5.8 Centroid Location

The Centroid location is found by calculating the first moment (center of mass) of all the selected pixels to be analyzed. The selection process is controlled by the aperture settings. When no apertures are enabled the centroid is computed over the entire area of the imager. When a manual aperture is present, the centroid calculation only involves the data contained within the manual aperture. When Auto Aperture is enabled, it defines the region of the centroid calculation. An Auto Aperture takes precedence over a Manual Aperture.

The following equations describe the X and Y centroid locations from the collection of data points that satisfy the above criteria:

$$x\ centroid = \frac{\sum(X \times z)}{\sum z}$$

$$y\ centroid = \frac{\sum(Y \times z)}{\sum z}$$

Where:

X The x locations of selected pixels

Y The y locations of selected pixels

z The value of selected pixels

5.9.1 D4-Sigma Method

D4σX/M, D4σY/m, D4σ

Second moment method: ISO 11145, ISO 11146-1, and ISO 11146-3.

From laser beam propagation theory, the Second Moment, or D4-Sigma, beam width definition is found to be of fundamental significance. It is defined as 4 times the standard deviation of the energy distribution evaluated separately in the X and Y transverse directions over the beam intensity profile.

$$D4\sigma X: \quad d_{\sigma x} = 4 \cdot \sigma_x$$

$$D4\sigma Y: \quad d_{\sigma y} = 4 \cdot \sigma_y$$

Where:

d_σ The 4-Sigma beam width

σ The standard deviation of the beam intensity

The standard deviations are derived from the distribution variances and are equal to the square roots of the variances. The variances are:

$$\sigma_x^2 = \frac{\sum_x \sum_y (x - \bar{x})^2 \cdot Z(x,y)}{\sum_x \sum_y Z(x,y)}$$

$$\sigma_y^2 = \frac{\sum_x \sum_y (y - \bar{y})^2 \cdot Z(x,y)}{\sum_x \sum_y Z(x,y)}$$

Where:

Z The intensity of the pixel at (x,y)

$\bar{x}$ The x coordinate of the centroid

$\bar{y}$ The y coordinate of the centroid

AA模擬使用“laserbeamsize” library

- https://github.com/scottprahl/laserbeamsize