RESUM DE TESI DOCTORAL

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Títol de la tesi:	Far-field characterization of automotive headlamps from near-field measurements			
Unitat estructural:	Òptica i Optometria			
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Resum[2]:

Transport by road is by far the most dangerous of all transport modes, and at night is when a higher number of traffic fatalities happen in comparison with the rest of the day. Improving the safety of drivers in night-driving conditions implies enhancing automotive lighting design as a central issue. Testing and validating such designs takes place in photometric tunnels where, according to normative, measurements must be performed at a distance of 25m. such installations are scarce and have to be rented with each new headlamp design or prototype.

Many systems have been developed and commercialized trying to compact the instrumentation required, showing the potential industrial interest of such a unit. The main objective of this PhD work is to propose a compact, cost effective method to obtain far-field photometric distributions of the headlamp through a series of measurements performed in the near-field. The sensor used is a CCD camera with the lens focused to infinity, so the direction and the energy of a bundle of rays at each camera position may be calculated through a combination of deflectometric and photometric techniques. The sensor is displaced across a measurement plane close to the source to sample the complete illumination distribution of the source. To obtain the distribution in a distant plane, an image-processing algorithm projects the information gathered by the sensor and provides smooth light distributions in the final plane, thereby minimizing possible sampling problems. A set of procedures for calibrating the hardware unit have been performed and extensively described. The exposure of the system has been externally controlled to expand the dynamic range of the sensor using self-developed electronics. All these processes have led to a successful comparison of relative photometric distributions measured using a photometer in far-field conditions to those measured using the proposed system working in near-field conditions.

In addition, these comparisons have shown the linear relationship between accumulated grey levels and illumination in the final plane, so if the global constant value relating illumination and accumulated grey levels was known, absolute photometric distributions would be possible to measure. A theoretical model of the measurement chain has been successfully established, allowing the calculation of the abovementioned global constant according to the different

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working conditions of the system. The re-calculation of the constant under different experimental conditions is performed through a simple substitution in the model which depends on the parameters of the measurement modified and on some simple experimental measurements.

The final test of the unit regarding its capability to measure absolute photometric distributions was the comparison of the obtained results with a set of reference data obtained in a photometric tunnel for seven distributions of three different headlamps measured under the conditions fixed by the normative. The comparison has permitted to validate the method proposed and the set-up built. The method here proposed is general and can be applied to any extended source (pilots, luminaries…) and to any type of final surface, once it is geometrically defined.

Signatura: **Data: Terrassa, 25 de Gener de 2006**

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