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Measurement of anomalies in the angular correlation of electron and positron internally produced in excited 8Be and 4He

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Theoretical prediction for the distribution of the angle between electrons and positrons originating in internal pair creations is a monotonic featureless decrease with the opening angle. Recent studies on excited states of 8Be and 4He nuclei, made in ATOMKI, Hungary, however, revealed deviations from this expectation. If true, such a result may have a fundamental impact: the anomaly can be explained by introducing a new short-lived neutral boson that can still fit into known experimental and theoretical constraints. Although serious work has been done on the theoretical side, an independent laboratory has not yet verified these results, despite related experiments are being prepared worldwide. In this work we will describe the ongoing construction of a suitable Time Projection Chamber-based (TPC) spectrometer for light charged particles, utilising magnetic field as a means for energy measurement and also Multiwire Proportional Chambers (MWPC) together with Timepix3 pixel detectors, for spatial and angular resolution. The experimental effort will be operated at the Institute of Experimental and Applied Physics (IEAP) Van-de-Graaff accelerator facility in order to either confirm or refute the above-mentioned anomaly. Details of the detectors will be described, together with relevant technical theoretical and experimental aspects of the experimental setup, as well as results obtained with prototypes built for the current development phase of this project.

Collaboration

Primary authors: Dr CORTEZ, André (Czech Technical University in Prague); Dr NATAL DA LUZ, Hugo (Czech Technical University in Prague); Dr ALLI, Babar (Czech Technical University in Prague); Dr FAJT, Lukás (Czech Technical University in Prague); Dr SÝKORA, Rudolf (Czech Technical University in Prague); VENTURA CORTEZ, André Filipe (Laboratório de Instrumentação e Física Experimental de Partículas)

Presenters: Dr CORTEZ, André (Czech Technical University in Prague); VENTURA CORTEZ, André Filipe (Laboratório de Instrumentação e Física Experimental de Partículas)

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