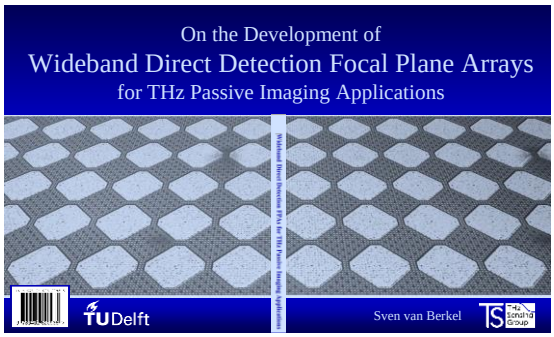
CMOS Integrated Antennas

for 200GHz-600GHz imaging cameras

Collaborators in this topic: Dr Sven van Berkel, ELCA TiCAM team (Dr M. Spirito, E.S. Malotaux, C. De Martino), Prof A. Neto, Dr D. Cavallo, Prof N. LLombart

The TICAM project, a collaboration between the TS group, the ELCA group and NXP, investigated the use of CMOS technology for the development of wide-band THz antenna coupled direct detectors for detecting persons in automotive scenarios with adverse weather conditions. Under these conditions, optical or infrared cameras do not operate well. This ERC grant co-supported this activity with the aim of investigating imaging array architectures based on overlapped leaky wave feeds to improve the sensitivity vs resolution trade-off in an imaging system. This work lead to the design of the first leaky-wave enhanced connected array in CMOS with polarization re-use.

If you are interested in this topic, you can find detailed information in the PhD thesis of Sven van Berkel:

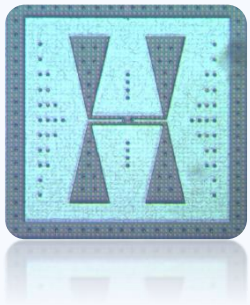


https://doi.org/10.4233/uuid:bf37535b-3f93-42ab-a337-22aec9cdf981

On-chip double leaky slot lens antenna

Key idea: Integrated lens antenna in 22nm-CMOS. The antenna is based on a on-chip double leaky slot feeding a low resistivity silicon lens. The detector is located directly at the antenna terminals in the same CMOS chip

Performance: 220GHz-600GHz bandwidth, >57% radiation efficiency



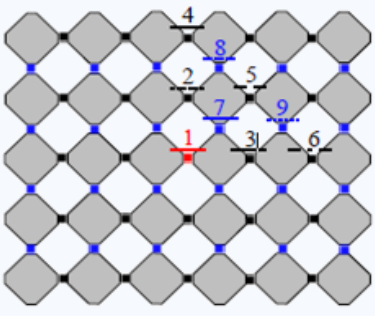
S.L. van Berkel, E.S. Malotaux, C. De Martino, M. Spirito, D. Cavallo, A. Neto and N. Llombart, "A Double Leaky Slot Antenna for Wideband THz Direct Detection in CMOS Technology," in IEEE Transactions on Terahertz Science and Technology, vol. 10, no. 5, pp. 540-553, Sept. 2020, doi: 10.1109/TTHZ.2020.3006750.

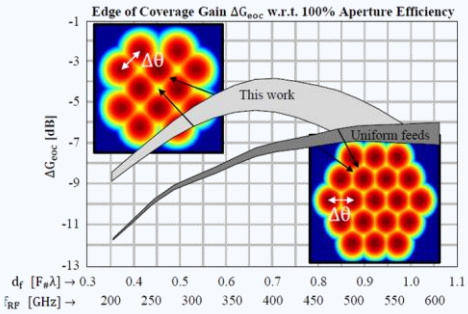
S.L. van Berkel, E.S. Malotaux, C. De Martino, M. Spirito, D. Cavallo, A. Neto and N. Llombart, "Wideband Modeling of CMOS Schottky Barrier Diode Detectors for THz Radiometry," IEEE Transaction on Terahertz Science and Technology , under Review

Imaging Array with overlapped leaky-wave connected array

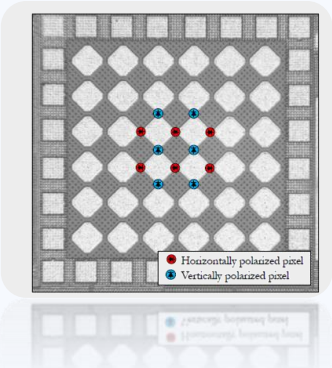
Key idea: We proposed a new imaging array architecture based on dual-polarized overlapped leaky-wave connected array that leads to an enhanced trade-off between sensitivity and resolution in an imaging camera.

Performance: we can achieve diffraction limited resolution with a 2.5 dB increase in edge of coverage gain w.r.t. uniform aperture feeds in the 200GHz-600GHz bandwidth





22nm-CMOS



Sven van Berkel, Daniele Cavallo, Marco Spirito, Andrea Neto, and Nuria Llombart, "Tightly Sampled Leaky-Wave Connected Array with Polarization Re-Usage", IEEE TAP Communication, in preparation

S.L. van Berkel, E.S. Malotaux, B. van den Bogert, M. Spirito, D. Cavallo, A. Neto and N. Llombart, "High resolution passive THz imaging array with polarization reusage in 22nm CMOS," In Proc. of 44th International Conference on Infrared, Millimeter, and Terahertz Waves (IRMMW-THz 2019), Paris, France, Sep. 1-6 2019