

## Intercomparison of Mobility Particle Size Spectrometers

Project No.: OSIA-2016-1-4

### Basic information:

**Principal Investigator:** Alfred Wiedensohler

**Home Institution:** Leibniz-Institut für Troposphärenforschung  
Permoserstraße 15  
04318 Leipzig

**Participant:**

**Instrument No.1:** DE-TROPOS Eisenbahnstraße, Homemade TROPOS  
TSI CPC Model 3010, SN: 2339  
TSI UCPC Model 3025, SN: 1307

**Location of the quality assurance:** TROPOS Eisenbahnstraße

**Comparison period:** June 27, 2016 – July 06, 2016

**Last Intercomparison (with Project No.):**

### Summary of Intercomparison:

**Pre-Status:**  
The DE-TROPOS Eisenbahnstraße was not in good condition. The DMA part of the system is within the range of +/-10% of the Reference MPSS No.2. The TSI UDMA was broken.

**Final Status:**  
The DE-TROPOS Eisenbahnstraße passed the quality standards of ACTRIS and GAW.

**List of Components:**

	Specification	Reference MPSS No.2	DE-TROPOS Eisenbahnstraße
Position (Line)		onside	onside
Company		TROPOS	TROPOS
Software		TROPOS 6.1	TROPOS
CPC		TSI CPC, Model 3772	TSI CPC, Model 3010; TSI UCPC Model 3025
Flow ratio		1.0 : 5.0	1.0 : 5.0; 1.5:15
Source		Kr85	Kr85
HV cassette		positive	positive
DMA		Hauke medium	Hauke medium
Flow meas.	aerosol	✓	✓
Dryer		✓	✓
RH sensor		✓	✓
T sensor		✓	✓
RH sensor	Sheath air	✓	✓
T sensor		✓	✓
Dryer		✓	✓
p sensor		✓	

- 27.06.2016: Setup the Reference MPSS No.2 on the station including checks and calibrations.
- 27.07.2016: overnight run → pre-status
- 28.07.2016: take CPCs for CPC-Workshop to TROPOS, lab 130
- 30.07.2016: CPC-Workshop
- 30.06.2016: Check and clean the instrument and change the Nafion dryer.
- 01.07.2016: final run together the Reference MPSS No.2

**TROPOS Total CPC Status**

Instrument	Variable	Status
TROPOS Total CPC 3010, #2337	Power	good
	Laser	good
	Flow	good
	Liquid level	full

**TROPOS Reference Instrument Status**

Instrument	Variable	Status
TROPOS Reference Instrument No.2	Saturator Temp	39.0°C
	Condenser Temp	22.0°C
	Optics Temp	40.0°C
	Cabinet Temp	32.8°C
	Ambient Pressure	97.7 kPa
	Orifice Pressure	70.8 kPa
	Nozzle Pressure	2.8 kPa
	Laser Current	53 mA

**DE-TROPOS Eisenbahnstraße Status**

Instrument	Variable	Status
TROPOS Total CPC 3010, #2339	Power	good
	Laser	good
	Flow	good
	Liquid level	full

## Pre-Status of the Candidate (June 27<sup>th</sup> – June 28<sup>th</sup>)

### Components and zero check

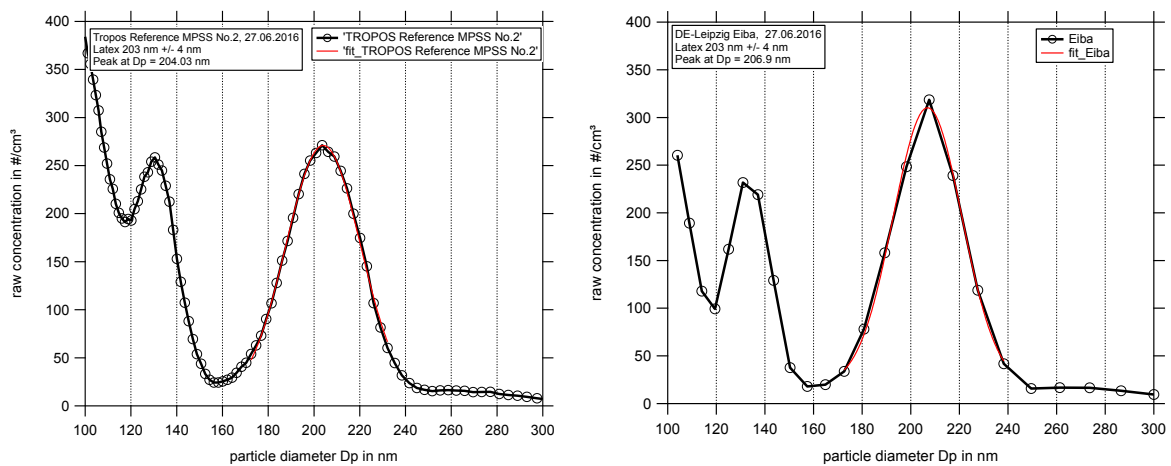
Instrument	Line	Flow		Zero	
TROPOS Reference MPSS No.2		1.015	l/min	0	# cm <sup>-3</sup>
TROPOS Total CPC 3010, #2337		1.015	l/min	0	# cm <sup>-3</sup>
DE-TROPOS Eiba (total)		2.495	l/min	0	# cm <sup>-3</sup>
DE-TROPOS Eiba (UCPC)		1.452	l/min	0	# cm <sup>-3</sup>
DE-TROPOS Eiba (CPC)		0.98	l/min	0	# cm <sup>-3</sup>

### High voltage calibration

Instrument	[V]	0 V	4 mV	80 mV	800 mV
TROPOS Reference MPSS No.2	final	0.0	4.9	99.8	1000
DE-TROPOS Eiba	final	0.0	6.2	101.9	1002

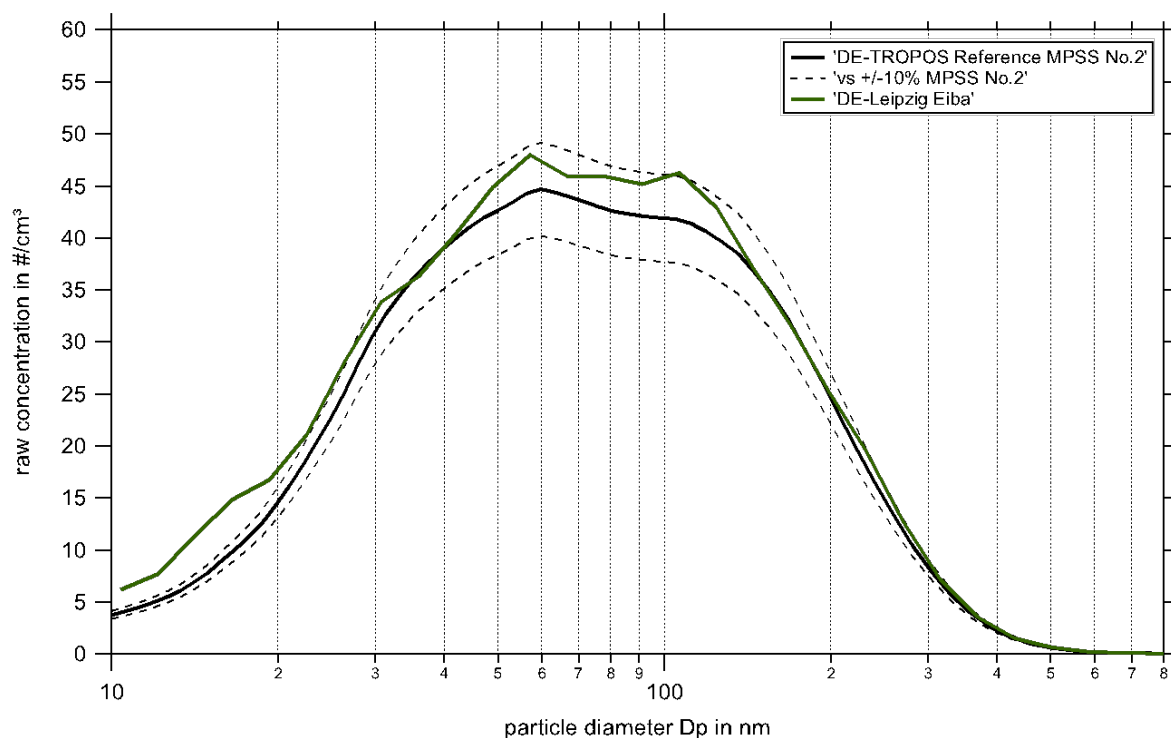
### Latex 203nm ±4nm (pressure 988 hPa, 23.0°C)

Instrument	Latex 203 [nm]	slope
TROPOS Reference MPSS No.1	204.03	5.05
DE-TROPOS Eiba	206.9	-



**Figure 01:** Measurement of latex 203 nm: Particle size distribution (raw concentration) for latex 203 nm on June 27<sup>th</sup>, 2016.

### Particle Number Size Distribution



**Figure 02:** Raw-Comparison of mean particle number size distribution of TROPOS Reference MPSS No.2 against DE-TROPOS Eisenbahnstraße from June 27, 2016 06:00 pm until June 28, 2016 06:00 am. Multiple charge correction, internal diffusion losses and CPC efficiency are included for both of the TROPOS Reference MPSS.

### Final-Status of the Candidate (July 01<sup>th</sup> – July 06<sup>th</sup>)

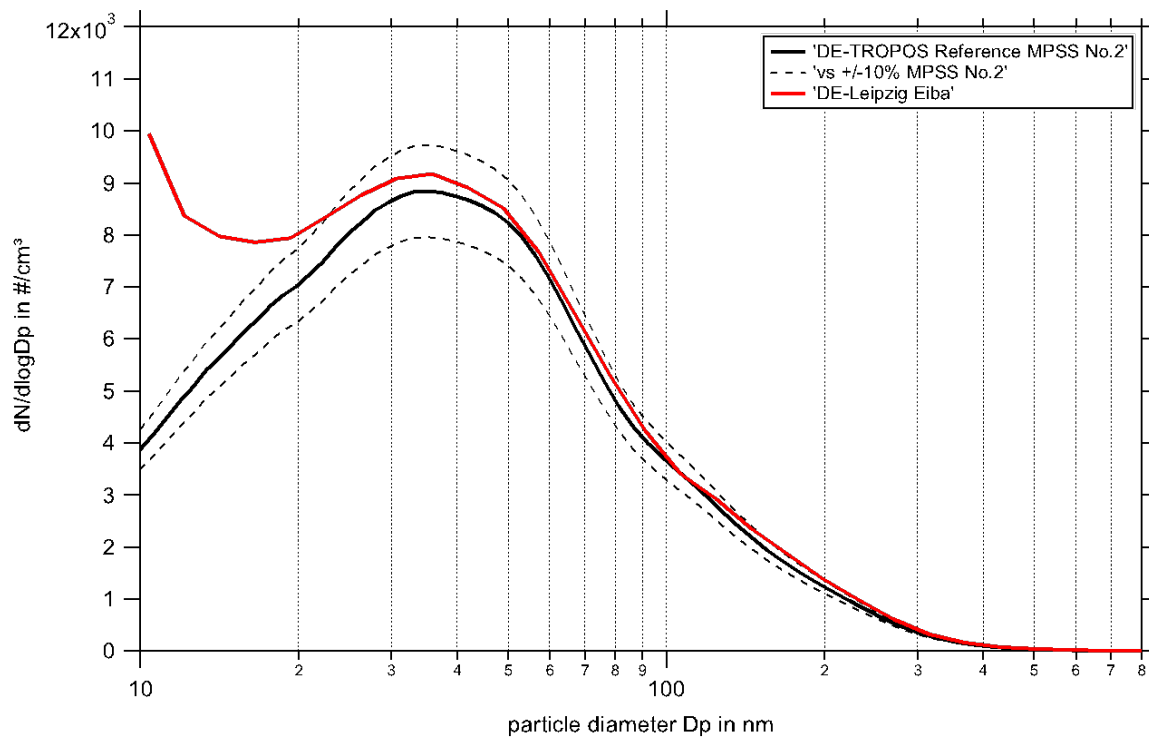
#### Components and zero check

Instrument	Line	Flow		Zero	
TROPOS Reference MPSS No.2		1.015	l/min	0	# cm <sup>-3</sup>
TROPOS Total CPC 3010, #2337		1.015	l/min	0	# cm <sup>-3</sup>
DE-TROPOS Eiba (total)		1.001	l/min	0	# cm <sup>-3</sup>
DE-TROPOS Eiba (UCPC)		-	l/min	0	# cm <sup>-3</sup>
DE-TROPOS Eiba (CPC)		1.009	l/min	0	# cm <sup>-3</sup>

#### High voltage calibration

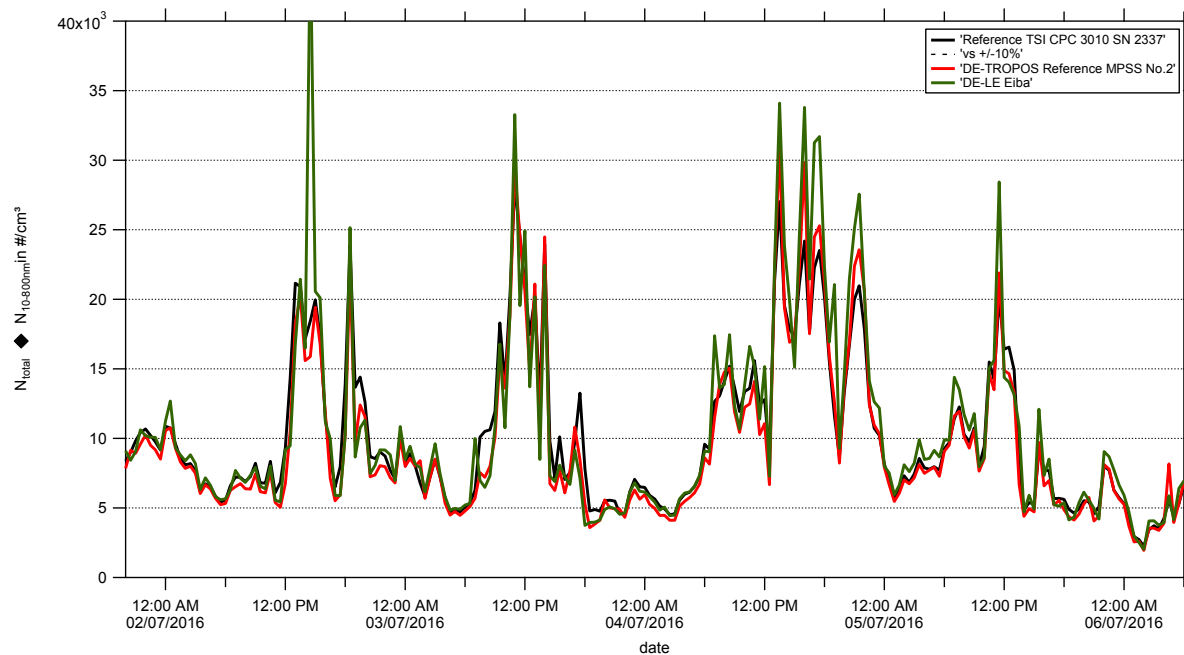
Instrument	[V]	0 V	4 mV	80 mV	800 mV
TROPOS Reference MPSS No.2	final	0.0	5.01	99.9	1000
DE-TROPOS Eiba	final	0.0	6.1	101	1001

### Particle Number Size Distribution



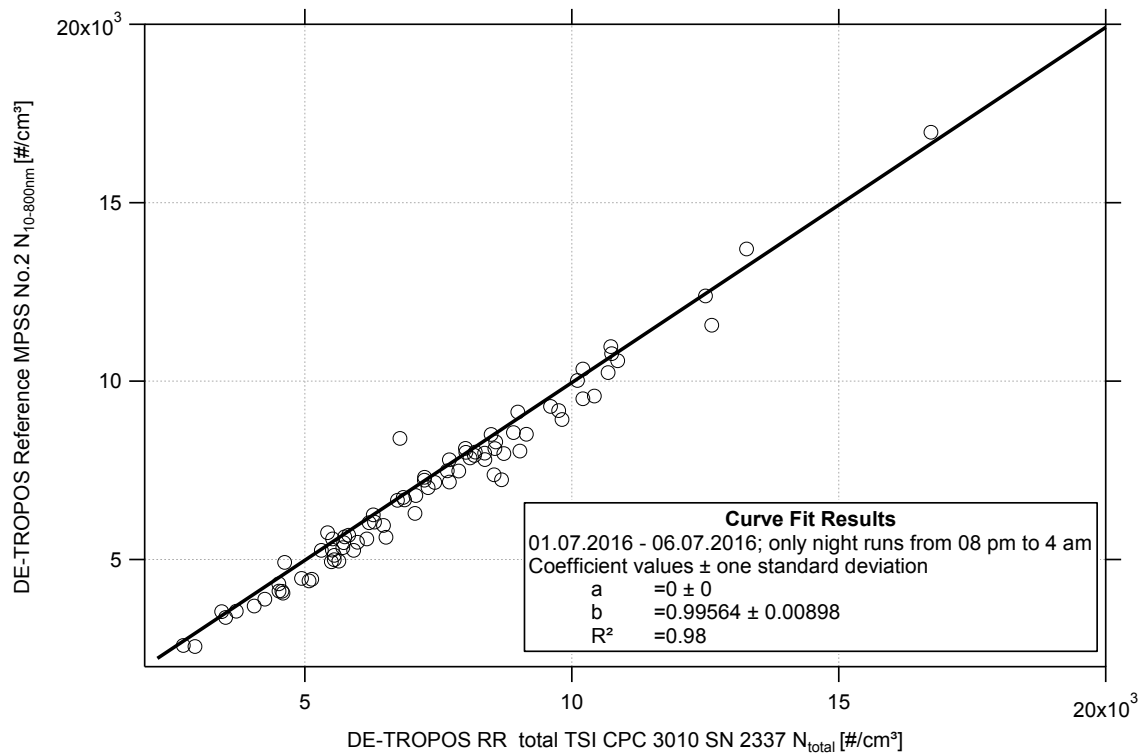
**Figure 03:** Comparison of mean particle number size distribution of TROPOS Reference MPSS No.2 against DE-TROPOS Eisenbahnstraße from July 01, 2016 08:00 pm until July 06, 2016 06:00 am. Multiple charge correction, internal diffusion losses and CPC efficiency are included for both of the TROPOS Reference MPSS.

### Time Series

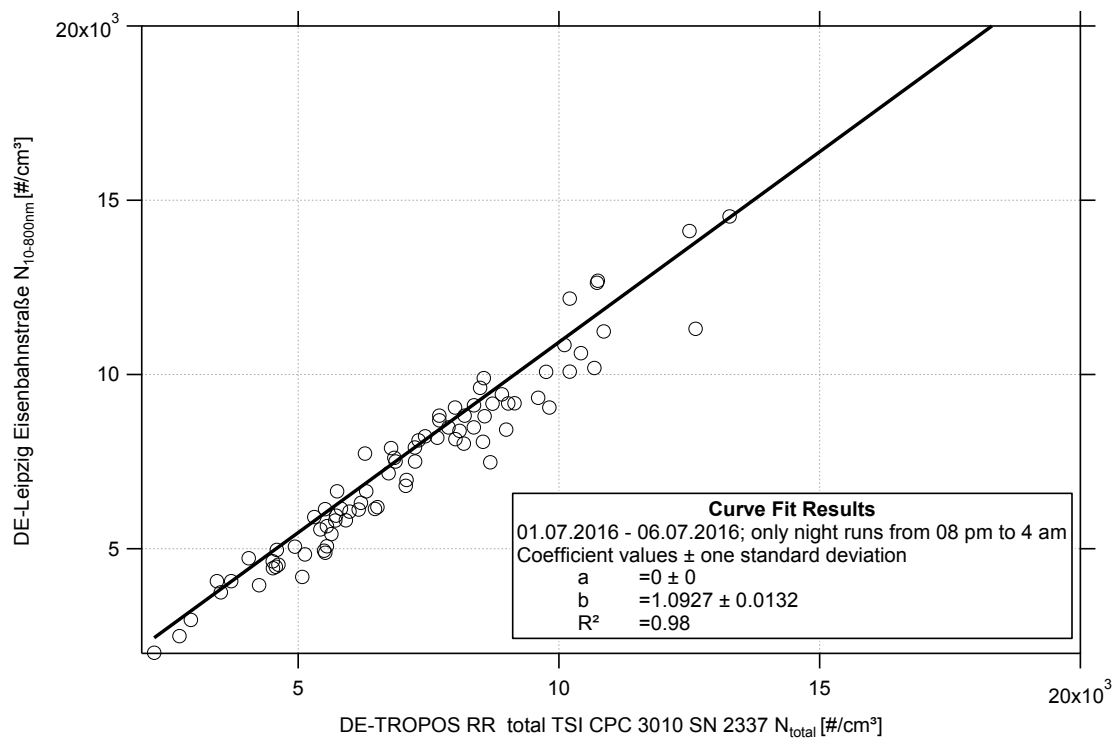


**Figure 04:** Time series (July 01, 2016 06:00 pm – July 06, 2016 06:00 am) of the integrated particle number concentration ( $N_{10-800nm}$ ) of the MPSS and total number concentration ( $N_{total}$ ) of the reference TSI-CPC Model 3010. The inversion was performed using TROPOS software. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

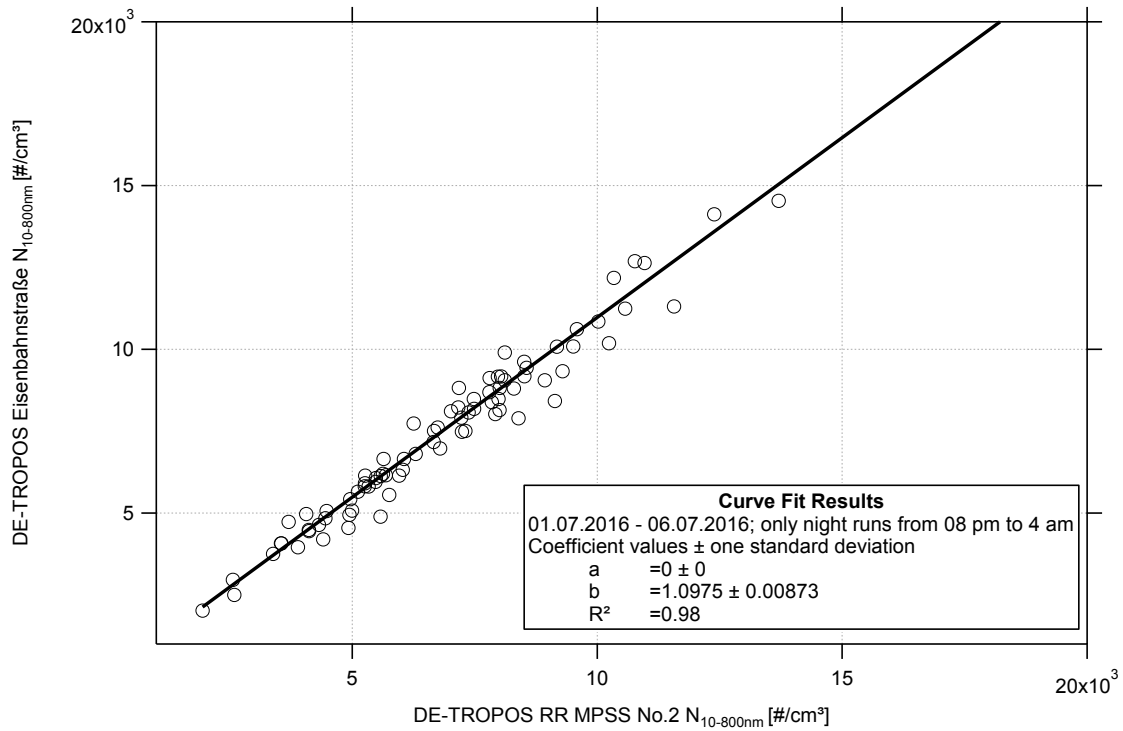
**Correlation: 01.07. – 06.07.2016; only night runs from 08 pm to 04 am**



**Figure 05:** Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and TROPOS Reference MPSS No.2. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

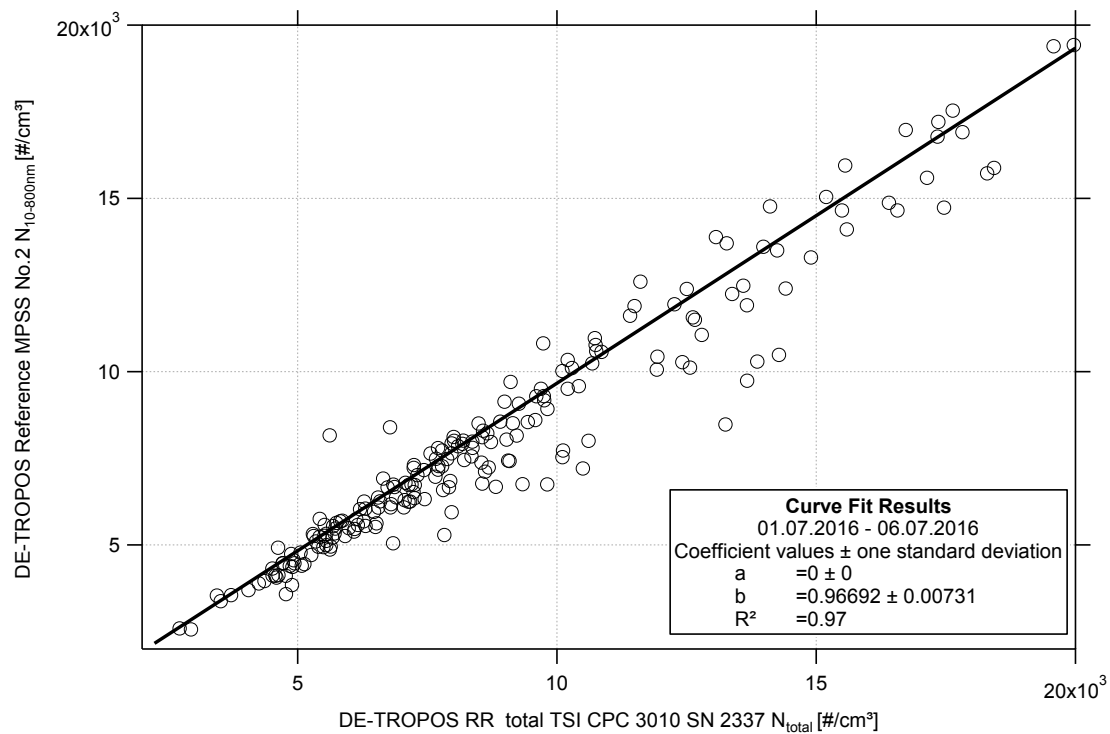


**Figure 06:** Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and DE-TROPOS Leipzig Eisenbahnstraße. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.



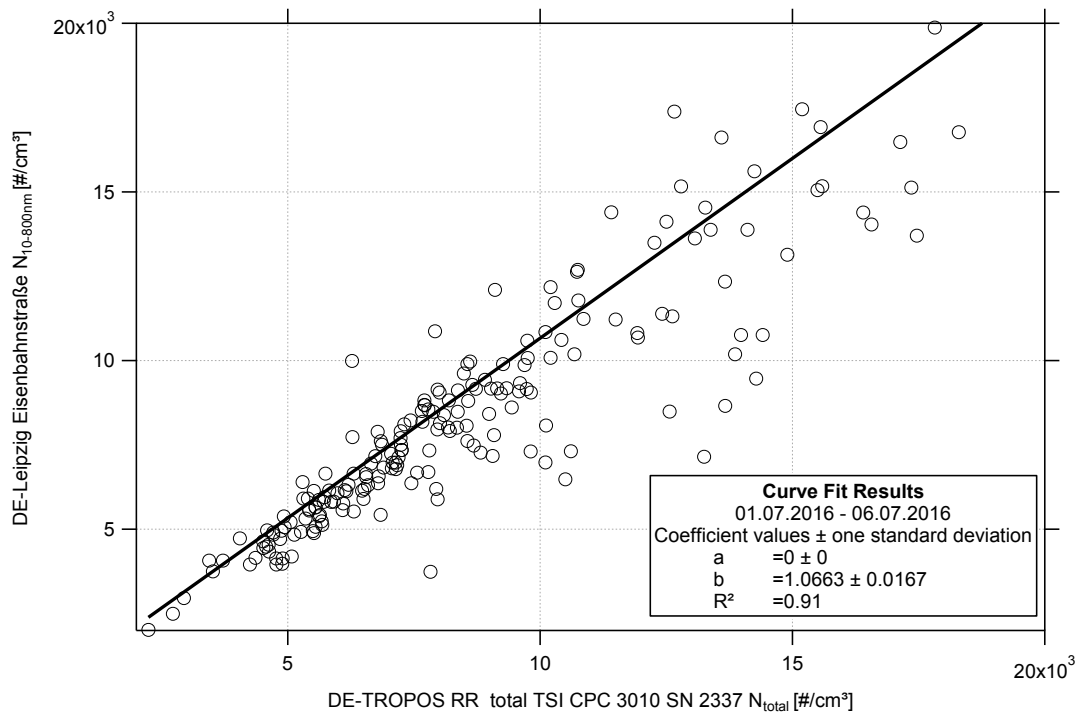
**Figure 08:** Linear regression between the number concentrations of the TROPOS Reference MPSS No.2 and DE-TROPOS Eisenbahnstraße. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.

**Correlation: 01.07. – 06.07.2016**

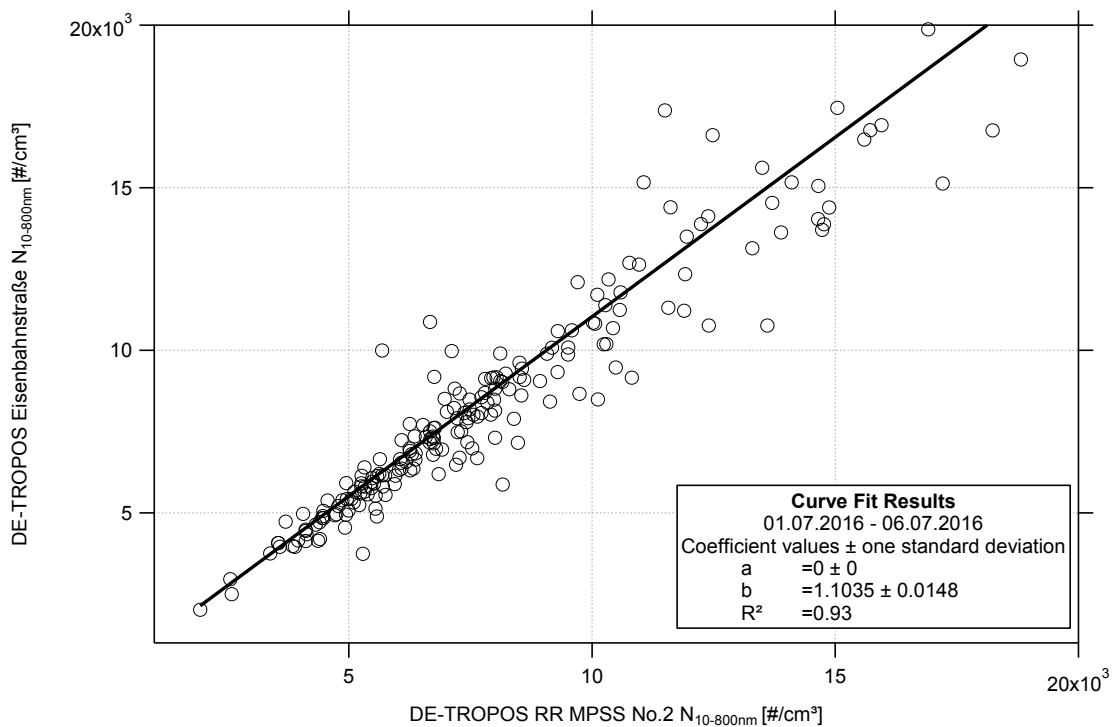


**Figure 09:** Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and TROPOS Reference MPSS No.2. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.





**Figure 10:** Linear regression between the number concentrations of the TROPOS Reference TSI CPC Model 3010 SN: 2337 and DE-TROPOS Leipzig Eisenbahnstraße. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.



**Figure 11:** Linear regression between the number concentrations of the TROPOS Reference MPSS No.2 and DE-TROPOS Eisenbahnstraße. Multiple charge correction, internal diffusion losses and CPC flow corrections are included.