**Geometric Optics: Lenses**

Mount the motor so that the shaft is horizontal. Couple the motor shaft to the photodetector translation stage. From your previous knowledge of the lead screw pitch, what distance does the translation stage move per motor step?

Now align the laser into the detector. Close the aperture and/or adjust the amplifier gain until the voltage signal is within the measurement range.

With this scanning photodiode setup and your step-read MATLAB loop controlling the LabJack, do the following:

1. Without anything between the laser and detector, measure the beam profile at several distances from the laser aperture by scanning transverse to the beam propagation direction. Notice the effect of the aperture size on the shape of the beam cross-section. How would you measure the “true” beam shape? What is the beam width? What is the divergence angle?
2. Pass the beam through a convex lens. Use multiple beam scans to measure the location of the focus. Compare this to the nominal focal length written on the lens. Repeat for a concave lens.
3. Using two lenses in series, construct a “beam expander” with a collimated output beam of larger diameter than the input beam. Measure the resulting beam width and determine the magnification. Compare to the prediction from lens geometry.

CAUTION: Make sure not to exceed the translation stage limits! Turn off the motor control first to rotate the motor shaft by hand.