



# LED 設計與光源模組之熱管理

李孝文

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# Agendas

- Introduction on Lecturer
- Thermal Hierarchy of HB LED Integrated Optical System
- Projection/Illumination Optical System Requirements
- HB LED Chips Property
- Optical/Thermal Management
- Optical/Thermal Packaging
- Materials Issues
- Measurement
- Furture Work and Conclusions

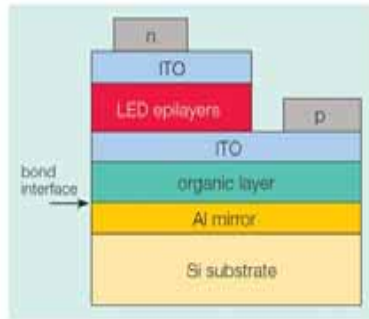


# Thermal Hierarchy of HB LED Integrated Optical System

## Light Bulb Package Level



## LED Chips Level



- **System Specifications**
  - Optical Power, Beam Spatial Profile
  - Colors Planning

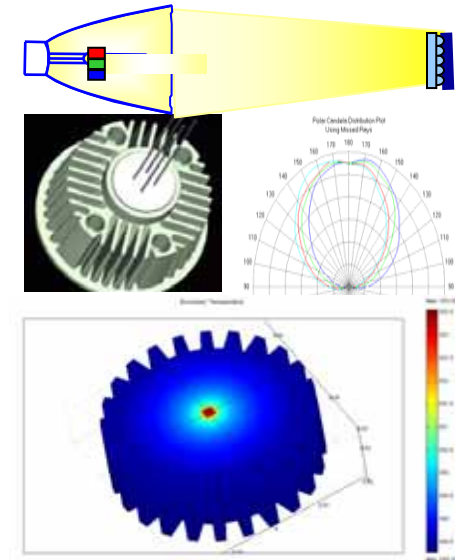
- **Thermal Simulation / Management**
  - LED Chips Selection, Submount,
  - Heat Sink, Buffer Layer, Housing.

- **Illumination LED Optics**
  - Shaping, Collimation Angle, Gamut

## System Level



## Module Level





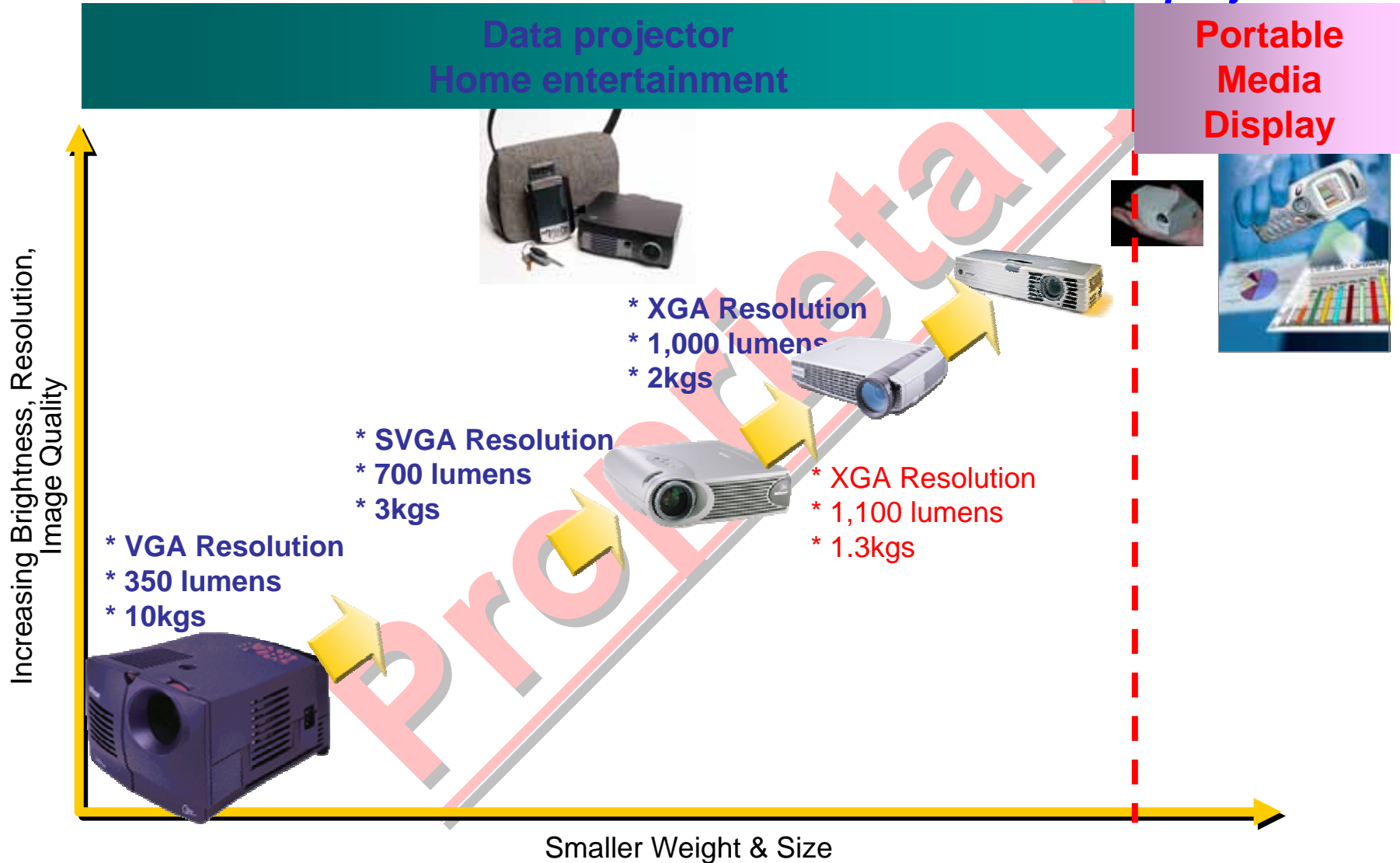
# Projection/Illumination Optical System Requirements

Proprietary



# Projector Product Trend

- Evolution to Mini-projectors





# Light Source for Personal projection

Micro-panel + solid state light source

LCD

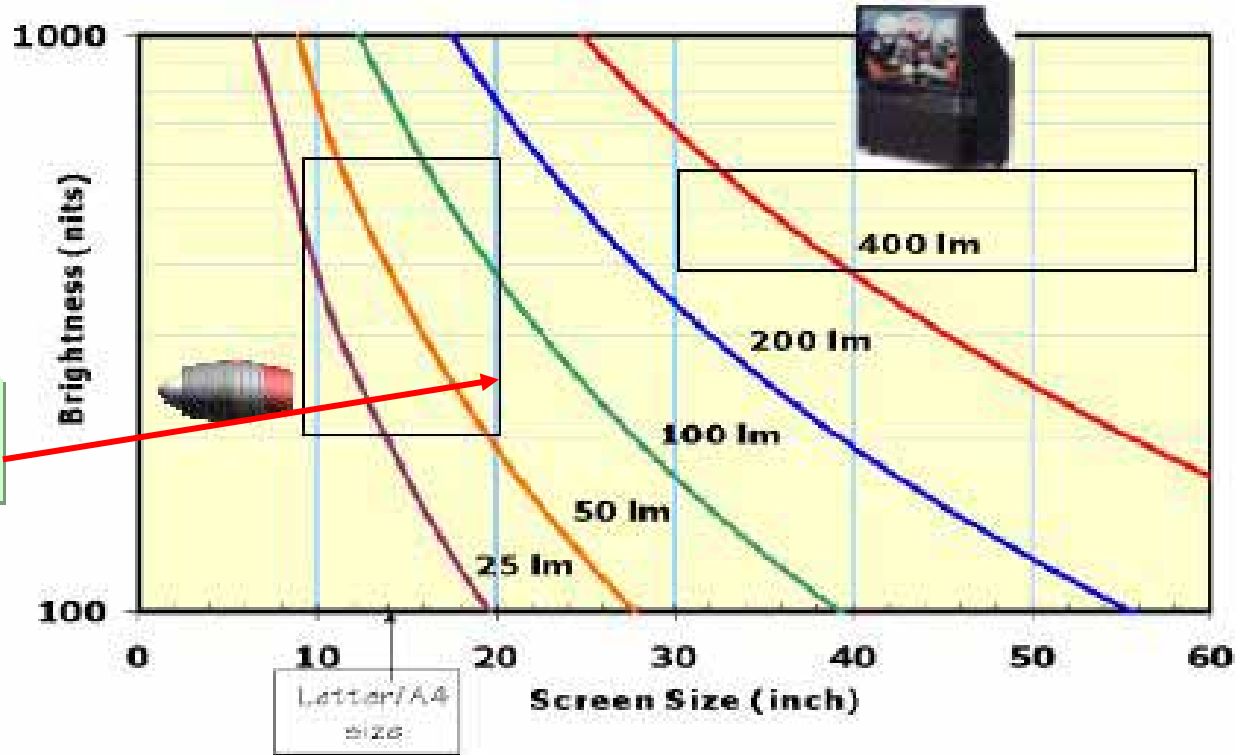
LED

DLP

OLED

LCoS

LD

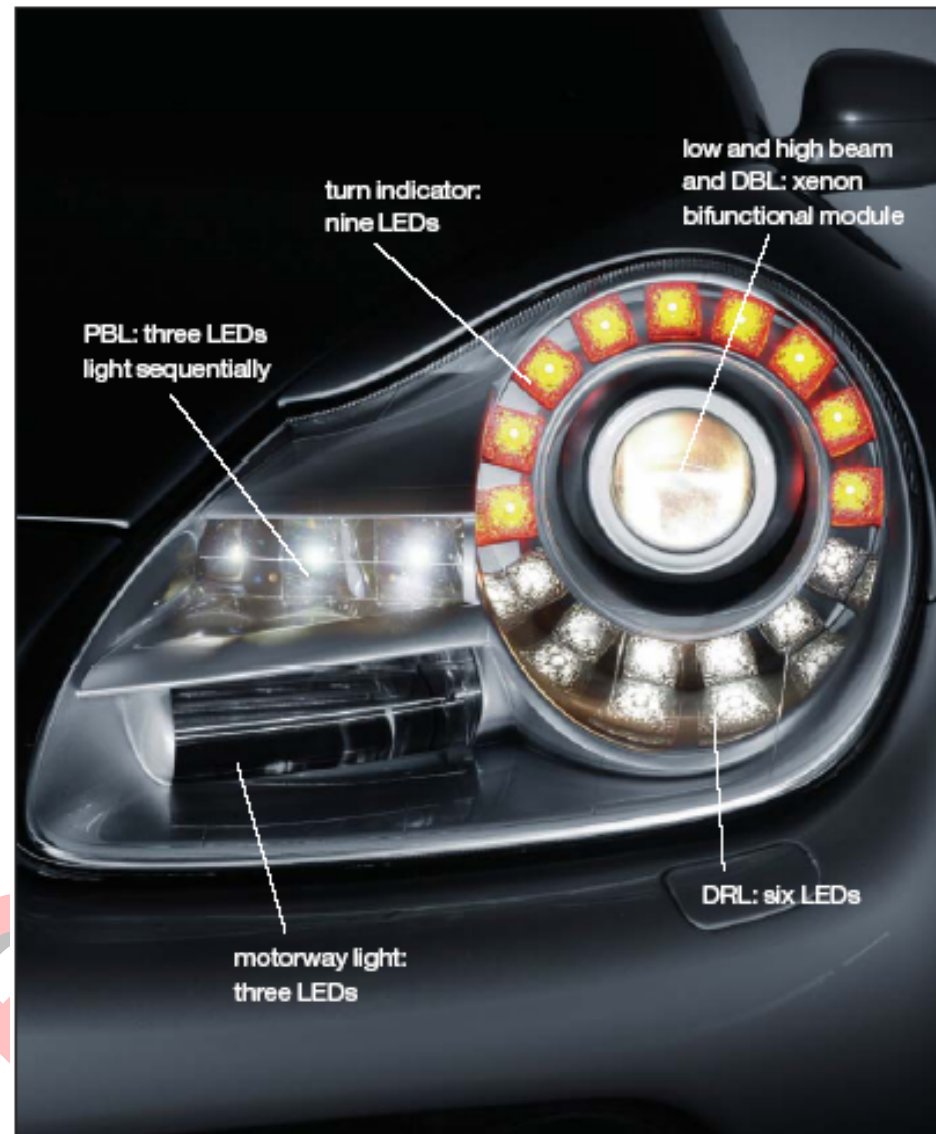


50 lm  
200nits@20"

Letter/A4 size



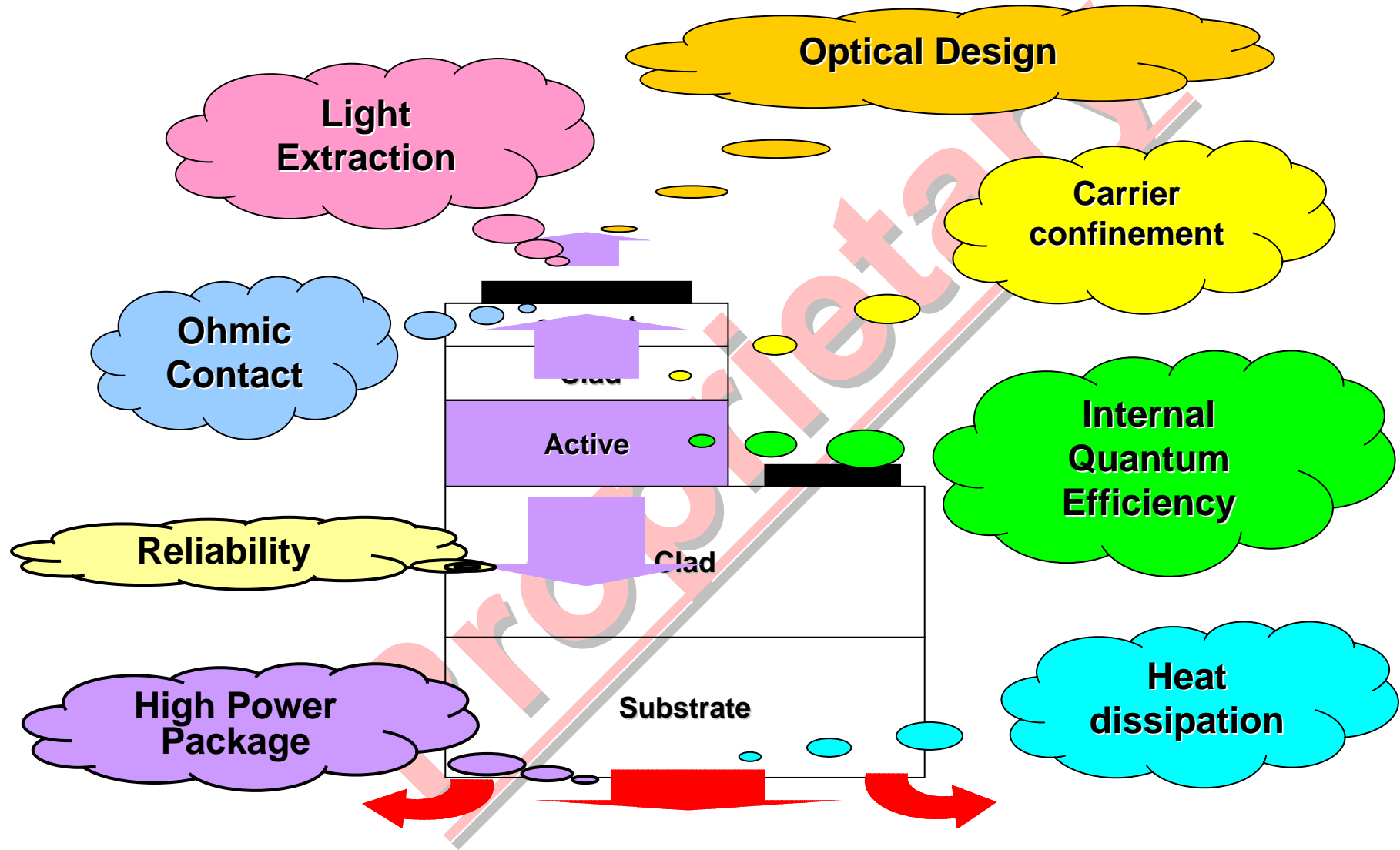
# Valeo's XLED headlamps



Source : LEDs Magazine 2005



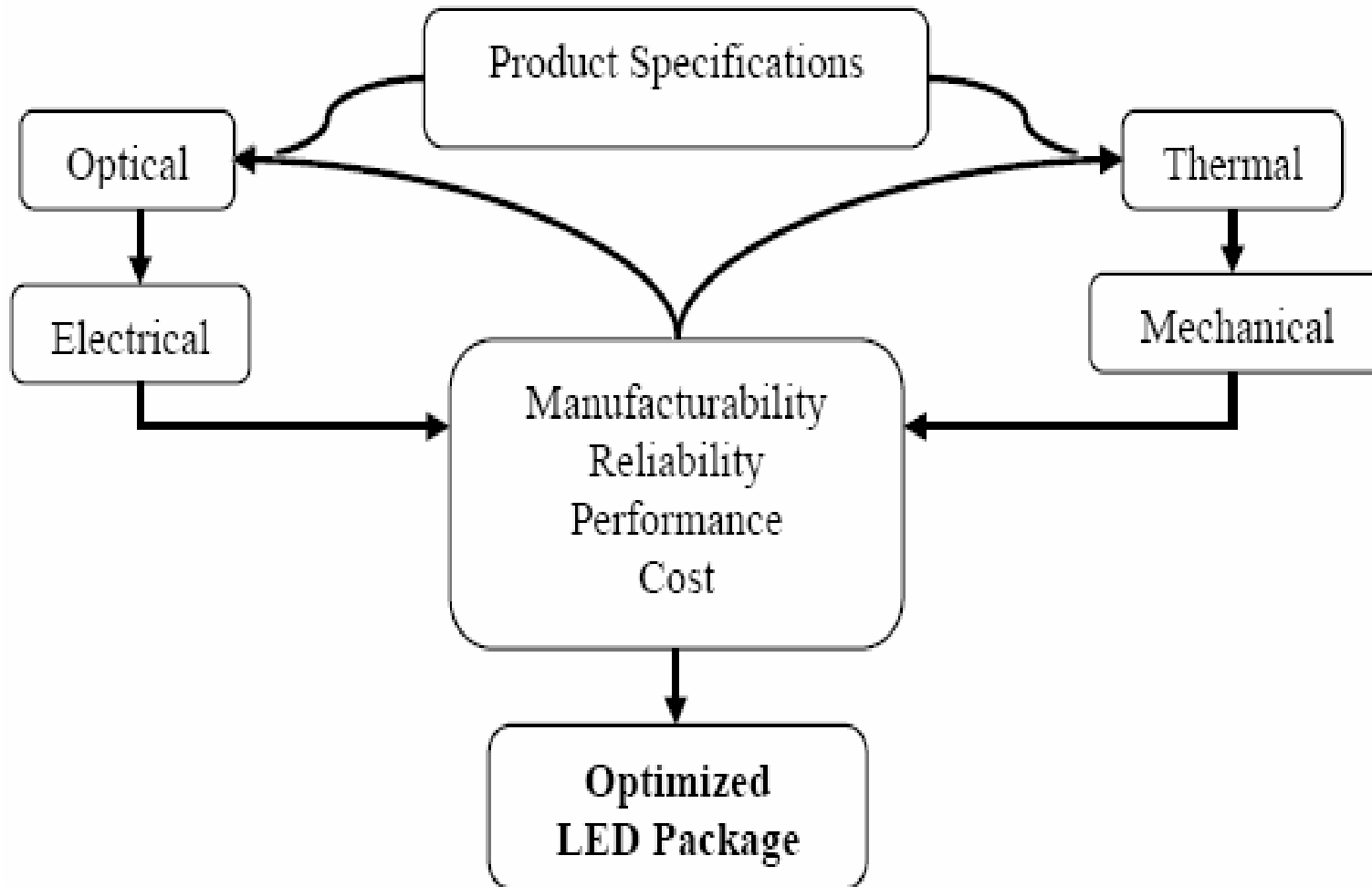
# HB LED Chips Property







# Optical/Thermal Management





Source : Innovations in Optics, Inc.,





# Material Issues

**Table 1. Comparisons for luminaire design**

	5mm LED 	Power LED 
<i>LED die</i>		
Resistive losses	✓	
Internal losses	✓	
Total light output		✓
Overall efficiency	✓	
<i>LED lamp</i>		
Package thermal design		✓
Total current/LED		✓
Typical efficiency	✓	
Multisourced	✓	
Lumens per unit area		✓
Choice of wavelengths	✓	
Choice of viewing angles	✓	
<i>Light Fixture</i>		
Minimum heat-sinking requirements	✓	
Simple drive circuit	✓	
Simple PCB design	✓	
Redundancy	✓	
Bulb replacement form factor		✓

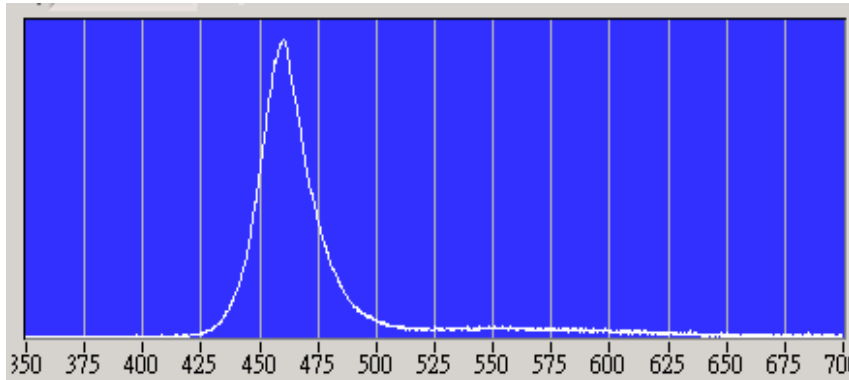
**Table 2. Comparison of cost factors**

	Small-die LED 	Power LED 
Drive circuitry	low	medium to high
Heat sinking	low	high
Lensing	low	medium to high
PCB	low	high (metal core)
LED mounting	moderate	moderate

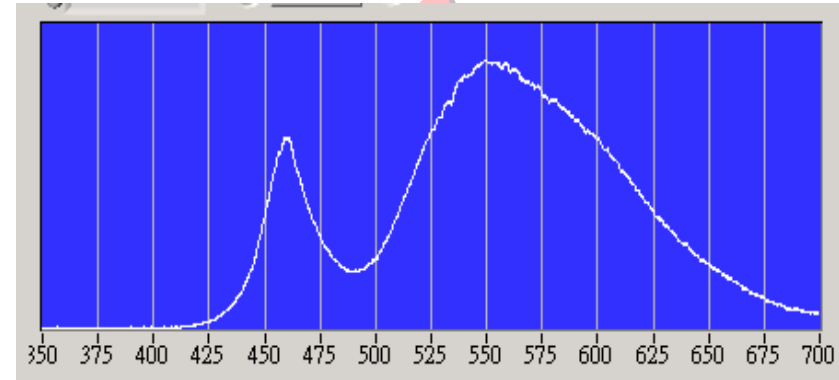
The 5 mm package versus the power LED : not a light choice for the luminaire designer



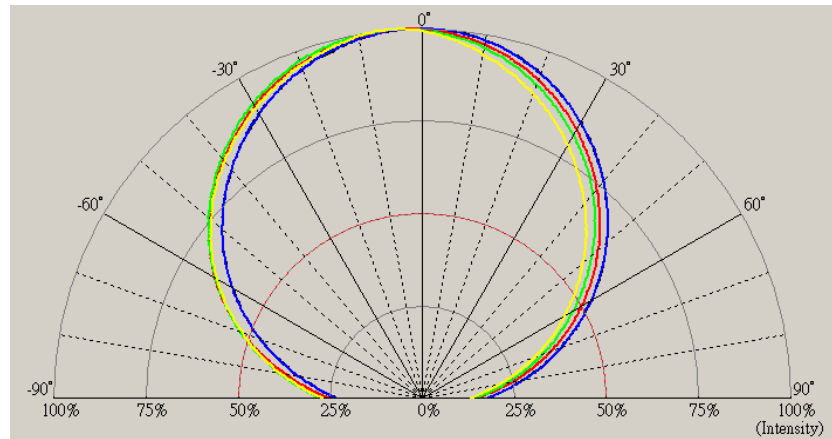
# Measurement on Beam Shaping and Color Temperature



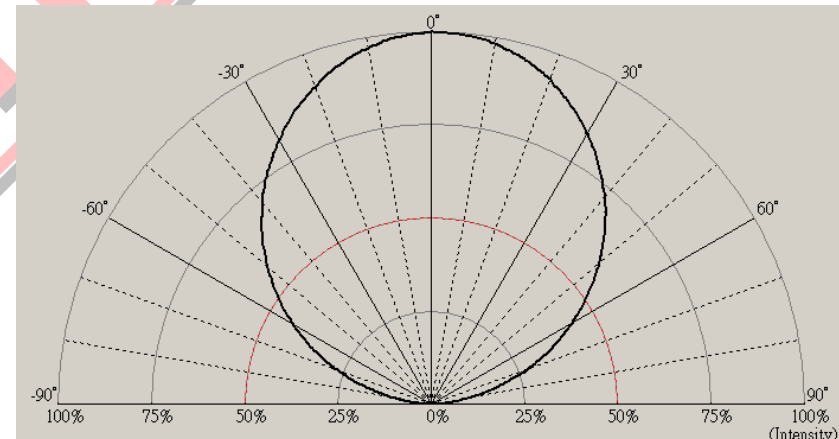
Blue LED Spectrum



White Light CT Spectrum



RGB Spatial Profile



White Light Spatial Profile

**Perfect Lambertian Profile!**

**Good for Lighting Design!**



## Future Work and Conclusions

- Next Generation Thermal Management Mechanism
- Next Generation Materials Process Development
- Next Generation Packaging Development
- Conclusions

Proprietary