System Level Optimization of Drone Based Continuous Variable Quantum Key Distribution Using Monte Carlo Techniques

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Quantum Key Distribution (QKD) could be used to exchange keys between mobile platforms such as drones, satellites, airplanes, and unmanned aerial vehicles, or between aerial platforms and ground. The nature of those platforms creates a stochastic jitter of their optics pointing system. The pointing direction jitter creates a random change of the received signal with its own unique statistics. As a result, the key exchange performance can be significantly deteriorated. In this work the effect of the stochastic jitter on performance of the information reconciliation phase of the continuous variable QKD protocol is analyzed as a function of the system parameters such as the telescope gain. Parameter optimization can then be performed to minimize the reconciliation error probability. Analytical evaluations of the performance have been obtained in closed form but pose challenges in numerical computation due to the extremely small quantities involved. This paper provides results of Monte Carlo simulation techniques to perform the optimization while validating some of the analytical results. This work is continuation of R&D in the context of a science for peace NATO grant focused on implementation vulnerabilities of QKD techniques leveraging drones and other aerial platforms.