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P4.039 HOLMES: neutrino mass measurement with ^{163}Ho

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The experiment HOLMES, founded by the European Research Council, will perform a calorimetric measurement of the energy released in the electron capture of ^{163}Ho to directly measure the neutrino mass with a sensitivity of ~1eV. This approach allows to eliminate the problematics connected to the use of external sources and the systematic uncertainties arising from decays on excited states. Such measurement will be performed with low temperature thermal detectors, where the decay energy is converted into a temperature signal measured by sensitive thermometers.

HOLMES, besides of being an important step forward in the direct neutrino mass measurement with a calorimetric approach, will also establish the potential of this approach to extend the sensitivity down to 0.1eV and lower.

The best configuration has been defined with Monte Carlo simulations: HOLMES will collect about 3×10^{13} decays with 1000 detectors characterized by an instrumental energy resolution of the order of the eV and a time resolution of few microseconds. For a measuring time of 3 years, this translates in a total required ^{163}Ho activity of about 300 kBq, equivalent to about 6.5×10^{16} ^{163}Ho nuclei, or 18 μg.

The HOLMES detectors will have ^{163}Ho implanted into Gold absorber coupled to Transition Edge Sensors, which will be read using microwave multiplexed RF-SQUIDs in combination with a ROACH2 based acquisition system. An extensive R&D activity is in progress in order to maximize the multiplexing factor while preserving the performances of the individual detectors.

R&D activities aimed at optimizing the single detector performances, the ^{163}Ho isotope production and embedding are in progress and will converge in a preliminary measurement of an array of 16 detectors planned by the end of 2016.

We outline here the HOLMES project with its technical challenges, and its status and perspectives.