PAUL SCHERRER INSTITUT

PSI

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CS_2M:
CASMO – SIMULATE – SNF – MCNP

CS_2M: Systematic and consistent neutronic approach for Spent Nuclear Fuel, from power plants to long-term depository

- Goal: Spent Nuclear Fuel assessment (content) taking into account their irradiation life and cooling in a realistic way

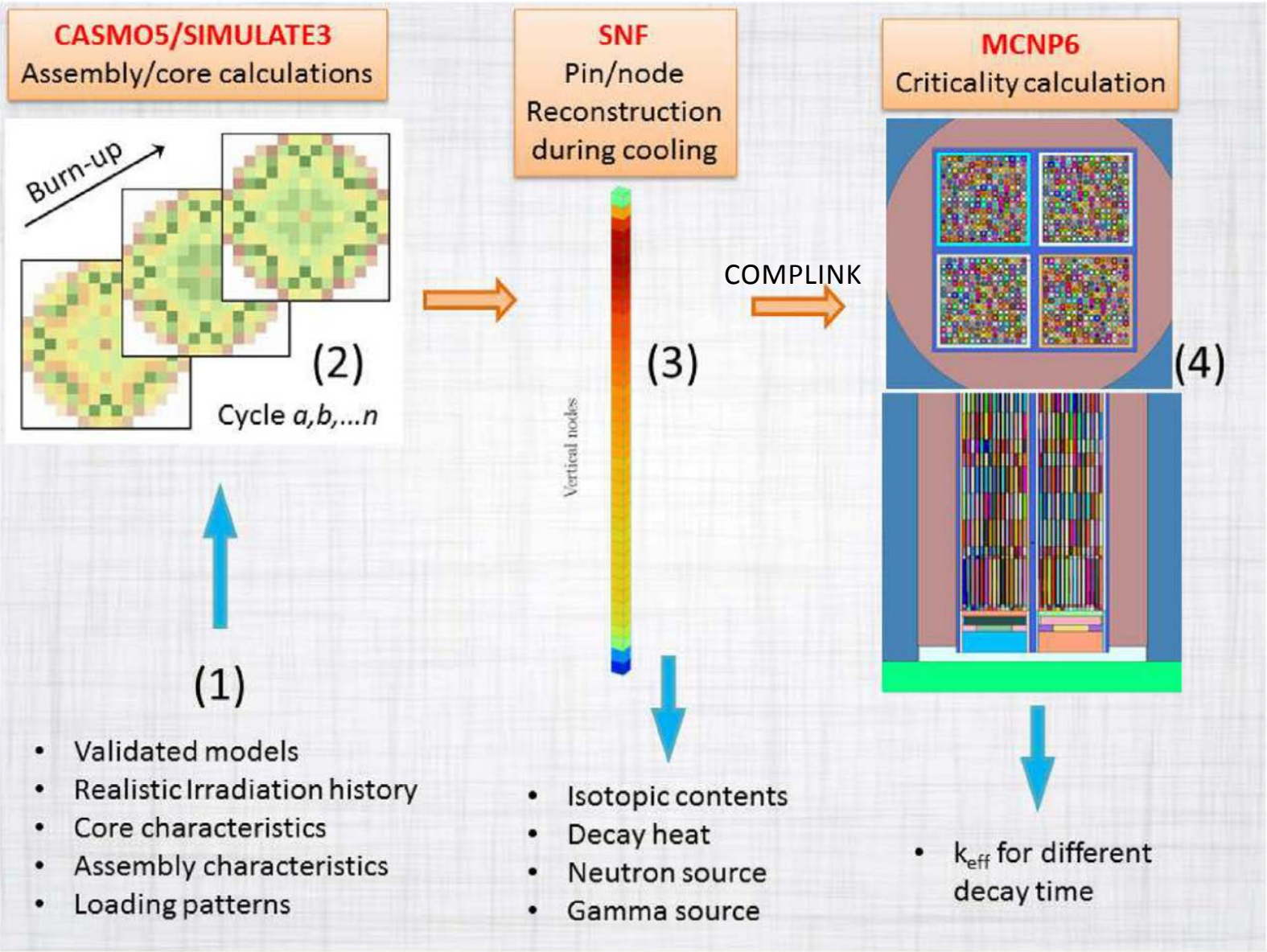
- Large amount of information + experience is already at the LRT
  - Fuel history from utilities (>40 years of operation)
  - State-of-the-art tools (deterministic + Monte Carlo)
  - Validated models (CMSYS)
  - Nuclear data control
  - Canister design (following Nagra guidance)

- Method: only “connecting the dots” (or linking the above)

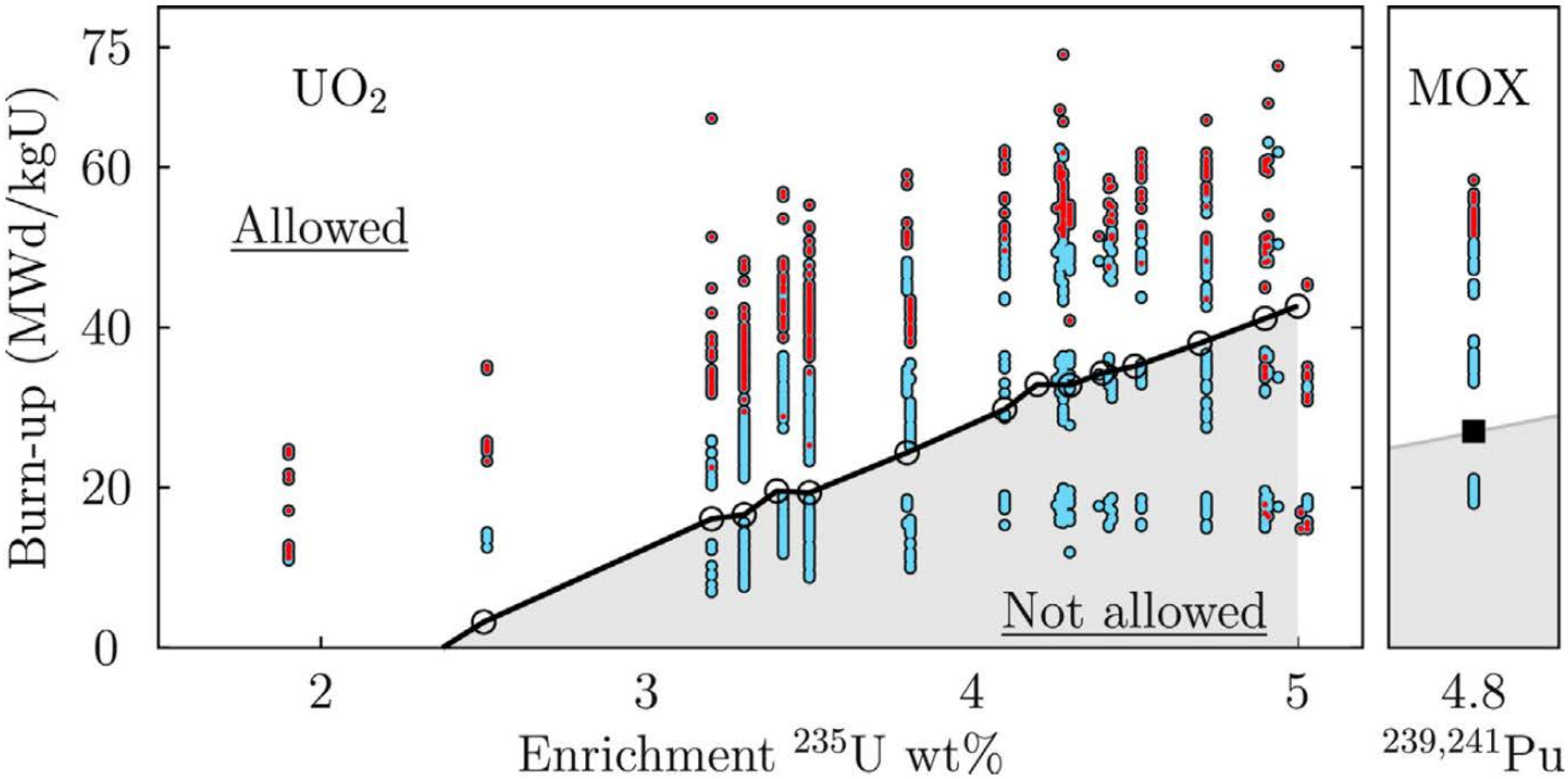
- Output: consistent (from the same source) loading curves + decay heat + radiotoxicity + fuel content for all Swiss nuclear fuels (12 000 assemblies)

- (see Journal of Hazardous Materials 357 (2018) 384)

CS$_2$M: Just linking existing tools



Example for canister loading curves and decay heat

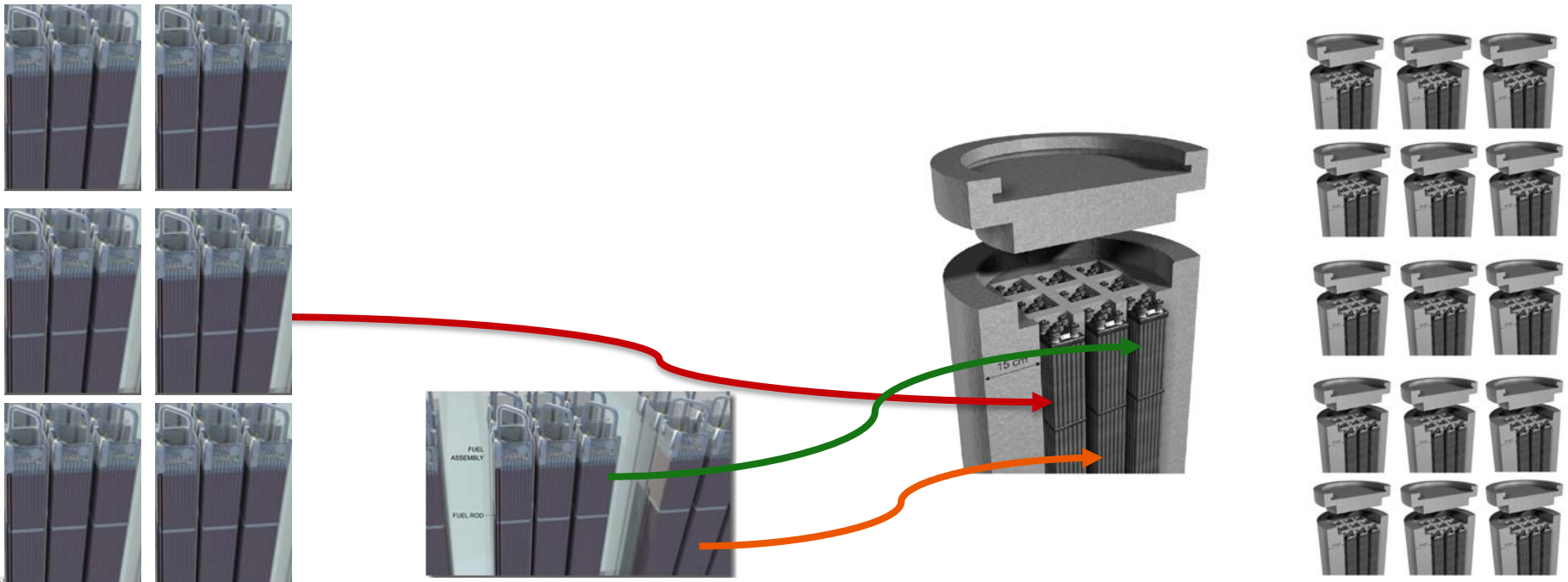


- Allowed: not critical for final storage (*e.g.* k_{eff}<0.95)
- Not allowed: can have k_{eff}>0.95
- Same curve for decay heat, isotopic contents…

Future developments

- Propagation of uncertainties for each quantities (e.g. nuclear data)

- How to efficiently load canisters with different assemblies ?
  - Up to now, based on same assembly loaded for all 4 positions
  - How to search among the 12 000 assemblies to select 4 of them to efficiently fill all canister considering boundary conditions (k_{eff},decay heat,…) ?
    Number of combinations: 836,568,065,997,000 $\approx 10^{15}$ solutions



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Wir schaffen Wissen – heute für morgen