REQUIREMENTS FOR FISSION PRODUCT YIELDS IN DECAY HEAT STUDIES
Industrial challenges resulting from the calculation of the decay heat and of its uncertainty

- Deep impact on the design of emergency cooling systems
- Impact on the cooling time that is needed before maintenance,
- Impact on the design of transport waste casks and storage facilities

Propagation of nuclear data uncertainties on decay heat calculations

- Decay heat bursts
- MOX fuel of fast reactors
- MOX and UOX fuels of LWR
- ...

For example, in the case of the MOX fuel assembly of a LWR, the uncertainties of

- ~ 6500 fission yields
- ~ 800 periods and branching ratios
- ~ 120 cross-sections

are propagated.
Example of the thermal fission burst of $^{235}\text{U}$

**Decomposition of the decay heat uncertainty (without correlation)**

- **TOTAL (%)**
- **Energy**
- **Decay Data**
- **Fission Yields**

**Diagram**

- Y-axis: Uncertainty (%)
- X-axis: Cooling time (sec)

Graph showing the contribution of different factors to the total uncertainty over time.
Example of the decay heat uncertainty of the MOX fuel of the PHENIX fast reactor (J-C BENOIT)

The following graph compares two calculations of uncertainty propagation:

- all correlations data = 0 (totally anti-correlated)
- all correlations data = 1 (totally correlated)
The uncertainty on decay heat results from the propagation of variance and covariances values of the nuclear data involved to describe the fuel during both depletion calculation and cooling time.

Individual fission yield uncertainties (no correlation taken) are the main contributors to the decay heat uncertainty.

The use of covariance data may have a huge impact on the final result.