

Measurement Challenges of Secure Communications

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The National Physical Laboratory is undertaking research in the area of single photon science in order to improve the accuracy of measurement techniques and provide a metrology infrastructure for quantum information technologies such as secure communications. An overview of current standards requirements, and work underway at NPL to meet these challenges, will be presented.

Quantum key distribution (QKD) is the first significant quantum information technology (QIT) to bring products to the market place. In order to promote confidence in this new technology, it is generally agreed that there need to be standards against which its performance can be validated and certified. This in turn means that the capability for carrying out the certification has to be put in place.

There are a number of activities being undertaken at the National Physical Laboratory (NPL) in the area of single photon science. One such activity concerns the characterization of photon counting detectors using the technique of parametric downconversion. Correlated photons can be used to provide absolute calibration of detector quantum efficiency (q.e.) in the photon counting regime. This allows detector scales to be extended into this regime without the need to obtain traceability from the ‘macroscopic’ mW power region, which can lead to a degradation in accuracy. In addition to the q.e., other properties of detectors such as afterpulsing, jitter, etc can also be crucial to their performance in applications such as QKD.

The aims of these activities are to provide a metrology infrastructure for the QIT industry, and to use single photon physics to improve existing measurement accuracy and develop new measurement techniques for non-QIT industries. This work is therefore focused on developing the techniques and facilities to carry out measurements to a known, quantifiable uncertainty. NPL is engaging with the QKD industry to establish the measurement landscape for this technology.

The current perspective of the measurement landscape will be presented. The measurement requirements and challenges that are needed to ensure there is reliable data for the optical and electronic performances of the optics, sources, detectors and electronics involved in the whole process of quantum key distribution will be discussed. The current status of work at NPL to meet these challenges will be presented.