

# Intelligent Pixel Headlamp in Future: Optical Design(TPX, MPX) and Performance (with samples )

面向未来的智能像素大灯（千级像素，百万像素）光学及其性能

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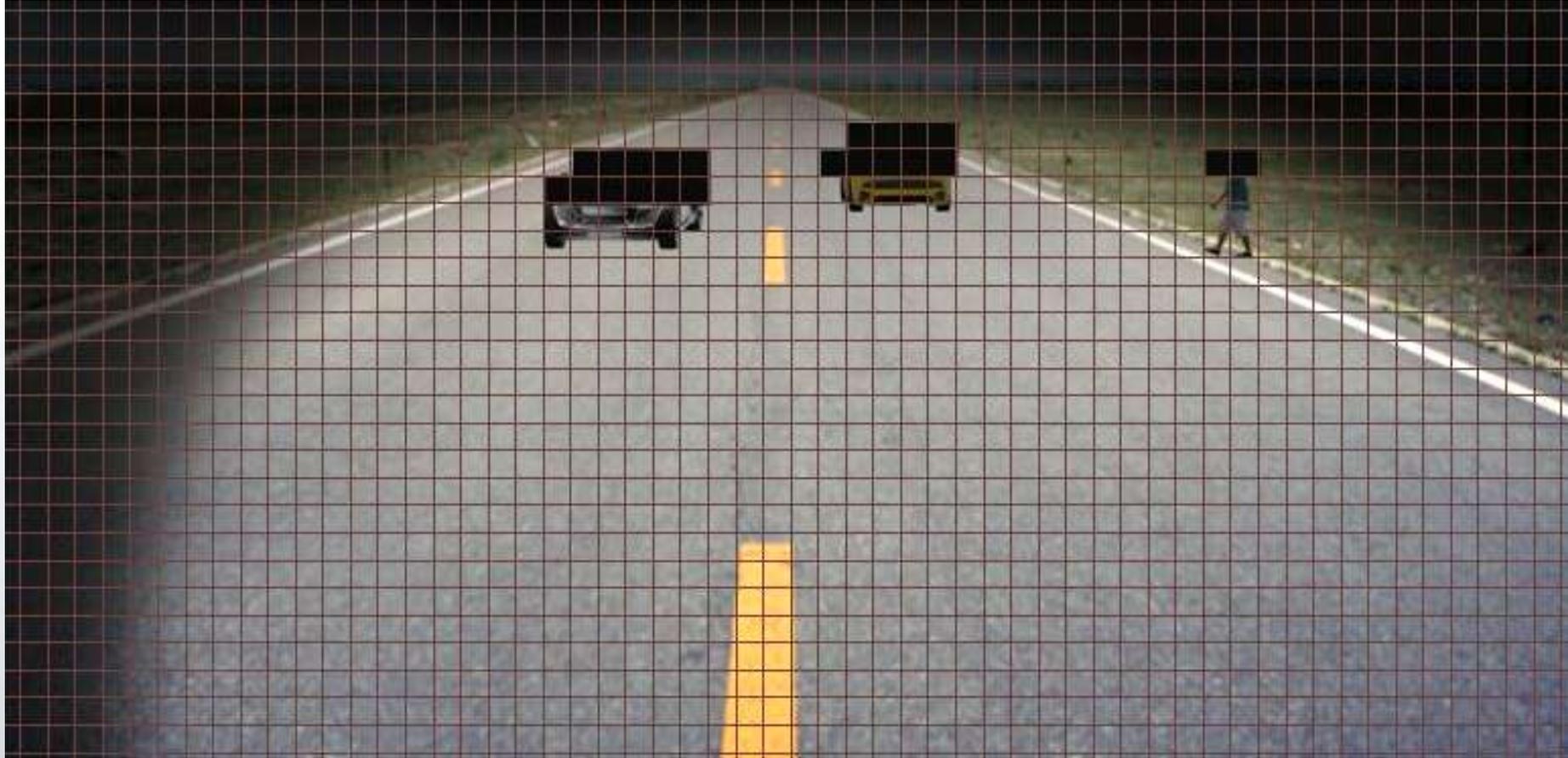
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# Pixel beam Introduction 像素照明介绍

## 1. High Resolution Adaptive Lighting 高分辨率自适应照明



Adaptive & More illumination light on Road for driver

# 一. Pixel beam Introduction 像素照明介绍

## 2. Communication & On-road Projection 信息交互与路面投影



# 一. Pixel beam Introduction 像素照明介绍

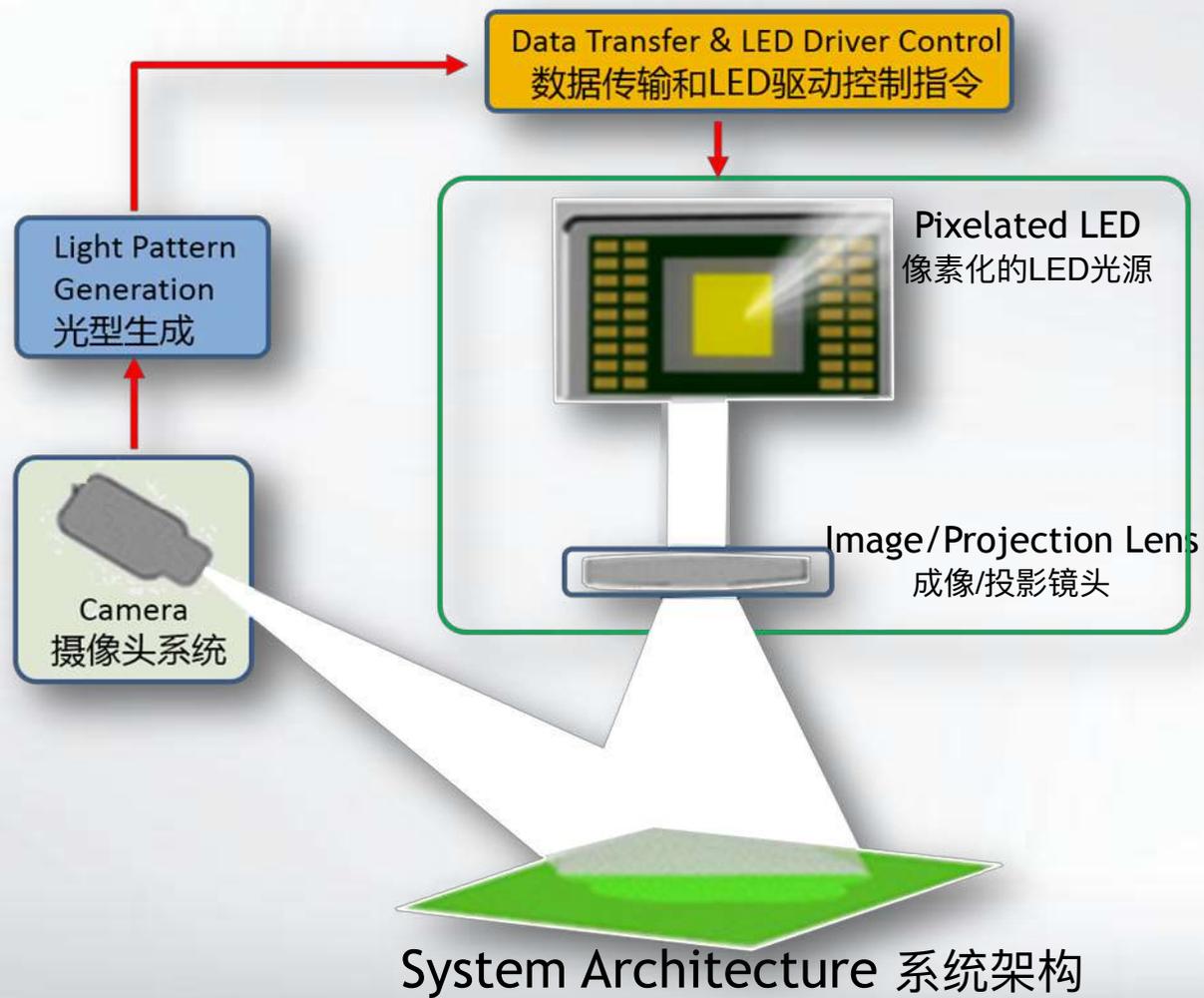
## 2. Communication & On-road Projection 信息交互与路面投影





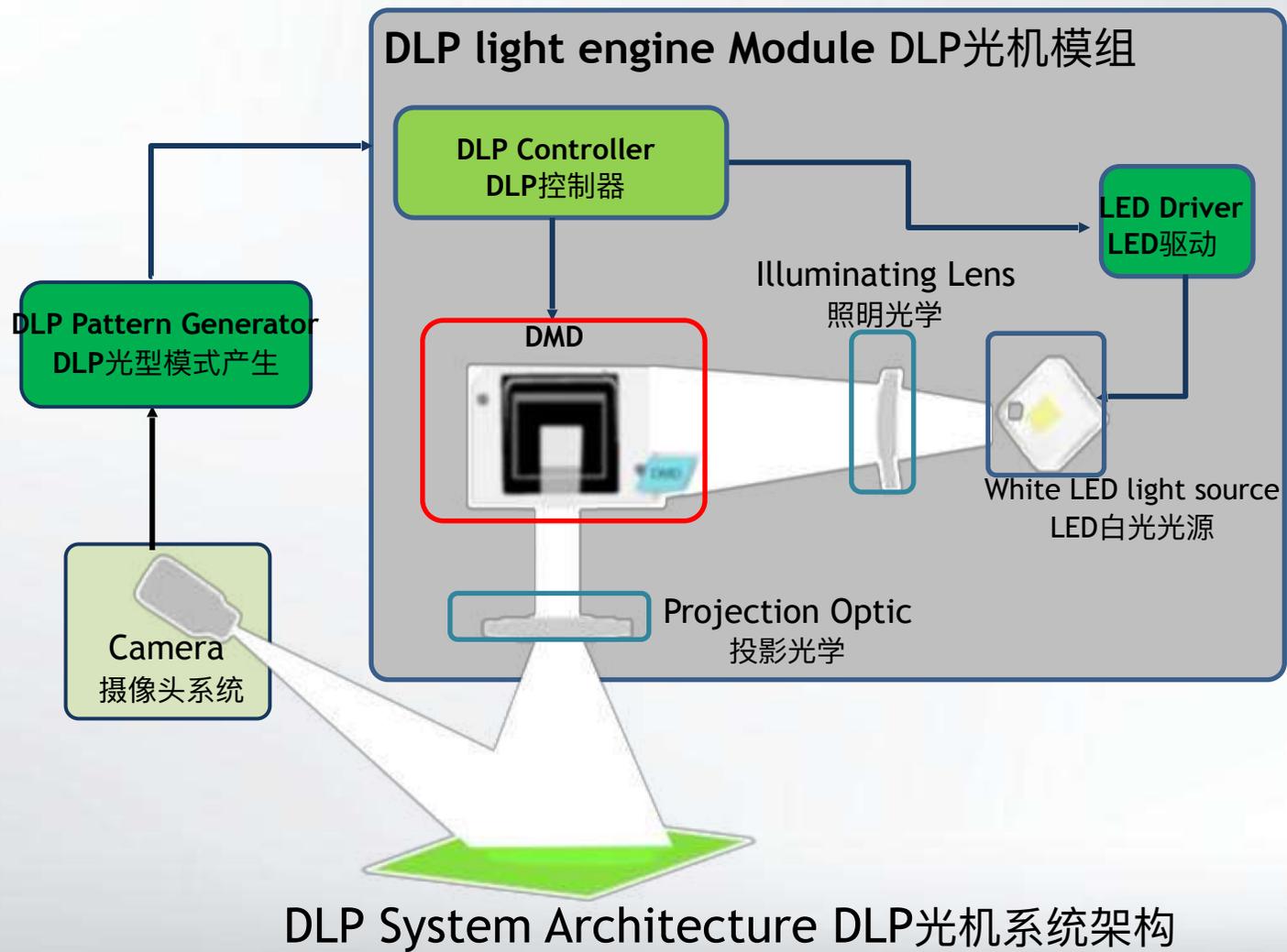
## 二. Pixelated Led and DLP technology 像素化的LED和DLP技术

### 1. Pixelated Led 像素化的LED光源的照明



## 二. Pixelated Led and DLP technology 像素化的LED和DLP技术

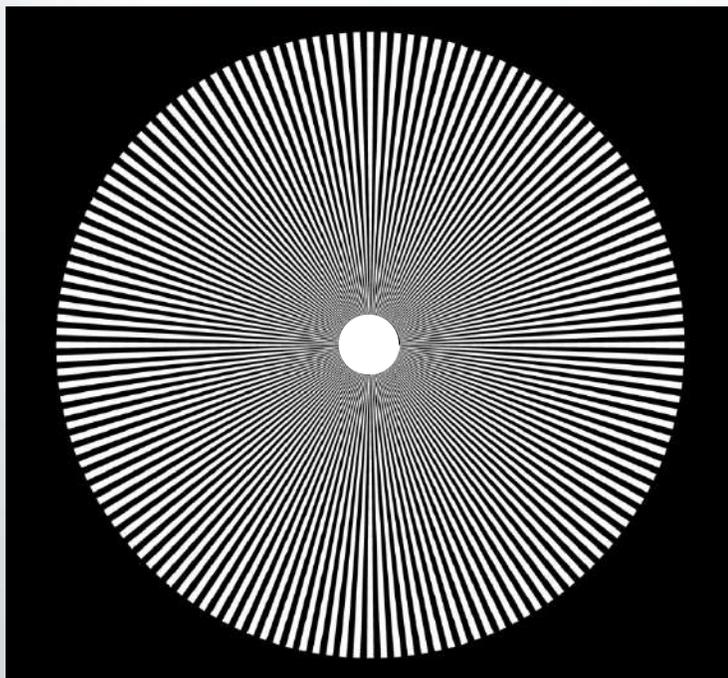
### 2. DLP technology based on DMD 基于DMD芯片的DLP照明技术



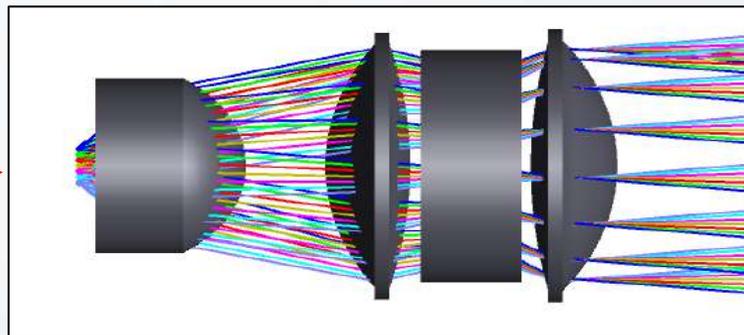
# 三. Optical Systems 光学系统简介

## 1. Image Optics Design 成像光学设计

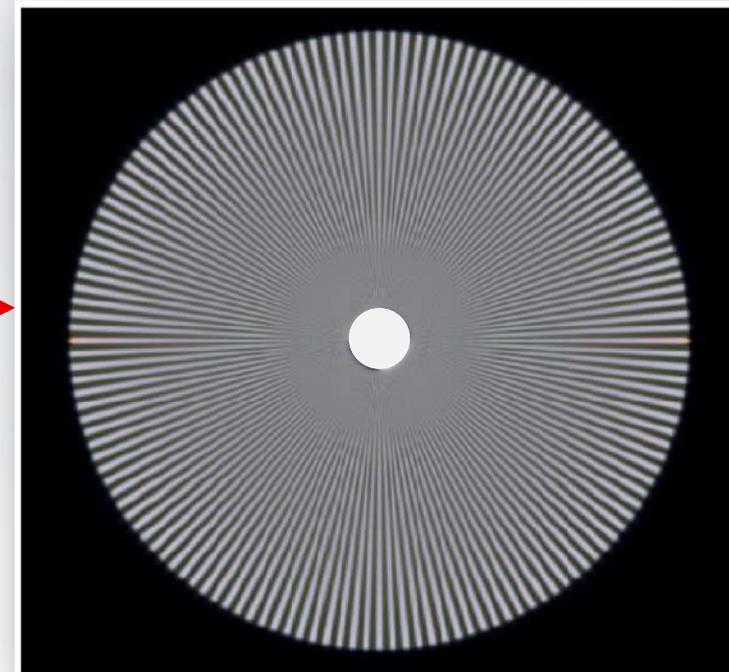
Pattern Input 光型/图形模式输入



Projection Lenses  
成像/投影镜头



Pattern Output 光型/图形模式输出



Imager Device (DMD, LCD, ...)  
Resolution  
成像器件的硬件分辨率

Projection Lens  
Resolution  
投影镜头的光学分辨率

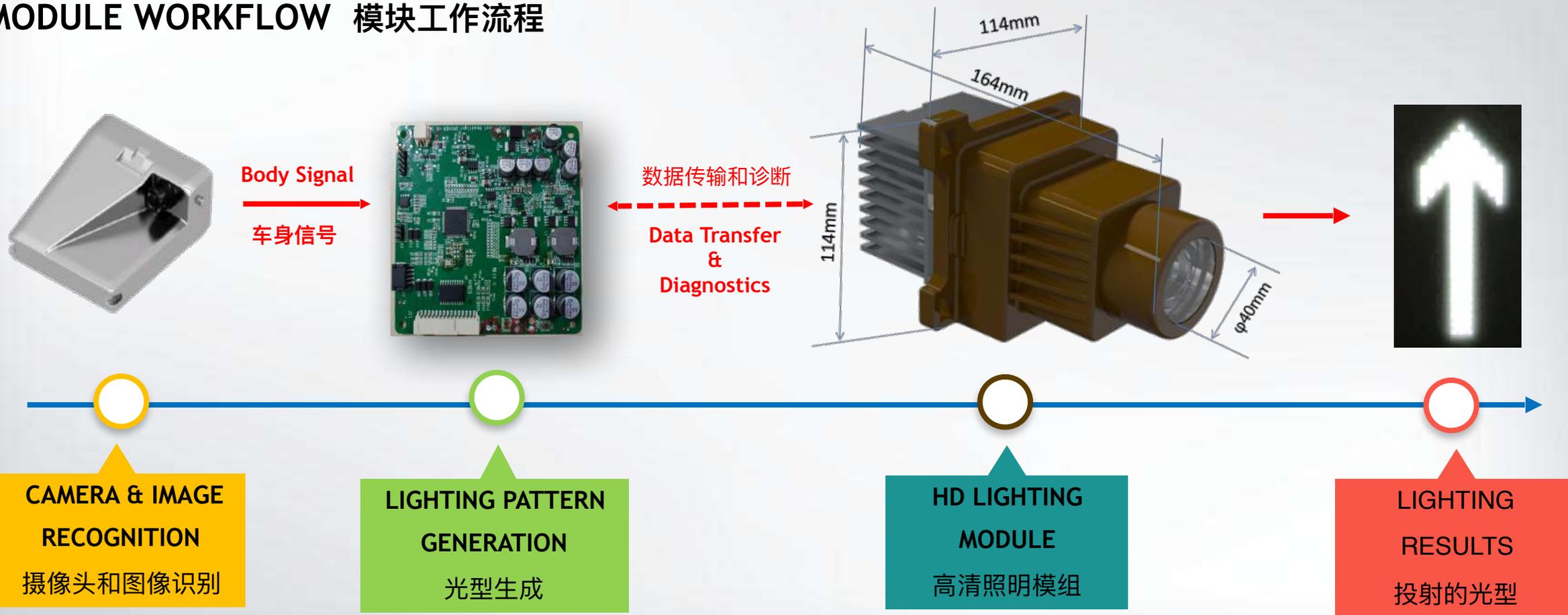
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Result Resolution Output  
最终看到的分辨率

### 三. Optical Systems 光学系统简介

## 2. HD lighting based Pixelated Led 基于LED的千级像素高清照明

### MODULE WORKFLOW 模块工作流程

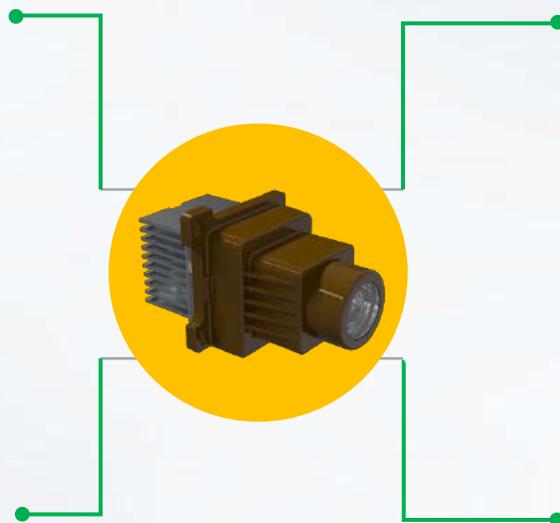
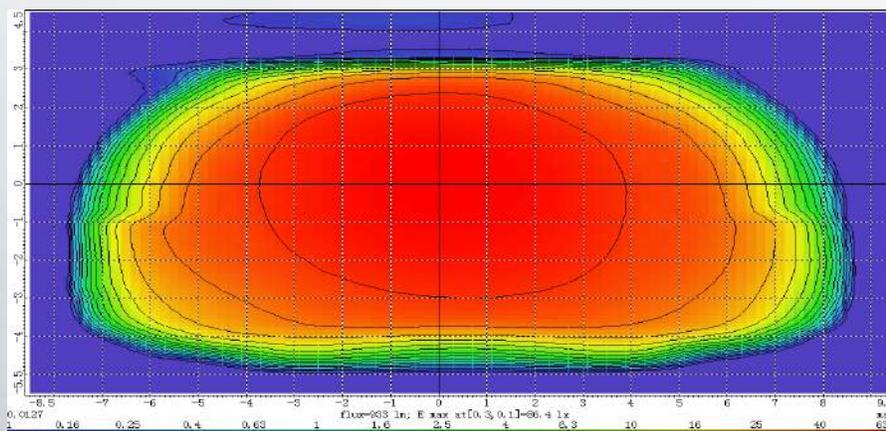
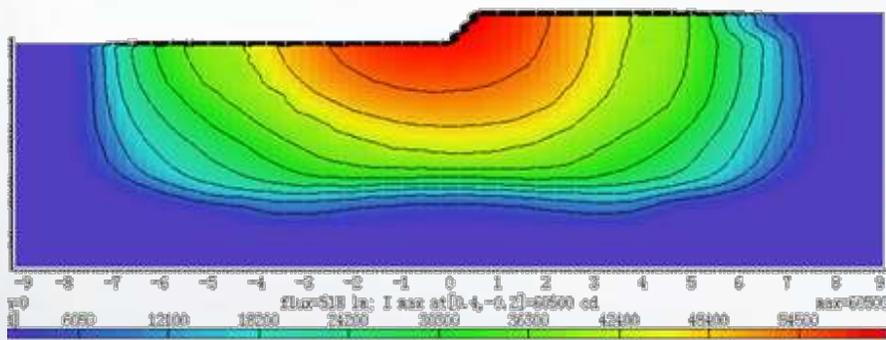


### 三. Optical Systems 光学系统简介

## 2. HD lighting based Pixelated Led 基于LED的千级像素高清照明

### ADAPTATIVE HB / LB

自适应的远光/近光



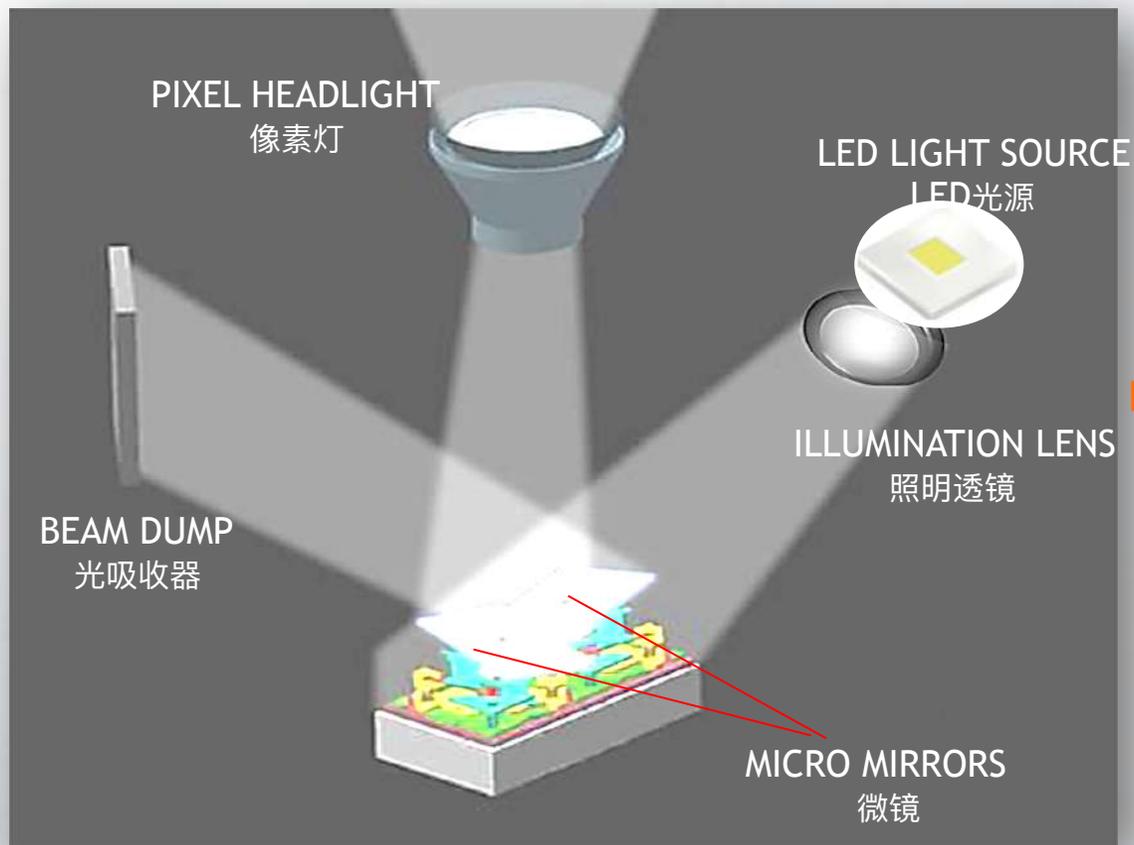
### LINE SYMBOL PROJECTION

线型符号投影

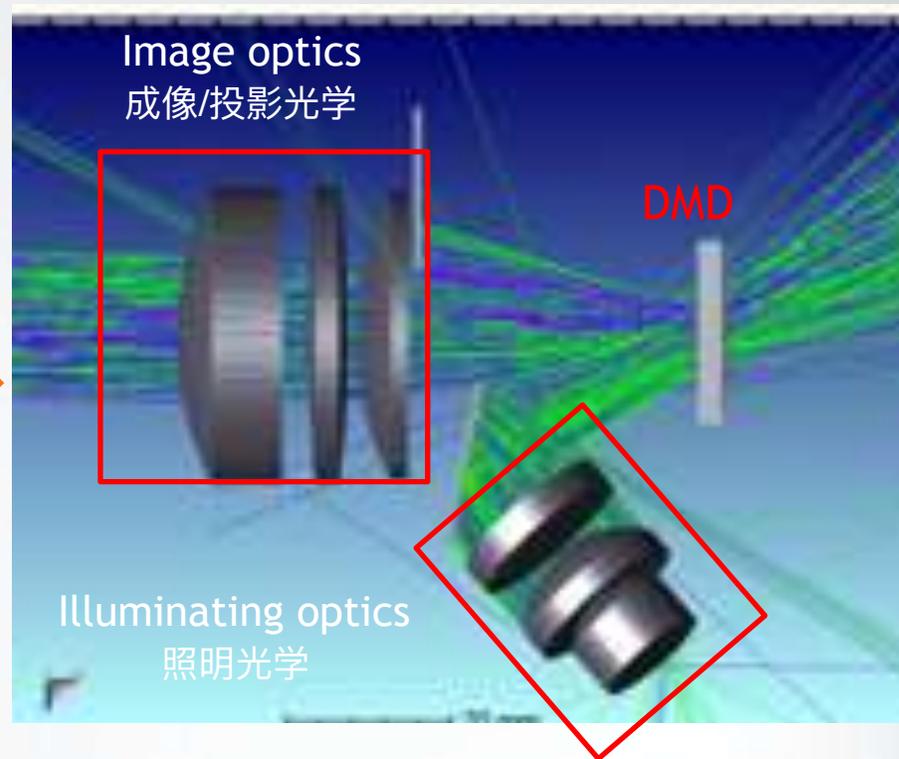


### 三. Optical Systems 光学系统简介

#### 3. Digital Graphic Lighting based DLP technology 基于DLP的数字影像照明



The principle of DLP Technology DLP 技术原理示意图

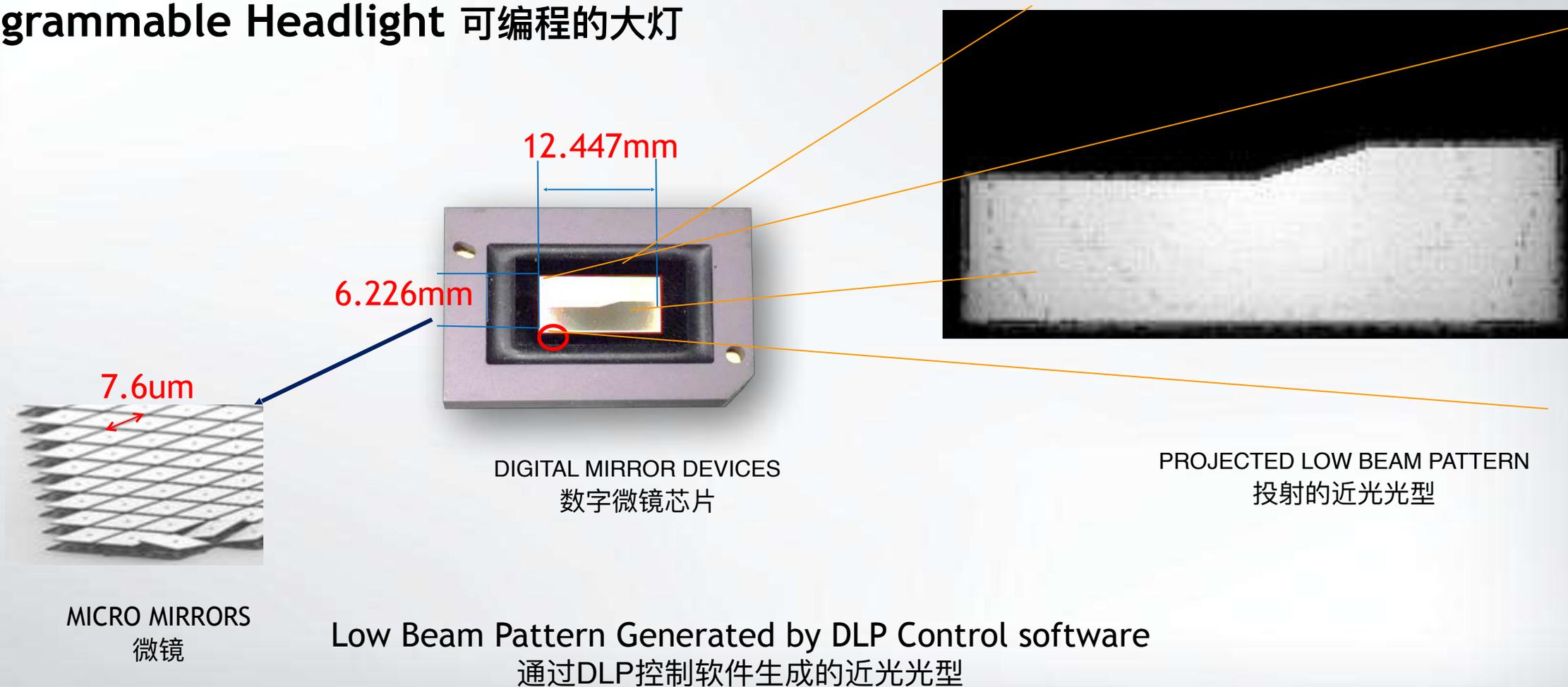


DLP Optics  
DLP光机光学结构

### 三. Optical Systems 光学系统简介

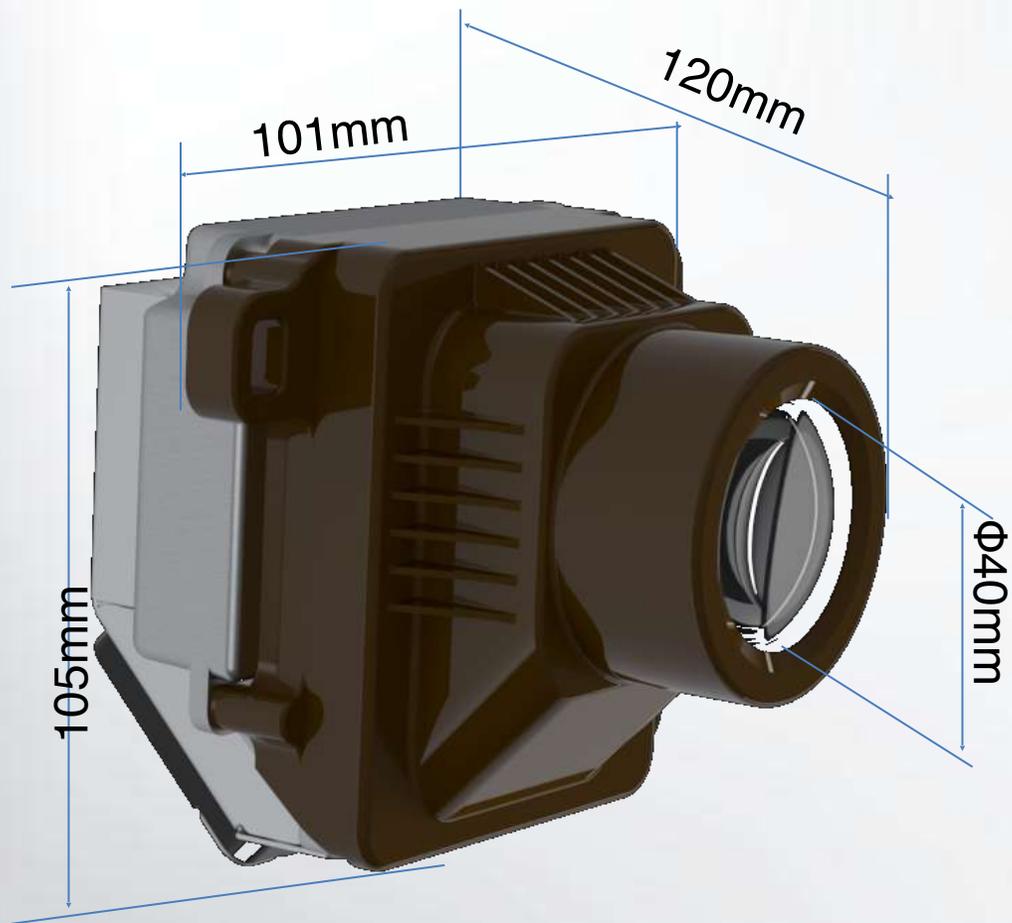
#### 3. Digital Graphic Lighting based DLP technology 基于DLP的数字影像照明

##### Programmable Headlight 可编程的大灯



### 三. Optical Systems 光学系统简介

#### 3. Digital Graphic Lighting based DLP technology 基于DLP的数字影像照明



Digital Graphic Module  
数字影像照明模块



DLP PROTOTYPE & IMAGE PROJECTION  
DLP样机和影像投影

### 三. Optical Systems 光学系统简介

#### 3. Digital Graphic Lighting based DLP technology 基于DLP的数字影像照明

Module Photometry Performance:

模块光度学性能:

FOV =  $16^{\circ} \times 8^{\circ}$

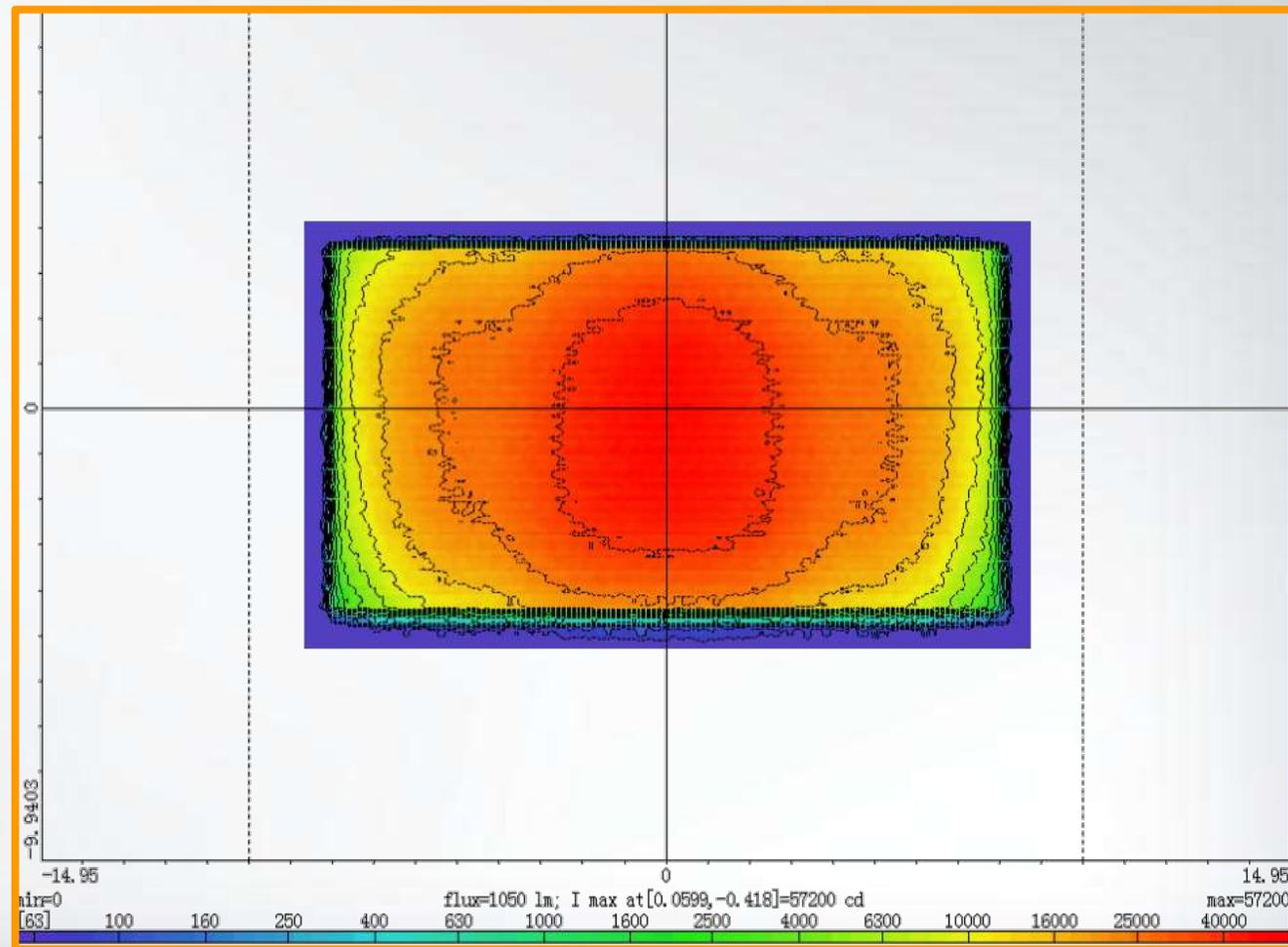
I<sub>max</sub> = 91 Lx@25m

Optical efficiency: 32.9%

Engine lumen output: 1050

lm

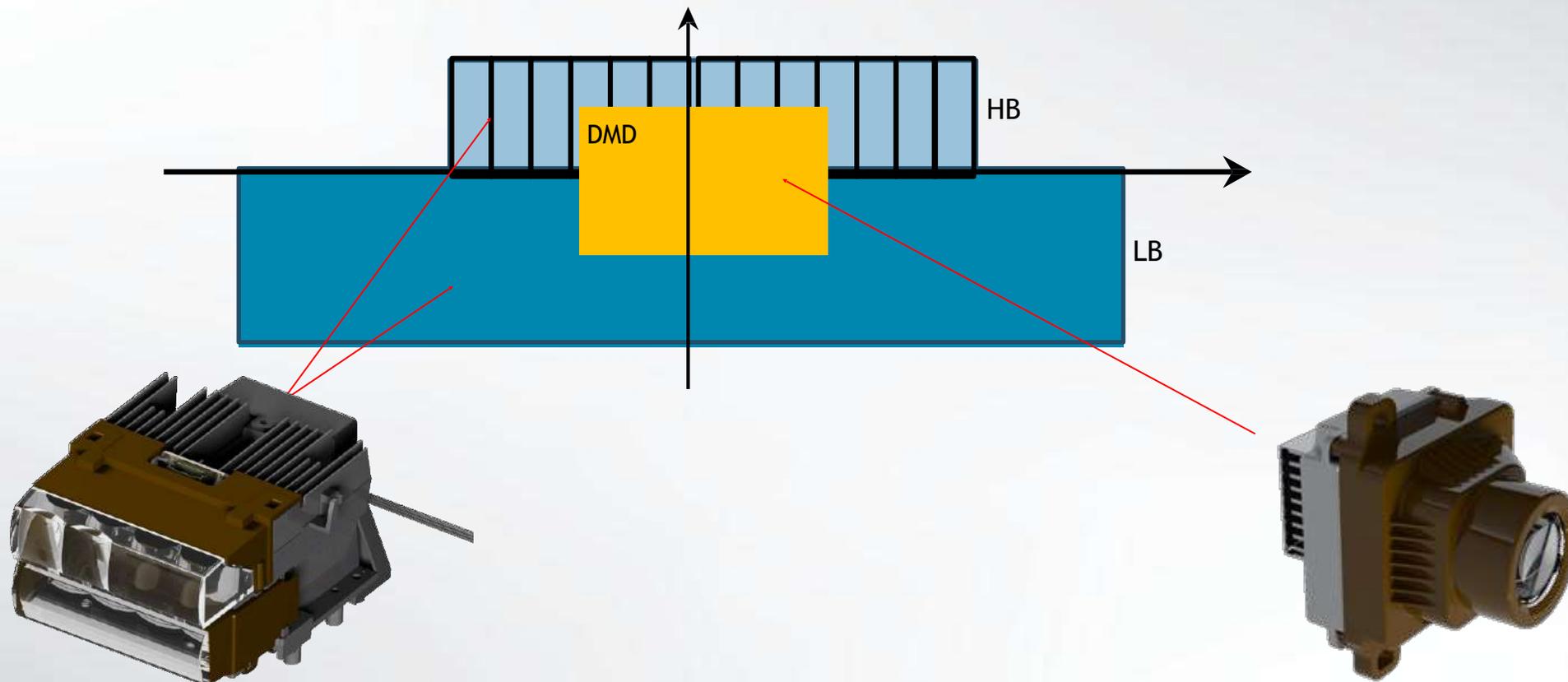
Based on 62% DMD efficiency



### 三. Optical Systems 光学系统简介

#### 3. Digital Graphic Lighting based DLP technology 基于DLP的数字影像照明

DLP Headlamp Structure DLP前大灯组成



Auxiliary Lighting Modules

E.g. with ① ADB module and Low Beam ② Bi-function Lens

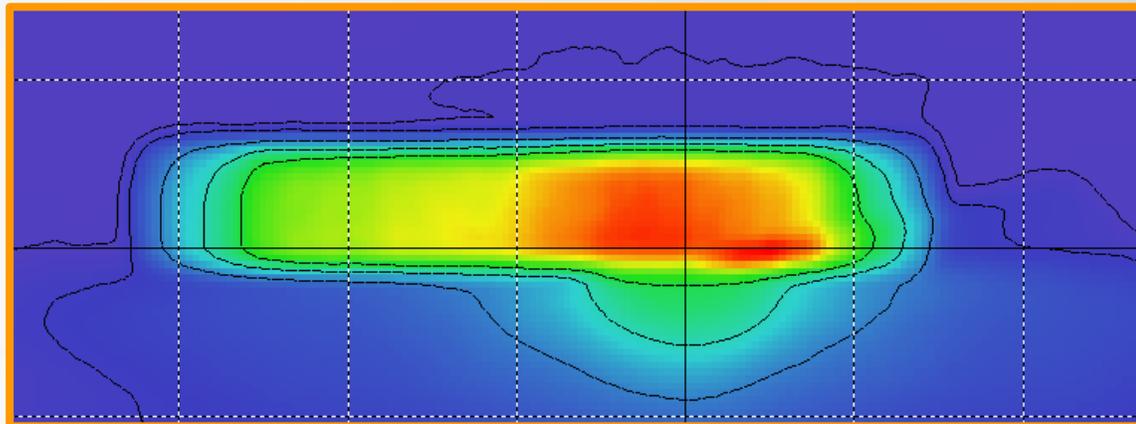
Digital Graphic Module

### 三. Optical Systems 光学系统简介

#### 3. Digital Graphic Lighting based DLP technology 基于DLP的数字影像照明

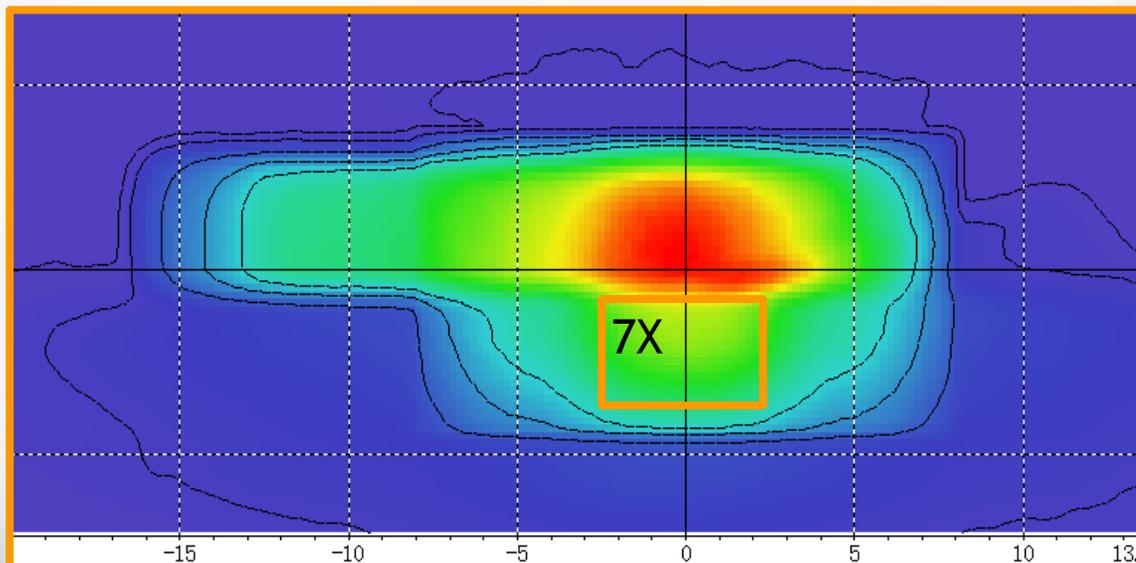
DLP Headlight DLP前大灯

➤ High Beam ( low beam On)



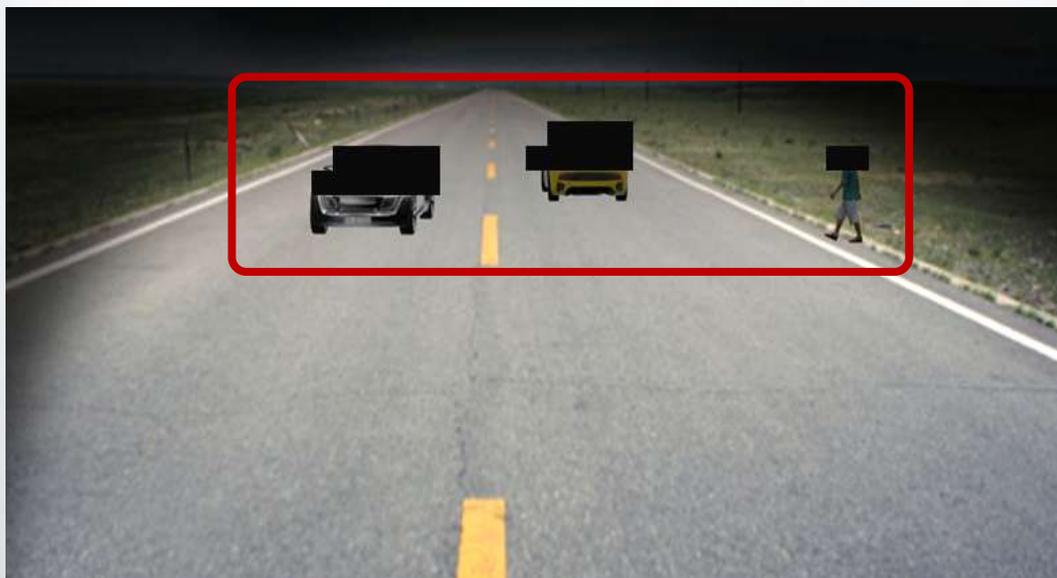
➤ High Beam (low beam On & DMD On)

- ❖ High beam Boost
- ❖ Low beam boost
- ❖ V2X Projection : 7X illuminance

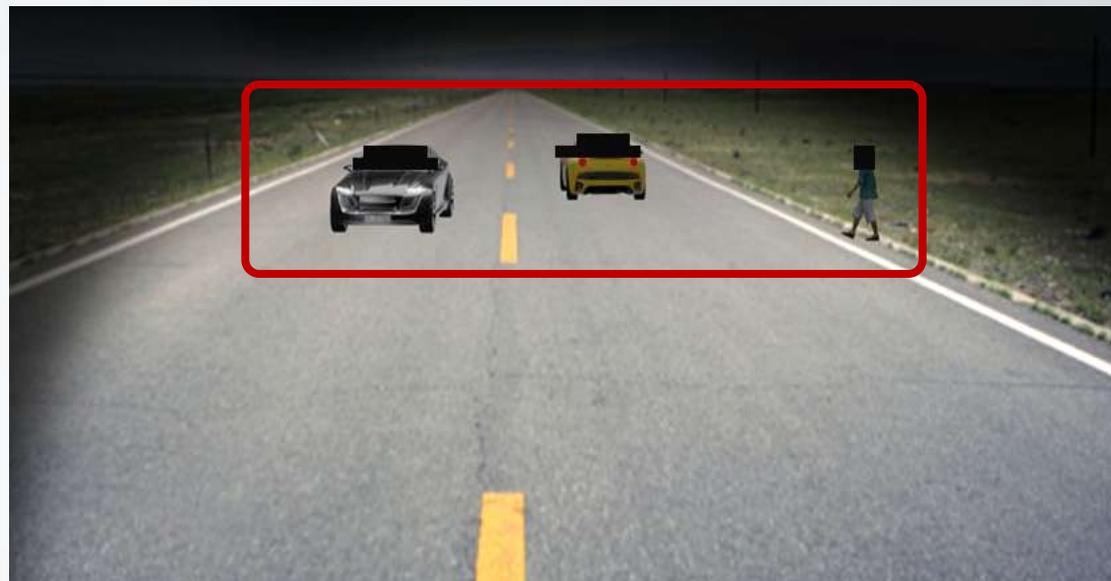


## 四. Result Discussion 结果讨论

### 1. Adaptive Lighting Application 防眩目功能应用



Pixelated Led Solution 像素化的LED方案  
Flux : 1121 Lm



DLP Solution DLP方案  
Flux : 1050 Lm

Although DLP lighting is more precise, 1K+ pixels (  $\sim 0.3^\circ$  ) is enough for automotive lighting , e.g. Glare free high beam, Dynamic bending light, Adverse weather lighting.

DLP照明更精细, 但千级像素对于汽车照明如防眩目、动态弯道照明、恶劣天气照明等应用是完全足够的,

## 四. Result Discussion 结果讨论

### 1. V2X / Communication Application 互联/交互应用



1.3M Pixels (  $\sim 0.05^\circ$  ) is needed for V2X, projecting vivid Info symbols on road.

百万像素的DLP技术能够投射生动的交互信息在路面上，是V2X交互应用所必须的。

## 五. Conclusion 总结



### Cost/成本

- DLP / Pixelated Led



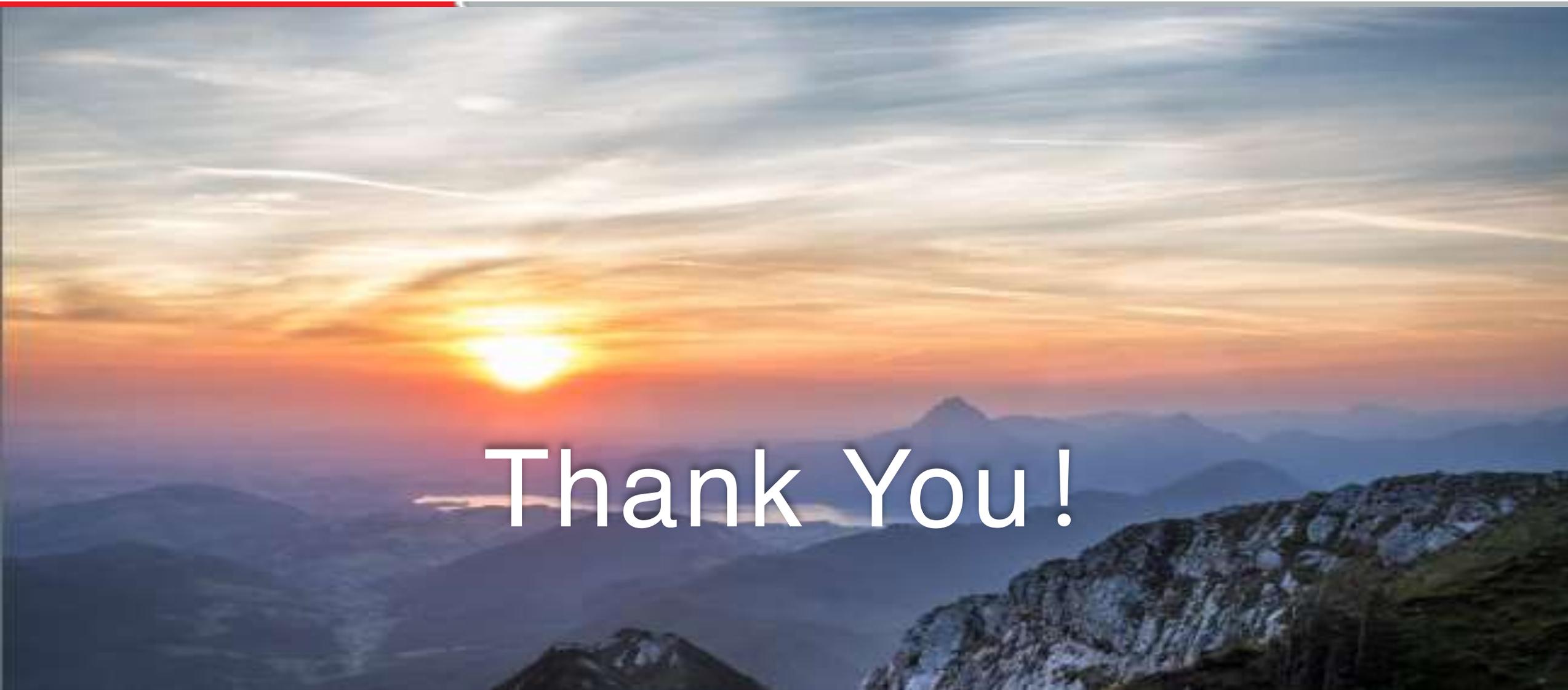
### OEM Market / 市场应用

- High Level Market
- Mid Level Market



### Performance / 性能

- HD Lighting
- V2X / Communication
- Auxiliary lighting module



Thank You!