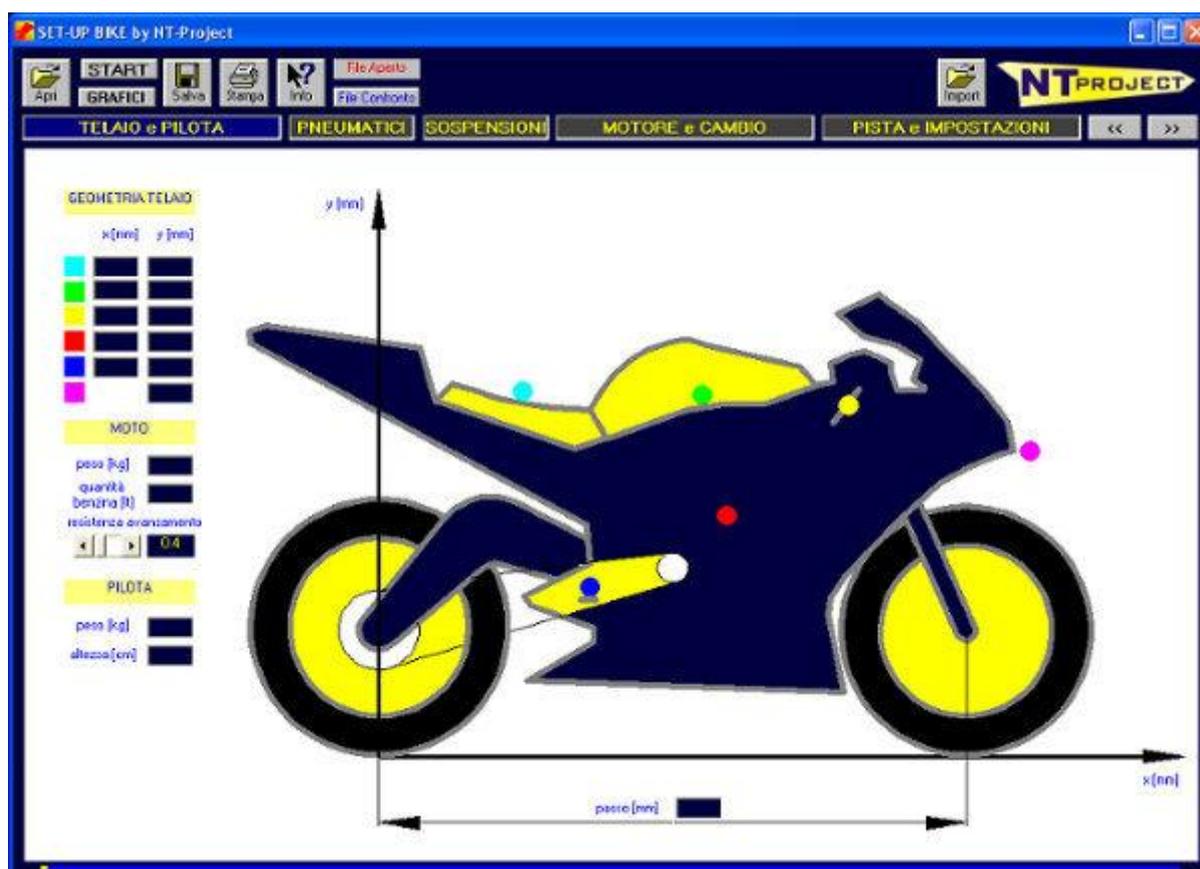


SET-UP BIKE - presentation



The software SET-UP Bike at the opening presents this screenshot, to follow we will see in detail the features.

SET-UP BIKE - entering data

For the use of the software SET-UP Bike you need to enter the information necessary to define the dynamic of the motorcycle.

The data are divided substantially into two areas, those related to the fixed characteristics of the motorcycle, and those relate to the set-up and which then can be varied in a phase of fine tuning.

For what concerns the fixed characteristics of the bike, you must enter:

FRAME DATA



GEOMETRIA TELAIO

x [mm] y [mm]

Cyan	340	831
Green	704	876
Yellow	1040	849
Red	580	500
Blue	360	401
Magenta		678

MOTO

peso [kg]	181
quantità benzina [lt]	17
resistenza avanzamento	0.3
passo [mm]	1380

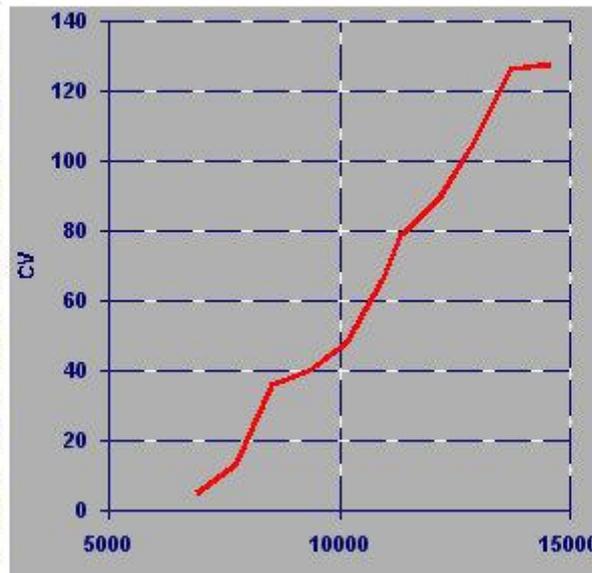
Are substantially the center of gravity of the bike and of the tank, and the key points to define the rider driving position (saddle, handlebars and footpegs). Moreover you must enter the wheelbase and the weight of the bike without the rider.

ENGINE DATA

CURVA DI POTENZA DATI BANCO ARBITRARIA

albero ruota

Regime RPM	Potenza kW
6936	4.02
7736	9.79
8536	26.5
9336	29.38
10136	35.52
10936	48.79
11336	58.08
12136	65.44
12936	78.09
13736	93
14536	94

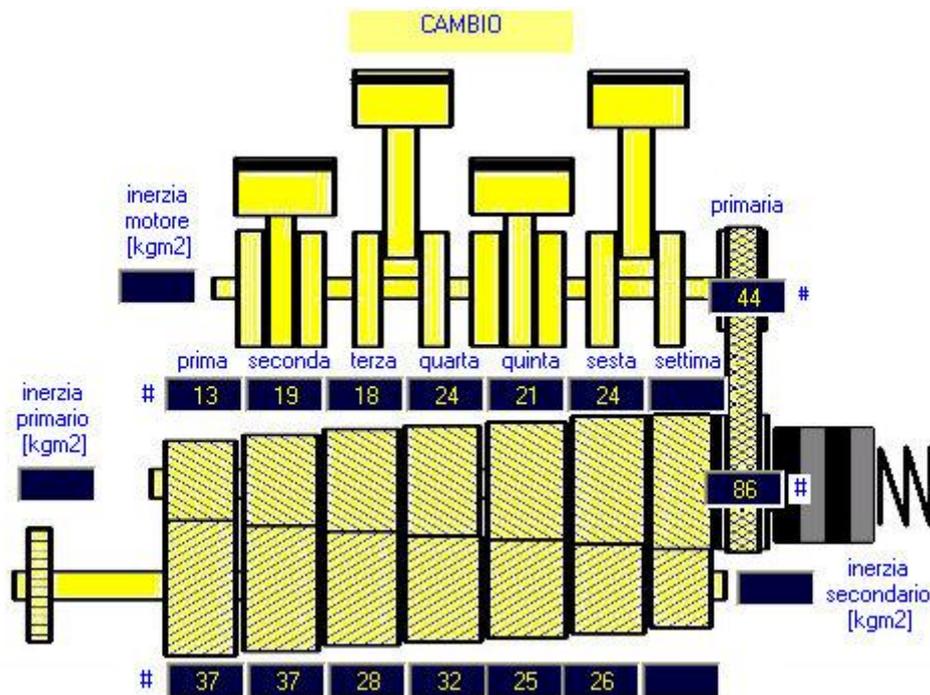


MOTORE

n° cilindri	4
cilindrata [cm ³]	600
corsa [mm]	42.5
rapp.compr.	13.1

Must be entered the power curve data of the motorcycle that you read at the dyno. The software anyway allows also to insert arbitrary power curves to perform simulations of test.

GEARBOX DATA



Finally must be entered the gear ratios, simply by indicating the number of teeth of each pair of gears. For more refined calculations, can also be inserted the inertia of crankshaft and transmission shaft.

SET-UP BIKE - *set-up data*

In addition to the data to define the fixed characteristics of the motorcycle, must be added the data of the set-up that you are using, or that you want to use on the bike.

Changing these data you'll see how change the performance of the motorcycle with the different set-up track by track, and so you can find preventively the best set-up for each, and for each condition.

FINAL RATIO



For what concerns the engine one of the most important decisions is that of identifying the sprockets which allow to exploit it at the best according to the characteristics of the track and the conditions. In the software SET-UP Bike you will insert the number of teeth and thanks to the calculation will see those that will give the best performance.

FRONT SUSPENSION - FORK



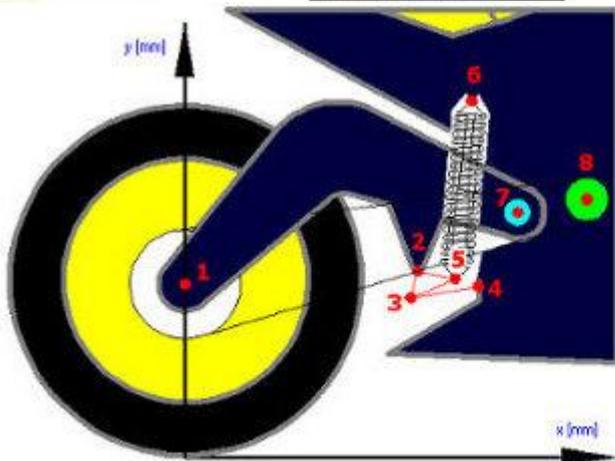
massa ruota [Kg]	14
rigidezza molla [N/m]	17800
precarico molla [N]	200
damping comp [Ns/m]	550
damping ext [Ns/m]	1100

For what concerns the frame the setting of the suspension is certainly one of the most important and more difficult steps to have the optimal fine tuning. In the software can then insert the settings of the fork, both for what concerns the preload and the stiffness of the spring, both for bound and rebound damping coefficients, and thanks to the calculation you can identify the settings that allow to obtain the best performance.

REAR SUSPENSION

POSTERIORE

- PRO-LINK
- UNIT-PRO-LINK
- PRO-LEVER
- UNI-TRACK
- BACK-LINK
- MONO-CROSS
- FULL-FLOATER



	x [mm]	y [mm]
1	0	314.9
2	381.2	373.7
3	374.2	328.2
4	483.6	357.0
5	444.5	366.8
6	442.9	664.2
7	535.6	488.7
8	616	497

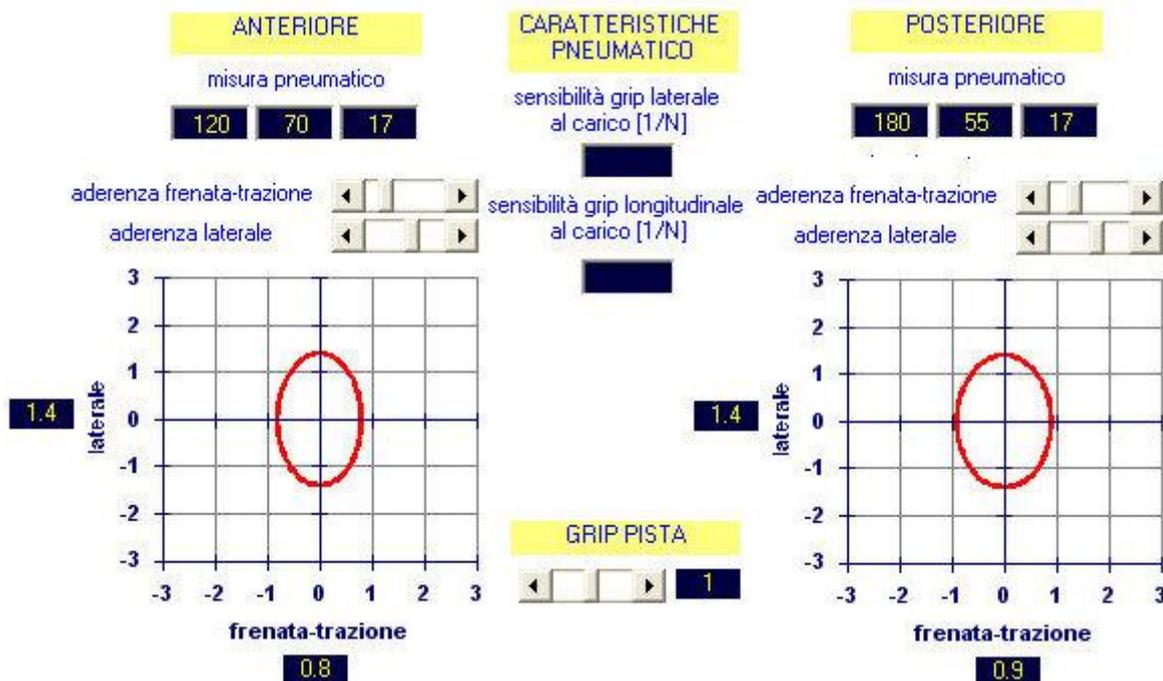
massa ruota [Kg]	16
rigidezza molla [N/m]	95000
precarico molla [N]	300
damping comp [Ns/m]	3000
damping ext [Ns/m]	6000

For what concerns the rear suspension, in addition to the shock setting (pre-load, stiffness and damping) must be entered also the geometry of the suspension. In fact in the software has been implemented kinematics and cineto-static of all major types of suspension (pro-link, pro-unit-link, pro-lever, uni-track, back-link, mono-cross, full-floater), then you will simply have to choose which type of suspension uses the motorcycle and indicate the dimensions of the levers.

SET-UP BIKE - tyres and track data

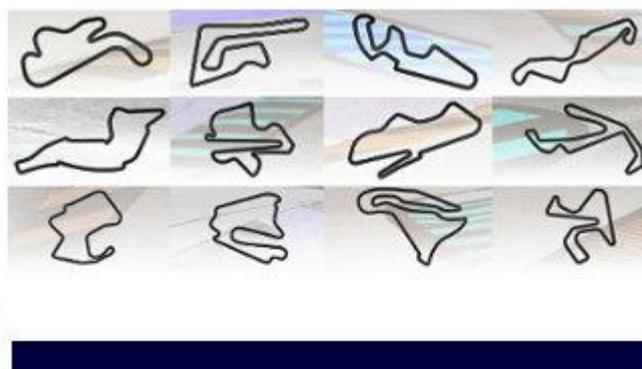
After entering the data of the bike and the set-up that you want to test, before starting the calculation you will have to tell the software the level of grip that the tires and the track conditions offer and select the track on which you want make the simulation.

TYRES DATA



The level of grip that the tyres offer is easily insertable through the friction ellipse, and the values to use will come advised you from NT-Project in function of the tyres that you use. The software take account also of the sensibility at the load of the tyres, these is very important for the setting indications that will get from the calculation.

TRACK DATA



For what concerns the track on which to perform the simulation in the software are already inserted the trajectories of the main tracks (world superbike, civ, cev, etc.), moreover you can enter the trajectory using the acceleration or gps data collected by your acquisition system. . The software can use the data exported from all the main acquisitions (2d, aim, alfano, starlane, rks, unipro)

SET-UP BIKE - *calculation*

Selected the track, you can start the calculation. In a few seconds the software will perform the dynamic simulation finding the best performance which the virtual driver is able to get under the conditions of the track and the set-up chosen.

Before looking in detail the results obtained and the main examples of using the software we show a scheme summing up the key functions of the software from which technicians and riders can get very useful information for the fine tuning and for driving.

INPUT

BIKE FEATURES	It is manageable in order to simulate all types of motorcycles, but also to be able to do in the process of development important technical evaluations.
WEIGHT, HEIGHT and RIDER DRIVING POSITION	It is manageable to see how changes the dynamic behavior of the motorcycle according to the physical characteristics of the rider and then adjust quickly the set-up to the various riders.
SET-UP CHOSEN	It is manageable in order to compare the performance with several final gear ratio and different suspension settings , so being able to identify in advance the best set-up.
GRIP CONDITION	It is manageable in order to preventively simulate the various possible situations (track with much grip, slippery, rain, etc.).
WEATHER CONDITIONS	It is manageable to see the temperatures that the tires take on different the conditions and then understand if they work or not in the right range.
TRACK	It is manageable in order to simulate the behavior of the motorcycle on each track, and to find track by track the solutions and the settings.

OUTPUT

LAP TIME	PERFORMANCE ANALYSIS	ENGINE LOAD
When you want to compare different solutions the lap time is certainly the first result to look to understand which solution can be overall the best.	In addition to the lap time it is important to investigate as it has been obtained the performance, for this the software does a detailed analysis, of the problems that the rider encountered in the different parts of the track, of how drives, and of how uses the gear.	Between the various results calculated, the engine load can be very important to see how the virtual rider is forced to cut the power in the various points of the track to fulfill the constraints of adherence and wheelie, and this can be useful when you compare solutions to understand which can be more driveable.

BRAKES USE

The results for the brakes can be useful both from a technical point of view, to see the magnitude of the braking torques, the intensity of use, etc., but also for the rider to see in which points may be useful to use the rear brake, or to compare which of the set-up solution can be more effective on braking.

REAR SHOCK TRAVEL

Thanks to the analysis kinematic and kineto-static that the software performs is possible to see not only how works the rear suspension in its entirety, but also specifically the shock functioning.

FORK LOAD and TRAVEL

The suspension settings are fundamental therefore to be able to know the loads that act on the fork and its operation based on the set-up chosen is very important to optimize the settings.

TYRES TEMPERATURE

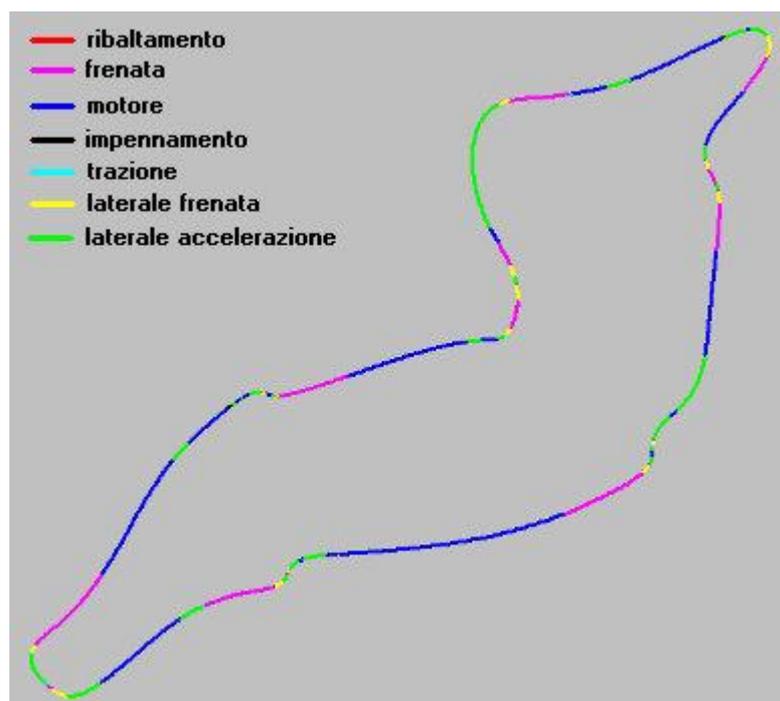
It's certainly one of the most important results that the software offers, in fact, based on the conditions of air and track temperature, are calculated the temperatures of the front and rear tires in the center and to the sides, this is very important to understand in advance how each set-up will make to work the tires in the different points of the track, and which set-up can be more effective to obtain the optimum temperature of the tires.

SWING ARM TORQUE and ROTATION

As for the front suspension can evaluate in advance the forces acting on the swing arm (chain force inclusive) and how responds the rear suspension according to the set-up chosen is fundamental to improve rapidly the settings.

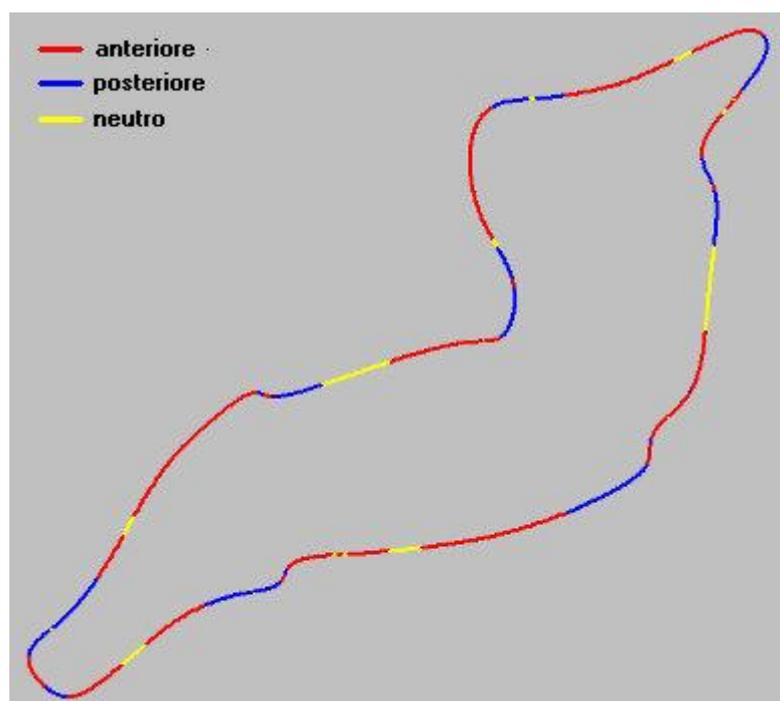
SET-UP BIKE - performance analysis

As we said the lap time is the result that overall gives an idea on which choice may be the best in terms of pure performance, but for technician and rider is also very important to understand how has been obtained this performance, for this the software SET-UP Bike make a detailed analysis of the performance. In fact it shows point by point the difficulties that has encountered the virtual rider (pretty much like the sensations that the real rider reports at the end of the run to its technical, but in this case the information are precise and unambiguous), this allows to the technician to understand beforehand where is better to act to improve the performance, or to understand better the feelings of the rider to give him the right solution more easily.



This first chart shows in the details from what the performance is limited at each point of the track. The results are then summarized in an overall calculation on the lap.

ANALISI PRESTAZIONE	%
ribaltamento	0.00
frenata	18.60
motore	43.98
impennamento	0.55
trazione	0.38
laterale frenata	7.22
laterale accelerazione	29.27

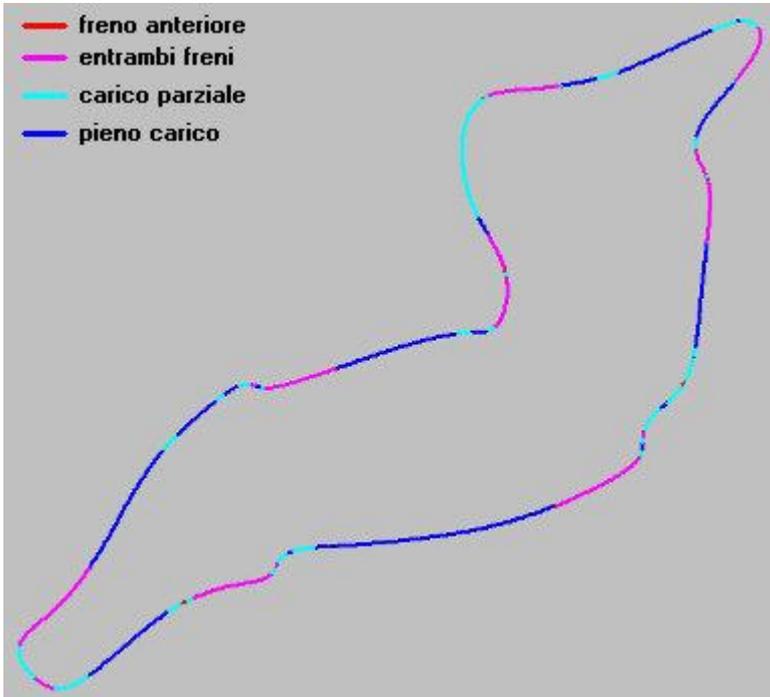


This second graph shows instead if the loss of adherence tends to be at the front rather than at the rear in each point of the track.

ANALISI LATERALE	%
anteriore	63.62
posteriore	25.05
neutro	11.32

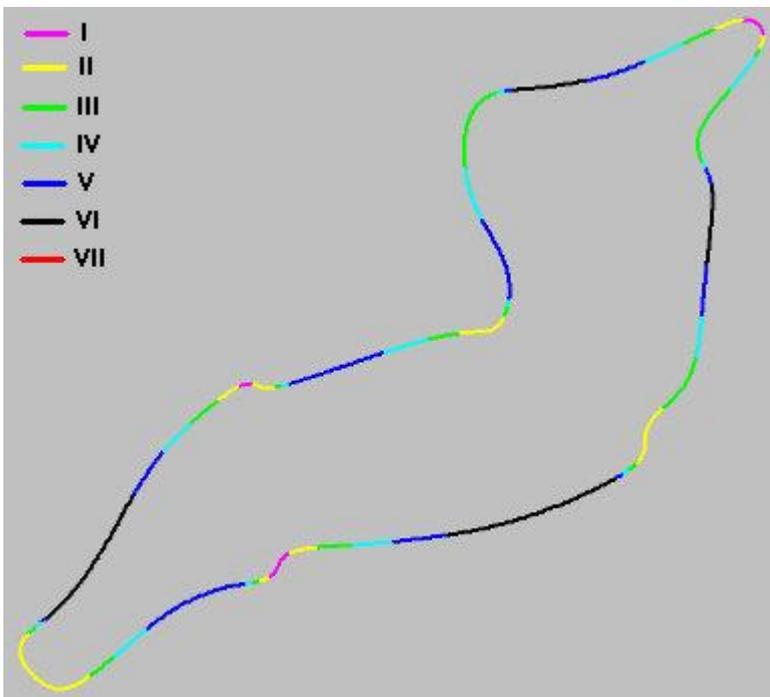
SET-UP BIKE - *driving and gearbox analysis*

In addition to the performance analysis the software shows how the virtual rider is driving this may be useful to make in advance assessments for example on the optimum gear ratios, but also to make a comparison with the real rider to improve the driving in the points key of the track.



This first chart shows in detail how the virtual rider is driving in each point of the track. The results are then summarized in an overall calculation on the lap.

ANALISI GUIDA	%
freno anteriore	0.88
entrambi freni	25.60
carico parziale	28.83
pieno carico	44.69

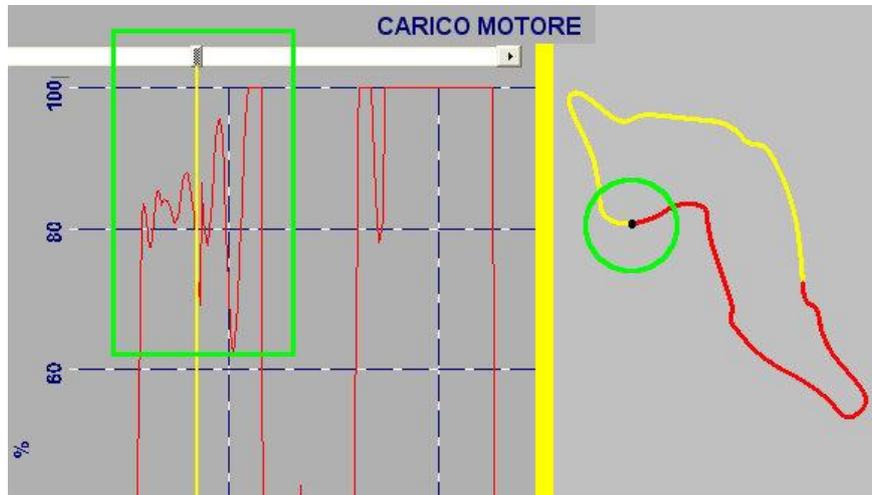


This second graph shows instead how the gearbox has been used in each point of the track.

ANALISI CAMBIO	%
I	5.53
II	21.99
III	23.63
IV	17.34
V	17.83
VI	13.68
VII	0.00

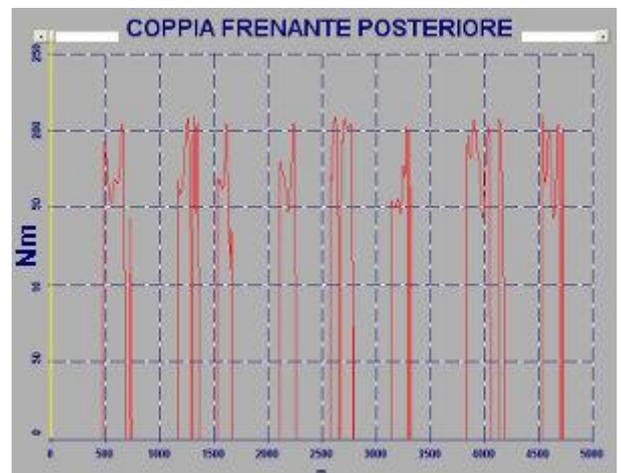
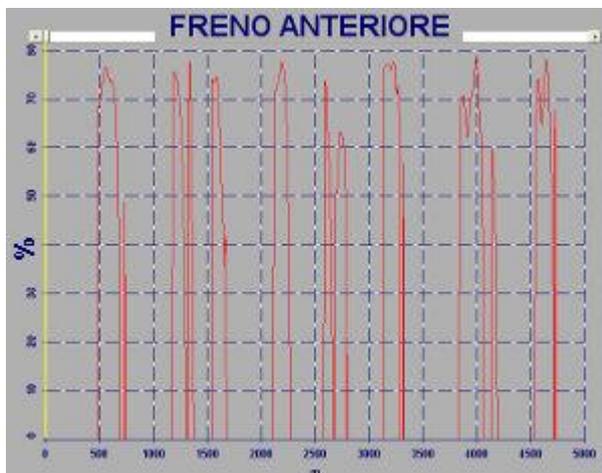
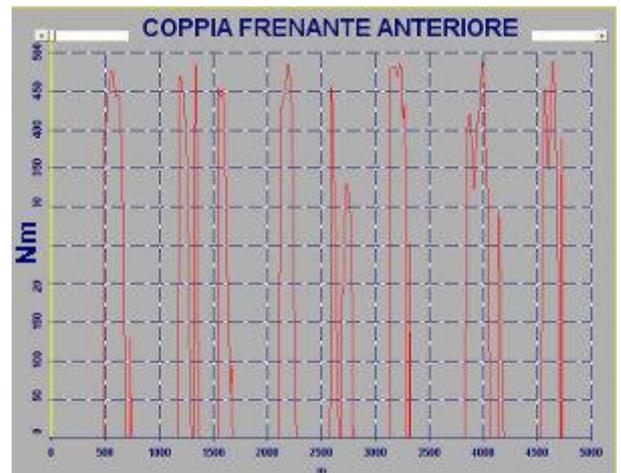
SET-UP BIKE - engine

In the driving is essential to easily manage the power given from the engine, the virtual rider can do this with any type of engine, but if these actions are complicated and harder will be for the real rider replicate them, so from the analysis of how the power is cut from the virtual rider, the technician can understand which set-up can be the most suitable to facilitate the driving, or where possible, how to set the traction control to improve the situation.



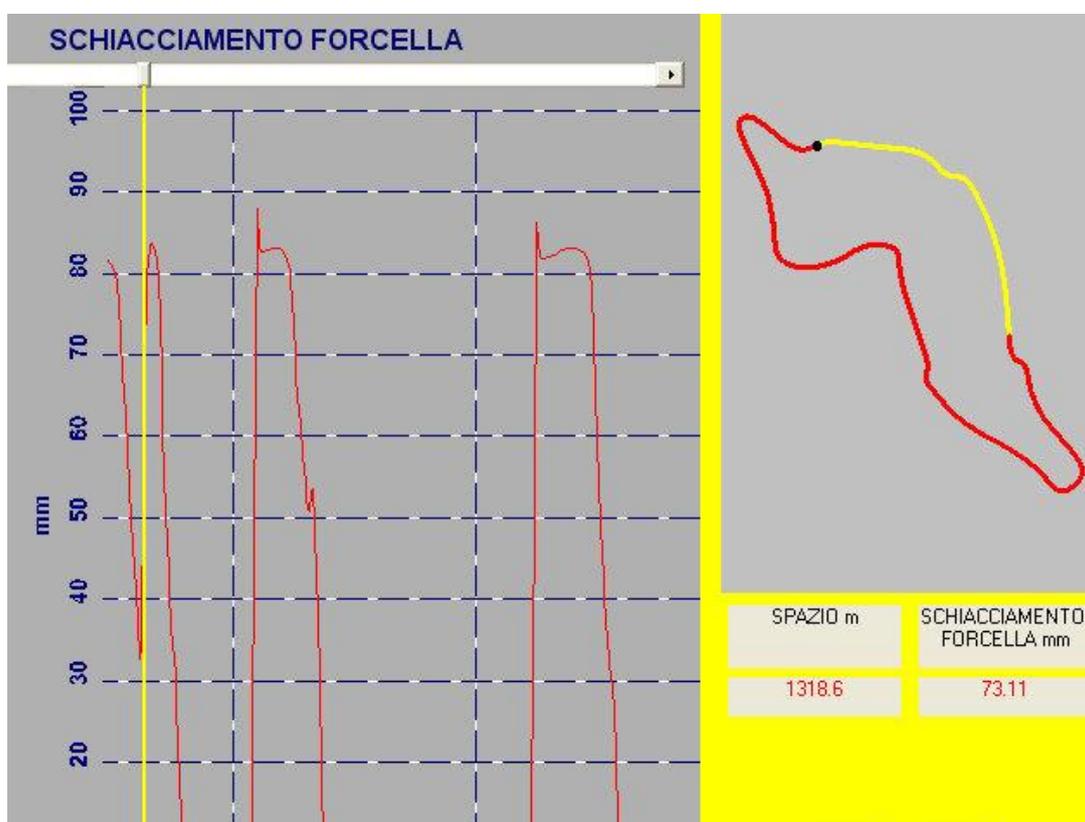
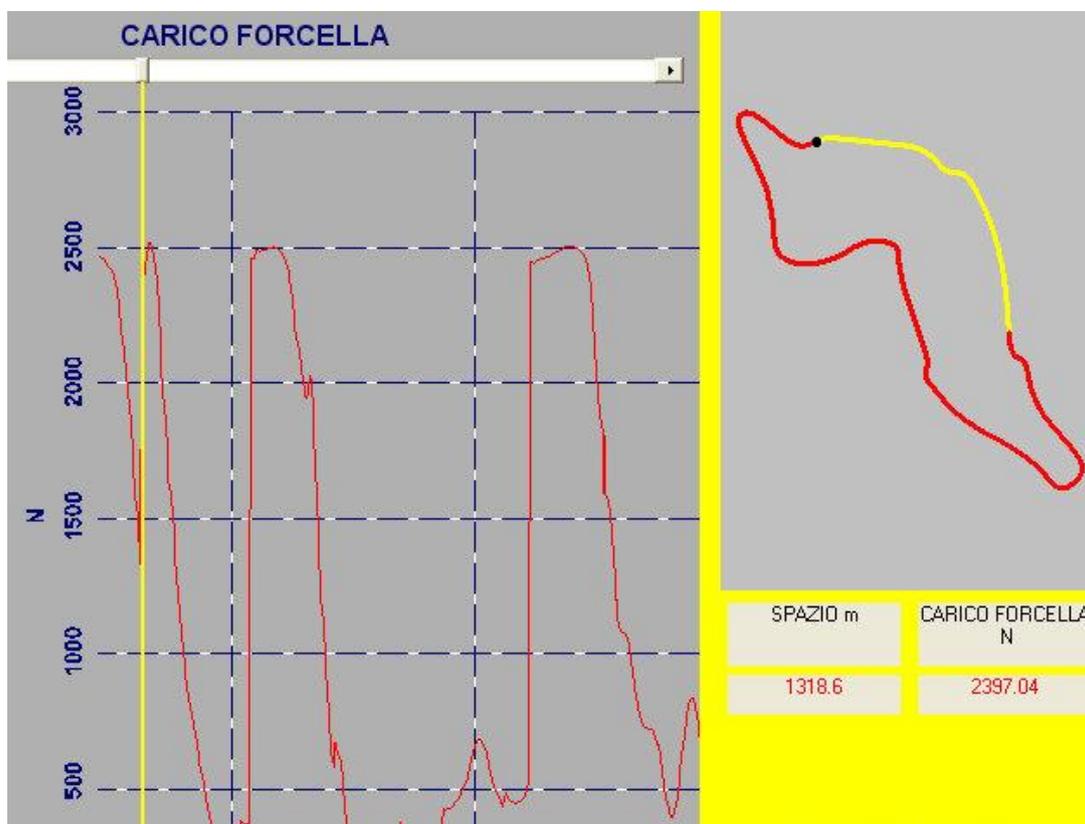
SET-UP BIKE - brakes

Another very important aspect is the use of the brakes, the software shows how they are used by the virtual driver and this allows you to see from track to track as they are stressed, and which is the optimal distribution of use between front and rear at every point of the track. The latter may be very useful to the real rider to better understand in which points of the track the use of the rear brake can make the braking much more effective.



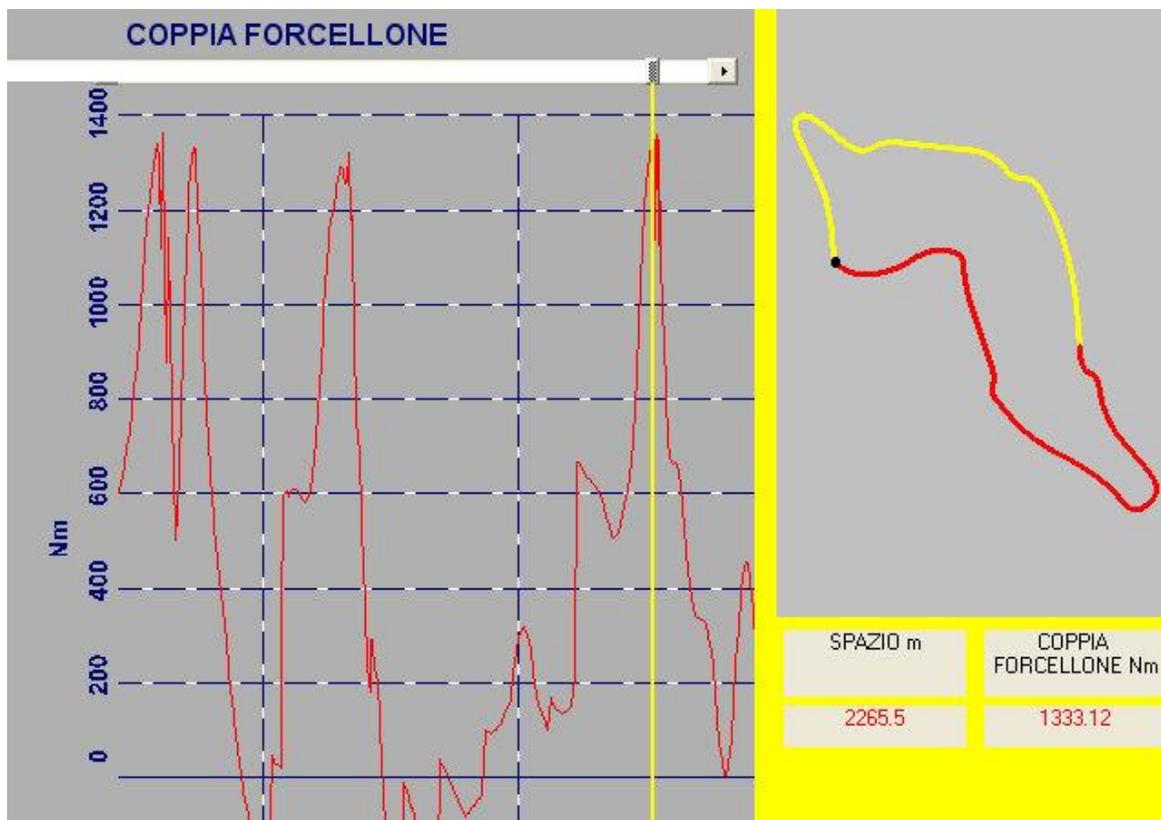
SET-UP BIKE - fork

The set-up of the suspension is fundamental, for this the software calculates the loads that act on the fork and how it responds in every point of the track according to the settings of preload, spring stiffness, damping in compression and in extension, which you've chosen.



SET-UP BIKE - rear suspension

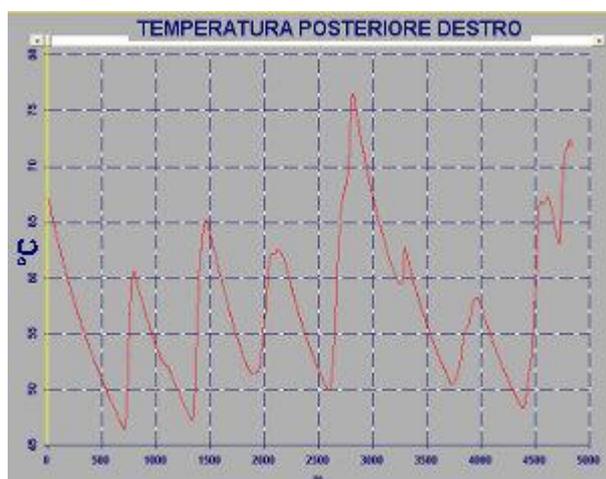
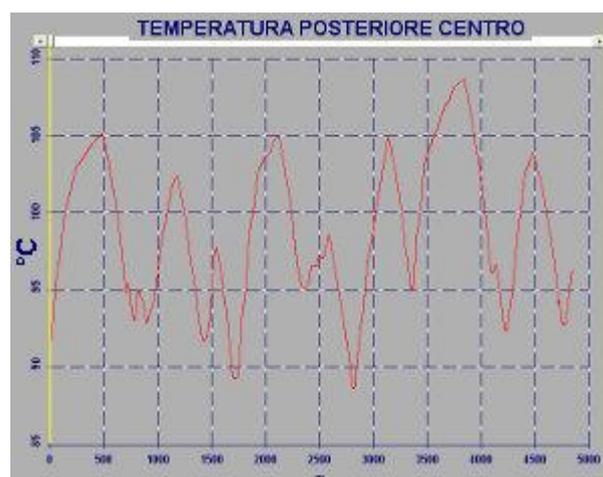
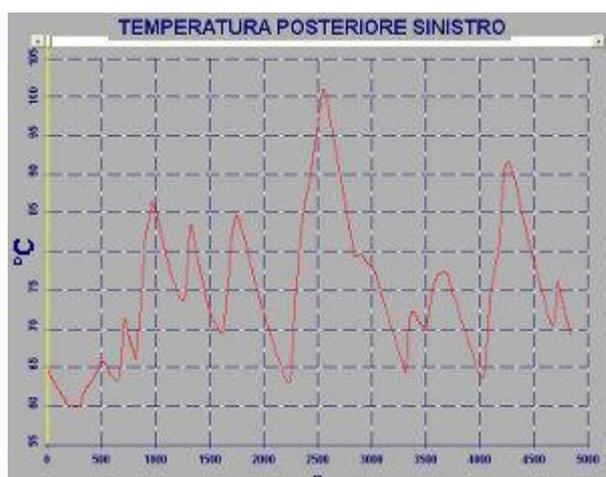
The set-up of the suspension is essential, for this the software calculates the forces acting on the swing arm and how responds the rear suspension in every point of the track according to the characteristics of the linkage (pro-link unit-pro-link, pro-lever , uni-track, back-link, mono-cross, full-floater) and of the settings of preload, spring stiffness, damping in compression and in extension, that you've chosen.



SET-UP BIKE - *tyres temperature*

The temperature of the tires as you know is one of the most influential parameters on the performance and durability of the tires. The software SET-UP Bike presents a computational model that allows you to see the trend of the tire temperature on the different tracks according to grip the conditions, the weather and set-up choices that are made.

The software not only calculates the temperature of front and rear tyres, but also divides each tire into three zones (left, center and right) to see depending from the features of the track where the tire is more stressed and can overheat, and where instead have difficulty to reach the operating temperature.



	MIN	MAX	MED
temperatura ant. sinistro [°C]	40	88	62
temperatura ant. centro [°C]	53	81	69
temperatura ant. destro [°C]	39	87	55
temperatura post. sinistro [°C]	60	101	75
temperatura post. centro [°C]	89	109	98
temperatura post. destro [°C]	46	76	58

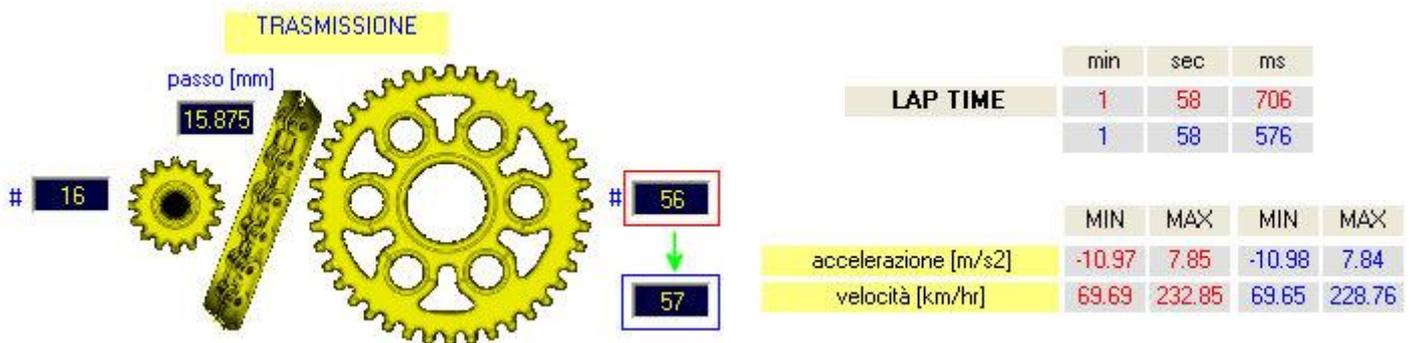
SET-UP BIKE - *example of use*

As we have seen the software SET-UP Bike is able to provide multiple technical information useful to analyze in detail the performance of the motorcycle, the use of the engine and of the brakes, the suspension behavior, and the temperature of the tires. All this can be exploited to find the best set-up solutions in the different tracks and conditions.

Afterwards we will see some examples of use of the software to find the optimal set-up.

DETERMINATION OF THE BEST FINAL GEAR RATIO ON A SPECIFIC TRACK

With the software you can find in advance the final gear ratio which allows to obtain the best performance.



DETERMINATION OF THE FINAL GEAR RATIO WITH DIFFERENTS GRIP CONDITIONS TO HAVE THE BEST DRIVEABILITY

When you have very different grip conditions, for example in case of rain, thanks to the software you can previously find the final gear ratio that allows you to have a bike more rideable without losing performance.

	MIN	MAX	MIN	MAX
carico [%]	0	72.25	0	88.28

	min	sec	ms
LAP TIME	2	32	664
	2	32	657

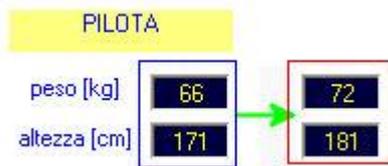
DETERMINATION OF THE BEST SUSPENSION SET-UP ON A SPECIFIC TRACK

Thanks to the software you can test all the solutions of the set-up suspension, this allows to identify in advance the best set-up from which start. In the images shown, for example you can see how changing preload and stiffness of the suspension will be able to have a better performance. In addition to this you can see that the solution found allows a better corner speed, while it is less effective in the exit from the corners. Then the software will not only show the lap time, but allows more detailed analysis of each set-up.



DETERMINATION OF THE SUSPENSION SET-UP WITH RIDERS OF DIFFERENT WEIGHT and HEIGHT

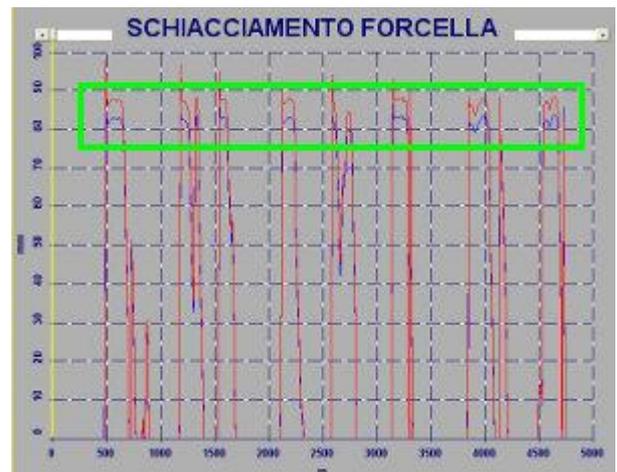
When you have riders of different weight and height inevitably changes the dynamic behavior of the motorcycle, so it is necessary to act on the suspension to immediately find the same balance. Thanks to the software all this can be done very quickly.

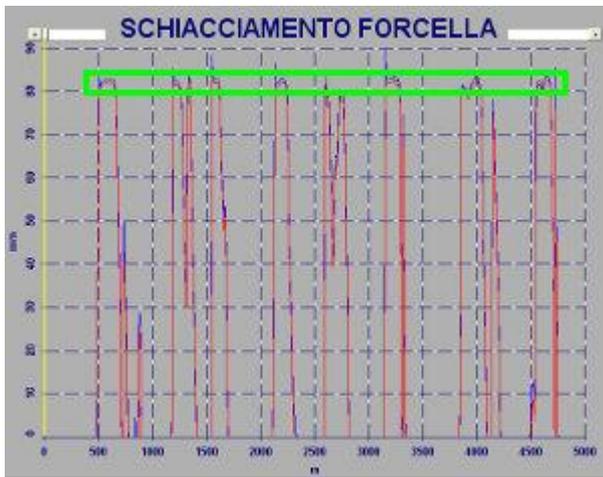


If for example, we've found a good set-up with a rider and we want to initially adapt this to a rider with different weight and height, thanks to the software doing a simulation with the new rider data we can see how changes the behavior of the suspension.

carico forcella [N]	91	2648	91	2554
coppia forcellone [Nm]	454	1412	443	1403

We see that especially as regards the fork the loads change much and consequently the travel of the fork and consequently the balance of the bike. Thanks to the software we can find fastly the preload and the damping settings that allow to regain the same behavior of the fork.





	min	sec	ms
LAP TIME	1	58	985
	1	59	050

As you see from the graphs we've found immediately the set-up that allows you to have the same balance and you can go on track already with a set-up improvement and suited to the physical characteristics of the other driver.

DETERMINATION OF THE SUSPENSION SET-UP WITH DIFFERENT CONDITIONS OF GRIP

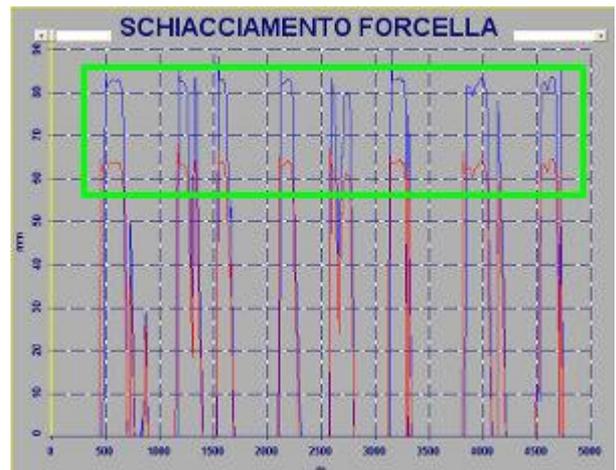
Sometimes can happen that the grip conditions change appreciably before entering on the track and you have not then references. Thanks to the software you can simulate in advance the new conditions and then quickly find the most suitable suspension settings.

If for example a bit of rain has made wet the track, is sufficient simulate with the software a grip decrease and to see what happens to the loads and to the behavior of the suspensions.



carico forcella [N]	320	2191	91	2554
coppia forcellone [Nm]	537	1263	443	1403

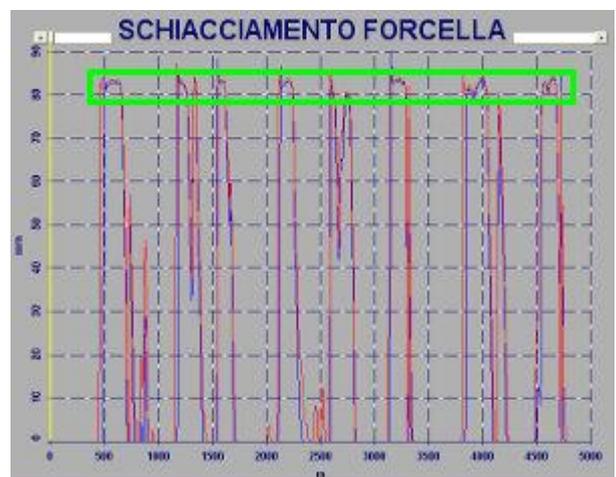
At this point, thanks to the software you can quickly find the optimal set-up of stiffness, preload and damping in order to regain the optimal balance of the bike.



massa ruota [Kg]	14
rigidezza molla [N/m]	17800
precarico molla [N]	1000
damping comp [Ns/m]	550
damping ext [Ns/m]	1100

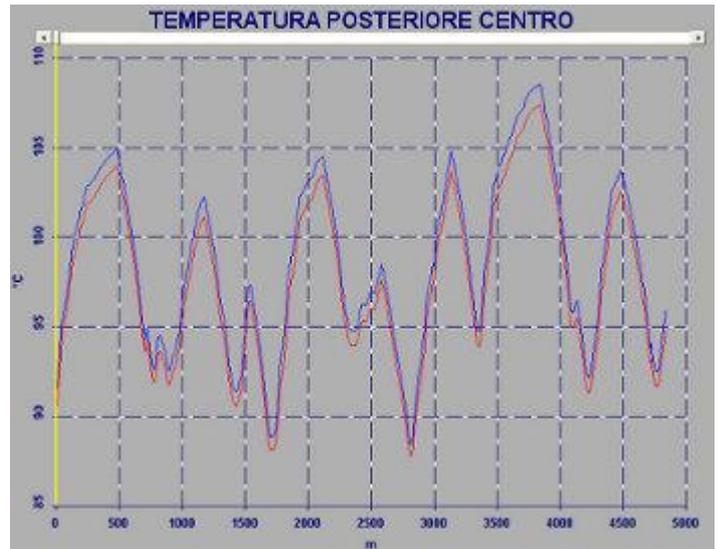
	650
	500
	1000

	min	sec	ms
LAP TIME	2	10	254
	2	10	464



ANALISYS OF THE TYRES TEMPERATURE GOMME WITH DIFFERENT CHOICES OF SET-UP

One of the most frequent problems that you encounter on the track is the achievement and maintenance of the optimum tire temperatures, thanks to the software is possible to see with the different choices of set-up how changes the temperature of the tires and then make the choice also in function of eventuals tire temperature problems.



SET-UP BIKE

As you have seen from the calculations that are made and from the examples of use the software **SET-UP Bike** is extremely useful in many situations and allows you to integrate the data that you can acquire on track with preventive information that will allow you to reach the **best performance in a time shorter!**

The use is extremely simple for a **full-scale operations, both in the workshop, both on the track.**

The results that are calculated can be **useful, both to technicians in the development of the motorcycle, both to the technicians and the mechanics for the fine tuning on the track, both to the riders and that compare their feelings and their driving with that of the virtual rider to correct eventual errors or provide more precise indications at the technicians.**

SET-UP Bike is therefore an indispensable instrument in the racing team to have a 360° technical help !!!