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A pilot experiment on the cluster structure of the neutron-rich 10,12Be at the ACCULINNA-2 fragment separator.

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In the study of nuclear structure, clustering becomes predominant at the driplines, where nucleon binding is weak. Antisymmetrized Molecular Dynamics (AMD) describes the possibility of deuterium and alpha clusters in the neutron-rich Beryllium isotopes 10,12Be and the question of the existence of an alpha-cluster structure in their ground states still remains open. The 10,12Be ground-states are described to be an α-α core with valence neutrons into π-type or σ-type molecular orbitals. To address such exotic configurations, we conducted a study focus on alpha clusters via the 10,12Be(d,6Li)6,8He transfer reaction in inverse kinematics. The measurement was conducted at the ACCULINNA-2 fragment separator (FLNR, JINR) using a secondary 30 AMeV 10,12Be beam, produced via the fragmentation of a primary 45 AMeV 18O beam on a 2-mm thick 9Be production target. This pilot run in May 2025 aimed to validate the experimental methodology for an upcoming full-scale measurement. The energies and angles of 6Li in coincidence with the He isotopes were measured with the two telescopes, e.g double-sided silicon strip detectors followed by 4x4 CsI(Tl) and 3x3 LYSO scintillators. For gating the interested reaction channel and reconstructing the excitation energy spectrum in 10,12Be, we faced the non-linear light output response of CsI(Tl) and LYSO scintillators during data analysis. This work is dedicated to the calibration of CsI(Tl) and LYSO scintillators for different ions. Their light yield exhibits a strong non-linear dependence on particle type and stopping power (dE/dx), resulting in different light response functions for different isotopes. We present preliminary results from the ongoing calibration procedure and data analysis.

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