A solid Deuterium UCN Source at the research reactor TRIGA Mainz

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A strong source for ultracold neutrons (UCN) [1] shall be built for the research reactor FRM-II. This source, called Mini-D2, will be installed at the beam tube SR4, that is horizontally pointing directly to the already existing cold neutron source. For converting cold neutrons to UCN a solid D_2 converter with 200 cm^3 volume at a temperature of 5K is frozen out at the beginning of this beam tube, near to the cold source. The inner part of the beam tube (diameter 6 cm, (length 8 m) is cooled to 30 K and covered with beryllium in order to store and accumulate UCN and to bring them to different experiments. Simulations indicate, that with this setup, UCN densities up to 10^4 cm^{-3} can be reached.

For a test of this conversion mechanism, a smaller setup has been built (see figure 1) and is currently operated at the pulsed TRIGA reactor in Mainz. This test setup contains all essential parts that will later be used for the FRM-II UCN-source, such as the converter, the storage tube, the D_2-gas system and the software programable control (SPC) -system. For this configuration, a UCN density of $3.5x10^3$ UCN/cm^3 per 6MJ pulse is expected [2].

The solid Deuterium UCN Source (SDUCNS) was installed at the TRIGA Mainz in late autumn 2004 . First cool down tests (freezing out the deuterium gas at 5 – 8 K) where made successfully in December 2004. A first measurement with neutrons from the TRIGA reactor in the pulse mode was also performed in December 2004. This measurement indicated some problems with the UCN Silicon detectors, which are covered with a converter foil (Ti foil with $^6Li/^{62}Ni$-multilayer) [3], and the data acquisition electronics.

After the disassembling of the cryostat, the UCN detector system was checked. It turned out, that the converter foil of the Si detector was broken. Also the data acquisition electronics was checked with a Si-detector and an α- source and has been re-adjusted.

A new bigger UCN detector will be supplied with a new converter aluminium foil, which is covered by a pure ^6Li layer. This detector will be installed outside of the cryostat, connected with a UCN guide (1.5 – 2 meter away form the cryostat), in order to reduce the thermal and epithermal neutron background.

References

[1] S. Paul et. al., The 3rd UCN Workshop, Pushkin, St. Petersburg, Russia, June 18-22, 2001

[2] Yu. N. Pokotilovski et. al., this report

[3] G. Petzold et. al., The 3rd UCN Workshop, Pushkin, St. Petersburg, Russia, June 18-22, 2001

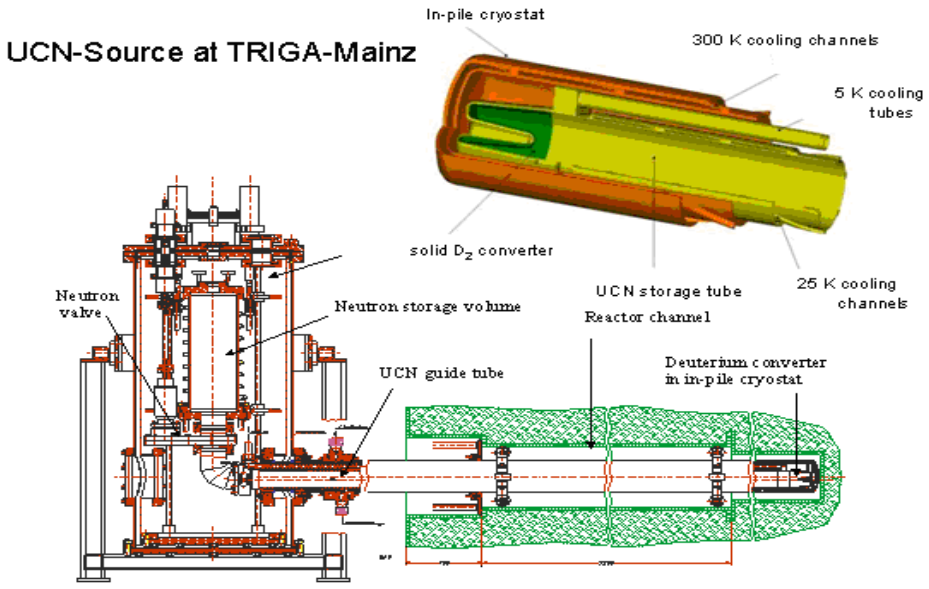

Figure 1: Vertical cross section of the test facility