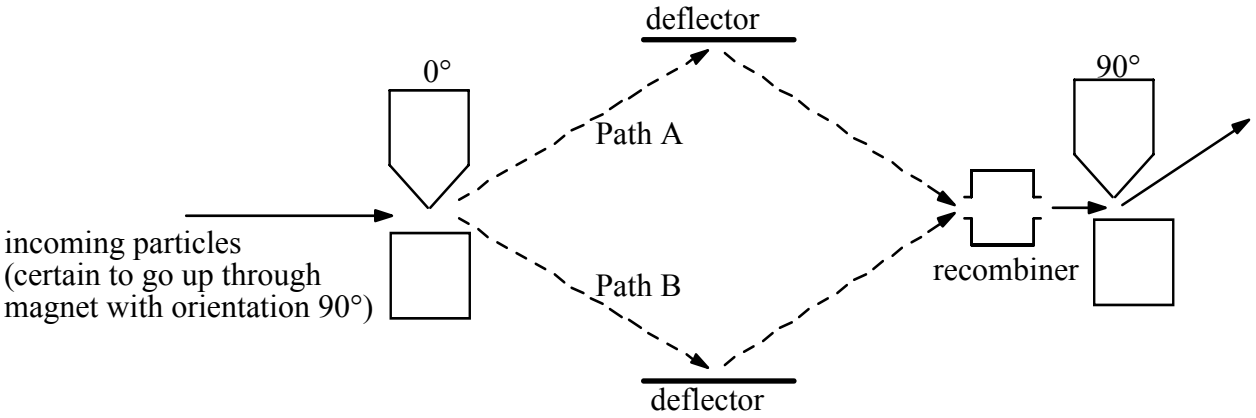
Handout #1: The two-path experiment



Suppose we set up the two-path experiment as shown above, with the incoming particles prepared in such a way that they are certain to go up through a magnet with orientation 90°. When we put particle detectors in Paths A and B, we find that any incoming particle activates one or the other of them. Hence we conclude:

1. Every incoming particle follows either Path A or Path B.

Further, if we block off Path B—so that any particle that makes it through the second magnet must have followed Path A—we find that 50% of the particles entering the second magnet go up, and 50% go down. (We also find, if we rotate the second magnet so that it has orientation 0°, that every particle entering it goes up, as expected.) Hence we conclude:

2. Every particle that follows Path A has a 50% chance of going up through the second magnet.

Finally, if we block off Path A—so that any particle that makes it through the second magnet must have followed Path B—we again find that 50% of the particles entering the second magnet go up, and 50% go down. (We also find, if we rotate the second magnet so that it has orientation 0°, that every particle entering it goes down, as expected.) Hence we conclude:

3. Every particle that follows Path B has a 50% chance of going up through the second magnet.

From 1, 2, and 3, it follows that

4. Every incoming particle has a 50% chance of going up through the second magnet.

But if we leave Paths A and B undisturbed—i.e., don't block them off, and don't put detectors in them—we observe what is depicted above: every incoming particle in fact goes up through the second magnet. Hence 4 is false, and even though it seems that we have excellent experimental confirmation for 1, 2, and 3, at least one of them must be given up.