Blocked Area Calculation Report (Step-wise)

File: 1.2b 1hz 55um.csv
Pressure: 1.2 bar
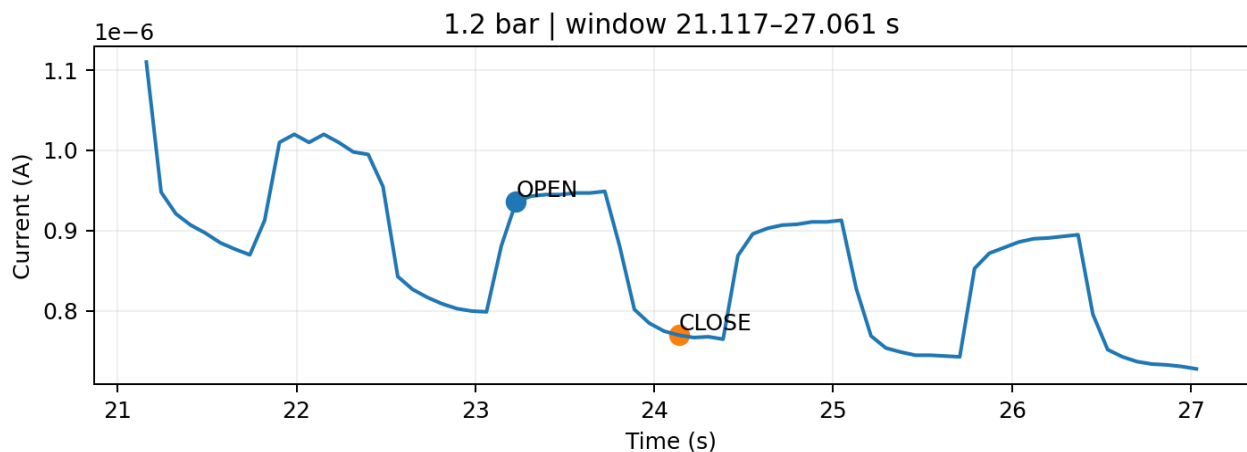**Device:** 55um
Date: 2026-01-02 16:46:55

1) Selected window

Window start = 21.117444 s, Window end = 27.061242 s

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

Point	Snapped time (s)	Snapped current (A)
OPEN	23.227527	9.360000000000e-07
CLOSE	24.137144	7.700000000000e-07

3) Window plot with selected points

1.2 bar | window 21.117–27.061 s

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| = |9.360000000000e-07/1.0| = 9.360000000000e-07 S
G_closed = |I_close/V| = |7.700000000000e-07/1.0| = 7.700000000000e-07 S
R_open = 1/G_open = 1.06838e+06 Ω
R_closed = 1/G_closed = 1.2987e+06 Ω
ΔR = R_closed − R_open = 230325 Ω
k = (A×ΔR)/(ρl) = 97.5053
A′/A = 1/(1+k) = 0.0101517
Blocked% = 100×(1 − A′/A) = 98.9848 %
```

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

[1] Input Parameters

```
Pressure (P) = 1.2 bar = 120000 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 × 120000 × 2.67) / (1.00e+07 × 0.00015)
       = 1.06800
w = a × factor^(1/3)
  = 0.00500 × (1.06800)^(1/3)
  = 0.00511 cm = 51.11 µm
r = (a² + w²) / (2w)
  = (5.00000e-03 + 2.61209e-05) / (2 × 0.00511)
  = 0.00500 cm
θ = 2 × arcsin(a / r)
  = 2 × arcsin(0.00500 / 0.00500)
  = 3.09774 rad
Triangle Area = a × (r − w)
              = 0.00500 × (0.00500 − 0.00511)
              = -5.48275e-07 cm²
Sector Area = 0.5 × r² × θ
            = 0.5 × 0.00500² × 3.09774
            = 3.87403e-05 cm²
Arc (Blocked) Area = Sector − Triangle
                   = 3.87403e-05 − -5.48275e-07
                   = 3.92886e-05 cm²
```

[3] Final Result

```
Blocked Area (%) = (Arc Area / Channel Area) × 100
                 = (3.92886e-05 / 5.50000e-05) × 100
                 = 71.43 %
```