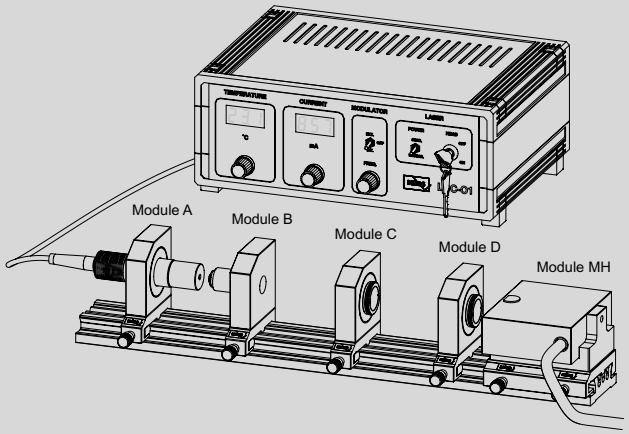
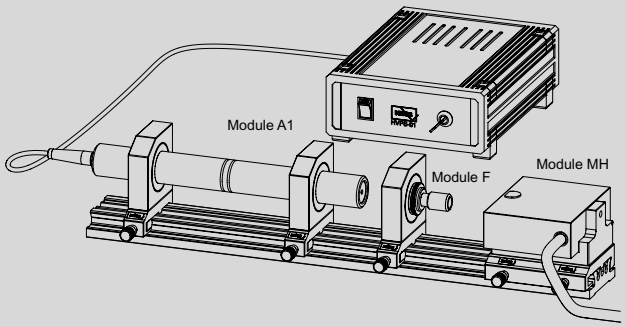
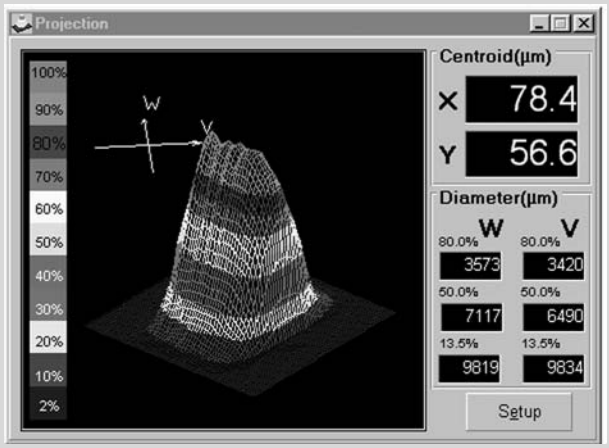
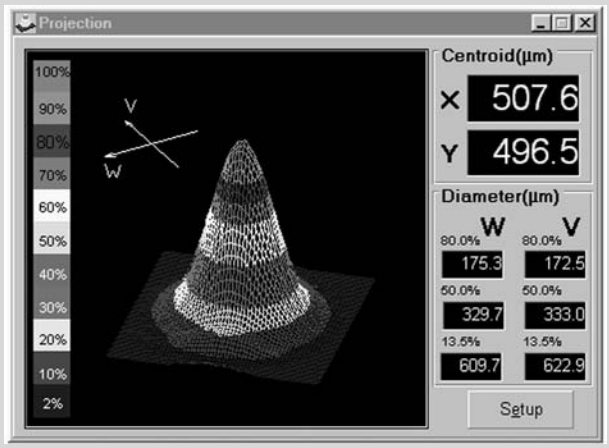
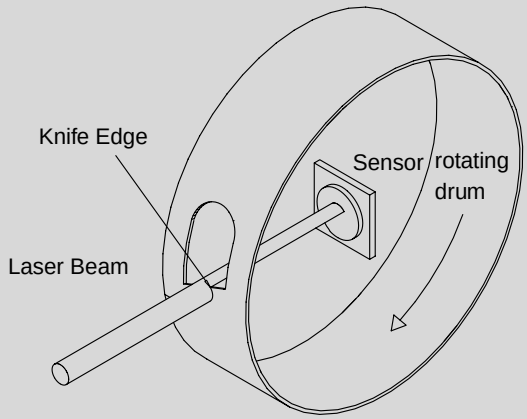






Experiment 29 Laser Beam Analysis





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1. Introduction

In almost all cases a Laser application requires a Laser beam with low divergence emitted in the so called fundamental Gaussian mode (TEM_{00}). This is not always guaranteed for each laser and especially for high power Laser systems because the emission may be multimode.

Considering the Laser diodes which posses even elliptical beam shapes it is important to have a tool for analysing the structure of the beam shape for different types of Laser in order to be sure to fulfil the required demands for a particular application. Especially for Laser printing, material processing, fibre optics coupling, optical data storage and Laser pumping the spatial intensity distribution of the laser used must be well defined.

The smallest obtainable spot size diameter of a Laser beam depends beside its wavelength on the purity of the spatial mode spectra of the Laser. In case of the Laser printer the desired resolution will not be obtained if the Laser emits additional transverse modes. If more transverse modes are existing the beam shape is no longer circular and depends on the number of higher transverse modes causing a variety of different patterns to occur. This also means that the intensity distribution is different and the application will not fulfil the desired performance.

Within this project a laser beam profiler based on the knife edge method is used to measure the spatial intensity distribution. As probe Lasers a HeNe-Laser and a diodelaser are used.

The HeNe-Laser emits a pure Gaussian TEM_{00} whereas the diodelaser emits an elliptical beam. By means of different optical elements (beam expander and cylindrical lenses) the influence on the intensity distribution will be measured and discussed.

The collection of the data is performed automatically by a PC with special software. For this reason an extra board is built into the PC which controls the beam analyser, collects and stores the data either on floppy or the hard disk of the PC. Based on the recorded data a 2D/3D graphical presentation of the intensity profile is displayed on the monitor or can be printed out on an ink jet colour printer.

2. Experimental Set-up

The complete experimental system is provided with two Laser sources with various optical elements to expand, collimate, shape and focus the emitted beams.

2.1. Set-up with the Diodelaser Module

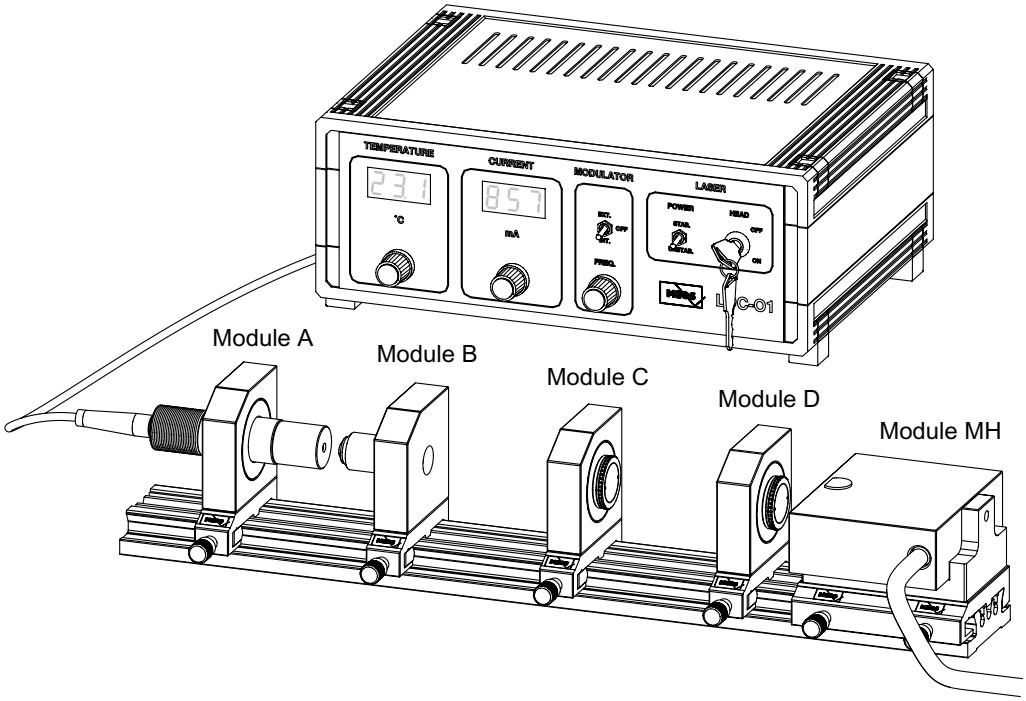

Fig. 1: Setup with the Diodelaser Module

2.1.1. The beam analyser head

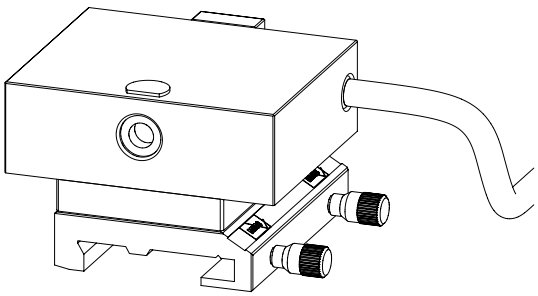

Fig. 2: Beam Analyser head

The Module MH includes the detector head, computer plug-in card, control software, a 10 % and 0.5 % transmission optical filter. The wavelength range is 400 to 1100 nm and the measurable beam size range (1/e2) is 30 µm up to 9 mm. The unit is mounted on a carrier in such a way that the entrance is in line with the optical axis of the rail system.

2.1.2. Diodelaser Module

The Module A contains a Laser diode that emits 30 mW at a wavelength around 820 nm ***(Laser Class 3)***. The Laser diode is mounted on a Peltier Element, so that the temperature can be varied from 10-30 °C.