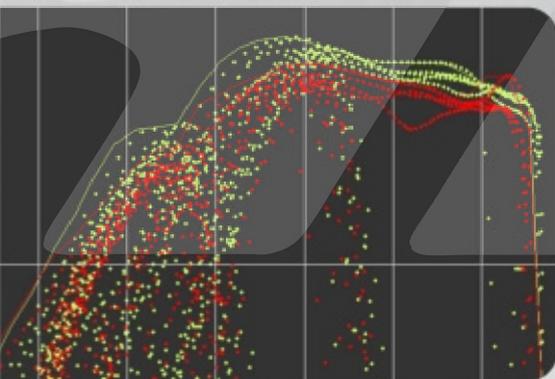
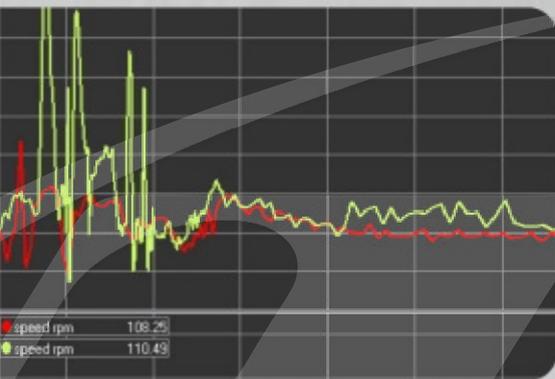




Racing Data Power

Brake PRESSURE SENSOR

A REVOLUTION IN YOUR KART TECHNICAL ANALYSIS ON-TRACK SESSIONS



Brake pressure sensor:
a braking efficiency measurement
based upon objective data.
A useful integration of driver
feedback.

Date: 15 March 2008

Track: Lonato (BS, Italy)

Kart: Birel IAME ICA100

Instrumentation:

MyChron4 + GPS + eBox Extreme
with brake pressure sensor

DYNAMIC ANALYSIS

RELEASE 1.00



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Introduction

This track session has been done using a Birel IAME ICA100 2007 chassis, on which different configurations have been tested looking for a setup that provides better overall cornering capabilities for the kart. Of course these modifications involved the braking efficiency as well, a key aspect of the vehicle tuning, which is quite difficult to evaluate using objective data not based upon the driver feedback.

1 – Loggers: MyChron4 + GPS + eBox Extreme + 0-2000 PSI Brake pressure sensor

This test was performed using the following data acquisition network: **MyChron4**, connected through the CAN bus to **GPS Module** and **eBox Extreme** expansion box for analog and digital inputs. This network configuration provides the user with all necessary parameters for a cross comparison of the figures and allows a data analysis consistent with the actual behavior of the kart.

2 – Track

The test was performed at the Lonato circuit in northern Italy. Track surface was very rubberized with dry weather conditions and 15°C (59° F) ambient air temperature.

3 – Chassis analysis

The test has been focused on braking analysis. More specifically, it focuses on the course of the braking strength and its effect on chassis conditions, comparing the deceleration obtained with the plant working pressure.

Axle, hub and bearing modifications are the most typical intervention aimed to modify the effects on braking. One then must factor in track surface conditions as well as temperatures and tire use.

Using **Race Studio Analysis** x-y graph, we are setting pressure measured on the braking plant on the X-axis and GPS longitudinal acceleration on the Y-axis.

In addition to the scatter plot, envelop lines have been superimposed to make the visualisation of the distribution of the dots on x-y plane easier.

As far as brake analysis is concerned, the interesting thing to note is what appears in the lower part of the graph where negative accelerations that the kart is subject to because of the braking effect are reported.

Starting from the right part of the graph it is possible to see peaks represented by isolated points. These points highlight the less effective transients of the braking. Even though the brake is strongly pressed, the pressure peak of the braking plant does not correspond to an equally important deceleration. In two of the three analysed cases, plant pressure appreciably passes 45 bar pressure corresponding to a deceleration of only 0.2-0.3G. These are the first phases of the hard braking. Wheels locking prevents the power from

becoming braking force, and much of this power is absorbed by tires sliding on the asphalt. This condition applies more to the light blue and red tests in the figure below.

The most interesting part of the graph is the lower portion as stated before. In effect the more the scattering goes to low acceleration values the more the braking comes out to be effective. Looking to the red colored test we can appreciate that it envelopes a wider area with the presence of a plethora of points in the middle and in the lower part, corresponding to greater deceleration, showing that the braking force is more effective.

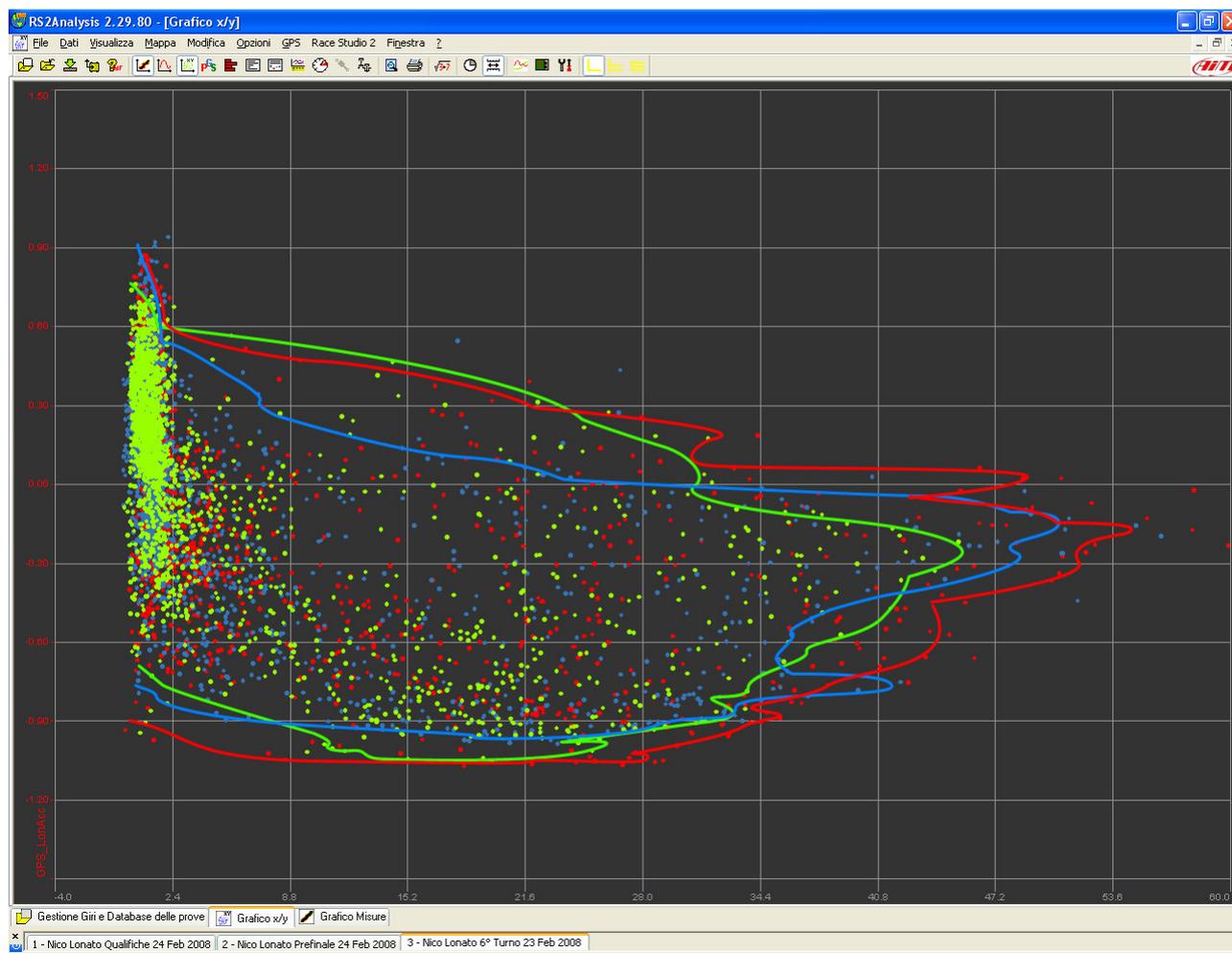


Figure 1

To be more clear we are going to analyze only one line and to evaluate the same three tests basing the analysis on **Figure 2**.

The set of points draws a real graph that, contrary to the scattering, allows us to identify, moment by moment, the registered values concerning each phase. In this particular line the test in blue highlights a course that is not very likely to be regulated and it is rather ineffective. The deceleration values are not so different from the other two graphs but the double peak highlights the fact that the driver had to press and release the brake in the central phase of the braking. In the ending phases, on the contrary, as soon as pressure goes under 15 bar, braking action diminishes very quickly as a confirmation of the low adjustability.

The test in green shows a higher chassis efficiency during braking. In fact, the power used on the brake is less, and the deceleration values are the same as they are for the other

tests, with peaks lower than 40 bar. In this case too, nevertheless, the racer had to reapply pressure to the brake pedal toward the end the braking zone. This behavior comes out in all the other laps too and can be due to driving style as well as to the tunings made on the kart. This is something that appears in any situation where the racer faces a hard braking with this kind of setup.

Considering the last case (the red one in the graphs) it seems that under braking the racer can better manage the adjustability of the foot brake pedal. After an initial pressure the pedal is slowly released and GPS data shows that an immediate deceleration follows. In this specific corner there is not a great deceleration but the action on the pedal seems to be less nervous, very linear and adjustable. This happens in a lot of hard braking, as can be verified through the graph in **Figure 1**.

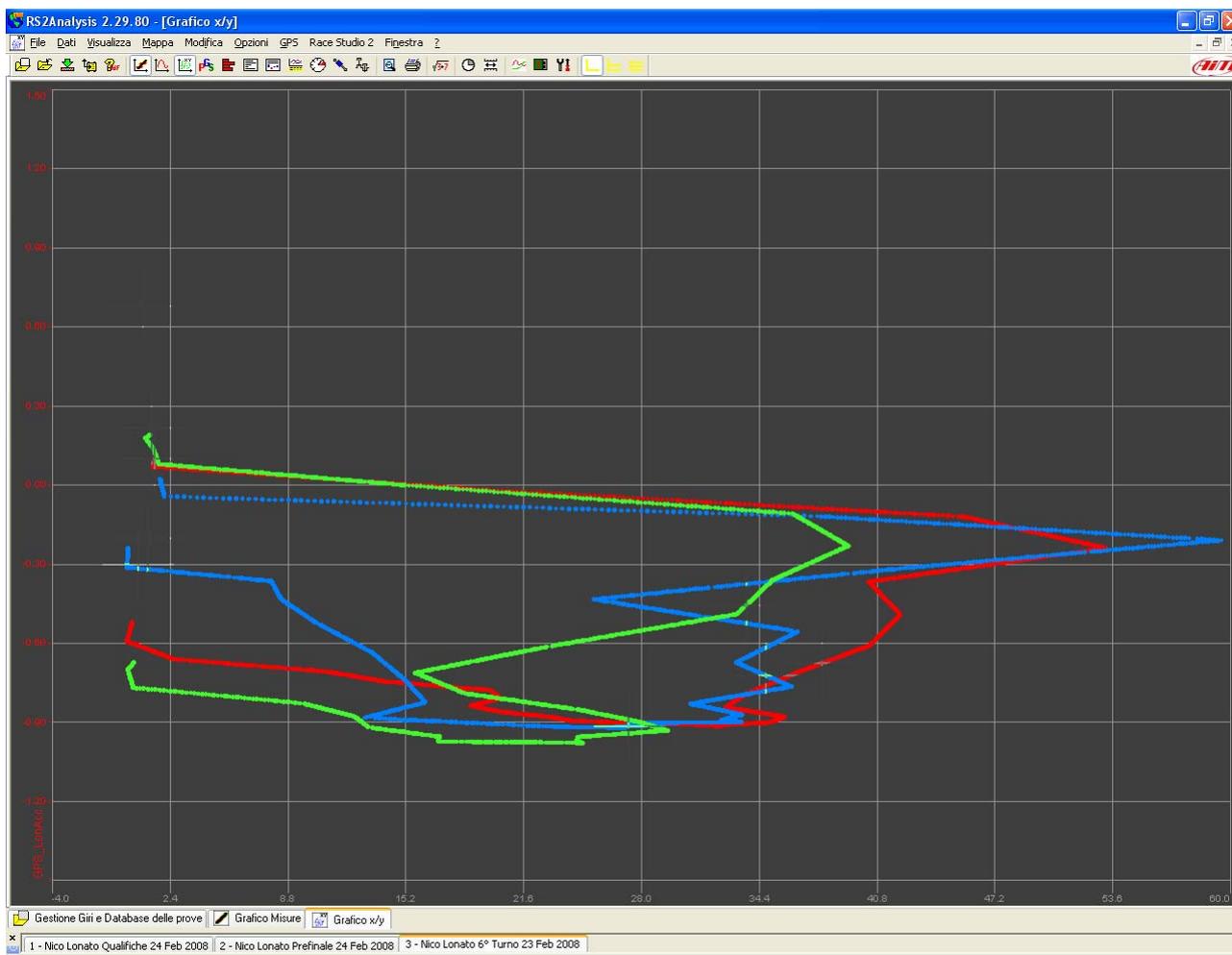


Figure 2

Data analysis cannot focus, of course, on only one corner: so we use the distribution of the points on the x-y graph to have a wider view of the behavior of the kart over the entire track and on more laps of each session.

The last graph (Figure 3) shows again the same hard braking where longitudinal acceleration and brake pressure are plotted versus distance. By doing this it is possible to see point by point the actions of the racer and the subsequent effects. Hard braking point of the green graph is 6 meters later if compared to the other two tests. The most interesting thing is to see how the conclusion of the braking is not so different from the tests in red and in blue. The final result, however, is that braking distance is reduced by 6

meters, reaching a greater deceleration peak with respect to the other two tests, and with a lower working pressure.

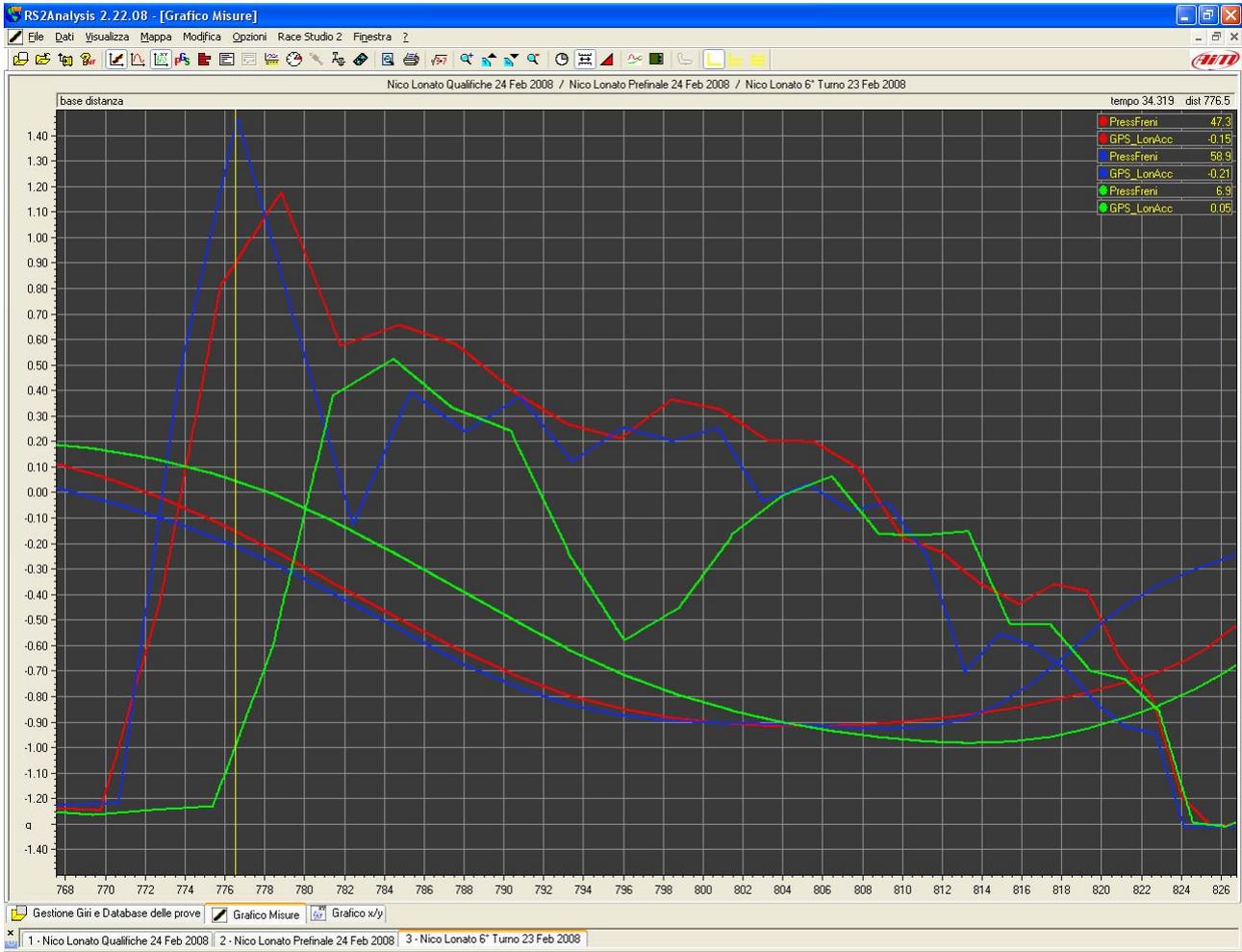


Figure 3

4 – Conclusion

The brake pressure sensor allows us to highlight the less perceivable aspects of the braking phases. Analysing data sampled through this sensor makes it possible to make some objective considerations on braking space, pedal adjustability, the racer's driving style, and on the reactions of the chassis to brake set up changes.



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