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Boron-lined tubes and readout electronics for low count-rate environments

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With Boron-10 converters replacing helium-3 the total sensitive detector area per instrument increased likewise due to the lower efficiency per layer. However, commonly used alloys for substrates contain a significant amount of radioisotopes which lead to an undesired background counting rate. For detector applications exposed to a low flux, like in our case measuring environmental neutrons generated by cosmic-ray particles, such can easily increase the error of the signal. The tubes we have developed feature B4C coatings of up to 0.2 m² on high-purity copper substrates. Furthermore the geometry and the pressure have been designed for a dE/dx suppression of unwanted contributions from gammas, electrons, muons and also heavy-isotope decays like from remains of radon. In combination with the form factor our pulse shaping electronics determines pulse length and height, which allows to discriminate against other particle species. The main goal of this development is to provide a detector system largely free of intrinsic background at considerably lower costs.

Primary authors: KÖHLI, Markus (University of Heidelberg); Mr WEIMAR, Jannis (Physikalisches Institut, Heidelberg University); Mr BRAUNEIS, Benjamin (Physikalisches Institut, Heidelberg University); Prof. SCHMIDT, Ulrich (Physikalisches Institut, Heidelberg University)

Presenter: KÖHLI, Markus (University of Heidelberg)

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