Positron emission tomography wireless acquisition architecture

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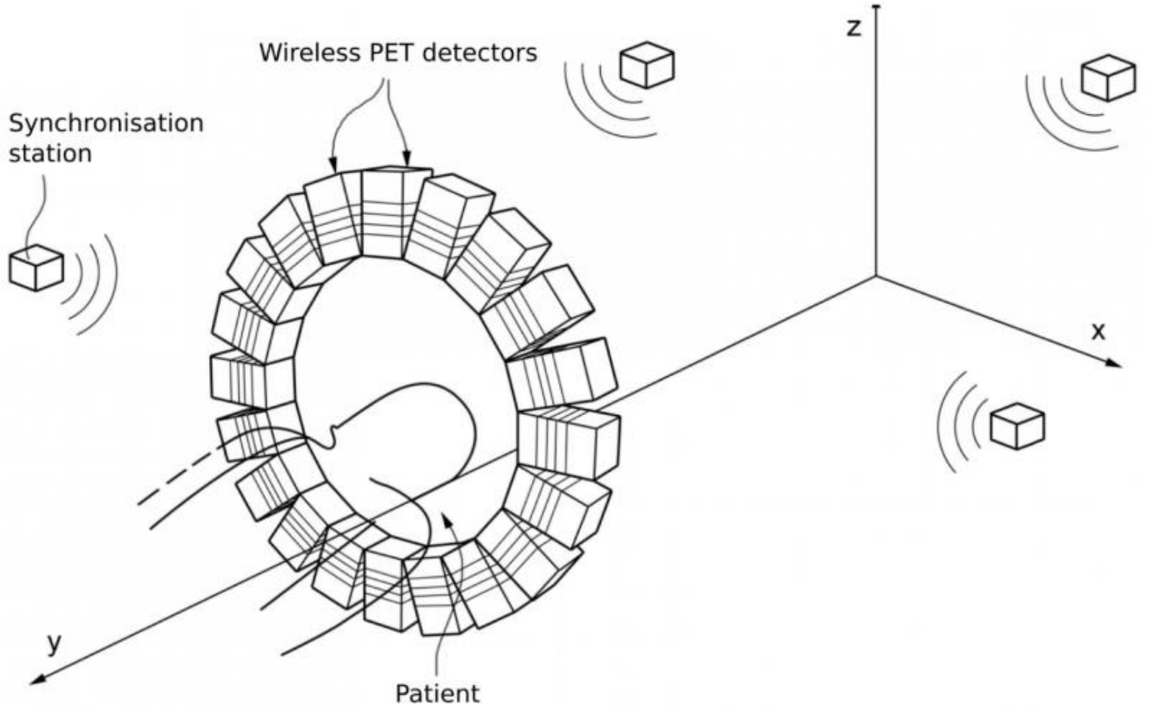
Invention

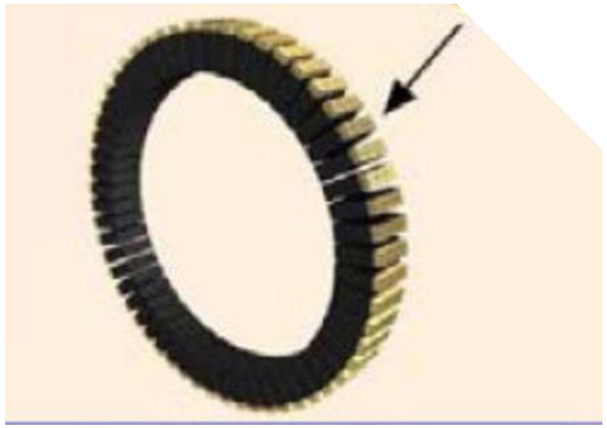
Positron Emission Tomography (PET) systems generally require cables to acquire and synchronize positron-electron annihilation emission data. Such cables can introduce **space and electro-magnetical compatibility problems**. The invention solves these problems via a **novel data synchronization system** based on SoC-FPGA devices and GPS-like time calibration algorithms.

Four or more transmitters are placed at known locations in the room housing the PET system and synchronized with each other via cable. The transmitters emit a **synchronization signal**, a common time label (timestamp), and a unique identifier for the transmitter itself. PET detectors receive these signals and compute their position from the spatiotemporal relationships between the timestamps, the reception times of the various signals, and the positions of each transmitter. This position is used to **refine the timestamp accuracy** as required for the PET application in question. The position and timestamp computation algorithm is analogous to that used in GPS satellite navigation systems and can be performed in the same programmable device that handles the discrimination of the photon detection peak or in any case in an integrated device mounted on the same electronic board that houses the photodetectors and the discrimination circuits.

AGE SCIENTIFIC S.R.L., WISER S.R.L. are co-owners of the patent.

Drawings
& pictures





Industrial applications

PET is a diagnostic method of **Nuclear Medicine**, used especially in oncology, both in the diagnostic phase to identify diseased tissue and staging a tumour, and during follow-up after surgery or radiotherapy to assess the progress of a treatment.

The proposed technology can be applied in:

- integrated PET/MRI systems for broad-spectrum molecular imaging;
- high sensitivity total-body PET systems;
- mobile/variable geometry PET systems;
- diagnostics for monitoring treatment outcome in patients or for real-time monitoring and control of charged particle range in patients.

Benefits of the proposed invention include:

- the **simplification** of the synchronization tree of the PET system;
- the **automatic control** of the detectors position;
- the **compatibility** with next-generation decentralized acquisition systems;
- the **lower production cost**;
- the **reduced footprint and weight** of the detectors.

Possible developments

The medical devices used in diagnostics are increasingly making use of state-of-the-art technologies and **wireless data transmission** both to reduce the size of instruments and to improve/increase data synchronization.

In the field of PET tomography, the proposed invention provides an **alternative detection technique** that can be applied to integrated PET/MRI systems for broad-spectrum molecular imaging; high-sensitivity total-body PET systems; and mobile/variable geometry PET systems.

Future partnerships to increase the potential and applications of the technique may involve **companies producing nuclear electronic applications** and **medical-specialist Centers**, especially in **Nuclear Medicine departments** (more than 100 in Italy).

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