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The CYGNO experiment for Dark Matter direct detection

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Innovative experimental techniques are needed to further search for dark matter weakly interacting massive particles. The ultimate limit is represented by the ability to efficiently reconstruct and identify nuclear and electron recoil events at the experimental energy threshold. Gaseous Time Projection Chambers (TPC) with optical readout are very promising candidates thanks to the 3D event reconstruction capability of the TPC technique and the high sensitivity and granularity of last generation scientific light sensors. The Cygno experiment is pursuing this technique by developing a TPC operated with He(Ar)-CF4 gas mixture at atmospheric pressure equipped with a Gas Electron Multipliers (GEM) amplification stage that produces visible light collected by scientific CMOS camera. A fast photodetector is used to measure the drift time of the primary ionisation electrons and thus reconstruct the third coordinate of the ionisation track. Events are then reconstructed with an innovative multi-stage pattern recognition algorithm based on advanced clustering techniques. In this contribution, we present the performances of prototype detectors assessed by exposing them to radioactive sources. We show that good energy and spatial resolution as well as discriminating power between nuclear and electron recoils is achieved in the KeV energy range. Finally, we discuss the plan to build a 1m3 demonstrator expected to be installed and operated at LNGS in 2021/22. This experimental campaign aims at proving the scalability of such a detector concept to a bigger apparatus able to significantly extend our knowledge about DM and neutrinos.

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