Mandate for the convener of the FCC/TLEP-WG4 "Top Quark Physics"

1. Physics Objectives

a. Understand the experimental precision with which TLEP could measure all top quark properties (mass, width, Yukawa coupling, gauge couplings, CKM matrix elements, etc.) by accumulating about one million top-anti-top pairs at production threshold. Define the optimal threshold scan strategy.

b. Evaluate the top-quark-related added value of a run above threshold as a function of its duration and its centre-of-mass energy (say 400, 450, and 500 GeV) to the physics programme of TLEP.

c. Estimate the sensitivity to new physics through rare top decays.

d. Understand the external limitations (measurement of other observables, measurement of the beam energy and the beam energy spread, theoretical uncertainties, etc.), and contribute to proposing ways to alleviate them.

e. Set constraints on the performance and the relevance of the various sub-detectors, as well as on the experimental environment (e.g., beam energy spread), to make the experimental precision match or approach the expected statistical accuracy.

f. Define the software needs to make possible these measurements and their interpretation with the required precision (online, generator, simulation, reconstruction, analysis, global fits, …).

2. Managerial objectives

a. Define and start the activities of the group with a global vision, seeking for international collaboration. Synergies with linear collider studies, in particular, will have to be exploited whenever deemed relevant and useful.

b. Attract people for the studies relevant to the group. The list of TLEP subscribers with a declared interest in the measurement of top-quark properties is compiled in the mailing list (e-group) TLEP-TopProperties@cern.ch. One of the roles of the convener is to extend this list as much as possible (and ask new interested people to subscribe to the study through http://tlep.web.cern.ch).

c. Maintain a high level of contacts with the other groups of the studies, in particular “Detector Designs”, “Experimental Environment” and “Machine-Detector Interface”, “Offline software”, “QCD and $\gamma\gamma$ physics”, “Experimental Signatures of New Physics”, and several “Phenomenology” physics groups. It is highly advisable to have group members participate to the more technical (and more urgent) activities of the other groups, especially if relevant to achieve the scientific objectives of the group.

d. Create adequate sub-groups to match the group scientific objectives, and suggest appropriate sub-conveners, possibly starting with a high-profile convener for each of the sub-groups.

e. Find, within about a year, one (or two) associate(s) to work as co-conveners, and able to take over the convener task after two years or thereabout (although of prolongation of the mandate of the first convener until the end of the study is not excluded, of course). The collaboration with a top-quark-theory expert could be an important asset.

f. Appoint editors towards the production of intermediate reviews and a final yellow report. (See “Timescale and deliverables below.)

g. Report progress to the physics coordination of the study and at regular TLEP physics meetings (held monthly for the time being).

3. Timescale and deliverables

The Working Group “Top Quark Physics” is part of the physics coordination of the TLEP design study, itself part of the FCC (Future Circular Collider Design Study at CERN). The FCC study consists of three phases:

- a first phase, called “Exploration” until March 2015 or thereabout, which will serve exploring all possible options and potential studies, and identifying requirements and constraints;

- a second phase, called “Analysis” until September 2016 or thereabout, where the identified baselines are conceptually studied in detail and in an integrated fashion;

- a third and last phase, called “Elaboration”, expected to last until the end of 2017, which delivers all information required for the final Conceptual Design Report (CDR) of the study.

Each phase will conclude with a workshop and a review milestone that will layout the directions of the next phase. It would therefore be instrumental to foresee an interim written reports of the work of the group after the first two phases. A final yellow report, which will be part of the FCC CDR, is to be delivered at the beginning of 2018, and will document the scientific achievements of the group, expected to match or exceed the objectives set in the first section.

The “Phase 0” for TLEP physics studies, called “Preparation” is happening now. It should be concluded within a few weeks by the delivery, from the group convener to the physics coordinator, of a document describing in some details the “scope” for the group, with work areas, deliverables, and timeline, at least for Phase 1.