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Status of Design and Manufacturing of PENELOPE neutron trap

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We present the current status of design, testing and manufacturing of the magnet system of the PENeLOPE neutron lifetime measurement experiment, carried out by Babcock Noell GmbH on behalf of and in close cooperation with Technical University of Munich. Ultra cold neutrons produced by the experimental reactor facility in Garching are stored in a large volume magnetic bottle and held confined for periods of several minutes, where the combination of electric and magnetic fields allows basically all protons emerging from neutron decay to be captured by a high efficiency detector. This allows the decay curve to be captured with unprecedented accuracy. The magnetic bottle is formed by a nested array of 24 pairwise oppositely poled superconducting coils with local fields up to 5.5 T providing magnetic confinement for neutron energies up to 110 neV while maintaining an essentially field free trap volume. The coil formers made of 316LN constitute the wall between experimental vacuum and the LHe bath providing the cooling and support the force of the repelling coils. This circumstance and the intricate geometry makes manufacture particularly challenging. The coils are wound and potted on individual formers, which are then assembled to the full magnet structure. This is achieved by means of laser welding. Due to spatial constraints, the welds are as close as 6 mm to the coil windings. With the help of specialized companies we were able to produce 6 mm deep vacuum tight and load bearing structural welds without raising the temperature at the coil's windings above 180°C, which is considered the maximum acceptable temperature for the insulation and potting resin chosen.

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