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SG50: Data Formats for the URR and Covariance

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Main Priorities

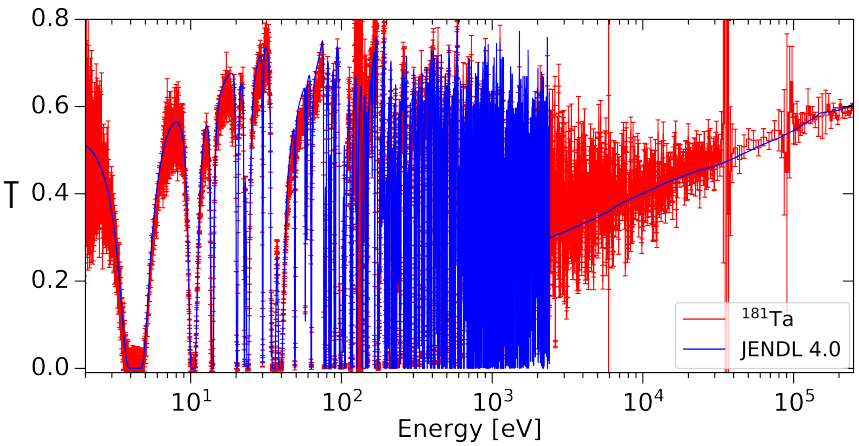
- Reproducibility
  - Experimental data and uncertainties/correlations
  - Raw (e.g. count rate) -> Reduced data (T,Y,SI,σ_x,etc.)
  - Strict QA
    - Procedure/algorithm used for reduction
  - Publication accessible and/or detail data reduction?
    - Good example: AGS Manual
    - Bad example: Harvey's Ta T data (U-238 pub.)
- Machine readable and standardized
- Covariance
- AMARA (As Much As Reasonably Achievable)

Differential URR measurement

- Raw
  - T: $\frac{C_s - B_s}{C_o - B_o}$
  - Y: $\eta \frac{C-B}{\phi}$
  - SI, $\sigma_t(E), \sigma_\gamma(E)$, etc.
- Variance & Covariance
- Low statistical error (Obvious)
- High resolution (Less obvious)
- Absolute measu. preferable (to ratio w.r.t. known) (very difficult, gray area)

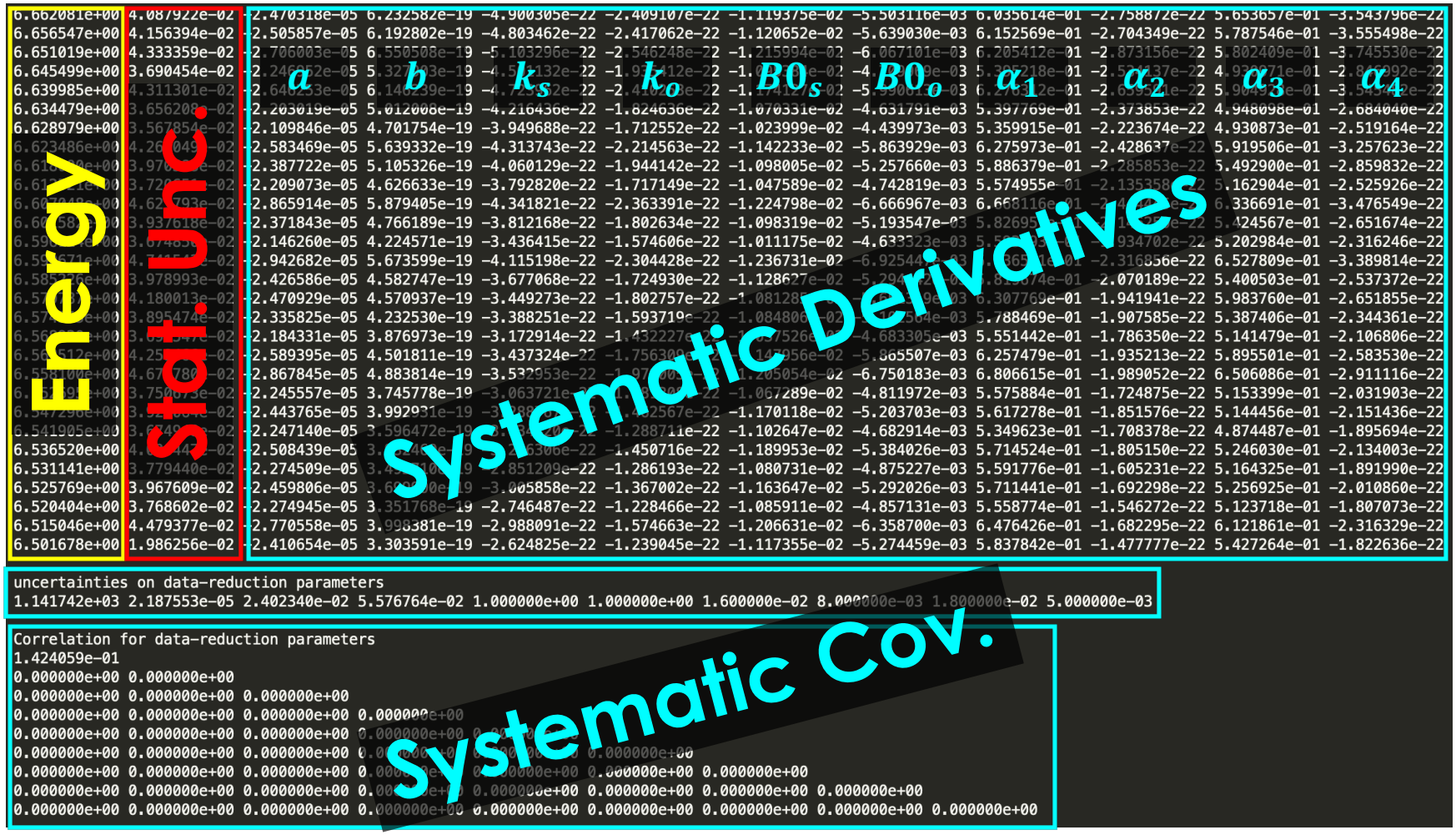
Additional URR data

- Maxwellian Averaged Cross Sections (MACS)
- Strength functions
- Average RRR pars
- Etc.



Compact covariance storage: example

- SAMMY and AGS have very similar formats
- Would be better with a standard format: JSON, HDF5, YAML, etc.



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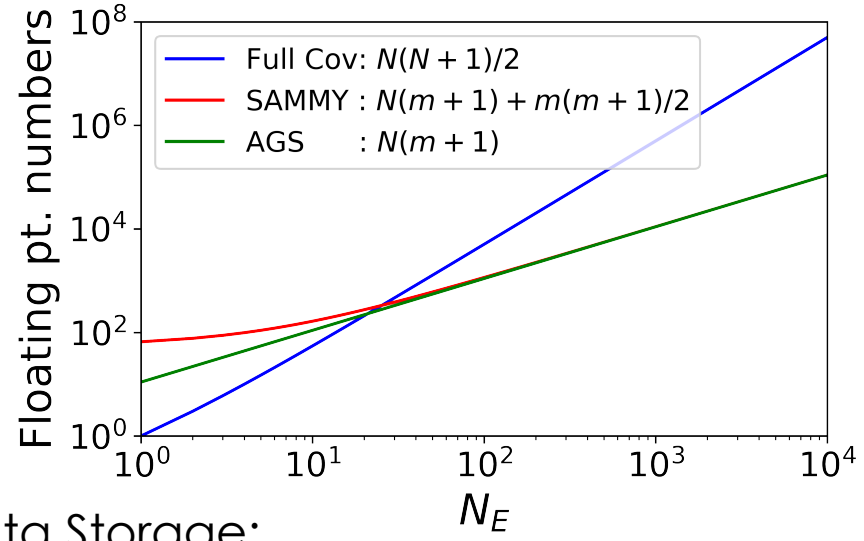
Compact covariance storage: example

$$T = \frac{\alpha_1 C_s + \alpha_2 k_s B + B0_s}{\alpha_3 C_o + \alpha_4 k_o B + B0_o},$$

$$B = a e^{-bt}$$

$$\mathbf{C}_{tot} = \mathbf{C}_{stat} + \mathbf{C}_{sys}$$
$$\mathbf{C}_{tot} = \mathbf{C}_{stat} + SMS^T$$



Data Storage:
- Full Cov = $N_E(N_E+1)/2$
- SAMMY = $N_E \cdot (N_P+1) + N_P(N_P+1)/2$

$$\mathbf{C}_{tot} = \begin{pmatrix} \text{Stat. Var.} & 0 \\ 0 & \end{pmatrix} + \begin{pmatrix} \text{Systematic Ders.} \end{pmatrix} \begin{pmatrix} \text{Systematic Cov.} \end{pmatrix} \begin{pmatrix} \text{Systematic Ders.} \end{pmatrix}^T$$

We should also keep in mind…

- What tools are used to reduce raw data? Availability?
  - Typically in-house codes…
  - AGL/AGS @ Geel
  - RPIXDR/TRANS @ RPI
  - ROOT @ CERN (maybe LANL too)
  - There are more…
- What tool will use this data? Availability?
  - SAMMY (FITACS)*
  - EMPIRE
  - REFIT (NEA & RSICC)
  - EDA, CoH3
  - CONRAD
  - TALYS

Sorry if I missed your code…

Blue = Open Source

Evaluator wishes for future work:
- How do these data systematically compare to other data?
- Reduce correlations to other x.s.

* 95% open source

Acknowledgments

- NDCS group
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ROOT: https://root.cern/releases/release-62202/
SAMMY: https://code.ornl.gov/RNSD/SAMMY
EMPIRE: https://www-nds.iaea.org/empire/index.html
TALYS: https://tendl.web.psi.ch/tendl_2019/talys.html