Preliminary Design Review of Prototype Clock and Control Module

(ATLAS Level-1 Calorimeter Trigger)

Introduction

The PDR for the prototype Clock and Control module (CCM) was held during June1999. It was intended to determine that the scope of the evolving prototyping programme would allow the various functions of the final ATLAS CCM to be adequately evaluated. The review assessed the functionality, features and feasibility of the design, and was conducted largely by e-mail, with a final series of meetings with the designers during which the collated list of comments was discussed.

It was intended that the review panel should assess the system specifications from several different aspects, so the reviewers were chosen for having expertise in areas of electronics and system engineering, data acquisition and software. The panel consisted of:

Tony Gillman (RAL)

Norman Gee (RAL)

Paul Hanke (Heidelberg)

Bob Hatley (RAL)

Sam Silverstein (Stockholm)

Comments from several others in the level-1 calorimeter trigger community were also received, and were channelled via these people.

The designers provided the review panel with a single specifications document, which was required to be read in conjunction with similar specification documents for the TTC system (in particular, the TTCrx), the DSS and the prototype ROD modules. As all of the panel members had also reviewed, or had direct experience of, at least one of these other systems the panel as a whole could assess the module in its proper context.

The CCM prototype specifications document was available on the Web, at:

http://hepnts1.rl.ac.uk/atlas-l1/Modules/Modules.html

General comments

The prototype CCM module is somewhat of a misnomer, as the specifications document describes a complex evolving programme covering several types of module, leading to a final ATLAS module whose precise definition cannot yet be given. The programme outlines several stages, each of which will evaluate one or more functions, leading to a final stage prototype module for use in the prototype calorimeter trigger system. In that sense the review differs from other prototype PDRs, which in general assess the feasibility of a single module (or ASIC) to emulate the final module (or ASIC) whose full functionality is already known.

As with some other prototype modules, the CCM prototype system relies heavily on the DSS test module as a platform. A basic understanding of this module, which has already been reviewed, was therefore needed in order to assess the CCM prototype system. Further details can be found at:

http://hepnts1.rl.ac.uk/atlas-l1/Modules/Modules.html

There was a general feeling among the panel that the CCM prototype specifications document could benefit in many places from some careful textual revision. The document describes a complex programme, and it is therefore essential that it describes unambiguously the various modules and combinations of modules required as this programme evolves. It was also noted that the programming model had been copied and pasted from an early version of the DSS specifications document, and therefore lacked the latest revisions. A general recommendation of the panel was that appropriate revisions to both the text and to some of the figures should be made in order to improve clarity.

It was widely agreed that the final CCM, to which this programme will lead, should be seriously considered for use in all three of the calorimeter trigger sub-systems — the PreProcessor, Cluster Processor and Jet/Energy Processor. As crate space will be limited, it was recommended that any design (including prototypes) using CMC daughter-cards should be constrained mechanically to be single-width. The panel felt that the functionality described in the document already matched the perceived needs of at least the PreProcessor, so if it were also adaptable to the Jet/Energy Processor this would conform to the general trend of increasing the commonality of module designs, in order to minimise costs, design time, and complexity. Prototype CCMs could then be used throughout the full prototype calorimeter trigger system.

The panel felt that in general the document outlined a prototyping programme of sufficient scope to enable a full evaluation of the various functions foreseen for the final ATLAS CCM. Apart from the issues summarised above, a number of minor points were raised and some major areas of concern were revealed, which will be discussed in the following section.

Specific comments

Only the more important of the points raised by the review panel will be summarised here, most of which related to hardware aspects of the programme. They are divided into three sections.

a) TTC interface function

The most fundamental point concerned the technique proposed for electrical fanout of the converted optical TTC signal. The documents proposes multiple format conversions (PECL—>TTL—>LVDS—>TTL) which the panel found unnecessary. The differential IN inputs on the TTCrx chip require p-p signals in the range 5 mV to 2 V, so will accept differential PECL signals directly. By using these inputs instead of the proposed TESTIN input, it would be possible to distribute the TTC signal in a PECL format, thereby avoiding the conversions. This would considerably simplify the system, reduce costs and power dissipation and improve clock skew. The only requirement is the addition of a simple bias network as specified in the TTCrx document. It was noted that the ATLAS TileCal digitiser system already uses this configuration. The panel therefore recommended that this alternative distribution technique be adopted for the CCM system.

The panel queried if the proposed TTC Receiver and Fanout card should appropriately be designed in a CMC format. The front-panel space available on this size of card would seriously limit the number of cable connectors, and hence fanout. As these cards require the DSS module (or other VME module) as carrier, and as a potentially large number of signals are required for the full prototype trigger system, there would be a relatively large cost overhead. The panel therefore recommended that the TTC Receiver and Fanout card be

designed as a stand-alone 6U VME module, with a front-panel fanout of least 16 and minimal VME capability.

It was noted that the current version of the TTCrx chip obtained many of its programmable parameters via download from a PROM. Changes to any of these will therefore require removal and reprogramming of this PROM, which is inconvenient but unavoidable. This procedure will be unnecessary in the rad-hard production versions of the chip, in which I^2C re-programming will replace the PROM.

b) CAN-bus interface function

The panel was concerned that the level-1 trigger community should minimise any customised designs and felt that ideally there should be an ATLAS standard globally defining monitoring requirements of the nature described here. It recommended that the DCS co-ordinator be approached for further information, and that regular contact be maintained with the DCS group. Any standard software already developed by this group should be adopted where appropriate.

c) CTP interface function

Insufficient detail was provided in the specifications document to assess this function. The panel was not convinced that the CCM was the most appropriate location to assemble ROD BUSYs. It recommended that further information be obtained on the CERN ROD Busy module, to determine whether it could be used independently to perform this function.

A.R.Gillman 30 July 1999