# Towards Five-dimensional Tomography Using a Near-Field Scattering Tomography System

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Health care improvement over the last century relies largely on the development of the imaging modalities, such as, CT, MRI, and Ultrasound. The existing imaging modalities are not reliable tools for some screening or diagnosis cases. Even though the performance of an imaging modality can improve by combining two or more imaging modality scanning results, there is no screening or reliable imaging for certain diseases [1]. For example, Buist [2] expresses the need for a new modality to detect breast cancer in early stages for dense breast tissue, and Shahir [3] states the need for an alternative for the dental imaging.

Electromagnetic waves can penetrate the human body due to the dielectric nature of human body parts and are safe because of the non-ionizing property, so there are not any limitations and/or concerns regarding the usage of the Near-field scattering tomography (NFST) system in clinical practice. The NFST system can enable an existing imaging modality (i.e. CT scanner) to reconstruct an image with an extra dimension (permittivity) in addition to conductivity and spatial information. An NFST-CT hybrid imaging modality can reconstruct the 5-dimensional (5D) tomographic image of an object under-test while CT, MRI and Ultrasound can reconstruct up to 4D tomographic images. The 5-dimensions are permittivity, conductivity (gray-scale) and spatial information (X, Y, and Z) [3]. The 5$^{th}$ dimension could bring a tremendous amount of information to the table for a successful diagnosis where the existing modalities are not reliable.

We are going to discuss our experimental results for in vitro dental NFST-CT hybrid imaging at 75-110 GHz. Estimated by solving the electromagnetic inverse scattering, the permittivity profiles and conductivity profiles of a few samples including teeth are going to be presented.

**References:**

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