Contribution ID: **8** Type: **Notebook talk**

Liquid Argon Reconstruction Done in pythON : LARDON

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Liquid Argon Time Projection Chambers (LArTPC) are widely used as detectors in current and future neutrino experiments.
One of the advantage of LArTPCs is the possibility to collect data from a very large active volume (up to tens of kilo-ton in the case of the DUNE experiment) with a mmˆ3-scale resolution. LArTPC technology using different designs are currently being tested in large-scale prototypes at CERN by collecting cosmic rays and beam-test data. One of the prototypes collected cosmic data at a 10 Hz rate; each event sized 115 Mbytes : hence a fast online reconstruction tool is mandatory.
The reconstruction of LArTPC events relies on the combination of several 2D projections (along time and space) together, in order to retrieve the 3D and the calorimetric informations. This can be done by many ways: with pattern recognition, using particle-flow techniques, or by fitting tracks as line in each projections and then 3D match them.
The latter is the algorithm flow chosen in the LARDON pipeline. By profiting from the array structure of numpy, and with the help of other optimized libraries such as numba, rtree, sklearn, LARDON is able to reconstruct an event in 3D in 20s, which is about 60 times faster than the official code of the collaboration with comparable performances. In particular, a large fraction of the LARDON code focuses on the noise - which is currently reduced by a factor of 10. In the light of a future data taking runs with cosmic rays in fall 2021, LARDON is foreseen to be used as the online reconstruction code for one of the DUNE prototypes.
In this talk, I will first explain the specificities of the LArTPC events. By using a notebook, I will show how the different type of noise are handled and removed. The hit finder and track fitting methods will be also shown. The remaining issues and possible improvements of the code will be then discussed.

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