

Timothy J. Williams

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SUMMARY

- Programmatic, project, and group leadership roles in labs and industry
- Active in leadership-class parallel computational science since 1990
 - Published scientific results and computational methods
- 15 years experience at DOE labs (LLNL, LANL, ANL)
- Inside viewpoint as computational scientist, fresh perspective from years in financial industry

SKILLS

- Project/program management
- Proposal writing
- Workshop organization
- Team management
- Distilling highlights from scientific research
- High-level HPC science presentations
- Research background in plasma turbulence
- Consultant on HPC applications from multiple scientific fields
- Application development
 - Financial engineering
 - Computational science
 - Plasma physics
 - Groundwater flow
 - Global ocean simulation
 - Cosmology
 - Global optimization methods
- Parallel processing
 - MPI, OpenMP, distributed
- C++, Java, Fortran, Perl, SQL,
 - Generic, object-oriented programming

EXPERIENCE

Principal Project Specialist - Computational Science

Argonne National Laboratory, IL, July 2009 – present
[Leadership Computing Facility](#)

- Manager, ALCF [Early Science Program](#)
 - Theta program (2015 – present)
 - Mira program (2010 – 2012)
 - Designed proposal review process, managed reviews
 - Hired and managed 11 postdocs
 - Organized 5 onsite workshops
- Steering Committee, ASCR Exascale Requirements Reviews
 - One workshop per program office by September 2016
 - Planning, organizing workshops

- Chair, ALCF Postdoctoral Committee (for hiring)
- Co-organized and co-chaired SC14 Birds-of-a-Feather (BoF) “[Application Readiness and Portability for Leadership Computing](#).”
- Co-organized and chaired 2012 SIAM Annual Meeting Minisymposium around early Blue Gene/Q applications (AN12, [MS30](#) & [MS42](#))
- Catalyst (in-depth consultant/collaborator) on INCITE, ALCC, ESP projects
 - See website for examples (<http://alcf.anl.gov/~zippy>)
- Acting leader of Catalyst group for about 5 months
- Led Team8, which dramatically improved *capability* usage of our production BG/P machine (fraction of jobs running on 20% or more of the machine), through scheduling algorithm and policy changes
- Represent ANL/ALCF in strategic/outreach activities
 - Team member, “Linear Scalars,” SC14 Intel Parallel Universe Computing Challenge (HPC trivia and parallel programming competition for charity)
 - [CSSEF](#) multi-institutional proposal development (successful)
 - IBM/Blue Gene Consortium functions: presentation, panel member
 - [Fall Creek Falls Workshop](#)
 - [CScADS](#)
 - Strategic discussions with GE Global Energy
 - BG/Q procurement Executive Reviews
 - Flash HEDP Co-Design for Exascale proposal

Quantitative Developer

Citadel Investment Group, Chicago, IL, April 2006 – July 2009

Mortgage-Backed Securities

Statistical Arbitrage on Fixed-Income and Currencies

- Developed valuation system using new mathematical model for non-agency mortgage-backed securities
 - Collateralized mortgage obligations (CMO), credit default swaps (CDS)
 - Simulation pricing using $O(100)$ interest rate paths
 - Single-program multiple-data (SPMD) parallel processing across $O(100)$ 64-bit Linux compute nodes
- Developed new system for valuing and trading fixed-income instruments
 - Futures on interest rates, currencies, commodities, bonds
 - Distributed pricing servers take requests from web front end

Software Engineer - Vice President

Morgan Stanley, New York, NY, 2000 – 2006

Fixed Income Information Technology

- Technical lead of Model Library Group (8 developers)
 - Defining Fixed-Income-wide base-class interfaces for products, models, and products.
- Designed and implemented FidMath class library for fixed-income security valuation; deployed in C++ and Java. FidMath was the premier central analytics library across all of Morgan Stanley Fixed Income.
 - Bond pricing, yield-curve modeling
 - One of two development leads, executing against a monthly release schedule for the past 18 months
 - FidMath used for risk and/or trading by wide range of trading desks: credit derivatives, global high yield, governments desk, new agencies desk, commodities, securitized products, municipal bonds desk, retail brokerage.
 - Daily risk on bond positions totaling over 7 billion US dollars managed using FidMath.

- Developed and validated library for valuation of credit default swaps, and modeling probability of default.
 - Delivered 5 releases over 15 months as part of a 40-person application development team.
 - Application computed daily risk for a global credit derivatives portfolio totaling 5 billion US dollars.
- Developed distributed derivatives pricing and risk-management system using XML messaging over TCP/IP and IBM MQ Series persistent messaging

Computational Scientist

Los Alamos National Laboratory, Los Alamos, NM, 1995 - 2000

Advanced Computing Laboratory

- Designed and implemented POOMA (Parallel Object-Oriented Methods and Applications) C++ class library for scientific computing on parallel processors.
 - Innovative use of templates and policy-based design
 - Part of team of O(10) developers
- Developed scientific applications using POOMA
 - Multi-material hydrodynamics
 - Particle-in-cell plasma simulation

Computational Scientist and Consultant

National Energy Research Supercomputer Center, Livermore, CA, 1994 - 1995

Massively Parallel Computing Group

- High-performance application development for Cray T3D parallel computer.
 - ParFlow groundwater contaminant transport simulation.
 - Toroidal flux-tube-geometry gyrokinetic particle-in-cell simulation of tokamak plasma microturbulence.
- Organized and lectured at NERSC Massively Parallel Processing Summer Workshop (1994).

Computational Physicist

Lawrence Livermore National Laboratory, Livermore, CA, 1989 - 1994

Magnetic Fusion Energy Theory and Computations Group

Massively Parallel Computing Initiative

- Published in top physics journals. Research in turbulent cross-field transport in tokamak plasmas, using gyrokinetic particle-in-cell (PIC) simulation.
- Research in parallel computing for computational science
 - Developed parallel algorithms for dynamic alternating-direction-implicit solvers.
 - Developed and published parallel banded linear-system direct solver which minimizes operations and interprocessor communications.
- Demonstrated 3D plasma PIC simulation on BBN TC2000 and Thinking Machines CM2 computers, using several parallel programming paradigms.
- Global ocean simulation, with Earth Systems Modeling Project.

EDUCATION

Ph.D. in Physics, College of William and Mary, Williamsburg, VA, 1988

Thesis: "Statistically Constrained Decimation of a Turbulence Model."

M.S. in Physics, College of William and Mary, Williamsburg, VA, 1984

B.S. in Physics and Mathematics, Carnegie Mellon University, Pittsburgh, PA, 1982

SELECTED PUBLICATIONS

- B. Wang, S. Ethier, W. Tang, T. Williams, K. Ibrahim, K. Madduri, S. Williams, L. Oliker, "[Kinetic Turbulence Simulations at Extreme Scale on Leadership-Class Systems](#)," SC13 technical paper (2013), DOI=10.1145/2503210.2503258.
- S. Coghlan, K. Kumaran, R. M. Loy, P. Messina, V. Morozov, J. C. Osborn, S. Parker, K. M. Riley, N. A. Romero, and T. J. Williams, "[Argonne applications for the IBM Blue Gene/Q, Mira](#)," IBM J. Res. Dev. 57, 1 (January 2013), 140-150. DOI=10.1147/JRD.2013.2238371 .
- A. M. Bailey, et al., "Blue Gene/Q: Sequoia and Mira," Chaper 10 in: Vetter, Jeffrey S., ed. *Contemporary High Performance Computing: From Petascale Toward Exascale*. Chapman & Hall/CRC, 2013.
- S. Karmesin, J. Crotinger, J. Cummings, S. Haney, W. Humphrey, J. Reynders, S. Smith, T. Williams, "[Array Design and Expression Evaluation in POOMA II](#)," in *Computing In Object-Oriented Parallel Environments, Lecture Notes in Computer Science 1505* (Springer, 1998).
- S. F. Ashby, W. J. Bosl, R. D. Falgout, S. G. Smith, A. F. B. Tompson, T. J. Williams, "[A Numerical Simulation of Groundwater Flow and Contaminant Transport on the Cray T3D and C90 Supercomputers](#)," The International Journal of High Performance Computing Applications, Vol. 13, No. 1, 1999.
- N. Mattor, T. J. Williams, D. W. Hewett, and A. M. Dimits, "[The Delayed Coupling Method: An Algorithm for Solving Banded Diagonal Matrix Problems in Parallel](#)," Proceedings of IMACS 97 conference (1997).
- E. L. Altschuler, T. J. Williams, E. R. Ratner, R. Tipton, R. Stong, F. Dowla, and F. Wooten, "[Possible Global Minimum Lattice Configurations for Thomson's Problem of Charges on a Sphere](#)," Phys. Rev. Lett. **78**, 2681 (1997).
- A. M. Dimits, T. J. Williams, J. A. Byers, and B. I. Cohen, "[Scalings of Ion-Temperature-Gradient-Driven Anomalous Transport in Tokamaks](#)," Phys. Rev. Lett. **77**, 71 (1996).
- T. J. Williams and A. M. Dimits, "[Gyrokinetic Simulation for Realistic Tokamak Parameters](#)," NERSC Buffer, **19** No. 10, 1 (1995).
- N. Mattor, T. J. Williams, and D. W. Hewett, "[Algorithm for solving tridiagonal matrix problems in parallel](#)," Parallel Computing **21** 1769 (1995).
- A. M. Dimits, et al., "[Gyrokinetic and Global Fluid Simulations of Tokamak Microturbulence and Transport](#)," (Proc. of 16th Int. Conf. on Plasma Phys. and Cont. Fusion Res.) IAEA, Seville, Spain IAEA-CN-60/D-P-I-5, 1994.
- E. L. Altschuler, T. J. Williams, E. R. Ratner, F. Dowla, and F. Wooten, "[Method of Constrained Global Optimization](#)," Phys. Rev. Lett. **72** 2671 (1994).
- B. I. Cohen, T. J. Williams, A. M. Dimits, and J. A. Byers, "[Gyrokinetic simulations of E×B velocity-shear effects on ion-temperature-gradient modes](#)," Phys. Fluids B. **5**, 2967 (1993).
- T. J. Williams, "[3D Gyrokinetic Particle-In-Cell Simulation of Fusion Plasma Microturbulence on Parallel Computers](#)," Proc. 1993 SCS Simulation Multiconference High Performance Computing Symposium, Arlington, VA, March 29-April 1, 114-119.
- B. I. Cohen and T. J. Williams, "[Implementation of a Semi-Implicit Orbit-Averaged Gyrokinetic Particle Code](#)," J. Comput. Phys. **107**, 282 (1993).
- T. J. Williams and Y. Matsuda, "[3D Gyrokinetic Particle-In-Cell Codes On The TC2000 And CM2](#)." In *The 1992 MPCI Yearly Report: Harnessing the Killer Micros*, E. R. Brooks et al. eds., UCRL-ID-107022-92, 303-311.
- B. I. Cohen and T. J. Williams, "[Semi-Implicit Particle Simulation of Kinetic Plasma Phenomena](#)," J. Comput. Phys. **97**, 224 (1991).
- T. J. Williams, Y. Matsuda, and E. Boerner, "[Parallel Particle Simulation On the TC2000 and CM-2](#)," In *The 1991 MPCI Yearly Report: Attack of the Killer Micros*, E. R. Brooks et al. eds., UCRL-ID-107022, 133-138.
- T. J. Williams, E. R. Tracy, and G. M. Vahala, "[Decimation of a Turbulence Model Under Statistical Constraints](#)," Phys. Rev. A **40**, 3272 (1989).
- T. J. Williams, E. R. Tracy, and G. M. Vahala, "[Strong Decimation of the Betchov Model of Turbulence](#)," Physica D **37**, 200 (1989).
- T. J. Williams, E. R. Tracy, and G. M. Vahala, "[Application of Kraichnan's Decimated Amplitude Scheme to the Betchov Model of Turbulence](#)," Phys. Rev. Lett., **49**, 1922 (1987).