

The MIGDAL experiment

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The Migdal effect has been invoked to extend the sensitivity of dark matter experiments to lighter, sub-GeV mass candidates. However, the Migdal effect has not been observed in nuclear scattering and, given how applications of this effect could impact the DM landscape, an experimental validation of the effect is very much needed. This is the goal of the MIGDAL (Migdal In Galactic Dark mAtter exPLoration) experiment at the NILE facility at the Rutherford Appleton Laboratory (RAL). The experiment uses a table-top size low-pressure Optical TPC, which combines information from charge and light readouts to reconstruct 3D ionization tracks produced in the 50 Torr CF_4 gas volume. This technology provides a unique and unambiguous detection of the Migdal topology, namely a nuclear and electron recoil sharing an interaction vertex. We present preliminary results from data taken at RAL using an intense beam of fast neutrons from a D-D generator. We also describe the analysis pipeline of data from the various detector subsystems, which includes the use of YOLOv8, a state-of-the-art convolutional neural network that's trained to simultaneously identify and classify particle tracks observed by the CMOS camera readout.

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