Enabling Full Virtual Vehicle/Tire Co-Development: The Bridgestone-Volkswagen Approach

BRIDGESTONE
Solutions for your journey

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Golf GTI – 50 Years of Passion

Virtual Tire Development – One Decade of Collaboration Bridgestone and Volkswagen

The Next Level: The Golf GTI EDITION 50

Record-breaking drive

on the Nordschleife

GTI | 50

Performance Package

Lap time:

07:44,523 min

Fastest Nordschleife lap driven in a front-wheel-drive production vehicle

Car:

Golf GTI EDITION 50 with Performance package

Driver:

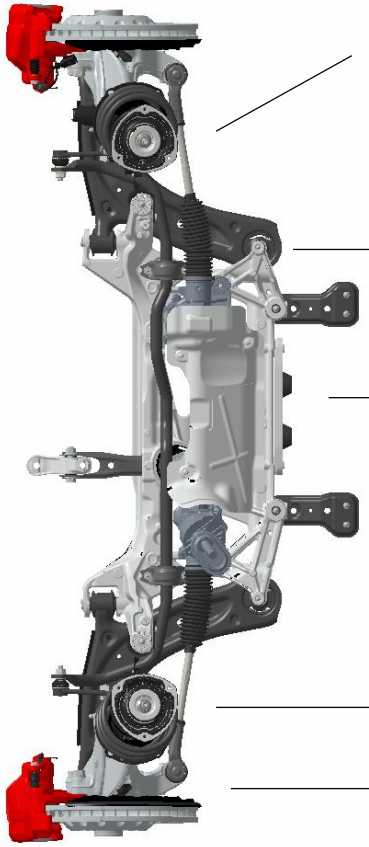
Benjamin Leuchter

Performance Package

a dedicated suspension for maximum performance

GTI | 50
Performance Package

Front Suspension



Stiffer **springs**
Eigenfrequency ≈1,9 Hz
-5 mm **reduced ride height**

Stiffer **control arm bushing**

Specific **data sets** for:
Steering system, DCC,
Vehicle dynamics manager
and Stability control systems

Stiffer **top mount**

Wheel carrier
increased camber -2°

Max. Performance

Bridgestone
Potenza Race 235/35 R19
newly developed
VW specification
–10% rolling resistance
–1.2 kg tyre weight*

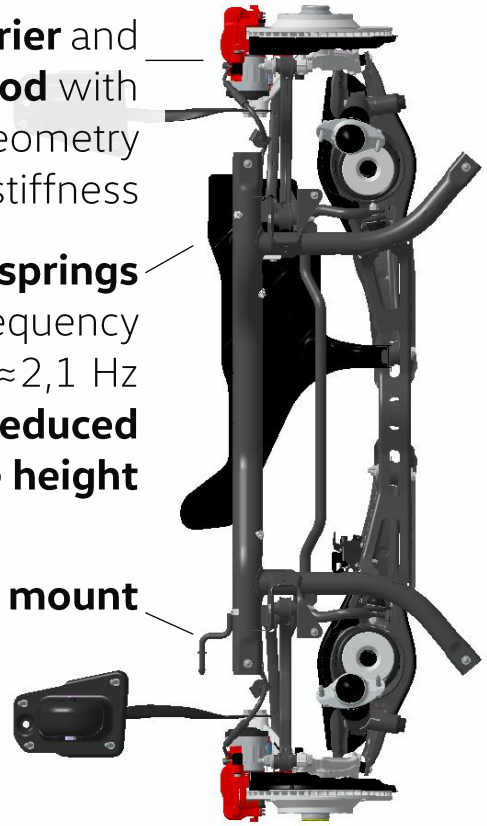
Rim "Warmenau"
71% degree of opening
-3,3 kg rim weight**

Rear Suspension

Wheel carrier and **track rod** with optimised geometry for higher stiffness

Stiffer **springs**
Eigenfrequency
≈2,1 Hz
-5 mm **reduced ride height**

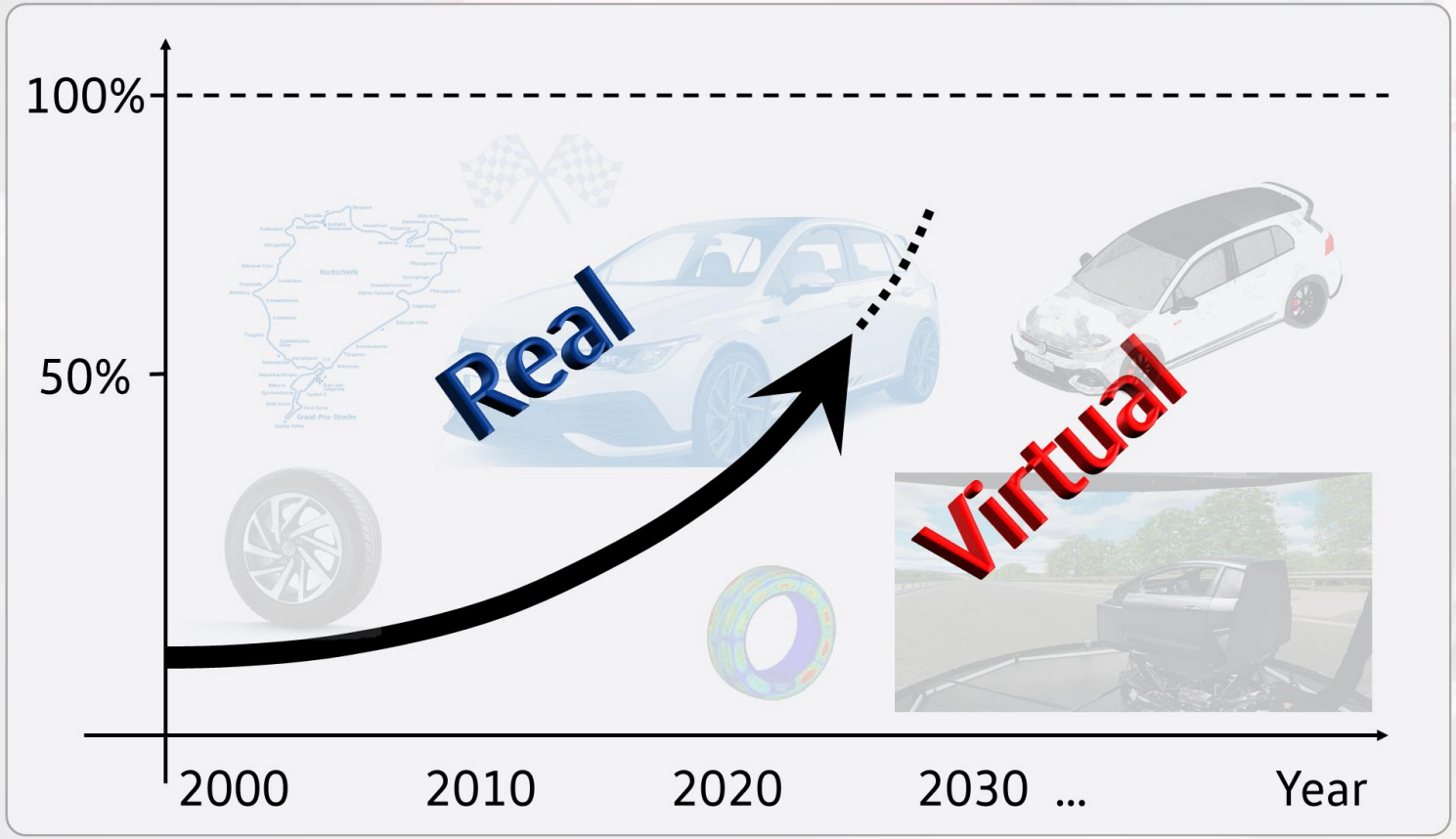
Stiffer **top mount**

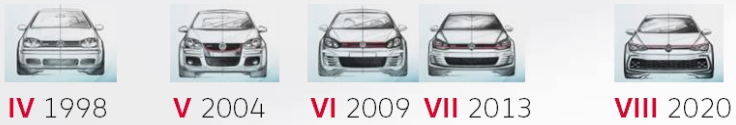


* compared with predecessor
** compared with "Queenstown"

Frontloading of Development Tasks by Virtual Methods

Virtualization of the Tire Development Process





Frontloading

Shifting driving dynamics **tests** from the **real to** the **virtual** world in the early development phase

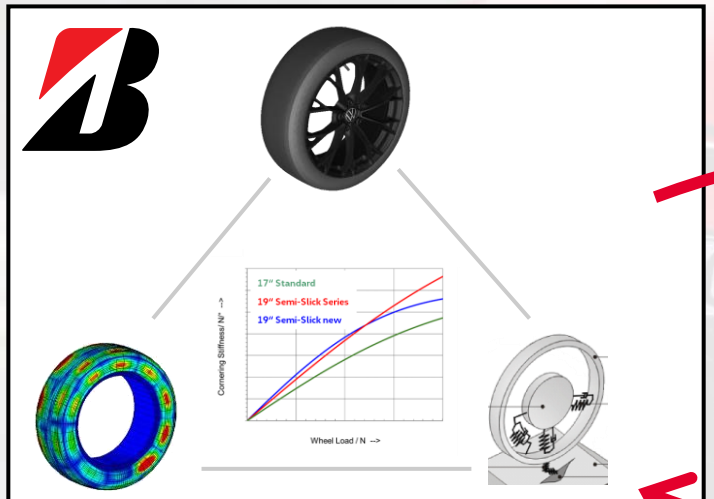
More **efficient**, **cost-saving** and environmentally friendly development process with **less** use of physical **hardware**

Digital Twins

to engage the maturity of the 1st physical prototypes

Modelling of Digital Twins

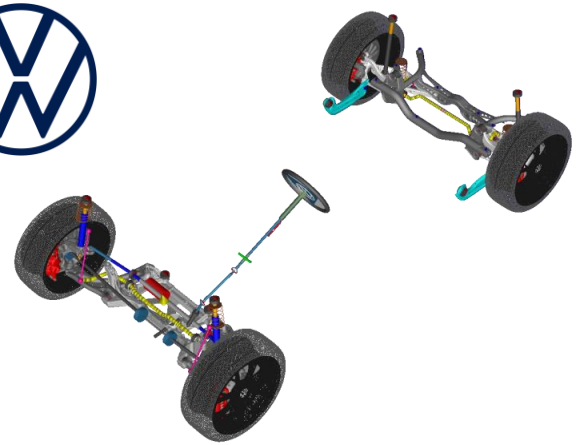
Achieving the full potential by combining Bridgestone and Volkswagen Expertise



Tire Model

Data

Exchange



Vehicle Model

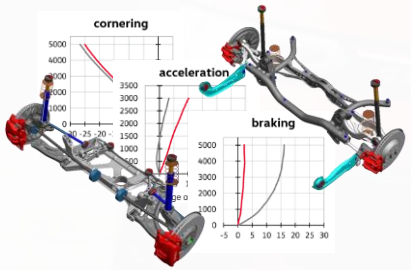
- Suitable digital twins of the vehicle and tire are a basic requirement for virtual driving dynamics evaluation of the real-world counterparts
- They must cover all vehicle attributes relevant to driving dynamics with sufficient accuracy

Sharing the Digital Twin of the Vehicle

The right data in the right complexity

Suspension Characteristics

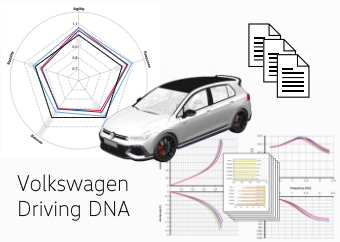
Kinematics and Compliance Tests



KPI's, Targets, ...

Driving Dynamics Properties

Objective Tests and Vehicle Information



Volkswagen
Driving DNA

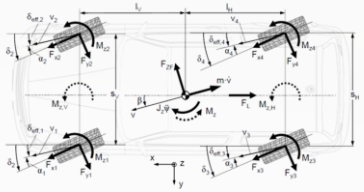
Vehicle Model Export

Detailed
parametrization of relevant chassis components and properties

Multibody-System Model
to describe the vehicle driving dynamics and complex interactions

Simplified Vehicle Model

export of complex MBS Model



Validated and Realtime capable

Models for external usage

Steering Assist

advanced inhouse Steering Model

Essential for Driving Simulator Application
The Steering Wheel Torque has a significant influence on the realistic perception of driving behavior.

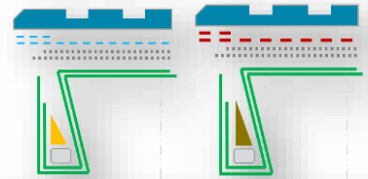
Bridgestone Virtual Tire Development

Full integration of all capabilities

Real Car

Real Outdoor Tests

Modelling of Reference Vehicle

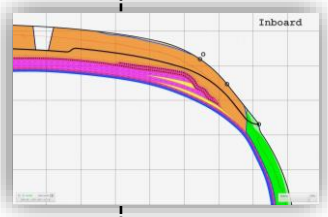


Bridgestone Reference Spec

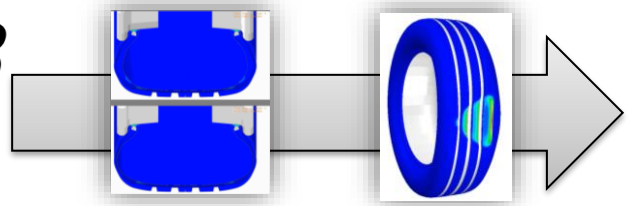
Physical Indoor Test Campaign

Tire models

Step#1 - Validation



Making of virtual specs



Virtual Test Campaign

Tire models

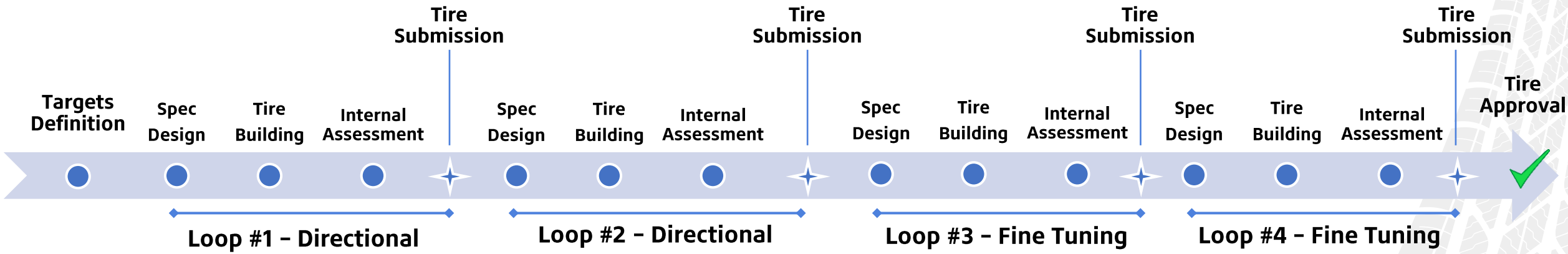
Step#2 - VTD

VTD, DiL and AI integration forged a seamless workflow, now embedded in every stage of product development

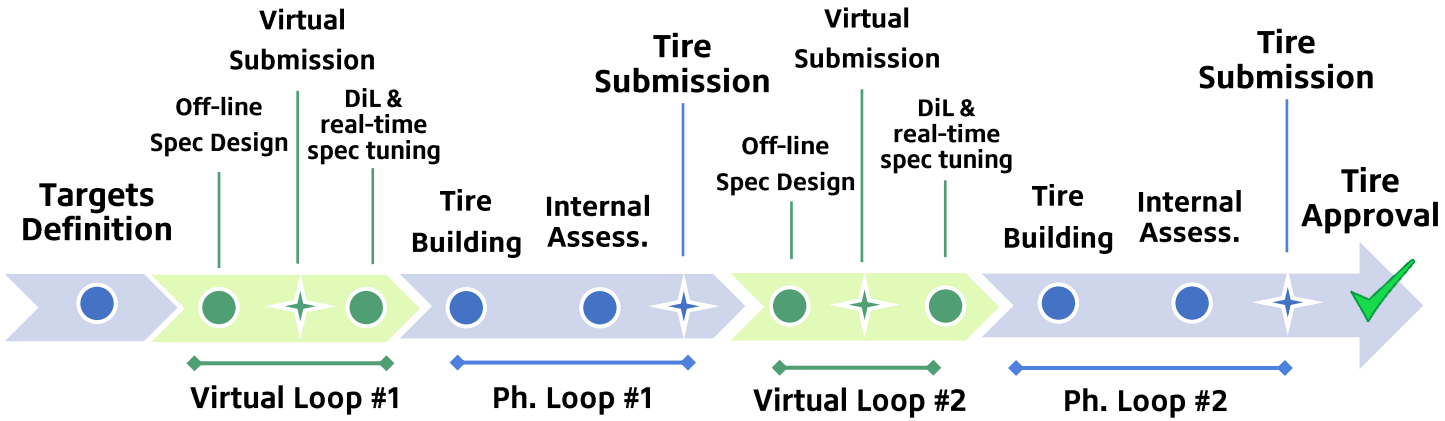
Tangible Benefits

An end-to-end ecosystem replacing physical loops with faster, more efficient virtual iterations

Classical Approach based on Physical prototyping



Approach based on Bridgestone Virtual Tire Development



Virtual development enables more precise designs, minimizing physical loops required to achieve targets

New Development Process for Tire Handling Evaluation

Engage the Maturity of the 1st Hardware using Virtual Methods (Frontloading)

Virtual Testing

Physical Testing

Tire Prototypes

Approval Level

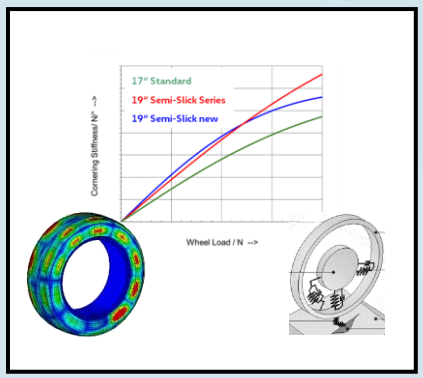
① Tire preselection based on objective targets

② Best tire candidates tuned by expert drivers

Virtual Approval

reduced number of physical tests due to virtual predevelopment

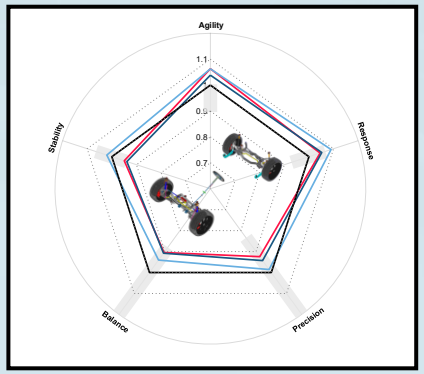
③ Fine-tuning of physical tires



Tire Design and Modeling

Offline

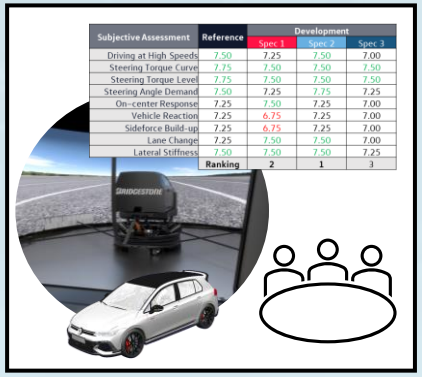
Loops



Vehicle Dynamics Objective Assessment

Driver

in the Loop



Driving Simulator Subjective Assessment

1st Hardware approved by Digital Twins

Proving Ground Hardware Assessment

BRIDGESTONE

Solutions for your journey

Thank You