

REPORT

Independent Review of The GEANT4 Project October 9 – 11, 2002

Submitted February 19, 2003

Members of the Review Team:

Andrea Dell'Acqua – CERN
Albert De Roeck – CERN
Ralf Gerhards – DESY
Patricia McBride, Chair – Fermi National Accelerator Laboratory
Marjorie Shapiro – Lawrence Berkeley National Laboratory
Charles C. Young – Stanford Linear Accelerator Center

GEANT4 representation, organization and support for the review:

Richard Mount – GEANT4 Collaboration Board Chair
John Apostolakis – GEANT4 Technical Steering Board Chair and Spokesperson

GEANT4 Delta Review

The delta review of the GEANT4 project was held on October 9-11, 2002 at CERN. This review was a follow-up to an external review that was held in June 2001. Many members of the original review team returned to participate in the delta-review and two new members were invited to join the committee. The committee was asked to evaluate the collaboration's response to the previous recommendations and to comment on new issues that have arisen since the time of the previous review. The charge to the Delta Review committee is included with this report.

Richard Mount, chair of the Collaboration Board, reviewed the charge to the committee on the first morning of the review. John Apostolakis, spokesman of the GEANT4 collaboration, began the review with an overview of key issues and progress since the last review. The agenda for the review was composed of nearly two full days of presentations from the members of the collaboration, from representatives of the four LHC experiments and from the head of the Collaboration Board. The complete agenda is included at the end of this report.

During the delta review, the committee primarily concentrated on the activities of the collaboration relating to the recommendations from the last review in June 2001. The full text from the report is available elsewhere. The findings relating to the previous recommendations are presented in **bold** type. In addition, the committee was made aware of several new issues and, therefore, has added a few additional recommendations. These new recommendations appear in a separate section near the end of this document.

The GEANT4 project has made a lot of progress in the past eighteen months since the previous review. During this time, the GEANT4 simulation toolkit gained much greater acceptance within the HEP community and several major experiments are working with the product.

Major Findings:

The committee finds that the GEANT4 Collaboration has been successful in addressing many of the recommendations from the first review regarding user support. The Collaboration appears to be more responsive to the needs of the user community, and in particular, of the HEP community. Dialogue with the LHC experiments has increased and the product documentation has improved.

The physics processes are the primary focus of a detector simulation package. A comprehensive validation program is key to the success of the product. The committee finds that although progress has been made on validation, there is still more work to be done.

The user base for the GEANT4 package will continue to grow and proportionally resources will be required for user support. The Collaboration will be faced with a

challenge to find a way to use existing resources effectively in order to provide effective support and maintenance of the code and documentation.

Major New Recommendations:

The committee recommends that the Collaboration work with the experimental community to develop a detailed validation plan. Significant resources should be devoted to this effort in the coming year. Coordination for the effort should be based inside the GEANT4 Collaboration.

The committee recommends that the Collaboration work to find creative ways to increase resources. It is important to continue to put significant resources into documentation and user support in addition to supporting active efforts in product development and maintenance.

The Collaboration is clearly moving towards making GEANT4 a robust and performant simulation package that will serve the user community well. The review committee commends the entire GEANT4 Collaboration for its efforts.

The committee would also like to thank the GEANT4 Collaboration and CERN for their organization and support of the meeting, and their hospitality.

Charge to the Committee

- 1) Review the progress made by the GEANT4 Collaboration in the areas where recommendations were made by the June 2001 review. Recommend additional progress or actions in these areas as necessary.

- 2) As time and the availability of GEANT4 members permits, examine any other issues that the review committee finds relevant.

Previous Recommendations and Current Findings

The collaboration has addressed many of the concerns expressed by the committee during the previous review. The recommendations were classified in four categories: Physics Models and Functionality of GEANT4, Software Engineering, User Community and Management, Organization and Resource Issues.

The majority of the previous recommendations were addressed by the collaboration during their presentations and we present our findings related to these recommendations in this section.

Previous recommendations for Physics Models and Functionality of GEANT4:

The physics models are at the core of the GEANT4 package. One of the strengths of GEANT4 design is its modularity and flexibility in the choice of physics process, but this flexibility results in a significant burden for the user. The previous committee made several recommendations to address the functionality issues for the physics process in GEANT4.

A clear and well-documented validation of the physics models is one of the major requirements for the product to gain wide acceptance in the user community. The validation strategy for GEANT4 was not clearly defined at the time of the previous review. The recommendation 3.1 relating to the validation of the GEANT4 physics processes is included below:

Recommendation 3.1: A validation strategy is needed to insure that a novice user could run with a standard physics list that will provide adequate results, e.g. comparable to or better than the last CERN release of GEANT3, over a wide energy range. The limitations of this default physics list should be documented. The strategy should address the issue of estimating systematic uncertainties in the standard table(s). The GEANT4 collaboration should appoint a physics leader to develop (in conjunction with the GEANT4 developers and core users) this validation strategy and a corresponding set of milestones. The strategy, the milestones and the current status of the validation should be available openly from the GEANT4 web pages.

Findings: The collaboration has addressed many of the issues in support of the novice user. The updated documentation, tutorials and web publication of the set of standard physics lists for hadronic physics is a big step in helping users inside and outside the collaboration get started with the code. The effort by the collaboration to provide more user support in the area of physics processes is applauded, however, the committee finds that much more work is needed in the area of validation.

***Updated Recommendation 3.1:* The committee would like to see a global strategy for validation. This strategy should be developed in collaboration with the LHC experiments and other users. The users should be responsible to define the requirements for their simulation code and work with the collaboration to be certain that the goals are reached. The committee recommends that the collaboration recruit a global physics coordinator to drive this effort.**

There are two electromagnetic (EM) working groups inside the GEANT4 collaboration with very distinct fields of applications. The demarcation in responsibility between the two groups was not clearly defined at the time of the previous review. There appears to be significant overlap in the validity ranges of the two codes. In particular, for novice users it may not always be obvious which code to use. It was found to be very difficult to combine models from both codes and at the same time guarantee sensible results.

Recommendation 3.2: We recommend that the EM groups document the validity ranges of their models, and the tradeoffs where they overlap. We also recommend providing default configurations and guidelines for users in identifiable communities, e.g. HEP and medical applications.

Findings: The documentation of the models and the validity ranges are important to the users. Steps have been taken to address the concerns of the last review. The committee feels that the planned addition of the Catalogue of Physics process will help users to configure the package.

Recommendation 3.3: We recommend that the GEANT4 Collaboration clearly define the (different) areas of responsibilities and physics coverage of the two EM groups. The CB should ensure that the relation between the two groups remain that of healthy competition and productive interaction.

Findings: Both electromagnetic working groups appear to have evolved in a productive manner. Healthy competition can lead to more vigorous development in both groups. The duplication of effort and overlap of coverage should be evaluated in view of the limited resources of the collaboration.

***Updated Recommendation 3.3:* The committee encourages the collaboration to explore the concept of common interfaces for EM processes. Care should be taken with this integration effort so that the successful physics development and support efforts inside both groups can continue.**

GEANT4 contains a large number of hadronic models each of which has its own validity range. These ranges overlap. In view of the wealth of choices, there was no clear and easily available documentation at the time of the last review to guide the users to choose the model(s) most appropriate for their application and need.

Recommendation 3.4: We recommend documenting the validity ranges of the various hadronic models. Where a particular energy range has multiple models, the tradeoffs should be clearly stated. We also recommend providing default configurations or guidelines for users in identifiable communities, e.g. HEP and medical applications.

Findings: The release of standard Physics Lists for the hadronic processes is a significant step towards making the hadronic physics models accessible. However, it is still extremely difficult for even knowledgeable physicists to understand the validity ranges of the models, their limitations and the trade-offs between models applicable in the same range.

Updated Recommendation 3.4: The Hadronic Physics Working group should publish a short document describing the overall strategy a user should follow to evaluate whether the standard physics list is adequate for his needs and to modify the list if necessary. The documents should contain a short summary of all existing models and a table giving their range of applicability and their limitations.

Although several projects had been initiated to validate the hadronic models by comparing simulation results with test beam data, essentially no comparison results were shown at the first review. The committee was concerned about the status of the validation effort for the hadronic processes and felt the hadronic area in GEANT4 was falling behind schedule.

Recommendation 3.5: The mission and schedule of the hadronics group should be clarified. The physics goals should be made clear. A coordinated validation program, driven by physics requirements and in the context of an overall strategy discussed above, is needed.

Findings: The Hadronic Working Group presented a development strategy that included a long list of new models, but no detail planning relating to implementation and testing of these models. The group needs a global plan for the development and maintenance of the hadronic models and for the validation of these physics processes.

Updated Recommendation 3.5: The Hadronic Physics Working group, in close collaboration with the experiment users, should develop an overall strategy for building appropriate physics lists and validating these lists using test beam and published data.

As part of this strategy, a set of priorities for the deployment of physics models should be developed. These priorities should be clearly documented on the GEANT4 web page and should be regularly reviewed by the GEANT4 collaboration, with input from the experimental community.

At the first review it was noted that the toolkit did not contain adequate mechanisms for validating complex geometries. The major experiments had expressed valid concerns about the verification of their geometry descriptions and made requests for the addition of tools for checking detector geometries. The review committee concurred and responded with the following recommendation:

Recommendation 3.6: The GEANT4 team should provide a basic set of tools to validate complicated detector geometries. These tools should be available to users not only as a set of C++ classes that the end user can access from his own application but also as part of an interactive geometry display package. A minimal set of requirements for interactive capabilities are those provided by interactive GEANT3.

Findings: Since the time of the last review the GEANT4 team has assembled a set of useful tools for validating complicated detector geometries. This collection of tools seems to address the needs of the large collaborations. Further improvements of the visualization, for example for the OLAP tool, would be appreciated.

We congratulate the collaboration for their willingness to adopt packages that were developed by the user community in this effort.

The GEANT4 Collaboration, initially formed to provide the HEP community with a flexible toolkit for simulation, has expanded to include institutions whose primary work is in space science, medicine, industrial research, and commercial applications. New licensing and liability issues have arisen with the increased diversity of the user community.

Recommendation 3.7: The CB should evaluate what usage and licensing policies are appropriate, and develop the corresponding guidelines right away.

Findings: The Committee did not see much progress on these issues since the time of the last review.

Updated Recommendation 3.7: The Committee recommends that the collaboration act quickly in determining the licensing policy for GEANT4 and make a choice between the two acceptable licenses.

Recommendation 3.8: The CB should address the liability issue, especially in relation to the medical fields, in addition to encouraging in-depth testing and validation.

Findings: The collaboration presentations during the review did not address this issue.

Updated Recommendation 3.8: The Committee recommends that the CB address the liability issue and encourage in-depth testing and validation.

Previous recommendations for Software Engineering of GEANT4:

At the time of the previous review, the release schedule for GEANT4 appeared to be calendar driven. The user community did not know the planned changes for each release. The lack of transparency deprived users of information necessary to plan their own activities. It also deprived the GEANT4 team of valuable user input in discussions of the feature set and the schedule for its adoption.

Recommendation 4.1: We recommend a release schedule planned around a set of corrections and improvements. Both the schedule and the planned features should be readily accessible to all users and developers.

Findings: The collaboration has addressed these issues well. The release plan is more flexible and transparent. It accommodates not only planned features but also corrections and improvements. The user community will be well served by this change.

Updated Recommendation 4.1: We encourage the collaboration to continue to work with the user community in developing the release schedule.

In addition to the bi-annual public releases, monthly reference releases were provided only to the members of the collaboration. The committee was dismayed to find that users sometimes had to wait long periods for a release that corrects a blocking problem, just because they may not have had access to the code.

Recommendation 4.2: We recommend the adoption of more frequent, though not necessarily fully tested, “beta” releases that address important blocking problems. They should be available to all users. These “beta” releases are in addition to having a stable and working version of the program at any time, with a documentation of all known bugs or deficiencies in that particular version.

Findings: The collaboration has addressed this issue by introducing “beta” releases that are available to all users. The expeditious removal of blocking problems will shorten application development time, and reduce user frustration.

GEANT4 consists of a whole product tree of interrelated components: the code itself and a variety of documentation. While the documentation is generally well designed, it was not being updated regularly at the time of the last review.

Recommendation 4.3: We recommend defining and managing the complete product tree, including documentation as well as the code, as part of a release. If the documentation is not ready, the release cannot be deemed to be ready.

Findings: The collaboration has addressed this issue. The documentation is now treated as part of the release, similar to the code. Recent experience has shown that there is a good procedure in place to ensure their coherence.

User Requirement Documents (URD) are the reference for the functionalities GEANT4 will implement. The set of URDs that was available at the time of the last review had not been updated recently and the committee was concerned about the long-term coherence and maintainability of the GEANT4 product.

Recommendation 4.4: URD's are an integral part of the documentation and product trees. A coherent set covering all of GEANT4 must be finished and put in place expeditiously.

Findings: There have been major improvements in this area. The web-based forms are a major improvement. Some URD's have been updated. We commend the collaboration on its commitment to finishing a coherent set of documentation.

Recommendation 4.5: We recommend that the Collaboration periodically review and update the entire documentation tree.

Findings: An internal documentation review is complete, and a plan for updates and maintenance has been established. The catalog of physics processes will be a welcome addition to the documentation tree.

Updated Recommendation 4.5: The collaboration is encouraged to provide the necessary resources to sustain this effort, and continue to perform periodic reviews and updates of the documentation.

Although the GEANT4 collaboration has developed a good and consistent class design, there are cases where the physics community requires the use of 3rd party software that does not follow the GEANT4 design. One notable example of this is the Fluka hadronic physics package. This issue was discussed at the time of the last review and the committee had the following recommendation:

Recommendation 4.6: We recommend a greater willingness to incorporate 3^d party software such as Fluka or HETC, perhaps using a “loose integration” model. The attributions for these packages must be made more transparent, for example by incorporating the original package name in GEANT4 such as GEANT4HadronicFluka or GEANT4HadronicHETC.

Findings: The GEANT4 collaboration has recognized that it cannot develop all the code itself and that external packages need to be incorporated into GEANT4.

Updated Recommendation 4.6: The committee continues to encourage the creation of interfaces to 3rd party codes, rather than the rewrite of existing packages. Actual incorporation of 3rd party software will require cooperation and good will on both sides.

The committee notes that the HEP physics community considers the use of Fluka in conjunction with GEANT4 a priority.

Software design appeared to be moving more and more to individual working groups. The TSB did not appear to be strongly coupled in some of the major decisions of the working groups.

No clear overall design authority existed at the time of the last review. The technical management body (TSB) was not consulted in some major design decisions inside the working groups.

Recommendation 4.7: There should be an overall design authority to coordinate and review the design from individual working groups.

Findings: The architecture working group has been created, and is the overall design authority within the collaboration. It is doing a good job in addressing design issues that span multiple categories.

Updated Recommendation 4.7: We recommend that the architecture working group also address issues of design inside the individual working groups

Previous recommendations for the Support of the GEANT4 User Community:

The ever-broader adoption of GEANT4 inevitably has led to many requests for new features and functionalities. It is important that users be involved in the planning for development of the GEANT4 product. The user community needs to be able to track planned changes and also have a voice in setting priorities. There were a number of recommendations relating to improving the support of the GEANT4 user community.

Recommendation 5.1: All of the GEANT4 web pages (aside from those related to personnel or management of the collaboration, and those pages that would violate relevant licensing agreements) should be world readable. These web pages should be updated frequently, and should be reviewed each time a new release is frozen. The pages should contain links to relevant third party software that is not itself part of the GEANT4 release, e.g. visualization and graphics libraries and their documentation, and Fluka documentation once a Fluka interface has been developed.

Findings: The collaboration's plans for the web pages seemed sensible. The committee did not review the plans in detail, but endorses the basic design principle. The policy of making most web pages world readable was welcomed by the committee members.

Recommendation 5.2: We recommended that the Collaboration provide sufficient resources to the core development team to allow for the support of a growing user community. We believe this will happen to some extent quite naturally, because many of the new users will become developers with time.

Findings: This issue remains as a concern of the committee. The collaboration has already identified it as a concern and has begun to develop a model for support. We encourage them in this effort. They have done a good job over the past year, however, the growing user community means the effort required for support is increasing. Balancing support and development will become difficult without careful planning and adequate resources.

Updated Recommendation 5.2: See new recommendations # 1 and #2.

As the toolkit has gained wider acceptance and sees broader usage, the user community has changed. It is more likely that the users were not part of the development team and have not worked directly with the developers of the product. The committee considered it very important that these new users would not be excluded from support.

Recommendation 5.3: We recommend that GEANT4 adopt a more flexible approach in its interaction with users. The GEANT4 Collaboration should examine its support structure, and in particular, improve its support of those users that are not affiliated with development team.

Findings: The committee feels that the collaboration has done a good job in the area of user support over the past year. The support structure seems to be more effective. The addition of User Workshops and Hypernews has helped improve communication with the user community.

There was a strong concern that reasonable requests for support or enhancement of the GEANT4 functionality would be rejected for purely formal reasons. The process for requesting support was formal and seemed to be structure to exclude users from outside the collaboration. The previous committee recommended more flexibility and that decisions on which algorithms to implement and which user requests to fulfill as well as their relative priorities be based on physics arguments.

Recommendation 5.4: We recommend a more flexible approach with fewer formal barriers where users help set the physics requirements and priorities. High priority items should be implemented expeditiously. We further recommend that the process be open and transparent to all users.

Findings: The collaboration has successfully reduced the formal barriers between the developers and the user community. The TSB remains the main body for discussion of major new requirements with global impact on the

product. Requirements with smaller impact can be directly submitted to the working groups. The system seems to function smoothly.

The recent addition of a web based user requirement entry and tracking system is welcomed. The system has been tested within the collaboration and should soon become a helpful tool for communication between the user community and the developers for setting requirements.

Updated Recommendation 5.4: The collaboration should continue to work to avoid unnecessary bureaucracy in evaluation and prioritization of requirements in order to speed up the fulfillment of user requests.

There were concerns about the level of user support and adequate and prompt response to user requests coming from the simulation/software coordinators at the major LHC experiments who are major customers of the GEANT4 product.

Recommendation 5.5: We recommend that GEANT4 collaborators increase their participation in appropriate workshops and that they publish both their models and the validation results in refereed journals. We also recommend a wider adoption of HyperNews or similar tools for communication.

Findings: The communication with the user community has improved significantly since the time of the last review. HyperNews is now seeing heavy use and has become a primary user forum. The recent User Workshops have been well attended and the committee was pleased to hear that more workshops are planned for the near future.

Updated Recommendation 5.5: The committee continues to encourage the collaboration to participate in outside forums where dialogue with other experts in the field of physics simulation is possible.

A program of GEANT4 tutorials and training classes was already developed at the time of the last review. The committee felt that the user community appreciated these tutorials and recommended that they continue.

Recommendation 5.6: Tutorials and Training classes are an important means to promote the product and to improve its acceptance. We recommend continuing to give tutorials and training classes with priority.

Findings: The Tutorials and Training classes that have been offered by the GEANT4 collaboration have been well received. We applaud the collaboration's efforts in initiating these classes and recommend that they continue to offer them at regular intervals. The collaboration might also consider making the training sessions available on the web or on CD.

Previous recommendations for GEANT4 Management, Organization and Resource Issues:

The previous committee reviewed the organization and management of the collaboration. It is useful to consider if changes would be helpful in the context of an evolving product and a growing user community.

The size of the Collaboration Board (CB) was increasing as more institutions were joining the collaboration. Since the membership of the CB included a representative from each institution, it seemed that this management body could become ineffective over time.

Recommendation 6.1: We recommend that the GEANT4 Collaboration evaluate the appropriate makeup of the CB as a management body in light of a growing collaboration.

Findings: The Collaboration has begun to evaluate their management structure and presented a plan of action for creating a smaller executive committee within the Collaboration Board.

Updated Recommendation 6.1: See new recommendation #12.

The previous committee was concerned that the scope of the GEANT4 project had expanded without a well-defined global plan. The Technical Steering Board (TSB) did not appear to be strongly coupled into some of the major decisions that are made inside the working groups.

Recommendation 6.2: GEANT4 should have a clearly defined scope and a corresponding long term plan. This allows the individual working groups to develop consistent goals and plans.

Findings: The committee still feels that a long-term plan for the development and support of GEANT4 is a requirement for ensuring the success of the project. The concern is that there may be an expansion of the scope of the project beyond the available support resources.

Updated Recommendation 6.2: The GEANT4 Collaboration in close cooperation with the collaborating institutes and the primary users should develop a long-term plan for the development and support of the GEANT4 product.

New Recommendations from the Delta Review

The findings reported in the previous section related to the previous recommendation led the committee to add a few recommendations. Several updated recommendations were included in the previous section. There were also a few new issues raised during the review that are addressed in a few additional recommendations.

Collaboration Resources

The GEANT4 collaboration is supported by institutions around the world. Over the past few years, the size of the user community has grown significantly faster than the collaboration itself. This imbalance in growth rate has the potential to strain the resources of the various institutes and the result will be that it may not be possible to maintain an adequate level of support for the product in the future.

A considerable effort has gone into revising the structure and updating the content of the documentation. The documentation has improved considerably and the review committee wants to congratulate the Collaboration for this achievement.

The committee had the impression, however, that the burden of support for the documentation is placed on the shoulders of a handful of people and should now be shared by more people in order to continue the improvements to the documentation that were discussed and to guarantee its long-term maintainability.

The success of GEANT4 strongly depends on the interaction of the Collaboration with the users of the toolkit. In particular, in view of the upcoming demands of the LHC experiments, the end-user support is even more vital and needs to be strengthened. The existing person power is clearly not enough to guarantee end-user support at a satisfactory level and to balance the support for the LHC experiments and other users.

New Recommendation 1:

We strongly recommend the Collaboration to explore new ways to increase the person power available to user support and documentation. In some instances, reassignment of technical personnel inside the collaboration may be desirable.

Good communication between developers and users is important for the success of GEANT4. Presentations, workshops, and onsite technical support are needed to promote the project and to increase its acceptance within the various communities.

New Recommendation 2:

We recommend that the Collaboration institutions provide sufficient resources for collaboration members to promote the project.

User Support

The GEANT4 Collaboration has been built on a model of distributed support. In addition to the resources in the core development team, the user community could provide some level of user support in the future. A plan for this transition is needed.

New Recommendation 3:

The experiments inside the Collaboration should examine ways to develop additional support mechanisms for GEANT4. These could include taking over the responsibility for training and the first level of support.

Working Groups

The committee was surprised to see that the advanced examples were part of the responsibility of the low EM working group. Although these examples could be useful to the user community, this is not an appropriate home for this activity inside the collaboration structure.

The committee is also concerned about the potential for extending the mission of the collaboration beyond the resources available. Testing tools and straightforward examples are important to guarantee the success of the product. Including outside packages in the core product can complicate testing procedure and, therefore, should be minimized, particularly in the examples.

New Recommendation 4:

We recommend that the responsibility for the “advanced examples” be moved to an appropriate working group.

In addition, we recommend that the Collaboration not bind the examples to a particular analysis tool.

Conveners

Some working groups have a large workload and could benefit from adding a co-convenor to aid in the management of the working group. The current single convenor model has resulted in a management structure with possible single points of failure, heavy workloads for the conveners and the risk of lack of continuity in leadership if a convenor leaves the collaboration.

New Recommendation 5:

The committee feels that the Collaboration should appoint co-conveners in working groups with heavy workloads.

The large workload and the need to broaden the knowledge base within the Collaboration argue for the need to grow additional leaders within the collaboration.

New Recommendation 6:

The Collaboration should consider fixed (renewable) terms for the working group conveners.

Hadronic Working Group

The complexity of hadronic physics and the inability of any available model to cover the complete range of use cases envisioned by the user community poses serious management issues for the Hadronic Physics Working group. Because appropriate modeling of hadronic interactions is essential for the success of many of the collaborating GEANT4 experiments, as well as for non-collaborators, it is essential that the GEANT4 Collaboration work closely with the experimenters to insure that the released product addresses the issues of relevance to the experimenters.

A satisfactory implementation of hadronic models is mission-critical for the LHC experiments. A concern has been expressed by many users that the “hadronic physics” is falling behind schedule in some areas. With large scale simulations expected in 2003, fast reaction in the case of problems is necessary and the committee feels cannot be guaranteed at present.

New Recommendation 7:

We recommend that the Collaboration appoint a co-convenor for the hadronic physics working group immediately.

New Recommendation 8:

We recommend the formation of a body to review the hadronic physics goals of GEANT4 in the first half of 2003.

This review committee should be composed of experts in the hadronic physics models as well as representatives of the experiments. The experimenters should be requested to prepare their requirements for hadronic physics simulations in advance.

Coexistence with external frameworks

A clear requirement was presented by the LHC Experiments to enable them to run within experiment specific frameworks such as Athena, Gaudi or COBRA. The GEANT4 Collaboration indicated their intention to make this possible.

New Recommendation 9:

We encourage the GEANT4 Collaboration work on design issues that will enable the integration of GEANT4 with external frameworks with high priority. The present capabilities of a stand-alone simulation framework should be maintained, however, to serve communities other than the LHC experiments.

Physics Coordinator

The proposal for a set of User Requirement Committees is endorsed, however we do not feel that this replaces the need for a physics coordinator inside the collaboration. (See recommendation 3.1) The committee feels that the leadership of both the validation effort and user support should have a strong base inside the collaboration.

New Recommendation 10:

We recommend that the Collaboration recruit a physics coordinator to set overall priorities, monitor the activities of the physics working groups and be the interface to the experiments.

Collaboration

The review committee takes note of the intention of the collaboration to change its structure. The Collaboration has been operating under an agreement or Memorandum of Understanding. The committee heard a discussion of a plan for a new Collaboration Agreement that was under discussion inside the Collaboration.

The committee supports the Collaboration's attempt to move beyond the previous agreement, however, one item caught the attention of members of the committee. The proposal to eject all experiments from the Collaboration, however, was received with some surprise and skepticism. At this time, when user feedback from the experiments is very important, this appears to be the wrong signal.

New Recommendation 11:

We recommend that the experiments continue to play a major role in driving the direction of GEANT4 development. Any new structure should ensure continuation of this close collaboration.

Collaboration Board

The previous review committee recognized that the collaboration and the membership of the CB had grown. (See Recommendation 6.1) Ensuring adequate resources for the collaboration will become even more important as the support load grows. The Collaboration and its leadership must be able to respond quickly to the growing demand.

New Recommendation 12:

The committee endorses the proposal to create an Executive Committee within the Collaboration Board.

Agenda for Delta Review

Wednesday, October 9

Session TSB-0, Introduction

10:00 Key Issues, progress J. Apostolakis

Session TSB-1, User workshops and support

10:10 User workshops and HyperNews M. Asai

10:25 Requirements collection and prioritization
J. Apostolakis

10:40 Release definition and scheduling G. Cosmo

10:50 Web Pages D. Wright

11:00 Advanced Examples M. G. Pia

Session TSB-2, Physics validation and performance

11:15 EM (std) M. Maire

11:45 EM (low E) M. G. Pia

13:00 Lunch

14:00 Hadronics – Physics lists; progress J.P. Wellisch

14:30 Hadronics – Validation J.P. Wellisch

Physics comparison results (experiment/institution/member representatives)

15:00 Atlas P. Loch

15:20 CMS P. Arce

15:40 LHCb W. Pokors

15:50 Alice I. Gonzalez

16:10 Harp V. Ivantchenko

16:30 Babar D. Wright

16:50 ESA P. Nieminen

Thursday, October 10

Session TSB-3, Organization

9:00 Priorities and contents of releases J. Apostolakis

9:15 Evidence of the relation between EM groups
J. Apostolakis

9:30 Architecture group and inter-category design/interface changes
M. Asai

9:45 Collaboration resources J. Apostolakis

10:00 Coffee break

Session TSB-4, Products

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|--------------|--|-----------|
| 10:45 | URD improvements | G. Cosmo |
| 11:00 | Geometry checking tools | G. Cosmo |
| 11:15 | Granular beta-releases and products management | G. Cosmo |
| 11:30 | Documentation improvements | D. Wright |
| 11:45 | Coffee Break | |

12:00 External frameworks and Interactivity: requirements
M. Stavrianako

12:25 External frameworks & Interactivity: outlook
J. Apostolakis

13:00 Lunch

14:30 Collaboration agreement and license R. Mount
Session dedicated to CB issues (including HEPURC)

16:00 Review Committee closed session

Friday, October 11

8:00 Review Committee closes session

11:00 Closeout session