CMS Upgrade MB Response to SLHC Proposal:

07.12 The Versatile Link Common Project -- F. Vasey & J. Troska

It is our intent to approve this proposal. Please see the comments from the referees.

Specific requests before final approval are:

1. Explain the personnel resources required and the plans to acquire additional resources to assure successful completion, particularly to include sufficient participation from CMS personnel.

2. Explain how a generic symmetric link is appropriate for very asymmetric applications in terms of cost and power.

3. Explain the non-adoption of the commercially common link frequencies of 4.25 or ~ 10 GB/s and the technological complications of this choice.

4. Explain how this project will proceed to the pre-production, production and user support after the proposal ends.

5. Explain the operating requirements of the number of links of each type needed, their power, modularity, package size and mass limitations.

6. Explain if there are any assumptions about the re-use of the existing link infrastructure.

The Versatile Link Common Project

CMS ref: 07.12

Contact: F Vasey, J Troska

Ref 1

Ref 2

IMHO, the "Versatile Link Common Project" proposal is generally well prepared and structured and definitely worth pursuing, as I don't see any realistic alternatives for reading out (and controlling) a future Tracker other than optical links. Moreover, I think it does not make sense to simply scale up the current optical links, and thus consider the Versatile Link a crucial R&D program towards S-LHC experiments.

* Project Goals

Developing a high-speed optical link is certainly a very ambitious task, but I think it is feasible and once there is such an object, I'm sure it will be exploited by all potential users as there won't be any alternative (unless other people start a similar project).

* Persons involved

I think the project is in good hands with Francois, i have no doubt that he is capable of leading it to success. Personally, i think that workpackage 2.1 (front-end components), which resides in Francois' group, is most crucial to the whole project. The total manpower appears rather limited to me, but i can imagine other institutes jumping the train once it got started.

* Contents

Personally, I'm not quite sure whether a generic optical link could serve all purposes (timing, control and readout), especially one that is symmetric - I think there is no doubt that the overall traffic from a Tracker is heavily asymmetric. Hence, such a link might come along with a severe cost penalty which is certainly not desirable. It is idealistic (and OK) to start with the idea of a versatile link, but probably one should add some possibility for diversion at a later stage, regarding not only link types and topologies, but probably also bandwidth requirements (e.g.: controls might not need the same speed as readout).

Speaking of bandwidth, this is another critical item. The proposal mentions "up to ~5 Gbit/s" in the introduction, and that is clearly related to the suggested GBT speed of 4.8 GB/s. However, commercial high-speed opto-transceivers appear to be available for 4.25 or ~10 GB/s, whereas I could not find anything in between. Driving up 4.25 GB/s devices to the envisaged 4.8 GB/s might not be an easy task and will presumably hardly be supported by industry (as this is not a standard speed). Otherwise, using 10 GB/s devices with only half of their bandwidth (if possible at all) would be tremendous waste of money. Developing a 4.8 GB/s transceiver from scratch is supposedly unaffordable for us. Hence I'd prefer if the GBT specs were revised to match the industrial availability. I know that this issue probably relates to GBT more than to the Versatile Link project, but as they must operate together, it is something of importance to both.

Ref 3

Overall the project is potentially very well aligned with a subset of our upgrade needs for optical links, particularly part 3 (components) and in terms of producing demonstrator links in part 2 (system). It is perhaps critically aligned in the sense that we might not have other choices, but we can be reassured that it is being led by staff well experienced with CMS needs.

The project stops before pre-production qualification after a Market Survey stage and there we have to assume that there will be a commitment to manage the later production and offer user support. This is clearly the only pragmatic approach in which such work can begin now but we need to be sure to first of all provide some input of our requirements.

The joint ATLAS-CMS working group has produced some good reports on lessons learned (reported at TWEPP) and its plans to combine efforts have resulted in this project. The project collaboration is however weak in that there are only two groups large enough to make serious developments. There is little representation from CMS but Jan and Francois will no doubt keep CMS interests in mind. However we should not expect the CERN group to remain committed to solely supplying CMS, particularly if ATLAS struggle to have their deliveries in good time. The CERN group is very keen to have more help from CMS but would like to work with reliable partners, eg those with experience from the present Tracker.

The project is probably resourced at a sufficient level to cover the scope that is proposed, with some uncertainties on the whether the back-end parts and the passive components will be realised in a final form by the groups concerned. The missing parts will be developed in any case. My guess is that the front-end components will be well managed by the CERN group. I don't yet know if there are any particularly strong industrial partnerships yet. I think that SMU will deliver a demonstrator/in-system test setup since this somehow appears relatively straightforward. I cannot comment on the Strasbourg group's capabilities. My biggest known concern is regarding the Oxford/Taiwan contribution which is ATLAS-centric, even if it is limited to passive components, as we have very specific needs for fibres and connectors in CMS if we re-use our multi-ribbon cables (e.g. this locks us into using ribbon fanouts, and MFS ribbon connectors).

There appears to be no provision to provide parts to users and no user support. The distributed nature of the project might make this a problem. However, I expect that given some support we could rely on Jan and Francois to take care of providing parts for test systems.

We have to watch out for the usual problems with component obsolescence – again I think Francois and Jan are very conscious of this problem.

Some recommendations:

CMS should support this project.

We should try to provide some starting requirements along the lines of:

estimate of many links we need (of each type/topology)?

Bandwidth? Architecture? Modularity? Power limits? Package size and mass limits?

We must study whether we re-use our PP1s and the optical cables currently installed to USC55.

Other comments

How is the low power, low mass objective to be realised? The crucial parts are those within the Tracker volume.

Does the powering system chosen have an impact on the design, or components?

This is an important project for a new Tracker and we must participate in defining specifications.