F1 2011 Korea (Race)*
A Statistical Graphics Review

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*Source data used to generate this report was obtained from the Timing Information press releases published via the F1/FIA Media Centre

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1 Race Summary Data

In this section, you will be able to find macroscopic charts that summarise the race over the whole field.

1.1 Race Summary Chart

The *Race Summary Chart* attempts to summarise position related data across the whole race, and for each driver.

Key The *red dot* denotes the GRID position; the *black dot* denotes the FINAL position; the *horizontal line* denotes the END OF FIRST LAP position; the *vertical line* denotes the RANGE OF RACE POSITIONS held during the race

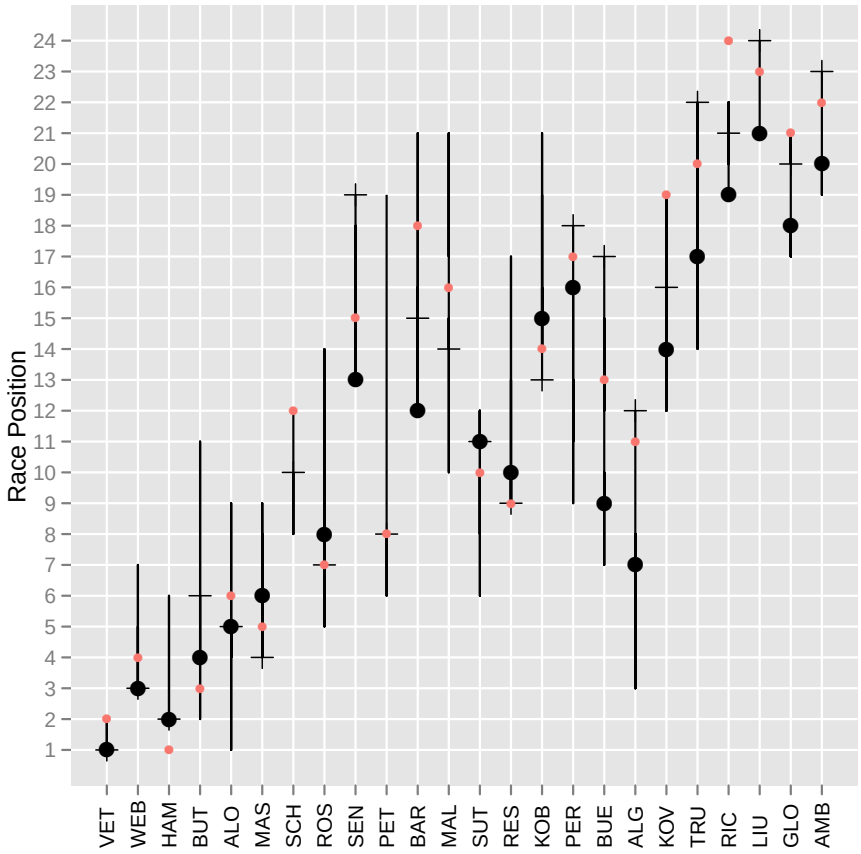

Figure 1: Race Summary Chart

Things to look for Who makes or loses places from the start (do the GRID and END OF FIRST LAP positions differ)? Do have drivers have a particularly good race, as denoted by a large gain in places comparing GRID and FINAL positions? Drivers who were placed in a wide variety of positions may have had an eventful race.

Feedback The *Race Summary Chart* is an experimental chart type; feedback/comments welcome: tony.hirst@gmail.com

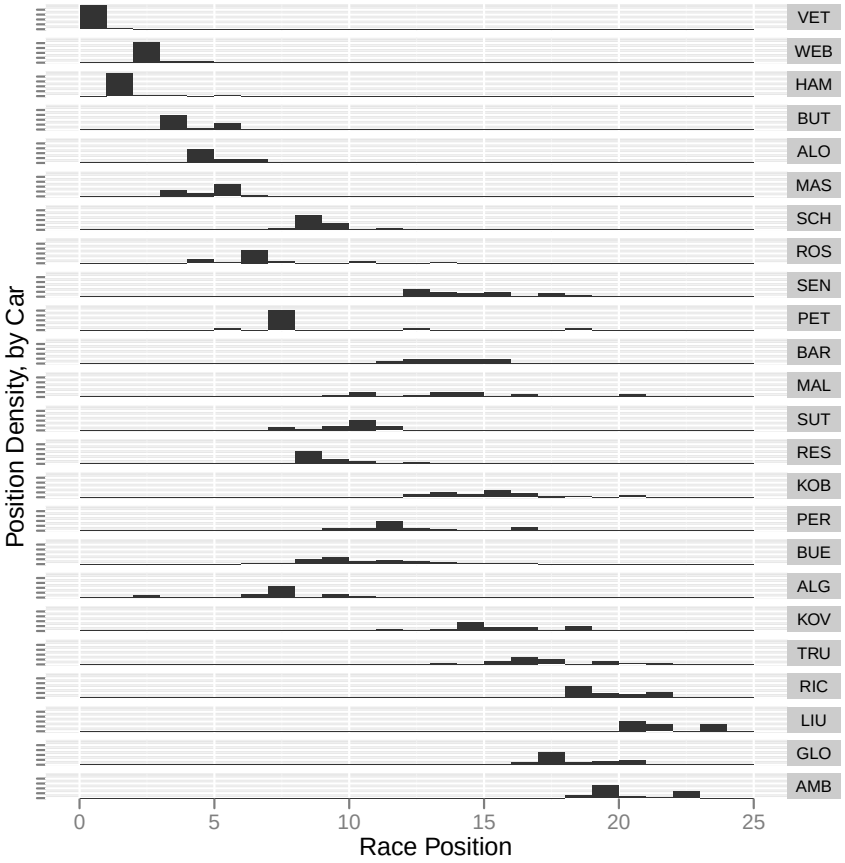

Figure 2: Position Density Chart

1.2 Position Density Chart

The *Position Density Chart* attempts to capture the amount of time each driver held each race position. It is inspired by the commonly reported cross-season statistic, 'number of laps in lead'.
Things to look for Was the race a procession, (cars holding the same positions for much of the race), or does there appear to have been some position changes (e.g. with cars taking different race positions for a significant amount of the race)? Note that if a car was in first position for half the race, and second place for half the race, we would not be able to distinguish this from a case where first and second changed places each lap!
To do Explore the possibility of a complementary chart that captures the number of position changes for each car over the course of the race.
Feedback The *Position Density Chart* is an experimental chart type; feedback/comments welcome: tony.hirst@gmail.com

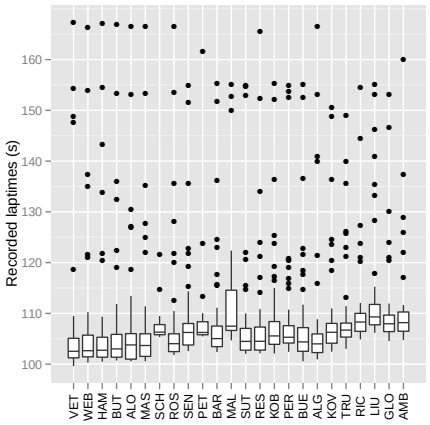

Figure 3: Laptime distribution

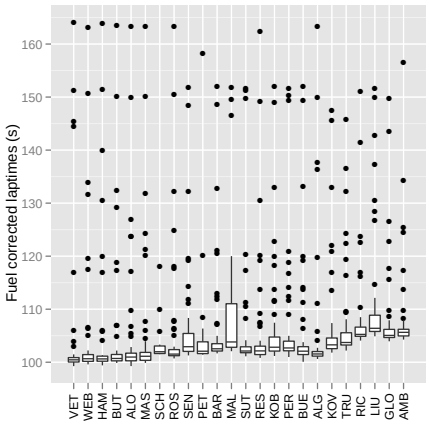

Figure 4: Fuel corrected laptime distribution

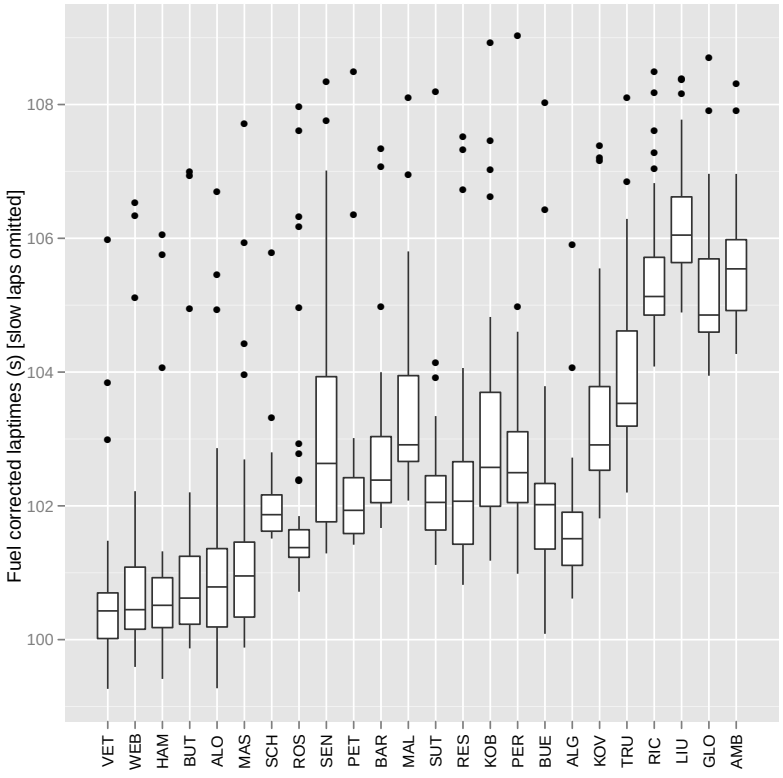

Figure 5: Fuel Corrected Laptime Distribution (Slow laps omitted)

1.3 Laptime Distributions

The laptime distributions summarise the overall distributions of recorded and fuel corrected lap times for each driver. This is not necessarily very informative, (the stint analysis laptime distributions provided for each team may be more useful).

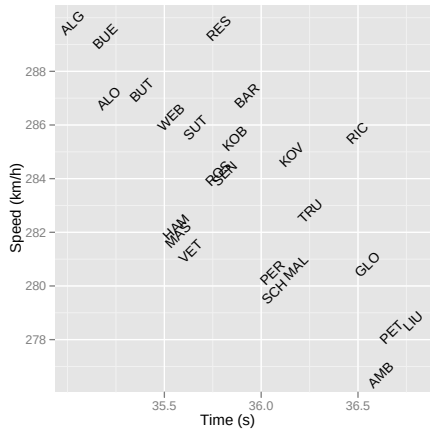

Figure 6: Sector 1/Inter1 Comparison

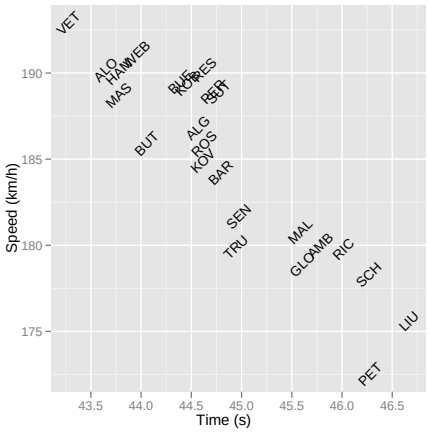

Figure 7: Sector 2/Inter2 Comparison

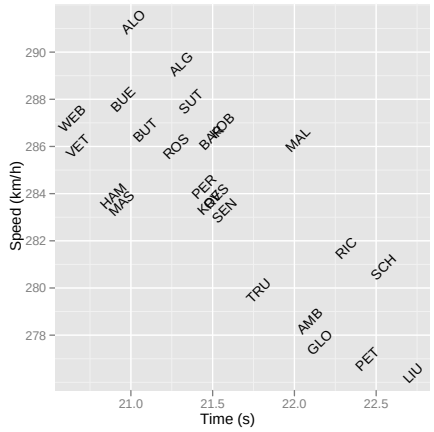

Figure 8: Sector 3/Finish Comparison

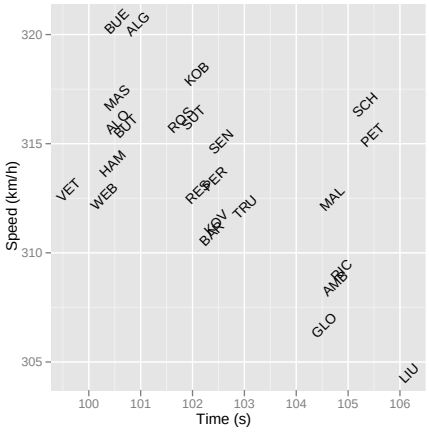

Figure 9: Fastest Lap/Trap Comparison

1.4 (Sector) Times and Speeds

How do the drivers compare in terms of speed and laptime over the race as a whole, as well as in sector?

Things to look for Do the fastest cars in each sector also record the smallest times? How do drivers in each team compare?

1.5 Stint Summary

The *stint summary* chart summarises stints, defined for the purposes of this graphic as periods between pit entries/exits. As well as pit stops, drive through penalties and stop-and-go penalties also result

To do find some way of marking pit stops vs DT etc. Colour stint by tyre (prime/option, new/old)

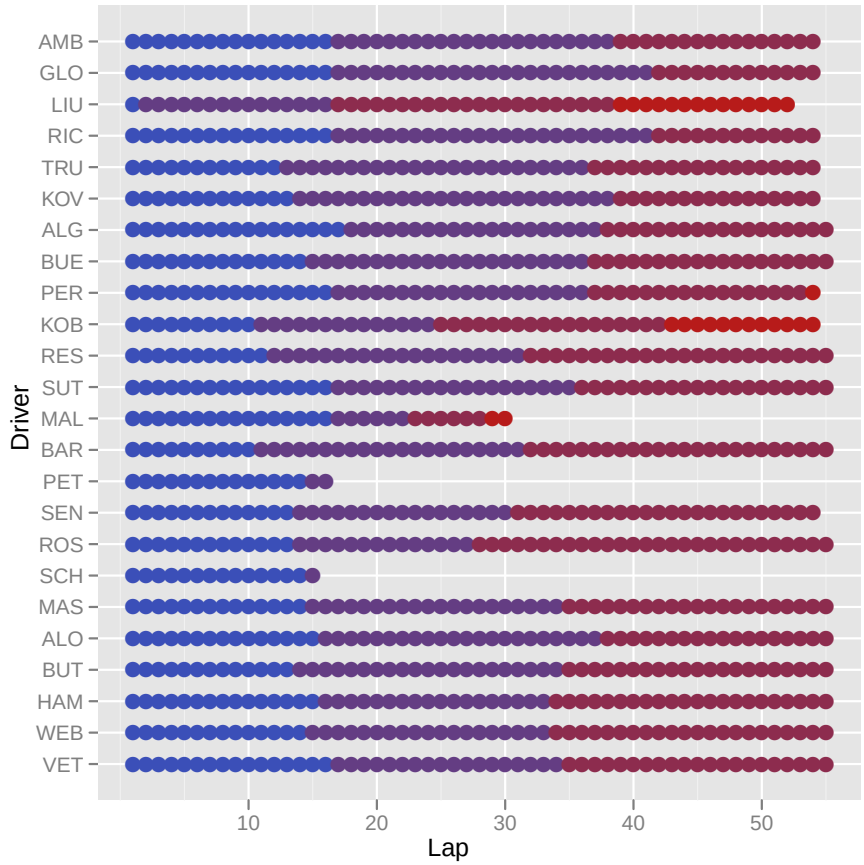

Figure 10: Stint Summary; colours denote stint number. *(Note that drive-through/DT and stop-and-go penalities result in an increase in the stint count.)*

Things to look for Does the occurrence and number of stints suggest different pit stop strategies were in place?

Notes I have to admit, I don't find this chart very informative. Is there a better way of presenting the information that allows us to more easily compare stint lengths? Maybe colouring by tyre would make this chart more useful, perhaps using an underlaid cross to highlight PIT laps on occasions where drivers move onto the same set of tyres they were using in the previous stint?

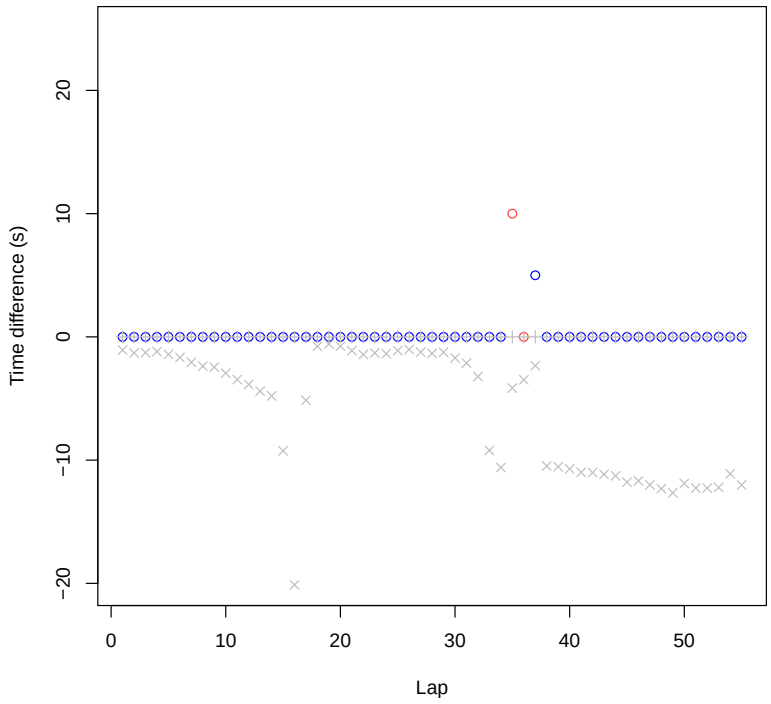

Figure 11: Battle plot for 1st

1.6 Battle Plots for Position

The *battle plots for position* show activity around the specified race position, depicting the car in the corresponding position on each lap and the time to the cars in the positions immediately ahead and immediately behind.

The colour of the car along the x-axis identifies the team, and the symbol shows whether it is driver 1 (*circle*) or driver 2 (*triangle*) in the team. When the "position car" symbol is off the x-axis, it identifies the number of positions that that car *gained* (above the line) or *lost* (below the line) since the last lap in order to enter the specified race position.

The grey + symbols *above* the line identify the time to the car in race position immediately ahead, and the grey x symbols *below* the line identify the time to the car in race immediately behind the car in the race position of interest.

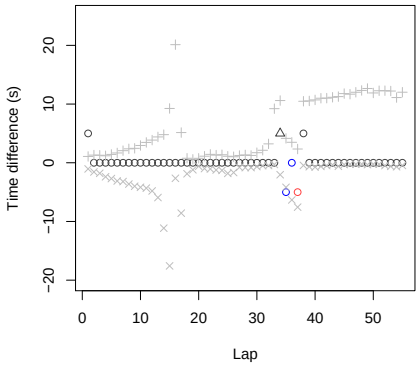

Figure 12: Battle plot for 2nd

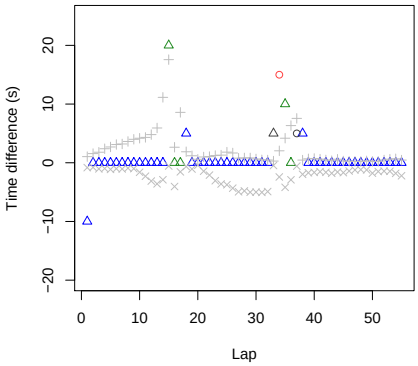

Figure 13: Battle plot for 3rd

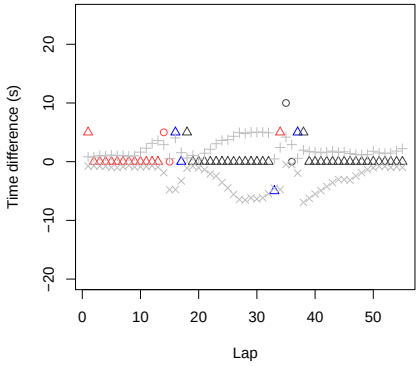

Figure 14: Battle plot for 4th

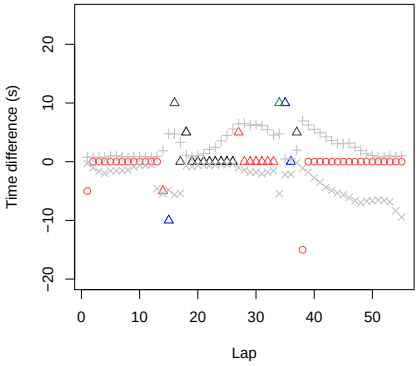

Figure 15: Battle plot for 5th

Things to look for If the car in the race position ahead is close (the + marks above the axis are close to the axis), the car in the current position may be battling for the position ahead. If the car in the race position behind is close (the x marks below the line are close to the axis), the car in the current position may be fighting to keep the position. If car-in-front or car-behind marks are going away from the axis as we move left to right (increasing lap count), that means the car in the current position is either falling behind the car ahead, or pulling away from the car behind.

2 Team Summaries

The team summary pages summarise team based statistics, allowing comparisons to be drawn diretly between team members.

The team summaries include the following chart types:

- **Fuel corrected aptime distribution by stint** The *fuel corrected laptime distribution by stint* chart is a graphical statistical summary of fuel corrected lap times by stint for each driver.
- **Race position chart** Inspired by the popular chart that depicts race position for the whole field, the *race position charts* show the positions, by lap, for each car in the team. PIT events are also highlighted.
- **Battle plot** The *battle plot* is an experimental chart, inspired in part by traditional race history charts, that attempts to show the extent to which a particular driver was in battles with the cars in the race positions immediately in front of, and immedialtely behind, the car in question. Position changes (number of positions gained/lost) since the prvious lap are also depicted, as well as PIT events. A race position overlay provides additional context, though we could also claim that the battle plot provides context for race position chart. (Battle plots may also be used to show when there is at least one car out of race position between the car of interest and the cars in the race positions immediately ahead and behind.) Maybe this chart (and/or the *race position chart* should also mark the number of lead laps completed at the end of the race, so we can see how many laps behind the lead car (if any) each driver was?)

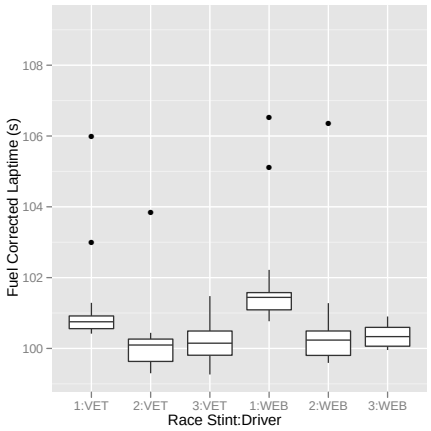

Figure 16: RBR: Fuel corrected laptimes/stint

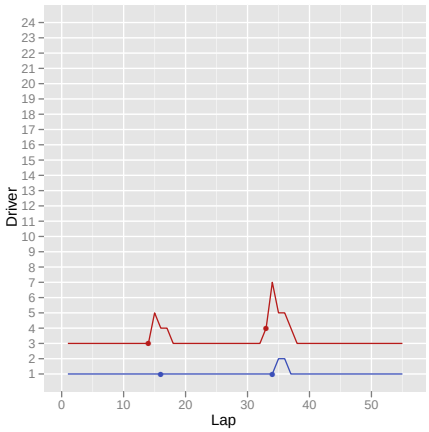

Figure 17: Position Chart: VET, WEB

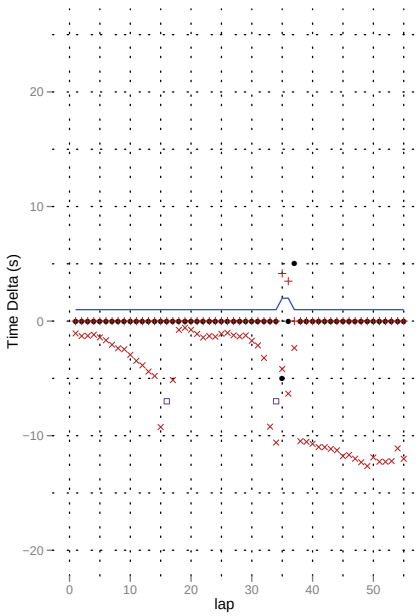

Figure 18: Battle Plot, *VET*

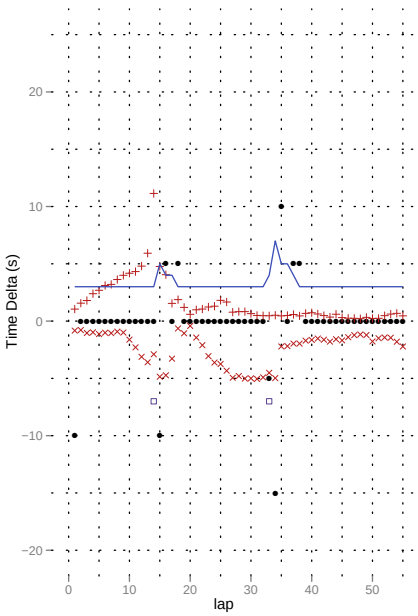

Figure 19: Battle Plot, *WEB*

2.1 Red Bull Racing (RBR)

The **Red Bull Racing** drivers are *Sebastian Vettel (VET, 1)* and *Mark Webber (WEB, 2)*.

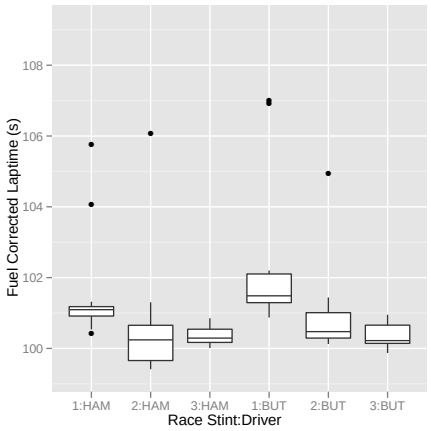

Figure 20: MCL: Fuel corrected laptimes/stint

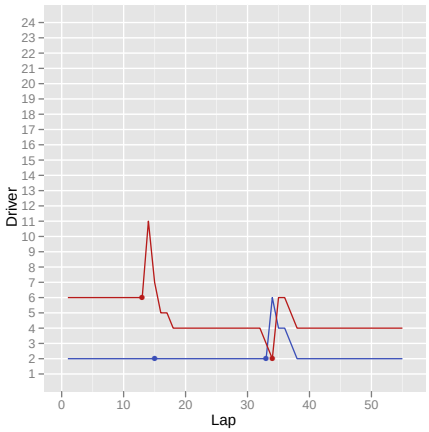

Figure 21: Position Chart: HAM, BUT

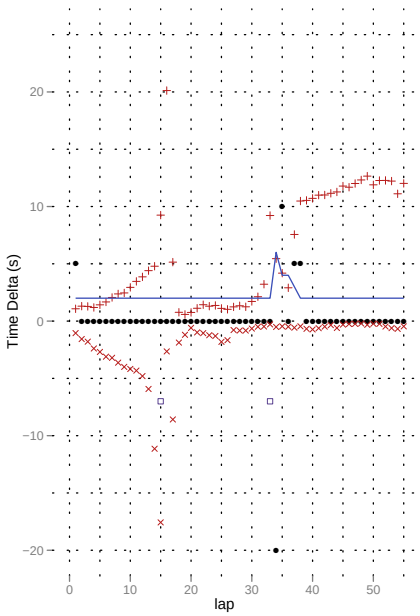

Figure 22: Battle Plot, *HAM*

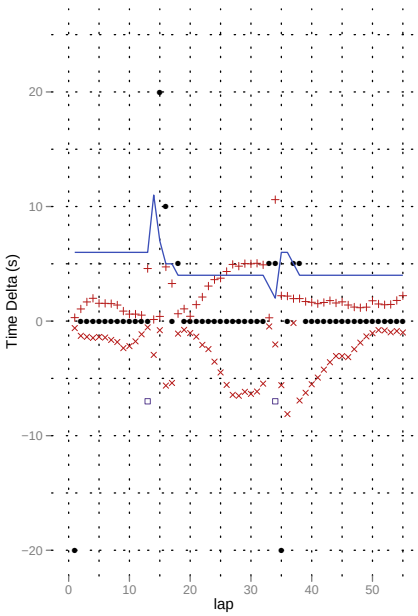

Figure 23: Battle Plot, *BUT*

2.2 McLaren (MCL)

The **McLaren** drivers are *Lewis Hamilton (HAM, 3)* and *Jenson Button (BUT, 4)*.

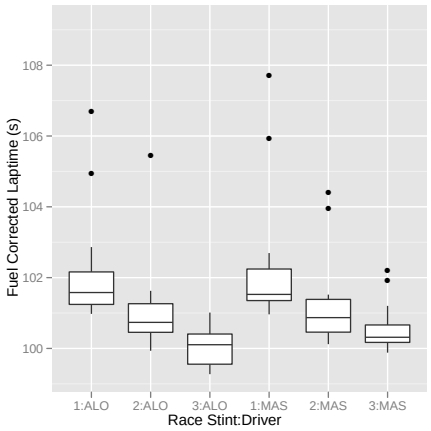

Figure 24: FER: Fuel corrected laptimes/stint

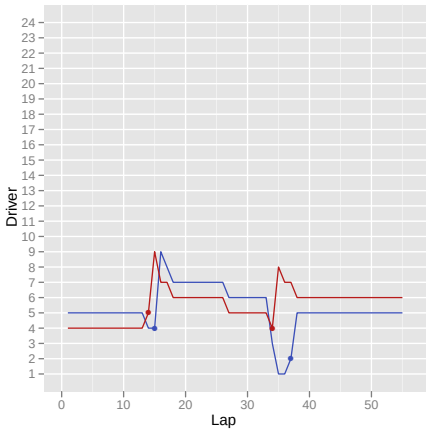

Figure 25: Position Chart: ALO, MAS

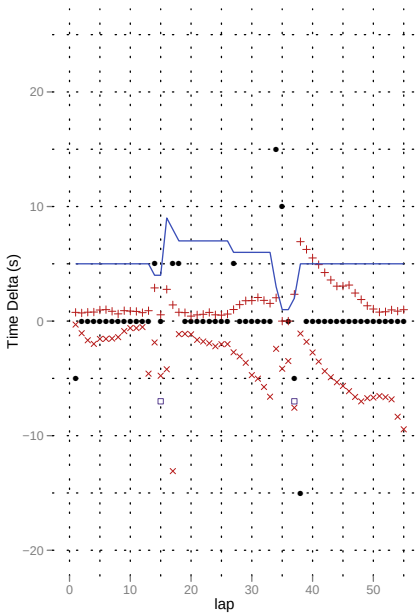

Figure 26: Battle Plot, *ALO*

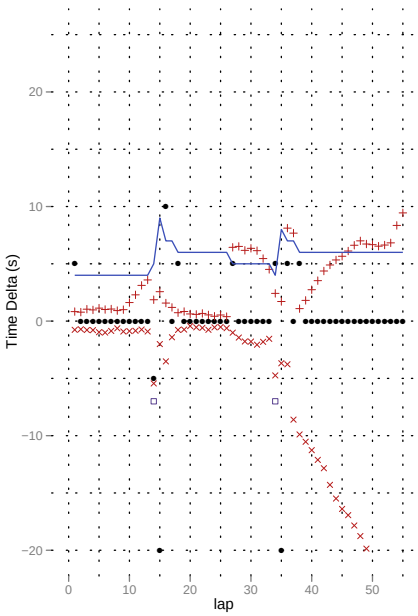

Figure 27: Battle Plot, *MAS*

2.3 Ferrari (FER)

The **Ferrari** drivers are *Fernando Alonso (ALO, 5)* and *Felipe Massa (MAS, 6)*.

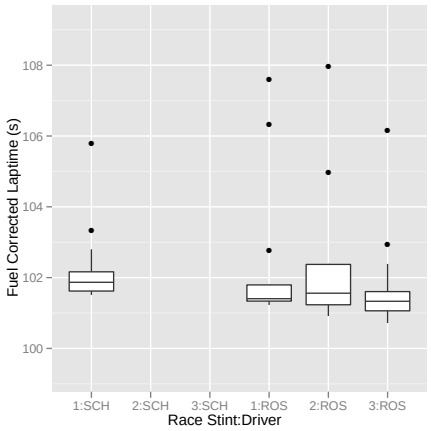

Figure 28: MER: Fuel corrected laptimes/stint

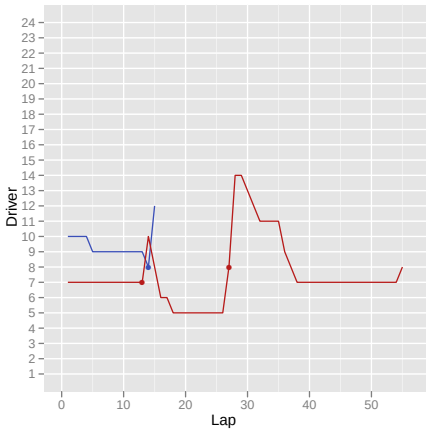

Figure 29: Position Chart: SCH, ROS

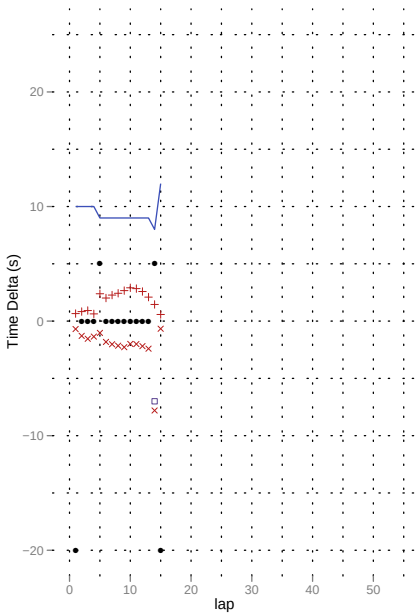

Figure 30: Battle Plot, *SCH*

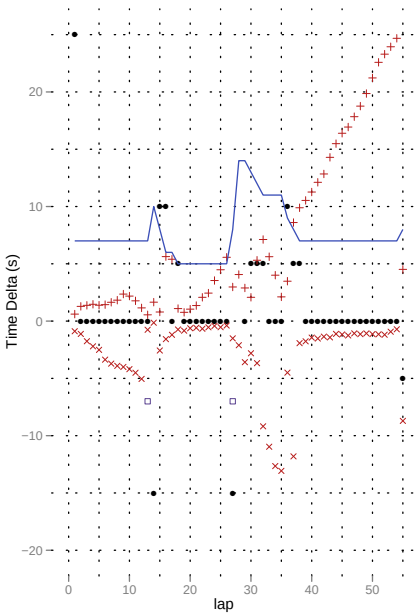

Figure 31: Battle Plot, *ROS*

2.4 Mercedes (MER)

The **Mercedes** drivers are *Michael Schumacher (SCH, 7)* and *Nico Rosberg (ROS, 8)*.

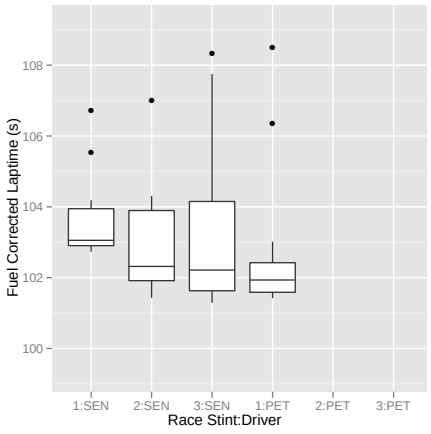

Figure 32: REN: Fuel corrected laptimes/stint

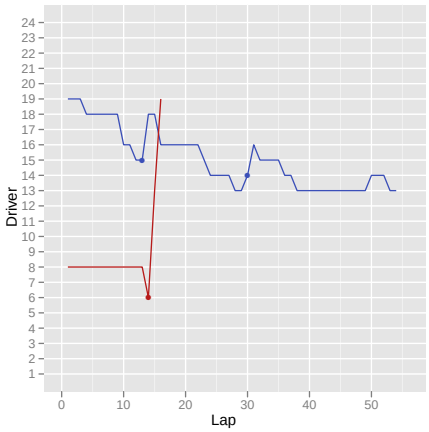

Figure 33: Position Chart: SEN, PET

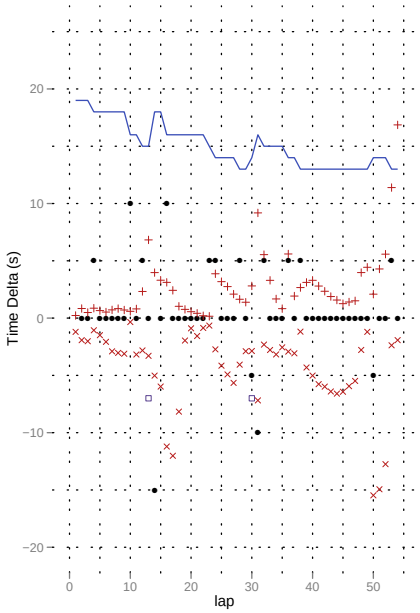

Figure 34: Battle Plot, *SEN*

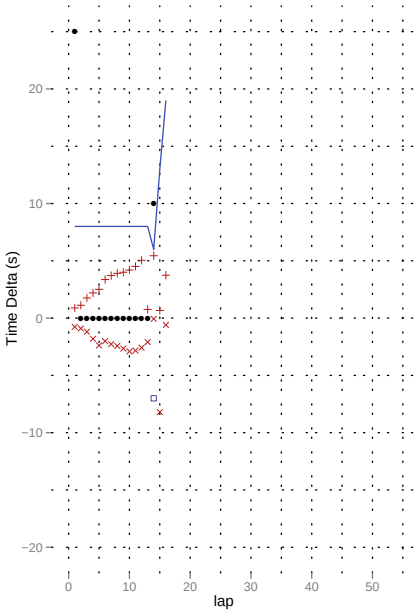

Figure 35: Battle Plot, *PET*

2.5 Renault (REN)

The **Renault** drivers are *Bruno Senna (SEN, 9)* and *Vitaly Petrov (PET, 10)*.

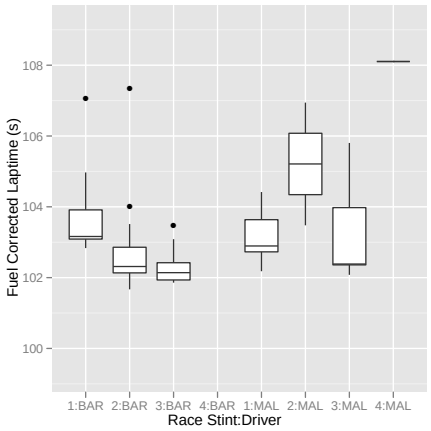

Figure 36: WIL: Fuel corrected laptimes/stint

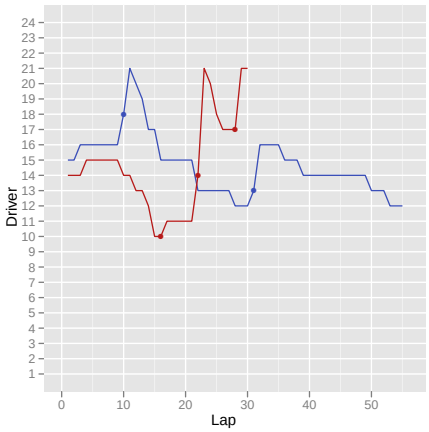

Figure 37: Position Chart: BAR, MAL

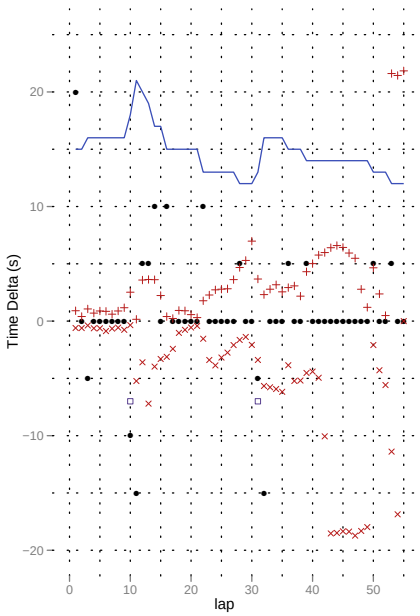

Figure 38: Battle Plot, *BAR*

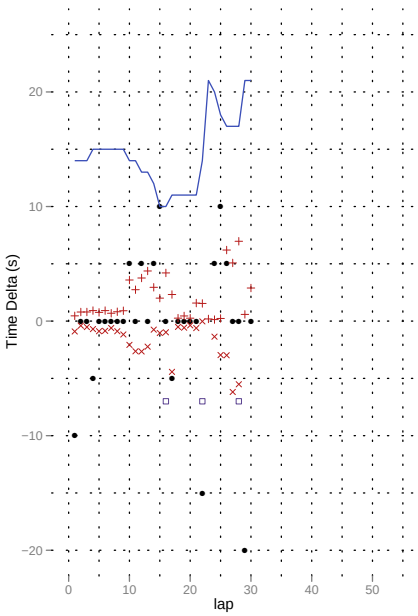

Figure 39: Battle Plot, *MAL*

2.6 Williams (WIL)

The **Williams** drivers are *Rubens Barrichello (BAR, 11)* and *Pastor Maldonado (MAL, 12)*.

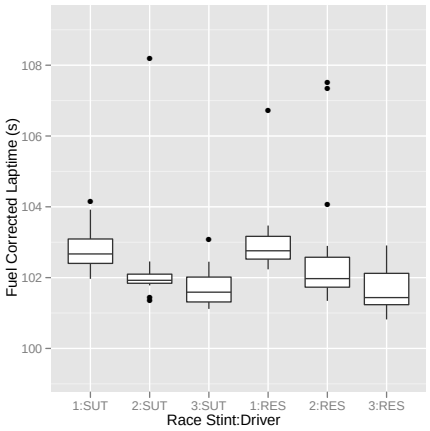

Figure 40: FOR: Fuel corrected laptimes/stint

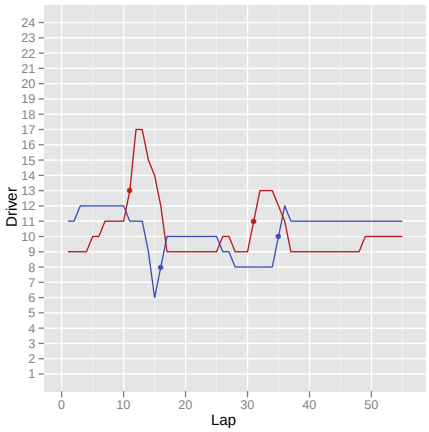

Figure 41: Position Chart: SUT, RES

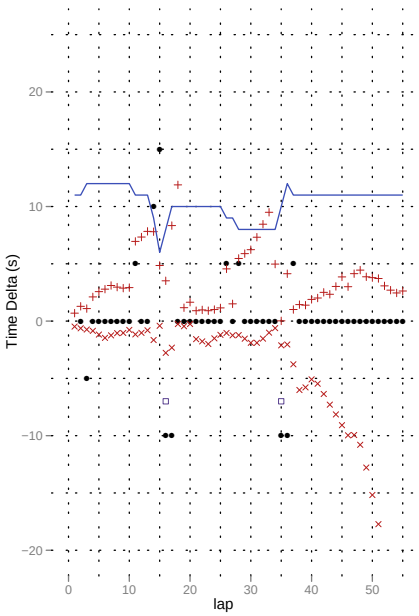

Figure 42: Battle Plot, *SUT*

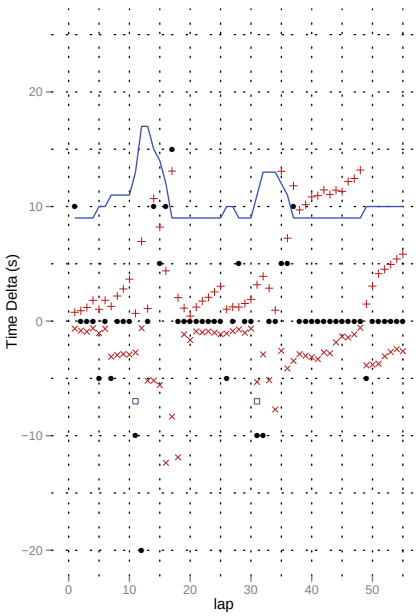

Figure 43: Battle Plot, *RES*

2.7 Force India (FOR)

The **Force India** drivers are *Adrian Sutil (SUT, 14)* and *Paul di Resta (RES, 15)*.

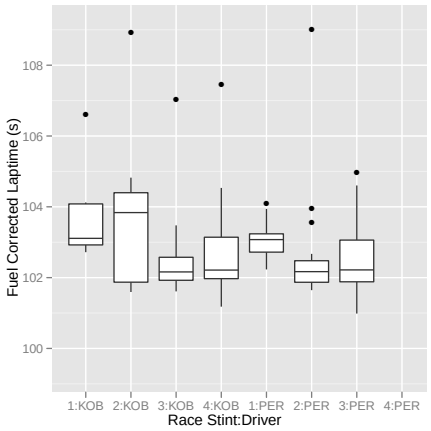

Figure 44: SAU: Fuel corrected laptimes/stint

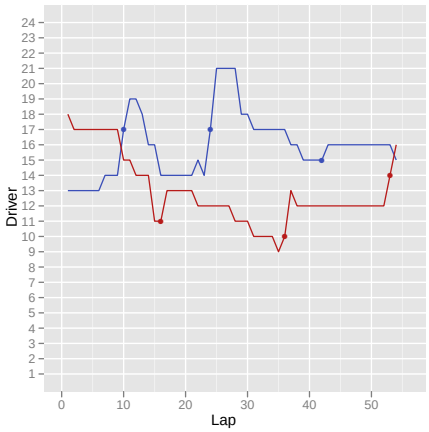

Figure 45: Position Chart: KOB, PER

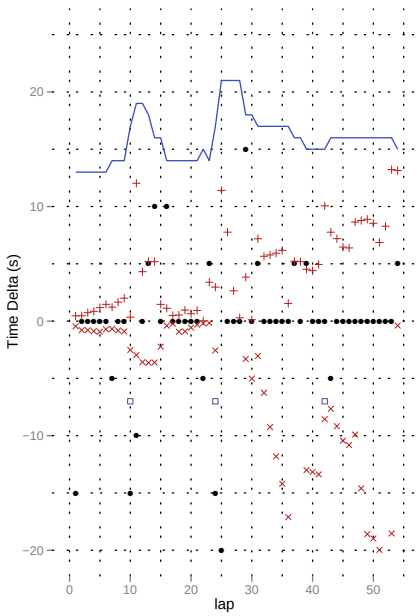

Figure 46: Battle Plot, *KOB*

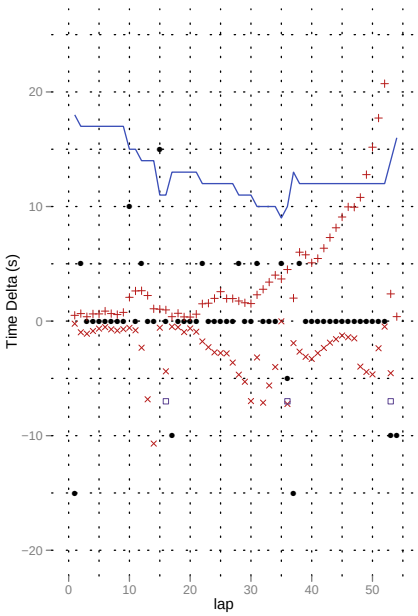

Figure 47: Battle Plot, *PER*

2.8 Sauber (SAU)

The **Sauber** drivers are *Kamui Kobayashi (KOB, 16)* and *Sergio Pérez (PER, 17)*.

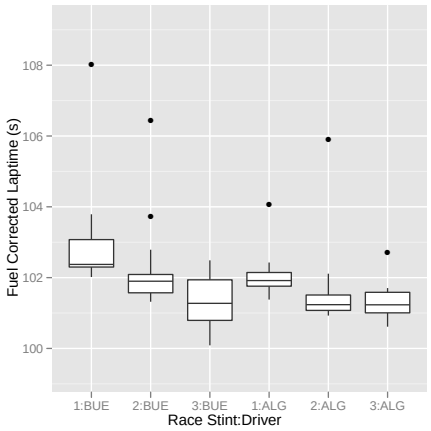

Figure 48: TOR: Fuel corrected laptimes/stint

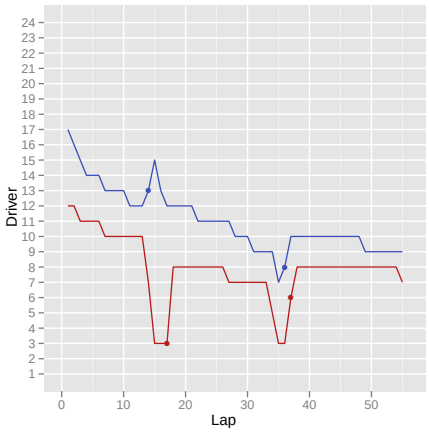

Figure 49: Position Chart: BUE, ALG

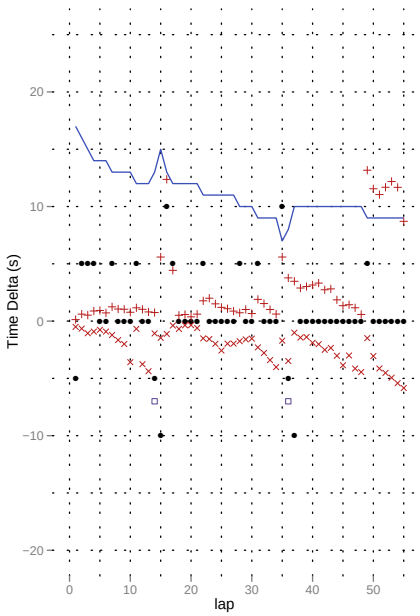

Figure 50: Battle Plot, *BUE*

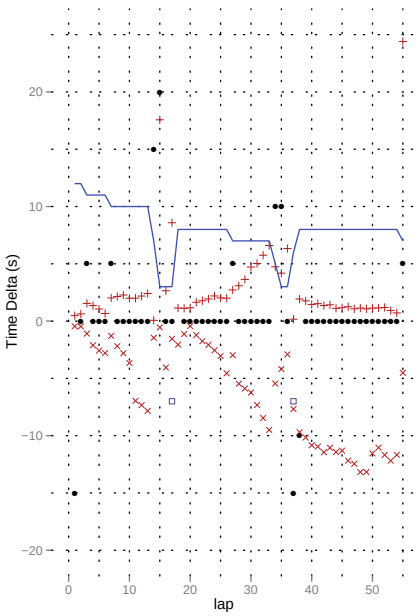

Figure 51: Battle Plot, *ALG*

2.9 Toro Rosso (TOR)

The **Toro Rosso** drivers are *Sébastien Buemi (BUE, 18)* and *Jaime Alguersuari (ALG), 19.*

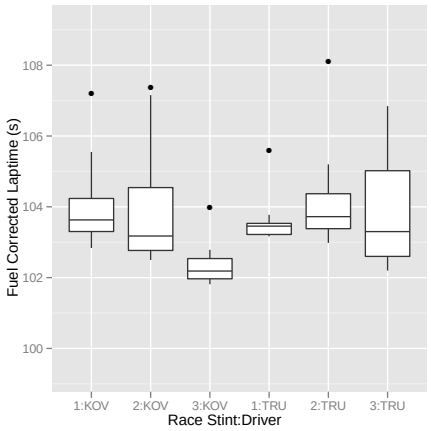

Figure 52: LOT: Fuel corrected laptimes/stint

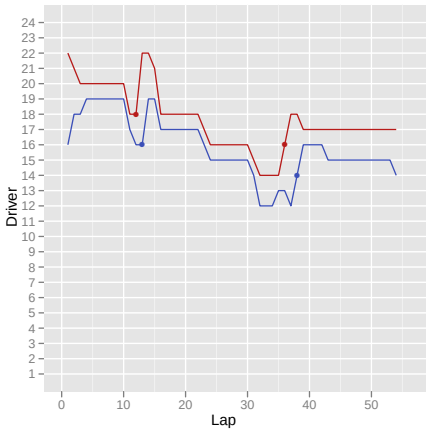

Figure 53: Position Chart: KOV, TRU

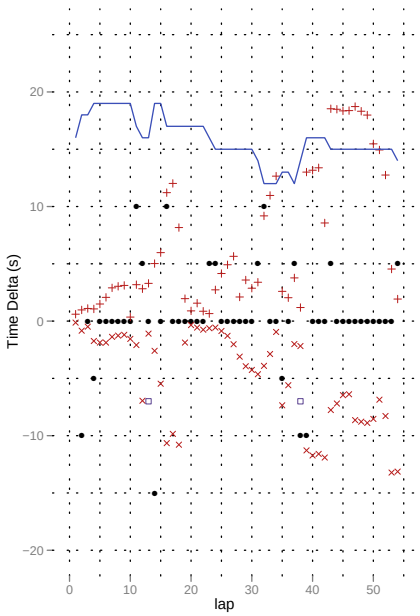

Figure 54: Battle Plot, *KOV*

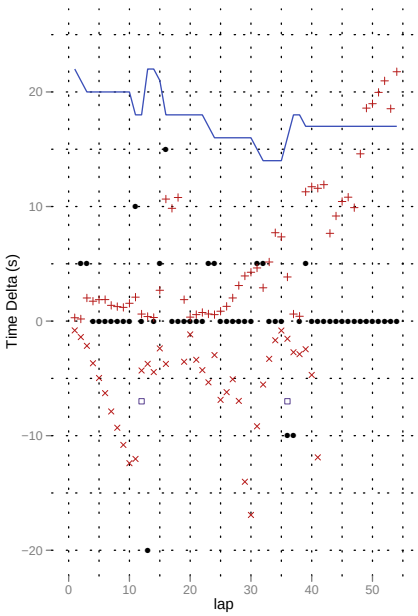

Figure 55: Battle Plot, *TRU*

2.10 Team Lotus (LOT)

The **Team Lotus** drivers are *Heikki Kovalainen (KOV, 20)* and *Jarno Trulli (TRU, 21)*.

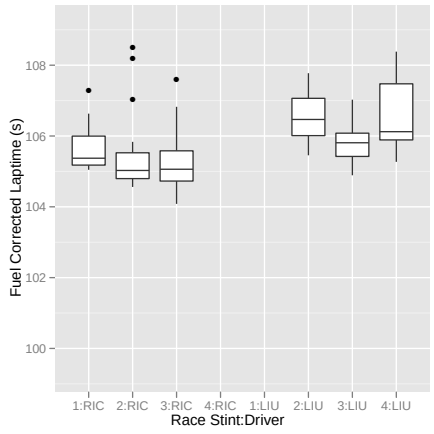

Figure 56: HRT: Fuel corrected laptimes/stint

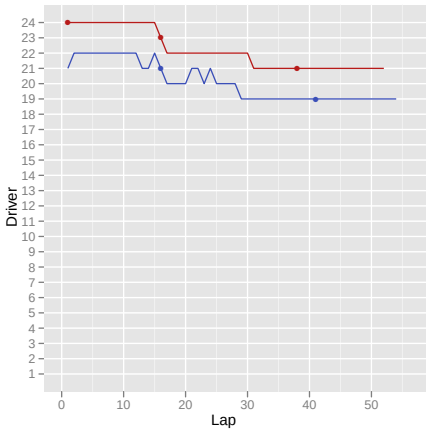

Figure 57: Position Chart: RIC, LIU

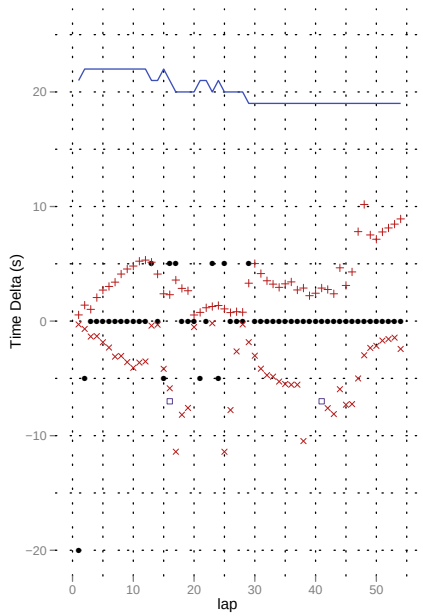

Figure 58: Battle Plot, *RIC*

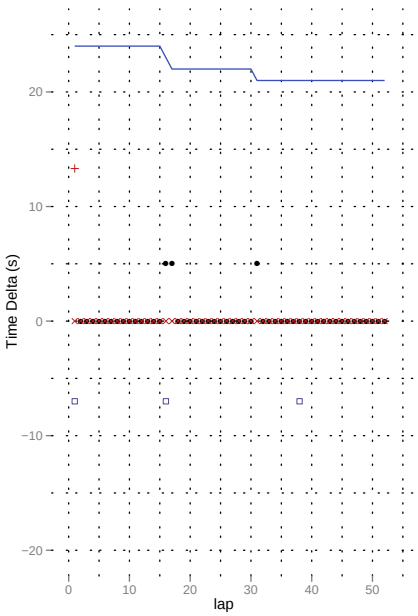

Figure 59: Battle Plot, *LIU*

2.11 HRT (HRT)

The **HRT** drivers are *Daniel Ricciardo (RIC, 22)* and *Vitantonio Liuzzi (LIU, 23)*.

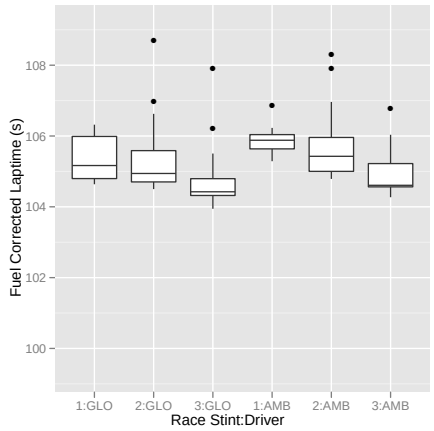

Figure 60: VIR: Fuel corrected laptimes/stint

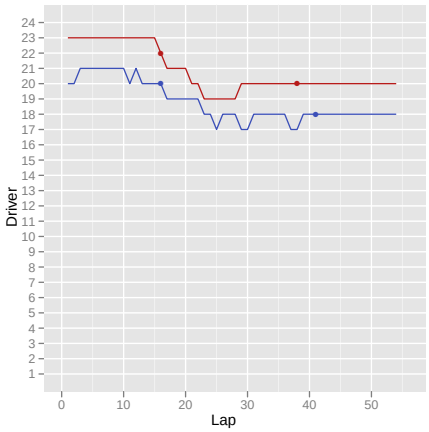

Figure 61: Position Chart: GLO, AMB

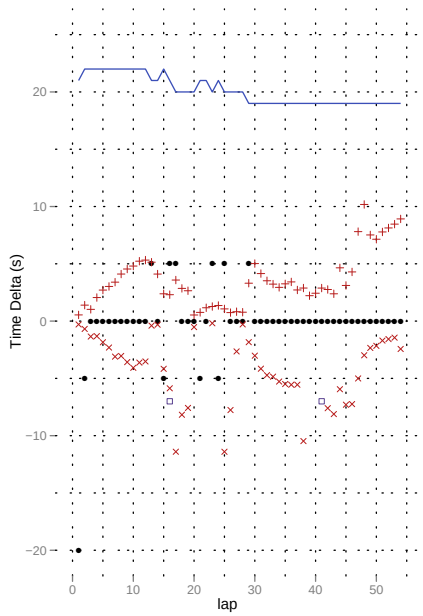

Figure 62: Battle Plot, *GLO*

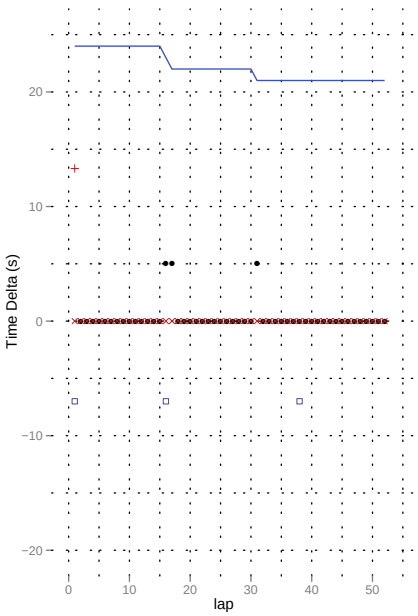

Figure 63: Battle Plot, *AMB*

2.12 Marussia Virgin (VIR)

The **Marussion Virgin** drivers are *Timo Glock (GLO, 24)* and *J'erôme d'Ambrosio (AMB, 25)*.

3 Feedback

This report format is something of an experiment, providing a "safe", yet authentic, context for me to explore data handling and visualisation design in conceptual terms, as well as giving some real data to work with as I try to get my head round the R statistical programming language. It's also providing something of a testbed for me to get back to grips with automated report generation/workflows.

Given the audience demographics of Formula One, I'm also mindful that folk reading this may be interested in how similar techniques, whether relating to data publicaation, data visualisation or automated document creation, may be relevant to their own work related - or personal - projects... which is why I'm trying to be as open as I can about how this document was created, and everything that has gone in to making it. I don't think there's quite enough here for an Open University shortcourse (that's the day job!), but you never know...!

All comments appreciated, particularly on:

- *chart types*: there are several experimental chart types, as well as my take on more traditional motor sport style chart. Feedback and suggestions welcome on the usefulness/clarity of these charts, things to look for in the charts, suggested improvements to the visual design of the charts.

- *scripts*: the latest version of the "source code" for this document is available from: *https://github.com/psychemedia/f1DataJunkie/blob/master/raceReports/korea2011f1Race.Rnw*

Please send feedback to: *tony.hirst@gmail.com*, or visit *f1datajunkie.blogspot.com*

At the moment, I'm using a single, monolithic script to generate the report. Ideally, this needs splitting into several components that are then drawn together automagically. (If you can provide hints/examples/advice on how to do this, maybe even using this document as an example, it'd save me a load of time.;-) The R functions used to generate charts are collected at the top of the document - all comments on how to improve them in terms of "best practice" much appreciated. I generate the PDF from the source Sweave document within RStudio (*rstudio.org* using the MacTeX LateX processor).

Please feel free to fork the "source code" of this documents and make your own changes to it, for example, by using the report as a shell for your own comments/analysis of the race. (I'm still a git/github novice, so I don't at the moment know how to pull any changes back into my repository!)

A copy of the current version of this document can be found at:
https://github.com/psychemedia/f1DataJunkie/blob/master/raceReports/korea2011f1Race.pdf

PS If any motor racing industry folk want to know more, please do get in touch...:-)