Zwischenbericht (Sachbericht)

Fördermaßnahme: Helmholtz-Hochschul-Nachwuchgruppe	
Förder-Nr.: HGF-VH-NG-502	Titel des Vorhabens: Supersymmetry at the Terascale
Federführender Wissenschaftler: Isabell-A. Melzer-Pellmann	
Berichtszeitraum: 05/2009 bis 03/2010	

Sachbericht (bitte möglichst max. 2 Seiten)

a) Fortschritt des im Antrag beschriebenen Arbeitsprogramms

SUSY Particle Search and Analysis

The SUSY analysis group of CMS has defined several "Reference Analyses" (RA). RA1 and RA2 contain analyses with hadronic final states, RA3 concentrates on photons and RA4 to RA7 are characterized by different numbers of leptons in the final state. Our group is working on RA4 (one lepton in the final state), RA5 and RA6 (two same-sign and opposite-sign leptons in the final state). So far, the postdoc has performed the RA5 analysis and all group members have contributed to the review of a large document about different data-driven background estimation methods for the RA4 analysis.
Just recently a "Lepton Commissioning Group" has been formed with the goal of establishing a closer connection to the leptonic working groups. One PhD student has joined this group to work on electron isolation and data-driven methods to determine the standard model background.

Data Quality Monitoring

Monitoring of the data quality based on physics variables is a very important tool to identify problems on a short timescale after data taking. As the signal of events with supersymmetric (SUSY) particles is expected to lie within the tails of the investigated distributions (of variables like e.g. the transverse energy), it is essential to have clean events.

At CMS exists a team of core developers, responible to provide a framework for the monitoring software of the different detector components and physics groups. One PhD student (who started in February 2010) joined this group for his technical year. He is currently involved in the process of verification of new software versions.

In addition, the SUSY group has set up a small team to monitor physics variables which are important for SUSY specific analyses. One PhD student (who started in October 2009) and one postdoc (working part-time on this project, mainly as supervisor of the PhD student) are members of this group. The work of this group has been summarized in an analysis note which was put into a physics analysis summary of the JetMET group [4].

Studies for the Upgrade of the Hadron Calorimeter

For the Phase I upgrade of the CMS detector upgrade, a finer segmentation for the hadron calorimeter is foreseen. This offers the possibility to enhance the energy resolution and linearity by applying a software based energy weighting. One PhD student worked within the last year on simulation studies to investigate this topic. Tabulated weighting factors are used to compensate for the different response to hadronic and electromagnetic energy depositions of pion showers. Different readout

schemes (still under discussion within CMS) are investigated in order to find the optimal configuration for the planned detector upgrade. In addition to several talks at CMS upgrade meetings and an internal note summarizing the results, a poster was presented at an international conference (including proceedings for this conference) [1,2] and a talk was given in a workshop on Silikon photo multipliers [3].

CMS Center at DESY

Recently, the postdoc has taken responsibility for the CMS Center, including the organisation of official CMS shifts (offline data quality monitoring, one shift per day).

b) Erreichte Meilensteine

- Development of data quality monitoring tools for SUSY specific variables
- Studies for the upgrade of the hadron calorimeter
- Responsibility for the DESY CMS Center

c) Einhaltung des Finanzierungs- und Zeitplans

Personnel:

Postdocs:

- Dirk Krücker (started 01.06.2009) – paid by DESY
- (2^{nd} position still open due to problems with 2^{nd} candidate and difficulties in finding other excellent candidates – now in the process of application interviews)

PhD Students:

- Matthias Stein (started 01.12.2008) – paid by DESY, no official group member, but supervised by the group leader
- Hannes Schettler (started 01.10.2009) – paid by Hamburg University
- Niklas Pietsch (started 01.02. 2010) – paid by Hamburg University

The status of the personal expenses follows the original financial plan of the proposal with corrections for the later employment of the personnel. The money which was not used yet due to lack of a 2nd postdoc will be used for another PhD position.

Investments

The investments of the group are in accordance to the proposal, including the computing equipment of the group with 3 laptops for 3 group members.

Additional expenses

The travel expenses are in accordance to the proposal, mainly due to visits to CERN and conference participation. The travel expenses of the two PhD students are paid by the Hamburg University.

d) Publikationen, Vorträge, Preise etc. bitte gegebenenfalls als Anhang beifügen

[1] Poster at the international conference “Lepton Photon 2009” (approved by CMS): Studies with an Energy Weighting Method for the Upgrade of the Hadronic Barrel Calorimeter of CMS;

[2] Proceedings of the international conference “Lepton Photon 2009” (approved by CMS as CR-2010/028):
Studies with an Energy Weighting Method for the Upgrade of the Hadronic Barrel Calorimeter of CMS;

[3] Talk at the “SiPM workshop” at DESY 2010:

[4] CMS Physics Analysis Summary PAS JME-10-002: Performance of Missing Transverse Energy in 900 and 2360 GeV pp Collision Data.