2025 Simulation Ramp-Up for Project Validation

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2026 SMART PROTOTYPES SUMMIT VI-GRADE

Over the course of 2025, our team has carried out a major ramp-up in virtual vehicle development capabilities, with a strong focus on simulation-driven methodologies. Significant progress has been achieved across multiple domains, including tire modelling, chassis control development, and high-fidelity vehicle dynamics modelling. In parallel, the extensive use of driving simulators has enabled rapid consolidation of methods and accelerated validation through Driver-in-the-Loop assessments. Beyond technical advances, a key outcome of this ramp-up year has been the creation and swift operational deployment of a dedicated digital subsidiary, designed to deliver simulation tools, models, and expertise within very short lead times. This organization now acts as a central enabler for vehicle development projects, supporting fast, robust, and fully virtual decision-making from early concept phases to final tuning.

SUMMARY

Introduction

2025 : Simulation ramp-up

Technical Focus : improve workshop efficiency

2026 : Road Map

01 - INTRODUCTION

2025 – TIME FOR TRANSFORMATION

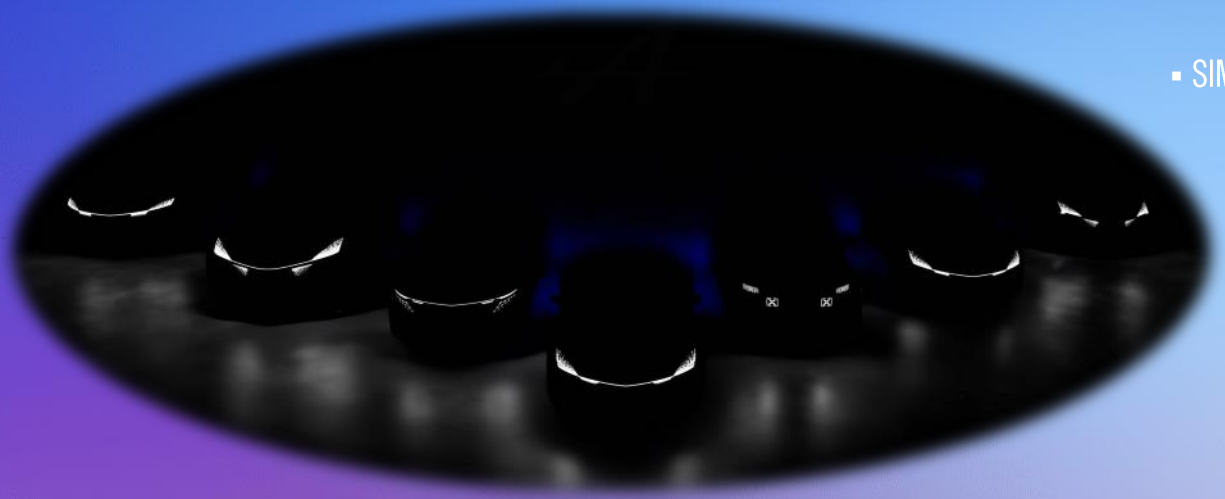
- ROADMAP PRESENTED AT 2025 ZPS CONFERENCE BY RENAUD HANTZ WITH AMBITIOUS OBJECTIVES
  - AFTER AN ACCELERATION PROGRAMM, **FAST RAMP UP** IN SIMULATION AND SIMULATOR
  - DIL SIMULATORS **OPERATIONNAL IN A SHORT TIME** AFTER DELIVERY
  - SIMULATION AND DIL RESULTS USED BY PROJECTS FOR **EARLY CONVERGENCE**

- NEW MINDSET : SIMULATE TO DEFINE, NOT JUST TO CONFIRM
  - SIMULATION **SUPPORTS THE ENTIRE DEVELOPMENT CYCLE**
  - **SHORT-LOOP** COLLABORATION WITH ENGINEERING TEAMS
  - **ACCELERATING INNOVATION**
  - FROM REACTIVE TO PREDICTIVE DEVELOPMENT

- PRESENTATION TODAY FOCUS ON THIS SUCCESS

ALPINE CARS SIMULATION TEAM

- INTEGRATED IN VEHICLE **CUSTOMER PERFORMANCE SERVICES**
  - RIDE & HANDLING, STEERING AND BRAKING CUSTOMER PERFORMANCES
  - GLOBAL CHASSIS CONTROL
  - POWERTRAIN DRIVABILITY
  - ADAS



- SIMULATION TEAM < 10 PERSONS
  - RESPONSIBLE OF **DIGITAL TWIN** OF ALL THE MODELS OF THE DREAM GARAGE AND MORE
  - USE MULTIBODY MODEL FOR COMFORT STUDIES, & CRT FOR HANDLING
  - SIMULATION OF POWERTRAIN DRIVABILITY
  - IN CHARGE **OF DIM-250 OPERATIONS**
  - **USER OF FSS** [COMFORT USE CASES]
  - DEVELOP EXTERNAL MODELS AND TOOLS TO IMPROVE SIMULATION EXPERIENCE

- INTEGRATED IN PROJECT PROCESS
  - FROM FIRST **KICK OFF TO FINAL** TRACK/VIRTUAL **CORRELATION**
  - **INNOVATION LAB** : FROM FIRST FAST PROTOYPE TO ADVANCED FUNCTIONS

02 – SIMULATION RAMP-UP

2025 : SIMULATION RAMP-UP – DIL / FSS – DEVELOPMENT

Fast ramp-up

Methodology robustification for Handling
- Vehicle modelling from Multibody to CRT
- Control model
- Virtual KnC viewer : compare different solutions, integrate external sources
- Transversal offline test, automatic post-treatment report

Internal development of addon tools

Operationnal in a short time

Tire model viewer

From reactive to predictive

Methodology robustification for Ride
- Multibody Vehicle modeling and optimization [offline]
- Standard comfort maneuvers correlated with Alpine Test Tracks [offline]
- Replay comfort maneuvers results on FSS

2025

Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec

Prepare Tire joint test on static DIL

ZPS

DIM-250 Delivery

Accelerating Innovation

Externalise advanced aero & control and advanced suspensions control

Advanced control for dual twin electric engine

First experiments on physical modeling of virtual tire [thermal]

Supports the development cycle

Short-Loop

Externalise suspensions forces only [not kinematic and compliances] with live interaction with simworkbench for fast tuning

First experiments FSS for ride comfort

First DIL experiment :

Early Convergence

Tools developed by Alpine simulation team

USE PROJECTS TO DEVELOP OR INTEGRATE PHYSICAL AND CONTROL EXTERNAL MODEL

App

- ePWT – rwd atv – regenerative brake
- Battery [model & derating]*
- ePWT [model & derating]*
- ePWT Drivability
- External suspensions force
- Brake thermal & derating
- Chassis Twist

A110

- Gearbox
- Steering*
- Brake Pedal Force*
- Ice engine

- Performance sustainability
- Connect to HIL bench

A390

- ePWT – Awd & Alpine Active torque vectoring

R5-T3e

- Handbrake
- Chassis control*

A290

- ePWT Drivability

Innovations & upstream

- 4 wheel steer
- Hybrid : ICE + ePWT
- Tyre* & tyre contact
- Differential
- Advanced suspension control – aero force compensation
- Advanced dampers
- x by wire
- Brakes [regen & thermal]*
- Aerodynamics physics and controls
- Physical tire

2025 | Start in 2025 - wip | Investigations for 2026 [*started]

03 – TECHNICAL FOCUS

Improve workshop efficiency with simworkbench

TECHNICAL FOCUS : IMPROVE WORKSHOP EFFICIENCY WITH SIMULINK AND SIMWORKBENCH

App

ePWT – rwd atv – regenerative brake

Battery [model & derating]*

ePWT [model & derating]*

ePWT Drivability

External suspensions force

Brake thermal & derating

Chassis Twist

A110

Gearbox

Steering*

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ePWT Drivability

Innovations & upstream

4 wheel steer

Hybrid : ICE + ePWT

Tyre* & tyre contact

Differential

Advanced suspension control – aero force compensation

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x by wire

Brakes [regen & thermal]*

Aerodynamics physics and controls

Physical tire

2025

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EXTERNAL MODEL – STRICT ORGANISATION

- GOALS :
  - USE **SIMWORKBENCH** SERVICES : OVERRIDE SIMULINK SETTINGS VARIABLES WHILE DRIVING
  - **TRANSVERSAL APPROACH** : ANY MODEL CAN BE EASILIY REUSED IN ANY PROJECT

➔ NEED A **STRICT METHODOLOGY & ORGANISATION**

- EXAMPLE: ALPINE ACTIVE TORQUE VECTORING FOR REAR WHEEL DRIVE APPLICATION
  - INITIAL DEVELOPMENT ON INBOARD MOTOR, RWD CAR
  - APPLICATION OF LOGIC CONTROL ON IN-WHEEL MOTORS RWD
  - DERIVATIVE APPLICATION ON FWD INBOARD MOTOR

Top model, specific to a **simulation environment** & a **vehicle project**

- Dil [simworkbench and real time database]
- offline[CRT]
- replay mode [Matlab standalone]
- *Integration in other application*
- Specific to a vehicle project : All parameters are defined in script, ready to be changed in simworkbench in live

Referenced models assembly in a core model :

- Referenced models are like « alpine » library
- Assemble single ref. models to create a complex one

  Example : aerodynamics with Detailled S.Cd maps [car, wings, ...] and advanced control for DRS and rear wing downforce variation

Referenced models :

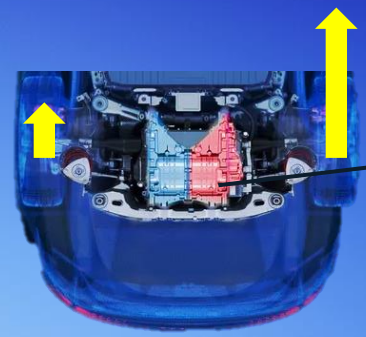
- Can refers to other referenced model
  - Physical [functionnal model, external software]
  - Control [4 wheel steer logics for instance]

ALPINE ACTIVE TORQUE VECTORING

Driver Request
Vehicle State
Calibration

Alpine Control logics
[developped by global chassis control team]

TorqueRequest_RL
TorqueRequest_RR

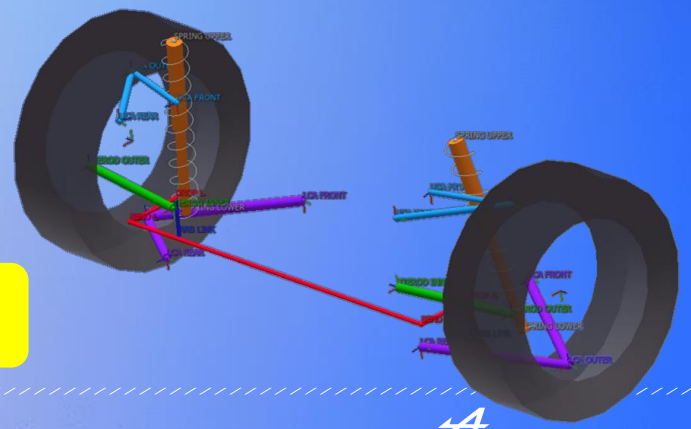


Independant dual e-motors 1 by wheel

All parameters/maps for tuning available in simworkbench

EXTERNAL SIMULINK SUSPENSIONS FORCES

All functionnal parameters & maps are available in simworkbench for fast prototype and « live » change on both axles : spring, dampers, end-stop, clearance, anti-roll, preload ... with Alpine engineers « language » [units, conventions, ...]



GOAL : fast prototype while operating DIL ... will be then re-injected in standalone CRT model

04 –2026 ROAD MAP

2026 : ROAD MAP

Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec

SPS

Dim-250 : improve driver immersion

- Externalise Brake Pedal Feel
- Improve sound, especilaly tires
- Improve Steering feeling
- Alpine motion Cueing philosophy
- Use Y0 MMI touchscreen for fast mapping

CRT models & external models : use more simworkbench services for efficient workshop

- Brake thermal Model & derating
- Externalise Steering model / steer by wire
- Tire derating
- Performances sustainability
- Digital twin correlation with first representative prototypes
- Integrate pwt thermal management and derating
- Chassis Control functions integration
- Chassis Twist
- Improve steering feebacks

FSS and comfort studies : improve multibody models

- Comfort references tracks
- Replay offline simulation vs. measures on FSS
- Event lanes
- Replay offline simulation vs. Measures and modifications proposal based on FSS drive
- Digital twin correlation with first representative prototypes

// THANK YOU //

ALPINE