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PPRP
Peer Review

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Open (none)

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Applicant Details

Applicant	Professor Geoffrey Hall	Organisation	Imperial College London
Applicant	Professor Peter Robert Hobson	Organisation	Brunel University
Applicant	Dr David Michael Newbold	Organisation	University of Bristol

Title of Research Project

Upgrades of the Tracker and Trigger of the CMS experiment at the CERN LHC

Review Information

Response Due Date	03/08/2012	Reviewer Reference:	1-YGYCW

Research Council Contact Details

STFC Administration Contact:	Email:	Telephone:

Strengths

Please comment on the strengths of the proposal. Refer to 'Help' for guidance.

This is a very strong proposal. It builds upon the prominent UK contributions and leadership in the construction and first years of exploitation in CMS and on successful and innovative developments in the previous upgrade R&D phase. The groups involved, specially Imperial and RAL are strong, focused, and with excellent delivery track record.
The proposal aims to preserve and enhance the UK leadership in the CMS trigger and advanced tracker readout and overall DAQ. These are crucial for the success of CMS in the high luminosity environment of the next phases of LHC running and its physics output.
The proposed project has strong leadership and many individuals who are world leaders in their area of expertise and therefore offers every guarantee one might wish for achievement of the stated goals.
The proposal is very well prepared and presented, with attention to detail and very good risk analysis. the description of WP1, WP2 and WP4 are very clear.

Weaknesses

Please comment on the weaknesses of the proposal. Refer to 'Help' for guidance.

WP3, the trigger upgrade, is ambitious and very important. It will keep UK ownership of the next generation of calorimeter trigger and it will ensure UK leadership in the tracking trigger which will be introduced for the first time in CMS. The timeline

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and milestones are well thought out and clearly presented.

The argument made that a strong and closely integrated group is necessary for successful delivery is of course true. However the distribution of tasks among the institutes is not always clear and well defined. That does not allow to judge the level of effort requested in all cases.

The Imperial part is quite clear and in line with their outstanding performance in the original CMS construction in this area. The "hardware and core firmware development" and the "trigger studies and offline software development" elements appear also to be well planned and described.

The management structure of WP3, the relationship between Bristol and RAL, and the distribution between the groups of the WP3 element "online software development" are not so clearly presented. This reviewer hopes that this is only a presentation issue where a good and logical structure and plan simply does not come across as such. If this is not true then there is significant risk that multiple not well defined roles may jeopardise the timely delivery of part of WP3.

Leadership

How would you rate the UK activity in this area and its international standing and how would you rate the achievement of the team and their leadership in the field, both nationally and internationally?

UK activity in all proposed areas (trigger, DAQ, advanced readout electronics) is well established and recognized. In particular in CMS the UK groups have delivered on all their commitments during the original construction and are thus ideally positioned to deliver in the upgrade in the same areas.

The development by the proposers of the IPbus protocol which became a CMS standard, the demonstration of the CBC chip, and the decision by CMS that "the (future) trigger processing board should be based on the UK board" (Mini-T5 / MP7) show the strength and standing of the UK in all areas relevant to this proposal.

The PI, professor G. Hall, has long experience and an outstanding record of delivery. He is a world-class leader in complex detector development and construction projects. His strong presence in CMS since the beginning gives him the standing and respect, as well as the understanding of the experiment and the collaboration which are very important to bring such a project to successful completion.

Marc Raymond is a true expert with long experience and impeccable delivery track record. He can be fully trusted to deliver his part of the project and his experience and versatility make him invaluable if any problems arise in the project which fall in his area of expertise.

The proposed project is well planned and firmly based on solid achievements during the upgrade R&D phase. At the same time it is also ambitious as it will extend UK leadership in the areas of readout, trigger and DAQ in CMS.

Advancement

How would you rate any potential advancement in the field, and their impact resulting from the proposed project?

The proposed readout chip for the upgraded CMS tracker (CBC), the MP7 trigger board and its implementation also in the upgraded pixel readout, and the proposed Time Multiplexed Trigger, all represent major technical advances in key technologies in the field. Their application in the upgrade of CMS will enable the efficient exploitation of the very high luminosity (above original design) expected from the LHC in the next 15 years. And of course these also consolidate the UK capabilities and reputation in these areas which will be important for the next generation of large experiments.

Therefore this proposal represents significant technological advancements and will also lead to increased efficiency in the

physics exploitation of the LHC.

International Context

How does the project fit within the international standing?

The upgrades of the LHC in the next ten years are a central point of the international experimental particle physics programme, aiming at studies of the recently discovered Higgs boson to determine its key properties and clerify its nature (SM or member of a larger family) and searches for SUSY or other New Physics phenomena at the highest energies available to us.

The elements of this proposal (trigger, tracker readout, DAQ) are all crucial for the successful upgrade of CMS so that it can profit fully from the increased luminosity of the LHC. The proposal is integrated into the official CMS upgrades path and is aligned with the currently agreed timeline for these upgrades.

Therefore the proposal fits perfectly within its international context, which should be a condition for approving projects of this size and nature.

Highlights

How would you rate the past achievements of the team and impact on the field, both nationally and internationally?

Imperial has the strongest UK group in CMS and one of the top groups in the collaboration as shown by their contributions to the original design and construction as well as the leadership positions which they have held in the collaboration. Their contributions to the calorimeter, the silicon tracker and the trigger were all important for the experiment and recognised as such internationally. Strong individuals with dedication, long experience, world-class skills and recognition make this an outstanding team by any standard. Timely delivery of the calorimeter trigger (GCT) which was not their original responsibility, but they stepped in to solve a crisis, was truly masterful.

The RAL CMS group is smaller than the Imperial group and much smaller than the RAL ATLAS group. However it is made of excellent individuals and they have a good reputation.

Brunel is a small group which however knows how to focus in their areas of expertise and therefore are able to contribute to a degree appropriate to their size and resources.

Bristol has been traditionally involved in readout and trigger systems. However their delivery record may not be seen by everybody as the best in the country, and in particular their participation in the original CMS calorimeter trigger left something to be desired.

Goals

Do you consider the major goals proposed over the period are appropriate and deliverable?

Yes, the goals are appropriate and deliverable.

Aims

Can the applicant(s) deliver the stated aims

Yes, the applicants can deliver the stated aims. They have achieved similar aims in the past and they have an excellent starting point building upon recent achievements in the R&D phase.

Importance

Please state how important you think it is to fund this project.

This is an important project which consolidates and enhances the UK position in CMS for the mid-term future. It will deliver crucial elements for the upgraded detector, which will be important for the efficient and successful exploitation of the expected high luminosities to be delivered by the LHC in the next 15 years.

It is important for the UK to capitalise on significant investment in the construction of large projects by investing in their upgrades, specially if these projects have already delivered discoveries and have great promise for their future running. CMS is definitely one such project.

Justification

Has the level of requested resources been justified?

WP1, WP2 and WP4 descriptions provide enough detail to be able to assess the level of required resources and indeed they appear to be overall reasonable.

Particularly well-thought are the working allowance allocations. Exchange rates in a volatile international economical background might vary outside expectations and this is correctly mentioned as a possible call on contingency. The assigned WA is sensible to cover fluctuations if no major event happens. To allow for extra RA/TD manpower as proposed in the WA is also reasonable based on experience from other similar projects in the past given the complexity of the task and the usual allocation, availability and flexibility of TD staff time. The proposal is very well prepared in terms of estimates for procurements and productions. The resources requested for management of the project and managerial/administrative support are entirely appropriate given the complexity of the project and the considerable reporting load on the PI.

In WP3 there is not enough detail on the tasks of each institute and certainly not of individual positions.

Particular points where the panel could look for more specific justification before approving the relevant resources are:

. Position "New RA WP3" at Bristol

. Position "RA 1" at RAL

. The extent to which Bristol positions "Grimes" and "New RA WP4" have distinct and adequate tasks to carry out

. The split of both requested studentships in the Bristol bid equally between WP3 and WP4 which may be either a lack of detailed planning at this stage or an indication of "padding"

Impact

Comment on the extent to which the proposal shows the potential economic and societal impact of the project and what will be done to ensure that potential beneficiaries have the opportunity to benefit from the research? Please rate your confidence in your ability to evaluate societal and economic impact potential and activities.

The impact of the proposed programme is significant. Expertise in pushing the limits of ultra fast readouts, real time decisions (trigger) and DAQ is a valuable asset for the UK, both in terms of expert individuals and industrial capabilities. Communication of the science is also covered adequately.

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Additional Resource Comments

Do you have any additional comments regarding resources?.

No, detailed comments have been already given elsewhere in this form

Additional Comments

Please provide any additional comments that you would like to be fed back to the applicant.

None

Level of Resources

How would you rate the level of resources available to support the credibility of the proposal?

The available resources (manpower on the CGs and at RAL), their expertise, and the required infrastructures in the groups make this a very credible proposal. This comment refers only to the existing resources (before this proposal) and not for the resources requested for which I comment separately under "Justification".

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