



Procedures for performing the polarization measurement. (a-d) are the UQSD measurement strategy, (e) is the MED measurement strategy. (a) In UQSD, when $\tan 2\theta_a > \sin 2\theta_n$, the H4 rotates the polarization by $2\theta_4$, thereby transforming $|d_2\rangle$ to $|h\rangle$. (b) Then the horizontal component is divided into two parts by H5, one part is the common state ($|d_2\rangle$), and the other is transformed to $|v\rangle$ by H6, which is set at 45° . (c) The residual ($|q_1\rangle$ and $|q_3\rangle$) is unambiguously discriminated by H7 followed by a PBS. (d) When $\tan 2\theta_a < \sin 2\theta_n$, the H4 rotates $|d_2\rangle$ to $|h\rangle$. Then the states are projected to the basis states $|h\rangle$ and $|v\rangle$. When we detect the photon in the $|v\rangle$ state, we assert that the photon is in the state $|d_1\rangle$. Otherwise, we obtain an inconclusive result. (e) In MED, the H4 rotates the polarization suitably to minimize the guessing error.