

Letter of Intent: Development of Pileup Mitigation Tools within the Context of a Dual Readout Calorimeter (DRC) for CMS

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The general motivation for the proposed work is given in a longer document [1].

- Our primary focus will be to address issues related to the severe pileup conditions expected for HL-LHC.
- In addition, we will address questions regarding suitability of DRC to HL-LHC, such as radiation hardness of components and the placement of photosensors in a CMS FCAL design. We expect to work closely with our collaborators on one [2] or both concurrent DRC related proposals, dividing responsibility according to our primary goals.

Specifically, we will:

- Develop concepts for pileup mitigation (including from timing) in the evolving CMS DRC design.
- Validate these concepts (and related ones for Shashlik calorimeters in beam tests).
- Continue the work described in [1] on development of 10-20 ps timing
- Continue to involve a network of experts (beyond CMS) in these efforts.

An initial 1-year budget proposal is:

- \$50k for specific design and testing within the FCAL upgrade effort.
- \$50k for continued effort toward the goal of a generic 10-20 ps timing solution.

About 70% would be for material and fabrication; the remainder for travel.

As was evident in a recent ECFA workshop, it is important to mitigate pileup in a forward calorimetry upgrade for CMS operation at high luminosity. We have recognized this issue in [1], and have considered solutions in discussions over the past year, with a preliminary vision presented to RD52 in Spring 2013. The ERC research project of Lecoq *et al.* [3] also considers aspects of the proposed activities.

Based on more than a year of activity in the CMS Forward Calorimetry Task Force, we feel that the physics simulations and technical considerations, particularly those relating to dealing with the challenge of high pileup at the trigger and reconstruction level, indicate that a DRC option is attractive. However, issues remain that need to be clarified via R&D effort, as proposed here, before the DRC option can be adopted with confidence.

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- [1] S. White, "Experimental Challenges of the European Strategy for Particle Physics," <http://arxiv.org/abs/1309.7985>
[2] C. Tully, "4D Dual-Readout Crystal Fiber Calorimeter (CFcal) Letter of Intent for Phase 2 Upgrade R&D."
[3] P. Lecoq, "TICAL: 4D total absorption Time Imaging CALorimeter," http://erc.europa.eu/sites/default/files/document/file/erc_2013_adg_results_pe.pdf

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