

Beyond Spherical Limits: How Aspherical Glass Lenses Elevate Automotive Lighting Performance & Design

Lighting all the path of the world with glass aspheric lenses

HUAJU OPTIC
Alex.JIA
Feb.05.2026

CONTENTS

01 The Importance and Development of the Vehicle Headlight Projection System

02 Optical Design in the Projection System with Aspherical Glass Lens

03 Advantages of Glass Aspherical Lenses in HL

04 Company Profile



01

The Importance and Development of the Vehicle Headlight Projection System

- **The transformation of car lighting functions in the era of automotive intelligence: From basic illumination to information interaction and smart projection**
- **Adaptive headlights, intelligent pixel headlights, and the use of colored light projection in vehicle lighting**
- **The significance of the vehicle body projection system in driving safety and improving the driving experience**

01: The Importance and Development of the Vehicle Headlight Projection System

- Transformation of car lighting functions



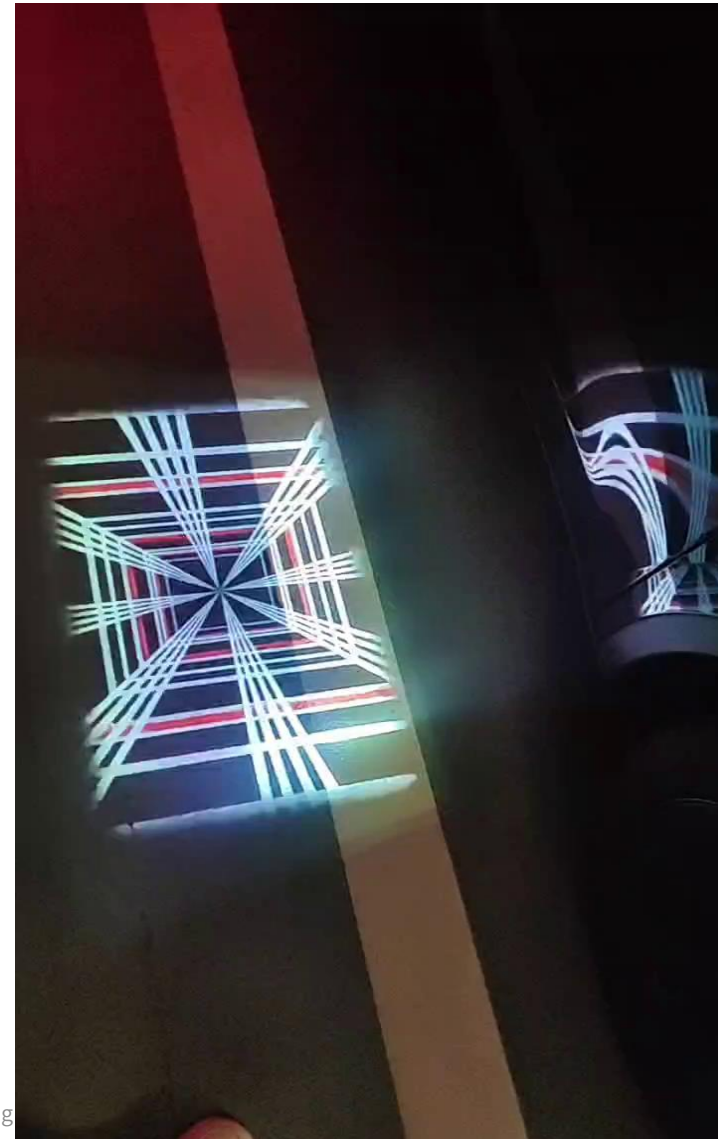
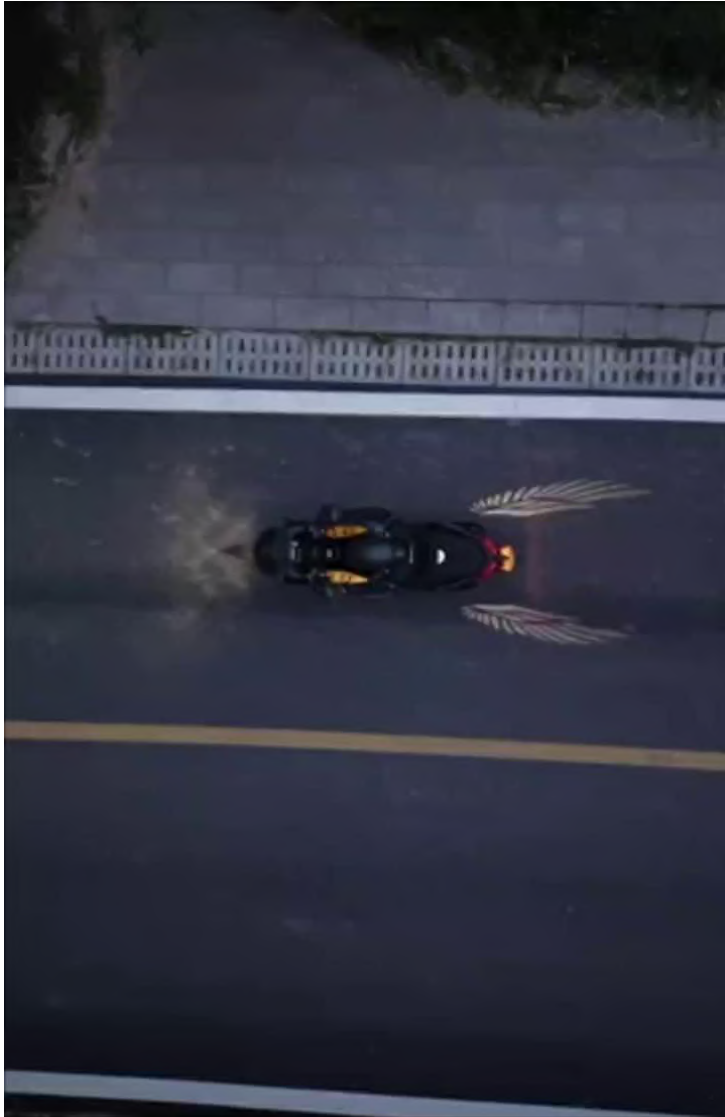
01: The Importance and Development of the Vehicle Headlight Projection System

- Intelligent pixel headlights



01: The Importance and Development of the Vehicle Headlight Projection System

- Colored light projection in vehicle lamps



01: The Importance and Development of the Vehicle Headlight Projection System

- Driving safety and the driving experience

Driving Safety

01

Enhances perception of various environments and information transmission

02

Improves visibility in complex circumstances

03

Reduces the risks of misoperation and crash

01

Direct information interaction

02

Extending the scope of intelligent driving

03

Technology Experience and Brand Differentiation

Driving Experience

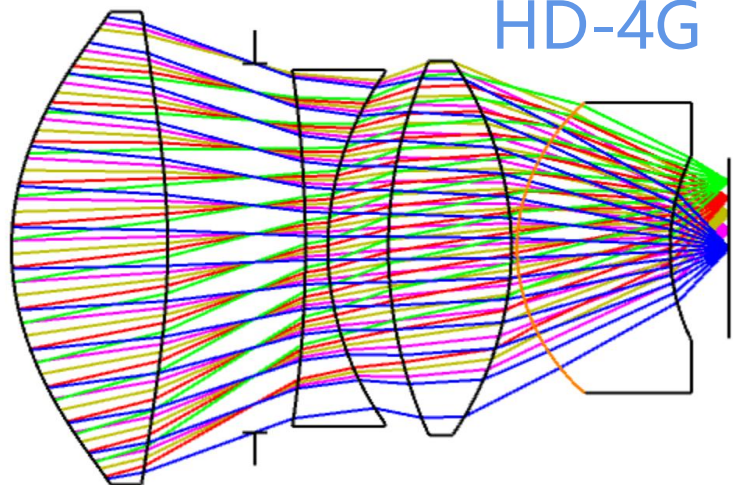
02

Optical Design in the Projection System with Aspherical lens

- **Optical design for Micro LED projector**
- **Optical design for DLP projector**

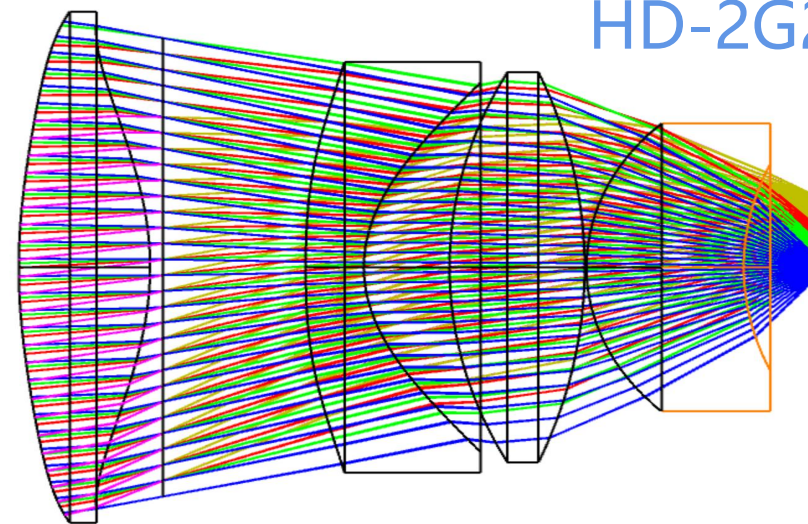
02: Optical design for Micro LED projector

HD-4G

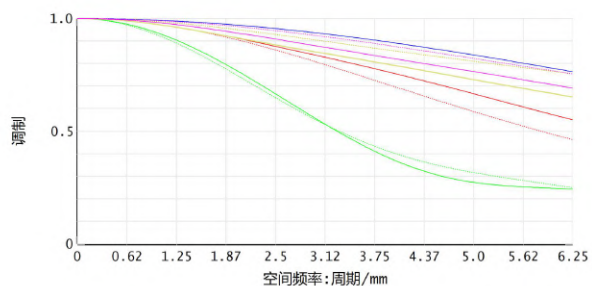


50 mm

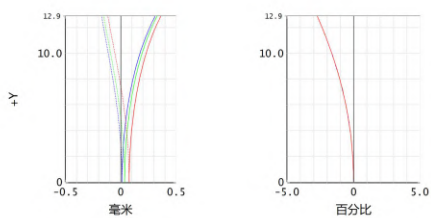
HD-2G2P



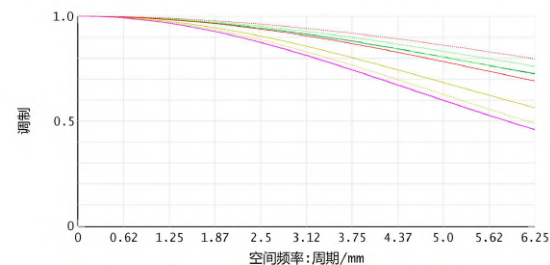
20 mm



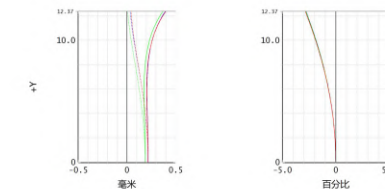
0.0000 mm-子午 0.0000 mm-弧矢 6.8000 mm-子午 6.8000 mm-弧矢 5.1000 mm-子午
5.1000 mm-弧矢 3.4000 mm-子午 3.4000 mm-弧矢 1.7000 mm-子午 1.7000 mm-弧矢



0.4800-子午的弧 0.4600-弧矢的弧 0.5250-子午的弧 0.5250-弧矢的弧 0.6170-弧矢的弧	0.4600-子午的弧 0.5250-弧矢的弧
125/5/16 大 弧矢差 12.892度 实际场曲 = 0.1895 毫米 平均场曲 = 0.2955 毫米 像对轴子波长	2025/5/16 最大 弧矢差 12.892度 最大畸变 = 2.7357% H008_zmk 1的结构1

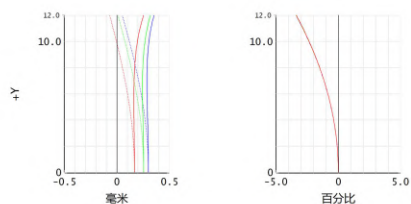
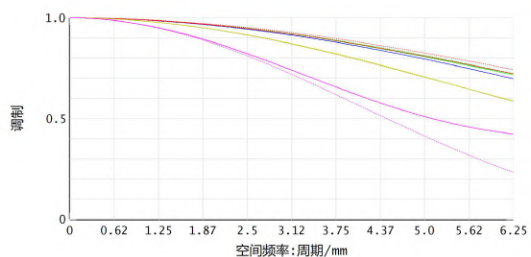
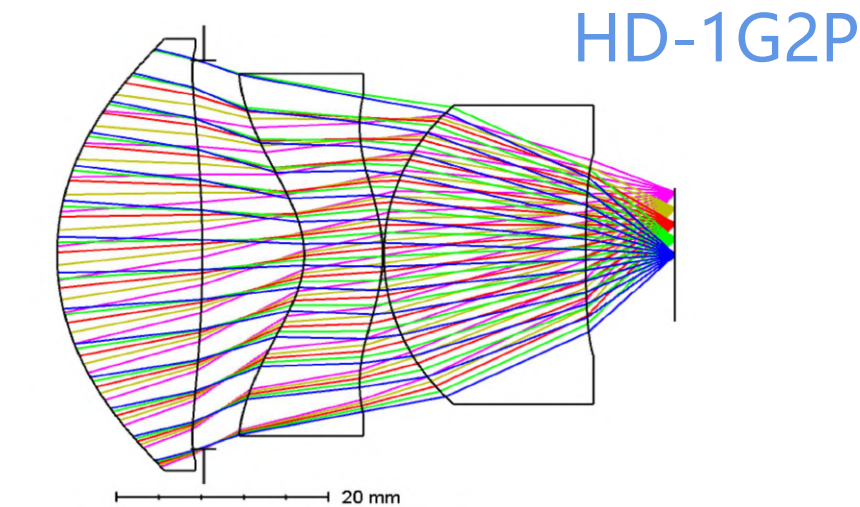
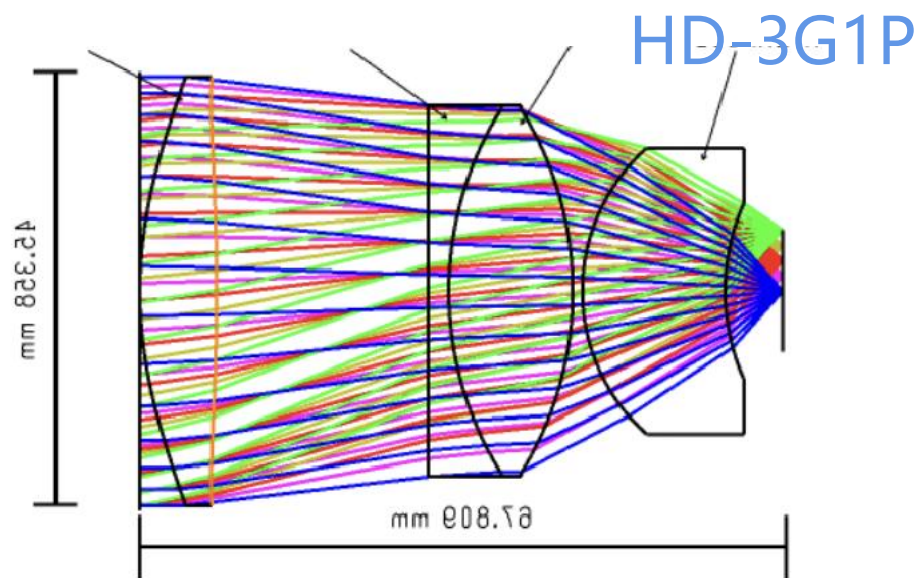


0.00, 0.00 (度)-子午 0.00, 0.00 (度)-弧矢 0.00, 3.00 (度)-子午 0.00, 3.00 (度)-弧矢 0.00, 6.00 (度)-子午
0.00, 6.00 (度)-弧矢 0.00, 12.00 (度)-子午 0.00, 12.00 (度)-弧矢 3.00, 12.00 (度)-子午 3.00, 12.00 (度)-弧矢

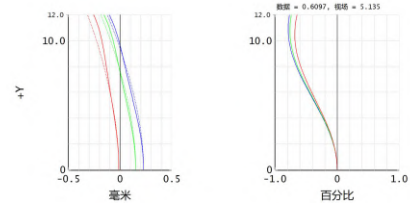
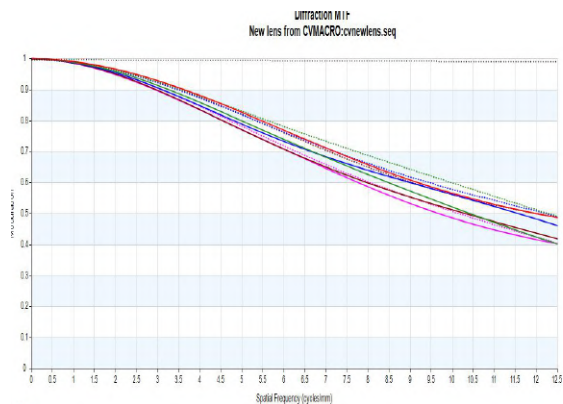


0.4440-子午的弧 0.4440-弧矢的弧 0.5400-子午的弧 0.5400-弧矢的弧 0.4180-子午的弧 0.4180-弧矢的弧	0.4440-子午的弧 0.5400-弧矢的弧 0.4180-子午的弧 0.4180-弧矢的弧
1218170_0P760 2025/5/16 最大 弧矢差 12.369度 实际场曲 = 0.1806 毫米 平均场曲 = 0.1945 毫米 像对轴子波长	1218170_0P760 2025/5/16 最大 弧矢差 12.369度 最大畸变 = 2.8062% 2FG-OBT_zmk 1的结构2

02: Optical design for Micro LED projector

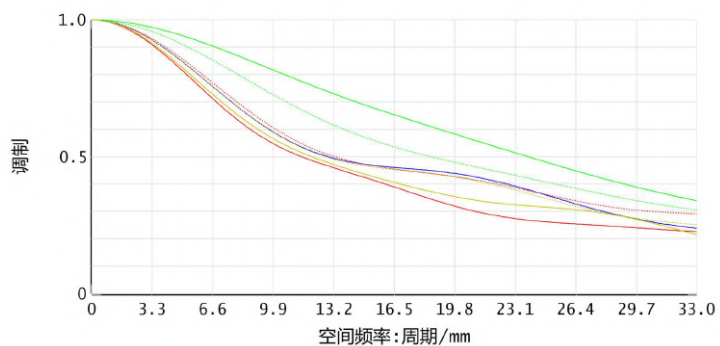
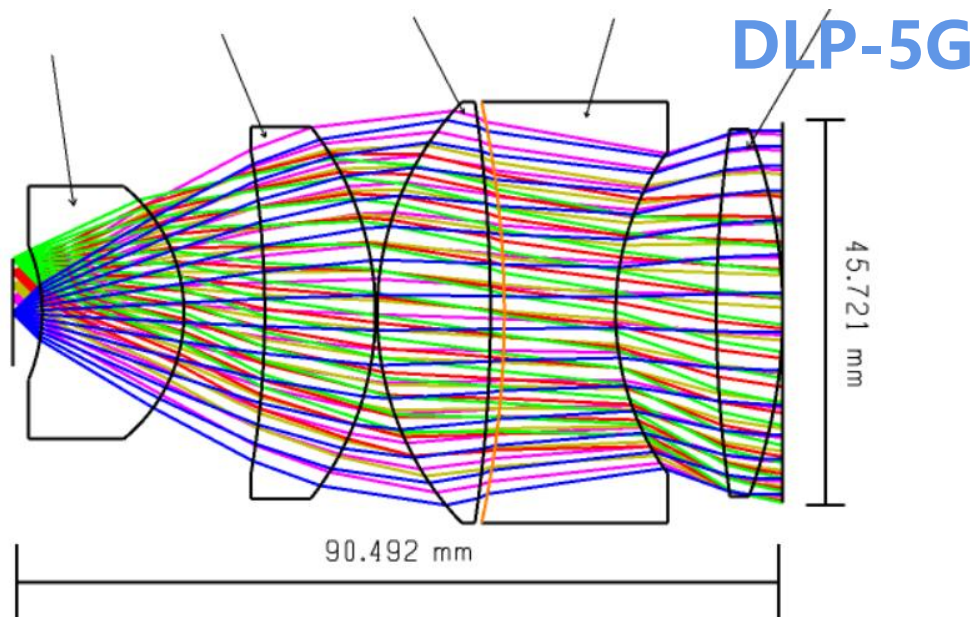


<p>new lens from CVMACRO:cvnewlens.seq</p> <p>2025/5/16</p> <p>最大视场角 = 12.000度</p> <p>最大像高 = 0.2459 毫米</p> <p>子午畸变 = 0.0795 毫米</p> <p>影响因子波长</p>	<p>New lens from CVMACRO:cvnewlens.seq</p> <p>2025/5/16</p> <p>最大视场角 = 12.000度</p> <p>最大像高 = 3.3937%</p>	<p>F-Tan(Theta) 畸变</p> <p>畸变 = 0.6563 畸变 = 0.5876 畸变 = 0.4861</p>
--------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------

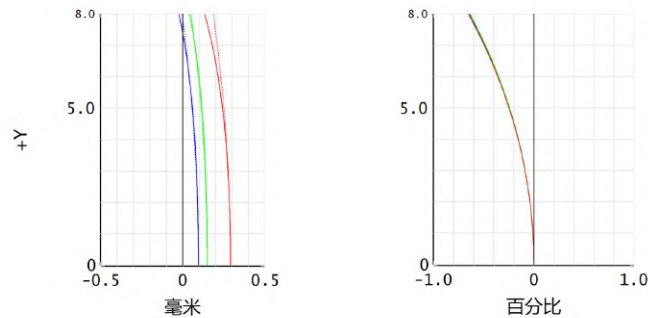


<p>new lens from CVMACRO:cvnewlens.seq</p> <p>2025/5/16</p> <p>最大视场角 = 12.000度</p> <p>最大像高 = 0.3390 毫米</p> <p>子午畸变 = 0.3084 毫米</p> <p>影响因子波长</p>	<p>New lens from CVMACRO:cvnewlens.seq</p> <p>2025/5/16</p> <p>最大视场角 = 12.000度</p> <p>最大像高 = 3.3937%</p>	<p>F-Tan(Theta) 畸变</p> <p>畸变 = 0.6097 畸变 = 5.135</p>
--------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------	------------------------------------------------------

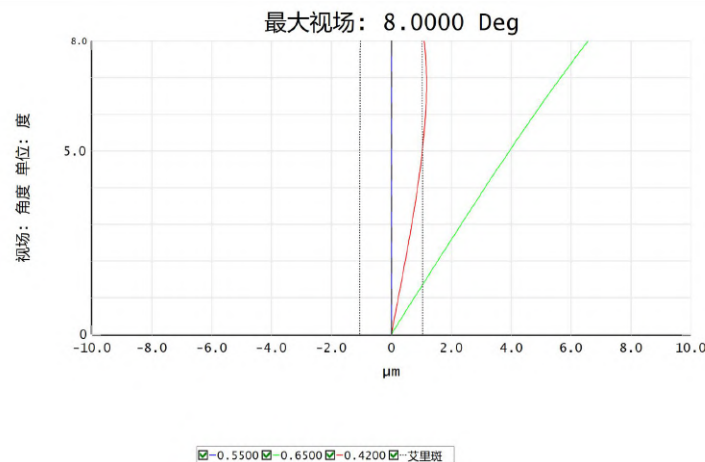
02: Optical design for DLP projector



0.0000 (度)-子午 0.0000 (度)-弧矢 8.0000 (度)-子午 8.0000 (度)-弧矢
 5.3333 (度)-子午 5.3333 (度)-弧矢 2.6667 (度)-子午 2.6667 (度)-弧矢



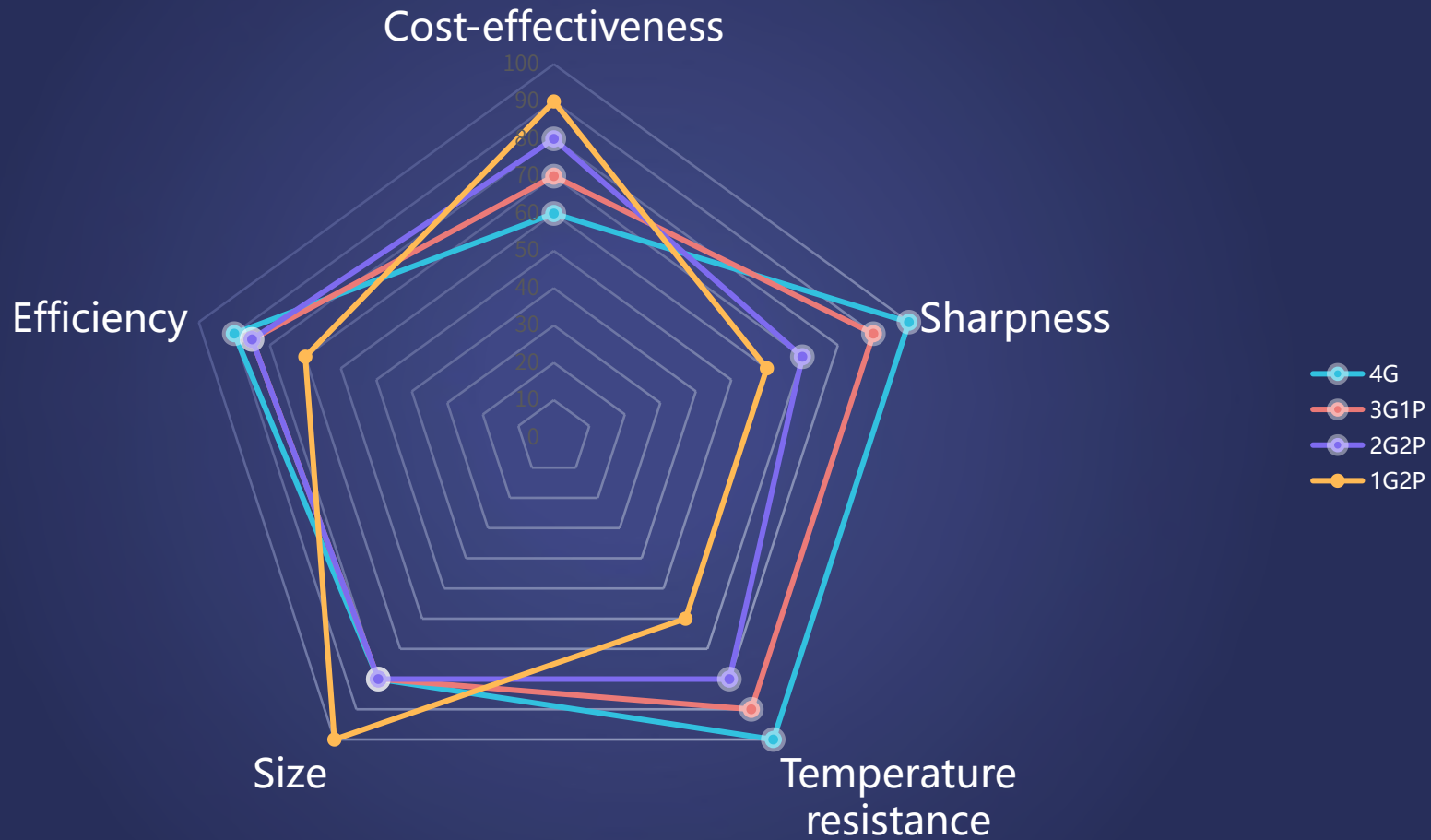
场曲	F-Tan(Theta) 畸变
2025/5/16 最大 视场是 8.0000 度. 弧矢场曲 = 0.1000 毫米 子午场曲 = 0.1199 毫米 图例对应于波长	2025/5/16 最大 视场是 8.0000 度. 最大畸变 = 0.6427% 20250515.zmx 1的结构1



0.5500 0.6500 0.4200 艾里斑

02: Optical design in the projection system

Design performance analysis for projector



03

Advantages of Glass Aspherical Lenses in HL

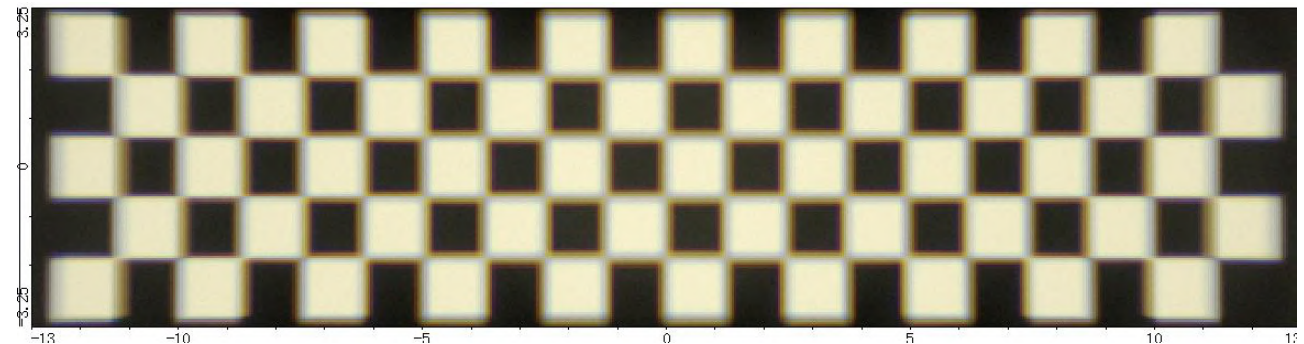
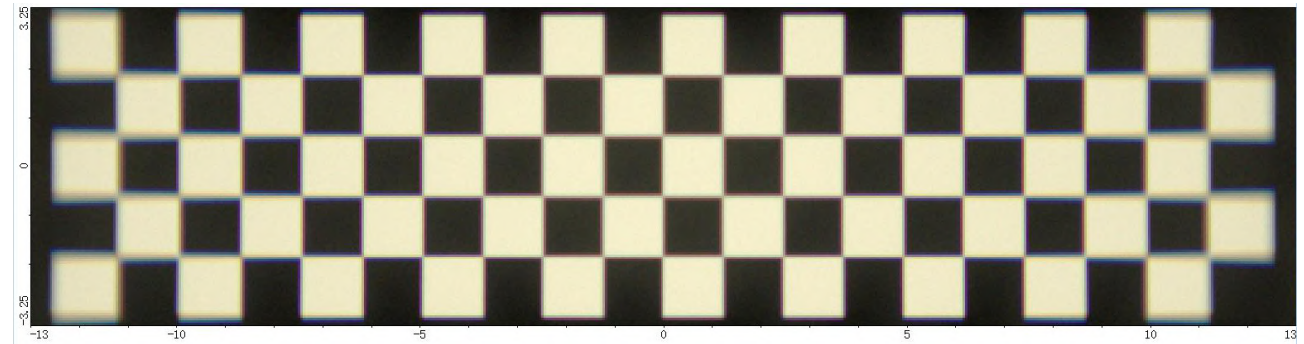
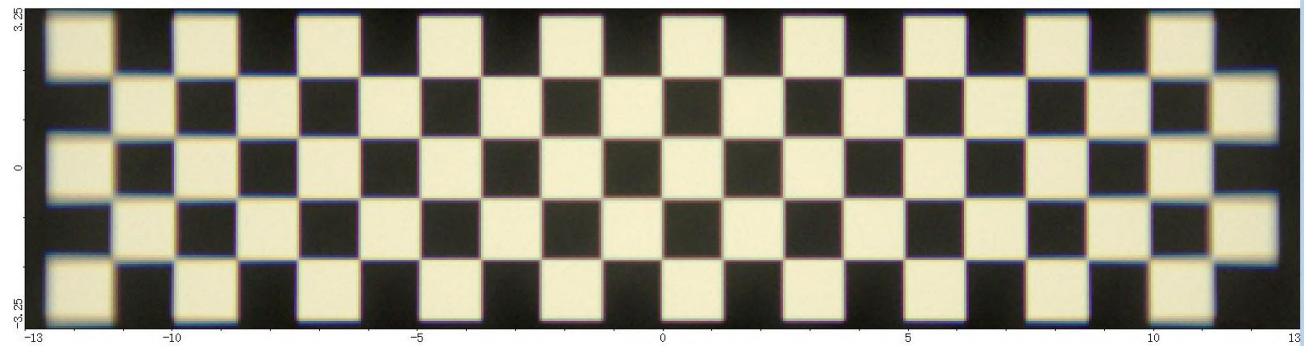
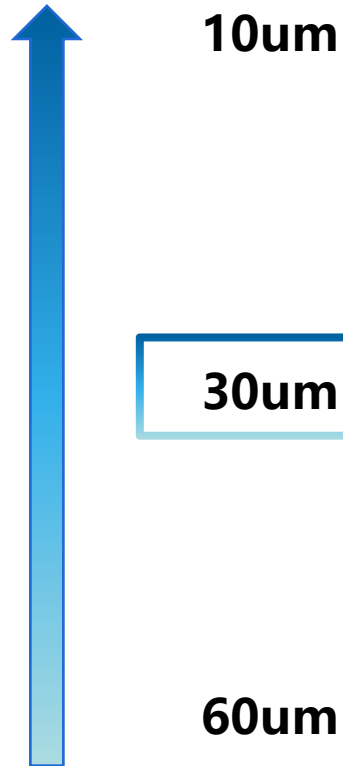
- **Glass Aspherical Lenses in HB/LB**
- **The influence of aspheric accuracy on projection effect**
- **The application of Glass aspheric surfaces in optical design**

03: Advantages of Glass Aspherical Lenses in HB/LB

Comparison Dimension	Glass Aspherical Lens	Plastic Aspherical Lens
Optical Performance	High	Medium (significant thermally)
Light Efficiency	High	Medium-High (prone to attenuation)
Thermal Stability	Excellent	Poor (deformation and yellowing effect)
Service Life	Long	Short (3-5 years, prone to aging)
Cost for lens	High	Medium-High dimension thickness
Cost for Tooling	Very low	High
Environmental Physical recycling rate	95% >90% optical-grade reuse	10% zero optical-grade recycling

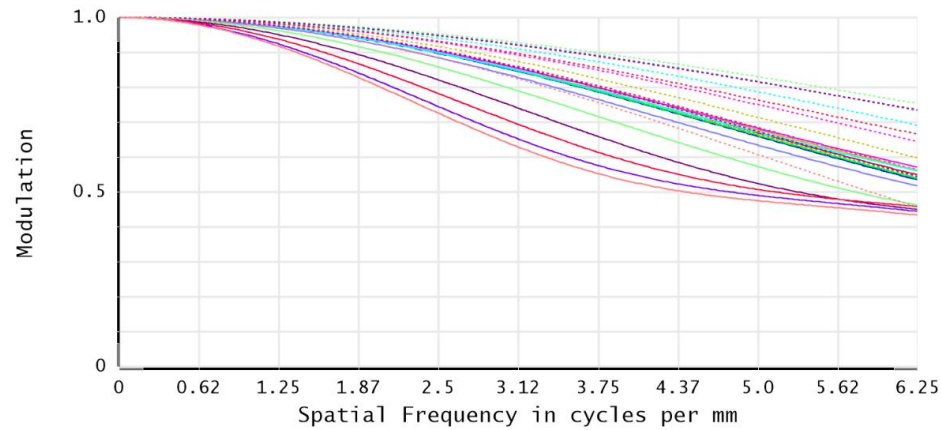
03: Glass aspheric lenses in Optical design

- The influence of aspheric accuracy on projection effect



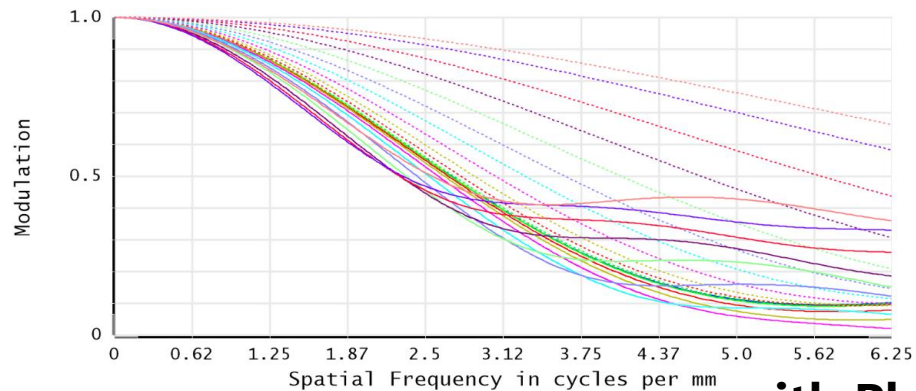
03: Glass aspheric lenses in Optical design

- The application of Glass aspheric surfaces in optical design



0.00 (deg)-Tangential	0.00 (deg)-Sagittal	1.18 (deg)-Tangential	1.18 (deg)-Sagittal	2.36 (deg)-Tangential	2.36 (deg)-Sagittal
3.55 (deg)-Tangential	3.55 (deg)-Sagittal	4.73 (deg)-Tangential	4.73 (deg)-Sagittal	5.91 (deg)-Tangential	5.91 (deg)-Sagittal
7.09 (deg)-Tangential	7.09 (deg)-Sagittal	8.27 (deg)-Tangential	8.27 (deg)-Sagittal	9.45 (deg)-Tangential	9.45 (deg)-Sagittal
10.64 (deg)-Tangential	10.64 (deg)-Sagittal	11.82 (deg)-Tangential	11.82 (deg)-Sagittal	12.50 (deg)-Tangential	12.50 (deg)-Sagittal

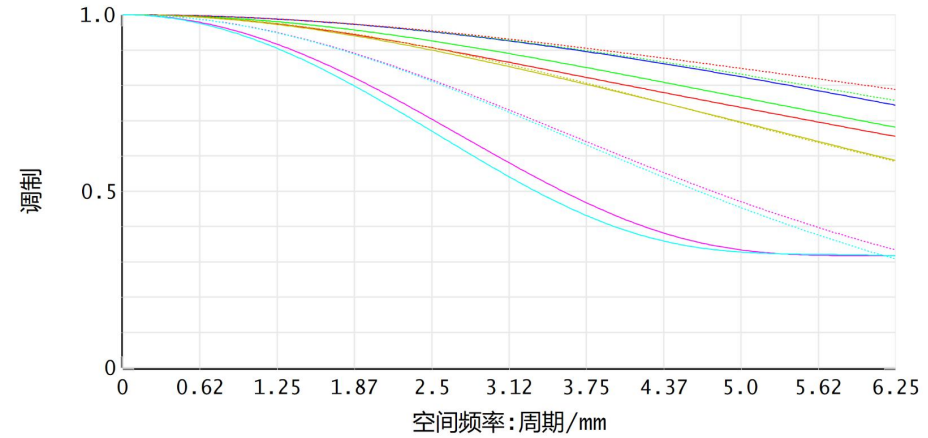
Polychromatic Geometric MTF



0.00 (deg)-Tangential	0.00 (deg)-Sagittal	1.18 (deg)-Tangential	1.18 (deg)-Sagittal	2.36 (deg)-Tangential	2.36 (deg)-Sagittal
3.55 (deg)-Tangential	3.55 (deg)-Sagittal	4.73 (deg)-Tangential	4.73 (deg)-Sagittal	5.91 (deg)-Tangential	5.91 (deg)-Sagittal
7.09 (deg)-Tangential	7.09 (deg)-Sagittal	8.27 (deg)-Tangential	8.27 (deg)-Sagittal	9.45 (deg)-Tangential	9.45 (deg)-Sagittal
10.64 (deg)-Tangential	10.64 (deg)-Sagittal	11.82 (deg)-Tangential	11.82 (deg)-Sagittal	12.50 (deg)-Tangential	12.50 (deg)-Sagittal

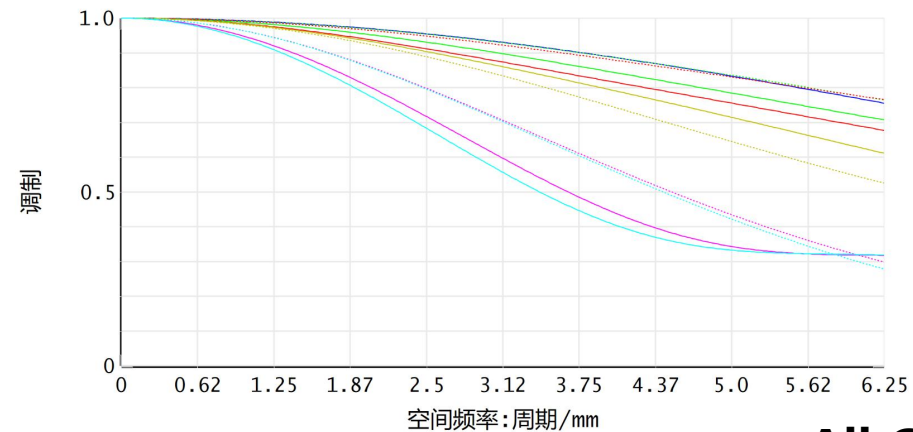
Polychromatic Geometric MTF

with Plastics



25°C

<input checked="" type="checkbox"/> 0.0000 mm-子午	<input checked="" type="checkbox"/> 0.0000 mm-弧矢	<input checked="" type="checkbox"/> 1.6000 mm-子午	<input checked="" type="checkbox"/> 1.6000 mm-弧矢	<input checked="" type="checkbox"/> 3.2000 mm-子午	<input checked="" type="checkbox"/> 3.2000 mm-弧矢
<input checked="" type="checkbox"/> 4.8000 mm-子午	<input checked="" type="checkbox"/> 4.8000 mm-弧矢	<input checked="" type="checkbox"/> 6.6000 mm-子午	<input checked="" type="checkbox"/> 6.6000 mm-弧矢	<input checked="" type="checkbox"/> 6.8000 mm-子午	<input checked="" type="checkbox"/> 6.8000 mm-弧矢



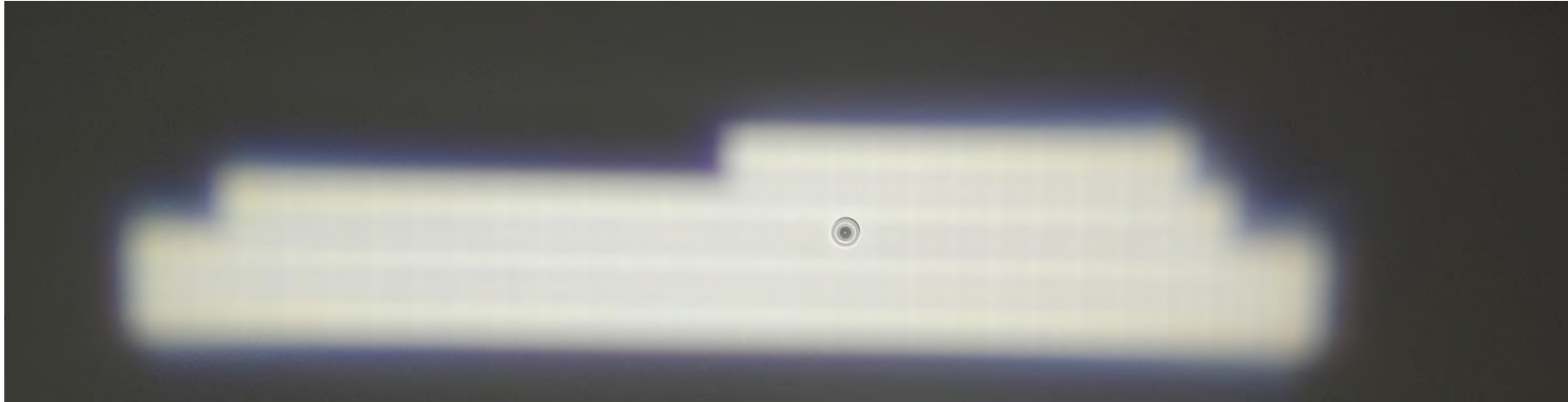
90°C

All Glass

<input checked="" type="checkbox"/> 0.0000 mm-子午	<input checked="" type="checkbox"/> 0.0000 mm-弧矢	<input checked="" type="checkbox"/> 1.6000 mm-子午	<input checked="" type="checkbox"/> 1.6000 mm-弧矢	<input checked="" type="checkbox"/> 3.2000 mm-子午	<input checked="" type="checkbox"/> 3.2000 mm-弧矢
<input checked="" type="checkbox"/> 4.8000 mm-子午	<input checked="" type="checkbox"/> 4.8000 mm-弧矢	<input checked="" type="checkbox"/> 6.6000 mm-子午	<input checked="" type="checkbox"/> 6.6000 mm-弧矢	<input checked="" type="checkbox"/> 6.8000 mm-子午	<input checked="" type="checkbox"/> 6.8000 mm-弧矢

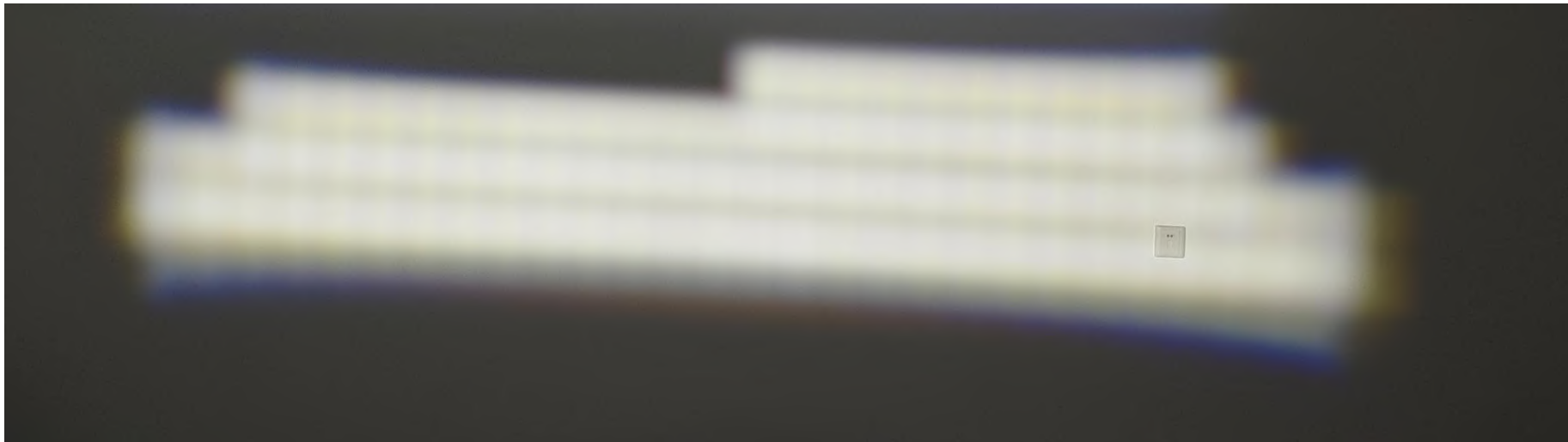
- The application of Glass aspheric surfaces in optical design

Application case **100Pix**



with glass aspheric:

1GS+1GA

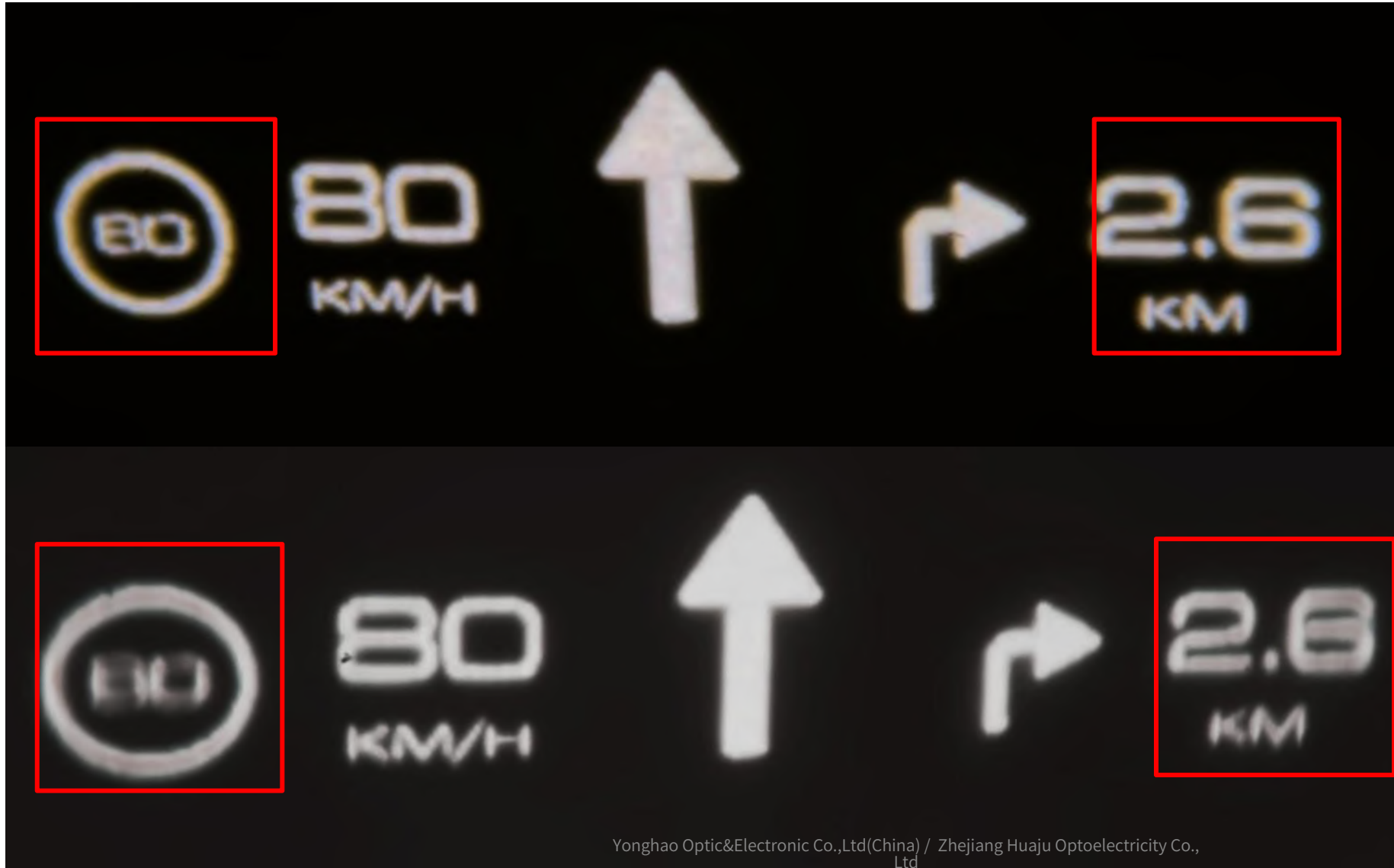


**without
glass aspheric:**

1GS+2P

● The application of Glass aspheric surfaces in optical design

Application case 25K Pixel



with glass aspheric:

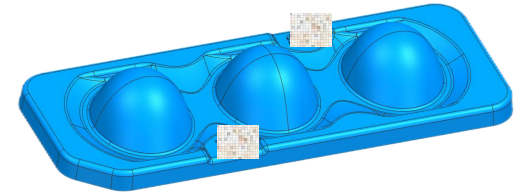
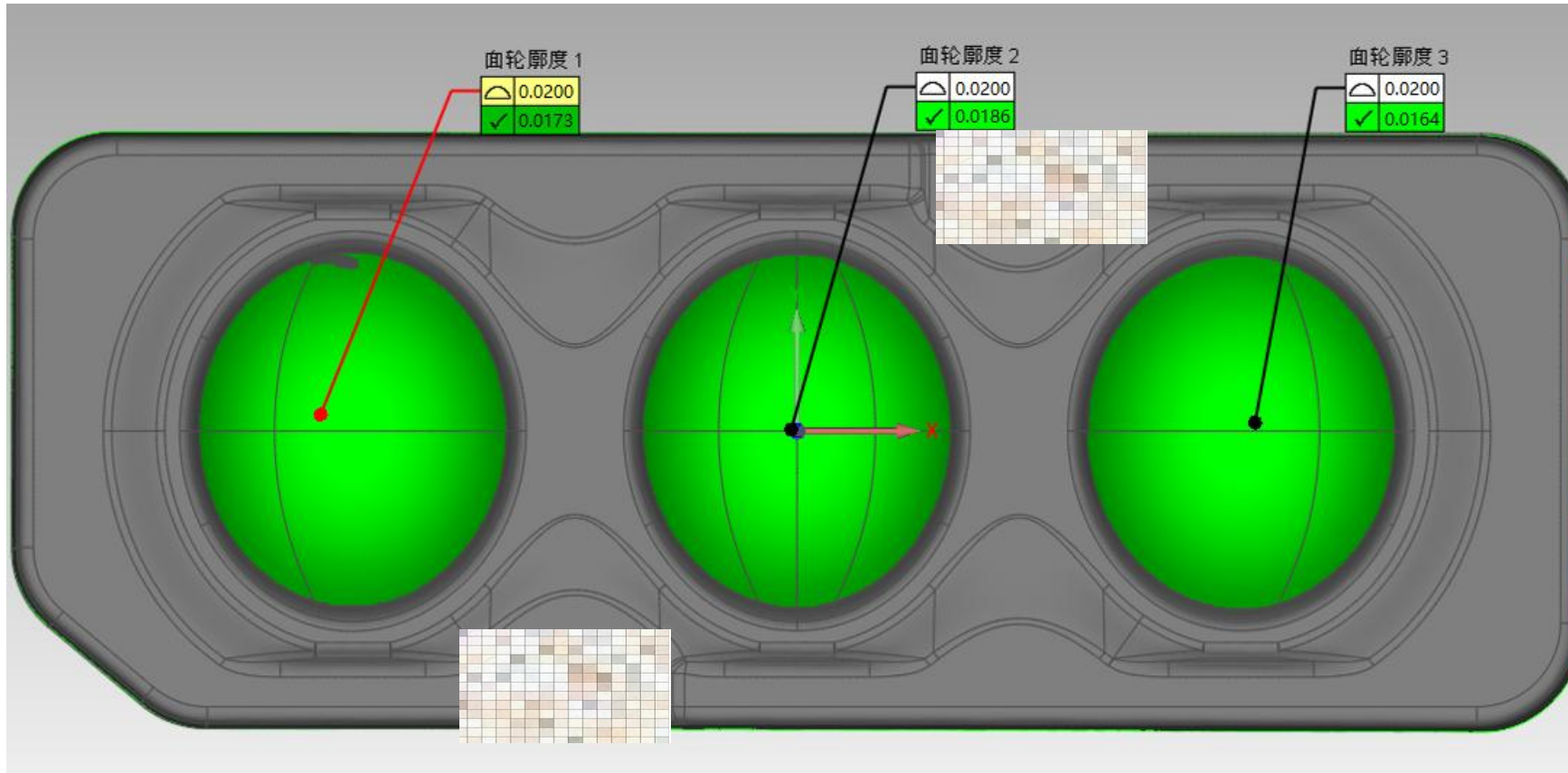
3 GSpherical
1 Glass ASpherical

without
glass aspheric:

3 Gspherical
1 PMMA

- The application of Glass aspheric surfaces in optical design

- Collimator for DLP system



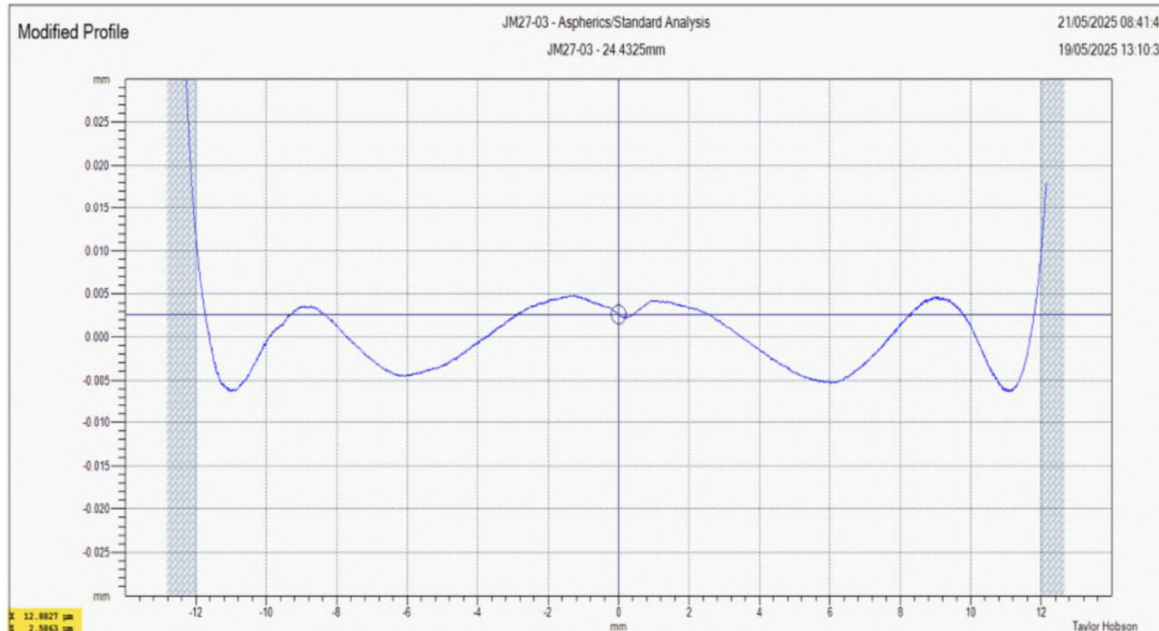
L: 46mm

PV 10um

● The application of Glass aspheric surfaces in optical design

- HD/DLP system projection function

形状误差

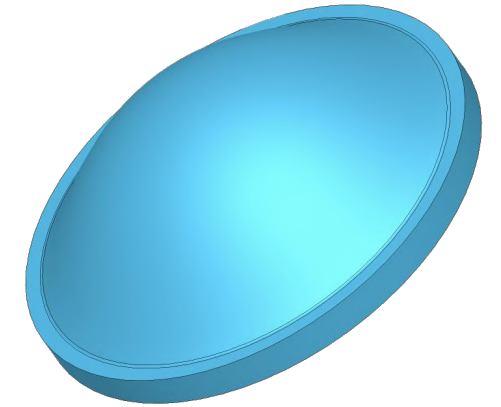


Pt(Pvt)	18.6798	μm	Pa	3.1271	μm	Fig	2.6290	μm
Smn	1.808	Deg	Smx	27.076	Deg	Tilt	0.631	Deg
Xp	-11.9989	mm	Xv	11.0748	mm	Xt	12.2799	mm
RMS(RMSI)	3.5233	μm	Slope mx	0.3633	Deg	Slope mx(x)	-10.9886	mm
Slope rms	0.1412	Deg						
Pvi	19.8400	μm	RMSi	3.4159	μm			

Design File C:\ProgramData\Taylor Hobson\PGI Optics\Results\Temp\PGIOptics.design

Settings File C:\ProgramData\Taylor Hobson\PGI Optics\Results\Temp\PGIOptics.sta

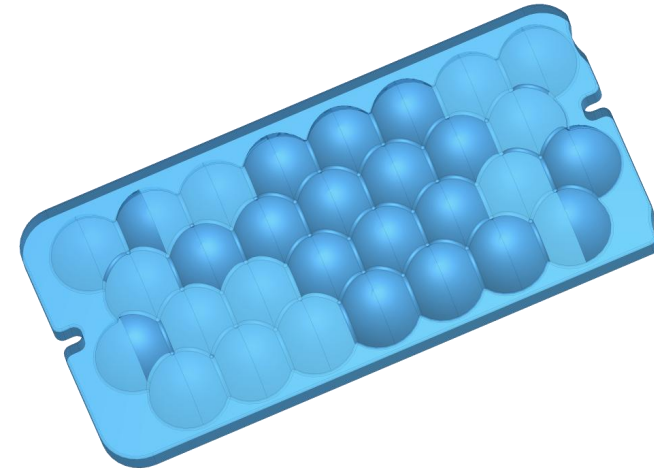
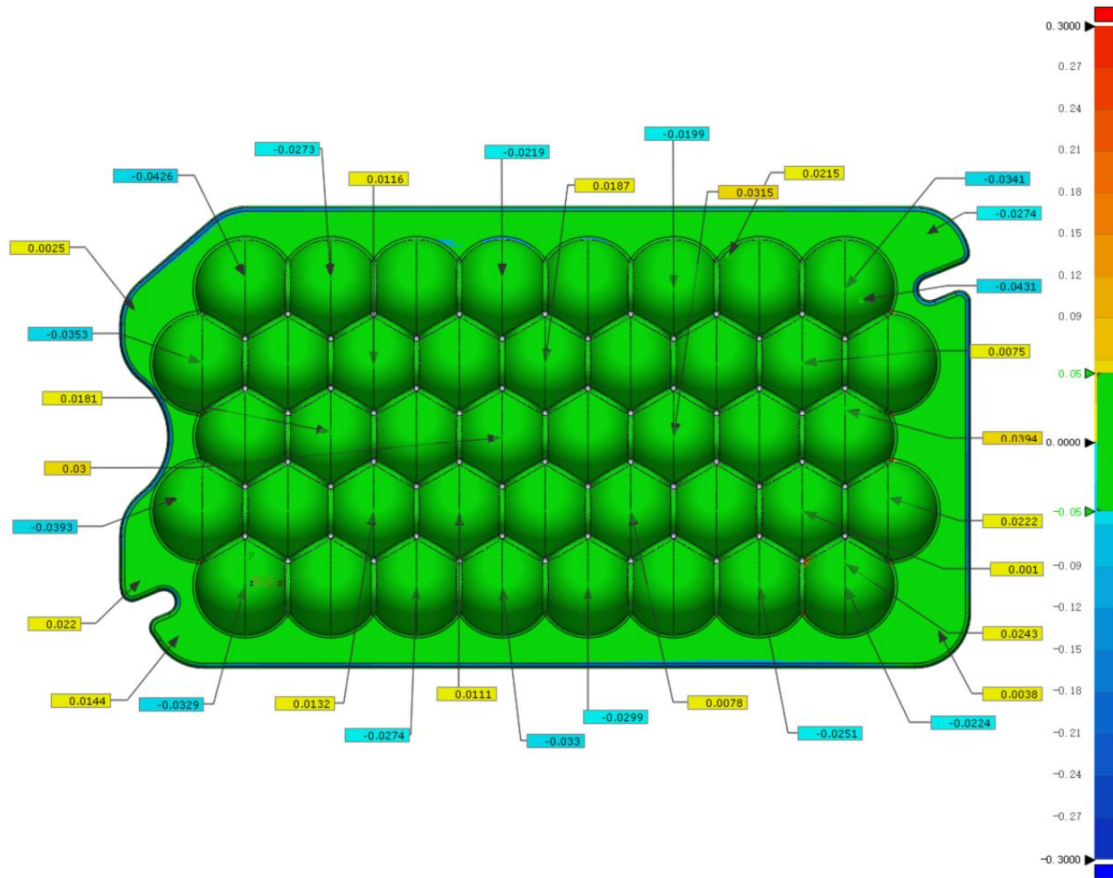
二次形状设置	
基础半径	11.082042000mm
圆锥常数	-1.6305380184
形状	凸面
系数	
A01	0.000000E+00
A02	0.000000E+00
A03	0.000000E+00
A04	-8.019000E-05
A05	0.000000E+00
A06	-1.70153677835E-07
A07	0.000000E+00
A08	2.80511228193E-09
A09	0.000000E+00
A10	-1.20943854239E-12
A11	0.000000E+00
A12	0.000000E+00
A13	0.000000E+00
A14	0.000000E+00
A15	0.000000E+00
A16	0.000000E+00
A17	0.000000E+00
A18	0.000000E+00
A19	0.000000E+00
A20	0.000000E+00
A21	0.000000E+00
A22	0.000000E+00
A23	0.000000E+00
A24	0.000000E+00
A25	0.000000E+00
A26	0.000000E+00
A27	0.000000E+00
A28	0.000000E+00
A29	0.000000E+00
A30	0.000000E+00
A31	0.000000E+00
A32	0.000000E+00
A33	0.000000E+00
A34	0.000000E+00
A35	0.000000E+00
A36	0.000000E+00
A37	0.000000E+00
A38	0.000000E+00
A39	0.000000E+00
A40	0.000000E+00
Clear Aperture Settings	
有效孔径	24.000mm
Slope Error Settings	
Slope Error Band	2.0000mm
Axis Alignment Settings	
Alignment Mode	Auto



aspheric Φ 30
PV 10μm

● The application of Glass aspheric surfaces in optical design

- Collimator for AR HUD system



L: 75mm
PV 30um

04

Company profile

HUAJU Optic

浙江华聚光电股份有限公司



Plant One

Location: Jinhua,China

Plant area: 40,000m²

Staff: 350

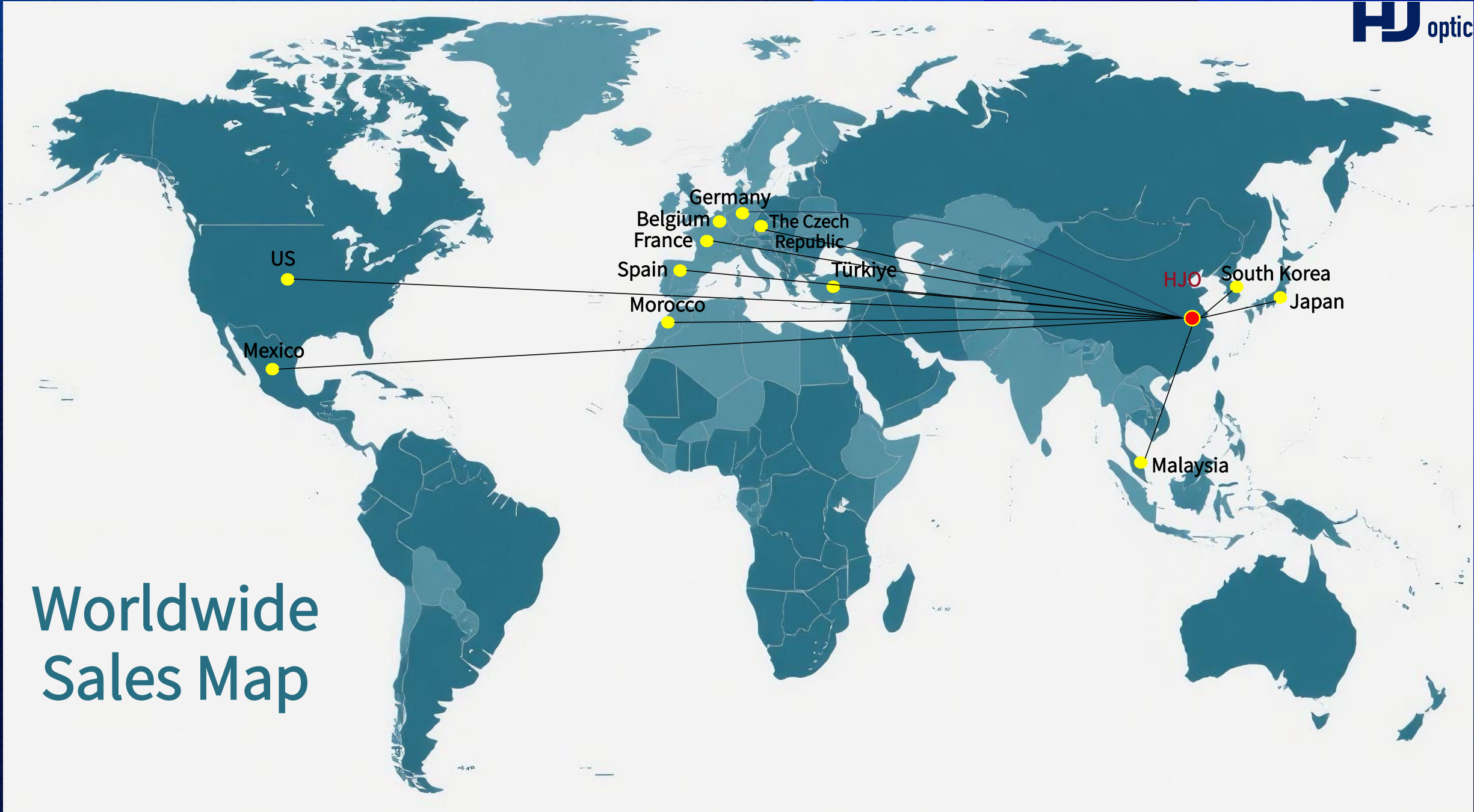


Plant Two

Location: Jiaxing, China

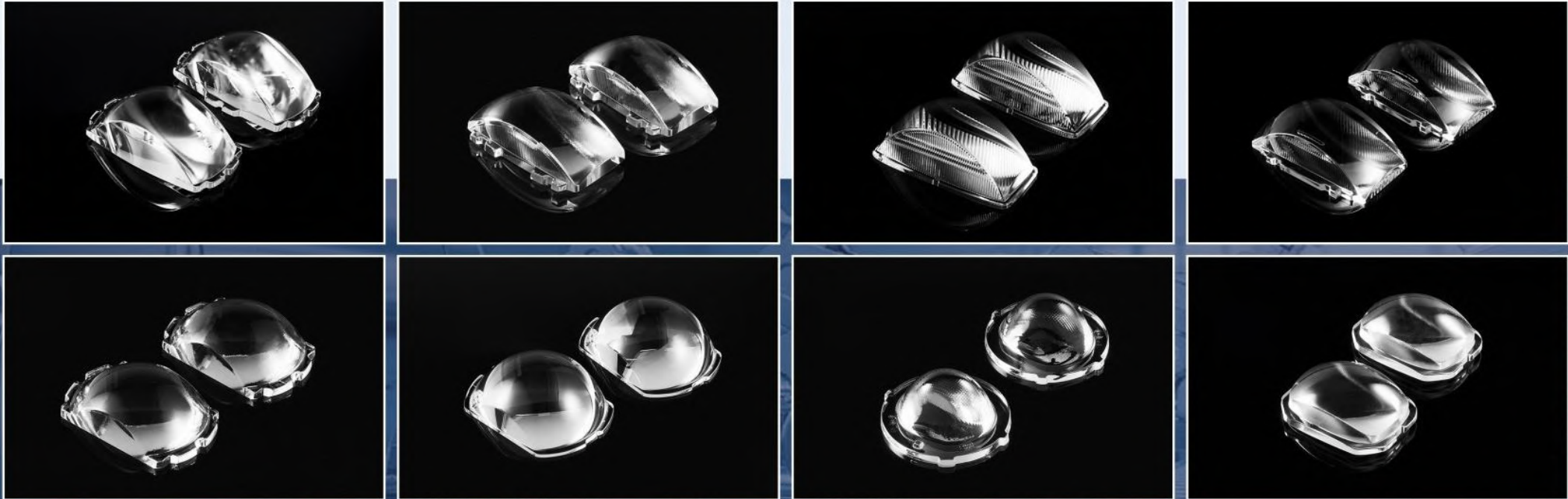
Plant area: 20,000m²

Staffs: 160



Worldwide Sales Map

Product Display - Lenses for Automotive



Product Display - Crystal Interior & Exterior Trim



Product Display - Projector in Headlamp System



Contact

Thank You /



Alex.Jia
Feb.05.2026

本PPT及其附件含有永豪光电（中国）有限公司/浙江华聚光电股份有限公司的保密信息，禁止任何其他人以任何形式使用（包括但不限于全部或部分地泄露、复制或散发）
This PPT and its attachments contain confidential information from Yonghao Optic&Electronic Co.,Ltd(China)/Zhejiang Huaju optoelectricity Co.,Ltd, Any use of the information contained herein in any way (including, but not limited to, total or partial disclosure, reproduction, or dissemination) by persons other than the intended recipient(s) is prohibited.

学术引用

- <https://zh.wikipedia.org/wiki/%E5%85%89%E5%AD%A6%E7%8E%BB%E7%92%83>
- <https://zh.wikipedia.org/wiki/%E8%89%B2%E5%B7%AE>
- <https://zh.wikipedia.org/wiki/%E9%9D%9E%E7%90%83%E9%9D%A2%E9%95%9C>