

PROBLEMS AND PLANS FOR STANDARD EM

V. IVANCHENKO
26 JANUARY 2018

OUTLINE

- Recent news from CERN
- Recent news from LHC
- Geant4 10.4 EM validation results
- Preliminary plan for 2018

RECENT NEWS FROM CERN

- The reorganization of CERN SFT group was introduced at the end of 2017
- Père Mato is now Simulation leader with 3 sub-project leaders
 - Gabriele Cosmo – geometry and maintenance
 - Alberto Ribon – physics
 - Witold Pokorski – R&D
- Strategy of Simulation is slightly change
 - Successful R&D projects after validation will be integrated into Geant4
 - 2018 main goal – validation and head-to-head comparison between Geant4 EM and vector prototype
- The main goal: more synergy between Geant4 maintenance and R&D projects toward LHC

RECENT NEWS FROM LHC

- It is planned that run-2 will be completed in 2018
- After that a long shutdown will take place
 - Detectors will be upgraded
 - LHC energy increased from 13 to 14 TeV
 - Luminosity will be increased
- Based on existing analysis of run-1 and run-2 data we may conclude, that the Standard Model is in a very good agreement with the LHC data
 - Further data accumulation and newer analysis will require higher MC statistics and will require reduction of systematic uncertainty in simulation

GEANT4 10.4 EM VALIDATION RESULTS

- CPU performance benchmark (Soon Yung Jun) shows small speed-up of EM:
 - <https://g4cpt.fnal.gov/>
- Results: <https://geant4-tools.web.cern.ch/geant4-tools/emtesting/>
 - Main results are consistent with Geant4 10.2 and 10.3
- Summary was reported at the recent Geant4 Technical Forum:
https://indico.cern.ch/event/680975/contributions/2851036/attachments/1584511/2505095/TF_Jan_EMPhys-v2.pdf



PRELIMINARY
PLAN FOR 2018

INFRASTRUCTURE AND GENERAL SUPPORT FOR EM PHYSICS FOR LHC

- Perform regular execution and regression analysis using existing testing suites
 - Full migration of the testing tool to EOS and ROOT6 (A.Bagulya)
- Addition of CMS HGCALE test-beam into testing suite (S. Banerjee & ?)
 - Test-beams are ongoing
- Further evaluation of tileatlas test (J.Apostolakis & ?)
 - ATLAS tilecal problem: A.Dotti report demonstrates that the results are more sensitive to Geant4 version than in our tileatlas application with hard-coded geometry

INFRASTRUCTURE AND GENERAL SUPPORT FOR NEW HEP FACILITIES

- Dark matter particle searches (ShiP at CERN, others)
 - Extended example dmparticle (V.Grichine)
 - More physics model for production and interactions of DMP
 - Extensions of EM models with triplet production (many contributors)
 - Bremsstrahlung
 - Gamma conversion
 - Positron annihilation
- Extended validation suite with unit tests of EM models
 - Full set of gamma model tests exist
 - Need to check models after each reference tag and perform regression tests

FURTHER DEVELOPMENT OF MSC AND ENERGY LOSS FLUCTUATIONS MODELS

- Improving GS msc model and optimization for HEP applications (M. Novak)
- Investigate alternative models for energy loss fluctuation (M. Novak)
- New tuning of Urban models (L. Urban)
- Extended testing of e^+ - transport (M. Novak)
- Study on of the displacement beyond boundary algorithm (?)

- After 10.4ref01 we may switch accurate lateral displacement sampling of the Urban model to be the default

FURTHER UPDATE OF IONIZATION PROCESSES

- Ionisation of relativistic ions (A.Bagulya)
- Extensions of transition radiation models (V.Grichine)
- Validations for medical applications (T.Toshito, T.Yamashita, S.Guatelli)

BREMMSTRAHLUNG AND PAIR PRODUCTION MODELS

- Improving the Seltzer-Berger model (M.Novak)
- Investigate improvements to the standard EM pair production models, and high energy bremsstrahlung models (M.Novak)
- New tests for high energy gamma conversion based on data (F.Hariri)
- Implement directional bremsstrahlung splitting (D.Sawkey)

OPTICAL PHOTON PHYSICS

- Complete redesign of optical processes and material properties (A.Howard, D.Sawkey)
- Develop an optical example so that processes can be investigated using a macro and analysis tools (D.Sawkey)

DOCUMENTATION

- For Geant4 10.4 the documentation tools were changed (A.Howard, D.Sawkey et al.)
- ADM and PDM were significantly modified and improved
- We need continue this process further
- Migration to DRUPAL-7 will require modifications in our EM web

SUMMARY

- These slides are based on your e-mail responses
- Please, communicate with me asap if some items were forgotten and not included
- On base of these slides 2018 plan will be compiled