# Anglemeter Tutorial

## Laser alignment

The basic measurement principle for laser alignment is the based on a simpe fact that light propagates through space in perfect straight line from zero to infinity. However in our real world, there is some limitation to this statement since unlike space where light travels through vacuum, in a practical application the laser beam travels through air and it is influenced. This light characteristic forms the basic reference from which all laser alignment measurements and instruments are taken.
Duma Optronics, as a leading manufacturer of precision laser measuring and alignment products, offers a full line of products for measuring parameters such as laser beams angular deviation in respect to an optical axis. Our innovative products offer measuring capability with accuracies down to 0.01 arcseconds.
Our large selection of laser measurment and alignment products include the AngleMeter family and the Alignmeter family, which potentially improves manufacturing efficiency, reduces downtime and increase profitability.
Both products are easy to use, highly versatile, compact, and directly interface to a computer.

## The Technology

## AngleMeter

The AngleMeter family uses an optical design similar to refractive telescopic sights and is classified in terms of objective lens F# and the its focal length. Drawing 1 describes a simplified representation of the AngleMeter optical design, which is based on an objective lens along with a detector placed exactly in its focal plane. A laser beam incident on the input aperture of the objective lens will be diffracted and focused at the detector surface. Its location on the detector surface is directly proportional to the angular deviation of the laser beam with respect to the AngleMeter optical axis. The angular deviation is calculated by AD=X/FL (focal length).

The objective lens diameter or input aperture is calculated by, FL/F#. In general terms, larger objective lens diameters, will allow larger laser beam angular deviations before laser incident point will be out of entrance aperture. Longer focal length will increase accuracy and resolution while decreasing the overall field of view. The appropriate combination of lens and field of view should be chosen on the basis of the required resolution and accuracy. Duma optronics offers a full line of AngleMeter combinations to cover a wide spectrum of customer needs.

## Optical parameters

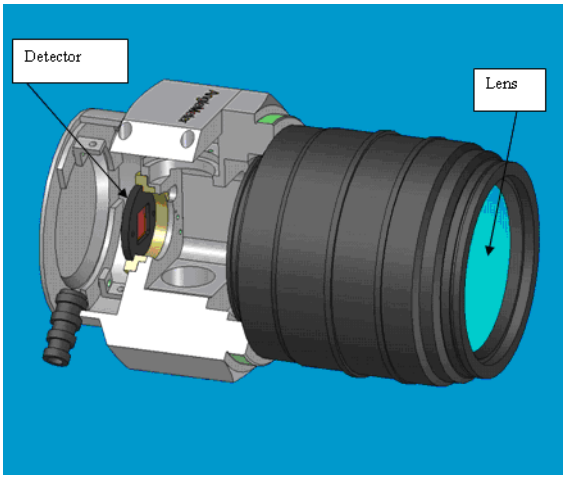
AngleMeter instruments are usually designed for the specific application for which they are intended. Those different designs create certain optical parameters.
Those parameters are:

Field of View — the ratio of detector active size to the focal length of objective lens yields the AngleMeter field of view. A field of view of 1/10 rad (5.7 degrees), for example, is produced by a 10 mm detector and a 100mm objective lens.
The field of view depends on the application of the Angle Meter and the desired resolution.
Lower focal length leads to a higher field of view and easier initial alignment.

Objective lens diameter – The diameter of the objective lens determines the maximum laser beam size and its amount of movement on the entrance pupil. It is usually expressed in millimeters. Duma offers a full line of lenses with optical length varying from 50mm to 300 mm and various objective diameters. Please refer to the brochure.

Detection area- the incoming laser beam is focused on to the detector by objective lens. The detector converts the light position on its surface to an electronic signal; this signal is later processed by a computer to display accurate angular movement of incoming laser beam relative to the AngleMeter input aperture.

Two main types of detectors are offered: CCD detectors and PSD Detectors (please refer to the Position Tutorial for more information)
For application of laser beams with short pulses a CCD detector is advantageous; however for high resolution alignment with CW lasers position detectors are superior in performance.




**Drawing 1.**