```
final simplex: (array([[9.31286824e+02, 3.81664729e+03, 1.59856787e+03, 1.33331506e+00,
                                                                                                1.19696863e+03, 5.60895381e+04, 3.09516222e-02, 9.35522168e-01,
                                                                                                4.36870861e+02, 1.16075468e+04, 1.48341116e-04, 7.72554358e-01,
                                                                                                9.03570829e-01, 1.96935592e+00, 4.56431710e+00],
                                                                                               [9.31286824e+02, 3.81664729e+03, 1.59856787e+03, 1.33331506e+00,
                                                                                                1.19696863e+03, 5.60895381e+04, 3.09516222e-02, 9.35522168e-01,
                                                                                                4.36870861e+02, 1.16075468e+04, 1.48341116e-04, 7.72554357e-01,
                                                                                                9.03570830e-01, 1.96935592e+00, 4.56431710e+00]
                                                                                               [9.31286824e+02, 3.81664729e+03, 1.59856787e+03, 1.33331506e+00,
                                                                                                1.19696862e+03, 5.60895380e+04, 3.09516222e-02, 9.35522167e-01,
                                                                                                4.36870861e+02, 1.16075469e+04, 1.48341116e-04, 7.72554358e-01,
                                                                                                9.03570826e-01, 1.96935592e+00, 4.56431709e+00]
                                                                                               [9.31286824e+02, 3.81664729e+03, 1.59856787e+03, 1.33331506e+00,
                                                                                                1.19696863e+03, 5.60895381e+04, 3.09516222e-02, 9.35522168e-01,
                                                                                                4.36870861e+02, 1.16075469e+04, 1.48341116e-04, 7.72554358e-01,
                                                                                                9.03570828e-01, 1.96935592e+00, 4.56431709e+00],
                                                                                               [9.31286824e+02, 3.81664729e+03, 1.59856787e+03, 1.33331506e+00,
                                                                                                1.19696863e+03, 5.60895381e+04, 3.09516222e-02, 9.35522168e-01,
                                                                                                4.36870861e+02, 1.16075468e+04, 1.48341116e-04, 7.72554357e-01,
                                                                                                9.03570830e-01, 1.96935592e+00, 4.56431710e+00]
                                                                                               [9.31286824e+02, 3.81664729e+03, 1.59856787e+03, 1.33331506e+00,
                                                                                                1.19696863e+03, 5.60895381e+04, 3.09516222e-02, 9.35522168e-01,
['SM data type data plots for mutation', 'Sensor/D00] e+02, 1.16075467 = 0.04, Initial Guess e+0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0
                                                                                                1.19696863e+03, 5.6089538 - 4 Converged 21e-02, 9.35522168e-01,
                                                                                                4.36870861e+02, 1.16075468e+04Converged 16e-04, 7.72554357e-01,
                                                                                                                                                                               0e+00],
                                                                                                9.03570830e-01, 1.96935592e+00
                                                                                               [9.31286824e+02, 3.8166472 + Converged 7e+03, 1.33331506e+00,
                                                                                                1.19696862e+03, 5.60895380e+04, 3.09516222e-02, 9.35522167e-01,
                                                                                                4.36870861e+02, 1.$\ddot$6075469e+04, 1.48341116e-04, 7.72554359e-01,
                                                                                                9.03570824e-01, 1.9b935592e+00, 4.56431709e+00],
                                                                                                31286824e+02, 3.$1664729e+03, 1.59856787e+03, 1.33331506e+00,
                                                                                                1.19696863e+03, 5.60895381e+04, 3.09516221e-02, 9.35522168e-01, 4.36870861e+02, 1.16075468e+04, 1.48341116e-04, 7.72554358e-01,
                                                                                                9.035<del>70828e-01, 1.</del>96935592e+00, 4.56431710e+00],
                                                                                                9.31286824e+02.3.81664729e+03, 1.59856787e+03, 1.33331506e+00, 1.9696863e+03, 1.60895381e+04, 1.09516222e-02, 1.09516222e-03, 1.09516222e-02, 1.09516222e-03, 1.0951622
                                                                   10^{-5}
                                                                                 10^{-4}
                                                                               Full circuft 36% 7086 Piote 02, 1.16075468e+04, 1.48341116e-04, 7.72554357e-01,
                                                                                                       <del>35708306-01, 1.9</del>6935592e+00, 4.56431710e+00],
                                                                                               [931286824e+02, 3.81664729e+03, 1.59856787e+03, 1.33331506e+00,
                                                                                                1.19696863e+03, 5.60895381e+04, 3.09516222e-02, 9.35522168e-01,
                                                                                                4.36870861e+02, 1 16075468e+04, 1.48341116e-04, 7.72554357e-01,
                                                                                                9.03570830e-01, 1.96935592e+00, 4.56431710e+00],
                                                                                                [9.31286824e+02, 3.$1664729e+03, 1.59856787e+03, 1.33331506e+00,
                                                                                                   .19696863e+03, 5.$0895381e+04, 3.09516221e-02, 9.35522168e-01,
                                                                                                 4\36870861e+02, 1.\ddata6075468e+04, 1.48341116e-04, 7.72554357e-01,
                                                                                                9.03570832e-01, 1.96935592e+00, 4.56431710e+00]
                                                                                                [9.3] \times 86824e+02, 3.81664729e+03, 1.59856787e+03, 1.33331506e+00,
                                                                                                1.19696863e+03, 5.60895381e+04, 3.09516221e-02, 9.35522168e-01,
                                                                                                4.36870861e+02, 1.16075468e+04, 1.48341116e-04, 7.72554357e-01,
                                                                                                9<sub>0</sub>03570833e-01,<sub>10</sub>96935592e+00, 4.56431710e+00],
                                                                   10^{-5}
                                                                                 10^{-4}
                                                                                                [9.31286824e+02, 3.81664729e+03, 1.59856787e+03, 1.33331506e+00,
                                                                                                1.19696863e+03, 5.60895381e+04, 3.09516221e-02, 9.35522169e-01,
                                                                                                4.36870861e+02, 1.16075467e+04, 1.48341116e-04, 7.72554356e-01,
                                                                                                9.03570836e-01, 1.96935592e+00, 4.56431710e+00],
                                                                                                [9.31286824e+02, 3.81664729e+03, 1.59856787e+03, 1.33331506e+00,
                                                                                                1.19696863e+03, 5.60895381e+04, 3.09516222e-02, 9.35522168e-01,
                                                                                                4.36870861e+02, 1.16075468e+04, 1.48341116e-04, 7.72554357e-01,
                                                                                                9.03570830e-01, 1.96935592e+00, 4.56431710e+00],
                                                                                               [9.31286824e+02, 3.81664729e+03, 1.59856787e+03, 1.33331506e+00,
                                                                                                1.19696863e+03, 5.60895381e+04, 3.09516221e-02, 9.35522168e-01,
             epsilon Initial guesses Converged
                                                                                                4.36870861e+02, 1.16075468e+04, 1.48341116e-04, 7.72554357e-01,
                                   608.397103 931.286824
                                                                                                9.03570833e-01, 1.96935592e+00, 4.56431710e+00]]), array([0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.047825, 0.047825, 0.047825, 0.047825, 0.047825, 0.047825, 0.047825, 0.047825, 0.047825, 0.047825, 0.04
                                   15250.457700 3816.647287
                                                                                               0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825,
                                 1668.059050 1598.567871
                                                                                               0.04782825, 0.04782825, 0.04782825, 0.04782825, 0.04782825,
                                                         1.333315
                                                                                               0.04782825]))
                                   687.964693 1196.968625
                                                                                                    fun: 0.04782825305729667
                                   23497.611400 56089.538076
                                                                                               message: 'Optimization terminated successfully.'
                                                         0.030952
                                                                                                  nfev: 8471
                                                         0.935522
                                                                                                   nit: 6285
                                    590.606548 436.870861
                                                                                                status: 0
                                    35287.125700 11607.546834
                                                                                               success: True
                                                         0.000148
                                                                                                      x: array([9.31286824e+02, 3.81664729e+03, 1.59856787e+03, 1.33331506e+00,
                                                         0.772554
                                                                                               1.19696863e+03, 5.60895381e+04, 3.09516222e-02, 9.35522168e-01,
                                                         0.903571
                                                                                               4.36870861e+02, 1.16075468e+04, 1.48341116e-04, 7.72554358e-01,
                                                         1.969356
                                                                                               9.03570829e-01, 1.96935592e+00, 4.56431710e+00])
                                                          4.564317
```

inducer -> sensor (GFP output)

 $10^{-3}$ 

inducer -> S -| Output (GFP)

10<sup>-3</sup>

RSS (converged)=0.048

RSS (% reduction)=0.988

Across all four plots:

RSS (initial)=4.027

A s 322.889721

Cs -69.491179

Νs

Сr

Νr

Сh

Αо

Со

N\_o

B s -11433.810413

B\_r 32591.926676

A h -153.735687

B h -23679.578866

0.134382

509.003932

-0.031416

0.543791

-0.000382

-0.057275

-3.384599

-1.163866

2.755299

 $10^{-4}$ 

 $10^{-4}$ 

 $10^{-2}$ 

 $10^{-2}$ 

 $10^{-1}$ 

 $10^{-1}$ 

1.198934

0.062367

0.391731

0.000530

0.829830

4.288170

3.133222

1.809018

 $4 \times 10^{3}$ 

 $3 \times 10^{3}$ 

 $2 \times 10^{3}$ 

 $6 \times 10^{3}$ 

 $4 \times 10^{3}$ 

 $3 \times 10^{3}$ 

 $10^{4}$ 

 $10^{3}$ 

 $10^{4}$ 

10<sup>-5</sup>