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Systematics and Calibration for the KDK+ experiment

Sunday, 15 February 2026 09:45 (15 minutes)

KDK and KDK+ research is focused on measuring the rare decays of Potassium-40 (40K). The KDK experiment recently recorded the first experimental measurement of 40K electron capture decay directly to the ground state of 40Ar. KDK+ will follow this with an experiment aimed at obtaining a refined experimental decay constant for the β+ decay in 40K as the currently accepted value is in tension with modern theoretical predictions. The initial measurement will be performed using a liquid scintillator due to a high counting efficiency for β+ decays, and they can be loaded with a variety of chemicals for calibration purposes. This liquid scintillator will be contained in a 300 mL vessel with PMTs placed on either end and placed in the centre bore of an annulus with four Sodium Iodide crystals surrounding it measured by PMTs. This apparatus requires systematic calibration of the NaI crystals, the liquid scintillator, and the PMTs measuring them. Work has been done to calibrate the liquid scintillator vessel, as well as an extensive investigation into the methodology for loading potassium into a liquid scintillator. The liquid scintillator has also been tested extensively for stability as a loss in light yield has been observed over long periods and this must be understood over a long-term experiment.

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