Issues in data 6-12 Sep.

Issues recently discovered in CLEAR's data

- Digitizers' saturation for some of the channels, especially when vertical scale was set to minimize the ADC error
- Acquisition lauched twice on day 8 from 17:20 for '30 min
- Beam characteristics have not *always* measured on the YAG keeping the same spec.s - e.g. the beam width during irradiation with train charge 10nC/train has been measured with lower bunch number on the screen.
- Different horizontal time scales among different channels, within the same digitizer
- Timing issue in the bergoz charge data (or in the digitizers) - not understood the reason. This occurs most frequently on files saved day 7 and much less on day 8
- Last irradiation with highest dose rates required to decrease the HV in order not to saturate the digitizers. This means that to compare the ratio signal/beam one has to correct with CCE calibration at the end of the day (took a few minutes later)

Strategy and solutions

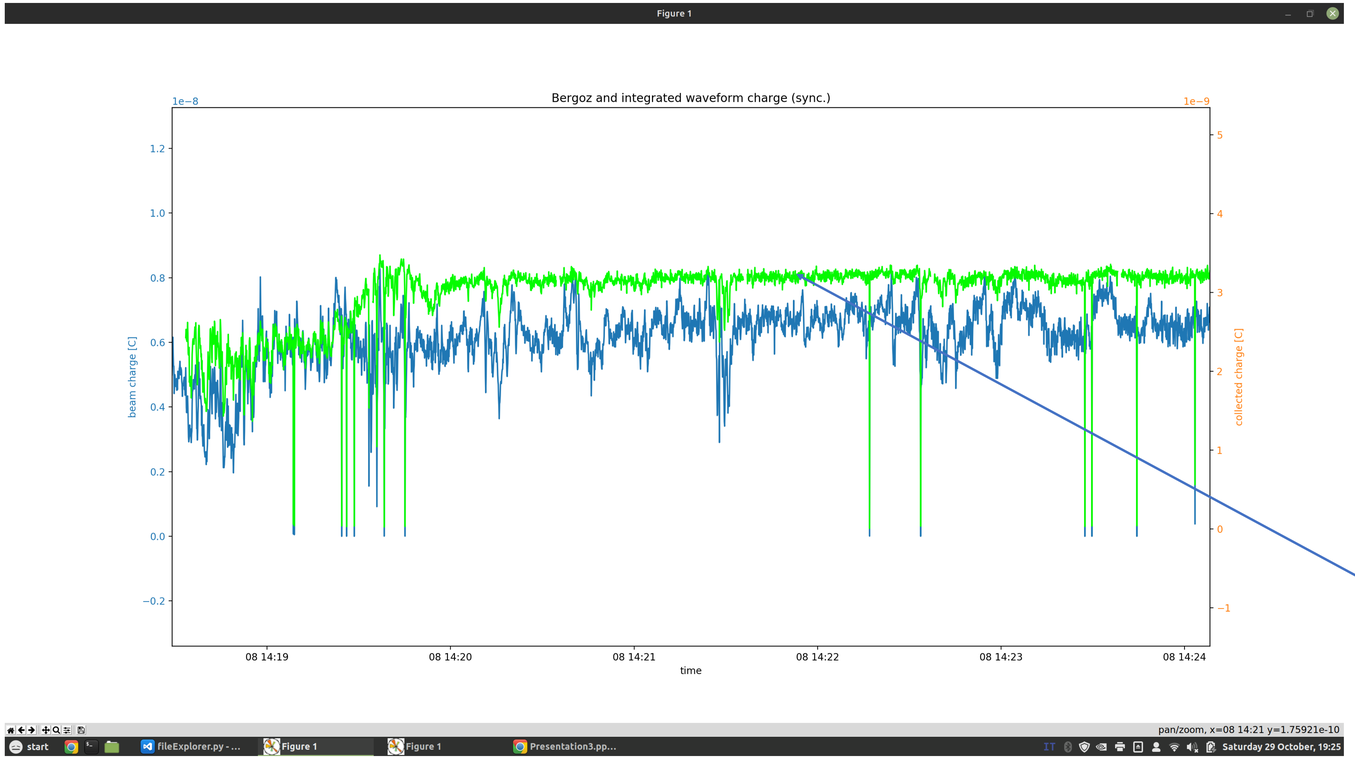
- Tagging algorithm to detect digitizer's saturation and flag 'issued' datapoints
- Comparison of detector/beam correlation functions among different acquisition can show synchronization issues related with bad timing. Diagnostic function (inspectFile_syncWaveform) developed

News in the analysis software

- Fixed a bug in the synch algorithm (synch was shifted 1 trigger left)
- More robust synchronization algorithm performing synchronization on all dgt. Channels!

Lessons for the future

- Acquisition system which saves calibrated data both in horizontal (time) and vertical (voltage) scales
  - Check calibration with test signals at the beginning and end of the experiment
- Online monitoring system capable of detecting missing shots
- Online monitoring system capable of detecting digitizers (FERS) saturation
- Online monitoring system with raw synchronization algorithm implemented – e.g. capable to detect missing shots or issues in data taking *on site*
- Check beam parameters more often
- Try to find a way to gather SYNCHRONIZED data from the beginning – i.e. using JAPC
- Online plotting of the correlation function between acquired data and beam charge – this is of fundamental importance to detect timing issues in data acquisition of the Bergoz charge!



Legend

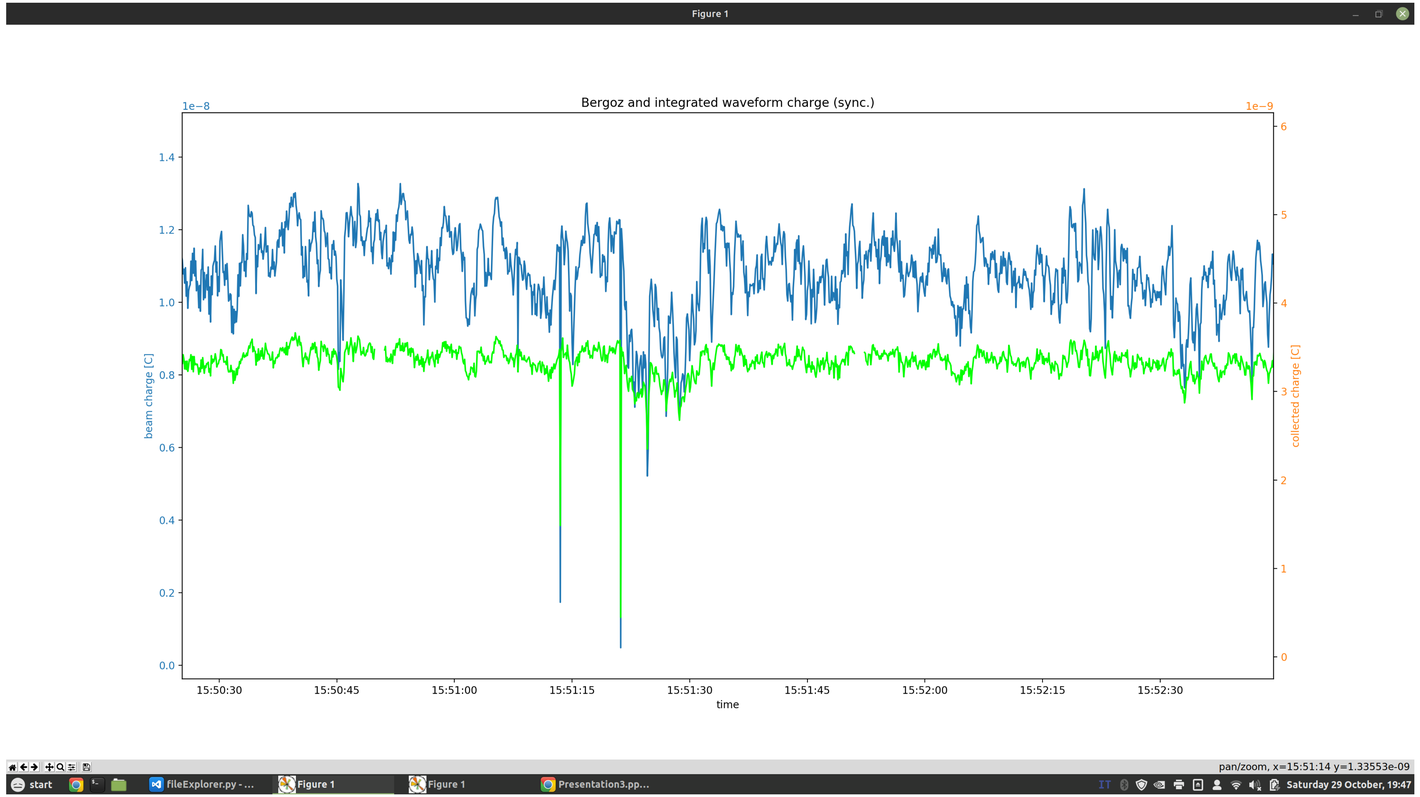
Blue line: beam charge datapoint as measured by Bergoz @10Hz

Green line: integrated charge from digitizer 1 ch1 @10Hz

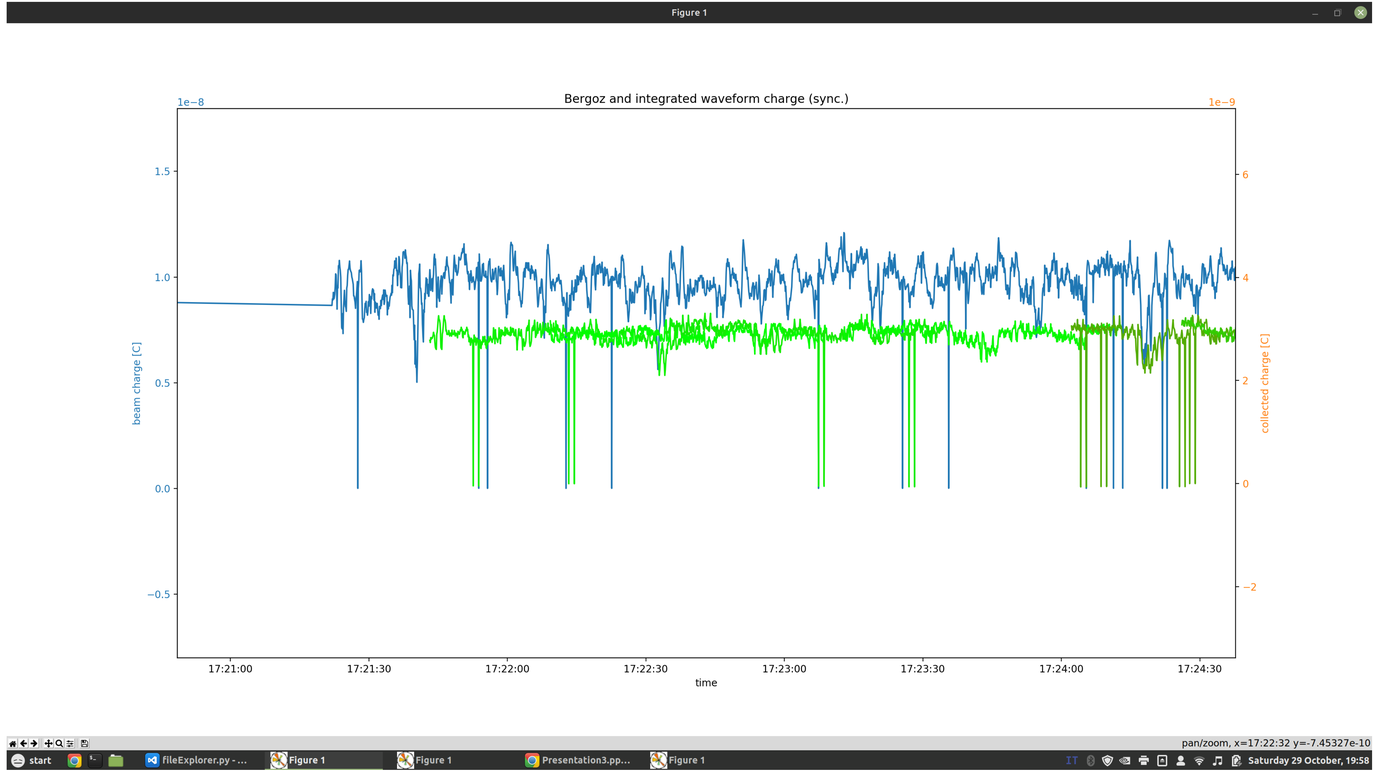
Problems

1- Saturation observed in all digitizers.
For example, look at the clipping of signal fluctuations at higher amplitudes

2- With beam charge 0.6e-8 we have integrated signal 3.2e-9, while (see next slide) with almost-twice beam charge 1.2e-8C we have 3.3e-9.
A displacement in beam centroid?

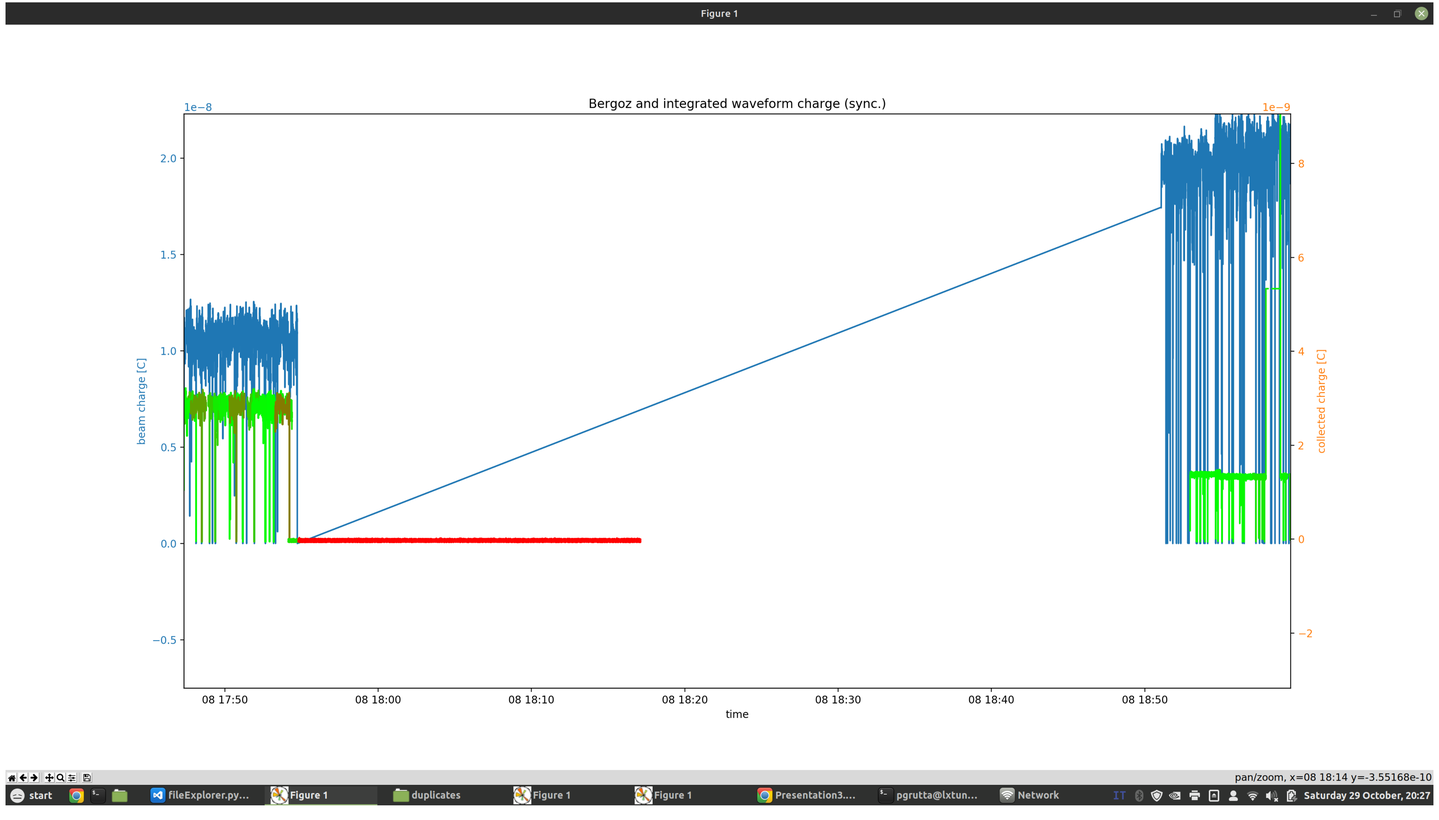


No saturation observed in this data, digitizer's setting unchanged (based on the logbook screenshots).



(not a) Problem

3- Acquisition routine launched twice with a few seconds delay. Data is gathered twice



Legend

Blue line: beam charge datapoint as measured by Bergoz @10Hz
Green line: integrated charge from digitizer 1 ch1 @10Hz
Red line: integrated charge from digitizer 1 ch1 @10Hz, synch alg. failed

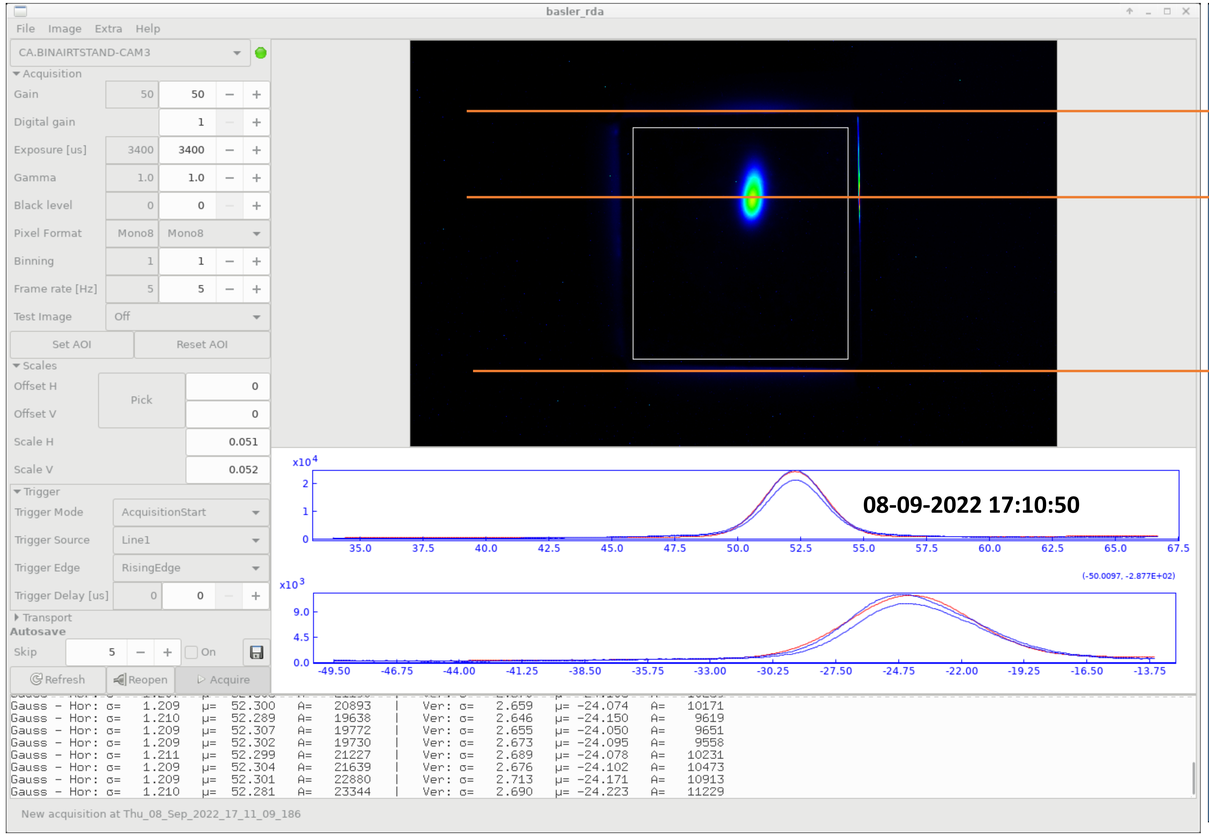
Problem

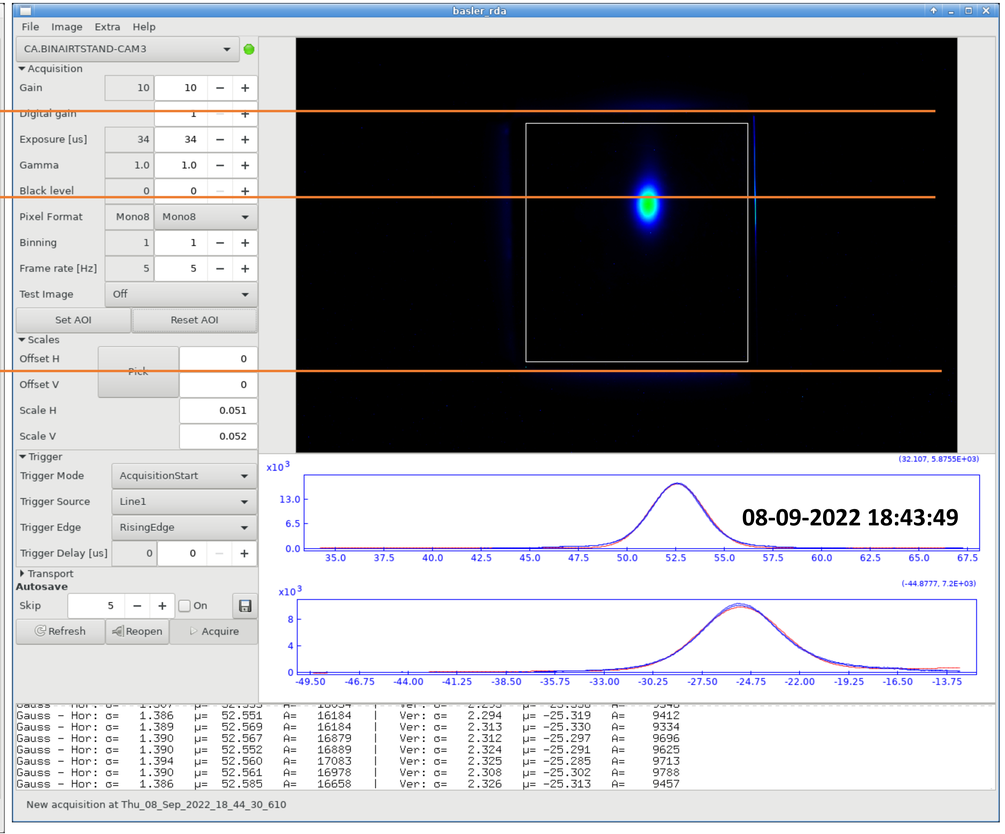
After 18:50, beam charge set to deliver highest dose rate for the day (160 bunches to 200 bunches + attenuation to 100%). This resulted in physical (i.e. dgt saved OK) lower signal amplitudes.

4- A possible sapphire saturation effect is not detected in the further days, in same conditions. Therefore, it is likely that **beam parameters** (centroid? width?) were very **different** in before 17:50 and after 18:50.

Naïve check of YAG pictures in the logbook goes in this direction…
(see two slides next)

Proof that digitizers were set correctly for data acquired around 17:50 and 18:50

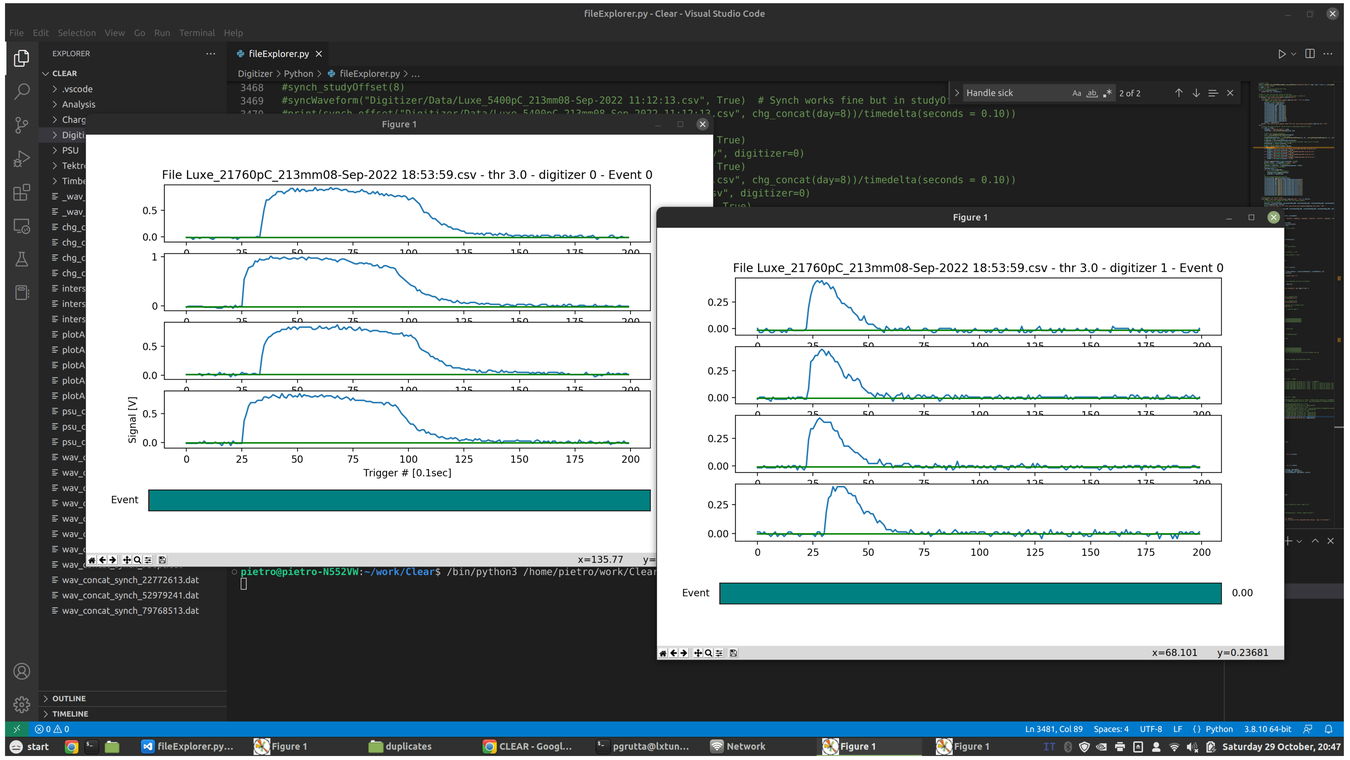




You can't use plots below because in general the square region may be different.

By using YAG edges as reference, you can measure the position of the centroid in pixel units and compare quantitatively the two figures.

Such a naïve comparison in the slide is meant to show qualitatively the effect.



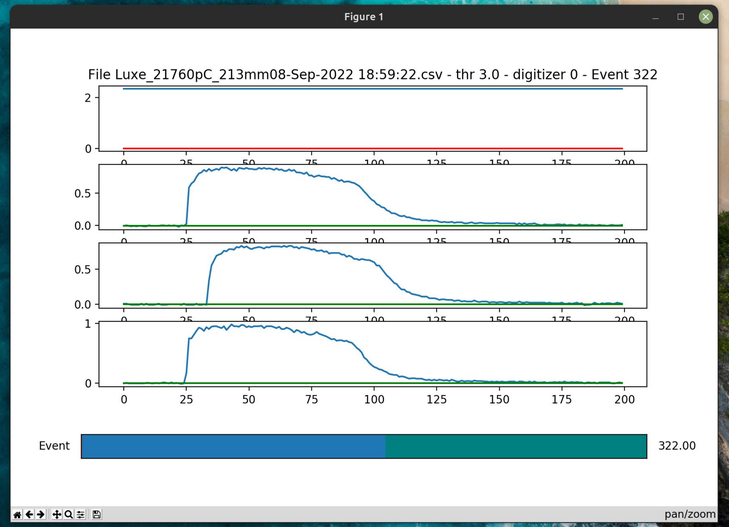
Problem

From Oasis's screenshots in CLEAR's logbook, all the digitizers are always set to the same horizontal and vertical scale. This is not always the case, as illustrated in this example.

5- The **digitizers horizontal scales** of 1 and 2 are **different from one file to another** – and **even within the same file**!

Scale (40ns/div) cannot be inferred from sample points (200) but only form the signal itself by comparing peak widths.

This is a big issue. In that comparison between different waveforms require going through the logbook!



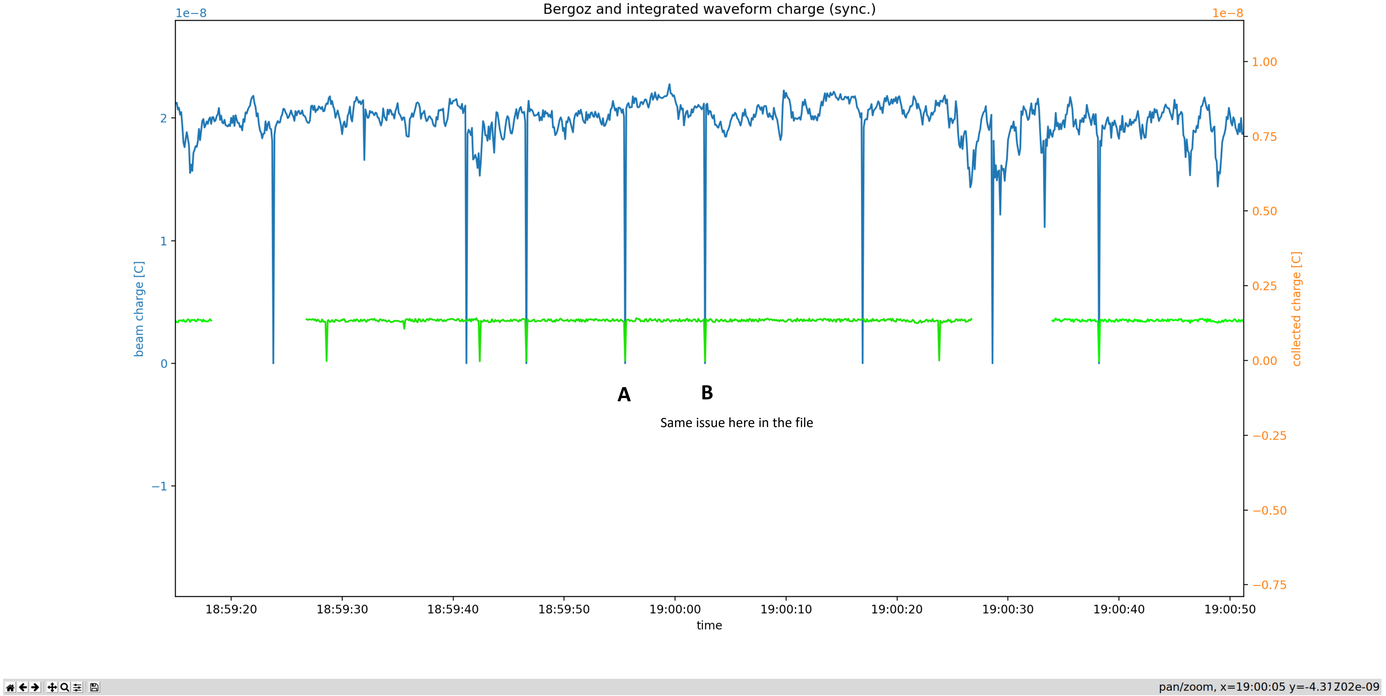
Problem

Day 8th Sept. digitizer setting different. In fact, saturation at 18:58 means 1V scale. Then settings were changed among different channels (likely offset values). For a brief moment, the digitizer full scale reached 2V in ch1 dgt0 at 18:58:50.

6 – Setting upload cause timing lags (no more 0.1sec between a point and another one!)

Problem

6,7 – Time differences between adjacent points in the Bergoz DAT is about 0.1 sec, however, you cannot synchronize the entire 1 minute digitizer MAT file! Either the time from Bergoz or from digitizers – e.g. they have same trigger this should not occur! – is not consistent over the same file!



Problem

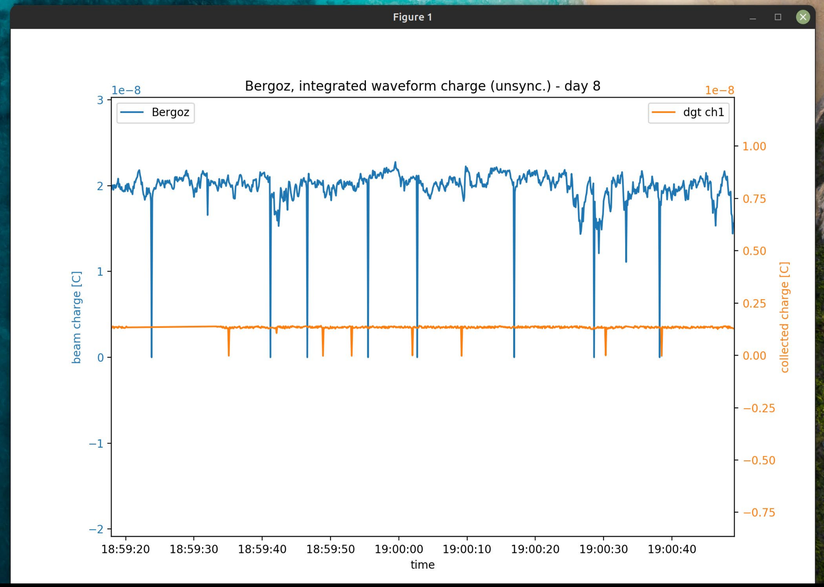
6,7 – The same issue is shown in this acquisition took later, the same day.

This problem occurs on 20% of day 7th measures. Almost zero on day 8th .

This is present even before generation of timetags - that is, it is present also if you compare the waveform in trigger time with bergoz datapoints in trigger units!

It is not a time scale issue, as evident from the figure here.
For example, peaks A and B are perfectly synchronized with Bergoz. A stretch of the temporal scale, in an attempt to accommodate the other peaks, would spoil this.

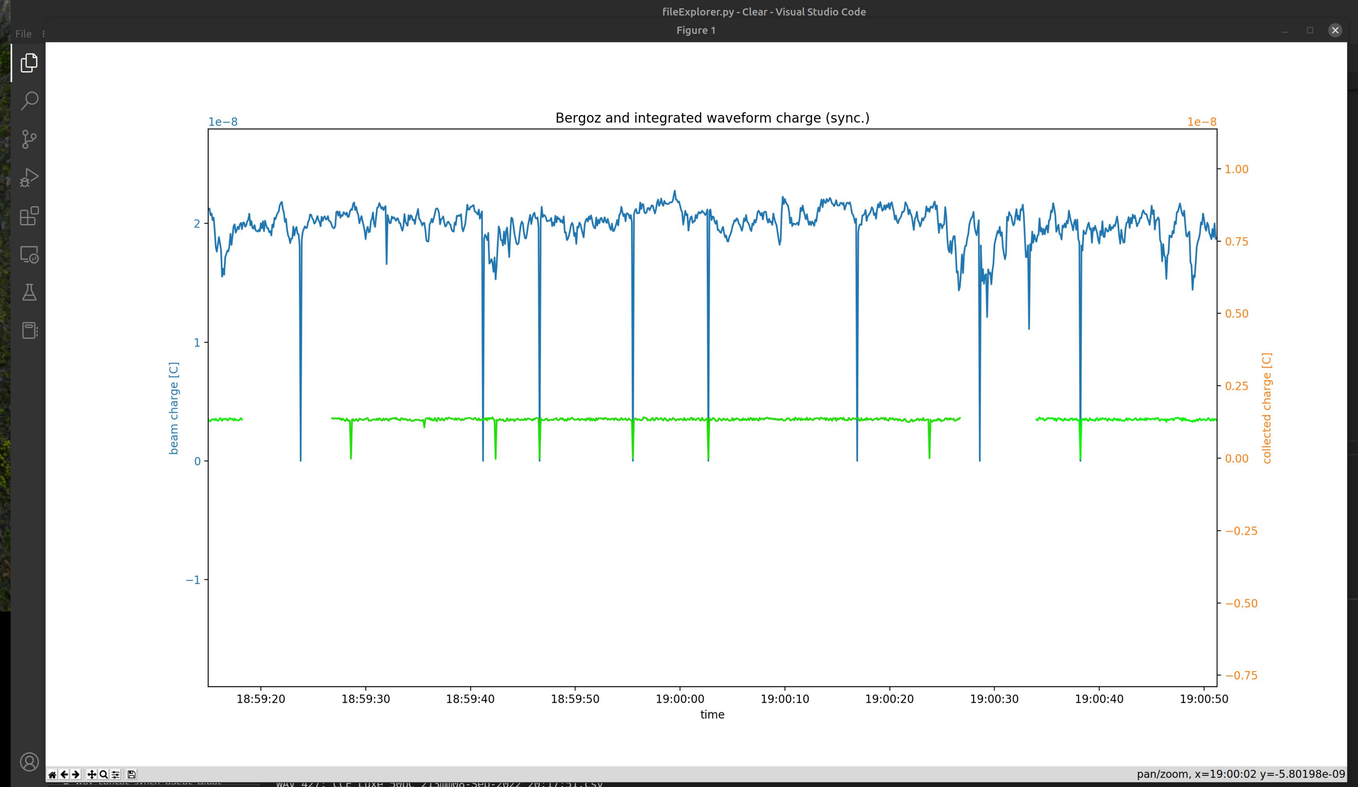
A few more examples and comments follow in the next slides.

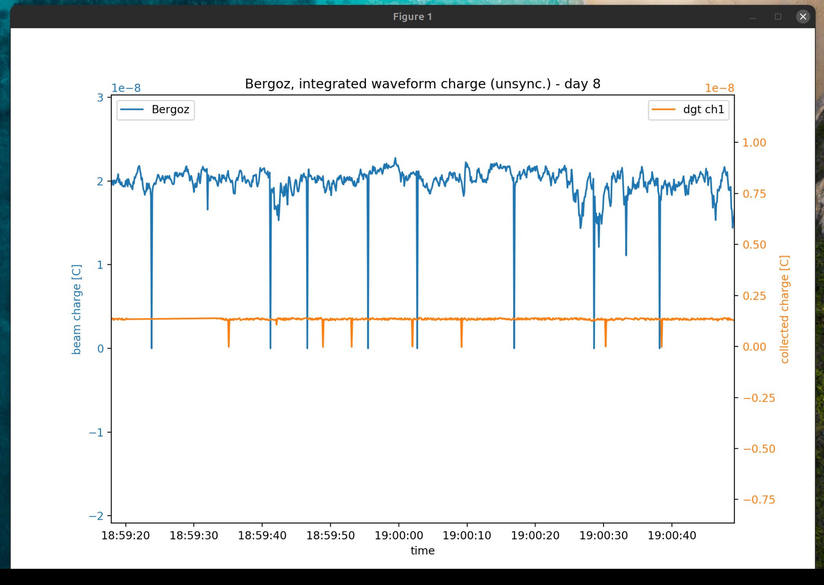


Not an issue of the synchronization algorithm: it doesn't change time scales anyway...

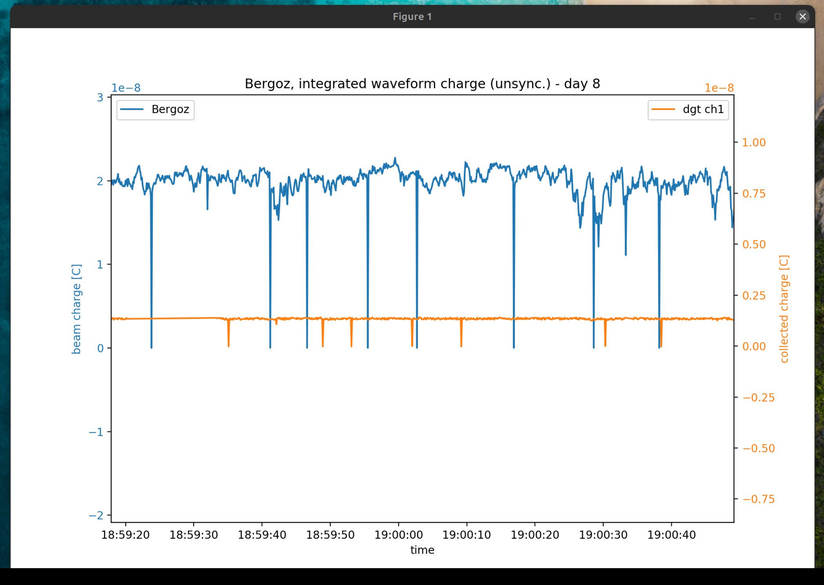
Possible causes are

- Not thread-safe code to acquire data from Bergoz (callback callable is async so two concurrent calls may be executed before data is saved on file.)
- Response delay from the digitizer when a setting is changed: Oasis sends commands with new settings and digitizer takes delay to apply.

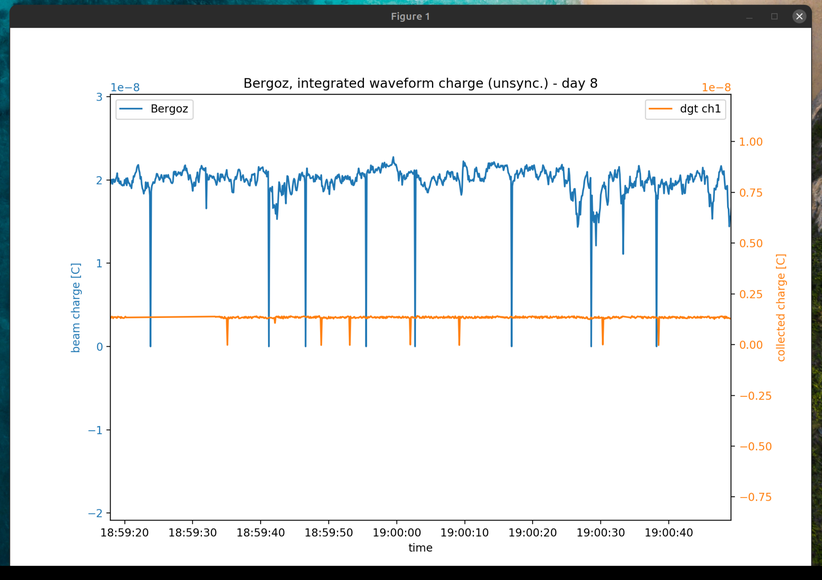




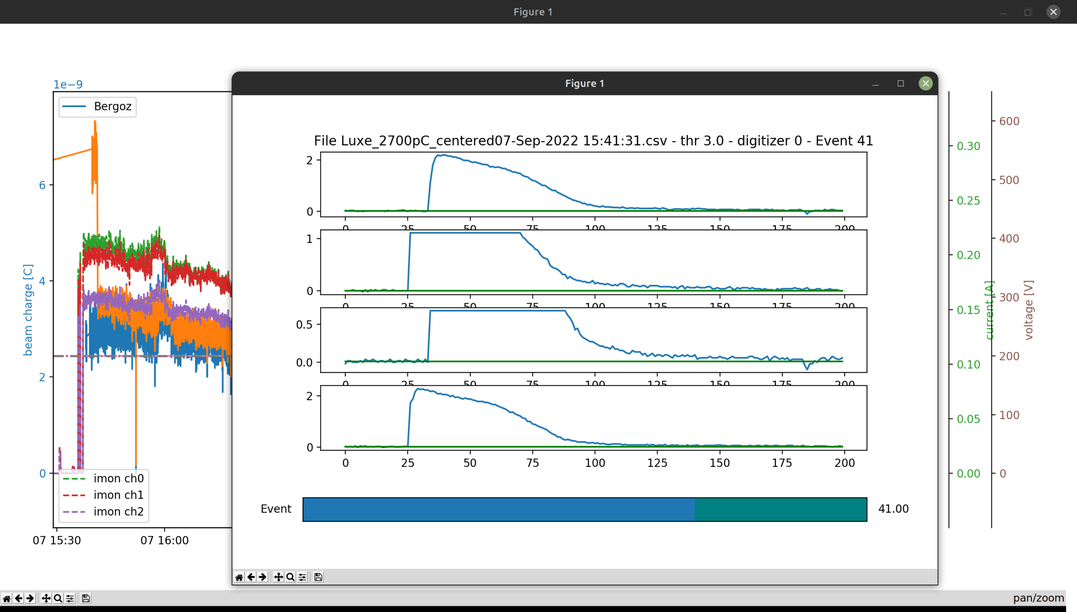
Different acquisition rate? Maybe the bergoz?



The time attached to each bergoz data point is calculated by the initial time recorded in the file. This because the timestamps attached to each charge measure are completely unrealiable since they are local times of the computer (e.g. between one shot and another there is no fixed 0.1sec difference). Therefore it may have occurred that a very long irradiation.dat bergoz datafile containing missing shots and this causes timing to be wrong in some cases. However, this should preserve the fact that between one shot and another there is always 0.1 sec time delay.



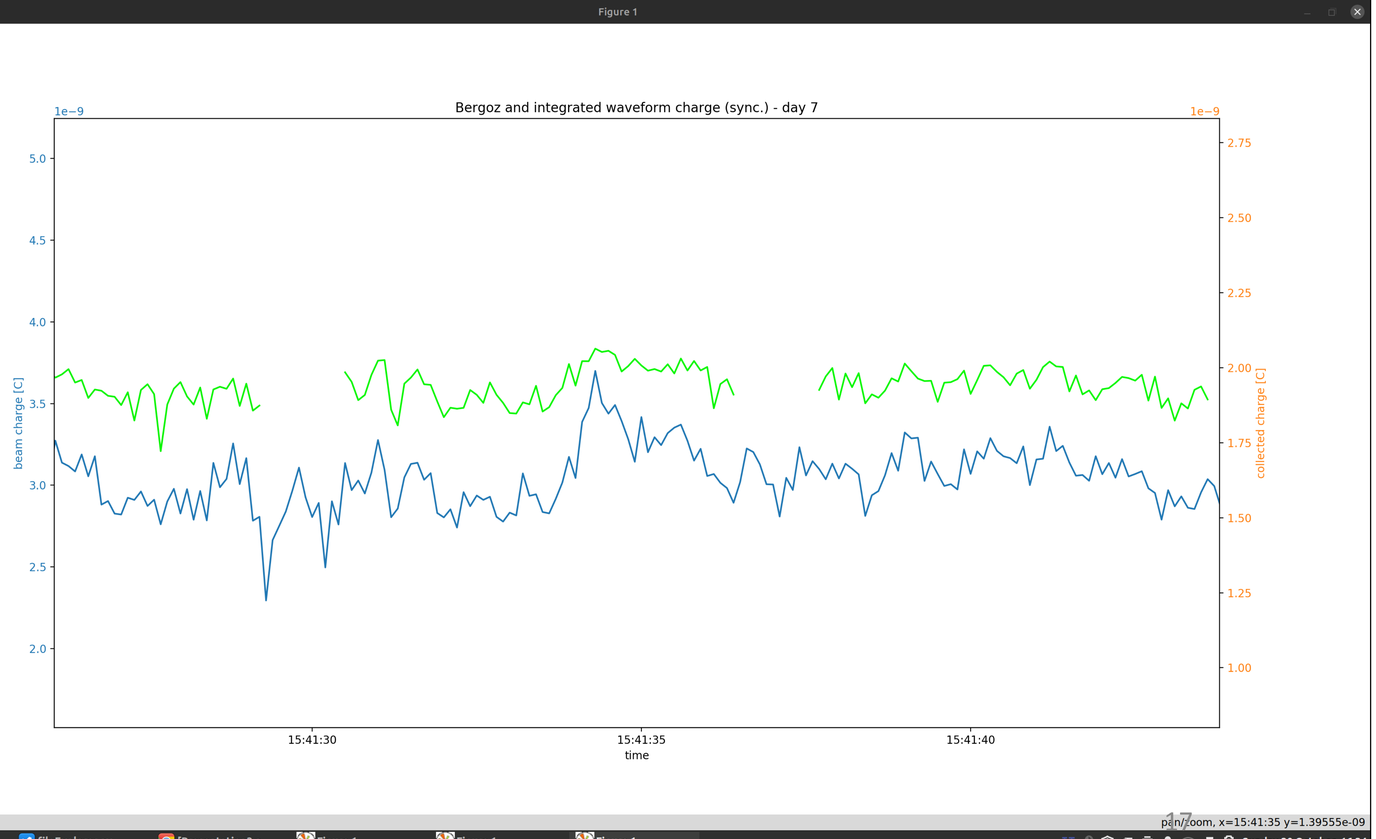
Here for example the problem is not present anymore....so it is a isolated issue around 19:01:50 to 19:05:50



Timing issues between Bergoz and Digitizer trace seems more frequent with small acquisitions (less than 1 minute).

Another example of saturation here.

Lesson for the future with FERS: develop online algorithm to detect saturation and histogram saturation shots over time.



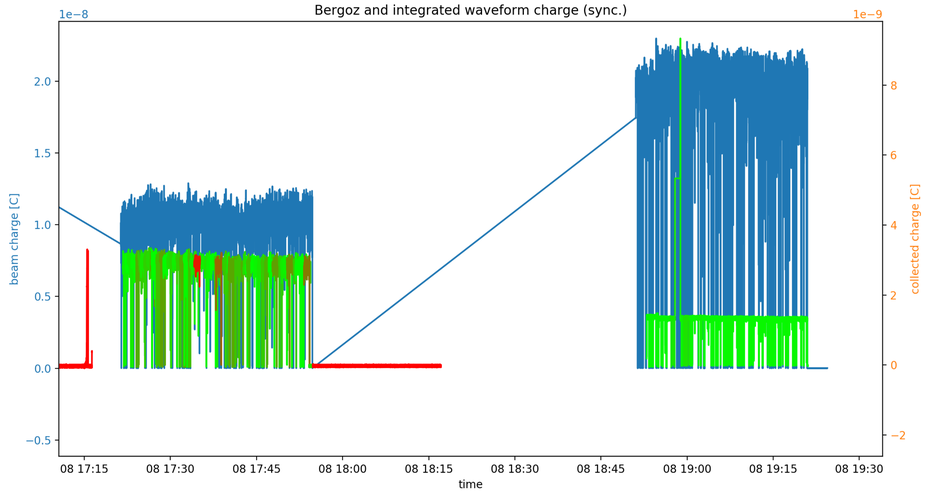


Figure 1
Bergoz and integrated waveform charge (sync.)
1e−8
1e−9
beam charge [C]
collected charge [C]
time
08 17:15
08 17:30
08 17:45
08 18:00
08 18:15
08 18:30
08 18:45
08 19:00
08 19:15
08 19:30
pan/zoom

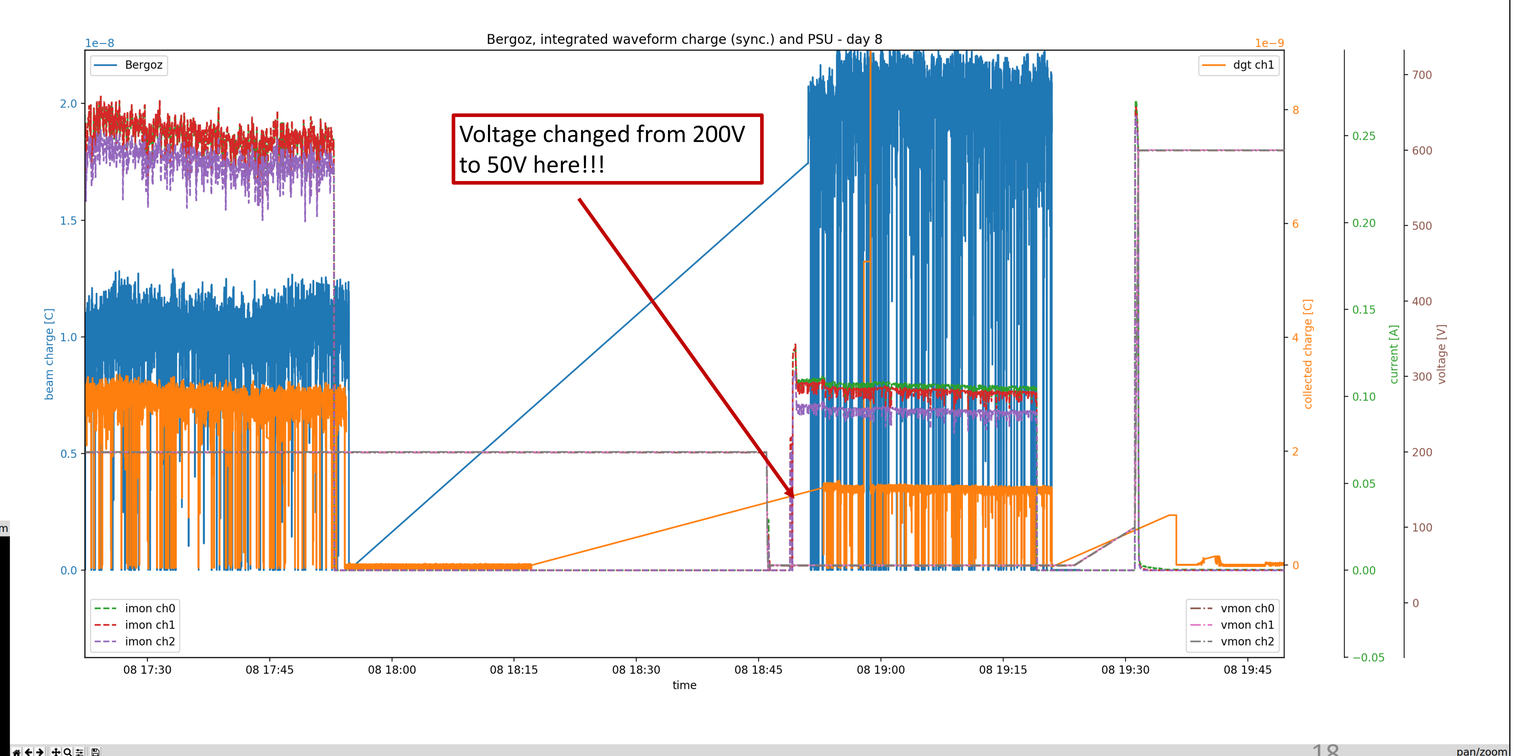
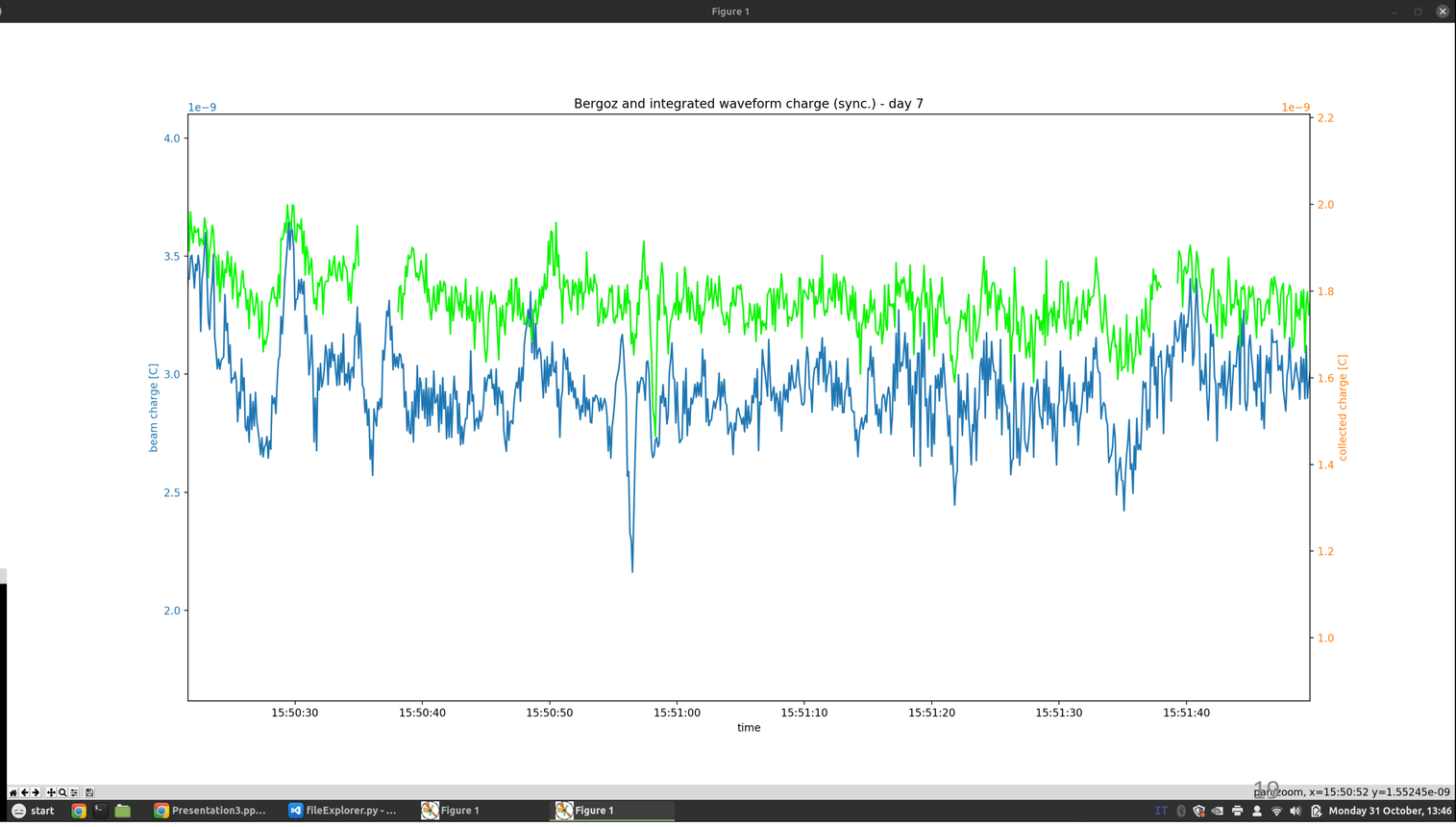


Figure 1
Bergoz, integrated waveform charge (sync.) and PSU - day 8
Voltage changed from 200V to 50V here!!!
Bergoz
dgt ch1
imon ch0
imon ch1
imon ch2
vmon ch0
vmon ch1
vmon ch2
beam charge [C]
collected charge [C]
current [A]
voltage [V]
time
pan/zoom
start
fileExplorer.py - ...
CLEAR - Google C...
Figure 1
Figure 1
Sunday 30 October, 16:10

This example shows that you can synch one part of the waveform but not in the entire range within the same file. This means that either the rate 10Hz of the digitizer or the rate of the Bergoz data is not truly 10Hz.

However, this is not always the case as shown in the next slide picture



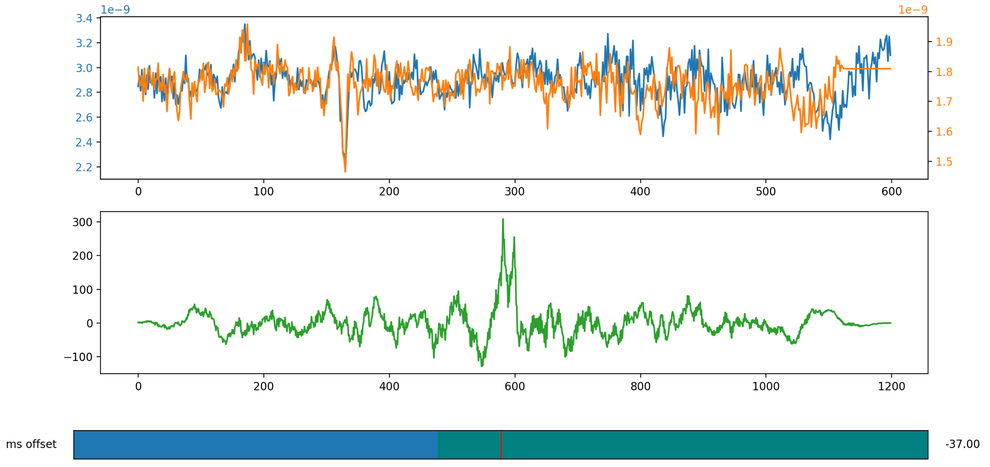


Figure 1
1e−9
1e−9
ms offset
-37.00

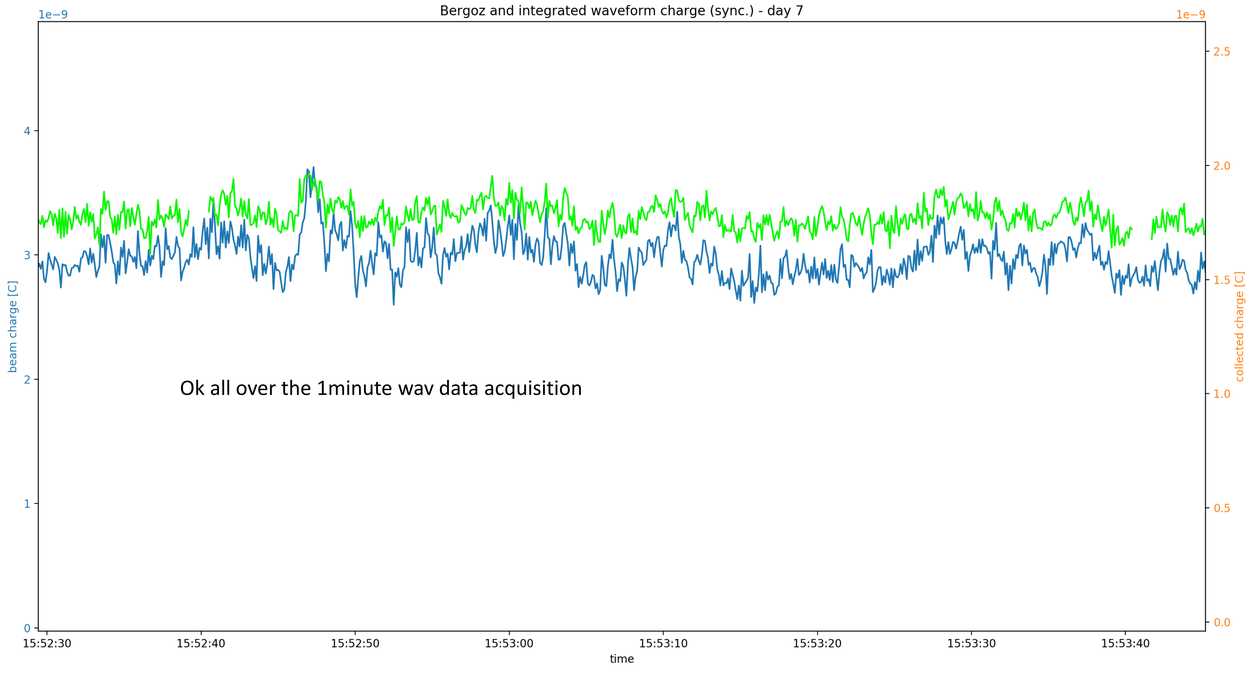


Figure 1
Bergoz and integrated waveform charge (sync.) - day 7
1e−9
1e−9
beam charge [C]
collected charge [C]
time
Ok all over the 1minute wav data acquisition
pan/zoom, x=15:53:01 y=1.93522e-10
start
Presentation3.pp...
FileExplorer.py - ...
Figure 1
Figure 1
Monday 31 October, 13:48

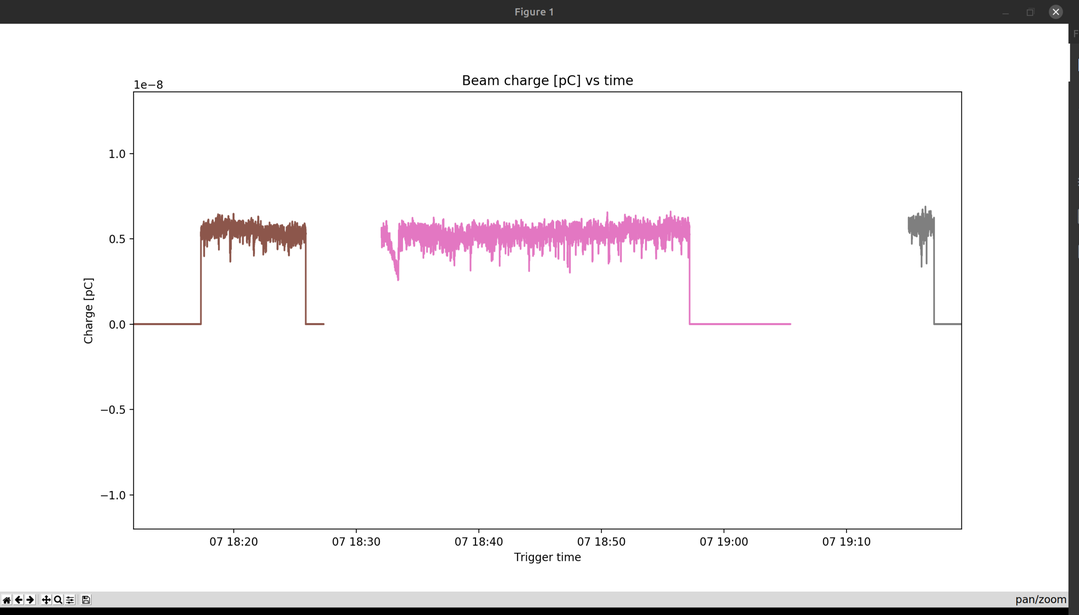
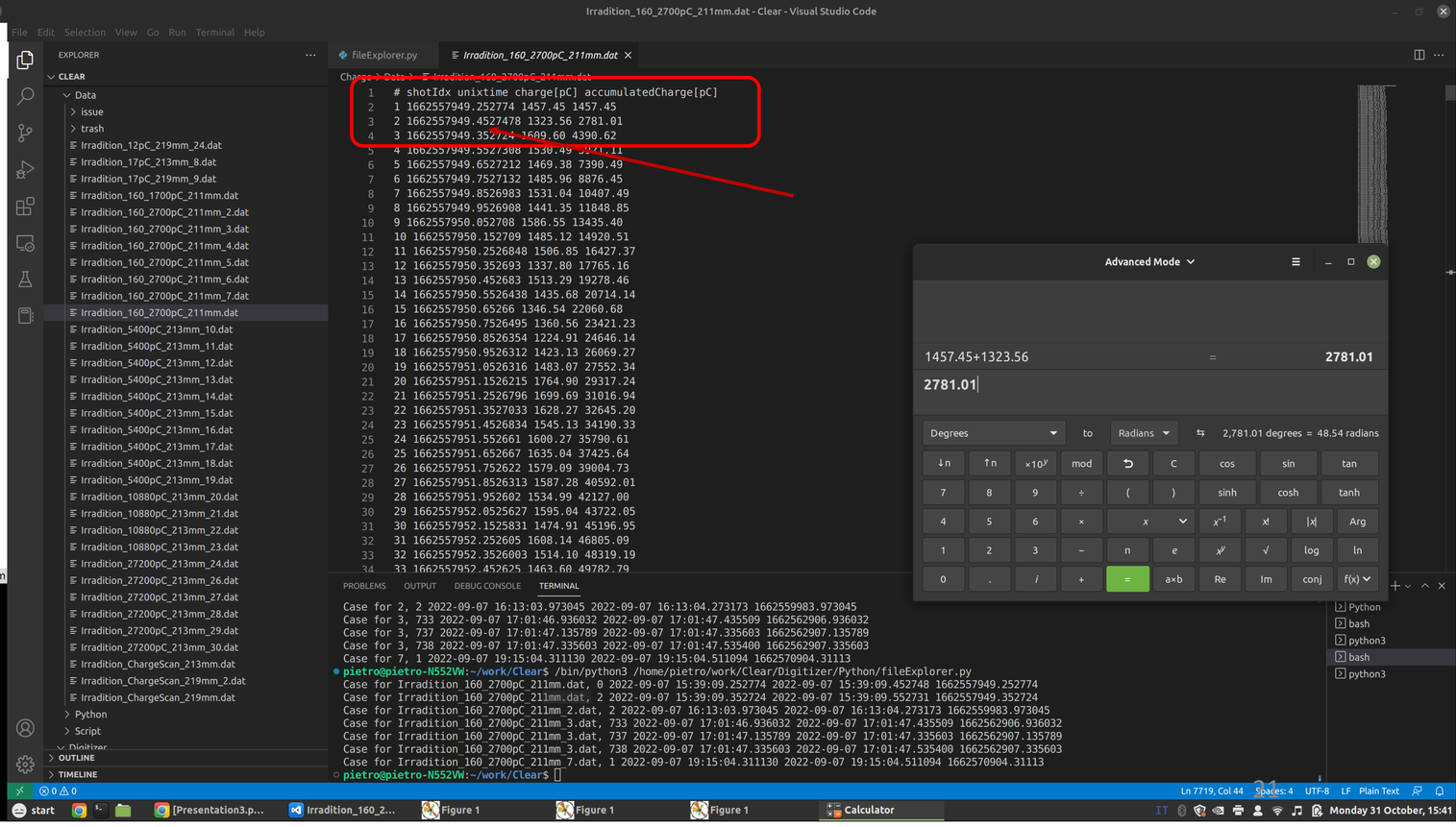


Figure 1
Beam charge [pC] vs time
1e−8
1.0
0.5
0.0
−0.5
−1.0
Charge [pC]
07 18:20
07 18:30
07 18:40
07 18:50
07 19:00
07 19:10
Trigger time
pan/zoom


Irradition_160_2700pC_211mm.dat - Clear - Visual Studio Code
File Edit Selection View Go Run Terminal Help
EXPLORER
CLEAR
Data
issue
trash
Irradition_12pC_219mm_24.dat
Irradition_17pC_213mm_8.dat
Irradition_17pC_219mm_9.dat
Irradition_160_1700pC_211mm.dat
Irradition_160_2700pC_211mm_2.dat
Irradition_160_2700pC_211mm_3.dat
Irradition_160_2700pC_211mm_4.dat
Irradition_160_2700pC_211mm_5.dat
Irradition_160_2700pC_211mm_6.dat
Irradition_160_2700pC_211mm_7.dat
Irradition_160_2700pC_211mm.dat
Irradition_5400pC_213mm_10.dat
Irradition_5400pC_213mm_11.dat
Irradition_5400pC_213mm_12.dat
Irradition_5400pC_213mm_13.dat
Irradition_5400pC_213mm_14.dat
Irradition_5400pC_213mm_15.dat
Irradition_5400pC_213mm_16.dat
Irradition_5400pC_213mm_17.dat
Irradition_5400pC_213mm_18.dat
Irradition_5400pC_213mm_19.dat
Irradition_10880pC_213mm_20.dat
Irradition_10880pC_213mm_21.dat
Irradition_10880pC_213mm_22.dat
Irradition_10880pC_213mm_23.dat
Irradition_27200pC_213mm_24.dat
Irradition_27200pC_213mm_26.dat
Irradition_27200pC_213mm_27.dat
Irradition_27200pC_213mm_28.dat
Irradition_27200pC_213mm_29.dat
Irradition_27200pC_213mm_30.dat
Irradition_ChargeScan_213mm.dat
Irradition_ChargeScan_219mm_2.dat
Irradition_ChargeScan_219mm.dat
Python
Script
Digitizer
OUTLINE
TIMELINE
fileExplorer.py
Irradition_160_2700pC_211mm.dat
Charge > Data > Irradition_160_2700pC_211mm.dat
shotIdx unixtime charge[pC] accumulatedCharge[pC]
1 1662557949.252774 1457.45 1457.45
2 1662557949.4527478 1323.56 2781.01
3 1662557949.352724 1609.60 4390.62
4 1662557949.5527308 1530.49 5921.11
5 1662557949.6527212 1469.38 7390.49
6 1662557949.7527132 1485.96 8876.45
7 1662557949.8526983 1531.04 10407.49
8 1662557949.9526908 1441.35 11848.85
9 1662557950.052708 1586.55 13435.40
10 1662557950.152709 1485.12 14920.51
11 1662557950.2526848 1506.85 16427.37
12 1662557950.352693 1337.80 17765.16
13 1662557950.452683 1513.29 19278.46
14 1662557950.5526438 1435.68 20714.14
15 1662557950.65266 1346.54 22060.68
16 1662557950.7526495 1360.56 23421.23
17 1662557950.8526354 1224.91 24646.14
18 1662557950.9526312 1423.13 26069.27
19 1662557951.0526316 1483.07 27552.34
20 1662557951.1526215 1764.90 29317.24
21 1662557951.2526796 1699.69 31016.94
22 1662557951.3527033 1628.27 32645.20
23 1662557951.4526834 1545.13 34190.33
24 1662557951.552661 1600.27 35790.61
25 1662557951.652667 1635.04 37425.64
26 1662557951.752622 1579.09 39004.73
27 1662557951.8526313 1587.28 40592.01
28 1662557951.952602 1534.99 42127.00
29 1662557952.0525627 1595.04 43722.05
30 1662557952.1525831 1474.91 45196.95
31 1662557952.252605 1608.14 46805.09
32 1662557952.3526003 1514.10 48319.19
33 1662557952.452625 1463.60 49782.79
Advanced Mode
1457.45+1323.56 = 2781.01
2781.01
Degrees to Radians 2,781.01 degrees = 48.54 radians
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
Case for 2, 2 2022-09-07 16:13:03.973045 2022-09-07 16:13:04.273173 1662559983.973045
Case for 3, 733 2022-09-07 17:01:46.936032 2022-09-07 17:01:47.435509 1662562906.936032
Case for 3, 737 2022-09-07 17:01:47.135789 2022-09-07 17:01:47.335603 1662562907.135789
Case for 3, 738 2022-09-07 17:01:47.335603 2022-09-07 17:01:47.535400 1662562907.335603
Case for 7, 1 2022-09-07 19:15:04.311130 2022-09-07 19:15:04.511094 1662570904.31113
pietro@pietro-N552VW:~/work/Clear$ /bin/python3 /home/pietro/work/Clear/Digitizer/Python/fileExplorer.py
Case for Irradition_160_2700pC_211mm.dat, 0 2022-09-07 15:39:09.252774 2022-09-07 15:39:09.452748 1662557949.252774
Case for Irradition_160_2700pC_211mm.dat, 2 2022-09-07 15:39:09.352724 2022-09-07 15:39:09.552731 1662557949.352724
Case for Irradition_160_2700pC_211mm_2.dat, 2 2022-09-07 16:13:03.973045 2022-09-07 16:13:04.273173 1662559983.973045
Case for Irradition_160_2700pC_211mm_3.dat, 733 2022-09-07 17:01:46.936032 2022-09-07 17:01:47.435509 1662562906.936032
Case for Irradition_160_2700pC_211mm_3.dat, 737 2022-09-07 17:01:47.135789 2022-09-07 17:01:47.335603 1662562907.135789
Case for Irradition_160_2700pC_211mm_3.dat, 738 2022-09-07 17:01:47.335603 2022-09-07 17:01:47.535400 1662562907.335603
Case for Irradition_160_2700pC_211mm_7.dat, 1 2022-09-07 19:15:04.311130 2022-09-07 19:15:04.511094 1662570904.31113
pietro@pietro-N552VW:~/work/Clear$
Python
bash
python3
bash
python3
Ln 7719, Col 44 Spaces: 4 UTF-8 LF Plain Text
start
[Presentation3.p...
Irradition_160_2...
Figure 1
Figure 1
Figure 1
Calculator
Monday 31 October, 15:41

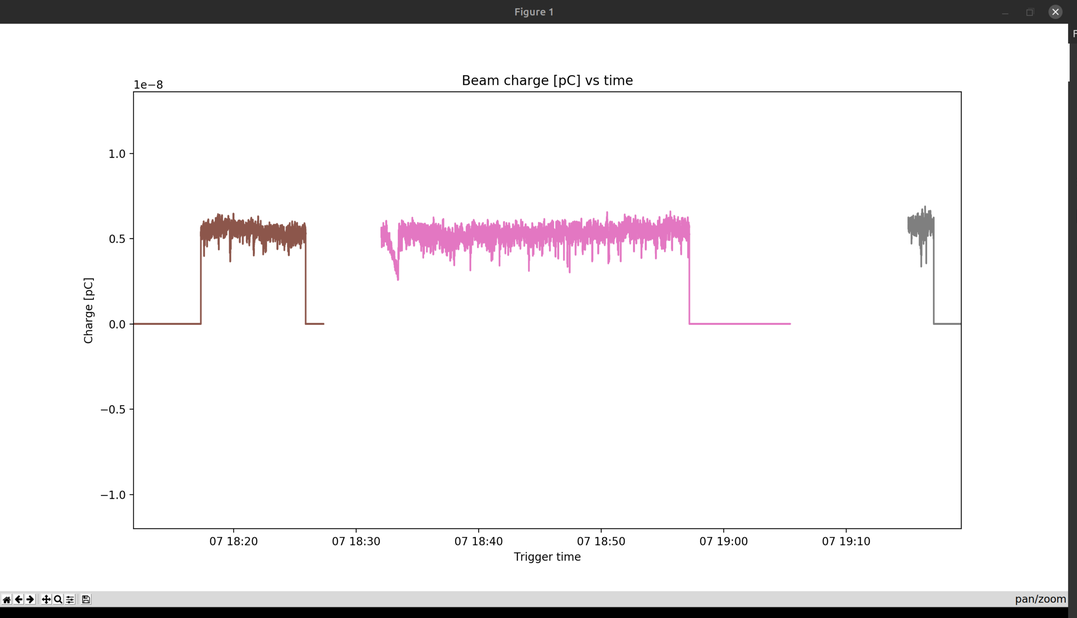
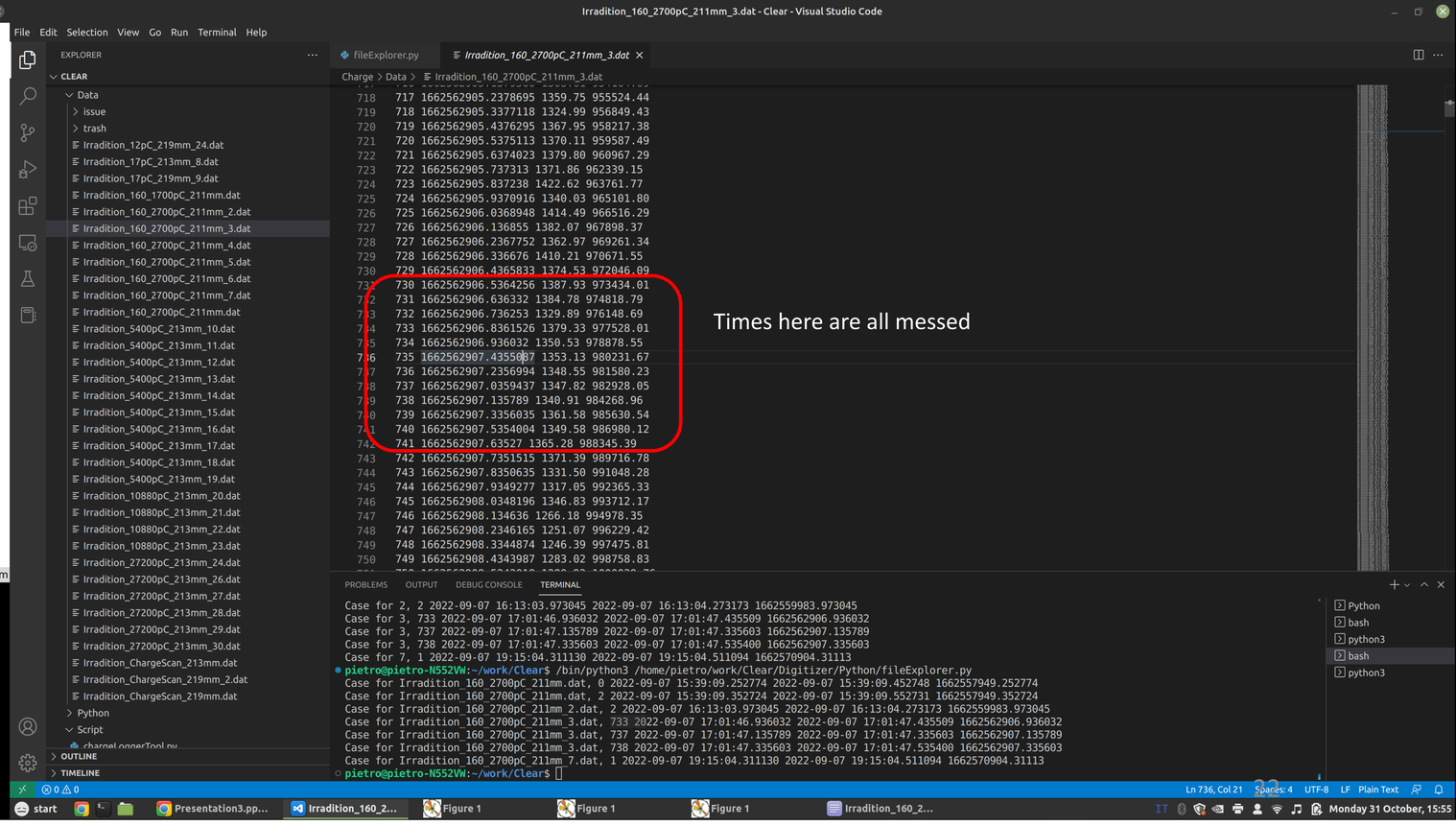
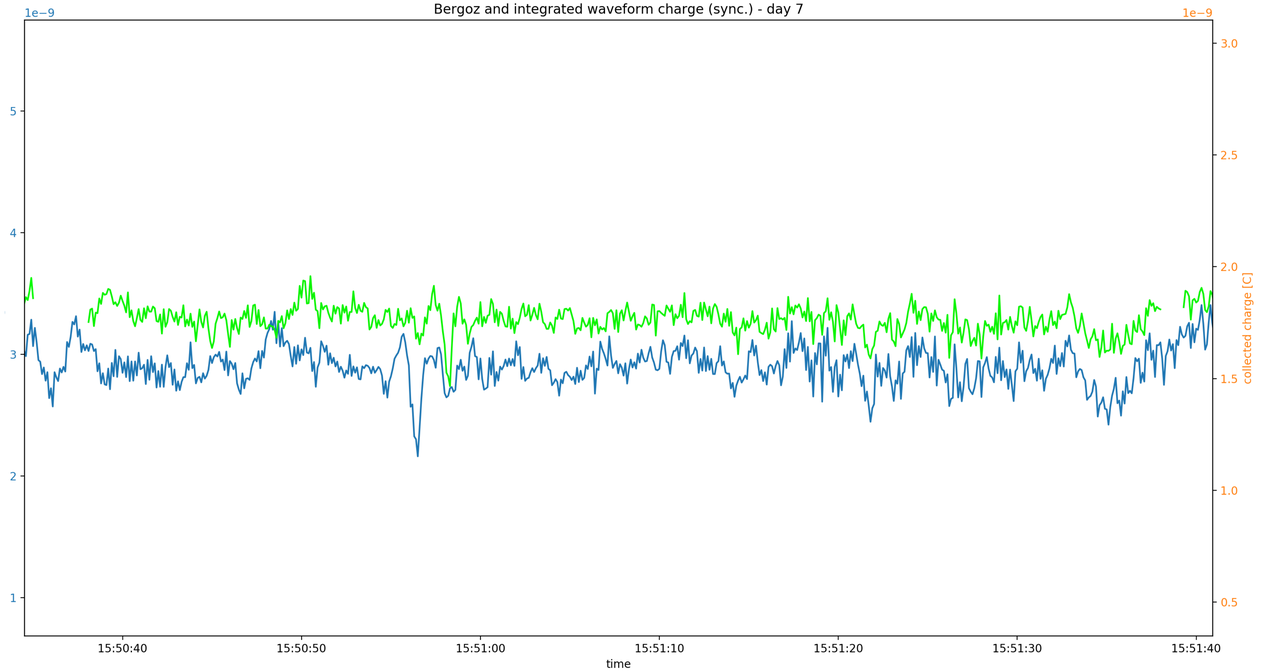


Figure 1
Beam charge [pC] vs time
1e−8
1.0
0.5
0.0
−0.5
−1.0
Charge [pC]
07 18:20
07 18:30
07 18:40
07 18:50
07 19:00
07 19:10
Trigger time
pan/zoom


Irradition_160_2700pC_211mm_3.dat - Clear - Visual Studio Code
File Edit Selection View Go Run Terminal Help
EXPLORER
CLEAR
Data
issue
trash
Irradition_12pC_219mm_24.dat
Irradition_17pC_213mm_8.dat
Irradition_17pC_219mm_9.dat
Irradition_160_1700pC_211mm.dat
Irradition_160_2700pC_211mm_2.dat
Irradition_160_2700pC_211mm_3.dat
Irradition_160_2700pC_211mm_4.dat
Irradition_160_2700pC_211mm_5.dat
Irradition_160_2700pC_211mm_6.dat
Irradition_160_2700pC_211mm_7.dat
Irradition_160_2700pC_211mm.dat
Irradition_5400pC_213mm_10.dat
Irradition_5400pC_213mm_11.dat
Irradition_5400pC_213mm_12.dat
Irradition_5400pC_213mm_13.dat
Irradition_5400pC_213mm_14.dat
Irradition_5400pC_213mm_15.dat
Irradition_5400pC_213mm_16.dat
Irradition_5400pC_213mm_17.dat
Irradition_5400pC_213mm_18.dat
Irradition_5400pC_213mm_19.dat
Irradition_10880pC_213mm_20.dat
Irradition_10880pC_213mm_21.dat
Irradition_10880pC_213mm_22.dat
Irradition_10880pC_213mm_23.dat
Irradition_27200pC_213mm_24.dat
Irradition_27200pC_213mm_26.dat
Irradition_27200pC_213mm_27.dat
Irradition_27200pC_213mm_28.dat
Irradition_27200pC_213mm_29.dat
Irradition_27200pC_213mm_30.dat
Irradition_ChargeScan_213mm.dat
Irradition_ChargeScan_219mm_2.dat
Irradition_ChargeScan_219mm.dat
Python
Script
chargeLoggerTool.py
OUTLINE
TIMELINE
fileExplorer.py
Irradition_160_2700pC_211mm_3.dat
Charge > Data > Irradition_160_2700pC_211mm_3.dat
718 717 1662562905.2378695 1359.75 955524.44
719 718 1662562905.3377118 1324.99 956849.43
720 719 1662562905.4376295 1367.95 958217.38
721 720 1662562905.5375113 1370.11 959587.49
722 721 1662562905.6374023 1379.80 960967.29
723 722 1662562905.737313 1371.86 962339.15
724 723 1662562905.837238 1422.62 963761.77
725 724 1662562905.9370916 1340.03 965101.80
726 725 1662562906.0368948 1414.49 966516.29
727 726 1662562906.136855 1382.07 967898.37
728 727 1662562906.2367752 1362.97 969261.34
729 728 1662562906.336676 1410.21 970671.55
730 729 1662562906.4365833 1374.53 972046.09
731 730 1662562906.5364256 1387.93 973434.01
732 731 1662562906.636332 1384.78 974818.79
733 732 1662562906.736253 1329.89 976148.69
734 733 1662562906.8361526 1379.33 977528.01
735 734 1662562906.936032 1350.53 978878.55
736 735 1662562907.4355087 1353.13 980231.67
737 736 1662562907.2356994 1348.55 981580.23
738 737 1662562907.0359437 1347.82 982928.05
739 738 1662562907.135789 1340.91 984268.96
740 739 1662562907.3356035 1361.58 985630.54
741 740 1662562907.5354004 1349.58 986980.12
742 741 1662562907.63527 1365.28 988345.39
743 742 1662562907.7351515 1371.39 989716.78
744 743 1662562907.8350635 1331.50 991048.28
745 744 1662562907.9349277 1317.05 992365.33
746 745 1662562908.0348196 1346.83 993712.17
747 746 1662562908.134636 1266.18 994978.35
748 747 1662562908.2346165 1251.07 996229.42
749 748 1662562908.3344874 1246.39 997475.81
750 749 1662562908.4343987 1283.02 998758.83
Times here are all messed
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
Case for 2, 2 2022-09-07 16:13:03.973045 2022-09-07 16:13:04.273173 1662559983.973045
Case for 3, 733 2022-09-07 17:01:46.936032 2022-09-07 17:01:47.435509 1662562906.936032
Case for 3, 737 2022-09-07 17:01:47.135789 2022-09-07 17:01:47.335603 1662562907.135789
Case for 3, 738 2022-09-07 17:01:47.335603 2022-09-07 17:01:47.535400 1662562907.335603
Case for 7, 1 2022-09-07 19:15:04.311130 2022-09-07 19:15:04.511094 1662570904.31113
pietro@pietro-N552VW:~/work/Clear$ /bin/python3 /home/pietro/work/Clear/Digitizer/Python/fileExplorer.py
Case for Irradition_160_2700pC_211mm.dat, 0 2022-09-07 15:39:09.252774 2022-09-07 15:39:09.452748 1662557949.252774
Case for Irradition_160_2700pC_211mm.dat, 2 2022-09-07 15:39:09.352724 2022-09-07 15:39:09.552731 1662557949.352724
Case for Irradition_160_2700pC_211mm_2.dat, 2 2022-09-07 16:13:03.973045 2022-09-07 16:13:04.273173 1662559983.973045
Case for Irradition_160_2700pC_211mm_3.dat, 733 2022-09-07 17:01:46.936032 2022-09-07 17:01:47.435509 1662562906.936032
Case for Irradition_160_2700pC_211mm_3.dat, 737 2022-09-07 17:01:47.135789 2022-09-07 17:01:47.335603 1662562907.135789
Case for Irradition_160_2700pC_211mm_3.dat, 738 2022-09-07 17:01:47.335603 2022-09-07 17:01:47.535400 1662562907.335603
Case for Irradition_160_2700pC_211mm_7.dat, 1 2022-09-07 19:15:04.311130 2022-09-07 19:15:04.511094 1662570904.31113
pietro@pietro-N552VW:~/work/Clear$
Python
bash
python3
bash
python3
Ln 736, Col 21 Spaces: 4 UTF-8 LF Plain Text
start
Presentation3.pp...
Irradition_160_2...
Figure 1
Figure 1
Figure 1
Irradition_160_2...
Monday 31 October, 15:55



pan/zoom, x=15:51:03 y=0.173779

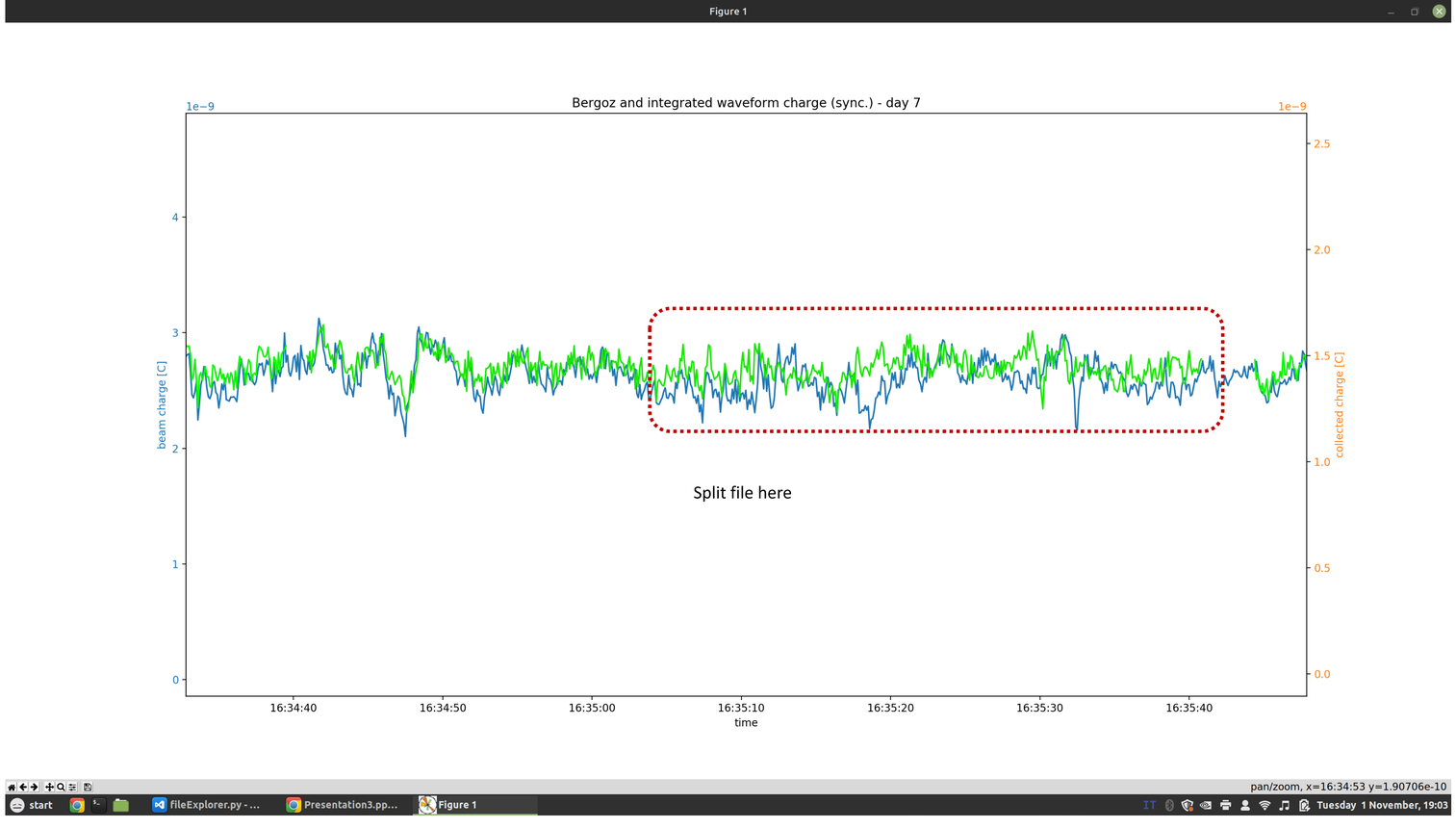
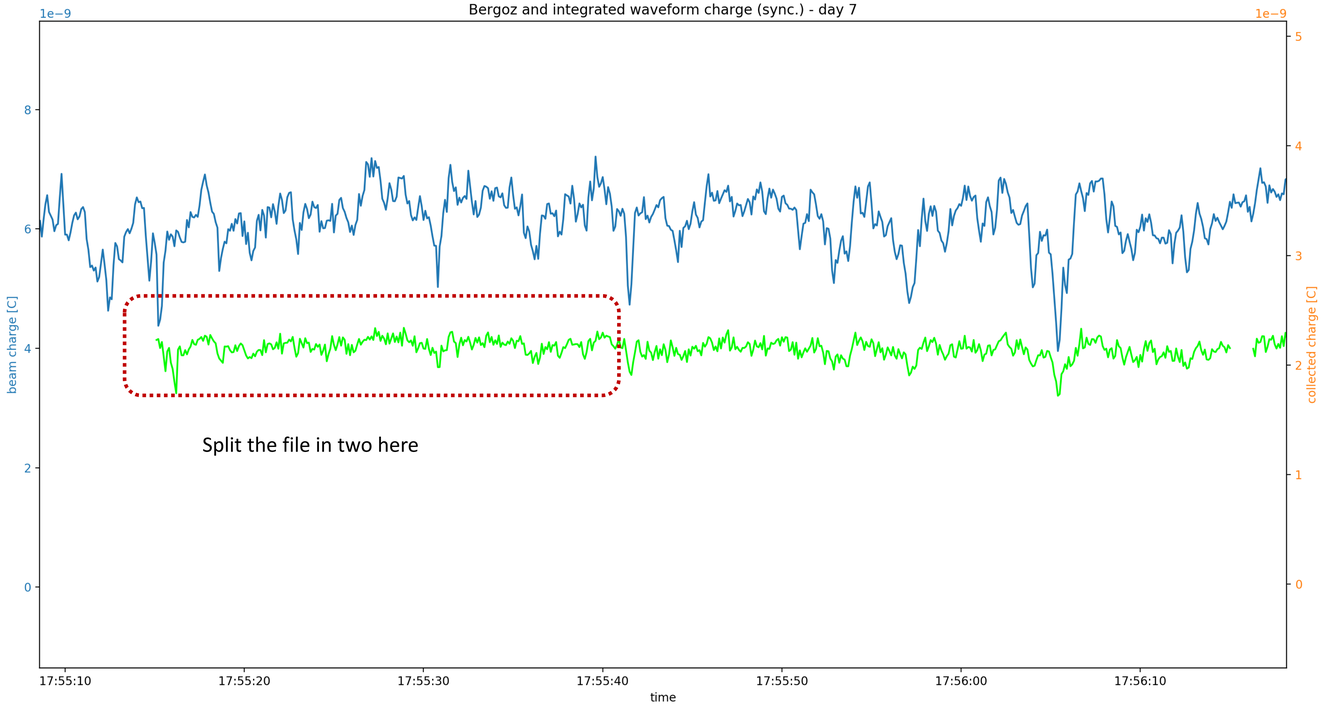
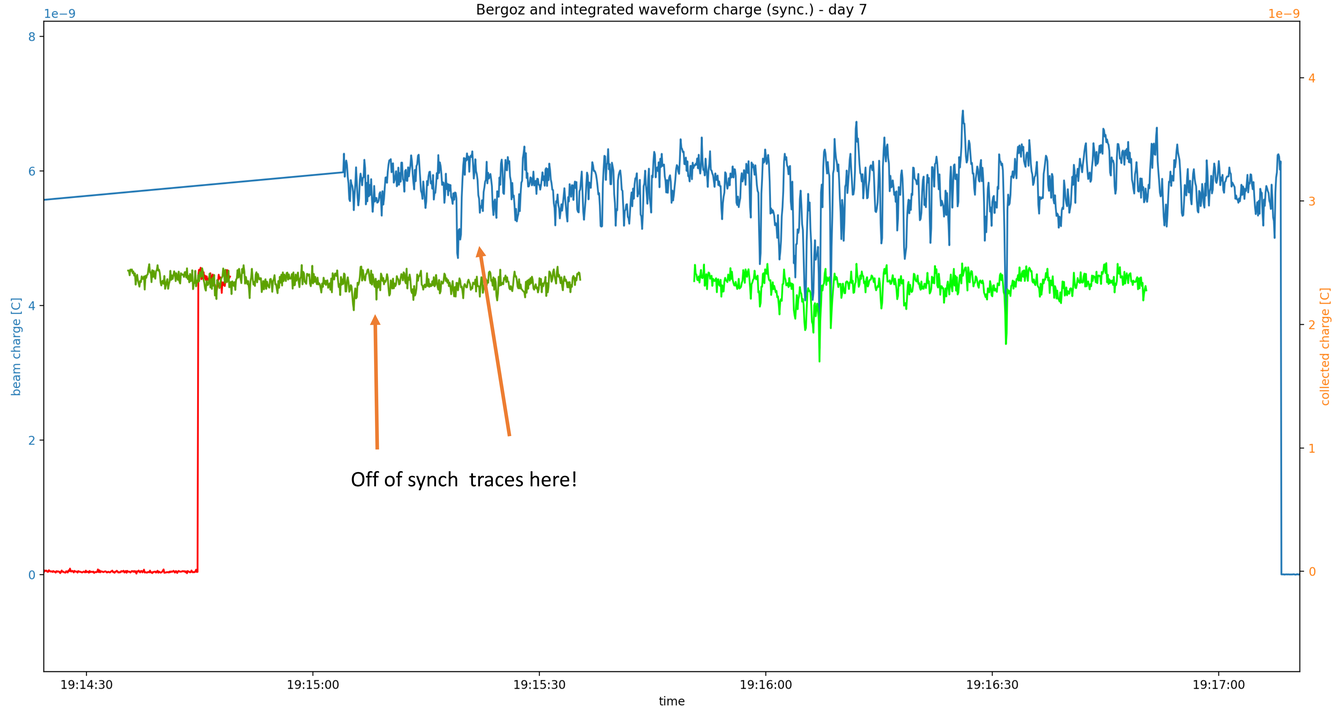
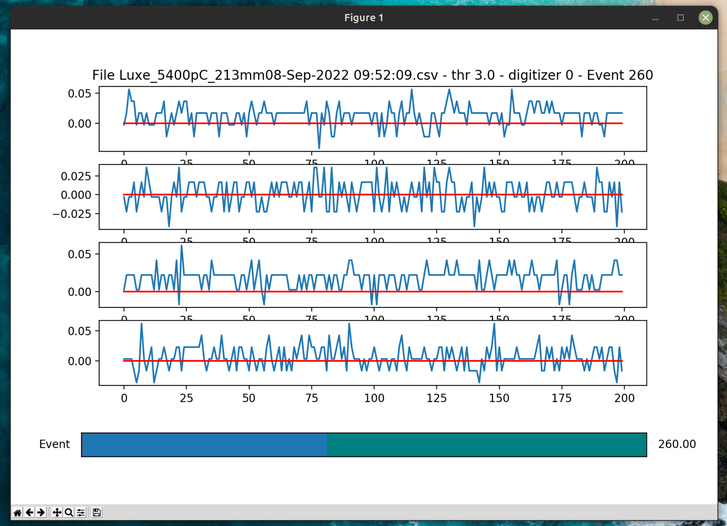


Figure 1
Bergoz and integrated waveform charge (sync.) - day 7
1e−9
1e−9
beam charge [C]
collected charge [C]
Split file here
time
16:34:40
16:34:50
16:35:00
16:35:10
16:35:20
16:35:30
16:35:40
pan/zoom, x=16:34:53 y=1.90706e-10
start
FileExplorer.py - ...
Presentation3.pp...
Figure 1
Tuesday 1 November, 19:03


Bergoz and integrated waveform charge (sync.) - day 7
1e−9
1e−9
beam charge [C]
collected charge [C]
Split the file in two here
time
17:55:10
17:55:20
17:55:30
17:55:40
17:55:50
17:56:00
17:56:10
pan/zoom, x=17:55:53 y=4.89725e-09


Bergoz and integrated waveform charge (sync.) - day 7
1e−9
1e−9
beam charge [C]
collected charge [C]
Off of synch traces here!
time
19:14:30
19:15:00
19:15:30
19:16:00
19:16:30
19:17:00
pan/zoom, x=19:16:35 y=1.42631e-09

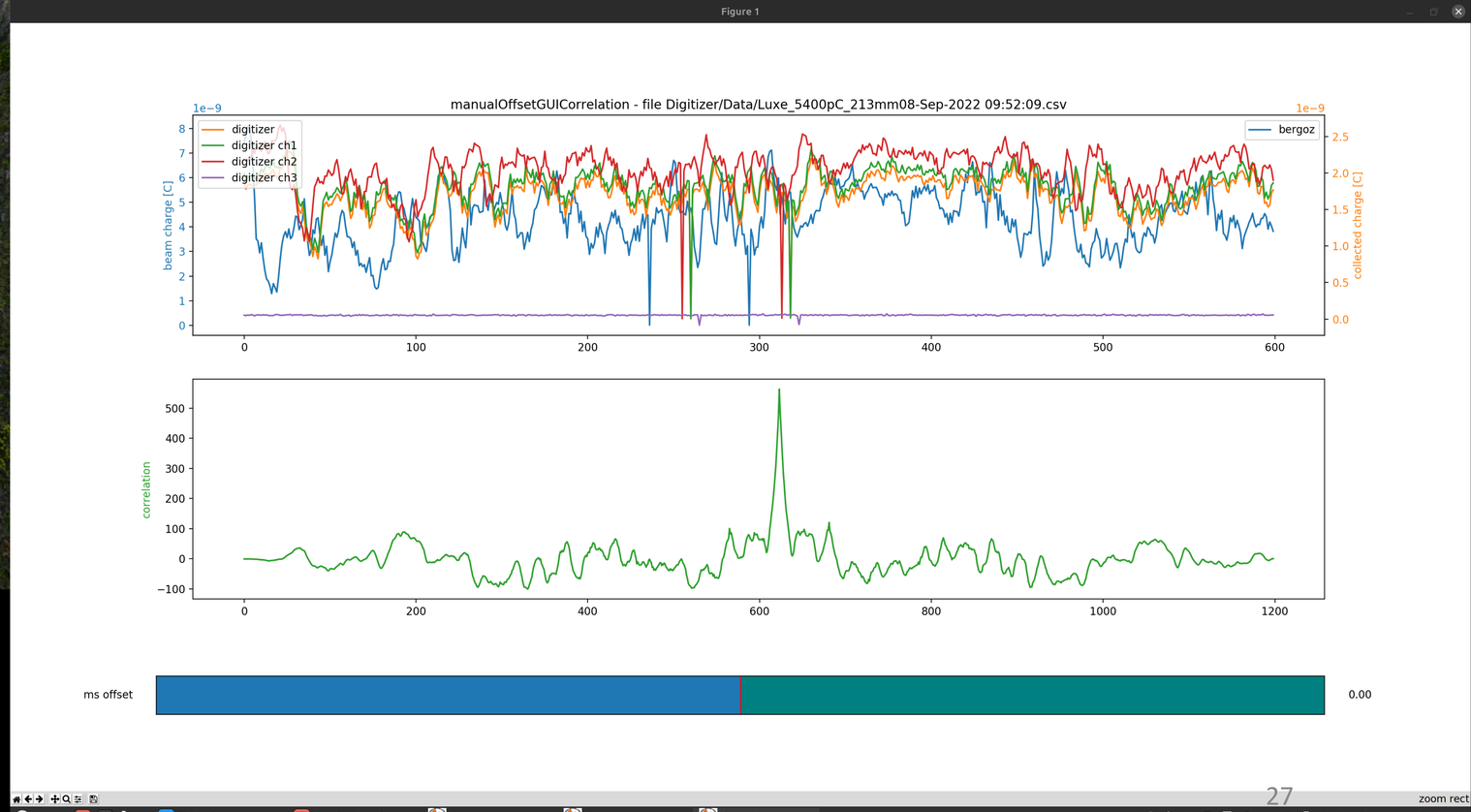


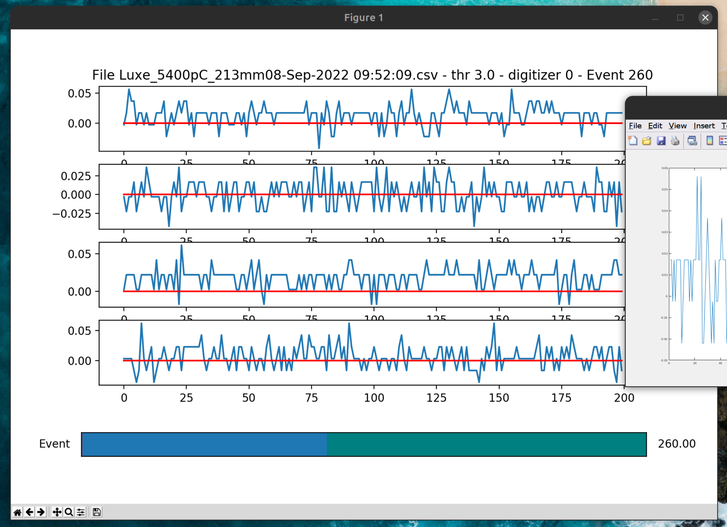
Problem

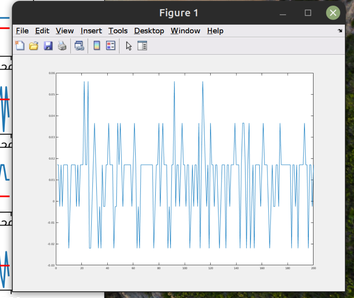
8- The right figure shows that digitizer's data within the same acquisition (file) contains time differences between digitizer0-1-2 data. That is, there is a relative offset (in trigger units) between the waveforms acquired from digitizer 0 and those from digitizer 1.

Trigger offset between channels of the same digitizer is 0.

Trigger offset between different digitizers is variable, usually within the range 0-10.

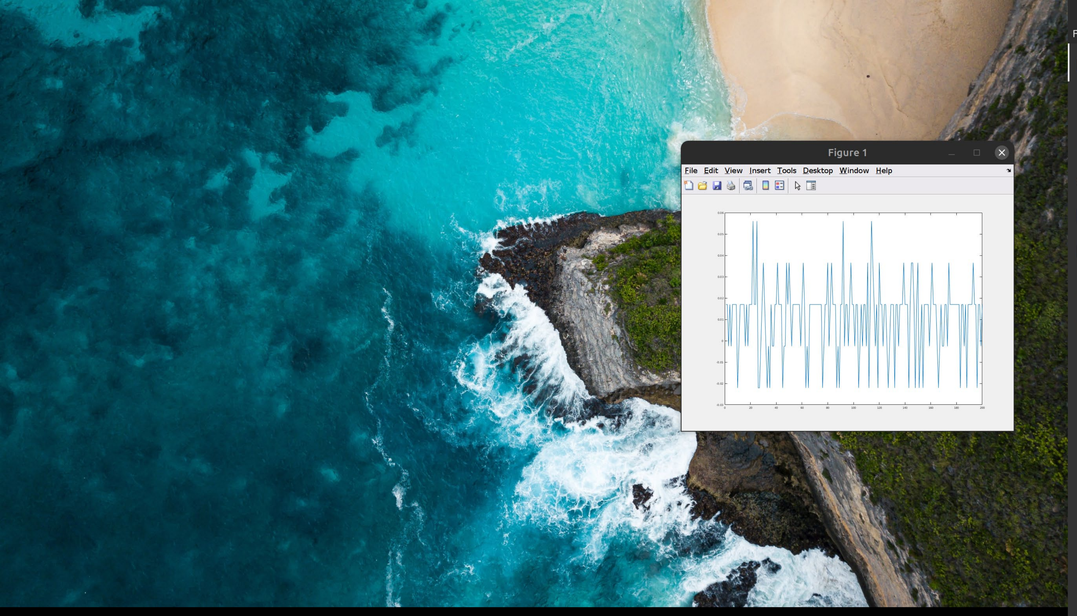






Problem

8- The issue is present in the source files, as verified by myself inspecting the matlab files.



Problem

8- A systematic study of this offset shows that this effect doesn't follow a specific temporal trend, but rather appears randomly

fileExplorer.py - Clear - Visual Studio Code

File Edit Selection View Go Run Terminal Help

EXPLORER

CLEAR

.vscode
Analysis
Charge
Digitizer
Data
Python
fileExplorer.py
notebook.ipynb
test.py
Scripts
6SeptList_synch.txt
6SeptList.txt
7SeptList_synch.txt
7SeptList.txt
8SeptList_excludedfromIrratiation.txt
8SeptList_synch.txt
8SeptList.txt
9SeptList_synch.txt
PSU
Tektronix
Timber
_wav_concat_synch_append_7Sept.dat
_wav_concat_synch_append_8Sept.dat
chg_concat_6Sept.dat
chg_concat_7Sept.dat
chg_concat_8Sept.dat
chg_concat_9Sept.dat
intersectAndDivide_7Sept.dat
intersectAndDivide_8Sept.dat
plotAllDay_Bergoz_7Sept.dat
plotAllDay_Bergoz_8Sept.dat
plotAllDay_Digitizers_6Sept.dat
plotAllDay_Digitizers_7Sept.dat
plotAllDay_PwrSupply_7Sept.dat
plotAllDay_PwrSupply_8Sept.dat
psu_concat_6Sept.dat
psu_concat_7Sept.dat
psu_concat_8Sept.dat
wav_concat_6Sept.dat
wav_concat_7Sept.dat

OUTLINE
TIMELINE

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

```
WAV 206: Luxe_2700pC_centered07-Sep-2022 18:51:21.csv
WAV 207: Luxe_2700pC_centered07-Sep-2022 18:52:23.csv
WAV 208: Luxe_2700pC_centered07-Sep-2022 18:53:24.csv
WAV 209: Luxe_2700pC_centered07-Sep-2022 18:54:25.csv
WAV 210: Luxe_2700pC_centered07-Sep-2022 18:55:26.csv
WAV 211: Luxe_2700pC_centered07-Sep-2022 18:56:28.csv
WAV 212: Luxe_2700pC_centered07-Sep-2022 18:57:29.csv
WAV 213: Luxe_2700pC_centered07-Sep-2022 18:58:30.csv
WAV 214: Luxe_2700pC_centered07-Sep-2022 18:59:31.csv
WAV 215: Luxe_2700pC_centered07-Sep-2022 19:00:32.csv
WAV 216: Luxe_2700pC_centered07-Sep-2022 19:01:34.csv
WAV 217: Luxe_2700pC_centered07-Sep-2022 19:02:35.csv
WAV 218: Luxe_2700pC_centered07-Sep-2022 19:03:36.csv
WAV 219: Luxe_2700pC_centered07-Sep-2022 19:04:37.csv
WAV 220: Luxe_2700pC_centered07-Sep-2022 19:05:38.csv
WAV 221: Luxe_2700pC_centered07-Sep-2022 19:06:39.csv
WAV 222: Luxe_2700pC_centered07-Sep-2022 19:07:41.csv
WAV 223: Luxe_2700pC_centered07-Sep-2022 19:08:42.csv
WAV 224: Luxe_2700pC_centered07-Sep-2022 19:09:43.csv
WAV 225: Luxe_2700pC_centered07-Sep-2022 19:10:44.csv
WAV 226: Luxe_2700pC_centered07-Sep-2022 19:11:45.csv
WAV 227: Luxe_2700pC_centered07-Sep-2022 19:12:47.csv
WAV 228: Luxe_2700pC_centered07-Sep-2022 19:13:48.csv
WAV 229: Luxe_2700pC_centered07-Sep-2022 19:14:49.csv
WAV 230: Luxe_2700pC_centered07-Sep-2022 19:15:50.csv
WAV 231: Luxe_2700pC_centered07-Sep-2022 19:16:51.csv

 --- Diagnostic (lag different digitizers)... ---
WAV 0: Luxe_25pC_centered07-Sep-2022 09:53:03.csv : [[0, 0], [0, 0], [0, 0], [0, 0]]
WAV 1: Luxe_25pC_centered07-Sep-2022 09:55:25.csv : [[0, 0], [0, -51], [0, 0], [0, 0]]
WAV 2: Luxe_25pC_centered07-Sep-2022 09:57:17.csv : [[0, 0], [0, -2], [0, 0], [0, 0]]
WAV 3: Luxe_25pC_centered07-Sep-2022 09:58:47.csv : [[0, 0], [0, 38], [0, 0], [0, 0]]
WAV 4: Luxe_25pC_centered07-Sep-2022 10:00:26.csv : [[0, 0], [0, 120], [0, 0], [0, 0]]
WAV 5: Luxe_25pC_centered07-Sep-2022 10:01:59.csv : [[0, 0], [0, 0], [0, 0], [0, 0]]
WAV 6: Luxe_25pC_centered07-Sep-2022 10:03:54.csv : [[1, 1], [1, 3], [1, 1], [1, 1]]
WAV 7: Luxe_25pC_centered07-Sep-2022 10:05:29.csv : [[0, 0], [0, -36], [0, 0], [0, 0]]
WAV 8: Luxe_25pC_centered07-Sep-2022 10:06:55.csv : [[0, 0], [0, -52], [0, 0], [0, 0]]
WAV 9: Luxe_25pC_centered07-Sep-2022 10:08:25.csv : [[0, 0], [0, 1], [0, 0], [0, 0]]
WAV 10: Luxe_25pC_centered07-Sep-2022 10:10:37.csv : [[0, 0], [0, -15], [0, 0], [0, 0]]
WAV 11: Luxe_25pC_centered07-Sep-2022 10:11:47.csv : [[0, 0], [0, -4], [0, 0], [0, 0]]
WAV 12: Luxe_25pC_centered07-Sep-2022 10:12:56.csv : [[0, 0], [0, 0], [0, 0], [0, 0]]
WAV 13: Luxe_25pC_centered07-Sep-2022 10:14:25.csv : [[0, 0], [0, 89], [0, 0], [0, 0]]
WAV 14: Luxe_25pC_centered07-Sep-2022 10:16:05.csv : [[0, 0], [0, 56], [0, 0], [0, 0]]
WAV 15: Luxe_25pC_centered07-Sep-2022 10:17:30.csv : [[0, 0], [0, -168], [0, 0], [0, 0]]
WAV 16: Luxe_25pC_centered07-Sep-2022 10:19:51.csv : [[-92, -152], [-25, 168], [-13, -37], [387, 0]]
WAV 17: Luxe_2700pC_centered07-Sep-2022 15:39:55.csv : [[0, 0], [0, -16], [0, 0], [0, 0]]
WAV 18: Luxe_2700pC_centered07-Sep-2022 15:40:02.csv : [[0, 0], [0, 4], [0, 0], [0, 0]]
WAV 19: Luxe_2700pC_centered07-Sep-2022 15:40:09.csv : [[0, 0], [0, 5], [0, 0], [0, 0]]
WAV 20: Luxe_2700pC_centered07-Sep-2022 15:40:16.csv : [[0, 0], [0, -19], [0, 0], [0, 0]]
WAV 21: Luxe_2700pC_centered07-Sep-2022 15:40:23.csv : [[0, 0], [0, 10], [0, 0], [0, 0]]
WAV 22: Luxe_2700pC_centered07-Sep-2022 15:40:31.csv : [[0, 0], [0, 14], [0, 0], [0, 0]]
WAV 23: Luxe_2700pC_centered07-Sep-2022 15:40:38.csv : [[0, 0], [0, -4], [0, 0], [0, 0]]
WAV 24: Luxe_2700pC_centered07-Sep-2022 15:40:45.csv : [[0, 0], [0, -34], [0, 0], [0, 0]]
WAV 25: Luxe_2700pC_centered07-Sep-2022 15:40:52.csv : [[0, 0], [0, 1], [0, 0], [0, 0]]
WAV 26: Luxe_2700pC_centered07-Sep-2022 15:41:00.csv : [[0, 0], [0, -18], [0, 0], [0, 0]]
```

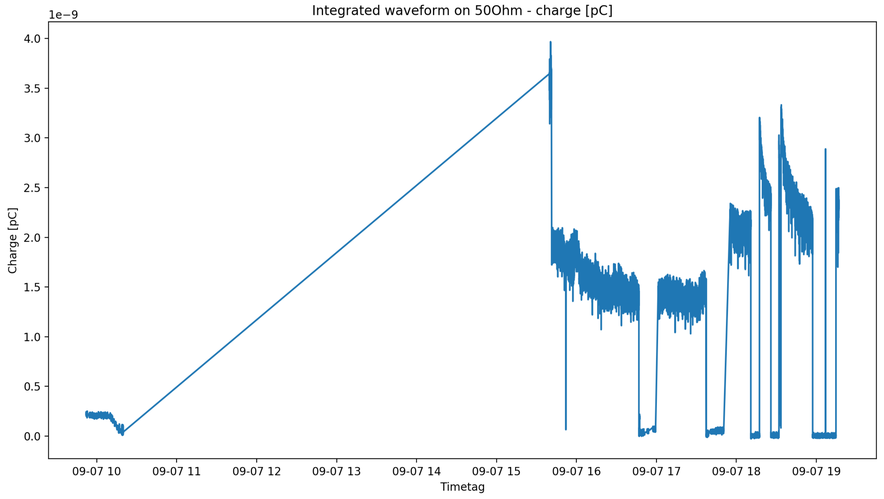
Correlation lag between ch1 dgt1 and ch1 dgt 2

Correlation lag between ch4 dgt1 and ch4 dgt 2

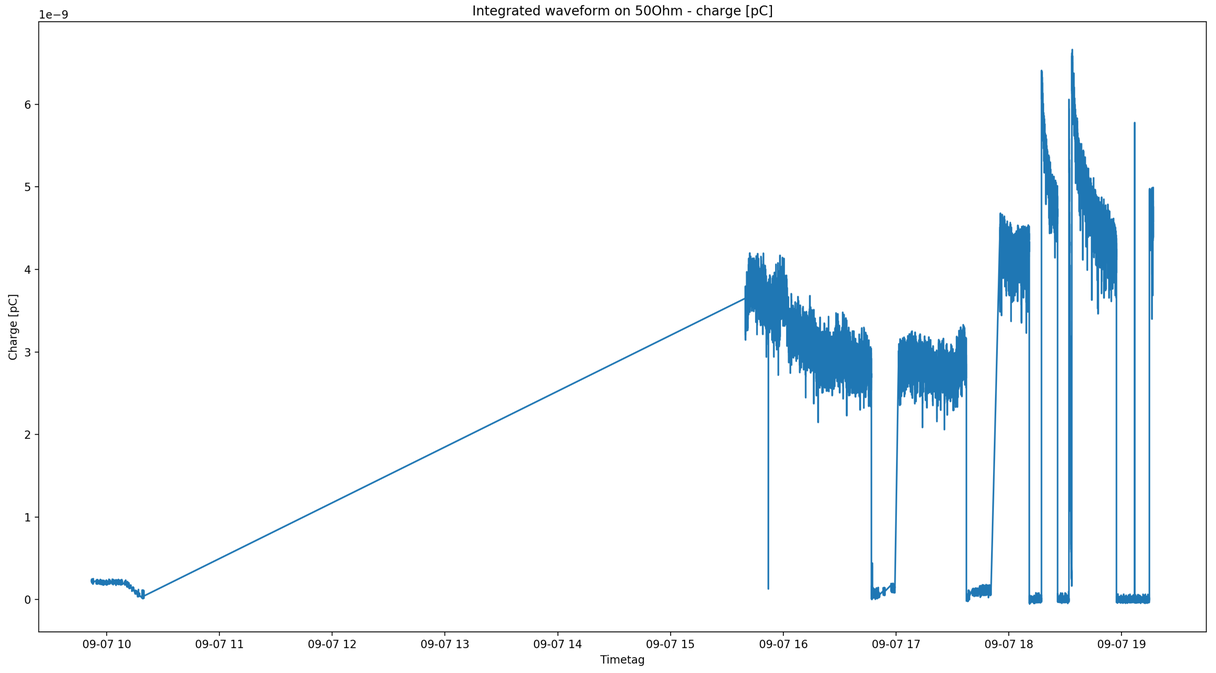
Python
bash
python3
python3
python3
bash

Ln 3850, Col 60 Spaces: 4 UTF-8 Python 3.8.10 64-bit

start fileExplorer... Presentatio... Figure 1 Figure 1 [Figure 1] Figure 1 [pietro@pie... MATLAB R2... Figure 1 Wednesday 2 November, 18:27



Before (left) and after (right) the correction for digitizers horizontal scale



x=09-07 14 y=1.95734e-09

start | plotAllDay_Digiti... | Presentation3.pp... | CLEAR - Google C... | Figure 1 | Figure 1

Sunday 6 November, 13:15