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Triggerless Search of Dark Matter Candidates with DarkSide-20k

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DarkSide-20k is a direct dark matter search detector using a two-phase Liquid Argon Time Projection Chamber (LArTPC) with an active mass of 50 tonnes of low radioactivity Argon from an underground source. Two planes of cryogenic SiPMs covering the top and the bottom faces of the TPC detect the light signals produced by the scattering of a WIMP particle on an Argon nucleus. The TPC is surrounded by a Gadolinium-loaded plastic shell for active neutron veto with underground liquid Argon.

The DarkSide-20 Data Acquisition (DAQ) gathers data from the top and bottom detector planes of the TPC, as well as the Veto photo-detectors, in triggerless or “self-trigger” mode. Noise is minimized on a channel basis by digital processing the signals in the waveform digitizers, thanks to FPGAs which implement suitable algorithms to identify photo-electron signals with high efficiency. Each fragment of data collected by each waveform digitizer is to be time-stamped with a global time source at the sampling frequency for data analysis. Individual channel signals are processed in the first stage by Front End Processors, or FEPs, to reduce to a reasonable amount the information to be sent to the event building stage. Event building and selection are performed on fully assembled data collected over a fixed time period, a “Time Slice”. Each of these is assigned to a given computer node in a Time Slice Processor (TSP) farm providing an online selection of interesting events and data logging of raw and preprocessed data for offline analysis.

Minioral

Yes

IEEE Member

No

Are you a student?

No

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