Minutes of the ABP Computing Working Group meeting

13th October 2016

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Arising matters

- Laurent reported on the main points from the last IT User Meeting:
  - Windows 10 has become the default windows version. Windows 7 will be maintained up to 2020.
  - There was a discussion about the possibility of using CEPH as a replacement for AFS. IT stated that this does not match the required security standards.
  - The svn service is being discontinued, it is not possible anymore to create new repositories. IT suggests to move to gitlab.cern.ch (available also from Technical Network). Riccardo mentioned that within this system it is difficult to handle contributions from external collaborators.
- Many participants reported major issues lately on LSF jobs. It was discussed whether this might be a good motivation to accelerate the migration to HTCondor. It was noted that in important step in this direction will be the release of CERN documentation from the IT side.
- All members of the ABP group will be invited to participate to an online survey on the usage of AFS and lxplus within the group. This will allow to collect information to assess the impact of the upcoming phase-out process.

The SixTrack Code

The SixTrack code was presented by Riccardo (slides are available here):

- SixTrack is an open source single particle tracking code used to simulate charged particle trajectories in synchrotrons for many turns with or without acceleration, with or without dynamic effects.
- It is mainly used for high energy proton machines (e.g. LHC and FCC). The relativistic beta of the beam is taken into account, still with some approximation. The usage for PS and PSB would require some validation and debugging.
- The correct simulation of combined function magnets would require some development work.
- The effect of synchrotron radiation is not included in the simulations.
- SixTrack simulations are used at CERN to evaluate the impact of magnetic field imperfections and weak-strong beam-beam effects, to simulate losses and collimation efficiencies, and to simulate failure scenarios (e.g. crab cavities in the HL-LHC).
- SixTrack is made of F77/90 code blocks that are assembled with two pre-processing steps to generate real fortran code, which is then compiled and executed. It can be linked with BOINC libraries for the LHC@Home project.
- This structure makes the learning curve extremely steep especially for the developer: dead or duplicated code, unused variables, cryptic names, unclear work flow due to extensive usage of goto statements.
- Vectorization is used as a form of parallelization.

- The main tracking algorithm can be parallelized in the number of particles and can run asynchronously (should fit well GPU models, developments are on going towards a tracking library derived from SixTrack, see SixTrackLib).
- Two external tools, i.e. SixDesk and SixDB, are used to prepare, submit, manage, collect and process jobs for LHC and FCC studies starting from MadX input and a parameter definition file. The code is presently being reviewed by Alessio and it heavily affected by the change of IT infrastructure (AFS and LSF phaseout).
- The studies are broken down into small jobs simulating 64 particles each.
- The SixTrack website cern.ch/sixtrack is used as a single point of information where the main documentation (user manual, physics manual and developer manual) can be found.
- The github platform is used to manage the source code, the development contributions form different users, and for issue collection and follow-up.
- Present resources working on the SixTrack code (including SixDesk and Collimation) count 30% FTE summing all CERN staffs (2) and 100% summing all CERN fellows (3). Students and several external collaborators do also contribute. Resources are not sufficient to fix all bugs and feature request within the time scale of a year. Typically user needs are covered by user themselves who often commit the code back to the baseline (when possible). The github platform proved to be very helpful in this process.
- SixTrack is very well suited to a computing infrastructure like lxbatch, it can run on the BOINC volunteer computing platform, and it can also be used, almost unmodified, on supercomputers like CRAY o BlueGene using MPI. In addition SixTrackLib would benefit from GPU with substantial FP64 Flops.
- Development plans include the introduction of new physics (e.g. electron lens, beam-beam further development), extending the physics to PSB/PS/SPS and multiple ion species (to simulate ion fragmentation). A work of clean-up and branch merging is also needed.
- In parallel SixTrackLib is being developed (can be embedded in other applications and supports GPUs).