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Mon-Af-Or5-06: Design and first tests of a unique, superconducting multipole magnet for the ultracold-neutron trap PENeLOPE

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The Precision Experiment on Neutron Lifetime Operating with Proton Extraction (PENeLOPE) will use a large superconducting multipole magnet to trap ultracold neutrons. To achieve this, a large volume of 750 L needs to be enclosed within a steep magnetic-field gradient of at least 2 T, requiring a unique multipole arrangement with a high current density of 316 A/mm^2 and thin support structures. Additionally, it needs to be able to ramp within 100 s, so ultracold neutrons can be filled into the trap, stored, and then detected.
The goal is to measure the beta-decay lifetime of free neutrons with unprecedented precision and accuracy. The novel combination of counting neutrons surviving the trapping period and detecting protons from neutron decay in situ should be able to resolve the discrepancies between previous neutron-lifetime experiments. This presentation will cover the design of the magnet and show results of first tests at Technical University of Munich.
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