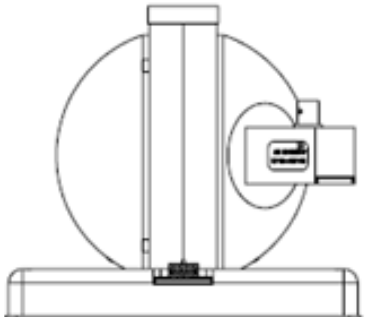
Case Study:

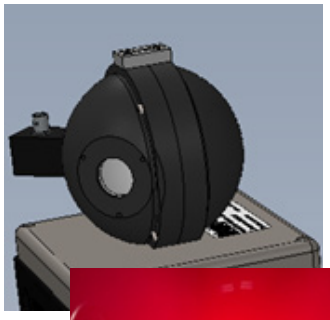
High Brightness RGB Uniform Light Source for Virtual Reality Sensor Test Illumination

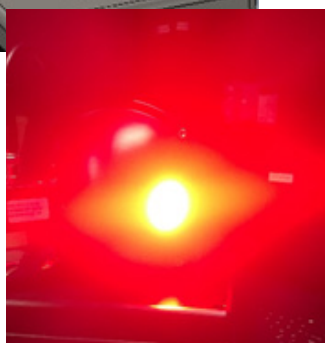
Contact:

Greg McKee
Chief Technologist
603-369-0403
gmckee@labsphere.com

Labsphere, Inc.
231 Shaker Street
North Sutton, NH US 03260
www.labsphere.com







The Situation

A red, green, and blue (RGB) source was needed for testing virtual reality sensors. The instrument was required to control the spectral input, have extremely high luminance levels and high uniformity passing through a 5cm^2 aperture. This uniform illumination source had to also fit within a specific, space-limited workspace.

The Challenge

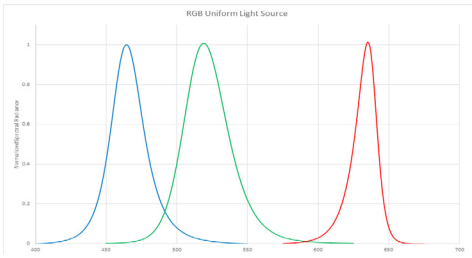
Labsphere was asked to engineer and develop a red, green, blue (RGB) uniform flat fielding source. The luminance distribution requirements were to be composed, at a minimum, of 30% Red (150,000 nits), 60% Green: (300,000 nits), and 10% Blue (50,000 nits). All in all, >500,000 nits across the visible spectral region. There must be 98% or greater luminance uniformity across 5cm^2 luminance aperture at normal viewing rastor map and off-axis ±30°. The solution was required to have an embedded photopic detector with NIST traceable calibration to monitor the luminance through the aperture. The finished solution required a compact design that could fit within tight vertical limits above and about the luminance aperture.

Labsphere's Solution

The core of the RGB source design was driven by the luminance level requirements through the aperture. The geometric design was driven by the luminance uniformity requirements through the light emitting aperture and the restrictive space constraints. To provide the intense light output levels Labsphere used a small integrating sphere with its highest reflecting diffuse material, Spectralon (>99% reflectance through the visible). The light engine itself was an RGB LED array cluster engineered by Labsphere. The light engine interface allowed for efficient coupling between itself and the integrating sphere. The integrating sphere accommodated the light engine, light aperture and a photodetector appropriately apertured to monitor the luminance over the high dynamic range of the system. The light engine was fitted with a 100W thermo-electric cooler to compensate for heat generated by the light engine and to maintain stability and repeatability. Calibration was performed in one of Labsphere's many state-of-the-art radiometric/photometric labs, referencing NIST traceable artifacts. The uniformity mapping was performed with a high resolution imaging colorimeter with robotic controlled automation.

Performance

Red luminance	210k nits
Green luminance	260k nits
Blue luminance	86k nits
Normal Uniformity	98%
Angular Uniformity	99%



Relative Spectral Radiance