



# Ray File Format for the Description of the Emission Property of Light Sources

**Ray File Format for the  
Description of the  
Emission Property of  
Light Sources**

Publication of this report  
has been approved by IES.  
Suggestions for revisions  
should be directed to IES.

**Prepared by:**  
**The Subcommittee on Ray File Format**  
**for LED Packages and Other Light Sources**

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## INTRODUCTION

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In the past few decades, the optical design of illumination systems (non-imaging optics) has benefited greatly from the advances in computer hardware and software. Many commercially available ray-tracing optical design and simulation software programs have been developed to support a wide variety of optical design tasks. All of these software packages can use ray files as source models. Ray files are typically generated by light source manufacturers using either an optical simulation or physical measurements using near field goniometers. These ray files are then put in a specific format for each optical design program, which allows optical engineers to integrate the light source characteristics into their optical system design simulations. Ray files describe light sources by a large number of rays with individual start location, direction, flux, and optional spectral and/or polarization data.

Ray files are mainly intended for optical engineers, who are designing optical systems using light sources. Ray files are a characterization of the near field characteristics of a light source. Users may also be familiar with *ANSI/IES LM-63-02 (R2008) IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information* formatted files, typically called “IES files”, which are far field characterizations of a lamp or luminaire. IES files are used by lighting application engineers to layout the lighting in a space and predict light levels. Although the far field files are useful for lighting application layouts, they are not adequate when designing optics that are placed in close proximity to the light source.

One complication in providing ray files for light source characterization is that each ray file can be very large, containing millions of rays and using > 250MB of data per file. Currently a manufacturer must provide ray files for all of its light sources, in up to 16 unique file formats since none of the commercially available ray tracing software uses the same file format. This situation leads to a large amount of data that must be created, managed, stored, and distributed to ray file users.

Because all ray files store essentially the same data, the industry has come together to create a single standard ray file format that all light source manufacturers can distribute and all optical design software can use for simulations. The format has been created by a group that includes LED manufacturers, optical simulation software vendors, near field goniometer vendors, and academia. The new format is meant to allow simple conversion of all existing ray files into the new format, and it will be generally backward compatible in future revisions.

This document defines the IES standardized ray file format to describe the emission properties of light sources that can be used in all commercially available design, analysis, and metrology software.

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## 1.0 SCOPE

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This document provides recommendations for a standard ray file format to describe the emission properties of light sources. The ray file format contains information necessary to interface between ray tracing or other optical design, simulation, analysis and metrology software used in lighting applications.

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## 2.0 NORMATIVE REFERENCES

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- 2.1** *ANSI / IES RP-16-10, Nomenclature and Definitions for Illuminating Engineering*. New York: Illuminating Engineering Society of North America, 2010.
- 2.2** *ISO 8601, Data elements and interchange formats – Information interchange – Representation of dates and times*. Geneva: International Organization for Standardization, 2004.
- 2.3** IEEE 754-2008, Standard for Binary Floating-Point Arithmetic. New Jersey: Institute of Electrical and Electronics Engineers.
- 2.4** *The Unicode Standard*. California: The Unicode Consortium.
- 2.5** The International System of Units (SI), 8th Edition, Bureau International des Poids et Mesures, 2006.
- 2.6** *ISO/IEC 8859-1:1998, Information technology – 8-bit single-byte coded graphic character sets – Part 1: Latin alphabet No. 1*.

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## 3.0 DEFINITIONS

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### 3.1 ASCII

An encoding scheme for Latin characters, according to *ISO/IEC 8859-1*. For the purpose of this standard, only the character 0 and characters from 32 up to and including 126, in decimal form, shall be used.