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Modules for an organ-specific personalized PET scanner

In today's world early detection of cancer has proven to be the most crucial step for effective treatment. This is only possible by making the non-invasive imaging techniques more affordable and accessible for individuals. AvanTomography modules would achieve this goal by designing a module for positron emission tomography (PET) scanner. This module can enable the assembly of lower-cost PET scanners with more versatile designs. A scanner comprising of AvanTomography modules would involve electronically and mechanically separated modules that could be combined together to create a scanner according to the desired area to be scanner, i.e. breast, arm, leg, small animal, full body etc. Mechanical connection between the modules would be a structure resembling Lego® pieces, where modules can be attached and detached easily depending on the desired gantry size and application. Since the scanner geometry can be arranged, patient could be scanned in different scanning positions, i.e. standing, sitting or lying down. As a full ring scanner wouldn't be needed for smaller areas of interest, it would be possible to make a low-cost scanner that only includes few modules. Such a personalized PET scanner would achieve a high sensitivity just by being close to the object. If necessary, the sensitivity of the scanner could be increased by stacking more modules around the object of interest. All of these are possible using the axial geometry of scintillator crystal positioning, which is referred as AX-PET. This technology is already made available and proven to work in an experimental setting by CERN.
Main property of Axial PET (AX-PET) technology is the scintillating crystals that are aligned in parallel with the axis of the scanner instead of the traditional radial orientation, stacked in several layers. Crystal layers are interleaved with an array of wavelength shifter (WLS) strips, placed orthogonal to the crystals.
AvanTomography modules could also be tailored according to the application. For example, if a breast scanner is desired, then the modules would be designed to be optimal in a square plate structure rather than a rectangular shape. With this geometrical configuration, it is possible to use crystals up to 30 cm in length and still achieve a good image quality thanks to the overlaid WLSs.

Summary

The aim of these modules is to design a scanner that is tailored for the needs of the patient and the user. While providing a lower cost ans smaller sized solution to the PET scanners in the market, this scanner aims to achieve a good resolution and sensitivity by using a different crystal configuration, also called axial PET.

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