

Fit File Repair Tool

Merging a Bike Computer and Zwift activity file

Initial situation:

I have two files – one recorded with my bike computer (paired with my smart trainer), the other file recorded with Zwift (or any other trainer software!) running on my PC.

Merging the two files is a challenge because timestamps are similar but not equal.

Why are timestamps in both files not equal?

- The bike computer's internal watch might be wrong because it didn't have a GPS link before you started the recording of your indoor trainer session
- The watch built in the (smart) trainer might be wrong because it has to be set manually
- The computer (running Zwift etc) might have a wrong time

I use a Garmin Edge 830 as bike computer and Zwift (running on a PC) as training platform. Even if my Edge 830 had a GPS link some hours before I started my trainer session and my PC is connected to the internet, I normally have a shift of 5 to 10 seconds between the two files that my devices record.

Motivation and Approach

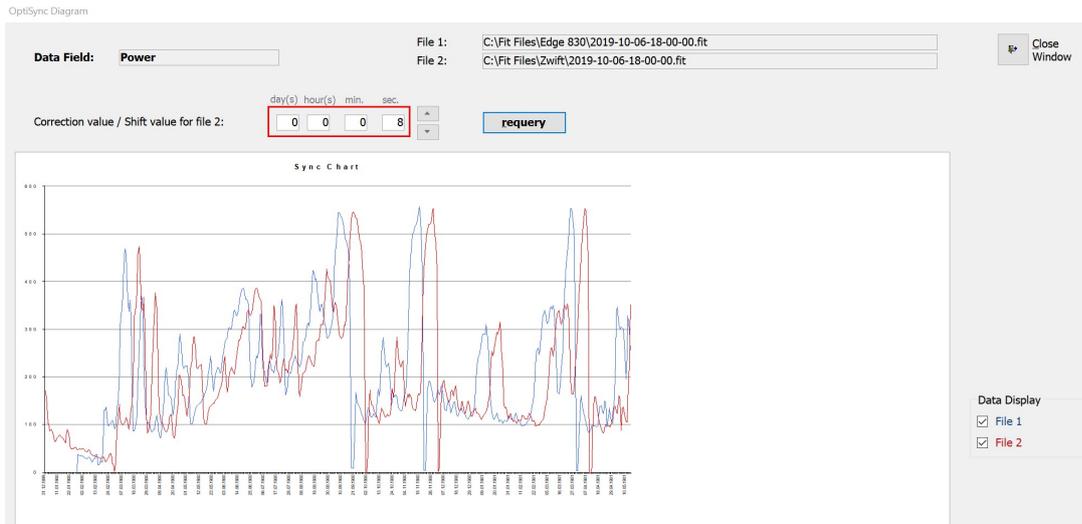
Why do I want to merge data of both files?

Because my Edge 830 calculates and stores Training Effect, Training Load etc which helps me to calculate my weekly training load. But my Edge 830's fit file contains no GPS position data, elevation and not the distance values which Zwift calculates etc.

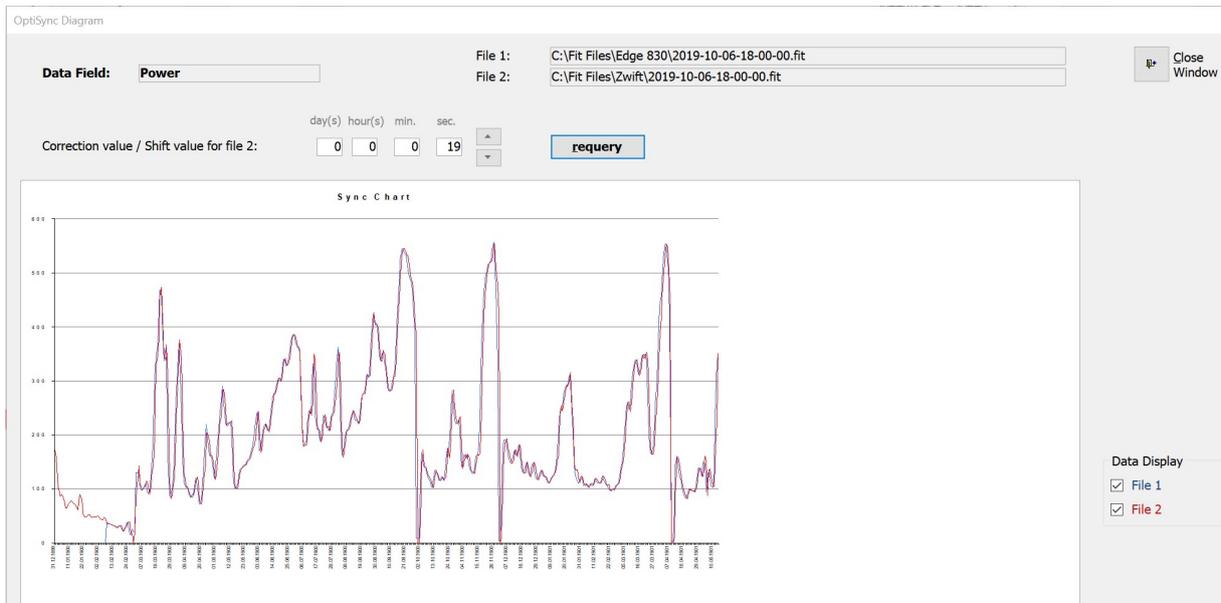
Having the Fit File Repair Tool I thought it would be easy to combine the "best of both worlds" by merging the bike computer's fit file and the Zwift fit file. But I noticed how hard it is to synchronise the merge because the timestamps are not equal.

Therefore I invested a lot of time during the last weeks to develop a technique to synchronize two activity files using a data field which both files contain and which has the same contents. Heart Rate, Cadence and Power are the data fields I chose because these are the values a bike computer (connected to a smart trainer via ANT+ or bluetooth) can record and which are contained in Zwift files as well. In these cases my algorithm compares the graphs and moves the second graph over the first one until it matches perfectly.

Original situation without time shift:



My algorithm shifts the second graph until a good match is reached:



In this case the calculated time shift value is 19 seconds.

I named my algorithm "OptiSync" and implemented it in Fit File Repair Tool.

File 1: Bike computer file

In this documentation the bike computer recording consists of a **fit** file. But the file can be in **tcx/hrm/xml** format as well.

The bike computer file contains Heart Rate, Cadence, Power (which I want to keep) but:

- no GPS position data and
- “real world” distance values (0-25 km) which I want to replace by values calculated by Zwift
- “real word” speed values which I also want to replace by values calculated by Zwift

The screenshot shows the 'Fit File Repair Tool' interface. At the top, there are buttons for 'Import and repair file', 'Export file', and 'Upload file'. The main area contains a data table with the following columns: Timestamp, Duration, Position Lat., Position Long., Altitude (m), Distance (km), Dist. GPS (km), Heart Rate, Cadence, Speed (km/h), Power (Watts), Temp. (°C), LAP, Error, and Select. The table displays 37 rows of cycling data starting from 06.10.2019 17:49:23. Below the table, there is a 'Min./Max./Avg. values' section and a 'quick select' menu.

Timestamp	Duration	Position Lat.	Position Long.	Altitude (m)	Distance (km)	Dist. GPS (km)	Heart Rate	Cadence	Speed (km/h)	Power (Watts)	Temp. (°C)	LAP	Error	Select
06.10.2019 17:49:23	00:00:00				0,00		62				18,0	1		<input type="checkbox"/>
06.10.2019 17:49:24	00:00:01				0,00		62				18,0	1		<input type="checkbox"/>
06.10.2019 17:49:26	00:00:03				0,00		63				18,0	1		<input type="checkbox"/>
06.10.2019 17:49:27	00:00:04				0,00		64				18,0	1		<input type="checkbox"/>
06.10.2019 17:49:29	00:00:06				0,00		65				18,0	1		<input type="checkbox"/>
06.10.2019 17:49:30	00:00:07				0,00		66				18,0	1		<input type="checkbox"/>
06.10.2019 17:49:31	00:00:08				0,00		67				18,0	1		<input type="checkbox"/>
06.10.2019 17:49:32	00:00:09				0,00		68				18,0	1		<input type="checkbox"/>
06.10.2019 17:49:33	00:00:10				0,00		69				18,0	1		<input type="checkbox"/>
06.10.2019 17:49:35	00:00:12				0,00		70				18,0	1		<input type="checkbox"/>
06.10.2019 17:49:39	00:00:16				0,00		69				18,0	1		<input type="checkbox"/>
06.10.2019 17:49:42	00:00:19				0,00		70				18,0	1		<input type="checkbox"/>
06.10.2019 17:49:45	00:00:22				0,00		71				18,0	1		<input type="checkbox"/>
06.10.2019 17:49:47	00:00:24				0,00		72				18,0	1		<input type="checkbox"/>
06.10.2019 17:49:50	00:00:27				0,00		73				18,0	1		<input type="checkbox"/>
06.10.2019 17:49:53	00:00:30				0,00		74				18,0	1		<input type="checkbox"/>
06.10.2019 17:50:06	00:00:43				0,06		74	68	18,57		18,0	1		<input type="checkbox"/>
06.10.2019 17:50:07	00:00:44				0,07		74	68	18,86	0	18,0	1		<input type="checkbox"/>
06.10.2019 17:50:08	00:00:45				0,07		74	68	18,96	37	18,0	1		<input type="checkbox"/>
06.10.2019 17:50:09	00:00:46				0,08		74	68	19,25	35	18,0	1		<input type="checkbox"/>
06.10.2019 17:50:10	00:00:47				0,08		74	70	19,44	35	18,0	1		<input type="checkbox"/>
06.10.2019 17:50:11	00:00:48				0,09		74	70	19,80	34	18,0	1		<input type="checkbox"/>
06.10.2019 17:50:12	00:00:49				0,10		74	71	20,07	34	18,0	1		<input type="checkbox"/>
06.10.2019 17:50:13	00:00:50				0,10		74	73	20,56	31	18,0	1		<input type="checkbox"/>
06.10.2019 17:50:14	00:00:51				0,11		74	77	21,08	30	18,0	1		<input type="checkbox"/>
06.10.2019 17:50:15	00:00:52				0,11		73	77	21,56	28	18,0	1		<input type="checkbox"/>
06.10.2019 17:50:16	00:00:53				0,12		74	80	22,15	29	18,0	1		<input type="checkbox"/>
06.10.2019 17:50:17	00:00:54				0,13		73	80	22,51	32	18,0	1		<input type="checkbox"/>

Min./Max./Avg. values

Timestamp	Position Lat.	Position Long.	Altitude	Distance	Dist.(GPS)	Heart Rate	Cadence	Speed	Power	Temp.	Lap
Min. 06.10.2019 17:49:23				0,00		62	0	0,00	0	18	1
Max. 06.10.2019 18:52:37				25,33		154	128	49,28	686	19	1
Avg.						122	83	23,50	208	18	
Avg.+ (Avg. without breaks)						123	83	24,03	212	18	

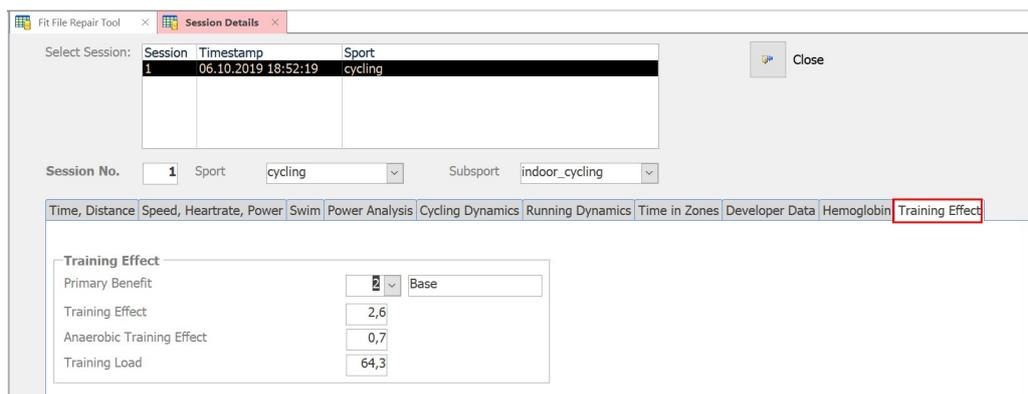
quick select

all	nothing	between	Invert selection
up to here	from here	every [n] record	

My device used the “smart recording” mode, there are some gaps at the beginning of the file which is not a problem to the syncing process:

Timestamp	Duration
06.10.2019 17:49:23	00:00:00
06.10.2019 17:49:24	00:00:01
06.10.2019 17:49:26	00:00:03
06.10.2019 17:49:27	00:00:04
06.10.2019 17:49:29	00:00:06
06.10.2019 17:49:30	00:00:07
06.10.2019 17:49:31	00:00:08
06.10.2019 17:49:32	00:00:09
06.10.2019 17:49:33	00:00:10
06.10.2019 17:49:35	00:00:12
06.10.2019 17:49:39	00:00:16
06.10.2019 17:49:42	00:00:19
06.10.2019 17:49:45	00:00:22
06.10.2019 17:49:47	00:00:24
06.10.2019 17:49:50	00:00:27

My bike computer file contains “Training Effect” data (which I want to keep) as shown on register tab “Session Details”:



File 2: Zwift file

File contains Heart Rate, Cadence, Power, GPS position data (Watopia) and “virtual reality” distance values (0-31 km).

Fit File Repair Tool

Import and repair file | Export file | Upload file | C:\Fit Files\Zwift\2019-10-06-18-00-00.fit | Speed/Pace: Speed | Settings/Information | Quit Application

Records Sessions and Laps | Event Log | Developer Data | Power | Devices, File Info | Advanced Repair Features | Indoor Activities | Data Analysis | Message Type Info | Data corruption | Data Privacy

Filter | Sort records by | Delete | Show

Timestamp	Duration	Position Lat.	Position Long.	Altitude (m)	Distance (km)	Dist. GPS (km)	Heart Rate	Cadence	Speed (km/h)	Power (Watts)	Temp. (°C)	LAP	Error	Select
06.10.2019 17:48:59	00:00:00	40,778742°N	73,966028°W	33,8	0,00	0,00	64	0	7,40	171		1		<input type="checkbox"/>
06.10.2019 17:49:00	00:00:01	40,778721°N	73,966044°W	33,8	0,00	0,00	65	55	9,92	159		1		<input type="checkbox"/>
06.10.2019 17:49:01	00:00:02	40,778699°N	73,966060°W	33,8	0,01	0,01	66	55	11,64	101		1		<input type="checkbox"/>
06.10.2019 17:49:02	00:00:03	40,778672°N	73,966076°W	33,8	0,01	0,01	66	61	12,61	101		1		<input type="checkbox"/>
06.10.2019 17:49:03	00:00:04	40,778646°N	73,966098°W	33,8	0,01	0,01	68	62	13,36	86		1		<input type="checkbox"/>
06.10.2019 17:49:04	00:00:05	40,778616°N	73,966125°W	33,8	0,02	0,02	69	65	14,07	90		1		<input type="checkbox"/>
06.10.2019 17:49:05	00:00:06	40,778589°N	73,966151°W	33,8	0,02	0,02	69	65	14,67	84		1		<input type="checkbox"/>
06.10.2019 17:49:06	00:00:07	40,778557°N	73,966178°W	33,8	0,03	0,02	70	66	15,18	78		1		<input type="checkbox"/>
06.10.2019 17:49:07	00:00:08	40,778528°N	73,966210°W	33,8	0,03	0,03	70	65	15,57	65		1		<input type="checkbox"/>
06.10.2019 17:49:08	00:00:09	40,778493°N	73,966243°W	33,8	0,04	0,03	70	66	15,88	65		1		<input type="checkbox"/>
06.10.2019 17:49:09	00:00:10	40,778463°N	73,966275°W	33,8	0,04	0,04	70	67	16,21	71		1		<input type="checkbox"/>
06.10.2019 17:49:10	00:00:11	40,778428°N	73,966312°W	33,8	0,04	0,04	69	67	16,59	75		1		<input type="checkbox"/>
06.10.2019 17:49:11	00:00:12	40,778393°N	73,966339°W	33,8	0,05	0,05	69	67	16,96	79		1		<input type="checkbox"/>
06.10.2019 17:49:12	00:00:13	40,778359°N	73,966371°W	33,8	0,05	0,05	69	67	17,33	78		1		<input type="checkbox"/>
06.10.2019 17:49:13	00:00:14	40,778326°N	73,966409°W	33,8	0,06	0,06	70	68	17,68	73		1		<input type="checkbox"/>
06.10.2019 17:49:14	00:00:15	40,778286°N	73,966441°W	33,8	0,06	0,06	70	68	17,99	71		1		<input type="checkbox"/>
06.10.2019 17:49:15	00:00:16	40,778249°N	73,966479°W	33,6	0,07	0,07	70	68	18,29	68		1		<input type="checkbox"/>
06.10.2019 17:49:16	00:00:17	40,778214°N	73,966511°W	33,6	0,07	0,07	71	68	18,59	62		1		<input type="checkbox"/>
06.10.2019 17:49:17	00:00:18	40,778174°N	73,966548°W	33,6	0,08	0,08	71	68	19,02	76		1		<input type="checkbox"/>
06.10.2019 17:49:18	00:00:19	40,778133°N	73,966586°W	33,6	0,08	0,08	72	69	19,40	90		1		<input type="checkbox"/>
06.10.2019 17:49:19	00:00:20	40,778096°N	73,966618°W	33,6	0,09	0,09	72	69	19,75	81		1		<input type="checkbox"/>
06.10.2019 17:49:20	00:00:21	40,778050°N	73,966645°W	33,6	0,10	0,09	72	68	19,93	54		1		<input type="checkbox"/>
06.10.2019 17:49:21	00:00:22	40,778007°N	73,966683°W	33,6	0,10	0,10	73	68	20,10	48		1		<input type="checkbox"/>
06.10.2019 17:49:22	00:00:23	40,777962°N	73,966715°W	33,6	0,11	0,10	73	68	20,30	49		1		<input type="checkbox"/>
06.10.2019 17:49:23	00:00:24	40,777921°N	73,966747°W	33,6	0,11	0,11	73	67	20,52	48		1		<input type="checkbox"/>
06.10.2019 17:49:24	00:00:25	40,777876°N	73,966774°W	33,6	0,12	0,12	74	67	20,74	52		1		<input type="checkbox"/>
06.10.2019 17:49:25	00:00:26	40,777825°N	73,966806°W	33,4	0,12	0,12	74	67	21,15	52		1		<input type="checkbox"/>
06.10.2019 17:49:26	00:00:27	40,777777°N	73,966838°W	33,4	0,13	0,13	74	66	21,38	47		1		<input type="checkbox"/>

Datensatz: 14 | 1 von 379 | Suchen

Min./Max./Avg. values

Timestamp	Position Lat.	Position Long.	Altitude	Distance	Dist.(GPS)	Heart Rate	Cadence	Speed	Power	Temp.	Lap
Min. 06.10.2019 17:48:59	40,763533°N	73,953304°W	4,4	0,00	0,00	64	0	0,00	0		1
Max. 06.10.2019 18:52:09	40,799631°N	73,982089°W	132,8	31,72	31,71	155	128	76,10	688		1
Avg.			36,5			122	83	30,10	207		
Avg.+ (Avg. without breaks)						122	83	30,12	207		

quick select

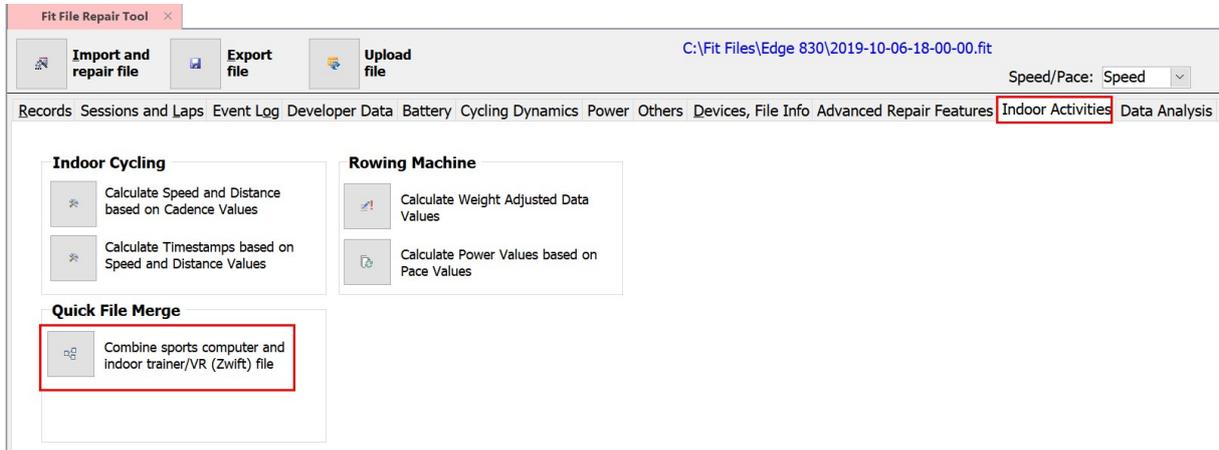
all	nothing	between	Invert selection
up to here	from here	every [n] record	

The Zwift file doesn't contain Training Effect data.

Merging both files

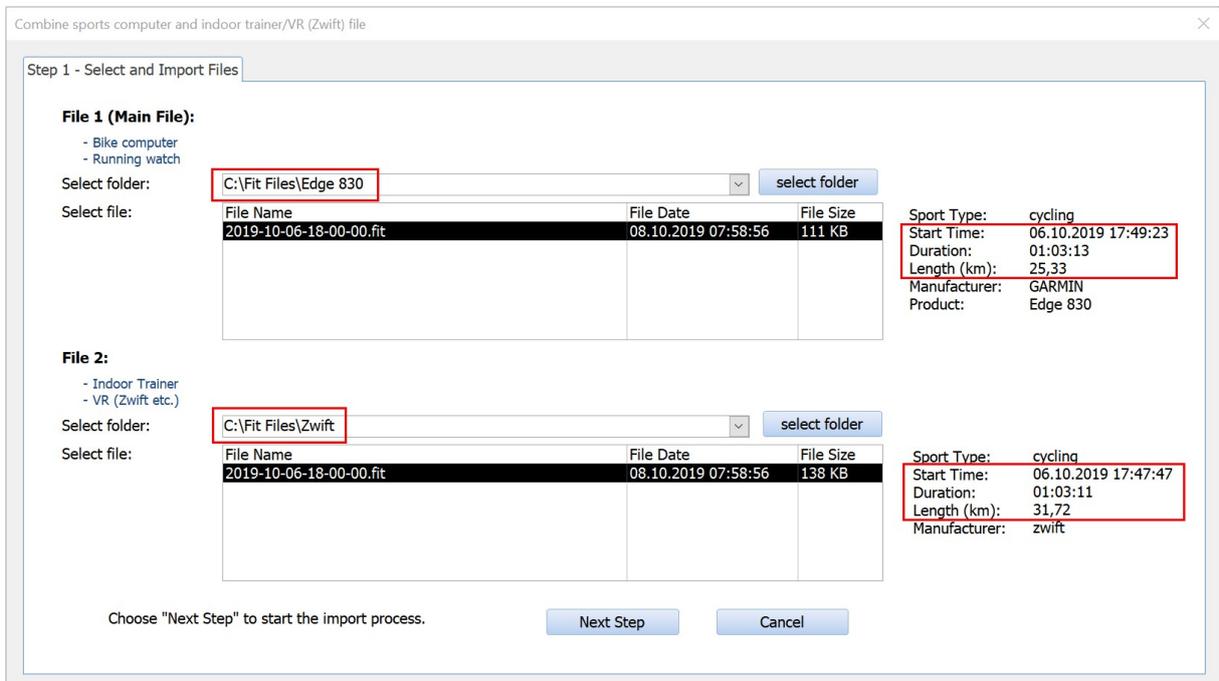
Step 1:

Call the new function “Combine sports computer and indoor trainer file”



Step 2

Select the file folder(s) which contain your two files and select the proper files:



Please verify you selected the correct files by verifying the file information that is displayed after you selected the files.

Please click on the button “Next Step” – now the two files will be imported which will take a while.

Step 3

Note the result and the initial correction / time shift value for file 2 – and the suggested data field for performing a sync with “OptiSync”. The tool analyses the contents of the data fields heart rate, cadence and power and suggests the best choice.

Combine sports computer and indoor trainer/VR (Zwift) file

Step 2 - Select Sync Options

File 1:	C:\Fit Files\Edge 830\2019-10-06-18-00-00.fit	Start Time	06.10.2019 17:49:23	Duration	01:03:14
File 2:	C:\Fit Files\Zwift\2019-10-06-18-00-00.fit		06.10.2019 17:48:59		01:03:10

Synchronization of recorded data is done via timestamps.

Correction value / Shift value for file 2: day(s) hour(s) min. sec.

Finding the correct shift value for file 2 using "OptiSync"

Suggested Field for Data Sync:

Selected Field for Data Sync:

Choose "Next Step" to define the Merge Options.

Step 4

Either use the suggested data field or choose another data field for performing the syncing process, then click on the button “Go!”.

“OptiSync” will calculate some seconds, then the found correction / shift value will be displayed:

Combine sports computer and indoor trainer/VR (Zwift) file

Step 2 - Select Sync Options

File 1:	C:\Fit Files\Edge 830\2019-10-06-18-00-00.fit	Start Time	06.10.2019 17:49:23	Duration	01:03:14
File 2:	C:\Fit Files\Zwift\2019-10-06-18-00-00.fit		06.10.2019 17:48:59		01:03:10

Synchronization of recorded data is done via timestamps.

Correction value / Shift value for file 2: day(s) hour(s) min. sec.

Finding the correct shift value for file 2 using "OptiSync"

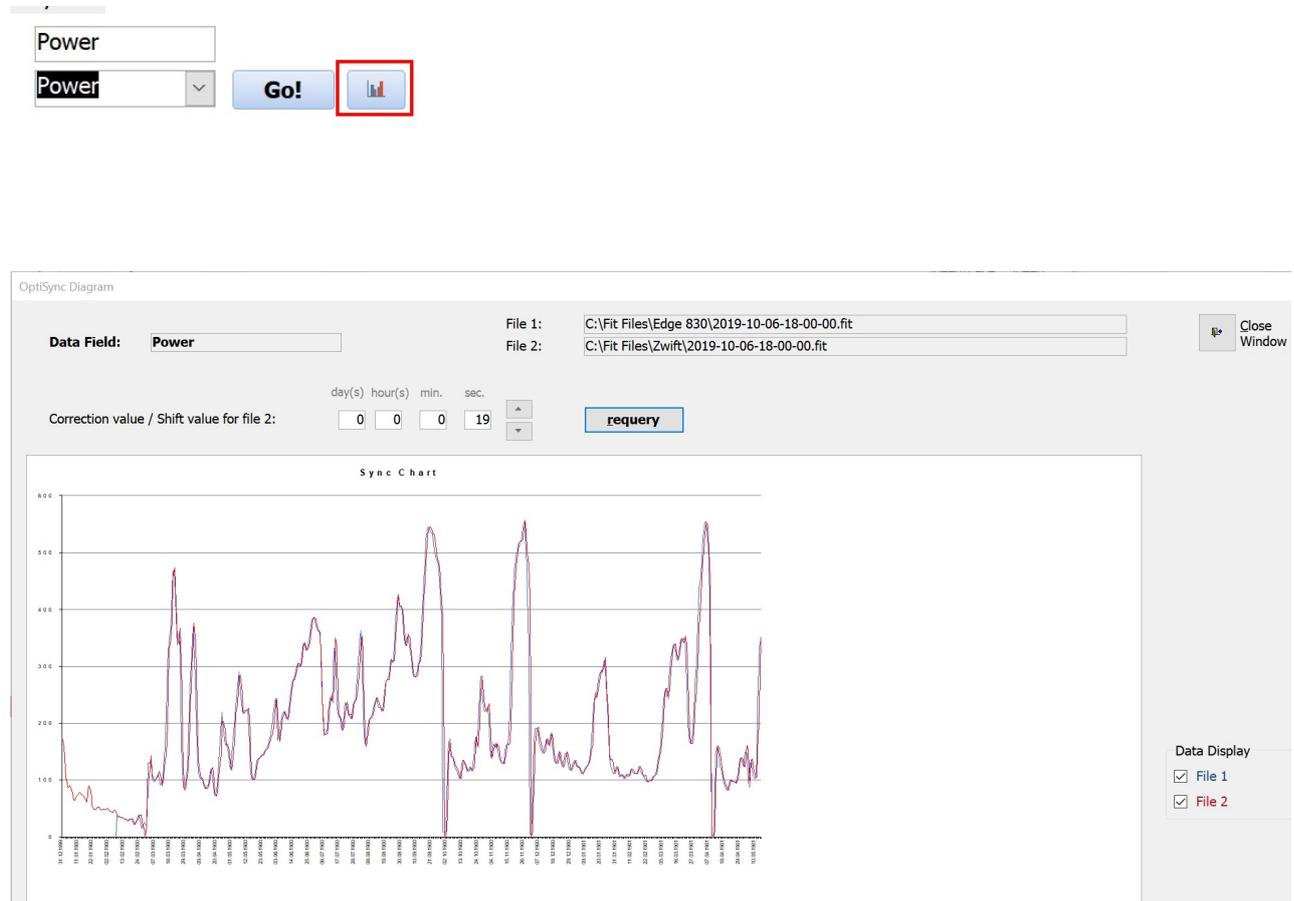
Suggested Field for Data Sync:

Selected Field for Data Sync:

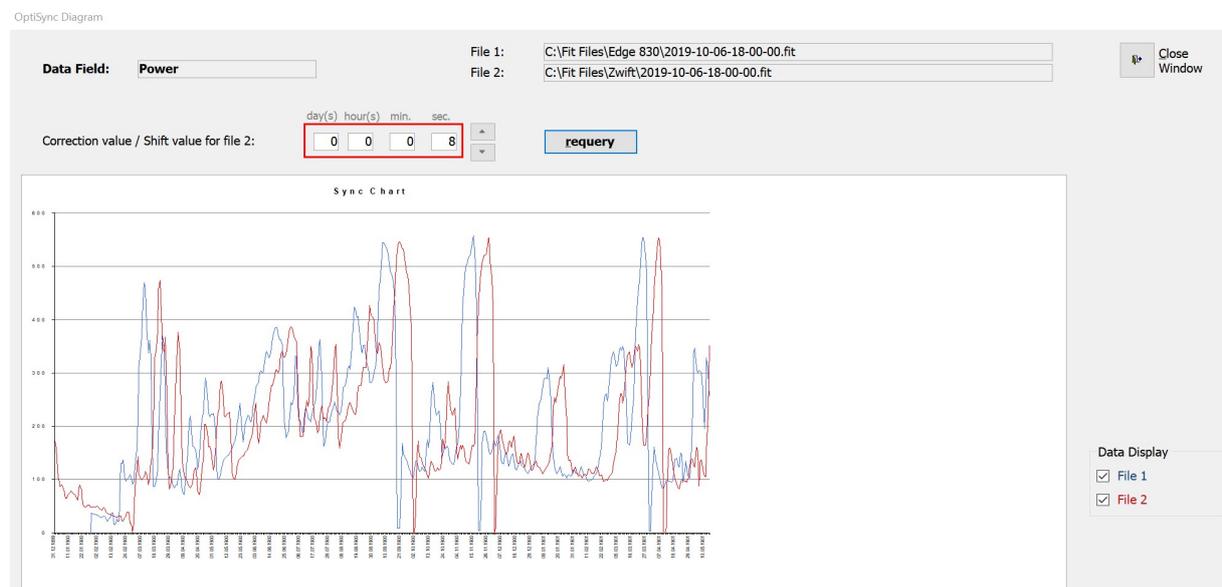
Choose "Next Step" to define the Merge Options.

Step 5

OptiSync diagram: After a successful execution of “OptiSync” you can display a diagram which shows data of the selected field and applies the calculated correction value for file 2:



You can manually change the correction / shift value and will see the difference when you requery the graph:



Step 6

Please close the diagram window and click on "Next Step".

Combine sports computer and indoor trainer/VR (Zwift) file

Step 2 - Select Sync Options

File 1:	C:\Fit Files\Edge 830\2019-10-06-18-00-00.fit	Start Time	06.10.2019 17:49:23	Duration	01:03:14
File 2:	C:\Fit Files\Zwift\2019-10-06-18-00-00.fit		06.10.2019 17:48:59		01:03:10

Synchronization of recorded data is done via timestamps.

Correction value / Shift value for file 2: day(s) hour(s) min. sec.

Finding the correct shift value for file 2 using "OptiSync"

Suggested Field for Data Sync:

Selected Field for Data Sync:

Choose "Next Step" to define the Merge Options.

Now you can choose which data fields you want to merge from file 2 into file 1.

I would like to import GPS position data, distance, altitude and speed data from Zwift:

Combine sports computer and indoor trainer/VR (Zwift) file

Step 3 - Select Merge Options

File 1:	C:\Fit Files\Edge 830\2019-10-06-18-00-00.fit
File 2:	C:\Fit Files\Zwift\2019-10-06-18-00-00.fit

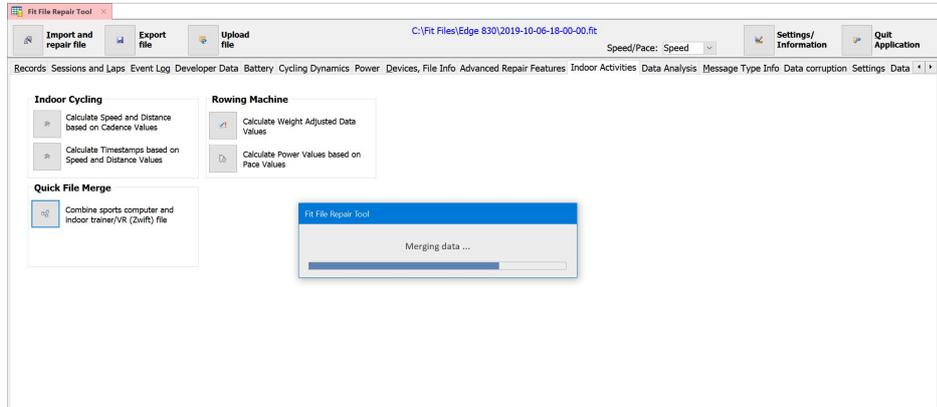
Which data would you like to import from file 2?

<input checked="" type="checkbox"/> GPS data	<input type="checkbox"/> Power
<input checked="" type="checkbox"/> Distance	<input type="checkbox"/> Cadence
<input checked="" type="checkbox"/> Altitude	<input type="checkbox"/> Temperature
<input checked="" type="checkbox"/> Speed	<input type="checkbox"/> R-R values
<input type="checkbox"/> Heart Rate	<input type="checkbox"/> Performance condition
<input type="checkbox"/> Cycling Dynamics	<input type="checkbox"/> Hemoglobin
	<input type="checkbox"/> Laps

Choose "OK" to start the merge process.

Step 7

Click on "OK" and the Data Merge will happen:



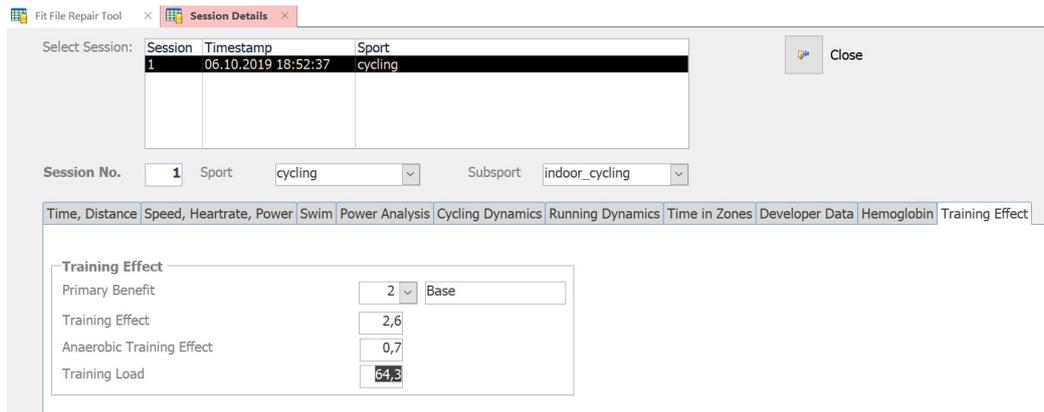
Step 8

Analyse the result: The result contains of file 1 plus the merged data from file 2.

Timestamp	Duration	Position Lat.	Position Long.	Altitude (m)	Distance (km)	Dist. (GPS) (km)	Heart Rate	Cadence	Speed (km/h)	Power (Watts)	Temp. (°C)	LAP	Error	Select	Show
06.10.2019 17:49:23	00:00:00	40,778616°N	73,966125°W	33,8	0,02	0,00	62		14,03		18,0	1		<input type="checkbox"/>	
06.10.2019 17:49:24	00:00:01	40,778557°N	73,966178°W	33,8	0,03	0,01	62		15,14		18,0	1		<input type="checkbox"/>	
06.10.2019 17:49:26	00:00:03	40,778528°N	73,966210°W	33,8	0,03	0,01	63		15,52		18,0	1		<input type="checkbox"/>	
06.10.2019 17:49:27	00:00:04	40,778463°N	73,966275°W	33,8	0,04	0,02	64		16,16		18,0	1		<input type="checkbox"/>	
06.10.2019 17:49:29	00:00:06	40,778428°N	73,966312°W	33,8	0,04	0,03	65		16,54		18,0	1		<input type="checkbox"/>	
06.10.2019 17:49:30	00:00:07	40,778393°N	73,966339°W	33,8	0,05	0,03	66		16,91		18,0	1		<input type="checkbox"/>	
06.10.2019 17:49:31	00:00:08	40,778359°N	73,966371°W	33,8	0,05	0,04	67		17,28		18,0	1		<input type="checkbox"/>	
06.10.2019 17:49:32	00:00:09	40,778326°N	73,966409°W	33,8	0,06	0,04	68		17,63		18,0	1		<input type="checkbox"/>	
06.10.2019 17:49:33	00:00:10	40,778249°N	73,966479°W	33,6	0,07	0,05	69		18,23		18,0	1		<input type="checkbox"/>	
06.10.2019 17:49:35	00:00:12	40,778133°N	73,966586°W	33,6	0,08	0,07	70		19,34		18,0	1		<input type="checkbox"/>	
06.10.2019 17:49:39	00:00:16	40,778007°N	73,966683°W	33,6	0,10	0,08	69		20,04		18,0	1		<input type="checkbox"/>	
06.10.2019 17:49:42	00:00:19	40,777876°N	73,966774°W	33,6	0,12	0,10	70		20,68		18,0	1		<input type="checkbox"/>	
06.10.2019 17:49:45	00:00:22	40,777726°N	73,966860°W	33,4	0,14	0,12	71		21,53		18,0	1		<input type="checkbox"/>	
06.10.2019 17:49:47	00:00:24	40,777626°N	73,966913°W	33,2	0,15	0,13	72		22,08		18,0	1		<input type="checkbox"/>	
06.10.2019 17:49:50	00:00:27	40,777463°N	73,966967°W	33,0	0,17	0,15	73		23,06		18,0	1		<input type="checkbox"/>	
06.10.2019 17:49:53	00:00:30	40,777111°N	73,967096°W	32,4	0,21	0,19	74		25,42		18,0	1		<input type="checkbox"/>	
06.10.2019 17:50:06	00:00:43	40,776470°N	73,967289°W	29,2	0,28	0,26	74	68	34,11		18,0	1		<input type="checkbox"/>	
06.10.2019 17:50:07	00:00:44	40,776384°N	73,967310°W	28,8	0,29	0,27	74	68	35,57	0	18,0	1		<input type="checkbox"/>	
06.10.2019 17:50:08	00:00:45	40,776296°N	73,967326°W	28,2	0,30	0,28	74	68	37,04	37	18,0	1		<input type="checkbox"/>	
06.10.2019 17:50:09	00:00:46	40,776199°N	73,967326°W	27,4	0,31	0,29	74	68	38,82	35	18,0	1		<input type="checkbox"/>	
06.10.2019 17:50:10	00:00:47	40,776100°N	73,967310°W	26,4	0,32	0,30	74	70	40,90	35	18,0	1		<input type="checkbox"/>	
06.10.2019 17:50:11	00:00:48	40,775998°N	73,967294°W	25,4	0,33	0,31	74	70	43,11	34	18,0	1		<input type="checkbox"/>	
06.10.2019 17:50:12	00:00:49	40,775888°N	73,967278°W	24,4	0,35	0,33	74	71	45,28	34	18,0	1		<input type="checkbox"/>	
06.10.2019 17:50:13	00:00:50	40,775773°N	73,967273°W	23,4	0,36	0,34	74	73	47,28	31	18,0	1		<input type="checkbox"/>	
06.10.2019 17:50:14	00:00:51	40,775652°N	73,967305°W	22,4	0,37	0,35	74	77	48,99	30	18,0	1		<input type="checkbox"/>	
06.10.2019 17:50:15	00:00:52	40,775540°N	73,967369°W	21,8	0,39	0,37	73	77	49,57	28	18,0	1		<input type="checkbox"/>	
06.10.2019 17:50:16	00:00:53	40,775448°N	73,967476°W	21,4	0,40	0,38	74	80	49,60	29	18,0	1		<input type="checkbox"/>	
06.10.2019 17:50:17	00:00:54	40,775373°N	73,967605°W	20,8	0,41	0,39	73	80	49,74	37	18,0	1		<input type="checkbox"/>	

Min./Max./Avg. values		Timestamp	Position Lat.	Position Long.	Altitude	Distance	Dist. (GPS)	Heart Rate	Cadence	Speed	Power	Temp.	Lap
Min.	06.10.2019 17:49:23	40,783539°N	73,953304°W	4,4	0,02	0,00	62	0	0,00	0	0,00	18	1
Max.	06.10.2019 18:52:37	40,799631°N	73,982089°W	132,8	31,72	31,70	154	128	75,89	686	19	18	1
Avg.				36,5			122	83	30,06	208	18		
Avg.+ (Avg. without breaks)							122	83	30,09	208	18		

Training Effect data are still there:



Step 9

The export file that you create when you select “Export File” contains merged data of both files and can be uploaded to Garmin Connect, Strava and any other platform of your choice.

