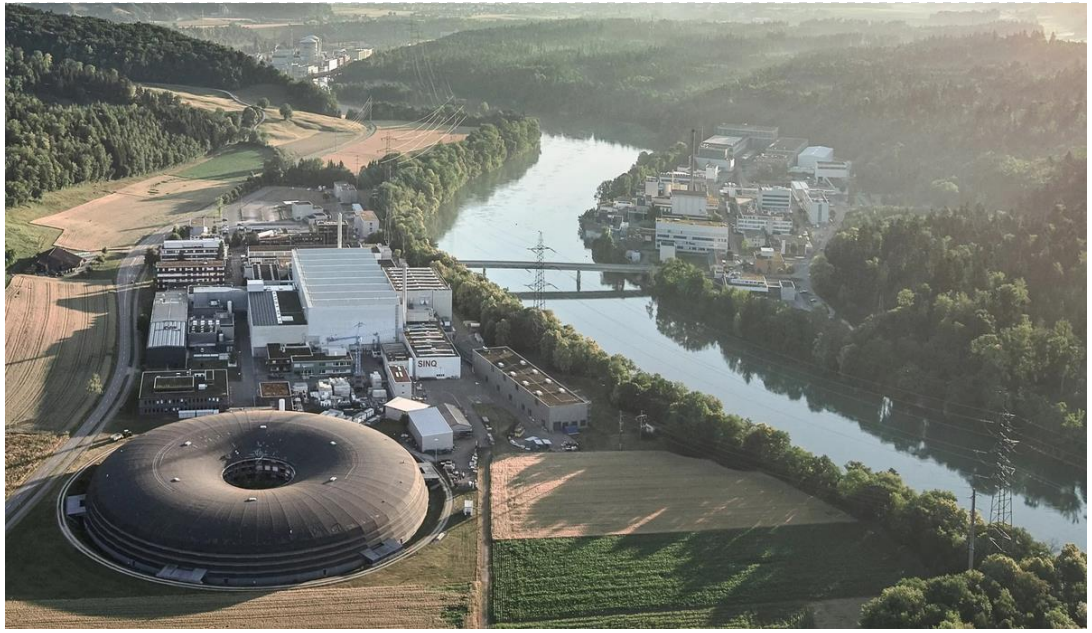
PSI Center for Nuclear Engineering and Sciences



Overview of the results – SG16

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WPNCS SG16 Meeting, January 23th, 2025, online,

Summary

- Overview of the results
- Focus on k_inf and decay heat
- Next steps

Overview of the results

- 13 participating organizations:
  - PSI,
  - BASE,
  - BGZ,
  - CEA,
  - CIEMAT,
  - CRIEPI,
  - IRSN,
  - ORANO,
  - ORNL,
  - SEAINGENIERIA,
  - STUDSVIK,
  - UPM,
  - VTT

- Two models considered
  - Pincell: 28 calculations
  - Assembly: 28 calculations

Overview of the results

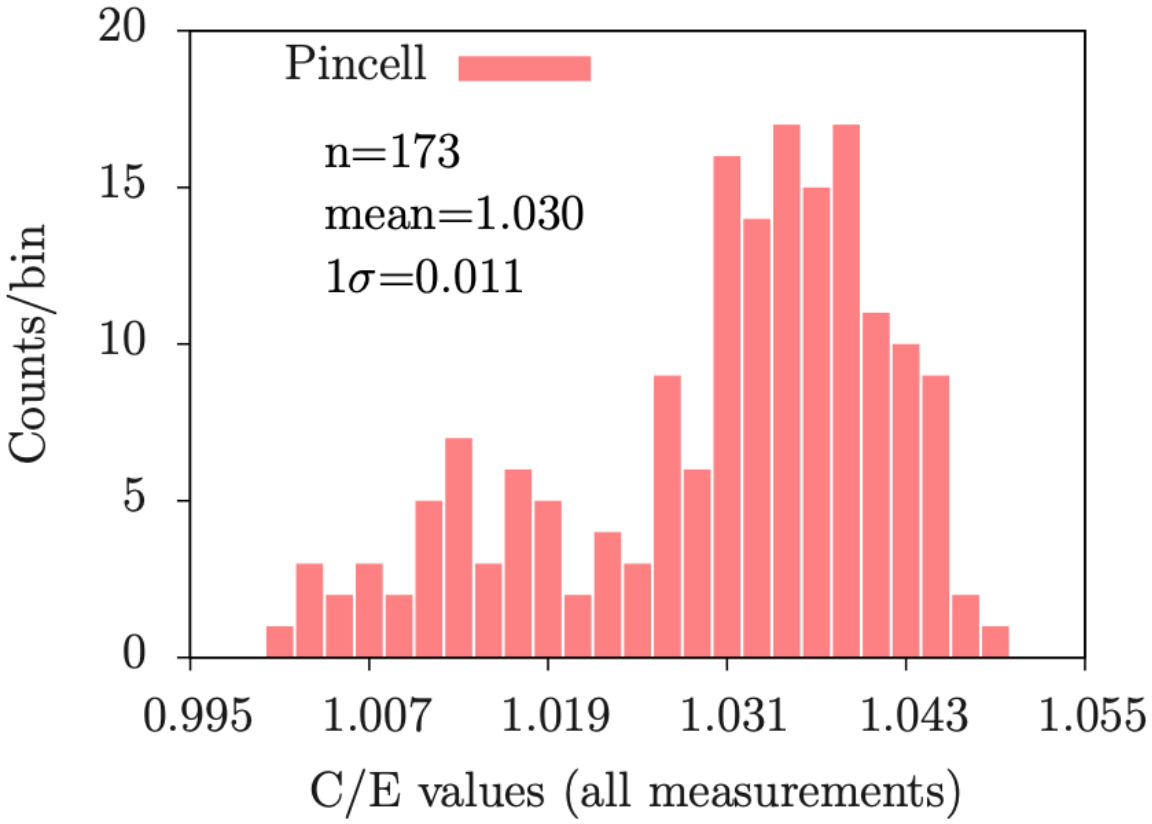
- Codes MC:
  - SERPENT2 (17 cases),
  - MCNP+ORIGEN2 (1 case),
  - VESTA/MORET (1 case),
  - MVP (4 cases),
  - EVOLCODE-2 (2 cases)

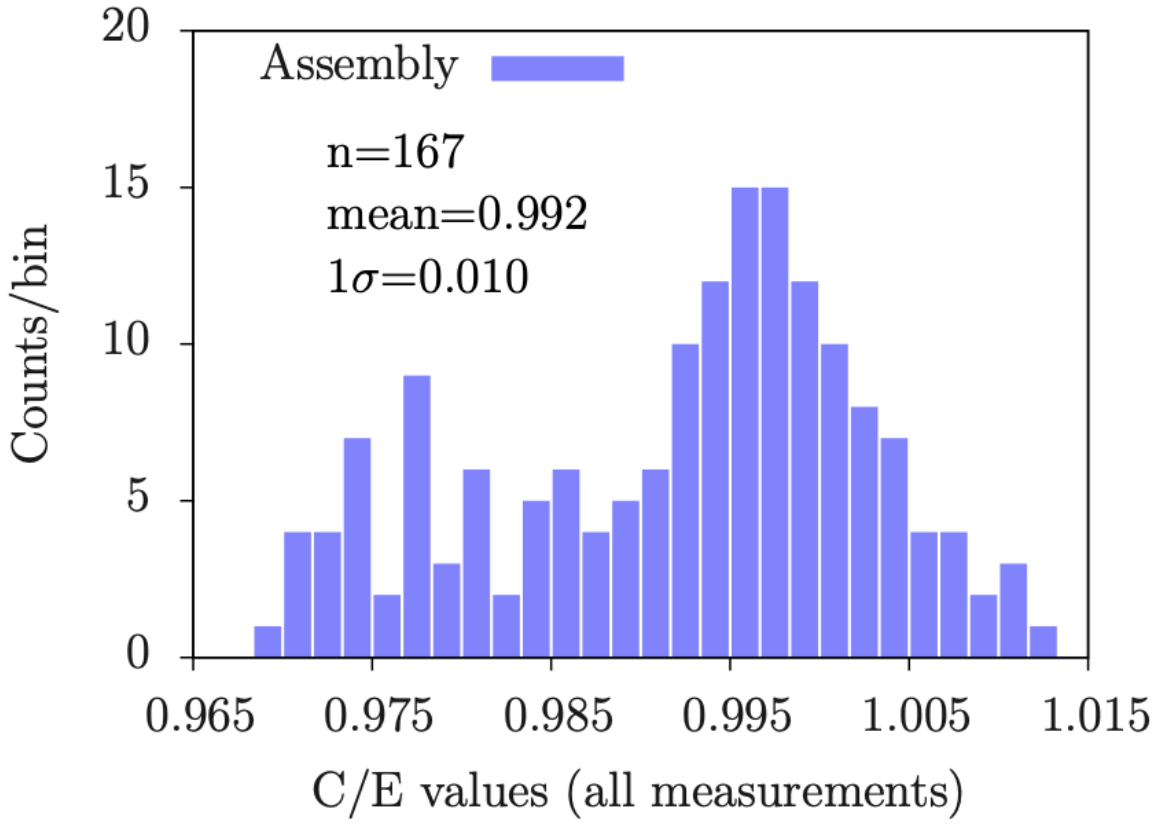
- Code Deterministic:
  - Helios2 (1 case),
  - TRITON (2 cases),
  - OrigenArp (2 cases),
  - DARWIN (1 case),
  - POLARIS (1 case),
  - CASMO5 (1 case)

Overview of the results

- Transport libraries:
  - ENDF/B-VIII.1 (1 case)
  - ENDF/B-VIII.0 (5 cases)
  - ENDF/B-VII.1 (12 cases)
  - ENDF/B-VII.0 (1 case)
  - ENDF/B-V and –VI (1 case)
  - JEFF-3.1.1 (3 cases)
  - JEFF-3.2 (3 cases)
  - JEFF-3.3 (2 cases)
  - JENDL-4.0 (3 cases)
  - JENDL-5.0 (2 cases)
- Other options:
  - Different decay data libraries
  - Different transport (DBRC)
  - Different decay data & FY libraries
  - Test libraries (future JEFF4)
- Not included in the statistics:
  - CMS5 irradiation history
  - Fuel density from the EPRI report

Results: decay heat





95%/95% Tolerance intervals:	1.006 – 1.054	0.970 – 1.015

Results: decay heat and modelling

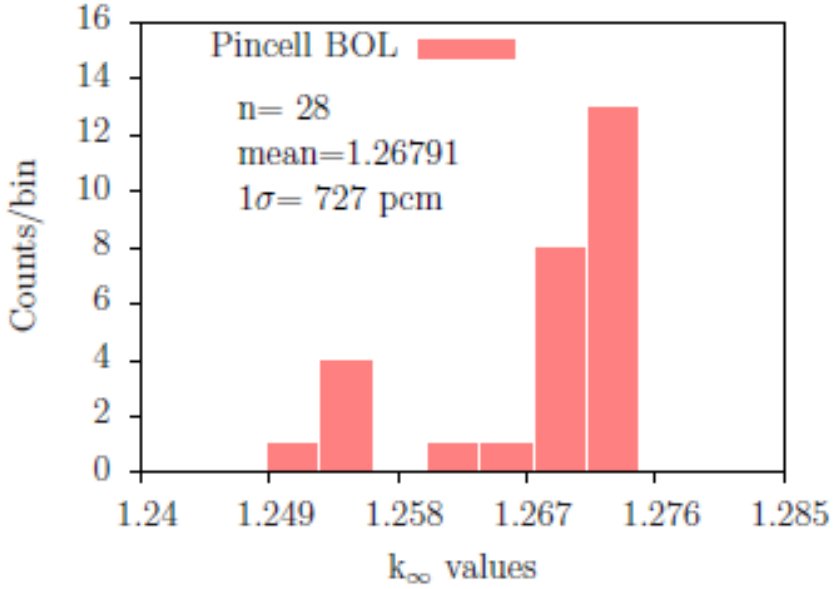
- The current benchmark is based on the description of the SKB 2006 report.

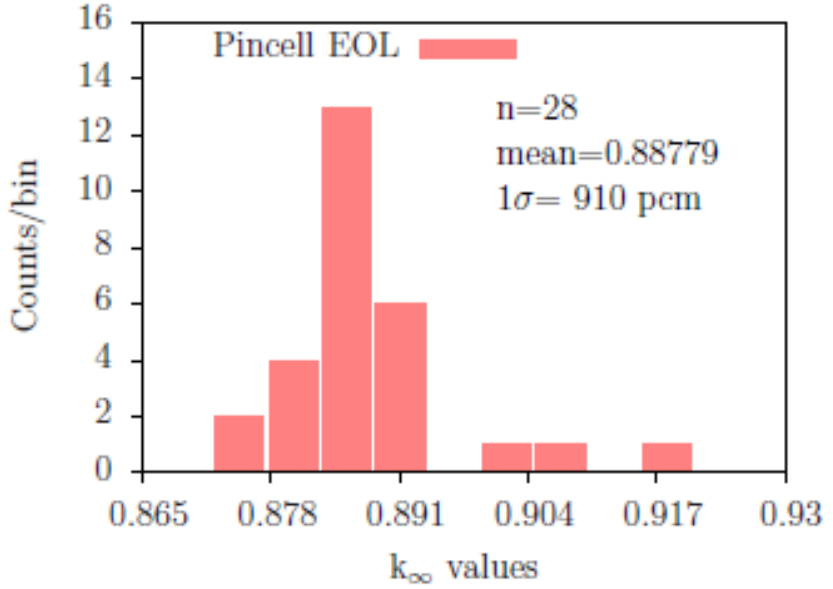
- In 2024, the new EPRI report proposes for the 0E2 assembly
  - Slightly updated burnup
  - Different fuel density (SKB: 10.35 g/cm^3 - benchmark: 10.34 g/cm^3 - EPRI: 10.7 g/cm^3)
  - This matters if calculations are not normalized to the total mass (calculations given in W/g or W/t)

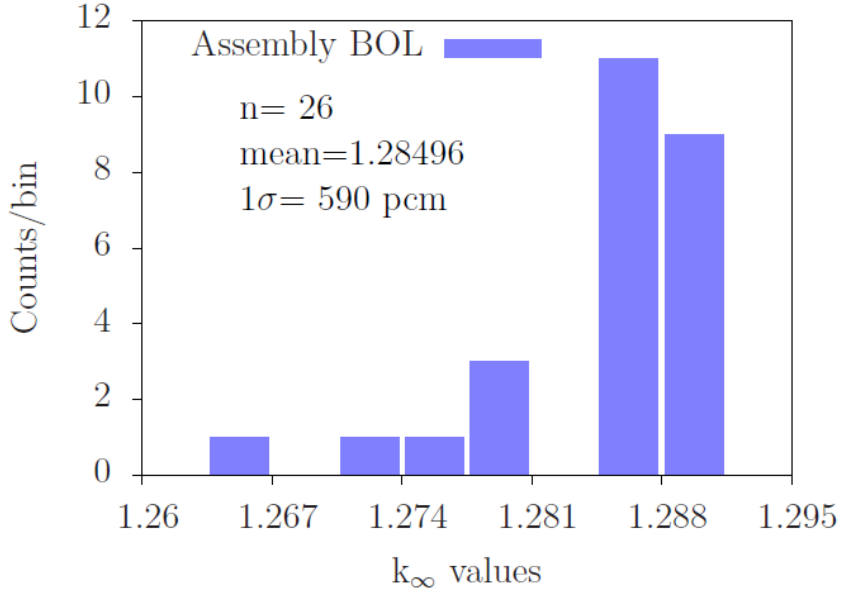
- New (EPRI) fuel density leads to $\overline{C/E} = 1.031$ vs. $\overline{C/E} = 0.986$ (PSI results for the assembly, with SERPENT2, ENDF/B-VII.0)

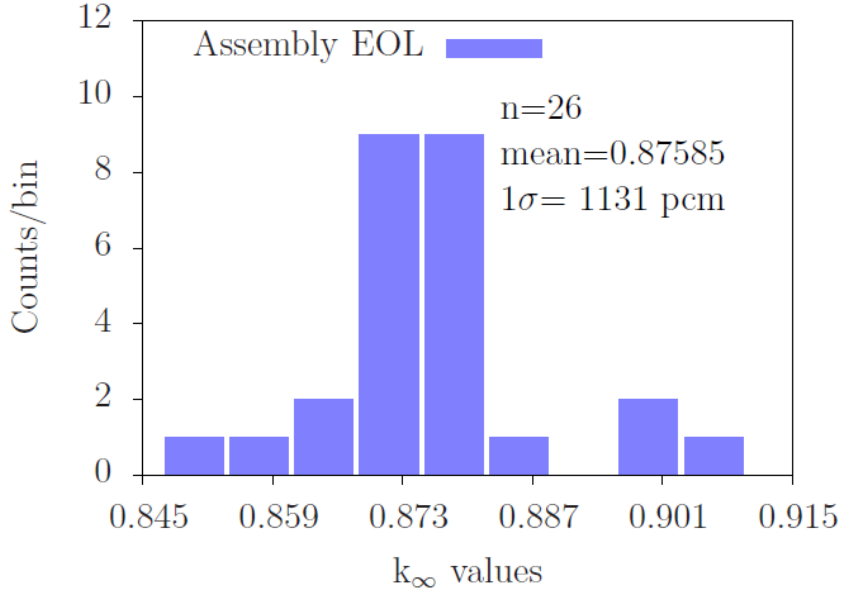
- Such difference > than 4$\boldsymbol{\sigma}$

Results: k_inf









Next steps

- Many other quantities were provided
  - k_inf
  - Number densities
  - Decay heat contributors

- To be presented and analyzed in the dedicated publication

- What's next (to be discussed):
  - Publication (NEA report and journal paper),
  - New analysis (blind, or other case with or without measurements),
  - Uncertainties,
  - Stop.

Many thanks

- Questions ?