# NDnano Summer Undergraduate Research 2016Project Summary

**1**. Student name: Muhammad Talha Choudhry
**2.** Faculty mentor name: Prof. Lei liu
**3.** Project title: High speed THz near field imaging with optical imaging resolution

**4.** Briefly describe any new skills you acquired during your summer research:
I have learnt basics of THz technology and further how to implement it. I have learnt how to make presentations in summer research. Finally, I learnt to perform THz imaging with three methods:
1). Single element imagers that obtain images by mechanical scanning
2). Coded-aperture imaging (CAI) using two-dimensional aperture masks
3). THz beam steering and forming antenna based on photo-induced Fresnel Zone Plates

**5.** Please briefly share a practical application/end use of your research:
The technique of this research project could be applied to realize a variety of novel reconfigurable quasi-optical THz circuits and components such as universally tunable filters, planar tunable zone-plates and spatial arrays for much improved THz wave manipulation capability desired in THz imaging, sensing and communication

**Project summary:**

1. Terahertz technology holds key applications in THz imaging, sensing, radio astronomy and communication. In this project, we try to get image of Cancerous & Normal tissue by scanning each pixel. At frequency of 585 GHz we scan the tissue slides by using four mirrors system.

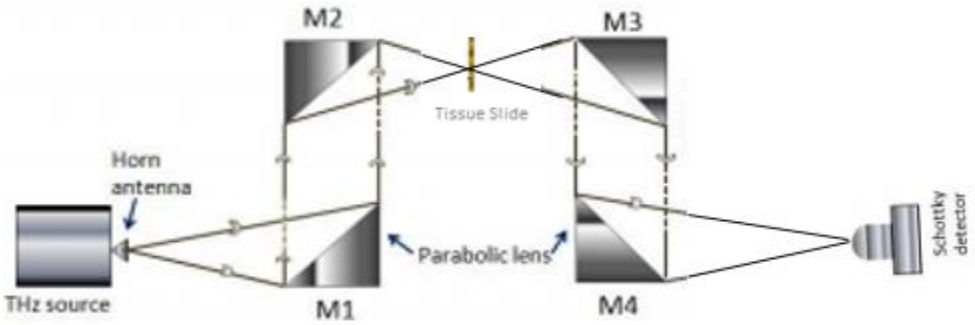


**Fig (1)**

Fig (1) shows experimental setup, I scanned whole tissue slide by using stage (Thorlab 973579-7227) which was operated by Labview program. Finally, the image was processed by using Origin & Labview program.

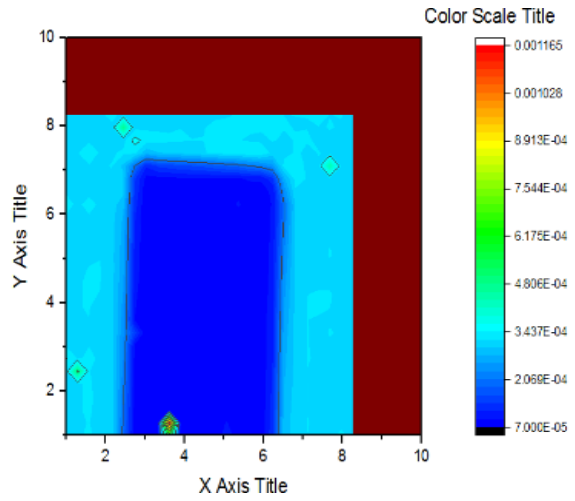


**Fig (2)**

**Fig (1):** Experimental setup of Single element imagers that obtain images by mechanical scanning

**Fig (2):** Image of tissue slide plotted by origin software pixel size is 10×10.

We can see clear image of slide in fig (2) but we are not able to see any tissue because our tissue wasn't fresh. Using THz we can see only fresh tissue because it contains some amount of water. When THz passes through the water somepart of it get absorbed.

**2.** THz antennas with beam steering and forming capabilities are essential for emerging tracking, remote sensing and imaging, surveillance, and adaptive THz wireless communications. The experimental configuration for beam steering and forming is shown in Fig. 3. At 740 GHz PI-FZP antenna far-field radiation intensity and beam steering angles were measured by mechanical two-dimensional (2D) scanning of the VNA port 2 receiver, as illustrated in Fig. 3. Since the PI-FZP antenna aperture size is 20 mm × 16 mm, the far-field region of the antenna is calculated ($2D^*D/\lambda$) to be larger than 2 m away from the aperture; a distance of 2.5 m was used for the experimental data reported here.

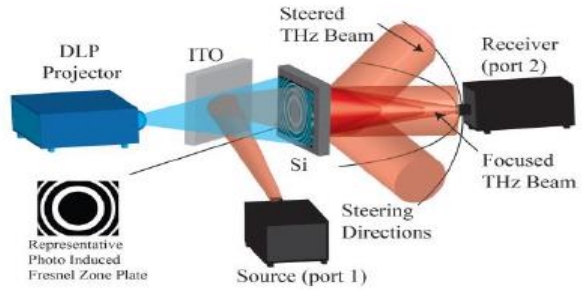


**Fig 3**

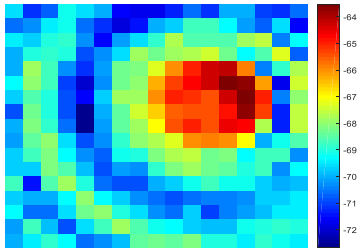


**Fig 4**

**Fig 3**. Shows the experimental setup of THz beam steering and forming antenna based On photo-induced Fresnel Zone Plates

**Fig 4.** Shows the pattern of Fresnel zone plate, that image was obtained on MATLAB which is our final result