



USER MANUAL

SonoUno: Sonification Software for astronomical
data in two column files.

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1. Software description

SonoUno is a sonification software for two column tables of astronomical data. The software is being developed based on the study of other software (Sonification Sandbox, MathTrax and xSonify) and standards of accessibility like the ISO 9241-171:2008 (Guidance on software accessibility). In order to develop the first approach of graphical user interface, we perform a theoretical framework based on bibliography of user cases, focused on blind and visual impairment people.

The develop language is Python and we use modular design, in order to do collaborative work. The sonoUno now is multiplatform, tested on windows, Ubuntu y Mac High Sierra; the development team work continuously to maintain this benefit. The principal goal of the SonoUno is to allow the user to open data files (txt or csv extension), reproduce the plot and sonification of the data. At the moment, the sonification is perform by variation of pitch in differents instruments.

Additionally, SonoUno allow to select a specific range of data on the abscissas axis, mark and save point of interest in the data, and apply predefined mathematical functions (for example, logarithm and square). In the section settings, the user can configure the plot and change between several predefined instruments (acoustic piano, clavinet, celesta and tubular bells, between others). We expect to include more sound configurations shortly.

Finally, the software allows the user to save the sound, the plot and a text file with the points marked on the data.

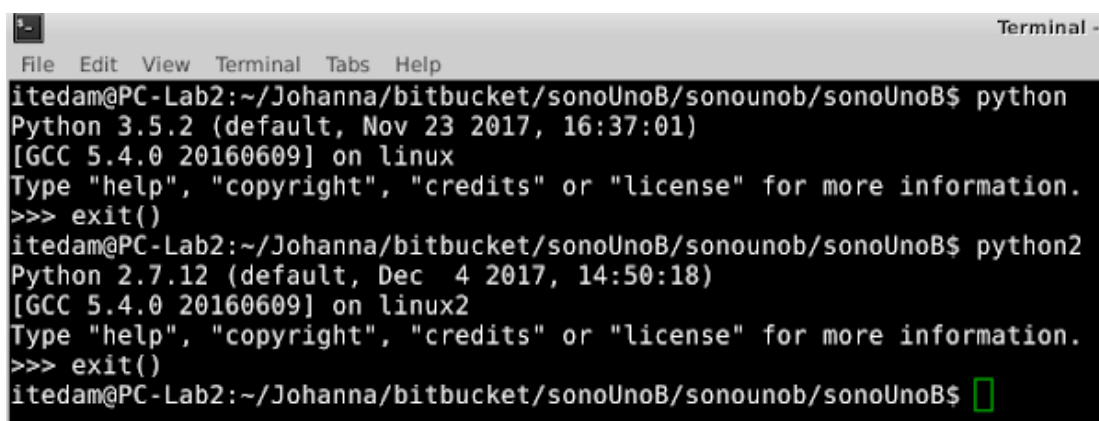
2. Software installation

2.1. Ubuntu

2.1.1. Python and needed libraries

If you installed previously the soft at your computer, do not take into account this section. If not, the next steps are the libraries installation.

1. Go to the Ubuntu terminal and execute the 'python' command:

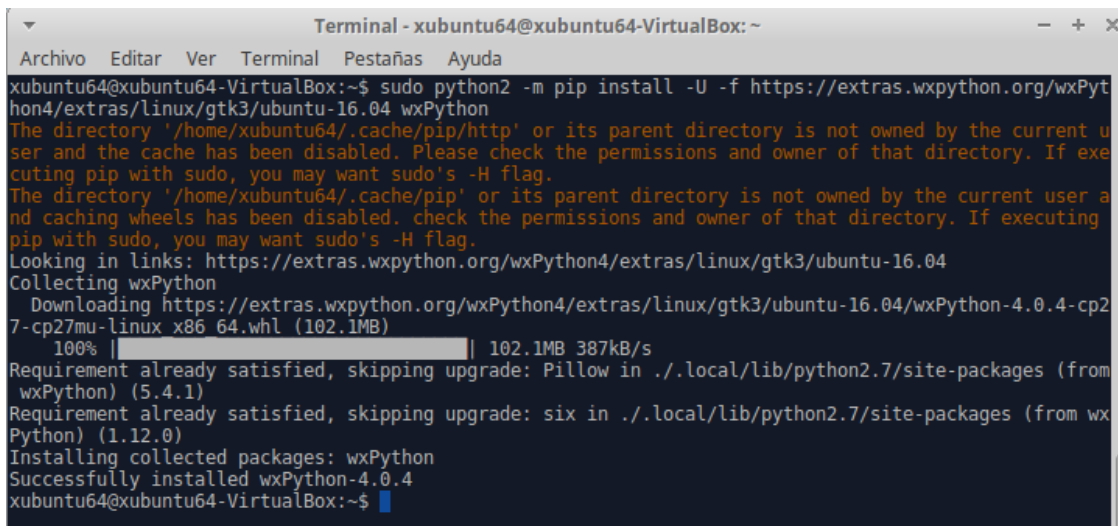


```
itedam@PC-Lab2:~/Johanna/bitbucket/sonoUnoB/sonounob/sonoUnoB$ python
Python 3.5.2 (default, Nov 23 2017, 16:37:01)
[GCC 5.4.0 20160609] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> exit()
itedam@PC-Lab2:~/Johanna/bitbucket/sonoUnoB/sonounob/sonoUnoB$ python2
Python 2.7.12 (default, Dec  4 2017, 14:50:18)
[GCC 5.4.0 20160609] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>> exit()
itedam@PC-Lab2:~/Johanna/bitbucket/sonoUnoB/sonounob/sonoUnoB$
```

Image 1 - Checking the installed version of Python in your computer.

2. If the version is 3.x.x, type exit() and check with 'python2'. If the version here is 2.7.x (see Image 1) we can continue with the following steps, if not, you must install or update python 2.7 in the operating system, using the command:
 - a. `sudo apt-get install --upgrade python`

3. Once that we checked that we have python 2.7 installed (is called python2 in this instructive), we can proceed with the libraries installation.
4. First you have to type:
 - a. `sudo apt update`
5. Install wxPython with the next command:
 - a. `python2 -m pip install --user -U -f https://extras.wxpython.org/wxPython4/extras/linux/gtk3/ubuntu-16.04 wxPython`

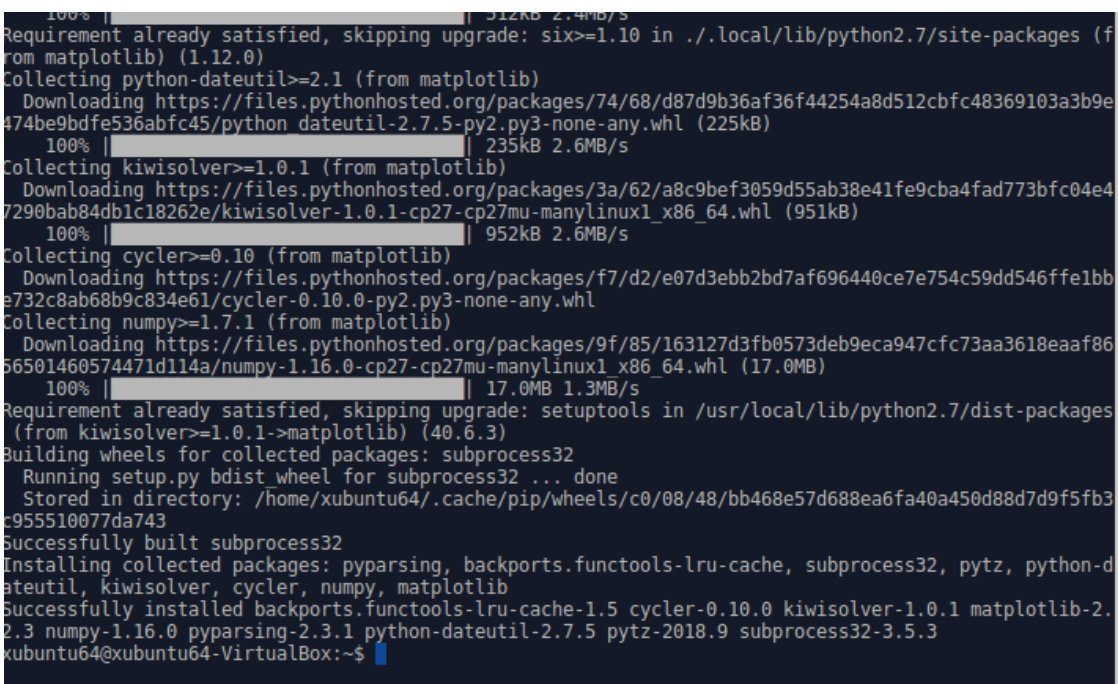


```
Terminal - xubuntu64@xubuntu64-VirtualBox: ~
Archivo  Editor  Ver  Terminal  Pestañas  Ayuda
xubuntu64@xubuntu64-VirtualBox:~$ sudo python2 -m pip install -U -f https://extras.wxpython.org/wxPython4/extras/linux/gtk3/ubuntu-16.04 wxPython
The directory '/home/xubuntu64/.cache/pip/http' or its parent directory is not owned by the current user and the cache has been disabled. Please check the permissions and owner of that directory. If executing pip with sudo, you may want sudo's -H flag.
The directory '/home/xubuntu64/.cache/pip' or its parent directory is not owned by the current user and caching wheels has been disabled. check the permissions and owner of that directory. If executing pip with sudo, you may want sudo's -H flag.
Looking in links: https://extras.wxpython.org/wxPython4/extras/linux/gtk3/ubuntu-16.04
Collecting wxPython
  Downloading https://extras.wxpython.org/wxPython4/extras/linux/gtk3/ubuntu-16.04/wxPython-4.0.4-cp27-cp27mu-linux_x86_64.whl (102.1MB)
    100% |#####| 102.1MB 387kB/s
Requirement already satisfied, skipping upgrade: Pillow in ./local/lib/python2.7/site-packages (from wxPython) (5.4.1)
Requirement already satisfied, skipping upgrade: six in ./local/lib/python2.7/site-packages (from wxPython) (1.12.0)
Installing collected packages: wxPython
Successfully installed wxPython-4.0.4
xubuntu64@xubuntu64-VirtualBox:~$
```

Image 2 - Installation of wxPython with the previous command.

NOTE: The installation can take several minutes, be patient. If the installation take more than 30 minutes cancel the process (Ctrl+C) and execute the command once again. The aspect of the installation, can be seeing in Image 2.

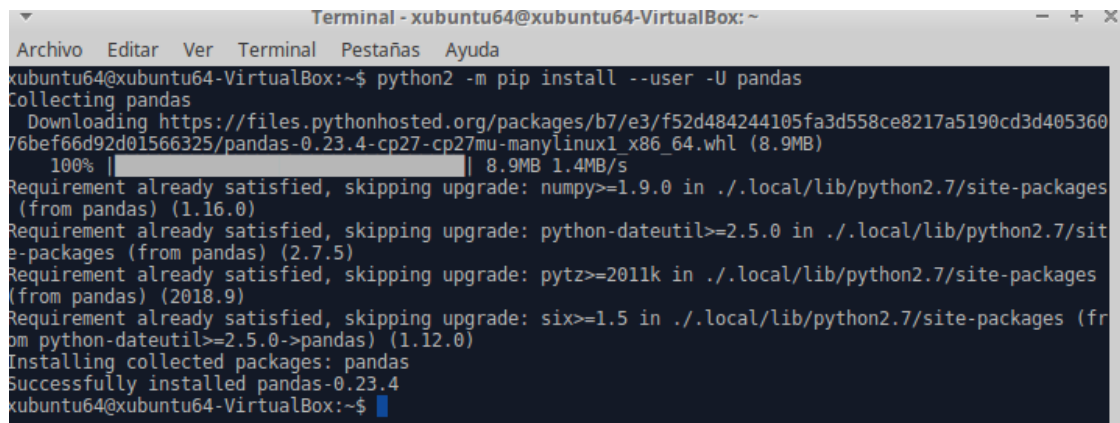
6. Install matplotlib 2.2.3 or upper (Image 3):
 - a. `python2 -m pip install --user -U matplotlib`



```
100% |#####| 312kB 2.4MB/s
Requirement already satisfied, skipping upgrade: six>=1.10 in ./local/lib/python2.7/site-packages (from matplotlib) (1.12.0)
Collecting python-dateutil>=2.1 (from matplotlib)
  Downloading https://files.pythonhosted.org/packages/74/68/d87d9b36af36f44254a8d512cbfc48369103a3b9e474be9bdf536abfc45/python_dateutil-2.7.5-py2.py3-none-any.whl (225kB)
    100% |#####| 235kB 2.6MB/s
Collecting kiwisolver>=1.0.1 (from matplotlib)
  Downloading https://files.pythonhosted.org/packages/3a/62/a8c9bef3059d55ab38e41fe9cba4fad773bfc04e47290bab84db1c18262e/kiwisolver-1.0.1-cp27-cp27mu-manylinux1_x86_64.whl (951kB)
    100% |#####| 952kB 2.6MB/s
Collecting cycler>=0.10 (from matplotlib)
  Downloading https://files.pythonhosted.org/packages/f7/d2/e07d3ebb2bd7af696440ce7e754c59dd546ffe1bbe732c8ab68b9c834e61/cyclor-0.10.0-py2.py3-none-any.whl
Collecting numpy>=1.7.1 (from matplotlib)
  Downloading https://files.pythonhosted.org/packages/9f/85/163127d3fb0573deb9eca947cfc73aa3618eaaaf8656501460574471d114a/numpy-1.16.0-cp27-cp27mu-manylinux1_x86_64.whl (17.0MB)
    100% |#####| 17.0MB 1.3MB/s
Requirement already satisfied, skipping upgrade: setuptools in /usr/local/lib/python2.7/dist-packages (from kiwisolver>=1.0.1->matplotlib) (40.6.3)
Building wheels for collected packages: subprocess32
  Running setup.py bdist_wheel for subprocess32 ... done
  Stored in directory: /home/xubuntu64/.cache/pip/wheels/c0/08/48/bb468e57d688ea6fa40a450d88d7d9f5fb3c955510077da743
Successfully built subprocess32
Installing collected packages: pyparsing, backports.functools-lru-cache, subprocess32, pytz, python-dateutil, kiwisolver, cycler, numpy, matplotlib
Successfully installed backports.functools-lru-cache-1.5 cycler-0.10.0 kiwisolver-1.0.1 matplotlib-2.2.3 numpy-1.16.0 pyparsing-2.3.1 python-dateutil-2.7.5 pytz-2018.9 subprocess32-3.5.3
xubuntu64@xubuntu64-VirtualBox:~$
```

Image 3 - Last part of the installation of matplotlib with the previous command.

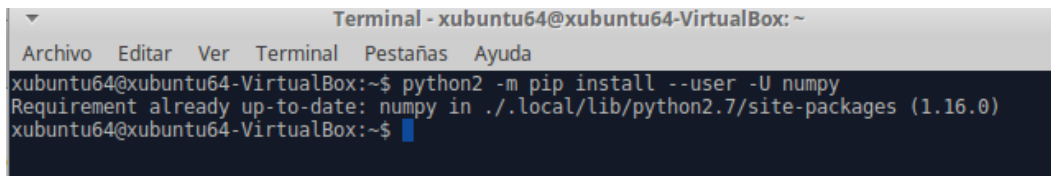
7. Install pandas (Image 4):
 - a. `python2 -m pip install --user -U pandas`



```
Terminal - xubuntu64@xubuntu64-VirtualBox: ~
Archivo  Editar  Ver  Terminal  Pestañas  Ayuda
xubuntu64@xubuntu64-VirtualBox:~$ python2 -m pip install --user -U pandas
Collecting pandas
  Downloading https://files.pythonhosted.org/packages/b7/e3/f52d484244105fa3d558ce8217a5190cd3d405360
76bef66d92d01566325/pandas-0.23.4-cp27-cp27mu-manylinux1_x86_64.whl (8.9MB)
100% |#####| 8.9MB 1.4MB/s
Requirement already satisfied, skipping upgrade: numpy>=1.9.0 in ./local/lib/python2.7/site-packages
(from pandas) (1.16.0)
Requirement already satisfied, skipping upgrade: python-dateutil>=2.5.0 in ./local/lib/python2.7/sit
e-packages (from pandas) (2.7.5)
Requirement already satisfied, skipping upgrade: pytz>=2011k in ./local/lib/python2.7/site-packages
(from pandas) (2018.9)
Requirement already satisfied, skipping upgrade: six>=1.5 in ./local/lib/python2.7/site-packages (fr
om python-dateutil>=2.5.0->pandas) (1.12.0)
Installing collected packages: pandas
Successfully installed pandas-0.23.4
xubuntu64@xubuntu64-VirtualBox:~$
```

Image 4 - Installation of pandas with the previous command.

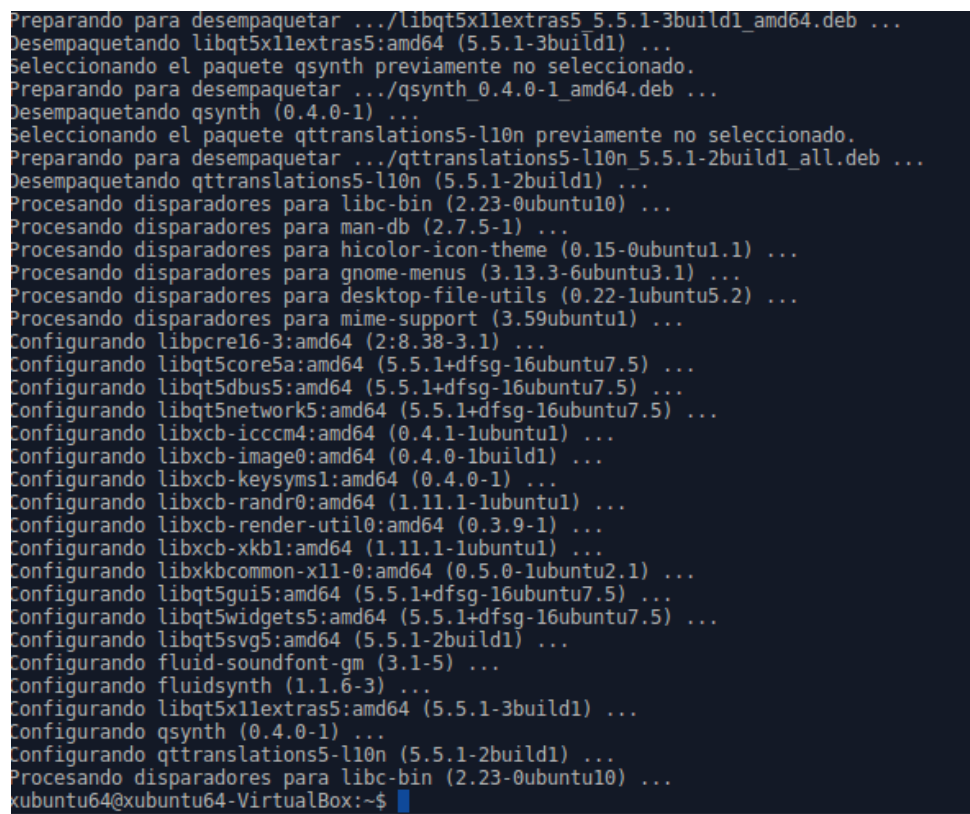
8. Install numpy (Image 5):
 - a. `sudo python2 -m pip install -U numpy`



```
Terminal - xubuntu64@xubuntu64-VirtualBox: ~
Archivo  Editar  Ver  Terminal  Pestañas  Ayuda
xubuntu64@xubuntu64-VirtualBox:~$ python2 -m pip install --user -U numpy
Requirement already up-to-date: numpy in ./local/lib/python2.7/site-packages (1.16.0)
xubuntu64@xubuntu64-VirtualBox:~$
```

Image 5 - Installation of numpy with the previous command.

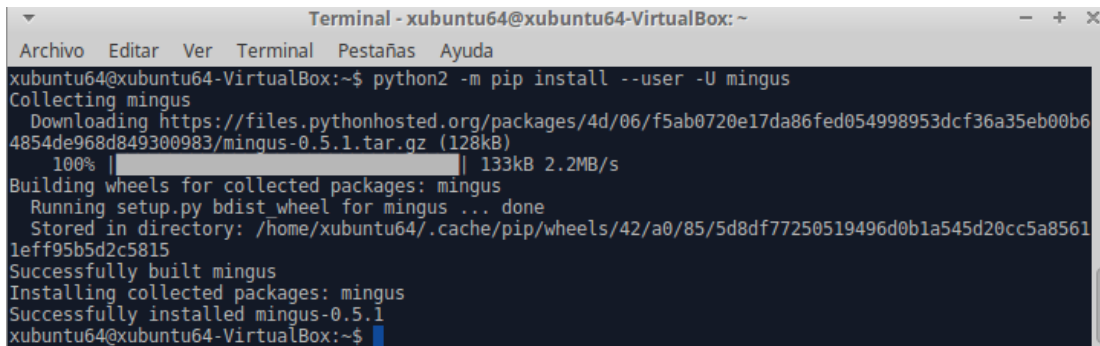
9. Install fluidsynth (Image 6):
 - a. `sudo apt-get install fluidsynth`



```
Preparando para desempaquetar .../libqt5x11extras5_5.5.1-3build1_amd64.deb ...
Desempaquetando libqt5x11extras5:amd64 (5.5.1-3build1) ...
Seleccionando el paquete qsynth previamente no seleccionado.
Preparando para desempaquetar .../qsynth_0.4.0-1_amd64.deb ...
Desempaquetando qsynth (0.4.0-1) ...
Seleccionando el paquete qttranslations5-l10n previamente no seleccionado.
Preparando para desempaquetar .../qttranslations5-l10n_5.5.1-2build1_all.deb ...
Desempaquetando qttranslations5-l10n (5.5.1-2build1) ...
Procesando disparadores para libc-bin (2.23-0ubuntu10) ...
Procesando disparadores para man-db (2.7.5-1) ...
Procesando disparadores para hicolor-icon-theme (0.15-0ubuntu1.1) ...
Procesando disparadores para gnome-menus (3.13.3-6ubuntu3.1) ...
Procesando disparadores para desktop-file-utils (0.22-1ubuntu5.2) ...
Procesando disparadores para mime-support (3.59ubuntu1) ...
Configurando libpcre16-3:amd64 (2:8.38-3.1) ...
Configurando libqt5core5a:amd64 (5.5.1+dfsg-16ubuntu7.5) ...
Configurando libqt5dbus5:amd64 (5.5.1+dfsg-16ubuntu7.5) ...
Configurando libqt5network5:amd64 (5.5.1+dfsg-16ubuntu7.5) ...
Configurando libxcb-icccm4:amd64 (0.4.1-1ubuntu1) ...
Configurando libxcb-image0:amd64 (0.4.0-1build1) ...
Configurando libxcb-keysyms1:amd64 (0.4.0-1) ...
Configurando libxcb-randr0:amd64 (1.11.1-1ubuntu1) ...
Configurando libxcb-render-util0:amd64 (0.3.9-1) ...
Configurando libxcb-xkb1:amd64 (1.11.1-1ubuntu1) ...
Configurando libxkbcommon-x11-0:amd64 (0.5.0-1ubuntu2.1) ...
Configurando libqt5gui5:amd64 (5.5.1+dfsg-16ubuntu7.5) ...
Configurando libqt5widgets5:amd64 (5.5.1+dfsg-16ubuntu7.5) ...
Configurando libqt5svg5:amd64 (5.5.1-2build1) ...
Configurando fluid-soundfont-gm (3.1-5) ...
Configurando fluidsynth (1.1.6-3) ...
Configurando libqt5x11extras5:amd64 (5.5.1-3build1) ...
Configurando qsynth (0.4.0-1) ...
Configurando qttranslations5-l10n (5.5.1-2build1) ...
Procesando disparadores para libc-bin (2.23-0ubuntu10) ...
xubuntu64@xubuntu64-VirtualBox:~$
```

Image 6 - Last part of the fluidsynth installation process, done with the previous command.

10. Install mingus (Image 7):
 - a. `python2 -m pip install --user -U mingus`



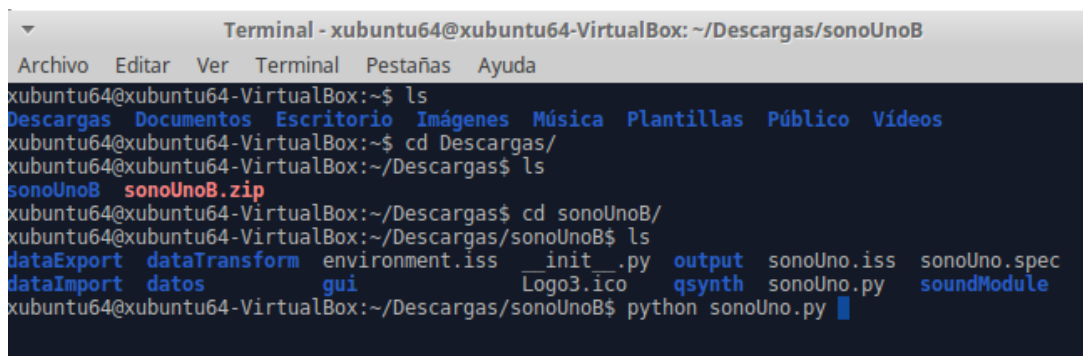
```
Terminal - xubuntu64@xubuntu64-VirtualBox: ~
Archivo  Editor  Ver  Terminal  Pestañas  Ayuda
xubuntu64@xubuntu64-VirtualBox:~$ python2 -m pip install --user -U mingus
Collecting mingus
  Downloading https://files.pythonhosted.org/packages/4d/06/f5ab0720e17da86fed054998953dcf36a35eb00b64854de968d849300983/minigus-0.5.1.tar.gz (128kB)
    100% |#####| 133kB 2.2MB/s
Building wheels for collected packages: mingus
  Running setup.py bdist_wheel for mingus ... done
  Stored in directory: /home/xubuntu64/.cache/pip/wheels/42/a0/85/5d8df77250519496d0b1a545d20cc5a8561leff95b5d2c5815
Successfully built mingus
Installing collected packages: mingus
Successfully installed mingus-0.5.1
xubuntu64@xubuntu64-VirtualBox:~$
```

Image 7 - Installation of mingus with the previous command.

NOTE: if any of the last libraries (from 5 to 10) is missing, the soft does not run. The installation can take several minutes.

2.1.2. Run the software

1. Unzip the file.
2. Open a terminal and go to the software folder. Probably you have more than one folder before you can run SonoUno.
3. To check in which folder is `sonoUno.py`, use the command “ls” (Image 8). The `sonoUno.py` must be among the files in the folder.

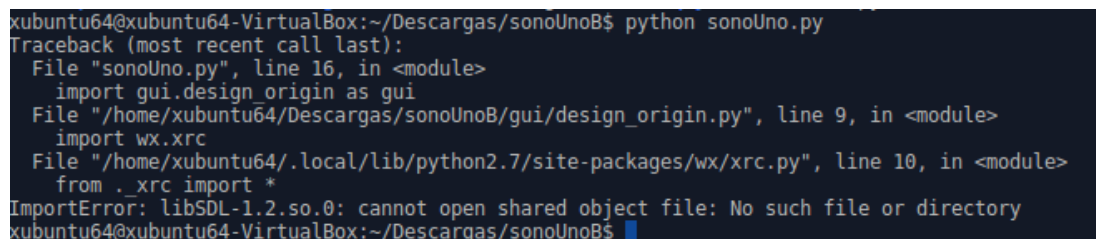


```
Terminal - xubuntu64@xubuntu64-VirtualBox: ~/Descargas/sonoUnoB
Archivo  Editor  Ver  Terminal  Pestañas  Ayuda
xubuntu64@xubuntu64-VirtualBox:~$ ls
Descargas  Documentos  Escritorio  Imágenes  Música  Plantillas  Público  Vídeos
xubuntu64@xubuntu64-VirtualBox:~$ cd Descargas/
xubuntu64@xubuntu64-VirtualBox:~/Descargas$ ls
sonoUnoB  sonoUnoB.zip
xubuntu64@xubuntu64-VirtualBox:~/Descargas$ cd sonoUnoB/
xubuntu64@xubuntu64-VirtualBox:~/Descargas/sonoUnoB$ ls
dataExport  dataTransform  environment.iss  __init__.py  output  sonoUno.iss  sonoUno.spec
dataImport  datos          gui              Logo3.ico    qsynth  sonoUno.py  soundModule
xubuntu64@xubuntu64-VirtualBox:~/Descargas/sonoUnoB$ python sonoUno.py
```

Image 8 - Aspect of the sonoUno folder on the command window.

4. Once you are sure that you are at the right folder, make:
 - a. `python2 sonoUnoB.py`

NOTE: if you have the error “ImportError: libSDL-1.2.so.0: cannot open shared object file: No such file or directory” (Image 9); run “`sudo apt-get install libsdl-ttf2.0-0`”. If don’t solve the problem, contact the development team.



```
xubuntu64@xubuntu64-VirtualBox:~/Descargas/sonoUnoB$ python sonoUno.py
Traceback (most recent call last):
  File "sonoUno.py", line 16, in <module>
    import gui.design_origin as gui
  File "/home/xubuntu64/Descargas/sonoUnoB/gui/design_origin.py", line 9, in <module>
    import wx.xrc
  File "/home/xubuntu64/.local/lib/python2.7/site-packages/wx/xrc.py", line 10, in <module>
    from .xrc import *
ImportError: libSDL-1.2.so.0: cannot open shared object file: No such file or directory
xubuntu64@xubuntu64-VirtualBox:~/Descargas/sonoUnoB$
```

Image 9 - libSDL possible error when you try to run the software the first time on Ubuntu.

5. A window must be open (Image 10), if that is the case, the soft is ready to be used.

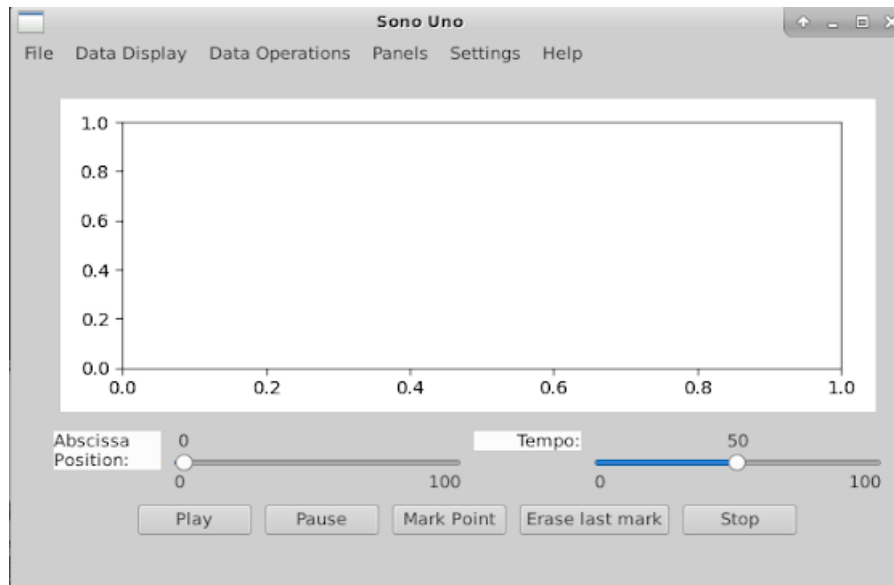


Image 10 - SonoUno main window on Ubuntu.

2.2. MacOS

2.1.1. Python and needed libraries

If you installed previously the soft at your computer, do not take into account this section. If not, the next steps are python and the libraries installation.

1. Go to the Ubuntu terminal and execute the 'python' command (Image 11):

```
johanna — -bash — 80x24
Last login: Sun Jan 13 16:40:08 on console
[Johannas-iMac:~ johanna$ python
Python 2.7.10 (default, May  7 2017, 01:41:22)
[GCC 4.2.1 Compatible Apple LLVM 9.0.0 (clang-900.0.19.5)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> exit()
Johannas-iMac:~ johanna$
```

Image 11 - MacOS terminal with the command python executed.

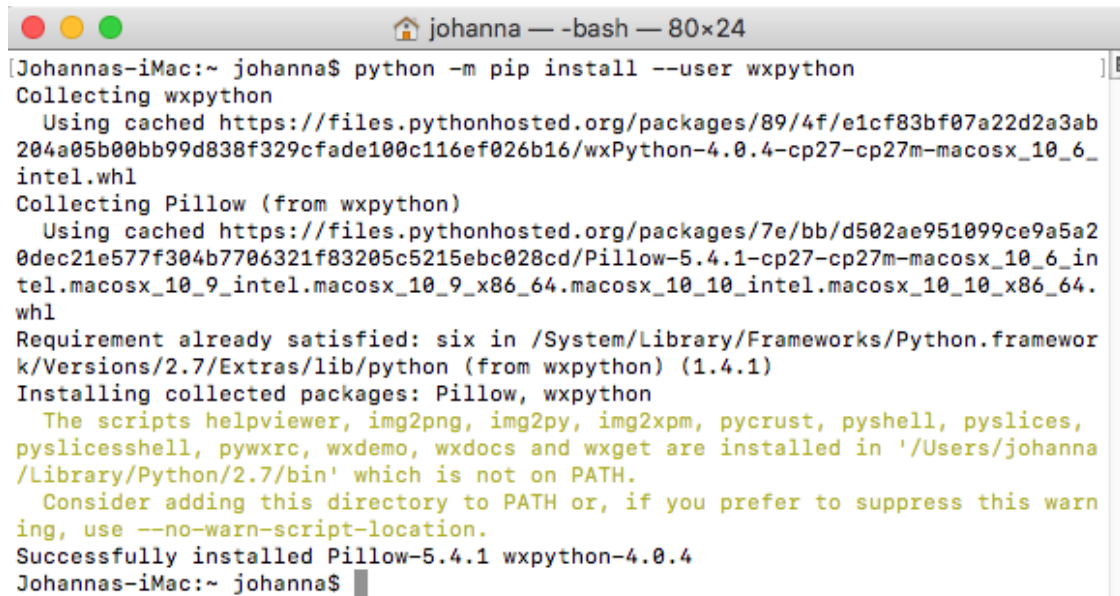
2. If the version is 3.x.x, type exit() and check with 'python2'. If the version is 2.7.x, you can continue with the following steps. If not, you must update or install python 2.7.15 in the operating system, using the installer on <https://www.python.org/ftp/python/2.7.15/python-2.7.15-macosx10.6.pkg>
3. After install python, check if you have pip installed on your system with the next command (Image 12):
 - a. python2 -m pip -V

```
johanna — -bash — 80x24
[Johannas-iMac:~ johanna$ pip -V
pip 18.1 from /Library/Python/2.7/site-packages/pip-18.1-py2.7.egg/pip (python 2.7)
Johannas-iMac:~ johanna$
```

Image 12 - Show the execution of "pip -V" command and the answer that pip is installed on the system.

NOTE: To install pip you can try “easy_install pip” or “sudo easy_install pip” if admin privilege is needed.

4. Once that we checked that we have python 2.7.x and pip installed (is called python2 in this instructive), we can proceed with the libraries installation.
5. Install wxPython 4.0 with the next command:
 - a. `python2 -m pip install --user wxpython`



```
Johannas-iMac:~ johanna$ python -m pip install --user wxpython
Collecting wxpython
  Using cached https://files.pythonhosted.org/packages/89/4f/e1cf83bf07a22d2a3ab204a05b00bb99d838f329cfade100c116ef026b16/wxPython-4.0.4-cp27-cp27m-macosx_10_6_intel.whl
Collecting Pillow (from wxpython)
  Using cached https://files.pythonhosted.org/packages/7e/bb/d502ae951099ce9a5a20dec21e577f304b7706321f83205c5215ebc028cd/Pillow-5.4.1-cp27-cp27m-macosx_10_6_intel.macosx_10_9_intel.macosx_10_9_x86_64.macosx_10_10_intel.macosx_10_10_x86_64.whl
Requirement already satisfied: six in /System/Library/Frameworks/Python.framework/Versions/2.7/Extras/lib/python (from wxpython) (1.4.1)
Installing collected packages: Pillow, wxpython
  The scripts helpviewer, img2png, img2py, img2xpm, pycrust, pyshell, pyslices, pyslicesshell, pywxrc, wxdemo, wxdocs and wxget are installed in '/Users/johanna/Library/Python/2.7/bin' which is not on PATH.
  Consider adding this directory to PATH or, if you prefer to suppress this warning, use --no-warn-script-location.
Successfully installed Pillow-5.4.1 wxpython-4.0.4
Johannas-iMac:~ johanna$
```

Image 13 - Installation of wxPython with the previous command.

NOTE: The installation can take several minutes, be patient. If the installation take more than 30 minutes cancel the process (Ctrl+C) and execute the command once again. The aspect of the installation, can be seeing in Image 13.

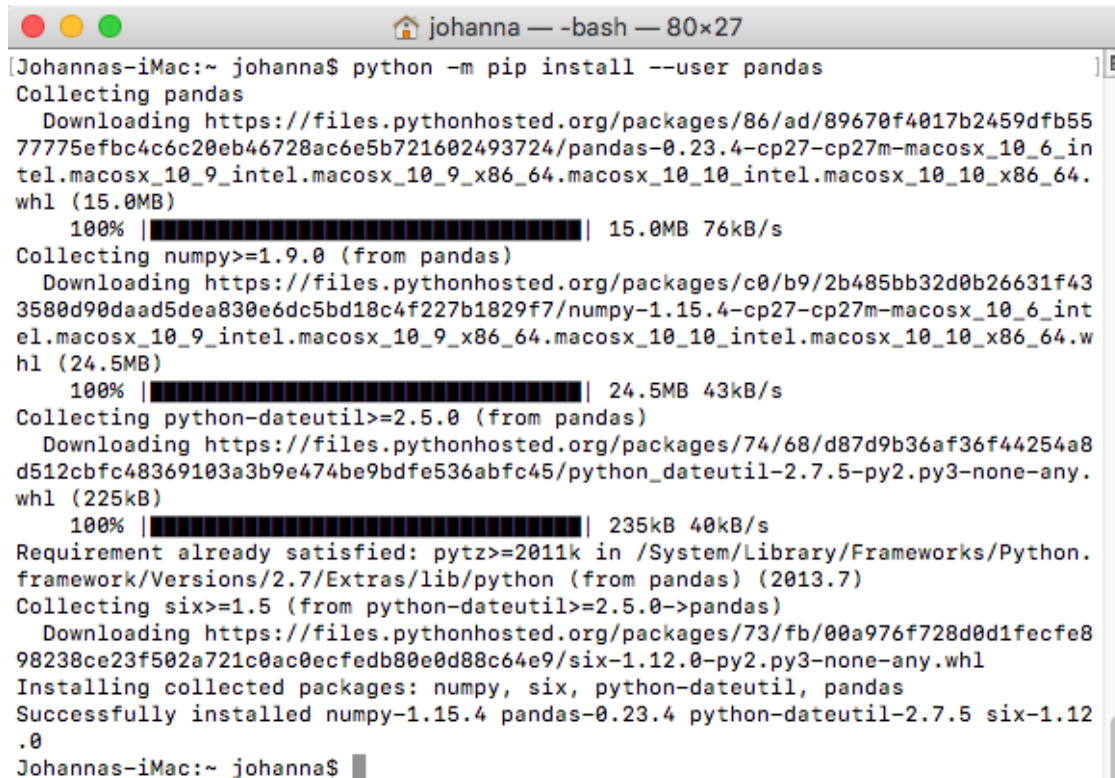
6. Install matplotlib 2.2.3 or upper (Image 14):
 - a. `python -m pip install --user matplotlib`



```
Requirement already satisfied, skipping upgrade: python-dateutil>=2.1 in /Users/johanna/Library/Python/2.7/lib/python/site-packages (from matplotlib) (2.7.5)
Collecting kiwisolver>=1.0.1 (from matplotlib)
  Downloading https://files.pythonhosted.org/packages/79/d8/94633718f3f77dc6b38687a77ba199325a1cb158d2d4b00c9dc17f2b5c72/kiwisolver-1.0.1-cp27-cp27m-macosx_10_6_intel.macosx_10_9_intel.macosx_10_9_x86_64.macosx_10_10_intel.macosx_10_10_x86_64.whl (110kB)
    100% |#####| 112kB 2.1MB/s
Collecting cycler>=0.10 (from matplotlib)
  Downloading https://files.pythonhosted.org/packages/f7/d2/e07d3ebb2bd7af696440ce7e754c59dd546ffe1bbe732c8ab68b9c834e61/cyclor-0.10.0-py2.py3-none-any.whl
Collecting subprocess32 (from matplotlib)
  Downloading https://files.pythonhosted.org/packages/1f/b5/dcb236f263f61cdaac6dad65df42bbff91f66ef90854ae1a96ad4c8dd654/subprocess32-3.5.3-cp27-cp27m-macosx_10_6_intel.whl
Collecting pytz (from matplotlib)
  Downloading https://files.pythonhosted.org/packages/61/28/1d3920e4d1d50b19bc5d24398a7cd85cc7b9a75a490570d5a30c57622d34/pytz-2018.9-py2.py3-none-any.whl (510kB)
    100% |#####| 512kB 2.2MB/s
Requirement already satisfied, skipping upgrade: six>=1.10 in /Users/johanna/Library/Python/2.7/lib/python/site-packages (from matplotlib) (1.12.0)
Collecting backports.functools-lru-cache (from matplotlib)
  Downloading https://files.pythonhosted.org/packages/03/8e/2424c0e65c4a066e28f539364deee49b6451f8fcd4f718fefa50cc3dcf48/backports.functools_lru_cache-1.5-py2.py3-none-any.whl
Requirement already satisfied, skipping upgrade: setuptools in /Library/Frameworks/Python.framework/Versions/2.7/lib/python2.7/site-packages (from kiwisolver>=1.0.1->matplotlib) (39.0.1)
Installing collected packages: pyparsing, kiwisolver, cycler, subprocess32, pytz, backports.functools-lru-cache, matplotlib
Successfully installed backports.functools-lru-cache-1.5 cyclor-0.10.0 kiwisolver-1.0.1 matplotlib-2.2.3 pyparsing-2.3.1 pytz-2018.9 subprocess32-3.5.3
Johannas-iMac:sonoUnoB johanna$
```

Image 14 - Last part of the installation of matplotlib with the previous command.

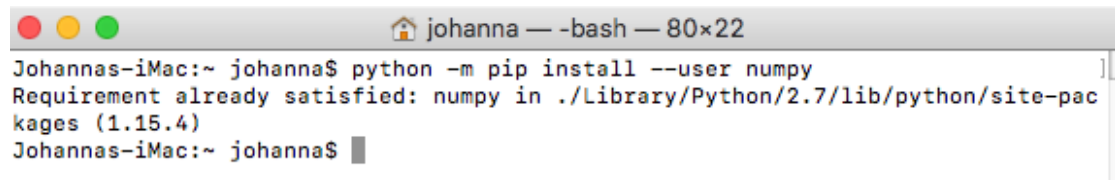
7. Install pandas (Image 15):
 - a. `python -m pip install --user pandas`



```
Johannas-iMac:~ johanna$ python -m pip install --user pandas
Collecting pandas
  Downloading https://files.pythonhosted.org/packages/86/ad/89670f4017b2459dfb5577775efbc4c6c20eb46728ac6e5b721602493724/pandas-0.23.4-cp27-cp27m-macosx_10_6_intel.macosx_10_9_intel.macosx_10_9_x86_64.macosx_10_10_intel.macosx_10_10_x86_64.whl (15.0MB)
    100% |#####| 15.0MB 76kB/s
Collecting numpy>=1.9.0 (from pandas)
  Downloading https://files.pythonhosted.org/packages/c0/b9/2b485bb32d0b26631f433580d90daad5dea830e6dc5bd18c4f227b1829f7/numpy-1.15.4-cp27-cp27m-macosx_10_6_intel.macosx_10_9_intel.macosx_10_9_x86_64.macosx_10_10_intel.macosx_10_10_x86_64.whl (24.5MB)
    100% |#####| 24.5MB 43kB/s
Collecting python-dateutil>=2.5.0 (from pandas)
  Downloading https://files.pythonhosted.org/packages/74/68/d87d9b36af36f44254a8d512cbfc48369103a3b9e474be9bdf536abfc45/python_dateutil-2.7.5-py2.py3-none-any.whl (225kB)
    100% |#####| 235kB 40kB/s
Requirement already satisfied: pytz>=2011k in /System/Library/Frameworks/Python.framework/Versions/2.7/Extras/lib/python (from pandas) (2013.7)
Collecting six>=1.5 (from python-dateutil>=2.5.0->pandas)
  Downloading https://files.pythonhosted.org/packages/73/fb/00a976f728d0d1fecfe898238ce23f502a721c0ac0ecfedb80e0d88c64e9/six-1.12.0-py2.py3-none-any.whl
Installing collected packages: numpy, six, python-dateutil, pandas
Successfully installed numpy-1.15.4 pandas-0.23.4 python-dateutil-2.7.5 six-1.12.0
Johannas-iMac:~ johanna$
```

Image 15 - Installation of pandas with the previous command.

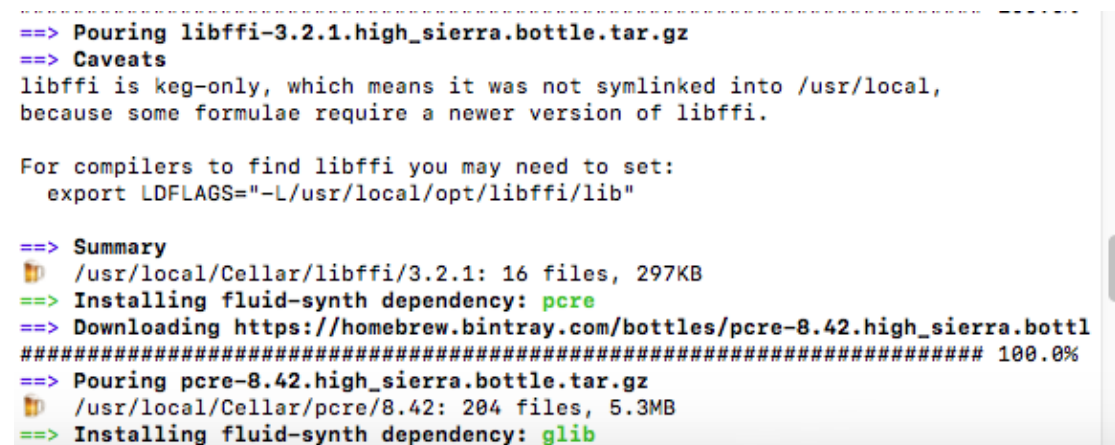
8. Install numpy (Image 16):
 - a. `python -m pip install --user numpy`



```
Johannas-iMac:~ johanna$ python -m pip install --user numpy
Requirement already satisfied: numpy in ./Library/Python/2.7/lib/python/site-packages (1.15.4)
Johannas-iMac:~ johanna$
```

Image 16 - Installation of numpy with the previous command.

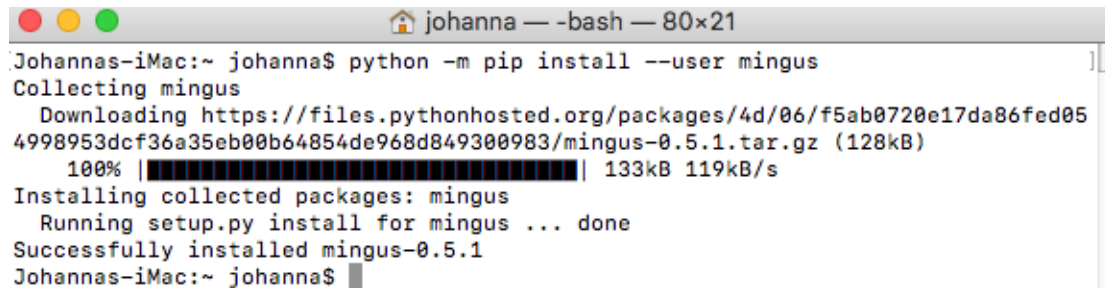
9. Install fluidsynth (Image 17):
 - a. `brew install fluid-synth`



```
=====  
==> Pouring libffi-3.2.1.high_sierra.bottle.tar.gz  
==> Caveats  
libffi is keg-only, which means it was not symlinked into /usr/local,  
because some formulae require a newer version of libffi.  
  
For compilers to find libffi you may need to set:  
  export LDFLAGS="-L/usr/local/opt/libffi/lib"  
  
==> Summary  
  /usr/local/Cellar/libffi/3.2.1: 16 files, 297KB  
==> Installing fluid-synth dependency: pcre  
==> Downloading https://homebrew.bintray.com/bottles/pcre-8.42.high_sierra.bottl  
##### 100.0%  
==> Pouring pcre-8.42.high_sierra.bottle.tar.gz  
  /usr/local/Cellar/pcre/8.42: 204 files, 5.3MB  
==> Installing fluid-synth dependency: glib
```

Image 17 - Part of the installation of fluidsynth with the previous command.

10. Install mingus (Image 18):
 - a. `python -m pip install --user mingus`



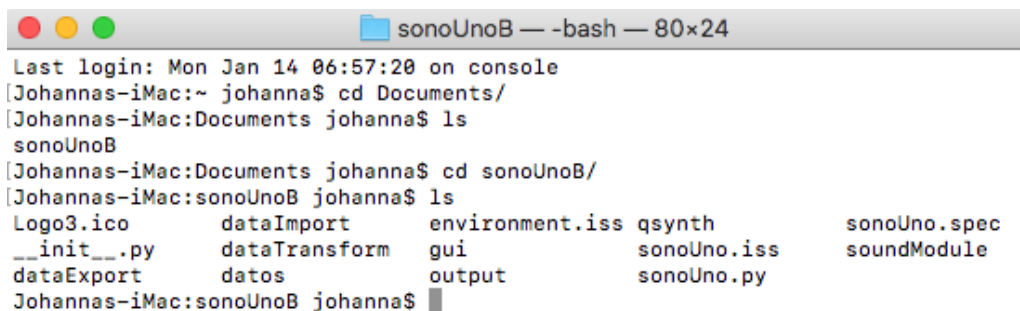
```
johanna — -bash — 80x21
Johannas-iMac:~ johanna$ python -m pip install --user mingus
Collecting mingus
  Downloading https://files.pythonhosted.org/packages/4d/06/f5ab0720e17da86fed054998953dcf36a35eb00b64854de968d849300983/mingus-0.5.1.tar.gz (128kB)
    100% |#####| 133kB 119kB/s
Installing collected packages: mingus
  Running setup.py install for mingus ... done
Successfully installed mingus-0.5.1
Johannas-iMac:~ johanna$
```

Image 18 - Installation of mingus with the previous command.

NOTE: if any of the last libraries (from 5 to 10) is missing, the soft does not run. The installation can take several minutes.

2.1.2. Run the software

1. Unzip the file, if it is compressed.
2. Open a terminal and go to the software folder. Probably you have more than one folder before you can run SonoUno.



```
sonoUnoB — -bash — 80x24
Last login: Mon Jan 14 06:57:20 on console
Johannas-iMac:~ johanna$ cd Documents/
Johannas-iMac:Documents johanna$ ls
sonoUnoB
Johannas-iMac:Documents johanna$ cd sonoUnoB/
Johannas-iMac:sonoUnoB johanna$ ls
Logo3.ico      dataImport      environment.iss  qsynth          sonoUno.spec
__init__.py    dataTransform   gui             sonoUno.iss     soundModule
dataExport     datos           output          sonoUno.py
Johannas-iMac:sonoUnoB johanna$
```

Image 19 - Aspect of the sonoUno folder on the command window.

3. To check in which folder is sonoUno.py, use the command “ls” (Image 19). The sonoUno.py must be among the files in the folder.
4. Once you are sure that you are at the right folder, make:
 - a. `python sonoUnoB.py`
5. A window must be open (Image 20), if that is the case, the soft is ready to be used.

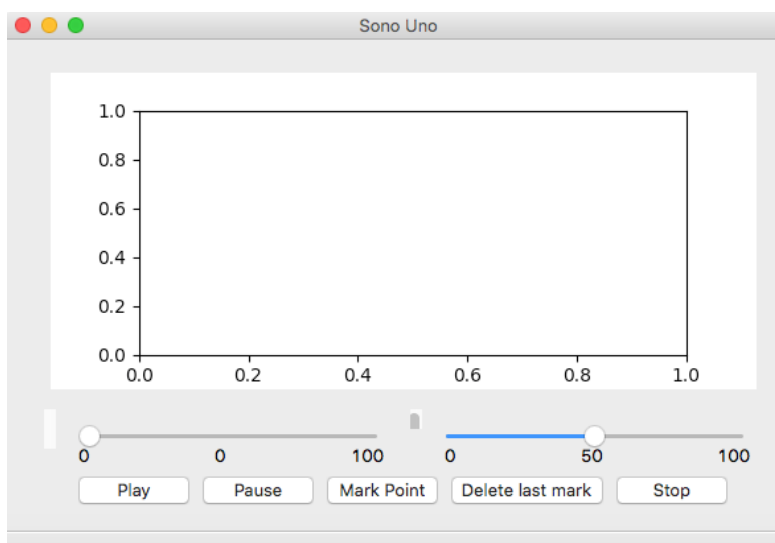


Image 20 - SonoUno main window on Mac.

2.3. Windows

2.3.1. Installation with the installer

There is an installer file given by the developer team. The steps are:

1. Double click on the installer file (if a windows ask for permission to execute the installer you must accept).
2. The principal window informs that you will install the software SonoUno and recommend to close all other applications before start (Image 21). To continue you must press “Next”.

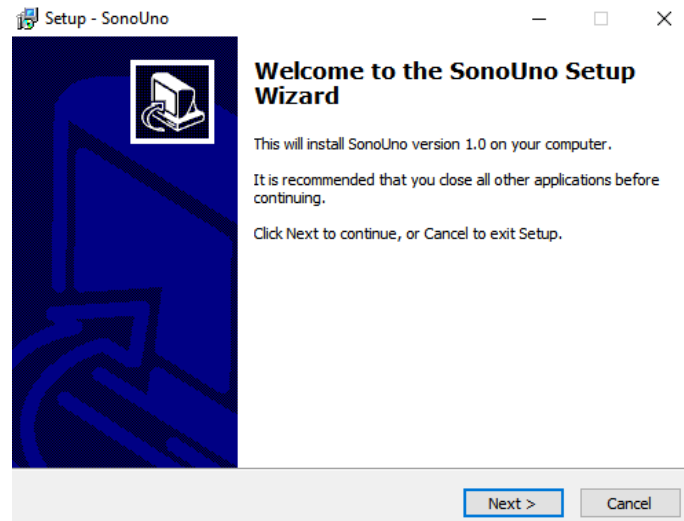


Image 21 - Principal windows of the installer on Windows.

3. The next window ask if the user want to add a folder in the start menu (Image 22). By default, the folder creation was selected and the name is sonoUno. If you don't want to create the folder, press the check box with the label “Don't create a Start Menu folder”. To continue you must press the button “Next”.

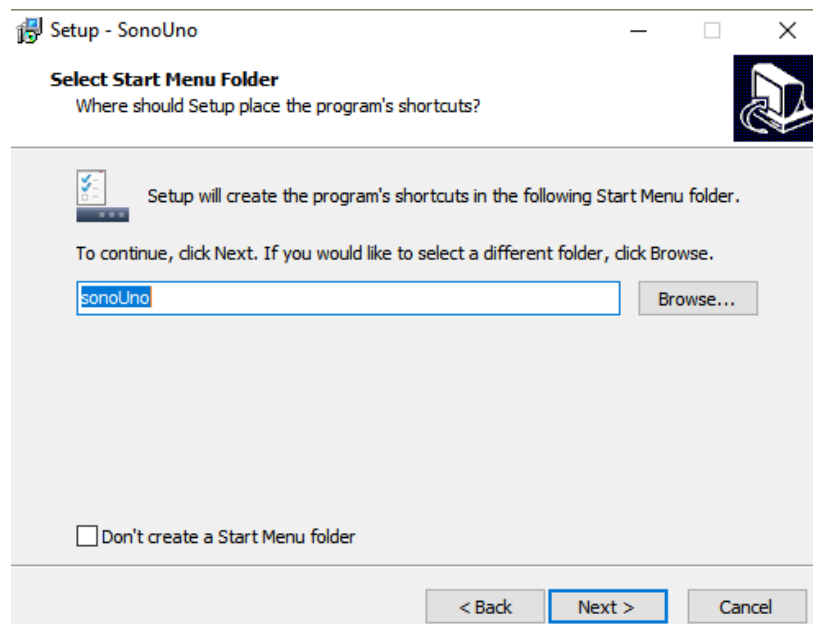


Image 22 - Select the location folder on the start menu.

4. The next window (Image 23) ask if you want to create a desktop icon and add the directory to the PATH variable. By default, the two options are selected. Is not recommended uncheck the “Add to PATH variable” checkbox, because if is uncheck you must add the directory manually at the end of the installation. To continue, press the button “Next”.

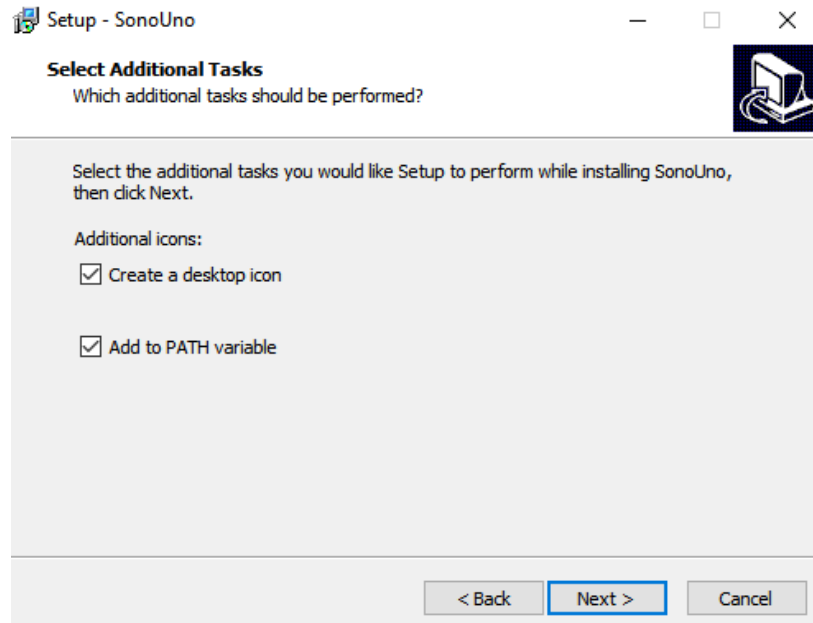


Image 23 – The window allow to create a desktop icon and to add the PATH variable to the system.

5. The next window show the actions selected by the user before the installation (Image 24). If you want modify anything, you must press “Back”. Otherwise, you can continue pressing the button “Install”.

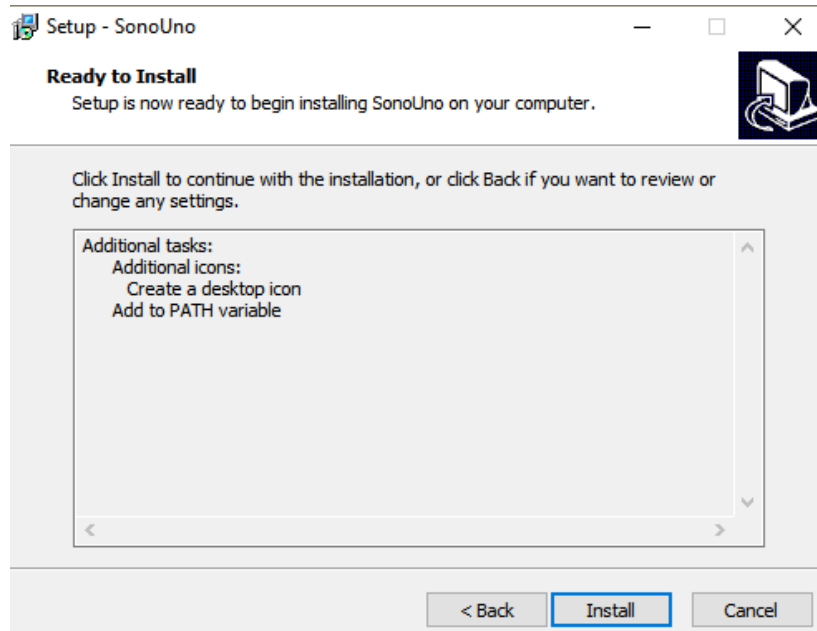


Image 24 - The previous window to the installation show the actions selected.

6. During the installation, the window has a bar that is filling and the option to cancel the installation (Image 25).

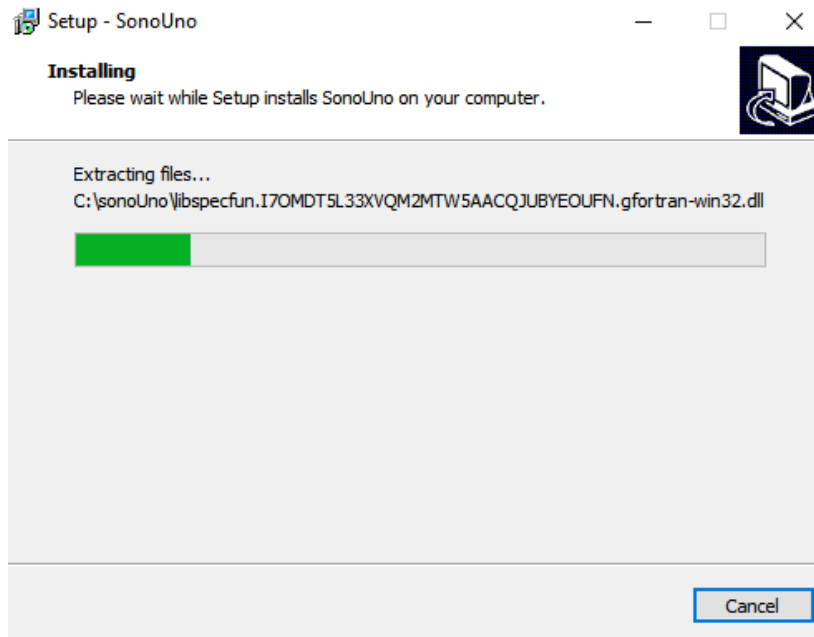


Image 25 - During the instalation, the window show a bar that is filling.

7. When the installation finish, automatically show the final window (Image 26), where show that the installation was finished and give the option to close the installer with the button "Finish".

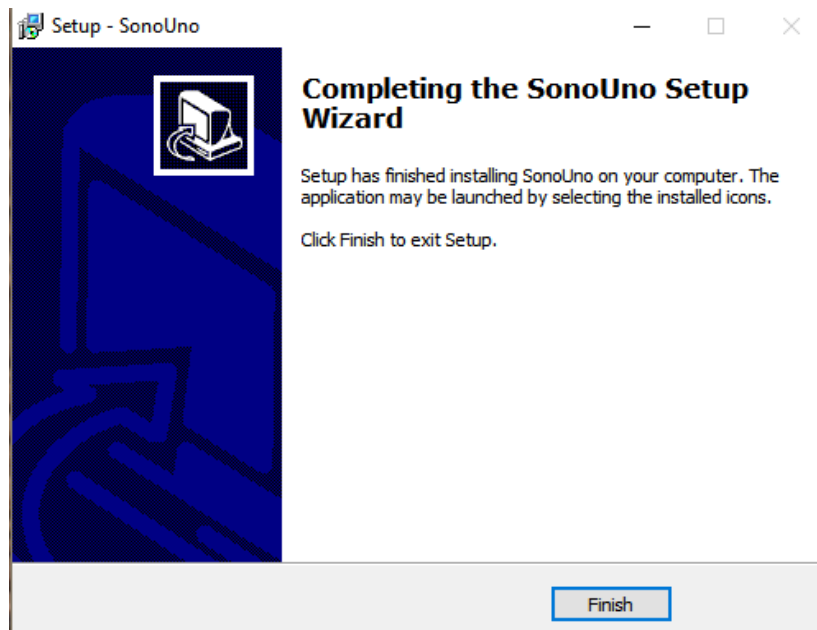


Image 26 - The final window confirm that the software has been installed.

The installer creates a folder on the disk C named sonoUno, where is the software and all its dependencies. On Windows, in order to reproduce the sound, it's needed a software named QSynth and include its directory on the PATH variable. The installer does all this automatically if you keep the default configuration of the checkbox. With the object of include the directory of the software on the PATH variable, is not allowed to change the destination folder of the sonoUno. Therefore, is recommended to keep checked the creation of the desktop icon, if not you can look for the executable on the directory "C:\sonoUno", named "sonoUno.exe".

2.3.2. Installation from the source

2.3.2.1. Prerequisites

Only for windows, the better installation of fluidsynth is through the QSynth software, located in <https://sourceforge.net/projects/qsynth/files/>. You can download an executable file and install this software.

When you have the installer, by default in Download folder of the file system (Image 27). To execute the installer, do double click on the file named “qsynth-x.x.x-setup”. If the installer ask for permission click Yes (Image 28).

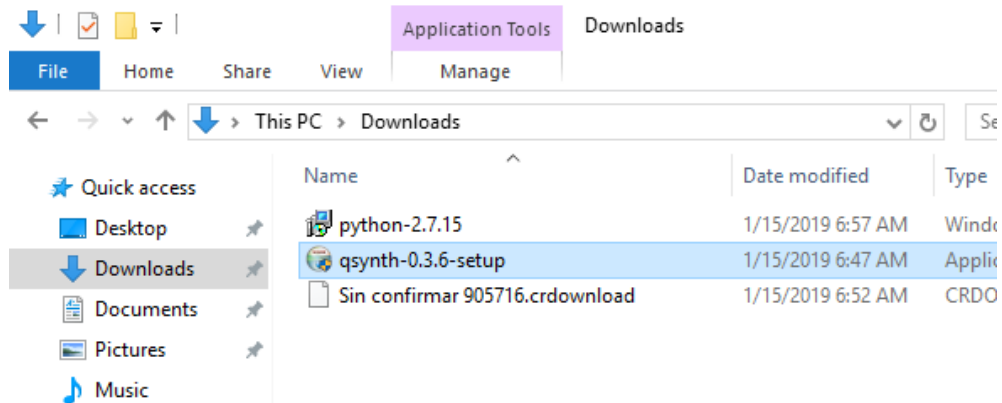


Image 27 - Download folder of the Windows 7 file system. Contain the qsynth installer and the sonoUnoB zip folder.

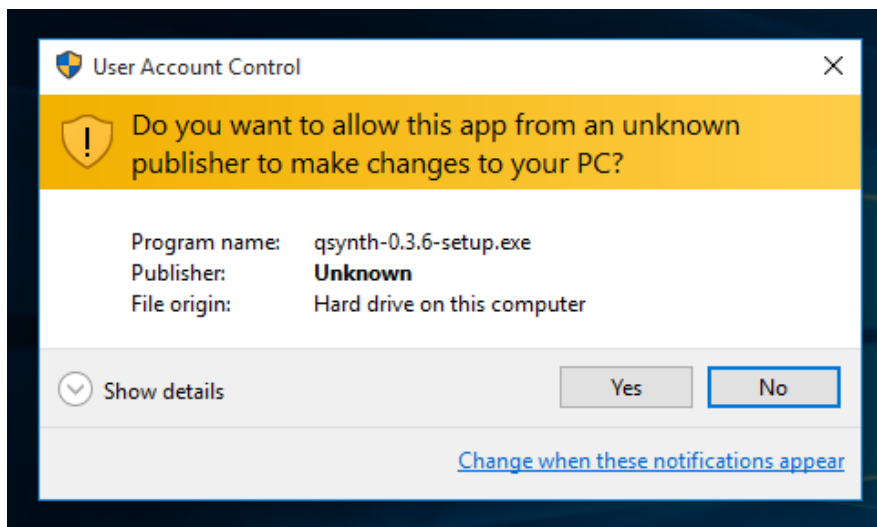


Image 28 - Qsynth installer asking for permission to install the software.

The first window is a welcome and recommendation, click Next to continue (Image 29). Next, the license agreement is shown, the user can read the text and then click “I Agree” to continue with the process (Image 30). The QSynth setup ask for the destination folder, by default is “C:\Program Files (x86)\QSynth” (Image 31). The next step is for select the destination folder of the start menu and then press “Install” (Image 32). The installation process takes a few minutes, with a status bar that is filling on the window. When the installation is finished the “Next” button is enable (Image 33), and the final window said that the program is installed on the computer (Image 34).

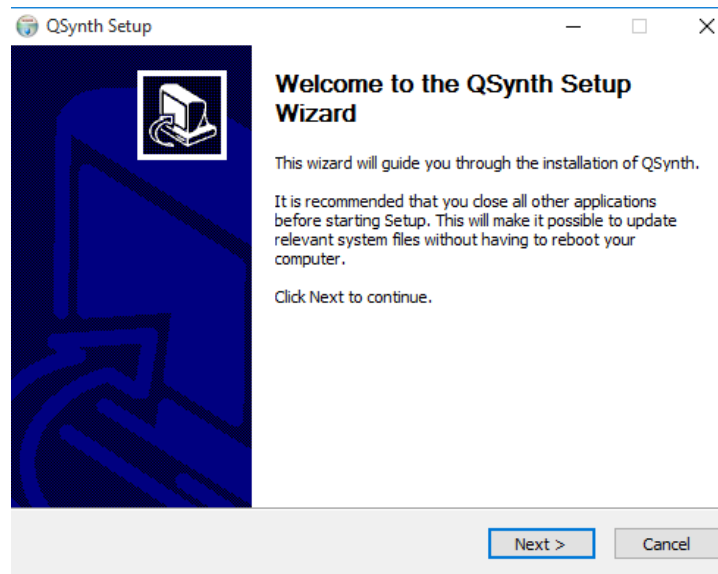


Image 29 - First window of the Qsynth installation wizard.

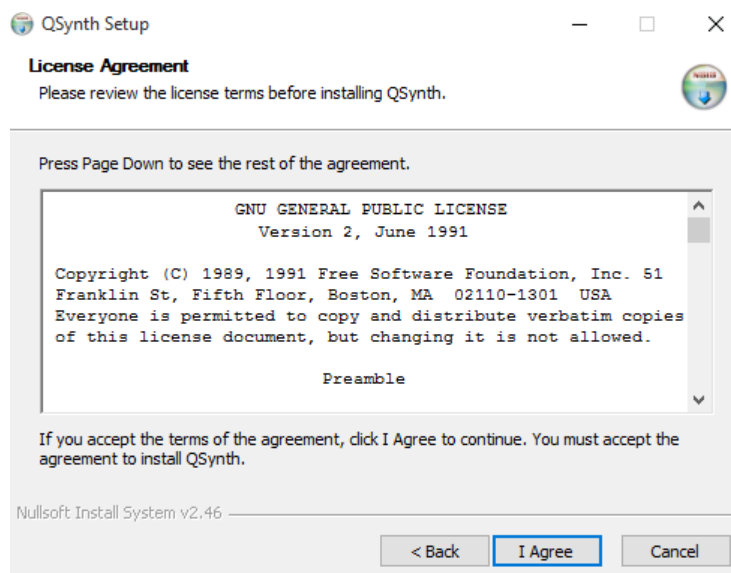


Image 30 - Text of the license agreement that must be accepted to continue with the installation.

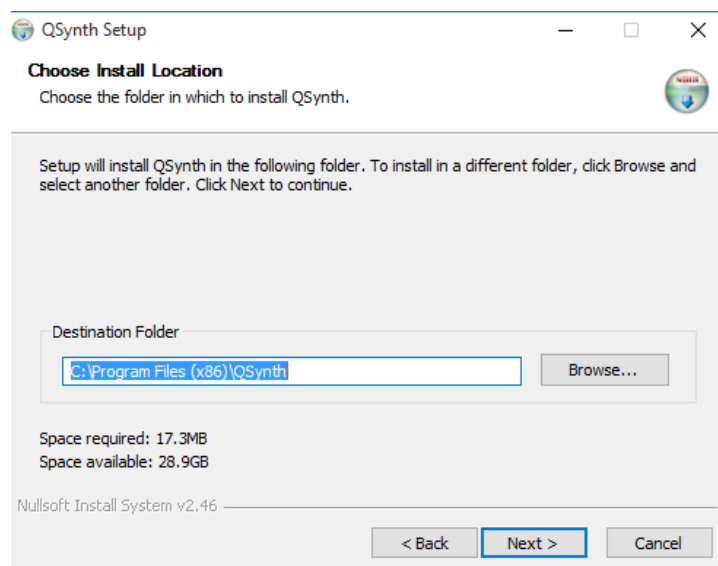


Image 31 - Window to select the destination folder of the installation, by default is C:\Program Files (x86)\QSynth.

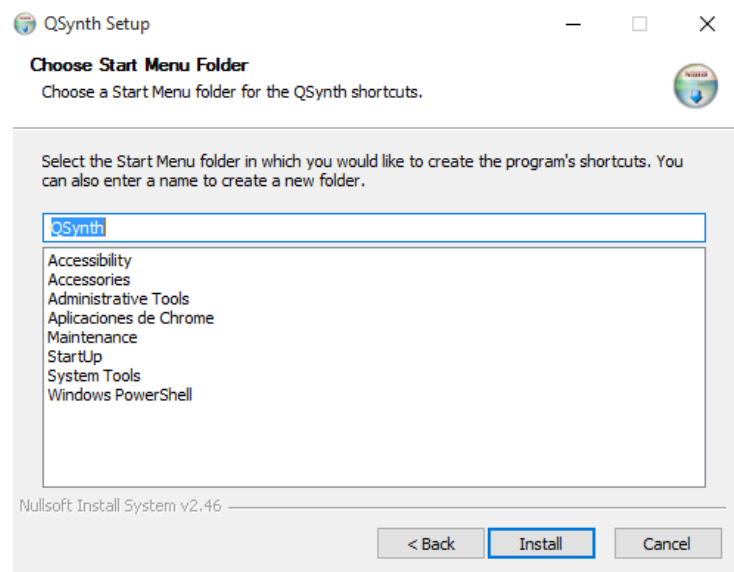


Image 32 - Window to choose the destination folder of the start menu.

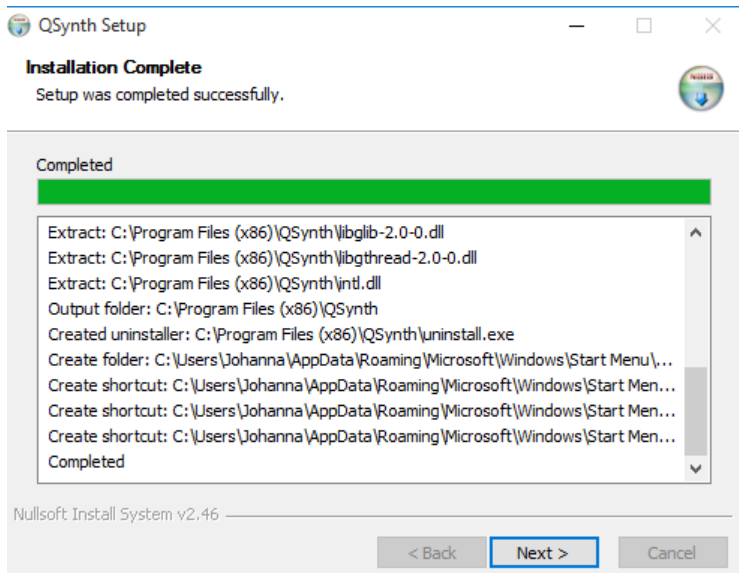


Image 33 - Installation process.

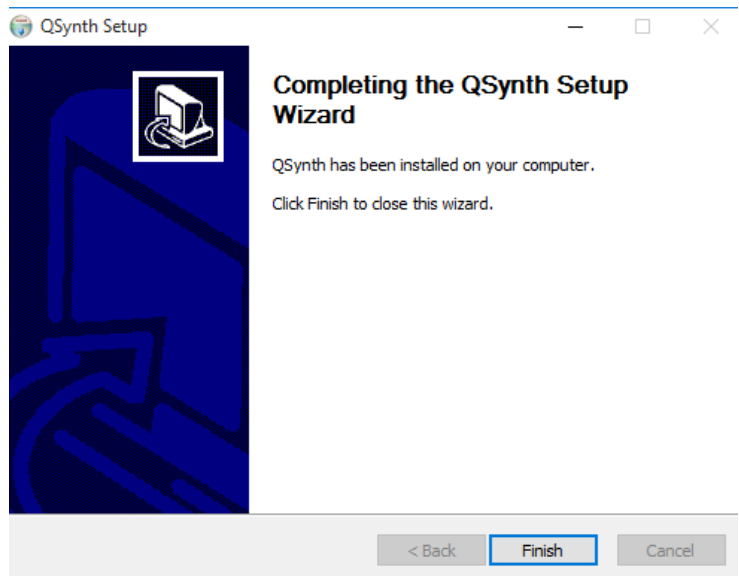


Image 34 - The last window of the Qsynth installation wizard.

The next thing to install is python 2.7, an installer is provide on the official website (<https://www.python.org/downloads/release/python-2715/>). To download the installer used on this instructive use the next link: <https://www.python.org/ftp/python/2.7.15/python-2.7.15.msi>. Once you have the installer, double click on it. Maybe the installer ask for confirmation (Image 35), click Execute.

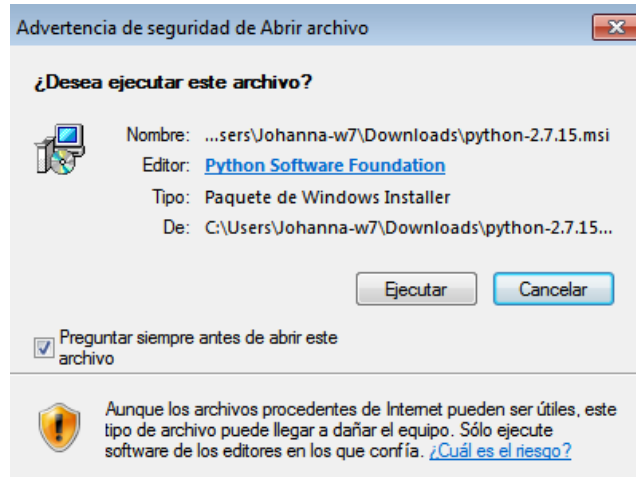


Image 35 - Pop-up window asking for permission to execute the installer of python on Windows.

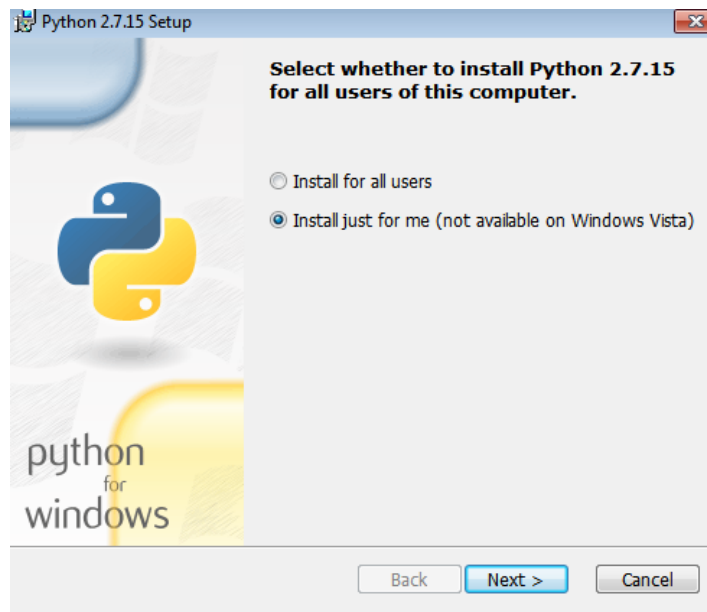


Image 36 - First window of the installer setup of python, the item "Install just for me" is checked.

The first step on the python installer is to select whether to install python: for all users or just for me; in this tutorial “Install just for me” was selected (Image 36). Next, the user can select the destination directory, by default is “C:\Python27\” (Image 37). Then, the installer allows the user to customize the installation, in this window the default settings are keep (Image 38). When the next button are press the installer ask for permission before installing the software (Image 39), click yes and the next window present a status bar that is filling (Image 40). Finally, the last windows inform that the process is complete (Image 41).

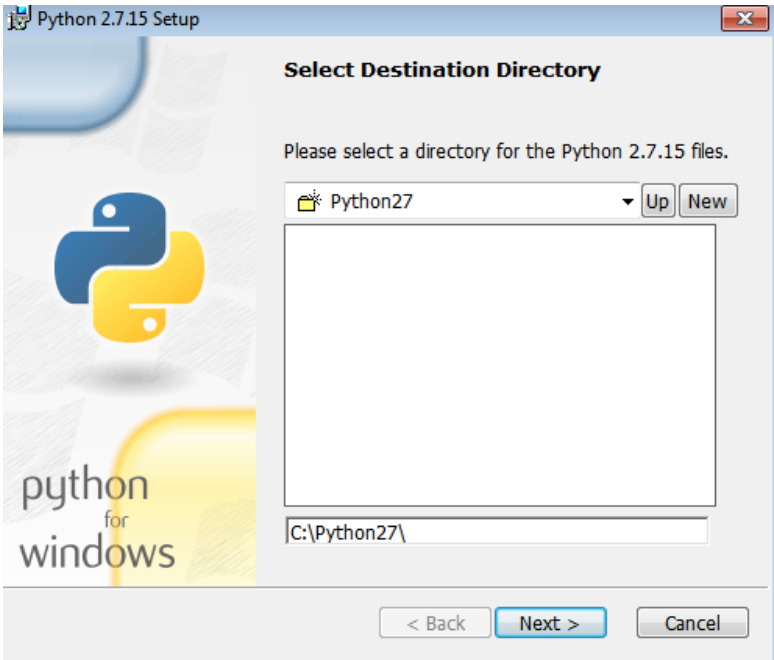


Image 37 - "Select destination directory" window, the "C:\Python27\" directory is set by default.



Image 38 - "Customize Python" window, the default setting are keep.

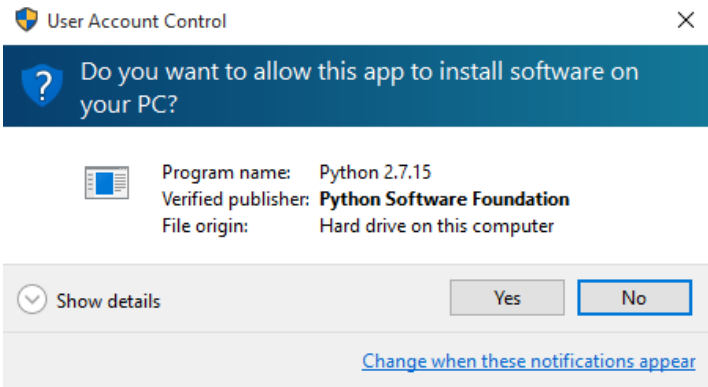


Image 39 - The installer ask for permission again.

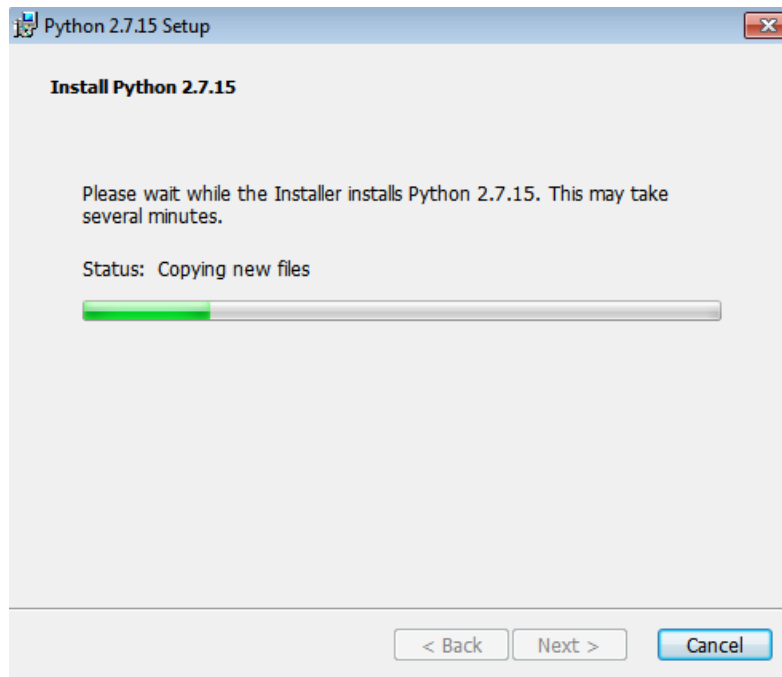


Image 40 - The next window is the installation process, with a status bar.



Image 41 - The last window notify that the software was installed.

The next important step is to set the environment variables, the only part that differs between Windows 7 and 10 is the location of control panel button on the start menu. On Windows 7, click the start menu and the control panel button is on the right (Image 42), but on Windows 10, the user have to select "All apps" and search for "Window system" folder, the control panel button is inside this folder (Image 43).

In the control panel window, select "System and security" (Image 44), then "System" (Image 45) and finally, "Advance system settings" (Image 46). In the new window bottom the user can find the "Environment variables" button (Image 47), witch one open the environment variables window (Image 48), where the user can set the PATH variable.

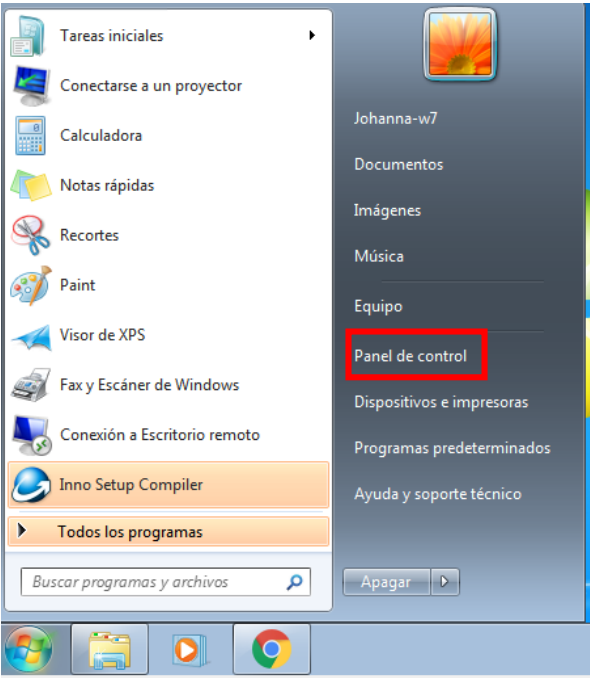


Image 42 - Selection of control panel on the start menu of Windows 7 system.

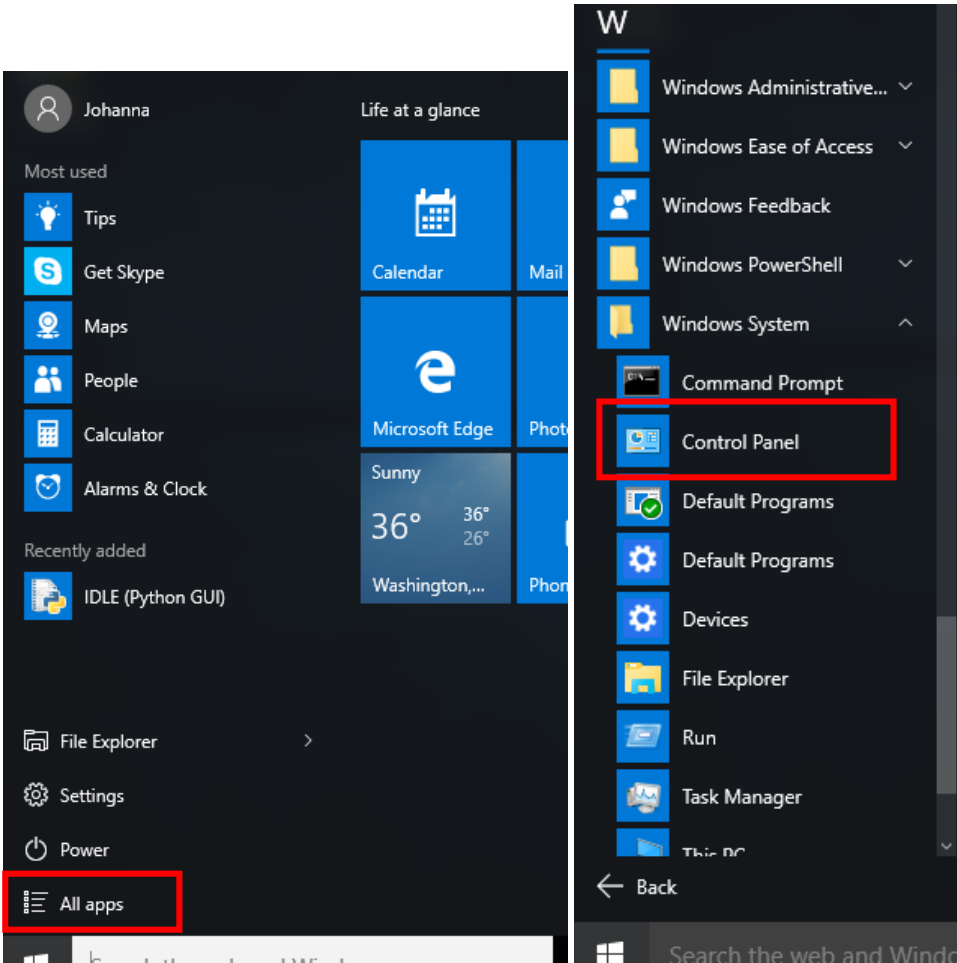


Image 43 - Selection of control panel on the start menu of Windows 10 system.

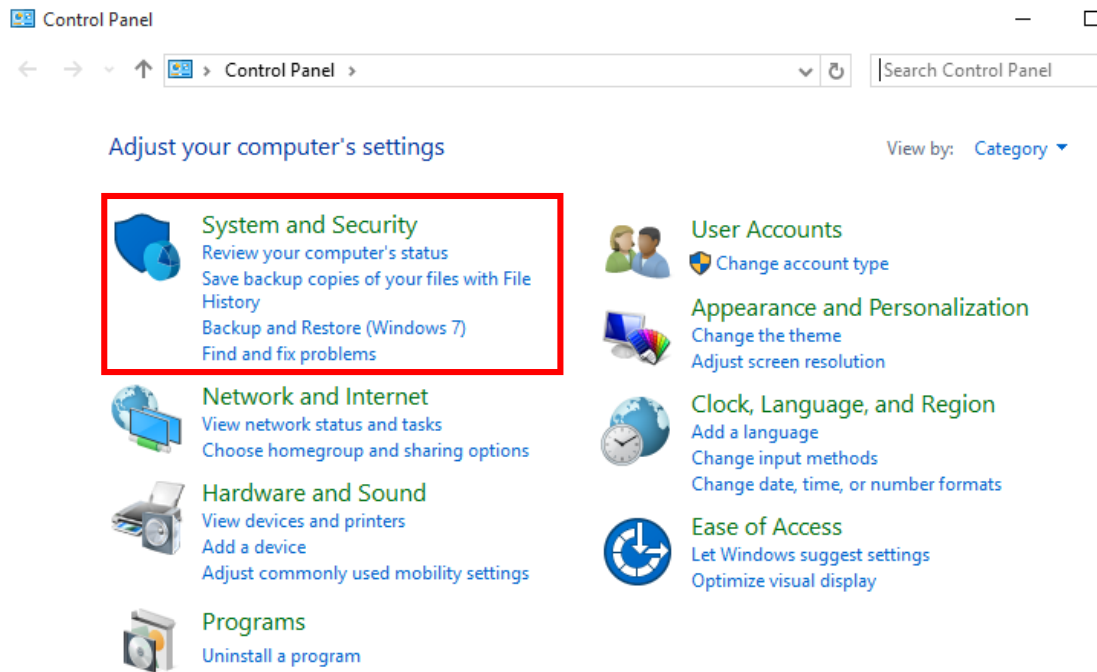


Image 44 – “System and security” section marked with a rectangle on the control panel.

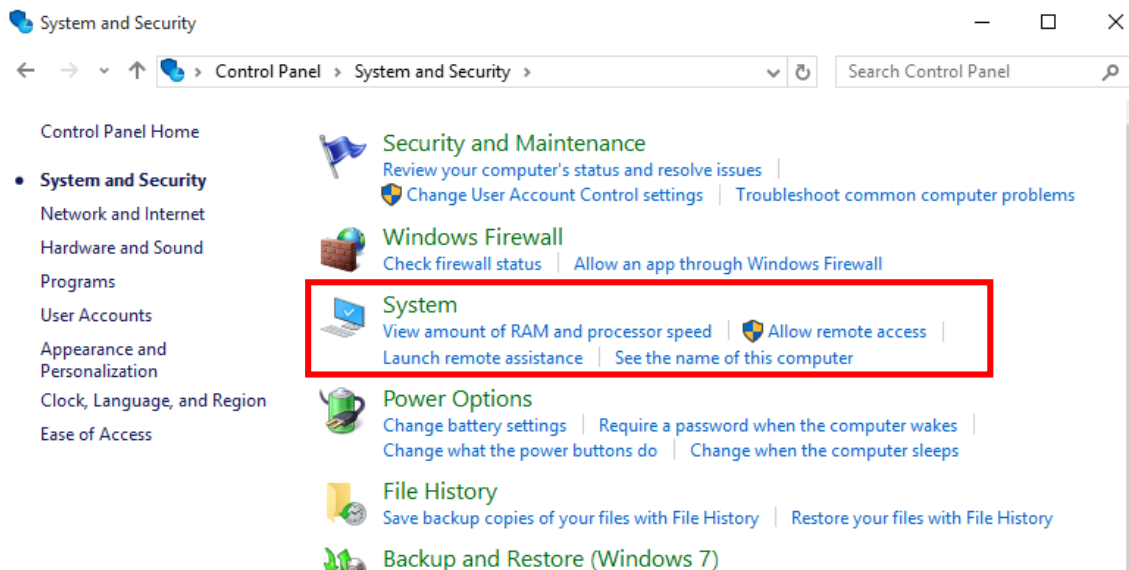


Image 45 - System section marked with a rectangle on “System and security”.

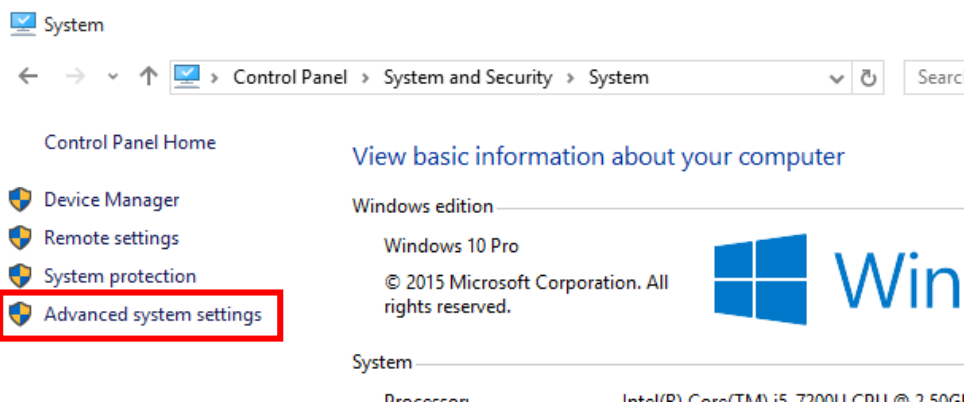


Image 46 - “Advanced system settings” section marked with a rectangle on “System”.

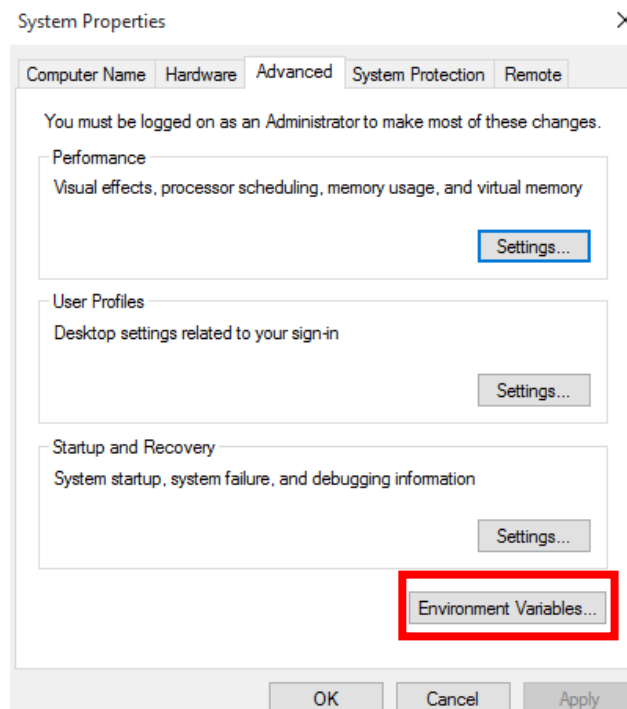


Image 47 - "Environment Variables" button marked with a rectangle on "System properties".

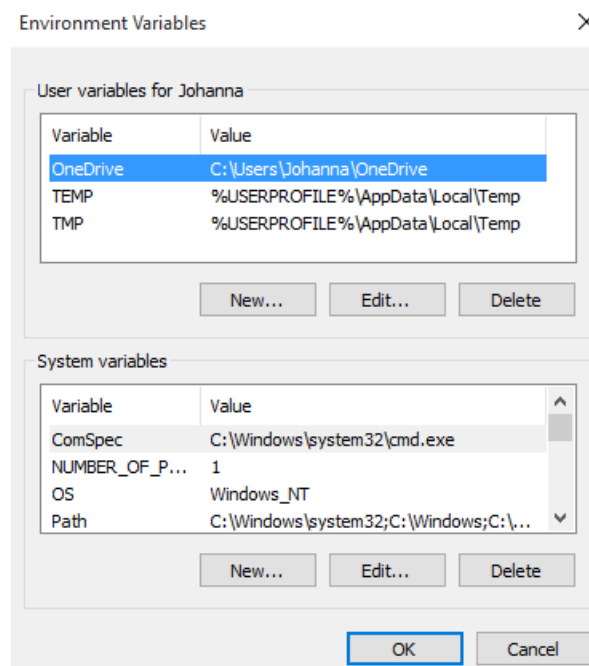


Image 48 - Environment variables window.

Another way to access to the environment variables windows is typing “environment variable” on the start menu (Image 49), the button “Edit the system environment variables” open the same window that the first way (Image 48).

Once the user is in the environment variables window, if the user variable PATH exist, the user has to click on “Edit” and add the new path to the variable. On the other hand, if the PATH user variable does not exist, the user must click on the “New” button, that action open a pop-up window where the user can set the variable name and value (Image 50). The name of the variable is “PATH” and the value is the new path, in this case the directory of the QSynth

installation folder (by default C:\Program Files (x86)\QSynth) and the two directories needed for python: C:\Python27 and C:\Python27\Scripts (Image 51). Finally, click Ok and Ok.

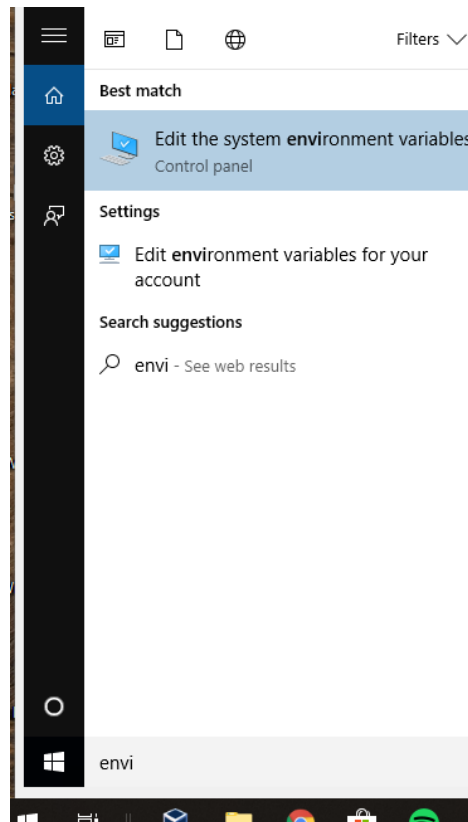


Image 49 - Search on start menu typing "Environment variable".

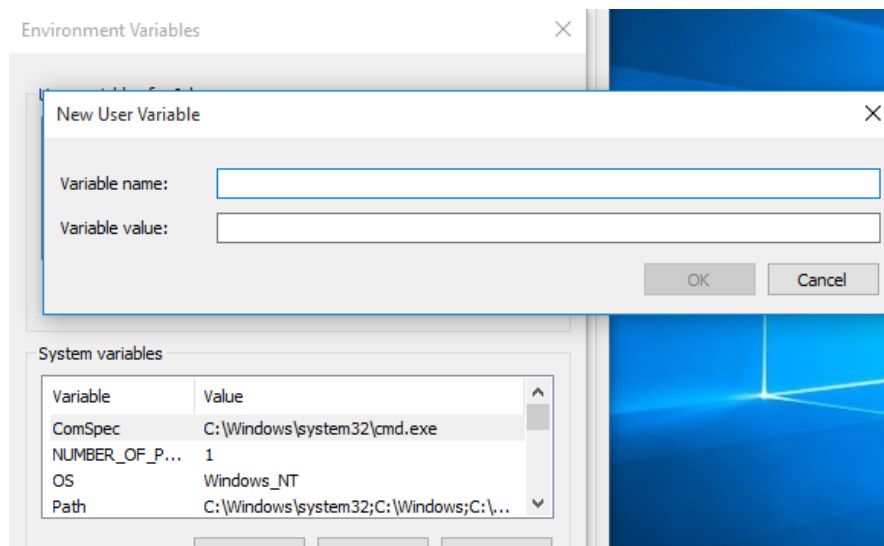


Image 50 - Press the new button on the user variables section of the environment variable window.

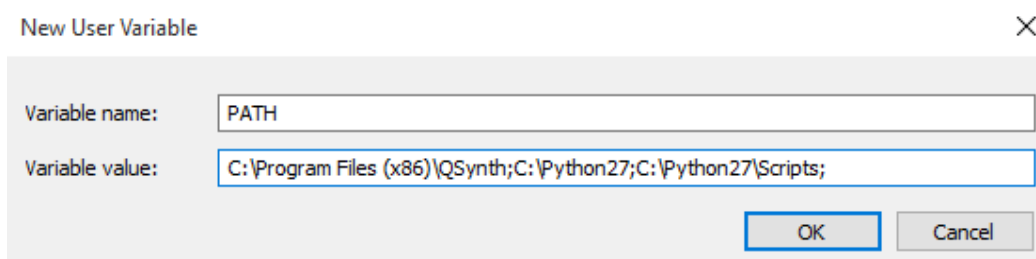


Image 51 - Select the name PATH and paste the directories on the value box.

The last part is to install the libraries, to do that the user have to open the command window (Image 52), typing “cmd” on the start menu. Follow the nexts steps:

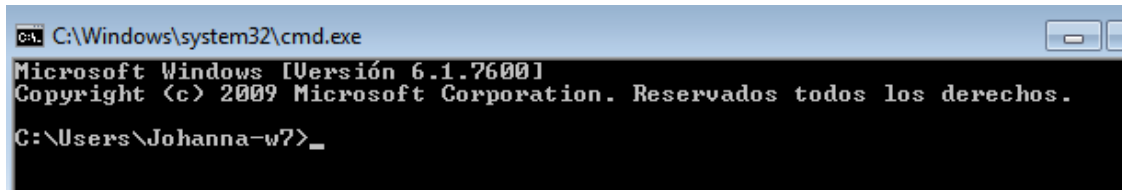


Image 52 - Command window on Windows operative system.

1. Install wxPython with the next command:

- a. `python -m pip install -U wxPython`

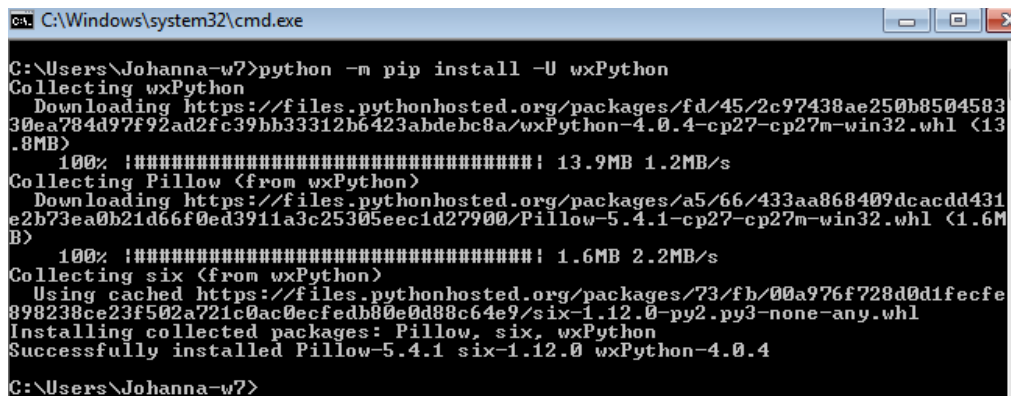


Image 53 - Installation of wxPython with the previous command.

NOTE: The installation can take several minutes, be patient. If the installation take more than 30 minutes cancel the process (Ctrl+C) and execute the command once again. The aspect of the installation, can be seeing in Image 53.

2. Install matplotlib 2.2.3 or upper (Image 54):

- a. `python -m pip install -U matplotlib`

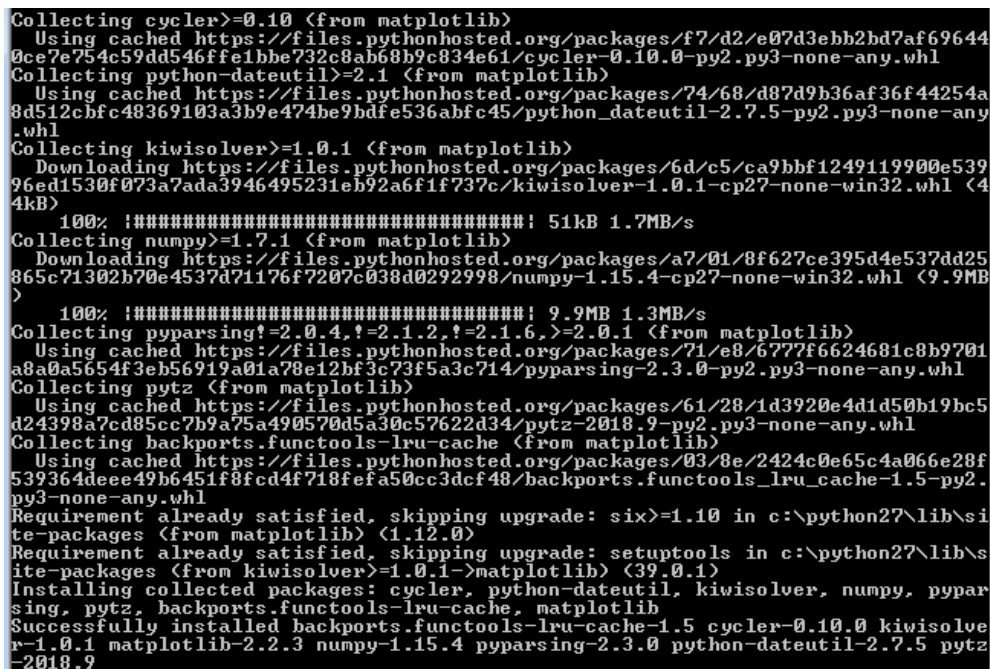
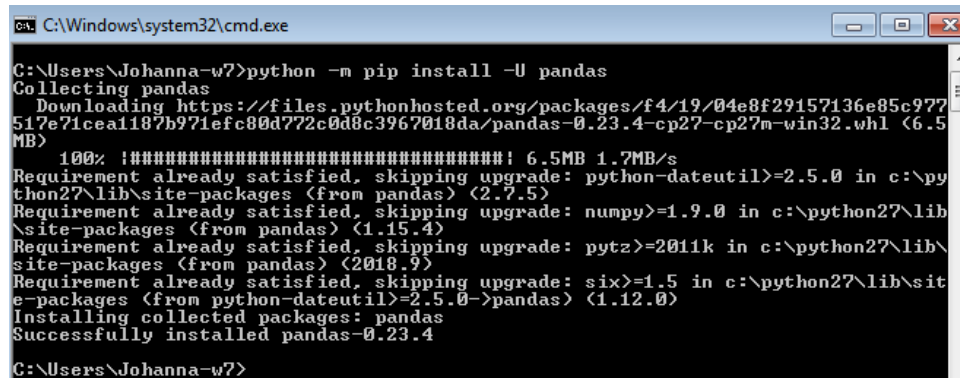


Image 54 – Part of the installation of matplotlib with the previous command.

3. Install pandas (Image 55):
 - a. `python -m pip install -U pandas`



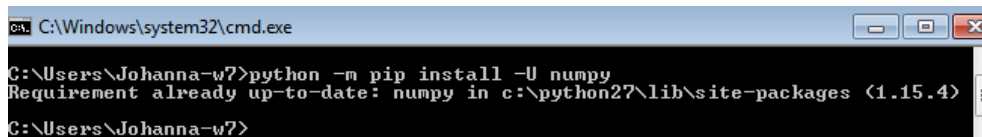
```
C:\Windows\system32\cmd.exe

C:\Users\Johanna-w7>python -m pip install -U pandas
Collecting pandas
  Downloading https://files.pythonhosted.org/packages/f4/19/04e8f29157136e85c977517e71cea1187b971efc80d772c0d8c3967018da/pandas-0.23.4-cp27-cp27m-win32.whl (6.5 MB)
    100% |#####| 6.5MB 1.7MB/s
Requirement already satisfied, skipping upgrade: python-dateutil>=2.5.0 in c:\python27\lib\site-packages (from pandas) (2.7.5)
Requirement already satisfied, skipping upgrade: numpy>=1.9.0 in c:\python27\lib\site-packages (from pandas) (1.15.4)
Requirement already satisfied, skipping upgrade: pytz>=2011k in c:\python27\lib\site-packages (from pandas) (2018.9)
Requirement already satisfied, skipping upgrade: six>=1.5 in c:\python27\lib\site-packages (from python-dateutil>=2.5.0->pandas) (1.12.0)
Installing collected packages: pandas
Successfully installed pandas-0.23.4

C:\Users\Johanna-w7>
```

Image 55 - Installation of pandas with the previous command.

4. Install numpy (Image 56):
 - a. `python -m pip install -U numpy`



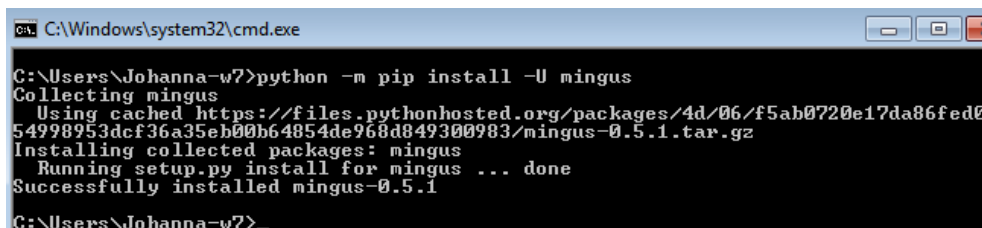
```
C:\Windows\system32\cmd.exe

C:\Users\Johanna-w7>python -m pip install -U numpy
Requirement already up-to-date: numpy in c:\python27\lib\site-packages (1.15.4)

C:\Users\Johanna-w7>
```

Image 56 - Installation of numpy with the previous command.

5. Install mingus (Image 57):
 - a. `python -m pip install -U mingus`



```
C:\Windows\system32\cmd.exe

C:\Users\Johanna-w7>python -m pip install -U mingus
Collecting mingus
  Using cached https://files.pythonhosted.org/packages/4d/06/f5ab0720e17da86fed054998953dcf36a35eb00b64854de968d849300983/mingus-0.5.1.tar.gz
Installing collected packages: mingus
  Running setup.py install for mingus ... done
Successfully installed mingus-0.5.1

C:\Users\Johanna-w7>
```

Image 57 - Installation of mingus with the previous command.

NOTE: if any of the last libraries (from 1 to 5) is missing, the soft does not run. The installation can take several minutes.

To open the software, follow the next steps:

1. Unzip the file, if it is compressed.
2. Open a terminal and go to the software folder. Probably you have more than one folder before you can run SonoUno.



```
C:\Users\Johanna-w7>cd Documents

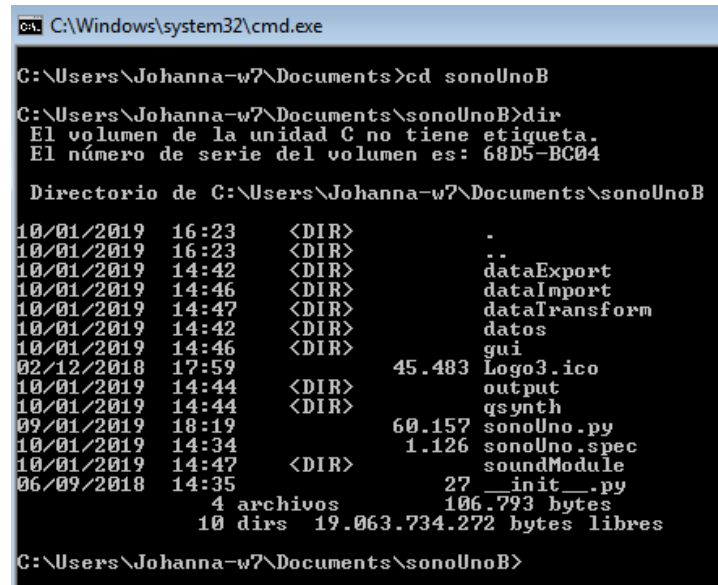
C:\Users\Johanna-w7\Documents>dir
El volumen de la unidad C no tiene etiqueta.
El número de serie del volumen es: 68D5-BC04

Directorio de C:\Users\Johanna-w7\Documents
10/01/2019  16:08    <DIR>          .
10/01/2019  16:08    <DIR>          ..
10/01/2019  15:58    <DIR>          sonoUnoB
               0 archivos             0 bytes
               3 dirs 19.114.565.632 bytes libres

C:\Users\Johanna-w7\Documents>
```

Image 58 - Location of the sonoUno on the command line.

3. To check in which folder is sonoUno.py, use the command “dir” (Image 58). The sonoUno.py must be among the files in the folder.



```

C:\Windows\system32\cmd.exe

C:\Users\Johanna-w7\Documents>cd sonoUnoB
C:\Users\Johanna-w7\Documents\sonoUnoB>dir
El volumen de la unidad C no tiene etiqueta.
El número de serie del volumen es: 68D5-BC04

Directorio de C:\Users\Johanna-w7\Documents\sonoUnoB

10/01/2019  16:23    <DIR>          .
10/01/2019  16:23    <DIR>          ..
10/01/2019  14:42    <DIR>          dataExport
10/01/2019  14:46    <DIR>          dataImport
10/01/2019  14:47    <DIR>          dataTransform
10/01/2019  14:42    <DIR>          datos
10/01/2019  14:46    <DIR>          gui
02/12/2018  17:59             45.483 Logo3.ico
10/01/2019  14:44    <DIR>          output
10/01/2019  14:44    <DIR>          qsynth
09/01/2019  18:19             60.157 sonoUno.py
10/01/2019  14:34             1.126 sonoUno.spec
10/01/2019  14:47    <DIR>          soundModule
06/09/2018  14:35             27 ____init__.py
               4 archivos             106.793 bytes
               10 dirs             19.063.734.272 bytes libres

C:\Users\Johanna-w7\Documents\sonoUnoB>
    
```

Image 59 - Aspect of the sonoUno folder on the command line on Windows.

4. Once you are sure that you are at the right folder, make:
 - a. python sonoUnoB.py

A window must be open (Image 60), if that is the case, the soft is ready to be used.

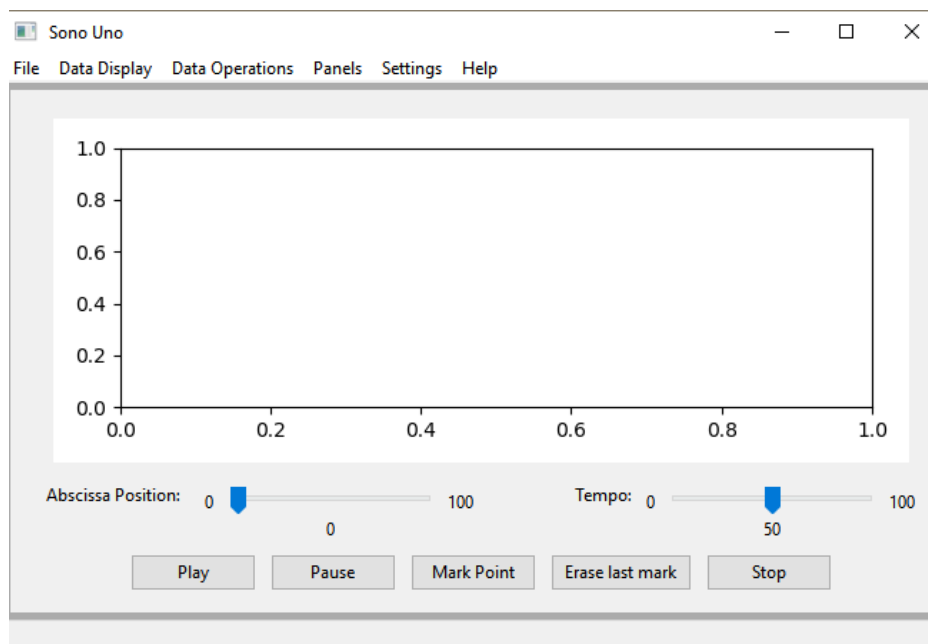


Image 60 - SonoUno main window on Windows.

3. Opening the software

Once the software is installed, to open it you have to do double click on the desktop icon, or look for the executable “sonoUno.exe” on the directory “C:\sonoUno”. That action opens the sonoUno main window and a windows command windows on the second plain (Image 61).

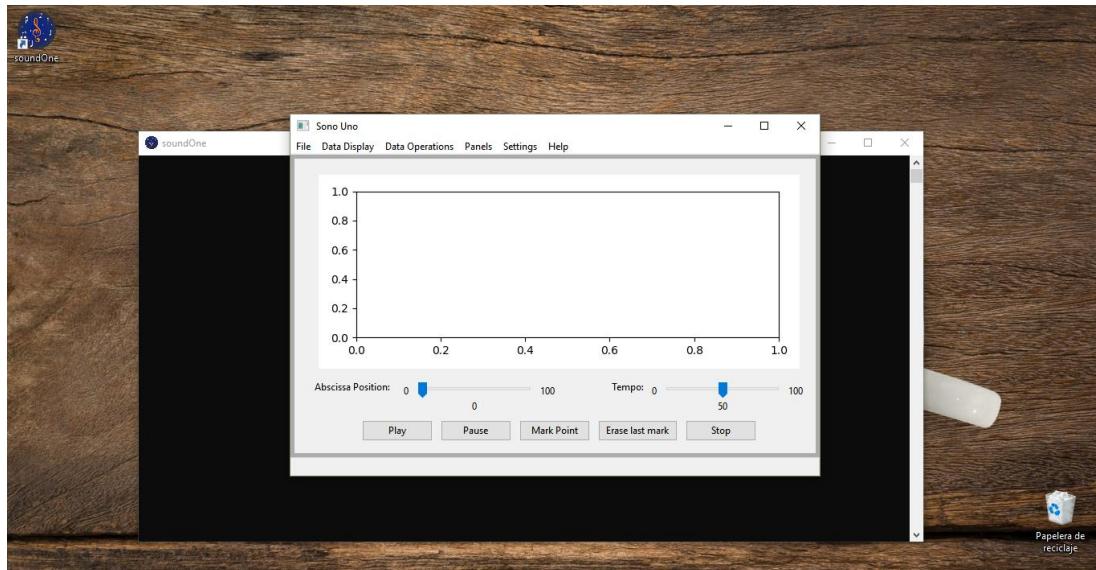


Image 61 - Errors command window and sonoUno main window.

The command window is shown to detect any problem that is not catch by the program itself. If an error occurs on that windows is recommended to do a screenshot or copy the message and communicate this to the development team. For the final version, that window will be not included.

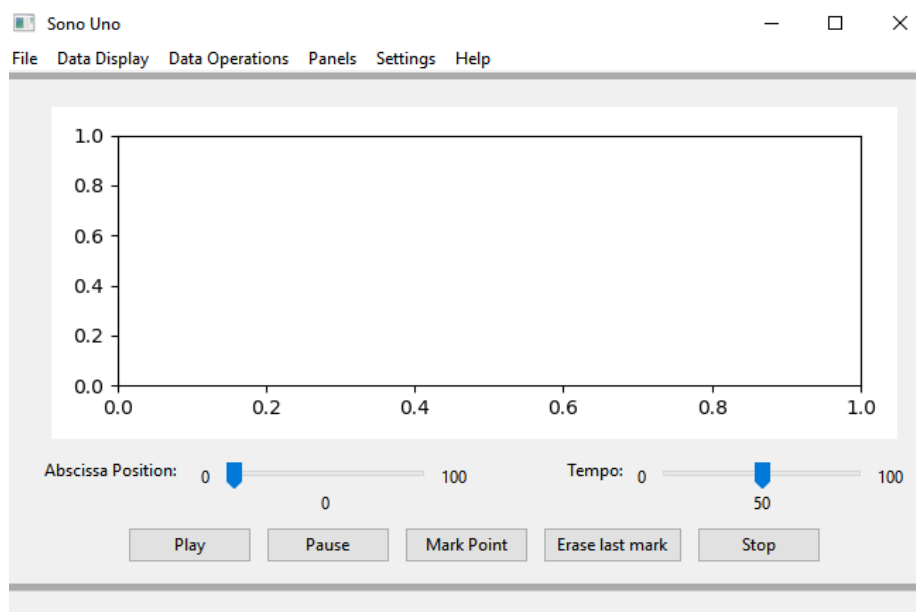


Image 62 - SonoUno initial window.

The initial window of the software only shows the plot and the reproduction options of the data (Image 62), the other functionalities are hide and were shown in the next chapters. This design was based on a user cases study.

In order to probe the SonoUno, you have to import a data file. If you don't have a data file, the installer provide a folder named "data" with simple functions on the installation directory (C:\sonoUno).

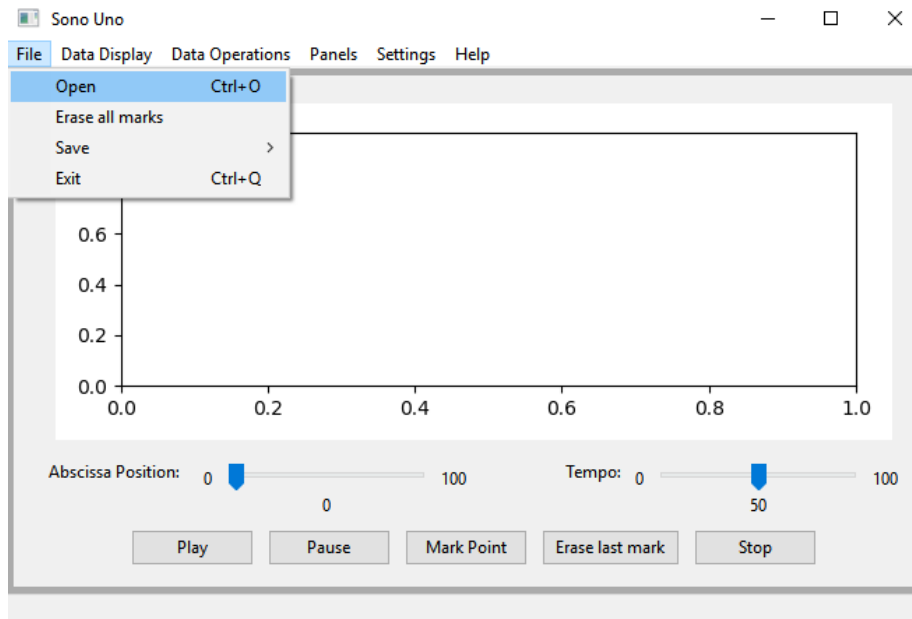


Image 63 - Open a file: choose the item Open on the menu File.

The first step to open a data file, is to select the item Open on the menu File (Image 63). This action shows a new windows of the file system of the computer, where you can choose the data file. Once you have the data file selected, press the button “Open” (Image 64).

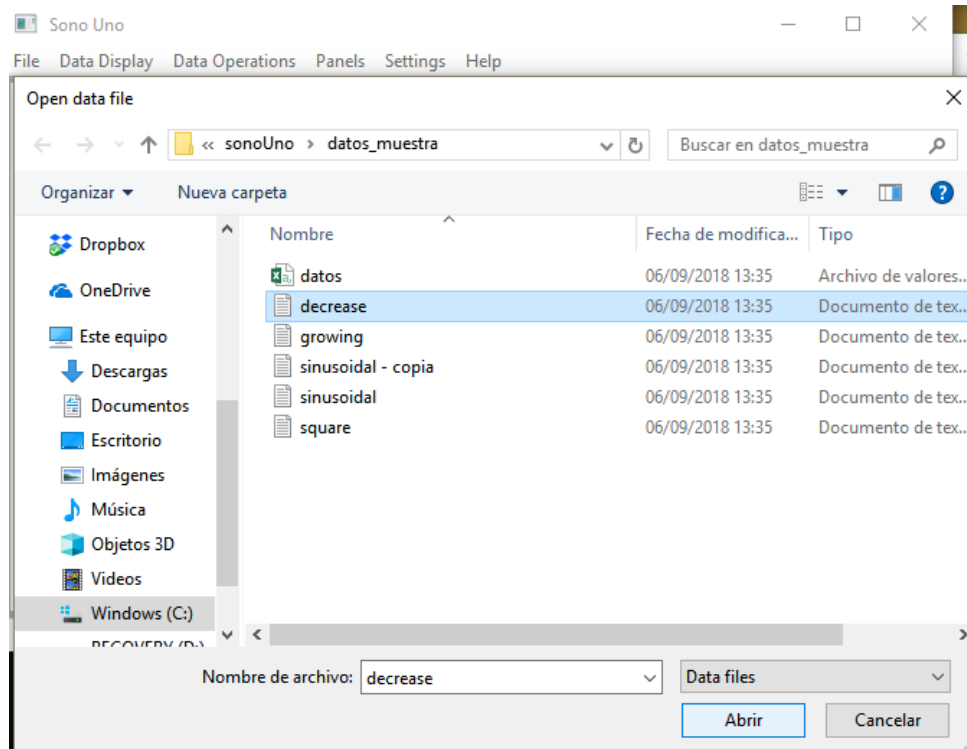


Image 64 - New window of the file system of the computer.

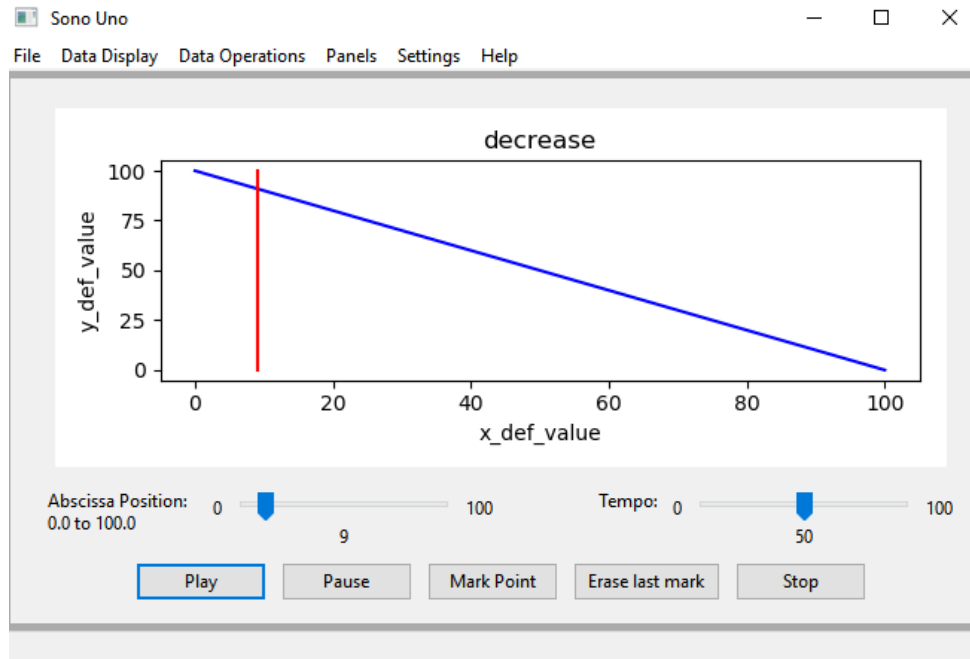


Image 65 - Reproduction of the data file after press the button Play.

After open the data file, the SonoUno show the plot and is ready to reproduce the pitch variation in Piano. In order to reproduce the sound, you have to press the button Play (Image 65). If the software installation is correct, you must listen a pitch variation on Piano and see a red vertical bar moving through the data, this bar indicate the position of the data that is been sonificated.

If the software doesn't produce sound, check the speakers or headphones on your computer. If the problems continue or you have another problem, inform this to the developer team.

4. Items to keep in mind

- The extra windows of the software are generated with the native language of the operative system, for example, if your system are in English the pop-up windows will be in English. On the other hand, the software language is always English. In the future the team expect to unify the languages.
- In the files to import the first column must have continuous values, it is used as a coordinate dependent axis.

5. Software functionalities

5.1. Input and Output options

5.1.1. Open a file

To open a file, one of the option is to press the item Open of the menu File (Image 66). This action shows a pop-up window of the file browser of the computer (Image 67), were you can search and open the data file.

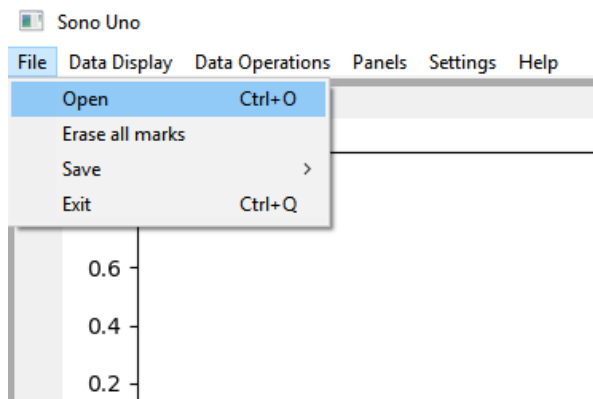


Image 66 - Show the items on the menu File and the focus of the keyboard is on the Open item.

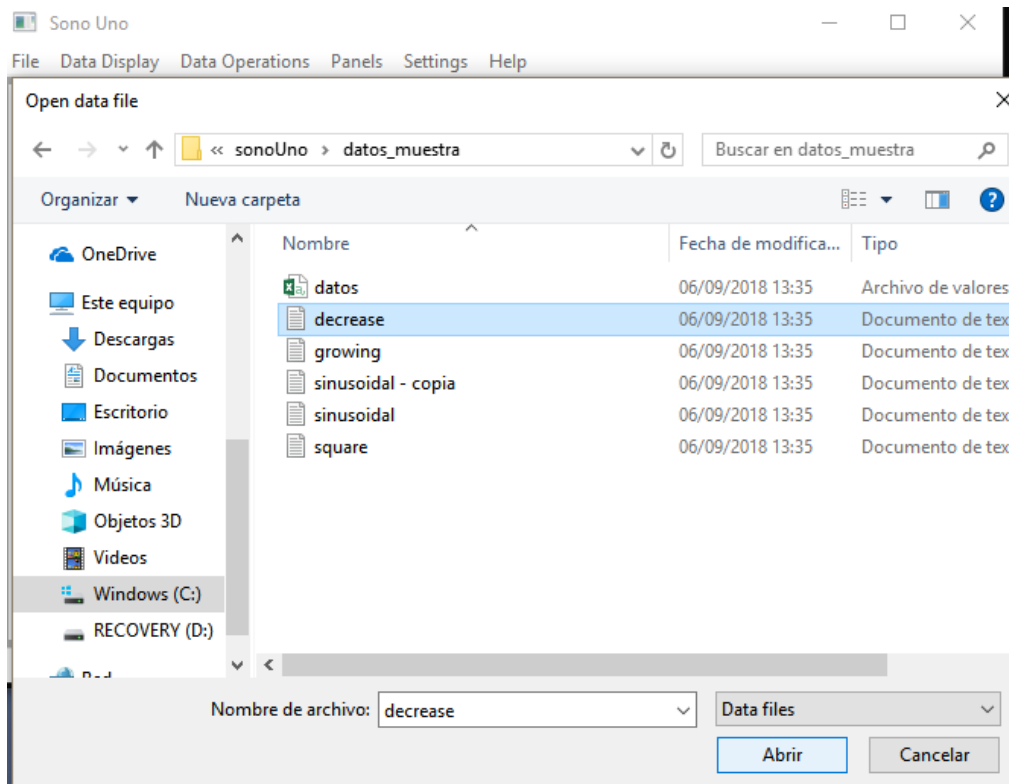


Image 67 - Pop-up windows of the File browser, shown after press the item or button Open.

When you have the data file selected, you must press the button Open or the Enter key. Then the sonoUno generate the graph of the data (Image 68) and update the abscissas slide bar. With the button Play you can reproduce the sound of the data.

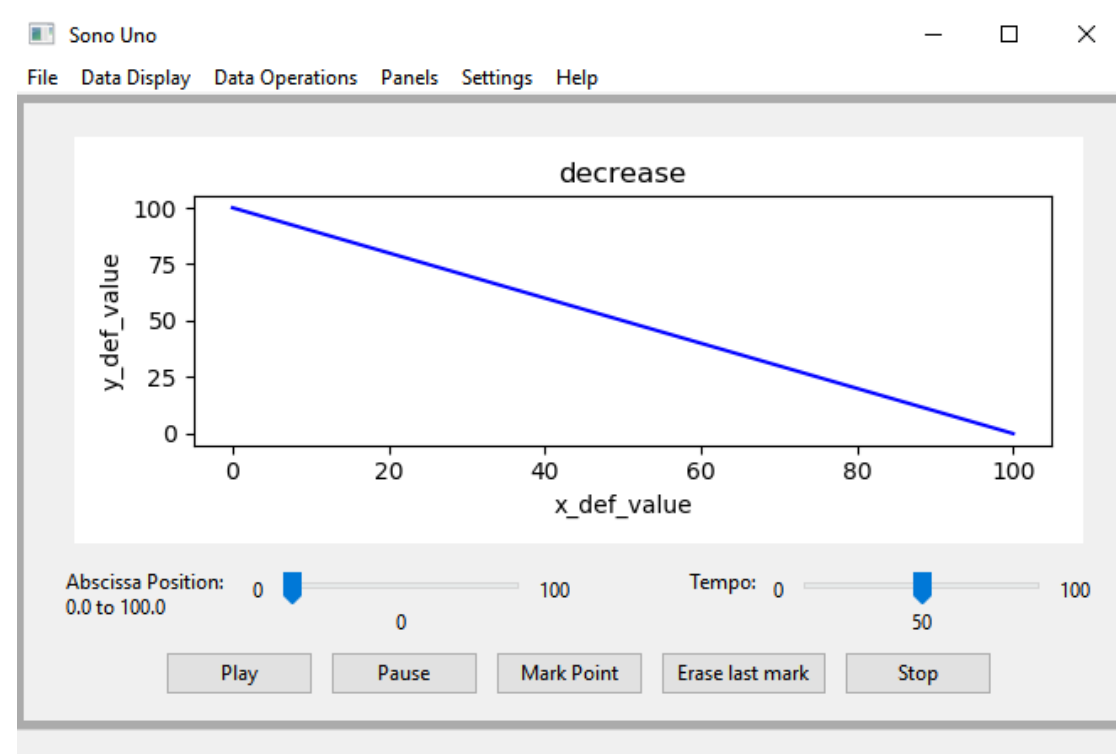


Image 68 - The sonoUno framework with the graph of the imported data.

Other ways to open a data file is to show the file panel with the item File of the menu Panels (Image 69). The file panel contains five buttons and is located on the left of the user (Image 70).

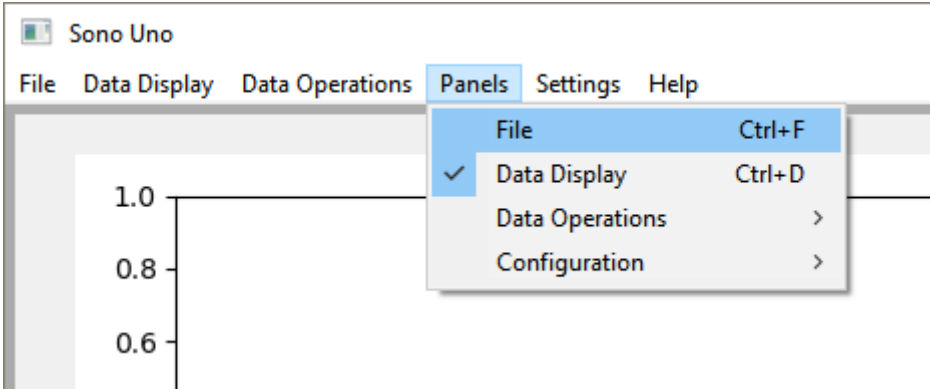


Image 69 - Show the items of the menu Panels and the focus keyboard is on the File item.

The first button (Open) show the file browser pop-up windows (Image 67), the next steps are the same of the previous way.

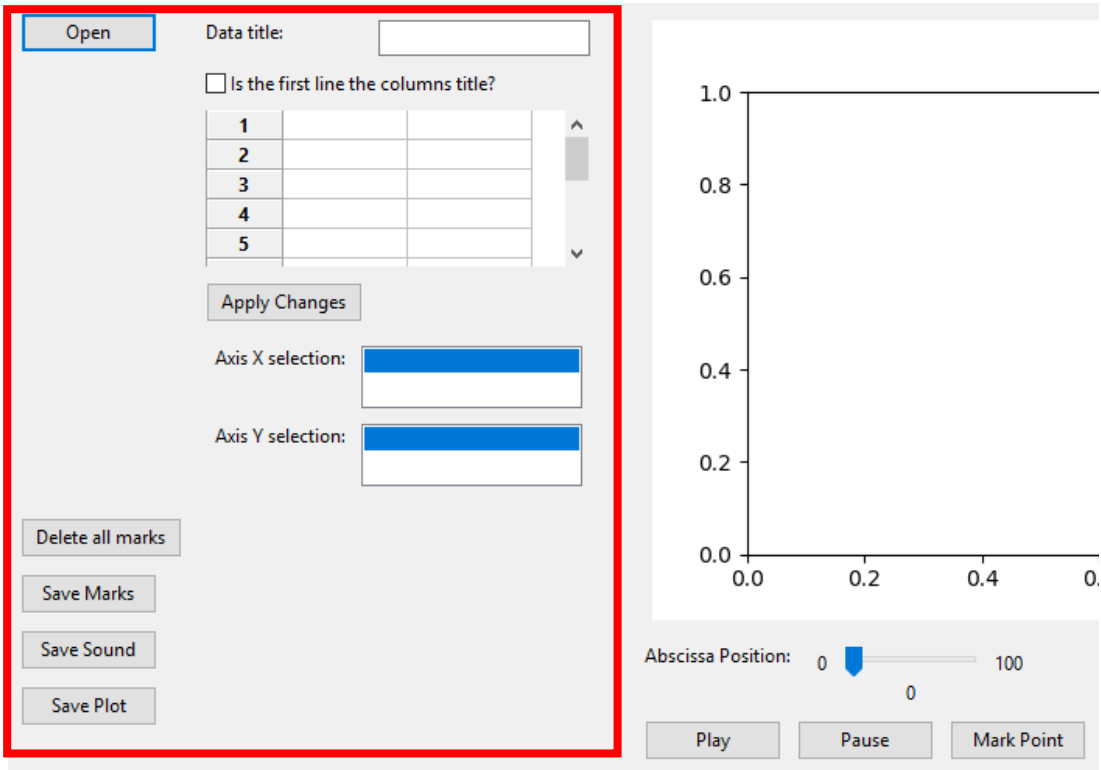


Image 70 - Show the file panel, where there are five buttons (Open, Erase all marks, Save Marks, Save Sound, Save plot) with the keyboard focus on the Open button and several elements that allow to set the titles and select the columns to plot.

In addition to the open and save buttons, the panel file contains some elements that allow the user to change the title of the data, include a new line on the grid if the data file don't have the columns title in the first row, change the columns titles and select which column plot as X axis and which as Y axis.

When import a file 'decrease' for example (this file is on the 'sample_data' folder), the data title text box shows the data file title, the first 11 data values are shown in the grid, and the first row values of each column are shown in the axis list selection (Image 71).

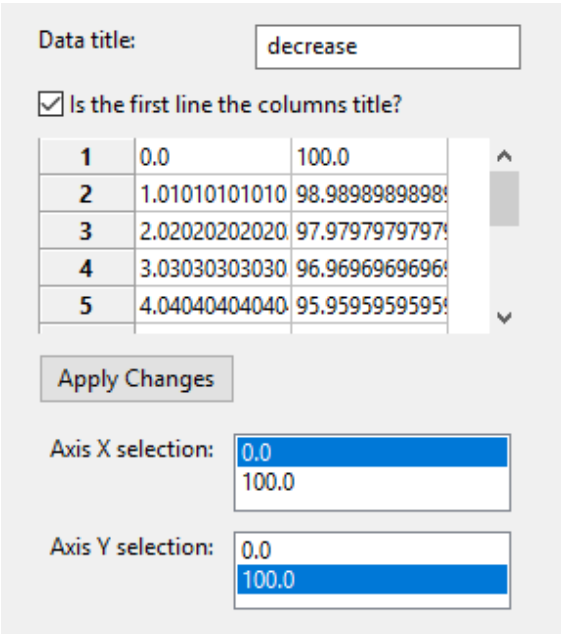


Image 71 - Shown the elements that allow to change the titles and select the axis with values of 'decrease' file.

The first row of this file don't contain the title of each column, the user can uncheck the verification box of 'Is the first line the columns title?' and this action create a new first row that allow the user to write the columns titles. Finally, to save the changes the user has to press the 'Apply Changes' button and the new columns titles have to be shown on the axis selections (Image 72).

Data title: decrease

☐ Is the first line the columns title?

1	X	Y
2	0.0	100.0
3	1.01010101010	98.9898989898
4	2.02020202020	97.9797979797
5	3.03030303030	96.9696969696

Apply Changes

Axis X selection: X
Y

Axis Y selection: X
Y

Image 72 - Shown the verification box unchecked and the new columns titles set by the user.

For the next example, a galaxy data file was download from the Sloan Digital Sky Survey database and opened with the software (Image 73). Link: <http://skyserver.sdss.org/dr15/en/tools/quicklook/summary.aspx?id=1237648720693755918>

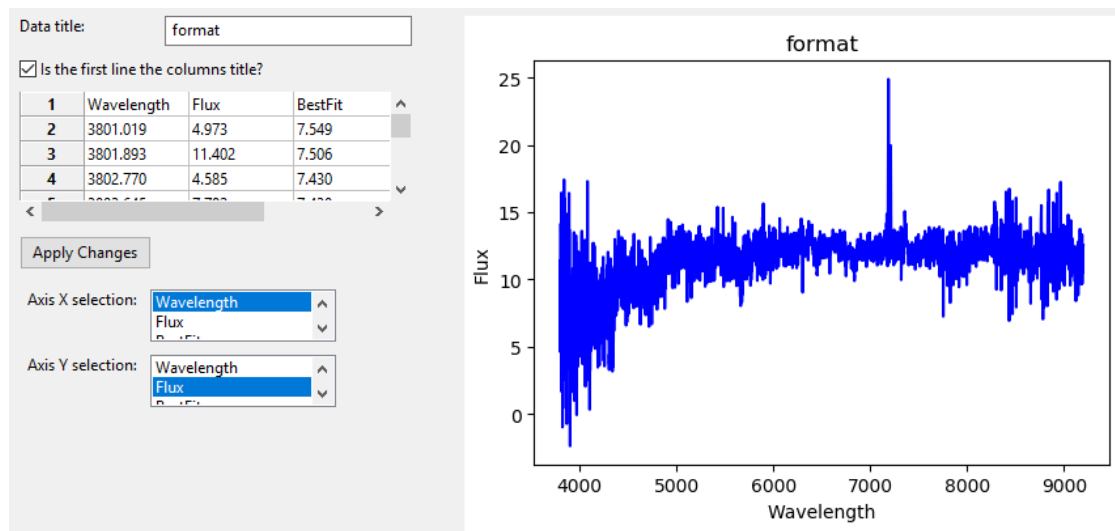


Image 73 - Show the download data opened on the software.

This new file has the column title on the first row, the user can modify the titles or change the column to plot, for example maintain Wavelength as X axis, and change to Best Fit on the Y axis (Image 74).

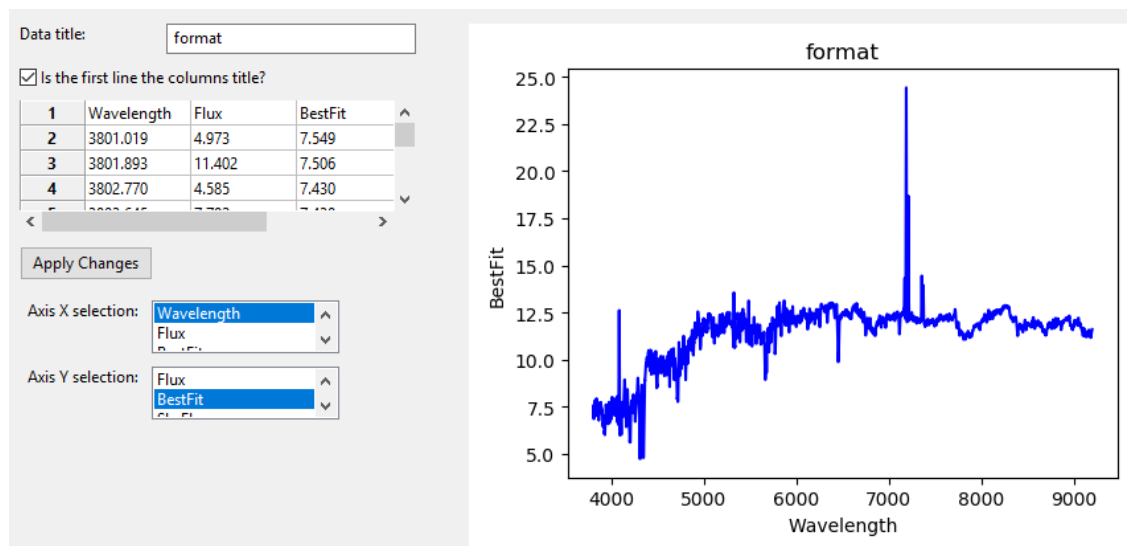


Image 74 - Show the change on the Y axis from Flux to BestFit.

NOTE: The user has to keep in mind that this changes only have effects on the software, the file opened didn't change and the changes made can't be saved on the software until close the session for now.

5.1.2. Erase all marks button

Before start with this functionality, we must explain that the sonoUno allow the user to mark points of interest on the data, and store the coordinates on a vector. This marks are shown with a vertical black line on the plot (Image 75).

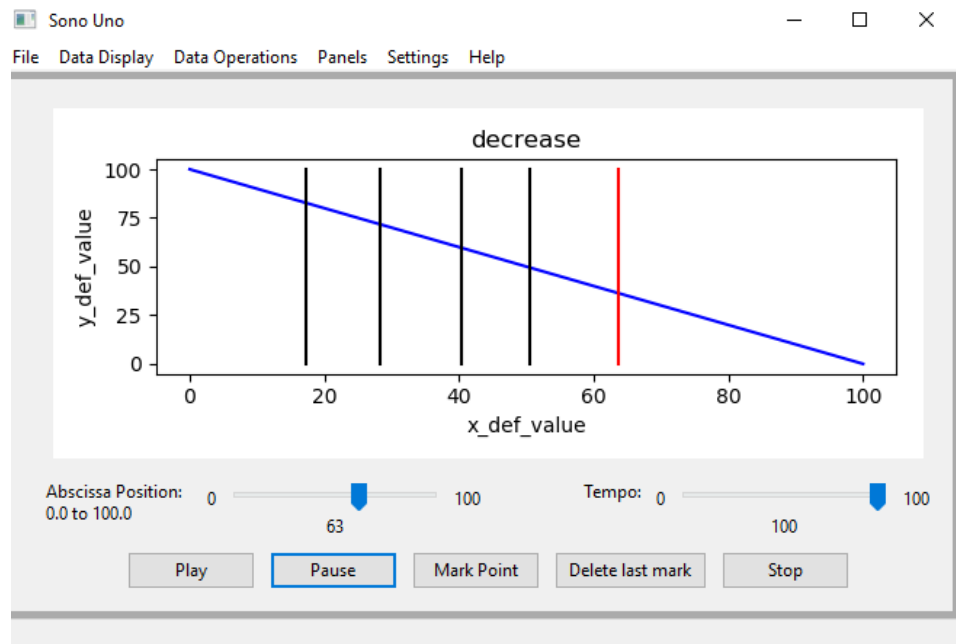


Image 75 - Display the sonoUno interface with an open data file, in the plot there are one vertical red line (position of the playing coordinate) and several vertical black lines (coordinates of the mark points).

The functionality of the item Delete all marks, placed on the menu file (Image 76), is to erase all the marks on the data without save anything.

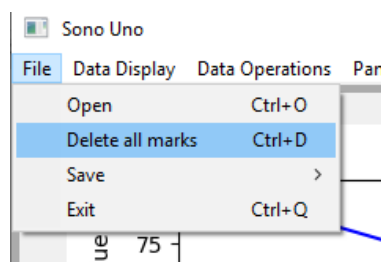


Image 76 - Show the items of the menu file and the keyboard focus on the item Delete all marks.

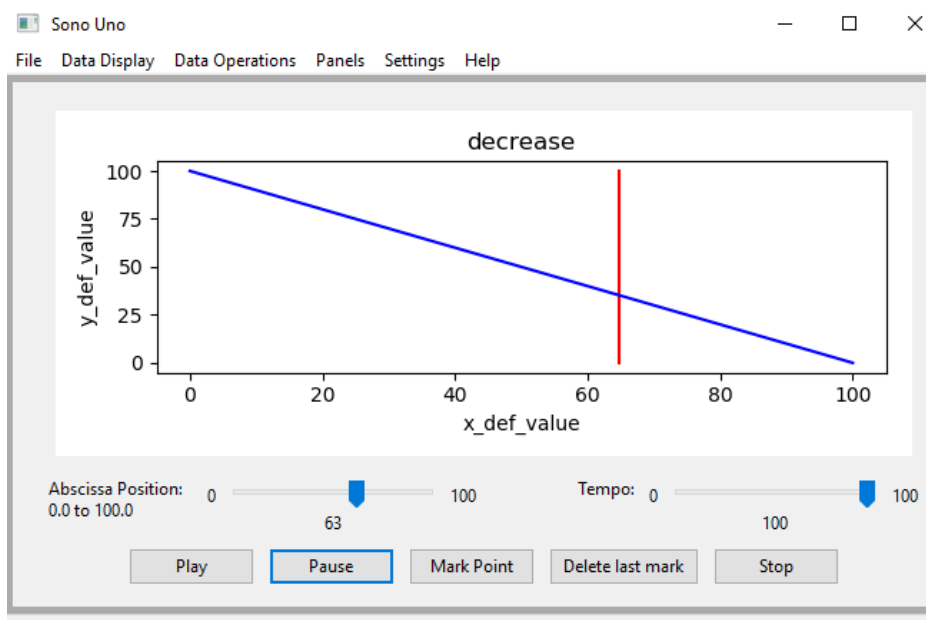


Image 77 - SonoUno interface with data plotted and the vertical red line. The vertical black lines were erased after use the Delete all marks button.

Since the marks vector is deleted with that action, the marks on the data plot are deleted too. Now, on the graph there are the data and, if the position is different to initial, also the vertical red line (Image 77).

In addition, other way to delete the marks is to use the button Delete all marks placed on the file panel. To show the file panel you have to select the item File on the menu Panels (Image 69). The panel with the five button is on the top-left of the user in the sonoUno framework.

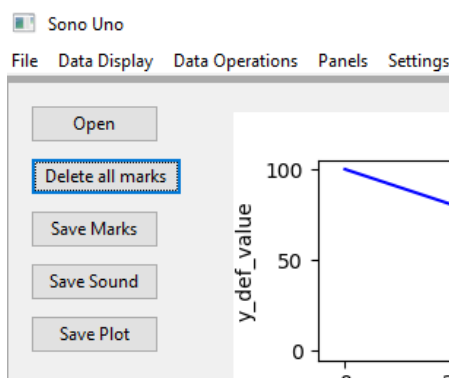


Image 78 - Show the panel file with its five buttons, the keyboard focus is on Delete all marks button..

5.1.3. Save files

There are two ways to save files: one is in the file menu, the save submenu; and the other is with the button placed on the file panel (Image 78), witch one have to be shown with the File item in the Panels menu. The both methods have the same results.

Before continue with the save methods, remember that the software allows to do marks of interest on the data, saving the coordinates (Image 79), this topic is explain in the corresponding section, we mention it here because in the next lines is described the save method of the marks.

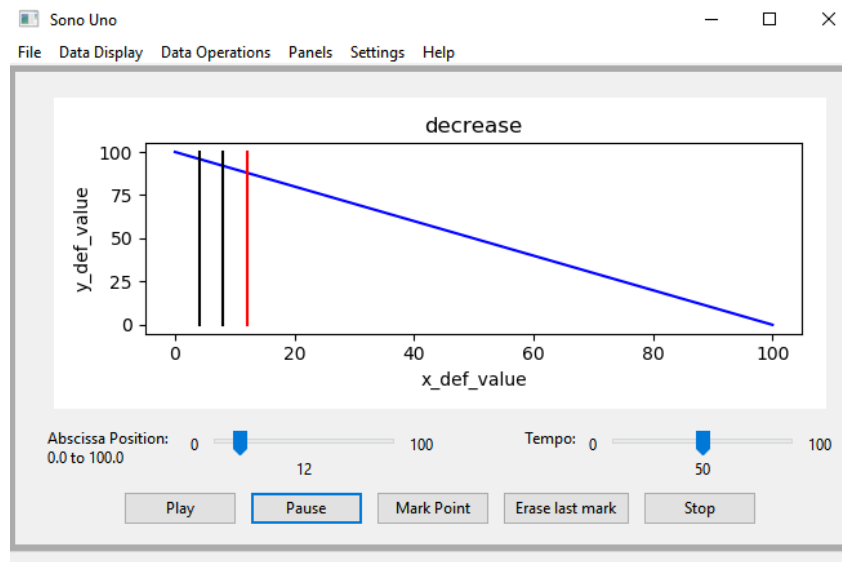


Image 79 - Shown the sonoUno interface with the vertical red line, indicating the reproduction position, and to marks on the data, which are indicated with two vertical black lines.

One of the save options is to save the coordinates marks on the data. To do that the user have to press the save marks item, placed on the save submenu on the file menu (Image 80), or press the save marks button on the file panel on the left of the window (to enable the panel press the file item on the panels menu) (Image 81).

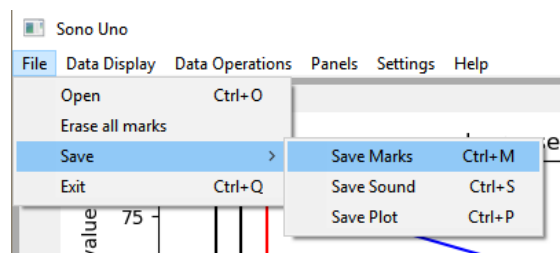


Image 80 - Show the save submenu selected in the menu file. Inside the save submenu there are three items, the save marks item has the focus keyboard.

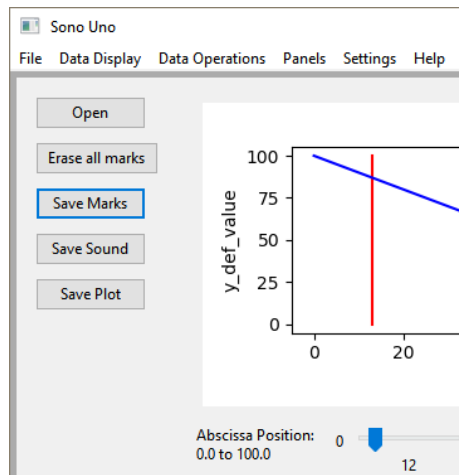


Image 81 - Show the file panel enabled on the left of the interface, where the save marks button has the focus keyboard.

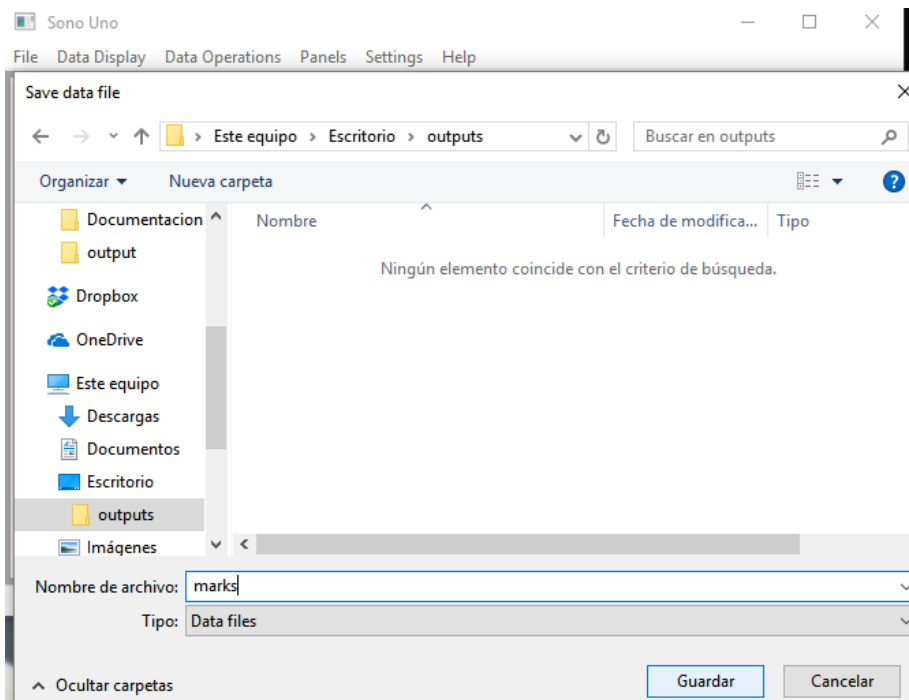


Image 82 - Pop-up window of the computer file system, where the user can select the destination folder of the save file.

The save marks option shows a pop-up window of the file system (Image 82) that allow the user to select the directory and the name of the destination text file. After save them, the marks are deleted from the sonoUno and the plot (Image 83).

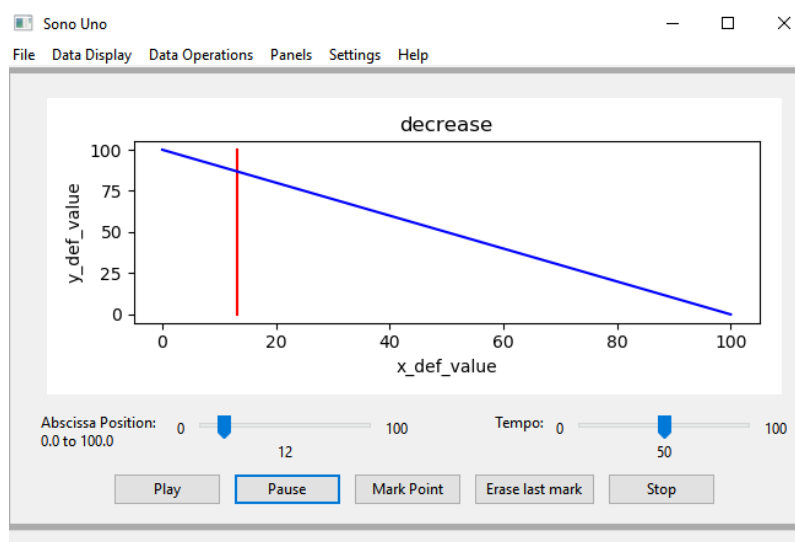


Image 83 - Show the interface after save the marks, the coordinates data and the vertical black lines were deleted from the software.

Other save option is the sound of the data. The software will save the sound corresponding to the actual data plot. In order to save the sound, the user have to press the save sound item on the save submenu of the file menu (Image 84), or the button save sound on the file panel on the left of the window (to enable the panel press the file item on the panels menu) (Image 85). Until now, the sound stored have a predefined tempo, different from the tempo set by the user. Besides, the only instrument to save the sound is Piano.

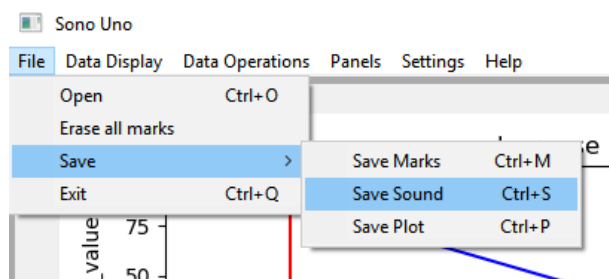


Image 84 - Show the second option on the save submenu from the file menu, which is the save sound item.

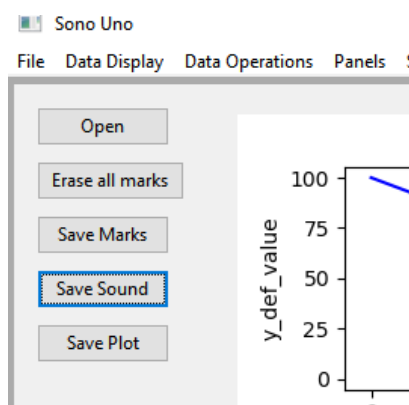


Image 85 - Show the save sound button placed on the file panel, on the left of the software window.

Like the first save option, the save sound element shows a pop-up window of the file system, where the user can choose the directory and the name of the file to save (Image 86).

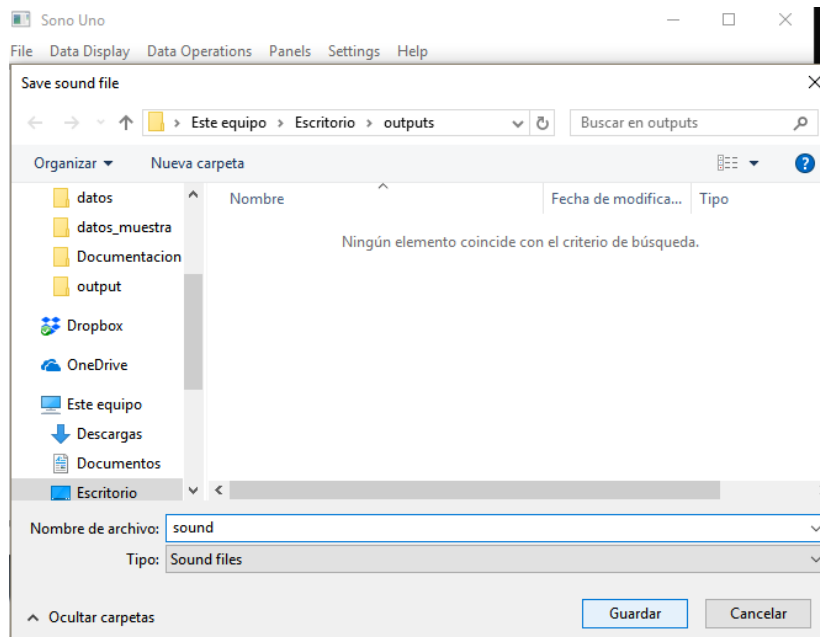


Image 86 - Pop-up windows shown after press save sound, allow the user to select the destination folder and the name of the file to save.

Finally, the user can save the plot with the save plot item on the save submenu of the file menu (Image 87), or the button save plot on the file panel on the left of the window (to enable the panel press the file item on the panels menu) (Image 88).

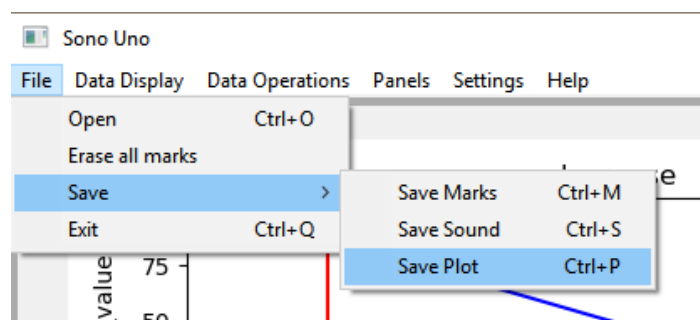


Image 87 - Show the last option of the save submenu from the file menu, which is save plot item.

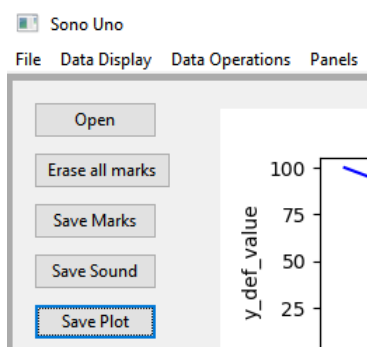


Image 88 - Show the save plot button placed on the file panel in the left of the sonoUno framework.

The save plot element show a pop-up windows like the others, which allow to set the directory and the name of the file to save (Image 89). To save the file press save on the pop-up window or the enter key.

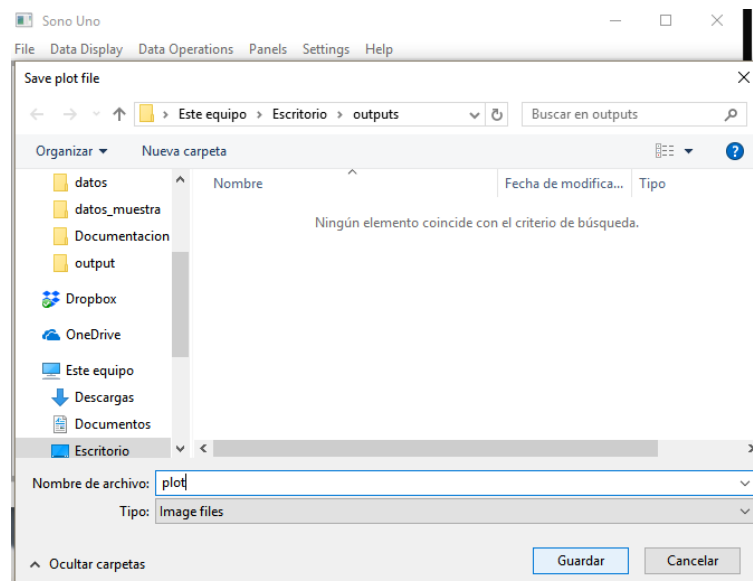


Image 89 - Pop-up windows shown after press save plot, allow the user to select the destination folder and the name of the file to save.

The stored files have defined extensions, the coordinates are save on csv format, the plot on png and the sound on MIDI. As an example, an image is shown with the three files on a folder named outputs (Image 90), the icon is assigned by the operative system and the name by the user.

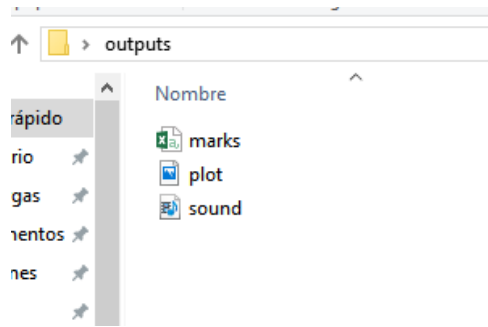


Image 90 - Show a folder named outputs with the three saved files on the file system.

If the user opens the coordinate file with a text editor like notepad++ (Image 91), the program show two column separate by coma. The first row is the name of the coordinate, for the example is x and y, and the next rows are the coordinates.

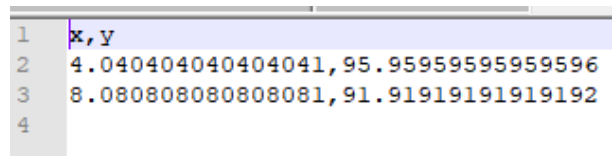


Image 91 - Show the coordinates file saved with the button save marks. Inside the file the user can see two columns separated by a coma with the coordinates saved.

There is an image of the plot too (Image 92). The plot file is opens with the Windows photo viewer. In addition, the Image 93 show the sound file on the Windows Media Player. Is important that the player has the codec for MIDI format, if not the file will be produce an error.

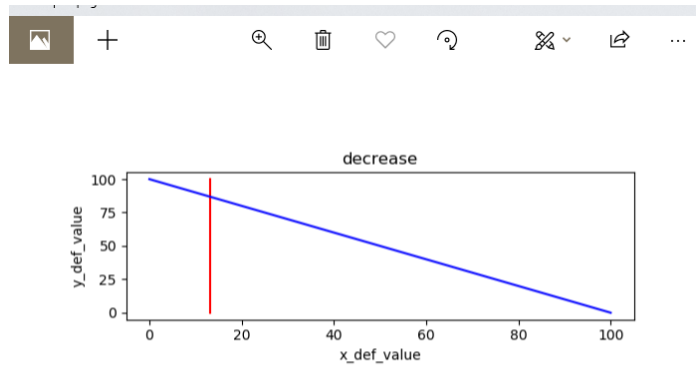


Image 92 - Show the file of the saved plot, opened with the photos viewer of the Windows operative system.

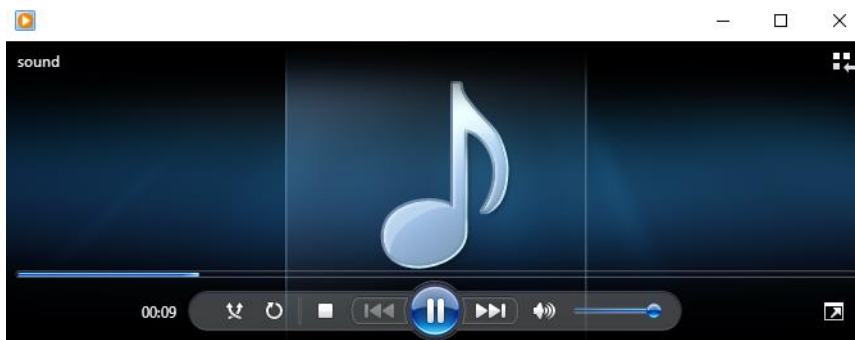


Image 93 - Show the Windows Media Player reproducing the saved MIDI file.

5.1.4. Exit the sonoUno

One way to exit the program is to press the X button on the top right of the window (Image 94). Another way is press the exit item on the file menu (Image 95) or the shortcut key 'Ctrl+Q'.

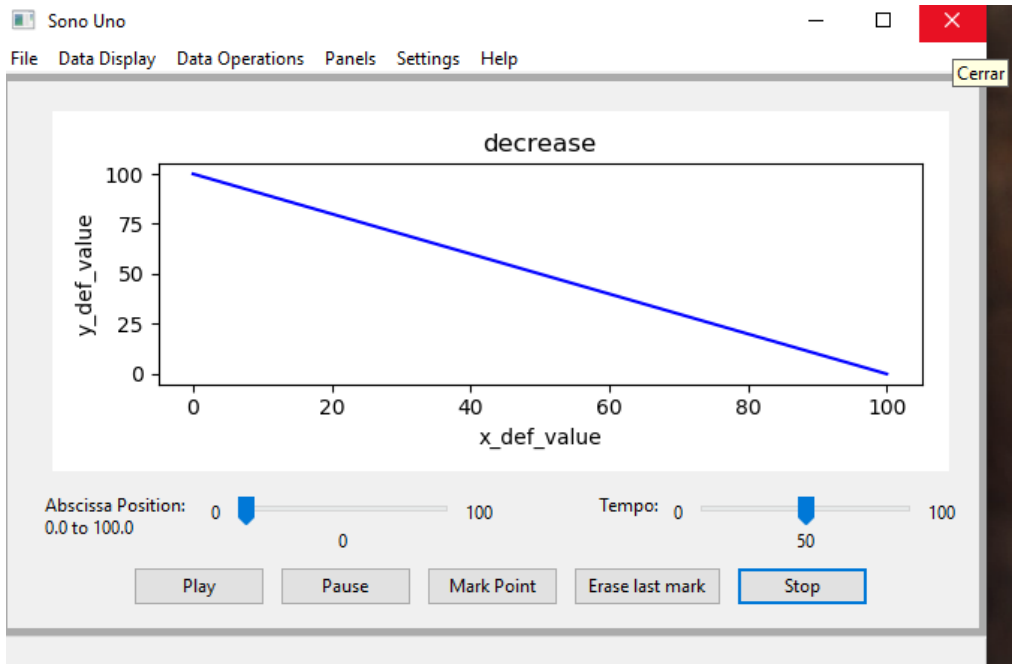


Image 94 - Show the sonoUno interface with the mouse cursor on the X button on the top right position of the window.

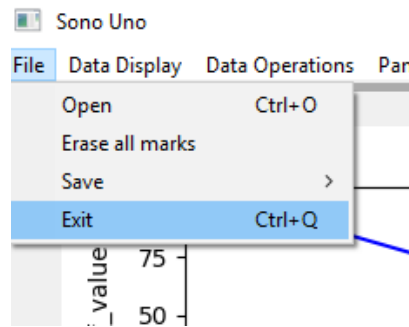


Image 95 - Show the file menu and the focus keyboard is on the exit item.

5.2. Reproduction options

5.2.1. Abscissas position

This functionality allows the user to move the position vertical red line through the data, indicating the position to reproduce when the button play is pressed. In order to do that, the element is a slide bar under the plot (Image 96), the positions of this slider are the number of rows of the data file. For example, if the slider is in 14 position, the vertical red line will be on the value of the first column on the 14 position, in this example is between the values -2 to -1.

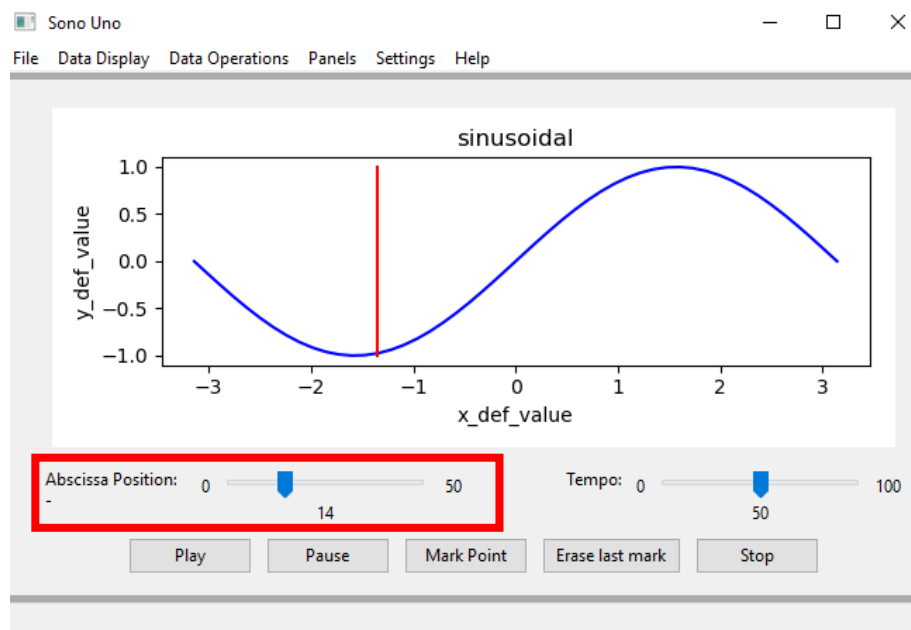


Image 96 - The abscissa position slider is place on the left under the plot (red rectangle), the position of the slider corresponds with the vertical red line on the plot.

Another way to access the abscissa position is with the abscissa position item on the data display menu (Image 97), or the shortcut key 'Shift+A'. The two actions set the keyboard focus on the previous label of the slider element on the sonoUno framework. Then the user can press the tabulation key to access to the abscissa slider. On the slider, the user can change the value with the mouse or the arrow keys.

The abscissa position slider can be modified before, during and after the reproduction of the data. If the reproduction is in progress, after the change the reproduction continues from the new set value.

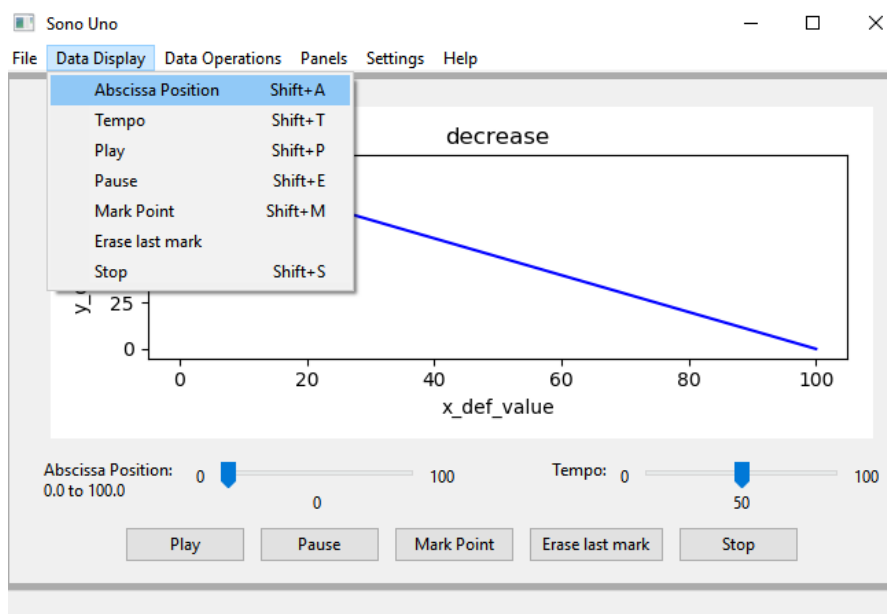


Image 97 - Show the data display menu with its seven items, the keyboard focus is on the first, which is the abscissa position item.

5.2.2. Tempo selection

This functionality allows to select the tempo of the reproduction of the sound, varies between 0 and 100, being 100 the fastest and 0 the slowest time. The maximum corresponds with a tempo of a second approximately, and the minimum is around 200 milliseconds to ensure the good function of the software on the three platforms (Windows, Linux and Mac).

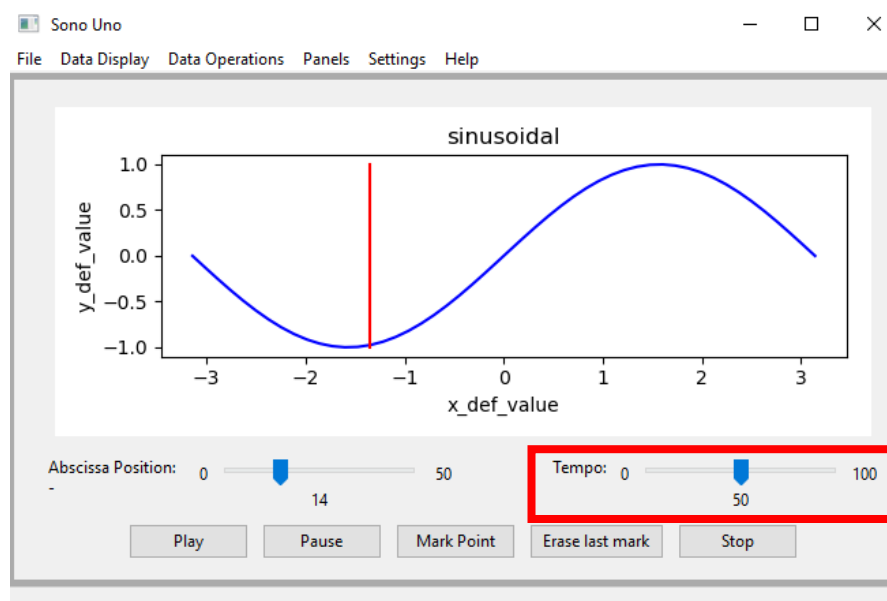


Image 98 - The tempo slider is on the right under the plot (red rectangle).

The tempo element is a slider with a label, placed under the plot and to the right of the abscissa slider (Image 98). The operation is analogous to the abscissa position slider.

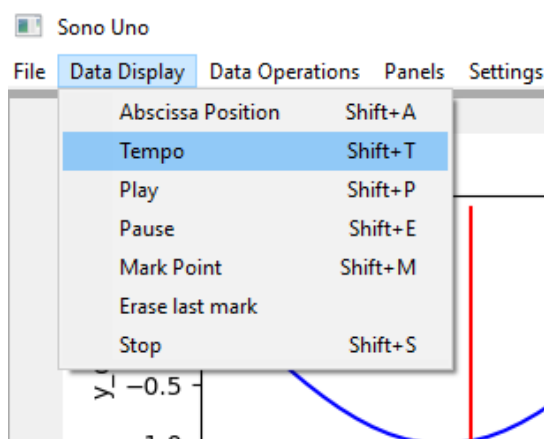


Image 99 - Show the data display menu with its seven items, the keyboard focus is on the second, which is the tempo item.

A second way to access the tempo slider is with the item tempo on the data display menu (Image 99), or the shortcut key 'Shift+T'. Those actions set the keyboard focus to the label of the tempo slider. Then the user can use the tab key to access to the tempo slider.

5.2.3. Play button

Is the first button of data reproduction. When is pressed start the reproduction of the data, the vertical red line and the abscissa position slider start to go forward, indicating the position of the playing coordinates.

NOTE: Each instrument has limited tones, for that if the Y axis have more values of that number of tones, the user can perceive that two near values have the same tone assigned. For example, the piano has 85 tones and the linear function of the example has 100 values.

The play button is located in the bottom left of the window (Image 100), under the sliders of position and tempo. This is the first of the reproduction button.

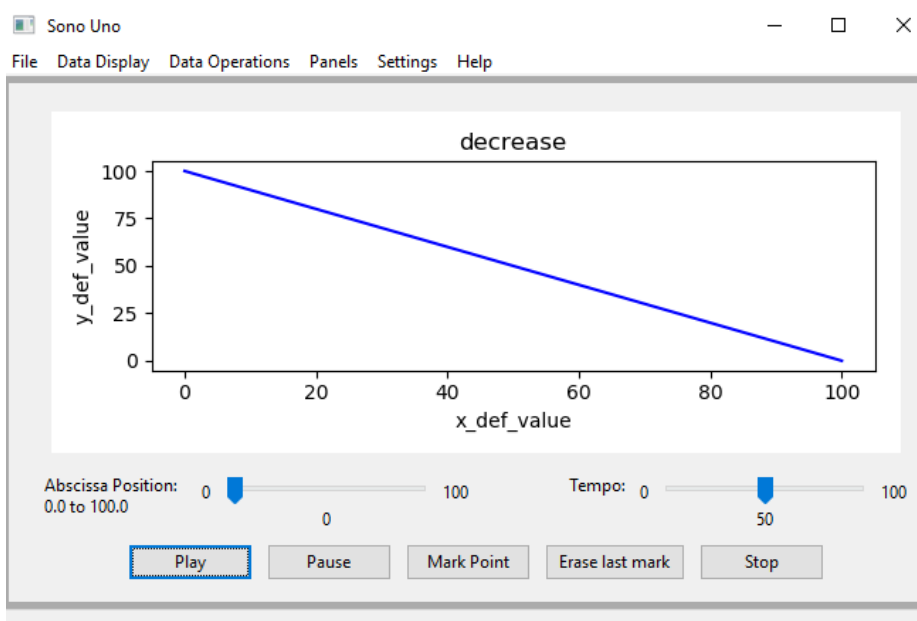


Image 100 - The play button is found on the bottom left part, under the abscissa position slider. It's the first of the reproduction button.

Other way to start the reproduction is with the play item on the data display menu (Image 101), or the shortcut key 'Shift+P'. This item differs from the previous two, because when is pressed produce the effect directly, without modify the keyboard focus.

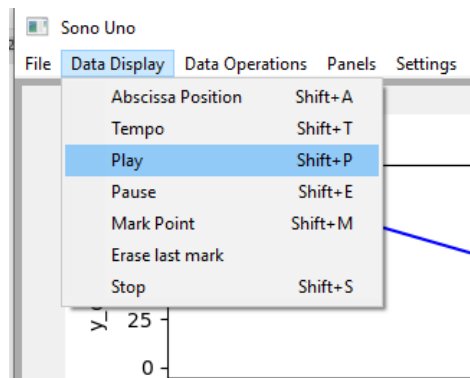


Image 101 - Show the data display menu with its seven items, the keyboard focus is on the third, which is the play item.

5.2.4. Pause button

It is the second reproduction button, it's function is to pause the reproduction of the data, maintaining the vertical red line position to be able to continue later with the play button. The pause button is placed to the right of the button play, under the sliders of abscissa and tempo (Image 102).

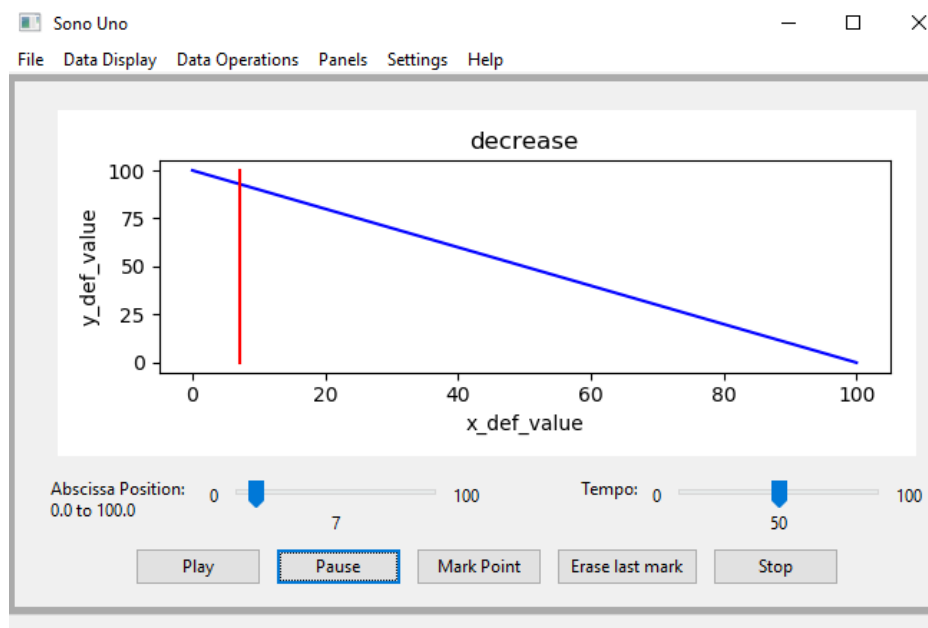


Image 102 - The pause button is found on the bottom left part, under the abscissa position slider and after the play button. It's the second of the reproduction button from left to right.

Other way of pause the reproduction is with the item Pause on the data display menu (Image 103), or the shortcut key 'Shift+E'. The two options do the action without modifying the keyboard focus.

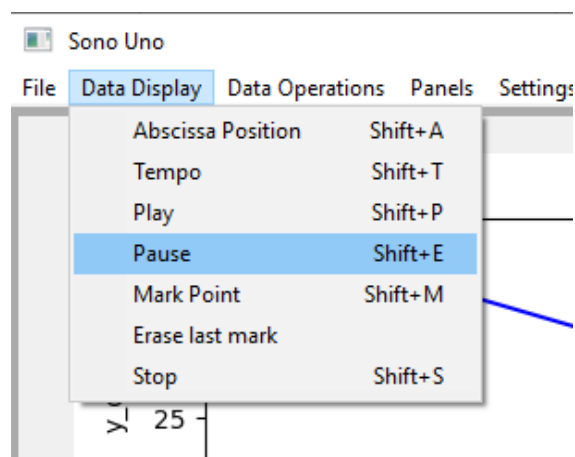


Image 103 - Show the data display menu with its seven items, the keyboard focus is on the fourth, which is the pause item.

5.2.5. Mark point button

It is the third reproduction button, allow the user to mark a specific coordinate from the data. When the button is pressed save the current position on a vector and plot it with a vertical black line. The position on the frame is on the center bottom, under the sliders of abscissa and tempo (Image 104).

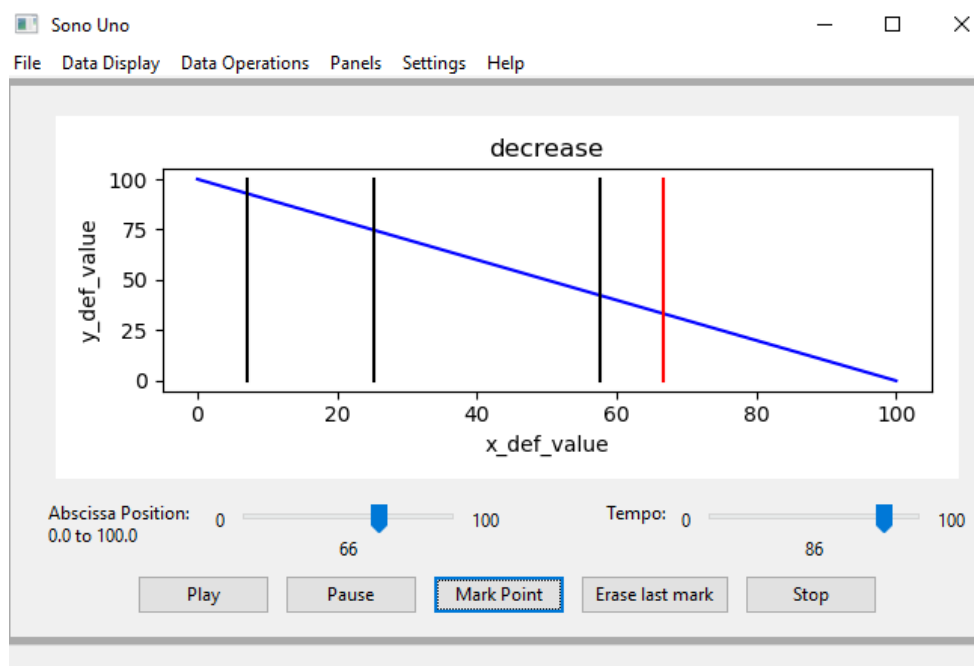


Image 104 - The mark point button is found on the bottom center part, under the sliders and after the pause button. It's the third of the reproduction button from left to right.

Parallel, the user can mark a point on the graph with the item mark point of the data display menu (Image 105), or the shortcut key 'Shift+M'. Both methods do the same action directly without modifying the keyboard focus.

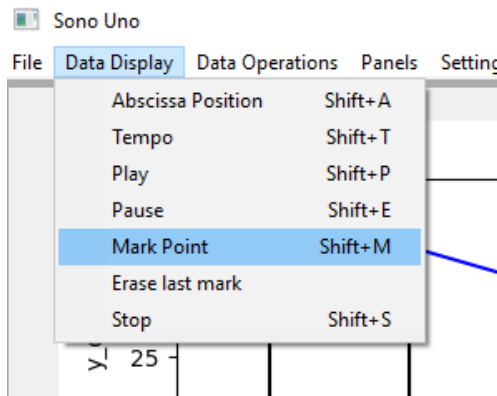


Image 105 - Show the data display menu with its seven items, the keyboard focus is on the fifth, which is the mark point item.

5.2.6. Delete last mark button

This functionality allows the user to erase the last mark made with the mark point element. It's useful when the user has made a mark without this intention or the place is incorrect. The button is placed on the right bottom of the window, it's the forth button of reproduction, after the mark point button and before the stop button (Image 106).

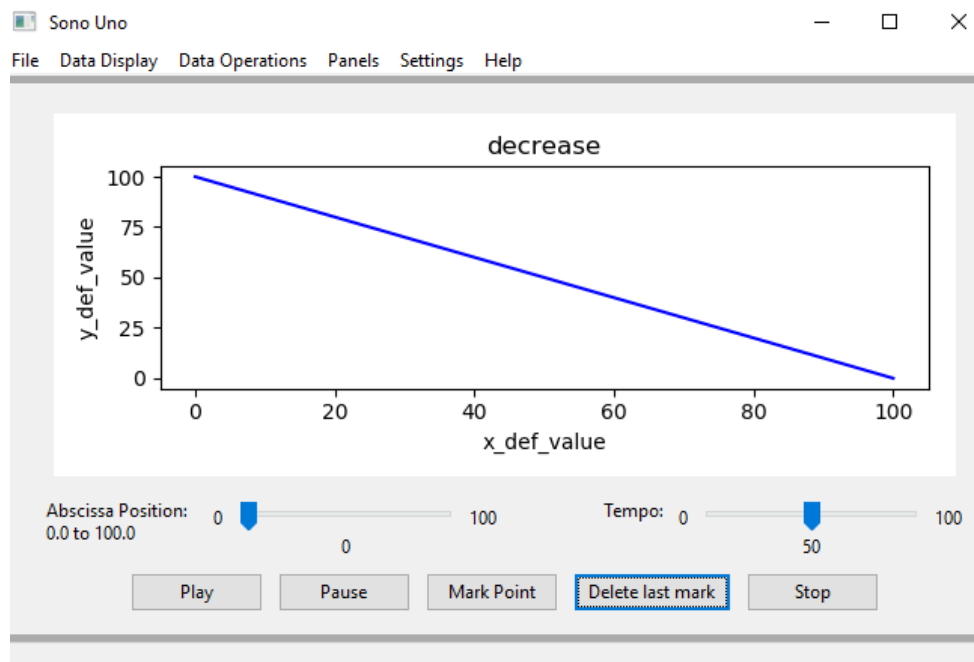


Image 106 - The delete last mark button is found on the bottom right part, under the tempo slider and after the mark point button. It's the fourth of the reproduction button from left to right.

Another way to erase the last mark point is with the item delete last mark from the data display menu (Image 107), or with the shortcut key 'Shift+D'.

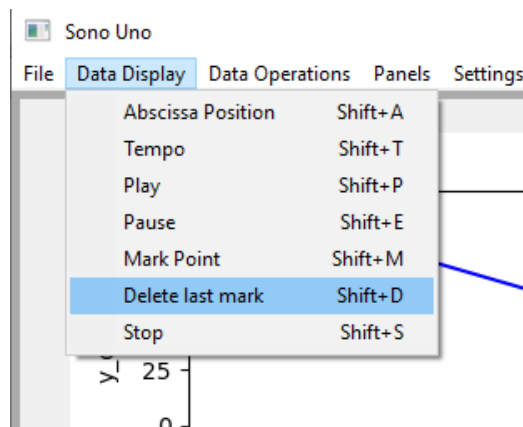


Image 107 - Show the data display menu with its seven items, the keyboard focus is on the sixth, which is the delete last mark item.

5.2.8. Stop button

It is the last reproduction functionality. Its function is to stop the reproduction of the data restarting the process, which means that set the abscissa position to zero and delete the vertical red line from the plot. The button is placed on the right bottom of the windows, is the fifth and the last, after the delete last mark button (Image 108).

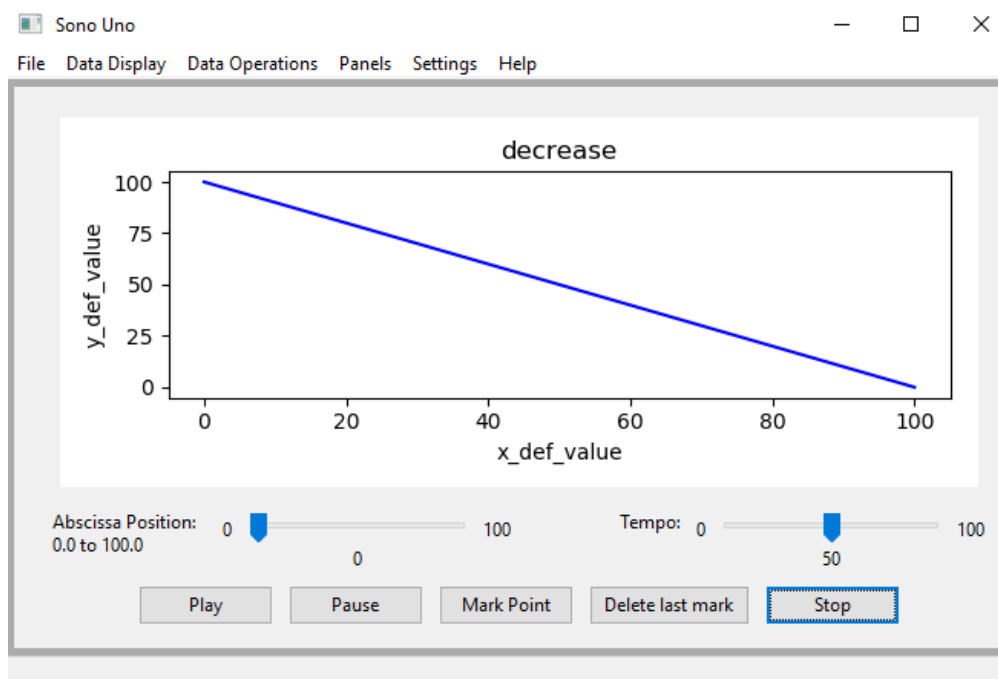


Image 108 - The stop button is found on the bottom right part, under the tempo slider and after the delete last mark button. It's the last of the reproduction button from left to right.

Other way to stop the reproduction is with the stop item from the data display menu (Image 109), or with the shortcut key 'Shift+S'.

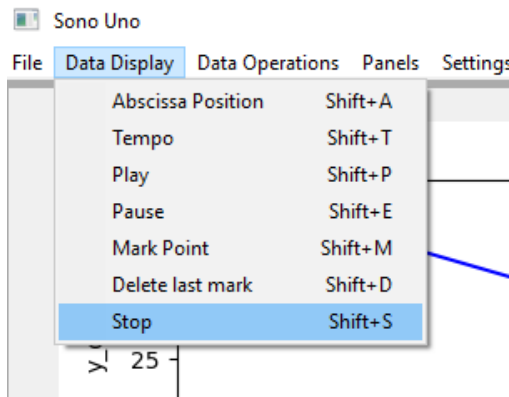


Image 109 - Show the data display menu with its seven items, the keyboard focus is on the last, which is the stop item.

5.3. Data management options

5.3.1. Cuts on the abscissas axis

The sonoUno presents some possible operations with the data. In this case, it is explained the abscissas cut function, which allow to cut the abscissas axis between the data limits and select a range of interest. One ways to access the cut sliders is from the horizontal limit submenu of the data operation menu (the items are lower limit for the horizontal inferior limit and upper limit for the horizontal superior limit) (Image 110). Each one of the actions enable the sliders and mathematical functions panel and set the keyboard focus on the respective label, then with the tab key or the mouse the user can focus on the slider.

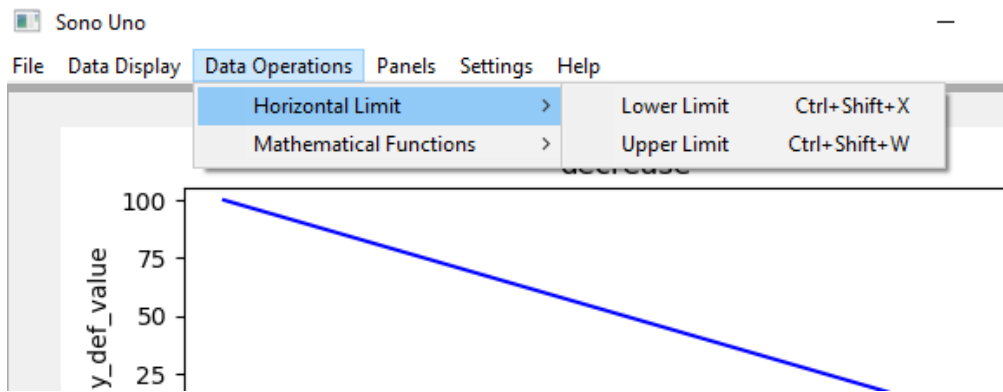


Image 110 - Show the horizontal limit submenu of the data operations menu, where are two options: lower limit and upper limit.

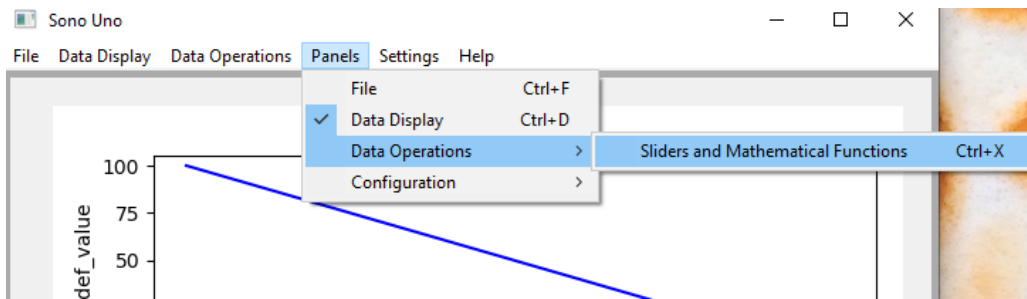


Image 111 - Show the data operation submenu of the panels menu, where the user can enable and disable the sliders and mathematical functions panel with the item of the same name.

The second way to access the cut sliders is enable the corresponding panel with the sliders and mathematical functions item on the Data operation submenu from the panels

menu (Image 111). When this item is checked the cut sliders and mathematical functions panel is shown, this panel is placed under the reproduction buttons described above (Image 112).

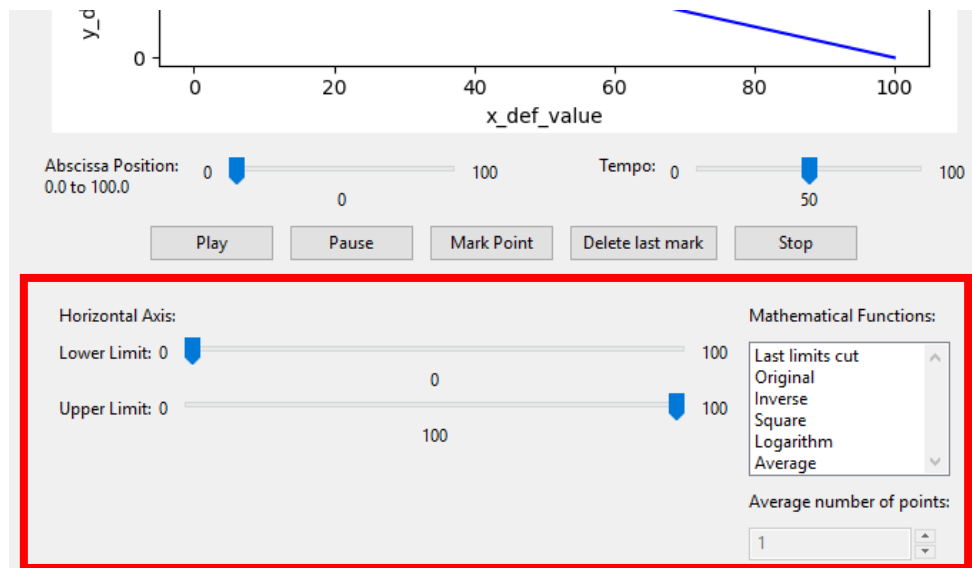


Image 112 - Show the panel of sliders and mathematical functions in a red rectangle. Inside this section the user can find the cut sliders and some predefined mathematical functions.

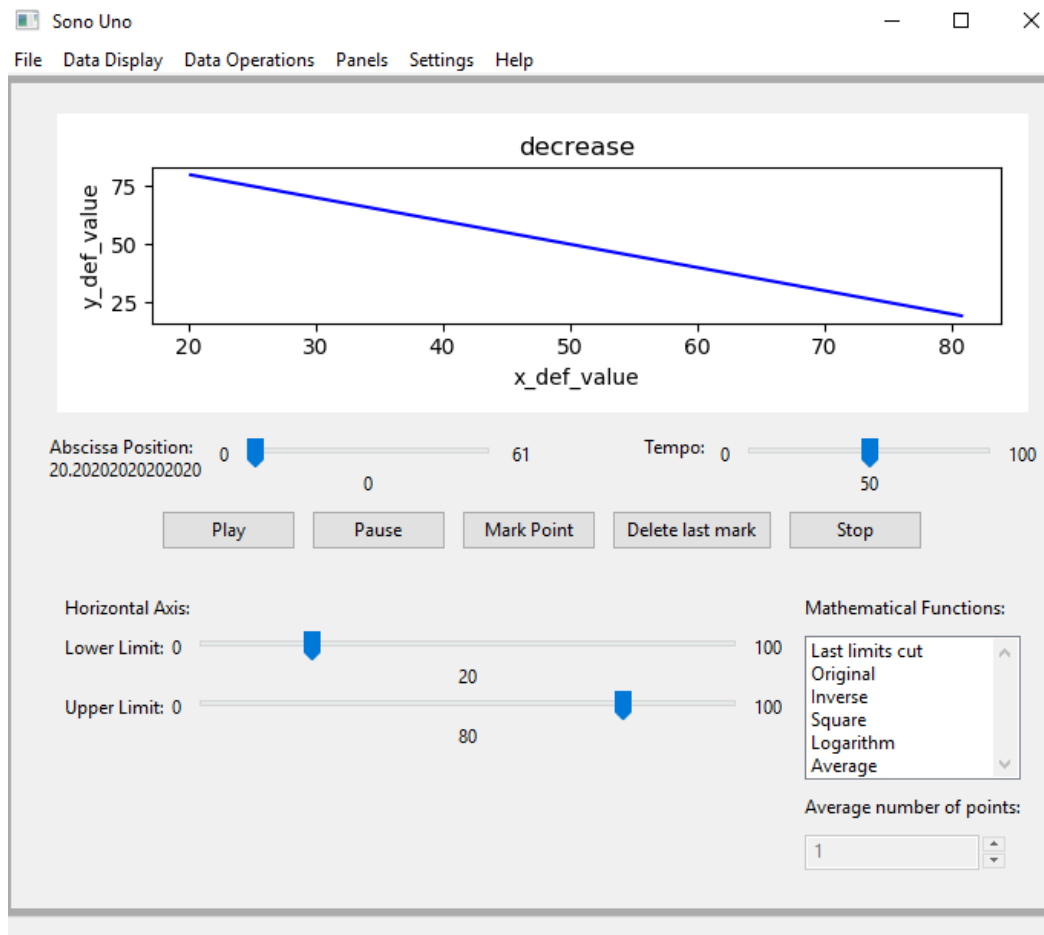


Image 113 - Show an example of the cut sliders, the lower limit is set to 20 and the upper limit is set to 80. The user can perceive the changes on the cut sliders and the plot.

The left part of the mentioned panel contains the cut sliders, those sliders can be set by the mouse or the arrows keys. Is important that the lower limit not be upper that the upper

limit or vice versa, if that is the case there are not visible error but the sliders do not modify the limits on the plot.

The Image 113 is an example of cut limits, the inferior cut value is 20 and the superior cut value is 80, in a decreasing function of 100 values. It must be notice that when the user does a cut on the data, the plot is updated to the new values for refill the available space.

5.3.2. Predefined mathematical functions

In this section other possible data operations are shown, those are some predefined mathematical functions like the inverse, the square, the logarithm and the average. In the last, the user must indicate the number of values to consider for calculate the average.

There are two ways to access the mathematical functions, one is with the mathematical functions item from the data operations menu (Image 114), which have the functions items; the other way is with the sliders and mathematical functions item from the data operation submenu in the panels menu (Image 111). The items on the submenu mathematical functions and the items from the mathematical functions list on the sonoUno framework (Image 115) do the action when each one is pressed. The average item enables the number of points text box for select the number of values to be consider on the average calculus, by default is 1.

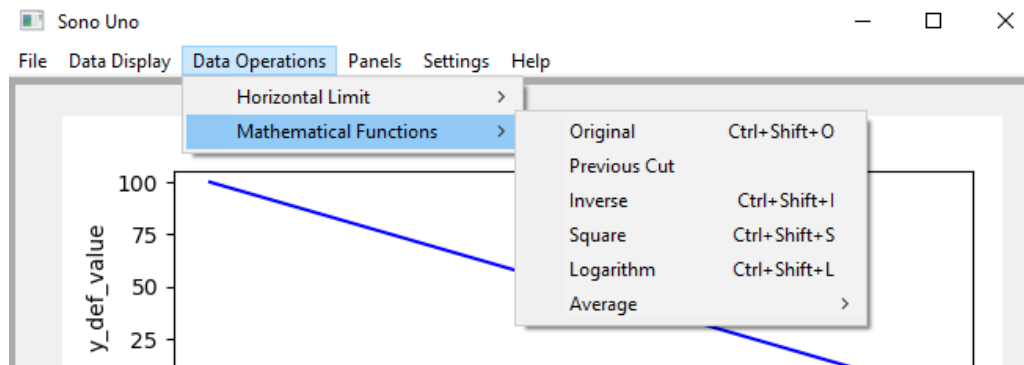


Image 114 - Show the mathematical functions submenu of the data operation menu, with its six items of the predefined functions.

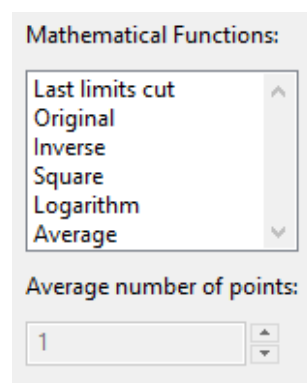


Image 115 - Show the list of predefined mathematical function, are the same of the previous image. The text box of the bottom will be enable with the average function and allow to set the number of points.

Coming up next, the mathematical functions are applied to a decreasing function with 100 values. The example starts with the decreasing function, lower limit set to 20 and upper limit set to 80.

The functionality named 'Original' allow to restore the plot to the original data without modifying the cut limit sliders. It's useful for display the original data with the previous horizontal cut stored (Image 116).

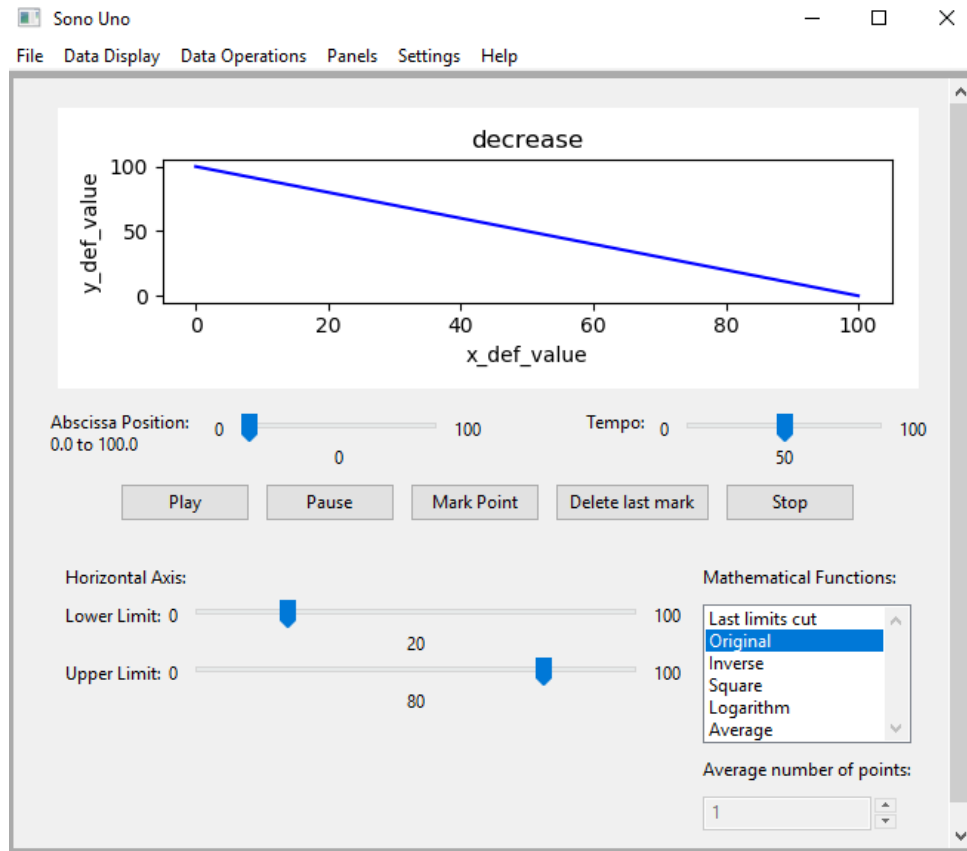


Image 116 - The original function is selected, the cut limit sliders remains on the same position but the limits of the data on the reproduction and plot are the original.

The functionality named 'Last limit cut' is to recover the last cut limits values set by the user (Image 117). When is pressed after the 'Original' function, the plot is redraw with the previous upper and lower limits. On the example the upper limit is 80 and the lower limit is 20. Is useful to alternate with the original function, the user must to have in mind that is not possible to restore a previous cut value after change a cut slider.

The inverse function reverses the ends of the ordinate axis (Image 118). It's notice that all the mathematical functions are calculated based on the original data. The next function performs the square root to the original data (Image 119). The logarithm item apply this function to the original data (Image 120). Finally, the average function use the number of point entered by the user for group the data and calculate the average on the original data. In the example the number of point is six (Image 121).

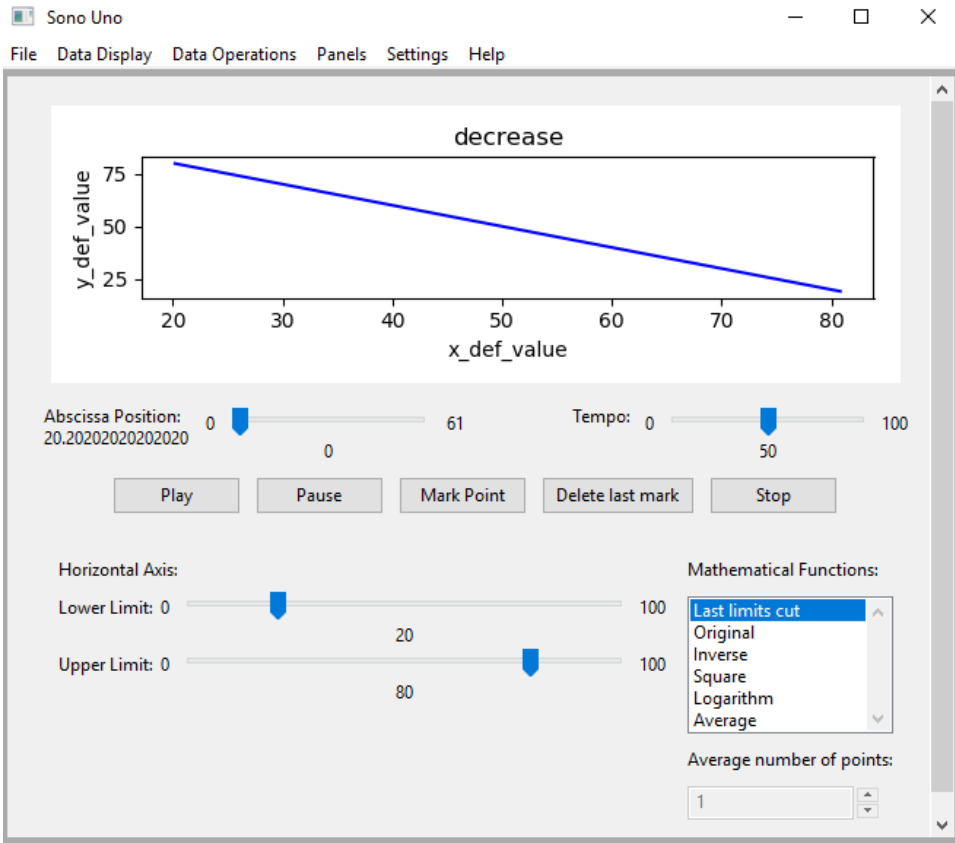


Image 117 - The last limits cut is selected, the data for the reproduction and the plot have the same limits of the cut sliders again.

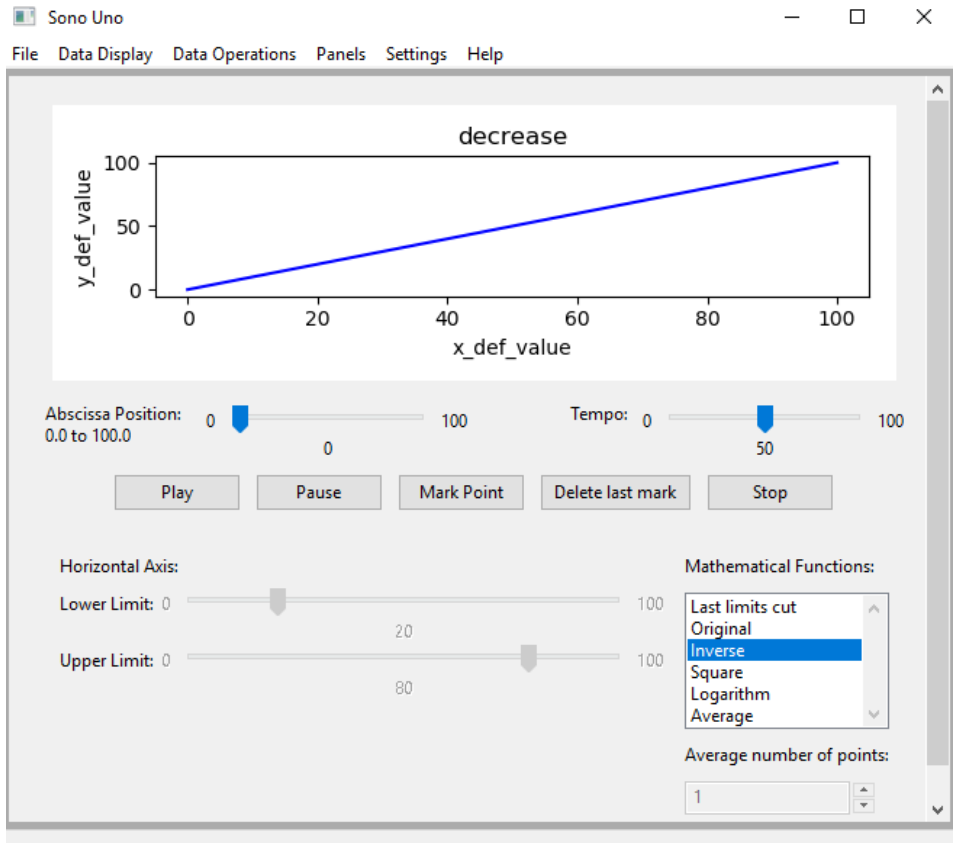


Image 118 - The inverse function is selected, the data has been reversed with respect to the ordinate axis.

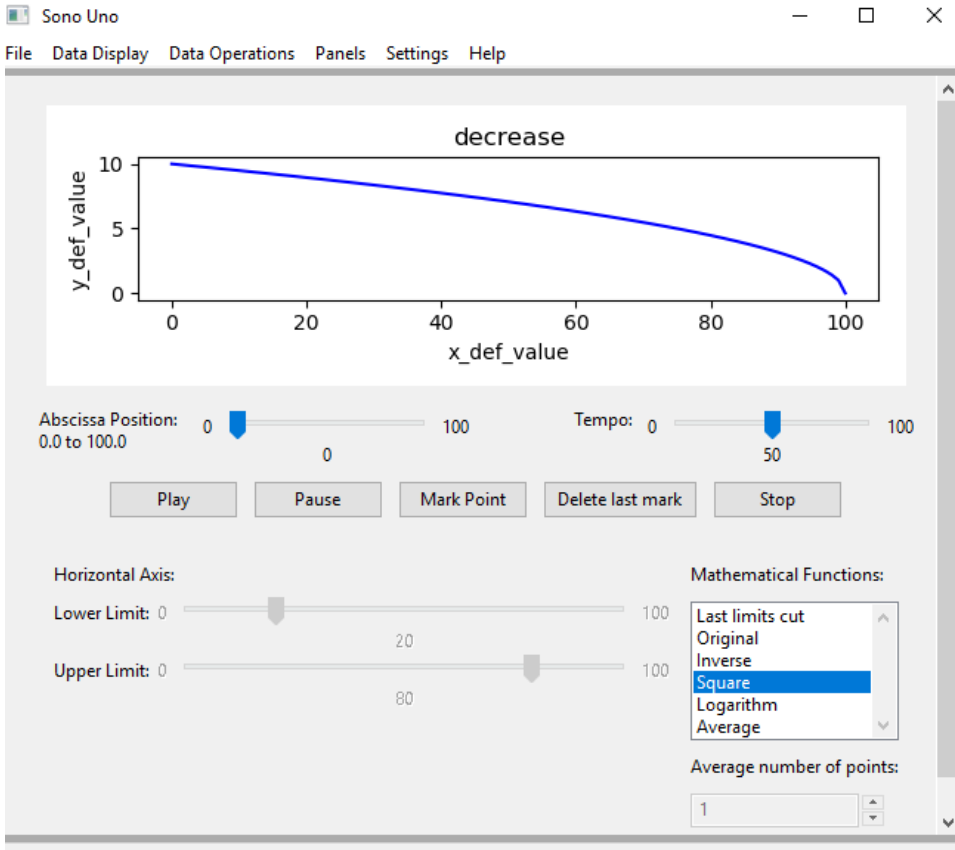


Image 119 - The square function is selected. The image shows the square of the decreasing function.

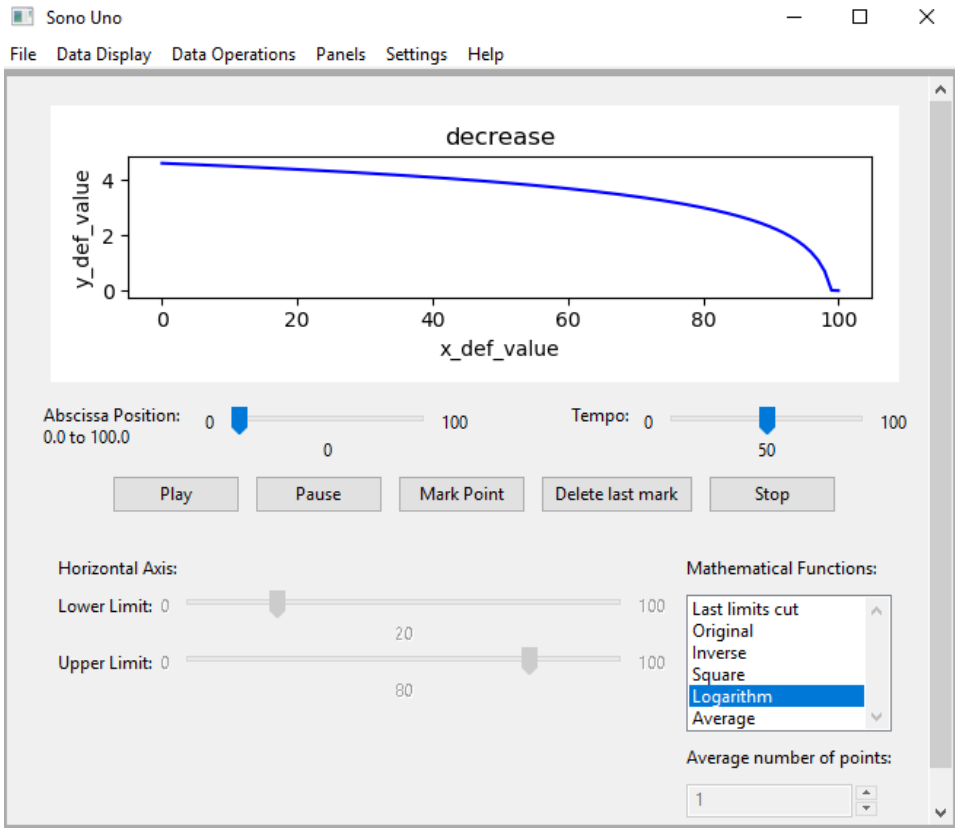


Image 120 - The logarithm function is selected. The plot shows the logarithm of the decreasing function.

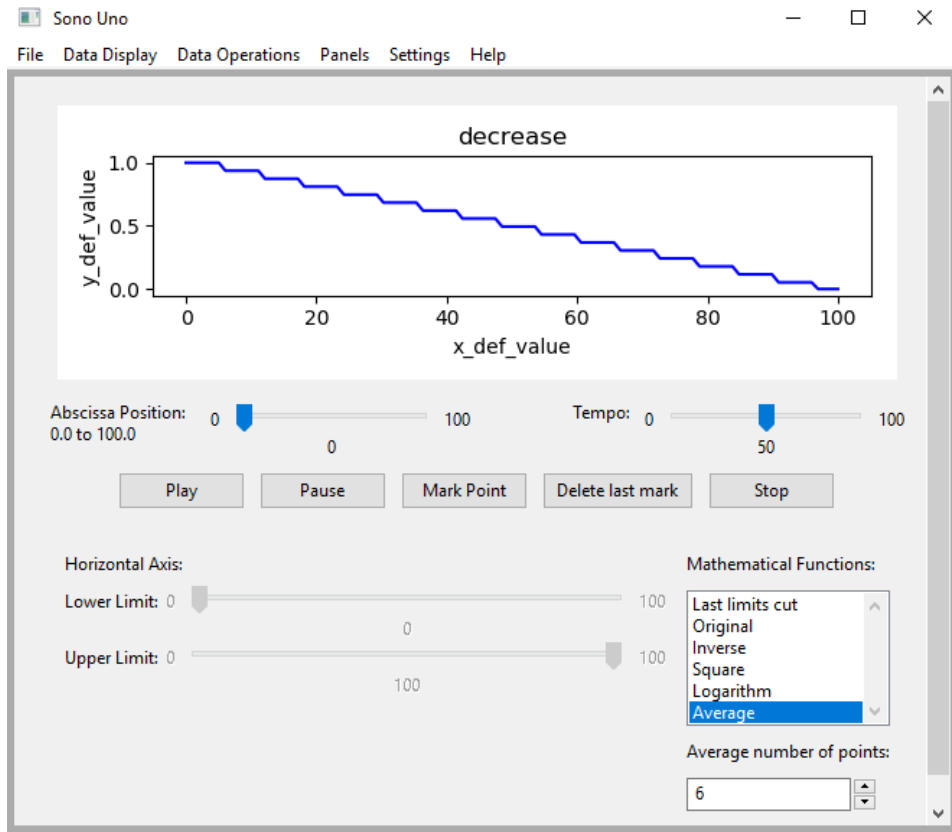


Image 121 - The average function is selected. The text box under the mathematical functions list are enable. In the image the number of points to set the average are six.

5.4. Configuration options

The sonoUno allow the user to adjust some sound and plot settings, these functionalities are in the settings menu (Image 122), or the all configuration item on the configuration submenu from the panels menu (Image 123).

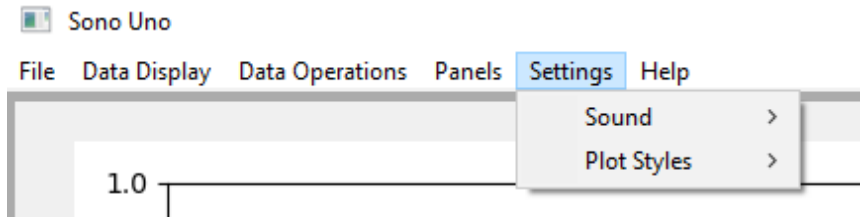


Image 122 - Show the menu setting with its two submenu: sound and plot style.

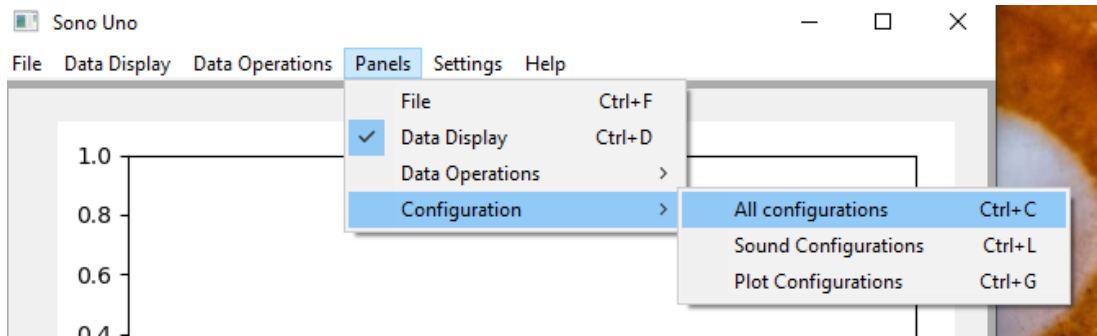


Image 123 - Show the configuration submenu of the panels menu, where are three items and the keyboard focus are on the all configurations item (first place).

Both options show the configuration panels on the left of the interface, under the file panel if it is enable. If we check the item all configurations, but the items sound configurations

and plot configurations are unchecking, the configuration panel only shown the toggle buttons of sound configurations and plot configurations (Image 124). With this buttons the user can show or hide the particular configurations too.

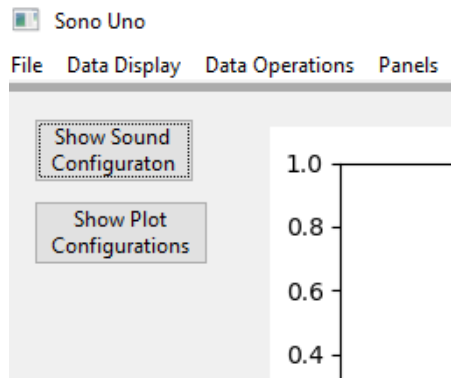


Image 124 - The all configuration item from the previous image enable or disable the configuration panel, which is placed on the top left of the sonoUno frame and contain the toggle button for sound and plot configurations.

5.4.1. Sound configurations

There are three ways of access to the sound configurations, one is with the sound font and instrument item in the sound submenu from de settings menu (Image 125), the other with the sound configurations item in the configuration submenu from the panels menu (Image 126), and finally, the show sound configuration button from the configuration panel in the left of the window, explained on the previous section (Image 124).

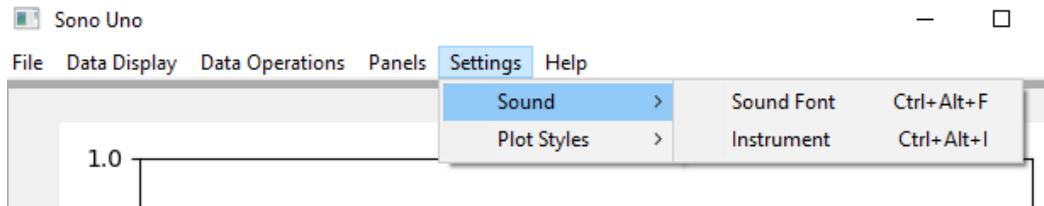


Image 125 - Show the sound submenu of the setting menu, where are two items: sound font and instruments.

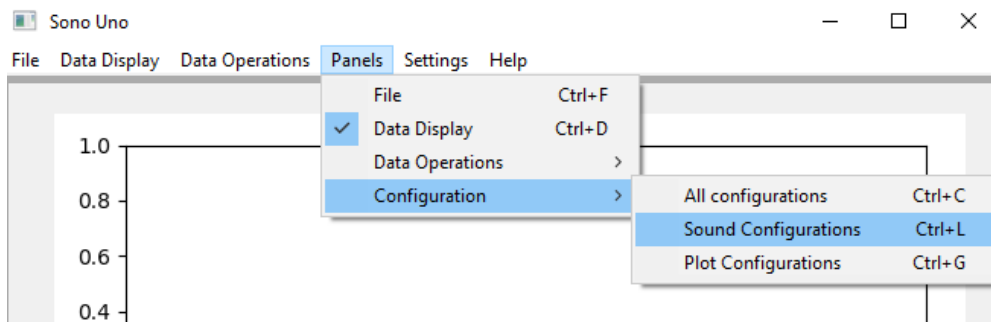


Image 126 - Show the configuration submenu of the panels menu, where are three items and the keyboard focus is on the sound configurations item (second place).

Once the sound configuration section is shown on the left of the window (Image 127), the user can access to the configuration elements, the first part is the name of the sound font used to produce de sound and the next combo box, with a list, allow the user to choose between some different instruments to generate the sound.

It must be taken into account that to change the instrument the reproduction must be stopped; in other case the change will be produce after press the stop button.

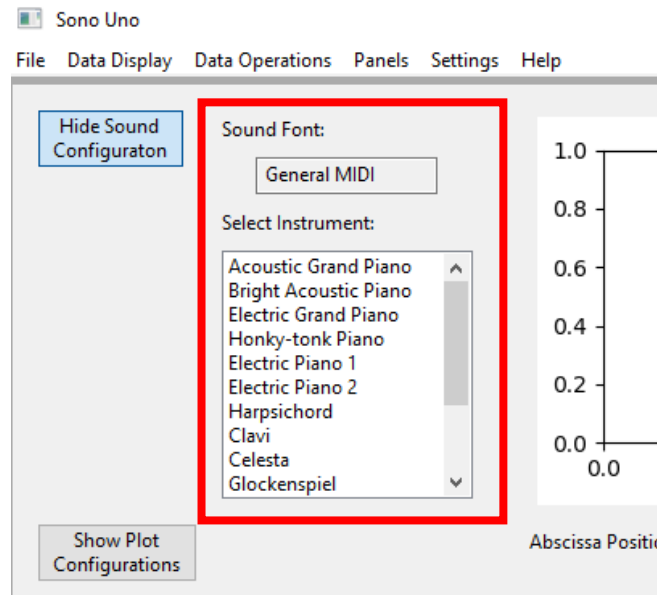


Image 127 - Shown the sound configurations panel, which is on the left of the window and contain the name of the sound font used and the different instruments that the user can choose.

By the moment that's all that user can set, the developer team expect to add more sound configurations shortly.

5.4.2. Plot configurations

The plot configurations given are the plot style (line, marker and color) and grid option. To access the plot configurations panel, exist three ways, one is the plot style submenu from the setting menu, where are the items plot line style, plot marker style and plot color style (Image 128). Other way is the plot configurations item on the configuration submenu from the panels menu (Image 129). In addition, if the all configuration panel is enable (section “5.4. Configuration options”) (Image 123), the user can utilize the show plot configuration button (Image 130), which when is pressed change the name to hide plot configurations and allow to hide the plot settings.

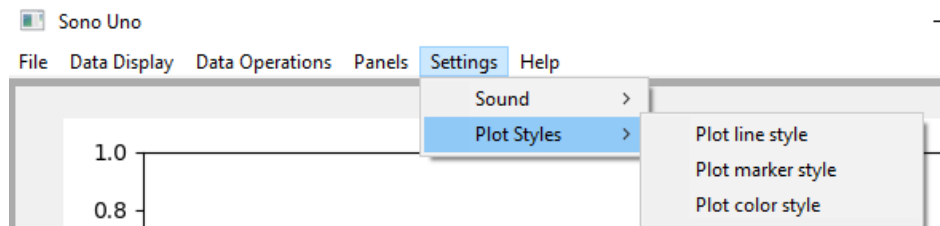


Image 128 - Shown the plot style submenu of the setting menu, which contain the different styles that the user can set.

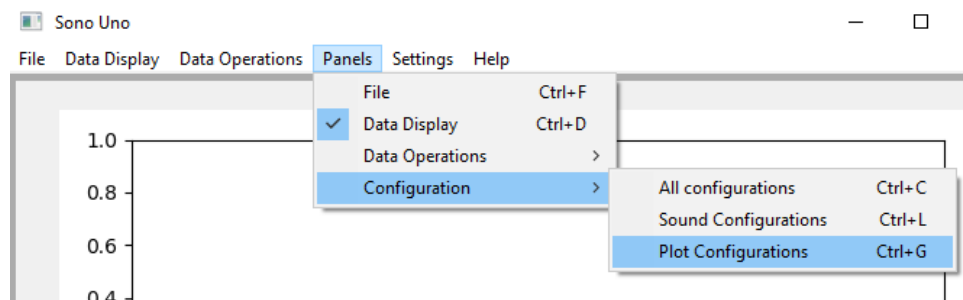


Image 129 - Shown the configuration submenu of the panels menu, which contain three items and the keyboard focus is on the plot configurations item.

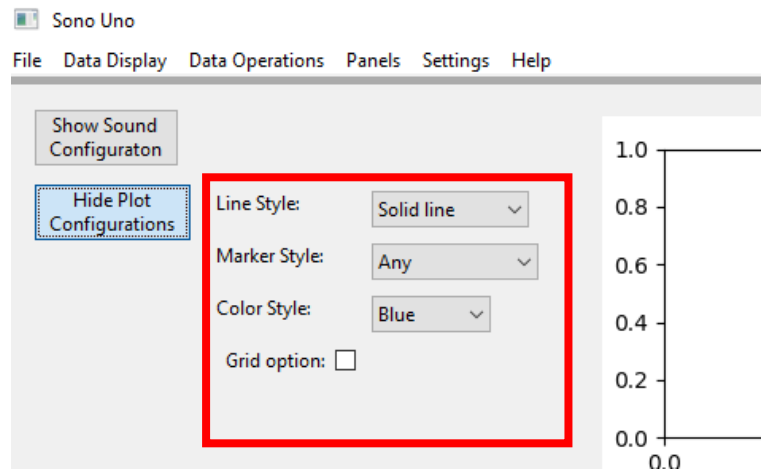


Image 130 - Shown the plot configuration panel (red rectangle), where the user can choose between different line styles, markers and colors. In addition, the grid option can be selected.

5.4.2.1. Line style of the data plot

On the plot configuration panel, after the line style label, is placed the drop-down list with five options of style, which are: discreet, solid line, dashed line, dash-dot line and dotted line. In the example of the Image 131 the dash-dot line style is shows, with blue color and without markers.

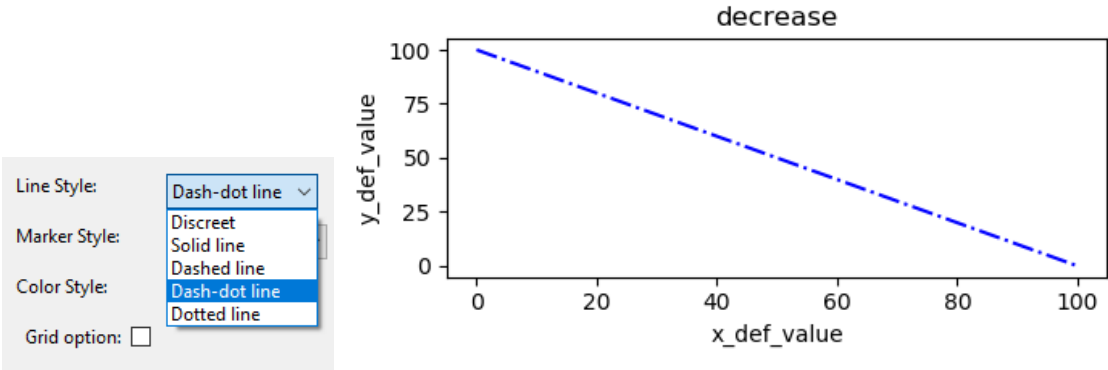


Image 131 - The line style element is a drop-down list, where are five options. In the image the dash-dot line style is selected.

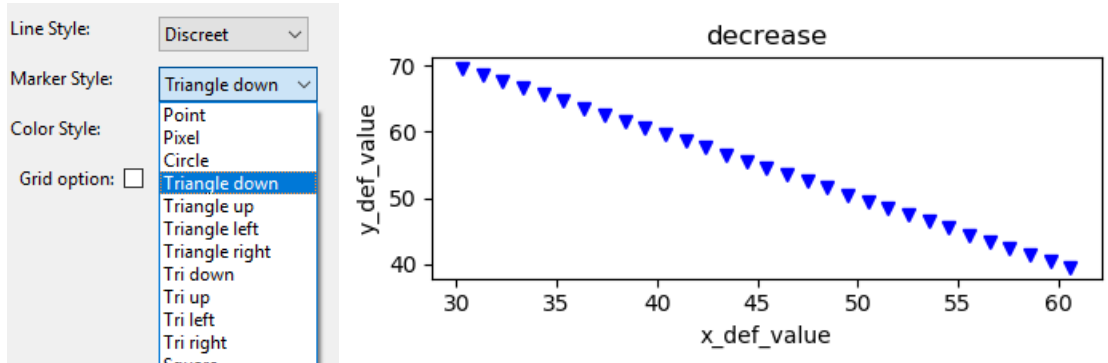


Image 132 - The marker style element is a drop-down list, where are a lot of options. In the image the triangle down marker style is selected and represent each coordinate of the data.

Analogously to the line style, after the marker style label, is found the drop-down list with different options of markers, some of them are: Point, Circle, Triangle down and Tri up. In the Image 132 is used the triangle down marker, with the discreet line style and the color blue.

Next, after the color style label, is placed the drop-down list with seven colors: blue, green, red, cyan, magenta, yellow and black. In the example of the Image 133 is used the red color, with the solid line style and the point marker.

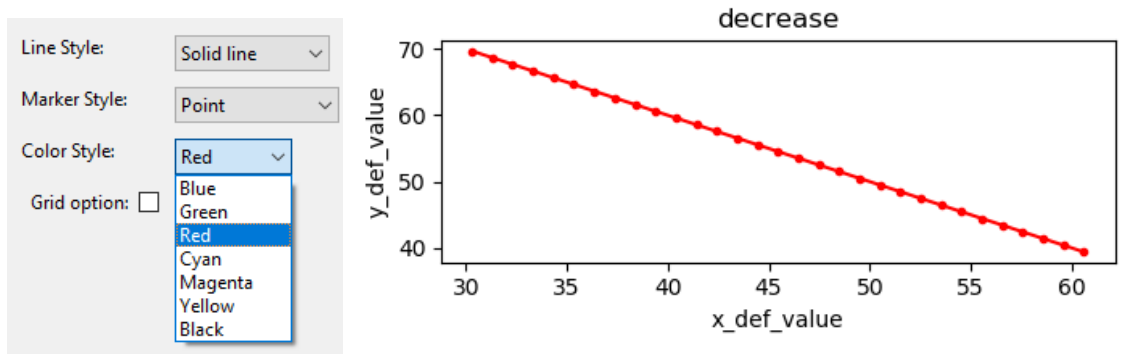


Image 133 - The color style element is a drop-down list, where are seven options. In the image the red color style is selected. In addition, the solid line style and point marker are chosen.

5.4.2.2. Grid options

Firstly, to add the grid at the plot, the user has to check the checkbox with the grid option label. Then, the software shows three new elements that allow to configure the grid style (color, line style and width) (Image 134).

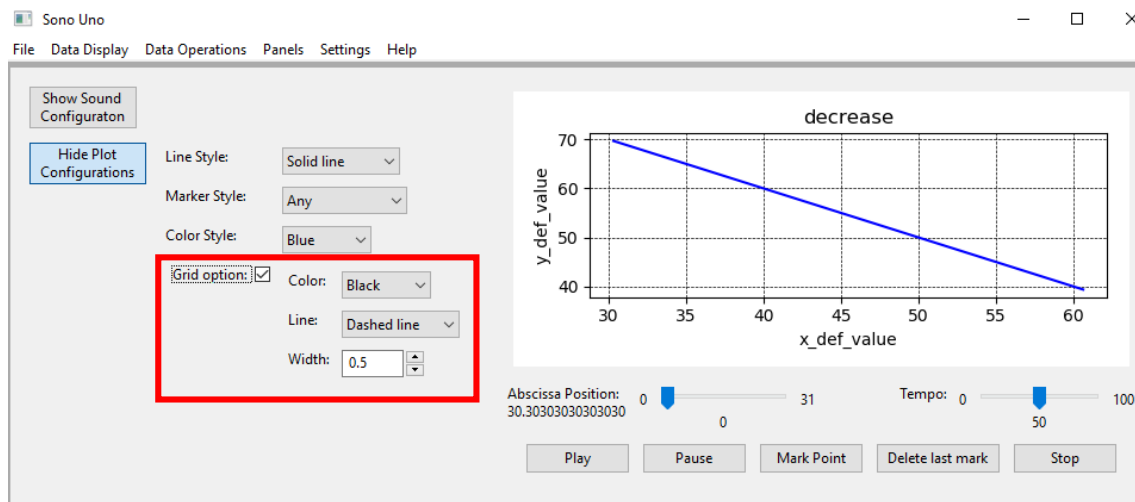


Image 134 - The grid option is selected, this action show the grid on the plot and enable three elements for set the grid style (color, line and width).

To change the color, the drop-down list placed after the color label is used, allow the user to choose between eight colors. In the Image 135 is shown the color list and the grid in the plot with black color.

The line style option, allow the user to choose between four options: Solid, Dashed, Dash-dot and Dotted. The drop-down list is found after the line label, under the color option. In the Image 136 is show the line style list and the continuous style is selected.

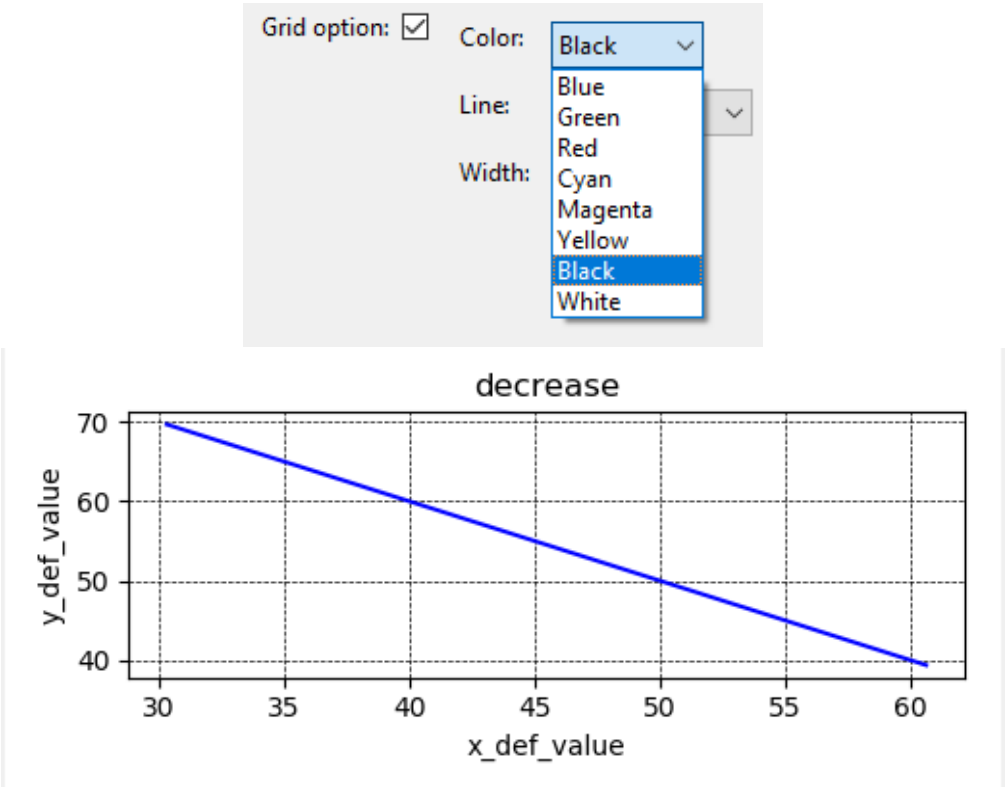


Image 135 - The grid color style element is a drop-down list, where are eight options. In the image the black color style is selected.

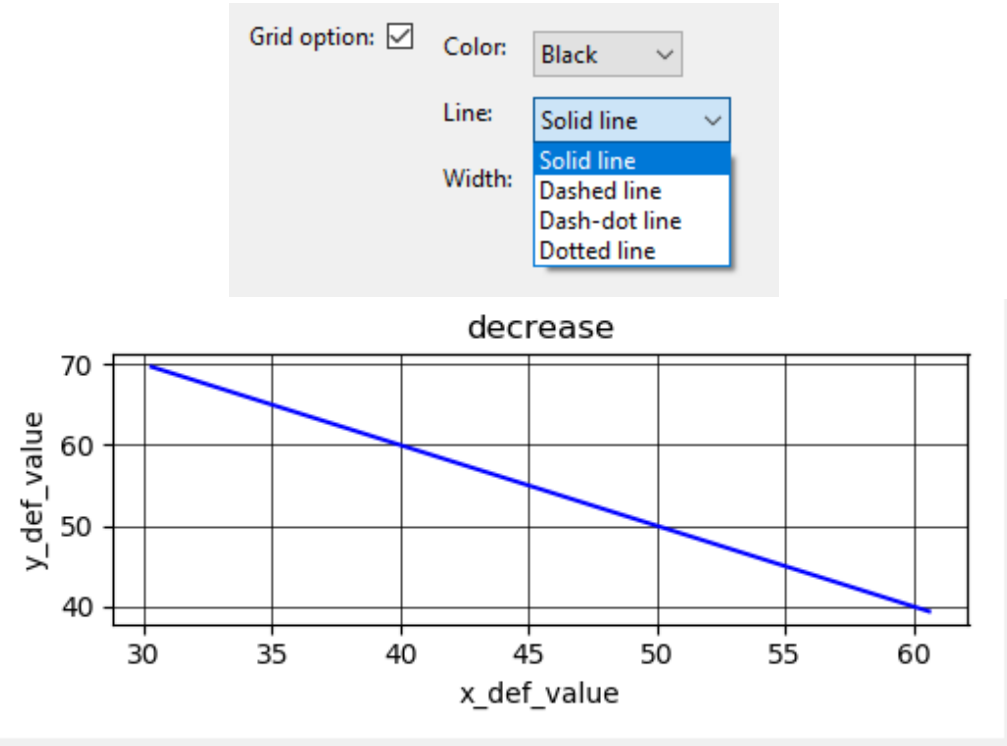


Image 136 - The grid line style element is a drop-down list, where are four options. In the image the solid line style is selected.

Finally, to adjust the width of the grid line, there is a number box with the width label, in which the user can type or use the arrow button to increase or decrease the value. In the Image 137 the width are changed to 1.3, the default width is 0.5.

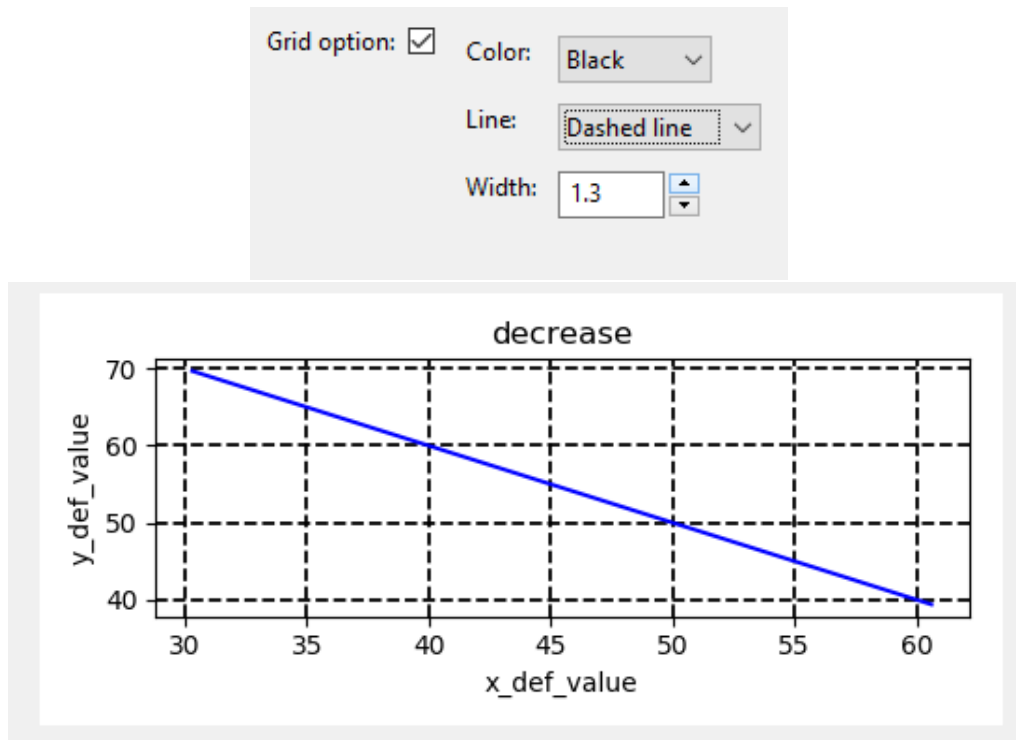


Image 137 - The grid width style element is a number box with up and down buttons. In the image the number 1.3 is selected.

6. Future work

The development team propose some future work to add to the software, some of the things are the possibility of import more than two columns and select the axis of the graph and sound; integrate the IPython or Octave functionality on the sonoUno; and have the option to cut the vertical limits of the array.