Quantum Eraser

Task 1
Explain how a single photon behaves in the interferometer if there are no polarizers. What can observed at the detectors?

Task 2
Set the polarizers 1 and 2 so that they are orthogonal to each other (e.g. horizontal vs. vertical). What happens with both interference patterns?

Task 3
Add a third polarizer after the second beam splitter, with a polarization in the 45° direction compared to polarizers 1 and 2. What happens to the interference pattern in the beam where the third polarizer was inserted?

Summary

The interference of a photon in a Mach-Zehnder interferometer solely depends on whether it is possible in principle to determine which path it has taken (the so-called _____ information). As soon as the two paths can be _____ – for example because the photons have different polarizations – the interference _____. The photon then has the character of a _____ instead of a _____. However, the quantum eraser restores the _____. It consists of a third polarizer that mixes (or "superimposes") the different polarizations of the two paths. This irretrievably deletes the original information about the _____. The photon now no longer "knows" which path it has taken and immediately shows _____ characteristics again. The mere possibility of path differentiation is sufficient to _____ interference. The quantum world reacts to potential _____. This experiment impressively demonstrates that the existence or deletion of the _____ determines the behavior of the quantum object - i.e. whether it interferes or not.

Word bank:
disappears, distinguished, interference, measurability, particle, path, path information, prevent, wave, wave, which-path