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KDK: Measurement of the potassium-40 ground state electron capture for backgrounds in rare-event searches

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Potassium-40 (K^{40}) is a long-lived, naturally occurring radioactive isotope. This radionuclide decays mainly by beta emission to calcium, and by electron-capture to an excited state of argon. An additional electron-capture of K^{40} to the ground state of argon theoretically exists but has never been experimentally observed. Predicted intensities are highly variable (0-0.8%) and this decay channel can be an important background for many rare-event searches, especially those involving NaI-based scintillators (ex. DAMA, ANAIS-112, COSINE-100, SABRE, COSINUS etc..). KDK (Potassium (K) Decay (DK)) is an international collaboration dedicated to the first measurement of this branching ratio. The experiment is performed using a silicon drift detector with a thermally deposited, enriched K^{40} source inside the Modular Total Absorption Spectrometer (MTAS, Oak Ridge National Laboratory). MTAS is a large NaI detector whose high gamma-ray efficiency enables the proper discrimination between ground and excited state electron capture events. This setup has been characterized in terms of energy calibration, tagging efficiency and dead time. We report on our latest experimental results and the process of opening the blind data set.

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