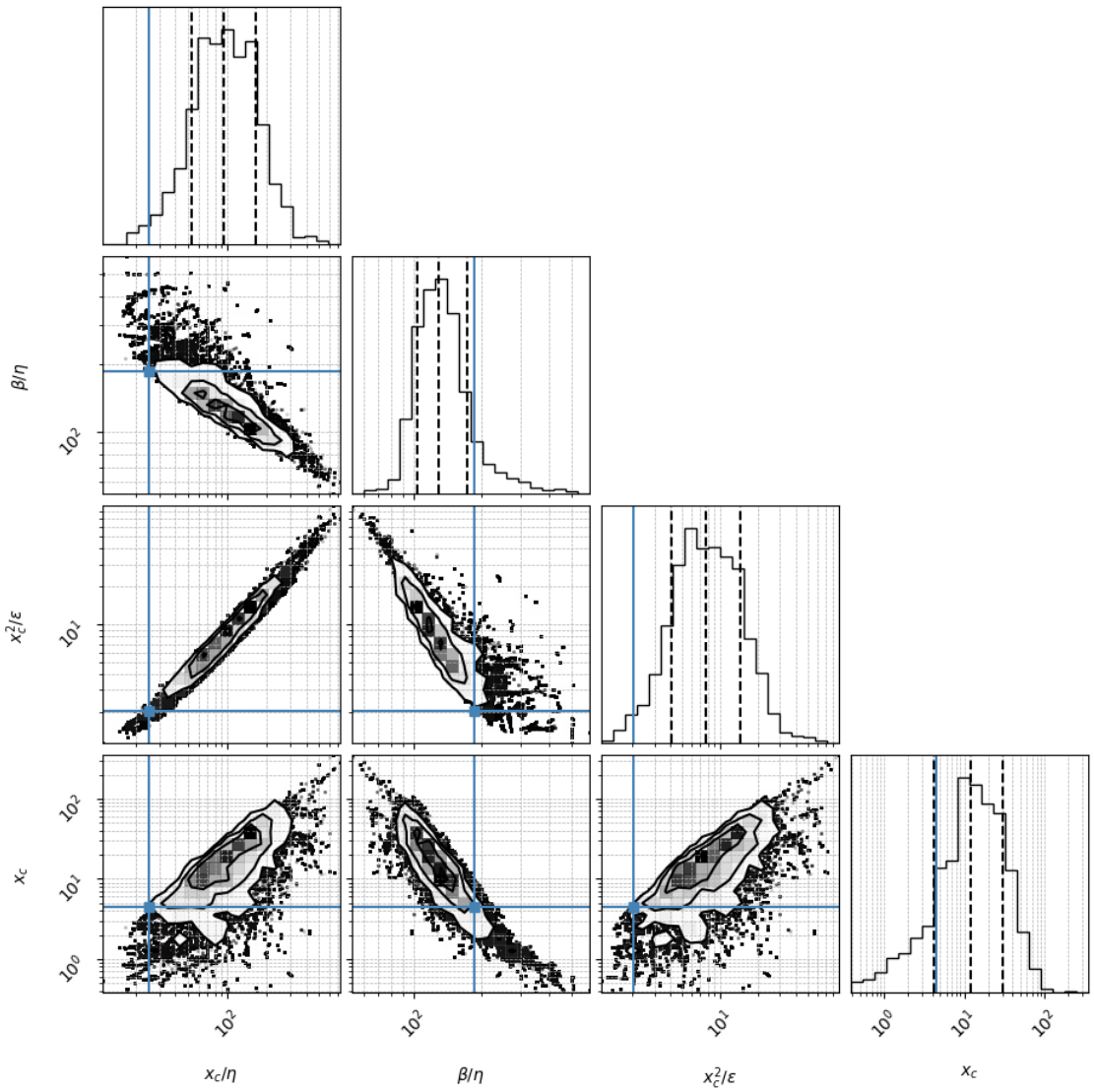
mcmc_analysis_ecoli_baysian

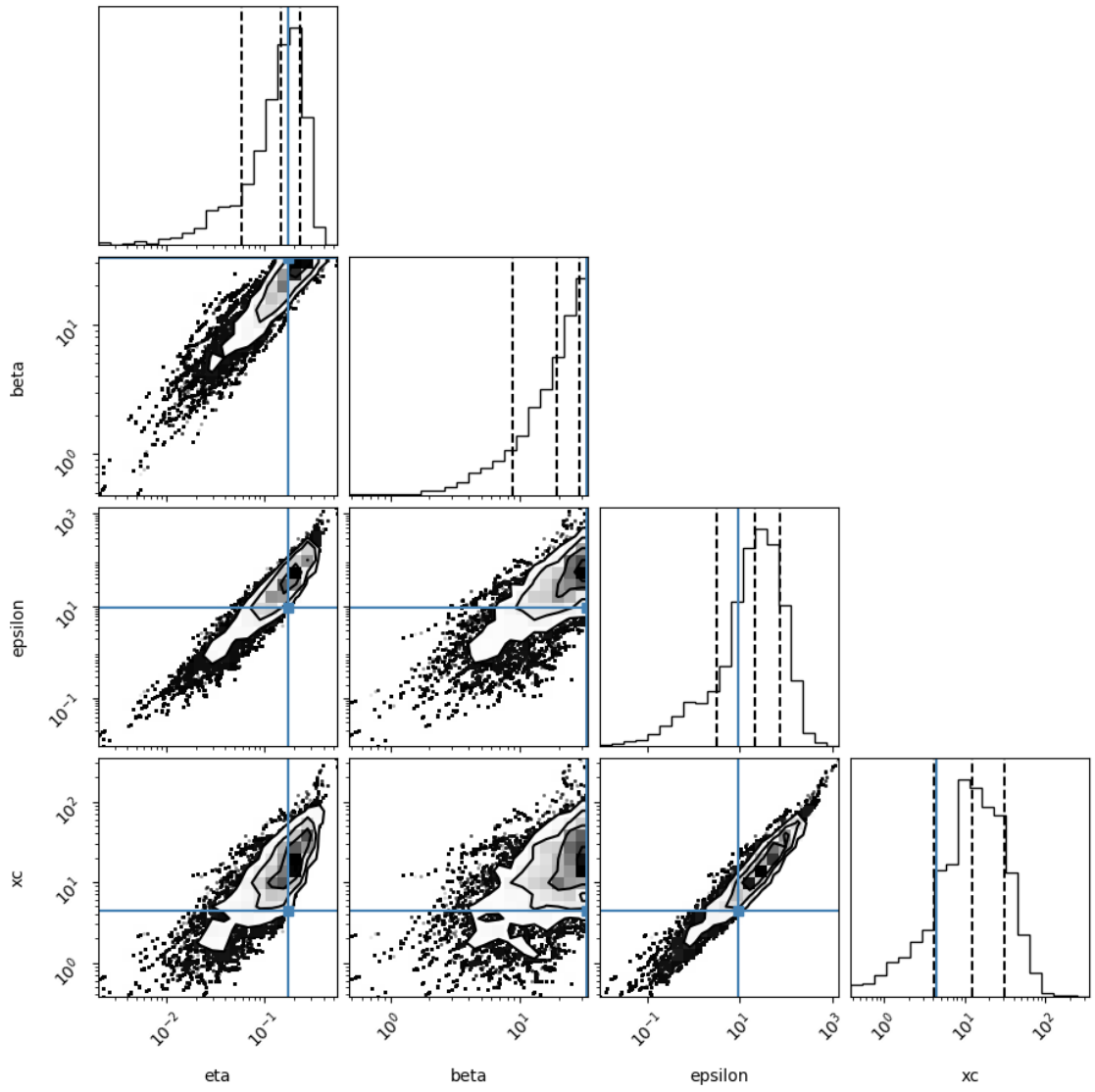
November 24, 2025

1 # 1. Density coner plot

A sample is 1 parameter set scanned. For the corner plot below, the quantiles (represented by the solid lines) are 0.16,0.5,0.84 of the samples. Dots represent individual samples (outside the line surrounding 0.84 of the samples) The parameter search is performed in the transformed space of x_c/η, β/η, x_c^2/ϵ, x_c but we also show the regular parameters

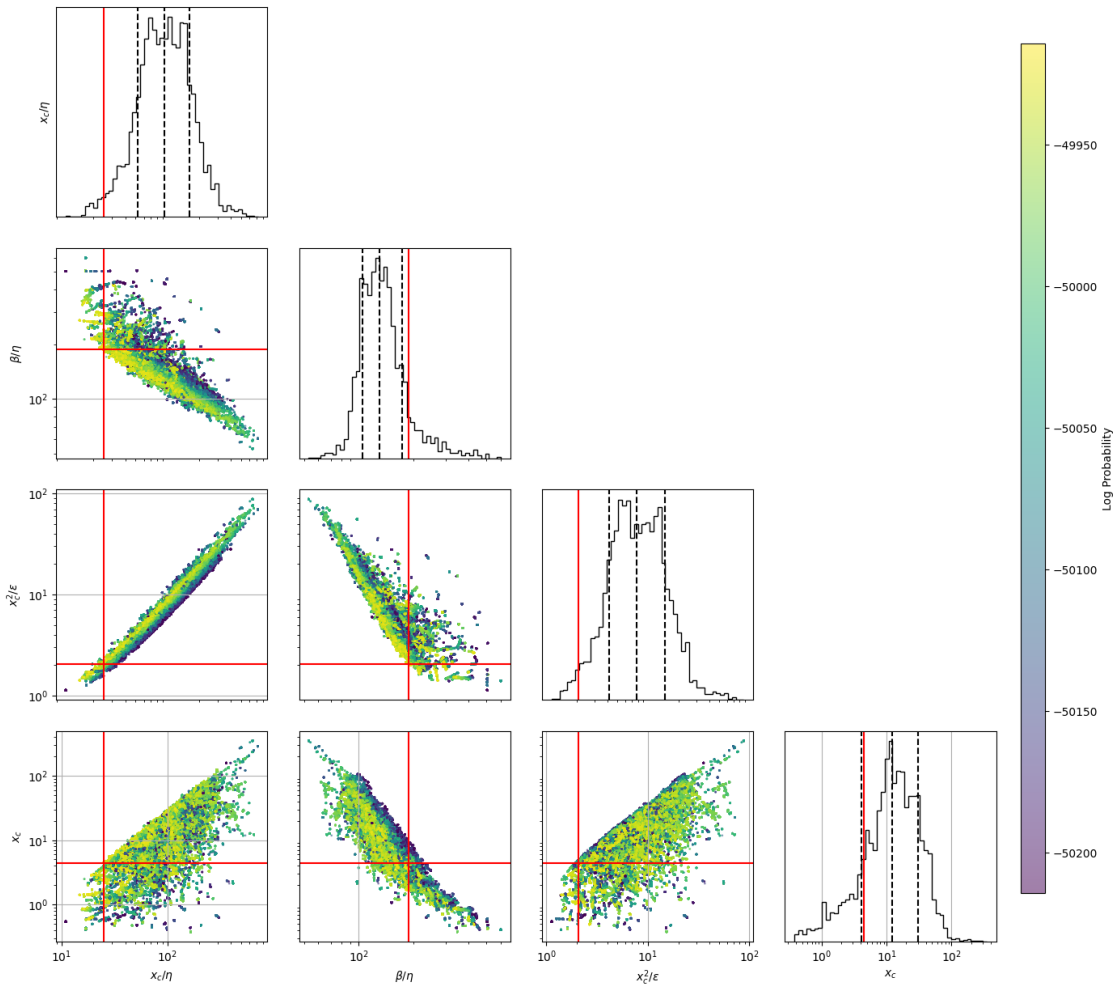
```
(16,)
```


β/η
x_c^2/ε
x_c
10^2
10^1
10^0
x_c/η
β/η
x_c^2/ε
x_c



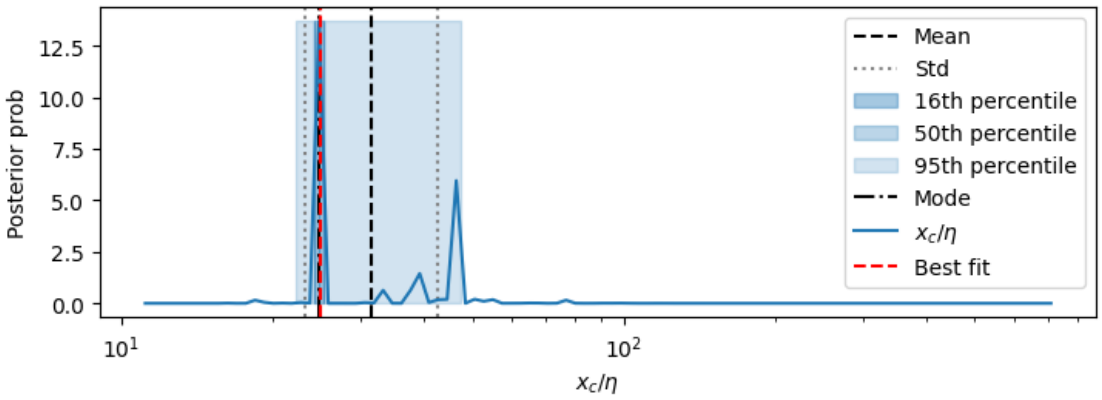
2 2. Heat map corner plot of raw samples

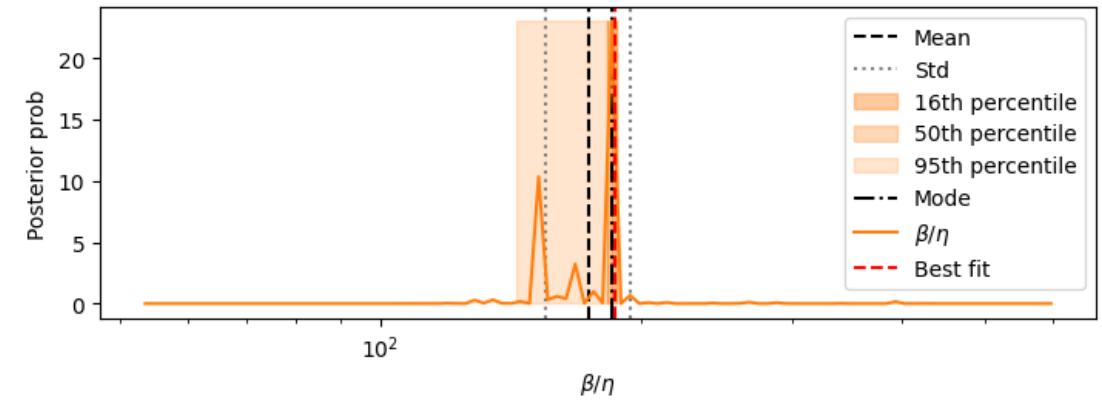
This plot shows all the raw sample points and their lnprobability

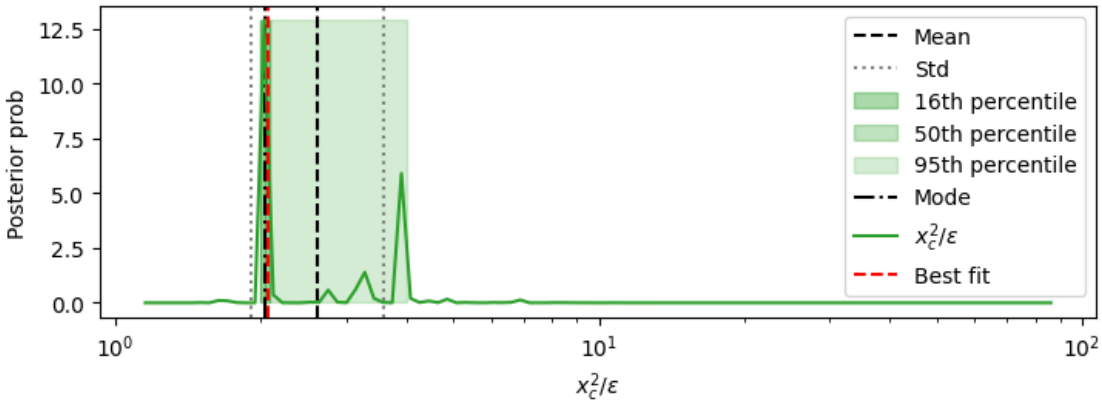


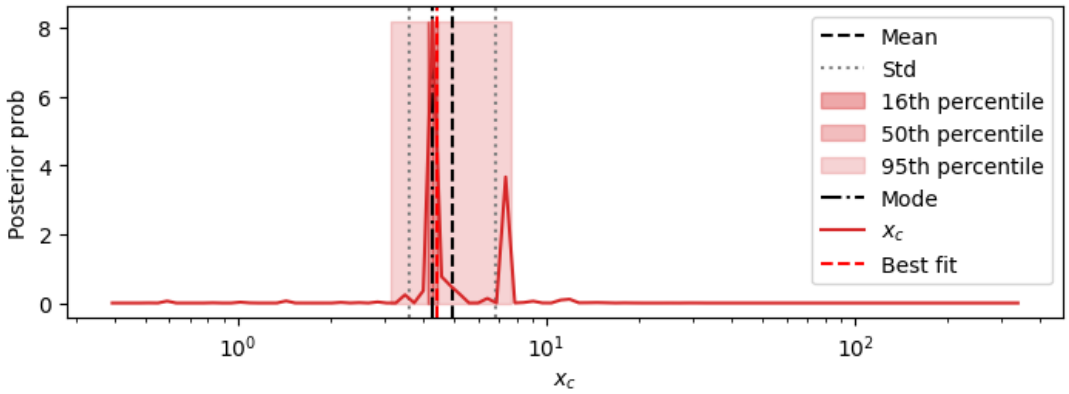
3 3. Posterior distributions of parameters

1d marginalizations of posterior distributions. we use a grid of size nbins=100-150


Posterior prob
12.5
10.0
7.5
5.0
2.5
0.0
10^1
10^2
x_c/η
Mean
Std
16th percentile
50th percentile
95th percentile
Mode
x_c/η
Best fit

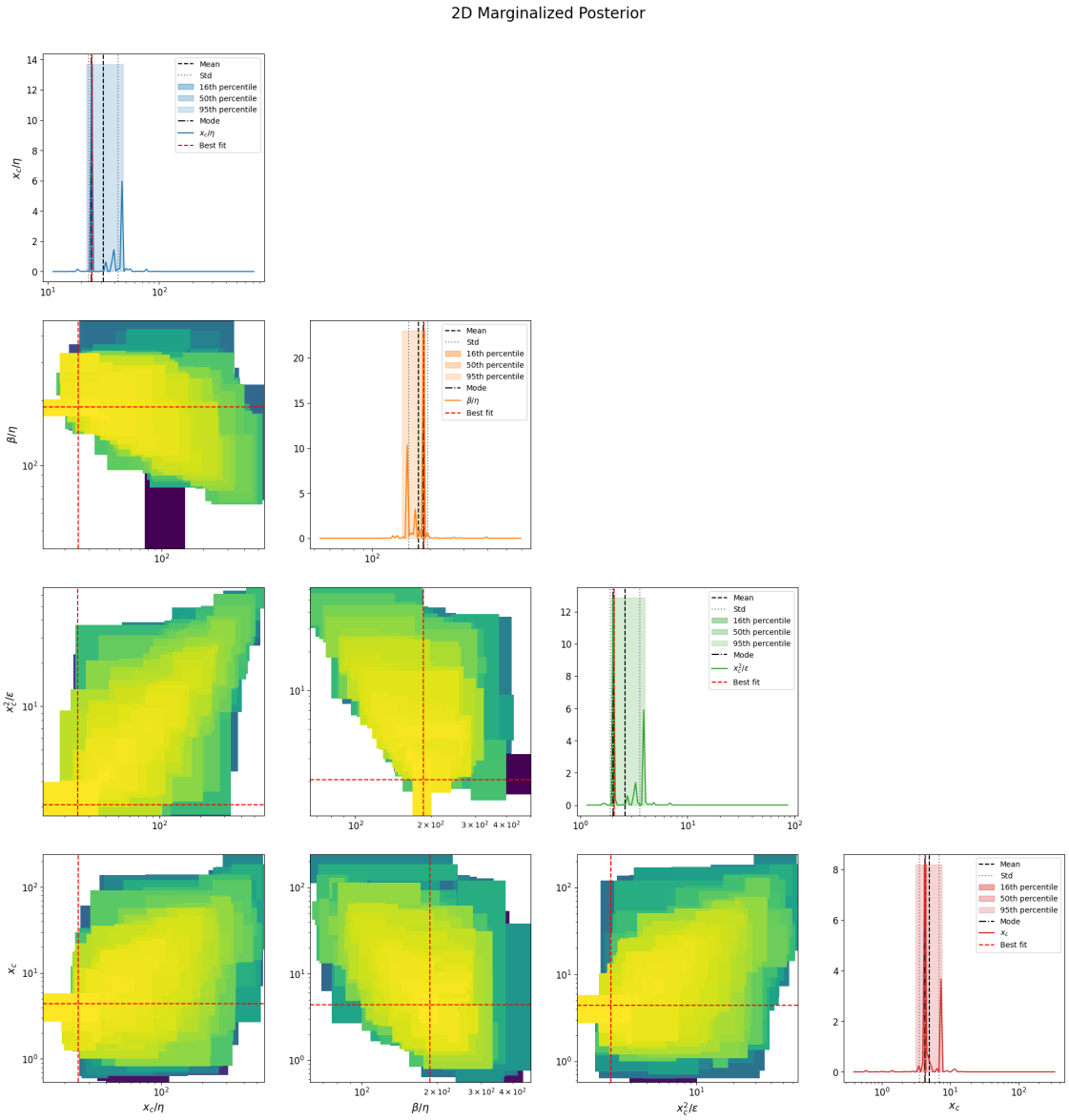

Posterior prob
20
15
10
5
0
10^2
β/η
Mean
Std
16th percentile
50th percentile
95th percentile
Mode
β/η
Best fit


Posterior prob
12.5
10.0
7.5
5.0
2.5
0.0
10^0
10^1
10^2
x_c^2/ε
Mean
Std
16th percentile
50th percentile
95th percentile
Mode
x_c^2/ε
Best fit


Posterior prob
8
6
4
2
0
10^0
10^1
10^2
x_c
Mean
Std
16th percentile
50th percentile
95th percentile
Mode
x_c
Best fit

2D marginalizations of posterior distributions

```
/Volumes/alon/navehr/SRtools/SRtools/samples_utils.py:474: UserWarning: The
input coordinates to pcolormesh are interpreted as cell centers, but are not
monotonically increasing or decreasing. This may lead to incorrectly calculated
cell edges, in which case, please supply explicit cell edges to pcolormesh.
  ax.pcolormesh(X, Y, Z, **kwargs)
```




```
Rescaling the samples TIME by 0.041666666666666664
```

4 4. Table of results

mode is the marginalized mode, max_likwlihood is the sample with highest likelihood mode_overall is the 4D posterior mode

	mean	\
xc/eta	31.424	
beta/eta	174.055	
xc^2/epsilon	2.607	
xc	4.967	
eta	0.163	
beta	28.891	
epsilon	10.036	
sqrt(xc/eta)	5.609	
s= eta^0.5*xc^1.5/epsilon	0.469	
beta*xc/epsilon	14.614	
eta*xc/epsilon	0.0832	
Fx=beta^2/eta*xc	807.258	
Dx =beta*epsilon/eta*xc^2	56.841	
Pk=beta*k/epsilon	1.492	
Fk=beta^2/eta*k	9929.22	
Dk =beta*epsilon/eta*k^2	6570.655	
Fk^2/Dk=beta^3/eta*epsilon	16665.223	
epsilon/beta^2	0.0194	
k/beta	0.021	
k^2/epsilon	0.0245	
eta/xc	0.0386	
beta/xc	7.236	
epsilon/xc^2	0.468	
k/xc	0.117	
best fit no ext hazard_MedianLifetime	66.1	
best fit no ext hazard_MaxLifetime	119.6	
best fit_MedianLifetime	66.22	
best fit_MaxLifetime	118.37	
data_MedianLifetime	68.09	
data_MaxLifetime	137.66	
ML_lnprob	-49914.225683	

	std	\
xc/eta	[8.262, 11.209]	
beta/eta	[18.672, 20.916]	
xc^2/epsilon	[0.706, 0.969]	
xc	[1.373, 1.898]	
eta	[0.0249, 0.0294]	
beta	[4.733, 5.66]	
epsilon	[3.141, 4.573]	

sqrt(xc/eta)	[0.841, 0.989]
s= eta^0.5*xc^1.5/epsilon	[0.0751, 0.0893]
beta*xc/epsilon	[1.629, 1.834]
eta*xc/epsilon	[0.00116, 0.00118]
Fx=beta^2/eta*xc	[377.51, 709.131]
Dx =beta*epsilon/eta*xc^2	[21.499, 34.577]
Pk=beta*k/epsilon	[0.495, 0.742]
Fk=beta^2/eta*k	[2196.167, 2819.873]
Dk =beta*epsilon/eta*k^2	[1992.387, 2859.441]
Fk^2/Dk=beta^3/eta*epsilon	[6783.412, 11439.914]
epsilon/beta^2	[0.00761, 0.0125]
k/beta	[0.00227, 0.00255]
k^2/epsilon	[0.0111, 0.0204]
eta/xc	[0.00657, 0.00792]
beta/xc	[1.625, 2.095]
epsilon/xc^2	[0.0828, 0.101]
k/xc	[0.0231, 0.0288]
best fit no ext hazard_MedianLifetime	0.51
best fit no ext hazard_MaxLifetime	0
best fit_MedianLifetime	0.51
best fit_MaxLifetime	0
data_MedianLifetime	0.51
data_MaxLifetime	0
ML_lnprob	[-49914.22568292802, -49914.22568292802]

	mode \
xc/eta	24.762
beta/eta	185.312
xc^2/epsilon	2.031
xc	4.275
eta	0.174
beta	32.747
epsilon	9.902
sqrt(xc/eta)	4.976
s= eta^0.5*xc^1.5/epsilon	0.412
beta*xc/epsilon	15.454
eta*xc/epsilon	0.0827
Fx=beta^2/eta*xc	1444.238
Dx =beta*epsilon/eta*xc^2	89.191
Pk=beta*k/epsilon	1.807
Fk=beta^2/eta*k	12050.826
Dk =beta*epsilon/eta*k^2	6877.514
Fk^2/Dk=beta^3/eta*epsilon	20461.808
epsilon/beta^2	0.0235
k/beta	0.0205
k^2/epsilon	0.0199
eta/xc	0.0404

beta/xc	7.622
epsilon/xc^2	0.492
k/xc	0.117
best fit no ext hazard_MedianLifetime	66.1
best fit no ext hazard_MaxLifetime	119.6
best fit_MedianLifetime	66.22
best fit_MaxLifetime	118.37
data_MedianLifetime	68.09
data_MaxLifetime	137.66
ML_lnprob	-49914.225683

	percentile_16 \
xc/eta	[24.248, 25.287]
beta/eta	[183.07, 187.581]
xc^2/epsilon	[1.987, 2.075]
xc	[4.132, 4.424]
eta	[0.17, 0.179]
beta	[32.06, 33.45]
epsilon	[9.329, 10.509]
sqrt(xc/eta)	[4.924, 5.029]
s= eta^0.5*xc^1.5/epsilon	[0.407, 0.417]
beta*xc/epsilon	[15.285, 15.624]
eta*xc/epsilon	[0.0823, 0.0831]
Fx=beta^2/eta*xc	[1383.536, 1507.604]
Dx =beta*epsilon/eta*xc^2	[86.29, 92.19]
Pk=beta*k/epsilon	[1.73, 1.887]
Fk=beta^2/eta*k	[11720.113, 12390.872]
Dk =beta*epsilon/eta*k^2	[6541.013, 7231.328]
Fk^2/Dk=beta^3/eta*epsilon	[19401.983, 21579.525]
epsilon/beta^2	[0.0225, 0.0245]
k/beta	[0.0201, 0.021]
k^2/epsilon	[0.0187, 0.0211]
eta/xc	[0.0395, 0.0412]
beta/xc	[7.384, 7.867]
epsilon/xc^2	[0.482, 0.503]
k/xc	[0.113, 0.121]
best fit no ext hazard_MedianLifetime	[65.61, 66.61]
best fit no ext hazard_MaxLifetime	[119.6, 119.6]
best fit_MedianLifetime	[65.73, 66.73]
best fit_MaxLifetime	[118.37, 118.37]
data_MedianLifetime	[67.60000000000001, 68.60000000000001]
data_MaxLifetime	[137.66, 137.66]
ML_lnprob	[-49914.22568292802, -49914.22568292802]

	percentile_50 \

```
xc/eta                                                    [24.248, 25.287]
beta/eta                                                 [183.07, 187.581]
xc^2/epsilon                                               [1.987, 2.075]
xc                                                         [4.132, 4.424]
eta                                                         [0.17, 0.179]
beta                                                       [32.06, 33.45]
epsilon                                                   [9.329, 10.509]
sqrt(xc/eta)                                               [4.924, 5.029]
s= eta^0.5*xc^1.5/epsilon                                  [0.407, 0.417]
beta*xc/epsilon                                           [15.285, 15.624]
eta*xc/epsilon                                            [0.0823, 0.0839]
Fx=beta^2/eta*xc                                        [758.426, 1950.641]
Dx =beta*epsilon/eta*xc^2                                  [54.311, 98.494]
Pk=beta*k/epsilon                                            [1.73, 1.887]
Fk=beta^2/eta*k                                       [11720.113, 12390.872]
Dk =beta*epsilon/eta*k^2                                [6541.013, 7231.328]
Fk^2/Dk=beta^3/eta*epsilon                            [19401.983, 21579.525]
epsilon/beta^2                                            [0.0225, 0.0245]
k/beta                                                     [0.0201, 0.021]
k^2/epsilon                                               [0.0187, 0.0211]
eta/xc                                                    [0.0395, 0.0412]
beta/xc                                                     [7.384, 7.867]
epsilon/xc^2                                                [0.482, 0.503]
k/xc                                                        [0.113, 0.121]
best fit no ext hazard_MedianLifetime                       [65.61, 66.61]
best fit no ext hazard_MaxLifetime                          [119.6, 119.6]
best fit_MedianLifetime                                     [65.73, 66.73]
best fit_MaxLifetime                                      [118.37, 118.37]
data_MedianLifetime                  [67.60000000000001, 68.60000000000001]
data_MaxLifetime                                          [137.66, 137.66]
ML_lnprob                          [-49914.22568292802, -49914.22568292802]

                                                                 percentile_95
\
xc/eta                                                      [22.298, 47.431]
beta/eta                                                 [143.511, 187.581]
xc^2/epsilon                                                [1.987, 3.991]
xc                                                          [3.144, 7.638]
eta                                                         [0.121, 0.201]
beta                                                      [20.969, 33.45]
epsilon                                                    [5.794, 24.187]
sqrt(xc/eta)                                                [4.722, 7.182]
s= eta^0.5*xc^1.5/epsilon                                    [0.37, 0.587]
beta*xc/epsilon                                            [11.0, 15.624]
eta*xc/epsilon                                            [0.0808, 0.0847]
Fx=beta^2/eta*xc                                        [294.883, 1950.641]
Dx =beta*epsilon/eta*xc^2                                  [26.237, 98.494]
```

Pk=beta*k/epsilon	[0.862, 2.45]
Fk=beta^2/eta*k	[7102.336, 12390.872]
Dk =beta*epsilon/eta*k^2	[3582.669, 8838.207]
Fk^2/Dk=beta^3/eta*epsilon	[4376.283, 21579.525]
epsilon/beta^2	[0.00746, 0.159]
k/beta	[0.0177, 0.0295]
k^2/epsilon	[0.0116, 0.0485]
eta/xc	[0.022, 0.0448]
beta/xc	[3.455, 8.381]
epsilon/xc^2	[0.251, 0.503]
k/xc	[0.092, 0.148]
best fit no ext hazard_MedianLifetime	[65.61, 66.61]
best fit no ext hazard_MaxLifetime	[119.6, 119.6]
best fit_MedianLifetime	[65.73, 66.73]
best fit_MaxLifetime	[118.37, 118.37]
data_MedianLifetime	[67.60000000000001, 68.60000000000001]
data_MaxLifetime	[137.66, 137.66]
ML_lnprob	[-49914.22568292802, -49914.22568292802]

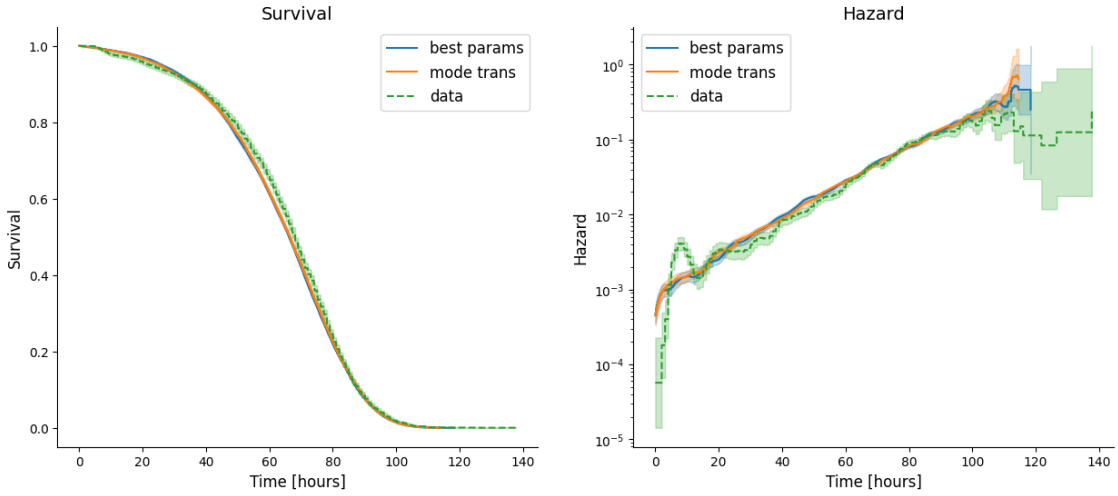
	max_likelihood	mode_overall
xc/eta	24.982	24.982
beta/eta	186.673	186.673
xc^2/epsilon	2.061	2.061
xc	4.408	4.408
eta	0.176	0.176
beta	32.936	32.936
epsilon	9.426	9.426
sqrt(xc/eta)	4.998	4.998
s= eta^0.5*xc^1.5/epsilon	0.412	0.412
beta*xc/epsilon	15.401	15.401
eta*xc/epsilon	0.0825	0.0825
Fx=beta^2/eta*xc	1394.851	1394.851
Dx =beta*epsilon/eta*xc^2	90.567	90.567
Pk=beta*k/epsilon	1.747	1.747
Fk=beta^2/eta*k	12296.637	12296.637
Dk =beta*epsilon/eta*k^2	7038.655	7038.655
Fk^2/Dk=beta^3/eta*epsilon	21482.412	21482.412
epsilon/beta^2	0.00869	0.0232
k/beta	0.0152	0.0209
k^2/epsilon	0.0265	0.0189
eta/xc	0.04	0.04
beta/xc	7.472	7.472
epsilon/xc^2	0.485	0.485
k/xc	0.113	0.113
best fit no ext hazard_MedianLifetime	66.1	NaN
best fit no ext hazard_MaxLifetime	119.6	NaN
best fit_MedianLifetime	66.22	NaN

best fit_MaxLifetime	118.37	NaN
data_MedianLifetime	68.09	NaN
data_MaxLifetime	137.66	NaN
ML_lnprob	-49914.225683	-49914.225683

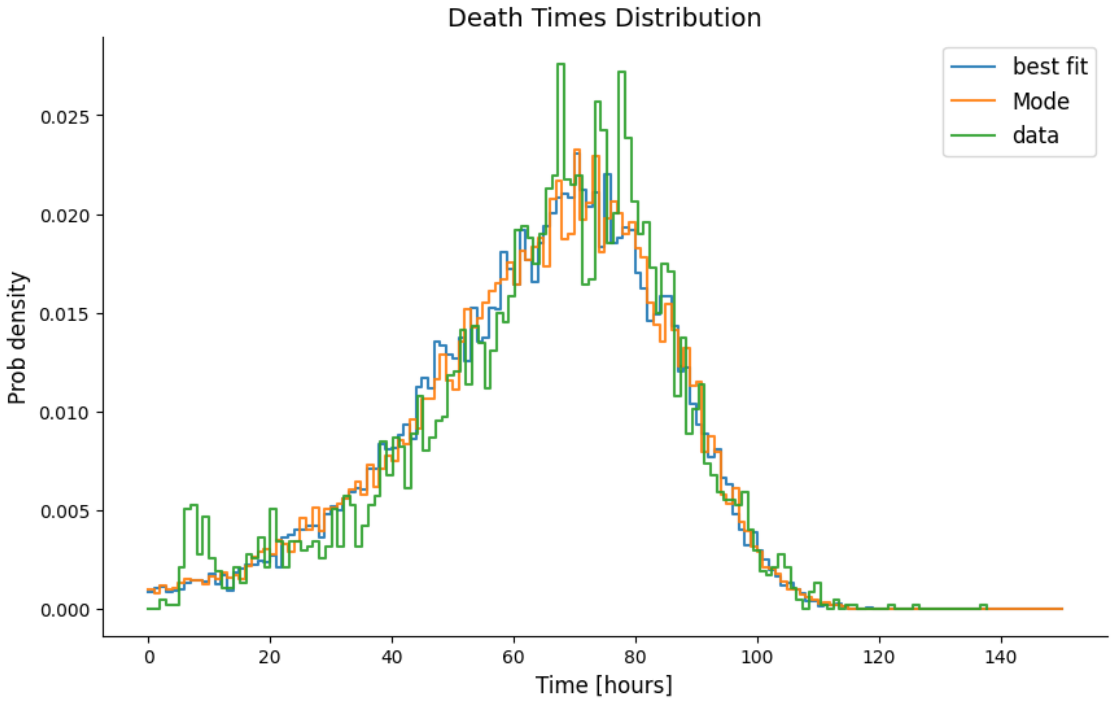
5 5. Fits of simulations to data

best params is the sample with highest likelihood. mode trans is the 4D posterior mode in the transformed space of x_c/η, β/η, x_c^2/ϵ, x_c

```
Text(0, 0.5, 'Hazard')
```




```
Text(0, 0.5, 'Prob density')
```


Death Times Distribution
best fit
Mode
data
Prob density
0.025
0.020
0.015
0.010
0.005
0.000
0
20
40
60
80
100
120
140
Time [hours]