A BGO set-up for the direct measurement of the ^{2}H(p,γ)^{3}He fusion cross section at LUNA

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Deuterium is the first nucleus produced in the Universe, whose accumulation marks the beginning of the so called Big Bang Nucleosynthesis (BBN). Its primordial abundance depends on the cross sections of relevant nuclear reactions involved in the deuterium construction and destruction during the BBN. Presently the main obstacle to an accurate theoretical deuterium abundance evaluation is due to the poor knowledge of the ^{2}H(p,γ)^{3}He cross section at BBN energies ($30 < E_{cm}[keV] < 300$) [1].

In this poster a new experimental approach to accurately measure the reaction cross section is described. The measurement is based on the LUNA accelerator, located at the underground INFN Gran Sasso laboratory, and a windowless gas target of ^2H. The experiment consists of two main phases characterized by two different setups. The former is based on a close 4π BGO detector, whose high efficiency (about 60% in the energy range of interest) provides measurements down to very low energies [2]. The latter, instead, covers the medium-high energies ($70 < E_{cm}[keV] < 260$) using a High Purity Germanium detector (HPGe), whose high resolution allows the differential cross section of the reaction to be evaluated by using the peak shape analysis.

In this poster the characterization of the first phase (the BGO phase) set-up, the background conditions, the potential sources of uncertainty and the preliminary results will be discussed.

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[1] E. Di Valentino et al., Phys. Leyy. D **90**, 023543 (2014).

[2] V. Mossa, Study of the $^2H(p,\gamma)^3He$ reaction in the Big Bang Nucleosynthesis energy range Universitá degli Studi di Bari, PhD Thesis, (2018).