# P04

# Investigating the angular characteristics of sensors based on complementary metal-oxide-semiconductor field-effect transistors at 2.52 THz.

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Terahertz radiation, which is defined as the frequency range of the electromagnetic spectrum between 100 GHz and 10 THz [1], can penetrate non-conductive materials. It is non-ionising in nature and resonates with the rotational and vibrational modes of complex biomolecules. The development of high-power THz sources and high-sensitivity THz detectors is made possible by these properties. Field-effect transistors (FETs) with integrated antennas are being used in the development of such THz radiation detectors [2]. The compatibility of FET technology with commercial complementary metal–oxide–semiconductor manufacturing processes, and its ability to operate efficiently at room temperature, are key advantages.

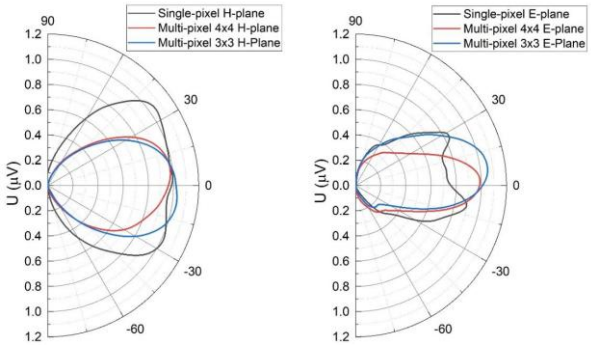


Fig. 1 Normalised angular dependence plots of different antenna configurations. H and E planes are separated.

This work outlines the development of terahertz sensors based on FET technology, as well as studying their angular characteristics while operating at 2.52 THz. The study involved several stages of detector development, including investigating suitable low-noise amplifier components, modelling the amplifier circuit to validate the expected behaviour, soldering the components, and assembling the complete sensor device. Measurements were then carried out to determine the angular dependency of the detected power, with the antenna area scanned using a mirror system that guided the THz wave from a 2.52 THz source.

Figure 1 illustrates the improved beam focusing and symmetry with multi-pixel array in relation to angular dependence. The single-pixel configuration has a broad H-plane lobe and asymmetric, double-peaked E-plane response showing non-uniform sensitivity. Multi-pixel arrays effectively eliminate spatial distortions and increase directivity.

## REFERENCES

[1] R. Köhler et al., “Terahertz semiconductor-heterostructure laser,” Nature, vol. 417, no. 6885, pp. 156–159, 2002.
[2] S. Boppel et al., “CMOS Integrated Antenna-Coupled Field-Effect Transistors for the Detection of Radiation From 0.2 to 4.3 THz,” IEEE Transactions on Microwave Theory and Techniques, vol. 60, no. 12, pp. 3834–3843, 2012.