

A solid Deuterium UCN Source at the 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 D2 converter with 200 cm³ 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 30K 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 10⁴ cm⁻³ can be reached. For a test of this conversion mechanism, a smaller setup has been build 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 D2-gas system and the SPC-system.

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) was done successfully in December 2004.

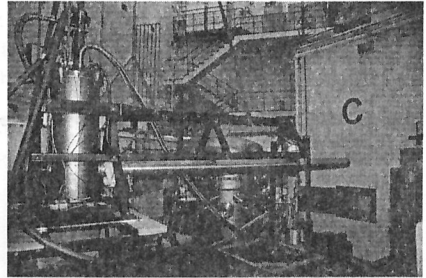


Figure 1: Solid Deuterium Source at the beam channel C of the TRIGA reactor Mainz

A first measurement with neutrons from the TRIGA reactor in the pulse mode [2] 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 Li⁶/Ni⁶²-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 electronic was checked with a Si-detector and an alpha-source, and has been re-adjusted.

A new bigger UCN detector has been supplied with a new converter aluminum foil, which is covered with a pure Li6 layer. This detector was installed outside of the cryostat, connected with a UCN guide (1.5 - 2 meter away from the cryostat), in order to reduce the thermal and epithermal neutron background.

Further test are going on in Mainz, to detect the first UCN's, produced in solid deuterium.

References

- [1]: S. Paul et.al., " A new UCN source for the Munich Reactor FRM-II", 3rd UCN Workshop, Pushkin, St. Petersburg, Russia, 2000
- [2]: K. Eberhardt and A. Kronenberg, "A Versatile Neutron Source for Basic Research", Applied Science and Education, Kerntechnik, 2000
- [3]: G. Petzold et.al., " A high-efficiency Si PIN diode detector for ultracold neutrons", 3rd UCN Workshop, Pushkin, St. Petersburg, Russia, 2000