How to train on your Velodyne using Power

By Hunter Allen –
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O.k. Great, now you have bought your new Velodyne, got it put together, installed your bike, loaded your CyclingPeaks Software, figured out how to toggle between six buttons and 4 screens while riding one handed at a heart rate of 170… what the heck do you actually do with it?

Well, the answer is, lots of things. For example you can:

- Monitor your "fitness baseline"

- Find your optimal cadence

- Maintain your fitness level during the winter season

- Year around power specific training with repeatable power intervals

- Do controlled time trials

- Find your "LT" power and easily create a power training program

Let's take each of those items and break them down so that you can get the biggest bang for your 'training' buck so to speak.

First and foremost, you need to start some formal testing with it. The very first test you should do is a test in which you just start to find out how the thing works and establish your 'fitness baseline'. I call this test your "monthly test", as you should be doing this once a month in order to track changes in your fitness and make assessments and changes to your training program based on the results of the test.

The Monthly Test- 20minute warm-up, which is just riding along at a moderate pace, about 65% of your max HR. Then do (3) fast pedaling efforts for 100rpm for one minute each with one minute between each. Then 3 minutes easy.. Then Go for it – (1) 5 minute all out. Punch it and hold it! Make sure that you start at a high pace, but not soo high that you die at the end. You should have a little in reserve to kick it to the finish line in the last minute. Then 10minutes easy, then (3) 30 seconds "Super Sprints". Jump as hard as you can and then Sprint like crazy for 30 seconds. REST 3minutes between each. WAY EASY ! Then time for (3) 1 minute all out efforts. REST for at least 4-5 minutes between each. Finish the Ride and cool down. Again, you are trying to produce the most average Watts over the entire period. It's not a good test, if you go out too hard and then just explode and limp home…Cool down.

You need to do a separate test on another day for a solid 20 minute effort as hard as you can go. Same warm-up as above, including the fast pedaling intervals, but now just do the 20 minute Time Trial.

What these tests do, is that they gather some information about your fitness in different time periods. Because, although you may think you are fit for that upcoming time trial, you may test very poorly in the 20 minute test, in relation to the 5 minute test. So, from that info, you can change and tailor your workouts, but more about that later. This test also is your first test with a Velodyne or powermeter and there is a little learning curve, so it's nice to have a test from the beginning that isn't too involved and you can get an idea of how to pace yourself better for upcoming future tests.

Once you have the data from the test, make sure to "pull" it out of the software, so that you can put it into an Excel Spreadsheet for each time interval. This will be your baseline against which you will be testing each month.

O.k. So now that you have done the "Monthly Test", you can start training with Power, and not so much HR anymore. Based on your 20 minute test, you should have a good idea of your Lactate threshold wattage, and from there you can calculate your power zones using a zone calculator in CyclingPeaks Software. Input the normalized or average power from your 20 minute test into the >Threshold wattage< box on the software. And click on Coggan Training Levels , This will then help you to establish some zones in which to train. Also, be sure to set up your Heart rate training zones as well. Use your average heart rate for last 10 minutes of your 20 minute Test as your Threshold Heart rate.

Establish Optimal Cadence

These are more tests that are designed to help you figure out what is your optimal cadence over different time periods. You see, not everyone is meant to spin a fast gear like Lance. Some of us are more efficient and produce more power for each heartbeat, in the 85-90 rpm range. Some are more efficient in the 95-100 rpm range. Which are you? That's what we are going to figure out.

This involves a series of 3 tests. The first test is a self-selected test and you've already done it! That baseline test was also the first cadence test! You did the test protocol in the cadence that felt right to you. That's all that matters. You did your best in the gear and cadence that felt like you are putting out the greatest power that you can do. This is your baseline.

Make sure to take it easy the day before, so that you do a good test. No sense in doing the test if you are sick, tired or stayed up all last night with the drinking buddies. So, be sure to do the test on a day that you are planning on being strong and psyched to go !

Now, from the basis of this first test, you need to look at the specific intervals and figure out your average cadence from each effort. Go into the CyclingPeaks Software and copy the information out of the Summary window on the Journal page, after you have highlighted the significant test periods. This is really the only important thing at this point in the process.

So, once you have your average cadence for each interval, then this will help you determine the 'restricted cadence' of the next test. If your self-selected was 85rpm, then the next test should be a low cadence test with cadence restricted to 70rpm and below for each time interval. This means that you must set the resistance and gearing as such that you can go as hard as you possibly can, but stay under 70rpm. This will then give you a comparison to the self-selected cadence. Did you produce more power for some time intervals for the lower cadence? What about Heart rate? Was your heart rate lower per watt for the self-selected? What was the power/hr ratio for this compared to your self-selected? These are things you'll need to be asking yourself.

Now, the final test. This needs to be a high cadence test. So, go 15rpm's above the self-selected to get high cadence. Once completing this test, you can compare all three together and see at which time interval you are the most efficient. Efficiency incorporates the max Watts you produced, the average Watts you produced, your max heart rate and average heart rate for each time interval. For the 1 minute test, was your max HR higher for the high cadence as compared to self-selected, but the average Watts were lower? So, you need to look at the whole picture when comparing the 3 tests side by side. And guess what? Some of them will be so similar that it's a toss-up to which is better. If Average Watts and average HR are very similar, than I look to the Max Watts for a tie-breaker. If that is similar(within 15Watts), then I look to actual distance covered and see which is greater. If all are still the same, then go with what you think, but be prepared to test this time interval again in 4-6 weeks.

So, now you should a clear picture (or spreadsheet) ;-) of your cadence, power and heart rate for each time interval. You should be able to now see which cadence is more efficient for 1 minute and all of the rest of the time periods. Now, you ask, why is this important? It's important because there will be many times in a race or training ride, in which you will have a good ballpark idea of how long an interval will be. This way you can select the correct gear for the upcoming effort and know that you are maximizing your effort. Know that there is a 30 second out of the saddle burst you have to do on every lap? Know you are going to attack 100meters before a corner and then accelerate hard for the next 2 minutes? Know you have a little rise in the road that you have to pop over? Got a 40k TT coming up? Now, you can select the right gear for each situation.

The other side of this is that you find out what your weaknesses are regarding cadence also. If your Watts fall by 30-40 Watts when riding in a bigger gear, than you might want to start incorporating some low cadence/high force workouts into your routine. If your Watts fall by 20-30 when spinning a smaller gear, or if you know you have trouble

with little accelerations, then maybe you want to incorporate some fast pedaling intervals into the equation.

By testing your cadence you now have a baseline and a place to go. Time to start working on those weaknesses.   Testing your optimal cadence now allows you to really figure out where you can improve your power output at different time levels.

HOW TO USE YOUR VELODYNE IN TRAINING

The first thing you'll notice is that your power is highly fluctuating. Andy Coggan, Phd, has coined the usage of the word "stochastic" to describe cycling. This means that cycling is highly variable and not quite random, but darn close. So, you spend plenty of time not pedaling, pedaling a whole lot, pedaling with a huge wattage and also just kinda noodling along. Lots of things will affect your power: wind, hills, type of rider(s) you are riding with and many more things.

So, if your power output is highly variable, then how are you going to train in some certain range of power?

Well, a lot of times, you're not. You simply just won't be able to hold a steady range of power on the terrain that you are riding. There will be too many external influences that won't allow you to ride in a specified range.

However there will be plenty of times that you will be able to. In order to do this, you'll have to plan for that and really get yourself psyched to go out and do a workout based on power. Other times, you are going to use your powermeter as a retro tool, a way to view the info on your ride after the ride is over.   Both are valid and should be used. Sometimes, you think you are pedaling 90 rpm, but when you downloaded the data from the powermeter you find that you were only pedaling 85rpm. The powermeter download allows you have this retro-look.

Training Opportunities using your Velodyne.

Why train indoors? Two big reasons – it's easy to regulate your wattage and there are no external factors that can affect your training plan (like wind and darkness!). Here's a few ideas…

- Testing- Each month use the Velodyne for your specific test! With a Velodyne and CyclingPeaks Software, you have everything you need to test your fitness!
- Flat Road simulation - utilizing a specific wattage protocol
- Time Trial efforts - work on pacing and to select the best cadence.
- Hill Climb efforts – develop more leg power.
- Specific Intervals and training protocols.

- "Race Winning Intervals"

Each of these have many ways in which you can use the Velodyne's power display.

For a time trial simulation, you will use it as a pacing tool, and make sure you are not exceeding a certain wattage during your time trial and therefore blowing up too soon and losing valuable time.

For a hill climb effort, you will be able to push a certain number of Watts in order to maintain the highest pace you can sustain in the climb. You will also be able to adjust you cadence in order to see your power go up and then also see your HR go down.

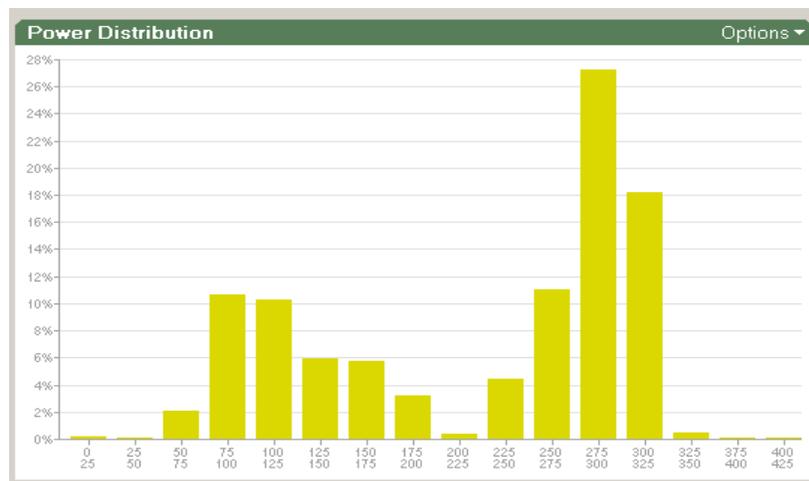## What to look at in your Velodyne ride downloaded data:

First things first, take off as much smoothing as possible in the software program. You really need to look at the true data and not smoothed data. Get used to seeing the real data and tell all your friends how many Watts you really produce and not some guesstimate based on your smoothed data. Notice that Velodyne power data will be inherently smoother than power data generated by a power meter. This is due to inertia effect provided by Velodyne's massive flywheel.

Look at:
- Periods of significant efforts. For example: A 15 minute interval that you did at Sub LT HR.
- Significant fluctuations in power and count them.
- Cadence when you have time periods of high power output.
- How many kilojoules of energy did you expend?
- MAX wattage, and average wattage for selected duration of interest.
- Heart Rate at significant time periods.
- Try to pinpoint areas of a ride that have significance and look at them to see what made or broke that part of the ride.
- Look at the area of time that you struggled the most and see what happened. Maybe your cadence was too low for 10 minutes before. Maybe your pedaling stroke became sloppy as you got more fatigued and your torque went too high compared to the power output.

Now that you have imported the data into CyclingPeaks, you can then start drilling deeper into the data.

First thing to do is to view your power distribution chart on the "Journal Page". If it is a race simulation, then check out how much time you spent NOT pedaling. That is interesting because it is important to know if you pedaled TOO much in a race ! The name of the game is saving energy!!! The downloaded power distribution charts of road race winners usually has a typical distribution chart that looks like this:

Power Distribution Options ▼

(chart with x-axis watt ranges: 0/25, 25/50, 50/75, 75/100, 100/125, 125/150, 150/175, 175/200, 200/225, 225/250, 250/275, 275/300, 300/325, 325/350, 375/400, 400/425; y-axis 0% to 28%)

Lots of time spent under 60% of your Lactate Threshold Watts (saving energy and resting) and then lots of time at your Lactate threshold. For this rider, lots of time under 175 Watts and then lots of time over 275 Watts. So, that means the winners usually pedal the least, but when they pedal they pedal the hardest!

Now if it is normal training ride, then time not spent pedaling is not as important. However what is important is how much time you spend in your power zones and also begin to look for the time drop-off around your LT. Notice in the graph above that there is a huge drop-off in this rider's time spent from 275-300 Watts, to the next bar

(300-325 Watts). This is a good estimate, ballpark guess, of this rider's Lactate Threshold. This riders LT is probably somewhere on the upper end of the 275-300 bar, but doubtful it is over 300 Watts. How can we tell this? Well, an athlete can spend plenty of time at or just below LT, but limited time above it. So, it's easy to make a case for a winning racer to spend loads of time just at their LT, but not much above it, as they know how to pace themselves well.   Start to look for this trend in your Velodyne download when your do a race simulation.

The next thing to start looking toward is your Heart Distribution Chart. This can show you how much time you spent in your Heart rate zones. Not as interesting, but it gives you a look into how much work your heart did.

By examining the Cadence PIE chart, you can start to see how much time you spend in different cadence ranges. This can be informative if you are actively trying to increase or decrease your cadence for a specific workout or for overall physiological change !!!

From there, move the Mean Maximal Line Graph and "hover" over the line with your pointer to see how many Watts you put out at significant times. Remember though, if you did a workout with 5 minute efforts, and then look at the Watts you produced at 6 minutes, it will not be a valid comparison to a previous ride, when you did specific 6 minute efforts. You must compare same time periods together from workout to workout. Also be aware that if you didn't do any sprints, then your peak power will not be representative of your true peak when you do sprints.

Now, let's move onto your **GRAPH !**
Once in the graph, decide how you like to view your data. Personally, I recommend the stacked view (rows stacked on top of each other) with no smoothing to start. If it is a road ride, then I prefer to view the Watts, heart rate and speed. If it is a Velodyne ride, then I prefer to view Watts, heart rate and cadence.

Then begin scanning through your ride and remembering areas of interest!   Create a "range" around the specific area of interest so you can further gain insight into the numbers. Let's say you went over a 20 minute climb. This should be easy to view, as your Heart rate will be high, your speed low and your power fairly constant. It might look something like this:
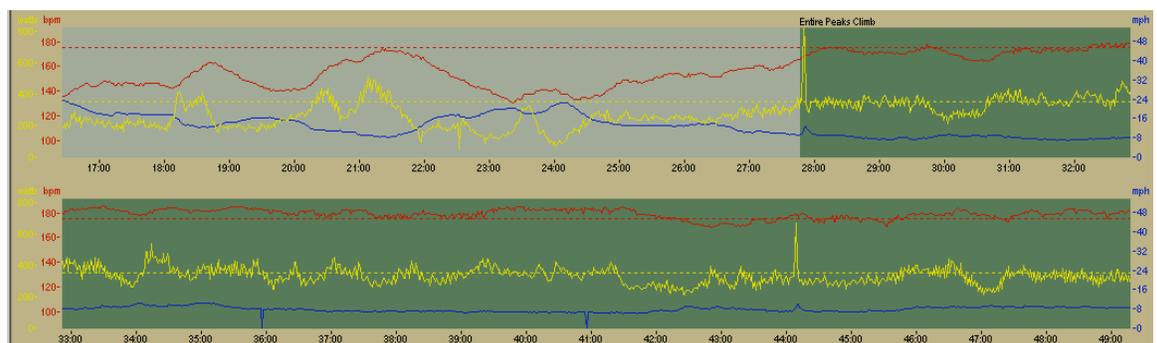
Notice how when the climb begins, the power (yellow) becomes smoother, the Speed (blue) is lower, and the Heart Rate (Red) goes right to the roof !

Once you have created areas of interest you can then compare these to previous efforts, to efforts of others, or to look deeper into that specific area to maybe examine your cadence.

Another way to help you in creating areas of interest, is by using the "Fast Find" feature in CyclingPeaks. Let's say you did a bunch of 3 minute efforts, then 30 second efforts, and a 10 minute effort and then a bunch of one minute fast pedaling efforts.
You can easy find these efforts automatically, by defining them based on the length of the interval and the Watts that were held during that time. Once found, name them and even "link" them together, by clicking on the "link" beside the "eye". Then you don't have to type them over and over and also this will give you your rest time between each effort in your "summary" on the Journal page.

Your Graph might look like this when it's all said and done !
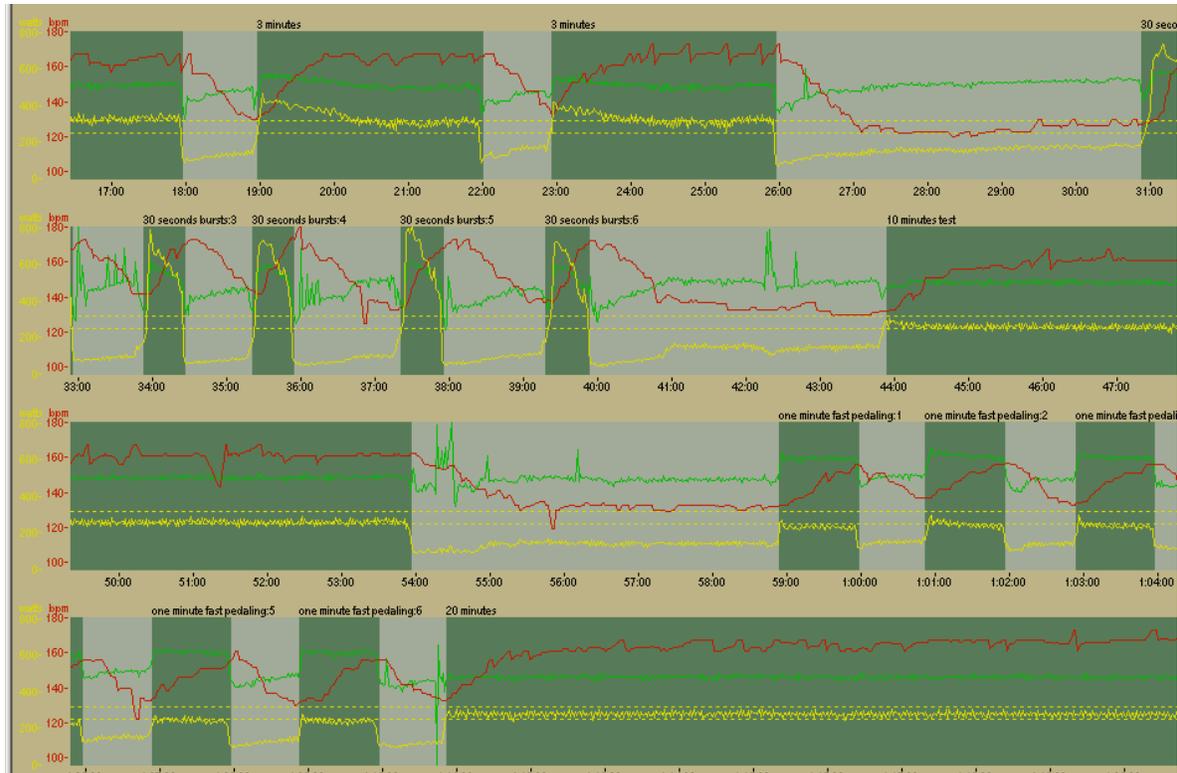
After having defined your areas of interest, you can now examine them further by reviewing the range box and the data contained for each area or by going to the Summary in the Journal page and reviewing there. Also at this point, you might want to update your Notes section in the Journal page. Remember that this section and the Ride Goal are searchable under the Calendar page. So, type in here things that you might want to search for in the future. From the above graph, I would type: 3 x 3 minutes, 6 x 30 second bursts, 10 minute effort, one minute fast pedaling and 20 minutes at LT. This way, this workout will be included in a "Search" of all 3 minute efforts you have done for the year.

A few other things to look for:
In race/interval files:
- Use the "Fast Find" feature to pull out all of the times that you "burned a match". If your LT is 300 Watts, then find how many times you went over 350Watts for 60 seconds or more and when those were. It's likely that was a "match" you burned. (What is a "Match"?- see the article at the end of this paper). Use "Fast Find" to count the number of laps in a race that you did and define them.
- Look at your TSS score and IF for the ride and see how they fit into your entire season so far. Use the IF to help you determine when your LT power has increased or decreased.
- Look for your "Peaks" and determine where they are in the file. This will help you to further gain insight into the hardest parts of your race.
- If you got dropped, find the time before it and begin to "walk backwards" to see what efforts at how many Watts you had to do, and where your breaking point

was. This is particularly useful to examine what exactly it takes for you to get dropped in a race. You can then use this information to tailor your training plan.

In Training Rides:
- How many kilojoules of energy did you use during your ride and did you re-fuel enough ?
- What was your normalized power for the ride? For a description of normalized power, click here.

This will get you started on looking at your data in a more productive manner and also allow you to get the greatest use out of CyclingPeaks Software.

Threshold power: what is it, why is it important, and how do I measure it?

Andrew R. Coggan, Ph.D.

For more than 30 years, exercise physiologists have known that the exercise intensity at which lactate begins to accumulate in a person's blood – that is, their lactate threshold (LT) – is a powerful predictor of their endurance performance ability. This is because although an individual's cardiovascular fitness, i.e., their maximal oxygen uptake (VO_2max) sets the upper limit to their rate of aerobic energy production, it is their metabolic fitness, i.e., their LT, that determines the percentage or fraction of their VO_2max that can they can utilize for any given period of time. The physiological factors determining LT are complex, but in this context blood lactate levels essentially serve as an indirect marker for biochemical events within exercising muscle. More specifically, a person's LT reflects the ability of their muscles to match energy supply to energy demand, which in turn determines the fuel "mix" (i.e., carbohydrate vs. fat) used and the development of muscle fatigue. Consequently, LT – especially when expressed as a power output, which also takes into account cycling efficiency – is the single most important physiological determinant of performance in events ranging from as short as a 3 km pursuit to as long as a 3 week stage race. Just as importantly, because the metabolic strain experienced when exercising at a given intensity is dependent upon the power output relative to power at LT, this parameter provides a physiologically sound basis around which to design any powermeter-based training program.

CyclingPeaks explicitly recognizes the crucial importance of power at LT by allowing you to enter a value for your current "threshold power" (and threshold heart rate) into your "Athlete Settings" file. This value is then used to calculate the intensity factor and training stress score for every file you analyze [see "What are normalized power, intensity factor (IF), and training stress score (TSS)?"]. In addition, if you wish CyclingPeaks will use your threshold power to automatically calculate seven suggested training ranges, or levels, based on a system developed by Dr. Coggan and adopted by USA Cycling® as part of their coaching program. (Alternatively, CyclingPeaks also allows to custom define your own power-based training levels.)

So, how do you go about determining your threshold power? Obviously, one way is via laboratory testing with invasive blood sampling, but few people have access to such testing on a regular basis. In addition, power at LT as determined in this manner is often significantly below what athletes and coaches tend to think of as a "threshold". A more convenient and possibly more accurate way of determining your functional threshold power is therefore to simply rely on data collected using your powermeter in the field. For example, because exercising above threshold power is quite strenuous and there is a limit to how long you can do so, there will often be a rather noticeable drop-off around this point in the power frequency distribution found on your "Home Page". Thus, after uploading all of your training data into CyclingPeaks, you should be able to get an approximate idea of your threshold power simply by examining this graph. (This approach works even better for identifying maximal heart rate.) This initial estimate can then be confirmed and refined several different ways. For example, your normalized

power during a **hard** ~1 hour mass start race will often be close to your threshold power. Since CyclingPeaks automatically calculates normalized power even if you haven't yet entered a value for your threshold power, using the program to first analyze several race files provides a convenient way of checking whether your first guess seems close. An even more precise estimate can be obtained based on your average power during a ~1 hour TT, or from longer LT-type intervals done in training. Finally, those who are more mathematically inclined may wish to perform formal testing to determine their "critical power" as described in the scientific literature. Briefly, this approach consists of plotting the total work performed (in joules) during a series of relatively short (i.e., between 3 and perhaps 30 min), all-out efforts against their duration (in seconds), then fitting a straight line to the data points. The slope of this line is critical power, which corresponds quite closely with functional threshold power determined using any of the previously-described methods.

Since one goal of any training program is to increase power at threshold, the value you have entered into CyclingPeaks should be periodically reassessed to be certain it is still accurate. How often threshold power will change significantly will depend in part on an individual's training history and habits – for example, someone who is just beginning in and/or returning to cycling may see large and rapid changes in their threshold power, whereas an experienced rider who has been training for many years and/or an athlete who maintains a high level of conditioning year round will probably experience much less variation. In general, however, assessing threshold power a few times per year (e.g., near the start of training as a baseline, partway through the pre-competition period to track improvement, and during the season to determine peak fitness achieved) is probably sufficient.

What are *normalized power*, *intensity factor (IF)*, and *training stress score (TSS)*?

by Andrew R. Coggan, Ph.D.

One of the first things that catches the attention of any beginning powermeter user is how variable, or "jumpy", their power output tends to be. This is largely due to the constantly changing resistances (e.g., small changes in elevation, gusts of wind) that must be overcome when cycling outdoors. Because of this variability, training with a powermeter is not directly comparable to training using a heart rate monitor. In particular, it is very difficult (as well as counterproductive) to try to keep power constantly within a certain range, or zone, at all times during a training session. Just as importantly, this variability means that the overall average power for a ride or part of a ride is often a poor indicator of the actual intensity of the effort. This is especially true for races, since power can vary dramatically from one moment to the next as, e.g., a rider first tries to conserve energy and then attacks.

To account for this variability, CyclingPeaks uses a special algorithm to calculate an adjusted or <u>normalized power</u> for each ride or segment of a ride (longer than 30 seconds) that you analyze. This algorithm is somewhat complicated, but importantly it incorporates two key pieces of information: 1) the physiological responses to rapid changes in exercise intensity are not instantaneous, but follow a predictable time course, and 2) many critical physiological responses (e.g., glycogen utilization, lactate production, stress hormone levels) are curvilinearly, rather than linearly, related to exercise intensity, By taking these factors into account, normalized power provides a better measure of the true physiological demands of a given training session - in essence, it is an estimate of the power that you could have maintained for the same physiological "cost" if your power output had been perfectly constant (e.g., as on a stationary cycle ergometer), rather than variable. Keeping track of normalized power is therefore a more accurate way of quantifying the actual intensity of training sessions, or even races. For example, it is common for average power to be lower during criteriums than during equally-difficult road races, simply because of the time spent soft-pedaling or coasting through sharp turns during a criterium. Assuming that they are about the same duration, however, the normalized power for both types of events will generally be very similar, reflecting their equivalent intensity. In fact, normalized power during a **hard** ~1 hour long criterium or road race will often be similar to what a rider can average when pedaling continuously during flat 40k time trial – the normalized power from mass start races can therefore often be used to provide an initial estimate of a rider's threshold power (see below).

Although normalized power is a better measure of training intensity than average power, it does not take into account differences in fitness within or between individuals. CyclingPeaks therefore also calculates an <u>*intensity factor (IF)*</u> for every workout or time range analyzed. IF is simply the ratio of the normalized power as described above

to your threshold power (entered under "Athlete Settings" at your "Athlete Home"). For example, if your normalized power for a long training ride done early in the year is 210 W and your threshold power at the time is 280 W, then the IF for that workout would be 0.75. However, if you did that same exact ride later in the year after your threshold power had risen to 300 W, then the IF would be lower, i.e., 0.70. IF therefore provides a valid and convenient way of comparing the relative intensity of a training session or race either within or between riders, taking into account changes or differences in threshold power. Typical IF values for various training sessions or races are as follows:

        <0.75   recovery rides
        0.75-0.85 endurance-paced training rides
        0.85-0.95 tempo rides, aerobic and anaerobic interval workouts (work and rest periods combined), longer (>2.5 h) road races
        0.95-1.05 lactate threshold intervals (work period only), shorter (<2.5 h) road races, criteriums, circuit races, longer (e.g., 40 km) TTs
        1.05-1.15 shorter (e.g., 15 km) TTs, track points race
        >1.15   prologue TT, track pursuit, track miss-and-out

Note that one particularly useful application of IF is to check for changes in threshold power – specifically, an IF of more than 1.05 for a race that is approximately 1 hour in duration is often a sign that the rider's threshold power is actually greater than that presently entered into the program. Thus, by simply examining a rider's IF for various events during the course of a season, increases or decreases in threshold power can often be revealed without the need for frequent formal testing.

While exercise intensity is clearly an important factor in determining the type and magnitude of physiological adaptations to training, exercise frequency and duration – which together determine the overall training volume – are important factors as well. However, there is obviously an interaction between training intensity and volume, i.e., at some point as intensity goes up volume must come down, and vice-versa, or else an you will become overtrained. To quantify the overall training load and hopefully help avoid such a situation, CyclingPeaks uses your power data to calculate a _training stress score (TSS)_ for every workout, and provides a graphical summary of your recent TSS on your Athlete Home page. TSS, which is modeled after Dr. Eric Bannister's heart rate-based training impulse (TRIMPS), takes into account both the intensity (i.e., IF) and the duration of each training session, and might be best viewed as a predictor of the amount of glycogen utilized in each workout. Thus, a very high TSS resulting from a single race or training session can be used an indicator that one or more days should be scheduled. For example, while individuals will tend to differ in how much training they can tolerate, depending on their training background, natural abilities, etc., the following scale can be used as an approximate guide:

        <100   low (recovery generally complete by following day)

100-200	medium (some residual fatigue may be present the next day, but usually gone by 2nd day)
200-30 0	high (some residual fatigue may be present even after 2 days)
300-400	very high (residual fatigue lasting several days likely)
>400	epic (residual fatigue often present even after 3 or more days)

As well, the cumulative TSS per week or per month can be used help identify the maximum intensity and volume of training that still leads to improvements, rather than overtraining.

By allowing convenient tracking of normalized power, IF, and TSS for each workout and over time, CyclingPeaks provides both individual athletes and coaches a powerful tool for analyzing the enormous amount of data gathered by training with a powermeter. The results of such analyses can then serve as the springboard for improvements in training and, ultimately, race performance.

What is a "Match"?

By Hunter Allen- www.peakscoachinggroup.com

A "match" is an elusive term used by riders, and coaches within the bike racing world. When you burn a "match", you have done a hard effort. It's an effort that in which you had to dig deep, or you had to really push yourself. Any bike racer knows what it –feels- like to have burned a match, but until now, no one has really tried to quantify a -match-.

Why do you need to know what a -match- is? Well, you as a rider, start out the day with a full set of matches in your matchbook, but every time you go hard, do an attack, have to hammer over a hill, you burn one of your matches. All of us have different size matchbooks, but nobody has an infinite number, so it's important to burn your -matches- at the right time during a race or in training. Otherwise you are left with an empty matchbook and then your chances of performing well have been drastically reduced. Burn all your matches before the end of the race and it's doubtful you will win. Indeed, I propose that not only is it doubtful that you will win, but it's certain that you won't win.

So, your goals are fourfold: figure out what exactly is a –match- to you, figure out the size of your matchbook, try to increase the number of matches you have, and then burn your matches at the right time in the race in order to optimize your chances for success.

As a starting point, I propose that for most riders and racers, a match can be defined as an effort in which you go over threshold power by at least 20% and hold it there for at least one minute. Of course, burning the proverbial –match- could involve an effort longer than 1 minute, but as the time period gets longer that you are burning a match, the % above your threshold power would be lower. The chart below begins to take a stab at defining a "match" for different time periods. Before you read this, remember that there is no exact definition of match, I am just introducing this concept quantitatively so that riders can refine it for themselves, and illustrating how CyclingPeaks software can really help with that.

| Time	% over Threshold power	Example: if Threshold Power	Power needed to burn a 'match'
1 minute	+20%	300Watts	360 Watts
5 minutes	15-20%	300Watts	345- 360 Watts
10 minutes	8-12%	300Watts	324-336 Watts
20 minutes	0-8%	300Watts	300-324 Watts

Now, that you have a general idea of what a match is, you need to figure out how many matches you have at your disposal. The only way that I know to do this is to do a super hard training ride in which you have pre-planned matches that you are going to burn, or to do a really tough race with lots of -match burning- ! The great thing is that you know based on your rating of perceived exertion and also your rate of exhaustion, when

you burned a match and when you are out of matches! So, listen to your body here and then go back through your downloaded data to "find" all of your matches.

This is where CyclingPeaks Software can help you.   By using the "Fast Find" feature, under the Edit button, you are able to enter some parameters in order to find those matches. Let's assume that your threshold power is 300 Watts. So, take 120% of 300 Watts, which is 360Watts and enter that into the >leading edge<. Then take 300Watts and enter that in as your trailing edge, since you are still going hard at that point.   Then select 1 minute as the minimum duration and then 5 minutes as the maximum duration. Here's what it looks like:
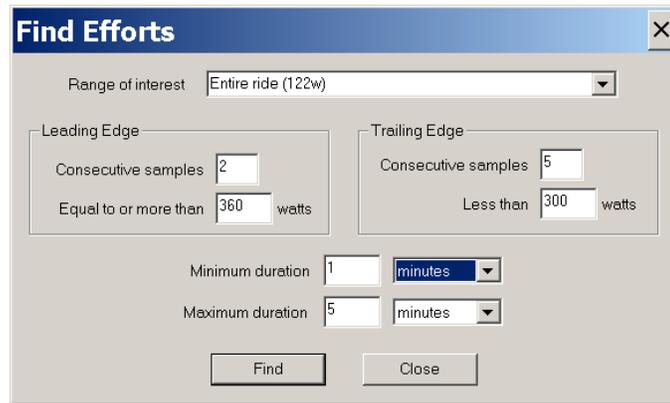
Now, once this is done, all of your -matches- will be highlighted. You can then review the graph of your ride to put significance to each match by typing in the ranges text area, some description about that match. For example: Hard attack on hill, or prime sprint, etc. Or you could just simply label each "Find" as a, -match- and then use the >linking< button to link them all together. It might look like this:
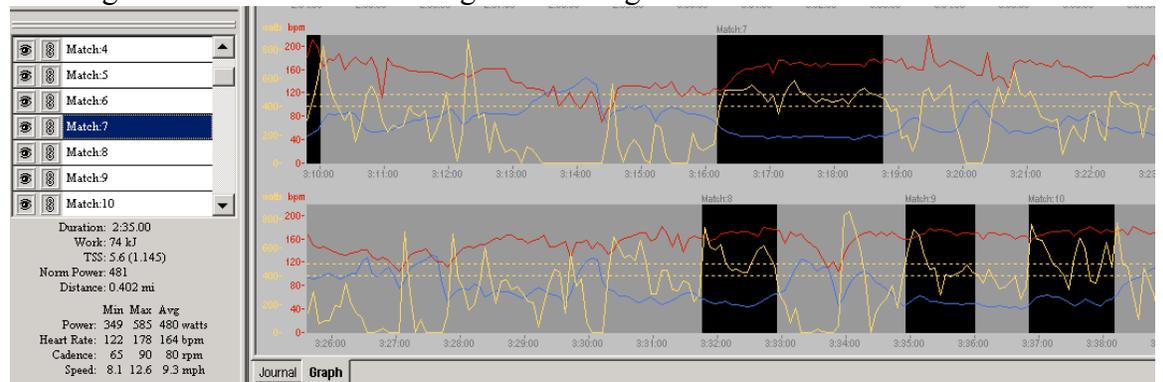
If you notice in the above screenshot, I have also used another way of viewing a -match-. I placed a gridline at 400Watts(this riders' threshold power), and then I placed another gridline at 480Watts(120% of his threshold power). So you can visually scan through the graph and look at any area that is above the 480 gridline. These are definite -matches-. The space under the yellow line (Watts), but above the 400 Watts line is the

time spent burning a match. Any significant time spent above 480 Watts is like sending up a "flare"!

Now that you know what your matches are, and how many you have before you are "cooked", then you can go about changing your training in order to increase the size of your matchbook and also increase the intensity of the flame from each match.   At the same time, by using a power meter in a race, you can review the data post mortem and determine if you spent too many -matches- in the beginning of the race or if you spent them at the correct time to optimize your chances for success. This is one of the great benefits of racing with a power meter. It allows you to see objectively if you raced tactically correct.   At the same time, you can now begin to develop a better training plan based around your weaknesses (amount of "matches" and intensity of the flame), in order to better "toast" your competition.

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