



World Calibration Centre
for Aerosol Physics



Leibniz Institute for
Tropospheric Research

Project No. CPC-2021-2-2

CPC Model: TSI CPC 3750

CPC Serial Number: SN3750213901

Customer: TSI

Description: Calibration of a Condensation Particle Counter

Date of Calibration: November 17, 2021

Summary of Intercomparison:

The candidate passed the quality standards of ACTRIS and GAW. The candidate reached 99% efficiency at 40 nm. The D_{p50} is at 9.68 nm. The CPC efficiency curve corresponds to the standard of ACTRIS and GAW.

Certificate / Reference: WCCAP

Date of issue:	November 17, 2021	Signature
Reviewed by:	TROPOS	Name: Dipl.-Met. Kay Weinhold



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Table 1. Diagnostic information of candidate

	Unit	Status
Participant		TSI
CPC Model		TSI 3750 SN3750213901
Firmware		2.4.0
Manufacture date		September 2021
Last service date		
Arrival date		2021-11-16
Software Version		
Saturator Temperature	°C	39
Condenser Temperature	°C	24.6
Optics Temperature	°C	40
Cabinet Temperature	°C	21.9
Ambient Pressure	mbar	100.7
Vacuum Pressure	kPa	71.5
Inlet Pressure	kPa	-0.2
Critical Orifice Pressure	kPa	68.5
Aerosol Nozzle Pressure	kPa	2.75
Laser Current	mA	38
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, 1006 mbar



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

Diameter	EL 3068B (#/cm ³)	Pulse Output		Internal Output		Internal/ Pulse
		Concentration (#/cm ³)	Efficiency (μ)	Concentration (#/cm ³)	Efficiency (μ)	
40nm	1243	1228	0.99	1242	1.00	1.01
30nm_2	2077	2053	0.99	2086	1.00	1.01
30nm	1175	1168	0.99	1182	1.01	1.02
20nm	1408	1343	0.95	1361	0.97	1.02
14nm	1052	860	0.82	868	0.83	1.01
11nm	1390	883	0.64	892	0.64	1.00
10nm	1358	717	0.53	726	0.53	1.00
9nm	1608	641	0.40	648	0.40	1.00
8nm	2068	524	0.25	530	0.26	1.04
7nm	1387	103	0.07	105	0.08	1.14
6nm	1432	1	0.00	1	0.00	
5nm	1814	0	0.00	0	0.00	

Table 3. Linearity of candidate CPC against the Electrometer

EL 3068B (#/cm ³)	Pulse Output		Internal Output		Internal/ Pulse
	Concentration (#/cm ³)	Efficiency (μ)	Concentration (#/cm ³)	Efficiency (μ)	
2032	2019	0.99	2045	1.01	1.02
4197	4114	0.98	4198	1.00	1.02
8427	8087	0.96	8329	0.99	1.03
12670	11997	0.95	12490	0.99	1.04
18849	17488	0.93	18403	0.98	1.05
29568	26406	0.89	28522	0.96	1.08
43629	36795	0.84	41122	0.94	1.12
49839	41013	0.82	46307	0.93	1.13
62173	48595	0.78	55986	0.90	1.15



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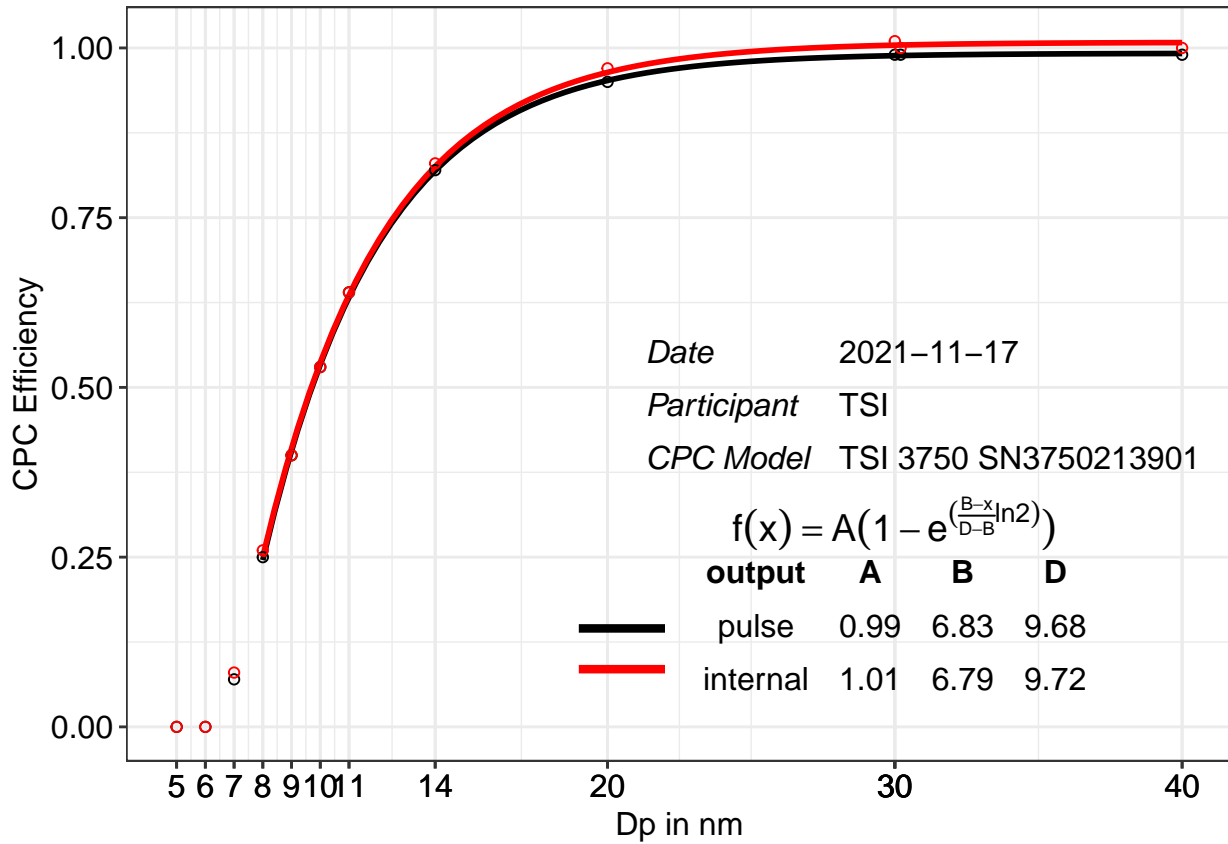


Fig. 1. Counting efficiency of candidate CPC against aerosol electrometer 3068 SN 70838596; silver particles between 5 nm and 40 nm were used for calibration.



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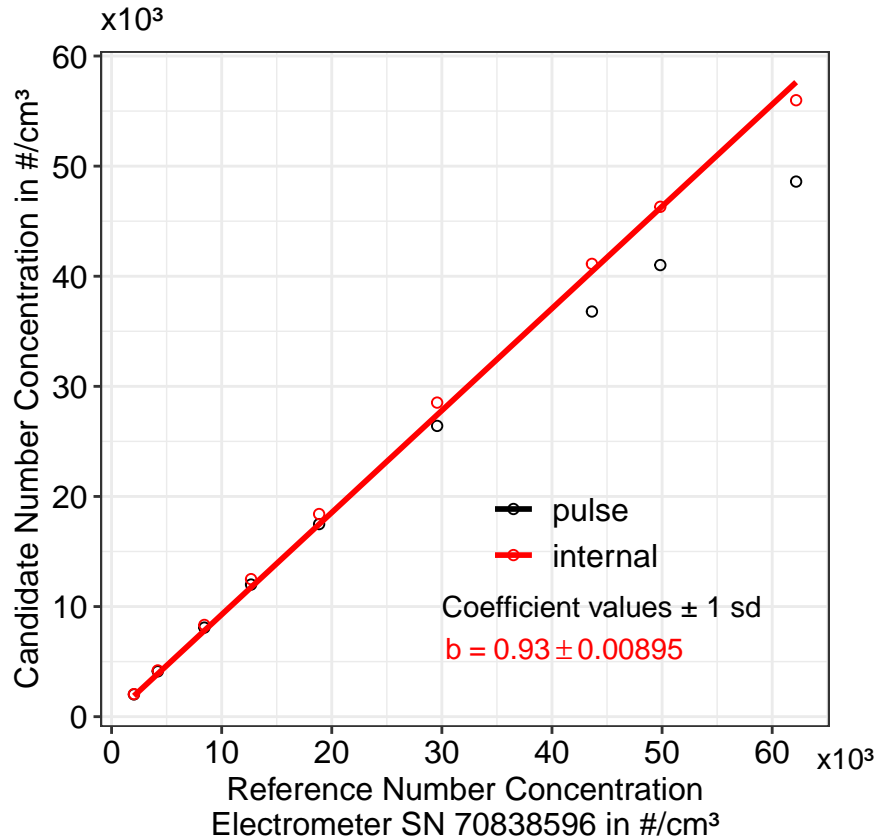


Fig. 2. Linearity for candidate CPC against aerosol electrometer 3068 SN 70838596; silver particles with a diameter of 30 nm were used for number concentrations between 2000 particles per cm^3 and 60000 particles per cm^3 .

Date of issue: *November 17, 2021*
Reference: TSI electrometer, model 3068, SN 70838596
Reviewed: TROPOS/Kay Weinhold
