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Introduction of the new LUNA experimental setup for high precision measurement of $^{13}\text{C}(\alpha,n)^{16}\text{O}$ reaction for astrophysical purposes

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The $^{13}\text{C}(\alpha,n)^{16}\text{O}$ reaction is very important in astrophysical context. This reaction is the dominant neutron source for the synthesis of the main s-process component of heavy elements in thermally pulsing, low-mass asymptotic giant branch stars. As a new project at the LUNA 400 kV accelerator, the investigation of this reaction is being performed in the Laboratori Nazionali del Gran Sasso (LNGS), Italy. This underground laboratory provides an ideal environment to detect rare events from astrophysical reactions thanks to the strong reduction in cosmic-ray induced background.

For the above mentioned purpose the experimental setup needs to be able to detect the reaction neutrons with high efficiency, also considering possible angular distributions. Multistage target holder, high capacity cooling system and the implementation of the in-beam checking of target thickness is also required. Moreover, due to the low cross section of the $^{13}\text{C}(\alpha,n)^{16}\text{O}$ reaction in the planned alpha energy range, the minimization of environmental and beam induced background are essential.

The poster introduces the design and the parameters of the experimental setup including the process of target composition analysis using various techniques.

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