Installing and setting up nuSIM

P. Kyberd and K. Long

Introduction

This document summarises the steps needed to set-up and run nuSIM. A summary of the tasks that nuSIM performs may be found in [1]. nuSIM has been developed in python; python 3 is assumed.

Getting the code

nuSIM is maintained using the GitHub version-control system. The latest release can be downloaded from the nuSTORM wiki (https://www.nustorm.org/trac/wiki/Software-and-computing).

Dependencies and required packages

nuSIM requires the following packages:

- Python modules: `scipy`, `matplotlib`, and `pandas`;
- CERN programme library: `pyroot` (which may be installed using the standard `root` installers, see the documentation at https://root.cern/install/).

It may be convenient to run nuSIM in a "virtual environment". To set this up, after updating your python installation to python 3, and installing root, execute the following commands:

1. `python3 -m venv --system-site-packages venv`
   - This creates the director `venv` that contains files related to the virtual environment.
2. `source venv/bin/activate`
3. `python -m pip install pandas scipy matplotlib`

To exit from the virtual environment, execute the command `deactivate`.
The command `source venv/bin/activate` places you back into the virtual environment.

Unpacking the code, directories, and running the tests

After downloading the package from GitHub, or cloning the repositiry, you will find a "`README.md`" file which provides some orientation and instructions to run the code. In particular, a `bash` script "`startup.bash`" is provided which:

- Sets the "`nuSIMPATH`" environment variable so that the files that hold constants etc. required by the code can be located; and
- Adds "`01-Code`" (see below) to the PYTHONPATH. The scripts in "02-Tests" (see below) may then be run with the command "python 02-Tests/< filename >.py".

Below the top directory, the directory structure in which the code is presented is:

`01-Code`: contains the python implementation as a series of modules. Each module contains a single class or a related set of methods.

`02-Tests`: contains self-contained test scripts that run the various methods and simulation packages defined in the code directory.

`11-Parameters`: contains the parameter set used in `02-Tests/RunSimulation.py` to generate muon decays in the production straight.

The instruction in the `README.md` file should be followed to set up and run the code.

Making a contribution

nuSIM is archived in the git repository `longkr/nuSTORM`. To clone the code using `git clone` you will need your own account on GitHub and permission to clone the code. Instructions to request such permission is posted on the nuSTORM wiki.

References

[1] P. Kyberd and K. Long, "nuSIM: parameters for first simulation of neutrino spectra," Tech. Rep. nuSIM-2021-01, March, 2021. `https://www.nustorm.org/trac/raw-attachment/wiki/Software-and-computing/Documentation/2021/nuSIM-doc-01.pdf`.