# A report on the cooperation between TNO and SRON toward THz focal plane imaging

# A Report on The Cooperation Between TNO and SRON Toward THz Focal Plane Imaging

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This contribution will report on the status of the cooperation between TNO and SRON toward the development of high sensitivity, large bandwidth imaging arrays. The cooperation started almost two year ago (European Microwave Week, 27-31 October 2008, Amsterdam, The Netherlands), (IEEE Antennas and Propagation Symposium, San Diego, CA, 5-12 July 2008) and its aim is to anticipate the needs of a future THz instrument that would constitute part of the payload of a scientific satellite for future deep space investigation in the Japanese mission SPICA (2017) (Core Science Requirements for the European SPICA Instrument, ESIRAL-REQ-0012, Iss. 0.1.).

Three challenging requirements would characterize such instrument: an extreme sensitivity (noise equivalent power NEP<$10^{-19}$), a large number of pixels and the decade BW.
While SRON proposes Kinetic Inductance detectors, KIDS, (J. Baselmans, S.J.C.Yates, R.Barends, Y.J.Y. Lankwarden, J.R. Gao, H. Hoevers, T.M. Klapwijk, “Noise and sensitivity of aluminum kinetic inductance detectors for sub-mm astronomy”, J. Low Temp. Phys.,524-529, 151 (2008)) to satisfy the sensitivity requested for the actual receiver, the enhancement of the throughput which is necessary to fulfill the BW and pixel requirements is being addressed by TNO by proposing an integrated focal plane array loaded by dielectric lenses. It is essential for the feed arrangement to be designed in conjunction with the KID type receivers. This limits the designs options: in practice the same CPW structure hosts the low frequency resonator (GHz) read out signal and the slot antennas that absorb the high frequency (THz) incoming radiation.

The program is divided in more phases each characterized by an intermediate task. The first phase was the demonstration of the potentials of the KIDS to provide the required sensitivity. To this end a first 670 GHz, narrow band, single pixel design has been developed, manufactured and then tested at SRON.
Despite a number of unforeseen problems, that had to be dealt with and took over 1 year to solve, eventually measurements have confirmed the theoretical predictions. The existing system is realized, for the first time for KIDS, with technology that can be scaled without significant difficulties to frequencies in the low (1-3) THz range. The team is currently working at the design of a broader band feed which could eventually be designed by the thousands on the same wafer.