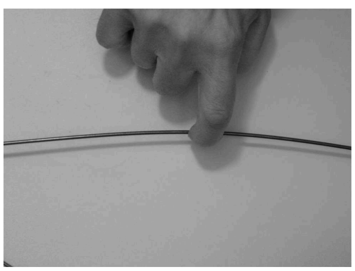
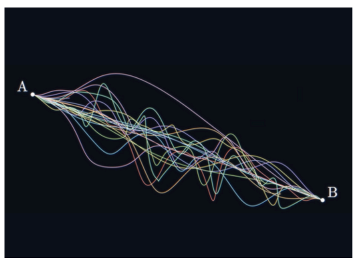
*Introducing **NOPIS**: A Non-Optimal Path Imaging System for Medical Diagnostics*

***Abstract*– Current imaging devices like CT, MRI have significant limitations in the detection of serious diseases, they often fail to capture subtle signals indicative of diseases e.g. pancreatic cancer, This cancer often goes undetected until it reaches an advanced stage, to come up with a solution we introduce NOPIS, A new imaging modality that allows the detection of anomalies and various diseases on a subatomic level, opening doors for early cancer detection way before its physical occurrence and offering painless treatment for patients across the globe. We develop a new design by integrating advanced metamaterials and the latest technology to achieve a leap in the field of medical imaging. The device introduces a new level of sensitivity, breaks current resolution limits, and minimal material wastage thanks to precisely engineered metamaterials and quantum technologies designed to be reusable and safe for patients.**

Think of a runner sprinting downhill, He naturally takes the most efficient path - optimal path - a shortcut to its destination. But what if he decided to explore every other route instead?





The **Principle of Least Action** [1] tells us that particles (the runner) always take the most efficient path[7]. But what if they didn't? , in addition to being able to control their deviation. With NOPIS (Non-Optimal Path Imaging System), we harness the unexpected—light rays traveling along unconventional paths. By capturing these elusive signals, NOPIS unveils what traditional imaging misses: microscopic clues, hidden patterns, and early signs of disease. It's not just breaking the rules—it's rewriting them for a healthier future.

I. Device Architecture

The device mainly consists of three main components: Particle emitter, Housing Chamber, Detection system. Particle emitter emits photons in the TetraHertz range to maximize the use of metamaterials and achieve high sensitivity in addition to being a non-ionizing technique compared to X-rays for example. Eyes on *Detection system layers* which is the most significant among previous parts.

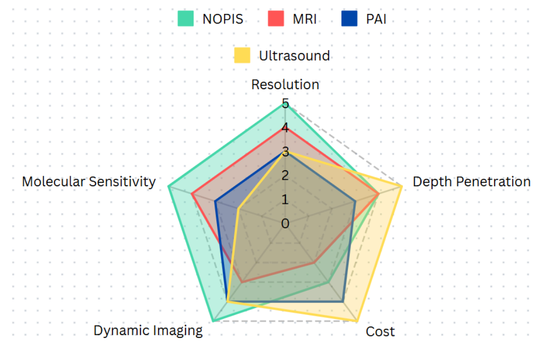
***Detection system composition*:**

1. Calorimeters detector (Energy Counters) It Measures how much energy a photon or particle loses as it interacts with tissues.
2. Time-of-flight (ToF) Detectors ToF detectors measure the travel time of particles, allowing the reconstruction of their deviated paths in both space and time[3].
3. Silicon Photomultipliers (SiPMs): enables detection of single photons in medical imaging.
4. Cherenkov Detector: visualizes radiation distribution during cancer treatments, helping physicians precisely map and verify radiation therapy delivery in real-time [4].

II. Image formation and Visualization

- 3D and 4D Images: The resulting image would display detailed 3D structures at a molecular level, such as protein dynamics or cellular interactions, and by integrating the time factor we can produce a 4D-imaging framework.
- Hidden Layers: Non-optimal paths may reveal hidden phenomena, such as rare molecular interactions, decay processes, or weak forces that are typically invisible to standard imaging techniques

III. What makes NOPIS different?



Our device stands solid compared to current imaging modalities, regarding factors like Resolution, Molecular sensitivity, Depth penetration. While PAI gets close at some points but still has a challenge when coming to sensitivity and used technology.

IV. Applications

Early cancer detection before visible tumors form, is limited in current devices because early-stage tumors often produce weak signals that are difficult to detect using current imaging modalities such as CT, MRI, or PET[5].

V. Challenges

1. Combining calorimeters, ToF detectors, SiPMs, and Cherenkov detectors, metamaterials all in one device may result in making the device bulky and initially High costs.
2. Signal processing and Noise reduction, where vast amounts of signals will be received and their identification would require training through iterative learning and we may need to implement Ai and Ai model training to facilitate the process of pattern recognition to differentiate between infected and healthy cells.

Reference List

[2] Oliveira, A. R. E. (2014). History of Two Fundamental Principles of Physics: Least Action and Conservation of Energy. Advances in Historical Studies, 03(02), 83–92. https://doi.org/10.4236/ahs.2014.32008

[3] G. Scioli, "The Time Of Flight (TOF) system of the ALICE experiment," *Eur. Phys. J. C*, vol. 39, Suppl. 3, pp. 7–12, 2005. [Online]. Available: https://doi.org/10.1140/epjcd/s2004-01-007-9. [Accessed: Nov. 29, 2024].