T 16: GRID Computing / Experimentelle Methoden I

Zeit: Montag 16:00–18:30 Raum: Z6 - SR 2.006

T 16.1 Mo 16:00 Z6 - SR 2.006

Dynamic Integration and Scheduling of Opportunistic Resources — •Matthias Jochen Schnepf, Christoph Heidecker, Manuel Giffels, and Günter Quast — Karlsruhe Institute of Technology

The demand for computing resources in high energy physics (HEP) varies over time due to conferences and periods of data taking. To cover such peak loads the integration of opportunistic resources on-demand can be used. However, HEP software needs a specific software environment which is usually not provided by opportunistic resources. This makes it necessary to use container or virtualization technologies which provide the HEP software environment on opportunistic resources.

The CMS group at the Karlsruhe Institute of Technology developed the ROCED cloud scheduler to dynamically provision, integrate and manage opportunistic resources in combination with the HTCondor batch system and modern virtualization and container technologies. The transparent integration of opportunistic resources into a single batch system allows users to access thousands of additional CPU cores without resource specific customizations. However, it turned out that network limitations in conjunction with I/O intensive tasks can cause CPU inefficiencies on opportunistic sites. In order to reduce these inefficiencies, we currently working on a resource scheduling based on the available network bandwidth and the I/O demands of individual jobs. In this presentation, an overview of developed technologies, integrated resources and the status of I/O based job scheduling will be given.

T 16.2 Mo 16:15 Z6 - SR 2.006

VISPA: Multi-user access to deep learning infrastructure for physics research — •Ralf Florian von Cube, Martin Erdmann, Benjamin Fischer, Robert Fischer, Erik Geiser, Christian Glaser, Thorben Quast, Marcel Rieger, Felix Schlüter, and Martin Urban — III. Physikalisches Institut A, RWTH Aachen University

The VISPA (Visual Physics Analysis) platform enables access to remote resources for performing physics analyses through a modern web-browser. A set of common tools to meet the demands of most physics data analysts is provided such that local software installations by users are not needed.

Recently, the VISPA cluster was extended by GeForce GTX 1080 cards and software to develop deep neural networks was installed. This enables users to explore modern methods of machine learning in their data analyses.

Access to resources is managed by a permission system, and allows experiment specific permission on dedicated resources.

The setup was successfully used in university Bachelor and Master courses and workshops with 100 participants.

T 16.3 Mo 16:30 Z6 - SR 2.006

Systematic Uncertainties In Machine Learning Based Analyses — Raphael Friese, Günter Quast, Roger Wolf, Sebastian Wozniewski, and •Stefan Wunsch — Institut für Experimentelle Teilchenphysik, Karlsruher Institut für Technologie

During the last years, the field of machine learning became more and more important, also in high-level data analyses in particle physics. In the next years the published results of the LHC experiments will more and more rely on these methods. An essential part of such analyses is the proper estimation of the contributing uncertainties. On the other hand, up to date, profound studies of the effects of systematic uncertainties in the usage of modern machine learning methods are still missing. This talk proposes possible approaches to identify and propagate systematic uncertainties to the final result in machine learning based analyses.

T 16.4 Mo 16:45 Z6 - SR 2.006

Advantages of caching concepts for HEP analysis work-flows — •Christoph Heidecker, Matthias Schnepf, Max Fischer, Manuel Giffels, and Günter Quast — Karlsruher Institut für Technologie, Karlsruhe, Deutschland

Current experiments in High Energy Physics deliver tremendous amounts of data waiting for further processing. This leads to enormous challenges for the storing systems, but also for data distribution to end-users for further analyses. The situation is even compounded by the fact that HEP trends to utilize opportunistic resources as extension to common HEP computing facilities. For an efficient utilization of these resources an adequate data throughput of I/O intensive analyzes is essential. Data locality concepts that direct job to a processing unit holding necessary data in its local cache promise to solve those throughput limitations.

At KIT, two different caching concepts have been studied to enable short turn around cycles of I/O intensive analyses. Both concepts have been transparently integrated into the batch system HTCondor. The first approach utilizes coordinated caches on SSDs in the worker nodes and an HTCondor batch system that schedules jobs taking into account data locality. Another approach utilizes CEPH as a distributed file system acting as a system-wide cache. In combination with XRootD caching and data locality plug-ins, this approach is very well suited to tackle bandwidth limitations on opportunistic resources like HPC centers offering parallel file systems. In this talk, both caching concepts and the current development status are presented.

T 16.5 Mo 17:00 Z6 - SR 2.006

Integration of a heterogeneous compute resource in the ATLAS workflow — •Felix Bührer, Anton Gamel, and Markus Schumacher — Albert-Ludwigs-Universität Freiburg, Physikalisches Institut

High-Performance Computing (HPC) and other research cluster computing resources provided by universities can be useful supplements to the collaboration's own WLCG computing resources for data analysis and production of simulated event samples. The shared HPC cluster "NEMO" at the University of Freiburg has been made available to local ATLAS users through the provisioning of virtual machines incorporating the ATLAS software environment analogously to a WLCG center. In addition to the provisioning of the virtual enviroment, the talk describes the on-demand integration of these opportunistic resource into the Tier-3 scheduler in a dynamic way. Resources are scheduled using an intermediate layer monitoring requirements and requesting the needed resources.

The performance of the virtualized environment is evaluated. Recent developments on monitoring and work towards a more flexible scheduling of opportunistic resources, which are required due to the different requirements needed for various data analysis tasks are discussed.

T 16.6 Mo 17:15 Z6 - SR 2.006

Study of breakdown voltage from current-voltage characteristic of SiPM — •Ayesha Ali, Reimund Bayerlien, Ivor Fleck, Waleed Khalid, and Ulrich Werthenbach — University Siegen

Silicon photomultipliers (SiPM) have proven to be very attractive photon- detection devices with high detection efficiency down to single-photon resolution. The SiPM features high gain, low-voltage operation, insensitivity to magnetic field and excellent timing resolution. The SiPM has acquired a proven performance in medical imaging and high energy physics. One of the basic characteristic of a SiPM is the breakdown voltage. Its calculation allows us to set the over-voltage which is the key parameter controlling the operation and opto-electronic characteristics of the detector. Other important parameters for the characterization of SiPMs are gain, dark count rate, the recovery time of the pixels, the rise and fall times of the pulses and photon detection efficiency. They all are a function of the over-voltage. The current-voltage curve and breakdown voltage of a 4x4 channel SiPM array have been studied as a function of temperature. Thermal movement of lattice atoms and electrons causes the dark count rate. Cooling the material reduces the thermal movement. Therefore, the dark count rate declines with lower temperatures and the breakdown voltage shifts towards lower values. The results of these measurements will be presented in this talk.

T 16.7 Mo 17:30 Z6 - SR 2.006

Parameterization-based Tracking for the P2 experiment. — •Iurii Sorokin — Institut für Kernphysik Uni Mainz / PRISMA Cluster of Excellence

The P2 experiment in Mainz aims to determine the weak mixing angle θ_W at low momentum transfer by measuring the parity-violating asymmetry of elastic electronproton scattering. In order to achieve the intended precision of $\Delta \sin^2(\theta_W)/\sin^2(\theta_W) = 0.13\%$ within the planned 10 000 hours of running the experiment has to operate at the rate of 10^{11} detected electrons per second. Although it is not required to measure the kinematic parameters of each individual electron, every attempt is made to achieve the highest possible throughput in the track reconstruction chain.

In the present work a parameterization-based track reconstruction method is described. It is a variation of track following, where the results of the computation-heavy steps, namely the propagation of a track to the further detector plane, and the fitting, are pre-calculated, and expressed in terms of parametric analytic functions. This makes the algorithm extremely fast, and well-suited for an implementation on an FPGA.

The method also takes implicitly into account the actual phase space distribution of the tracks already at the stage of candidate construction. Compared to a simple algorithm, that does not use such information, this allows reducing the combinatorial background by many orders of magnitude, down to $O(1)$ background candidate per one signal track.

T 16.8 Mo 17:45 Z6 - SR 2.006

Bestimmung von Ausschlussgrenzen mit GammaCombo — Johannes Albrecht[1], Alexander Battig[1], Matthew W. Kenzie[2], •Titus Mombächer[1] und Stefanie Reichert[1] — [1]TU Dortmund — [2]University of Cambridge

Oft werden bei experimentellen Suchen nach seltenen Zerfällen keine Signalkandidaten beobachtet. Um dennoch Aussagen über die Vereinbarkeit der Messung mit theoretischen Modellen treffen zu können, müssen Ausschlussgrenzen bestimmt werden. Die verschiedenen dazu entwickelten statistischen Methoden sind für den Anwender oft kompliziert zu implementieren.

In diesem Vortrag wird die Verwendung verschiedener Methoden mithilfe des GammaCombo-Frameworks vorgestellt und anhand der Suchen nach den Zerfällen $B^0_{(s)} \to e^+e^-$ und $B^+ \to K^+e^\pm\mu^\mp$ mit dem LHCb-Experiment diskutiert und verglichen.

T 16.9 Mo 18:00 Z6 - SR 2.006

Momentum transfer reconstruction for the P2 Experiment — •Alexey Tyukin for the P2-Collaboration — Institute for nuclear physics, PRISMA, Johann-Joachim-Becher-Weg 45, 55128 Mainz

The P2 experiment at the future MESA accelerator in Mainz is designed to determine the weak mixing angle, a core parameter of the Standard Model, with great precision. It will require measuring the parity violating asymmetry of elastic electron-proton scattering. The asymmetry depends on the momentum transfer Q^2. Therefore a reconstruction of the electron tracks in the inhomogeneous magnetic field of the P2 detector is essential. For this, the detector will have four tracking planes of thin high voltage monolithic active pixel sensors (HV-MAPS).

This talk will cover the performance of the Q^2 reconstruction. A Geant4 simulation is used to produce realistic detector hit distributions. For track reconstruction the General Broken Lines fit is used, which requires particle track propagation in an inhomogeneous magnetic field using a Runge-Kutta method. During the stepwise propagation also the track parameter error matrix is calculated by the Bugge-Myrheim method. Systematical effects producing offsets in the resulting values have to be understood for proper Q^2 reconstruction. The average Q^2 value of $0.006\,\mathrm{GeV}^2/c^2$ can be reconstructed with about 4% uncertainty for a single event, leading to a high overall precision due to large electron rates of the experiment.

T 16.10 Mo 18:15 Z6 - SR 2.006

In-situ calibration of the single photo-electron charge distributions of the PMTs in IceCube — •Martin Rongen and Martin Leuermann for the IceCube-Collaboration — III. Physikalisches Institut B, RWTH Aachen University

The IceCube Neutrino Observatory instruments about 1 km^3 of deep, glacial ice at the geographic South Pole with 5160 photomultipliers (PMTs) to detect Cherenkov light of passing particles. As the arrival times and amplitudes of light at the PMTs are the only observables, a precise calibration of the PMTs characteristics is needed. Currently, one averaged single photo-electron (SPE) charge-distribution template obtained in the lab is used to describe the gain characteristic of all PMTs in the detector simulation. Having observed a median deviation of in-situ data from this template, as well as strong PMT-to-PMT fluctuations, the per-PMT charge distributions are now being calibrated. This is especially challenging due to the absence of a well-known, low-occupancy light source. In this talk, we present a convolution method to measure precise SPE charge distributions in the presence of high charge contamination.