opendața

SHPOLO

Analysis of the Drell–Yan Process based on RUN2 Open Data from the CMS Experiment

<u>Korsakov I</u>¹., Shmatov S¹., Lanyov² A. ¹Meshcheryakov Laboratory of Information Technologies, JINR ²Veksler and Baldin Laboratory of High Energy Physics, JINR

62nd meeting of the PAC for Particle Physics

1. Motivation

Search for dark matter candidate particles (DM) and verification of predictions "portal" models of DM are one of the priorities of the physical program of experiments at the Large Hadron Collider. The efforts of the collaborations will make it possible to verify the predictions of only a small number of simplified theoretical scenarios. In this regard, the task rise of reinterpreting previously obtained experimental results within the framework of extended theoretical models. To do this, it is proposed to use open data [1] from LHC, which are posted in public access. The initial stage of such an analysis is to compare measurements of the characteristics of the processes of the Standard Model on open data with official experimental results and to simulate the processes of formation of particles of the extended calibration sector (as a reference model) and TM particles







NIESHCHERY AKOV

5. What has been done

- All statistics from and RUN2015 have been analyzed
 - ✓ The production of muon pairs in the Drell-Yan process at s 13 TeV in proton-proton collisions at the LHC has been analyzed using open CMS data from the second run in 2015, with an integrated luminosity of 2.67,pb⁻¹
 ✓ Differential cross sections of the studied process as a function of the muon pair invariant mass have been obtained, and the kinematic distributions of muon pairs have been investigated
 ✓ A comparison of the analysis results with Standard Model predictions and previously published CMS data has been carried out
 ✓ The measurements show good agreement with leading-order electroweak theory and next-to-leading order QCD calculations
 ✓ The results are consistent with the Standard Model and the official CMS collaboration measurements

Distributions of the number of dimuons based on the invariant mass. The orange color represents the contribution of the Drell-Yan process from Monte Carlo simulations. Other colors depict contributions from background events. The lower histogram illustrates the ratio of reconstructed data to background.

6. What is planned to be done

- It is planned to model the production of a new gauge boson Z' and to measure the upper limit of the Z'→ℓ+ℓ⁻ decay cross section using open data and Run 3 data from the CMS experiment. In this study, Z' is treated as a "portal" between the Standard Model and the "dark" sector, a choice that is traditional for our group due to extensive experience with such physics objects.
- The tasks also include verifying future results against Standard Model predictions, placing constraints on possible Z' and dark matter particle masses within a simplified dark matter model, and comparing the results based on open data with previously published CMS collaboration data.

7. References

[1] CMS Open Data, <u>https://opendata.cern.ch/</u>

[2] CMS Collaboration, "Measurement of the differential Drell-Yan cross section in proton-proton collisions at $\sqrt{s} = 13$ TeV", Journal of High Energy Physics, December 2019