



RENAULT NISSAN MITSUBISHI

# LIDAR's INTEGRATION IN RENAULT SYMBIOZ

## Lessons learned

November the 20<sup>th</sup>, 2018



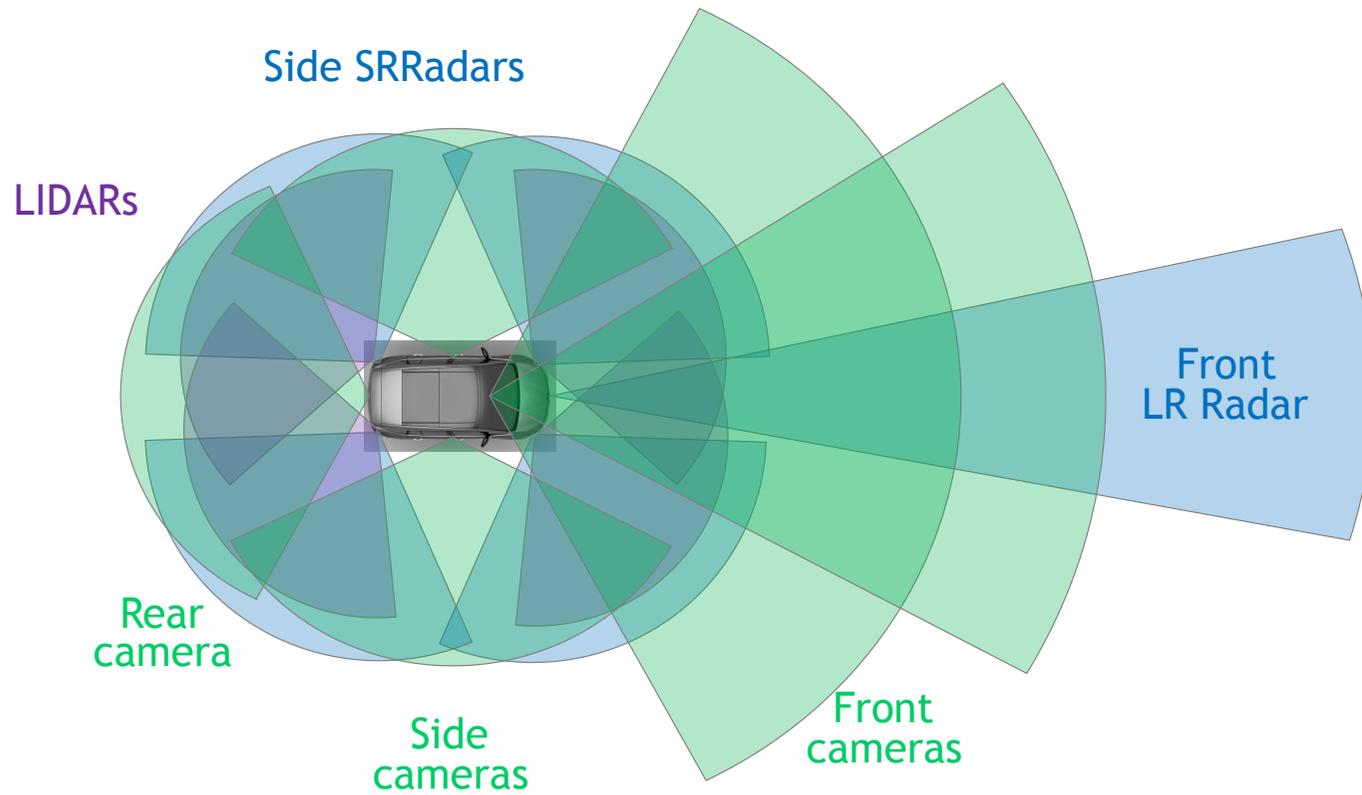


## WHAT IS A LEVEL 4 AUTONOMOUS VEHICLE?





# A VEHICLE WITH NUMEROUS SENSORS





## WHERE CAN WE INSTALL LIDAR FOR FRONT END?



- **Higher areas are preferred for vehicle localization and obstacle detection**
  - ❶ for single or dual sensors
  - ❸ for dual sensors
  - ❺ for single sensor behind windshield
- **Lower areas are preferred for obstacle and lane detection**
  - ❷ for single sensor
  - ❹ for dual sensors



## WHERE CAN WE INSTALL LIDAR FOR FRONT END?



- ⑥ Possibility to install on the roof for **Robotaxi applications**: good fit for 360° field-of-view sensors.
- ⑦ Possibility to install in side-mirror area.



# RENAULT SYMBIOZ CONCEPT THE VISION OF THE FUTURE OF MOBILITY

- **2 vehicles & 1 house presented 1 year ago**

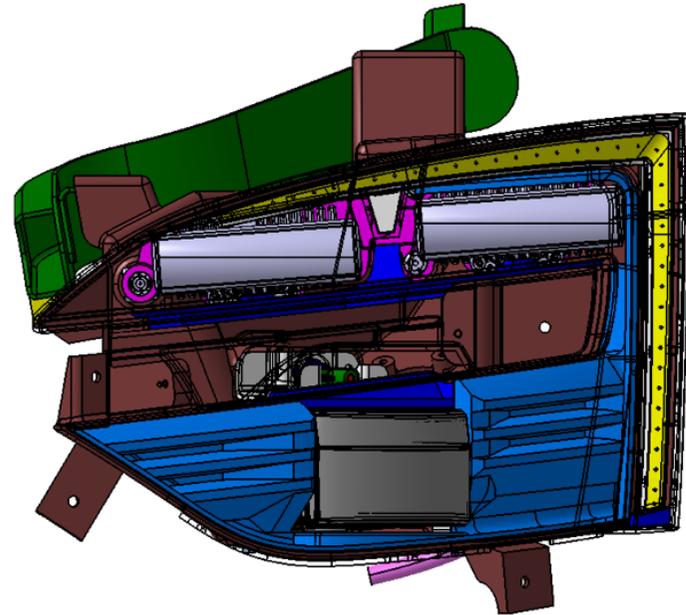
- SYMBIOZ CONCEPT & its house realized by Styling department

- SYMBIOZ 2 CONCEPT realized by Engineering department with driving automation level 4.





## CORNER LIDAR INTEGRATION IN HEADLAMPS



- The miniaturisation of LB and HB gives space for new functions.



# OPTICAL INTEGRATION

## ■ Signal transmission

- To limit losses of range detection to 10%, high level of transmission (90%) at 905nm is required.
- Surface close to the normal of LiDAR installation to limit deviation
- Interference with pulsed LED from headlamps functions has to be investigated.





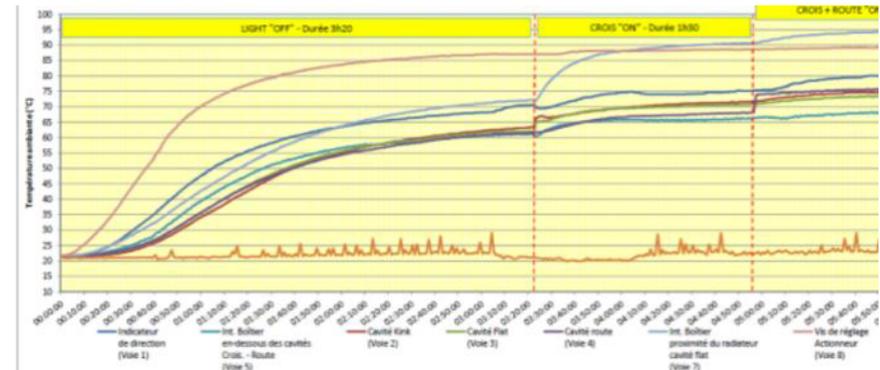
# THERMAL INTEGRATION

## ■ LiDAR needs to operate day and night

- Thermal constraints in headlamp can conduct to high temperature above 95° in specific situation (summer time in traffic jam) for the sensor.

## ■ Condensation / Ice

- Humidity in the SYMBIOZ headlamp was problematic.
- Management of internal humidity will be mandatory.
- De-icing will be also problematic.
- Washing and heating system for the outer lens must be evaluated.





## SHOCK & MECHANICAL INTEGRATION

### ■ Pedestrian impact

- LiDAR is an element not easy to brake.
- Must be taken in consideration for lower leg impact.

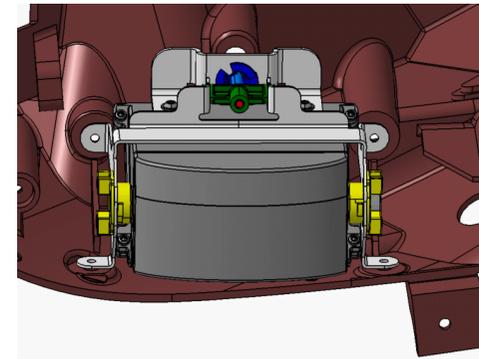


### ■ Beam flickering

- Analysis to realize in order to avoid low eigen frequency for this heavy module.

### ■ Aiming

- In the case of SYMBIOZ, aiming was mandatory due to the narrow vertical field of view
- Need to take into account 7° of tilt deviation (mechanical dispersion, load, acceleration, braking)





## STYLING INTEGRATION

- **Lighting engineers' sensitivity to Styling problematics**
  - They are used to find the compromise between performance, technical constraints and styling wishes.

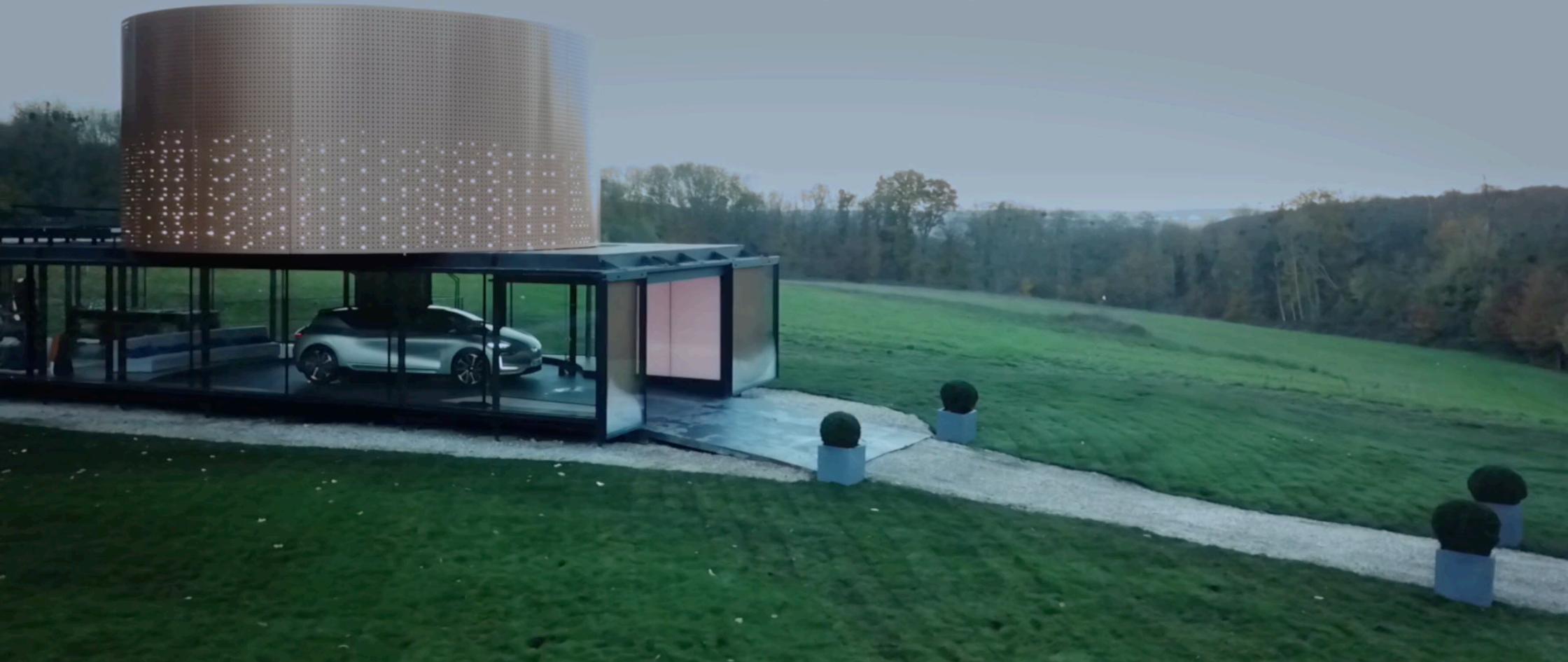




## CONCLUSION

- For level 3-4 automation, many sensors are required for redundancy.
- Corner area is a good candidate to install LiDAR and especially in headlamps.
- Outer lens shape is important for the detection range.
- Washing and heating system of outer lens will be required for mud, condensation and ice.
- Sensitivity of lighting team to styling designers mindset will help for integration.
- Smaller and lighter LiDAR is expected to help in their integration.

# RENAULT SYMBIOZ DEMO CAR: EXPERIENCE TOMORROW TODAY





**THANK YOU FOR YOUR ATTENTION**