

CARL A. WILLIS

1611 Arno Street SE, Albuquerque NM 87102
Phone: 505-412-3277 Email: carl.willis@gmail.com

Nuclear engineer with experience in **radiation detection and measurement, particle accelerator applications, radiation transport modeling, and radiation safety.**

EMPLOYMENT

- **Qynergy Corporation**, Albuquerque, NM (2010-present, full time). Development Engineer. Directed research on piezoelectric neutron generators and associated ion sources; design, assembly, and testing of scintillating ion chambers for a Sandia National Laboratory client; contributed modeling, design, and experiments on tritium-based betavoltaic power sources; provided major technical contributions to a diverse R&D portfolio, including electrochemical solution growth of GaN, asymmetric aqueous ultracapacitors, and thermal battery materials. Maintained DOD Secret security clearance, 2011-2012.
- **Linac Systems, LLC**, Albuquerque, NM (2006-2010, full time). Nuclear Engineer. Developed novel neutron-producing accelerator target system for BNCT, including thermal and nuclear design aspects, prototype construction, and thermal-hydraulic testing. Target continues to be used in Japan. Advised the Chief Scientist and customers on accelerator applications including isotope production and neutron activation analysis, and on radiation protection and shielding. Assisted with design, assembly, operation, and servicing of 2–5 MeV proton and deuteron linear accelerators. Managed institutional radiation safety program (worker dosimetry, training; monitoring of accelerator radiation hazards; securing / maintaining state licensing for radiation machines and byproduct material).
- **Ion Linac Systems, Inc.**, Albuquerque, NM (2011-present, consultancy only). Radiation Safety Officer (RSO) for experimental proton linear accelerator facility.
- **Willis Scientific Enterprises, LLC**, Albuquerque, NM (2015-present). Developed, organized, and led three 40-hour radiation safety and measurement workshops at the Chernobyl Nuclear Power Plant, Ukraine in 2015 and 2016, in cooperation with ChNPP administration, aimed at familiarizing first responders and other occasional radiation workers with practical experience in radiation protection practices at this unique nuclear facility.

EDUCATION

- **M.S. Nuclear Engineering, The Ohio State University**, Columbus, OH (2005). Thesis: “Neutronics and Shielding Design of an Accelerator-Based Neutron Source for Neutron Activation Analysis.”
- **B.S. Physics and Chemistry, Guilford College**, Greensboro, NC (2003). Thesis: “Neutron Activation Using a Farnsworth Fusor.”

FELLOWSHIPS, INTERNSHIPS

- **Los Alamos Neutron Science Center** (Los Alamos, NM) summer 2005. NE Graduate Fellowship practicum. Worked with G. Muhrer on target neutronics for the NXGENS long-pulse spallation neutron source. Extensive use of MCNPX on Linux parallel-processor platform.
- **The Ohio State University Nuclear Engineering Program** (Columbus, OH) 2003-2006. Research Assistant. Conducted radiobiology experiments involving mixed-field dosimetry at the OSU Research Reactor with T. E. Blue and R. Barth.

ENGINEERING SKILLS

- **Experimental skills:** design, use, and repair of nuclear instrumentation including HPGe, scintillation, Geiger, proportional, and fission detectors, and associated electronics; microelectronics fabrication with Si, SiC, and GaN; SEM and EDX use; troubleshooting, soldering, use of test equipment such as network analyzers, oscilloscopes; extensive work with high-voltage and high-power RF systems; coursework and experience in machining; high vacuum technique; laboratory glassblowing
- **Computational tools:** MCNP/MCNPX, MatLab, LabVIEW, FLUENT, SolidWorks, Vector Fields SOPRANO (electromagnetics modeling code); SIMION; MS Office; MS Windows and Linux operating systems

PUBLICATIONS

- **C. Willis**, D. Swenson. "High-power lithium target for accelerator-based BNCT," Proc. 24th Linear Accelerator Conference (Linac08), Victoria BC, Sept. 29-Oct. 3 2008, p223-225
- **C. Willis**, G. Muhrer. "Target system neutronics study for NXGENS," NIM A 570 (2007), p374-383
- **C. Willis**, Krishnan, V. Khorsandi, B. Blue, T.E. Swindall, M. Barth, R.F. "Cell Survival Experiments for BNCT at the OSU Research Reactor." Trans. Am. Nuc. Soc. 97 (2007), p312-314
- "Neutronics and shielding design of an accelerator-based neutron source for neutron activation analysis" (M.S. Thesis, Ohio State University, 2005)
- H. J. Im, **C. Willis**, M. D. Pavel, S. Saengkerdsub, S. Dai, "Transparent Matrix Structures for Detection of Neutron Particles Based on Di-ureasil Xerogels," App. Phys. Letters 84, p2448-2450.

ONLINE MEDIA

- YouTube content creator on nuclear topics with 2200 subscribers:
<https://www.youtube.com/user/Thallium208>
- Blog: www.carllwillis.wordpress.com
- Forum administrator, Open Source Fusion Research Consortium, www.fusor.net. This forum has been the preeminent experimental recreational nuclear fusion community online for nearly two decades.
- Plasma artist (www.electrifying.me) with installation experience; invited artist, Jan.-July 2017, "The Art of Plasma", Museum of Neon Art (Los Angeles)

COMMUNITY ENGAGEMENT

- Volunteer, Portal To The Public (PoP), Explora, Albuquerque (2011-present). NSF-funded informal science education outreach program. Teach museum visitors about particle accelerator technology through hands-on activities developed with assistance from Explora staff. Training sessions in learning styles and guided inquiry.
 - Instructor, Sandia National Laboratories HMTech (2016): Summer STEM educational program for high school students organized by the SNL Black Leadership Committee. Designed, funded, and led class in radiation detection and measurement; each student built a Geiger counter they could keep, and used it and other instruments to measure properties of radiation from a variety of sources.
 - Science and engineering mentor. Extensive descriptions of my independent mentorship activities in The Boy Who Played With Fusion by Tom Clynes (2015) and Science Fair Season by Judy Dutton (2011). Mentor for several students through Eldorado HS gifted program, APS (2012-2014).
 - Commentator, “The Half Life of Genius: Physicist Raemer Schreiber” (2016), feature-length documentary film on the life and legacy of Raemer Schreiber, with Richard Rhodes, Taylor Wilson, and Roger Meade. Provide commentary on Project Rover, the Louis Slotin accident, and Schreiber’s doctoral thesis on neutron physics.
 - Invited presenter, Science On Tap, Albuquerque (2015-2016). Repeat presenter to local informal science lecture event organized by UNM and local museums.
 - Invited presenter, High Energy Amateur Science conference, Richmond, VA (2010-2014; 2016). Delivered presentations about various topics in recreational nuclear physics.
 - Invited lecture on Chernobyl, “Nuclear New Mexico” class (instructed by Eileen Shaughnessy), UNM (11 April 2016).
 - Invited panelist, “A Dark Achievement: Commemorating 30 Years of the Chernobyl Sarcophagus”, Department of Science and Technology in Society, Virginia Tech (5 December 2016). Delivered presentation on construction of the New Safe Confinement at ChNPP.
 - Presenter, Teen Science Café, Explora, Albuquerque (April 2016). Led high-school students in experiments with various radiation sources and discussed the changing social views toward radiation throughout history, with emphasis on popular culture.
 - Presenter, Discover STEM Week, National Museum of Nuclear Science and Technology, Albuquerque (2014-2016). Conduct demonstrations and hands-on activities relating to particle accelerators and radiation for middle- and high-school classes.
 - Tour coordinator, nuclear sites in Kazakhstan (2012). Organized program and managed finances for a group of six to travel to the Semipalatinsk Nuclear Test Site, the National Nuclear Center of Kazakhstan (Almaty), and the Tien Shan Cosmic Ray Observatory.
 - Tour coordinator, Chernobyl Nuclear Power Plant and Exclusion Zone (2010, 2011, 2013). Organized program and managed finances for small-group, week-long visits to ChNPP facilities and parts of the Chernobyl Exclusion Zone.
 - Collector and curator of radioactive and nuclear material culture. Collection includes spent fuel from CP-1 reactor, thorium-230 prepared by Marie Curie, and numerous radium quack cures.
 - Amateur radio operator, Extra Class license (KF4KIG)
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