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High Performance Organ-Specific Nuclear Medicine Imagers.

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One of the exciting applications of nuclear science is nuclear medicine. Well-known diagnostic imaging tools such as PET and SPECT (as well as MRI) were developed as spin-offs of basic scientific research in atomic and nuclear physics. Development of modern instrumentation for applications in particle physics experiments offers an opportunity to contribute to development of improved nuclear medicine (gamma and positron) imagers, complementing the present set of standard imaging tools (PET, SPECT, MRI, ultrasound, fMRI, MEG, etc). Several examples of new high performance imagers developed in national laboratories in collaboration with academia will be given to demonstrate this spin-off activity. These imagers are designed to specifically image organs such as breast, heart, head (brain), or prostate. The remaining and potentially most important challenging application field for dedicated nuclear medicine imagers is to assist with cancer radiation treatments. Better control of radiation dose delivery requires development of new compact in-situ imagers becoming integral parts of the radiation delivery systems using either external beams or based on radiation delivery by inserting or injecting radioactive sources (gamma, beta or alpha emitters) into tumors.