

## Responsibility for drafting response to Geant4 Review 2007 recommendations

Draft 1.1, J. Apostolakis, M. Asai  
21:30 CET, 10 November 2008

### *Proposal for responsible persons for recommendations*

We propose that for each recommendation, one person or a small team assess the status or prepare a draft response. Please find the proposed names in the sections below. Here is an index of initials of persons:

**K.A.** Katsuya Amako  
**J.A.** John Apostolakis  
**M.A.** Makoto Asai  
**G.C.** Gabriele Cosmo  
**G.F.** Gunter Folger  
**S.I.** Sebastien Incerti  
**V.I.** Vladimir Ivanchenko  
**H.K.** Hisaya Kurashige  
**M.V.** Marc Verderi  
**D.W.** Dennis Wright

**Note:** the bold and italics are added by us (J.A., M.A.) to guide the eye and emphasize the topic and/or key aspect of a recommendation. **Bold** only are the most challenging, in our current estimation – please consider these first and respond to the SB with proposed response including proposed plans for achieving or explanation why it is impossible or not desirable. **Bold italic** are assessed as underway or better understood – please do prepare a draft response and inform in case there are indeed major roadblocks or unknowns.

## **EM Physics**

**V.I./S.I.** Recommendation 1: We recommend setting up an easily accessible central repository with detailed **references to data comparisons and validation papers** for the models, e.g. a web page linked from the EM home page.

**V.I./S.I.** Recommendation 2: We recommend rapid integration of the ICRU 73 heavy **ion stopping power** model.

**V.I./S.I.** Recommendation 3: We recommend providing **guidance on the tradeoff** between physics **accuracy and** computing **speed**. For example, collect and publish via the web results from users in various domains regarding computing speed vs range cut, and provide a Wiki-like forum where users can document their experience; etc.

**V.I./S.I.** Recommendation 4: We recommend providing **guidance on the choice between the two EM models** for specific particle species, energies, etc.

**J.A.** Recommendation 5: We recommend **integrating the two EM models into a single package**, similar to what exists in hadronic models. This will allow a user to choose one model in one energy range and the other model in a different energy range in order to optimize physics and computing performance for his application.

## **Hadronic Physics**

**J.A.** Recommendation 6: We recommend continuing the **dialog with the FLUKA** collaboration to find a cooperative way to provide users with the best features of Geant4 and FLUKA. One possible implementation could be a loosely coupled interface between Geant4 and FLUKA hadronic physics model.

**D.W.** Recommendation 7: We recommend that Geant4 develop **detailed plans to improve the hadronic package**, in particular to improve the simulated shower shapes.

**D.W.** Recommendation 8: We recommend putting in place a set of **simple hadronic benchmarks** which allow quickly identifying very basic problems like disagreement with well known shower shapes.

**D.W.** Recommendation 9: We recommend that Geant4 accelerate the development of physics models to address these needs [an **accurate prediction of the triple differential** cross sections ( $d^3\sigma/(dE dZ d\theta)$ ) for recoiling particles from all interactions, including heavy-mass ion-ion reactions].

## ***Computing Performance***

**G.C.** Recommendation 10: We recommend extending the scope of the computing professionals to ***review and optimize all Geant4 code.***

**J.A.** Recommendation 11: We recommend that ***Geant4 encourage users*** to monitor their applications, and provide feedback so additional “hot spots” can be identified.

**K.A./G.C.** Recommendation 12: We recommend the creation of a **performance optimization guide**. It is likely that such information already exists and just needs to be collected into one document.

**H.K./M.A./M.V.** Recommendation 13: We recommend providing a simple mechanism for users to ***turn off “irrelevant” processes*** for a given region.

**M.A./M.V.** Recommendation 14: We recommend providing ***guidance on the use of VRT*** (variance reduction techniques) in Geant4 so users can better take advantage of them. References to publications and data regarding the validation of the VRT methods in Geant4 should be made available in the performance optimization guide.

**G.C.** Recommendation 15: We recommend systematic **tracking of code performance** for each part of the code, and for each physics model. Comparisons with previous versions should be an ***integral part of the release notes.***

**M.A./J.A.** Recommendation 16: We recommend that Geant4 keep itself abreast of developments in the area of **multi cores** and advanced instructions, so it can take advantage of them when there is sufficient infrastructure and support to do so.

**G.C./J.A.** Recommendation 17: We recommend that Geant4 publish a plan regarding the **expected computing performance** of the toolkit over the next five years.

## ***Usability Issues - Physics Validations***

**V.I./S.I./D.W.** Recommendation 18: We recommend aggressively populating the [proposed] **database with all relevant experimental data**, as well as validation results provided by others.

**V.I./S.I./D.W./J.A.** Recommendation 19: We recommend continuously and systematically **benchmarking against other Monte Carlo transport codes.**

## ***Usability Issues - Release Validations***

**J.A.** Recommendation 20: We recommend defining and automating a **common validation procedure to be run for every release**, monitoring a comprehensive set of variables and exploiting the comparisons with the collected experimental results.

**V.I./S.I./D.W.** Recommendation 21: We recommend defining **quantitative metrics for validation** results.

**V.I./S.I./D.W.** Recommendation 22: We recommend that **all validation results**, both the quantitative metrics and the underlying distributions, be **made easily accessible** to the user.

## ***Usability Issues - Documentation***

**K.A.** Recommendation 23: We recommend **updating the documentation on the web** right away, and formulating a plan to have periodic reviews of the web site to keep it up to date.

**V.I./S.I./D.W./G.F.** Recommendation 24: We recommend that Geant4 document the **limitations, and validity and applicability ranges** of the different EM and hadronic models, and the physics lists. Where models have overlapping validity ranges, document the **tradeoffs**.

**K.A./J.A.** Recommendation 25: We recommend that Geant4 **improve** its code documentation. Example approaches by other groups include Doxygen, and README files that can be browsed in LXR.

**G.C.** Recommendation 26: We recommend **improving the release notes** with the addition of expected changes in physics and computing performances, while keeping the current extensive list of code change descriptions. We encourage strengthening the editorial coordination of the release note preparation.

**G.F.** Recommendation 27: We recommend that Geant4 review the current **installation procedure** with the aim of adding conveniences for users, such as additional defaults, self configuring procedure, a template .spec file to create an RPM in the user's environment.

## ***Usability Issues – User Support***

**J.A.** Recommendation 28: We recommend setting up a **user** community supported **Wiki** as a collaborative tool. Geant4 should advise which documentations are appropriate to be moved to it.

**M.A.** Recommendation 29: We recommend that Geant4 continue its vigorous support to implement and integrate **user driven physics models**.

## ***Other Issues***

**J.A.** Recommendation 30: We recommend that Geant4 develop **manpower and resource plans** for the next five years. They should be consistent with timely delivery of features and capabilities to the user community.

**J.A.** Recommendation 31: We recommend that Geant4 **seek the additional support** implied by the manpower and resource plans from all available sources.