Polarization-Dependent Detection Efficiency measurement for SNSPDs

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Detection efficiency (DE) can be described as the probability that a detector generates a measurable signal when a single photon arrives, and it depends on factors such as wavelength and count rate, under specified operating conditions. Unlike detectors calibrated with conventional radiometric methods, there is still no universally accepted standard for calibrating single-photon detectors. This requires a joint effort among national metrological institutes (NMIs) to define a consistent and accurate methodology for evaluating detector performance and efficiency traceable to the SI.
Here we present the INRiM facility for the Detection DE measurement of light-polarization-sensitive single-photon detectors. A first version of the measurement facility for telecom wavelength was developed in 2020 in the framework of an informal pilot study on the calibration of the DE of an indium gallium arsenide single-photon avalanche detectors (InGaAs/InP-SPAD) [1]. These measurements were carried out by four NMIs, PTB, INRiM, NPL and CMI, employing distinct version of the substitution method [2].
Today, the INRiM facility is a state-of-the-art, fully automatized setup for characterisation of single-photon detectors at 1550 nm and it is also suitable for light-polarization-sensitive detectors as Superconductive Nanowire Single Photon Detectors (SNSPDs), thanks to the introduction of a dedicated polarization measurement and control system, that allows to reconstruct the estimated efficiency distribution across the Poincarè sphere's surface and with a relative uncertainty < 5% (k = 2).

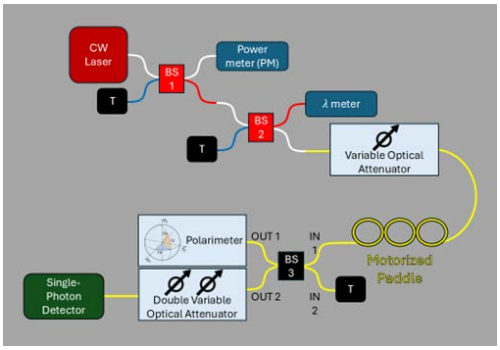

Fig. 1: *INRiM facility for DE measurement at telecom wavelength, adapted for light-polarization-sensitive detectors.*

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References

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