The most important part in driving technique is arguably braking. Braking event is the first thing that happens in cornering phase and thus it sets-up the whole corner. The advantage or penalty of braking done (in)correctly carries over up until next braking event, including straights. The pattern I am seeing on the sim data is incorrect and completely unrealistic brake application, which could be due to simulation quality or/and drivers actually trying to workaround the lack of feedback that IRL drivers get through body when braking. What sim racers are doing is actually emulating ABS by the way they set-up brake pressure in bars per 1% of pedal movement.

Before we continue further, here are the assumptions:

- Everything is relative to high downforce car unless explicitly specified
- All examples are for “generic” hair-pin style corners, think Barcelona T10, Hockenheim T6, Magny-Cours T5 etc
- Turn numbers are from maps available on wikipedia of respectable circuits

**The correct way of braking. Purpose of braking.**

The proper brake shape is always a triangle and there are physical reasons why it can not NOT be a triangle. The triangle shape is due to the driver *having* to compensate for aero load drop as the car slows down, it’s not a preference or driving style but a necessity. If the shape for some reason is not a triangle, driver is totally losing time under braking because he’s not using all available grip to slow down the car.

The targets of braking are to:

1) Slow the car down to Vtarget in as short a distance as possible
2) Prepare the “platform” for cornering. (“platform” is basically a fancy word for “car” :))

While 1) is obvious to everybody, 2) is less obvious. The 2) goal of the driver is to have a specific balance of weight (not mass) per each wheel during cornering up until throttle application. The car has to be slowed down, stabilized AND loaded properly.

For example, if you brake too early even with perfect triangle shape, at the time when you need the grip on the front (max lat G) the front has already “lifted up” as in “unloaded” itself, because of sprigs stiffness and low rebound value on the dampers. What it means is that car setup/chassis has a requirement on how driver sets it up for a corner with his braking. If a driver brakes too early he will actually be faster in a “slow” car setup compared to himself in a “fast” car setup.

The “stable platform” requirement is why you see drivers doing weird shit like both braking and staying on throttle in fast corners: it’s not the most efficient way to achieve 1), but it may be the ONLY way to achieve 2) depending on setup.

**Breaking down the braking (pun totally intended)**

There are cornering phases: deceleration, roll, acceleration. Each one of them can be further divided into sub-phases. We are obviously looking at the “deceleration” phase that consists of:

1. Aero braking (not discussed here, only purpose to save fuel so irrelevant)
2. Brake application
3. Peak brake pressure
4. Bleed off

Notice there's no engine braking on the list. More on that further.

Brake application
The driver should release the throttle and develop peak pressure as fast as possible. There SHOULD be and overlap of throttle/brake at around 35-40% of throttle. If there's no such overlap, it means the driver is not releasing the throttle fast enough, hesitating (lack of confidence) or not aggressive enough with braking

Peak pressure
Is the highest point in the triangle. It should be a point guys, if there's a plato (flat top) at peak pressure level, it means the driver is not using available brake performance. If he still manages to slow down and even has zero rolling phase mid corner, still means he could've braked later.

Bleed off
As discussed earlier, it's a compensatory thing to adjust for drop of aero load AND for reduction of available grip once driver starts to turn-in, thus asking for lateral grip which should be "free'd-up" by using less longitudinal grip. If the slope of this phase is not constant, means the driver braked too early. It's very common to have too HIGH min corner speed because the driver brakes too EARLY, normally it will be accompanied with "double brake" shape on the data (peak, release, then increase of pressure again, release again).

**What does it mean for sim racers**
Now you should be able to analyze your data yourself and see everything wrong with it. How to fix this and how to make sim time useful for IRL? Here we go:

1. You should NOT be able to stay at 100% of brake pressure for more than an instant. The car SHOULD lock the fronts if you do. You need to setup the sim in such a way that 100% brake pos from Vmax of the car ALWAYS locks the fronts immediately. Then you brake at 99% of pedal pos:) This should force you you bleed off correctly and actually judge brake application on a per-corner basis. In slower corners you'd be locking up at 50% of pedal pos and it's fine, IRL you don't brake with the same pressure in every corner.
2. Do look at your own data  after every run and force yourself to train your left leg to "paint" that desired triangle on the data.

Lap times may actually be slower in sim with proper braking rather than just slamming to 100% and keeping it for half a turn at 100%, because it will be much more difficult not to lock up. Every corner will become a guess: "how hard can i hit the pedal" and once all bets are off you would

have to survive with your guess through the corner. Remember you are NOT allowed to increase brake pressure, only decrease, not allowed to lock, not allowed to abruptly drop brake pedal as it would violate “platform stability” goal.

This is the way you need to brake IRL and something that is totally trainable on a sim.

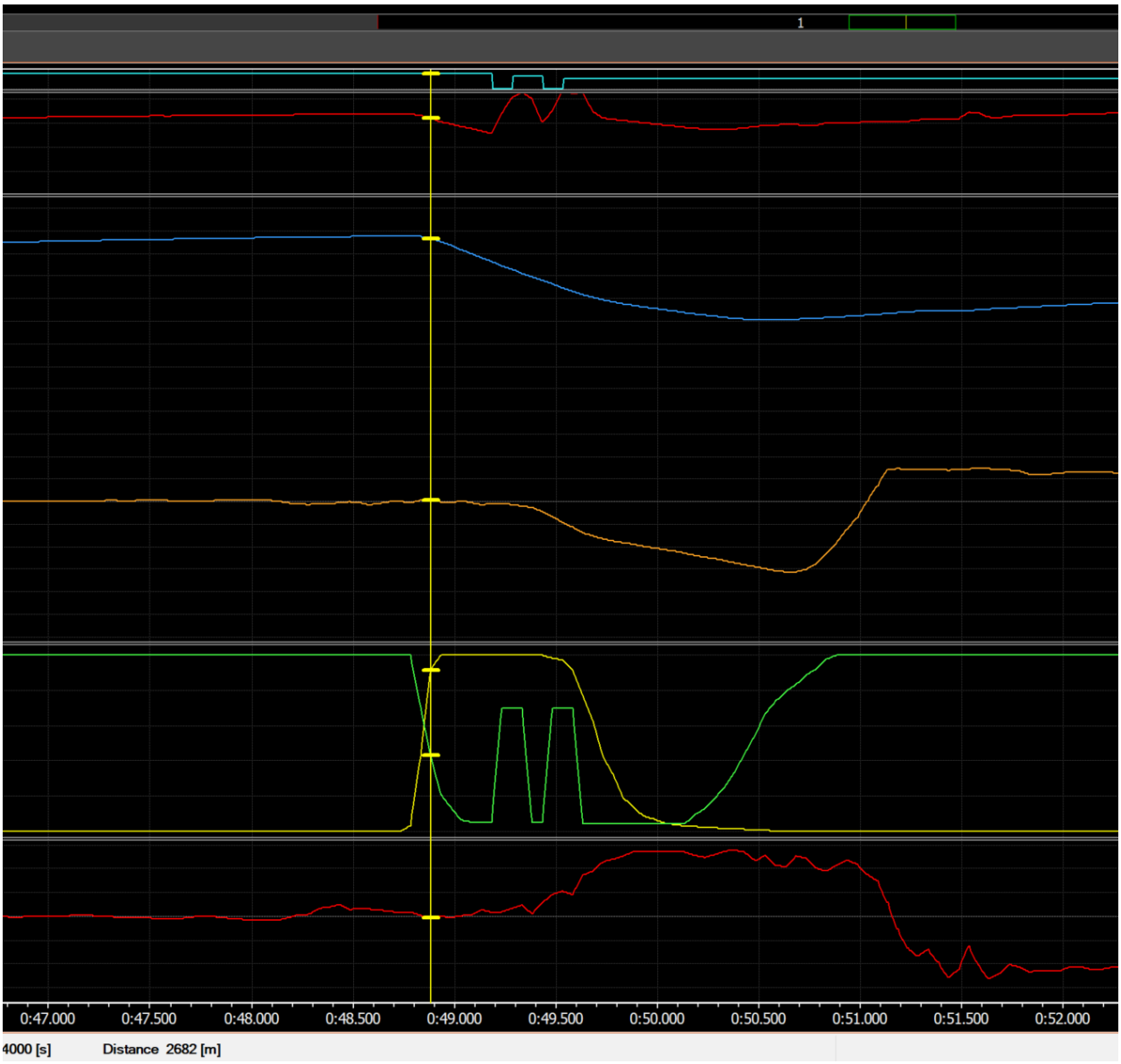
**Bonus: What about engine braking?**
Nothing about it. It does not exist. Just forget about it, engine brake does not exist as a tool for a racing driver in a properly setup car. Engine is to go faster, brakes are to go slower.

So… you need to fit your downshifts in such a place so that they disturb the car the least, remember the platform stability goal. Normally it would be right before the turn-in or even during turn-in and downshifts are very close to each other. They ideally need to happen when revs are low, so rev miss-match doesn’t cause too much instability on rear axle. On some cars, like FR2.0, that auto blip to a fixed amount of 40% of throttle, it makes sense to downshift at a time when resulting 40% blip won't cause a “push” forwards. F3 cars calculate target rpm dynamically and will never over-blip, so for F3 makes sense to downshift as late as possible and as fast as possible

Point is, you NEVER downshift early or evenly across braking phase. It would be either late and compressed, or late’ish and a bit spaced out for the fixed amount of auto-blip. Remember the car will actually deny early downshift! It will just ignore the request if target rpm is too close to rev limiter.

**Examples**

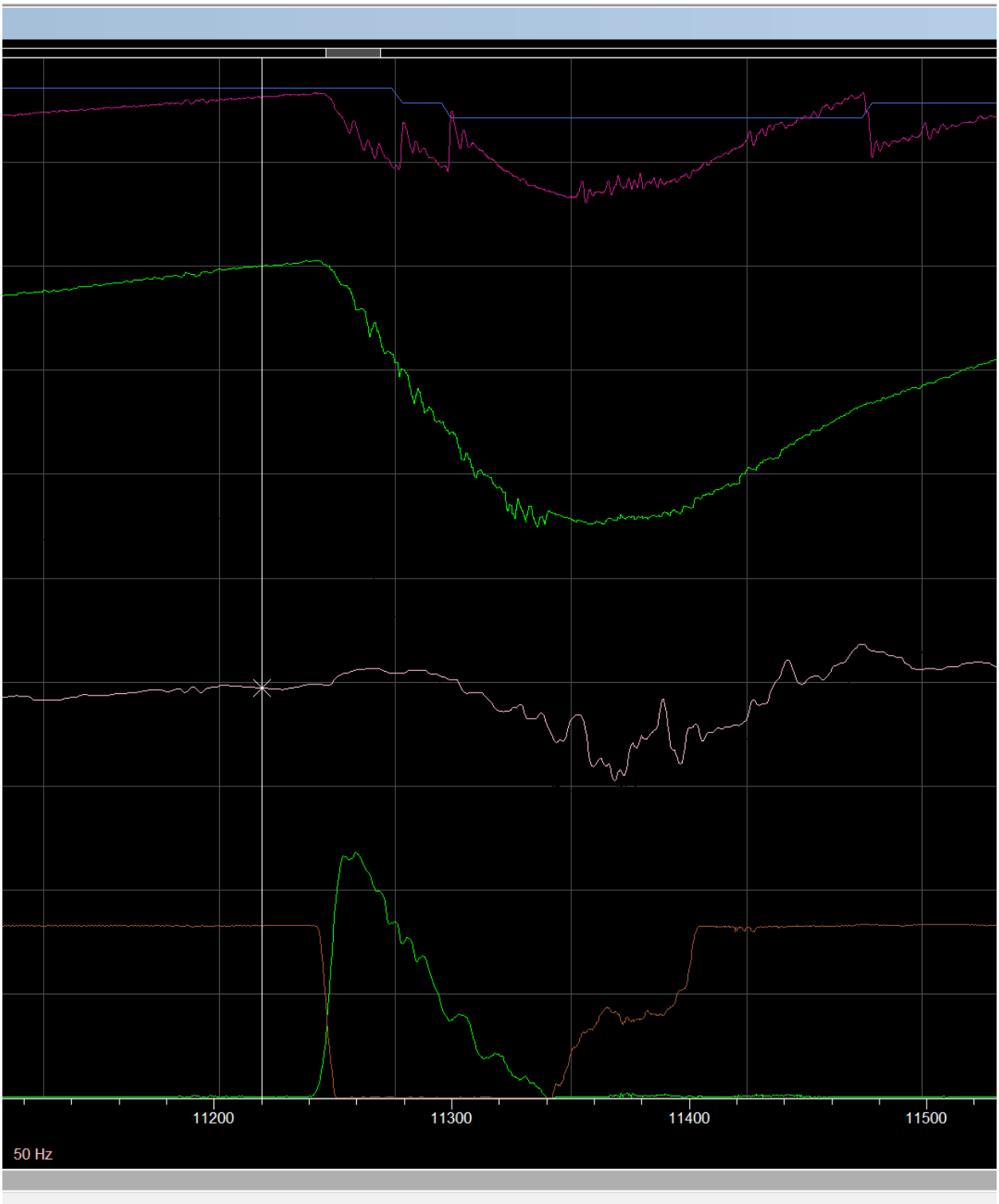
Incorrect sim brake




1) No peak, not a triangle
2) Throttle/brake coss-over at higher point than 40%
3) Angle at which throttle/brake cross each other is not sharp enough
4) Throttle stays on late into braking phase

Result: braked too early, pushed the car into understeer

Correct IRL brake:




1) Throttle and brake graphs cross at correct level and angle between them is sharp
2) Almost perfect triangle shape

3) Zero rolling phase, throttle applied immediately after braking and ONLY after braking
4) The speed graph shows that front wheels are under-rotating (on the verge of locking) throughout ALL of the braking phase: even when brake pressure decreases, wheels are still about to lock, means drivers is using all the available grip all the time.

Result: balanced car through the corner, that eventually allows the driver to pick up the throttle immediately without waiting for the car to “settle” mid corner. The oversteer corrections come together with throttle hence a “step” in throttle application, which is a result of tire wear.