DVN Lidar Conference 2018

Evolutions of LIDAR dedicated to Autonomous Driving

PSA GROUPE

Alain SERVEL
Whilk GONÇALVES

Novrember 20th 2018

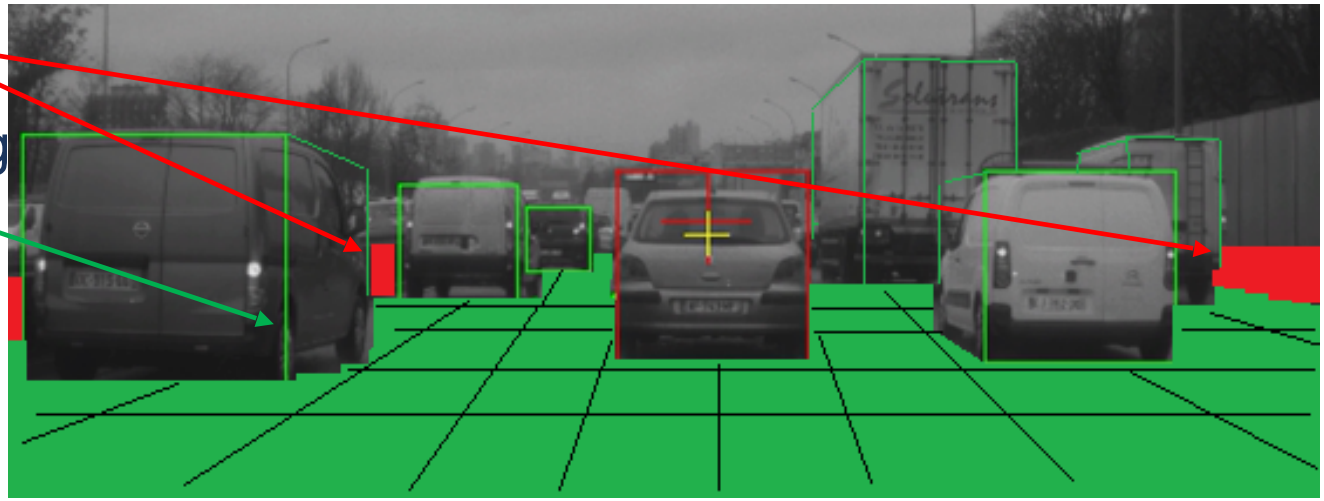
RADAR or LIDAR, for Level 3 Automated Driving ?

Traffic Jam Chauffeur		Highway Chauffeur
		
Eyes Off		Eyes Off
Traffic Jam Conditions	→	No condition on Traffic
Speed Range = [0-60 kph]	→	Speed Range = [0-130 kph]
No lane change	→	With autonomous lane change
Minimum Risk Maneuver L3+		Minimum Risk Maneuver L3+
Driver Monitoring		Driver Monitoring
Approved Dual Carriage Way	→	Approved Dual Carriage Way +
		Route planning

RADAR or LIDAR, for Level 3 Automated Driving ?

Traffic Jam Chauffeur function (0 to 60 km/h) needs a precise detection of free space (occupancy grid), in front of AD vehicle. These data can be used to enhance an off-board 3D map. Embedded frontal ranging sensors have to:

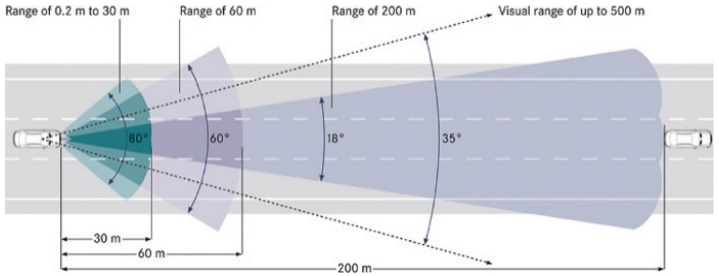
- Determine road limits
- Detect relevant or neighboring vehicles sizes



High resolution in X,Y, Z (t) is necessary (20 cm expected)

RADAR or LIDAR, for Level 3 Automated Driving ?

RADARs are designed to analyse echoes by the use of low cost digital beamforming (angle of arrival) and FMCW/PMCW for relative distances and speed measurements. They are specialized on different perception sectors:



- Long Range 77 GHz for front (LRR)
  - Dedicated to ACC and A.D.
  - Multi-modes (fields) / FMCW
  - Use MIMO antennas for 4D detection

- Corner radars 24* GHz or 77-79 GHz (MRR/SRR)
  - Dedicated to EABS (EuroNcap) and A.D.
  - Beam-forming / PMCW
  - Wide F.O.V. / low distance resolution

	LRR	MRR	SRR
Range (m)	>220	>150	>70
Résol (m)	1	0,5	0,1
H FOV (°)	20	50	120
H Resol (°)	<2	<5	<7
V FOV (°)	10	20	40
V Resol (°)	-	-	-

RADAR or LIDAR, for Level 3 Automated Driving ?

LIDARs use Time Of Flight measurements of multiple Laser pulses (> 100K /s), realized through the following technologies:

- Mechanical scanning of an optical block (T/R)
  - Wide horizontal field of view
  - Narrow vertical field of view
  - Life duration ?
- MEMs mirrors scanning
  - Agile scanning of road scene
  - Very good angular resolution
- Flash Lidars
  - Matrix of laser diodes / photodiodes arrays

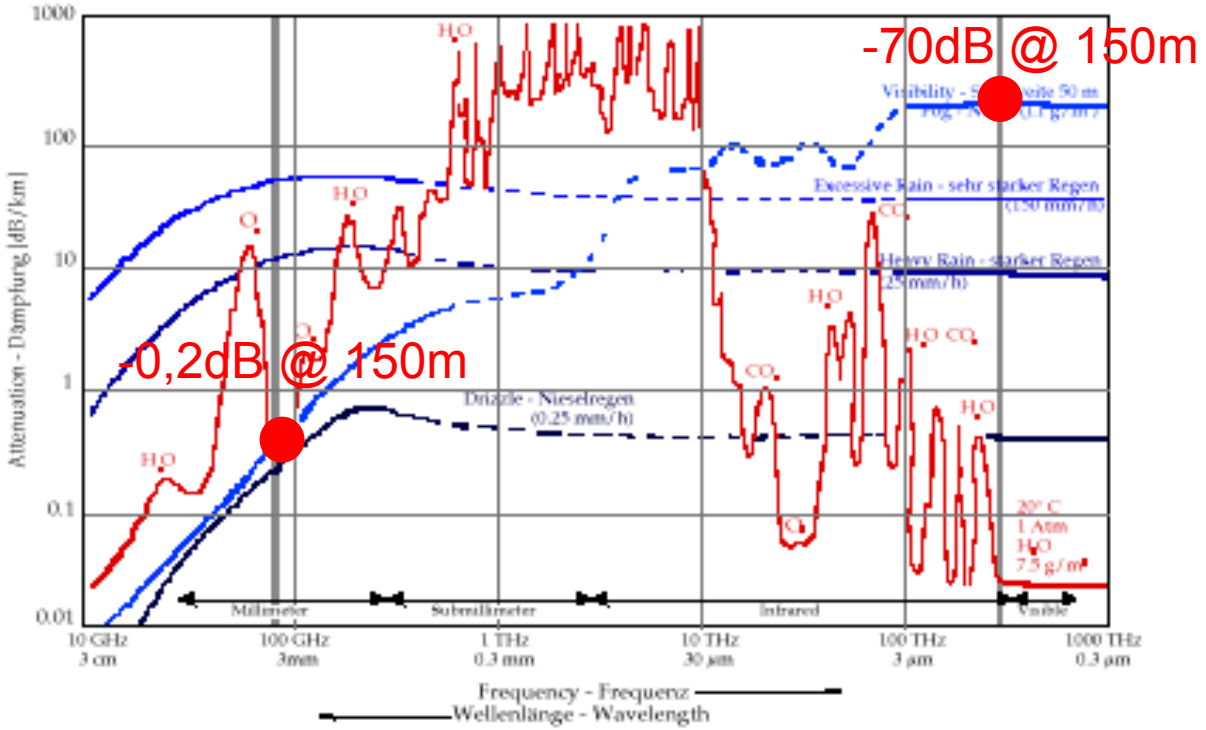
	Ref	A	B	C	D
Techno Scanning	Solid-State asked	Rotating Mirror	MEMS	Scanning Mirror	Flash
Range (m)	150	150	150	200	50
H FOV (°)	120	133	120	120	123
H Resol (°)	0,2	0,25	0,2	0,1	1
V FOV (°)	20	10	25	35	27,5
V Resol (°)	0,2	0,6	0,2	0,27	1

RADAR or LIDAR, for Level 3 Automated Driving ?

Ranging sensors (Lidar or Radar) can reveal their limits or advantages depending on objects materials and weather conditions…

RADAR or LIDAR, for Level 3 Automated Driving ?

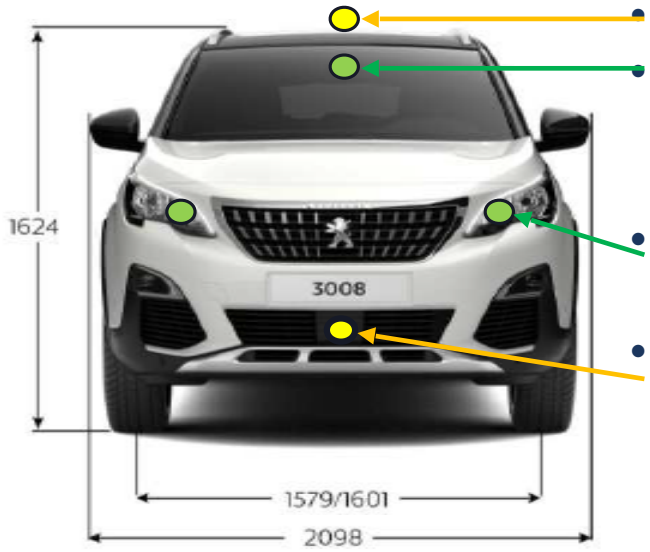
LIDARs performances decrease with dirt (sensor's optics), bad weather conditions (rain, fog, snow) and vehicle's reflectivity. But they take advantages from regulation (license plates…). RADARs are not so affected :



INTEGRATION REQUIREMENTS : Mounting Positions

Best performance can be reached in a window of :

- Y position: Central (0 cm) +/- 10 cm
- Z position: 35 – 130 cm
- Each position / cover influence: long functional validations are necessary



- Style impact, high temperature..
- Wipers cleaning area, windscreen transmission
- Lighting systems
- Cover damages, dirt

Extended areas between the grill and headlamps

The new DS Concept car has shown how the brand tends to extend the traditional lit areas, with big DRL & Signalization surfaces – where other ADAS devices can be also installed - New materials & new possibilities in bigger surfaces

LIGHTING SIGNATURES & LIDAR

Peugeot with a strong lit signature :

- ➢ Two eyes with the lighting modules
- ➢ Apparent technology – visible modules & technology

LIDAR integration will be explicit – showing new modules and technologies

Expectations for the integration of Lighting and Lidar devices

- Optimized location in the car – field of view and coverage
- Modularity, improving packaging
- Ready to install modules
- Reduction of connecting points
- Weight and cost reduction, eliminating separate packaging for sensors and lighting modules
- Easy upgrades to be issued through lighting packages and lighting driving modules

Thank you for your attention!