



World Calibration Centre
for Aerosol Physics



Leibniz Institute for
Tropospheric Research

Project No. CPC-2021-2-6

CPC Model: PALAS

CPC Serial Number: ENVI CPC 100 SN 16226

Customer: PALAS

Description: Calibration of a Condensation Particle Counter (PALAS CPC)

Date of Calibration: November 17, 2021

Summary of Intercomparison:

The candidate reached 102% efficiency at 40 nm. The Dp50 is at 7.96 nm.

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		Palas
CPC Model		ENVI CPC 100 SN 16226
Firmware		
Manufacture date		
Last service date		
Arrival date		2021-11-17
Software Version		100528
Saturator Temperature	°C	35
Condenser Temperature	°C	16.3
Optics Temperature	°C	47
Cabinet Temperature	°C	
Ambient Pressure	mbar	
Vacuum Pressure	kPa	
Inlet Pressure	kPa	
Critical Orifice Pressure	kPa	
Aerosol Nozzle Pressure	kPa	
Laser Current	mA	
Liquid Level		full
Aerosol Flow	L/min	0.894
Zero	avg 10 min	
Physical inspection		
Functional test		



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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	0	0	1273	1.02	Inf
30nm_2	2077	0	0	2115	1.02	Inf
30nm	1175	0	0	1210	1.03	Inf
20nm	1408	0	0	1438	1.02	Inf
14nm	1052	0	0	1041	0.99	Inf
11nm	1390	0	0	1324	0.95	Inf
10nm	1358	0	0	1251	0.92	Inf
9nm	1608	0	0	1312	0.82	Inf
8nm	2068	0	0	979	0.47	Inf
7nm	1387	0	0	35	0.03	Inf
6nm	1432	0	0	0	0.00	
5nm	1814	0	0	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	0	0	2074	1.02	Inf
4197	0	0	4213	1.00	Inf
8427	0	0	8080	0.96	Inf
12670	0	0	12035	0.95	Inf
18849	0	0	18073	0.96	Inf
29568	0	0	28143	0.95	Inf
43629	0	0	41635	0.95	Inf
49839	0	0	47602	0.96	Inf
62173	0	0	59044	0.95	Inf



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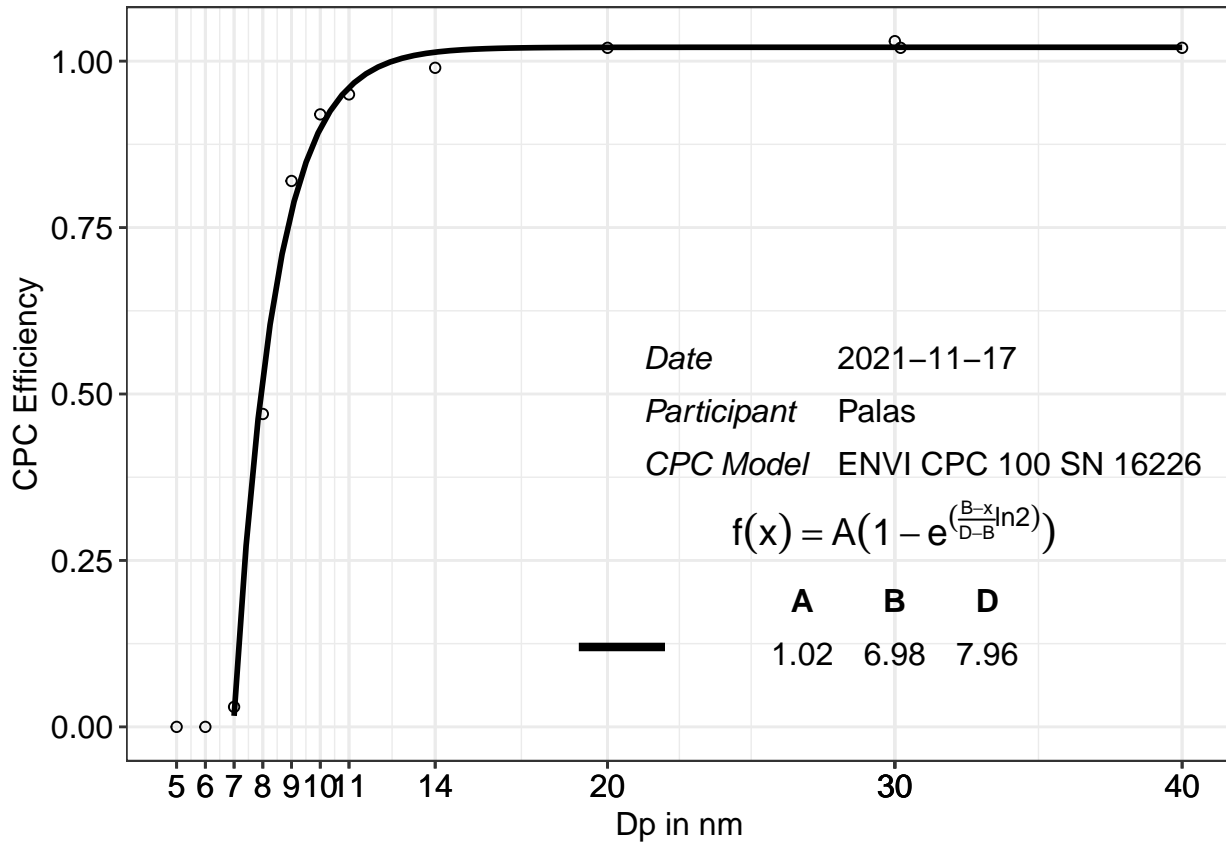


Fig. 1. Counting efficiency of candidate CPC against aerosol electrometer 3068 SN 70838596; silver particles between 5 nm and 40 nm were used for calibration.



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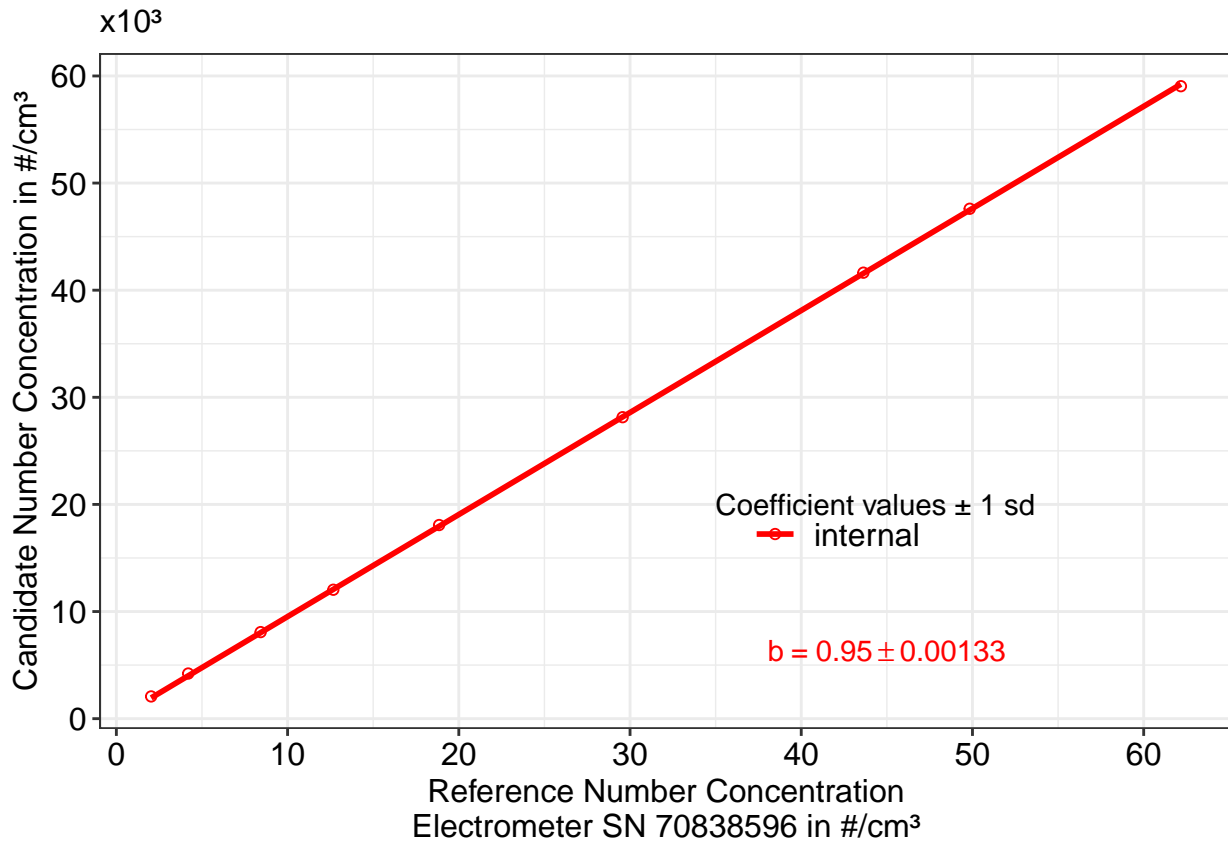


Fig. 2. Linearity for candidate CPC against aerosol electrometer 3068 SN 70838596; silver particles with a diameter of 30 nm were used for number concentrations between 2000 particles per cm^3 and 70000 particles per cm^3 .

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