Contribution ID: **14** Type: **not specified**

NSC KIPT participation in the CMS experiment: the history and present activities

Tuesday, May 28, 2024 3:20 PM (15 minutes)

The National Science Centre “Kharkiv Institute of Physics and Technology”(NSC KIPT) has been participating in the CMS experiment since the early 1990’s. The main efforts were then focused on R&D studies aimed at searching for an appropriate scintillation material for the CMS hadron calorimeter (HCAL), which was in development. The Institute was also involved in construction of HCAL prototypes and their beam-testing at CERN, as well as in computer simulations of the CMS hadronic calorimetry in general. This was followed by the mass production of endcap HCAL scintillator tiles in Ukraine, in which KIPT performed the tile quality control based on light output measurements. Upon successful completion of this work in the early 2000s, preparations started at the NSC KIPT for participation in processing of CMS data –samples of proton-proton collisions to be obtained at the LHC. Based on computer simulations, the possibility was estimated to observe a Higgs boson with a mass above the on-shell ZZ decay threshold in the CMS experiment. Also, a computing facility was constructed, which became the first Ukrainian WLCG site and then (in 2009) commissioned (under the name of T2_UA_KIPT) as the Tier-2 (T2) centre of the CMS grid infrastructure. After the LHC startup, more than 20 PB of CMS experimental information have been transferred to the T2_UA_KIPT site for processing, with a high level of the site stability and reliability being provided. At present, in addition to the computing infrastructure of the experiment, the NSC KIPT is also involved in activities on the support and upgrades of the CMS hadron calorimetry. In particular, the measurements were carried out at the NSC KIPT that illuminated the strong dose-rate dependence of the light output reduction in plastic scintillators under irradiation and thus provided an explanation for the “premature”signal degradation in the endcap HCAL observed upon completion of the LHC Run 1. An experimental study of the radiation resistance of various scintillation materials is also being carried out in order to assess prospects for their future usage in either the CMS or other high-energy physics experiments. Another important subject of our activities within the CMS is participation in the physics analysis of the data obtained in the experiment. Last years, this work has been mainly focused on searching for supersymmetry signals based on the analysis of proton-proton collision samples recorded in the LHC Run 2 through selection of the events with a large missing transverse momentum and two high transverse-momentum leptons.
The work was supported in part by grants of the NAS of Ukraine (NASU) within the targeted research program “Collaboration in advanced international projects on high-energy and nuclear physics”and the “NASU informatization program”.

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Session Classification: Highlights from CERN LHC Experiments

Track Classification: Other subjects related to work at CERN (computing, outreach, etc.)