A Measurement Platform for Characterizing Single-Photon Detectors and QKD Optical Systems

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Quantum Key Distribution (QKD) systems rely on precise generation, transmission, and detection of single photons to ensure secure communication [1]. Reliable evaluation procedures and measurement infrastructures are therefore essential for verifying the performance of QKD optical systems and their key components [2].

In this work, an encoding test protocol was implemented on the measurement platform to verify the validity of quantum state preparation and measurement processes in a QKD system. As shown in Fig. 1, the system performance was characterized across complementary measurement bases using a dual-SPAD receiver configuration (SPAD#1 and SPAD#2).

In the standard basis configuration (Bob(0)), strong correlations were observed between the quantum states transmitted by Alice and the measurement results obtained by Bob. Nearly perfect agreement was observed at specific photon count intensity levels, while dark counts were properly suppressed [3]. These low-level detection signals provide important information for characterizing the noise floor of the system.

In contrast, measurements performed in the phase-rotated basis (Bob(π/2)) exhibited the expected anti-correlation behavior, in which Bob's measurement results reflected the intensities of the states sent by Alice.

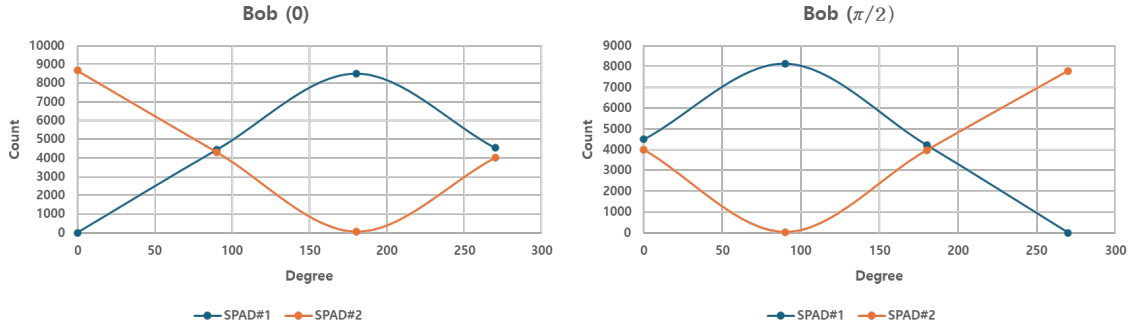

Fig. 1. *Encoding test protocol using a dual-SPAD receiver for QKD system evaluation*

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References

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