

# Status and Testing of the Shift Monte Carlo Code within SCALE

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# Outline

- Brief recap of Shift
- Integration of Shift into SCALE
- Testing of Shift-based sequences in SCALE

# Shift overview – Exnihilo code system

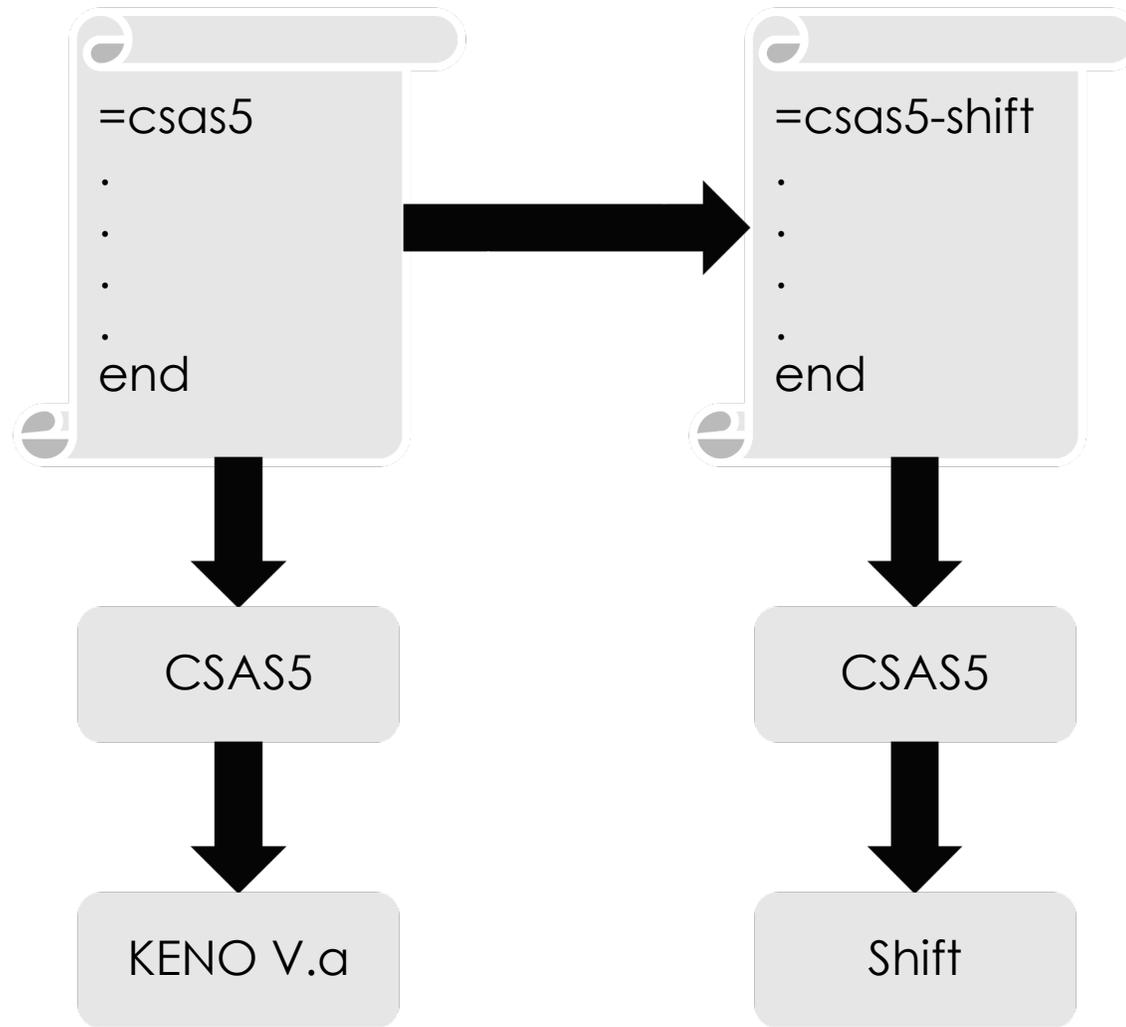


- Flexible, high-performance Monte Carlo radiation transport *framework*
- Shift is physics agnostic
  - SCALE CE physics
  - SCALE MG physics
- Shift is geometry agnostic
  - SCALE geometry
  - Exnihilo RTK geometry
  - MCNP geometry
  - DagMC-CUBIT CAD geometry
- Fixed-source and eigenvalue solvers
- Integrated with Denovo for hybrid methods
- Multiple parallel decompositions and concurrency models
- Shift is designed to scale from supercomputers to laptops

# Strategy for Shift integration into SCALE

- The goal is to be as transparent as possible to the user
- Ultimately, the only input change that should be required is changing “=csas5” or “=csas6” to “=csas5-shift” or “=csas6-shift”
- The CSAS input is processed and translated for use in Shift
- The output is received and processed to be similar to CSAS output
  - Key outputs are being formatted into identical edits to minimize impact on post-processing scripts
- Shift integration funded by both NRC and NCSP

# Strategy in pictures



# Mechanics of Shift integration into SCALE

- Replace legacy FORTRAN data structures with C++
- Implementation of new geometry package (Geometria) to support KENO V.a and KENO-VI geometries
  - Geometria is surface based, while both KENOs are solid based
  - Array and hole implementation presented challenges
- Message passing from sequence (CSAS) to transport module (Shift) and back – especially during unexpected execution termination
  - Getting error messages back
  - Translating error messages to something KENO users can understand

# Testing CSAS-Shift: The plan

- Initial implementation funded by NRC
  - Report issued in August 2016 with results for entire VALID library
  - Limited feature support
  - Incomplete implementation of KENO-VI geometry capabilities
- Development in FY18 focused on completing implementation of CSAS capabilities
  - Transition from demonstration to production
- Testing therefore initially focused on additional capabilities

# Testing CSAS-Shift: Initial results

- Many challenges identified, including:
- Output handling
  - Most information in HDF5 file, not text output
  - Tables missing and different
- Geometry problems
  - Problems with hexagonal and dodecahedral arrays
  - Failure to detect double defined spaces
- Unsupported capabilities, especially with arrays and holes
- Approximately 18% of VALID library failed

# Current status

- Furious development efforts in preparation for SCALE 6.3 beta releases
- Output improved to be more similar to existing KENO output
- Many geometry problems fixed
  - Hexagonal and dodecahedral arrays back online
  - Boundary conditions can be applied to any shape as an outer boundary
  - Some tracking algorithm improvements
- Testing and development continuing to support SCALE 6.3

Thank you to the DOE NCSP  
for funding this work and lots  
of other work like it!

That's it – any  
questions?

