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Homestake Ultra-Low Background Counting Facility and Detection of Double-Beta Decay to Excited States DONGMING MEI, The University of South Dakota, KEVIN LESKO, Lawrence Berkeley National Laboratory, CHRISTINA KELLER, YONGCHEN SUN, ZHONGBAO YIN, The University of South Dakota, ROBERT MCTAGGART, South Dakota State University, BARBARA SZCZERBINSKA, Dakota State University, ANDREW ALTON, Augustina College, WILLIAM ROGGENTHEN, South Dakota School Mines & Technology, YUEN-DAT CHAN, AL SMITH, GERSENDE PRIOR, Lawrence Berkeley National Laboratory — A powerful, ultra-low background counting facility, for material screening is crucial to the success of many deep underground science and engineering laboratory (DUSEL) experiments dealing with extremely rare-occurring processes that are of great scientific importance. In order to reach the ultimate sensitivity necessary for these experiments such as (e.g.) in dark matter searches and nuclear double beta-decay, only materials with the lowest possible radioactivity can be used in fabricating the experimental devices, and the entire setup must be located in a deep underground site. The Homestake Mine, home to the first solar neutrino experiment, provides an excellent opportunity to host DUSEL, as well as the required ultra-low background laboratory facility. Besides low background counting, detectors in this facility can also be used to perform important physics experiments, such as studying the nuclear double-beta decay to excited-state process, a topic which has recently drawn both strong experimental and theoretical interests. Experimentally, it is a great advantage to be able to detect unambiguously the gamma-rays from the de- excitation of the daughter nucleus to its ground state, as proposed in our method.

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