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Direct search for dark matter with the DarkSide-20k experiment

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Almost a century ago, astrophysics observations lead to the suspicion of dark matter (DM) existence in gravitationally bound astrophysical objects such as our galaxy, the Milky Way. Since then, it became a pillar in modern cosmology. Yet, although many efforts were made to detect it, no DM signal have been observed in direct or indirect detection experiments.
There exists many candidates for DM ,the most favored being the Weakly Interacting Massive Particle (WIMP). The DarkSide collaboration builds direct detectors of WIMPs, using the TPC technology, operated at cryogenic temperature with liquid argon. Their next detector is DarkSide-20k (DS20k, 20t of liquid argon in the fiducial volume), it should start taking data in 2027 for a decade.

Once the detector is built, it is absolutely needed to understand perfectly its response to both signal and background. Indeed, DM search is in the realm of physics of rare events, thus the separation between background and signal is key. This is why the calibration of dark matter direct detectors is at high stake. I took part in DS20k calibration by simulating the whole calibration process and establishing a suitable strategy to make it as efficient as possible. I used six photon sources, simulating light background, and three neutron sources. The calibration with neutrons is of high importance because they are the residual background in our experiment, and they are able to mimic the interaction between the WIMP and nucleus of argon.
I will present the detector, its calibration facilities and the results following the simulations.

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