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 at times with the systems 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 Tem	TC2	TC3	TC4	VSetpoin	VSense 1	VSense 2	Board on	TP1: Syste	TP2: Syste	TP3: Syste	TP4: Syste	TP5: Syste	TP6: Syste	TP7: Syste	TP8: Syste	TP9: Syste	TP10: Sys	TP11: Sys	TP12: 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

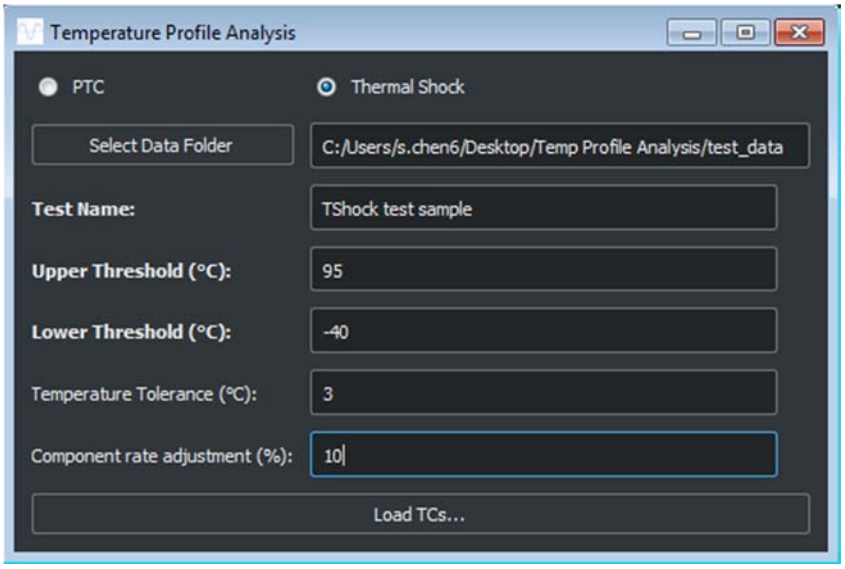
1. Temporal Plotting

2. Summary Tables with basic statistics

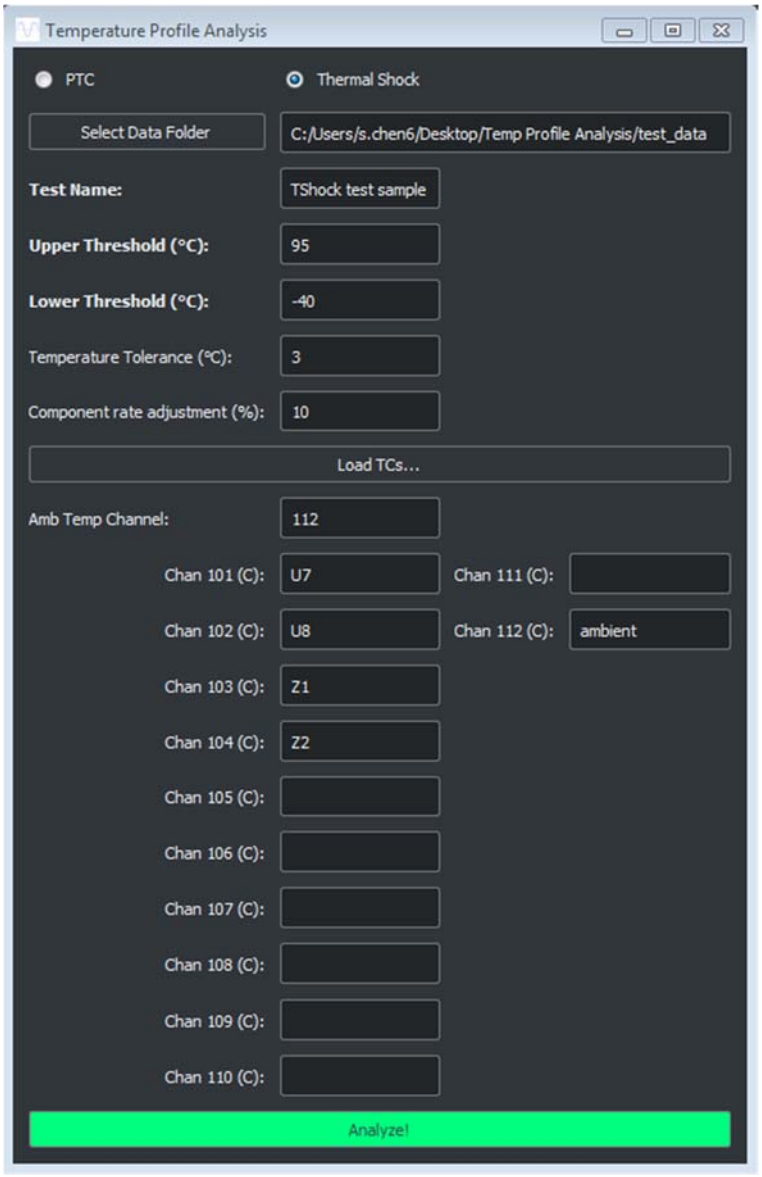
- List out of range data (Usually because of reading errors or opened thermal couple)
- Statistic summary of all the cycles
- List out all the calculate result of each cycle: (the attributes listed as below)
    - Cold_soak_duration_minute
    - Cold_soak_mean_temp_c
    - Cold_soak_max_temp_c
    - 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

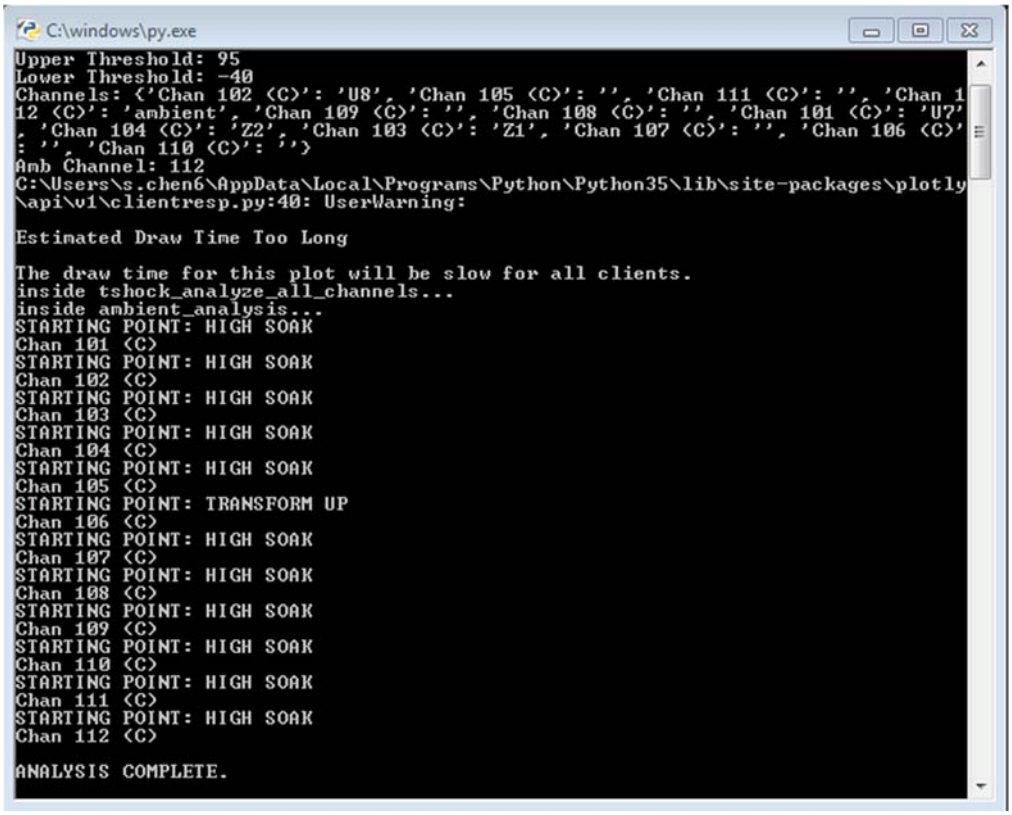


- In this interface, user provides inputs to this program. * Choose the folder which include the raw test data files.
- (the files could be one or many, if many, please rename them by the time order. For instance, dat00001.csv, dat00002.csv and dat00003.csv).
- Choose the type of test.
- Give a name or description to this data file in Test Name box.
- Input the Upper & Lower Threshold, and Temperate Tolerance.
- Input Component rate adjustment if it exists. (if none leave blank)



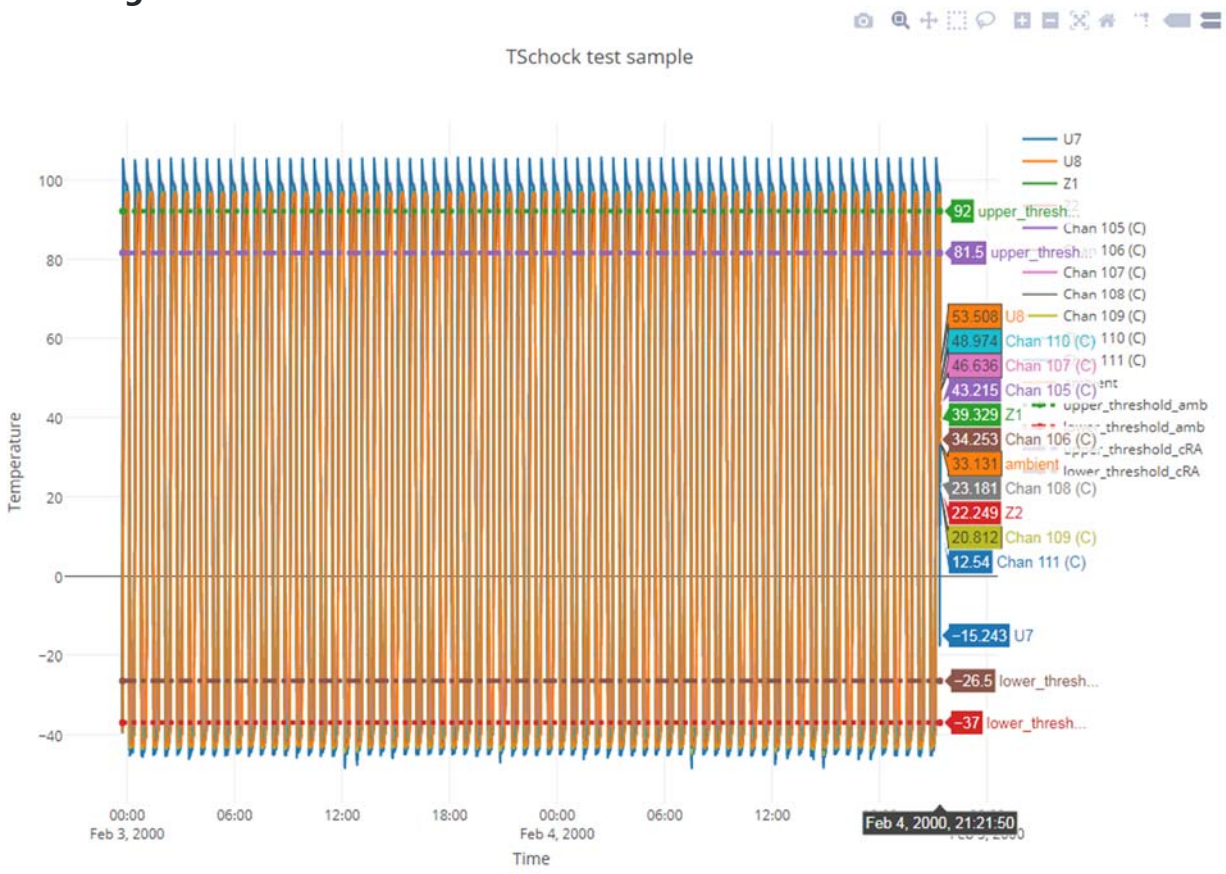
- In this interface, this program can detect how many channels are in this test.
- User can label which channel is the Ambient.
- User can include a brief label for each channel or leave it blank.
- All of these brief labels will show in the worksheet tab of output excel file.

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

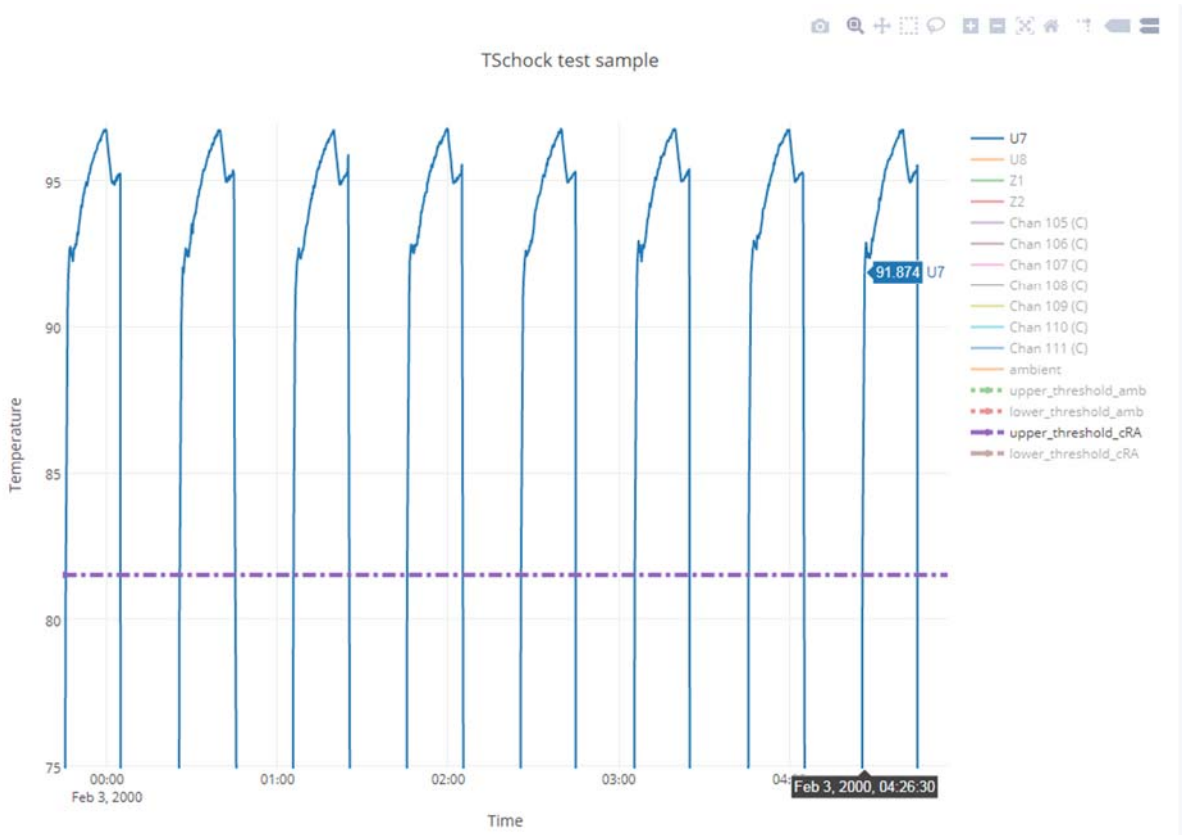


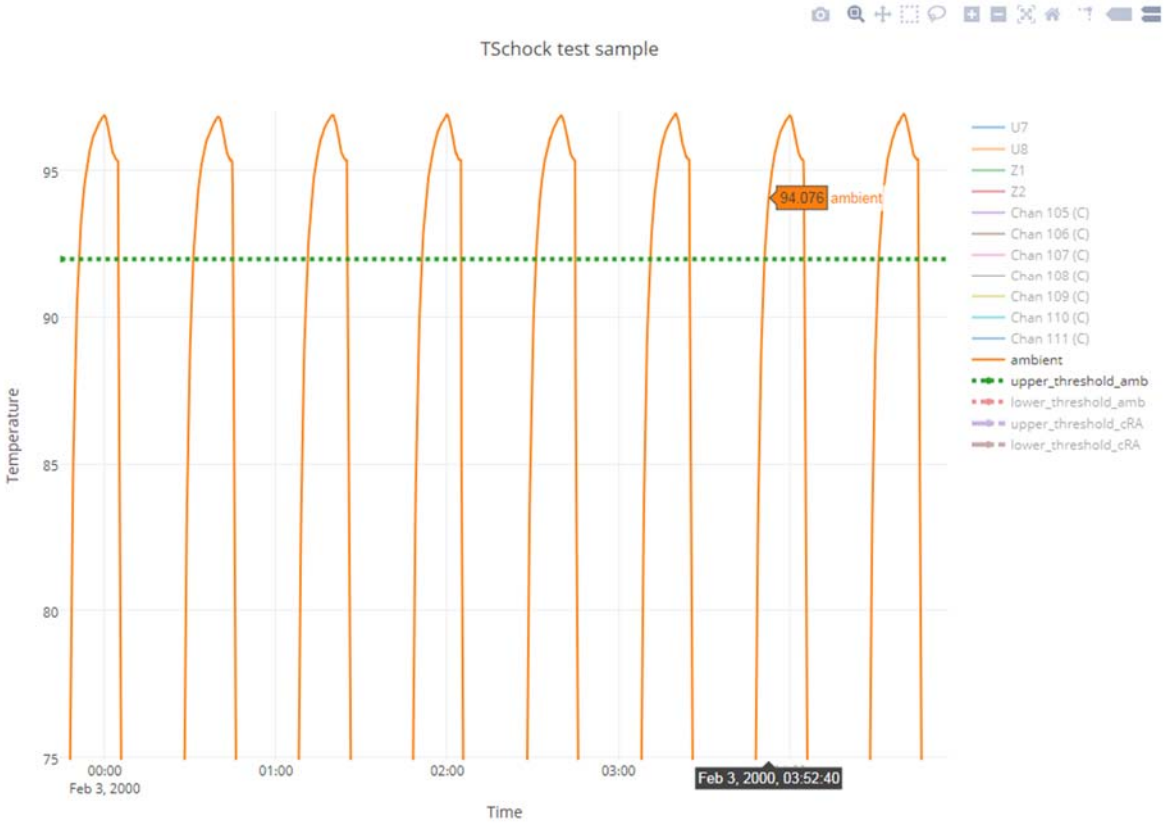
- In this interface, the notification can show the progress of analysis, and also can show how the channel start.

3. Plotting

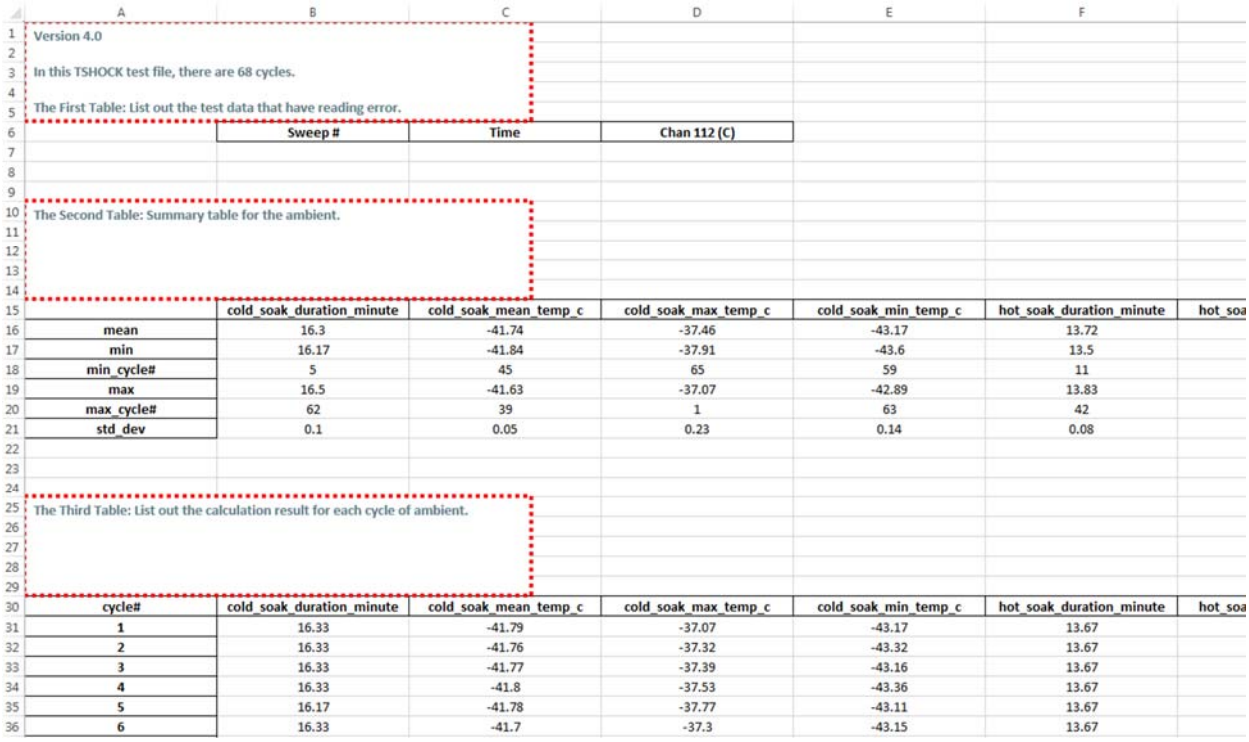


- This is the general plot of raw test data.
- The X axis is the time scale and index.
- The Y axis is the temperature(C) over that scan.
- This graph can show only selected channels, and also can zoom in and out.
- The easiest way to save the graph is to take a snippet and save as a png file type


TSchock test sample
Temperature
Time
95
90
85
80
75
00:00
Feb 3, 2000
01:00
02:00
03:00
91.874 U7
Feb 3, 2000, 04:26:30
U7
U8
Z1
Z2
Chan 105 (C)
Chan 106 (C)
Chan 107 (C)
Chan 108 (C)
Chan 109 (C)
Chan 110 (C)
Chan 111 (C)
ambient
upper_threshold_amb
lower_threshold_amb
upper_threshold_cRA
lower_threshold_cRA


TSchock test sample
Temperature
Time
95
90
85
80
75
00:00
Feb 3, 2000
01:00
02:00
03:00
94.076 ambient
Feb 3, 2000, 03:52:40
U7
U8
Z1
Z2
Chan 105 (C)
Chan 106 (C)
Chan 107 (C)
Chan 108 (C)
Chan 109 (C)
Chan 110 (C)
Chan 111 (C)
ambient
upper_threshold_amb
lower_threshold_amb
upper_threshold_cRA
lower_threshold_cRA

4. Output Excel



Version 4.0

In this TSHOCK test file, there are 68 cycles.

The First Table: List out the test data that have reading error.

Sweep #	Time	Chan 112 (C)

The Second Table: Summary table for the ambient.

	cold_soak_duration_minute	cold_soak_mean_temp_c	cold_soak_max_temp_c	cold_soak_min_temp_c	hot_soak_duration_minute	hot_soa
mean	16.3	-41.74	-37.46	-43.17	13.72	
min	16.17	-41.84	-37.91	-43.6	13.5	
min_cycle#	5	45	65	59	11	
max	16.5	-41.63	-37.07	-42.89	13.83	
max_cycle#	62	39	1	63	42	
std_dev	0.1	0.05	0.23	0.14	0.08	

The Third Table: List out the calculation result for each cycle of ambient.

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_soa
1	16.33	-41.79	-37.07	-43.17	13.67	
2	16.33	-41.76	-37.32	-43.32	13.67	
3	16.33	-41.77	-37.39	-43.16	13.67	
4	16.33	-41.8	-37.53	-43.36	13.67	
5	16.17	-41.78	-37.77	-43.11	13.67	
6	16.33	-41.7	-37.3	-43.15	13.67	

- Each worksheet tab of the output excel represent one channel.
- Each worksheet consists of 3 tables as displayed above.

5. Independency

- Python3
- Pandas - Data wrangling and processing
- Matplotlib - Plotting
- XlsWriter - Creates analysis tables
- PyQt5 – GUI

Authors

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