PAUL SCHERRER INSTITUT

PSI

D. Rochman, M. Hursin

JEFF-3.3 uncertainties on PIE data and reactor quantities

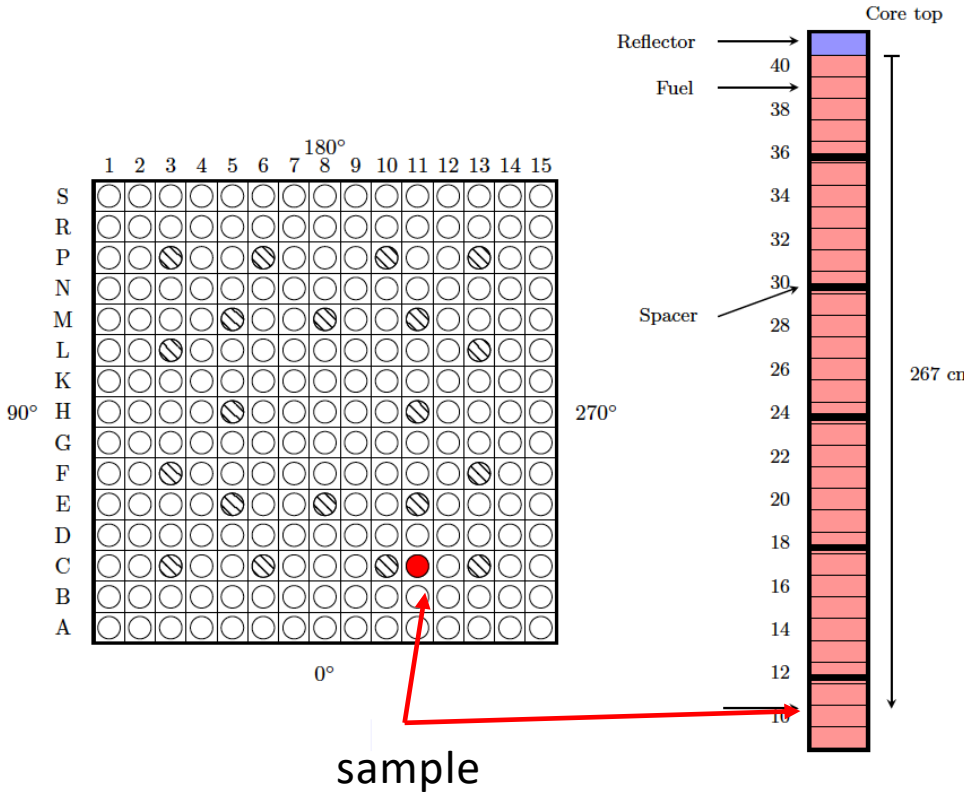
JEFF Meeting, via remote connection, JEFDOC-2014
26 November 2020

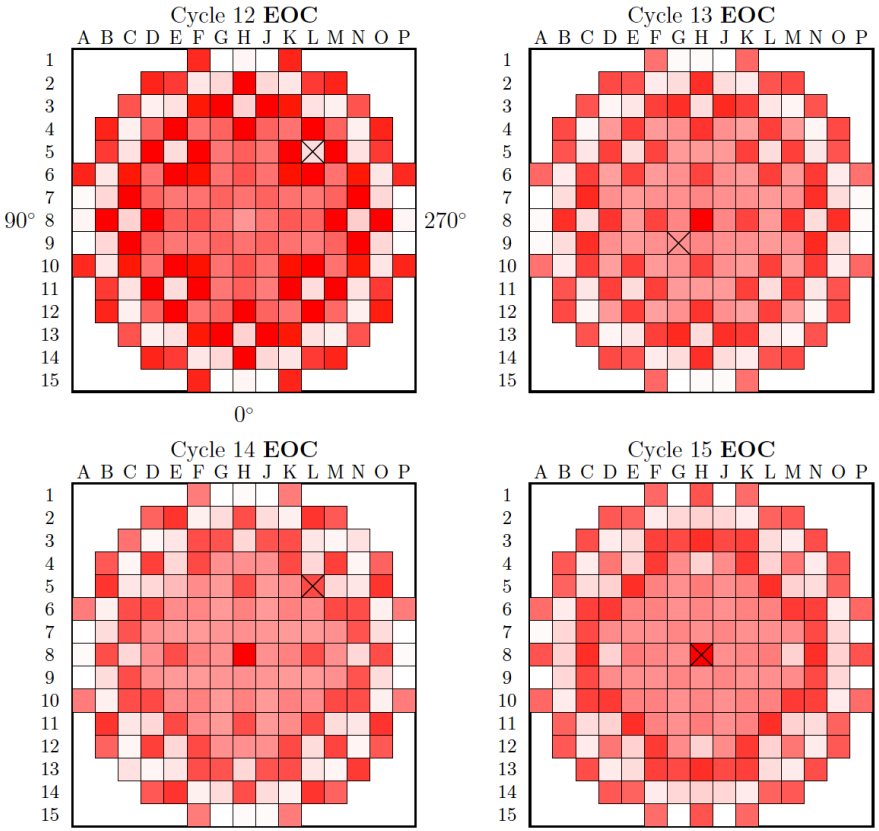
Summary

- Impact of JEFF-3.3, ENDF/B-VIII.0 and JENDL-4.0 uncertainties for
  - PIE data
  - Boron curve
  - SNF decay heat

PIE data

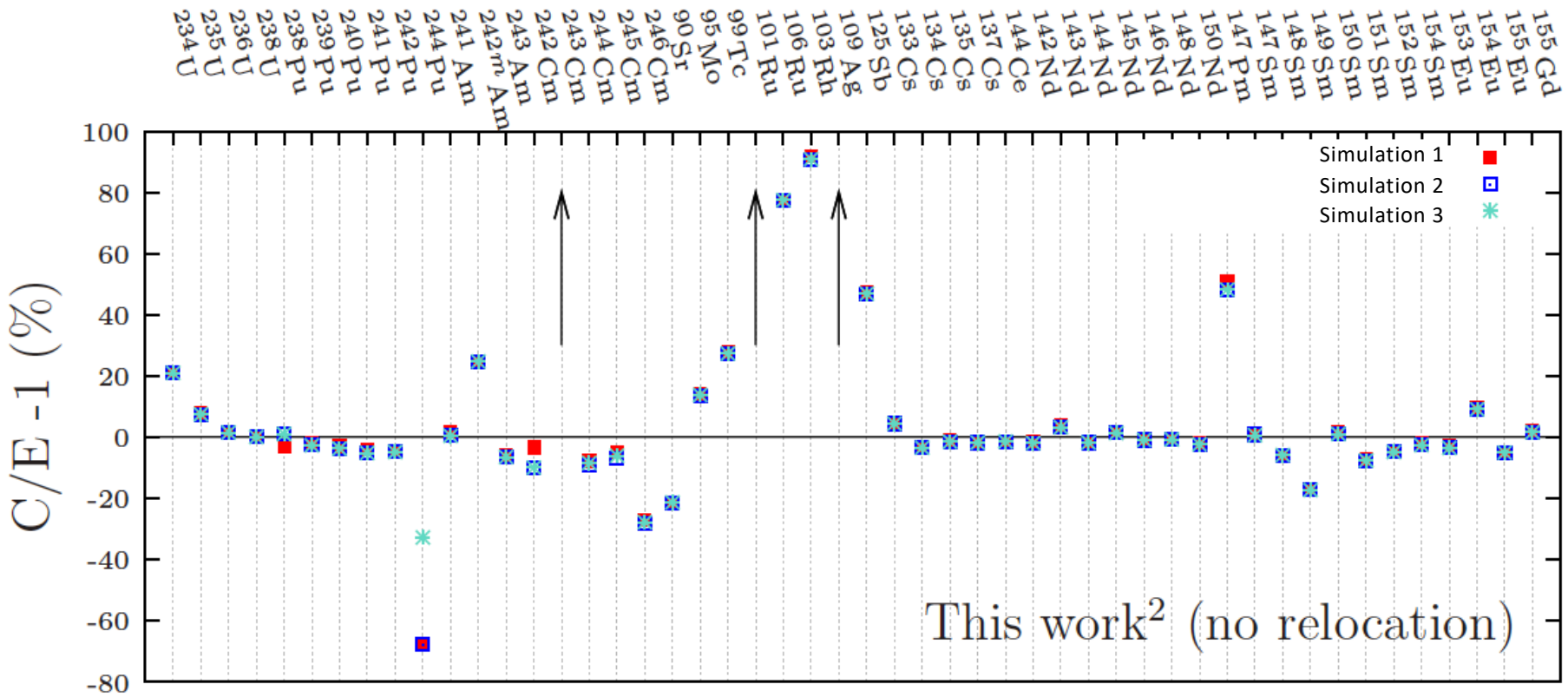
- PIE data: isotopic concentrations from irradiated samples in a specific reactor
- Measured actinides and fission products (e.g. in mg/gU)
- Used for transport and depletion code validation
- See SF-COMPO:





PIE data

- Example:



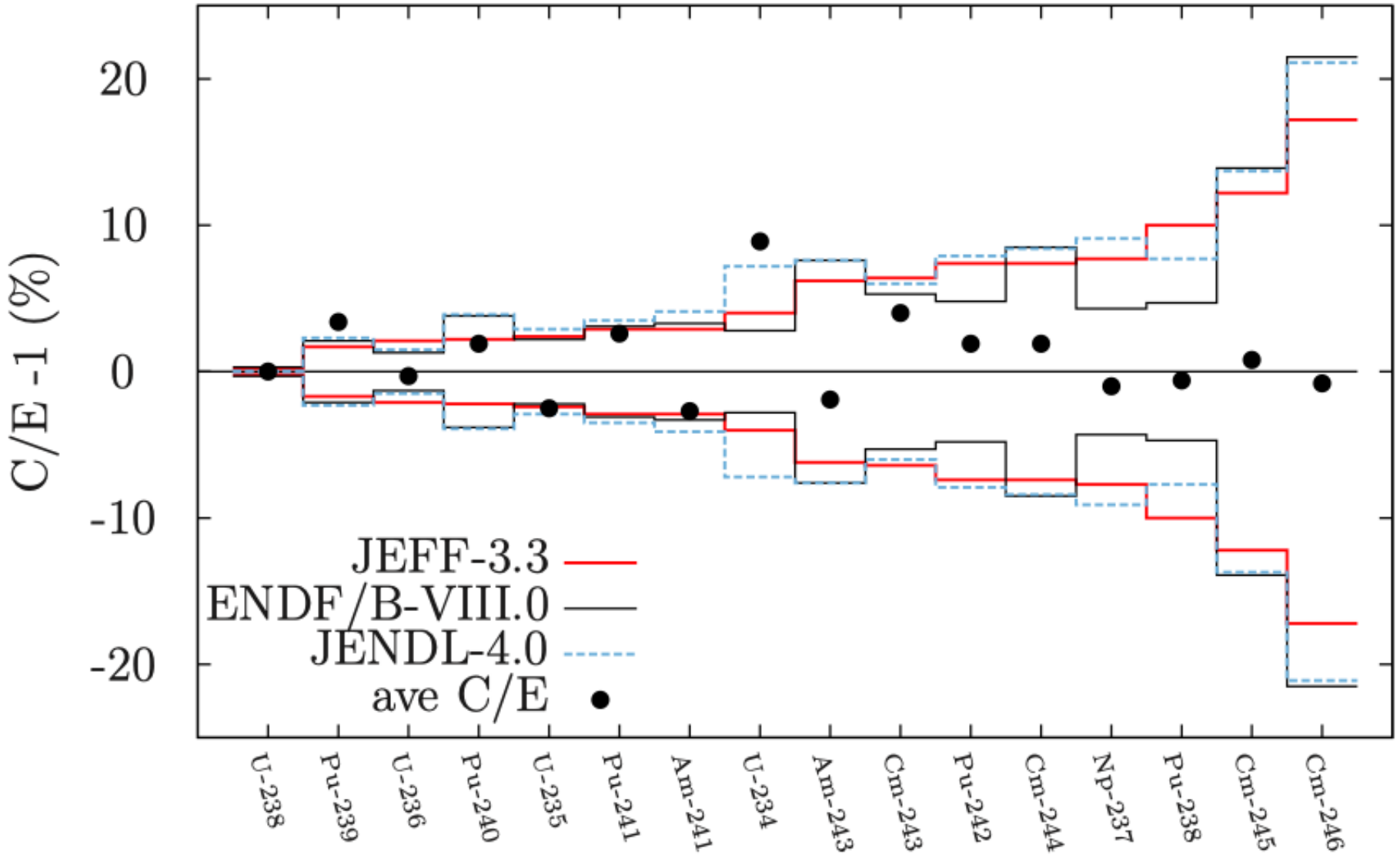
PIE data

- PSI database: 27 samples irradiated in Swiss reactors
  - UO_2, MOX, PWR, BWR, 30 to 120 MWd/kgU

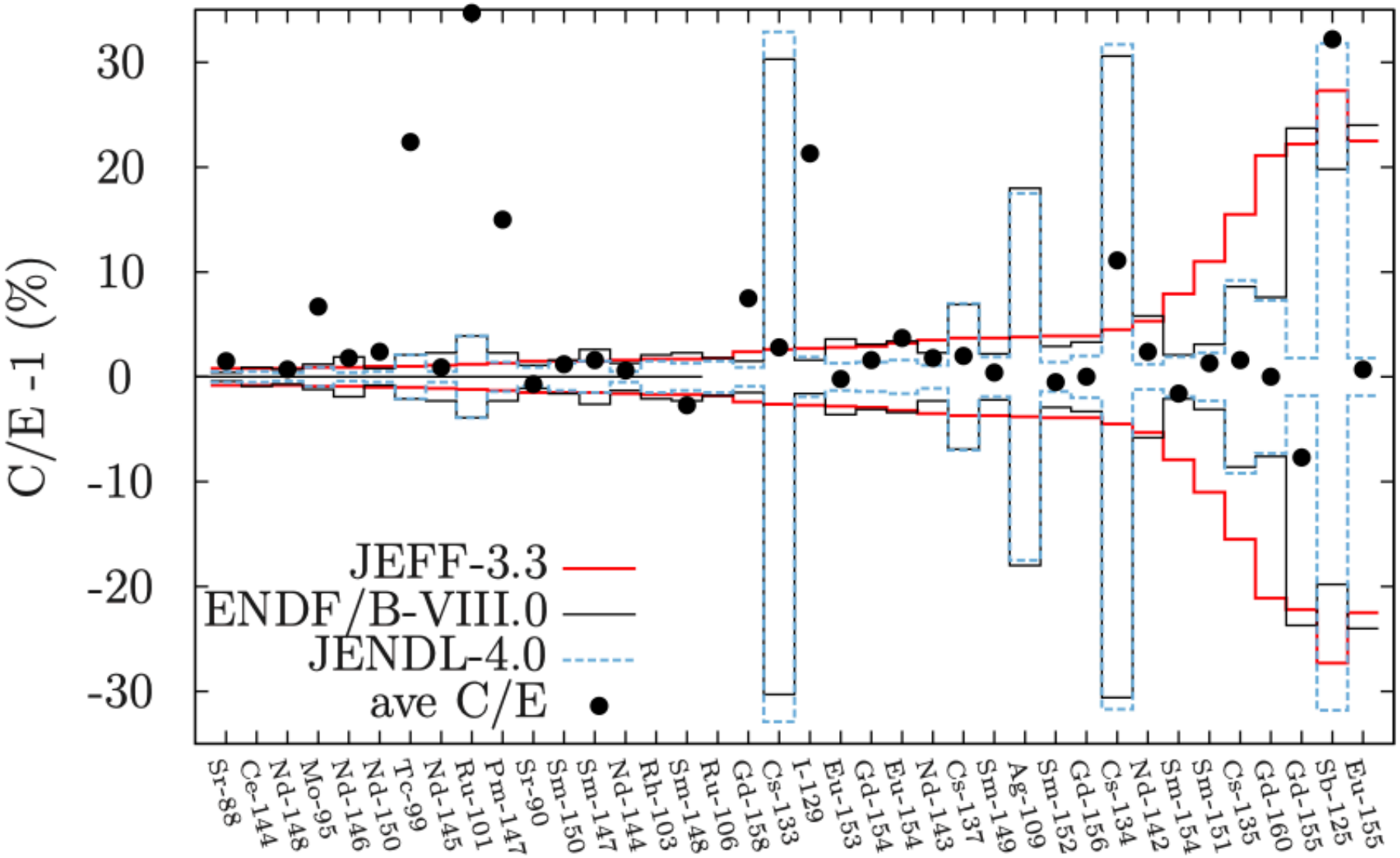
- Uncertainty propagation:
  - Repeat 1000 times the same CASMO5 calculation
  - Each time changing perturbations on nuclear data
  - Performed with JEFF-3.3, JENDL-4.0 and ENDF/B-VIII.0, all covariances

  - Results presented are averaged over the 17 samples:
    - 6 PWR MOX
    - 9 PWR UO_2
    - 2 BWR UO_2

PIE data: actinides (averaged over 17 samples)

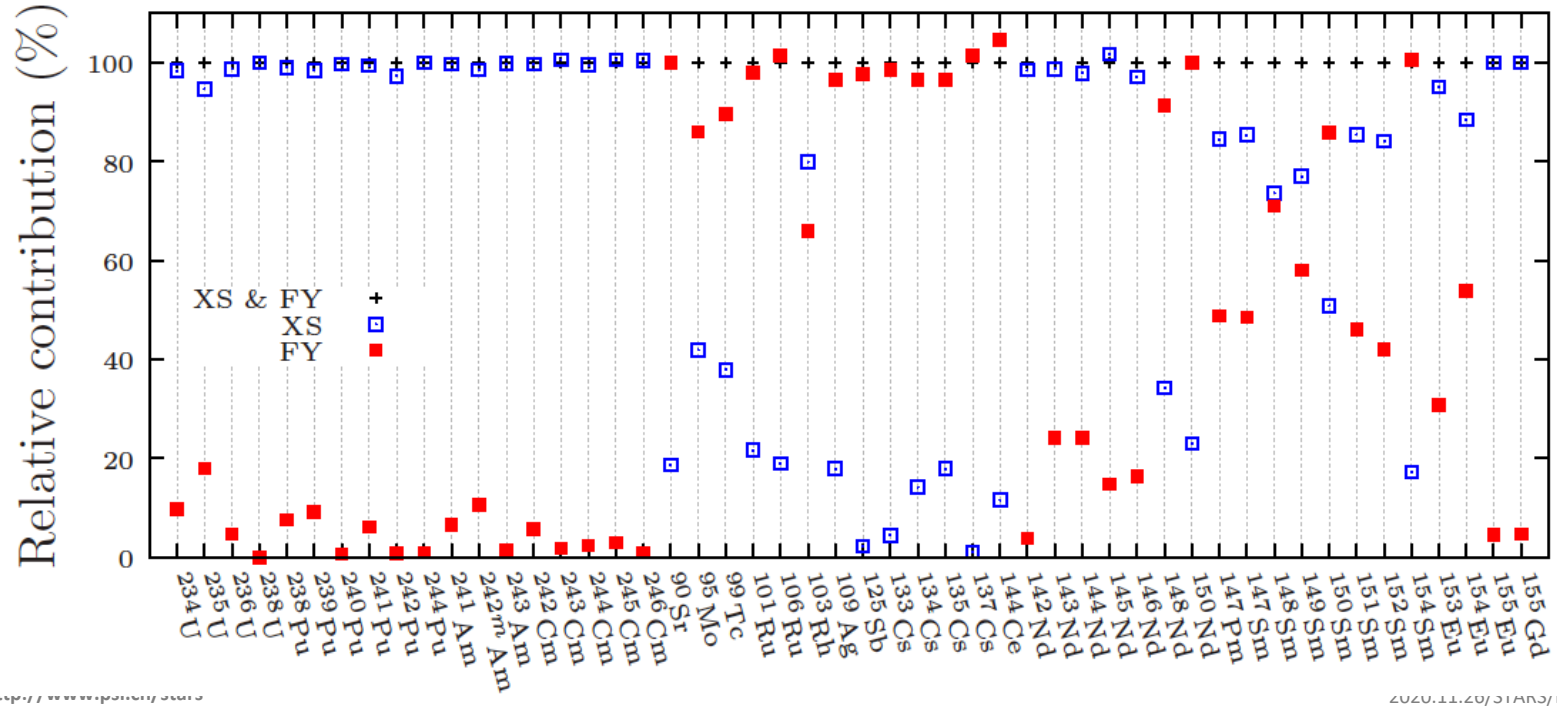


PIE data: fission products (averaged over 17 samples)



PIE data: Remarks for JEFF-3.3

- For measured isotopes:
  - Good general performances compared to average C/E
  - Missing covariances in JEFF-3.3:
    - U236,Am242m,Pu242,
    - Eu153,154, Gd155,156,158,160, Cs135, Ag109, I129, Sm148, Nd144, Pm147, Ce144, Tc99, Nd148
  - No fast range covariances: Am241
  - Strong differences in libraries for ΔFY for Cs133,134, Ag109



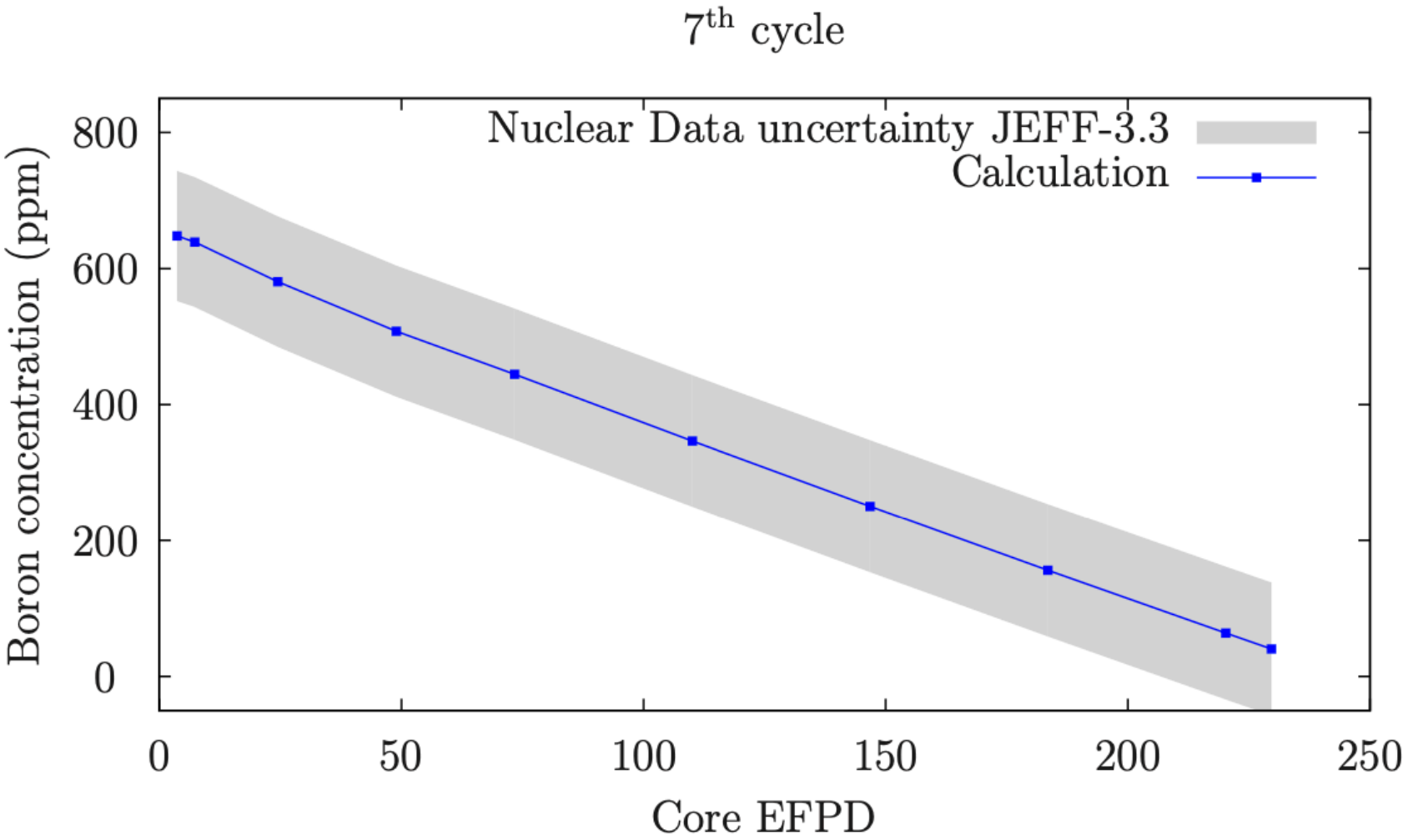
Reactor and SNF Quantities

- System: PWR
- Propagation through 7 cycles
- Results are shown only for the 7th cycle, including MOX

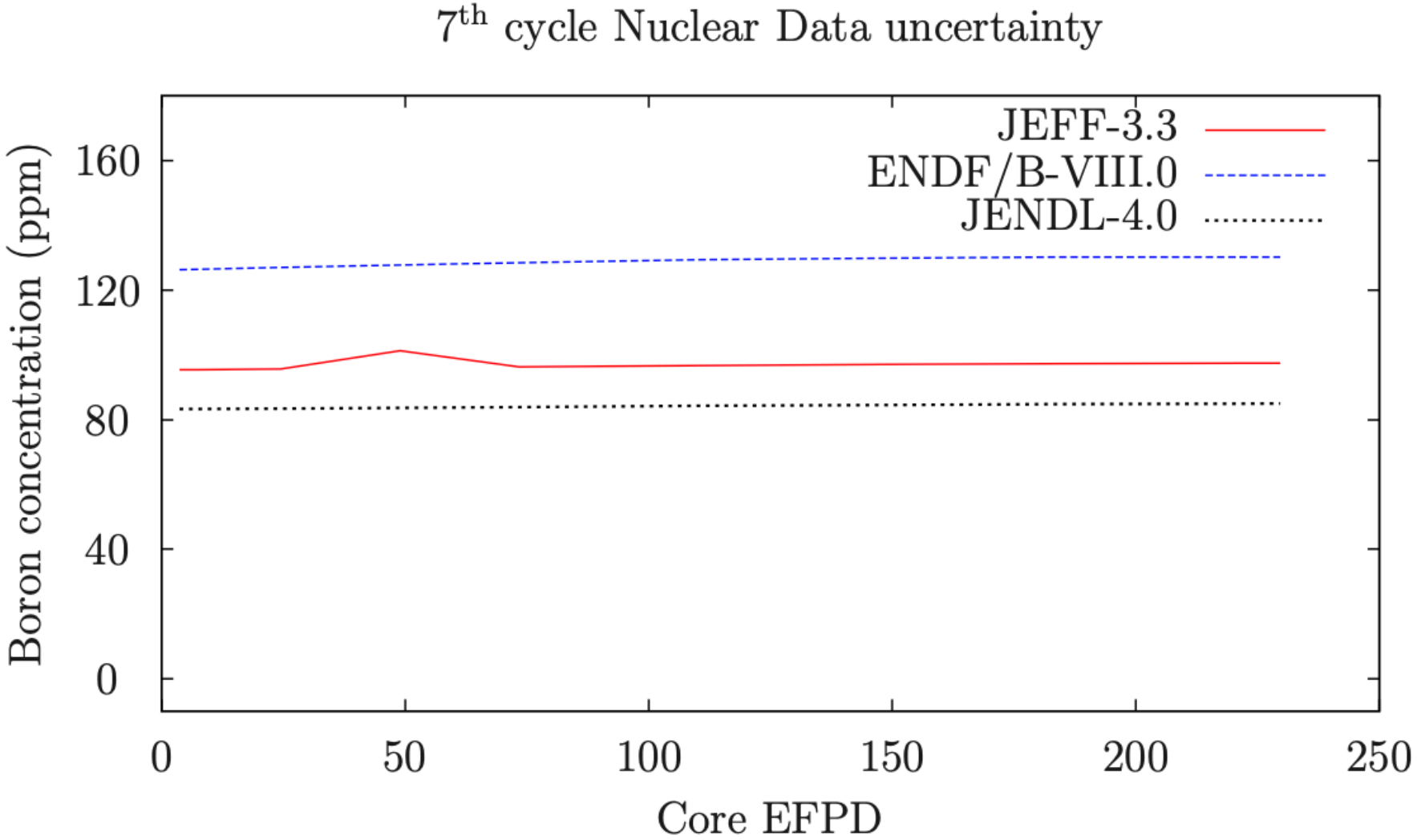
- Uncertainty propagation:
  - Repeat 100 times the same CMSYS (CASMO5/SIMULATE/SNF) calculation
  - Each time changing perturbations on nuclear data
  - Performed with JEFF-3.3, JENDL-4.0 and ENDF/B-VIII.0, all covariances

- Quantities of interest:
  - Boron curve
  - SNF Decay heat

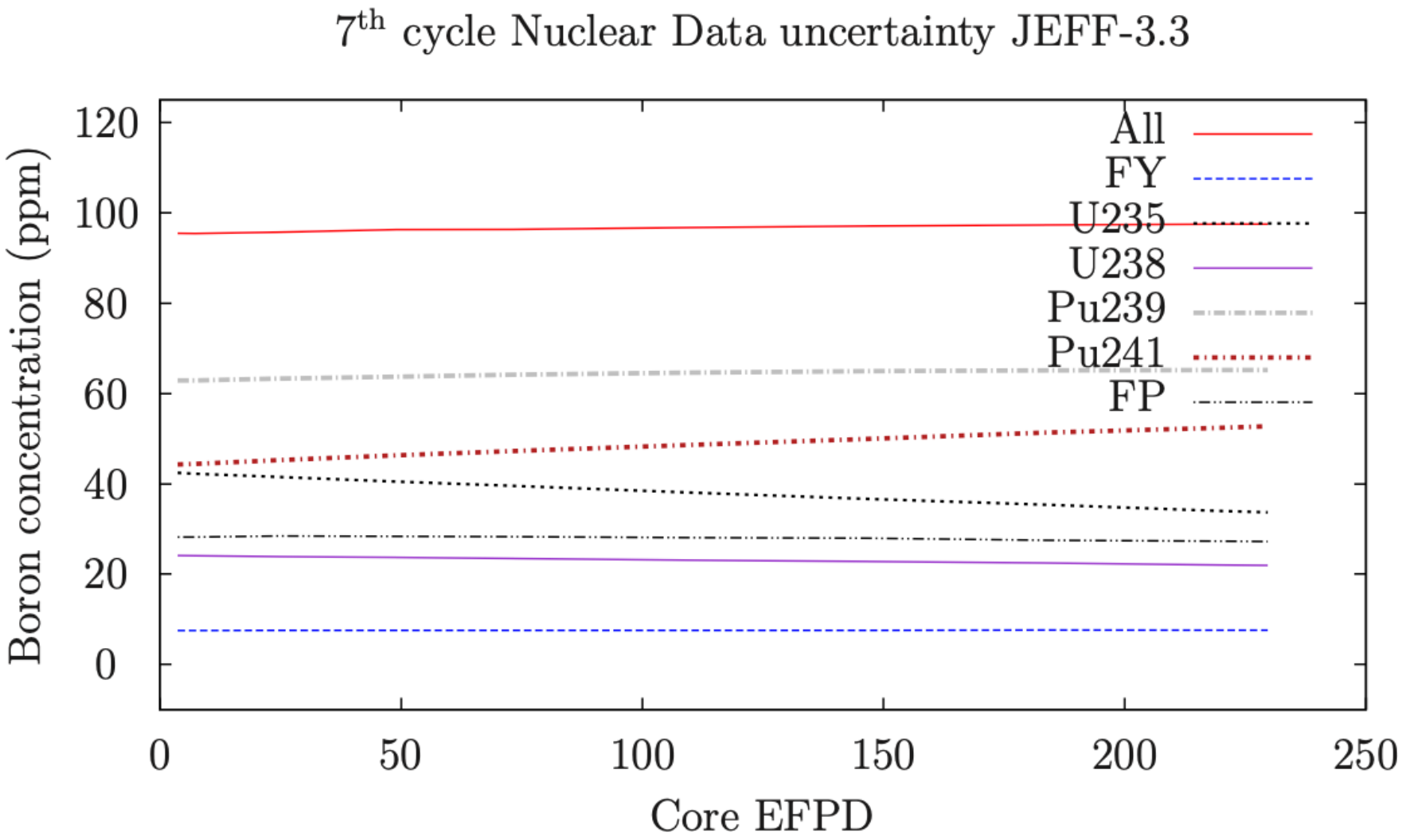
Reactor Quantities: Boron curve



Reactor Quantities: Boron curve

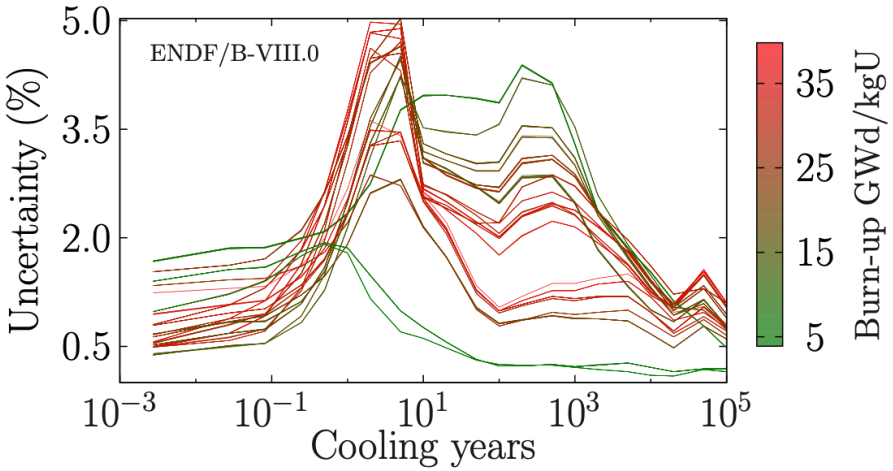


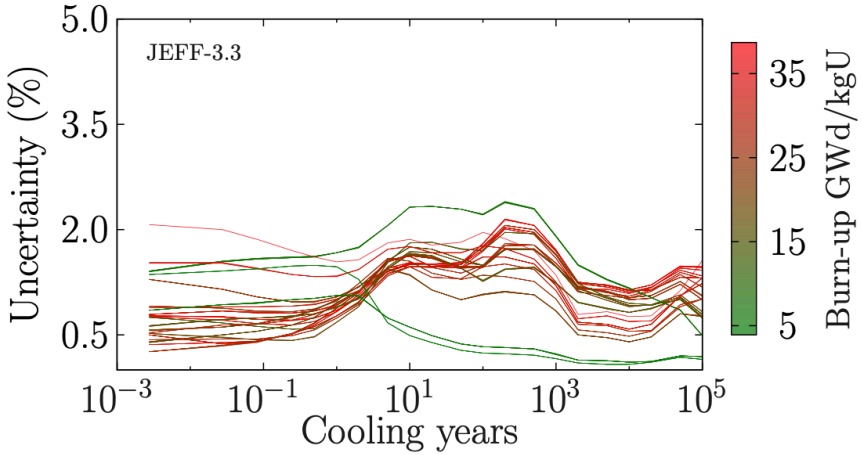
Reactor Quantities: Boron curve

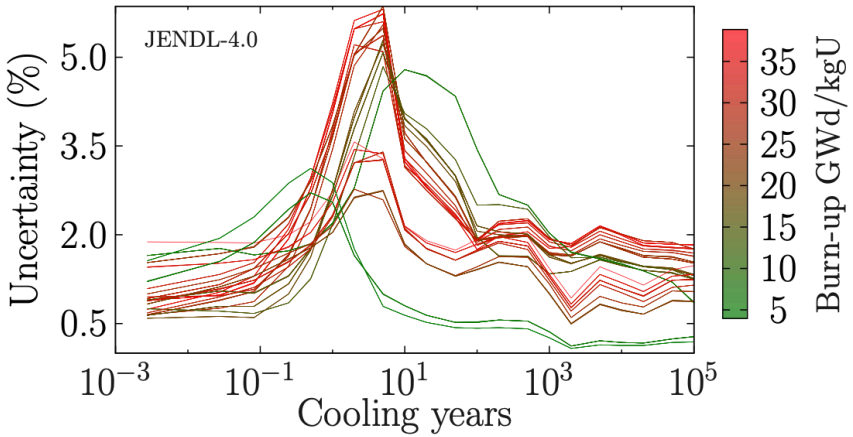


SNF Quantities: Decay heat

- 121 SNF at end of the 7th cycle







Conclusions

- Uncertainties propagated for PIE data, boron curves and SNF decay heat

- Some differences between JEFF-3.3 and JENDL-4.0, ENDF/B-VIII.0 for decay heat and
- PIE data, to be explored.

PAUL SCHERRER INSTITUT

PSI

Wir schaffen Wissen – heute für morgen