Introduction to Quantum Flytrap and Michelson Interferometer

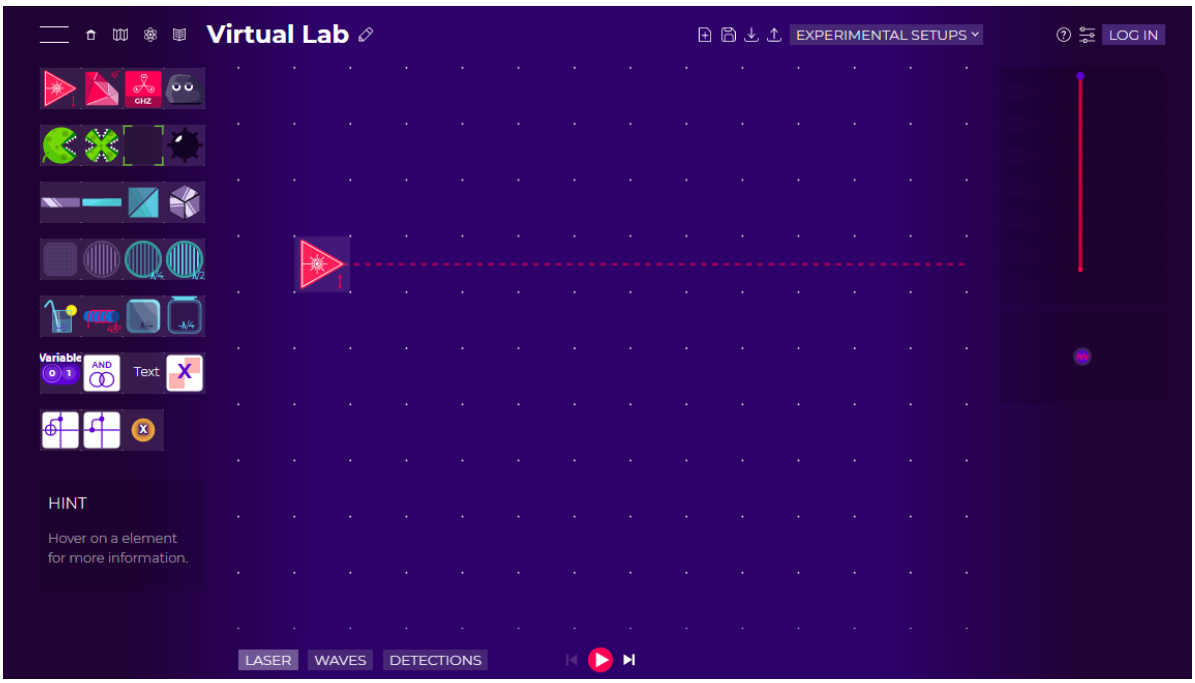
18 August 2021, Magdalen Physics and Engineering Programme

SECTION 1

Getting Started

Visit https://quantumflytrap.com/

Select VIRTUAL LAB from the top bar. You should see a screen as follows.



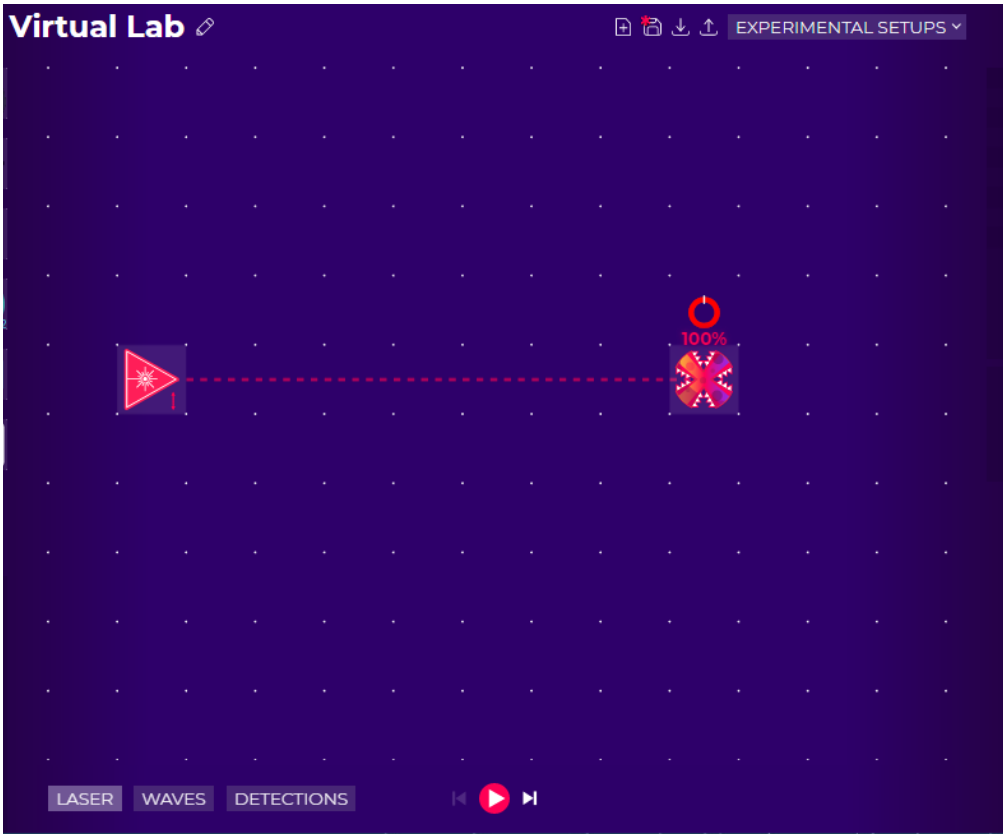
Hover the mouse/pointer over different icons to read brief descriptions about them at the lower bottom of the screen.

SECTION 2

Detector

Place an OMNIDIRECTIONAL DETECTOR in front of the LASER.

The number on top of the DETECTOR shows the percent of LASER light detected.



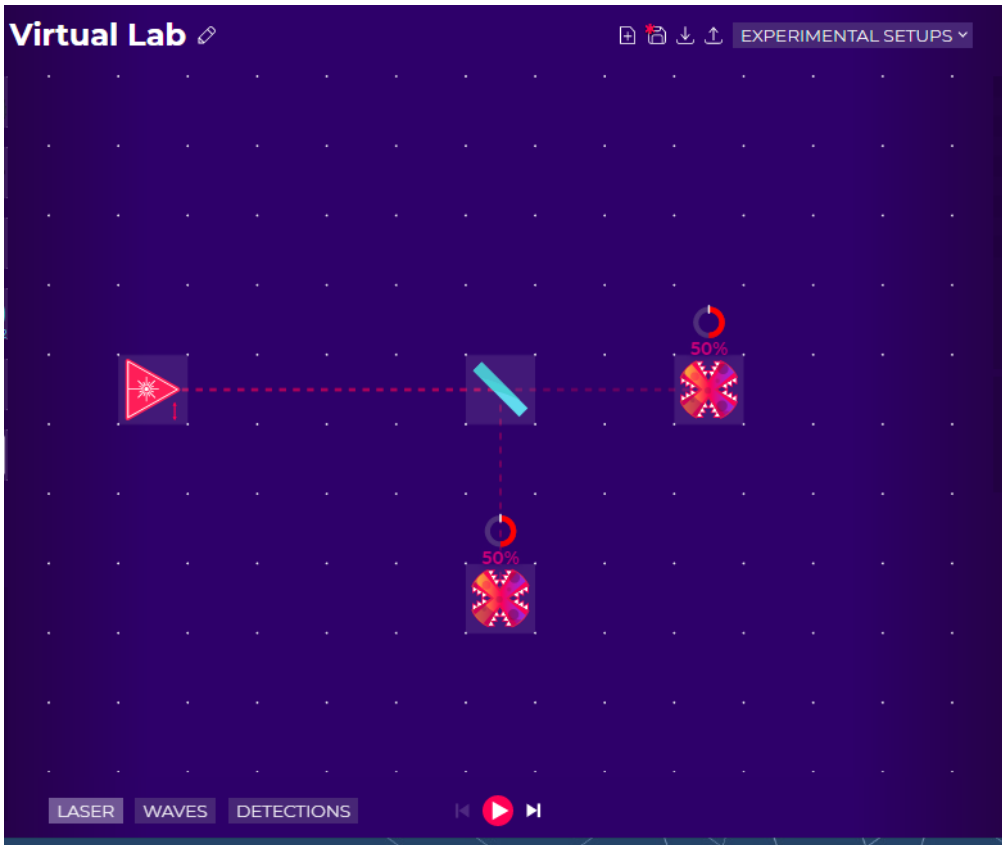
SECTION 3

Beam Splitter

Place a BEAM SPLITTER between the LASER and the OMNIDIRECTIONAL DETECTOR. Click on the BEAM SPLITTER a number of times until you see part of the laser beam reflected downwards.

Place another OMNIDIRECTIONAL DETECTOR to detect the downward beam.

What numbers do you see with the detectors? What do they tell you about the BEAM SPLITTER?



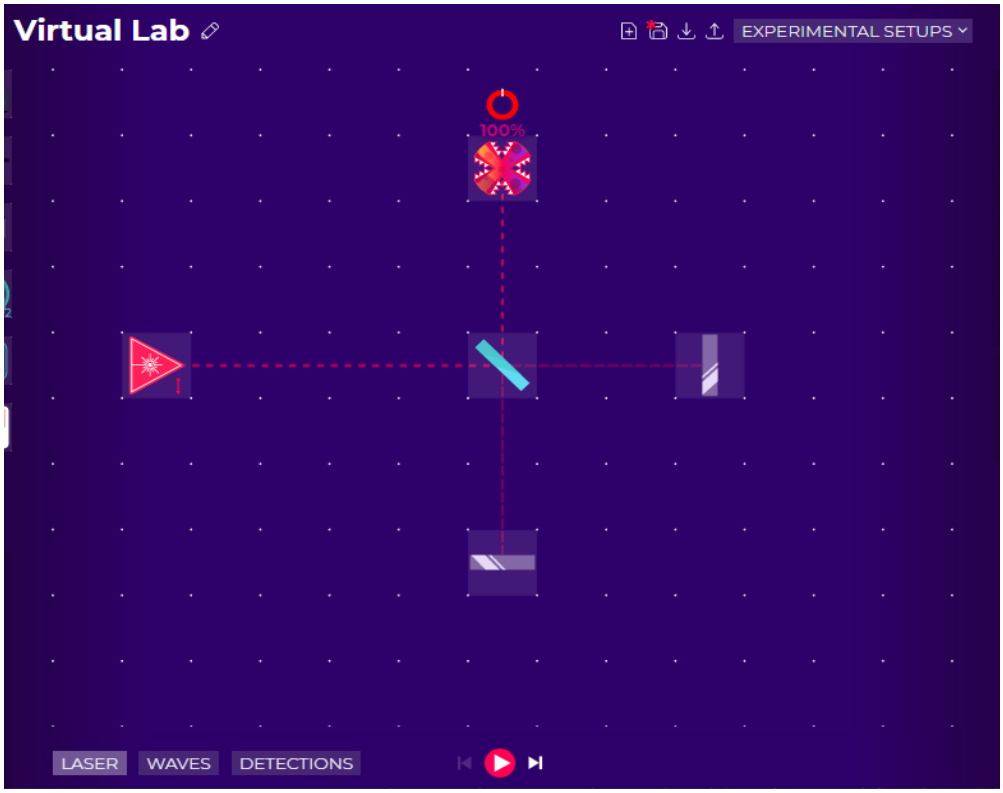
SECTION 4

Interferometer

Using two MIRRORS, one BEAM SPLITTER and one DETECTOR, set up a Michelson Interferometer as shown below.

Can you trace the complete path of the LASER beam? Draw it in your notebook.

How do you explain the number shown with the DETECTOR?

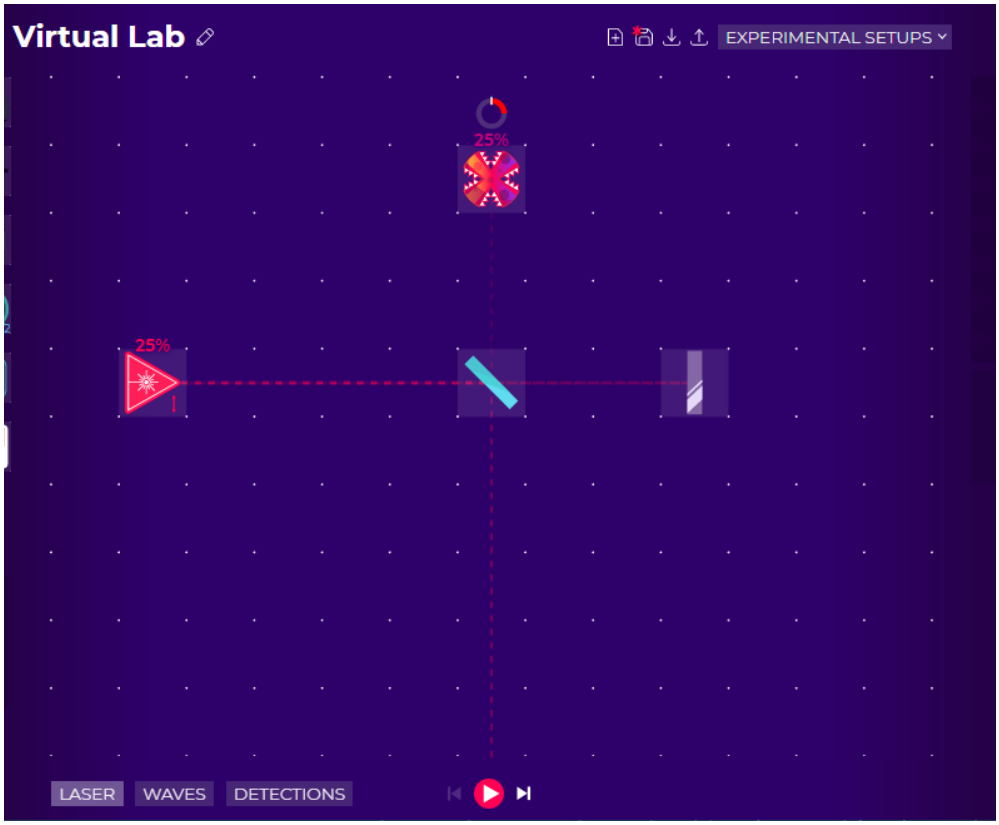


Now remove either of the MIRRORs.

Draw the complete path of the LASER beam in your notebook.

How do you explain the number shown with the DETECTOR?

What about the number shown with the LASER?

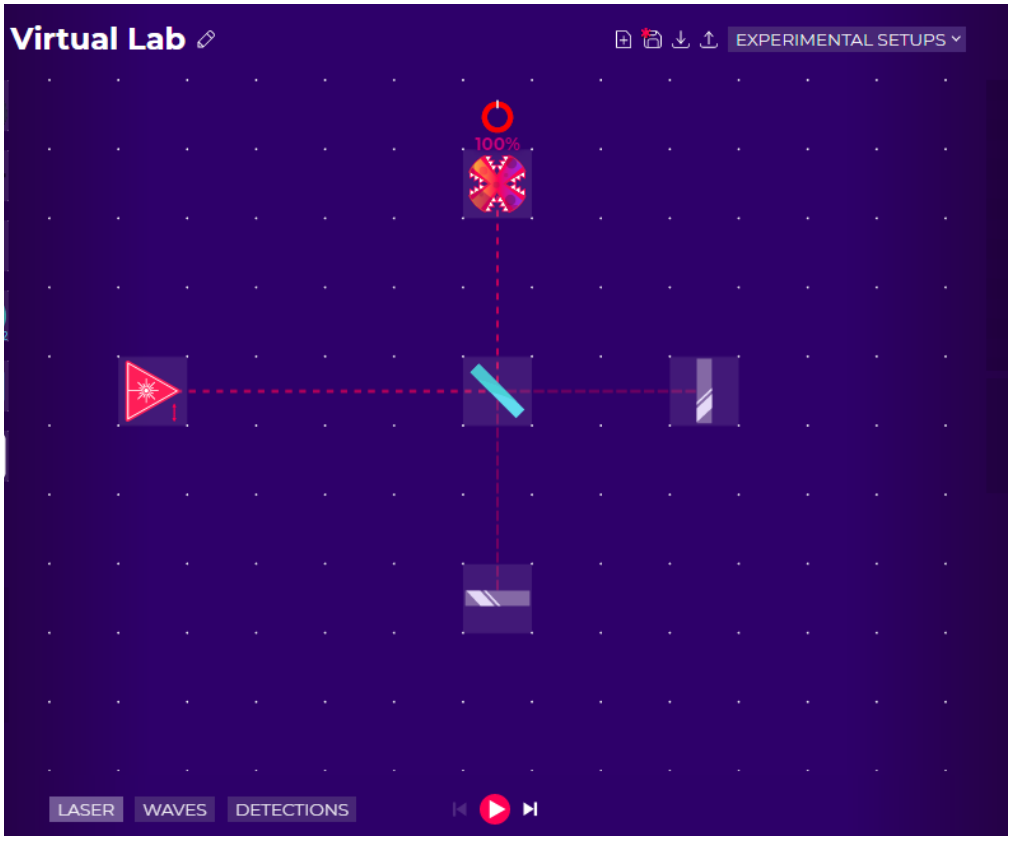


SECTION 5

Path Length Difference

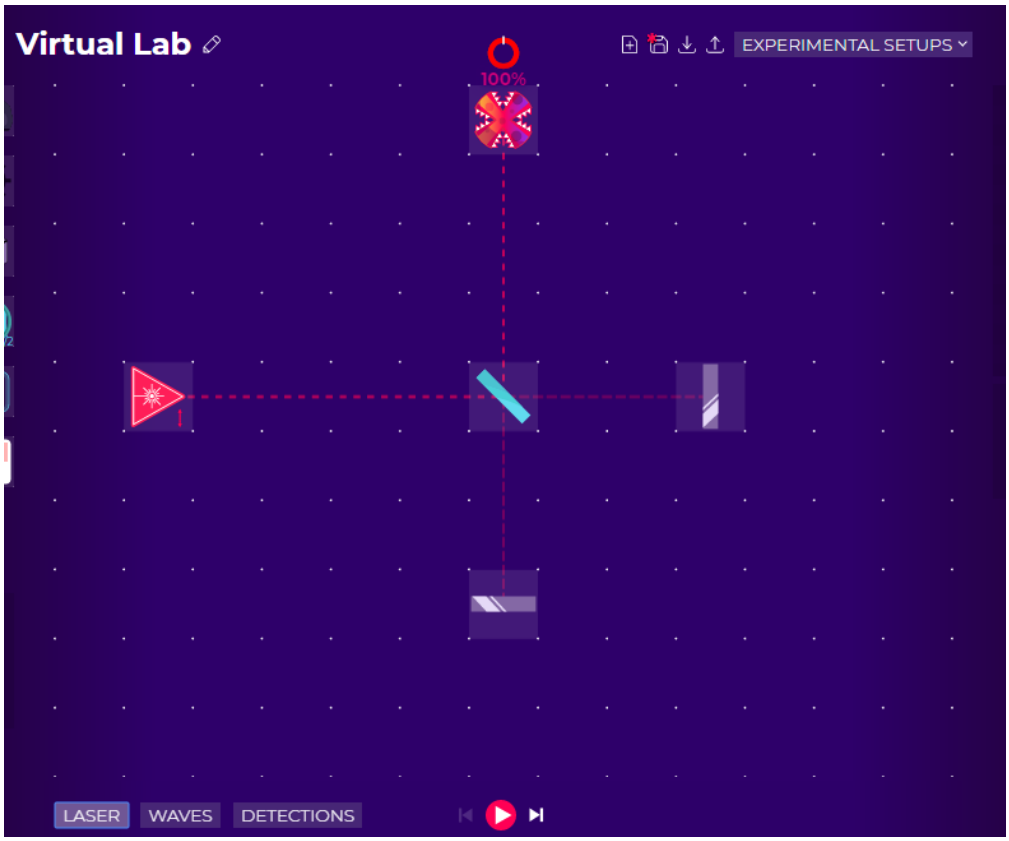
Set up a Michelson Interferometer again (using two MIRRORS, one BEAM SPLITTER and one DETECTOR) as shown below.

What number do you see with the detector?



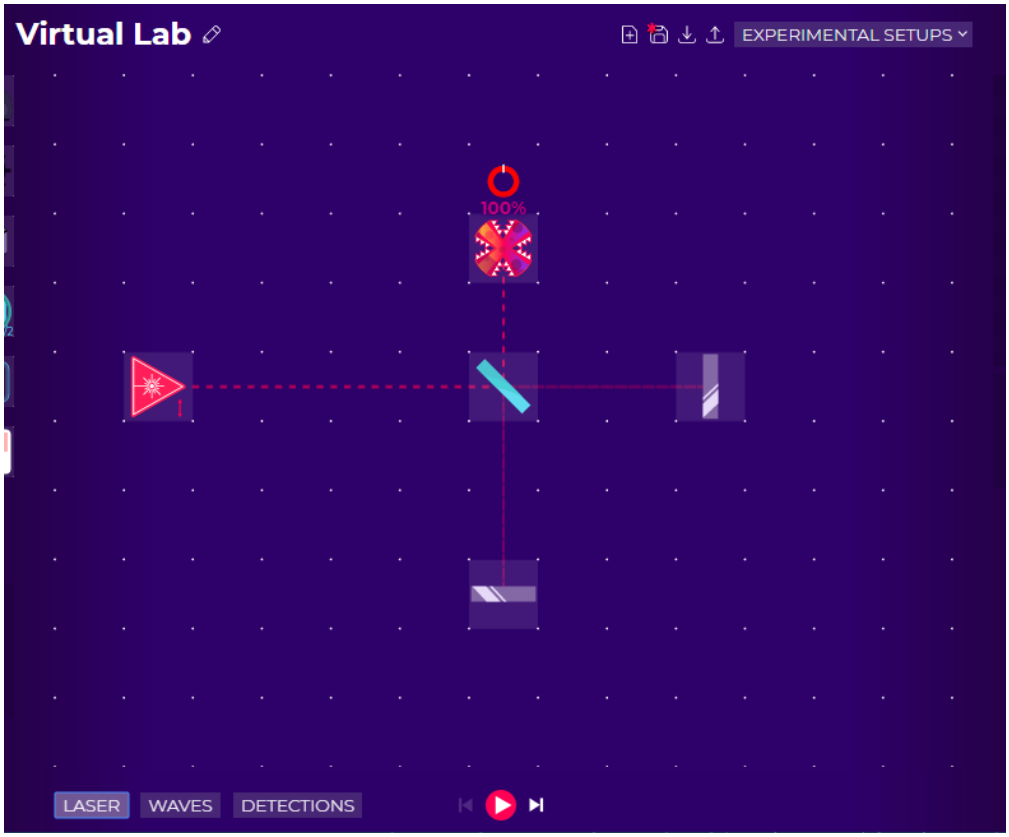
Move the DETECTOR one step/block away from the LASER beam.

Does the number on the detector change? How do you explain it?



Move the DETECTOR two steps/blocks closer to the LASER beam.

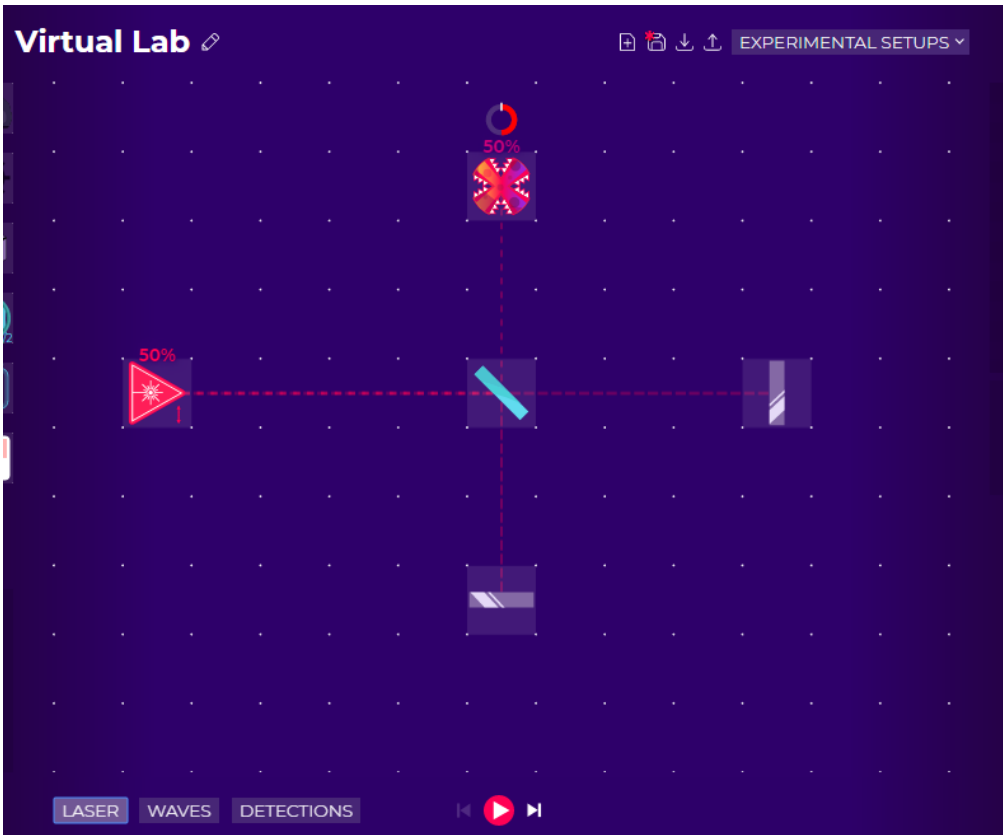
Does the number on the detector change? How do you explain it?



Move the DETECTOR one step/block away from the LASER beam. The DETECTOR number should stay unchanged.

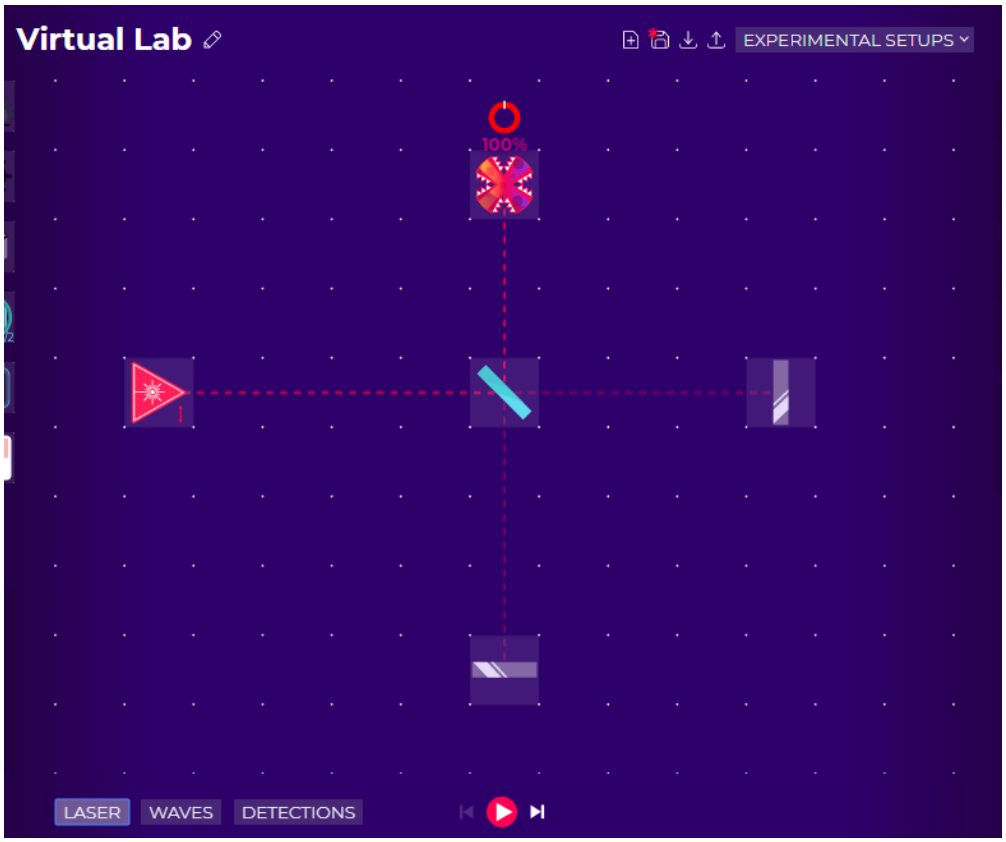
Move the right MIRROR one step/block away from the LASER beam.

Does the number on the detector change? Why or why not?



Move the bottom MIRROR one step/block away from the LASER beam.

Does the number on the detector change? Why or why not?

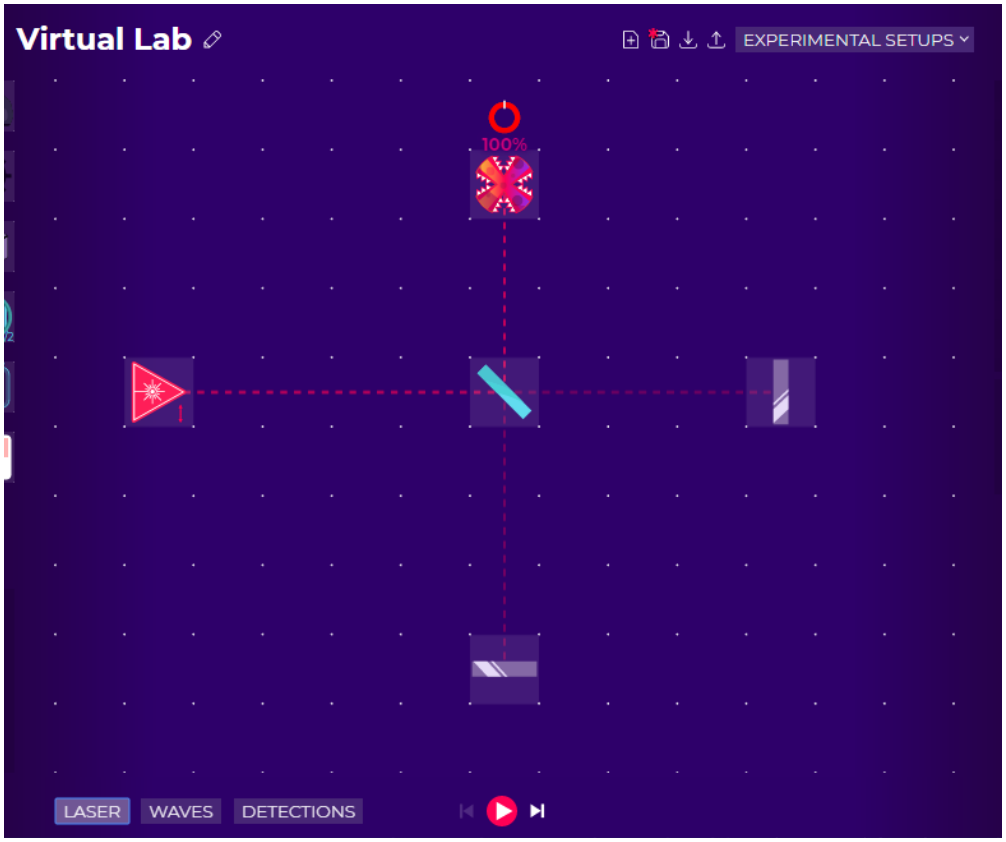


SECTION 6

Phase Shift

Set up a Michelson Interferometer again (using two MIRRORS, one BEAM SPLITTER and one DETECTOR) as shown below.

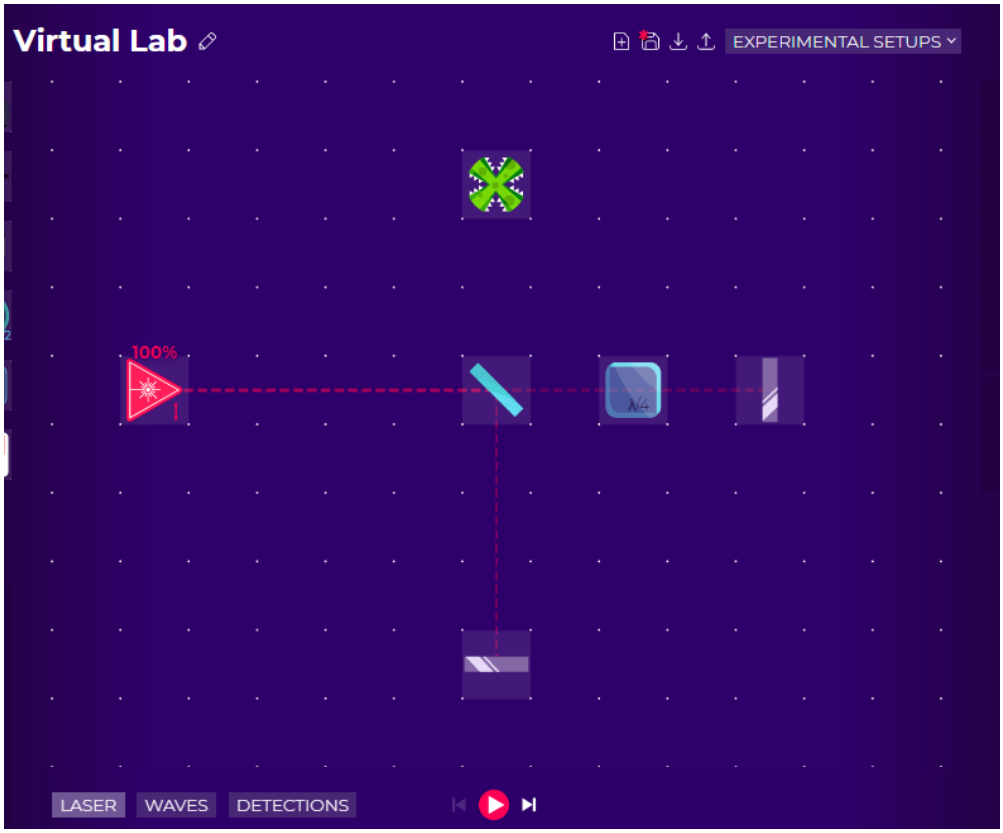
What number do you see with the detector?



Place a GLASS block in front of one of the MIRRORs.

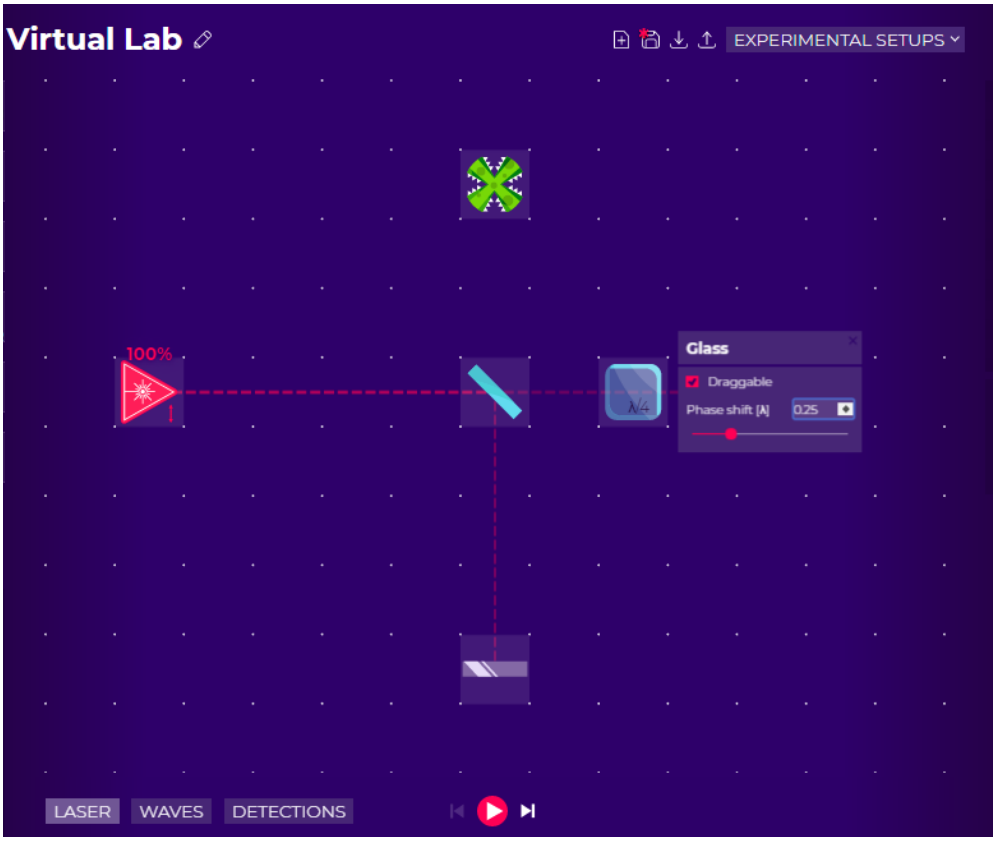
What number do you see with the detector? How do you explain it?

Can you trace the complete path of the LASER beam? Draw it in your notebook.

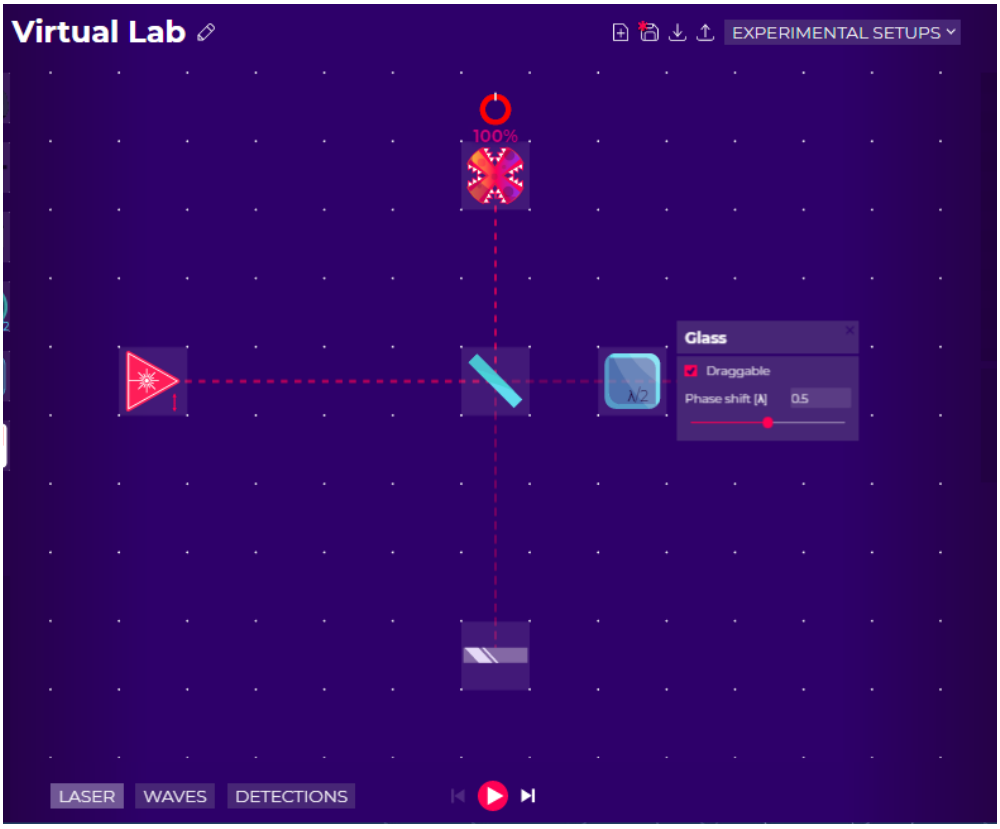


The default phase shift of the GLASS is 0.25 x wavelength (λ). It must be visible on the GLASS icon.

Right-click the GLASS. You should see a pop-up window, as shown below.



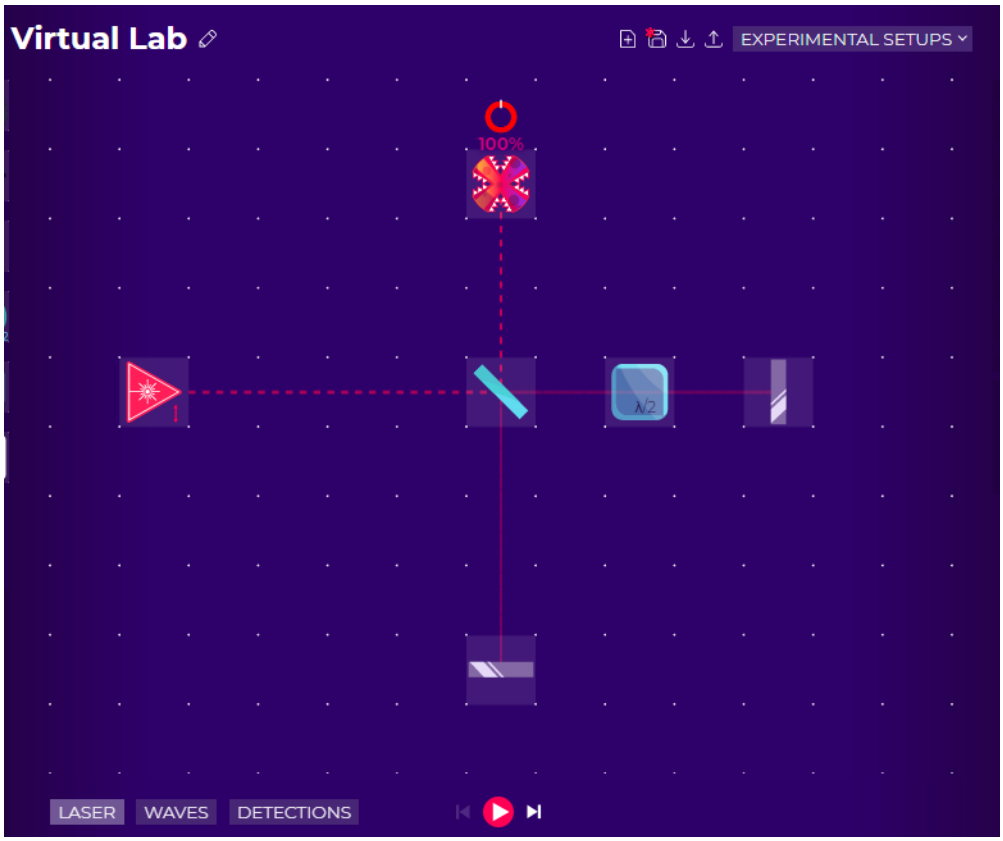
Change the phase shift to 0.5 units, as shown below.



Click the cross button at the top-right of the GLASS window. The GLASS icon should now show the value λ/2.

What number do you see with the detector? How do you explain it?

Can you trace the complete path of the LASER beam? Draw it in your notebook.

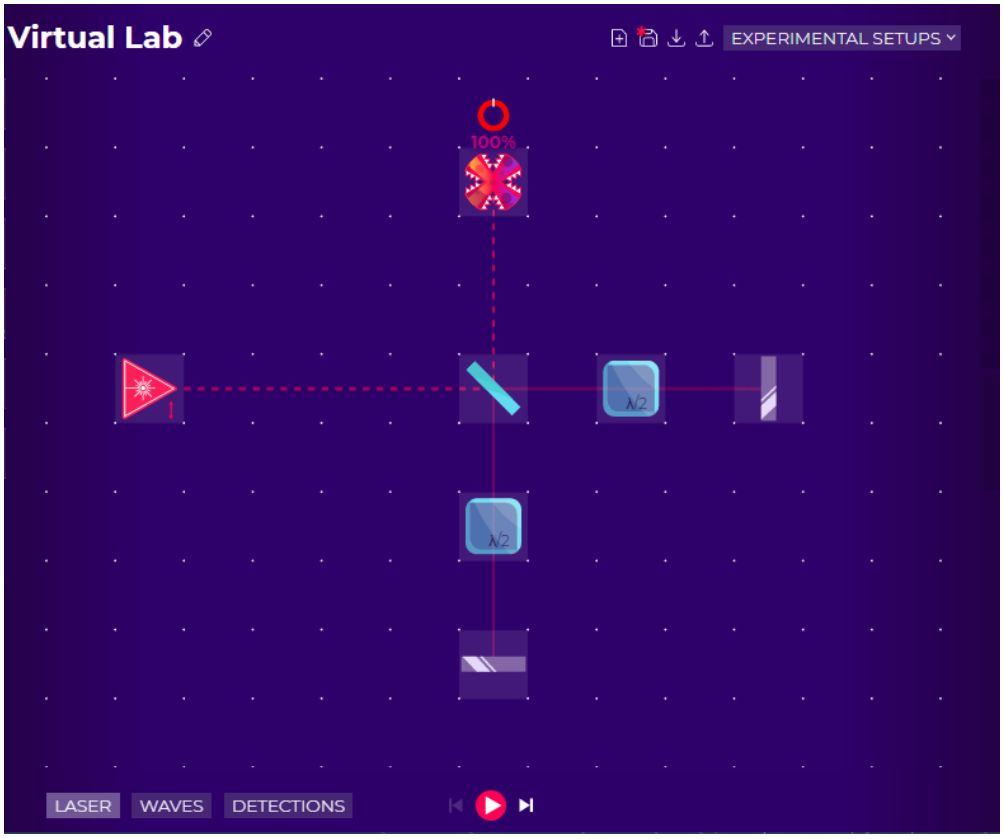


Place a GLASS block in front of the other MIRROR. Now there should be a GLASS block in front of each of the MIRRORs, as shown below.

Set the phase shifts of both GLASSes to λ/2.

What number do you see with the detector? How do you explain it?

Can you trace the complete path of the LASER beam? Draw it in your notebook.



Now, set both the phase shifts to λ/4, as shown below.

What number do you see with the detector? How do you explain it?

Can you trace the complete path of the LASER beam? Draw it in your notebook.