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SP6: Integrated YBCO detector arrays for single-shot THz spectroscopy

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The analysis of variations in the temporal and spectral shape of pulsed radiation emitted by accelerator-based sources in the THz range places high demands on the detection system due to the ultra-short pulse lengths and high repetition frequencies. Detectors based on the high-temperature superconductor YBa2Cu3O7-x (YBCO) offer both a high sensitivity and a fast response time. For direct THz detection response times of 16 ps (FWHM) have been demonstrated [1].

We present a novel detection system aimed at bunch-by-bunch monitoring of the spectrum of single THz pulses. The system consists of an integrated array of YBCO detectors combined with broadband readout in a liquid nitrogen cryogenic system. In the array, the superconducting detectors are coupled to narrowband double-slot antennas [2] for the frequencies 0.14, 0.35, 0.65 and 1 THz, thus enabling a sampling of the pulsed signal at four discrete frequency points with a picosecond time resolution. First tests of a two-channel and a four-channel detector system have recently been successfully conducted at ANKA and at the DIAMOND Light Source.

References

[1] P. Thoma, et al., Appl. Phys. Lett. 101, 142601, 2012.

[2] A. Schmid, et al., IEEE Trans. Appl. Supercond. 26, 3, 2016.

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