Intercomparison of Condensation Particle Counter

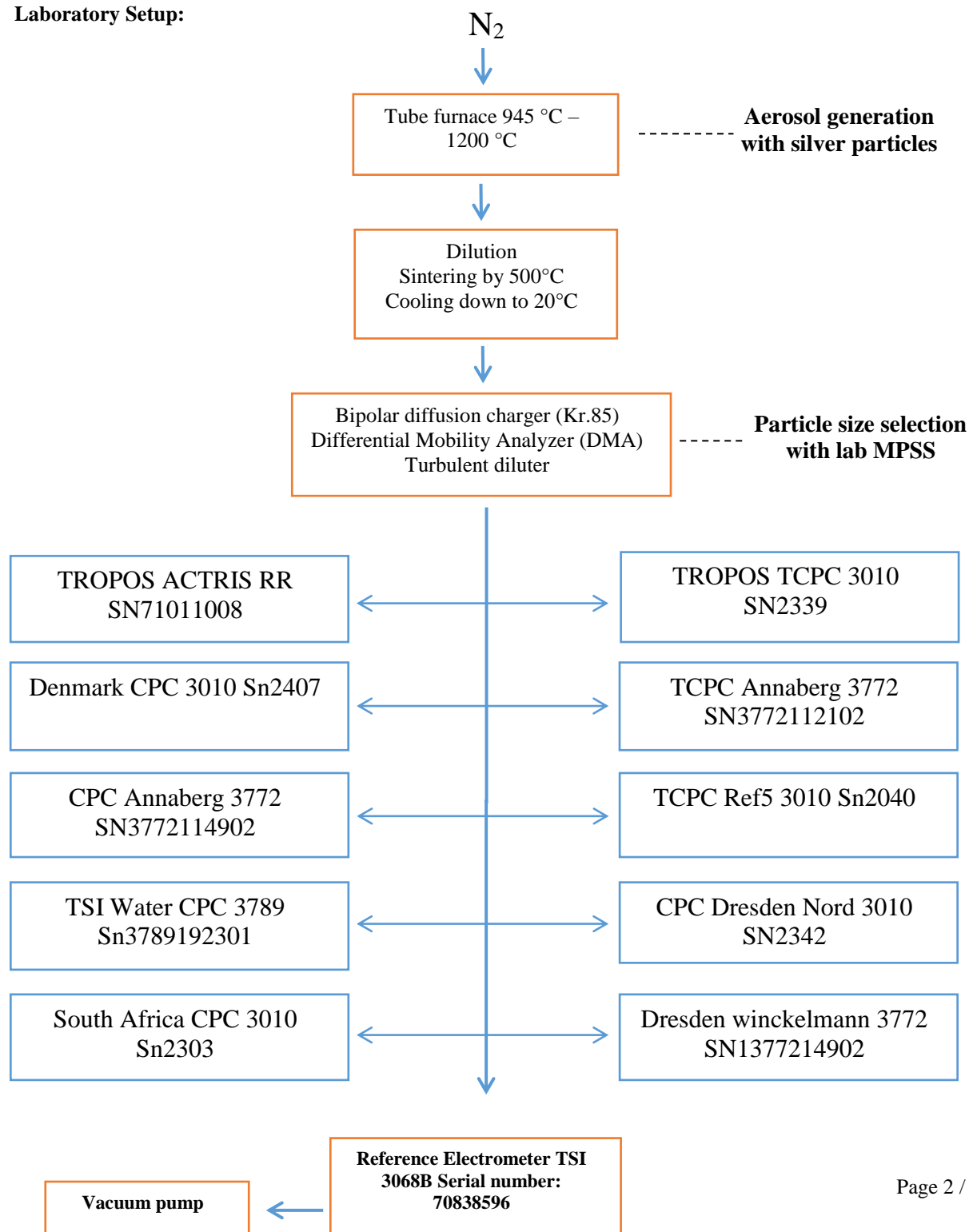|	
Project No.:	*CPC-2019-3-17*
Principal Investigator:	Kay Weinhold
Home Institution:	TROPOS
Participant:	–
Candidate:	T-CPC Ref5
Counter (SN):	*TSI CPC Model 3010 SN2040*
Location of the quality assurance:	TROPOS Leipzig, lab 130
Comparison period:	July 12, 2019
Last Intercomparison (with Project No.):	
TROPOS Reference Instrument:	Electrometer: TSI model 3068B #70838596, Last calibration in September 2018
Additional Equipment:	Bubble flow meter 'Gilibrator', Gilian (Sensidyne) #1711008-S, Last calibration in January 2018

Summary of Intercomparison

Status:
The candidate passed the quality standards of ACTRIS and GAW. The candidate reached 100% efficiency at 40 nm. The Dp50 is at 10.3 nm. The CPC efficiency curve corresponds to the standard of ACTRIS and GAW.

Laboratory Setup:

N_2

Tube furnace 945 °C – 1200 °C - - - - - - - - **Aerosol generation with silver particles**

Dilution
Sintering by 500°C
Cooling down to 20°C

Bipolar diffusion charger (Kr.85)
Differential Mobility Analyzer (DMA)
Turbulent diluter - - - - - - **Particle size selection with lab MPSS**

TROPOS ACTRIS RR SN71011008	TROPOS TCPC 3010 SN2339
Denmark CPC 3010 Sn2407	TCPC Annaberg 3772 SN3772112102
CPC Annaberg 3772 SN3772114902	TCPC Ref5 3010 Sn2040
TSI Water CPC 3789 Sn3789192301	CPC Dresden Nord 3010 SN2342
South Africa CPC 3010 Sn2303	Dresden winckelmann 3772 SN1377214902

Reference Electrometer TSI 3068B Serial number: 70838596

Vacuum pump

Date of arrival of instrument in calibration lab: *July 12, 2019*
Instrument: *Condensation Particle Counter*
Model and serial number of instrument: *CPC 3010 S/N 2040*

Result of physical inspection: *no damages*
Result of functional test: *functional test successful*

Internal parameters of instrument   *nominal flow rate 1.0 l/min*

Model and identification number of
aerosol electrometer: *TSI Electrometer Model 3068, S/N 70838596*

Electrometer calibration certificate: *September 05, 2018, calibrated at PTB Braunschweig*

Corrections of electrometer, for instance,
differing flow rate: *Within tolerance range (+/-2%); reference: 4.0 l/min, measured: 3.970 l/min*

Software for recording: *LabView 2010; National Instruments; Program „LabCount.vi"*

Date of calibration: *July 12, 2019*
Lab temperature and pressure: *23°C, 996.08mbar*
Measured aerosol flow rate of CPC: *1.024 l/min*
Uncertainty in measured flow rate: *3%*
Flowmeter used: *Gilian Gilibrator V; S/N 1711008-S, January, 2018*

Particles and gases used for calibration: *silver particles and nitrogen*
Method of particle generation: *tube furnace generator*
Zero measurement of instrument: *0 particles/cm³ in 5 minutes*

Results (using pulse output):

Particle size (nm)	*40*	*30*	*20*	*15*	*12*
Number concentration (cm-3)	1128	1560	1607	1453	740
Counting efficiency η	*1.00*	*1.00*	*0.99*	*0.92*	*0.69*
Particle size (nm)	*10*	*09*	*08*	*07*	*06*
Number concentration (cm-3)	585	428	170	47	1
Counting efficiency η	*0.45*	*0.27*	*0.13*	*0.03*	*0.00*
Particle size (nm)	*40*				
Number concentration (cm-3)	1110				
Counting efficiency η	*1.01*				

Special Information regarding to the Candidate:

Was it necessary to:	yes/no	information
do a second run	no	-
clean the optics	no	-
clean the nozzle	no	-
clean the saturator	no	-
change the wick	no	-
change the laser	no	-
change internal settings	no	-

The plot legend reads:

date: July 12, 2019
participant: **TCPC Ref5**
CPC Model: TSI 3010 #2040

$$f(x) = A\left(1 - e^{\left(\frac{B-x}{C-B}ln2\right)}\right)$$

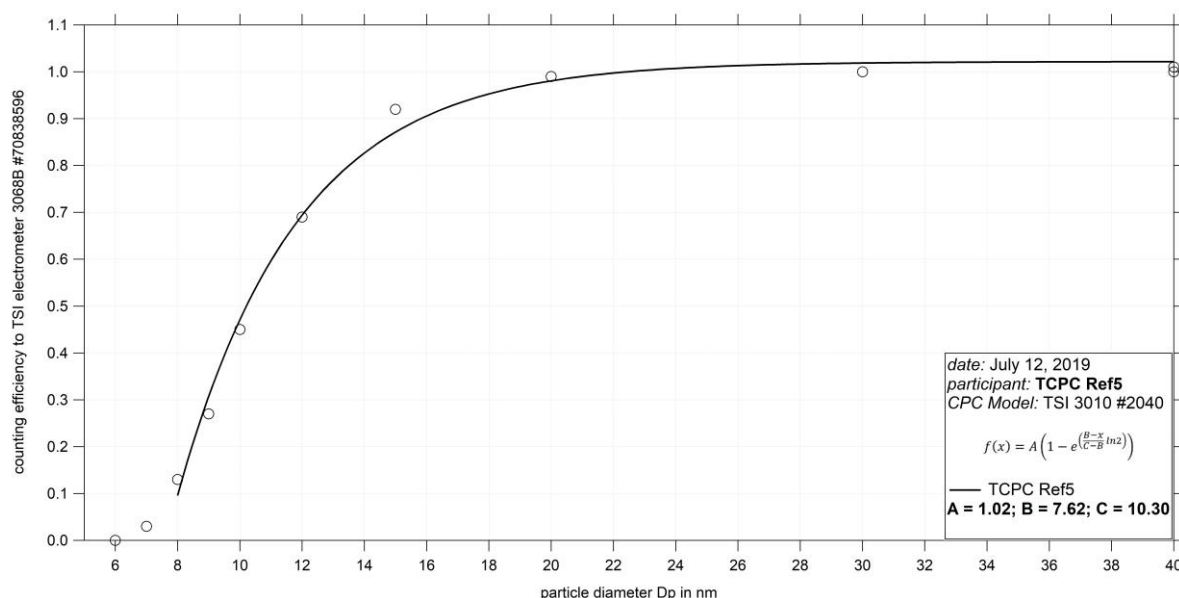—— TCPC Ref5
A = 1.02; B = 7.62; C = 10.30

Fig. 1: Counting efficiency for TCPC Ref5 3010 SN2040 against aerosol electrometer 3068 SN 70838596; silver particles between 6 and 40 nm were used for calibration; the calculated Dp50 is 10.3 nm.

Status information:

Status	T SAT	T CON	T OPT	T CAB	P AMB
from display	-	-	-	-	-
Status	**P OR**	**P NO**	**Laser**	**LV**	**flow**
from display	-	-	-	full	1.024

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Reviewed: TROPOS / Kay Weinhold   Page 4 / 4

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