Charge for the ECFA HL-LHC workshop preparatory groups

1. Introduction

The ECFA HL-LHC workshop of Oct. 1-3 2013 will be a meeting for the HL-LHC community to discuss the HL-LHC Upgrade programmes, to identify synergies, and to further collaborate in areas of common interest. The four LHC experiments, ALICE, ATLAS, CMS and LHCb will contribute to the workshop. The workshop steering committee[1] proposes that groups are formed to prepare sessions of the workshop addressing the following topics:
- Physics goals, theoretical developments and performance reach
- Tracking devices and associated electronics and readout
- Calorimetry and associated electronics and readout
- Muon systems and associated electronics and readout
- Trigger/DAQ/Offline/Computing
- Electronics and read-out systems
- Long Shutdown constraints and radiation and activation effects
- Accelerator and Experiment interface

2. Objective

The workshop will be organized with plenary sessions dedicated to each of the above-mentioned areas. The preparatory groups will identify the key topics to be discussed and will organize the session of the workshop. They will propose the agenda and the speakers to the Steering Committee. They will write a document of few pages summarizing the main outcomes of the workshop and proposing further steps in each area of work.

Preliminary guidelines on the topics and issues to be addressed by each group are proposed at the end of this charge. The groups will finalize this list once they are formed.

3. Membership of the preparatory groups

The preparatory groups will include membership of all four LHC experiments and contribution from CERN Theory and Accelerator divisions when relevant. They will involve experts in each sub-topic covered by the groups. It is proposed to have two chairs per group (one from each of ATLAS and CMS). The steering committee members are ex-officio members of the preparatory groups.

4. Methodology

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The chairs of the groups will organize the work and the meetings to fulfil the objectives outlined above. It is proposed to set-up a common TWIKI page and e-group mailing list(s) to collect and circulate information and progress from each group. The meetings of the groups will be open to members of other groups, especially to cover cross-aspects (eg specific detector physics aspects, electronics systems…), experts outside the group can also be invited by the chairs. The chairs of the groups will report plans and progress to the workshop Steering committee.

A meeting of the various groups will be held on June 10 to assess the progress, discuss coordination of common areas between the groups, to identify the remaining work and to define the workshop agenda, including topical cross-group presentations if relevant.

5. **Preliminary guidelines on topics to be addressed by the preparatory groups**

5.1. Physics goals and performance reach

The group should propose key physics channels to study the HL-LHC physics reach and to highlight specifications for the detector performance. It should explore/harmonize issues related to the event generators and tunes. Areas where theoretical progress is also required should be highlighted.

The following questions could be addressed: what are the physics benchmarks for precision measurements and what are the requirements from theory, what could be a trigger menu including exclusive (Higgs) and inclusive (searches) signals, what are the main origin of errors in key physics channels and what are the possible mitigations with detector performance enhancement, for instance with increased resolution, granularity, and acceptance in trigger thresholds and η coverage. The HI and Flavor physics potential reach as a function of the integrated luminosity should also be addressed as dedicated topics.

A target for the workshop would be to present preliminary performance projections for a few physics benchmarks simulated with realistic detector descriptions and beam conditions.

5.2. Tracker, Calorimeter and Muon systems

The groups should address the need and motivations for detector replacements, including longevity and performance issues at the higher luminosities. They will explore the new detector requirements and consider the capabilities of existing technologies to fulfil these requirements and establish their viability and cost for use in the upgrades, including timeline of the projects. The groups may also identify needs for R&D, especially where further joint efforts across experiments would be desirable (this should include electronics systems and services (cooling, cabling, power supplies…)). The need for common test facilities should be considered. Another target for the workshop would be to present preliminary performance studies for the detector concepts developed by the experiments.

5.3. Trigger/DAQ/Offline/Computing

The overall goals are similar to those defined for the detector systems. The group should assess the requirements for the trigger and subsequent data processing, and the benefit from track triggering (especially for ALTAS and CMS) and higher rate at the input and output of the High Level Trigger. It should assess the availability and potential for technical solutions on the time scale of the projects, including cost considerations. It will propose future actions, possibly common to all experiments.

5.4. Electronics and read-out systems

The group will address the issue of longevity of all types of electronic and read-out systems, on and off-detector. This will be done in conjunction with expert from the detector system groups when relevant. It will assess the potential and cost of new technologies as for detector systems. The group may also identify the needs for further R&D efforts, especially where further joint R&D efforts across experiments would be desirable.

5.5. Long Shutdown constraints and radiation and activation effects

The group should consider the framework and software issues for simulation of beam backgrounds, radiation and activation levels in the experimental areas. It should assess the validity of the current simulations for detector radiation damage studies and the impact of activation on the upgrade activities during the Long Shutdowns, and for maintenance during the HL-LHC operation period. The group should also evaluate the infrastructure upgrade needs and the length of the shutdowns for the scope of work foreseen by the experiments. Areas of potential common developments, for example in remote handling technology or simulation tools, may be identified.

5.6. Accelerator and experiment interface

The group should address the issue related to the accelerator modifications having implication in the experimental areas, especially at the ATLAS and CMS Interaction Regions when the new accelerator quadrupoles will be installed. It should consider the technical impact on the detector upgrades foreseen, as well as on the schedule of activities. Special requirements for the ALICE and LHCb programmes should also be identified. As a further goal, the group should propose a common set of assumptions for the beam conditions and the luminous region to be simulated for event pile-up generation, based on scenarios agreed with the accelerator representatives, especially concerning the fill profiles w/o luminosity levelling.