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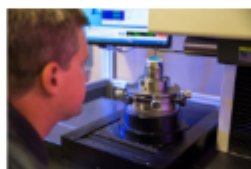
## Measuring Aspheres in a 3-D World

Author: Justin Tracy, Advanced Process Engineer, LACROIX Precision Optics

As aspheres are becoming more prevalent in optical systems and more companies are getting into designing systems with them, it is crucial that both, the designers and manufacturers understand what is needed and what the limitations are in regards to metrology. The most critical aspect in this designer/manufacturing relationship is communication, as this ensures that the supplied asphere is what the customer needs without the additional costs of unnecessary measurements or tolerances. As a result, the following is provided as a basic practical guide to the benefits of 3-D measurements of aspheres as well as a couple of real-world examples of parts that we have manufactured.

Aspheric surfaces can be measured either 2 dimensionally (form and waviness) or 3-Dimensionally (irregularity). LACROIX Precision Optics has the capability to perform both measurements, as requested. There are advantages and disadvantages to each and understanding both sides can help determine which method is best for performance and budgetary needs. There are various methods for performing 3-D measurements. The intention here is to focus on why one may prefer 3-D over 2-D, not to review the merits of the individual technologies as they apply to specific aspheric shapes.

For 2-D measurements, the manufacturer will normally use a contact profilometer, which pulls a stylus across the part over the vertex. The deviation of the stylus tip along the path is then compared to the desired form of the asphere and the resulting error is displayed. Normally, some type of low pass filtering is used to remove measurement noise, due to environmental conditions, friction, and other sources. This method is relatively quick and provides accurate readings, but only along a single slice of the part. Generally, there are no issues measuring parts with a large magnitude of departure from the best-fit sphere or with inflection points, including gull wings, with the primary limitation being the sag range of the probe being used (typically over 25mm). This is the most common and low-cost method, which is generally used in modern aspheric production.



[www.lacroixoptics.com](http://www.lacroixoptics.com) | [info@lacroixoptics.com](mailto:info@lacroixoptics.com) | (978) 688-3883

## Measuring Aspheres in a 3-D World

This white paper provides a basic practical guide on the benefits of 3-D measurements of aspheres as well as a couple of real-world examples of parts that we have manufactured. This white paper also goes into detail why one may prefer measuring aspheres in 3-D over 2-D, not to review the merits of the individual technologies as they apply to specific shapes. Also, we will distinguish the difference between measuring aspheres in 2-D (waviness) and 3-D (irregularity).

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