Multicode Comparison of Time Independent Pulsed Sphere Benchmark Results

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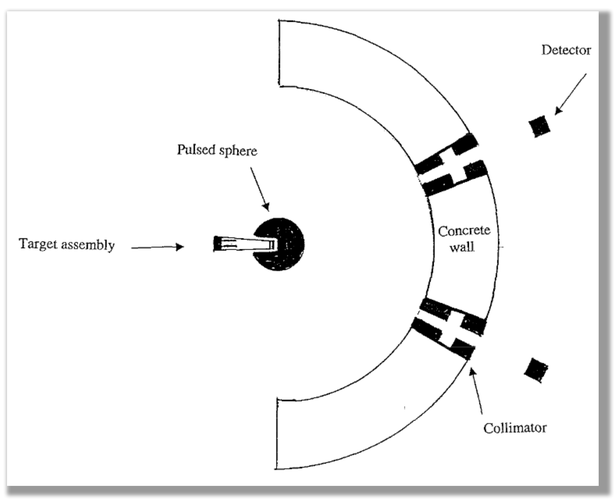
Objective

Compare results from running the LLNL Pulsed Sphere Benchmarks on multiple codes.

Experimental Setup

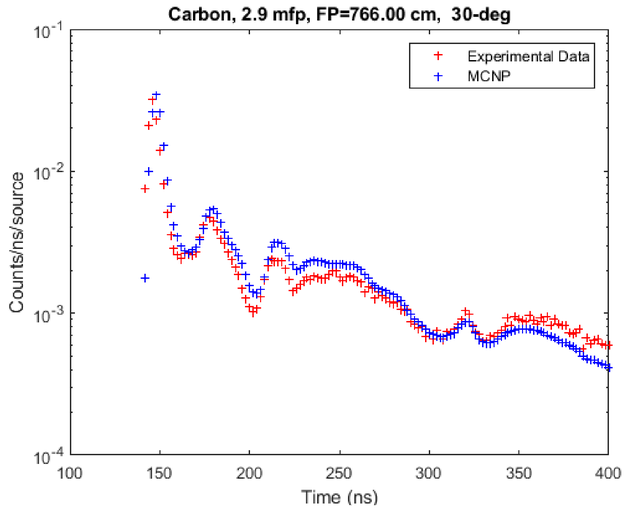
- Spheres of various materials
  - 1 - 20 cm
- Detectors at 500 – 1000 cm flightpaths.
  - 26°, 30°, and 120° angles
- $^{3}H(d,n)^{4}He$ reaction
- Creates a pulse of neutrons
  - 12.5 – 15.5 MeV
  - 2-10 ns FWHM



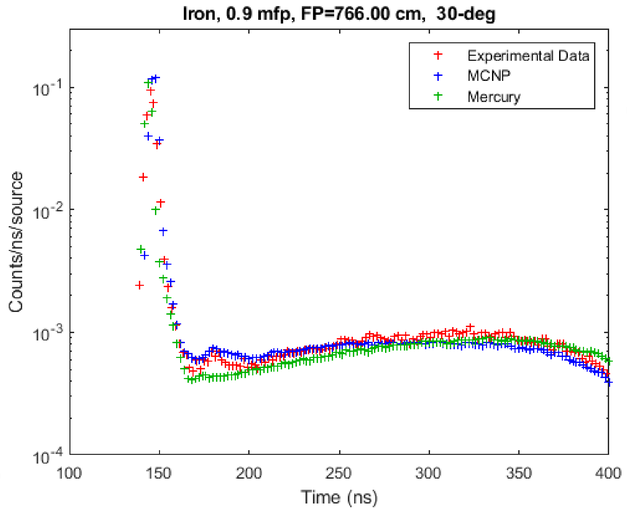
Detector Assembly (Not to Scale) [1]

Results

MCNP

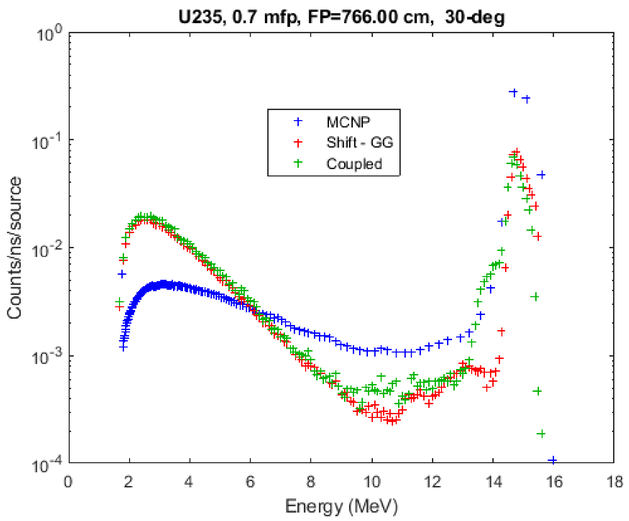


Mercury



Shift

- Shift does not possess time of flight (ToF) tallies only energy.
- ToF tallies can be estimated using the "first-flight" assumption.
- Two Shift input methods were used.
  - An MCNP5 coupled build which converts an entire MCNP input file besides the tally card.
  - Shift input files in the geometria (GG) language with several key limitations.



Conclusions

The results generally align with experimental data, however, Shift results require more scrutiny.

Future Work

- Improve the input files for Shift using the geometria language.
- Investigate differences between Shift results and other codes (tallies, nuclear data, geometry, sources)
- Explore applications of time dependent simulations of the Pulsed Sphere benchmarks.

References

[1] Marchetti, A A, and G W Hedstrom. "New Monte Carlo Simulations of the LLNL Pulsed-Sphere Experiments." *Lawrence Livermore National Laboratory*, 1998, doi:10.2172/304515.

Acknowledgements

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