Blocked Area Calculation Report (Step-wise)

File: 2.4b 0.5hz 55um.csv
Pressure: 2.4 bar
Device: 55um
Date: 2026-01-02 16:47:47

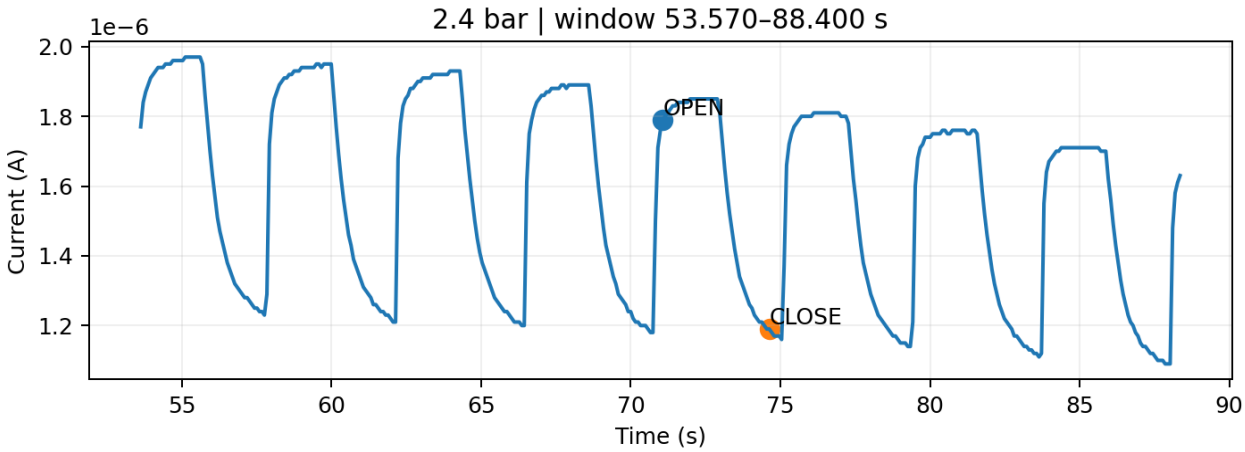
1) Selected window

Window start = 53.569998 s, Window end = 88.399836 s

2) Picked points (NO averaging; single raw datapoint)

Point	Snapped time (s)	Snapped current (A)
OPEN	71.072210	1.790000000000e-06
CLOSE	74.628167	1.190000000000e-06

3) Window plot with selected points



4) Experimental blocked area (exact order)

```
V = 1.0 V
ρ = 0.0896 Ω·m, l = 0.000145 m, w = 0.0001 m, d = 5.5e-05 m
A = w×d = 5.5e-09 m², ρl = ρ×l = 1.2992e-05 Ω·m²
G_open = |I_open/V| = |1.790000000000e-06/1.0| = 1.790000000000e-06 S
G_closed = |I_close/V| = |1.190000000000e-06/1.0| = 1.190000000000e-06 S
R_open = 1/G_open = 558659 Ω
R_closed = 1/G_closed = 840336 Ω
ΔR = R_closed − R_open = 281677 Ω
k = (A×ΔR)/(ρl) = 119.244
A′/A = 1/(1+k) = 0.0083164
Blocked% = 100×(1 − A′/A) = 99.1684 %
```

5) Theoretical blocked area (PDF-style: sector − triangle)

[1] Input Parameters

```
Pressure (P) = 2.4 bar = 240000 Pa
Membrane radius (a) = 50.00 µm = 0.00500 cm
Membrane thickness (t) = 1.50 µm = 0.00015 cm
Young's modulus (E) = 7.00e+06 Pa
Poisson's ratio (ν) = 0.3
Constant (C_f) = 2.67
Effective modulus (E') = E/(1-ν) = 1.00e+07 Pa
Channel cross-section A = 5.50000e-05 cm²
```

[2] Intermediate Calculations

Factor = (a × P × C_f) / (E' × t)
= (0.00500 × 240000 × 2.67) / (1.00e+07 × 0.00015)
= 2.13600
w = a × factor^(1/3)
= 0.00500 × (2.13600)^(1/3)
= 0.00644 cm = 64.39 µm
r = (a² + w²) / (2w)
= (5.00000e-03 + 4.14643e-05) / (2 × 0.00644)
= 0.00516 cm
θ = 2 × arcsin(a / r)
= 2 × arcsin(0.00500 / 0.00516)
= 2.64095 rad
Triangle Area = a × (r − w)
= 0.00500 × (0.00516 − 0.00644)
= -6.39213e-06 cm²
Sector Area = 0.5 × r² × θ
= 0.5 × 0.00516² × 2.64095
= 3.51700e-05 cm²
Arc (Blocked) Area = Sector − Triangle
= 3.51700e-05 − -6.39213e-06
= 4.15621e-05 cm²

[3] Final Result

Blocked Area (%) = (Arc Area / Channel Area) × 100
= (4.15621e-05 / 5.50000e-05) × 100
= 75.57 %