

# Demands of ITU Triathlon Competition

Bicycling Biomechanics

Bicycling Physiology

Bicycling training

Strategy/Tactics Skills

GPS

Filming

SRM

Equipment Choice

Gender Differences

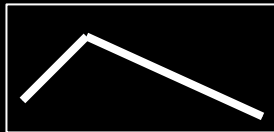
Maintenance

Packing for travel

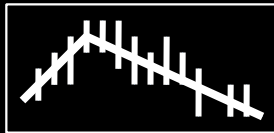
Strength and conditioning

# ***DEMANDS OF COMPETITION***

Continuous



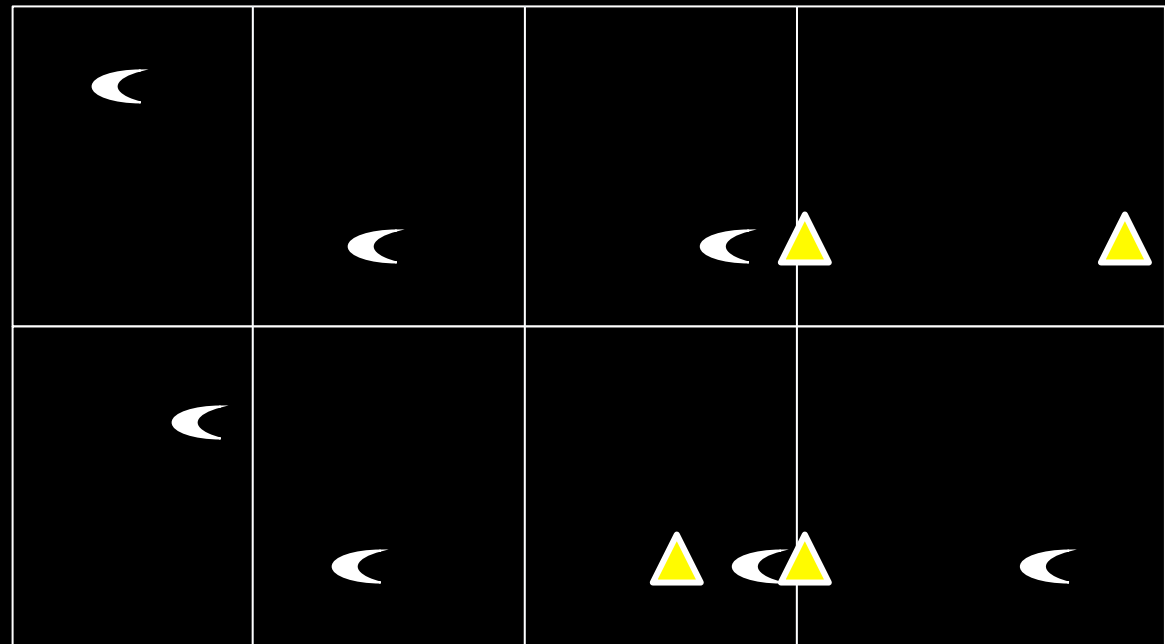
Intermittent



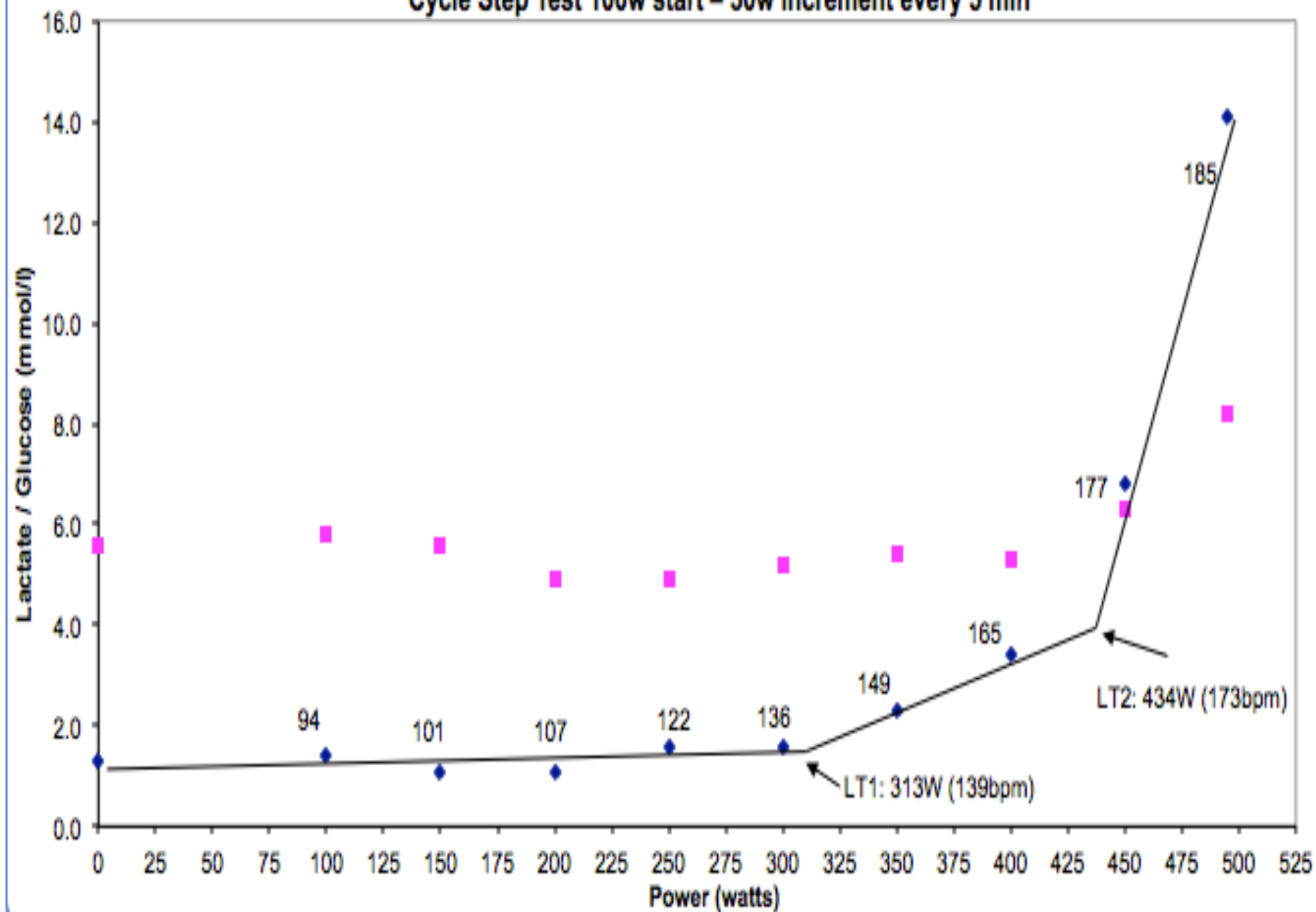
1 min

10 min

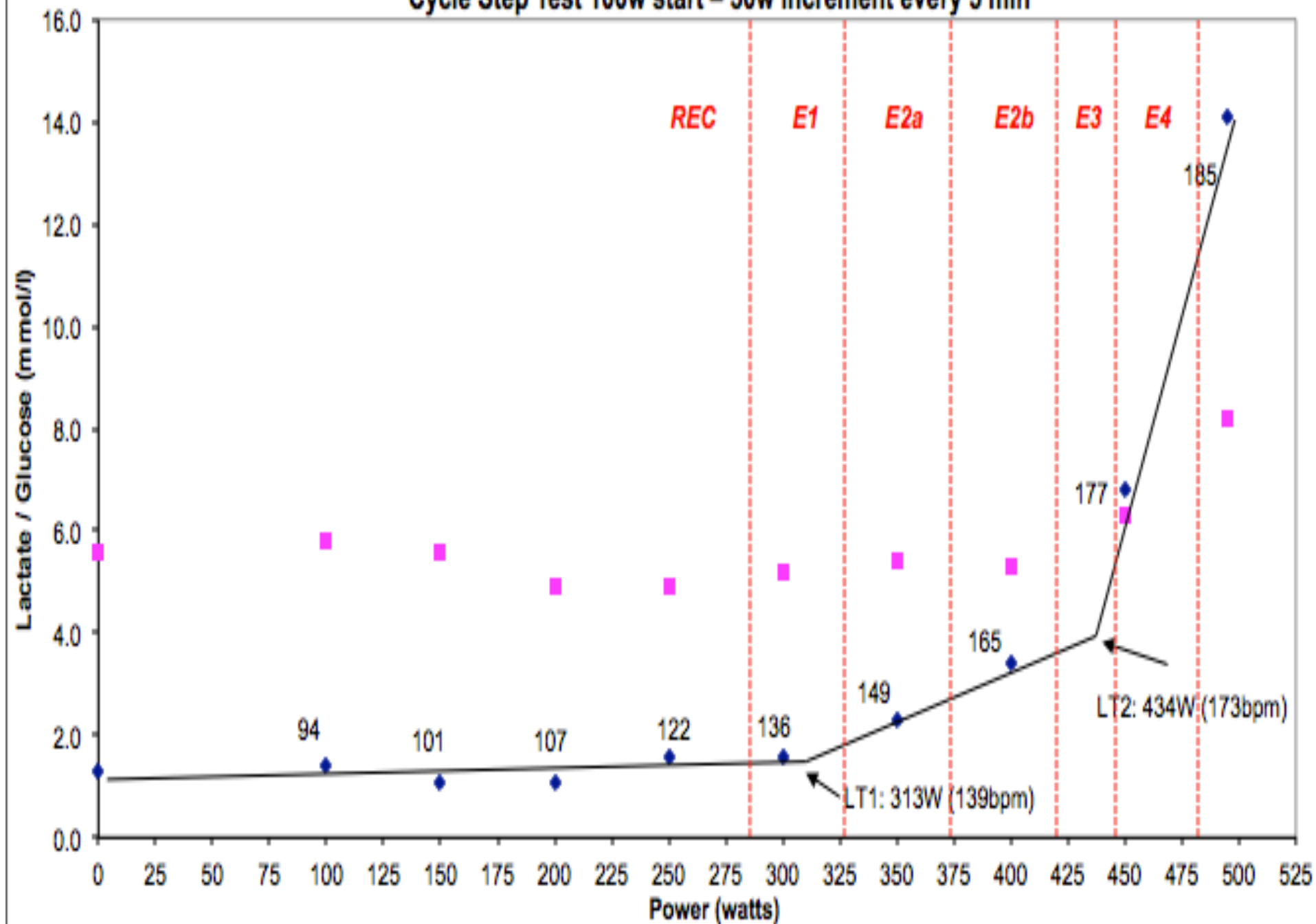
1 hr

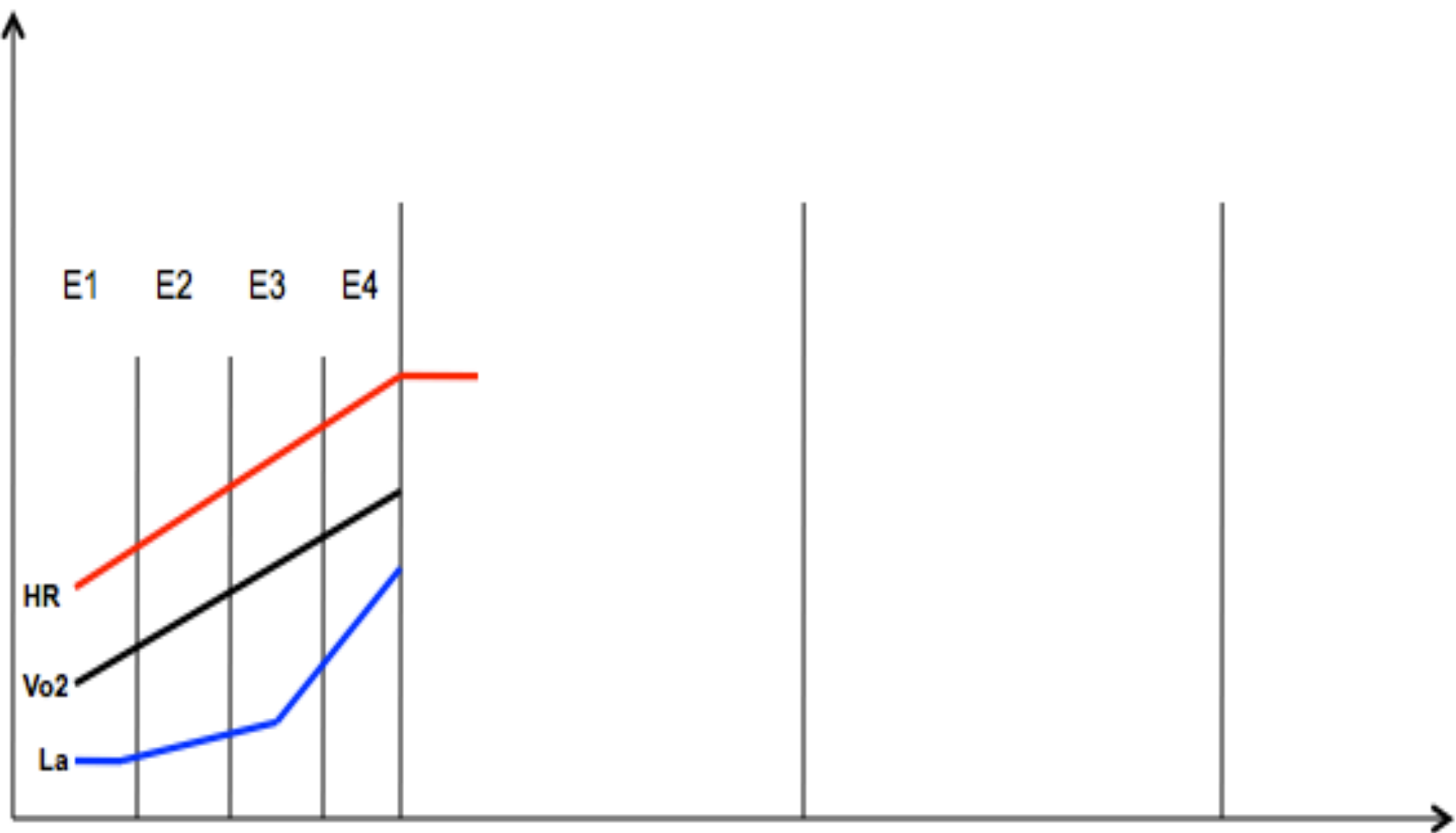


Cycle Step Test 100w start – 50w increment every 5 min



Cycle Step Test 100w start – 50w increment every 5 min





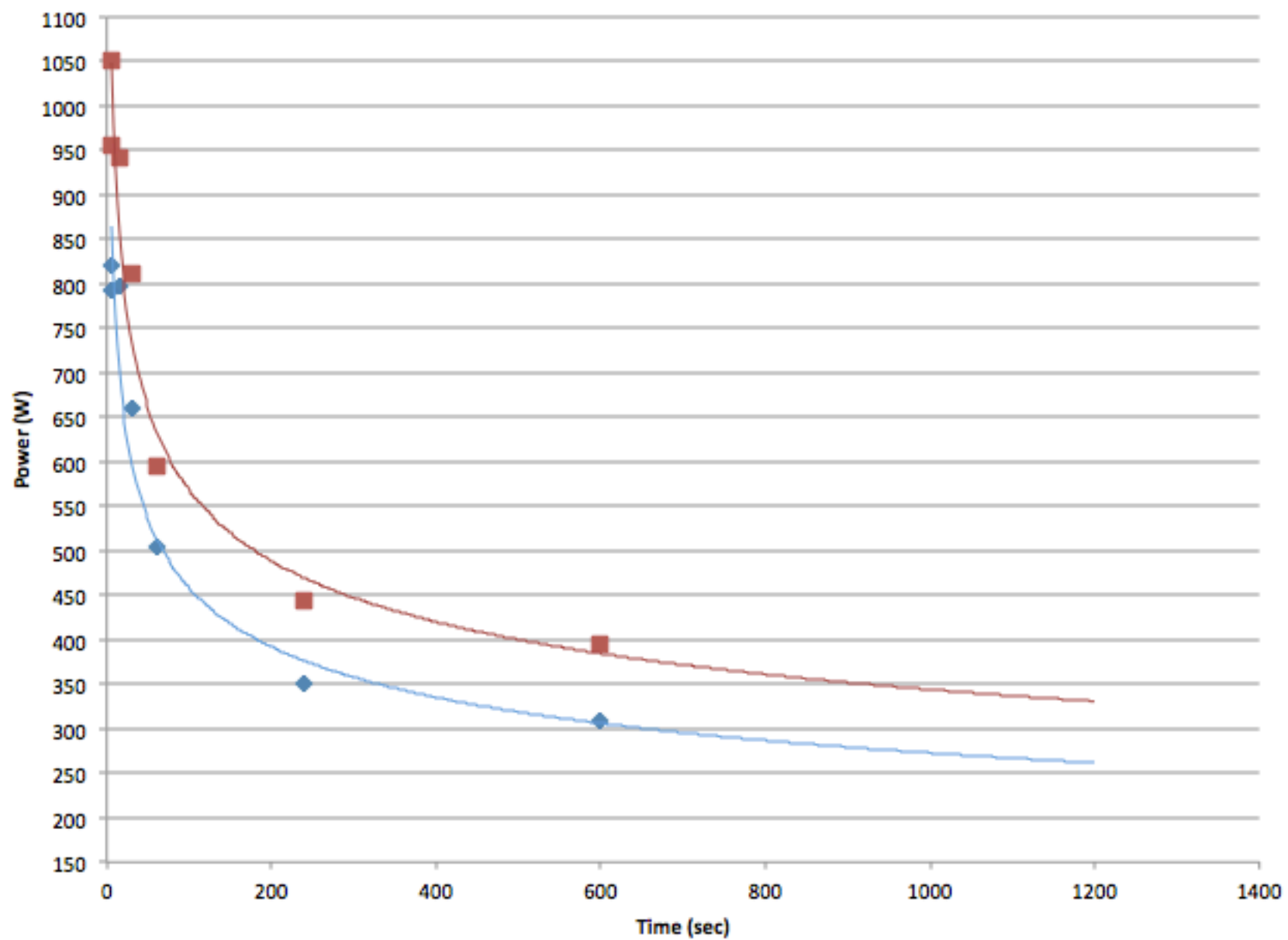
LT      AT      V02max

MMP 40 min    MMP 6 min    MMP 1 min    MMP 30 sec    MMP 15sec    MMP 1 sec

0    150    300    450    600    750    900    1050    1200  
POWER (Watts)

# *Power Profile*

- Determine highest power output a triathlete can maintain for a given duration of SINGLE effort
- Protocol: (All efforts are maximal)
  - 6s (0:54) Small Gear, standing start
  - 6s (1:54) Bigger Gear, standing start
  - 15s (3:45)
  - 30s (5:30)
  - 60s (8:00) Rolling Start 70-80 cadence
  - 4min (10:00)
  - 10min
    - Lactates Pre / Post on the over 1s (60s, 4 min and 10min)
    - Vo2 during 4min and 10min



# *Over One's*

Warm-Up

5min recovery

1min "all out" interval

8min Recovery - E1 - Easy

4min "all out" interval - evenly paced.

10min Recovery - E1 - Easy

10min "all out" interval - evenly paced

5min Recovery - E1 - Easy

2 x 4min with 3min recovery (best power possible)



# *Under One's*

- Warm-Up
- 6 sec standing start with gear allowing  $> 120$  cadence
- 1min rec
- 6 sec standing start with gear allowing  $< 100$  cadence 1.54 rec
- 15 sec from 30-40 cadence
- 3.45 rec
- 30 sec from 30-40 cadence
- 5.30 rec
- 10x 6sec (every 20 sec) - u turn spec cadences so less than 10km/h and cadence  $< 40$
- 6min rec
- 4x 15sec (every 1 min) start cadence 50-60
- 6min rec
- 2x 30 sec (every 2 min) - start cadence 80+

# *Under One's fatigue Resistance*

12x5sec; 1:6 W:R

6x10sec; 1:6 W:R

4x15sec; 1:6 W:R

10min Rest

12x5sec; 1:3 W:R

6x10sec; 1:3 W:R

4x15sec; 1:3 W:R

10min Rest

12x5sec; 1:1 W:R

6x10sec; 1:1 W:R

4x15sec; 1:1 W:R

start cadences 1:6 < than 60 / 1:3 70-80 / 1:1 > than 90

# ***“Pointscore Session”***

3-5x 10min "on" with 3 min recovery

Within the "on's" Athletes ride high on velodrome in a line - staying behind and above the wheel in front of them - riding approx 28-30kph

When the motorbike comes up underneath and behind them they stay in order , accelerate and dive down the track to chase and hold the motorbike (motorbike is going 45-52 kph depending on gears they are riding )

They chase and hold the motorbike until we approach the 2nd group of athletes and those on the motorbike pull up the track and 1st wheel goes to last position  
Then the next group chases the motorbike

Its optimal for athletes to produce power with cadence and minimise the crank torque In this sessions we are looking at start cadences of around 75-80 -

Women ride between 86.4 and 90 - Men between 88.8 and 92.6

Set up as per comp bike

- The velodrome gives us a controlled environment - the banking encourages and rewards power production with cadence and enables the athletes to produce velocity with cadence - like a rotary engine
- A sample effort from Ryan Bailie
  - 8 efforts per 10 min period 40-42 seconds of work per effort (equal rest between)
  - max power 950 - 16.10 watts / kg
  - start cadence 75
  - max cadence 122
  - start speed 30
  - max speed 54 (just before getting on motorbike wheel)

## TRAINING ZONES

Training Zone	Former Name	Description	Duration of Effort (min)	Heart Rate (%HRmax)	Power output (% of 4 min max or MAP)	Power output (from Power Profile Test)	Blood Lactate (mmol/L)	Perceived Exertion
Recovery	Recovery	Recovery		<60%	40-50%		<1.5	Recovery
Training Zone 1 (T1)	E1	Aerobic/fat	> 120 min	60-75%	50-65%	0.6*10 min - 0.75*10 min	<1.5	Easy
Training Zone 2 (T2)	E2a	Extensive endurance (Aerobic/Fat)	120-450	75-84%	65-73%	0.75*10 min - 0.83*10 min	1.5-3.5	Comfortable
Training Zone 3 (T3)	E2b	Intensive endurance (Aerobic/CHO)	15-90	82-89%	73-80%	0.83*10 min - 0.9*10 min	3.3-3.6	Comfortable - Uncomfortable
Training Zone 4 (T4)	E3	Threshold	15-60	88-93%	80-90%	10 min-20W - 10 min	3.5-6.0	Uncomfortable
Training Zone 5 (T5)	VO2max	VO2max	3-7	92-100%	90-100%	4 min-20W - 4 min+10	>6.0	Stressful

MAP = Maximal Aerobic Power determined from progressive step test

Use these as a guide only as individual differences will present

# *Platforms for success*

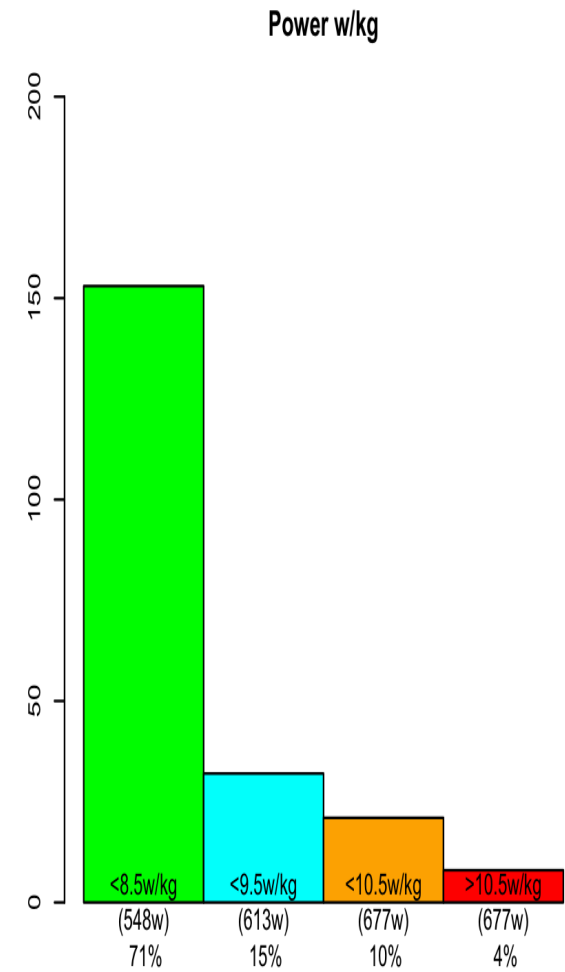
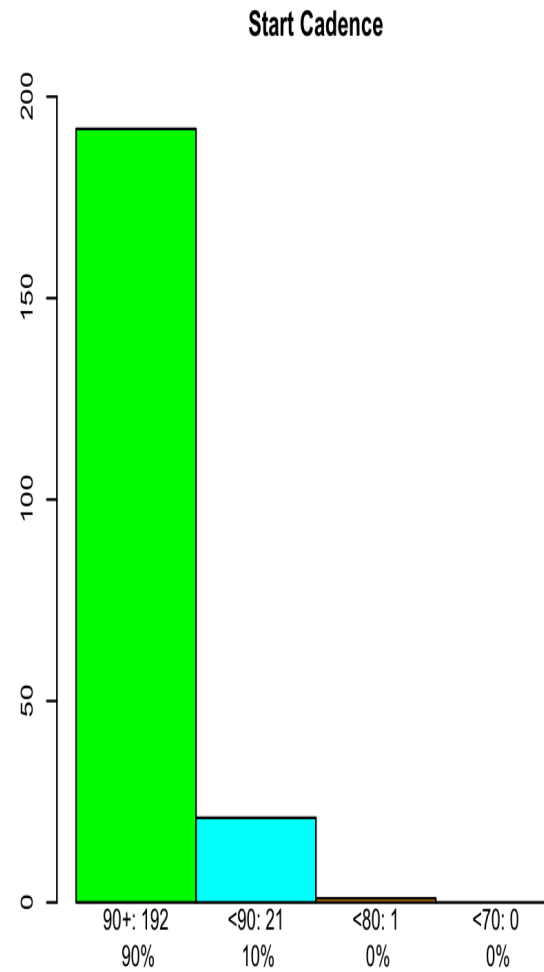
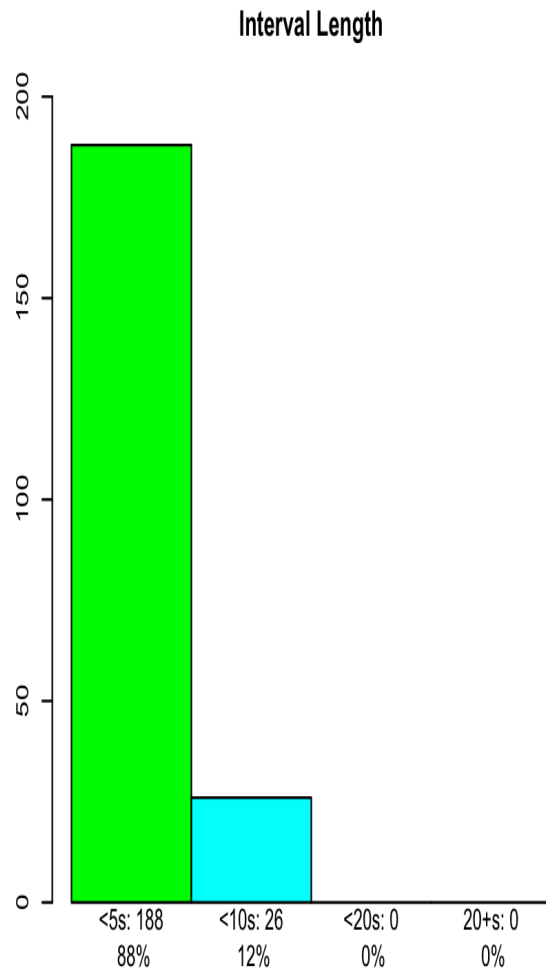
- Its goes way beyond hitting the pedals
- Technical
- Tactical
- Physiological
- Psychological

# *London 2013 WTS Final*

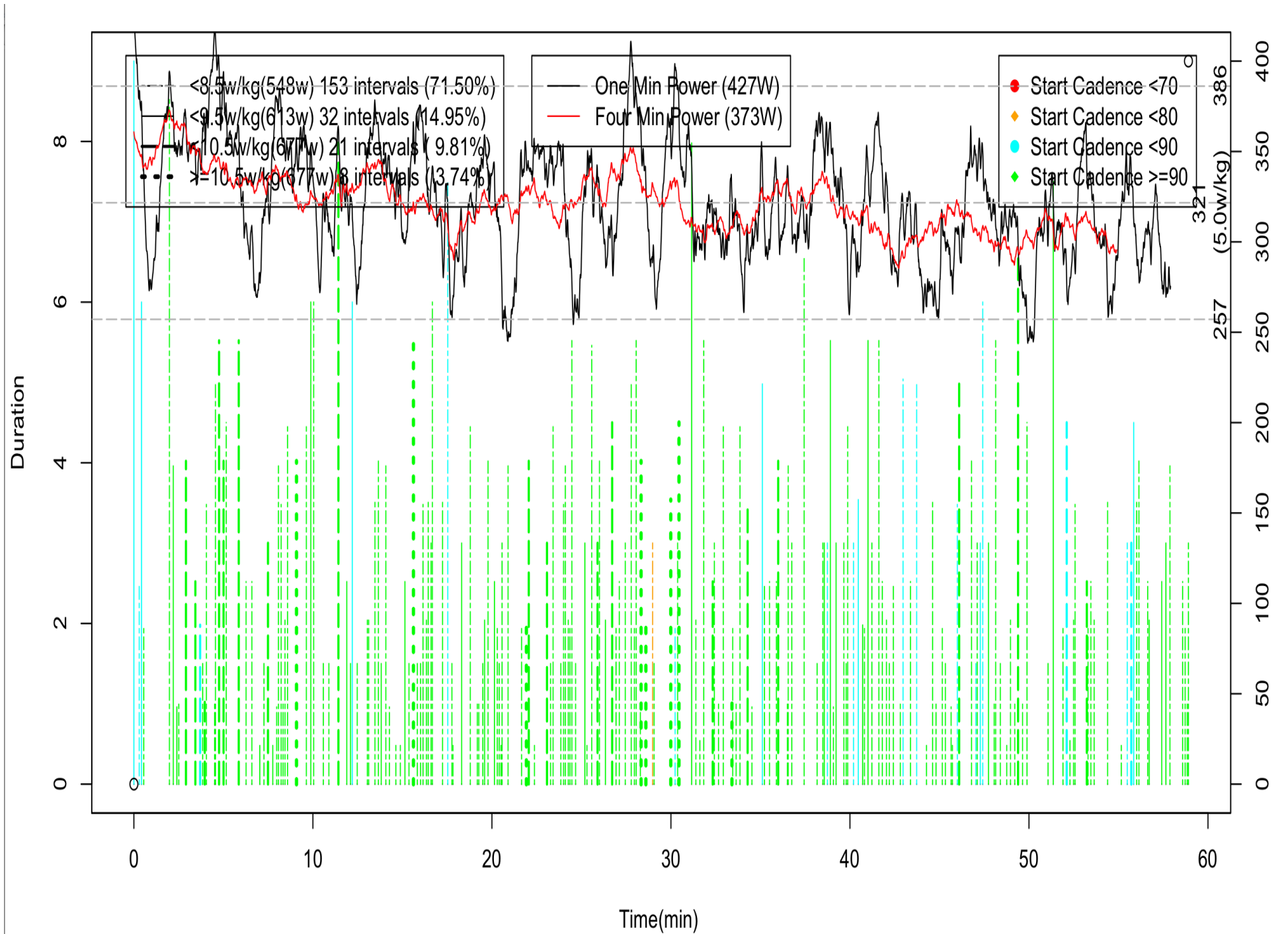
Aaron Royle

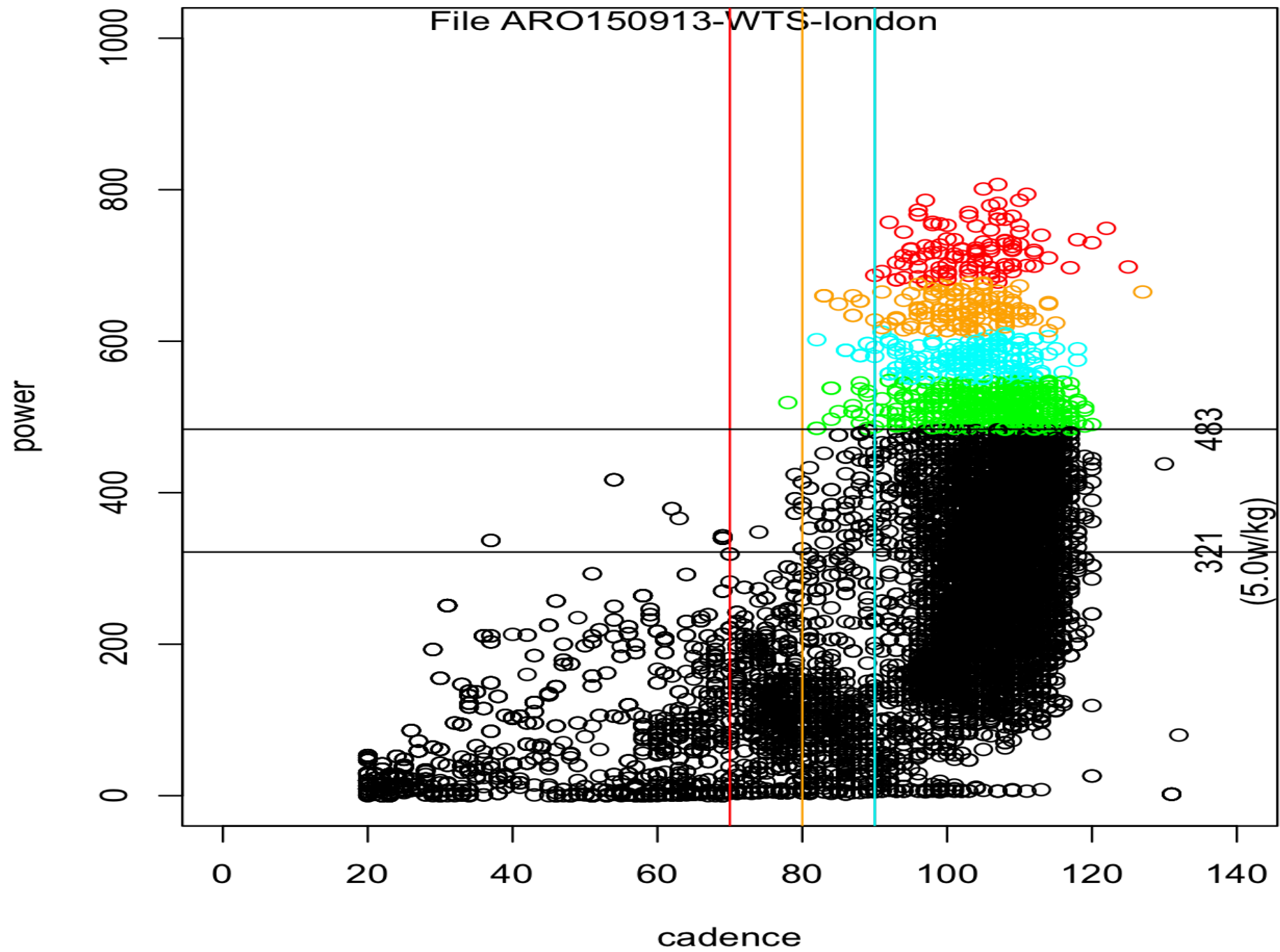
Average power 5.0 w/kg

File ARO150913-WTS-london. Total Intervals: 214









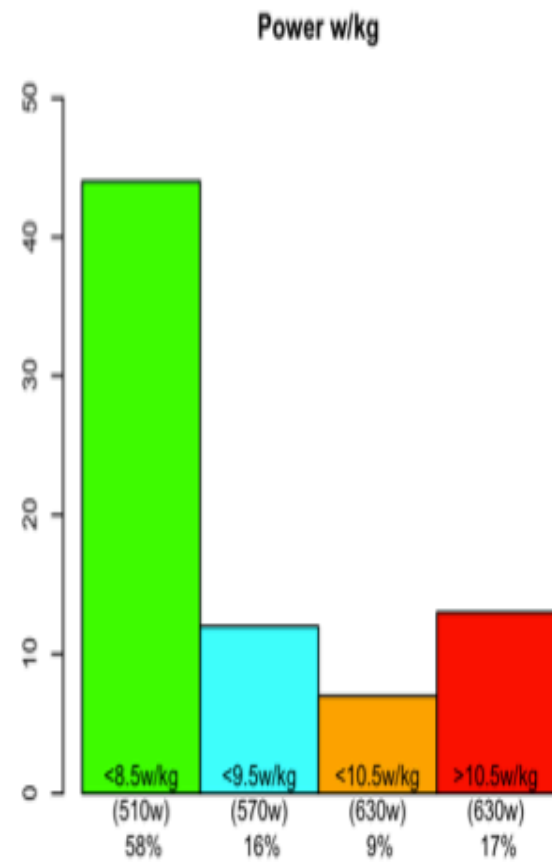
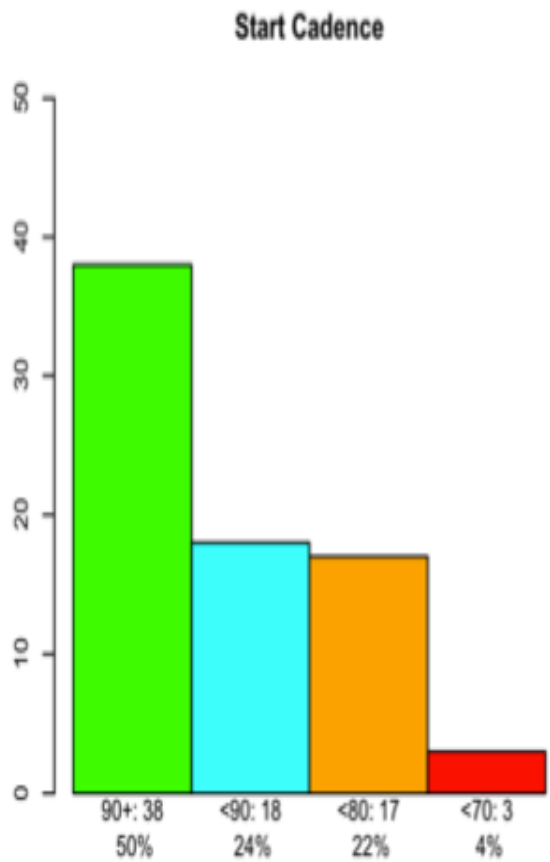
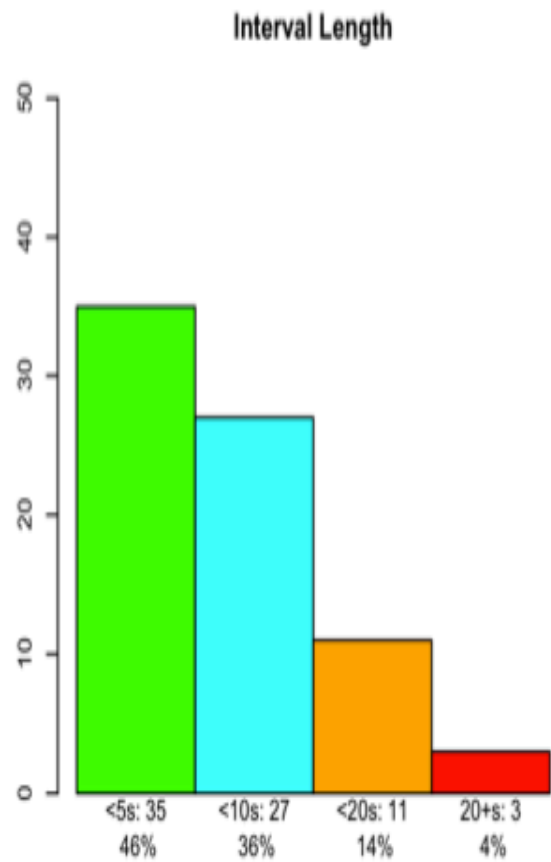
Dur	Rec: 5s	10s	30s	60s	60+	( 214 )
5 sec:	1	12	83	46	46	( 188 )
10 sec:	1	4	8	5	8	( 26 )
15 sec:	0	0	0	0	0	( 0 )
20 sec:	0	0	0	0	0	( 0 )
20+sec:	0	0	0	0	0	( 0 )

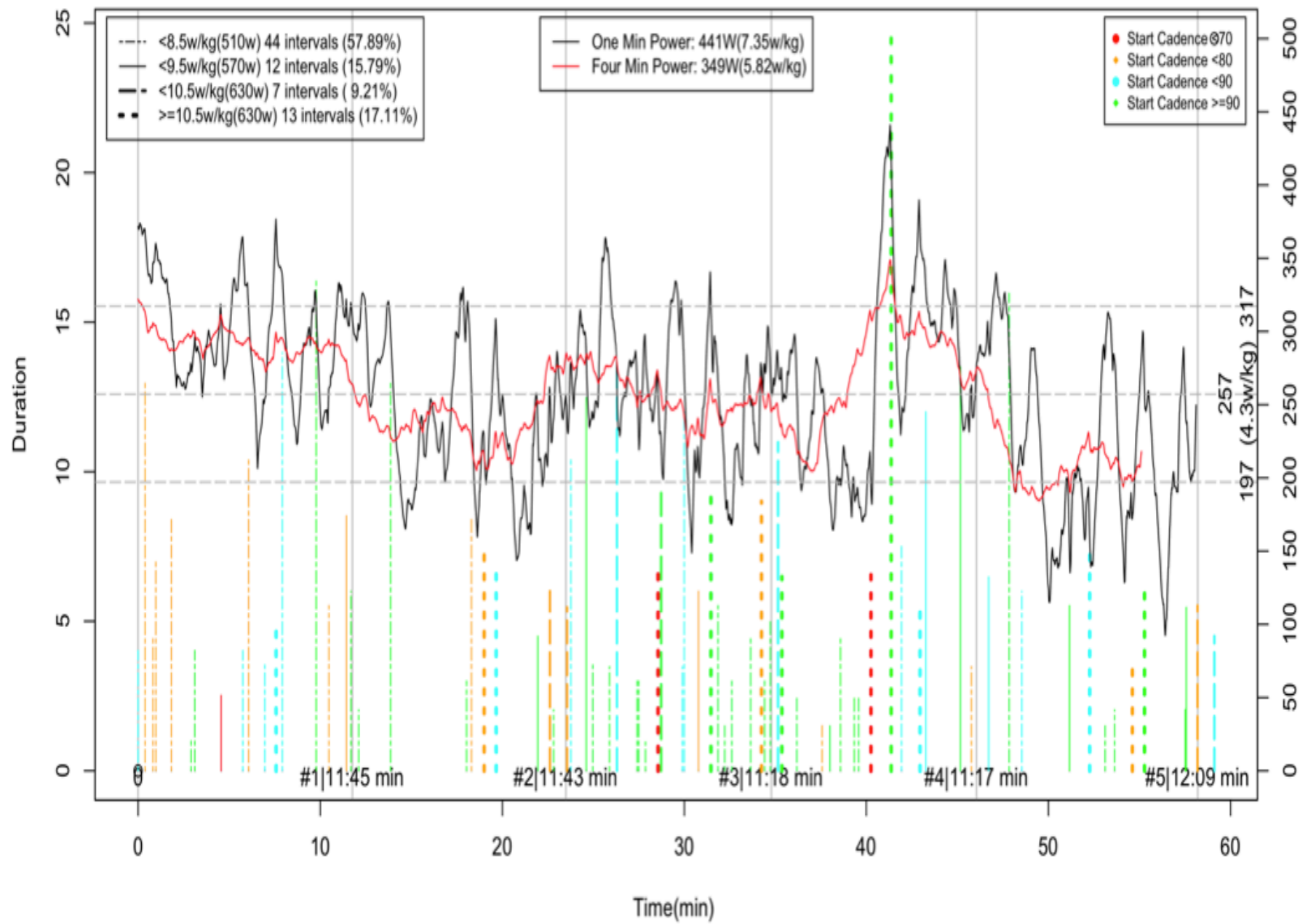
# *2014 Comm Games*

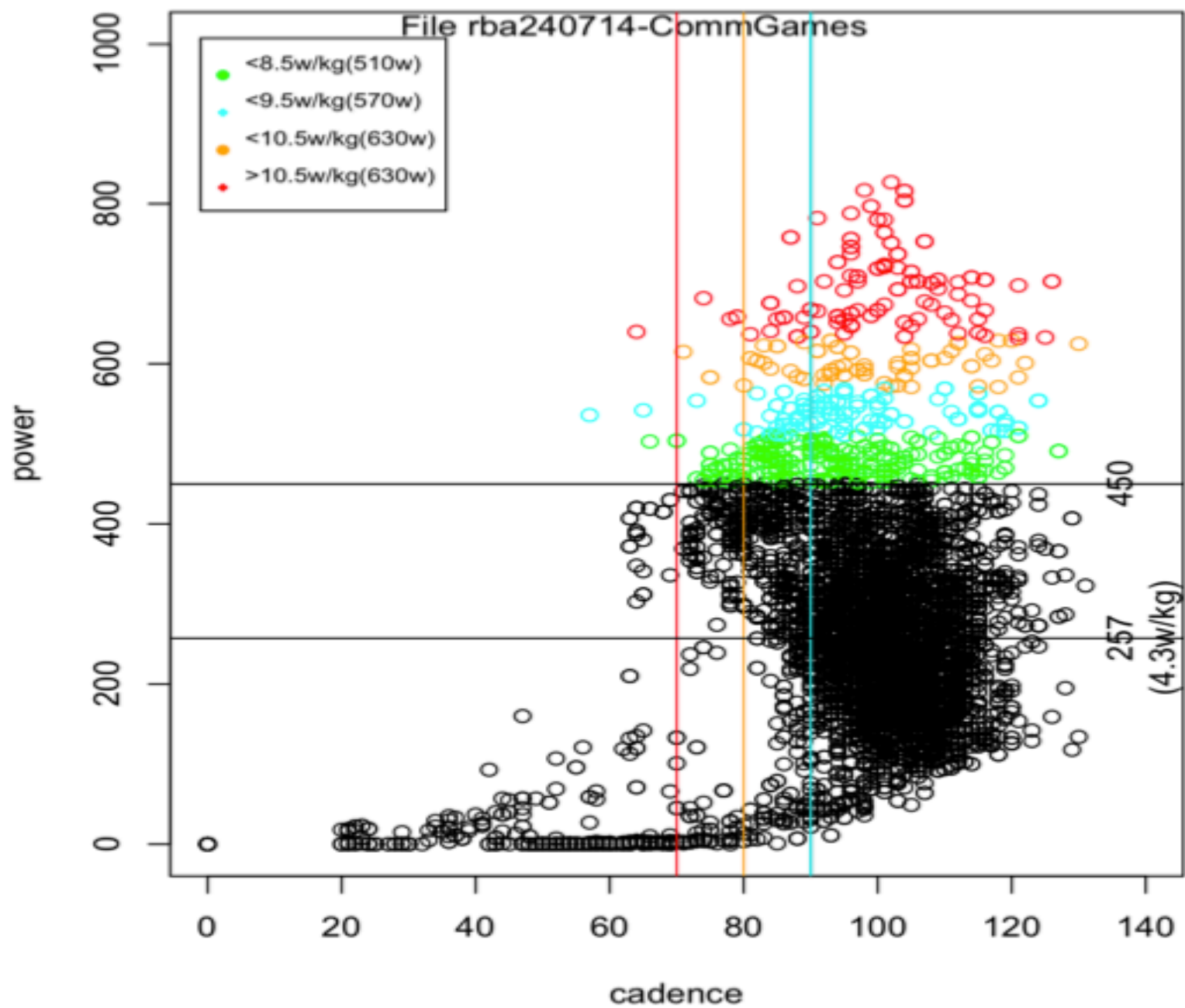
Ryan Bailie

Average power 4.5 w/kg

File rba240714-CommGames. Total Intervals: 76



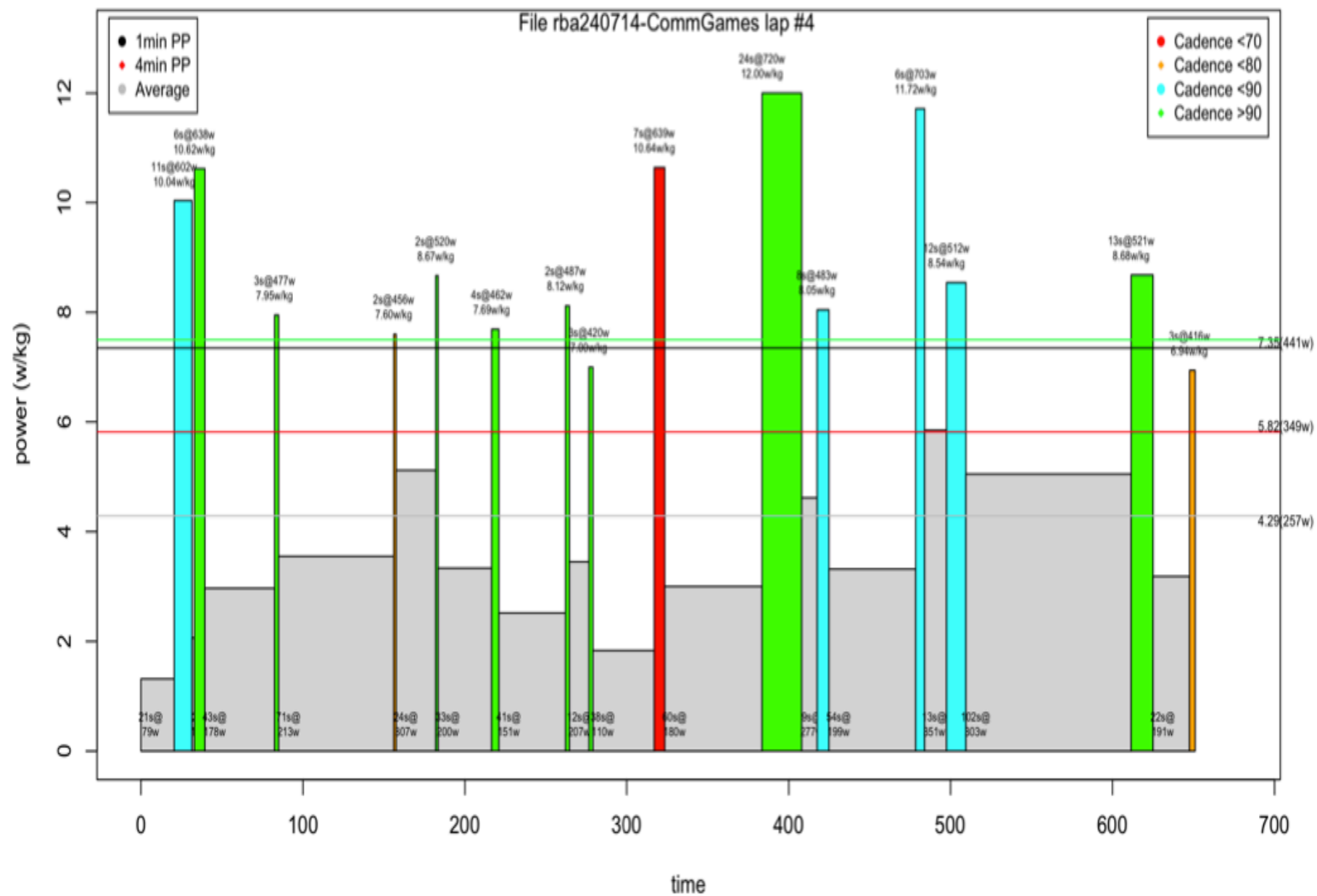




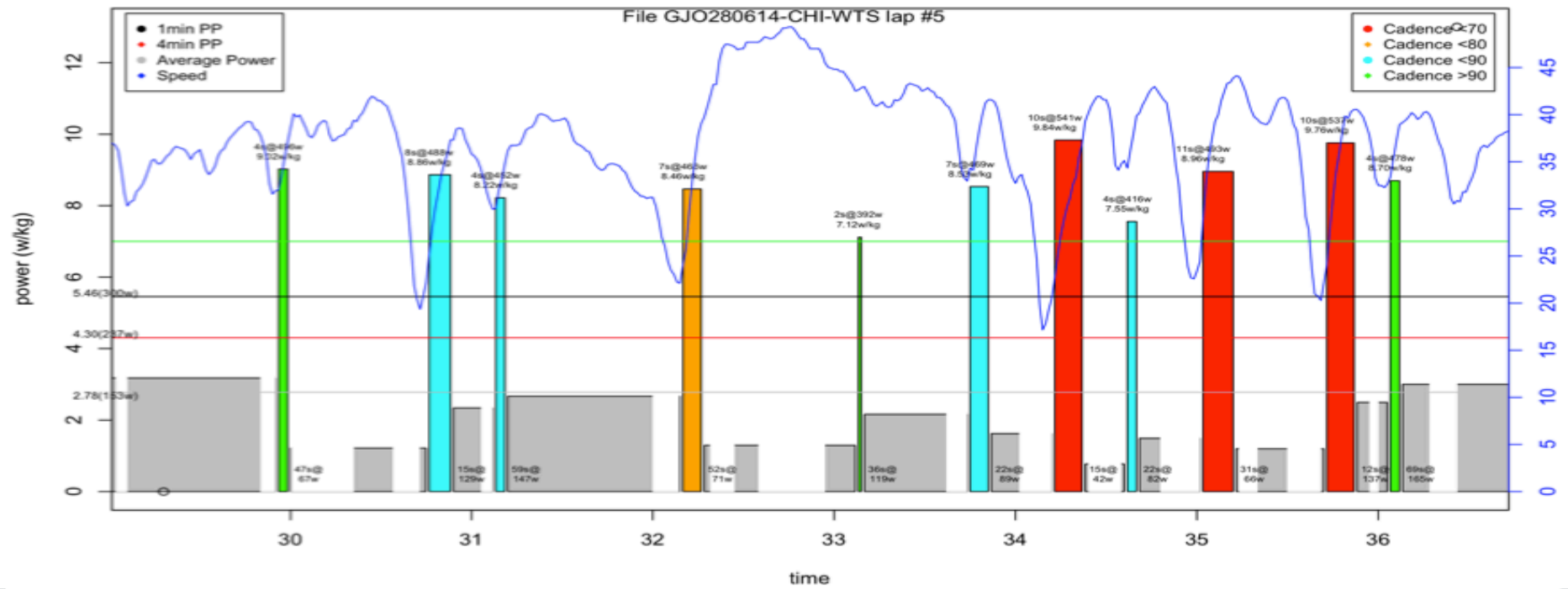
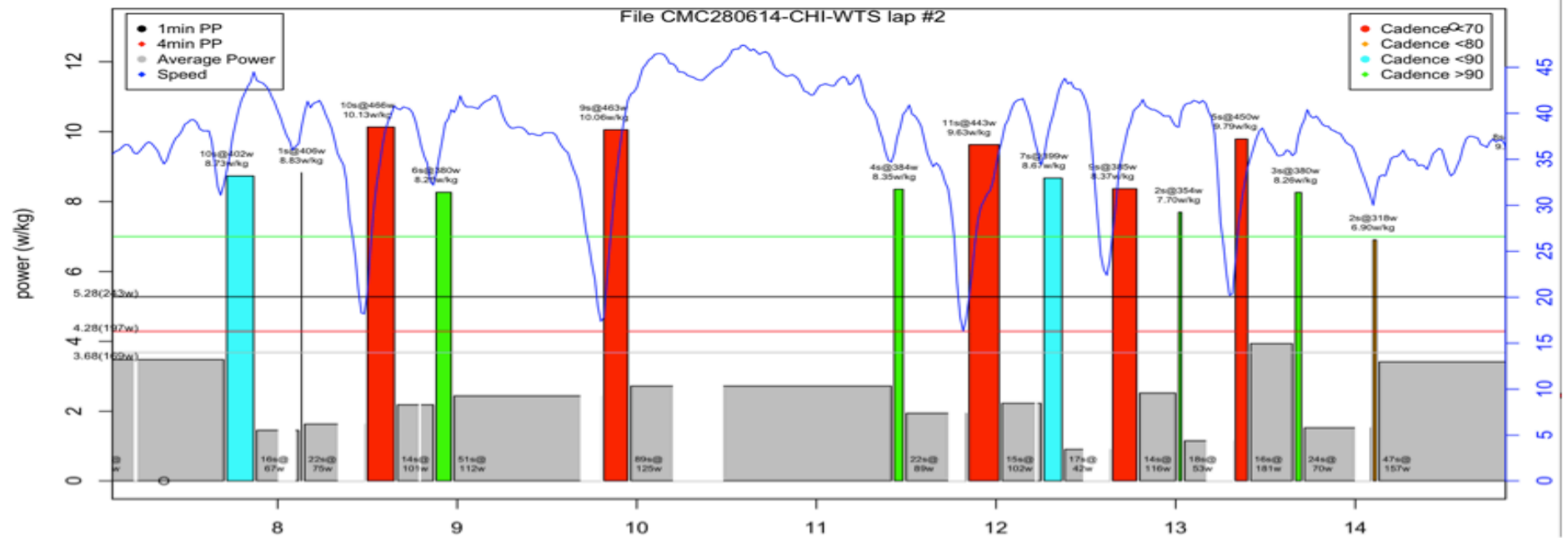


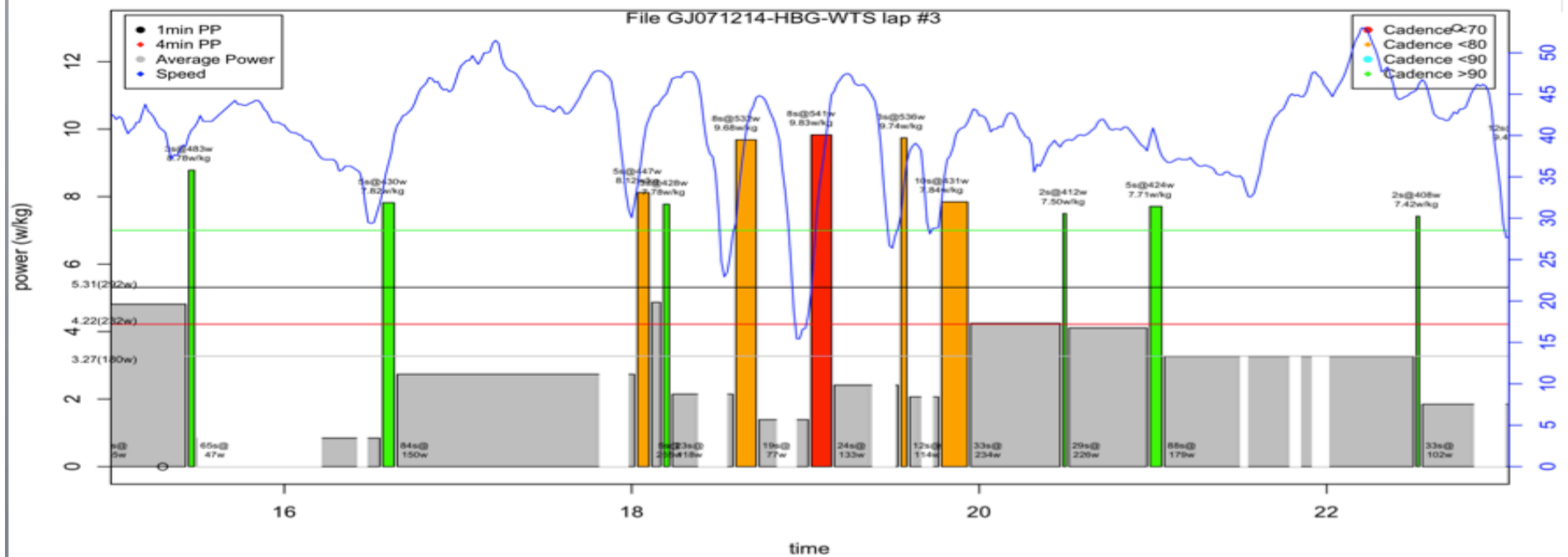
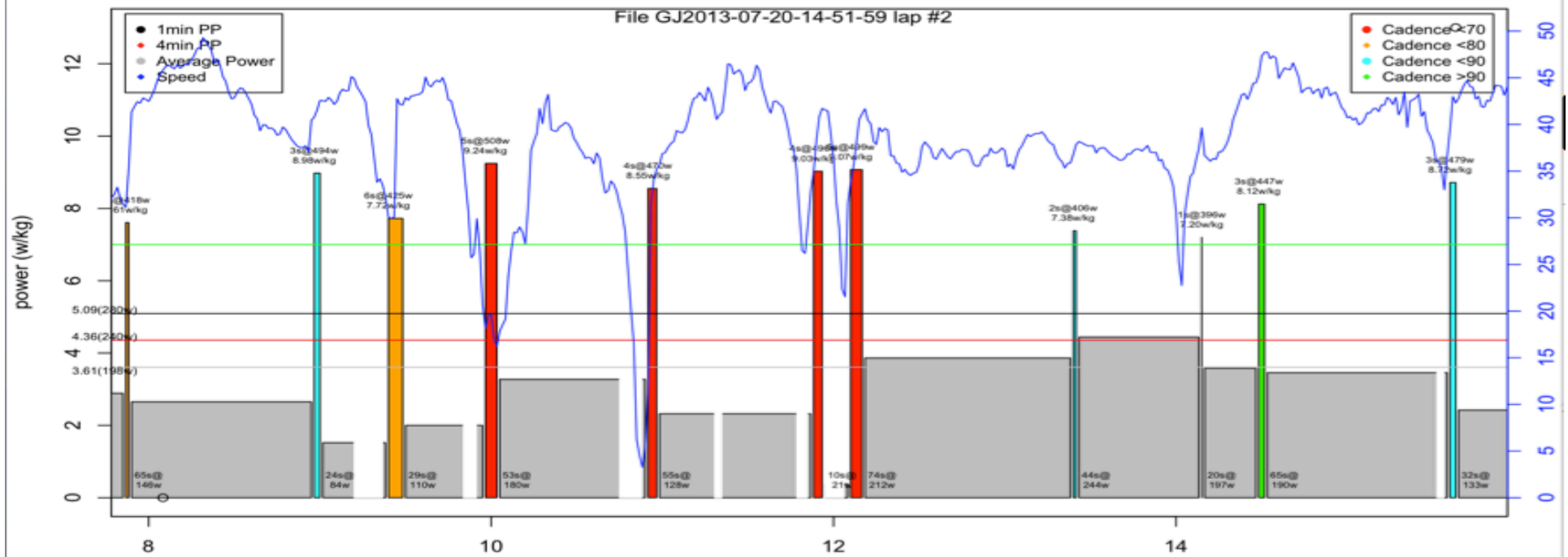
Dur	Rec: 5s	10s	30s	60s	60+	( 76 )
5 sec:	7	12	11	2	3	( 35 )
10 sec:	2	13	6	2	4	( 27 )
15 sec:	2	1	6	1	1	( 11 )
20 sec:	2	0	0	0	0	( 2 )
20+sec:	0	1	0	0	0	( 1 )





Hot Laps.....





Auckland WTS –

Aaron Royle

Average power 4.3 w/kg

- Great result. This power data is really interesting. RPM is massive, 1min peak power is really high

#### Intervals:

- 118 intervals – high
- length: 55% < 5sec. Lots of short intervals
- Start cadence: 60% >90RPM, only 4% < 70RPM
- W/kg, 49% < 8w/kg.

#### Power Graph:

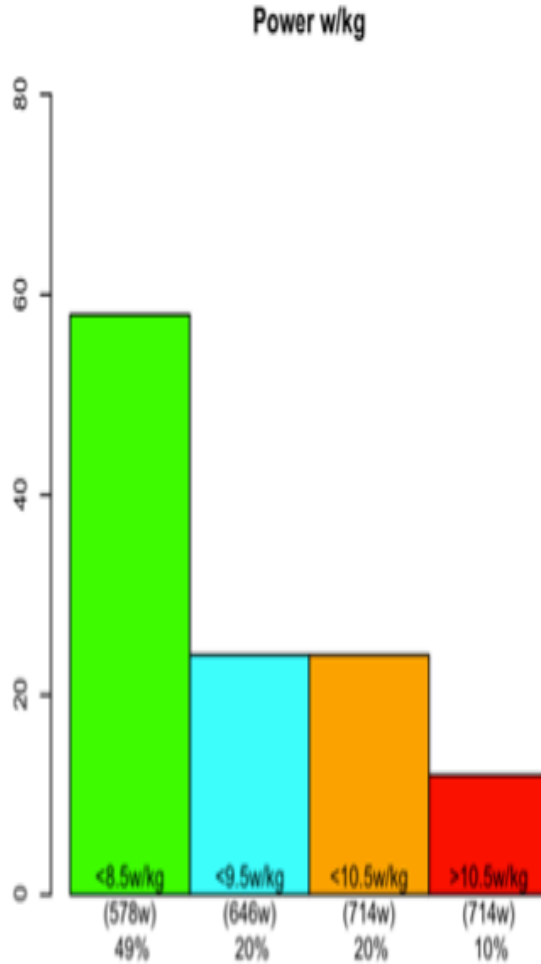
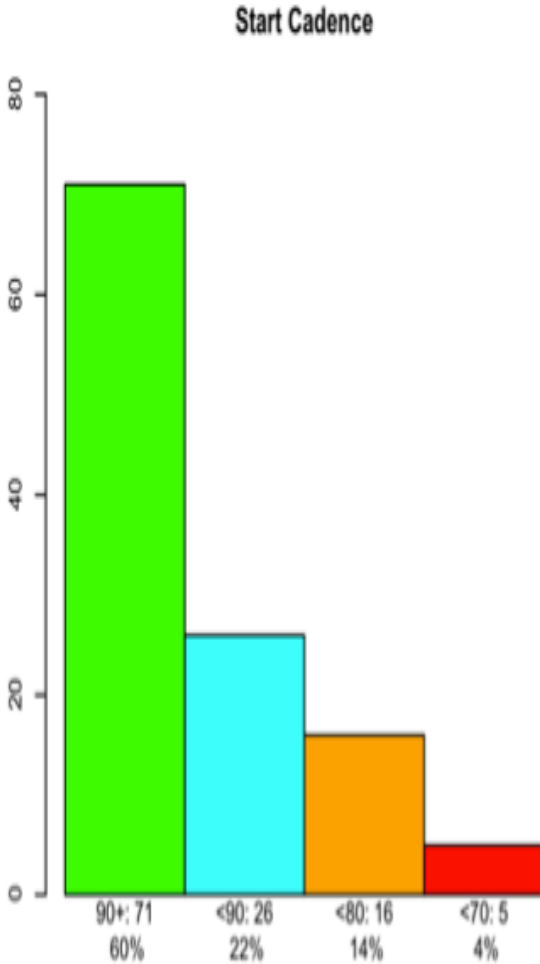
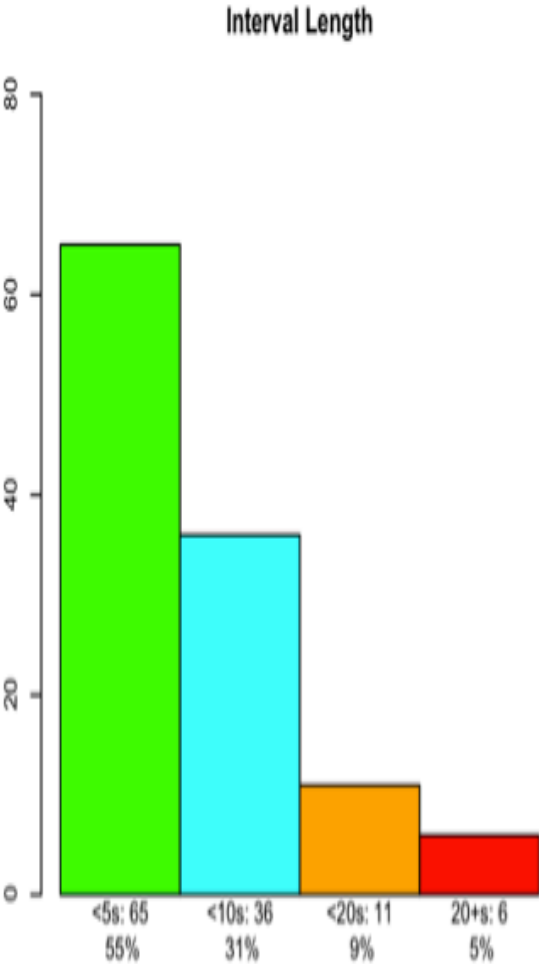
- 1min Peak 7.21w/kg... very high
- 4min peak 5.38w/kg
- Very dynamic ride
- First lap highest power

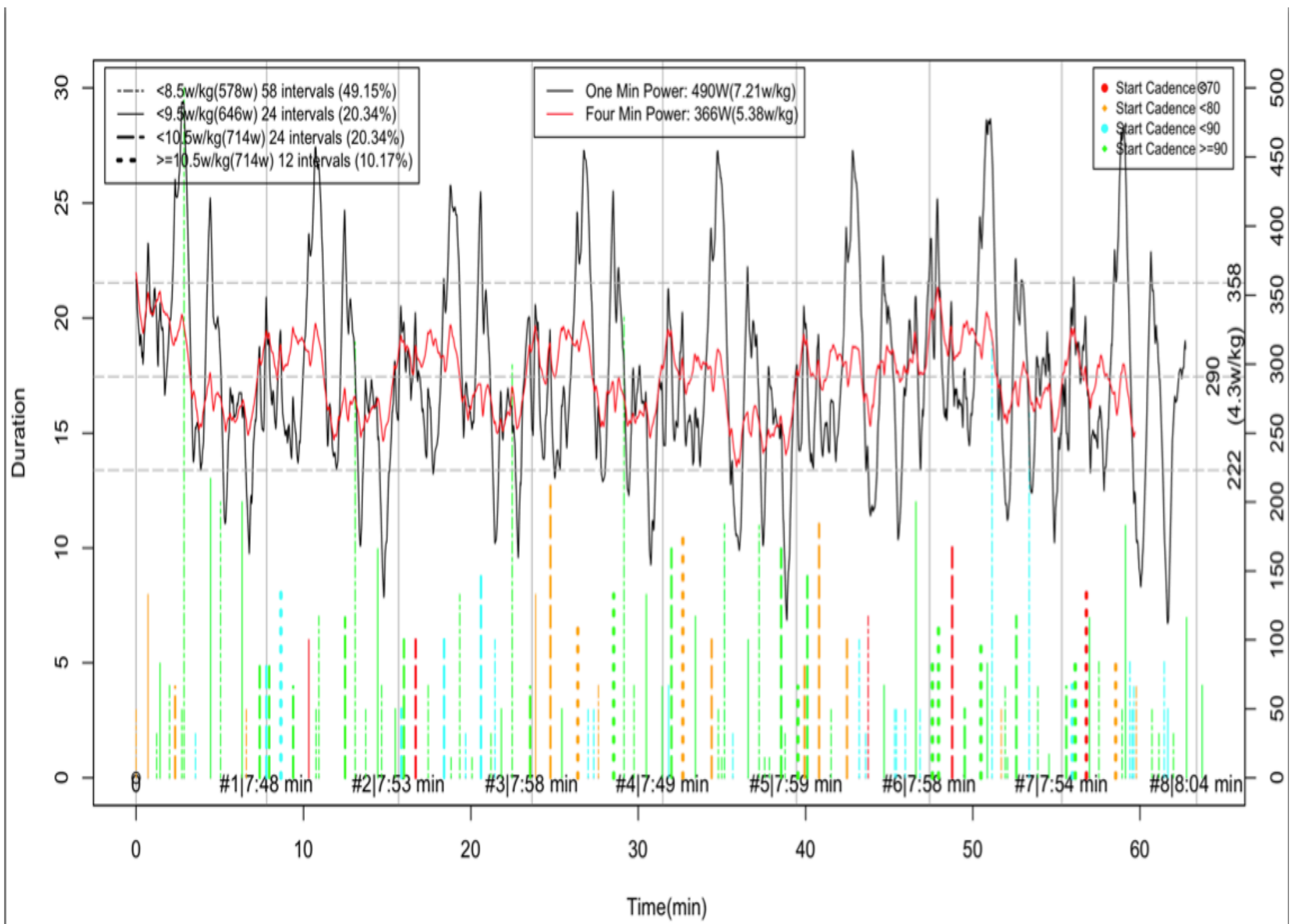
#### Power vs Cadence:

- wow... most power at high W >90RPM
- Very little power @ high torque in spite of the hilly course.

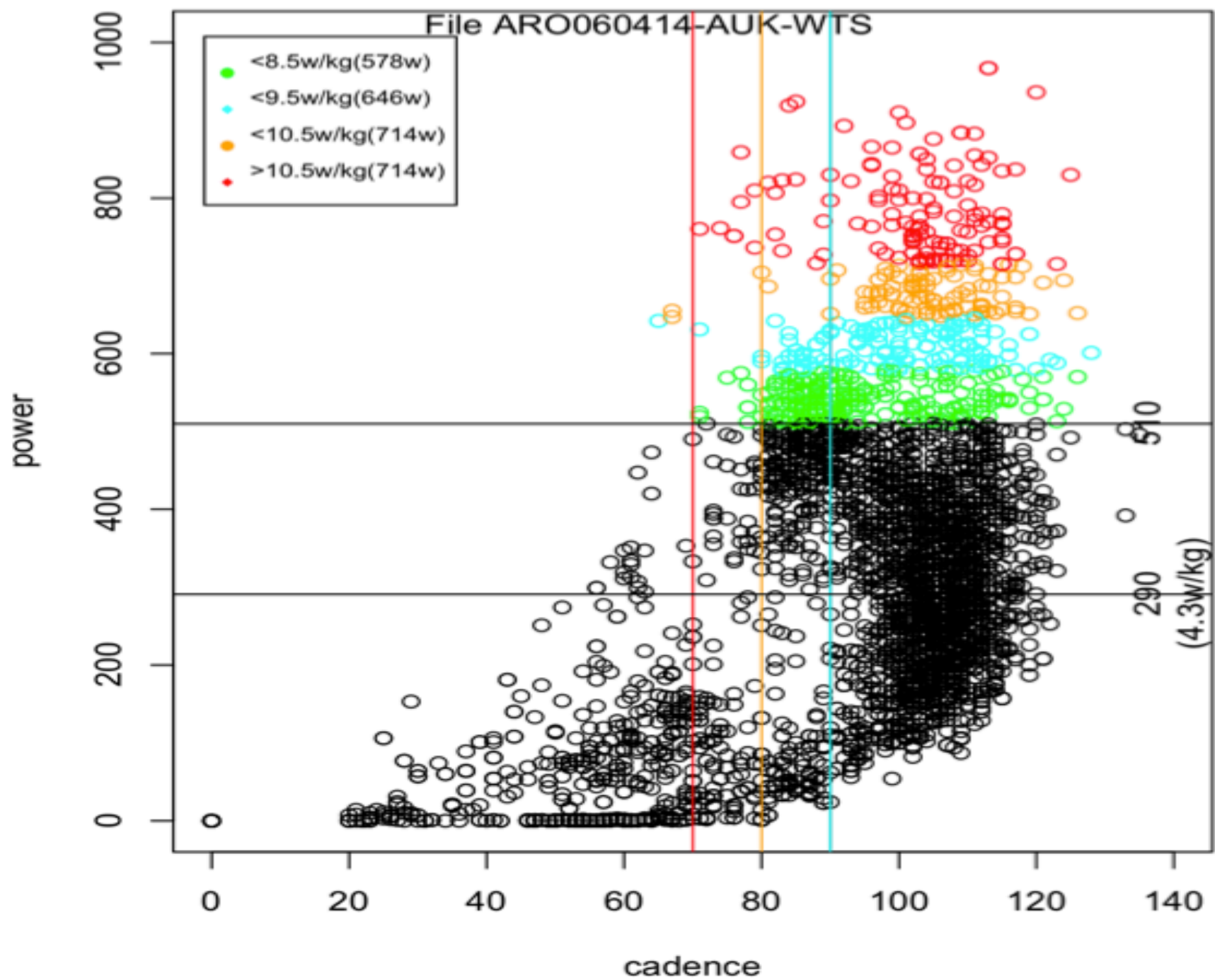
#### Hot lap:

- very chunky section around 200 seconds that high both long spike and "recovery" @ high power
- 1 min peak power, very close to 7.5w/kg line (green)

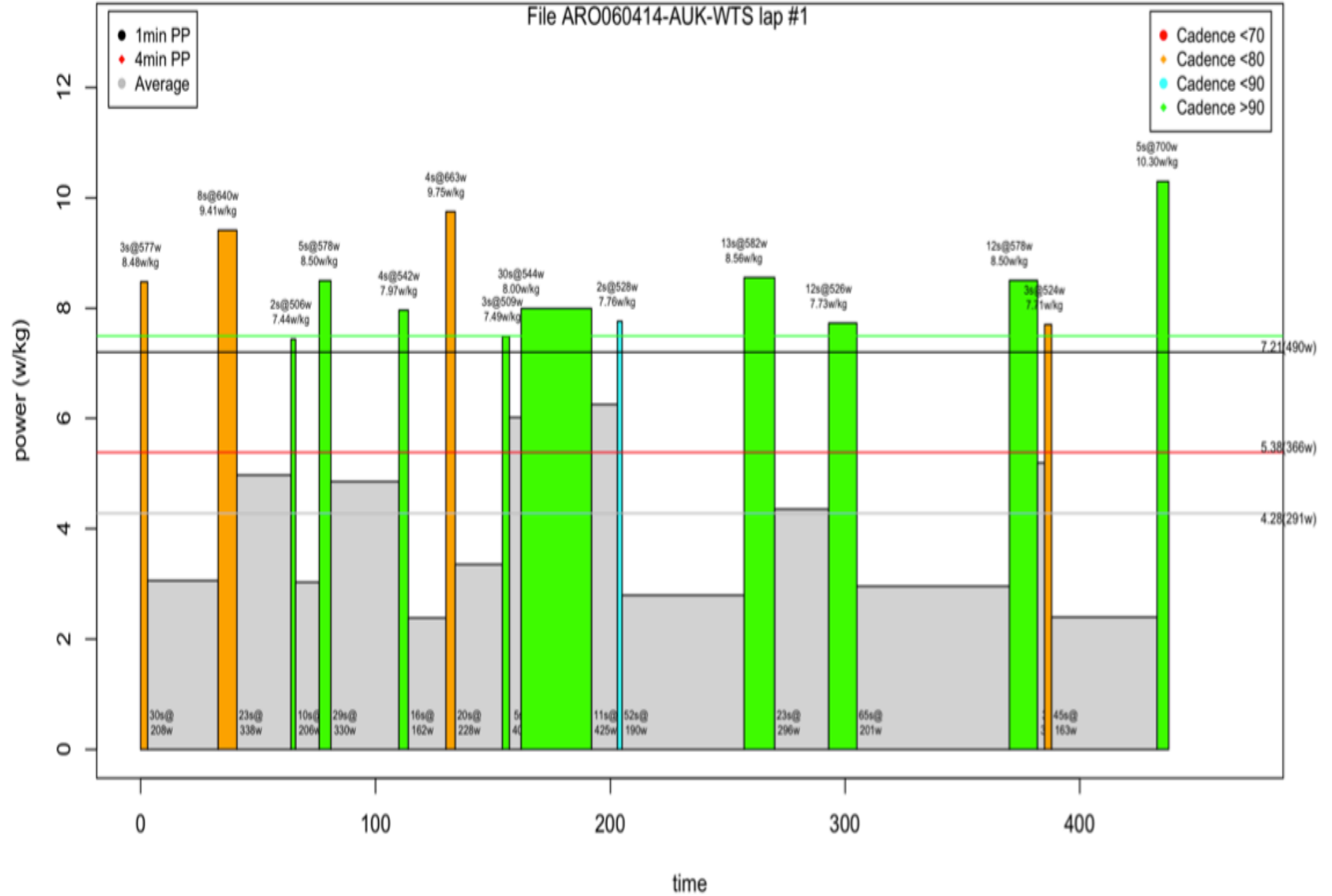








File ARO060414-AUK-WTS lap #1



Dur	Rec: 5s	10s	30s	60s	60+	( 118 )
5 sec:	0	16	32	6	11	( 65 )
10 sec:	1	20	6	5	4	( 36 )
15 sec:	1	6	2	2	0	( 11 )
20 sec:	0	2	2	0	0	( 4 )
20+sec:	0	0	1	0	1	( 2 )

## *So that's the demands*

- So now we need to get out there and meet and exceed the demands of competition and anything our competitors will throw at us
- ITS ALL ABOUT VOCABULARY

# *Platforms for success*

- Its goes way beyond hitting the pedals

Why  
How  
What

- Technical
- Tactical
- Physiological
- Psychological

If its not you than who ?

If its not now than when ?

# Under 1's

- Developing 30 sec MMP
  - 4 sessions per week
- Developing 1min MMP
  - 4 sessions per week

# Over 1's

- Developing 4 min MMP
  - 4 sessions per week
- Developing 10min MMP
  - 4 sessions per week

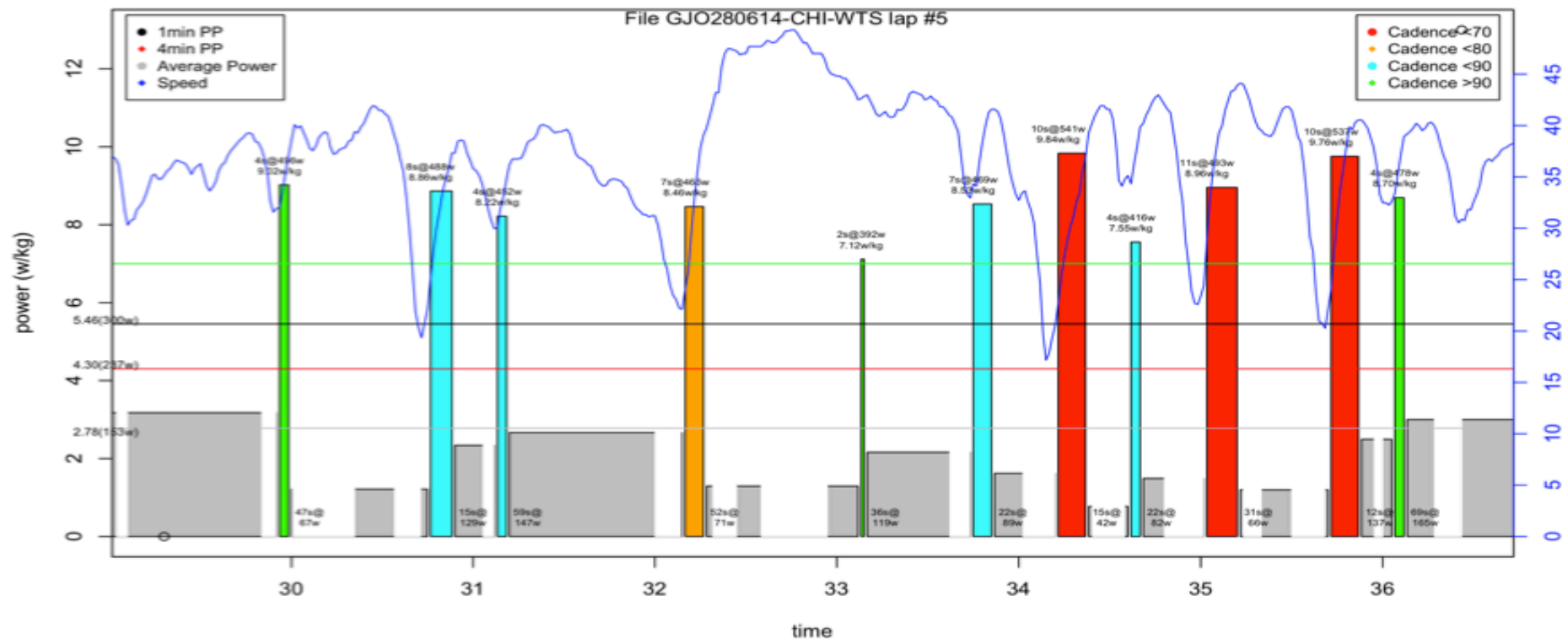
# Over 1's

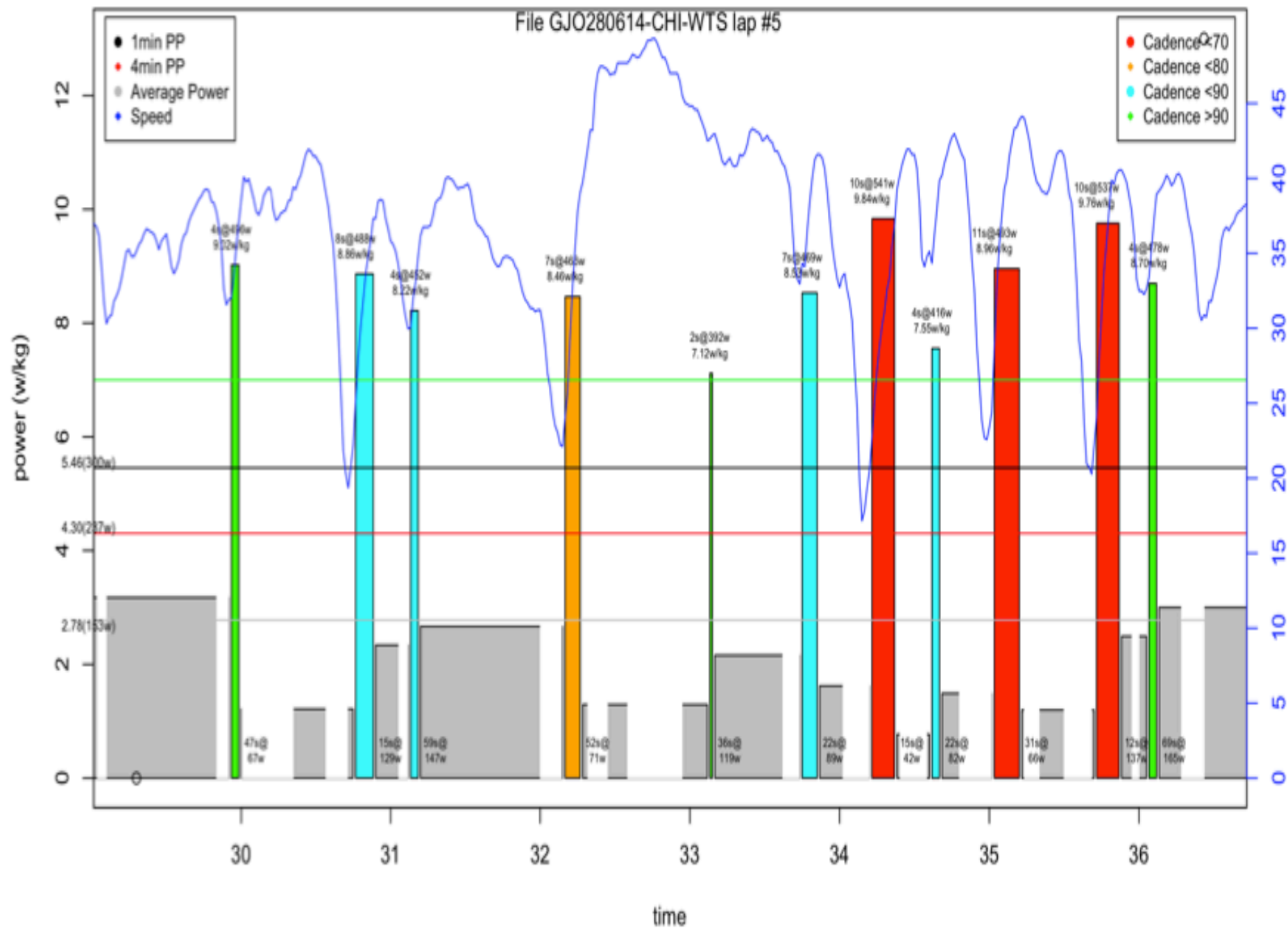
- Developing 4 min MMP
  - 4 sessions per week
- Developing 10min MMP
  - 4 sessions per week



# Under 1's fatigue resistance

- ITU Junior - Preparing for Chicago
- 2x key sessions





**Table 4.3 ANAEROBIC INTERVAL TRAINING**  
 (ALL INTERVALS TO BE COMPLETED AT MAXIMUM EFFORT)

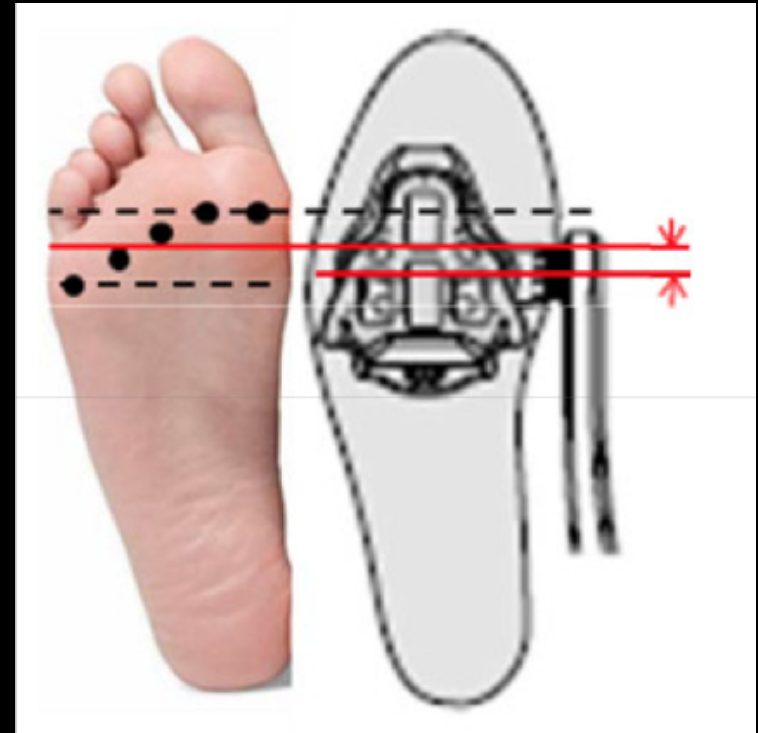
Code	Training Type	Time for Effort	Work : Rest RATIO	R.P.M	Number of Efforts
AC	ALACTATE CAPACITY	10 - 15sec	1 : 10+ (for quantity) 1: 50 (for quality)	-	3 - 8
AP	ALACTATE POWER	5 - 6sec	1 : 10+ (for quantity) 1: 50 (for quality)	-	3 - 8
LC	LACTATE CAPACITY	60 - 120sec	1 : 6+	120 - 150	3 - 6
LT	LACTATE TOLERANCE	75sec	1 : 3	120 - 150	3 - 6
LP	LACTATE POWER	20 - 30sec	1 : 30+	160 +	3 - 8
AS	ANAEROBIC STRENGTH	50 - 90sec	1 : 6+	70 - 80	3 - 5

## **Bike Fit Philosophy ...**

- This philosophy is based on a clear understanding of the demands of draft legal triathlon competition, the desires of the home coach and years of integrated IST experience.

- Bike course demands
  - Technical
  - Tactical
  - Physiological
  - Performance thinking
- Environmental considerations
- Equipment demands

- The draft legal triathlete requires a cycling position that:
- Promotes lower torque, higher cadence power production without diminishing the athletes' capacity to produce power under high torque, low cadence situations.
- Aids the athletes' ability to run at peak speeds off the bike
- Maintains the basic needs of all cyclists – balance, stability, cornering, descending, high speed
- Complies with the I.T.U. Technical Equipment Regulations



# Taking it to a Pro level - Travel and bike bags / packing

- We need to optimise our operations and make travel easy ..... its a stressor we can minimise if you do it well
- Do it poorly it will compromise your ability to perform .....



*Compromise equals  
Mediocrity*

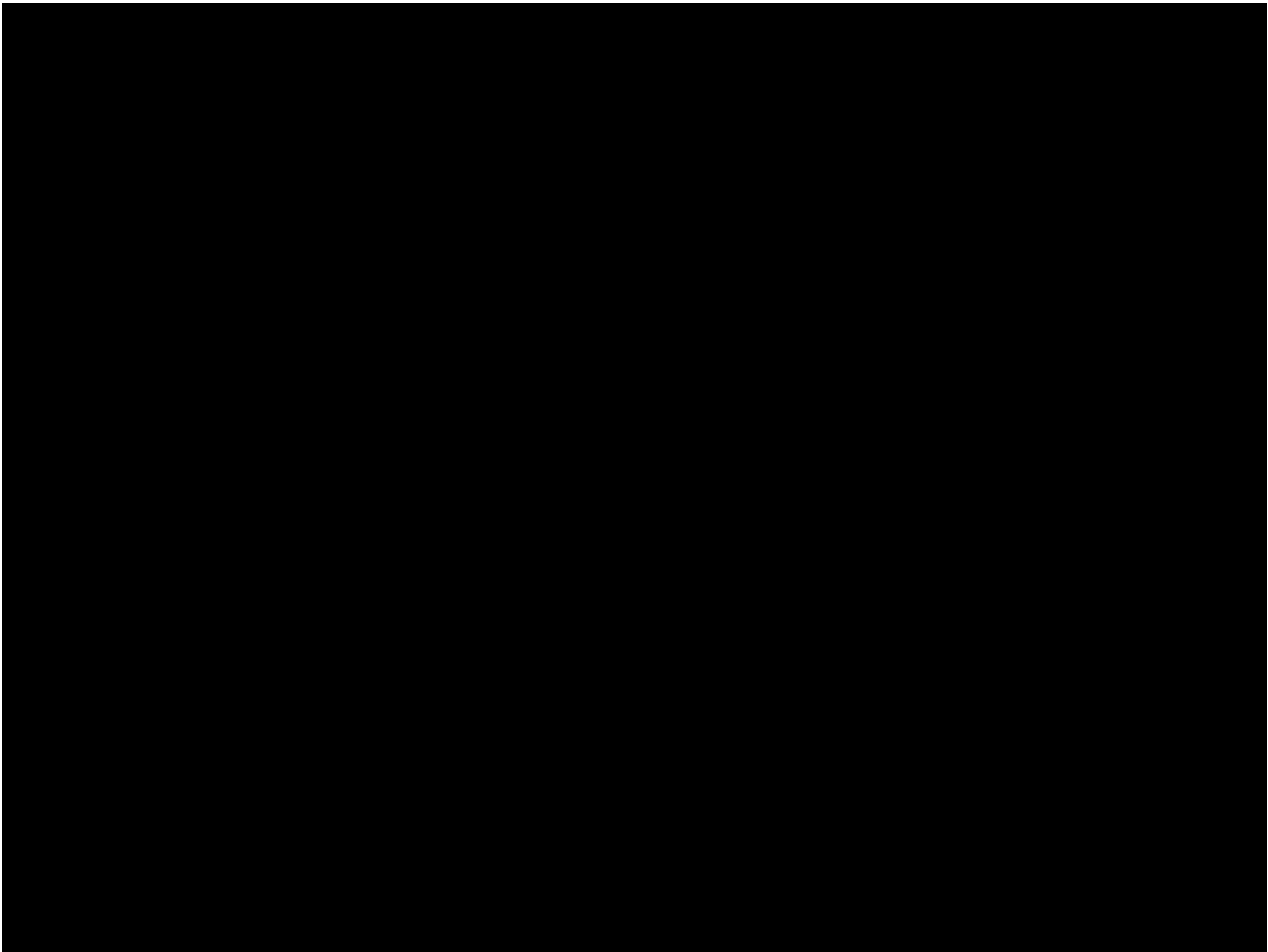


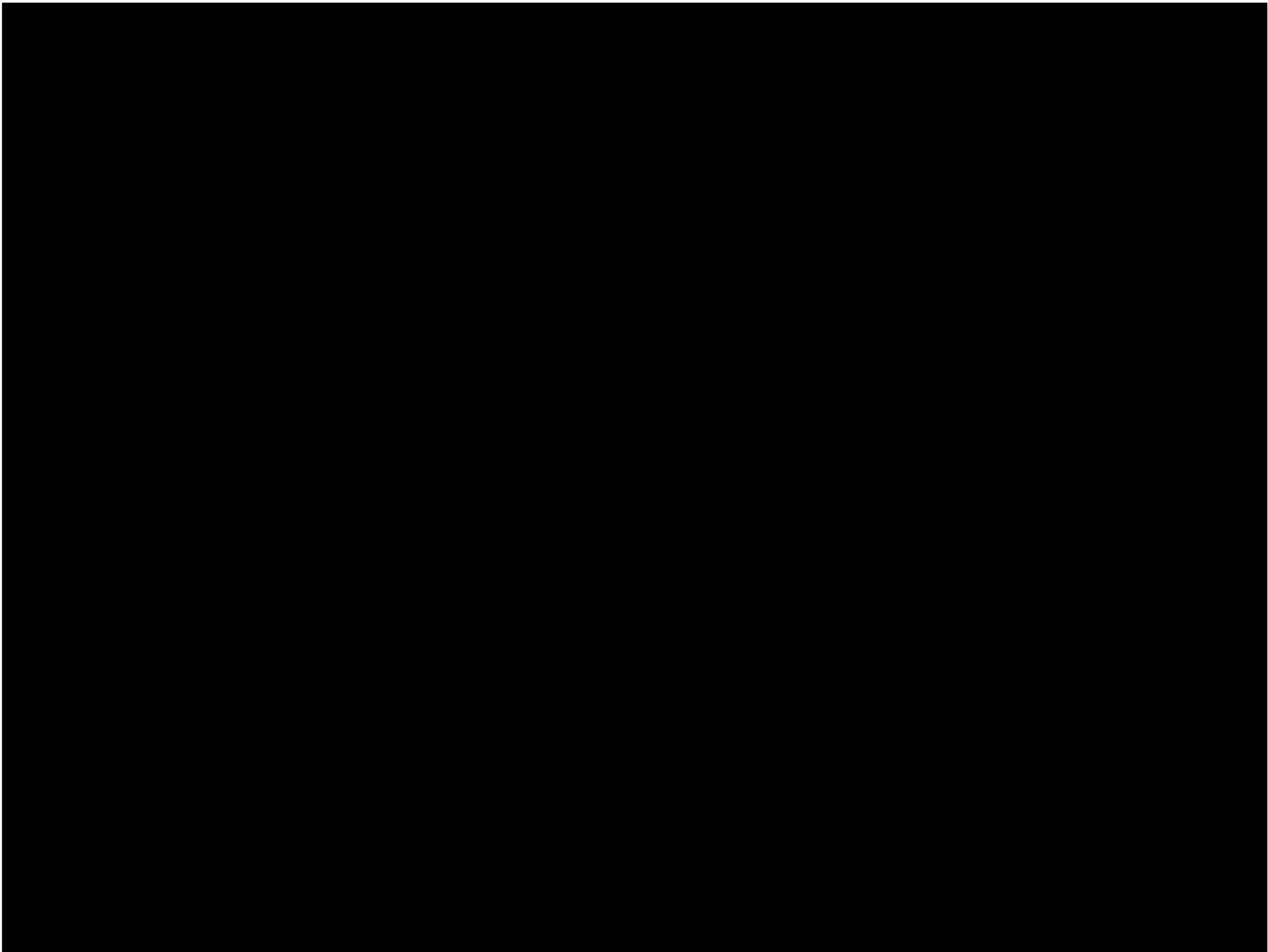
100%  
Guaranteed

- Bike Bags - 2x sets wheels
- Style of Bag
- Bike packing - foam and foam
- Rear Mech off
- Dummy Axles
- Wheel axle plugs
- Wheels in Bags

- Thread Maintenance
- Carbon Paste
- Torque
- Tools
- Seat Clamp
- Rear Tip
- Skewers

- The components of the fit that are optimised for draft legal triathlon are:
- Foot position such that the pedal spindle is between the 3<sup>rd</sup> and 5<sup>th</sup> MTP
- Reduced peak knee flexion while optimising peak knee extension
- Hip angle and knee forward of foot trend toward a time trial position
- Reducing FSA by lowering back angle whilst maintaining hip angle closed (as above)





- **Foot position**
- By moving the foot further over the pedal (pedal spindle is our reference point) the range of movement (in particular dorsi-flexion) at the ankle through the pedal stroke is reduced.
- As a result this promotes, or can be coached, a greater level of plantar flexion at the ankle through the pedal stroke. This pedaling action assists in an athlete's ability to ride at higher cadences.

- **Peak knee flexion**
- A reduced peak knee flexion enables the athlete to apply force to the pedals earlier in the down stroke. The athlete is able to push the pedals forward over the crest of the crank circle rather than wait for the crank to pass 12 o'clock and apply force downwards.
- Typical road cycling peak knee flexion is 110-112degrees. It is not uncommon to reduce knee flexion in the vicinity of 105-110degrees for draft legal triathletes.



- The three methods of reducing knee flexion are raising saddle height, moving the saddle rearward and reducing crank length.
- To achieve the desired knee flexion, knee extension, knee forward of foot, hip angle and upper body angles it is more common, and generally more effective, to reduce crank length. The use of all three methods is likely to be used in a fit to varying extents and success.

- By reducing crank length only, multiple changes occur which benefit the riders needs:
  - Reduced knee flexion
  - Increased knee forward of foot
  - Increased hip angle closed
- Of course changing crank length alone will not optimise the position and of great importance is maintaining knee extension, which will require an athlete's saddle to be raised.

- **Hip angle closed**
- Current understanding of the relationship between cycling and off the bike running is that the longer period of time that the hip flexor muscles are in a shortened state or operate through a smaller range of movement the greater the negative effect on an athlete's off the bike run capacity.
- By increasing hip angle closed we are increasing the range of movement and increasing the maximum length of which the hip flexor muscles achieve.
- General adjustments to the bike to achieve this would be to move the saddle forward and upwards – this must occur without negatively affecting knee extension or angle.
- If shorter cranks have been used to improve knee flexion then this will add to the saddle adjustments and further open the hips.

- **Knee Forward of Foot**
- This is the method of identifying or quantifying where the athlete's knees are in relationship to his/her foot at the point of maximum force application/production in the pedal stroke.
- Our normal range for road cycling is +10mm to -10mm while in draft legal triathlon it is not uncommon to see +20mm to 0mm. This is especially true when an athlete is using shorter cranks. Because the peak knee flexion is reduced it is unlikely that the athlete will experience anterior knee pain as you may see with a standard road fit with positive knee forward of foot/high peak knee flexion.

- **Frontal Surface Area**
- Without proper aerodynamic testing this area of fit is based on an athletes comfort, ability to hold position in the hoods and drops, degree of anterior pelvic tilt, use of the normal ranges of back angle and reach and an assumption that reducing back angle reduces frontal surface area.
- What is key to optimising an athletes back angle and reach is that it allows the athlete to ride effectively and it does not impact any of the other key components listed above.

- Control the controllable's and ensure our equipment is at worlds best standards - 99% right is 100% wrong
- Travel Bags
- Carry on bag - choose a small suitcase - soft, light, on wheels and with a retractable handle - this way for domestic travel and race weekend travel you have 2 bags (bike and travel bag) - both on wheels and easy to get around - nothing lugged over single shoulders - efficient and easy. Most airlines permit you to carry laptop in a small satchel - this is where drawstring race bags come in handy to carry laptop if req and wallet / purse etc
- Main Suitcase / Bag - on wheels with handle - light and ensure that it can "piggy back" your Carry on bag ----- 3 bags don't go into 2 hands otherwise
- This is an example of what works to piggy back
- [http://www.brookstone.com/add-a-bag-luggage-strap?bkiid=World\\_Landing\\_Page\\_Travel\\_Luggage\\_Accessories|CategoryWidget|589747p&catId=L2\\_LuggageAccess|L1\\_Travel](http://www.brookstone.com/add-a-bag-luggage-strap?bkiid=World_Landing_Page_Travel_Luggage_Accessories|CategoryWidget|589747p&catId=L2_LuggageAccess|L1_Travel)



- Bike Bags
- Can fit
- 1x bike and 2x sets of wheels and some gear
- 23kg or less total weight
- Fit in the cars / vans
- This Evoc "style" is optimal and many brands are made in this style of bike bag
- <http://www.chainreactioncycles.com/ca/en/evoc-bike-travel-bag-280l-2014/rp-prod64766>
- These Scicons are too big and we struggle or cant fit them sometimes - and they exceed airline reg's sometimes - an example is JAL - they give 2x pieces for free @ 23kg - but this bag is too big for their size regulations
- <http://www.sciconbags.com/bike-bags/aerocomfort-2-0.html#media>
- If it cant fit 2x sets of wheels its no good

- Bike Packing
- Please ensure you have
  - - Foam tubing to cover all tubes - no marks need occur on bikes from travel - use the white tubing - its low density (light and full of air) and best for absorbing shock
  - - Large block of foam under chainrings / cranks to absorb impact - extra protection is essential for those on SRM's - dont take a short cut and wreck 3.5k worth of crank
  - - Large block of foam arounds rear tip and rear derailleur area - Rear Derailleur OFF
  - - Plugs for the ends of wheel axles and *heaps of spare ones* as they always go missing and break often - **THIS IS THE BIGGEST ISSUE THAT CAUSES TRAVEL DAMAGE - DONT SHIRK ON THIS -**
  - - Dummy axles/Chainkeeper if required in your bike bag
  - - Something to protect seat pillar and seat - foam tube and towel for example
  - - Wheels in wheel bags



- Chainkeeper
- These act as dummy axles (stop the frame from being squeezed) and they keep the chain off the chain stays in travel (save scratches) and they do their best work when you take the rear wheel when cleaning your bike as they allow you to clean the chain, rear mech etc well.
- FYI the space at the rear tips is 130mm on a 10/11 speed road bike / 100mm for the front tips
- Below is an example –
- BBB brand is good also



- Carbon Paste
- If you have carbon bars or stem or seat pillar - ***YOU MUST*** use Carbon Paste - you can buy from bike shop
- Every year I see the result of people overtorquing bolts in an attempt to keep said components from slipping, this wreaks carnage through snapped bolts, stripped seatclamps, cracked clamps, and crushed seatpillars.
- Inserting components dry isn't ideal - and using anything other than carbon paste will mean that your seat or bars will slip if you use a grease or oil.
- Dry components make noise, they corrode, and they too sometimes slip.
- Carbon Paste - Use it for anything threaded or anything carbon on your bike. Its adhesive effect on carbon/carbon interfaces (i.e. carbon seatpost/carbon frameset) will allow you to reduce the amount of tightening torque you'll need by upwards of 30%. It prevents the seizure of carbon/carbon interfaces. It's an antidote for corrosion, noise, over-torquing, and slippage.

- Torque
- You all need torque wrench for doing up bars - stem and seat clamp with Carbon Paste you can run the max torque and be confident its done up fine - many of you overtighten seat bolts and bar stems - and worse was you didnt have uniformity with the torques in multi bolt applications For example if you have a bar/stem interface - 4 bolts and you have 1 bolt at 6 N.m. and 1 bolt at 5.5 N.m and 2 bolts at 3 N.m then most of the load is on the 1 bolt at 6N.m - so it has lots of load and you have over tightened it - recipe for trouble - a snapped stem bolt is a DNF if you dont crash in the instant it snaps - its a dummy error
- The ritchey 4mm torque wrench is a great option for those of you with 4mm stem and seat bolts also.

- Tools
- Multi Tools dont cut it - they are good for back up and for the smaller keys like brake pads etc 3 way Allen keys are best - and backed up with torque wrench to finish off
- A 5/6 mm allen key ("Z" key) is required to tighten rear brake mounts
- A set of "L style" Metric allen keys with Ball End is vital - you will need the smaller ones for brake pad replacement - and the 4/5/6mm for "bigger jobs" - You may not need the bigger ones - ie 8mm unless req for your pedals
- for example this style (in Metric)  
<http://www.homedepot.com/b/Tools-Hardware-Hand-Tools-Wrenches-Hex-Keys/N-5yc1vZc265?rpp=96>
- Ensure you insert tools all the way into bolt heads - to maximise contact area and avoid rounding out bolt heads
- Ensure your 3 way tool is replaced when worn - the cheaper ones die early you are better off asking for a forged one like Park Tool or the like (rather than the cheaper cast ones)
- Pedal Spanner - light and long with quality head - the 2x offset heads are good
- some good ones
- <http://www.evanscycles.com/products/lezyne/cnc-pedal-spanner-15mm-ec034132>
- <http://www.evanscycles.com/products/lezyne/classic-pedal-spanner-15mm-ec034130>
- avoid these type
- <http://www.thedogswheels.co.uk/images/products/Pedal-Spanner-Cycle-Bicycle-Bike.jpg> - soft "muck metal"
- <http://www.chainreactioncycles.com/ca/en/cyclo-pedal-spanner/rp-prod42806> - too short - not enough leverage
- <http://www.sjscycles.co.uk/cyclo-forged-pedal-spanner-15-15-mm-prod19390/> - these ones are often too thick for road pedals
- \*Dont buy a pedal spanner if you have pedals like this - that only do up with Allen Key inside the axle - [http://www.competitivecyclist.com/images/items/900/SHI/SHI0627/ONECOL\\_D1.jpg](http://www.competitivecyclist.com/images/items/900/SHI/SHI0627/ONECOL_D1.jpg)

- Thread Maintenance
- A dry or a dry and dirty thread will let you down !
- Ensure threads are clean and lubricated - most of your steel bolts do up into softer alloy - dirty and dry threads will bind or grip to the softer thread in the alloy and strip the thread of the alloy - Clean and Wet
- Getting some anti seize thread compound is good - especially for bigger things like pedals - seat clamp bolts - headset bearings - brake bolts
- Simply chain oil is great on the smaller bolts you often undo or adjust for packing
- - Clean and Wet - - Clean and Wet - - Clean and Wet - - Clean and Wet - Clean and Wet - Clean and Wet - Got it
- Seat Clamp
- You all need a spare one for your bike - they will break one day - be prepared
- Spare rear tip
- pre aligned !!! - out of the packet they are no good - so get a couple pre aligned and ready to bolt on if req - and carry some spare mount screws if applicable

- Tyres / Wheels
- Race day tires must be 100% - no compromises - dont ride around on race tires for days pre race - no hopeful or wishful when it comes to tires !
- Take Spare wheels to ITU events where wheel stops are in place and to ride pre event
- Ensure you travel with a spare race tire - whether it be a tubular (with some glue) or HP to meet the demands of your wheels
- Race wheels should all be using a tyre sealant .... Better do have 30-40ml of this in each tyre and have a chance of finishing in your bunch that not having it and having to ride the rim to a wheel stop and then change (its not 100% guaranteed to work but it does work most of the time)
- You need tubes with removable valve cores - or if you are riding tubulars they have removable valve cores .....
- <http://www.probikekit.com/display.php?code=A0682> -
- Ensure you have wheel cards (sample template attached below - you can print and get laminated - 2 cards on an A4 Landscape) - print up more than you need (3 sets) - you need some strong cloth type tape (white physio tape is good) to attach these to your wheels - ensure you dont place on the cassette side. You need a china-graph pencil to write your race number on and then clean it off for the next time.

- Skewers
- Have a read below please
- <http://sheldonbrown.com/skewers.html>
- I don't want you guys riding external cam skewers – Mavics are great - Shimanos are great -
- Internal or enclosed cam are the way to go



CAN

Your name goes here

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CAN

Your name goes here

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