

LASER MODIFICATIONS & UPGRADES

Current system

- Three lasers (2 blues and 1 red) with diagnostics
- Two optical switches and intensity attenuators
- Operation since 2001/03, SW feedback (stabilization) 2006, P5 2007

Reference: [1]

The current system performs as designed, but may need modifications/upgrades to ensure reliability and performance in the long term.

Proposed modifications/upgrades [2]:

1. New optical switches
 - a. Quote: 65 k\$ each
 - b. Motivation: Spare of the current system.
2. A new solid state laser pump to replace Kr lamp:
 - a. Quote: 65 k\$
 - b. Motivation: improve stability and reduce maintenance work, consumables of current pump system no more available
3. A new orange laser for EE:
 - a. Quote: 200 k\$
 - b. Motivation: add second wavelength to disentangle photon-detector (VPT) evolution from crystal transparency changes
4. Spares for IR/Orange lasers in EB/EE
 - a. Spares for the second wavelength, if needed (24/7 monitoring)

ECAL PM pre-analysis of the proposals

The ECAL PM, admittedly not an expert of lasers and optical systems, classifies the proposals at items 1. and 2. as “maintenance modifications” aimed at improving the robustness and reliability of the current system, to guarantee that the design performance is maintained throughout the CMS nominal lifetime. The motivations for these modifications are based on the weakness of some hardware components of the current system. Should the system fail, the design performance of the monitoring system, and as a consequence the ECAL performance, may not be achieved.

The proposals at items 3. and 4. are instead seen as an upgrade of the current system, aimed at improving the monitoring capability. A decision in this case should be conditioned to the proof that the current monitoring system (including LEDs) is insufficient, and that continuous monitoring (24/7) is needed on a second wavelength to achieve performance specifications.

This classification, if correct, leads to a prioritization of the interventions. The review committee is setup to help the ECAL PM and ECAL IB make a decision.

For simplicity we hereon refer to all modifications and upgrades simply as “upgrades.”

Review Committee members (chair to appoint)

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Charge for the review committee

The review committee is invited to give recommendation to the ECAL PM on the above proposal and on the prioritization of the upgrades.

If the aforementioned classification is correct, the time scale for a recommendation on the upgrade proposals 1. and 2. can be relatively short, of the order of 1 month. The time scale for the proposals 3. and 4. is longer. A precise plan will be agreed between the Review Committee and the ECAL PM, readily after the committee is instantiated.

The committee should try to analyze:

- The motivations of each proposal and, in particular
 - The potential benefits to ECAL and CMS in terms of robustness of the monitoring system, maintenance workload and cost reduction
 - The potential improvements in performance (e.g. in case of upgrade 3.), and the expected benefits for CMS performance
- The risk of doing/not doing the upgrade
- The ease of integration of the proposed upgrade in the current system
- The compatibility of the deployment with the run schedule for 2011-2012
- Validity of the proposed solutions and of the cost estimates (analysis of the quote from the vendors)
- Congruity between the costs and benefits of each upgrade

Some detailed questions on the different proposals are listed below, possibly reflecting the ignorance of the ECAL PM. The review committee may outline and discuss other cases.

Proposal 1:

- Is the optical switch barely a spare or is it a new/different one?
- What is the turnaround time for repair (and re-commissioning) of the current switch?
- Are there indications that the present switch is approaching the end of its lifetime, or will do so in the foreseeable future?
- Does a new switch require any additional work for integration in the monitoring system?

Proposal 2:

- Address issues on slide 12 of [1] and define a plan, in particular:
 - Can anything be done to verify the operability in B-field? Can a lamp be borrowed/tested elsewhere?
 - Can the B-field be shielded to the extent needed? How long does the production of a shield require?
 - In case Darwin 527-40-M will result not to be operable, are there alternatives or we left with the current system only?

- Clarify whether the deployment of the new laser pumps has any impact on the current monitoring
 - How long does installation/commissioning take?
 - Can it be deployed in parallel to the current system to allow the monitoring for a safe switch from the old to the new system? (DAQ SW may be different)
 - How is the new pump commissioned?
- Quantify the work needed to deploy the new laser pumps also in term of manpower

Proposal 3 and 4:

- Can the need for a precise monitoring at a second wavelength be justified quantitatively?
- Considering the differences in photon-detector stabilities, do we need continuous monitoring at a second wavelength both in EE and EB?
- In particular,
 - Can the performance of the current LED monitoring system be verified and its limitation in acting as a second wavelength system in EE be quantified?
 - The survey presented in [2], assumes that we need a laser with a power tunable over 2 decades. Is this justified if the application is for (additional) monitoring only?
 - More in general can the specifications for the second laser wavelength be clarified?
 - Operability 24/7?
 - Dynamic range?
 - ...
 - A market survey is advocated when the specifications are clarified.

Supporting parties

The ECAL DPG, the Laser Monitoring team (HW/SW) and the ECAL Technical Field Coordination can provide input, results and material to help clarify and try to answer specific request of their competence.

References

[1] **CMS collaboration**, The CMS Experiment at the LHC, Section 4.9, http://iopscience.iop.org/1748-0221/3/08/S08004/pdf/1748-0221_3_08_S08004.pdf; **CMS collaboration**, The electromagnetic calorimeter project: technical design report, CERN-LHCC-97-033, <http://cdsweb.cern.ch/record/349375>; Changes to CMS ECAL electronics: addendum to the technical design report, CERN-LHCC-2002-027, <http://cdsweb.cern.ch/record/581342>; Additional detail in **L. Zhang et al.**, Performance of the monitoring light source for the CMS lead tungstate Crystal calorimeter, IEEE Trans. Nucl. Sci.52(2005)1123; **M. Anfreville et al.**, Laser monitoring system for the CMS lead tungstate crystal calorimeter, CMS-NOTE-2007-028, <http://cdsweb.cern.ch/record/1073694>.

[2] **Ren-Yuan Zhu**, ECAL Plenary, CMS week Dec 2010, <http://indico.cern.ch/getFile.py/access?contribId=9&resId=0&materialId=slides&confId=115503>