Tmax – Tstop

Instruction

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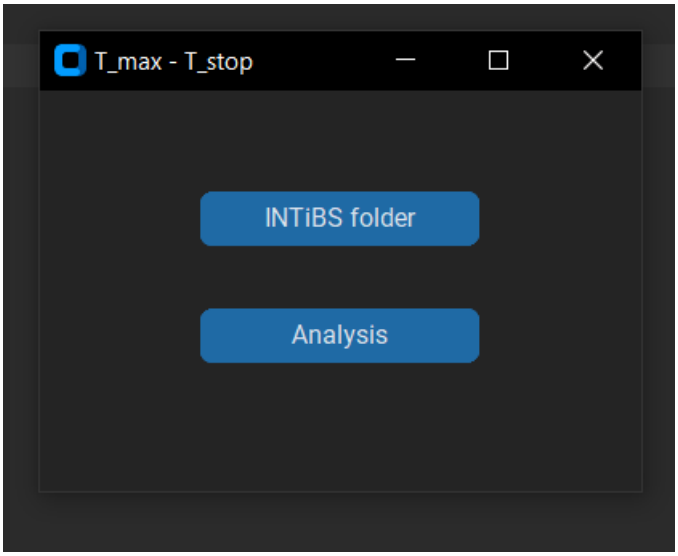


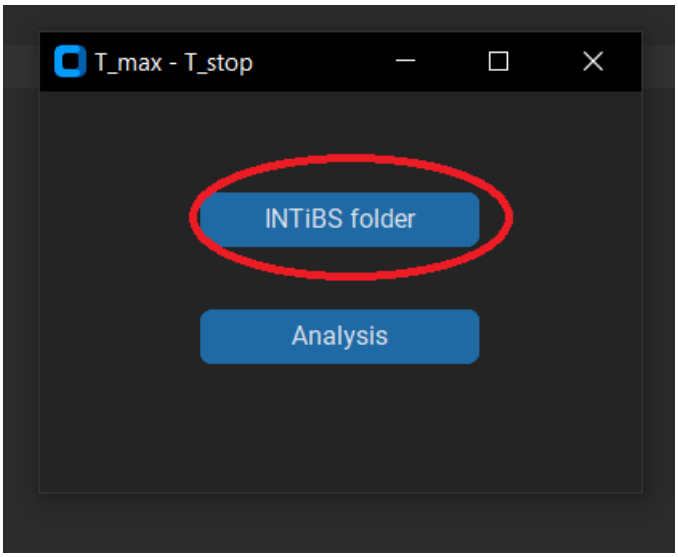
Sebastian Cieśla

1. INTiBS Folder

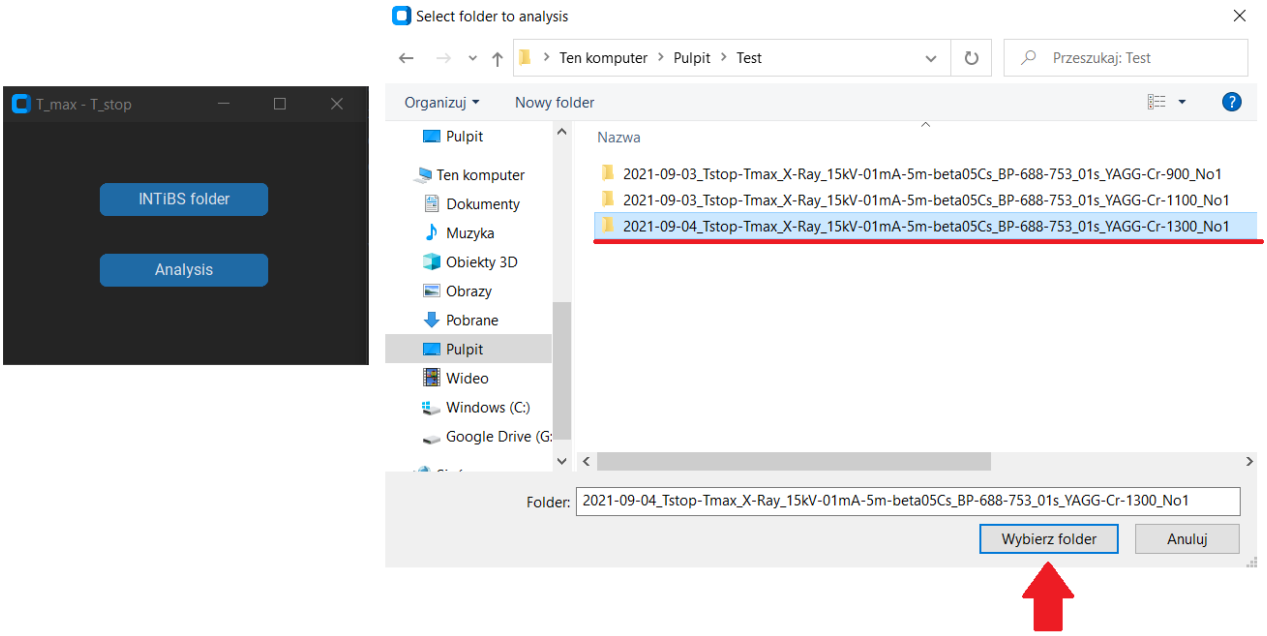
The INTiBS function allows you to organize the data obtained in the process of the Tmax-Tstop procedure and extracts and saves important measurement data (temperature, intensity) to an Excel file. This function saves time in selecting the appropriate measurement data.

The use of this option is possible only for a folder with data created by software and equipment located at INTiBS PAN in Wrocław, Poland.

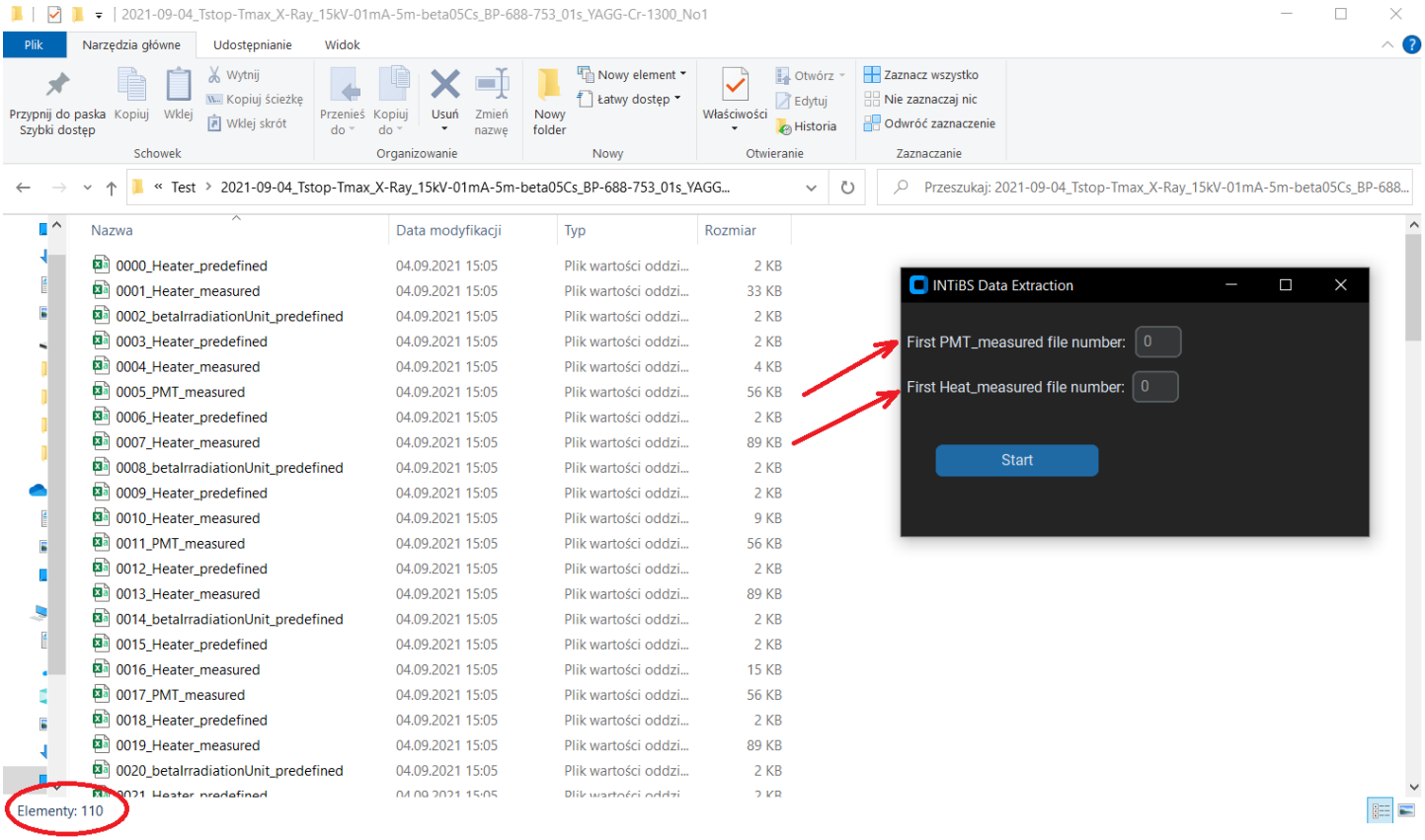
1. We choose the INTiBS folder option



2. After clicking, it is necessary to indicate the folder with data

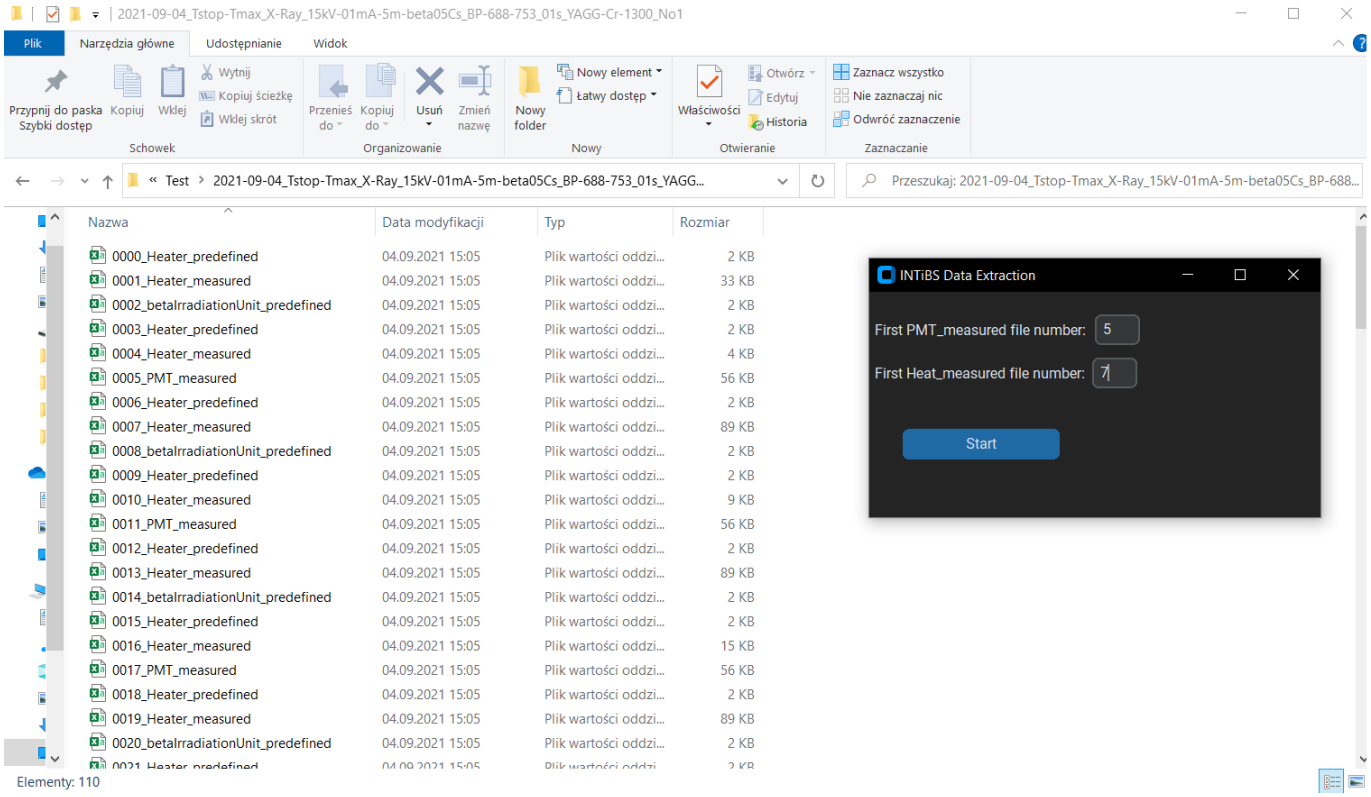


3. Enter the file number of the first temperature measurement and the number of the first intensity measurement.

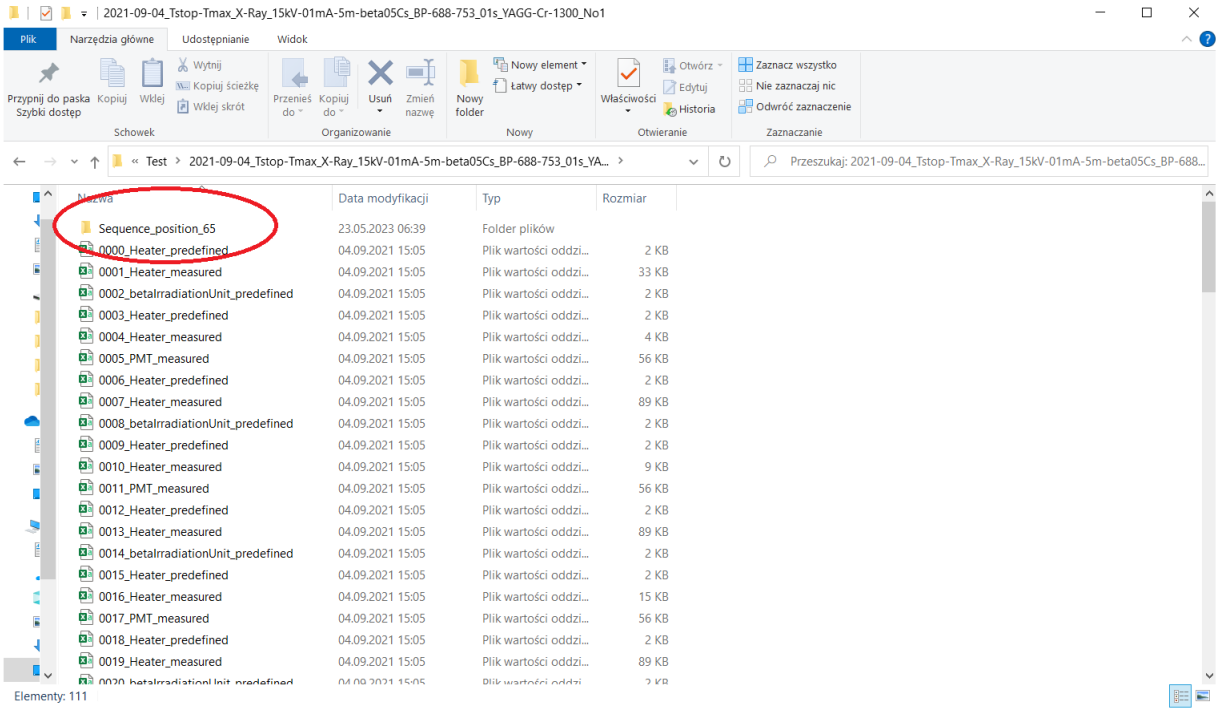


4. In this case, the PMT measurement is 5 (Intensity) and 7 (Temperature).

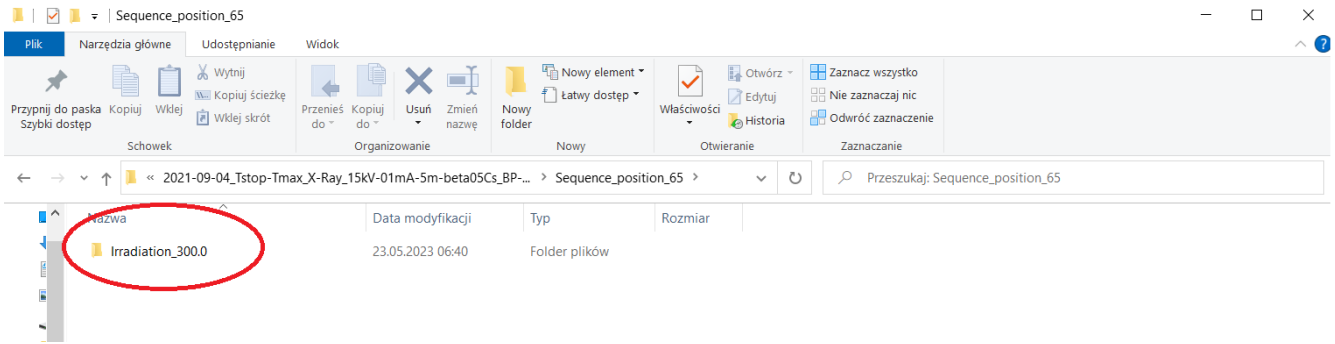
After entering the value, click "Start"



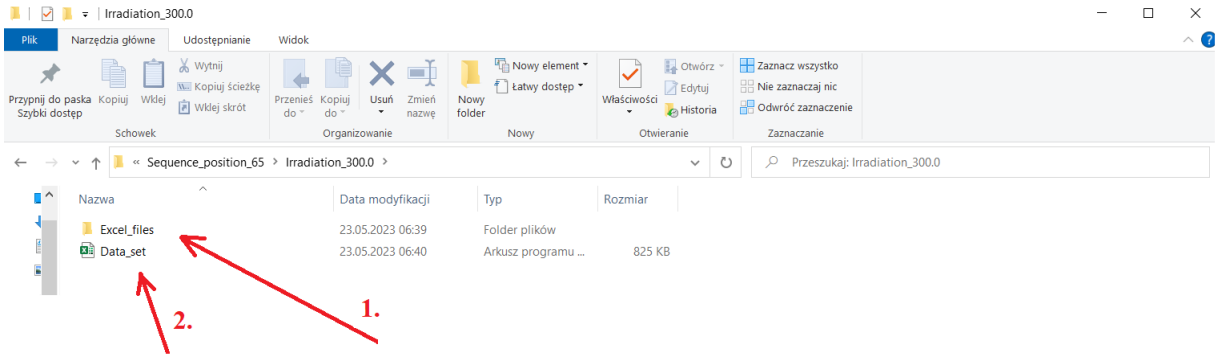
5. After a few seconds, the program window will be automatically closed and a new folder "Sequence Position _ X" will be created in the previously selected folder with measurement data.



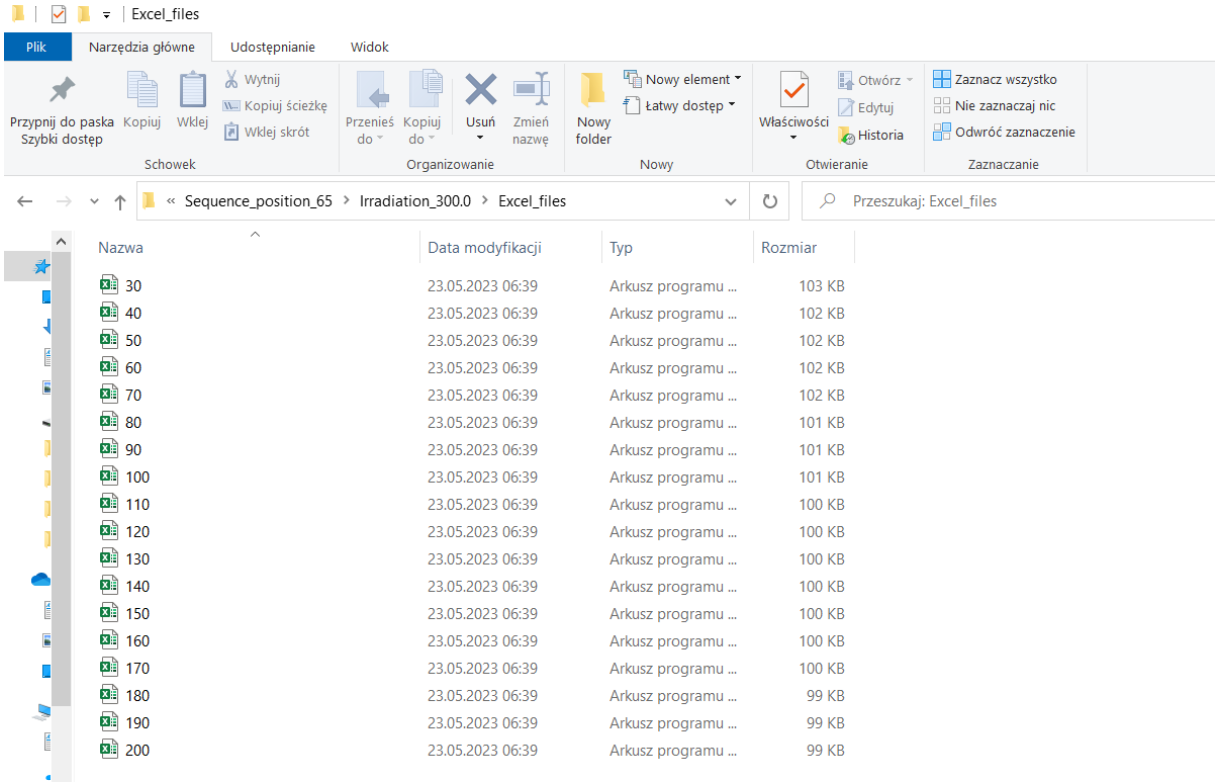
6. The measurement data is separated into a folder for sequence position (place of the sample in the apparatus) and irradiation time (Irradiation).

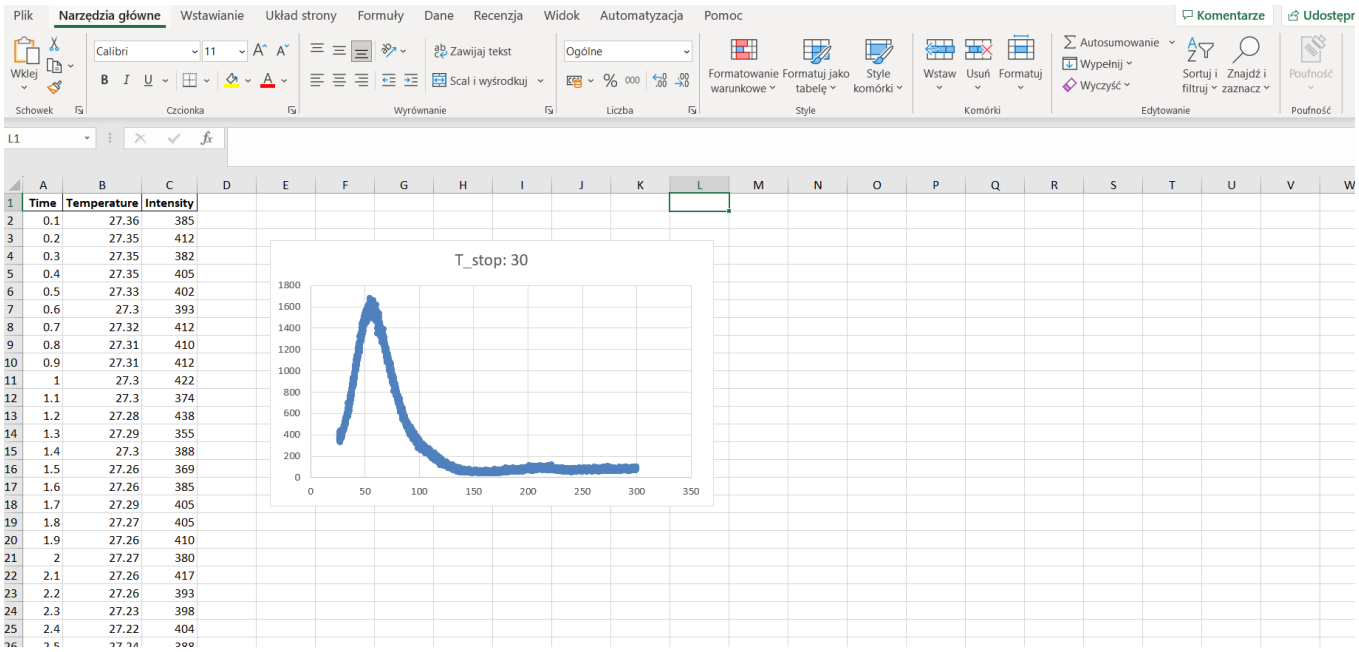


7. After entering the "Irradiation" folder. A new folder "Excel files" appears and also a new Excel file Data_set



➔ Excel_files: temperature data is stored in this folder and the filenames correspond to the Tstop temperature

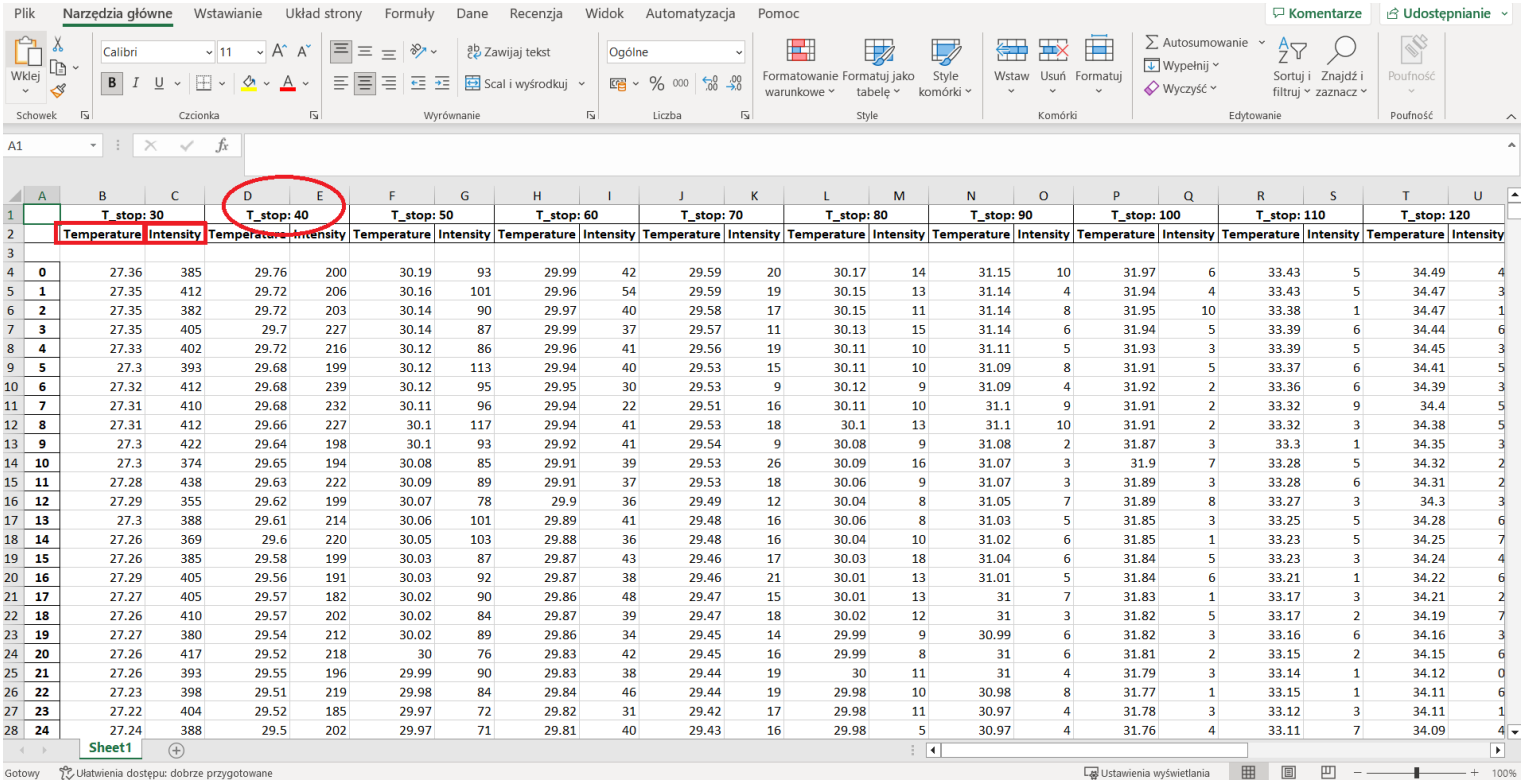




Time	Temperature	Intensity
0.1	27.36	385
0.2	27.35	412
0.3	27.35	382
0.4	27.35	405
0.5	27.33	402
0.6	27.3	393
0.7	27.32	412
0.8	27.31	410
0.9	27.31	412
1	27.3	422
1.1	27.3	374
1.2	27.28	438
1.3	27.29	355
1.4	27.3	388
1.5	27.26	369
1.6	27.26	385
1.7	27.29	405
1.8	27.27	405
1.9	27.26	410
2	27.27	380
2.1	27.26	417
2.2	27.26	393
2.3	27.23	398
2.4	27.22	404

Each file has 3 columns (Time of measurement, temperature and measured intensity)

➔ 2. Data_set is a file where all measurement data for each Tstop temperature is saved. There is Tstop in the headers, and temperature and intensity data below in columns.

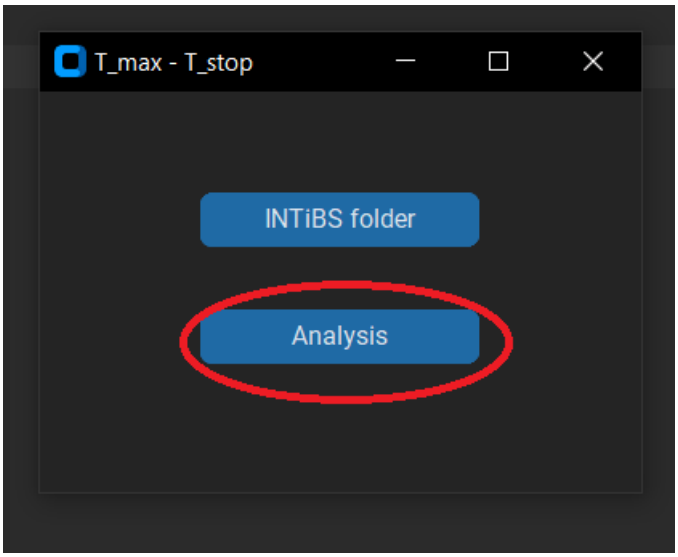


	T_stop: 30		T_stop: 40		T_stop: 50		T_stop: 60		T_stop: 70		T_stop: 80		T_stop: 90		T_stop: 100		T_stop: 110		T_stop: 120	
	Temperature	Intensity	Temperature	Intensity	Temperature	Intensity	Temperature	Intensity	Temperature	Intensity	Temperature	Intensity	Temperature	Intensity	Temperature	Intensity	Temperature	Intensity	Temperature	Intensity
0	27.36	385	29.76	200	30.19	93	29.99	42	29.59	20	30.17	14	31.15	10	31.97	6	33.43	5	34.49	4
1	27.35	412	29.72	206	30.16	101	29.96	54	29.59	19	30.15	13	31.14	4	31.94	4	33.43	5	34.47	3
2	27.35	382	29.72	203	30.14	90	29.97	40	29.58	17	30.15	11	31.14	8	31.95	10	33.38	1	34.47	1
3	27.35	405	29.7	227	30.14	87	29.99	37	29.57	11	30.13	15	31.14	6	31.94	5	33.39	6	34.44	6
4	27.33	402	29.72	216	30.12	86	29.96	41	29.56	19	30.11	10	31.11	5	31.93	3	33.39	5	34.45	3
5	27.3	393	29.68	199	30.12	113	29.94	40	29.53	15	30.11	10	31.09	8	31.91	5	33.37	6	34.41	5
6	27.32	412	29.68	239	30.12	95	29.95	30	29.53	9	30.12	9	31.09	4	31.92	2	33.36	6	34.39	3
7	27.31	410	29.68	232	30.11	96	29.94	22	29.51	16	30.11	10	31.1	9	31.91	2	33.32	9	34.4	5
8	27.31	412	29.66	227	30.1	117	29.94	41	29.53	18	30.1	13	31.1	10	31.91	2	33.32	3	34.38	5
9	27.3	422	29.64	198	30.1	93	29.92	41	29.54	9	30.08	9	31.08	2	31.87	3	33.3	1	34.35	3
10	27.3	374	29.65	194	30.08	85	29.91	39	29.53	26	30.09	16	31.07	3	31.9	7	33.28	5	34.32	2
11	27.28	438	29.63	222	30.09	89	29.91	37	29.53	18	30.06	9	31.07	3	31.89	3	33.28	6	34.31	2
12	27.29	355	29.62	199	30.07	78	29.9	36	29.49	12	30.04	8	31.05	7	31.89	8	33.27	3	34.3	3
13	27.3	388	29.61	214	30.06	101	29.89	41	29.48	16	30.06	8	31.03	5	31.85	3	33.25	5	34.28	6
14	27.26	369	29.6	220	30.05	103	29.88	36	29.48	16	30.04	10	31.02	6	31.85	1	33.23	5	34.25	7
15	27.26	385	29.58	199	30.03	87	29.87	43	29.46	17	30.03	18	31.04	6	31.84	5	33.23	3	34.24	4
16	27.29	405	29.56	191	30.03	92	29.87	38	29.46	21	30.01	13	31.01	5	31.84	6	33.21	1	34.22	6
17	27.27	405	29.57	182	30.02	90	29.86	48	29.47	15	30.01	13	31	7	31.83	1	33.17	3	34.21	2
18	27.26	410	29.57	202	30.02	84	29.87	39	29.47	18	30.02	12	31	3	31.82	5	33.17	2	34.19	7
19	27.27	380	29.54	212	30.02	89	29.86	34	29.45	14	29.99	9	30.99	6	31.82	3	33.16	6	34.16	3
20	27.26	417	29.52	218	30	76	29.83	42	29.45	16	29.99	8	31	6	31.81	2	33.15	2	34.15	6
21	27.26	393	29.55	196	29.99	90	29.83	38	29.44	19	30	11	31	4	31.79	3	33.14	1	34.12	0
22	27.23	398	29.51	219	29.98	84	29.84	46	29.44	19	29.98	10	30.98	8	31.77	1	33.15	1	34.11	6
23	27.22	404	29.52	185	29.97	72	29.82	31	29.42	17	29.98	11	30.97	4	31.78	3	33.12	3	34.11	1
24	27.24	388	29.5	202	29.97	71	29.81	40	29.43	16	29.98	5	30.97	4	31.76	4	33.11	7	34.09	4

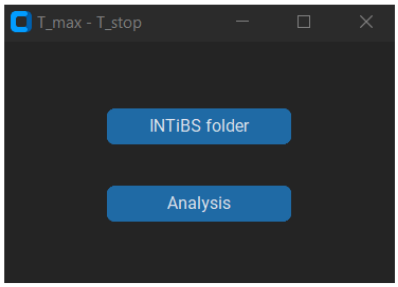
2. Analysis

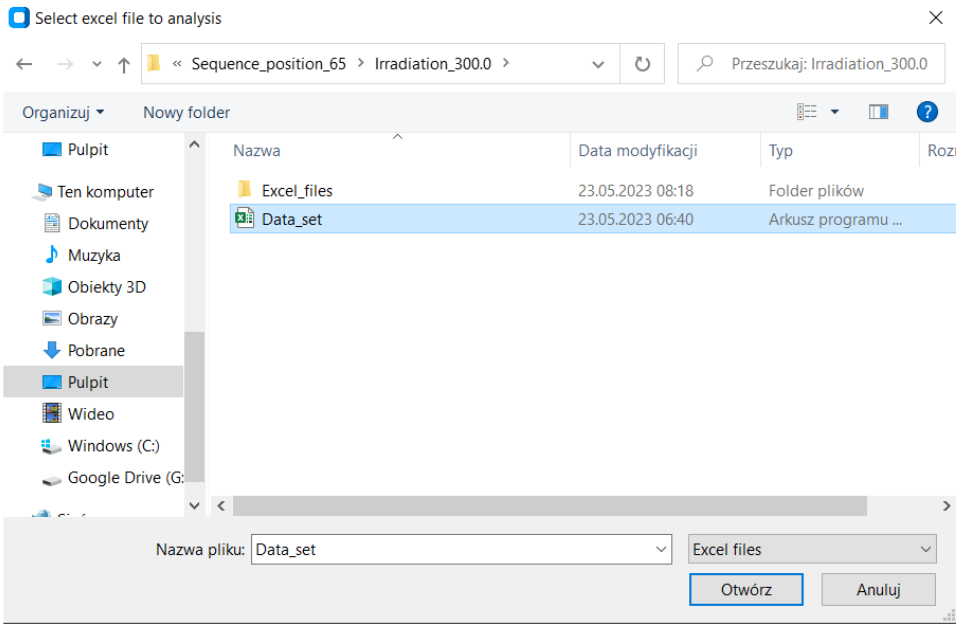
The analysis function allows you to perform the procedure Tmax - Tstop. The program, according to this procedure, first finds the first maximum intensity and then proceeds to perform the IRM (Initial Rise Method) for each Tstop temperature. After the analysis, the program presents the results in the form of a report saved in pdf format, excel files with data and saves all the necessary charts.

1. We select the "Analysis" function

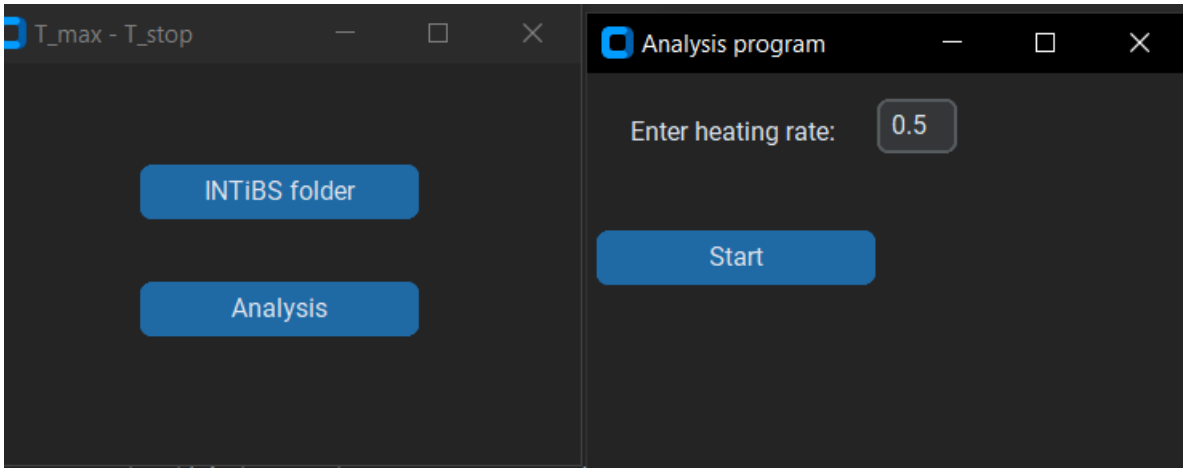


2. We select the Excel file with all the data (look at chapter 3. Requirements for analysis)

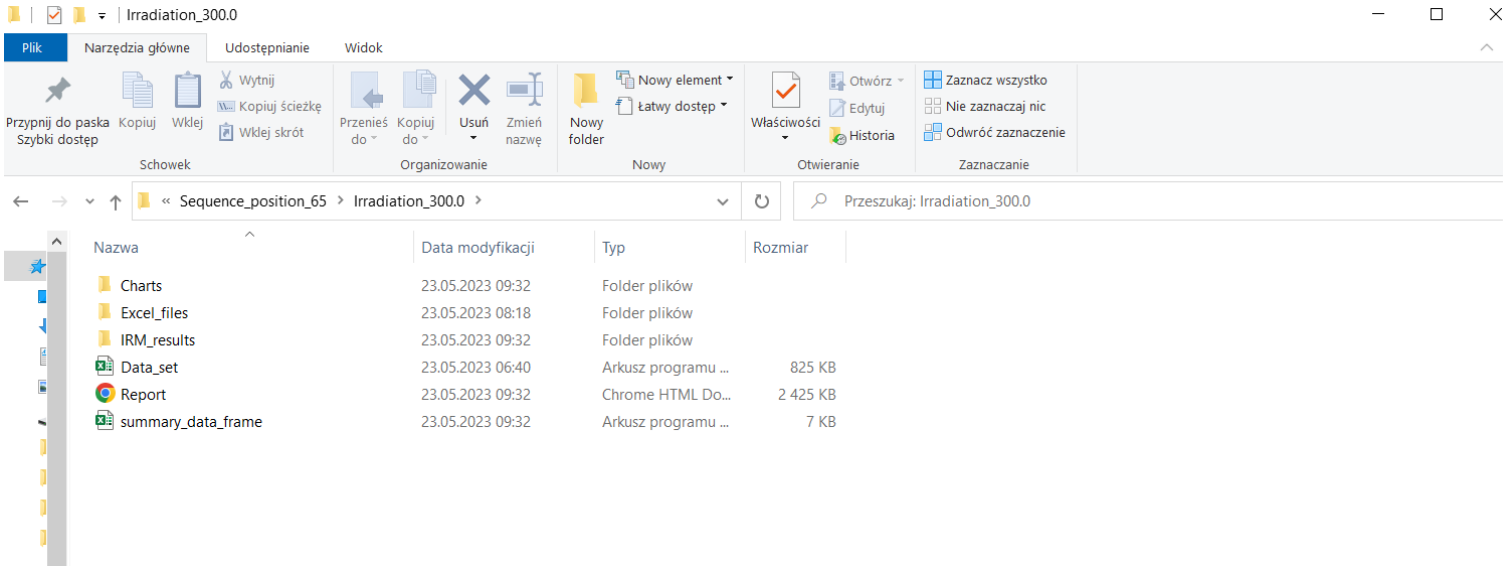




3. After loading the Excel data file, enter the heating rate, then click the 'Start' button.

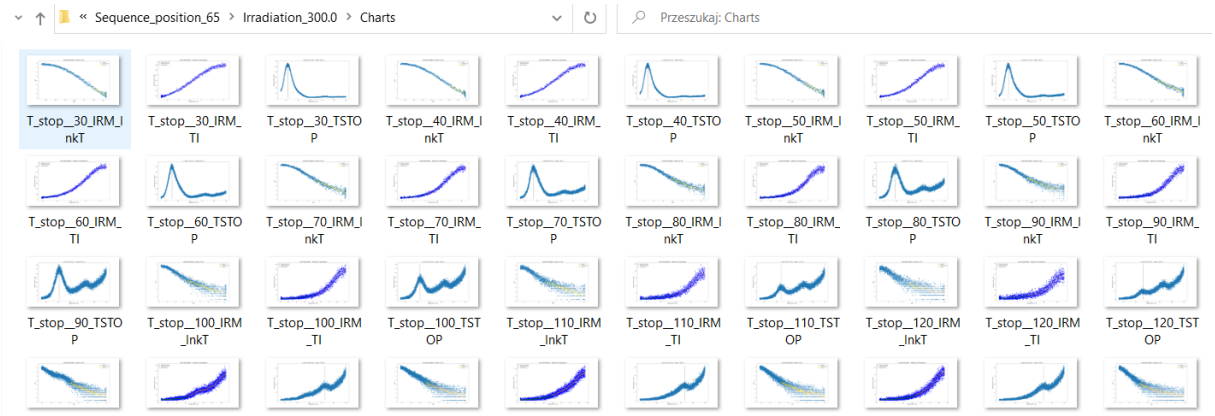


4. The analysis takes about 30 seconds. This is due to the creation of graphs, IRM measurement files and the creation of a summary report.



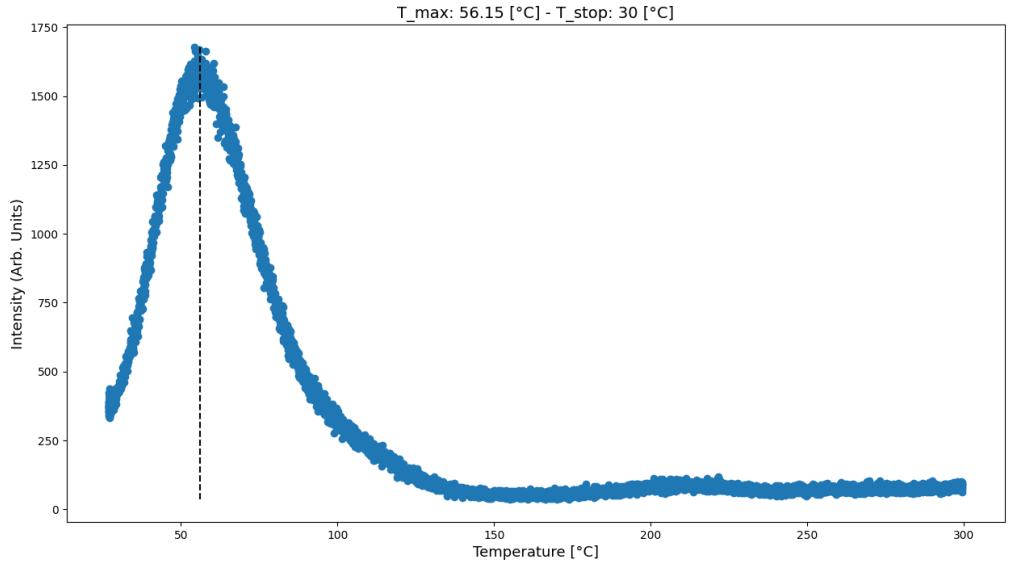
➔ Folder IRM_results: contains data files that have been transformed into (1/kT and log(Int)) - this transformation comes from the application of the IRM method. In this folder, each file is named Tstop temperature.

➔ Folder Charts: contains the following charts:

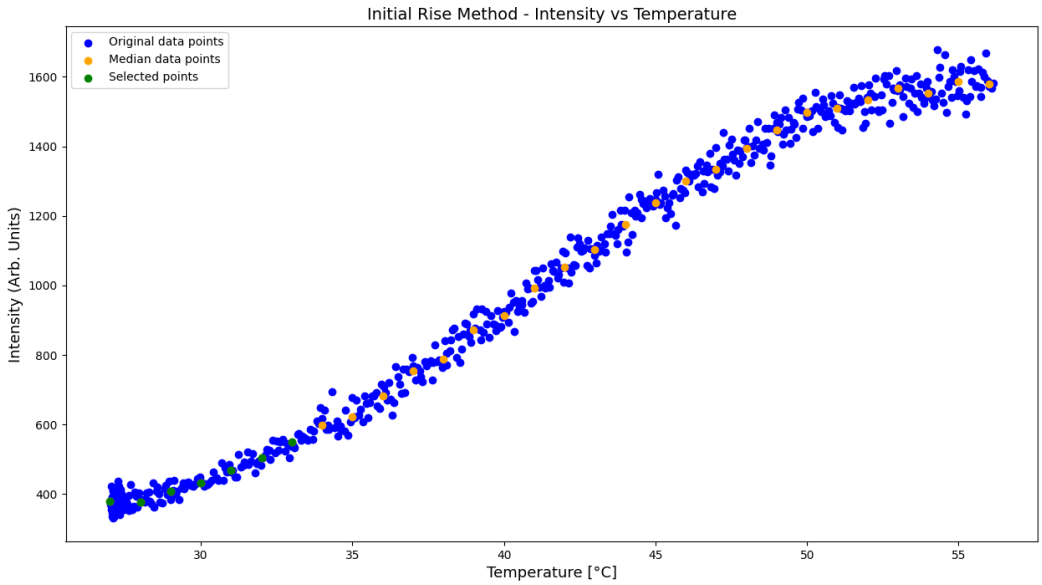


Each of them has the name Tstop at the beginning (for faster finding of the selected chart)

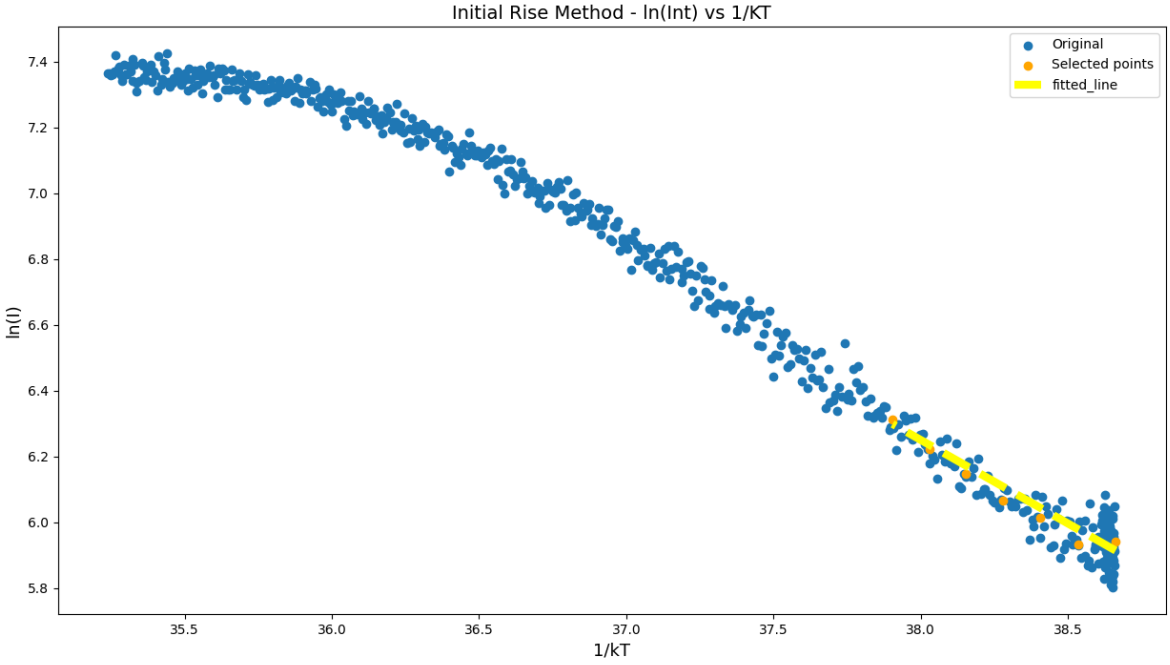
a) (tstop)_TSTOP: Graph with marked Tmax temperature



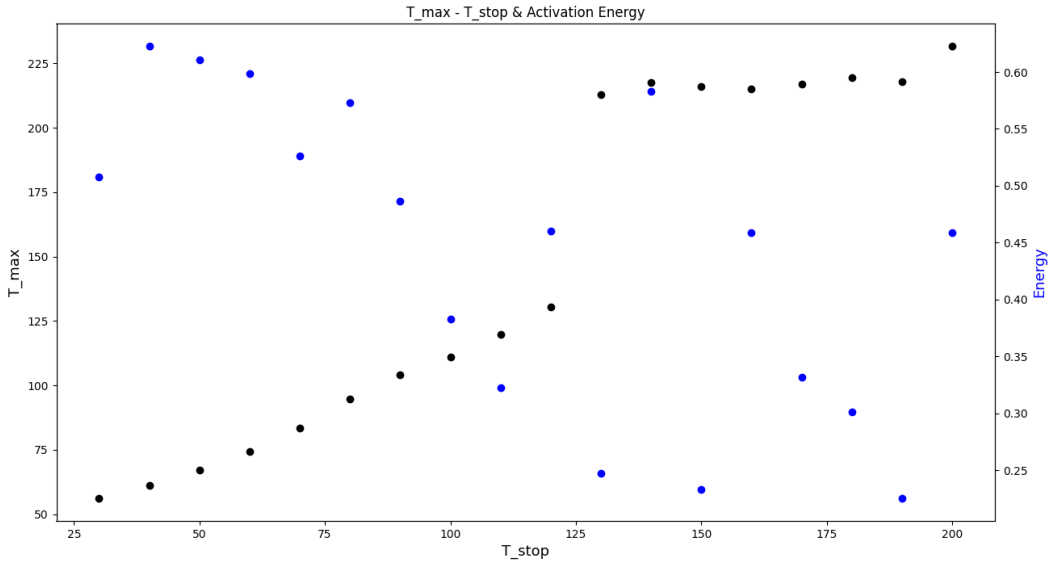
b) (tstop)_IRM_TI: Selected points (green) are taken into the IRM analysis.



c) (tstop)_IRM_lnKT: Transformed data with the best fit function for the required segment using the IRM method (15% max intensity)



d) T_max – T_stop: Chart with summary of T_max, T_stop and activation energy.



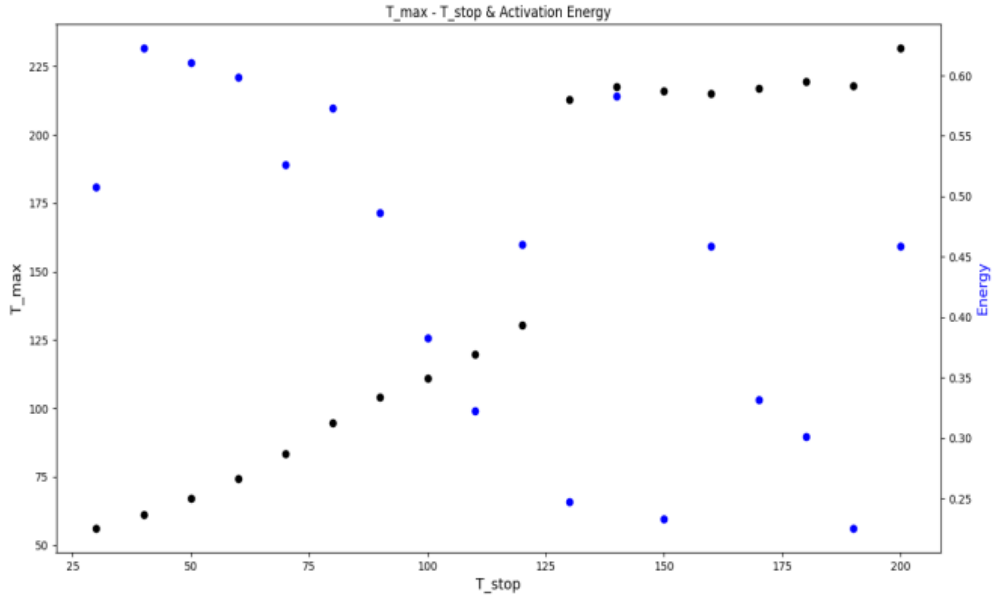
➔ File summary_data_frame: contains all the data with the calculated parameters.

	A	B	C	D	E	F	G	H
1		T_stop [°C]	T_stop (value)	T_max [°C]	Energy [ev]	u(E) [eV]	s	u(E)/E [%]
2	0	T_stop: 30	30	56.15	0.507711229	0.044181746	1600688.002	8.70214088
3	1	T_stop: 40	40	61.03	0.622713308	0.0273551	79630905.29	4.392888341
4	2	T_stop: 50	50	67.21	0.610349705	0.021751391	33332527.08	3.563758714
5	3	T_stop: 60	60	74.4	0.598231122	0.021224893	13592666.64	3.547942027
6	4	T_stop: 70	70	83.38	0.52620042	0.015314855	658769.6287	2.910460419
7	5	T_stop: 80	80	94.72	0.572895014	0.01899956	1733331.172	3.316412166
8	6	T_stop: 90	90	104.17	0.486455392	0.015747214	62329.7669	3.23713433
9	7	T_stop: 100	100	111.16	0.382942811	0.014965196	1582.037448	3.907945537
10	8	T_stop: 110	110	119.73	0.322785242	0.014737053	167.729326	4.565590805
11	9	T_stop: 120	120	130.38	0.460173299	0.086061868	9161.701523	18.70205596
12	10	T_stop: 130	130	212.99	0.247442223	0.008355355	2.232357926	3.376689412
13	11	T_stop: 140	140	217.52	0.583157142	0.173038617	13725.79232	29.67272532
14	12	T_stop: 150	150	216.19	0.233372052	0.008525652	1.432037968	3.65324484
15	13	T_stop: 160	160	215.07	0.458565742	0.060539334	604.5496489	13.20188755
16	14	T_stop: 170	170	217.06	0.331497666	0.017994638	20.48296707	5.428285121
17	15	T_stop: 180	180	219.62	0.30104437	0.022724598	8.626882945	7.548587756
18	16	T_stop: 190	190	217.96	0.225239324	0.008014708	1.109923622	3.558307696
19	17	T_stop: 200	200	231.74	0.459000789	0.085078264	398.7788878	18.53553766

➔ File Report: Summary pdf file. It contains graphs along with a table with parameters.

23-05-2023 09:32

Tmax - Tstop Analysis Report

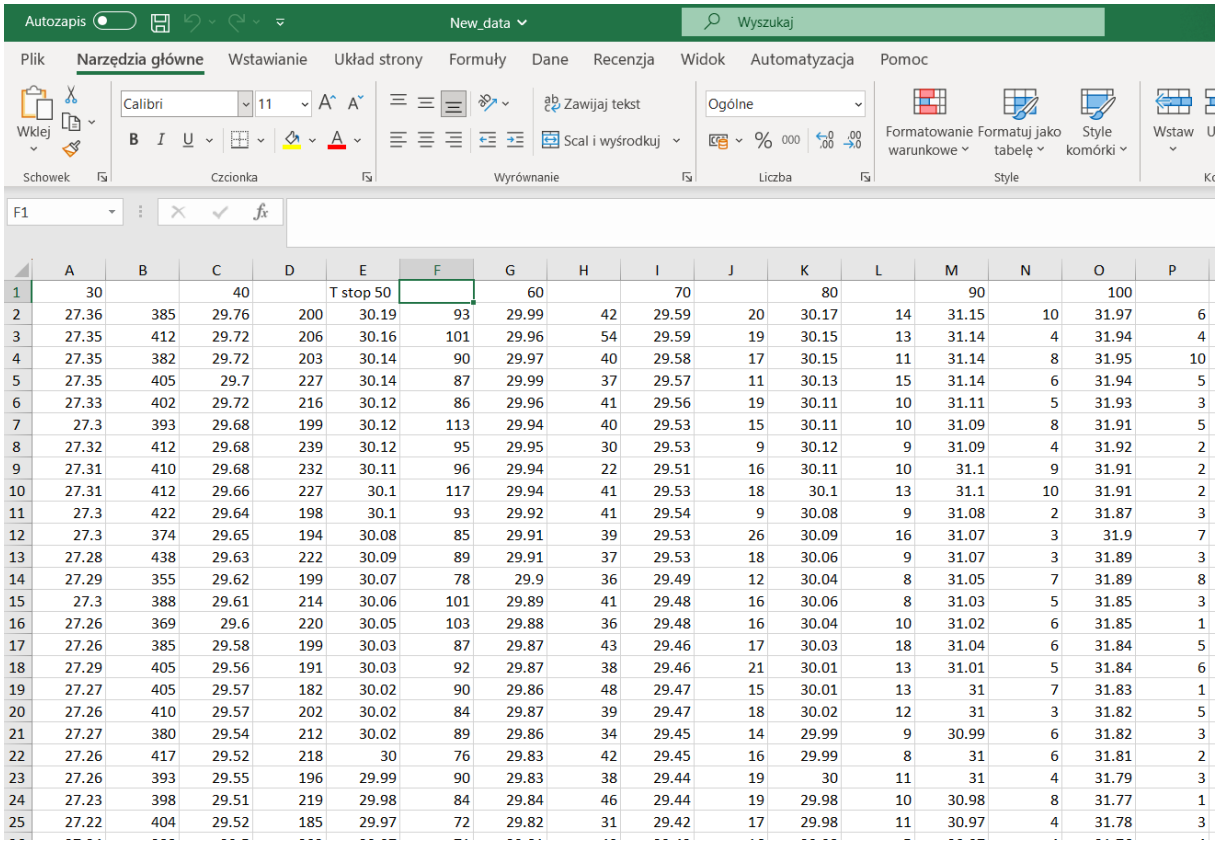


Summary table

T_stop (value)	T_max [°C]	Energy [ev]	u(E) [eV]	s	u(E)/E [%]
30.0	56.15	0.508	0.044	1600688.002	8.702
40.0	61.03	0.623	0.027	79630905.293	4.393
50.0	67.21	0.61	0.022	33332527.081	3.564

3. Requirements for analysis

A file for analysis that was not created by the "INTiBS folder" algorithm, must have a specific form: (an example below)



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	30		40		T stop 50		60		70		80		90		100	
2	27.36	385	29.76	200	30.19	93	29.99	42	29.59	20	30.17	14	31.15	10	31.97	6
3	27.35	412	29.72	206	30.16	101	29.96	54	29.59	19	30.15	13	31.14	4	31.94	4
4	27.35	382	29.72	203	30.14	90	29.97	40	29.58	17	30.15	11	31.14	8	31.95	10
5	27.35	405	29.7	227	30.14	87	29.99	37	29.57	11	30.13	15	31.14	6	31.94	5
6	27.33	402	29.72	216	30.12	86	29.96	41	29.56	19	30.11	10	31.11	5	31.93	3
7	27.3	393	29.68	199	30.12	113	29.94	40	29.53	15	30.11	10	31.09	8	31.91	5
8	27.32	412	29.68	239	30.12	95	29.95	30	29.53	9	30.12	9	31.09	4	31.92	2
9	27.31	410	29.68	232	30.11	96	29.94	22	29.51	16	30.11	10	31.1	9	31.91	2
10	27.31	412	29.66	227	30.1	117	29.94	41	29.53	18	30.1	13	31.1	10	31.91	2
11	27.3	422	29.64	198	30.1	93	29.92	41	29.54	9	30.08	9	31.08	2	31.87	3
12	27.3	374	29.65	194	30.08	85	29.91	39	29.53	26	30.09	16	31.07	3	31.9	7
13	27.28	438	29.63	222	30.09	89	29.91	37	29.53	18	30.06	9	31.07	3	31.89	3
14	27.29	355	29.62	199	30.07	78	29.9	36	29.49	12	30.04	8	31.05	7	31.89	8
15	27.3	388	29.61	214	30.06	101	29.89	41	29.48	16	30.06	8	31.03	5	31.85	3
16	27.26	369	29.6	220	30.05	103	29.88	36	29.48	16	30.04	10	31.02	6	31.85	1
17	27.26	385	29.58	199	30.03	87	29.87	43	29.46	17	30.03	18	31.04	6	31.84	5
18	27.29	405	29.56	191	30.03	92	29.87	38	29.46	21	30.01	13	31.01	5	31.84	6
19	27.27	405	29.57	182	30.02	90	29.86	48	29.47	15	30.01	13	31	7	31.83	1
20	27.26	410	29.57	202	30.02	84	29.87	39	29.47	18	30.02	12	31	3	31.82	5
21	27.27	380	29.54	212	30.02	89	29.86	34	29.45	14	29.99	9	30.99	6	31.82	3
22	27.26	417	29.52	218	30	76	29.83	42	29.45	16	29.99	8	31	6	31.81	2
23	27.26	393	29.55	196	29.99	90	29.83	38	29.44	19	30	11	31	4	31.79	3
24	27.23	398	29.51	219	29.98	84	29.84	46	29.44	19	29.98	10	30.98	8	31.77	1
25	27.22	404	29.52	185	29.97	72	29.82	31	29.42	17	29.98	11	30.97	4	31.78	3

1. In row number 1, the Tstop temperatures must be recorded for each measurement. It can be simply written temperature e.g. **30** or add additional text "**t stop 50**" it is important that the number is included. For example the preferred format for Tstop = 60 is e.g. : **60** or **Tstop 60**.

AVOID SPECIAL CHARACTERS!

2. A dot as a decimal symbol

3. Insert the temperature and intensity values starting from row 2. The columns represents a sequence of temperature and intensity that means: Column A contains a temperature data and column B intensity data for Tstop 30, Column B (Temp), Column D (Int) for Tstop 40 and so on.

4. The amount of data for each column must be the same.