GAUSSIAN LASER BEAMS

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Testing the operating power of the laser

632.8nm He-Ne Laser rated at 10mW

Our measured power output of the laser was 5.7 mW using our calculated gain offset

Measuring Beam Waist by hand

Taking measurements in .001” increments
We were able to achieve as beam waist of 4.19 ± .02 *10^-4 m
This process was tedious but effective
Taking 25 minutes to record all the measurements per profile of the beam.

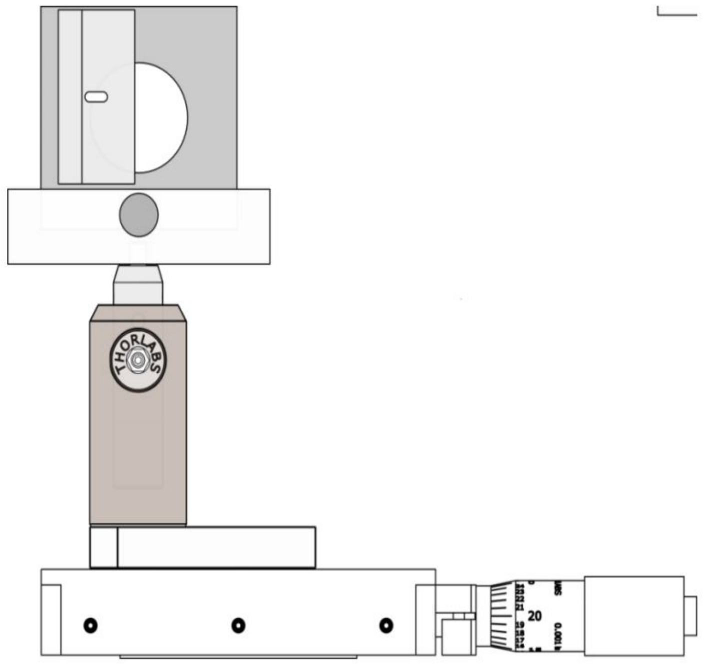
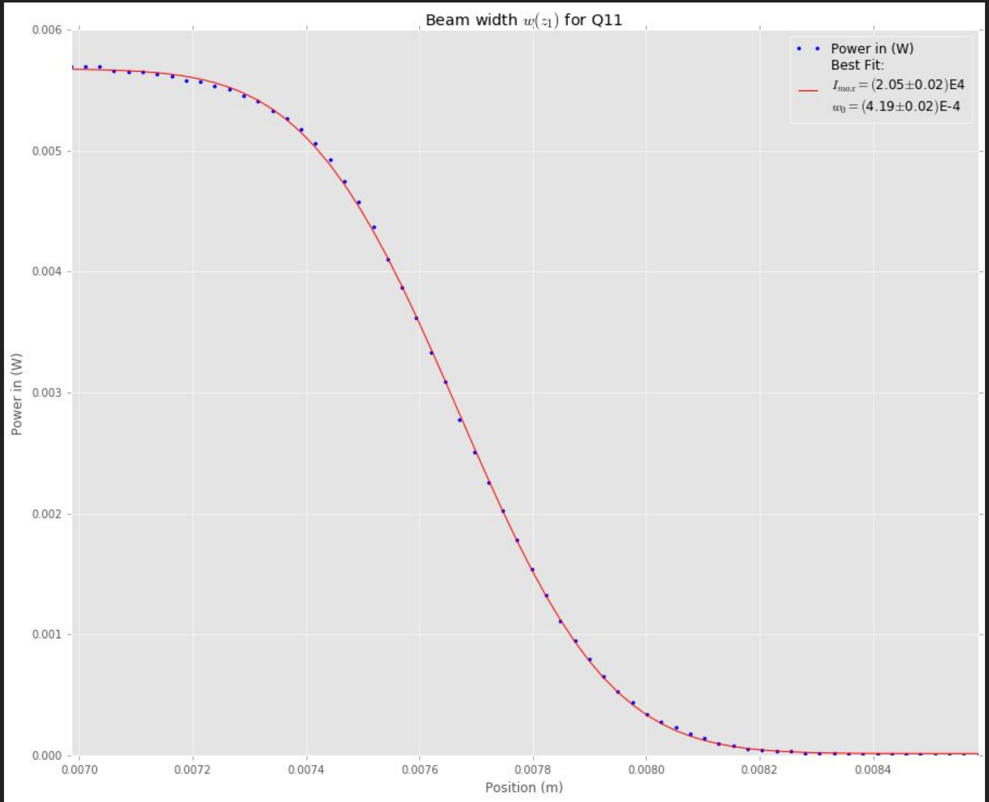


Figure 2: Razor blade mounted on a translation stage

Curve Fitting P(x)



Automation for Measuring Beam Waist

Step increments: 0.05 mm

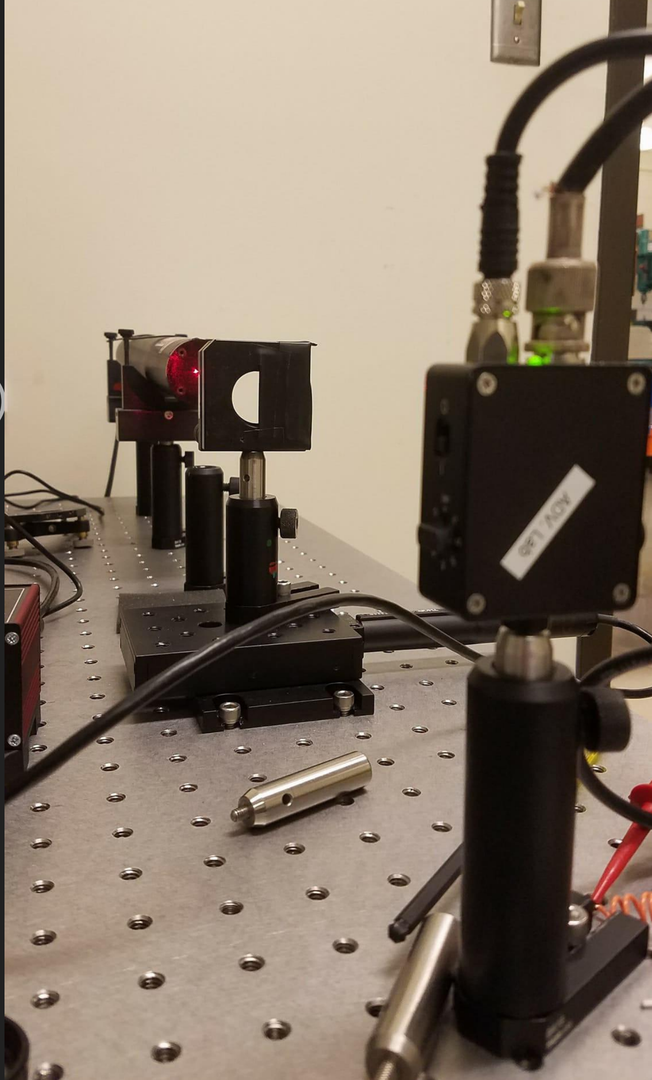
Wait delay: 900 ms (to minimize effects of moving parts)

Max Velocity: 1 mm/s (along the X axis)

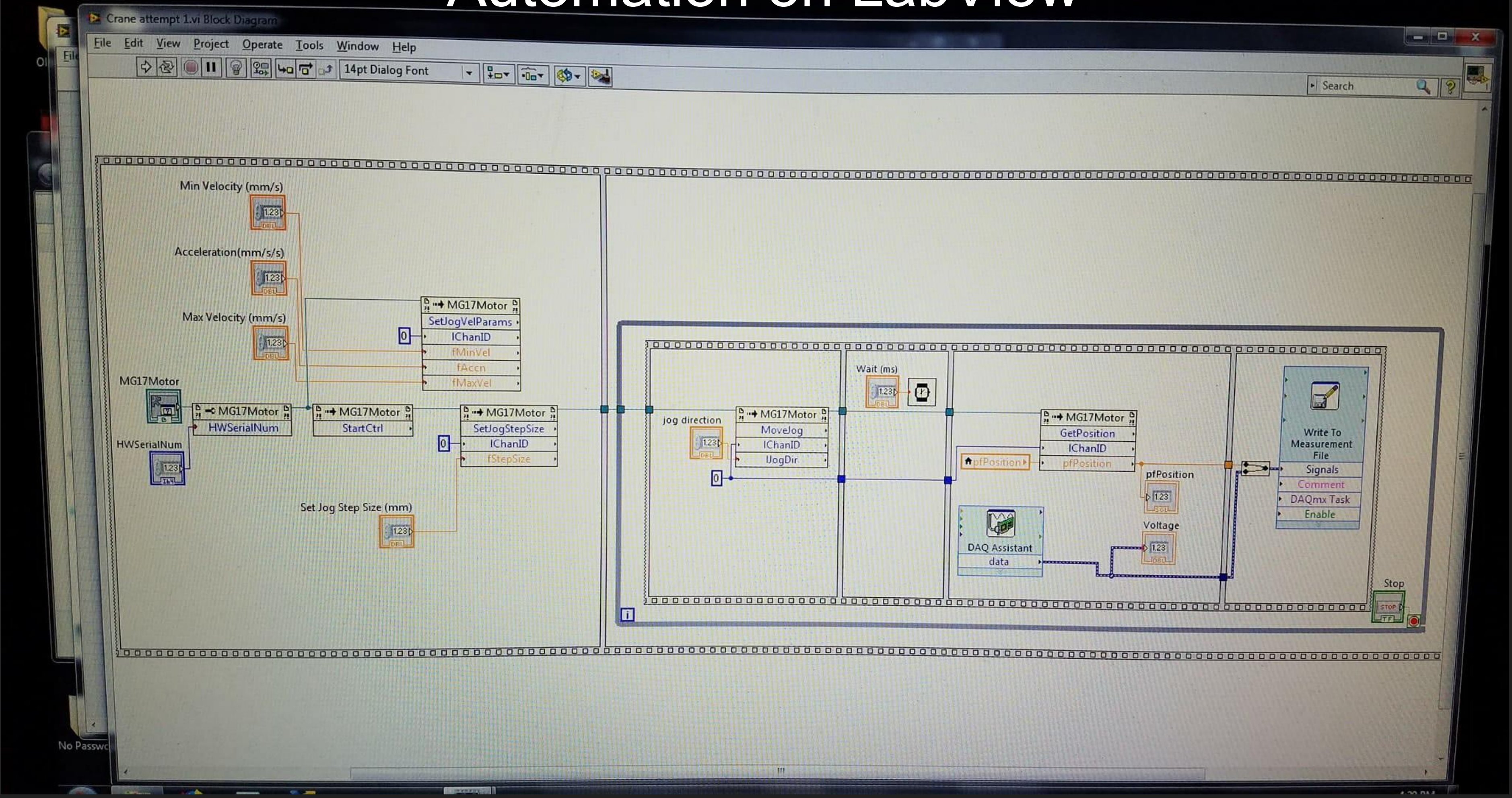
Acceleration:1 mm/s^s

Varying the translation stage’s position in 1” increments

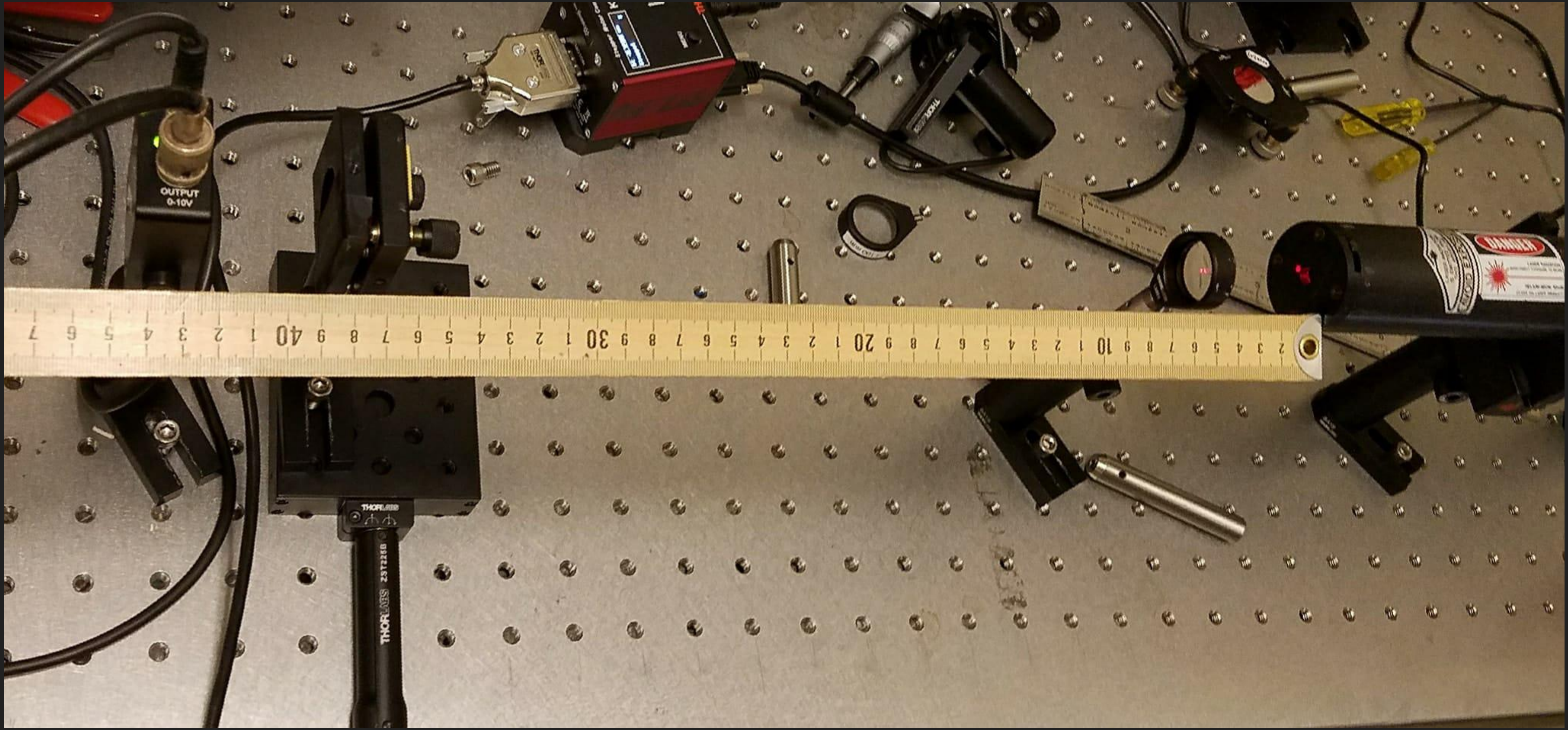
(along the Z axis)



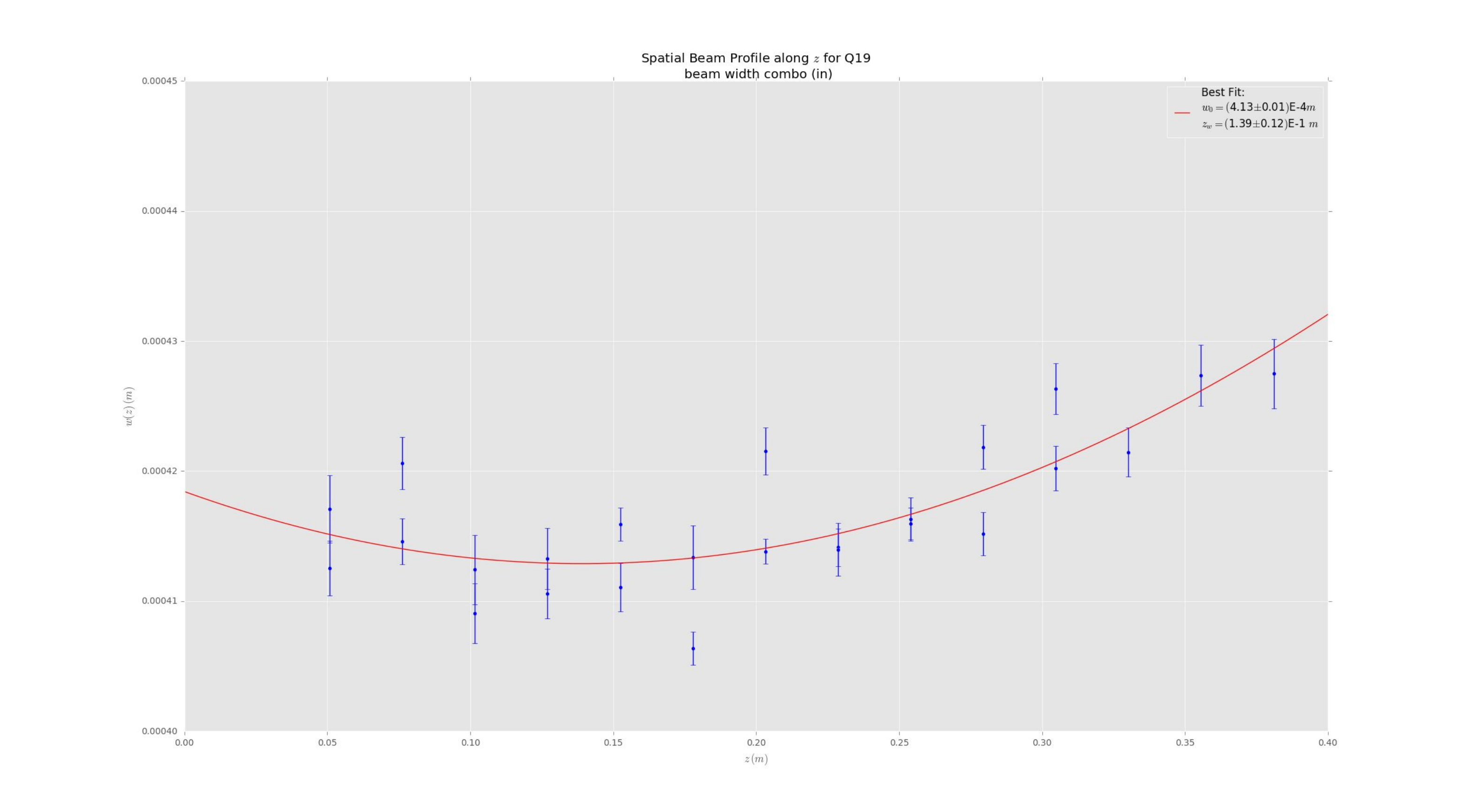
Automation on LabView



Measuring the beam waist by varying the distance of the razor from the lens, keeping the distance from laser to photodetector constant



Beam width profile: No Lens



Ray approximation

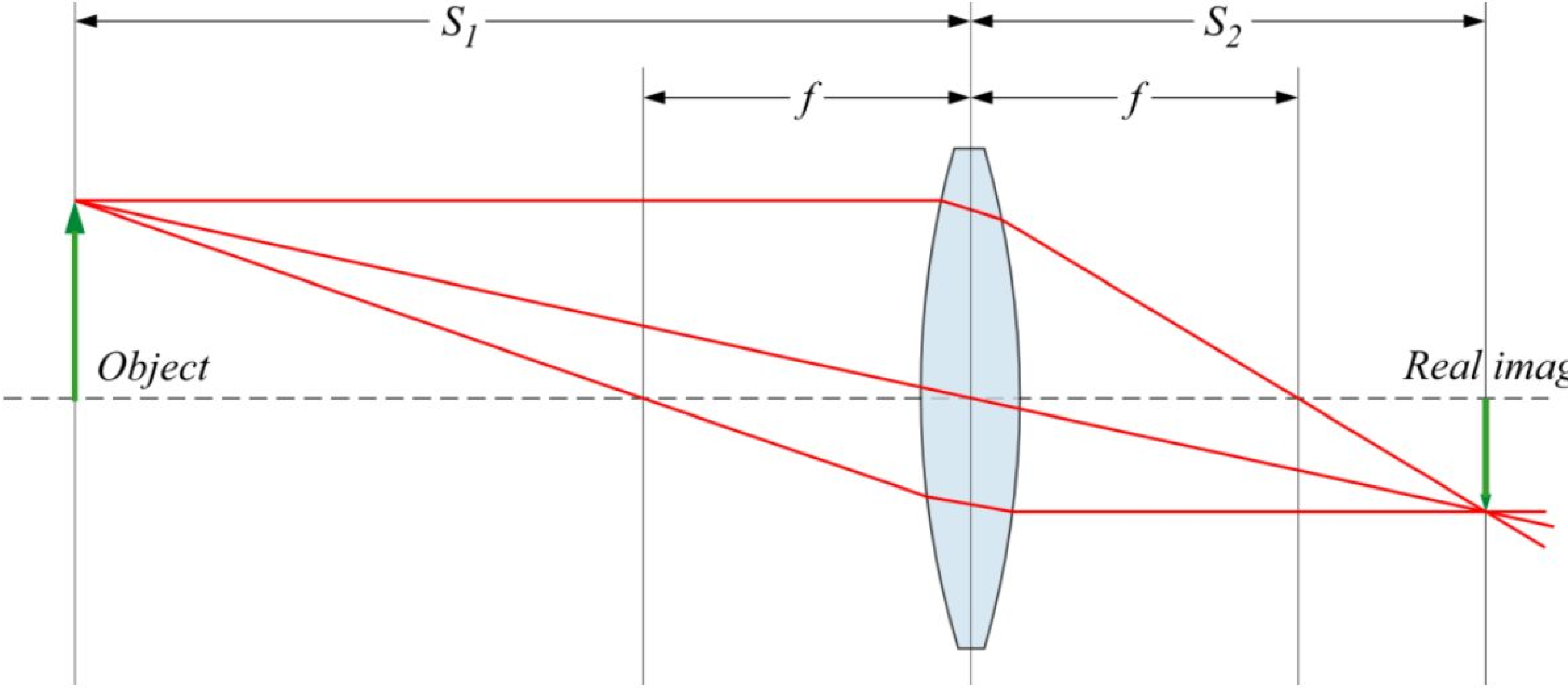
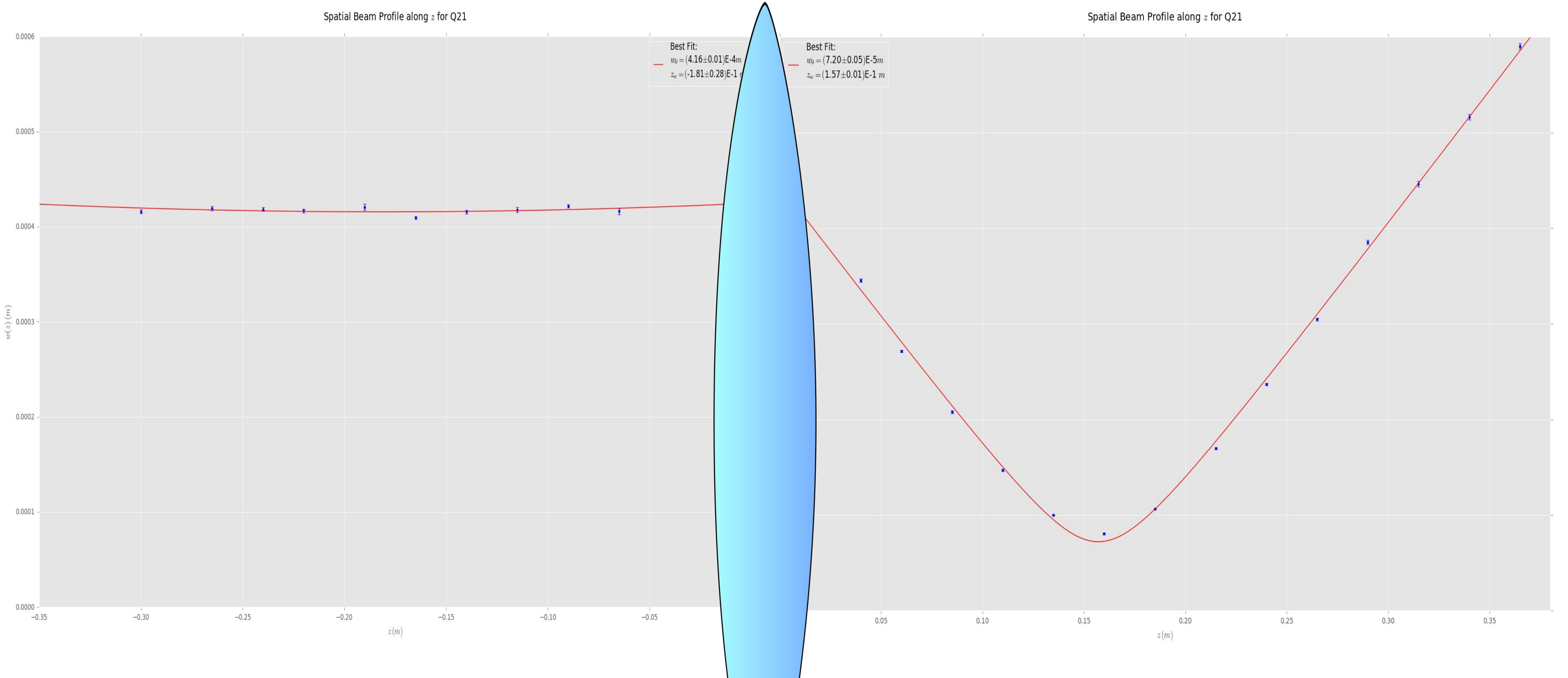
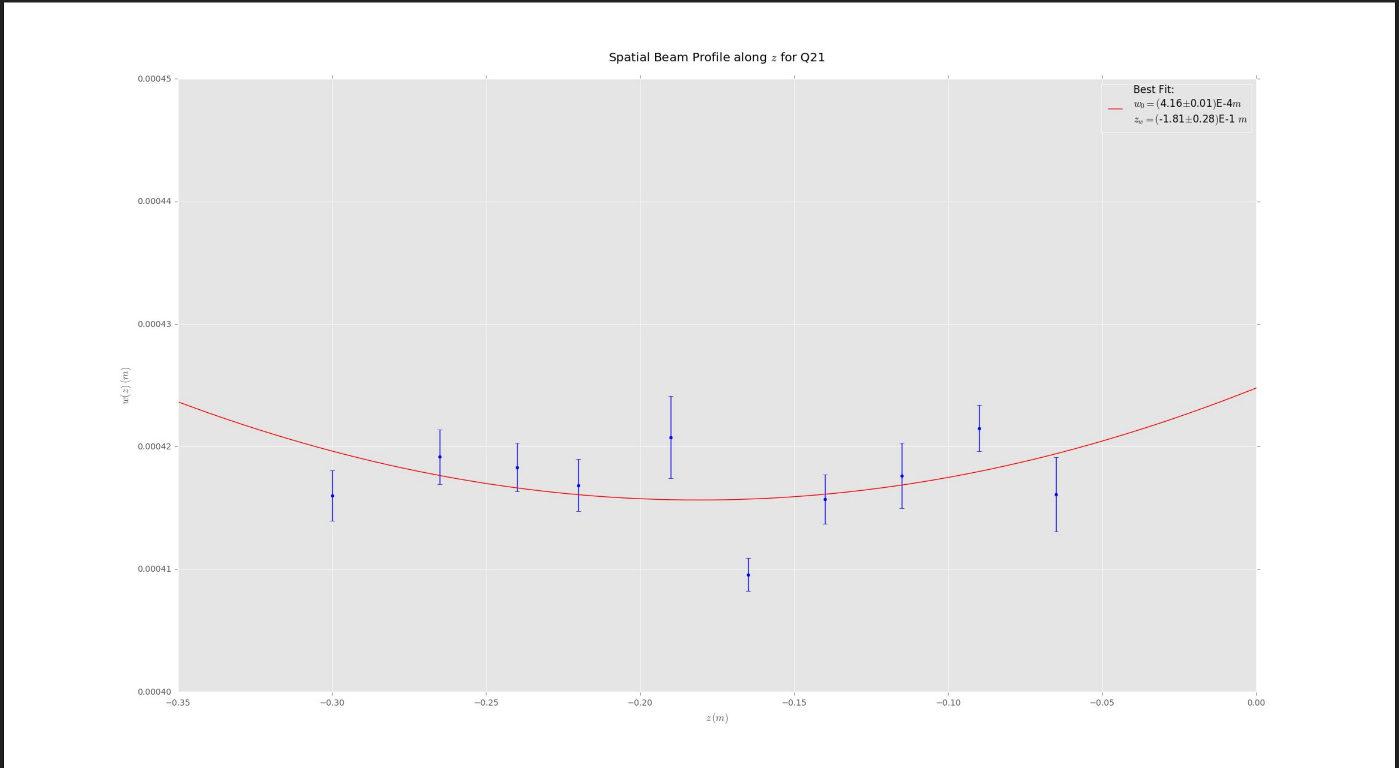


Figure 4 Diagram showing the focusing of light by a thin lens in the ray approximation. The diagram identifies the quantities in the thin lens equation: image distance, object distance, and focal length.

Results and Fitted Data with Lens



Zoomed in on upstream side: Poor Fit



Thin Lens Equation

- Confidence in parameters of beam before reaching the lens
- Use locations of beam waists as object and image distances
- A **thin lens** is a **lens** with a thickness (distance along the optical axis between the two surfaces of the **lens**) that is negligible compared to the radii of curvature of the **lens** surfaces
- The thin lens equation, as rays traces, does not strictly hold true. Rather the light follows a hyperbolic trajectory
- Data (from fit):
  - S_o = 0.181 m (less reliable)
  - S_i = 0.157 m
- Obtained Focal Length
  - F = 0.084 m