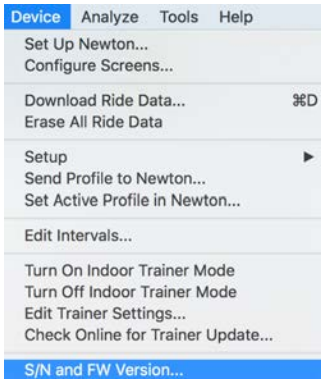
Newton®/PowerPod® CdA Measurement Instruction Manual

January 2017
Newton FW 5.15+
PowerPod FW 6.21+

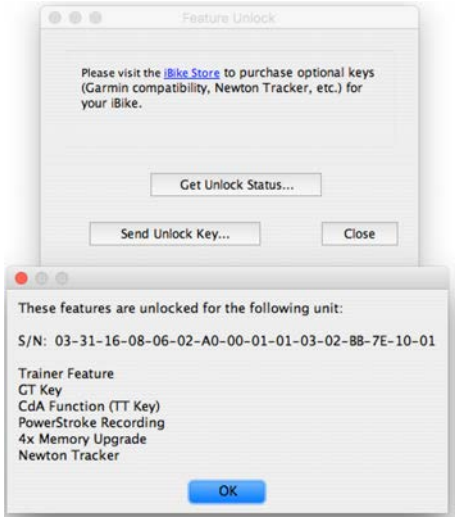
THE CDA FEATURE REQUIRES FW 5.15 OR HIGHER (NEWTON), OR FW 6.21 OR HIGHER (POWERPOD), AND PURCHASE OF THE OPTIONAL CDA FIRMWARE KEY.

Use Isaac to check the version of firmware in your Device:



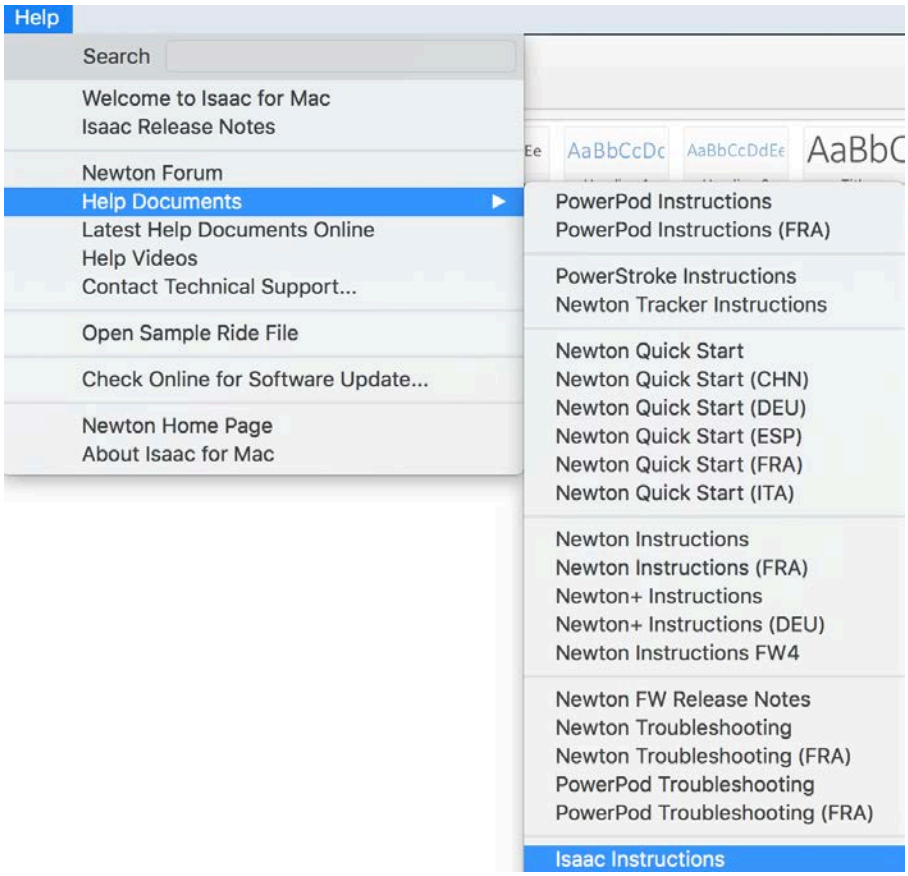
To see if your PowerPod or Newton ("Device") has the CdA key installed, connect your Device to your computer and launch Isaac. Then, go to "Device/Unlock Feature…", then click the "Get Unlock Status" button. If the key is installed on your PowerPod/Newton it will be listed as "CdA Function (TT Key)"

CdA Key is installed→



FOR MORE INFORMATION ABOUT PURCHASING THE CdA KEY, VISIT:
http://www.ibikesports.com/product/newton-cda-wind-tunnel-upgrade-key/

NOTE: FOR BEST RESULTS WE STRONGLY RECOMMEND THAT YOU FAMILIARIZE YOURSELF WITH "ISAAC INSTRUCTIONS" BEFORE READING THIS MANUAL. ISAAC INSTRUCTIONS ARE AVAILABLE THROUGH THE "HELP" MENU OF ISAAC SOFTWARE



GETTING STARTED

The PowerPod and Newton are precision measurement instruments that, when used with with a Direct Force Power Meter (DFPM) provide wind-tunnel-like measurements of CdA (aerodynamic drag) and related parameters ("Time Advantage"). **However, accurate CdA measurements can happen only *after* proper setup and calibration of your PowerPod/Newton and Direct Force Power Meter!**

BEFORE STARTING CDA TESTING, PLEASE READ AND CAREFULLY FOLLOW THE INSTRUCTIONS IN THIS MANUAL.

IMPORTANT: Make sure you review the operating manual of your Direct Force Power Meter (DFPM), **and make sure your DFPM is properly temperature acclimated and "calibrated/zeroed", prior to beginning CdA measurements**.

NOTE: "ONE-LEG" POWER METERS SUCH AS STAGES ARE NOT RECOMMENDED FOR CDA TESTING.

CdA measurements are best when:

1) Device setup and calibration is performed properly (!)
2) (Newton only) Cal Wind is performed before the testing, *after* the Newton is acclimated to outdoor temperature (ride 10 minutes to stabilize all electronics)
3) You're doing a solo ride (not in a pack)
4) The pavement type is the same as that used in the calibration ride
5) Outdoor winds are calm
6) You are not testing in cross-winds
7) You make repeated measurements, over the same roads, on the same day, of at least 3 minutes per measurement run
8) Temperature is reasonably constant during testing
9) Bike is working properly (i.e. brakes aren't rubbing on the wheels, tires are inflated properly)
10) Your DFPM is calibrated properly and working properly

CdA measurements aren't accurate when:

1) You're drafting/riding in a pack
2) You are riding in strong winds
3) You've have not performed Device setup and calibrations
4) You have not cycled for at least 10 minutes prior to starting CdA testing
5) Your DFPM is not calibrated, or is a "one-leg" DFPM (Stages, etc.)
6) (Newton only) you do not perform Cal Wind properly before the ride
7) Road conditions are significantly different from your calibration ride (e.g. you calibrated on asphalt but you're doing your tests on chip-seal)
8) You are riding at speeds less than 15 mph
9) Your bike's condition has changed significantly (e.g. tire pressure is low)
10) You're riding indoors, where Newton/PowerPod does not measure opposing forces

EQUIPMENT REQUIREMENTS

To do CdA testing you will need ALL of the following**:**

1) PowerPod or Newton with CdA key installed
   a. To confirm that the CdA key is installed on your Device, use the Isaac command "Device/Unlock Feature/Check Unlock Status". If CdA key is installed you will see it listed in the Unlock List
2) Compatible bike computer (PowerPod only)
3) ANT+ or ANT+/BLE speed and cadence sensors
4) ANT+ or ANT/BLE Direct Force Power Meter (DFPM) (note: due to potential accuracy issues, "one-leg" power meters such as Stages and 4iii are not recommended)
5) Isaac software

NOTE: CdA aerodynamic measurements are tricky to make, especially outdoors. Please follow these instructions carefully so you will get good results!

NOTE: "ONE-LEG" POWER METERS SUCH AS STAGES ARE NOT RECOMMENDED FOR CDA TESTING.

STEP 1: SETUP POWERPOD/NEWTON PROFILE

For accurate CdA measurements, you'll need to customize your PowerPod/Newton profile for you and your bike. Do the following:

1) Connect your PowerPod or Newton (Device) to Isaac
2) Go to "Device/Setup Newton…" (NOTE: "Newton" commands work both for PowerPod *and* Newton)
3) Follow the setup screens, and enter your rider weight; rider height; weight of bike + gear; "normal" riding position, and tire type and road type.
4) **CRITICAL: on the final setup screen, click "BEST ACCURACY".** This puts your Device into "Out and Back" calibration mode. *If you accidentally click a different button (Better Accuracy" or "Keep Accuracy", simply go through the "Device/Setup Newton" wizard again)*
5) You'll get a confirmation message saying that your device's profile has been updated.

STEP 2: DFPM SETUP AND CALIBRATION

Because of the sensitivity of CdA measurements you need to do the following with your DFPM:

1) Pair your DFPM to your PowerPod/Newton Device (STEP 3, below)
2) Prior to any CdA testing, ride with your DFPM for at least 10 minutes, to make sure it is acclimated to outdoor temperature
3) Before starting your CdA measurements, confirm that your DFPM has been calibrated (zeroed) using the "Calibrate" feature of your ANT+ bike computer

STEP 3: ANT+ SENSOR PAIRING

After installing your CdA key, you will need to do a one-time sensor pairing of your Device to your ANT+ sensors, including your DFPM.

NOTE: DFPM PAIRING TO YOUR DEVICE WON'T WORK <u>UNLESS</u> THE OPTIONAL CDA KEY HAS BEEN PURCHASED AND INSTALLED.

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

STEP 4: OUT-AND-BACK CALIBRATION RIDE

Your PowerPod or Newton requires an out-and-back (O&B) calibration ride, to fine-tune its tilt and wind sensors. An O&B calibration ride MUST be done before performing any CdA measurements.

NEWTON OUT AND BACK CALIBRATION RIDE:

1) Make sure you have completed STEP 1 above to set your Newton to "Best Accuracy". Best Accuracy enables the out-and-back calibration ride.
2) After selecting the "Best Accuracy" button in ISAAC, the center window of the Newton will start to flash "do Cal", indicating that your Newton is now configured for an out-and-back calibration ride (Cal Ride).
3) Pick a quiet, low-traffic place to do a *solo* (no drafting allowed) Cal Ride. The road can be flat or hilly; it makes no difference.
4) Make sure your DFPM is operating and that it has been calibrated properly
5) Attach your Newton to its mount, then click any button to wake up the Newton. Speed is shown in the top window. You'll see "----W" and "do Cal" alternate in the center window, indicating that your Newton is set for a Cal Ride.

6) ***Start riding***. IMPORTANT: DURING YOUR CAL RIDE, STAY IN YOUR "NORMAL" RIDE POSITION YOU USE MOST OFTEN (FOR EXAMPLE, "HOODS" POSITION ON YOUR ROAD BIKE, OR "TIME TRIAL" POSITION ON YOUR TT BIKE).
7) After 8 seconds of riding the Newton screen changes. "Cal" appears in the middle window, and "Start" flashes in the bottom window.

8) If you want to keep riding and start your Cal Ride at a different place from your current location, that's OK! Just keep riding to your desired starting point; while you ride to it the "Cal Start" message will continue to flash.
9) When you are ready to begin the Cal Ride, **click the center button** to start the Cal Ride. Remember: DURING YOUR CALIBRATION RIDE, STAY IN THE RIDE POSITION YOU USE MOST OFTEN (FOR EXAMPLE "HOODS" ON YOUR ROAD BIKE, OR "TIME TRIAL" ON YOUR TT BIKE)
10) The top window shows bike speed, the center window alternates between "Cal" and distance traveled, and the progress bar fills as you ride.

11) During the Cal Ride you can bike at a leisurely pace, and it's OK to stop if needed. Your Cal Ride will be unaffected.
12) **Ride for five minutes, until *"go bac(k), turn 180 degrees"* flashes**.

13) If you still need to keep riding a bit farther to get to a place where you can turn around safely, it's OK.
14) When safe, ***slow to a STOP, then turn around*.**
15) Ride back to the starting point, **along the same route** as the "Out" portion of your ride.
16) The progress bar empties as you ride back. **Keep riding until the progress bar is completely empty, *and* "Cal Done" flashes.**
17) **Once the Cal Ride is completed, your Newton returns to its normal screens, and your Newton is calibrated.**

NOTICE: AFTER BEGINNING YOUR CAL RIDE, IF YOU WISH TO TERMINATE (ABORT) IT, PRESS-HOLD THE CENTER BUTTON FOR TWO SECONDS. THIS ABORTS THE CAL RIDE AND LEAVES ANY PRIOR RESULTS UNCHANGED.

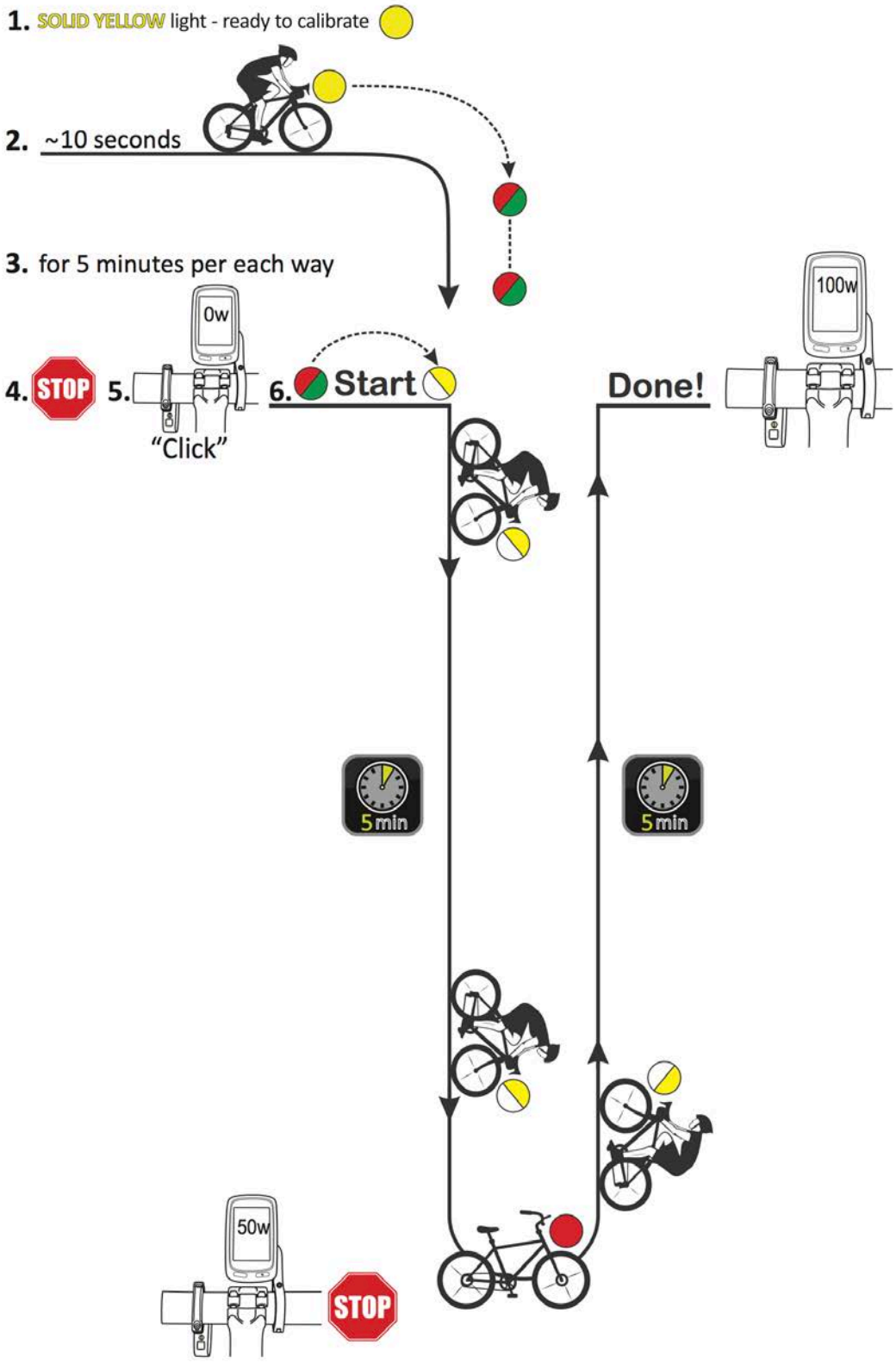
POWERPOD (PP) OUT AND BACK CALIBRATION RIDE

1) Make sure you have completed STEP 1 above to set your PowerPod to "Best Accuracy". Best Accuracy enables the out-and-back calibration ride.
2) Pick a quiet, low-traffic place to do a *solo* (no drafting allowed) Cal Ride. The road can be flat or hilly; it makes no difference.
3) Make sure your DFPM is operating and that it has been calibrated properly
4) Attach PP to your bike, **making sure that PP cannot rotate after its mount screw is tightened** (see PowerPod illustrated instructions for details).
5) Wake up your sensors and your PP. The PP light shows solid yellow.
6) With the status light showing solid yellow, start riding your bike. *After 10 seconds of riding*, the light changes to flashing red/green, indicating that the PP is now "armed" and to begin the out-and-back (O&B) calibration measurements.
7) Ride your bike to the place you've selected to start your O&B ride. *PowerPod status light will flash between red and green while you ride to your starting point*.
8) When you've reached starting point of your O&B ride, confirm that the PP light is flashing red/green.
9) To start O&B calibration measurements, click the PowerPod button. **The light will change from flashing red/green to flashing yellow**.
10) Now, ride your bike five minutes for the "out" portion of your ride. While riding the light will continue to flash yellow and your bike computer **watts will start to climb slowly, from 1 to 50**. The power number indicates the % completion of the calibration ride (i.e. 25W means the O&B ride is 25% complete)
11) Your bike speed during the O&B ride is not important, but DO NOT DRAFT BEHIND OTHER CYCLISTS OR CARS.
12) **After riding five minutes (the end of the "out" portion/half-way-complete/50% completion point of the ride), the status light will change to solid red, and watts will no longer increase, but will "stick" at 50W**.
13) **When it is safe, *SLOW TO A COMPLETE STOP***. *It's OK if you have to continue to ride a while with the watts stuck at "50", before you find a safe place to stop and turn around*.
14) After coming to a complete stop, get off your bike, and cross the road, turn around, and then ride back along the same route to the starting point.
15) On the "back" portion of your ride the status light will change from solid red to flashing yellow and your watts will slowly climb to 100W.
16) Ride back to the starting point of your ride. You can ride fast or slow and stop if needed, it makes no difference. The watts will slowly climb from 51W to 100W (51% to 100% complete).
17) Near your starting point the O&B you will see "100W" (100% complete) on your bike computer. **The flashing yellow light will go out**. Your PowerPod is now calibrated and, after a few seconds, actual watts will appear on your bike computer screen.

SEE NEXT PAGE FOR A PICTORIAL DESCRIPTION OF POWER POD CALIBRATION

NOTICE: AFTER BEGINNING YOUR CAL RIDE, IF YOU WISH TO TERMINATE (ABORT) IT, PRESS-HOLD THE POWERPOD BUTTON UNTIL THE STATUS LIGHT GOES TO SOLID YELLOW. THIS ABORTS THE CAL RIDE AND LEAVES ANY PRIOR RESULTS UNCHANGED.

PowerPod Out-and-Back Ride

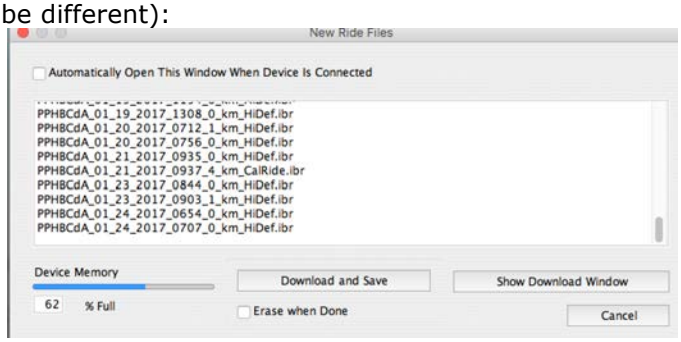


STEP 4: CALCULATE "NORMAL" CDA

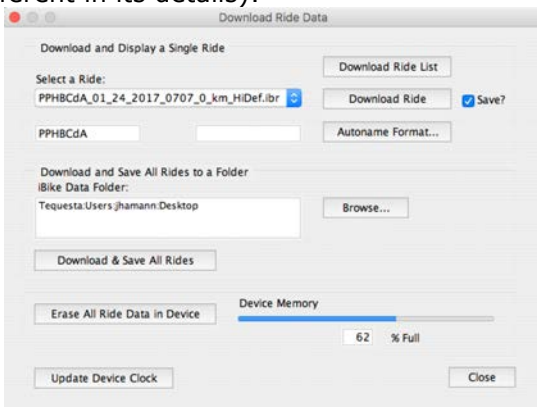
After completing your Calibration Ride (STEP 3) the opposing force (PowerPod/Newton) and applied force (DFPM) data from your calibration ride is stored in your PowerPod/Newton ride file.

Your cal-ride data will be used to determine your "Normal" CdA (that is, your CdA measured from the "normal" ride position you used during your out-and-back ride).

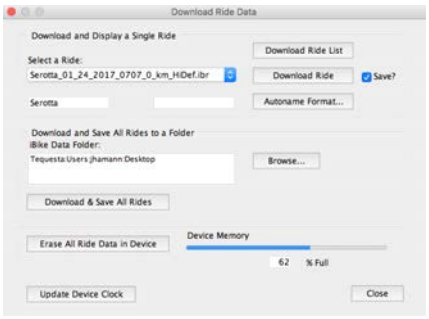
1. Attach your Device (PowerPod or Newton) to Isaac
2. Click on the Download Ride Data button  or use the Isaac command "Device/Download Ride Data…" A window similar to this will appear (your ride file content will be different):



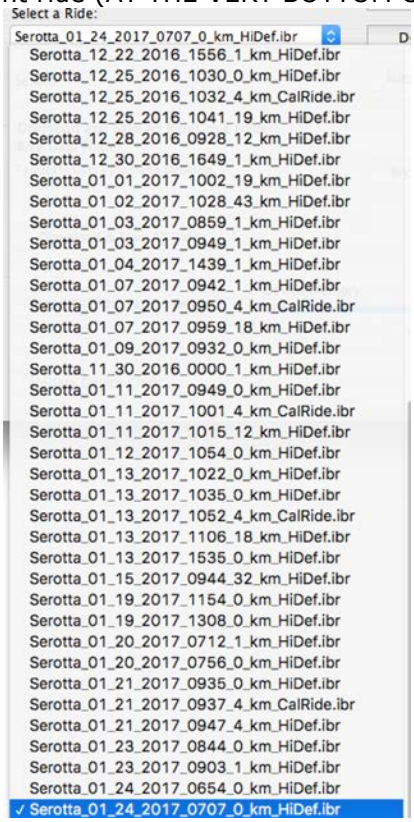
3. Click the "Show Download Window" button. A new window will appear (your window will look different in its details):



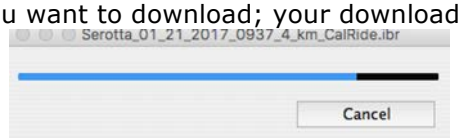
4. In the box to the far left of the "Autoname Format…", type the name you'd like to give to your ride file (in this example, "Serotta"). Notice that the name of the ride file in the dropdown menu changes to what you have typed:



5. Now, click on the "Select a Ride" Dropdown menu bar. A complete list of your ride files stored in your Device appears, with a check mark and blue highlight placed next to your most recent ride (AT THE VERY BOTTOM OF THE LIST):

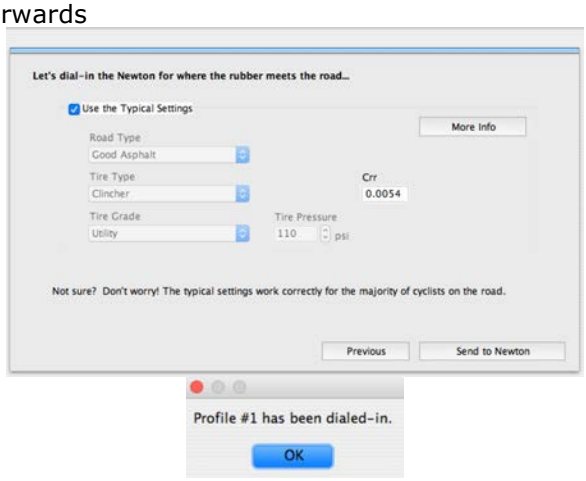


6. LOOK FOR RIDE FILES THAT END IN "CalRide.ibr". These files are your out-and-back cal rides. Your most recent cal ride will be located closest to the bottom of the list, ("Serotta_01_27_2017_0937_4km_CalRide.ibr" in the list above)
7. Click on the cal ride you want to download; your download will commence



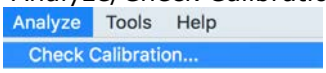
8. After your download finishes, a profile wizard will pop-up, allowing you to fine tune your settings in a series of windows. As you click through the screens you'll see the same entries as you made when you performed STEP 1

9. On the last window, make sure to click the "Send to Newton"; a confirming message will be sent afterwards

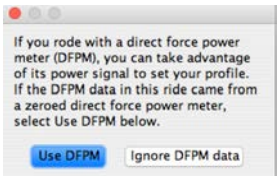


10. Your cal ride data will now appear in the main window of Isaac

11. Now, we will determine the "normal" value of CdA as measured during your Cal Ride, using the command "Analyze/Check Calibration…"

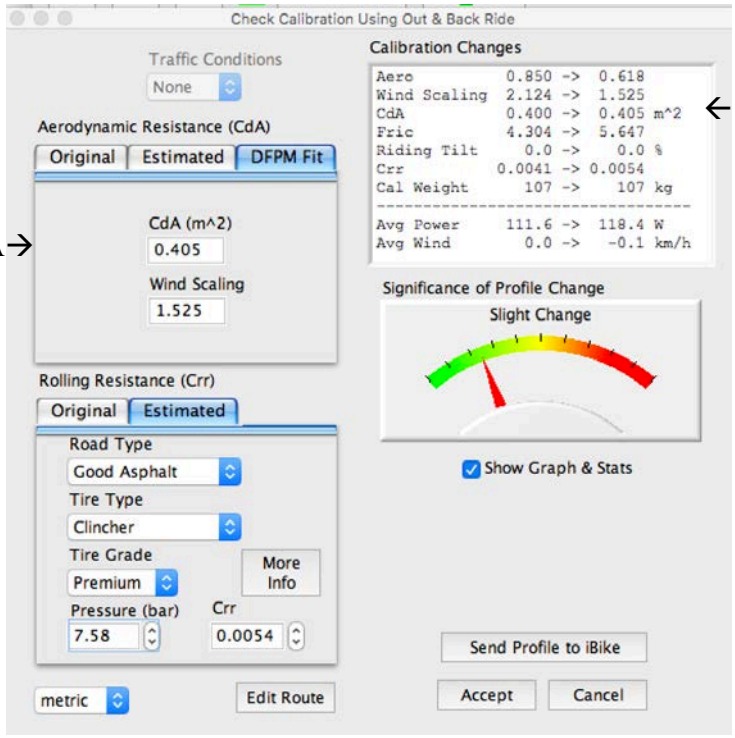


12. A pop-up window appears, asking you if you want to use DFPM data. Click the "Use DFPM" button



13. Isaac will now perform calculations in the background, determining the best fit CdA value between your DFPM data and PowerPod/Newton data. You will see "Before" and "after" values in the "Calibration Changes" table. The CdA in the right column is your measured CdA:

Measured CdA→



← measured CdA is on right

14. Click the "Send Profile to iBike" button to load your best-fit profile into your PowerPod/Newton

You are now ready to start CdA measurements!

How CdA measurements work

The governing principle behind CdA measurement that the force you apply to the pedals is equaled by the forces opposing the bike's forward motion (Newton's Third Law).

Your PowerPod (or Newton) measures opposing forces: opposing gravity (hills), opposing acceleration (inertia), opposing wind, and opposing friction. These opposing forces slow down the bike, requiring you to apply force at the pedal to keep the bike moving. The forces applied by you *precisely* equals the opposing forces (Newton's 3rd law), moment-by moment.

For CdA aerodynamic measurements, applied *and* opposing forces must both be known. Why? When applied *and* opposing forces are measured *simultaneously,* then CdA drag coefficient calculations can be made in a straightforward manner.

In conjunction with a DFPM, your PowerPod or Newton measures CdA continuously during your bike ride. Newton reports Continuous CdA™ numbers on its display; after the ride, both PowerPod and Newton ride files allow you to see CdA information in Isaac.

NEWTON Continuous CdA™ and Time Advantage measurements

Continuous CdA™. By comparing opposing force data (measured by your Newton or PowerPod) and your DFPM force data, Newton computes and displays CdA information in real time, while you are pedaling.

Time Advantage™. When you're positioned more aerodynamically (as compared with your "normal" ride position), for the same amount of power you will go faster. Time Advantage computes how much time you've gained (or lost) due to changes in "normal" ride position. Newton displays cumulative Time Advantage on its screen

After the ride, CdA and Time Advantage data from PowerPod and Newton can be accessed in Isaac

POWERPOD Continuous CdA and Time Advantage measurements

Using PowerPod, in the same manner as described for Newton, you will perform your CdA tests "in the field". During your testing PowerPod records both your applied forces (from the DFPM) and your opposing forces (from the PowerPod) in the PowerPod ride file.

After the ride, Isaac software provides post-ride measurement and analysis of Continuous CdA and Time Advantage. You will download your PowerPod file to Isaac, then use the Isaac command "Tools/CdA Analysis…" to display your CdA and Time Advantage data.

Note that, when riding PowerPod, CdA data cannot be shown on your ANT or BLE bike computer screen.

MEASURING CONTINUOUS CDA WITH POWERPOD/NEWTON AND DFPM

Before proceeding with CdA measurements, make sure you've performed Steps 1 through 4 of these instructions. If these four steps are not done properly, then your CdA measurements won't be accurate.

Also, before beginning actual CdA measurement testing, ride at least 8 minutes, so that your PowerPod/Newton and DFPM both acclimate to outdoor riding conditions.

Here is the recommended test procedure for CdA testing:

1) Find a spot with calm winds, very light traffic, and where the road surface is like the one where you did your out-and-back calibration ride.
2) Ideally, you'll want a flat course with good pavement and very light traffic. If you can find a loop that is ideal, because wind effects will be minimized.
3) NEWTON ONLY: Select the power window on your Newton screen
    a. Press-hold the center button of your Newton (to enter Setup). When in setup, click the up arrow repeatedly until you find "CdA off" (it might say "CdA On"). Click the center button; the bottom window flashes. Click the up arrow until "on" flashes. Then, click the center button to accept; "done" flashes. Press-hold the up arrow to exit Setup.
4) Ride your bike for at least 8 minutes to allow your PowerPod/Newton and DFPM to acclimate.
5) Now, start your CdA testing: hold the same riding position for about 3 minutes. This allows lots of data to be gathered. NEWTON ONLY: you'll see CdA and Time Advantage data "rotate" on the bottom window of your power screen.
6) After you've gathered your CdA data for your testing parameters, try experimenting with different ride positions, different gear, etc. Ride for at least 3 minutes for each test, and do NOT remove your PowerPod or Newton between measurements. NEWTON ONLY: you can mark each test with the Lap marker (press-hold left arrow)
7) We suggest you write down your testing configurations
8) During testing on Newton ONLY: CdA measurements are displayed "live" on the main power screen, with two significant digits.

NOTE: DURING CdA MEASUREMENTS YOU CANNOT APPLY BRAKES, TURN SHARP CORNERS, OR BE BUFFETED BY WIND GUSTS (cars, other cyclists, etc.). IF ANY OF THESE HAPPEN YOUR CdA MEASUREMENTS WILL BE INACCURATE.

NOTE: WE DO NOT RECOMMEND USING "ONE-LEG" DIRECT FORCE POWER METERS FOR CDA MEASUREMENTS, BECAUSE ONE-LEG POWER METERS DO NOT MEASURE THE CYCLIST POWER PRODUCED BY BOTH LEGS.

TIME ADVANTAGE

Time Advantage™ is another feature, related to CdA measurement, that is exclusive to the PowerPod/Newton/DFPM combination.

What is Time Advantage?

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

DEFINITION: YOUR "NORMAL RIDING POSITION" IS THE POSITION YOU MEASURED WHEN PERFORMING THE OUT AND BACK CALIBRATION RIDE WITH YOUR DFPM.

As long as you stay in your normal riding position, the total 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, by 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 your PowerPod or Newton. 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), DUE TO DEVIATIONS FROM YOUR NORMAL RIDE POSITION.

Time advantage is measured in seconds. Suppose you look at your Newton at mile 6.2 of your ride and Time Advantage reads a positive 30. This means that, at mile 6.2 of your ride, you have *gained* 30 seconds of time, *relative to your "normal" riding time*, because of moment-to-moment improvements of your normal riding position. Alternative if, instead, your Time Advantage reads -15, the way you have changed ride positions means that you've *lost* fifteen seconds compared to staying in your normal riding position.

How are Continuous CdA and Time Advantage related?

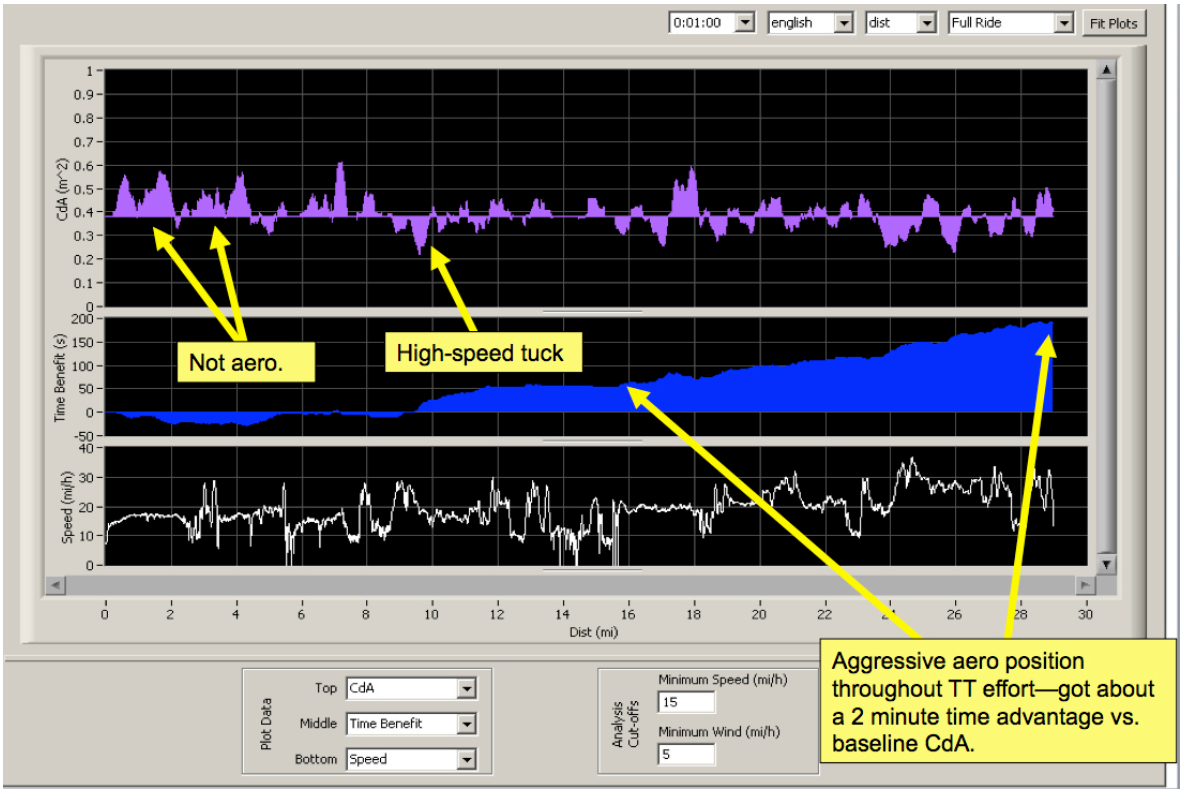
If your current value CdA is higher than your baseline CdA then you are relatively less aerodynamically efficient compared to your normal riding position and, for the same amount of applied force, you won't go as fast. Conversely, if your current CdA is lower than your normal value then you are MORE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

Time Advantage compares your Continuous CdA to your baseline, "normal" CdA, moment-by-moment. Using the comparative CdA values between your baseline CdA and your Continuous CdA, the Newton (or PowerPod, using Isaac) computes the cumulative amount of time you gain or lose, moment-by-moment, due to deviations from your baseline CdA.

The Newton display reports the net time effect of better-and-worse ride positions and displays the *cumulative* Time Advantage number in the bottom window of your Newton (the bottom window alternates automatically between cadence, HR, Continuous CdA, and Time Advantage). Note that with PowerPod you cannot see Time Advantage statistics during your ride. With PowerPod CdA and Time Advantage reports are available only after riding, when you download your ride to Isaac.

Graphical Example

Here is a graphical depiction of an actual PowerPod/Newton ride with a DFPM, using the "Tools/CdA Analysis…" feature of Isaac



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 "normal" CdA value as determined by the O&B calibration ride done previously with the DFPM.**

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 (becoming more "aero") and his 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 Newton does not record changes in Time Advantage when bike speed is below 15 mph or when net opposing wind speed is below 5 mph (caused typically by tailwinds). In this example, 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 Newton 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 more "aero" 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 (3 minutes, 20 seconds) SOONER than he would have had he ridden in his normal riding position for the entire ride!**

Using a PowerPod or Newton gives this rider feedback about the quality of his riding position (Continuous CdA), AND quantifies the Time Advantage of his aerodynamic improvements.

USING CONTINUOUS CDA AND TIME ADVANTAGE ON POWERPOD OR NEWTON

Once you've set up your PowerPod/Newton and DFPM you can ride as usual:

1) For Newton, all traditional functions, measurements, and screens of the Newton are unchanged.
2) PowerPod functionality is unchanged. During your riding PowerPod will record both DFPM and PowerPod data, for download and analysis after the ride, using Isaac.
3) On Newton, to enable on-screen CdA display, go to "Setup/CdA off". Press the center button, click the up arrow to set CdA "On", and click to accept.
4) With CdA "On", the bottom window of your Power Screen will alternate between cadence, heart rate, Continuous CdA, and Time Advantage.
5) When viewing the Power Screen, the power number displayed in the middle window is the power reported by the DFPM.
6) When bike speed is less than 15 mph Continuous CdA displayed on Newton 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 on Newton.
8) To reset Time Advantage to zero, perform a Trip Reset.
9) Ride files downloaded to Isaac will contain both Newton/PowerPod and DFPM information.

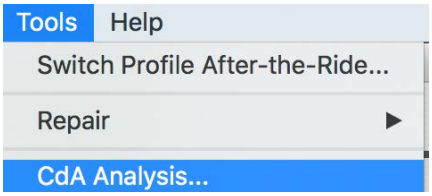
Other important things to remember:

1) Continuous CdA and Time Advantage measurements are accurate only when riding solo; these measurements won't be accurate when riding in a pack.
2) 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.
3) For maximum accuracy, you MUST be sure to let your Newton acclimate to outdoor temperature AND to perform a wind offset calibration prior to each ride.
4) Make sure to calibrate (zero-offset) your DFPM prior to your ride.
5) Remember: the accuracy of the PowerPod/Newton/DFPM combination is highly dependent upon proper setup, calibration, and use.

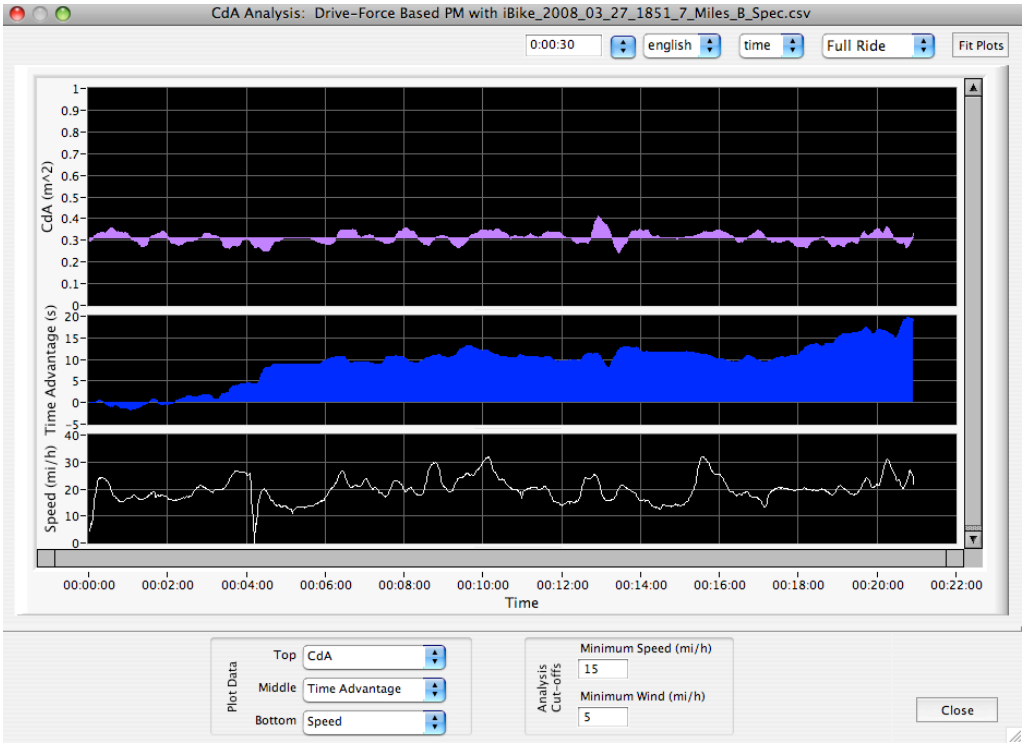
NOTE: CDA DATA IS GATHERED ON EVERY RIDE WHERE YOU USE A POWERPOD/NEWTON AND DFPM. REMEMBER, THOUGH, THAT CDA MEASUREMENTS WON'T BE AS RELIABLE WHEN YOU'RE NOT DOING CAREFUL TESTING.

USING ISAAC SOFTWARE TO ANALYZE CDA DATA

Once you've finished your on-the-road CdA testing, you can download your PowerPod/Newton ride file, and use the "Tools/CdA Analysis…" command to view and analyze your CdA data:



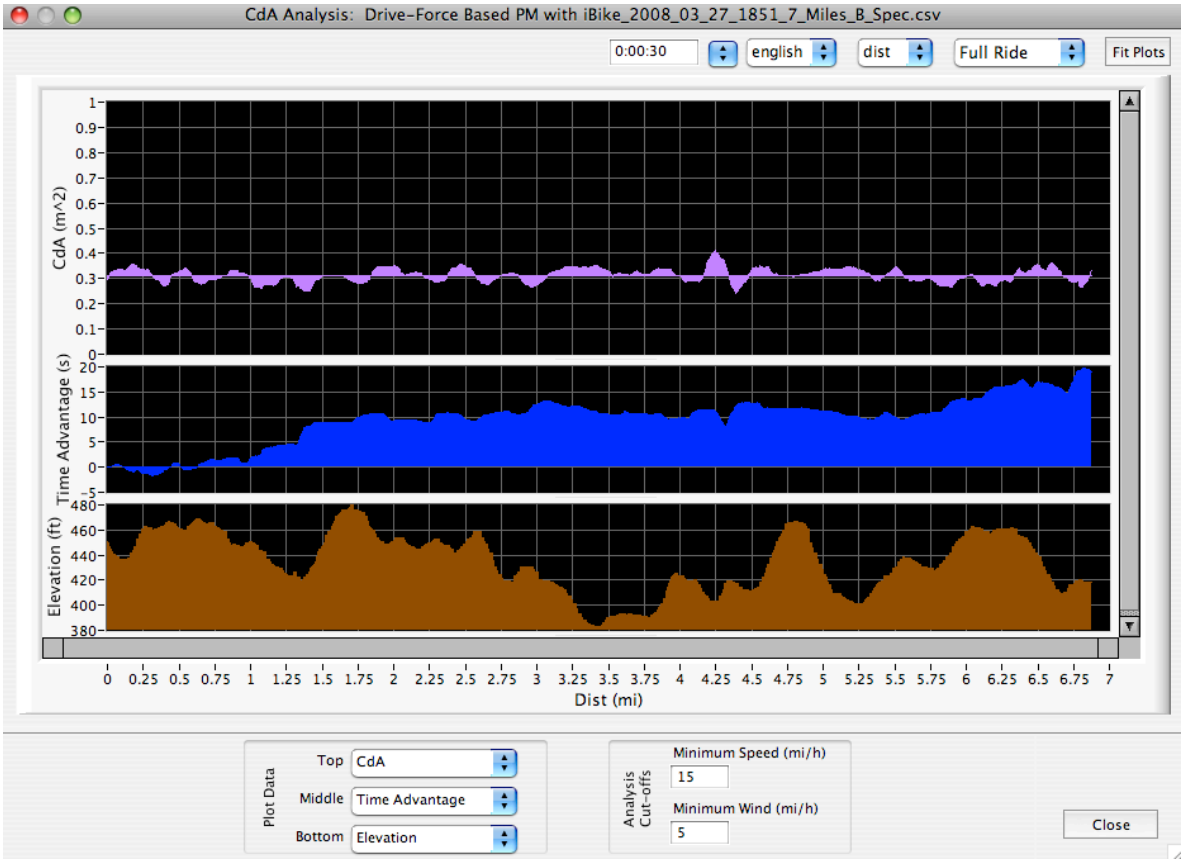
A window like this will appear:



Here you can see your CdA vs time (or distance, by changing the top right menu item); Time Advantage, and Speed. The parameters plotted can be selected in the window below the graphs.

NOTE: THE CdA and Time Advantage vs. time graph numbers in the graph are correspond to the numbers displayed on a Newton 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.

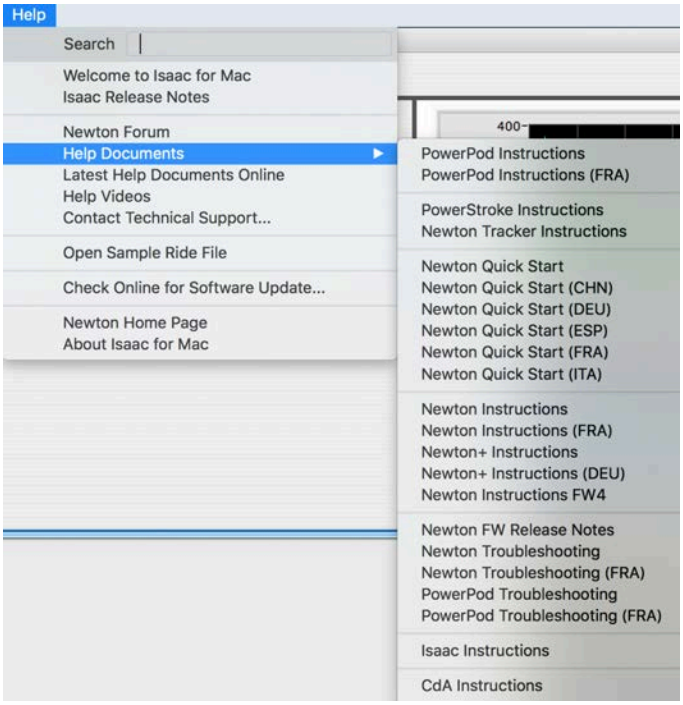
POWER METER COMPARISON

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

Newton power is shown in white, and DFPM power is shown in green.

HELP: WHERE TO FIND IT

The Help menu of Isaac software includes a complete list of documentation for PowerPod, Newton, and Isaac:



Select the document to view the corresponding information.

VELOCOMP POWER METER FORUM

There are tens of thousands of Velocomp power meter owners; here's a great place to meet many of them, to get your questions answered, and to contribute your insights to others:

http://www.ibikeforum.com

TECHNICAL SUPPORT

If you have questions that are addressed by the Help documents and links, please email us at:

technicalsupport@velocomp.com

We will get back to you quickly.