

Walter J. McNeil

4746 Starfire Ln., Wamego, KS 66547
wmcneil@ksu.edu 785-341-2696

Curriculum Vitae

EDUCATION:

Ph.D. Nuclear Engineering, Kansas State University December 2010
B.S. Mechanical Engineering with Nuclear Option, Kansas State University December 2004

RESEARCH & WORK EXPERIENCE:

Kansas State University Manhattan, KS
Mechanical & Nuclear Engineering Department 2015 – pres.

Assistant Professor, Tenure-track faculty

- Obtained career *h*-index of 20 with 1012 citations from Google Scholar
- Secured \$8.17M of extramural research funding (\$5.5M as PI). Advised 11 Graduate students, supported 20 undergraduate researchers in the field of radiological sensors, systems, methods, and applications
- Thrust Area Lead for Replacement of Dangerous Radiological Sources (RDRS) in the Consortium for Nonproliferation Enabling Capabilities (CNEC); a \$26M NNSA Consortium
- Ranked 11th at KSU by Office of the Vice President of Research in research award dollars over a 3-year average, 2018-2020
- Had 3 graduate students employed at top-tier organizations before completing Ph.D studies.
- Established 4 new laboratories: Radiological System Integration Laboratory (RSIL), Kansas State University Material Interrogation Facility (KSUMI), a mobile laboratory for remote site field operations and radiological testing, an active neutron interrogation test lab for explosives detection.
- Mapped dirty-bomb radiological contamination with drones and ground vehicles fusing radiological and 3D photogrammetry data into virtual reality environment supporting the military NBCRV vehicle upgrade.
- Combined Finite Element and Stochastic methods simulating photomultiplier tube signal formation
- Invented micro-nuclear mechanical systems for neutron generation and strain measurement
- Developed radiological isotope identifier systems, tech. transferred for production for the military
- Developed a new graduate level, special topics course NE860 “Radiation Sensor Signal Processing and Data Analysis”
- Developed a new undergraduate laboratory course, ME519 “Electric Circuits for MNE”.

Space and Naval Warfare Systems Command (SPAWAR Systems Center – Pacific) San Diego, CA
Radiological threat detection system integration: Research, Development, Limited-Production. 2010 – 2015

Ph.D. Nuclear Engineer (Physicist)

TECHNICAL:

- Trained/Taught system users and designers on radiation sensor physics, mechanics, human factors in software and operational strategies for maximum performance and effectiveness in real-world scenarios.
- Evaluated technical readiness of new sensor technologies for specially-trained military users including detector radiation response and extreme-environment testing to establish technical limitations.
- Performed physics calculations to predict radiation sensor performance and limitations.
- Consulted on low-power, low-noise circuitry layout for HV supplies and pulse-processing for rad. sensors.
- Designed portable radiation detection systems for maximum sensitivity and minimum size: NaI/CsI, LaBr, CeBr, CLYC, CZT, Solid-state neutron detectors. Doubled sensitivity of He-3 through novel repackaging.
- Improved design and assembly process of portable HPGe cryogenic gamma spectrometer sensor package.
- Implemented thermally efficient cryostat housing design with optimized electro-mechanical cryogenic cooler to produce the lightest and lowest power-consuming hand-held HPGe spectrometer available to-date
- Performed painstaking electronic trouble-shooting of low-level, high-frequency, analog signals to find and eliminate sources of interference noise in analog sensor signals.

LEADERSHIP/MANAGEMENT:

- Directed design, development, and testing of state-of-the-art radiation detection systems involving multidisciplinary teams of mechanical, electrical, and computer engineers.

- Prioritized technical work and man-hours between progressing project phases as well as different programs based on technical needs and project dead-lines, forming strategies to address unforeseen challenges.
- Presented design-reviews, program reports, and prototype demonstrations to sponsors including Defense Threat Reduction Agency (DTRA), DIA, and Federal Bureau of Investigation (FBI).
- Acted as a technical resource for proposal writing for multi-million dollar awards collaborating with national laboratories and universities.
- Sat on Radiation Safety Committee (RSC) representing the radiological safeguards of the entire SSC-PAC command of 4000 personnel. Committed to fully-transparent compliance with Navy radiological controls.

Semiconductor Materials and Radiological Technologies Laboratory

Manhattan, KS

Cutting edge nuclear detection sensors through advanced materials and design.

2004 - 2010

Graduate Research Assistant

Dept. of Defense, Defense Threat Reduction Agency Grant

- Invented novel Lithium foil neutron detector, patented and commercially licensed. **R&D100 award**
- Developed and fabricated high-efficiency micro-structured silicon diode neutron sensors through VLSI processing and high aspect-ratio etching with an inductively-coupled plasma system. **R&D100 award**
- Conceived new processing techniques to retain diode electrical performance and to fill deep microscopic trenches with ⁶LiF neutron conversion material.
- Designed and fabricated a 5x5 low-efficiency diode sensor array for neutron beam sampling and imaging.
- Characterized novel neutron detector systems with a neutron diffractometer offering selected mono-energetic neutrons near thermal energies at the KSU TRIGA Mark II nuclear reactor.
- Developed system of clustered perforated diode neutron detectors for increased sensitivity, collaborating with multiple defense contractors.

National Science Foundation (NSF) Grant

- Designed and constructed a 1-Dimensional Perforated Neutron Detector Array with 120 micron spatial resolution for use at the Spallation Neutron Source at Oak Ridge National Lab in small-angle neutron scattering experiments for non-destructive stress measurements.

Dept. of Energy, Nuclear Education Engineering Research (NEER) Grant

- Modeled gamma-ray spectroscopic response based on charge transport with trapping to predict charge collection efficiency in 3-dimensional geometries of CdZnTe, including the non-linear weighting potentials from the Frisch collar design and irregular bulk defects.
- Installed facilities for CdZnTe detector fabrication and manufactured Frisch collar CdZnTe detectors to achieve exceptional energy resolution room-temperature gamma-ray spectrometers. **R&D100 award**

Schlumberger Technology Corp.

Sugar Land Product Center, Houston, TX

Design and development of tools and sensors for oil exploration

Summer 2004

Design Engineering Intern – Nuclear/Acoustics Division

- Created mechanical designs and testing apparatus for severe environment testing of sonic transducers and receivers housed in prototype logging tools, including physical shock platforms and pressure vessels.
- Estimated total cost projection during interdisciplinary development of \$300,000 sonic oil-well logging tool prototype including electronic and mechanical components.
- Designed physical shields for sonic sensors and performed structural analysis with ANSYS.

Brookhaven National Lab

Long Island, NY

Nonproliferation & National Security Department

Summer 2003

Intern Research Assistant

- Executed surface polishing and etching of CdZnTe crystals, electroless gold deposition for electrical contacts, and Ammonium Fluoride chemical processes for side surface electrical passivation.
- Fabricated first ever CdZnTe Frisch collar detector and demonstrated record breaking energy resolution for 662 keV gamma-rays with room-temperature semiconductor and no electronic signal corrections.

Schlumberger Oil-well Services

Labuan, Malaysia

Acoustic, inductive, resistive, and nuclear wire-line data logging services.

Summer 2002

Field Engineering Intern - Reservoir Development Drilling and Measurements

- Performed maintenance, repairs, and calibrations on seismic, nuclear, and resistance interrogation tools in between client jobs.
- Assisted a field engineer with an off-shore rig job on a heavily deviated well in South China Sea.
- Interpreted oil-well logs and re-cataloged a large neglected archive of logs.
- Updated an on-line out-sourcing database of tools shared between regions.

Leading Technology Composites

Wichita, KS

Resin Transfer Molding Technician

Summer 2001

- Performed manual resin transfer molding (RTM) process on carbon fiber bone-mounted wrist braces for medical industry including mixing batches of resin, pneumatic injections and vibration-guided void release. Took processing yields from 20% to 80%.
- Constructed carbon fiber preforms and cores for the RTM process with cutting dies and pneumatic presses.
- Executed tooling break-out, product inspections, and die preparations for RTM.

KSU TRIGA Mark II Nuclear Reactor

Manhattan, KS

Student Worker

2001-2002

- Facility Maintenance routine and non-routine, crane operations, equipment removal for upgrades such as the primary coolant loop heat ex-changer and air-conditioning units. Trouble-shot malfunctioning equipment and electrical systems.
- Executed in-core and near-core specimen irradiation experiments. Established irradiation facilities and shielding configurations and performed documented radiation surveys for scheduled experiments.
- Conducted supervised reactor operations and standard procedures as a licensed operator trainee.
- Characterized thermal neutron flux for 3 of the 4 beams in the facility with a Gallium-Arsenide coated-diode neutron detector.

J-MAC Industries: Now “Aluminum Products Division of Husky Liners”

Argonia, KS

Anodized aluminum flow-through tailgates and sunshades for pick-ups.

1994-2000

Owner's Son

- Performed all manufacturing tasks: Saw cutting, hydraulic press forming, shearing, punching, welding (TIG & MIG), crating, packaging, shipping & receiving.
- Addressed facility maintenance as well as equipment installations and repairs including metal shears, punch presses, etc.
- Drafted floor-plan for entire plant relocation based on equipment usage, ergonomics, manufacturing process flow, and work-in-progress space constraints.

AWARDS & CERTIFICATES:

- “R&D 100 Award”: R&D Magazine's top 100 technologically significant inventions of the year, for development of the Lithium Foil Proportional Gas Neutron Detector - 2014
- “R&D 100 Award”: R&D Magazine, Micro-structured Semiconductor Detector - 2009
- “R&D 100 Award”: R&D Magazine, Insulated Frisch Collar CdZnTe detector. - 2005
- DAWIA Level I Certification – Systems Planning, Research, Development and Engineering, SPRDE
- Award for “Extraordinary Leadership & Service” presented by the Department head of Mechanical & Nuclear Engineering. - Fall 2004
- Best Presentation, Rad. Shielding section, American Nuclear Society student conference, Berkeley - 2003
- Off-shore survival training including underwater helicopter ditching. - 2001
- Private pilot's license with high performance and complex ratings. - 1998

PROFESSIONAL ACTIVITIES:

- Excellent situational trouble-shooting and problem solving abilities in experiments, testing, and design.
- Exceptional communication skills with complex explanations to interdisciplinary audiences.
- Highly self-motivated and a quickly responsive to short-notice actions and sudden priority shifts.
- Willing to take lead responsibility working with multidisciplinary groups of professionals and experts.
- Go-to person to represent organization - last-minute presentations, seminars, and VIP tours.

- President of the American Nuclear Society, student chapter - 2003; Treasurer and Secretary - 2002
- Secretary of American Society of Manufacturing Engineers, student chapter – 2003
- President of social organization Graduate Nuclear Or Mechanical Engineering Students (GNOMES) 2008

FUNDED PROJECTS:

As Role of PI -

- Low-Profile HPGE Gamma Ray Spectrometer for Radiological Detection, Localization, and Isotope Identification, *Department of Defense*, **Role: PI**, 2018-2019, \$149,980
- Discrete 3D Electronics for Mobile Radiation Detection Systems, *Radiation Detection Technologies, Inc. DOE STTR*, PI, 2019, \$85,390
- Modular Radiological Survey Imaging System (MRSIS), *Radiation Detection Technologies, Inc. DOE STTR*, PI, 2019, \$39,333
- Electronics Additive Manufacturing, *Honeywell Federal Manufacturing & Tech. LLC*, **PI**, 2019, \$50,000
- Low-Profile PMT Scintillator Read-out System, *Defense Threat Reduction Agency*, **PI**, 2018-2021, \$2,649,830
- Neutron Interrogation Imaging, *Honeywell Federal Manufacturing & Tech. LLC*, **PI**, 2018, \$90,620
- Enhanced Gamma-ray Diagnostic Imaging, *Honeywell Federal Manufacturing & Tech. LLC*, **PI**, 2018, \$56,137
- Low-Profile HPGE Gamma Ray Spectrometer for Radiological Detection, Localization, and Isotope Identification, *Department of Defense*, **Role: PI**, 2016-2017, \$148,810
- Radiological Systems Research for Detection, Localization, and Isotope Identification, *Department of Defense*, **Role: PI**, 2017-2022, (\$547,809 funded on contract valued at \$2,241,004)
- Proposal for a Consortium for Nonproliferation-Enabling Capabilities, *Department of Energy, National Nuclear Security Administration*, **Role: PI**, 2016-2021, \$1,465,878

As Role of Co-PI -

- Additive Manufacture of Sensor Signal Processing Circuitry, *Honeywell Federal Manufacturing & Tech. LLC*, Co-PI, 2019, \$66,021
- Dedicated Laboratory for Radioactive Sample Handling, *US Department of Energy*, Co-PI, 2019, \$167,493
- Solid State Dual Neutron/X-Ray Imager, *Honeywell Federal Manufacturing & Tech. LLC*, Co-PI, 2020, \$252,238
- Dual-Sided Microstructured Semiconductor Neutron Detector with Integrated Pixel Read-Out, *Radiation Detection Technologies, Inc. DOE STTR*, Co-PI, 2019, \$62,892
- Solid State Dual Neutron/X-Ray Imager, *Honeywell Federal Manufacturing & Tech. LLC*, Co-PI, 2019, \$173,812
- Electronics X-ray Inspection Shielding and Prediction Simulation, *Honeywell Federal Manufacturing & Tech. LLC*, Co-PI, 2019, \$21,453
- Electronics X-ray Inspection Shielding and Prediction Simulation, *Honeywell Federal Manufacturing & Tech. LLC*, Co-PI, 2019, \$190,497
- Electronics X-ray Inspection Shielding and Prediction Simulation, *Honeywell Federal Manufacturing & Tech. LLC*, Co-PI, 2018, \$178,812
- Nuclear Research Fellowship Program, *Nuclear Regulatory Commission*, Co-PI, 2017-2021, \$393,820
- Solid State Dual Neutron / X-Ray Imager, *Honeywell Federal Manufacturing & Tech. LLC*, Co-PI, 2018, \$173,812
- Radiation Transport Simulation for Active Shielding Measurement, *KBRwyle*, Co-PI, 2017, \$52,461

COURSES TAUGHT:

- KSU ME535 Measurements and Instrumentation Laboratory, Junior/Senior level course
- KSU ME573 Fundamentals of Heat Transfer, Senior level course
- KSU NE860 Radiological Sensor Signal Acquisition and Data Processing (Special Topics, graduate)
- KSU ME699 Electrical Circuits for MNE Laboratory (Special topics, undergraduate, pilot course)

GRADUATE STUDENT ADVISING:

- *Diego Laramore* PhD Graduated
- *Maria Pinilla* PhD Graduated Co-advised
- *Long Vo* PhD Graduated Co-advised
- *Nathan Hines* PhD Candidate (4th year)
- *Nathanael Simerl* PhD Candidate (4th year)
- *Aaron Hellinger* PhD Candidate (3rd year) Co-advised
- *Sanchit Sharma* PhD student (3rd year) Co-advised
- *Jace Beavers* PhD student (3rd year)
- *Alan Burl* PhD student (2nd year)
- *Keith Huddleston* PhD student (2nd year)
- *Tyler Heiber* MS (3rd year)
- *Miranda Dodson* MS student (2nd year) Co-advised

SOFTWARE FAMILIARITY:

Cad 3D-Modeling

- Pro-Engineer
- Solidworks

Programming Languages and Interpreters

- C++
- MatLab
- LabView

Computer Networking

- File Server System - FTP, SFTP, HTTP
- Virtual Machines - Linux Host, Windows Host

Packaged Professional Programs

- L-Edit - (Layout/Drawing Editor)

- Silvaco TCAD - (Semiconductor Physics / Charge Transport)
- COMSOL Multiphysics (Semiconductor Physics / Charge Transport and FEM field modeling)
- MCNP - (Neutron Transport)
- SRIM - (Energetic Charged Particle Penetration)
- CASINO - (Energetic Electron Penetration)
- GADRAS – (Spectroscopic G/N Detector Response)
- GEANT – (Radiation Transport Nuclear Physics)
- SWORD – (Gamma-ray/Neutron Transport, Modeling)

PATENTS:

No. 8519350: “*Gas-filled neutron detectors having improved detection efficiency*”

No. 7855372: “*Non-streaming high-efficiency perforated semiconductor neutron detectors, methods of making same and measuring wand and detector modules utilizing same*”

No. 722030: (Provisional) “*Switchable Passive Neutron Source*”

PUBLICATIONS:

- [1] L. K. Vo, S. Sharma, M. Pinilla, W. L. Dunn, A. A. Bahadori, and W. J. McNeil, “Time dependent signatures: Moisture content interpretation in well logging applications with a DT neutron generator,” *Nucl. Instruments Methods Phys. Res. Sect. B Beam Interact. with Mater. Atoms*, vol. 466, pp. 37–41, 2020.
- [2] D. Laramore *et al.*, “Simulation of charge drift in surface doped, pixelated micro-structured semiconductor neutron detectors,” *Nucl. Instruments Methods Phys. Res. Sect. A Accel. Spectrometers, Detect. Assoc. Equip.*, vol. 978, p. 164351, 2020, doi: <https://doi.org/10.1016/j.nima.2020.164351>.
- [3] M. I. Pinilla, A. Hellinger, L. K. Vo, W. L. Dunn, W. McNeil, and A. Bahadori, “Design studies using MCNP6® for an oil well logging prototype tool and a test facility,” *Radiat. Phys. Chem.*, vol. 167, p. 108393, 2020.
- [4] M. P. Pfeifer *et al.*, “Validation of Radiation Transport Methods for Ball Grid Array Inspection Systems,” *Trans. Am. Nucl. Soc.*, vol. 122, pp. 621–624, 2020.
- [5] L. Vo, A. Hellinger, M. Pinilla, W. Dunn, A. Bahadori, and W. McNeil, “Development of test facilities for studies relevant to replacing dangerous radiological sources,” in *AIP Conference Proceedings*, 2019, vol. 2160, no. 1, p. 50001.
- [6] M. P. Pfeifer, N. Simerl, J. Porter, W. J. McNeil, and A. A. Bahadori, “Comparison of MCCAD and DAGMC for Predictive Capability with BGA Inspection Systems,” *Transactions*, vol. 120, no. 1, pp. 767–770, 2019.
- [7] D. Laramore, S. Sharma, S. L. Bellinger, A. A. Bahadori, and W. J. McNeil, “Simulation of charge carrier transport in pixelated micro-structured semiconductor neutron detectors,” in *2019 IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC)*, 2019, pp. 1–3.

- [8] D. Laramore, W. J. McNeil, and A. A. Bahadori, "Design of a micro-nuclear-mechanical system for strain measurement," *Radiat. Phys. Chem.*, vol. 155, pp. 209–212, 2019.
- [9] S. Sharma, D. Laramore, S. Bellinger, W. J. McNeil, and A. A. Bahadori, "Simulation of signal formation and imaging in a dual-sided micro-structured semiconductor neutron detector," in *2019 IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC)*, 2019, pp. 1–3, doi: 10.1109/NSS/MIC42101.2019.9059683.
- [10] D. S. McGregor, S. L. Bellinger, W. J. McNeil, M. F. Ohmes, and K. A. Nelson, "Gas-filled neutron detectors having improved detection efficiency." Google Patents, 27-Aug-2013.
- [11] S. L. Bellinger, R. G. Fronk, W. J. McNeil, T. J. Sobering, and D. S. McGregor, "Enhanced variant designs and characteristics of the microstructured solid-state neutron detector," *Nucl. Instruments Methods Phys. Res. Sect. A Accel. Spectrometers, Detect. Assoc. Equip.*, vol. 652, no. 1, pp. 387–391, 2011.
- [12] S. L. S. L. Bellinger, R. G. G. Fronk, W. J. J. McNeil, T. J. J. Sobering, and D. S. S. McGregor, "Improved High Efficiency Stacked Microstructured Neutron Detectors Backfilled With Nanoparticle LiF ," *IEEE Trans. Nucl. Sci.*, vol. 59, no. 1, pp. 167–173, 2011, doi: 10.1109/TNS.2011.2175749.
- [13] D. S. McGregor *et al.*, "Non-streaming high-efficiency perforated semiconductor neutron detectors, methods of making same and measuring wand and detector modules utilizing same." Google Patents, 21-Dec-2010.
- [14] K. A. Nelson *et al.*, "Investigation of CdZnTe and LiNbO₃ as electro-optic neutron detectors," *Nucl. Instruments Methods Phys. Res. Sect. A Accel. Spectrometers, Detect. Assoc. Equip.*, vol. 620, no. 2–3, pp. 363–367, 2010.
- [15] W. J. McNeil, "Perforated diode neutron sensors," Kansas State University, 2010.
- [16] S. L. Bellinger, R. G. Fronk, W. J. McNeil, T. J. Sobering, and D. S. McGregor, "High efficiency dual-integrated stacked microstructured solid-state neutron detectors," in *IEEE Nuclear Science Symposium & Medical Imaging Conference*, 2010, pp. 2008–2012.
- [17] S. L. Bellinger, R. G. Fronk, W. J. McNeil, J. K. Shultis, T. J. Sobering, and D. S. McGregor, "Characteristics of the stacked microstructured solid state neutron detector," in *Hard X-Ray, Gamma-Ray, and Neutron Detector Physics XII*, 2010, vol. 7805, p. 78050N.
- [18] S. L. Bellinger, W. J. McNeil, and D. S. McGregor, "Variant designs and characteristics of improved microstructured solid-state neutron detectors," in *2009 IEEE Nuclear Science Symposium Conference Record (NSS/MIC)*, 2009, pp. 986–989.
- [19] D. S. McGregor, W. J. McNeil, S. L. Bellinger, T. C. Unruh, and J. K. Shultis, "Microstructured semiconductor neutron detectors," *Nucl. Instruments Methods Phys. Res. Sect. A Accel. Spectrometers, Detect. Assoc. Equip.*, vol. 608, no. 1, pp. 125–131, 2009.
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- [21] D. S. McGregor *et al.*, "Perforated diode neutron detector modules fabricated from high-purity silicon," *Radiat. Phys. Chem.*, vol. 78, no. 10, pp. 874–881, 2009.
- [22] W. J. McNeil *et al.*, "1-D array of micro-structured neutron detectors," in *2009 IEEE Nuclear Science Symposium Conference Record (NSS/MIC)*, 2009, pp. 2008–2011.
- [23] S. L. Bellinger, W. J. McNeil, and D. S. McGregor, "Improved fabrication technique for microstructured solid-state neutron detectors," *MRS Online Proc. Libr. Arch.*, vol. 1164, 2009.
- [24] T. C. Unruh *et al.*, "Design and operation of a 2-D thin-film semiconductor neutron detector array for use as a beamport monitor," *Nucl. Instruments Methods Phys. Res. Sect. A Accel. Spectrometers, Detect. Assoc. Equip.*, vol. 604, no. 1–2, pp. 150–153, 2009.
- [25] A. G. Antonacci *et al.*, "PATARA II: A 64-channel solid-state Neutron Detector readout system with integrated analog and digital processing for the SNS," in *2009 IEEE Nuclear Science Symposium Conference Record (NSS/MIC)*, 2009, pp. 68–74.
- [26] W. J. McNeil *et al.*, "1-D array of perforated diode neutron detectors," *Nucl. Instruments Methods Phys. Res. Sect. A Accel. Spectrometers, Detect. Assoc. Equip.*, vol. 604, no. 1–2, pp. 127–129, 2009.
- [27] D. S. McGregor, T. C. Unruh, and W. J. McNeil, "Thermal neutron detection with pyrolytic boron nitride," *Nucl. Instruments Methods Phys. Res. Sect. A Accel. Spectrometers, Detect. Assoc. Equip.*, vol. 591, no. 3, pp. 530–533, 2008.
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- [32] W. J. McNeil *et al.*, "Preliminary tests of a high efficiency 1-D silicon pixel array for small angle neutron scattering," in *2007 IEEE Nuclear Science Symposium Conference Record*, 2007, vol. 3, pp. 2340–2342.

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- [34] D. S. McGregor *et al.*, "Perforated semiconductor neutron detectors for battery operated portable modules," in *Hard X-Ray and Gamma-Ray Detector Physics IX*, 2007, vol. 6706, p. 67060N.
- [35] C. J. Solomon, J. K. Shultis, W. J. McNeil, T. C. Unruh, B. B. Rice, and D. S. McGregor, "A hybrid method for coupled neutron-ion transport calculations for 10B and 6LiF coated and perforated detector efficiencies," *Nucl. Instruments Methods Phys. Res. Sect. A Accel. Spectrometers, Detect. Assoc. Equip.*, vol. 580, no. 1, pp. 326–330, 2007.
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- [40] M. J. Harrison, A. P. Graebner, W. J. McNeil, and D. S. McGregor, "Carbon coating of fused silica ampoules," *J. Cryst. Growth*, vol. 290, no. 2, pp. 597–601, 2006.
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- [42] W. J. McNeil, S. L. Bellinger, T. C. Unruh, E. L. Patterson, J. K. Shultis, and D. S. McGregor, "Development of perforated si diodes for neutron detection," in *IEEE Nucl. Sci. Symp. Conf. Rec.*, 2006.
- [43] A. Kargar, A. M. Jones, W. J. McNeil, M. J. Harrison, and D. S. McGregor, "CdZnTe Frisch collar detectors for γ -ray spectroscopy," *Nucl. Instruments Methods Phys. Res. Sect. A Accel. Spectrometers, Detect. Assoc. Equip.*, vol. 558, no. 2, pp. 497–503, 2006.
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- [47] A. E. Bolotnikov *et al.*, "New results from performance studies of Frisch-grid CdZnTe detectors," in *Hard X-Ray and Gamma-Ray Detector Physics VI*, 2004, vol. 5540, pp. 33–45.