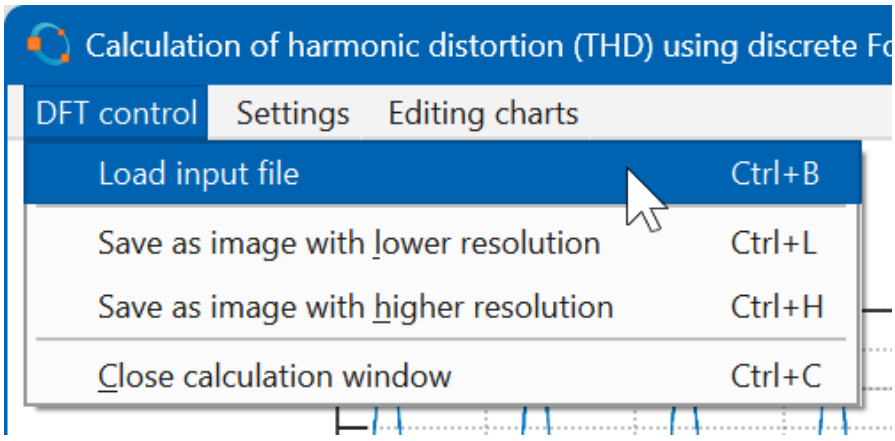
Program control

If program correctly reads monitor resolution after startup (as described at beginning) it wants to select file for processing from directories. Program remembers path where selected file is located in its settings file (file with the same name as program and with file extension **.nuf** in directory where program is stored) and offers it as default during subsequent launches. Description of settings file is in separate chapter. After loading data file, program window displays graph with data from file and asks for description to better identify what it is. This description will be displayed in first line of results. After that, program calculates THD and displays results. You can also cancel input file query by clicking "Cancel" button in input file dialog. Program will alert you with a message and, depending on when file input was requested, there are two possible behaviors: if file input was requested after program was opened, when nothing has been processed yet, the program will display an empty window with only control menu, and you can enter file or exit the program from this menu. If some file has already been processed and displayed, its display will be preserved.

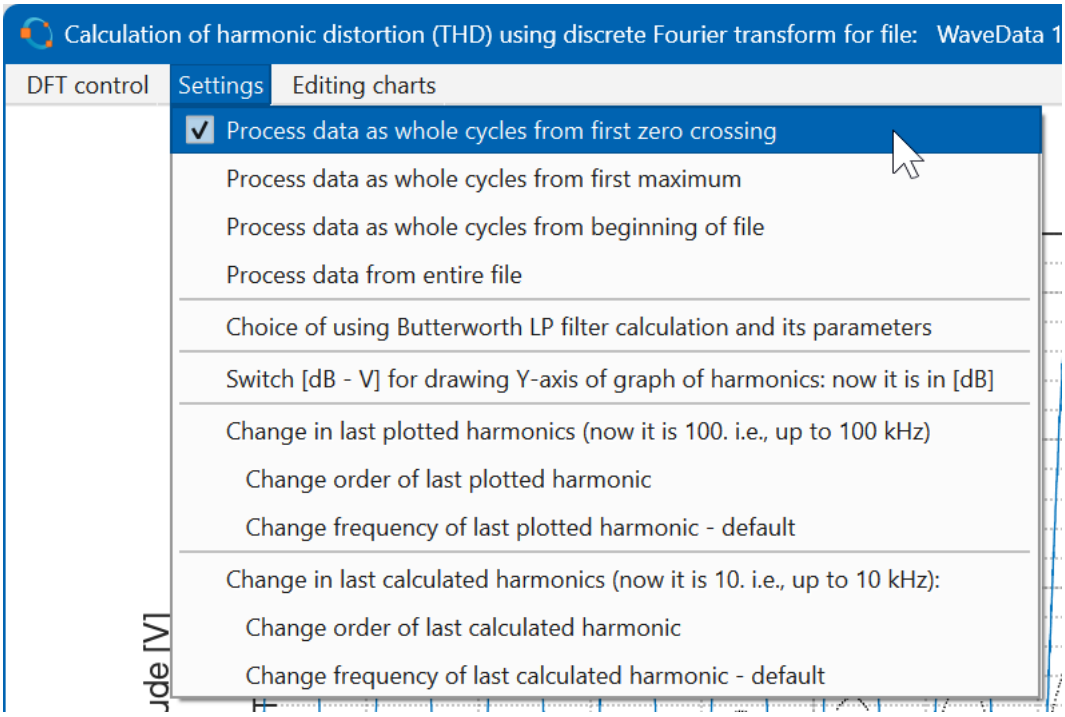
Program has three main menus for control:

1) **Menu „DFT control“** are used for elementary operations, and their functions should be clear from individual submenu names. Perhaps for item "Save as image..." it would be possible to explain that saves whole window with calculations into image files .jpg, .gif, .tif, or .png, and by selecting from menu items, you can choose image resolution from two options. Menu looks like this:



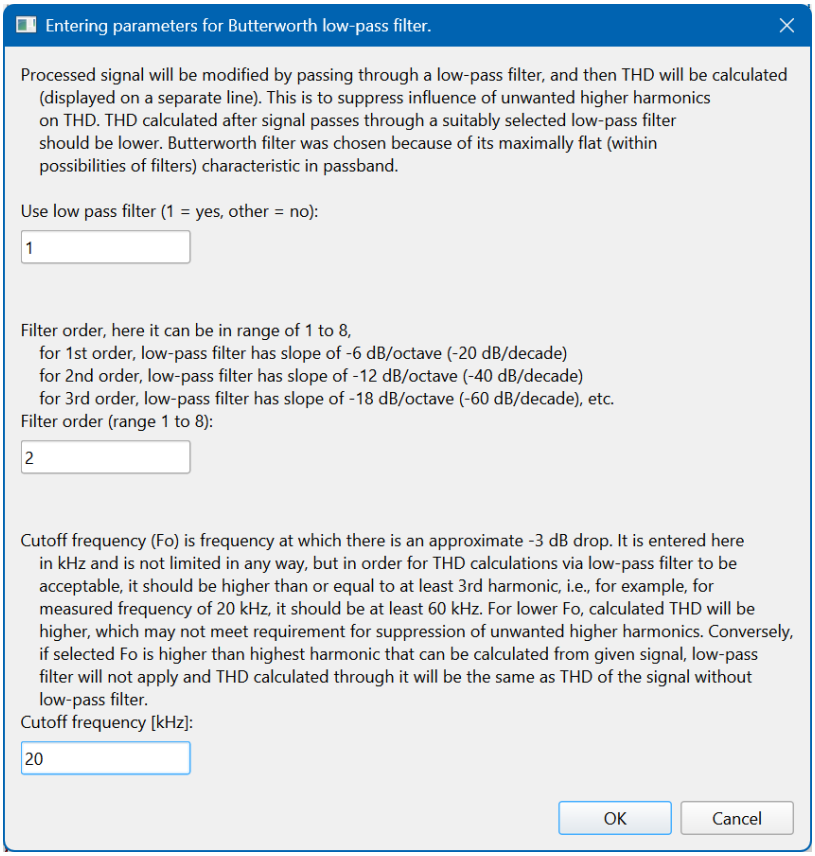
Note about saving as an image: because saved image does not exactly correspond to what is seen on screen, saving is done in several steps: first, image on screen is redrawn so that it looks as good as possible in saved file (although it looks quite strange on screen), then it is saved to file and redrawn again so that it looks as good as possible on screen. For this reason, maximum window size is always used to save program window to image files. If window is smaller than maximum size when calling save to image files, it will be enlarged before saving and returned to its original size after saving. So, when saving, image changes and jumps, but this is normal and I haven't found another way to save it to files in a satisfactory manner.

2) **Menu „Settings“** this is where you set how program will work. Menu is divided into following sections:



a. First section switches between four ways of processing input file (data), selected method is checked. More details can be found in chapter "Modification of measured data and calculations".

b. In second section, you can set parameters for additional Butterworth low-pass filter. Clicking on this menu opens following dialog:

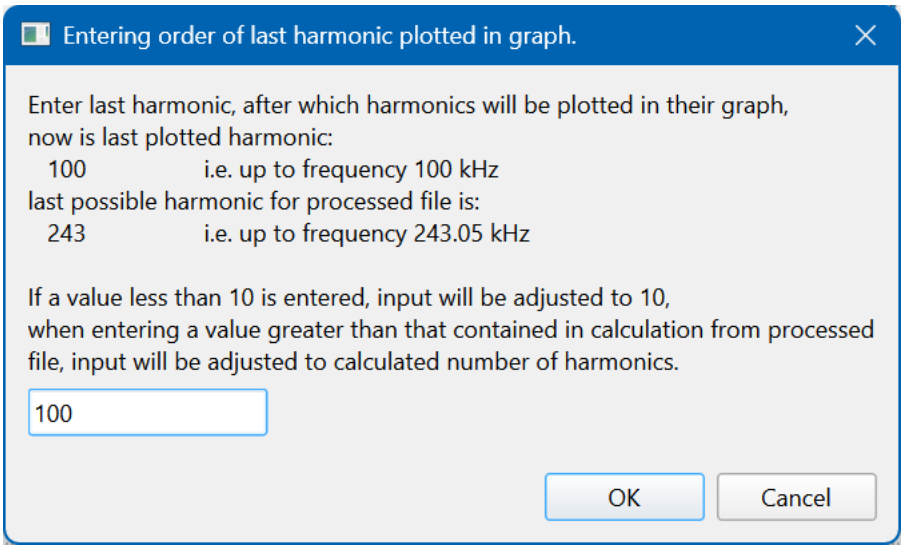


and all necessary information is described in it.

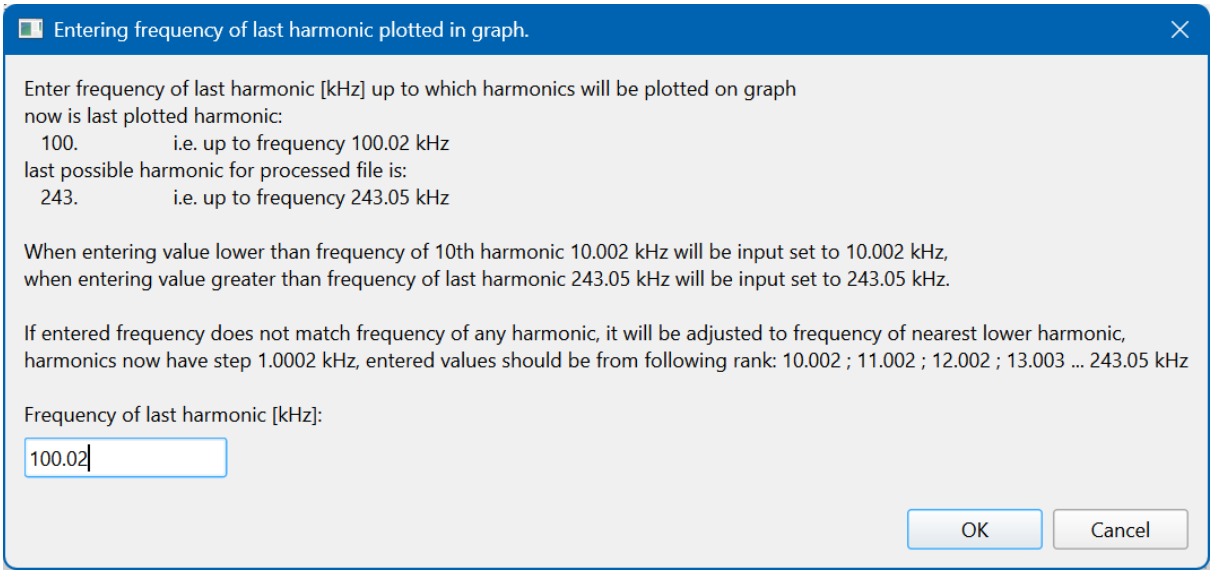
c. In third section, by clicking on submenu to select whether amplitude in graph of calculated harmonics will be drawn in dB or volts.

d. In fourth section, there are two active submenus for specifying of last harmonic up to which harmonics will be plotted on graph. Upper menu in this section is for informational purposes only and shows up to which harmonic and frequency are currently plotted; this menu is not clickable.

Clicking first submenu opens following dialog box for specifying order of highest harmonic up to which harmonics will be plotted:



Clicking second submenu opens following dialog box for specifying frequency of highest harmonic up to which harmonics will be plotted:



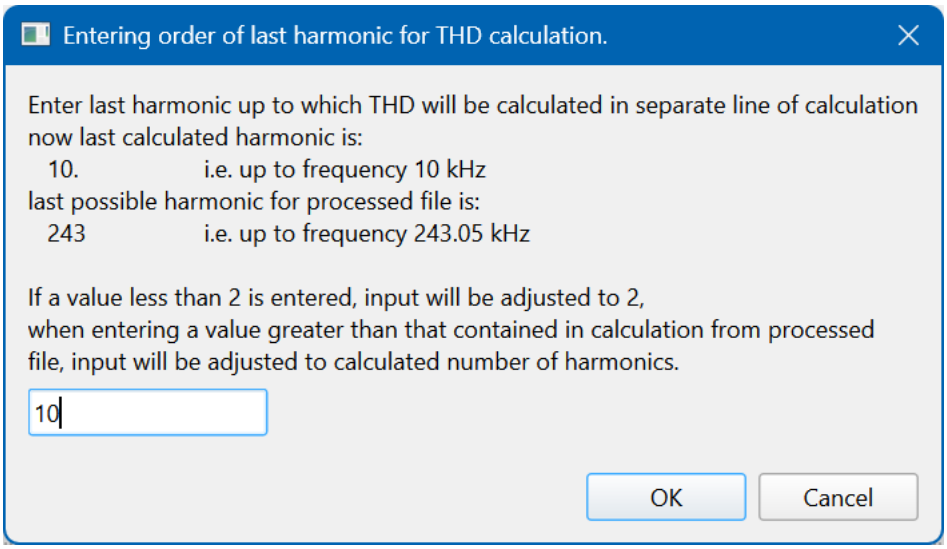
About this choice: Since individual harmonics have frequencies that are integer multiples of frequency of fundamental harmonic, which is not necessarily maintained when entering them, therefore, if a frequency is entered that falls within required range but is not frequency of any harmonic, program will select frequency of nearest lower harmonic and replace entered frequency with that harmonic's frequency. Step of harmonic frequencies, start and end of applicable range, and frequencies of first three harmonics, that is, suggested series of harmonic frequencies, is provided in last paragraph of menu.

As you can see from image of individual menus above, one of submenus is always marked with note "**– default**" after text. These are set automatically by program so that default is always submenu that was last opened, thereby preserving that setting as default for further processing and new files, so you don't have to specify it every time. However, disadvantage of this approach is that if, for example, last frequency of 10 kHz is selected and a new file with a fundamental frequency higher than that is opened, harmonic at selected frequency will not be present in that file; in this case, program will select a valid frequency as if value had been entered outside range for specified file.

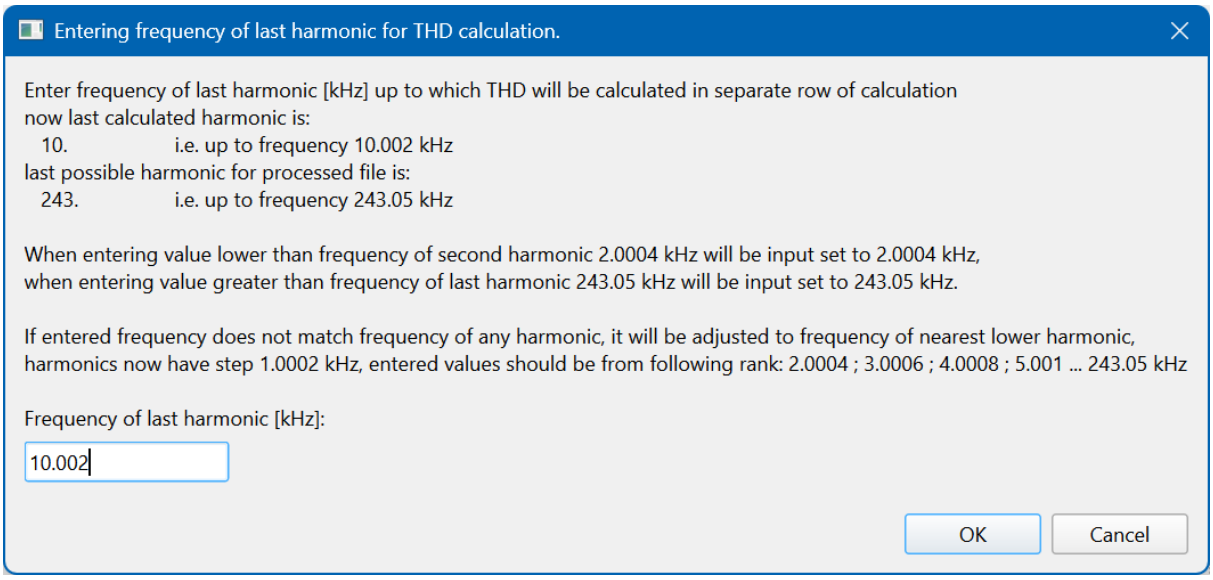
Changes to entered frequency made by program can be surprising at first glance, but I couldn't think of a better solution in this case…

e. In the last, fifth section, there are again two active submenus for specifying last harmonic, up to which THD will be calculated in separate calculation row. Upper menu in this section is again only informative; it shows up to which harmonic and frequency are currently calculated, this menu is not clickable. Both submenus look very similar and serve the same function as submenu described in previous paragraph d); however, last harmonic specified in them is used to calculate THD in a separate calculation row, so I am only including their images here; for a description of them, see the previous paragraph.

Clicking first submenu opens following dialog box for specifying order of highest harmonic up to which harmonics will be calculated:

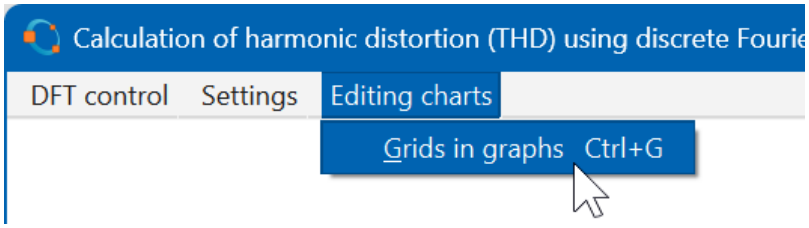


Clicking second submenu opens following dialog box for specifying frequency of highest harmonic up to which harmonics will be calculated

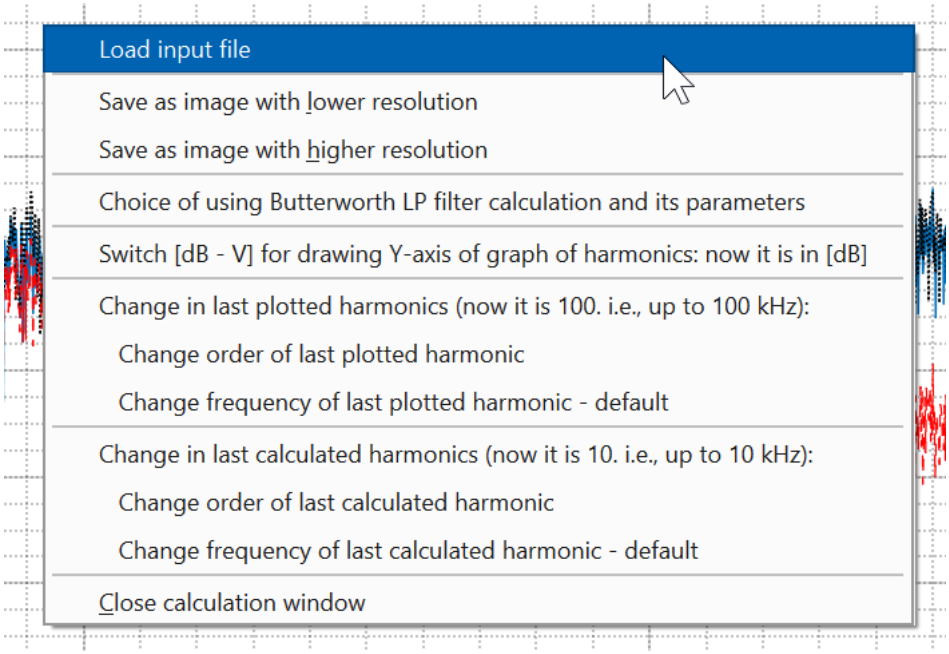


options offered in this menu (frequencies and max. number of harmonics) relate to waveform currently being processed and everything else necessary is described there.

3) **Menu „Editing charts“** this menu (for now) has only one item, and clicking on it selects whether auxiliary grids will be drawn in graphs or not.



After right-clicking in program window, you can also display context menu, which contains selection from individual menus described earlier in this chapter and looks like this:



Program settings file

When closing figure (main window), program saves selected settings to file so that they are preserved and do not need to be re-entered each time program is launched. File has the same name as program, extension **.nuf**, and is in the same directory as program. If program cannot find this file when it starts up, for example if it has been renamed, moved to another location without this file, or if it is starting up for first time, it will use default values. File is text file, so it can be viewed or edited in Notepad or another editor, but when saving it, it is important to ensure that **.nuf** extension is retained and not overwritten with .txt, as Notepad does by default. Individual settings consist of a description, an equal sign, and a value. Their meaning is (hopefully) clear. Values can be changed in editors, but the text before the equal sign, including equal sign itself, CANNOT be changed. Program searches for values based on this, and would not find them with different text.

Notes:

- values read by program begin with "Method of data processing =" and end with " Butterworth low-pass filter order (range 1 to 8, otherwise 2nd order will be used) =", before and after these items are comments and informational values.
- Values in rows "Number of drawn harmonics" and "Number of calculated harmonics" are one less than values given in queries and outputs. This is because they are NUMBERS of higher harmonics, not considering fundamental (first) harmonic.

For example, file may look like this (but values are individual):

File with settings for Harmonic Distortion Calculation program, version dated 1 April 2026
created in the GNU Octave environment, author Luděk Ruffer lruffer@volny.cz

Values of data processing method denotes:
1 = Process data as whole cycles from first zero crossing
2 = Process data as whole cycles from first maximum
3 = Process data as whole cycles from beginning of file
4 = Process data from entire file
When another value or no value is loaded, following is set = 1

Method of data processing = 1

Number of drawn harmonics = 99
Frequency [Hz] of last plotted harmonic = 100021
For harmonic plotting, default setting for new files is = Frequency

Number of calculated harmonics = 9
Frequency [Hz] of last harmonic into calculation = 10002
For harmonic calculation, default setting for new files is = Frequency

Amplitude of drawn harmonics in V (1 is V, 0 is dB) = 0

Last processed path to data file = C:\NUF\impulse\ocsiloskop - srovnání\

Position of figure (window) when program ends = 28 86 2483 1253

Use Butterworth low pass filter (yes, other is no) = yes
Butterworth low-pass filter cutoff frequency [Hz] = 20000
Butterworth low-pass filter order (range 1 to 8, otherwise 2nd order will be used) = 2

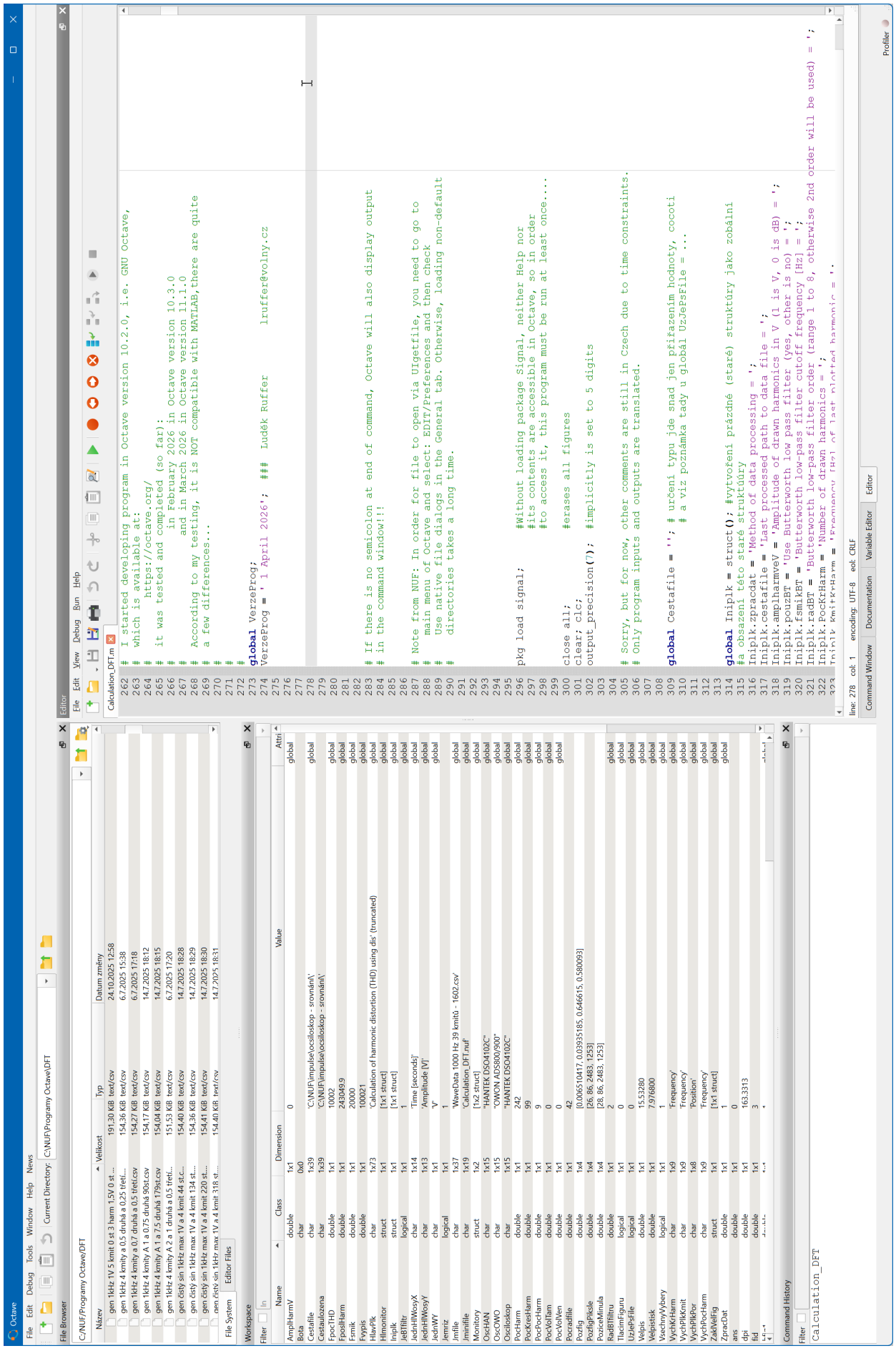
Further values are informational only, are not read when program is launched.

Computer on which program runs has these monitors:
Monitor 1: is primary; width 3840 ; height 2160 ; enlargement 150% ; logical width 2560 ; logical height 1440 ; values read by program
Monitor 2: is not primary; width 2560 ; height 1440 ; enlargement 125% ; logical width 2048 ; logical height 1152 ; values read by program

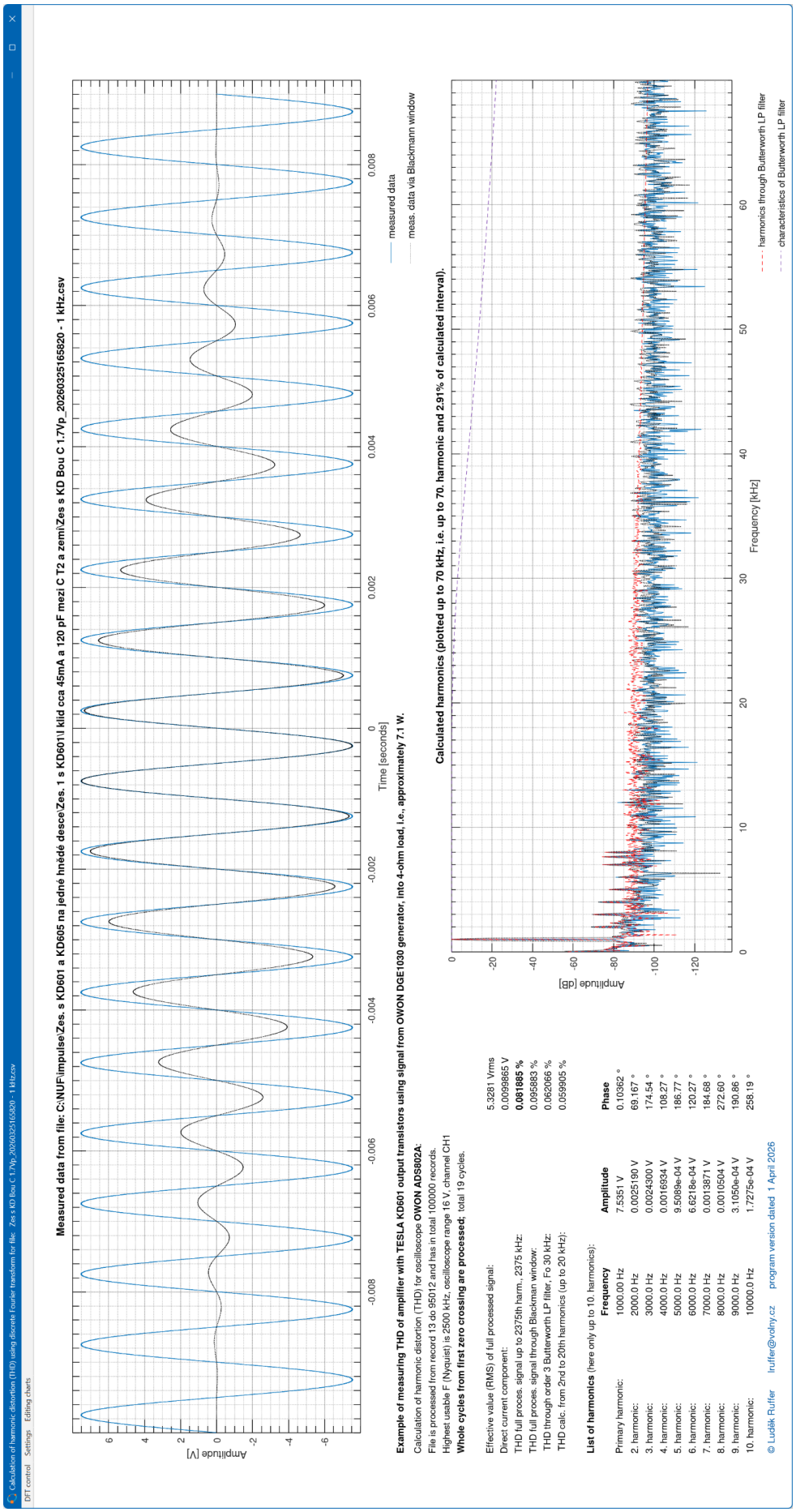
File has been saved 05.04.2026 at time of 17:21:26.

End of settings file.

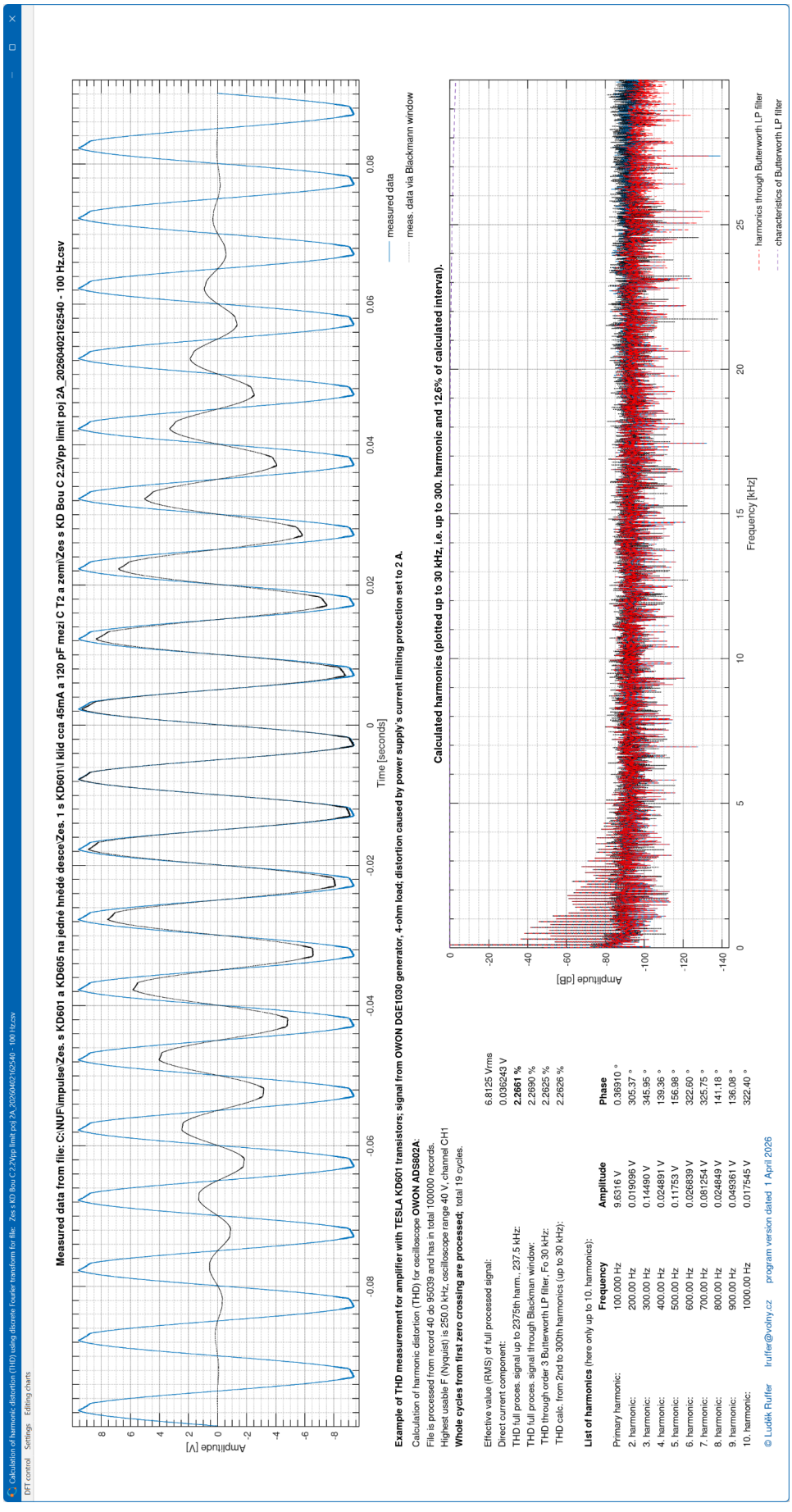
Example of Octave v10.3.0 environment with screenshot of beginning of program in editor:



Example of THD calculation using this program



Example of THD calculation for distorted signal; distortion was caused by power supply's overcurrent protection, which was set to 2 A; power supply was old Czech ARITMA TSZ75.



Comments by author

Although I tried to make a program as best, I was able, it is highly probable that there will be some, let's say, discrepancies or "bugs" in it. I know about some of them, but they are not that important, fixing them would take a lot of work, and they didn't bother me in my use, so I haven't done anything about them (yet). For example, limiting figure size to minimum when dragging it with mouse by its edges gave me quite a bit of trouble, but I hope I've eliminated major bugs.

If you encounter any problems that cause you inconvenience, please send message to my email address listed at end of this document. However, anyone can try to fix it themselves (it's open source), but even in that case, I would appreciate a message, and even more so description of possible fixes or modifications to program.

Disclaimer

Use of anything from this description is at your own risk; author assumes no responsibility for any damage caused by use or inability to use procedures, programs, or parts thereof described herein. If you do not agree with this statement, do not use anything from this description, including this program.

Luděk Ruffer lruffer@volny.cz 5 April 2026