Elliott D. Biondo, Ph.D.

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Education

University of Wisconsin   **Madison, WI**
Ph.D., Nuclear Engineering and Engineering Physics   *Aug. 2016*
M.S., Nuclear Engineering and Engineering Physics   *May. 2013*

University of Minnesota   **Minneapolis, MN**
B.ChE., Chemical Engineering   *May 2011*
B.S., Chemistry   *May 2011*

Experience

Oak Ridge National Laboratory   **Oak Ridge, TN**
R&D Staff | HPC Methods for Nuclear Applications Group   *2022–present*
  – Demonstrated transport on mixed CAD/CSG "layered" geometries for advanced reactor and national security applications

R&D Associate Staff | HPC Methods for NucleAr Applications Group   *2019–present*
  – Procured funding and implemented mixed CAD/CSG "layered" geometries in the `Shift` Monte Carlo radiation transport code
  – Developed and prototyped a novel method for free gas elastic scattering aimed at improved GPU performance
  – Assessed the use of Singular Value Decomposition (SVD) to compress variance reduction parameters in `Shift`

Postdoctoral Research Associate | High Performance Computing Methods & Applications Team   *2016–2019*
  – Implemented on-the-fly Doppler broadening on the CPU/GPU in `Shift` as a component of the ExaSMR project
  – Implemented Cartesian mesh surface tallies in `Shift` to facilitate coupling with nodal codes
  – Assessed the efficacy of a novel fission source convergence technique

University of Wisconsin   **Madison, WI**
Nuclear Regulatory Commission Graduate Fellow | Computational Nuclear Engineering Research Group 2011–2016
  – Dissertation: "Hybrid Monte Carlo/Deterministic Neutron Transport for Shutdown Dose Rate Analysis"
  – Methods development, computational implementation, and nuclear systems analysis with a focus on radiation transport, CAD geometry, and neutron activation
  – 15,000+ lines of code/tests/documentation added to the Python for Nuclear Engineering open source toolkit

Oak Ridge National Laboratory   **Oak Ridge, TN**
Graduate Student Intern | Radiation Transport Group   *Summer 2014*
  – Added CAD geometry support to the ADVANTG Monte Carlo variance reduction parameter generator code

Polar Semiconductor Inc.   **Bloomington, MN**
Process Engineering Intern | Manufacturing Group   *Summer 2010*
  – Collected/analyzed scanning electron microscope data to improve QA processes for silicon wafer production

University of Minnesota   **Minneapolis, MN**
Undergraduate Research Assistant II | Dept. of Chemistry   *2009-2010*
  – Synthesized and characterized novel heterocyclic organic compounds with potential tuberculostatic activity

Naval Surface Warfare Center   **Bethesda, MD**
Battery Research Intern | Power & Protective Systems Branch   *Summers of 2005 & 2006*
  – Conducted safety and performance tests of Li-ion batteries for unmanned underwater vehicle applications

Skills

  – Extensive experience developing UNIX-based, scientific software on a collaborative team
  – Expert in C/C++, Python (including NumPy, MatPlotLib), MATLAB, familiarity with Fortran
  – Experience with parallel programming with CUDA, OpenMP, and MPI
  – Experience with industry-standard software development tools including `git`, `cmake`, `gdb`, and `gprof`

Funded Grants

ORNL Laboratory Directed Research & Development Seed Proposal   **$190K**
Principle Investigator   *2021-2023*
"Layered Geometry for Flexible Monte Carlo Radiation Transport"

Refereed Journal Articles

1. **E. Biondo**, T. Evans, G. Davidson, S. Hamilton, "Singular Value Decomposition of Adjoint Flux Distributions for Monte Carlo Variance Reduction", *Annals of Nuclear Energy*, Vol. 141, pp. 107327, 2020.

2. **E. Biondo**, G. Davidson, T. Pandya, S. Hamilton, T. Evans, "Deterministically Estimated Fission Source Distributions for Monte Carlo k-Eigenvalue Problems", *Annals of Nuclear Energy*, Vol. 119, pp. 7–22, 2018.

3. **E. Biondo**, P. Wilson, "Transmutation Approximations for the Application of Hybrid Monte Carlo/Deterministic Neutron Transport to Shutdown Dose Rate Analysis", *Nuclear Science and Engineering*, Vol. 187, Issue 1, pp. 27–48, 2017.

4. **E. Biondo**, A. Davis, P. Wilson, "Shutdown Dose Rate Analysis with CAD Geometry, Cartesian/Tetrahedral Mesh, and Advanced Variance Reduction", *Fusion Engineering and Design*, Vol. 106, pp. 77–84, 2016.

5. S. Hamilton, T. Evans, K. Royston, **E. Biondo**, "Domain decomposition in the GPU-accelerated Shift Monte Carlo code", *Annals of Nuclear Energy*, Vol. 166, pp. 108687, 2022.

Full-Length Topical Papers

1. **E. Biondo**, V. Sobes, A. Holcomb, S. Hamilton, T. Evans, "Algorithm for Free Gas Elastic Scattering without Rejection Sampling", *ANS M&C 2021 - The International Conference on Mathematics and Computational Methods Applied to Nuclear Science and Engineering*, Raleigh, North Carolina, 2021.

2. B. Ade, G. Davidson, K. Bekar, and **E. Biondo**, "Integration of Shift Monte Carlo Framework into SCALE for Criticality Safety, Depletion, and Few-Group Cross Section Generation", *PHYSOR 2018: Reactor Physics paving the way towards more efficient systems*, Cancun, Mexico, 2018.

3. **E. Biondo**, P. Wilson, "Application of the Multi-Step CADIS Method to Fusion Energy Systems Analysis", *International Conference on Mathematics & Computational Methods Applied to Nuclear Science & Engineering*, Jeju, South Korea, 2017.

4. **E. Biondo**, A. Ibrahim, S. Mosher, R. Grove, "Accelerating Fusion Reactor Neutronics Modeling by Automatic Coupling of Hybrid Monte Carlo/Deterministic Transport on CAD Geometry", *Joint International Conference on Mathematics and Computation (M&C), Supercomputing in Nuclear Applications (SNA) and the Monte Carlo (MC) Method (ANS MC2015)*, Nashville, TN, 2015.

5. E. Relson, P. Wilson, **E. Biondo**, "Improved Mesh Based Photon Sampling Techniques for Neutron Activation Analysis", *International Conference of Mathematics and Computational Methods Applied to Nuclear Science and Engineering (M&C 2013)*, Sun Valley, ID, 2013.

Conference Summaries

1. **E. Biondo**, A. Davis, A. Scopatz, P. Wilson, "Rigorous Two-Step Activation for Fusion Systems with PyNE," *Proc. of the 18th Topical Meeting of the Radiation Protection & Shielding Division of ANS*, 2014.

2. **E. Biondo**, E. Relson, A. Davis, P. Wilson, "Implementation, Benchmarking, and Application of R2S-ACT: an Open-Source, Mesh-Based, Rigorous 2-Step Activation Workflow," *Transactions of the American Nuclear Society*, Vol. 109, pp. 1180-1183, 2013.

3. **E. Biondo**, A. Scopatz, M. Gidden, R. Slaybaugh, C. Bates, P. P.H. Wilson, "Quality Assurance within the PyNE Open Source Toolkit," *Transactions of the American Nuclear Society*, Vol. 111, 2014.

4. C. Bates, **E. Biondo**, K. Huff, K. Kiesling, A. Scopatz, "PyNE Progress Report," *Transactions of the American*

Nuclear Society, Vol. 111, 2014.

5. A. Scopatz, **E. Biondo**, C. Brachem, J. Xia, P. Wilson, "PyNE Progress Report," *Transactions of the American Nuclear Society*, Vol. 109, pp. 1206-1208, 2013.

Technical Reports

1. **E. Biondo**, "Implementation of the Windowed Multipole Method in Shift," Technical Report ORNL/TM-2021/2056, Oak Ridge National Laboratory, Oak Ridge, TN, 2021.

2. D. Peplow, G. Davidson, C. Celik, **E. Biondo**, A. Hackett, W. Ray, D. Archer, J. Ghawaly, A. Nicholson, M. Willis, B. Quiter, M. Bandstra, R. Meyer, C. Chow, I. Stewart, J. Johnson, "Monte Carlo Simulation of Background and Source Measurements with CSG and CAD Geometries", Technical Report ORNL/TM-2021/2078, Oak Ridge National Laboratory, Oak Ridge, TN, 2021.

3. D. Archer, M. Banstra, **E. Biondo**, C. Celik, G. Davidson, J. Ghawaly, A. Hackett, J. Johnson, A. Nicholson, D. Peplow, B. Quiter, W. Ray, M. Salathe, M. Swinney, M. Willis, "Modeling Urban Scenarios & Experiments (MUSE) Final Report," Technical Report ORNL/TM-2021/1888, Oak Ridge National Laboratory, Oak Ridge, TN, 2021.

4. S. Johnson, T. Evans, G. Davidson, S. Hamilton, T. Pandya, K. Royston, and **E. Biondo**, "Omnibus User Manual," Technical Report ORNL/TM-2018/1073, Oak Ridge National Laboratory, Oak Ridge, TN, 2020.

5. G. Davidson, S. Bhatt, M. Swinney, **E. Biondo**, J. Salcedo Perez, K. Banerjee, A. Perry, E. Asano, E. Gonzalez, B. Kiedrowski, "Initial Coupled Simulations of a Critical Dual-Purpose Canister in a Saturated Repository," Technical Report ORNL/SPR-2020/1723, Oak Ridge National Laboratory, Oak Ridge, TN, 2020.

6. **E. Biondo**, G. Davidson, T. Evans, "Monte Carlo Fission Source Convergence Acceleration with Deterministically Estimated Fission Source Distributions," Technical Report ORNL/SR-2017/101, Oak Ridge National Laboratory, Oak Ridge, TN, 2017.

7. B. Ade, K. Bekar, G. Davidson, **E. Biondo**, "Integration of the Shift Monte Carlo Framework into SCALE/TRITON and Addition of Few-Group Cross Section Tallies to Shift," Technical Report ORNL/SPR-2017/523, Oak Ridge National Laboratory, Oak Ridge, TN, 2017.

8. A. Davis, M. Sawan, P. Wilson, **E. Biondo** A. Ibrahim, P. Shriwise, E. Marriott, "Report on the ITER CLITE Shutdown Dose Rate Calculations," Technical Report, US ITER, Oak Ridge, TN, 2016.

9. **E. Biondo**, "Hybrid Monte Carlo Variance Reduction with CAD Geometry for Fusion Energy Systems," Technical Report RNSD-TN-14-002, Oak Ridge National Laboratory, Oak Ridge, TN, 2014.

10. **E. Biondo**, "Multiplier and Driver Mesh-Based Rigorous 2-Step Activation Analysis," Technical Report, Shine Medical Technologies, Monona, WI, 2013.

11. **E. Biondo**, W. Noland, "Steps Toward the Synthesis of Diels-Alder Adducts of Vinylidene Bis-Heterocycles with Potential Biological Activity," Technical Report, University of Minnesota Department of Chemistry, Minneapolis, MN, 2009.

12. **E. Biondo**, J. Banner, "The Effects of Overcharge on the Performance and Safety of Lithium Ion Pouch Batteries," Technical Report, Caderock Division of the Naval Surface Warfare Center, Bethesda, MD, 2006.

13. **E. Biondo**, J. Banner, D. Fuentevilla, "Environmental Performance Testing of Mark 141 Batteries," Technical Report, Caderock Division of the Naval Surface Warfare Center, Bethesda, MD, 2005.

Professional Experience

Current Issues in Computational Methods—-Roundtable   Nov. 2019
"Advanced Computing Architectures for Production Nuclear Applications"
American Nuclear Society Winter Meeting
Washington, DC

Exnihilo Tutorial Session   Sept. 2018
20th Topical Meeting of the Radiation Protection & Shielding Division of ANS
Santa Fe, NM

Python for Nuclear Engineering (PyNE) Tutorial Session   Mar. 2016
American Nuclear Society Student Conference
Madison, WI

"DAGMC Tools for Nuclear Engineering Analysis"   Jan. 2016
Institute of Plasma Physics Chinese Academy of Sciences (ASIPP)
Hefei, China

Python for Nuclear Engineering (PyNE) Tutorial Session   Apr. 2015
Joint International Conference on Mathematics and Computation Supercomputing in Nuclear Applications and the Monte Carlo Method (ANS MC2015)
Nashville, TN

"LaTeX and Beamer"   Mar. 2015
The Hacker Within
Madison, WI

"Command-line Olympics"   Feb. 2015
The Hacker Within
Madison, WI

Python for Nuclear Engineering (PyNE) tutorial session   Sept. 2014
18th Topical Meeting of the Radiation Protection & Shielding Division of ANS
Knoxville, TN

Awards

Graduate Fellowship, Nuclear Regulatory Commission, full tuition and $26,000/year stipend   *2013–2016*
Best of RPSD 2014, special session for top presenters at American Nuclear Society RPSD meeting   *Sept. 2014*
Student Paper Award, American Nuclear Society Winter 2013 Meeting, $100 award   *Nov. 2013*
Chancellor's Opportunity Award, University of Wisconsin, $5,000 award for new graduate students *Aug. 2011*
National Gold Scholarship, University of Minnesota, in-state tuition for out-of-state residents   *2007–2011*