





Optimal coupling of suspension setup and tire dynamic footprint through FEM modelling and DiL approach

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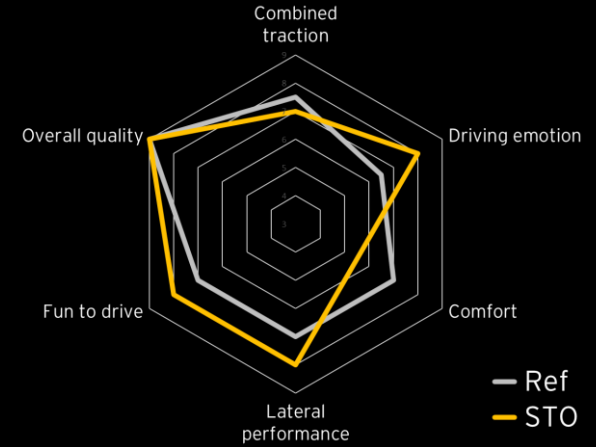
Bridgestone EMIA

Huracan STO

Overview and goals



- > V10 engine 640 hp
- > Track oriented - RWD
- > 0-100km/h → 3,0 s
- > 100-0km/h → 30 m

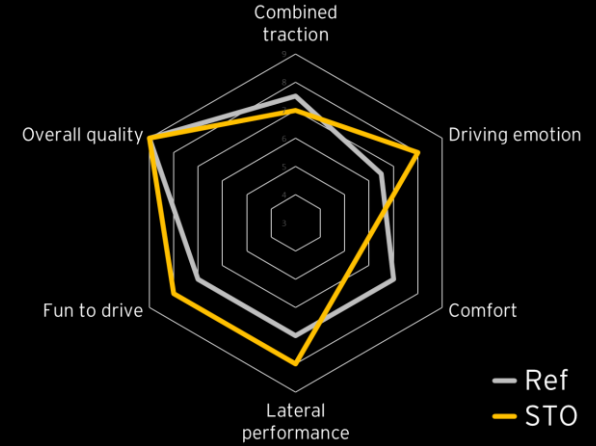


Huracan STO

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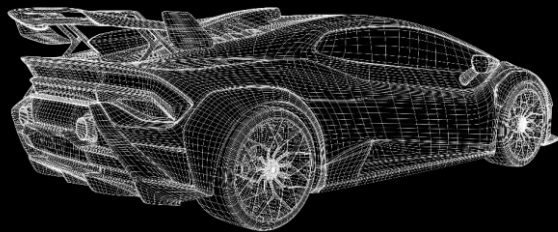


Tire development focused on:

- Optimizing traction capabilities
- Improving turn exit at low speed
- Optimizing combined traction behavior

Huracan STO

Optimization workflow



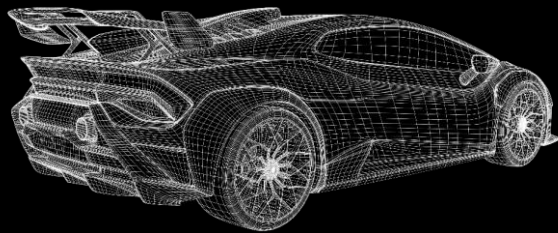
LAMBORGHINI
FULL VEHICLE
DYNAMIC SIMULATION



BRIDGESTONE
TIRE
VIRTUAL PROTOTYPING

Huracan STO

Optimization workflow



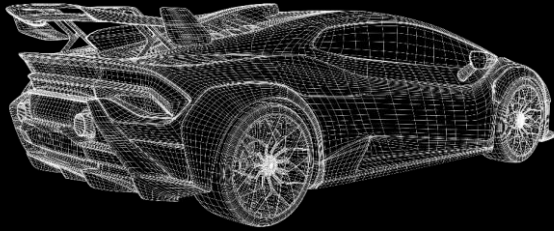
LAMBORGHINI
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DYNAMIC SIMULATION



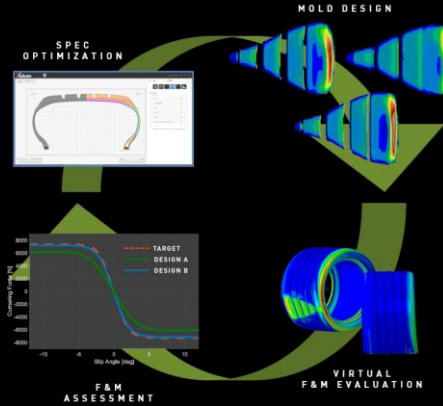
BRIDGESTONE
TIRE
VIRTUAL PROTOTYPING

Huracan STO

Optimization workflow



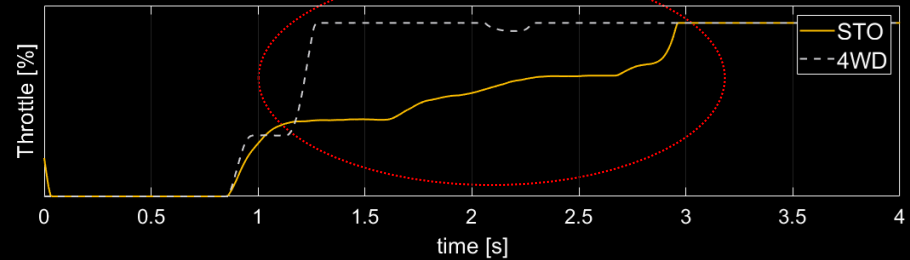
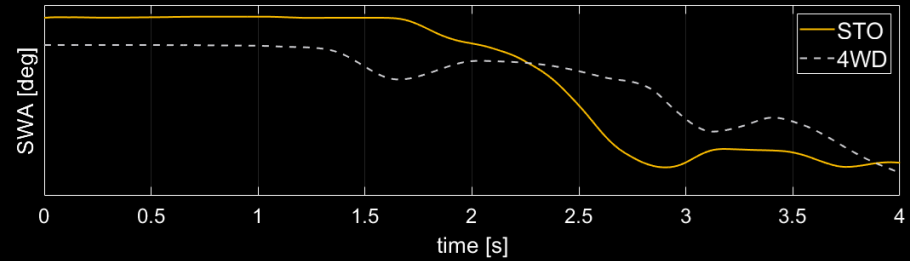
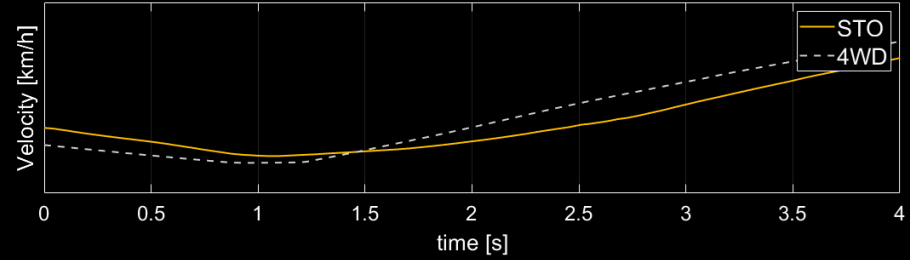
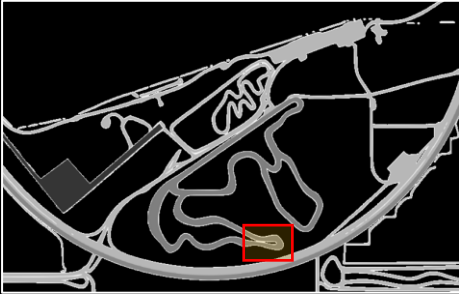
LAMBORGHINI
FULL VEHICLE
DYNAMIC SIMULATION



BRIDGESTONE
TIRE
VIRTUAL PROTOTYPING

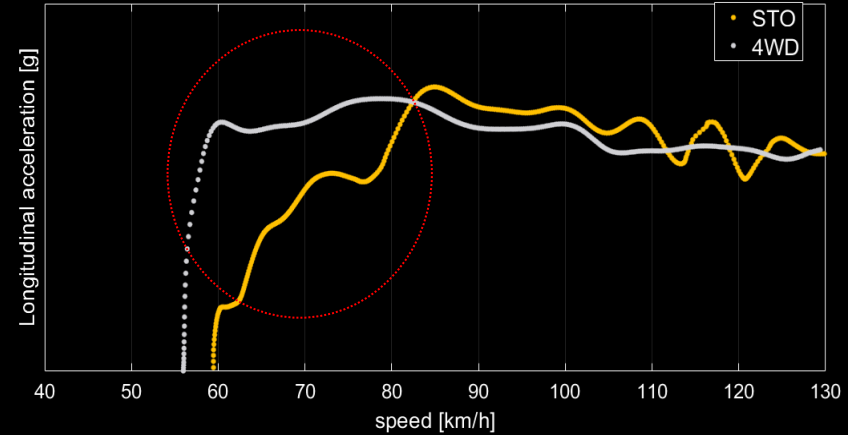
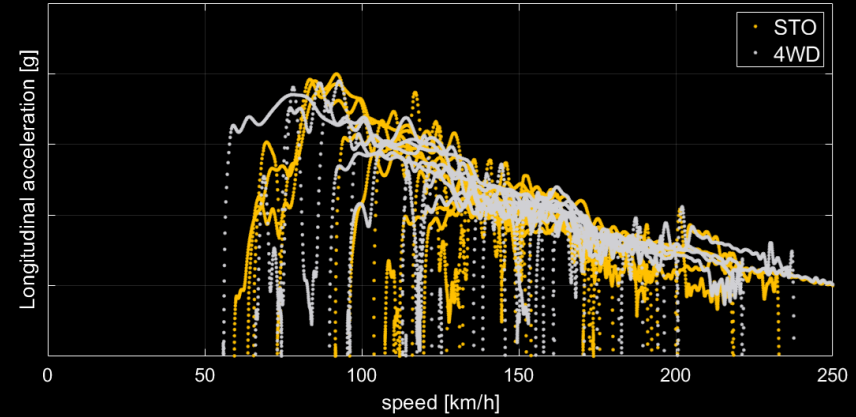
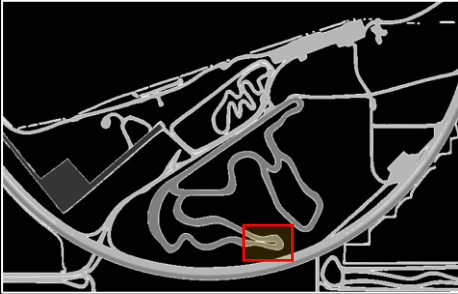
Use Case

NTC – T5 Hairpin



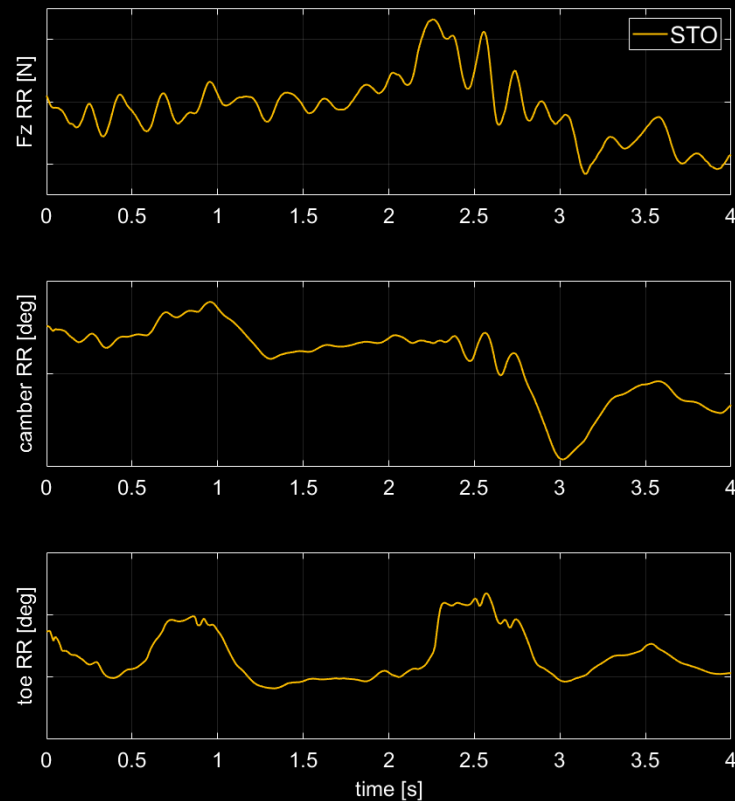
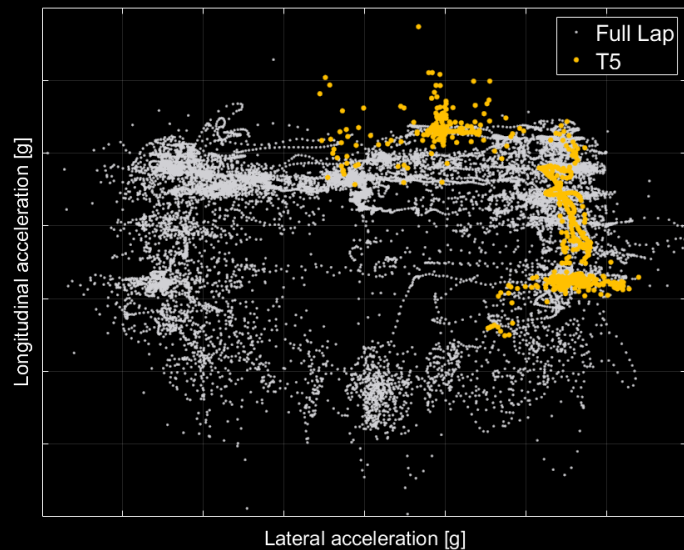
Use Case

NTC – T5 Hairpin



Tire working condition

NTC – T5 Hairpin



Tire working condition

Static vs T5 Hairpin

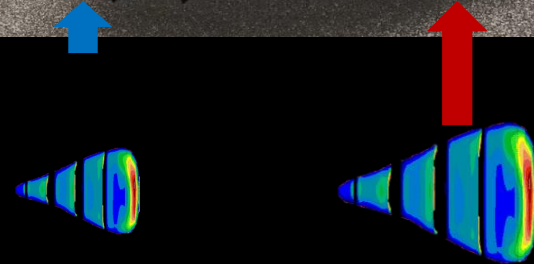


STATIC



Static loads condition
Static Camber angle
NO Slip angle

NTC – T5



Load transfer condition
Actual T5 Camber angle
Actual T5 Slip angle

Bridgestone Virtual Tire Development

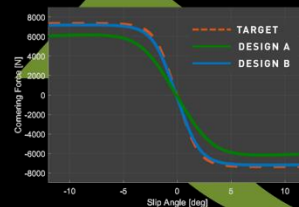
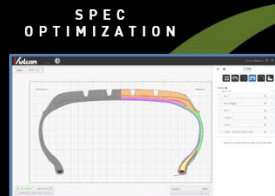
From reference spec to optimized virtual tires



BRIDGESTONE
REFERENCE SPEC

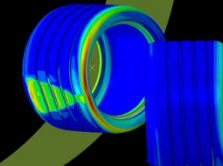
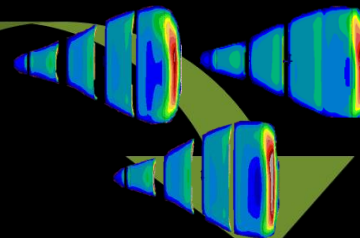


DIGITAL TWIN
OF
REFERENCE SPEC



F&M
ASSESSMENT

MOLD DESIGN



VIRTUAL
F&M EVALUATION



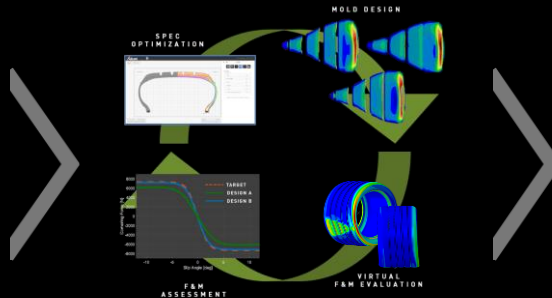
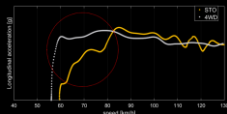
OPTIMIZED
VIRTUAL SPECS

100% VIRTUAL TIRE
DEVELOPMENT LOOP

Virtual Tire Development substantially reduced the number of physical loops

Cavity profile and Pattern design

Optimization of Footprint to maximize the grip

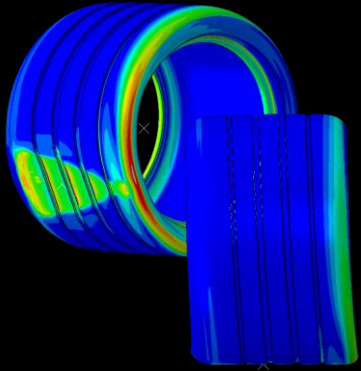


	REFERENCE	OPTION A	OPTION B	OPTION C	OPTION D	OPTION E
Footprint in Cornering						
Contact Area (Cornering)	100%	99%	102%	100%	107%	105%
Outside Shoulder Contact Area	100%	100%	105%	101%	106%	104%
Cornering Force Peak Forecast on real tires	100%	92%	106%	96%	111%	109%

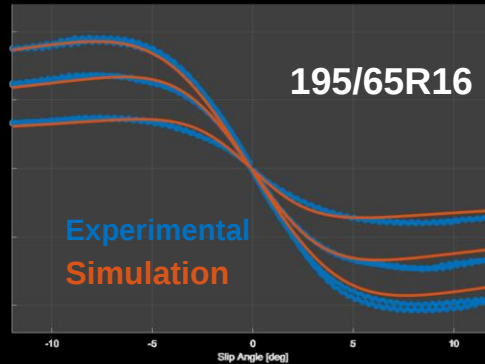
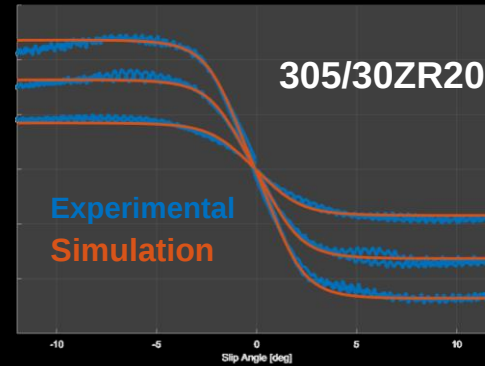
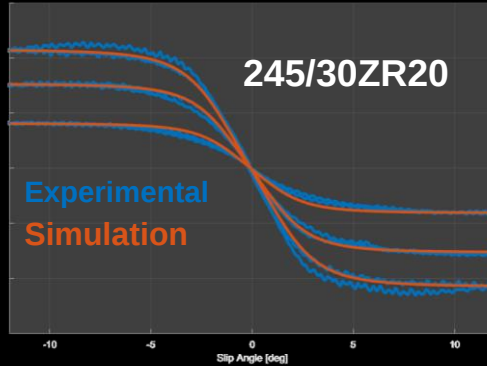
Virtual Tire Development allowed to compare several different tire design in a very short time

Virtual F&M Evaluation

From FEM modelling to MF-Tyre for vehicle simulations



VIRTUAL
F & M EVALUATION

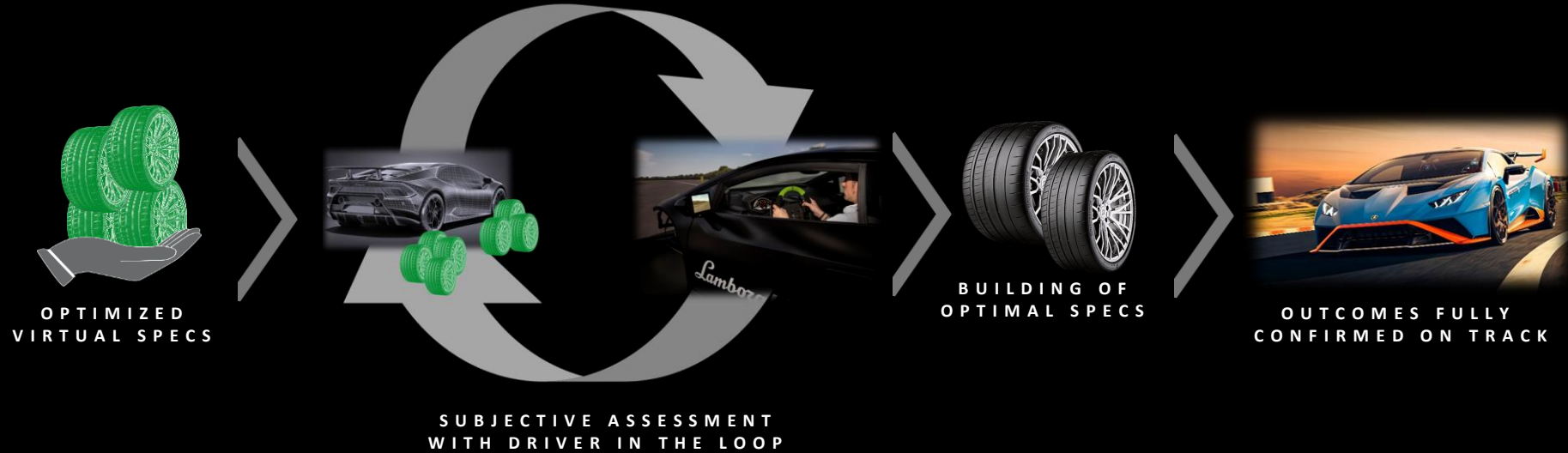


MF-TYRE OF VIRTUAL
TIRES

Virtual F&M Evaluation allowed to build MF-Tyre of fully virtual specs

Driver In the loop for tire development

Subjective assessment in a fully virtual environment



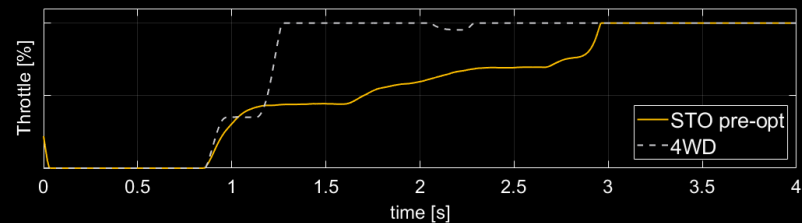
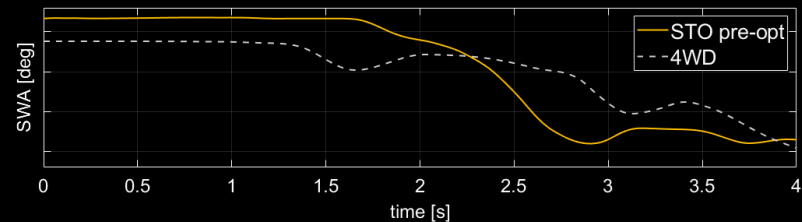
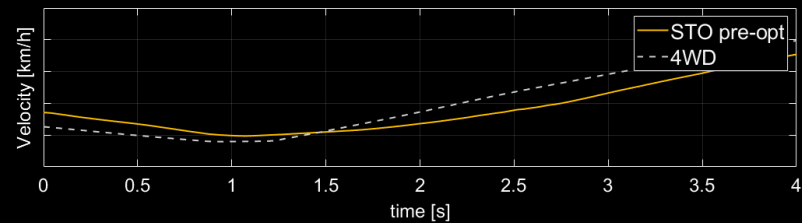
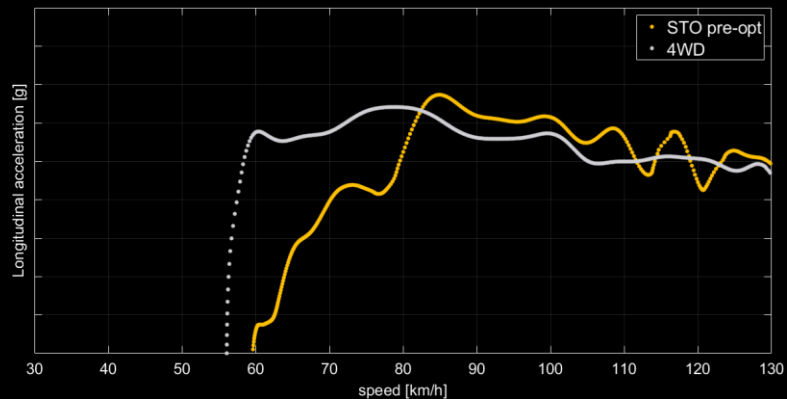
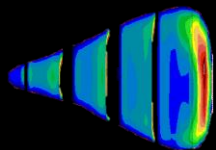
More than 70 different Front-Rear combinations assessed in 2 days

Results

Closing the loop with DiL



PRE-OPTIMIZATION

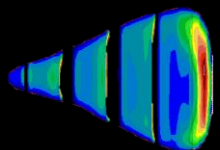


Results

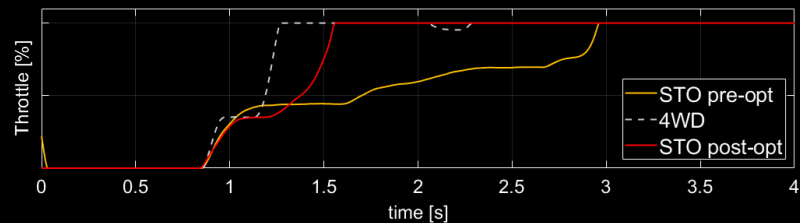
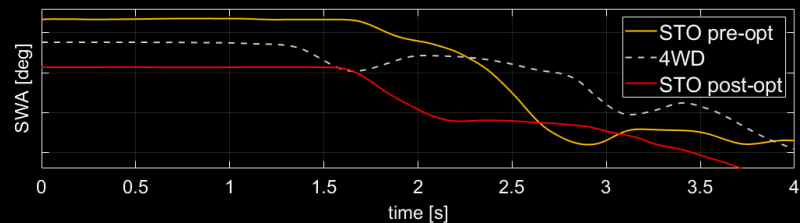
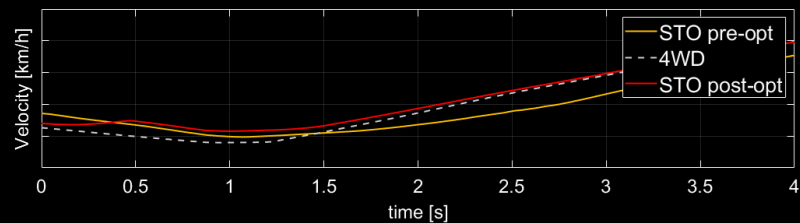
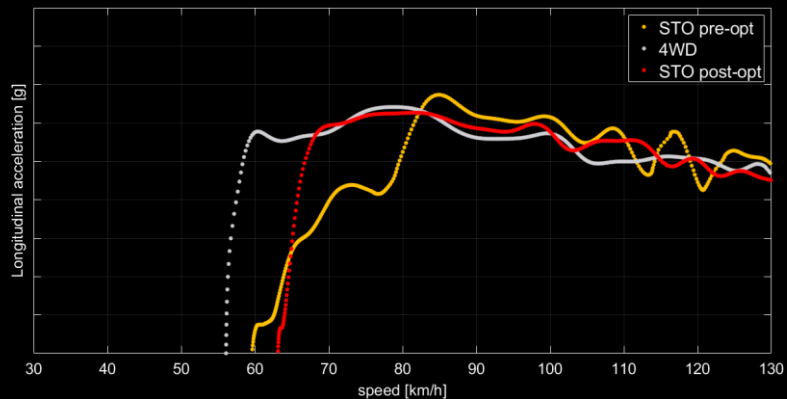
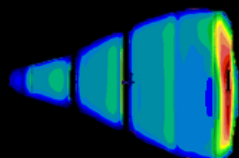
Closing the loop with DiL



PRE-OPTIMIZATION



POST-OPTIMIZATION



Lamborghini/Bridgestone Virtual Development

Exploiting mutual capabilities



EFFICIENCY



Allowed faster response by providing Lamborghini with virtual tires before any physical building saving 75% of time during the development

Virtual Dev.

Classical Physical Approach

FUTURE ORIENTED

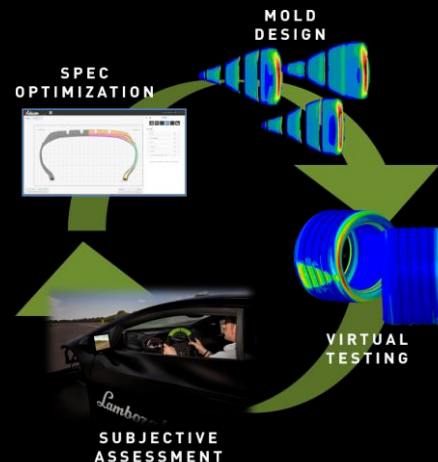


Provided Lamborghini with 100% virtual models of non-existing products

SUSTAINABLE



Allowed reduction of physical tests on vehicle (-900 km) and CO2 emission saving up to 200 experimental tires



Lamborghini and Bridgestone made the development efficient and sustainable thanks to its full virtualization

