

# Blocked Area Calculation Report (Step-wise)

File: 1.4b 55um.csv

Pressure: 1.4 bar

Device: 55um

Date: 2026-01-02 16:47:07

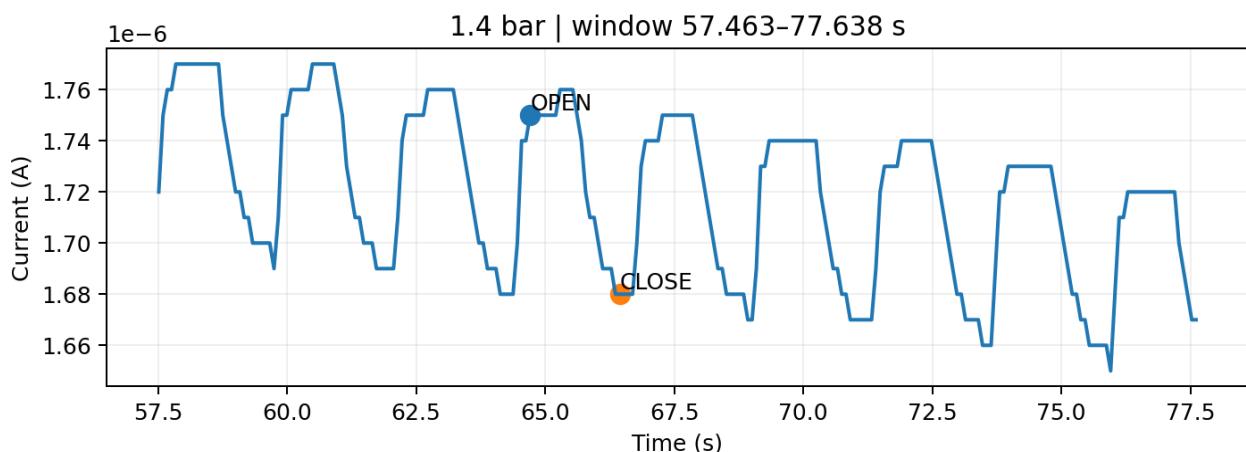
## 1) Selected window

Window start = 57.463141 s, Window end = 77.637822 s

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

Point	Snapped time (s)	Snapped current (A)
OPEN	64.708957	1.750000000000e-06
CLOSE	66.445323	1.680000000000e-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, p1 = ρ×l = 1.2992e-05 Ω·m²
Gopen = |Iopen/V| = |1.750000000000e-06/1.0| = 1.750000000000e-06 S
Gclosed = |Iclose/V| = |1.680000000000e-06/1.0| = 1.680000000000e-06 S
Ropen = 1/Gopen = 571429 Ω
Rclosed = 1/Gclosed = 595238 Ω
ΔR = Rclosed - Ropen = 23809.5 Ω
k = (A×ΔR)/(p1) = 10.0795
A'/A = 1/(1+k) = 0.0902571
Blocked% = 100×(1 - A'/A) = 90.9743 %
```

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

### [1] Input Parameters

Pressure (P) = 1.4 bar = 140000 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 × 140000 × 2.67) / (1.00e+07 × 0.00015)
       = 1.24600

w = a × factor^(1/3)
   = 0.00500 × (1.24600)^(1/3)
   = 0.00538 cm = 53.80 μm

r = (a² + w²) / (2w)
   = (5.00000e-03 + 2.89480e-05) / (2 × 0.00538)
   = 0.00501 cm

θ = 2 × arcsin(a / r)
   = 2 × arcsin(0.00500 / 0.00501)
   = 2.99510 rad

Triangle Area = a × (r - w)
                = 0.00500 × (0.00501 - 0.00538)
                = -1.83446e-06 cm²

Sector Area = 0.5 × r² × θ
                = 0.5 × 0.00501² × 2.99510
                = 3.76403e-05 cm²

Arc (Blocked) Area = Sector - Triangle
                     = 3.76403e-05 - -1.83446e-06
                     = 3.94748e-05 cm²
```

## [3] Final Result

```
Blocked Area (%) = (Arc Area / Channel Area) × 100
                  = (3.94748e-05 / 5.50000e-05) × 100
                  = 71.77 %
```