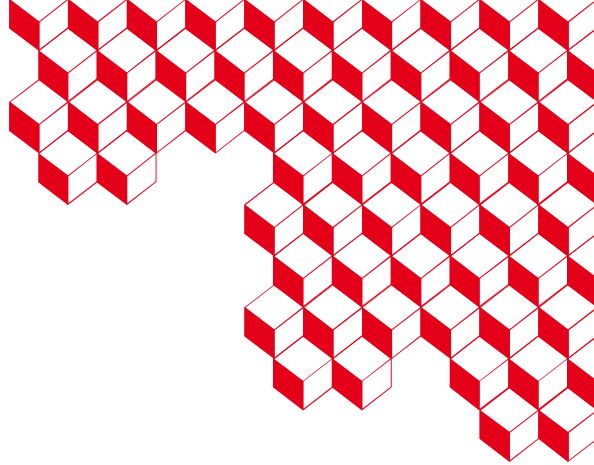


Further improvements to the nuclear data processing code GALILÉE-1

Mireille Coste-Delclaux - Cédric Jouanne - Claude Mounier

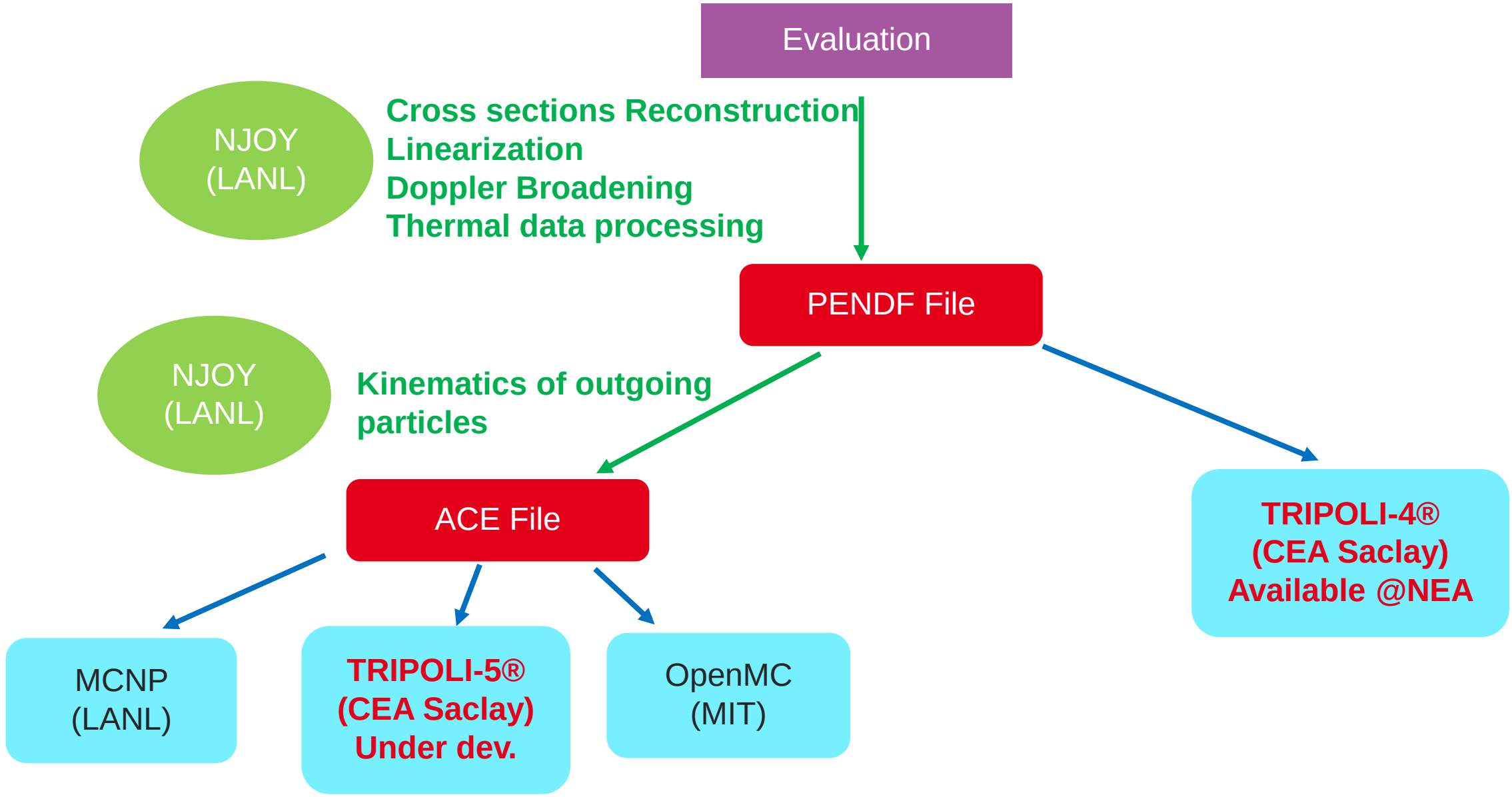
Wonder 2026, Aix-en-Provence

Outline

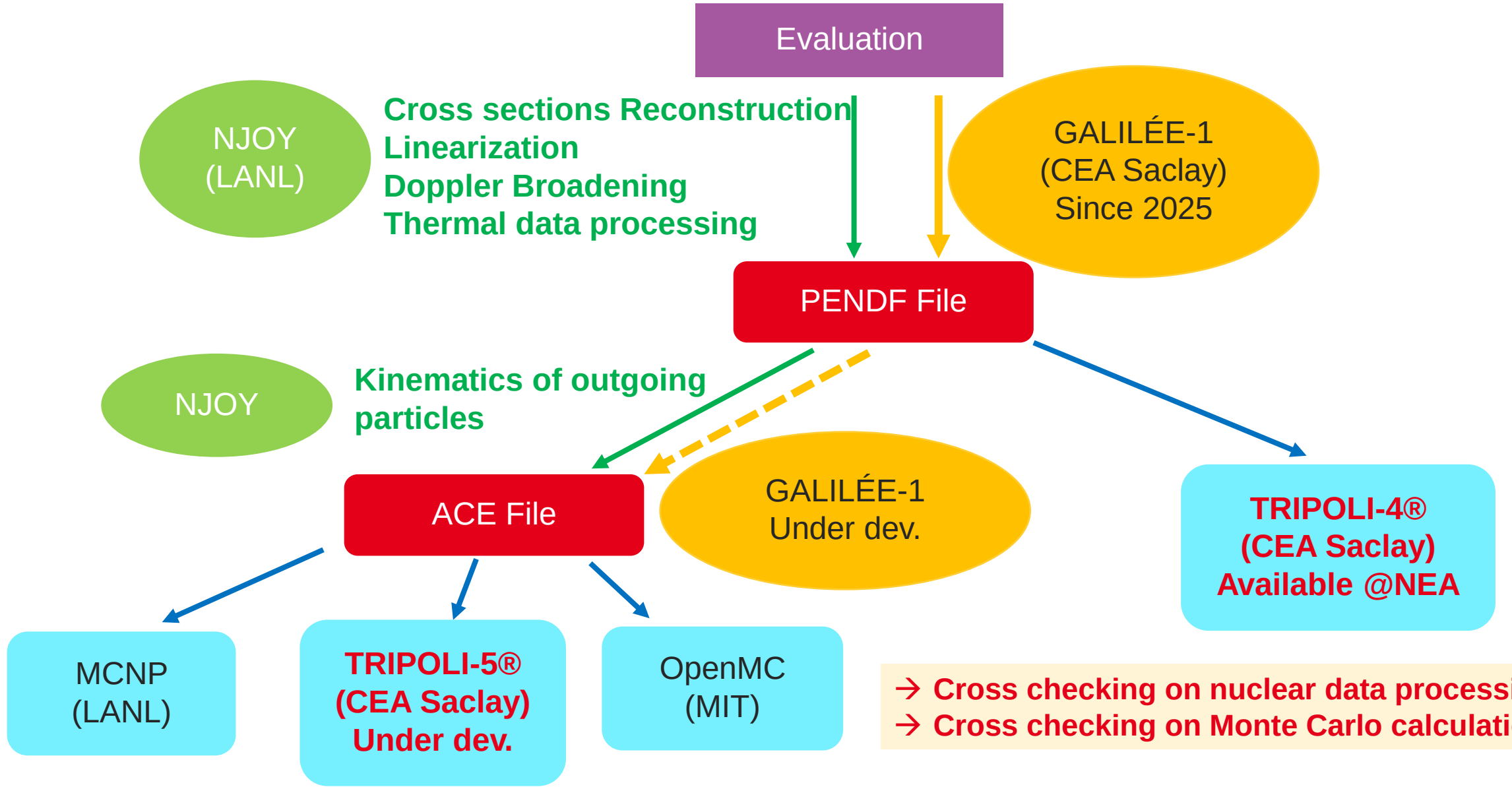
1 – Nuclear data Processing & Simulation
2 – TSL processing
3 – Probability Table processing
4 – Conclusion

M. Coste-Delclaux, et al. (2024). « Recent developments in the GALILÉE-1 processing code ».
EPJ Web of Conferences (Vol. 294, p. 06003). EDP Sciences. (2024)

Nuclear data processing for Monte Carlo codes



Nuclear data processing for Monte Carlo codes



→ Cross checking on nuclear data processing
→ Cross checking on Monte Carlo calculations

Current state of GALILÉE-1 regarding the GNDS format

- GALILÉE-1 is able to process TRIPOLI-4® libraries with evaluations in GNDS format:
  - Cross-sections reconstruction in RRR, URR & Continuum
  - Probability Tables

  Based on the new specifications, we plan to cross-check the ENDF/BVIII.1 TRIPOLI-4® library (ENDF-6 format against the GNDS.2.2.rc1 format)

- The reaction products are currently being read

GNDS vs ENDF-6

Big Ten (ieu-met-fast-007_2Z)

Two-zone homogenized model:
an inner cylindrical core enriched to 10% in U235, surrounded by a natural-uranium outer cylinder

Experimental value: 0.99480 (100)

	k_{eff}	Δk_{eff}
NJOY (PENDF) without PT	0.99219 (3)	-3
GALILÉE-1 from ENDF-6 without PT	**0.99222 (3)**	**-**
GALILÉE-1 from GNDS without PT	0.99215 (3)	-7
NJOY (PENDF) with PT	0.99511(3)	-3
GALILÉE-1 from ENDF-6 with PT	**0.99514 (3)**	**-**
GALILÉE-1 from GNDS with PT	0.99514 (3)	0

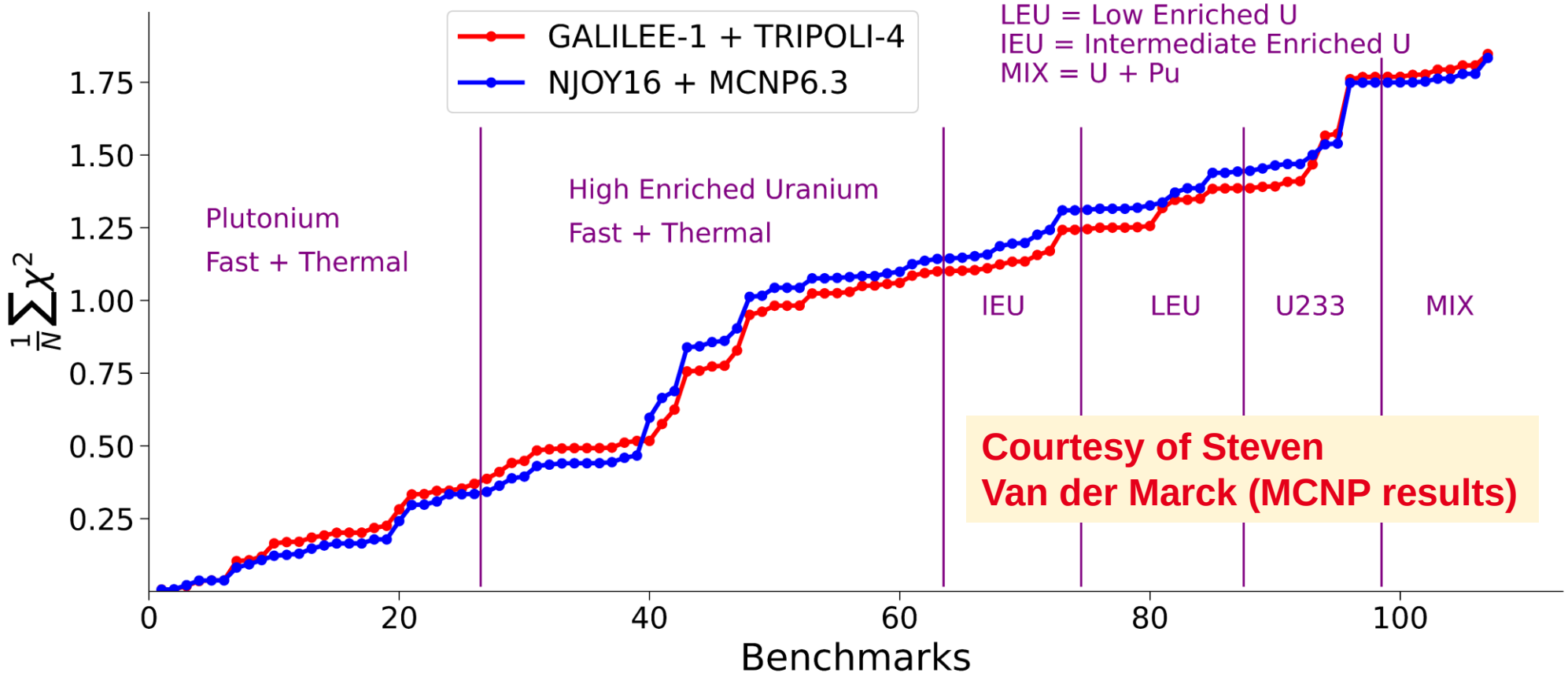
GALILÉE-1 + TRIPOLI-4® or NJOY16 + MCNP

Very good agreement between NJOY + MCNP and GALILÉE-1 + TRIPOLI-4® calculations

→ very high level of confidence in the use of the library

Example : ICSBEP criticality benchmarks using JEFF-4 Library

$$\chi_i^2 = \frac{(C_i - E_i)^2}{\sigma_{E_i}^2 + \sigma_{C_i}^2}$$



Courtesy of Steven Van der Marck (MCNP results)

The differences are mainly due to the definitions of the geometry.

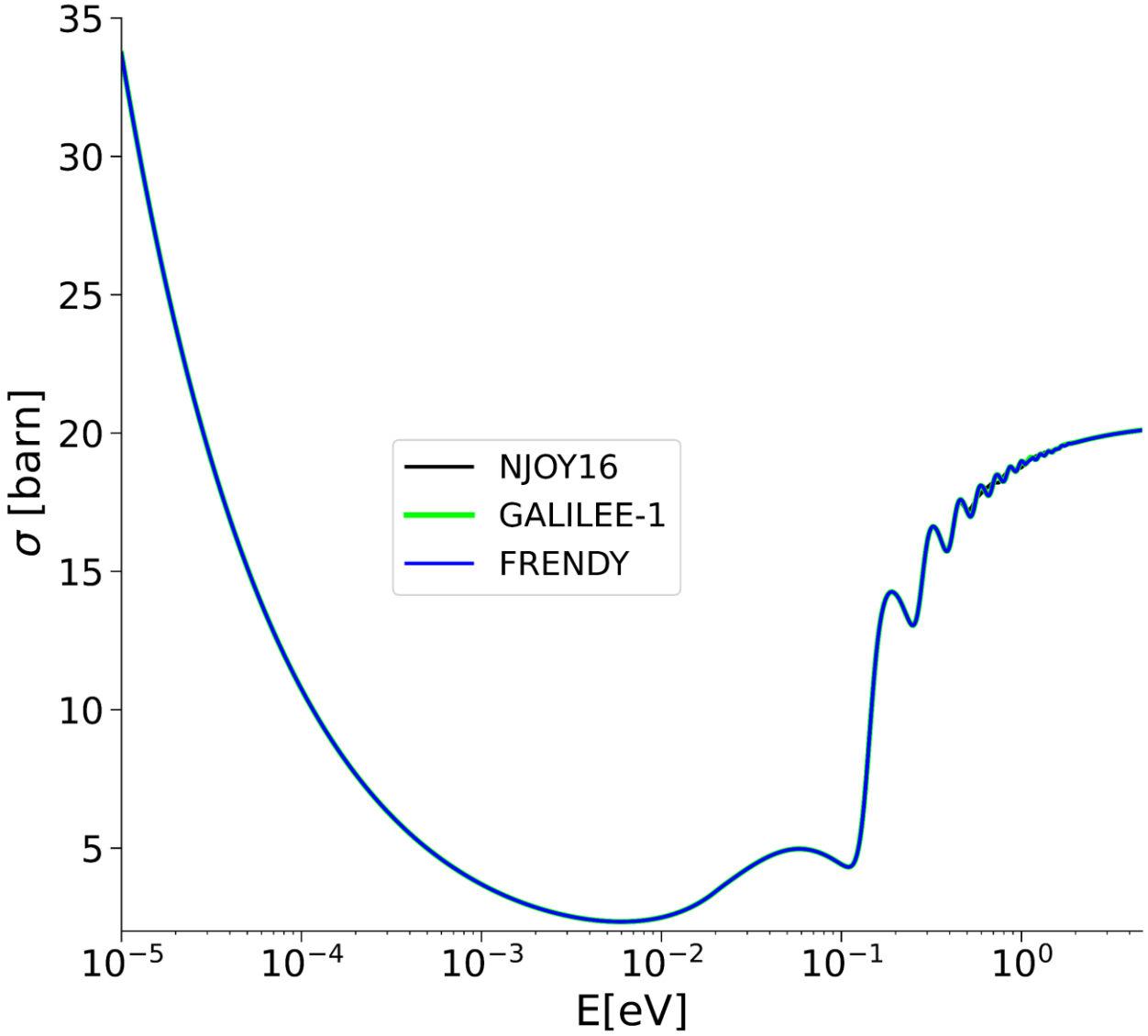
Thanks to Oscar for sharing the MCNP files.

TSL processing

GALILÉE-1 now supports the treatment of double elastic scattering, including both coherent and incoherent components

Inelastic cross section

JEFF-3.3 : H1 in ZrH @294K



TSL processing

Inelastic cross section

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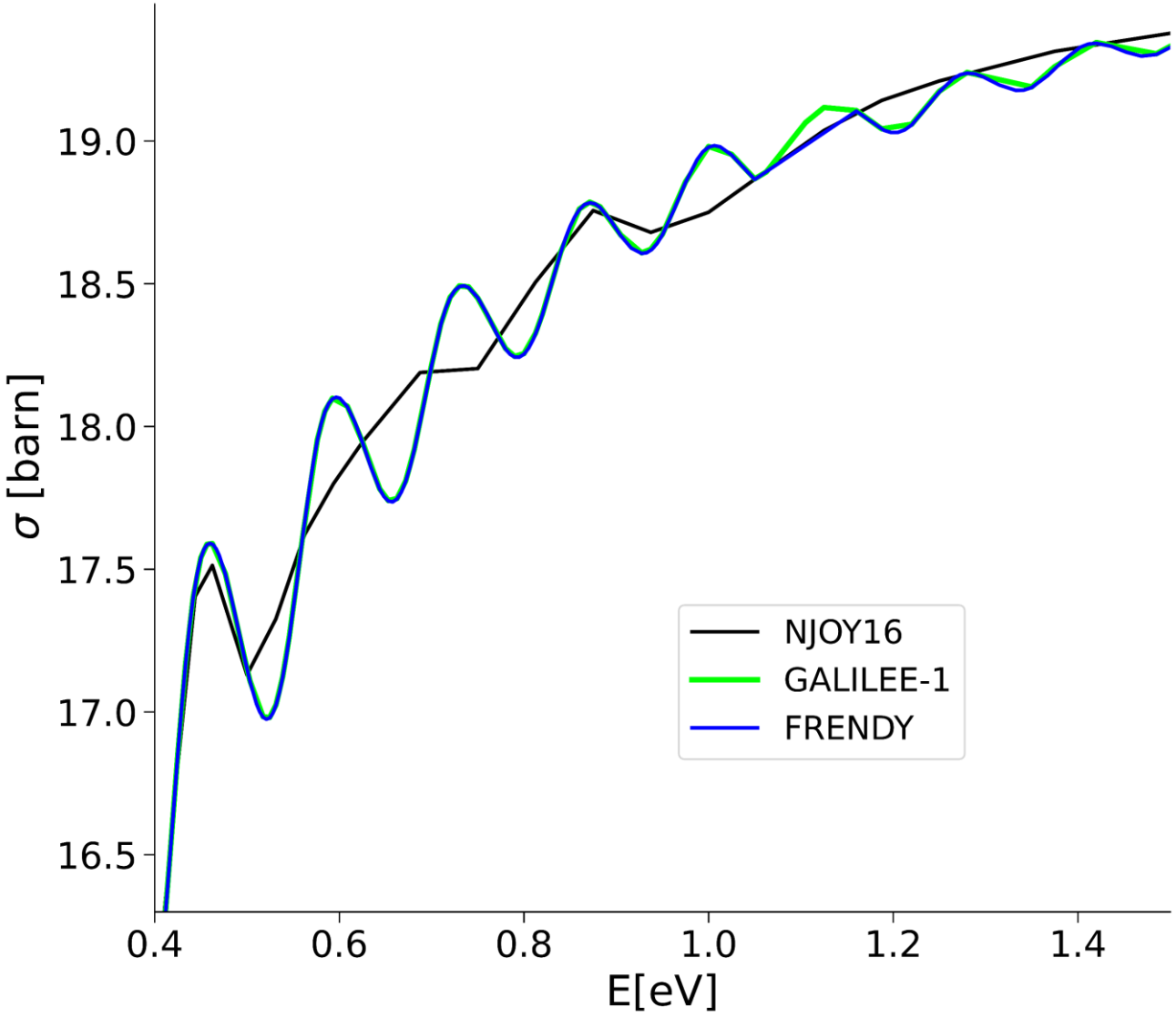
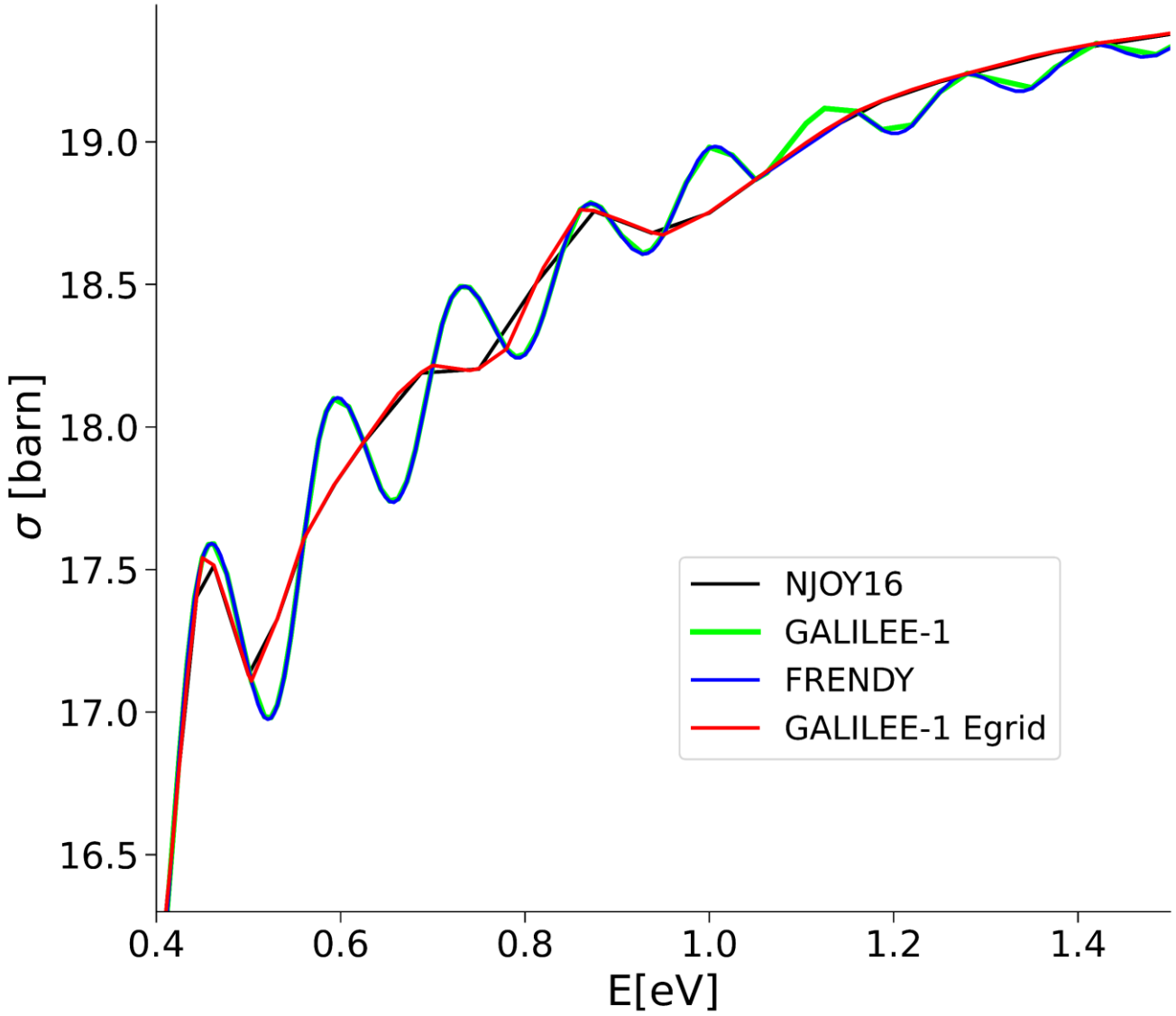


TSL processing

Inelastic cross section

JEFF-3.3 : H1 in ZrH @294K

Vibration-induced oscillations
→ Impact of Energy grid (NJOY)



Probability Table processing

JENDL-5 Library : U238 @ 23 keV (294 K)

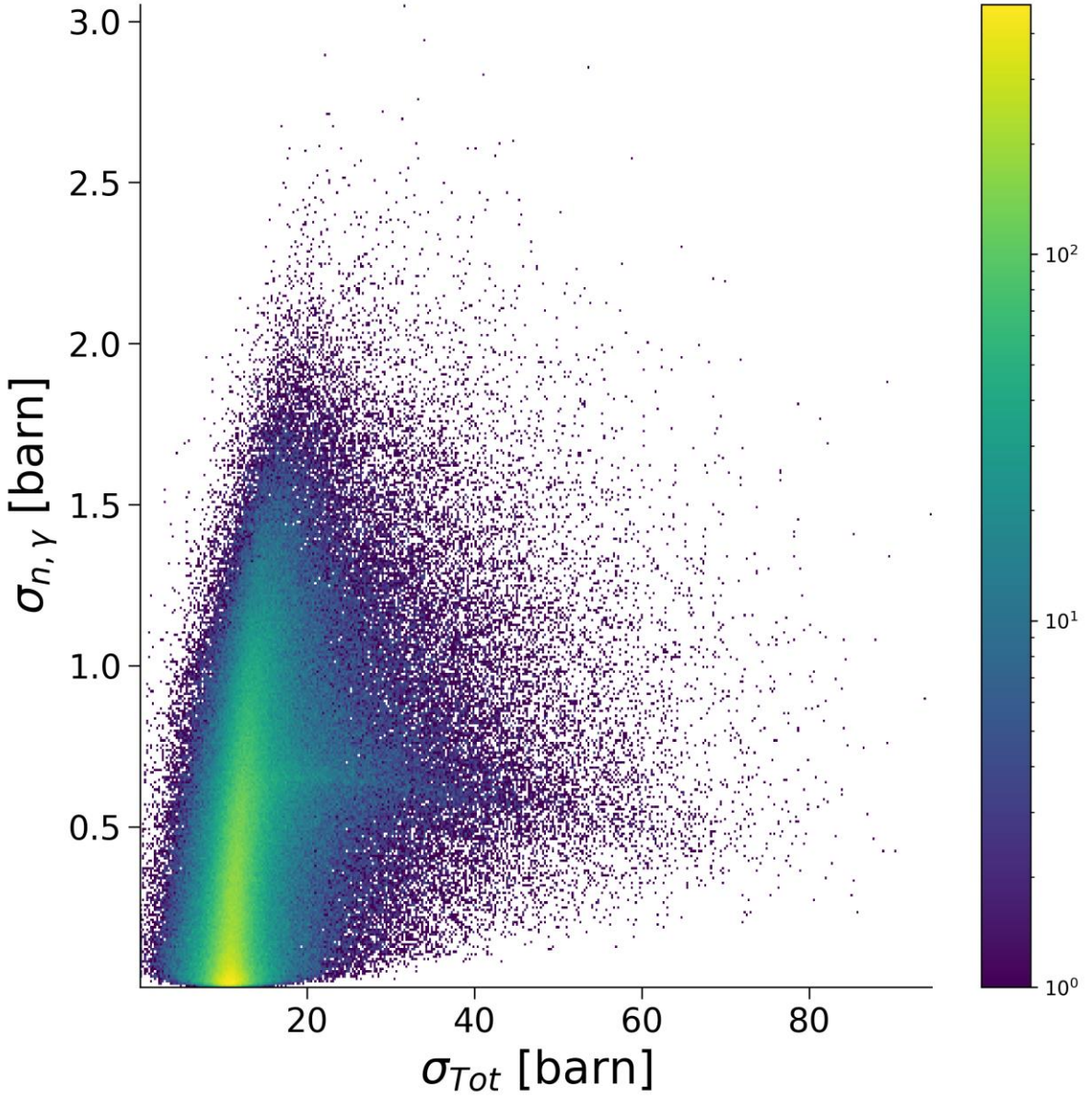
GALILÉE-1 :
Two ways for generating probability tables (PTs):

1/ Random PENDF in URR + Cross sections Moments

2/ Random cross sections values at one energy + Tally

Probability tables are calculated using total cross sections

→ Representation of small partial cross sections ?



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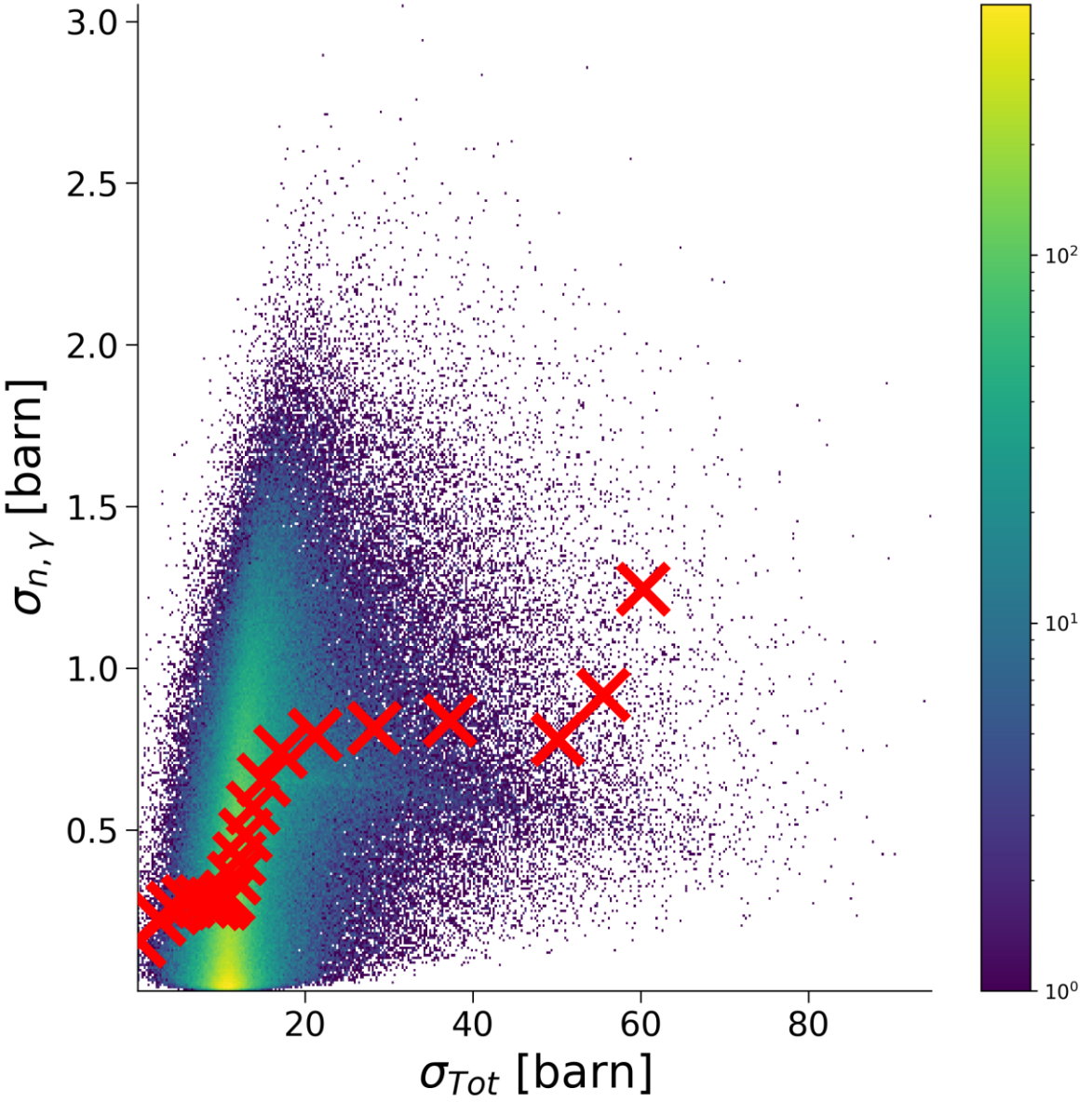
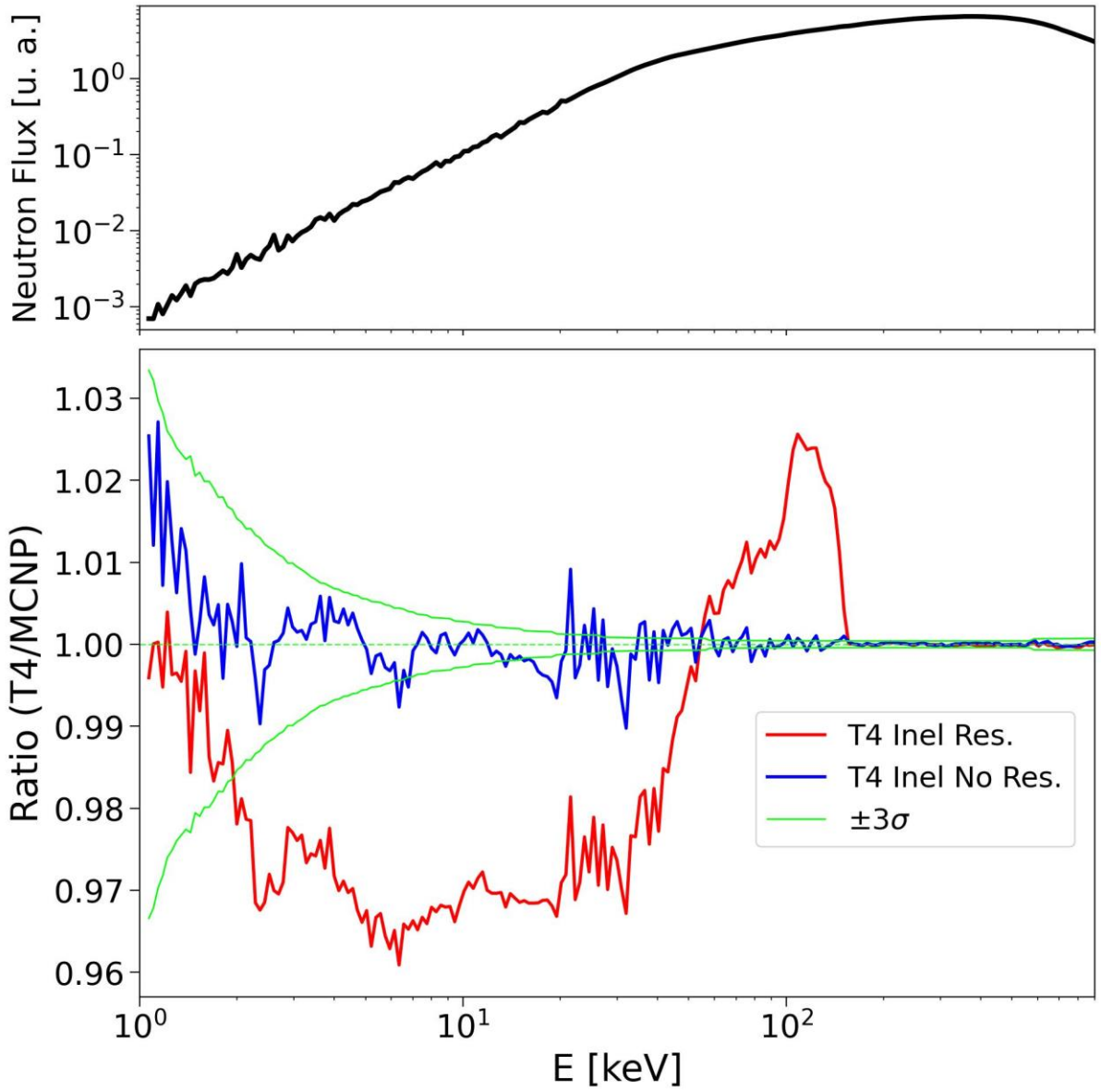


Probability Table processing

Big Ten (ieu-met-fast-007_2Z)

Calculation Mode	K_{eff}	ΔK_{eff}
MCNP without PTs	0.99151 (3)	-1
TRIPOLI-4 without PTs	**0.99152 (2)**	**-**
MCNP using PTs	0.99458 (2)	+2
TRIPOLI-4 using PTs Non resonant inelastic (URR)	**0.99456 (2)**	**-**
TRIPOLI-4 using PTs Resonant inelastic (URR)	0.99513 (2)	+57



Conclusion

- **GALILÉE-1 is now fully operational for generating nuclear data libraries for TRIPOLI-4®.**
- **Further developments are needed to produce accurate and reliable probability tables.**
- **Next milestone (2027): Generation of ACE libraries for TRIPOLI-5®, MCNP, and other Monte Carlo codes.**
- **Long-term objective: Generation of multigroup nuclear data libraries (APOLLO libraries).**

Thank You !

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