HK 30: Instrumentation VIII

Zeit: Dienstag 16:30–18:15 Raum: S1/01 A3

Gruppenbericht HK 30.1 Di 16:30 S1/01 A3

Test of Time-Reversal Invariance at COSY — •Yury Valdau[1,2], Dieter Eversheim[1], and Bernd Lorentz[3] — [1]Helmholz Institute für Strahlen- und Kernphysik, University Bonn, Germany — [2]National Research Center "Kurchatov Institute" Petersburg Nuclear Physics Institute B.P. Konstantinov, Gatchina, Leningrad district 188300, Russia — [3]Forschungszentrum Jülich, Institute für Kernphysik, Wilhelm-Johnen-Straße, Jülich, 52425

The experiment to test the Time Reversal Invariance at Cosy (TRIC) is under the preparation by the PAX collaboration. It is planned to improve present limit on the T-odd P-even interaction by at least one order of magnitude using a unique genuine null observable available in double polarized proton-deuteron scattering. The TRIC experiment is planned as a transmission experiment using a tensor polarized deuterium target placed at the internal target place of the Cooler-Synchrotron COSY-Jülich. Total double polarized cross section will be measured observing a beam current change due to the interaction of a polarized proton beam with an internal tensor polarized deuterium target from the PAX atomic beam source. Hence, in this experiment COSY will be used as an accelerator, detector and ideal zero degree spectrometer. In addition to the high intensity polarized proton beam and high density polarized deuterium target, a new high precision beam current measurement system will be prepared for the TRIC experiment. In this report status of all the activities of PAX collaboration towards realization of the TRIC experiment will be presented.

HK 30.2 Di 17:00 S1/01 A3

Precise measurements and shimming of magnetic field gradients in the low field regime — •Fabian Allmendinger[1], Olivier Grasdijk[3], Werner Heil[2], Klaus Jungmann[3], Sergei Karpuk[2], Hans-Joachim Krause[4], Andreas Offenhäuser[4], Maricel Repetto[2], Ulrich Schmidt[1], Yuri Sobolev[2], Lorenz Willmann[3], and Stefan Zimmer[2] for the MIXed-Collaboration — [1]Physikalisches Institut , Universität Heidelberg — [2]Institut für Physik, Universität Mainz — [3]University of Groningen — [4]Peter Grünberg Institut, Forschungszentrum Jülich

For many experiments at the precision frontier of fundamental physics, the accurate measurement and knowledge of magnetic field gradients in particular in the low field regime ($<\mu$T) is a necessity: On the one hand, in the search for an Electric Dipole Moment (EDM) of free neutrons or atoms, field gradients contribute to geometric-phase-induced false EDM signals for particles in traps. On the other hand, clock comparison experiments like the ^{3}He/^{129}Xe spin clock experiment suffer from gradients, since the coherent T_2^*-time of free spin precession, and thus the measurement sensitivity, scales $\propto |\nabla\vec{B}|^{-2}$. Here we report on a new and very effective method, to shim and to measure tiny magnetic field gradients in the range of pT/cm by using effective T_2^*-measurement sequences in varying the currents of trim coils of known geometry.

HK 30.3 Di 17:15 S1/01 A3

Generation of narrow peaks in spectroscopy of charged-particles — •Dirk Dubbers[1] and Ulrich Schmidt[2] — [1]Physikalisches Institut der Universität, INF 226, 69120 Heidelberg — [2]Physikalisches Institut der Universität, INF 226, 69120 Heidelberg

In spectroscopy of charged particles, narrow peaks may appear in initially smooth continuous spectra if magnetic transport of the particles is involved. Such anomalies can occur in all systems with less than 100% geometric detection efficiency. As unexpected peaks may be misinterpreted as new physics, their generation is investigated, both analytically and experimentally, for various detector configurations, including those used in searches for the spontaneous decay of the vacuum in heavy-ion collisions.

HK 30.4 Di 17:30 S1/01 A3

A novel enhanced calibration method for DSSSD detectors — •Levent Kaya, Andreas Vogt, Peter Reiter, Benedikt Birkenbach, Rouven Hirsch, Michael Seidlitz, and Nigel Warr — Institut für Kernphysik, Universität zu Köln

Double-sided silicon strip detectors (DSSSD) are employed for the detection of charged particles in low-energy nuclear physics providing position and energy information for the impinging particle. Intersecting areas of both p- and n-side strips form individual pixel segments allowing for a high detector granularity. However, due to limitation in fabrication and the response of readout electronics, the performance of different channels may vary. In order to achieve best energy information, a calibration of each p- and n-side strip with a very high precision is mandatory. DSSSD responses are analyzed employing energy correlation matrices between adjacent strips in order to determine charge-sharing and energy-loss effects. A novel calibration method is based on the fact that each event is registered simultaneously on the p- and n-side strips. A two-dimensional calibration procedure allows for a significant enhancement of the energy resolution. In this way, the performance of DSSSDs with position-dependent radiation damage is improved clearly by excluding locally damaged detector areas without losing the information of complete p- or n-side strips. Supported by Bonn-Cologne Graduate School.

HK 30.5 Di 17:45 S1/01 A3

Quantitative detection of microscopic lithium distributions with neutrons — •Giulia Neri[1], Roman Gernhäuser[1], Josef Lichtinger[1], Sonja Winkler[1], Dominik Seiler[1], Michael Bendel[1], Julia Kunze-Liebhäuser[2], Jassen Brumbarov[2], Engelbert Portenkirchner[2], Axel Renno[3], and Georg Rugel[3] — [1]Technische Universität München, Physik-Department, Germany — [2]Institut für Physikalische Chemie, Leopold-Franzens-Universität Innsbruck, Austria — [3]Helmholtz Zentrum Dresden Rossendorf, Helmholtz-Institut Freiberg für Ressourcentechnologie, Germany

The importance of lithium in the modern industrial society is continuously increasing. Spatially resolved detection of tritium particles from ^{6}Li(n,α)^{3}H nuclear reactions is used to reconstruct microscopic lithium distributions. Samples are exposed to a flux of cold neutrons. Emitted charged particles are detected with a PSD. Introducing a pinhole aperture between target and detector, the experimental setup works like a "camera obscura", allowing to perform spatially resolved measurements. Tritium detection analysis was successfully used to reconstruct the lithium content in self-organized TiO_{2-x}-C and Si/TiO_{2-x}-C nanotubes electrochemically lithiated, for the first time. Titanium dioxide nanotubes are a candidate for a safe anode material in lithium-ion batteries. Also lithium distributions in geological samples, so called "pathfinder-minerals" containing lithium, like lepidolite from a pegmatite, were analyzed. With this development we present a new precision method using nuclear physics for material science.

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HK 30.6 Di 18:00 S1/01 A3

BGO shields for the MINIBALL spectrometer — •Dawid Rosiak and Peter Reiter — Institut für Kernphysik, Universität zu Köln

An enhanced detection sensitivity of the high-resolution MINIBALL spectrometer is required for future experiments at the HIE-ISOLDE accelerator at CERN. These measurements will be based on direct reactions and fusion-evaporation reactions, populating excited nuclei at high excitation energies. Moreover, high angular-momentum transfer will cause higher γ-ray multiplicities. The existing MINIBALL spectrometer with its closely packed eight triple cluster detectors was designed for highest solid-angle coverage, causing best γ-ray efficiency for low-multiplicity events. Therefore the triple-cluster detectors will be surrounded with additional BGO Compton suppression detectors in order to cope with the scattering between detectors from high energetic γ-rays and double hits from higher γ-ray multiplicities. After extended Monte-Carlo studies with a newly developed MINIBALL simulation code based on GEANT4 a final Compton suppression detector geometry for the MINIBALL spectrometer was determined. This additional BGO detectors in combination with the MINIBALL array will improve the peak-to-total ratio up to 50% and cause just a slight reduction from 8.0% to 7.2% in efficiency. In collaboration with the IPN Orsay the first BGO prototype is under construction. The status of the project and first measurements with the newly developed BGO detector will be presented.