Innovations
UNIVERSITY OF COLORADO
ANSCHUTZ MEDICAL CAMPUS

Device for Creating Nuclear Medicine Radioisotopes On-site

Category

Medical Devices – Diagnostic and Bioanalytic

Problem

Costly on-site isotope generation for PET imaging

Technology Overview

Device capable of creating short half-life radioisotopes used for PET scans at the site of imaging

IP Status

- Patent Pending
- Available for Exclusive or Non-Exclusive Licensing

Value Proposition

- On-site generation of short half-life isotopes, like F-18, N-13, and O-15
- Low-cost and minimal infrastructure alternative to traditional cyclotron radioisotope production

Market Attractions

- Over 40 million nuclear medicine procedures performed annually
- Demand for radioisotopes increasing ~5% annually
- Global market valued at $9.6 billion in 2016

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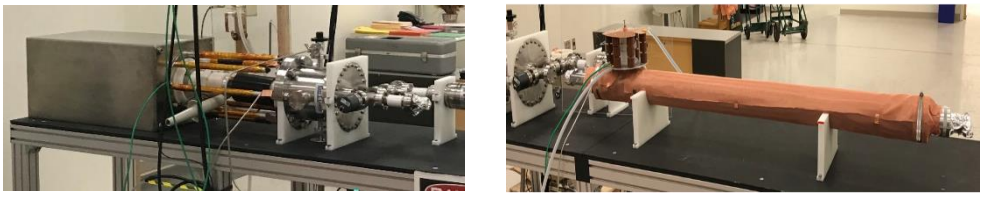
Problem: Radioisotopes are currently used for diagnosis and therapy of various medical conditions throughout hospitals worldwide, with over 40 million nuclear medicine procedures performed annually. Positron emission tomography (PET) is a 3D imaging technique that allows for visualization of physiological processes *in vivo* and can be used to aid in the diagnosis of various oncologic, cardiac, and neurological disorders. Some important biomarkers used in PET have half-lives on the order of minutes, making quick administration following generation imperative and on-site production necessary. Such radioisotopes are typically produced with cyclotrons. These machines are well-suited for producing large quantities of PET isotopes; however, a typical cyclotron weighs more than 10 tons and costs millions of dollars to install and operate. This is cost-prohibitive for smaller hospitals and research labs, and limits access to short half-life isotopes for patients in more rural areas.

Technical Solution and Key Value Propositions: A research group at the University of Colorado has developed a cost-efficient device capable of creating short half-life radioisotopes suitable for PET scans at the site of imaging. The device combines a pulsed plasma ion source with a pulse line ion accelerator (PLIA) to create PET isotopes of interest including, C-11, N-13, O-15, and F-18. Implementation of this device will provide a low-cost and minimal footprint alternative to cyclotron production of radioisotopes, making the generation of short-half life tracers on-site accessible to hospitals, labs, and imaging facilities where cyclotron installment is not feasible.

Photographs of the device components are shown below.



(Left) Pulsed plasma ion source and (Right) PLIA with the copper mesh outer electrode in place.

Data Update:

Expected future enhancements include:
1) Development of a solid-state plasma source capable of high-rep-rate operation
2) Construction of a high-voltage pulse transformer accelerator stage
3) Demonstrate production of Carbon-11, Nitrogen-13, and Oxygen-15

Key Documents and Sources:

"Multi-Stage Z-Pinch Linear Particle Accelerator." Provisional patent application filed April 9, 2019; available under CDA.

"High-voltage wave propagation on a fast PLIA structure." Pending scientific publication; available under CDA.

Westerly et al. 2018. Design considerations for a pulse line ion accelerator (PLIA)-

based PET isotope generator. *Med. Phys.* 45(8), 3812-18.