The Meson target stations and the high power spallation neutron source SINQ at PSI

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Abstract:

The high intensity proton accelerator (HIPA) at the Paul Scherrer Institut (PSI) delivers protons of energy 590 MeV and a c.w. beam current of up to 2.4 mA, i.e. 1.4 MW beam power. The beam is sent to two meson production targets Target M and Target E used for creating the world's most intense pion and muon beams for nuclear experiments. Both consist of graphite wheels of effective thicknesses of 5 mm and 40 mm, respectively. They are rotating with 1 Hz to dissipate the energy deposit by the proton beam (20 kW/mA in case of Target E). Mainly due to failures of the bearings the target insert has to be removed remotely once a year by shielded exchange flasks and the bearings are exchanged remotely in the hot cell. Due to multiple scattering in Target E mainly the proton beam gets divergent afterwards with an opening angle of about 5 - 6 mrad and about 10 % of the beam is lost. A well cooled and designed collimator system reduces the beam power by about 20 % in addition and finally shapes the beam for transport to the spallation neutron source SINQ. Compared to all other spallation neutron sources currently in operation SINQ is operated in DC mode. It produces neutrons of thermal and cold spectra used for various applications like material research. The target of the spallation source consists of a bundle of lead filled Zircaloy tubes (Cannelloni). A couple of tubes (~15) are filled with special specimens of different materials for later post irradiation analysis like material tests or radiochemical examination. The SINQ target insert is irradiated for 2 years with a total beam load of about 12-13 Ah. Due to its high irradiation it is exchanged by remote handling in a similar way as the meson production targets mentioned above. After 1 year cooling the special specimen rods are taken out remotely in a hot cell and the rest of the target is disposed as radioactive waste.

In this talk we will outline the basic design of the two meson target stations as well as SINQ and report on recent developments.