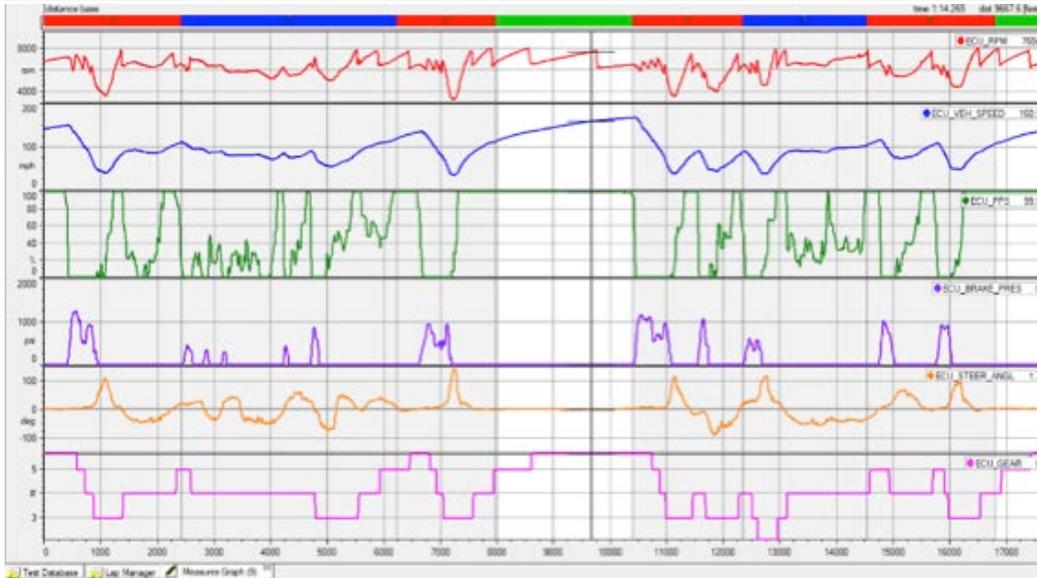


The Power of User Profiles and Math Channels by Ray Phillips

Are you getting the most out of your data system or is it mainly a lap timer that has some great features, such as predictive timing? Well, if you aren't using User Profiles (as they're called in AIM) or Workspaces (as they're called in MoTeC), then you aren't getting the most out of your data system. By the way, they're called other names in other data systems and just about every system that I know of has them. To make things simpler, I'm going to refer to them as User Profiles in this article. So what are User Profiles? They are pages with charts, scatter plots, track maps, etc. that you can tailor to you and your car which will allow you to look at your data QUICKLY and EFFICIENTLY between your sessions on the track. I realize that there are a number of racers who already do this, but they are usually only looking at a Time/Distance chart that would look something like this:



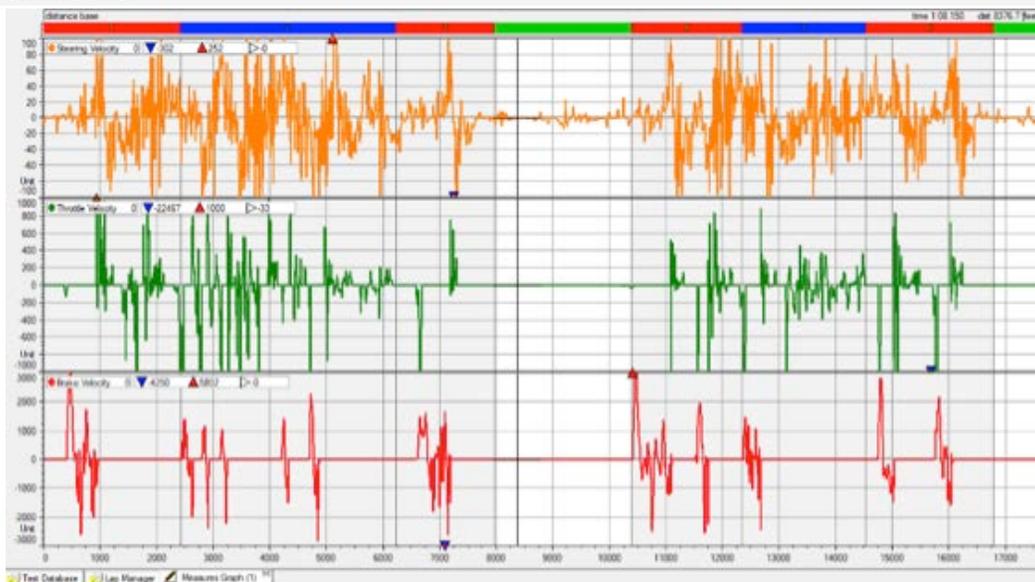
This graphic shows RPM, speed, throttle, brake pressure, steering, and the gear. There is certainly nothing wrong with using this type of Time/Distance chart, and it is great to use it when comparing two or more laps together. In fact, I refer to this chart as a Lap Compare Profile. However, many times there is a large variance between the two drivers and this can lead to the slower/more inexperienced driver trying something on the track that they aren't ready for yet. The potential consequences of this are not good. Other factors also come into play such as setup differences between the two cars or simply just the driving style differences. In my opinion, many times it is better to focus on what the driver can do differently within their capabilities in order to find time on the track, while at the same time minimizing the chance for error. The right combination of User Profiles and Math Channels can help you coach yourself!

I have found that looking at track reports is a great way for drivers to visualize what is happening on the track. If I was focused on the braking and I wanted to see how the driver is getting on the brakes, and more importantly, how they are releasing the brakes, I could look at a Brake Track Report such as this one:



This is a track map of COTA in Austin, TX and it is immediately apparent that the driver used the most brake pressure at Turn 1 and did a decent job of releasing the brakes after reaching the maximum brake pressure. However, at Turn 12, the driver applied the brakes, released the brakes, and then applied the brakes again, signaling that the driver can brake later with improvement of their brake application and release. There are a number of other items related to braking that can be discussed, based on what is shown in this track report, but you get the idea.

The use of Math Channels takes the data analysis to another level. Math Channels allow you to really dig into the data, which will help you identify driving techniques, car handling issues that you might be dealing with (i.e. too much understeer at corner entry), and specific areas to focus on that are measurable, so that you can track your progress. If I wanted to see how smooth the driver is with the controls (throttle, brake, and steering) I can look at a Driver Smoothness graph, which shows the velocity of which the driver is on and off the throttle pedal, on and off the brake pedal, and the speed at which they are turning the steering wheel. It would look like this:



This chart can almost be considered the driver's signature because it can really highlight the driver's driving style. You can quickly see that there is a lot of steering velocity (orange) and much of it corresponds to a lot of throttle pedal velocity (green). This indicates that the driver was not comfortable with the car on this lap and was not confident with progressively squeezing on the throttle until they were at full throttle. If they were, then there wouldn't be so much throttle velocity. For the brake velocity (red), this chart shows that they are

quickly on the brakes (the initial spike up) but sometimes the brake release (the downward spikes) is just as quick as the brake application. Therefore, they should work on slowing down the brake release, especially at the slower corners. Getting back to a track report, it is possible to use math channels to see if the driver is coasting (no brake and no throttle) and show it on the track map. Here is a Coasting Track Map:



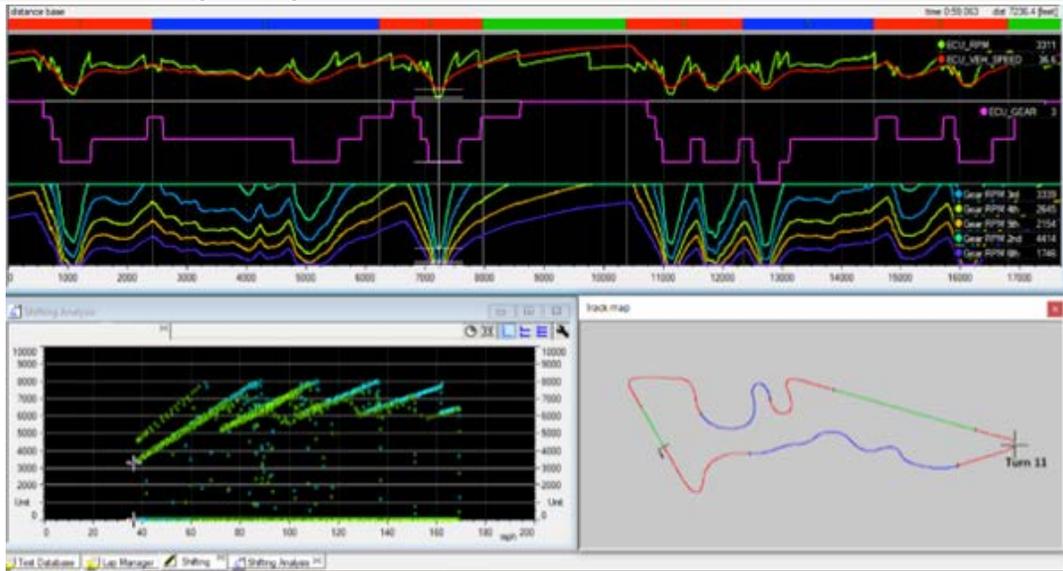
All the areas in red represent coasting. As you can see, there's a fairly large amount of coasting at turn 6. With this map immediately available after downloading data, it is very easy to identify where the driver is coasting. This chart can be pulled up after every session in order to determine if the coasting has been reduced. In fact, you could even create a Math Channel to calculate the distance that the driver has coasted over a given lap, and compare the distances between laps and/or sessions. This would be done by using a Channels Report chart, which is simply a table of values (min, max, average, etc.) that you designate for each lap in a session.

| Lap | Time | Dist | GPS_Speed | | Distance Braking | Distance Coasting | Distance Throttle | Add / Remove |
|---------------|------------------|--------------|-------------|--------------|------------------|-------------------|-------------------|--------------|
| | | | min | max | max | max | max | |
| lap 3 | 02:27.260 | 17597 | 22.1 | 165.8 | 4351.53 | 36.20 | 13222.72 | |
| lap 4 | 02:25.811 | 17624 | 32.1 | 164.8 | 3835.90 | 36.59 | 12895.62 | |
| lap 5 | 02:23.235 | 17620 | 33.6 | 166.9 | 3746.14 | 12.49 | 13525.34 | |
| lap 6 | 02:22.685 | 17655 | 29.1 | 165.5 | 3567.07 | 12.43 | 13679.00 | |
| lap 7 | 02:20.983 | 17610 | 34.7 | 167.0 | 3699.20 | 55.18 | 13226.87 | |
| lap 8 | 02:22.643 | 17633 | 33.5 | 167.3 | 3751.18 | 55.06 | 13211.26 | |
| lap 9 | 02:20.992 | 17604 | 35.4 | 166.1 | 3391.56 | 52.48 | 13676.97 | |
| lap 10 | 02:20.667 | 17588 | 33.7 | 165.1 | 3495.78 | 23.91 | 13572.79 | |
| lap 11 | 02:21.002 | 17624 | 33.2 | 163.0 | 3780.49 | 35.20 | 13332.85 | |
| lap 12 | 02:22.737 | 17612 | 30.1 | 165.7 | 4049.66 | 39.01 | 13461.20 | |
| lap 13 | 02:27.302 | 17661 | 32.2 | 164.1 | 3502.48 | 22.98 | 13300.99 | |
| lap 14 | 04:27.457 | 17748 | 3.2 | 144.5 | 3706.25 | 3096.95 | 9893.16 | |
| lap 15 | 02:28.256 | 17703 | 25.5 | 156.6 | 4361.10 | 33.56 | 13426.73 | |

So far, I have only shown one type of a chart at a time, but the other benefit of User Profiles is that multiple charts can be combined in one User Profile. I refer to the User Profile shown below as the Shifting Analysis Profile. In the Time/Distance graph at the top, I have used Math Channels to calculate the RPMs of gears 2nd through 6th, so that I can determine if the gear being used at a specific corner is keeping the engine in the appropriate torque range. At Turn 11 at COTA, the driver is using 3rd gear and the engine is at about 3300 RPMs with the car traveling at 36.6 mph. If the engine needs to be above 4000 RPMs in order to stay within the desired torque range, then 2nd gear would be a better choice because the engine would be at about 4400 RPMs. Alternatively, if the driver can roll more speed into the corner, then 3rd gear might be the best choice, after all.

The scatter plot at the bottom left hand corner shows the gears that the driver's using (2nd through 7th), the RPMs that the engine is running at in each gear, and the speed at which the car is traveling in each gear. But it is also showing how much the driver is using the engine to slow the car down. The blue dots are the engine RPMs when the throttle is above 75%. If the green dots are on top of the blue dots, then that indicates that the driver is using the engine to slow the car versus just using the brakes. If the green dots overlap the blue dots all the way to the normal shift point RPMs, then the driver has definitely downshifted too early and is

probably on the verge of over-revving the engine. On this lap, the driver got close to the shift point of 8000 RPMs when downshifting to 4th gear.



There are so many more ways that User Profiles and Math Channels can be used but there's too much to cover in one article. I haven't even mentioned what can be done to analyze the mechanical aspects of the car! I personally use close to forty User Profiles and many more Math Channels on a regular basis. Although this probably sounds like a lot, you can click through the User Profiles very quickly and not all of them need to be looked at every time you come off the track. But it sure is nice to have them available when measuring your progress, and if you need to look at something in the data quickly!

~ Ray Phillips

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