For these problems, use the simulation “Delayed Choice Experiments” in the QuVis HTML5 collection.

1) Have a play with the simulation for a few minutes, getting to understand the controls and displays. Note down three things about the controls and displayed quantities that you have found out.

2) Consider the setup with only a single beamsplitter in place. What does the photon visualization suggest to you is happening at the beamsplitter? What are the detection probabilities for this case in Detectors 1 and 2? How does the quantum state change at the moment the photon is detected?

b) Now consider the setup with the mirrors and two beamsplitters in place and assume the photon is incident from the top beam. What are the detection probabilities in Detectors 1 and 2? Show this result mathematically by deriving the quantum state after the second beamsplitter from the quantum states at different points in the interferometer and the action of the second beamsplitter.

c) After passing the beamsplitter, has the photon split into two distinct photons, each with half the energy of the original photon? Justify your answer with the help of the simulation.

3) Set up two different delayed choice experiments in the simulation. For each of them,

a) describe the experimental setup

b) state what you observe

c) explain what conclusions about the behaviour of photons you can draw from your observations