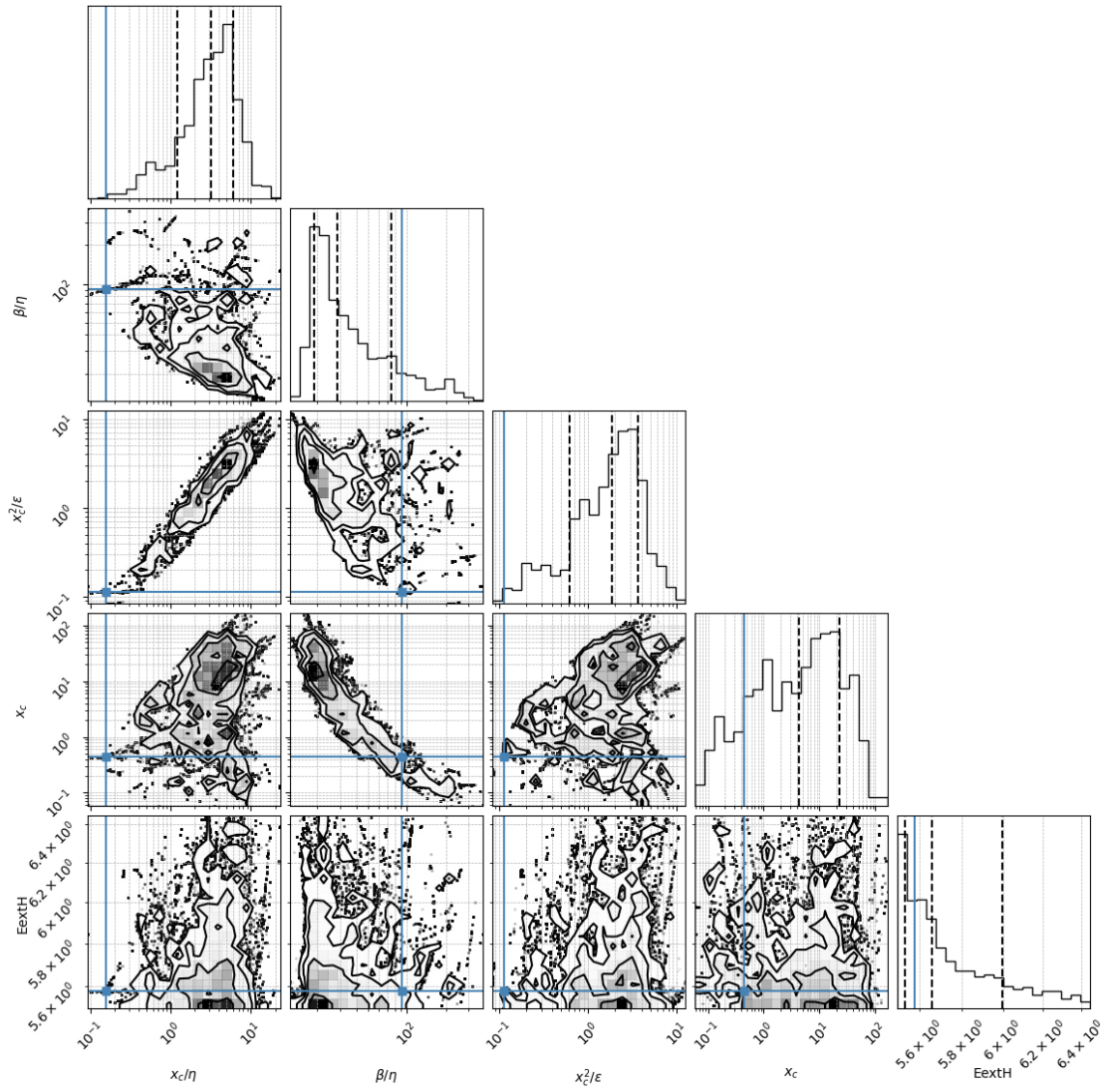
mcmc_analysis_Jack_Russell_vetCompass_baysian

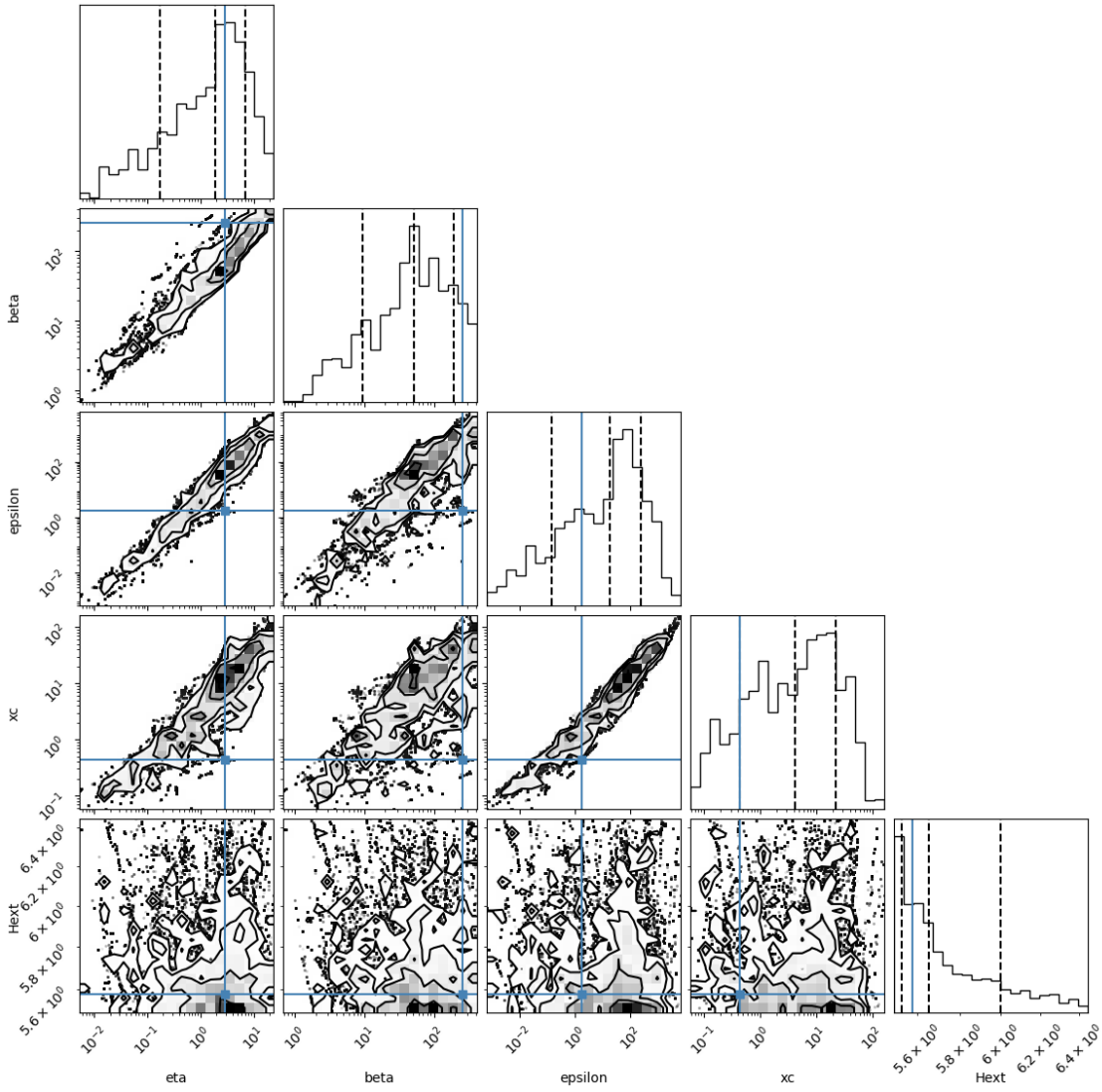
November 24, 2025

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

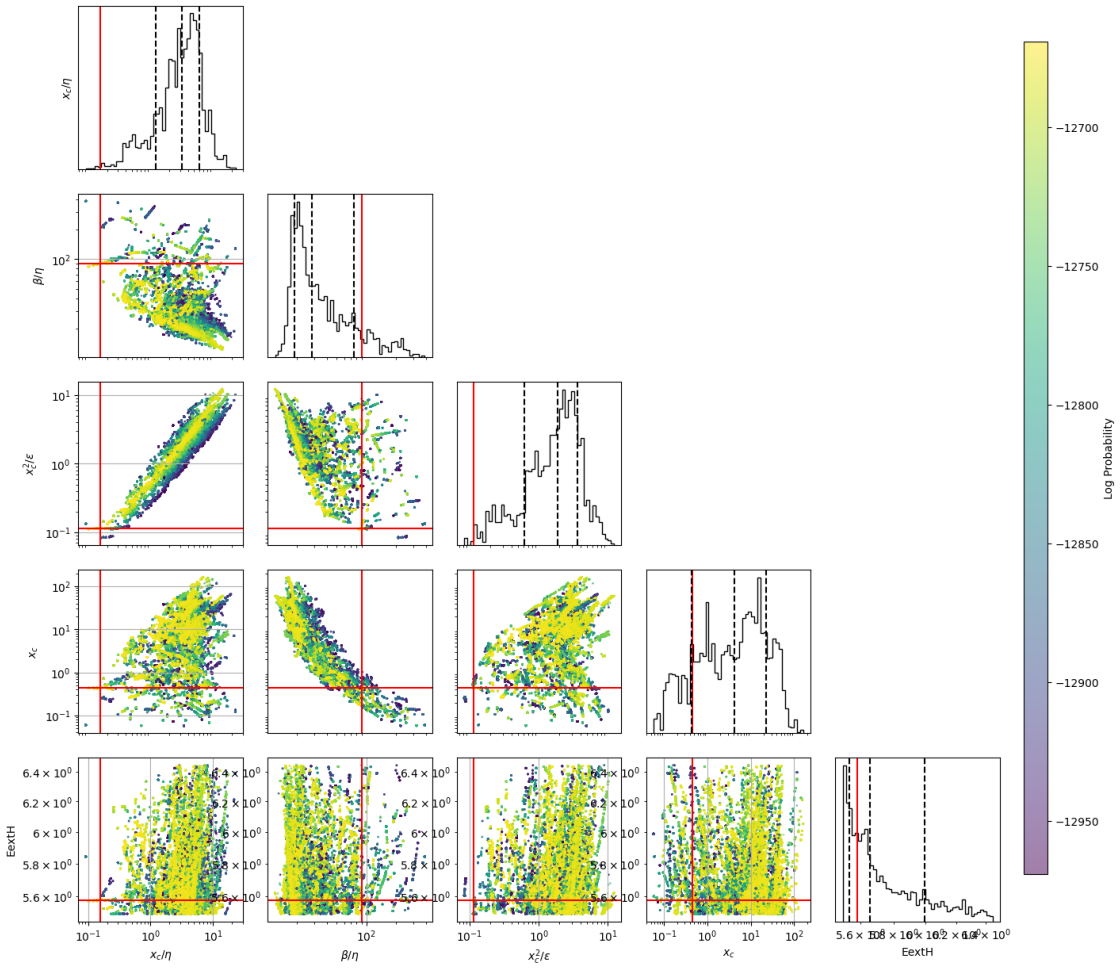
```
(25,)
```


x_c/η
β/η
x_c^2/ε
x_c
EextH



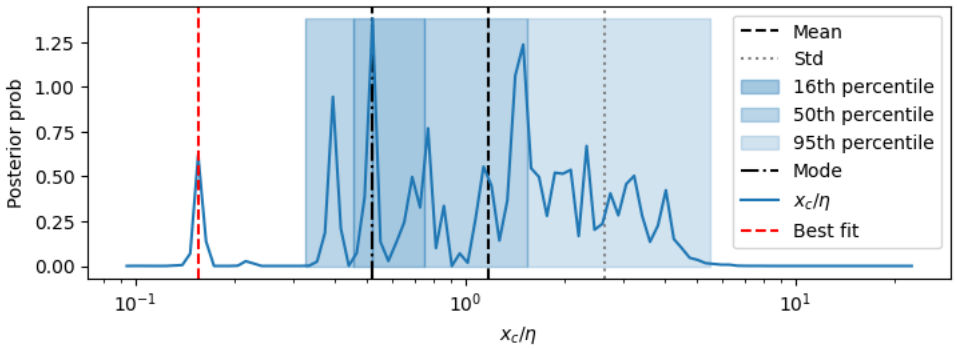
2 2. Heat map corner plot of raw samples

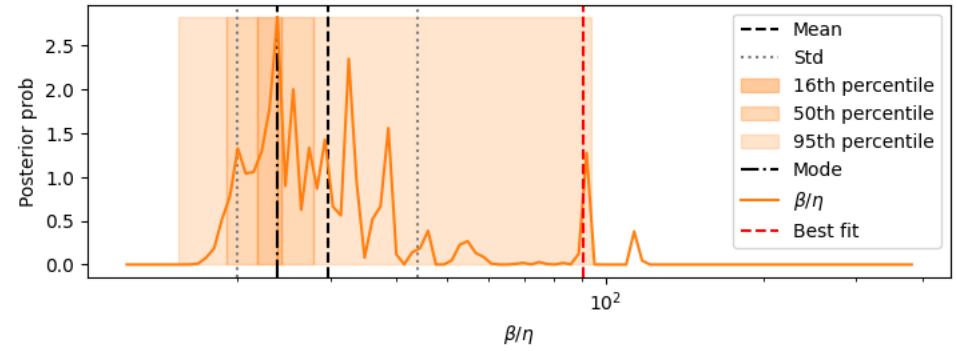
This plot shows all the raw sample points and their lnprobability

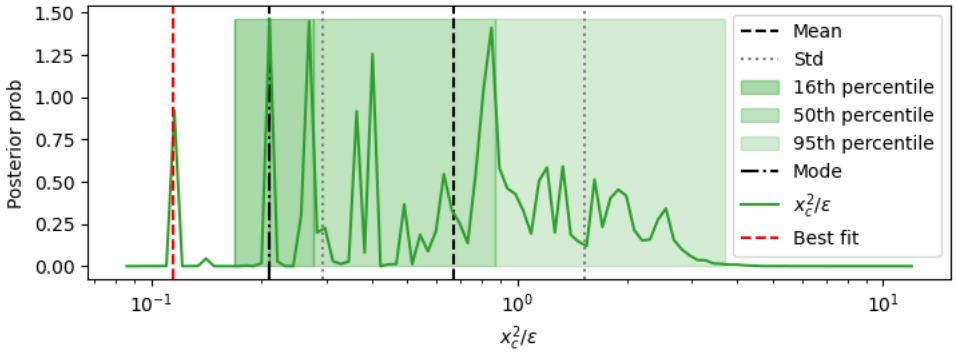


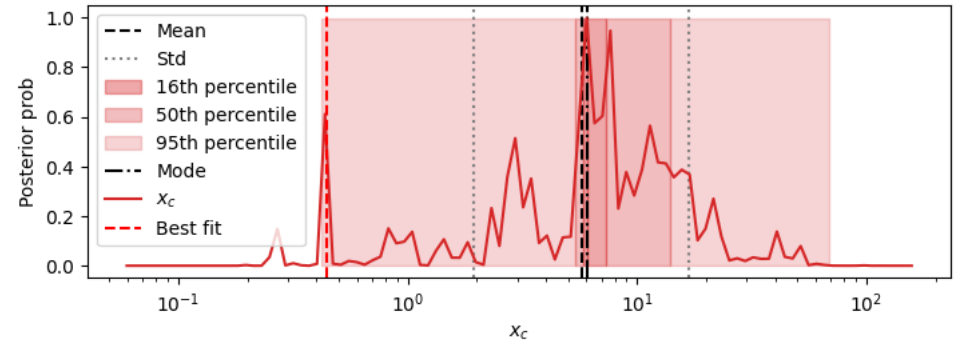
3 3. Posterior distributions of parameters

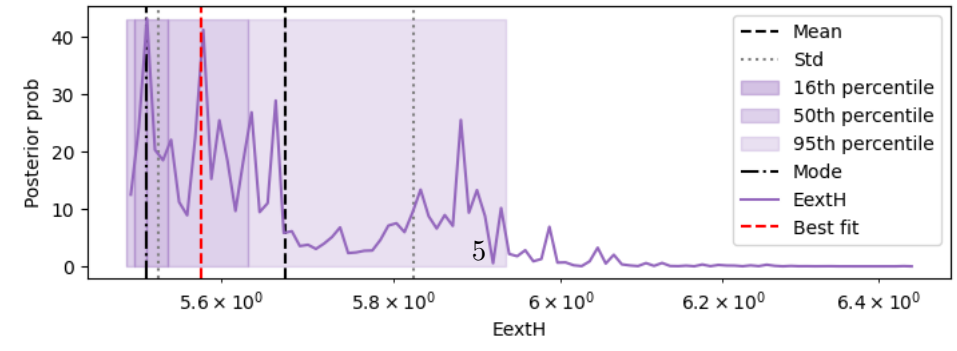
1d marginalizations of posterior distributions. we use a grid of size nbins=100-150


Posterior prob
1.25
1.00
0.75
0.50
0.25
0.00
10^{-1}
10^{0}
10^{1}
x_c/η
Mean
Std
16th percentile
50th percentile
95th percentile
Mode
x_c/η
Best fit


Posterior prob
2.5
2.0
1.5
1.0
0.5
0.0
10^{2}
β/η
Mean
Std
16th percentile
50th percentile
95th percentile
Mode
β/η
Best fit

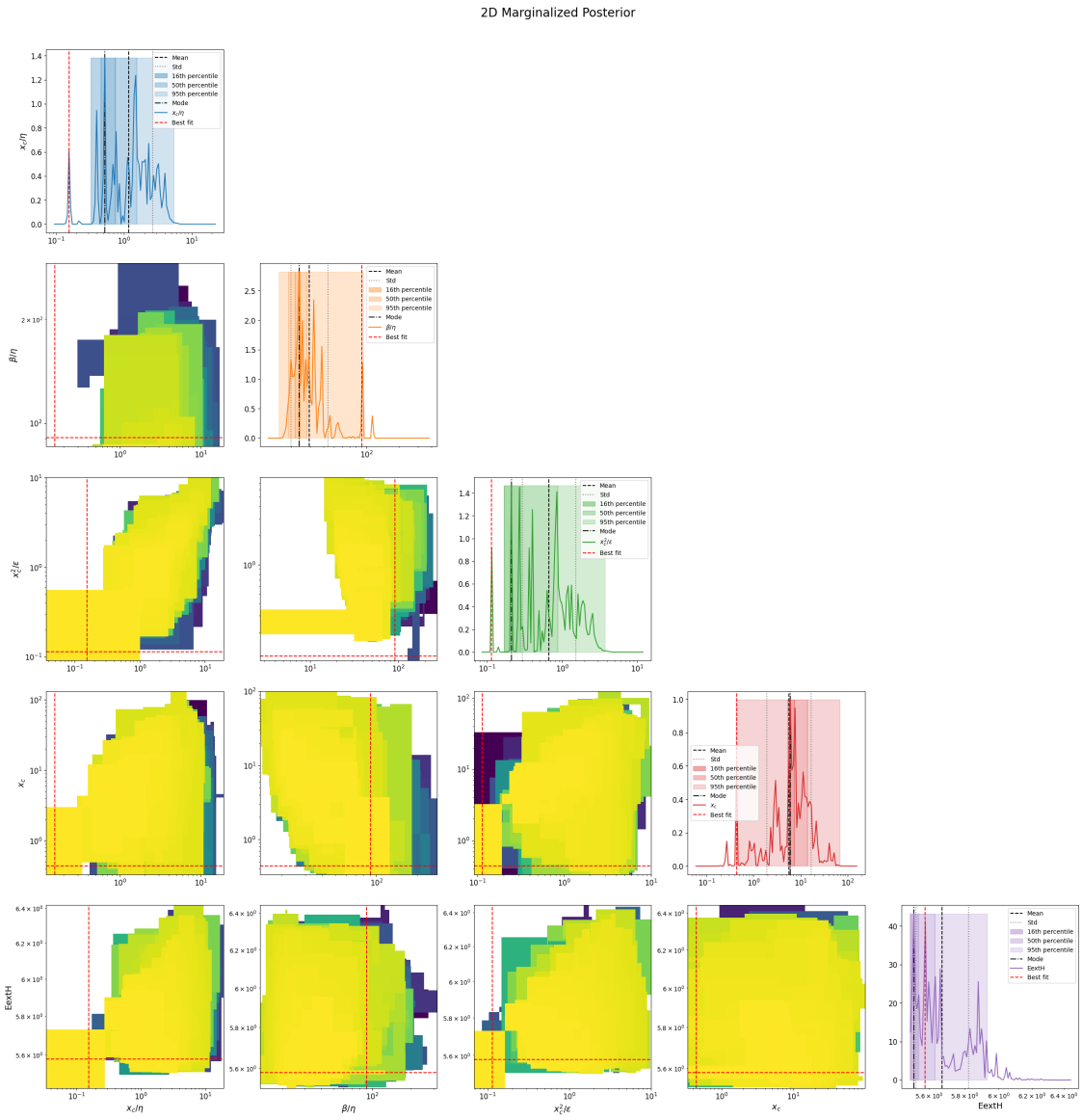

Posterior prob
1.50
1.25
1.00
0.75
0.50
0.25
0.00
10^{-1}
10^{0}
10^{1}
x_c^2/ε
Mean
Std
16th percentile
50th percentile
95th percentile
Mode
x_c^2/ε
Best fit


Posterior prob
1.0
0.8
0.6
0.4
0.2
0.0
10^{-1}
10^{0}
10^{1}
10^{2}
x_c
Mean
Std
16th percentile
50th percentile
95th percentile
Mode
x_c
Best fit


Posterior prob
40
30
20
10
0
5.6×10^{0}
5.8×10^{0}
6×10^{0}
6.2×10^{0}
6.4×10^{0}
EextH
Mean
Std
16th percentile
50th percentile
95th percentile
Mode
EextH
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 365
```

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	1.173	
beta/eta	29.657	
xc^2/epsilon	0.67	
xc	5.713	
ExtH	5.673	
eta	5.016	
beta	147.303	
epsilon	51.854	
sqrt(xc/eta)	1.077	
s= eta^0.5*xc^1.5/epsilon	0.615	
beta*xc/epsilon	16.903	
eta*xc/epsilon	0.571	
Fx=beta^2/eta*xc	810.444	
Dx =beta*epsilon/eta*xc^2	47.075	
Pk=beta*k/epsilon	1.499	
Fk=beta^2/eta*k	8538.842	
Dk =beta*epsilon/eta*k^2	6014.764	
Fk^2/Dk=beta^3/eta*epsilon	11505.264	
epsilon/beta^2	0.00244	
k/beta	0.00348	
k^2/epsilon	0.00498	
eta/xc	0.842	
beta/xc	24.689	
epsilon/xc^2	1.474	
k/xc	0.0847	
best fit no ext hazard_MedianLifetime	13.69	
best fit no ext hazard_MaxLifetime	21.36	
best fit_MedianLifetime	13.47	
best fit_MaxLifetime	21.88	
data_MedianLifetime	13.54	
data_MaxLifetime	21.34	
ML_lnprob	-12669.054772	

std \	
xc/eta	[0.653, 1.476]
beta/eta	[9.662, 14.331]
xc^2/epsilon	[0.377, 0.861]
xc	[3.781,

11.177]
ExtH [0.145,
0.149]
eta [2.662,
5.673]
beta [72.859,
144.165]
epsilon [42.237,
227.748]
sqrt(xc/eta) [0.36,
0.54]
s= eta^0.5*xc^1.5/epsilon [0.212,
0.325]
beta*xc/epsilon [5.77,
8.761]
eta*xc/epsilon [0.0451,
0.0489]
Fx=beta^2/eta*xc [634.932,
2931.861]
Dx =beta*epsilon/eta*xc^2 [32.42,
104.145]
Pk=beta*k/epsilon [1.153,
4.996]
Fk=beta^2/eta*k [4763.968,
10776.193]
Dk =beta*epsilon/eta*k^2 [4550.667,
18694.927]
Fk^2/Dk=beta^3/eta*epsilon [9434.558,
52420.307]
epsilon/beta^2 [0.0019,
0.00857]
k/beta [0.00172,
0.00339]
k^2/epsilon [0.00406,
0.0221]
eta/xc [0.468,
1.053]
beta/xc [16.825,
52.824]
epsilon/xc^2 [0.826,
1.881]
k/xc [0.0555,
0.161]
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
0.53
data_MaxLifetime
0
ML_lnprob                                [-12669.054772033034,
-12669.054772033034]

                                                    mode  \
xc/eta                                             0.522
beta/eta                                          23.805
xc^2/epsilon                                       0.21
xc                                                6.028
ExtH                                              5.516
eta                                               9.806
beta                                            294.377
epsilon                                         147.491
sqrt(xc/eta)                                       1.222
s= eta^0.5*xc^1.5/epsilon                          0.373
beta*xc/epsilon                                  13.151
eta*xc/epsilon                                    0.569
Fx=beta^2/eta*xc                                1908.377
Dx =beta*epsilon/eta*xc^2                         71.968
Pk=beta*k/epsilon                                  1.011
Fk=beta^2/eta*k                                21499.561
Dk =beta*epsilon/eta*k^2                       16915.035
Fk^2/Dk=beta^3/eta*epsilon                     35786.587
epsilon/beta^2                                   0.00101
k/beta                                           0.00193
k^2/epsilon                                      0.00233
eta/xc                                             1.914
beta/xc                                           62.008
epsilon/xc^2                                       3.707
k/xc                                              0.0653
best fit no ext hazard_MedianLifetime              13.69
best fit no ext hazard_MaxLifetime                 21.36
best fit_MedianLifetime                            13.47
best fit_MaxLifetime                               21.88
data_MedianLifetime                                13.54
data_MaxLifetime                                   21.34
ML_lnprob                                  -12669.054772

percentile_16  \
xc/eta                                                          [0.455,
```

0.748]
beta/eta [21.827,
24.222]
xc^2/epsilon [0.168,
0.277]
xc [5.793,
7.356]
ExtH [5.503,
5.539]
eta [9.402,
12.1]
beta [250.697,
303.987]
epsilon [98.661,
159.841]
sqrt(xc/eta) [1.173,
1.274]
s= eta^0.5*xc^1.5/epsilon [0.325,
0.39]
beta*xc/epsilon [12.854,
14.083]
eta*xc/epsilon [0.553,
0.574]
Fx=beta^2/eta*xc [1113.414,
2283.845]
Dx =beta*epsilon/eta*xc^2 [46.322,
95.259]
Pk=beta*k/epsilon [0.845,
1.211]
Fk=beta^2/eta*k [17924.142,
25788.187]
Dk =beta*epsilon/eta*k^2 [13763.075,
20788.843]
Fk^2/Dk=beta^3/eta*epsilon [23821.491,
38821.343]
epsilon/beta^2 [0.000828,
0.0014]
k/beta [0.00164,
0.00213]
k^2/epsilon [0.00215,
0.00297]
eta/xc [1.336,
2.198]
beta/xc [59.415,
99.192]
epsilon/xc^2 [2.425,
3.995]

```
k/xc                                                          [0.0627,
0.0796]
best fit no ext hazard_MedianLifetime                           [13.2,
14.2]
best fit no ext hazard_MaxLifetime                            [21.36,
21.36]
best fit_MedianLifetime                                       [12.98,
13.98]
best fit_MaxLifetime                                          [21.88,
21.88]
data_MedianLifetime                    [13.059999999999999,
14.069999999999999]
data_MaxLifetime                                              [21.34,
21.34]
ML_lnprob                             [-12669.054772033034,
-12669.054772033034]

percentile_50  \
xc/eta                                                        [0.326,
1.536]
beta/eta                                                     [18.998,
27.829]
xc^2/epsilon                                                  [0.168,
0.872]
xc                                                            [5.35,
13.905]
ExtH                                                           [5.494,
5.63]
eta                                                             [5.22,
12.1]
beta                                                        [131.865,
303.987]
epsilon                                                      [37.589,
159.841]
sqrt(xc/eta)                                                    [1.079,
1.877]
s= eta^0.5*xc^1.5/epsilon                                     [0.279,
0.676]
beta*xc/epsilon                                               [11.733,
15.428]
eta*xc/epsilon                                                [0.532,
0.585]
Fx=beta^2/eta*xc                                            [336.233,
2574.354]
Dx =beta*epsilon/eta*xc^2                                     [17.713,
95.259]
Pk=beta*k/epsilon                                             [0.464,
```

```
1.539]
Fk=beta^2/eta*k                                                  [6472.73,
25788.187]
Dk =beta*epsilon/eta*k^2                                         [6032.34,
23852.574]
Fk^2/Dk=beta^3/eta*epsilon                                      [4676.959,
45684.732]
epsilon/beta^2                                                    [0.000255,
0.00455]
k/beta                                                             [0.00164,
0.00404]
k^2/epsilon                                                       [0.00156,
0.00664]
eta/xc                                                                [0.651,
3.063]
beta/xc                                                           [16.499,
117.671]
epsilon/xc^2                                                          [1.091,
3.995]
k/xc                                                               [0.0359,
0.0934]
best fit no ext hazard_MedianLifetime                                   [13.2,
14.2]
best fit no ext hazard_MaxLifetime                                    [21.36,
21.36]
best fit_MedianLifetime                                               [12.98,
13.98]
best fit_MaxLifetime                                                  [21.88,
21.88]
data_MedianLifetime                    [13.059999999999999,
14.069999999999999]
data_MaxLifetime                                                      [21.34,
21.34]
ML_lnprob                             [-12669.054772033034,
-12669.054772033034]

percentile_95  \
xc/eta                                                                [0.326,
5.481]
beta/eta                                                         [15.426,
93.767]
xc^2/epsilon                                                          [0.168,
3.706]
xc                                                                 [0.419,
68.324]
ExtH                                                                  [5.494,
5.932]
```

```
eta                                                    [0.893,
14.315]
beta                                                  [38.904,
419.145]
epsilon                                               [1.507,
1784.054]
sqrt(xc/eta)                                           [0.604,
3.263]
s= eta^0.5*xc^1.5/epsilon                              [0.279,
1.245]
beta*xc/epsilon                                       [10.232,
69.539]
eta*xc/epsilon                                         [0.493,
0.682]
Fx=beta^2/eta*xc                                      [10.437,
31820.219]
Dx =beta*epsilon/eta*xc^2                              [1.88,
402.849]
Pk=beta*k/epsilon                                     [0.0422,
80.493]
Fk=beta^2/eta*k                                       [678.573,
27734.306]
Dk =beta*epsilon/eta*k^2                              [336.265,
142462.172]
Fk^2/Dk=beta^3/eta*epsilon                            [563.452,
168025.563]
epsilon/beta^2                                        [5.29e-05,
0.12]
k/beta                                                [0.00127,
0.0128]
k^2/epsilon                                           [0.00014,
0.166]
eta/xc                                                 [0.163,
3.063]
beta/xc                                                [0.83,
253.828]
epsilon/xc^2                                           [0.0815,
5.128]
k/xc                                                  [0.00731,
1.193]
best fit no ext hazard_MedianLifetime                     [13.2,
14.2]
best fit no ext hazard_MaxLifetime                     [21.36,
21.36]
best fit_MedianLifetime                                [12.98,
13.98]
best fit_MaxLifetime                                   [21.88,
```

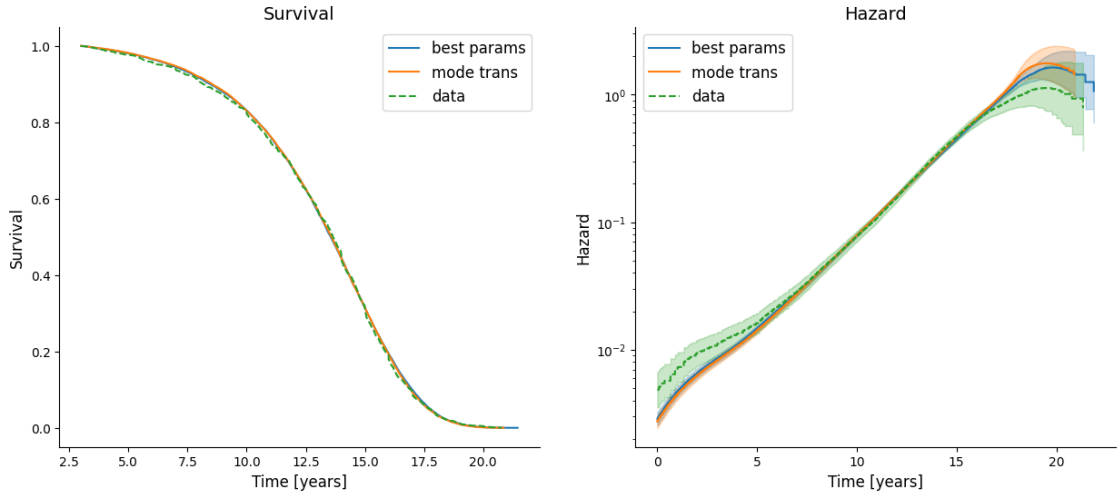
21.88]
data_MedianLifetime [13.059999999999999,
14.069999999999999]
data_MaxLifetime [21.34,
21.34]
ML_lnprob [-12669.054772033034,
-12669.054772033034]

	max_likelihood	mode_overall
xc/eta	0.155	0.155
beta/eta	90.817	90.817
xc^2/epsilon	0.114	0.114
xc	0.443	0.443
ExtH	5.577	5.577
eta	2.864	2.864
beta	260.115	260.115
epsilon	1.717	1.717
sqrt(xc/eta)	0.393	0.393
s= eta^0.5*xc^1.5/epsilon	0.291	0.291
beta*xc/epsilon	67.148	67.148
eta*xc/epsilon	0.739	0.739
Fx=beta^2/eta*xc	53289.514	53289.514
Dx =beta*epsilon/eta*xc^2	793.609	793.609
Pk=beta*k/epsilon	75.738	75.738
Fk=beta^2/eta*k	47245.474	47245.474
Dk =beta*epsilon/eta*k^2	623.797	14504.298
Fk^2/Dk=beta^3/eta*epsilon	3578300.997	33543.833
epsilon/beta^2	0.000025	0.000025
k/beta	0.00192	0.00192
k^2/epsilon	0.146	0.146
eta/xc	6.461	6.461
beta/xc	586.782	586.782
epsilon/xc^2	8.739	8.739
k/xc	1.128	1.128
best fit no ext hazard_MedianLifetime	13.69	NaN
best fit no ext hazard_MaxLifetime	21.36	NaN
best fit_MedianLifetime	13.47	NaN
best fit_MaxLifetime	21.88	NaN
data_MedianLifetime	13.54	NaN
data_MaxLifetime	21.34	NaN
ML_lnprob	-12669.054772	-12669.054772

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')
```