

Blocked Area Calculation Report (Step-wise)

File: 0.2b 55um 1hz.csv

Pressure: 0.2 bar

Device: 55um

Date: 2026-01-02 16:46:12

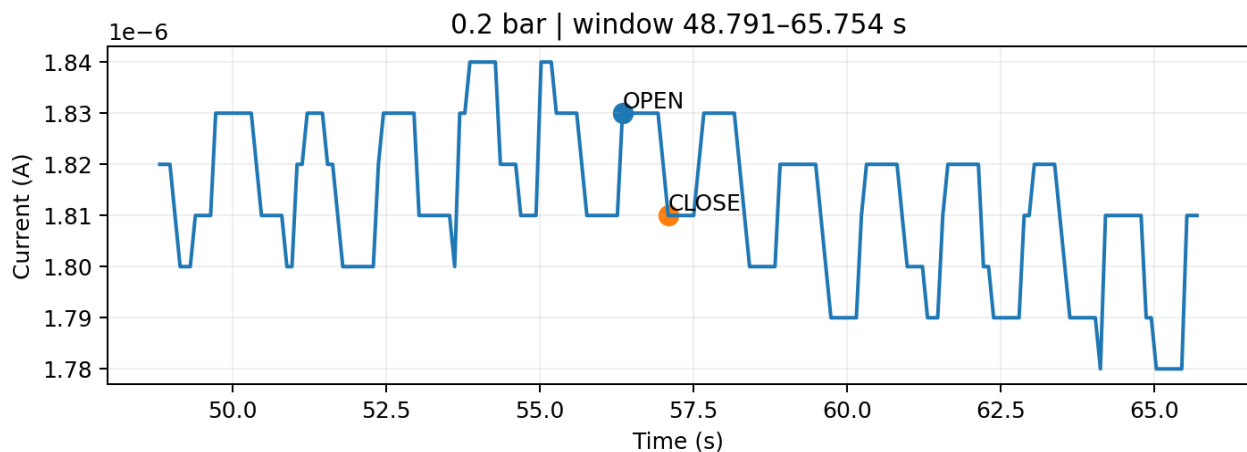
1) Selected window

Window start = 48.790931 s, Window end = 65.753837 s

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

| Point | Snapped time (s) | Snapped current (A) |
|-------|------------------|---------------------|
| OPEN | 56.344417 | 1.8300000000000e-06 |
| CLOSE | 57.088859 | 1.8100000000000e-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 = wxd = 5.5e-09 m², p1 = ρxl = 1.2992e-05 Ω·m²
G_open = |I_open/V| = |1.8300000000000e-06/1.0| = 1.8300000000000e-06 S
G_closed = |I_close/V| = |1.8100000000000e-06/1.0| = 1.8100000000000e-06 S
R_open = 1/G_open = 546448 Ω
R_closed = 1/G_closed = 552486 Ω
ΔR = R_closed - R_open = 6038.1 Ω
k = (AΔR)/(p1) = 2.55615
A'/A = 1/(1+k) = 0.281203
Blocked% = 100×(1 - A'/A) = 71.8797 %
```

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

[1] Input Parameters

```
Pressure (P) = 0.2 bar = 20000 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 × Cf) / (E' × t)
        = (0.00500 × 20000 × 2.67) / (1.00e+07 × 0.00015)
        = 0.17800
w = a × factor(1/3)
    = 0.00500 × (0.17800)(1/3)
    = 0.00281 cm = 28.13 μm
r = (a2 + w2) / (2w)
    = (5.00000e-03 + 7.91079e-06) / (2 × 0.00281)
    = 0.00585 cm
θ = 2 × arcsin(a / r)
    = 2 × arcsin(0.00500 / 0.00585)
    = 2.04963 rad
Triangle Area = a × (r - w)
               = 0.00500 × (0.00585 - 0.00281)
               = 1.51898e-05 cm2
Sector Area = 0.5 × r2 × θ
             = 0.5 × 0.005852 × 2.04963
             = 3.50785e-05 cm2
Arc (Blocked) Area = Sector - Triangle
                   = 3.50785e-05 - 1.51898e-05
                   = 1.98887e-05 cm2
```

[3] Final Result

```
Blocked Area (%) = (Arc Area / Channel Area) × 100
                  = (1.98887e-05 / 5.50000e-05) × 100
                  = 36.16 %
```