**Uncertainty of Position**

Since the laser beam is restricted to the bound between the width of the slit, the position of any photon in the slit will follow a uniform distribution, and hence finding the standard deviation of the uniform distribution of the position of photons at each slit width will give the variable of .

For a uniform distribution spanning from positions , the standard deviation is calculated by the formula:

For our purposes, the distance is the slit width, hence:

**Uncertainty of Momentum**

Original intensity distribution equation:

Simplified for constant “α”:

Replacing constant “α” with dependent variable “w”:

Given that:

Hence:

Intensity distribution equation with respect to “w”:

Probability density function of the distribution of photons:

Variance of the continuous random variable is given as:

, which can be manipulated as follows to find the standard deviation of angle :

The momentum of a photon, travelling towards can be calculated as follows:

Although it is not feasible to find the momentum of every single photon, can still be evaluated by decomposing the vector component of from the angle , where: