

Aaron M. Graham

Email: grahamam@ornl.gov
Business Address: 1 Bethel Valley Road, P.O. Box 2008, MS-6172,
Oak Ridge, TN 37831-6172
[ORNL Staff Profile](#) | [LinkedIn](#) | [ORCID](#) | [GitHub](#)

EDUCATION

University of Michigan Ann Arbor, Michigan
Ph.D., Nuclear Engineering and Radiological Sciences and Scientific Computing August 2017
Thesis: *Subgrid Methods for Resolving Axial Heterogeneity in Planar Synthesis
Solutions for the Boltzmann Transport Equation*
Advisors: Prof. Thomas Downar, Dr. Benjamin Collins

University of Michigan Ann Arbor, Michigan
B.S.E., Nuclear Engineering and Radiological Sciences May 2013

PROFESSIONAL EXPERIENCE

Oak Ridge National Laboratory Oak Ridge, Tennessee
Power Reactor Modeling Group, Nuclear Energy and Fuel Cycle Division June 2019 – Present
R&D Staff Member

- VERA Software Integrator and Technical Lead
- Lead developer for MPACT code
- Lead developer for nodal diffusion code Katana and nodal cross section generation methodology in MPACT
- Lead developer for Mole, a multi-species, multi-phased transport code for molten salt reactors modeling
- Developed a wide range of features in VERA to support modeling of PWRs, BWRs, gas-cooled reactors, and MSRs
- Multiphysics coupling with following code packages:
 - Thermochemica thermochemistry code for MSR modeling and simulation
 - CTF for thermal hydraulic feedback and MSR species transport
 - Simplified TH solvers for BWRs and PWRs (internal to MPACT)
 - Simplified species transport capability for MSRs (internal to MPACT)
 - MOOSE-based applications

Oak Ridge National Laboratory Oak Ridge, Tennessee
Reactor Physics Group, Reactor and Nuclear Systems Division August 2017 – May 2019
Postdoctoral Research Associate

- Implementation of hexagonal geometry support in MPACT mesh and solvers
- Generation of nodal constants to improve nodal core fidelity using VERA

- Added mass transport capabilities to VERA code package for MSR modeling and simulation
- New infrastructure for generating user-requested data in MPACT
- Implemented channel-based neutronics/TH coupling in VERA for MSR applications
- Implemented Sn transport sweepers in MPACT transport code
- Developed modeling capability for cylindrical cores in VERA

University of Michigan

Department of Nuclear Engineering and Radiological Sciences
Graduate Fellow, MPACT Development Team

Ann Arbor, Michigan
 January 2013 – August 2017

- Developed advanced techniques for capturing subgrid heterogeneities in planar synthesis methods (Ph.D. thesis topic)
- Investigation of MOC calculations on GPUs using OpenACC compiler directives
- Improvements to axial NEM solver in MPACT
- Added geometry modeling features to MPACT, including PWR baffle and semi-explicit spacer grid representation
- Implemented capability to use HDF5 libraries in MPACT
- Developed various models of Watts Bar Unit 1 PWR for MPACT transport code
- Numerous other contributions as parts of internships, listed below

Oak Ridge National Laboratory

Consortium for Advanced Simulation of Light Water Reactors
NESLS/CASL Summer Intern

Oak Ridge, Tennessee
 June 2016 – August 2016

- Modified subplane scheme in MPACT to improve homogenized cross-sections for 2D MOC calculations using 3D CMFD and 1D SP₃ results
- Developed new rod cusping technique based on subplane scheme
 - Modified subplane scheme to capture control rod effects in 3D CMFD and 1D SP_N calculations and improve homogenized 2D MOC cross-sections
 - Added capability to use 1D collision probabilities calculations to improve homogenized cross-sections for CMFD and SP₃ systems

Oak Ridge National Laboratory

Consortium for Advanced Simulation of Light Water Reactors
NESLS/CASL Summer Intern

Oak Ridge, Tennessee
 June 2015 – August 2015

- Modified MPACT's 2D/1D implementation by adding the subplane capability, allowing reduction in number of compute cores required for calculations
- Made improvements to CTF coupling and simplified TH implementations
- Provided support for transient development in MPACT
 - Improved rod cusping corrections for the Spert III E-core transient benchmark
 - Added capability to read transient data from cross-section library
 - Performed transient calculations using OLCF computing resources

Oak Ridge National Laboratory

Consortium for Advanced Simulation of Light Water Reactors
NESLS/CASL Summer Intern

Oak Ridge, Tennessee
 June 2014 – August 2014

- Developed simple, efficient control rod cusping correction for MPACT 2D/1D code
- Implemented simplified thermal-hydraulics capability in MPACT to provide approximate TH feedback to neutronics calculations
- Implemented multiphysics coupling between MPACT transport code and CTF TH code

Westinghouse Electric Company

Methods Group

Summer Intern

Cranberry Township, Pennsylvania

May 2013 – August 2013

- Configured and compiled VERA code package on Westinghouse computing clusters
- Built AP1000TM PWR models for MPACT transport code
- Performed simulation and analysis of AP1000TM models using MPACT on Westinghouse and Oak Ridge National Laboratory computing clusters
- Implemented new features and bug fixes in MPACT to aid AP1000TM simulations

JOURNAL ARTICLES

10. (Submitted) Kyoung Lee, Matthew Jessee, **Aaron Graham**, Dave Kropaczek, “Coupled Neutronics and Species Transport Simulation of the Molten Salt Reactor Experiment,” targeting *Nuclear Engineering and Design*.
9. Nicholas Herring, Benjamin Collins, Thomas Downar, **Aaron Graham**, “[The Legendre Polynomial Axial Expansion Method](#),” *Nuclear Science and Engineering*, July 2022.
8. Zack Taylor, Robert Salko, **Aaron Graham**, Benjamin Collins, Ivan Maldonado, “[Implementation of Two-Phase Gas Transport into VERA for Molten Salt Reactor Analysis](#),” *Annals of Nuclear Energy* 165, January 2022.
7. **Aaron Graham**, Robert Salko, Benjamin Collins, Zack Taylor, “[Multiphysics Coupling Methods for Molten Salt Reactor Modeling and Simulation in VERA](#),” *Nuclear Science and Engineering* 195(10), pp. 1065-1086, October 2021.
6. Luke Cornejo, Benjamin Collins, Shane Stimpson, **Aaron Graham**, “[Multilevel in Space and Energy CMFD in VERA](#),” *Nuclear Science and Engineering* 195(8), pp. 890-905, August 2021.
5. Shane Stimpson, **Aaron Graham**, Benjamin Collins, “[Extended Applications of Subgrid Representation in the MPACT 2D/1D Code](#),” *Nuclear Science and Engineering* 195(7), pp. 778-793, July 2021.
4. **Aaron Graham**, Benjamin Collins, Thomas Downar, “[The Subray Method of Characteristics](#),” *Nuclear Science and Engineering* 193(6), pp. 601-621, January 2019.
3. **Aaron Graham**, Benjamin Collins, Shane Stimpson, Thomas Downar, “[Subplane Collision Probabilities Method Applied to Control Rod Cusping in 2D/1D](#),” *Annals of Nuclear Energy* 118, pp. 1-14, August 2018.

2. Brendan Kochunas, Benjamin Collins, Shane Stimpson, Robert Salko, Daniel Jabaay, **Aaron Graham**, Yuxuan Liu, Kang-Seog Kim, William Wieselquist, Andrew Godfrey, Kevin Clarno, Scott Palmtag, Thomas Downar, Jess Gehin, “[VERA Core Simulator Methodology for PWR Cycle Depletion](#),” *Nuclear Science and Engineering* 185(1), pp. 217-231, February 2017.
1. Benjamin Collins, Shane Stimpson, Blake Kelley, Mitchell Young, Brendan Kochunas, **Aaron Graham**, Edward Larsen, Thomas Downar, “[Stability and Accuracy of Three-Dimensional Neutron Transport Simulations Using the 2D/1D Method in MPACT](#),” *Journal of Computational Physics* 326, pp. 612-628, August 2016.

Conference Papers

30. (Invited) Robert Salko, Belgacem Hizoum, Vineet Kumar, Aaron Wysocki, **Aaron Graham**, Dave Kropaczek, Agustin Abarca, Maria Avramova, Benjamin Collins, “Subchannel Methods Development for Modeling of Light Water Reactors at Oak Ridge National Laboratory,” Proceedings of *NURETH-20*, Washington, D.C., USA (August 20–25, 2023).
29. **Aaron Graham**, Kang-Seog Kim, “[On-the-Fly Energy Group Condensation for Whole-Core Multiphysics Simulations](#),” Proceedings of *ANS Summer Conference 2023*, Indianapolis, IN, USA (June 11–14, 2023).
28. **Aaron Graham**, Andrew Godfrey, Benjamin Collins, “[Multiphysics Decay Heat Coupling for Light-Water Reactor Safety Analysis](#),” Proceedings of *ANS Summer Conference 2023*, Indianapolis, IN, USA (June 11–14, 2023).
27. Ryan Sweet Ian Greenquist, **Aaron Graham**, Clay Lietwiler, Faisal Odeh, Malinda Saia, “[Coupled Neutronics, Thermal Hydraulics, and Fuel Performance Simulations of a Natural Circulation Based SMR](#),” Proceedings of *ANS Summer Conference 2023*, Indianapolis, IN, USA (June 11–14, 2023).
26. **Aaron Graham**, Benjamin Collins, Robert Salko, Mehdi Asgari, “[Multiscale Thermal Hydraulic Coupling Methods for Boiling Water Reactor Simulation](#),” Proceedings of *Physor 2022*, Pittsburgh, PA, USA (May 15–20, 2022).
25. Jordan Rader, Andrew Godfrey, **Aaron Graham**, Clay Lietwiler, Hunter Smith, Malinda Saia, “[Comparisons of Nodal Diffusion and Whole-Core Transport Methods for Multiple Cycles of a Small Light Water Reactor](#),” Proceedings of *Physor 2022*, Pittsburgh, PA, USA (May 15–20, 2022).
24. Kyle Gamble, Aysenur Toptan, Pierre-Clement Simon, **Aaron Graham**, Mehdi Asgari, Baris Sarikaya, James Tusar, Moussa Mahgerefteh, “[Pellet Cladding Mechanical Interaction as a Potential Failure Mechanism During a Control Rod Drop Accident in a Boiling Water Reactor](#),” Proceedings of *Physor 2022*, Pittsburgh, PA, USA (May 15–20, 2022).
23. Sooyoung Choi, Andrew Ward, **Aaron Graham**, Benjamin Collins, Brendan Kochunas, Mehdi Asgari, “[Preliminary Simulation Results of Peach Bottom Unit 2](#),” Proceedings of *Physor 2022*, Pittsburgh, PA, USA (May 15–20, 2022).
22. Kang-Seog Kim, **Aaron Graham**, Matthew Jessee, “[Dancoff-based Wigner-Seitz Approximation for the Subgroup Resonance Self-Shielding in the VERA Neutronics Simulator MPACT](#),” Proceedings of *Physor 2022*, Pittsburgh, PA, USA (May 15–20, 2022).

21. Kyoung Lee, Benjamin Collins, Zack Taylor, **Aaron Graham**, “[Transient Convective Delayed Neutron Precursors of \$^{235}\text{U}\$ for the Molten Salt Reactor Experiment](#),” Proceedings of *Physor 2022*, Pittsburgh, PA, USA (May 15–20, 2022).
20. Tarek Ghaddar, **Aaron Graham**, Benjamin Collins, “[Method of Characteristics Sweep Acceleration in MPACT Using GPUs](#),” Proceedings of Transactions of the American Nuclear Society 124(1), pp. 206–208 (June 2021).
19. **Aaron Graham**, Shane Stimpson, Benjamin Collins, Thomas Downar, “[Subgrid Methods to Address Axial Heterogeneities in MPACT](#),” Proceedings of Proceedings of the Consortium for Advanced Simulation of Light Water Reactors Symposium (embedded in ANS Winter Conference), pp. 410–416 (November 16–19, 2020).
18. Shane Stimpson, Fausto Franceschini, Benjamin Collins, Andrew Godfrey, Kang-Seog Kim, **Aaron Graham**, “[MPACT Diffusion Coefficient Improvement through Westinghouse Collaboration](#),” Proceedings of Proceedings of the Consortium for Advanced Simulation of Light Water Reactors Symposium (embedded in ANS Winter Conference), pp. 404–409 (November 16–19, 2020).
17. Baocheng Zhang, **Aaron Graham**, Fausto Franceschini, “[Use of VERA to Improve Baffle/Reflector Data Generation for Westinghouse Core Design Code System](#),” Proceedings of Proceedings of the Consortium for Advanced Simulation of Light Water Reactors Symposium (embedded in ANS Winter Conference), pp. 129–136 (November 16–19, 2020).
16. Benjamin Collins, Shane Stimpson, **Aaron Graham**, “[The 2D/1D Method: Past, Present, and Future](#),” Proceedings of Proceedings of the Consortium for Advanced Simulation of Light Water Reactors Symposium (embedded in ANS Winter Conference), pp. 51–56 (November 16–19, 2020).
15. Aaron Reynolds, Shane Stimpson, **Aaron Graham**, “[Control Rod Depletion in MPACT](#),” Proceedings of Transactions of the American Nuclear Society 123, pp. 1323–1326 (November 16–19, 2020).
14. Kevin Connolly, **Aaron Graham**, “[Extending MPACT to 2D Hexagonal Geometry](#),” Proceedings of Transactions of the American Nuclear Society 122(1), pp. 399–402 (June 2020).
13. Paul Turinsky, **Aaron Graham**, Hisham Sarsour, Benjamin Collins, “[Generation of Nodal Core Simulator Utilizing VERA Core Simulator](#),” Proceedings of *Physor 2020: Transition to a Scalable Nuclear Future*, Cambridge, UK (March 29 – April 2, 2020).
12. Shane Stimpson, **Aaron Graham**, Benjamin Collins, “[Development of a Coupled Subplane Capability in MPACT](#),” Proceedings of *Physor 2020: Transition to a Scalable Nuclear Future*, Cambridge, UK (March 29 – April 2, 2020).
11. **Aaron Graham**, Benjamin Collins, Robert Salko, Zack Taylor, Cole Gentry, “[Development of Molten Salt Reactor Modeling and Simulation Capabilities in VERA](#),” Proceedings of *Global and Top Fuel 2019*, Seattle, WA, USA (September 2019).
10. Shane Stimpson, **Aaron Graham**, Benjamin Collins, “[Subgrid Treatments of Spacer Grids in the 2D/1D Subplane Approach](#),” Proceedings of *M&C 2019*, Portland, OR, USA (August 2019).

9. Shane Stimpson, **Aaron Graham**, Benjamin Collins, “[Enhancements to the 2D/1D Subplane Method in MPACT](#),” Proceedings of *M&C 2019*, Portland, OR, USA (August 2019).
8. **Aaron Graham**, Benjamin Collins, Thomas Downar, “[Resolving Subgrid Heterogeneity Using the Subray Method of Characteristics](#),” Proceedings of *Physor 2018*, Cancun, Mexico (April 2018).
7. **Aaron Graham**, Benjamin Collins, Thomas Downar, “[Subplane-based Rod Decussing Techniques for the 2D/1D Method in MPACT](#),” Proceedings of *M&C 2017*, Jeju, Korea (April 2017).
6. **Aaron Graham**, Benjamin Collins, Thomas Downar, “[Improvement of the 2D/1D Method in MPACT Using the Subplane Scheme](#),” Proceedings of *M&C 2017*, Jeju, Korea (April 2017).
5. **Aaron Graham**, Benjamin Collins, Thomas Downar, “[Assessment of Thermal Hydraulic Feedback Models](#),” Proceedings of *Physor 2016*, Sun Valley, ID, USA (May 2016).
4. Brendan Kochunas, Benjamin Collins, Daniel Jabaay, Shane Stimpson, **Aaron Graham**, Kang-Seog Kim, William Wieselquist, Kevin Clarno, Scott Palmtag, Thomas Downar, Jess Gehin, “[VERA Core Simulator Methodology for PWR Cycle Depletion](#),” Proceedings of *M&C 2015*, Nashville, TN, USA (April 2015).
3. Shane Stimpson, Fausto Franceschini, Benjamin Collins, Andrew Godfrey, Kang-Seog Kim, **Aaron Graham**, Thomas Downar, “[Improved Diffusion Coefficients for 2D/1D Axial Transport Solvers Applied to AP1000 Models](#),” Proceedings of *M&C 2015*, Nashville, TN, USA (April 2015).
2. Ang Zhu, Yunlin Xu, **Aaron Graham**, Mitchell Young, Thomas Downar, Liangzhi Cao, “[Pin-resolved Whole Core Transient for the 2D-1D Methodology in MPACT](#),” Proceedings of *M&C 2015*, Nashville, TN, USA (April 2015).
1. Fausto Franceschini, Andrew Godfrey, Shane Stimpson, Thomas Evans, Benjamin Collins, Jess Gehin, John Turner, **Aaron Graham**, Thomas Downar, “[AP1000 PWR Start-up Core Modeling and Simulation with VERA-CS](#),” Proceedings of *Advances in Nuclear Fuel Management V*, Hilton Head Island, SC, USA (March 2015).

Technical Reports

41. **Aaron Graham**, Kang-Seog Kim, “[On-the-Fly Energy Condensation for Whole-Core Multiphysics Simulations](#),” Oak Ridge National Laboratory Tech. Report ORNL/TM-2023/2927 (May 2023).
40. **Aaron Graham**, Andrew Godfrey, “[Coupled Decay Heat and Thermal Hydraulic Capability for Loss-of-Coolant Accident Simulations](#),” Oak Ridge National Laboratory Tech. Report ORNL/TM-2023/2903 (April 2023).
39. Kyoung Lee, Dave Kropaczek, Donny Hartanto, Matthew Jessee, **Aaron Graham**, Jorge Paz Soldan Palma, Theodore Besman, “[Uncertainty Quantification Methodology for Off-Gas Source Term for the IMSR®](#),” Oak Ridge National Laboratory Tech. Report ORNL/SPR-2023/2708 (January 10, 2023).

38. Kyoung Lee, Zack Taylor, **Aaron Graham**, Matthew Jessee, “Mole FY22 Development Activities,” Oak Ridge National Laboratory Tech. Report ORNL/SPR-2022/2642 (September 2022).
37. Mark Baird, Benjamin Collins, Andrew Godfrey, **Aaron Graham**, Brendan Kochunas, Ron Lee, Robert Lefebvre, Robert Salko, Erik Walker, Tara Pandya, William Gurecky, “[VERA 4.3 Release Notes](#),” Oak Ridge National Laboratory Tech. Report ORNL/SPR-2022/2533 (September 2022).
36. **Aaron Graham**, Daniel Jabaay, Yuxuan Liu, Brendan Kochunas, Shane Stimpson, Benjamin Collins, “[MPACT Programmer’s Manual Version 4.3](#),” Oak Ridge National Laboratory Tech. Report ORNL/SPR-2021/2327 (September 2022).
35. Thomas Downar, Brendan Kochunas, **Aaron Graham**, Shane Stimpson, Benjamin Collins, “[MPACT Software Management Plan](#),” Oak Ridge National Laboratory Tech. Report ORNL/SPR-2021/2328 (September 2022).
34. **Aaron Graham**, Brendan Kochunas, “[MPACT Software Test Plan, Requirements, and Test Report Version 4.3](#),” Oak Ridge National Laboratory Tech. Report ORNL/SPR-2021/2329 (September 2022).
33. Editors: Edward Larsen, Benjamin Collins, Brendan Kochunas, **Aaron Graham**, Shane Stimpson, “[MPACT Theory Manual Version 4.3](#),” Oak Ridge National Laboratory Tech. Report ORNL/SPR-2021/2330 (September 2022).
32. Daniel Jabaay, **Aaron Graham**, “[MPACT User’s Manual Version 4.3](#),” Oak Ridge National Laboratory Tech. Report ORNL/SPR-2021/2331 (September 2022).
31. Thomas Downar, Brendan Kochunas, Yuxuan Liu, Shane Stimpson, **Aaron Graham**, “[MPACT Verification and Validation Manual Version 4.3](#),” Oak Ridge National Laboratory Tech. Report ORNL/SPR-2021/2332 (September 2022).
30. Luke Cornejo, Jake Hirschhorn, **Aaron Graham**, Benjamin Collins, “[VERAOneWay Coupling for Transients](#),” Oak Ridge National Laboratory Tech. Report ORNL/TM-2022/2581 (August 2022).
29. **Aaron Graham**, Robert Salko, Mehdi Asgari, Dave Kropaczek, “[Bypass Flow Model Implementation for VERA BWR](#),” Oak Ridge National Laboratory Tech. Report ORNL/TM-2022/2552 (August 2022).
28. Jordan Rader, **Aaron Graham**, Andrew Godfrey, Ryan Sweet, Ian Greenquist, “Coupled Neutronic and Thermal Hydraulic Analysis of a Natural Circulation Based Small Modular Reactor (SMR) Using VERA,” Oak Ridge National Laboratory Tech. Report ORNL/TM-2021/2303 (April 2022).
27. Mehdi Asgari, Dave Kropaczek, **Aaron Graham**, Robert Salko, Kang-Seog Kim, Kyle Gamble, Aysenur Toptan, Scott Palmtag, Thomas Downar, Brendan Kochunas, Tomasz Kozlowski, “Final Report for “Modeling and Analysis of Exelon BWRs for Eigenvalue & Thermal Limits Predictability” Projects,” Oak Ridge National Laboratory Tech. Report ORNL/TM-2021/2349 (December 2021).

26. **Aaron Graham**, Shane Henderson, Robert Salko, Aaron Wysocki, Benjamin Collins, “[VERA Transient Capability to Support ATF/High Burnup Fuel/HALEU Conversion](#),” Oak Ridge National Laboratory Tech. Report ORNL/SPR-2021/2325 (November 2021).
25. Tarek Ghaddar, **Aaron Graham**, “[Hexagonal Geometries in MPACT](#),” Oak Ridge National Laboratory Tech. Report ORNL/TM-2021/2180 (August 2021).
24. Jake McMurray, Kaitlin Johnson, Benjamin Collins, **Aaron Graham**, Kyoung Lee, Benjamin Betzler, Zack Taylor, Robert Salko, Shane Henderson, Markus Piro Rui Hu, David Holcomb, “[Integration Roadmap for Multi-scale, Multi-physics Mass Accountancy in Molten Salt Reactors](#),” Oak Ridge National Laboratory Tech. Report ORNL/SPR-2021/1866 (September 30, 2021).
23. Hisham Sarsour, Igor Arshavsky, Benjamin Collins, **Aaron Graham**, Robert Salko, Aaron Wysocki, Paul Turinsky, “Fidelity Enhancement of Nuclear Power Plant Simulators Utilizing High Fidelity Simulation Predictions,” Oak Ridge National Laboratory Tech. Report ORNL/SPR-2021/2033 (June 13, 2021).
22. Robert Salko, Belgacem Hizoum, **Aaron Graham**, Benjamin Collins, Mehdi Asgari, “[Summary of CTF Modeling and Numerical Improvements for Boiling Water Reactor Simulation](#),” Oak Ridge National Laboratory Tech. Report ORNL/TM-2021/2004 (May 1, 2021).
21. Mark Baird, Benjamin Collins, William Cramer, Andrew Godfrey, **Aaron Graham**, Brendan Kochunas, Ron Lee, Robert Lefebvre, Lori Moore, Tara Pandya, Robert Salko, Erik Walker, “VERA 4.2 Release Notes,” Oak Ridge National Laboratory Tech. Report CASL-U-2020-1945-000 (March 31, 2021).
20. Kang-Seog Kim, Erik Walker, Benjamin Collins, Matthew Jessee, Tara Pandya, Ugur Meretyurek, **Aaron Graham**, “Neutron-Gamma Coupled Transport Capability of MPACT for Gamma Detector Response,” Oak Ridge National Laboratory Tech. Report ORNL/TM-2021/1926 (February 28, 2021).
19. Daniel Jabaay, **Aaron Graham**, “MPACT User’s Manual Version 4.2,” Oak Ridge National Laboratory Tech. Report ORNL/TM-2021/1908 (March 31, 2021).
18. Thomas Downar, Brendan Kochunas, **Aaron Graham**, Shane Stimpson, Benjamin Collins, “MPACT Software Management Plan (Rev. 2),” Oak Ridge National Laboratory Tech. Report ORNL/TM-2021/1912 (March 31, 2021).
17. Luke Cornejo, Shane Stimpson, **Aaron Graham**, Benjamin Collins, “[Coupling MOOSE-Wrapped MPACT to Bison](#),” Oak Ridge National Laboratory Tech. Report ORNL/TM-2020/1804 (October 16, 2020).
16. **Aaron Graham**, Benjamin Collins, “Integration of Analysis Tools for Multiphysics Molten Salt Reactor Analysis,” Oak Ridge National Laboratory Tech. Report ORNL/SPR-2020/1886 (September 30, 2020).
15. **Aaron Graham**, Rishi Pillai, Benjamin Collins, Jake McMurray, “[Engineering Scale Molten Salt Corrosion and Chemistry Code Development](#),” Oak Ridge National Laboratory Tech. Report ORNL/SPR-2020/1582 (July 31, 2020).

14. Robert Salko, **Aaron Graham**, Robert Lefebvre, Brandon Langley, "[Demonstration of MSR Salt Property Database Operation with a Reactor Analysis Tool](#)," Oak Ridge National Laboratory Tech. Report ORNL/TM-2019/1362 (September 30, 2019).
13. Daniel Jabaay, Yuxuan Liu, Brendan Kochunas, Shane Stimpson, **Aaron Graham**, Benjamin Collins, "MPACT Programmer's Manual," Oak Ridge National Laboratory Tech. Report CASL-U-2019-1876-000 (July 30, 2019).
12. Yuxuan Liu, Robert Salko, Daniel Jabaay, Brendan Kochunas, Kang-Seog Kim, **Aaron Graham**, Benjamin Collins, "Development of Explicit Heat Calculation and Coupling between MPACT and CTF," Oak Ridge National Laboratory Tech. Report CASL-U-2019-1807-000 (February 28, 2019).
11. Shane Stimpson, **Aaron Graham**, Benjamin Collins, "[Enhancements to the Subplane Capability in MPACT](#)," Oak Ridge National Laboratory Tech. Report CASL-U-2018-1738-000 (December 21, 2018).
10. Brendan Kochunas, Shane Stimpson, Yuxuan Liu, Ben Yee, Ang Zhu, Andrew Fitzgerald, **Aaron Graham**, Benjamin Collins, Kang-Seog Kim, "MPACT Performance Improvement in VERA-CS," Oak Ridge National Laboratory Tech. Report CASL-U-2016-1115-000 (June 30, 2016).
9. MPACT Development Team, "MPACT Theory Manual Version 2.2.0," Oak Ridge National Laboratory Tech. Report CASL-U-2016-1107-000 (June 9, 2016).
8. MPACT Development Team, "MPACT Standard Input User's Manual Version 2.2.0," Oak Ridge National Laboratory Tech. Report CASL-U-2016-1108-000 (June 9, 2016).
7. MPACT Development Team, "MPACT VERA Input User's Manual Version 2.2.0," Oak Ridge National Laboratory Tech. Report CASL-U-2016-1109-000 (June 9, 2016).
6. Kang-Seog Kim, Benjamin Collins, **Aaron Graham**, Brendan Kochunas, Yuxuan Liu, Scott Palmtag, Aaron Pawel, Shane Stimpson, Erik Walker., "Improvement of the VERA Neutronics Simulator MPACT," Oak Ridge National Laboratory Tech. Report CASL-I-2015-0289-000 (August 21, 2015).
5. Brendan Kochunas, Benjamin Collins, **Aaron Graham**, Daniel Jabaay, Shane Stimpson, Kang-Seog Kim, William Wieselquist, Robert Salko, Thomas Downar, "Operational Reactor Depletion Analysis Capability," Oak Ridge National Laboratory Tech. Report CASL-U-2014-0189-000 (September 30, 2014).
4. Yunlin Xu, Ang Zhu, **Aaron Graham**, Andrew Gerlach, Liangzhi Cao, Thomas Downar, John Lee, "[Implementation of the Transient Capability in MPACT: Phase II](#)," Oak Ridge National Laboratory Tech. Report CASL-I-2014-0186-000 (September 30, 2014).
3. Benjamin Collins, **Aaron Graham**, Ang Zhu, Brendan Kochunas, Thomas Downar, "Demonstration of Full Core Reaction Depletion with MPACT," Oak Ridge National Laboratory Tech. Report CASL-U-2014-0140-000 (August 10, 2014).
2. Benjamin Collins, Ang Zhu, Daniel Jabaay, **Aaron Graham**, Thomas Downar, "Demonstration of Reactor Startup Flux Maps with MPACT," Oak Ridge National Laboratory Tech. Report CASL-X-2014-XXXX-000 (May 31, 2014).

1. Mitchell Young, Yunlin Xu, **Aaron Graham**, Andrew Gerlach, Benjamin Collins, Thomas Downar, John Lee, “Implementation of the Transient Capability in MPACT: Phase I,” Oak Ridge National Laboratory Tech. Report CASL-I-2014-0044-000 (March 31, 2014).

Miscellaneous Presentations

8. High-Fidelity Multiphysics Core Simulations of Molten Salt Reactors, “2019 MeV School Reception,” Oak Ridge National Laboratory, Oak Ridge, Tennessee (July 15, 2019).
7. VERA-MSR Workshop, “VERA Neutronics and Multiphysics Coupling Training Sessions,” Oak Ridge National Laboratory, Oak Ridge, Tennessee (February 12, 2019).
6. ORNL Postdoc Symposium 2018 Poster Session, “High-Fidelity Multiphysics Core Simulations of Molten Salt Reactors Using VERA-MSR,” Oak Ridge National Laboratory, Oak Ridge, Tennessee (August 2018).
5. NESLS Internship Poster Session, “Dynamic Control Rod Homogenization Methods in MPACT,” Oak Ridge National Laboratory, Oak Ridge, Tennessee (August 2016).
4. NESLS Internship Poster Session, “Improvement of Axial Resolution in MPACT Transport Code,” Oak Ridge National Laboratory, Oak Ridge, Tennessee (August 2015).
3. CASL Student Workshop Poster Session, “Rod Cusping Treatment in MPACT,” Oak Ridge National Laboratory, Oak Ridge, Tennessee (June 2015).
2. NESLS Internship Poster Session, “Rod Cusping Treatment in MPACT,” Oak Ridge National Laboratory, Oak Ridge, Tennessee (August 2014).
1. Westinghouse Internship Poster Session, “Modeling the AP1000™ PWR in MPACT,” Westinghouse Electric Company, Cranberry Township, Pennsylvania (August 2013).

AWARDS & SERVICE

Mentoring

Matthew Louis	ORNL Summer Intern, 2023 Integration of VERA with the NEAMS Workbench
Aaron Reynolds	ORNL Summer Intern, 2019 Implementation of Control Rod Depletion in VERA
Zack Taylor	University of Tennessee Ph.D. Student / ORNL Summer Intern, 2018 – Present Mass transport and chemistry model developments in VERA-MSR
Shane Henderson	ORNL post-bachelor’s, 2017 – 2018 VERA Development
Jake Gorton	ORNL Summer Intern, 2018 Multiphysics calculations of BWRs using VERA
Tarek Ghaddar	ORNL Summer Intern, 2018 Method of Characteristics Calculations on GPU Using Kokkos

Copyrights

- Copyright TXu 2-159-078 for [MPACT](#)
- Copyright TXu 2-359-676 for [Mole](#)
- Copyright TXu 2-312-454 for [Katana](#)

ORNL Awards

- Technology Commercial License for VERA: Electric Power Research Institute, Westinghouse Electric Company, Western Services Corporation, Analysis and Measurement Services Corp., Exelon Generation Co., Framatome

Other Service and Awards

- Conference Paper Reviews: Global/Top Fuel, Physor, M&C, ANS Conferences
Journal Reviews: *Nuclear Science and Engineering*
Annals of Nuclear Energy
Computer Physics Communications
- Professional Service: ANS University of Michigan Student Chapter, Secretary (2013 AY)
Honor Societies: Alpha Nu Sigma
Professional Societies: American Nuclear Society (ANS)
Scholarships: University of Michigan Regents Merit Scholarship (2009 AY)
Michigan Competitive Scholarship (2009–2013 AY)
University of Michigan Engineering Budd Scholarship (2010 AY)
Fellowships: National Academy for Nuclear Training Scholarship (2013 AY)
NEUP IUP Graduate Fellowship (2014-2016 AY)

TECHNICAL SKILLS

- Languages: Fortran 90/2003, Python, C++
High Performance Computing: MPI, OpenMP, OpenACC,
experience with a variety of HPC platforms
Development Tools: Git, TriBITS, CMake, Visual Studio,
Profiling/Debugging Tools (gdb, Alinea ddt, gprof, valgrind, etc.)
Physics Codes – User: MCNP, KENO, Thermochemica, MOOSE applications
Physics Codes – Developer: VERA, MPACT, CTF, Futility, MOOSE applications
Other Software: MATLAB, Mathematica, \LaTeX , Microsoft Office
Training/Development Courses: Construx Online Courses
2018 MeV School - Advanced Reactors, Argonne National Lab
Construx Software Bootcamp