Polymer Optics Automotive Ltd.

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Polymer Optics Automotive Ltd

General Presentation

POLYMER OPTICS AUTOMOTIVE LTD

Company background

- Polymer Optics Limited (POL) was founded in 1998.
- Polymer Optics Automotive Limited – a subsidiary of POL formed in 2014 to enable the company to better develop the business area and resource it accordingly.
- POL's Engineers each have over 30 years experience in optical design and plastics optical manufacturing.
- POL is an Optical Design AND Manufacturing Consultancy specialising in plastic optics and optical systems…. however, POL supplies most of its customers with product via partner manufacturers.
- Advanced experience in wide range of manufacturing processes and process development.
- Advanced experience in secondary processes and process development
- Diverse experience in optical systems for specialist applications for:

Automotive **Aerospace** **Industrial** **White goods** **Mobile Phones** **Medical** **Scientific**

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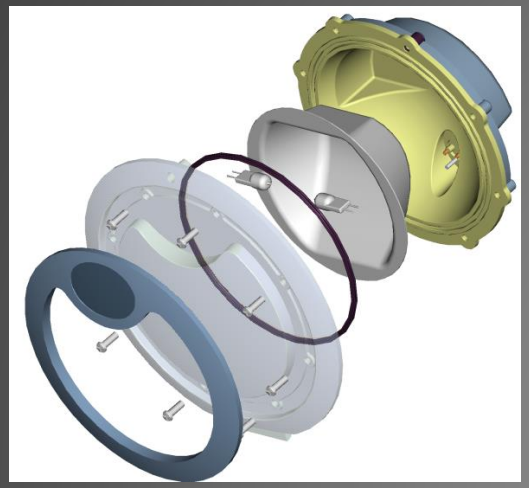
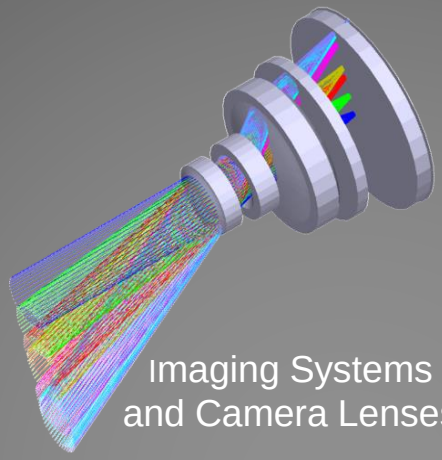
POL's Wide Field of Expertise



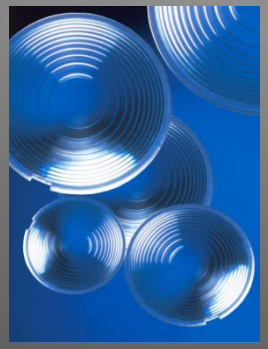
Illumination Systems

Precision Lenses for:

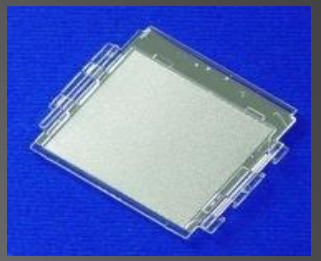
General Illumination
Eyepiece & Objective Lenses
Aircraft Lighting
Vehicle Lighting
Aviation Beacons

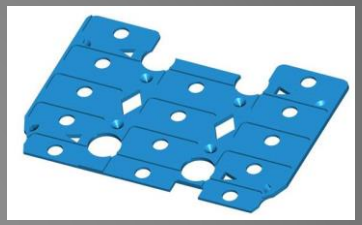


Imaging Systems and Camera Lenses

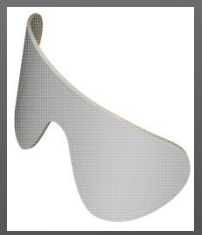


Fresnel Lenses

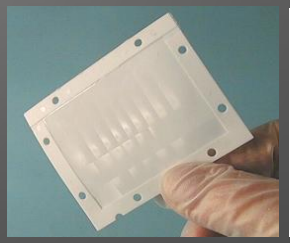


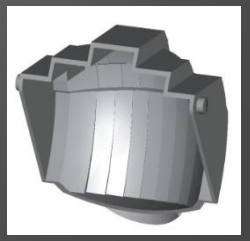


Lightguides



Ophthalmics and Eye Protection





Passive Infrared (PIR) Detector Optics

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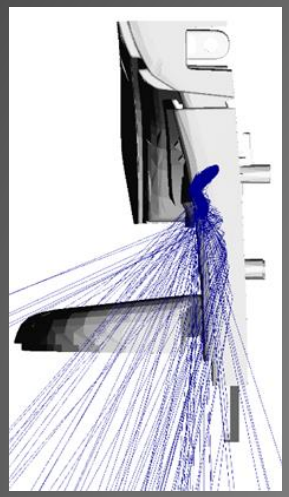
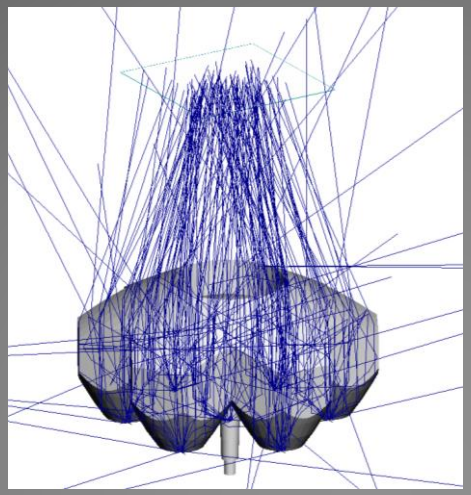
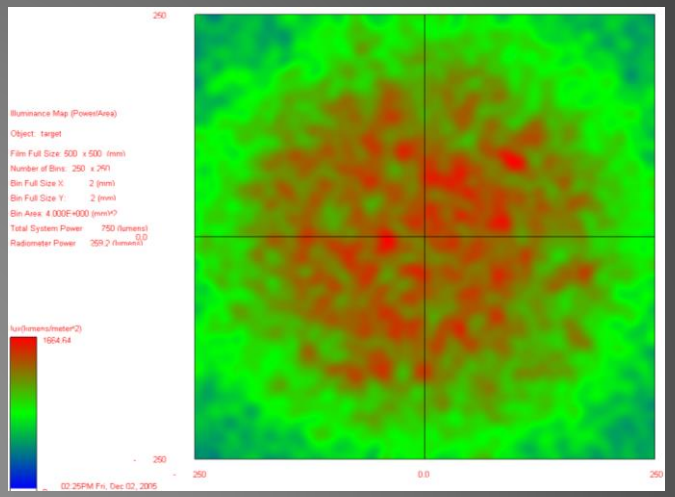
Optical Design and Analysis



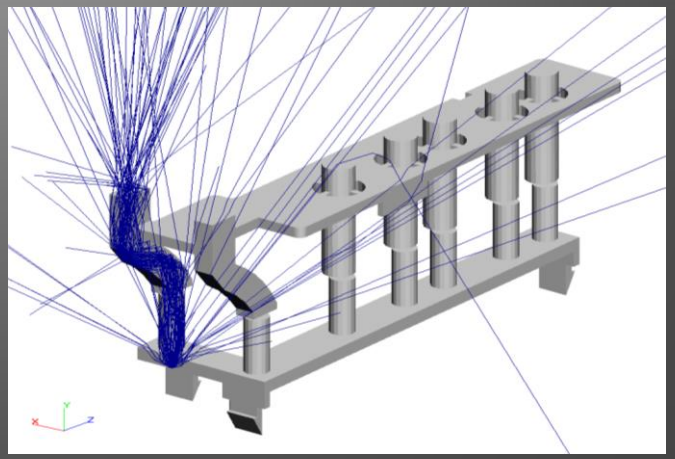




We use a number of the latest computer optical design softwares for advanced 3D “un-constrained” optical raytracing, photometric analysis and imaging systems design.

Powerful commercial software further enhanced by our in-house developed design programs, to give POL specialist capabilities for novel types of optical applications.

Advanced optical ray tracing and photometric mapping routines give real-world simulation results of optical system for better design performance and to remove need for prototyping before the production tooling.



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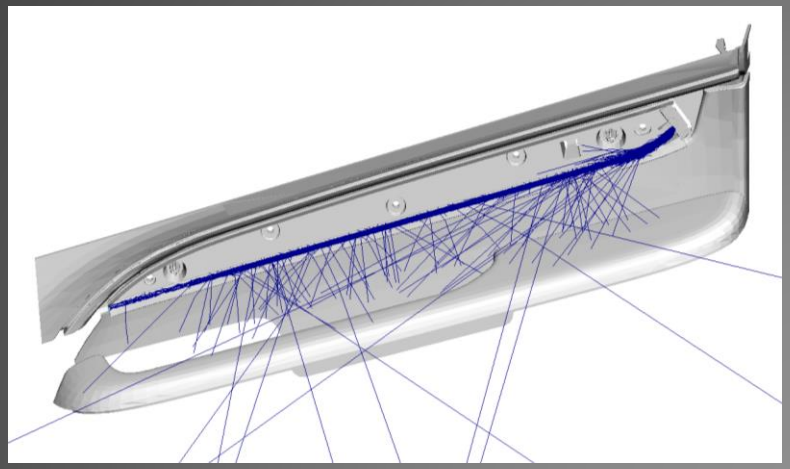
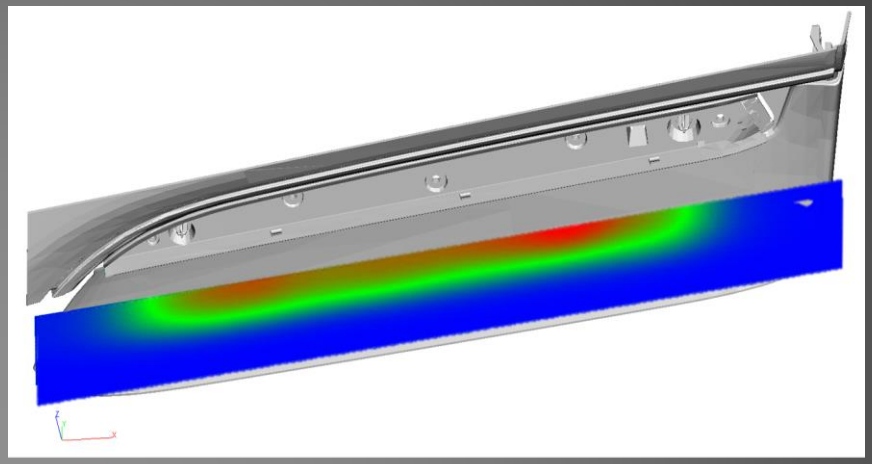
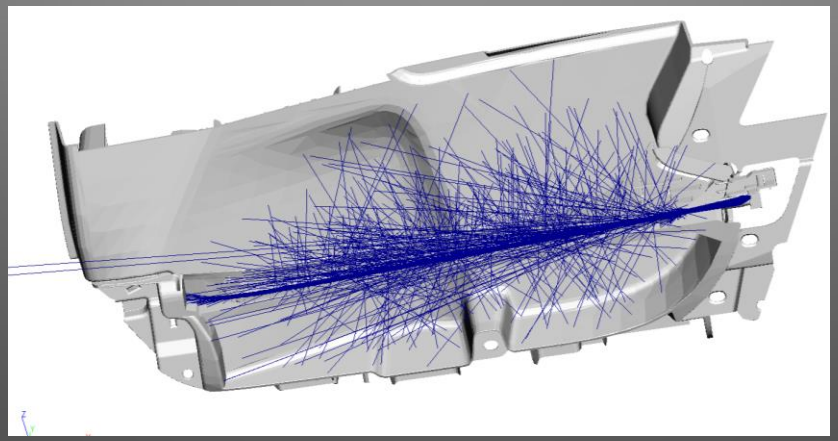
Optical Design and Analysis





Armrest and Door Facia Lightguide Interior Ambient Lighting Analysis



Door Pocket Interior Ambient Lighting Lightguide Analysis

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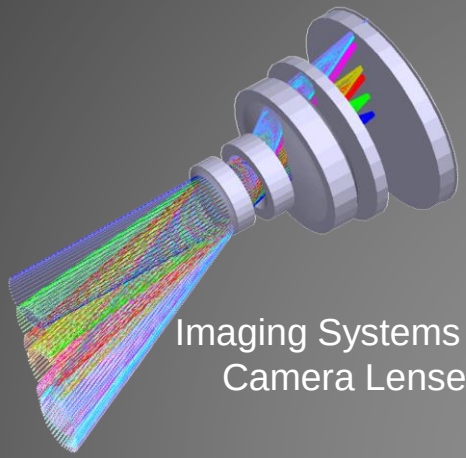
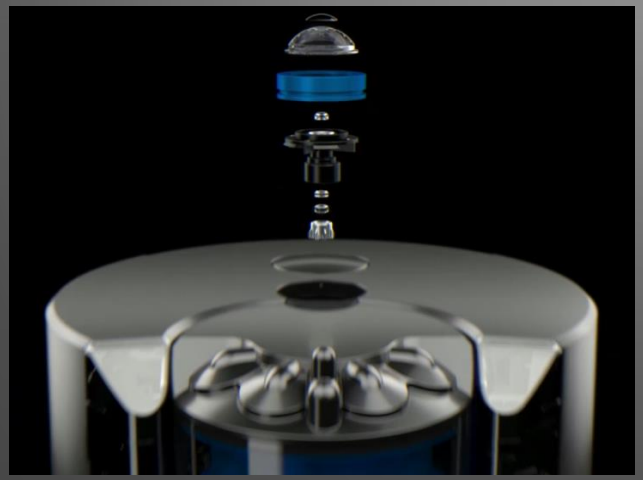
Imaging Optics and Camera Lenses



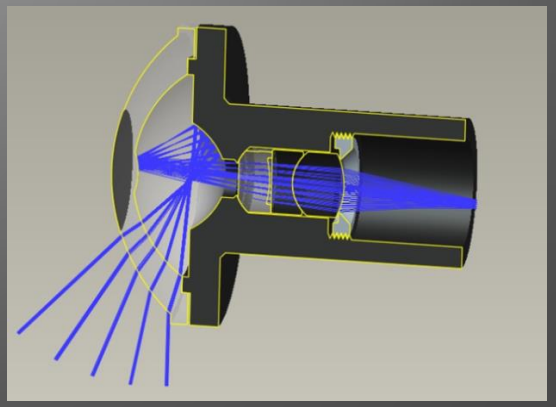
Imaging Systems and Camera Lenses

Increase in miniature cameras being used in parking assists and all-round vehicle presence monitoring, POAL can design and manufacture the lens systems for visible and IR applications.

Dyson 360 Eye is fitted with a panoramic lens designed by POAL, giving the robot vacuum cleaner 360 deg. vision.



dyson



Silicone Optics

Optical:
•Excellent transparency giving high light transport efficiency
•No yellowing under high temperatures and prolonged high UV exposure
•High colour and mechanical stability gives prolonged product life

Mechanical:
•Flexible resins giving high impact resistance
•Thick and thin component sections can be moulded accurately with no sinks
•Flexibility of the resin allows undercuts to be accommodated in the part design
•Seals can be moulded into the optic, reducing need for secondary sealing on assemblies
•Optics have intrinsic vibration dampening and shock resistance
•Minimal compression set under deformation loads
•Enables over-moulding onto light sources and other components
•Hardness – 70 Shore A and other hardnesses available for specialist applications

Environmental:
•High thermal resistance from -40°C to 150°C
•High chemical resistance

POL Standard 944 Silicone Optic

POL Standard 570 and 571 Silicone Optics

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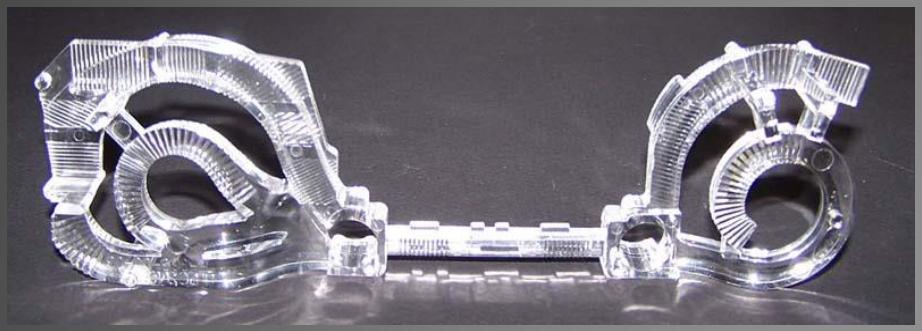
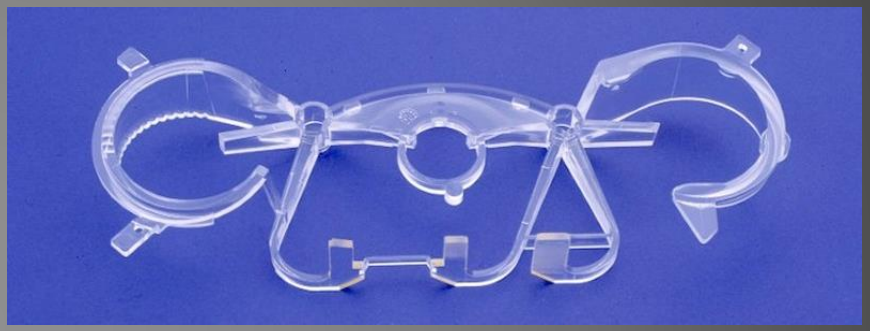
Light Control Techniques

Competitor Prismatic Lightguide Designs

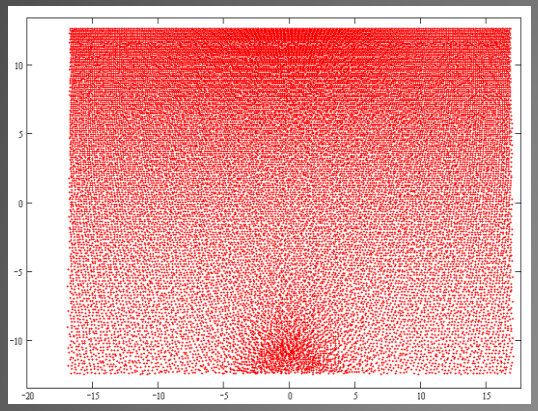




Prismatic features are widely used in automotive lightguide designs..

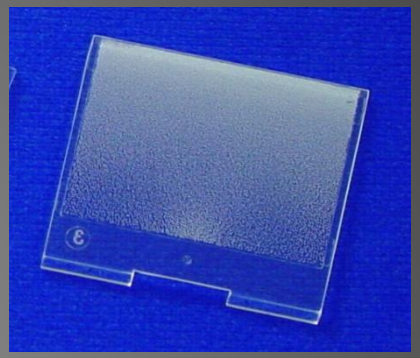
But can be difficult and expensive to control for uniform and consistently accurate performance and tooling design

Light Control Techniques



Typical Small Display Light Control Pattern

Laser Patterned Tool Insert
10cm^2 - approx. 40K dots!



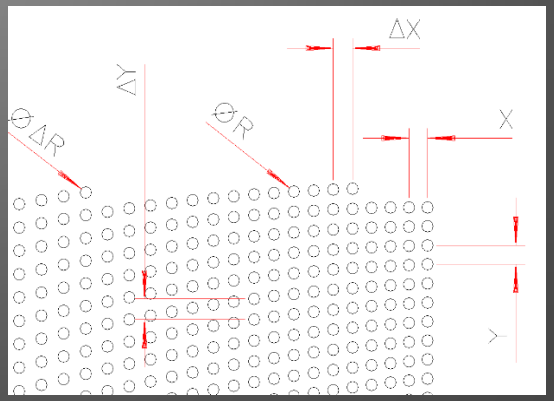
Injection Moulded Lightguide

POL/POAL has developed light control techniques over many years to give fine control of light distribution and evenness of displays.

Dot density distribution and light scattering properties of the etched dots can be varied to control illumination extraction and evenness

Very high repeatability in the laser machining and in the injection moulded product from the tool.

Patterns can also be etched directly to plastics for prototyping stages.



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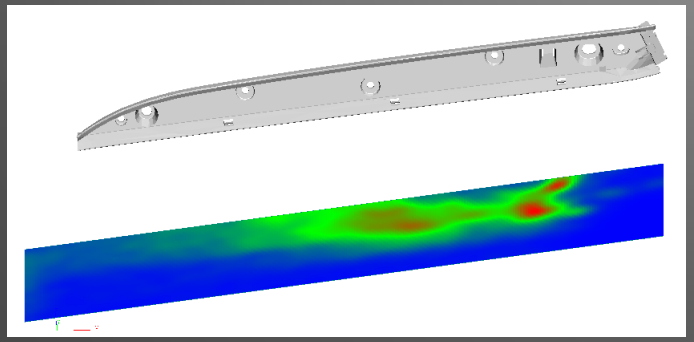
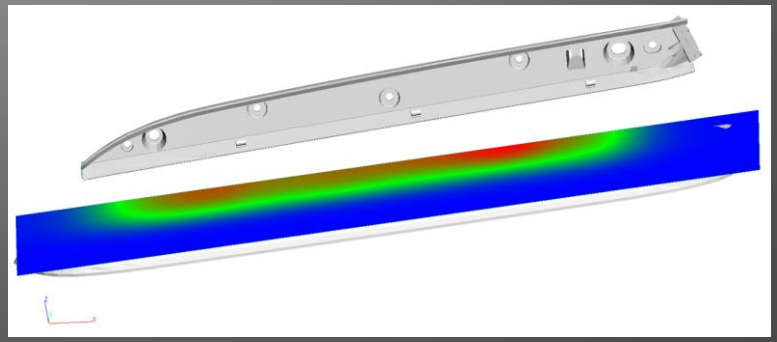
JLR Discovery 5 Door Illumination

POAL design, developed and prototyped the armrest and map pocket illuminations for the 2017 Land Rover Discovery 5



Analysis – Customer's Lightguide Design



Analysis of New POAL Lightguide Design

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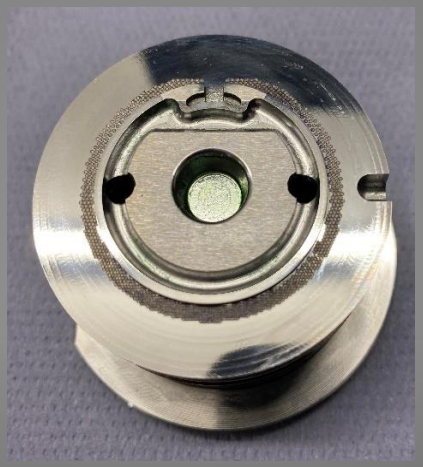
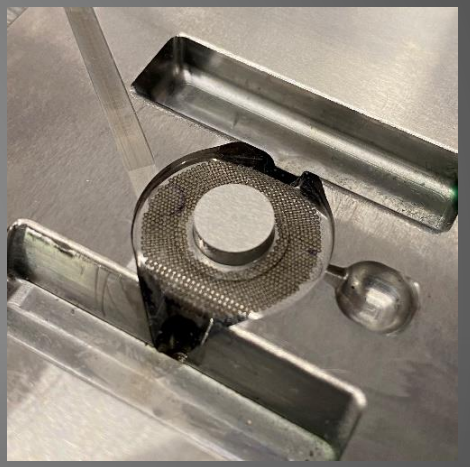
Optical Tooling Manufacture

With three decades of experience and continuous development of light control techniques, POL has invested in its own laser etching facilities for metal mould tool patterning. The machines are custom built to POL's specification, to enable large tool inserts to be machined with a laser focal spot size of only 10um - patterns can be machined to high accuracy with very small feature sizes.





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Polymer Optics Automotive Limited

Projects

POLYMER OPTICS AUTOMOTIVE LTD

Blue Chip Customer Base

NISSAN

Qashqai
Juke
2020 Juke

BENTLEY

Novel RGB
Developments

RENAULT

Illuminated Exterior
Badge Concept

INFINITI

Q30 Range

JAGUAR

F Type
Console
Concepts

ROLLS ROYCE

Dashboard Graphics
Illumination
Concepts

Audi

Q3 Range

HYUNDAI

Novel Rear Tail
Light Concepts

LAND ROVER

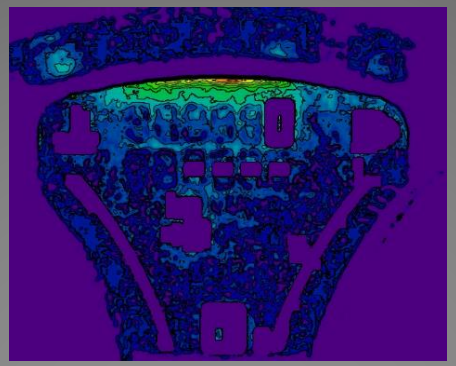
Discovery 4
Evoque

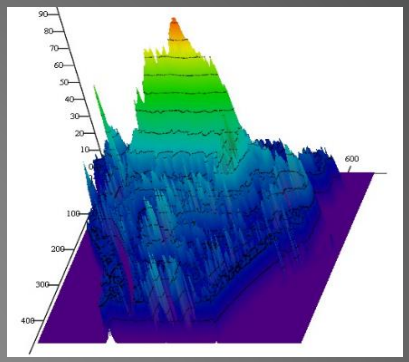
BMW

Door
Illumination
Concepts

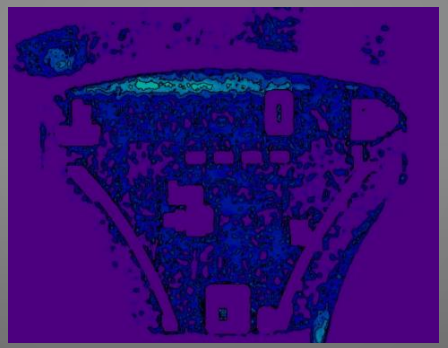
POLYMER OPTICS AUTOMOTIVE LTD

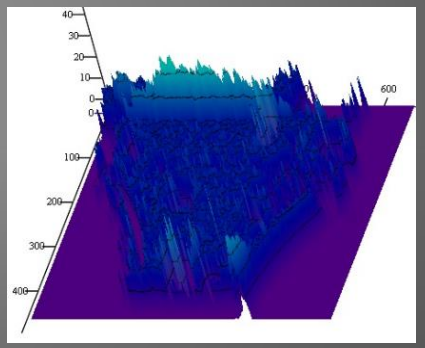
Nissan JUKE LCD Illumination





High level of light-bleed in the original LCD design



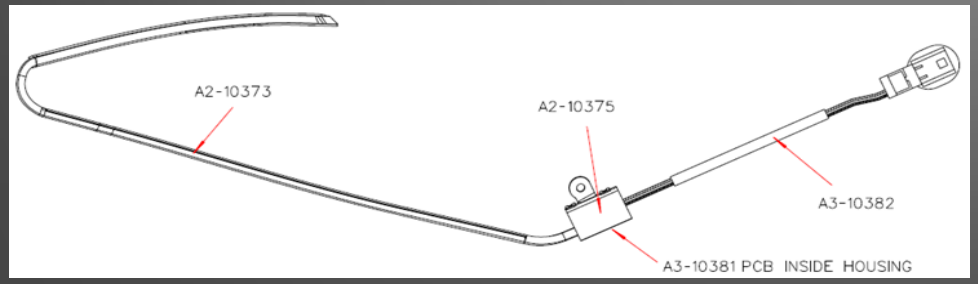


Dramatically reduced stray light giving higher contrast display

POAL's illumination measurement techniques help quantify the problem, then quantify the improvements

The improved display contrast has reduced illumination test rejects on the JUKE assembly line, reducing rework and costs

Nissan Qashqai Illumination

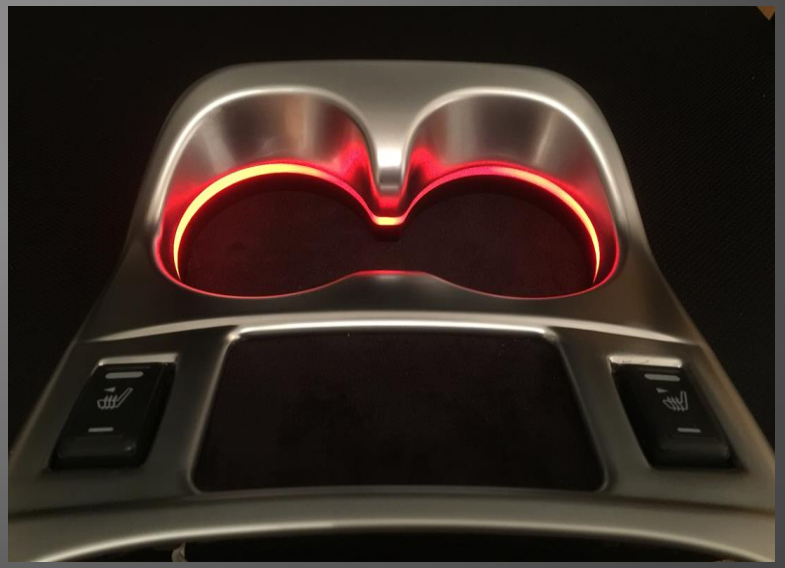


POAL developed the interior illumination system for the 2014 Nissan Qashqai which draws on POAL's wide polymer optical product development experience to introduce some novel product features:

- 500mm long lightguide illuminated from one end only, saving cost in the electronics and wiring harness.
- Laser etched tool surfaces provide precise light extraction and intensity in areas where required.
- Cross-section of lightguide designed for easy clipping into assembly with no light losses.
- Lightguide is hard coated for abrasion and chemical resistance against various reagents.
- Design for Assembly (DFA) and Poka Yoke techniques used to reduce cost and ensure reliability.

Ring and Cup-holder Illumination

POAL's 360 deg. lightguide technology can be used for cup-holders and other inner and outer ring illumination effects, giving a continuous circle of uniform and seamless illumination



Infiniti Q30 Illumination – Interior Light

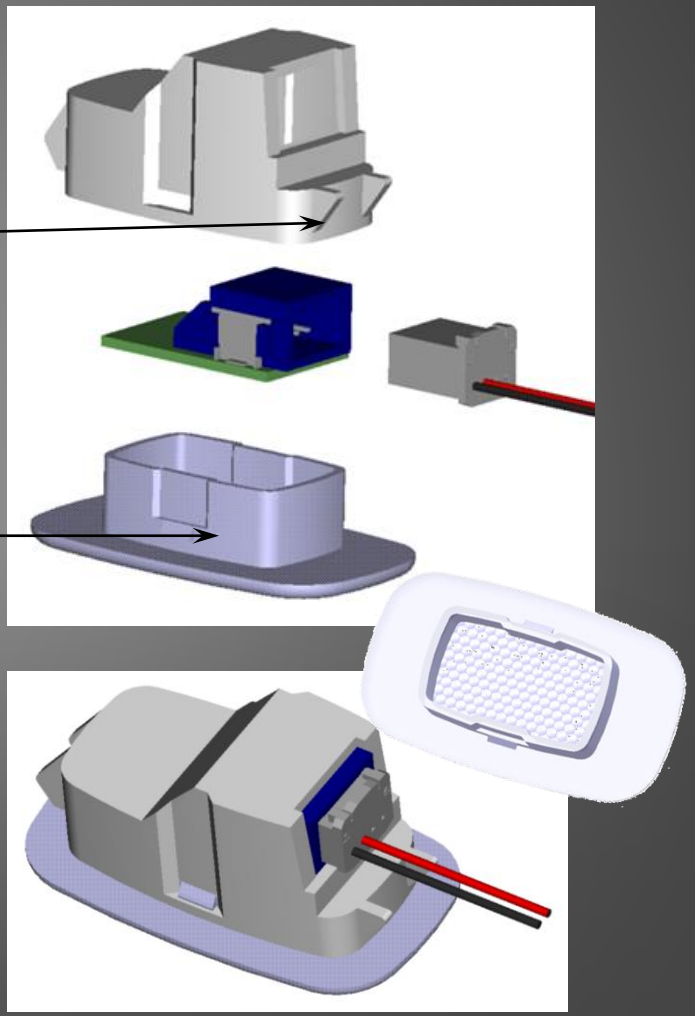
POAL design advantages:

Simple “line-of-draw” tooling construction for housing - clip features engineered in the plastic housing part for resilience and reliability

Lens component made in hard acrylic, for better clarity and no hard coating protection required

Two simple side actions on the outside of the lens part allow insert changes inside for different optical functions

Closed assembly gives dust and water ingress protection to meet tight specifications



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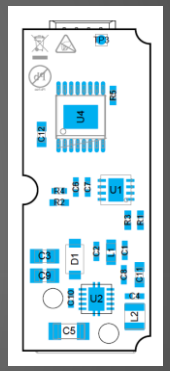
New Nissan Juke Door Illumination

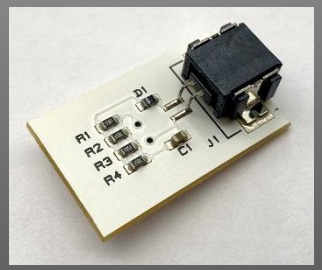
POLYMER OPTICS AUTOMOTIVE LTD

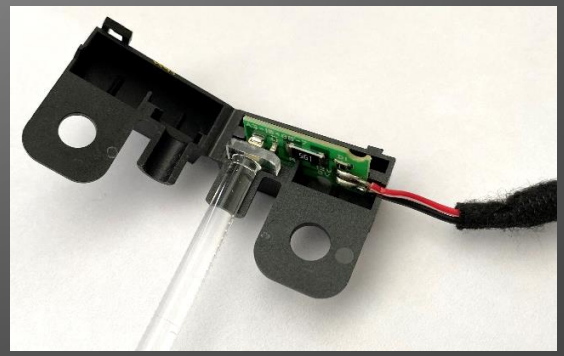
Electronics Manufacture

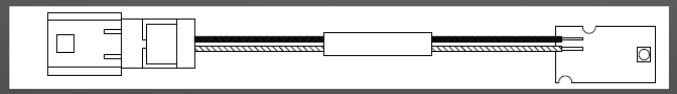
Through POL's electronic design and manufacturing partners, we supply complete "plug and play" illumination systems, with the control electronics and light sources fully integrated into the opto-mechanical assembly, for delivery to the final product assembly lines.

We also manufacture our own "boiler-plate" LIN/CAN Bus controlled RGB LED driver for automotive applications, which can be configured for a wide range of target vehicles and control protocols.

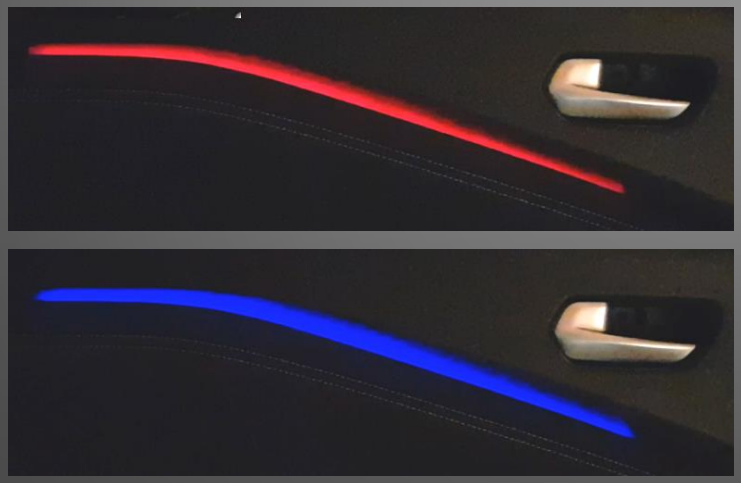








New Nissan Juke Door Illumination



POAL's retrofitted LIN RGB control into a door for demonstration for Nissan

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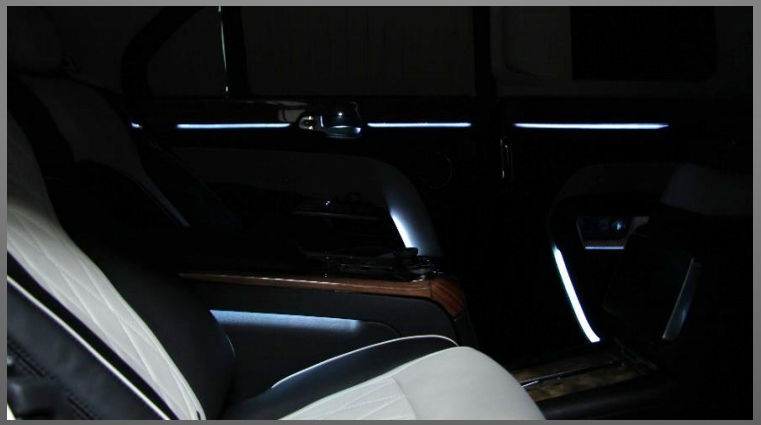
Complete Interior Illumination for luxury vehicle



POAL has designed, develop & production tooled and now manufacturing the interior lighting system, comprising of 31 separate RGB LIN-bus controlled illuminations.

We developed the mechanical assemblies, electronic PCBAs and control software for these illumination components.

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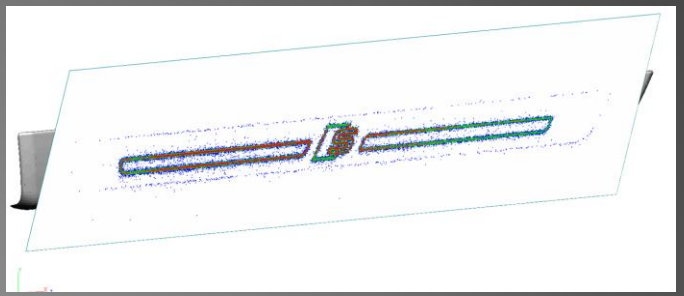
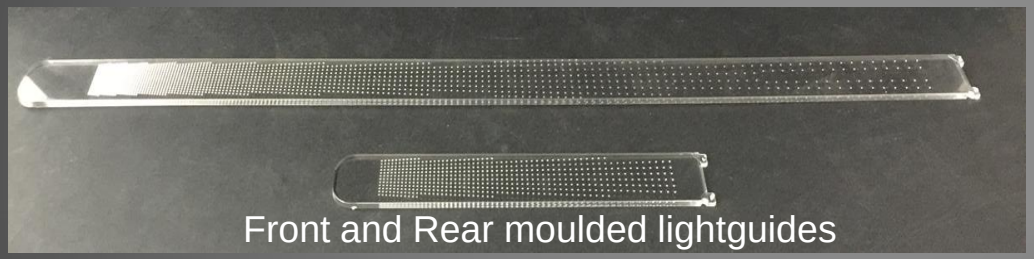
Audi and JLR Illuminated Tread Plates

System ray-trace analysis





Front and Rear moulded lightguides

Finalised tread-plate illuminations

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Polymer Optics Automotive Limited

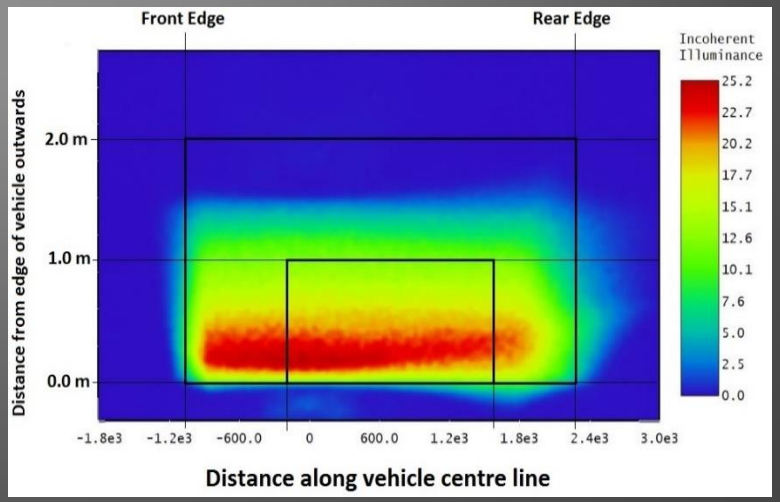
New Technologies

Free-form Optics

POAL has developed free-form optics for reading lights in automotive interiors, hence the illumination can be efficiently and accurately controlled into the required beam foot-print.

Also, the normal “key-stone” distortions of the beam can be corrected (where the beam is projected at an angle to the target area).

POAL has developed free-form optic solutions for vehicle Manoeuvring Lights - illumination can be projected from front to rear of the vehicle from the door-mirror mounted position



POLYMER OPTICS AUTOMOTIVE LTD

Ring and Cup-holder Illumination

Rapid Prototype Ring Illumination Demonstrator

POAL has developed a lightguide based solution to give a uniformly illuminated - complete 360 degrees ring of light..

This technology only uses one LED to illuminate the entire 360 deg. ring of uniform and seamless illumination!

POLYMER OPTICS AUTOMOTIVE LTD

GloWorm® Illumination

GloWorm®

The POAL GloWorm® technology - wide range of applications where specific areas of a vehicle interior are to be illuminated with a defined foot-print of light, such as arm rests, console walls, door pocket interiors..

Example – a typical door pocket illumination design - lightguide is mounted in the pocket edge to illuminate the facia of the door lining, the changing shape of the door facia and distance between the lightguide and target surface, will give a variation in the illumination brightness and foot-print width across the target surface. With POAL's GloWorm® technology, we can control the illumination brightness, width and position at every point across the door facia, for optimum, uniform & aesthetically pleasing illumination..
With this, we can correct almost any automotive interior illumination geometry, or use it to produce different illumination effects.

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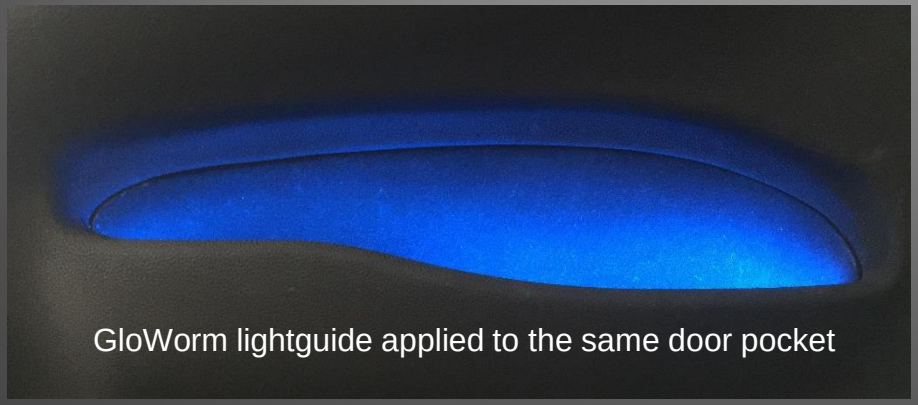
GloWorm® Illumination

Standard lightguide in vehicle door pocket

GloWorm®

Shaped illumination from a simple lightguide!



GloWorm lightguide applied to the same door pocket

In a typical map pocket application, using GloWorm®, the light projected from a shaped lightguide path is designed to fill the entire shape of the map pocket zone evenly

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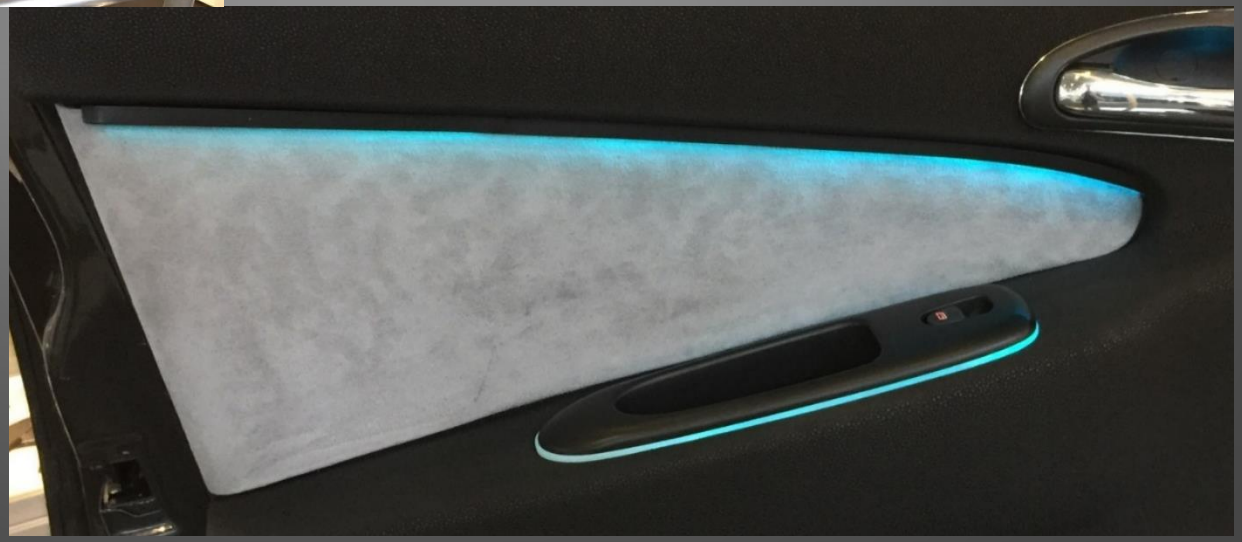
Panel “Wash” Illumination

POAL’s standard lightguide illumination, using laser machined light control structures, is a very compact design solution to be concealed in a minimum package space.

Allows single & multi-colour illumination to be applied to a wide range of interior design schemes for projected lighting & directly viewed illumination.
Oblique lighting projected down decorative interior panels, highlights the subtle textures.



Doors bezel Feature Illumination

POAL's laser machined lightguide techniques, allow the light to be directed around long complex paths to illuminate wide range of features.

The door-pull bezel is illuminated by one RGB LED source only - the lightguide fits around the internal features of the assembly, but maintain the flow of light for uniform illumination.

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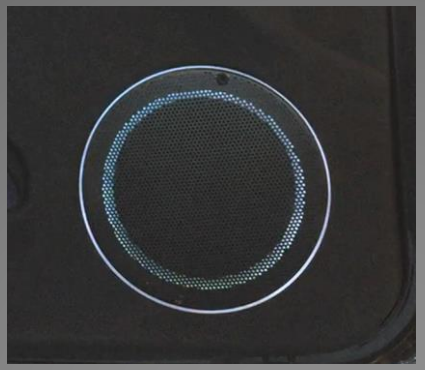
Speaker Grill Illumination



Speaker & door handle lighting can be achieved with one LED source

Inner and outer speaker grill illuminations two LEDs, also routing the light around various fixings and maintaining perfect colour mixing of the RGB illumination

POAL's illumination techniques allow best use of the light to provide diverse illumination effects.

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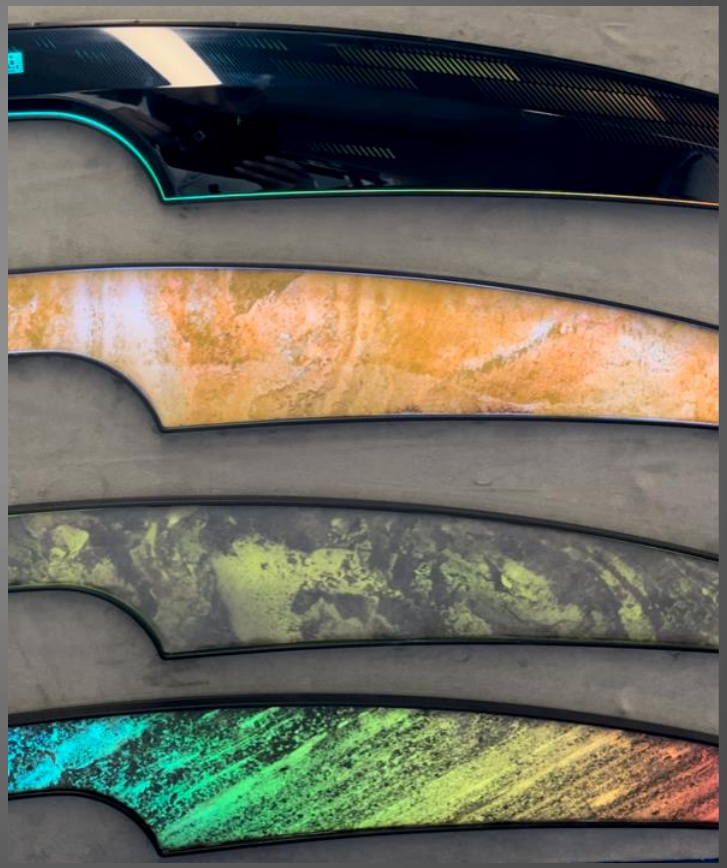
Decorated trim backlighting

Doors & IP - backlighting natural & sustainable materials can be achieved with minimal LED sources

By advanced control of light distribution and uniform light extraction using our lasered structures - complex illuminations can be produced with minimum number of LED's... POAL's illumination techniques allow best use of the light to provide diverse illumination effects. Hence saving cost and making colour uniformity easier to control.



POAL Design Advantages

- The most optimum illumination performance can be designed within the product constraints
- The optics can be designed to make best advantage of design for assembly (DFA) techniques
- The product can be engineered to give the most cost effective solution
- This doesn't necessarily mean cheap components.. But balance of best cost to performance and savings elsewhere in the product!

Best Performance → Lowest Cost → Biggest Advantage

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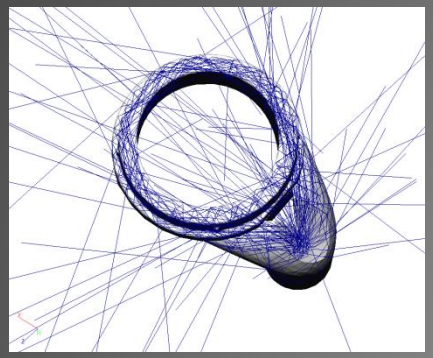

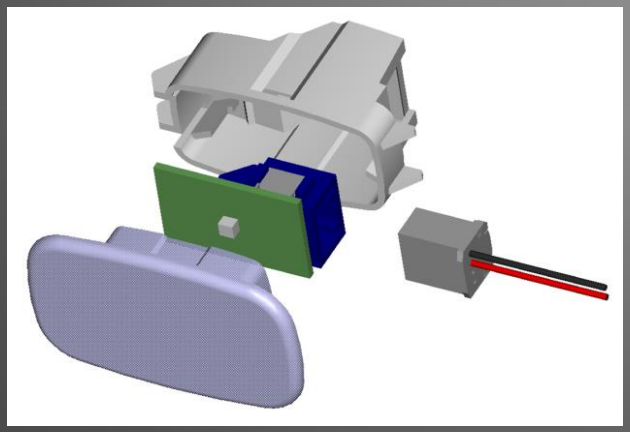

Thank you!
POAL team