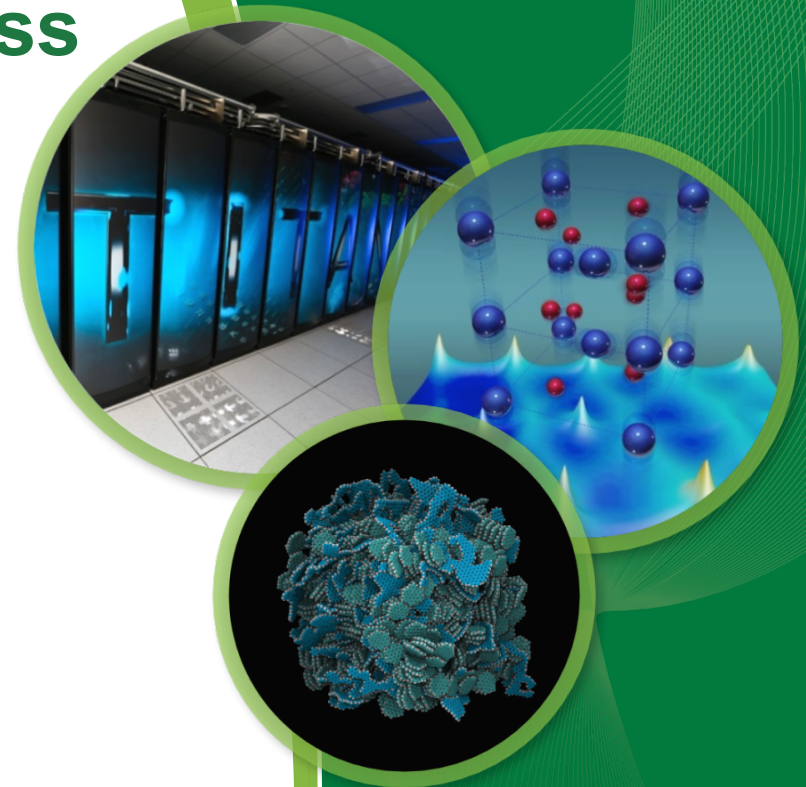


Cross-isotope correlations based on differential cross section measurements using natural samples

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Cross-isotope covariance

- Uncertainty information of the resonance parameters of the individual isotopes is tied together with cross-isotope covariance through the analysis of **natural samples**
- A full resonance parameter covariance matrix is necessary to accurately reflect the state of knowledge of the cross section simultaneously for:
 - individual isotopes, and
 - their combination in the cross section of the natural element

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Correlated uncertainties

10% uncertainty in experimental measurement
of a natural sample

does not imply

10% uncertainty in the cross section of the individual isotopes

Only through cross-isotope covariances can the evaluator accurately reflect the fact that the

cross section for the natural element
(the sum of the individual isotopes)

can be better known
(i.e., it can have a smaller variance)

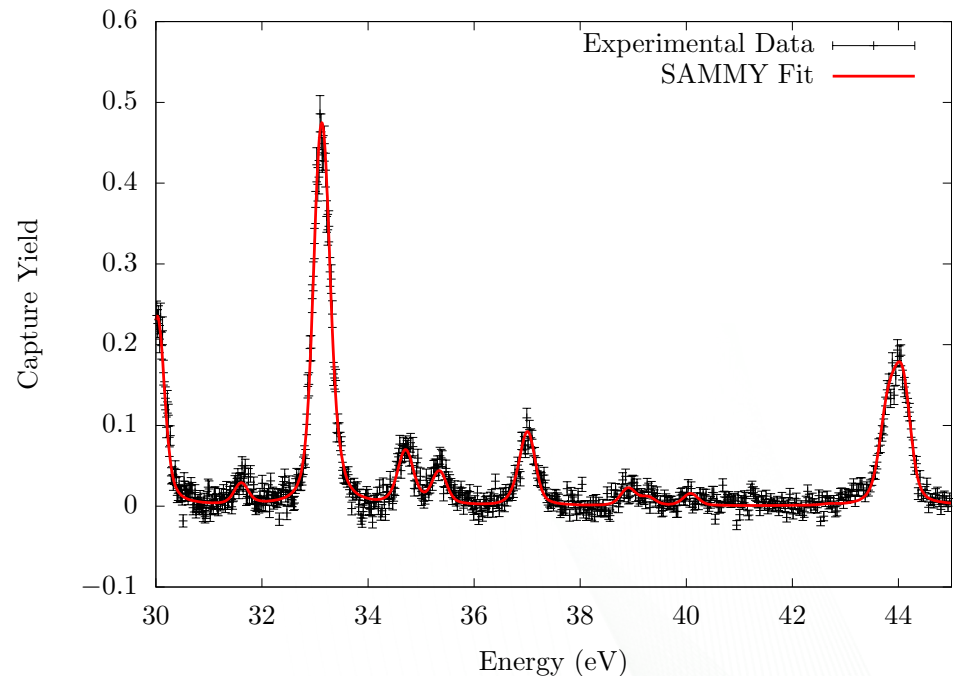
than each of the

cross sections of any of the individual isotopes

Demonstration of the impact of cross-isotope covariance

- Only statistical uncertainty is considered in this demonstration
- All systematic sources of uncertainty will be rigorously treated in the final covariance evaluation

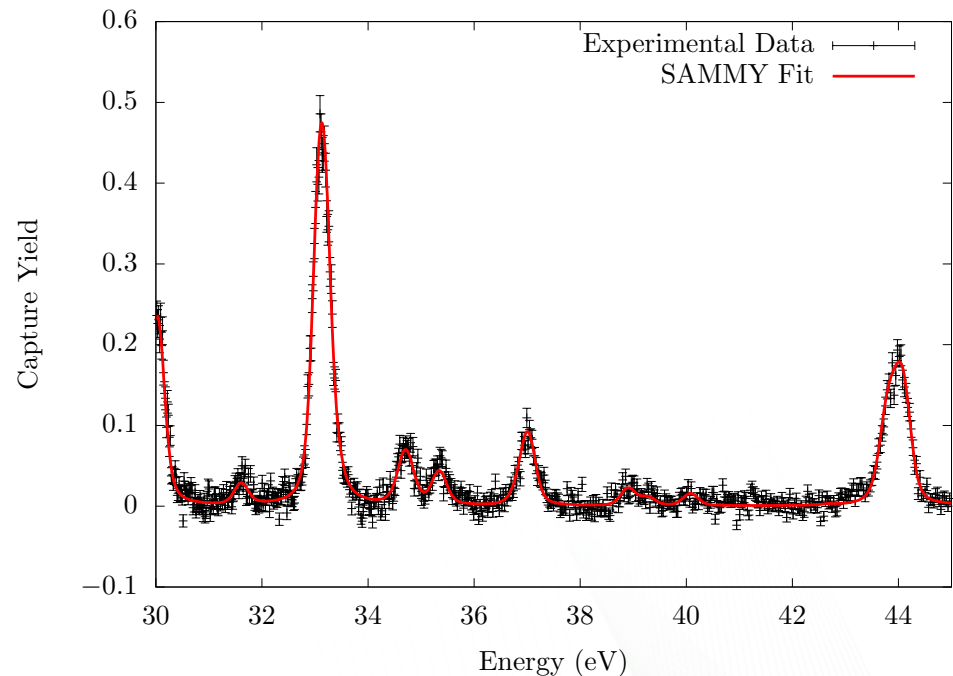
SAMMY fit of RPI data



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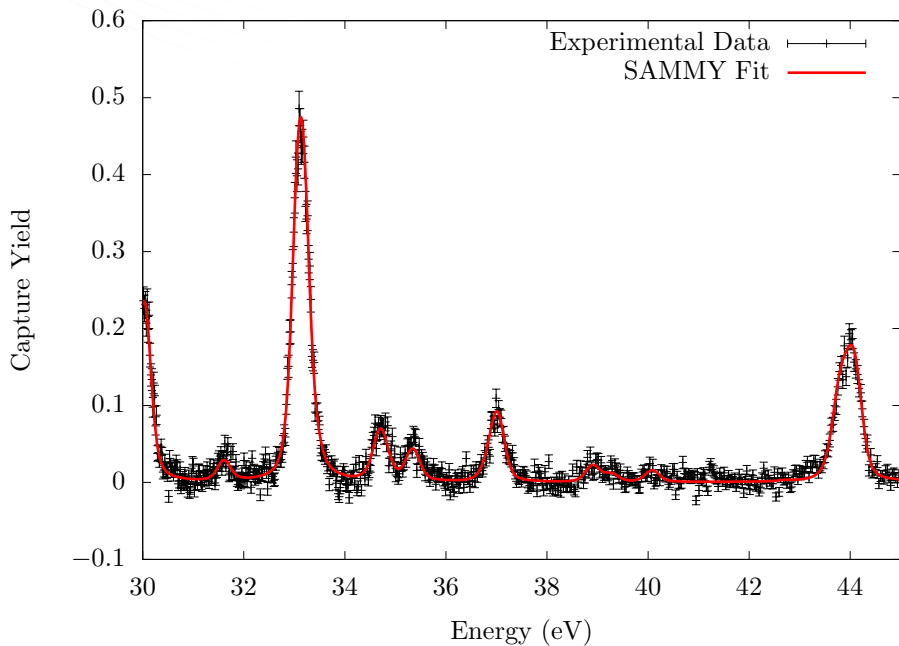
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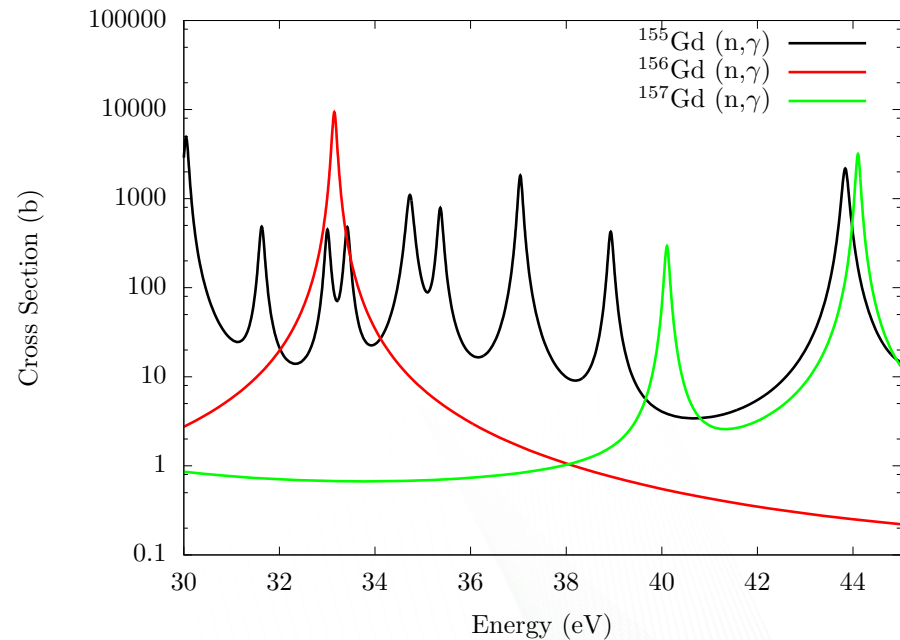


Resonances of gadolinium isotopes in the energy region of 30 to 45 eV

SAMMY fit of RPI data

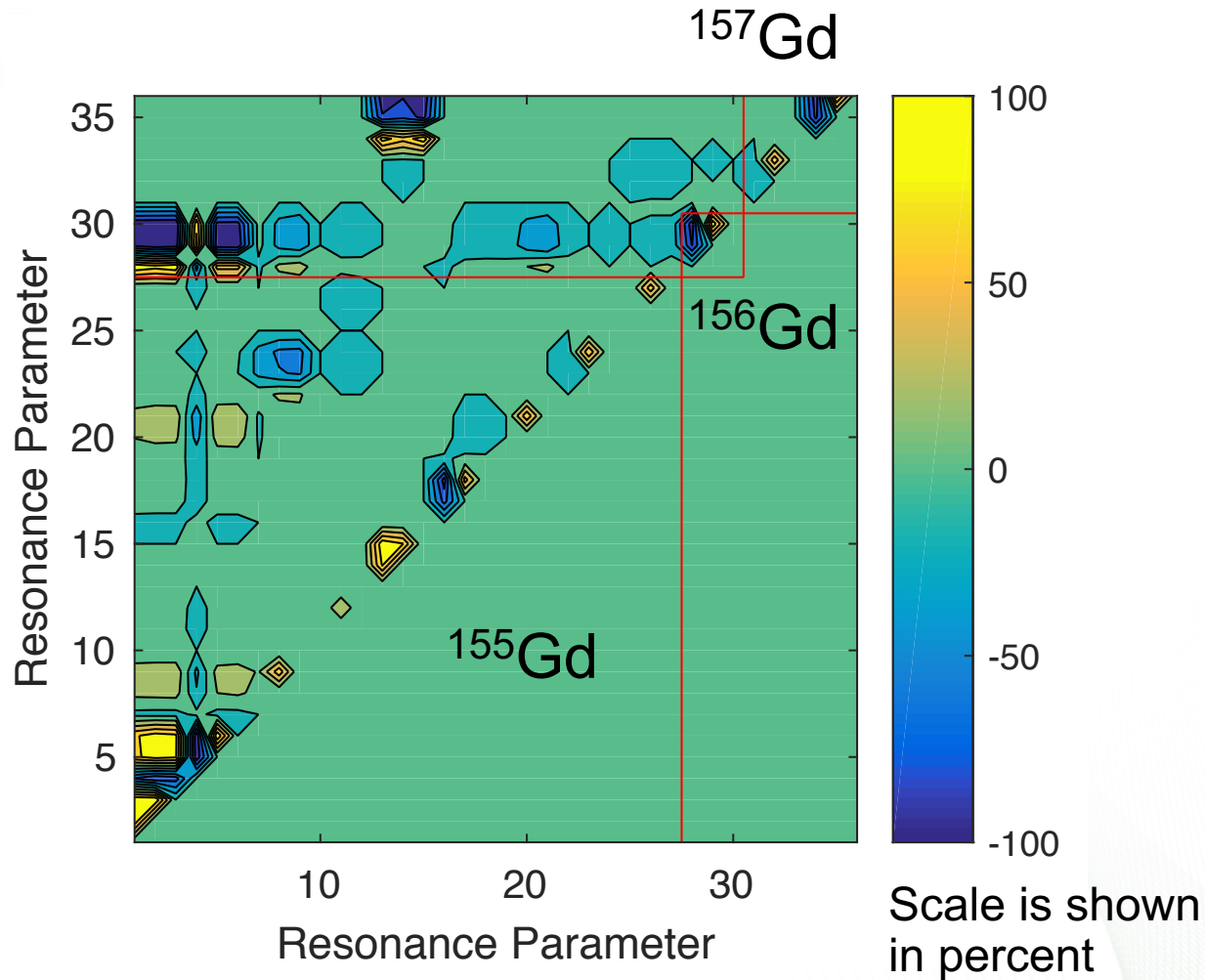


Gadolinium capture cross section



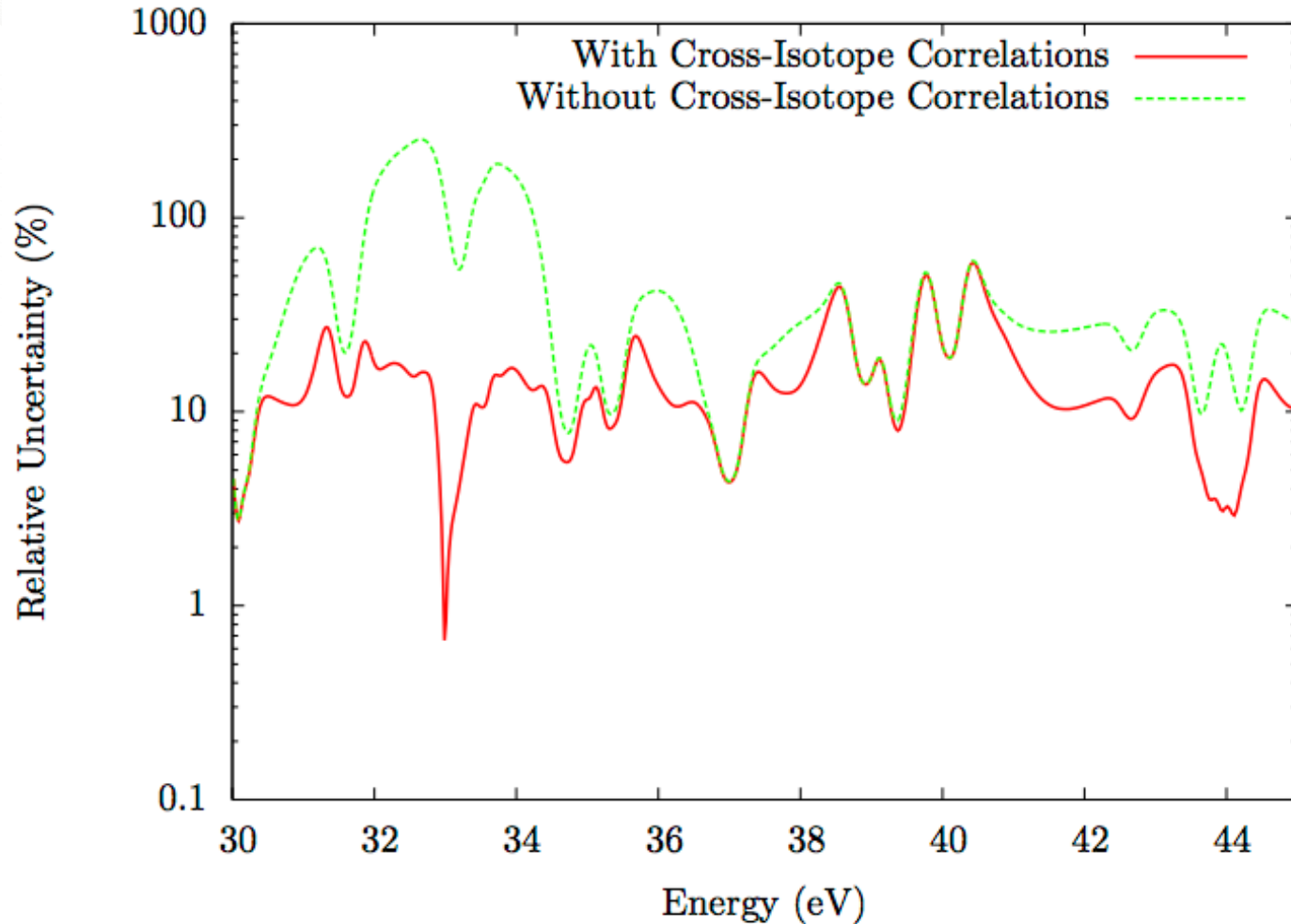
Cross-isotope correlations based on differential cross section
8 measurements using natural samples

Upper triangular portion of the joint resonance parameter correlation matrix for resonances of ^{155}Gd , ^{156}Gd , and ^{157}Gd between 30 and 45 eV



Cross-isotope correlations based on differential cross section measurements using natural samples

Cross-isotope correlations are usually not reported in general-purpose nuclear data libraries



Cross-isotope correlations based on differential cross section measurements using natural samples