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Manufacture of the Proton Electron Radiation Channel (PERC) installed at the Research Neutron Source FRM II

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PERC is a novel experiment in the field of low energy particle physics under construction at the FRM II in Garching, Germany. The project aims to investigate angular correlations and energy spectra in the β -decay of free cold neutrons.

PERC consists of 13 superconducting solenoid coils. In a 6 m section of the 8 m long decay solenoid e- & p+ from neutron decay are accumulated. At the end of the long solenoid, a set of tilted coils (bending coils) separates the e- & p+ from the residual uncharged neutrons, which are absorbed by a beam stop. Downstream of the bending coils, several coils producing a higher and tunable magnetic field in the range from 3 T to 6 T act as magnetic filter on the angle of the e- & p+. Downstream of these selector coils, another tilted coil guides the e- & p+ back to the original horizontal axis and further to the detection area by a solenoid creating a lower magnetic field. The novel design and the high magnetic field of PERC are the basis to improve measurement accuracy by an order of magnitude. PERC is supported by the Priority Program SPP 1491 of the DFG.

In addition to the superconducting coils, the PERC system consists of the cryostat, the central warm bore (an ultra-high vacuum chamber to house the neutron guide and beam stop) and several auxiliaries such as power supplies and cryogenic feeding turret.

The system has a total length of ~ 12 m and weighs 15 tons, the cold mass weighs 6 tons. It contains about 50 km of NbTi wire and is cooled by liquid Helium. The design and manufacture of the PERC system has been commissioned from the PERC collaboration (TUM/DFG) to BNG. This document presents the manufacture of the superconducting coil-systems.

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