Few points about Geant development

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Geant validation

- Validation is essential to roll out new versions of the code
- For the moment we rely on three major sources of validation
  - ”Thin target” benchmarks
  - Simplified calorimeter benchmark
  - Experiment validation
- Usually the release process is quite smooth… even if we occasionally have some quirks
- The real trouble is that the situation is such that we lack a good measure of progress when optimizing physics processes

Thin target benchmarks

- *Theoretically* these should be the golden standard
- Trouble is that they are of varying quality and most of the time we do not have exhaustive information on the conditions of the experiment
- Moreover they are scattered very sparsely on the energy - material - output particle matrix
- In the electromagnetic the situation is manageable
  - Aided by the fact that we have only two particles at play
- In the hadronic the tests we have are so scattered that an improvement in available thin-target simulation is no guarantee of an improvement in the model

Simplified calorimeter

- These *derive* from test-beams
- The precision of the geometry description allows only “qualitative” statements and “stability” assessments
  - Does the new model goes “in the right direction” given what the experiments tell us?
  - Did the results changed “a lot”?
- Not useless, but not very helpful either
- Only “visual inspection” possible, since the assessment is qualitative, no possibility of automatic alarms and limited number of histos produced

Experiment validation

- It should be a foregone conclusion, not a surprise party ;-)
- However there is a huge gap between relatively few and uneven thin target tests and a full experimental setup
- And hence our validation can go only so far
- This gap could be filled by the current test-beams experiments that are being conducted in view of the upgrades
- This is a ”golden opportunity” for simulation that could provide accurate validation for several years to come

Proposed strategy

- Identify together the most promising / useful test beams
- Create an accurate & standalone (no experiment framework) GEANT4 & GEANTV description of them
- This code should simulate the experimental conditions, score the experimental results and compare them with the actual data
- Have this code accepted by the experiments
- Run regularly this code with automatic alarms for non-regression testing and verification of the physics models
- Of course we will change only GEANT and not the code or the scoring without agreeing with the experiments

Manpower

- Both the GEANT team and the experiments are stretched in manpower and they can hardly afford this overhead
- However we cannot miss this occasion
  - Trying to do this “after the fact” is much more work, if possible at all
- I would be willing to dedicate a fellow to this work, however our quota for the foreseeable future is already full
- … but if we could all together ask PH to give one “extra” fellow to SFT “sharing the pain” to be entirely dedicated to this work it might just work

Changing subject…

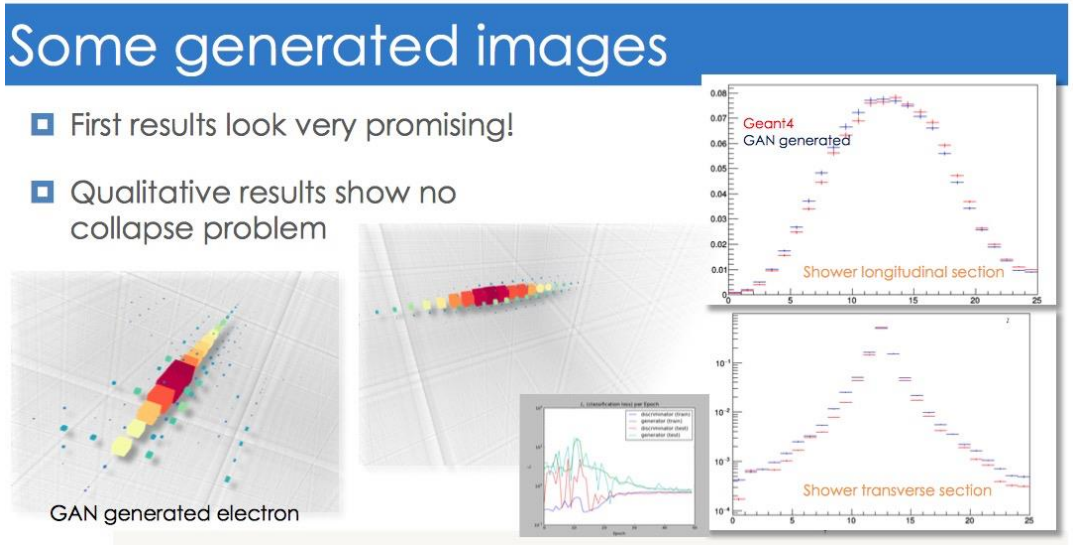
VecGeom integration

- Geant4 is fully integrated with VecGeom geometry
- CMS has decided to move fully to VecGeom
- We estimated that this will give a ~5-10% speedup
- Validation of VecGeom for CMS is very advanced, and it is transparent for the experiment
  - Apart the custom volumes…
- *If* other experiments would follow, the validation effort would just be incremental and the quality of VecGeom (which is already pretty good) would further increase

VecGeom integration … moreover

- We will soon start experimenting the integration of the VecGeom navigator into Geant4
- This may give a (much?) more substantial speedup (not estimated yet…)
- The transition from a VecGeom geometry validated version to a VecGeom navigator + geometry version would be much easier
- I invite you to give it a “second thought”

ML



- Preliminary results obtained with ML for simulation seem quite good
- We are at the point where input from the experiments would be very useful to guide our next steps
- At the moment this work is supported via an Intel IPCC grant
- If we want some CERN support, we should express some interest from the experiments
- One way would be to write a short paper (few pages) stating the common interest in pursuing this R&D
- And coordinate our common activities (if any…) in this area

Conclusion

- Waiting for your input…