HK 25: Instrumentation VIII

Time: Wednesday 14:00–15:30 Location: SCH/A.101

HK 25.1 Wed 14:00 SCH/A.101

Bending Losses in Scintillating-Plastic Fibers* — Christian Dreisbach, Karl Eichhorn, Jan Friedrich, Igor Konorov, Martin Losekamm, Stephan Paul, •Alicia Pechan, and Thomas Pöschl — Technische Universität München, Physik-Department E18, Garching, Germany

The AMBER experiment at CERN's Super Proton Synchroton aims to measure the proton radius in high-energy elastic muon-proton scattering. At the Technical University of Munich, we develop a scintillating-fiber hodoscope to provide precise time information for the incoming and outgoing muons. Each detector consists of four layers of 500-μm scintillating-plastic fibers read out by silicon photomultiplier (SiPM) arrays.

The detector layout requires bending of the fibers towards the SiPMs, resulting in signal-height variations due to the associated bending losses. To characterize this effect, we performed a dedicated experiment to study the dependence of the losses on the bending radius for the scintillating fibers we use. In this contribution, we present the experimental setup and the results of this investigation.

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HK 25.2 Wed 14:15 SCH/A.101

Simulation framework for the digitisation module of scintillators and its implementation in NeuLAND — •Yanzhao Wang[1], Jan Mayer[1], Igor Gasparic[2], and Andreas Zilges[1] — [1]University of Cologne, Institute for Nuclear Physics — [2]GSI Helmholtzzentrum für Schwerionenforschung

The New Large-Area Neutron Detector NeuLAND, as a part of the R^3B experiment in FAIR, aims at providing a high detection efficiency and spatial-temporal resolution of the neutrons generated by the nuclear reaction from the high-intensity radioactive beam[1]. Simulations of the interactions between the neutrons and NeuLAND and its digitised output signals are imperative for the development of its event reconstruction algorithm.
In this talk, we are introducing a simulation framework and its implementation on the digitising module TAMEX most lately used in NeuLAND. Light yields of the scintillators are transformed into the actual energy values and time stamps of the particle interactions, taking into account multiple physical processes, such as light attenuation, PMT saturation, signal pile-up, the couplings between different PMT outputs and the variations among scintillators and digitiser channels. Additionally, the generic interface within the framework leaves a huge potential for similar implementations on different scintillation detectors in R^3B.
Supported by the BMBF (05P21PKFN1).
[1] K. Boretzky *et al.*, Nucl. Instrum. Methods Phys. Res. A1014 (2021) 165701

HK 25.3 Wed 14:30 SCH/A.101

Towards a spatially resolving detector for ultra-cold neutrons — •Konrad Franz for the tauSPECT-Collaboration — Department Chemie, Johannes Gutenberg Universität Mainz

One of the challenges in ultra-cold neutron (UCN) detection is to convert the electrically inert neutron into an electrical signal. In the presented detector design this is achieved by employing a conversion layer stacked with a scintillation layer, in which the neutron induced α-particle generates a light pulse. This scintillation light is then guided onto an array of silicon photomultipliers (SiPMs). Spatial resolution can be achieved by reading out each SiPM individually. A main advantage of this setup is its compatibility with high magnetic fields, which allows for in-situ detection of UCNs in such environments. Combining spatial resolution with a magnetic field gradient enables UCN energy resolution.
The talk will give an overview of the detector design and will outline its advantages. Furthermore, the current status of the development will be presented and the main challenges moving forward will be discussed.

HK 25.4 Wed 14:45 SCH/A.101

A normalization detector for the neutron lifetime experiment τSPECT — •Martin Engler for the tauSPECT-Collaboration — Department of Chemistry, Johannes Gutenberg University, Mainz

The τSPECT experiment aims to measure the free neutron lifetime, using fully magnetic storage. Neutrons with energies of $\approx 50\,\mathrm{neV}$ are stored in a magnetic field gradient and then counted after varying storage times. The individual measurements have to be normalized, in order to account for statistical and systematical changes in the yield of the neutron source. To monitor the flux of storable neutrons during the filling process, an in-situ neutron detector, detecting light from a ^{10}B coated ZnS:Ag scintillator coupled to an array of silicon photomultipliers, has been designed and built.

This talk will cover the detectors design, challenges, as well as the results of the first runs.

HK 25.5 Wed 15:00 SCH/A.101

A neutron trigger detector for pulsed neutron sources — •Julian Auler for the tauSPECT-Collaboration — Institut für Physik, Johannes Gutenberg-Universität, Mainz

A variety of experiments investigating properties of neutrons can be performed at pulsed source facilities like the research reactor TRIGA Mainz. A typical problem faced by these experiments is the non-availibility of a reliable facility-provided trigger signal in coincidence with the neutron production. Here we present the design, implementation and experimental results of a neutron pulse detector that provides a coincident trigger signal for precise experimental timing.

The described neutron pulse detector is based on a multilayer design with a ^{10}B top layer ($\sim 80\,\mathrm{nm}$) employing the $^{10}\mathrm{B}(\mathrm{n},\alpha)^{7}\mathrm{Li}$ reaction and deposited on a scintillator foil (0.25 mm) with a one-sided coating of ZnS(Ag) as scintillation layer. A silicon photomultiplier (SiPM) is used as photosensor, which makes the detector suitable for use in experimental areas with high magnetic fields and at the same time has the advantage that no high-voltage supply is required.

HK 25.6 Wed 15:15 SCH/A.101

Polyethylene Naphthalate Based Neutron and Radon Detectors — •Kim Tabea Giebenhain, Hans-Georg Zaunick, Roman Bergert, and Kai-Thomas Brinkmann — Justus-Liebig-Universität, Giessen, Germany

Polyethylene naphthalate (PEN) is a material with intrinsically scintillating capabilities. Using a thin foil of PEN together with a SiPM array has shown to be an excellent combination for alpha detection and therefore as a radon detection device. Coupled with a BNNT mat with a high ^{10}B content, it was tested for its capabilities as a neutron detector in the thermal energy range.
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