Michael Borland, Ph.D.
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Michael Borland has extensive experience in the design, commissioning, operation, and simulation of electron guns, linear accelerators, and storage rings, and is well known for contributions to accelerator-driven light sources. He received his Ph. D. in 1991 from Stanford University for design and commissioning of a 1.5-cell thermionic rf gun. After moving to Argonne, he played a prominent role in the design, commissioning, and transition to operations of the APS complex, particularly for the Particle Accumulator Ring and Storage Ring. Dr. Borland is the principal author of `elegant`, one of the most widely-used codes for accelerator design and simulation. In 2001, using `elegant`, he discovered the CSR-driven microbunching instability in the LCLS design, which is now a topic of international interest. He is an Argonne Distinguished Fellow and Associate Division Director for Accelerator Systems at Argonne's Advanced Photon Source, as well as a fellow of the American Physical Society. Dr. Borland has served on numerous review panels in the US and abroad. Dr. Borland has been leading the beam physics design effort for the APS Upgrade since 2013, resulting in a design that is at the forefront of storage ring light sources. Review committees regularly assess the APS-U simulation effort as "defining the state of the art" in storage ring modeling for light sources.

Education

- 1985-1991: Ph.D. in Applied Physics from Stanford University.
  Thesis title: *A High-Brightness Thermionic Microwave Electron Gun*
- 1981-1985: B.S. Cum Laude in Physics from the California Institute of Technology

Research and Management Experience

- 2013-Present: Leader of beam physics effort for APS Upgrade, Argonne National Laboratory. Activities include oversight and participation in accelerator design, accelerator simulation, and simulation code development related to a multi-bend achromat (MBA) lattice for the APS upgrade.
- 10/2008-present: Associate Director, Accelerator Systems Division, Argonne National Laboratory. Activities include oversight and participation in accelerator operations and accelerator physics. Leader of an LDRD-funded effort to design an MBA lattice for an APS upgrade, which provided a strong basis for starting the APS upgrade project.
- 10/2003-10/2008: Operations Analysis Group Leader and Senior Scientist, Argonne National Laboratory. Activities included development and guidance of software for accelerator operation and simulation, including parallelization of `elegant`.

- 9/2002-9/2003: Senior Scientist, Lyncean Technologies, on leave of absence from the Advanced Photon Source. Activities included lattice design, start-to-end modeling, magnet design, and controls development for a compact accelerator for Compton x-ray production.
- 8/1999-9/2002: Linear Accelerator Manager, Advanced Photon Source. Activities included design and commissioning of a bunch compression system enabling saturation of the LEUTL FEL, development and guidance of procedures and software for automated linac operation; development of `elegant` to support modeling of FEL-driver linacs, including start-to-end simulation.
- 10/1995-9/2002: Operations Analysis Group Leader, Advanced Photon Source. Activities included development and guidance of procedures and automation for APS accelerator operation.
- 5/1991-9/2002: Particle Accumulator Ring Manager, Advanced Photon Source. Activities included physics design, modeling, oversight of engineering, and commissioning for a compact storage ring. Development of `elegant` to support storage ring modeling. Creation of the Self-Describing Data Sets file protocol and toolkit concept, significant contributor to development.

Selected Honours and Awards

- Named Argonne Distinguished Fellow in 2014 in recognition of my contributions to accelerator science and simulation. This is Argonne's highest scientific title.
- Winner of the Asian Committee on Future Accelerators IPAC13 Prize for Accelerator Science, for a recent, significant contribution to the accelerator field, for the program `elegant`, the SDDS Toolkit, and discovery of the coherent synchrotron radiation microbunching instability in magnetic bunch compressors.
- Co-winner of the 2013 Arthur H. Compton award from the APS Users Organization, for implementing the first "top-up" operation in a synchrotron light source (with L. Emery, J. Galayda, and D. Moncton).
- Elected a Fellow of the American Physical Society in 2007, in recognition of my contributions to modeling of next-generation accelerators.
- Co-recipient of the 1996 Distinguished Performance Award from the University of Chicago, in recognition of my role in building and commissioning the APS.

Selected Publications and Proceedings

Google scholar citation counts are shown in square brackets.

M. Borland, "elegant: A Flexible SDDS-Compliant Code for Accelerator Simulation," APS LS-287, presented at ICAP 2000, Darmstadt, Germany [908].

Z. Huang *et al.*, "Suppression of microbunching instability in the linac coherent light source," Phys. Rev. ST Accel. Beams **7**, 074401 (2004) [317].

S. V. Milton *et al.*, "Exponential gain and saturation of a self-amplified spontaneous emission free-electron laser," Science 292, 2037 (2001) [296].

J. Arthur *et al.*, "Linac coherent light source (LCLS) conceptual design resport," SLAC-R-593, 2002 [199].

M. Borland, "Simple method for particle tracking with coherent synchrotron radiation," Phys. Rev. ST Accel. Beams 4, 070701 (2001) [185].

M. Borland *et al.*, "Start-to-End Simulation of Self-Amplified Spontaneous Emission Free-Electron Lasers from the Gun through the Undulator," NIM A 483 (2002) 268-272 [133].

S. V. Milton *et al.*, "Observation of self-amplified spontaneous emission and exponential growth at 530 nm," Phys. Rev. Let. 86 (1), 79 (2000) [96].

M. Borland, "Simulation and analysis of using deflecting cavities to produce short x-ray pulses with the Advanced Photon Source," Phys. Rev. ST Accel. Beams **8**, 074001 (2005) [76].

M. Borland, "A high-brightness thermionic microwave electron gun," Stanford University Ph. D. Thesis, SLAC-402, UC-414, Feb. 1991 [66].

A. Lumpkin *et al.*, "First Observation of -Dependent Electron-Beam Microbunching Using Coherent Transition Radiation," PRL 85, 79 (2001) [59].

M. Bei *et al.*, "The potential of an ultimate storage ring for future light sources," NIM A 622 (3), 518-535 (2010) [55].

S. Di Mitri *et al.*, "Design and simulation challenges for FERMI@ elettra," NIM A 608 (1), 19-27 (2009) [54].

M. Borland, "A self-describing file protocol for simulation integration and shared postprocessors," Proc. PAC 1995, 2184-2186 (1995) [43].

M. Borland *et al.*, "Lattice design challenges for fourth-generation storage-ring light sources," J. Synch. Rad. 21 (5), 912-936 [47].

Y. Ivanyushenkov *et al.*, "Development and operating experience of a short-period superconducting undulator at the Advanced Photon Source," PRST-AB 18 (4) 040703 (2015) [43].

M. Borland *et al.*, "Modeling of the microbunching instability," PRST-AB 11 (3), 030701 (2008) [43].

L. Emery and M. Borland, "Top-up operation experience at the Advanced Photon Source," Proc. of PAC 1999, 200-202 (1993) [41].

W. Guo *et al.*, "Generating picosecond x-ray pulses in synchrotron light sources using dipole kickers," PRST-AB 10 (2), 020701 (2007) [33].

M. Borland, "Progress toward an ultimate storage ring light source," Journal of Physics: Conference Series, 425 (4), 042016 (2013) [29].

L. Emery and M. Borland, "Possible long-term improvements to the advanced photon source," Proc. of PAC 2003, 256-258 (2003) [28].

M. Borland *et al.*, "A highly flexible bunch compressor for the APS LEUTL FEL," Proc. Linac 2000, 863-865 (2000) [28].

Y. Wang and M. Borland, "Pelegant: A Parallel Accelerator Simulation Code for Electron Generation and Tracking," AIP Conference Proceedings 877 (1), 241-247 (2006) [26].