World Calibration Centre
for Aerosol Physics

Leibniz Institute for
Tropospheric Research

Project No.	**CPC-2022-WCCAP-134**
CPC Model:	TSI CPC 3772
CPC Serial Number:	SN37721600801
Customer:	Lund University, Adam Kristensson
Description:	Calibration of a Condensation Particle Counter
Date of Calibration:	February 10, 2022

Summary of Intercomparison:

The candidate passed the quality standards of ACTRIS and GAW with respect the known limitations of this CPC (typical counting efficiency 5% lower than 1). The candidate reached 94% efficiency at 40 nm. The Dp50 is at 6.55 nm.

Certificate / Reference: WCCAP

Date of issue:	February 12, 2022	Signature	
Reviewed by:	TROPOS	Name:	Dr. Thomas Tuch

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	Unit	Status
Participant		TSMPS Lund
CPC Model		TSI 3772 SN37721600801
Firmware		
Manufacture date		2016
Last service date		
Arrival date		
Software Version		Labcount 2021
Saturator Temperature	°C	39
Condenser Temperature	°C	22.0
Optics Temperature	°C	40
Cabinet Temperature	°C	35.1
Ambient Pressure	mbar	1025
Vaccuum Pressure	kPa	
Inlet Pressure	kPa	99.7
Critical Orifice Pressure	kPa	71.6
Aerosol Nozzle Pressure	kPa	Sensor not working
Laser Current	mA	39
Liquid Level		full
Aerosol Flow	L/min	0.97
Zero	avg 10 min	0
Physical inspection		ok
Functional test		ok

Table 1. Diagnostic information of candidate

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Aerosol electrometer	TSI Electrometer Model 3068, SN 70838596
Particles and gases used for calibration	silver particles and nitrogen
Method of particle generation	tube furnace generator
Electrometer calibration certificate	September, 2021, calibrated at PTB Braunschweig
Corrections of electrometer (i.e. differing flow rate)	Within tolerance range (+/-2%); reference: 4.0 l/min, measured: 4.0 l/min
Logging software	LabView 2021; National Instruments; Program „LabCount.vi“
Uncertainty in measured flow rate	3%
Flowmeter used	Gilian Gilibrator 3; SN 21181001005, 2021
Lab Tempreature and Pressure	23.0°C, 1006 mbar

Table 2. Calibration and laboratory conditions

Diameter	EL 3068B (#/cm3)	Pulse Output	
		Concentration (#/cm3)	Efficiency (µ)
40nm	1235.24	1164.66	0.943
30nm	4328.53	4041.32	0.934
20nm	3568.68	3311.49	0.928
14nm	2065.86	1843.14	0.892
11nm	2423.35	1969.38	0.813
10nm	1781.89	1372.70	0.770
9nm	1135.68	805.22	0.709
8nm	1211.99	755.16	0.623
7nm	1572.52	805.55	0.512
6nm	1579.50	630.96	0.399

Table 3. Efficiency of candidate CPC per diameter against the Electrometer

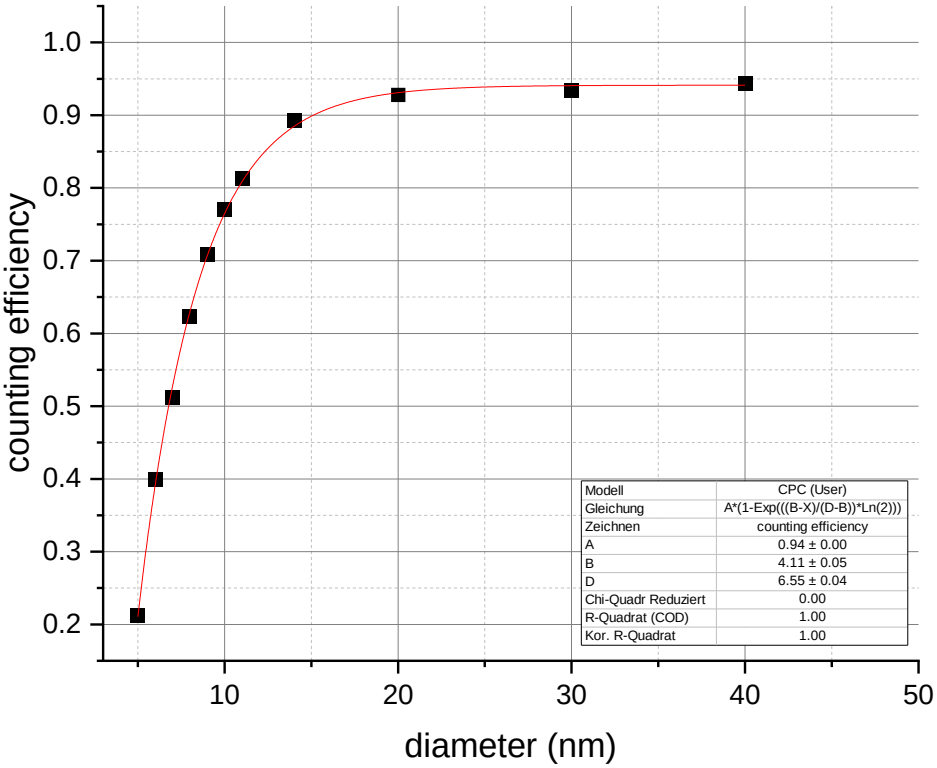

Fig. 1. Counting efficiency of candidate CPC SN37721600801 against aerosol electrometer 3068 SN 70838596; silver particles between 5 nm and 40 nm were used for calibration. Parameter A describes the plateau efficiency, parameter B the intersection of the fit curve with the diameter axis (0% counting efficiency) and parameter D is the calculated Dp_{50} for this fit at 6.55 nm.

Reference CPC TSI 3750 SN3750213905	Candidate CPC TSI 3772 SN37721600801	Efficiency (μ)
1039.9	1039.6	0.997
1500.1	1504.3	1.003
2001.2	2010.3	1.005
2500.1	2516.0	1.006
2999.9	2989.6	0.997
3500.4	3448.7	0.985
3990.5	3986.6	0.999
4510.0	4374.2	0.970
5076.7	5039.4	0.993
5988.4	5998.1	1.002

Table 3. Efficiency of candidate CPC per concentration against the WCCAP reference CPC using ambient air to cover the whole size spectrum of the ambient particle number size distribution.

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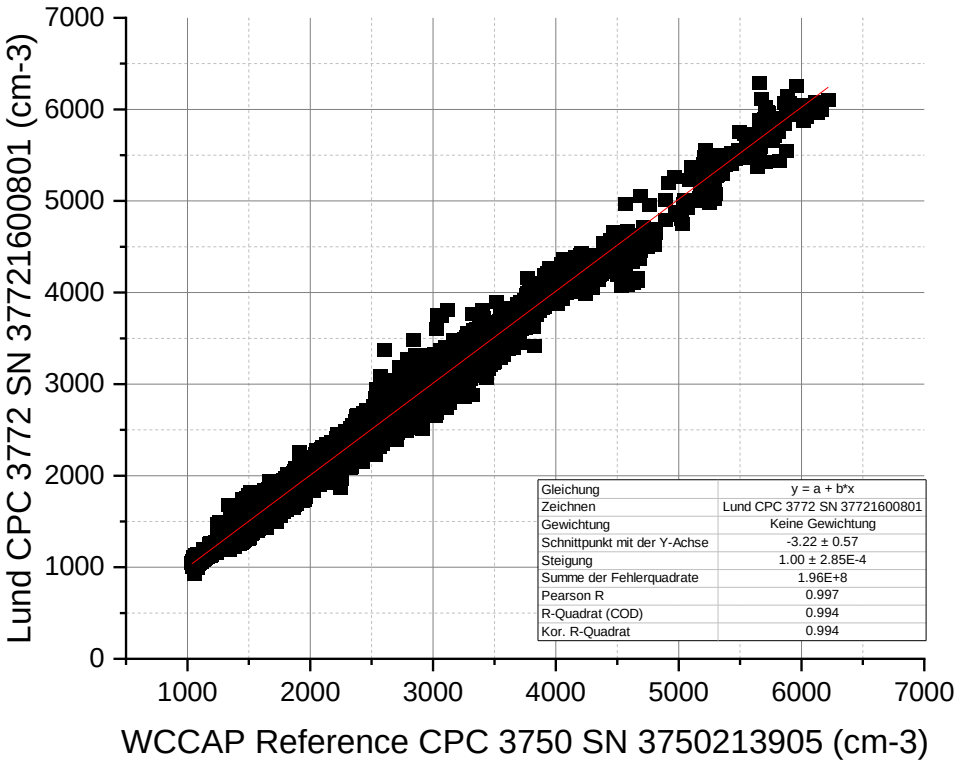

Fig. 2. Linearity for candidate CPC against WCCAP Reference CPC 3750 used as secondary reference; ambient air. This approach has been chosen to demonstrate that the performance of the candidate CPC is identical to the WCCAP reference CPC for all particle sizes in ambient air.

Date of issue:	*February 10, 2022*
Reference:	TSI electrometer, model 3068, SN 70838596
Secondary reference:	TSI CPC, model 3750, SN3750213905
Reviewed:	TROPOS/Dr. Thomas Tuch

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