

Referee report

on the project

Physics research with ATLAS detector at the LHC Run-III

(JINR participation)

(within the JINR theme 02-0-1081-2009/2019)

The ATLAS collaboration has been organized in order to perform the experiments of fundamental importance at the Large Hadron Collider at unprecedented high energies. The universal general purpose detector ATLAS has been developed, constructed and commissioned with a large participation of the JINR scientists and engineers. The JINR team in ATLAS continues to maintain and support many detector systems for which it is responsible and participates in extensive detector upgrade.

Since the start of collecting data, the main accent in the ATLAS-related JINR activity began shifting to data analysis. In analysis of the Run-I data at 7-8 TeV the main topics of physics analysis in JINR were search of Higgs boson, search of supersymmetry, physics of top quarks, manifestation of New Physics in some exotic processes etc. Many results in these fields have been published by the ATLAS collaboration with essential input from the JINR physicists.

In the Run-II period the JINR group actively participated in all ATLAS activities providing collection of the excellent quality new data at increased luminosity and the energies up to 14 TeV. Some results based on collected in Run-II data have been published already, but there is still a lot of data to be analyzed, what is foreseen, in particular, in the current project.

The ATLAS Collaboration in 2015-2019 has published, with a leading participation of the JINR physicists, 24 papers in journals and 32 papers in other published materials, the JINR speakers gave more than 20 talks at the conferences.

For the next 2020-2024 period the JINR group within this project has set for itself three fields of activity:

1. Participation in running of the ATLAS experiment.

This includes making shifts, on-call expert jobs, data quality control, maintenance support of the Hadronic Tile Calorimeter, Liquid Argon Hadronic Calorimeter, of part of electronics, support of the ATLAS Distributed Computing, including GRID, etc.

2. Physics research and data analysis.

The JINR-ATLAS management has taken an important decision: to support in JINR only those research activities, which are supported or have clear plans to be supported by the whole ATLAS Collaboration. With this condition, the following physics tasks are planned, in particular, in the project:

- Study of intrinsic heavy quark components in the proton;
- Production of heavy hadrons and baryons, including, in particular, those containing b - and c -quarks, exotic structures. Finding of the form of the gluon distribution at medium and large transverse momenta.
- Measurement of a Z boson produced in association with b - or c -jets.
- Study of Bose-Einstein correlations as a sensitive probe of the space–time geometry of the hadronization region.
- Theoretical support by the SANC group with calculation of the electroweak and QCD NLO corrections to the Drell-Yan-like processes.
- Higgs boson properties and its associated production (tH , $t\bar{t}H$).
- Searches for exotic states and processes beyond the Standard Model: excited bosons Z^*/W^* , neutral Z' gauge bosons, new massive bosons decaying into Z , W or Higgs boson and a photon, quantum black holes, SUSY related searches.

For many of these tasks a solid background exists such as publications, conference reports and discussions in the ATLAS Working Groups.

3. Participation in the software maintenance and development.

JINR team will participate

- in development and support of the control system of the data indexing on the GRID servers, system parameters and production monitoring and as well as full support of the *EventIndex* system.

- in support of components of the real time TDAQ system, development of the operational monitoring systems and networks monitoring. The authors plan also to participate in the development and maintenance of the TDAQ system for the Run-III.

Summarizing, in the previous period of 2015-2019 the project participants has made a large and visible contribution in the success of the whole international ATLAS Collaboration, both in running of the experiment in Run-II and in obtaining physics results. In the current project they have presented an extensive ambitious program of new research at the frontier of particle physics.

I have a couple of remarks to the project.

It is not clear from the text, how many JINR scientists are involved in physics analysis. For some reason it is indicated the number of persons participating in the ATLAS upgrade program, but the upgrade is not the subject of this very project and is not discussed here at all.

For completeness, it would also be desirable to compare the physics program of the current project with the program of the CMS project in JINR, which is another general purpose detector at LHC: what are the differences (if any) or peculiarities.

Concluding, I highly appreciate the submitted project. The requested resources are reasonable.

I recommend approving the project “Physics research with ATLAS detector at the LHC Run-III” with the first priority.

Doctor of Science

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