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Scientific and technical basis in optical design for embeded leds in energy saving streetlights.

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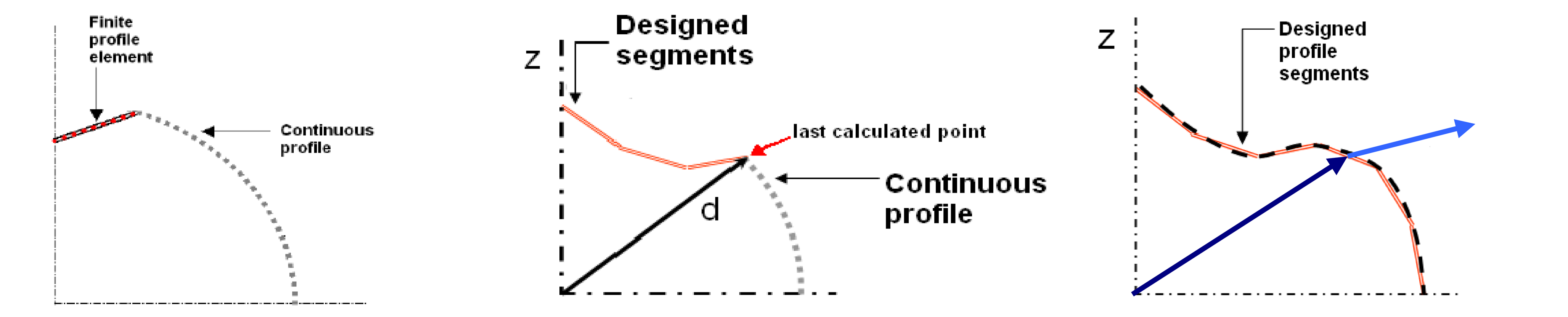
INTRODUCTION

Development of LED technologies introduces a breakthrough in the new generation of street lighting concept. Systems based in LED & OLEDS devices open an alternative formula in the difficult equilibrium among energy saving, comfort illumination and ecological responsibility.

In this work we present a suitable optical design strategy capable of obtaining an initial manufacturable plastic optical device for street light purposes [1].

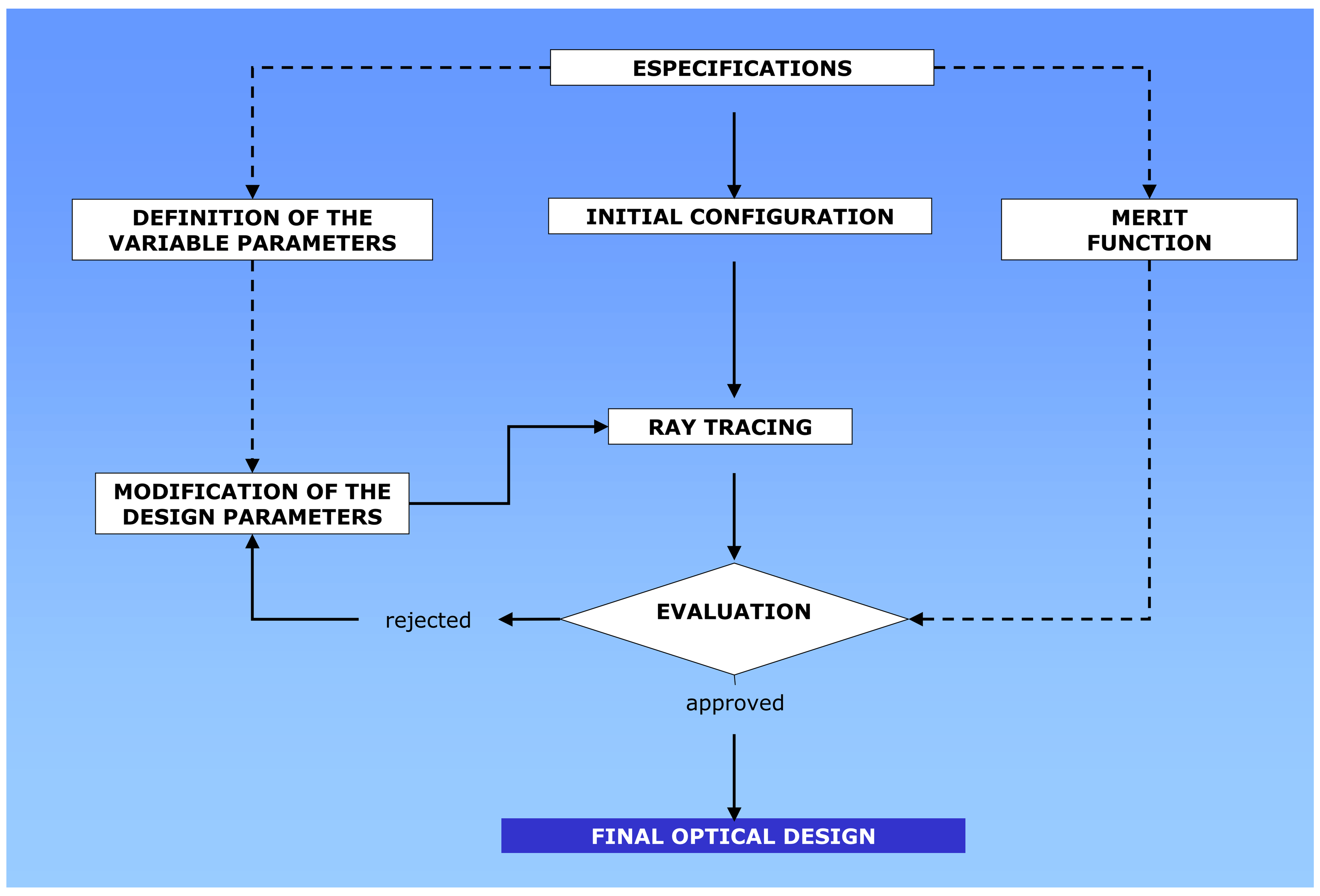
BASICS ABOUT OPTICAL DESIGN STRATEGY

To guarantee a suitable final optical design it is necessary to merge three key points: i) a finite element description of the optical surface, ii) the continuity and derivability of the same surface and iii) an analytical implementation of Snell's law.



a) Finite profile elements **b) Continuity and derivability** **c) Snell's Law analytical solution**

OPTICAL DESIGN PROCESS [2]



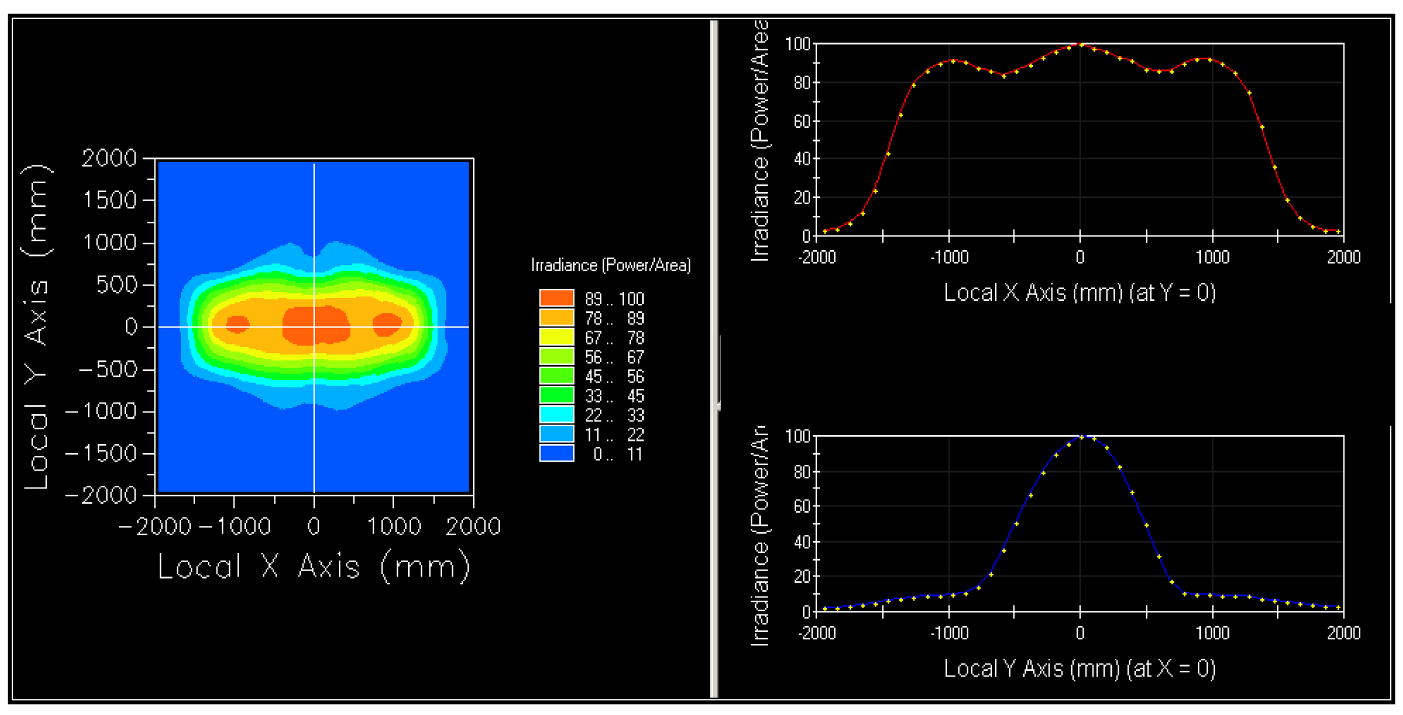
MAIN PARAMETERS

Comparative table for different lamp parameters. Yellow colour denotes the best option for street lighting solutions for each parameter [3,4,5,6,7].

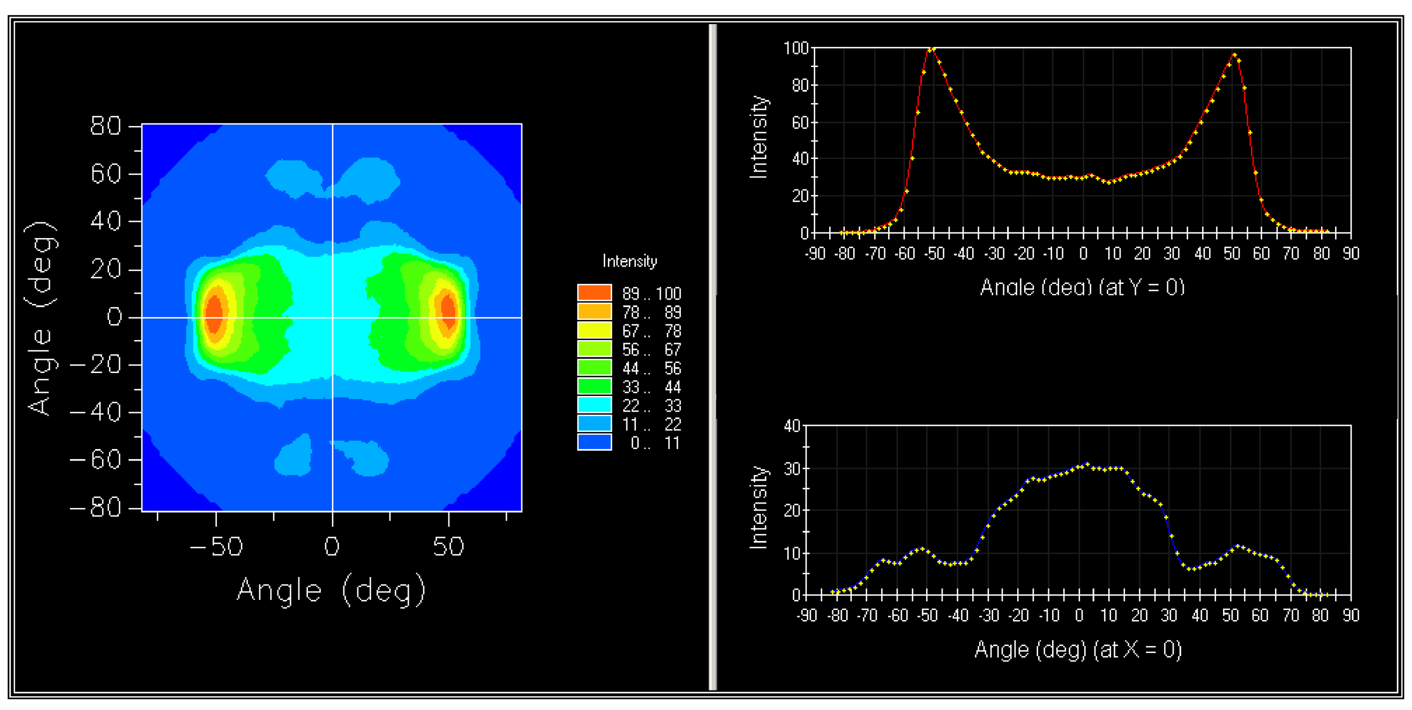
	Hg Lamps	Na Lamps	Metallics Halogens	Optical design for LEDs
Efficacy (lm/W)	83-169	19-63	65-115	70-140
CRI (%)	42-52	25-60	65-93	65-75
Life (hoursx1000)	12-24	14-55	3.5-20	10-50
Colour Temperature (ºKx1000)	3.5 to 4.0	1.8 to 2.0	3.0, 3.5, 4.0, 6.0	2.5 to 6.7
Total good option	1	1	2	4

RESULTS

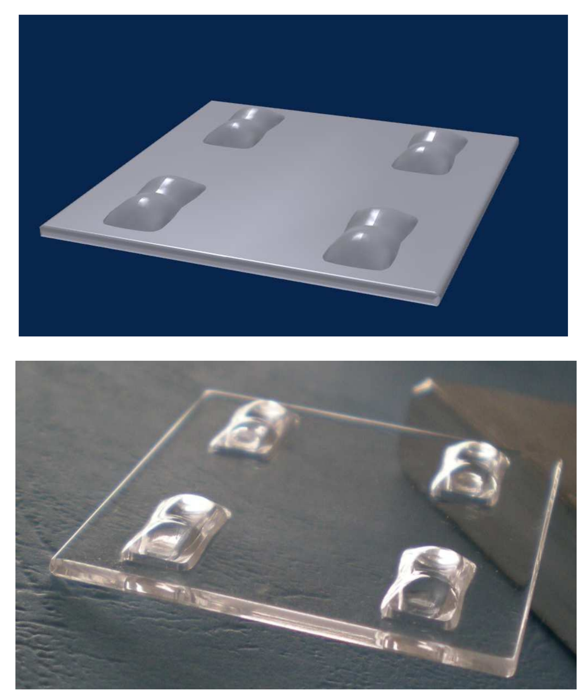
Illuminance radiation pattern [7]



Intensity radiation pattern [7]



Prototype manufacturing [8]



HIGHLIGHTS RESULTS

Uniformity along x profile: ±56º - Uniformity along y profile: ±26º High-efficiency optical design: 84%

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CONCLUSIONS

- A new methodology for designing freeform plastic optical has been presented.
- In the optical design process, saving energy parameters and manufacturing constrains have been considered.
- The optical design presents a new solution which is more efficient than typical luminaries of mercury or sodium vapor [7,8].
- A set of lenses has been simulated and manufactured.

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