

Postdoctoral Position and 3 PhD Positions within the CMS Experiment

Scientific Environment

The Institute of High Energy Physics (HEPHY) of the Austrian Academy of Sciences in Vienna, Austria, performs a rich experimental particle physics program participating in accelerator and non-accelerator based experiments. The institute has a major involvement in CMS at CERN and in the Belle / Belle II experiment at KEK. A new experimental group working on direct Dark Matter detection is currently built up. A theory group completes the research profile of the institute.

Involvement in CMS

The Institute of High Energy Physics is one of the founding members of the CMS Collaboration. We have been strongly involved in the design, construction and operation of two of the major components of the experiment: the trigger system and the tracking detector. Our experience in building silicon based detectors, the construction of FPGA based hardware and development of the appropriate firmware together with our expertise in reconstruction algorithms and its implementation in software allow us to play a leading role in the collaboration. Today we are again providing major contributions to the upgrade of both systems to prepare the CMS experiment for operation at the High Luminosity LHC. We are looking for students and a postdoc to join our team and work on the following projects:

Postdoctoral Position: *Development of new CMS Trigger Software*

The upgrade of a significant fraction of the Level-1 (L1) Trigger into a MicroTCA-based system will imply substantial changes to the software for configuring, monitoring and testing the system, as well as to the software for validating and analyzing the L1 event data. The goal of the L1 trigger software upgrade project is to fulfill similar functional (e.g. configure all the subsystems electronics) and non-functional (e.g. availability) requirements as the present system, whilst accommodating or taking advantage of the expected changes: 1) New hardware architecture (MicroTCA instead of VME); 2) Tenfold increase in FPGA capacity; 3) Increased accelerator luminosity and energy; 4) Increased algorithm complexity.

PhD Position: *Development of a Physics Object based Trigger Map*

As part of the Trigger Upgrade, the Level-1 Global Trigger will be redesigned and implemented in a more compact system using MicroTCA-based technology. As part of a PhD thesis a complete "trigger object map (TOP)" should be developed in firmware for the Virtex-7 family on a MicroTCA platform and the corresponding adjustment to the existing control software

should be made. The selection of the desired objects (electron/gamma, tau, jet), which should be done via the TOP architecture in an FPGA, is only possible by using complex trigger algorithms. It is important to find out which objects have triggered an event. This method should be implemented in a pipeline structure.

PhD Position: *Electronics Developments for the CMS Tracker*

New front-end readout ASICs are developed for the upgrade of the CMS Tracker, that also need corresponding electronics circuits at the back-end side which receives the data from the front-end, processes them and passes them on to a PC system. We are looking for a PhD student with a degree in electrical engineering or physics (with a dedication to electronics) who will develop the layout of silicon sensors that match the readout ASICs as well as design downstream readout circuits based on existing FPGA platforms and program the firmware using VHDL.

PhD Position: *Track Reconstruction with CMS*

The successful candidate will improve existing and explore new methods of track reconstruction and vertex finding that are able to cope with the high levels of event pile-up expected in the next data-taking period of CMS. The candidate will also participate in the upgrade activities of CMS, in particular the development of track finding and track trigger algorithms for the next-generation tracker. We expect experience with large software systems and OO programming techniques, as well as interest in algorithms for pattern recognition and statistical data analysis.

Additional Information

Supplementary Material to the positions advertised above can be found at <http://www.hephy.at/en/teaching/projects-theses/>. The remuneration follows the scheme of the Austrian Science Fund (FWF). The annual income ("Bruttojahresgehalt") for the PostDoc will be at least 47.765 € and for the PhD-Positions will be at least 27.381 €. The position will be located in Vienna and opened for a period of three years. The Postdoctoral position has the possibility of an extension. Under exceptional circumstances the PostDoc position could eventually lead to a permanent appointment.

Application

Applications should include a CV and a publication list. Applicants should arrange to have two recommendation letters. Recommendation letters as well as the application should be sent to Eveline Ess (Eveline.Ess@oeaw.ac.at). The deadline is Nov. 15th, 2013, but applications will be considered beyond this date until the position is filled. For further information please contact Jochen Schieck (Jochen.Schieck@oeaw.ac.at).