

CZ+SK 2023 HEP workshop

Report of Contributions

Contribution ID: 3

Type: **not specified**

Signals of Beyond Standard Model Physics in Flavor Changing Processes and Latest NA62 Results

Wednesday 28 June 2023 10:45 (20 minutes)

We will provide a review of potential signals of Beyond Standard Model Physics in flavor changing neutral current (FCNC) processes and latest NA62 results.

Primary author: BLAZEK, Tomas (Comenius University (SK))

Presenter: BLAZEK, Tomas (Comenius University (SK))

Session Classification: Session II

Contribution ID: 4

Type: **not specified**

Neutral pion identification at Future Circular Collider

Wednesday 28 June 2023 11:45 (20 minutes)

Future Circular Collider (FCC) is a 100 km long particle collider to be built around the year 2040 in the CERN laboratory. The first stage of operation is going to be a lepton collider FCC-ee which aims to test the Standard model with unprecedented precision at maximal central energies of 365 GeV. Neutral pions originating from such collisions are crucial for reconstructions of particles such as the τ lepton and their identification poses a challenge for detectors. Neutral pions decay almost immediately into a pair of photons separated by a small angle and can be easily misidentified as a single photon. We should be able to distinguish the signal of a neutral pion from the signal of a single photon with a fine segmented calorimeter. In the thesis we worked with the FCC-ee noble liquid calorimeter design. The main goal of the thesis was to understand the geometry of the calorimeter planned for FCC-ee experiment and investigate the options offered by multivariate analysis methods for the reconstruction and identification of neutral pions against a single photon background.

Primary author: HAVIERNIK, Matej (Charles University (CZ))

Presenter: HAVIERNIK, Matej (Charles University (CZ))

Session Classification: Session II

Contribution ID: 6

Type: **not specified**

Overview of the π^0 radiative decay width

Wednesday 28 June 2023 11:25 (20 minutes)

I plan to shortly overview the π^0 decay processes and discuss some relevance in experimental measurements and phenomenological applications.

Primary author: KAMPF, Karol (Charles University (CZ))

Presenter: KAMPF, Karol (Charles University (CZ))

Session Classification: Session II

Contribution ID: 7

Type: **not specified**

Next-generation multi-fluid hydrodynamics for energies from few to tens of GeV

Wednesday 28 June 2023 14:30 (20 minutes)

The hydrodynamic modelling of heavy-ion collisions at energies from few to tens of GeV per NN pair brings new challenges as compared to simulations at top RHIC or LHC energies. The contraction of the incoming nuclei is much weaker resulting in a long inter-penetration phase and a more complex initial-state geometry. Conventional hydrodynamic models, where the fluid phase starts at a fixed proper time τ_0 , therefore miss the compression stage of collision and may be therefore less sensitive to the EoS of the medium. Multi-fluid dynamics treats the incoming nuclei as two baryon-rich droplets of cold nuclear fluid creating a third baryon-free fluid from the friction between the two colliding fluids.

We present MUFFIN (MUlti Fluid simulation for Fast IoN collisions), a next-generation event-by-event three-fluid dynamic model to simulate heavy-ion collisions at RHIC BES, newly reimplemented with the use of 3+1 dimensional relativistic viscous hydrodynamic code vHLL. We discuss the challenges in constructing the approach and present benchmark calculations for Au-Au collisions at different RHIC BES energies.

Primary author: CIMERMAN, Jakub (Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University)

Presenter: CIMERMAN, Jakub (Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University)

Session Classification: Session III

Contribution ID: 8

Type: **not specified**

Search for excited tau lepton and leptoquarks with ATLAS

Wednesday 28 June 2023 09:40 (20 minutes)

The ATLAS Collaboration has recently released results of a search for an excited tau lepton. It is based on the LHC Run 2 data and it exploits 13 TeV proton-proton collisions with two hadronically decaying tau leptons and at least two jets in the final state. It is the first dedicated search for the excited tau lepton at the LHC. In the same final state, ATLAS also searched for a leptoquark coupling to a tau lepton and a light quark flavour jet which is the first ATLAS search for this particle.

Primary author: PLESKOT, Vojtech (Charles University (CZ))

Presenter: PLESKOT, Vojtech (Charles University (CZ))

Session Classification: Session I

Contribution ID: 10

Type: **not specified**

Simulace a měření mikrokanálového fotonásobiče (MCP-PMT) ošetřeného depozicí ochranné atomové vrstvy (ALD)

Wednesday 28 June 2023 10:00 (20 minutes)

V současné době je již naprosto zřejmé, že časové detektory budou tvořit zásadní komponentu v dalším rozvoji detekčních zařízení, a to nejen ve fyzice vysokých energií. Mikrokanálový fotonásobič,

Micro Channel Plate PhotoMultiplier (MCP-PMT) je velmi rychlý (a velmi drahý) fotonásobič s rozmanitým využitím a časový detektor na něm založený představuje v současnosti to nejlepší, z pohledu časového rozlišení,

co existuje. Kromě toho, že je jeho odezva velmi rychlá, je tato odezva také dosti odolná (v dostatečném rozsahu nemění se) vůči magnetickému poli.

MCP-PMT je použit v řadě současných či připravovaných detektorů času letu (ToF, Time of Flight). Otevřeným (tj. zatím nikým nevyřešeným) problémem je snižování zisku (gain) těch MCP-PMT, které byly "ošetřeny" pomocí

depozice ochranné atomové vrstvy, ALD (Atomic Layer Deposition), a to ve srovnání s MCP-PMT bez ALD. Existují hypotézy a částečné modely, jak k poklesu zisku dochází, ale kompletní modely fotonásobiče

s MCP-PMT nikoliv.

Primary author: BUCKO, Jakub (Charles University (CZ))

Presenter: BUCKO, Jakub (Charles University (CZ))

Session Classification: Session I

Contribution ID: 11

Type: **not specified**

Precision measurements of kaon decays at NA62 experiment

Wednesday 28 June 2023 11:05 (20 minutes)

During the years 2016-2018 the NA62 experiment at CERN collected the world's largest dataset of charged kaon decays. This led to the observation of the $K^+ \rightarrow^+ \nu \bar{\nu}$ decay and the leading measurement of its branching fraction at the level of $\sim 10^{-10}$. In this talk the NA62 experiment reports recent results from analyses of $K^+ \rightarrow^0 e^+ \nu \gamma$ (Ke3g), $K^+ \rightarrow^{++} \pi^+ \pi^0$ (Kpimm) and $K^+ \rightarrow^+ \gamma \gamma$ (Kpigg) decays, using a data sample recorded in 2017–2018. The radiative Ke3g decay has a data sample of $O(100k)$ candidates with a sub-percent background contamination. Published results with the most precise measurement of Ke3g branching fractions and T-asymmetry are presented. The Kpimm sample consists of $\sim 27k$ signal events with negligible background contamination. The recently published results include the most precise measurement of branching fraction and the decay form factor. The Kpigg sample consists of 4k signal events with 10% background contamination. The presented Kpigg analysis improves the precision of the branching fraction measurement by a factor of 3 with respect to the previous measurements.

Primary author: HIVES, Zdenko (Charles University (CZ))

Presenter: HIVES, Zdenko (Charles University (CZ))

Session Classification: Session II

Contribution ID: **18**Type: **not specified**

B-Physics Measurements at ATLAS

Wednesday 28 June 2023 09:20 (20 minutes)

Although ATLAS is not specialized in B-physics, its performance (namely of the tracking and muon system) allows for competitive B-physics measurements. The talk will overview the results of the ATLAS B-physics group and the methods used to perform the analyses. Performance expected at HL-LHC will also be mentioned.

Primary author: REZNICEK, Pavel (Charles University (CZ))

Presenter: REZNICEK, Pavel (Charles University (CZ))

Session Classification: Session I

Contribution ID: 19

Type: **not specified**

Helicity and vorticity in heavy-ion collisions and hyperon polarization

Wednesday 28 June 2023 13:50 (20 minutes)

Heavy-ion collisions at center-of-mass nucleon collision energies 2.3–11.5 GeV are analyzed within the parton-hadron-string dynamics (PHSD) transport model. After the separation of spectator nucleons, the momentum distributions of particles constituting a fireball are fluidized and the energy and baryon number densities, temperature, and velocity fields are obtained in the Landau frame. It is shown that the velocity field has dominantly Hubble-like transversal and longitudinal expansion and a small vortical component on top of it. The vorticity is concentrated in the form of two oppositely rotating vortex rings moving in opposite directions along the nuclear collision axis. Global polarization of various hyperons species induced by the local vorticity of the medium is calculated. The polarization of all anti-hyperon species is found to be significantly larger than that of hyperons. The observable global polarization of Lambda hyperons is strongly influenced by the feed-down from weak and electromagnetic decays of heavier hyperons. Strong suppression is found to be due to electromagnetic decays of Sigma0 hyperons, which multiplicities obtained in the transport are poorly constrained both from the microscopic input of the Sigma0 production reactions and from the experimental data. The results of the calculation are compared with the available measurements of hyperon polarization.

References:

- N.S. Tsegelnik, E.E. Kolomeitsev, V. Voronyuk, Phys. Rev. C 107, 034906 (2023).
- N.S. Tsegelnik, E.E. Kolomeitsev, V. Voronyuk, Particles 2023, 373 (2023).
- V. Voronyuk, E.E. Kolomeitsev, N.S. Tsegelnik, arXiv:2305.10792

Primary author: KOLOMEITSEV, Evgeni**Presenter:** KOLOMEITSEV, Evgeni**Session Classification:** Session III

Contribution ID: 24

Type: **not specified**

Non-critical particle number fluctuations in heavy-ion collisions

Wednesday 28 June 2023 14:10 (20 minutes)

In the QCD phase diagram, vicinity of the critical point is accompanied with big changes of the susceptibilities. They should manifest themselves in the moments of the number distribution for conserved quantum numbers, e.g., the baryon number. Unfortunately, detectors cannot measure the baryon number, but only the number of stable protons. Also, in a real experiment, detectors cover just a part of the phase-space of the complete hadron production, which—in addition—conserves the baryon number. This talk will mention some of these non-critical effects and their influence on the observed moments of the proton number distribution.

Primary author: TOMASIK, Boris (Univerzita Mateja Bela (SK))

Presenter: TOMASIK, Boris (Univerzita Mateja Bela (SK))

Session Classification: Session III

Contribution ID: 26

Type: **not specified**

The Higgs boson - discovery and recent results

Wednesday 28 June 2023 08:40 (20 minutes)

The Higgs boson discovery by the ATLAS and CMS experiments at the LHC is briefly reminded. The contribution focuses on the summary of the recent results, with the emphasis on specific measurements that the Prague group was strongly involved in: observation, discovery and precision measurement of the Higgs boson decay to the pair of tau-leptons and searches for lepton-flavour-violating decays $H \rightarrow \tau + e$, $H \rightarrow \tau + \mu$. Prospects for future measurements will be also briefly discussed.

Primary author: DAVIDEK, Tomas (Charles University (CZ))

Presenter: DAVIDEK, Tomas (Charles University (CZ))

Session Classification: Session I

Contribution ID: 27

Type: **not specified**

Introduction

Wednesday 28 June 2023 08:30 (10 minutes)

Contribution ID: 33

Type: **not specified**

Alice experiment - history, present and future

Wednesday 28 June 2023 13:10 (20 minutes)

In the presentation the development of the Alice experiment at the LHC will be described, starting from the first sketches, Letter of Intent and Technical Proposal designs, and finally the detector setup as built in 2009. The talk will continue with the main physics results of run-1 and run-2. During LS2 the Inner Tracking System (ITS) was completely replaced with a new silicon pixel tracker and the TPC readout was upgraded with GEM chambers. The Alice collaboration is preparing the third version of the ITS using bent silicon detectors. The last part of the talk will discuss the Alice-3 project, which was recently submitted to the LHCC.

Presenter: SAFARIK, Karel (Czech Technical University in Prague (CZ))

Session Classification: Session III

Contribution ID: 34

Type: **not specified**

Produkcia podivnosti v Xe–Xe zrážkach pri energii 5,44 TeV na experimente ALICE

Wednesday 28 June 2023 13:30 (20 minutes)

Jednou z popredných oblastí štúdia fyziky vysokých energií je štúdium silne interagujúcej hmoty, kvark-gluónovej plazmy. Zvýšená produkcia podivných častíc bola jedna z prvých navrhnutých signatúr tohto stavu. V práci sa zaoberáme produkciou multi-podivných baryónov (Ξ^- a Ω^-) a ich antičastíc meraných experimentom ALICE na LHC v Xe–Xe zrážkach pri energii 5,44 TeV. Porovnanie získaných výsledkov s pp, p–Pb a Pb–Pb systémami má potenciál preskúmať mikroskopický pôvod navýšenej produkcie podivných častíc, ktorý je dodnes neznámy.

Presenter: DZALAIIOVA, Natalia (Comenius University (SK))

Session Classification: Session III

Contribution ID: 35

Type: **not specified**

Asymmetries in top quark production

Wednesday 28 June 2023 09:00 (20 minutes)

The latest ATLAS results on the $t\bar{t}$ production charge asymmetry will be presented along with the asymmetry measurements in $t\bar{t}\gamma$ and $t\bar{t}W$ final states.

Presenter: BARTOS, Pavol (Comenius University (SK))

Session Classification: Session I

Contribution ID: **36**

Type: **not specified**

Ukončenie workshopu

Contribution ID: 37

Type: **not specified**

Lunch break