

DRIVING SIMULATOR APPLICATION FOR TIRE ASSESSMENT

RUTGER UIL

PRINCIPAL ENGINEER PERFORMANCE SCIENCE

VI-GRADE ZERO PROTOTYPES SUMMIT JAPAN 2022

22ND OF SEPTEMBER

GOODYEAR

LOOKING BACK

GOODYEAR AND VI-GRADE PARTNERSHIP



TIMELINE



—First and only tire manufacturer to purchase dynamic driving simulator

AKRON, Ohio, Jan. 15, 2020 – The Goodyear Tire & Rubber Company announced today it will enhance its product development capabilities with the purchase of new vi-grade driving simulators, including a dynamic model, a first for tire manufacturers.

Goodyear has selected a COMPACT Simulator recently delivered to the company's Innovation center in Luxembourg and a Dynamic Driving Simulator (DDSG) (Driver-to-Motion) that will be installed in Akron, Ohio, in the coming months.

"This level of simulation sophistication will allow Goodyear to drive breakthroughs in future tire creation, leading to an enhanced customer and driver experience," said Chris Hessel, Goodyear's senior vice president and chief technology officer. "I'm proud to say that Goodyear is leading the industry with vi-grade and our simulation solutions, and we look forward to sharing that benefit with our customers."

The automotive industry trend toward a virtual development cycle provides an opportunity for tire development and this new simulation avenue will allow Goodyear to work more collaboratively with automobile manufacturers on original equipment fitments.

COMPACT SIMULATORS

FIRST HALF OF 2020 COMPACT
SIMULATOR INSTALLED GLOBALLY

2ND DIM250 ANNOUNCED

GOODYEAR ANNOUNCED INVESTMENT
FOR 2ND DIM250 FOR INNOVATION CENTER
LUXEMBOURG



1/2020

6/2020

12/2020

1/2021

7/2022

1ST DIM250 ANNOUNCED

BEGINNING OF 2020 GOODYEAR
ANNOUNCED INVESTMENT IN SEVERAL VI-
GRADE DRIVING SIMULATORS



SIMCENTER AKRON

FIRST VI-GRADE DIM250 DYNAMIC
SIMULATOR INSTALLED IN GOODYEAR
INNOVATION CENTER AKRON, OHIO

SIMCENTER LUXEMBOURG

SIMCENTER COMPLETION AND
INSTALLATION OF 2ND DIM250 DYNAMIC
DRIVING SIMULATOR IN GOODYEAR
INNOVATION CENTER LUXEMBOURG IN
JULY 2022



INSTALLATION LOCATIONS



USA: Innovation
Center Akron, Ohio

- Compact Simulator
- DiM250 Dynamic Simulator



LUX: Innovation
Center Colmar-Berg

- Compact Simulator
- DiM250 Dynamic Simulator



SIMCENTER LUXEMBOURG



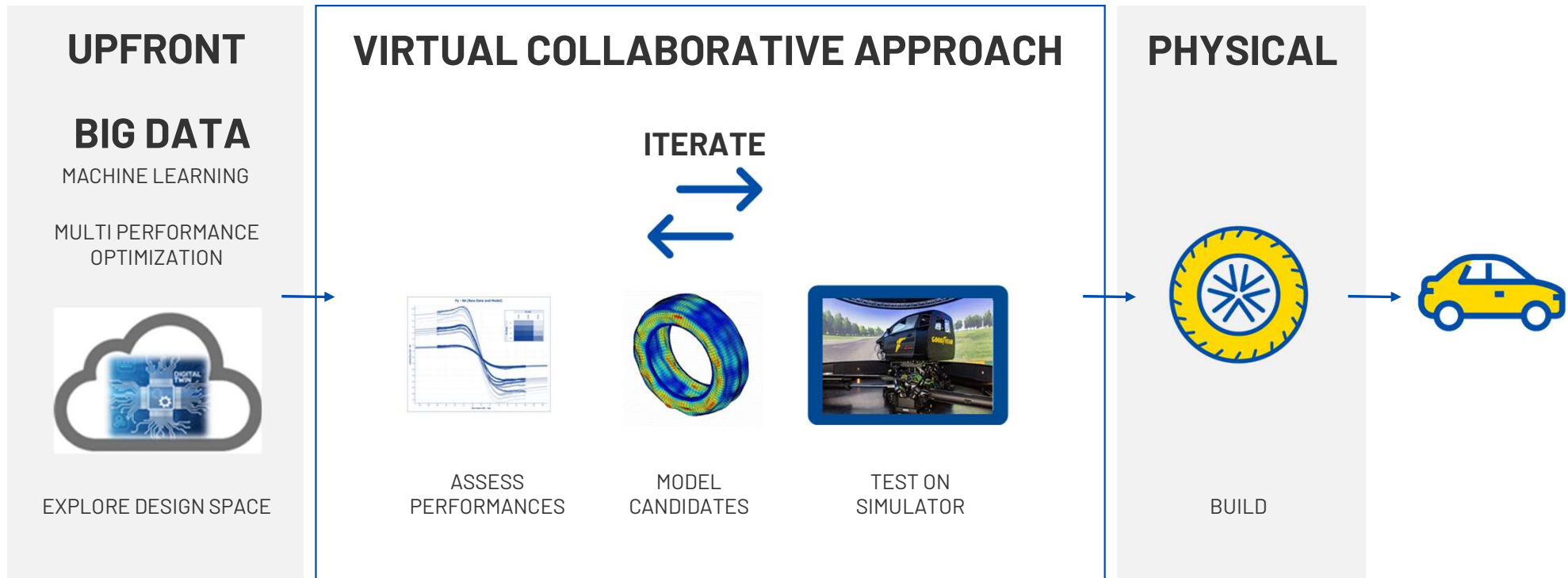


VIRTUAL DEVELOPMENT APPROACH

USING DRIVING SIMULATOR TECHNOLOGY

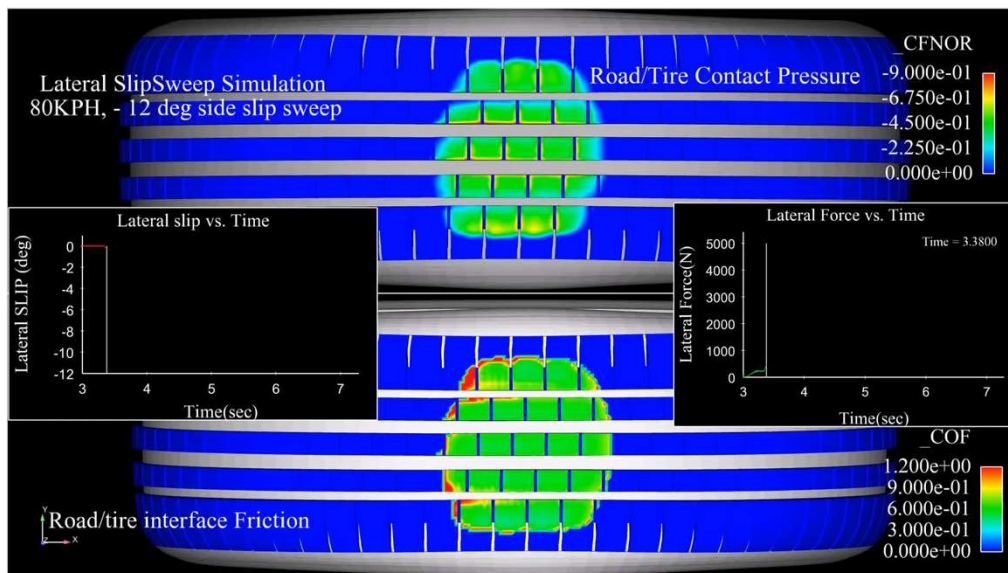
GOODYEAR

VIRTUAL DEVELOPMENT PROCESS

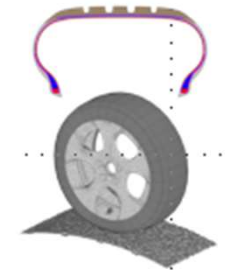
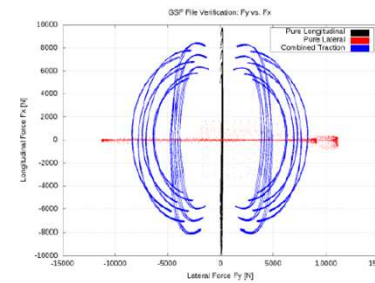


VIRTUAL TIRE ASSESSMENT APPROACH

Study: Demonstrate capability with **virtual** derived tire models



FE simulations



RT derived model

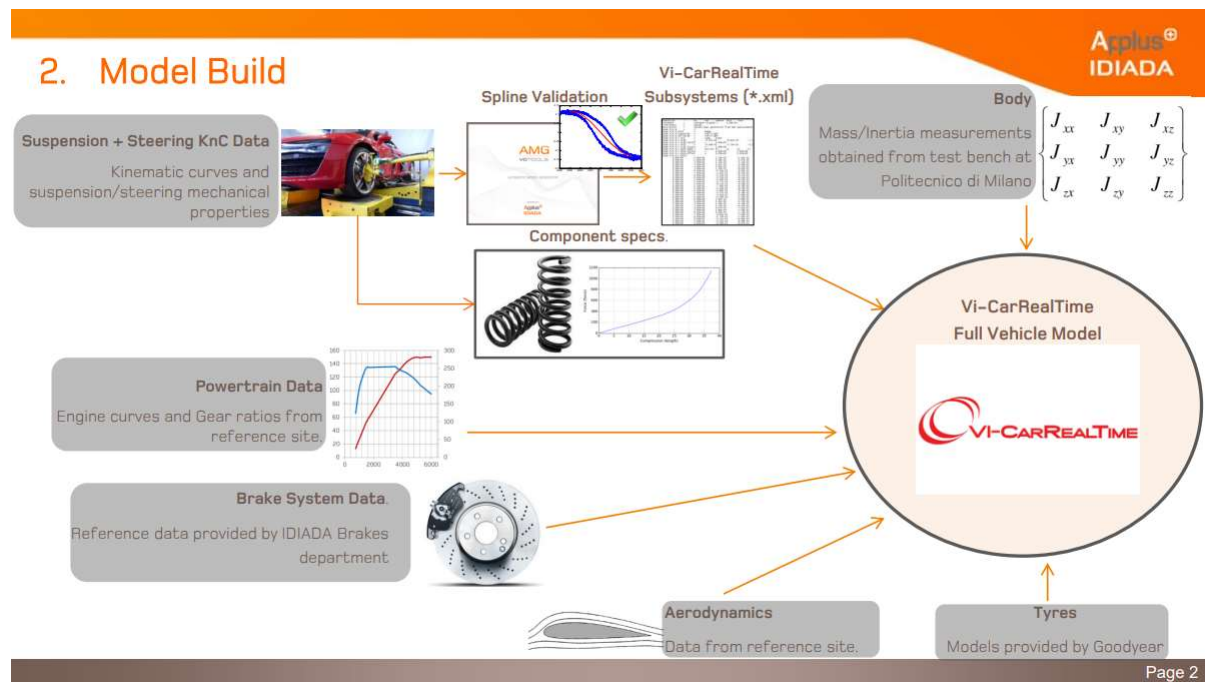


Dynamic Simulator



VEHICLE MODEL CHARACTERIZATION

Vehicle Platform GOLF 8 1.5 eTSi



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Vehicle model characterization performed by IDIADA Engineering Services

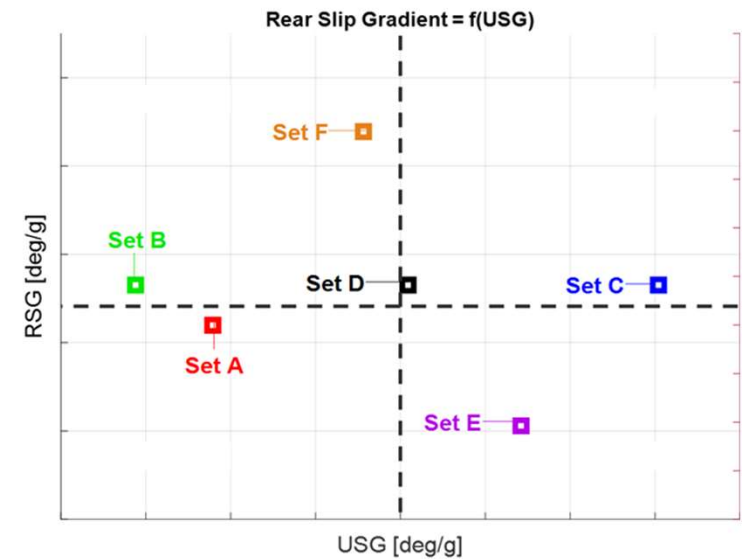


TIRE MODEL CHARACTERIZATION

Tire Line	Size
Tire Line 1	235/35R19 91Y XL
Tire Line 2	225/45R17 91W
Tire Line 3	205/55R16 91V

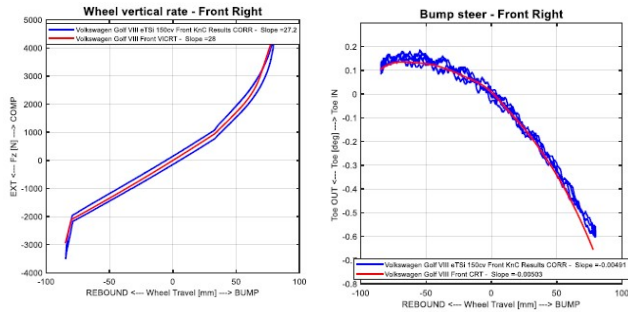


	Front Tire	Front Inflation	Rear Tire	Rear Inflation
Set A	235/35R19	2.5 bar	235/35R19	2.5 bar
Set B	235/35R19	2.5 bar	225/45R17	2.5 bar
Set C	205/55R16	2.5 bar	225/45R17	2.5 bar
Set D	225/45R17	2.8 bar	225/45R17	2.5 bar
Set E	235/35R19	2.8 bar	235/35R19	2.3 bar
Set F	205/55R16	2.5 bar	205/55R16	2.8 bar

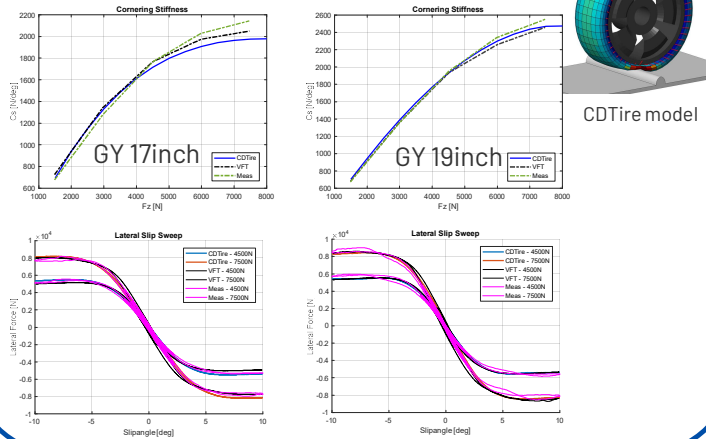


VEHICLE/TIRE MODEL INTEGRATION

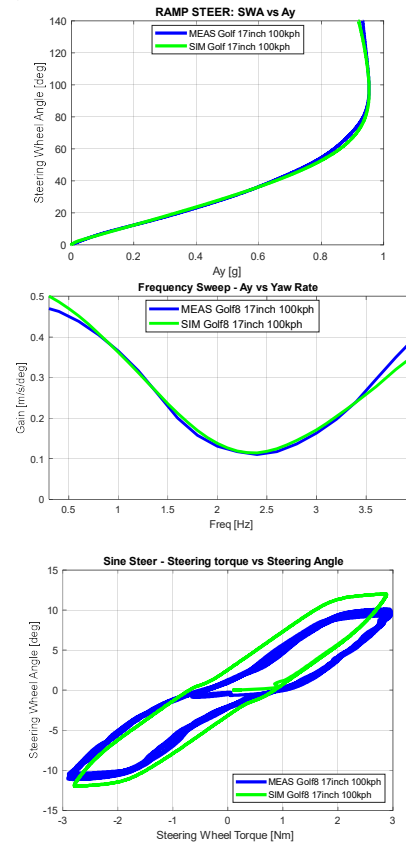
Vehicle model characterization



Tire model parameterization



Validation simulation vs objective characterization



Driving Simulator assessment

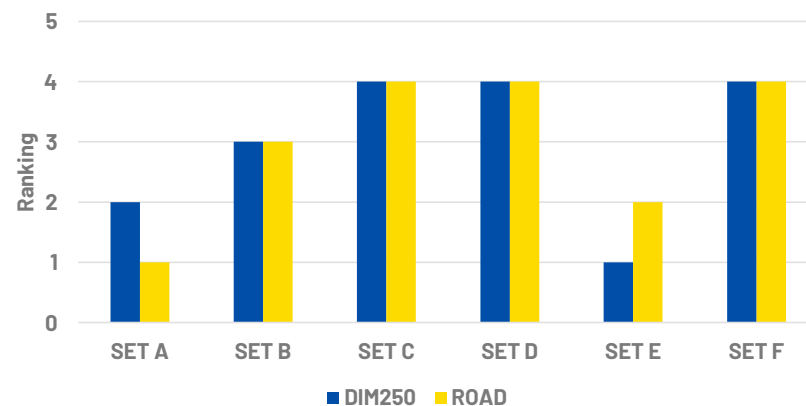


SIMULATOR ASSESSMENT

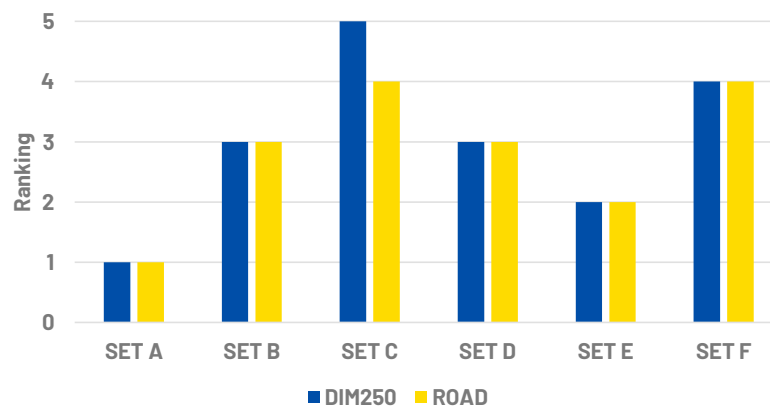
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STEERING OVERALL



HIGH SPEED HANDLING OVERALL



VIR June 2019

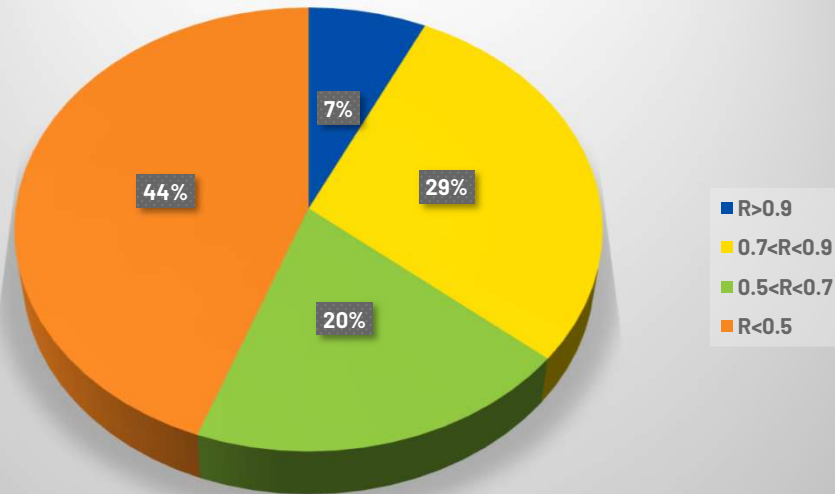
VIR (DiM 250 ETL) December 2020



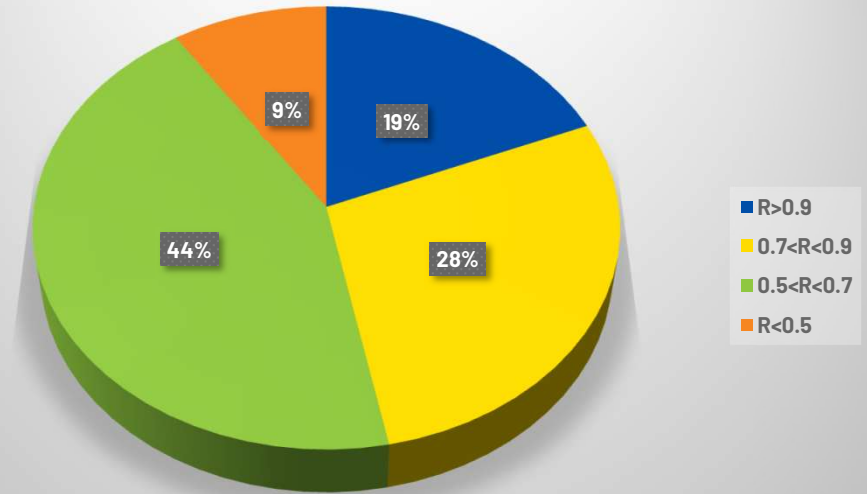
SIMULATOR ASSESSMENT

PEARSON CORRELATION SUBJECTIVE EVALUATION DIM250 VS ROAD

STEERING/HANDLING ATTRIBUTES
169 COEFFICIENTS



HIGH SPEED HANDLING ATTRIBUTES
64 COEFFICIENTS



STEERING/HANDLING ITEMS ARE SHOWING OVERALL LOWER CROSS-CORRELATION, HIGH SPEED HANDLING ATTRIBUTES EXHIBITS HIGHER CORRELATION



OUTLOOK

DRIVING VIRTUAL TIRE DEVELOPMENT THROUGH DRIVING SIMULATOR TECHNOLOGY TO DEVELOP EVEN BETTER PRODUCTS





THANK YOU
ありがとう

VI-GRADE ZERO PROTOTYPES SUMMIT JAPAN 2022

