

PROCEDURE

TO PLOT MASS SPECTROSCOPY AND THERMOGRAVIMETRY DATA FROM NETZSCH DISPSAV AND PROTEUS IN ORIGIN SOFTWARE

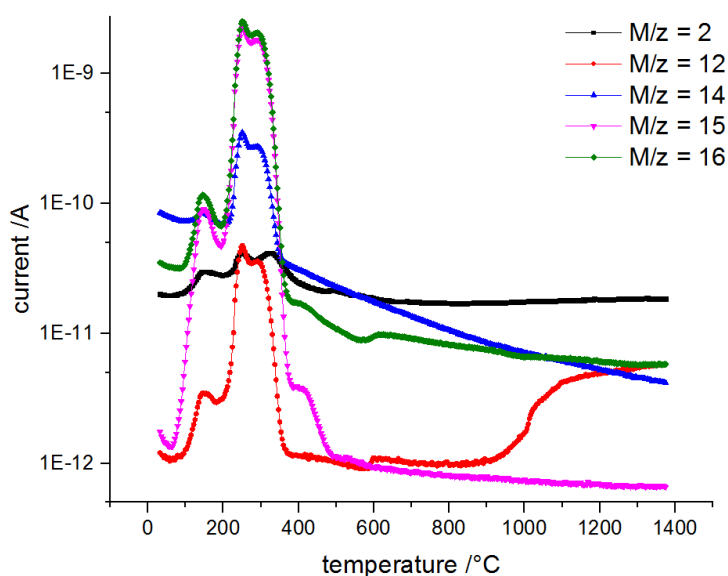
Sylvain Kern

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This is a guide to process and plot the mass spectroscopy (MS) and thermogravimetry (TG) data recorded from the Netzsch pieces of equipment in Origin 2016 software.¹ This also includes some scripts to automate the process.

All source files can be found at . . . along with this very procedure in .pdf or .md formats for user convenience.

¹ Origin 2016 - <https://www.originlab.com/index.aspx?go=PRODUCTS/Origin>

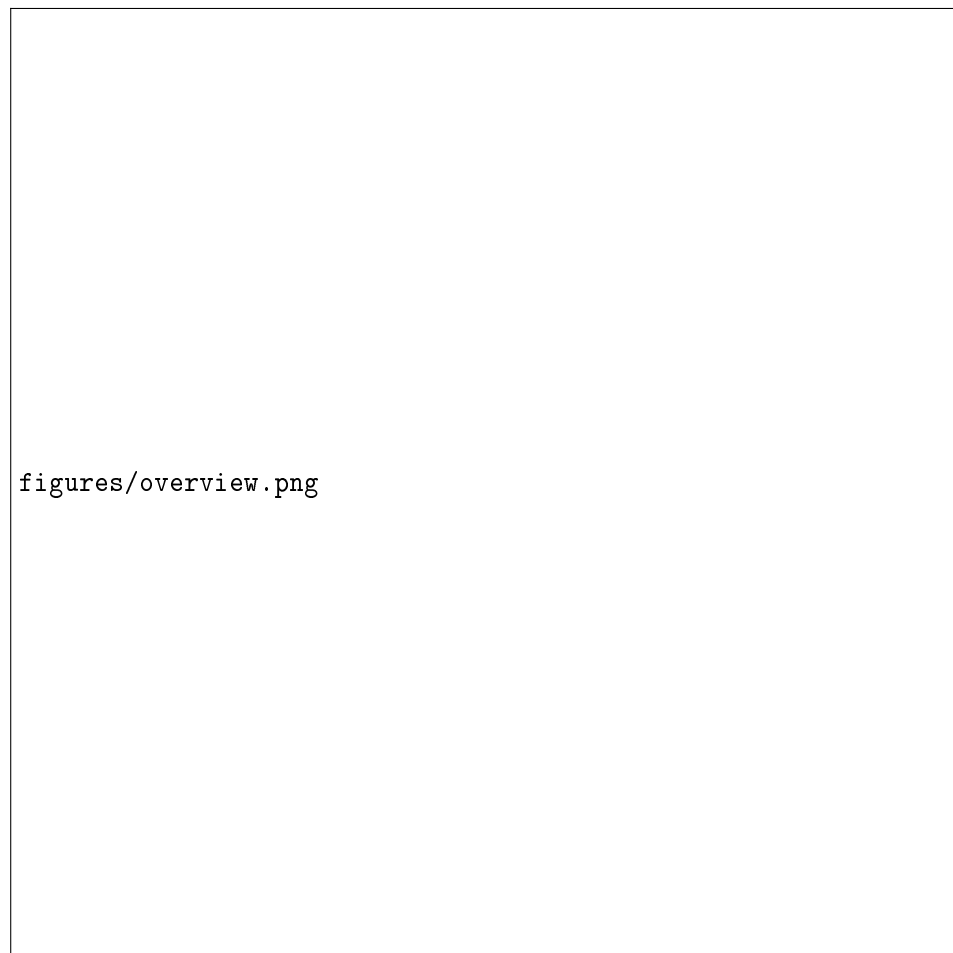


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1 *Manual procedure*

Here is a way to quickly² get TGMS plots from data collected in the different Netzsch pieces of software, using Origin.



² The manual procedure is actually quite long and repetitive, so there is an Origin script presented in section 2.

This is a visual overview of the procedure explained below.

That's it, `tgmsplot-script` is now installed on your computer!

1.1 *Exports*

1.1.1 *Export MS data from Dispsav*

1. Open Aëolos Dispsav.
2. Go to the Process tab, go to Cycles... and open the desired .mdc.
3. Then go to File > Convert to ASCII... and save the exported file in a chosen directory.

1.1.2 Export TG data form Netzsch Proteus

1. Open Proteus Analysis.
2. Go to File > Open... and open the .ngb-sss file of your choice.
3. Then go to Extras > Export Data... and make sur that the Full range box is selected and click Export. Eventually choose the destination folder.

1.1.3 Export baseline data

The baseline data is in the same form than the TG data, so the steps are exactly similar than those on the paragraph above.

1.2 Imports in Origin

The data treatments will be executed on Origin software. To continue, open Origin.

1.2.1 Import MS data in ASCII format

Here are the steps to import the first MS data worksheet, *i.e* the relative intensity extrema for each M/z .

1. On Origin, go to File > Import > Import Wizard or press Ctrl+3.
2. On the Import Wizard - Source window, select the MS data file you saved. Make sur the data type ASCII is selected, and click Next.

This procedure has been made using Origin 2016 version 93E. The software may differ a bit if you use more recent versions of the software. For more help, see Origin's user guide: www.originlab.com/doc/User-Guide

If the Import line does not appear on the File menu, make sure an Origin project is open by clicking File > New > Project.

Data Type

☒ ASCII ☐ Binary ☐ User Defined

Data Source

☒ File [C:\Users\Admin\Desktop\sylvain_stage\procedures_origin\donnees-test\MS\He\ae36 phms40c ...] ☐ Clipboard

Import Filter

☒ List filters applicable to both Data Type and file name

Import Filters for current Data Type: User Files Folder: ASCII

Description:

Target Window

☒ Worksheet ☐ Matrix ☐ None [User Defined filter needs to create window]

Template: <default>

Template could be used only when import mode is start new books or start new sheets

Import Mode: Replace Existing Data

Cancel << Back Next >> Finish

- On the Import Wizard - Header Lines window, specify the number of header lines –i.e. the number of lines which will be ignored by Origin. Leave the Number of subheader lines at 0, and Long Names at 0 too.

Number of main header lines(exclude subheader lines): 9

Number of subheader lines: 0

☐ Auto determine header lines

Column Label Assignment from Subheader Lines

Short Names: <None> Comments: <None> to 0

Long Names: <None> System Parameters: <None> to 0

Units: <None> User Parameters: <None> to 0

☐ Extract Long Names and Units from Same Line Characters to skip on each line: 0

Preview Font: System Preview Lines: 50

Prefix: S=Short Name, L=Long Name, U=Units, P=Parameters, C=Comment, MH=Main Header, SH=Subheader

001 001MH ASCII SAMPLE CYCLES : e36 phms40dub 412mg monolith

002 002MH DATE : 19/11/2013 TIME : 09:50:23

003 003MH CONVERTED CYCLES : 186

004 004MH

005 005MH Number of stored cycles 186

006 006MH Printed start cycle 1

007 007MH Printed end cycle 186

008 008MH Number of stored datablocks 4

009 009MH

010 Datablock 0 Analog Input [V]

011 '0/0' [V] TC min: 0.234409 max: 8.54384

012 Datablock 1 Ion Current [A]

013 '1/0' 2.00 min: -2.3045E-014 max: 7.54705E-013

014 '1/1' 12.00 min: -3.38069E-014 max: 1.20491E-014

015 '1/2' 14.00 min: 1.68903E-013 max: 3.98264E-013

016 '1/3' 15.00 min: -3.20437E-014 max: 1.54455E-012

017 '1/4' 16.00 min: 6.96464E-014 max: 2.06829E-012

018 '1/5' 18.00 min: 7.4644E-014 max: 6.0460E-014

019

Cancel << Back Next >> Finish

The data preview should look like this: header lines in black and data lines in gray.

Then, click Next.

4. On Variable Extraction window, verify that the Save file into a workbook box is ticked. Leave the other boxes blank and click Next.

Extract variables from file names and file headers

- ☐ Specify location of variable names and values using delimiters
- ☐ Specify location of variable names and values using character positions
- ☐ Specify delimiter and Wizard scans for variable names and values
- ☐ Call a user defined Origin C function

Source File

Function Name

- ☐ Add variables to page info
- ☐ Create User Parameter rows for each variable

File Info

- ☒ Save file info. in workbook

5. On File name options, tick the Worksheet with filename box and leave the others alone. Then go Next.

Rename

- ☐ Auto
- ☒ worksheet with filename
- ☐ worksheet with variable
- ☐ workbook with file name
- ☐ workbook with variable
- ☐ Rename Long Name for Book only
- ☐ Include path when rename workbook

Append

- ☐ file name to workbook comments
- ☐ file name to column comments
- ☒ Include path when appending file name

6. On Data Columns, select the number of columns there are in the imported file, – here 6, click Apply and make sure that the data is properly formatted in the preview window. Select the 1,000.00 numeric separator and go to the Next page.

Column Separator

☒ Delimiter ☐ Tab/Space ☐ Tab ☐ Comma
☐ Semicolon ☐ Space ☐ Other ☐

☐ Treat consecutive delimiters as one

☐ Fixed Width 4

Column Designations

<Unchanged>

Right click column heading to set format and designation for individual column.

Number of columns 6

Text Qualifier <None> ☐ Remove

☐ Keep target column format

☒ Remove leading zeroes from numbers

☐ Force Rows to same size by filling missing value

☐ Column Width Preview (Click and drag edge of column header to resize columns)

Custom Date Format <None>

Custom Time Format <None>

Numeric Separator 1,000.00

Add Sparklines Yes(if less than 50 columns)

A(Y) (T&N)	B(Y) (T&N)	C(Y) (T&N)	D(Y) (T&N)	E(Y) (T&N)
Datablock 0	Analog Input	[U]		--
'0/0'	[U] TC	min:	0,23441	max:
Datablock 1	Ion Current	[A]		--
'1/0'	2	min:	-2,3045E-14	max:
'1/1'	12	min:	-3,38069E-14	max:
'1/2'	14	min:	1,68903E-13	max:
'1/3'	15	min:	-3,20437E-14	max:
'1/4'	16	min:	6,96464E-14	max:
'1/5'	18	min:	-7,16411E-15	max:
'1/6'	28	min:	8,48202E-13	max:
'1/7'	30	min:	1,51461E-13	max:
'1/8'	31	min:	-2,55389E-14	max:

7. On Data Selection, just leave Partial import to None click Next – the data should be correctly displayed in the window below, just like in the last step. Then go Next.

Partial Import None

From Column 1 To 0 Skip Columns 0 Read Columns 0

From Row 1 To 0 Skip Rows 0 Read Rows 1

Non-numeric data in a numeric field Read as text

A(Y) (T&N)	B(Y) (T&N)	C(Y) (T&N)	D(Y) (T&N)	E(Y) (T&N)
Datablock 0	Analog Input	[U]		--
'0/0'	[U] TC	min:	0,23441	max:
Datablock 1	Ion Current	[A]		--
'1/0'	2	min:	-2,3045E-14	max:
'1/1'	12	min:	-3,38069E-14	max:
'1/2'	14	min:	1,68903E-13	max:
'1/3'	15	min:	-3,20437E-14	max:
'1/4'	16	min:	6,96464E-14	max:
'1/5'	18	min:	-7,16411E-15	max:
'1/6'	28	min:	8,48202E-13	max:
'1/7'	30	min:	1,51461E-13	max:
'1/8'	31	min:	-3,55389E-14	max:
'1/9'	42	min:	-3,7694E-14	max:
'1/10'	43	min:	-3,74612E-14	max:
'1/11'	44	min:	-3,22126E-14	max:
'1/12'	45	min:	-3,75118E-14	max:
'1/13'	46	min:	-3,59657E-14	max:

8. On Save Filters, leave everything as it is, unless you want to save

this import filter for a next time. Click Finish.

Now your worksheet should look like this:³

	A(X)	B(Y)	C(Y)	D(Y)	E(Y)	F(Y)
Long Name						
Units						
Comments						
F(x)=						
Sparklines						
1	Datablock 0	Analog Input	[V]		--	
2	'0/0'	[V] TC	min:	0,23441	max:	8,54384
3	Datablock 1	Ion Current	[A]		--	
4	'1/0'	2	min:	-2,3045E-14	max:	7,54705E-13
5	'1/1'	12	min:	-3,38069E-14	max:	1,20491E-14
6	'1/2'	14	min:	1,68903E-13	max:	3,98264E-13
7	'1/3'	15	min:	-3,20437E-14	max:	1,54455E-12
8	'1/4'	16	min:	6,96464E-14	max:	2,06829E-12
9	'1/5'	18	min:	-7,16411E-15	max:	4,31659E-14
10	'1/6'	28	min:	8,48202E-13	max:	2,08033E-12
11	'1/7'	30	min:	1,51461E-13	max:	4,36167E-13
12	'1/8'	31	min:	-3,55389E-14	max:	8,21005E-15
13	'1/9'	42	min:	-3,7694E-14	max:	-7,51887E-15
14	'1/10'	43	min:	-3,74612E-14	max:	3,30935E-14
15	'1/11'	44	min:	-3,22126E-14	max:	1,21587E-13
16	'1/12'	45	min:	-3,75118E-14	max:	8,46162E-14
17	'1/13'	46	min:	-3,59657E-14	max:	-1,62815E-14
18	'1/14'	58	min:	-3,71239E-14	max:	-4,52501E-15
19	'1/15'	59	min:	-3,7519E-14	max:	1,19628E-14
20	'1/16'	73	min:	-3,71024E-14	max:	-1,42418E-14
21	'1/17'	91	min:	-3,75622E-14	max:	-1,78932E-14
22	Datablock 2	Analog Input	[mbar]		--	
23	'2/0'	AI 1	min:	3,63425E-6	max:	4,22764E-6
24	Datablock 3	Float Var.	[]		--	
25	'3/0'	Temp [°C]	min:	39	max:	1452
26	--		--		--	
27	Cycle	Date	Time	RelTime[s]	'0/0'	'1/0'
28	1	19/11/2013	09:50:23:01	0,015	0,23441	-4,01502E-15
29	2	19/11/2013	09:50:23:01	0,015	0,23441	-4,01502E-15
30	3	19/11/2013	09:51:18:66	55,661	0,23472	-1,60586E-14
31	4	19/11/2013	09:52:14:30	111,308	0,24939	-1,72305E-14
32	5	19/11/2013	09:53:09:92	166,923	0,28559	-1,59787E-14

³ It is possible that Origin creates another empty worksheet with the same name as the one you created, and I don't know why. You can just delete it by right-clicking on it > Delete.

To import the second MS piece of data, see the following steps.

1. Create a new worksheet by right-clicking a worksheet tab on the bottom, "Add".
2. Open File > Import > Import Wizard or press Ctrl+3.
3. On the Import Wizard - Source window, select the MS data file you saved. Make sure the data type ASCII is selected, and click Next.
4. On the Import Wizard - Header Lines window, specify the number of header lines –i.e. the number of lines which will be ignored by Origin. This time, put the Number of subheader lines at 1, and Long Names at 1 too.

Number of main header lines(exclude subheader lines) 35 ☐ Line number start from bottom

Number of subheader lines 1 ☐ Auto determine header lines

Column Label Assignment from Subheader Lines

Short Names <None> Comments <None> to 0

Long Names **i** System Parameters <None> to 0

Units <None> User Parameters <None> to 0

☐ Extract Long Names and Units from Same Line Characters to skip on each line 0

Preview Font System Preview Lines 50

Prefix: S=Short Name, L=Long Name, U=Units, P=Parameters, C=Comment, MH=Main Header, SH=Subheader

028	028MH	'1/15'	59.00	min:	-3.7519E-014	max:	1.19628E-014
029	029MH	'1/16'	73.00	min:	-3.71024E-014	max:	-1.42418E-014
030	030MH	'1/17'	91.00	min:	-3.75622E-014	max:	-1.78932E-014
031	031MH	Datablock 2 Analog Input [mbar]					
032	032MH	'2/0'	AI 1	min:	3.63425E-006	max:	4.22764E-006
033	033MH	Datablock 3 Float Var. []					
034	034MH	'3/0'	Temp [°C]	min:	39	max:	1452
035	035MH						
036	036SH	L	Cycle	Date	Time	RelTime[s]	'0/0' '1/0' '1/1' '1/2' '1
037		1	19/11/2013	09:50:23:01	0.015	0.234409	-4.01502E-015
038		2	19/11/2013	09:50:23:01	0.015	0.234409	-4.01502E-015
039		3	19/11/2013	09:51:18:66	55.661	0.234721	-1.60586E-01
040		4	19/11/2013	09:52:14:30	111.308	0.249389	-1.72305E-0
041		5	19/11/2013	09:53:09:92	166.923	0.285593	-1.59787E-0
042		6	19/11/2013	09:54:05:55	222.553	0.334594	-1.76531E-0
043		7	19/11/2013	09:55:01:18	278.185	0.414492	-1.70443E-0
044		8	19/11/2013	09:55:56:81	333.816	0.499072	-1.6465E-01
045		9	19/11/2013	09:56:52:46	388.645	0.586974	-1.77405E-01

Cancel << Back **Next >>** Finish

The data preview should look like this, with the subheader lines highlighted in blue.

Then, click Next.

- On Variable Extraction window, verify that the Save file into a workbook box is ticked. Leave the other boxes blank and click Next.
- On File name options, tick the Worksheet with filename box and leave the others alone. Then go Next.
- On Data Columns, select the number of columns there are in the imported file, – here 25, click Apply and make sure that the data is properly formatted in the preview window. Select the 1,000.00 numeric separator and go to the Next page.

Column Separator

☒ Delimiter ☐ Tab/Space ☐ Tab ☐ Comma
☐ Semicolon ☐ Space ☐ Other ☐

☐ Treat consecutive delimiters as one

☐ Fixed Width 4 Apply

Column Designations

<Unchanged> Apply

Right click column heading to set format and designation for individual column.

Number of columns 25 Apply

Text Qualifier <None> Remove

☐ Keep target column format

☒ Remove leading zeroes from numbers

☐ Force Rows to same size by filling missing value

☐ Column Width Preview (Click and drag edge of column header to resize columns) Add Column Delete Column

Custom Date Format <None> Apply

Custom Time Format <None> Apply

Numeric Separator 1,000.00

Add Sparklines Yes(if less than 50 columns)

V (T&N)	U (V) (T&N)	W (V) (T&N)	X (V) (T&N)	Y (V) (T&N)
45127E-14	-3,3779E-14	-3,40531E-14	3,69606E-6	39
45127E-14	-3,3779E-14	-3,40531E-14	3,69606E-6	39
62539E-14	-3,66653E-14	-3,65715E-14	3,70018E-6	40
7519E-14	-3,66701E-14	-3,75622E-14	3,70224E-6	42
7406E-14	-3,67361E-14	-3,62972E-14	3,68782E-6	47
69569E-14	-3,6782E-14	-3,65866E-14	3,69812E-6	56
65169E-14	-3,69191E-14	-3,68988E-14	3,70018E-6	69
64655E-14	-3,64322E-14	-3,74515E-14	3,69606E-6	84
7256E-14	-3,69268E-14	-3,67231E-14	3,69812E-6	97
70389E-14	-3,71024E-14	-3,59251E-14	3,70018E-6	111
56317E-14	-3,6504E-14	-3,60733E-14	3,70018E-6	121
5000E-14	-3,5470E-14	-3,7267E-14	3,6750E-6	120

Cancel << Back Next >> Finish

8. On Data Selection, just leave Partial import to None and click Next – the data should be correctly displayed in the window below, just like in the last step. Then go Next.

Partial Import None

From Column 1 To 0 Skip Columns 0 Read Columns 0

From Row 1 To 0 Skip Rows 0 Read Rows 1

Apply

Non-numeric data in a numeric field Read as text

A (V) (T&N)	B (V) (D)	C (V) (Tm)	D (V) (T&N)	E (V) (T&N)
1	19/11/2013	266:23	0,015	0,23441
2	19/11/2013	266:23	0,015	0,23441
3	19/11/2013	267:19	55,661	0,23472
4	19/11/2013	268:14	111,308	0,24939
5	19/11/2013	269:10	166,923	0,28559
6	19/11/2013	270:05	222,553	0,33459
7	19/11/2013	271:01	278,185	0,41449
8	19/11/2013	271:57	333,816	0,49907
9	19/11/2013	272:52	389,465	0,58428
10	19/11/2013	273:48	445,112	0,65887
11	19/11/2013	274:44	500,774	0,71879
12	19/11/2013	275:39	556,437	0,76904
13	19/11/2013	240:35	612,085	0,81367
14	19/11/2013	241:31	667,7	0,85705
15	19/11/2013	242:26	723,316	0,9098
16	19/11/2013	243:22	778,978	0,97378
17	19/11/2013	244:18	834,61	1,03683

Cancel << Back Next >> Finish

9. On Save Filters, leave everything as it is, unless you want to save

this import filter for a next time. Click Finish.

Your second worksheet should look like this.

Now you have two worksheets, one with M/z data, the other with the actual MS curves.

To make future worksheet reference easier, I renamed the worksheets with the respective names "mz sheet", "ms data". To do the same, right-click a worksheet tab on the bottom, "Name and Comments..." and fill the "Short Name" field.



	A(X)	B(Y)	C(Y)	D(Y)	E(Y)	F(Y)	
Long Name							
Units							
Comments							
F0/- Sparklines							
1	Datablock 0	Analog Input	[V]				
2	'0/0'	[V] TC	min:	0.23441	max:	8.54384	
3	Datablock 1	Ion Current	[A]				
4	'1/0'	2	min:	-2.3045E-14	max:	7.54705E-13	
5	'1/1'	12	min:	-3.38069E-14	max:	1.20491E-14	
6	'1/2'	14	min:	1.68903E-13	max:	3.98264E-13	
7	'1/3'	15	min:	-3.20437E-14	max:	1.54455E-12	
8	'1/4'	16	min:	6.96464E-14	max:	2.06829E-12	
9	'1/5'	18	min:	-7.16411E-15	max:	4.31659E-14	
10	'1/6'	28	min:	8.48202E-13	max:	2.08033E-12	
11	'1/7'	30	min:	1.51461E-13	max:	4.36167E-13	
12	'1/8'	31	min:	-3.55389E-14	max:	8.21005E-15	
13	'1/9'	42	min:	-3.7694E-14	max:	-7.51887E-15	
14	'1/10'	43	min:	-3.74612E-14	max:	3.30935E-14	
15	'1/11'	44	min:	-3.22126E-14	max:	1.21587E-13	
16	'1/12'	45	min:	-3.75118E-14	max:	8.46162E-14	
17	'1/13'	46	min:	-3.59657E-14	max:	-1.62815E-14	
18	'1/14'	58	min:	-3.71239E-14	max:	-4.52501E-15	
19	'1/15'	59	min:	-3.7519E-14	max:	1.19628E-14	
20	'1/16'	73	min:	-3.71024E-14	max:	-1.42418E-14	
21	'1/17'	91	min:	-3.75622E-14	max:	-1.78932E-14	
22	Datablock 2	Analog Input	[mbar]				
23	'2/0'	A1	min:	3.63425E-6	max:	4.22764E-6	
24	Datablock 3	Float Var.	[]				
25	'3/0'	Temp [°C]	min:		39	max:	1452
26	--	--	--	--	--	--	
27	Cycle	Date	Time	ReTime[s]	'0/0'	'1/0'	
28	1	19/11/2013	09:50:23.01	0.015	0.23441	-4.01502E-15	
29	2	19/11/2013	09:50:23.01	0.015	0.23441	-4.01502E-15	
30	3	19/11/2013	09:51:18.66	55.661	0.23472	-1.60586E-14	
31	4	19/11/2013	09:52:14.30	111.308	0.24939	-1.72305E-14	
32	5	19/11/2013	09:53:09.92	166.923	0.28559	-1.59787E-14	

	A(X)	B(Y)	C(Y)	D(Y)	E(Y)	F(Y)	G(Y)	H(Y)	I(Y)	J(Y)
Long Name										
Units										
Comments										
F0/- Sparklines										
1	1	19/11/2013	266.23	0.015	0.23441	-4.01502E-15	-1.77078E-14	3.16359E-13	-2.22537E-14	1.24057E-13
2	2	19/11/2013	267.19	55.661	0.23472	-1.60586E-14	-3.04259E-14	3.05827E-13	-2.81147E-14	1.15784E-13
3	3	19/11/2013	267.19	55.661	0.23472	-1.60586E-14	-3.04259E-14	3.05827E-13	-2.81147E-14	1.15784E-13
4	4	19/11/2013	268.14	111.308	0.24939	-1.72305E-14	-3.24719E-14	3.07468E-13	-2.95645E-14	1.18719E-13
5	5	19/11/2013	269.10	166.923	0.28559	-1.59787E-14	-3.24532E-14	3.05755E-13	-3.18105E-14	1.10384E-13
6	6	19/11/2013	270.05	222.553	0.34569	-1.76531E-14	-3.38069E-14	3.03437E-13	-3.16278E-14	1.17156E-13
7	7	19/11/2013	271.01	278.185	0.41449	-1.70443E-14	-3.25024E-14	3.09315E-13	-3.20437E-14	1.17971E-13
8	8	19/11/2013	271.57	333.819	0.49907	-1.6480E-14	-3.24101E-14	3.07056E-13	-3.05478E-14	1.07659E-13
9	9	19/11/2013	272.52	389.465	0.58428	-1.7769E-14	-3.22245E-14	3.07359E-13	-3.09377E-14	1.19047E-13
10	10	19/11/2013	273.48	445.112	0.65887	-2.3045E-14	-3.21291E-14	3.04119E-13	-3.07255E-14	1.17341E-13
11	11	19/11/2013	274.44	500.774	0.71879	-1.34928E-14	-3.28612E-14	3.09499E-13	-2.84843E-14	1.12819E-13
12	12	19/11/2013	275.39	556.437	0.76904	-7.37815E-15	-3.20897E-14	3.12775E-13	-2.2933E-14	1.16392E-13
13	13	19/11/2013	280.35	612.085	0.81367	-3.33125E-15	-3.13307E-14	3.14447E-13	-1.68297E-14	1.13196E-13
14	14	19/11/2013	281.31	667.7	0.85705	-1.68108E-15	-3.06631E-14	3.17941E-13	-1.1553E-14	1.16477E-13
15	15	19/11/2013	282.26	723.316	0.9008	-8.8638E-16	-2.99781E-14	3.21972E-13	-4.27801E-15	1.19216E-13
16	16	19/11/2013	283.22	778.978	0.97378	-6.005E-16	-2.90845E-14	3.24711E-13	3.20446E-15	1.16354E-13
17	17	19/11/2013	284.18	834.61	1.03863	-2.12603E-15	-2.92914E-14	3.29083E-13	1.02303E-14	1.12432E-13
18	18	19/11/2013	285.13	890.267	1.10362	-5.05878E-15	-2.856E-14	3.29456E-13	1.05633E-14	1.15834E-13
19	19	19/11/2013	286.09	945.918	1.16728	-5.69251E-15	-2.97838E-14	3.24581E-13	1.22779E-14	1.09476E-13
20	20	19/11/2013	287.04	1001.56	1.22346	-8.66174E-15	-2.84457E-14	3.24231E-13	1.41242E-14	1.11472E-13
21	21	19/11/2013	288.00	1057.24	1.27309	-8.16882E-15	-2.81908E-14	3.1733E-13	1.2685E-14	1.12228E-13
22	22	19/11/2013	288.96	1112.87	1.31803	-1.02724E-14	-2.88008E-14	3.15806E-13	1.37991E-14	1.09709E-13
23	23	19/11/2013	289.91	1168.52	1.36766	-1.41284E-14	-2.94103E-14	3.16762E-13	1.05988E-14	1.07114E-13
24	24	19/11/2013	290.87	1224.18	1.4229	-1.61157E-14	-2.83991E-14	3.11606E-13	1.34448E-14	1.05271E-13
25	25	19/11/2013	291.83	1279.84	1.47763	-1.53986E-14	-2.81487E-14	3.11362E-13	1.03339E-14	1.07345E-13
26	26	19/11/2013	292.78	1335.45	1.53869	-2.28782E-14	-2.78393E-14	3.03697E-13	1.50824E-14	1.08367E-13
27	27	19/11/2013	293.74	1391.11	1.59799	-3.22889E-14	-2.80248E-14	3.05174E-13	1.83356E-14	1.08553E-13
28	28	19/11/2013	294.70	1446.72	1.65292	-4.22103E-14	-2.69212E-14	3.05427E-13	2.24047E-14	1.11933E-13
29	29	19/11/2013	295.65	1502.35	1.7041	-5.02898E-14	-2.58833E-14	3.05693E-13	2.88262E-14	1.08829E-13
30	30	19/11/2013	296.61	1558.03	1.75404	-6.05623E-14	-2.61259E-14	3.09922E-13	3.55098E-14	1.1276E-13
31	31	19/11/2013	297.57	1613.73	1.80741	-6.33115E-14	-2.52148E-14	3.01834E-13	4.14554E-14	1.14932E-13
32	32	19/11/2013	298.52	1669.41	1.85859	-6.77693E-14	-2.62309E-14	3.10439E-13	4.62842E-14	1.18952E-13
33	33	19/11/2013	299.08	1725.07	1.91696	-7.06243E-14	-2.4359E-14	3.14671E-13	5.53112E-14	1.15509E-13
34	34	19/11/2013	299.04	1780.75	1.97251	-6.93489E-14	-2.46477E-14	3.12584E-13	6.29995E-14	1.20038E-13
35	35	19/11/2013	299.69	1836.43	2.0315	-6.73745E-14	-2.38638E-14	3.1363E-13	6.73509E-14	1.17664E-13
36	36	19/11/2013	299.65	1892.11	2.08237	-5.98744E-14	-2.40557E-14	3.10882E-13	7.39515E-14	1.19244E-13
37	37	19/11/2013	299.51	1947.8	2.1373	-5.62559E-14	-2.24065E-14	3.12893E-13	8.24538E-14	1.17948E-13
38	38	19/11/2013	299.46	2003.5	2.18683	-5.55878E-14	-2.10131E-14	3.15581E-13	8.8003E-14	1.15548E-13
39	39	19/11/2013	299.42	2059.18	2.24217	-5.37044E-14	-2.13031E-14	3.1496E-13	9.75074E-14	1.14343E-13
40	40	19/11/2013	299.38	2114.85	2.29679	-5.41937E-14	-1.94182E-14	3.29961E-13	1.1428E-13	1.17647E-13

1.2.2 Import TG data in .txt format

This is a bit shorter than the MS import but it is the same idea.

1. Create a new worksheet and switch to it.
2. Reach File > Import > Import Wizard and browse the desired file.
- 3.

1.2.3 Import baseline data in .txt format

The steps are the same than the TG import in paragraph 1.2.2 since the files are formatted in the same way.

1.3 Preliminary treatments

You can rearrange the columns of your worksheets the way you want, delete some of the useless information, put names, units, comments etc. . .

sThe following steps treat the data to prepare the TGMS plots.

1.4 *Place the M/z labels on MS columns*1.5 *Calculate the relative intensity on mz sheet*1.5.1 *Polynomial regression of the temperature curve in TG data*

Since temperature *vs.* time is not given in the MS data, it is needed to whether fit a curve, whether interpolate the data, to get new temperature points corresponding to MS time points.

Assuming the PID controller for the furnace is well adjusted, the temperature increase in the furnace should be linear so I chose to fit a degree one polynomial in this case.

1.5.2 *Baseline mass loss data interpolation and subtraction⁴*

The time points for TG and baseline may not be the same. If it is the case, we will want to interpolate the baseline mass loss data in order to get the correct values to subtract from TG ones, since the baseline data does not follow a predictable model.

1.6 *Plotting graphs*1.6.1 *For TG*1.6.2 *For MS*1.6.3 *Plot TGMS graph*2 *Origin scripting for automated plots*

To reduce the time spent on overly repetitive tasks, I produced a LabTalk – Origin's scripting language – file run by Origin to execute the procedure detailed above in section 1.

2.1 *Scripts installation*

Download the folder that contains the source files here Place the `tgmsplot-script` in the following folder:

```
C:\ProgramFiles\Origin2016\
```

2.2 *Usage**Using buttons*

```
installbuttons
```


The fit must only consider the points where the temperature grows

– approximately – linearly, therefore it must omit all points from segment 2 and 3. The temperature increase shows some variations at the beginning, until a stabilized growth settles. Usually, this variation becomes marginal around $T = 200\text{ }^{\circ}\text{C}$.

⁴ This is only needed if the TG and baseline data don't have the same measurement points. If they have been exported from Proteus with the same settings, please ignore this part.

If you have a different version of Origin, it may not be `'...\Origin2016'` but whatever your version is.

Using the run.file command

Open the command window –this icon  on the right of the top toolbar. Then run the following command:

```
run.file("C:\ProgramFiles\Origin2016\tgmsplot-script\main.ogs")
```

This will sequentially import MS,⁵ TG and BL data, and will draw the graphs.⁶

A file browser window appears, select the MS file you want to load. Click Ok then do the same for the TG and baseline files.

Then choose the plot type you want, and if needed, the different M/z corresponding curves to plot. The data is now plotted.

Partial data imports

To import only the MS data, run the following in the command window:

```
run.file("C:\Program
→ Files\Origin2016\tgmsplot-script\import-ms.ogs")
```

The same goes for TG and BL data:

```
run.file("C:\Program
→ Files\Origin2016\tgmsplot-script\import-tg.ogs")
```

```
run.file("C:\Program
→ Files\Origin2016\tgmsplot-script\import-bl.ogs")
```

Then, execute the plot program:

```
run.file("C:\Program Files\Origin2016\tgmsplot-script\plot.ogs")
```

2.2.1 Script and execution details

The source folder contains the following files:

I recommend using main.ogs rather than the individual separate files, as some dependency issues may appear.

2.2.2 Button groups

i n p r o g r e s s

create new project unlocks access to the buttons

⁵ It works for MS bargraphs.

⁶ To do separate MS or TG importations, or just plot, see the title below.

Note that the MS curves are not to scale on the y axis, which is not ticked. The TGMS plot is only meant to give a qualitative overview and not precise quantitative information.

2.3 *Issues*

i n p r o g r e s s

Bargraph data format not supported.

Not very robust.

Scripts dependance –only main is advised for execution.