T 114: Neutrinos V

Time: Thursday 15:50–17:20 Location: POT/0051

T 114.1 Thu 15:50 POT/0051

Characterization of the ECHo-100k detector response — •Raghav Pandey[1], Arnulf Barth[1], Sebastian Berndt[2], Holger Dorrer[2], Christoph E. Düllmann[2], Christian Enss[1], Andreas Fleischmann[1], Nina Kneip[3], Federica Mantegazzini[1], Klaus Wendt[3], and Loredana Gastaldo[1] — [1]Kirchhoff Institute for Physics, Heidelberg University — [2]Department of Chemistry - TRIGA Site, Johannes Gutenberg-Universität Mainz — [3]Institute of Physics, Johannes Gutenberg-Universität Mainz

In the ECHo-100 experiment high energy resolution and high statistics Ho-163 electron capture spectra will be acquired with more than 10000 single detector pixels that fully enclose implanted Ho-163. A well-understood and reliable detector response is at the basis for a precise analysis of the spectral shape in the endpoint region around 2.8 keV. We present the results obtained with ECHo-100k detectors containing Ho-163. We discuss the shape of the acquired spectrum with respect to the spectrum acquired with ECHo-1k detectors and with the spectrum acquired with the same ECHo-100k detectors but consisting only of the lower half of the absorber, meaning without complete Ho-163 enclosure.

T 114.2 Thu 16:05 POT/0051

First ^{7}Be Electron Capture Spectrum measured with MMCs — •Arnulf Barth[1], Karl Johnston[2], Federica Mantegazzini[1], Peter Rubovič[3], and Loredana Gastaldo[1] — [1]Kirchhoff-Institute for Physics, Heidelberg University — [2]ISOLDE, CERN — [3]Institute of Experimental and Applied Physics, Czech Technical University in Prague

^{7}Be, with a half-life of about 53 days and a Q-value of about 862 keV is the lightest nuclide to undergo electron capture. In nature, electron capture processes typically occur in atoms within a medium. ^{7}Be electrons provide very low screening from environment effects from the host material, causing a change in half-life and other atomic properties. This makes ^{7}Be an optimal candidate to study the effect of different host materials on the electron capture process and on the energy transferred to the nuclear recoil. We present the first measurement of the ^{7}Be spectrum using low temperature metallic magnetic calorimeters where ^{7}Be has been ion-implanted into gold. We achieved a baseline resolution of 4 eV FWHM and could observe the peak corresponding to the capture of the 1s electron, which includes the atomic de-excitation energy and the nuclear recoil energy. These very promising results demonstrate the possibility to perform a detailed study of the effect of the environment on the electron capture process by implanting ^{7}Be in different host materials.

T 114.3 Thu 16:20 POT/0051

Reducing temperature drifts and their effect on MMC detector response for the ECHo experiment — •Cicek Cihan, Arnulf Barth, Daniel Unger, Daniel Hengstler, Andreas Fleischmann, and Loredana Gastaldo — Kirchhoff Institute for Physics, Heidelberg University

In the ECHo experiment, large arrays of metallic magnetic calorimeters are mounted at the mixing chamber plate of a dilution refrigerator kept at a temperature below 20 mK. The temperature of the mixing chamber is regulated and shows average drifts at the level of 1 μK. Methods to improve the stability are presently under study.
Even if very small, these temperature fluctuations degrade the energy resolution of detectors optimized for the ECHo experiment. To cure this effect, each ECHo chip hosts two temperature sensors. For each triggered event in pixels on a chip, the signal of the temperature channels are also acquired and will be used for an off-line correction. We discuss methods which allow for identification and correction of temperature instabilities and present the effect of this correction on energy resolution.

T 114.4 Thu 16:35 POT/0051

Analysing KATRIN neutrino mass data using a neural network — Christian Karl[1,2], Susanne Mertens[1,2], •Alessandro Schwemmer[1,2], and Christoph Wiesinger[1,2] for the KATRIN-Collaboration — [1]Physik Department, Technische Universität München, Garching — [2]Max-Planck-Institut für Physik, München

The Karlsruhe Tritium Neutrino (KATRIN) experiment probes the effective electron anti-neutrino mass by a precision measurement of the tritium beta-decay spectrum near the endpoint. A world-leading upper limit of 0.8 eV c^{-2} (90 % CL) has been set with the first two measurement campaigns. Improvements w.r.t. the measurement configuration allowed for an enhanced signal-to-background ratio as well as a reduction of systematic uncertainties and a substantial increase in statistics. Subsequently the combined sensitivity of the first five datasets is estimated to be below 0.5 eV c^{-2} (90 % CL). In this talk we will present a novel approach for the analysis of these datasets using a neural network.

T 114.5 Thu 16:50 POT/0051

High voltage preparation and first measurement of a new ^{83m}Kr conversion line with the KATRIN experiment — •Benedikt Bieringer and Matthias Böttcher for the KATRIN-Collaboration — Institute for Nuclear Physics, University of Münster

The Karlsruhe Tritium Neutrino Experiment (KATRIN) is targeted to measure the neutrino mass with a design sensitivity of 0.2 eV at 90 % confidence level through electron spectroscopy of β^- decay electrons from a windowless gaseous tritium source. To determine the spectrometer properties and to calibrate the beamline work function, a Condensed Krypton Source (CKrS) can be inserted into the beamline, providing conversion electrons from ^{83m}Kr. For precision spectroscopy, the KATRIN experiment features a stabilized high voltage system up to −35 kV with ppm level precision. This talk presents the extention of the KATRIN high voltage system to support retarding potentials of up to −40 kV and a consecutive first measurement of a new ^{83m}Kr conversion line using the CKrS following the idea of EPJ C 82 (2022) 700.

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T 114.6 Thu 17:05 POT/0051

Optimization-based Bayesian sensitivity on neutrino mass and constraints on cosmology with the KATRIN experiment — Stephanie Hickford[1], Leonard Köllenberger[1], and •Weiran Xu[2] — [1]Institute for Astroparticle Physics, Karlsruhe Institute of Technology — [2]Laboratory for Nuclear Science, Massachusetts Institute of Technology

The Karlsruhe Tritium Neutrino (KATRIN) experiment has pushed the direct bound of the neutrino mass down to sub-eV level in their first two scientific campaigns. The upcoming data release using a frequentist approach which includes the most recent three measurement campaigns is currently in preparation.

A comprehensive Bayesian analysis provides an alternative interpretation for the prior information and the neutrino mass results. Performing Bayesian sampling is computationally intensive and challenging when including all the systematic uncertainties, e.g. for the shifted analyzing plane configuration of the main spectrometer. New methods to optimize the model calculation will be presented, together with the Bayesian sensitivity for KATRIN's first five measurement campaigns. Constraints on cosmological models with the released data will also be presented within the Bayesian framework.