

Temperature Analysis Profile

This program analyzes the temperature of raw environmental test data for automotive lighting systems. The tests expose lighting systems to various temperature profiles while the systems are powered. The primary function of this project is to detect if the changing of temperature of each sample and the ambient is as consistent and regular as the particular and regular changed temperature condition.

Input Raw Data Sample

1. Thermal Shock data (CSV.)

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N |
|---|---------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------|
| 1 | Sweep # | Time | Chan 101 | Chan 102 | Chan 103 | Chan 104 | Chan 105 | Chan 106 | Chan 107 | Chan 108 | Chan 109 | Chan 110 | Chan 111 | Chan 112 (C) |
| 2 | 1 | 02/02/200 | -39.67 | -36.88 | -39.16 | -38.98 | -38.57 | -38.00 | -38.64 | -38.85 | -39.22 | -38.58 | -38.60 | -39.23 |
| 3 | 2 | 02/02/200 | 0.71 | -21.09 | -20.88 | -19.07 | -30.03 | -23.05 | -7.16 | 4.02 | -5.03 | -19.62 | -0.94 | -32.58 |
| 4 | 3 | 02/02/200 | 41.51 | -9.48 | -5.90 | -1.35 | -19.17 | -6.09 | 11.60 | 32.44 | 19.63 | -2.16 | 34.37 | -22.41 |
| 5 | 4 | 02/02/200 | 62.64 | -1.90 | 6.50 | 12.53 | -9.15 | 8.15 | 24.15 | 50.90 | 37.16 | 13.32 | 58.98 | -11.98 |
| 6 | 5 | 02/02/200 | 75.47 | 5.01 | 18.25 | 24.16 | 0.20 | 20.52 | 34.44 | 66.14 | 51.61 | 27.72 | 76.56 | -2.82 |
| 7 | 6 | 02/02/200 | 81.49 | 10.23 | 26.76 | 32.85 | 8.11 | 30.11 | 40.21 | 75.39 | 61.89 | 38.97 | 86.71 | 5.64 |
| 8 | 7 | 02/02/200 | 85.29 | 14.79 | 35.49 | 40.49 | 15.56 | 38.18 | 46.55 | 83.57 | 70.48 | 49.10 | 93.83 | 13.81 |
| 9 | 8 | 02/02/200 | 88.05 | 18.90 | 42.56 | 47.72 | 22.25 | 44.71 | 51.97 | 90.08 | 77.23 | 57.66 | 98.75 | 21.75 |

(And so on...)

2. PTC data (CSV. or TXT.)

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W |
|---|----------|------------|----------|---------|----------|---------|-----------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|------------|------------|-----------|
| 1 | Date | Time | Amb Temp | TC2 | TC3 | TC4 | VSetpoint | VSense 1 | VSense 2 | Board on | TP1: Syst | TP2: Syst | TP3: Syst | TP4: Syst | TP5: Syst | TP6: Syst | TP7: Syst | TP8: Syst | TP9: Syst | TP10: Syst | TP11: Syst | TP12: Syst | System 93 |
| 2 | 2/6/2017 | 6:50:57 PM | -42.518 | -42.032 | 6.50E+34 | -42.125 | 9 | 0.003 | 0.003 | 0 | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | |
| 3 | 2/6/2017 | 6:51:03 PM | -42.594 | -42.025 | 6.50E+34 | -42.146 | 9 | 0.003 | 0.003 | 0 | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | |
| 4 | 2/6/2017 | 6:51:09 PM | -42.702 | -42.049 | 6.50E+34 | -42.132 | 9 | 0.004 | 0.003 | 0 | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | |
| 5 | 2/6/2017 | 6:51:15 PM | -42.777 | -42.042 | 6.50E+34 | -42.129 | 9 | 0.004 | 0.004 | 0 | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | |
| 6 | 2/6/2017 | 6:51:21 PM | -42.842 | -42.056 | 6.50E+34 | -42.143 | 9 | 0.003 | 0.003 | 0 | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | |
| 7 | 2/6/2017 | 6:51:27 PM | -42.889 | -42.042 | 6.50E+34 | -42.163 | 9 | 0.004 | 0.005 | 0 | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | |
| 8 | 2/6/2017 | 6:51:33 PM | -42.918 | -42.063 | 6.50E+34 | -42.16 | 9 | 0.003 | 0.004 | 0 | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | |
| 9 | 2/6/2017 | 6:51:39 PM | -42.921 | -42.056 | 6.50E+34 | -42.19 | 9 | 0.005 | 0.005 | 0 | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | |

(And so on...)

Current Limits

This program can only analyze the cycles that can reach the threshold, but will leave those cycles cannot reach as blank.

Core Functions

1. Temporal Plotting

2. Summary Tables with basic statistics

- List out outage data (Usually because of reading errors or opened thermal couple)
- Statistic summary of all the cycles
- List out all the calculate result of each cycle: (the attributes listed as below)
 - Cold_soak_duration_minute
 - Cold_soak_mean_temp_c
 - Cold_soak_max_temp_c
 - Cold_soak_min_temp_c
 - Hot_soak_duration_minute
 - Hot_soak_mean_temp_c
 - Hot_soak_max_temp_c
 - Hot_soak_min_temp_c
 - Down_recovery_time_minute
 - Down_RAMP_temp_c
 - Down_RAMP_rate_c/minute
 - Up_recovery_time_minute
 - Up_RAMP_temp_c
 - Up_RAMP_rate_c/minute

Introduction

1. Gui

Temperature Profile Analysis

☐ PTC ☒ Thermal Shock

Select Data File: n6/Desktop/profile-analysis-master/test_data/dat00002.csv

Test Name: TShock test sample

Upper Threshold (°C): 95

Lower Threshold (°C): -40

Temperature Tolerance (°C): 3

Component rate adjustment (%): 10

Load TCs...

- In this interface, user give the input of this program.
- Choose the raw testdata file and the type of this test.
- Give a name or discription to this datafile over Test Name box.
- Input the Upper & Lower Threshold, and Temperate Tolerance.
- Input Component rate adjustment if it exists.

Temperature Profile Analysis

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 ☒ Thermal Shock

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Test Name: TShock test sample

Upper Threshold (°C): 95

Lower Threshold (°C): -40

Temperature Tolerance (°C): 3

Component rate adjustment (%): 10

Load TCs...

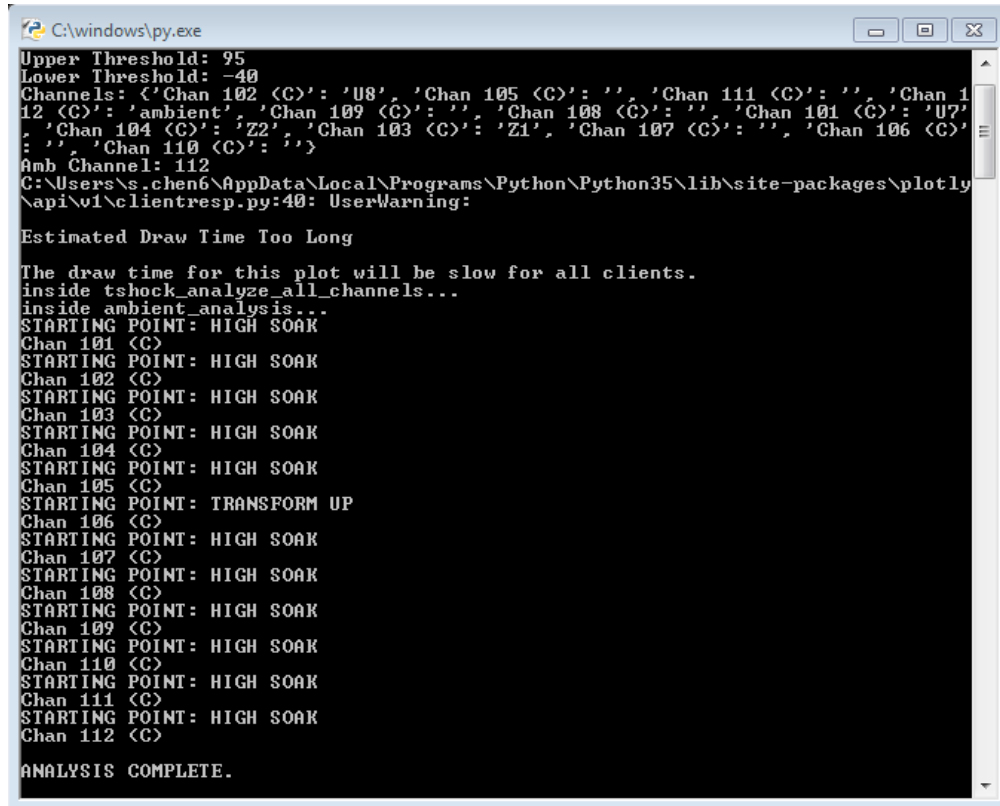
Amb Temp Channel: 112

| | | | |
|---------------|----|---------------|---------|
| Chan 101 (C): | U7 | Chan 111 (C): | |
| Chan 102 (C): | U8 | Chan 112 (C): | ambient |
| Chan 103 (C): | Z1 | | |
| Chan 104 (C): | Z2 | | |
| Chan 105 (C): | | | |
| Chan 106 (C): | | | |
| Chan 107 (C): | | | |
| Chan 108 (C): | | | |
| Chan 109 (C): | | | |
| Chan 110 (C): | | | |

Analyze!

- In this interface, this program can detect there are how many channels in this test.
- User can label out which channel is the Ambient.
- Give a brief discription for each channel or leave it blank.
- All of these brief label will show in the tab of output excel file.

2. Analyze! (Click "Analyze!" Button)



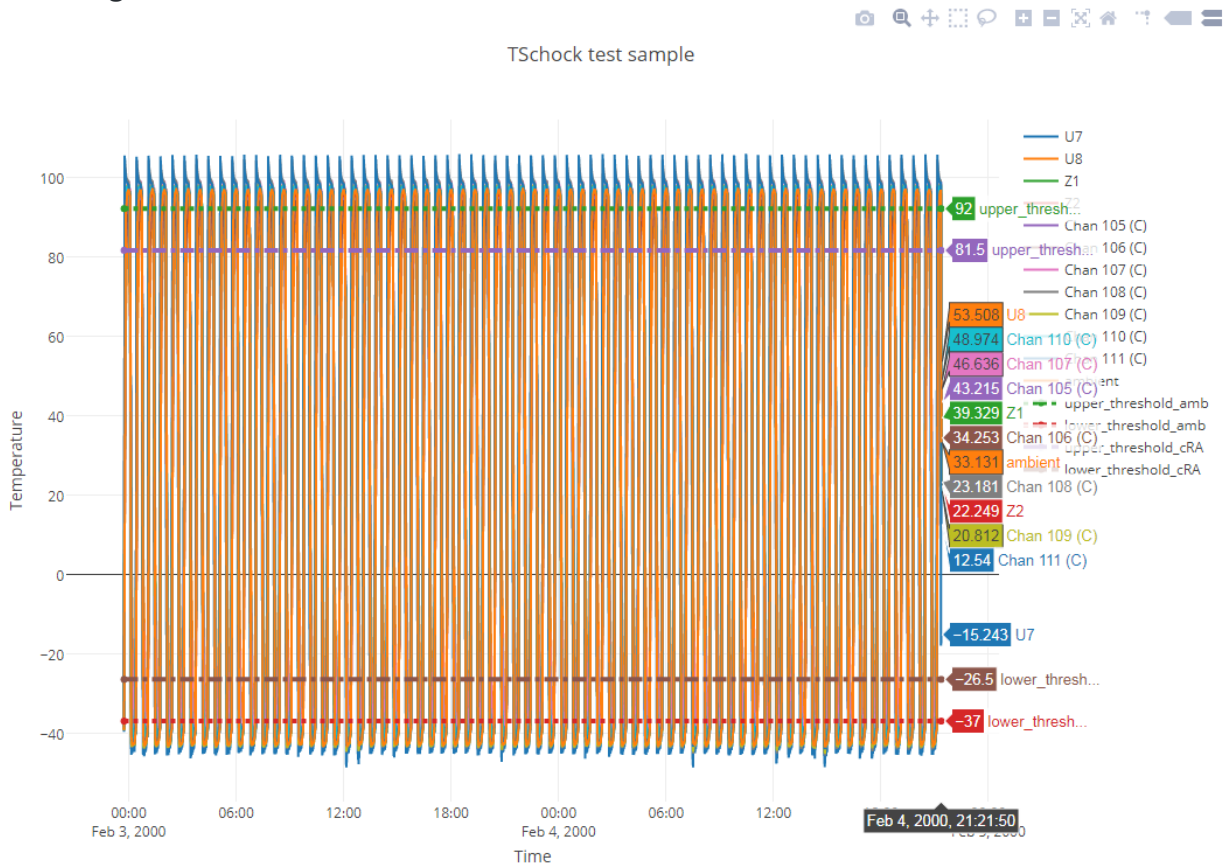
```
C:\windows\py.exe
Upper Threshold: 95
Lower Threshold: -40
Channels: <'Chan 102 <C>': 'U8', 'Chan 105 <C>': '', 'Chan 111 <C>': '', 'Chan 1
12 <C>': 'ambient', 'Chan 109 <C>': '', 'Chan 108 <C>': '', 'Chan 101 <C>': 'U7'
, 'Chan 104 <C>': 'Z2', 'Chan 103 <C>': 'Z1', 'Chan 107 <C>': '', 'Chan 106 <C>
': '', 'Chan 110 <C>': ''>
Amb Channel: 112
C:\Users\s.chen6\AppData\Local\Programs\Python\Python35\lib\site-packages\plotly
\napi\v1\clientresp.py:40: UserWarning:

Estimated Draw Time Too Long

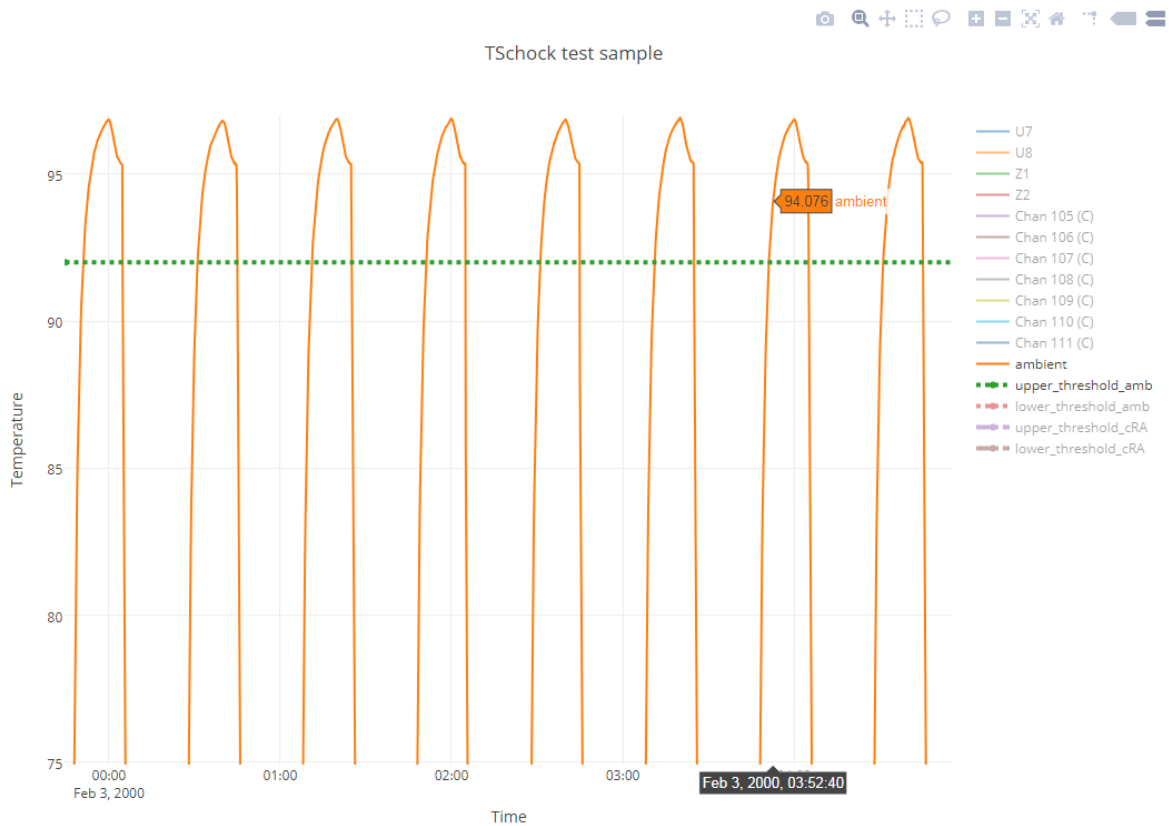
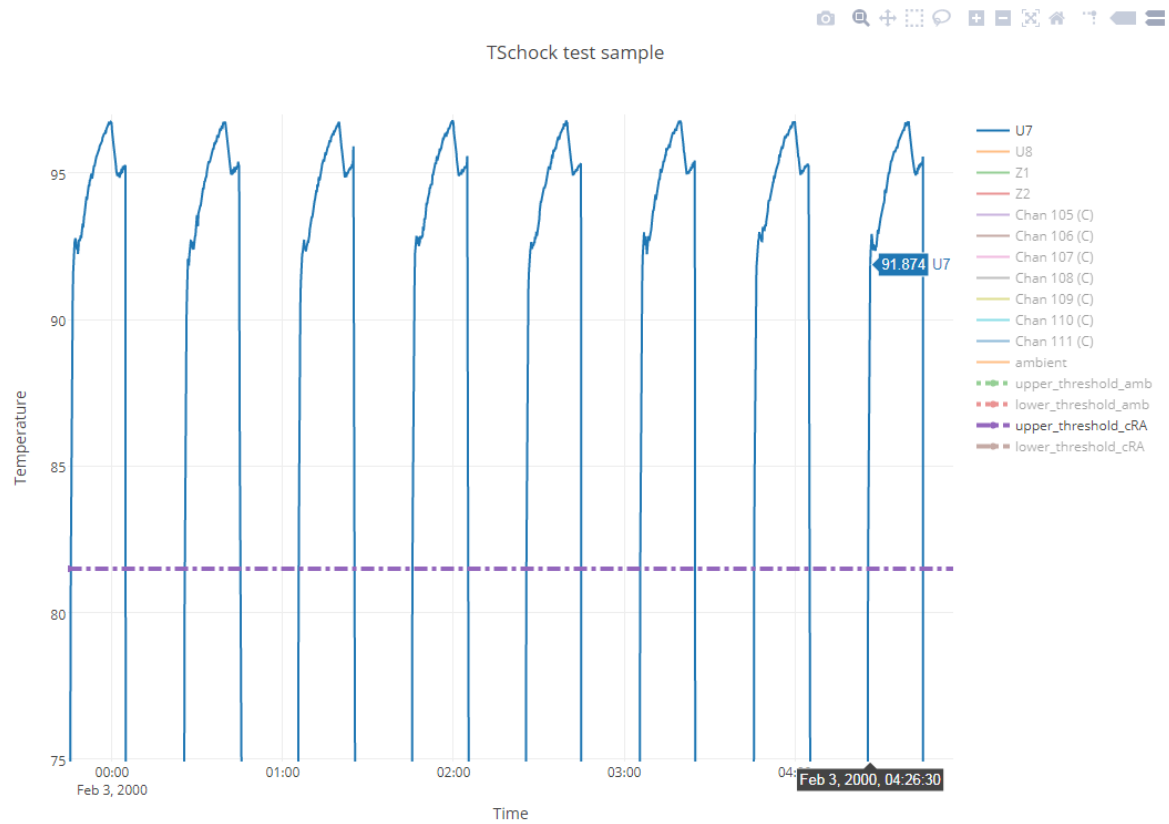
The draw time for this plot will be slow for all clients.
inside tshock_analyze_all_channels...
inside ambient_analysis...
STARTING POINT: HIGH SOAK
Chan 101 <C>
STARTING POINT: HIGH SOAK
Chan 102 <C>
STARTING POINT: HIGH SOAK
Chan 103 <C>
STARTING POINT: HIGH SOAK
Chan 104 <C>
STARTING POINT: HIGH SOAK
Chan 105 <C>
STARTING POINT: TRANSFORM UP
Chan 106 <C>
STARTING POINT: HIGH SOAK
Chan 107 <C>
STARTING POINT: HIGH SOAK
Chan 108 <C>
STARTING POINT: HIGH SOAK
Chan 109 <C>
STARTING POINT: HIGH SOAK
Chan 110 <C>
STARTING POINT: HIGH SOAK
Chan 111 <C>
STARTING POINT: HIGH SOAK
Chan 112 <C>
ANALYSIS COMPLETE.
```

- In this interface, the notification can show the progress of analysis, and also can show how the channel start.

3. Plotting



- This is the general plot of raw testdata.
- The X axis is the time scale and index.
- The Y axis is the temperature(C) over that scan.
- This graph can show only selected channels, and also can zoom in and out.



4. Output Excel

| | A | B | C | D | E | F | |
|----|---|---------------------------|-----------------------|----------------------|----------------------|--------------------------|---------------------|
| 1 | Version 4.0 | | | | | | |
| 2 | | | | | | | |
| 3 | In this TSHOCK test file, there are 68 cycles. | | | | | | |
| 4 | | | | | | | |
| 5 | The First Table: List out the test data that have reading error. | | | | | | |
| 6 | | Sweep # | Time | Chan 112 (C) | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |
| 10 | The Second Table: Summary table for the ambient. | | | | | | |
| 11 | | | | | | | |
| 12 | | | | | | | |
| 13 | | | | | | | |
| 14 | | | | | | | |
| 15 | | cold_soak_duration_minute | cold_soak_mean_temp_c | cold_soak_max_temp_c | cold_soak_min_temp_c | hot_soak_duration_minute | hot_soak_max_temp_c |
| 16 | mean | 16.3 | -41.74 | -37.46 | -43.17 | 13.72 | |
| 17 | min | 16.17 | -41.84 | -37.91 | -43.6 | 13.5 | |
| 18 | min_cycle# | 5 | 45 | 65 | 59 | 11 | |
| 19 | max | 16.5 | -41.63 | -37.07 | -42.89 | 13.83 | |
| 20 | max_cycle# | 62 | 39 | 1 | 63 | 42 | |
| 21 | std_dev | 0.1 | 0.05 | 0.23 | 0.14 | 0.08 | |
| 22 | | | | | | | |
| 23 | | | | | | | |
| 24 | | | | | | | |
| 25 | The Third Table: List out the calculation result for each cycle of ambient. | | | | | | |
| 26 | | | | | | | |
| 27 | | | | | | | |
| 28 | | | | | | | |
| 29 | | | | | | | |
| 30 | cycle# | cold_soak_duration_minute | cold_soak_mean_temp_c | cold_soak_max_temp_c | cold_soak_min_temp_c | hot_soak_duration_minute | hot_soak_max_temp_c |
| 31 | 1 | 16.33 | -41.79 | -37.07 | -43.17 | 13.67 | |
| 32 | 2 | 16.33 | -41.76 | -37.32 | -43.32 | 13.67 | |
| 33 | 3 | 16.33 | -41.77 | -37.39 | -43.16 | 13.67 | |
| 34 | 4 | 16.33 | -41.8 | -37.53 | -43.36 | 13.67 | |
| 35 | 5 | 16.17 | -41.78 | -37.77 | -43.11 | 13.67 | |
| 36 | 6 | 16.33 | -41.7 | -37.3 | -43.15 | 13.67 | |

- Each tab of the output excel represent one channel.
- Each sheet is consisted with 3 tables as this instruction mentioned above.

5. Independency

- [Python3](#)
- [Pandas](#) - Data wrangling and processing
- [Matplotlib](#) - Plotting
- [XlsWriter](#) - Creates analysis tables
- [PyQt5](#) – GUI

Authors

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