

Geant4 Collaboration Meeting Plenary 4

<https://indico.cern.ch/event/942142/sessions/358915/#20200923>

These “live notes” are used to collect questions and comments during presentations for discussion after presentation, in discussion sessions, or offline.

If you have questions or comments, please add them below, prefixing with your name so we know who to come back to!

Update on geometry developments (Gabriele Cosmo)

- Questions, comments
- (Makoto) Will there be an example for the external navigator?
 - (Gabriele) The external navigator for using Fluka geometries is included in FLAIR/Moira package distributed through Fluka.
- (Vladimir) 10.7 will be used by CMS as a production release. CMS has interest, that this release is both robust and CPU efficient.
 - (Gabriele) Minor releases of Geant4 are supposed to be -by definition- robust and, in general, more performant of previous releases...
- (Giovanni) examples/extended/persistency/gdml/G03 includes since many years color extension. Would it be possible to make it part of the GDML core standard? This standardisation would facilitate adoption by all tools that can export GDML (FASTRAD, ESABASE, EDGE, FreeCAD prototype, etc). This has been a user requirements in space for many years, and I guess it is shared by a lot of users. It is also almost essential for CAD export
 - (Gabriele) Visualization attributes, as well as any other attribute attached to logical volumes (like sensitive detectors, field managers, etc,...) cannot be considered part of the GDML schema, which is limited to geometrical description. GDML provides ways to import/export additional entities associated to volumes, either through extensions of the schema (as you mentioned and demonstrated in the example G03), or through the powerful mechanism of auxiliary information (also demonstrated in the examples). To also note that since recent releases, Geant4 can import GDML files and automatically color the setup, using material density description coming with the GDML file.
 - Thank you Gabriele. I respectfully disagree, though, from the user point of view. A color should not be considered the same way as the definition of a sensitive detector. Every CAD tool has colors assigned to the basic geometry elements, and the coloring is not related to the material properties (although it may be).

Color is an extremely powerful tool to highlight / categorise / remember the role of a particular geometrical element, and pass this extremely useful information on to your collaborators (or to your future self!). If a volume is one day yellow, the next day grey, the next day red, it is confusing for the people working on the model. The same is actually true also for toggling volume visibility on/off and vis mode (wireframe/solid): once you finally manage to hide or set to wireframe a set of elements in order to highlight an important part of the model, you want to have this preserved for the next time you open it, and to pass these vis details on to your collaborators. I agree that there are technical ways to achieve this in GDML right now, but the fact that this is not standardised is not allowing this exchange of information to happen extensively and uniformly

- (Marc) For VecGeom on GPU with CUDA backend : does it make some restrictions on the functionalities or the type of solids usable ?
 - (Ben) I believe this is how Opticks does things (the types of solids are limited *I think* by the NVidia API/Algorithms), but I'm not sure how the VecGeom implementation deals with this.
 - (Gabriele) Not all solids in VecGeom are ported to CUDA, the majority are though. For what concerns the navigation algorithm, this is fully ported, although optimisation structures are not yet there.

Recent developments on magnetic field (John Apostolakis)

- Questions, comments
- (Marc) Just a comment : having two methods with opposite biases as you presented (one bias = always inside, the other = always outside) with the tangent technique for the outside might be an efficient way to reduce the error on the intersection point under some tolerance (wrt a unique asymptotic biased method).
- (John Allison) Access to intermediate stepper/integrator points for drawing - do they continue to be available for visualisation?

Status of tasking model (Jonathan Madsen)

- Questions, comments
- (G.Amadio) TLS context switches in TBB
 - I suggest checking that events remain on the same thread with a user action that sets the thread id at the beginning and another action that checks at each step until the end of the event.
 - (GC) What is the use case for doing this in a user action??

- See this blog post about work isolation in TBB:
<https://software.intel.com/content/www/us/en/develop/blogs/the-work-isolation-functionality-in-intel-threading-building-blocks-intel-tbb.html>
 According to the post above, code that is not in general reentrant needs to run in isolation. Quote from there: “Is it safe for a thread to reenter outer level parallel tasks (as if there was recursion)? **Storing to a thread local value, re-acquiring a mutex already acquired by this thread**, or other resources that can suffer if used by the same thread again **can all cause problems.**”
- (Jonathan) @Guilherme -- after thinking more about your question, I think the answer is that thread-local statics aren't affected by context switches. Only if co-routines are used will you have an individual task that starts in one thread and might get migrated to another thread before it completes. The OS context switch might migrate the thread to another physical CPU but it won't change the thread ID used for locating TLS
- (Jonathan) Also -- I have previously designed a way to handle the migration of the TLS to different threads and discussed it with Gabriele.
- (Gabriele) Should also consider that LHC experiments are daily using TBB with Geant4 simulations in production and are -not- suffering of TLS context switches.
- (Jonathan) I thought those experiments weren't using the MT build of Geant4?
 - (GC) Yes they are, of course. They have their custom run-manager to run with TBB and steer the event loop as they like...
 - (JM?) I think there would still be an issue if TBB tasking is used within the event. It seems to me that this would be an issue if you have sub-event tasks within Geant4 bc you still have that issue where resuming the event task migrates to different thread
 - (GC) With sub-event level parallelism that might be... although in ATLAS they do sub-event level simulations already though their framework

New scoring functionalities (Makoto Asai)

- Questions, comments
- (John Ap.) Each mesh or new probe seems to live in a separate geometry 'world'. This creates an abundance of worlds in an application that has many mesh/probe scorers. (It can also be a limitation ... if not vector size, then eventually memory.) Could multiple probes or meshes be accommodated in one parallel world so long as they don't overlap?
- Answer> All probes are put into a single geometry (= parallel world.) This assumes that they do not overlap ...

Review of planned features for release 10.7 (Ben Morgan)

- Questions, comments

- (John Ap.) The phrasing of “Separate safety computation and state from navigator” would better read “a) Separate safety (its computation and the related state) from navigator. b) Study revised design to enable lightweight navigators, including ones without state.” I would expect a beta-version of “a)” by early November; so likely not robust in time for 10.7. b) is certainly for 2021.

Release 10.7 schedule (Gabriele Cosmo)

- Questions, comments
- (Ben) Do we have timelines for experiments/labs to migrate to CentOS8?
 - (Gabriele) Not that I know for the moment.
- (Gunter) List of compilers for Centos 7 is rather large. Propose to drop gcc 5, 6 and 7 as they are already rather old. [Agreed.]
- (Giovanni) gcc 7.5 is the default version of Ubuntu 18.04, though ?
 - (Ben) I think this was only for CentOS7, native Ubuntu would still be tested.

Review & discussion on features for inclusion in major release 11 (All)

- Dedicated live notes here:
https://docs.google.com/document/d/1Z_UD_yWzeRr44dZeVJoBLY6PLKaL7ObII_LqOqAakok/edit