

THE PSI ULTRACOLD NEUTRON SOURCE

M. Daum

for the UCN collaboration at PSI.

A new type of ultracold neutron (UCN) source based on the spallation process is under construction at PSI. The essential elements of this source are a pulsed 600 MeV proton beam with highest intensity ($I_p \geq 2 \text{ mA}$) and a low duty cycle ($\sim 1\%$), a heavy-element spallation target, a large moderator and converter system consisting of about 4 m^3 of heavy water (D_2O) at room temperature and 30 dm^3 of solid Deuterium (sD_2) at a low temperature ($\sim 6 \text{ K}$) for the production of ultracold neutrons. Operating the UCN source in a pulsed mode, e.g. beam on 8 s, beam off 800 s, makes it possible to hold the sD_2 at low temperatures despite the large power deposition during the beam pulse of a few seconds. Spallation neutrons are thermalized in the D_2O , further cooled in the sD_2 and down-scattered into the ultra-cold neutron range ($E_{\text{kin}} \leq 250 \text{ neV}$). An UCN density in excess of $1000/\text{cm}^3$ is expected in a typical experiment, i.e. almost two orders of magnitude higher than at any other UCN source available today.