

# Synchrotron Investigations

## 9.5 Light intensity sample experiment

In this experiment we are going to derive a relationship between the intensity of light from a constant source and the distance away from the light.

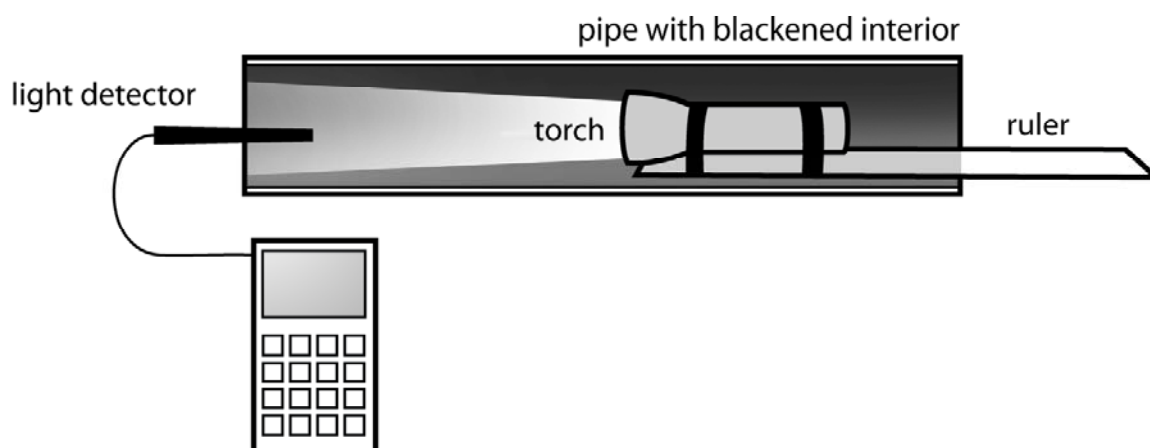


Image courtesy: DUIT Multimedia

### Materials

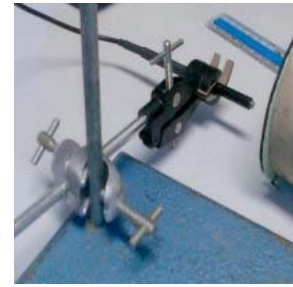
- pipe or postal tube, roughly 8 to 10 cm in diameter, length one meter
- **NOTE:** *The inside of the pipe must be non-reflective*
- a torch or similar light source
- a one metre ruler
- duct tape or something similar
- data collector – such as a calculator/computer based, loaded with software
- relevant light detector probe
- clamp or retort stand, suitable for holding the light detector in the mouth of the pipe.

### Instructions

1. Attach the torch securely to the end of the metre ruler using the duct tape. It is important that the axis of the light beam is parallel to the ruler. Note: the focusing mirrors have been removed from around the bulb.
2. Insert the ruler and torch into the pipe, pushing it down as far as possible without losing control of the ruler. As shown in the picture to the right, the control end of the ruler protrudes through a slot cut in the end of the tube. This minimises light interference.



3. Mount the light detector in the mouth of the pipe, facing the torch. It is critical for success that the light detector is positioned in the centre of the axis of the beam of light.



4. Measure the initial separation between the detector and filament of the torch bulb.



5. Note the measurement on the ruler at the other end of the tube which corresponds to this. Use this measurement to move the ruler so that the separation between the detector and source is correct for the first measurement.



6. Start the experiment with a minimum distance of 20 cm between the light source and the light probe.
7. It is essential that outside light leakage is kept to a minimum while taking measurements. You can do this by poking the light detector through a slot in the tube. A black shroud over the whole apparatus can also increase accuracy.
8. Measure the light intensity at the initial position, recording the distance and light intensity.
9. Move the ruler carefully back through the pipe, pausing regularly to record the distance and light intensity. The most reliable data set will generally be found in the range of 20 cm to 60 cm.
10. Graph the data and state the nature of the function.

Distance (cm)	Lux

The data displayed below was collected by the authors.

Distance	Lux
15	382
20	215
25	147
30	103
50	40
60	25
70	18
100	8

