Podium

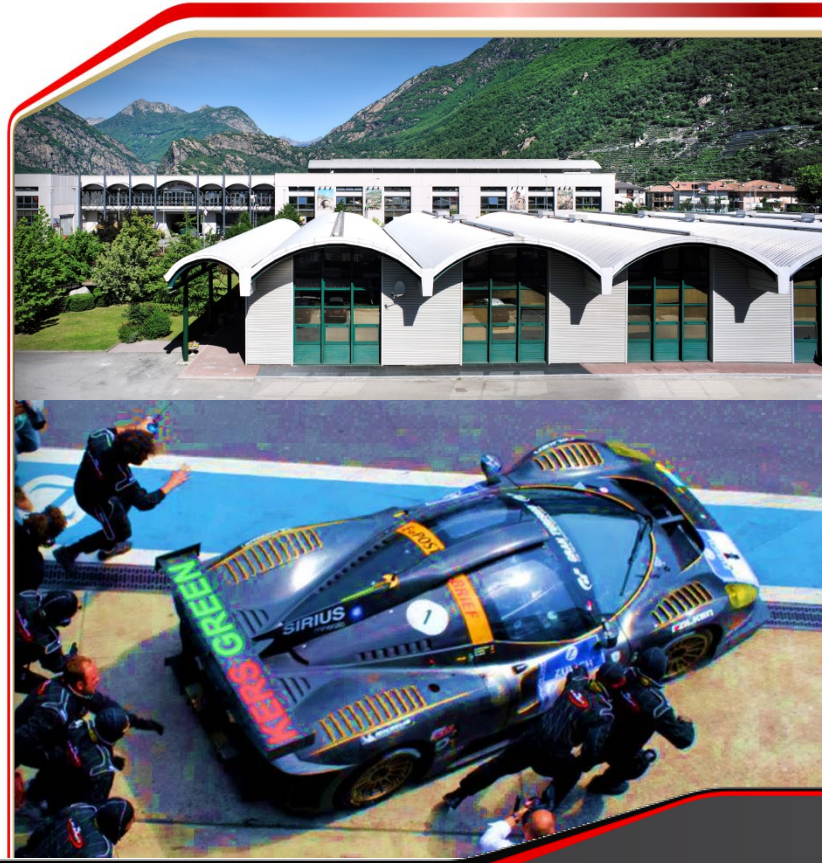
engineering

Automotive and Motorsport Expertise

Podium Engineering

Born in the firm belief that design quality, high project commitment and absolute respect of deadlines are key competitive factors for a consulting and engineering company, Podium Engineering is a dynamic organization grown in the Turin's automotive and motorsport background.

Thanks to a wide set of skills acquired working on many different automotive and motorsport projects our engineering team is successfully involved in designing **complete race cars, vehicle prototypes** and **high performance hybrid/electric powertrain**.



From Concept to final product

The main areas in which we are active are:

- **Motorsport Engineering** (design and development of car project from white scratch to track and race support)
- **Innovative prototype integration** (components and subsystems i.e. suspension, frames, bodywork, onboard electronics)
- **Hybrid systems design** (integration and development i.e. motor and engine coupling, EE system interface, etc.)
- **Energy accumulator design and manufacturing**

We are able to follow the entire design and development process taking care of specs analysis, **performance estimation**, **life cycle costs** and detailed design of final products. From the concept definition and the mechanical integration through control strategies and electronics development, delivering **turn-key solutions** is our calling card.

Podium Engineering has developed electric & hybrid Powertrain expertise for niche customers in transportation world, dealing both with prototypes and with small volume productions.

About us

- Podium Engineering is a small organization able to respond quickly to the requirements of demanding and innovative projects merging together research experiences with the most innovative technologies the industry has.
- All the people working with Podium Engineering have a strong academic background (multidisciplinary engineering degrees and PhDs) and most of them have also previous significant industrial experiences in leading worldwide companies.
- Mechanics, automotive, electronics and mechatronics engineering are the key competencies of the company.

Engineering activities

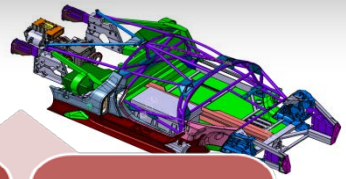
Podium Engineering has a set of design tools developed to manage the preliminary steps of the design process in order to:

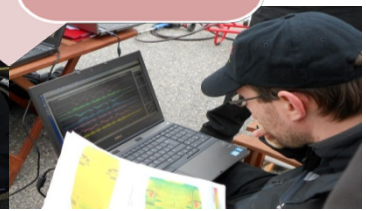
- ensure vehicle feasibility
- target the subsystems performance
- schedule the whole project

Our team of proven automotive engineers can manage 3D Modeling, vehicle dynamics, aerodynamics and thermal analysis, structural analysis, electronic controls and wiring with a concrete and multidisciplinary approach optimized to reduce time to market and save costs.

Vehicle Technology Expertise

- **Concept design**
  - Chassis and powertrain concept development
  - Innovative solution to match customer requirements
- **Detailed Design**
  - Vehicle Dynamics and elasto-kinematics analysis
  - CAD design
  - FEM analysis and optimisations
- **Prototype &Validation**
  - Workshop management
  - Test Bench analysis and validation
- **Electronics:**
  - Wiring Harness design and development.
  - Drafting of electric diagrams and bill of materials documentation.
  - Integration testing and system performance development.
  - Wireless systems design.
- **Controls and Software development:**
  - Control strategies definition and model based design within Matlab/Simulink environment.
  - Automatic code generation using Matlab/Simulink models by means of embedded coder. Use of Rapid Control Prototyping and Hardware-In-the-Loop (HIL) technologies.
  - Use of communication protocols such as CAN, LIN, Ethernet, RS232, RFID. Use of data acquisition systems for analysis and characterization of embedded devices.





HEV: System integration

Podium Engineering can manage any aspects of hybrid system installation and development.

Our passion for engineering challenges and the experience on hybrid system allow us to achieve customer demanding installation constraints by **adapting battery pack** shape, designing **mechanical and electronical interface**, **cooling system** and **high voltage wiring loom.**

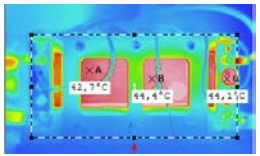
Our engineering team is able to manage hybrid system performance development: **model based power strategy evaluation**, **electronic control design** and **validation test** can be performed to the highest automotive standards.

High Power Batteries System

Having designed and delivered a world-leading performance **KERS battery system** (P4/5 Competizione, EXP Class Winner @ 2012 Nürburgring 24H), we have a proven track record of designing, developing and manufacturing complex battery system solutions for demanding applications whilst optimizing performance, cost, weight and life.

We are independent provider of battery design, development and supply for demanding automotive applications. Podium Engineering acts as a **system integrator** between customers and cell suppliers to provide battery solutions tailored to specific needs. We take particular care over **cell specification and selection**, to ensure that the appropriate cells are chosen. **High drain power lithium cells** and **lithium ion capacitor** are the technologies that are usually used in our products.

HEV: Design process and facilities



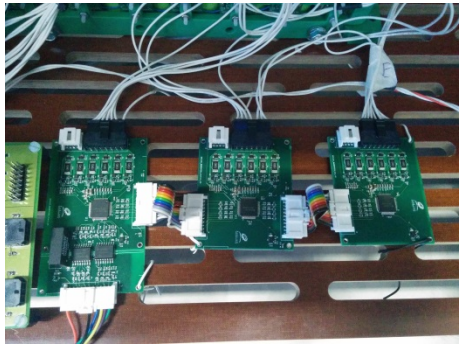
Cells and Modules Testbench	
Power	20 kW
Current	600 A
Voltage Range	3 ÷ 160 V
Monitored Parameters	Cells Temperature - Cells Voltage - Cells Current
Controlled Parameters	Current – Voltage – Time -Air Temperature - Current/Power Cycle Profile

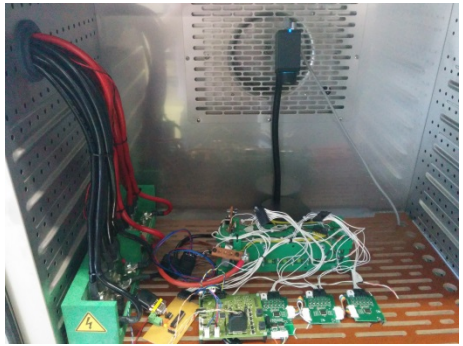
Each battery pack is designed and developed both with **simulations** and **tests** carried out with our in-house **battery test bench** where battery cells and modules could be tested in order to validate every single stage of the design process.

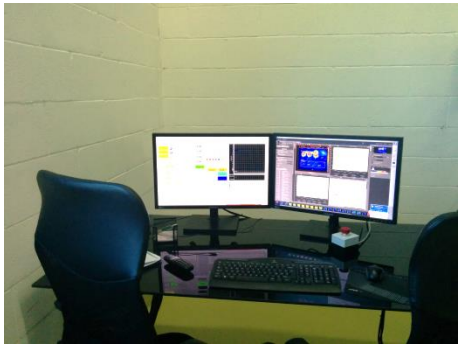
Electro-thermal modelling and simulation of Li-ion cells aid pack design, thermal management assessment and validation. Furthermore **CFD analysis** are adopted to design the cooling system required according to the mission profile of the battery pack. Air/Liquid cooling could be simulated and tested in order to optimise overall performances. We conduct performance evaluation / validation against **real drive profiles** (e.g. Nordschleife, LeMans) in order to release the final design.

- **Battery test bench** – up to 600/340Amps in discharge/charge to test high voltage batteries (up to 160V) with the desired current/power profiles monitoring voltage, current, temperatures
- **Thermal Camera** – R&D thermal camera to monitor temperature of electronics and battery systems
- **Strain Measurement** – cell deformation evaluation
- **Environmental Simulation Chamber** – climate chamber (with a temperature range -40°C + 180°C) to test electronics and battery systems.

Test Bench







HEV: Battery Management System

Aside performance battery design we also focus on **safety** and **reliability**. In order to best match the demanding different applications we designed and developed a **custom BMS** that can be easily adapted to several battery pack configurations and applications. Our system is able to balance and to monitor voltage and temperature of the cells. The BMS, measuring voltage and current, is able to estimate the SOC and SOH of the battery.

The battery pack integration within the electric/electronic architecture of the car is ensured by the CAN interface and usually it also manages the control of relays and the insulation monitor. Being custom realized the dimensions and shapes are adapted to the application reducing weight and volumes.

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