



# HPC for automotive industry Renault Nissan



> A FRENCH GROUP TO SERVE A STRONG INTERNATIONAL STRATEGY



> AN AUDACIOUS AND PASSIONATE COMPANY



**GROUPE RENAULT**

RENAULT, A BRAND SOLD IN 125 COUNTRIES



**RENAULT**  
Passion for life

**2 118 844** VEHICLES  
SOLD IN 2014

HPC User forum  
Eric Landel

12 October 15

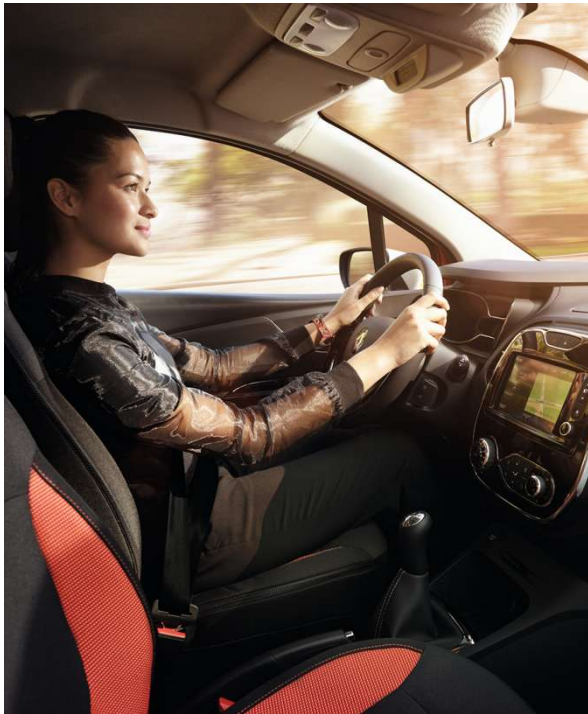


Renault Nissan Confidential C

2









# RENAULT : A VIBRANT, CONNECTED TO PEOPLE AND FORWARD LOOKING BRAND CARS FOR LIVING LIFE TO THE FULL



**GROUPE RENAULT**

# 5 CHALLENGES for Renault

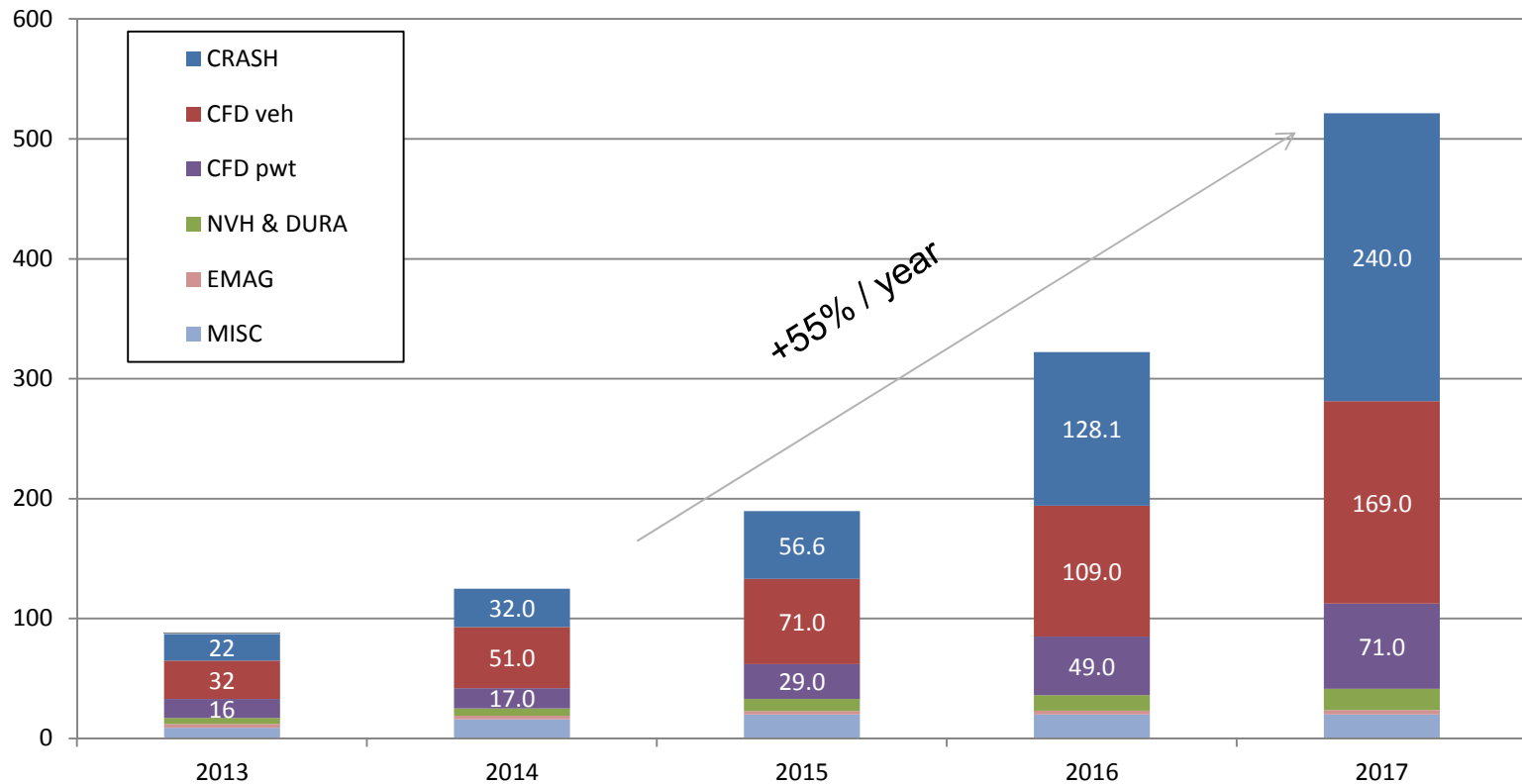
CUSTOMER		Target
	<b>Safety</b>	0 injuries
	<b>Environnement</b>	0 impact
	<b>Driving Pleasure Life on Board</b>	0 stress
	<b>Affordability</b>	0 Left out
	<b>Mobility system</b>	0 flaw



Numerical simulation is very helpful for developing and introducing new technologies

### 3 main domains for HPC :

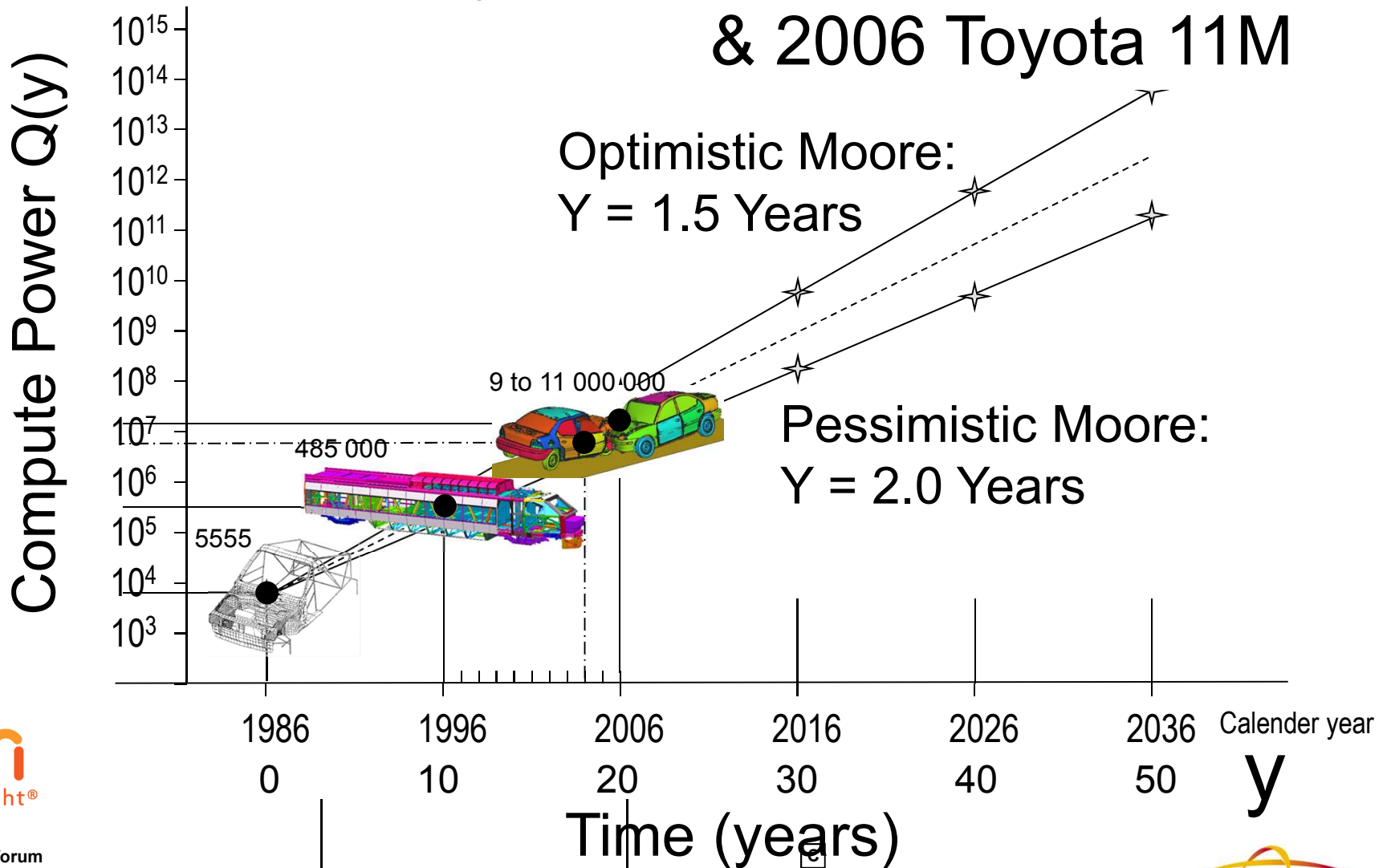
1. Crash (passive safety)
2. Aerodynamic (environment)
3. Combustion (environment)



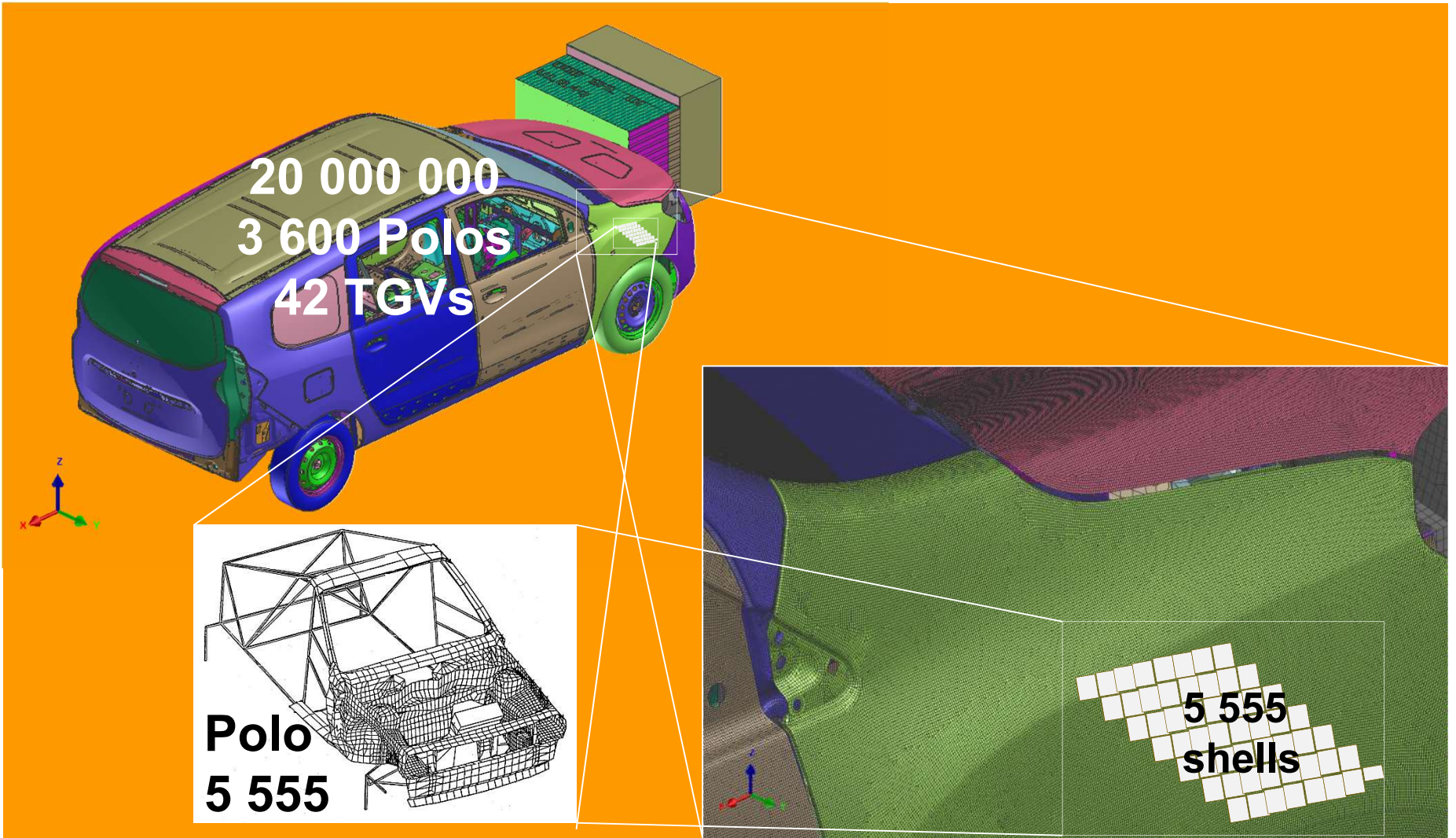
# Compute Power vs. Number of Years

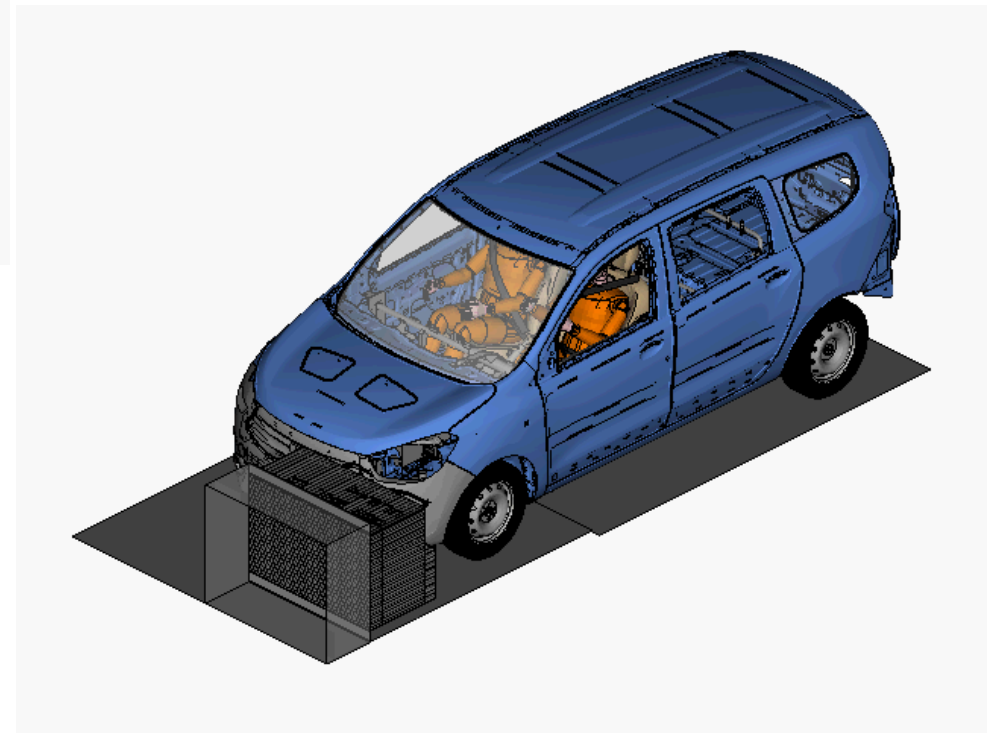
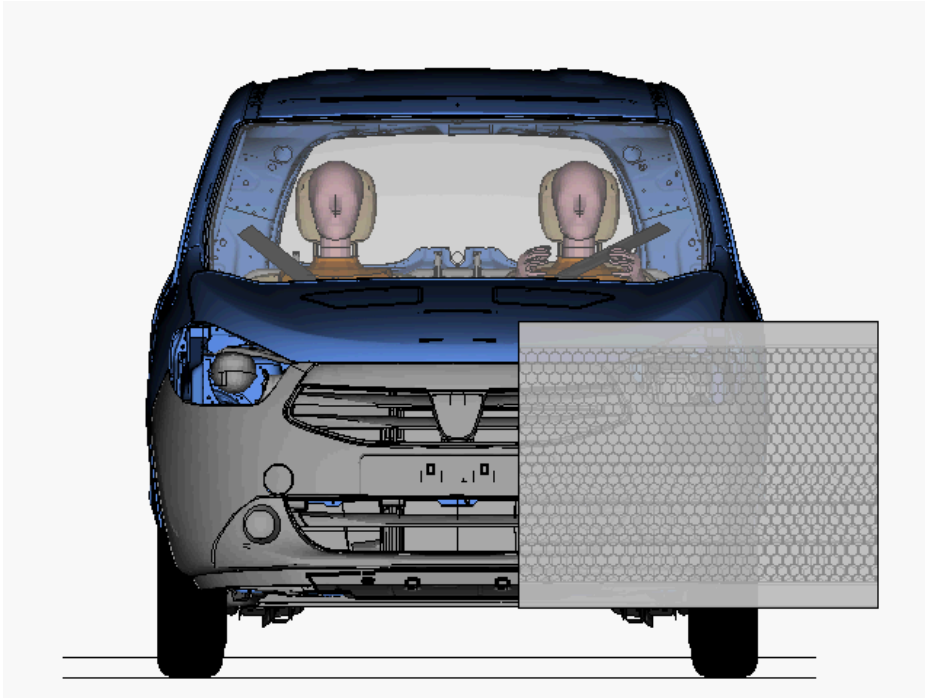
$$Q(y) = Q_0 2^{(y/Y)}$$

2004 NEON-04 9M  
& 2006 Toyota 11M



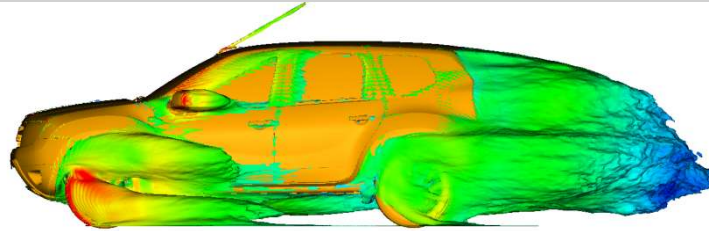
# Moore's Law 2013: DACIA Lodgy





# External aerodynamic :

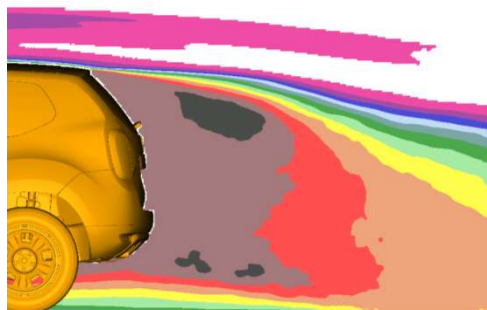
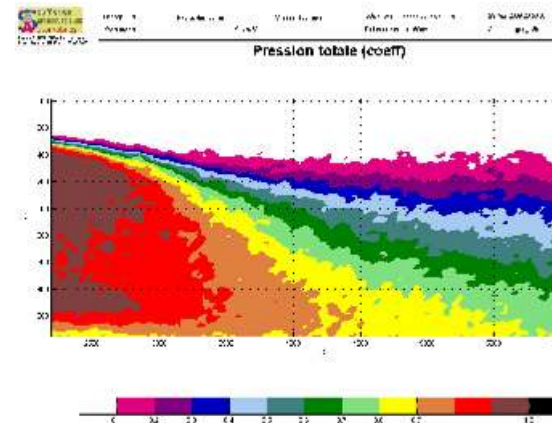
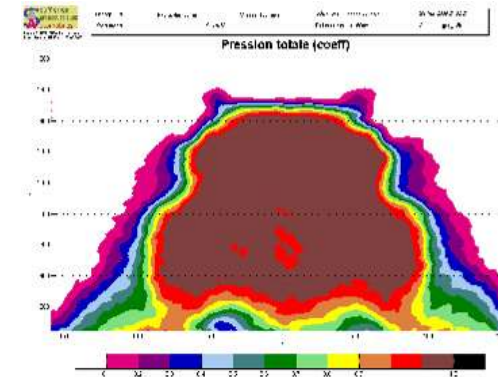
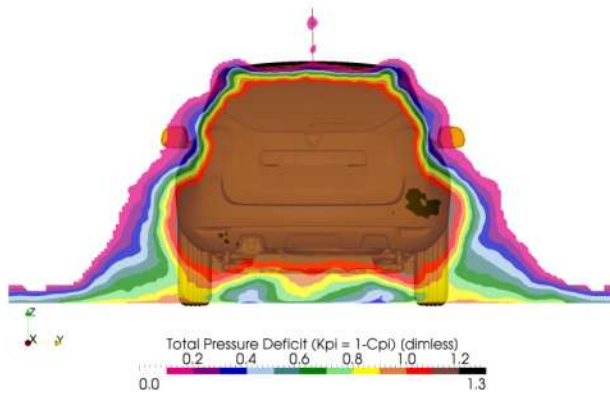
- Accurate prediction of Drag coefficient
- Analysis of wake



DE-1DSM : HXZ\_BASE\_svn13012\_R25607C6

Plan X = culot + 50 mm

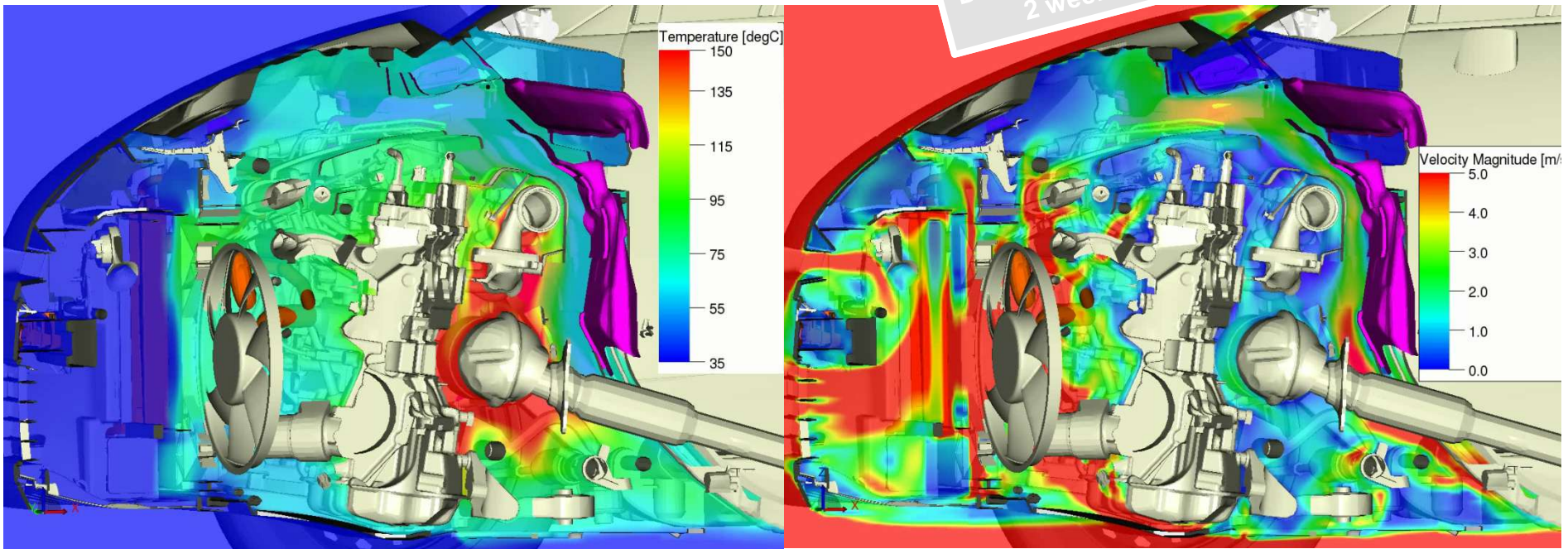
	SCx	Ecart
Expérimental	1.016	
LaBS	1.010	-1%



# Aero thermal behavior in the engine compartment

- Transient case: detecting constraining regions during transient case (natural convection) and quantifying the increasing of temperature

Drawback : CPU time on server  
2 weeks on 240 cores



0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200

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↑  
Velocity=0

↑  
FAN OFF

12 October 15

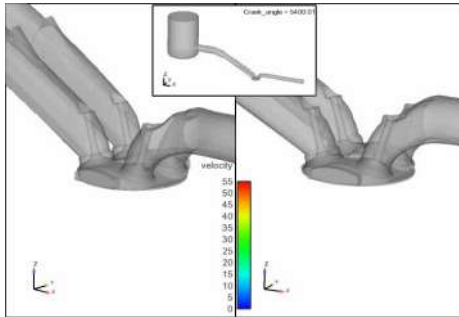
Time (s)

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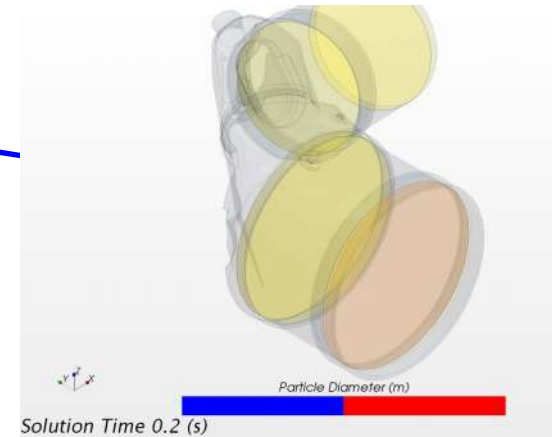
10



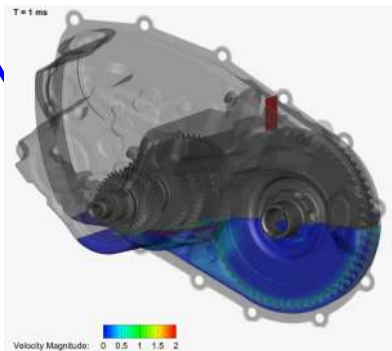
# Powertrain description : Fluid dynamic for powertrain designing



Combustion chamber designing :  
Internal aerodynamic, Injection  
Combustion, Pollutants emissions



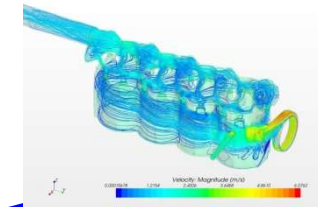
Implementation of aftertreatment  
systems :  
Designing of the diffusor  
Implementation of urea injection



Gear box lubrication :  
Designing of the collector  
Efficiency of the lubrication

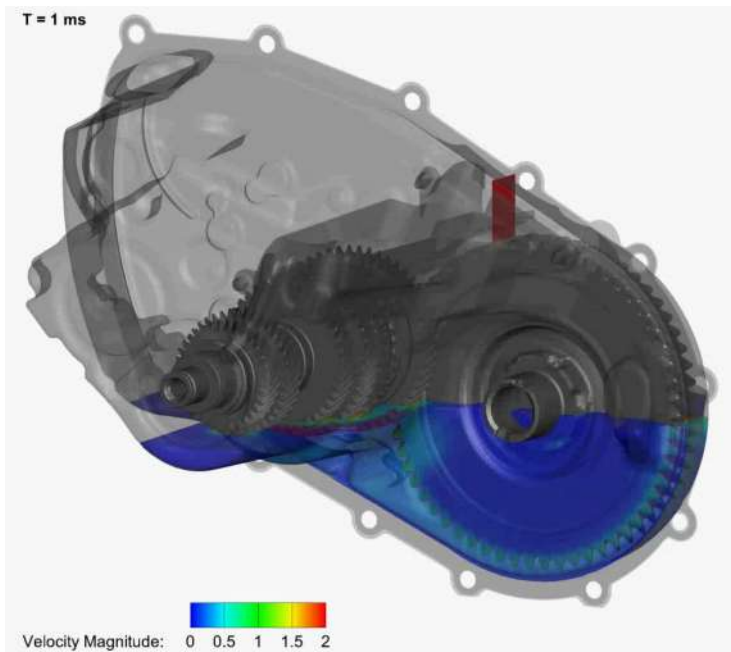


Base engine lubrication :  
Aeration

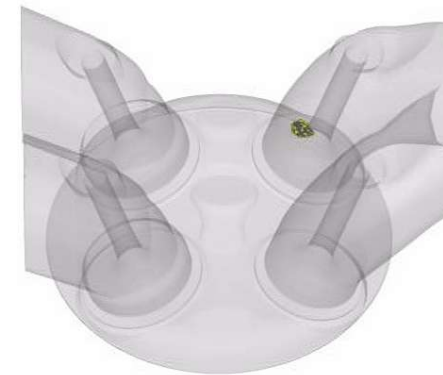


Thermal behavior :  
Cooling efficiency in water jacket  
Impingement efficiency on power unit

# Powertrain Continuum mechanics description : Close future



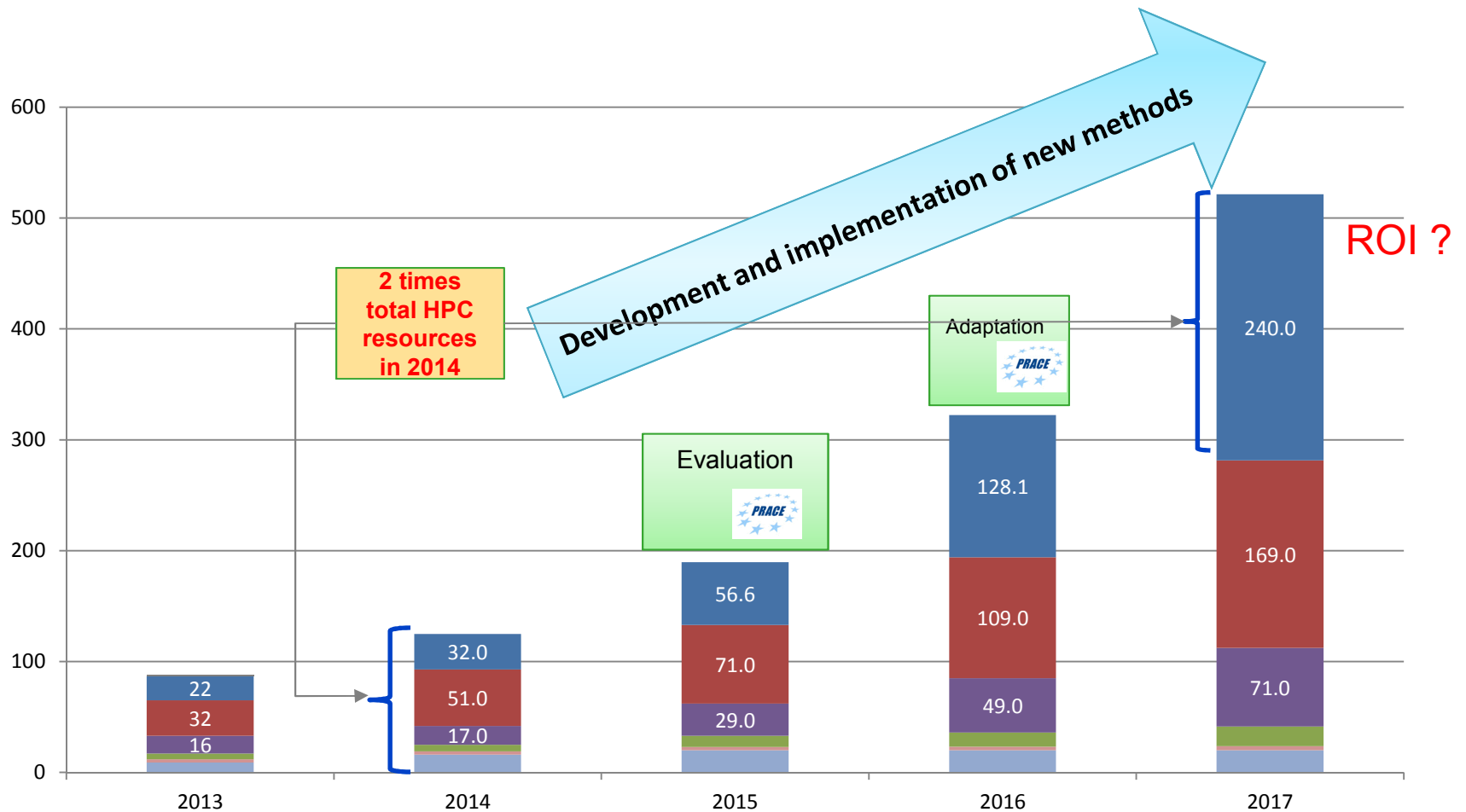
Development of the gear box lubrication



Time = 4.02 CA

Cylinder cycle to cycle calculations

# Investment : PRACE is a very helpful support for right investment



For evaluation, development and implementation of new methods, large resources are needed

Thank you for your attention