

Radon reduction and evaluation system for rare search events experiments

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Terrestrial radioactive backgrounds present a continuous challenge to low background experiments. A prototype ^{222}Rn reduction and evaluation system has been constructed where different types of charcoals were investigated to find the most efficient ^{222}Rn adsorbing and ^{222}Rn -free element. Average ^{222}Rn breakthrough times and other adsorbing characteristics were studied in N_2 , Ar, and Xe carrier gases in the range of the temperatures 295-190 K. While ^{222}Rn breakthrough times in N_2 and Ar follow the Arrhenius relationship in the range of 295-253K, this does not seem to be the case for Xe gas at lower temperatures. Due to their low polarizability in the investigated range of temperatures, N_2 and Ar have negligible attraction to the charcoal adsorbent used. This requires relatively small amounts of adsorbing material to retain radon until it completely decays away and results in longer breakthrough times. By contrast, Xe atoms almost instantly occupy a large fraction of charcoal adsorption sites resulting in faster breakthrough times for ^{222}Rn . Consequently, significantly larger masses of adsorbent are required to reduce ^{222}Rn . Various types of charcoals that may potentially be rendered almost ^{222}Rn free through chemical purification methods. The experimental method, apparatus, and detailed experimental results, as well as their impact on G3 experiments, will be presented.

Primary author: Dr PUSHKIN, Kirill (University of Michigan)

Presenter: Dr PUSHKIN, Kirill (University of Michigan)

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