Signal and trajectory reconstruction in a Dual-Phase Liquid Argon Time Projection Chamber

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Abstract : A neutrino is a fundamental particle that has the particularity of interacting very rarely and therefore it is very difficult to study. The Deep Underground Neutrino Experiment (DUNE) is a project that will allow us to answer questions about the nature of the neutrino. DUNE consists of two detectors placed in the path of an intense neutrino beam, one near the beam source and one 1300 km further away. The far detector technology is expected to give us, with an excellent resolution, the 3D picture of a neutrino interaction happening inside a liquid argon volume. In addition, the interaction energy will also be measured with high precision.

The DUNE collaboration is currently studying two prototype designs of this far detector before launching the full-scale version, expected to have an active volume of $60 \times 12 \times 12\ m^3$. We will focus in this poster on the so-called "Dual-Phase" design, which uses liquid argon but also contains a small amount of gaseous argon. One aspect of this prototype phase is to develop the most efficient tools to analyze the data. Pandora is a multi-algorithm software that tries, via pattern recognition, to reconstruct the 3D trajectory of particles created from a neutrino interaction inside the detector. My work is to adapt and optimize Pandora's current algorithms to specific features of the Dual-Phase technology. The final goal is to achieve the expected reconstruction efficiencies matching DUNE's ambitious physics program.