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Uses of SCALE in UNF-ST&DARDS

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UNF-ST&DARDS is used to inform decision making by:

Curating SNF Data

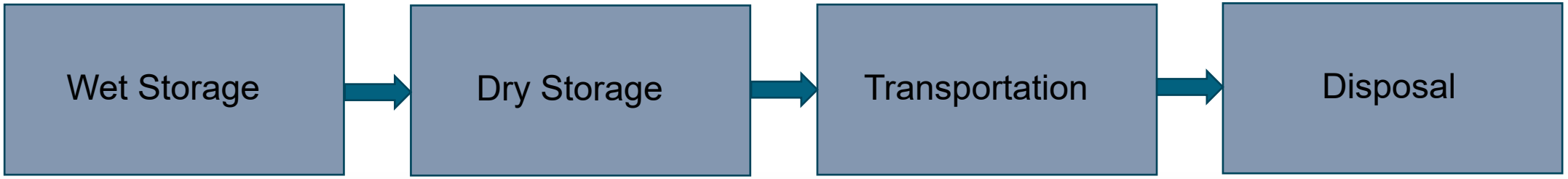
- Site specific assembly and cask data
  - GC-859 reported
- Cask design data
- Assembly design data
- Derived data from calculations

Performing Analysis

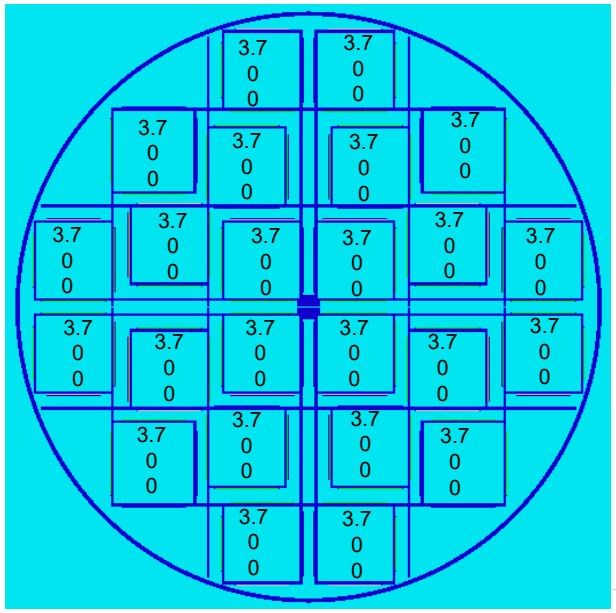
- Depletion and decay
  - Decay heat, nuclide inventories, source terms
- Thermal
- Criticality
- Shielding

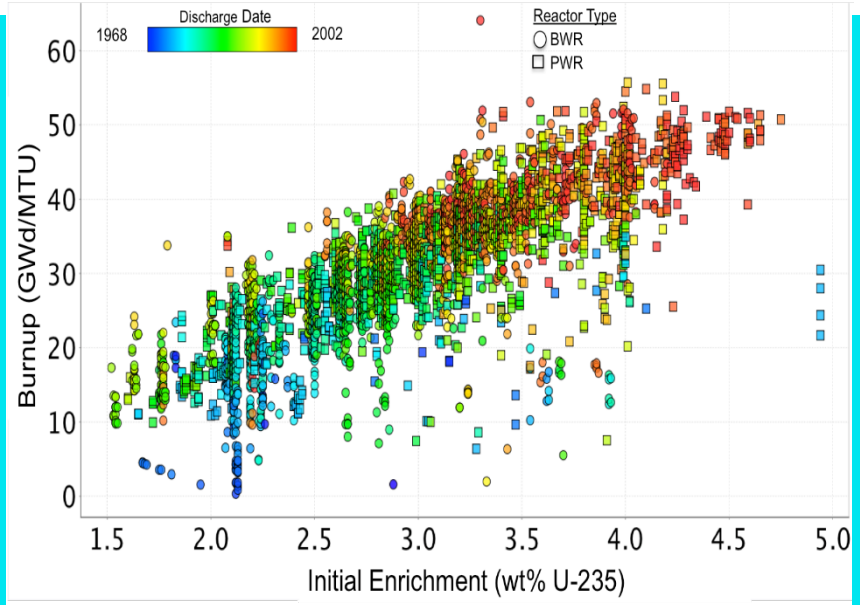
As-loaded analysis can be used to quantify uncredited margin

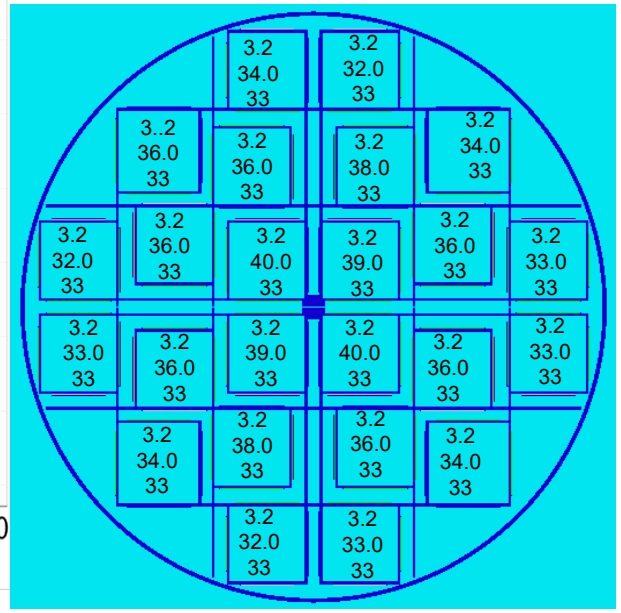
- SNF storage and transportation certification process uses a bounding approach
  - Limiting fuel type, initial enrichment, burnup, cooling time
- In practice, discharge SNF assemblies are diverse (e.g., wide variation in SNF assembly burnup values)
- Can accommodate variation in assumptions across the back end of the fuel cycle



Criticality example of as-loaded analysis





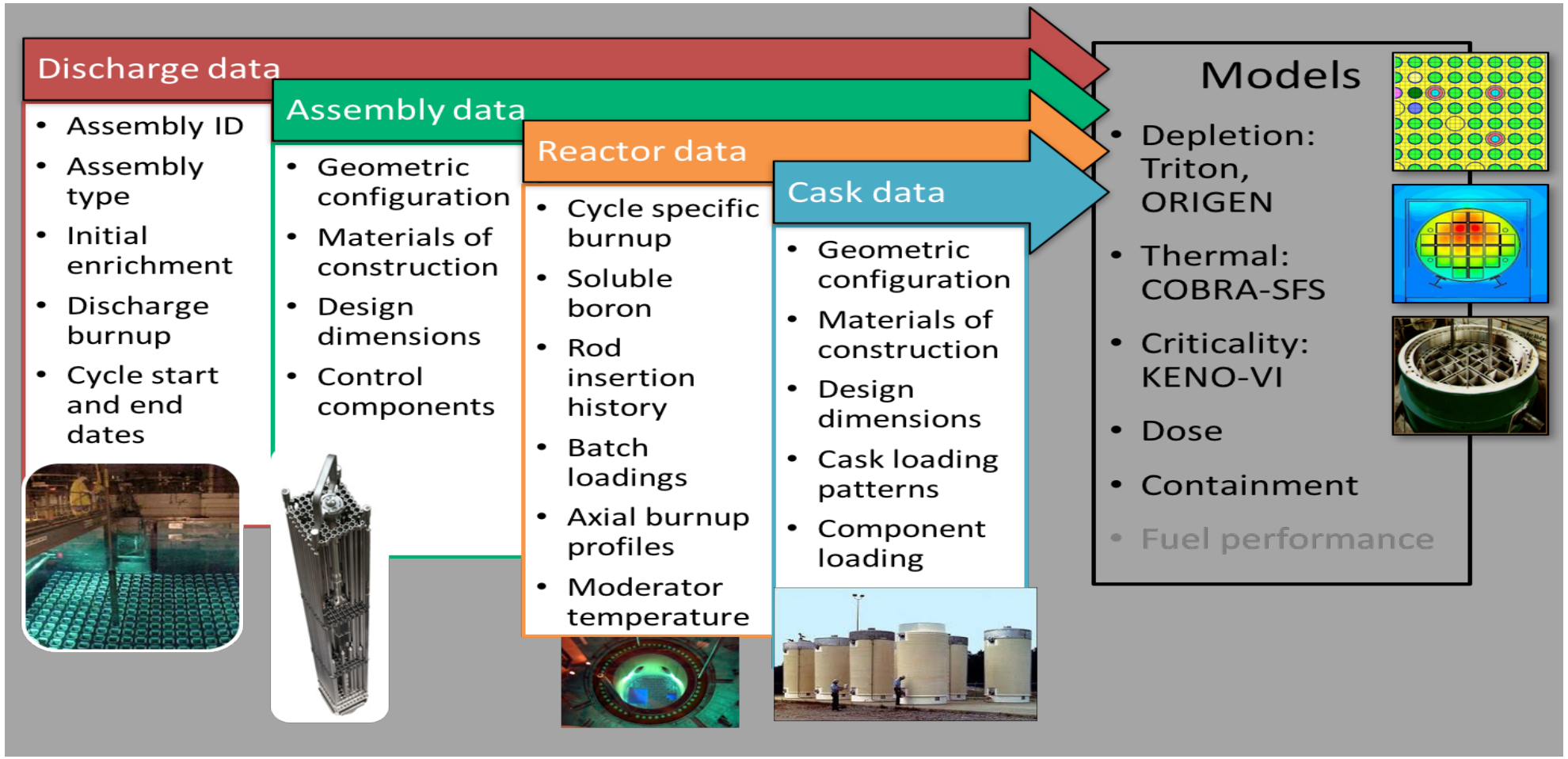


Design-basis k_{eff} = 0.90

As-loaded k_{eff} = 0.66

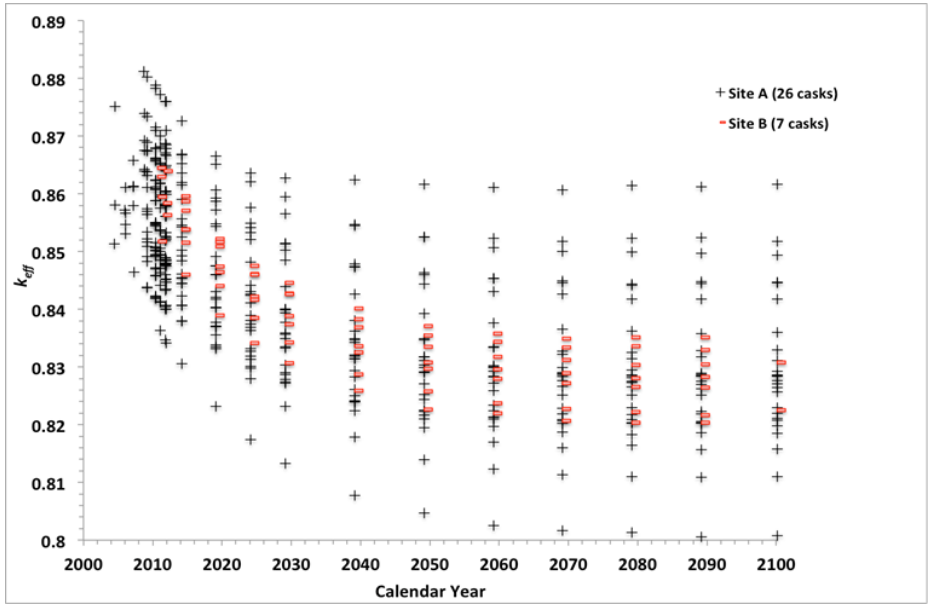
Uncredited margin = 0.90-0.66 = 0.24 Δk_{eff}

Overview of Analysis Sequences



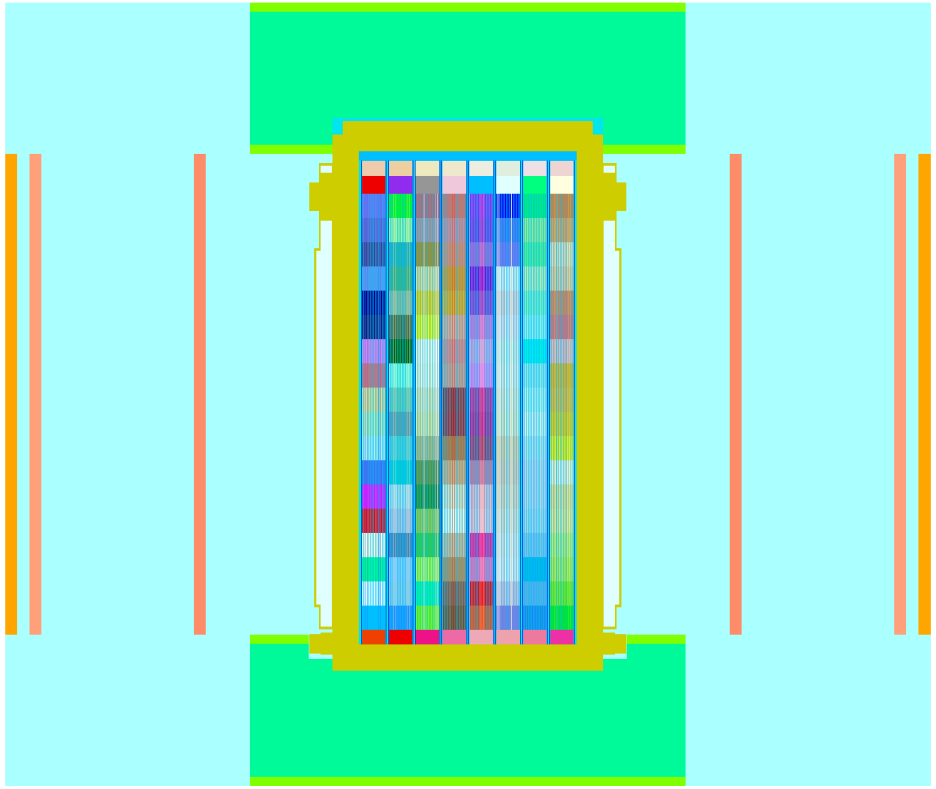
Criticality Analysis

- **Full BUC for as-loaded casks**
  - TRITON Generated libraries for most assembly designs
  - ORIGAMI for assembly specific calculations
  - CE KENO-VI criticality calculations
- **Transportability Determination**
  - Differences between storage and transportation Certificates of Compliance (CoCs)
- **Direct Disposal Screening**
  - Hypothetical degradation scenarios
  - Long timelines compared to materials experience



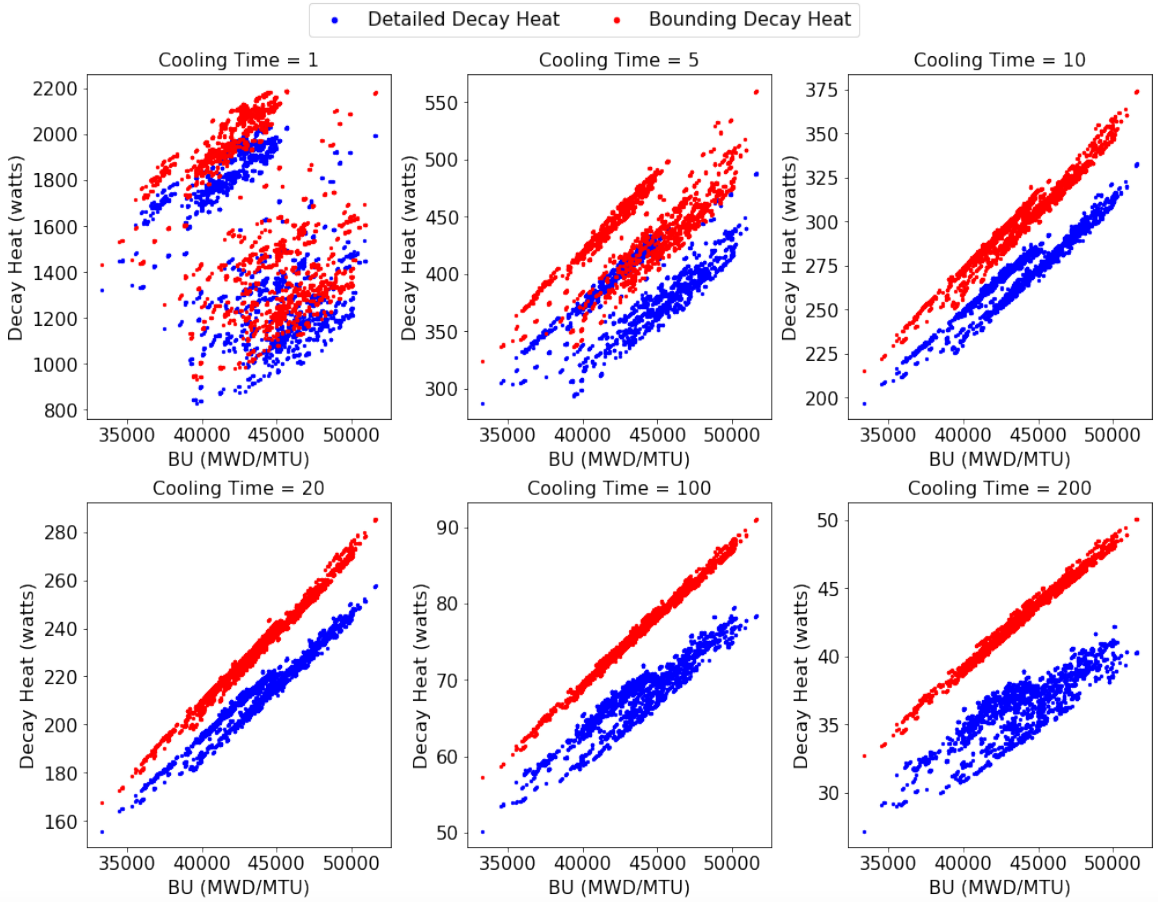
Shielding Analysis

- **As loaded MAVRIC models**
  - Same ORIGEN libraries as for other sequences
  - Activation of assembly hardware accounted for
- **Determine transportability based on 10 CFR 71 limits**
- **ISF Site Boundary Dose calculations**
- **Other Transportation Dose Assessments**



Validation of UNF-ST&DARDS as-loaded analysis methods

- Desire to take credit for contents…. Still represent operating history conservatively
- Comparison to detailed data from specific operating reactors
- Primarily decay heat and criticality so far
- Recently Obtained Dose Rates
- Isotopic and Criticality code bias and uncertainty for as-loaded casks with TSUNAMI



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Questions?