A 5-day Short Course

Radiation Detection and Measurement

Course Overview

This 5-day course was developed to provide an overview of the instruments and techniques important in the detection and spectroscopy of ionizing radiation, and to strengthen an understanding of the physical processes underlying their application. It stresses the development of a basic understanding of the principles of operation of these devices, and helps develop an ability to inter-compare and select instrumentation best suited for different applications. It will provide an opportunity for those new to the field to gain a broad perspective of measurement options, and for practitioners to refresh their knowledge in areas outside their own specialties. This course is based on the new updated 4th edition textbook "Radiation Detection and Measurement" by Dr. Glenn Knoll and now covers many new subjects as well as new scintillator materials that can achieve better energy resolution by a factor of two compared with traditional materials. The 4th edition textbook also presents new material on ROC curves, micropattern gas detectors, new sensors for scintillation light, and digital techniques in detector pulse processing, as well as revised discussions on TLDs and cryogenic spectrometers, radiation backgrounds, and the VME instrumentation standard. Dr. Knoll's book has attained widespread recognition as the standard published work in the field, and a copy is provided to all course registrants. The presentation and lecture notes, which were developed by Dr. Knoll, will also be distributed and serve as a supplement to the text.

THIS COURSE WILL HELP YOU….

- Strengthen your understanding of the instruments and techniques important in the detection and spectroscopy of ionizing radiation.
- Evaluate and compare the latest developments in radiation instrumentation presented by leading manufacturers.
- Improve your perspective and ability to evaluate measurement systems for different applications.
- Understand the applicability and limitations of all major types of detectors.
- Gain a thorough understanding of gamma and neutron spectroscopy and the systems used in multichannel analysis.

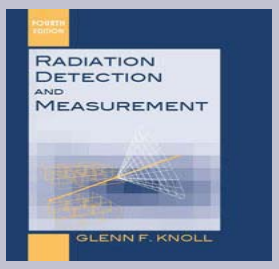
Course Instructors

Dr. John Engdahl

Dr. JOHN C. ENGDAHL is a Professor of Engineering at Bradley University in Peoria, Illinois, and Adjunct Professor of Radiology, University of Illinois College of Medicine at Peoria. Dr. Engdahl received his B.S, M.S., and Ph.D. degrees in Nuclear Engineering from The University of Michigan. His experience in nuclear instrumentation and measurements has been varied, including spacecraft instruments and related defense applications with TRW Defense and Space Systems, and gamma ray cameras and nuclear medicine applications with GE Medical Systems as Manager of Product Development and also with Sopha Medical Systems. He also has experience as a Radiological Physicist at Henry Ford Hospital. Most recently, he was Director of Advanced Research for the Siemens Nuclear Medicine Group where he managed research of new clinical applications and new technology for nuclear medical imaging instrumentation. Dr. Engdahl is a member of the IEEE, the American Nuclear Society, the American Association of Physicists in Medicine.

Dr. David Wehe

DR. DAVID WEHE has been involved in radiation detection and measurements for nearly 30 years. Upon graduation from the University of Michigan, he taught physics at the United States Naval Academy, followed by work as a consultant to the electric power industry on instrumentation and system reliability issues. At the Oak Ridge National Laboratory, he developed instrumentation for the High Flux Isotope Reactor and applied physics-based approaches for estimating physical parameters. Since joining the faculty at the University of Michigan in 1986, he has been actively teaching laboratory courses in Radiation Measurements, and performing research in radiation detector development and imaging systems. He served as the Director of the Michigan Memorial Phoenix Project, which included the 2-MW Ford Nuclear Reactor. His interests span applications in nuclear medicine, astrophysics, non-proliferation and treaty verification, nuclear forensics, and industrial imaging. He was named as a Eugene P. Wigner Fellow of the Oak Ridge National Laboratory, and awarded the State of Michigan Teaching Award for excellence in higher education. Dr. Wehe actively consults with the industry and the National laboratories on instrumentation development. He currently serves on the National Nuclear Forensics Science Panel, as Editor for the journals Nuclear Instruments and Methods in Physics Research and Nuclear Energy and Technology, and is the General Chairman for the International symposium on Radiation Measurements and Applications (SORMA) series.



Dr. Knoll's 4th edition textbook
"Radiation Detection and Measurement"
will be provided to all course registrants

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Continuing Education Credits

The American Academy of Health Physics (AAHP) has awarded this course 32 continuing education credits.

Who Should Attend ...

This course has been developed for scientists, health physicists, technical managers, engineers, RSO's, technicians and other personnel having responsibilities relating to performing, documenting, and reviewing radiation measurements.

Instructional Topics

RADIATION INTERACTIONS
- Charged Particles
- Fast Electrons
- Gamma Rays and X-Rays
- Neutron Interactions
- Effects in Detector Spectra

BASIC DETECTOR PROPERTIES
- Pulse Height Spectra & Counting Curves
- Energy Resolution
- Detection Efficiency
- Dead-time

IONIZATION CHAMBERS
- Ionization in Gases
- Current Mode Ion Chambers
- Application to Radiation Dosimetry
- Pulse Mode Operation
- Gridded Ion Chambers

PROPORTIONAL COUNTERS
- Gas Multiplication
- Design Features of Proportional Tubes
- Detection Efficiency and Counter Curves
- Position Sensing Techniques

GEIGER-MUELLER COUNTERS
- The Geiger Discharge
- Counting Plateau
- Fill Gases and Quenching
- Time Behavior

SCINTILLATION DETECTORS
- Organic, Liquid and Plastic Scintillators
- Inorganic Scintillators
- Intercomparison of Scintillator Performance

PHOTOMULTIPLIER TUBES AND PHOTODIODES
- Light Collection and Coupling
- Photocathodes and Electron Multipliers
- Characteristics of PM Tubes
- Use of Photodiodes with Scintillators

SEMICONDUCTOR DIODE DETECTORS
- Basic Principles and Configurations
- Energy and Time Resolution
- Applications in Charged Particle and Electron Spectroscopy

GERMANIUM GAMMA RAY DETECTORS
- HPGe detector configurations
- Operational characteristics

OTHER SEMICONDUCTOR DETECTORS
- Si(Li) Spectrometers
- Applications in X-Ray Spectroscopy
- Candmium telluride and mercuric iodide

NEUTRON DETECTION AND SPECTROSCOPY
- Slow Neutron Conversion Reactions
- Proportional and Scintillation Detectors
- Moderation Detectors
- Proton Recoil Spectrometers

PULSE PROCESSING AND SHAPING
- Conventional and Active Reset Preamplifiers
- Pulse Shaping Methods
- Baseline Restoration
- Pile-up Rejection
- Timing and Coincidence

MULTICHANNEL ANALYSIS
- MCA Components and Operation
- ADC Characteristics and Specifications
- PC-Based Systems
- Spectrum Stabilization and Analysis

MISCELLANEOUS DETECTORS
- Cerenkov Detectors
- Liquid Ionization and Proportional Detectors
- Photographic Emulsions
- Track Etch Detectors
- Thermoluminescent Dosimeters
- Superheated Drop Detectors

DETECTOR BACKGROUND AND SHIELDING
- Sources of Background
- Effectiveness of Shielding Materials
- Active Background Suppression

INTERCOMPARISON OF DETECTOR PROPERTIES
- Detection Efficiency
- Speed of Response
- Energy Resolution
- Suitability for Various Applications

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