Managing the evolution of Geant4

Some thoughts on the process and related topics with the input from

Philippe Canal, Daniel Elvira, Chris Jones, Soon Yung Jun, Jim Kowalkowski, Liz Sexton-Kennedy and others;

apologies for any mistakes or misinterpretations

Fermilab Geant4 Group et al. collected by

Krzysztof Genser/Fermilab/SCD, August, 2018

A recent Large Change

- In case of a large change like MT, Geant4 Multi-Threading Task Force was created

  (quoting from from: https://twiki.cern.ch/twiki/bin/view/Geant4/MultiThreadingTaskForce)

  - The task force has been created by the Geant4 SB in February 2013 with a mandate of two years with the following charges:
    – collect all the relevant expertise and act as the center of gravity,
    – drive the collaboration-wide effort of MT migration, and
    – drive the collaboration-wide effort of documenting MT-related matters.
  - The Task Force coordinator was Andrea Dotti

- The initial work on the MT mode was performed by Xin Dong (Northeastern University) (it was his PhD thesis) supervised by Gene Cooperman, in collaboration with John Apostolakis; see e.g.:

  – "Multithreaded Geant4: Semi-automatic Transformation into Scalable Thread-Parallel Software", Xin Dong, Gene Cooperman and John Apostolakis, 2010 *Lecture Notes in Computer Science*, Springer Berlin Heidelberg, **volume 6272**, p.287-303

  – With some of the investigative work predating it by several years

🔶 **Fermilab**

Today's situation

- Changes are proposed within working groups which approve them; Steering Board approves changes proposed by the working groups

- Given other potential large changes, similar in scope and impact to the Gent4MT and to make sure the toolkit keeps adapting to the evolving needs and environments, a more comprehensive approach may be needed

🔶 **Fermilab**

Geant4 R&D Working Group?

- Based on the MT experience, the creation of an R&D working group within the Geant4 Collaboration to steer all the activity related to the evolution of Geant4 would seem a very natural approach, generalizing what was done in the MT case

  (see next page for the suggested scope)

- The creation of such a group may be especially beneficial as we may face changes which could affect many areas of the code, and not only pertaining to local aspects under one working group purview

Geant4 R&D Working Group cont'd

- Permanent group with the following possible charges and scope:
  - Fostering innovation
  - Surveying and 'coordination' of R&D efforts
  - Reporting on emerging hardware technologies or software techniques
  - Making the code changes and/or providing guidelines and for initial testing, validation and benchmarking of the new versions of the code till they become the official ones
  - Providing information/recommendations regarding backward incompatible changes, helping to decide when they are necessary or worthwhile to make and their extent, both internal to the toolkit and visible to the users
  - Demonstrating clear benefits brought by the advocated changes
  - "Cross-cutting"
    - I.e. could offer technical advice/recommendation in all areas of the toolkit
  - Could recommend creation of a task force to perform a specific deployment
  - **Working with experiments to increase synergy and minimize the adoption cost of new features and to assure meeting experiments needs**
    - **E.g. by prototyping & co-development**
    - **Early code access at the development stage has proven itself to be crucial in accelerating the process, avoiding incompatibilities and in following closely the experiments needs**
      - **E.g. Testing by CMS of the pre-alpha GeantV code resulted in significant changes to interfaces and loop control**

🟰 **Fermilab**