Last station, Portimao... and how to handle it with few historical data!

With Portimao MotoGP race, we close our first year in cooperation with Motorsport.com for the development of technical articles on the preview of the race weekend, with a specific focus on tires behaviour and strategies. See you next season!

So the suspense is all in this question: how to prepare a race on a track for which there is no availability of "historical data", with an asphalt of rather unknown characteristics and a layout to be discovered for the queen category of competitions on two wheels?

Good question for everyone, even for the MegaRide technicians, who face motorsport issues with an approach coming from scientific research and who have experience of circuits and in their database tons of data of many tracks, but not yet of Portimao...

Here is our approach, suggested for the definition of the preliminary setup, which will then be finished on the track by free practice. *** Obviously it speaks of a method and not of the specific conditions of this weekend's race and is not linked to the data of any competing team.

Although apparently obvious, the first step is to collect information from "suppliers". Michelin and Brembo, first of all, who provide the teams with general indications on what to expect from the new circuit and its components, obtained thanks to the tests and simulations in their possession.

Regarding the brakes, for example, Portimao is classified with a stress index 2 by Brembo technicians, on a scale from 1 to 5. The most demanding braking is surely before curve 1, the end of the finish straight, where drivers slow down by about 200 km/h. In addition, the Lusitanian circuit is characterized by different ups and downs that make particularly complex the braking sections: the risk is that they may be anticipated too far up or delayed dangerously downhill. Track slopes up to 12% are reached, while in the transverse direction up to 8%.

On the basis of these preliminary aspects, it is possible to move on to the two crucial simulation phases, which first consist in feeding rather complex physical models, developed in order to predict the expected conditions in terms of grip, useful in turn for the development of subsequent vehicle dynamics simulations.

Such physical models, able to provide a preview of the expected grip, are fed with data relating to the compound used: as enthusiasts will certainly know, a so-called "soft" tire generally offers grip even at lower operating temperatures, compared to a "hard" one, but the latter offers in general greater durability and mechanical resistance, even on hot tracks. For this purpose, MegaRide has developed a device called VESevo, which provides as a service to the motorsport teams and which is able to "hammer" the tires, obtaining in response the viscoelastic characteristics of the compounds of the tread, otherwise obtainable only by removing portions of rubber (which is prohibited by regulation, as well as harmful to the functionality of the tire) to be analyzed in the laboratory.

To feed the aforementioned models, it is also necessary to know the characteristics of the asphalt, which can be evaluated through signal analysis techniques, such as PSD (Power Spectral Density), carried out on laser scans from the road surface. The roughness of the road decisively influences the response of the tire: asphalt characterized by the presence of minerals with a smooth surface usually enhance the “adhesive” component of the grip, while vice versa, rough tarmac can excite the tire from a “hysterical” point of view with frequencies that facilitate the local achievement of the optimal thermal working range. In practice, there is always a mix of components, present on different scales of roughness so-called “fractal”, which must be included in order to define a tire setup that ensures the maximum forces that the rubber can exchange with the ground, thus optimizing the performance and balance of the entire vehicle.

Based on the circuit, therefore, on the roughness characteristics of the asphalt, and on the type of compound used, it is possible to have an evaluation of the expected grip, fundamental parameter to carry out the simulations with the complete vehicle model.

To this end, simulation software has become more and more used to virtually run on a suitably reconstructed track, in order to acquire data in anticipation of the Grand Prix and predict the behavior that the vehicle will show during the weekend. In this context, our software, such as the thermoRIDE physical model, can simulate the temperature trend of the tires favoring the development of the optimal setup in view of the race, foreseeing any problems related to the difficulty to reach the optimal temperature with consequent loss of performance and/or irregular wear.

On the occasion of the Portuguese Grand Prix, the preliminary data were collected by the teams during the test session in early October, which also saw the participation of some drivers, as well as several testers, which, among other things, expressed many positive opinions on the route, but highlighted some dangerous points. The most critical, and in some ways more risky, is located by the last curve, the 15, the “Galp”, a wide-radius bend to be faced in acceleration: here the right shoulder of the tire is stressed significantly, especially at the rear. Due to the limited availability of experimental data, MegaRide simulation engineers reconstructed this section of the circuit and, simulating single maneuvers, used their thermal model to describe the thermal behavior of the highly stressed right shoulder of the rear tire.

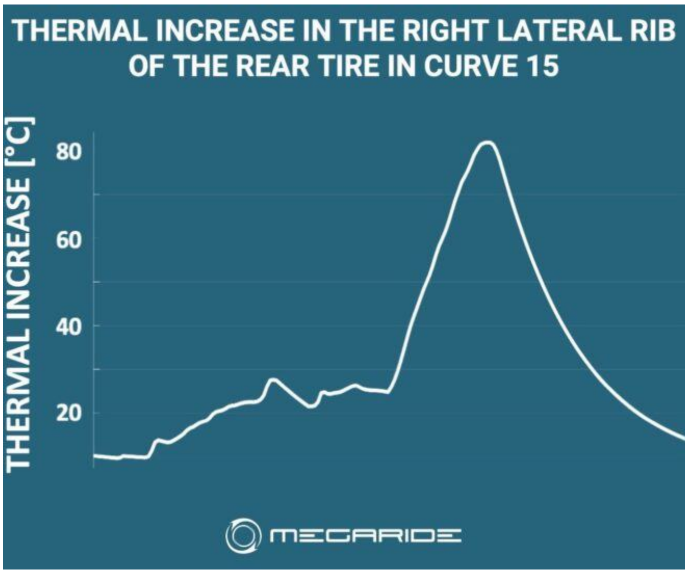

Figure 1: A typical tyre curve generated through use of Pacejka's Magic Formula.

The results of the simulations show a significant thermal increase making evident the potential risk of overheating in the final stages of the race, when the tread layer will be reduced due to wear and its low thermal inertia will lead it to change very quickly its temperature. This phenomenon is often the cause of a "nervous" behavior of the compound, which usually manifests in the final stages of the race to make the tire unmanageable within its own thermal window, leading to situations of under/over heating which lead to a net decrease in adherence. The reduced escape routes of the Galp therefore require particular attention to the management of thermal dynamics by the rider, and consequently it is vital for the engineers to offer them a bike setup that makes this management possible.

In short, if you do not have first-hand data available, method, models and experience are always the way to make the difference. And of course (and luckily) the courage of the driver who, bending on the asphalt, does not calculate it, but feels it!