Brief information about the project

Name of the project	AP09058640 «Physics beyond the Standard Model in processes involving the top quark and Higgs boson» (0121PK00202)
Relevance	Over the past ten years, the work results of the Large Hadron Collider at CERN have led to significant progress in the experimental study of the t-quark and Higgs boson. They include the discovery of rare processes that were not observed at other colliders, and measurement of parameters with high accuracy, whose values cannot be predicted in the framework of the standard model (SM). The top quark is a unique laboratory for testing the SM, and along with the Higgs boson, is an effective option for searching for effects beyond the SM. As a research method, we use a model independent and gauge invariant method. In the framework of this method, we will carry out a complete analysis of the decays of the t-quark and Higgs boson. We plan to calculate the partial decay widths of the t-quark and Higgs boson, which goes by flavor changing neutral current transitions, using the spiral amplitude technique. The next stage is the calculation of asymmetry parameters. After the results will be compared with experimental data from the LHC. The study of such processes is particularly important for deep understanding of the flavor changing neutral currents decays, which allows us to study the effects of physics beyond the SM. It is planned to calculate the matrix elements and t-quark decay widths, and Higgs bosons' decays. The possible contributions of the "New physics" will be parametrized by using model independent gauge invariant six-dimension operators in the framework of the effective field theory approach SMEFT (Standard Model Effective Field Theory). Particular attention will be paid to operators containing both the fields of the top quark and the Higgs boson and simultaneously contributing to the processes with both the top quark and the Higgs boson.
Purpose	This research project is devoted to the study of decays of the t-quark and Higgs boson in the framework of model independent and gauge invariant method.
Objectives	The main objectives of the project include the calculation of the width and other characteristics of decays at high energies, as well as a description of the behavior of kinematic distributions depending on the energies and angles of the emitted particles at various anomalous parameters. For this purpose, we are going to implement the next activities: – the calculation of the top quark decay widths taking into account the anomalous contributions; – the calculation of the decay widths of Higgs boson and the construction of kinematic distributions of the decay products; – the calculation of the corresponding matrix elements of this process;

	– the derivation of the analytical dependences of the interaction parameters of the t-quark and Higgs boson on the coefficients of basic anomalous operators of six dimension in the SMEFT approach; – to establish an experimental restriction on the constants of the studied decays.
Expected and achieved results	Over the past ten years, the work results of the Large Hadron Collider at CERN have led to significant progress in the experimental study of the t-quark and Higgs boson. They include the discovery of rare processes that were not observed at other colliders, and measurement of parameters with high accuracy, whose values cannot be predicted in the framework of the standard model (SM). The top quark is a unique laboratory for testing the SM, and along with the Higgs boson, is an effective option for searching for effects beyond the SM. As a research method, we use a model independent and gauge invariant method. In the framework of this method, we will carry out a complete analysis of the decays of the t-quark and Higgs boson. We plan to calculate the partial decay widths of the t-quark and Higgs boson, which goes by flavor changing neutral current transitions, using the spiral amplitude technique. The next stage is the calculation of asymmetry parameters. After the results will be compared with experimental data from the LHC. The study of such processes is particularly important for deep understanding of the flavor changing neutral currents decays, which allows us to study the effects of physics beyond the SM. It is planned to calculate the matrix elements and t-quark decay widths, and Higgs bosons' decays. The possible contributions of the "New physics" will be parametrized by using model independent gauge invariant six-dimension operators in the framework of the effective field theory approach SMEFT (Standard Model Effective Field Theory). Particular attention will be paid to operators containing both the fields of the top quark and the Higgs boson and simultaneously contributing to the processes with both the top quark and the Higgs boson.
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List of publications with links to them	1. Boos E., Nurbakova G., Habyl N., Rustembayeva S., Temirkhanova D. Top-quark physics in hadronic collisions // International Journal of mathematics and physics // №1, Vol.12. 2021. – P.57-71. https://doi.org/10.26577/ijmph.2021.v12.i1.09 (in English) Boos E., Nurbakova G., Khabyl N., Rustembayeva S., Imanova S. Standard model and predictions for the Higgs boson // Physical sciences and technology. – 2022. – Vol. 9. – N.2. –P. 45-58. https://doi.org/10.26577/phst.2022.v9.i2.07 (in English)
Patents	-