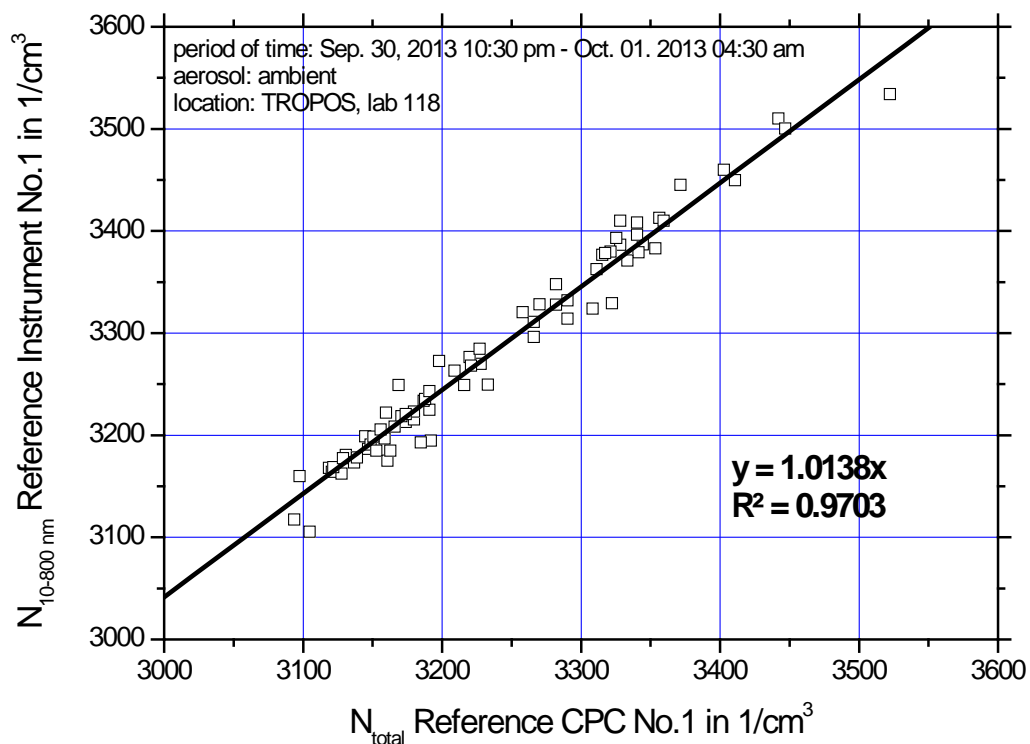


Fig.6. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No. 1. Internal diffusion losses and flow corrections are included.

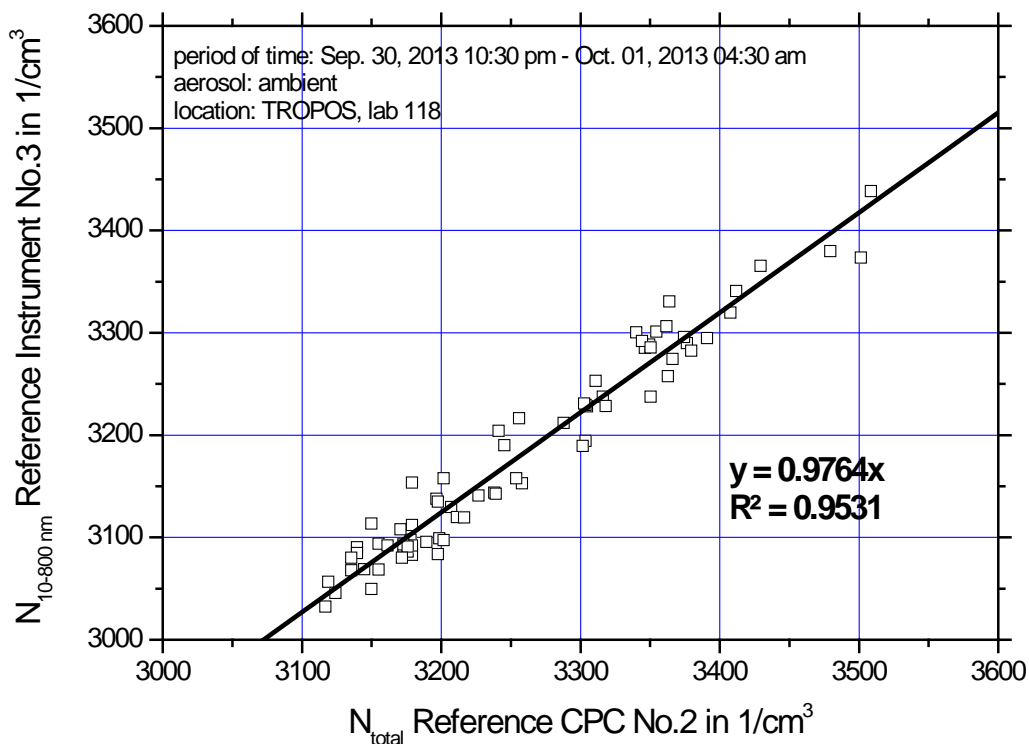


Fig.7. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusion losses and flow corrections are included.

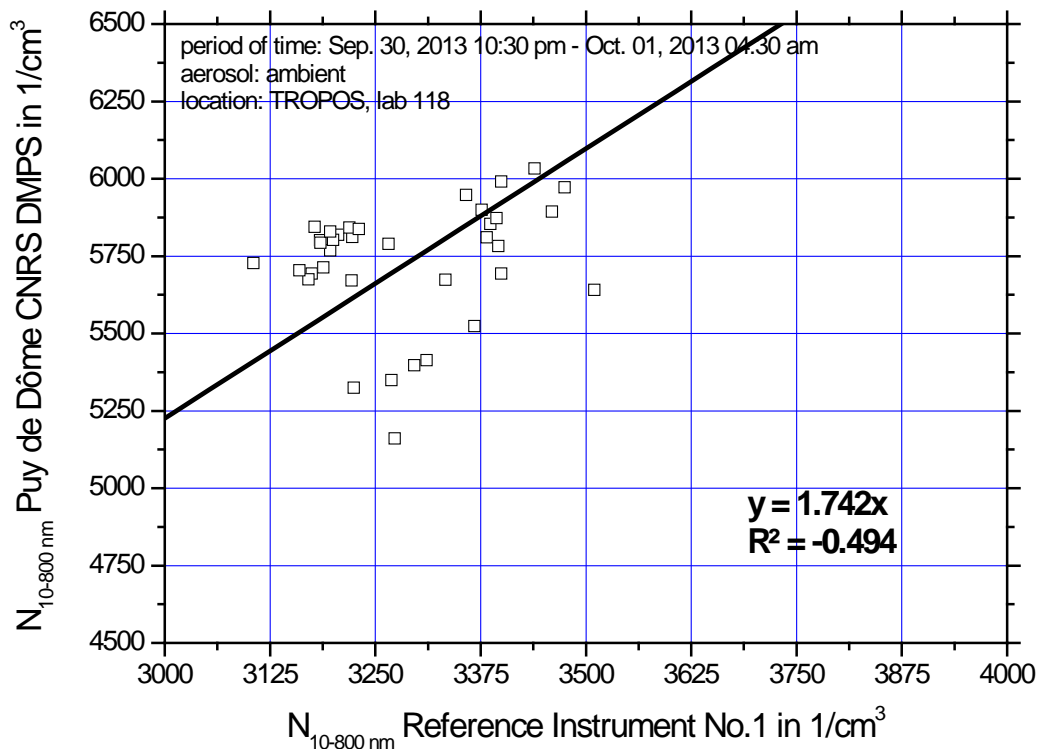


Fig.8. Linear regression between the number concentrations of the TROPOS reference instrument No. 1 and Puy de Dôme CNRS SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

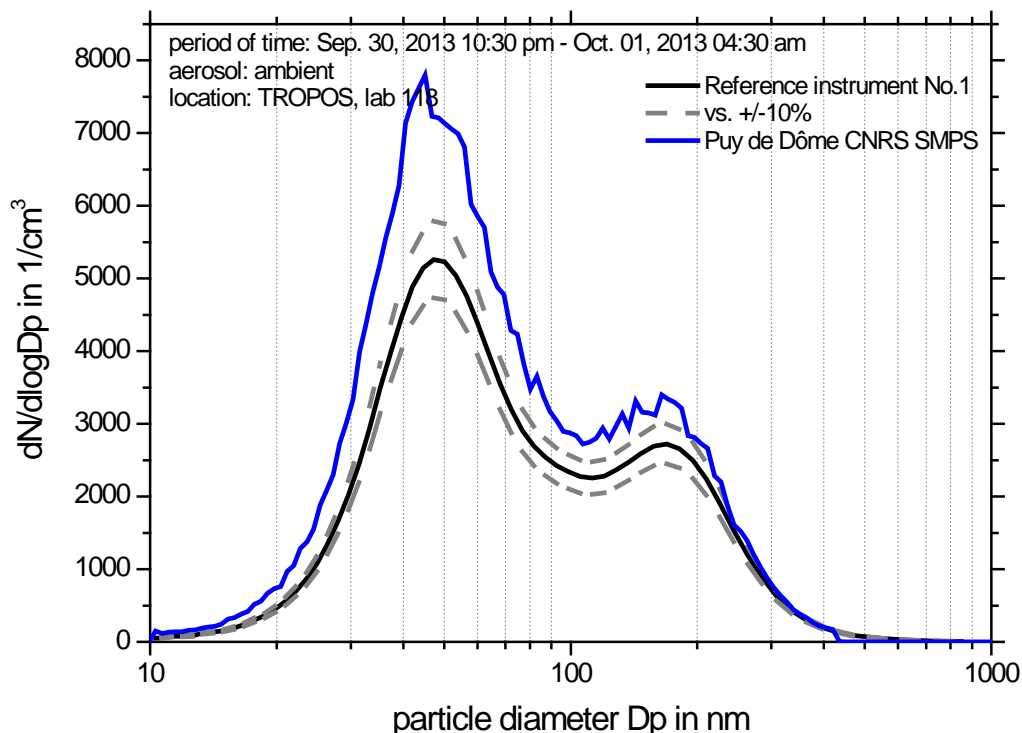


Fig.9. Comparison of mean particle number size distributions between Sep. 30, 2013 10:30 pm and Oct. 01, 2013 04:30 am. Internal diffusional losses and CPC efficiency were included.

B: Final run

1. Time series

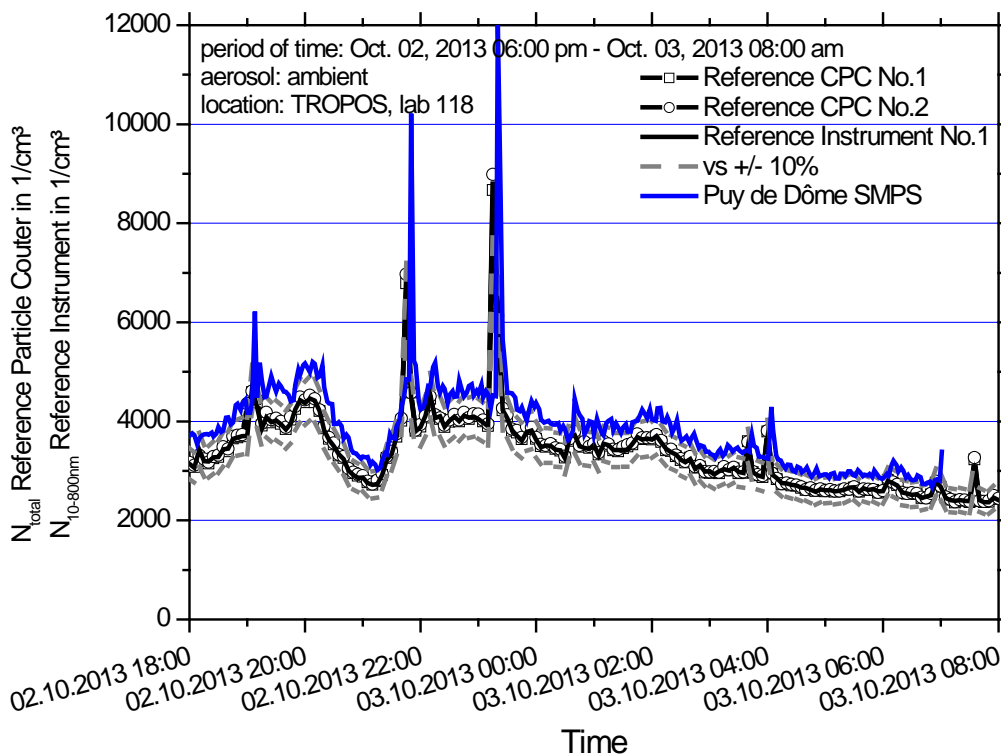


Fig.10. Time series (Oct. 02, 2013 06:00 pm – Oct. 03, 2013 08:00 am) of the integrated Particle Number Concentration ($N_{10-800\text{nm}}$). Flow corrections are included.

2. Correlation

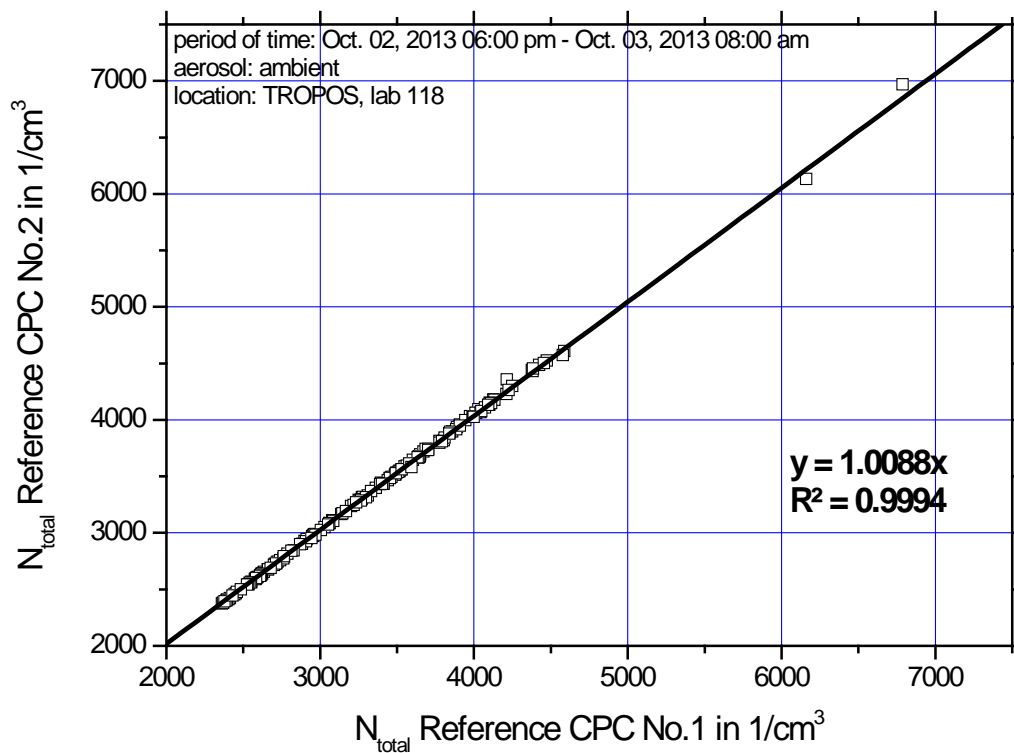


Fig.11. Linear regression between two TROPOS reference CPCs (Model 3772). Flow corrections are included.

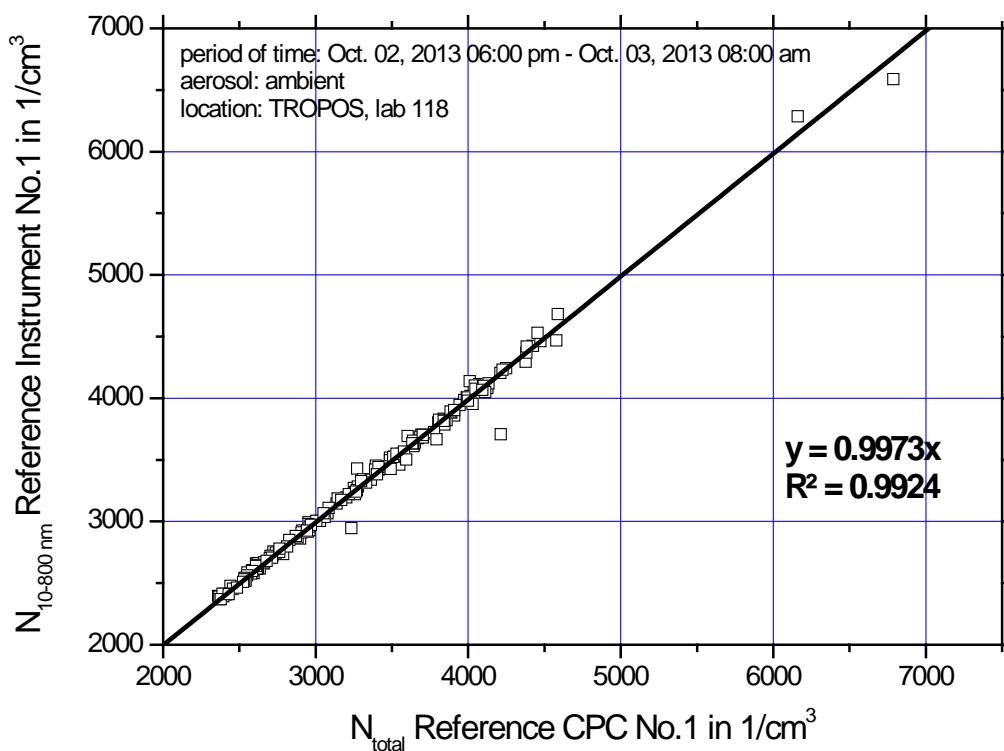


Fig.12. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No. 1. Internal diffusion losses and flow corrections are included.

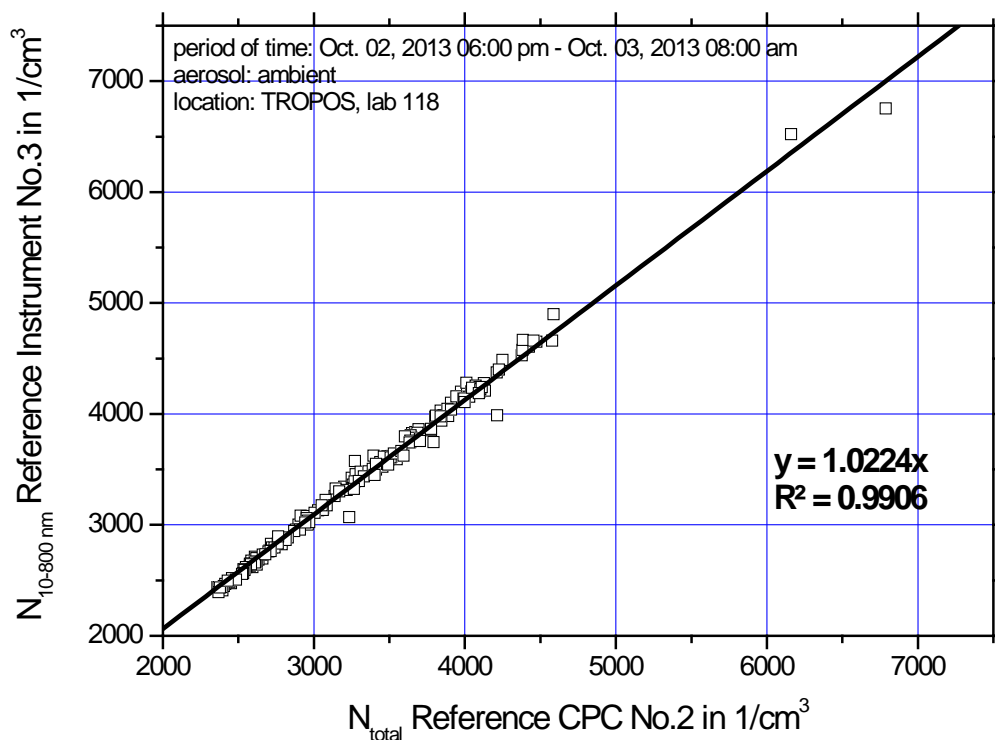


Fig.13. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusion losses and flow corrections are included.

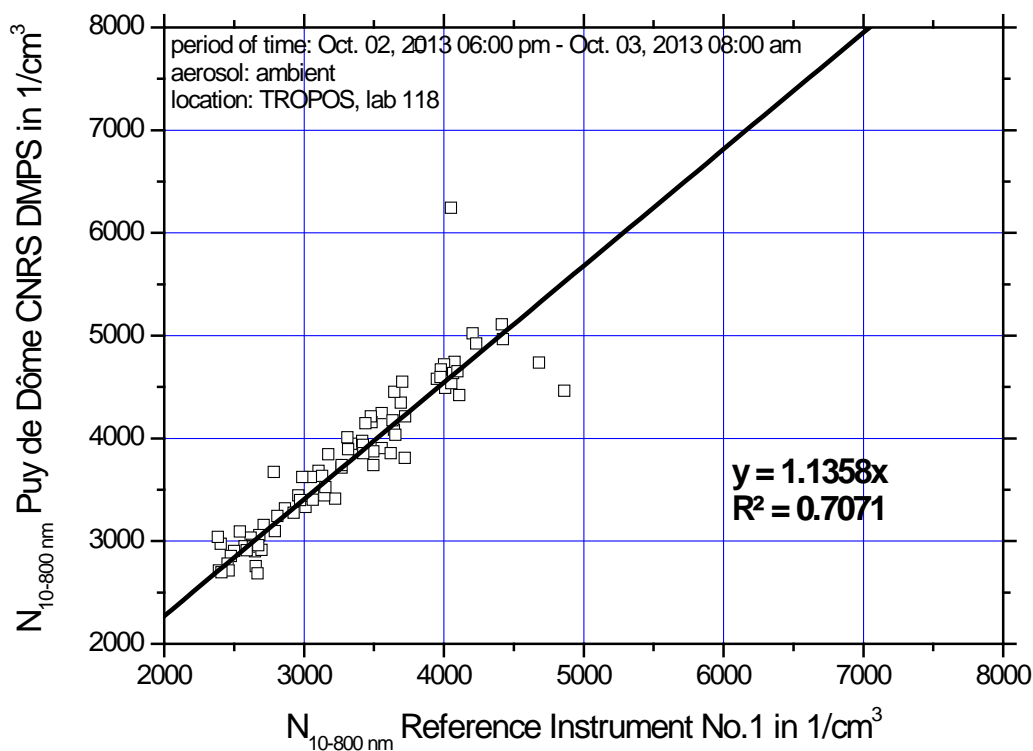


Fig.14. Linear regression between the number concentrations of the TROPOS reference instrument No.1 and Puy de Dôme CNRS SMPS. Internal diffusion losses and flow corrections are included.

3. Size distribution

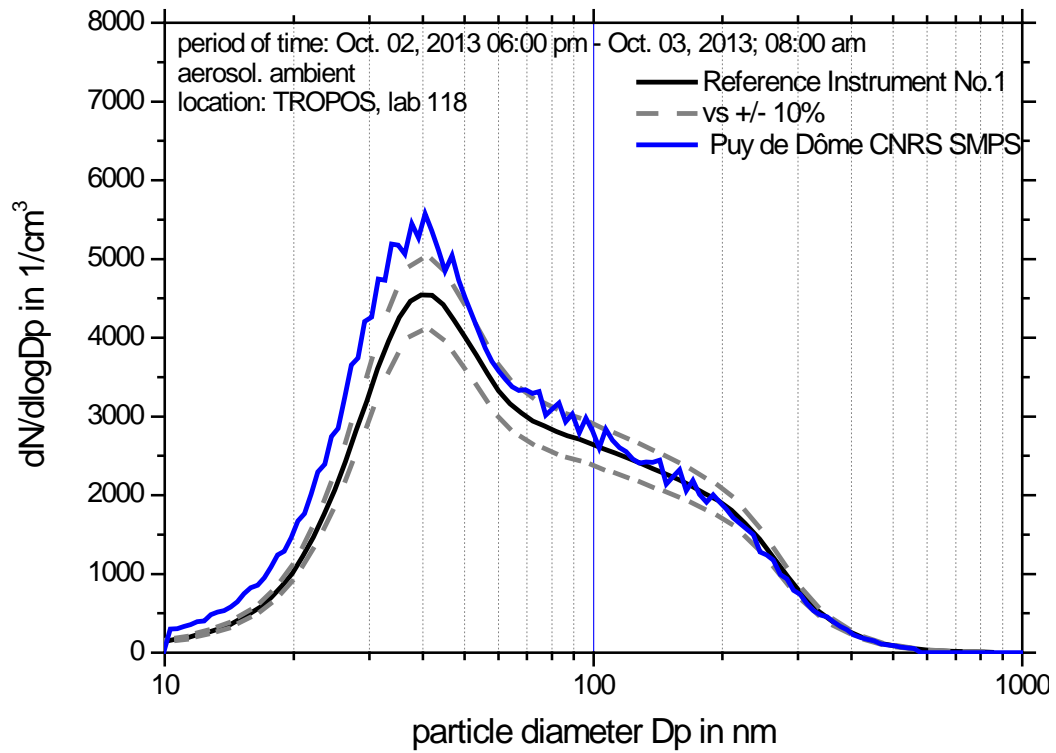


Fig.15. Comparison of mean particle number size distributions (Oct. 02, 2013 06:00 pm - Oct. 03, 2013 08:00 am). Internal diffusion losses and CPC efficiency are included.

Intercomparison of Sirta Grimm SMPS

Basic information

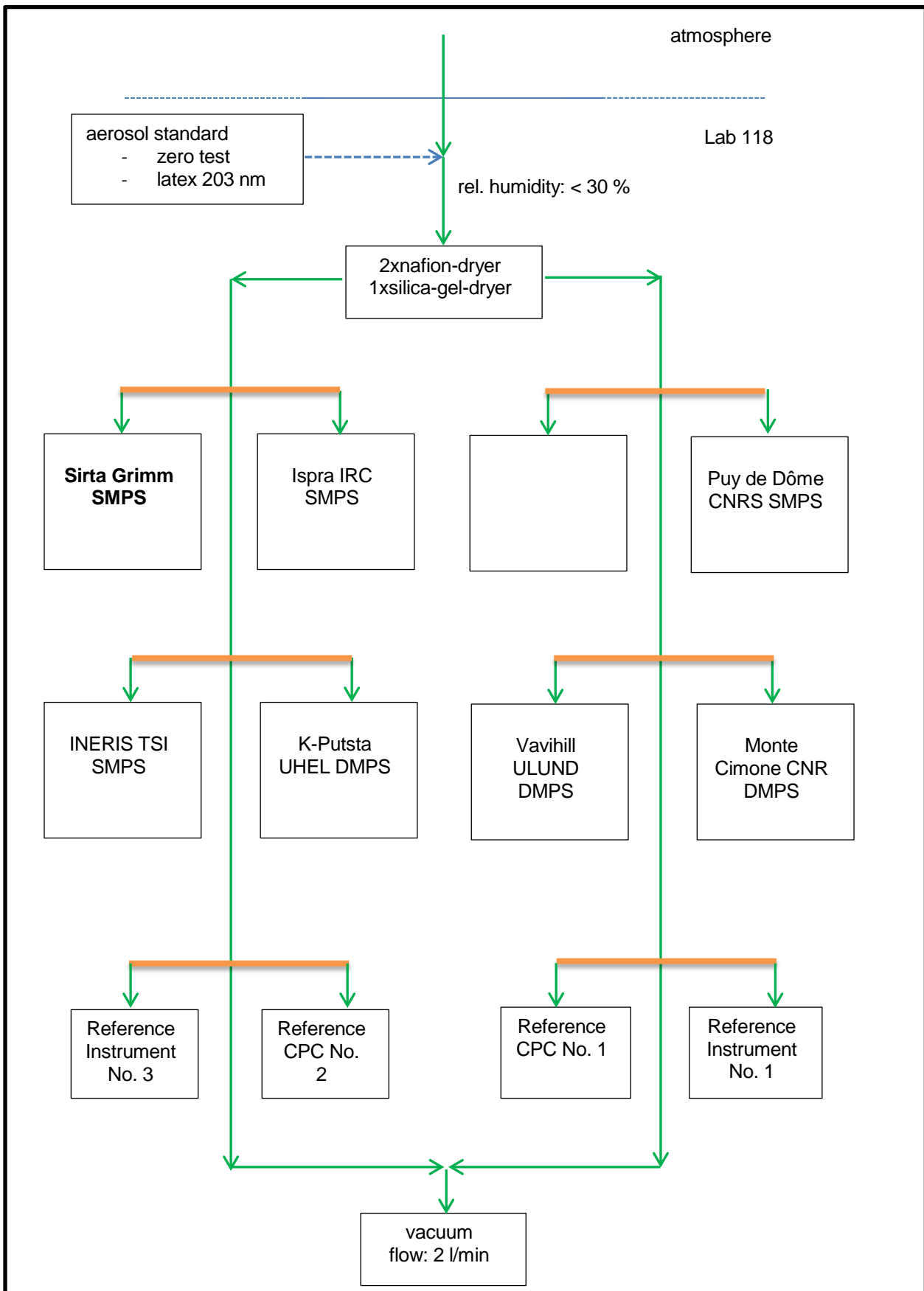
Location of the quality assurance:	TROPOS, lab. 118
Delivery date:	Sep. 30, 2013
Setup in the laboratory:	Sep. 30, 2013
Comparison period:	Sep. 30, 2013 – Oct. 03, 2013
Instrument:	Sirta Grimm SMPS
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	Jean Sciare (jean.sciare@lsce.ipsl.fr)

Summary:

From Sep. 30, 2013 to Oct. 03, 2013 the Sirta Grimm SMPS participated successfully the TROPOS ACTRIS Workshop. The workshop consisted of an entrance test and a final run. In addition to the overnight ambient measurements, we had numerous high voltage checks, zero- and PSL- measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that, we show for each run the time series of the particle number concentration, the particle number size distribution, and correlation plots. If anything was written in the log book, so we added this also in this report. As reference standards, we used CPCs model TSI 3772 for total particle number concentration and two TROPOS mobility particle size spectrometer. The particle counters have been calibrated against a calibrated TSI electrometer 3068 B with the serial number 70838596.

For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. The Sirta Grimm SMPS showed in the PSL-measurements a particle diameter of 200.0 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. If we look at the final ambient measurement run, the Sirta Grimm SMPS is within the uncertainty range of +/- 10 %. The Sirta Grimm SMPS passed the ACTRIS Workshop. There is no re-examination required.

Laboratory setup



Latex 203 nm

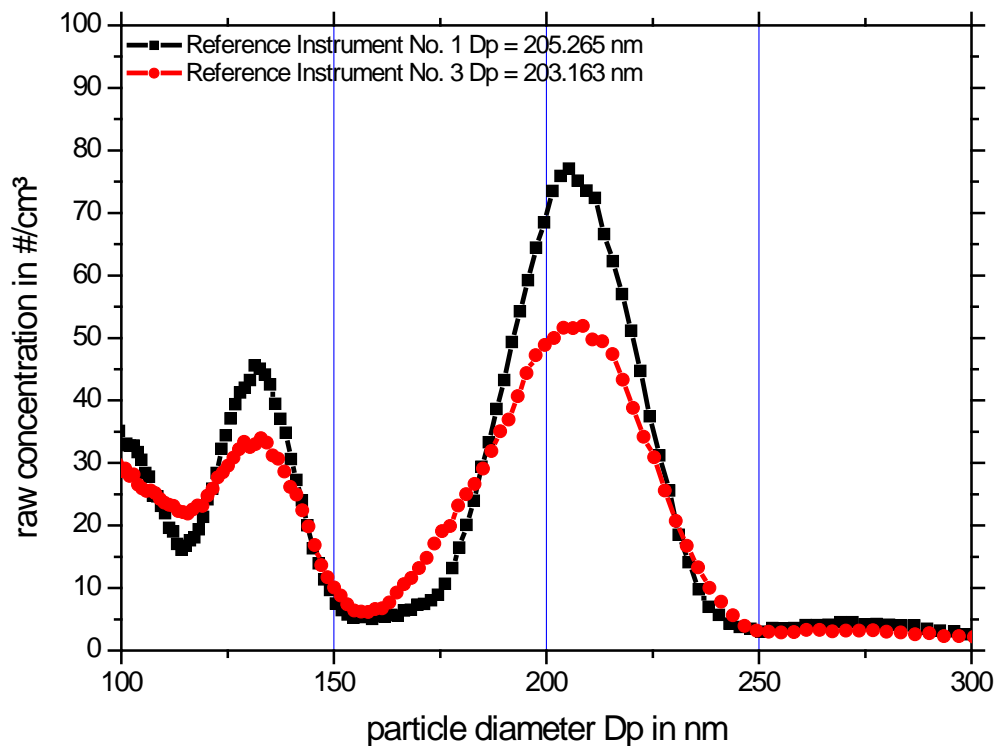


Fig.1. Measurement of latex 203 nm for reference instruments: Particle size distribution (raw concentration) for latex 203 nm on Sep. 30, 2013 between 15:19 and 15:28 (UTC time).

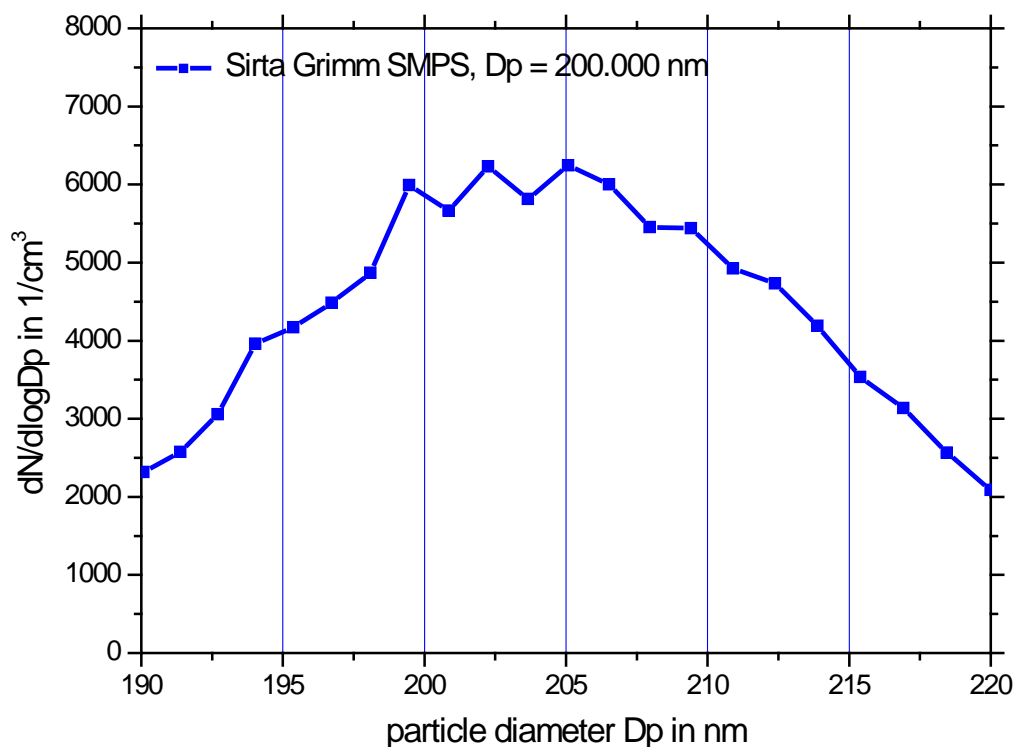


Fig.2. Measurement of latex 203 nm for SMPS-Sirta: Particle size distribution (dN/dlogDp) for latex 203 nm on Oct. 01 between 15:00 and 15:30 (UTC time).

A: First run

1. Time series

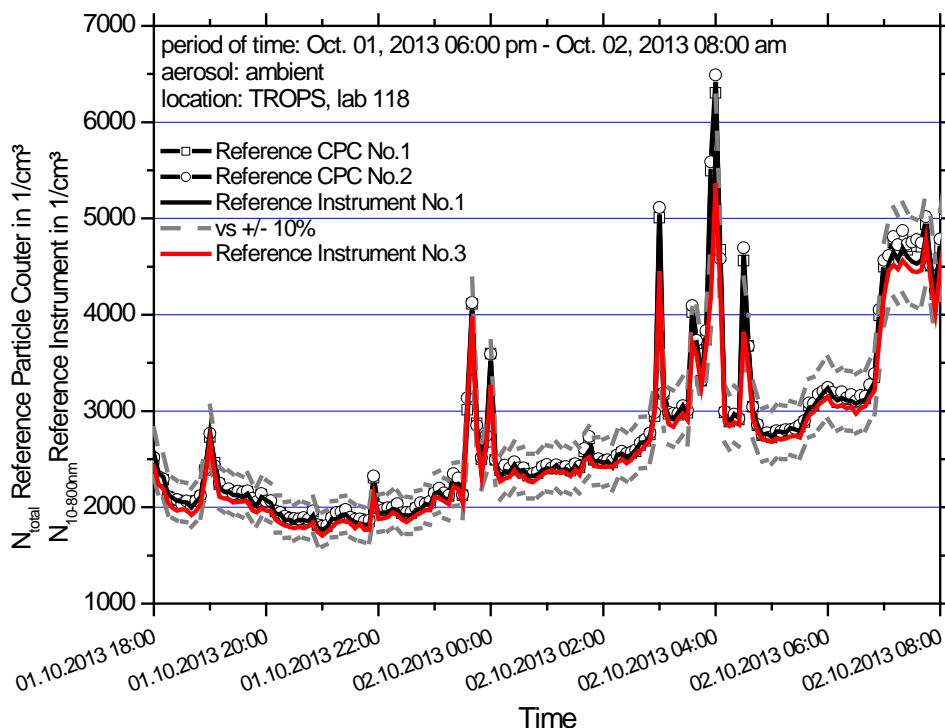


Fig.3. Time series (Oct. 01, 2013, 06:00 pm – Oct. 02, 2013 08:00 pm) of the integrated Particle Number Concentration ($N_{10-800\text{nm}}$). Flow corrections were included.

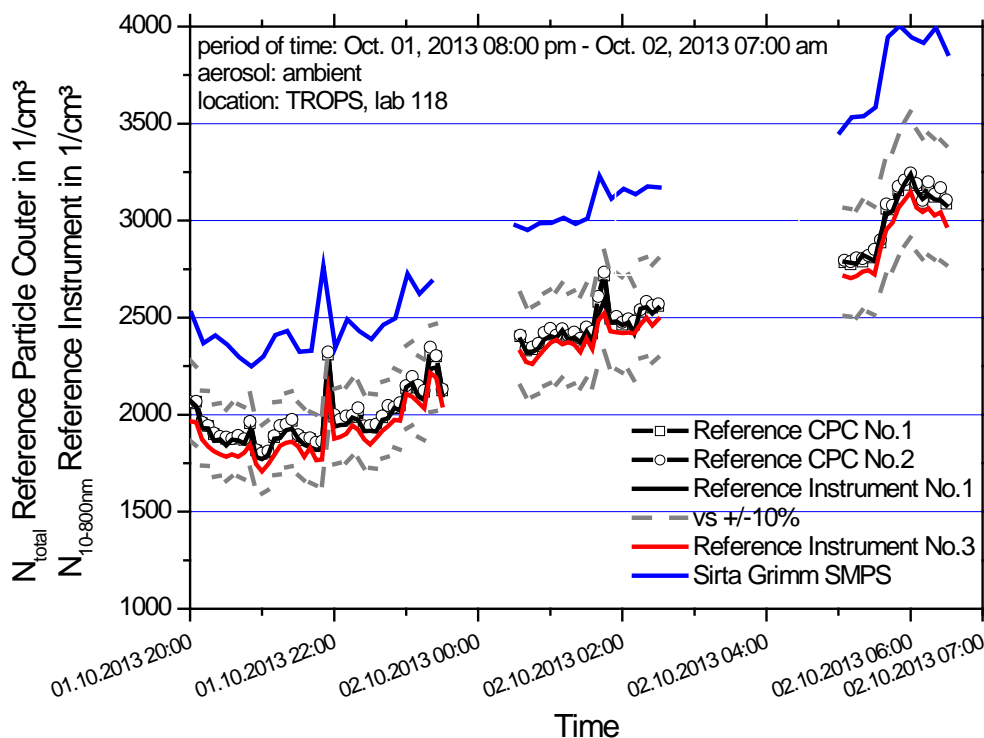


Fig.4. Time series (Oct. 01, 2013 08:00 pm – 11:30 pm and Oct. 02, 2013, 0:30 am – 2:30 am, 5:00 am – 06:30 am) of the integrated Particle Number Concentration ($N_{10-800\text{nm}}$). Flow corrections were included.

2. Correlation

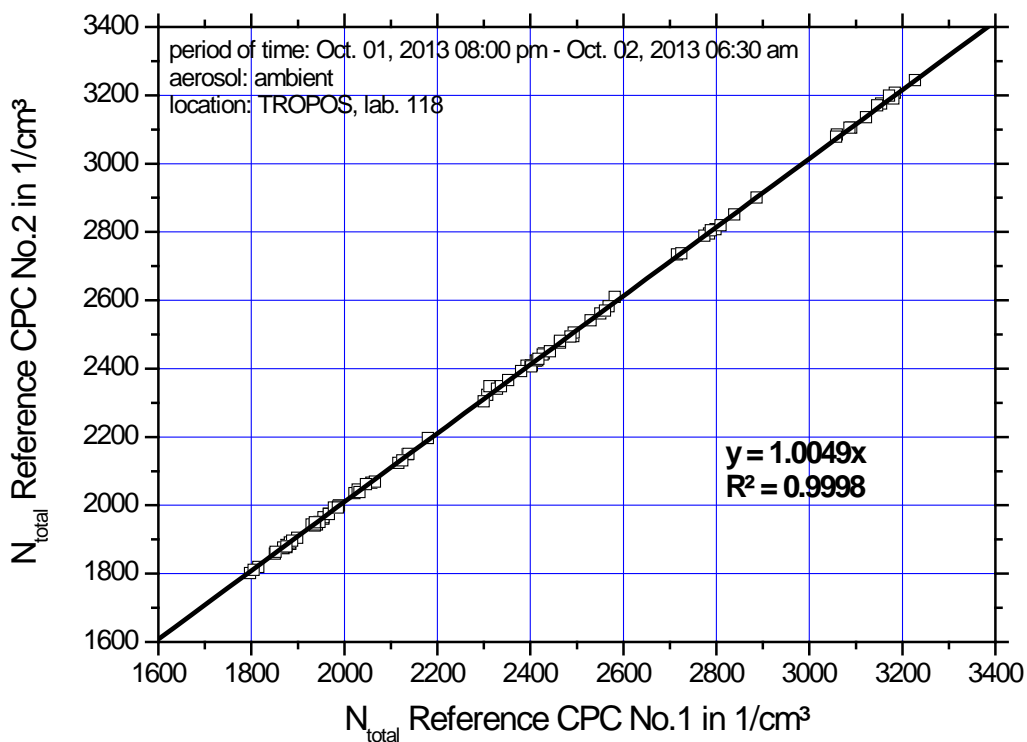


Fig.5. Linear regression between two Reference TROPOS CPCs (Model 3772). Flow corrections are included.

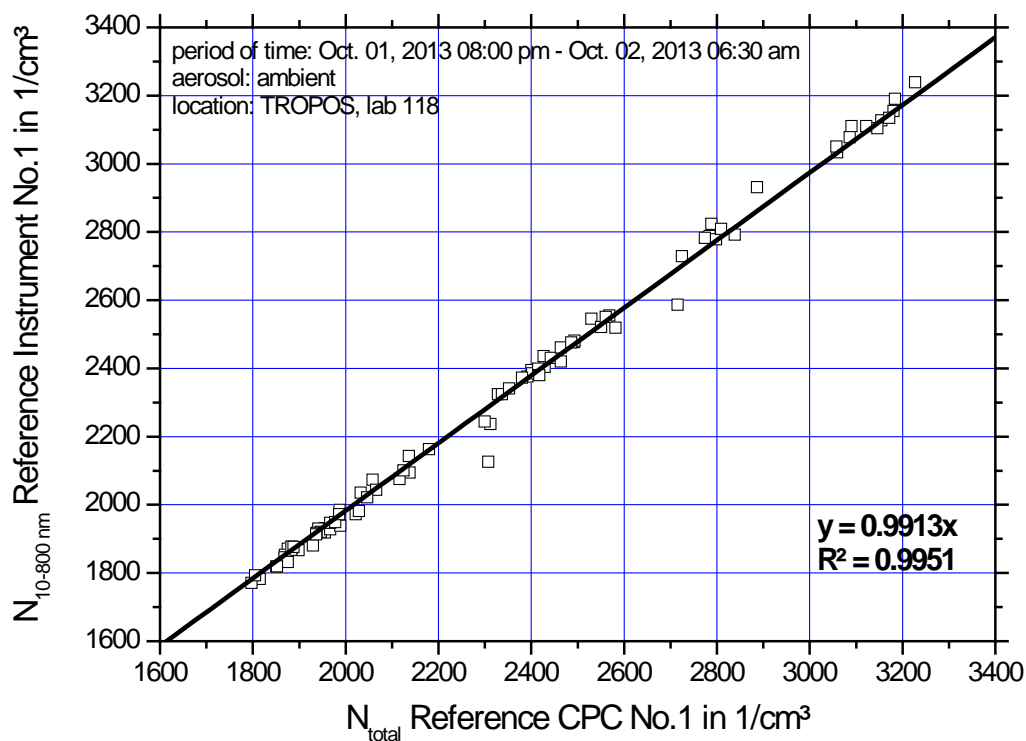


Fig.6. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No. 1. Internal diffusion losses and flow corrections are included.

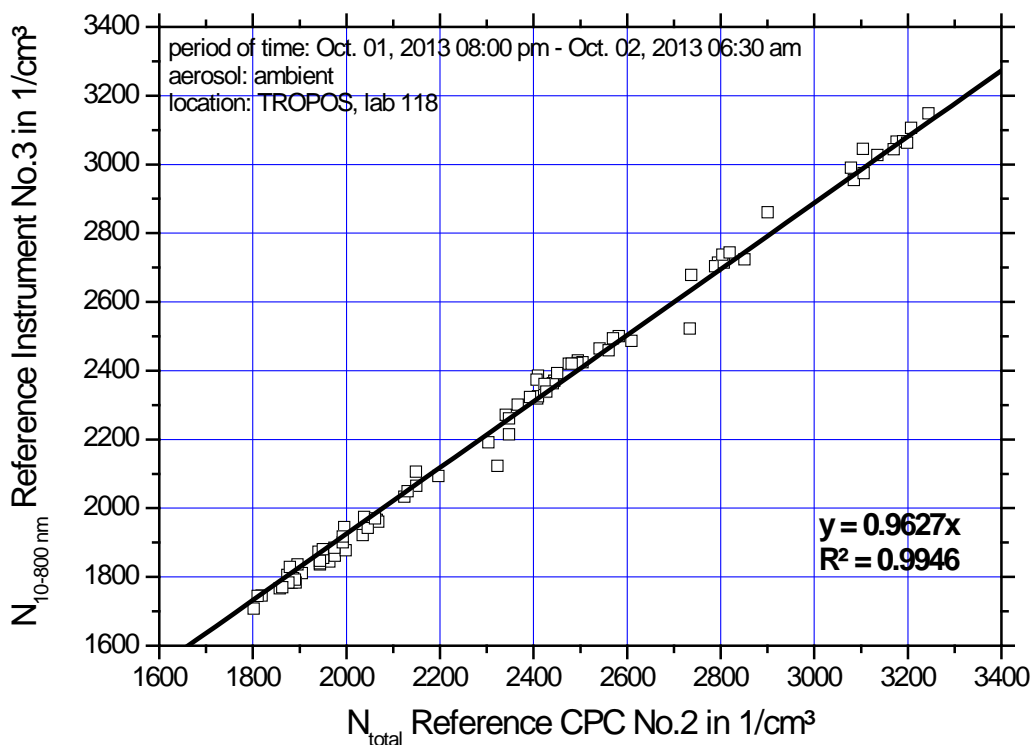


Fig.7. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusion losses and flow corrections are included.

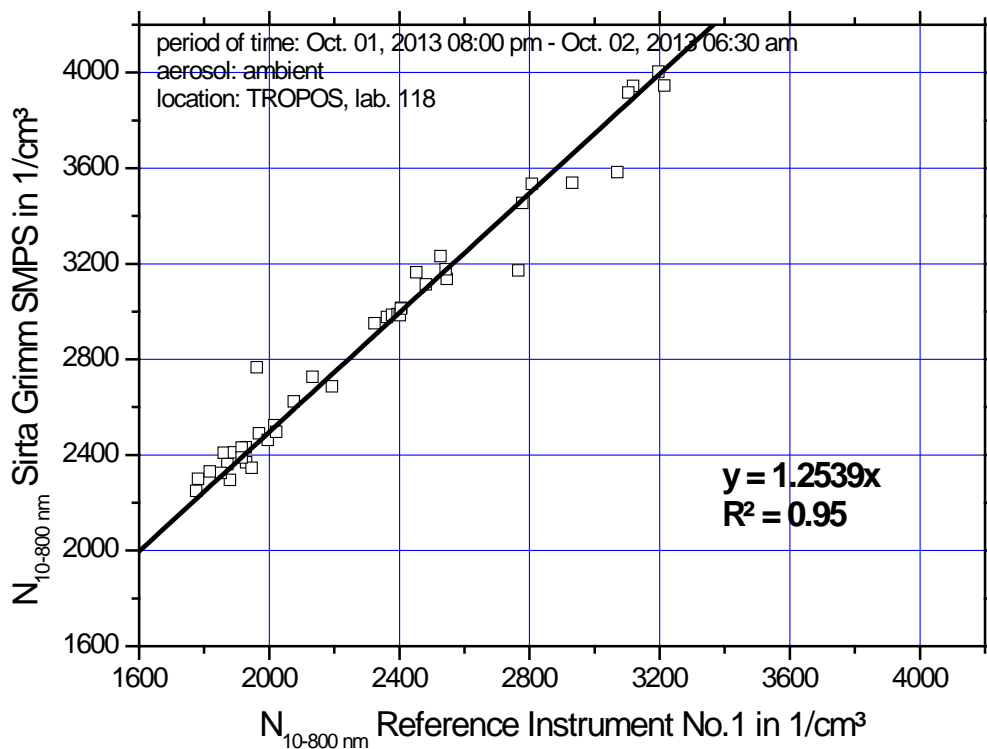


Fig.8. Linear regression between the number concentrations of the TROPOS reference instrument No. 1 and Sirta Grimm SMPS. Internal diffusional losses and flow corrections are included.

3. Size distribution

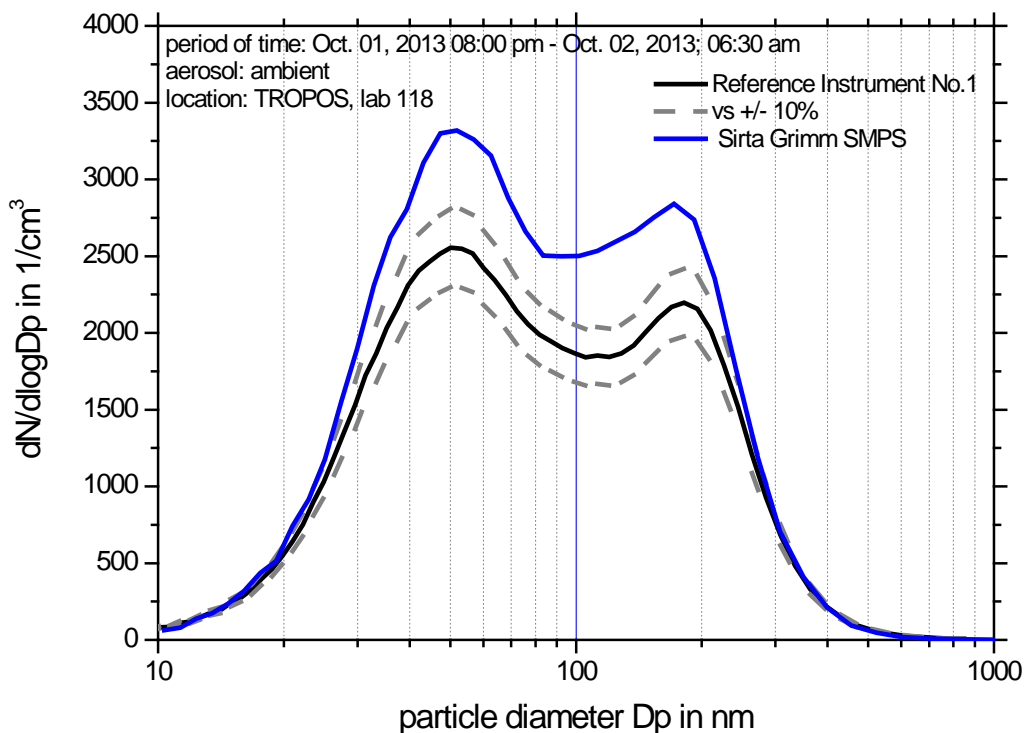


Fig.9. Comparison of mean particle number size distributions (Oct. 01, 2013 08:00 pm – 11:30 pm and Oct. 02, 2013 00:30 am – 02:30 am, 05:00 am – 06:30 am). Internal diffusional losses and CPC efficiency were included.

B: Final run

1. Time series

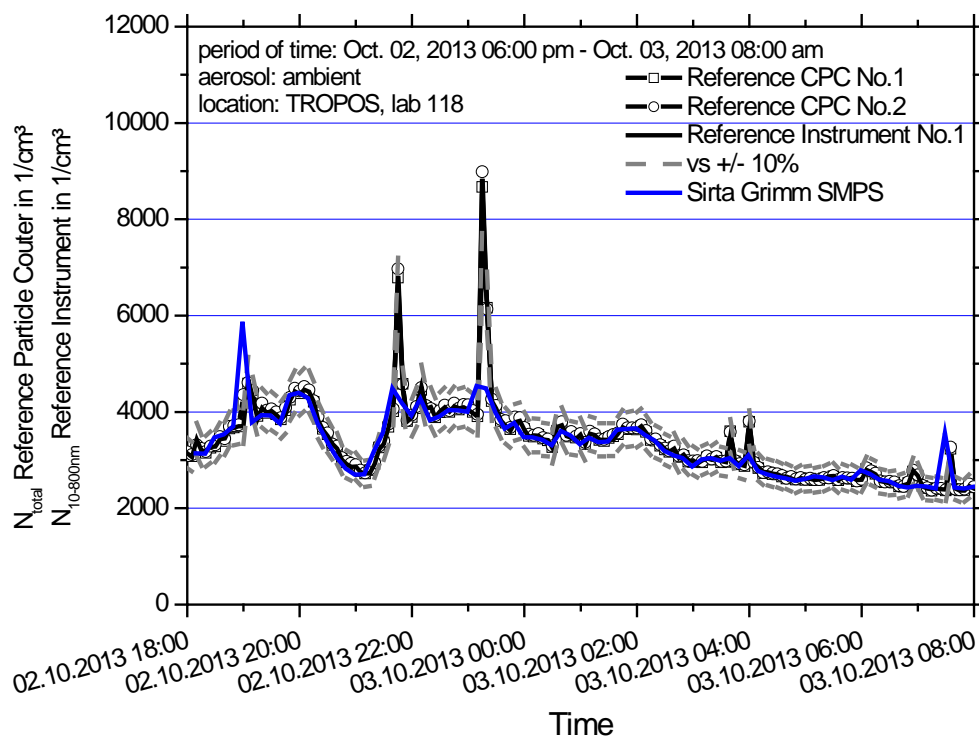


Fig.10. Time series (Oct. 02, 2013 06:00 pm – Oct. 03, 2013 08:00 am) of the integrated Particle Number Concentration ($N_{10-800\text{nm}}$). Flow corrections were included.

2. Correlation

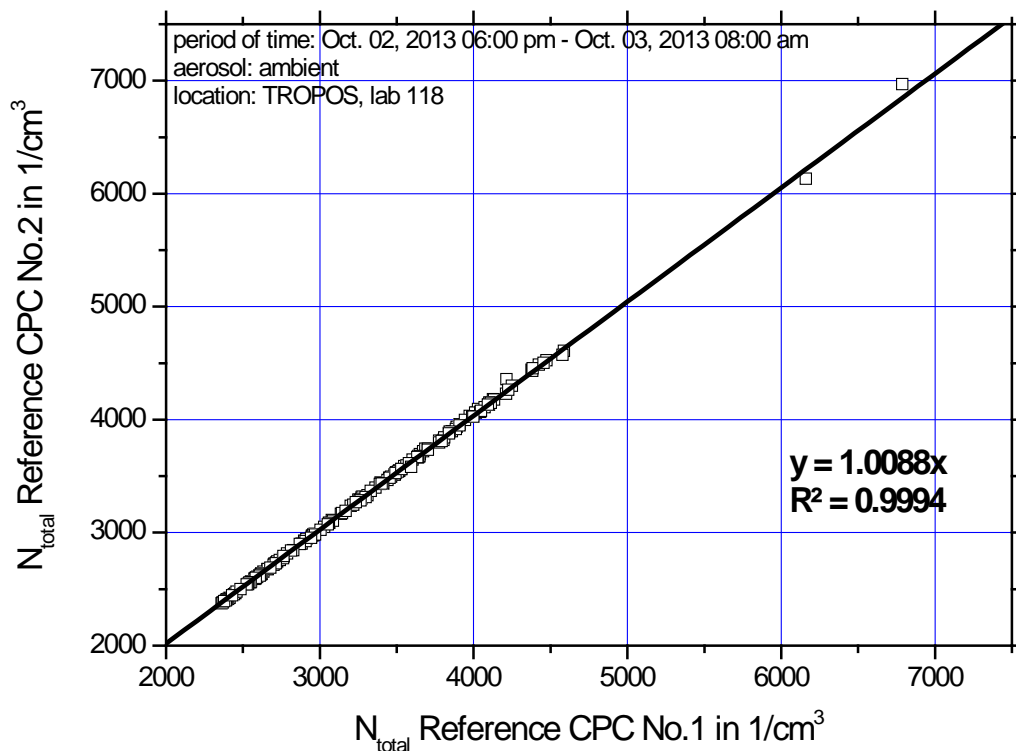


Fig.11. Linear regression between two TROPOS reference CPCs (Model 3772). Flow corrections were included.

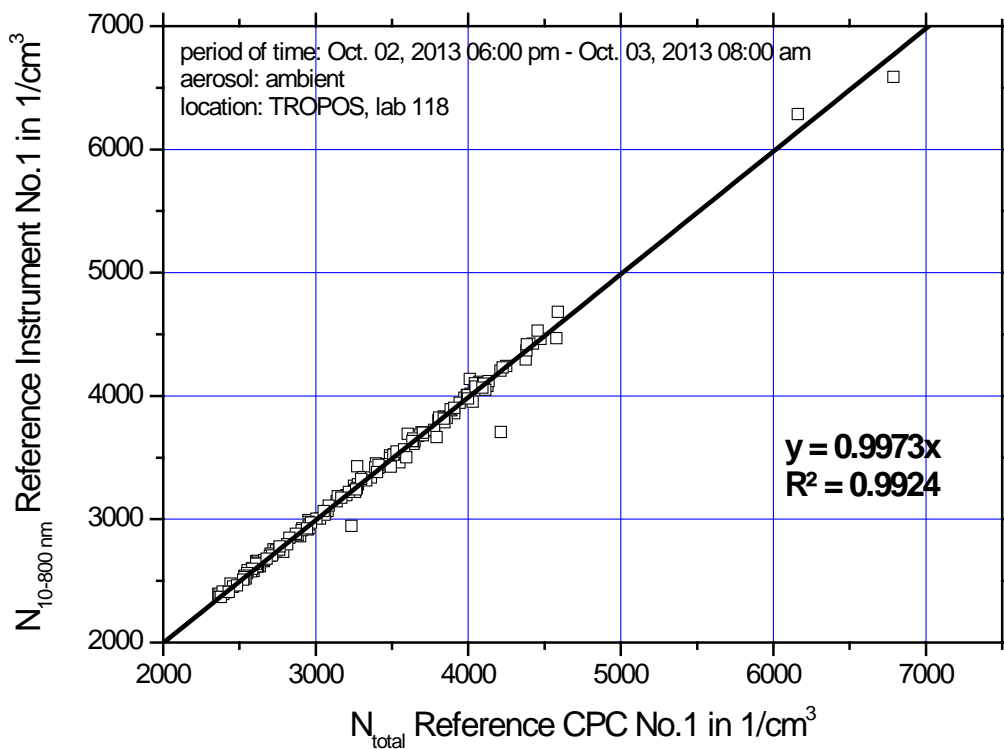


Fig.12. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No. 1. Internal diffusional losses and flow corrections were included.

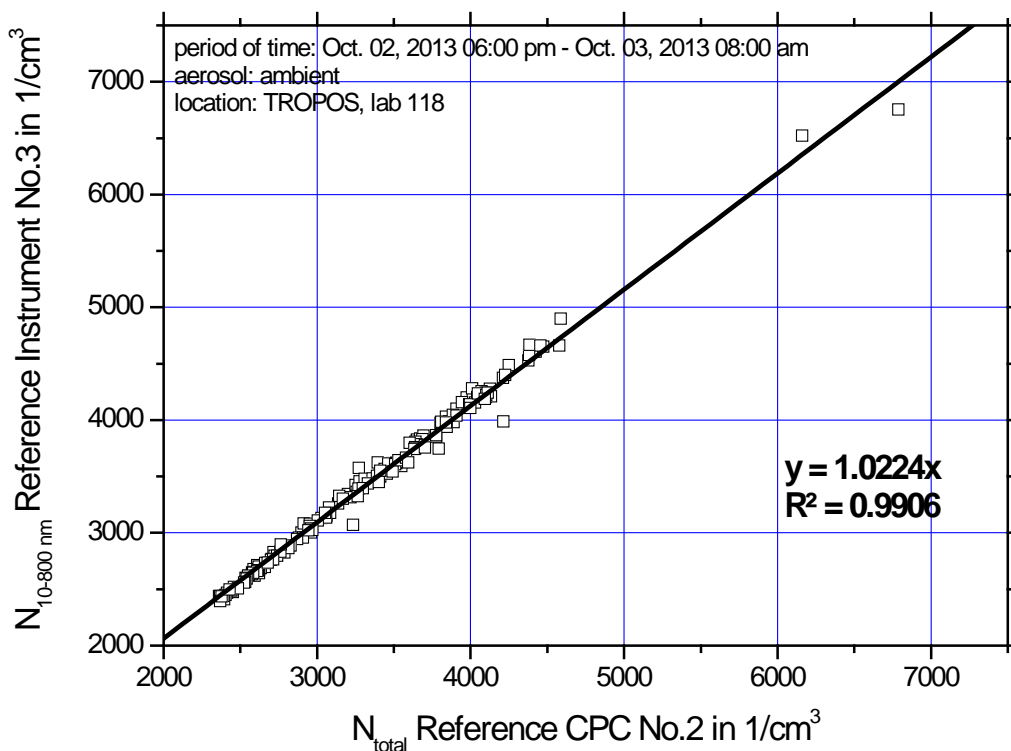


Fig.13. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusional losses and flow corrections were included.

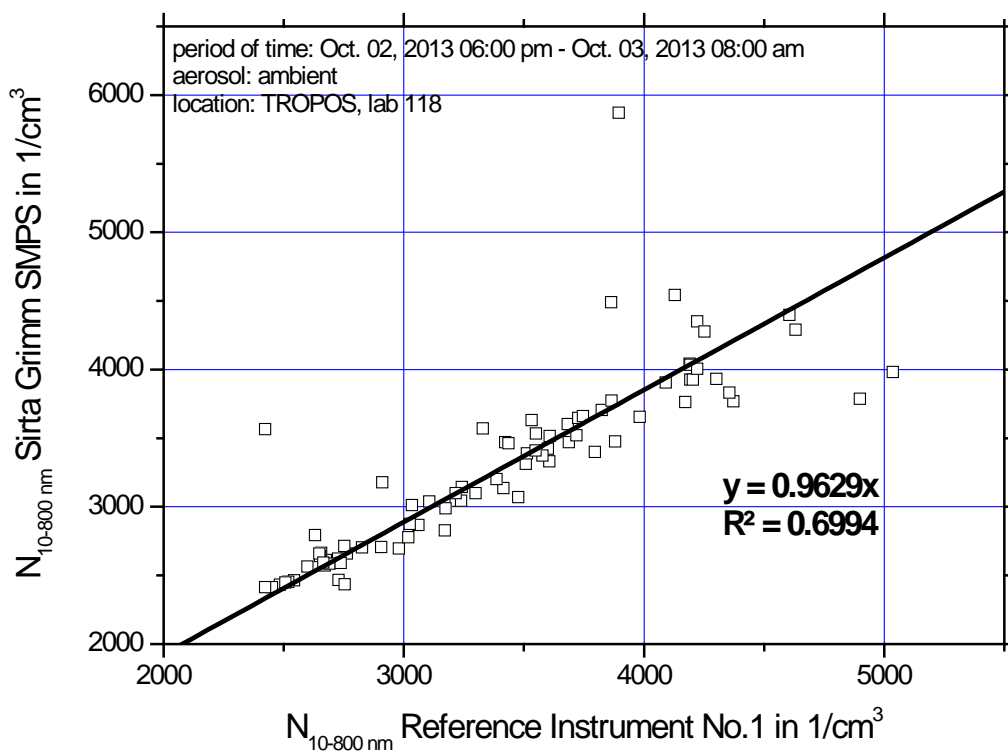


Fig.14. Linear regression between the number concentrations of the TROPOS reference instrument No. 1 and Sirta Grimm SMPS. Internal diffusional losses and flow corrections were included.

3. Size distribution

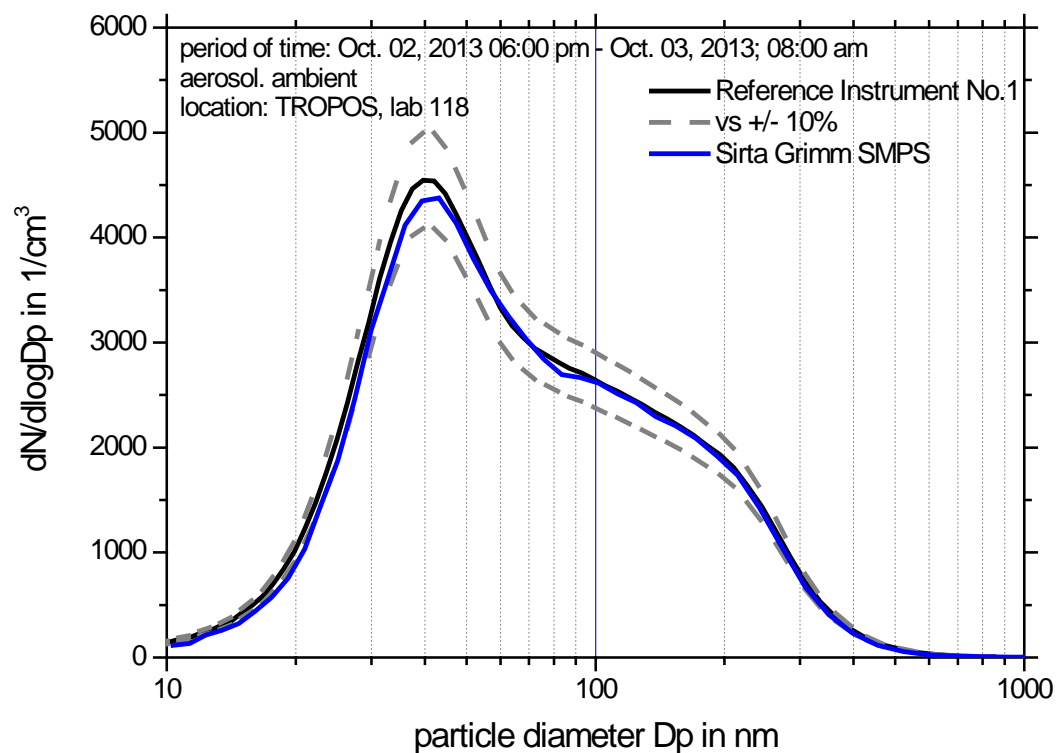


Fig.15. Comparison of mean particle number size distributions (Oct. 02, 2013 06:00 pm – Oct. 03, 2013 08:00 am). Internal diffusional losses and CPC efficiency were included.

Intercomparison of Vavihill ULUND DMPS

Basic information

Location of the quality assurance:	TROPOS, lab. 118
Delivery date:	Oct. 01, 2013
Setup in the laboratory:	Oct. 01, 2013
Comparison period:	Oct. 01, 2013 – Oct. 03, 2013
Instrument:	Vavihill ULUND DMPS
TROPOS Reference Instrument:	TROPOS Reference Instrument No. 1 TROPOS Reference Instrument No. 3
Total CPC:	CPC 3772; SNr. 3772114801 CPC 3772; SNr. 3772124802
Additional equipment:	aerosol nebulizer for latex calibration
Involved people:	Göran Frank (goran.frank@nuclear.lu.se)

Summary:

From Oct. 01, 2013 to Oct. 03, 2013 the Vavihill ULUND NILU DMPS participated successfully the TROPOS ACTRIS Workshop. The workshop consisted of an entrance test and a final run. In addition to the overnight ambient measurements, we had numerous high voltage checks, zero- and PSL- measurements. The report is divided into three sections. The first section shows the laboratory setup and the PSL measurement. After that, we show for each run the time series of the particle number concentration, the particle number size distribution, and correlation plots. If anything was written in the log book, so we added this also in this report. As reference standards, we used CPCs model TSI 3772 for total particle number concentration and two TROPOS mobility particle size spectrometer. The particle counters have been calibrated against a calibrated TSI electrometer 3068 B with the serial number 70838596.

For the PSL-calibrations, we used Latex particle with a nominal size of 203 nm +/- 4 nm. The latex particles have been generated with an aerosol nebulizer. The sheath air flow rate of the candidate system was calibrated to match the latex particle size, if possible. Vavihill ULUND DMPS showed in the PSL-measurements a particle diameter of 204.08 nm. Both the zero check and the high-voltage calibration passed the requirements in the final run. If we look at the final ambient measurement run, the Vavihill ULUND DMPS is within the uncertainty range of +/- 10 %. The Vavihill ULUND DMPS passed the ACTRIS Workshop. There is no re-examination required.

Log book:

Oct. 02, 2013

10:15 -> suction of room air, try to fix leak inside of UDMA
15:15 -> ambient air measurement without diffusion filter
17:00 -> zero check
17:15 -> start ambient air measurement with diffusion screen

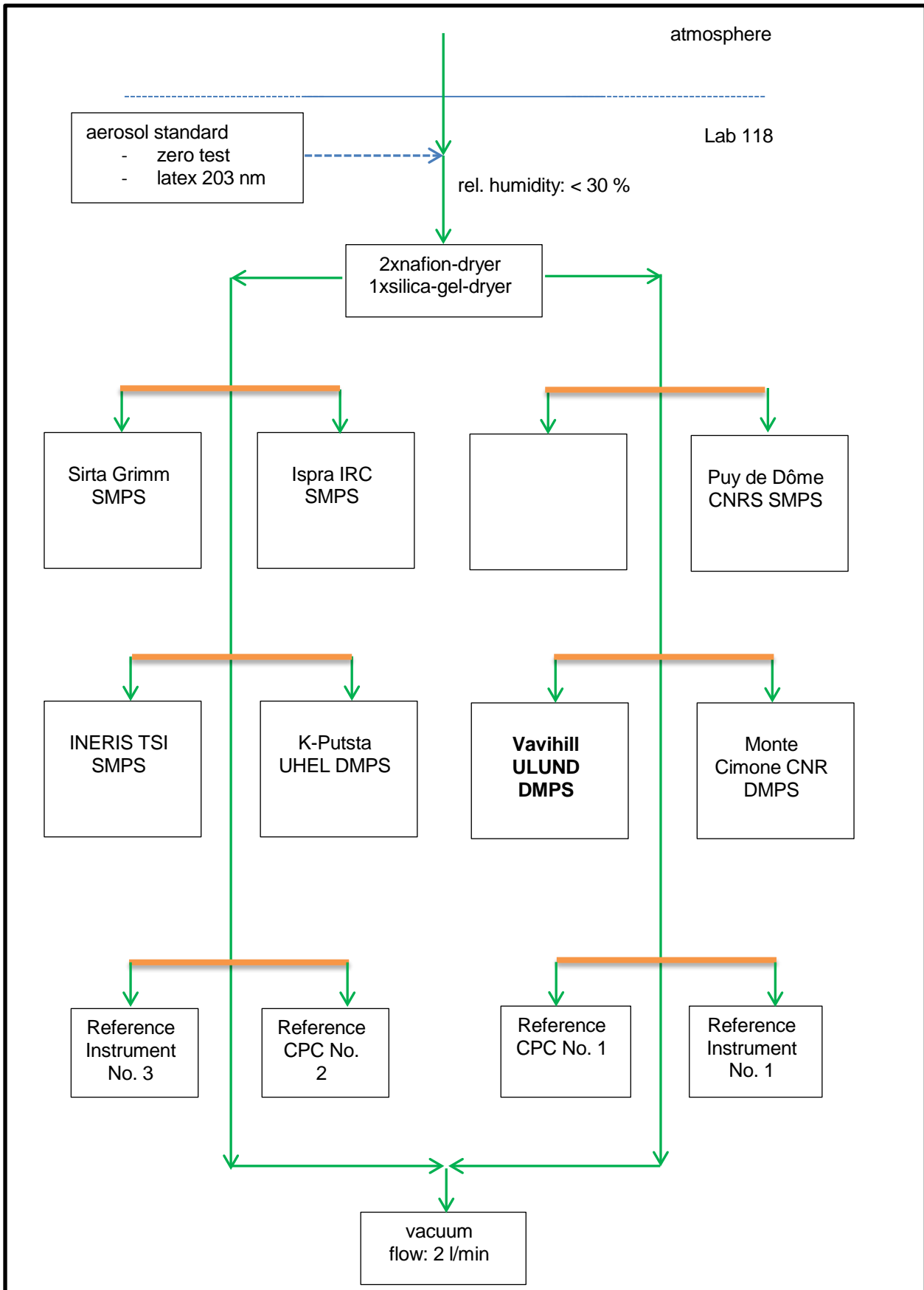
Oct. 03, 2013

14:05 -> disconnect and stop sampling

Power supply check:

<u>Set</u>	<u>Measurement</u>
45.48	48.8
61.14	64.5
89.03	85.4
109.84	113.1
146.69	150.2
195.36	199.2
259.32	263.1
342.93	346.8
451.56	451.56
591.73	591.73
771.26	775

Laboratory setup



Latex 203 nm

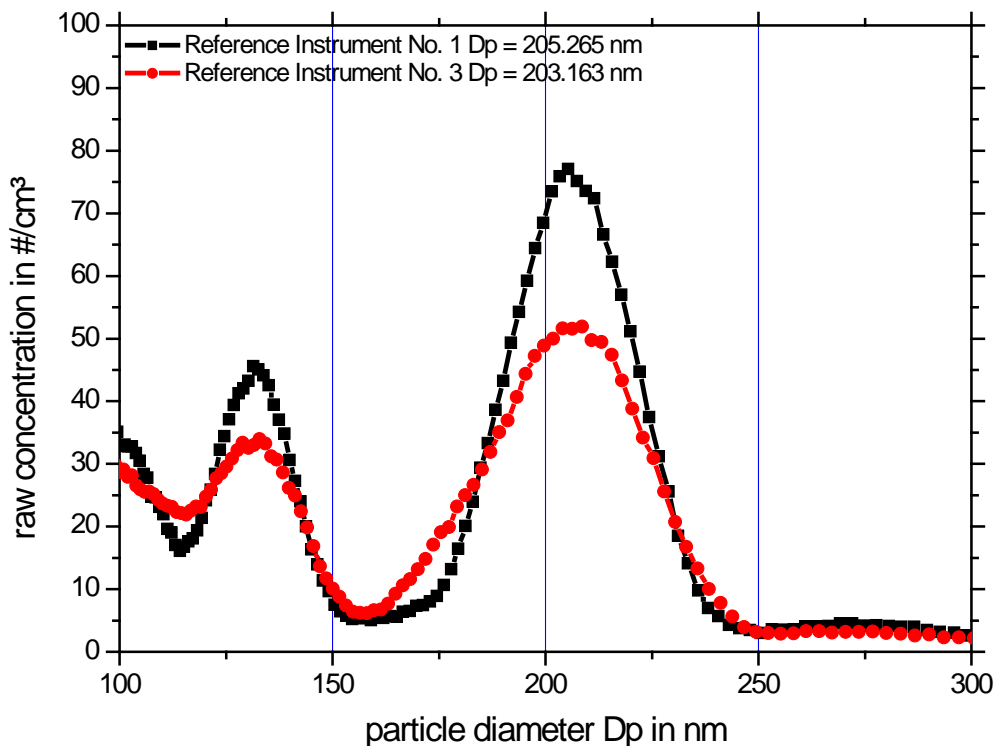


Fig.1. Measurement of latex 203 nm for reference instruments: Particle size distribution (raw concentration) for latex 203 nm on Sep. 30, 2013 between 15:19 and 15:28 (UTC time).

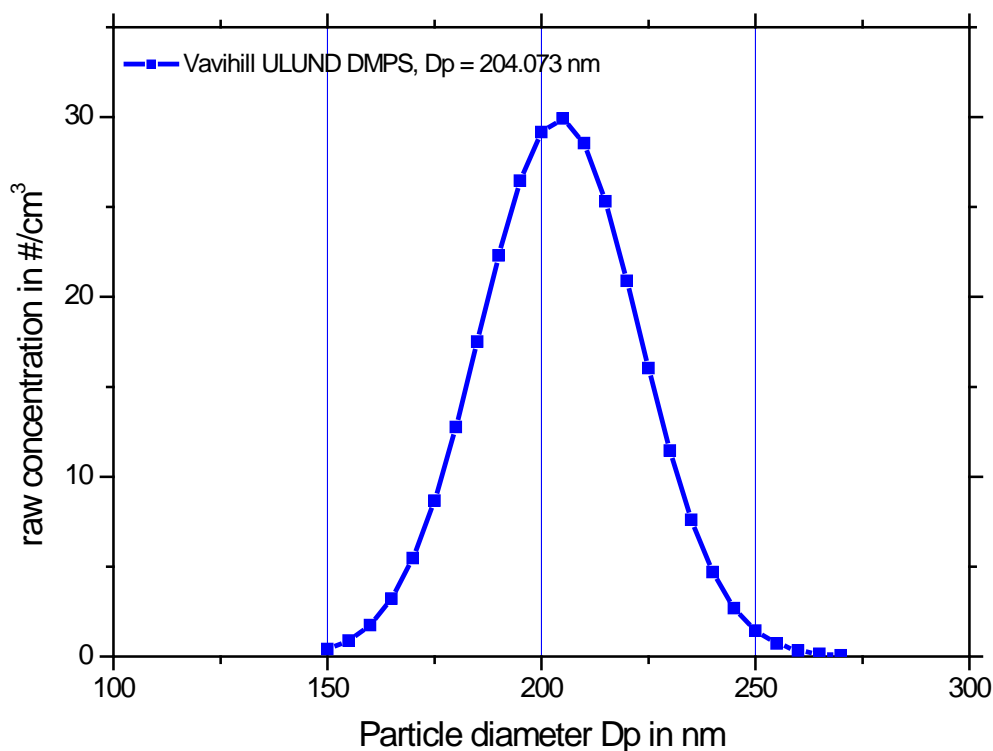


Fig.2. Measurement of latex 203 nm for Vavihill ULUND DMPS: Particle size distribution (raw concentration) for latex 203 nm on Oct. 01, 2013 between 15:00 and 15:30 (UTC time).

CPC efficiency

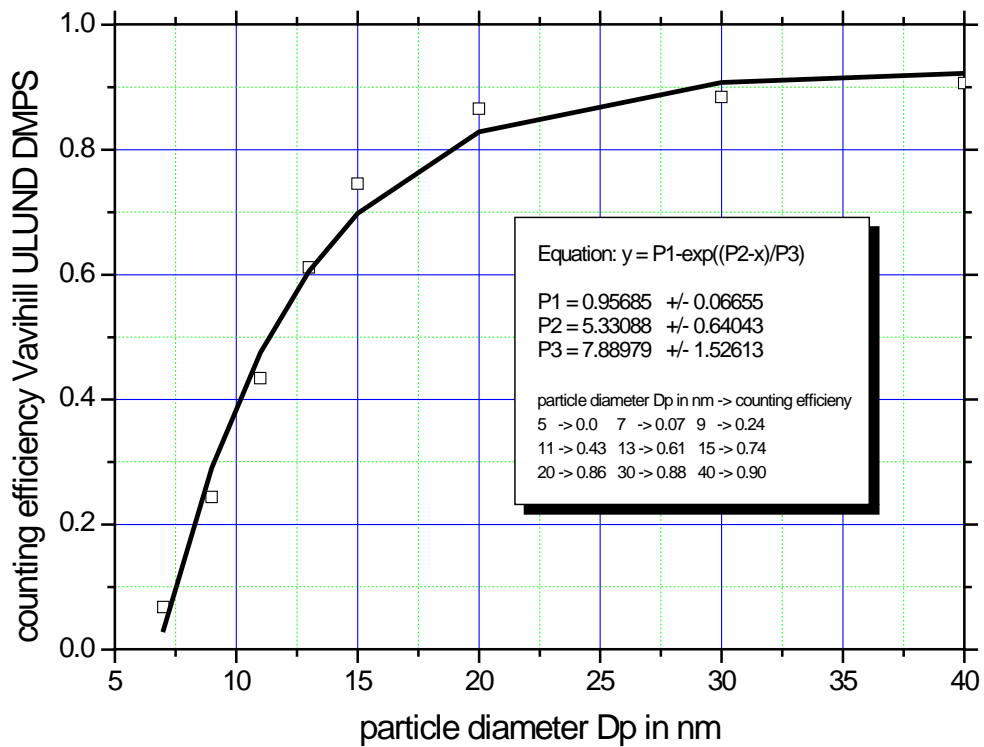


Fig.3. CPC efficiency curve. Based on TSI Electrometer 3068B. Serial number: 70838596.

A: First run

1. Time series

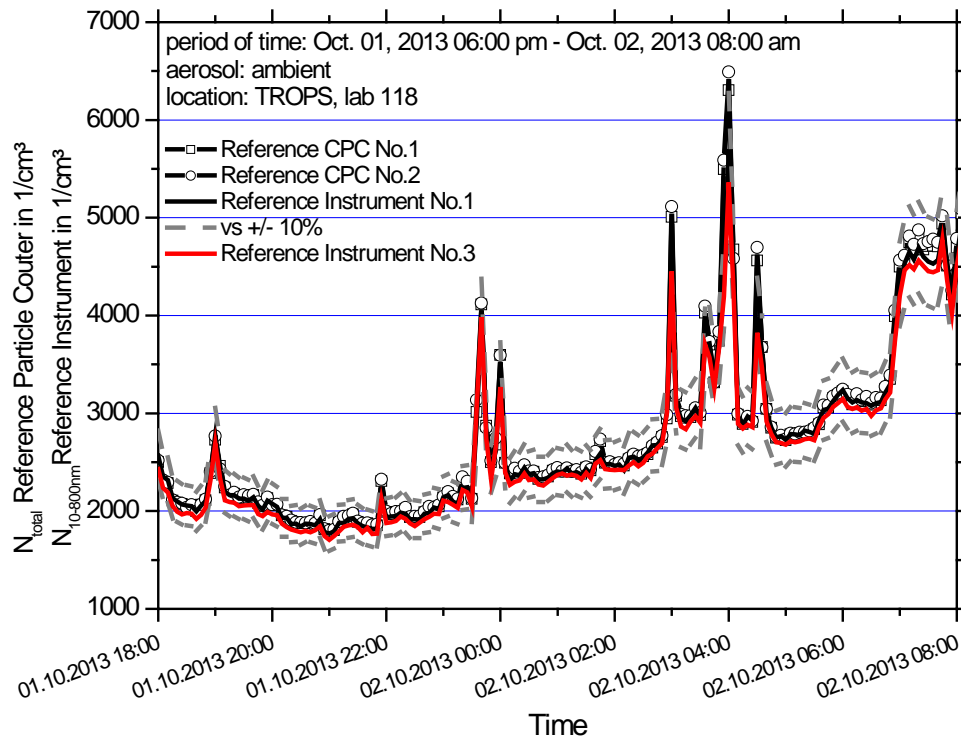


Fig.4. Time series (Oct. 01, 2013, 06:00 pm – Oct. 02, 2013 08:00 pm) of the integrated Particle Number Concentration ($N_{10-800\text{nm}}$). Flow corrections were included.

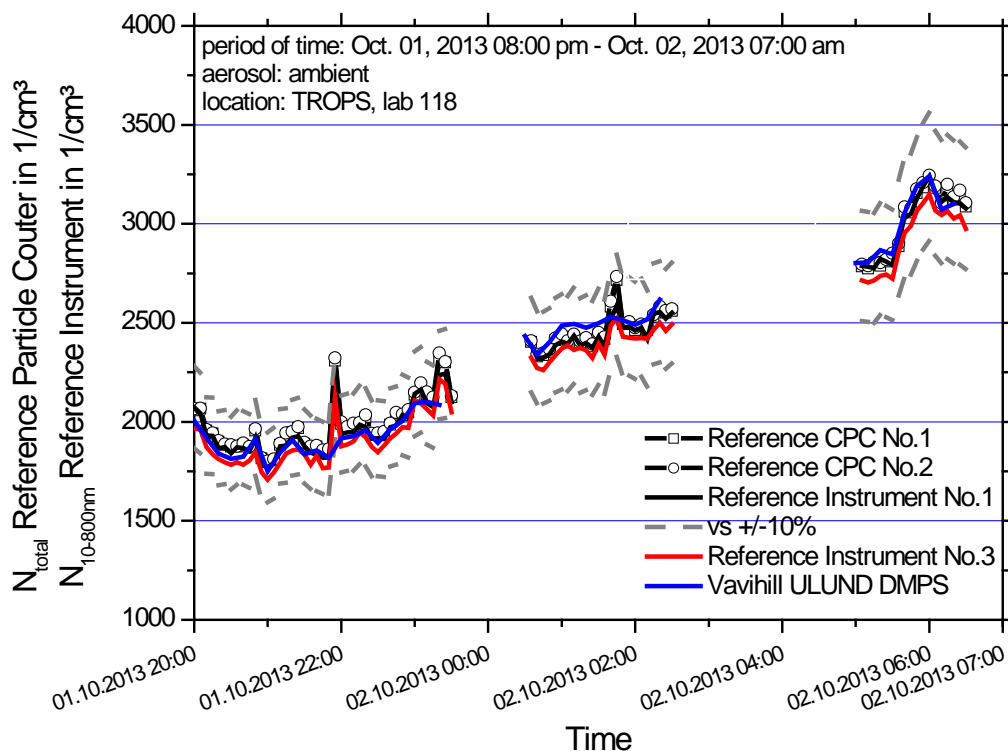


Fig.5. Time series (Oct. 01, 2013 08:00 pm – 11:30 pm and Oct. 02, 2013, 0:30 am – 2:30 am, 5:00 am – 06:30 am) of the integrated Particle Number Concentration ($N_{10-800\text{ nm}}$). Flow corrections were included.

2. Correlation

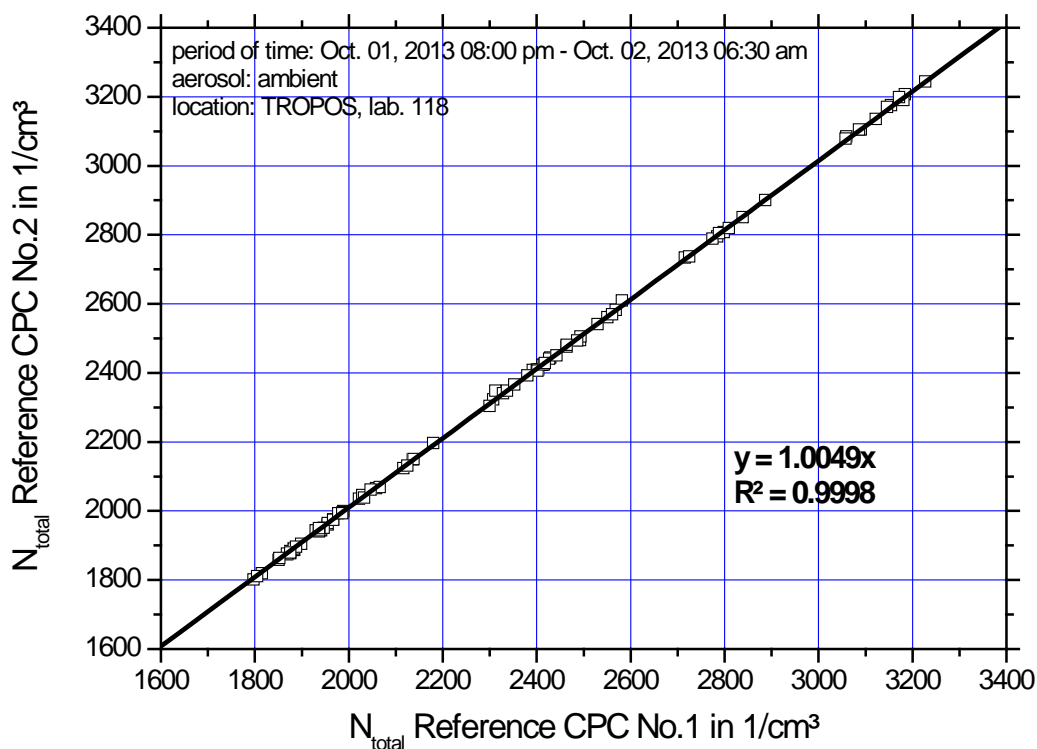


Fig.6. Linear regression between two Reference TROPOS CPCs (Model 3772). Flow corrections were included.

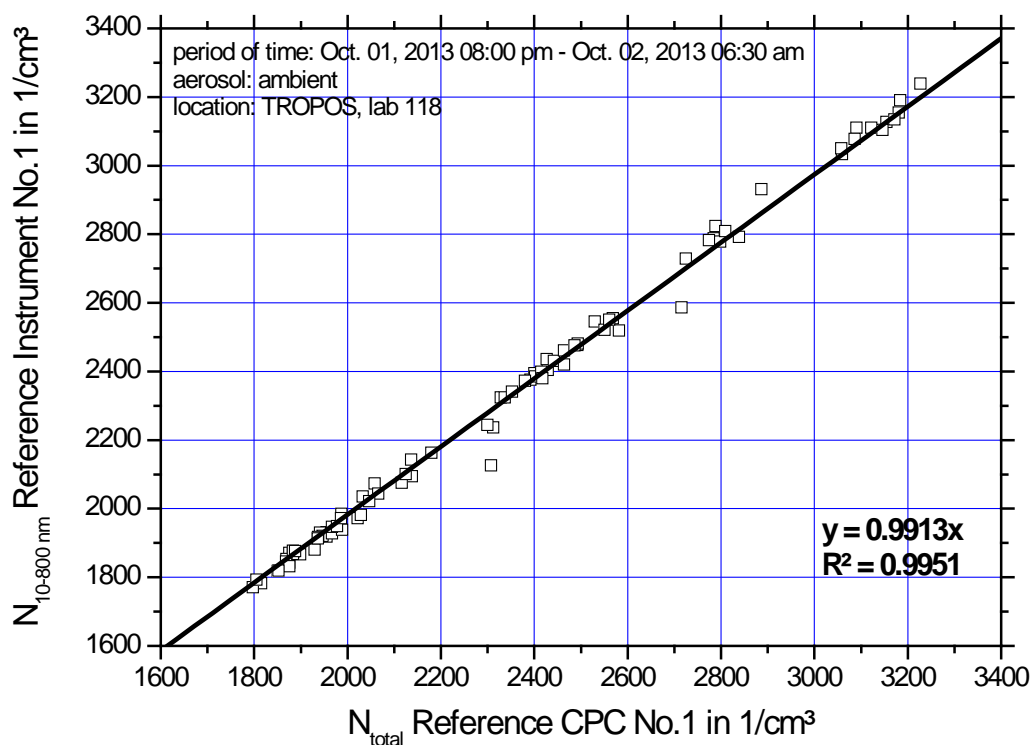


Fig.7. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No. 1. Internal diffusional losses and flow corrections were included.

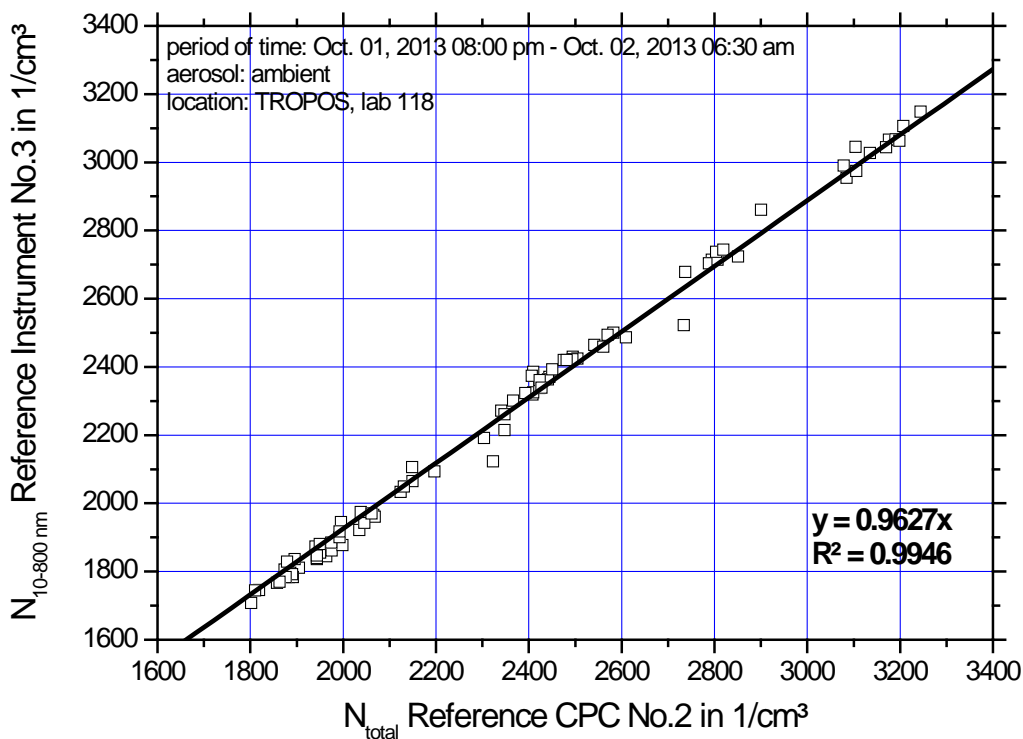


Fig.8. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusional losses and flow corrections were included.

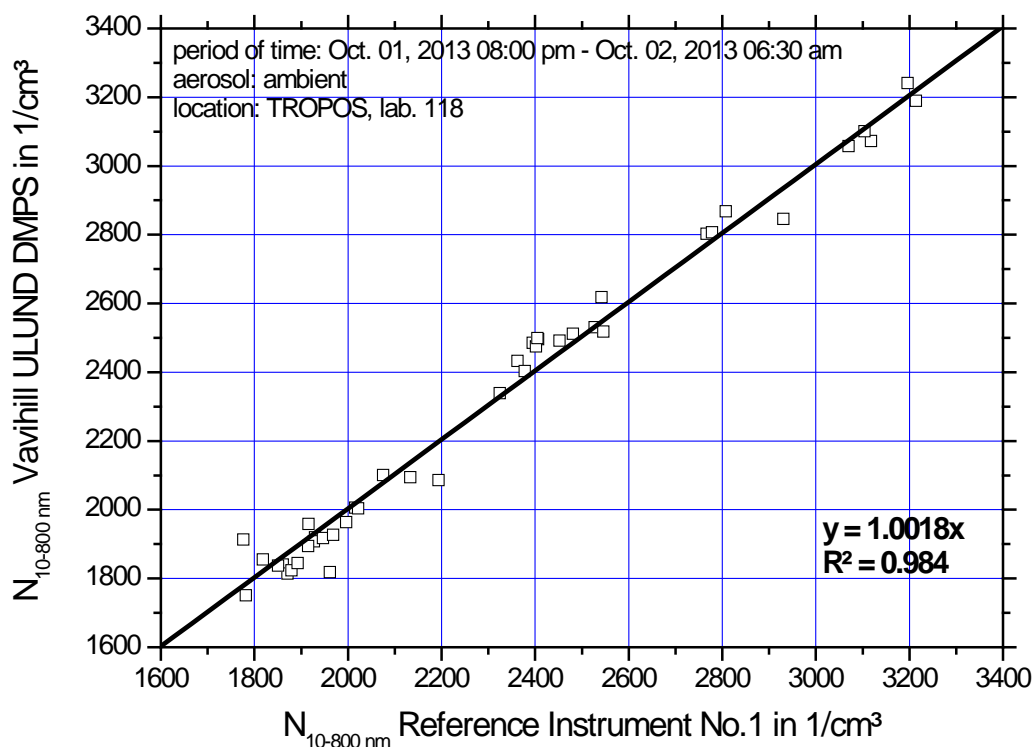


Fig.9. Linear regression between the number concentrations of TROPOS reference instrument No. 1 and Vavihill ULUND DMPS. Internal diffusional losses and flow corrections were included.

3. Size distribution

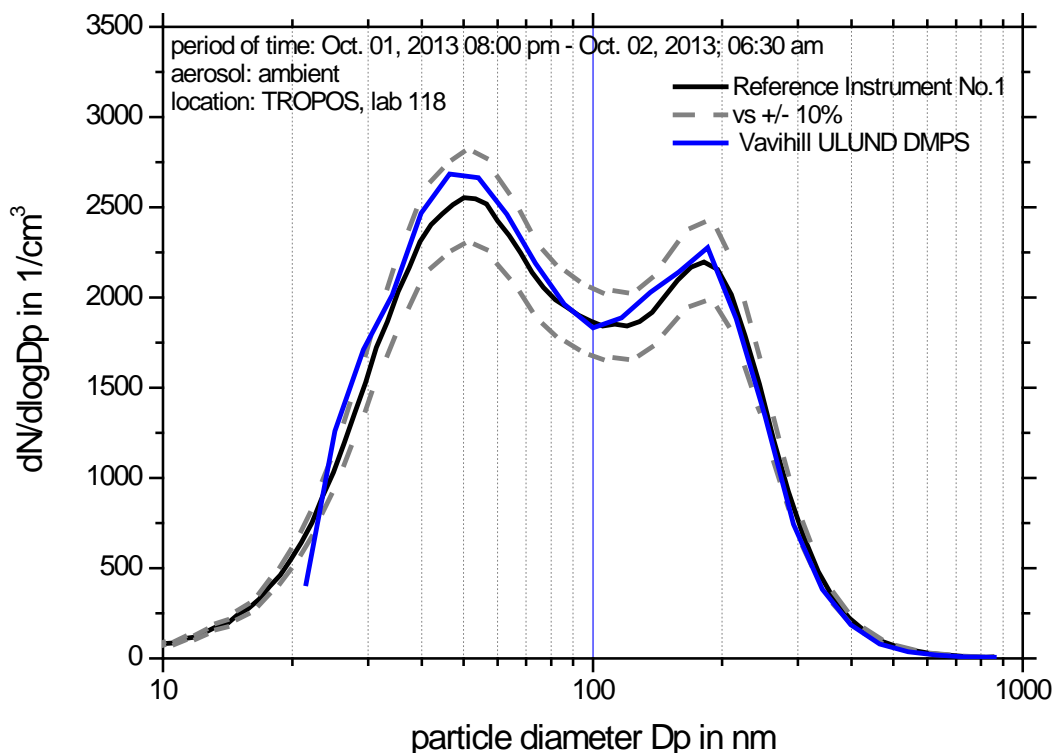


Fig.10. Comparison of mean particle number size distributions (Oct. 01, 2013 08:00 pm – 11:30 pm and Oct. 02, 2013 00:30 am – 02:30 am, 05:00 am – 06:30 am). Internal diffusional losses and CPC efficiency were included.

B: Final run

1. Time series

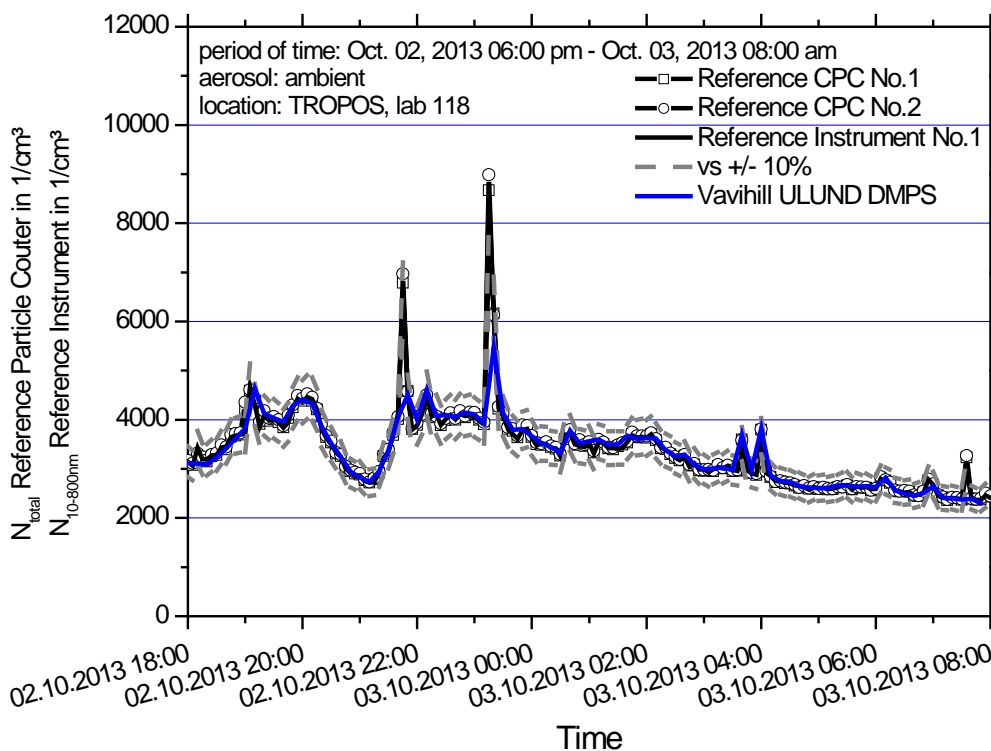


Fig.11. Time series (Oct. 02, 2013 06:00 pm – Oct. 03, 2013 08:00 am) of the integrated Particle Number Concentration ($N_{10-800\text{ nm}}$). Flow corrections were included.

3. Correlation

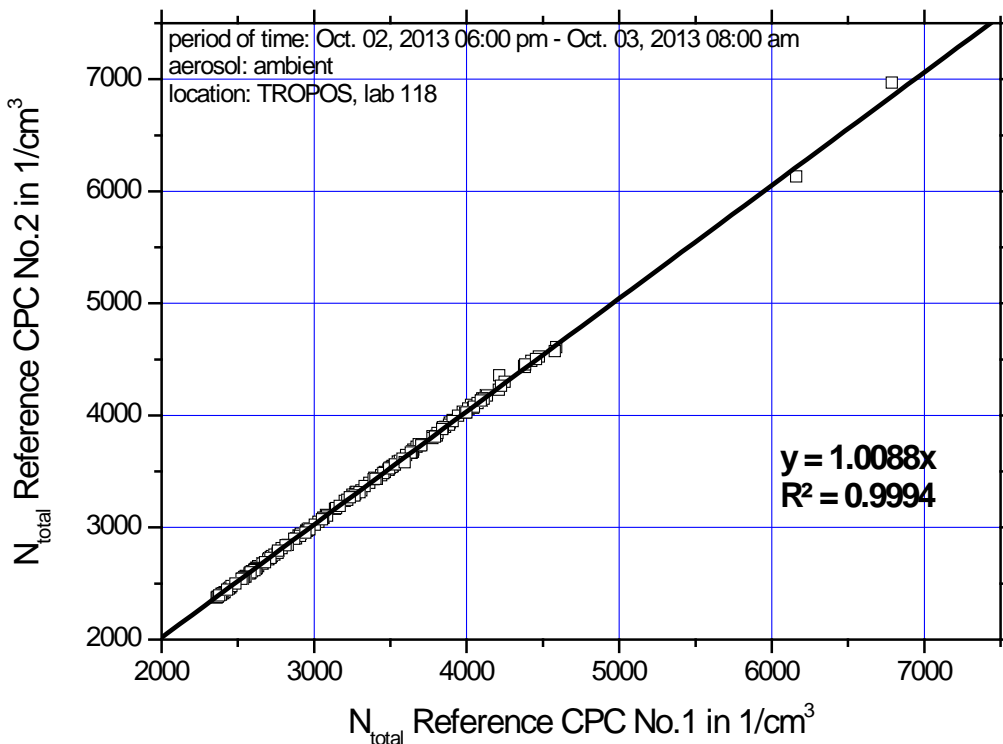


Fig.12. Linear regression between two TROPOS reference CPCs (Model 3772). Flow corrections were included.

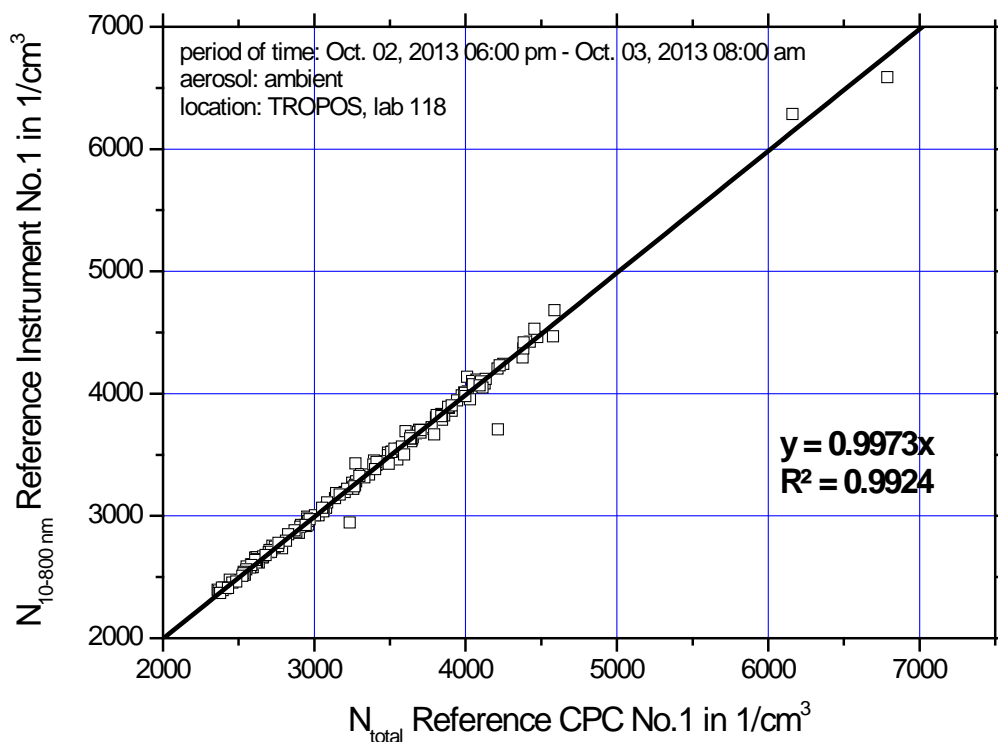


Fig.13. Linear regression between the number concentrations of the TROPOS reference CPC No. 1 and the TROPOS reference instrument No. 1. Internal diffusional losses and flow corrections were included.

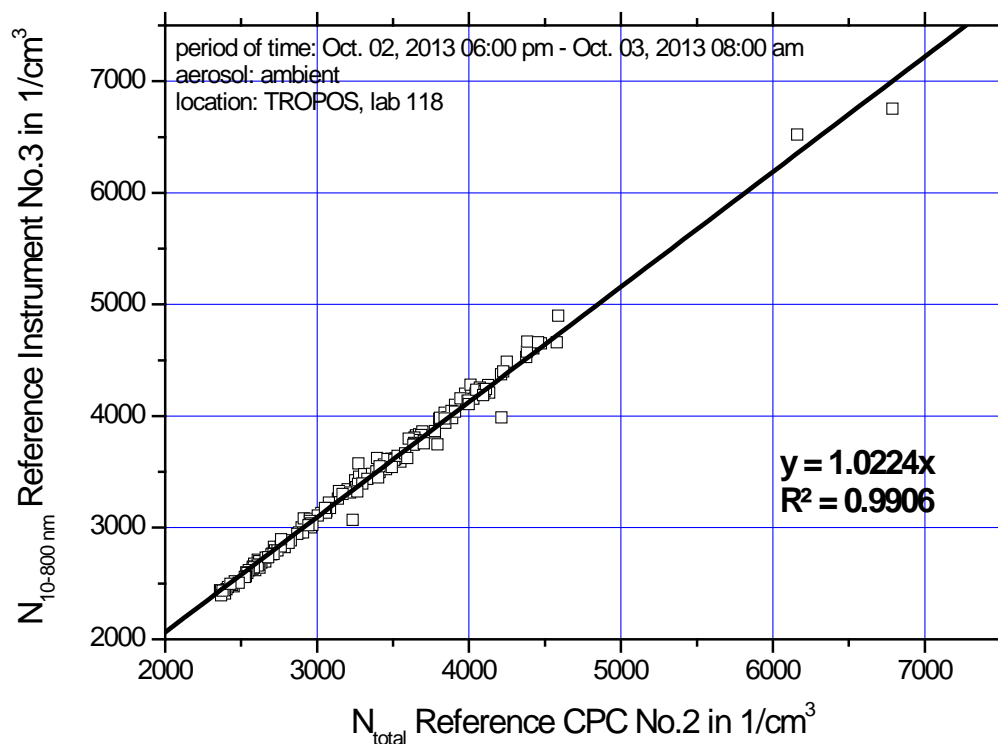


Fig.14. Linear regression between the number concentrations of the TROPOS reference CPC No. 2 and the TROPOS reference instrument No. 3. Internal diffusional losses and flow corrections were included.

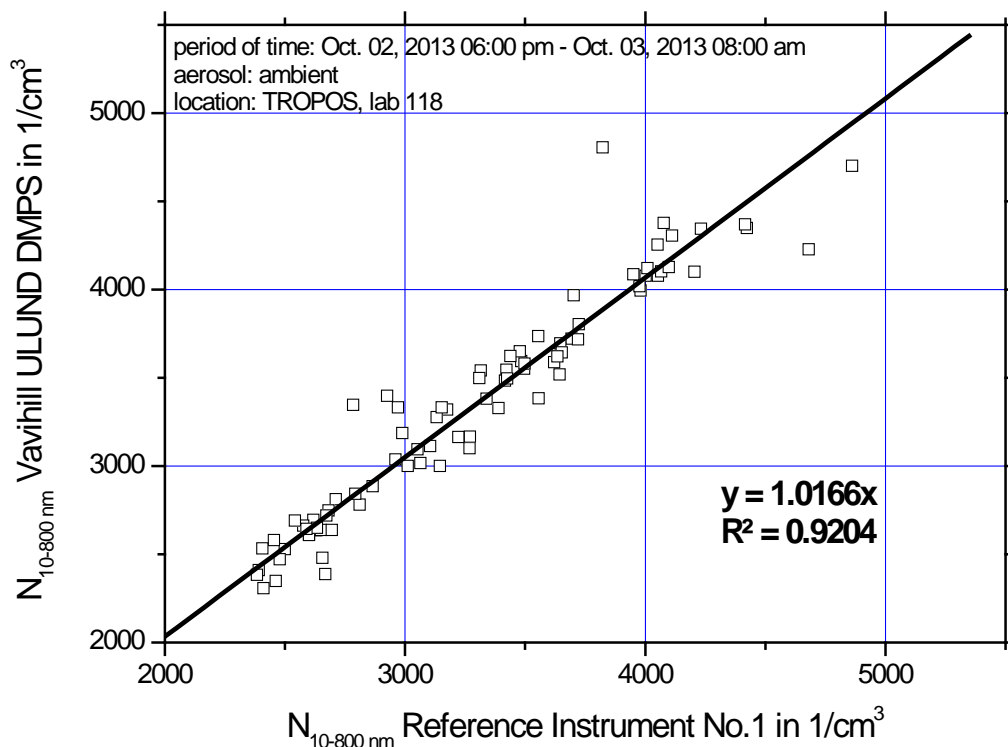


Fig.15. Linear regression between the number concentrations of the TROPOS reference instrument No.1 and Vavihill ULUND DMPS. Internal diffusional losses and flow corrections were included.

3. Size distribution

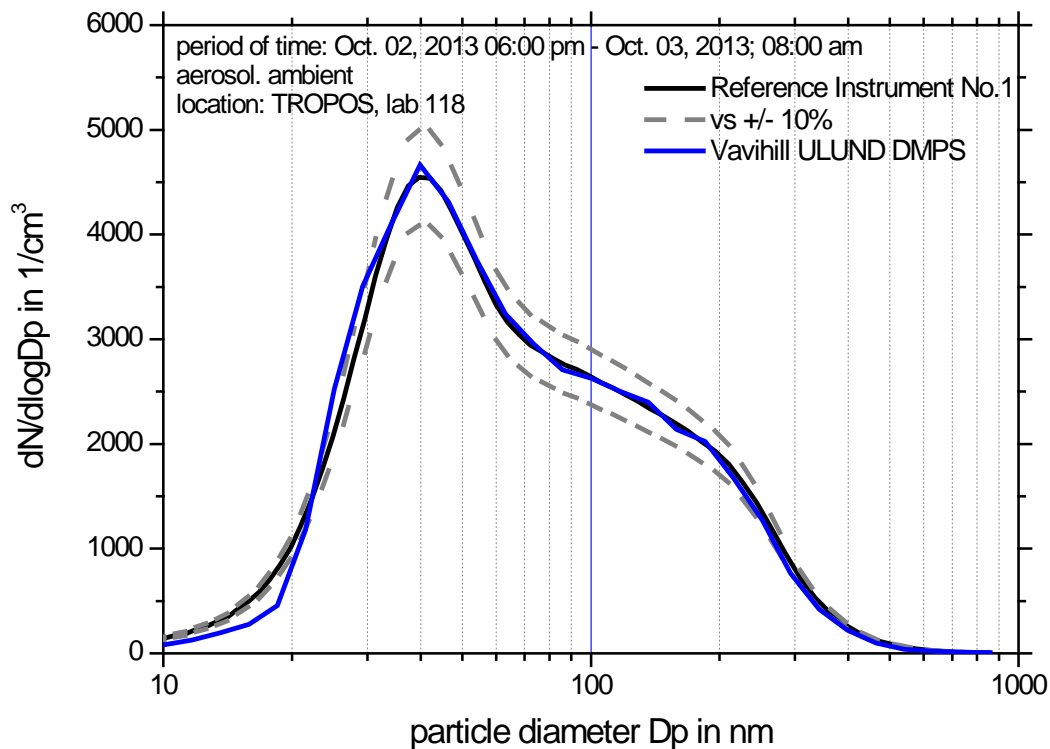


Fig.16. Comparison of mean particle number size distributions (Oct. 02, 2013 06:00 pm – Oct. 03, 2013 08:00 am). Internal diffusional losses and CPC efficiency were included.