

driver analysis through data comparison

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Driver comparison through data analysis

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BSC MOTORSPORT ENGINEERING YEAR 3

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1.0 INTRODUCTION

Data analysis is a key aspect to the motorsport industry, it is the only form of raw data from driver and a vehicle combined. This data can help a driver improve but also tell the team of engineers whether the vehicle is acting and driving the way it should be. Drivers don't always like being told and sometimes it is not easy to tell a driver that he is doing something wrong, but by doing it in the correct manor and having data and graphs to show this can all be made easier. Three drivers have been chosen all on different capabilities, two sessions will be run the first being a one-and-a-half-hour session to get as much raw data as possible and the second session following with various improvements made. By the use of the MOTEC software each driver will be analysed and points picked out.

2.0 LITERATURE REVIEW

Driver analysis can be used to look into many different aspects, it can tell whether a driver is lacking in a section and losing speed or if the car is not set up properly and not performing as it should. Drivers do not always take criticism greatly even though if well intended and tactically presented feedback is given it can help massively (Fey, 1993)

Data loggers work by capturing, storing and displaying various data sets, each part of data represents what is happening to the car. Most systems use a unit which once is turned on uses an internal clock to tell the on-board microprocessor to read a value from each sensor in turn, and to write this into the memory, the microprocessor has the ability to read a wide range of input information, this works at high levels of speed and with a high degree of precision. (templeman, 2008)

There are four main categories that are used when looking into the data from the vehicle

- Throttle application
 - Braking
 - Cornering technique
 - Gear shifting
- (Fey, 1993)

3.0 METHODOLOGY

The test session was started using the simulator using an Aston Martin GP2 car and the track was Brands Hatch GP. This course was chosen as it had various different corners and none of the drivers had past experience from the track so it was easy to see where each driver was lacking.

The first session started off in the simulator where three drivers were allocated, Josh (DRIVER A), Tim (DRIVER B) and Dan (DRIVER C). A time slot of one and a half hours was given to run an efficient test session. The main aim was to give each driver as many laps as possible to gather various data and to set their best laps.

Driver A (Josh) had used a simulator in the past so we would expect to see him pick things up fairly quick. Whereas Driver B (Tim) has a vast amount of experience driving vehicles on track and also simulator which would suggest he will have the most consistent driving. Driver C (Dan) had no past experience from driving on either track or simulator so there is three very different drivers to compare data from.

Starting off, a four minute warm up lap was given to each driver to get to grips of the vehicle and also get use to the track. Once this duration was over, a 25-minute timer was started for the drivers to test their abilities. This session was used to purely obtain raw data from each driver so there is a base line to analyse through MOTEC software. Each team member took a role as one of the computers monitoring different data sets making sure that the data obtained was equitable.

Session 2

With a meeting prior to the session to analyse the various drivers, the team met and went through each data set using the MOTEC software. The key point for this was to pick out different improvements that can be fed back to the drivers while going through the next session to try improve the time but also help them take better driving lines, braking improvements and just being able to control the car better. The session was run in a similar way that session one was - each driver had a 4 minute warm up followed by a 20-minute time to do as many laps of the Brands Hatch GP circuit as possible. The reason for dropping the time from 25 to 20 minutes was because the session did not flow very well as time limits were getting breached. This gave the team a bit of room for error in case anything was to happen. Driver A started first followed by Driver B Then Driver C, as Driver C.

4.0 DATA ANALYSIS

Test Session 1

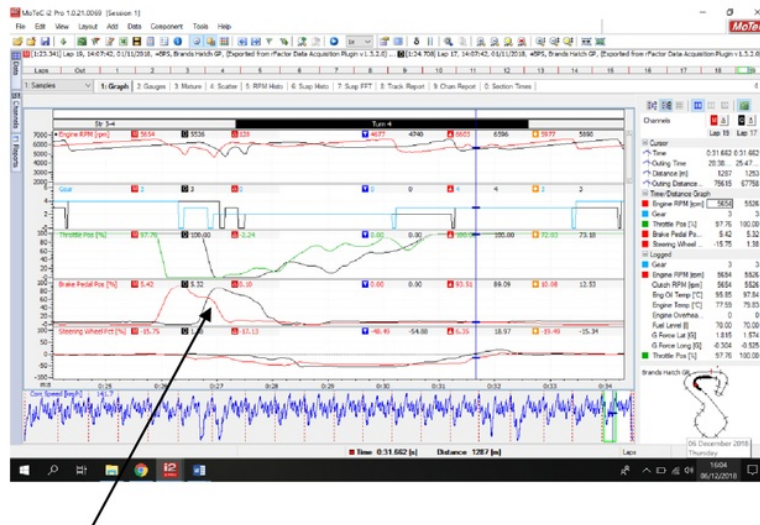
From analysing various data from the Motec software, the fastest lap time of this session was Driver A. All drivers had various different driving methods and styles.

4.1 Driver A (Josh)

First the positives :-

- Reaches 100% throttle quickly and consistently
- Fastest Lap was when his braking was much earlier than other laps but still the same duration (Please see Fig.01 Below)
- Uses all of the rev range through each gear

Fig.01

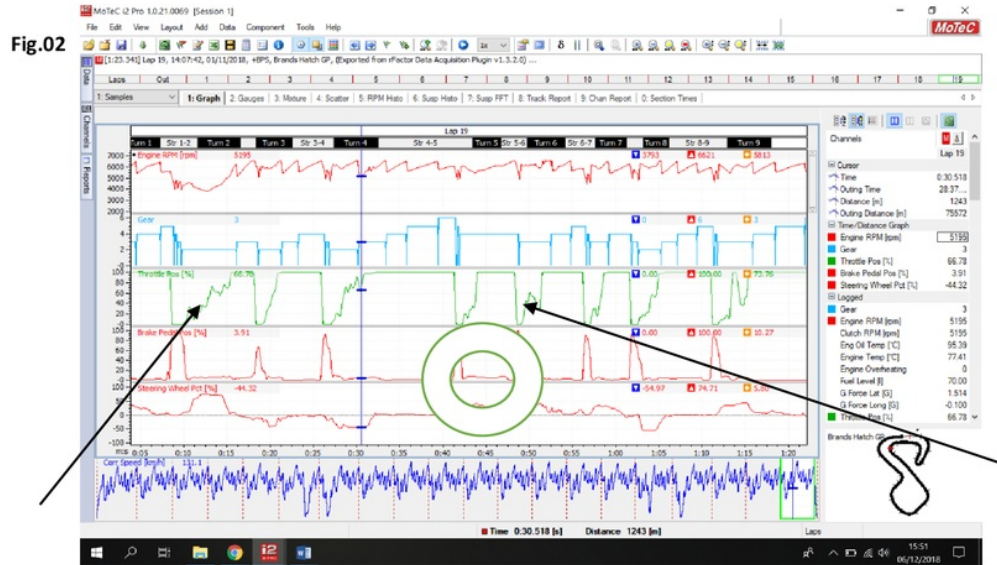


The Arrow above shows two data traces. The red line is lap 19 which was his fastest lap and this could be the main implement of him gaining time. Even though his braking duration is the same, he is clearly braking much earlier. From the group above showing throttle position, Driver A is merging the throttle as he is coming off the brake and no hesitation has occurred.

4.1.1 Driver A

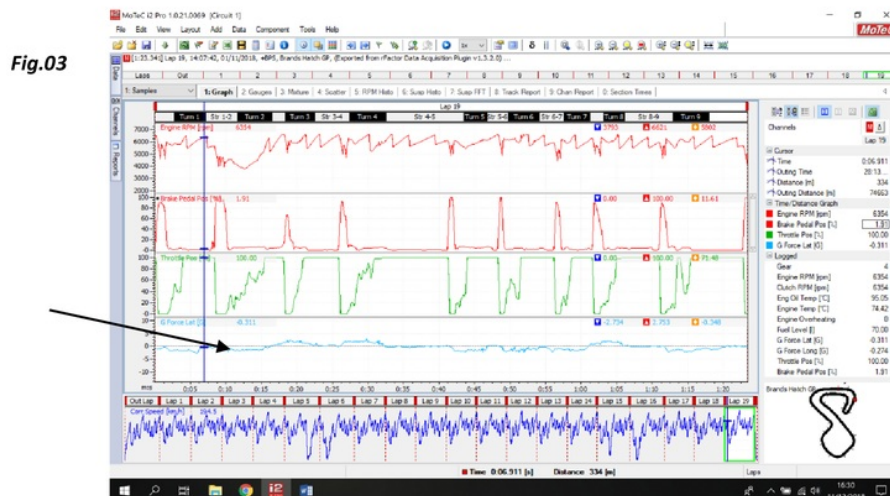
Negatives: -

- Very poor throttle consistency
- Aggressive braking and resting foot on brake throughout laps
- Most the time throttling to early and hesitating which is causing an unbalance on the vehicle



The two arrow above point into the throttle position column for driver an on lap 19 as we can see throughout this lap he is very hesitant with his throttle. It is never a smooth curve and there is many stages where he looses speed by having to correct the vehicle and it will put an in balance across the chassis. We can see this by Fig.03 Below as we see his lateral G effected.

Also as we can see from the circle that throughout the lap he had been resting his foot very marginally on the pedal without realising which would of resulted in him loosing time throughout the course.



4.2 Driver B

Driver B was the most experienced driver out of the three. He has the most driving experience. Because of this his driving consistency and awareness around the track should be much better.

Positives: -

- His merging throttle and brake is very good
- His time between each lap is very consistent
- Second Quickest lap time

As mentioned above as this driver has had the most experience so analysing his positives is not as necessary as they are all very similar and relate back to him having good experience.

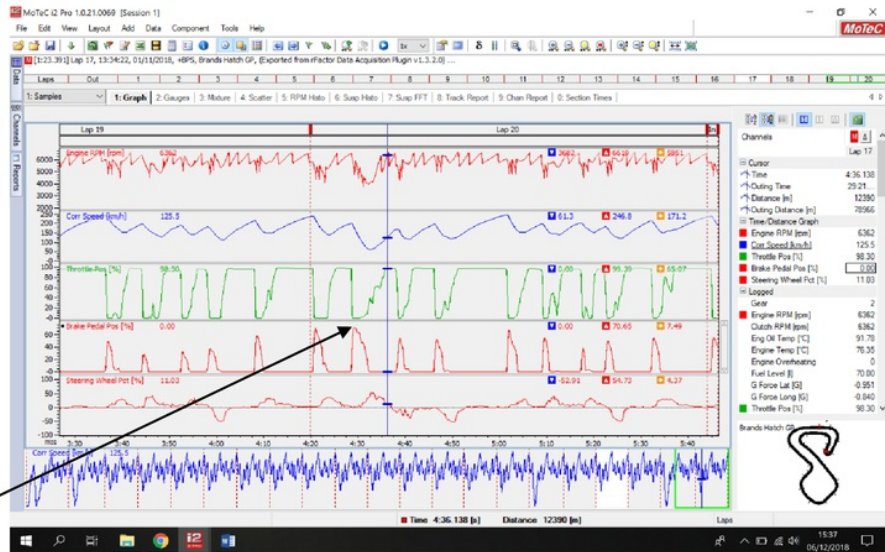
The more important part would be looking at his negatives and to show why he is not gaining on Driver A.

4.2.1 Driver B

Negatives: -

- Braking forces are not always hitting 100%
- Turn 5 hesitation and not getting on the throttle quick enough
- Turn 6 lap 16 he carried too much speed into the corner and as a result of this he understeered as brake too late.

Fig.03



One of the main factors of Driver B's issues is that he is not braking hard enough throughout the track. Referring back to Driver A he was braking much harder but did not have the consistency of what Driver B has, there is no hesitations throughout any point he is either on the brake or off, this is shown the black arrow above. From the second session when feedback is given to driver B I would like to see that after he has an instruction to brake harder his lap time would hopefully be better.

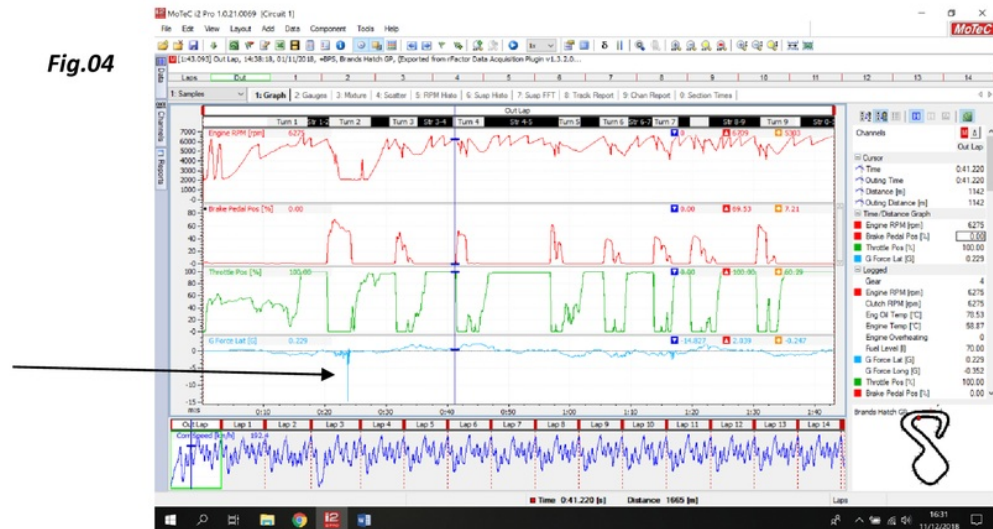
4.3 Driver C

Driver C was the most inexperienced driver of the three as he had not been on the simulator before or even driven on track, as of this his time to start getting consistent lap times within each other will be a lot greater than Driver A and Driver B. It will be nice to see how by analysing his data and giving him feedback of how far he will come on from session 1 to session 2.

Negatives: -

- Not reaching more than 63% braking
- Needs to be using the throttle and the brake together to gain time out of corners
- Not very consistent
- Not making the most of the gears as he is not using the rev range

Fig.04



Above in **Fig.04** Driver 3 Data is shown. When looking into this driver, it is clear to see that he has little experience, his braking efforts show no more percentage than 69.43% this would cause massive issues through out the whole track as when coming into corners driver C is not braking quick enough at all causing him to over steer and spin out as seen in the arrow above showing his lateral G spiking massively.

4.4 Session 2 Driver A

Driver A had the fastest lap time around the circuit again by

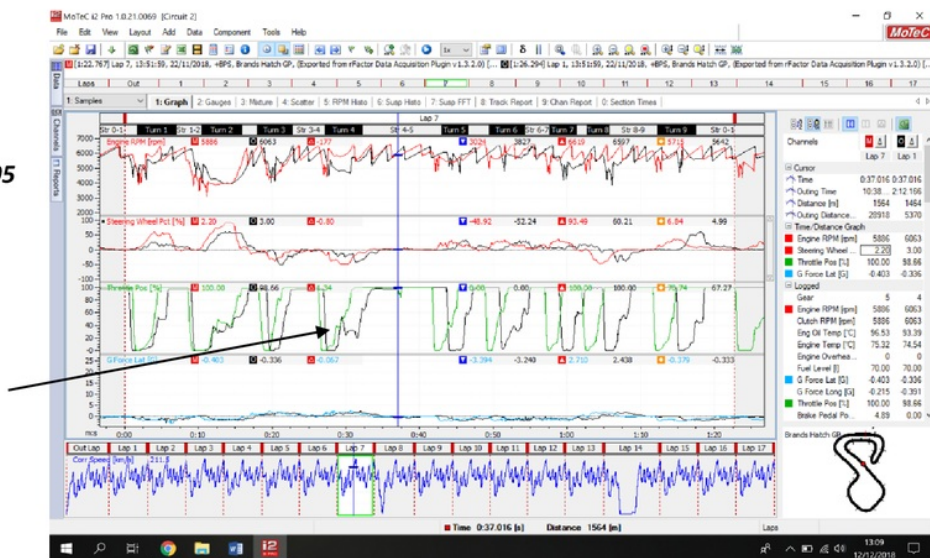
Improvements were given to Driver A taking into account of the various sections of the course that he is loosing time in, from the improvements that will be given his lap time and driving should improve overall.

Improvements given: -

- Turn slower when approaching the turns
- Brake softer and be more consistent
- DO NOT rest foot on pedal
- Merge throttle and brake when coming out of turns
- Smother throttle application

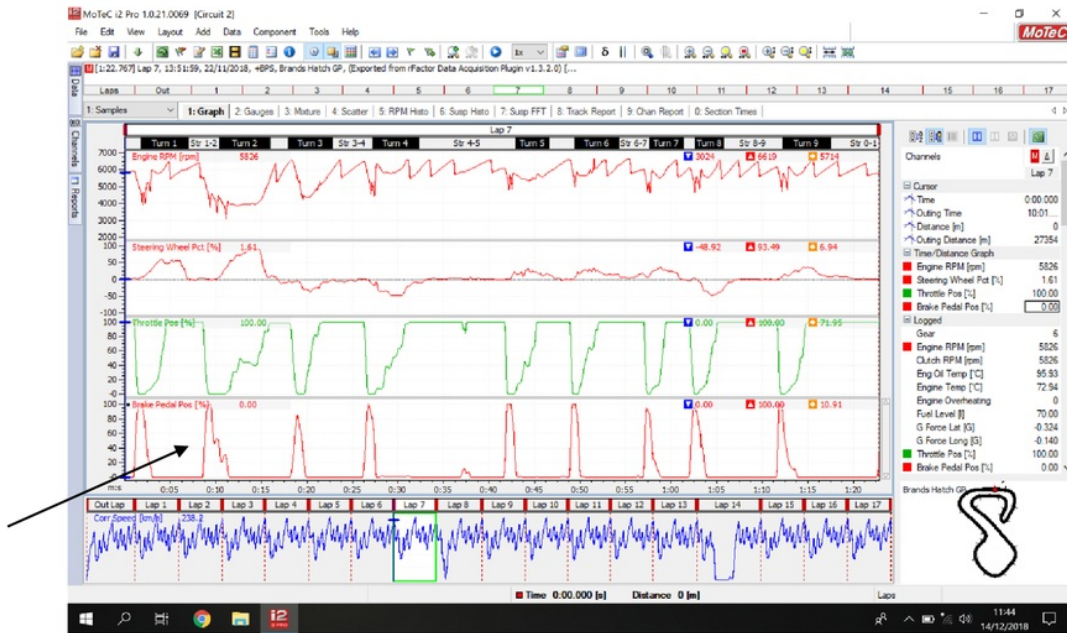
From these improvements above the data was then loaded on to MOTEC for session 2 to be analysed. One of the main improvements Driver A was his overall driving consistency, below in **Fig.05** we can see two data overlays, looking into the throttle position column the green line is his Lap 7 which is his fastest lap and the black line is Lap 1. Below the arrow shows a clear point of how his throttle consistency has improved massively from lap 1, his note was given around lap 2 to be easier with the throttle and do not hesitate when coming out of corners, and as we can see below this clearly shows that the note had been taken in and he is improving.

Fig.05



4.4.1 Session 2 Driver A

One of the main points mentioned in section 4.1 was that Driver A had been resting his foot on the brake pedal without realising, this would not only slow the car down but actually impact his driving around the course majorly as he would not be able to get on the throttle as quick as there would always be a point dragging him down, Below in **Fig.06** we can see that he is now completely not resting his foot at all.



The arrow above shows the column of brake pedal position.

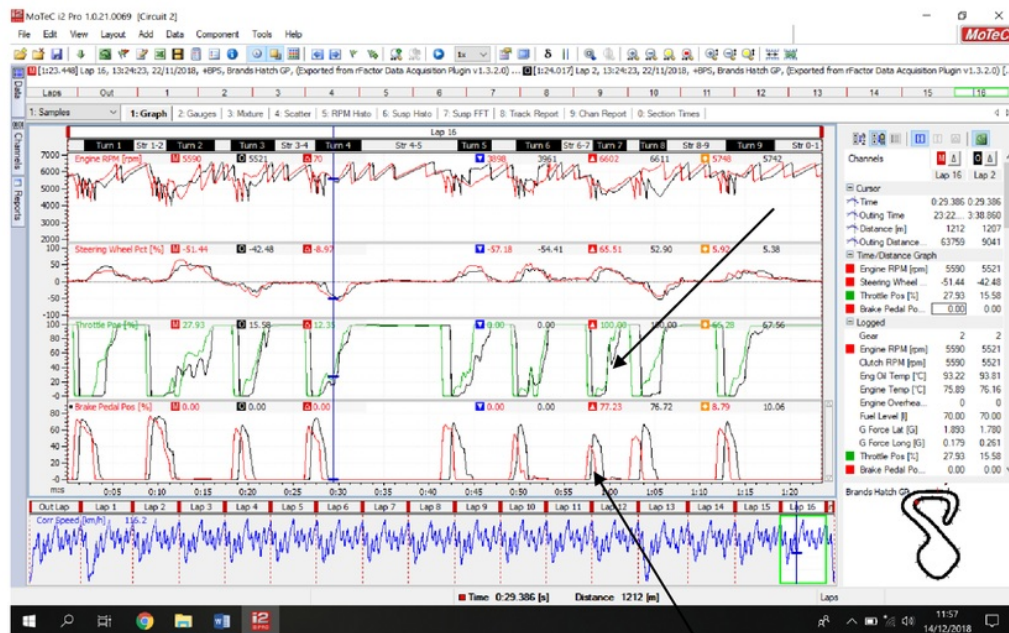
4.5 Session 2 Driver B

Driver B was one of the hardest drivers to analyse as his data showed small errors and no major key points to pick out, so the major point was to look into where this driver is loosing time.

Improvements: -

- Reach 100% throttle quicker at turn 5
- Turn 8 brake earlier and make sure to get on throttle when exiting corner
- Be more alert with braking to take better Apex's

Fig.07



One of the main improvements for Driver C was to be able to brake a lot sooner so a better driving line was taken. The image above **Fig.07** shows two data overlays in the MOTEK software, looking into the brake section of the Data a red and black line can be seen, the red line being his fastest lap which was lap 16 and the black line being lap 2 which was just after him out laps. Around lap 4 a command was given to Driver B to make sure at turn 8 to get on the brake sooner and also merge the throttle when exiting the bend. This can be seen from the data that over the course of the session Driver B has taken the command in and is showing that he can enter and exit the corner better.

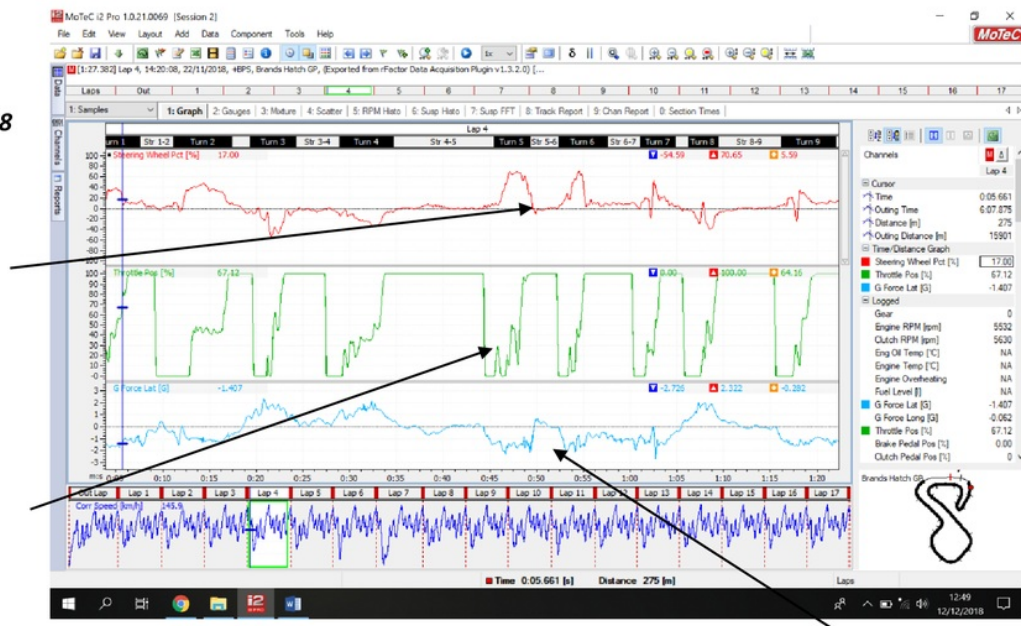
4.6 Session 2 Driver C

Driver C was one of the easiest drivers to pick out improvements on. His data sets clearly showed that he had very little experience from the simulator however there is a lot of room for improvement.

Improvements: -

- Reduce speed when approaching corners
- Harder on the brake
- Throttle sooner and do no hesitate

Fig.08



Above in **Fig.06** is a screen shot of the data from Driver C in the MOTEC software, the main improvement for Driver C was to be more aware around the track, for example reduce speed when approaching corners but from the arrows above we can see that he is carrying too much speed when going into corners and from this is having to oversteer which is making his lateral G be unbalanced and when this is the case the vehicle will become unsettled and Driver C will lose a lot of speed when coming out of the corner, if he was to take the corner easy and apply the throttle when approaching and then get back on when exiting the corner we would see his lateral G much lower as the car is more balanced.

5.0 CONCLUSION

throughout this project the main aim was to analyse three different drivers, each of these have different driving styles and through the use of the MOTEC software each driver can be analysed deeply.

From the various data that has been analysed from session one, different points were made for each driver both some positive but also mainly negative as improvements can always be made. From analysing the data each driver had two-three major points picked out so they would be able to go into session two with major points to think about when going around the track. Every point that was picked out through each driver had improved from session one through to session two as each driver was more alert and able to think about different elements before encountering them, for example Driver C was not braking hard enough and early enough and when this point was noted in session 2 he was both braking much more sufficient.

One of the aspects that would be interesting to change is the vehicles layout, i.e spring rates, track. As each driver can improve minor points what has been picked out, by tweaking the vehicle it may aid in either good or bad. This would obviously depend with the various drivers

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