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The Search for Double Alpha Decay at the FRS Ion Catcher, GSI: Ra-224 Data Analysis Status

The idea of the capability of nuclei to emit two alpha particles simultaneously dates back to the late 1970s, inspired by the concept of two-proton radioactivity. Subsequently, observation of the exotic decay was considered unfeasible due to the extremely low branching ratio, which was calculated to be on the order of 10^{-20} or less. Recent theoretical work by Mercier *et al.* (PRL **127**, 012501 (2021)) raised the estimate to 10^{-8} , which triggered several experiments to search for the double alpha decay at GSI, CERN, and MSU.

In this report, we will focus on the results of an experiment on the search for Ra-224 double alpha decay, which was conducted at the FRS Ion Catcher (GSI). The offline production of Ra-224 from a Th-228 source provides a clean spectrum of decay products and reduces the contribution of random coincidences. To allow onward filtering of candidate double alpha-decay events, a Monte Carlo-based simulation and analytical data handling procedures have been developed. Background simulation results will be shown, and estimates of the time and energy resolution of the DSSD detectors will be presented.

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