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*
- Implemented embeded geometric universes in the `Celeritas` GPU-based high-energy physics code
- Demonstrated the use of mixed CAD/CSG "layered" geometries in the `Shift` Monte Carlo radiation transport code for advanced reactor and nat. sec. applications

R&D Associate Staff | HPC Methods for Nuclear Applications Group — *2019–2022*
- Procured funding and implemented mixed CAD/CSG "layered" geometries in `Shift`
- Developed and prototyped a novel, rejection-free algorithm for free gas elastic scattering aimed at improved GPU performance
- Assessed the use of Singular Value Decomposition (SVD) for in-memory compression of variance reduction parameters in `Shift`

Postdoctoral Research Associate | HPC Methods & Applications Team — *2016–2019*
- Implemented the "multipole" on-the-fly Doppler broadening method on the CPU and GPU in `Shift` as a component of the ExaSMR project
- Implemented Cartesian mesh surface tallies in `Shift`
- Assessed the efficacy of a novel fission source convergence technique

University of Wisconsin — **Madison, WI**
Nuclear Regulatory Commission Grad. Fellow | Comp. Nuc. Eng. Research Group — *2011–2016*
- Ph.D. 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, and documentation added to the Python for Nuclear Engineering (PyNE) 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 *Summer 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**, G. Davidson, B. Ade, "Layered CAD/CSG Geometries for Spatially Complex Radiation Transport Scenarios," *Annals of Nuclear Energy*, Vol. 181, 2023.
2. **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, 2020.
3. **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, 2018.
4. **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, 2017.
5. **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, 2016.
6. J. W. Bae, B. Kos, **E. Biondo**, "Integration of the Shift Monte Carlo transport code into R2S workflows" *Fusion Engineering and Design*, submitted March, 2023.
7. S. Hamilton, T. Evans, K. Royston, **E. Biondo**, "Domain decomposition in the GPU-accelerated Shift Monte Carlo code," *Annals of Nuclear Energy*, Vol. 166, 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.
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: International Conference of Mathematics and Computational Methods Applied to Nuclear Science and Engineering*, 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.

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. 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.

Other Professional Experience

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

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

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

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

Presenter, Python for Nuclear Engineering (PyNE) Tutorial Session — *Apr. 2015*
M&C 2015: International Conference of Mathematics and Computational Methods Applied to Nuclear Science and Engineering
Nashville, TN

Presenter, Python for Nuclear Engineering (PyNE) tutorial session — *Sept. 2014*
RPSD 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 grad. 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 (4^{th} highest score out of 10)