Blocked Area Calculation Report (Step-wise)

File: 3.2b 1hz 30um.csv
Pressure: 3.2 bar
Device: 30um
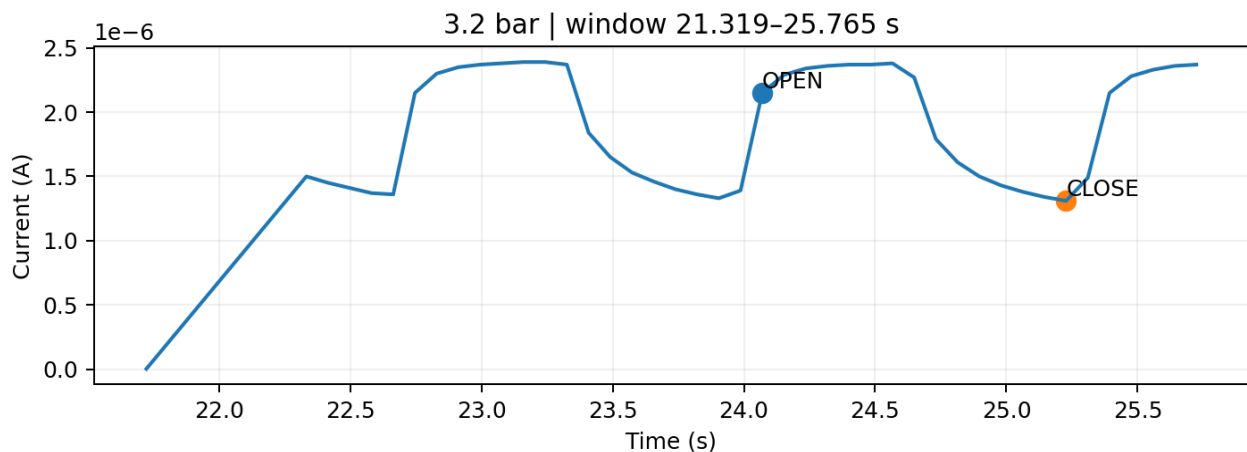**Date:** 2026-01-02 16:51:54

1) Selected window

Window start = 21.318657 s, Window end = 25.765170 s

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

Point	Snapped time (s)	Snapped current (A)
OPEN	24.069902	2.150000000000e-06
CLOSE	25.227775	1.310000000000e-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 = 3e-05 m
A = w×d = 3e-09 m², ρl = ρ×l = 1.2992e-05 Ω·m²
G_open = |I_open/V| = |2.150000000000e-06/1.0| = 2.150000000000e-06 S
G_closed = |I_close/V| = |1.310000000000e-06/1.0| = 1.310000000000e-06 S
R_open = 1/G_open = 465116 Ω
R_closed = 1/G_closed = 763359 Ω
ΔR = R_closed − R_open = 298242 Ω
k = (A×ΔR)/(ρl) = 68.8676
A′/A = 1/(1+k) = 0.0143128
Blocked% = 100×(1 − A′/A) = 98.5687 %
```

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

[1] Input Parameters

```
Pressure (P) = 3.2 bar = 320000 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 = 3.00000e-05 cm²
```

[2] Intermediate Calculations

```
Factor = (a × P × C_f) / (E' × t)
       = (0.00500 × 320000 × 2.67) / (1.00e+07 × 0.00015)
       = 2.84800
w = a × factor^(1/3)
  = 0.00500 × (2.84800)^(1/3)
  = 0.00709 cm = 70.87 µm
r = (a² + w²) / (2w)
  = (5.00000e-03 + 5.02304e-05) / (2 × 0.00709)
  = 0.00531 cm
θ = 2 × arcsin(a / r)
  = 2 × arcsin(0.00500 / 0.00531)
  = 2.45759 rad
Triangle Area = a × (r − w)
              = 0.00500 × (0.00531 − 0.00709)
              = -8.89981e-06 cm²
Sector Area = 0.5 × r² × θ
            = 0.5 × 0.00531² × 2.45759
            = 3.46130e-05 cm²
Arc (Blocked) Area = Sector − Triangle
                   = 3.46130e-05 − -8.89981e-06
                   = 4.35128e-05 cm²
```

[3] Final Result

```
Blocked Area (%) = (Arc Area / Channel Area) × 100
                 = (4.35128e-05 / 3.00000e-05) × 100
                 = 145.04 %
```