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LIME - a gas TPC prototype for directional Dark Matter search for the CYGNO experiment

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The CYGNO experiment aims at the development of a large gaseous TPC with GEM-based amplification and an optical readout by means of PMTs and scientific CMOS cameras for 3D tracking down to O(keV) energies, for the directional detection of rare events such as low mass Dark Matter and solar neutrino interactions.

The largest prototype built so far towards the realisation of the CYGNO experiment demonstrator is the 50 L active volume LIME, with 4 PMTs and a single sCMOS imaging a $33 \times 33 \text{ cm}^2$ area for 50 cm drift, that has been installed in underground Laboratori Nazionali del Gran Sasso in February 2022.

We will illustrate LIME performances as evaluated overground in Laboratori Nazionali di Frascati by means of radioactive X-ray sources and cosmic rays, and in particular the detector stability, energy response and energy resolution. We will discuss the MC simulation developed to reproduce the detector response and show the comparison with actual data. We will furthermore examine the background simulation worked out for LIME underground data taking and illustrate the foreseen expected measurement and results in terms of natural and materials intrinsic radioactivity characterisation and measurement of the LNGS underground natural neutron flux. The results that will be obtained by underground LIME installation will be paramount in the optimisation of the CYGNO demonstrator, since this is foreseen to be composed by multiple modules with the same LIME dimensions and characteristics.

Collaboration

CYGNO

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