Patent/Utility model Licensing Opportunity:

Proton CT system with improved proton energy detector

Industrial sector:

Nuclear medicine

Applications:

Cancer treatment/Proton Therapy

Invention executive summary

IFAE, in collaboration with the University of Birmingham and the University of Geneva, has developed and protected a novel proton detector for proton CT and proton therapy. This new device is based on a new range telescope architecture that overcomes current limitations in beam section accuracy. The improved precision would enable better targeting of malignant tissues while minimizing unintended irradiation of healthy areas.

In addition, the detector offers superior multi-proton tracking capabilities compared to conventional X-ray CT-based radiotherapy and standard proton therapy detectors. This improvement significantly contributes to reducing overall radiation exposure for patients.

State-of-the-art

Proton Beam Therapy (PBT) is gaining importance as an effective cancer treatment, particularly for tumours in areas of difficult access. Its precision relies on the Bragg peak phenomenon, enabling localized energy deposition while minimizing damage to surrounding healthy tissue.

Accurate treatment planning requires detailed 3D maps of the patient's Relative Stopping Power (RSP). Currently, X-ray CT is used for this purpose, but it introduces notable uncertainties due to indirect RSP estimation. Proton CT (pCT) directly uses protons for imaging and offers a promising alternative by reducing these conversion-related errors and potentially simplifying logistics and costs by using the same facility for both imaging and treatment.

A typical pCT system uses silicon trackers and a residual energy detector to reconstruct tissue density. However, current systems face challenges in achieving high data rates and handling multiple protons simultaneously, as required by clinical beams.

Existing approaches, such as those using silicon strip detectors with absorber layers, suffer from limitations in energy resolution due to material heterogeneity and are also cost-prohibitive for large-area implementations.

Goal

Companies that manufacture PBT equipment and hospitals specialized on cancer treatment using PBT willing to collaborate with IFAE, the University of Birmingham and the University of Geneva through co-development and/or license agreement.

Intellectual Property Protection Status

Patent publication number: US20240085580A1 (USTPO)

Priority date: 08/09/2023

Invention description

The proposed pCT detector is based on scintillator bars, which overcome the limitations of silicon layers based detectors. These bars allow both range measurement and scintillation light detection, improving energy estimation, especially for low-energy protons. Additionally, the scintillator material has a density similar to that of water, reducing uncertainties in energy conversion. The system also offers a major cost advantage, being up to 100 times cheaper than silicon-based calorimeters.

Invention advantages

- Improved energy resolution thanks to full-range and light-based measurement using scintillator bars.
- Higher accuracy due to water-like material density, reducing RSP estimation errors.
- High-rate capability (≥10^8 protons/s) with improved multi-proton tracking capabilities to handle beam instabilities.
- Cost-efficient design, up to 100 times cheaper than silicon-based calorimeters.
- Robust imaging performance, even with multiple protons per event.

Contact

Institut de Física d'Altes Energies

CERCA Research Centres of Catalonia

BIST Barcelona Institute of Science and Technology

techtransfer@ifae.es / www.ifae.es

IFAE is a physics research center located in Barcelona, dedicated to design and develop radiation detectors and high-performance cameras for Medical/IoT/ICT sectors and fundamental research (CERN, ESA, ESO).