



World Calibration Centre  
for Aerosol Physics



Leibniz Institute for  
Tropospheric Research

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**Project No.** CPC-2021-1-14

**CPC Model:** TSI CPC 3750

**CPC Serial Number:** SN3750193301

**Customer:** UBA Waldhof - TCPC

**Description:** Calibration of a Condensation Particle Counter

**Date of Calibration:** November 10, 2021

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### Summary of Intercomparison:

The candidate passed the quality standards of ACTRIS and GAW. The candidate reached 101% efficiency at 40 nm. The Dp50 is at 9.53 nm. The CPC efficiency curve corresponds to the standard of ACTRIS and GAW.

Certificate / Reference: WCCAP

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Date of issue:	November 10, 2021	Signature
Reviewed by:	TROPOS	Name: Dipl.-Met. Kay Weinhold

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Table 1. Diagnostic information of candidate

	Unit	Status
Participant		Waldhof TCPC 3750193301
CPC Model		TSI 3750
Firmware		2.0.4
Manufacture date		
Last service date		
Arrival date		
Software Version		
Saturator Temperature	°C	39
Condenser Temperature	°C	24.4
Optics Temperature	°C	40
Cabinet Temperature	°C	24.2
Ambient Pressure	mbar	101.1
Vacuum Pressure	kPa	68.1
Inlet Pressure	kPa	0.1
Critical Orifice Pressure	kPa	65.8
Aerosol Nozzle Pressure	kPa	2.38
Laser Current	mA	43
Liquid Level		full
Aerosol Flow	L/min	0.97
Zero	avg 10 min	0
Physical inspection		ok
Functional test		ok



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Table 2. Calibration and laboratory conditions

	Information
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 2010; National Instruments; Program „LabCount.vi“
Uncertainty in measured flow rate	3%
Flowmeter used	Gilian Gilibrator 3; SN 21181001005, 2021
Lab Temperature and Pressure	23.0°C, 1018 mbar



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Table 2. Efficiency of candidate CPC per diameter against the Electrometer

Diameter	EL 3068B (#/cm <sup>3</sup> )	Pulse Output		Internal Output		Internal/ Pulse
		Concentration (#/cm <sup>3</sup> )	Efficiency ( $\mu$ )	Concentration (#/cm <sup>3</sup> )	Efficiency ( $\mu$ )	
40nm	1592	1595	1.00	1624	1.02	1.02
30nm_2	1369	1378	1.01	1394	1.02	1.01
30nm	1211	1222	1.01	1245	1.03	1.02
20nm	1216	1190	0.98	1207	0.99	1.01
14nm	1404	1183	0.84	1202	0.86	1.02
11nm	1228	804	0.65	815	0.66	1.02
10nm	1527	845	0.55	858	0.56	1.02
9nm	1575	687	0.44	698	0.44	1.00
8nm	1402	403	0.29	409	0.29	1.00
7nm	1704	166	0.10	168	0.10	1.00
6nm	1689	3	0.00	3	0.00	
5nm	1216	0	0.00	0	0.00	
4nm	438	0	0.00	0	0.00	

Table 3. Linearity of candidate CPC against the Electrometer

EL 3068B (#/cm <sup>3</sup> )	Pulse Output		Internal Output		Internal/ Pulse
	Concentration (#/cm <sup>3</sup> )	Efficiency ( $\mu$ )	Concentration (#/cm <sup>3</sup> )	Efficiency ( $\mu$ )	
1959	1966	1.00	1996	1.02	1.02
4257	4241	1.00	4328	1.02	1.02
8350	8106	0.97	8375	1.00	1.03
12226	11694	0.96	12228	1.00	1.04
21100	19439	0.92	20876	0.99	1.08
28852	25338	0.88	27845	0.97	1.10
41999	35141	0.84	40075	0.95	1.13
48722	39837	0.82	46246	0.95	1.16
61953	48093	0.78	57906	0.93	1.19



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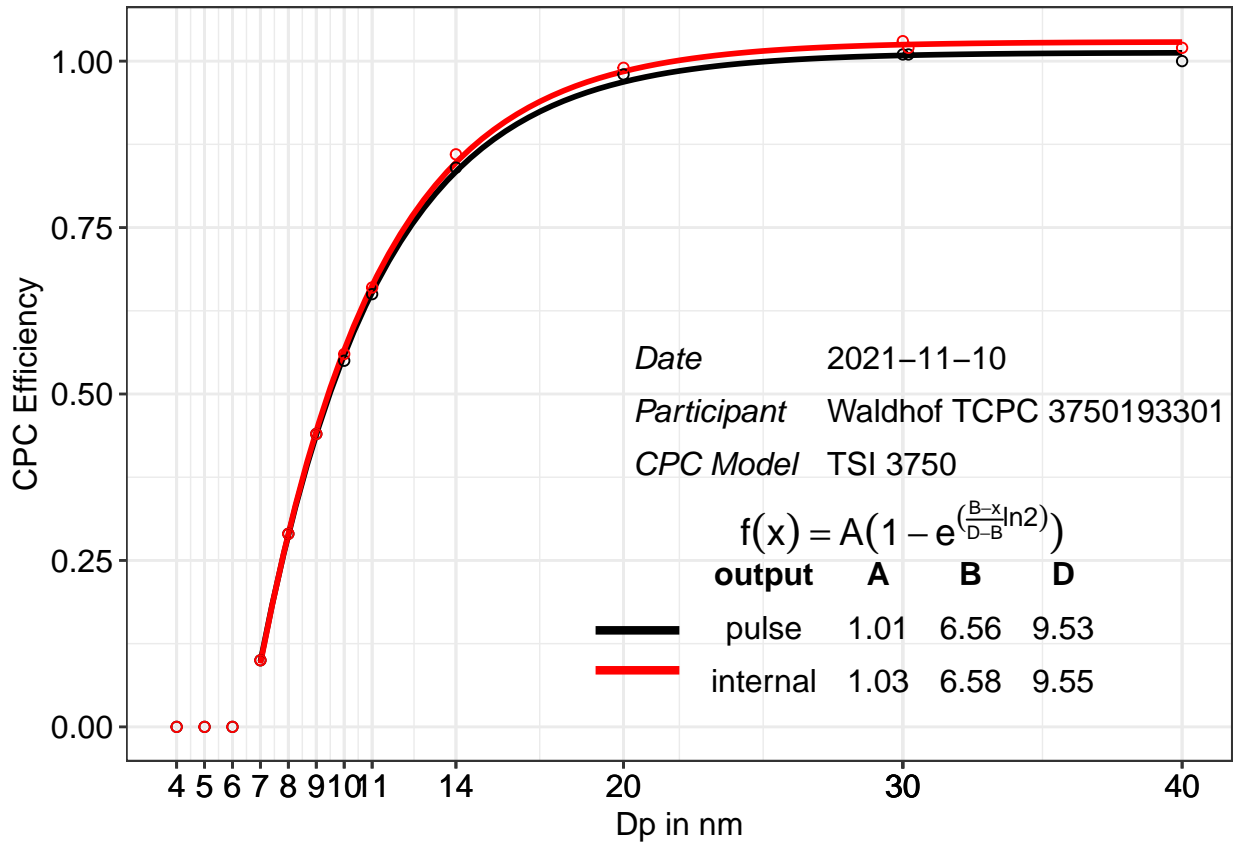


Fig. 1. Counting efficiency of candidate CPC against aerosol electrometer 3068 SN 70838596; silver particles between 5 nm and 40 nm were used for calibration.



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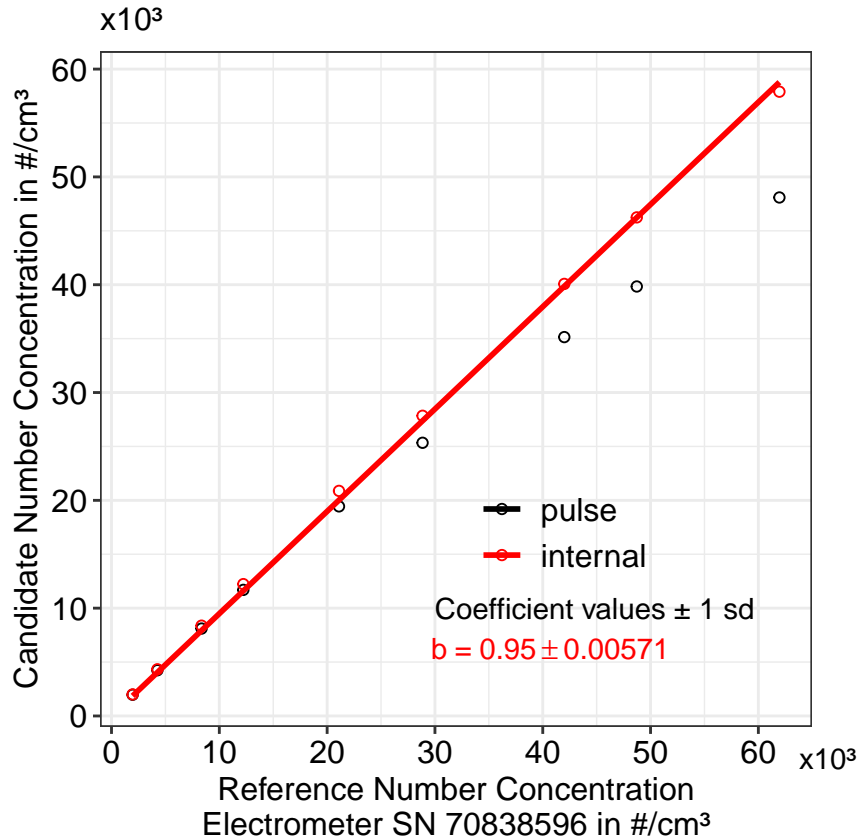


Fig. 2. Linearity for candidate CPC against aerosol electrometer 3068 SN 70838596; silver particles with a diameter of 30 nm were used for number concentrations between 2000 particles per cm<sup>3</sup> and 60000 particles per cm<sup>3</sup>.

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**Date of issue:** *November 10, 2021*  
**Reference:** TSI electrometer, model 3068, SN 70838596  
**Reviewed:** TROPOS/Kay Weinhold

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