Elliott D. Biondo, Ph.D.

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Citizenship: USA | Clearance: DOE Q

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*

- Implemented advanced computational geometry features in the `Celeritas` GPU-based Monte Carlo high-energy physics code, including multi-universe tracking and tree-based acceleration
- Implemented a finite element method for solving the pressure distribution through multi-land 2π and segmented squeeze film dampers

R&D Associate Staff | *HPC Methods for Nuclear Applications Group* — *2019–2022*

- Procured funding and implemented mixed CAD/CSG "layered" geometries in the `Shift` Monte Carlo radiation transport
- 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 Windowed Multipole on-the-fly Doppler broadening method on the CPU and GPU in `Shift`
- 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

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, Carderock Division **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 scientific applications on a collaborative team
- Expert in C/C++ with CUDA and MPI, Python (including NumPy, MatPlotLib), and MATLAB
- Graduate-level coursework in mathematics, including linear algebra, differential equations, complex analysis, and numerical methods

Funded grants

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

Awards

Best Paper and Presentation, Mathematics and Computation Division, ANS Annual Meeting *June 2024*
A. Bachmann, S. Johnson, S. Hart, E. Biondo, T. Evans
"Investigation of Doppler broadening methods within the Shift Monte Carlo radiation transport code"

Finalist, Early Career Competition, Oak Ridge National Laboratory *Dec. 2023*
"Accelerated Monte Carlo Radiation Transport for Fusion Reactor Applications"

Finalist, Gordon Bell Prize, Association for Computing Machinery *Nov. 2023*
E. Merzari, S. Hamilton, T. Evans, P. Romano, P. Fischer, M. Min, S. Kerkemeier, Y. H. Lan, J. Fang, M. Phillips, T. Rathnayake, E. Biondo, K. Royston, N. Chalmers, T. Warburton
"Exascale Multiphysics Nuclear Reactor Simulations for Advanced Designs"

Graduate Fellowship, Nuclear Regulatory Commission *2013–2016*
Full tuition and stipend

Best of RPSD 2014, American Nuclear Society Annual Meeting *June 2015*
E. Biondo, A. Davis, A. Scopatz, P. Wilson
"Rigorous Two-Step Activation for Fusion Systems with PyNE"
Special session at the ANS Annual 2015 meeting for top presenters at ANS RPSD 2014 meeting

Student Paper Award, American Nuclear Society Winter Meeting *Nov. 2013*
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"

Chancellor's Opportunity Award, University of Wisconsin *Aug. 2011*
$5,000 award for new graduate students

National Gold Scholarship, University of Minnesota *2007–2011*
In-state tuition for out-of-state residents

Refereed journal articles

1. **E. Biondo**, T. Evans, S. Johnson, S. Hamilton, "Comparison of Nested Geometry Treatments within GPU-Based Monte Carlo Neutron Transport Simulations of Fission Reactors," *International Journal of High Performance Computing Applications*, submitted March, 2024.
2. T. Evans, K. Royston, S. Hamilton, G. Davidson, **E. Biondo**, S. Johnson, "Automated Hybrid Variance Reduction on Advanced Architectures in the Shift Monte Carlo Code," *Nuclear Science and Engineering*, 2025.
3. **E. Biondo**, G. Davidson, T. Evans, S. Hamilton, S. Johnson, T. Pandya, K. Royston, J. Salcedo-Pérez, "Status of GPU Capabilities within the Shift Monte Carlo Radiation Transport Code," *European Physical Journal N: Nuclear Sciences & Technologies*, Vol. 11, Issue 5, 2025. Presented at *SNA + MC 2024: Joint International Conference on Supercomputing in Nuclear Applications + Monte Carlo*, Paris, France, 2024.
4. J. W. Bae, B. Kos, **E. Biondo**, "Shutdown Dose Rate Analysis with the Shift Monte Carlo Radiation Transport Code and Modular Verification Workflow," *Fusion Engineering and Design*, Vol. 194, 2023.
5. **E. Biondo**, G. Davidson, B. Ade, "Layered CAD/CSG Geometries for Spatially Complex Radiation Transport Scenarios," *Annals of Nuclear Energy*, Vol. 181, 2023.
6. 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.
7. **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.
8. **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.
9. **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.
10. **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.

Refereed conference proceedings

1. A. Lund, J. Esseiva, S. Johnson, **E. Biondo**, P. Canal, T. Evans, H. Hollenbeck, S. Y. Jun, G. Lima, B. Morgan, S. Tognini, "Accelerating detector simulations with Celeritas: profiling and performance optimizations," *CHEP 2024: 27th International Conference on Computing in High Energy and Nuclear Physics*, Krakow, Poland, 2024.
2. S. Johnson, J. Esseiva, **E. Biondo**, P. Canal, M. Demarteau, T. Evans, S. Y. Jun, G. Lima, A. Lund, P. Romano, and S. Tognini, "Celeritas: accelerating Geant4 with GPUs," *CHEP 2023: 26th International Conference on Computing in High Energy & Nuclear Physics*, Norfolk, VA, 2023.
3. E. Merzari, S. Hamilton, T. Evans, P. Romano, P. Fischer, M. Min, S. Kerkemeier, Y. H. Lan, J. Fang, M. Phillips, T. Rathnayake, **E. Biondo**, K. Royston, N. Chalmers, T. Warburton, "Exascale Multiphysics Nuclear Reactor Simulations for Advanced Designs," *SC 2023: International Conference for High Performance Computing, Networking, Storage, and Analysis*, Denver, CO, 2023.
4. **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.

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. **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.
7. 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*, Cancún, Mexico, 2018.
8. **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.
9. **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 + SNA + MC 2015: Joint International Conference on Mathematics and Computation, Supercomputing in Nuclear Applications, and the Monte Carlo Method*, Nashville, TN, 2015.
10. 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.

Contributed conference proceedings

1. A. Bachmann, S. Johnson, S. Hart, **E. Biondo**, T. Evans, “Investigation of Doppler broadening methods within the Shift Monte Carlo radiation transport code,” *ANS Annual Conference*, Las Vegas, NV, 2024.
2. **E. Biondo**, A. Davis, A. Scopatz, P. Wilson, “Rigorous Two-Step Activation for Fusion Systems with PyNE,” *ANS Annual Meeting*, “Best of RPSD 2014” session, San Antonio, TX, 2015.
3. **E. Biondo**, A. Davis, A. Scopatz, P. Wilson, “Rigorous Two-Step Activation for Fusion Systems with PyNE,” *Topical Meeting of the ANS Radiation Protection and Shielding Division (RPSD 2014)*, Knoxville, TN, 2014.
4. **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.
5. C. Bates, **E. Biondo**, K. Huff, K. Kiesling, A. Scopatz, “PyNE Progress Report,” *ANS Winter Meeting*, Anaheim, CA, 2014.
6. **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.
7. A. Scopatz, **E. Biondo**, C. Brachem, J. Xia, P. Wilson, “PyNE Progress Report,” *ANS Winter Meeting*, Washington, DC, 2013.

Presentations not accompanied by conference proceedings

1. **E. Biondo**, “Ray Tracing Methods for GPU-Accelerated Particle Transport Simulations,” *PASC 2025: Platform for Advanced Scientific Computing*, Brugg, Switzerland, 2025.
2. **E. Biondo**, “Celeritas geometry update,” *High-Energy Physics Center for Computational Excellence (HEP-CCE) All Hands Meeting*, Fermi National Accelerator Laboratory, Batavia, IL, 2025.

3. **E. Biondo**, S. Johnson, et al., “GPU-Based Monte Carlo Particle Transport Simulations for Nuclear Energy and High-Energy Physics Applications,” *On the trail to Exascale and Scalable AI workshop*, Liverpool, United Kingdom, 2024.

4. **E. Biondo**, G. Davidson, T. Evans, S. Hamilton, S. Johnson, T. Pandya, K. Royston, José Salcedo-Peréz, “Advanced Computing Architectures for Production Nuclear Applications,” Panelist presentation as part of the “Current Issues in Computational Methods—-Roundtable” session, *American Nuclear Society Winter Meeting*, Washington, DC, 2019.

5. **E. Biondo**, “DAGMC Tools for Nuclear Engineering Analysis,” *DAGMC Collaboration Meeting*, Institute of Plasma Physics Chinese Academy of Sciences (ASIPP), Hefei, China, 2016.

Selected technical reports

1. A. Bachmann, S. Johnson, **E. Biondo**, S. Hart, T. Evans, “Comparison of Temperature-Dependent Cross Section Treatments Within the Shift Monte Carlo Radiation Transport Code,” Technical Report ORNL/TM-2024/3273, Oak Ridge National Laboratory, Oak Ridge, TN, 2024.

2. S. Johnson, **E. Biondo**, J. Esseiva, S. Y. Jun, G. Lima, A. Lund, B. Morgan, S. Tognini, P. Canal, M. Demarteau, T. Evans, P. Romano, “Celeritas R&D Report: Accelerating Geant4,” Technical Report ORNL/TM-2023/3022, Oak Ridge National Laboratory, Oak Ridge, TN, 2024.

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

4. 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.

5. D. Archer, M. Bandstra, **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.

6. 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.

7. 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.

8. **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.

9. 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.

10. 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.

11. **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.

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

13. **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.
14. **E. Biondo**, J. Banner, “The Effects of Overcharge on the Performance and Safety of Lithium Ion Pouch Batteries,” Technical Report, Naval Surface Warfare Center, Carderock Division, Bethesda, MD, 2006.
15. **E. Biondo**, J. Banner, D. Fuentevilla, “Environmental Performance Testing of Mark 141 Batteries,” Technical Report, Naval Surface Warfare Center, Carderock Division, Bethesda, MD, 2005.

Teaching and mentorship experience

Mentor, Science Undergraduate Laboratory Internships (SULI) *Summer 2025*
Owen Strong, University of Illinois
Lead undergraduate student through a computational geometry project involving ray tracing torii
Oak Ridge, TN

Mentor, Appalachian STEM Academy *July 2024*
Two-week summer program guiding 5 high school students through a nuclear engineering project.
Oak Ridge, TN

Mentor, Appalachian STEM Academy *July 2023*
Two-week summer program guiding 4 high school students through a nuclear engineering project.
Oak Ridge, TN

Presenter, Exnihilo Workshop *Sept. 2018*
Four-hour workshop demonstrating the rad. trans. capabilities in the Exnihilo software suite
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*
Four-hour workshop demonstrating the capabilities of the PyNE package
American Nuclear Society Student Conference
Madison, WI

Presenter, Python for Nuclear Engineering (PyNE) Tutorial Session *Apr. 2015*
Four-hour workshop demonstrating the capabilities of the PyNE package
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*
Four-hour workshop demonstrating the capabilities of the PyNE package
RPSD 2014: 18th Topical Meeting of the Radiation Protection & Shielding Division of ANS
Knoxville, TN

Other professional experience

Minisymposium organizer, Ray Tracing for Scientific Applications *June 2025*
PASC 2025: Platform for Advanced Scientific Computing
Brugg, Switzerland

Session chair, Multi-Scale, Multi-Physics Simulations: II *Apr. 2025*

M&C 2025: International Conference on Mathematics and Computational Methods Applied to Nuclear Science and Engineering

Denver, CO

Session chair, G-7: Monte Carlo codes: current status and future trends *Oct. 2024*

SNA + MC 2024: Joint International Conference on Supercomputing in Nuclear Applications + Monte Carlo

Paris, France