Joanna Piper Morgan PhD

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Journal Publications

- **J. P. Morgan**, I. Variansyah, T. S. Palmer, and K. E. Niemeyer. (2025) One-Cell Inversion for Solving Higher-Order Time-Dependent Radiation Transport on GPUs. Accepted. Nuclear Science and Engineering. **In press**. doi 10.1080/00295639.2025.2510004. arXiv:2503.00264. 10.1080/00295639.2025.2510004. arXiv:2503.00264.

- **J. P. Morgan**, I. Variansyah, B. Cuneo, T. S. Palmer, and K. E. Niemeyer. (2025) Performant and Portable Monte Carlo Neutron Transport via Numba. *Computing in Science and Engineering (IEEE)* **27(1),** p . doi 10.1109/MCSE.2025.3550863. arXiv:2409.04668.

- **J. P. Morgan**, A. Mote, S. Pasmann, G. Ridley, T. S. Palmer, K. E. Niemeyer, R. G. McClarren. The Monte Carlo Computational Summit – October 25 & 26, 2023 – Notre Dame, Indiana, USA. *Journal of Computational and Theoretical Transport.* *53***(5)**, 361–382. doi 10.21105/joss.06415.

- **J. P. Morgan**, I. Variansyah, S. Pasmann, K. B. Clements, B. Cuneo, A. Mote, C. Goodman, C. Shaw, J. Northrop, R. Pankaj, E. Lame, B. Whewell, R. McClarren, T. Palmer, L. Chen, D. Anistratov, C. T. Kelley, C. Palmer, and K. E. Niemeyer. Monte Carlo / Dynamic Code (MC/DC): An accelerated Python package for fully transient neutron transport and rapid methods development. *Journal of Open Source Software*. **9(96)**, 6415. doi 10.1080/23324309.2024.2354401. arXiv:2402.08161.

Peer Reviewed Conference and Other Publications

- **J. P. Morgan**, B. Cuneo, I. Variansyah, K. E. Niemeyer. Enabling GPU portability into the Numba-JITed Monte Carlo particle transport code MC/DC. (2025). To appear in the International *Conference on Mathematics and Computational Methods Applied to Nuclear Science and Engineering (ANS M&C 2025)*. Denver, CO, USA. doi 10.13182/MC25-47142. arXiv:2501.05440

- B Cuneo, **J. P. Morgan**, I. Variansyah, K. E. Niemeyer. Comparing the Performance of MC/DC's on-GPU Event-based Processing Methods in Multigroup and Continuous-energy Problems. To appear in the International *Conference on Mathematics and Computational Methods Applied to Nuclear Science and Engineering (ANS M&C 2025)*. Denver, CO, USA.

- **J. P. Morgan**, I. Variansyah, T. S. Palmer, and K. E. Niemeyer. "Exploring One-Cell Inversion Method for Transient Transport on GPU." In *Proceedings International*

Conference on Mathematics and Computational Methods Applied to Nuclear Science and Engineering. Niagara Falls, Ontario, Canada (2023). arXiv:2305.13555.

- **J. P. Morgan**, T. J. Trahan, T. P. Burke, C. J. Josey, and K. E. Niemeyer. (2023) "Hybrid-Delta Tracking on a Structured Mesh in MCATK." In *Proceedings International Conference on Mathematics and Computational Methods Applied to Nuclear Science and Engineering*. Niagara Falls, Ontario, Canada. arXiv:2306.07847.

- I. Variansyah, **J. P. Morgan**, K. E. Niemeyer, and R. G. McClarren. (2023). "Development of MC/DC: a performant, scalable, and portable Python-based Monte Carlo neutron transport code." In *Proceedings International Conference on Mathematics and Computational Methods Applied to Nuclear Science and Engineering*. Niagara Falls, Ontario, Canada.arXiv:2305.07636.

- **J. P. Morgan**, A. Long, K. Long, and K. E. Niemeyer. (2022). "Novel MC TRT Method: Vectorizable Variance Reduction for Energy Spectra" In *Transactions of the American Nuclear Society*, volume 126, pp. 276–278. Anaheim, California, USA. doi [10.13182/T126-38137](10.13182/T126-38137). zenodo:6646813

- **J. P. Morgan**, T. S. Palmer, and K. E. Niemeyer. (2022). "Explorations of Python-Based Automatic Hardware Code Generation for Neutron Transport Applications." In *Transactions of the American Nuclear Society*, volume 126, pp. 318–320. Anaheim, California, USA. doi [10.13182/T126-38066](10.13182/T126-38066). zenodo:6643659.

Education

- **Ph.D., Mechanical Engineering** September 2020 – June 2025
  Oregon State University (OSU); School of Mechanical Industrial and Manufacturing Engineering, Corvallis, Oregon
  Minor: Nuclear Engineering, **Emphasis:** Thermal Fluid Sciences (TFS), **GPA:** 3.84
  Dissertation Title: *Algorithms and Software Engineering Schemes for Time-Dependent Radiation Transport on Heterogeneous Compute Architectures.*
  Academic Advisor: Kyle E. Niemeyer **Minor Advisor:** Todd S. Palmer

- **M.S., Mechanical Engineering**, September 2020 – March 2022
  Oregon State University (OSU); School of Mechanical Industrial and Manufacturing Engineering, Corvallis, Oregon
  Emphasis: Thermal Fluid Sciences (TFS), **GPA:** 3.83
  Project Report: *Explorations of Monte Carlo Solution and Implementation Methods for Thermal Radiation and Neutron Transport*
  Academic Advisor: Kyle E. Niemeyer

- **B.S., Mechanical Engineering,** *magna cum laude,* September 2016 – June 2020
  Oregon Institute of Technology (OIT); Dept. of Mechanical and Manufacturing Engineering Technology, Klamath Falls, Oregon
  Minors: Applied Physics; Applied Mathematics

Research Experience

- **Postdoctoral Research Scholar**
  Lawrence Livermore National Lab, Nuclear Criticality Safety Division, September 2025

- **Graduate Research Assistant**
  Oregon State University, *School of MIME*, June 2020 – June 2025
  Subject (1): Python based acceleration and abstraction of compute kernels for dynamic Monte Carlo in a rapid methods development code MC/DC[1] as part of the Center for Exascale Monte Carlo Neutron Transport[2] (CEMeNT)
  Subject (2): Investigation of the one cell inversion method as an alternative to transport sweeps for deterministic dynamic neutron transport on GPUs
  Mentors: Kyle E. Niemeyer & Todd S. Palmer

- **Co-Op Research Intern**
  Advanced Micro Devices (AMD), HPC GPU Apps Support Group, September 2023 - May 2024
  Mentors: Damon McDougall, Christopher Kime

- **Graduate Research Intern**
  Los Alamos National Laboratory, XCP-3, June 2022 – May 2023
  Subject: Implementing Woodcock delta tracking on a structured mesh within the production code MCATK. *This work was pushed to a production version release.*
  Mentors: Travis J. Trehan, Timothy P. Burke, & Collin J. Josey

- **Graduate Research Intern**
  Los Alamos National Laboratory, CCS-2, June 2021 – June 2022
  Subject: Novel methods exploration in vectorizable variance reduction for thermal radiation transport (TRT)
  Mentors: Kendra Long & Alex Long

- **Lee Teng Undergraduate Research Fellow**
  Argonne National Laboratory, June 2019 – September 2019
  Subject: Cancer radiotherapy scanner magnet design & analysis
  Mentors: Brahim Mustapha

- **Science Undergraduate Laboratory Intern (SULI)**
  Thomas Jefferson National Accelerator Facility, June 2018 – August 2018
  Subject: Superconducting quadrupole magnet optimization
  Mentors: Renuka Rajput-Ghoshal

Publications in Preparation

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[1] https://github.com/CEMeNT-PSAAP/MCDC
[2] https://cement-psaap.github.io/

- **J. P. Morgan**, I. Variansyah, K. B. Clements, K. E. Niemeyer. Hybrid Woodcock-delta Tracking Schemes Using a Track-Length Estimator. **in preparation**

- **J. P. Morgan**, T. S. Palmer, and K. E. Niemeyer. Efficient Preconditioning for Space-Parallel One Cell Inversions in Slab Geometry using a Second Moment Method. **in preparation**

- M. Derman, **J. P. Morgan**, K. E. Niemeyer, T. S. Palmer. Unnamed paper on complex eigenvalue decomposition. **in preparation**

Conference and Poster Presentations

- **J. P. Morgan**, B. Cuneo, I. Variansyah, K. E. Niemeyer. May 2025. Enabling GPU Portability into the Numba-JITed Monte Carlo Particle Transport Code MC/DC. International Conference on Mathematics and Computational Methods Applied to Nuclear Science and Engineering (M&C 2025), Denver, CO

- **J. P. Morgan.** February 2025. AMD Tools Development Workshop, University of Oregon, Eugene, OR

- **J. P. Morgan**, K. E. Niemeyer. July 2024. Performant and Portable High-Performance Computing at Scale via Python and Numba. SciPy. Tacoma, WA

- **J. P. Morgan**. "Exploring One-Cell Inversions for Transient Transport on GPUs." Copper Mountain Conference on Iterative Methods (SIAM). April 2024.

- **J. P. Morgan**. "High Performance Python for Rapid Methods Development in Monte Carlo / Dynamic Code." Sustainable Scientific Software Conference. April 2024.

- **J. P. Morgan**, I. Variansyah, T. S. Palmer, and K. E. Niemeyer. "Exploring One-Cell Inversion Method for Transient Transport on GPU." High Energy Density Summer School, San Diego, California. July 2023

- **J. P. Morgan**, I. Variansyah, T. S. Palmer, and K. E. Niemeyer. "Exploring One-Cell Inversion Method for Transient Transport on GPU." International Conference on Mathematics and Computational Methods Applied to Nuclear Science and Engineering. Niagara Falls, Ontario, Canada (2023).

- **J. P. Morgan**, T. J. Trahan, T. P. Burke, C. J. Josey, and K. E. Niemeyer. "Hybrid-Delta Tracking on a Structured Mesh in MCATK." International Conference on Mathematics and Computational Methods Applied to Nuclear Science and Engineering. Niagara Falls, Ontario, Canada (2023).

- **J. P. Morgan**, T. S. Palmer, & K. E. Niemeyer, "Hardware Code Generation Techniques for Accelerating Python.", Scientific Python, Austin, Texas, USA, July 2022

- **J. P. Morgan**, T. S. Palmer, & K. E. Niemeyer, "Hardware Code Generation Techniques for Accelerating Python", Annual Meeting of the American Nuclear Society, Anaheim, California, USA, June 2022

- **J. P. Morgan**, A. Long, K. Long & K. E. Niemeyer, "A novel MC TRT method: vectorizable variance reduction for the energy spectra", Annual Meeting of the American Nuclear Society, Anaheim, California, USA, June 2022

- **J. P. Morgan** and B. Mustapha, "Carbon therapy X-Y scanner magnet analysis," in Lee Teng Internship - Posters and Final Report Presentations, Fermi National Accelerator Facility, Batavia, Illinois. August 2019.

- **J. P. Morgan** and R. Rajput-Ghoshal, "Jefferson lab electron ion collider interaction region quadrupole magnet optimization," in Undergraduate Research Poster Presentations, Thomas Jefferson National Accelerator Facility, Newport News, Virginia, August, 2018.

Conference Attendance and Professional Development

- May 2025, International Conference on Mathematics and Computational Methods Applied to Nuclear Science and Engineering (M&C 2025), Denver, CO*

- February 2025, AMD Tools Development Workshop*, University of Oregon, Eugene, OR

- July 2024, Scientific Computing in Python (SciPy), Tacoma, WA*

- May 2024, NEA Workshop for Radiation Transport Simulation Developers (RTS 2024), Frascati, Italy

- April 2024, 18th Copper Mountain Conference on Iterative Methods (SIAM), Copper Mountain, CO*

- April 2024, Sustainable Scientific Software Conference (S3C), Seattle, WA*

- January 2024, NUWEST, Albuquerque, NM
  unable to attend due to weather

- January 2024 US Research Software Sustainability Institute (URSSI), Portland, OR
  Hosted at Oregon State University Portland Center
  Attended as a teaching assistant

- August 2023, International Conference on Mathematics and Computational Methods Applied to Nuclear Science and Engineering (ANS M&C International), Niagara Falls, Ontario, Canada*

- July 2023, High Energy Density Science (HEDS) Summer School, San Diego, CA
  at University of California San Diego

- July 2022, Scientific Computing in Python (SciPy), Austin, TX*

- June 2022, American Nuclear Society Annual Conference, Anaheim, CA*

- October 2021, Conference on Mathematics and Computational Methods Applied to Nuclear Science (ANS M&C), Raleigh, North Carolina (*virtual*)

- June 2018, United States Particle Accelerator School (USPAS), Albuquerque, NM Fundamentals of Accelerator Physics and Technology with Simulations and Measurements Lab

  * presented at

Teaching Experience

- Supplemental Instructor, *Student Services & Dept. Natural Sciences*
  Oregon Institute of Technology, September 2017 – March 2020
  Class: Physics for medical imaging
  Directed by: Robyn Wilde

- Peer Consultant, *Student Services*
  Oregon Institute of Technology, January 2018 – June 2020
  Subjects: Numerical methods, differential & integral calculus, linear algebra, intro to algebra, trigonometry, college algebra, statistics, heat transfer, statics, thermodynamics, fluid dynamics, strengths of materials, physics with calculus.

- Mathematics Grader, *Dept. Mathematics*
  Oregon Institute of Technology, January 2018 – March 2020
  Subjects: Numerical methods (in MATLAB), differential & integral calculus, linear algebra, intro to algebra, trigonometry, college algebra, statistics.
  Directed by: Cristina Negoita and Terri Torres

Professional Affiliations

- Member, American Nuclear Society (ANS)

- Member, Out in Science Technology Engineering and Mathematics (oSTEM)

- Member, Tau Beta Pi, Oregon Delta 2018 (Engineering Honors Society)

Other Activities

- Volunteer; Whiteside Theater, Corvallis, OR (March 2023 – Present)

- Student Commissioner; Library Recourse Commission (October 2017 – June 2020).

- Committee Member; University Librarian Search Committee (March 2018 – June 2018).

- Student Building Manager; Oregon Institute of Technology College Union (February 2017 – March 2020).

- President; Oregon Institute of Technology Chapter of Circle K International Community Service Club (May 2019 – June 2020)

- Treasurer; Oregon Delta – Tau Beta Pi (May 2019 – May 2020)

- Notary Public; State of Oregon (November 17th, 2016 – November 16th, 2020)

Awards and Fellowships

- Illinois Accelerator Institute; *Lee Teng Undergraduate Research Fellowship in Accelerator Science* (2019).

- ASME; *Irma and Robert Bennett Scholarship* (2019).

- Pride Foundation; *Lenehan-Warn Technical Education Scholarship* (2017).

Skills

Languages and Language Adjecents
- C/C++ (OpenMP, C-CUDA, HIPCC/ROCm, Kokkos, AVX/SIMD, MPI, Intel MKL, LAPACK) (beginner-intermediate)
- Python (Numba, mpi4py, Numpy, Scipy, Matplotlib, CuPy, CProfiler) (intermediate)
- Matlab (intermediate), VBA in Excel
- FORTRAN (beginner)
- LLVM (beginner-intermediate)
- Compilers: Numba (LLVM bindings for Python), Intel Compilers, HIP and ROCm (Clang) compilers, GCC, CRAY Compilers

Software Development Tools
- Profilers: Intel Vtune, NVIDIA N-Sight, TotalView
- Debuggers: valgrind, gdb

Engineering Design and Simulation Tools
- CAD/CAE: Creo, SolidWorks, AutoCAD, Inventor, NX, CST Studio Suite (Electromagnetic Field Simulation), Opera (Electromagnetic and Electromechanical Simulation), FEMM
- Nuclear Engineering Codes: MCNP, MCATK (developed in), MC/DC (developed in), Shift (developed in)
- Visualization Toolkits: Paraview, Visit

MISC Development Tools:
- Services: Git(hub), Gitlab, Bitbucket,
- Terminal: Bash, z-shell, ssh & X-11 forwarding
- Package Publishing: Conda, PyPi, Sphinx, Read the Docs
- Continuous Integration: Github actions, Jakamar runners

- Website Builders: Sphinx, Read the Docs, Jekyll, Ruby
- LaTeX

REFERENCES

Available upon request