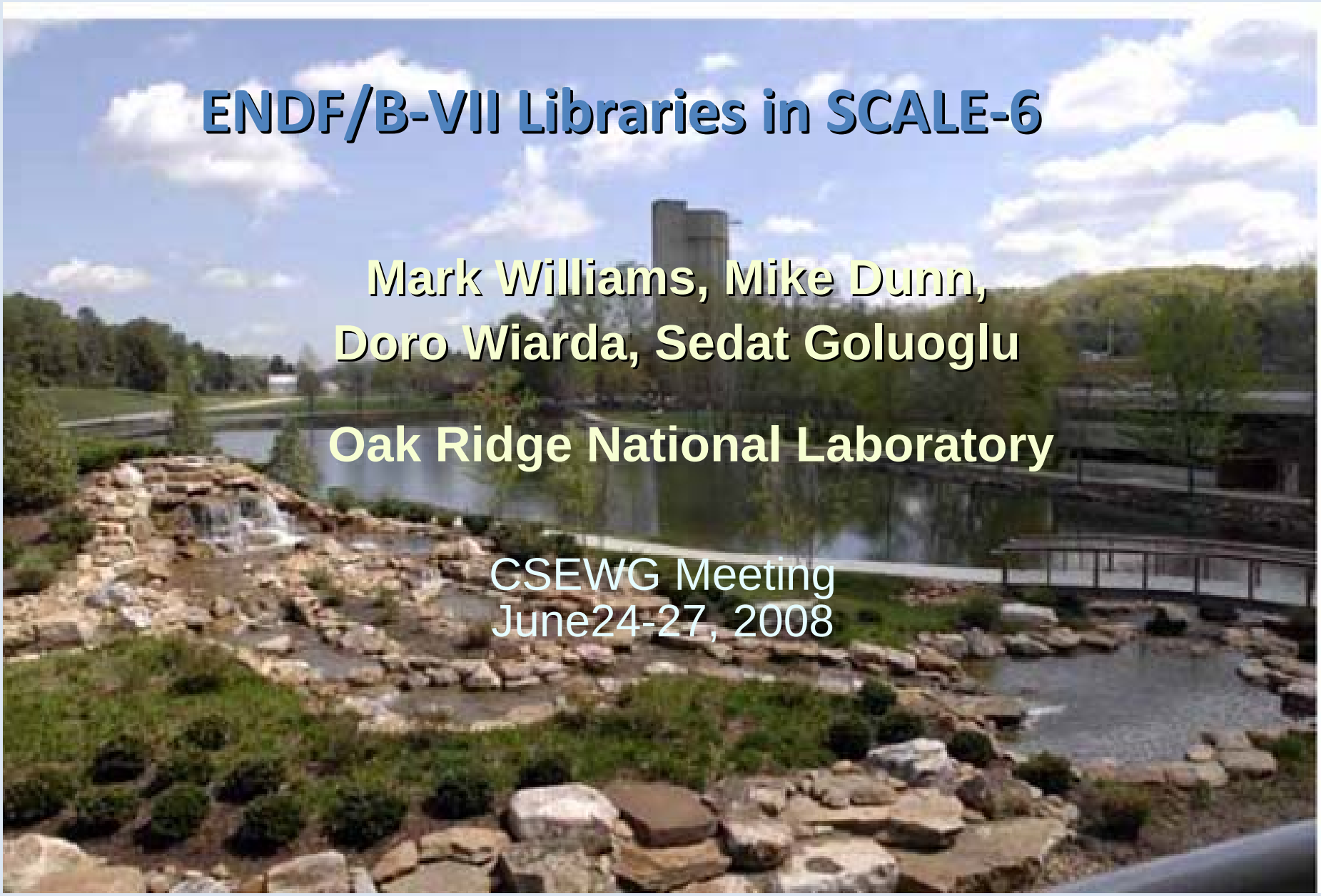


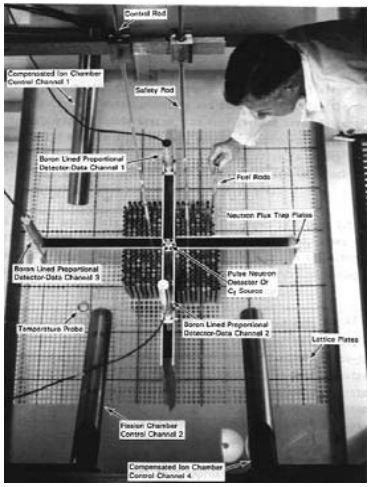
ENDF/B-VII Libraries in SCALE-6

Mark Williams, Mike Dunn,
Doro Wiarda, Sedat Goluoglu

Oak Ridge National Laboratory

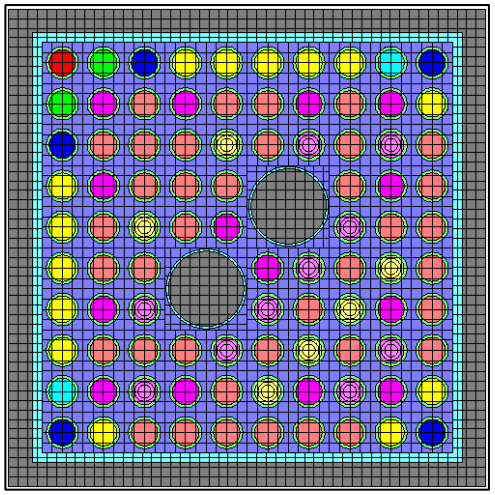
CSEWG Meeting
June24-27, 2008

SCALE is modular code system used for wide variety of applications

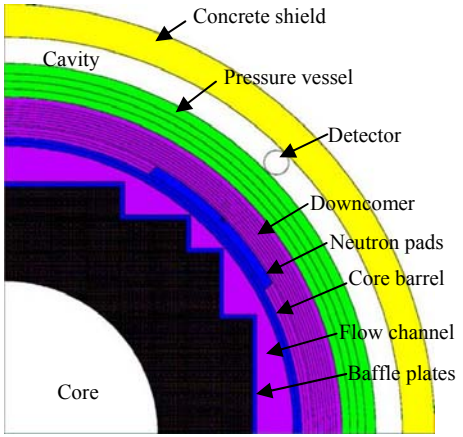


criticality safety

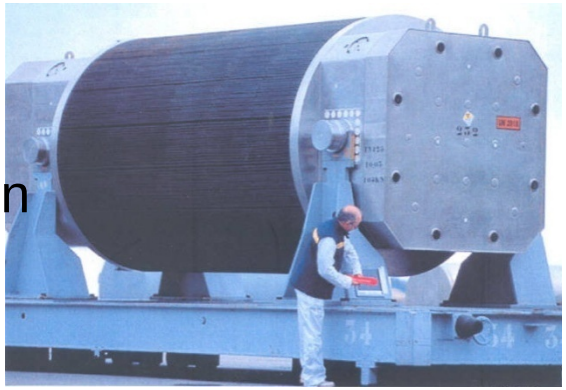
reactor lattice physics

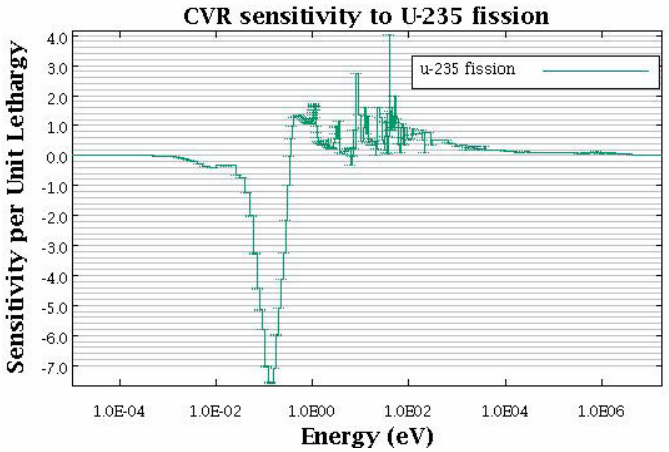


shielding analysis



burned fuel characterization





sensitivity analysis

ornl
OAK RIDGE NATIONAL LABORATORY

SCALE-6 includes new nuclear libraries processed from ENDF/B-VII

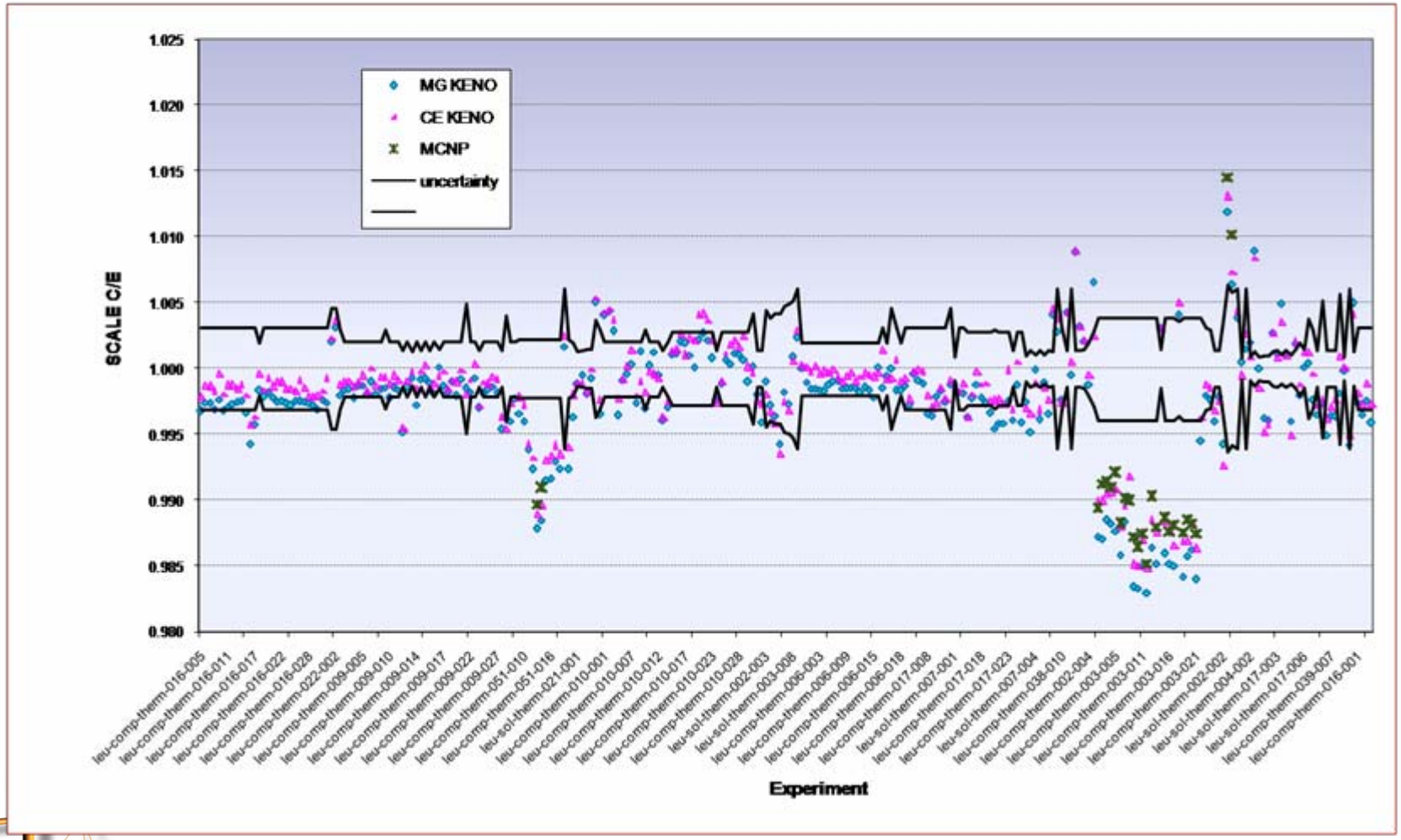
- Pointwise libraries for continuous-energy Monte Carlo (*KENO*) and for self-shielding MG data (*CENTRM*)
- 238 multigroup (MG) library for reactor lattice physics transport calculations (*NEWT*)
- 238 MG data, decay and branching data for isotopic depletion calculations (*ORIGEN-S*)
- 200n/47g MG coupled neutron-gamma library for shielding calculations (*MAVRIC*).
- Covariance library based on ENDF/B-VII, ENDF/B-VI, JENDL, and lo-fi data (*TSUNAMI*)

AMPX code system was used to process ENDF/B data

Verification/Validation Techniques for SCALE Nuclear Data Libraries

- **Intercode comparisons**
  - CE vs MG SCALE results
  - SCALE vs other codes
- **Validation with critical experiments**
- **Validation with reactor isotopic measurements**
- **Validation with shielding experiments**

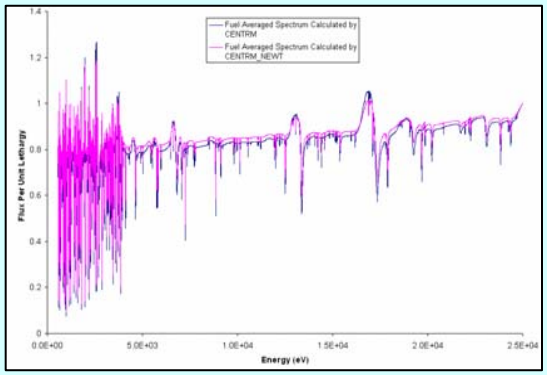
CE and MG KENO ENDF/B-VII Results for LEU Criticals



TRITON Lattice Physics Sequence

- **CENTRM:** 1-D continuous energy, deterministic transport
- **NEWT:** 2-D multigroup, flexible mesh deterministic transport

  or **KENO:** 3-D multigroup Monte Carlo
- **ORIGEN-S:** detailed isotopic compositions



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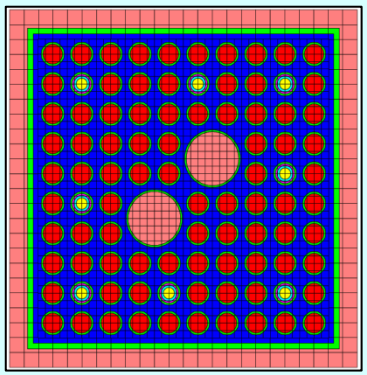

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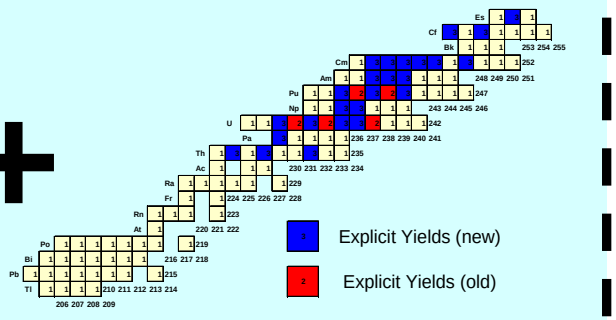


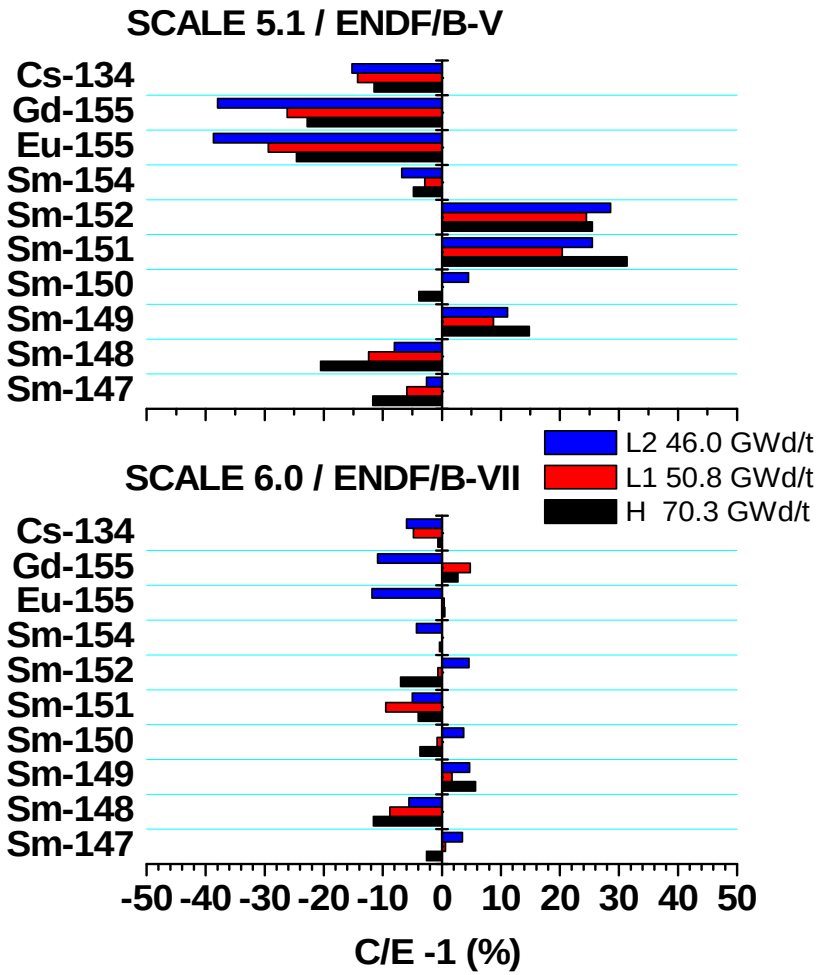
CENTRM
1D-Continuous-Energy Spectrum

NEWT
2-D General-Geometry Deterministic Transport

ORIGEN-S
Isotopic Distribution ~1600 nuclides

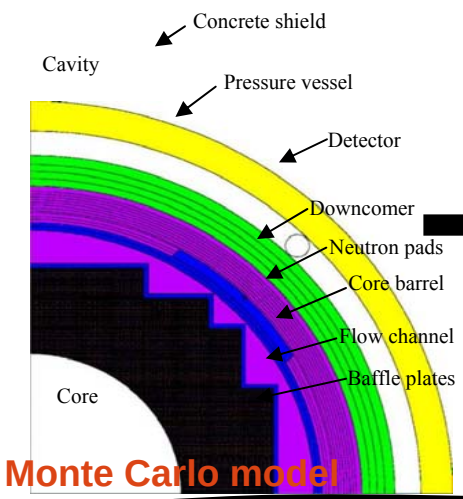
T R I T O N

TRITON Results for PWR Spent Fuel Isotopic Experiments

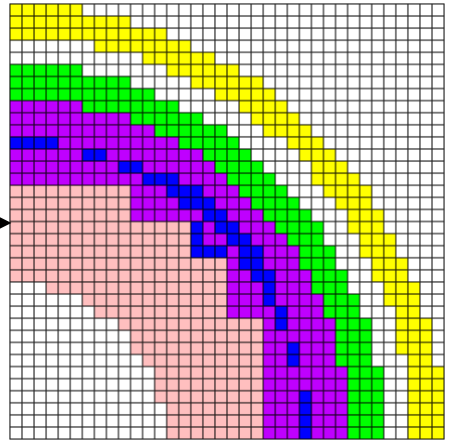


MAVRIC/MONACO Shielding Analysis with Automated Variance Reduction

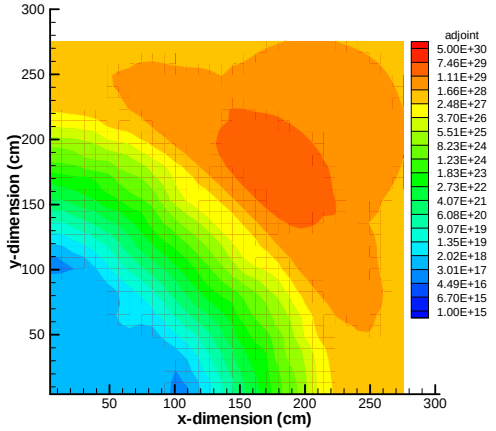
- **Example: PWR Ex-Vessel Thermal (^{10}B) Detector Response**



Monte Carlo model

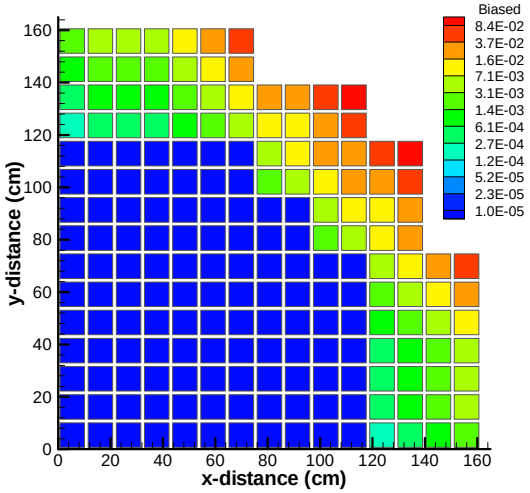


Deterministic model



Adjoint data

Calculate/apply VR Parameters



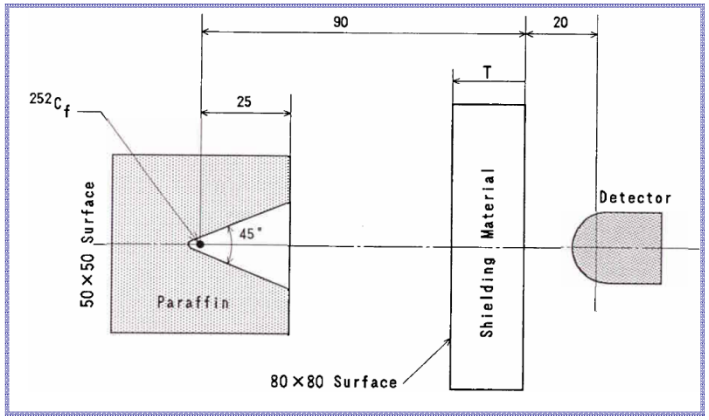
Faster Results

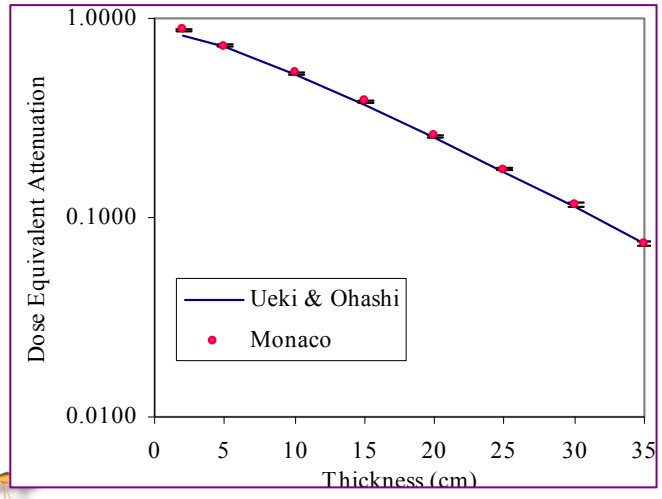
CASE	CPU TIME TO ACHIEVE RE=1% (h)	SPEEDUP
No VR	8.86E+4 (10.1 yrs)	1
Manual VR	13.6	6500*
A3DVR	**1.02**	**87000**

* Required ~3 weeks by an experienced MC practitioner using all applicable VR capabilities

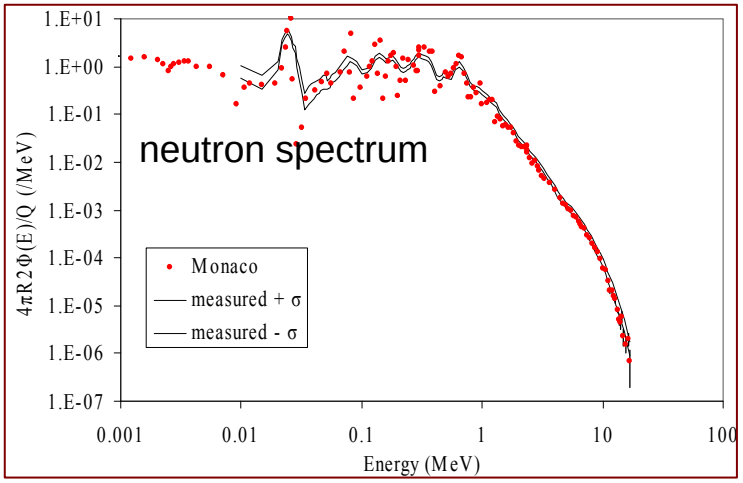
MAVRIC/MONACO Monte Carlo Calculations of Coupled Neutron-Photon Shielding Experiments

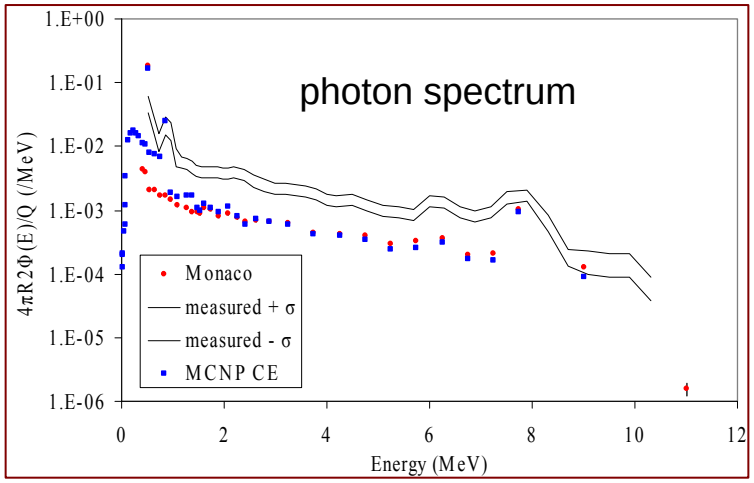
1. Ueki shielding experiments





2. Neutron transmission through steel sphere with Cf source





SUMMARY

- **SCALE-6 has several new ENDF/B-VII data libraries processed by AMPX**
- **Libraries are currently being validated**
- **Initial results for critical benchmarks, depletion isotopic measurements, and shielding experiments look good**