Sarah Cousineau

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Education

1998 BS in Physics, *summa cume laude*, University of North Dakota
2000 MS in Accelerator Physics, Indiana University, Bloomington
2003 PhD in Accelerator Physics, Indiana University, "Understanding Space Charge and Controlling Beam Loss in High Intensity Synchrotrons"

Professional Experience

2020-now Section Head for Accelerator Science and Technology, Research Accelerator Division. Responsibilities: Provide top-level leadership for the Accelerator Physics (AP), Beam Instrumentation (BI), and Mechanical Engineering (ME) groups, consisting of 30 physicists, engineers, and technicians; $12M budget. Notable accomplishments:

- Served as the acting RAD Division Director at regular intervals
- Developed productive relationships with DOE program sponsors in BES, HEP, and NP
- Supported major beam instrumentation AIP project completed on time and within budget
- Led new externally funded machine learning initiative to enhance accelerator reliability
- Facilitated reconfiguration the Beam Test Facility to increase scientific impact and versatility
- Initiated cross-directorate collaboration to explore isotope production at SNS (LDRD)
- Launched improvements in work organization and staff development for the ME group
- Lead the American Physics society Division of Beams executive committee, created new student support program and Phys Rev Acc and Beams best paper recognition program
- Facilitated or led several high-impact R&D achievements including,
    - The first 1 part-per-million (ppm) beam space measurement
    - The first demonstration of injection-painted, self-consistent beam distributions.
    - Novel laser-based measurement with picosecond resolution capability

2024 Leadership Experience Advancement Program Fellow, Brookhaven National Laboratory. Worked quarter time for the Deputy Director of Science at BNL on a workforce development project to create stronger professional ties among the distinct accelerator organizations. Notable accomplishments:

- Organized and led accelerator leadership retreat to identify professional development opportunities, resolve challenges
- Developed charter and framework for a new Accelerator Community of Practice (ACoP)
- Recruited first ACoP leadership, organized first two events, and successfully launched kickoff

2018-2020 Second Target Station Accelerator Systems WBS2 Lead. Developed the CD1-level scope for STS accelerator systems. Notable accomplishment:

- Developed the WBS structure for the accelerator portion of the STS project
- Defined key requirements for the technical scope and associated KPPs
- Culminated in successful CD1 approval

2016-2020 Group Leader for Beam Science and Technology group, Research Accelerator Division. Responsibilities: Lead the Accelerator Physics, Beam Instrumentation, and Ion Source groups; $9M budget. Notable accomplishment:

- Transitioned R&D portfolio toward a more challenge-driven, impact-focused research paradigm, prioritizing publications and external competitiveness, leading to increased funding and the division's first Early Career Award.
- Initiated new online system to request, approve, and organize beam study time
- Facilitated ion source improvements leading to world-record breaking ion source service cycles
- Initiated and launched the outage tunnel tour program for all ORNL staff to increase communication and awareness (now a routine practice)
- Led externally funded projects that delivered high-impact R&D achievements including,
    - Demonstrated of laser-assisted charge exchange for microsecond duration pulses
    - First-ever 6D measurement of the beam phase space

2005-2016 Research Professional, Research Accelerator Division. Responsibilities: Participated in beam studies to improve beam power and beam quality, and to reduce beam loss; developed high level application software to improve efficiency of beam tuning. Notable accomplishments:

- Led beam ring commissioning shifts contributing to first characterization of the high intensity beam and critical troubleshooting of many issues
- Through joint faculty appointment, developed a strong relationship with UT Depart of Physics and Astronomy resulting in a continuing flow of graduate students into the group
- Recruited first externally funded projects to division (DOE HEP)
- Advised UT graduate student, one to two semester undergraduate interns per year
- Performed the first benchmark of the SNS accumulator ring beam
- Debugged major operational issue with extracted beam from the SNS ring

2003-2005 Postdoctoral Scientist, Research Accelerator Division. Responsibilities: Participated in the commissioning of the SNS accelerator. Notable accomplishments:

- Participated in beam commissioning of the SNS accelerator
- Developed accelerator physics application software for control, characterization, tuning
- Developed and used PIC simulation code pyORBIT to model the SNS accelerator
- Discovered and explained sustained, space charge driven microbunch phenomenon at Los Alamos Proton Storage ring

1999-2002 Graduate Research Assistant, Indiana University. Notable accomplishments:

- Developed a material scattering PIC simulation model of the SNS collimation system
- Provided final design parameters for SNS ring collimation system location and apertures
- Proposed new understanding of space charge driven half integer resonance supported by experiment and simulation
- Doctoral thesis: "Understanding Space Charge and Controlling Beam Loss in High Intensity Synchrotrons"

Honors, Distinctions, and Awards

2023 Outstanding Referee Recognition, Physical Review Journals
2020 Fellow, American Physical Society
2017 ORNL Significant Event Award for, "Demonstration of Microsecond H- Laser-Assisted Stripping"
2015 Recipient, ORNL Awards Night, Mentor of Student Research Award
2008 Mentor Excellence Award, US. DOE Office of Science
2003 Mentor Excellence Award, US DOE Office of Science

1999	Excellence in Teaching Award, Indiana University
1998-2002	Women in Science Fellowship Recipient, Indiana University

Research Grants

2024-now	"Radioisotope Production at SNS," ORNL LDRD
2020-2023	(PI) "Machine Learning for Improving Accelerator and Target Performance," DOE BES
2016-2018	(PI) "Laser Stripping for High Intensity Synchrotrons", DOE HEP
2015-2018	(PI) "Six-Dimensional Experimental Characterization of High Intensity Hadron Beams in Front End Systems," NSF
2012-2016	(PI) "Laser Stripping for High Intensity Synchrotrons", DOE HEP

Professional Leadership Roles

2024-now	Divisional Associate Editor for Accelerators and Beams, Physical Review Letters
2024-now	Science and Technology Steering Committee, Brookhaven National Laboratory
2024-2027	Scientific Program Committee Chair, International Particle Accelerator Conference 2027
2023-now	US DOE High Energy Physics Advisory Panel (HEPAP)
2022-now	Advisory Council, US Particle Accelerator School
2020-2022	Chair line, American Physical Society Division of Physics of Beams Executive Committee (*Vice-Chair 2020, Chair 2021, Past-Chair 2022*)
2021-2023	Coordinator, Editorial Board for ORNL Review Research Insights
2015-2022	Chair, US Particle Accelerator School Curriculum Committee
2017-2019	Founding Member, Women in Neutron Science committee (WiNS)
2016-2017	Graduate, Battelle Operations Leadership Academy (LOLA)
2013-2017	Member, Physical Review Accelerators and Beams Editorial Board
2010-2013	Member at Large, American Physical Society Division of Physics of Beams Executive Committee
2007-2008	Vice-President, ORNL Committee for Women
2005-2007	NScD Representative, ORNL Committee for Women

Professional Service

2025	(Chair) Director's Review of Injector Operations and RHIC Removal & Repurposing
2025	DOE Quadrennial Review of LBNL Advanced Light Source
2024-2025	Machine Advisory Committee, GSI/FAIR
2023-2025	(Chair) Thomas Jefferson National Laboratory Accelerator Advisory Committee
2023	(Co-Chair) Electron Ion Collider CD3a Directors Review
2023	Director's Review, SNS Second Target Station project
2023	Thomas Jefferson National Accelerator Laboratory Technical Advisory Committee (2023)
2021-2022	Internal Review Committee, ORNL AI LDRD program
2022	DOE Early Career Award Internal Review, Nuclear Physics
2021	DOE Science and Technology Review for the Facility for Rare Isotope Beam
2020	(Co-Chair) Conceptual Design Review of the Electron Ion Collider
2020-2024	Technical Advisory Committee, SNS Second Target Station project
2017-2023	Machine Advisory Committee, PIP-II Project
2020	Thomas Jefferson National Accelerator Laboratory Biennial S&T Review
2019	(Chair) Physical Review Accelerator Beams (PRAB) journal review
2018	Thomas Jefferson National Accelerator Laboratory Facility Operation Review

2017 Thomas Jefferson National Accelerator Laboratory Biennial S&T Review (2017)

Educational Activities

2007-2021, biannually	Instructor, "Fundamentals of Accelerator Physics," US Particle Accelerator School US Particle Accelerator School Awards Committee
2009, 2010	Instructor, "SNS to the Classroom," an ORISE workshop high school teachers
2005	"Einstein in the City" high school science fair organizer, 2005 Particle Accelerator Conference
2017-2019	Student Travel Award Committee
2016-2022	IPAC Student Scholarship Award Committee
2015-2018	APS DPB Education and Outreach Committee

Selected Plenary and Keynote Talks

2024	"Journey to the world's highest power hadron beams at the Spallation Neutron Source," Opening Plenary, 2025 International Particle Accelerator Conference
2020	"Accelerator R&D as a Driver for Science", Opening Plenary, 2020 International Particle Accelerator Conference
2015	"High Power Proton Facilities: Operational Experience, Challenges, and the Future," Closing Plenary, International Particle Accelerator Conference
2016	"Laser Stripping: A Novel Method for Achieving High Density Beams in Future Accelerators," Opening Plenary, Southeast Conference for Undergraduate Women in Physics, Norfolk
2018	"The World's Largest Scientific Tools," Keynote Opening Seminar, 2018 Tennessee State Science Bowl
2018	"A Hitchhikers Guide to Accelerators and Life as an Accelerator Physicist," Annual Harbison Lecture, MICDS STEM School, St. Louis

Refereed Publications

1. Steven Goldenberg, Malachi Schram, Kishansingh Rajput, Thomas Britton, Chris Pappas, Dan Lu, Jared Walden, Majdi I Radaideh, **Sarah Cousineau** and Sudarshan Harave, *Distance preserving machine learning for uncertainty aware accelerator capacitance predictions*, Mach. Learn.: Sci. Technol. 5 045009 (2024)
2. N Goth F Liu, B Maldonado, P Ramuhalli, M Howell, R Maekawa and **S Cousineau**, *Dynamic systems modeling of the spallation neutron source cryogenic moderator system to optimize transient control and prepare for power upgrades*, *2024* IOP Conf. Ser.: Mater. Sci. Eng. 1301 012088 (2024)
1. Y. Alanazi, M. Schram, K. Rajput, S. Goldenberg, L. Vidyaratne, C. Pappas, M. Radaideh. D. Liu, P. Ramuhalli, **S. Cousineau**, *Multi-module based CVAE to predict HVCM faults in the SNS Accelerator*, Machine Learning with Applications **13**, 100484 (2023).
2. A. Hoover, K. Ruisard, A. Aleksandrov, A. Zhukov, S. **Cousineau**, *Analysis of a hadron beam in five-dimensional phase space,* Phys. Rev. Accel. Beams **26**, 064202 (2023)
3. A. Aleksandrov, **S. Cousineau**, T. Gorlov, Y. Liu, A. Oguz, A. Shishlo, A. Zhukov, *Experimental demonstration of sequential excitation scheme for H- laser assisted charge exchange,* Phys. Rev. Accel. Beams **26**, 143501 (2023)
4. M. Radaideh, C. Pappas, M. Wezensky, P. Ramuhalli, **S. Cousineau**, *Early Fault Detection in Power Electronics Using Ensemble Learning,* International Journal of Prognostics and Health Management, Vol **14**, 1 (2023) https://doi.org/10.36001/ijphm.2023.v14i1.3419

5. M. Radaideh, C. Pappas, J. Walden, D. Liu, L. Vidyaratne, T. Britton, K. Rajput, M. Schram, **S. Cousineau**, *Time Series anomaly detection in power electronics signals with recurrent and ConvLSTM autoencoders*, Digital Signal Processing **130**, 103704 (2022), https://doi.org/10.1016/j.dsp.2022.103704
6. M. Radaideh, L. Lin, H. Jiang, **S. Cousineau**, *Bayesian Inverse Uncertainty Quantification of the Physical Model Parameters for the Spallation Neutron Source First Target Station*, Results in Physics **36**, 105414, (2022)
7. M. Radaideh, H. Tran, L. Lin, H. Jiang, D. Winder, S. Gorti, Guannan Zhang, J. Mach, S. Cousineau, *Model calibration of the liquid mercury spallation target using evolutionary neural networks and sparse polynomial expansions,* Nucl. Instr. and Methods B, **525**, p. 41-54, (2022)
8. J. Wong, A. Aleksandrov, **S. Cousineau**. T. Gorlov, Y. Liu, *Laser-assisted charge exchange as an atomic yardstick for proton beam energy measurement and phase probe calibration*, Phys. Rev. Accel. Beams **24**, 032801 (2021)
9. A. Aleksandrov, **S. Cousineau**, K. Ruisard, A. Zhukov, *First measurement of a 2.5 MeV RFQ output emittance with 1 part-per-million dynamic range,* Nucl. Instr. and Methods A, **987,** 164829 (2020)
10. K. Ruisard, A. Aleksandrov, **S. Cousineau**, A. Shishlo, V. Tzoganis, *High dimensional characterization of the longitudinal phase space formed in a radio frequency quadrupole*, Phys. Rev. Accel. Beams **23**, 124201 (2020)
11. M. Stockli *et al*, *Upgrading the LANSCE Accelerator with a SNS RF-driven H- Ion Source*, Review of Scientific Instruments **91**, 013321 (2020)
12. T. Gorlov, A. Alexander, **S. Cousineau**, Y. Liu, A. Rakhman, A. Shishlo, *Sequential Resonance Excitation for Laser Stripping for a H- Beam*, Phys. Rev. Accel. Beams **22**, 121601 (2019)
13. Z. Zhang, **S. Cousineau**, A. Aleksandrov, A. Menshov, A. Zhukov, Design and Commissioning of the Beam Test Facility at the Spallation Neutron Source, Nucl. Instr. and Methods A, **949**, 162826, (2019)
14. J. Holmes, **S. Cousineau**, N. Evans, T. Gorlov, and M. Plum, *Feasibility Study for Painting a Self-Consistent Beam into the Spallation Neutron Source Accumulator Ring*, Phys. Rev. Accel. Beams, Phys. Rev. Accel. Beams **21**, 124403 (2018)
15. B. Cathey**, S. Cousineau,** A. Aleksandrov, A. Zhukov, *First Six Dimensional Phase Space Measurement of an Accelerator Beam*, Phys. Rev. Lett., **121**, 064804 (2018)
16. **S. Cousineau**, A. Rakhman, M. Kay, A. Aleksandrov, V. Danilov, T. Gorlov, Y. Liu, C. Long, A. Menshov, M. Plum, A. Shishlo, A. Webster, and D. Johnson, *High efficiency laser-assisted H- charge exchange for microsecond duration beams,* Phys. Rev. Accel. Beams, **20**, 120401 (2017)
17. **S. Cousineau,** A. Rakhman, M., A. Aleksandrov, V. Danilov, T. Gorlov, Y. Liu, M. Plum, A. Shishlo, and D. Johnson, *First Demonstration of Laser-Assisted Charge Exchange for Microsecond Duration H- Beams*, Phys. Rev. Lett., **118**, 078401 (2017)
18. Y. Liu, A. Rakhman, A. Menshov, A. Webster, T. Gorlov, A. Aleksandrov, and **S. Cousineau**, *Laser and Optical System for Laser Assisted Hydrogen Ion Beam Stripping at SNS,*Nuclear Instruments and Methods A, 857, p 171 (2017)
19. S. Henderson *et al*, *The Spallation Neutron Source Accelerator System Design*, NIM A 763 (2014)
20. J.A. Holmes, **S. Cousineau**, V. Danilov, L. Jain, *Comparison Between Measurements, Simulations, and Theoretical Predictions of the Extraction Kicker Transverse Dipole Instability in the Spallation Neutron Source*, Phys. Rev. ST Accel. Beams, **14**, 074401 (2011)
21. **S. Cousineau**, J.A. Holmes, M. A. Plum, W. Lu, *Dynamics of Uncaught Foil-Stripped Electrons in the Spallation Neutron Source Accumulator Ring*, Phys. Rev. ST Accel. Beams, **14**, 064001 (2011).

22. M. Plum, **S. Cousineau**, J. Galambos, S.H. Kim, P. Ladd, C.F. Luck, C.C. Peters, Y. Polsky. R. W. Shaw, R. J. Macek, and D. Raparia*, Stripper Foil Failure Modes and Cures at the Oak Ridge Spallation Neutron Source*, Phys. Rev. ST Accel. Beams, **14**, 030101 (2011)
23. T. Pelaia and **S. Cousineau**, *A Method for Probing Machine Optics By Constructing Transverse Real Space Beam Distributions Using Beam Position Monitors*, Nucl. Instr. and Methods A, accepted (2008)
24. D. Jeon, J. Stovall, H. Takeda, S. Nath, J. Billen, L. Young, I. Kisselev, A. Shishlo, A. Aleksandrov, S. Assadi, C.M. Chu, **S. Cousineau**, V. Danilov, J. Galambos, S. Henderson, S. Kim, L. Kravchuk, E. Tanke, *Acceptance Scan Technique for the Drift Tube Linac of the Spallation Neutron Source*, Nucl. Instr. and Methods A, **570** (2), p. 297 (2006)
25. **S. Cousineau**, *Space Charge and High Intensity Beam Issues in the Design and Commissioning of the Spallation Neutron Source Accelerator,* Nucl. Instr. and Methods A, **561** (2), p. 187 (2007)
26. **S. Cousineau**, V. Danilov, J. Holmes, R. Macek, *Space-Charge-Sustained Microbunch Structure in the Los Alamos Proton Storage Ring*, Phys. Rev. ST Accel. Beams, **7**, 094201 (2004)
27. V. Danilov, **S. Cousineau**, J. Holmes, S. Henderson, *Self-Consistent Time Dependent Two Dimensional and Three Dimensional Space Charge Distributions with Linear Force*, Phys. Rev. ST Accel. Beams **6,** 094202 (2003)
28. **S. Cousineau**, V. Danilov, A. Fedotov, J. Holmes, S.Y. Lee, *Studies of Resonant Beam Behavior in the Proton Storage Ring*, Phys. Rev. ST Accel. Beams **6**, 074202 (2003)
29. **S. Cousineau**, A. Fedotov, J. Holmes, J. Galambos, R. Macek, J. Wei, *Space Charge Induced Resonance Excitation in High Intensity Rings*, Phys. Rev. ST. Accel. Beams **6**, 034205 (2003)
30. M. Henriksen and **S. Cousineau**, *An X-ray Survey of Galaxies in Pairs*, Astrophysical Journal **511**, 595 (1999)
31. **S. Cousineau**, *Constructing a Celestial Calendar Wheel*, The Physics Teacher **37**, 477 (1999)