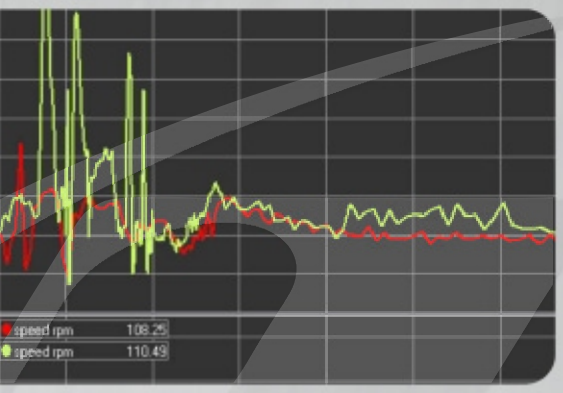
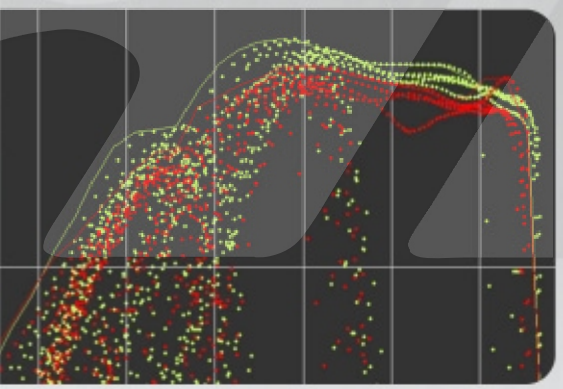
Racing Data Power

LCU-ONE CAN

FULL CONTROL OF YOUR ENGINE

ON-TRACK SESSIONS





Accurate monitoring of your kart carburetor: how to gain more than half of a second thanks to LCU-ONE Lambda controller

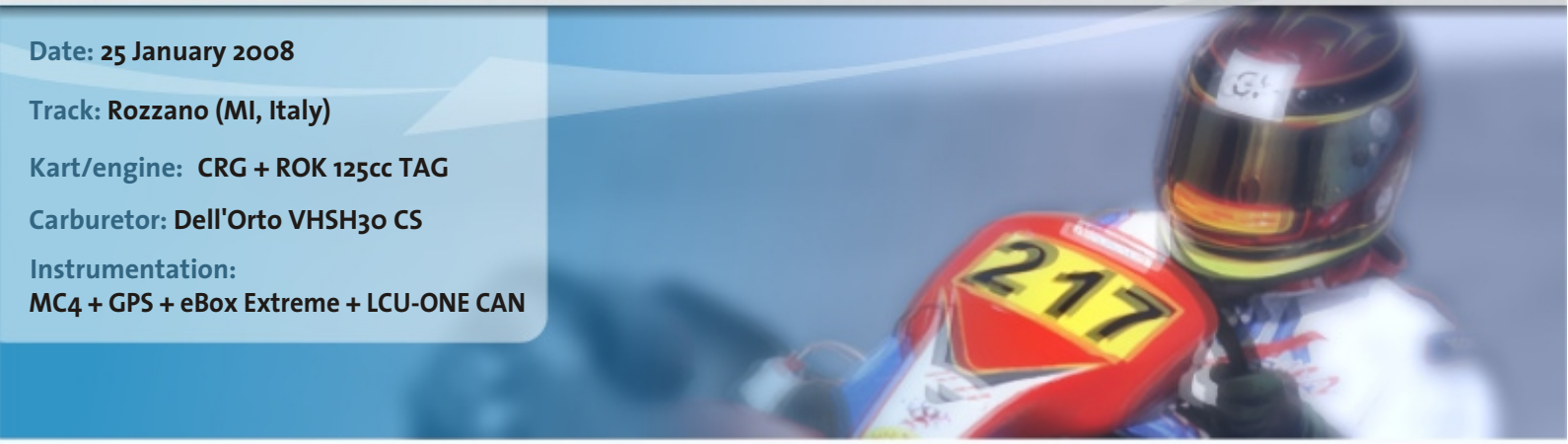
Date: 25 January 2008

Track: Rozzano (MI, Italy)

Kart/engine: CRG + ROK 125cc TAG

Carburetor: Dell'Orto VHSH30 CS

Instrumentation:
MC4 + GPS + eBox Extreme + LCU-ONE CAN



ENGINE ANALYSIS

INTRODUCTION:

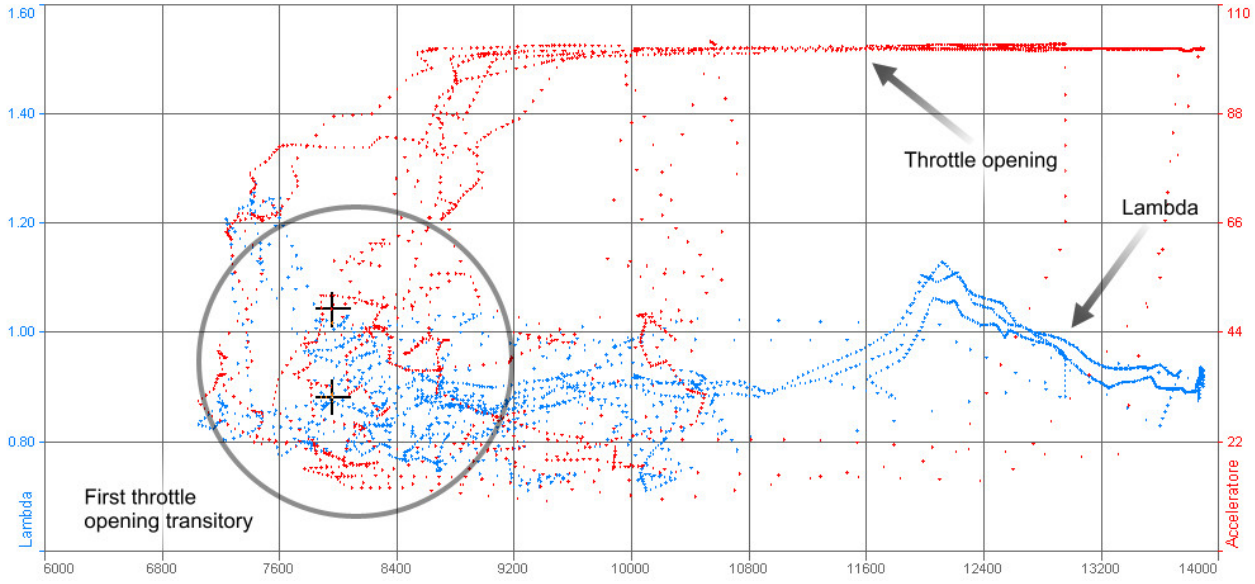
This test has been made with Dell'Orto company staff with the aim of getting, together with data supplied by LCU-ONE CAN, an optimal carburetion with all RPM values.
In this test, exhaust throttle temperature sensor has not been used because of ROK 125 cc engine has a minimal transit of unburned mixture, due to scavenge phase, that would change Lambda probe readings giving a false lean mixture value due to left oxygen.

TEST:

The test started with a basic carburetion optimized following the driver experience.
Start up configuration was:

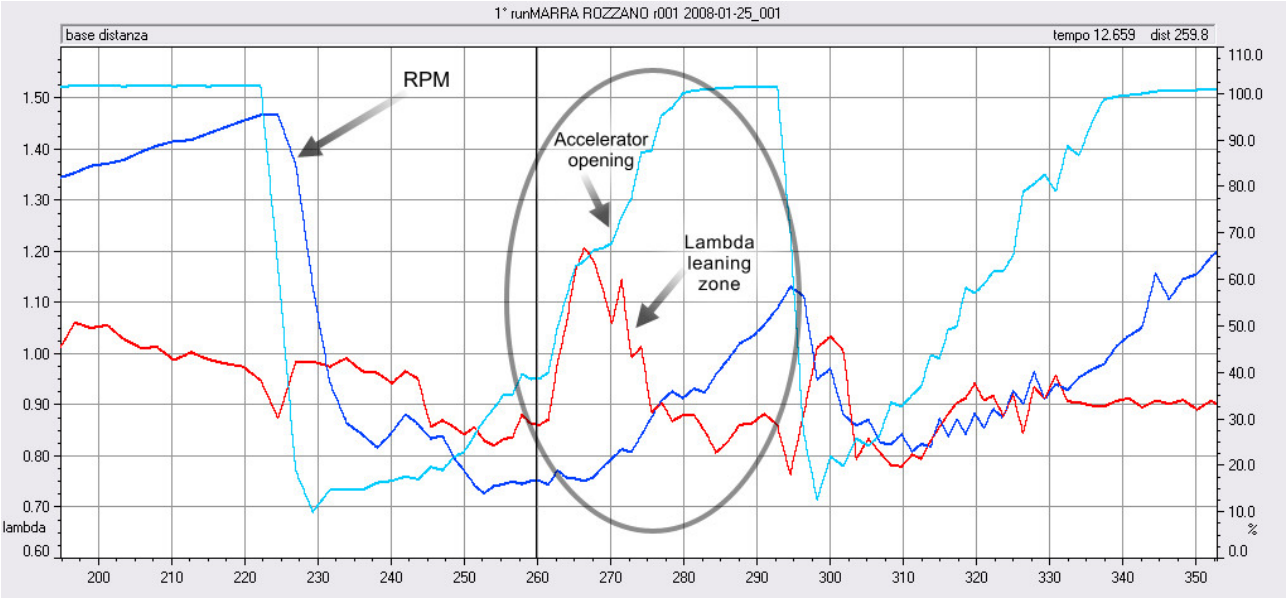
Carburetor Dell'Orto VHSH 30 CS
40 Throttle valve
Atomizer DP 266
Idle jet 60
Main jet152
Minimum sprayer 51
Needle K28 at the 3rd notch
Floating weight 4 grams

With this tuning the driver made some laps with a lap time of 34.490 and Lambda values course plotted together with TPS channel (carburetor throttle opening) is:

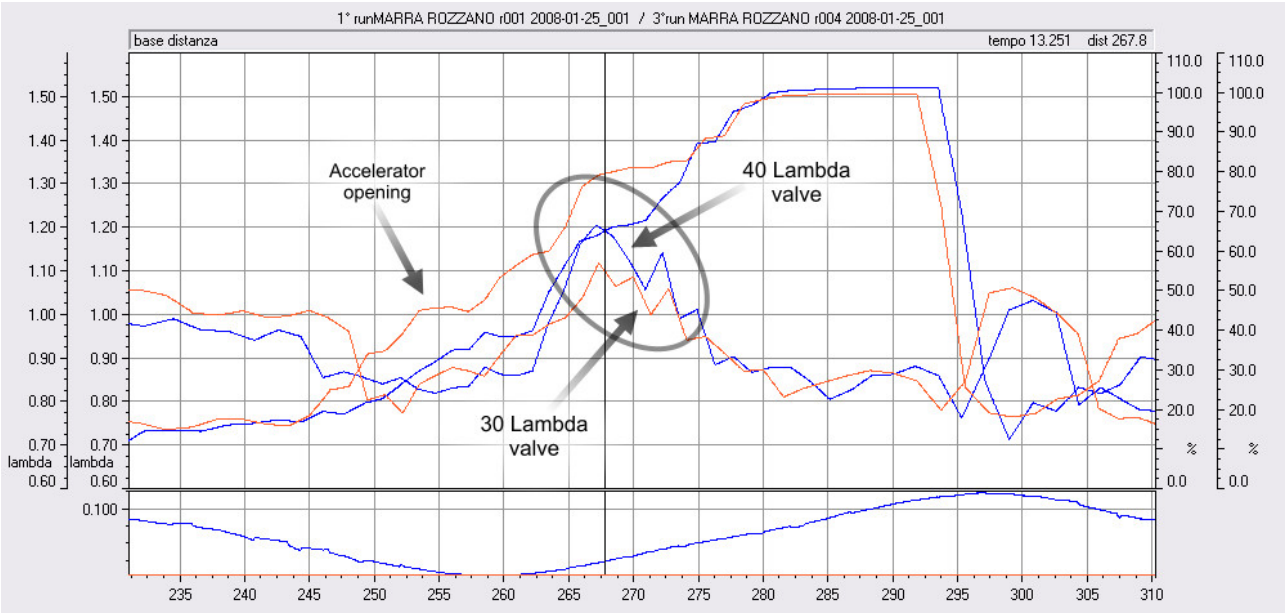


Accelerator value until a 100% value is red coloured while Lambda course on RPM value is blue coloured.
You can observe that in correspondence of the opening transitory values (highlighted zone) the engine makes carburetion jumps.

This anomaly can be evidenced with the plot versus distance diagram.
In fact:

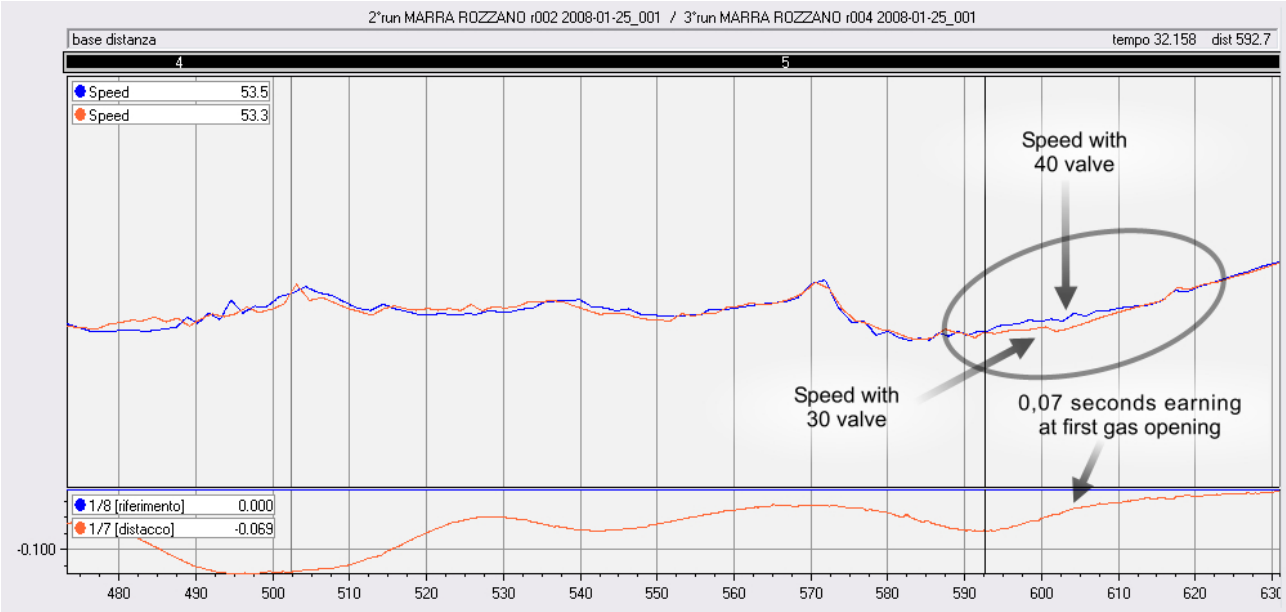


In red is shown Lambda course, in light blue TPS course and in dark blue RPM course.
We would point out how, in the highlighted zone (throttle opening phase), Lambda course has some peaks upwards due to engine leaning.
To reduce the problem a tuning on throttle valve has been made: a 30 throttle valve has been mounted. This valve, causing a flow speed growth in the carburetor Venturi, leads to an enrichment in the first opening phase.
These modifications led to a diminishing of the engine leaning in the first opening phase, as shown in the figure below:

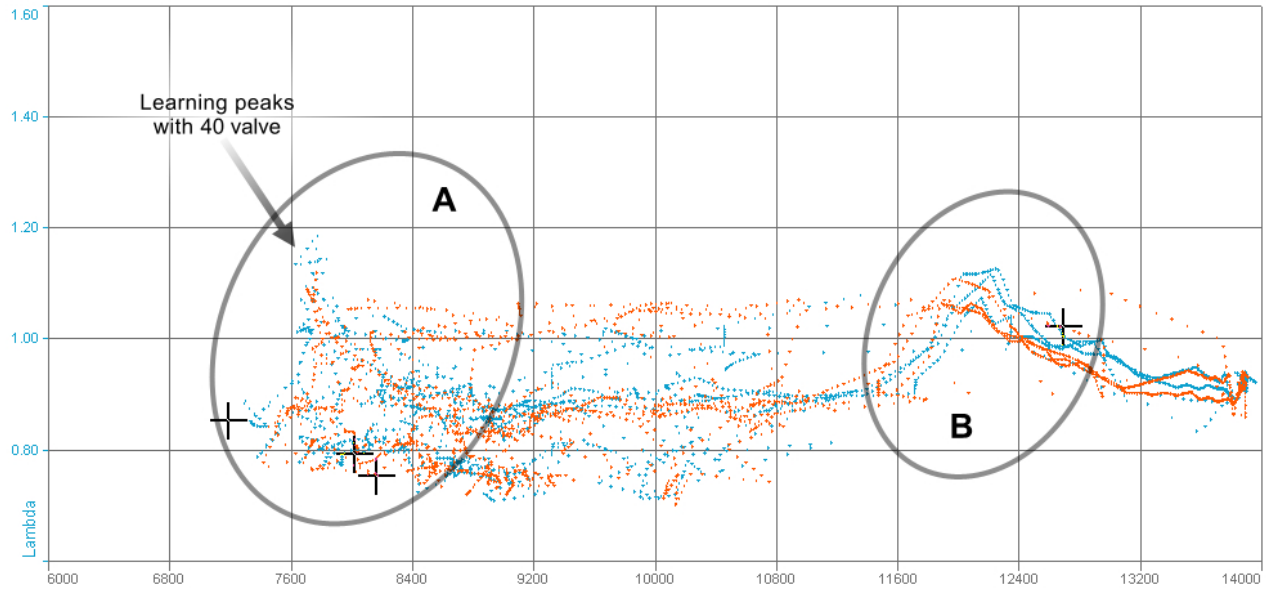


In orange you can notice throttle opening and Lambda with 30 valve graphs while in light blue you can see the same graphs with 40 valve.
In correspondence of the vertical slide you can see how Lambda graph is lower with 30 valve than with 40 valve and consequently the mixture is less leaned.
In chronometric terms this led to a slightly better lap time 34,480 sec.

The chronometric detection shows a scarce difference but this explains with the track changed characteristics.
In reality analyzing only the first opening phase on the corner that takes on the straight, the kart earned about one-tenth of a second. In the zone highlighted below you can notice how – despite red cornering speed is lower than blue one – after 50 metres the two speeds matches. This indicate a better acceleration of the vehicle with a 30 valve.

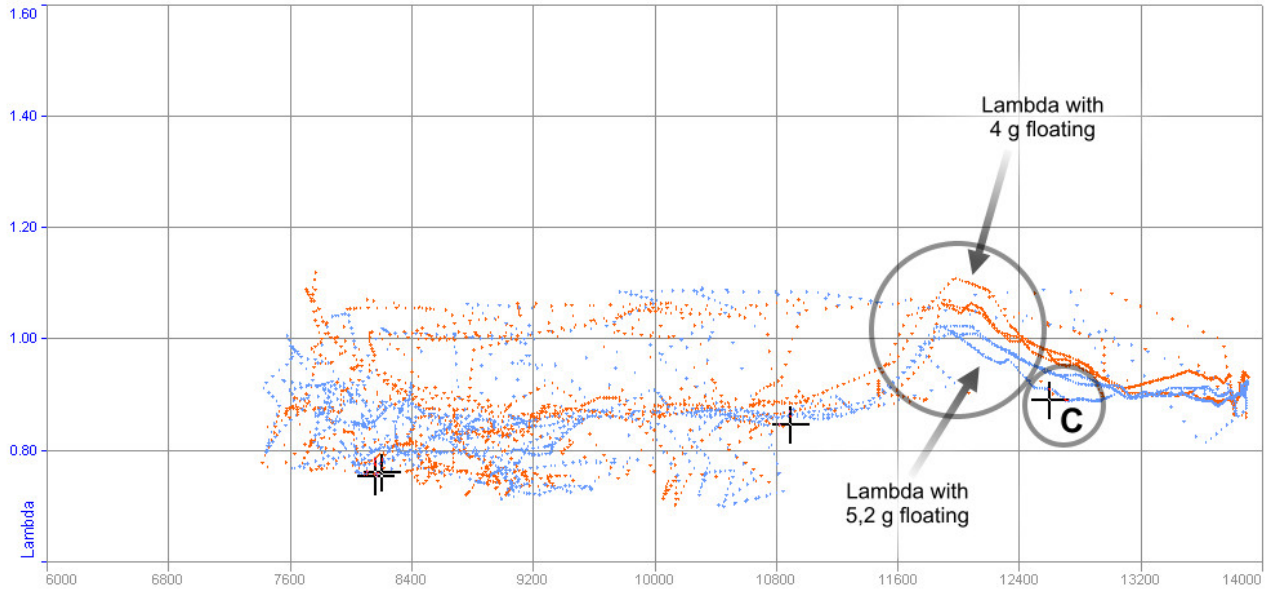


XY Lambda diagrams with 30 valve (orange) and with 40 valve (light blue) are:



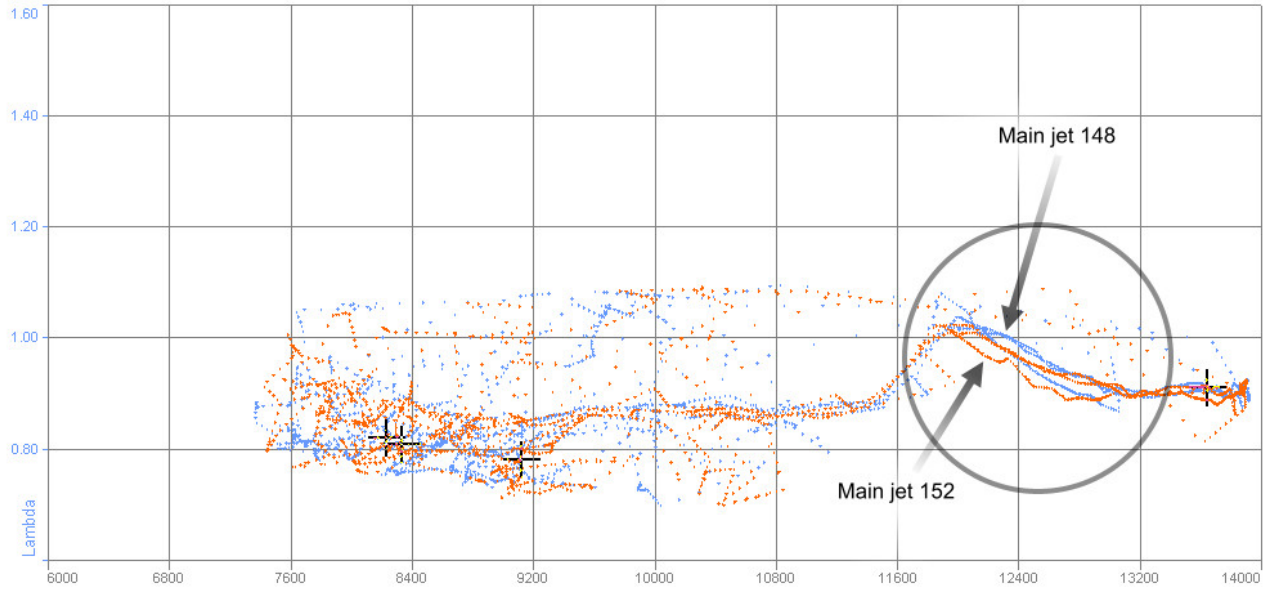
You can notice how in the highlighted zone there are no more engine leaning peaks.
We still have to arrange the corner labelled as “B”, around 12.000 RPM, that shows a peak in 100% throttle opening zone.

To make this tuning we choose to mount a floating weighting 5,2, substituting that weighting 4 g.
This way the entire corner enriches at full throttle.
In fact:



It's clear how the light blue corner (5,2 g floating) is all displaced downward (richer) with a diminishing of the peak at 12.000 RPM if compared with the orange corner with 4 g floating.
Now Lambda value course of the engine is more flat but too rich in point C and we have to lean with maximum jet.
We decide a diminishing of 4 points of main jet taking it form 152 to 148.

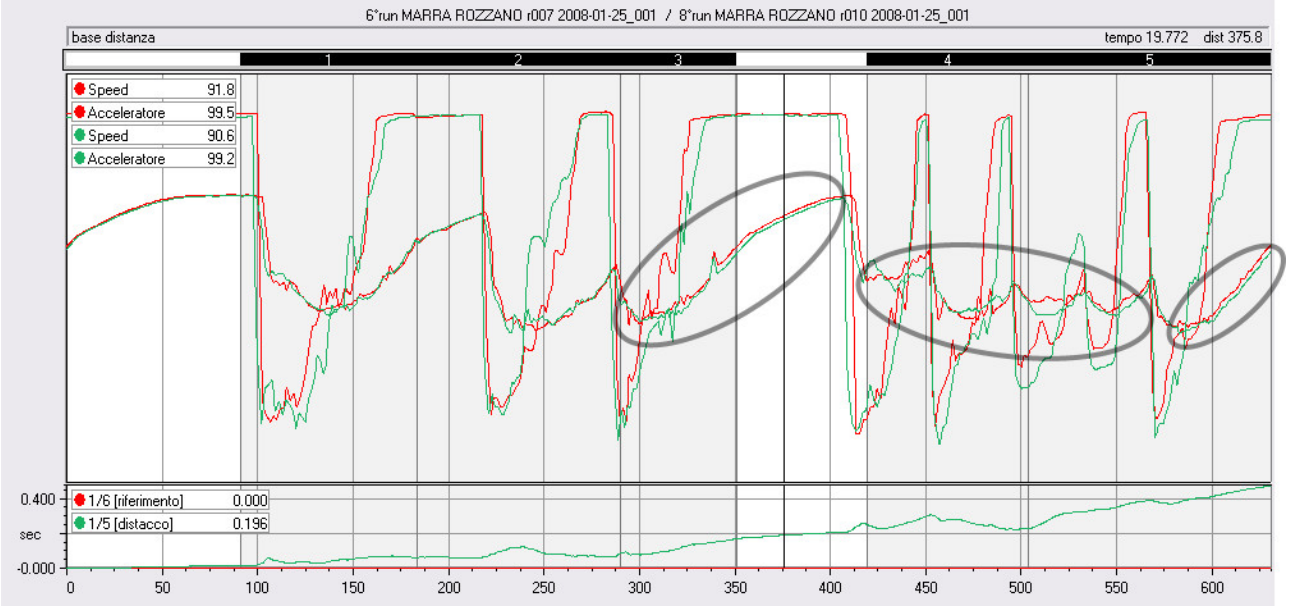
This way we obtain a curve like the one showed below:



In light blue you can observe Lambda with 148 max jet values course while in orange Lambda with 152 max jet.
The light blue line is higher in high RPM values zone and the engine is thereby less rich.
With this configuration lap time decreased at 34,400 sec.
To compare the work we made on the carburetion we mounted a Dell'Orto VHSH 30 carburetor with the manufacturer default calibration for ROK 125cc engine.
Default calibration:

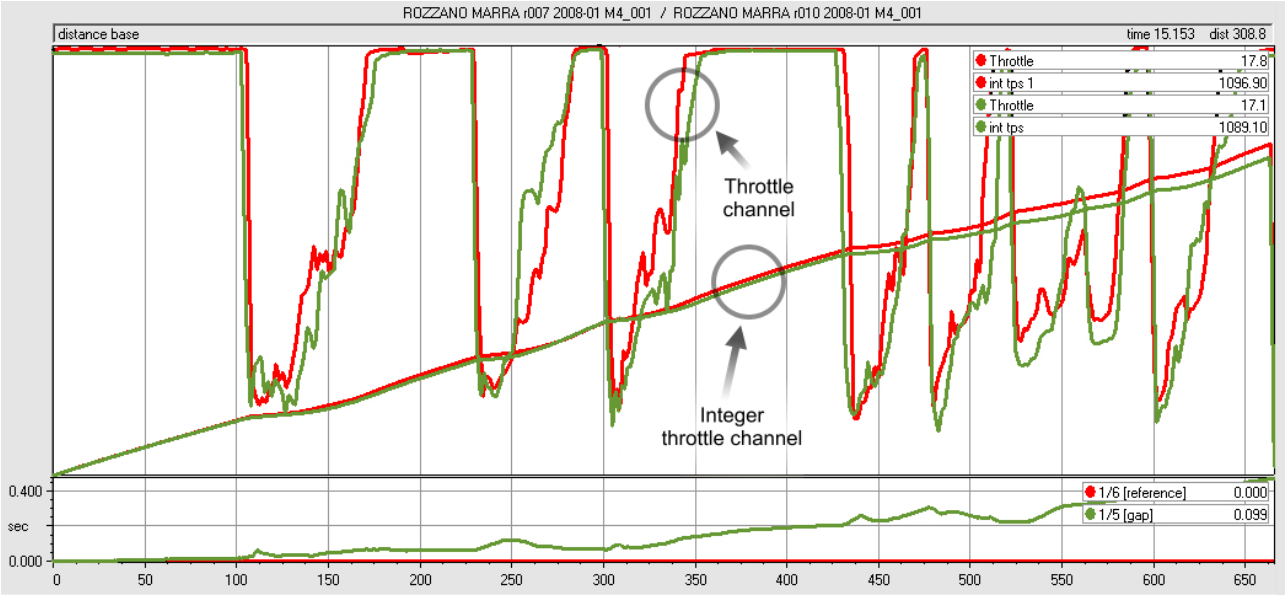
Idle jet 45
Main jet 160
Atomiser DP 264
Throttle valve 40
Needle K28
Floating 4 g

Kart performance is strongly penalised.
In fact as you can see in the figure below:



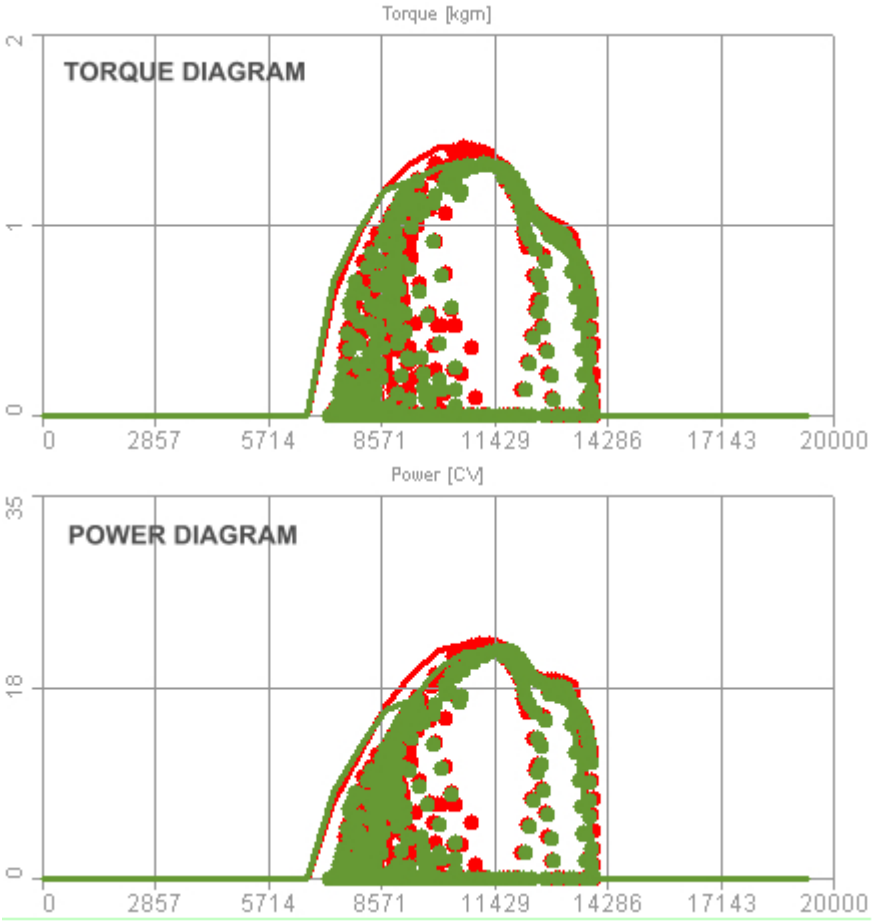
In red is shown speed and TPS course with the optimal carburetion, while in green are shown the same channels with standard carburetion.
Please note: speed red line is constantly up the green one in the straight (see tagged circles).
This indicates a better engine performance, confirmed also by lap time.
In fact lap time passed from 34,400 sec to 34,920 sec.
More than half of a second difference!

A short specification of the graph shown above is now needed.
Analysing TPS graph you can notice how throttle opening rate during transient between 0% and 100% differs between the two shown laps (34.400 sec and 34.920 sec).
In effect the graphs have different courses.
Creating the math channel that computes the integral of throttle channel (subtended area of the graph) you can notice that:



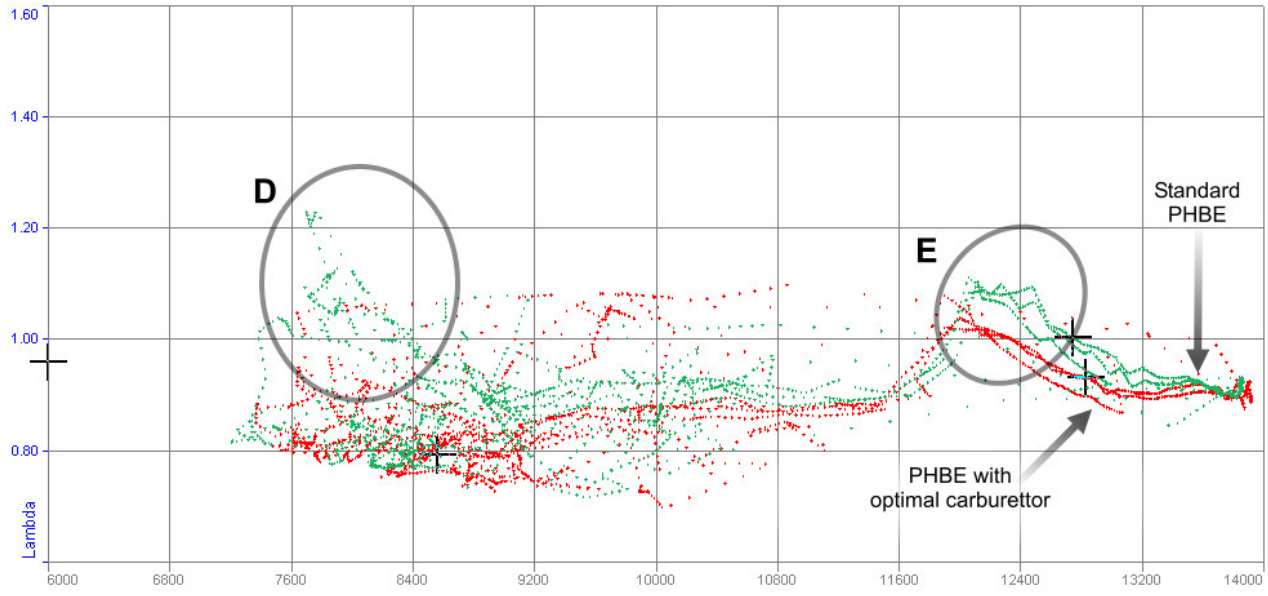
- in the first 300 metres the driver keeps the throttle 6‰ more opened (in practice they are identical) in favour of the slower lap (34.920) and he obtains anyway 0,1 seconds advantage.
- from 300 to 520 metres the faster lap has the throttle 4,2 % more open but the advantage in terms of time increases only until 0.23 sec.
- from 520 to 660 metres the slower lap has the throttle 0,3 % more open. Despite this, in this part of the track the faster lap earns more in absolute terms: 0,3 sec. At the end time difference comes up to be half of a second.

In the part of the track 300-520 metres, faster lap earns less if compared to slower one despite the gas is in percentage more open.
In the part of the track where the faster lap has less time percentage of throttle opening the driver earns more.
This demonstrates that the gain depends on a better carburation that allows us to obtain more power with partial throttle opening.
This is easily expectable if we give a look to torque and power curve:



The red curve refers to the engine well carburetted while the green one refers to the engine with default carburetion supplied buy the manufacturer: please notice how a well done carburettor calibration leads to power gain.
Naturally the manufacturer creates a maximum calibration for VHSH 30 carburettor that fits almost any track in any weather condition.

Plotting Lambda value versus RPM we obtain:



In red optimal carburetion course while in green stock carburetion one.
Please note how in point D, first throttle opening transitory, the standard carburetor leans the engine, as well as the peak in point E of the stock calibration is higher and the engine is thereby less rich.
In this test we did not use exhaust throttle temperature sensor because of with ROK 125 cc engine there is a minimum unburned mixture passage in the exhaust throttle due to the scavenge phase, that would change the Lambda probe reading giving a false lean mixture reading due to left oxygen.

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