MEGARIDE
APPLIED VEHICLE RESEARCH

Physical tire modeling for real-time simulation

MEGARIDE
APPLIED VEHICLE RESEARCH

COMPANY & RESEARCH HIGHLIGHTS

powered by

DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

MEGARIDE®
APPLIED VEHICLE RESEARCH
an official UniNa spinoff company

UniNa Vehicle Dynamics research group

MULTIPHYSICAL TIRE MODELS

MODULAR SIMULATION PLATFORM

SCIENCE APPLIED TO RACES

MEGARIDE
APPLIED VEHICLE RESEARCH

A HOLISTIC VIEW IN TIRE MODELING

powered by
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

2 PERFORMANCE + 1 PARAMETERIZATION TOOLS

T.R.I.C.K.
from vehicle onboard sensors to tire data

RIDElab
multiphysical tire data analysis and MF-ID

RIDEtool
structural, thermal and viscoelastic parameterization

4 PHYSICAL MODELS (RIDEsuite)

adheRIDE
advanced MF

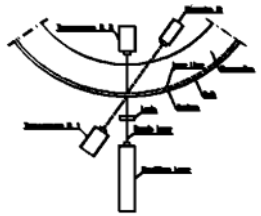
weaRIDE
tire wear model

thermoRIDE
tire thermal model

threedeeRIDE
multicontact model

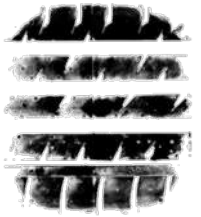
1 INNOVATIVE DEVICE + TESTBENCHES

VESevo
non-destructive tread compound analyzer



thermobench
tire thermal analysis

footprints-ID
shape & contact pressure



CONTENTS

MEGARIDE
APPLIED VEHICLE RESEARCH

OVERVIEW

powered by
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

2 PERFORMANCE + 1 PARAMETERIZATION TOOLS

T.R.I.C.K.
from vehicle onboard sensors to tire data

RIDElab
multiphysical tire data analysis and MF-ID

RIDEtool
structural, thermal and viscoelastic parameterization

4 PHYSICAL MODELS (RIDEsuite)

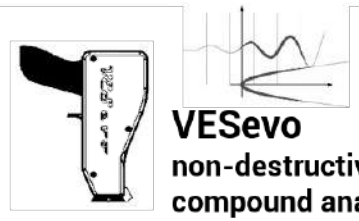
adheRIDE
advanced MF

weaRIDE
tire wear model

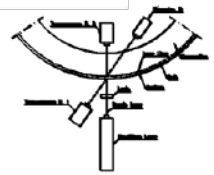
thermoRIDE
tire thermal model

threedeeRIDE
multicontact model

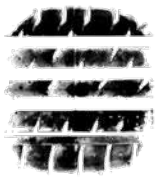
1 INNOVATIVE DEVICE + TESTBENCHES



VESevo
non-destructive tread compound analyzer



thermobench
tire thermal analysis



footprints-ID
shape & contact pressure

Do you need data from your tires for models identification and performance optimization?

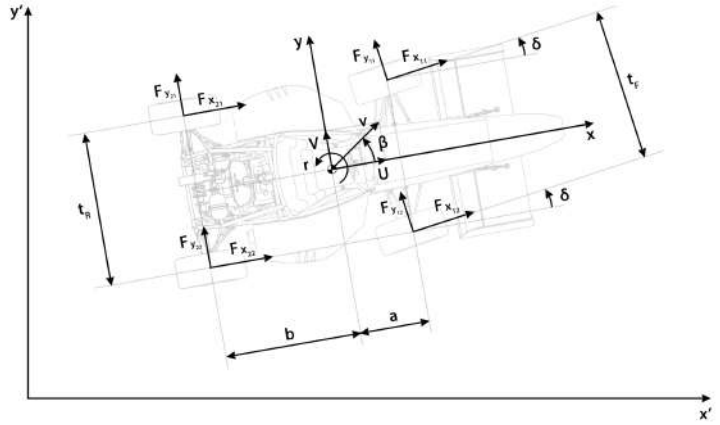
T.R.I.C.K.

T.R.I.C.K. has been conceived as an innovative methodology to tires characterization, using the data from vehicle, used as a moving laboratory. Real tires, in real working conditions, in contact with real road.

GLOBAL AIM

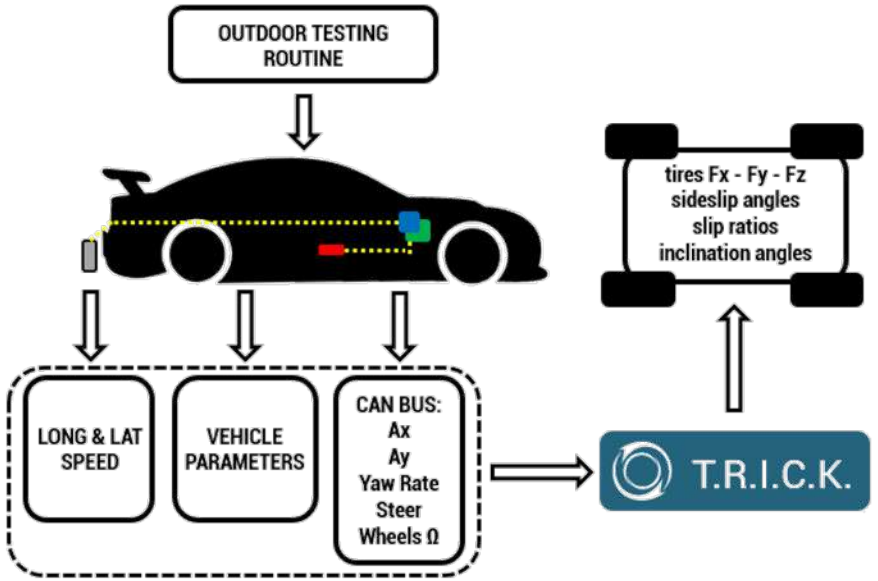
Solution

- **T.R.I.C.K.: Tire-Road Interaction Characterization & Knowledge**
- **characterize the vehichle system using it as a «moving lab»**



Target:

- **objectivation of tire and driving performance during testing**
- **achievement of tire-road interaction experimental curves**
- **analysis of tires in real working conditions**
- **procedure easily implementable in customers' process**



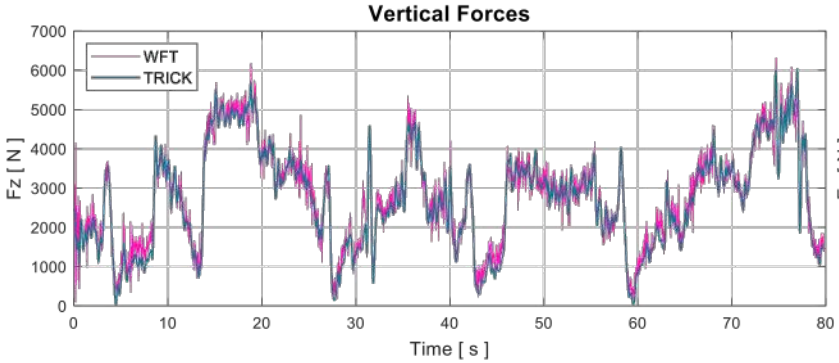
* for further info:
F. Farroni – T.R.I.C.K.: Tire/Road Interaction Characterization & Knowledge – A tool for the evaluation of tire and vehicle performances in outdoor test sessions – Mechanical Systems and Signal Processing – 72-73 808-831 (2016)

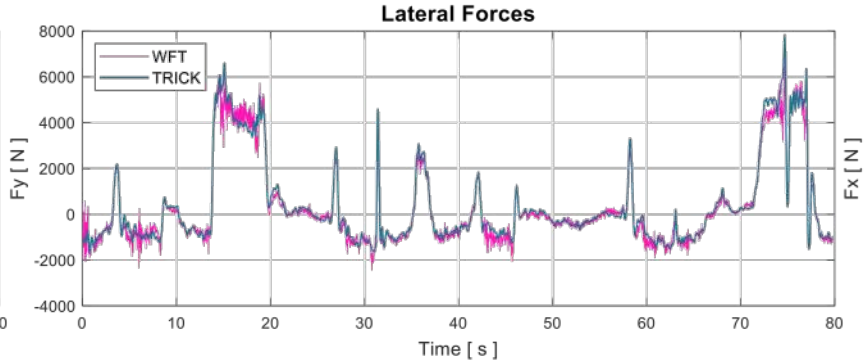
MEGARIDE
APPLIED VEHICLE RESEARCH

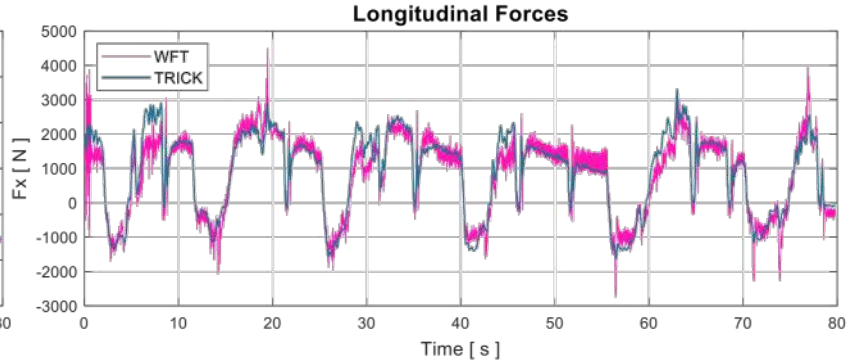
OUTPUT ANALYSIS

powered by
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

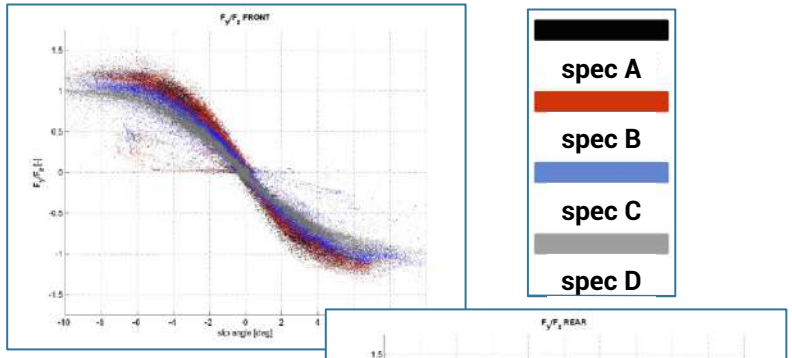
Validation performed thanks to specific tests with wheel force transducer

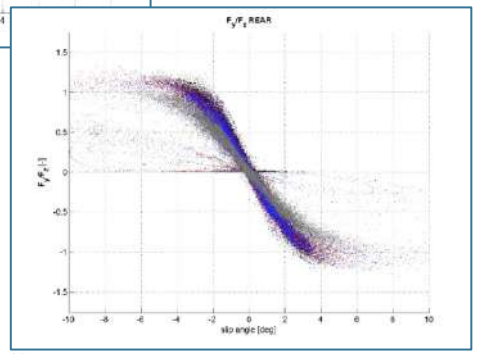


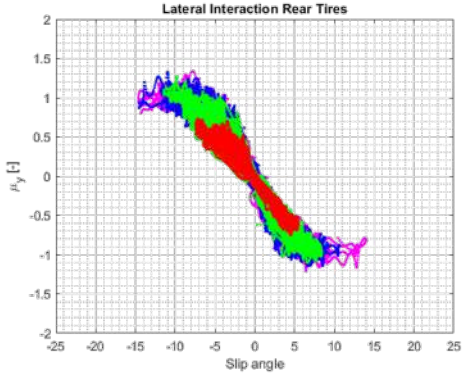


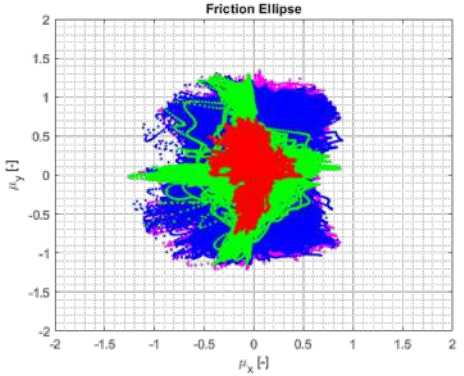


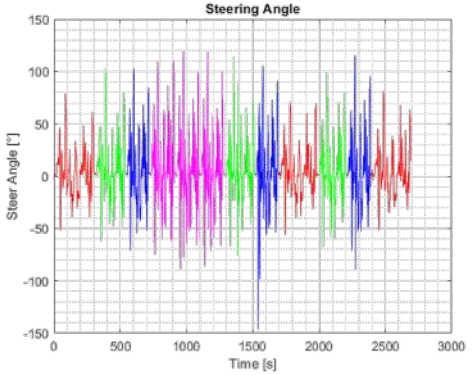
Tire performance objectivation and comparitive analysis











Driving style comparison

- **definition of specific testing routines and manoeuvres, allowing to analyse tire behavior in the widest possible range of working conditions**

T.R.I.C.H.

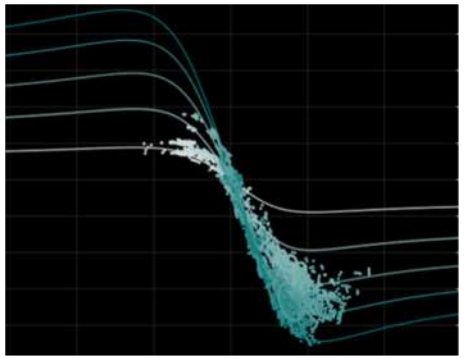
MEGARIDE
APPLIED VEHICLE RESEARCH

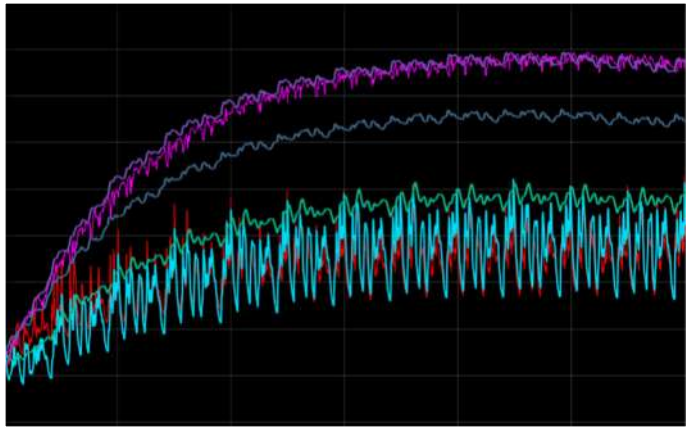
POSSIBLE SCENARIOS OF USE

powered by
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

TRICK tool output possible application…

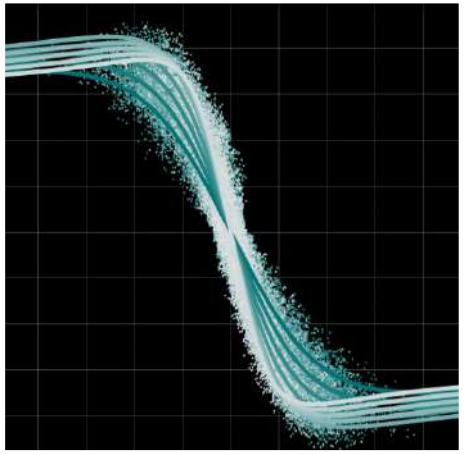
MF tire model →





← **Tire thermal model**

Multiphysical tire model →



⋆ for further info:
F. Farroni, A. Sakhnevych, F. Timpone
Development of a grip and thermodynamics sensitive procedure for the determination of tyre/road interaction curves based on outdoor test sessions
4th International Tyre Colloquium – Tyre Models for Vehicle Dynamics Analysis

T.R.I.C.K.

MEGARIDE
APPLIED VEHICLE RESEARCH

OVERVIEW

powered by
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

2 PERFORMANCE + 1 PARAMETERIZATION TOOLS

T.R.I.C.K.
from vehicle onboard sensors to tire data

RIDElab
multiphysical tire data analysis and MF-ID

RIDEtool
structural, thermal and viscoelastic parameterization

4 PHYSICAL MODELS (RIDEsuite)

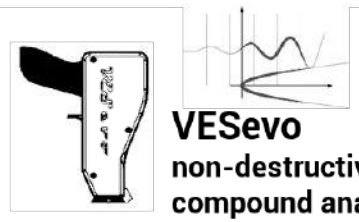
adheRIDE
advanced MF

weaRIDE
tire wear model

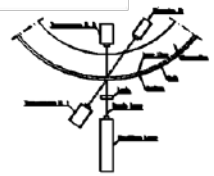
thermoRIDE
tire thermal model

threedeeRIDE
multicontact model

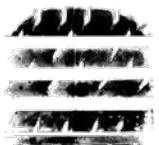
1 INNOVATIVE DEVICE + TESTBENCHES



VESevo
non-destructive tread compound analyzer



thermobench
tire thermal analysis



footprints-ID
shape & contact pressure

Do you want to know your tires' optimal thermal range?

thermoRIDE

thermoRIDE is able to provide real-time tire temperature distribution, with particular reference to the internal inaccessible layers, deeply correlated to friction phenomena.

MEGARIDE
APPLIED VEHICLE RESEARCH

GLOBAL AIM

powered by
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

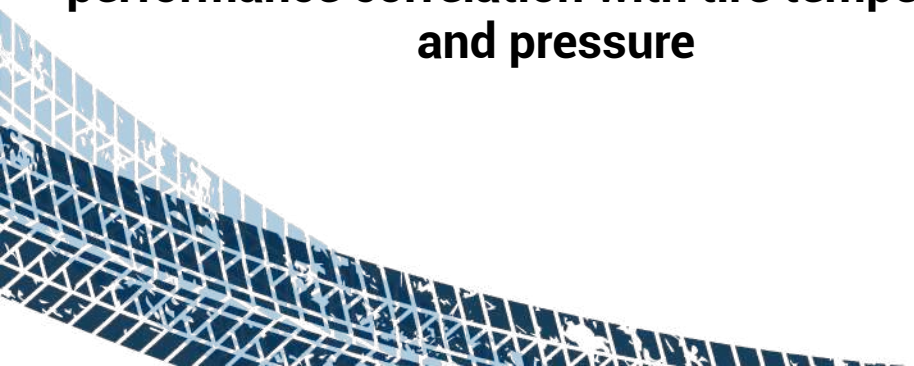
Prediction of tire temperature local distribution for race events

Use information on inner layers temperature

Bringing tire model to the next level

Advanced analysis & simulations concerning performance correlation with tire temperature and pressure

Setup development for thermal working range optimization



thermoRIDE

INPUT

Physical Quantity	Description	Unit	Reference frame
vSlidingFLLong	Longitudinal sliding speed	m/s	ISO
vSlidingFLLat	Lateral sliding speed	m/s	ISO
nWheelFL	Wheel rotation speed	rad/s	ISO
aCamberFL	Tire camber	rad	ISO
FxTyreFL	Tire longitudinal force	N	ISO
FyTyreFL	Tire lateral force	N	ISO
FzTyreFL	Tire normal force	N	ISO
TTrackFL	Road temperature	°C	-
TAirFL	External air temperature	°C	-
TDiscFL	Disc temperature	°C	-

Kinematic signals	Dynamic signals	Boundary conditions

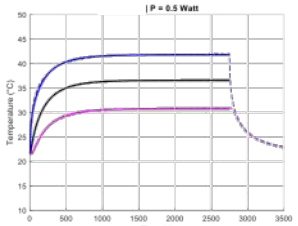
MEGARIDE
APPLIED VEHICLE RESEARCH

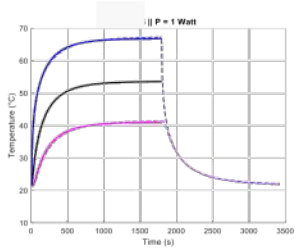
INPUT

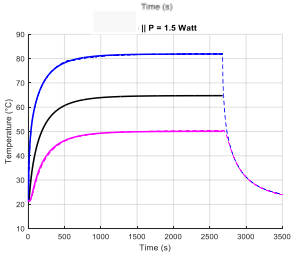
powered by

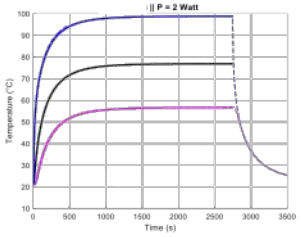
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

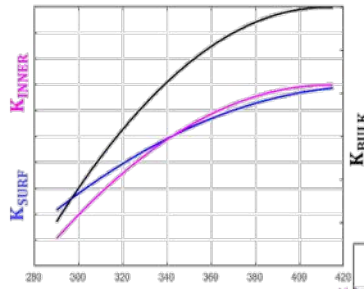
Thermal characterization

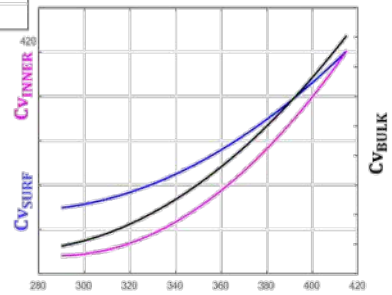






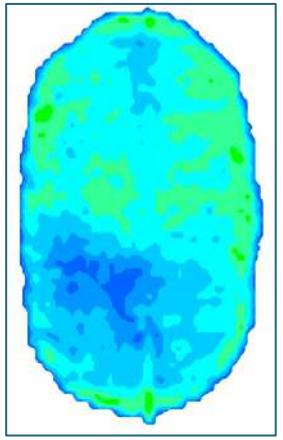


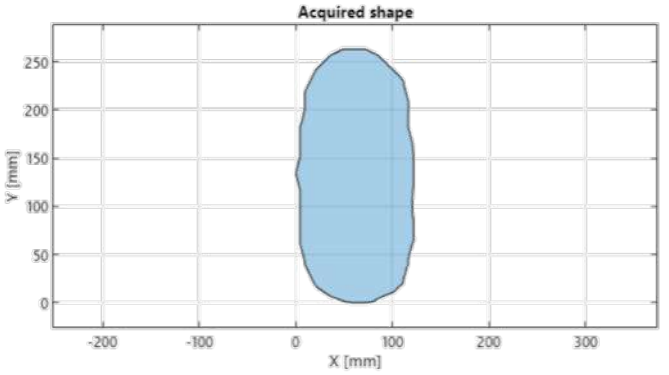


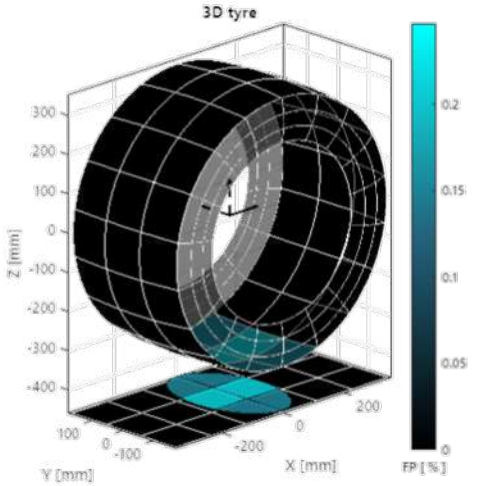


RIDEtool

Structural characterization



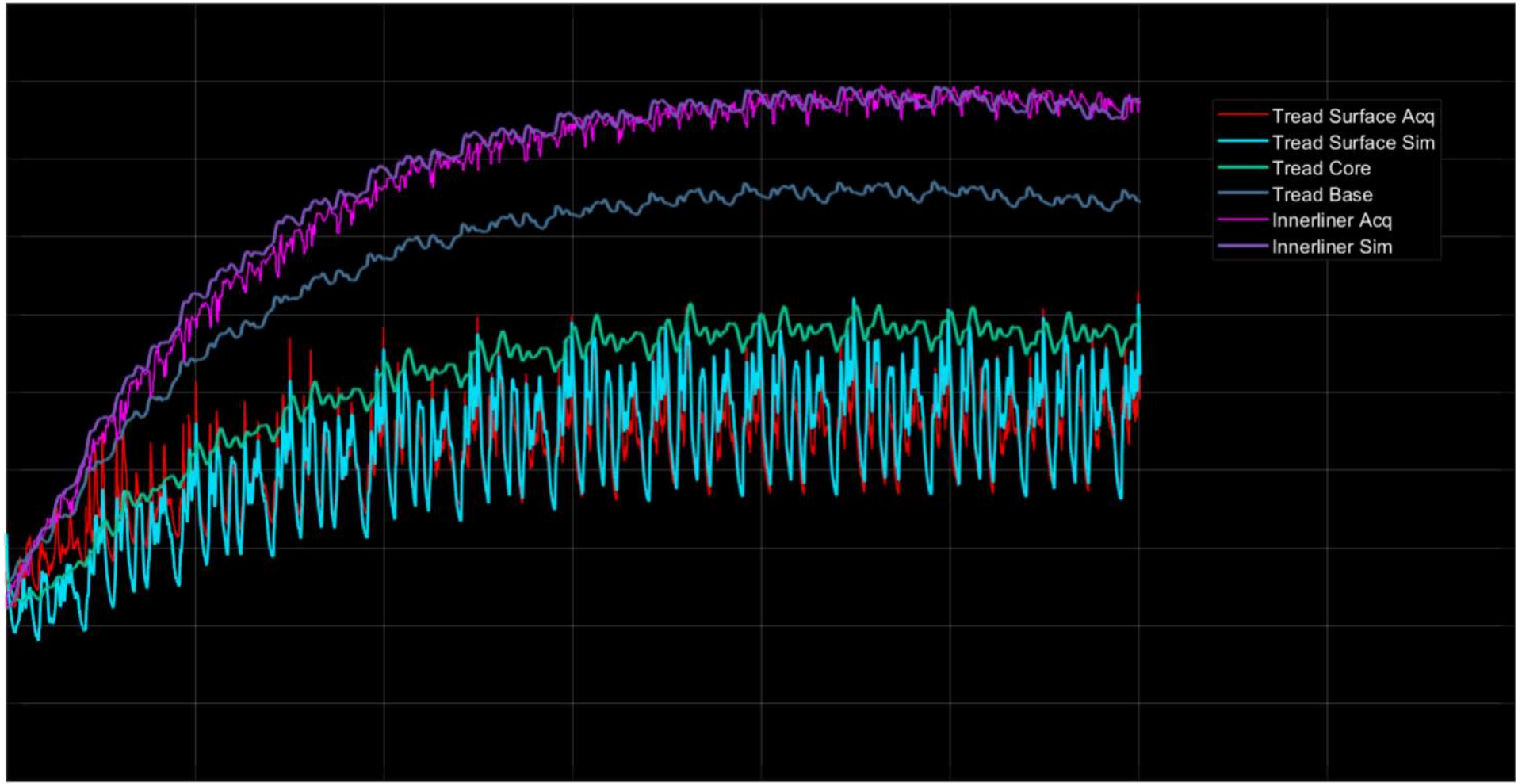




thermoRIDE

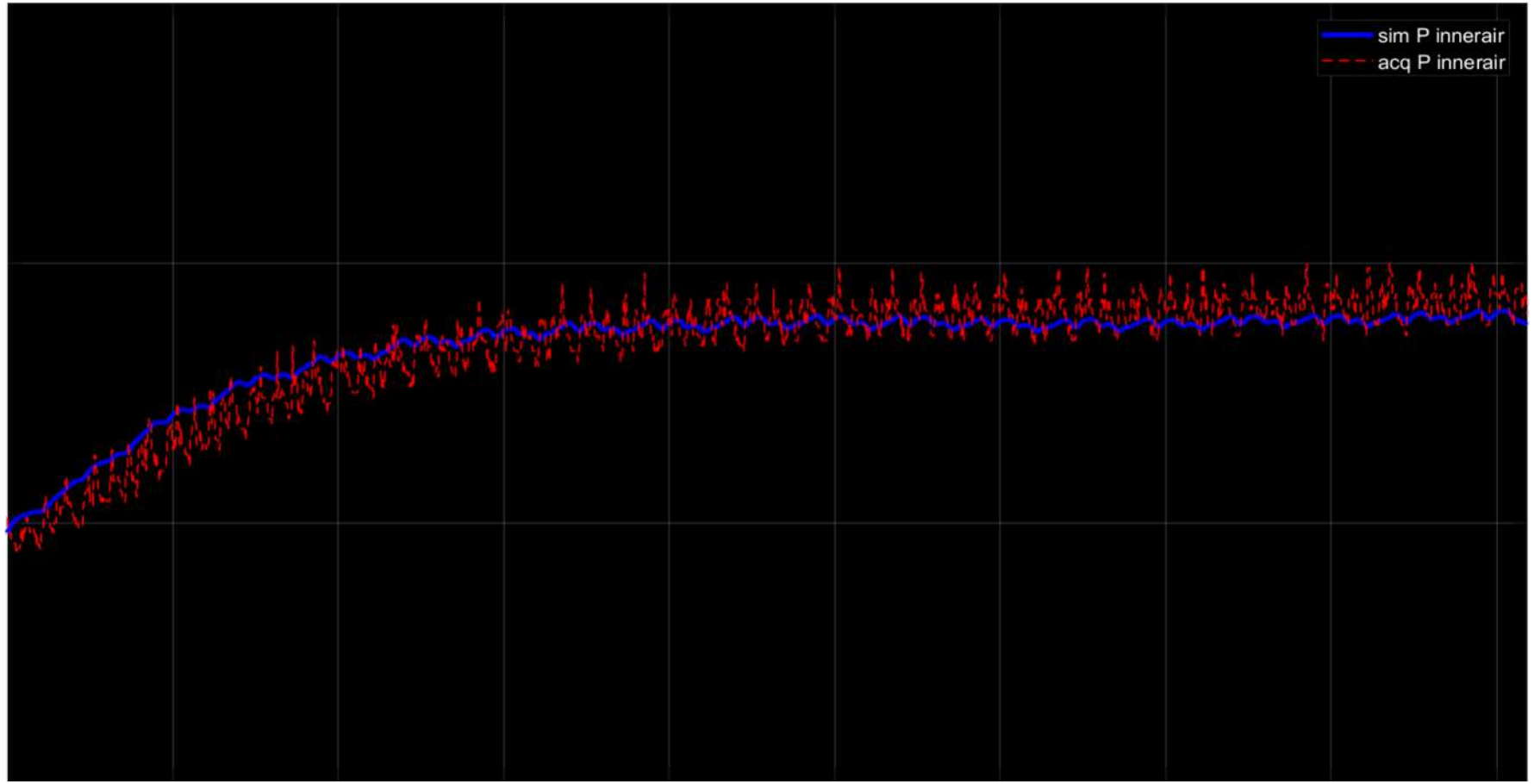
OUTPUT ANALYSIS

- **temperatures:**
  - **tread surface**
  - **tread core**
  - **tread base**
  - **inner liner**
  - **inner air**
  - **rim**



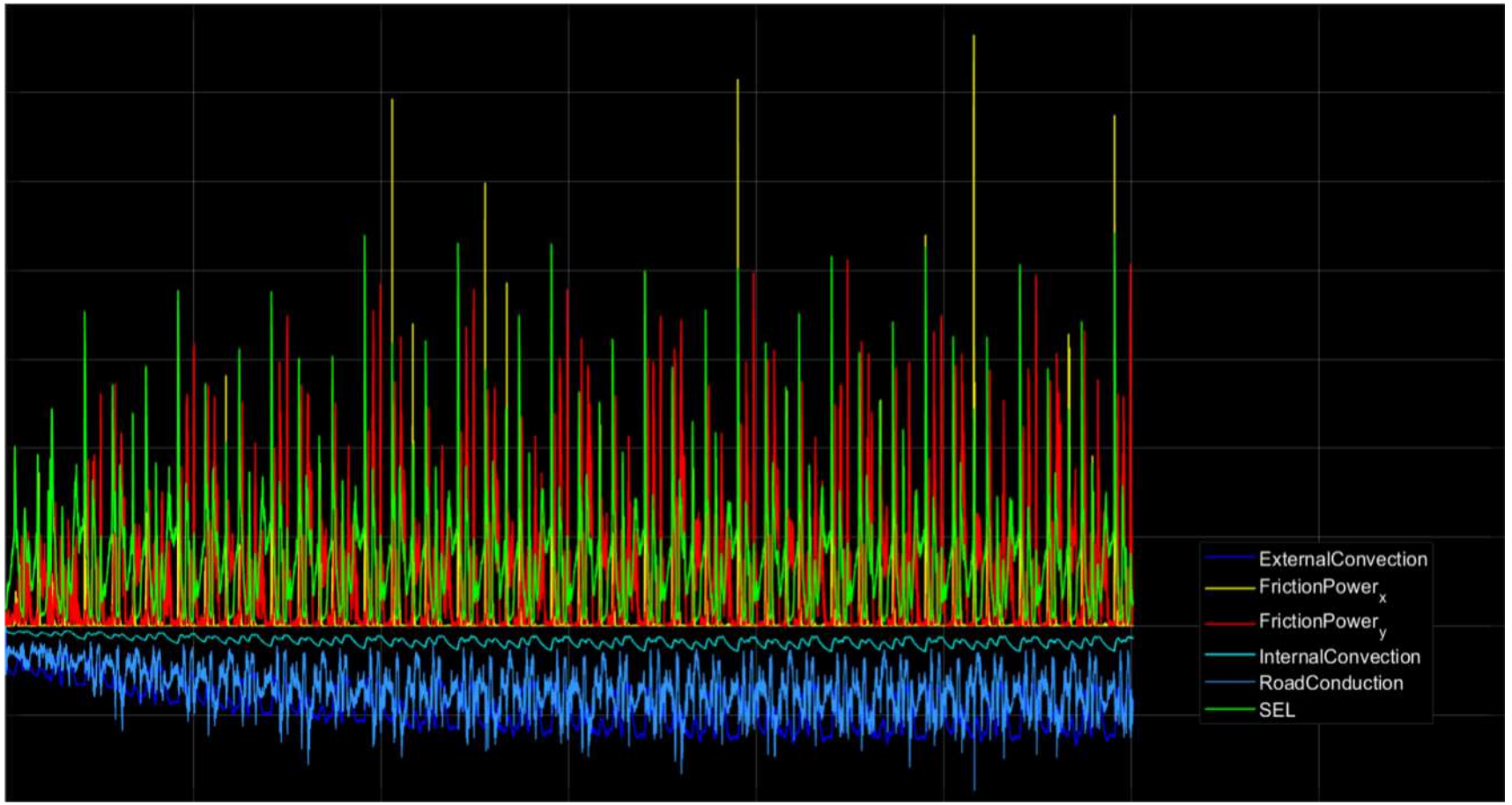
OUTPUT ANALYSIS

- **inner air pressure**



OUTPUT ANALYSIS

- **thermal exchanges:**
  - **friction power**
  - **SEL**
  - **external convection**
  - **internal convection**
  - **road conduction**



MEGARIDE
APPLIED VEHICLE RESEARCH

OVERVIEW

powered by
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

2 PERFORMANCE + 1 PARAMETERIZATION TOOLS

T.R.I.C.K.
from vehicle onboard sensors to tire data

RIDElab
multiphysical tire data analysis and MF-ID

RIDEtool
structural, thermal and viscoelastic parameterization

4 PHYSICAL MODELS (RIDEsuite)

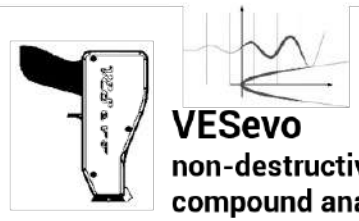
adheRIDE
advanced MF

weaRIDE
tire wear model

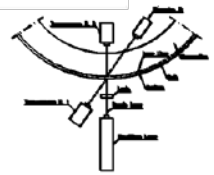
thermoRIDE
tire thermal model

threedeeRIDE
multicontact model

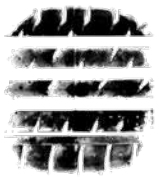
1 INNOVATIVE DEVICE + TESTBENCHES



VESevo
non-destructive tread compound analyzer



thermobench
tire thermal analysis



footprints-ID
shape & contact pressure

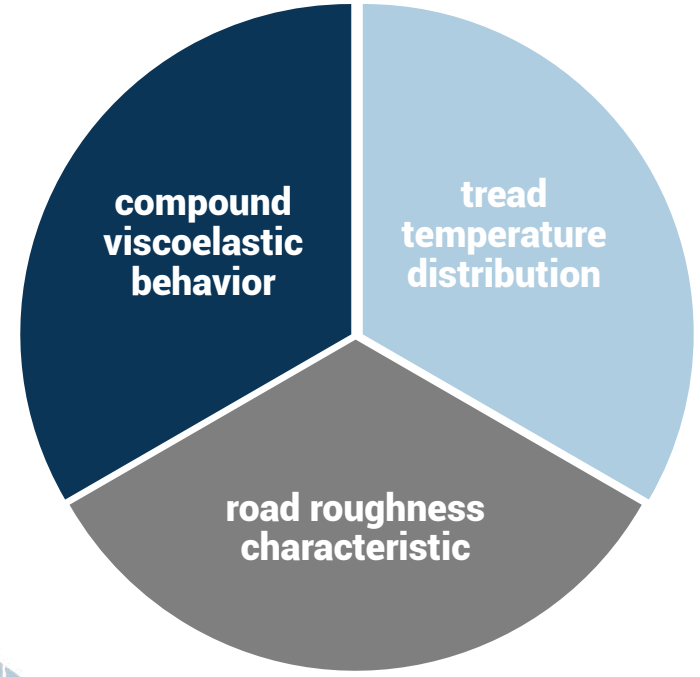
How do mechanical abrasion and chemical degradation affect tire dynamics?

weaRIDE

Abrasion phenomenon is modeled to simulate the tire tread thickness evolution during the lifecycle, as a function of the cumulated damage within the viscoelastic material.

PHYSICAL MODELING

weaRIDE takes into account of the following most relevant factors influencing the tire-road contact mechanics:



tread temperature distribution

Tire tread temperature distribution influences the instantaneous tire-road interaction since it modifies the viscoelastic properties of the compound, affecting both the grip value and the damage rate

compound viscoelastic behavior

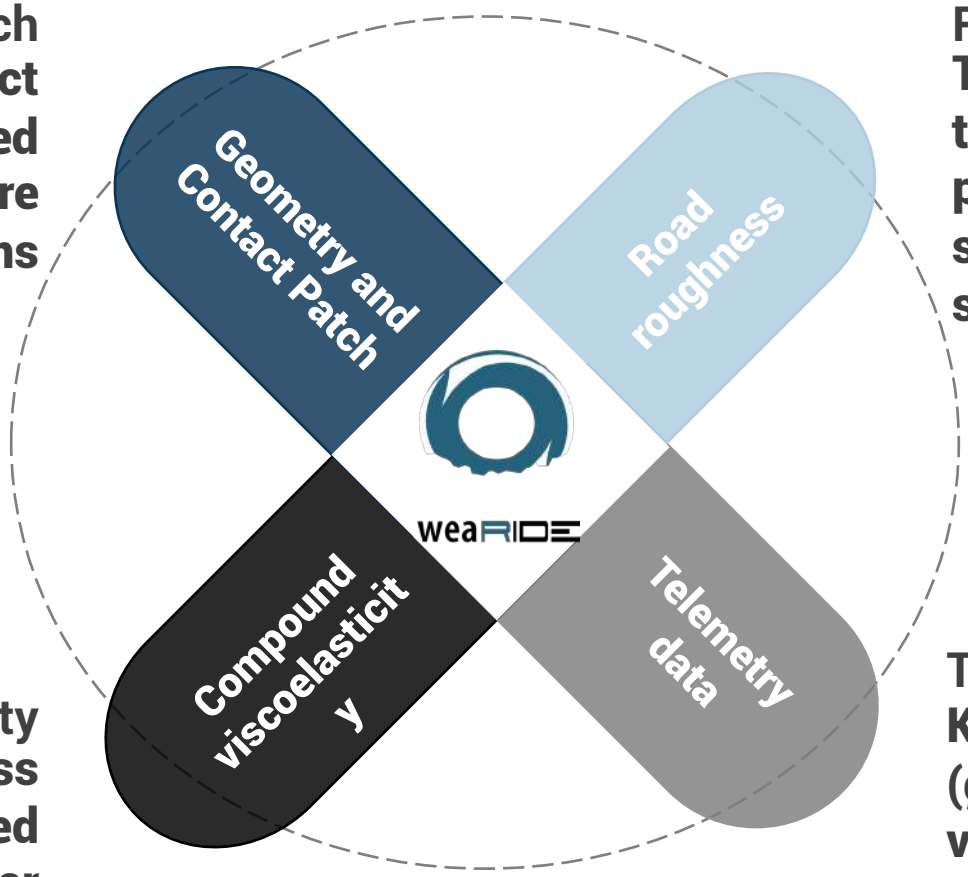
Compound viscoelastic properties play a fundamental role in modeling wear, considering both storage modulus and loss factor properties, and employing TTS coefficients to take into account of actual instantaneous temperatures and sliding speeds

road roughness characteristics

The road properties are responsible for the level of indentation (stress & strain), considering the roughness characteristics and the instantaneous viscoelastic properties of the tread compound

INPUT

Geometry and Contact Patch
Geometrical quantities and contact patch characteristics are evaluated as a function of instantaneous tire operating conditions



Road roughness
The road roughness, in particular the macro wavelength and the profile variance can be evaluated starting from laser texture scanner acquisitions

Compound viscoelasticity
Storage modulus E', and the loss factor $tan(\delta)$ are characterized for a specific compound rubber

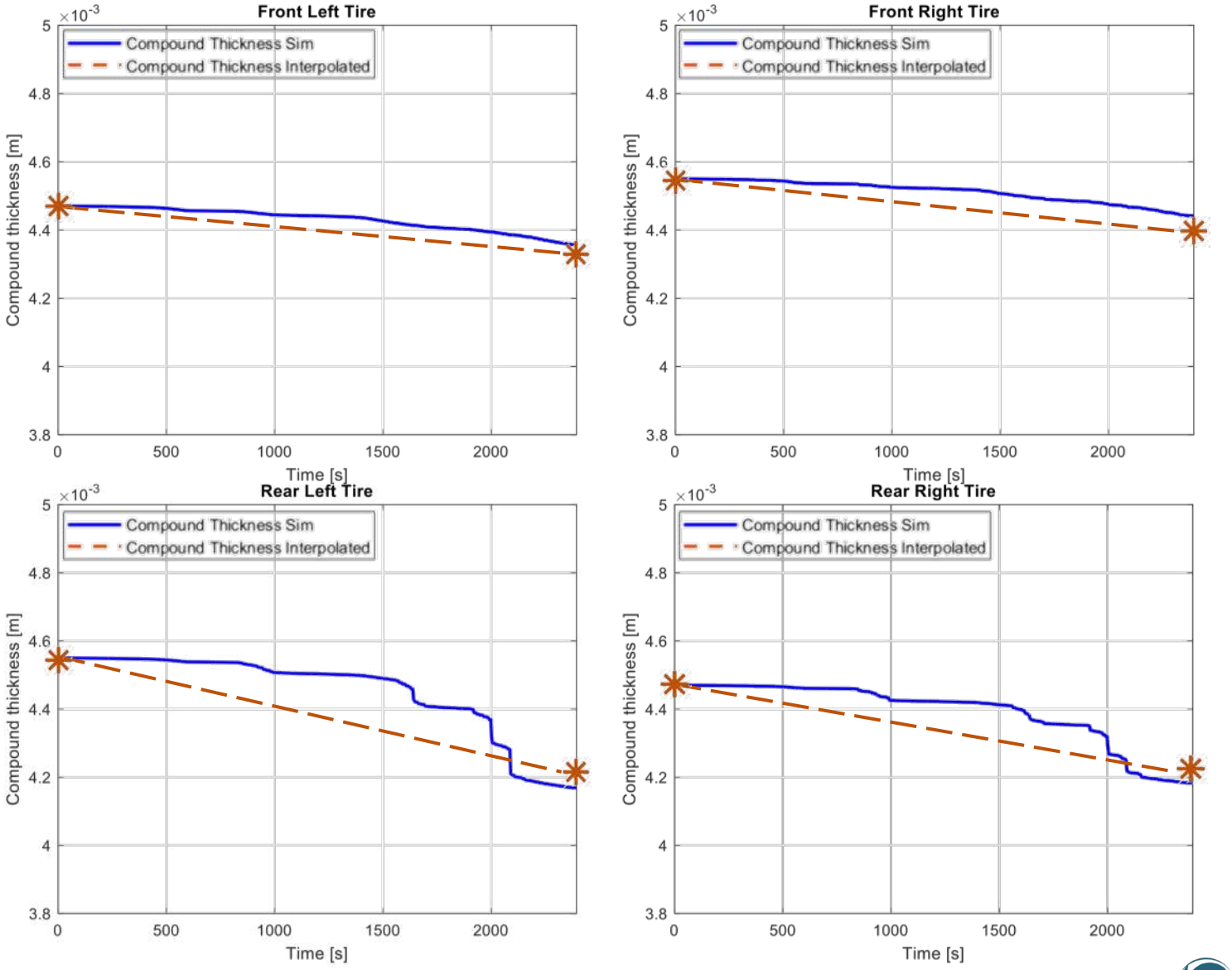
Telemetry data
Kinematic and dynamic data (generalized force and sliding velocity), coupled with the thermal dynamics (temperature gradient across the compound thickness)

OUTPUT ANALYSIS

The results from the models are validated by means of data acquired with proper instrumentation.

Average acquired values ✱

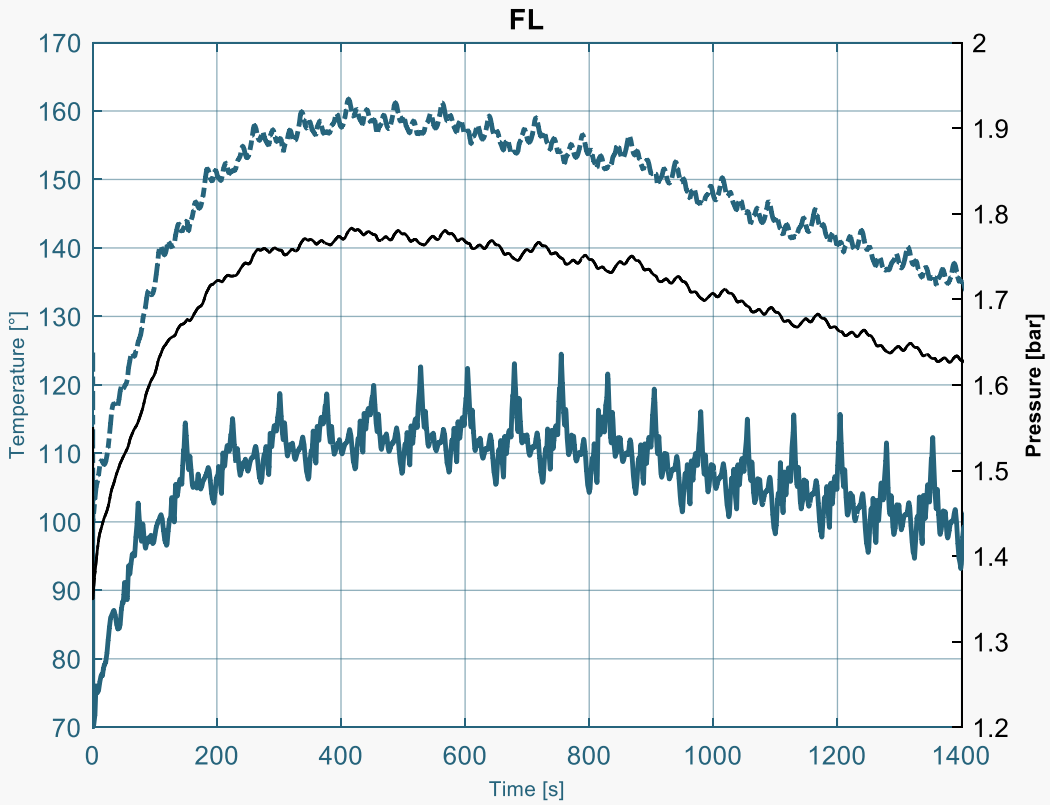
The results provided by the weaRIDE model are of crucial importance to carry out advanced performance analysis to evaluate the impact of compound thickness decrease on tire thermodynamics and dynamics.



OUTPUT ANALYSIS

thermoRIDE and weaRIDE cosimulation

- **impact of tread depth variation on tire thermodynamics**



- **for further info:**

F. Farroni, A. Sakhnevych, F. Timpone
Physical modelling of tire wear for the analysis of the influence of thermal and frictional effects on vehicle performance
Proceedings of the Institution of Mechanical Engineers, Journal of Materials: Design and Applications, n.1-2, pages 151-161 (2017)

MEGARIDE
APPLIED VEHICLE RESEARCH

OVERVIEW

powered by
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

2 PERFORMANCE + 1 PARAMETERIZATION TOOLS

T.R.I.C.K.
from vehicle onboard sensors to tire data

RIDElab
multiphysical tire data analysis and MF-ID

RIDEtool
structural, thermal and viscoelastic parameterization

4 PHYSICAL MODELS (RIDEsuite)

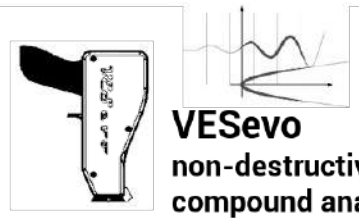
adheRIDE
advanced MF

weaRIDE
tire wear model

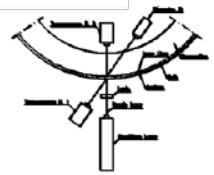
thermoRIDE
tire thermal model

threedeeRIDE
multicontact model

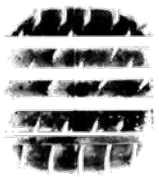
1 INNOVATIVE DEVICE + TESTBENCHES



VESevo
non-destructive tread compound analyzer



thermobench
tire thermal analysis



footprints-ID
shape & contact pressure

What if your tire model had sensitivity with temperature, wear, pressure and tread viscoelasticity?

adheRIDE

adheRIDE, the dynamic module of RIDEsuite, represents an advanced Pacejka-based interaction model, whose parameters are no more static or fixed, but evolving throughout the entire run, depending in real-time on multiphysical fundamental effects.

GLOBAL AIM

Vertical Load

Slip Angle

Slip Ratio

Wheel Speed

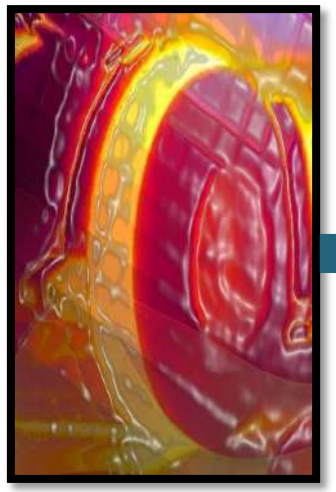
InclinationAngle

Temperature

Pressure

Wear

MULTIPHYSICAL MODEL



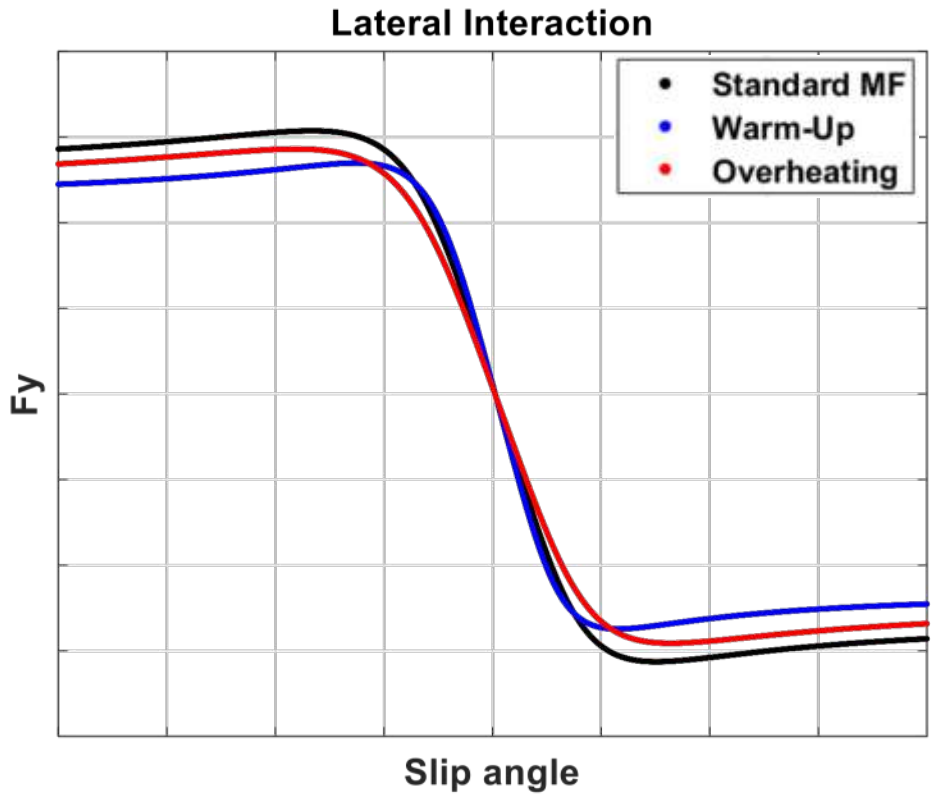
Fx

Fy

Mx

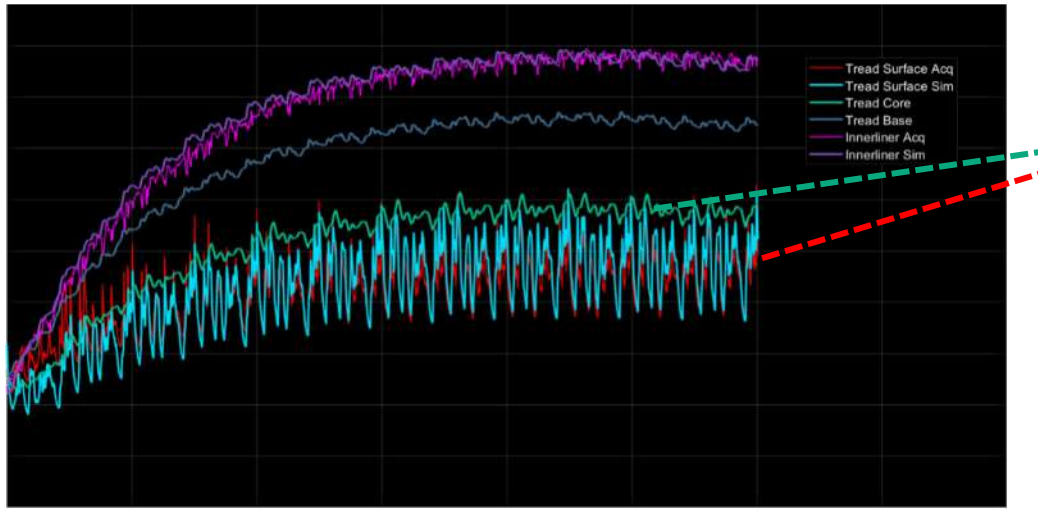
My

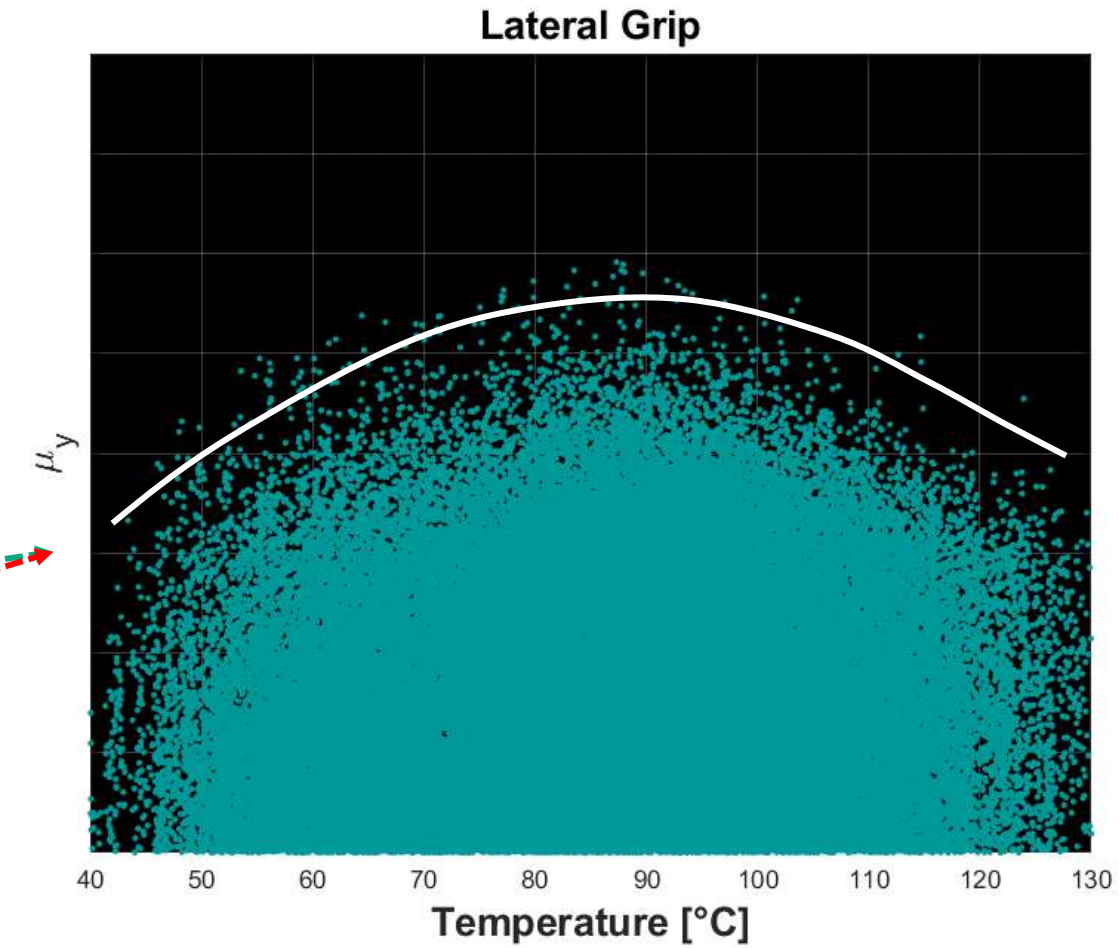
Mz



PHYSICAL MODELING

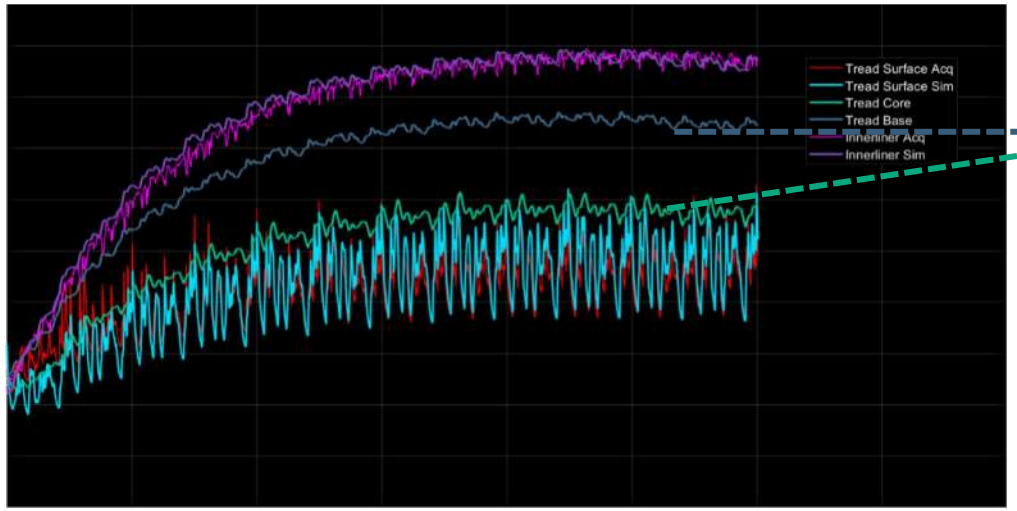
- **grip variation**
  - **bell-shaped curve**

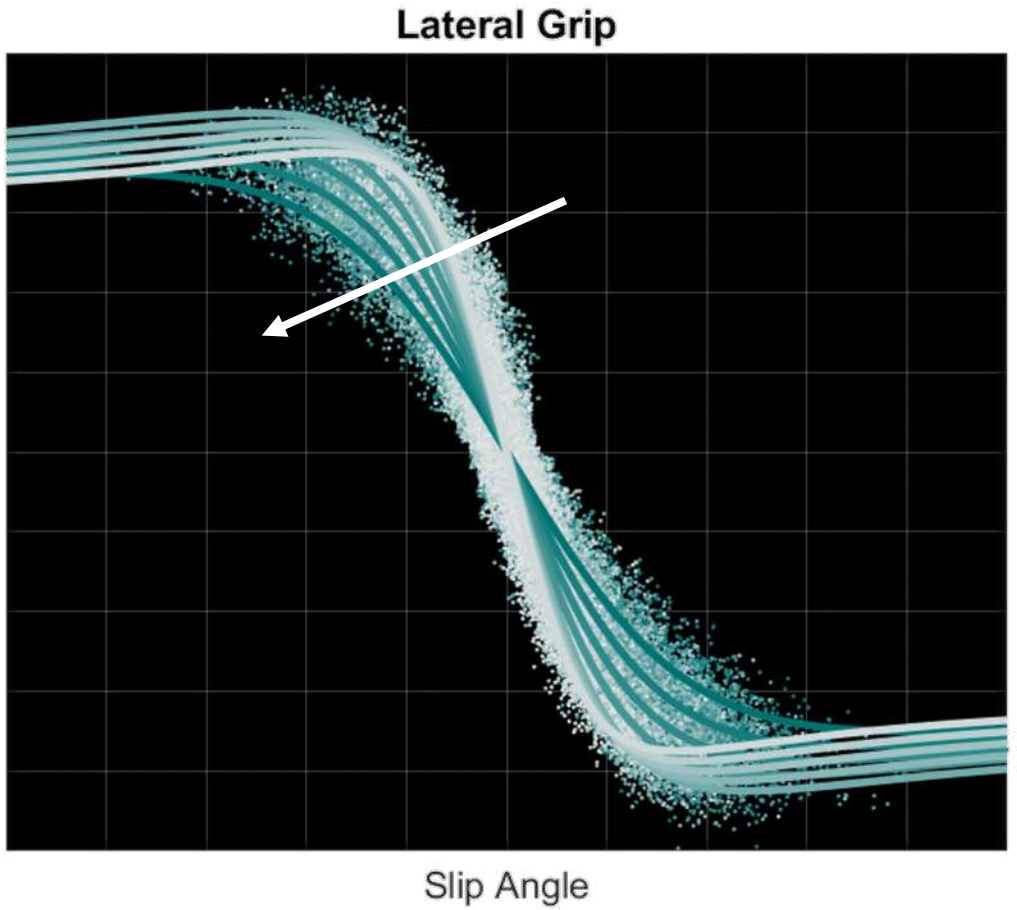




PHYSICAL MODELING

- **stiffness variation**
  - **stiffness decreases towards temperature**

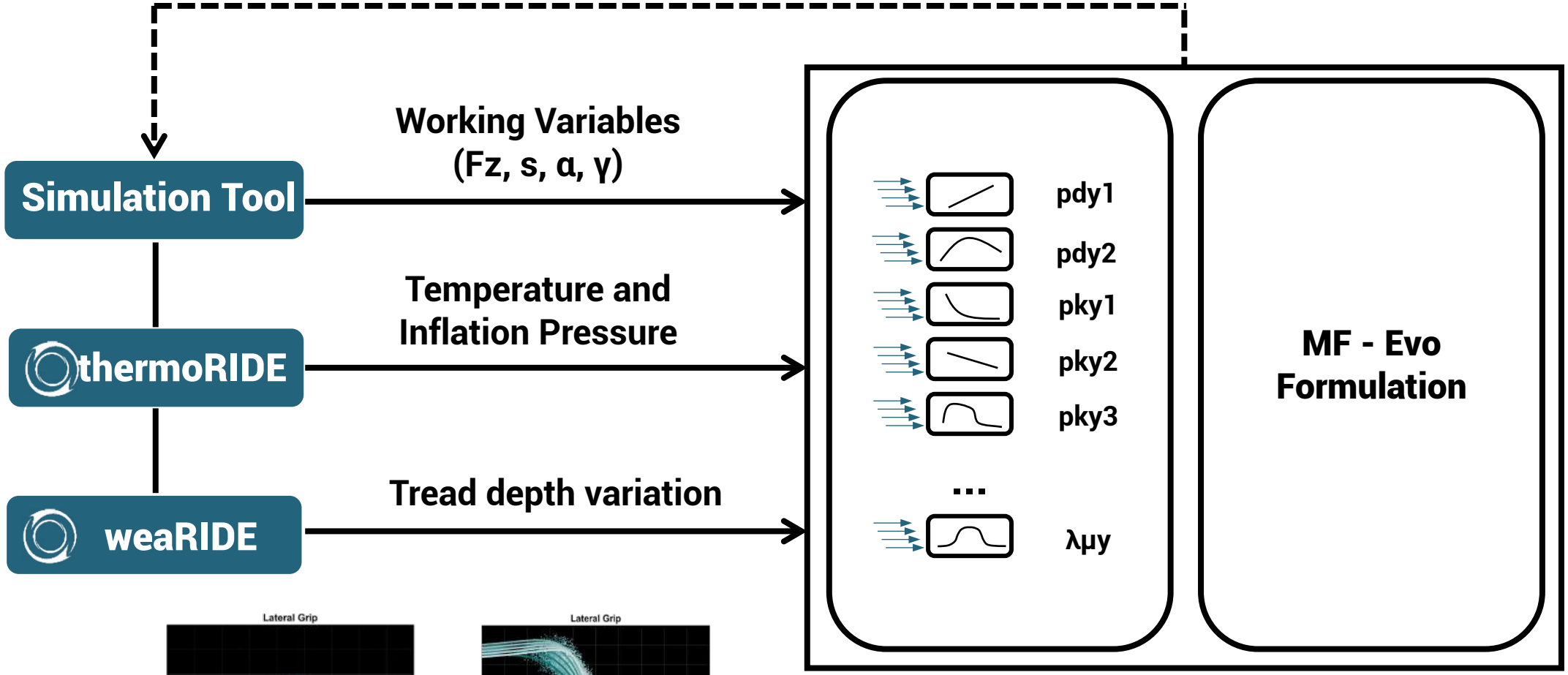


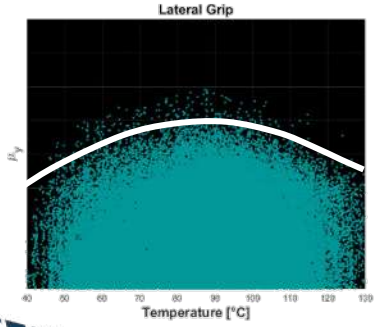


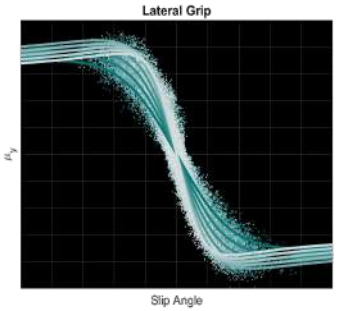
- **for further info:**

F. Farroni, A. Sakhnevych, A. Sammartino, F. Timpone
Multiphysics model for tire performance optimization
Tire Technology International (2020)

PHYSICAL MODELING





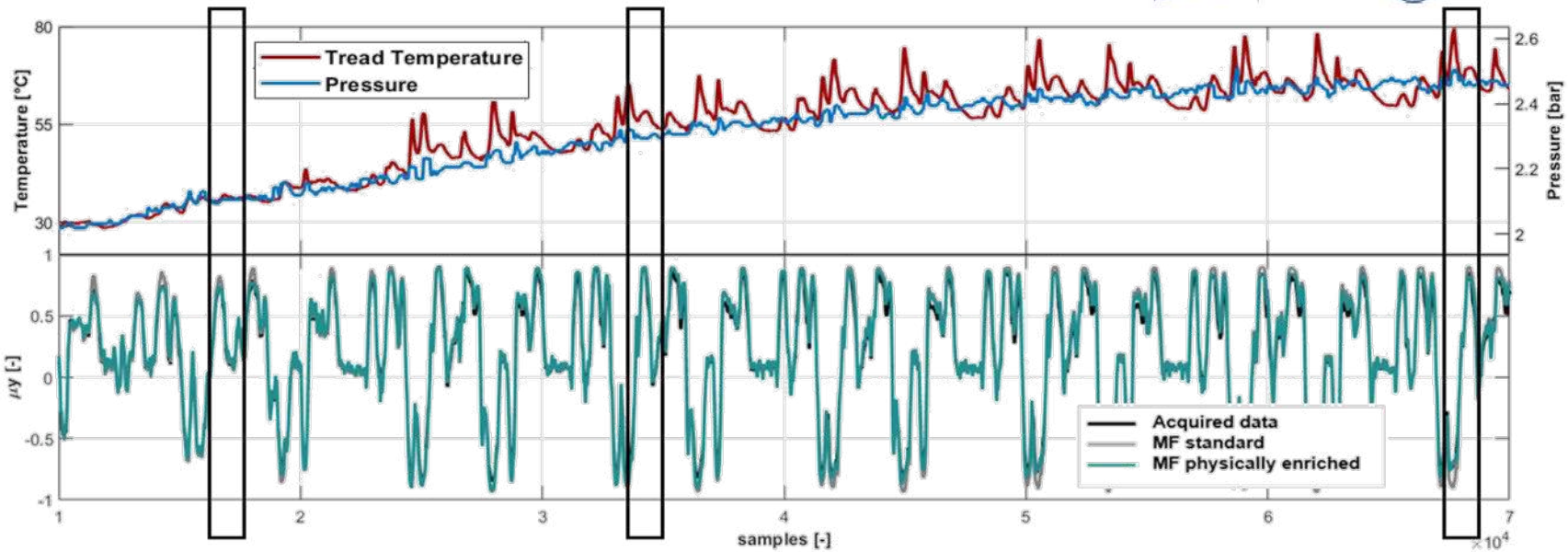


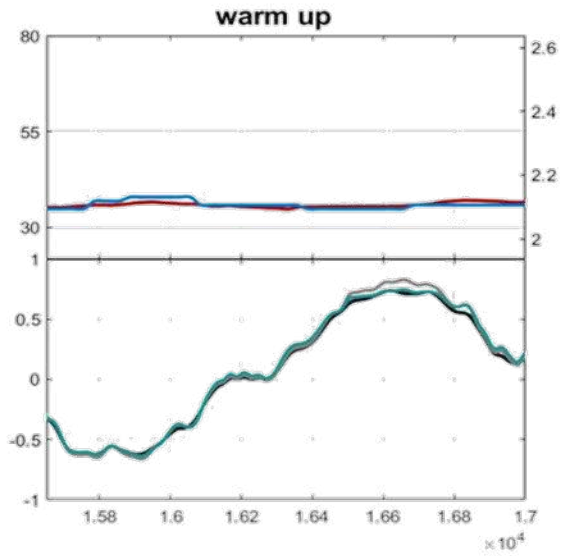
- for further info:

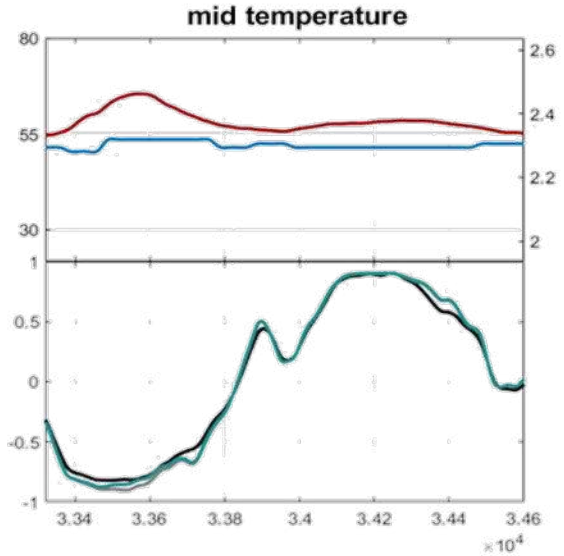
D.Capra, F. Farroni, A. Sakhnevych, G. Salvato, A. Sorrentino, F. Timpone
On The Implementation of an Innovative Temperature-Sensitive Version of Pacejka's MF in Vehicle Dynamics Simulations
Conference of the Italian Association of Theoretical and Applied Mechanics, 1084-1092 (2019)

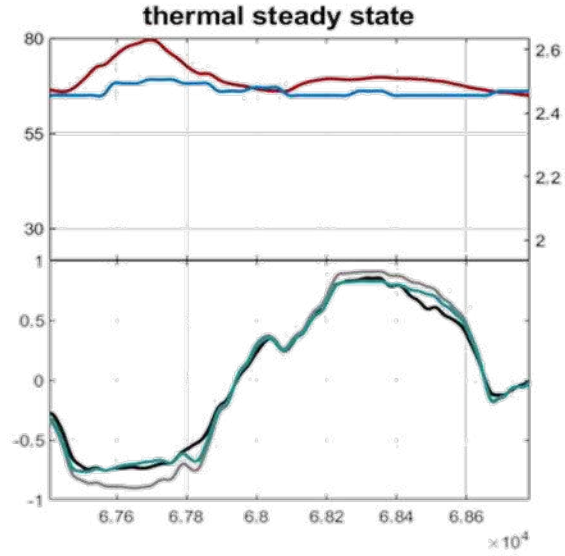
OUTPUT ANALYSIS

- **simulation of forces in the whole tire thermodynamic range (long run case-study)**









MEGARIDE
APPLIED VEHICLE RESEARCH

OVERVIEW

powered by
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

2 PERFORMANCE + 1 PARAMETERIZATION TOOLS

RIDElab
multiphysical tire data analysis and MF-ID

T.R.I.C.K.
from vehicle onboard sensors to tire data

RIDEtool
structural, thermal and viscoelastic parameterization

4 PHYSICAL MODELS (RIDEsuite)

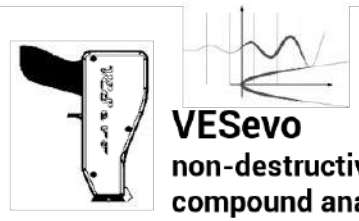
adheRIDE
advanced MF

weaRIDE
tire wear model

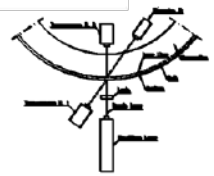
thermoRIDE
tire thermal model

threedeeRIDE
multicontact model

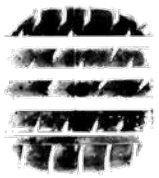
1 INNOVATIVE DEVICE + TESTBENCHES



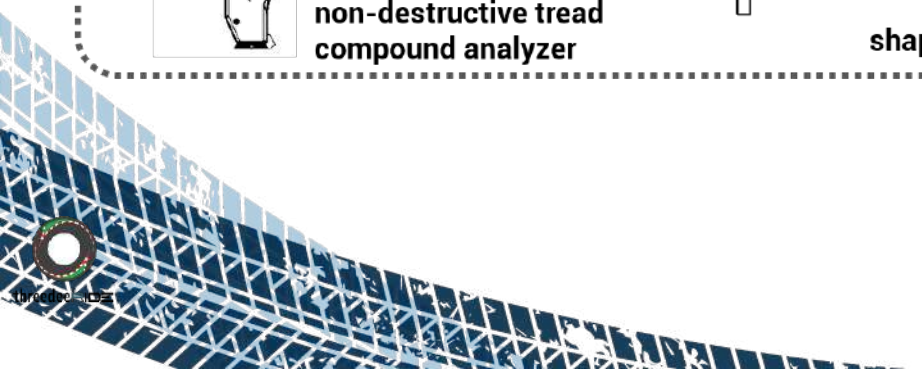
VESevo
non-destructive tread compound analyzer



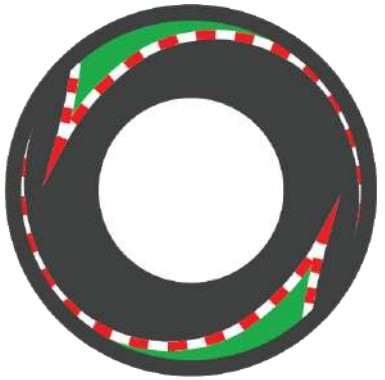
thermobench
tire thermal analysis



footprints-ID
shape & contact pressure



Does your ride model interact with a 3D road mesh, feeling temperature and pressure effects?



threedeeRIDE

threedeeRIDE is conceived with the aim to overcome the typical issue of single contact tire models. Such solution provides the extension of the model frequency range and information on the real loads to the suspension.

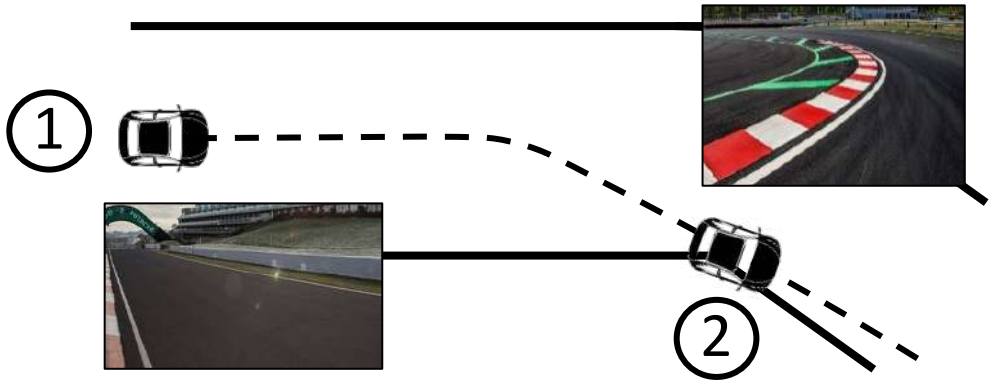
threedeeRIDE

OUTPUT ANALYSIS

A specific maneuver in a dynamic simulation has been designed to simulate a vehicle which:

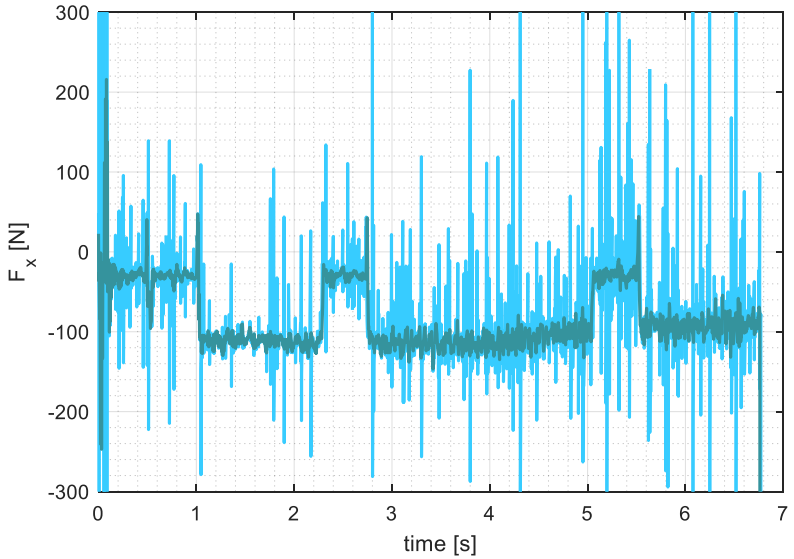
- **travels on road unevennesses**
- **impacts on a kerb**

A comparison between the default noisy single point model and threedeeRIDE is presented.

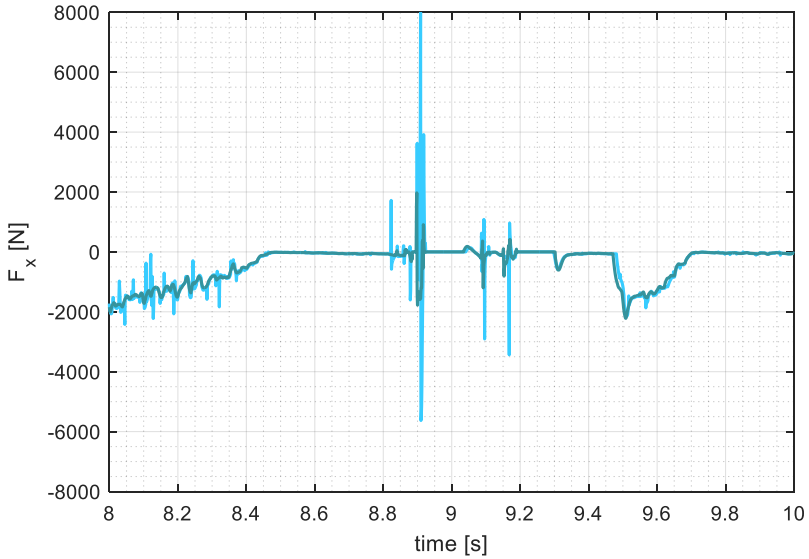


1 Uneven road

MF threedeeRIDE

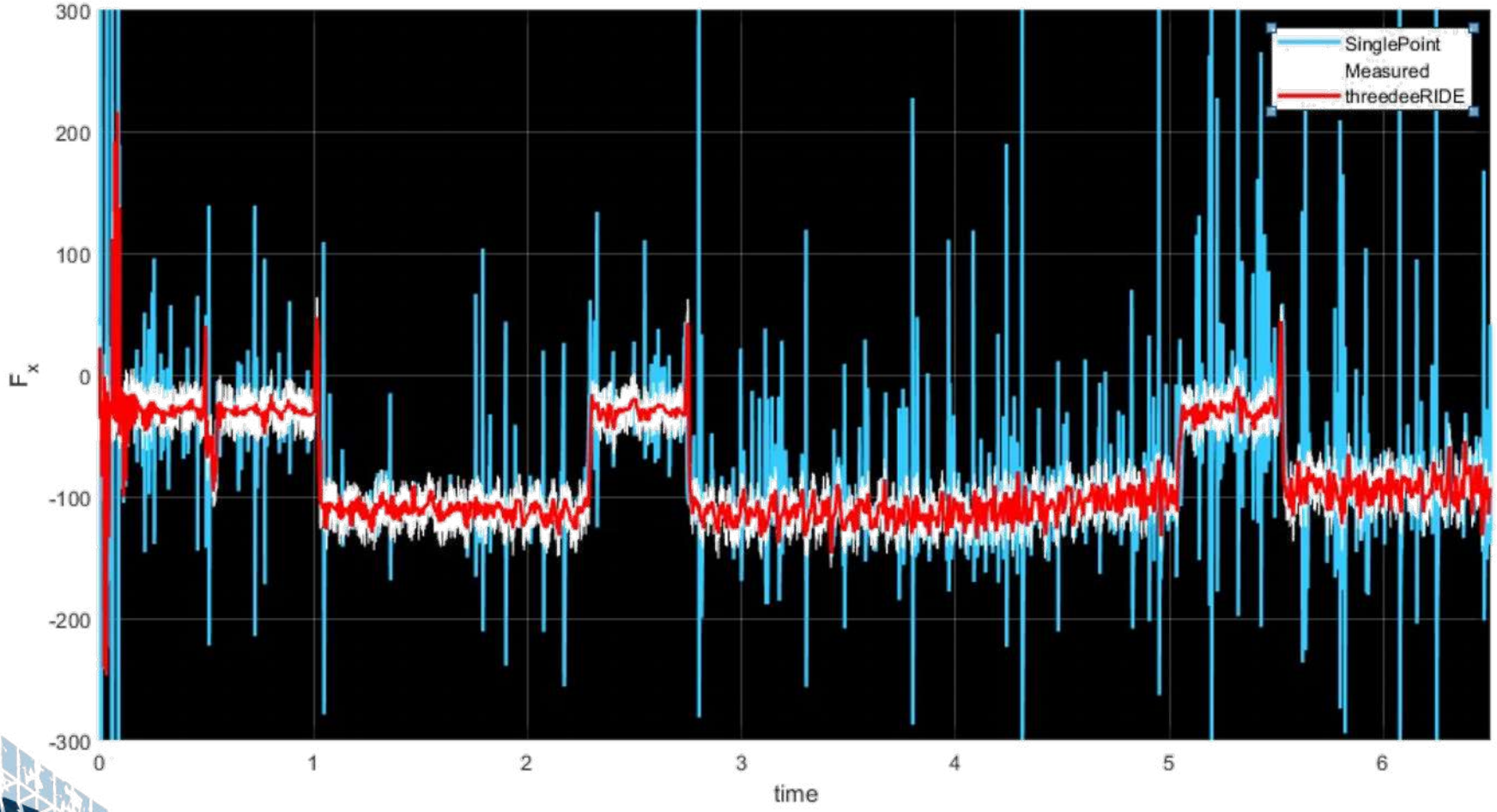


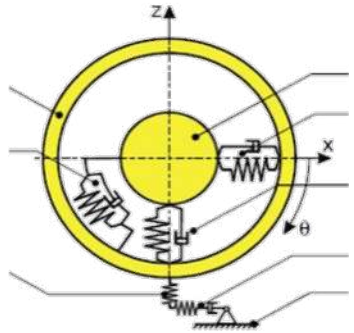
2 Kerb impact



OUTPUT ANALYSIS

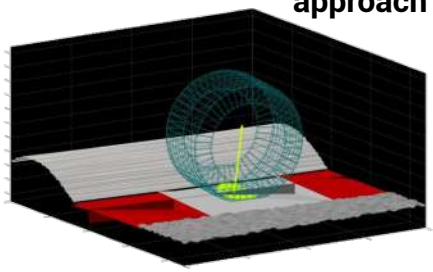
Another example of validation towards on track acquisition.





conventional single-point contact

multi-contact threedeeRIDE approach

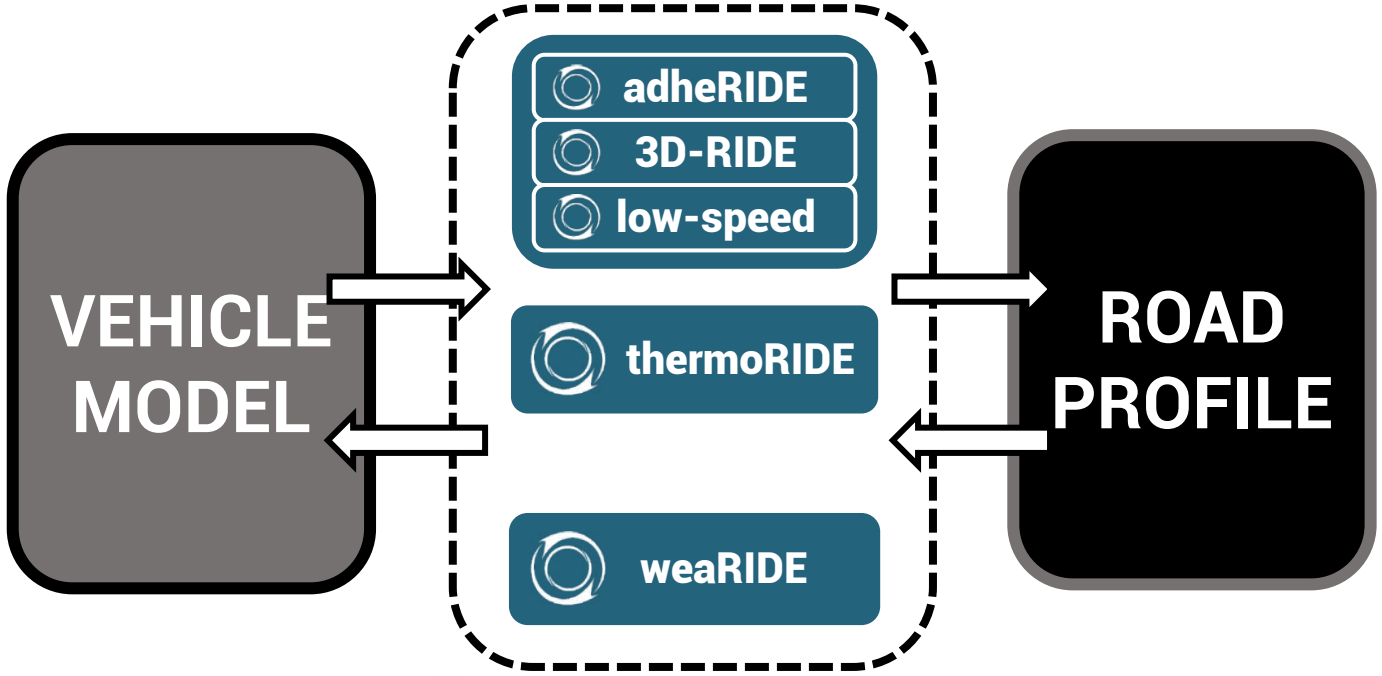


MEGARIDE
APPLIED VEHICLE RESEARCH

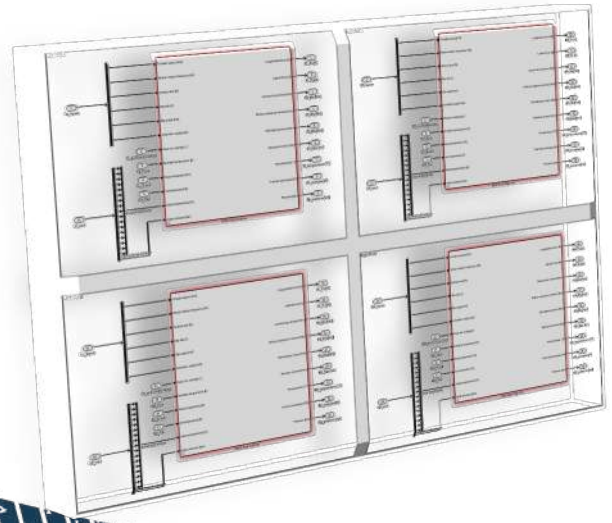
powered by

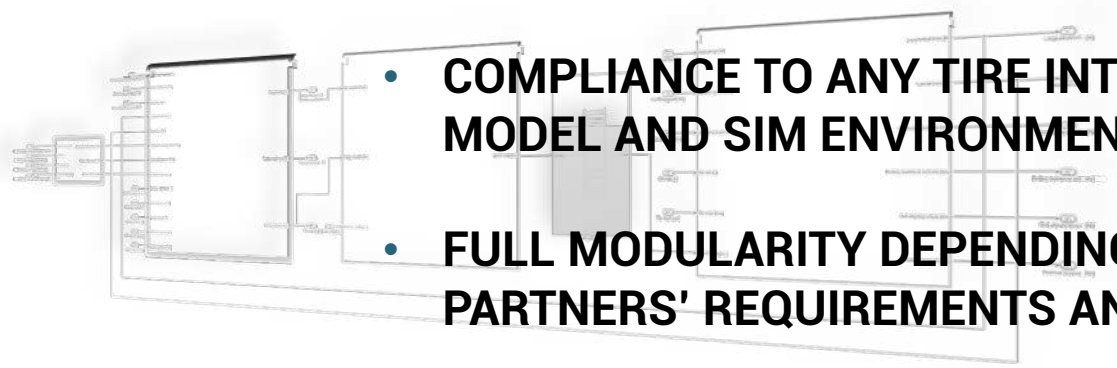
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

OVERVIEW



RIDEsuite





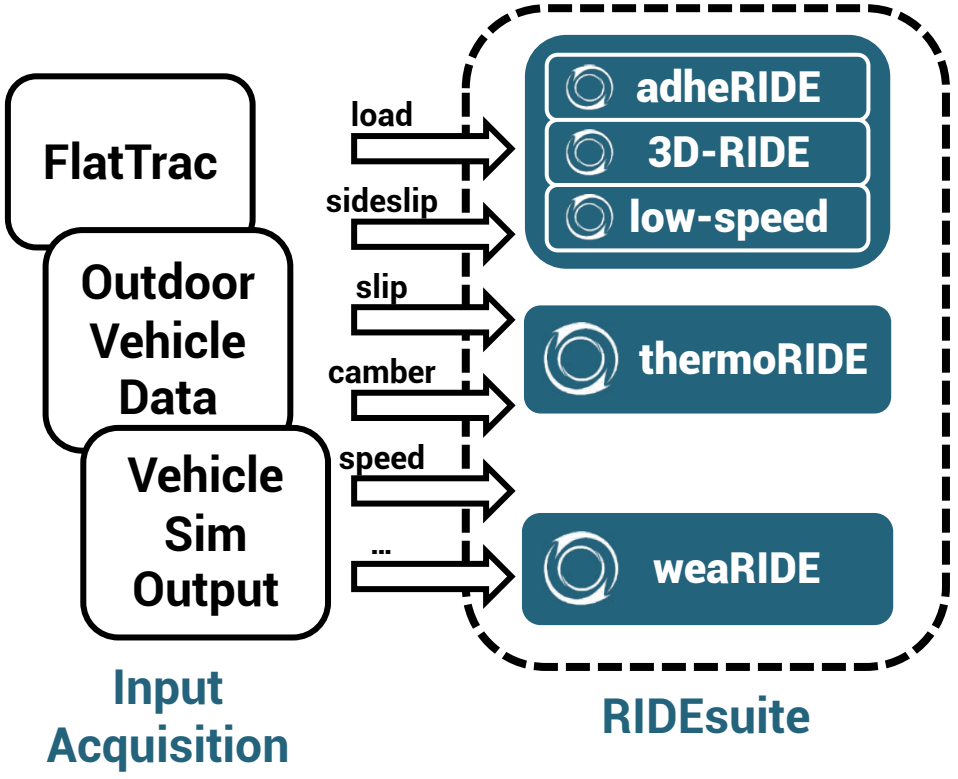
- COMPLIANCE TO ANY TIRE INTERACTION MODEL AND SIM ENVIRONMENT
- FULL MODULARITY DEPENDING ON PARTNERS' REQUIREMENTS AND NEEDS

MEGARIDE
APPLIED VEHICLE RESEARCH

powered by

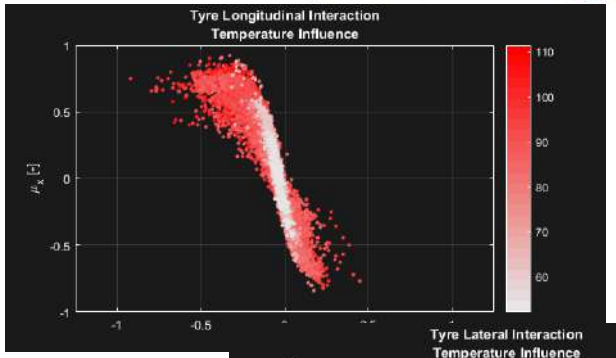
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

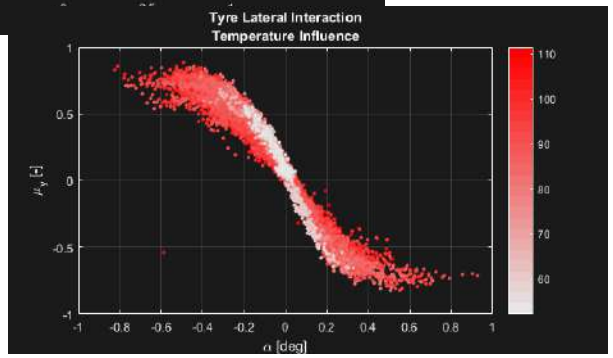
STAND-ALONE



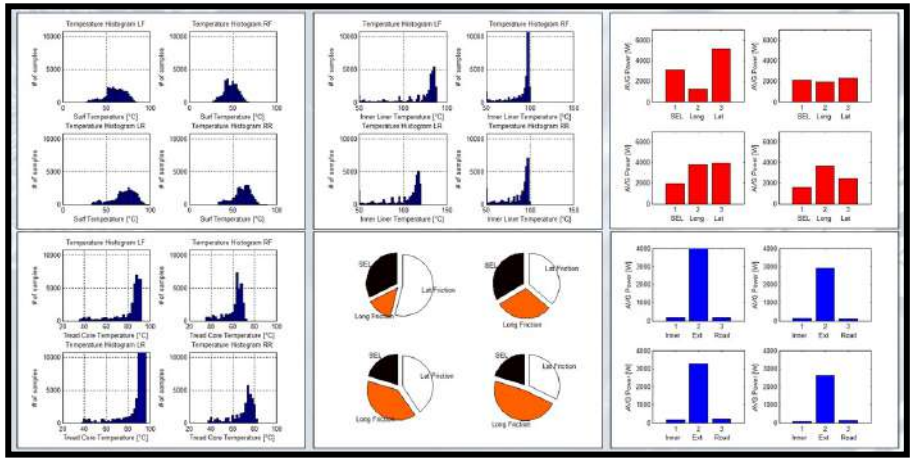
Input Acquisition

RIDEsuite





WARM-UP / HEAT EXCHANGE / THERMODYNAMIC OPTIMIZATION ANALYSIS



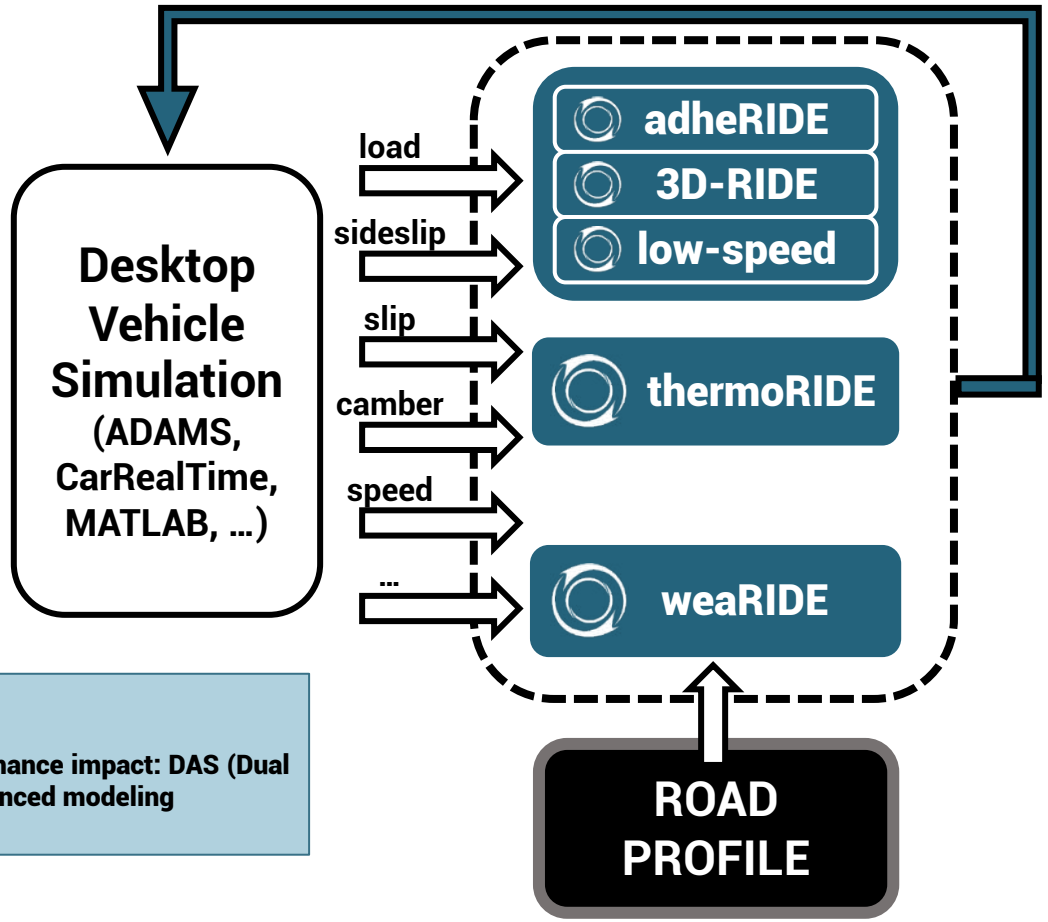
ANALYSIS ON TIRE DEPENDENCIES FROM INNER TEMPERATURE / WEAR / ROAD ROUGHNESS / TREAD VISCOELASTICITY

MEGARIDE
APPLIED VEHICLE RESEARCH

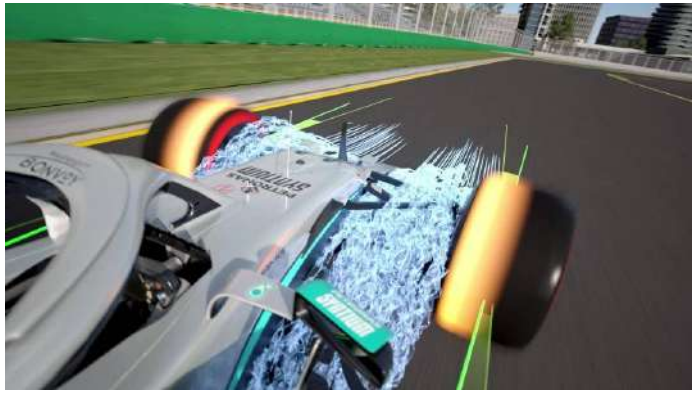
powered by

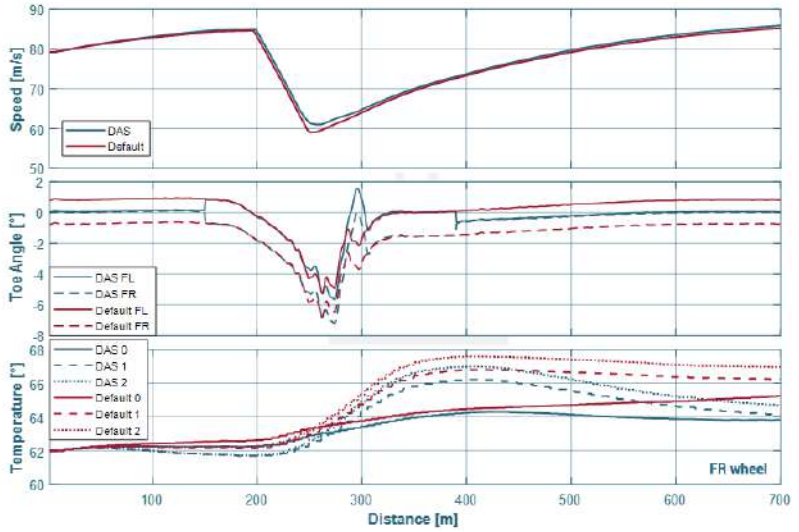
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

"OFFLINE" SIMULATIONS



CASE STUDY:
MERCEDES' DAS 2020





* for further info:
G. Tranquillo, A. Sorrentino, V. Van
From mechanical system to tire performance impact: DAS (Dual Axis Steering) explained thanks to advanced modeling
White paper (2020)

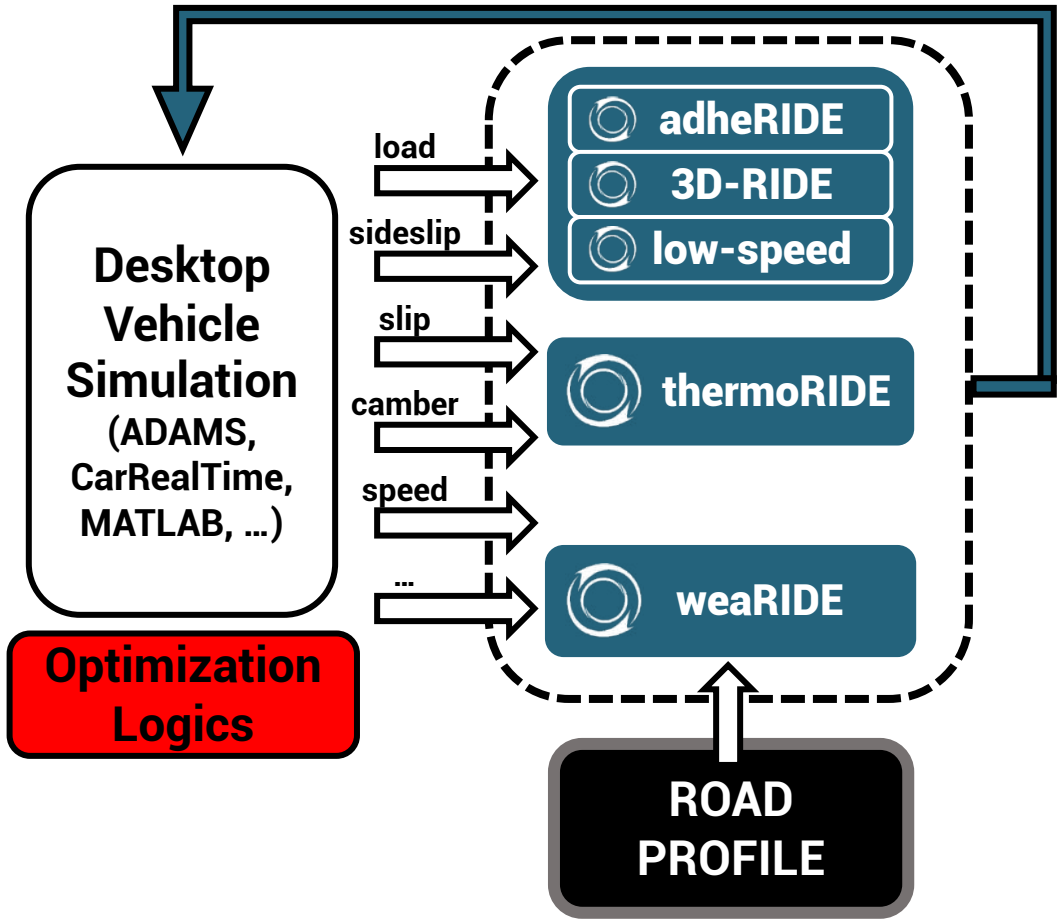
- DYNAMIC SIMULATIONS FOR CAR / BIKE / TRUCK
- TIRES IN THE SIMULATION LOOP ACCOUNTING FOR THERMAL / WEAR / ROAD MESH / SPEED PHENOMENA

MEGARIDE
APPLIED VEHICLE RESEARCH

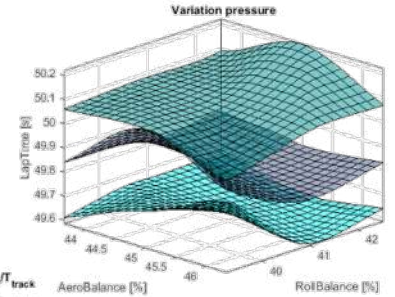
powered by

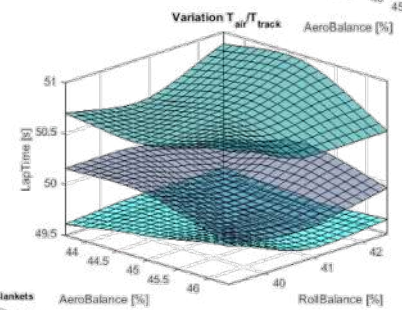
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

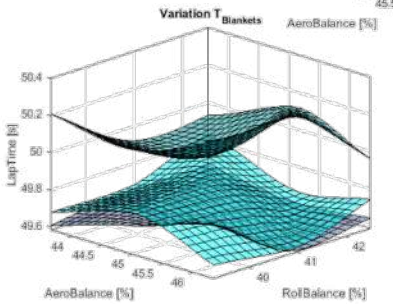
LAP-TIME OPTIMIZATION



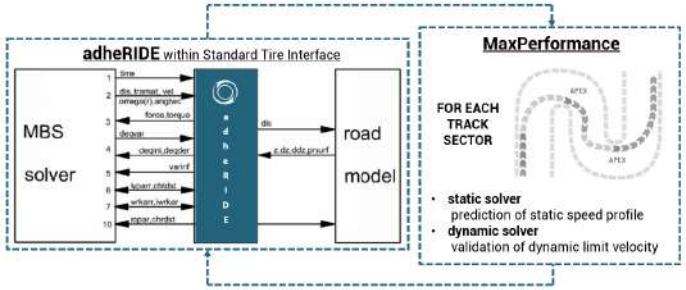
Forces
Moments
Temperatures
Tread Wear
…







- ADVANCED SETUP OPTIMIZATION (INFLATION PRESSURE / BLANKETS TEMPERATURE / …)
- GRIP&STIFFNESS VARIATIONS WITH TEMPERATURE IN THE ITERATIVE OPTIMIZATION ALGORITHMS

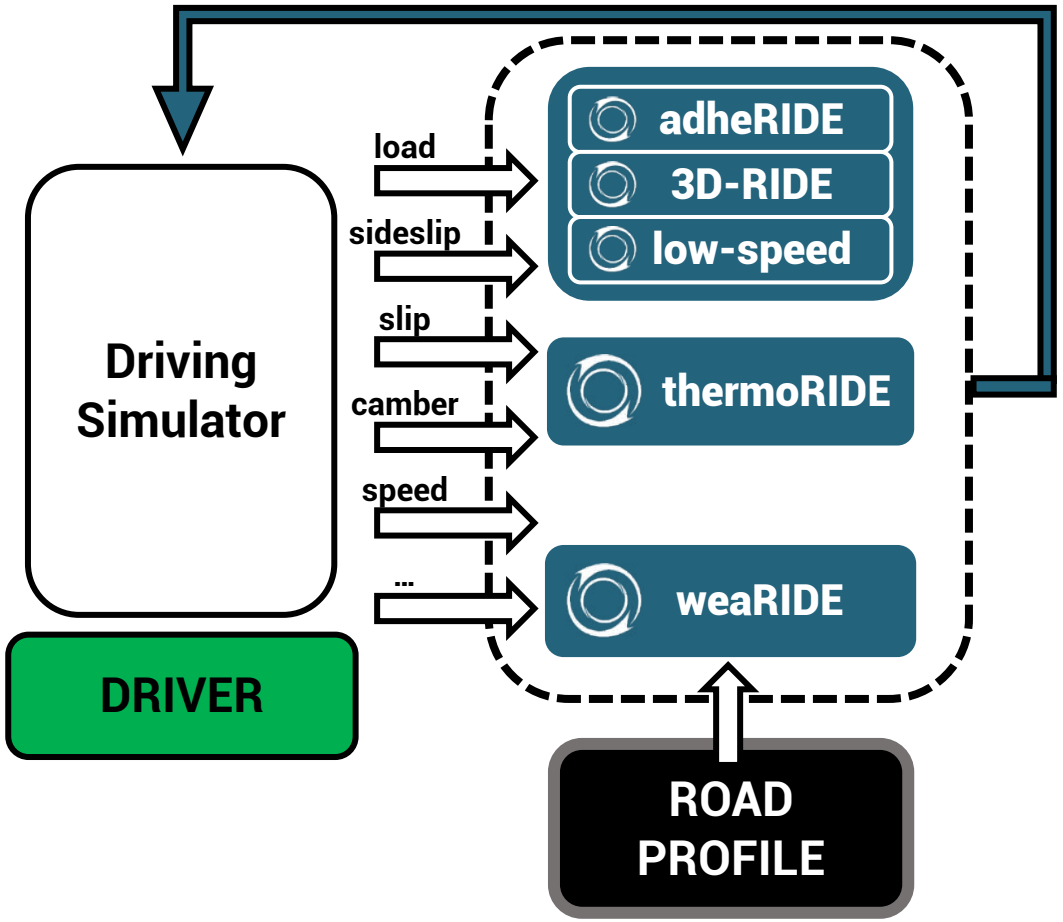


MEGARIDE
APPLIED VEHICLE RESEARCH

powered by

DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

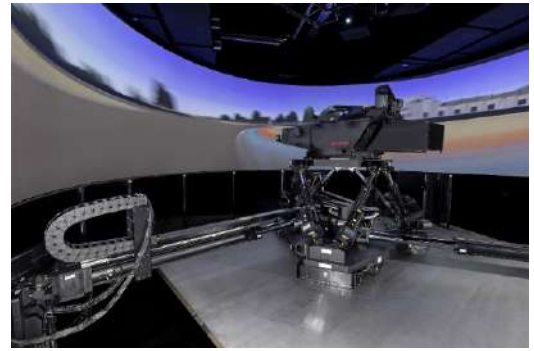
REAL-TIME PLATFORMS



- PHYSICAL MODELS OPTIMIZED FOR REAL-TIME
- ENHANCED FEELINGS FOR SUBJECTIVE ANALYSIS
- MULTICONTACT AND "LOW SPEED" RIDE MODELS

some of the RT users adopting RIDEsuite…

LUXURY AND RACING CAR MANUFACTURERS



MOTORSPORT TEAMS

PASSENGER AND GT VEHICLE MANUFACTURERS

MEGARIDE
APPLIED VEHICLE RESEARCH

OVERVIEW

powered by
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

2 PERFORMANCE + 1 PARAMETERIZATION TOOLS

RIDElab
multiphysical tire data analysis and MF-ID

T.R.I.C.K.
from vehicle onboard sensors to tire data

RIDEtool
structural, thermal and viscoelastic parameterization

4 PHYSICAL MODELS (RIDEsuite)

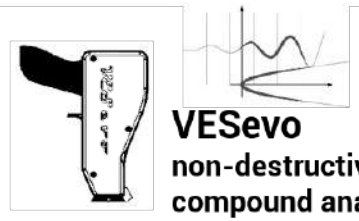
adheRIDE
advanced MF

weaRIDE
tire wear model

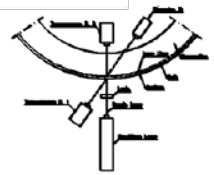
thermoRIDE
tire thermal model

threedeeRIDE
multicontact model

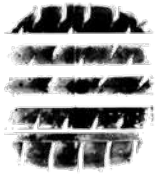
1 INNOVATIVE DEVICE + TESTBENCHES



VESevo
non-destructive tread compound analyzer



thermobench
tire thermal analysis



footprints-ID
shape & contact pressure

Do you need to analyze tire data and reproduce contact multiphysical effects in your models?

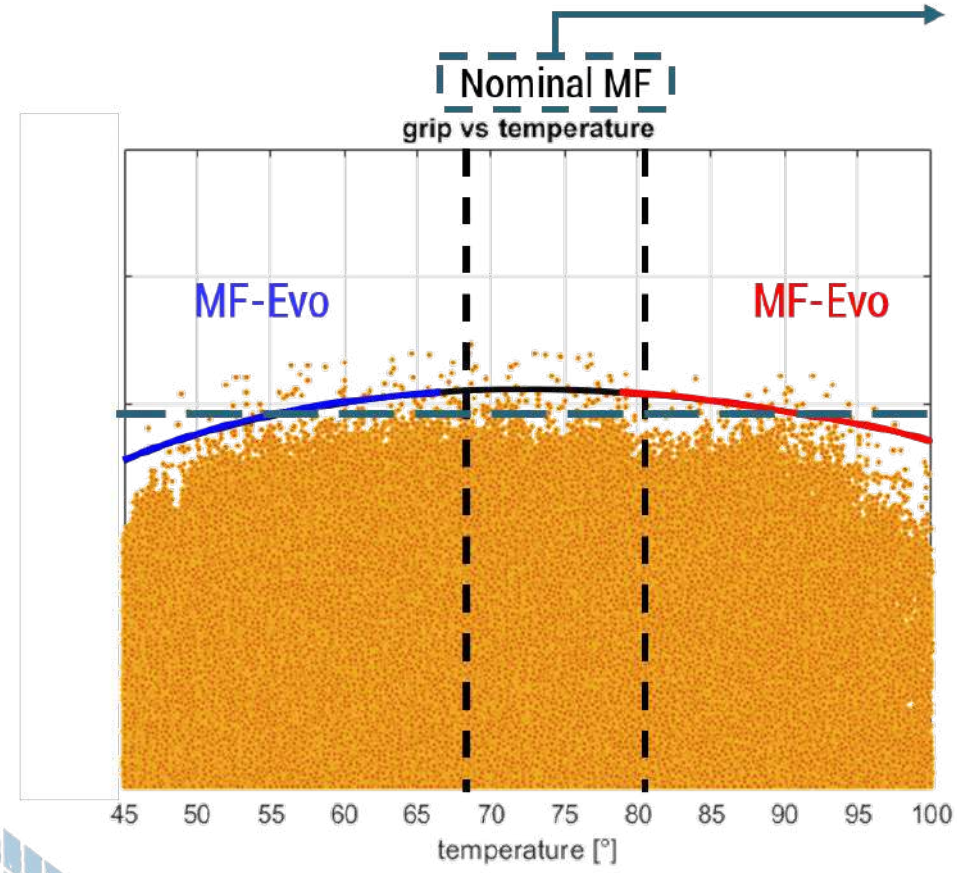
RIDElab

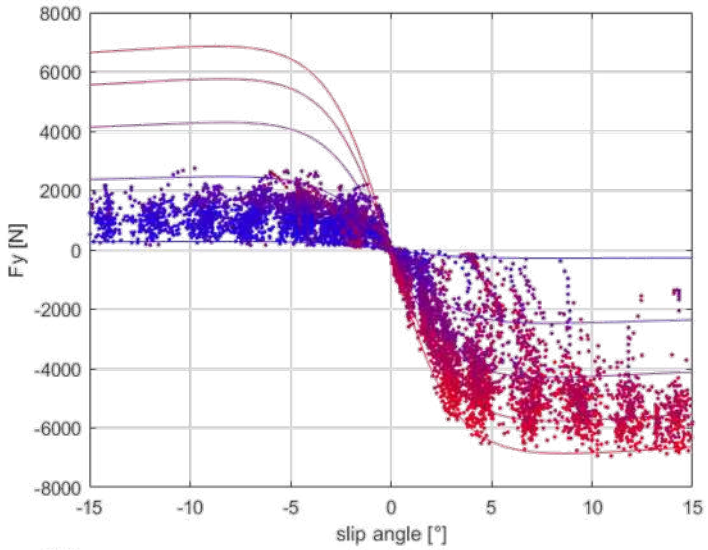
RIDElab is a data analysis and identification platform, designed to fill our and our partners' daily processing needs, to comprehend the dynamic characteristics of the tires and to decouple their physical dependencies.

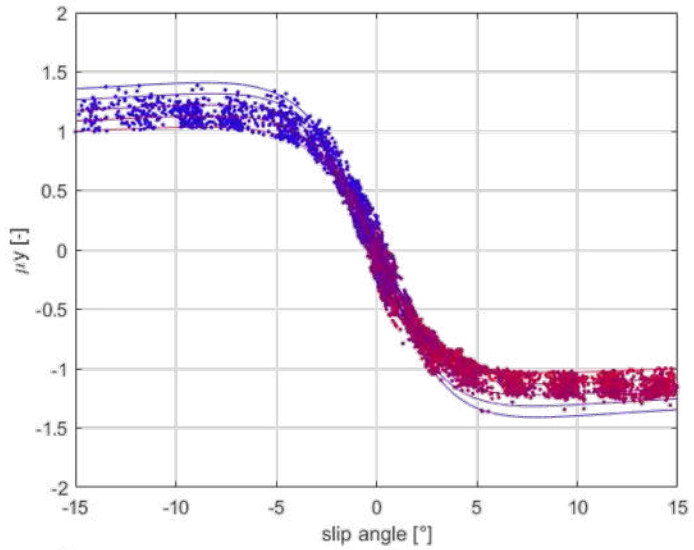
RIDElab

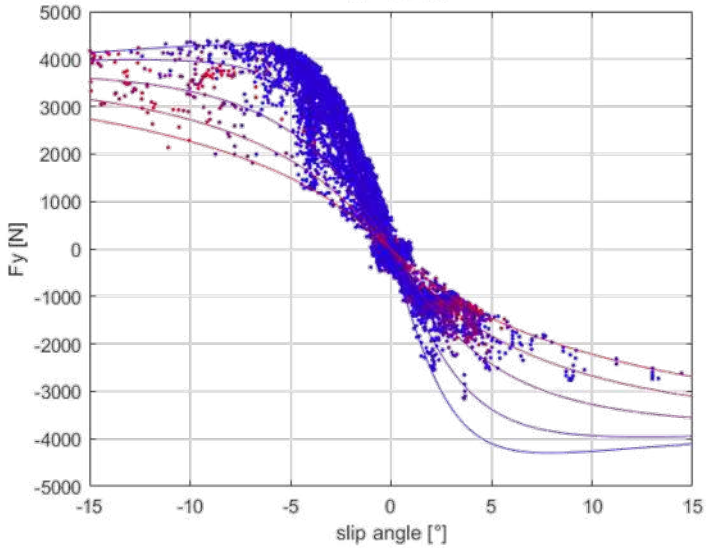
STANDARD MF IDENTIFICATION

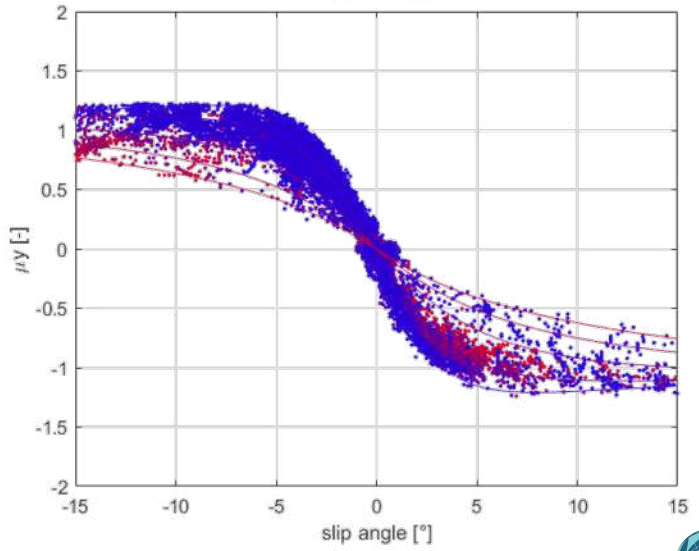
- **identification of the standard MF dependencies in a specific range of temperature, pressure and wear**







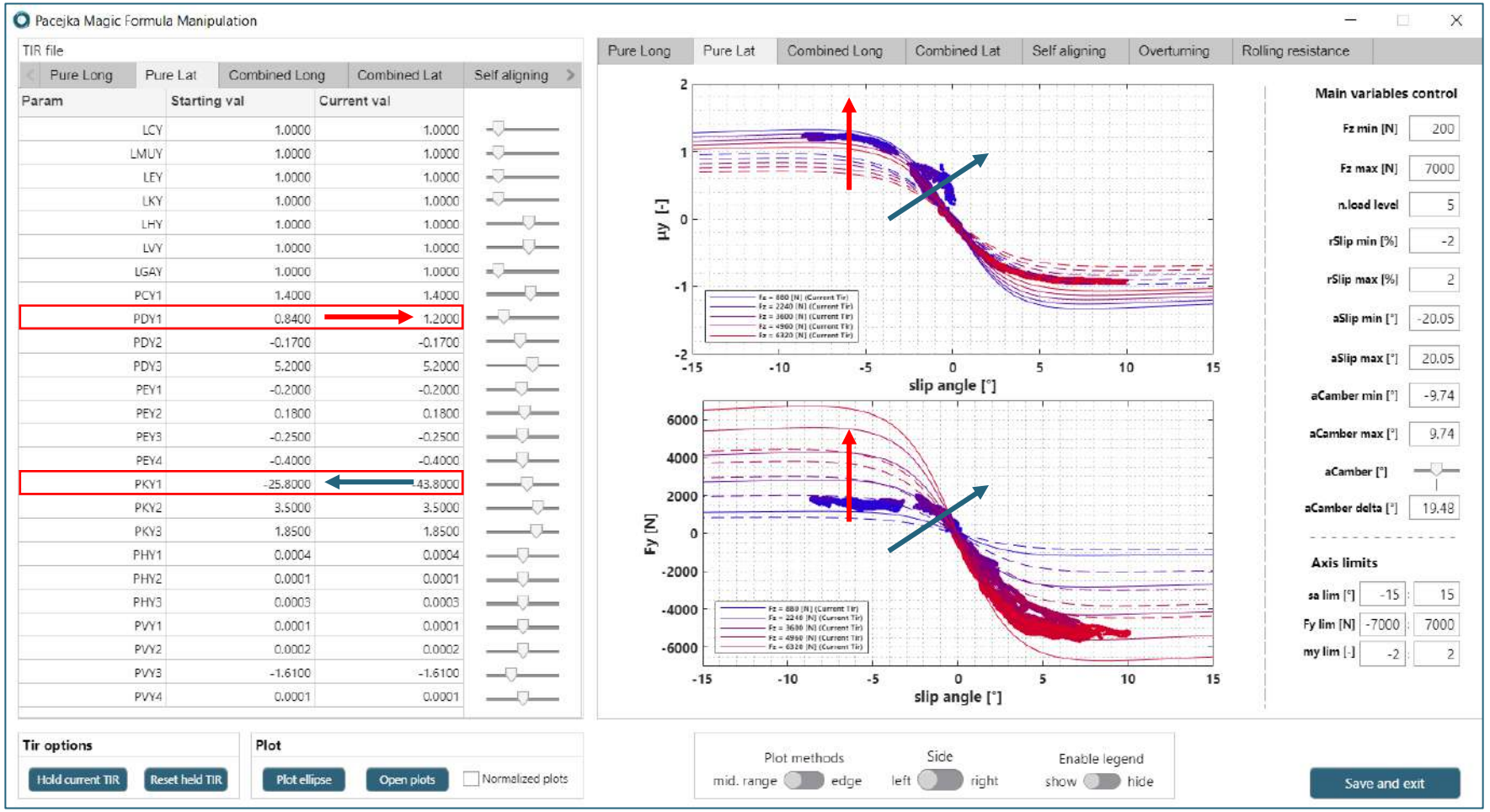




STANDARD MF IDENTIFICATION

- **identification of the standard MF dependencies in a specific range of temperature, pressure and wear**

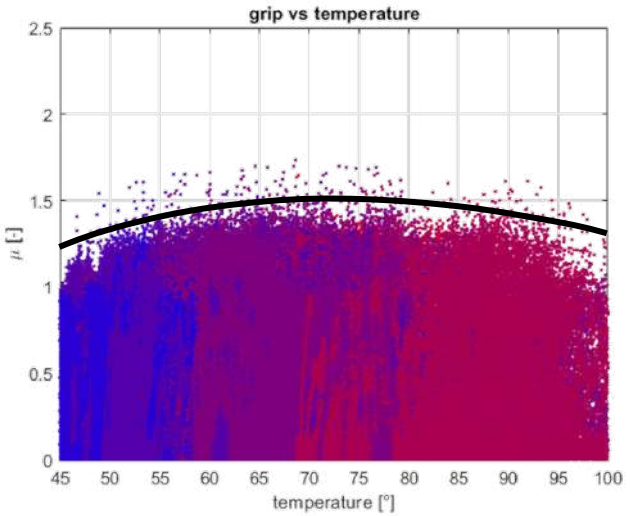
Curves can be modified in interactive way by means of scrolls and smart buttons, analyzing the direct effect of micro-parameters variations, estimating their sensitivity and creating "prototypal" TIR files characterized by desired curve shapes, representing an optimal starting set for the automatic error minimization algorithm responsible for the MF coefficients identification.

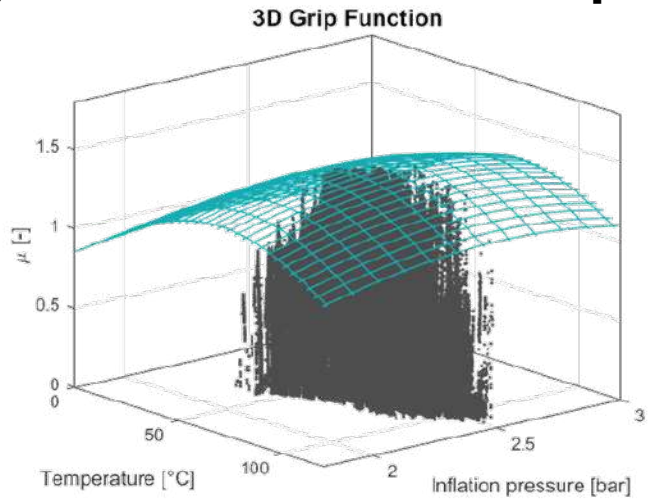


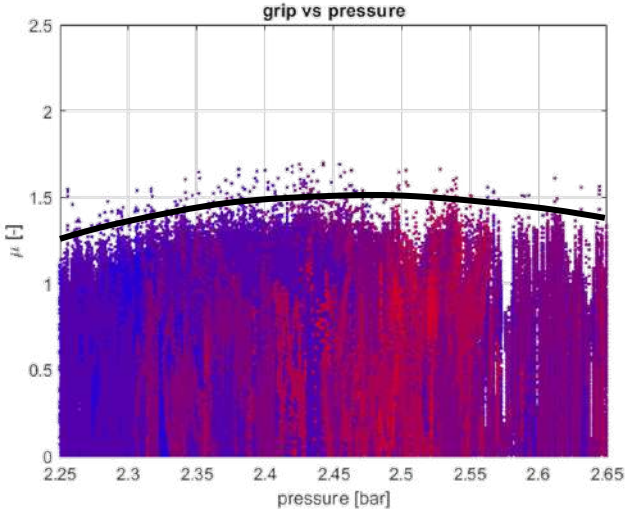
MF-EVO IDENTIFICATION

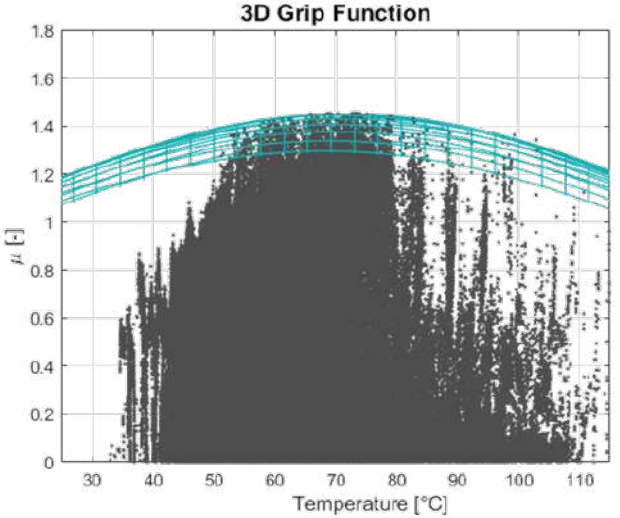
- **calibration of the additional multiphysical analytical formulations, taking into account of the entire pre-processed dataset to also extend the tire model reliability towards thermal and wear phenomena**

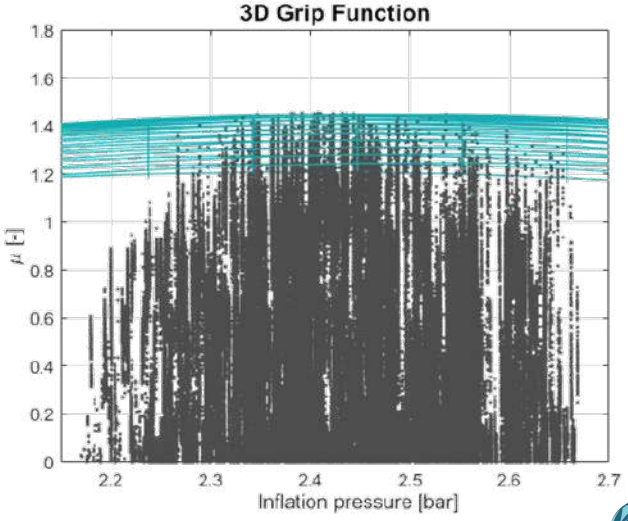
Grip additional dependencies calibration











RESEARCH ACTIVITIES

The 3 mistakes I did testing, analyzing and modelling tire/road grip, and what I learnt from them...

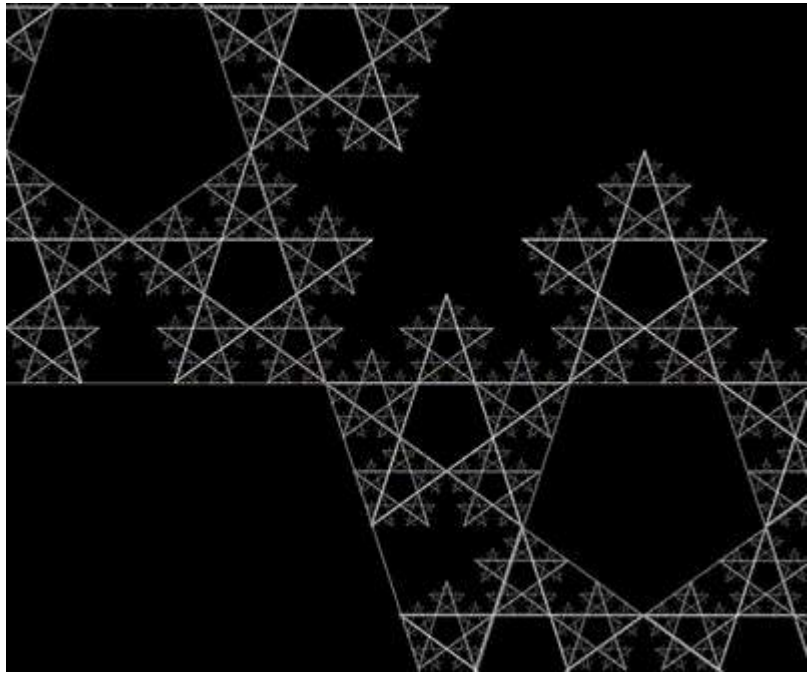
"An expert is a person who has made all the mistakes that can be made, in a very narrow field"

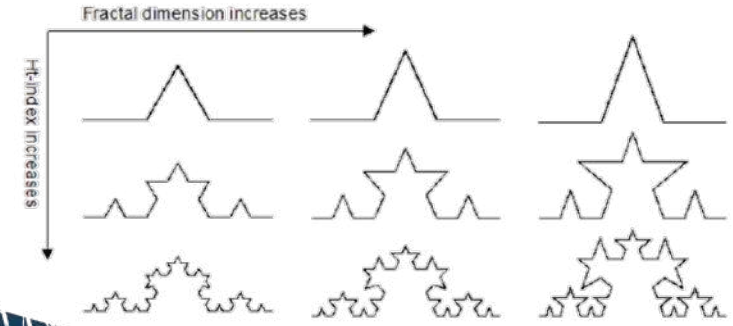
— Niels Bohr

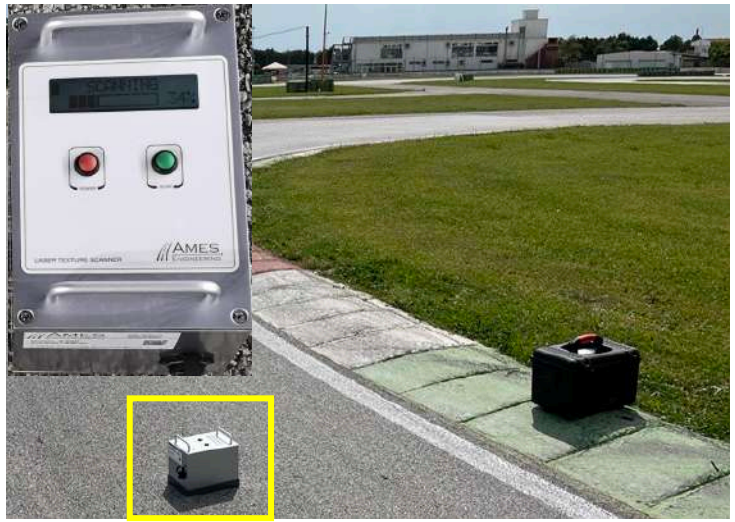
RESEARCH ACTIVITIES

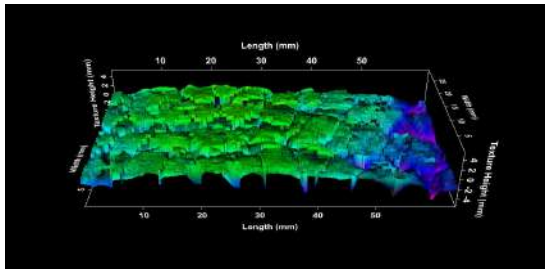
The 3 mistakes I did testing, analyzing and modelling tire/road grip, and what I learnt from them...

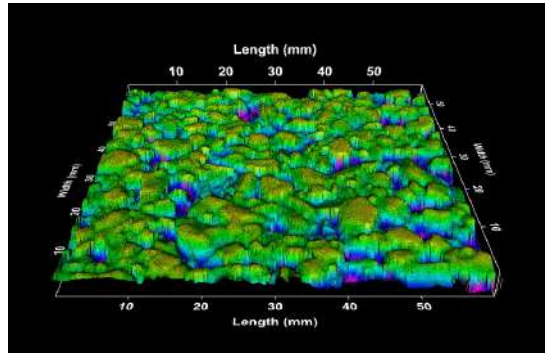
1. Considering the road/track asphalt as fractal

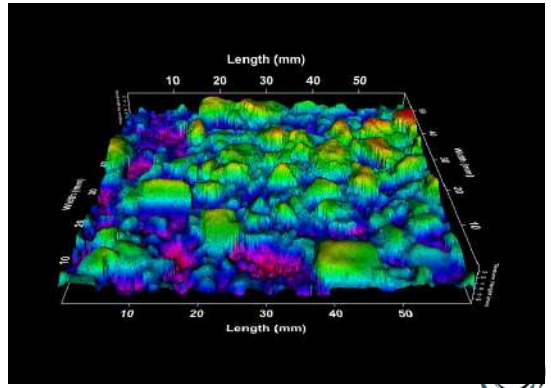








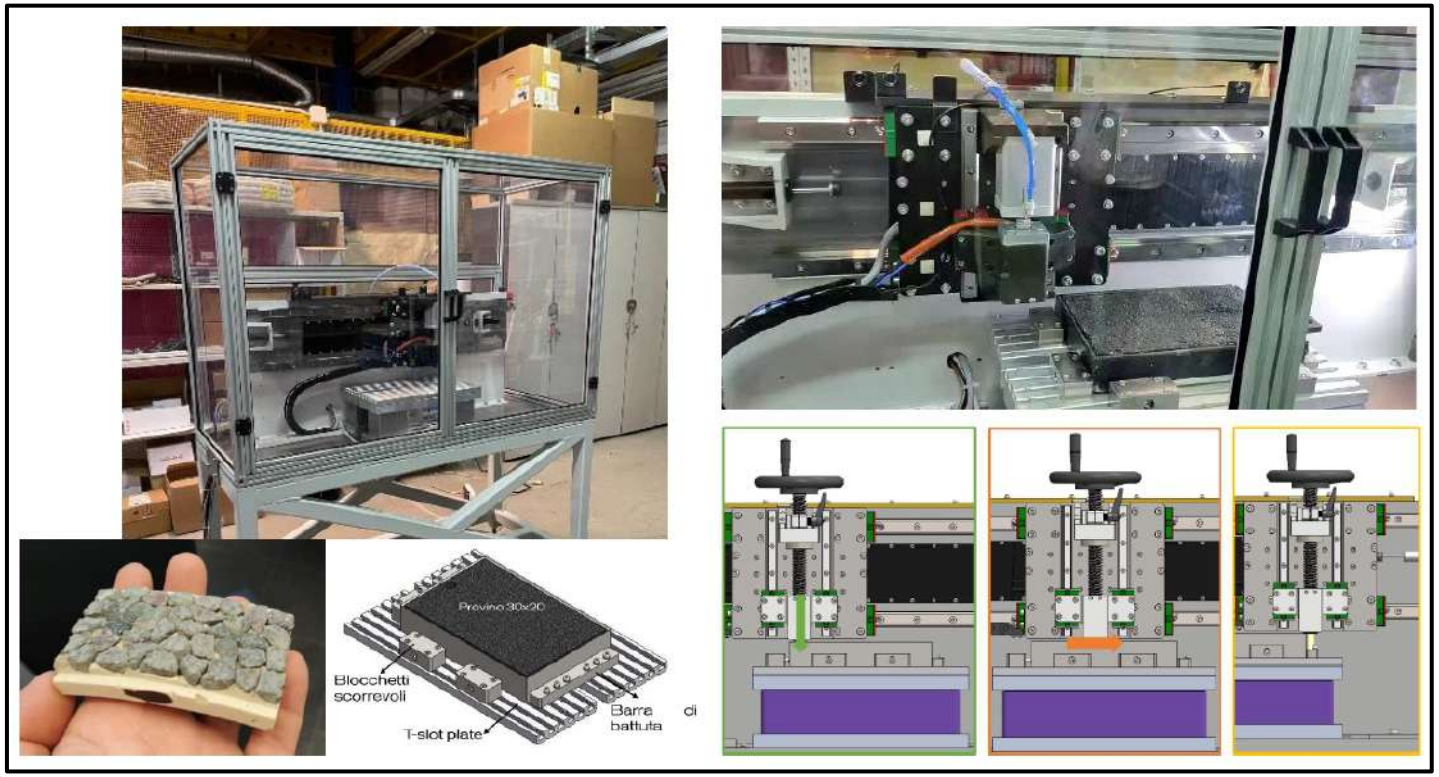




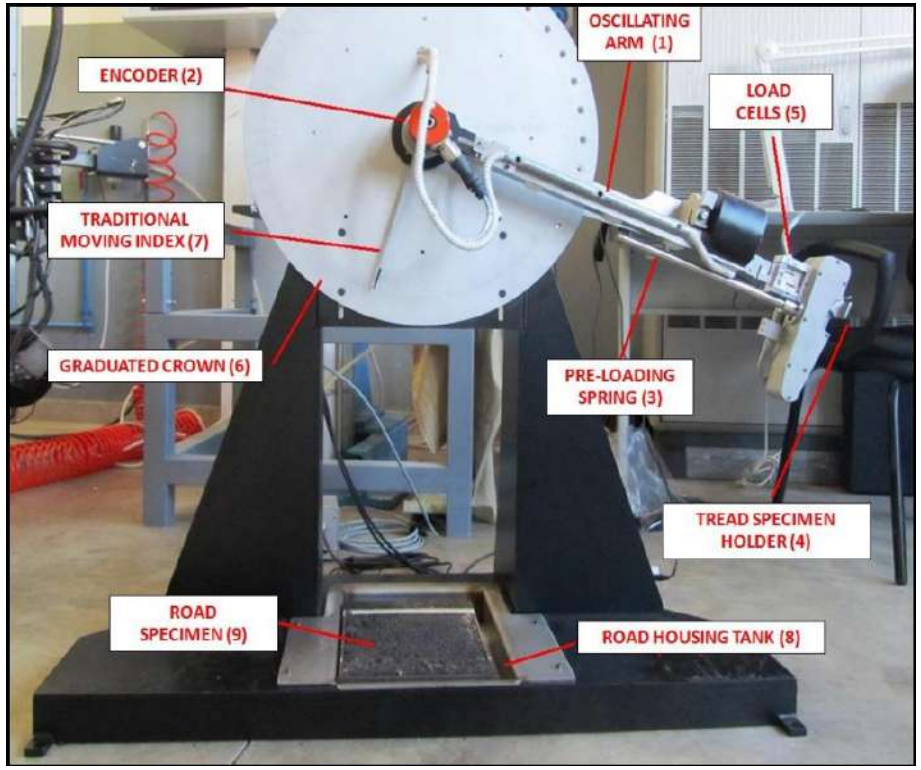
RESEARCH ACTIVITIES

The 3 mistakes I did testing, analyzing and modelling tire/road grip, and what I learnt from them...

2. Neglecting micro-roughness



Linear Friction Tester

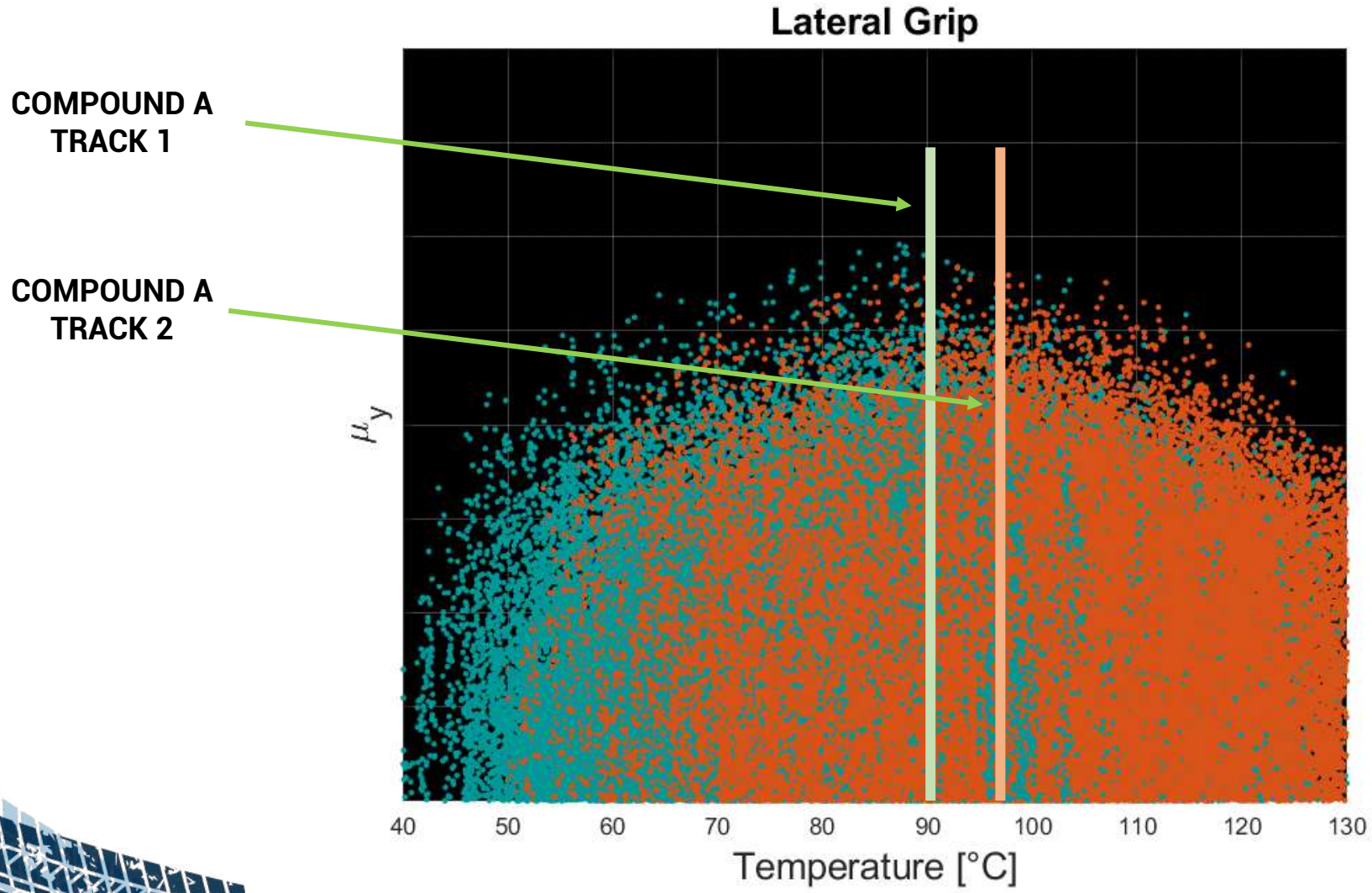


British Pendulum evo

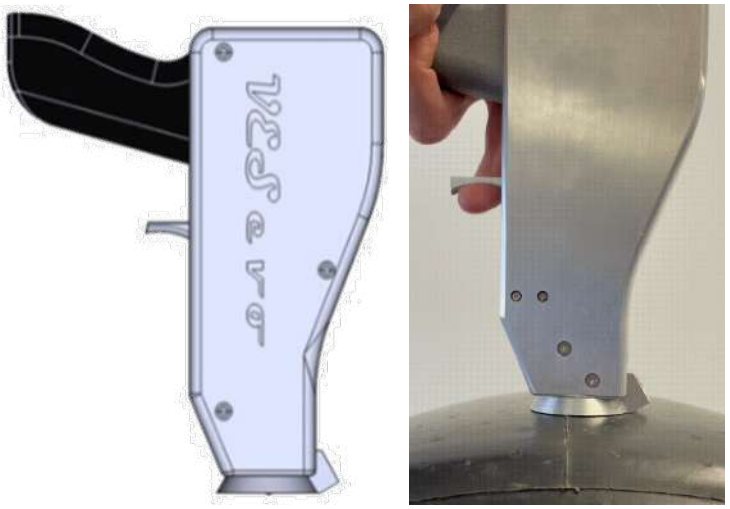
RESEARCH ACTIVITIES

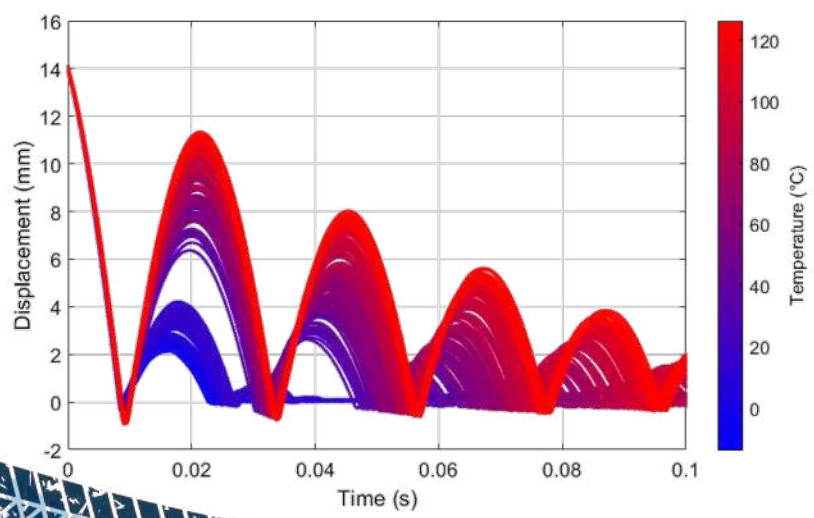
The 3 mistakes I did testing, analyzing and modelling tire/road grip, and what I learnt from them...

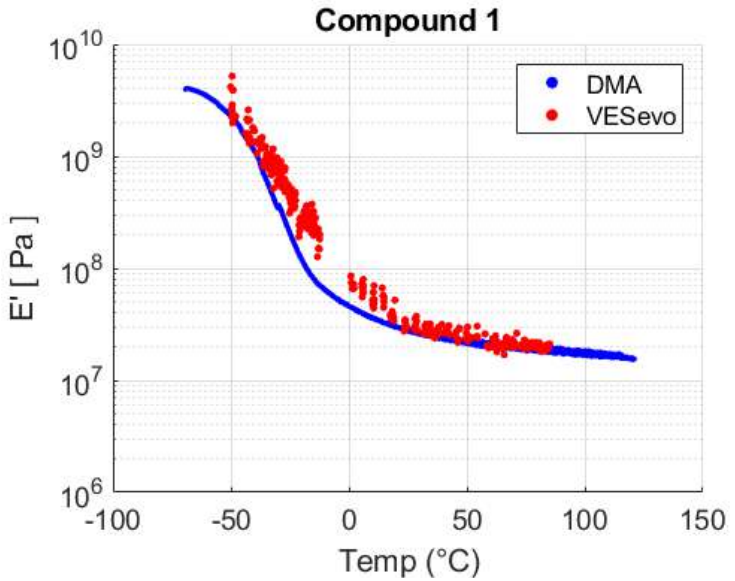
3. Looking for a fixed thermal working range for each tire tread compound

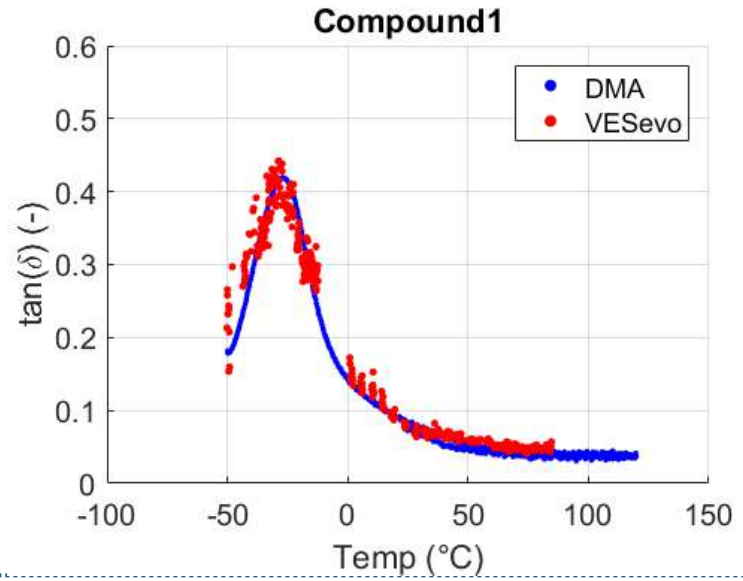


VESEVO




Displacement (mm)
Time (s)
Temperature (°C)


Compound 1
DMA
VESevo
E' [Pa]
Temp (°C)


Compound1
DMA
VESevo
tan(δ) (-)
Temp (°C)

MEGARIDE
APPLIED VEHICLE RESEARCH

VESEVO

powered by
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

- **Compact and ergonomics technology**
- **One device for complete viscoelasticity characterization**
- **Totally non-invasive procedure**
- **Smart data acquisition for real-time and in situ analysis**
- **Easy-to-use**

powered by

DIPARTIMENTO DI INGEGNERIA INDUSTRIALE

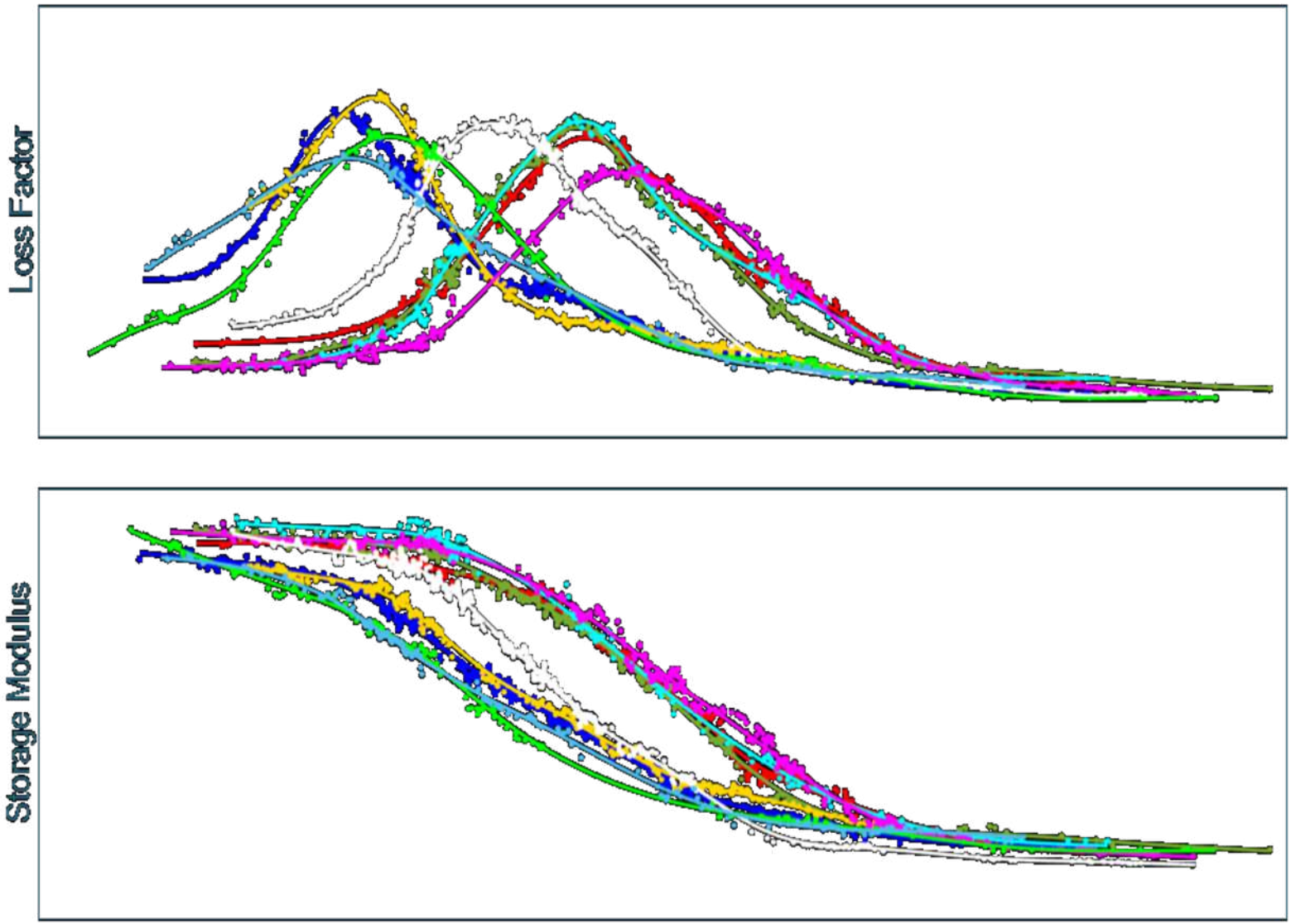
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

VESEVO

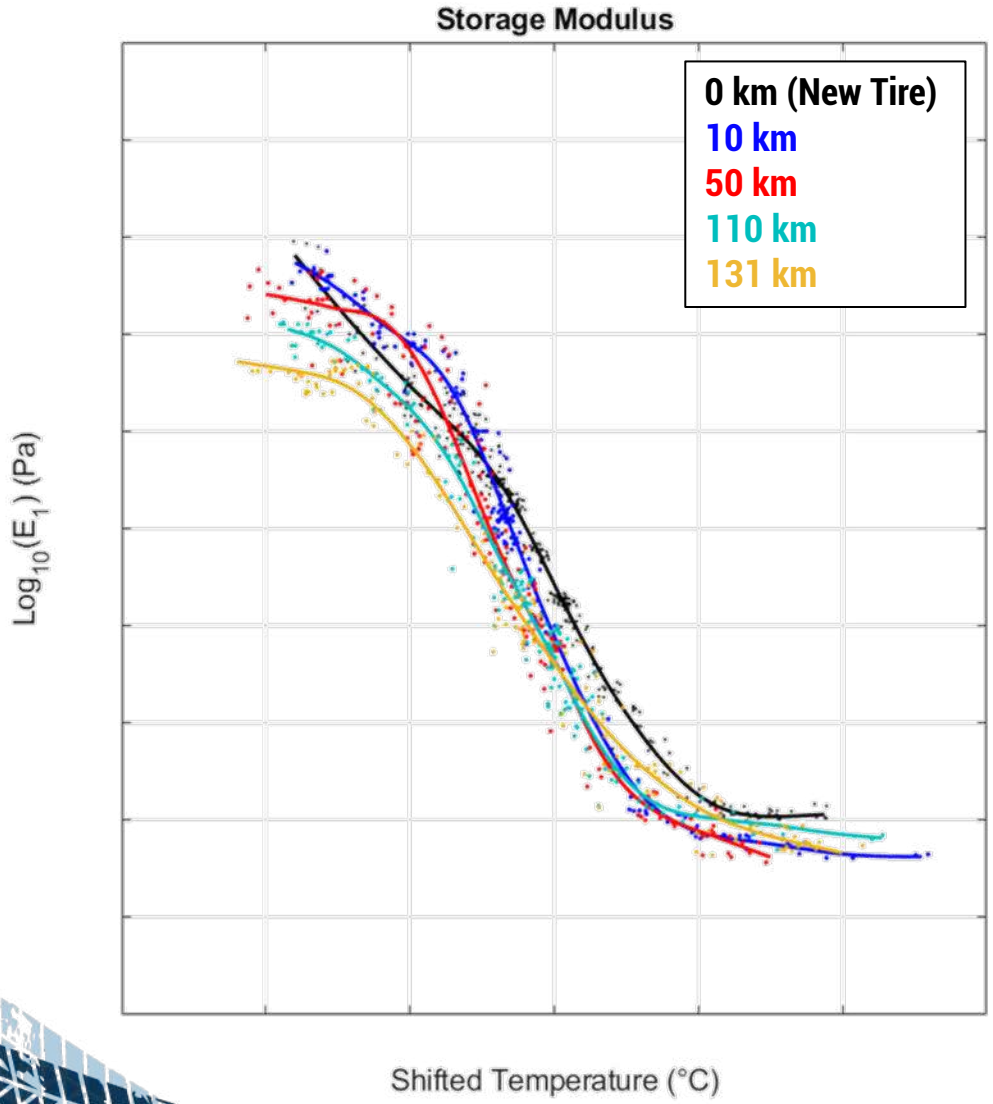
VESevo GEN2

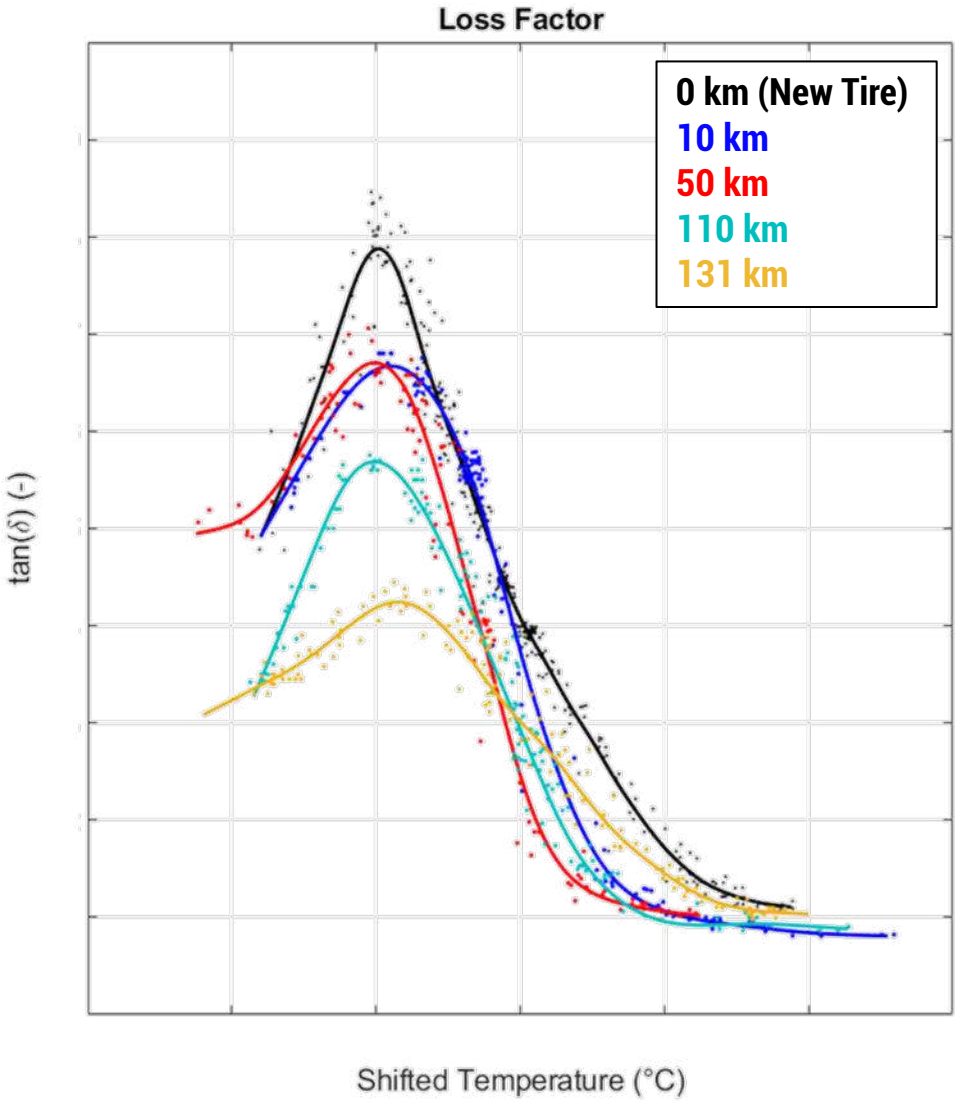
- NEW DESIGN AND ERGONOMICS
- EMBEDDED ELECTRONICS

VESEVO



VESEVO


Storage Modulus
0 km (New Tire)
10 km
50 km
110 km
131 km
Log10(E1) (Pa)
Shifted Temperature (°C)


Loss Factor
0 km (New Tire)
10 km
50 km
110 km
131 km
tan(δ) (-)
Shifted Temperature (°C)

info@megaride.eu
www.megaride.eu

Via Claudio 21, 80125 NAPOLI
DII – Dipartimento di Ingegneria Industriale
Università degli Studi di Napoli "Federico II"

https://www.facebook.com/MegaRidevehicledynamics/

https://www.instagram.com/megaride_vehicle_dynamics/