```
1.91617561e+03, 1.88742408e+04, 9.03017988e-03, 8.20433340e-01,
                                                                                                                                      3.70932072e+03, 3.97355551e+04, 4.38669619e-04, 4.06248259e+00,
                                                                                                                                      2.03306196e-01, 6.60641863e-01, 3.55041072e+00, 1.51483407e+00],
                                                                                                                                    [6.18047086e+02, 1.62788566e+04, 1.30065379e+03, 1.09654125e+00, 1.91617561e+03, 1.88742408e+04, 9.03017988e-03, 8.20433340e-01,
                                                                                                                                      3.70932072e+03, 3.97355552e+04, 4.38669619e-04, 4.06248259e+00,
                                                                                                                                      2.03306196e-01, 6.60641864e-01, 3.55041072e+00, 1.51483407e+00],
                                                                                                                                     [6.18047086e+02, 1.62788566e+04, 1.30065379e+03, 1.09654125e+00,
                                                                                                                                      1.91617561e+03, 1.88742408e+04, 9.03017988e-03, 8.20433340e-01,
                                                                                                                                      3.70932071e+03, 3.97355552e+04, 4.38669620e-04, 4.06248258e+00,
                                                                                                                                     2.03306196e-01, 6.60641864e-01, 3.55041072e+00, 1.51483407e+00],
                                                                                                                                     [6.18047086e+02, 1.62788566e+04, 1.30065379e+03, 1.09654125e+00,
                                                                                                                                      1.91617561e+03, 1.88742408e+04, 9.03017988e-03, 8.20433340e-01,
                                                                                                                                      3.70932072e+03, 3.97355552e+04, 4.38669620e-04, 4.06248259e+00,
                                                                                                                                      2.03306196e-01, 6.60641864e-01, 3.55041072e+00, 1.51483407e+00],
                                                                                                                                    [6.18047086e+02, 1.62788566e+04, 1.30065379e+03, 1.09654125e+00, 1.09654125e+00]
                                                                                                                                      1.91617561e+03, 1.88742408e+04, 9.03017988e-03, 8.20433340e-01,
                                                                                                                                      3.70932072e+03, 3.97355552e+04, 4.38669619e-04, 4.06248259e+00,
                                                                                                                                      2.03306196e-01, 6.60641863e-01, 3.55041072e+00, 1.51483407e+00],
                                                                                                                                     [6.18047086e+02, 1.62788566e+04, 1.30065379e+03, 1.09654125e+00,
                                                                                                                                      1.91617561e+03, 1.88742408e+04, 9.03017988e-03, 8.20433340e-01,
                                                                                                                                      3.70932071e+03, 3.97355552e+04, 4.38669620e-04, 4.06248259e+00,
                                                                                                                                      2.03306196e-01, 6.60641864e-01, 3.55041072e+00, 1.51483407e+00],
                                                                                                                                     [6.18047086e+02, 1.62788566e+04, 1.30065379e+03, 1.09654125e+00,
                                                                                                                                      1.91617561e+03, 1.88742408e+04, 9.03017988e-03, 8.20433340e-01,
            ['SM data type data plots for mutation', 'Output20]2e+03, 3.97355552e+0, Initial Guess Pe-04, 4.06248259e+00, 2.03306196e-01, 6.60641863e-01, 2.03306196e-01, 6.60641863e-01, 2.03306196e-01, 6.60641863e-01, 2.03306196e-01, 6.60641863e-01, 2.03306196e-01, 2.03306196e-
inducer -> sensor (GFP output)
                                                                                                                                      1.91617561e+03, 1.8874240 ---- 4Converged 8e-03, 8.20433340e-01,
                                                                                                                                      3.70932072e+03, 3.97355552<u>e+0</u>4<sub>Converged</sub>19e-04, 4.06248259e+00,
                                                                                                                                    2.03306197e-01, 6.60641863e-01, 3.50410/2e+00, 1.51483407e+00], [6.18047086e+02, 1.62788566e+04. Converged 79e+03, 1.09654125e+00,
                                                                                  4 \times 10^{3}
                                                                                                                                      1.91617561e+03, 1.$8742408e+04, 9.03017988e-03, 8.20433340e-01,
                                                                                                                                     3.70932072e+03, 3.97355552e+04, 4.38669620e-04, 4.06248259e+00, 2.03306195e-01, 6.69641865e-01, 3.55041072e+00, 1.51483407e+00],
                                                                                  3 \times 10^{3}
                                                                                                                                      [6.18047086e+02, 1.62788566e+04, 1.30065379e+03, 1.09654125e+00, 1.91617961e+03, 1.88742408e+04, 9.03017988e-03, 8.20433340e-01, 3.70932071e+03, 3.97355552e+04, 4.38669620e-04, 4.06248258e+00, 2.03306196e-01, 6.60641863e-01, 3.55041072e+00, 1.51483407e+00],
                                                                                  2 \times 10^{3}
                                                                                                                                     <u>[6]18047086e+02]1.</u>62788566e+04, 1.30065379e+03, 1.09654125e+00,
1091617581e+03, 1.88742408e+04, 9.03017988e-03, 8.20433340e-01,
                                                                                                10<sup>-5</sup>
                                                   10^{-2}
                                 10-3
              10^{-4}
                                                                     10^{-1}
                                                                                                                Full circuit 70937 3746+03, 3.97355552e+04, 4.38669620e-04, 4.06248258e+00, 2.03306196e-01, 6.60641863e-01, 3.55041072e+00, 1.51483407e+00],
    inducer -> S -| Output (GFP)
                                                                                          10^{4}
                                                                                                                                     [6.18047086e+02, 1.62788566e+04, 1.30065379e+03, 1.09654125e+00,
                                                                                                                                       1.91617561e+03, 1.$8742408e+04, 9.03017988e-03, 8.20433340e-01,
                                                                                                                                      3.78992672e+03, 3.97355552e+04, 4.38669619e-04, 4.06248259e+00,
                                                                                                                                    2.03306197e-01, 6.60641862e-01, 3.55041071e+00, 1.51483407e+00], [6.18047086e+02, 1.62788566e+04, 1.30065379e+03, 1.09654125e+00,
                                                                                  6 \times 10^{3}
                                                                                                                                      1.91617561e+03, 1.$8742408e+04, 9.03017988e-03, 8.20433340e-01,
                                                                                  4 \times 10^{3}
                                                                                                                                       3.70932072e+03, 3.$7355552e+04, 4.38669620e-04, 4.06248259e+00,
                                                                                                                                         03306196e-01, 6.60641863e-01, 3.55041072e+00, 1.51483407e+00],
                                                                                  3 \times 10^{3}
                                                                                                                                     [6.18047086e+02, 1.62788566e+04, 1.30065379e+03, 1.09654125e+00,
                                                                                                                                      1.91617561e+03, 1.88742408e+04, 9.03017988e-03, 8.204333340e-01,
                                                                                                                                    3.70932072e\pm03, 3.97355551e+04, 4.38669619e-04, 4.06248260e+00, 209306196e-01, 60641863e-01, 3.55041072e+00, 1.51483407e+00, [6.18047086e+02, 1.62788566e+04, 1.30065379e+03, 1.09654125e+00,
                                                   10^{-2}
                                                                     10^{-1}
                                                                                                 10^{-5}
                                                                                                                   10^{-4}
               10^{-4}
                                 10^{-3}
           Across all four plots:
                                                                                                                                      1.91617561e+03, 1.88742408e+04, 9.03017988e-03, 8.20433340e-01,
                                                                                                                                      3.70932072e+03, 3.97355552e+04, 4.38669620e-04, 4.06248259e+00,
               RSS (converged)=0.058
                                                                                                                                      2.03306196e-01, 6.60641865e-01, 3.55041072e+00, 1.51483407e+00],
                                                                                                                                     [6.18047086e+02, 1.62788566e+04, 1.30065379e+03, 1.09654125e+00,
               RSS (initial)=5.324
                                                                                                                                      1.91617561e+03, 1.88742408e+04, 9.03017988e-03, 8.20433340e-01,
                                                                                                                                      3.70932072e+03, 3.97355552e+04, 4.38669620e-04, 4.06248259e+00,
               RSS (% reduction)=0.989
                                                                                                                                      2.03306196e-01, 6.60641864e-01, 3.55041072e+00, 1.51483407e+00],
                                                                                                                                     [6.18047086e+02, 1.62788566e+04, 1.30065379e+03, 1.09654125e+00,
                           epsilon Initial guesses
                                                                                Converged
                                                                                                                                      1.91617561e+03, 1.88742408e+04, 9.03017988e-03, 8.20433340e-01,
                                                    618.047086 618.047086
                       0.000000
                                                                                                                                      3.70932072e+03, 3.97355552e+04, 4.38669620e-04, 4.06248259e+00,
                       0.000000
                                                  16278.856600 16278.856600
                                                                                                                                      2.03306196e-01, 6.60641863e-01, 3.55041072e+00, 1.51483407e+00]), array([0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517, 0
                                                   1300.653790 1300.653790
                       0.000000
                                                                                                                                     0.05811517, 0.05811517, 0.05811517, 0.05811517, 0.05811517,
                       0.000000
                                                       1.096541
                                                                                  1.096541
                                                                                                                                     0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811511517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517, \, 0.05811517,
                      0.000000
                                                  1916.175610 1916.175610
                                                                                                                                    0.05811517, 0.05811517]))
                                                 18874.240800 18874.240800
                      0.000000
                                                                                                                                         fun: 0.05811516974101728
                                                      0.009030
                                                                                  0.009030
                      0.000000
                                                                                                                                     message: 'Optimization terminated successfully.'
                      0.000000
                                                       0.820433
                                                                                  0.820433
                                                                                                                                        nfev: 11104
                   3025.485083
                                                        683.835638 3709.320721
                                                                                                                                         nit: 8326
                                                      32464.380200 39735.555143
          B h 7271.174943
                                                                                                                                      status: 0
                                                        0.000473
                      -0.000035
                                                                                   0.000439
                                                                                                                                     success: True
                      1.241131
                                                       2.821352
                                                                                   4.062483
                                                                                                                                             x: array([6.18047086e+02, 1.62788566e+04, 1.30065379e+03, 1.09654125e+00,
                      -0.428842
                                                       0.632148
                                                                                   0.203306
                                                                                                                                     1.91617561e+03, 1.88742408e+04, 9.03017988e-03, 8.20433340e-01,
                      -0.312126
                                                        0.972768
                                                                                   0.660642
                                                                                                                                     3.70932072e+03, 3.97355551e+04, 4.38669619e-04, 4.06248259e+00,
                       0.910237
                                                        2.640174
                                                                                    3.550411
                                                                                                                                     2.03306196e-01, 6.60641863e-01, 3.55041072e+00, 1.51483407e+00])
```

 10^{4}

 10^{3}

 10^{4}

 10^{-5}

Вs

C s

 N_s

A r

 C_{r}

Νr

Αh

C h

Fο

Αо

 B_o

Со

-0.404505

1.919339

1.514834

final simplex: (array([[6.18047086e+02, 1.62788566e+04, 1.30065379e+03, 1.09654125e+00,