Installing and setting up LhARA_Beamline

K. Long and R. Razak

Introduction

This document summarises the steps needed to set-up and run the linear optics simulation of the LhARA beamine. A summary of the tasks that LhARA_Beamline software suite performs will be documented in due course. The code has been developed in python; python 3 is assumed.

Getting the code

The linear optics package is maintained using the GitHub version-control system. The latest release can be downloaded from:

https://github.com/ImperialCollegeLondon/LhARAlinearOptics.git

Dependencies and required packages

The package requires the following packages:

- Python modules: `scipy` and`matplotlib`.

It may be convenient to run LhARA_Beamline in a "virtual environment". To set this up, after updating your python installation to python 3.9, 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.

Note that the Imperial HEP linux cluster provides python 3.9.18 by default.

Unpacking the code, directories, and running the tests

After downloading the package from GitHub, or cloning the repository, 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 "`LhARAOpticsPATH`" 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.

Running the code

Execute ”startup.bash” from the top directory (i.e. run the bash command ”source startup.bash”). This will:

- Set up ”LhARAOpticsPATH”; and
- Add ”01-Code” to the PYTHONPATH. The scripts in ”02-Tests” may then be run with the command ”python 02-Tests/¡filename¿.py”;
- Example scripts are provided in ”03-Scripts”, these can be used first to “Run” the simulation and then to “Read” the data file produced. Example scripts are provided for the DRACO, LION, and LhARA Stage 1 beam lines.