

INDUSTRIAL™
P3 PLANKTON
Automated Bioreactors

GRAPHING DATA FROM PBR LOGFILES

V1.2

SDG 04/02/2019

OUTLINE




1. DOWNLOAD THE LOGFILE FROM THE PBR
2. EXTRACT TIME SEGMENTS OF INTEREST FROM THE LOGFILE
3. SEPARATE DATA AND EVENT LOGS
4. DATA QUALITY CONTROL
5. BASIC GRAPHING
6. CALCULATE TIME IN DAYS
7. MATCH MANUALLY COLLECTED DATA WITH PBR DATA
8. ADVANCED GRAPHING!

1. DOWNLOAD THE LOGFILE FROM THE PBR

- INSERT A USB DRIVE INTO THE PORT ABOVE THE PBR CONSOLE
- GO TO ADVANCED SETTINGS > DOWNLOAD PBR LOGFILE
- TRANSFER THE LOGFILE FROM THE USB TO YOUR COMPUTER



2. EXTRACT TIME SEGMENTS OF INTEREST FROM THE LOGFILE

<input type="checkbox"/> Name	Date modified	Type
 _README	2018-12-13 4:02 PM	Text Document
 Log1	2018-11-01 11:33 AM	Microsoft Excel C
 Log2	2019-02-11 9:50 AM	Microsoft Excel C

- THE LOGFILES ARE EXPORTED AS FOLDER
 - INCLUDES A _README TEXT FILE
 - AND ONE OR MORE LOG FILES IN .CSV FORMAT

2. EXTRACT TIME SEGMENTS OF INTEREST FROM THE LOGFILE

Log1 - Microsoft Excel

A1	Date																		
1	Date	Temperati	pH	CO2_Injec	RelativeDe	LightInten	TankVolur	TotalNutri	NutA_Proj	NutB_Proj	NutC_Proj	Growth_Rate							
2	#####	0	0	0	0	0	0	0	0	0	0	0							
3	#####	23.82193	8.66694	0.516425	0.061551	0	0	0	1	1	0	0.038942							
4	#####	22.55604	8.593015	0.443986	0.063123	0	0	0	1	1	0	0.039995							
5	#####	21.59331	8.419525	0.381709	0.053781	0	0	0	1	1	0	0.031066							
6	#####	20.79358	8.529558	0.328167	0.045694	0	0	0	1	1	0	0.024285							
7	#####	20.06772	8.601989	0.282135	0.0269	0	0	0	1	1	0	0.019823							
8	#####	19.45814	8.652839	0.24256	0.011186	0	0	0	1	1	0	0.016041							
9	#####	18.94961	8.678477	0.208536	0.003687	0	0	0	1	1	0	0.012424							
10	#####	18.46825	8.678264	0.179285	0.001121	0	0	0	1	1	0	0.010734							
11	#####	18.11076	8.688519	0.154137	0.000801	0	0	0	1	1	0	0.009298							
12	#####	17.9608	8.648565	0.132516	0.00032	0	0	0	1	1	0	0.007724							
13	#####	17.90973	8.594296	0.113928	2.31E-05	0	0	0	1	1	0	0.006672							
14	#####	17.94233	8.591732	0.097947	2.10E-05	0	0	0	1	1	0	0.005955							
15	#####	17.95103	8.608397	0.084208	9.20E-06	0	0	0	1	1	0	0.005508							
16	#####	18.03578	8.585537	0.072397	0	0	0	0	1	1	0	0.005088							
17	#####	18.1151	8.599637	0.062242	0	0	0	0	1	1	0	0.004851							
18	#####	18.17052	8.621644	0.053511	2.20E-06	0	0	0	1	1	0	0.005237							
19	#####	18.25636	8.639164	0.046005	2.20E-06	0	0	0	1	1	0	0.005926							
20	#####	18.30743	8.669931	0.039552	4.40E-06	0	0	0	1	1	0	-0.02864							
21	#####	18.27157	8.695784	0.034004	0	0	0	0	1	1	0	-0.03702							
22	#####	18.25745	8.674204	0.029234	9.20E-06	0	0	0	1	1	0	-0.03913							
23	#####	18.31504	8.674204	0.025134	0	0	0	0	1	1	0	-0.03614							
24	#####	18.36067	8.66053	0.021608	0	0	0	0	1	1	0	-0.03434							

- BROWSE THE LOGFILES TO FIND THE START DATE AND TIME OF YOUR CULTURE

2. EXTRACT TIME SEGMENTS OF INTEREST FROM THE LOGFILE

- SAVE LOGFILE WITH A NEW FILE NAME AS AN EXCEL WORKBOOK
- IF YOUR LOG FOLDER CONTAINS MORE LOGFILES WITH DATA OF INTEREST, COPY AND PASTE THAT DATA BELOW

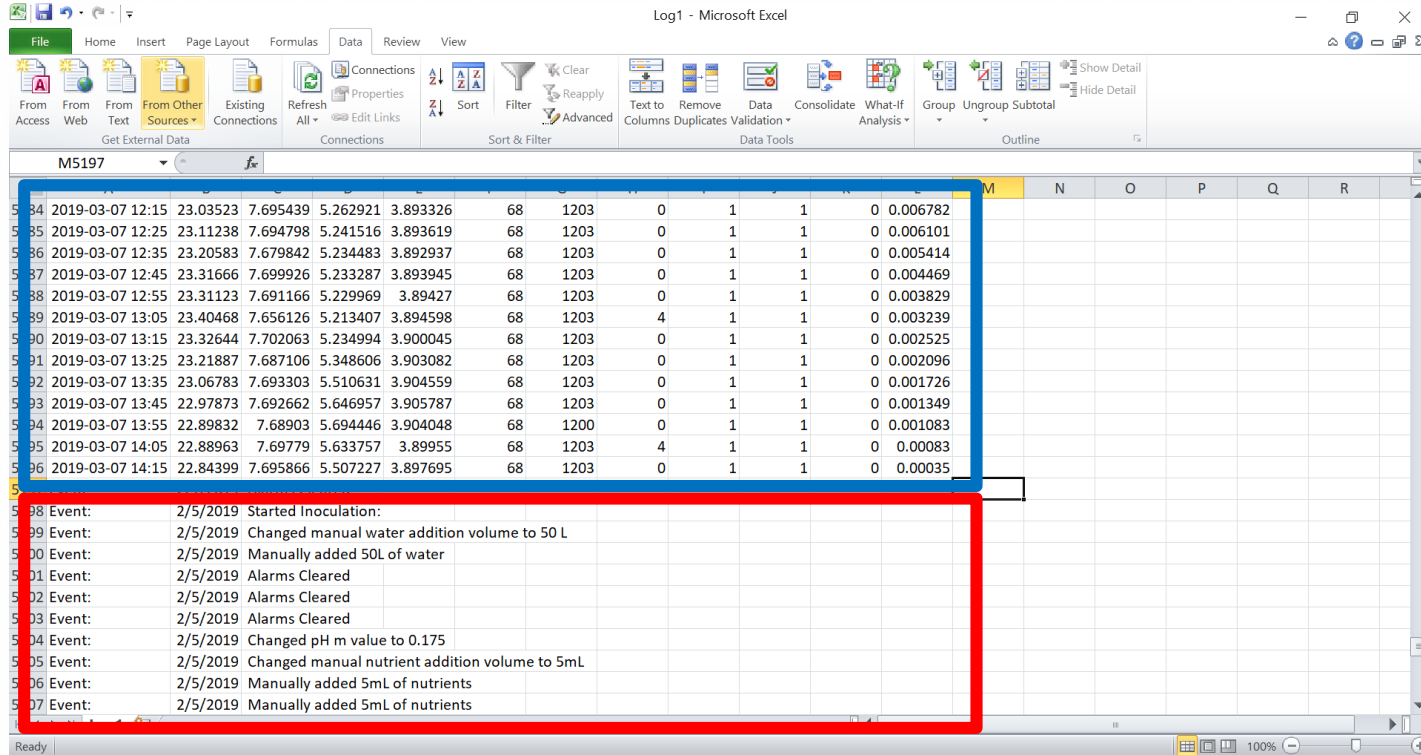
2. EXTRACT TIME SEGMENTS OF INTEREST FROM THE LOGFILE

Log1 - Microsoft Excel

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
884	2019-02-05 16:33	24.96395	10.33048	0.168915	0	0	34	0	1	1	0	0.002596							
885	2019-02-05 16:43	26.60037	9.349149	0.145221	0	0	7	0	1	1	0	0.006385							
886	2019-02-05 16:53	25.81802	8.646856	0.124851	0.012824	0	43	0	1	1	0	0.020158							
887	2019-02-05 17:03	25.24864	8.372306	0.107338	0.000796	0	43	0	1	1	0	0.020178							
888	2019-02-05 17:13	24.85203	8.277228	0.092282	0.000512	0	43	0	1	1	0	0.020198							
889	2019-02-05 17:13	0	0	0	0	0	0	0	0	0	0	0							
890	2019-02-05 17:30	0	0	0	0	0	0	0	0	0	0	0							
891	Event:	2/5/2019	Alarms Cleared																
892	2019-02-05 17:30	0	0	0	0	0	0	0	0	0	0	0							
893	2019-02-05 18:17	0	0	0	0	0	0	0	0	0	0	0							
894	Event:	2/5/2019	Alarms Cleared																
895	Event:	2/5/2019	Changed pH m value to 0.175																
896	Event:	2/5/2019	Changed manual nutrient addition volume to 5mL																
897	Event:	2/5/2019	Manually added 5mL of nutrients																
898	Event:	2/5/2019	Manually added 5mL of nutrients																
899	Event:	2/5/2019	Alarms Cleared																
900	Event:	2/5/2019	Alarms Cleared																
901	Event:	2/5/2019	Changed pH low alarm to 0																
902	Event:	2/5/2019	Alarms Cleared																
903	2019-02-05 18:18	21.9738	8.783845	0.076302	0	0	40	10	1	1	0	0.011851							
904	2019-02-05 18:28	21.61504	7.677065	0.060441	0	0	46	0	1	1	0	0.010728							
905	2019-02-05 18:38	21.21083	8.079168	0.051963	0	0	45	0	1	1	0	0.010118							
906	2019-02-05 18:48	20.8566	8.268896	0.044674	0	0	44	0	1	1	0	0.009911							
907	2019-02-05 18:58	20.50237	8.371879	0.038408	0	0	44	0	1	1	0	0.009909							

- YOU WILL SEE **EVENTS** AND **DATA**

3.SEPARATE DATA AND EVENT LOGS



The screenshot shows an Excel spreadsheet with two distinct sections. The first section, highlighted with a blue border, contains a data table with 13 rows (rows 84-96) and 13 columns. The second section, highlighted with a red border, contains an event log with 10 rows (rows 98-107) and 2 columns.

Row	Date	Time	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8	Col 9	Col 10	Col 11	Col 12	Col 13
84	2019-03-07	12:15	23.03523	7.695439	5.262921	3.893326	68	1203	0	1	1	0	0.006782
85	2019-03-07	12:25	23.11238	7.694798	5.241516	3.893619	68	1203	0	1	1	0	0.006101
86	2019-03-07	12:35	23.20583	7.679842	5.234483	3.892937	68	1203	0	1	1	0	0.005414
87	2019-03-07	12:45	23.31666	7.699926	5.233287	3.893945	68	1203	0	1	1	0	0.004469
88	2019-03-07	12:55	23.31123	7.691166	5.229969	3.89427	68	1203	0	1	1	0	0.003829
89	2019-03-07	13:05	23.40468	7.656126	5.213407	3.894598	68	1203	4	1	1	0	0.003239
90	2019-03-07	13:15	23.32644	7.702063	5.234994	3.900045	68	1203	0	1	1	0	0.002525
91	2019-03-07	13:25	23.21887	7.687106	5.348606	3.903082	68	1203	0	1	1	0	0.002096
92	2019-03-07	13:35	23.06783	7.693303	5.510631	3.904559	68	1203	0	1	1	0	0.001726
93	2019-03-07	13:45	22.97873	7.692662	5.646957	3.905787	68	1203	0	1	1	0	0.001349
94	2019-03-07	13:55	22.89832	7.68903	5.694446	3.904048	68	1200	0	1	1	0	0.001083
95	2019-03-07	14:05	22.88963	7.69779	5.633757	3.89955	68	1203	4	1	1	0	0.00083
96	2019-03-07	14:15	22.84399	7.695866	5.507227	3.897695	68	1203	0	1	1	0	0.00035

Row	Date	Event
98	2/5/2019	Started Inoculation:
99	2/5/2019	Changed manual water addition volume to 50 L
100	2/5/2019	Manually added 50L of water
101	2/5/2019	Alarms Cleared
102	2/5/2019	Alarms Cleared
103	2/5/2019	Alarms Cleared
104	2/5/2019	Changed pH m value to 0.175
105	2/5/2019	Changed manual nutrient addition volume to 5mL
106	2/5/2019	Manually added 5mL of nutrients
107	2/5/2019	Manually added 5mL of nutrients

- USE DATA>SORT>COLUMN A TO SEPARATE THESE TWO TYPES OF ENTRIES
- COPY AND PASTE DATA ROWS INTO A NEW “DATA” SHEET IN EXCEL WORKBOOK
- COPY AND PASTE EVENTS INTO A NEW “EVENT LOG” SHEET IN EXCEL WORKBOOK

3.SEPARATE DATA AND EVENT LOGS

IP_PBR Logfile_Feb2019 - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View

Clipboard Font Alignment Number Styles Cells Editing

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
4137	2019-03-07 10:05	23.046	7.7	5.1476	3.8989	66	1203	4	1	1	0	0.009514	28.77606	3.963	
4138	2019-03-07 10:15	23.092	7.7	5.1425	3.8985	66	1203	0	1	1	0	0.00973	28.78301	3.963	
4139	2019-03-07 10:25	23.184	7.7	5.1336	3.898	66	1203	0	1	1	0	0.009871	28.78995	3.963	
4140	2019-03-07 10:35	23.188	7.7	5.1339	3.8978	68	1203	0	1	1	0	0.009954	28.7969	3.963	
4141	2019-03-07 10:45	23.209	7.7	5.1484	3.8968	68	1203	0	1	1	0	0.009972	28.80384	3.963	
4142	2019-03-07 10:55	23.271	7.7	5.1725	3.8968	68	1203	0	1	1	0	0.009963	28.81079	3.963	

Log1 Eventlog **Data** Figs Flow

Ready 100%

- FOR GRAPHING USE “DATA” SHEET

3.SEPARATE DATA AND EVENT LOGS

The screenshot displays a Microsoft Excel spreadsheet titled 'IP_PBR Logfile_Feb2019'. The spreadsheet contains a table with the following data:

Date	Temperature_C	pH									
2019-01-30 14:40	23.82193	8.5									
2019-01-30 14:50	22.55604	8.5									
2019-01-30 15:00	21.59331	8.4									
2019-01-30 15:10	20.79358	8.5									
2019-01-30 15:20	20.06772	8.6									
2019-01-30 15:30	19.45814	8.6									
2019-01-30 15:40	18.94961	8.6									
2019-01-30 15:50	18.46825	8.6									
2019-01-30 16:00	18.11076	8.6									
2019-01-30 16:10	17.9608	8.6									
2019-01-30 16:20	17.90973	8.5									
2019-01-30 16:30	17.94233	8.5									
2019-01-30 16:40	17.95103	8.6									
2019-01-30 16:50	18.03578	8.5									
2019-01-30 17:00	18.1151	8.5									
2019-01-30 17:10	18.17052	8.6									
2019-01-30 17:20	18.25636	8.6									
2019-01-30 17:30	18.30743	8.6									
2019-01-30 17:40	18.27157	8.6									
2019-01-30 17:50	18.25745	8.6									
2019-01-30 18:00	18.31504	8.6									
2019-01-30 18:10	18.36067	8.66053	0.021608	0	0	0	0	1	1	0	-0.03434
2019-01-30 18:20	18.41609	8.661812	0.018577	2.20E-06	0	0	0	1	1	0	-0.03301

The Notepad window shows the following text:

```
File Edit Format View Help
C:\ReactorLogs
Reactor Log Format:
Date, Temperature_C, pH, CO2_Injectionsper10min, RelativeDensity, LightIntensity, TankVolume, T
```

The File Explorer window shows a list of files with their modification dates:

Date modified
2018-09-11 2:33
2019-01-25 9:45
2019-03-07 2:25
2019-03-07 2:26
2019-03-07 2:26

- IF YOU NEED COLUMN HEADERS AT THE FIRST ROW OF YOUR DATA SHEET, COPY AND PASTE HEADERS FROM THE "_README.TXT" FILE FROM THE LOGFILE FOLDER

4. DATA QUALITY CONTROL

- SOME ROWS WILL HAVE 0'S IN EVERY DATA COLUMN
- THIS USUALLY INDICATES A DISRUPTION OF POWER TO THE PBR
- REMOVE THESE ROWS AS THESE VALUES ARE INCORRECT
- THESE 0 ROWS ARE PRESERVED IN THE FIRST "LOG" SHEET IF YOU WISH TO INVESTIGATE THEM FURTHER – PLEASE SEND ORIGINAL SHEET TO INDUSTRIAL PLANKTON FOR TROUBLESHOOTING, ESPECIALLY IF POWER HAS BEEN CONSISTENT

4. DATA QUALITY CONTROL

IP_PBR Logfile_Feb2019 - Microsoft Excel

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
863	2019-02-05 14:21	31.31839	7.97063	1.051677	0.049059	0	46	0	1	1	0	0.004221						
864	2019-02-05 14:31	30.77618	8.00161	0.904159	0.039685	0	47	0	1	1	0	0.004979						
865	2019-02-05 14:41	30.21875	8.032164	0.777333	0.020839	0	46	0	1	1	0	0.005661						
866	2019-02-05 14:51	29.66024	8.122754	0.668297	0.008107	0	46	0	1	1	0	0.005904						
867	2019-02-05 15:01	29.09738	8.035154	0.574555	0.00019													
868	2019-02-05 15:11	28.57038	8.017421	0.493963	6.98E-05													
869	2019-02-05 15:21	28.09662	8.002464	0.424675	9.20E-06													
870	2019-02-05 15:31	27.61526	7.966998	0.365106	0													
871	2019-02-05 15:41	27.19474	7.940718	0.313893	0													
872	2019-02-05 15:51	26.75141	7.971272	0.269863	0													
873	2019-02-05 16:01	26.3461	7.928753	0.23201	0	0	45	0	1	1	0	0.00464						
874	2019-02-05 16:01	0	0	0	0	0	0	0	0	0	0	0						
875	2019-02-05 16:32	0	0	0	0	0	0	0	0	0	0	0						
876	2019-02-05 16:33	24.96395	10.33048	0.168915	0	0	34	0	1	1	0	0.002596						
877	2019-02-05 16:43	26.60037	9.349149	0.145221	0	0	7	0	1	1	0	0.006385						
878	2019-02-05 16:53	25.81802	8.646856	0.124851	0.012824	0	43	0	1	1	0	0.020158						
879	2019-02-05 17:03	25.24864	8.372306	0.107338	0.000796	0	43	0	1	1	0	0.020178						
880	2019-02-05 17:13	24.85203	8.277228	0.092282	0.000512	0	43	0	1	1	0	0.020198						
881	2019-02-05 17:13	0	0	0	0	0	0	0	0	0	0	0						
882	2019-02-05 17:30	0	0	0	0	0	0	0	0	0	0	0						
883	2019-02-05 17:30	0	0	0	0	0	0	0	0	0	0	0						
884	2019-02-05 18:17	0	0	0	0	0	0	0	0	0	0	0						
885	2019-02-05 18:18	21.9758	6.785045	0.070302	0	0	46	10	1	1	0	0.011851						
886	2019-02-05 18:28	21.61504	7.677065	0.060441	0	0	46	0	1	1	0	0.010728						

Less Than ? X

Format cells that are LESS THAN:

1 with Light Red Fill with Dark Red Text

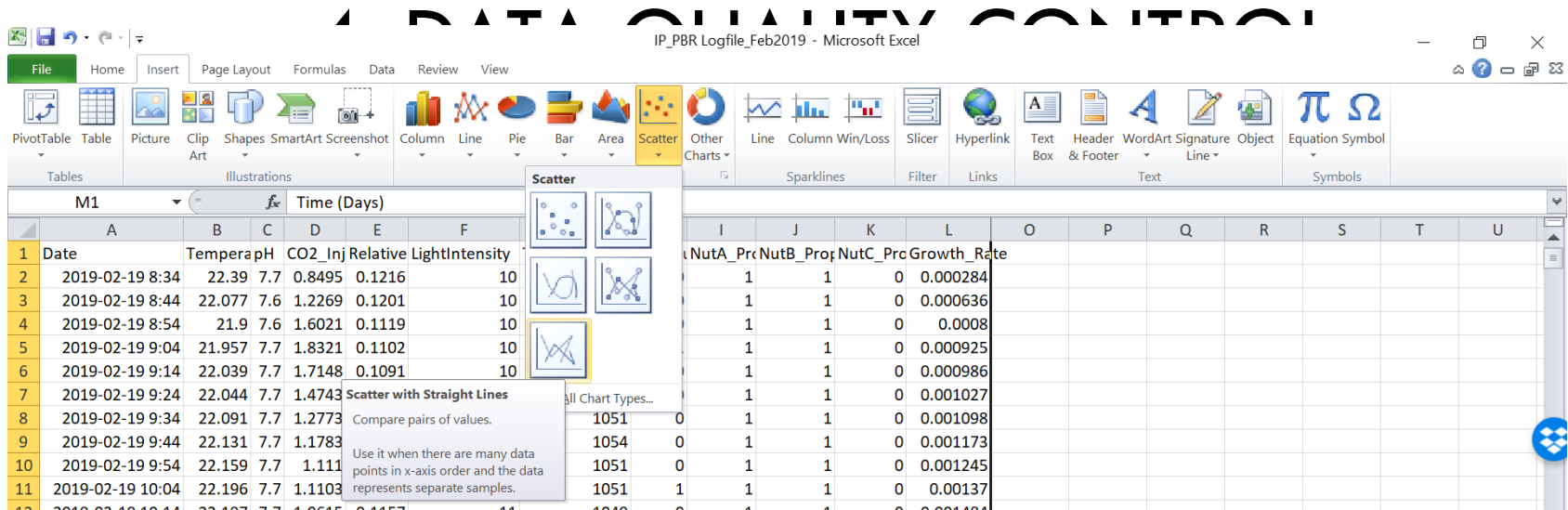
OK Cancel

Average: 21.67605113 Count: 5190 Sum: 112477.0293 100%

- USE CONDITIONAL FORMATTING TO HIGHLIGHT CELLS WITH A TEMPERATURE LESS THAN 1 DEGREE
- SCROLL THROUGH AND FIND THE ROWS WITH 0 ALL THE WAY ACROSS
- DELETE THESE ROWS

4. DATA QUALITY CONTROL

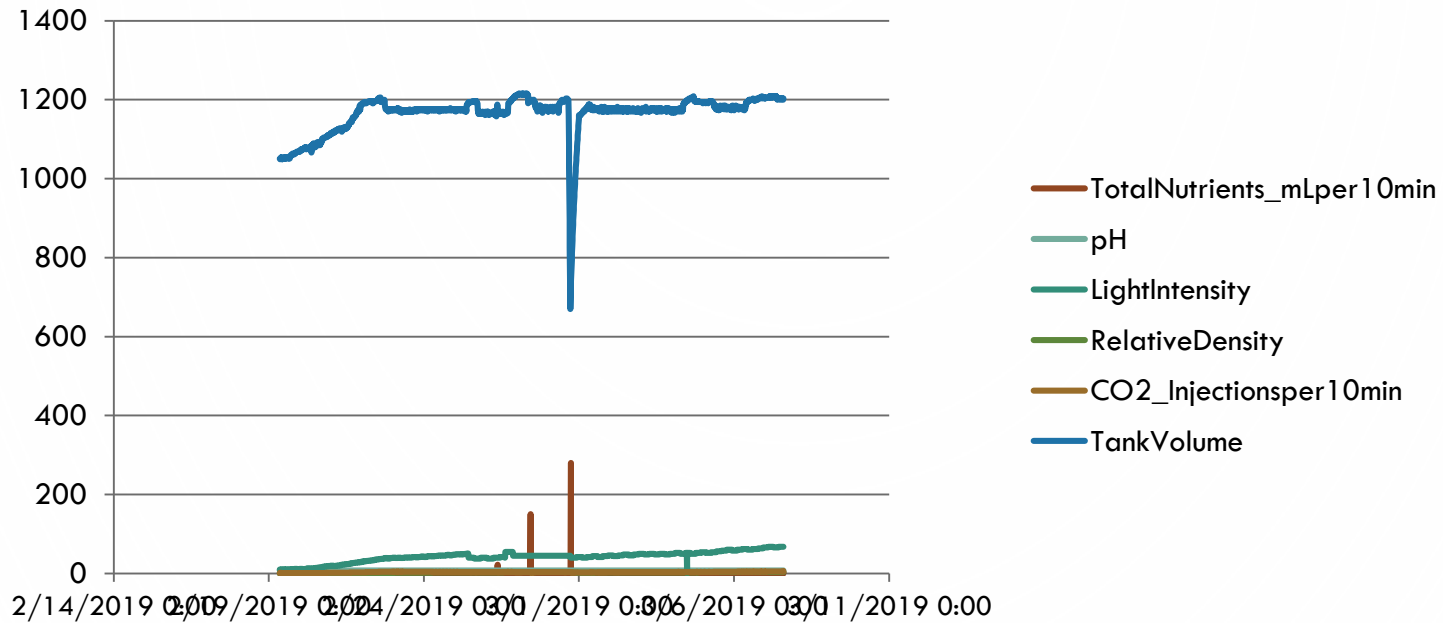
- REMOVE DATA FROM BEFORE AND AFTER THE TIME OF INTERESTED
 - IN EXAMPLE OVER 1000 ROWS WERE LOGGED BEFORE INOCULATION
- THE RAW DATA IS PRESERVED ON THE FIRST SHEET AND THE PBR IF YOU CUT OUT TOO MUCH



- NOW LETS TRY RE-CREATING THE DISPLAY FROM THE PBR
- INSERT A SCATTER PLOT WITH STRAIGHT LINES
 - Y – AXIS IS YOUR T, PH, CO2 ETC.
 - X –AXIS IS DATE

5. BASIC GRAPHING

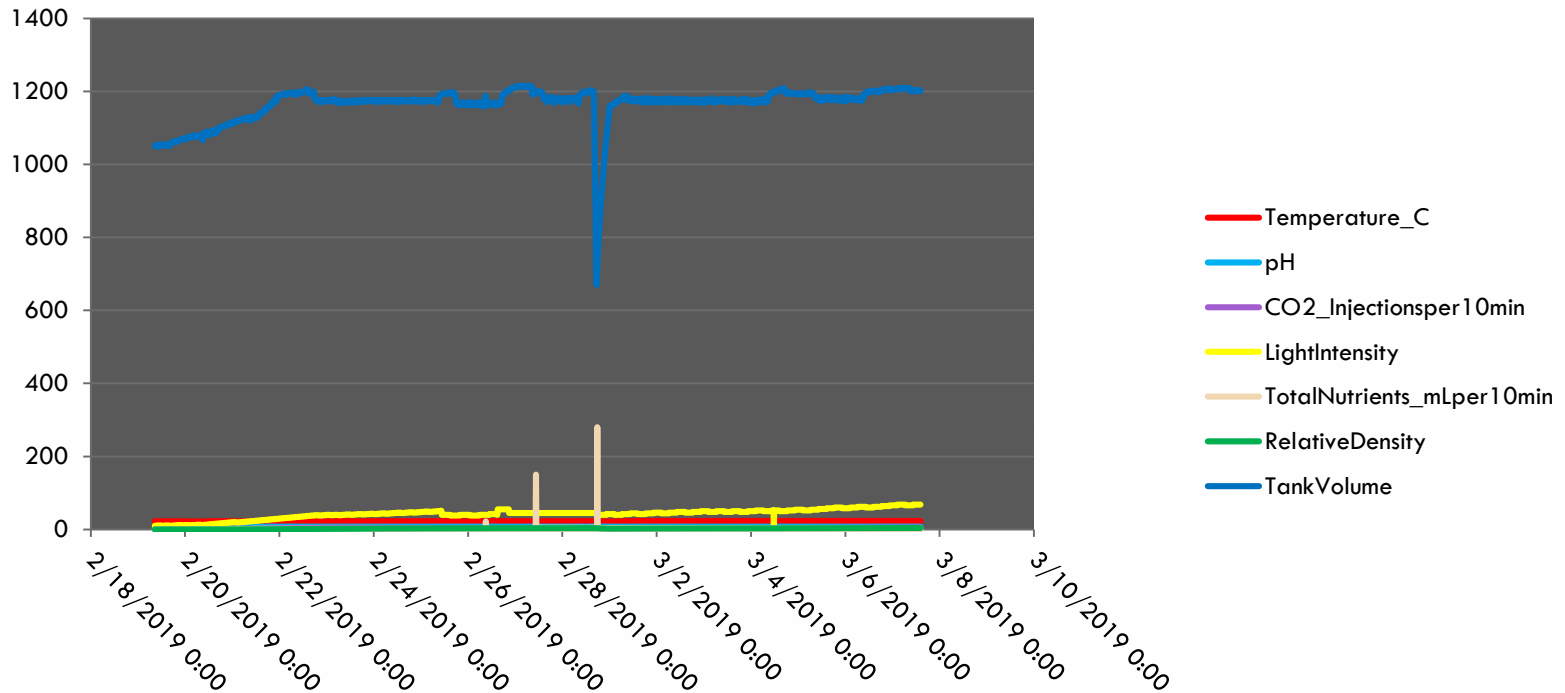
My Algae



THIS IS WHAT IT LOOKS LIKE TO START

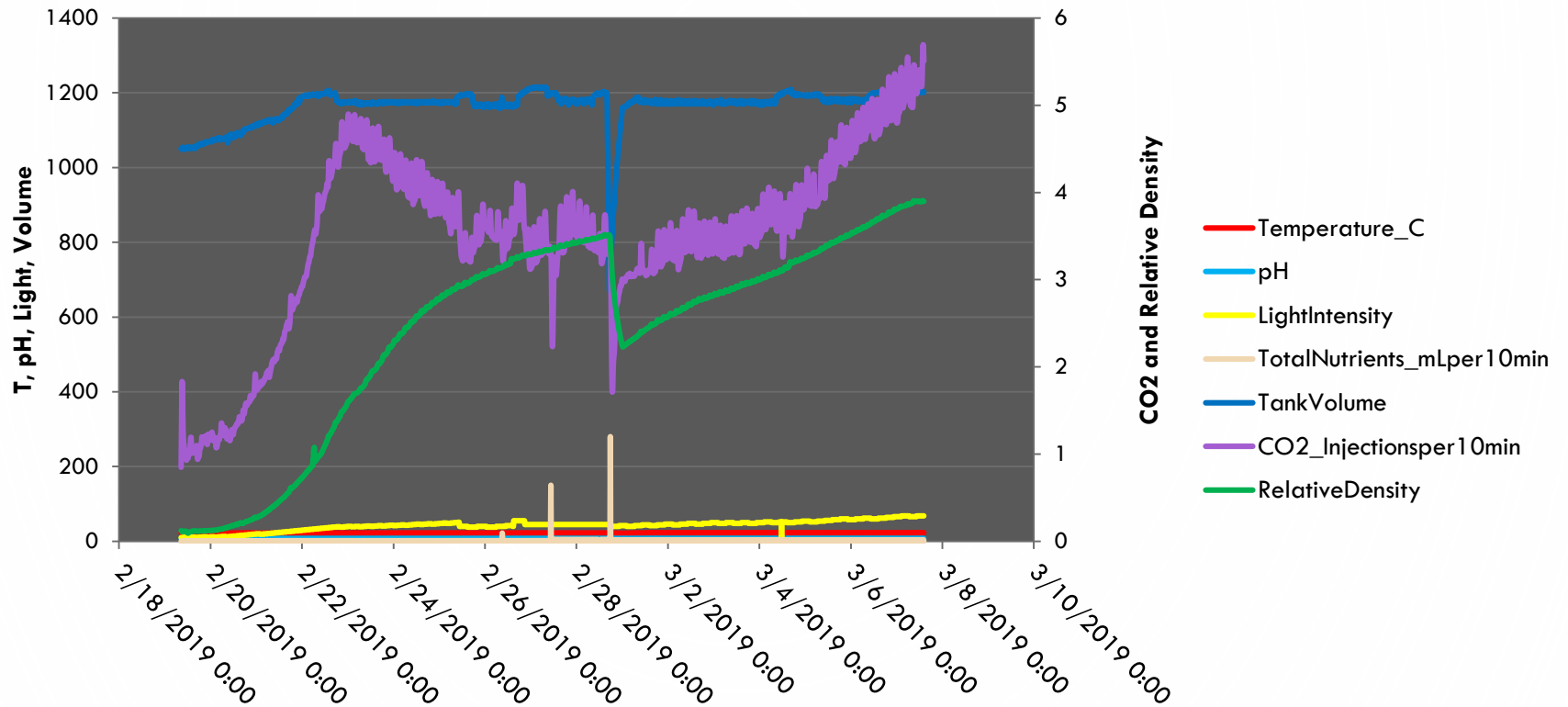
5. BASIC GRAPHING

- CHANGE COLOURS TO MATCH PBR
- ROTATE X-Axis LABELS 45 DEGREES



5. BASIC GRAPHING

- CAN HELP SCALING BY BINDING CERTAIN DATA SERIES TO SECONDARY Y-AXIS
 - DOUBLE CLICK ON THE SERIES
 - UNDER “SERIES OPTIONS” SELECT SECONDARY AXIS
- CO2 AND RELATIVE DENSITY IN THIS EXAMPLE



- CAN CLEARLY SEE FEB 28TH HARVEST NOW
 - DECREASE IN VOLUME IN THE TANK
 - DECREASE IN RELATIVE DENSITY
 - DECREASE IN CO2 INJECTIONS

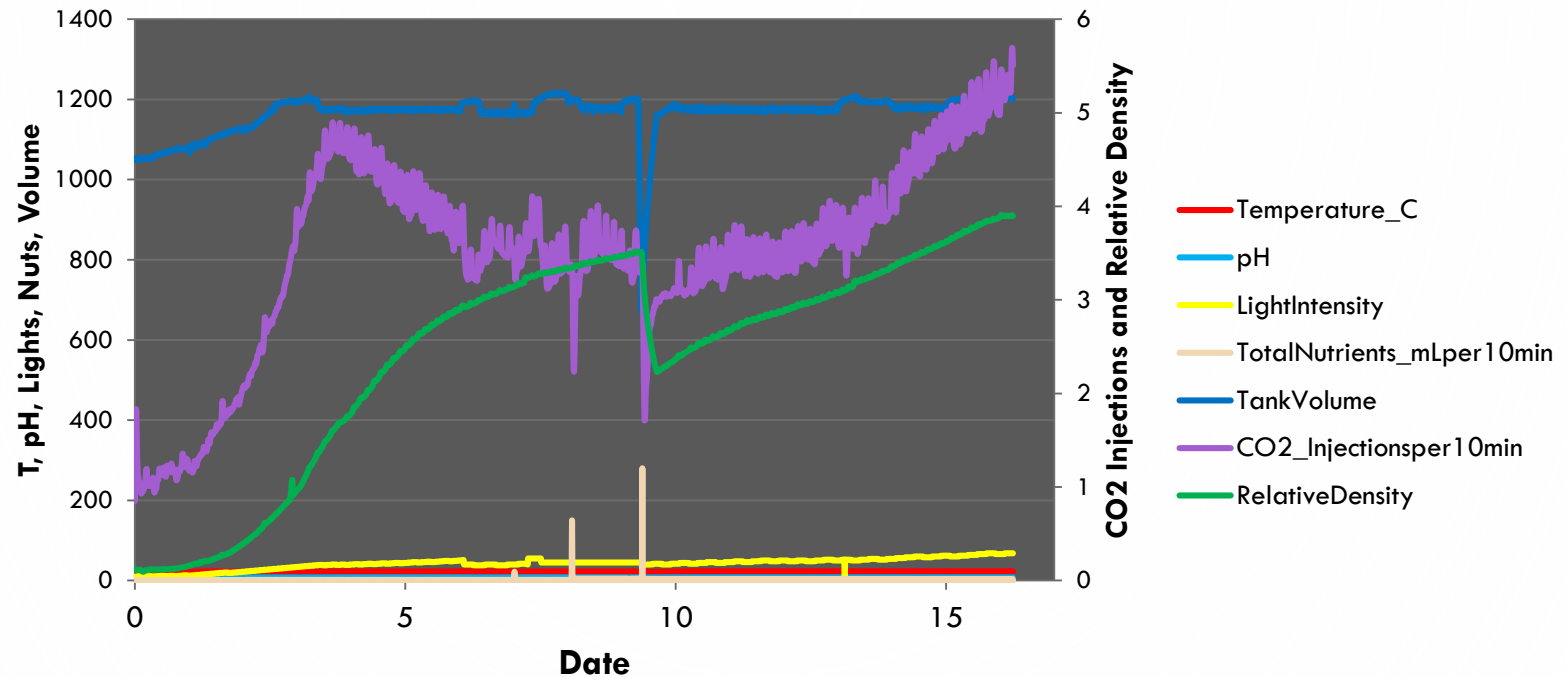
6. CALCULATE THE TIME IN DAYS

Microsoft Excel interface showing the formula bar with the formula `=A2-A$2` and a spreadsheet with the following data:

	A	B	C	D	E	F	G	H	I	J	K	L	M	O
1	Date	TemperapH	CO2_Inj	Relative	LightIntensity	TankVolume	TotalNu	NutA_Proc	NutB_Proc	NutC_Proc	Growth_Ra	Time (Days)		
2	2019-02-19 8:34	22.39	7.7	0.8495	0.1216	10	1051	0	1	1	0	0.000284	=A2-A\$2	
3	2019-02-19 8:44	22.077	7.6	1.2269	0.1201	10	1049	0	1	1	0	0.000636	0.006944444	
4	2019-02-19 8:54	21.9	7.6	1.6021	0.1119	10	1051	0	1	1	0	0.0008	0.013888889	

- ADD A TIME (DAYS) COLUMN AFTER YOUR DATA COLUMNS
- CALCULATE THE TIME IN DAYS SINCE THE START OF YOUR CULTURE

6. CALCULATE THE TIME IN DAYS



- NOW YOU CAN PLOT YOUR DATA AGAINST THE DAY SINCE THE CULTURE'S START