HK 29 Instrumentation und Anwendungen

Zeit: Dienstag 14:00–16:00 Raum: TU MA042

HK 29.1 Di 14:00 TU MA042

Beam-Induced Depolarisation in the HERMES Transversely Polarised Hydrogen Target — •Davide Reggiani, Erhard Steffens, and Phil Tait for the HERMES (Target Group) collaboration — Physikalisches Institut, Universität Erlangen-Nürnberg, 91058 Erlangen

The HERMES polarised hydrogen target is situated in the HERA electron storage ring in Hamburg. For the transverse spin program at HERMES, the magnetic holding field of the target is perpendicular to the HERA positron beam. An unwanted consequence is that the beam-induced resonance between hydrogen hyperfine states with $\Delta m_F = 0$, which was previously forbidden, can occur. The shape and spacing of these resonances will be shown. In order to prevent these resonances from reducing the nuclear polarization in the target cell, a pair of correction coils have been added to improve the field homogeneity. The change of the resonance shape and the increase of the target polarization obtained by using these coils will be presented along with an overview of the overall target performance.

HK 29.2 Di 14:15 TU MA042

Ein gepulstes NMR-System zur Polarisationsmessung an Festkörpertargets — •C. Hess, J. Dahmen, J. Heckmann, W. Meyer, E. Radtke und G. Reicherz — Institut für Experimentalphysik I, Ruhr-Universität Bochum, D-44780 Bochum

In Doppelpolarisationsexperimenten wie z.B. COMPASS werden polarisierte Festkörpertargets eingesetzt. Für die Analyse ist die Kenntnis des genauen Polarisationsgrades des Targetmaterials von entscheidender Bedeutung. Die Bestimmung der Polarisation erfolgt dabei über die Messung der NMR-Linie, wozu zur Zeit überwiegend die Methode der cw-NMR (continuous wave nuclear magnetic resonance) genutzt wird. In anderen Anwendungen der NMR (z.B. in der Kernphysik oder Medizin) kommt fast ausschließlich die Technik der gepulsten NMR zum Einsatz, die sich durch bessere Zeitauflösung und vor allem höhere Empfindlichkeit auszeichnet. Es liegt nahe, diese Technik auf ihre Eignung zur Polarisationsbestimmung zu untersuchen.

Mit dem im Aufbau befindlichen gepulsten NMR-System wurden im Bochumer PT-Labor erste Messungen unter Kryo-Bedingungen durchgeführt, deren Ergebnisse präsentiert werden.

HK 29.3 Di 14:30 TU MA042

Elektronenspinresonanz und Polarisationsverhalten von D-Butanol als polarisiertes Festkörpertarget — •J. Heckmann, J. Dahmen, S. Goertz, C. Hess, W. Meyer, E. Radtke und G. Reicherz — Institut für Experimentalphysik AG I, Ruhr-Universität Bochum, Universitätsstr. 150, D-44780 Bochum

An polarisierten Festkörpertargets werden hohe Polarisationswerte mit Hilfe der Dynamischen Nukleonenpolarisation (DNP) erzielt. Dabei werden die Nukleonen über ein paramagnetisches Elektronensystem polarisiert, welches durch Dotierung in das Targetmaterial eingebracht wird und bei DNP-typischen Bedingungen von T=1 K und B=2.5 T nahezu vollständig polarisiert ist. In der Beschreibung der DNP durch die Spintemperaturtheorie ist die Breite der Elektronenspinresonanz dieses Systems paramagnetischer Elektronen ein wichtiger Parameter für die Effizienz des Polarisationsübertrags auf die Nukleonen. Ein im Bochumer PT-Labor entwickeltes 70 GHz-ESR-Spektrometer erlaubt erstmalig die präzise Messung der ESR-Linienbreite polarisierbarer Targetmaterialien bei einem DNP-relevanten Feld von 2.5 T und damit die experimentelle Bestätigung des Zusammenhangs zwischen ESR-Linienbreite und Nukleonenpolarisation. Dieser wird am Beispiel von mit verschiedenen Radikalen dotiertem D-Butanol vorgestellt.

HK 29.4 Di 14:45 TU MA042

A new polarized solid state target for double polarization experiments with the COSY-TOF detector. — •Andrea Raccanelli and Hartmut Dutz for the COSY-TOF collaboration — Physikalisches Institut der Universitaet Bonn, Nussallee 12, 53115 Bonn

We present a new scheme for a polarized solid target to be used in double polarization experiments at COSY. We refer in particular to the planned experiment for the determination of the parity of the Θ^+. We analize the constraints and requirements set on a polarized target that is run in frozen spin mode and discuss the possible experimental solutions.

HK 29.5 Di 15:00 TU MA042

Observation and measurement of hydrogen and nitrogen frozen droplets at the ANKE Pellet Target* — •P. Fedorets[1,2], W. Borgs[2], M. Büscher[2], A. Bukharov[3], V. Chernetsky[1], and V. Chernyshev[1] for the ANKE collaboration — [1]ITEP, Moscow, Russia — [2]Forschungszentrum Jülich, Germany — [3]MPEI, Moscow, Russia

Targets of frozen hydrogen and deuterium droplets ("pellets") have been proposed for high luminosity experiments at internal accelerator beams. Such a pellet target is under construction at COSY-Jülich to study meson production in hadronic interactions. The expected luminosities higher than $L = 10^{32}\text{cm}^{-2}\text{s}^{-1}$ will be offer possibility for investigations in the sub-nb range. To produce nuclear micro targets, inside the cryogenic chamber of the target different gases can be liquefied with the help of liquid nitrogen and helium. Liquid jet with diameter down to $\sim 10\,\mu$m is formed inside a triple-point chamber (TPC), where conditions are kept close to the triple point values (T_{tr}=14 K, $p_{\text{tr}}\sim$100 mbar for hydrogen) with an accuracy of better than 0.1 K (and 5% of pressure). The liquid jet is broken into droplets by acoustic excitation. During flight into the accelerator vacuum the droplets freeze and a continuous flow of frozen pellets with diameters down to $\sim 20\,\mu$m is generated. The status of the ANKE pellet target and the results of tests on pellet production with hydrogen and nitrogen will be presented.

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HK 29.6 Di 15:15 TU MA042

The Polarized Internal Gas Target of ANKE at COSY* — •K. Grigoriev[1], R. Engels[2], A. Gussen[3], P. Jansen[3], H. Kleines[4], F. Klehr[3], P. Kravtsov[1], B. Lorentz[2], M. Mikirtytchiants[1], M. Nekipelov[1], V. Nelyubin[1], H. Paetz gen. Schieck[5], F. Rathmann[2], J. Sarkadi[4], H. Seyfarth[2], E. Steffens[6], H. Stroher[2], V. Trofimov[1], A. Vassiliev[1], and K. Zwoll[4] for the ANKE collaboration — [1]PNPI, Gatchina, Russia — [2]IKP, FZ Jülich — [3]ZAT, FZ Jülich — [4]ZEL, FZ Jülich — [5]IKP, Univ. zu Köln — [6]Phys. Inst. II, Univ. Erlangen-Nürnberg

For future few-nucleon interaction studies with polarized beams and targets at COSY-Jülich, a polarized internal storage cell gas target is currently being developed and will be implemented at ANKE spectrometer in 2005. Laboratory tests with the Atomic Beam Source and cell prototypes have been carried out. The results of these tests using the Lamb-shift polarimeter indicate that the signal from the polarized atoms can be distinguished from the background. Cell tests at ANKE for the determination of the dimensions of the stored COSY beam have been performed as well. In February 2005 first measurements with unpolarized internal storage cell gas target will be performed and results of these tests will be presented.

* Supported by BNBF, COSY-FFE, FZJ.

HK 29.7 Di 15:30 TU MA042

Gold Finger-hydrogen/deuterium target for COSY-TOF experiment — •Salem Abdel-Samad, M. Abdel-Bary, K. Kilian, J. Ritman, and J. Uehlemann for the COSY-TOF, Forschungszentrum Juelich collaboration — Forschungszentrum Juelich, 52425 Juelich

A very small and light liquid hydrogen/deuterium target has been developed for pp and pd interaction studies at COSY. It is very important is to keep the transversal size of the target very small and the heat conductors, mounting elements and thermal isolation as light as possible. The target has a long thin cooling finger, which was first made from copper, then aluminum and finally we now use extremely light heat pipes from thin stainless steel tube, 0.1 mm wall thickness. Isolation against heat radiation was done by very light aluminized Mylar foil (superisolation). In this work, a drastic reduction of the radiation heat load to the cold parts is achieved by coating the target finger and the heat pipe with a thin polished gold layer. Also the radiation heat load is reduced further from 1.4 Watt to 0.6 Watt on the actually used system by using an aluminum heat shield at 50 K around the cold parts at 15 K. This heat load will be reduced further without changing the geometry to less than 0.1 Watt by coating both sides of the aluminum shield with thin gold layer. The new results concerning the reduction of the heat load and the excellent performance during a six weeks beam time will be shown.

HK 29.8 Di 15:45 TU MA042

The Mainz Frozen Spin Target — •Mauricio Martinez — A2 Collaboration. Institut für Kernphysik Mainz

This talk will explain the basics ideas of how a Frozen Spin Target works. The DNP (Dynamical Nuclear Polarization) technique will be shown.

The different parts needed to create a Frozen Spin Target will be presented: A superconducting magnet is used to create a magnetic field of up to 5 Tesla around the target material. The very low temperatures (50 mK) are achieved by a cryostat using He3-He4 mixing. Microwave power is needed to induce the spin flip of the electron and transfer the polarization to the nucleons. An NMR (Nuclear Magnetic Resonance) circuit is used to measure the polarization of the target. The whole system is controlled and monitored using Simatic modules and Step7, ProTool and LabView software.