Confidential

非球面模压玻璃透镜在激光雷达Lidar上的应用

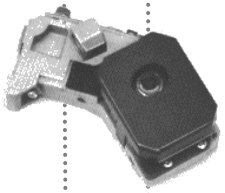
ALPSALPINE

ALPS光学元件的发展历史

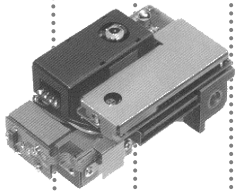
1985 1986 1990 1993 1996 2000 2005 2010 2018 2020

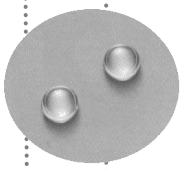
YEAR

CD pickup Unit
Dev.82-,Pro.85-



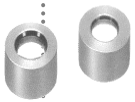
LD pickup Unit





Aspherical lens for CD
Dev.84-,Pro.86-

Aspherical lens for
Opt-comm.
Dev.89-,Pro.90-





CAN lens



Pigtail
Module



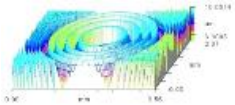
Receptacle
Module



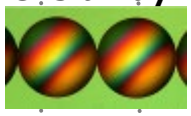
Optical
Filter



Diffraction
lattice



micro
Lens array





Bare Lens for
on board assembly

Micro Lens Array







Lens array with
Mirror



W=0.6 Lens

Lens with
Chucking area



CAN Type lens
For PD



2008
Production
site was
transferred
to Nagaoka

Pb free lens

ALPS现有的产品领域

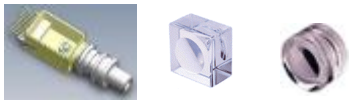
通信市场

Butterfly package

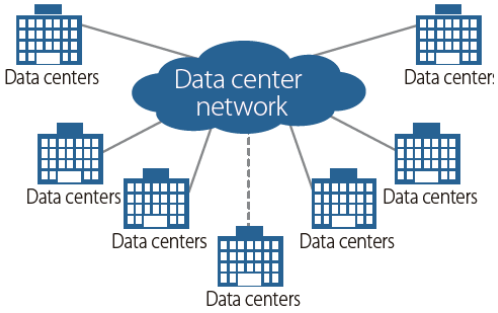


For Laser
FLBJ / BM /BN series

Fiber coupling
FLAx series

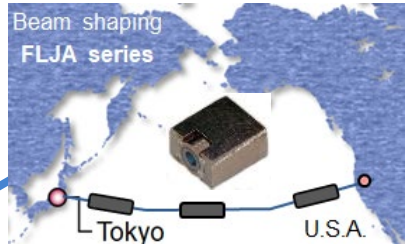


Laser coupling/
collimating
FLGx series





For submarine cable transponder





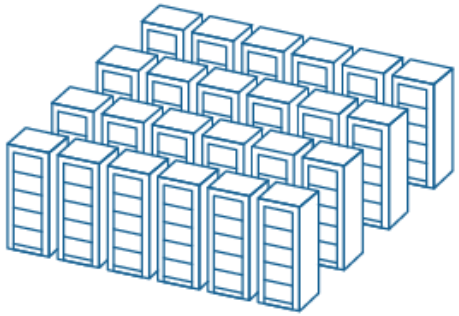
BOSA Bidi Optical sub assembly

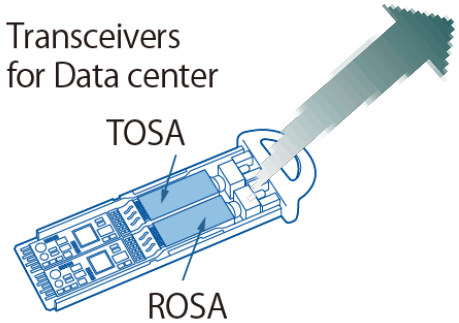
TO-CAN
FLBx series

TOSA

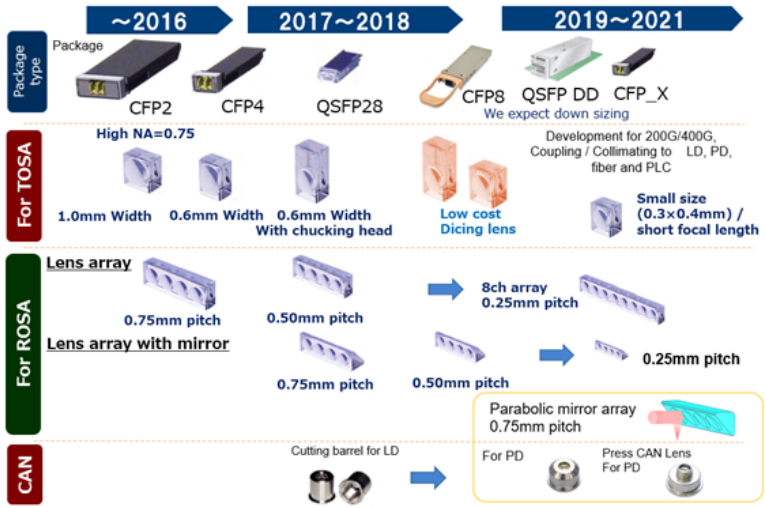
Tx Optical sub assembly

数据中心市场





高密度封装Roadmap



LENS开发能力

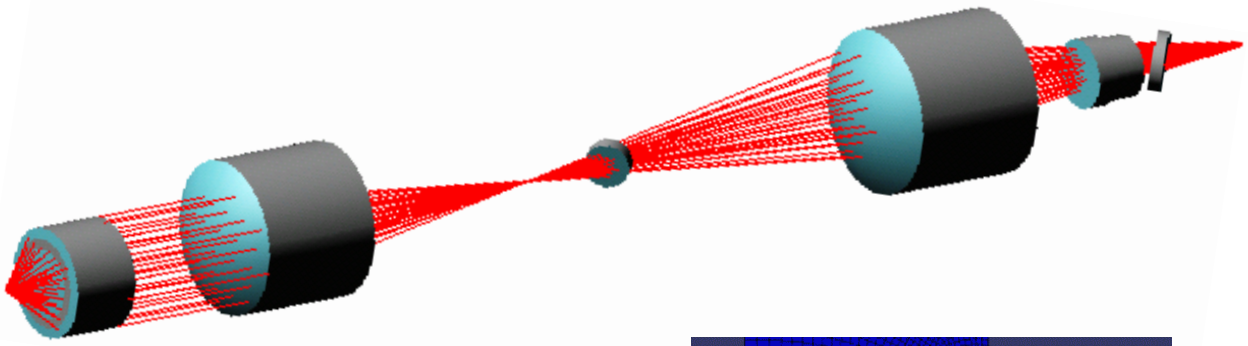
ALPSALPINE
Confidential

超过25年的设计和生产经验

设计应用

- **ZEMAX**

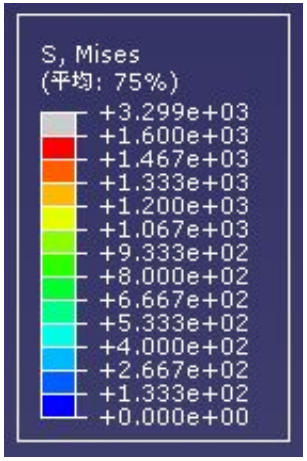
我们根据客户的各种要求来设计LENS,例如波像差(Wave Aberration)，耦合效率(Coupling Efficiency)，以及点图（Spot Diagram）

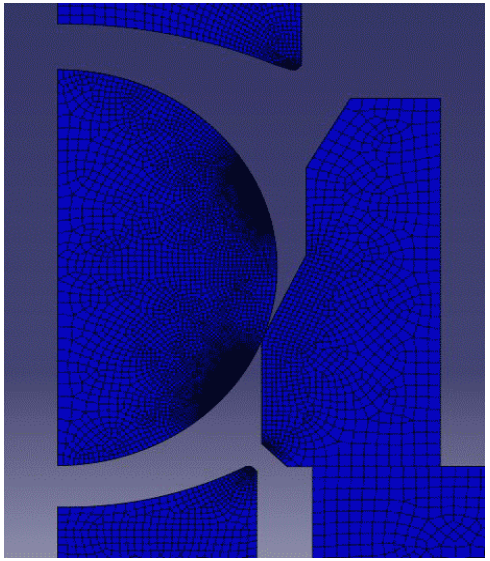


成型仿真

- **Abaqus**

我们通过成型仿真软件优化透镜的设计





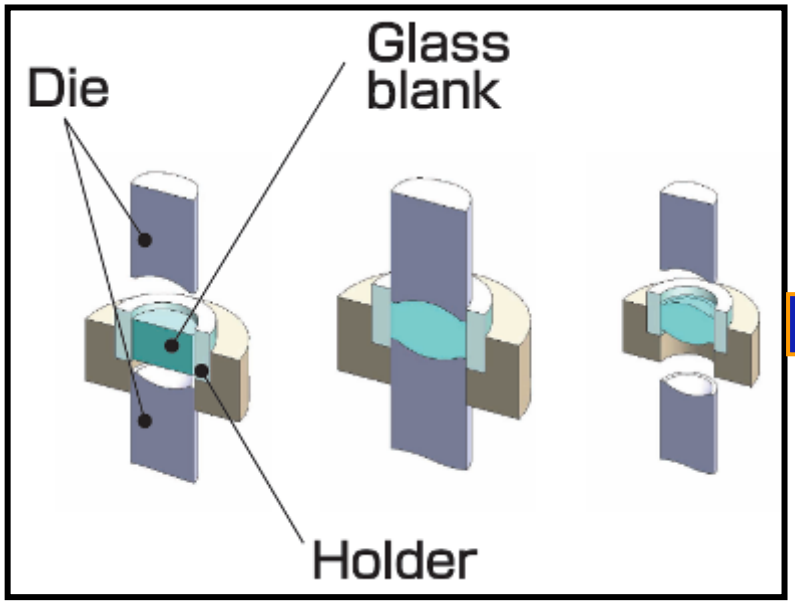
LENS玻璃成型技术

ALPSALPINE
Confidential

核心技术

1. 内制的精密型腔
2. 金属镜筒直接成型技术
3. 内制防反射膜

在玻璃和金属镜筒之间，
我们不使用任何粘贴材料



镜筒一体型透镜

CAN Type



圆筒型



异型筒

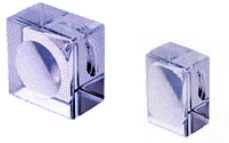


裸透镜

圆筒型



方型



透镜阵列



内制防反射膜

ALPSALPINE
Confidential

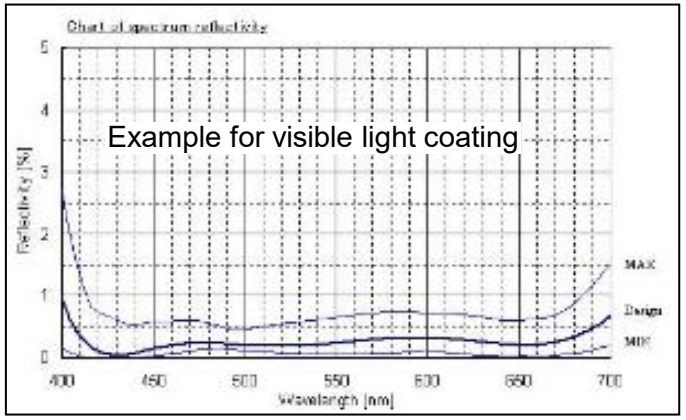
设施・设备

●防反射膜蒸镀设备



昭和真空：SGC-1300R

-Type : Ion deposition
-Layer thickness: <2%.
-Applicable range: 280~2400nm.



●测试



<<透光率>>

HITACHI:U-4000

Range : 300～3000nm
Repeatability ：±0.26%



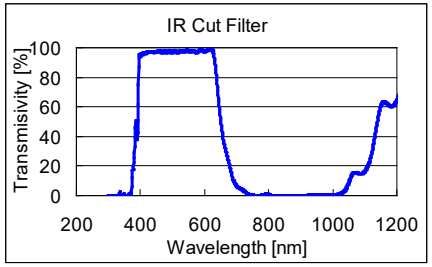
<<反射率>>

OLYMPUS:USPM-RU

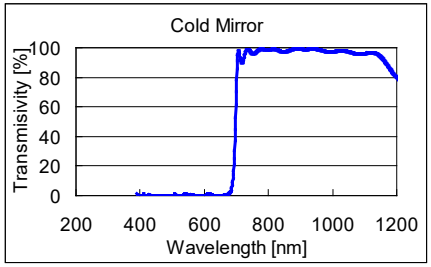
Range : 380～780nm
Repeatability ：±0.01%

●镀膜的案例

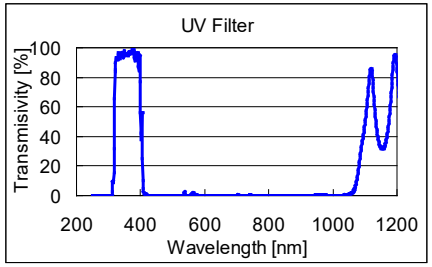
IR Cut Filter



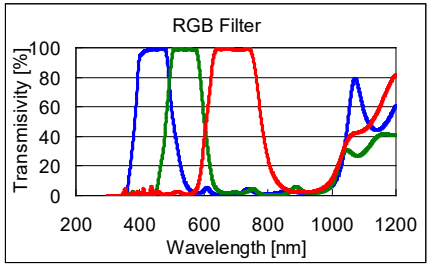
Cold Mirror



UV Filter

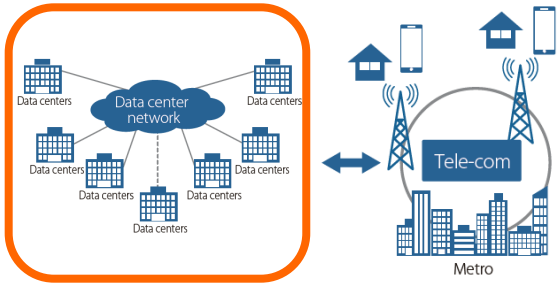


RGB Filter



现有标准品库

Data Center Market



100G CWDM4
400G DR4 etc..



200G/400G
Si Photonics

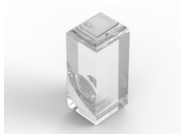


TO38

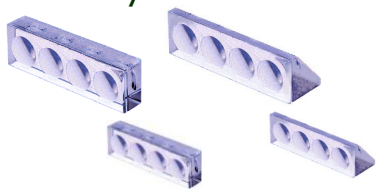


Square lens
Square lens with chucking head

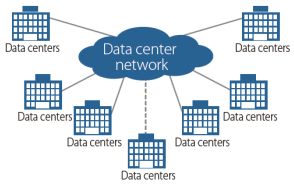




Lens array
Lens array with mirror



Telecom Market



10G TOSA/ROSA
25G DFB/EML etc..

Rx Optica sub assembly



TO-CAN



BOSA / Bi-Di

Bi-directional



Collimator/Coupling
with round holder



Combo-PON



Collimator/Coupling
with round bare



产品线分类介绍-1

金属套筒型透镜

Standard Shape (Φ2.0mm-Φ3.0mm)

Size ability : Φ1.8mm – Φ18mm
Custom shape of the holder





Gold plating



YAG welding

圆柱型裸透镜

Size ability : Φ0.6mm – Φ18mm

Standard Shape (Φ0.6-Φ1.0mm)



Φ1.0mm



Φ0.6mm

方型裸透镜

Size ability : W 0.3-5.0mm, H 0.4-5.0mm
Custom ability : Aspherical design

Standard Shape (W0.6mm-1.0mm)



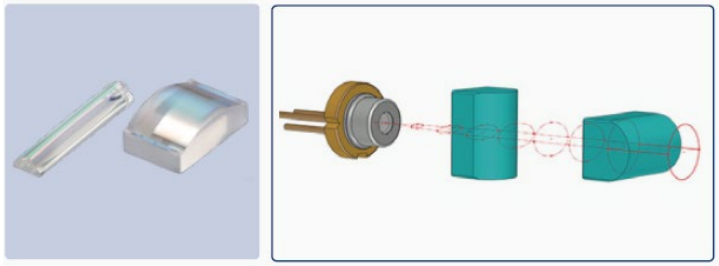
Standard



Minimum

产品线分类介绍-2

SAC/FAC快慢轴准直透镜

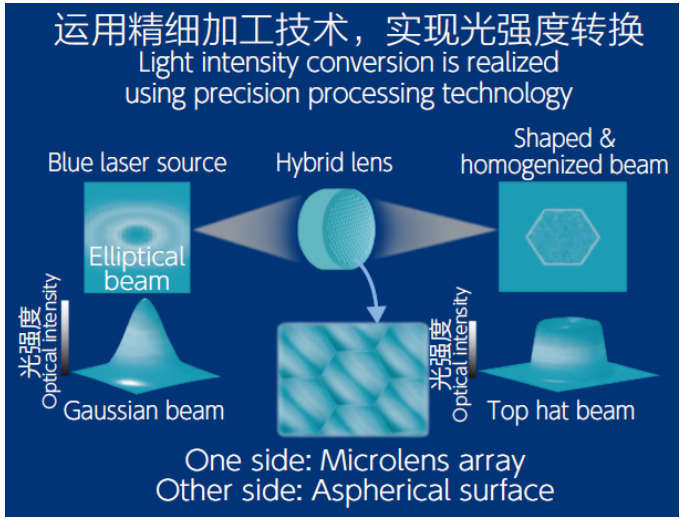


透镜阵列(可选带反射)



Pitch: 0.25, 0.5, 0.6, 0.75等

衍射阵列



Fly Eye

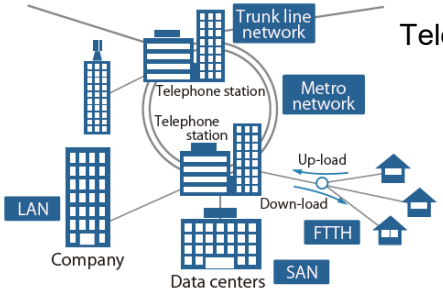


核心技术和市场划分

ALPSALPINE

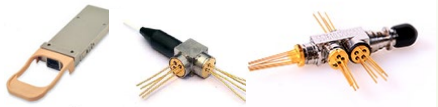
Confidential

Optical communication 980-1550 n m



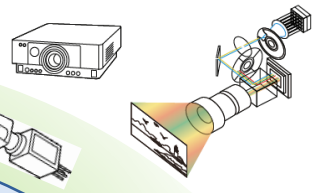
Telecom・Data Center market

Optica Transceiver

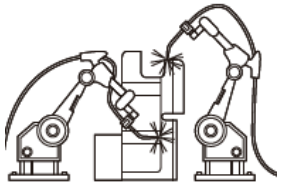


Industrial 380-980 n m

Laser Projector



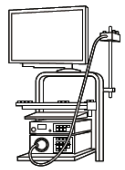
Industrial High Power Laser



Security



Medical equipment



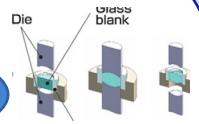
Module

Core Compo

SAC

FAC

Molding



Precision mold



Optical Simulation

Tech Core

Fine processing technology

Optical Design & production

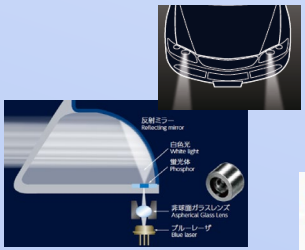


SAC

Automotive

360-1550nm

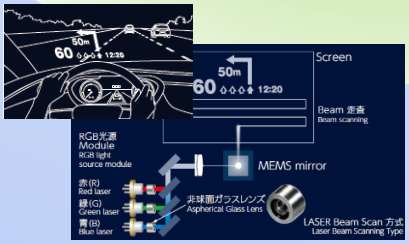
Laser Head Light



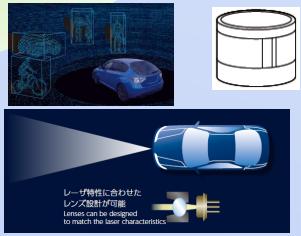
ADAS Sensing



Laser HUD



LiDAR



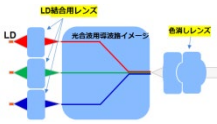
Y2020/Mar. IATF16949 certified

Consumer 360-830nm

AR/VR Wearable glass



RGB Laser engine



3 D sensor



用于车载市场的非球面玻璃透镜

ALPSALPINE
Confidential

激光在车载市场的应用

量产实绩
***激光大灯：累计出货量超过 200Kpcs.**
*Laser HUD　　：收到大量咨询
*LiDAR　　：收到大量定制化咨询.


IATF 16949
Management System Certificate

Certificate Number : JQA-AU0021-5/IATF Certificate Number:0066068 1 / 2

Organization:
ALPS ALPINE CO., LTD.
NAGAOKA PLANT
1-3-5 HIGASHITAKAMI, NAGAOKA-CITY, NIIGATA, JAPAN

Scope of Registration:
DESIGN AND MANUFACTURING OF THE FOLLOWING PRODUCTS:
-SENSORS
-LENS

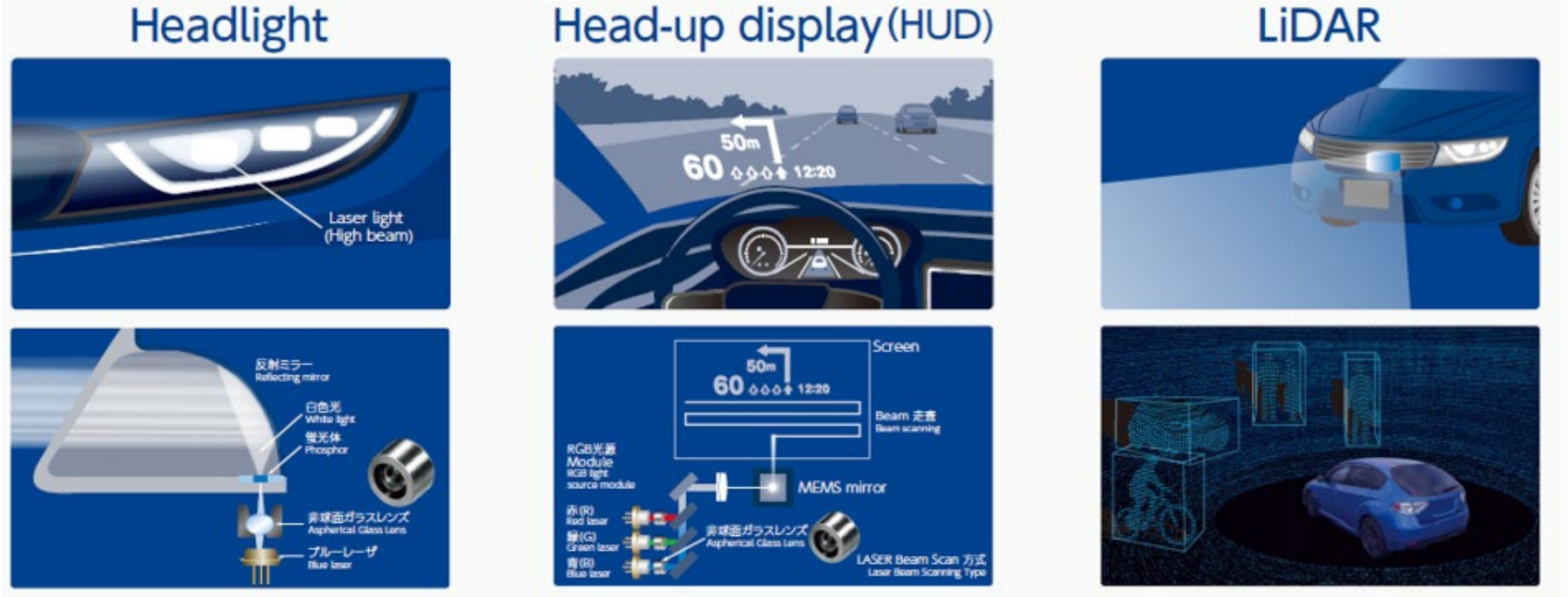
JQA (IAOB-1016) certifies that the above organization operates the Quality Management System within the above scope and complies with the requirements of the following standard:

IATF 16949:2016

Registration Date : March 6, 2020
Expiry Date : March 5, 2021

JAPAN QUALITY ASSURANCE ORGANIZATION

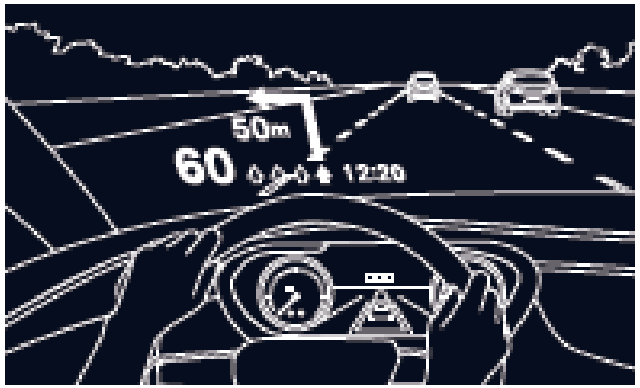
JQA



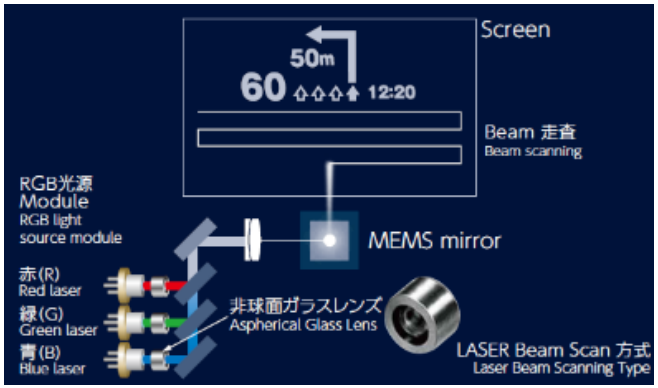
激光抬头显示器应用

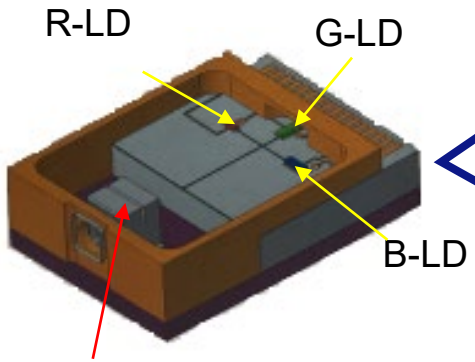
ALPS ALPINE
Confidential

我们推荐为激光抬头显示器采用非球面玻璃透镜.

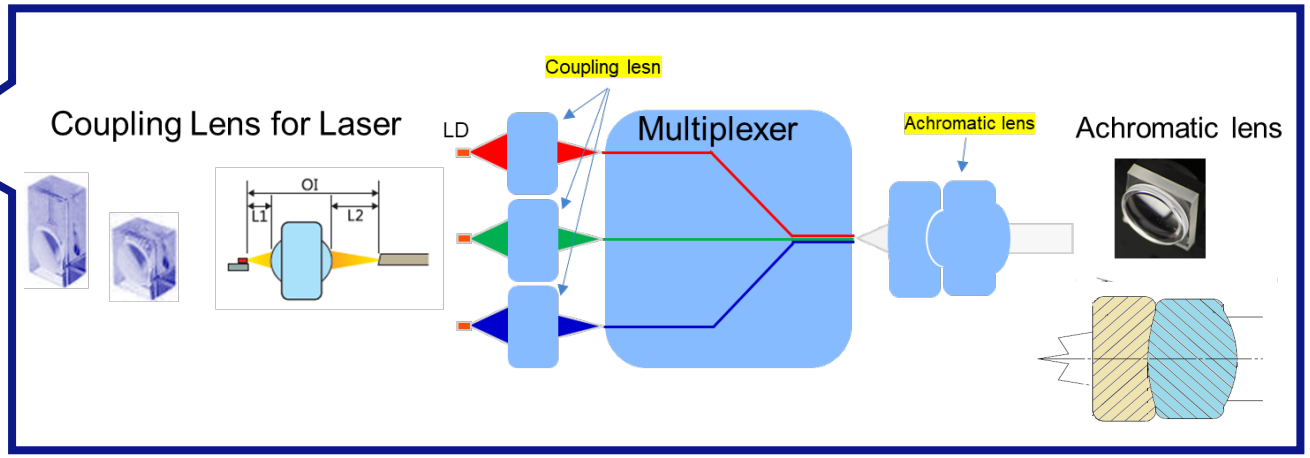


玻璃非球面透镜可以为车载激光抬头显示器提供高可靠性



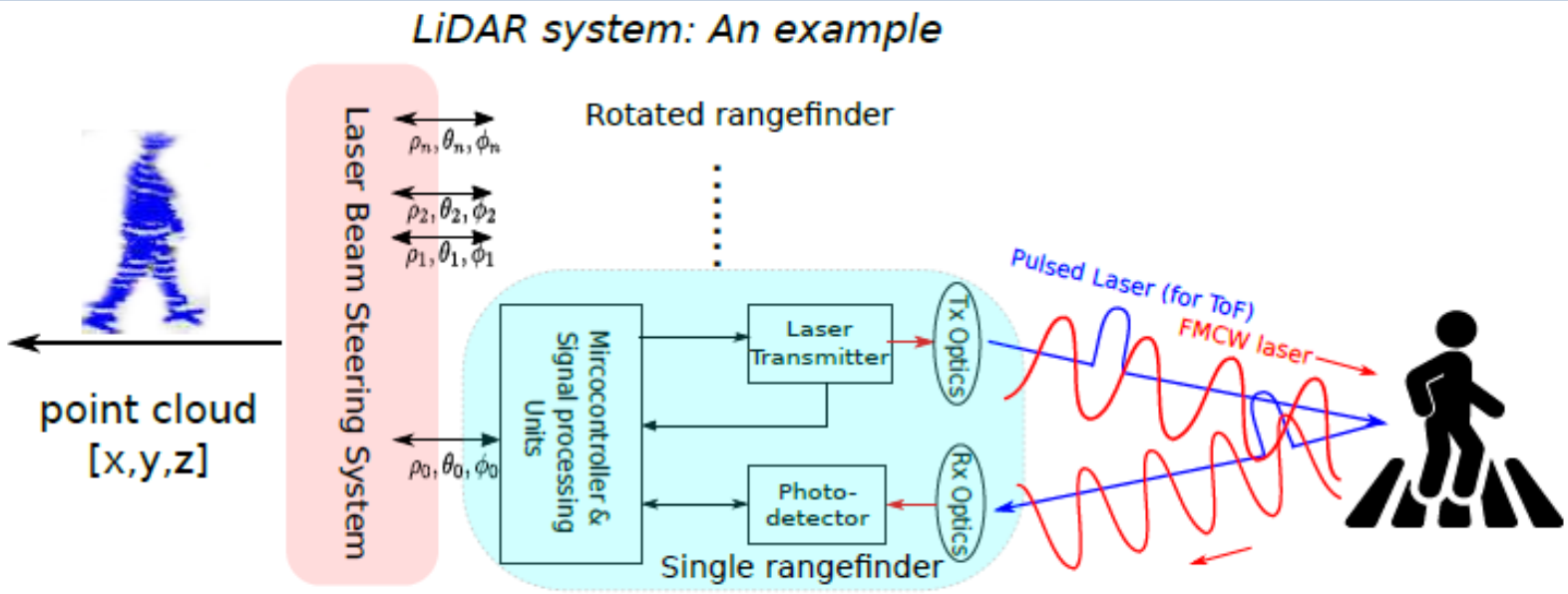


消色差透镜
Achromatic lens



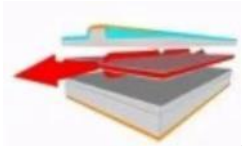
LiDAR系统概要

ALPSALPINE
Confidential

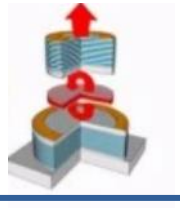


激光发射器

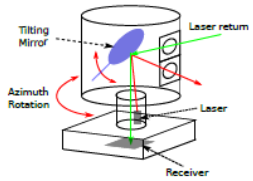
Edge Emitting Laser
边发射激光器



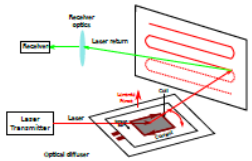
Vertical Cavity Surface Emitting Laser
垂直腔面发射激光器



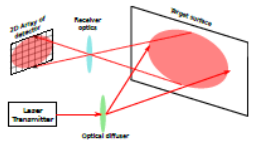
光路偏转系统



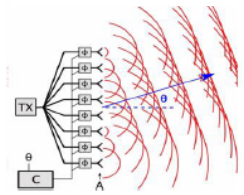
转镜



MEMS



Flash



OPA

光电探测器

- PD (光电二极管)
- APD (雪崩光电二极管)
- SPAD(单光子雪崩二极管)
- SiPM (硅光电倍增管)

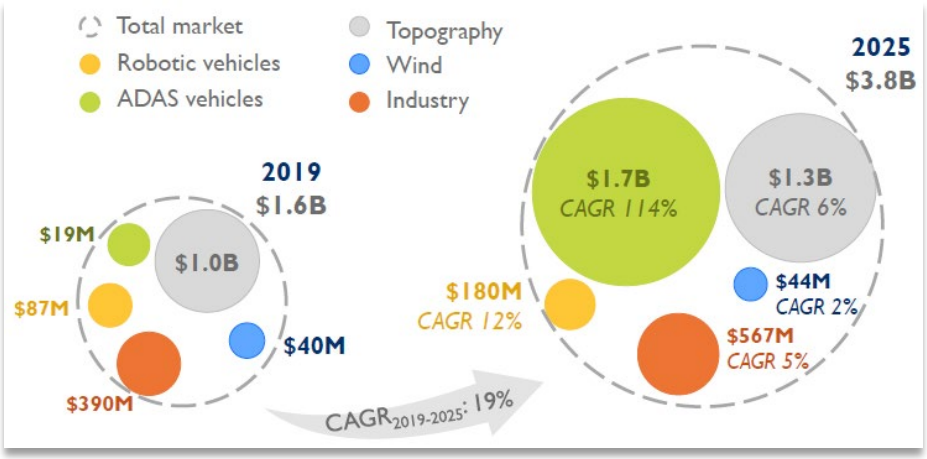
测量方法

- dToF
- iToF
- FMCW

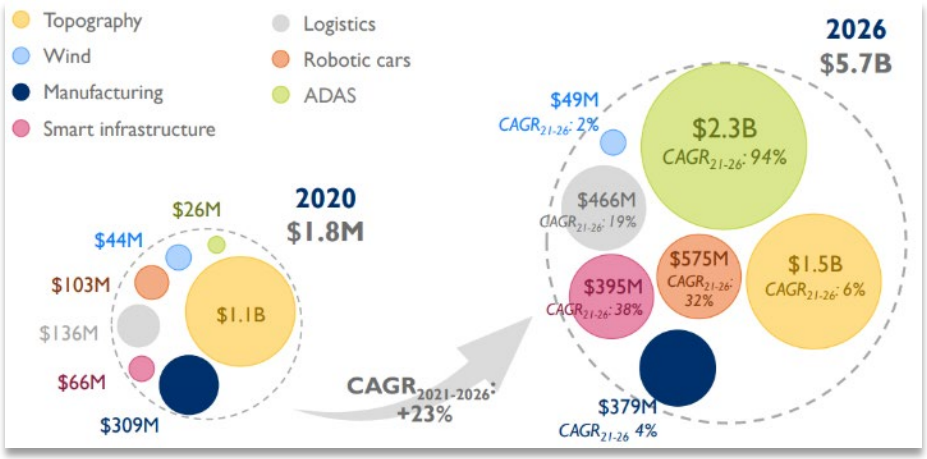
激光雷达市场发展趋势

ALPSALPINE
Confidential

Yole_2020

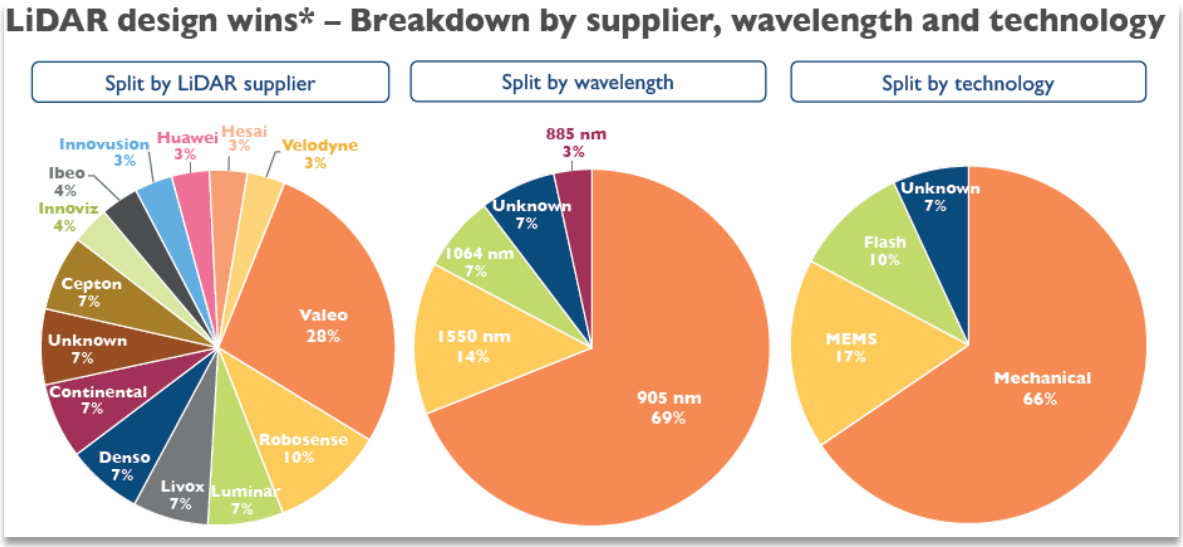


Yole_2021



2019-2025 Lidar全体GAGR：**19%** → 2021-2026 Lidar全体GAGR：**23%**

ADAS Lidar GAGR：114% → ADAS Lidar GAGR： 94%



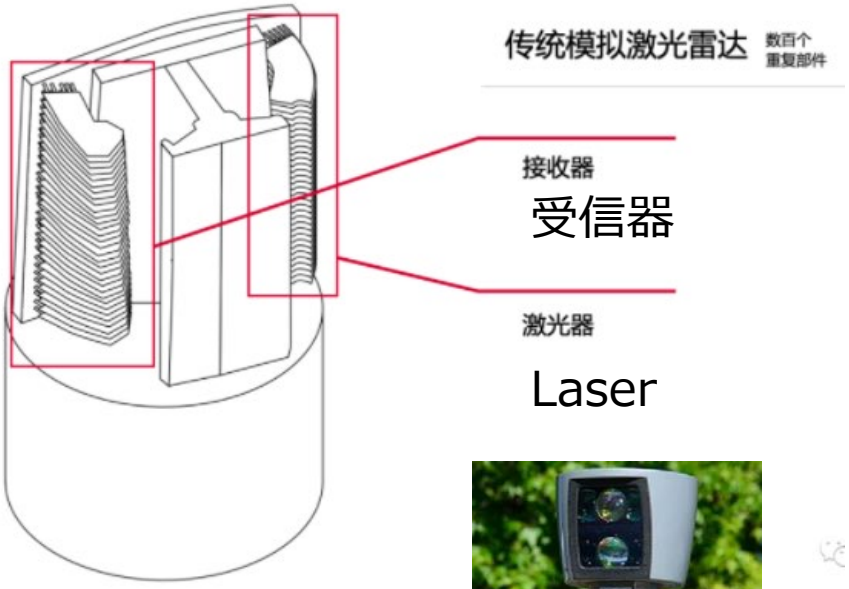
Yole_2021-Sep:

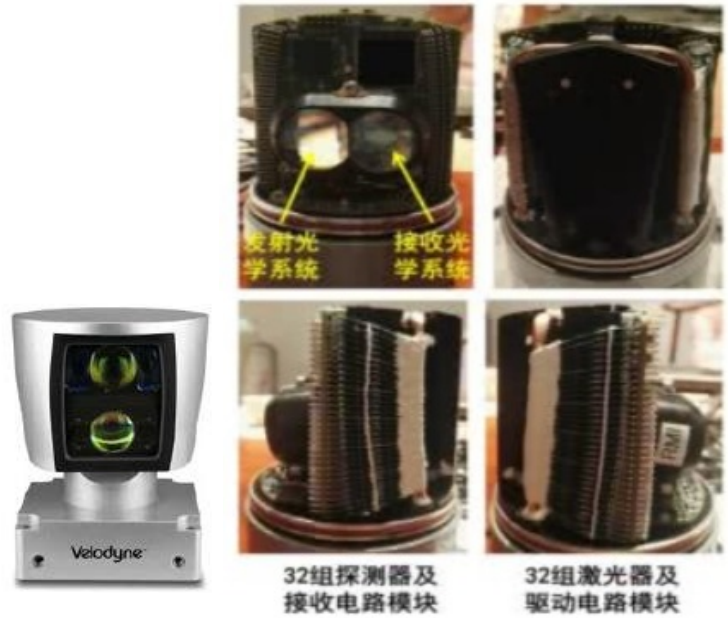
自动驾驶激光雷达市场份额前三:
Valeo(28%), Robosense (10%), Luminar (7%)

LD：905nm (64%), 1550nm (14%)

光路調整：机械旋转式(66%), MEMS式(27%), Flash式（10%）

整体旋转式Lidar





32线激光雷达分解图



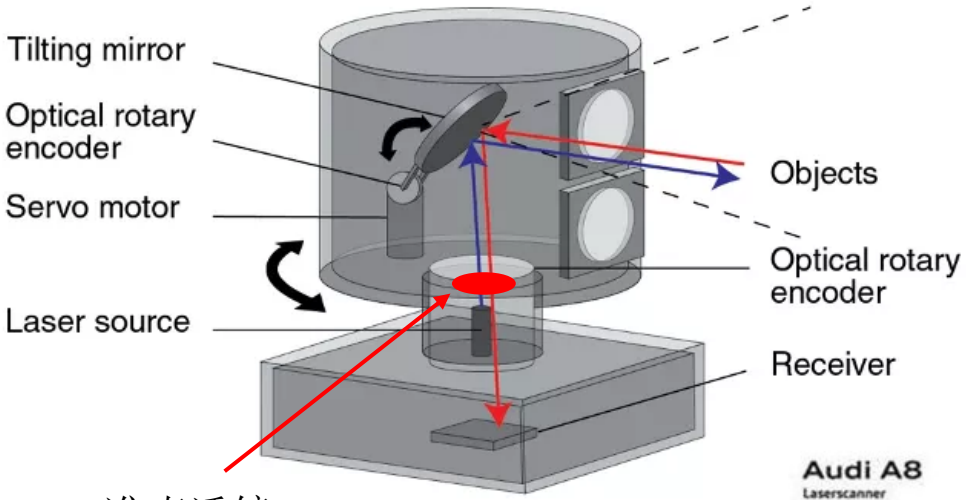


現在、Robotaxi，自动驾驶试验园区、主要的激光雷达都是整体旋转式。

价格昂贵，且因为机械部件原因，很难过车规认证。另外一方面，安装后对车辆的外观影响很大。

没有量产车搭载的报道。

转镜式Lidar



准直透镜

转镜式Lidar的激光发射器和接收器固定，仅有反射镜旋转。这种方式容易过车规。

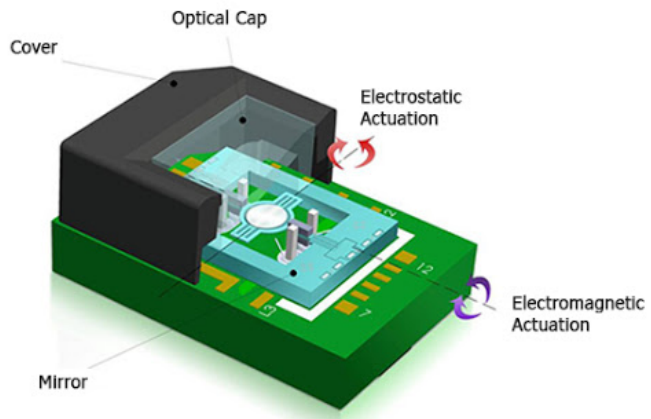


2021年上海车展Valeo展示了自动驾驶开发用DEMO车、激光雷达和奥迪A8用的一样。

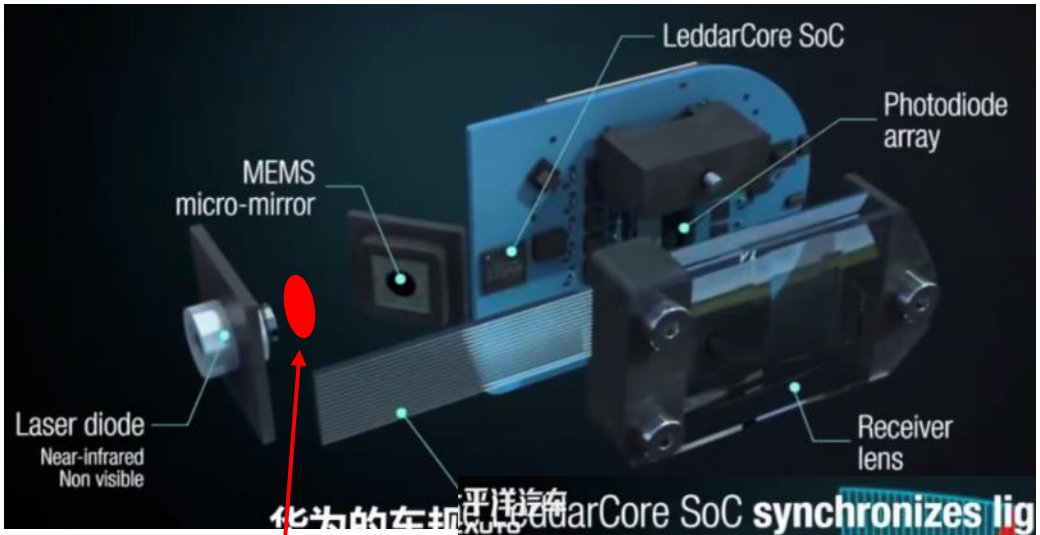


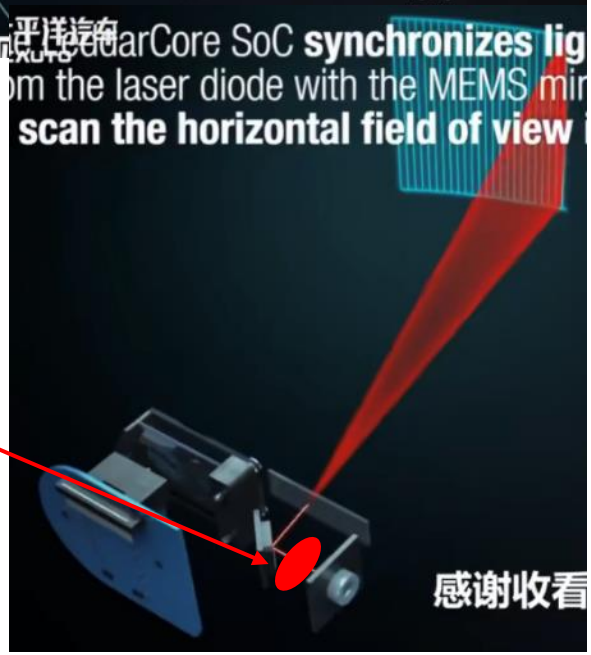
Audi A8搭载的Valeo激光雷达是世界最早量产的。

MEMS式Lidar



MEMS反光镜





MEMS式Lidar尺寸很小，在汽车搭载后不影响外观。很多新创公司进入了这个市场

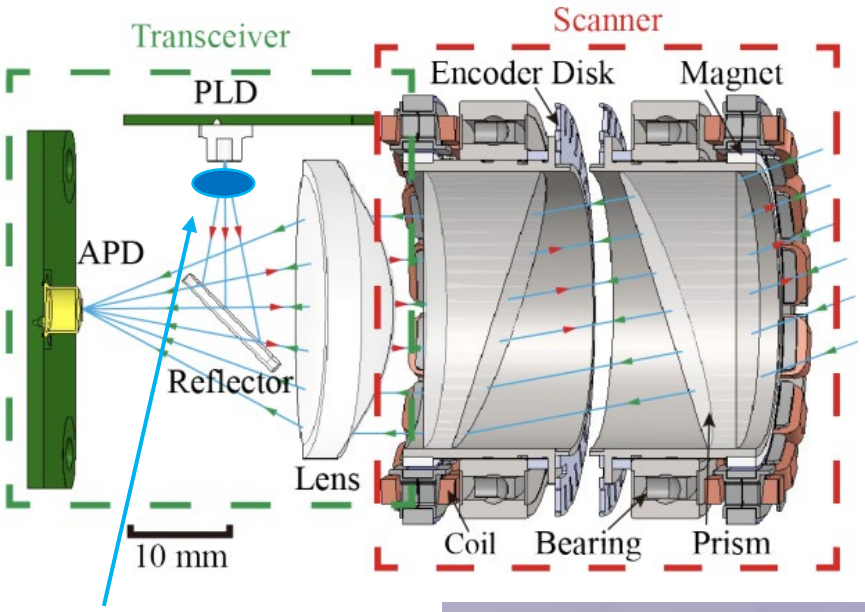
准直透镜



OEM: SAIC R Brand（Luminar）

Prism旋转式Lidar







准直透镜

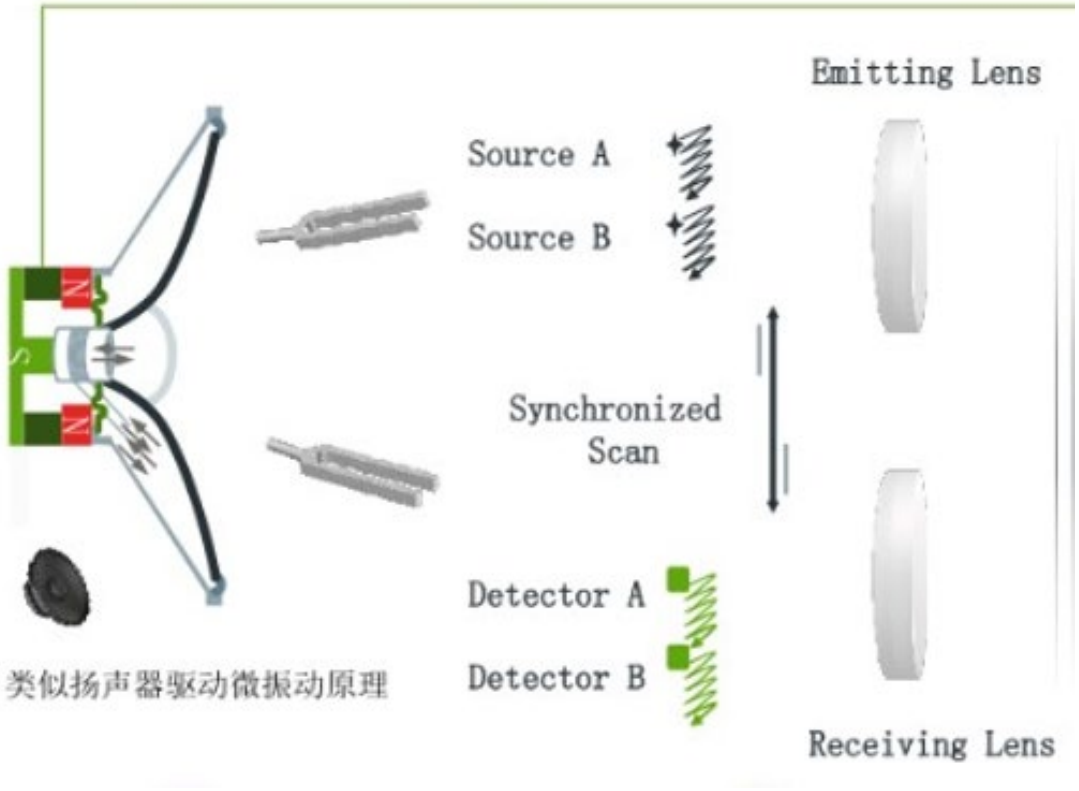
棱镜式激光雷达，主要的市场是机载Lidar。中国在量产中的是大疆的子公司揽沃科技。最近的小鹏汽车P5预计搭载两台揽沃的激光雷达。



X-Peng P5 + Livox(905nm Prism)

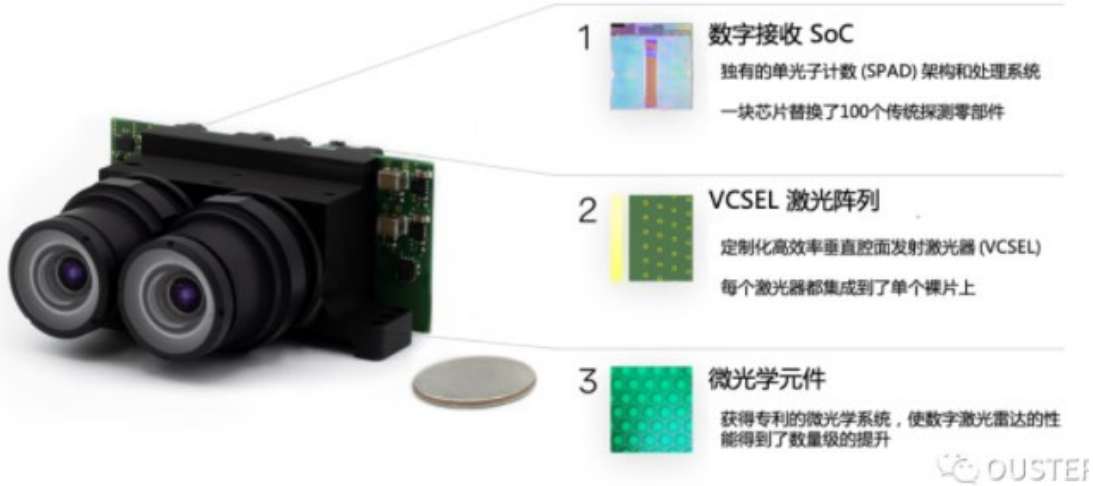
音圈马达振动式Lidar

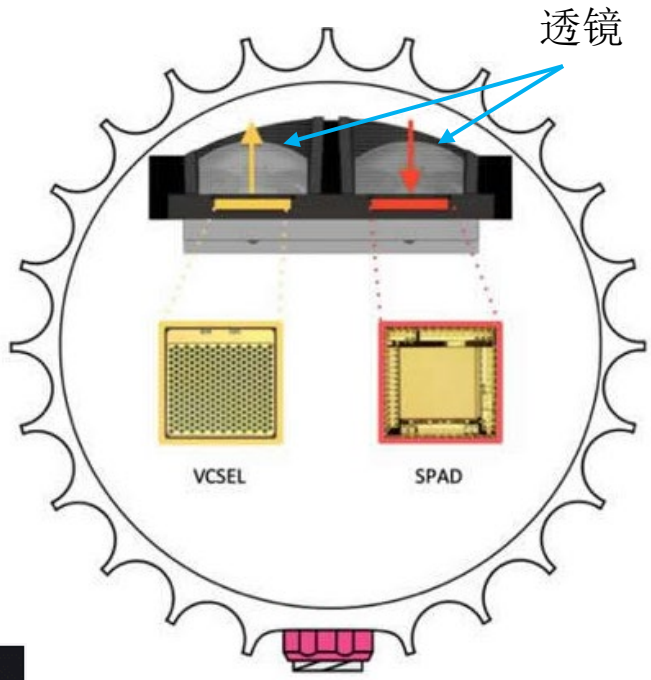




Flash式Lidar

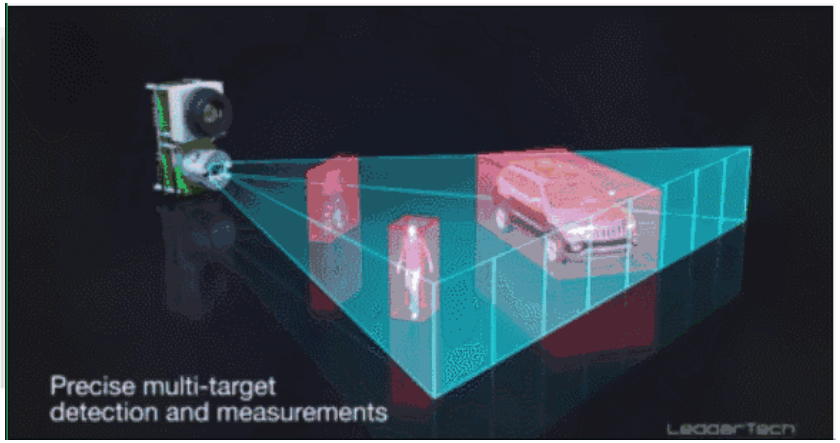
Ousterの例：数字激光雷达(有机械旋转部件)





Ouster数字激光雷达结构示意图

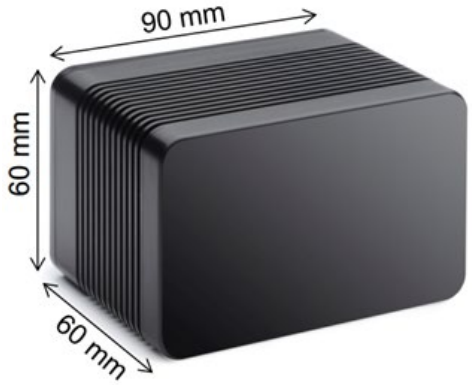


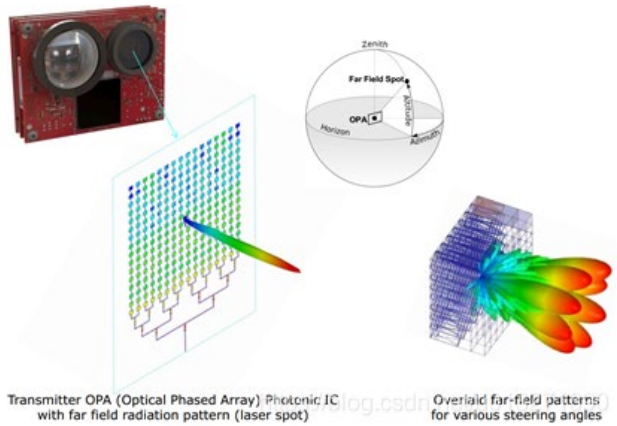


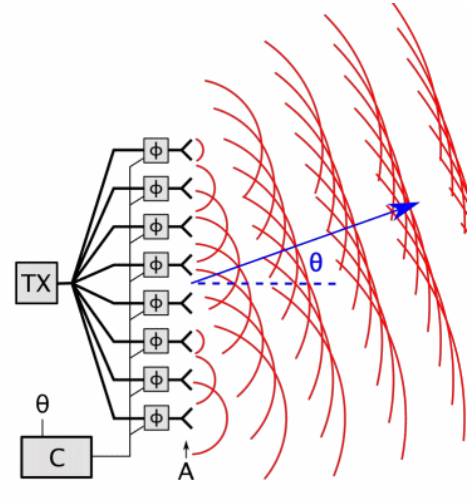
LadderTech例：数字激光雷达(无机械旋转部件)

Flash式Lidar是纯固态激光雷达，没有机械旋转部件。容易通过车规认证，行业普遍认为Flash式是未来的趋势。

OPA式Lidar









OPA式Lidar目前处于实验室开发阶段，还没有到达车规量产阶段。工业界认为OPA式的雷达是固态激光雷达的最终形式。

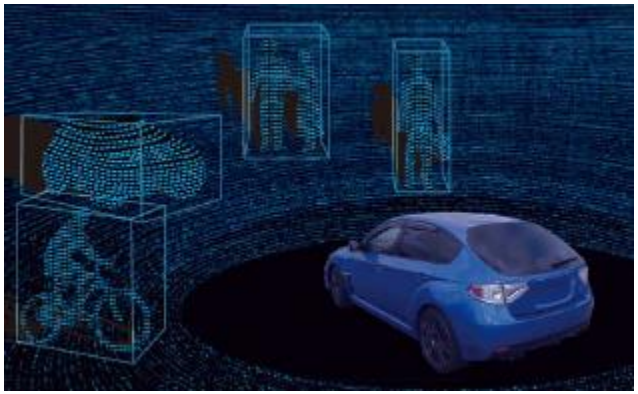
OPA: Optical Phased Array。

LiDAR激光雷达中的非球面玻璃透镜

ALPS ALPINE
Confidential

光学相关器件的组成: Laser, PD array Lens, Diffuser or DOE

Automotive LiDAR



各种激光雷达的技术方案演进还在不断演化，但都需要玻璃光学元件来调整激光。我们将一如既往提供最佳产品和服务

Lidar的种类

- Mechanical Type (dichroic mirror)
- MEMS
- flash
- Phased Array



FAC/SAC

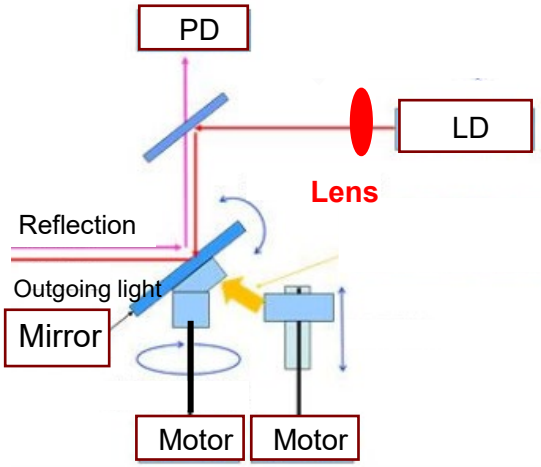


Lens array

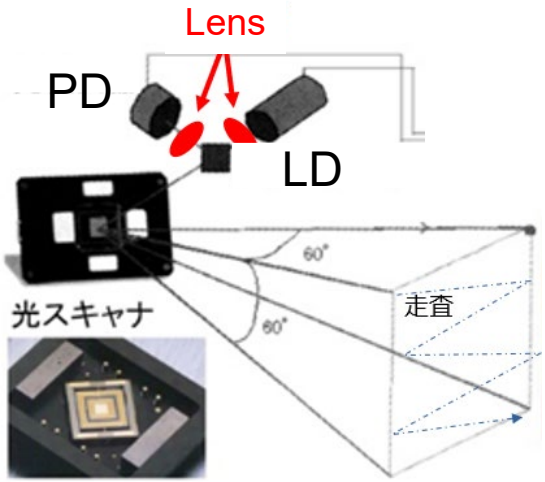


Fly eye

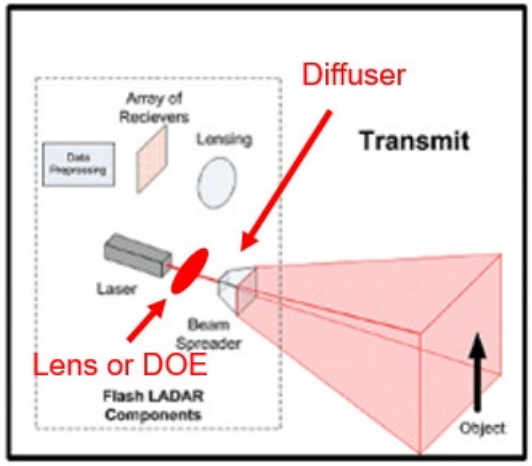
Mechanical Type (dichroic mirror)



MEMS

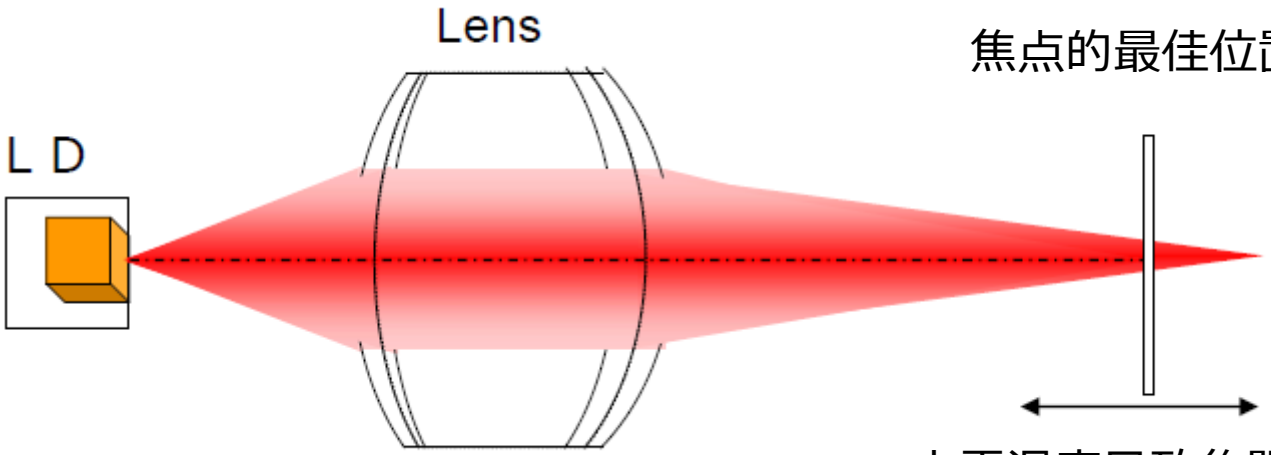


FLASH



玻璃透镜和塑料透镜的对比

塑料透镜　优势：价格便宜　　劣势：温度变化导致性能损失
玻璃透镜　优势：耐恶劣环境和温度变化　劣势：价格相对高，设计自由度一般



塑料和玻璃的热膨胀系数

塑料类：
PC树脂：70~80
POM树脂：80~110
PP树脂：170
尼龙：80
PET树脂：70

玻璃： **9**

ALPSALPINE keeps making efforts to improve quality and provide new products.
We hope to be of service to you continuously.

