# Elliott D. Biondo, Ph.D.

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## Education

**University of Wisconsin** — **Madison, WI**
Ph.D., Nuclear Engineering and Engineering Physics, GPA 3.87 — *Aug. 2016*
M.S., Nuclear Engineering and Engineering Physics, GPA 3.83 — *May 2013*

**University of Minnesota** — **Minneapolis, MN**
B.ChE., Chemical Engineering, GPA 3.49 — *May 2011*
B.S., Chemistry, GPA 3.49 — *May 2011*

## Experience

**Oak Ridge National Laboratory** — **Oak Ridge, TN**
*R&D Staff | HPC Methods for Nuclear Applications Group* — *2022–present*
- Demonstrated mixed CAD/CSG "layered" geometries for advanced reactor and nat. sec. 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 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 | HPC 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 Nuc. Eng. 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**, G. Davidson, B. Ade, "Layered CAD/CSG Geometry for Neutronics Modeling of Advanced Reactors," *PHYSOR 2022: International Conference on Physics of Reactors*, Pittsburgh, PA, 2022 (submitted).

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

3. **E. Biondo**, P. Wilson, "Application of the Multi-Step CADIS Method to Fusion Energy Systems Analysis," *M&C 2017: International Conference on Mathematics & Computational Methods Applied to Nuclear Science and 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," *M&C 2015: Joint International Conference on Mathematics and Computation, Supercomputing in Nuclear Applications and the Monte Carlo Method*, Nashville, TN, 2015.

5. B. Ade, **E. Biondo**, D. Schappel, E. Fountain, B. Betzler, G. Davidson, "Preliminary Assessment of as-Built Design Characteristics for the Transformational Challenge Reactor" *PHYSOR 2022: International Conference on Physics of Reactors*, Pittsburgh, PA, 2022 (submitted).

6. B. Ade, G. Davidson, K. Bekar, **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.

7. E. Relson, P. Wilson, **E. Biondo**, "Improved Mesh Based Photon Sampling Techniques for Neutron Activation Analysis," *M&C 2013: International Conference of Mathematics and Computational Methods Applied to Nuclear Science and Engineering*, 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*, Knoxville, TN, 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," *ANS Winter Meeting*, Washington, DC, 2013.

3. **E. Biondo**, A. Scopatz, M. Gidden, R. Slaybaugh, C. Bates, P. P.H. Wilson, "Quality Assurance within the PyNE Open Source Toolkit," *ANS Winter Meeting*, Anaheim, CA, 2014.

4. C. Bates, **E. Biondo**, K. Huff, K. Kiesling, A. Scopatz, "PyNE Progress Report," *ANS Winter Meeting*, Anaheim, CA, 2014.

5. A. Scopatz, **E. Biondo**, C. Brachem, J. Xia, P. Wilson, "PyNE Progress Report," *ANS Winter Meeting*, Washington, DC, 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, **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*

## Foreign Languages

**Swahili**
*ACTFL Oral Proficiency Interview (OPI)* — Feb. 2022
Score: Advanced Low