



Generation III Reference Manual

**November 2010
Firmware 424+**





Setting up and Using the Gen III iAero

Your iBike Gen III Aero (“iAero”) shares many common elements with the Gen III iBike Pro: mounting, calibrations, and software.

You will find detailed information regarding the many aspects of the iAero in other iBike manuals (iBike operation, iBike Mount Installation, iBike software)

The iAero Reference Manual describes ONLY those features and benefits unique to the iAero.

Congratulations on the purchase of your Gen III iAero™ Aero power meter!

Your new Generation III iBike® Aero power meter incorporates all the features of the innovative iBike Pro power meter *and* adds important new features including aerodynamic measurements and significantly improved power measurement performance under high speed and rough roads conditions.

With the iBike Aero on your bike you'll be able to learn much more about the amazing influence of aerodynamics on cycling performance. And even more important, you'll be able to measure your personal aerodynamic characteristics with Snapshot CdA™ measurements, and determine the optimum combination of equipment, clothing, ride position, along with power, to help you go your fastest.

Also, if you have a direct-force-power-meter (DFPM) on your bike, you'll be able to see new and exclusive Continuous CdA™ and Time Advantage™ measurements, either *after* your ride with iBike software features, or even *during your ride* if you have an optional wireless DFPM sensor that broadcasts power signals using ANT + Sport technology.

Without doubt the iBike Aero is the most sophisticated cycling computer ever designed and with your iAero you'll be able to taking your training efforts and cycling performance to the next level.

iBike® Aero power meter features

- Superior Reliability
 - No external screws for maximum moisture resistance
 - Improved case design for superior performance in rain and better locking
- Precision Accuracy
 - Comparable to high-performance power meters
 - New microprocessor significantly improves on-the-bike accuracy
- Light-weight
 - 62 grams total weight
- Portable
 - Moves easily and quickly to any of your bikes
 - On-the-bike profile storage simplifies portability
- Easy to Use
 - Installs and calibrates in minutes
 - Uses no special chain pickups, wheels, hubs or cranks
 - Improved calibration procedures speed-up and verify calibrations
- Intelligent
 - Approximately 13 hours of data storage, with readings stored once per second
 - Approximately 65 hours with readings stored once every five seconds
 - Data storage of hill slope, wind speed, altitude, bike speed, and total power for the entire ride
- Information-Rich
 - Interval timer
 - Lap timer
 - Cumulative readings:
 - Calories
 - Kilojoules
 - Elevation gain
 - Trip distance
 - Trip time
 - Odometer
 - Total hours logged
 - Current, average and maximum:
 - Power (watts)
 - Wind speed
 - Bike speed
 - Altitude
 - Hill slope
 - Temperature
 - iAero: training Intervals (user-programmed sequences of time intervals and training targets)
 - iPro: pre-programmed interval workouts for weight loss, cardio, and strength
 - Date and time
 - English and metric units
 - Trip data auto start/stop
 - Innovative Sub Trip feature
 - Instant-feedback bar graph
 - Heart rate and cadence features built-in (requires optional accessories)
- Mac and PC Compatible
 - Fast, USB-based data transfer to your PC (XP and Vista) or Mac (Intel Mac)
 - iBike software for data input, transfer, and ride analysis, both

Mac and PC versions

What's in the Box

- **Gen III iBike Aero** power meter
- **iBike wireless mount** (stem or handlebar, depending on which model you purchased)
- **Wireless speed, cadence, and heart rate sensors**
- **Mounting hardware** for wireless mount and sensor(s)
- **iBike USB Adapter** with cable
- **CR2032 batteries**
- **iBike CD** containing:
 - Read Me First letter
 - iBike Installation and Usage Manual
 - iBike Software Reference Manual
 - Wireless Mount Instructions
 - iBike software for Mac and PC:
 - System Requirements:
 - Windows XP or above, 128 MB RAM
 - Intel Mac with Mac OS X 10.4 (Tiger) or above, 128 MB RAM
 - iBike Consumer Warranty

**NOTE: IN ORDER TO RECEIVE FREE SOFTWARE AND FIRMWARE UPDATES PLEASE BE SURE TO REGISTER YOUR IBIKE AT:
<http://www.ibikesports.com/register/registration.aspx>**

NOTE: CONSULT YOUR IBIKE SOFTWARE MANUAL TO OBTAIN INSTRUCTIONS FOR DOWNLOADING THE SERIAL NUMBER STORED IN YOUR I'BIKES MEMORY.

SETTING UP AND USING THE IAERO

NOTE: FOR BEST RESULTS WE STRONGLY RECOMMENDED THAT YOU FAMILIARIZE YOURSELF WITH THE "iBIKE OPERATING INSTRUCTIONS", "iBIKE MOUNT INSTRUCTIONS", AND "IBIKE SOFTWARE INSTRUCTIONS" BEFORE READING THIS MANUAL

IMPORTANT: IBIKE AERO CALIBRATIONS

The iAero is a precision measurement instrument that, when calibrated properly, provides very useful and highly accurate measurements of power and aerodynamic data.

The key is this: accurate iAero measurements are a *result* of proper setup and calibration!

Please read the iBike Instructions to familiarize yourself with basic tilt, wind offset, and coast down calibration procedures. Make sure you understand them.

Having understood these procedures please remember this: YOUR IAERO REQUIRES CAREFUL CALIBRATION. FOR GOOD RESULTS WITH YOUR IAERO YOU MUST DO TILT, WIND OFFSET, COAST DOWN, AND CALIBRATION RIDES PROPERLY!

Also, for highest accuracy results, prior to each ride you should acclimate your iAero to riding temperature and perform the simple wind offset calibration.

The last two paragraphs are not meant to be scary; in fact, iAero calibrations are very simple to perform, take only a small amount of time to complete, and need to be done only once. But if they're done improperly, or partially, or not at all (!), you'll get less accurate results from your iAero. So, DO YOUR CALIBRATIONS COMPLETELY AND PROPERLY!

TIPS

- 1) Be careful and take your time. If you're doing a tilt calibration, mark the places where you'll turn the bike. After completing the tilt calibration, check your result. If you're doing coast-downs, remember MORE IS BETTER. Five coast-downs are better than four, and 10 are better than 5.

NOTE: IF YOU'RE USING YOUR IAERO WITH AN ANT+SPORT WIRELESS DFPM POWER SENSOR, THE CALIBRATION PROCEDURES ARE DIFFERENT. SEE A LATER SECTION IN THIS MANUAL FOR DETAILS.

- 2) VERY IMPORTANT: before doing *any* calibrations make sure your iAero has adjusted to the outdoor temperature. In particular, accurate wind speed measurement is critical to best results, so BEFORE you start calibrations, ride around with your bike for 10 minutes to let your iAero adjust to outdoor conditions.
- 3) Be certain that you perform the Wind Offset calibration before beginning your coast-downs and calibration ride.
- 4) For coast downs pick a road that is level to uphill and is relatively free of wind gusts caused by cars, trucks, or weather. REMEMBER: you'll do these coast-downs only once, so do it right: if it's windy, or traffic is heavy, wait for a better day!
- 5) If you're using a DFPM (direct-force power meter) as your reference for calibrations, make sure you've checked the calibration of your DFPM. If your DFPM calibration is incorrect then ALL the data from your iAero will be wrong, too!
- 6) When you've completed your calibration rides use the "Profiles/Download Coast-Downs & Calibration Ride" command data to analyze your results. And, VERY IMPORTANT, after you've done the analysis click the "Accept Profile and send to iBike" command to UPLOAD your analyzed results to your iAero. If you forget this step then ALL YOUR HARD WORK WILL BE MEANINGLESS!

These six tips will make the difference between superb results and exasperating problems.

Follow these tips carefully and you'll get your iAero going quickly and accurately!

USING THE iAERO FOR AERODYNAMICS MEASUREMENT

The iAero provides accurate and useful aerodynamic data as well as accurate and useful power data.

As is the case with any measurement instrument, knowing how the iAero works will help you understand when it is providing you maximum-accuracy data, and when won't be as accurate.

The governing principle is this: the force applied to the pedals is equaled by the forces opposing the bike's forward motion (Newton's Third Law).

The iAero measures opposing forces: opposing gravity (hills), opposing acceleration (inertia), opposing wind, and opposing friction. These opposing forces slow down the bike and the cyclist applies forces at the pedal that *precisely* equal the opposing forces, moment-by moment.

For aerodynamic measurements, applied *and* opposing forces must both be known. Why? When applied *and* opposing forces are known *simultaneously*, then drag coefficients can be determined in a straightforward manner.

The iAero measures two different but related kinds of aerodynamic drag coefficients, based on two different ways of measuring applied forces:

- 1) Snapshot CdA™. Whenever you're coasting the applied force is known exactly (it's zero!). The rider holds his position still and the iAero measures opposing forces while coasting (say, while coasting down a hill). The aerodynamic drag coefficient is measured as a "point-in-time" snapshot. Snapshot CdA is very similar to what is measured in a wind tunnel.
- 2) Continuous CdA™. In this situation both an iAero AND a wireless direct-force power meter (DFPM) are on the bike, providing applied-force information to the iAero. The DFPM provides continuous, accurate applied force data to the iAero. The iAero compares DFPM data to opposing force data and computes drag coefficients continuously, *in real time*. The restrictions of Snapshot CdA do not apply: you can be pedaling, changing ride position, even changing clothing. Continuous CdA provides constant updates on your CdA, and provides the basis for an amazing new measurement called Time Advantage™.

Needless to say, in either measurement scenario lots of fancy physics and computations are going on inside the iAero.

IMPORTANT

Aerodynamic measurements are tricky to make, especially outdoors. There are situations when the iAero will work very well, and others where it will have trouble. Here they are:

iAero drag coefficient and Time Advantage measurements are best when:

- 1) iAero calibrations are performed properly (!)
- 2) Tilt calibration is correct (should not be an issue unless mount is loose or you've adjusted your handlebars)

- 3) Wind offset is performed before the ride, *after* the iAero is acclimated to outdoor temperature
- 4) You're doing a solo ride (not in a pack)
- 5) The pavement quality is the same as that used in the calibration ride
- 6) Cross-winds are small
- 7) Temperature is reasonably constant during ride
- 8) Bike is working properly (i.e. brakes aren't rubbing on the wheels, tires are inflated properly)
- 9) (DFPM ONLY) your DFPM is calibrated properly and working properly

iAero drag coefficient and Time Advantage measurements aren't as good when:

- 1) You're drafting
- 2) when you've performed the setup calibrations improperly
- 3) you do not perform wind offset properly before the ride
- 4) road conditions are significantly different from your calibration ride (e.g you calibrated on asphalt but you're riding on a sandy beach)
- 5) ride temperatures change by 20F or more during the ride
- 6) Your bike's condition has changed significantly (e.g tire pressure is low)

SUMMARY: YOUR IAERO WORKS BEST WHEN 1) IT IS SET UP AND CALIBRATED PROPERLY; 2) YOU'VE CHECKED TILT AND PERFORMED A WIND OFFSET CALIBRATION PRIOR TO YOUR RIDE; 3) YOU'RE RIDING SOLO; 4) ROAD CONDITIONS ARE SIMILAR TO THOSE OF YOUR CALIBRATION RIDE

UNDERSTANDING HOW TO USE YOUR IAERO FOR CdA MEASUREMENTS

The ability to measure aerodynamic drag while riding is a revolutionary new feature made possible by the iAero. Please take a few moments to read this section so you can learn how the iAero works. Understanding how the iAero works will help you tremendously as you use your iAero to improve your cycling performance.

When you perform the initial coast-downs and calibration ride, the iAero and the iBike software together determine your "baseline" aerodynamic and frictional drag coefficients. These coefficients characterize your "normal" riding position and "normal" road/bike condition. These baseline aerodynamic and frictional drag coefficients are stored in the iAero.

What's new in the iAero is the ability to explore changes in your ride position, equipment, and clothing, *and to see their effect on your baseline aerodynamic drag coefficient.* Suppose your baseline aerodynamic drag coefficient is 0.28 (this number is determined in your calibration ride and is displayed in each of your ride files): by how much will your CdA decrease if you go into a tuck? What penalty (higher CdA) do you pay if you put on a jacket?

These are the kinds of questions any iAero can answer with ease.

The iAero provides two kinds of CdA measurements: Snapshot CdA™, and Continuous CdA™. Snapshot CdA measurements are available from *any* iAero, but *Continuous CdA measurements require the use of a direct force power meter (DFPM).*

The following sections will explain each kind of CdA measurement in detail.

HOW TO MEASURE SNAPSHOT CDA WITH THE IAERO

What is Snapshot CdA Measurement?

Imagine that you're riding your bike but that you are coasting and your body isn't moving. Your feet are stationary, your riding position isn't changing, and your clothes are the same. It's as if someone took a snapshot of you and your bike.

In this fixed position your bike and body present an unchanging (that is, fixed in time) barrier to wind and friction.

Snapshot CdA is the aerodynamic coefficient measured by the iAero whenever you're not pedaling and you're holding your body fixed. This is the kind of static CdA measurement performed in wind tunnels.

Snapshot CdA measurement can be performed by the iAero whenever you coast for 10 seconds. While coasting you hold the same position and after 10 seconds the iAero reports your Snapshot CdA number. If, say, you perform your Snapshot CdA measurements on a hill, then you can coast down the hill, experimenting with ride positions, equipment, etc. and the iAero will report your Snapshot CdA measurement on your iAero screen. Since the hill is the same you can ride back to the top of the hill, change ride positions, coast down the hill, and see how your CdA changes.

How does Snapshot CdA measurement work? Whenever you stop pedaling the iAero *knows* the following: applied force (zero, because you're not pedaling), opposing hill slope force (the iAero measures this), iAero-measured opposing acceleration force, and iAero *calculated* opposing frictional force (determined from the frictional drag coefficient measured during the calibration ride). So, the only remaining opposing force is from the wind. Since the iAero measures wind speed, it can calculate WHAT aerodynamic drag coefficient is required to make applied force = opposing force.

Now that you know the theory, here's the practical how-to:

Measuring Snapshot CdA Drag Coefficients

- 1) Find a quiet place where the wind isn't howling, trucks and cars aren't screaming by you, and the road surface is like the one where you did your calibration ride.
- 2) Ideally, this spot is a downhill, so that you can let nature help you coast (gravity pulls you down and speeds you up), and nature slows you down (opposing wind). If you don't have a downhill available that's OK: just find a place where you can go fast, then coast for 10 seconds or more.

NOTE: DURING THE CdA COAST DOWN YOU CANNOT APPLY BRAKES, TURN SHARP CORNERS, OR BE BUFFETED BY WIND GUSTS FROM PASSING VEHICLES. IF ANY OF THESE HAPPEN YOUR MEASUREMENTS WILL BE INACCURATE.

- 3) Select the power window on your iAero screen
- 4) Go to your starting point, speed up to at least 20 mph, then stop pedaling. It's ok if downhills make you continue to speed up more; the iAero will figure out the forces properly.
- 5) Hold the same riding position while coasting. Do NOT move your pedals while

- coasting: if your cadence is not zero, the iAero will not perform CdA calculations.
- 6) About 10 seconds after you've stopped pedaling, you will see your Snapshot CdA coefficient appear in the bottom window of your power screen. Read it as follows:
0_28 = 0.28 (i.e. Snapshot CdA = 0.28)

iAero CdA measurements are read out to two significant digits.

Now that you know how to measure Snapshot CdA, you can have fun:

For each riding position, equipment set-up, etc. do several measurements (more data is BETTER). Write down Snapshot CdA results after each coast-down. You can average them later on.

You can compare your measured, Snapshot CdA numbers to the baseline Snapshot CdA number stored in your iAero. When your Snapshot CdA numbers are LOWER than your baseline CdA number then you're more streamlined against the wind (compared to your usual ride position) and it will be easier to go faster.

When your aerodynamic coefficient goes UP, compared to your baseline CdA, it will take more effort to move against the wind.

HOW TO MEASURE CONTINUOUS CdA WITH THE IAERO

Continuous CdA Measurement

Continuous CdA measurements allow your body to be in motion at all times: (*e.g. pedaling, changing ride position, changing clothing*); you don't have to be motionless. Continuous CdA measurements are made once each second and are recorded in your ride file.

Continuous CdA is like a movie of your aerodynamic behavior at every point of your ride, in contrast to Snapshot CdA, which is a point-in-time snapshot of your static aerodynamic characteristics.

What are the benefits of Continuous CdA measurement? Several:

- 1) No rider stays in the same position all the time. Continuous CdA tells you when and by how much you are deviating from your normal ride position.
- 2) With Continuous CdA, you can optimize the combination of power output AND ride position simultaneously. Perhaps your most streamlined riding position isn't the position from which you generate the most power. Continuous CdA measurements, along with the iAero's power measurements, will help you get your best combination of ride position and power.
- 3) In a long ride your riding position may worsen due to fatigue. Continuous CdA will help you see how disciplined your ride position remains for the entire ride.
- 4) Continuous CdA enables another amazing measurement: Time Advantage™. Time Advantage will be discussed in a separate section.

In short, Continuous CdA takes power training to a much higher level and opens serious training to exciting new possibilities.

How Does Continuous CdA Measurement work and what does it require?

We've already learned that Snapshot CdA works by determining the aerodynamic drag coefficient that solves the equation

Applied forces = opposing forces

For Snapshot CdA, the rider is coasting and applied force = 0.

Of course, most of the time the cyclist is pedaling (!), applying force directly to the pedals. The iAero does not know the magnitude of the applied force and CdA can no longer be determined unless...

...unless you have a direct force power meter (DFPM) installed on your bike that transmits *its* applied force power data to the iAero.

As of the time of this writing (November 2008) the iAero can receive DFPM power signals sent by the Quarq CinQo, SRM Wireless, and PowerTap ANT+. All three DFPMs use ANT+Sport communication technology, allowing the iAero to receive DFPM signals. It is anticipated that more DFPM manufacturers will adopt ANT+Sport for wireless; when they do, the iAero will be able to receive power signals from these other manufacturers as well.

With the wireless DFPM and iAero working together at every point of the ride the iAero knows: applied force (from the DFPM), opposing gravitational force (iAero), opposing acceleration force (iAero), and opposing frictional force (iAero, based on baseline frictional drag coefficient). The only remaining opposing force is due to the wind and the iAero can determine, *in real time*, the CdA value required to make the above equation balance.

The iAero uses the same physics and mathematics to determine CdA; what's different is that CdA data is displayed continuously on the iAero screen.

SUMMARY: CONTINUOUS CDA REQUIRES THE IAERO **AND A COMPATIBLE WIRELESS DFPM TO BE MOUNTED ON YOUR BIKE.**

USING THE IAERO WITH AN ANT+SPORT WIRELESS DFPM POWER SENSORS

HOW TO CONNECT THE IAERO WITH YOUR WIRELESS ANT+SPORT SENSORS

- 1) Install your wireless DFPM on your bike according to directions provided by the manufacturer.
- 2) Install your iAero wireless mount and sensors on your bike.
- 3) Attach your iAero to your wireless mount.
- 4) Spin the crank to wake up the speed sensor, cadence sensor, and DFPM.
- 5) Attach the HR strap to your chest. This wakes-up the HR strap.
- 6) Spin the crank of your DFPM backwards several revolutions. This activates your DFPM.
- 7) Enter Setup and use the down arrow to find the "Scan No" screen.
- 8) Click the center button; "No" will flash. Click the up arrow so that "Yes" flashes.
- 9) Finally, press the center button of your iAero. Your iBike will scan for your wireless sensors and, after a few moments, you'll see "SPD FOUND", "CAD FOUND", "Pin FOUND" (power in found). If you're using an HR strap you'll also see "HRT FOUND".

Your iAero is now receiving speed and HR signals from your iAero sensors, and cadence and power data from your DFPM.

HOW TO ZERO-OFFSET CALIBRATE YOUR WIRELESS DFPM

- 1) Pair your wireless DFPM according to the steps above.
- 2) Go to Setup/PCAL (power calibrate).
- 3) Use the up arrow to find PCAL/START
- 4) Press the center button. After a few seconds you'll see the message PCAL/Done.

Your wireless DFPM is now calibrated.

NOTE: FOR DETAILED INSTRUCTIONS REGARDING THE USE OF YOUR WIRELESS DFPM, CONSULT THE DFPM OWNER'S MANUAL THAT WAS INCLUDED WITH YOUR DFPM

NOTE: WHEN USING A WIRELESS DFPM WITH THE IAERO, THE POWER INFORMATION DISPLAYED ON THE IAERO SCREEN IS MEASURED BY THE DFPM.

CALIBRATING YOUR IAERO AND WIRELESS DFPM TOGETHER FOR CONTINUOUS CDA MEASUREMENT

The calibration procedure for the iAero/WIRELESS DFPM combination is COMPLETELY DIFFERENT FROM ANY PREVIOUS IBIKE CALIBRATION PROCEDURE:

- a. Tilt calibration is the same, but
- b. NO COAST DOWNS ARE REQUIRED
- c. A single calibration ride, 4 miles long, IS REQUIRED
- d. The 4-mile ride is analyzed in iBike software.
- e. Baseline (normal) aerodynamic and frictional drag coefficients are determined by the iAero/DFPM data

Here is the calibration procedure:

- 1) Set up your iAero and DFPM on the bike and pair them (page 15)
- 2) Perform a tilt calibration. Be careful and take your time. Mark the places where you'll turn the bike.
- 3) VERY IMPORTANT: before starting your calibration ride make sure your iAero has adjusted to the outdoor temperature. Proper wind speed measurement is critical to best results, so BEFORE you start calibrations, ride around with your bike for 10 minutes to let your iAero adjust to outdoor conditions.
- 4) Be certain that you perform the Wind Offset calibration carefully before beginning your calibration ride.
- 5) Make sure the DFPM has had its zero-offset calibration completed. If your DFPM calibration is incorrect then ALL the data from your iAero will be wrong, too!
- 6) Once your iAero and DFPM are ready, do a four mile calibration ride (two miles out, two miles back).

NOTE: WHEN USING THE IAERO AND THE DFPM TOGETHER, THE POWER DATA DISPLAYED ON YOUR IAERO SCREEN WILL BE THAT MEASURED BY THE DFPM

- 7) When you've completed your calibration ride use the "Profiles/Download Coast-Downs & Calibration Ride" command data to analyze your results. The iBike software will compute aerodynamic and frictional drag coefficients based on the DFPM and iAero data captured during the calibration ride.
- 8) And, VERY IMPORTANT, after you've done the analysis click the "Accept Profile and send to iAero" command to UPLOAD your analyzed results to your iAero. If you forget this step then ALL YOUR HARD WORK WILL BE MEANINGLESS!

Your iAero and DFPM are now ready to measure power, Continuous CdA, Time Advantage, and all other iAero measurements.

Note that iAero Continuous CdA measurements are read out to two significant digits.

TIME ADVANTAGE

Time Advantage™ is another feature exclusive to the iAero/DFPM combination.

What is Time Advantage?

When you ride a bike, most of the time you're riding in your "normal" position.

DEFINITION: YOUR "NORMAL RIDING POSITION" IS THE POSITION YOU USED WHEN PERFORMING THE CALIBRATION RIDE WITH YOUR DFPM.

As long as you stay in your normal riding position, the relative amount of time it takes to complete your training ride is unaffected by your riding position; that is, your "normal" riding position gives a "normal" training time.

Now, suppose you're on a ride and you have deviated from your normal riding position for a portion of your ride, say, going into a tuck. Did going into a tuck save you time compared to staying in your normal riding position? Clearly, the answer is "yes", but *how much time did you save?*

Here's another situation: you attacked a hill and stood up to get more power. You know that "standing up" is less aerodynamically efficient and costs you some time. *How much extra time did it take to climb the hill due to aerodynamic inefficiencies?*

A final situation: you've perfected your "normal" ride position using the iAero. During a long ride, however, you get tired and your ride position becomes a bit sloppy. *How much longer did it take you to complete your ride because your ride position became worse?*

Time Advantage answers all these questions, and more.

DEFINITION: AT ANY POINT OF YOUR RIDE, "TIME ADVANTAGE" IS THE CUMULATIVE AMOUNT OF TIME YOU HAVE GAINED (OR LOST) UP TO THAT POINT, DUE TO DEVIATIONS FROM YOUR NORMAL RIDE POSITION.

Time advantage is measured in seconds. Suppose you look at your iAero at mile 6.2 of your ride and Time Advantage reads a positive 30. Then, up to that point of your ride you have *gained* 30 seconds of time, *relative to your "normal" riding time*, as a consequence of moment-to-moment improvements of your normal riding position. If, instead, your Time Advantage reads -15 then you've *lost* fifteen seconds compared to staying in your normal riding position.

How are Continuous CdA and Time Advantage related?

If your current value CdA is higher than your baseline CdA then you are relatively less aerodynamically efficient compared to your normal riding position and, for the same amount of applied force, you won't go as fast. Conversely, if your current CdA is lower than your normal value then you are MORE aerodynamic and you'll go faster compared to your normal riding position.

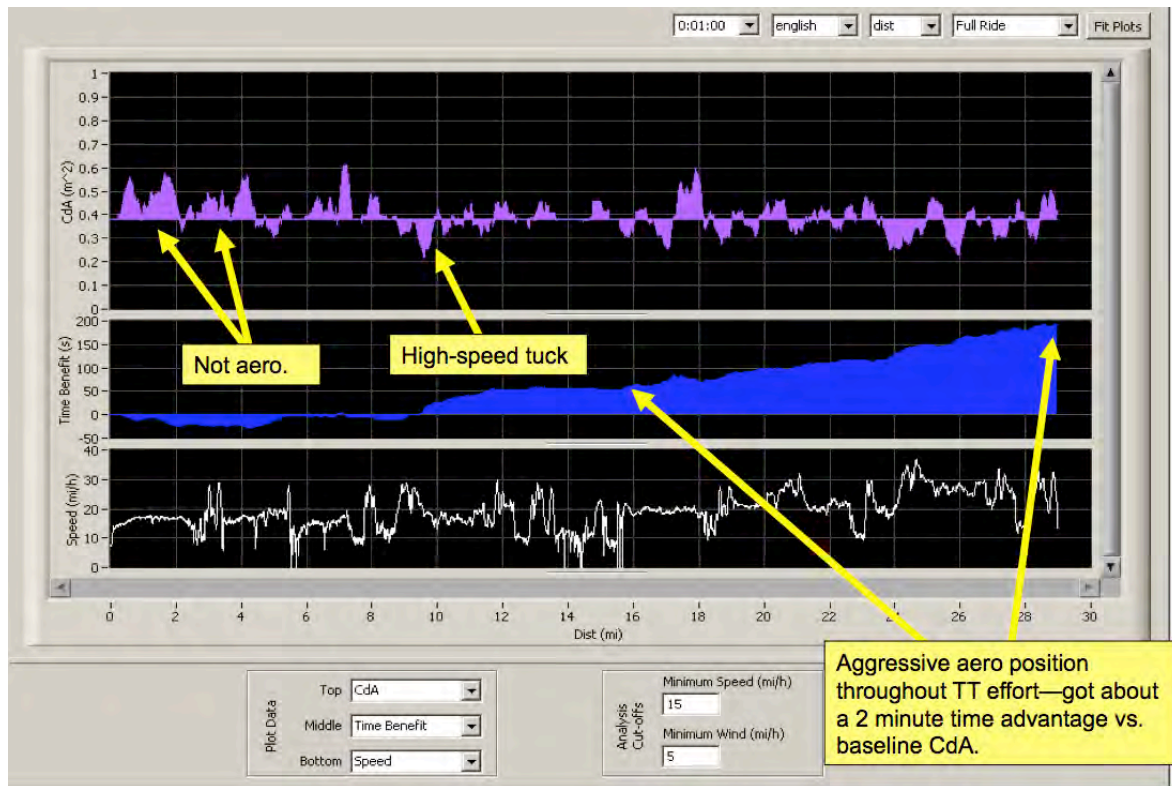
The iAero compares your Continuous CdA to your baseline CdA, moment-by-moment. Using the comparative CdA values between your baseline CdA and your Continuous CdA,

the iAero computes the cumulative amount of time you gain or lose, moment-by-moment, due to deviations from your baseline CdA.
 The iAero computes the net time effect of better-and-worse ride positions and displays the *cumulative* Time Advantage number in the bottom window of your iAero (the bottom window alternates automatically between cadence, HR, Continuous CdA, and Time Advantage).

In short, Continuous CdA make it possible for the iAero to determine the corresponding Time Advantage gained and lost by changes in aerodynamic drag throughout your ride.

Graphical Example

Here is a graphical depiction of an actual iAero ride with a CinQo DFPM.



This data was captured in an iAero ride file and was analyzed using features in the iBike software we'll discuss later on in this manual.

The top graph shows CdA versus distance. The middle graph shows Time Advantage vs. distance, and the bottom graph shows speed vs. distance.

This ride was about 29 miles long. In the top window you see in purple the rider's CdA vs distance. Note that an imaginary horizontal line can be drawn through the purple graph at about $CdA = 0.39$. **The value $CdA = 0.39$ is this rider's baseline CdA value as determined by the calibration ride done previously with the CinQo.**

For the first 4.4 miles of this ride the rider had CdA measurements that, most often, were above his normal value of 0.39. *A higher than normal CdA means the rider was relatively less aerodynamic and that he lost time due to his relatively poor riding position.* How much

time did his high CdA cost him? According to the graph, the time lost peaked at -42 seconds at mile 4.4. What does negative 42 seconds mean? It means that if the rider had pedaled equally hard, *but had always stayed in his normal ride position*, then he would have arrived at mile 4.4 about 42 seconds sooner. Said differently: at mile 4.4, aerodynamic riding inefficiencies has cost this rider about 42 seconds compared to his normal riding position.

At mile 4.4 the rider improves his riding position and CdA drops below his baseline value. *He reverses his negative Time Advantage and picks up a lot of time*. In fact, by mile 5.2 the rider is nearly back to zero Time Advantage—meaning that he is “on pace” compared to his normal riding position.

Between miles 6 and 8 there are some high CdA spikes but the Time Advantage curve does not react accordingly (a high CdA should cause Time Advantage to go more negative). Why does Time Advantage not move? *Time Advantage measurements become less accurate as bike speed and wind speed drop*. Accordingly, the iAero does not record changes in Time Advantage when bike speed is below 15 mph or when net opposing wind speed is below 5 mph. In this case, the rider is just below the 15 mph threshold between miles 6 and 7, and there also appears to be a tailwind too, causing wind speed to drop below 5 mph (we can't tell this from the graph). Time Advantage does NOT change between miles 6 and 8 because the iAero is operating below its minimum measurement threshold.

Just after mile 8 the rider goes into a tuck and his bike speed increases to nearly 30 mph. The rider gains a tremendous amount of Time Advantage: between mile 9.5 and 10 he gains about 35 seconds! *The faster you're riding, the more Time Advantage you get from a better-than-normal riding position*.

The rider continues the tuck until about mile 11.5. At this point he has gained 50 seconds overall since the beginning of the ride.

Between mile 11.5 and 16 his Time Advantage remains flat at about 50 seconds. This is due to low bike speeds of around 10 mph, a result of hill climbs. *At low bike speeds aerodynamic forces don't affect Time Advantage significantly*.

At mile 16 the rider goes into an aggressive tuck and really picks up the pace, too. Between mile 16 and 29 he picks up an ADDITIONAL 150 seconds of time advantage, and by the end of the ride his total time advantage is about 200 seconds.

What does 200 seconds of Time Advantage mean? It means that he finished his ride 200 seconds SOONER than he would have had he ridden in his normal riding position for the entire ride!

The iAero gave this rider constant feedback about the quality of his riding position (Continuous CdA), AND quantified the Time Advantage of his aerodynamic improvements, AND gave him all the benefits of power measurement.

Sounds like a winning combination!

USING CONTINUOUS CDA AND TIME ADVANTAGE ON THE IAERO

Once you've set up your iAero and DFPM you can ride as usual:

- 1) All traditional functions, measurements, and screens of the iBike are unchanged.
- 2) To enable on-screen CdA display, go to Setup/CdA. Press the center button, click the up arrow to set CdA "On", and click to accept.
- 3) With CdA "On", the bottom window of your Power Screen will alternate between cadence, heart rate, Continuous CdA, and Time Advantage.
- 4) When viewing the Power Screen, the power number displayed in the middle window is the power reported by the DFPM.
- 5) Ride files will contain both iAero and DFPM information.
- 6) When bike speed is less than 15 mph Continuous CdA displayed will be your baseline value.
- 7) When bike speed is less than 15 mph or total opposing wind speed is below 5 mph, Time Advantage will not be changed.
- 8) To reset Time Advantage to zero, perform a Trip Reset.

Other important things to remember:

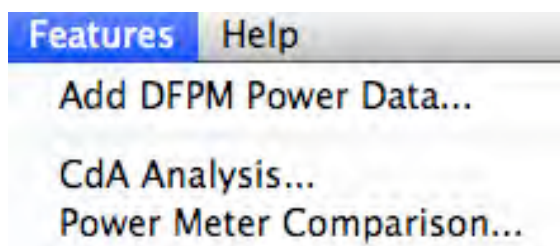
- 1) Continuous CdA and Time Advantage measurements are most accurate *when riding solo*.
- 2) Continuous CdA and Time Advantage measurements probably won't be accurate when riding in a pack.
- 3) Continuous CdA and Time Advantage measurement accuracy will be adversely affected by changes in frictional drag. For example, if you go from normal pavement to soft dirt your CdA and Time Advantage measurements will be inaccurate while you ride in the soft dirt.
- 4) For maximum accuracy you **MUST** be sure to let your iAero acclimate to outdoor temperature **AND** to perform a wind offset calibration prior to each ride.
- 5) Make sure to zero-offset your DFPM prior to your ride.
- 6) Remember: the accuracy of the iAero/DFPM is highly dependent upon proper setup, calibration, and use.

USING IBIKE SOFTWARE WITH IAERO FILES

Not only does your iAero provide revolutionary new means to measure aerodynamic drag, your iAero *also* unlocks new and exclusive features in the iBike software to help you interpret your iAero files, and improve your riding skills and training regimen.

Of course, ALL of the features of iBike software that work for the iBike Pro also function with the iAero. These features of iBike software are described in detail in the iBike Software Reference Manual.

In iBike software, iAero users gain *exclusive* access to *extra* features residing in iBike software in the Features Menu:



NOTE: THE "FEATURES" MENU ITEMS ARE ACCESSIBLE ONLY WHEN THE RIDE FILE SHOWN IN THE MAIN WINDOW WAS CREATED BY AN IBIKE AERO. RIDE FILES CREATED WITH AN IBIKE PRO DO NOT SUPPORT ANY OF THESE ANALYSES AND THE "FEATURES" MENU ITEMS WILL BE GRAYED-OUT.

In addition to the Features Menu, the main window of iBike software shows a new "DFPM" tab. We'll explain that tab in a moment.

Features Menu Overview

All of the commands listed in the Features menu require both an iAero file AND a direct force power meter (DFPM) file that was recorded at the same time.

IF you own an ANT+SPORT equipped DFPM (CinQo, Wireless SRM, PT ANT+), your iAero file has the DFPM information from the DFPM recorded in the iAero file. With the DFPM you'll see Continuous CdA and Time Advantage measurements displayed on your iAero screen, AND you can view this same data after your ride using iBike software.

What if you DON'T own a DFPM but DO own an older SRM, PowerTap, or Ergomo? If you own any of these DFPMs, *you can use iBike software to combine your iAero ride file with your wired SRM, PT, or Ergomo ride file and perform after-the-ride, CdA and Time Advantage analyses.*

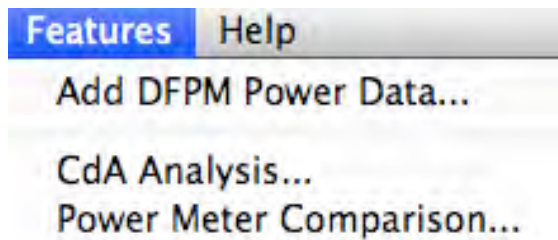
WORKING WITH IAERO/WIRELESS DFPM FILES

Use iBike software to download your iAero/DFPM file.

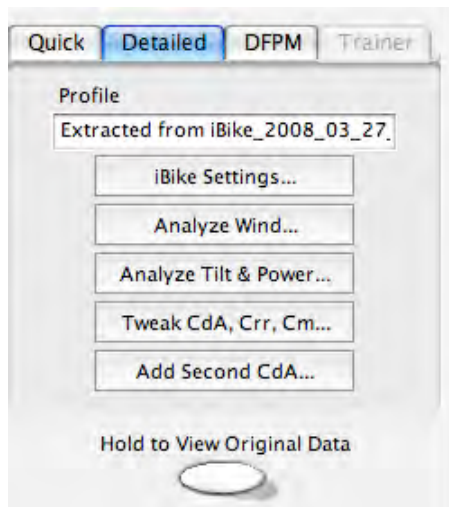
The downloaded file contains all of your iAero ride file information, as well as DFPM information.

NOTE: DFPM INFORMATION INCLUDES POWER DATA AND CADENCE DATA

Your iBike software automatically detects when the ride file comes from an iAero. When it sees that you have an iAero then the Features menu commands are unlocked (not grayed out):



Also, you'll see in the main window a Tab labeled DFPM that is not grayed out:

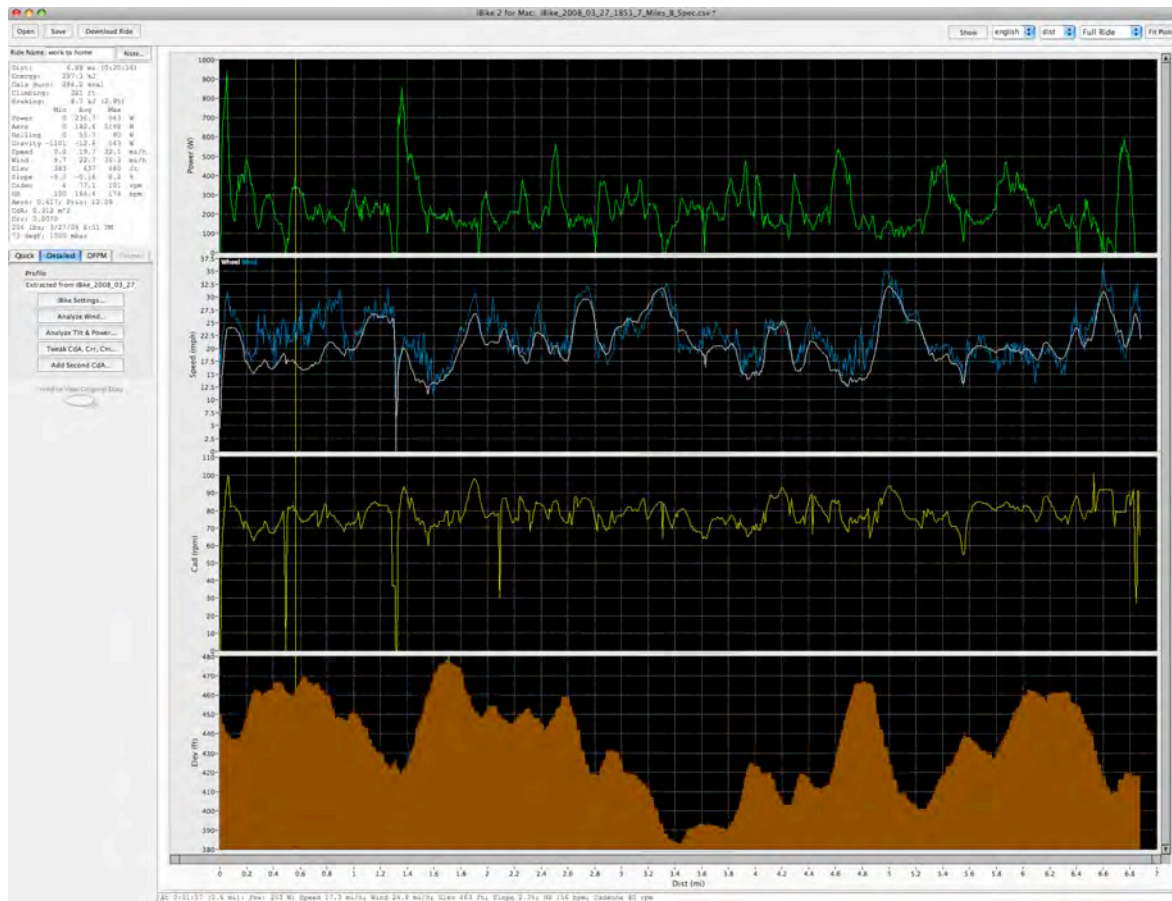


Here's how to use the exclusive iAero features with your wireless DFPM.

For these examples we'll use a ride file we made with our iAero and CinQo unit.

POWER DATA DISPLAY

Once you've downloaded your ride file it will appear in the main screen:



Your iAero data is displayed in the window (except for cadence data, which is measured by the CinQo).

NOTE: THE "DETAILED" TAB SHOWS GRAPHS AND STATS FROM THE IAERO. THE "DFPM" TAB SHOWS GRAPHS AND STATS FROM THE CINQO (OR OTHER DFPM).

Click the Detailed/Analyze Tile & Power button to check your ride. After analysis this ride file moves by only three watts (Use the Hold to View Original Data button to see the difference) so the iAero was well calibrated:

Ride Name: work to home Note...

Dist: 6.88 mi (0:20:56)
 Energy: 296.3 kJ
 Cals Burn: 283.3 kcal
 Climbing: 321 ft
 Braking: 8.7 kJ (2.9%)

	Min	Avg	Max	
Power	0	235.9	941	W
Aero	0	182.2	5198	W
Rolling	0	55.7	90	W
Gravity	-1101	-12.8	543	W
Speed	0.0	19.7	32.1	mi/h
Wind	9.7	22.7	36.3	mi/h
Elev	383	437	480	ft
Slope	-9.5	-0.16	8.2	%
Caden	4	77.1	101	rpm
HR	100	164.4	174	bpm

Aero: 0.417; Fric: 12.09
 CdA: 0.312 m²
 Crr: 0.0070
 204 lbs; 3/27/08 6:51 PM
 73 degF; 1020 mbar

Quick Detailed DFPM Trainer

Profile
 Extracted from iBike_2008_03_27.

iBike Settings...
 Analyze Wind...
 Analyze Tilt & Power...
 Tweak CdA, Crr, Cm...
 Add Second CdA...

Hold to View Original Data

iAero PRE ANALYSIS

Ride Name: work to home Note...

Dist: 6.88 mi (0:20:56)
 Energy: 300.0 kJ
 Cals Burn: 286.8 kcal
 Climbing: 321 ft
 Braking: 8.5 kJ (2.8%)

	Min	Avg	Max	
Power	0	238.9	852	W
Aero	0	179.2	4855	W
Rolling	0	55.7	90	W
Gravity	-1052	-7.3	628	W
Speed	0.0	19.7	32.1	mi/h
Wind	9.7	22.7	36.3	mi/h
Elev	383	437	480	ft
Slope	-9.4	-0.09	8.3	%
Caden	4	77.1	101	rpm
HR	100	164.4	174	bpm

Aero: 0.417; Fric: 12.09
 CdA: 0.310 m²
 Crr: 0.0070
 204 lbs; 3/27/08 6:51 PM
 73 degF; 1020 mbar

Quick Detailed DFPM Trainer

Profile
 Extracted from iBike_2008_03_27.

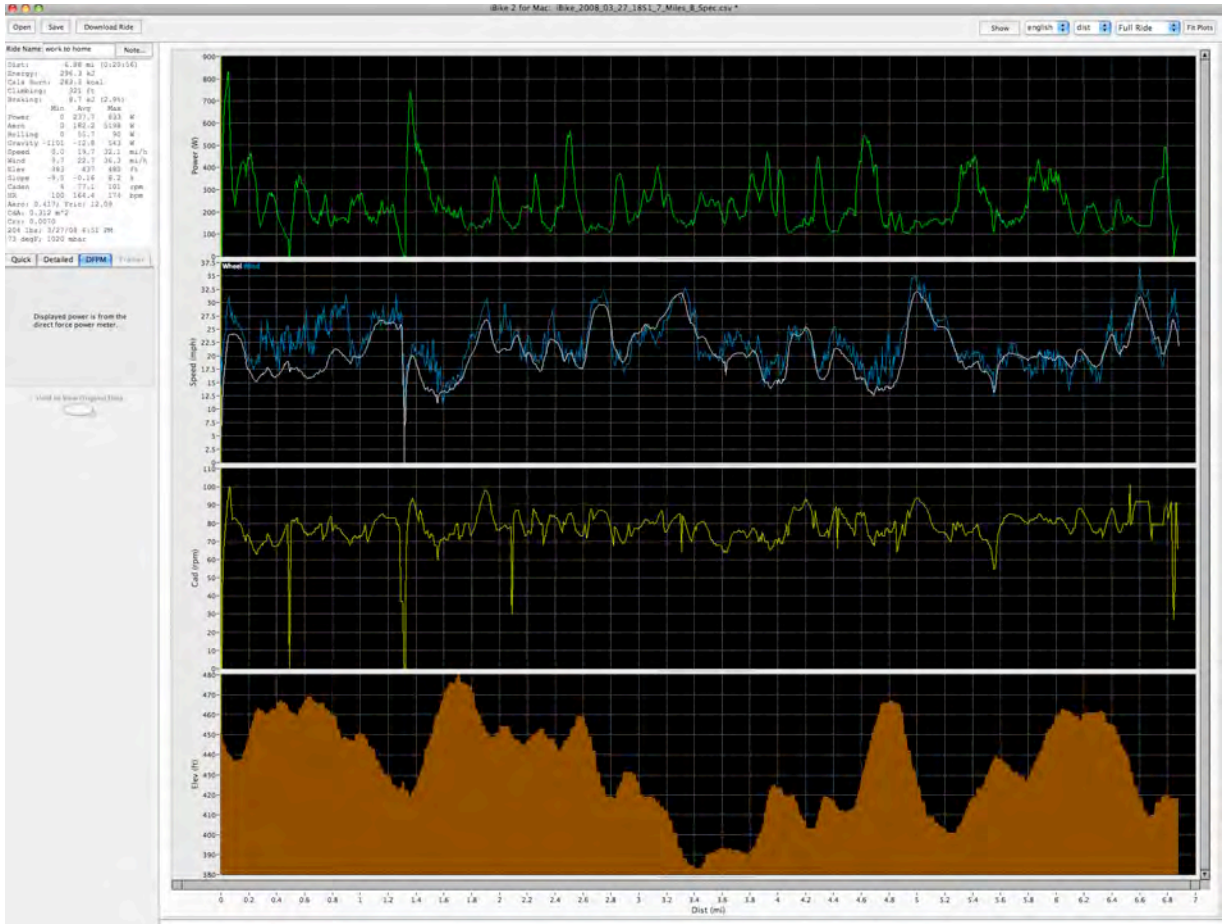
iBike Settings...
 Analyze Wind...
 Analyze Tilt & Power...
 Tweak CdA, Crr, Cm...
 Add Second CdA...

Hold to View Original Data

iAero POST ANALYSIS

The biggest change pre/post analysis is that the max watts drops. In this ride file there was an initial peak at the very start of the ride that the Analyze function repaired.

Next, click on the DFPM tab. You'll see the CinQo's graph and stats displayed:



Open Save Download Ride

Ride Name: work to home Note...

Dist: 6.88 mi (0:20:56)
 Energy: 296.3 kJ
 Cals Burn: 283.3 kcal
 Climbing: 321 ft
 Braking: 8.7 kJ (2.9%)

	Min	Avg	Max	
Power	0	237.7	833	W
Aero	0	182.2	5198	W
Rolling	0	55.7	90	W
Gravity	-1101	-12.8	543	W
Speed	0.0	19.7	32.1	mi/h
Wind	9.7	22.7	36.3	mi/h
Elev	383	437	480	ft
Slope	-9.5	-0.16	8.2	%
Caden	4	77.1	101	rpm
HR	100	164.4	174	bpm

Aero: 0.417; Fric: 12.09
 CdA: 0.312 m^2
 Crr: 0.0070
 204 lbs; 3/27/08 6:51 PM
 73 degF; 1020 mbar

Quick Detailed **DFPM** Trainer

Displayed power is from the direct force power meter.

Hold to View Original Data

CinQo

Comparing the CinQo and iAero stats is interesting:

Ride Name: work to home Note...

Dist: 6.88 mi (0:20:56)
 Energy: 296.3 kJ
 Cals Burn: 283.3 kcal
 Climbing: 321 ft
 Braking: 8.7 kJ (2.9%)

	Min	Avg	Max	
Power	0	235.9	941	W
Aero	0	182.2	5198	W
Rolling	0	55.7	90	W
Gravity	-1101	-12.8	543	W
Speed	0.0	19.7	32.1	mi/h
Wind	9.7	22.7	36.3	mi/h
Elev	383	437	480	ft
Slope	-9.5	-0.16	8.2	%
Caden	4	77.1	101	rpm
HR	100	164.4	174	bpm

Aero: 0.417; Fric: 12.09
 CdA: 0.312 m^2
 Crr: 0.0070
 204 lbs; 3/27/08 6:51 PM
 73 degF; 1020 mbar

Quick Detailed **DFPM** Trainer

Profile
 Extracted from iBike_2008_03_27.

iBike Settings...
 Analyze Wind...
 Analyze Tilt & Power...
 Tweak CdA, Crr, Cm...
 Add Second CdA...

Hold to View Original Data

iAero Pre

Ride Name: work to home Note...

Dist: 6.88 mi (0:20:56)
 Energy: 300.0 kJ
 Cals Burn: 286.8 kcal
 Climbing: 321 ft
 Braking: 8.5 kJ (2.8%)

	Min	Avg	Max	
Power	0	238.9	852	W
Aero	0	179.2	4855	W
Rolling	0	55.7	90	W
Gravity	-1052	-7.3	628	W
Speed	0.0	19.7	32.1	mi/h
Wind	9.7	22.7	36.3	mi/h
Elev	383	437	480	ft
Slope	-9.4	-0.09	8.3	%
Caden	4	77.1	101	rpm
HR	100	164.4	174	bpm

Aero: 0.417; Fric: 12.09
 CdA: 0.310 m^2
 Crr: 0.0070
 204 lbs; 3/27/08 6:51 PM
 73 degF; 1020 mbar

Quick Detailed **DFPM** Trainer

Profile
 Extracted from iBike_2008_03_27.

iBike Settings...
 Analyze Wind...
 Analyze Tilt & Power...
 Tweak CdA, Crr, Cm...
 Add Second CdA...

Hold to View Original Data

iAero Post

Open Save Download Ride

Ride Name: work to home Note...

Dist: 6.88 mi (0:20:56)
 Energy: 296.3 kJ
 Cals Burn: 283.3 kcal
 Climbing: 321 ft
 Braking: 8.7 kJ (2.9%)

	Min	Avg	Max	
Power	0	237.7	833	W
Aero	0	182.2	5198	W
Rolling	0	55.7	90	W
Gravity	-1101	-12.8	543	W
Speed	0.0	19.7	32.1	mi/h
Wind	9.7	22.7	36.3	mi/h
Elev	383	437	480	ft
Slope	-9.5	-0.16	8.2	%
Caden	4	77.1	101	rpm
HR	100	164.4	174	bpm

Aero: 0.417; Fric: 12.09
 CdA: 0.312 m^2
 Crr: 0.0070
 204 lbs; 3/27/08 6:51 PM
 73 degF; 1020 mbar

Quick Detailed **DFPM** Trainer

Displayed power is from the direct force power meter.

Hold to View Original Data

CinQo

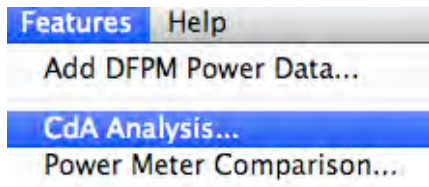
All three sets of data are VERY close (within 1%) of each other; *that's what we would expect.*

INTERESTING SIDE NOTE: why is there *ANY* difference between the iAero power measurements and the wireless DFPM?

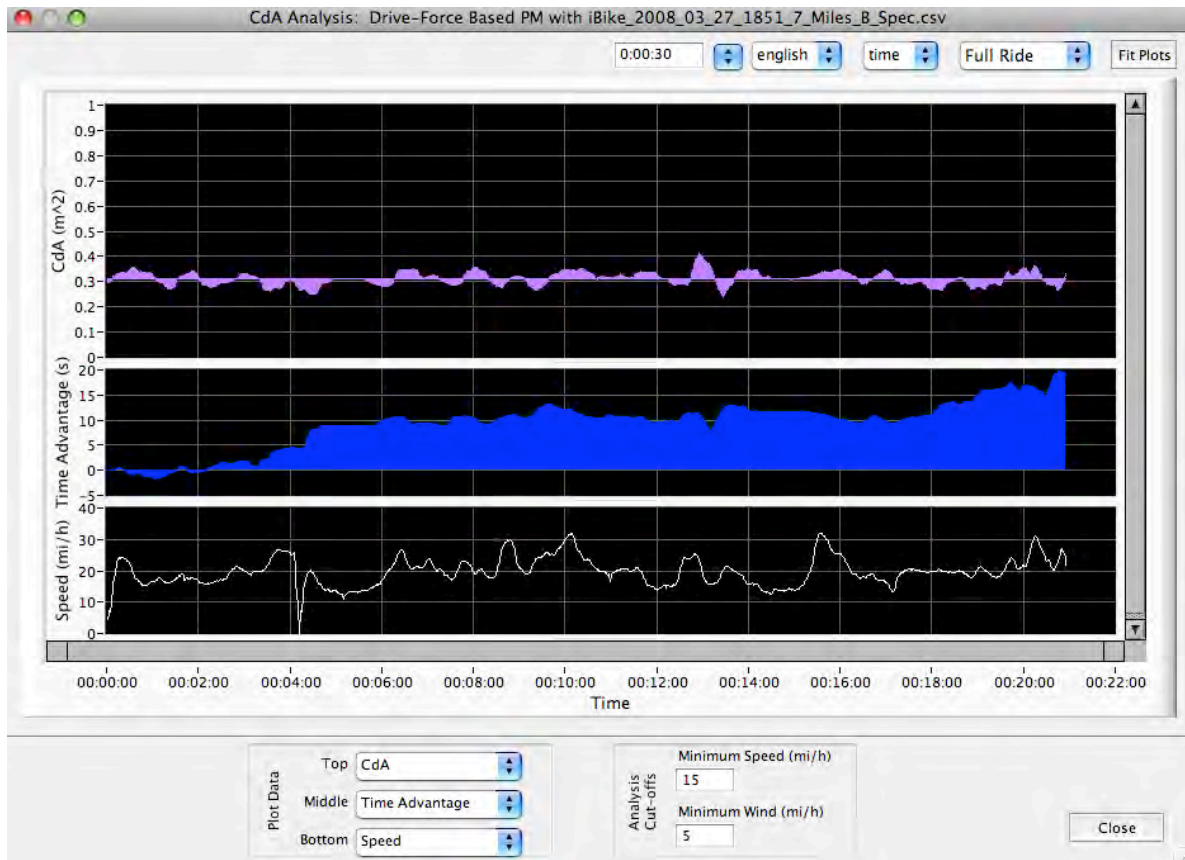
The iAero uses fixed, baseline drag coefficients to measure power. As you've learned, when a cyclist moves from the baseline position that affects Time Advantage and power. The iAero assumes the rider's position is fixed, but the wireless DFPM does not make this assumption. So, the iAero assumption that the rider doesn't move results in a 1.2W difference on overall ride stats. **Now, for this ride that's only a 0.5% difference, so on an overall basis the iAero assumption is excellent.** However, the moment-to-moment differences in power readings between the iAero and CinQo make it possible for the iAero to measure Continuous CdA and Time Advantage, too!

CONTINUOUS CDA/TIME ADVANTAGE

To see the Continuous CdA/Time Advantage graph select Features/CdA Analysis:



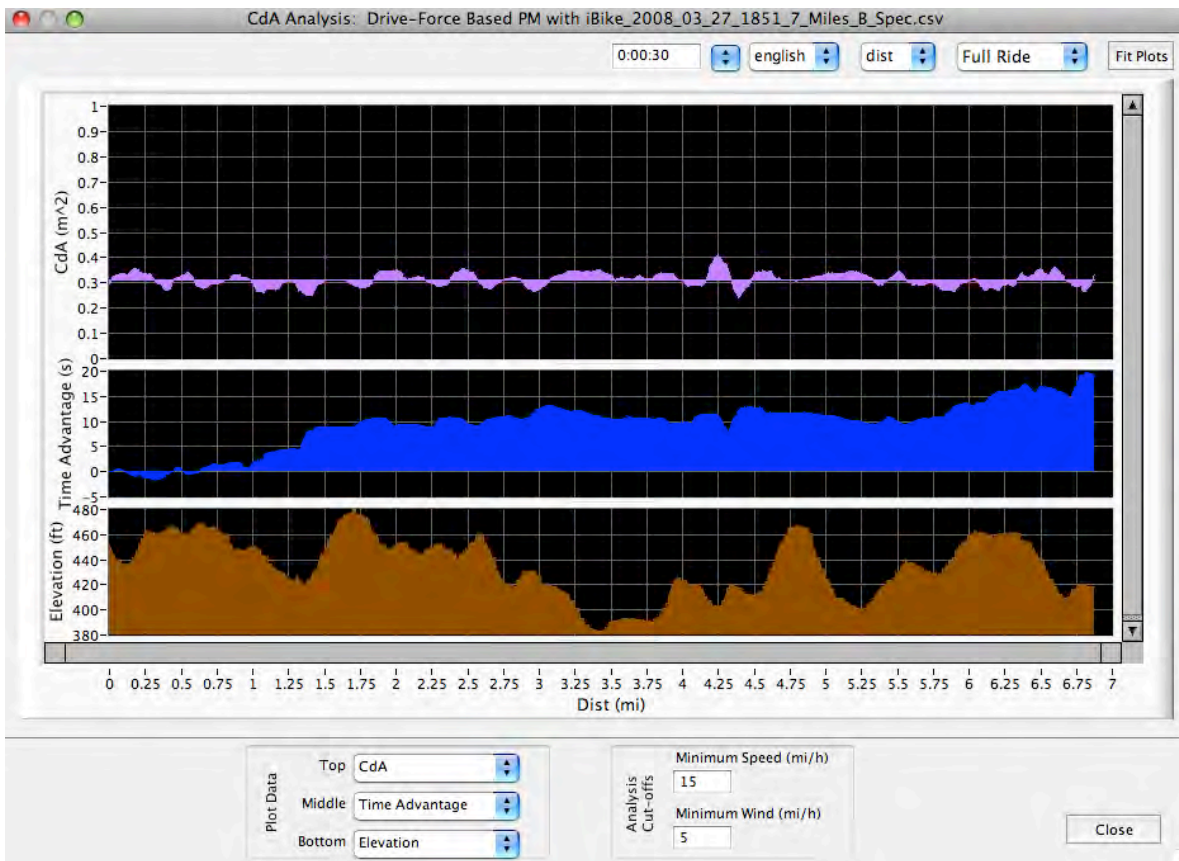
This window will appear:



Here you can see your CdA vs time (or distance, by changing the top right menu item); Time Advantage, and Speed.

NOTE: THE CDA and Time Advantage VS time graph is similar to the numbers that were displayed on your iAero power screen *during your ride*.

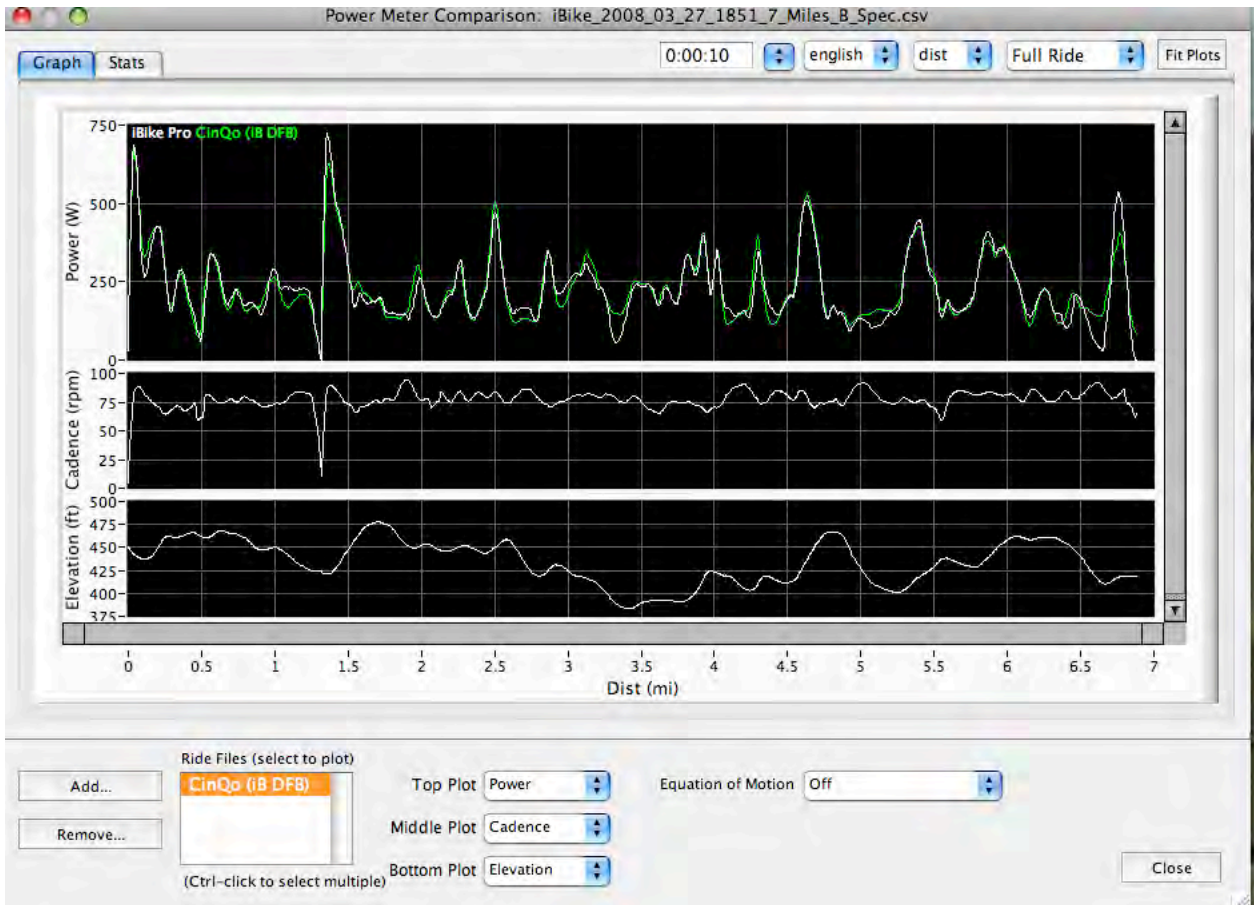
Note that you can select what data is displayed in each window. For example, if we wanted to compare CdA and Time Advantage to elevation, we might shift the bottom scale to distance, and bottom graph to elevation:



This graph can be used to help understand WHERE ride position is changed and WHEN to be extra careful about ride position.

POWER METER COMPARISON

If you'd like to see how your iAero and your DFPM power measurements compare moment-by-moment, select Features/Power Meter Comparison. The following graph will appear:



iAero power is shown in white, and CinQo power is shown in green.

Pretty close, huh? 😊

USING THE IAERO WITH A NON-ANT+SPORT DFPM

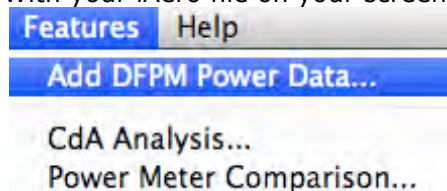
If you DON'T own an ANT+Sport wireless DFPM such as the CinQo but DO own another DFPM, including the wired SRM, PowerTap, or Ergomo, you can use your iAero together with any of these power meters to perform CdA and Time Advantage analyses.

Suppose you have a PT and an iAero on your bike and you use them simultaneously. After your ride you download your iAero ride into iBike software and your PT ride with CyclingPeaks or some other application.

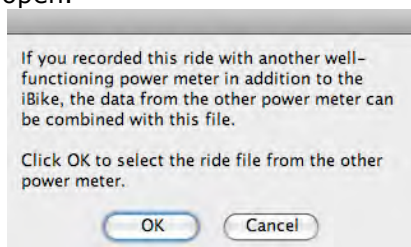
Because you own an iAero you can use special features in iBike software to compare your PT file to your iAero file, AND to perform Time Advantage and Continuous CdA analyses after you've finished your ride.

Here's how to do it:

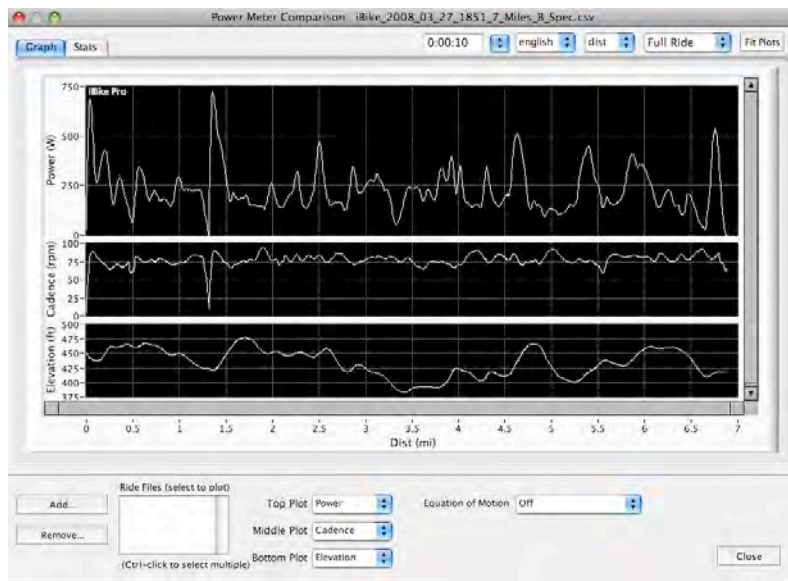
- 1) Download your iAero and PT (or other DFPM) ride files.
- 2) With your iAero file on your screen, select Features/Add DFPM Power data:



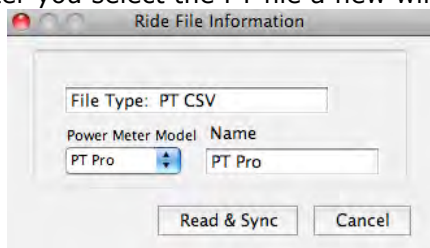
- 3) This window will open.



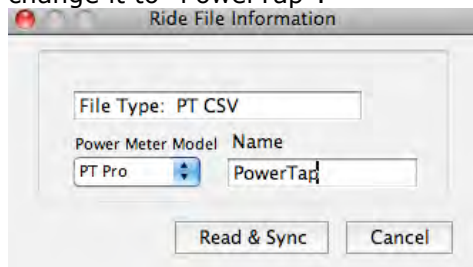
- 4) Please read the message! IF YOUR DFPM ISN'T PROPERLY CALIBRATED AND WORKING WELL YOU WON'T GET GOOD RESULTS! Click OK to accept.
- 5) A new window will appear that displays the iAero's data (in white lines):



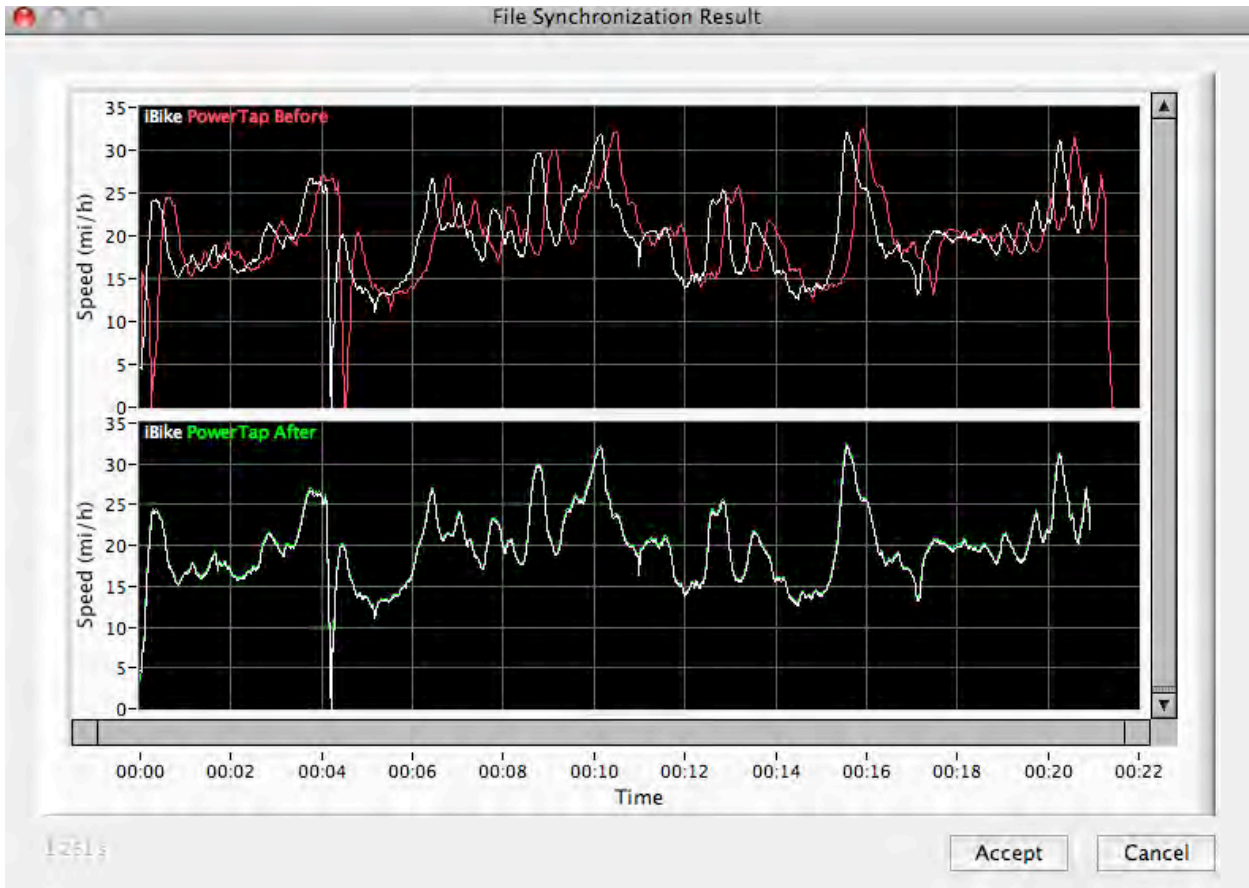
- 6) To add your PT data to this file, click the "Add" button in the lower left corner of the window.
- 7) A new window will appear. Navigate to your PT file and select it.
- 8) After you select the PT file a new window will appear:



- 9) Confirm that this is the file you want. Also, you can change the name that appears on the graph. If left as-is the PT data would appear on the graph as "PT Pro". We'll change it to "PowerTap":



10) Click the "Read & Sync" button. A new window will appear:



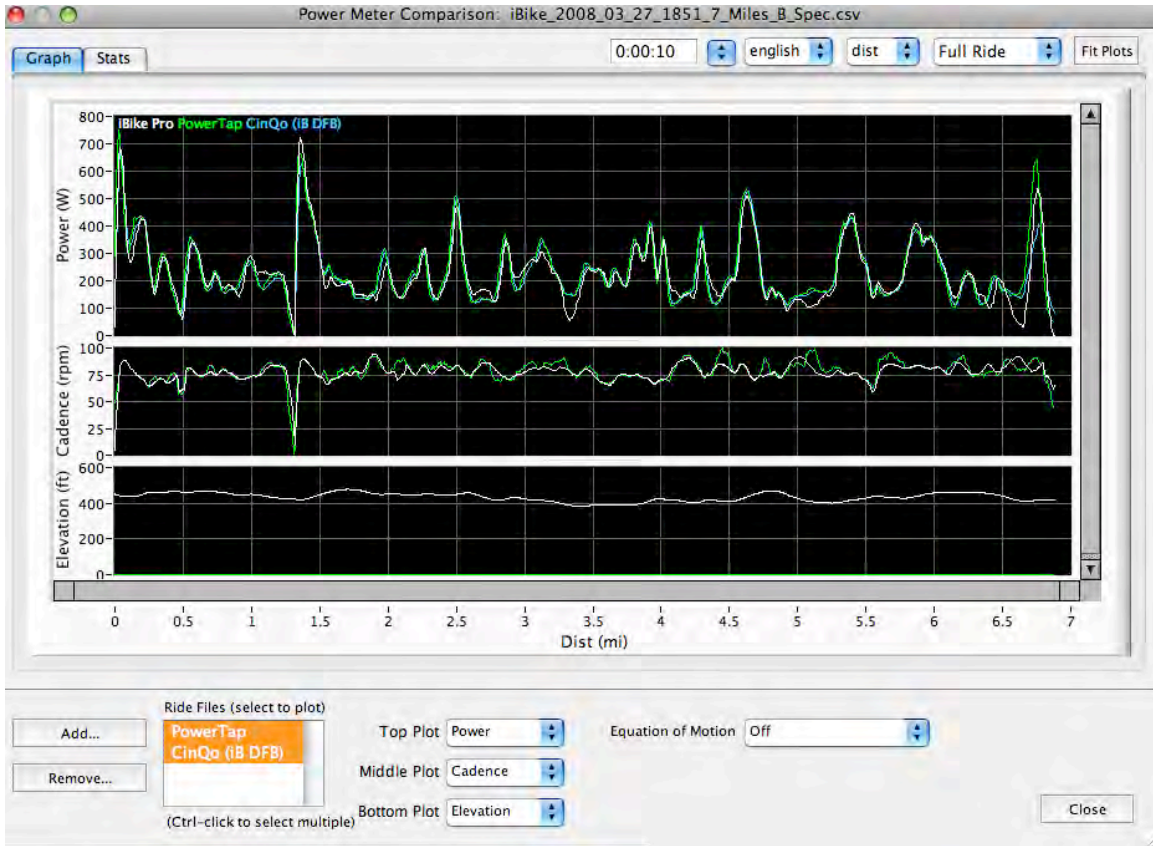
NOTE: THERE'S SOME POWERFUL SOFTWARE NEEDED TO CREATE THIS WINDOW! THE TOP GRAPH SHOWS THE "RAW" DATA FROM EACH RIDE FILE (IAERO IS WHITE, PT IS RED). NOT ONLY WERE THE TWO RIDE FILES STARTED AT DIFFERENT TIMES (RESULTING IN THE DISPLACEMENT, BUT ALSO THE PT DOES NOT RECORD AT 1 SECOND INTERVALS (THE IAERO DOES). SO, IT TAKES A LOT OF WORK TO LINE-UP THE TWO FILES EXACTLY. THE BOTTOM GRAPH SHOWS THE RESULT OF THE SOFTWARE'S MAGIC: PERFECT RIDE FILE ALIGNMENT!

11) Click "Accept" and the PowerTap data (in green) will be added to the iAero graph:

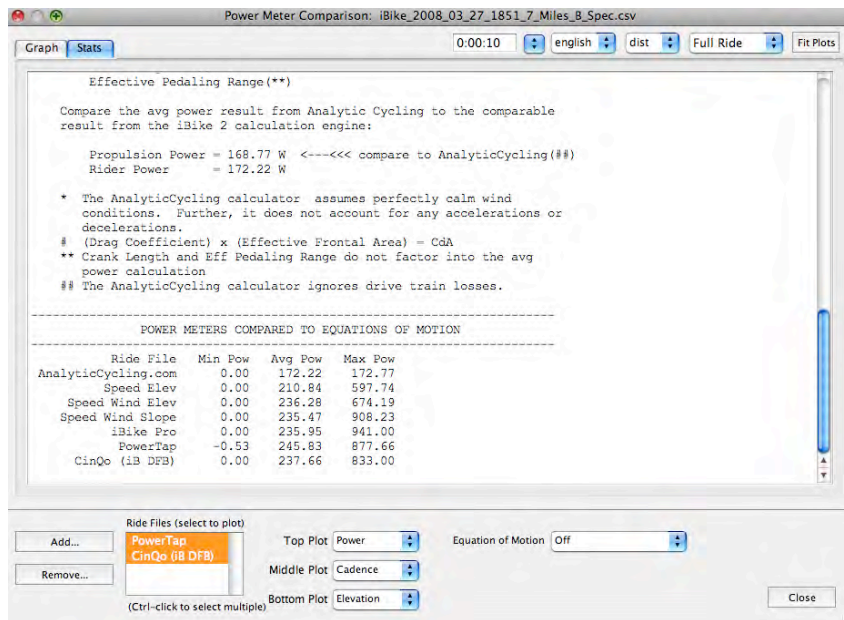


Pretty close, huh? 😊

- 12) If you have *ANOTHER* DFPM on your bike (we have a CinQo or SRM, and PT, Ergomo, and iAero on our bike), you can add MORE files too...just click the "Add" button and repeat the process
- 13) Here's the same graph, this time with the iAero, CinQo, and PT data together:



- 14) You can also compare stats from any PMs you've selected. Use the Stats tab and scroll to the bottom of the chart for comparisons:



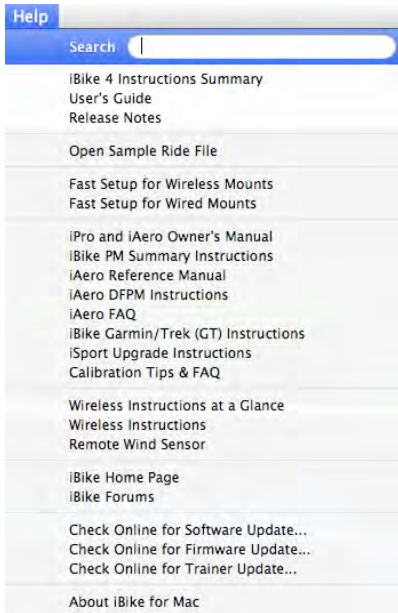
TROUBLESHOOTING

I CAN'T GET MY IAERO TO PAIR WITH MY DFPM. Answer: make sure you have a battery installed in your iBike wireless mount and that the batteries in your DFPM sensor are good. Perform a wireless "Scan" process to make sure your iAero has the correct wireless IDs for all wireless sensors on your bike.

MY TIME ADVANTAGE DATA LOOKS GOOFY. Answer: unless your iAero and DFPM are calibrated closely (after a ride their average power numbers are nearly identical) you will see a Time Advantage "offset" in your graph. This may be caused by improper wind offset calibration prior to starting your ride, or by improper iAero and DFPM calibrations. You may need to recalibrate BOTH PMs. You can "force" the iAero to match the DFPM in iBike software by using the Tools/Tweak CdA... command. Adjust baseline CdA so that the average power is about the same.

HELP: WHERE TO FIND IT

Located in the Help menu of iBike software is a complete list of important documents that were written for your iBike Pro, iAero, and iBike software, as well as direct links to the ibikesports website and iBike Forums:



Click on any link to get access to your selection.

IBIKE FORUMS

There are thousands of iBike owners, and here's a great place to meet many of them and get your questions answered:

<http://www.ibikeforum.com>

Sign on as a member so you can learn more about iBike software, and contribute your knowledge!

TECHNICAL SUPPORT

If you have questions regarding the operation of your iBike software that can't be answered from the help documents and links, please email us at:

technicalsupport@velocomp.com

We will get back to you quickly.