

Low-level measuring techniques for neutrons: high accuracy neutron source strength determination and fluence rate measurement at an underground laboratory

Wednesday, 10 April 2013 15:40 (20 minutes)

We report on low-level measuring techniques for neutrons that have been developed at the Physikalisch-Technische Bundesanstalt (PTB), the German National Metrology Institute. PTB operates well characterized neutron reference fields which are available for experiments and calibration activities and is involved in the development of new detectors and measurement techniques for neutron radiation.

PTB has characterized radioactive sources used in the BOREXINO and XENON100 experiments. For the BOREXINO experiment, a ^{228}Th gamma radiation source was required which would not emit more than 10 neutrons per second. The determination of the neutron emission rate of this specially designed ^{228}Th source was challenging due to the low neutron emission rate and because the ratio of gamma to neutron radiation was expected to be extremely high, of the order of 10^6 . For the XENON100 detector, PTB carried out a high accuracy measurement of the neutron emission rate of an AmBe source. The characterization of the source included a systematic check of its flux isotropy.

PTB has also done measurements in underground laboratories. A two month measurement campaign with a set of ^3He -filled proportional counters was carried out in PTB's former UDO underground laboratory at the ASSE salt mine (1100 m w.e.). The aim of the campaign was to determine the intrinsic background of detectors, which is needed for the analysis of data taken in low-intensity neutron fields. At a later time, PTB has done preliminary measurements of the neutron fluence rate at the underground laboratory Felsenkeller (110 m w.e.) operated by VKTA. By taking into account data from UDO, Felsenkeller, and detector calibrations made at the PTB facility, it was possible to estimate the neutron fluence rate at the Felsenkeller underground laboratory

Primary author: ZIMBAL, Andreas (Physikalisch-Technische Bundesanstalt (PTB))

Co-authors: Dr WIEGEL, Burkhard (Physikalisch-Technische Bundesanstalt (PTB)); Dr DEGERING, Detlev (Verein für Kernverfahrenstechnik und Analytik Rossendorf e. V. (VKTA)); SCHUHMACHER, Helmut (Physikalisch-Technische Bundesanstalt (PTB)); Prof. ZUBER, Kai (Technische Universität Dresden); REGINATTO, Marcel (Physikalisch-Technische Bundesanstalt (PTB))

Presenter: ZIMBAL, Andreas (Physikalisch-Technische Bundesanstalt (PTB))

Session Classification: Session 3 - Low background counting techniques

Track Classification: Low background counting techniques