# PET Imaging for Breast Cancer: clinical applications, requirements, and dedicated scanners

**Lawrence R. MacDonald, Ph.D.**

Research Associate Professor
Department of Radiology
University of Washington, Seattle

**Abstract:** Positron emission tomography (PET) has been investigated as a clinical and research tool for breast cancer patients since the introduction of whole-body PET scanners. Early studies concluded that PET's potential was restricted to relatively advanced disease because spatial resolution was insufficient for early stage tumors under 2-3 cm. This conclusion, and remaining challenges in diagnosis, staging, and management after using other breast imaging modalities, led to the development of high-resolution PET systems dedicated to breast cancer imaging in the 1990s. At about that time, breast MRI emerged to fill the role of secondary imaging modality following equivocal mammography and ultrasound. Now, with challenges remaining and an increasing interest in assessing therapies with PET, several groups are again developing dedicated breast PET systems.

This talk will review dedicated breast PET technology and the requirements for various clinical applications, and report on the development of a combined breast PET / x-ray mammography system (PET/X) under development at the University of Washington. PET/X has rectangular geometry, currently being assessed using simulations, and we are now building detector blocks using Geiger-mode SiPMs. With a focus on therapy monitoring, we seek to minimize the variance of standardized uptake values (SUVs), as SUV-variance will dictate confidence intervals for measuring changes in tracer uptake associated with response to therapy.

**Bio:** *Dr. Lawrence MacDonald* received his Ph.D. in Physics from the University of California, Los Angeles, in collaboration with the UCLA Dept. of Molecular and Medical Pharmacology, developing an intraoperative imaging probe to identify brain tumor margins. He went on to work at a small startup company that developed a pre-clinical SPECT-CT system, and a small high-resolution gamma camera used for breast cancer detection and intra-operative sentinel lymph node imaging. He is currently a Research Associate Professor in the Department of Radiology at the University of Washington. Dr. MacDonald's research continues to focus on high-resolution dedicated nuclear imaging systems, as well as quantitative performance of clinical whole-body PET scanners. As a developer of new imaging systems, Dr. MacDonald also takes an interest in comparative-effectiveness analyses of new imaging technology and methods, in particular as applied to the use of PET for breast cancer imaging.