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PET Imaging - from Physics to Clinical Molecular Imaging

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From the beginnings many years ago in a few physics laboratories and first applications as a research brain function imager, PET became lately a leading molecular imaging modality used in diagnosis, staging and therapy monitoring of cancer, as well as has increased use in assessment of brain function (early diagnosis of Alzheimer's, etc) and in cardiac function. To assist with anatomic structure map and with absorption correction CT is often used with PET in a duo system. Growing interest in the last 5-10 years in dedicated organ specific PET imagers (breast, prostate, brain, etc) presents again an opportunity to the particle physics instrumentation community to contribute to the important field of medical imaging. In addition to the bulky standard ring structures, compact, economical and high performance mobile imagers are being proposed and build. The latest development in standard PET imaging is introduction of the well known TOF concept enabling clearer tomographic pictures of the patient organs. Development and availability of novel photodetectors such as Silicon PMT immune to magnetic fields offers an exciting opportunity to use PET in conjunction with MRI and fMRI. As before with avalanche photodiodes, particle physics community plays a leading role in developing these devices. The presentation will mostly focus on present and future opportunities for better PET designs based on new technologies and methods: new scintillators, photodetectors, readout, software.