David Pugmire, Ph.D.

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Education

Ph.D. Computer Science University of Utah, Salt Lake City, UT (2000)
Advisors: Professors Elaine Cohen, Christopher Johnson and Richard Risenfeld
B.S. Computer Science University of Utah, Salt Lake City, UT (1992)

Professional Experience

2021-Present	Distinguished Research Scientist, ORNL
2020-Present	Visualization Group Lead, ORNL
2016-Present	Joint Faculty Professor, EE and CS Department, University of Tennessee
2015-2021	Senior Research Scientist, ORNL
2013-2020	Visualization Team Lead, Scientific Data Group, ORNL
2011-2015	Research Scientist, Scientific Data Group, ORNL
2011-2013	Visualization Team Lead, Scientific Computing Group, ORNL
2007-2011	Research Scientist, Scientific Computing Group, ORNL
2003-2007	Research Scientist, High Performance Computing Group, LANL
2000-2003	Design Manager, IronCAD, LLC, Atlanta, GA.
1997-2000	Lead Software Engineer, IronCAD, LLC, Atlanta, GA.

Awards

1. Best Short Paper: "HyLiPoD: Parallel Particle Advection Via a Hybrid of Lifeline Scheduling and Parallelization-Over-Data". At EuroGraphics Symposium on Parallel Graphics and Visualization, 2021.
2. Honorable Mention Best Paper: "A Lifeline-Based Approach for Work Requesting and Parallel Particle Advection." At the IEEE Symposium on Large Data Visualization and Analysis (LDAV) 2019.
3. Best Paper Finalist, EGPGV 2018: "Performance-portable particle advection with VTK-m". At EuroGraphics Symposium on Parallel Graphics and Visualization, 2018.

4. Long Term Paper Impact, Computer Science and Mathematics Division, ORNL, December 2018: "Extreme scaling of production visualization software on diverse architectures". In IEEE Computer Graphics and Applications, 30:3, 2010.
5. Best Paper Finalist: "Performance Modeling of In Situ Rendering." At the International Conference for High Performance Computing, Networking, Storage and Analysis (SC) 2016.
6. Significant Event Award for "In Transit Visualization of Fusion Simulations", Dec 2016
7. Employee of the Month, Computing and Computational Sciences Directorate, June 2011
8. Significant Event Award for "Support to DOE in response to the Fukushima Daiichi damaged reactors", May 2011
9. SciDAC Vis Night 2011 juried award for best visual aesthetics for Magnetic Field Outflows from Active Galactic Nuclei.
10. People's Choice Awards, SciDAC Vis Night 2011 for Magnetic Field Outflows from Active Galactic Nuclei.
11. People's Choice Awards, SciDAC Vis Night 2011 for Magnetic Fields in Core-Collapse Supernovae
12. People's Choice Award, SciDAC Vis Night 2010, for Clean Energy for the Future with the ITER Reactor
13. ORNL Science and Technology Award of Excellence, 2010
14. R&D 100 Award for NPU-Based Image Compositor, 2006
15. Los Alamos Exceptional Contribution Award, 2006
16. Computing Division Exceptional Contribution Award, Los Alamos National Laboratory, 2005
17. Computing Division Exceptional Contribution Award, Los Alamos National Laboratory, 2004

Publications

[1] Tushar M Athawale, Chris R Johnson, Sudhanshu Sane, and David Pugmire. Fiber uncertainty visualization for bivariate data with parametric and nonparametric noise models. *IEEE Transactions on Visualization and Computer Graphics*, 2022

[2] Choongseok Chang, Seung-Hoe Ku, Michael Churchill, Ralph Kube, Robert Hager, Hanqi Guo, Jong Choi, David Pugmire, and Scott Klasky. Discovery of microturbulent homoclinic tangle near magnetic x-point from the xgc total-f electromagnetic simulation. *Bulletin of the American Physical Society*, 2022

[3] David Pugmire, Richard Archibald, and Scott Klasky. Maintaining trust in reduction: Preserving the accuracy of quantities of interest for lossy compression. *Driving*

Scientific and Engineering Discoveries Through the Integration of Experiment, Big Data, and Modeling and Simulation: 21st Smoky Mountains Computational Sciences and Engineering, SMC 2021, Virtual Event, October 18-20, 2021, Revised Selected Papers, page 22, 2022

[4] Ken Moreland, Dave Pugmire, Berk Geveci, Li-Ta Lo, Hank Childs, Mark Bolstad, Ruchi Shah, and Panruo Wu. The importance of scientific visualization on novel hardware. Technical report, Oak Ridge National Lab.(ORNL), Oak Ridge, TN (United States), 2022

[5] Abhishek Yenpure, Sudhanshu Sane, Roba Binyahib, David Pugmire, Christoph Garth, and Hank Childs. A guide to particle advection performance. *arXiv preprint arXiv:2201.08440*, 2022

[6] Rushil Anirudh, Rick Archibald, M Salman Asif, Markus M Becker, Sadruddin Benkadda, Peer-Timo Bremer, Rick HS Budé, CS Chang, Lei Chen, RM Churchill, et al. 2022 review of data-driven plasma science. *arXiv preprint arXiv:2205.15832*, 2022

[7] E Bethel, Burlen Loring, Utkarsh Ayachit, David Camp, Earl PN Duque, Nicola Ferrier, Joseph Insley, Junmin Gu, James Kress, Patrick O'Leary, et al. The sensei generic interface: Tool and processing portability at scale. In *In Situ Visualization for Computational Science*, pages 281–306. Springer, Cham, 2022

[8] Eric Suchyta, Scott Klasky, Norbert Podhorszki, Matthew Wolf, Abolaji Adesoji, CS Chang, Jong Choi, Philip E Davis, Julien Dominski, Stéphane Ethier, et al. The exascale framework for high fidelity coupled simulations (effis): Enabling whole device modeling in fusion science. *The International Journal of High Performance Computing Applications*, 36(1):106–128, 2022

[9] David Pugmire, Norbert Podhorszki, Scott Klasky, Matthew Wolf, James Kress, Mark Kim, Nicholas Thompson, Jeremy Logan, Ruonan Wang, Kshitij Mehta, et al. The adaptable io system (adios). In *In Situ Visualization for Computational Science*, pages 233–254. Springer, Cham, 2022

[10] E Bethel, Burlen Loring, Utkarsh Ayachit, Earl PN Duque, Nicola Ferrier, Joseph Insley, Junmin Gu, James Kress, Patrick O'Leary, Dave Pugmire, et al. Proximity portability and, m-to-n data partitioning and movement in sensei. In *In Situ Visualization for Computational Science*, pages 439–460. Springer, Cham, 2022

[11] Mengjiao Han, Tushar M Athawale, David Pugmire, and Chris R Johnson. Accelerated probabilistic marching cubes by deep learning for time-varying scalar ensembles. *arXiv preprint arXiv:2207.07260*, 2022

[12] Ana Gainaru, Lipeng Wan, Ruonan Wang, Eric Suchyta, Jieyang Chen, Norbert Podhorszki, James Kress, David Pugmire, and Scott Klasky. Understanding the

impact of data staging for coupled scientific workflows. *IEEE Transactions on Parallel and Distributed Systems*, 2022

[13] Ken Moreland, Dave Pugmire, and Jieyang Chen. The exploitation of data reduction for visualization. Technical report, Oak Ridge National Lab.(ORNL), Oak Ridge, TN (United States), 2022

[14] Roba Binyahib, David Pugmire, and Hank Childs. Hylipod: Parallel particle advection via a hybrid of lifeline scheduling and parallelization-over-data. Technical report, National Renewable Energy Lab.(NREL), Golden, CO (United States), 2021

[15] Jieyang Chen, Lipeng Wan, Xin Liang, Ben Whitney, Qing Liu, Qian Gong, David Pugmire, Nicholas Thompson, Jong Youl Choi, Matthew Wolf, et al. Scalable multigrid-based hierarchical scientific data refactoring on gpus. *arXiv preprint arXiv:2105.12764*, 2021

[16] Samuel D Schwartz, Hank Childs, and David Pugmire. Improving parallel particle advection performance with machine learning. In *Proc. Eurographics Symposium on Parallel Graphics and Visualization*, 2021

[17] Kenneth Moreland, Robert Maynard, David Pugmire, Abhishek Yenpure, Allison Vacanti, Matthew Larsen, and Hank Childs. Minimizing development costs for efficient many-core visualization using mcd3. *Parallel Computing*, 108:102834, 2021

[18] Francis J Alexander, James Ang, Jenna A Bilbrey, Jan Balewski, Tiernan Casey, Ryan Chard, Jong Choi, Sutanay Choudhury, Bert Debusschere, Anthony M DeGennaro, et al. Co-design center for exascale machine learning technologies (exalearn). *The International Journal of High Performance Computing Applications*, 35(6):598–616, 2021

[19] Xin Liang, Ben Whitney, Jieyang Chen, Lipeng Wan, Qing Liu, Dingwen Tao, James Kress, David Pugmire, Matthew Wolf, Norbert Podhorszki, et al. Mgard+: Optimizing multilevel methods for error-bounded scientific data reduction. *IEEE Transactions on Computers*, 71(7):1522–1536, 2021

[20] Julien Dominski, J Cheng, G Merlo, V Carey, R Hager, L Ricketson, J Choi, S Ethier, K Germaschewski, S Ku, et al. Spatial coupling of gyrokinetic simulations, a generalized scheme based on first-principles. *Physics of Plasmas*, 28(2):022301, 2021

[21] Samuel D Schwartz, Hank Childs, and David Pugmire. Machine learning-based autotuning for parallel particle advection. 2021

[22] Qian Gong, Xin Liang, Ben Whitney, Jong Youl Choi, Jieyang Chen, Lipeng Wan, Stéphane Ethier, Seung-Hoe Ku, R Michael Churchill, C-S Chang, et al. Maintaining trust in reduction: Preserving the accuracy of quantities of interest for

lossy compression. In *Smoky Mountains Computational Sciences and Engineering Conference*, pages 22–39. Springer, Cham, 2021

[23] Xin Liang, Qian Gong, Jieyang Chen, Ben Whitney, Lipeng Wan, Qing Liu, David Pugmire, Rick Archibald, Norbert Podhorszki, and Scott Klasky. Error-controlled, progressive, and adaptable retrieval of scientific data with multilevel decomposition. In *Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis*, pages 1–13, 2021

[24] David Pugmire, Caitlin Ross, Nicholas Thompson, James Kress, Chuck Atkins, Scott Klasky, and Berk Geveci. Fides: A general purpose data model library for streaming data. In *International Conference on High Performance Computing*, pages 495–507. Springer, Cham, 2021

[25] Jieyang Chen, Lipeng Wan, Xin Liang, Ben Whitney, Qing Liu, David Pugmire, Nicholas Thompson, Jong Youl Choi, Matthew Wolf, Todd Munson, et al. Accelerating multigrid-based hierarchical scientific data refactoring on gpus. In *2021 IEEE International Parallel and Distributed Processing Symposium (IPDPS)*, pages 859–868. IEEE, 2021

[26] Jeremy Logan, Mark Ainsworth, Chuck Atkins, Jieyang Chen, Jong Youl Choi, Junmin Gu, James M Kress, Greg Eisenhauer, Berk Geveci, William Godoy, et al. Extending the publish/subscribe abstraction for high-performance i/o and data management at extreme scale. *Bulletin of the IEEE Technical Committee on Data Engineering*, 43(1), 2020

[27] Wenjie Lei, Youyi Ruan, Ebru Bozdağ, Daniel Peter, Matthieu Lefebvre, Dimitri Komatitsch, Jeroen Tromp, Judith Hill, Norbert Podhorszki, and David Pugmire. Global adjoint tomography—model glad-m25. *Geophysical Journal International*, 223(1):1–21, 2020

[28] Dave Pugmire and Hank Childs. Parallel particle advection bake-off for scientific visualization workloads. Technical report, Oak Ridge National Lab.(ORNL), Oak Ridge, TN (United States), 2020

[29] Lipeng Wan, Matthew Wolf, Feiyi Wang, Jong Youl Choi, George Ostrouchov, Jieyang Chen, Norbert Podhorszki, Jeremy Logan, Kshitij Mehta, Scott Klasky, et al. I/o performance characterization and prediction through machine learning on hpc systems. In *CUG2020 Proceedings*, 2020

[30] David Pugmire, James Kress, Jieyang Chen, Hank Childs, Jong Choi, Dmitry Ganyushin, Berk Geveci, Mark Kim, Scott Klasky, Xin Liang, et al. Visualization as a service for scientific data. In *Smoky Mountains Computational Sciences and Engineering Conference*, pages 157–174. Springer, Cham, 2020

[31] Guido Reina, Hank Childs, Krešimir Matković, Katja Bühler, Manuela Waldner, David Pugmire, Barbora Kozlíková, Timo Ropinski, Patric Ljung, Takayuki Itoh,

et al. The moving target of visualization software for an increasingly complex world. *Computers & graphics*, 87:12–29, 2020

[32] Xin Liang, Ben Whitney, Jieyang Chen, Lipeng Wan, Qing Liu, Dingwen Tao, James Kress, Dave Pugmire, Matthew Wolf, Norbert Podhorszki, et al. Optimizing multi-grid based reduction for efficient scientific data management. *arXiv preprint arXiv:2010.05872*, 2020

[33] Nicholas Thompson, John Maddock, George Ostrouchov, Jeremy Logan, David Pugmire, and Scott Klasky. Towards 1ulp evaluation of daubechies wavelets. *arXiv preprint arXiv:2005.05424*, 2020

[34] James Kress, Matthew Larsen, Jong Choi, Mark Kim, Matthew Wolf, Norbert Podhorszki, Scott Klasky, Hank Childs, and David Pugmire. Opportunities for cost savings with in-transit visualization. In *International Conference on High Performance Computing*, pages 146–165. Springer, Cham, 2020

[35] WF Godoy, N Podhorszki, R Wang, C Atkins, G Eisenhauer, J Gu, P Davis, J Choi, K Germaschewski, K Huck, et al. Adios 2: the adaptable input output system. a framework for high-performance data management. softwarex 12, 100561 (2020), 2020

[36] James Kress, Matthew Larsen, Jong Choi, Mark Kim, Matthew Wolf, Norbert Podhorszki, Scott Klasky, Hank Childs, and David Pugmire. Comparing time-to-solution for in situ visualization paradigms at scale. In *2020 IEEE 10th Symposium on Large Data Analysis and Visualization (LDAV)*, pages 22–26. IEEE, 2020

[37] Roba Binyahib, David Pugmire, Abhishek Yenpure, and Hank Childs. Parallel particle advection bake-off for scientific visualization workloads. In *2020 IEEE International Conference on Cluster Computing (CLUSTER)*, pages 381–391. IEEE, 2020

[38] Zhenlu Qin, Jinzhen Wang, Qing Liu, Jieyang Chen, Dave Pugmire, Norbert Podhorszki, and Scott Klasky. Estimating lossy compressibility of scientific data using deep neural networks. *IEEE Letters of the Computer Society*, 3(1):5–8, 2020

[39] Hank Childs, Sean D Ahern, James Ahrens, Andrew C Bauer, Janine Bennett, E Wes Bethel, Peer-Timo Bremer, Eric Brugger, Joseph Cottam, Matthieu Dorier, et al. A terminology for in situ visualization and analysis systems. *The International Journal of High Performance Computing Applications*, 34(6):676–691, 2020

[40] Roba Binyahib, David Pugmire, Boyana Norris, and Hank Childs. A lifeline-based approach for work requesting and parallel particle advection. In *2019 IEEE 9th Symposium on Large Data Analysis and Visualization (LDAV)*, pages 52–61. IEEE, 2019

[41] Scott Klasky, Matthew Wolf, Kshitij Mehta, Kevin Huck, Berk Geveci, Sujin Phillip, Robert Maynard, Hanqi Guo, Tom Peterka, Kenneth Moreland, et al.

In situ analysis and visualization of fusion simulations: Lessons learned. In *High Performance Computing: ISC High Performance 2018 International Workshops, Frankfurt/Main, Germany, June 28, 2018, Revised Selected Papers*, volume 11203, page 230. Springer, 2019

[42] Roba Binyahib, David Pugmire, and Hank Childs. In situ particle advection via parallelizing over particles. In *Proceedings of the Workshop on In Situ Infrastructures for Enabling Extreme-Scale Analysis and Visualization*, pages 29–33, 2019

[43] Kenneth D Moreland, David Pugmire, David Rogers, Hank Childs, Kwan-Liu Ma, and Berk Geveci. Xvis: Visualization for the extreme-scale scientific computation ecosystem. final report. 2019

[44] Samuel Leventhal, Mark Kim, and David Pugmire. Pave: An in situ framework for scientific visualization and machine learning coupling. In *2019 IEEE/ACM 5th International Workshop on Data Analysis and Reduction for Big Scientific Data (DRBSD-5)*, pages 8–15. IEEE, 2019

[45] Dave Pugmire and Hank Childs. In situ particle advection via parallelizing over particles. Technical report, Oak Ridge National Lab.(ORNL), Oak Ridge, TN (United States), 2019

[46] James Kress, Matthew Larsen, Jong Choi, Mark Kim, Matthew Wolf, Norbert Podhorszki, Scott Klasky, Hank Childs, and David Pugmire. Comparing the efficiency of in situ visualization paradigms at scale. In *International Conference on High Performance Computing*, pages 99–117. Springer, Cham, 2019

[47] J Patchett, H Childs, A Bauer, PT Bremer, T Carrard, M Dorier, K Heitmann Garth, K Moreland, T Peterka, D Pleiter, et al. 4.3 workflow execution. *In Situ Visualization for Computational Science*, page 16, 2019

[48] Sebnem Duzgun, Ergin Isleyen, Doga C Demirkan, Ridvan Orsvuran, Ebru Bozdag, and David Pugmire. Virtual and augmented reality for visualization of big data: Examples from deep earth to subsurface. In *AGU Fall Meeting Abstracts*, volume 2019, pages IN21B–05, 2019

[49] Jieyang Chen, David Pugmire, Matthew Wolf, Nicholas Thompson, Jeremy Logan, Kshitij Mehta, Lipeng Wan, Jong Youl Choi, Ben Whitney, and Scott Klasky. Understanding performance-quality trade-offs in scientific visualization workflows with lossy compression. In *2019 IEEE/ACM 5th International Workshop on Data Analysis and Reduction for Big Scientific Data (DRBSD-5)*, pages 1–7. IEEE, 2019

[50] Mark B Kim and Dave Pugmire. Pave: An in situ framework for scientific visualization and machine learning coupling. Technical report, Oak Ridge National Lab.(ORNL), Oak Ridge, TN (United States), 2019

[51] Youyi Ruan, Wenjie Lei, Matthieu Lefebvre, Ryan Modrak, James Smith, Ridvan Orsvuran, Ebru Bozdag, Judith Hill, Norbert Podhorszki, Dave Pugmire, et al.

A new generation of earth mantle model from global adjoint tomography. *Acta Geologica Sinica (Beijing)*, 93(S1), 2019

[52] Dave Pugmire. A lifeline-based approach for work requesting and parallel particle advection. Technical report, Oak Ridge National Lab.(ORNL), Oak Ridge, TN (United States), 2019

[53] R Westermann, T Carrard, I Hotz, C Hansen, D Pugmire, K Heitmann, H Yu, M Hadwiger, J Krüger, HW Shen, et al. 3.17 ecp alpine algorithm overview. *In Situ Visualization for Computational Science*, page 11, 2019

[54] Kenneth D Moreland, David Pugmire, David Rogers, and Hank Childs. Stda05-18 p6 milestone delivery. Technical report, Sandia National Lab.(SNL-NM), Albuquerque, NM (United States), 2019

[55] C Garth, D Pugmire, T Carrard, B Muite, K Moreland, U Rüde, D Pugmire Sisneros, H Yu, HW Shen, G Weber, et al. 4.5 algorithmic challenges. *In Situ Visualization for Computational Science*, page 22, 2019

[56] Mark Kim, James Kress, Jong Choi, Norbert Podhorszki, Scott Klasky, Matthew Wolf, Kshitij Mehta, Kevin Huck, Berk Geveci, Sujin Phillip, et al. In situ analysis and visualization of fusion simulations: Lessons learned. In *International Conference on High Performance Computing*, pages 230–242. Springer, Cham, 2018

[57] David Pugmire, Abhishek Yenpure, Mark Kim, James Kress, Robert Maynard, Hank Childs, and Bernd Hentschel. Performance-portable particle advection with vtk-m. In Hank Childs and Fernando Cucchietti, editors, *Eurographics Symposium on Parallel Graphics and Visualization*. The Eurographics Association, 2018

[58] S Duzgun, E Isleyen, R Orsvuran, E Bozdag, D Pugmire, W Lei, Y Ruan, and J Tromp. Exploring earth's interior in collaborative immersive vr environments. In *AGU Fall Meeting Abstracts*, volume 2018, pages DI24B–33, 2018

[59] Hank Childs, SD Ahern, J Ahrens, AC Bauer, J Bennett, EW Bethel, PT Bremer, E Brugger, J Cottam, M Dorier, et al. In situ terminology project. *Under Submission*, 2018

[60] Scott Klasky, Matthew Wolf, Mark Ainsworth, Chuck Atkins, Jong Choi, Greg Eisenhauer, Berk Geveci, William Godoy, Mark Kim, James Kress, et al. A view from ornl: Scientific data research opportunities in the big data age. In *2018 IEEE 38th International Conference on Distributed Computing Systems (ICDCS)*, pages 1357–1368. IEEE, 2018

[61] Youyi Ruan, Wenjie Lei, Matthieu Philippe Lefebvre, Ryan Modrak, James A Smith, Ridvan Orsvuran, Ebru Bozdag, Yangkang Chen, Judith Hill, Norbert Podhorszki, et al. Global adjoint tomography-new generation earth mantle model. In *AGU Fall Meeting Abstracts*, volume 2018, pages S52A–03, 2018

[62] James Kress, Jong Choi, Scott Klasky, Michael Churchill, Hank Childs, and David Pugmire. Binning based data reduction for vector field data of a particle-in-cell fusion simulation. In *International Conference on High Performance Computing*, pages 215–229. Springer, Cham, 2018

[63] Kenneth D Moreland, David Pugmire, David Rogers, Hank Childs, and Berk Geveci. October 2018 ecp st project review: Ecp project wbs 2.3. 4.13 vtk-m/ecp. Technical report, Sandia National Lab.(SNL-NM), Albuquerque, NM (United States), 2018

[64] Andy Bauer, Hank Childs, Steffen Frey, Matthew Larsen, and Dave Pugmire. In situ visualization for computational science. Technical report, Oak Ridge National Lab.(ORNL), Oak Ridge, TN (United States), 2018

[65] Jong Youl Choi, Choong-Seock Chang, Julien Dominski, Scott Klasky, Gabriele Merlo, Eric Suchyta, Mark Ainsworth, Bryce Allen, Franck Cappello, Michael Churchill, et al. Coupling exascale multiphysics applications: Methods and lessons learned. In *2018 IEEE 14th International Conference on e-Science (e-Science)*, pages 442–452. IEEE, 2018

[66] Ergin Isleyen, Ridvan Orsvuran, Ebru Bozdag, Sebnem Duzgun, David Pugmire, Wenjie Lei, Youyi Ruan, and Jeroen Tromp. Exploring earth's interior in collaborative immersive vr environments. In *AGU Fall Meeting 2018*. AGU, 2018

[67] Kenneth D Moreland, David Pugmire, and Berk Geveci. Ecp milestone report wbs 2.3. 4.13 ecp/vtk-m fy18q1 [ms-18/01-03] multiblock/gradients/release stda05-5. Technical report, Sandia National Lab.(SNL-NM), Albuquerque, NM (United States), 2017

[68] Ebru Bozdag, David Pugmire, Matthieu Philippe Lefebvre, Judith Hill, Dimitri Komatitsch, Daniel B Peter, Norbert Podhorszki, and Jeroen Tromp. Visualising earth's mantle based on global adjoint tomography. In *AGU Fall Meeting Abstracts*, volume 2017, pages T44D–01, 2017

[69] Tao Lu, Dave Pugmire, Jong Youl Choi, Scott A Klasky, Qing Gary Liu, Norbert Podhorszki, Mark Ainsworth, and Matthew D Wolf. Canopus: A paradigm shift towards elastic extreme-scale data analytics on hpc. Technical report, Oak Ridge National Lab.(ORNL), Oak Ridge, TN (United States), 2017

[70] Kenneth D Moreland, David Pugmire, David Rogers, Hank Childs, Kwan-Liu Ma, and Berk Geveci. Xvis: Visualization for the extreme-scale scientific-computation ecosystem: Year-end report fy17. Technical report, Sandia National Lab.(SNL-NM), Albuquerque, NM (United States), 2017

[71] Mark Kim, Tom Evans, Scott Klasky, and David Pugmire. In situ visualization of radiation transport geometry. In *Proceedings of the In Situ Infrastructures on Enabling Extreme-Scale Analysis and Visualization*, pages 7–11. 2017

[72] Scott Klasky, Eric Suchyta, Mark Ainsworth, Qing Liu, Ben Whitney, Matthew Wolf, Jong Choi, Ian Foster, Mark Kim, Jeremy Logan, et al. Exacution: Enhancing scientific data management for exascale. In *2017 IEEE 37th International Conference on Distributed Computing Systems (ICDCS)*, pages 1927–1937. IEEE, 2017

[73] David Pugmire, Ebru Bozdağ, Matthieu Lefebvre, Jeroen Tromp, Dmitri Komatitsch, Daniel Peter, Norbert Podhorszki, and Judith Hill. Pillars of the mantle: Imaging the interior of the earth with adjoint tomography. in: Pearc17 proceedings of the practice and experience in advanced research computing 2017 on sustainability, success and impact, article no. 75. Technical report, Oak Ridge National Lab.(ORNL), Oak Ridge, TN (United States). Oak Ridge . . . , 2017

[74] David Pugmire, James Kress, Jong Choi, Scott Klasky, Tahsin Kurc, Randy Michael Churchill, Matthew Wolf, Greg Eisenhower, Hank Childs, Kesheng Wu, et al. Visualization and analysis for near-real-time decision making in distributed workflows. In *2016 IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW)*, pages 1007–1013. IEEE, 2016

[75] James Kress, David Pugmire, Scott Klasky, and Hank Childs. Visualization and analysis requirements for in situ processing for a large-scale fusion simulation code. In *2016 Second Workshop on In Situ Infrastructures for Enabling Extreme-Scale Analysis and Visualization (ISAV)*, pages 45–50. IEEE, 2016

[76] Matthew Larsen, Cyrus Harrison, James Kress, David Pugmire, Jeremy S Meredith, and Hank Childs. Performance modeling of in situ rendering. In *SC'16: Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis*, pages 276–287. IEEE, 2016

[77] Ebru Bozdağ, Daniel Peter, Matthieu Lefebvre, Dimitri Komatitsch, Jeroen Tromp, Judith Hill, Norbert Podhorszki, and David Pugmire. Global adjoint tomography: first-generation model. *Geophysical Journal International*, 207(3):1739–1766, 2016

[78] James Kress, Randy Michael Churchill, Scott Klasky, Mark Kim, Hank Childs, and David Pugmire. Preparing for in situ processing on upcoming leading-edge supercomputers. *Supercomputing frontiers and innovations*, 3(4), 2016

[79] Robert Sisneros and David Pugmire. Tuned to terrible: A study of parallel particle advection state of the practice. In *2016 IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW)*, pages 1058–1067. IEEE, 2016

[80] Kenneth Moreland, Christopher Sewell, William Usher, Li-ta Lo, Jeremy Meredith, David Pugmire, James Kress, Hendrik Schroots, Kwan-Liu Ma, Hank Childs, et al. Vtk-m: Accelerating the visualization toolkit for massively threaded architectures. *IEEE computer graphics and applications*, 36(3):48–58, 2016

[81] Jong Youl Choi, Tahsin Kurc, Jeremy Logan, Matthew Wolf, Eric Suchyta, James Kress, David Pugmire, Norbert Podhorszki, Eun-Kyu Byun, Mark Ainsworth, et al. Stream processing for near real-time scientific data analysis. In *2016 New York Scientific Data Summit (NYSDS)*, pages 1–8. IEEE, 2016

[82] James Kress, Scott Klasky, Norbert Podhorszki, Jong Choi, Hank Childs, and David Pugmire. Loosely coupled in situ visualization: A perspective on why it's here to stay. In *Proceedings of the First Workshop on In Situ Infrastructures for Enabling Extreme-Scale Analysis and Visualization*, pages 1–6, 2015

[83] Axel Huebl, David Pugmire, Felix Schmitt, Richard Pausch, and Michael Bussmann. Visualizing the radiation of the kelvin-helmholtz instability. *IEEE Transactions on Plasma Science*, 42(10):2638–2639, 2014

[84] David Pugmire, James Kress, Jeremy Meredith, Norbert Podhorszki, Jong Choi, and Scott Klasky. Towards scalable visualization plugins for data staging workflows. In *Big Data Analytics: Challenges and Opportunities (BDAC-14) Workshop at Supercomputing Conference*, 2014

[85] Roselyne Tchoua, Jong Choi, Scott Klasky, Qing Liu, Jeremy Logan, Kenneth Moreland, Jingqing Mu, Manish Parashar, Norbert Podhorszki, David Pugmire, et al. Adios visualization schema: A first step towards improving interdisciplinary collaboration in high performance computing. In *2013 IEEE 9th International Conference on e-Science*, pages 27–34. IEEE, 2013

[86] Hari Krishnan, Cyrus Harrison, Brad Whitlock, David Pugmire, and Hank Childs. Exploring collaborative hpc visualization workflows using visit and python. 2013

[87] Wei-Chen Chen, George Ostrouchov, David Pugmire, Prabhat, and Michael Wehner. A parallel em algorithm for model-based clustering applied to the exploration of large spatio-temporal data. *Technometrics*, 55(4):513–523, 2013

[88] Dean N Williams, Timo Bremer, Charles Doutriaux, John Patchett, Sean Williams, Galen Shipman, Ross Miller, David R Pugmire, Brian Smith, Chad Steed, et al. Ultrascale visualization of climate data. *Computer*, 46(9):68–76, 2013

[89] David Camp et al. Gpu acceleration of particle advectionworkloads in a parallel, distributed memory setting. 2013

[90] Brian Smith, Thomas Maxwell, Emanuele Santos, Gerald Potter, Dean Williams, David Kindig, Sean Williams, Galen Shipman, Charles Doutriaux, John Patchett, et al. The ultra-scale visualization climate data analysis tools (uv-cdat): Data analysis and visualization for geoscience data. *Computer*, 99(1):1, 2013

[91] Matthieu Lefebvre, Ebru Bozdag, Henri F Calandra, Judith C Hill, Norbert Podhorszki, Dave Pugmire, and Jeroen Tromp. A data centric view of large-scale seismic imaging workflows. Technical report, Oak Ridge National Lab.(ORNL), Oak Ridge, TN (United States). Oak Ridge . . . , 2013

[92] G Ostrouchov, D Pugmire, DL Rosenberg, W Chen, and A Pouquet. Computation and volume rendering of large-scale eof coherent modes in rotating turbulent flow data. In *AGU Fall Meeting Abstracts*, volume 2013, pages NG23A–1491, 2013

[93] E Wes Bethel, David Camp, Hank Childs, Christoph Garth, Mark Howison, Kenneth I Joy, and David Pugmire. Hybrid parallelism, 2012

[94] Choi Jong, Hasan Abbasi, Dave Pugmire, Scott A Klasky, and Qing Gary Liu. Mining hidden mixture context with adios-p to improve predictive pre-fetcher accuracy. Technical report, Oak Ridge National Lab.(ORNL), Oak Ridge, TN (United States), 2012

[95] Hank Childs, Eric Brugger, Brad Whitlock, Jeremy S Meredith, Sean Ahern, David Pugmire, Kathleen Biagas, Mark C Miller, Cyrus Harrison, Gunther H Weber, et al. Visit., 2012

[96] Cyrus Harrison, Jean Favre, Hank Childs, Dave Pugmire, Brad Whitlock, and Hari Krishnan. Patc course: Large scale data visualization with visit. 2012

[97] Wei-Chen Chen et al. Applying model-based clustering for analysis of community atmospheric model output. 2012

[98] PM Sutter, H-Y Karen Yang, PM Ricker, G Foreman, and D Pugmire. An examination of magnetized outflows from active galactic nuclei in galaxy clusters. *Monthly Notices of the Royal Astronomical Society*, 419(3):2293–2314, 2012

[99] David Camp, Hank Childs, Christoph Garth, David Pugmire, and Kenneth I Joy. Parallel stream surface computation for large data sets. In *Ieee symposium on large data analysis and visualization (ldav)*, pages 39–47. IEEE, 2012

[100] Hank Childs, David Pugmire, Sean Ahern, Brad Whitlock, Mark Howison, Gunther H Weber, and E Wes Bethel. Visualization at extreme scale concurrency, 2012

[101] Jong Youl Choi, Hasan Abbasi, David Pugmire, Norbert Podhorszki, Scott Klasky, Cristian Capdevila, Manish Parashar, Matthew Wolf, Judy Qiu, and Geoffrey Fox. Mining hidden mixture context with adios-p to improve predictive pre-fetcher accuracy. In *2012 IEEE 8th International Conference on E-Science*, pages 1–8. IEEE, 2012

[102] Roselyne Tchoua, Hasan Abbasi, Scott Klasky, Qing Liu, Norbert Podhorszki, David Pugmire, Yuan Tian, and Matthew Wolf. Collaborative monitoring and visualization of hpc data. In *2012 International Conference on Collaboration Technologies and Systems (CTS)*, pages 397–403. IEEE, 2012

[103] Jeremy S Meredith, Sean Ahern, Dave Pugmire, and Robert Sisneros. Eavl: the extreme-scale analysis and visualization library. 2012

[104] Chris Paciorek et al. Parallel statistical extreme value analysis of climate data. 2012

[105] Jeremy S Meredith, Robert Sisneros, David Pugmire, and Sean Ahern. A distributed data-parallel framework for analysis and visualization algorithm development. In *Proceedings of the 5th Annual Workshop on General Purpose Processing with Graphics Processing Units*, pages 11–19, 2012

[106] David Pugmire, Tom Peterka, and Christoph Garth. Parallel integral curves., 2012

[107] David Pugmire, Paul Sutter, Paul Ricker, Hsiang-Yi Yang, and George Foreman. Magnetic field outflows from active galactic nuclei. In *Proceedings of the 2011 companion on High Performance Computing Networking, Storage and Analysis Companion*, pages 129–130. 2011

[108] PM Sutter, H-Y Karen Yang, PM Ricker, G Foreman, and D Pugmire. An examination of magnetized outflows from active galactic nuclei in galaxy clusters: Magnetized outflows in galaxy clusters. *Monthly Notices of the Royal Astronomical Society*, 419(3), 2011

[109] M Prabhat, S Byna, C Paciorek, G Weber, K Wu, T Yopes, MF Wehner, G Ostrouchov, D Pugmire, R Strelitz, et al. Pattern detection and extreme value analysis on large climate data. In *AGU Fall Meeting Abstracts*, volume 2011, pages IN41C–03, 2011

[110] David L Green, Erwin F Jaeger, Guangye Chen, Lee A Berry, David Pugmire, John M Canik, and Philip M Ryan. Simulation of high-harmonic fast-wave heating on the national spherical tokamak experiment. *IEEE Transactions on Plasma Science*, 39(11):3020–3021, 2011

[111] James P Ahrens, David Rodgers, Becky Springmeyer, et al. Visualization and data analysis. Technical report, Los Alamos National Lab.(LANL), Los Alamos, NM (United States), 2010

[112] Allen Sanderson, Guoning Chen, Xavier Tricoche, David Pugmire, Scott Kruger, and Joshua Breslau. Analysis of recurrent patterns in toroidal magnetic fields. *IEEE Transactions on Visualization and Computer Graphics*, 16(6):1431–1440, 2010

[113] Laura Monroe and David Pugmire. A case study of collaborative facilities use in engineering design. In *The Engineering Reality of Virtual Reality 2010*, volume 7525, pages 58–65. SPIE, 2010

[114] Hank Childs, David Pugmire, Sean Ahern, Brad Whitlock, Mark Howison, Gunther H Weber, E Wes Bethel, et al. Extreme scaling of production visualization software on diverse architectures. *IEEE Computer Graphics and Applications*, 30(3):22–31, 2010

[115] David Camp, Christoph Garth, Hank Childs, David Pugmire, and Kenneth Joy. Streamline integration using mpi-hybrid parallelism on a large multicore architecture. *IEEE Transactions on Visualization and Computer Graphics*, 17(11):1702–1713, 2010

[116] Dave Pugmire, Hank Childs, Christoph Garth, Sean Ahern, and Gunther H Weber. Scalable computation of streamlines on very large datasets. In *Proceedings of the Conference on High Performance Computing Networking, Storage and Analysis*, pages 1–12, 2009

[117] Christoph Garth, Eduard Deines, Ken Joy, Hank Childs, Gunther H Weber, Wes Bethel, Sean Ahern, David Pugmire, and Chris Johnson. Vector field visual data analysis for petascale. 2009

[118] John Patchett, James Ahrens, Sean Ahern, and David Pugmire. Parallel visualization and analysis with paraview on a cray xt4. *Cray User Group*, pages 1–5, 2009

[119] E Wes Bethel, Chris Johnson, Sean Ahern, John Bell, Peer-Timo Bremer, Hank Childs, Estelle Cormier-Michel, Marc Day, Eduard Deines, Tom Fogal, et al. Occam's razor and petascale visual data analysis. In *Journal of Physics: Conference Series*, volume 180, page 012084. IOP Publishing, 2009

[120] Rui Zhang, Addi Malviya-Thakur, Jose Borreguero, Pete Peterson, Ross Whitfield, Jean Bilheux, Jiaxin Zhang, Pablo Moriano, Jieyang Chen, Ronald Lee, et al. Data reduction., 2009

[121] E. Wes Bethel, Chris Johnson, Charles Hansen, Claudio Silva, Steven Parker, Allen Sanderson, Lee Myers, Martin Cole, Xavier Tricoche, Sean Ahern, George Ostrouchov, Dave Pugmire, Jamison Daniel, Jeremy Meredith, Valerio Pascucci, Hank Childs, Peer-Timo Bremer, Ajith Mascarenhas, Ken Joy, Bernd Hamann, Christoph Garth, Cecilia Aragon, Gunther Weber, and Prabhat. Seeing the Unseeable. Technical Report 8, Summer 2008

[122] D Pugmire, D Modi, and L Monroe. Pick-n-place: A virtual reality assembly tool. *NW Highlights*, 2007

[123] David Pugmire, Laura Monroe, Carolyn Connor Davenport, Andrew DuBois, David DuBois, and Stephen Poole. Npu-based image compositing in a distributed visualization system. *IEEE Transactions on Visualization and Computer Graphics*, 13(4):798–809, 2007

[124] Cindy Grimm and David Pugmire. Visual interfaces for solids modeling. In *Proceedings of the 8th annual ACM symposium on User interface and software technology*, pages 51–60, 1995

[125] D Pugmire, R Sisneros, T Carrard, S Frey, M Larsen, K Isaacs, B Muite Gauger, and C Garth. 4.8 cost models. *In Situ Visualization for Computational Science*, 82(1):29, 1989

Peer Reviewed Posters

1. R. Pausch, A. Huebl, F. Schmitt, H. Burau, R. Widera, D. Pugmire, A. Debus, G. Juckeland, W. Nagel, M. Bussman, "The Electromagnetic Sky-Map Radiated by the Kelvin-Helmholtz Instability", Astrophysical Turbulence: From Galaxies to Planets, Dresden Germany, July 2013.
2. W.-C. Chen, G. Ostrouchov, D. Pugmire, M. Prabhat, M. Wehner, "Applying model-based clustering for analysis of Community Atmospheric Model output", Conference on Data Analysis (CoDA), Santa Fe, NM, 2012.
3. H. Childs, et. al, VisIt: An End-User Tool for Visualizing and Analyzing Very Large Data, SciDAC 2011, Denver, CO.
4. J. Colgan, D. Pugmire, et al. Lattice Calculations of the Photoionization of Li, American Physical Society, 35th Meeting of the Division of Atomic, Molecular and Optical Physics, 2004.

Keynote Presentations

1. Scientific Data Analysis and Visualization, Plenary Lecture, DOE ASCR/BES Data Workshop, Bethesda, MD, October 2011

Invited Talks

1. Scientific Visualization as a Service, Excalibur-SLE: Exascale HPC for System Level Engineering Workshop, Cambridge University, June 2021.
2. Visualization and Analysis Services, ASiMoV Workshop, Cambridge University, April 2021.
3. Visualization and Analysis Services with Data Staging, ECP Data Staging BOF, ECP Annual Meeting, April 2021.
4. In Situ – Experiences from the Trenches, In Situ Infrastructures for Enabling Extreme-Scale Analysis and Visualization (ISAV), November 2020.
5. Visualization and Analysis Services for Extreme Scale Computing, Rutherford Appleton Laboratory, July 2016
6. Visualization and Analysis Services for Extreme Scale Computing, Oxford University, July 2016

7. Visualization and Analysis Services for Extreme Scale Computing, Swansea University, July 2016
8. Visualization and Analysis Services for Extreme Scale Computing, Daresbury Laboratory, July 2016
9. Visualization and Analysis Services for Extreme Scale Computing, University of Leeds, July 2016
10. Visualization Applications, Hartree Summer School Series, Warrington UK, July 2016.
11. ADIOS Update, DOE Computer Graphics Forum, Monterey CA, April 2016
12. Preview of IPDPS Papers, DOE Computer Graphics Forum, Monterey CA, April 2016
13. Visualization at ORNL, DOE Computer Graphics Forum, Monterey CA, April 2016
14. Scientific Visualization for High Performance Computing, University of Tennessee, October 2015.
15. Performance and Extreme Parallelism in Visualization and HPC Computing, University of Leeds, School of Computing Colloquium, June 2015, Leeds UK.
16. Visualization Applications, Hartree Summer School Series, Warrington UK, June 2015.
17. Visualization Applications, Hartree Summer School Series, Warrington UK, June 2014.
18. Toward the Next Generation of HPC Data and Visualization, National Center for Supercomputing Applications, Urbana-Champaign, IL, April 2014
19. Visualization of Very Large Scientific Data, Rice University Oil and Gas Workshop, Houston, TX, March, 2014.
20. Scientific Visualization with VisIt, The Princeton Institute for Computational Science and Engineering, Nov. 2013, Princeton, NJ.
21. Visualization of Extremely Large Datasets using VisIt, OLCF Data Workshop, Knoxville, TN, August 2013.
22. The EVEREST Upgrade at ORNL, HPC User Forum, Tucson AZ, May, 2013.
23. Addressing Data Challenges for Exascale Computing, Data BOF, Supercomputing Conference, Salt Lake City, UT. Nov, 2012.
24. Data Analysis and Visualization of Very Large Data, HPC Users Forum, Dearborn, MI. Sep. 2012.
25. EAVL: Extreme Scale Analysis and Visualization Library, CSCADS, Snowbird, UT. July 2012.
26. PICS: A Flexible, Extensible System for Particle Based Analysis, ASTRONUM, Kona, HI. June 2012.
27. Scientific Data Visualization, DOE Office of Science Graduate Fellowship Seminar, Oak Ridge, TN. July 2011

28. Scientific Data Visualization, Innovations in Data-Intensive Astronomy Workshop, Green Bank, WV. May 2011.
29. Algorithm Scalability for Scalar and Vector Field Visualization, SIAM Conference on Parallel Processing for Scientific Computing, Seattle WA. Feb 2010.
30. Experiments in Pure Parallelism, CScADS, Snowbird, UT. July 2010.
31. Visualization with VisIt, ORNL Hexcore Workshop, Oak Ridge, TN. May 2010.
32. Petascale Analysis and Visualization, CScADS, Tahoe, CA. July 2009.
33. Magnetic Field Analysis, ORNL Hexcore Workshop, Oak Ridge, TN. May 2009.

Invited Seminars

1. National Institute of Informatics Shonan Seminar on The Moving Target of Visualization Software for an Ever More Complex World, Shonan, Japan, February 2019.
2. Schloss Dagstuhl Seminar on Scientific Visualization, Wadern, Germany July 2018

Tutorials

1. Visualization using VisIt, VISTA Webinar Series, Oak Ridge National Laboratory, March 2021.
2. High Performance I/O Frameworks 101, Supercomputing 2019, Denver Colorado, Novemeber 2019.
3. VTKm, IEEE Visualization 2019, Vancouver Canada, October 2019.
4. Scalable HPC Visualization and Data Analysis Using VisIt, Supercomputing 2017, Denver, CO, Nov 2017
5. Scalable HPC Visualization and Data Analysis Using VisIt, Supercomputing 2016, Salt Lake City, UT, Nov 2016.
6. Data Management, Analysis and Visualization Tools for Data-Intensive Science, Supercomputing 2015, Austin TX, Nov. 2015
7. Visualization with VisIt, Hartree Summer School, July 2016.
8. Effective HPC Visualization and Data Analysis using VisIt, Supercomputing 2015, Austin TX, Nov. 2015
9. Scientific Data Workflows, ISC, Frankfurt Germany, July 2015.
10. Visualization with VisIt, PRACE Winter School, Ostrava Czech Republic, January 2015.
11. Effective HPC Visualization and Data Analysis using VisIt, Supercomputing 2014, New Orleans, LA, Nov 2014.
12. Visualization with VisIt, Hartree Summer School Series, Warrington UK, June 2014.

13. Visualization with VisIt, British Petroleum Data Center, Houston, TX, March 2014.
14. Large Scale Visualization and Data Analysis with VisIt, OLCF Data Workshop, Knoxville, TN, Aug. 2013
15. Large Scale Visualization and Data Analysis with VisIt, Supercomputing 2012, SLC, UT, Nov. 2012
16. Introduction to VisIt, CSDMS 2011, Boulder, CO, October 2011
17. Introduction to VisIt. SciDAC 2011, Denver, CO. July 2011.
18. Introduction to VisIt. NRAO Workshop 2011, Green Bank, WV. May 2011
19. Introduction to Vector Field Visualization. Supercomputing 2010, New Orleans, LA. Nov 2010
20. Introduction to VisIt. SciDAC 2010, Chattanooga, TN. July 2010.
21. Introduction to VisIt. SciDAC 2009, San Diego, CA. June 2009.

Professional Service

- General Program Chair for ISAV 2022: In situ Infrastructures for Enabling Extreme-scale Analysis and Visualization
- General Program co-Chair for ISAV 2021: In situ Infrastructures for Enabling Extreme-scale Analysis and Visualization
- Supercomputing 2014-2015 Scientific Visualization and Data Analytics Showcase Committee Member
- 2017 DOE Computer Graphics Forum Site Chair
- 2008 DOE Computer Graphics Forum Technical Program Chair
- Paper Review Committe:
  - SuperComputing
  - EuroVis
  - IEEE Visualization
  - Eurographics Symposium on Parallel Graphics and Visualization
  - Transactions on Visualization and Computer Graphics
  - IEEE Symposium on Large Data Analysis and Visualization
  - In Situ Infrastructures for Enabling Extreme-scale Analysis and Visualization
  - Cluster
  - Journal of Parallel and Distributed Computing
  - International Symposium on Visual Computing
  - IEEE Virtual Reality
- Proposal Reviewer
  - DOE Early Career Award
  - NSF

– DOE Small Business Inovation Research phase 1, 2.

Post Doctoral Advisees

- Mark Kim, University of Utah, October 2015
- Jieyang Chen, University of California, Irvine, June 2019

Ph.D. Dissertation Co-Advisees

- James Kress, University of Oregon, graduated May 2020
- Samuel Leventhal, University of Utah, expected graduation 2023