Research of this project will deliver new method of tracking light passing through human tissues or scatter by other objects. Light travels 3.3km in just a millionth of a second. Here we propose a new method that uses techniques popular in cable Internet or Wi-FI hardware to track/image light travel at every 30 cm on its path. The method as proposed in this project is in the range of current flagship smartphones hardware.

The project field can be outlined as follows: Near-infrared light penetrates to the brain grey matter if delivered onto a head surface and can be successfully detected on the head surface after passing through the brain. Light absorption within the brain depends on its oxygenation and as such, the detected light carries information on brain activity. This is a fundamental principle of functional near-infrared spectroscopy brain imaging that applies to: non-invasive monitoring of brain condition on head trauma or intraoperative, 3D brain activity imaging exploring brain behaviour on every-day tasks or recovering from a trauma (e.g. stroke) or a brain-computer interface for environmental control helping with disabilities or just for entertainment.

The proposed method of detecting of distributions of time of flight of photons in frequency domain introduces new approach to the state-of-the-art time-correlated single photon counting method. This fundamental research opens paths to new types of non-invasive optical brain imaging systems or cameras tracking light rays in real time (imaging with the speed of light).