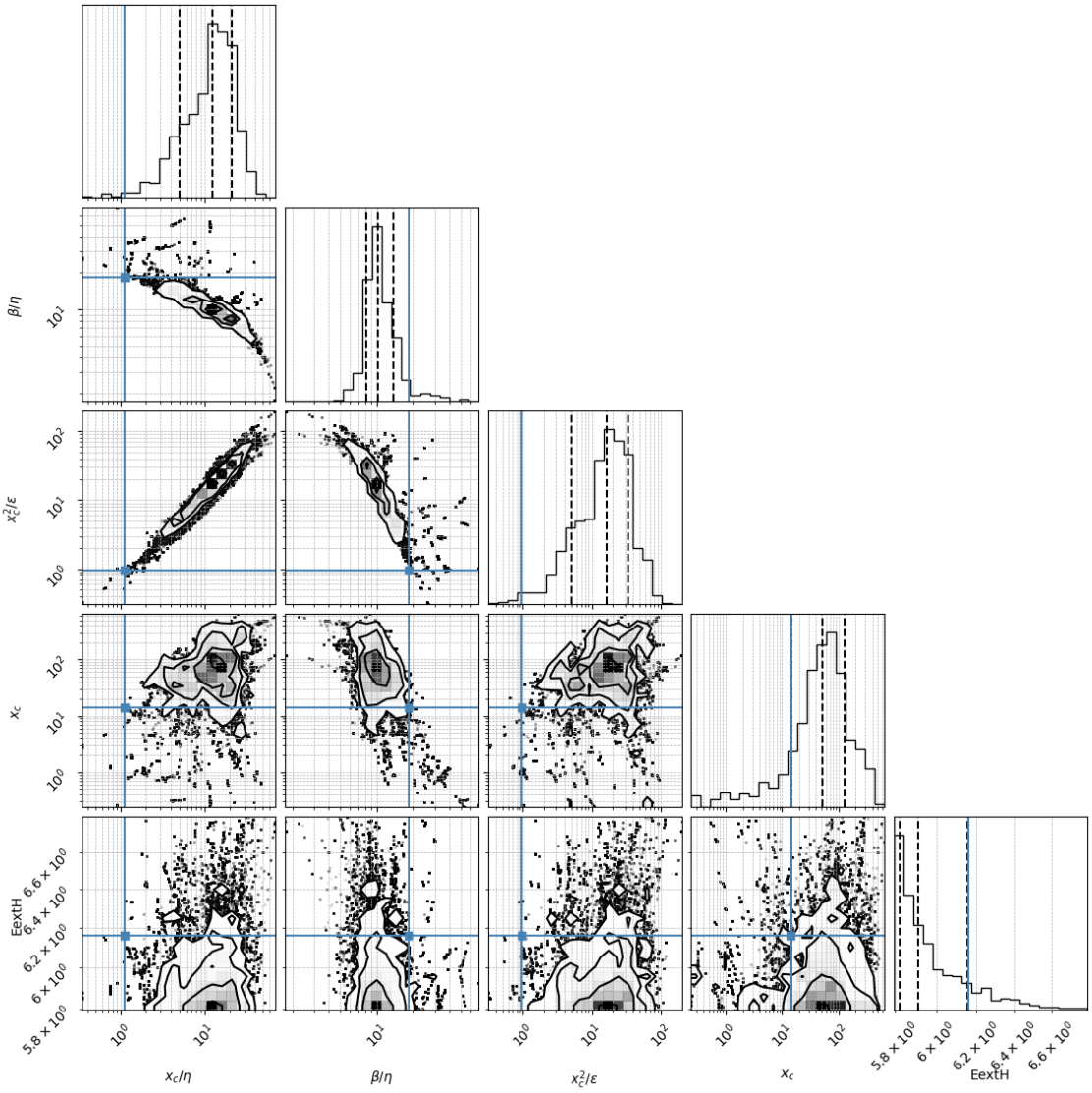
mcmc_analysis_Labradors_vetCompass_baysian

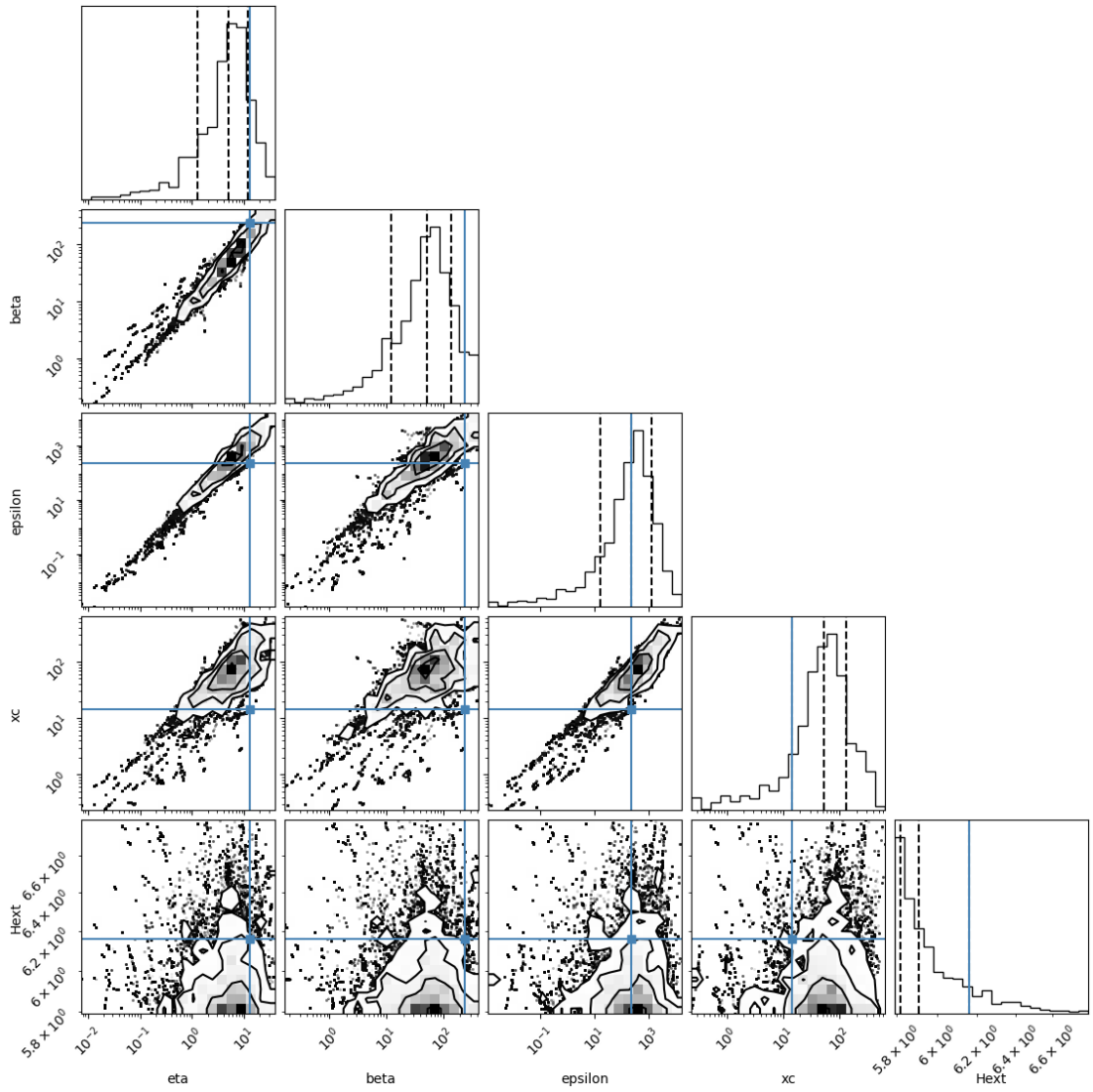
November 24, 2025

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

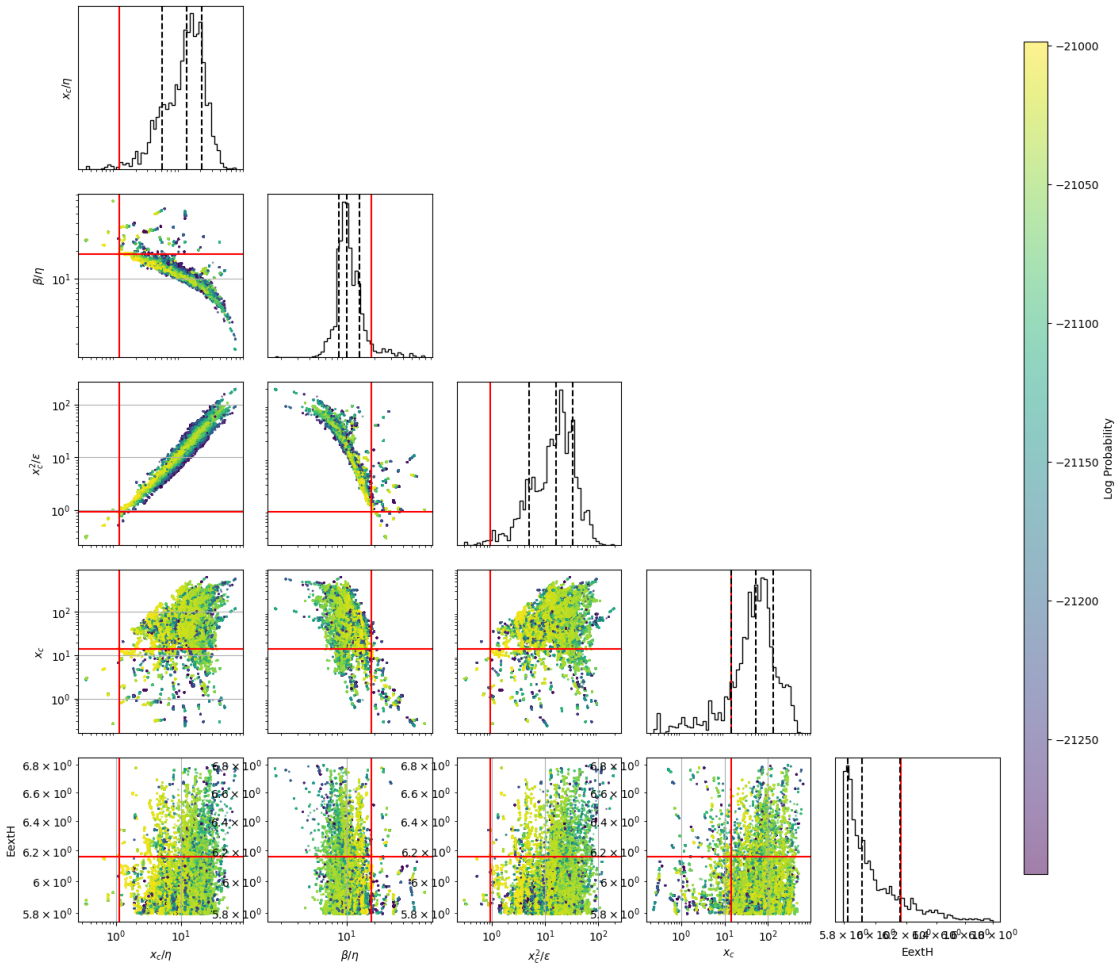
```
(25,)
```


x_c/η
β/η
x_c^2/ε
x_c
EextH



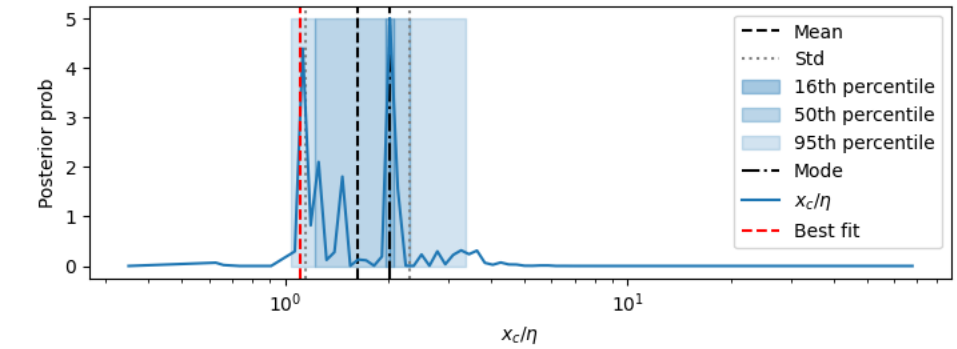
2 2. Heat map corner plot of raw samples

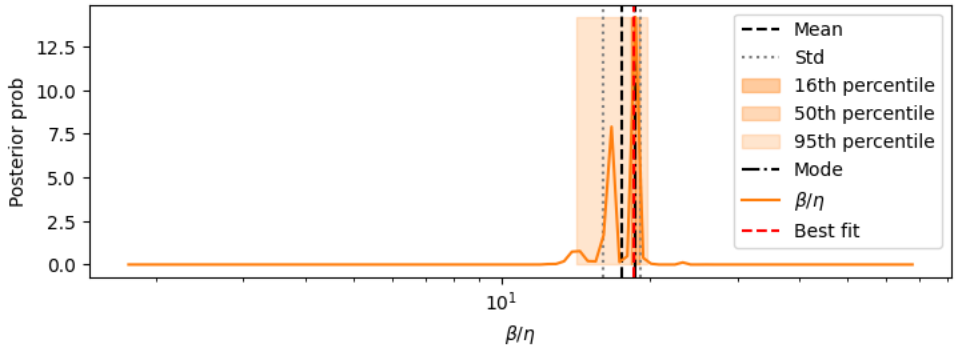
This plot shows all the raw sample points and their lnprobability

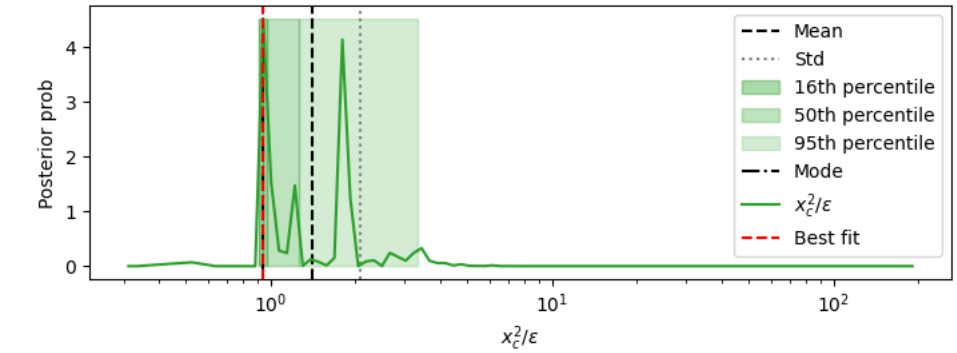


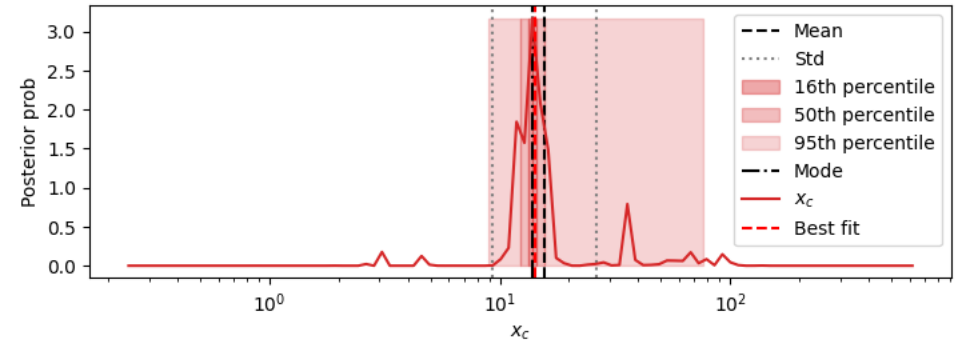
3 3. Posterior distributions of parameters

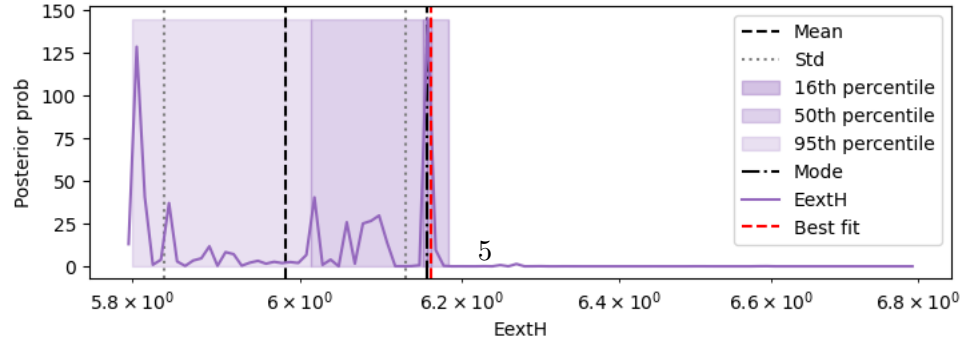
1d marginalizations of posterior distributions. we use a grid of size nbins=100-150


Posterior prob
x_c/η
Mean
Std
16th percentile
50th percentile
95th percentile
Mode
x_c/η
Best fit


Posterior prob
β/η
Mean
Std
16th percentile
50th percentile
95th percentile
Mode
β/η
Best fit

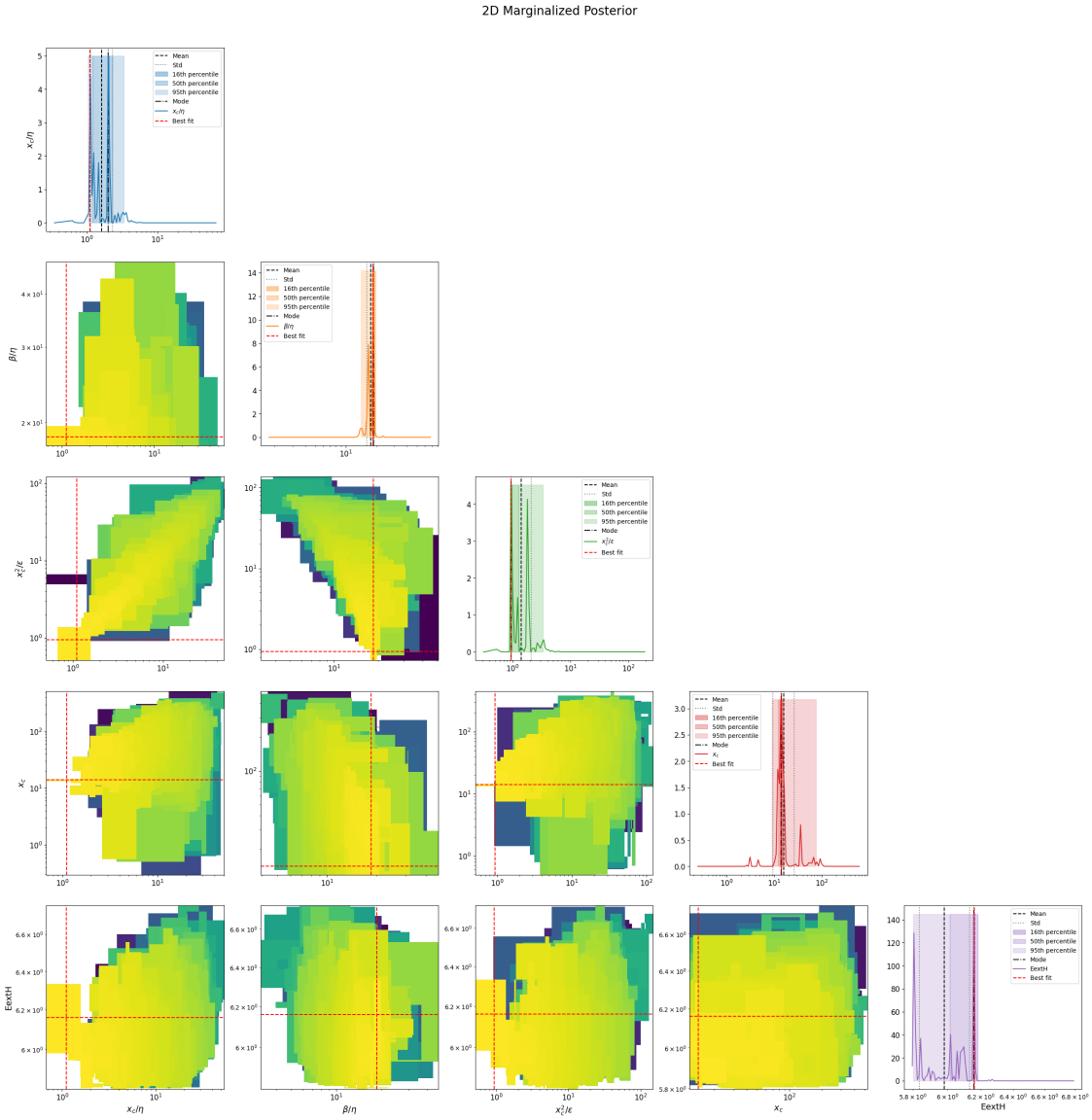

Posterior prob
x_c^2/ε
Mean
Std
16th percentile
50th percentile
95th percentile
Mode
x_c^2/ε
Best fit


Posterior prob
x_c
Mean
Std
16th percentile
50th percentile
95th percentile
Mode
x_c
Best fit


Posterior prob
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	1.627	
beta/eta	17.513	
xc^2/epsilon	1.401	
xc	15.696	
ExtH	5.982	
eta	9.658	
beta	168.307	
epsilon	175.026	
sqrt(xc/eta)	1.285	
s= eta^0.5*xc^1.5/epsilon	1.108	
beta*xc/epsilon	15.031	
eta*xc/epsilon	0.873	
Fx=beta^2/eta*xc	173.973	
Dx =beta*epsilon/eta*xc^2	11.683	
Pk=beta*k/epsilon	0.491	
Fk=beta^2/eta*k	5556.299	
Dk =beta*epsilon/eta*k^2	12165.186	
Fk^2/Dk=beta^3/eta*epsilon	2842.068	
epsilon/beta^2	0.00645	
k/beta	0.00312	
k^2/epsilon	0.00153	
eta/xc	0.615	
beta/xc	10.726	
epsilon/xc^2	0.714	
k/xc	0.0318	
best fit no ext hazard_MedianLifetime	12.4	
best fit no ext hazard_MaxLifetime	18.63	
best fit_MedianLifetime	12.31	
best fit_MaxLifetime	18.12	
data_MedianLifetime	12.3	
data_MaxLifetime	19.36	
ML_lnprob	-20998.55884	

std \		
xc/eta	[0.48,	
0.681]		
beta/eta	[1.438,	
1.567]		
xc^2/epsilon	[0.461,	
0.688]		
xc	[6.359,	

10.689]
ExtH [0.145,
0.149]
eta [3.45,
5.367]
beta [58.962,
90.757]
epsilon [102.087,
244.97]
sqrt(xc/eta) [0.201,
0.239]
s= eta^0.5*xc^1.5/epsilon [0.22,
0.275]
beta*xc/epsilon [0.762,
0.803]
eta*xc/epsilon [0.0452,
0.0476]
Fx=beta^2/eta*xc [65.838,
105.923]
Dx =beta*epsilon/eta*xc^2 [4.167,
6.477]
Pk=beta*k/epsilon [0.197,
0.33]
Fk=beta^2/eta*k [1949.774,
3003.869]
Dk =beta*epsilon/eta*k^2 [6907.185,
15980.822]
Fk^2/Dk=beta^3/eta*epsilon [1199.092,
2074.224]
epsilon/beta^2 [0.00229,
0.00355]
k/beta [0.00105,
0.00158]
k^2/epsilon [0.000855,
0.00194]
eta/xc [0.181,
0.257]
beta/xc [3.69,
5.625]
epsilon/xc^2 [0.235,
0.35]
k/xc [0.0129,
0.0217]
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
0.52
data_MaxLifetime
0
ML_lnprob                                [-20998.558840421138,
-20998.558840421138]

                                                    mode  \
xc/eta                                             2.024
beta/eta                                          18.639
xc^2/epsilon                                       0.941
xc                                                13.864
ExtH                                               6.157
eta                                                8.051
beta                                             231.253
epsilon                                          147.186
sqrt(xc/eta)                                       1.423
s= eta^0.5*xc^1.5/epsilon                          0.877
beta*xc/epsilon                                   15.491
eta*xc/epsilon                                     0.838
Fx=beta^2/eta*xc                                 132.697
Dx =beta*epsilon/eta*xc^2                          9.171
Pk=beta*k/epsilon                                  0.549
Fk=beta^2/eta*k                                 3949.85
Dk =beta*epsilon/eta*k^2                       16464.98
Fk^2/Dk=beta^3/eta*epsilon                      5073.451
epsilon/beta^2                                  0.00821
k/beta                                          0.00405
k^2/epsilon                                      0.0017
eta/xc                                             0.494
beta/xc                                           16.124
epsilon/xc^2                                       1.062
k/xc                                               0.036
best fit no ext hazard_MedianLifetime               12.4
best fit no ext hazard_MaxLifetime                 18.63
best fit_MedianLifetime                            12.31
best fit_MaxLifetime                               18.12
data_MedianLifetime                                 12.3
data_MaxLifetime                                   19.36
ML_lnprob                                   -20998.55884

percentile_16  \
xc/eta                                                          [1.971,
```

```
2.078]
beta/eta                                                    [18.298,
18.986]
xc^2/epsilon                                                  [0.911,
0.972]
xc                                                          [13.326,
14.423]
ExtH                                                          [6.152,
6.162]
eta                                                           [7.713,
8.404]
beta                                                      [222.354,
240.509]
epsilon                                                   [135.569,
159.799]
sqrt(xc/eta)                                                  [1.404,
1.442]
s= eta^0.5*xc^1.5/epsilon                                      [0.86,
0.894]
beta*xc/epsilon                                             [15.226,
15.762]
eta*xc/epsilon                                                 [0.83,
0.846]
Fx=beta^2/eta*xc                                          [125.136,
140.715]
Dx =beta*epsilon/eta*xc^2                                     [8.758,
9.603]
Pk=beta*k/epsilon                                              [0.519,
0.58]
Fk=beta^2/eta*k                                          [3786.259,
4120.51]
Dk =beta*epsilon/eta*k^2                                [15233.892,
17795.556]
Fk^2/Dk=beta^3/eta*epsilon                                [4718.073,
5455.597]
epsilon/beta^2                                             [0.00777,
0.00867]
k/beta                                                     [0.00389,
0.00421]
k^2/epsilon                                                [0.00156,
0.00184]
eta/xc                                                        [0.481,
0.507]
beta/xc                                                     [15.488,
16.786]
epsilon/xc^2                                                  [1.029,
1.097]
```

```
k/xc                                                    [0.0346,
0.0375]
best fit no ext hazard_MedianLifetime                     [11.91,
12.91]
best fit no ext hazard_MaxLifetime                        [18.63,
18.63]
best fit_MedianLifetime                                   [11.82,
12.82]
best fit_MaxLifetime                                      [18.12,
18.12]
data_MedianLifetime                                       [11.82,
12.82]
data_MaxLifetime                                          [19.36,
19.36]
ML_lnprob                          [-20998.558840421138,
-20998.558840421138]

percentile_50  \
xc/eta                                                    [1.221,
2.312]
beta/eta                                                [18.298,
18.986]
xc^2/epsilon                                               [0.911,
1.26]
xc                                                      [12.313,
15.611]
ExtH                                                       [6.013,
6.183]
eta                                                      [7.079,
10.869]
beta                                                   [150.182,
281.385]
epsilon                                                 [97.574,
159.799]
sqrt(xc/eta)                                               [1.197,
1.52]
s= eta^0.5*xc^1.5/epsilon                                  [0.86,
1.217]
beta*xc/epsilon                                         [14.708,
15.762]
eta*xc/epsilon                                             [0.814,
0.88]
Fx=beta^2/eta*xc                                       [111.282,
224.995]
Dx =beta*epsilon/eta*xc^2                                  [6.644,
11.545]
Pk=beta*k/epsilon                                          [0.519,
```

```
0.648]
Fk=beta^2/eta*k                                                  [3196.9,
6290.051]
Dk =beta*epsilon/eta*k^2                                        [9556.721,
17795.556]
Fk^2/Dk=beta^3/eta*epsilon                                       [2639.09,
5455.597]
epsilon/beta^2                                                   [0.00623,
0.00969]
k/beta                                                           [0.00308,
0.00421]
k^2/epsilon                                                      [0.00156,
0.00256]
eta/xc                                                               [0.433,
0.819]
beta/xc                                                         [12.167,
16.786]
epsilon/xc^2                                                       [0.794,
1.097]
k/xc                                                             [0.032,
0.0406]
best fit no ext hazard_MedianLifetime                              [11.91,
12.91]
best fit no ext hazard_MaxLifetime                                 [18.63,
18.63]
best fit_MedianLifetime                                            [11.82,
12.82]
best fit_MaxLifetime                                               [18.12,
18.12]
data_MedianLifetime                                                [11.82,
12.82]
data_MaxLifetime                                                   [19.36,
19.36]
ML_lnprob                              [-20998.558840421138,
-20998.558840421138]

percentile_95  \
xc/eta                                                             [1.041,
3.355]
beta/eta                                                        [14.133,
19.699]
xc^2/epsilon                                                       [0.911,
3.328]
xc                                                                 [8.972,
75.97]
ExtH                                                               [5.801,
6.183]
```

```
eta                                                    [5.964,
23.517]
beta                                                 [109.718,
329.209]
epsilon                                              [30.863,
1597.191]
sqrt(xc/eta)                                           [1.02,
1.832]
s= eta^0.5*xc^1.5/epsilon                              [0.86,
1.788]
beta*xc/epsilon                                      [13.258,
15.762]
eta*xc/epsilon                                         [0.798,
0.97]
Fx=beta^2/eta*xc                                     [61.892,
319.924]
Dx =beta*epsilon/eta*xc^2                              [4.597,
20.061]
Pk=beta*k/epsilon                                      [0.099,
0.808]
Fk=beta^2/eta*k                                      [3196.9,
9601.904]
Dk =beta*epsilon/eta*k^2                           [1729.026,
98360.077]
Fk^2/Dk=beta^3/eta*epsilon                           [825.721,
5455.597]
epsilon/beta^2                                       [0.00358,
0.0168]
k/beta                                               [0.00152,
0.00455]
k^2/epsilon                                          [0.000156,
0.00809]
eta/xc                                                 [0.298,
0.961]
beta/xc                                                [4.275,
18.192]
epsilon/xc^2                                             [0.3,
1.097]
k/xc                                                 [0.00658,
0.0557]
best fit no ext hazard_MedianLifetime                  [11.91,
12.91]
best fit no ext hazard_MaxLifetime                     [18.63,
18.63]
best fit_MedianLifetime                                [11.82,
12.82]
best fit_MaxLifetime                                   [18.12,
```

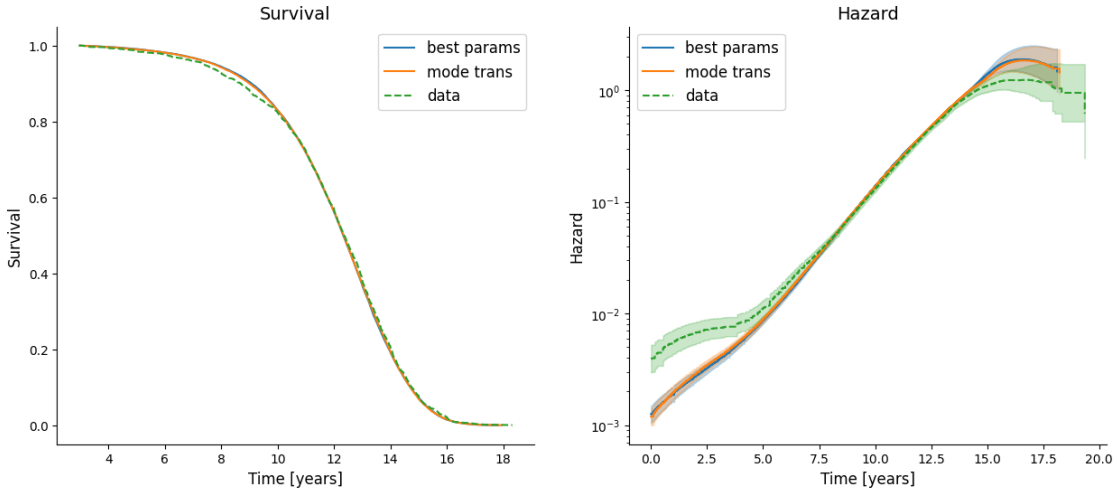
18.12]
data_MedianLifetime [11.82,
12.82]
data_MaxLifetime [19.36,
19.36]
ML_lnprob [-20998.558840421138,
-20998.558840421138]

	max_likelihood	mode_overall
xc/eta	1.112	1.112
beta/eta	18.484	18.484
xc^2/epsilon	0.939	0.939
xc	14.203	14.203
ExtH	6.161	6.161
eta	12.769	12.769
beta	236.036	236.036
epsilon	214.747	214.747
sqrt(xc/eta)	1.055	1.055
s= eta^0.5*xc^1.5/epsilon	0.891	0.891
beta*xc/epsilon	15.611	15.611
eta*xc/epsilon	0.845	0.845
Fx=beta^2/eta*xc	307.19	307.19
Dx =beta*epsilon/eta*xc^2	19.678	19.678
Pk=beta*k/epsilon	0.55	0.55
Fk=beta^2/eta*k	8725.943	8725.943
Dk =beta*epsilon/eta*k^2	15877.827	15877.827
Fk^2/Dk=beta^3/eta*epsilon	4795.497	4795.497
epsilon/beta^2	0.00385	0.00385
k/beta	0.00212	0.00212
k^2/epsilon	0.00116	0.00116
eta/xc	0.899	0.899
beta/xc	16.619	16.619
epsilon/xc^2	1.065	1.065
k/xc	0.0352	0.0352
best fit no ext hazard_MedianLifetime	12.4	NaN
best fit no ext hazard_MaxLifetime	18.63	NaN
best fit_MedianLifetime	12.31	NaN
best fit_MaxLifetime	18.12	NaN
data_MedianLifetime	12.3	NaN
data_MaxLifetime	19.36	NaN
ML_lnprob	-20998.55884	-20998.55884

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')
```