HK 63: Accelerators and Instrumentation II

Time: Wednesday 16:30–19:00 Location: H-ZO 90

Group Report HK 63.1 We 16:30 H-ZO 90

Status of the development at the S-DALINAC* — •Tobias Weilbach[1], Asim Araz[1], Wolfgang Ackermann[2], Uwe Bonnes[1], Jens Conrad[1], Ralf Eichhorn[1], Sylvain Franke[1], Joel Fuerst[3], Michael Hertling[1], Florian Hug[1], Christian Klose[1], Peter Kneisel[4], Martin Konrad[1], Thorsten Kürzeder[1], Clemens Liebig[1], Wolfgang F. O. Müller[2], Norbert Pietralla[1], Markus Platz[1], Achim Richter[1], Christian Röder[1], Felix Schlander[1], Sven Sievers[1], Bastian Steiner[2], and Thomas Weiland[2] — [1]Institut für Kernphysik, TU Darmstadt — [2]Institut für Theorie Elektromagnetischer Felder, TU Darmstadt — [3]Argonne National Laboratory, Argonne — [4]Jefferson Laboratory, Newport News

The superconducting electron accelerator S-DALINAC delivers a beam with a maximum energy of 130 MeV and beam currents up to 60 μA which is used for experiments in nuclear and astrophysics. In this talk an overview of the actual status and the latest upgrades is given.

To increase the injector energy up to 14 MeV and the current up to 150 μA new cavities and couplers for rf power up to 2 kW have been built and a new cryostat module has been designed.

To decrease the energy spread of the beam a non-isochronous recirculating scheme is planned and first results of the simulations are presented.

In order to reach the design Q factor one of our cavities was sent to Jlab for preparation and measuring of the maximum reachable Q value after a standard CEBAF treatment.

*Supported by DFG through SFB 634

Group Report HK 63.2 We 17:00 H-ZO 90

The new position sensitive triple cluster detector for AGATA — •P. Reiter[1], B. Birkenbach[1], B. Bruyneel[1], J. Eberth[1], H. Hess[1], D. Lersch[1], G. Pascovici[1], A. Wiens[1], and H.G. Thomas[2] for the AGATA-Collaboration — [1]IKP, University Cologne — [2]CTT, Montabaur

The Advanced Gamma Tracking Array will be based on the novel principle of γ-ray tracking and will be built from encapsulated, 36-fold segmented HPGe detectors. Equipped with fully digital electronics, AGATA will provide an optimal energy resolution and a very high efficiency combined with a position sensitivity of a few millimetres. In its final configuration AGATA will consist of 60 detectors and the first triple cluster detectors are successfully assembled. All 111 energy channels are equipped with cold FETs for enhanced energy resolution. The energy range was extended up to 200 MeV by applying a time over threshold technique with new preamplifiers. Energy resolution for high energetic γ-rays above 8 MeV is measured to be comparable with values obtained with the standard technique. A very low cross talk level was determined which compares well with the expected calculated contributions. The results of a new correction method to eliminate the influence of cross talk will be presented. The scanning results of AGATA crystals are reproduced by pulse shape simulations based on Ge crystal properties, electric field distributions and charge carrier mobility. The first triple cluster detectors are operated at INFN Legnaro and IKP Cologne for commissioning of the demonstrator sub-array. Supported by the German BMBF(06 KY205I)

HK 63.3 We 17:30 H-ZO 90

Recent developments for the future Penning trap mass spectrometer MATS — •Daniel Rodríguez[1], Klaus Blaum[2], Stefan Stahl[3], and Marta Ubieto-Diaz[2] for the MATS-Collaboration — [1]University of Huelva, Avda. de las Fuerzas Armadas s/n 21071 Huelva, Spain — [2]Max-Planck-Institute for Nuclear Physics, 69029 Heidelberg, Germany — [3]Stahl-Electronics, Kellerweg 23, 67582 Mettenheim, Germany

The applications of very precise mass measurements (δm/m $\leq 10^{-8}$) on exotic short-lived nuclei have opened up an attractive research realm which will be present also at the future international facility FAIR (Facility for Antiprotons and Ion Research) with MATS. The MATS Penning trap facility comprises several key elements: a Radio Frequency Quadrupole (RFQ) buncher for beam preparation, an Electron Beam Ion Trap (EBIT) for charge breeding, and two Penning trap systems, one for preparation and spectroscopy and one for mass measurements. The conceptual design of these elements is almost ready. One feature of the MATS facility will be the manipulation of highly charged ions and the monitoring of their cooling process using a novel cryogenic broadband Fourier Transform-Ion Cyclotron Resonance (FT-ICR) detection system. A prototype of this system is currently under commissioning at the Max-Planck-Institute for Nuclear Physics in Heidelberg. It will be used at first in the beam line of the Karlsruhe Tritium Neutrino experiment (KATRIN). In this contribution the layout of the MATS facility will be presented underlining the recent highlights obtained with this novel FT-ICR system.

HK 63.4 We 17:45 H-ZO 90

Photon Tagger NEPTUN* — •L. Schnorrenberger[1], M. Elvers[2], J. Endres[2], J. Glorius[1], J. Hasper[2], K. Lindenberg[1], N. Pietralla[1], D. Savran[1], V. Simon[1], K. Sonnabend[1], C. Wälzlein[1], and A. Zilges[2] — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]Institut für Kernphysik, Universität zu Köln, Germany

For various experiments in nuclear physics and astrophysics as well as for technical applications, monoenergetic photon beams are demanded. The low energy photon tagger NEPTUN at the Superconducting DArmstadt electron LInear ACcelerator S-DALINAC can provide tagged photon beams in the energy range from 6 MeV to 20 MeV at a resolution of 25 keV at 10 MeV.

Photons are produced by relativistic electrons impinging on a thin radiator target. The energy of the scattered electrons is analysed by a magnetic spectrometer. Knowing the difference in energy between the primary beam and the scattered electrons, the energy of each corresponding photon can be determined [1,2].

Recent experiments have shown that a mean resolution of about 35 keV can be obtained for energies between 2 MeV and 12 MeV. Ongoing further improvements on the electron beam will lead to an even better resolution. The analysis of first (γ,γ ') experiments is in progress.

* supported by the DFG under contract SFB 634

[1] M. Elvers *et al.*, J. Phys. G **35** (2008) 014027.

[2] K. Lindenberg, PhD Thesis, TU Darmstadt, 2008.

HK 63.5 We 18:00 H-ZO 90

Production of scintillation fiber combinations for the NEPTUN photon tagger * — •Cathrin Wälzlein[1], Janis Endres[2], Jan Glorius[1], Norbert Pietralla[1], Deniz Savran[1], Linda Schnorrenberger[1], Kerstin Sonnabend[1], and Andreas Zilges[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]Institut für Kernphysik, Universität zu Köln

At the S-DALINAC, the low-energy photon tagger NEPTUN has been constructed. An array of thin scintillation fibers is used to detect scattered electrons in the focal plane of the spectrometer. These fibers are connected to light guides to transmit the scintillation light to photomultiplier tubes. Connection methods were improved to reduce losses at the coupling areas. Additionally, the light yield is increased by using combinations of two scintillation fibers. A detection efficiency of nearly 100% is achieved. A report on the production process of the fibers and on their performance tests will be given.

* supported by the DFG (SFB 634)

HK 63.6 We 18:15 H-ZO 90

Development and construction of a detector array for (γ,n) experiments at NEPTUN* — •Vanessa Simon, Bastian Loeher, Norbert Pietralla, Linda Schnorrenberger, Deniz Savran, and Kerstin Sonnabend — Institut für Kernphysik, Technische Universität Darmstadt, Germany

The low-energy photon tagger NEPTUN [1] has been built at the superconducting electron accelerator S-DALINAC at TU Darmstadt. This spectrometer generates a tagged photon beam in an energy range between 6 MeV < E_γ < 20 MeV.

For (γ,n) experiments a neutron detector array will be designed in a 4π-geometry consisting of 17 detectors. Each detector contains liquid scintillators so that pulse shape discrimination methods can be applied. Four of the detectors are in addition loaded with 5% ^{10}B to further discriminate between neutrons and photons via the capture reaction $^{10}B(n,\alpha)^{7}Li$. The special conditions, as well as initial developments and construction work is shown. Furthermore, first experiments and efficiency measurements are presented.

* supported by the DFG (SFB 634)

[1] K. Lindenberg, PhD Thesis, TU Darmstadt, 2008.

HK 63.7 We 18:30 H-ZO 90

Determination of pulse shape starting time using neural networks — •Michael Schlarb, Roman Gernhäuser, and Reiner Krücken — Physik-Department E12, TU München

The Advanced Gamma Tracking Array (AGATA) which is currently being built, is a $4\,\pi$- detector of highly-segmented germanium crystals. For the purpose of a full reconstruction of the interaction locations within the detector a pulse shape analyis is performed, using a direct comparison between experimental and simulated signal. A prerequisite to achieve the necessary position resolution is a precise knowledge of the signals starting time t_0. It is preferable to have t_0 determined before the actual pulse shape analysis is conducted since it significantly simplifies the task of the latter. The influence an imprecise knowledge of t_0 has on the attainable position resolution is presented. Furthermore we investigated the use of neural networks to properly determine the starting time and generally achieved good results.

* funded by BMBF(06MT238),EURONS(T-J02-3), DFG (Exz-Clust 153-Universe)

HK 63.8 We 18:45 H-ZO 90

Analysis of the polarization sensitivity of the DAGATA polarimeter — •Babak Alikhani[1], Philpp Rudolf John[1,2], Jörg Leske[1], Oliver Möller[1], and Norbert Pietralla[1] — [1]Technische Universität Darmstadt TUD,Germany — [2]Middle East Technical University METU, Ankara, Turkey

Besides the energy and the spin of an excited nuclear state the determination of its parity is of crucial importance for instance for the interpretation of results from Nuclear Resonance Fluorescence experiments (NRF). For this purpose the sensitivity of the Compton Effect is used to measure the linear polarization of emitted photons. In comparison to standard Compton Polarimeters the DAGATA (Darmstadt GAmma-ray Tracking Assembly) polarimeter will significantly enhance the sensitivity for gamma rays above 4 MeV making use of its large volume 36-fold segmented HPGe AGATA crystal and the resulting superior position resolution. Results from Monte Carlo Simulations will be presented as well as approaches for data analysis to further improve the sensitivity. Application limits and realistic simulated spectra will be compared to results from existing polarimeters.