

Applying Whisper to Traditional USL Computational Methods

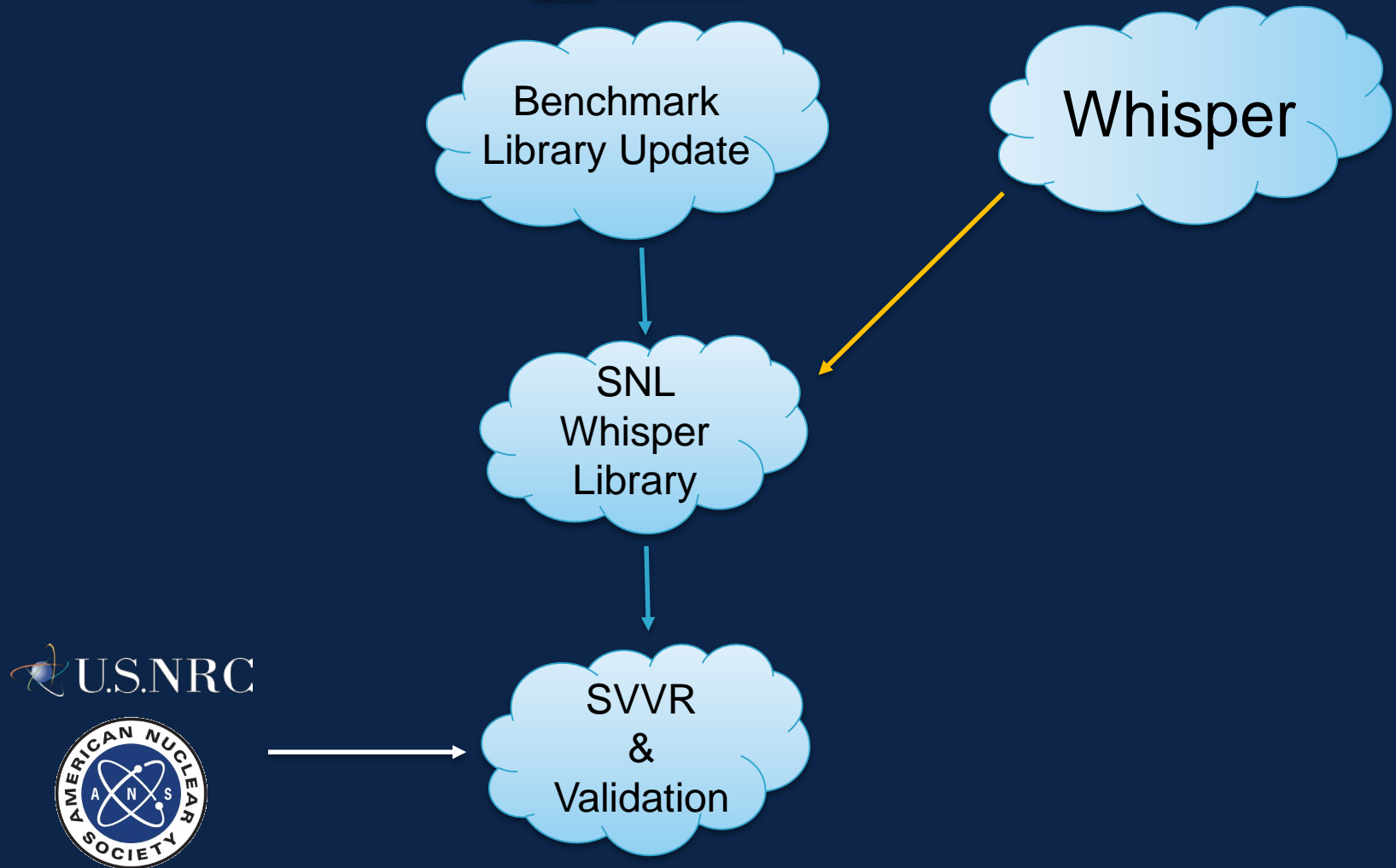
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Outline

- LANL and SNL Collaboration
- Updating and Expanding SNL's Benchmarks
- The SVVR and the General USL
- Building Whisper Libraries
- Whisper's Role in the Validation Process

Collaboration



Updating Benchmarks

- 594 Additional benchmarks added from multiple sources and were assumed to be reviewed but all benchmarks in are in review. (857 Total Benchmarks).
- All benchmarks material ZAIDs were converted to isotopes from elements.
- MLIB card was used to make future cross section updates easier.
- $S\alpha\beta$ cards and complementary binaries were added if missing.

Updating Benchmarks Cont...

- Per LANL good practices, 10000 neutrons per cycle, and enough cycles to ensure convergence and good statistics.
- All benchmarks included a heading with the ICSBEP benchmark values and uncertainties for Whisper processing.

Whisper

- Whisper is a statistical analysis software developed by LANL to support NCS and distributed with MCNP 6.2.
- For a each isotope, 12 cross-sections & sensitivities over 44 energy groups are used.
- Compares benchmark sensitivities to application and determines highest correlating benchmarks.

SNL's Whisper Library

- Created our own Whisper Libraries using our benchmarks
 - Sensitivity calculations, TOC, Adjusted covariance data, and Exclude files

- Whisper Library is updated when benchmarks are added, changed, or deleted.

- Benchmarks and Sensitivity data under version control

- SNL+LANL and LANL+SNL show little statistical differences.

	Bias ± Std.Dev
357 LANL cases	0.00175 ± 0.00024
357 SNL cases	0.00179 ± 0.00021
Ave. SNL-LANL	0.00004 ± 0.00010

SNL's SVVR and the General USL

- SVVR calculates a “generic” USL of 0.959 for the complete set
 - using statistical methods found in NUREG/CR-6698
 - includes a 0.02 MOS , historically 0.05 was used

- Planned NCSP SVVR procedure
 - Git server for benchmark version control
 - One version of MCNP for validation
 - Benchmark maintenance and updating

Whisper's Role in the Validation Process

- Whisper is used to determine if the benchmarks in our library have enough matches to a system or process to confidentially apply our general USL.
- NCSE determines if enough correlated benchmarks at a high enough confidence level (Ck values) such that additional benchmarks are not needed or with good judgment apply an AoA margin
- **! WHISPER'S REPORTED USL IS NOT USED FOR VALIDATION !**

Whisper's Role Cont...

- CR-6698 statistical methods can be applied to Whispers correlated benchmarks to calculate a USL to determine if the general USL is still bounding or confidence is questionable.

Application	Distribution	USL Traditional Methods on Whisper's Correlating Benchmark
SingleCyl_Mass_0.0005_100_15.846	NON-Normal	0.97227
SingleCyl_Mass_0.0005_1060.8_7.2117	NON-Normal	0.97154
SingleCyl_Mass_0.0005_40_5.08	Normal	0.96688
SingleCyl_Mass_0.01_75_17.441	NON-Normal	0.97094
SingleCyl_Mass_0_10_38.1	Normal	0.97411

ANSI/ANS-8.24

ANS-8.24-2007 section 5.1

*“Appropriate system or process parameters that correlate the experiments to the system or process under consideration **shall** be identified..”*

- Less experienced Analyst not as knowledgeable about the 1000's of benchmarks from the ICSBEP.
- Employing Whisper reduce the uncertainty in the benchmark selection process.

Thank You for Your Attention

