

## Test Report – Illumination Uniformity of LED-Based Traffic Sign Illuminator

Prepared for: [David Lindenberg, SolarTech \(UK\) Ltd](#)

Prepared by: [Robert Yeo, Pro-Lite Technology LLP, University Way, Cranfield, MK43 0BT, Tel: 01234 436110, \[robert.yeo@pro-lite.uk.com\]\(mailto:robert.yeo@pro-lite.uk.com\)](#)

Date of Measurements: 30<sup>th</sup> November 2006

Date of Report: 3<sup>rd</sup> December 2006

### Statement of Method

The illumination uniformity of a SolarTech (UK) Ltd LED-based road traffic sign illuminator was determined as follows. The LED illuminator was held at fixed distances from a white projector screen. A Radiant Imaging ProMetric™ PM-1423E-1 CCD imaging photometer (1536 x 1024 pixels, CIE standard photopic observer spectral response) recorded an image of the illumination pattern. The image of the screen was analysed using a set of virtual “spot meters” in an array which maps the uniformity of illumination that would be received onto the surface of the triangular traffic sign. The measured luminance variation was converted into an illuminance variation and the illuminance uniformity determined.

Conversion between luminance ( $L_v$ ,  $\text{cd/m}^2 = \text{lumen/steradian-m}^2$ ) and illuminance ( $E_v$ ,  $\text{lux} = \text{lumen/m}^2$ ) is performed using the following equation:

$$L_v = (E_v * \rho) / \pi$$

$$E_v = (L_v * \pi) / \rho$$

where  $\rho$  is the reflectance factor of the screen (experimentally determined to be 0.88 with reference to a Spectralon™ 99% white target imaged concurrently with the screen). Thus, the measured luminance values in  $\text{cd/m}^2$  obtained using the ProMetric camera can be converted into an illuminance value by multiplying by the factor 3.6.

### Results

The following charts show the luminance (and, by definition, illuminance) variation of the white screen illuminated by the SolarTech LED illuminator at a variety of distances. An alignment image of a triangular road sign was taken (Figure 1) to assist with analysis of the illumination uniformity on the screen as it would be projected onto the sign. This is projected onto the illumination pattern recorded at 270cm. For the illumination pattern recorded at 115cm, a virtual circular road sign of 27cm diameter is projected onto the images.

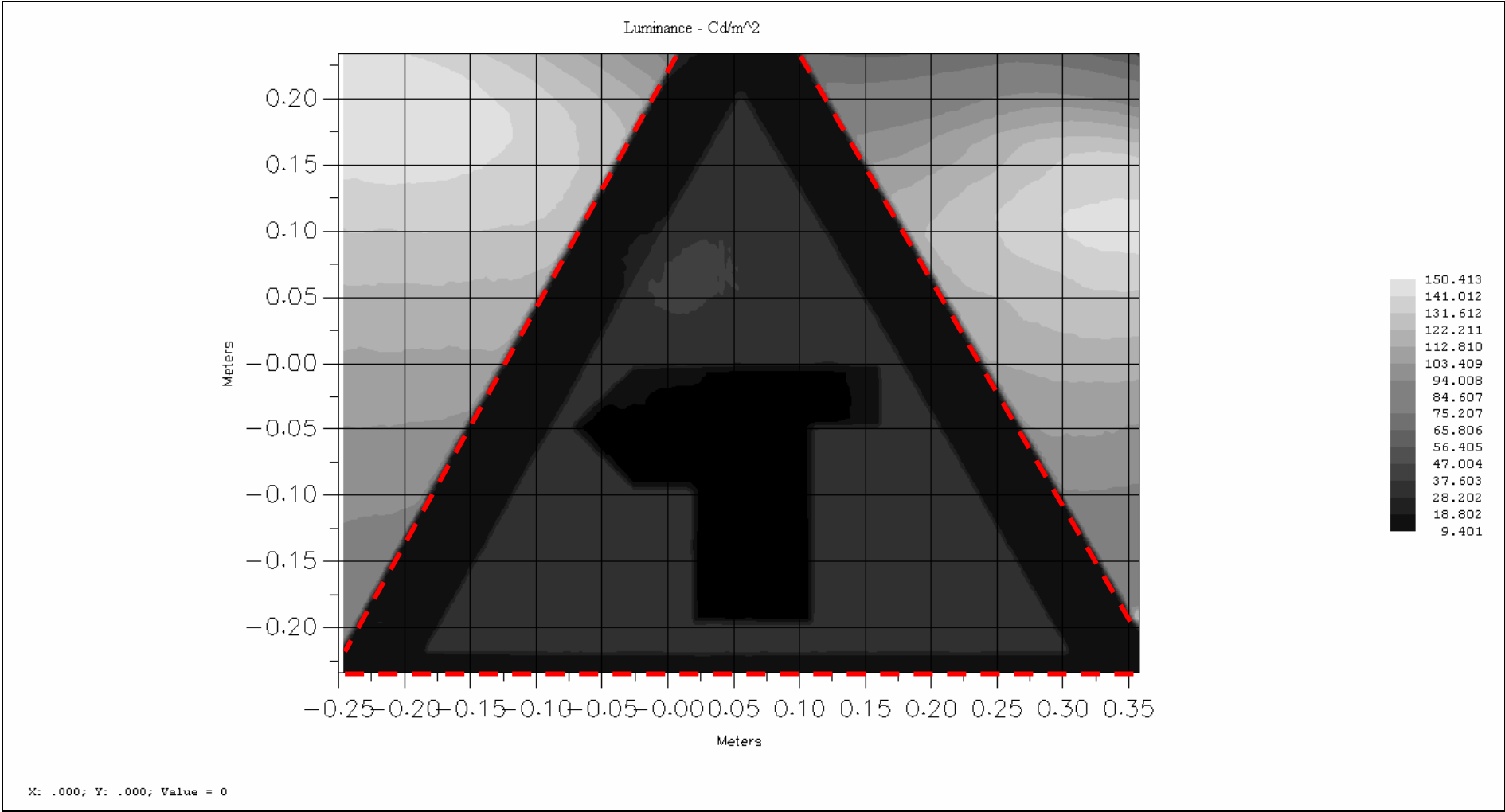


Figure 1: Alignment Image of Road Sign Used to Determine Area of Interest

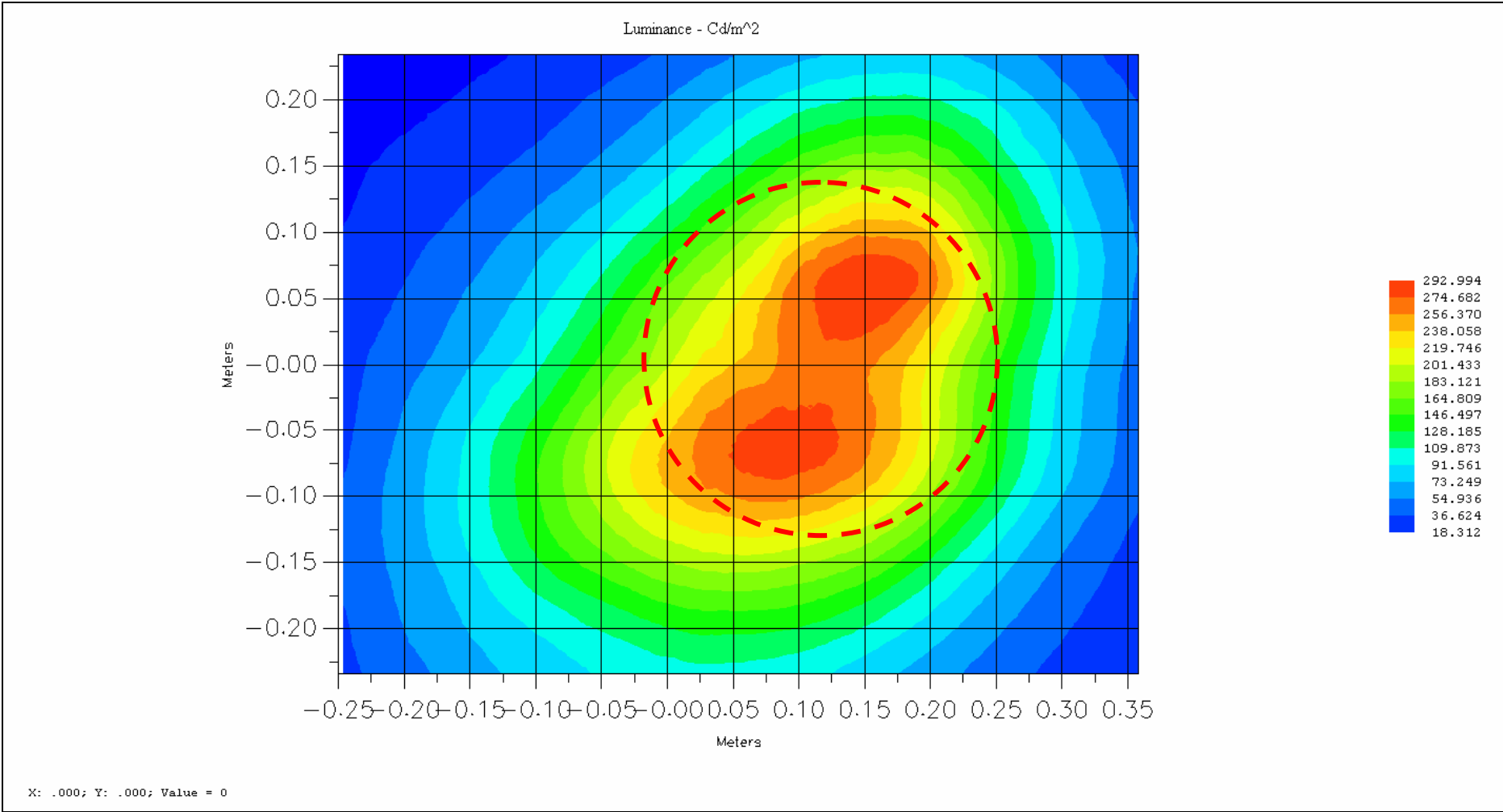


Figure 2: Iso-Luminance Plot with Illuminator Held at 115cm from Screen (Virtual 27cm Circular Road Sign Projected for Reference)

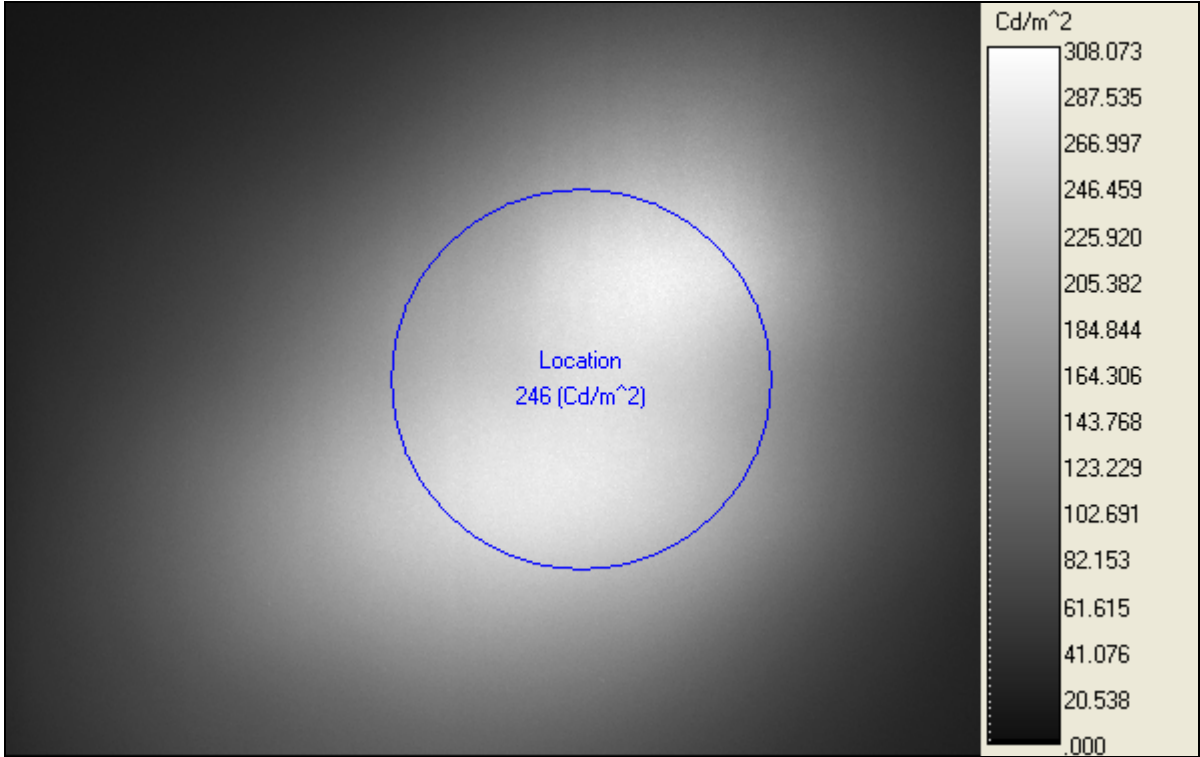


Figure 3: Average Luminance Within 27cm Diameter Circle at 115cm of 246 cd/m<sup>2</sup> (= 886 lux); Luminance Uniformity of 170/306 = 55%

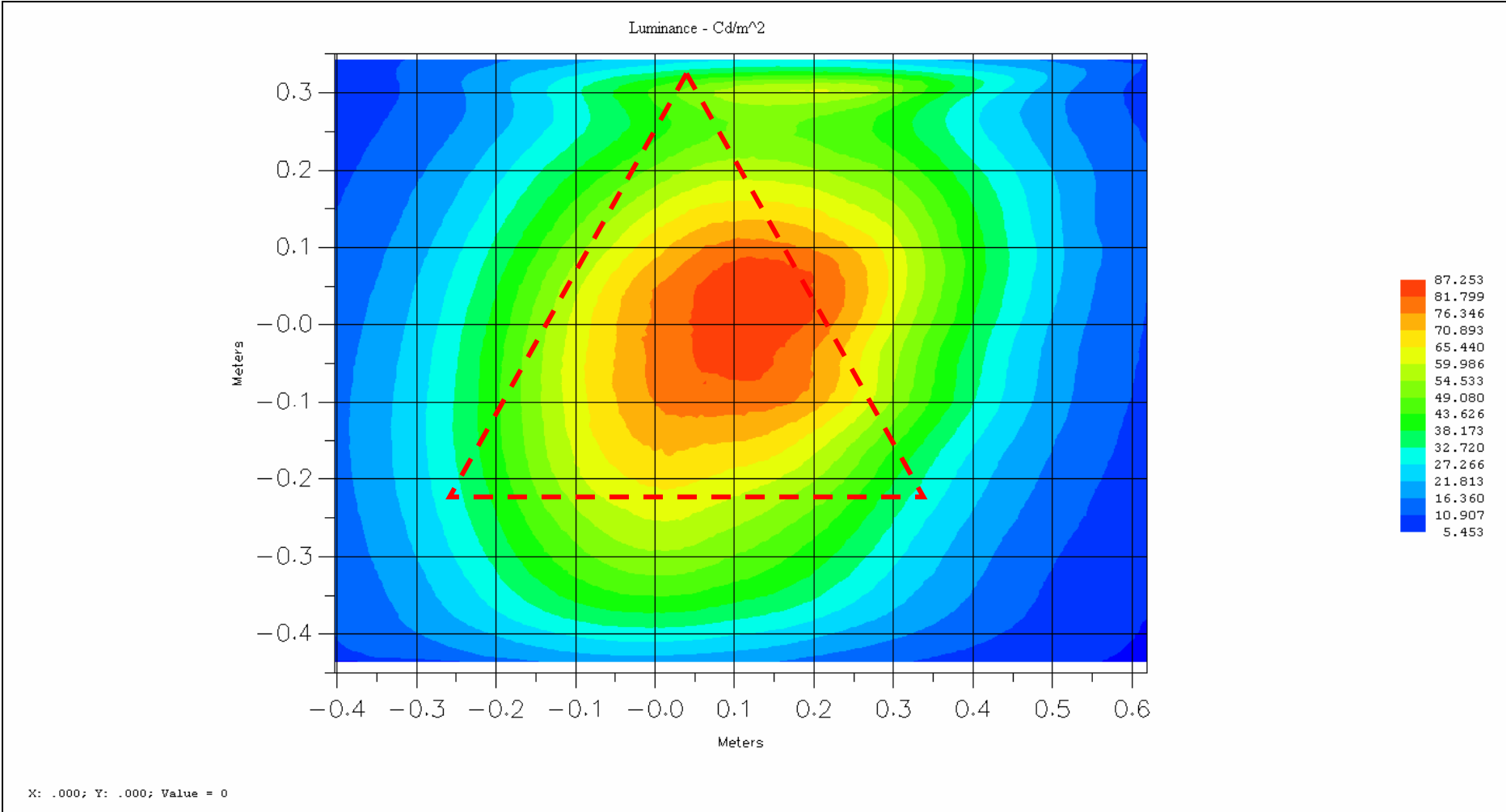


Figure 4: Iso-Luminance Plot with Illuminator Held at 270cm from Screen (Note Larger Field of View)

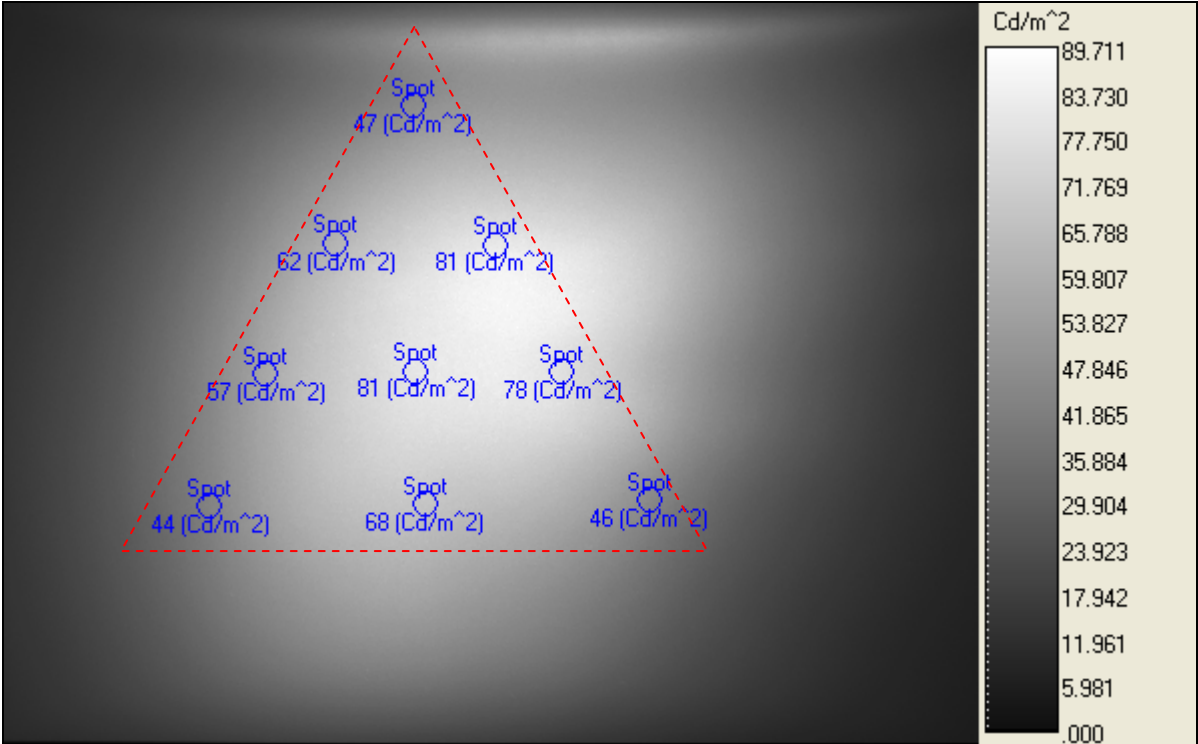


Figure 5: Luminance Uniformity Plot at 270cm ( $44/81 = 54\%$ ).  
Average Luminance of  $67 \text{ cd/m}^2$  (= 241 lux)