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Neutron optics for PERC

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The PERC experiment is currently under construction at the new beam port MEPHISTO at the FRM II. It aims to measure correlation parameters in neutron beta decay with an accuracy improved by one order of magnitude to a level of 10^{-4} .

Inside the PERC instrument, an 8 m long neutron guide contains the decay volume in a magnetic field of 1.5 T and is fed by a highly polarized cold neutron beam. In order to ensure a depolarization of the neutron beam on the level of 10^{-4} per bounce, completely non-magnetic coatings preferably made of diamagnetic materials are required. We present measurements of new supermirrors made from copper and titanium layers with excellent reflectivity. Despite the well-known high mobility of copper, which leads to degradation of the reflectivity caused by interdiffusion, our supermirrors are highly resistant to baking-out needed to fulfill the requirement of low residual gas pressure.

We also present results on solid-state neutron polarizers made with Iron/Silicon coatings. These polarizers are based on neutron transmission through the polarizer substrate. This opens the opportunity to choose a substrate material with higher neutron optical potential than the potential of the Fe for neutrons with spin antiparallel to the magnetic holding field, which eliminates total reflection of the unwanted spin component even in the low q -region. Main advantages are high degree of polarization over wide angular range as well as a very compact construction.

Primary author: Mr HOLLERING, Alexander (Physik-Department ENE, TUM)

Co-authors: MÄRKISCH, Bastian (Physik Department, TU München); Prof. SCHMIDT, Ulrich (Physikalisches Institut, Heidelberg University); Dr LAUER, Thorsten

Presenter: HOLLERING, Alexander

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