A study of the impact on different evaluation approaches on results

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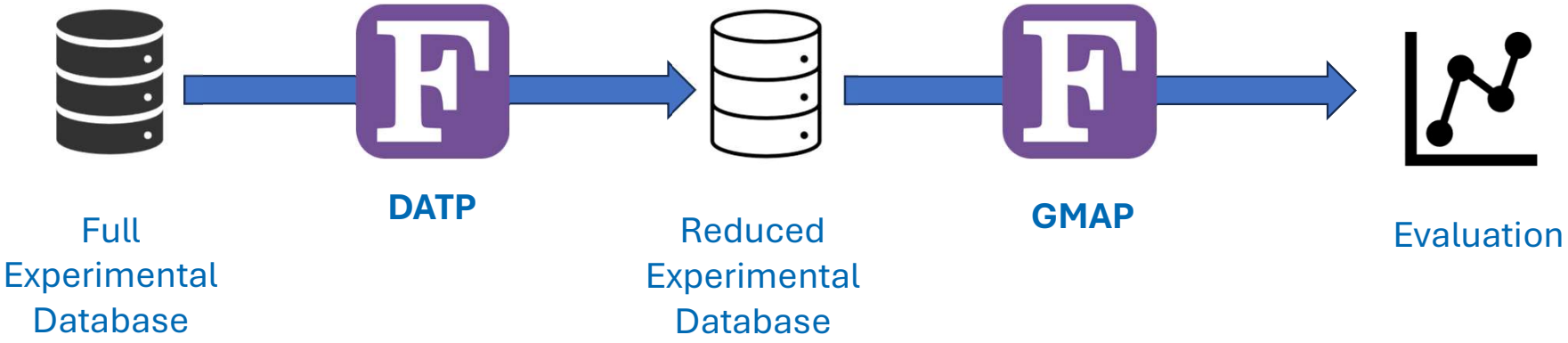
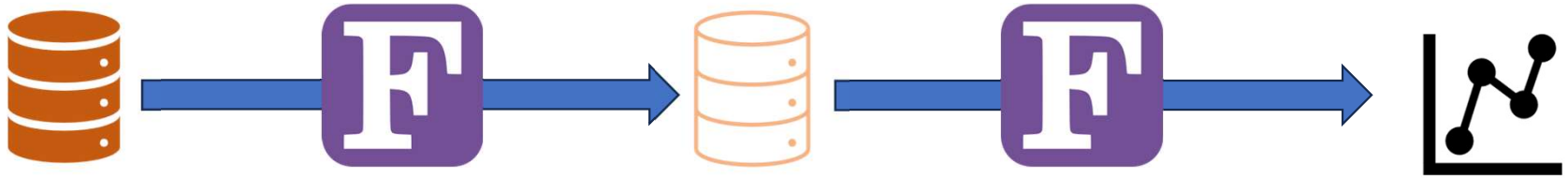
Outline

- Codes and method development
- Impact of different evaluation methods
- Impact of iterative reduction
- Impact of new Li-6(n,t) evaluation

Neutron Standards Pipeline



Data format modernization



Full Experimental Database

DATP

Reduced Experimental Database

GMAP

Evaluation

```
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 1 9 0 1  6   20  9  3  4  0  0
 UNCERTAINTIES
 3 STATISTICS
 4 BACKGROUND
 5 B DET. EFF.
 6 FF DET. EFF.
11 MERC TO REDUCE THE DIFFERENCE WITH A POSTERIOR *REV*
  .00  .00  .00
  .00  .00  .00
  .00  .00  .00
  .50  .50  .50
  .50  .50  .50
  .50  .50  .50
  .00  .00  .00
  .00  .00  .00
  .00  .00  .00
  .00  .00  .00
  .50  .50  .50
  0  0  9  2  2  2  0  0  0  0  1
 .1500E-03 .3626E+00   .0 33.3  1.0  1.5   .1   .2   .0   .0   .0   .0  3.1  1.8
 .2500E-03 .4776E+00   .0 20.0  1.0  1.5   .1   .2   .0   .0   .0   .0  1.7  1.8
 .3500E-03 .2598E+00   .0 14.3  1.0  1.5   .1   .2   .0   .0   .0   .0   .0  1.8
```

Legacy format


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   " 3 STATISTICS                                                                 ",
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   " 5 B DET. EFF.                                                                ",
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   0.2796,0.3046,0.2315, 0.282,0.2942,0.3061,0.3496,0.3067,0.3667,0.4238
 ],
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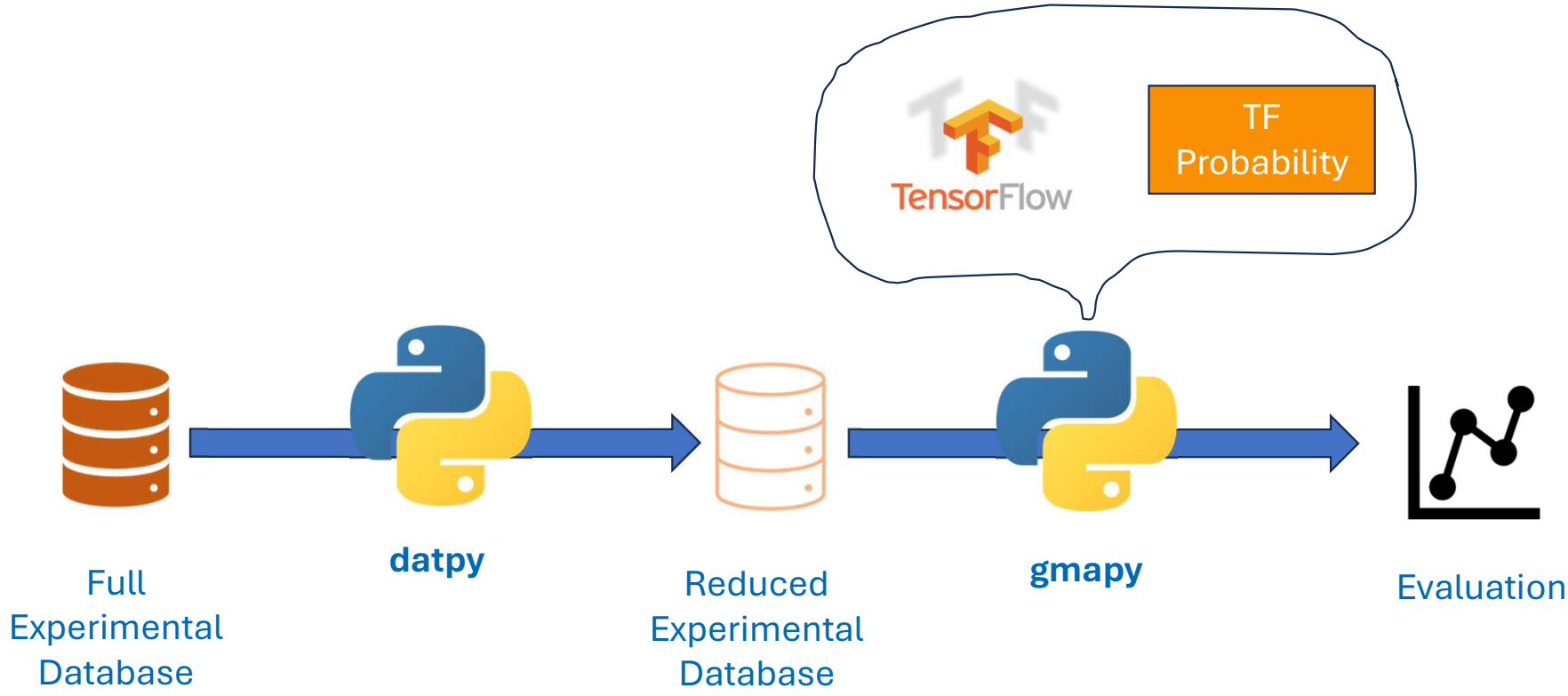
Modern format (JSON)

Code modernization



Flexibility in method choice

+ TF Probability

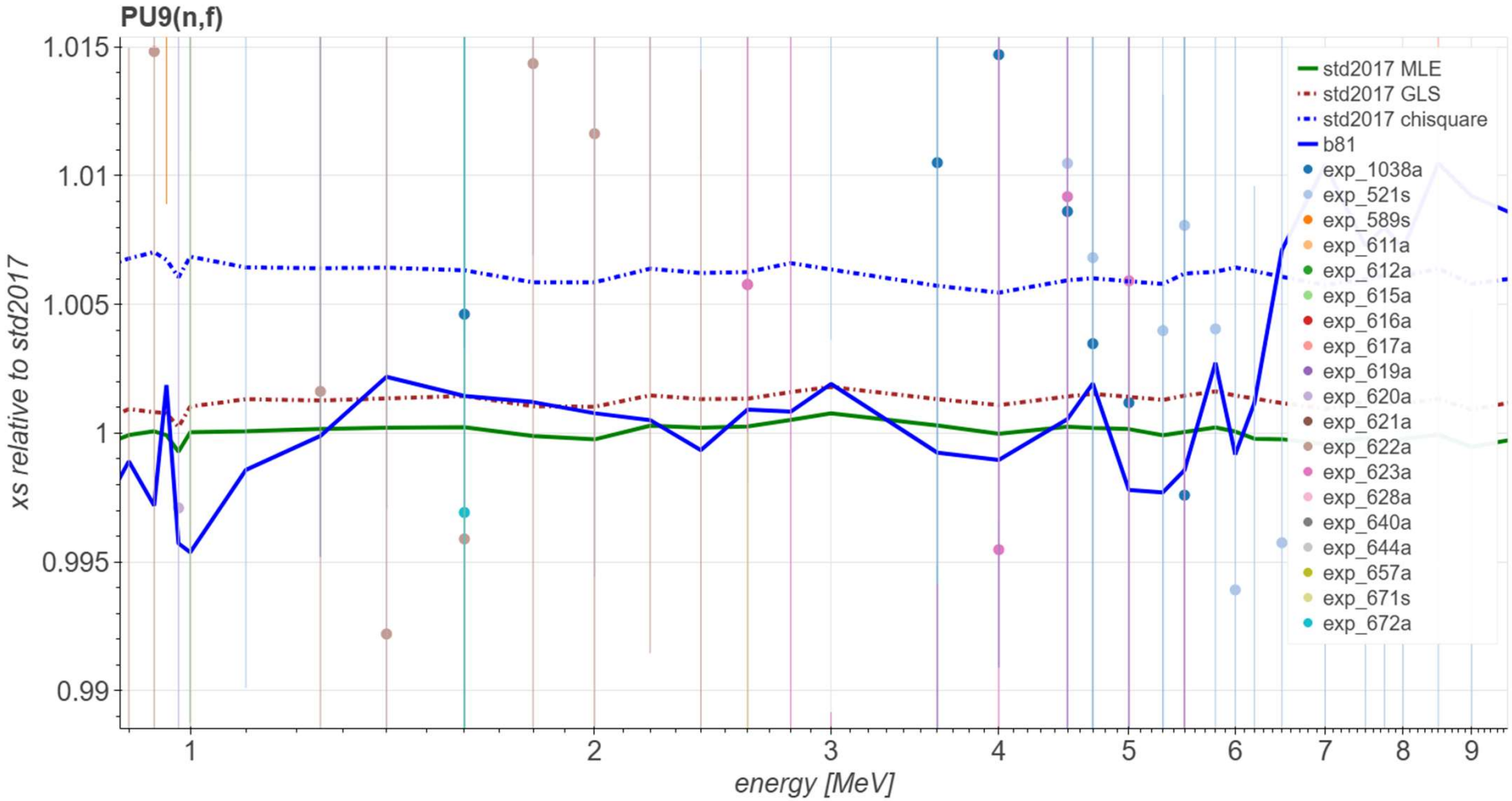
$$\log p(\vec{x} \mid \vec{d}) = -\frac{1}{2}\left(n \log(2\pi) + \log\det \Sigma + \chi^2(\vec{x})\right)$$

$$\chi^2(\vec{x}) = \left(\vec{d} - f(\vec{x})\right)^T \Sigma^{-1} \left(\vec{d} - f(\vec{x})\right)$$

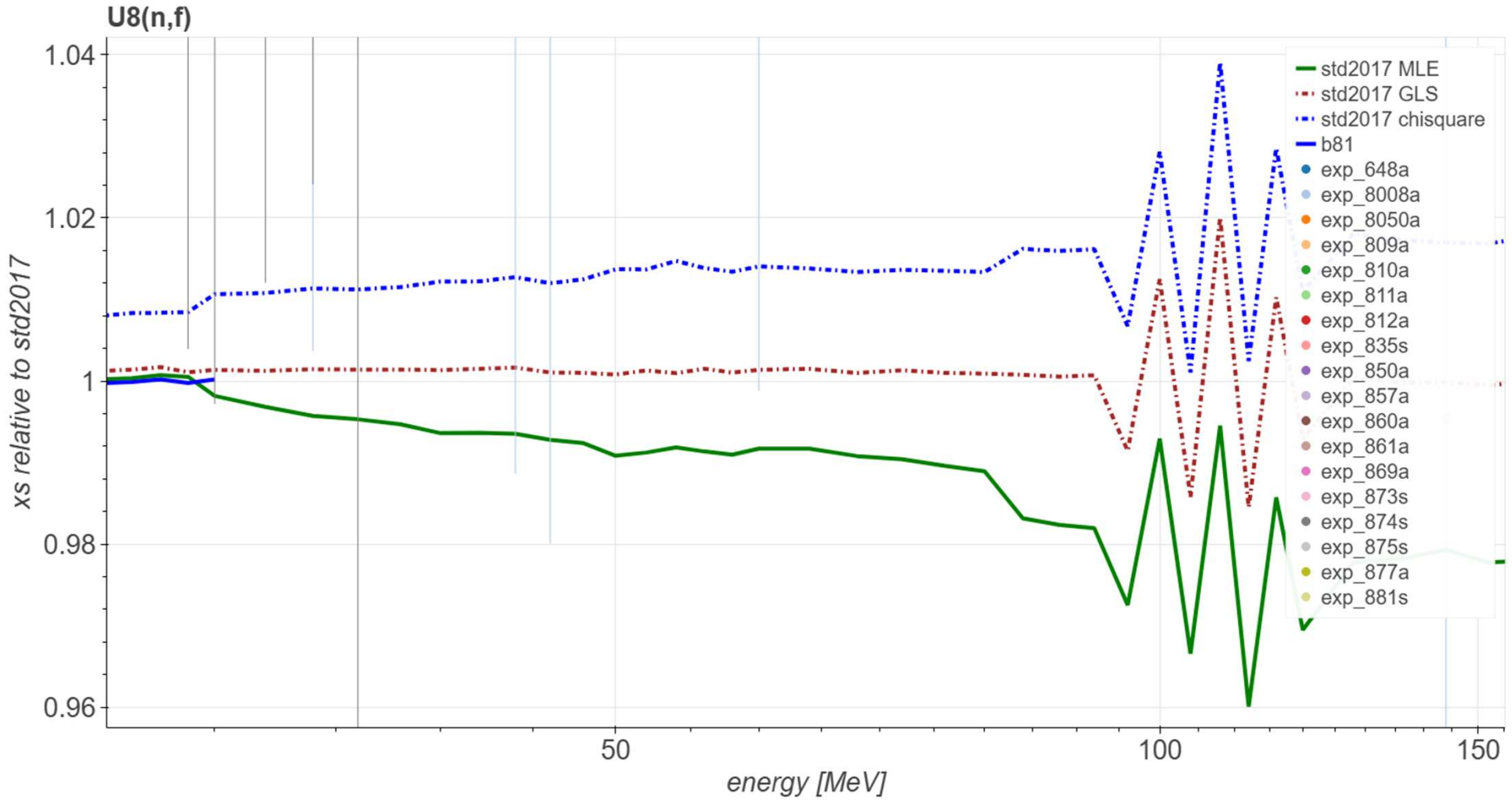
$$\Sigma = \left[\left(f(\vec{x})^T f(x)\right] \odot \Sigma_{\text{rel}}\right.$$

Maximum Likelihood / Maximum A-Posteriori: Find x to maximize log p(x|d))
ChiSquare minimization: Find x to minimize χ^2
Generalized Least Squares: Apply iteratively GLS equation (Fortran GMAP approach)
Bayesian inference: Sample from posterior distribution by MCMC (e.g. Hamiltonian Monte Carlo)

Impact on results 2017

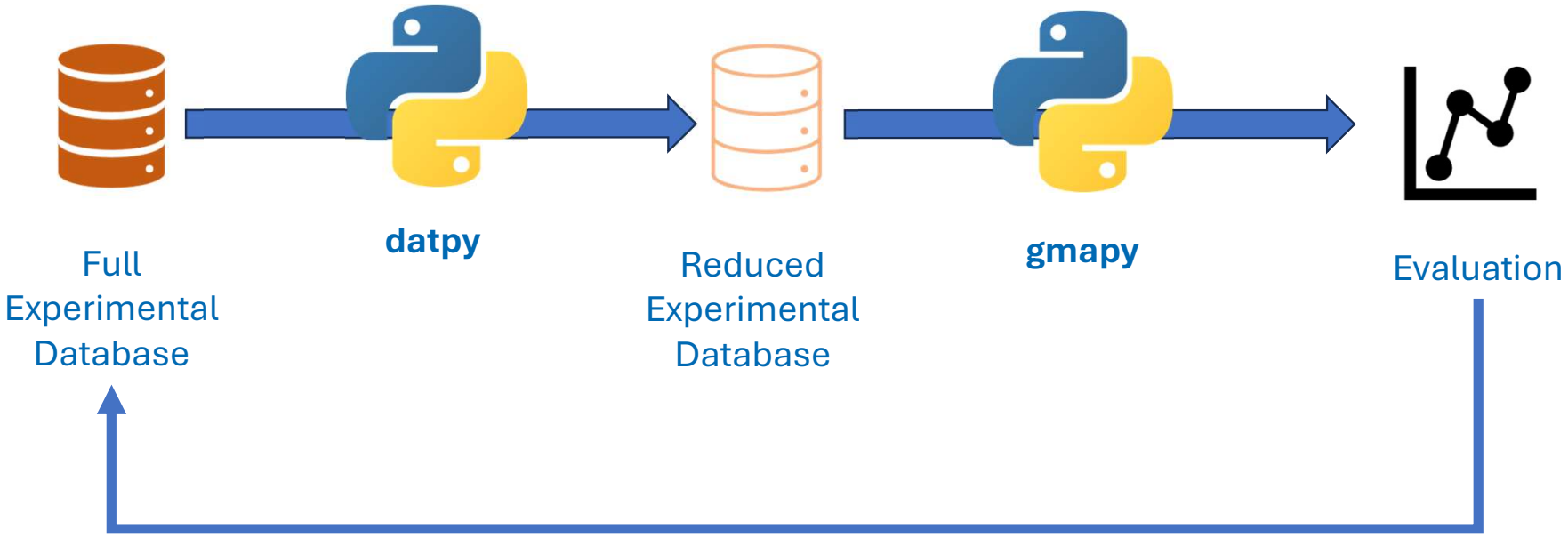


Impact on results 2017

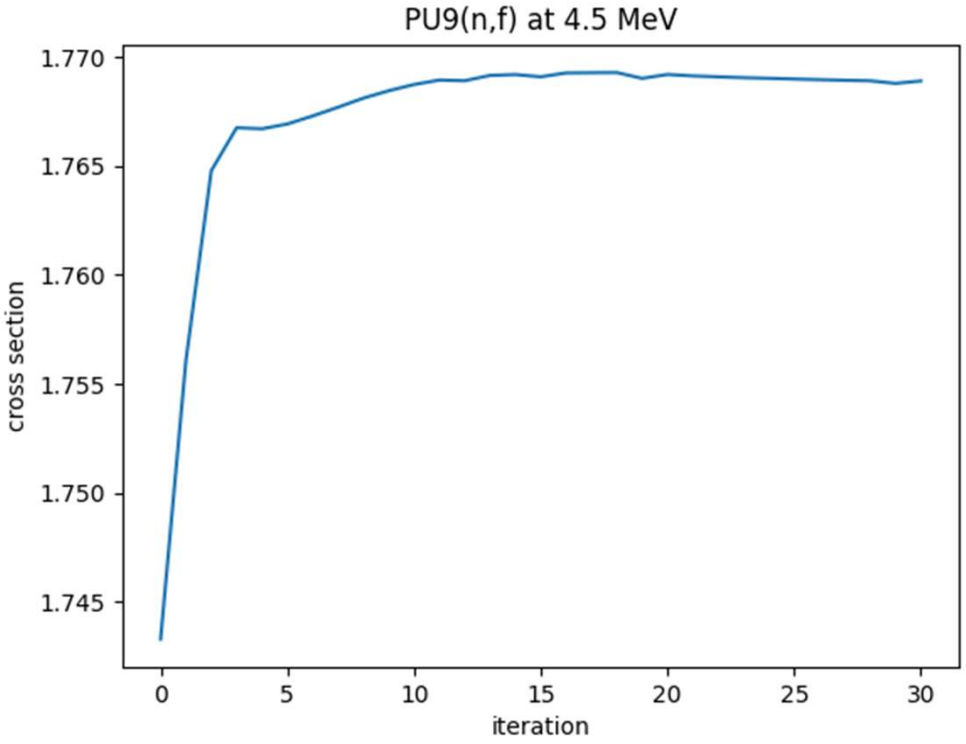


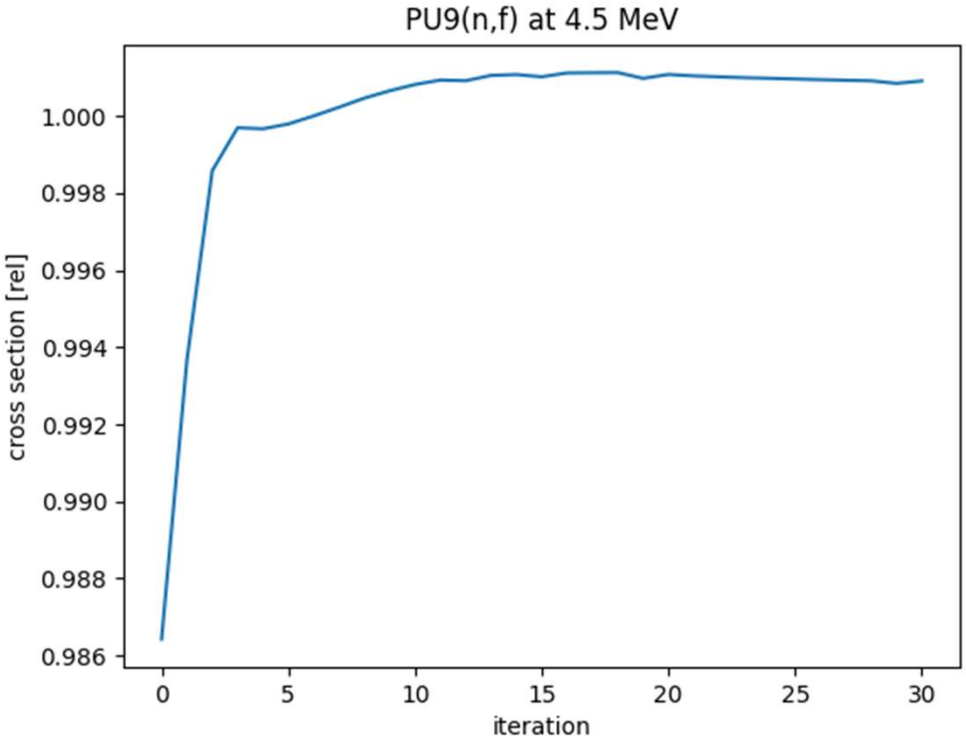
Iterative Data reduction

TensorFlow + TF Probability

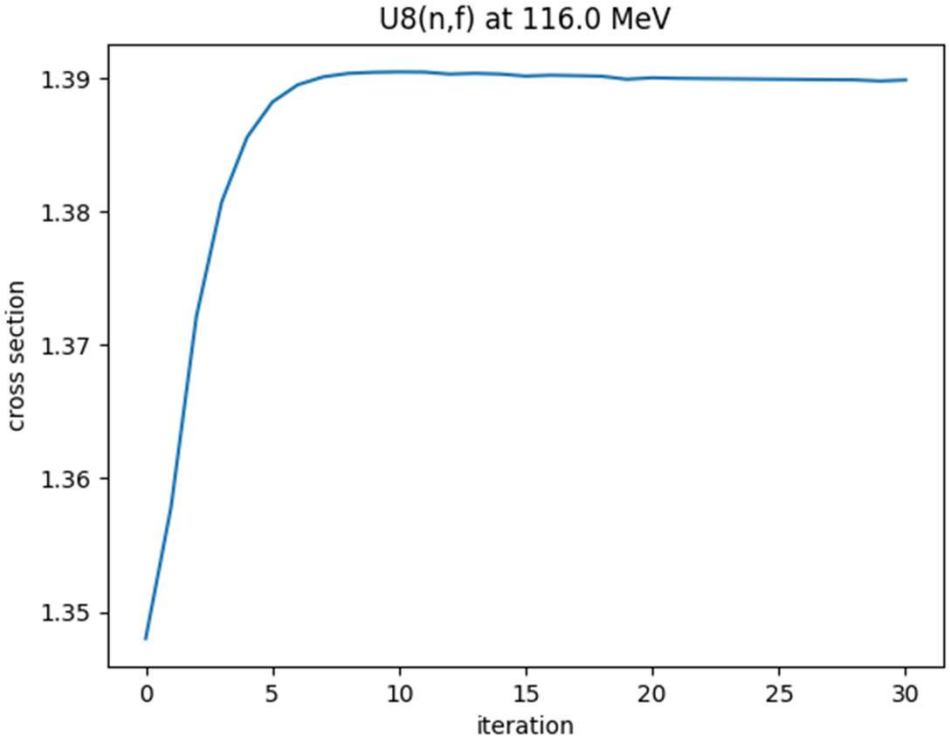


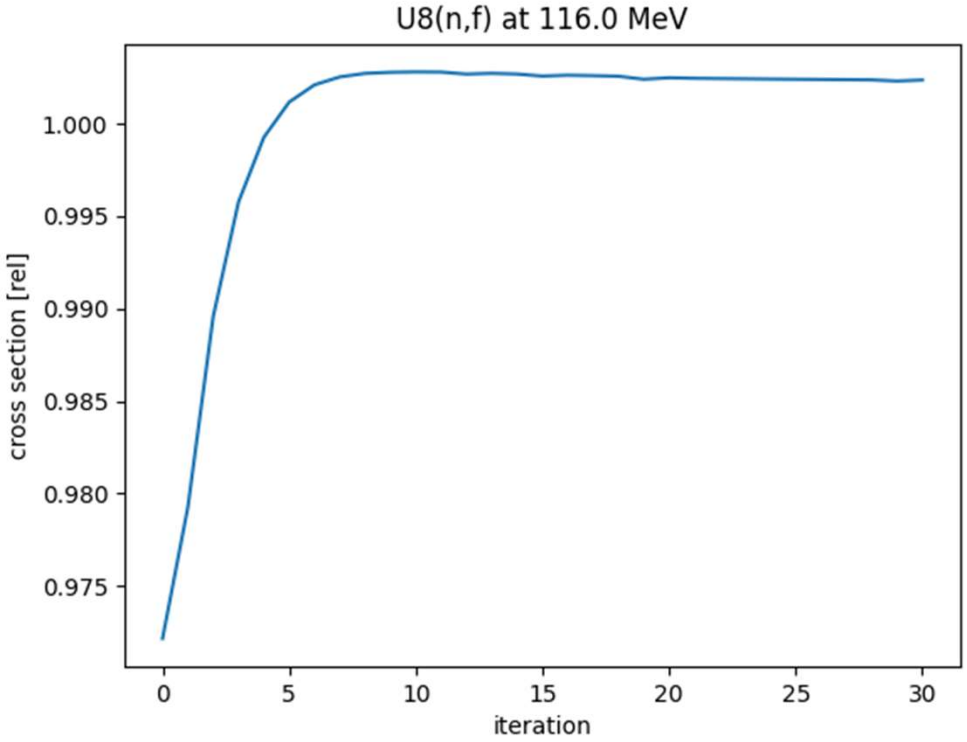
Iterative Data reduction



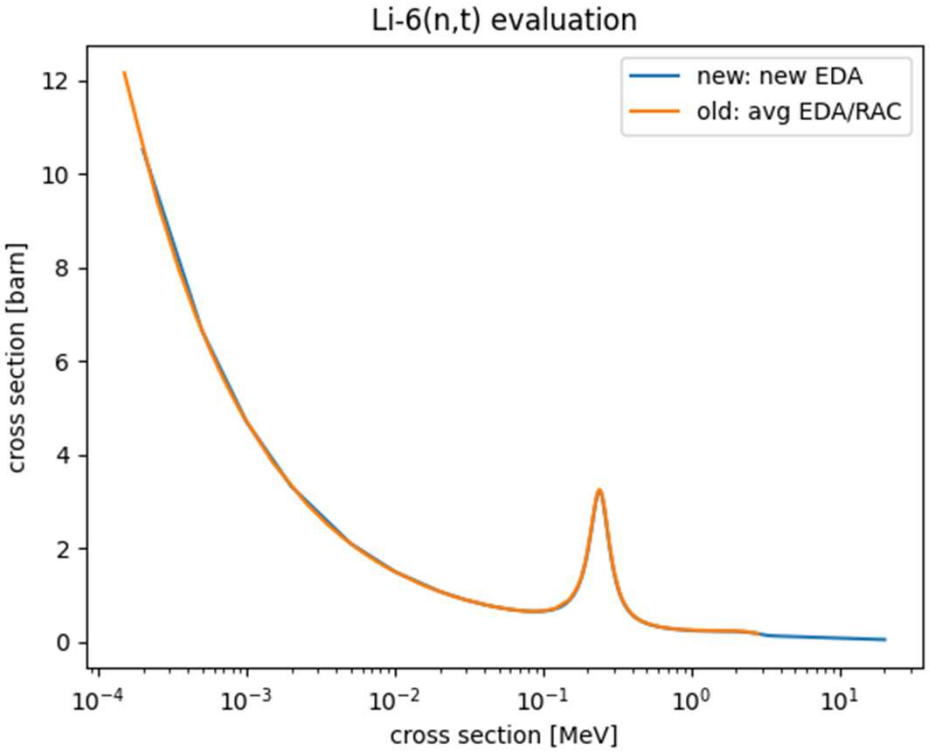


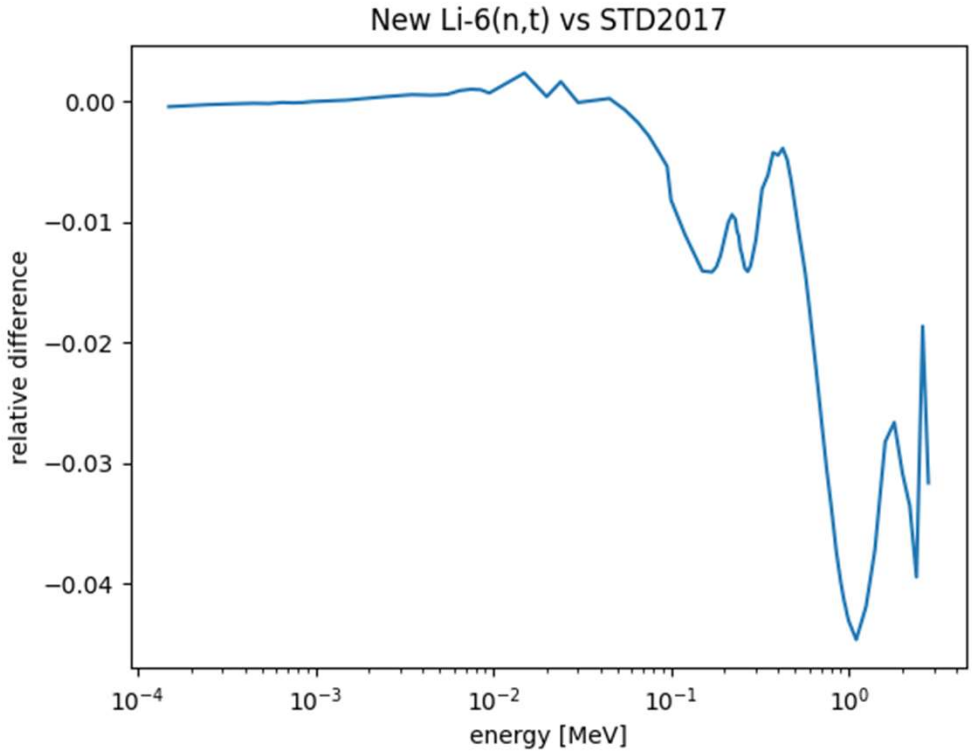
Iterative Data reduction



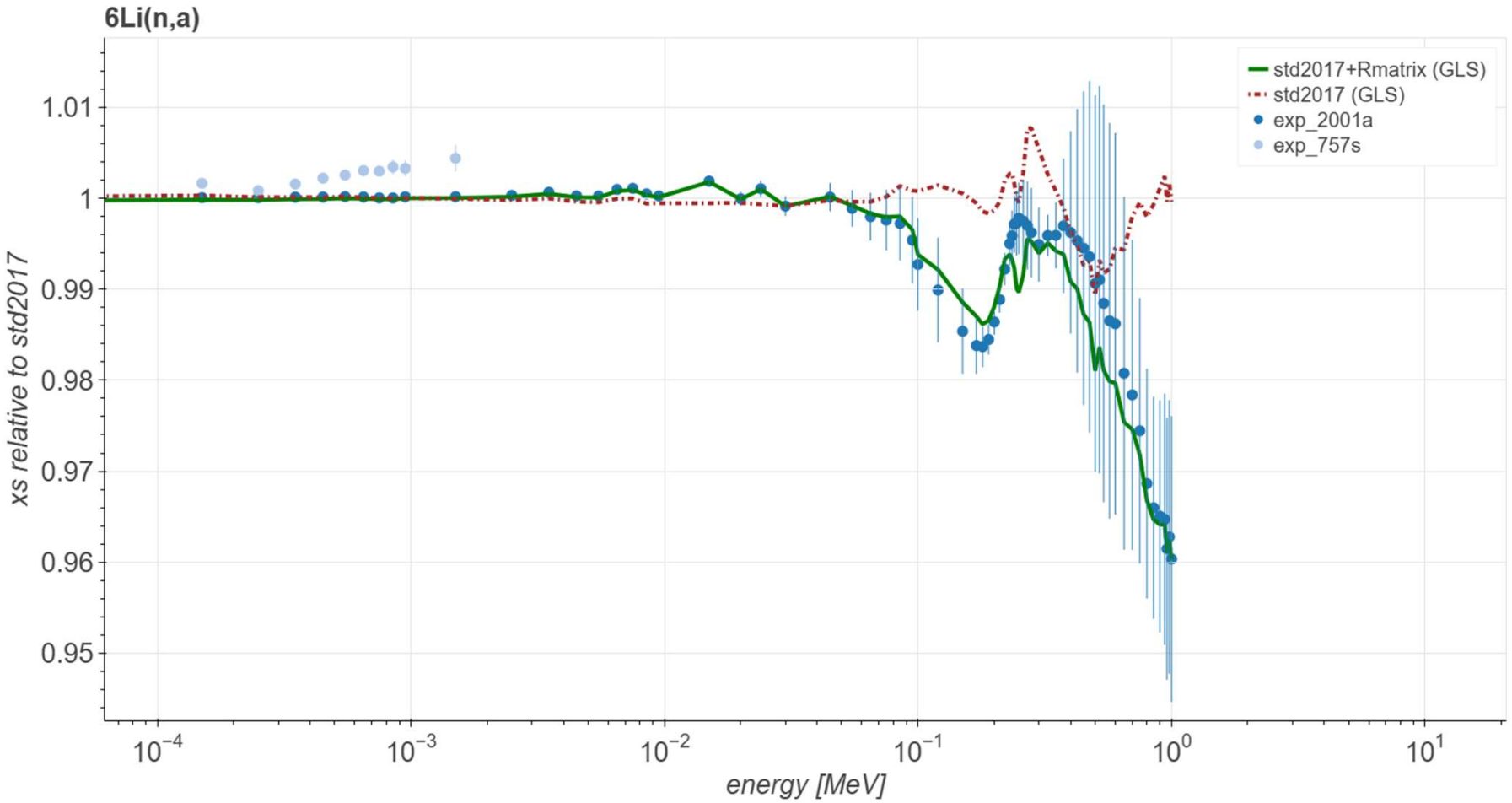


New (preliminary) 6Li(n,t) evaluation

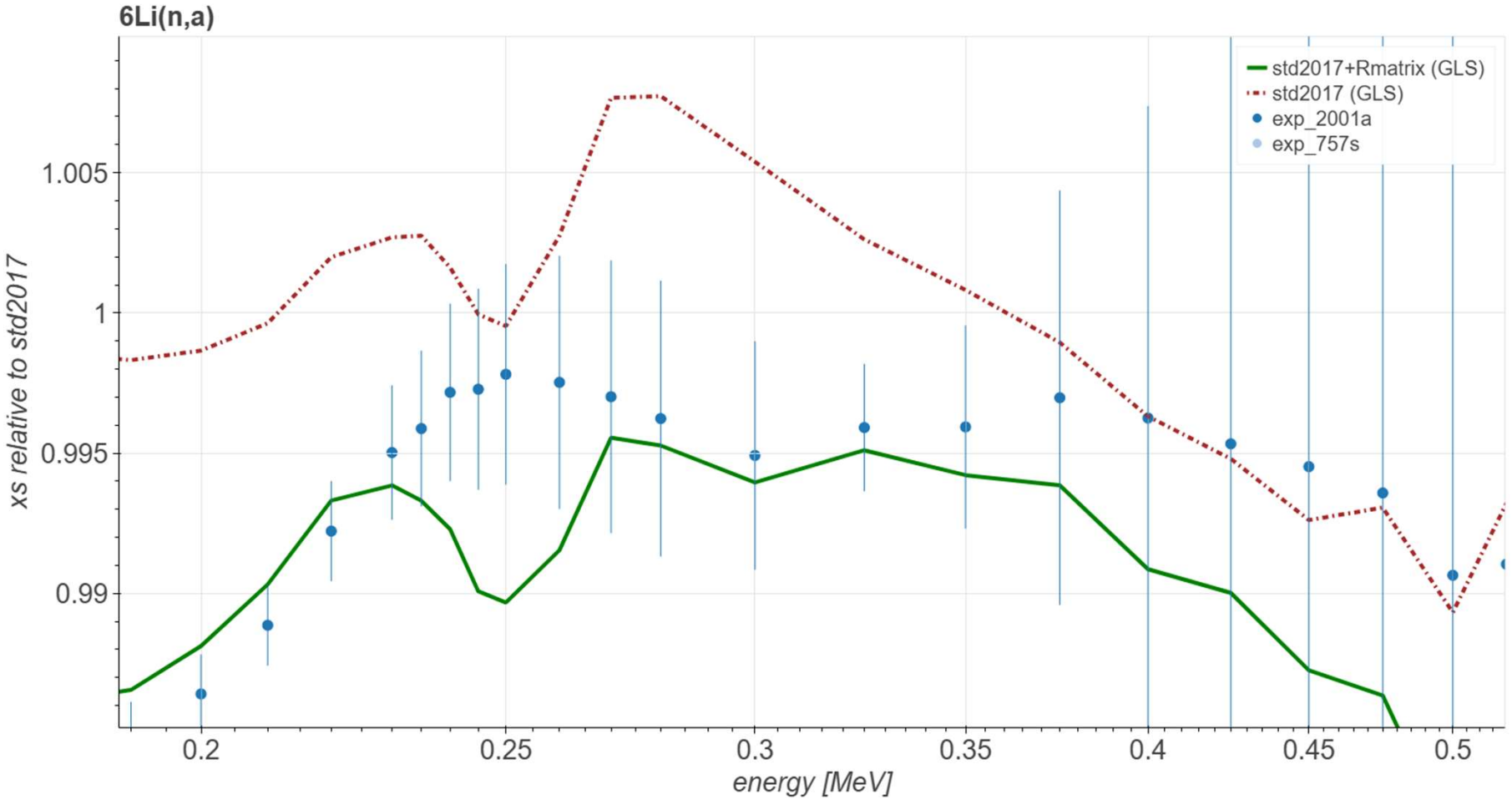




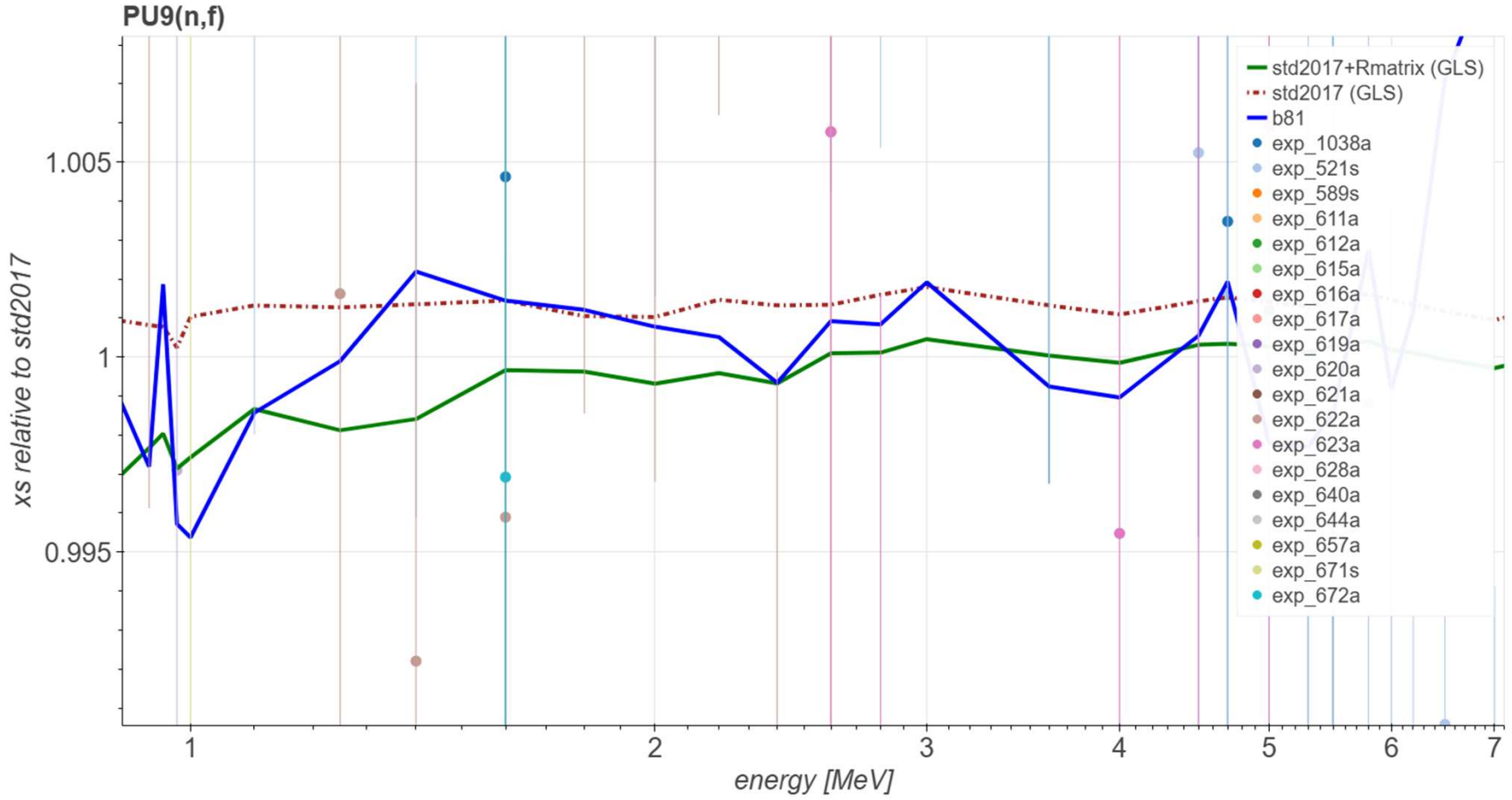
Impact of new Li-6(n,t) evaluation



Impact of new Li-6(n,t) evaluation



Impact of new Li-6(n,t) evaluation



Summary

- Differences between iterative GLS, Maximum Likelihood Estimation and chisquare minimization
- Iterative data reduction converges slowly
- Tentative evaluation with new Li-6(n,a) fit: Mild impact on other quantities