T 56: Experimentelle Methoden: unterschiedliche Techniken

Zeit: Dienstag 16:45–18:35 Raum: K.12.18 (K3)

Gruppenbericht T 56.1 Di 16:45 K.12.18 (K3)

The NA62 Experiment — •Gia Khoriauli — Johannes Gutenberg-Universität Mainz, Mainz, Deutschland

NA62 is a fixed target experiment at CERN operating on the 400 GeV proton beam supplied by the CERN SPS accelerator facility. The main physics goal of the experiment is to perform a very precise measurement of the kaon rare decay $K^+ \to \pi^+\nu\bar{\nu}$. This particular decay channel is strongly suppressed in the Standard Model but on the other hand its rate can be calculated with high accuracy. The NA62 is designed to measure the $K^+ \to \pi^+\nu\bar{\nu}$ decay rate with an uncertainty of a couple of percents. Therefore, any significant disagreement between the theoretically calculated and measured decay rate can serve as a clear evidence of some new physics phenomena. The experiment has been launched in October 2014. We review the performance of the NA62 sub-detectors and the first physics results. Main accents will be made on the contribution of the NA62 working group of the University of Mainz.

T 56.2 Di 17:05 K.12.18 (K3)

A data-driven technique to model the decay of Z bosons into tauons — Joram Berger, Rene Caspart, Fabio Colombo, Felix Frensch, Raphael Friese, Andrew Gilbert, Thomas Müller, Günter Quast, •Benjamin Treiber, and Roger Wolf — Karlsruhe Institute of Technology

The first direct evidence of the Higgs boson coupling to leptons was presented by the ATLAS and CMS collaborations with a significance of more than 3 σ in the $H \to \tau\tau$ decay channel. One of the many elements of the related analysis is a data-driven technique to reduce uncertainties in the main source of background to the signal, coming from $Z \to \tau\tau$ decays.

This method is based on recorded $Z \to \mu\mu$ collision data of which the muons can be selected with a high efficiency and purity. The muons are then replaced with simulated τ leptons. Using this method, the contribution from Z bosons decaying into two tauons can be studied with lower systematic uncertainties than one could achieve from pure Monte-Carlo simulation.

The technique, its principles and methods will be introduced as well as various steps of validation. Additionally, current limitations to it will be shown.

T 56.3 Di 17:20 K.12.18 (K3)

Vollständige Ereignisrekonstruktion am Belle-II-Experiment — •Christian Pulvermacher, Thomas Keck, Michael Feindt, Pablo Goldenzweig, Martin Heck und Thomas Kuhr — KIT, Karlsruhe

An B-Fabrik-Experimenten wie Belle II werden B-Mesonen über den Zerfall der $\Upsilon(4S)$-Resonanz stets paarweise erzeugt, Dabei erlaubt die reine Umgebung eines e^+e^--Colliders die Nutzung von Analysemethoden, die an einem Hadron-Collider nicht möglich wären, z. B. die vollständige Ereignisrekonstruktion. Diese kombiniert ein als Signal selektiertes B-Meson mit einem generisch rekonstruierten B und kann so den kompletten Zerfallsprozess abbilden. Da keine weiteren Teilchen im Ereignis vorhanden sein sollten, lässt sich dadurch die Reinheit der Signalselektion deutlich erhöhen sowie zusätzliche Information über den Viererimpuls der Signalseite gewinnen.

Um eine ausreichende Anzahl mit Signal-Bs kombinierbarer B-Mesonen zu erhalten, wird für Belle II ein automatisiertes Framework entwickelt, dass B-Mesonen in hadronischen und semileptonischen Zerfallskanälen mit hoher Effizienz rekonstruiert. Hierzu werden Zerfallsprodukte schrittweise vorselektiert, kombiniert, mittels multivariater Analysemethoden bewertet und schließlich für die weitere Rekonstruktionsstufen verwendet. Der hohe Grad an Automatisierung erlaubt dabei einfache Anwendung (inklusive Retraining) mit veränderter Konfiguration oder auf einen anderen Signal-Kanal und sichert eine hohe Effizienz und Reinheit der kombinierten B-Mesonen.

T 56.4 Di 17:35 K.12.18 (K3)

Optimierung der vollständigen Ereignisinterpretation von Belle II auf die Signalseitenselektion von Physik-Analysen — •Thomas Keck, Christian Pulvermacher, Thomas Kuhr, Martin Heck, Pablo Goldenzweig und Michael Feindt für die Belle II-Kollaboration — KIT, Karlsruhe, Deutschland

Das im Aufbau befindliche Belle II Experiment am japanischen Forschungszentrum KEK untersucht $B\bar{B}$ Mesonenpaare aus dem Zerfall der $\Upsilon(4S)$ Resonanz und wird voraussichtlich ab 2017 in Betrieb genommen.

Die für das Belle-Experiment entwickelte vollständige Rekonstruktion wurde für Belle II zur vollständigen Ereignisinterpretation weiterentwickelt. Es handelt sich dabei um einen hierarchischen Rekonstruktionsalgorithmus der mithilfe von multivariaten Klassifikationsmethoden eine große Zahl hadronischer und semileptonischer Zerfallskanäle von B-Mesonen vollautomatisch rekonstruiert. Analysen, die die vollständige Ereignisinterpretation zur Tagseitenrekonstruktion einsetzen, können diese auf ihre spezifische Signalseitenselektion optimieren. Die benötigte CPU-Zeit wird dadurch um eine Größenordnung reduziert bei einer gleichzeitigen Verbesserung der Seperation von richtig rekonstruierten Tag-Seiten B Mesonen und Untergrundkandidaten.

T 56.5 Di 17:50 K.12.18 (K3)

Removal of noble gases out of xenon by a cryogenic distillation column for the XENON1T experiment — •Michael Murra, Gianmarco Bruno, Alexander Fieguth, Christian Huhmann, Stephan Rosendahl, Sergej Schneider, and Christian Weinheimer — Institut für Kernphysik, Westfälische-Wilhelms Universität Münster

The XENON1T experiment is the next generation experiment for the direct detection of dark matter in the form of Weakly Interacting Massive Particles (WIMPS). With its 3.3 tons of liquid xenon XENON1T will increase the sensitivity on the WIMP-nucleon cross section down to 2.0×10^{-47} cm^2, which is more than one order of magnitude better than the current best limits by LUX and XENON100. A key requirement to reach this sensitivity is the reduction of radioactive backgrounds such as ^{85}Kr and ^{222}Rn. Because of different boiling points of Kr and Xe both components can be separated by a cryogenic distillation column, which has been constructed and characterized for XENON1T, where a reduction factor greater 120000 has been confirmed. Based on the same principle, the separation of Rn and Xe by cryogenic distillation is currently being tested at XENON100, using the system as radon source and detector at the same time. The cryogenic distillation column, the krypton removal measurements as well as the radon removal tests will be presented. Different aspects of this project have been funded by DFG-Großgeräte, BMBF and Helmholtz-Alliance for Astroparticle Physics (HAP)

T 56.6 Di 18:05 K.12.18 (K3)

Analysis of glacial ice with acoustic pulses for Enceladus Explorer — •Ruth Hoffmann — Bergische Universität Wuppertal

The Enceladus Explorer (EnEx) is a feasibility study for a future mission to the Saturn moon Enceladus. The mission aim it is to search for extraterrestrial life in the water filled secluded cracks in the south polar region of that moon using a steerable melt down probe. We have developed a positioning system for the probe based on acoustic pulses and trilateration algorithms. This task requires a good understanding of ice properties like the speed of sound and the attenuation length in ice and their dependence on the depth in a glacier or on the direction of the propagating signals, a knowledge that could also contribute to the design of a future large scale acoustic neutrino detector. In order to increase this understanding several field tests were performed over the last three years in the Alps and Antarctica using a specially developed pinger system in addition to the existing acoustic positioning system for the investigation of depth and frequency dependencies. In this talk the findings from these field tests will be presented.

T 56.7 Di 18:20 K.12.18 (K3)

VISPA - A web-based Platform for Research, Outreach and Education — •Daniel van Asseldonk, Martin Erdmann, Benjamin Fischer, Robert Fischer, Christian Glaser, Fabian Heidemann, Gero Müller, Thorben Quast, Marcel Rieger, Martin Urban, and Christoph Welling — III. Physikalisches Institut A, RWTH Aachen

We present the latest developments on the VISPA project (https://vispa.physik.rwth-aachen.de). It was originally designed and successfully used to perform modular data analyses in high-energy and astroparticle physics. Based on the previous experience, VISPA became

a flexible and extendable internet-based platform which offers tools to analyse physics data in a web-browser. Any computer or cluster that is connectable via SSH from the VISPA server can serve as a worker node and make its installed software, e.g. specific to experiments, accessible to the analyses. VISPA provides basic functionalities such as a terminal, a file browser, a code editor and user management. The platform is open source, written in Python and Javascript. A well-documented API allows users to write their own extensions. Extensions exist for job submission to HTC Condor and the World Wide LHC Computing Grid, job monitoring, and to browse physics data. With VISPA, students learn physics phenomena by doing data analysis exercises, experienced scientist are able to focus on physics rather than on computing. Via the CERN open data portal and the Helmholtz Alliance for Astroparticle Physics, VISPA provides access to public data and analyses opportunities to everyone.