# Blocked Area Calculation Report (Step-wise)

**File:** 1b 55um.csv
**Pressure:** 1.0 bar
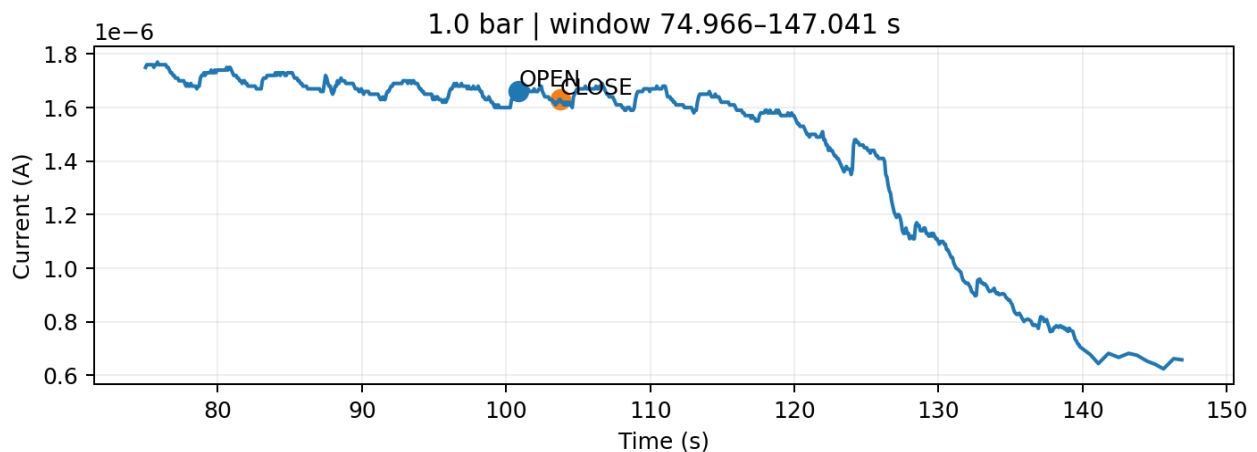**Device:** 55um
**Date:** 2026-01-02 16:47:37

## 1) Selected window

Window start = 74.966014 s, Window end = 147.040648 s

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

| Point | Snapped time (s) | Snapped current (A) |
|-------|------------------|---------------------|
| OPEN  | 100.874050       | 1.660000000000e-06  |
| CLOSE | 103.768268       | 1.630000000000e-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| = |1.660000000000e-06/1.0| = 1.660000000000e-06 S
G_closed = |I_close/V| = |1.630000000000e-06/1.0| = 1.630000000000e-06 S
R_open = 1/G_open = 602410 Ω
R_closed = 1/G_closed = 613497 Ω
ΔR = R_closed − R_open = 11087.3 Ω
k = (A×ΔR)/(ρl) = 4.69367
A'/A = 1/(1+k) = 0.175634
Blocked% = 100×(1 − A'/A) = 82.4366 %
```

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

**[1] Input Parameters**

```
Pressure (P) = 1.0 bar = 100000 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 × 100000 × 2.67) / (1.00e+07 × 0.00015)
       = 0.89000
w = a × factor^(1/3)
  = 0.00500 × (0.89000)^(1/3)
  = 0.00481 cm = 48.10 µm
r = (a² + w²) / (2w)
  = (5.00000e-03 + 2.31313e-05) / (2 × 0.00481)
  = 0.00500 cm
θ = 2 × arcsin(a / r)
  = 2 × arcsin(0.00500 / 0.00500)
  = 3.06392 rad
Triangle Area = a × (r − w)
              = 0.00500 × (0.00500 − 0.00481)
              = 9.71359e-07 cm²
Sector Area = 0.5 × r² × θ
            = 0.5 × 0.00500² × 3.06392
            = 3.83569e-05 cm²
Arc (Blocked) Area = Sector − Triangle
                   = 3.83569e-05 − 9.71359e-07
                   = 3.73855e-05 cm²
```

## [3] Final Result

```
Blocked Area (%) = (Arc Area / Channel Area) × 100
                 = (3.73855e-05 / 5.50000e-05) × 100
                 = 67.97 %
```