QUICK START TUTORIAL

CREATING A PROJECT STEP-BY-STEP

Welcome! We assume that you have successfully installed Pintar ***VirtuaLab***$_{TM}$ Optics on your computer. You are now ready to create your very first virtual optics experiment using the powerful Pintar ***VirtuaLab***$_{TM}$ Optics. Creating a virtual experiment with Pintar ***VirtuaLab***$_{TM}$ Optics is very similar to doing it in a real laboratory – setting up a relationship of lenses and mirrors, and viewing the resultant image or their effect on a light ray. But, doing it in a virtual laboratory is even more fun because you can let your imagination run wild without fear of accidents! Let's see you do that in your school lab!

Important: Pintar ***VirtuaLab***$_{TM}$ Optics operates under two modes: 'ray' mode and 'image' mode. This separation is designed to minimize the confusion that may arise from these two distinct objectives in optics experiments. In ray mode experiments, light (a light ray) is the subject of study as it is affected by optical elements like lenses and mirrors. In image mode experiments, an object is used to form an image. The resultant image is studied. In this tutorial, we shall do a couple of small experiments in both these modes.

For a novice user, the quickest way to become familiar with Pintar ***VirtuaLab***$_{TM}$ Optics is to follow this step-by-step tutorial. Throughout this tutorial, you will quick references to the detail description, as indicated by the ? symbol.

This tutorial assumes that you possess a fundamental working knowledge of Windows 9x, NT, Me, 2000 or XP.

In this tutorial, there are some words that have special procedural meaning for describing certain operations :-

Click	Press once on the mouse button.
Select	Click once on a specified object.
Drag	Click on a specified object. While holding down the mouse button on the object, drag the mouse. Let go the mouse button when you have dragged the object to the intended location.
Type	Press on one or more specified keys on the keyboard.
Draw	Select a tool from the Tool bar. Move the cursor to a location on the Workbench where you want to 'draw' the object, and click once
Choose	Click on a menu item in a menu.

Launching Pintar *Virtua*Lab$_{TM}$ Optics

We assume that you have successfully installed the Pintar ***Virtua*Lab**$_{TM}$ Optics. In the Optics folder, double-click on the icon labelled OPTI.exe.

EXPERIMENT 1

OBJECTIVE:

To verify the formula $1/o + 1/i = 1/f$ (Gaussian form of the thin lens formula), where '*o*' and '*i*' are the distances of the object and image respectively from the lens.

COMPONENTS USED:

For this experiment, you will just need one optical component: a convex lens.

METHOD:

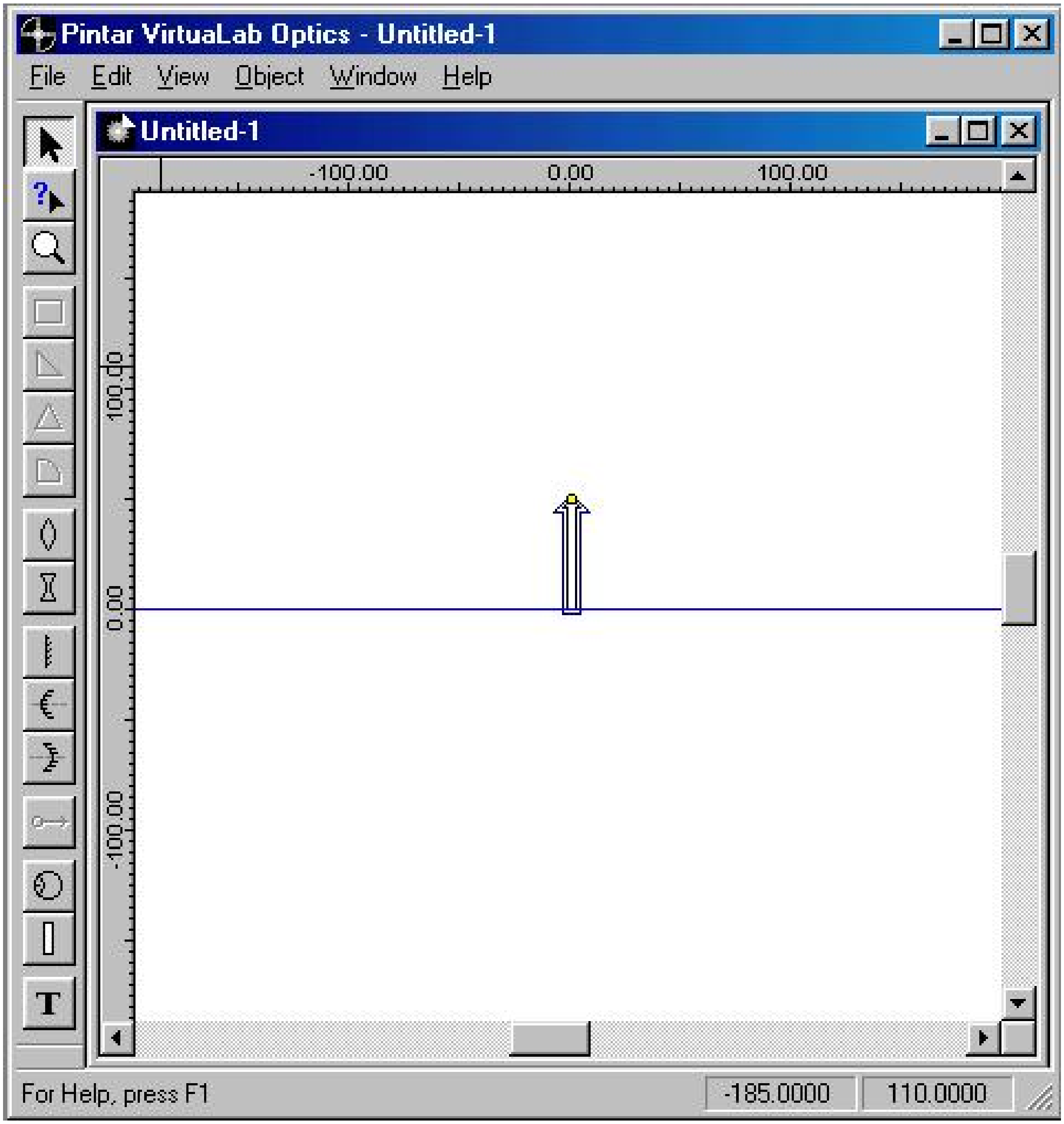
1. Starting a new project

Begin a new experiment by setting up a clean Workbench, on which objects for your experiment can be placed.

a. Choose 'New...' from the File menu. A dialog panel appears showing two choices : Ray mode and Image mode.
b. Select 'Image mode', and click 'OK'; or just double-click on the selection.

A new Workbench labelled 'Untitled –1' will be created. On the Workbench, you will see an object sitting upright on the principal axis.

? • **Starting a new experiment**

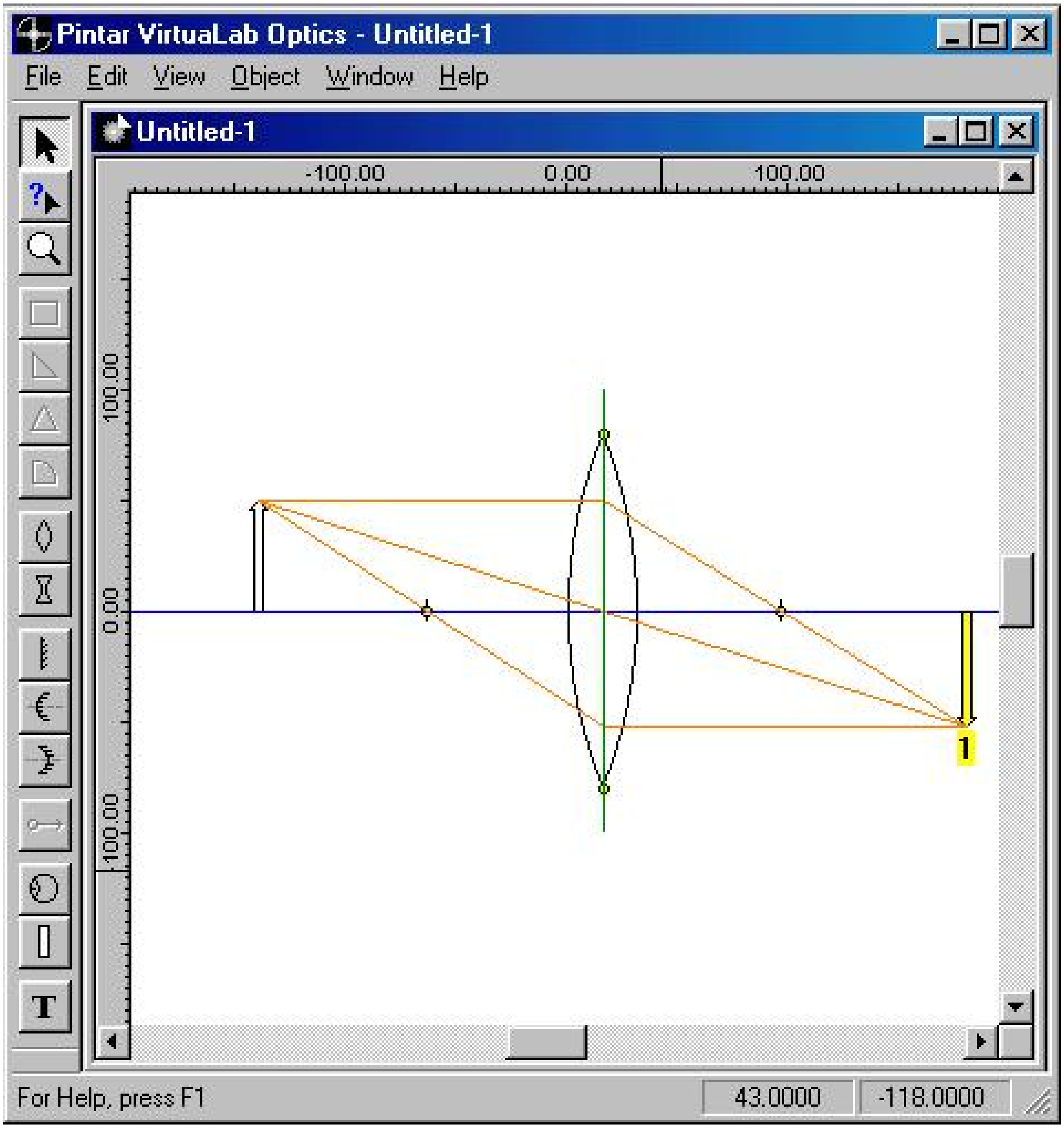


2. Drawing (placing) an optical component on the Workbench

The Tool bar holds the tools for drawing and manipulating optical components in an experiment. If you are unsure as to which is the convex lens tool, park your cursor over a tool in the Tool bar and label will appear. Repeat this action until you find the desired tool.

a. Select the convex lens tool in the Tool bar. The cursor changes to indicate that the convex lens tool has been selected.
b. Move the cursor to the principal axis on the Workbench.
c. Click once. The convex lens will be drawn where you clicked.

? • **Drawing (creating) a new optical component on the Workbench**

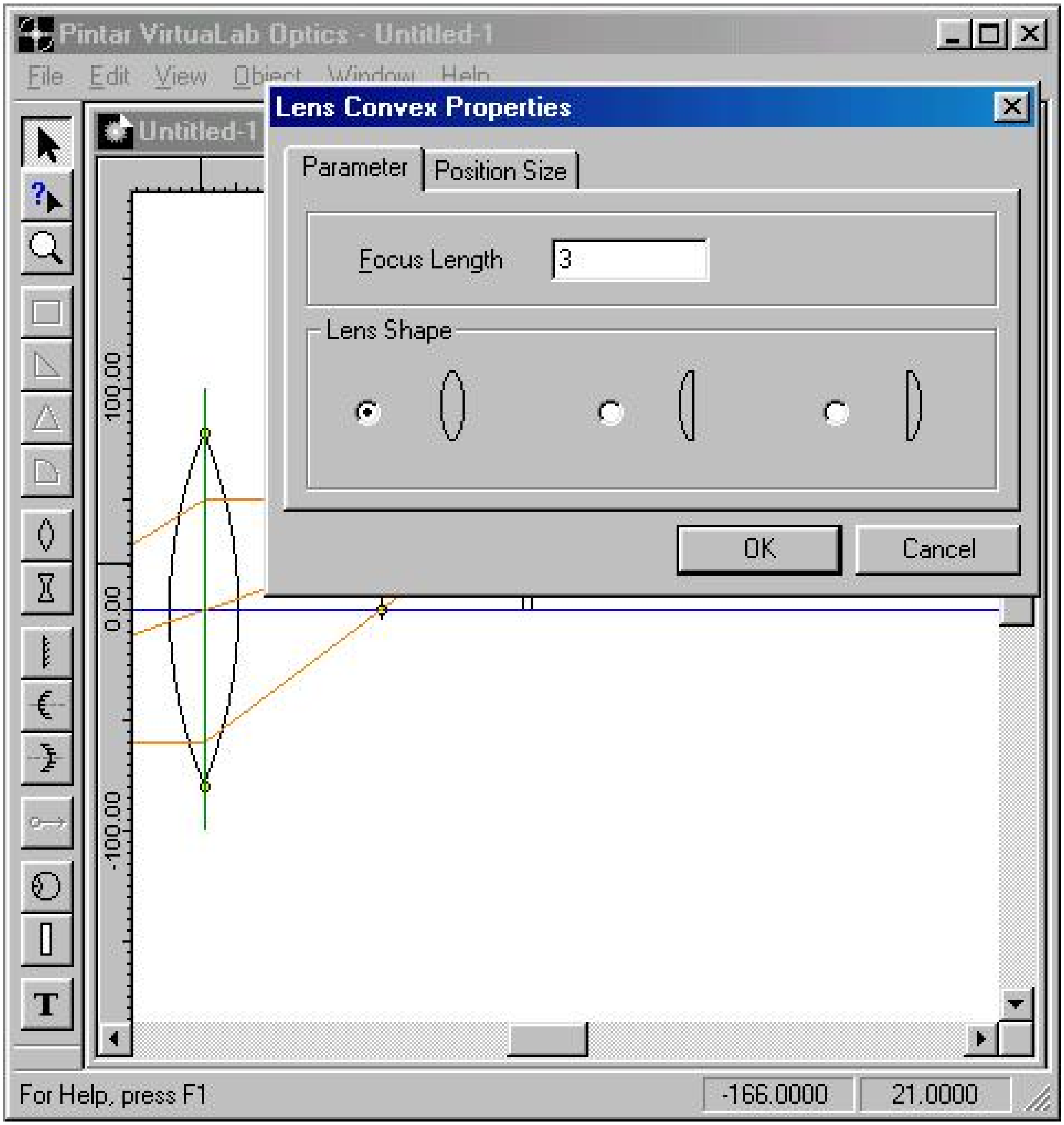


3. Set the parameters of the convex lens

We need the convex lens to have certain known properties before the experiment can be a success.

a. From the View menu, choose 'Unit'. Set the metric unit system to centimeters (cm)
b. Double-click on the convex lens. A convex lens properties dialog panel will appear.
c. Set:
    a. the focus length to 3cm.
    b. height to 5cm.
d. Click on 'OK'.

? • **Setting/changing the parameters of an optical component**



4. Annotate your experiment

It is always a good practice to annotate or label your experiment. For example, we want to label the principal axis, and give a title to the experiment.

a. Select the Text tool in the Tool bar. The cursor changes to indicate the text tool.
b. Move the cursor to the proximity of the principal axis and click. A text object with the default word "Text" appears at the position where you have clicked.
c. Double-click on the text object. The text properties dialog panel appears.
d. In the scrolling field replace the default word "Text" with "principal axis".
e. Choosing from the options available, set the alignment, font and font size.
f. When satisfied with the settings, click ‘OK’.

? • **[Text tool](#)**

5. Save your experiment

At this point, it is probably a good idea to save the experiment that you have created thus far.

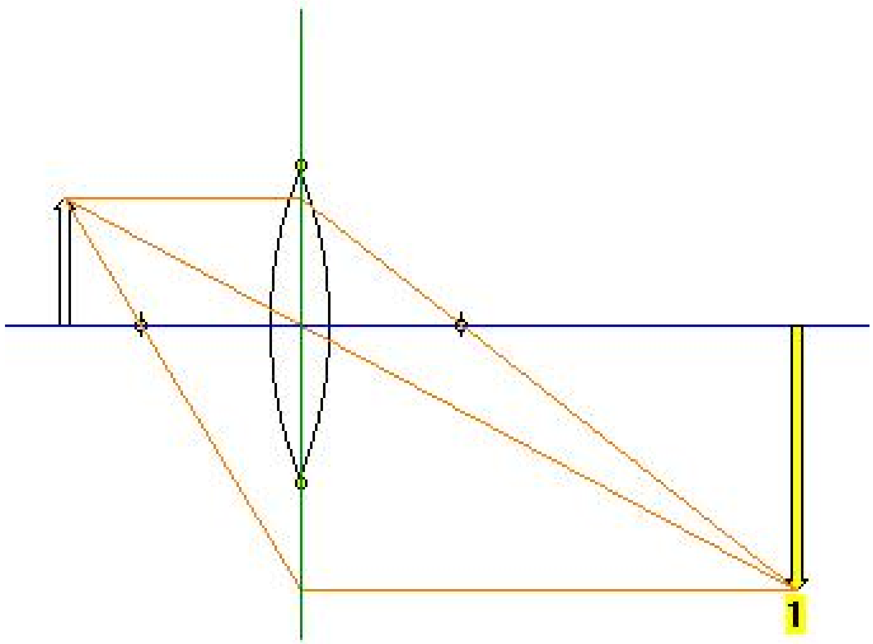
IMPORTANT: If you are using a free trial version of Pintar ***VirtuaLab***$_{TM}$ Optics, you will not be able to save your experiment because this featured has been disabled. Continue with Step 6.

a. Choose ‘Save As...’ from the File menu.
b. Name the project, "My Optics". You may want to save your project in the Examples folder.

? • **Saving an experiment**

6. Observe your experiment

You are now ready to observe the experiment and see how things will behave. Keep your fingers crossed.



7. Moving the lens and principle axis

Drag the convex lens along the principal axis. Note the change in the image.

Note: If you move the convex lens to a position such that the object is at the focus length from the lens (i.e., the object is on the focus point), the image formed will be at infinity. If the object is very slightly off the focus point, the image formed will still be extremely big. In such circumstances, Pintar ***VirtuaLab***$_{TM}$ Optics will display the text "image at infinity" or "image at almost infinity" instead of attempting to draw image.

Occasionally, you may need to shift the principal axis up or down in order to view the entire image. To shift the principal axis, drag the principal axis up or down. All optical elements on the principal axis will follow.

? • **Moving an optical component**

? • **Moving the principal axis in an image mode experiment**

8. Taking some readings for record

Starting with the convex lens at 1cm from (right of) the object,

a. Select the convex lens. Drag the lens to about 1cm from the object.

Note: If upon letting go the convex lens, it springs back to its original position, you have moved it too close to the object. The minimum distance between the object and a lens is 0.5cm.

b. Take down the distance of the image from the convex lens. If the image is virtual, the distance should be treated as a negative value.

9. Show ruler and grid

In order to place or read measurements, you will need the aid of the rules and grid.

a. To show the grid, choose 'Grid' from the View menu.
b. To hide the grid, choose 'Grid' from the View menu again. The checkmark disappears. The same applies for hiding the rulers.

10. Zoom (not scaling)

When you need to determine positions and distances with higher accuracy, zoom in to get a magnified view of the rulers. To zoom in,

a. Click once on the magnifying glass with a plus sign in the Control Panel.
b. Click again to zoom in further.

There may be occasions when the image formed extends past the visible range of the Workbench. To view the complete experiment, you will need to zoom out – allowing more visible room to work with. Zooming does not change the actual size of the Workbench.

a. Click once on the magnifying glass with a minus sign in the Control Panel.
b. Click again to zoom out further.

? • **The view menu >> Zoom In/Zoom Out**

11. Obtain more readings : the results

Repeat step 8, for each 1cm increment in object distance from the convex lens. Put the readings into a table like the one shown here :

	Object Distance, *o cm*	Image Distance, *i* cm	Focal Length, *f* cm
1	1.0	-1.5	3.0
2	2.0	-6.0	3.0
3	3.0	Infinity	3.0

4	4.0	12.0	3.0
5	5.0	7.5	3.0
6	6.0	6.0	3.0

Collect about half a dozen readings.

12. Ending your work session

Although this experiment is coming to an end, your learning adventure with the Pintar VirtuaLab Optics is just beginning.

a. Go directly to Experiment 2, or
b. Choose ‘Quit’ from the File menu if you wish to call it a day.

CONCLUSION:

From the data collected, the calculated focal length matches the set focal length of the convex lens, thereby verifying the Gaussian form of the thin lens formula, $1/o + 1/i = 1/f$, where o and i are the distances of the object and image respectively from the lens.

EXPERIMENT 2

OBJECTIVE:

To show that the angle of incidence always equal the angle of reflection.

COMPONENTS USED:

For this experiment, you will just need two optical components: a plane mirror and light source.

METHOD:

1. Starting a new experiment

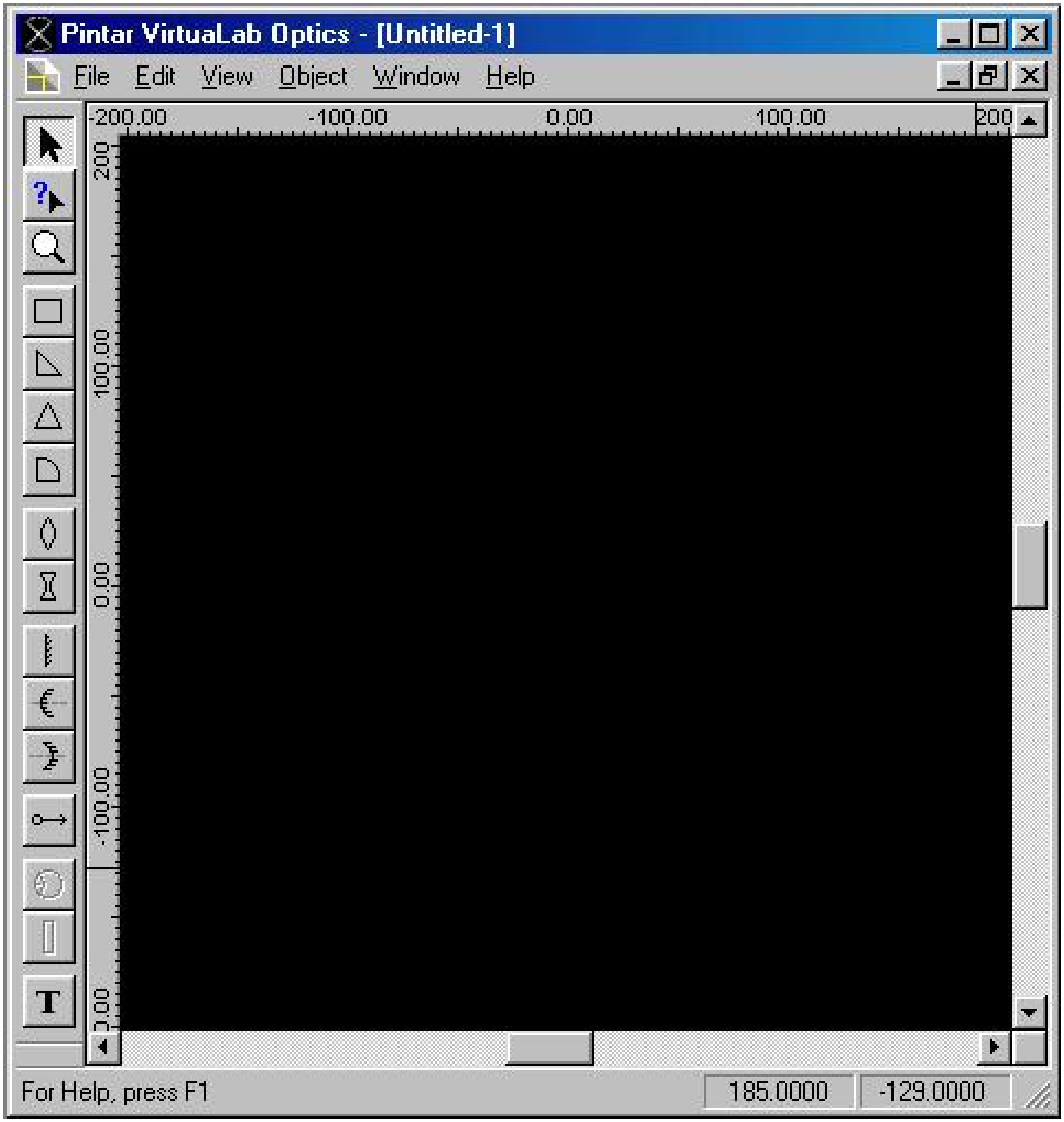
Begin a new experiment by setting up a clean Workbench, on which objects for your experiment can be placed.

a. Choose ‘New...’ from the File menu. A dialog panel appears showing two choices : Ray mode and

Image mode.

b. Select Ray mode. A new blank Workbench labelled ‘Untitled-1’ will be created.

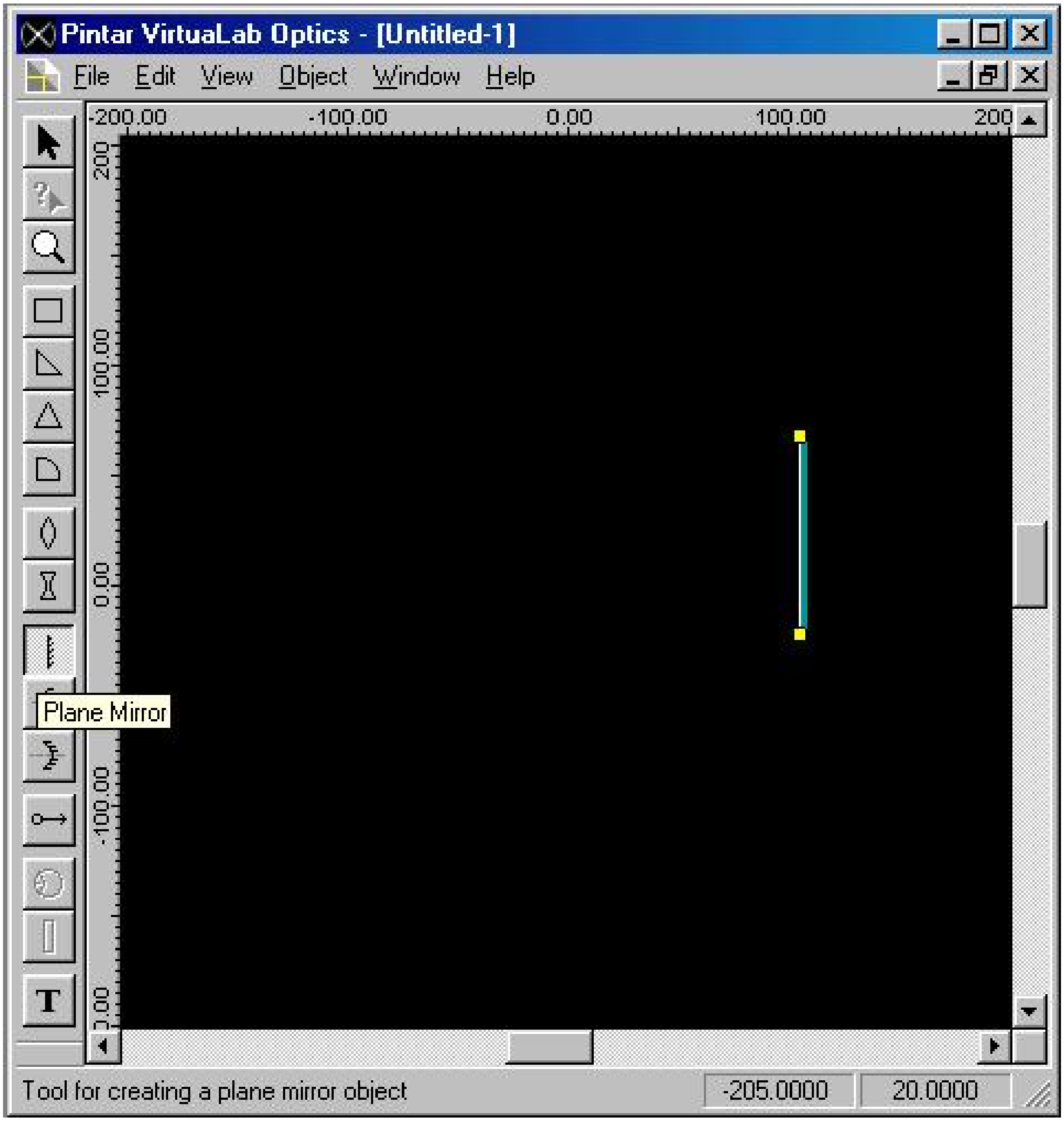
? • **Starting a new experiment**

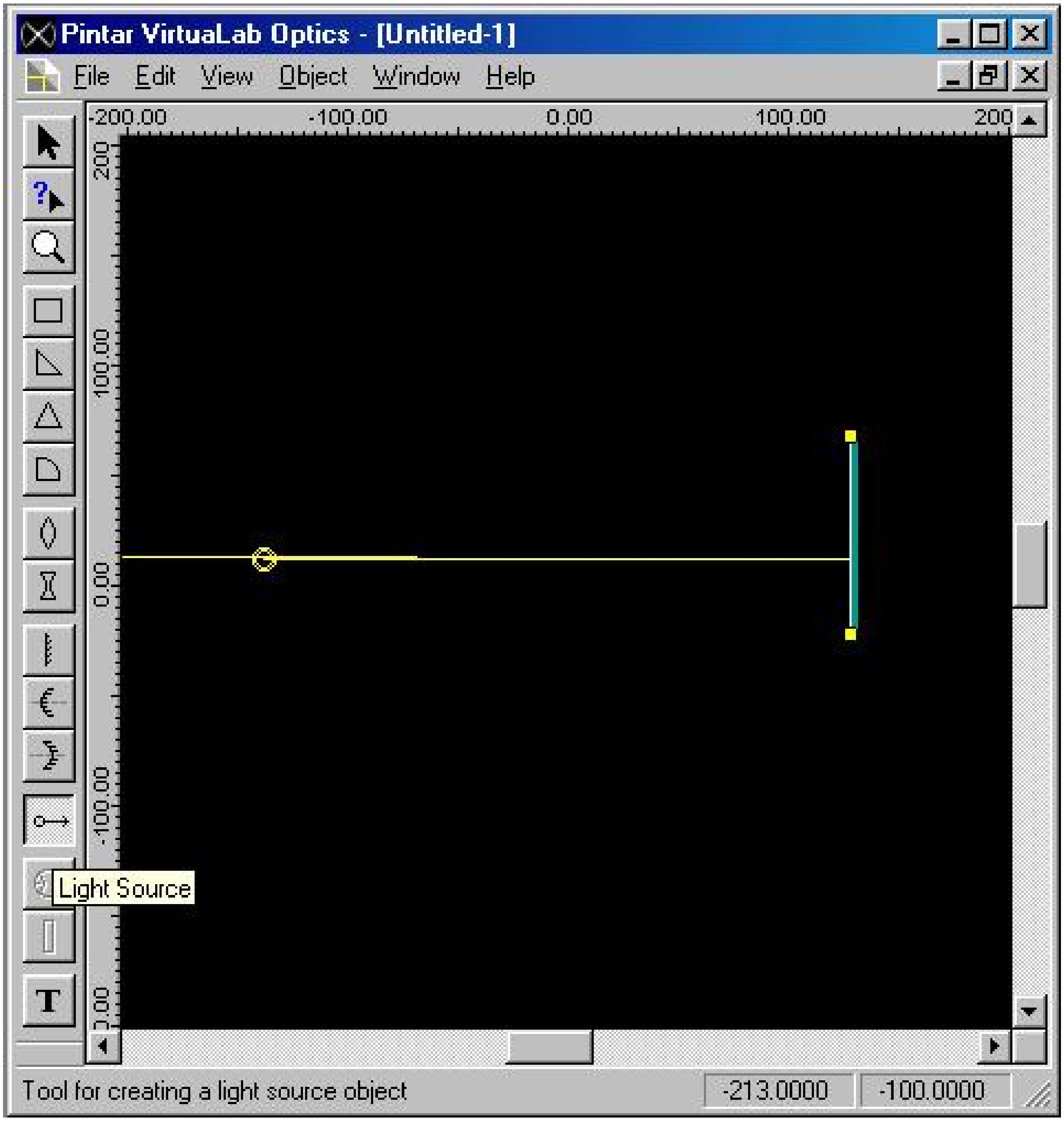


2. Drawing (placing) the optical components on the Workbench

Using appropriate tools from the Tool bar, draw the optical components you need on the Workbench.

a. Select the plane mirror tool in the Tool bar. The cursor changes to indicate that the plane mirror tool has been selected.
b. Move the cursor to the Workbench and click. A plane mirror will be drawn where you clicked.
c. Next, draw a light source on the Workbench, using the same procedure as for drawing the plane mirror.

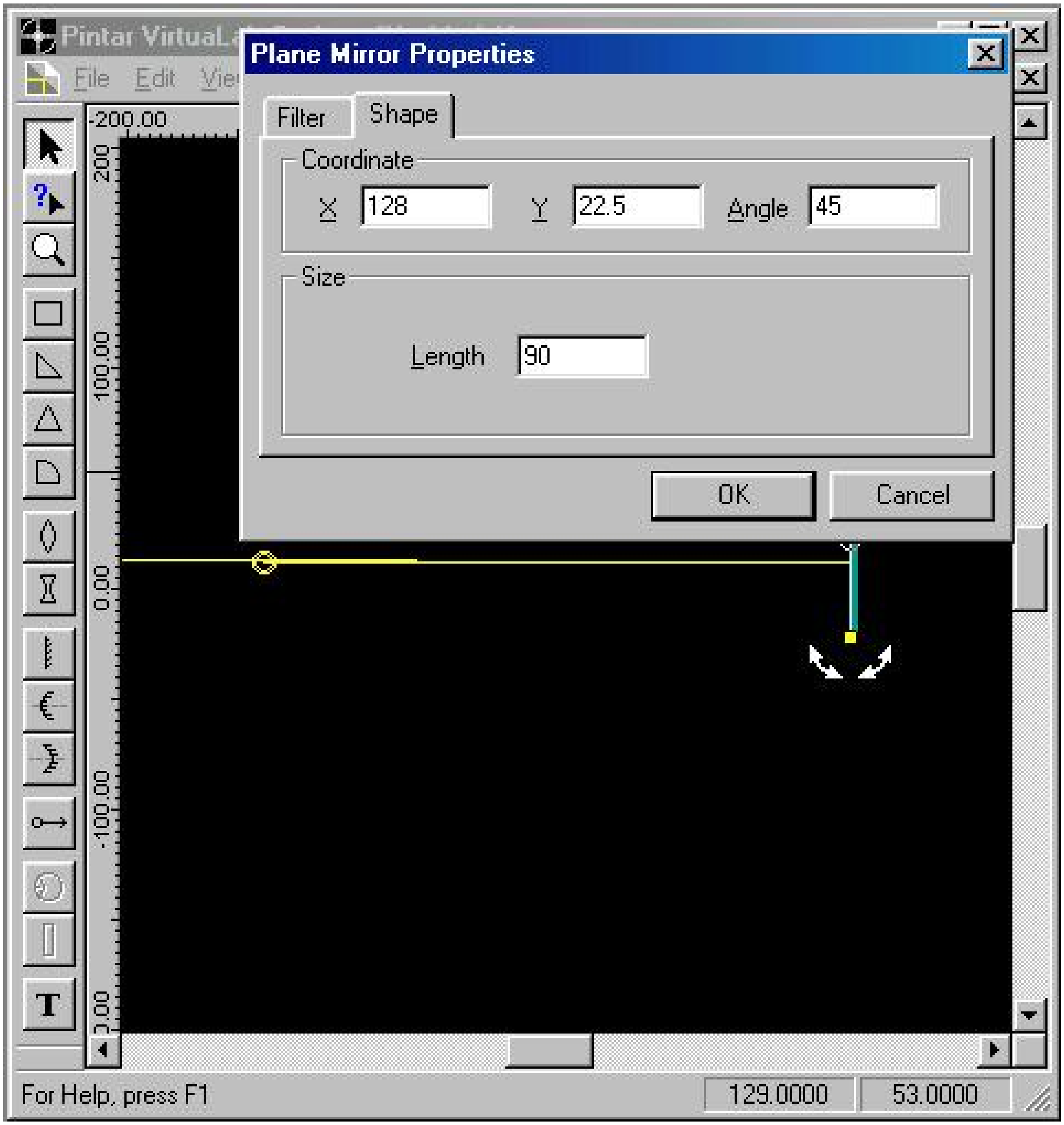




3. Set the parameters of the optical components

Set the properties of the optical components.

a. Double-click on the plane mirror. A properties dialog panel for the plane mirror will appear. Set ‘angle’ to 45 degrees.
b. Click on ‘OK’.
c. Double-click on the light source. A properties dialog panel for the light source will appear.
d. Click on the color bar to choose the red light (Default light beam is in yellow).
e. Click on 'OK'.


Plane Mirror Properties
Filter
Shape
Coordinate
X
128
Y
22.5
Angle
45
Size
Length
90
OK
Cancel
File
Edit
-200.00
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For Help, press F1
129.0000
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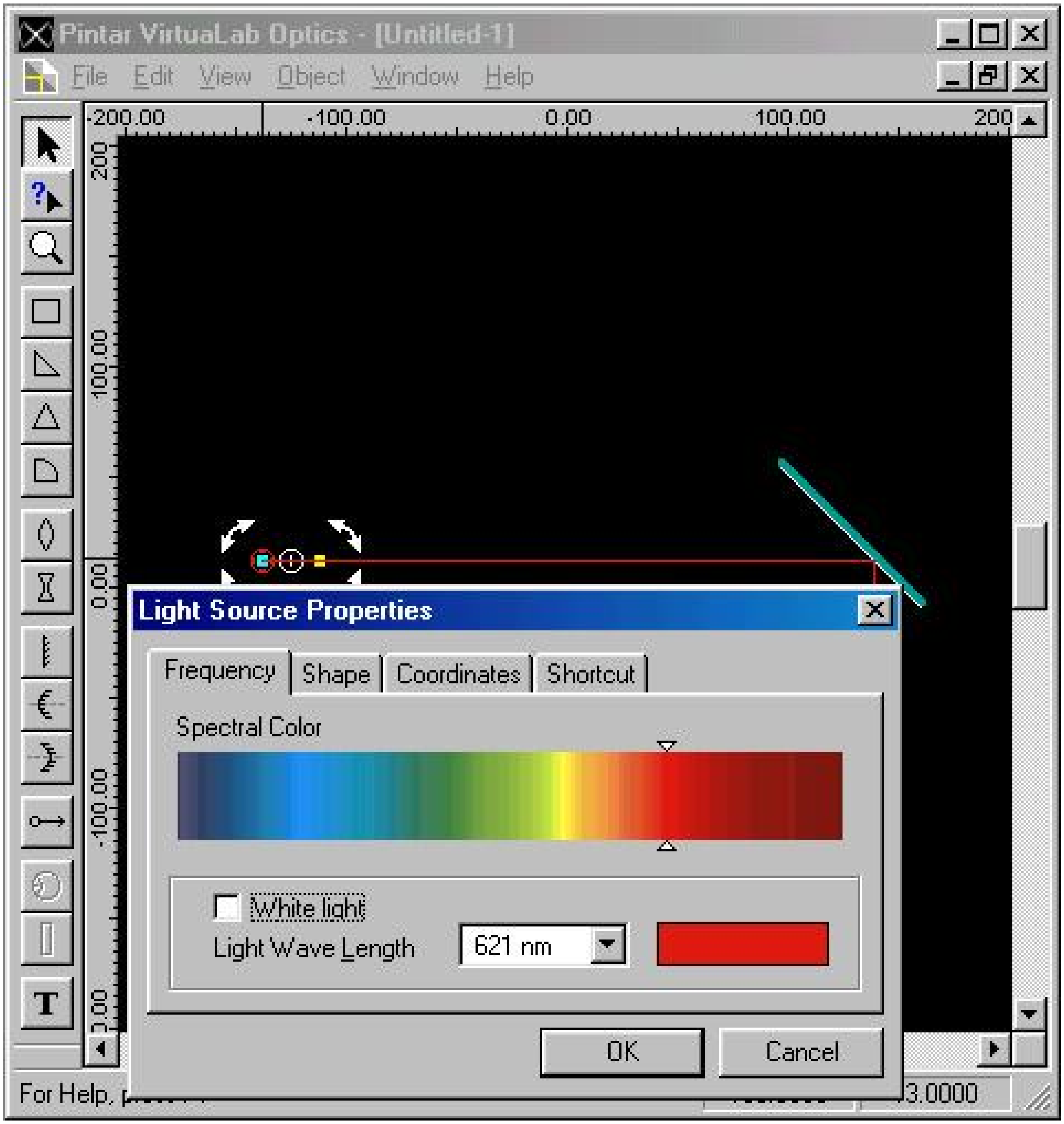


4. Annotate your experiment

You may annotate or label your experiment. Follow the same procedures as you have done in Experiment 1.

5. Save your experiment

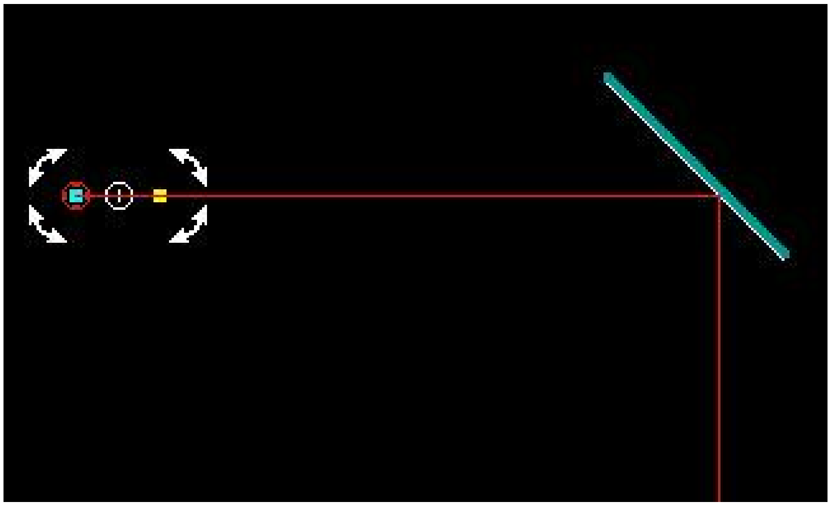
Save your experiment. Note that if you are using a free trial version of Pintar ***VirtuaLab***$_{TM}$ Optics, you will not be able to save your experiment because this featured has been disabled. Continue with Step 7.

a. Choose ‘Save As...’ from the File menu.
b. Name the project, "MyOptics2". You may want to save your project in the Examples folder.

? • **Saving an experiment**

6. Observe your experiment

You are now ready to observe your experiment to see how things will behave.



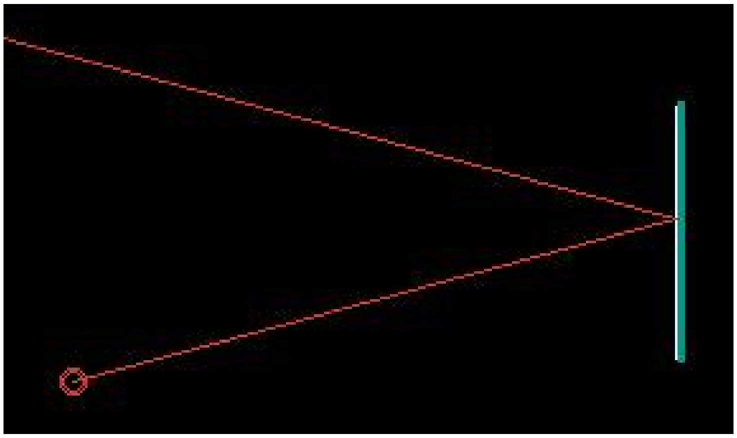
Drag the plane mirror around slightly and you will see that the reflected ray remains at 90 degrees to the incident ray.

? • **Moving an optical component**

8. Adjusting the experiment to perform another test

Reset the parameters of the optical components so that,

a. The plane mirror is now vertical ('angle' is zero degrees).
b. The light source is inclined at 15 degrees.



9. Move the light source again and observe

a. Change the position of the light source. Again, you will see a ray being projected from the light source and reflected off the mirror.
b. Change the angle of incline of the light source. You will still see that symmetry persists in every case

10. Ending your work session

Alas, all good things must end. Let your imagination loose and dream up experiments that escape the limitations of the school laboratory!

a. Choose ‘Quit’ from the File menu.

OBSERVATION AND CONCLUSION:

In this experiment, we have observed that the angle of incidence is always equa to the angle of reflection off a plane mirror.

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