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Final Performance of the Pulsed Superthermal UCN Sources at the TRIGA Mainz

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Research in fundamental physics with the free neutron is one of the key tools for testing the Standard Model at low energies. Significant improvements of the experimental performance using ultracold neutrons (UCN) require reduction of both systematic and statistical errors. The development of new UCN sources based on the superthermal concept is therefore an important step for the success of future fundamental physics with ultracold neutrons. Besides the construction of new huge UCN sources at several big research centers around the world, which are mainly based on the use of either solid deuterium or superfluid helium as UCN converter, there exists also the idea of competitive UCN sources using pulsed reactors of the TRIGA type. To demonstrate the feasibility of a UCN source at these reactors, a superthermal UCN source based on solid deuterium was built at the tangential beamport C of the reactor TRIGA Mainz. Based on the experience obtained during three years of successful operation and optimisation, a second upgraded source was built for the radial beamport D. This new source should increase the actually available UCN densities of 4 UCN/cm³ by minimum one order of magnitude.

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