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KDK: measuring a rare decay of potassium with implications for dark matter searches

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Potassium-40 is a contaminant found in many rare-event searches. Its decay by electron capture to argon-40 emits X-rays and Auger electrons at energies of 3 keV and below, right in the region where direct searches for dark matter expect their signal. Most of the electron capture decays are to an excited state of 40Ar which emits a 1.461 MeV gamma ray allowing identification of the low-energy quanta. However, it has been pointed out by Pradler et al (PLB 720 399 2013), that an untaggable direct decay to the ground state is also expected, and that it has implications for the long-standing DAMA/LIBRA claim of dark matter detection. The KDK (potassium decay) experiment aims to make the first measurement of this decay to the ground state. The experiment involves a 40K source and a sensitive X-ray detector, surrounded by a unique, very efficient detector for the 1.461 MeV gamma rays, the Modular Total Absorption Spectrometer (MTAS), at Oak Ridge. We present the experimental setup, including calibrations of the X-ray detector, preparations of the 40K source, and an experimental determination of the better-than-98% tagging efficiency of MTAS, as well as the status of measurements.

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