

## App Note 3: LED Lighting — Understanding Light Shaping Diffusers® (LSD®)

LSD® diffusers are specified by their FWHM angle(s). FWHM is an abbreviation for Full Width Half Maximum, the angle of diffusion a collimated laser would become after passing through the diffuser.

A 10° diffuser will produce a beam width of 10°. A 30°x5° elliptical diffuser will produce a beam 30° in the horizontal direction and 5° in the vertical direction.



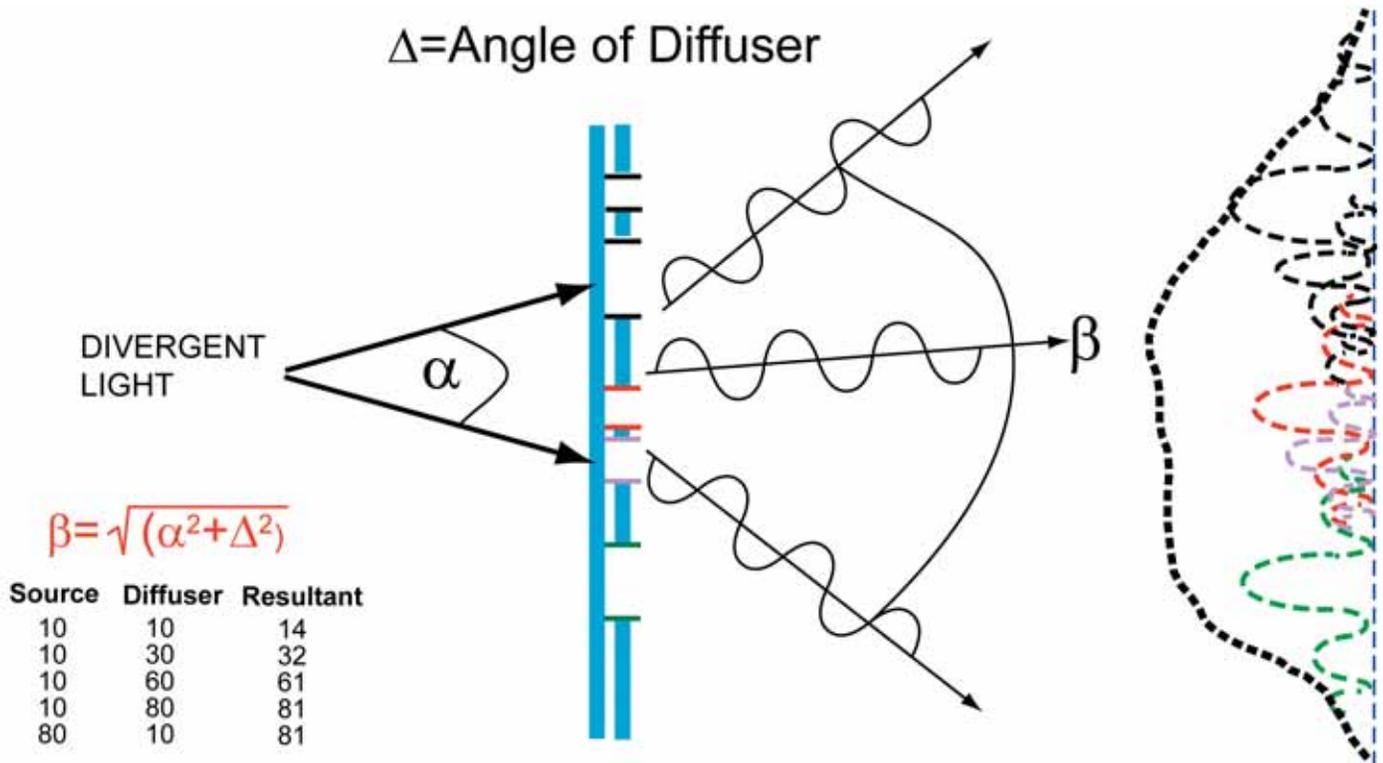
**Left Column:**  
No Diffuser  
5° Diffuser  
30° Diffuser

**Right Column:**  
30°x5° Diffuser  
60°x1° Diffuser

*These are actual un-retouched photos of the effect of a laser pointer shining through some of the LSD® angles on our standard 9-angle Sample sheet. Note that the results would be virtually the same if you used a very narrow angle collimated LED beam*

A typical LED emits a very wide angle of light, approximately 90° to 110° which is not useful or efficient if your "throw" is more than half a meter. Secondary optics, reflectors or TIR, are used to narrow and collimate the beam to an angle from 5

to 50 degrees. The 50 degree optic is less efficient than the 5 degree optic. An LSD® diffuser is then used as a tertiary optic to homogenize the beam, expand the beam angle and shape the beam.



When you design a lighting fixture with a narrow collimated beam angle, you can vary the angle and shape of the light by just changing the diffuser. A spot-light can become a flood-light or a narrow wall wash can become a very wide wall wash. From a design standpoint, it is best to collimate the beam to a narrow angle and then have the capability to change the output angle from very narrow to wide with no change except for the diffuser.

For example, If you collimate the beam to 5°, you can get a very narrow output of 7° with a 5° diffuser or up to 80° with an 80° diffuser. You can also shape the beam output from circular to highly elliptical.

For a complete list of LSD® angles, please download our catalog sheet (under "Downloads").