



Software Highlights and Review Preparation

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LHCC Referees, 2021-06-01



vCHEP2021



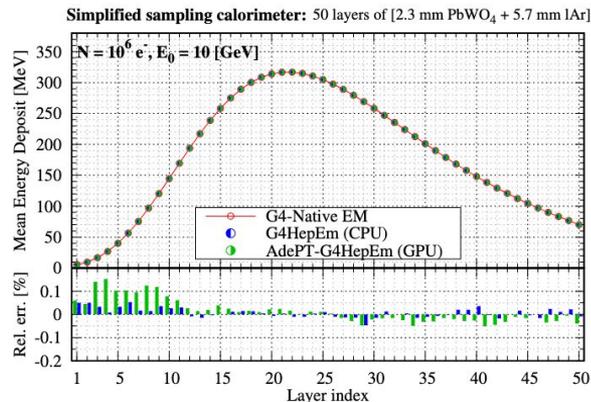
- [Computing in High Energy Physics](#) was held 17-21 May as a virtual event, supported by CERN
- 1140 people registered from 47 countries
 - 20 hours of timezones, from Brisbane to Honolulu
- 205 papers were accepted (full draft papers 6-10 pages long were submitted)
 - Will be published as proceedings, with 11 papers going to CSBS
- 30 plenary talks covering R&D highlights
- 175 parallel talks, organised into topical themes

This is the biggest event for the HEP software and computing community and many people from the HSF, WLCG, experiments and software projects contributed significantly to its success

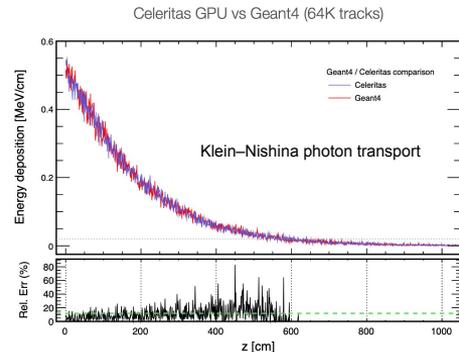
Simulation

- HSF Simulation WG topical meetings
 - R&D into simulation on GPUs (Celeritas, AdePT, Opticks)
 - Non-LHC topics: NEST (Noble Element Simulation Technique), Dark Matter detector simulation
- Geant4 11.0-Beta in preparation (end of June 2021)
 - **Tasking** system based on PTL v2.0.0 (or Intel/TBB) **set to default**
 - Robustness fixes and extensions
 - Switch to C++17 as minimum standard
 - Updated configuration system supporting modular builds
 - Quantum entanglement of e+ annihilation
 - Updated electro-magnetic integral approach
 - Deprecation/removal of legacy code/interfaces
- New release VecGeom v1.1.15
 - Revision of the build system and several bug fixes
 - New navigation optimization structure and GPU API extensions
 - Updated configuration system
- [Virtual] Geant4 Beginners Course – 25-31 May 2021
 - Full attendance; fully virtual on Zoom with hands-on sessions

New GPU friendly EM Physics library integrated into the AdePT prototype ([M Novak, J Handeld](#)) - per mil agreement with Geant4

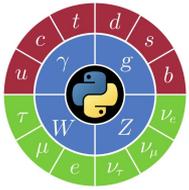


Celeritas is also doing Physics validation against Geant4 - from a recent HSF-sim meeting ([S Johnson, for Celeritas](#))



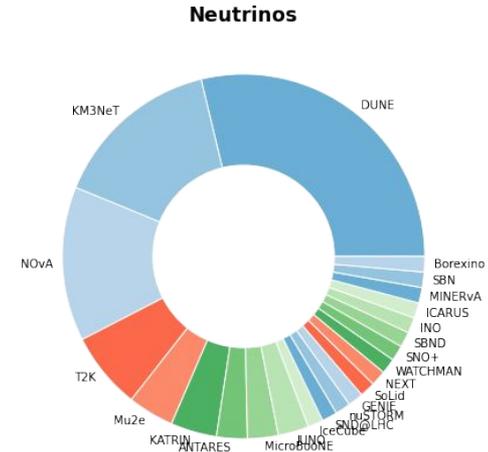
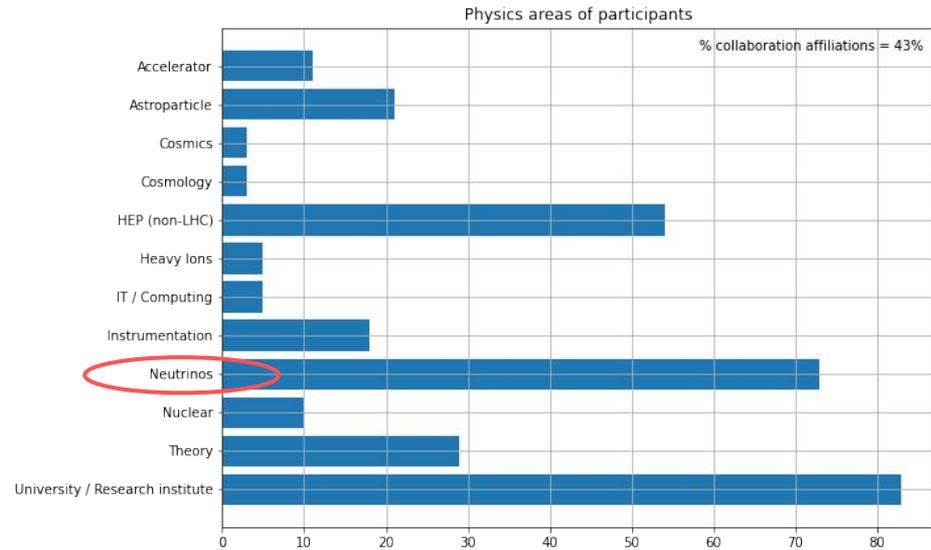
Packaging, Tools and Releases

- SPI/LCG Release News
 - LCG_100 based on ROOT 6.24.00 released in May
 - Also for aarch64/ARM, Cuda
 - Many layers for ATLAS, LHCb, Beams (`nxcal`s - new logging system based on Hadoop)
 - New Compilers provided on CVMFS: clang 11, clang 12, gcc 11, gcc10 (with `-fenable-frame-pointer`)
 - Spack: All packages from the ATLAS layer provided in spack build
 - “Julia” included in the software stack
 - New development builds: standard build with python3.9, special stack for `nxcal`s
- HSF Tools and Packaging
 - Meeting on Spack, build orchestrator, with now a lot of momentum in HEP
 - Key4hep, Fermilab projects (inv. LArSoft), FAIR experiments
 - Nice to see the community “self-organise” around support for HEP packages
 - Cutter as a tool for reverse-engineering compiled code to improve performance
- CVMFS
 - Ongoing discussion with experiments on CernVM-FS extensions targeted at user containers and user/analysis code distribution
 - New discussion and support forum: <https://cernvm-forum.cern.ch>
 - Participation at vCHEP with two presentations [container hub](#), [publish performance](#)
 - Several CernVM-FS and CernVM bugfix releases



PyHEP

- Very successful series of “module of the month” meetings
 - pyhf, Dask, etc.
- Preparations for PyHEP2021 well underway
 - Again, hugely popular, close to 750 people registered so far
 - New: significant engagement with the neutrino community
 - Of course, this will be an online event
 - Again, organised close in time to the SciPy event





ROOT and Analysis

- ROOT
 - Active discussions with the experiments and IT, also outside the mini-workshop, on foundation, skimming, and the role of several core packages
 - [Release v6.24](#) with C++17 support, thanks to a major llvm upgrade
 - Participation at vCHEP with four presentations ([Accelerating ML Inference](#), [Portable PRNGs](#), [Data Caching](#), [Object Stores](#) - a real breadth of R&D in ROOT!)
 - Team has been [active in helping diversity](#) amongst STEM students with disabilities
- HSF WG has been looking at non-LHC experiments
 - Conclusions of look at [Metadata](#) are available
 - Presentations from SBN, DUNE, JLab, sPHENIX, FAIR/GSI, LZ, Xenon1T, ... !

Other Meetings, Events and Activities

- Review of DUNE Framework requirements
 - Asked for by DUNE, organised by HSF Frameworks group
- Compute Accelerator Forum continues to be a popular focus point for all things accelerated - **meetings are recorded**
 - FPGAs covered recently
 - As well as abstraction layers and data layouts
- GSoC
 - GSoC programme was less extensive this year than last
 - Google halved the coding time and also COVID weariness
 - However, we received 27 slots for all proposals that had good candidates

HL-LHC Review Planning

HL-LHC Review Planning

- Overall preparations are well underway
- Each of the proposed documents has an editorial team, as a reminder:
 - Event Generators
 - Detector Simulation
 - Foundation and Core Tools
 - Analysis
 - DOMA
- Anticipation is that draft documents will be delivered by **30 June**
 - This will allow experiment and community comments over July and August
 - Final versions to be prepared in September
 - To be **delivered by 1 October**, as asked for

DOMA

- Chief editors have been appointed from the DOMA project
 - Oliver Keeble & Mario Lassnig
- They have discussed with the projects to gather inputs from the key projects
 - Rucio
 - File Transfer Service (FTS)
 - Inc. GFAL and Davix
 - Storage interfaces and caching layers
 - Network technologies
 - Honorable mentions (CVMFS, IAM, CRIC)
- A great deal of information has been collected, needs some prioritization discussion. Meetings are planned:
 - 1 June dedicated to Rucio, FTS and network
 - 8 June dedicated to storage
- Actively working on the document, draft to be ready by 30 June, as agreed
 - Overleaf document open for comment
 - Have requested input from experiments and facilities

Event Generators

- HSF Generator WG Conveners have taken charge and are in a data collection phase.
 - Andrea Valassi, Efe Yazgan, Josh McFayden
 - Meetings with each of the major generator communities ongoing
 - Evtgen (managers are in LHCb, but work is independent)
 - MadGraph5_aMC@NLO
 - Pythia
 - Sherpa
 - POWHEG (planned)
 - Herwig (planned)
 - LHAPDF (planned)
- From these inputs the draft document is being synthesised
- Working group paper “Challenges in Monte Carlo Event Generator Software for HL-LHC” has been published by Springer’s Computing and Software in Big Science:
 - <https://doi.org/10.1007/s41781-021-00055-1>

Detector Simulation

- We held a [mini-workshop](#) on 29 April
 - Presentations from Geant4 and the experiments
 - Set out expectations and priorities on both sides
- This has helped a lot to pin down what it meant by “agreed functionality and performance”
- Geant4 will now take care of drafting a first version of the review inputs with the spokespeople as editors.

Foundation Tools

- Will cover the role of ROOT as a foundation layer, meaning the I/O system and its evolution
 - This has been and continues to be discussed with the experiments
- ROOT team are drafting this document
 - with Axel and Pere taking the lead
 - now and hope to have it ready soon

Analysis

- We held a mini-workshop on 4 May
- Presentations...
 - From the experiments on their plans and expectations for HL-LHC analysis
 - Overview of the Python ecosystem from PyHEP convenors
 - Plans from ROOT team for HL-LHC
- Active discussion captured
- Similarly, this has helped a lot to pin down what it meant by “agreed functionality and performance”
- For the input drafts:
 - PyHEP working group leads will now take care of drafting a first version of the review inputs
 - ROOT team will take care of their section
- HSF Software coordinators will take care of overall harmonisation