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## Underground environmental neutron flux measurement with the CYGNO project

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A precise characterization of the environmental neutron spectrum in underground laboratories is crucial for designing future large-scale detectors and improving background modelling in rare-event searches. While fast neutrons already pose a significant background, thermal neutrons are expected to gain importance due to neutron-induced activation of detector materials. Previous flux estimates at Laboratori Nazionali del Gran Sasso (LNGS), one of the largest underground laboratories in the world, relied on indirect methods that offered limited spectral detail and produced inconsistent results. The CYGNO experiment offers a more direct approach using a high-resolution gaseous Time Projection Chamber (TPC), filled with a He:CF<sub>4</sub> (60:40) gas mixture and equipped with a triple-GEM amplification stage. Its dual optical readout via sCMOS cameras and PMTs enables full 3D reconstruction of particle tracks. In this context, LIME, the largest CYGNO prototype, completed two neutron data campaigns in the LNGS connection gallery, comprising both environmental monitoring and dedicated AmBe-source runs. In this contribution, we will present the analysis framework and simulation tools developed for these campaigns, outlining the methodology that will contribute to a more precise underground neutron flux determination.

**Presenter:** D'ASTOLFO, Melba (Gran Sasso Science Institute (IT))

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