HEP-TEC-2026

Report of Contributions

Contribution ID: **1** Type: **talks**

RESEARCH OF THE BEHAVIOR OF THE EFFECTIVE POTENTIAL IN SYSTEMS WITH PHASE TRANSITIONS THROUGH THE PRISM OF A–D–E TYPE SINGULARITIES

Wednesday, January 14, 2026 3:10 PM (30 minutes)

The Higgs boson discovery raised new questions about the Standard Model's mysteries, particularly the existence of three matter generations with vastly different masses. New physics might be revealed through electron-positron collider experiments at specific energy levels, as the Standard Model serves as a foundation for examining nature across all scales .
An extended scalar sector enables a sharp first-order electroweak phase transition (FOPT). While the Standard Model with 125 GeV Higgs shows only smooth crossover, introducing new light scalar degrees of freedom—such as in two-Higgs-doublet models—can create a decisive first-order transition. Arnold's classification of simple singularities (A–D–E series) is extensively used in modern critical phenomena theory.
Groebner basis calculations showed that across the physically allowed parameter space: mS = 400 GeV –TeV, $|\sin\theta| \leq 0.3$, $a_2 = 1–8$, $b_4 > 0$, with arbitrary Z_2-breaking b_1, b_3, a_1 within LHC bounds, the Milnor number remains stably $\mu = 9$.
The result has several important implications:
a) Searching for exceptional E_6–E_8 singularities in the scalar sector beyond the Standard Model requires significantly more complicated models (additional singlets, triplets, higher representations, or explicit breaking of global symmetries);
b) The stability of $\mu = 9$ explains the remarkable flatness of the potential along the singlet direction (the well-known "flat direction"in the Higgs portal), with cosmological consequences (inflation, strong first-order phase transitions, etc.);
c) The algebraic technique (Groebner bases + Milnor number) proves to be a powerful and universal tool for classifying critical points in multi-parameter field theories.
Thus, in real scalar extensions of the Standard Model with a single Z_2 singlet, the electroweak vacuum is always characterized by a composite singularity with Milnor number 9, which excludes it from belonging to the exotic simple A–D–E catastrophes, in particular to the theoretically most degenerate E_8.

Author: OBIKHOD, Tetiana (Institute for Nuclear Research NAS of Ukraine)

Presenter: OBIKHOD, Tetiana (Institute for Nuclear Research NAS of Ukraine)

Session Classification: Session INVITED TALKS.

Contribution ID: **2** Type: **talks**

BRANCHING RATIOS OF H1,2,3->MuMu IN THE BROKEN-PHASE N2HDM

Thursday, January 15, 2026 3:40 PM (20 minutes)

The discovery of the Higgs boson marked a triumph of the Standard Model, yet fundamental questions remain unanswered: what triggers the electroweak symmetry breaking, why does the Higgs have its observed mass, and are there additional scalar fields? These questions drive the search for an extended Higgs sector where the Next-to-Two-Higgs-Doublet Model (N2HDM) stands as a particularly compelling framework [1]. The N2HDM extends the Standard Model with two Higgs doublets and a real singlet, yielding three CP-even neutral scalars H1 H2 H3, and featuring four distinct Yukawa types (Type 1, Type 2, Type X/Lepton-Specific, Type Y/Flipped) through a softly-broken Z2 symmetry.
While LHC measurements have tightly constrained the properties of the SM-like Higgs (identified as H1) [2], the heavier states H2 and H3 remain largely unexplored. Their decays to di-muon pairs offer a particularly clean experimental signature and sensitive probe of Yukawa couplings, especially in lepton-specific scenarios. We presented the comprehensive analysis of H1 H2 H3 to muon pair branching ratios across all four N2HDM types using constraints from the latest global Higgs data fits.
Using best-fit parameters from a recent global 2analysis of LHC Higgs data and constructing a representative benchmark point for additional Higgs masses [1], we compute BR(H1,2,3+-) across all four Yukawa types. For the SM-like Higgs boson H1 (identified with the 125 GeV resonance), we find branching ratios remarkably consistent with Standard Model predictions:
Type 1: 1.9110-4
Type 2: 1.9210-4
Type X: 2.0510-4
Type Y: 2.1810-4

The calculation respects the unified parameter space of the N2HDM, where all three CP-even Higgs bosons originate from diagonalizing the same 33 mass matrix determined by fundamental parameters 1 8 m1,22 s tan and mixing angles 1 2 3. While the parameters are common, phenomenological constraints differ: H1 is tightly constrained to be SM-like by LHC measurements, while H2 and H3 face only direct search limits, allowing their masses (30-1500 GeV) and couplings greater freedom. For the additional Higgs bosons H2 and H3, we adopt a benchmark with masses mH2=600GeV and mH3=800GeV, total widths tot(H2)=20GeV and tot(H3)=30GeV, and effective couplings taken as midpoints of allowed ranges from global fits. The resulting branching ratios reveal striking type-dependent patterns spanning seven orders of magnitude.
These results exhibit clear patterns reflecting the Yukawa structure of each type:
1. Type 1 and Type Y show consistently small branching ratios (⊠10-7) for H2,3, as muon couplings are tied to up-type quark couplings that remain SM-like under constraints.
2. Type 2 displays enhanced branching ratios (10-6) for both H2 and H3, since muon couplings here are proportional to down-type quark couplings, which can be significantly enhanced while satisfying constraints.
3, Type X (Lepton-Specific) yields the largest H2 branching ratio (4.0310-6), reflecting the possibility of order-of-magnitude enhancements in lepton couplings in this scenario. The H3 value is more moderate due to different mixing patterns.

1. Binjonaid Maien. Confronting the Broken Phase of the N2HDM with Higgs Data. Particles, 8, (2025)
2. ATLAS Collaboration. Evidence for the Dimuon Decay of the Higgs Boson in pp Collisions with the ATLAS Detector. Phys. Rev. Lett. 135, v.135, (2025)

Authors: Mr PETRENKO, Ievgenii; ОБІХОД, Тетяна (ІЯД)

Presenter: Mr PETRENKO, Ievgenii

Session Classification: Session Contributed talks

Contribution ID: **3** Type: **talks**

FROM LHCb TO ENVIRONMENT MONITORING

Thursday, January 15, 2026 11:00 AM (20 minutes)

The Radiation Monitoring System for Run3 (RMS-R3), designed and manufactured at the Institute for Nuclear Research of the National Academy of Sciences of Ukraine, has been operating as part of the LHCb detector at CERN since late 2021 [1,2]. The system is based on metal foil detectors utilizing secondary electron emission [3]. It provides independent online luminosity monitoring critical for the experiment's feedback control scheme with the LHC control center.
During 2022-2025, RMS-R3 monitored diverse LHCb operational modes: pp collisions at $\sqrt{s}$ = 13.6 TeV with luminosity up to 2×10^{33} $cm^{-2}s^{-1}$, PbPb collisions at $\sqrt{s}\_NN$ = 5.36 TeV (up to 9×10^{26} $cm^{-2}s^{-1}$), and others AA collisions with fixed-target configurations with SMOG2 gas injection (pAr at $\sqrt{s}\_NN$ = 133 GeV, PbAr at $\sqrt{s}\_NN$ = 70.9 GeV, etc.). The system achieved ±5% luminosity measurement precision through calibration with PLUME [4], while RMS-R3 asymmetry analysis methods enabled tracking of interaction region positions and experimental conditions. Integration with LHCb's ECS (WinCC-based) and MONET web monitoring provided real-time operational tools for experiment control.
The extensive operational experience with RMS-R3 under harsh radiation conditions and diverse beam configurations initiated the development of mobile system for real-time observation (MSODR-E) and display of the radiation status in the environment as well as for radiation therapy. Three detector types integrated for complementary capabilities: Geiger-Müller counters (simple, reliable, high sensitivity without energy information), metal foil detectors/MFD (stable response via secondary electron emission, operate without external high voltage - critical for mobile systems), and Timepix3 silicon pixel detectors (highest spatial resolution and energy sensitivity for spectrometric analysis and radiation field visualization).
LiFePO4 batteries were used for the power supply system, which separately power the electronics and detectors using appropriate converters. This approach ensures long-term autonomous operation and charging via USB-C.
Integration of the BME280 environmental sensor for measuring temperature, humidity, and pressure, allowing readings to be adjusted based on external factors. Two-tier architecture consisting of STM32 microcontrollers for real-time data collection and Raspberry Pi 5 for high-level processing, visualization, storage, and remote access ensures fast analysis and minimal system latency. The MSODR-E development demonstrates successful technology transfer from high-energy physics instrumentation to field-deployable environmental monitoring applications.

Acknowledgements
This work has received funding through the grant of the National Academy of Sciences of Ukraine to research laboratories/groups of young scientists of the NASUin 2025-2026 No. 17/01-2025(6).
These studies were PARTIALLY supported within the Fellowships grant EU #3014 "RMS beam and background online monitoring system in the LHCb experimental environment"as well as in frames of the EURIZON Project (EC Grant Agreement № 871072).

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Authors: Dr RAMAZANOV, Dmytro (Institute for Nuclear research NAS Ukraine); Mr VORONET-

SKIY, Ivan (Institute for Nuclear Research NAS of Ukraine); Mr OKHRIMENKO, Oleksandr (Institute for Nuclear Research NAS of Ukraine); Dr CHERNYSHENKO, Serhii (Institute for Nuclear Research NAS of Ukraine); Prof. PUGATCH, Valery (Institute for Nuclear Research, National Academy of Sciences of Ukraine(KINR)); Mr KYVA, Volodymyr (Institute for Nuclear Research NAS of Ukraine)

Presenter: Dr CHERNYSHENKO, Serhii (Institute for Nuclear Research NAS of Ukraine)

Session Classification: Session Contributed talks

Contribution ID: **4** Type: **talks**

PROPOSAL FOR UPGRADE OF TRACKING SYSTEMS BY MAPS. FOR EXPERIMENTS CBM AND PANDA (FAIR/GSI)

Thursday, January 15, 2026 10:20 AM (20 minutes)

The international laboratories CBM and PANDA (GSI/FAIO,
Darmstadt) plan to begin physical research at the new accelerator complex in 2028.
A joint decision was made to join efforts to prepare experimental setups.
The report presents a proposal for upgrading the tracking systems
of these setups using the latest monolithic micropixel detectors (MAPS).

Author: PUGATCH, Valery (Institute for Nuclear Research, National Academy of Sciences of Ukraine(KINR))

Presenter: PUGATCH, Valery (Institute for Nuclear Research, National Academy of Sciences of Ukraine(KINR))

Session Classification: Session Contributed talks

Contribution ID: **5** Type: **talks**

TIMEPIX-3 IN ELECTRONIC PAINTING

Thursday, January 15, 2026 11:40 AM (20 minutes)

LIVE Electronic Painting is expected to be for imaging of various beauties of Nature evolving in time. As an approach to that action one can use lasers with tunable frequency as electronic sources of wide range colors, varying in real time. The created paintings will be imaged by means of sophisticated electronic devices (Timepix display, for instance).

Author: PUGATCH, Valery (Institute for Nuclear Research, National Academy of Sciences of Ukraine(KINR))

Presenter: PUGATCH, Valery (Institute for Nuclear Research, National Academy of Sciences of Ukraine(KINR))

Session Classification: Session Contributed talks

Contribution ID: **6** Type: **talks**

Decay of Z boson to a pair of tau leptons at the LHC: spin effects and New Physics

Wednesday, January 14, 2026 11:30 AM (30 minutes)

Possible anomalous New Physics contributions to dipole and weak dipole moments of the tau lepton bring renewed interest in development and revisiting charge-parity violating signatures in the tau-pair production in Z-boson decay at energies of the Large Hadron Collider.
Effects of anomalous contributions on polarization and spin correlations of the tau leptons, in the production process q qbar –> tau- tau+ with the tau decays included, will be discussed.
Because of the complex nature of the resulting distributions, Monte Carlo techniques are useful. Extensions of the Standard Model with electroweak radiative corrections and anomalous dipole moments are implemented in the Monte Carlo TauSpinner program. In addition, this implementation allows one to introduce arbitrary phase-shift between
vector and axial-vector couplings of Z boson to tau leptons,
which can have impact on observed transverse spin correlations.
Examples of the impact on experimental signatures will be presented
in case of the tau-decay channels: tau- -> rho- nu_tau and
tau+ -> rho+ nu_tau.

Author: KORCHIN, Alexander (NSC Kharkiv Institute of Physics and Technology, Kharkiv, Ukraine)

Presenter: KORCHIN, Alexander (NSC Kharkiv Institute of Physics and Technology, Kharkiv, Ukraine)

Session Classification: Session INVITED TALKS.

Contribution ID: **7** Type: **talks**

ON THE POSSIBILITY OF EXTRACTING ELECTRONS FROM THE BEAM HALO USING BENT CRYSTALS AT DESY

Wednesday, January 14, 2026 2:10 PM (30 minutes)

Based on numerical simulations of 6 GeV electron propagation through bent crystals with various orientations relative to the incident particle direction, as well as different bending radii and crystal thicknesses, we performed a comparative analysis of the deflection efficiency in planar and axial crystal orientations. To identify the optimal bent crystal parameters for maximum electron deflection efficiency, we compared the effectiveness of planar channeling in bent crystals with that of the Grinenko-Shul'ga mechanism, which is associated with particle deflection in the fields of atomic strings within a bent crystal.

Author: KYRYLLIN, Igor (NSC Kharkiv Institute of Physics and Technology)

Presenter: KYRYLLIN, Igor (NSC Kharkiv Institute of Physics and Technology)

Session Classification: Session INVITED TALKS.

Contribution ID: **8** Type: **talks**

Probing QCD Matter with the Integrated Hydrokinetic Model at RHIC

Wednesday, January 14, 2026 3:40 PM (30 minutes)

One of the main goals of relativistic heavy-ion experiments in the GeV range is to explore the QCD phase diagram, particularly at high baryon chemical potential, where critical features may emerge. At very high energies, such as at the LHC, the matter created is extremely hot with low net baryon density, and lattice QCD indicates a smooth crossover from quark–gluon plasma to hadronic matter. At lower collision energies, a significant fraction of baryon charge is stopped at midrapidity, producing matter with high baryon chemical potential. Models suggest that here the QCD transition may shift from a crossover to a first-order phase transition, with a critical point separating the two regimes. This could affect observables through the softening of the equation of state, enhanced fluctuations, and modified collective flow. Energy scans provide a unique opportunity to search for such signatures.
I will present results from the integrated hydrokinetic model (iHKM) [1] at RHIC BES energies using two equations of state: one featuring a first-order phase transition and another with a smooth crossover. Our analysis focuses on bulk hadronic observables, including transverse momentum spectra, elliptic flow, and femtoscopy [2-3]. The calculated observables are compared with experimental data, indicating that lower collision energies may favor a phase transition, while higher energies are more consistent with a crossover scenario.

Authors: ADZHYMAMBETOV, Musfer (Bogolyubov Institute for Theoretical Physics); NABOKA, Vladislav (Bogolyubov Institute for Theoretical Physics); SINYUKOV, Yuri (Bogolyubov Institute for Theoretical Physics)

Presenter: ADZHYMAMBETOV, Musfer (Bogolyubov Institute for Theoretical Physics)

Session Classification: Session INVITED TALKS.

Contribution ID: **9** Type: **talks**

DEPENDENCE OF SELF-INJECTED BUNCH PARAMETERS ON LASER AMPLITUDE IN LWFA WITHIN CONICAL PLASMA CHANNELS

Thursday, January 15, 2026 3:20 PM (20 minutes)

Laser wakefield acceleration (LWFA) is considered as modern and effective method [1, 2] of achieving TV/m acceleration field amplitudes [3] for electron bunches acceleration. An increasing in acceleration efficiency has been achieved when plasma channels used, especially demonstrated by the generation of GeV-scale electron beams within centimeter-length capillaries [4]. While various acceleration-system optimizations, such as hollow plasma-dielectric waveguides, have been considered to improve beam transport and focusing [5], different channel geometries (conical channels) also were considered.
The self-injected bunches parameters control remains difficult task. The way to increase the longitudinal momentum is to dynamically decrease the wake bubble size as the bubble moves through the plasma. This leads the self-injected bunch to be located in the end part of the wake bubble in the region of the maximum acceleration field. This work demonstrates how this effect can be achieved using a conical plasma channel. The main result is the obtaining the dependences of the bunch parameters from the laser amplitude.
It was demonstrated by numerical simulation WarpX code [6] that there is an optimal value of laser amplitude value for self-injected bunch acceleration: if the amplitude higher than optimal, the bunch is absorbed by the end wall of the wake bubble; if the amplitude lower than optimal, the bunch leaves the region of maximum acceleration and enters the zero-accelerating field. The optimal amplitude normalized found value is a0=3.0. At his value the maximum bunch charge and a longitudinal momentum of 57.4 mec with the longitudinal accelerating field in the bunch region of about 580 GV/m were obtained. Normalized laser amplitudes in the range from a0=2.0 to a0=4.4 were considered.

The study is supported by the National Research Foundation of Ukraine under the program "Excellent Science in Ukraine"(project # 2023.03/0182).

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Authors: BONDAR, Denys (NSC Kharkiv Institute of Physics and Technology); Dr MASLOV, Vasyl (NSC Kharkiv Institute of Physics and Technology); Dr ONISHCHENKO, Ivan (NSC Kharkiv Institute of Physics and Technology)

Presenter: BONDAR, Denys (NSC Kharkiv Institute of Physics and Technology)

Session Classification: Session Contributed talks

Contribution ID: **10** Type: **talks**

Welcome address

Wednesday, January 14, 2026 10:00 AM (15 minutes)

Presenter: SLISENKO, Vasyl (DIrector of Institute for Nuclear Research)

Session Classification: Session INVITED TALKS.

Contribution ID: **11** Type: **talks**

Welcome address

Wednesday, January 14, 2026 10:15 AM (15 minutes)

Author: GARKUSHA, Igor (Academician-Secretary of the NPAE department NAS Ukraine)

Presenter: GARKUSHA, Igor (Academician-Secretary of the NPAE department NAS Ukraine)

Session Classification: Session INVITED TALKS.

Contribution ID: **12** Type: **talks**

Status and prospects of LHCb physics at the LHC

Wednesday, January 14, 2026 10:30 AM (30 minutes)

Author: VAGNONI, Vincenzo (LHCb Collaboration Spokes Person (CERN, Geneva))

Presenter: VAGNONI, Vincenzo (LHCb Collaboration Spokes Person (CERN, Geneva))

Session Classification: Session INVITED TALKS.

Contribution ID: **13** Type: **talks**

Probing Cosmic Forms of Matter in the Laboratory: Status of the CBM Experiment

Wednesday, January 14, 2026 11:00 AM (30 minutes)

Author: GALATIUK, Tetyana (CBM Collaboration Spokes Person (GSI/FAIR, Darmstadt))

Presenter: GALATIUK, Tetyana (CBM Collaboration Spokes Person (GSI/FAIR, Darmstadt))

Session Classification: Session INVITED TALKS.

Contribution ID: **14** Type: **talks**

Theory ahievements and challenges in 2025

Author: KORCHIN, Alexander (NSC Kharkiv Institute of Physics and Technology, Kharkiv, Ukraine)

Presenter: KORCHIN, Alexander (NSC Kharkiv Institute of Physics and Technology, Kharkiv, Ukraine)

Contribution ID: **15** Type: **not specified**

The Schwinger effect in the early Universe

Wednesday, January 14, 2026 6:30 PM (30 minutes)

The production of gauge fields during inflation has a wide range of phenomenological implications. It can affect the background dynamics of inflation, modify the spectral properties of primordial scalar and tensor perturbations, and lead to the creation of charged particles through the Schwinger effect. The latter can significantly suppress the efficiency of gauge-field production during inflation. A clear and accurate understanding of this phenomenon is therefore essential for making reliable predictions of the associated physical observables.
In this talk, we review the physics of Schwinger pair production in both flat Minkowski spacetime and an expanding Universe. We discuss several analytical and numerical approaches used to study this effect in the context of inflationary magnetogenesis and highlight a number of open questions that remain to be addressed.

Authors: Dr SOBOL, Oleksandr (Taras Shevchenko National University of Kyiv); Prof. VILCHINSKY, Stanislav (Taras Shevchenko National University of Kyiv)

Presenter: Dr SOBOL, Oleksandr (Taras Shevchenko National University of Kyiv)

Session Classification: Session INVITED TALKS.

Contribution ID: **17** Type: **talks**

Isospin-symmetry violation in high-energy collisions

Wednesday, January 14, 2026 2:40 PM (30 minutes)

Author: GORENSTEIN, Mark (Bogolyubov Institute for Theoretical Physics)

Presenter: GORENSTEIN, Mark (Bogolyubov Institute for Theoretical Physics)

Session Classification: Session INVITED TALKS.

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

The Rating Quality for Theoretical Description of Experimental Data

Wednesday, January 14, 2026 4:30 PM (30 minutes)

The Rating Quality for Theoretical Description of Experimental Data

S. O. Omelchenko, V. M. Pugatch
Institute for Nuclear Research, National Academy of Sciences of Ukraine, Kyiv, Ukraine

1. $Introduction$. A new multi-parameter score-rating methodology for assessing the quality of theoretical description of experimental data in heavy-ion physics [1-11] is proposed. The approach overcomes the limitations of the traditional single-value criterion χ^2/ndf, which provides only an integral measure of agreement between theory and experiment.
The methodology is based on dividing the phase space into seven physically motivated kinematic regions of transverse momentum p_T distributions and particle ratios, corresponding to different underlying physical regimes. For each region, the quality of agreement is quantified by a score $Q_i \in [10; 1000]$ defined on a scale, ranging from very poor to excellent agreement.
A comprehensive rating R is constructed through a systematic procedure that includes region definition, weighting according to physical significance, aggregation of local scores, uncertainty estimation, stability checks, and visualization. This framework enables a transparent and comparative assessment of theoretical models, revealing their region-specific performance and complementarity.
2. $Methodology$. The phase space is divided into seven kinematic regions corresponding to different physical regimes: thermal spectra ($p_T < 0.8$ GeV/c), radial flow, hard processes relevant to QGP formation (2.5–4.0 GeV/c), medium-energy jets, high-energy jets with quenching, and the perturbative QCD regime ($p_T > 10$ GeV/c).
For each region, the local statistic is defined as:
$\mathrm{R}_i = \frac{\chi_i^2}{\nu_i}, \qquad \nu_i = N_i - kwhere\mathrm{N}_i$ is the number of data points and k is the number of model parameters. 3. $Score\ Assignment$. Based on the value of R_i, a quality score Q_i is assigned using a scale, ranging from $Q_i = 1000$ for excellent agreement to $Q_i = 10$ for very poor agreement. 4. $Weighting\ and\ Aggregation$. Weight coefficients reflect the physical significance of different kinematic regions. The aggregated quality measures include weighted averaging, geometric mean, minimum score, and dispersion penalties. 5. $Results\ and\ Discussion$. The methodology was applied to LHC data for K_S^0 mesons and Λ hyperons in p-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV. The analysis demonstrates model complementarity and sensitivity to nuclear shadowing effects. 6. $Conclusions$. The proposed score-rating methodology provides a transparent and robust framework for ranking theoretical models in heavy-ion physics and is well suited for systematic studies of LHC Run 3 data and beyond.

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Author: OMELCHENKO, Sergey (Institute for Nuclear Research NAS of Ukraine)

Co-author: Dr PUGATCH, Valery (Institute for Nuclear Research NAS of Ukraine)

Presenters: OMELCHENKO, Sergey (Institute for Nuclear Research NAS of Ukraine); Dr PUGATCH, Valery (Institute for Nuclear Research NAS of Ukraine)

Session Classification: Session INVITED TALKS.

Contribution ID: **19** Type: **talks**

SIMULATION OF THE RADIATION MONITORING SYSTEN PROTOTYPE FOR THE CBM EXPERIMENT

Thursday, January 15, 2026 12:40 PM (20 minutes)

The Compressed Baryonic Matter (CBM) experiment at FAIR is designed to explore the QCD phase diagram in the region of high baryon density and low temperature using high-intensity proton and heavy-ion beams. The unprecedented interaction rate, reaching up to 10 MHz, results in a severe radiation load on detector components, making continuous radiation monitoring a critical requirement for stable and safe operation.

To address this challenge, the Institute for Nuclear Research of the National Academy of Sciences of Ukraine proposes the RMS-CBM radiation monitoring system, based on the proven RMS-R3 technology developed for the LHCb experiment. Owing to its compact design, radiation tolerance, and operational reliability, this technology is well suited for forward fixed-target experiments such as CBM.

As part of the RMS-CBM prototype development, an electronic simulation of the detector module was carried out using the LTspice environment. A simplified electronic equivalent was implemented to achieve realistic behavior with moderate computational complexity. The model includes resistive representations of metallic sensor and accelerating foils, parasitic capacitances between layers, a current source modeling the radiation-induced charge signal, and a simplified two-stage charge-sensitive integrator. Time-domain simulations demonstrate stable amplification of short charge pulses with the expected signal shape, confirming the conceptual validity of the detector and integrator architecture. Noise spectral density analysis shows that the equivalent noise charge is of the order of 1 ke-, which satisfies CBM performance requirements and ensures reliable signal detection under high-rate conditions.

The simulation results confirm the technical feasibility of the RMS-CBM concept and its suitability for operation in the harsh radiation environment of the CBM experiment. Future work will focus on refining the electronic model by implementing a complete integrator circuit and detailed signal transmission elements, allowing precise evaluation of dynamic range, linearity, and long-term stability.

Author: KSHYVANSKYI, Oleksandr

Presenter: KSHYVANSKYI, Oleksandr

Session Classification: Session Contributed talks

Contribution ID: **20** Type: **talks**

IONIZATION LOSS AND CHARACTERISTIC RADIATION OF HIGH-ENERGY PARTICLES IN ORIENTED CRYSTALS

Thursday, January 15, 2026 3:00 PM (20 minutes)

Author: TROFYMENKO, Sergii (NSC 'Kharkiv Institute of Physics and Technology')

Co-author: KYRYLLIN, Igor (NSC Kharkiv Institute of Physics and Technology)

Presenter: TROFYMENKO, Sergii (NSC 'Kharkiv Institute of Physics and Technology')

Session Classification: Session Contributed talks

Contribution ID: **21** Type: **talks**

DETERMINATION OF THE POLE TOP QUARK MASS FROM LHC EXPERIMENTAL DATA FOR SINGLE- AND DOUBLE-DIFFERENTIAL CROSS-SECTIONS FOR TOP QUARK PAIR PRODUCTION

Thursday, January 15, 2026 10:00 AM (20 minutes)

Author: Mr SLIUSAR, Taras (Taras Shevchenko National University of Kyiv)

Co-authors: Dr ZENAIEV, Oleksandr (Hamburg University, II. Institute for Theoretical Physics); AUSHEV, Volodymyr (Kharkiv Institute of Physics and Technology)

Presenter: Mr SLIUSAR, Taras (Taras Shevchenko National University of Kyiv)

Session Classification: Session Contributed talks

Contribution ID: **22** Type: **talks**

Improvement of the loose kinematic reconstruction method of $t\bar{t}$ using CMS open data

Thursday, January 15, 2026 12:00 PM (20 minutes)

Author: Mr SPITSYN, Mykyta (Taras Shevchenko National University of Kyiv)

Co-authors: Dr ZENAIEV, Oleksandr (Hamburg University); Dr AUSHEV, Volodymyr (Taras Shevchenko National University of Kyiv)

Presenter: Mr SPITSYN, Mykyta (Taras Shevchenko National University of Kyiv)

Session Classification: Session Contributed talks

Contribution ID: **23** Type: **talks**

MEASUREMENT OF THE CROSS-SECTION PRODUCTION OF V0 HADRONS IN PROTON-PROTON COLLISIONS AT 7 TEV ENERGY IN THE LHCB EXPERIMENT

Thursday, January 15, 2026 5:00 PM (20 minutes)

The LHCb detector is a forward spectrometer covering the pseudorapidity range 2< η <5. It is equipped with a high-precision tracking system, which includes a silicon microstrip vertex detector (VELO) located around the interaction point (IP8), large-area silicon microstrip detectors upstream of the dipole magnet, and three silicon microstrip stations downstream of the magnet. The track reconstruction efficiency exceeds 96% with a momentum resolution of approximately 0.5% and an invariant mass resolution between 10 and 20 MeV/c^2. Identification of charged hadrons is performed using two Ring-Imaging Cherenkov(RICH) detectors. Photons, electrons and hadron candidates are identified by a calorimetric system consisting of scintillating pad detectors, preshower detectors and electromagnetic and hadronic calorimeters. Muons are identified by a system that combines iron layers and multi-wire proportional chambers. The trigger system consists of a hardware stage (L0), which utilizes data from the calorimeters and muon system, followed by a software stage (High Level Trigger, HLT) that provides full event reconstruction.
As part of the Ion Fixed Target(IFT) working group of the LHCb collaboration, registration efficiencies and differential production cross-section for Ks mesons and Lambda baryons in p-p collisions were measured. These measurements are essential for evaluating cold nuclear matter effects and play a key role in identifying and investigating signal from quark-gluon plasma. The data used in this analysis were collected in 2016 at an energy of √⊠⊠= 7 TeV for p-p collisions. Differential cross-section were obtained as function of rapitidy y and transverse momentum p_T for K_s^0 , Λ and $\bar{\Lambda}$ within the rapidity range 1.5<y<4 and transverse momentum range 0.15 GeV< p_T <10GeV.

Author: KOLIEV, Sergiy (Institute for Nuclear Research NAS of Ukraine)

Co-authors: OKHRIMENKO, Oleksandr (INR NAS of Ukraine); PUGATCH, Valery (Institute for Nuclear Research, National Academy of Sciences of Ukraine(KINR))

Presenter: KOLIEV, Sergiy (Institute for Nuclear Research NAS of Ukraine)

Session Classification: Session Contributed talks

Contribution ID: **24** Type: **talks**

Analysis of neutral long-lived kaons reconstruction efficiency via a missing 4-momentum method at Belle II experiment

Thursday, January 15, 2026 5:20 PM (20 minutes)

In this report, we present a method for the reconstruction of neutral long-lived kaons (K_L^0) using Monte Carlo simulations of the Belle II detector at the SuperKEKB accelerator in Tsukuba, Japan. The detector's nearly 4π hermetic coverage, layered subdetector structure, and the precisely known initial kinematics of the $e^-\,e^+$ collisions provide a unique environment for the study of flavor physics via decays of B mesons, D mesons, and tau leptons.
Due to their long lifetime and primarily hadronic interactions, K_L^0 mesons are notoriously difficult to reconstruct. They often penetrate the inner tracking systems without leaving a trace and may only leave partial energy deposits in the Electromagnetic Calorimeter (ECL) or hits in the K_L^0 and Muon detector (KLM). While these subdetectors can
capture a fraction of K_L^0 interactions, their overall reconstruction remains a significant challenge for many Belle II analyses.

Author: KULAKOV, Danylo (Taras Shevchenko National University of Kyiv)

Co-authors: Dr GANIEV, Eldar (Jozef Stefan Institute, Ljubljana, Slovenia); Prof. GLAZOV, Sasha (Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany); Dr RAIZ, Sebastiano (Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany)

Presenter: KULAKOV, Danylo (Taras Shevchenko National University of Kyiv)

Session Classification: Session Contributed talks

Contribution ID: **25** Type: **talks**

Integral and differential cross sections of muon pair-production in pp collisions at the LHC

Thursday, January 15, 2026 10:40 AM (20 minutes)

The integral cross sections and the transverse momentum distributions for the Z/γ* boson and light jet production in proton-proton collisions are calculated at energy 13 TeV. The hard processes with n = 0,1,2, and 3 outgoing partons are generated by MadGraph5_aMC@NLO at next-to-leading order of perturbative QCD. The parton events are re-weighted to determine uncertainties of the observables originating from the parton distributions and due to variations of renormalization and factorization scales. Parton showers are simulated within Pythia 8, matching and merging are provided by MLM and FxFx methods. Deviations of the computed integral cross sections from the recent results of ATLAS, CMS, and LHCb measurements are less than 4, 3, and 2%.

Author: Dr KOTLYAR, Volodymyr (NSC KIPT, Kharkiv and Department of Physics, Lund University)

Presenter: Dr KOTLYAR, Volodymyr (NSC KIPT, Kharkiv and Department of Physics, Lund University)

Session Classification: Session Contributed talks

Contribution ID: **26** Type: **talks**

Timepix and Medipix: an overview of recent progress and some lessons learned

Thursday, January 15, 2026 2:30 PM (30 minutes)

Author: CAMPBELL, Michael (Spokesperson of Medipix Collaborations, CERN, Geneva)

Presenter: CAMPBELL, Michael (Spokesperson of Medipix Collaborations, CERN, Geneva)

Session Classification: Session Contributed talks

Contribution ID: **27** Type: **not specified**

Accelerators for the Present and Future of Particle Physics

Thursday, January 15, 2026 6:20 PM (30 minutes)

Presenter: TITOV, Maksym (Senior Scientist at CEA (Directeur de Recherche du CEA) Commissariat à l'Énergie Atomique et Énergies Alternatives, CEA Saclay Institut de recherche sur les lois fondamentales de l'Univers (IRFU))

Session Classification: Session Contributed talks

Contribution ID: **28** Type: **talks**

Modeling soft physics in heavy ion collision experiments: from GeV to TeV energies

Wednesday, January 14, 2026 12:00 PM (30 minutes)

Presenter: Dr SINYUKOV, Yuri (Bogolyubov Institute for Theoretical Physics)

Session Classification: Session INVITED TALKS.

Contribution ID: **29** Type: **talks**

The Rating Quality for Theoretical Description of Experimental Data

The Rating Quality for Theoretical Description of Experimental Data

S. O. Omelchenko, V. M. Pugatch
Institute for Nuclear Research, National Academy of Sciences of Ukraine, Kyiv, Ukraine

1. $Introduction$. A new multi-parameter score-rating methodology for assessing the quality of theoretical description of experimental data in heavy-ion physics [1-11] is proposed. The approach overcomes the limitations of the traditional single-value criterion χ^2/ndf, which provides only an integral measure of agreement between theory and experiment.
The methodology is based on dividing the phase space into seven physically motivated kinematic regions of transverse momentum p_T distributions and particle ratios, corresponding to different underlying physical regimes. For each region, the quality of agreement is quantified by a score $Q_i \in [10; 1000]$ defined on a scale, ranging from very poor to excellent agreement.
A comprehensive rating R is constructed through a systematic procedure that includes region definition, weighting according to physical significance, aggregation of local scores, uncertainty estimation, stability checks, and visualization. This framework enables a transparent and comparative assessment of theoretical models, revealing their region-specific performance and complementarity.
2. $Methodology$. The phase space is divided into seven kinematic regions corresponding to different physical regimes: thermal spectra ($p_T < 0.8$ GeV/c), radial flow, hard processes relevant to QGP formation (2.5–4.0 GeV/c), medium-energy jets, high-energy jets with quenching, and the perturbative QCD regime ($p_T > 10$ GeV/c).
For each region, the local statistic is defined as:
$\mathrm{R}_i = \frac{\chi_i^2}{\nu_i}, \qquad \nu_i = N_i - kwhere\mathrm{N}_i$ is the number of data points and k is the number of model parameters. 3. $Score\ Assignment$. Based on the value of R_i, a quality score Q_i is assigned using a scale, ranging from $Q_i = 1000$ for excellent agreement to $Q_i = 10$ for very poor agreement. 4. $Weighting\ and\ Aggregation$. Weight coefficients reflect the physical significance of different kinematic regions. The aggregated quality measures include weighted averaging, geometric mean, minimum score, and dispersion penalties. 5. $Results\ and\ Discussion$. The methodology was applied to LHC data for K_S^0 mesons and Λ hyperons in p-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV. The analysis demonstrates model complementarity and sensitivity to nuclear shadowing effects. 6. $Conclusions$. The proposed score-rating methodology provides a transparent and robust framework for ranking theoretical models in heavy-ion physics and is well suited for systematic studies of LHC Run 3 data and beyond.

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Authors: ОМЕЛЬЧЕНКО, Сергій (ІЯД); ПУГАЧ, Валерій (ІЯД)

Presenter: ОМЕЛЬЧЕНКО, Сергій (ІЯД)

Contribution ID: **30** Type: **talks**

Macroscopic rotations for neutron stars with a deformed effective surface

Author: Dr MAGNER, Alexander (Institute for Nuclear Research NAS of Ukraine)

Presenter: Dr MAGNER, Alexander (Institute for Nuclear Research NAS of Ukraine)

Session Classification: Session Contributed talks

Contribution ID: **31** Type: **talks**

Radiation monitoring system for CBM

Thursday, January 15, 2026 12:20 PM (20 minutes)

A compact radiation-hard monitoring module based on metal foil detectors (MFDs) is being developed for the CBM experiment at FAIR/GSI (SIS-100) in fixed-target mode (Au+Au, 2–11 GeV/n). The baseline detector is a 5-mm-thick module built as a 54-mm square copper frame housing a 50 × 50 mm² foil sensor with two 1-mm-spaced HV electrodes and 50-μm foils mechanically fixed by 125-μm plastic strings. Prototype tests with an 89 cm microcable and a charge-integrator readout demonstrated stable operation and reliability.

Author: Dr RAMAZANOV, Dmytro (Institute for Nuclear research NAS Ukraine)

Co-authors: Mr KSHYVANSKYI, Oleksandr (Institute for Nuclear research NAS Ukraine); Dr CHERNYSHENKO, Serhii (Institute for Nuclear research NAS Ukraine); Mr VORONETSKIY, Ivan (Institute for Nuclear research NAS Ukraine); Prof. PUGATCH, Valerii (Institute for Nuclear research NAS Ukraine); Dr STRATILAT, Dmytro (Institute for Nuclear research NAS Ukraine)

Presenter: Dr RAMAZANOV, Dmytro (Institute for Nuclear research NAS Ukraine)

Session Classification: Session Contributed talks

Contribution ID: **32** Type: **talks**

Rainbow scattering in multilayered targets

Thursday, January 15, 2026 5:40 PM (20 minutes)

We consider a fast charged particle scattering on parallel atomic planes in the eikonal approximation of quantum electrodynamics. The eikonal approximation was chosen because it both accounts for quantum nature of the incident particle and has a wider region of applicability compared to the frequently used Born approximation. Based on Glauber's approach, we continued our previous works and showed how to simplify the calculation of the cross section of scattering on targets consisting of isolated structures in the eikonal approximation. In particular, this method can be used to obtain the differential cross section of scattering on atomic planes in crystals or on multilayered targets like multilayered graphene. It was shown that scattering patterns are specific for different numbers of layers (atomic planes). So for relatively small number of layers in the target, the differential scattering cross section can be used as diagnostic tool for the target structure.

Author: OMELCHENKO, Viktoriia (National Science Center 'Kharkiv Institute of Physics and Technology')

Presenter: OMELCHENKO, Viktoriia (National Science Center 'Kharkiv Institute of Physics and Technology')

Session Classification: Session Contributed talks

Contribution ID: **33** Type: **talks**

MACROSCOPIC ROTATIONS FOR NEUTRON STARS WITH A DEFORMED EFFECTIVE SURFACE

Wednesday, January 14, 2026 12:30 PM (30 minutes)

In this report we present the macroscopic model for neutron stars (NSs) described as a perfect cold liquid
drop at equilibrium within the Tolman-Oppenheimer-Volkoff theory modified by the Kerr and Hartle
approaches for slow azimuthal angular frequency around the symmetry axis. We take into account the NS
surface deformation within the leptodermic approximation [1]. Introducing the dimensionless frequency, we
use the linear perturbation approach to derive the GRT Kerr metric in the spherical coordinates outside
and inside of the NS. The second-order partial derivative differential equation for with respect to spherical
variables and is solved in a separable form in terms of a separation variables constant as a measure for
the NS perpendicular-to-axis angular momentum, internal density larger or of the order of that of the nuclear
matter, Schwarzschild and gravitational radii. The surface gradient terms are taken into account through the
energy density accounting for the density gradient term with the interparticle interaction constant for the
macroscopic equation of state (EoS) within the Extended Thomas Fermi (ETF) approach but with a strong
gravitation. The angular momentum and the moment of inertia (MI), , are macroscopically calculated in
the adiabatic approximation in terms of the statistically averaged and a correlation contributions by involving
the time–azimuthal gravitational coupling. The correlation term becomes significant for a strong
gravitational NS field which leads to a significant change of the Schwarzschild asymptote, in contrast to the
statistically averaged MI. These MI contributions and total energy are the sums of the volume and surface
components obtained through the ETF energy density. We show the volume «V» and surface «S»
contributions into the total statistical and correlational MI parts for the NS with its deformed surface in units
of the uniform sphere MI with the same mass and radius . There are restrictions of the total MI with and
without surface component due to a strong gravitational field because of the correlation and surface
contributions. For small NS surface deformations, one can approximate them by spheroidal shapes with a
small focus distance. The separation constant value for the symmetry breaking is taken finite. The correlation

and surface contributions to the MI are significant in the physical regions of the NS radius.
As perspectives, our analytical macroscopic approach can be generalized to many-component deformed
rotating systems, in particular to involve the isotopic symmetry energy like for a neutron-proton system. The
quark structure of the neutron star interior accounting for a strong gravitation is a challenge for a future work.

Authors: Prof. BONASERA, Aldo (Cyclotron Institute, Texas A&M University, Texas, USA); Prof. LEVON, Alexander (Institute for Nuclear Research); ULEIEV, Andriy (Institute for Nuclear Research); Prof. ZHENG, Hua (School of Physics and Information Technology, Shaanxi Normal University, Xi'an, China); MAGNER, Oleksandr (Institute for Nuclear Research); Dr FEDOTKIN, Sergey (Institute for Nuclear Research); Dr MAYDANYUK, Sergey (Institute of Modern Physics, Chinese Academy of Sciences, Lanzhou, China); Mr DEPASTAS, Theodor (Cyclotron Institute, Texas A&M University, Texas, USA); Dr GRYGORIEV, Ustim (Institute for Nuclear Research)

Presenter: MAGNER, Oleksandr (Institute for Nuclear Research)

Session Classification: Session INVITED TALKS.

Contribution ID: **34** Type: **talks**

Development of GRAiNITA, a next-generation callorimeter technology

Thursday, January 15, 2026 6:00 PM (20 minutes)

This presentation introduces an energy resolution study in GRAiNITA, a novel sampling calorimeter technology designed to address the high-resolution and cost-efficiency requirements of future collider experiments. The detector design features millimeter-sized $ZnWO_4$ scintillation grains distributed within a heavy liquid medium of sodium polytungstate. Scintillation light is captured by wavelength-shifting (WLS) fibers and transferred to SiPMs, a method that stochastically traps light near its creation point to offer better resolution than traditional shashlik-type calorimeters.

The talk will detail the performance characterization of a GRAiNITA prototype through beam tests conducted at the CERN SPS H9 accelerator and subsequent Geant4 simulations. By mapping the non-uniformity of light collection and its impact on energy resolution, the study establishes that the detector achieves a constant term below 0.65% and a stochastic term of approximately $1\%/\sqrt{E}$ due to secondary particle escape. These results validate the potential of GRAiNITA to provide precise measurements of neutral particles essential for flavor physics experiments at the Z^0 resonance.

Authors: DUBOVIK, Alexander (Institute for Scintillation Materials of the National Academy of Sciences of Ukraine, 60 Nauki Ave., Kharkiv 61072, Ukraine); BOYARINTSEV, Andrey (Institute for Scintillation Materials of the National Academy of Sciences of Ukraine, 60 Nauki Ave., Kharkiv 61072, Ukraine); MATHON, Bernard (Université Paris-Saclay, CNRS/IN2P3, IJCLab, Orsay, France); DOMINGUEZ GONCALVES, Carlos (Université Paris-Saclay, CNRS/IN2P3, IJCLab, Orsay, France); PICARD, David (Université Clermont-Auvergne, CNRS/IN2P3, LP-Clermont, 63177 Aubière, France); KLEKOTS, Denys (Taras Shevchenko National University of Kyiv; Université Paris-Saclay, CNRS/IN2P3, IJCLab, Orsay, France); BRETON, Dominique (Université Paris-Saclay, CNRS/IN2P3, IJCLab, Orsay, France); HULL, Giulia (Université Paris-Saclay, CNRS/IN2P3, IJCLab, Orsay, France); CHANAL, Hervé (Université Clermont-Auvergne, CNRS/IN2P3, LP-Clermont, 63177 Aubière, France); BOIARYNTSEVA, Ianina (Université Paris-Saclay, CNRS/IN2P3, IJCLab, Orsay, France;Institute for Scintillation Materials of the National Academy of Sciences of Ukraine, 60 Nauki Ave., Kharkiv 61072, Ukraine); TUPITSYNA, Irina (Institute for Scintillation Materials of the National Academy of Sciences of Ukraine, 60 Nauki Ave., Kharkiv 61072, Ukraine); LEFRANÇOIS, Jacques (Université Paris-Saclay, CNRS/IN2P3, IJCLab, Orsay, France); MAALMI, Jihane (Université Paris-Saclay, CNRS/IN2P3, IJCLab, Orsay, France); GOLINKA-BEZSHYYKO, Larysa (Kyiv National Taras Shevchenko University, 01033 Kyiv, Ukraine); MAGNE, Magali (Université Clermont-Auvergne, CNRS/IN2P3, LP-Clermont, 63177 Aubière, France); SCHUNE, Marie-Hélène (Université Paris-Saclay, CNRS/IN2P3, IJCLab, Orsay, France); IMRE, Miktat (Université Paris-Saclay, CNRS/IN2P3, IJCLab, Orsay, France); YERESKO, Mykhailo (Université Clermont-Auvergne, CNRS/IN2P3, LP-Clermont, 63177 Aubière, France); BEZSHYYKO, Oleg (Kyiv National Taras Shevchenko University, 01033 Kyiv, Ukraine); OLMO, Sebastien (Université Paris-Saclay, CNRS/IN2P3, IJCLab, Orsay, France); BARSUK, Sergey (Université Paris-Saclay, CNRS/IN2P3, IJCLab, Orsay, France); MONTEIL, Stéphane (Université Clermont-Auvergne, CNRS/IN2P3, LP-Clermont, 63177 Aubière, France); HOU, Yingrui (Université Clermont-Auvergne, CNRS/IN2P3, LP-Clermont, 63177 Aubière, France)

Presenter: KLEKOTS, Denys (Taras Shevchenko National University of Kyiv; Université Paris-Saclay,

CNRS/IN2P3, IJCLab, Orsay, France)

Session Classification: Session Contributed talks

Contribution ID: **35** Type: **talks**

BGOOD photoproduction experiment: recent results on unconventional baryon stucture study in the light quark sector

Thursday, January 15, 2026 2:10 PM (20 minutes)

Author: ROMANIUK, Mariia (Institute for Nuclear Research of NAS of Ukraine)

Presenter: ROMANIUK, Mariia (Institute for Nuclear Research of NAS of Ukraine)

Session Classification: Session Contributed talks

Contribution ID: **36** Type: **talks**

Ukrainian ultra-light technologies for novel detectors for particle physics

Wednesday, January 14, 2026 5:30 PM (30 minutes)

Authors: Dr TYMCHUK, Ihor (Kharkiv National University of Radio Electronics); PROTSENKO, Mykhailo (Kharkiv National University of Radio Electronics); Dr BORSHCHOV, Viatcheslav (Kharkiv National University of Radio Electronics)

Presenter: Dr TYMCHUK, Ihor (Kharkiv National University of Radio Electronics)

Session Classification: Session INVITED TALKS.

Contribution ID: **37** Type: **not specified**

Summary and closing of HEP-TEC-2026 conference

Thursday, January 15, 2026 6:50 PM (10 minutes)

Presenter: Dr DAVYDOVSKYY, Volodymyr (Institute for Nuclear Research NAS of Ukraine)

Session Classification: Session Contributed talks

Contribution ID: **38** Type: **talks**

LHC FOR SEARCH OF ASYPTOPIA (CANCELLED)

Wednesday, January 14, 2026 6:00 PM (30 minutes)

Presenter: Dr LENGYEL, Alexander (Institute of Electron Physics, National Academy of Sciences of Ukraine, Uzhhorod, Ukraine)

Session Classification: Session INVITED TALKS.

Contribution ID: **39** Type: **talks**

Determination of the strong coupling from high-energy data

Wednesday, January 14, 2026 5:00 PM (30 minutes)

Authors: GARZELLI, M.V. (Hamburg University, II. Institute for Theoretical Physics); Dr ZENAIEV, Oleksandr (Hamburg University, II. Institute for Theoretical Physics); ALESHKIN, S. (Hamburg University, II. Institute for Theoretical Physics); MACH, S. (Hamburg University, II. Institute for Theoretical Physics)

Presenter: Dr ZENAIEV, Oleksandr (Hamburg University, II. Institute for Theoretical Physics)

Session Classification: Session INVITED TALKS.

Contribution ID: **40** Type: **not specified**

Tracking and recognition of radiation quanta/particles interacting in semiconductor sensors

Thursday, January 15, 2026 4:30 PM (30 minutes)

The aim of the lecture is to present the current state of use of Timepix3 pixel detectors in the ATLAS and MoEDAL experiments at the LHC at CERN, specifically within the ATLAS-TPX3 and MoEDAL-TPX3 detector networks, which were designed, installed and operated by the teams of the IIEAP CTU in Prague. Their ability to visualize individual particle tracks/trajectories in the semiconductor sensors, similar to those in nuclear emulsions or bubble chambers, will first be briefly demonstrated.

Specifically, the results of measurements of a composition and spectral characteristics of mixed radiation fields within the ATLAS and MoEDAL environments, based on track recognition of charged particles, gamma photons and neutrons interacting in silicon sensors of TPX3 detectors of the installed networks, will be presented. They will be supplemented by results of a long-time measurement of radiation in extraterrestrial conditions using Timepix detectors installed on Earth satellites.

The main part of the talk will summarize the experimental results obtained from the ATLAS-TPX3 and MoEDAL-TPX3 networks synchronized with the LHC beam collisions. Their ability to measure the Time of Arrival (ToA) of radiation quanta and/or particles interacting in their sensors with a resolution of about 1.6 ns allows determining their Time of Flight (ToF) in the environment of these experiments. Such ToF measurements, combined with precise particle tracking and recognition techniques, open the way to distinguish reliably particles born at the interaction point (IP) of the LHC beams from the radiation background in all its complexity. This will be demonstrated in the talk by the example of its use for real-time luminosity measurements in the ATLAS experiment.

Author: Prof. POSPÍŠIL, Stanislav (Director Emeritus of the Institute of. Experimental and Applied Physics (IEAP) of the Czech Technical University in Prague (CTU))

Presenter: Prof. POSPÍŠIL, Stanislav (Director Emeritus of the Institute of. Experimental and Applied Physics (IEAP) of the Czech Technical University in Prague (CTU))

Session Classification: Session Contributed talks