

Blocked Area Calculation Report (Step-wise)

File: 0.4b 1hz 55um.csv

Pressure: 0.4 bar

Device: 55um

Date: 2026-01-02 16:46:27

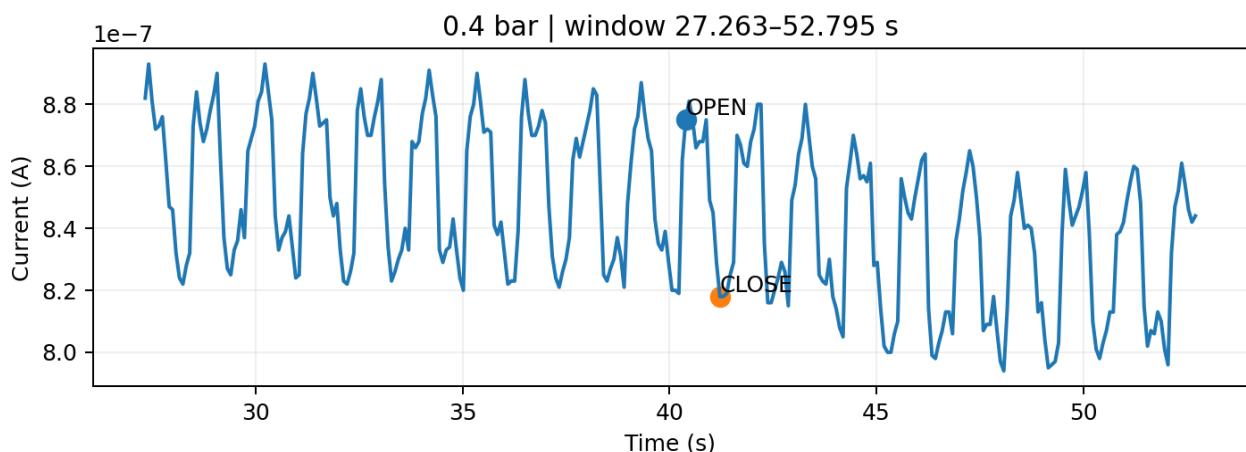
1) Selected window

Window start = 27.263271 s, Window end = 52.795143 s

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

Point	Snapped time (s)	Snapped current (A)
OPEN	40.389679	8.750000000000e-07
CLOSE	41.216671	8.180000000000e-07

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, p1 = ρ×l = 1.2992e-05 Ω·m²
G_open = |I_open/V| = |8.750000000000e-07/1.0| = 8.750000000000e-07 S
G_closed = |I_close/V| = |8.180000000000e-07/1.0| = 8.180000000000e-07 S
R_open = 1/G_open = 1.14286e+06 Ω
R_closed = 1/G_closed = 1.22249e+06 Ω
ΔR = R_closed - R_open = 79636.7 Ω
k = (A×ΔR)/(p1) = 33.7132
A'/A = 1/(1+k) = 0.0288075
Blocked% = 100×(1 - A'/A) = 97.1193 %
```

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

[1] Input Parameters

Pressure (P) = 0.4 bar = 40000 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 × 40000 × 2.67) / (1.00e+07 × 0.00015)
       = 0.35600

w = a × factor^(1/3)
   = 0.00500 × (0.35600)^(1/3)
   = 0.00354 cm = 35.44 μm

r = (a² + w²) / (2w)
   = (5.00000e-03 + 1.25576e-05) / (2 × 0.00354)
   = 0.00530 cm

θ = 2 × arcsin(a / r)
   = 2 × arcsin(0.00500 / 0.00530)
   = 2.46626 rad

Triangle Area = a × (r - w)
                = 0.00500 × (0.00530 - 0.00354)
                = 8.77790e-06 cm²

Sector Area = 0.5 × r² × θ
                = 0.5 × 0.00530² × 2.46626
                = 3.46288e-05 cm²

Arc (Blocked) Area = Sector - Triangle
                     = 3.46288e-05 - 8.77790e-06
                     = 2.58509e-05 cm²
```

[3] Final Result

```
Blocked Area (%) = (Arc Area / Channel Area) × 100
                  = (2.58509e-05 / 5.50000e-05) × 100
                  = 47.00 %
```