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Optics and optical instruments — Lasers and laser-related equipment — Test methods for laser beam power [energy] density distribution

Optique et instruments d'optique — Lasers et équipements associés aux lasers — Méthodes d'essai de distribution de la densité de puissance [d'énergie] du faisceau laser

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13694 was prepared by Technical Committee ISO/TC 172, *Optics and optical instruments*, Subcommittee SC 9, *Electro-optical systems*.

Introduction

Many applications of lasers involve using the near-field as well as the far-field power [energy] density distribution of the beam[1)]. The power [energy] density distribution of a laser beam is characterized by the spatial distribution of irradiant power [energy] density with lateral displacement in a particular plane perpendicular to the direction of propagation. In general, the power [energy] density distribution of the beam changes along the direction of propagation. Depending on the power [energy], size, wavelength, polarization and coherence of the beam, different methods of measurement are applicable in different situations. Five methods are commonly used: camera arrays (1D and 2D), apertures, pinholes, slits and knife edges.

This International Standard provides definitions of terms and symbols to be used in referring to power density distribution, as well as requirements for its measurement. For pulsed lasers, the distribution of time-integrated power density (i.e. energy density) is the quantity most often measured.

According to ISO 11145, it is possible to use two different definitions for describing and measuring the laser beam diameter. One definition is based on the measurement of the encircled power [energy]; the other is based on determining the spatial moments of the power [energy] density distribution of the laser beam.

The use of spatial moments is necessary for calculating the beam propagation factor K and the times-diffraction-limit factor M^2 from measurements of the beam widths at different distances along the propagation axis. ISO 11146 describes this measurement procedure. For other applications, other definitions for the beam diameter may be used. For some quantities used in this International Standard, the first definition (encircled power [energy]) is more appropriate and easier to use.

1) For the purposes of this International Standard, "near-field" is defined as the radiation field of a laser at a distance z from the beam waist which is less than the Rayleigh-length z_R. "Far-field" is defined in ISO 11145.