Minutes of the ABP Computing Working Group meeting

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General Information

INFN-CNAF cluster

- A new HPC cluster dedicated to CERN studies is now available at INFN-CNAF (in Bologna). The acceptance tests defined by the collaboration agreement are presently ongoing. Annalisa provided some basic instruction for its usage (slides here). A more detailed presentation will be given by A. Falabella (INFN-CNAF) at the next ABP-CWG meeting.
- The cluster consists of 12 nodes equipped with 32 cores each. HyperThreading is enabled so 64 cores are visible for each machine.
- Access to the cluster can be requested by sending an email to abp-cwg-admin@cern.ch.
- Users should connect via ssh to bastion.cnaf.infn.it and from there access the cluster front-end called ui-hpc2.cr.cnaf.infn.it.
- The LSF system is installed on the cluster to manage job submissions. Our jobs should be submitted in the "hpc_acc" queue.

Discussion on needs for GPU resources

- Adrian reviewed the main activities in ABP that make use of GPU resources.
- Three main projects were identified:
  - The SixTrackLib code for the tracking studies (e.g. Dynamic Aperture in the presence of beam-beam and other machine non-linearities);
  - the beam-beam simulation tool used for FCC parameter scans;
  - the PyHEADTAIL code for macroparticle simulations of collective effects.
- For all these applications GPUs enable simulation scales that cannot easily be accessed with conventional CPUs. Unfortunately, present simulation campaigns are using computational resources that soon will not be anymore available for CERN studies, i.e. the INFN-CNAF GPU cluster, to which we were granted access only for testing purposes abd the NTNU cluster available to Sondre as NTNU student.
- The possibities of adding GPU cards to the some of the nores at INFN-CNAF cluster should be considered.
- In particular, an investment in the order of 50 kCHF would secure the resources to continue the ongoing studies and provide a platform for future development.

SIRE

S. Papadopoulou presented **SIRE**, a Monte Carlo code used for the simulation of Intra-Beam Scattering (IBS) and radiation effects. Slides are available here.

- The code allows dealing with arbitrary beam distributions, while existing analytic models for IBS assume Gaussian distribution.
- SIRE is written in C and can be compiled using the GNU compiler without any other pre-requisite.
- No parallelization strategy is implemented.
- The lattice can be imported from the MAD-X twiss file. Other properties of the simulation are specified through a parameter file.
- Particles are tracked from point to point by their invariants. At each point of the lattice the scattering routine is called, 6D coordinates of the macro-particles are generated and particles are grouped in cells. The IBS collisions between pairs of macro-particles are iteratively computed, then invariants of particles are recalculated to continue tracking. Radiation damping and excitation effects are evaluated at the end of every loop.
- For a typical case five particles per cell are needed to achieve convergence.
- Comparisons against the IBS module of MAD-X (analytic treatment) are used for code bench-marking as well as to optimize the number and location of IBS kicks .
- The possibility of simulating non-gaussian profiles has proved to be important to correctly model the beam evolution in the LHC.
- The performance is adequate to the present needs. Nevertheless it would be desirable to introduce other effect like collision scattering (for the LHC) and Tousheck effects.
- Presently allocated resources are sufficient for code maintenance, more would be needed to undertake serious developments.