. The variable “*w*” is chosen as a measurement of the horizontal spread of the diffraction pattern because it is a measurement of the horizontal distance between the first minima of a diffraction pattern, and the first minima pinpoints where the diffracting light has a path difference . The variable “*I0*” is chosen because it is required to recreate

These two variables are later used to model the distribution of intensity as a function of momentum (see data processing), from which is derived.

*Equipment List*

|  |  |  |  |
| --- | --- | --- | --- |
| Equipment | Uncertainty | Quantity | Purpose |
| Laser protection goggles | - | 1 | Safety precaution |
| 1 mW helium-neon laser | - | 1 | Monochromatic, coherent light source |
| Micrometer | ± 0.00005 m | 1 | Controls “*d*” |
| C-clamp | - | 1 | Holds micrometer firmly in place |
| Clamp stand | - | 1 | Suspends the C-clamp |
| White plane surface | - | 1 | For the diffraction pattern to be projected on. |
| Digital Lux-meter | ± 1 Lux | 2 | Measure “*I0*” and control “*La*” |
| Meter Ruler | ± 0.005 m | 1 | Control “*D*” |
| Vernier Caliper | ± 0.0005 m | 1 | Measure “*w*” |
| Protractor | ± 0.5° | 1 | Control “*θi*” |
| Pencil and eraser | - | 1 | Drawing schematics for equipment setup |
| Blu tack | - | 1 pack | Hold equipment setups more firmly in place |
| Spirit level | - | 1 | Ensure the slit is perpendicular to the ground |

With respect to *Figure-2.*1, it is important to note that the proximate independent variable of “*d*” only controls the position of photons within the slit along the axis perpendicular to the slit, which we define as the “y” axis. Hence derived from this experiment should be expressed as to clarify only the position in the y direction is controlled in this experiment. Similarly, measuring the horizontal spread of the diffraction pattern at a constant distance also only provides insight into the momentum of photons along the “y” axis, which means derived from this experiment should also be expressed as to clarify that only the “y” component of the momentum vector is measured in this experiment.

*Data Collection*

Starting with *d* = *0.00005 m*, the slit width of the micrometer is varied by an increment of 0.00001 m each time until *d = 0.00037 m* is reached. Four trials of the following steps are carried out for each variation of slit width:

1. Check and ensure that:
   1. *La* ≤ 2±1 Lux on the lux-meter
   2. *θi* = 90°±0.5° on the protractor placed beneath the light source
   3. *D* = 1±0.005 m on the meter ruler

before measurement begins.

1. Measure “*w*” using a Vernier caliper as shown on *Figure-2.3*.
2. Recheck the Lux-meter and the protractor to Ensure the two conditions in step 1 are met, if not, expunge the previous measurement and conduct a retrial after the conditions are met.
3. Measure “*I0*” with a second Lux-meter. Shift the sensor of the Lux-meter horizontally across The Central maximum of diffraction pattern and record the maximum value.
4. Repeat step 3.

\*Note that laser protection goggles must be worn at all times to prevent vision damage.