

The PICO-500 Dark Matter Experiment

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The PICO collaboration searches for dark matter using superheated C3F8 in bubble chamber technology. The results of the operation of the PICO-60 detector at SNOLAB set the most stringent direct-detection constraint to date on the weakly interacting massive particle (WIMP)-proton spin-dependent cross section.

PICO-500 is the next-generation detector produced by PICO with a 250 kg live volume. Currently under development, it is the largest C3F8 bubble chamber ever constructed. As such, operating increasingly large bubble chambers at increasingly low nuclear recoil thresholds does pose significant experimental challenges pertaining to hydraulic control. A key aspect of PICO's success is the ability to analyze a well-defined fiducial volume for which the thermodynamic threshold is stable and characterized with confidence. The PICO-500 hydraulic control system is the most advanced of any PICO detector to date.

This presentation will discuss new functionality introduced for PICO-500, including a dedicated oil degassing station, the ability to re-circulate and filter oil in the detector, a control panel engineered for minimal system losses and dual redundancy for critical operation systems. Each of these additions is predicted improve the experiment's exposure by minimizing dead time during compression cycles, reducing spurious nucleations caused by hydraulic instability, and overall allowing for as much physics search data to be recorded as possible within the detector's lifespan.

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