



## PDR of the ATLAS L1Calo CMX - Report

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# Report of the Preliminary Design Review

## ATLAS L1Calo CMX Module

### *Abstract*

The Preliminary Design Review (PDR) of the ATLAS L1Calo CMX module was held at Stockholm University on 29 June, 2011. The Review Committee voted unanimously to approve the project as described in the PDR document, pending a limited number of actions and amendments.

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Distribution: TDAQ upgrade coordination, all participants mentioned in the report.

## PURPOSE OF THE REVIEW

This review examined the status of the CMX project, with emphasis on functional requirements and interfaces, technical aspects, and different modes of operation, organizational aspects including schedules for hardware development, production and commissioning, and strategies for software and hardware development and testing.

The main goals of the review included the following:

- Review the functional requirements of the CMX, including anticipated modes of operation, and interfaces with other subsystems.
- Evaluate the technical and engineering aspects of the proposed CMX design.
- Review the proposed project organisation and schedule
- Identify necessary corrections and amendments to the PDR document.
- Decide whether to approve engineering and development of the CMX according to the architecture and project organisation described in the PDR document.

## MEMBERS OF THE REVIEW COMMITTEE

### Review Committee

I. Brawn, RAL  
H. Evans, Indiana University  
S. Haas, CERN  
U. Schaefer, Mainz  
S. Silverstein, Stockholm (Chair)  
R. Spiwoks, CERN  
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## AGENDA

- |   |                |
|---|----------------|
| 1. Introduction                             | S. Silverstein |
| 2. Overview of CMX project                  | Y. Ermoline    |
| 3. Responses to received questions/comments | Y. Ermoline    |
| 4. Panel Q&A                                | All            |
| 5. Closed panel discussion                  | Reviewers only |
| 6. Summary of conclusions and close-out     | All            |

## AVAILABLE DOCUMENTATION

Preliminary design report:

<https://edms.cern.ch/document/1150213>

Review agenda and presentations:

<https://indico.cern.ch/conferenceDisplay.py?confId=144624>

## REPORT

The Review Committee voted unanimously to approve the CMX project described in the PDR report, pending a number of amendments and actions described below. The members of the CMX design team were thanked for preparing clear and well-written documentation and presentations, which contributed to a smooth and comprehensive review.

The Committee was of the opinion that given the clear challenges already facing the ATLAS trigger with increasing luminosity, that the CMX is a key item, and that the project is time-critical.

The Committee also anticipates that ATLAS TDAQ management will soon establish an integrated hardware trigger upgrade project, of which the CMX and its developers will be a part.

## RECOMMENDATIONS AND COMMENTS

### 1. FUNCTIONAL REQUIREMENTS

#### Interfaces:

- The document should be amended to indicate that the backplane data format descriptions in Appendix B describe the data content sent to the CMX, but not the exact arrangement of the data, which is yet to be determined.
- Data formats for other interfaces (including TP and the RODs) also need to be clarified. Appropriate milestones must be set to reach agreement on these formats with other systems in good time. See below under “Project organisation and schedule”.
- For optical transmission to the TP, it is desirable to have as many transmitters as we can, within reason. Transmitter and receiver multiplicities should be in multiples of 12, for full occupancy of the parallel optical modules.
- For backplane transmission to the CMX, the document should be amended to specify that internal termination on the main CMX FPGA should be enabled for the clock/parity lines from all of the processor modules to ensure optimal data timing.
- The question was raised as to whether the optical links might be designed to run at up to 11 Gbit/s, rather than the nominal 6.4 specified in the document. The Committee felt that the time and effort such investigations would entail could delay the development schedule. It was stressed that such delays are only acceptable if a strong physics case is made that the higher speeds are necessary.
- The optical links from the CMX to TP are crucial, and there should be close coordination between the CMX and TP developers to ensure their reliable operation.
- A request was made to clarify that after deployment of the CMX, the CTP will continue to receive the present jet and cluster threshold multiplicities, either from the CMX or the TP.
- It was noted that the CTP upgrade plans include provisions for optical inputs. It was recommended that LICalo look at the spare capacity of the existing CMM outputs to the CTP, and the impact of possible additional thresholds, and evaluate whether an optical output from the CMX would be justified. Such a decision would be arrived at by the time of the final design review (FDR).

#### Operational modes

- It was noted that the so-called Standalone Mode is challenging and adds significantly to the module complexity, and presents a potential risk that the core functionality of the CMX (operation with the TP) could be compromised. An engineering risk/benefit analysis

needs to be performed to evaluate the number of input links that can be safely added. It is noted and understood that Standalone Mode is a backup solution for topological processing, and some compromise in capabilities compared with the full TP may be unavoidable.

- It was also noted that while for the backwards-compatible mode the register should be as close as possible to that of the existing CMM, it is not an absolute requirement that the register map be identical. So small changes to accommodate the needs of the new hardware devices are acceptable.

#### Algorithms and Physics sign-off

- One milestone must be physics sign-off by the ATLAS L1 community. This procedure is not currently understood, so the details of this must be worked out prior to the FDR.

## 2. TECHNICAL AND ENGINEERING ASPECTS

- The current CMM rear transition modules (RTM) will be used for backward-compatible modes. Two will be needed for the MSU rig. If there are insufficient spares, more RTMs could be produced.
- In the test rig description, it should be added that a CTP data sink can be implemented using either a DSS or merger module.
- A power consumption/dissipation estimate needs to be made for the final design review (FDR), showing that the CMX power needs can be met in the CP and JEP crates. Note: the CMX may only draw power from the 5V supply (not 3.3V).
- To the test plan, it should be stated that a blind board with backplane connectors and mechanics will be produced to verify that the CMX will fit properly in the CMM positions in the CP and JEP. A front-panel mock-up is also requested.
- It is crucial that timing and clock resource issues be understood completely, especially for high-speed data transmission. These may have a strong influence on the final design.
- Two smaller programmable devices (I2C and VME interfaces) are based on obsolete chips, and will need to be ported to more modern devices. This implies some amount of design and coding effort.
- Addendum: Care must be taken to include accessible test and ground points in order to allow timing and other critical signals to be studied.

## 3. PROJECT ORGANISATION AND SCHEDULE

- Under section 6.3 (firmware development), the additional, minor firmware mentioned above should be added.
- The Committee was concerned that the current document does not include milestones for reaching agreements on interface specifications and data formats with connecting modules and systems. It was resolved that these milestones be defined and added to the specification, with a deadline of one month after the review.

## 4. MISCELLANEOUS CORRECTIONS AND AMENDMENTS

None offered