Felsenkeller shallow-underground accelerator laboratory for nuclear astrophysics

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Favored by the low background in underground laboratories, low-background accelerator-based experiments are an important tool to study nuclear reactions involving stable charged particles. This technique has been used for many years with great success at the 0.4 MV LUNA accelerator in the Gran Sasso laboratory in Italy, proteced from cosmic rays by 1400 m of rock [1]. However, the nuclear reactions of helium and carbon burning and the neutron source reactions for the astrophysical s-process require higher beam energies than those available at LUNA. Also the study of solar fusion reactions necessitates new data at higher energies. As a result, in the present NuPECC long range plan for nuclear physics in Europe, the installation of one or more higher-energy underground accelerators is strongly recommended.
An intercomparison exercise using the same HPGe detector at several sites has shown that with a combination of 45 m rock overburden, as can be found in the Felsenkeller underground site in Dresden, and an active veto against the remaining muon flux, in a typical nuclear astrophysics setup a background level can be achieved that is similar to the deep underground scenario [2].
Based on this finding, a used 5 MV pelletron tandem with 250 μA upcharge current and external sputter ion source has been obtained and transported to Dresden. Work on an additional radio-frequency ion source on the high voltage terminal is underway. The project is now fully funded. The installation of the accelerator in the Felsenkeller is expected for the near future. The status of the project and the planned access possibilities for external users will be reported.

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