The research related to this collaboration is aimed at the study of Quantum technology Radar (both in the optical and RF domains), with particular attention to applications of imaging, to evaluate the feasibility, possible fields of application and advantages with respect to the technology of classic radar. The research consists of a first part, aimed at gathering information on the state of the art of technology and application scenarios; and a second part, aimed at construction of a mathematical model of quantum imaging radar and a model for its classical counterpart, in order to compare its performances. Their final result, will be the development of a source code, containing the implementation of this model in order to conduct tests and simulations on well-defined scenarios.
The following results are expected from the research (including both the optical and the RF):

- Analysis of the state of the art of single pixel QI protocols and imaging QI protocols
- Analysis of the state of the art of the calculation methods of the performances related to the protocols
- Analysis of the state of the art of the technologies currently used in Quantum Illumination to generate and measure quantum signals
- Choosing a quantum imaging radar model deemed promising for a given application scenario, technology and/or performance
- Development of a quantum radar imaging model for the evaluation of performances according to operational requirements and environmental parameters
- Development of a classic imaging radar model, similar to the previous one, to evaluate the performance difference and demonstrate the possible benefit of quantum technology
- Source code, developed based on the templates in 5. and 6. to be used for an analysis of comparative performance of classical and quantum radar
- Identification of operational scenarios and conditions that present advantages significant from the application of the quantum solution, starting from the comparative analysis.

[4] Padgett, Miles J, and Robert W Boyd. "An introduction to ghost imaging: quantum and classical." Philosophical transactions. Series A, Mathematical, physical, and engineering sciences vol. 375,2099 (2017)

[5] X. Wang e Z. Lin, «Nonrandom Microwave Ghost Imaging», IEEE Transactions on Geoscience and Remote Sensing, vol. 56, vol. 8, pp. 4747–4764, Aug. 2018

[6] B. J. Lawrie e R. C. Pooser, «Toward real-time quantum imaging with a single pixel camera», Opt. Express, vol. 21, fasc. 6, p. 7549, Mar. 2013,

Technical Sheet
Funding institution:
LEONARDO
Project partners
CNIT, LEONARDO
Project duration
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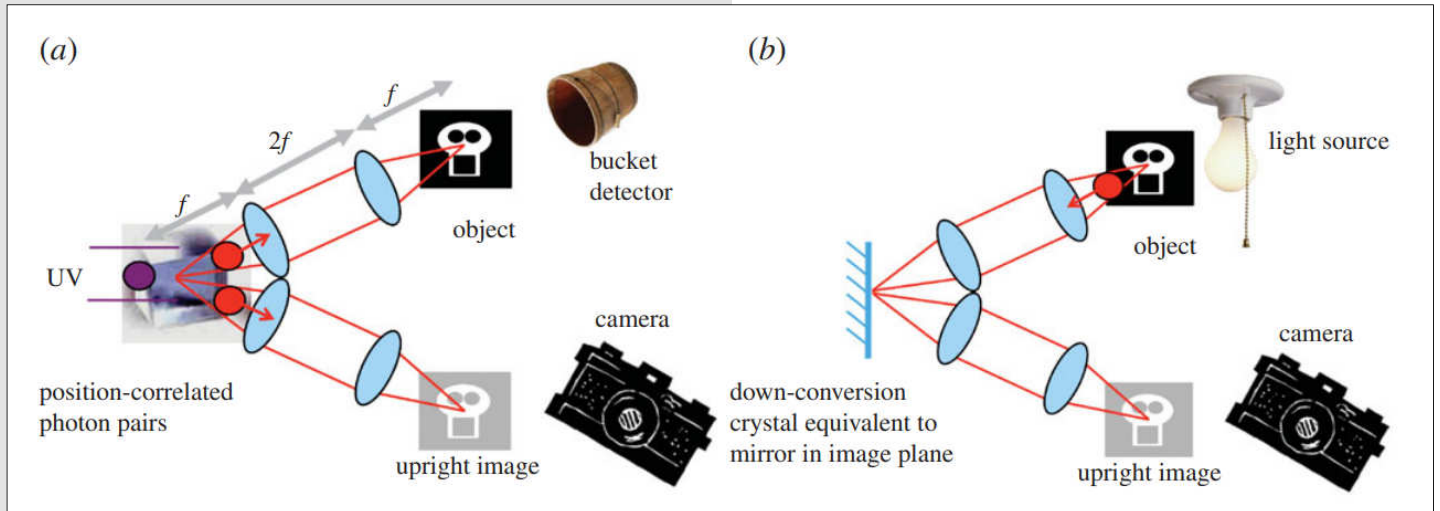
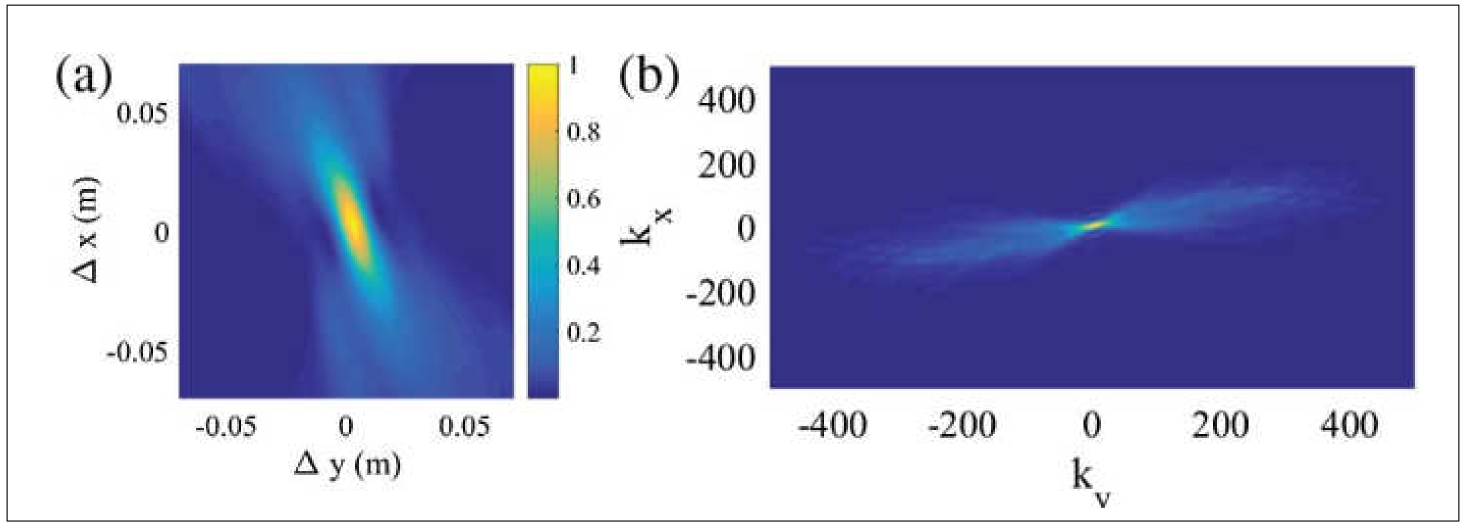
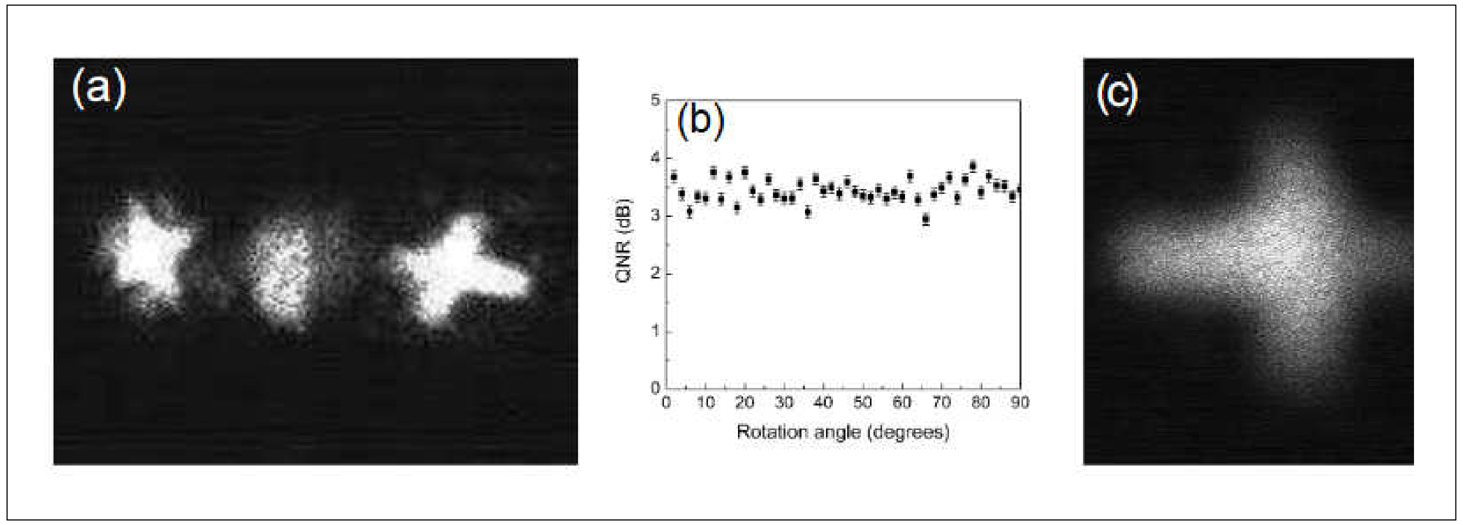
Involved countries
Italy



(a) The images produced by a ghost imaging system based on spontaneous parametric down-conversion (SPDC) are equivalent to those that could be produced by a classical imaging system and albeit the ghost imaging system has a different time sequence of events [4]



(b) right figure: 2D space-invariant approximation of incoherent PSF, for experimentally measured fields, left figure: Incoherent/optical transfer function corresponding to fields from a transmitting DMA displaced along the y axis by 30 cm[5]



(c) right figure: Image of conjugate, pump and probe beam profiles from left to right at the probe image plane; middle figure: quantum noise reduction as a function of cross rotation angle; left figure: a corresponding image of the conjugate in the conjugate image plane [6].