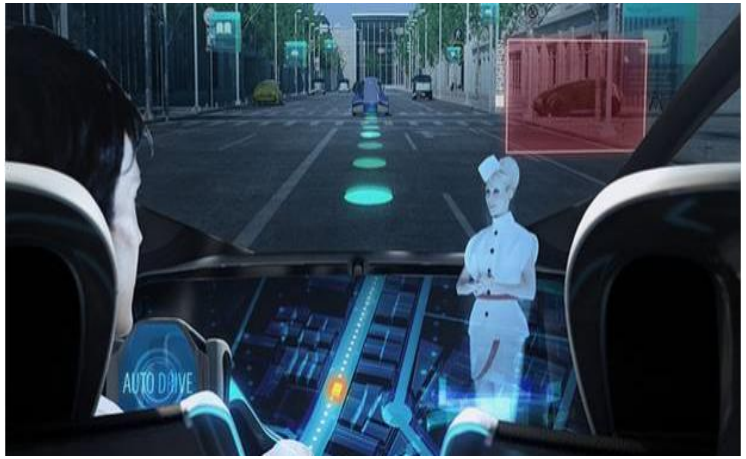


SMART TECHNOLOGY
FOR SMARTER CARS

Lighting Solutions - From ‘I’ Drive to ‘IT’ Drives

Francisco-Jose Villar
John S. Orisich

2019 DVN CONFERENCE
Detroit, January 16th, 2019

The 3 Automotive revolutions

SMART TECHNOLOGY
FOR SMARTER CARS

AUTOMATED VEHICLES

DIGITAL SOLUTIONS
that will lead to the emergence of
NEW FORMS OF MOBILITY

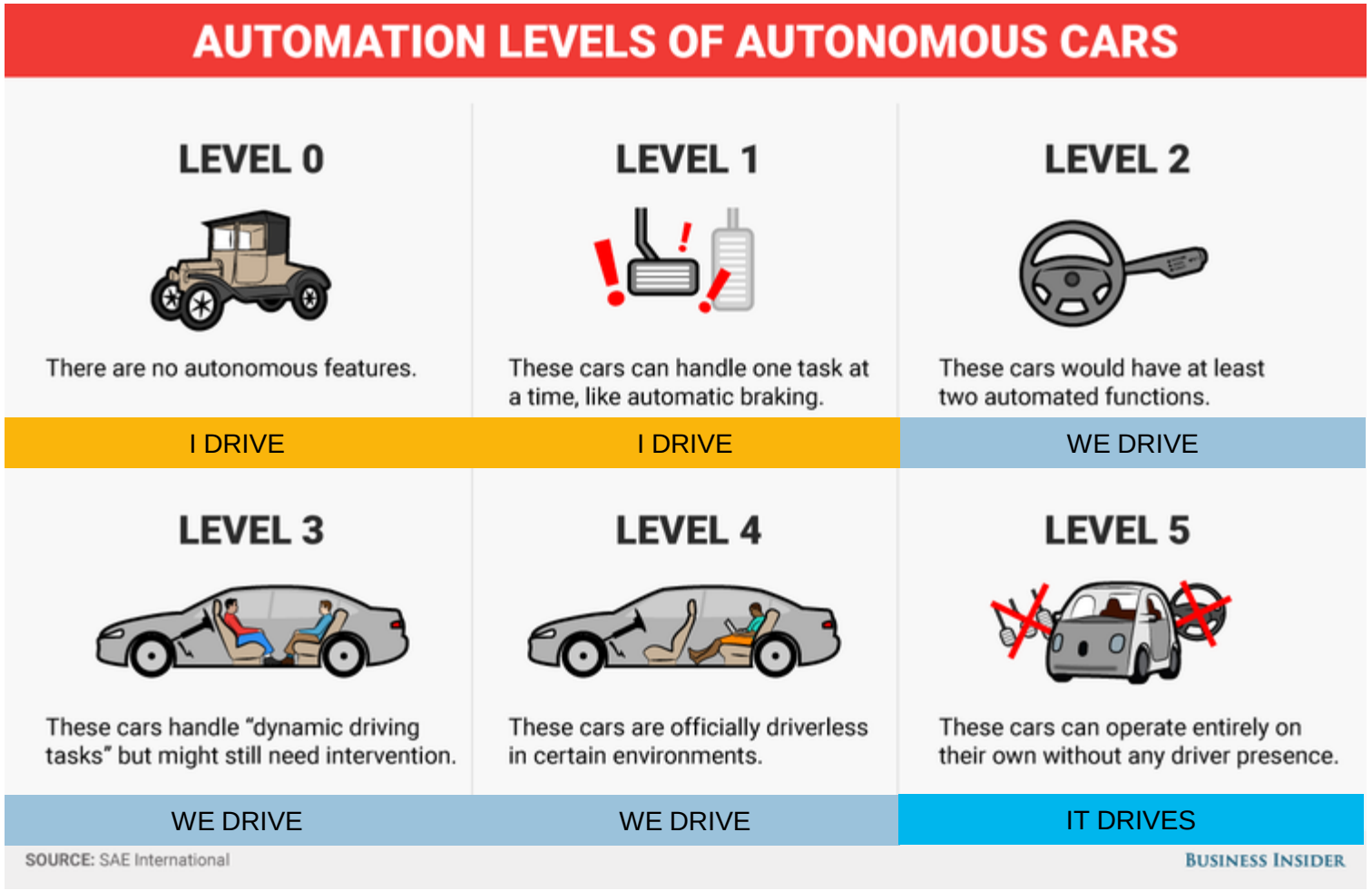
POWERTRAIN ELECTRIFICATION

The 3 Automotive revolutions will shape the future of lighting products & features development

So the question is…:

How will Lighting advance with these revolutions?

6 levels of autonomy



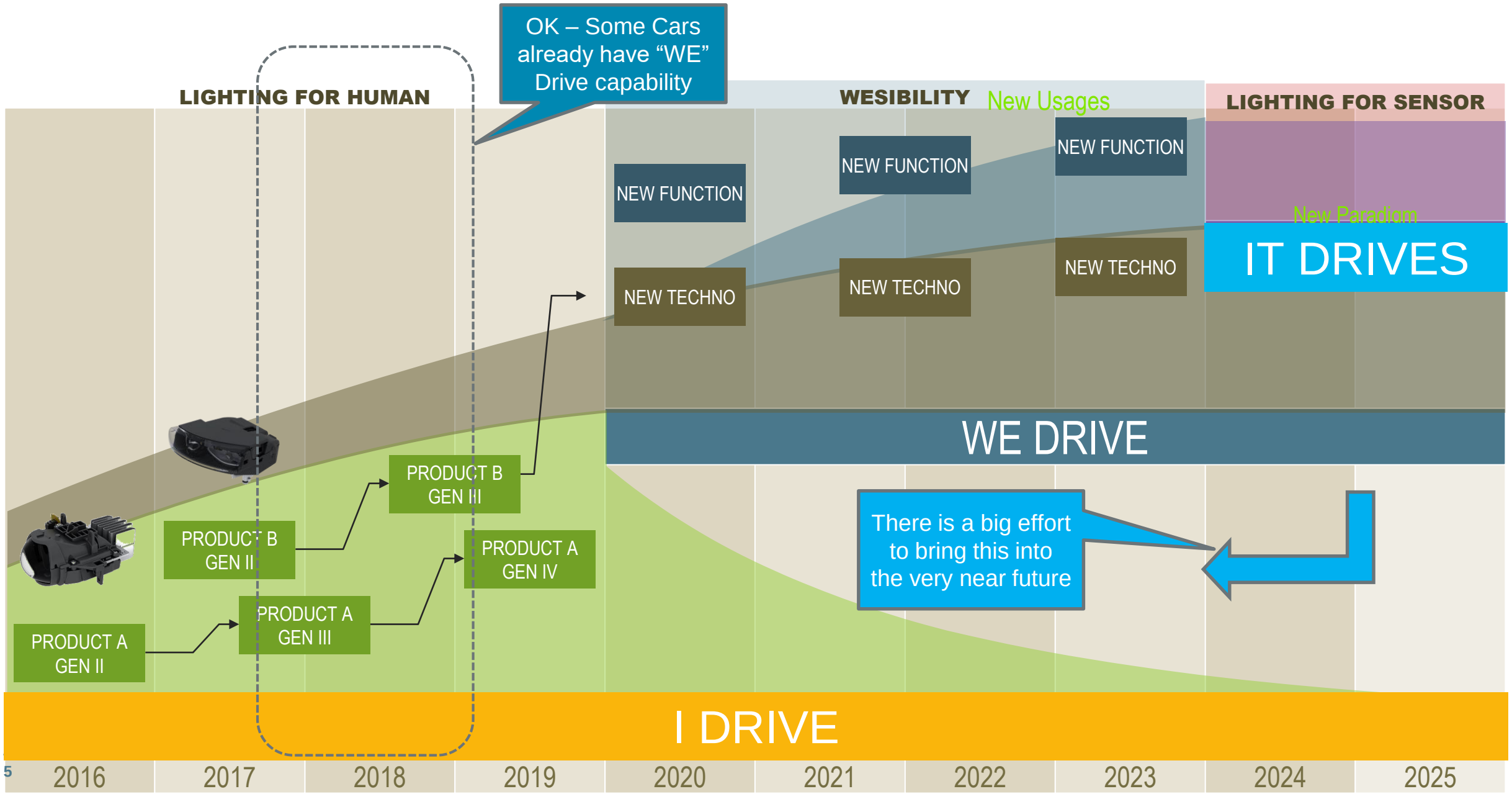
3 LIGHTING MODES

I DRIVE

WE DRIVE

IT DRIVES

IMPACT ON TECHNOLOGY DEVELOPMENT vs TIME



SMART TECHNOLOGY
FOR SMARTER CARS

For I Drive and We Drive modes,
High Definition Lighting Systems will be the preferred technology for the future

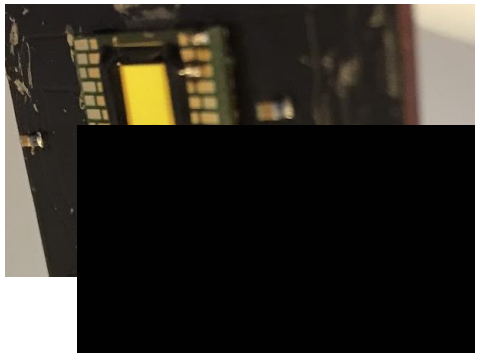
High pixelisation – key elements for success

Spatial Light Modulator

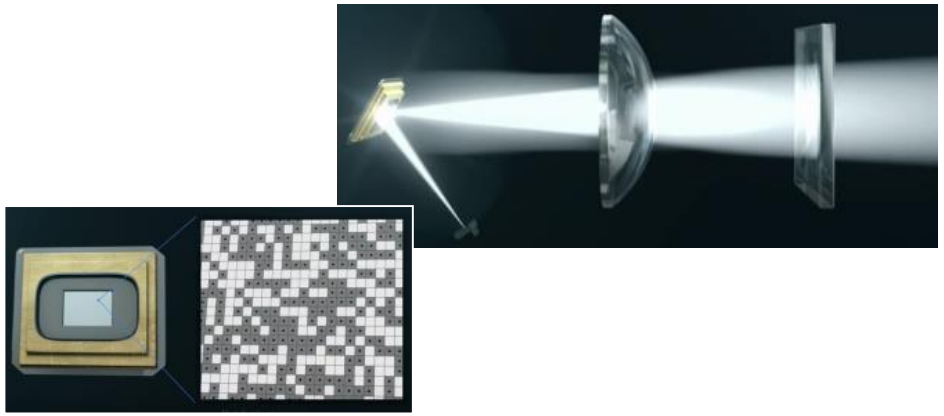
Image Projection System

System Architecture

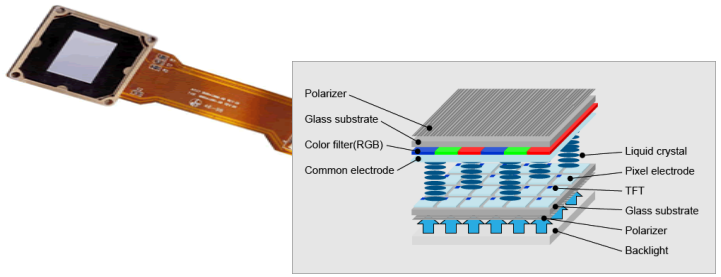
High density LED matrix



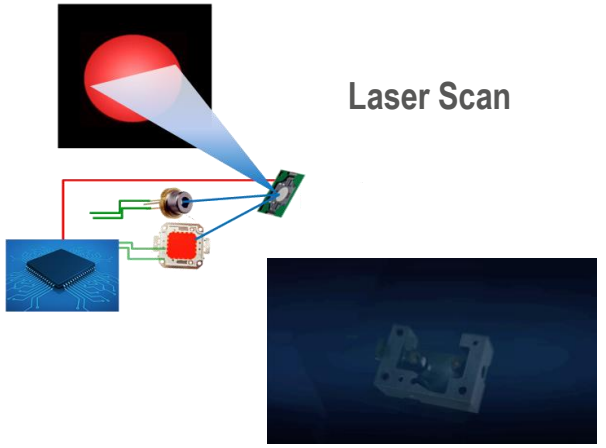
Matrix of micro mirrors



LCD / LCOS



Laser Scan



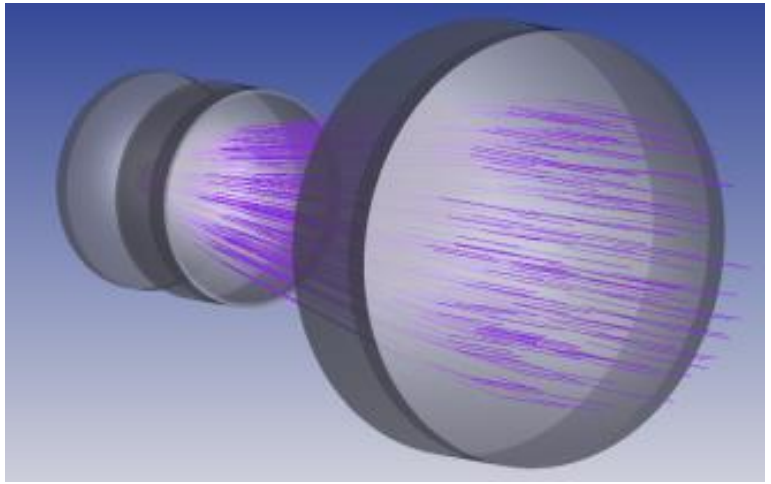
High pixelization – key elements for success

Spatial Light Modulator

Image Projection System

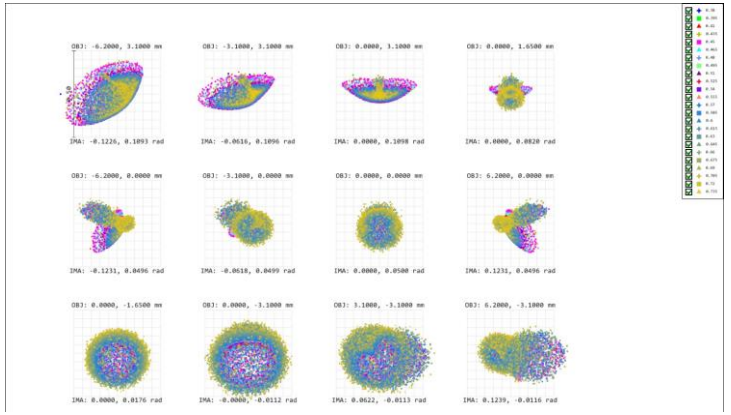
System Architecture

Optimization vs. Optical aberrations



Design flexibility & Style integration

New design & simulation methodologies



Industrial solutions for high precision optics

High pixelization – key elements for success

Spatial Light Modulator

Image Projection System

System Architecture

High data density

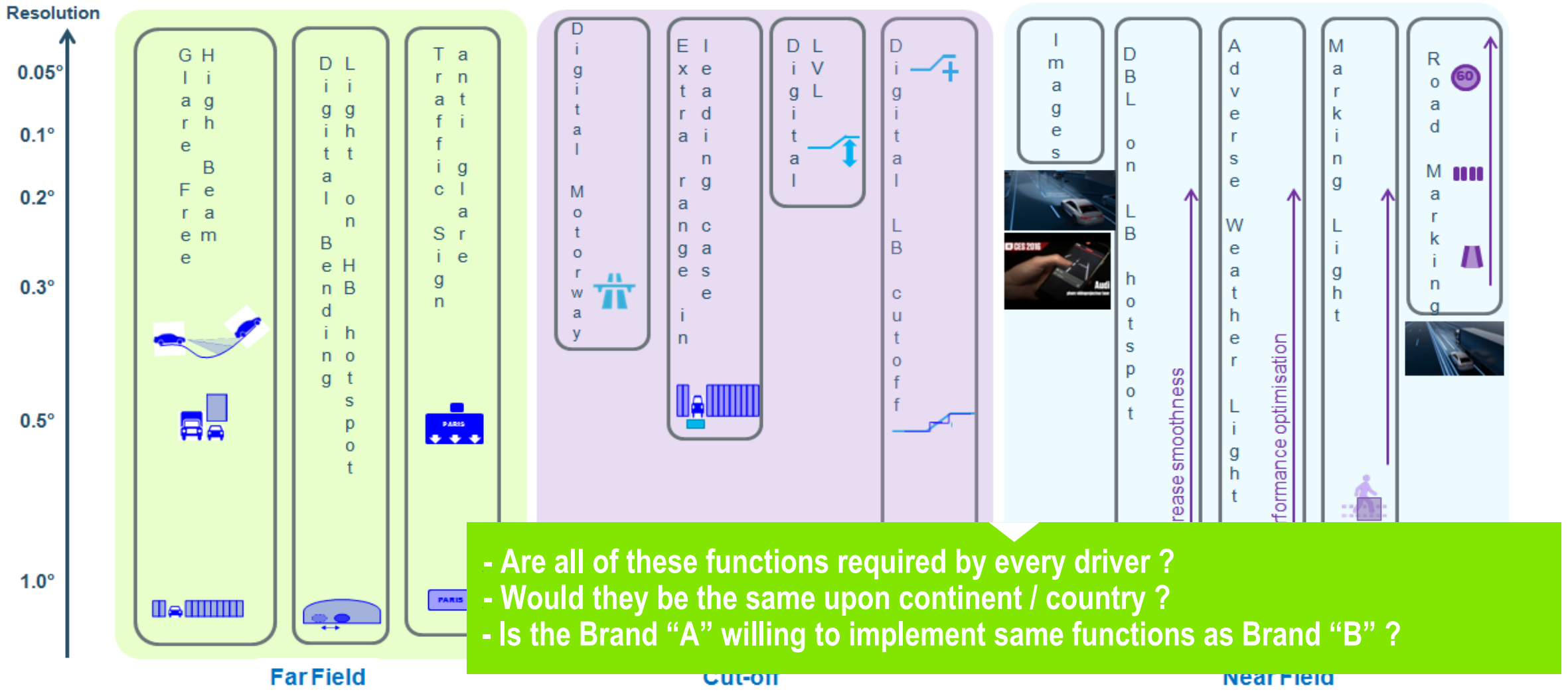
System linked with sensors

Versatile solution

Safety management (ISO 26262)

A quick video on DMD and Monolithic

Typical features for high definition lighting



- Are all of these functions required by every driver ?
- Would they be the same upon continent / country ?
- Is the Brand “A” willing to implement same functions as Brand “B” ?

User Experience

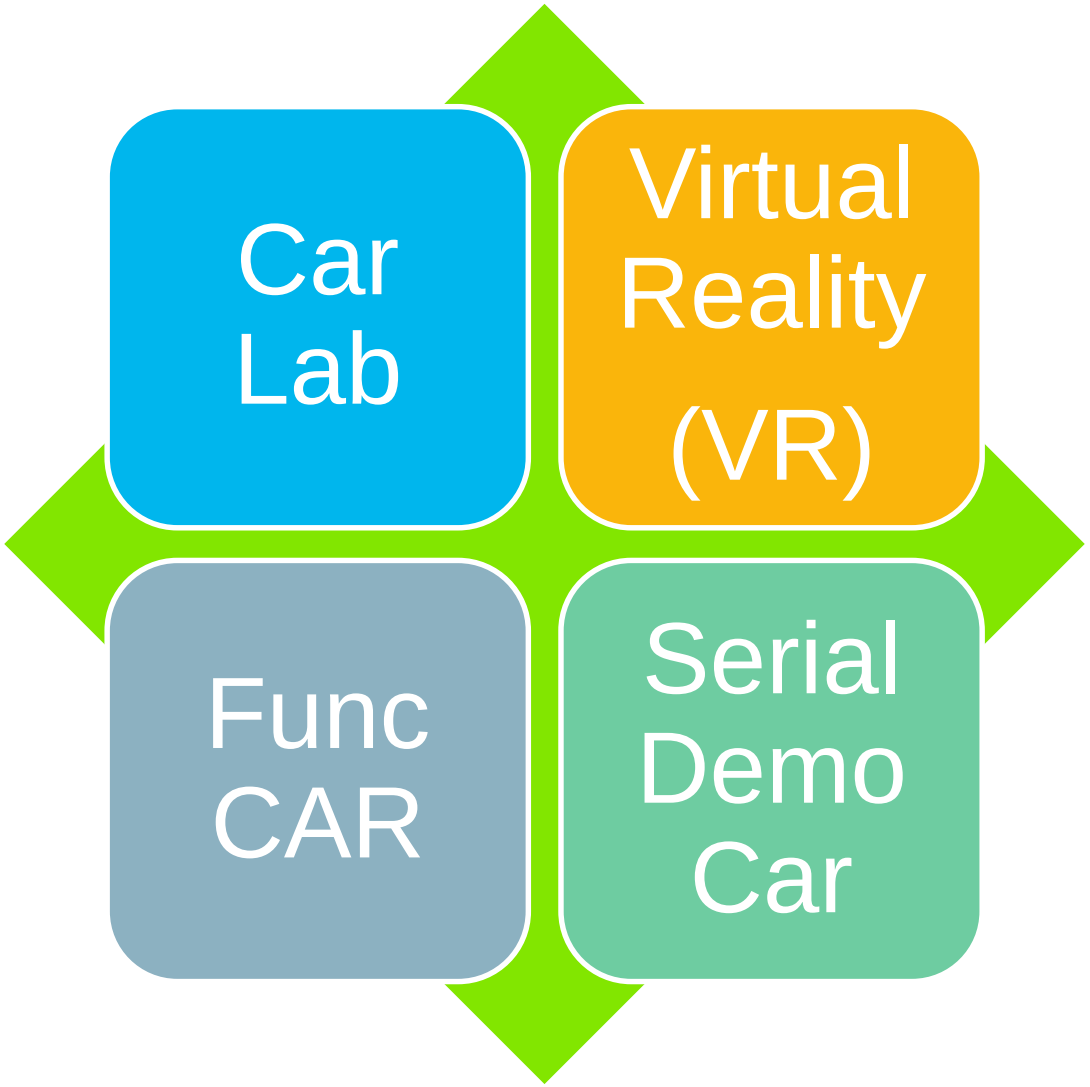
One of the major foundations of all HD lighting and advanced lighting development is based on the USER EXPERIENCE.

So, what is UX?

From Wikipedia…

User Experience (**UX**) refers to a person's emotions and attitudes about using a particular product, system or service. It includes the practical, experiential, affective, meaningful and valuable aspects of human–computer interaction and product ownership. Additionally, it includes a person's perceptions of system aspects such as utility, ease of use and efficiency. User experience may be considered subjective in nature to the degree that it is about individual perception and thought with respect to the system. User experience is dynamic as it is constantly modified over time due to changing usage circumstances and changes to individual systems as well as the wider usage context in which they can be found. In the end, user experience is about how the user interacts with and experiences the product.

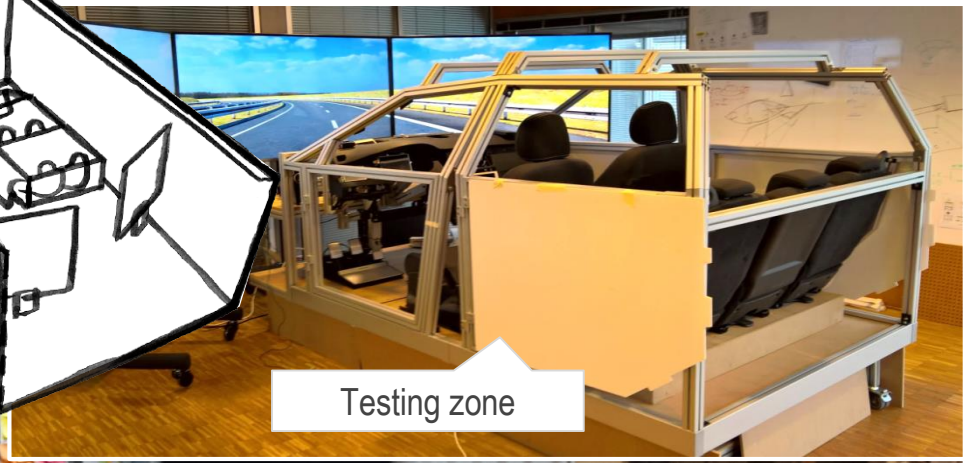
Valeo uses a 4 Step Methodology



User Centric Approach
It starts with Valeo Accelerator : « The CarLab »

Augmented Visibility

CarLab™ Valeo

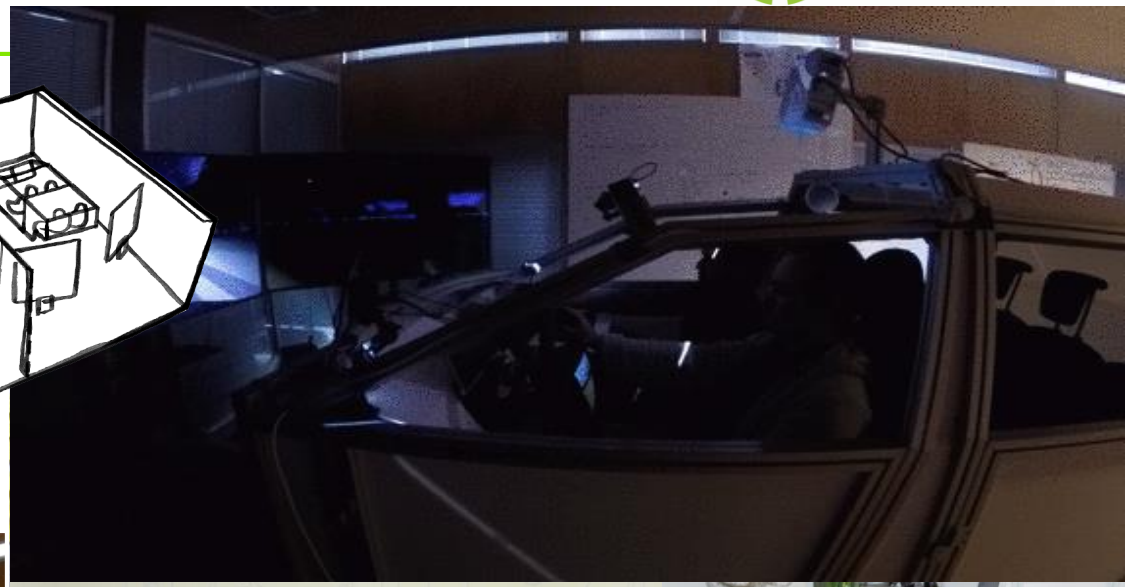


Valeo

User Centric Approach
It starts with Valeo Accelerator : « The CarLab »

Augmented Visibility

CarLab™ Valeo



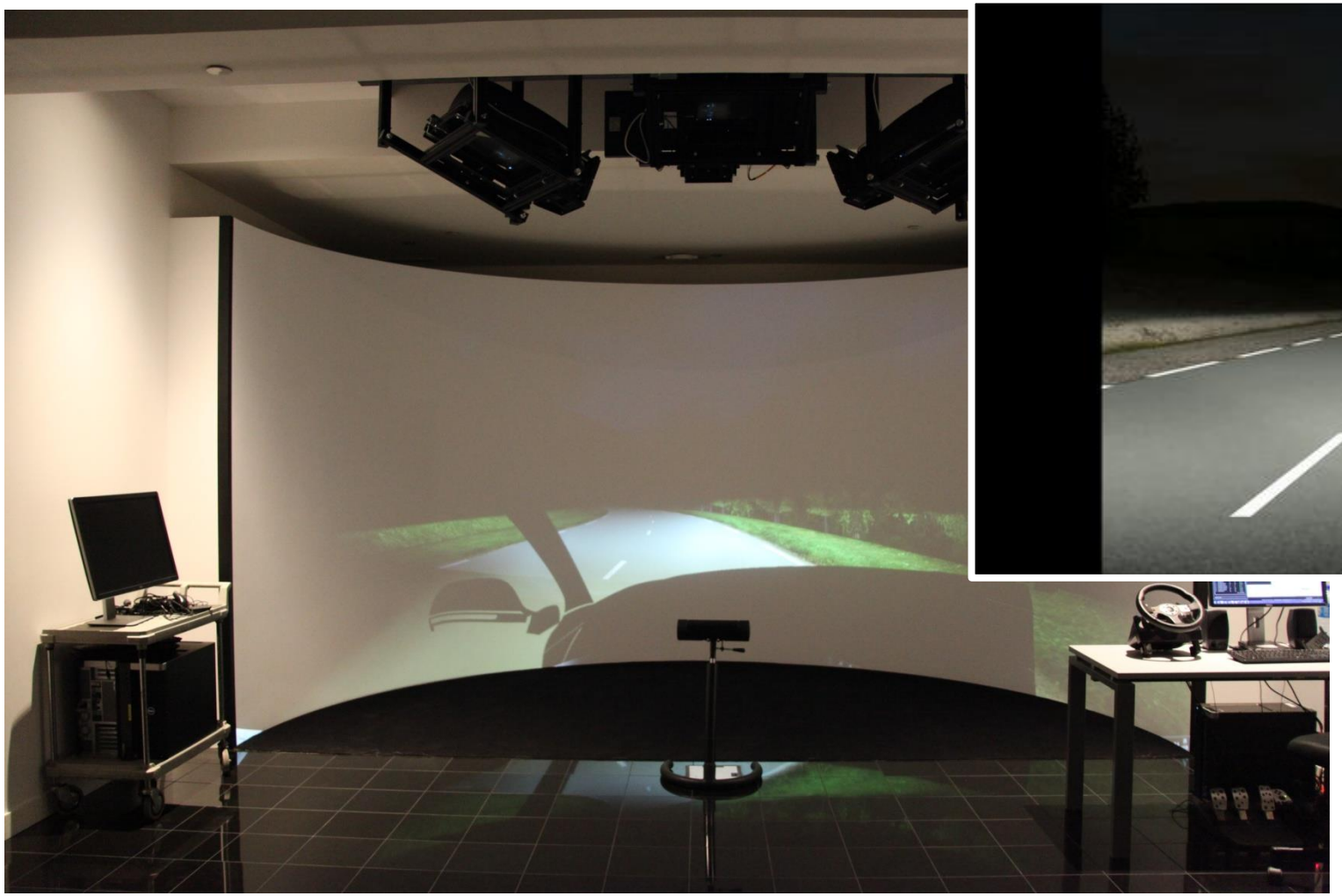
Valeo

User Centric Approach
2nd step: Real environment night drive simulator

VR

Augmented Visibility

User Centric Approach
2nd step: Real environment night drive simulator



User Centric Approach
3nd step: FuncCar & FuncVan

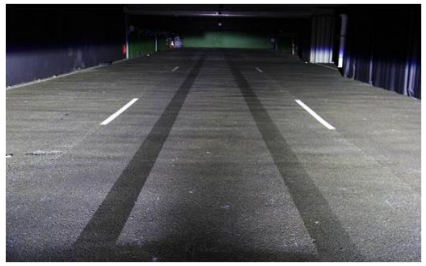
User Centric Approach
3nd step: Examples of Front Functions

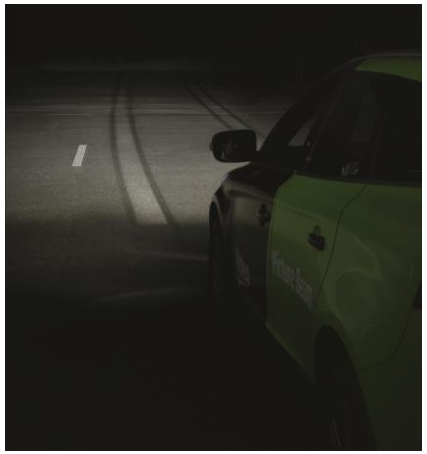
Dynamic driving is a must to fine tune the functions

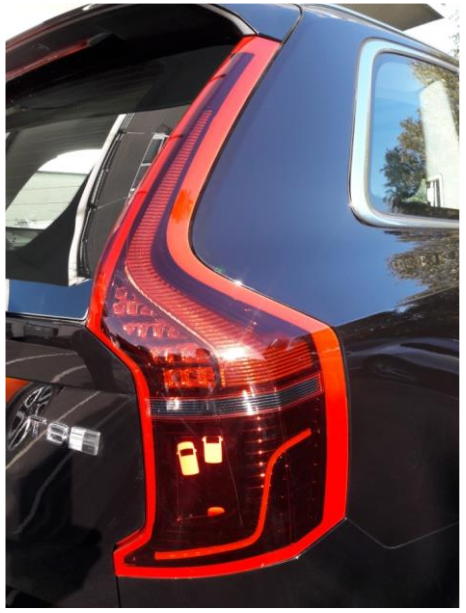
User Centric Approach
4th step – Demonstration vehicle - “Serial type” design

Serial Demo Car

Augmented Visibility







Valeo

IT DRIVES


WE DRIVE
LEVEL 5
These cars can operate entirely on their own without any driver presence.
IT DRIVES

“Autonomous Driving?“

“Robocars“ are coming

Valeo

“Autonomous Driving?“

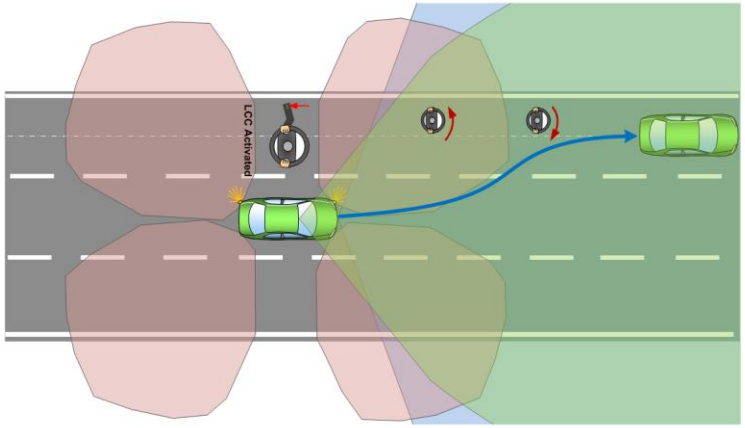
…not only passenger cars

How real is “Autonomous Driving “…?

Use cases (UX) drive sensor configuration

[NCAP]
Safety through collision avoidance

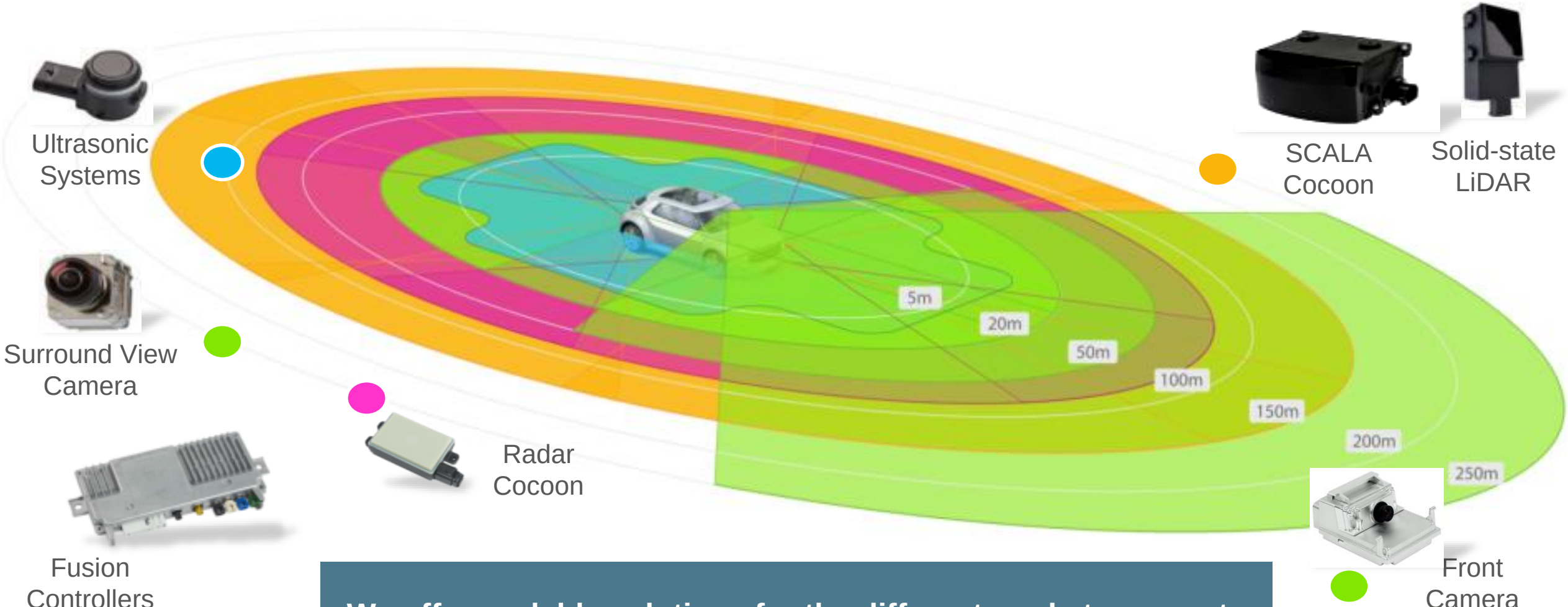
[SELF-DRIVING]
Relieve the driver in parking, traffic jams and on highways



[DRIVERLESS]
Handle urban traffic without human intervention

Cost-driven → **Performance**

Multi-sensor Cocoon – triple redundancy depending on level of automation



We offer scalable solutions for the different market segments

Sensor vertical mounting position - depending on level of automation

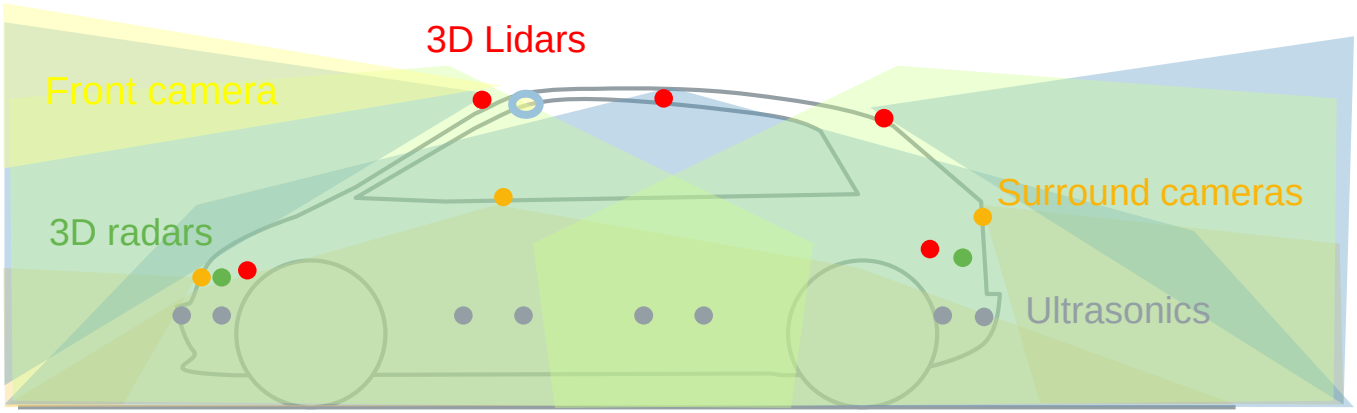
[NCAP]
Safety through collision avoidance

[SELF-DRIVING]
Relieve the driver in parking, traffic jams and on highways

[DRIVERLESS]
Handle urban traffic without human intervention

Front camera

Behind windshield for driver point of view and windshield cleaning



Camera Cocoon

Pod-like position above the waistline

Grill, mirrors and handle/CHMSL, Headlamps/Taillamps for below waistline

Corner radars

Bumper/Fascia with effects from painting

Headlamps / Taillamps

Scala Cocoon

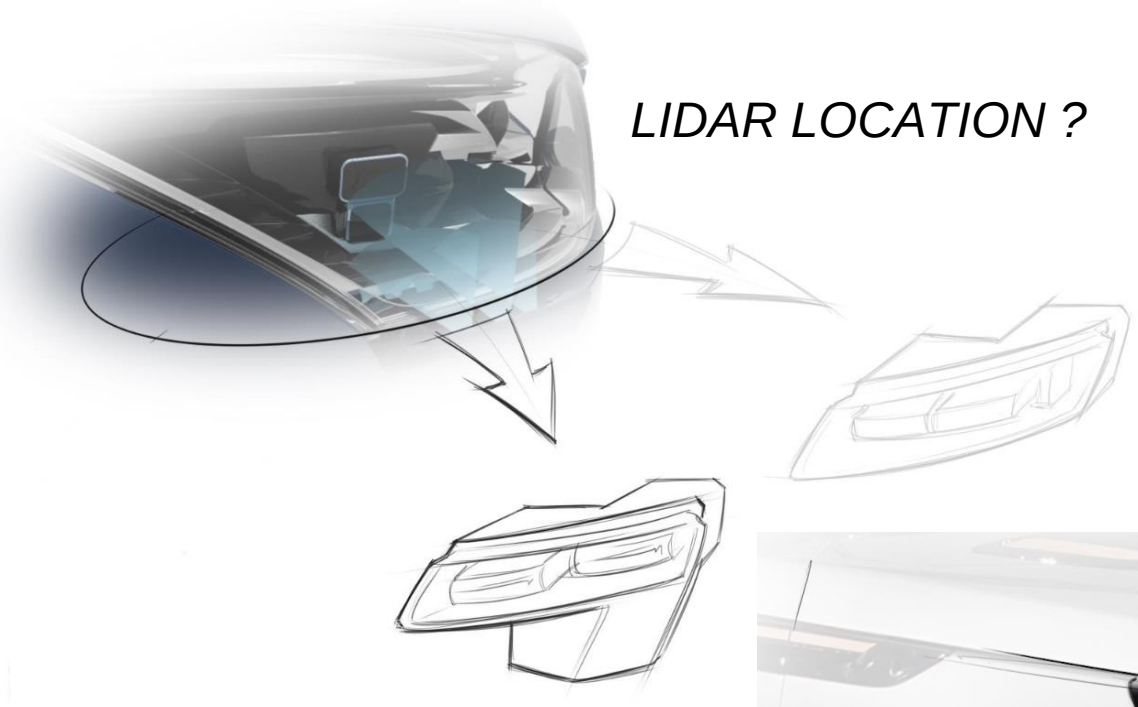
- Bumper / Facia (orifices)
- Headlamps / Taillamps

Sensors integration: is there a real need?

Sensors integration: is there a real need?

It could be...

Styling proposals for lidar integration



LIDAR LOCATION ?

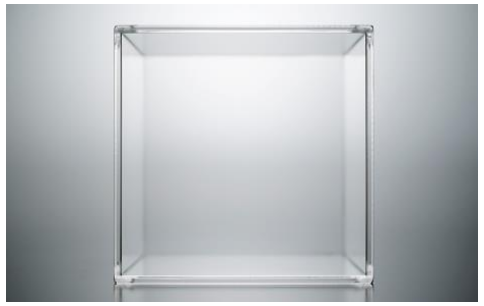
KEEPING THE HORIZONTALITY

CREATING STYLING EXTENSIONS

Radar integration - Styling 2 choices

Radar integration - Styling 2 choices

Radar integration - Styling synthesis

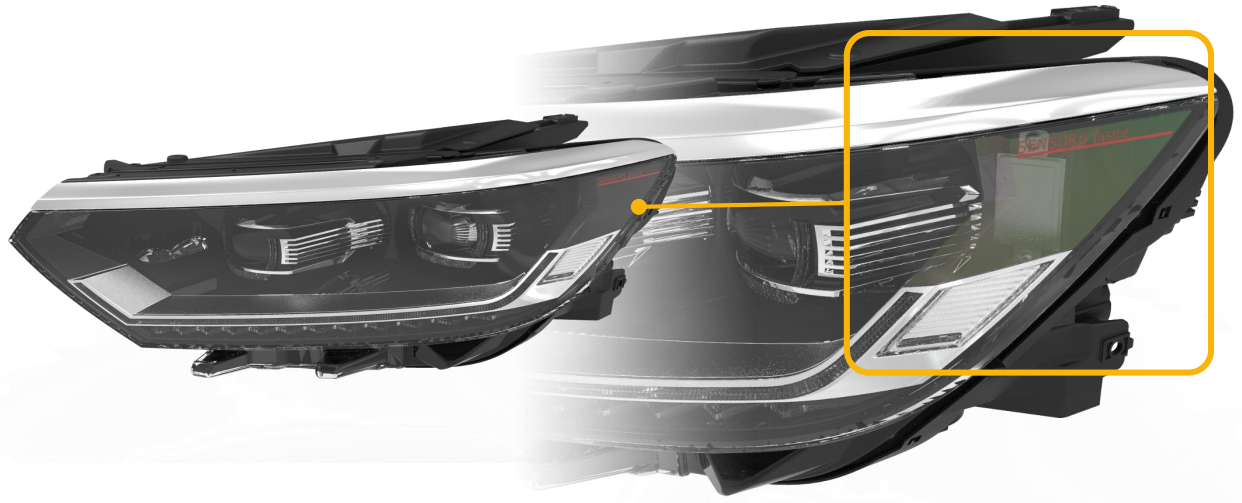


MAKES THE TECHNOLOGY TRANSPARENT

STYLING 2 CHOICES !

MAKES THE TECHNOLOGY PART OF THE DESIGN

Invisible



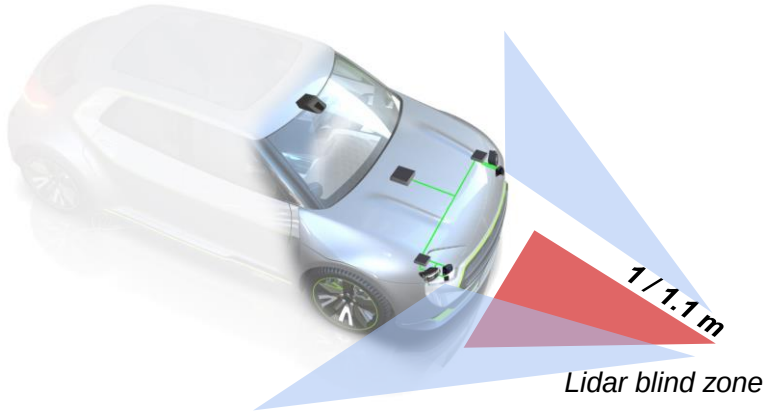
Visible

STANDARDIZATION IMPACTS

LiDar integration - performances impacts

Field of view

- Width increased due to side position (tilted Lidar)
- Blind central area very close from the standard central integration (+10 cm)
- Bezels design to consider Lidar FOV (145° on Scala)



Lidar blind zone

Detection range

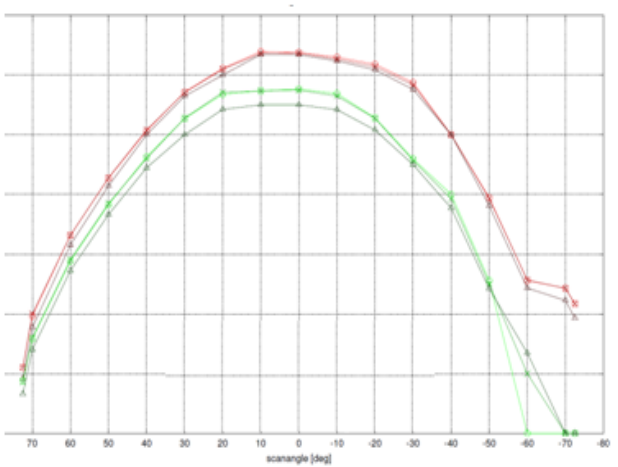
- Lamp outer lens reduces detection range by 10%
- Protection glass from Lidar can be removed in some cases to compensate

Distortion due to outer lens

- Increases with incidence angle
- Neutral lens to be studied, in line with the sensor

Parasite light from lighting/signaling functions:

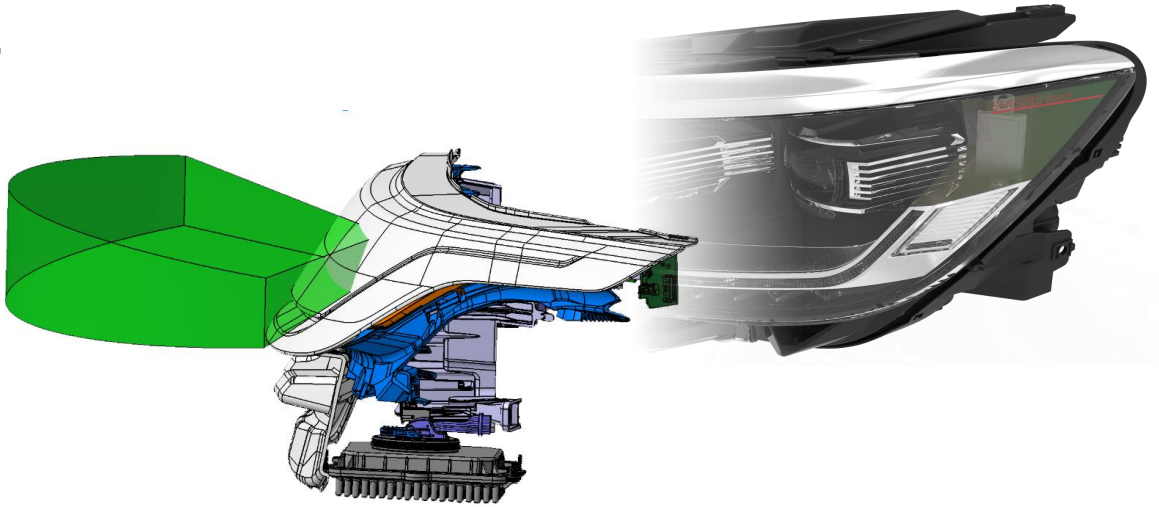
- Limited effects thanks to integration and wavelengths differences
- Taken into account in system calibration



Detection distance – Scala in lamp

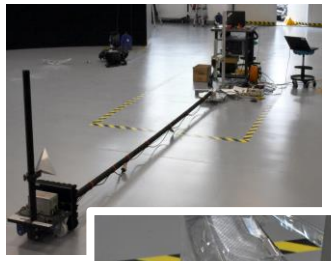
Radar integration - performances impacts

Metalized bezel to be avoided in front of Radar

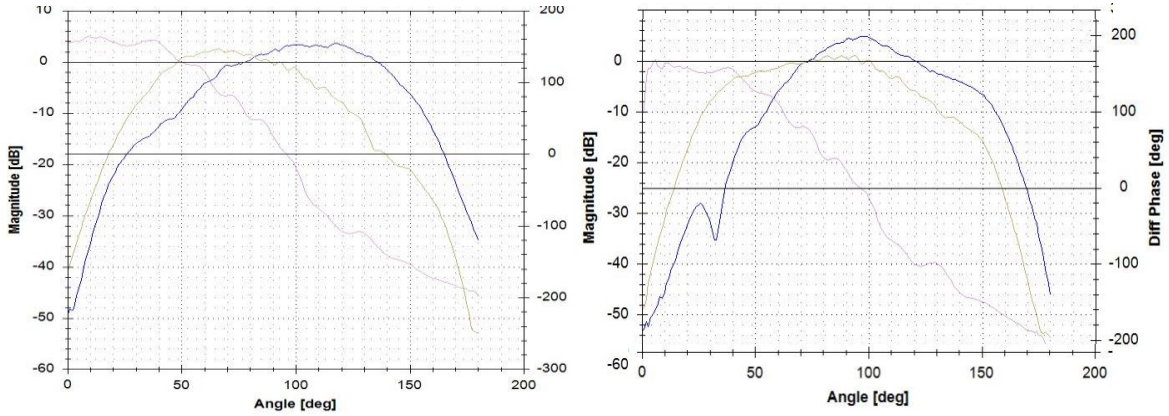


Radar FOV to be also considered

Transmission test (with Arc Test tool)



- On axis loss about 1.1 db
- Off axis, worst case : 4.1 db
- Comparison with bumper:
  - Non metalized painting: 0.75 db
  - Metalized painting : 7 db

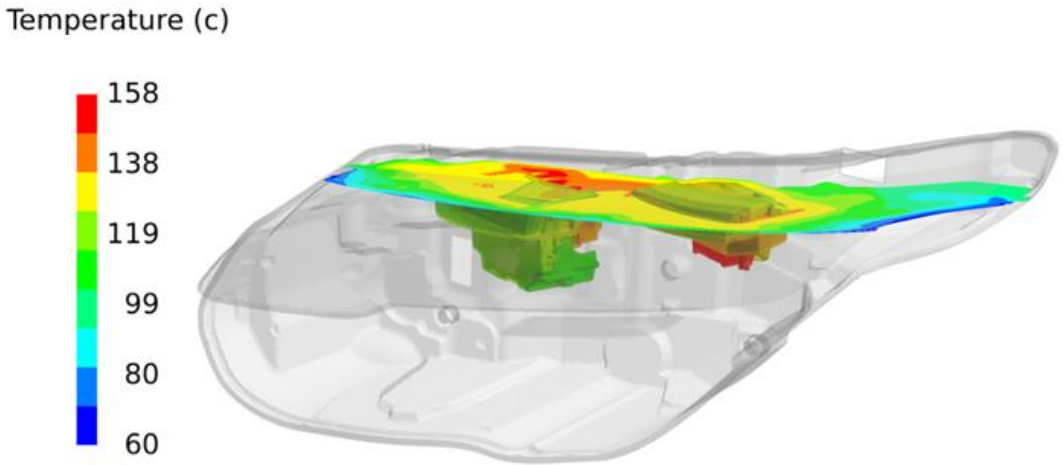


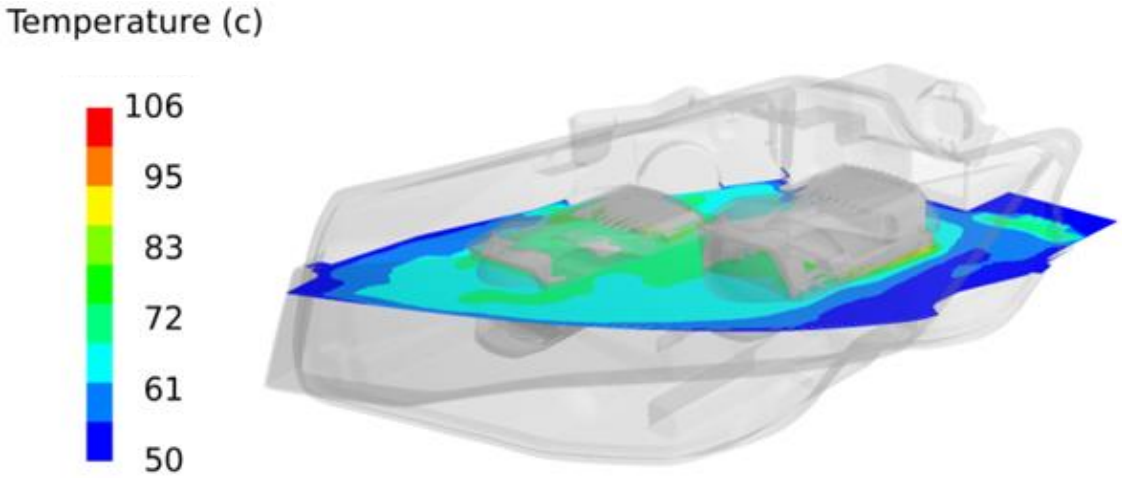
Radar measurement without/with PC lens

Thermal effects

Both Lighting modules, Drivers and Sensors generate heat and are sensitive to temperature

- Sensors: Typical T°max. = 85°C
- Global system….





Styling highly impacted by thermal mapping

EE Architecture

LED DRIVER

LIGHTING MODULES
(Beam + HD)

STRONG SYNERGY BETWEEN EE ARCHITECTURE FOR HIGH DEFINITION LIGHTING AND SENSORS INTEGRATION

SENSORS

PICTURE CONTROL MODULE
Including Lidar/Radar ECU

Exterior environment

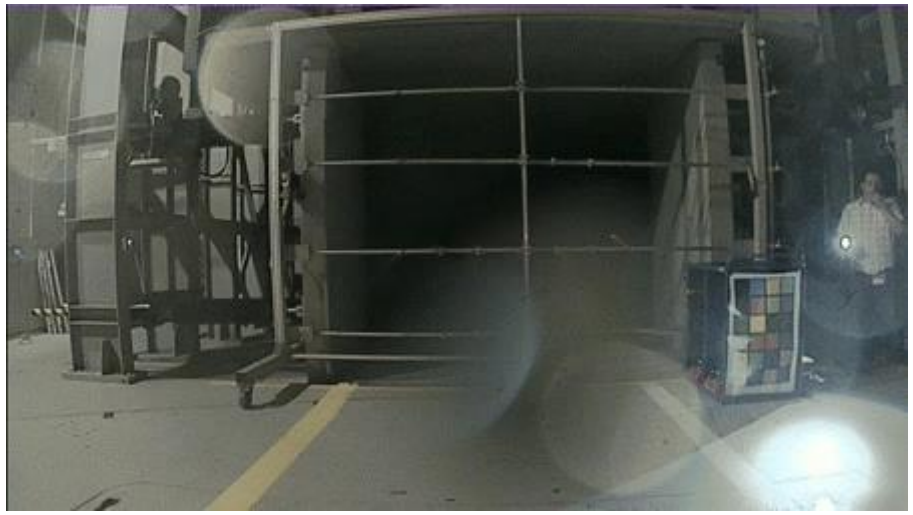
As field test of Autonomous vehicles are extending…
real life constraints are appearing.

Example under rain

Without Cleaning

With Cleaning

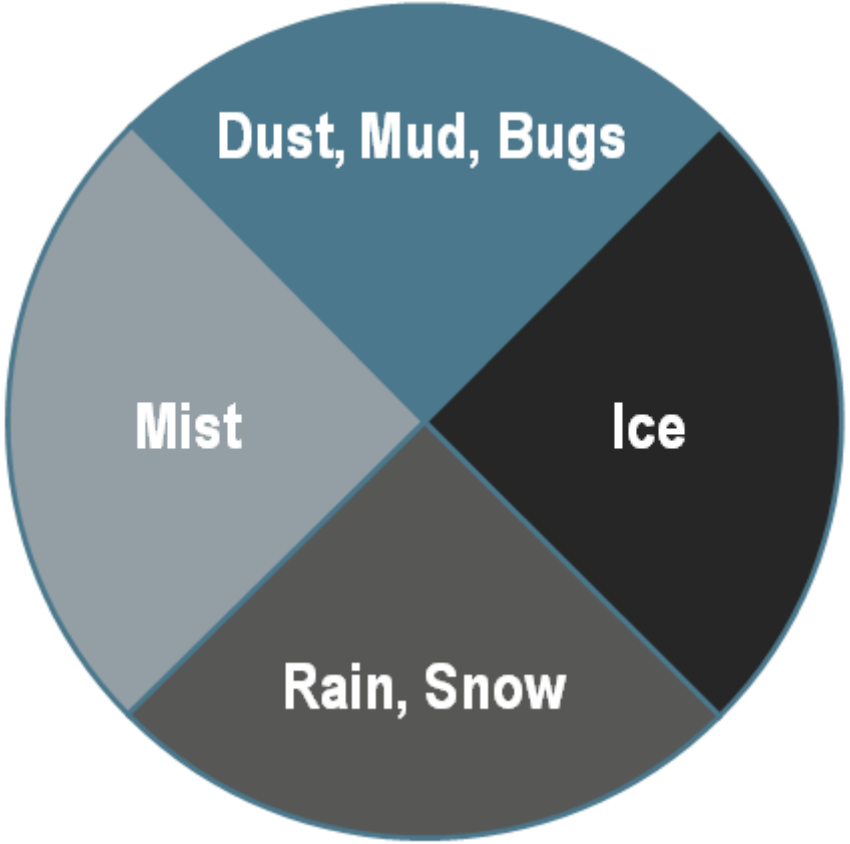
Example under rain, and by night



Without Cleaning

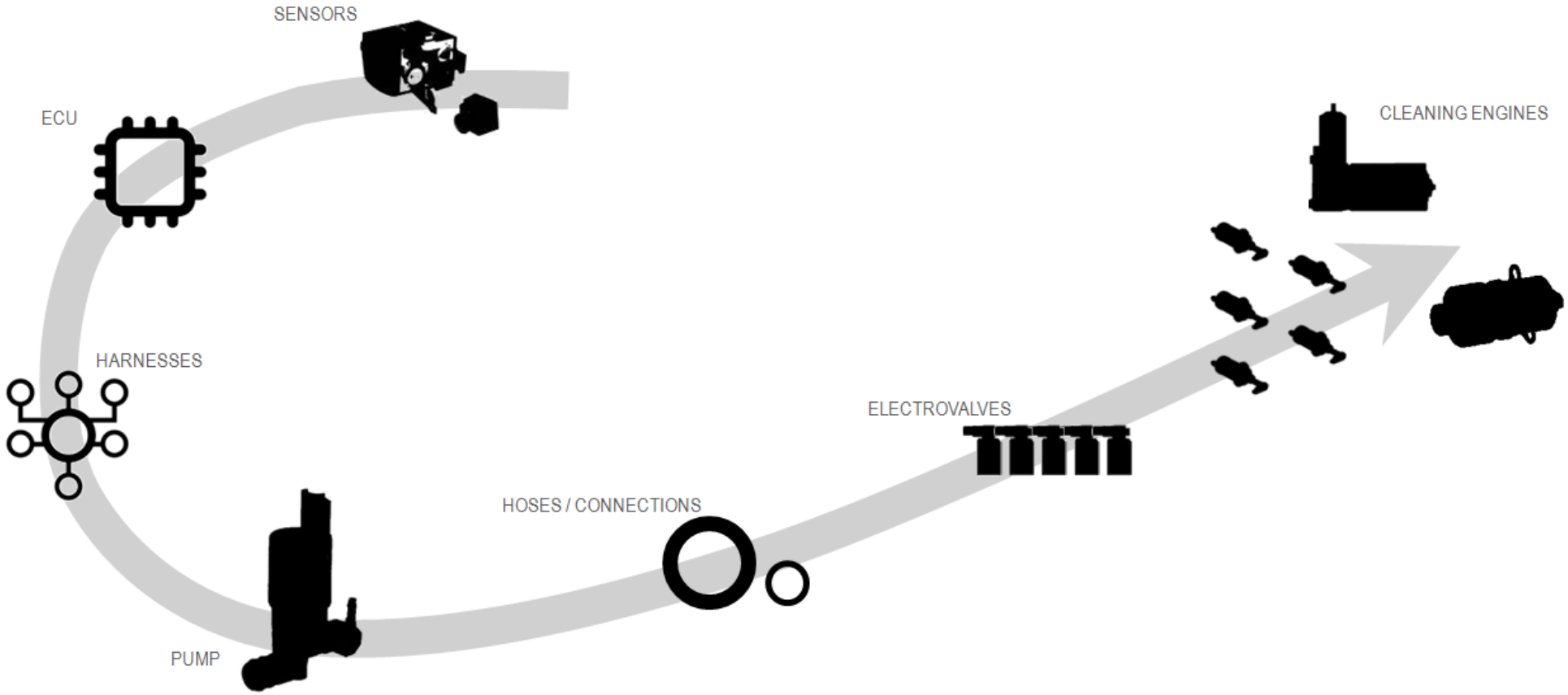
With Cleaning

Needs



We are facing four big types of “obstacles” impairing our sensors visibility. Systems of Sensors cleaning are needed.

What is a sensors cleaning system ?



Components interacting through an Hydraulic and Electronised system.

Focus on Cleaning

Without Cleaning

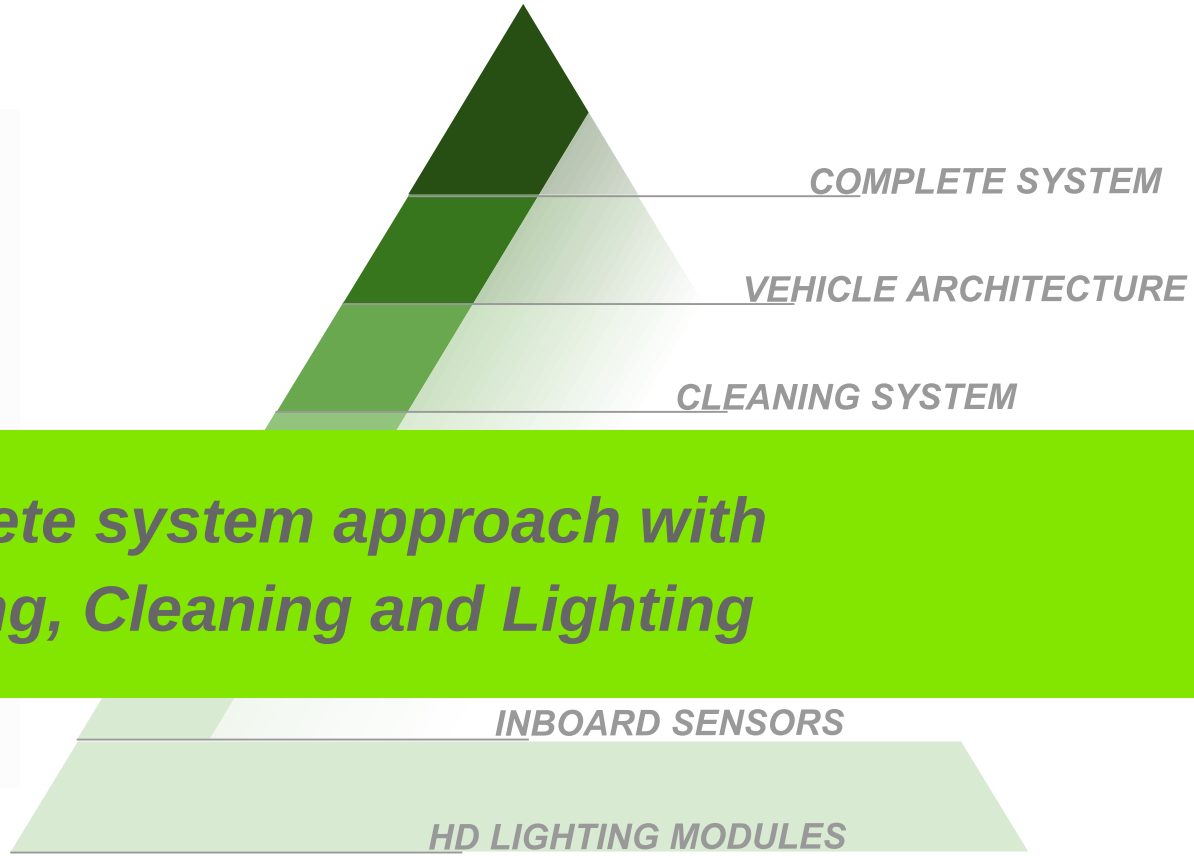
With Cleaning

Focus on integration for the future

Augmented Visibility

We are convinced that future of the Sensors Integration will belong to those who, like Valeo, are doing Lighting, Sensors and Cleaning.

SYNTHESIS



Complete system approach with Sensing, Cleaning and Lighting

Thank you for your attention!


Valeo
SMART TECHNOLOGY
FOR SMARTER CARS