Using Tracker – circle fit (Newton's Rings example)

This document assumes you have worked through *Analysing linear motion using Tracker* and can set axes, change the quantities displayed on graphs etc.

If you are not familiar with a Newton's Rings experiment, you could have a look at this document;

https://www.sserc.org.uk/wp-content/uploads/2013/07/Advanced_Higher_Physics_experiments.doc

Cutting to the chase – Newton's Rings is an interference pattern consisting of concentric rings.

The centre of the pattern should be a dark spot. Suppose we number the dark rings *m = 1, m = 2, m = 3* etc from the centre (the dark spot is *m=0*).

The radius squared for each ring should be proportional to *m.*

In other words, $r^2 \propto m$.

A graph of r^2 (y axis) versus *m* (x axis) should be a straight line that passes through the origin.


How to find the radius of each ring? You could use the line profile tool (see *Double Slit* document), but it's rather messy-looking.

Tracker has been around for well over a decade and is evolving all the time. One fairly recent innovation is a circle-fitting tool. That's what we're going to use.
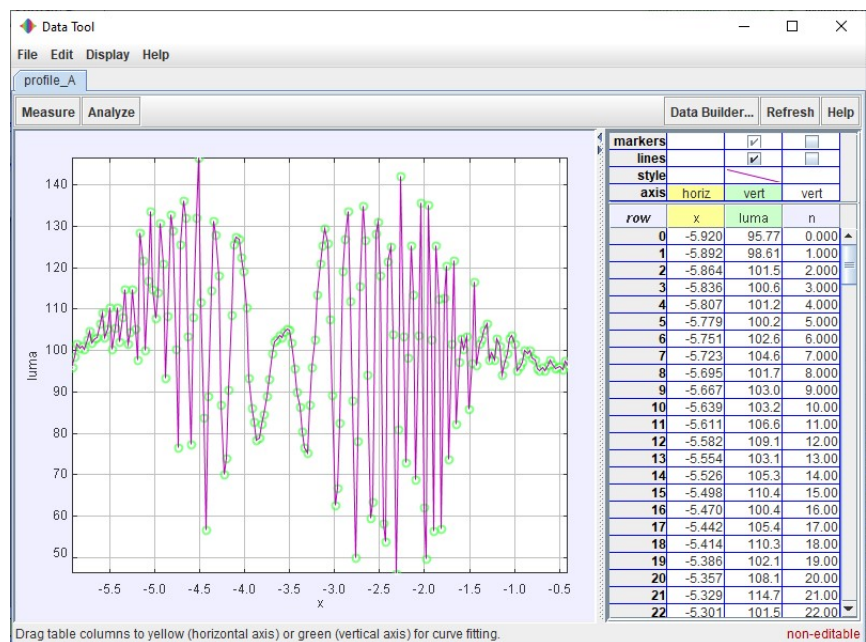
Launch Tracker and import the still image **nr.jpg**.

This was taken using a USB microscope. You'll notice that there is a piece of graph paper included in the image for calibration purposes. The length shown is 0.005 m (5 mm). If we were going to do serious quantitative work we'd have to think about uncertainties and significant figures.
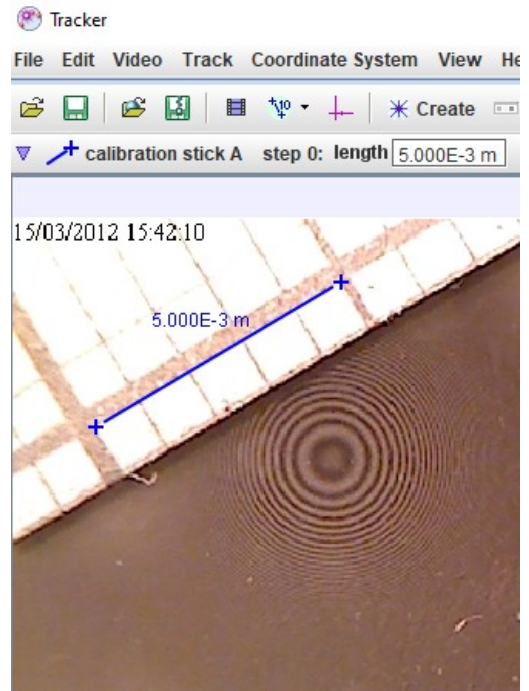

It will be helpful to zoom in on your image. Right click on it and select **Zoom In**. Repeat until your Newton's Rings pattern is the desired size. You may have to adjust its position on screen using the scroll bars indicated by the arrows.
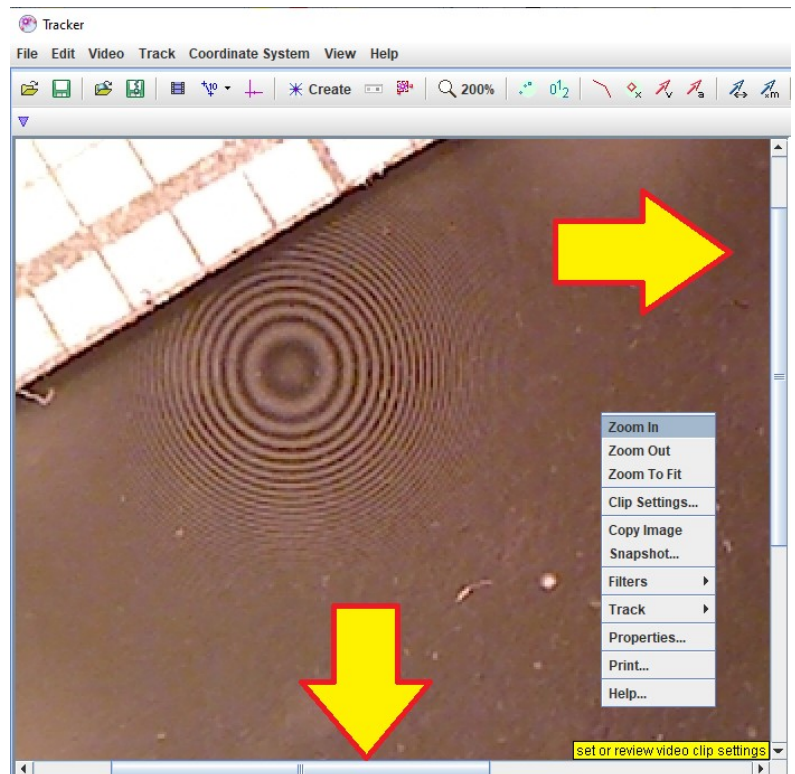
Click the **Create** button. Go to **Measuring Tools** and pick **Circle Fitter.**
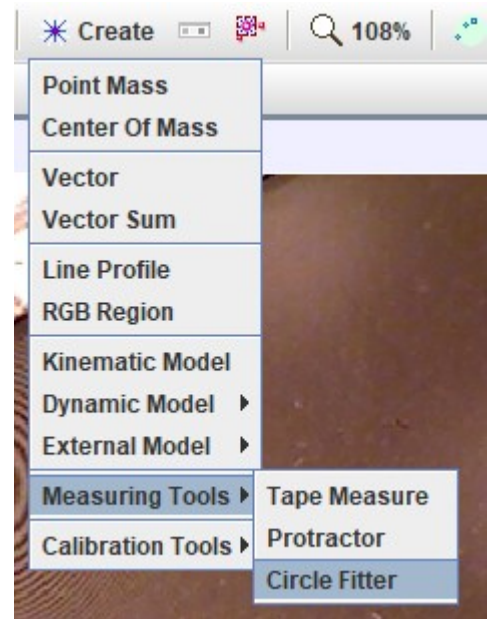

Go to the ring you are interested in. We've chosen *m=3*, the third dark ring. Shift click on well-spaced points on the ring. After 3 points, a circle should appear, fitted to the circle formed by the ring.
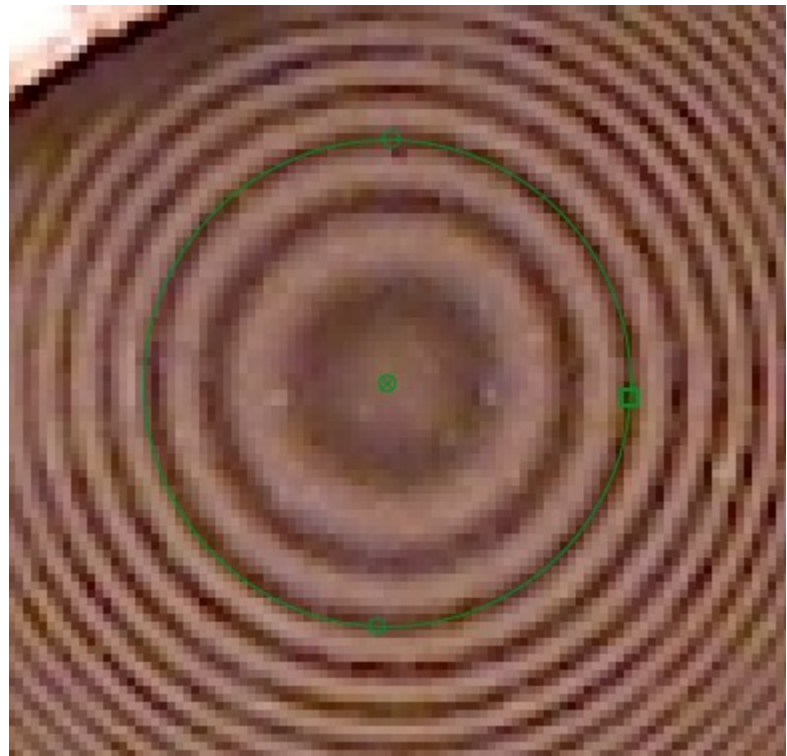
Keep clicking. The more points you click, the better the fit will be. You can see the radius of curvature of the ring is displayed below the menu bar, as shown by the arrow.

If you were doing this as an investigation, you would find the radius of as many rings as you could, then plot r^2 versus ring number m.
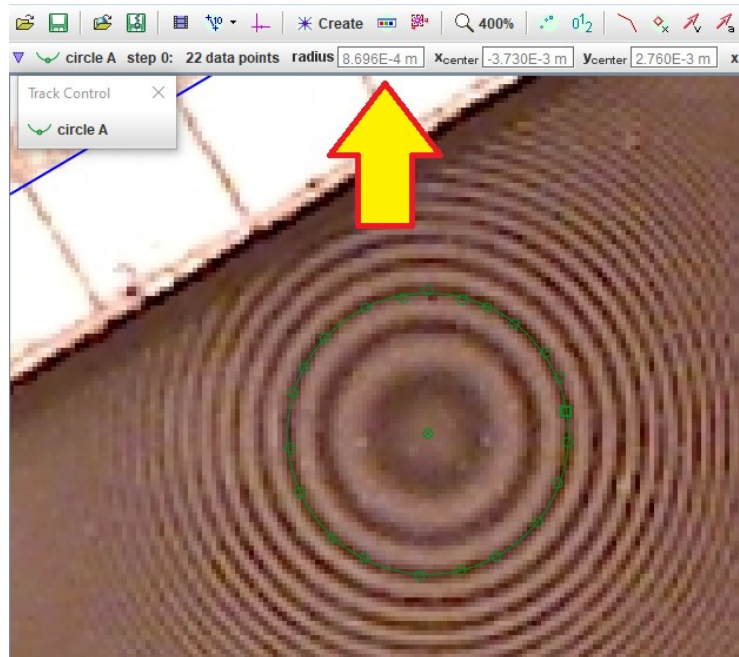
A detailed analysis of Newton's Rings requires you to know the radius of curvature of the lens you use. Most people use a spherometer if they have one, and other experimental methods are possible. You could use **Circle Fit** too, but you would need to be sure your close-up photo of the lens did not introduce any distortion. Circle fit does not require a complete circle, just a curved surface.