

# AvanTomography: A Module for an Application-specific, Personalized PET Scanner

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## Introduction

- Early detection of cancer is crucial step for an effective treatment.
- This is only possible by making non-invasive imaging techniques more affordable and accessible for individuals.
- As future of medicine shifts towards personalized medicine, scanners should follow the same trend.
- To provide the best results for each patient, new scanners need to become more versatile, adapting into the needs of the application area and the target object size.

## The Idea/Concept

- AvanTomography is a module designed to construct a scanner specific to the application.
- 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 scanned, i.e. breast, arm, leg, small animal, full body etc.
- Since the scanner geometry can be arranged, patient could be scanned in different scanning positions, i.e. standing, sitting or lying down.

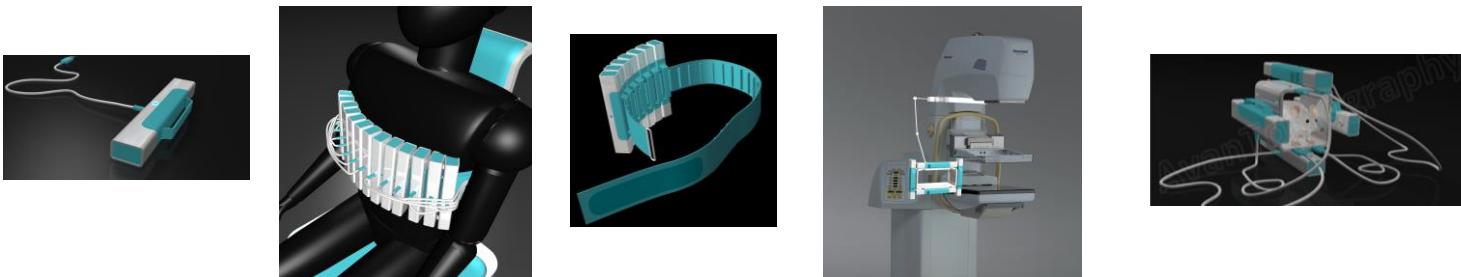


Fig.1: Future design alternatives for AvanTomography modules

- Modules are constructed using axial geometry, referred as AX-PET. In axial PET configuration, 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. This configuration provides an accurate DOI without parallax-error.

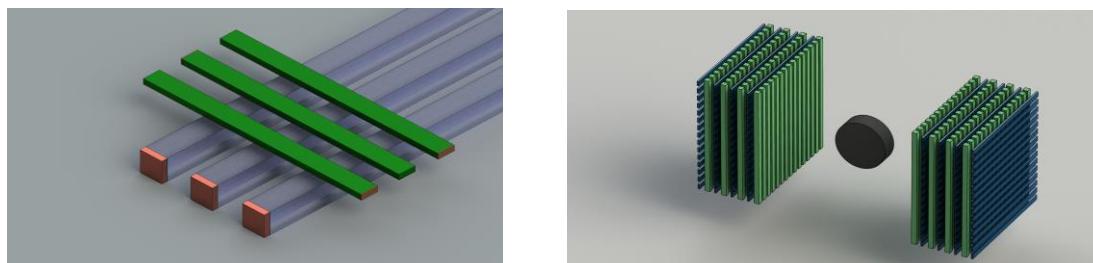


Fig.2: (Left) Axial PET Structure with WLS and crystals, (right) two-panel example with axial PET structure

## Potential Impact

- A personalized PET scanner comprising of AvanTomography modules would achieve a high sensitivity just by being close to the object.
- The sensitivity of the scanner can be increased by stacking more modules around the object of interest.
- As a full ring scanner wouldn't be needed for smaller areas of interest, it would be possible to make a smaller, low-cost scanner with only few modules.
- The AvanTomography modules can 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 (see Fig 2.).
- Patient comfort would be improved by enabling scans the in different positions.
- Specialized reconstruction algorithms would be developed to handle different structures of the panels.