



Contribution ID: 54

Type: **Poster and Speed Talk**

Ultra-Wide Band Intermediate Frequency Response of GaAs-Based THz Detectors with ps-scale THz Pulse Resolution

Thursday 4 July 2024 16:46 (3 minutes)

Terahertz (THz) radiation sources based on accelerators provide new fields of study for physical matter research and applications. The generated THz spectrum, its pulse shape and the arrival time of the pulse are of key importance for such experiments. Among available detector technologies, high electron mobility field effect transistors (HEMTs) based on Gallium arsenide (GaAs) are ideal detectors for picosecond (ps)-scale Terahertz (THz) beam alignment and synchronization at high power accelerator facilities, including free electron lasers (FELs). We develop detectors that serve two application cases: (i) beam line scientists who investigate beam dynamics and (ii) users who need to align and characterize the high power pulses for their experiments on-site in a quick and reliable manner. FET detectors are excellently suited because they are fast, sensitive, robust, compact and offer large frequency coverage.

Here, we present measurement findings from studies carried out at the Helmholtz Zentrum Dresden-Rossendorf to evaluate detector limits in the intermediate frequency (IF) domain. The second order non-linear coefficient of a LiNbO₃ crystal was used to generate THz signals with a 1 kHz Ti:sapphire oscillator-amplifier laser system (Astrella, Coherent). As IF post detection electronics, a 110 GHz Keysight Infinium oscilloscope was employed. We have examined different versions of antenna-coupled GaAs THz detectors. These detectors utilize various packaging methods and RF connectors, which could potentially restrict the detector's performance in IF range. The Ultra-Wide band IF response is crucial for accurately characterizing FEL pulses at FELBE. These results are bench-marks for future detector development and commissioning at accelerator facilities.

The work is supported by the German Federal Ministry of Education and Research (BMBF) under contract no. 05K22RO1 (at THM, Friedberg) and 05K22RD1 (at TU Darmstadt).

Summary

Primary authors: YADAV, Rahul (Terahertz Devices and Systems, IMP , TU Darmstadt); Mr BEK, Florian (Terahertz Devices and Systems, IMP , TU Darmstadt); Dr FARIDI, Fahd Rushd (Terahertz Devices and Systems, IMP , TU Darmstadt); Dr KOVALEV, Sergey (Institute of Radiation Physics, HZDR, Dresden); Dr PRAJAPATI, Gulloo Lal (Institute of Radiation Physics, HZDR, Dresden); KLOPF, J. Michael (HZDR); Prof. PENIRSCHKE, Andreas (Technische Hochschule Mittelhessen); Prof. PREU, Sascha (Terahertz Devices and Systems, IMP , TU Darmstadt)

Presenter: YADAV, Rahul (Terahertz Devices and Systems, IMP , TU Darmstadt)

Session Classification: Session 2: Beam Diagnostics

Track Classification: Beam diagnostics