**Need to install:**

* The file function.py contains most of the functions used in the code to make the actual code a bit more tidy.
* The Trotta code needs to be installed as well (SerPyShock) <https://github.com/trottadom/SerPyShock/tree/6f55932bbdc0a1595b9eb66c7eb773bf86cdf65c>

(Careful you can’t install it with pip because he’s missing a file for that, download the file and import it yourself)

* You need to download Speazy as well using the pip installation. <https://speasy.readthedocs.io/en/latest/installation.html>

If you are having issues installing it try to open the terminal inside Anaconda and download it there.

* Download the libraries at the top of function.py if not already installed.

**Variable to change:**

* Cell [3] : need to input the date of the detected shock, t1 is the time for the shock in the solar wind (SW) and t3 is the time of the shock in the magnetosheath (msh).
* The name of the spacecraft in the msh and SW should be inputted.
* “Index” is just the number at the front of the data in the json file for my partner (Chris) to know which shock is which (not really useful for the actual analysis)
* “time \_obs” is the time you want to plot before and after the shock (in min)
* “Name\_file” is the name of the json file you want to create to stoer data in (if the file already exists then it'll automatically save data there)

**How the code is working:**

Information satellite SW:

* Cell [4]: the code calculate the day, month and year of the shock from the input “date”.
* Change the format of the date for Chris (my partner), don’t really need this for the actual analysis
* Change the format of the time for the SW for the analysis
* Find the start time and end time to plot (time before and after the shock) as well as the time of the shock in the correct format.
* Define the minimum (“min\_up\_dur\_SW”) and maximum (“max\_up\_dur\_SW”) time after the shock for upstream and downstream windows for the Trotta code (this code calculate velocity using multiple averaging windows), as well as the time cadence at which you want your window to increase from the smallest to the largest.
* “up\_shk\_SW” and “sw\_shk\_SW” remove the data around the shock for the analysis as here it is a bit of a mess and messed up the analysis.
* The minimum and maximum time for the averaging windows are calculated and the up and down windows are calculated.

Get data Magnetic Field

* Cell [5]: The code is getting the magnetic field for the satellite and the date and time given
* It’ll then filtered the data to make it readable by the code
* It’s calculating the uncertainty of each measurement for up and down by doing standard deviation
* The code is created a vector for the magnetic field

Get data Velocity:

* Cell [6]: The code is doing the same as for the magnetic field, but because the resolution of the data is less than the magnetic field, the data are “extended” to get the same number of data as the magnetic field.

Get data density:

* Cell [7]: The code is doing the same as for the velocity but with only one set of value since it is not in 3D.

Infos needed for Chris:

* This is to check the value of the magnetic field, velocity and density, as well as the coordinate of the satellite

Calculating normal and velocity with one window:

* Cell [8]: The code is calculating the normal of the shock with the different method (MC, VC, MX1, MX2, MX3)
* It then calculates the velocity of the shock and thetabn
* Ask clement for detail of the equation of the methods and calculation of velocity
* This will give you the velocity of the shock but for a single averaging value (not very precise)

Compute normal and velocity with the Trotta code:

* Cell [9]: This will calculate the normal of the shock and the velocity of the shock with the method MC, MX1, MX2, MX3 but with multiple averaging windows setup in Cell [4]

ALL THIS HAS BEEN DONE FOR THE SW

* From cell [10]-[16], the code is doing the same thing but for the msh

Show graph B, V, n for SW and msh:

* The code is plotting the graphs of the magnetic field, velocity and density for the satellite defined before in the sw and msh

Append the list for chris in a json file:

* This part is not really useful for the analysis, everything under is just here to put the data analysed in a json file for my partner to analyse it. (can ignore)