



# Cycling with Power 101:

Training and Racing Using a Power Meter

12/9/15

# Thank you!

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- Fitwerx – Joe LoPorto ([fitwerx.com](http://fitwerx.com))

# General

- Disclaimers
- Prerequisites
- Buying a power meter will not magically make you faster!
- Using it intelligently WILL make you faster and guide race day execution.
- Don't throw away your HR monitor!

# Training and Racing

- How do you train/race today?
- How do you plan intensity of a workout, a weeks worth of workouts, a full A-race build?
- How do you plan/execute a race ?
- The problem with RPE and/or heart-rate based training

# Power

- Power(watts) = How fast you pedal \* how hard you pedal
- Directly measures your work effort.
- During the ride, we want to know how hard we are working – our work rate.
- We can manage the workout very precisely
- After the ride, we want to summarize what we just did:
  - What was my fatigue load?
  - What was my training stimulus?

# Example

- David goes out and rides 30 min @ 125 watts and 30 min @ 275 watts = 200 average watts.
- RJ goes out and rides 1 hour steadily @ 200 watts = 200 average watts
- Who put more training stress on their body ?  
Are these identical rides ?

# Training With Power

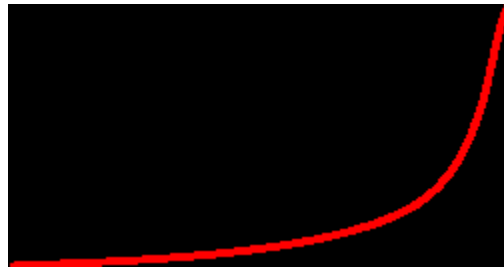
- Using a power meter and a training framework to make you stronger, faster, more efficient. Terms you need to know:
  - FTP (Functional Threshold Power)
  - Intensity Factor (IF)
  - Normalized Power (NP)
  - Training Stress Score (TSS)

# Training (continued)

- FTP – the highest power you can hold for a steady 1 hour ride (theoretically)
- This number will drive ALL your workouts and race planning
- Why? Coggan's work and the science behind this training method...



- Dr. Coggan analyzed test results of cyclists, plotting lactate against power output.
- The line curves up with lactate rising to the 4th power of power output!
- Cost of higher watts is expensive!!



Lactate vs Power

- Blood lactate concentrations have been convincingly shown to be a marker for a whole host of metabolic stresses.
- These stresses are apparent within 30 seconds of a spike in power.
- As power spikes, it has a cost that rises **exponentially**, in terms of fatigue and strain.
- Fatigue and strain are *cumulative* , within a single ride and across weeks.

# Normalized Power (NP)

- Example from before:
- 30 min at 125 watts; 30 min at 275 watts  
 $[(125^4 + 275^4)/2]^{.25} = 234$  NP watts
- Simple Average = 200 watts
- Actual Fatigue Load => 234 watts.
- *The 234 watt number goes in the log.*
- Average Power = how hard you rode.
- Normalized Power = how tired you got riding that Avg Pwr

# Intensity Factor (IF)

- All efforts are measured relative to each athlete's current fitness.
- "Current Fitness" = FTP
- Intensity Factor = "IF" = the NP of a given ride, divided by the *current* FTP.
- *A 200-NP watt ride for an athlete with an FTP of 250 watts was an 80% IF.*

# Training Stress Score (TSS)

- The point of training is to get tired and accumulate training stress.
- A function of intensity and duration.
- Managing TSS across a training plan makes us stronger, faster, more efficient.
- Measures the total load/stress of a workout
- Add them up over time; rolling average
- $TSS = IF^2 \times \text{Duration of ride} \times 100$

# TSS Examples

- 2 hour ride at 80% of FT
- $0.8^2 \times 2 \times 100 = 128$  TSS points
- 3 hour ride at 70% of FT
- $0.7^2 \times 3 \times 100 = 147$  TSS points
- Note that “intensity” is squared...time is not
- *Intensity has an outsized effect on your fatigue load and training stress!*

# How

- Measure your FTP. Train using that number. Repeat.
- Measuring your FTP: test! One standard way:
  1. Warmup 15 minutes
  2. 5 mins best effort to bleed off anaerobic capabilities
  3. 15 mins easy spin
  4. 20 minutes steady @ highest watts you can hold.  
Your FTP = 95% of average watts for this 20 min effort

# How

- Workouts/plans then become based off that number. Example: week 5 from Endurance Nation Outseason plan:
  - Tues: bike(60') : MS: 2 x 15' (2') @ 95-100%.  
Remainder @ 80-85%
  - Thurs – bike (60') MS: 8 x 2' (2') @ 120%.  
Remainder @ 80-85%.
  - Sat – bike (90') MS: 2x15'(4') 1x5'(5') @ 95-100%.  
Remainder @ 80-85%.



# How

- Training plans for various distances and race types will target specific intensities and percentages
  - Sprint and Olympic will train quite often over FTP
  - Half and IM will spend a lot of time at/near FTP
  - Cyclo-cross, criterium, road/time trials – all have their own emphasis.

# Training Session = TSS Delivery System

- Components of Weekly TSS:
  - Frequency: fixed by life
  - Volume: more flexible but life puts a ceiling on it quickly.
  - Intensity: infinitely more flexible, therefore primary means of manipulating TSS across a training week.
- Intensity-Focused Protocol
- Strengths:
  - Time efficient and therefore more realistic for AG'er
  - Training with power creates positive feedback loop.
  - IT WORKS!
- Weaknesses: counter to Tri-culture norms, base building

# Typical Training Week

- 2 x Interval Session:
  - Purpose: to lift FT
  - ZERO volume expectations for these sessions
- "Long" Ride
  - Purpose: Do a solid amount of work/rack up TSS
  - Another opportunity to do FTP work
  - Volume = Manageable and REPEATABLE

# Trainer Road

- Built in plans
- Integrated with Training Peaks, Strava, etc
- Available for desktop and mobile (IOS)
- Incredibly cheap: ~\$15/month
- Virtual Power for those without a power meter
- Demo

# Racing

- It's your A-race, how will you ...
  - plan your bike segment ?
  - ride a hilly course ?
  - handle a windy day ?
  - “save” enough for the run ?
- The Tale of Dylan Cohen
- Hint: Ironman is NOT a bike race!

# Pacing Guidelines

- Proper Pacing: no such thing as a “good bike split” followed by a poor run.
- Proper Pacing: a good run follows from a good bike split
- “Bike split I SHOULD” vs “Bike split I COULD”

# Power Data and Pacing

- Powermeter gives immediate, consistent, reliable pacing data unlike heart rate
- We will tie your race pacing goals back to your well-known, validated through training and testing, FTP!

# Power Data and Pacing

- You have to decide just how tired you want to get before running your marathon
- Tired is a function of how hard (intensity) for how long (duration). Sound familiar ???
- Reminder:  $TSS = IF^2 * Duration$
- TSS points: 270-290 is associated with a good run (IM)
- Translates to a range of (roughly) 68-75% FTP\*



# Example Pacing Plan

<b>FTP</b>	<b>250</b>
Goal Intensity (IF)	0.72
Goal Watts	180

<b>Gear</b>	<b>What</b>	<b>Goal</b>
1	First 30-40' plus slight downhills. (GW-5%)	171
2	Goal Watts	180
3	Long Hills/Easier Grades (GW+5%)	189
4	Short Hills/Steeper Grades (GW+10%)	198

# Execute this way and you observe:

- First hour: Gulp. Lots of folks are passing me 😞
- Flats: OK I'm moving through the field
- Hills: going backwards again, I suck
- Crest and Downhills: I'm killing it! Passing a lot of folks – boy that guy looks fried!
- Mile 70-90: cool, I'm reeling a lot of people in
- Mile 90-112: passing people like they are standing still
- Run: Mile 18 – why is EVERYONE walking !?!?!?

# Other considerations: variability

- Ride steady!!!
  - Remember: the cost of higher watts is extremely costly in terms of your available energy for the rest of the ride and run!
- Riding in a “spiky” fashion is measured by Variability Index(VI). Simply NP/AP.
- Each percent of VI over 1.02-1.03 is equivalent to a loss in power of the same amount.

# Variability: How to minimize it

- Example: VI of 1.06 translates into a power loss of 4% on a hilly course and even more on a flat course.
- That sucks – you worked REALLY hard to increase your FTP 4% and you just lost it by riding like a dope.
- So...hills. Gear down, spin easy, follow your guidance. Power over the crest and continue applying goal watts until you spin out.
- So....wind. Best strategy is to ignore it. Focus on your goal watts.
- Practice riding steady. It's a skill that can be learned!

# Other distances

- 70.3 – Use IF of 0.75-0.83 to determine your “gears”
- Olympic – 0.90-0.95. More like using the PM as a whip
- Sprint – 1+.

# Typical Setup

- Power meter somewhere on the bike: crank, pedals, rear hub
- Head/display unit (example: Garmin Edge 500)
- Data upload to ....TrainingPeaks (WKO+), GoldenCheetah, Garmin Connect.
- Demo – WKO+

# Equipment

# Questions/Demo



# References and Tools

- Bible: Coggan, Allen – “Training and Racing with a Power Meter”, 2<sup>nd</sup> Edition.
- Analysis: Trainingpeaks.com (WKO+) Free/\$\$
- Analysis: Golden Cheetah (goldencheetah.org) Free
- Workouts/Plans: Trainer Road, Endurance Nation
- Questions? rich\_miani@yahoo.com