

Zwischenbericht (Sachbericht)

Fördermaßnahme: Helmholtz-Hochschul-Nachwuchsguppe	
Förder-Nr.: HGF-VH-NG-502	Titel des Vorhabens: Supersymmetry at the Terascale
Federführender Wissenschaftler: Isabell-A. Melzer-Pellmann	
Berichtszeitraum: 04/2010 bis 03/2011	

Sachbericht (bitte möglichst max. 2 Seiten)

a) Fortschritt des im Antrag beschriebenen Arbeitsprogramms

Search for Supersymmetry (SUSY) – Data 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. After contributing to the synchronisation effort of the RA4 subgroup (one lepton in the final state) by performing crosschecks, the group now concentrates on RA5 and RA6 (two same-sign and opposite-sign leptons in the final state). So far, two students have redone the RA5 analysis exploiting the 2010 data. Two postdocs also follow this analysis. One student works on the RA6 analysis: he has been developing a new method to determine a possible signal over the Standard Model background. One postdoc follows this analysis. The RA3 and RA6 groups have already published papers [2,3]. One postdoc has implemented theoretical models into our experiment's software. The events he simulated are already being analysed by other groups within CMS.

Data Quality Monitoring

Monitoring of the data quality based on physics variables is a very important tool to identify problems on a short time scale after data taking. As the signal of events with SUSY particles is expected to lie within the tails of the investigated distributions (of variables like e.g. the missing transverse energy), it is essential to have clean events, which are not affected by any possible technical problems, errors etc.

At CMS a team of core developers provides a software framework for the monitoring of different detector components and physics objects. One PhD student worked within this group during his technical year. After finishing his technical year, a new student within our group took over his responsibilities.

In addition, a small team within the SUSY group monitored physics variables which are important for SUSY specific analyses in 2010. One PhD student and one postdoc (working part-time on this project) were members of this group. In 2011, this group will not continue but the two approaches will be combined. For this purpose, new code has to be developed to transfer the gained experience into the existing DQM software framework. Our group took the responsibility to develop this code with one PhD student and one postdoc (mainly as supervisor).

Studies for the Upgrade of the Hadron Calorimeter

During the long shutdown in 2013, the photo detectors of the outer part of the HCAL (HO) will be replaced by Silicon photomultipliers (SiPM). One postdoc has taken responsibility for developing the new HCAL simulation within the CMS software.

The inner barrel ring (Ring 0) of the HO will be equipped with SiPMs bought by DESY (through Landesexcellence). As these SiPM have to be tested, one PhD student of our group builds up a test stand and will work on tests of the SiPMs during his technical year. He works with a DESY fellow who is also supervising this work.

CMS Center at DESY

One postdoc is responsible 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
- Set-up and maintenance of a structure for efficient data analysis for SUSY searches
- Advanced status of several SUSY analyses

c) Einhaltung des Finanzierungs- und Zeitplans

Personnel:

Postdocs:

- Dirk Krücker (started 01.06.2009) – paid by DESY (YIG)
- Altan Çakir (started 16.08.2010) – paid by DESY (YIG)
- Elias Ron (started 15.02.2011) – regular DESY fellow who decided to join the group

PhD Students:

- Matthias Stein (started 01.12.2008) – paid by DESY
- Hannes Schettler (started 01.10.2009) – paid by Hamburg University
- Niklas Pietsch (started 01.02. 2010) – paid by Hamburg University
- Jakob Salfeld-Nebgen (started 01.09.2010) – paid by DESY (YIG)
- Francesco Costanza (started 01.01.2011) – paid by DESY

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 last year due to lack of a 2nd postdoc, is now used for another PhD position (Jakob Salfeld-Nebgen).

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 to CERN of the two PhD students (who are paid by the Hamburg University) are covered by the Hamburg University.

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

- [1] I-A. Melzer-Pellmann, „Performing a SUSY Analysis“, invited talk at the PreSUSY10 (School before the SUSY10 Conference), 19-21.08.2010, Bonn;
- [2] CMS Collaboration, „Search for Physics Beyond the Standard Model in Opposite-sign Dilepton Events in pp Collisions at $s = 7$ TeV“, CERN-PH-EP-2011-016 (contribution of the YIG by cross-checking the analysis);
- [3] CMS Collaboration, „A Search for Supersymmetry in pp Collisions at 7 TeV Using Events with Two Photons and Large Missing Transverse Energy“, CERN-PH-EP-2011-007 (contribution by the YIG by participation in the review of the paper).