

How Does the LISST-HOLO Measure Size?

The natural world holds an endless diversity of particle shapes and sizes. This diversity is not easily quantified using traditional instrumentation. Sequoia’s LISST-HOLO instrument is specifically designed to improve the measurement of particle shape and size.

However, this raises the question: **how does the LISST-HOLO measure the size of complex shapes (such as the ones on the right)?** Because the LISST-HOLO uses holography, it provides an in-focus image of every particle in the sample volume. Once a crisp image of the particle is obtained, the number of pixels it occupies can be converted to an equivalent spherical diameter (ESD), that is, the diameter of a circle containing the same number of pixels. Thus, shape is accounted for in the calculation of particle size.



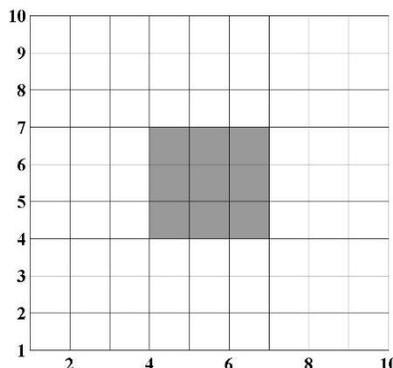
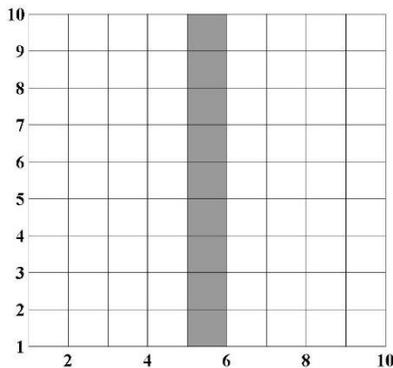
To filter out background noise, an image feature is only considered a particle if it occupies a minimum number of pixels. The user can set this minimum threshold. In the Holo Batch software, it is the parameter called ‘Minimum Particle Area (pix),’ located under the advanced tab. Here you can specify the minimum particle area in pixels. Any noise (or particle) smaller than the specified area is ignored. The default value for the Holo Batch software is 9 pixels. Each pixel of the Holo represents an area of 4.4 x 4.4 microns. Thus, 9 pixels is equal to a particle with an ESD of approximately 15 microns.



Two reconstructed images from the LISST-HOLO that show features that are only 2-3 pixels wide (10-15 microns).

What is the resolution and lower size limit of the LISST-HOLO? The true resolution limit of the LISST-HOLO is governed by the pixel size, which is 4.4 microns. Indeed, features that are only 2-3 pixels wide can be easily observed in the reconstructed images (examples above). The lower limit of the LISST-HOLO is listed as a conservative 25 micron ESD. However, features as small as 2-3 pixels (10-15 microns) can contribute to a 25 micron ESD particle.

The ESD of each particle is used to create a size distribution, however, true shape information (aspect ratio, eccentricity, orientation, ect.) is also exported from Holo Batch.



Two particles with drastically different shapes, however, both have the same equivalent spherical diameter (ESD). When creating a particle size distribution both will be placed in the same size bin.

(1 block = 1 pixel)