The project "ARIeL: Physics at Future e^+e^- colliders"
Referee's report

The project aims for both theoretical and experimental involvement into physics program of future electron-positron colliders. Keeping in mind all pros and cons of the future e^+e^- colliders the authors claim their proposal to be the most adapted for the CLIC detector.

The theoretical section of the project consists of the development of a Monte Carlo generator for a list of processes with leptonic final states, top quark pair production, associative Higgs and gauge boson production, and others. The uniqueness of this tool supposedly will be due to inclusion of the complete one-loop and leading multiloop radiative corrections with taking into account both longitudinal and transverse polarization options. The hard process simulation will be consequently interfaced to PYTHIA for possibility of complete detector simulation. There are also plans for creation of building blocks with going beyond 1-loop calculations.

With the expected experimental accuracy of the CLIC measurements, these improvements in theoretical simulations are very relevant. A development of dedicated Monte Carlo generator for polarized beams is an important goal.

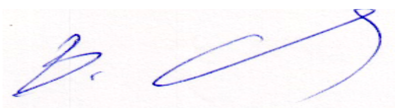
The experimental part of the proposal consists of four well devised analysis proposals, namely: $e^+e^- \rightarrow \gamma\gamma$ process measurement, precision measurement of the Higgs boson mass, top quark polarization, and a search for the anomalous quartic coupling in $\gamma\gamma \rightarrow W^+W^-$ and $\gamma\gamma \rightarrow ZZ$ scattering. Having JINR joined the CLICdp collaboration, all these studies will be based on the full CLICdp detector simulation and reconstruction software.

These studies of the CLICdp potential cover important topics of present scientific interests. The $\gamma\gamma$ production, being measured with high precision at CLIC will be sensitive to the BSM signals. A method to improve the Higgs boson mass measurement is definitely worth exploring. Usage of incoherent hard photon radiation (beamstrahlung) for the anomalous quartic couplings is quite inventive and its potential also should be studied.

The project group consists of professionals well familiar with the described topics and the project leaders are known for their previous works in the fields of experimental analysis and theoretical support for collider physics. The group has all experience and frameworks to successfully complete the declared tasks.

There are also some critical remarks. The disadvantage of the theoretical approach is the refusal to use any approaches for re-summing leading contributions in various asymptotic domains. Instead, the emphasis is on computing in fixed orders of perturbation theory. However, the LEP experience shows that the convergence of perturbation theory series is poor, for example, in soft and collinear photons. Also, in the area close to thresholds, it can be necessary to account Coulomb effects. Without the elimination of such problems, the implementation of precision predictions will be difficult. The team is well known for its contribution to LEP1 physics, where the Z resonance was studied in detail. Future e+e- collider projects also foresee additional high-precision studies of the Z resonance, where new project can contribute a lot. I recommend the project team to pay attention to these points.

Overall I find the project well prepared and would recommend to support it. It may worth converging to more realistic ambitions concerning the multiloop calculations and prioritizing development of the process generators in first place. The group also could benefit from more young students.



Professor V.I. Savrin
Referee

09.04.2018