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An absolute neutron flux measurement of the $^{51}V(p,n)^{51}Cr$ reaction for PICO bubble chambers calibration

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The PICO collaboration presently operates two bubbles chambers for the search of dark matter in the SNOLAB underground laboratory in Sudbury, Ontario. Multiple calibration chambers were created to understand the detectors'behavior when exposed to different background radiation. The PICO 0.1 bubble chamber is used to perform neutron calibration at the Tandem Van de Graaff facility of the Université de Montréal. The electrostatic accelerator uses a 1.6 MeV proton beam to produce mono-energetic neutrons from the $^{51}V(p,n)^{51}Cr$ reaction off a 14 nm thick vanadium target. Only the relative neutron flux had been measured with either one or two ^{3}He neutron counters since the beginning of the previous PICASSO experiment as a mean to normalize the chamber's count rate. A measurement of the absolute neutron flux was therefore made by Proton Activation Analysis (PAA). ^{51}Cr produced by the nuclear reaction always decays by beta decay, characterized by a half-life of 27.7 days, with the emission of a 320 keV gamma roughly 10% of the time. The activation of a new Vanadium target, followed by a gamma emission analysis with a calibrated High Purity Germanium detector (HPGe) enabled us to calculate the total amount of nuclear reactions triggered during the activation. The ^{3}He counters'efficiencies and absolute neutron flux where thereafter determined. This poster presentation describes the experimental setup and present the results of the measurement.

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