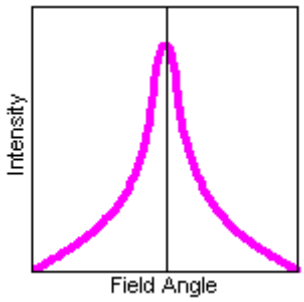
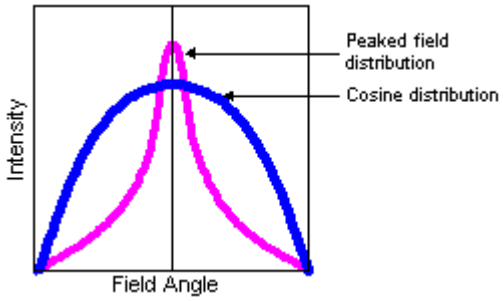
The Value of Comparative Photometric Testing

For a lighting designer or prospective purchaser of lighting equipment, providing a meaningful basis for performance comparison is clearly essential. Unfortunately, it is almost never done. Most manufacturers either report NO photometric information on their products, or provide center beam candlepower numbers, which are, to all intents and purposes, meaningless. Knowing the brightness of the center of the beam tells you nothing at all about the total amount of light projected, or its distribution across the field – and these are the factors that really matter.



Look at this diagram of a highly peaked field. Sure, the center of the beam is very bright, but it's almost impossible to focus a group of lights to make a wash, and pattern projection is far brighter in the center than at the outside of the beam. The contrast between the center of the beam and the outer regions is so great that smooth coverage is impossible. This realization has led lighting designers to demand of manufacturers a more useful distribution of light across the beam. The ideal distribution is referred to as cosine, where the beam angle is 2/3 of the field angle.

Cosine Distribution



To understand this, let's understand two terms that often get confused; beam angle and field angle.

Beam angle describes the area of the beam within which the measured candlepower (brightness) is no less than 50% of the maximum candlepower in the center of the beam.

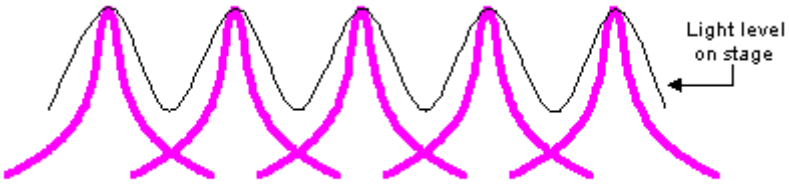
Field angle describes the area of the beam within which the measured candlepower (brightness) is no less than 10% of the maximum candlepower in the center of the beam.

Thus, in the example shown in figure 1, the beam angle would have been very narrow compared to the field angle, making it very difficult to cover a stage with adjacent luminaires.

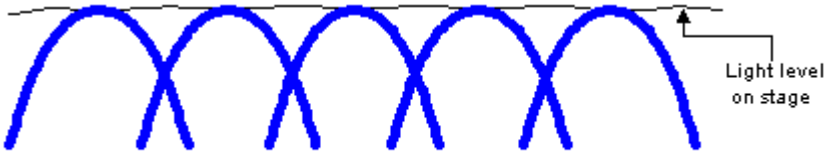
This relationship is described as the cosine ratio, the beam angle divided by the field angle. An ideal cosine ration would be .67. Lower ratios indicate excessively peaked fields; higher ratios would be too flat.

Useful Light

It becomes rather obvious that cosine distribution is a lot more useful than peaked field, for the purposes of lighting a stage. Look at a comparison between the two field types for the purposes of creating a wash (a number of lights used to cover an area).



Peak field coverage



Cosine coverage

It's clear that measuring the brightest point in the beam is not a useful guide to how effective the fixture will be in actual use. Given a cosine distribution within the beam, we become more interested in the total amount of light than in the strength of the hotspot. The amount of light in the diagrams used here is represented by the area covered by the curve, not its height. Setting up a wash of cosine-adjusted fixtures where the overlap occurs at the edge of the beam (50% intensity) gives a very even coverage on stage.

The amount of light emitted within the field angle is expressed in terms of field lumens - the total number of lumens (units of light) being emitted with the field. To get a really accurate measure of the total emitted lumens, ETC uses a very

sophisticated photometric system, using a video CCD camera to scan over 300,000 points in the beam and compute the total lumen output.

Visual Perception

It's important to appreciate that what you think you see isn't always what you get. For example, point a fixture with a highly peaked beam at a wall, next to a higher lumen output cosine-adjusted beam. The peaked beam may seem brighter. Its center may be brighter, and that's what your eye picks up. But it's the total lumen output in the field which counts, and that's harder to appreciate with the naked eye.

These factors mean that snap judgments on which fixture is brighter can be extremely misleading. There's no substitute for a thorough photometric evaluation.