Motec Beginners Guide Part II

By WR304

Many thanks to **Sean_S37** for converting it to PDF. To **Eden7c** for hosting this free download and everyone on the www.GTR-Game.com and www.Racesimcentral.com forums for their input which is much appreciated.

Important Note: This guide relies heavily upon Motec. Make sure your Ingame Motec sample rate is set to 10 instead of 100 for it to work correctly. (See Appendix 2 at the bottom of this guide for details.)

It assumes you've read the "Motec Beginners Guide Part I" and that you're using my updated Motec configuration file GTR Analysis190605.icf plus ***MMos***'s Mathematics Templates. (Included in PDF version Zip File).

Download here: **Motec_Interpreter_Configuration190605.zip**

Unzip both files to c:\GTR\Motec\Interpreter\Configurations

Load the Graphical Analysis Configuration by opening Motec select File- Interpreter Configuration- Load- Templates GTR Analysis140205.icf

Load ***MMos***'s Mathematics Template by opening Motec select File- Interpreter Configuration- Load- Mathematics- MosMath0.1.imc

You then have to go to View- Maths- User Constants- and change Con07 so that it reads Steering Lock and enter the value you use as steering lock in the GTR garage (eg: 13.5 where your steering lock is 13.5 degrees in GTR.) You need to remember to change this to match whichever setup you're analysing.

You can check this by clicking the File Details button within Motec going to Vehicle and the steering lock value used will be displayed there.

Optimising Your GTR Setups Using Motec

The default "Rennen" and "Schnell" setups in GTR provide a starting point for making a GTR setup but if you want to be truly competitive it's going to mean developing your own setup to suit your own driving style and personal preferences.

"The default setups (the one already loaded from start) are from Doug Arnao. The car specific "fast" and "race" setups that you can load are done by me.
Either ones are NOT intended to be fast and perfect setups, but just a safe and lets say valid base to start on and create your own (we don't won't to spoil you right away hehe)
More specific and faster setup will be given later"

Aristotelis

I believe there are four areas in particular where significant time and handling gains can be made over the default setups:

- **Tyres**
- **Gears**
- **Anti-Roll Bars**
- **Rebound Damper Settings**

These settings are similar across nearly all the default setups and my approach can be applied for all cars in the same way. Purely as an example I'm going to use the Porsche 911 GT3 RS as the basis for this guide.

Testing Procedure

The first place is deciding where to start.

Select Open Practice and a Private Test Session as this will allow you to develop the setup with no time pressure. I'll normally start by selecting the default "Rennen" setup and just driving a few laps of the circuit to get used to it. Change the fuel load to the race distance or stint you plan on using it for. It's best to always try and test the car as it will be used. Once you've got a good race setup it will provide the basis for your Qualifying and Rain setups. Once on track always try and make mental notes of how the car is responding: Understeer, oversteer, locked brakes, spins etc are all important indicators of what the setup is like. When testing you should always drive as fast as you possibly can (including the outlap) so that driver effort is equal between runs. Unless you're specifically looking at tyre wear 2-3 flying laps will normally be enough to get a feel for the car.

After each run there are several key areas that you should always check: The tyre pressures and tyre cross section temperatures in the GTR Garage and within Motec the "GTR Analysis" graphical tab, the Lap section times and the Suspension Histograms.

Be methodical and only make a single change at a time so that any improvement is easy to spot. My criteria for keeping a setting is normally that it must be able to produce a quicker lap time than the previous lap without it. Use the cumulative variance feature within Motec and the corrected speed trace on the "GTR Analysis" graphical tab to decide whether the change has been worthwhile.

If you're consistently unable to go faster than the previous best lap time be prepared to ditch the settings and go back to what was fastest. Sometimes this can mean losing several hours of work if necessary: Open the old Motec file of your best lap and you can see what the settings were by either editing the file or opening it, selecting the "File Details" tab and going to "vehicle" This is also how you can check what brand of tyres are fitted to the car.

The three major elements you should always be trying to identify and improve through your setup changes are:
"

1. **Grip Level** - This determines the maximum possible cornering speeds/G-Levels
2. **Handling Balance** - Understeer/Oversteer
3. **Controllability** - How hard is it to drive? "

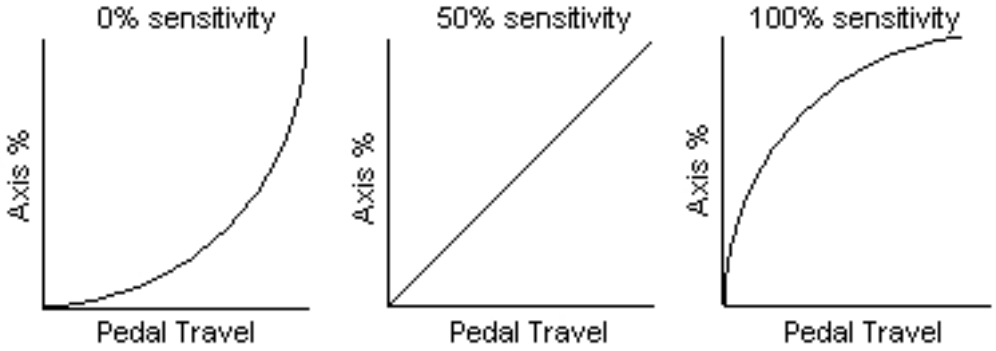
Dave Weitzenhof - NEOHIO Comp Clinic March 20, 2004

GTR Controller Settings

Throttle

Before you can decide what you like in a GTR car setup it's important to get your controller settings optimised for the game.

Changing controller settings aren't a quick fix that are going to gain you a significant amount of time. All they will do is help fine tune the controls for your own preferences and controller.



Picture 1: Changes to Pedal Sensitivity (Graphs by ***DarrenM***).

It's commonly accepted that a linear pedal response (centre graph) is the best option giving the best modulation and the most realistic responses. It means that the throttle input should increase at the same rate between 0-100% pedal travel. In GTR linear travel is theoretically at 50% sensitivity. ***Luis Branco*** pointed out that the car will be far easier to drive with a 0%

pedal sensitivity compared to the default 50% sensitivity however. This provides a slower response at first and then an accelerated response later in the throttle movement.

Picture 2: “50%” Throttle Response in GTR before adjustment

If a linear response is the best option normally then why isn’t 50% sensitivity always the best option in GTR?

It’s down to your **perception** of the amount of pedal movement you have available. What feels like a gentle brush of the accelerator pedal could result in an unexpected surge of power. In powerful GT cars such as the Ferrari 550 Maranello this can be a real problem. Reducing pedal sensitivity will help make throttle control easier.

The first thing to do is to test your own pedals. Open the Controller screen within GTR and set pedal sensitivity to 50%. Try moving the accelerator pedal until you reach 50% of the travel on the blue bar and note how far you have to push it to reach that point.

Now close your eyes and try the same thing again. Move the pedal to where you imagine you should be applying 50% throttle input and look at how far the blue bar has moved. Try this several times until you get a consistent idea of where you expect this to happen. For my Logitech Red MOMO Force pedals this “crossover” point happens earlier than I’d expect: The blue bar shows a value of 65-70% approx when I think I’m only pressing the accelerator at 50%. This means that I’m actually getting 65-70% power applied when I expected 50% power!

Press the accelerator pedal to your “crossover” point again and hold it at that point. Whilst holding the throttle input steady reduce the sensitivity slider from 50% until the blue bar is equal to or very slightly higher than 50% (Shown by the centre of the steering axis on the bar above). This will give you more pedal travel for modulation and make the car easier to drive. For Logitech Red MOMO Force pedals a sensitivity figure somewhere between 0% and 30% seems to work fairly well for the throttle.

If the bar is 50% or below when you reach your “crossover” point leave sensitivity at 50%.

If you’ve become used to a higher sensitivity level it will take a while to adapt to the changed pedal feel. “By using 0% sensitivity, you'll get the feeling that you can press the pedals more without the same in game fast reaction. This can tempt you to press the pedals more than it's needed, as initially it seems the car is delivering less power.” **Luis Branco**

Going for too low a sensitivity figure will create a spike in throttle input higher up the pedal travel however. Although it won’t spin you it may wear the tyres out faster so try a slightly higher value first (15-30% sensitivity.) before going as low as 0%. A higher level of sensitivity will give you more precise control but it won’t be as easy to adjust your low speed throttle input compared to a lower sensitivity figure.

As a general rule if you have higher quality pedals (BRD Speed 7, Ecci, Frex etc) then you should probably be able to use a slightly higher sensitivity compared to cheaper alternatives.

Brake
Changing Brake sensitivity will have a similar effect to on the throttle axis.

0% sensitivity will give you a non-linear response where the brakes lock up later, 50% sensitivity will give you a linear response and 100% sensitivity will give you a non-linear response where the brakes lock up sooner.

A lower brake sensitivity will be slightly better for trail braking but overall a linear 50% sensitivity provides the best control throughout the braking zone.

Steering
You should leave the steering axis at the default linear 50%.

Speed sensitive steering will slow the steering down at higher speeds making the car feel less twitchy. This allows for the limited amount of lock a typical computer steering wheel has. By default this is at 10% but a lot of people like to disable this option.

Altering the Setup
Once you’ve got an idea of what the default setup feels like it’s time to start changing it! I’ll first apply my base settings on top of the “Rennen” setup.

- Steering (For a MOMO Force start with 13.5deg. Other wheels will vary from this)
- Anti-Roll bar (initial settings of 120N/mm front and 40N/mm rear)
- Differential (initial settings of 50% Drive Side Locking, 40% Coast Side Locking, preload of 3)
- Toe-In/Out (initial settings Front –0.50deg, Rear 0.10)
- Tyre Compound (Soft Front/ Medium Rear)
- Cold Tyre Pressure (initial settings of 140kPa for all tyres)
- Camber (-3.0 degrees front, -2.0 degrees rear)
- Springs (minimum strength on all wheels)
- Dampers (reduce all damper settings to minimum setting 1)
- Packers: If there are any packers remove them
- Ride Height (lowest possible settings front and rear)

I’ll leave wings and caster unchanged to start with.

The advantage of having base settings to begin with is that you will always have at least some of the same initial handling characteristics no matter what track or car you're driving. These settings aren't set in stone and once you've found your own favoured settings use them instead.

Setup Order

Once you've done that it's time to do some more test laps. Note how the car feels now: If it's more responsive, has more grip, seems unsettled through the bumps etc. Note what RPM the engine is reaching at the fastest part of the circuit in 6th Gear and whether the brakes are locking up. Do 2-3 quick laps plus the outlap WITHOUT SPINNING and return to the garage by pressing "Escape" and "Return to Garage" from the menu. You can now set some of the main settings.

There's more than one way to work through the settings. What I'm going to describe here is my own personal setup method for GTR. Other people and setup guides will do this differently. The theory behind my approach is that the suspension settings (springs and dampers) plus the tyre pressures should only have a single aim: **To maximise grip at all times**. I feel that using these settings to alter the car handling characteristics is a compromise that should be avoided.

I prefer to use the differential locking, anti-roll bars, toe-in/out and front- rear downforce balance to adjust how the car feels.

The thinking behind leaving the springs and dampers at minimum strength until a reasonable compromise is reached for the other settings is that if the setup works well with no proper suspension settings dialled in: Grippy, stable, responsive etc then you should be able to retain those characteristics whilst enhancing the speed with a focused suspension setup.

My other reason is that it simplifies the setup process. To begin with you only have to consider the effects that adjusting the suspension in one direction (stiffening) will have on the other settings you've arrived at.

The first things to begin with are:

1. Tyre pressure
2. Camber
3. Gear ratios

You should be able to set these up to begin with after your first test lap session.
Then move on to:

4. Ride Height (Initial Estimate)
5. Brake bias
6. Steering Lock
7. Caster

These also shouldn't require a huge amount of laps to decide what to use. At this point you only need a rough estimate for ride height simply so that there isn't excessive grounding to keep the car driveable. It should still be grounding from time to time because the springs and dampers are still very soft.
Next I look at the handling:

8. Toe-in/out
9. Differential settings
10. Anti-roll bars
11. Wings

These elements all decide the basis of how your car will feel. Although you should test each setting individually it's the balance between them that decides how good your eventual setup will be. My preference is to have differential and anti-roll bar settings that verge on oversteery for the best low speed turn-in and then to use the toe-in and wing settings as a counter balance for high speed control and neutral handling. Try different combinations to see which works best for you.

Finally I look at the suspension:

12. Ride Height + Packers if required.
13. Spring Strength
14. Dampers

Once you begin dialling in some suspension settings you can arrive at a final setting for your ride heights and if needed put some packers in. Stiffer springs and dampers should eliminate any grounding problems and give you an idea of how the setup will feel overall.

Remember that until you setup the suspension the car will have some particular handling characteristics: It will tend to rebound sharply after hitting a kerb and could cause you to lose control unexpectedly. The car will also feel very bouncy which is normal until the correct damper settings are entered.

I should add that this setup method takes the form of cycles. I'll work through this list several times reviewing each aspect in turn until I'm happy overall. Although I do the suspension last to begin with that's only on the first cycle. In the next cycles the other areas are altered to allow for the new suspension settings where required. Camber and tyre pressures in particular will need adjusting throughout the setup process.

Tyres

The right tyre choice is a vitally important part of your setup. Unfortunately tyre information isn't recorded as a Motec trace so you're reliant upon the information given to you within GTR itself. There are 3 seperate places that tell you about your tyres.

The garage screen provides you with information on tyre pressures and temperatures across the tyre. It takes 2-3 flying laps for the tyres to warm up and reach their operating pressure (As the air within the tyres gets hotter the tyre pressure will increase). This operating pressure is shown by the value in kPa in the centre of the screen for each individual wheel. The 3 values in degrees c above this show what the operating tyre temperature is at the outside, centre and inside edge of each tyre.

Whenever you press "escape" and then "return to garage" these values will be updated with the value your tyres had at **exactly** the time you pressed escape rather than at the end of the last lap. When comparing tyre settings try and be consistent about the point you return to garage at each time. Tyre temperatures in particular can vary by a lot at different parts of the lap.

You can also check tyre temperatures on the incar LCD dashboard in real time (cycle between dashboard display modes by pressing Space as default). This is a very useful tool for seeing how your tyre temperatures respond to changes in weather, driving style and fuel load. This display is invaluable for helping you decide your race strategy as tyre temperatures are your indicator of how much grip you have available at a particular moment within a race. The incar LCD display only shows the centre tyre pressure for each tyre rather than the average of the tyre temperatures. Therefore you have to expect **increasing** the tyre pressure to result in a **higher** tyre temperature being displayed. (particularly on the rear tyres).

Check on tyre wear by pitting into the garage rather than pressing escape. This will give you the option of changing tyres as in a race. The 4 numbers at the bottom right of the clipboard show how worn the tyres are. The scale goes from 0-60. When wear goes over 60 you're in danger of puncturing. An X means that tyre is punctured or the wheel is missing. The higher the number the more worn the tyres are. You'll normally get a warning message over the pit radio when wear gets to around 30. Try to pit before this happens. Once the tyres are changed this information is lost so it's often a good idea to make a screen shot of the clipboard to refer back to later.

Tyre Compound

There are six tyre compounds from 3 different tyre manufacturers (Michelin, Pirelli and Dunlop) available in GTR: 3 compounds for use in dry conditions (Soft, Medium and Hard) and 3 compounds for use in wet conditions (Monsoon, Wet and Intermediate). The softer the tyre compound the more grip the tyre will have but it will also wear faster and tend to create higher temperatures.

Michelin tyres appear to be clearly the best tyres in GTR with Pirelli and Dunlop a little behind. Dunlop tyres tend to warm up quicker but don't last as long as the Michelins.

The best dry tyre compound choice for a race would preferably be soft compound front tyres and medium compound rear tyres. So long as you don't do any big slides, spin or overdrive the car a soft front/ medium rear combination should last for the duration of a 45minute+ stint with out any real problems.

You check by looking at the tyre wear indicator in the pit stop to see what state the tyres are in. You can then adjust your pit strategy for the next time to see how much further you could have gone with those tyres. You'll notice that the car handling starts deteriorating and you'll also get verbal warnings over the pit radio when the tyres are close to being worn out.

The tyre compound is one of the main factors that you can use to adjust tyre temperature. Moving from a softer to a harder compound tyre will typically drop the operating tyre temperature by 10-20c whilst moving from a harder to a softer compound will increase the operating tyre temperature by 10-20c.

The simplest way to think of the wet tyres is as the equivalent of the dry tyres but for wet conditions: A monsoon tyre is the softest compound and will give you the best grip in very bad weather. As soon as it dries out it will overheat however. A wet tyre is normally the best compromise whilst the Intermediate tyre isn't going to give you any grip in the wet *or* dry. It's worth avoiding.

Tyre Pressures
This is the key to a good setup.

1. Lowering tyre pressure will increase the average tyre temperature.

2. Increasing tyre pressure will increase tyre temperature in the centre of the tyre relative to the edges of the tyre.

I've found that the optimum operating pressure once the tyres are warm is around 170kPa. Uncheck the "Symmetrical Setup" box and then subtract the warm tyre pressure (middle figure) from 170. Change the cold tyre pressure by this value. For example the rear right tyre in Picture 1 operating pressure is 177kPa so you would reduce the rear right tyre cold pressure by 7kPa. The front right tyre cold pressure for this setup would need increasing 15kPa as it is under inflated. You'll end up with different cold pressures for each tyre which is normal.

Picture 3: Checking the Operating Tyre Pressures

Tyre pressure can also be used to adjust operating tyre temperature and the cars front/ rear handling balance. Increasing tyre pressure will increase tyre temperature on the incar LCD display whilst reducing tyre pressure will reduce tyre temperature on the incar LCD display. Simply concentrating on achieving the optimum operating tyre pressure across all four wheels appears to give the best handling overall however.

It's important to remember that you can't just set the tyre pressures once and that will be the final value you use. Although the only way to adjust the operating tyre pressure is through changing the cold tyre pressures other setup changes you make and different weather conditions will change what value the operating tyre pressures reach. The safest way is to check after each test run you make and then just keep tweaking the pressures throughout the setup process.

The interesting thing I've noticed in GTR is that an under-inflated tyre will hold onto the heat for longer after a corner: The over-inflated tyre reaches a higher temperature mid corner due to having less grip and sliding more but then the heat drops away again fairly quickly. The under-inflated tyre in contrast doesn't get as hot mid corner but the heat generated stays on the display for longer before falling away again.

The other thing I should mention is that the car will be quicker and easier to drive with under-inflated tyres compared to over-inflated tyres. Both will be significantly slower than using the optimum operating tyre pressure however.

In hot weather you'll need to remember to reduce cold tyre pressures over the ones arrived at in open practice and in cold weather or wet weather you'll need to increase cold tyre pressure in order to reach the optimum operating pressure. I don't have an absolute rule but reducing cold tyre pressure by 1kPa for every 5c that the track temperature is above the open practice track temperature of 26-27c works fairly well. If the track temperature is below 26c then I will increase cold tyre pressure by 1kPa for every 5c below 26-27c. For example if track temperature is 40c I would reduce cold tyre pressure by 3c.

If the car starts to feel slippery at the end of a long race reducing cold tyre pressure by a few kPa will help keep the handling consistent for longer.

Tyre Temperature
You should use tyre temperatures as a guide to how you hard you're able to drive. At the start of a race or test session your tyres will begin at 20c and gradually warm up. Until the tyres are warmed up you won't have any grip available for cornering or braking. It's best to be patient until the tyres are close to their optimum temperature before trying to lift the pace.

In an ideal world you'd have identical optimal operating tyre pressures and temperatures across all four wheels giving you the best grip and handling consistency. If the operating tyre pressures are the same across all four wheels but you still have wildly varying tyre temperatures then you have to sit down and ask yourself why?

The reason is that most of the tracks tend to have more bends that turn right than left (or vice versa) meaning that the tyres on one side of the car must work harder than on the other side. Tyre temperatures provide an idea of how your car deals with weight transfer. A hot tyre means that tyre is supporting more of the cars weight and working exceptionally hard. A cold tyre in contrast means that tyre isn't working to its full potential and may even be lifting of the track altogether! It's usually impossible to get the tyre temperatures identical across all four tyres but the closer you get the better the car will handle.

The optimum tyre temperature you're aiming for will usually be in the 90c to 100c range, regardless of tyre compound or weather. A value lower than this means that the tyres aren't warm enough and will be losing grip. The car will normally slide around more. A value higher than 100c means that the tyre is overheating. If the tyre is overheating the car will become extremely hard to drive and it will feel as though the overheating tyre is "snatching" and trying to spin you off the track under acceleration. Of the two it's normally better to have a tyre temperature that's too low rather than too hot.

You can adjust the cars weight transfer and hence the tyre temperatures using the springs, dampers and anti-roll bars. If you're starting from the default setups tightening the rear anti-roll bars and softening the front anti-roll bar will help to even out the tyre temperatures. Increasing spring stiffness on the wheel with the least stressed (coldest) tyre will help even out the tyre temperature difference between left and right wheels giving you more grip and more stable handling through longer stints.

"Think of this... the left side tires budget of grip is already max'd out (assuming you are pulling the full 2g lateral... check motec). There is no more grip to add to that side... the glass is full, adding more just means it will spill over (aka spin). So, your option is to add grip to the tires that ARE NOT already at maximum grip... those happen to be the inside tires:

If you want it to turn better? Give more grip to the INSIDE front tire
If you want it to get the power down better? Give more grip to the INSIDE rear tire.

How? Springs and pressures. Camber will be used afterwards only to fine-tune those other adjustments for tire wear and temps. Stiffer spring to the inside tire will "press it into the track harder" especially when it is unloaded as the inside tire in a turn. Try raising, slightly, the inside wheel's spring rates until you can carry more speed through the turns you want. Fine tune that even further with air-pressure (tires are springs too). Dont go giving both front and rear extra spring, just the one to accomplish what you want determined by the two questions above." **TMcArthur**

Brake bias seems to affect front/rear tyre temperatures as well. With the Ferrari 550 Maranello moving the brake bias forwards appears to keep the front tyres hotter whilst a rearwards brake bias looks to heat the rear tyres up more.

Driving style has a large influence on tyre temperature. Big slides and spins will heat the tyres up far more than a smooth accident free driving style. The longer the race distance you plan on doing the more important it is to drive smoothly as this will conserve tyre wear as well as keeping the handling consistent further into each stint. With GTR I found that to begin with I was always overheating the rear tyres by trying too hard. Over time I've adapted my driving style and found that it's now

possible to make the tyres last longer and stay cooler than before. If you think you're going slower than you should be that's about right!

With Dunlop tyres you will normally see them gain temperature for the first laps and then the temperature of the rear tyres will fall away and stabilise as the fuel load burns off lightening the back of the car. In a race this will often give you a second "sweet spot" where you can drive faster again. Tyre wear is heavily influenced by how you drive and by your low gear settings. Gentle acceleration from hairpins and few powerslides will make the tyres last longer plus it's often possible to cool the tyres down a bit by not pushing as hard for a few laps.

Camber

The second part of the tyre setup procedure is Camber. This is a very important setting in GTR. The Camber figure is the static angle that your tyres are to the road when the car is stationary. A 0.00 camber value means the tyre is upright. A negative value means the top of the tyre tilts inwards towards the car whilst a positive value means the top of the tyre tilts outwards away from the car.

In GTR you should only ever use negative camber. This means that only the inside edge of the tyre touches the tarmac at rest whilst the outside edge isn't in contact with the ground. When the car goes round a corner on the race track cornering forces will change the tyres angle relative to the road. The outside tyres will have an increased amount of the outside edge of the tyre in contact with the tarmac. On the inside wheels the same cornering forces will reduce the amount of the outside edge of the tyre in contact with the tarmac. The initial static camber setting is an attempt to allow for these cornering forces and your aim is to maximise the contact patch of the tyre throughout the lap. When cornering the ideal is for the full width of both outside wheels tyres to be in contact with the road along with as much of the inside wheels tyres as possible.

Although higher negative camber values appear to give more grip initially, it means that the car will be perched on only the inside edges of the tyres causing uneven wear across the tyre and resulting in a smaller contact patch overall.

You use the three temperatures of the tyre cross section in the Garage screen to check how much tyre is making contact with the ground. The aim is to have equal tyre contact whilst cornering shown by equal temperatures across the tyre. A hotter inside temperature than outside temperature means that the outside of the tyre isn't making enough contact with the ground. If the centre tyre temperature is higher than the other two it means the tyre is over-inflated. If the centre tyre temperature is lower than the other two it means that the tyre is under-inflated.

I usually aim for the inside tyre temperature to be roughly 5-7c higher than the outside tyre temperature after 2-3 flying laps with the centre figure between the other two. As you do more laps the tyre temperature cross section should gradually level out giving you a balanced tyre temperature. After 10 laps or so the three values should be almost the same temperature. This means that you are getting maximum tyre contact and even wear across the tyre.

Decreasing negative camber (a value nearer to 0.00) will reduce the temperature difference between inside and outside edges whilst increasing negative camber (a negative value further from 0.00) will increase the temperature difference between inside and outside edges.

Once the overall setup is finalised I find it useful to spend a while tweaking the cambers again from scratch. I will typically start at -2.5 degrees front and -1.5 degrees rear and then gradually increase the camber by -0.1 degrees at a time paying particular attention to how easy the car is to drive and how much grip is available. These are starting values and your final camber settings will normally be higher than these. Different cars, setups and circuits have different requirements so its difficult to say what final camber values you'll end up with. For the 911 GT3 RS and Ferrari 550 I've usually been ending up with roughly -3.0 to -3.5 degrees front and -1.9 to -2.2 degrees rear camber for my race setups. Make sure you're happy with the rest of the setup first before deciding the final camber settings.

For longer races using less camber will keep the handling balance more stable whilst using slightly more camber for a qualifying setup should give more grip for a single flat out effort. Reducing negative camber on the rear wheels (closer to 0.00) will make the car more stable and less likely to spin under acceleration or over kerbs.

Using asymmetrical camber can also give you more grip. Look at the track map and note how many left and right corners on the circuit there are and especially note the ones that lead onto the long straights. If there are a lot of right hand bends such as at Donington putting extra camber on the left hand side tyres (a higher negative number) will give improved grip through them. If in doubt go for less rather than more camber overall as it will give more consistent handling. Symmetrical camber will result in a car that's easier to drive.

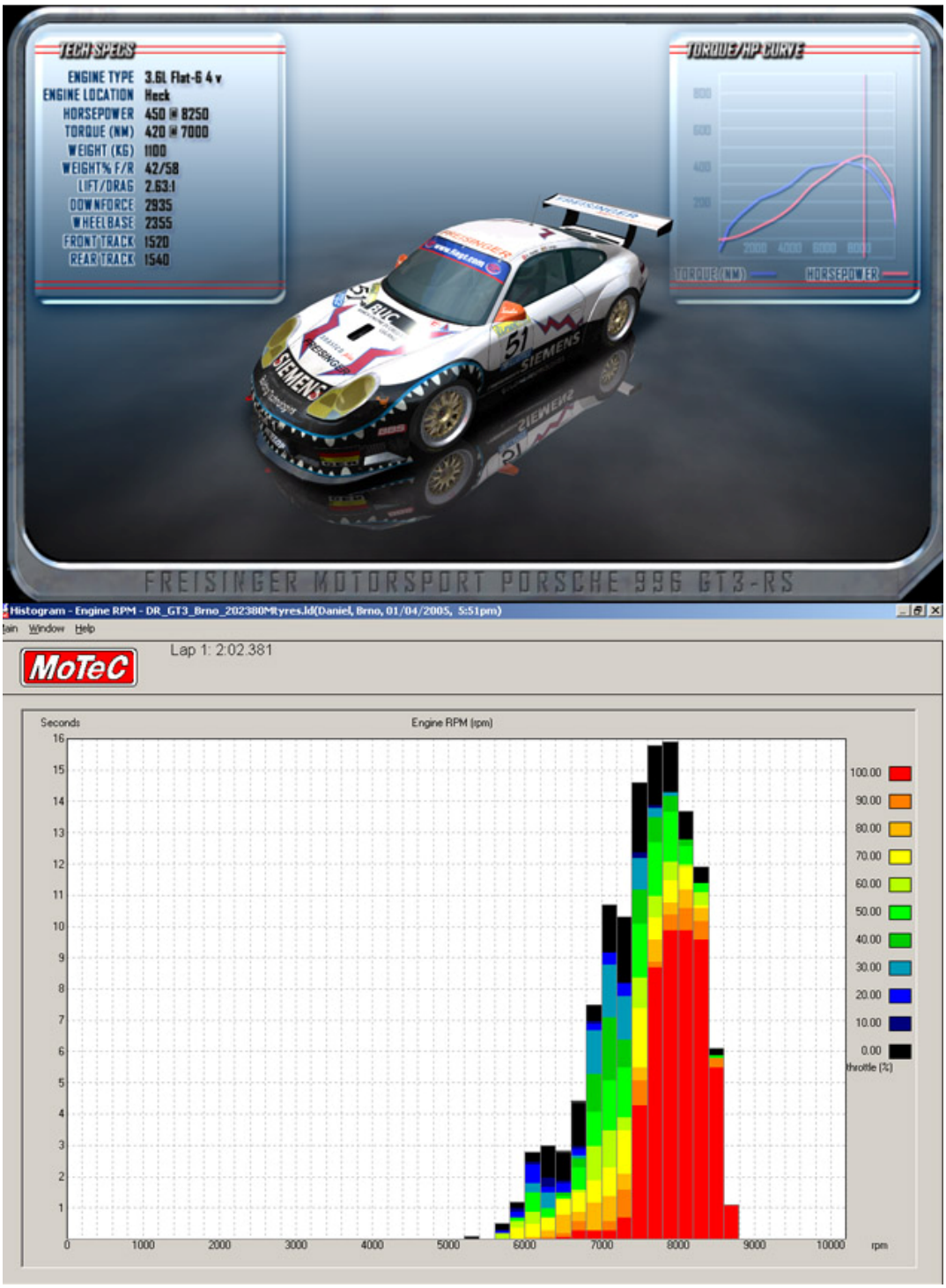
Gears

Make sure you have Throttle pedal sensitivity set to 50% or lower and Deadzone set to 0% in the controller settings.

Gearing is one of the areas where it's possible to gain a clear second per lap simply by optimising the ratios. Many of the cars are restricted in what changes you're allowed to make so you have to work within those limits. The Lotus Elise for example has a road gearbox so you're unable to change the ratios at all. The first thing to do for short races is to increase the RPM limiter to the maximum allowed figure. The basic guidelines are to find a gear that drives well out of the slowest corner, set the top gear so that maximum revs are reached at the fastest point of the circuit and space the remaining gears equally between the other two.

Find the correct top gear ratio by moving the cursor to the peak of the highest point of the "Corrected Speed" trace on the GTR Analysis sheet. You can now read off the RPM reached from the "RPM" trace at the bottom of the page. It should be as close to the RPM limiter figure as you can get it.

The first gear ratio is a critical choice for three reasons: Too short and you'll literally melt the rear tyres off the car within a couple of laps because they can't handle the torque and wheelspin generated. This is a big issue with the GT cars. If it's too short you could also easily spin under brakes as you shift down into it on corner entry causing the transmission and the rear wheels to lock suddenly. A tall first gear has the advantage of making power delivery smoother, significantly enhances the life of the tyres and allows the close spacing of the remaining gears. It varies from car to car but setting first gear at or just below the ratio second gear is in the default setup works fairly well.



Picture 4: Porsche 911 GT3 RS Power Output

If it's too long however the car won't accelerate quickly enough losing time. The way to check this is by first studying the engine statistics in the Showroom section of GTR and then by checking the engine RPM histogram in Motec. If the revs are dropping too far below the peak power and torque figures this histogram will show you in the form of a long "tail" where too much time is being spent at low revs. The example picture shows what an optimised gear layout for a Porsche 911 GT3 should look like.

Choose your shift points according to the max power output of the car. Aim to shift up a few hundred RPM above the peak horsepower of the car but before you hit the rev limiter. In the 911 GT3 RS for example I will shift up at around 8500RPM each time. When you shift up a gear it will drop RPM and the higher gear will re-engage lower down the rev range. (In the 911 GT3 RS with auto clutch enabled each up-shift at 8500RPM will drop around 1200RPM re-engaging at 7300RPM.) Shift up too early and the gear will re-engage at low RPM where there is less power available. Most of the GTR cars power output

falls away steeply after the peak power output is reached so holding the gear all the way to the rev limiter will actually lose you time. Closely spaced gear ratios will help keep the engine close to its peak power output for more of the lap.

For longer races I leave the RPM limiter at maximum for high revs and max speed when needed for overtaking but normally shift up a few hundred RPM below the peak power output (8000 RPM in the GT3 and around 7000 RPM in the Ferrari 550). This helps conserve the engine which will fail after 1-1.5hrs if driven flat out for the entire race.

Downshifting technique depends on race distance also. If you're using auto clutch in a short race using aggressive engine braking (6th straight to 4th as soon as you begin braking and then equally spaced downshifts 3rd - 2nd – 1st) keeping the RPM high but slightly below the RPM limiter will give you the best braking performance. For longer races this will damage your engine so use the brakes to slow and then use evenly spaced downshifts through the braking zone without over-revving the engine.

Brakes

Braking is heavily influenced by your game controller settings. **Make sure you have brake pedal sensitivity set to 50% or lower and Deadzone set to 0% in the controller settings.** This will make it easier to modulate the brakes.

Brake bias in GTR depends on the track, your choice of car and your driving style. I start with a brake bias of around 58Fr/42R initially and work from there. Your brake bias settings will typically end up somewhere between 60Fr/40R and 52Fr/48R. Porsche 911's need a more rearwards brake bias than the other cars.

Brake force restricts how much pressure can be applied whilst braking. A lower brake force figure will make it harder to lock the wheels. A setting in the range of 90-95% is normal with 90% generally being best for an NGT car. 100% brake pressure and lots of ducting is normally best for the GT cars.

Brake bias decides how the braking force will be split between the front and rear wheels. For circuits with several high speed to low speed braking zones (6th down to 1st on corner entry) such as Magny-Cours or Spa a rearwards brake bias matched with a higher coast side differential figure will give you the best braking performance. A rearwards bias will give better braking but at the expense of stability and can spin when you lift off the brake. As you learn the limits of the car moving the brake bias gradually rearwards will help you do faster lap times. The fastest qualifying setups tend to have a rearwards bias up to around roughly 52Fr/48R (Non Porsche 911).

A forwards brake bias normally offers less braking performance but you'll be able to trail brake deep into the corner, the transition from braking to accelerating will be safer and the car will be easier to drive particularly over longer race distances. Don't go further forwards than 60Fr/40R though or brake performance will be compromised.

Brake Ducts decide whether the brakes will overheat or not. You should aim for the minimum possible amount of ducts for the engine but not for the brakes! There's no way to check brake temperature within Motec so you have to have brake temps open on the in car dashboard as you drive around. If they're going over about 500c regularly you need more ducting. 400c is around the optimum temperature for best performance. The front brakes should normally be hotter than the rear brakes but not excessively. Not having enough ducting for the brakes will show up in two ways. The brakes will either begin to fade and it will feel as though the car won't stop at all or if you're using them repeatedly, (such as the final half of the lap at Donington) the brakes will start locking unpredictably .

With GT cars such as the Ferrari 550 Maranello or Lamborghini Murcielago you normally need at least 4-5 brake ducts. An NGT car such as the 911 GT3 RS or Ferrari 360 Modena will normally only need 2-3 brake ducts. In hot weather increase ducting over the figures arrived at in open practice.

To decide what brake bias you should use start with a 60Fr/40R brake bias and let the tyres and brakes warm up for a few laps. Once you're sure the tyres are up to temperature gradually move the brake bias backwards 1% each lap and note how it feels. Keep moving it back until the car becomes noticeably difficult to control or you spin out under brakes. Move it back forwards 1% from this value and that should hopefully be your final brake bias setting.

You can check to see what changes are being made using the “Weight Transfer” Graphical Analysis Template. Look at the corner where you have to do the heaviest braking. An improved brake setup should result in a higher negative figure on the Longitudinal G Force trace. The brake trace should show you spending less time braking, braking later than before and ideally with no lock ups of the front wheel traces.

Brake bias isn’t a static setting that you will leave unchanged. For wet weather moving the brake bias rearwards 1-2% from your dry settings should make the car easier to control. With the Ferrari 550 I normally use a brake bias between 58Fr/42R and 59Fr/41R in the dry but when it begins raining I adjust it back to 57Fr/43R.When it stops raining move the brake bias back to your normal dry settings.

If towards the end of a long race stint one end of the car has noticeably less grip (too much understeer or oversteer) consider moving the brake bias away from that end of the car towards the tyres that have more grip. Only make a small adjustment (0.5-1%) and change it back once you’ve pitted for new tyres.

The Porsche 911’s have a different weight distribution to the other cars so you need to use a further rearwards bias. Expect to use a brake bias 1-3% further rearwards than you perhaps would in the other cars. The 911 GT2 in particular benefits from using a rearwards bias in the 53fr/47R to 48Fr/52R range.

Steering Lock

A higher value helps you turn through slow corners. This is reliant upon the amount of lock available in your wheel also. Increase this value for tracks with tight corners. If you’ve got a Logitech Driving Force Pro try 23degrees to allow for the extra turn of the steering wheel.

Caster

This affects how stable the car is and how well it will turn into corners. A higher value is more stable at speed but a lower value will help low speed turning. This doesn’t make a huge amount of difference in GTR so I’d probably just leave it at default normally

Toe-in/ Toe-out

"The majority of cars are set up with toe-in on the front wheels and zero toe at the rear. The basic reason for this is that the forces which act on the front tires tend to cause toe-out, and the initial toe-in setting is to counteract this tendency.

Most production cars have the suspension mounted in rubber bushings. This isolates road noise and vibration, but it allows some flexing at the bushings. On the front suspension some of this flexing is in a fore and aft direction at the tire. When the car is in motion the road drag on the tire pushes it towards the rear of the car. This force is resisted by the rubber suspension pivots, but some flexing occurs. This tends to make the front tires toe out, and it increases at higher speeds. When you hit the brakes the flexing becomes much greater because the braking force on the tire is much greater than road drag.

If the car is to handle properly the front tires must not toe out in normal driving.
(...) **Toe-in causes stability and initial understeer in a turn. Toe-out causes instability and initial oversteer.**
(...) Cars with independent rear suspension also have a toe setting at the rear. Because the driving wheels tend to cause toe-in, the rear wheels are usually set at zero toe. The effect of toe-in or toe-out on the rear is much like the front, toe out causing instability and oversteer... Usually zero or a slight toe-in will be the final setting, with high powered cars having the greatest need for a toe-in setting."

How to Make Your Car Handle by Fred Puhn Page 75 and 769

I follow the above guidelines. –0.40 to –0.50 degrees toe on the front and +0.10 degrees toe on the rear seem to work well as a starting point. If you’re having problems with the car understeering move the front toe value towards 0 for better turn in. Keeping a fairly high negative toe figure on the front will stabilise the car accelerating over kerbs and make it easier to regain control after big impacts or sudden changes of direction such as the tyre chicanes at Enna Pergusa.

Adjusting the rear toe figure doesn't have as much affect as the front toe. A negative value will make the car more stable under acceleration but slightly more understeery whilst a positive value makes the car less stable under acceleration and turn in better. If you're having problems with a car such as the Ferrari 550 spinning on corner exit try changing the rear toe figure to a negative value instead of the positive value of the default setups.

It's important to note that my definition of which way is toe-in (negative value) and which way is toe-out (positive value) varies from the GTR Engineers Handbook. Quite simply my way is based on trying each setting and seeing what happened to the handling. A higher negative value on the front provides the characteristics you'd expect from more toe-in whilst a higher positive value on the front provides the characteristics you'd expect from more toe-out.

Differential Settings

- A higher power side number will result in better traction out of corners and power understeer
- A lower power side number will result in worse traction out of corners and power oversteer.
- A higher coast side number will result in better braking and understeer off the throttle.
- A lower coast side number will result in worse braking and lift off oversteer

"The power side needs some qualification: A higher power side does indeed produce some power understeer, but only as long as the engine is not strong enough (or you're very light on the throttle) to spin the rear wheels. When you get the rear wheels to spin, with a high power side number, you will get SNAP oversteer! This is because BOTH wheels will then start spinning at the same time.
With a lower power side number, less horsepower is needed to spin the rear wheels, so in that respect it can give you oversteer, BUT one of the wheels (the inside one) will start spinning a lot earlier than the other, and that will not bring nearly AS MUCH power-oversteer as TWO spinning wheels does.
So, a higher power number leads to more power understeer, up to a point when it all snaps sideways. A lower power number leads to a little more initial power oversteer, but makes the ensuing powerslide a lot more controllable as you apply more power than the rear tires can handle.
Note also, that a smaller power or coast ANGLE in Grand Prix Legends, corresponds to a larger power or coast PERCENTAGE in GTR. A typical 60/45 diff in GPL corresponds to about 40% power and 50% coast lock in GTR. An "alien" 30/85 GPL diff corresponds to roughly 70% power and 20% coast lock in GTR. A "rookie" 85/30 GPL diff would be 20% power and 70% coast lock in GTR (which is undriveable in GTR because the inside rear wheel will be spinning everywhere - the fact that it's driveable in GPL is a physics anomaly according to David Kaemmer himself). In NASCAR, I believe they use an unadjustable diff, that is fully locked when on power and fully open when coasting (which corresponds to a 0/90 diff in GPL, or 100% power and 0% coast in GTR)."

Roland Ehnstrom

The differential settings are largely down to preference. I like 50Drive/ Coast 40 preload of 3 which works well on the majority of circuits. Other people like different settings. You've just got to try different settings till you find ones you like.

It's possible to get an idea of how your differential settings are working by looking at the Oversteer Graphical Analysis Template. If you're getting a large wheel slip figure accelerating out of a corner then your power side differential may be set too low as the wheels aren't locked together tightly enough. If you're getting a large wheel slip figure braking or off the throttle then your coast side differential may be set too low. The main criteria is how the car feels however.

Preload decides how quickly the transition between power and coast differential effects occurs. This controls how your car feels on part throttle (Roughly between 1% and 40% throttle). This is useful for deciding how responsive you want the power delivery to be.

When you're braking or off the throttle completely only the Coast differential figure affects the feel of the car. Above 40% throttle approx only the Power differential figure will affect the feel of the car.

A low preload value will result in a car that's easier to control and will give a gentle transition between braking and accelerating as well as when you re-apply the throttle. This is useful for powerful cars making it easier to accelerate from slow corners. It will tend to be slightly more understeery however.

A high preload value will result in a more responsive throttle pedal making it easier to adjust the cars line mid corner. Small movements on the accelerator allow you to balance the car and hold it on the limit of traction. The downside is that the effects are harsher than with a lower preload value making the car less stable and easier to spin at low speed when you re-apply the throttle after a braking zone or on corner exit. It's also easier to break the rear tyres loose if you lift off the throttle too quickly.

A preload value of 3 seems to give a good balance for the majority of tracks but it's useful to experiment with this setting for tracks with long slow speed corners such as Barcelona or Brno where you're often driving on part throttle.

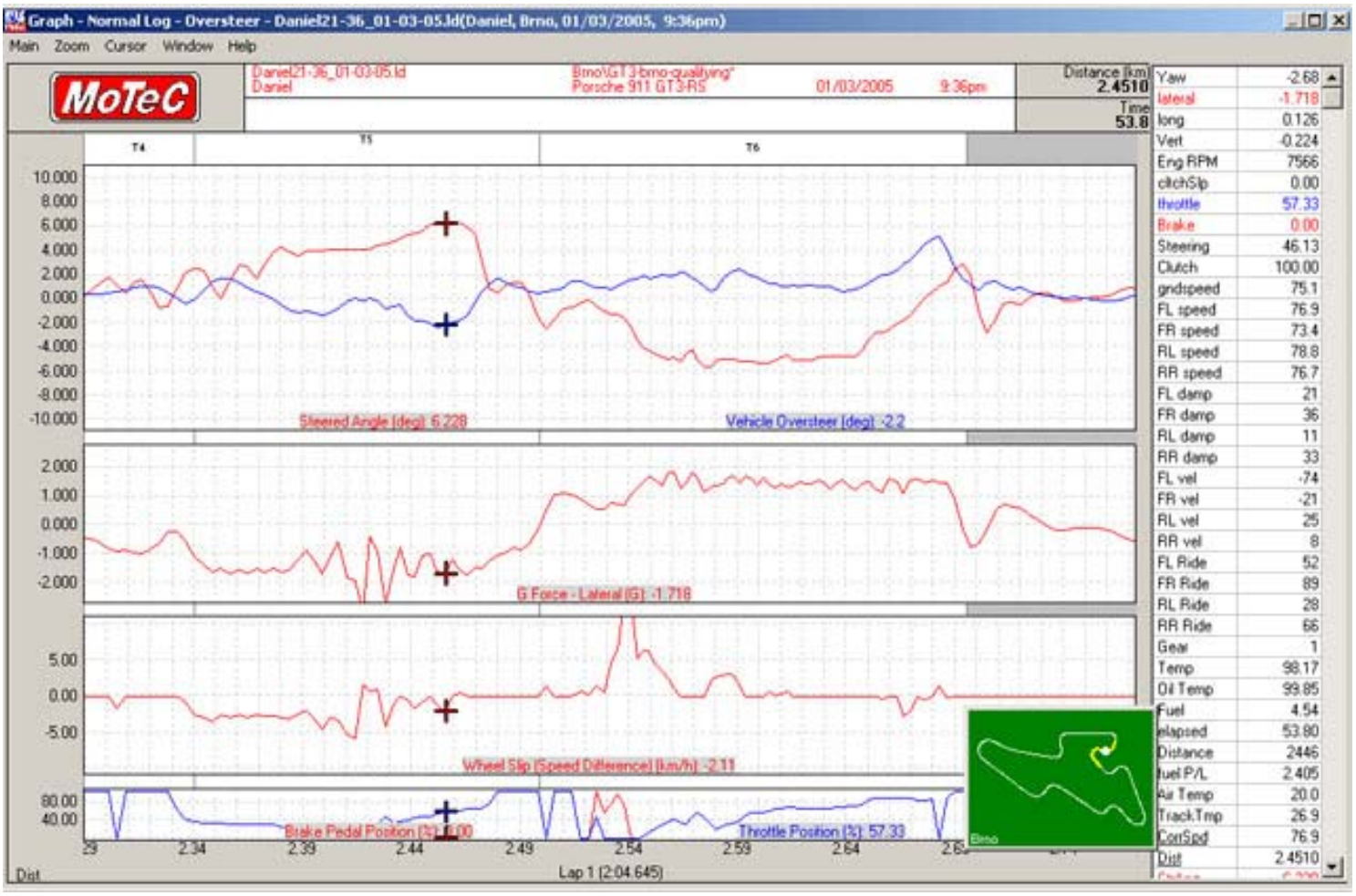
Anti-Roll Bars

This is another area that can add a whole new dimension to the handling of the car. The default setups tend to have fairly stiff front anti-roll bars and 0N/mm settings for the rear anti-roll bars. This has the advantage of making the car stable and very difficult to spin. The disadvantage is hideous understeer and uneven tyre temperatures. If you've ever had that "Why won't it go round the corner?" experience using the default setups it's largely because of this.

The general rule for setting the anti-roll bars is:

- More front anti-roll bar = understeer and worse turn-in but more precise handling
- Less front anti-roll bar = oversteer and better turn-in but less precise handling
- More rear anti-roll bar = oversteer and better turn-in to corners
- Less rear anti-roll bar = understeer and worse turn-in to corners

Tuning these settings will dramatically improve the handling of the car and help make the car easier to control on the limit.
If you're having problems with the tyre temperatures on one side of the car being higher than the other side (e.g.: Anderstorp, Monza) Increasing rear anti-roll bar and decreasing front bar will help to some extent. I'd recommend using my starting point of 120N/mm front and 40N/mm rear as it produces a nicely balanced car on most tracks but don't be afraid to experiment.



Picture 5: Porsche 911 GT3 Oversteer at Brno

You can check the handling bias of the car by looking at the Oversteer Graphical Analysis template. You'd normally expect the steering trace (red) to be higher than the oversteer trace (blue) but with both traces on the same side of the 0.00 centre axis. This means the back end is following what you're doing with the wheel. The oversteer trace should stay close to 0.00. Anything more than 1-2 degrees from centre in either direction means that the back of the car is probably sliding. More steering lock being applied cornering than on a previous lap and a oversteer trace that hardly moves from 0.00 means that the car may be moving towards understeer. This can also be seen where you change direction with the steering wheel but the oversteer trace lags behind what you're doing.

If the oversteer trace and steering trace are on opposite sides of the 0.00 centre axis this means that the car is oversteering badly and you're applying opposite lock to correct it. This can be clearly seen in the picture above where I'm holding the car on opposite lock through Turn 5 of Brno. Note how the wheel slip trace shows the rear wheels lose and then regain traction.

Differential and wing settings affect the oversteer trace as well so you'd use this template in the same way for those settings too.

Wings

Less wing lets you go faster and also changes the handling balance of the car. The only way to decide the wing levels in GTR is to test with different levels of front and rear wing and then compare lap times. You normally want the minimum possible for the least drag. Tight courses need more wing than fast courses. Enna Pergusa and Monza should have 1 for the splitter and a setting between 5 and 7 for the rear wing for maximum straight line speed.
Increasing rear wing will move the balance of the car towards understeer at speed. Reducing it will move the car towards oversteer at speed. Although this oversteer is normally controllable it has the effect of scrubbing the rear tyres which will

make them overheat quickly. It seems to be best to use the differential and anti-roll bar settings to induce oversteer and then have the rear wing as a counter balance to move the handling back towards neutral.

Suspension Settings

When developing a setup I will leave these till last to begin with. Decide the other settings initially by testing with the suspension as soft as it'll go. I think that this will give a consistent benchmark and allow you to isolate the suspension from the other settings. Any handling imbalances caused by unequal damper settings should be minimised this way. You'll be amazed at the lap times you can set with no suspension too!

There are four parts to setting the suspension: Packers, Ride Height, springs and Dampers.

Packers

Packers are an absolute last resort and in GTR you should only really need them at Spa. What they do is to stop the bottom of the car touching the ground when full suspension travel is reached. They can also be used for keeping a static rake angle between the front and rear of the car at high speeds. In theory this should maximise aerodynamic performance and is widely used in racing cars with high downforce levels.

My best advice for GTR is to just leave them on 0.0cm if possible. At Spa the dip at the bottom of Eau Rouge creates a lot of force and can bottom out even a very stiffly sprung car. Use the Motec "Ride Heights" graphical analysis template to check how the ride heights are responding. If any of the wheel traces reaches 0 this means that the car is grounding which can cause major handling problems: You'll normally recognise it as a loss of control and massive understeer. Putting a small amount of packers (0.5-1.0cm) in will reduce the severity of the effects on handling. The things to try FIRST however are stiffer springs, more fast bump damping and increased ride height.

Ride Height

Ride Height in GTR has two functions: It provides enough height to stop the car touching the ground but also controls the amount of under car downforce: The lower the ride height the more grip the car will have. You should aim for a static rake angle of between 0.5cm and 1cm (the difference in ride height between front and rear) wherever possible. More rear ride height is needed if you're going to be carrying a lot of fuel. As the fuel burns off rear ride height will gradually increase. Never have the front static ride height higher than the rear as it will affect the handling.

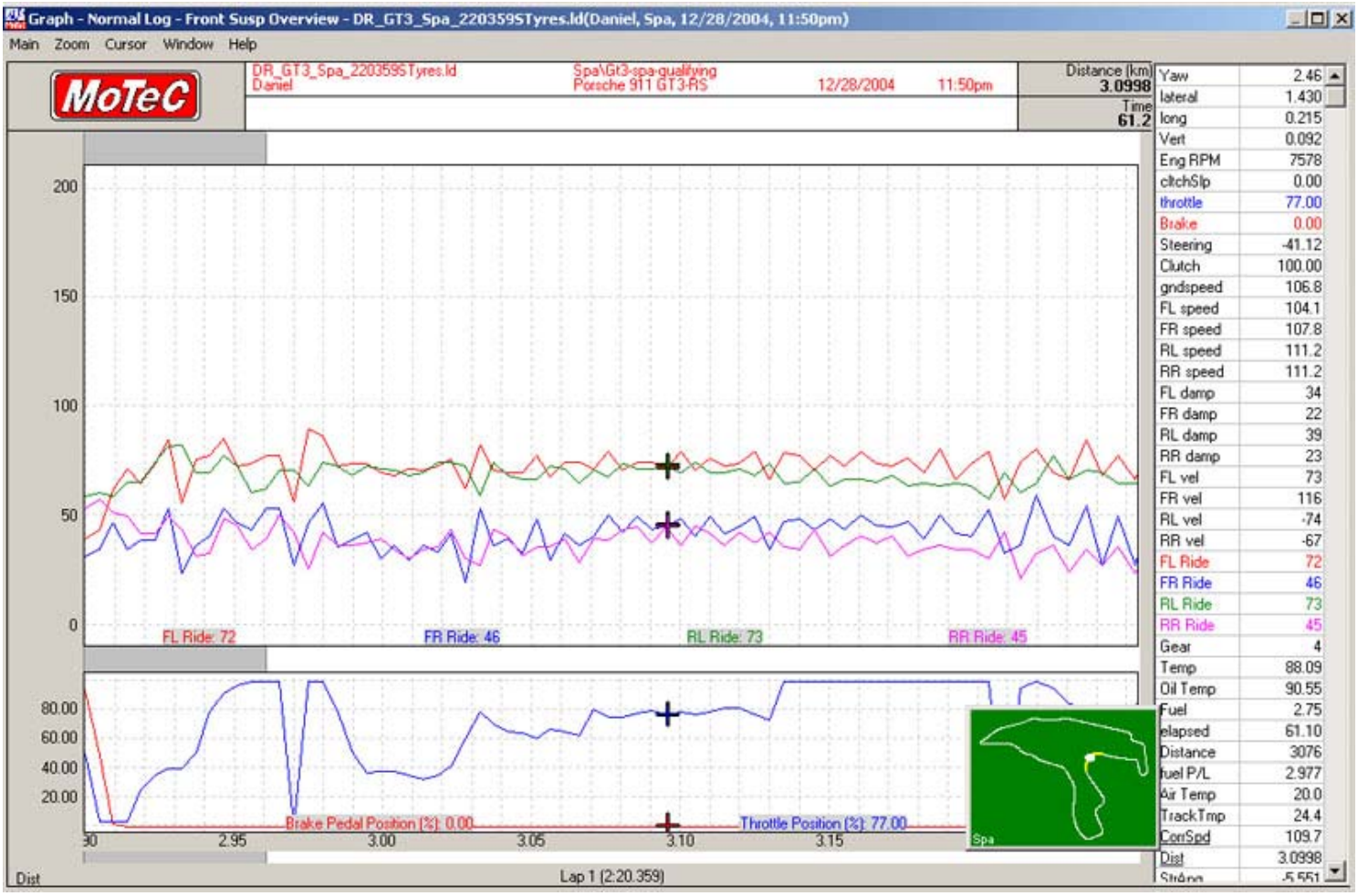
Starting with the ride height at minimum will theoretically give you the most grip in GTR. Because many of the tracks are very bumpy it's often necessary to raise the ride heights. I look at the suspension histograms and then try to arrive at what appears to be a reasonable ride height to avoid grounding before fine tuning it when I do the springs strengths.

Rear ride height at speed is nearly always lower than the front ride height with my setups however. You can check by looking at the average front and rear ride heights on the weight transfer graphical analysis template. (Hold down shift, double left click and drag the blue highlight over the section of graph you're interested in.). I think this must be due to the higher levels of downforce pushing the car down.

What you have to remember is that if you even the high speed ride heights out with ride height, damper changes or packers it's going to compromise handling at medium to low speeds.

If you look at my sample DR_GT3_Spa_220359Styres.ld Logged data file for example there's a 30mm ride height difference between front and rear ride heights at the end of the long straight at Spa.

Now if you look at the Pouhon bend on the same lap in Motec just comparing the front and rear ride heights on the Weight Transfer template you can see how the ride heights are almost exactly the same mid corner until I'm back on full throttle where the rear sinks down again.



Picture 6: Porsche 911 GT3 Ride Heights at Pouhon Corner Spa

If you map FL ride, FR ride, RL ride and RR ride onto a single graph you can see how the car is perfectly balanced between the front and rear ride heights on each side of the car mid corner for the best cornering stability.

For GTR the only thing that really seems to matter with suspension setup is getting as much cornering grip from the car as possible.

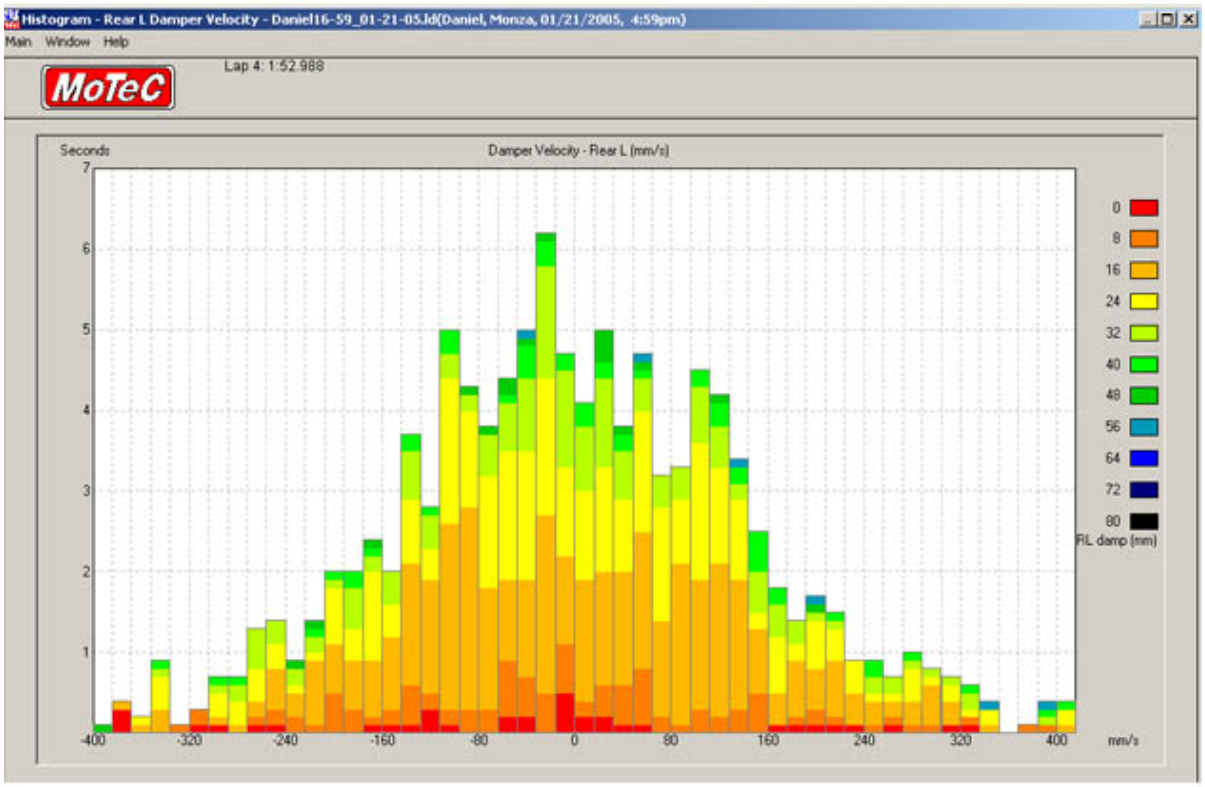
Equal ride heights at speed would be nice but it doesn't seem to be a priority for a good setup.

Springs

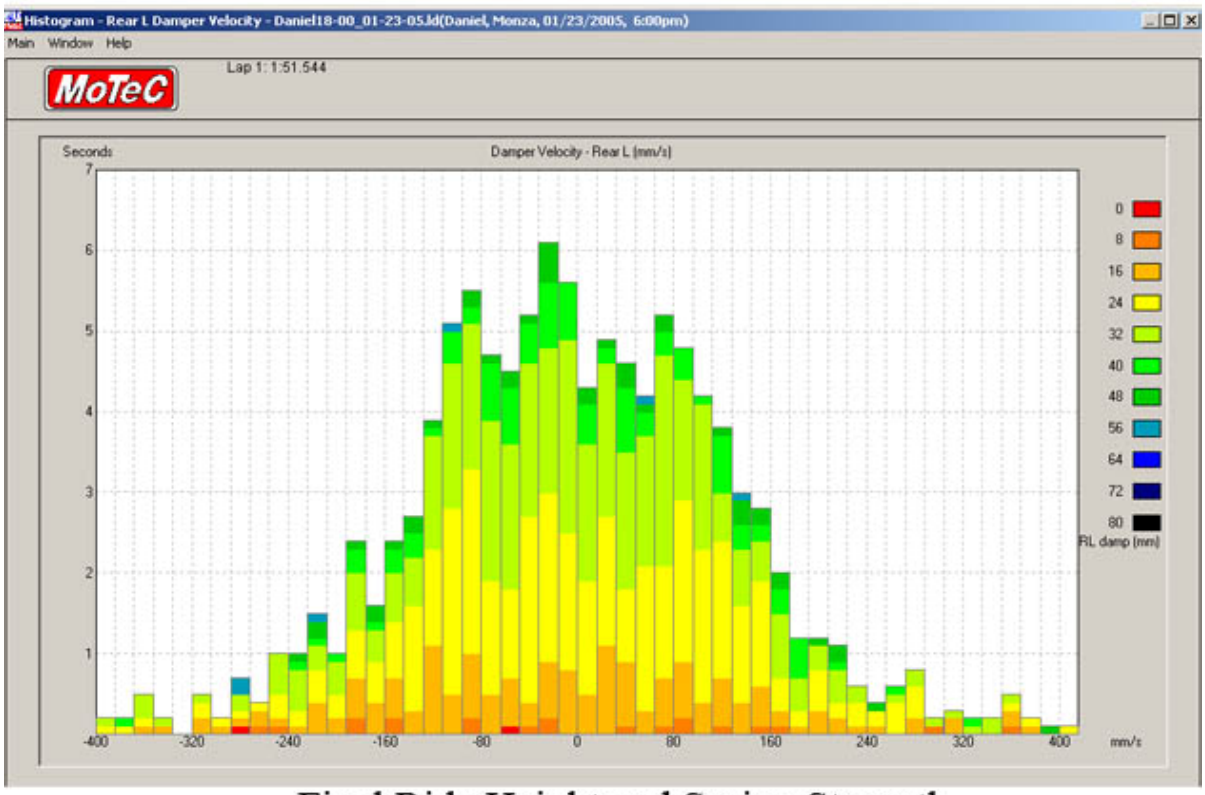
Springs are the mainstay of the suspension. A higher spring stiffness will make the suspension harder to compress and can give less grip. The aim is to use the softest possible springs once you've allowed for grounding. You should try and get the spring stiffness right before beginning on the damper settings.

Open the Histogram tab in Motec and look at the four templates (one for each wheel). A positive figure on the X-axis is the spring compressing and a negative figure on the X-axis is the spring rebounding. The Y axis shows how long the suspension spent at a particular speed during the lap. The histogram will probably look very jagged with a lot of time spent at high velocity because the spring is currently undamped.

Porsche 911 GT3 RS at Monza
Rear Left Wheel Travel Comparison



Minimum Ride Height and Undamped



Final Ride Height and Spring Strength

Picture 7: Porsche 911 GT3 RS Rear Left Wheel Suspension adjustments

What you're interested in for setting the spring stiffness is the coloured bars within the graph. These show how far into its travel the spring was compressing during the lap. Check the key on the right hand side. Lots of red means that the suspension is fully compressing. If there's a lot of red you should consider uprating the springs to a higher stiffness, as the suspension is too soft. This ISN'T the same thing as the ride height going to zero. Use the Front and Rear Suspension Overview graphical analysis templates to check for certain. If the suspension is fully compressing this can also cause serious handling problems. Remember that if it's only going red a bit this can be tuned out using the dampers.

The ideal depends on how much travel you have available. Although the key on the left goes up to 80mm by default the maximum value can only be the value you have set for ride height. This means that colours for front and rear suspension will normally not match. At this stage a majority of green with some orange and a bit of red is what you should be trying for. You just have to match the left and right sides together. If the left and right side colours aren't matching by a large amount fit a softer spring to the side which is compressing the least (The one with the most amount of green or blue in the histogram)

Keep doing test laps and checking the lap times and histograms until you're happy. (If in doubt go for the spring settings that give you the fastest lap times.)

Dampers

The final part of setting the suspension is the damper settings. So far you've tested the car with these settings on minimum. The main issue with the default settings is that they tend to rely on large amounts of slow rebound damping. If you don't have time to do a full test session simply putting slow bump and rebound down to 5 or 6 on all wheels on a default setup should help improve the handling.

The best way to set the suspension is to follow the Koni setup guidelines:

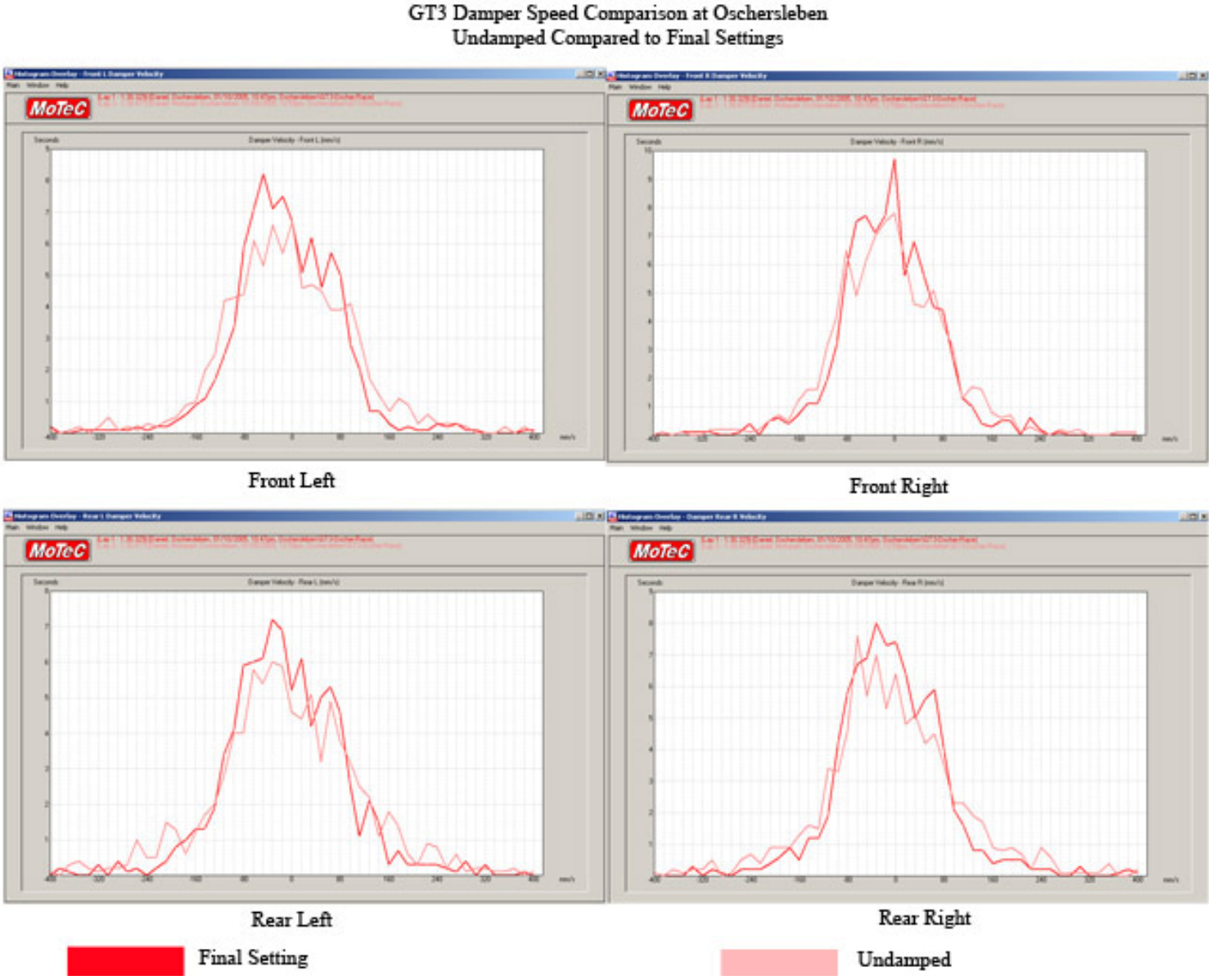
Adjusting the Bump Control

Step 1. Set all four dampers at minimum on both bump and rebound.
Step 2. Drive a few laps to get the feel of the car. Disregard body lean or roll and concentrate solely on how the car feels over bumps.
Step 3. Increase bump adjuster by three clicks on all four dampers. Drive a few laps. Again increase bump settings a further three clicks. Keep repeating until things start to feel hard and jolty over bumps.
Step 4. Back off (reduce) bump adjust by two clicks. Note. It is very unlikely that both front and rear will match. Get one end right and continue the same at the other until they are similar. Make a note of these figures in writing.

Adjusting Rebound Control

Step 1. Leave the newly chosen bump settings untouched. Rebound to fully soft, and do some laps noting particularly how the car rolls entering a corner.
Step 2. Increase rebound by three clicks. Drive it again noting how it enters a corner. You are looking for smoothness without a drastic attitude change or excessive sudden roll.
Step 3. Increase stiffness three or more clicks if necessary until smoothness is achieved. Too much will be indicated as above, so back off two clicks at the appropriate end of the car."

Competition Car Suspension by Allan Staniforth Page 240



Picture 8: Comparing different Damper settings in Motec

4 Way Dampers

The suspension compressing (bump) is shown by a positive value on the right hand side of the histogram. The suspension extending (rebound) is shown by a negative value on the left hand side of the histogram. The faster the suspension is travelling the more time will be spent at the edges of the histogram

The Koni guidelines are intended for use with a two way damper (bump and rebound setting). GTR uses 4 way dampers (fast bump/rebound and slow bump/rebound). The slow bump/rebound settings affect the centre of the graph up to around +/- 80mm/s roughly whilst the fast bump and rebound settings control the outer edges of the graph. The area between +160mm/s to +80mm/s bump and –160mm/s to –80mm/s rebound will be affected to some extent by both fast and slow settings. I use the Koni guidelines but treat fast and slow bump as a single bump setting initially and then treat fast and slow rebound as a single setting in the same way also.

I start by increasing both fast and slow bump 3 clicks together and doing some test laps. Once I've found the best combined setting I then back the slow bump or rebound down three clicks and gradually increase it again one click at a time. Continue adjusting till it feels right whilst comparing lap times between runs.

It's difficult to tell how much the car is rolling in GTR so for setting the Slow Bump and Rebound damping I concentrate on how the car feels in slow corners. As soon as the car seems to be "skating" around I soften the Slow damper settings off again.

The histogram should begin to take on a more symmetrical rounded shape as you gradually increase the damper strengths. Look carefully at the time scale on the left hand side of the graph. This is auto scaling so two similar looking graphs can in fact be very different. Once you're fairly happy overall begin to change individual bump/rebound settings. Do some test laps and then try it again with the original settings. It can sometimes take 100 laps+ before you get to a finalised setting.

Increasing **either** the fast or slow speed bump damping will make the suspension move slower when compressing whilst increasing **either** the fast or slow speed rebound damping will make the suspension move slower when extending. The more time spent in the middle of the histogram and the higher the peak the slower your suspension is moving. The area of the histogram is equal to the duration in seconds of the lap. All you're doing with the dampers is trying to redistribute that time equally between bump and rebound.

The aim is to try and achieve a balance between left and right sides of the graph and also a balance between left and right wheels wherever possible. This usually involves fairly equal bump and rebound settings on each wheel. It's unusual for me to have more than a 2-3 click difference between fast bump and fast rebound or slow bump and slow rebound on the same wheel.

- Increasing fast bump will **reduce** the amount of time spent at high damper speeds on the right of the graph. (positive value). To some extent it will also increase the amount of time spent at medium damper speeds +160mm/s to +80mm/s by slowing the entire suspension down.
- Increasing slow bump will **increase** the amount of time spent at low bump damper speeds 0mm/s to +80mm/s and also have the effect of moving the central point of the curve towards the **right**. (positive value).
- Increasing fast rebound will **reduce** the amount of time spent at high rebound damper speeds on the left of the graph (negative value). To some extent it will also increase the amount of time spent at medium damper speeds -160mm/s to -80mm/s.
- Increasing slow rebound will **increase** the amount of time spent at low rebound damper speeds 0mm/s to -80mm/s and also have the effect of moving the central point of the curve towards the **left**. (negative value).

It's usually impossible to get front and rear dampers exactly the same but if all four histogram curves look similar and spend similar times at equal damper speeds it means that the suspension frequency is fairly balanced which will make the car handle better. The front suspension will normally end up with higher peaks at the centre of the histogram than the rear suspension.

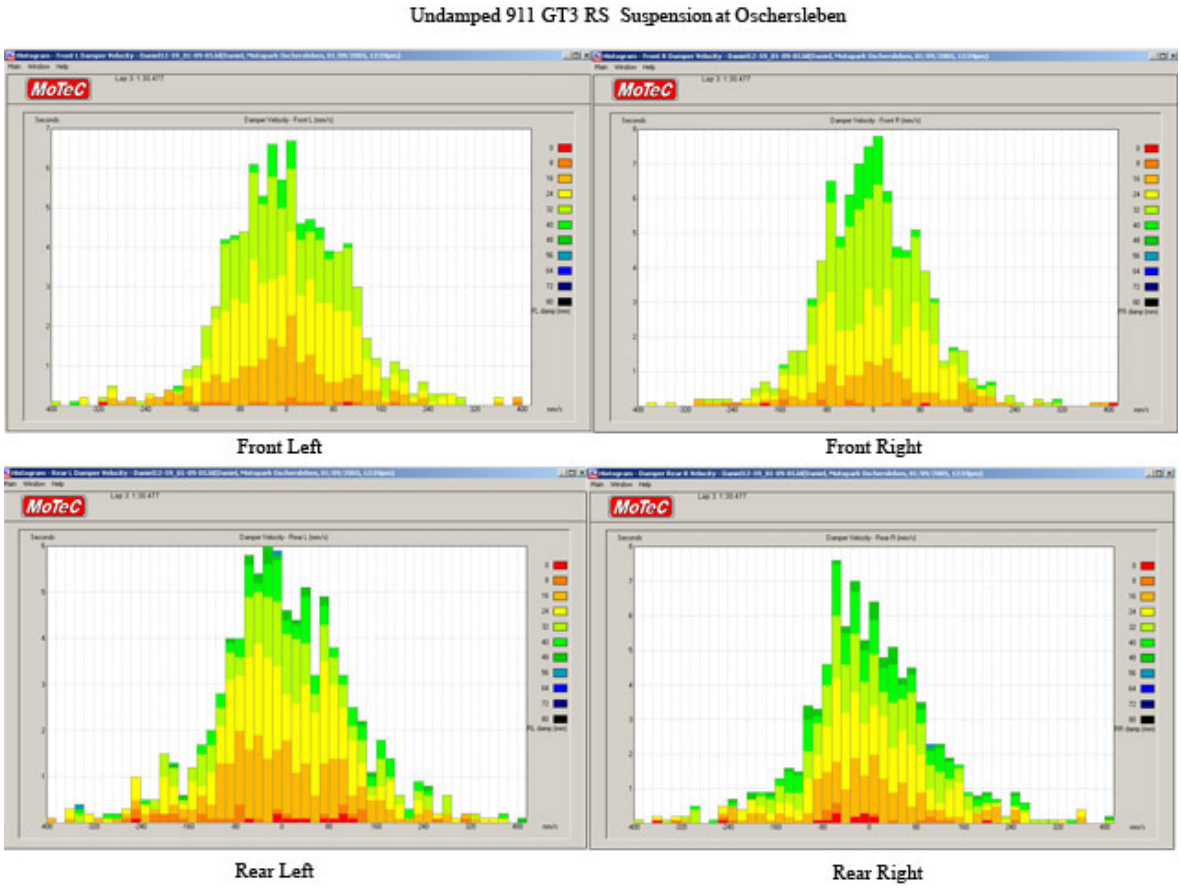
What the Koni guide doesn't mention is that the bump settings you arrive at with no rebound damping will usually be a little too hard due to the rebound damping slowing the whole suspension down. Once you've arrived at what appears to be a good rebound setting backing the fast and slow bump damper down another click or two will often make it handle better.

The key decider for these settings is lap times. As soon as the lap times start to suffer it's time to soften everything off again. Be very slow and careful getting these right.

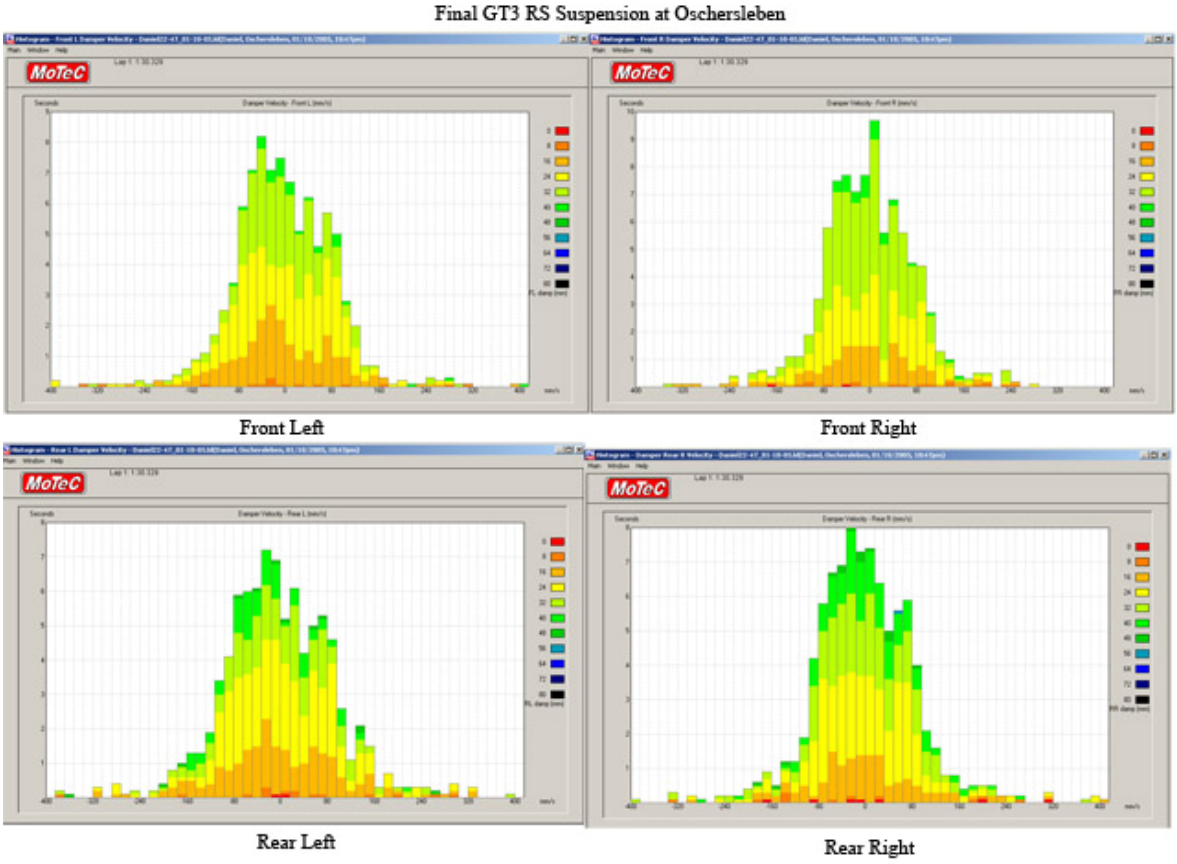
Take a look at the two sample suspension Histograms below.

The first Histogram shows an undamped Porsche 911 GT3 RS suspension at Oschersleben. This is shown by the amounts of red in the suspension travel bars indicating that it is running through its travel too easily. The suspension is also spending a lot of time at high damper speeds, which will result in a unpredictable car that won't feel very stable.

Overly stiff suspension will be shown by a higher proportion of the lap being spent at higher ride heights (blue or black on the bars) and a very thin narrow curve with a sharp point in the centre.



Picture 9: Undamped Porsche 911 GT3 Suspension at Oschersleben



Picture 10: Final Settings for a Porsche 911 GT3 RS Suspension at Oschersleben

The second Histogram shows how increasing the damper settings has slowed the suspension down and balanced it resulting in a more predictable car. The bar colours have become more similar between left and right wheels also. This is due to using different damper settings on each wheel to try and find the best balance. Each car and track has a different optimum setting so these histograms are only intended as an example.

The histograms provide a general overview of the suspension but to fine tune it you need to use the graphical analysis templates. Alongside the two suspension overview suspension templates are four individual templates for each wheel. This is because when you overlay lots of traces onto a single graph it can become confusing and difficult to interpret. Look at the major problem areas on a case by case basis: major changes in velocity speeds, zero damper travel or zero ride height all need looking at and considering.

You can fine tune the slow bump settings by looking at the Weight Transfer template. The difference in ride height between the front and rear of the car is an indicator of how well the slow bump settings are working. You can reduce the car diving under brakes by adding front slow bump and rear slow rebound. This will slow the transition and make the car feel more balanced. Be careful not to overdo it however. Increasing slow bump and rebound will make the car feel more stable and easy to drive but at the expense of grip.

The Final Step

Once you think that everything is sorted give it a final shakedown run of 10 laps or so. The setup should be predictable, safe and produce consistent lap times. Check the operating tyre pressures and temperatures again in the GTR Garage. The tyre pressures should still be fairly equal and the tyre cross section temperatures should be more equal to each other than after the shorter sessions you've been doing.

	Lap 1	Lap 2	Lap 3	Lap 4	Lap 5	Lap 6	Lap 7	Lap 8	Lap 9	Lap 10	Lap 11	Lap 12	Eclectic	Complete
Grd 0-1	3.144	2.752	2.922	2.641	2.769	2.714	2.502	2.743	2.690	2.714	2.717	2.676	2.502	2.743
Södra	3.489	3.196	3.179	3.179	3.137	3.155	3.510	3.193	3.173	3.232	3.185	3.196	3.137	3.193
Flight Straigl	17.466	16.468	17.343	16.721	16.483	16.766	17.165	16.597	16.676	16.738	16.661	16.604	16.468	16.597
Norra	3.229	3.207	3.418	3.361	3.153	3.381	2.901	3.128	3.133	3.257	3.087	3.188	2.901	2.901
Grd 2-3	3.652	3.399	3.415	3.438	3.442	3.302	3.495	3.349	3.518	3.343	3.559	3.450	3.302	3.495
Läktar	3.604	3.445	3.553	3.415	3.410	3.511	3.459	3.405	3.385	3.474	3.442	3.449	3.385	3.459
Grd 3-4	8.157	8.133	8.241	8.095	8.023	7.922	7.984	8.213	8.228	8.080	8.030	8.196	7.922	7.984
Startkurvan	6.054	6.205	6.075	5.968	5.979	5.961	5.799	5.892	5.823	6.036	6.106	6.186	5.799	5.799
Grd 4-5	5.591	5.549	5.588	5.551	5.725	5.452	5.590	5.449	5.631	5.571	5.501	5.616	5.449	5.590
Opel	5.456	5.509	5.315	5.326	5.259	5.375	5.281	5.314	5.325	5.360	5.421	5.335	5.259	5.281
Grd 5-6	9.313	9.119	9.129	8.917	8.934	8.857	9.006	8.940	9.099	8.928	9.126	8.976	8.857	9.006
Hansen	3.413	3.657	3.196	3.163	3.382	3.369	3.213	3.408	3.304	3.314	3.558	3.429	3.163	3.213
Grd 6-7	4.019	3.891	4.094	4.036	4.057	3.889	3.976	3.989	4.109	3.926	4.031	4.119	3.889	3.976
Karussell	8.017	7.959	8.123	7.934	7.948	7.883	7.914	7.857	7.974	7.955	7.944	7.946	7.857	7.914
Grd 7-8	2.234	2.094	2.159	2.103	2.150	2.113	2.170	2.040	2.074	2.143	2.111	2.216	2.040	2.170
Gislaved	2.727	2.618	2.635	2.477	2.556	2.432	2.494	2.504	2.446	2.415	2.631	2.669	2.415	2.494
	6.103	6.082	6.401	6.245	6.272	6.184	6.179	6.216	6.214	6.319	5.947	6.206	5.947	6.179
	0.437	0.461	0.444	0.440	0.444	0.439	0.440	0.441	0.442	0.443	0.434	0.435	0.434	0.440
	1:36.106	1:33.745	1:35.229	1:33.010	1:33.122	1:32.704	1:33.078	1:32.677	1:33.244	1:33.249	1:33.490	1:33.891	1:30.725	1:32.434

Picture 11: Porsche 911 GT3 RS Racing at Anderstorp

Open the Track Map tab in Motec and go to Reports-Section Times. What you're looking for is a table that's a sea of red. This means that you were within 2% of the fastest time for the section and is a sign that you're driving well and have a good setup.

Qualifying

The time you've spent making a race setup will make it simpler developing a qualifying setup. The main difference is the amount of time the setup should perform well for. Many people will try and do 5+ qualifying laps in one stint. In GTR it's usually only possible to do a single flying lap at full speed before the handling deteriorates however.

The fastest combination for qualifying is soft tyres front and rear, 2 laps worth of fuel (outlap and single hot lap), and I will typically increase camber by –0.1 degrees on all wheels compared to a race setup for a little extra grip. At some tracks reducing rear wing by 1 can be useful for all out speed too. Reducing Radiator ducting to 1 will give you slightly more

straight line speed. The car will smoke all lap but it doesn't affect engine performance. Leave Brake ducts the same or maybe reduce by 1 notch. Putting brake ducts to 1 will stop the brakes working properly making you slower not faster!

The rest of your race setup can normally be left unchanged. Tyre pressures need to be reset for the shorter distance. Soft rear tyres will always overheat at some point during the lap as you're driving flat out and not trying to conserve them. This means it's normally best to try and have them reach optimal pressure of 170kPa and temperature of 90-100c mid lap but only be at around 175kPa 100-110c by the end of the lap. As soon as they're over 185kPa 115c+ the car is going to be virtually undriveable and will cost you time.

Live Track Technology in GTR means that you won't have as much grip at the beginning of a session as later on. Grip levels increase as more rubber is laid down. For the best lap times you need to take this into account. In Open Practice there's a window between 60-80 laps approx where the track is fast. The grip then appears to fall away again until you go over 200laps where it speeds up again.

The alternative is to do a full race but advance the time by a few hours so that the AI cars lay down the rubber for you before going out and doing your hot laps on the grippy track.

Weather

Weather plays an important part in deciding your setup. Open Practice will normally have a track temperature of around 26-27c and air temperarature of 20c. If you're using the Changeable weather option this will vary a lot. High track temperatures 30c+ mean you'll have to adapt your setup. If you have the option enabled do some laps in pre- race practice and reset the tyre pressures. You normally need to reduce tyre pressures in hot weather and increase brake and radiator ducting. Reducing cold tyre pressure by 1kPa for every 5c that the track temperature is above the open practice track temperature of 26-27c works fairly well.

For wet weather races track and air temperature will normally be lower so you will need to increase tyre pressures in order for them to reach optimum pressure. If the track temperature is below 26c then I will increase cold tyre pressure by 1kPa for every 5c below 26-27c. For a wet race I normally just increase cold pressures by 2kPa. This gives you the option of switching to dry tyres when needed without compromising speed too much. The only other change I sometimes make is to increase rear wing by 1-2 for added safety. Moving the brake bias rearwards 1-2% in wet weather helps retain control. With the Ferrari 550 I normally have a brake bias of 59Fr/41R or 58Fr/42R. For wet weather I change it to 57Fr/43R which seems to help. When it stops raining move it back again. Having the brake bias adjusters mapped on your wheel buttons is useful.

Tyre choice is decided by tyre temperature. In wet weather have the tyre temperatures displayed on the dash so you know how hard to push. If you've started on dry tyres stay out on them as long as possible until the temperatures fall below 60-70c and the car becomes slippery. Follow the AI's example and don't pit unless you have to: It's not like Formula 1 where they pit at the first drop of rain.

Intermediate tyres aren't competitive so only use dry or wet tyres. As soon as the wet tyre temperatures rise above 110c on a drying track it's time to pit for dry tyres again.

Race Strategy

"There's no point being at 100% for 10% of the time when you can be at 97% for 90% of the time." *John Newhouse Autosimsport eMagazine Vol1/Issue3 P56.*

GTR is all about endurance racing. Full race distance at most circuits is 3 hours apart from Spa which is 24 hours. The main demands this puts on the driver and setup are a need for consistent lap times over a long period with a minimum of pit stops. There's no substitute for practice and knowing the circuit but there are several things you can do to improve your chances of finishing.

If you can get a proper driving cockpit layout it will be much more comfortable than a wheel on a desk with an office chair to sit on. You'll be able to concentrate far better and won't get tired as soon.

Tyres are a limited resource. Do too many slides, spins or lock ups and you'll wear the tyres excessively. Concentrate on smoothness and drive at a steady pace without taking any risks. Don't get sucked into driving flat out at the start to gain a place early on. Drive your own race and stay out of trouble. There's nothing more frustrating than banging in the fast laps for 40 min and then throwing the race away because your tyres had worn out causing a spin. Reduced negative camber levels, more rear downforce and slightly lower rear tyre pressures should help controllability when the tyres begin to wear. Having your brake and throttle sensitivity set to 0% will make the car easier to drive, more predictable and wear the rear tyres less. Be aware of how your car reacts under braking. If one end of the car begins developing problems with grip late in a stint consider moving the brake bias away from that end of the car towards the tyres that have more grip.

The RPM limiter can be set lower to reduce stress on the engine at the expense of reduced power. If you red line it on every up-shift and use engine braking every lap the car won't last much more than an hour before failing. My preference is to leave the RPM limiter at max for rapid overtaking when needed but use the dash LCD RPM figure for up-shifts and short-shift a few hundred RPM below the max power output RPM (8000RPM in the 911 GT3 RS or 7000RPM in the Ferrari 550). In braking zones gradual spaced out down shifts work best keeping the RPM well below the limiter.

Pit stop strategy is decided by your place on the starting grid and which car you're using. If you can make the tyres last that far consider a 2 stop strategy over a 3 hour race. This is very dependent on tyre wear however and some cars such as the Ferrari 550 can't carry enough fuel to do it!

The alternative is a 3 stop strategy which has the advantage of allowing you to push slightly harder as the tyres don't have to last as long. If you're near the back of the grid short fuelling for the first stint will hopefully make it easier to pass slower traffic. If you're nearer the front the optimum strategy is for four 45 minute stints which can be done using either soft front/medium rear or medium front/medium rear tyre compounds. This should give you a significant lap time advantage over the 2 stop strategy where you'd be probably be using medium front/hard rear tyres and carrying more fuel.

The quickest way to pit is to press "9" on the keyboard which is the pit-in request and to turn the engine on and off manually when you pit (you have to assign keys to starter and ignition). Scroll between options on the clipboard using the Up/Down keyboard arrows. Use the Left/Right keyboard arrows to select different options and press Enter when you're happy.

Remember that the amount of fuel shown on the clipboard isn't the amount of fuel that will go into the car. The tank will be **topped up** to the level shown on the clipboard including any fuel remaining in the tank when you pit. If you make any unscheduled pit stops (rain, damage etc) you need to manually adjust the fuel figure. Either put it below the fuel level in the car if you don't want more fuel or change it to the correct figure for your revised strategy.

Now go win some Races!

Appendix 1:

Further Reading:

Competition Car Suspension by Allan Staniforth
http://www.amazon.co.uk/exec/obidos/ASIN/1...0231701-3546238

Going Faster! Mastering the Art of Race Driving by Carl Lopez
http://www.amazon.co.uk/exec/obidos/ASIN/0...0231701-3546238

How to Make Your Car Handle by Fred Puhn
http://www.amazon.co.uk/exec/obidos/ASIN/0...0231701-3546238

North East Ohio Sports Car Competition Association Setup Guides
http://www.neohio-scca.org/comp_clinic/hand_out_reprints/comp_clinic_handout_reprint_menu.htm

Autosimsport eMagazine
www.autosimsport.com

Appendix 2:

Ingame Sampling Rates

You check this by browsing to C:\GTR\UserData\#playername and renaming the #playername.plr file to #playername.txt. (You can also right click and select "open with" Notepad). The lines concerning Motec should appear as below:

Data Acquisition Version="0" // Version of vehicle data to write out
Data Acquisition Rate="10" // rates 1, 2 ,5, *10*, 20, 50, 100
Data Acquisition In Race="1"
Data Acquisition EXE="C:\GTR\MoTeC\Interpreter\MINTWIN.EXE"
Data Acquisition File="userdata\vehicledata.spt"
MoTeC LogFolder="C:\GTR\MoTeC\Logged Data"
MoTeC Minimum Time="20" // minimum MoTeC recording time (sec)
MoTeC Multiple Logs="1" // generate unique filename for each new log

Remember to rename it back to .plr from .txt afterwards.