



Canadian Association  
of Physicists

Association canadienne  
des physiciens et physiciennes

Contribution ID: 33 Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

## **(G\*) KDK: Measuring the unique third forbidden electron capture decay of K-40 for backgrounds in rare-event searches**

*Thursday 10 June 2021 16:20 (10 minutes)*

Potassium-40 ( $^{40}\text{K}$ ) is a long-lived, naturally occurring radioactive isotope. The decay products are prominent backgrounds for many rare event searches, especially those involving NaI-based scintillators (ex. DAMA, SABRE, COSINUS etc.). The branching ratio of the electron capture directly to the ground state of Argon-40 has never been experimentally measured and presents an unknown background directly in the 2 - 6 keV energy signal region which needs to be understood. This branching ratio also has important implications for nuclear physics and geochronology. KDK (Potassium (K) Decay (DK)) is an international collaboration dedicated to this measurement. The experiment is performed using a silicon drift detector with a thermally deposited, enriched  $^{40}\text{K}$  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 (arXiv:2012.15232). We report on the analysis method and sensitivity for a 44-day  $^{40}\text{K}$  physics run.

**Author:** STUKEL, Matthew (Queen's University)

**Co-authors:** DI STEFANO, Philippe (Queen's University); Dr BREWER, Nathan (Oak Ridge National Laboratory); RASCO, Bertis (Oak Ridge National Laboratory); Dr RYKACZEWSKI, Krzysztof (Oak Ridge National Laboratory); Mr DAVIS, Heath (University of Tennessee); LUKOSI, Eric (University of Tennessee); HARIASZ, Lilianna (Queen's University)

**Presenter:** STUKEL, Matthew (Queen's University)

**Session Classification:** R3-4 Experimental Nuclear Physics II (DNP) / Physique nucléaire expérimentale II (DPN)

**Track Classification:** Nuclear Physics / Physique nucléaire (DNP-DPN)