Program and progress of the Felsenkeller shallow-underground accelerator for nuclear astrophysics

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Low-background experiments with stable ion beams are an important tool for putting the model of stellar hydrogen, helium, and carbon burning on a solid experimental foundation. The pioneering work in this regard has been done by the LUNA collaboration at Gran Sasso, using a 0.4 MV accelerator. The present contribution reviews the status of the project for a higher-energy underground accelerator in Felsenkeller, Germany. Measurements of the γ-ray background have shown satisfactory background there, when the 45 m rock overburden is combined with an active veto against remaining muons.
Two tunnels of the Felsenkeller underground site have recently been refurbished for the installation of a 5 MV high-current Pelletron ion accelerator. Civil construction has completed in March 2018. The accelerator and analyzing magnets are already in the tunnel, and the setting up of the beam lines is ongoing. The accelerator will provide up to 50 μA beams of $^{1}H^{+}$, $^{4}He^{+}$, and $^{12}C^{+}$ ions, enabling research on astrophysically relevant nuclear reactions with unprecedented sensitivity.
As part of the in-house research by HZDR and TU Dresden, two nuclear reactions shall be studied at Felsenkeller: The $^{12}C(\alpha,\gamma)^{16}O$ reaction which controls the carbon-to-oxygen ratio at the end of stellar helium burning, and the $^{3}He(\alpha,\gamma)^{7}Be$ reaction which affect the fluxes of solar ^{7}Be and ^{8}B neutrinos. In addition, the accelerator will be open as a facility to outside users from any field of science, free of charge and with access granted based on the recommendations of an independent scientific advisory board.