Themenvorschläge für Bachelor- und Masterarbeiten am CERN

Topics for Bachelor and Master Theses at CERN

Groups C. Amsler & V. Chiochia

1. Search for the Higgs Bosons (CMS experiment).
   This thesis would be a contribution to the ongoing analysis projects in our group. CMS will collect a few fb^{-1} of data in 2011/2012, thus allowing searches for the Higgs boson (SM- and MSSM-Higgs). A possible thesis project (i) would be the search for Z^0 decaying into $\mu^+\mu^-$, associated with the production of a $b\bar{b}$ pair in pp collisions at 7 TeV. This work is directly applicable to H- and A-Higgs searches in the channel $pp \to HX \to A(\to b\bar{b})\ Z^0(\to \mu^+\mu^-)X$. Another possible thesis project (ii) would be a search for the emission of a charged Higgs and a neutral Higgs, each leading to pairs of b-quarks associated with the emission of a $W^\pm$ and a Z^0.

   Masterthesis, data analysis (mainly for project (i)) or Monte-Carlo simulation (mainly for project (ii)), superviser: Dr. S. de Visscher

2. Scintillating optical fibers at low temperatures (AEgIS antigravitation project).
   The AEgIS experiment will measure the gravitational acceleration of antihydrogen and check with an accuracy of about 2% whether antimatter also falls with g = 9.81 m·s^{-2}. To measure the size of the antiproton cloud and the properties of the antihydrogen beam we are building a scintillation fiber detector operating at low temperature (4K) to detect the annihilation products (mainly pions) and to reconstruct the annihilation points. In this thesis one would participate in the assembly (e.g. connections to multipixel solid state photon counters) and commissioning of the detector.

   Bachelor- or Masterthesis, hardware (detector development), superviser: Dr. C. Canali oder Dr. J. Storey

3. Scintillation from liquid argon at very low energies (DARWIN dark matter project).
   Dark matter particles (WIMPs) from the sky could be detected by measuring the scintillation light produced by recoiling argon nuclei in a liquid argon target. The collision rate increases exponentially with decreasing recoil energy, and hence good sensitivity at low energy is essential. In this thesis one would measure and calibrate the scintillation light from a small liquid argon cell using radioactive sources such as a krypton source emitting 9.2 keV photons, an iron source emitting 5.9 keV photons, and our generator of monochromatic (2.5 MeV) neutrons based on dd fusion ($dd \to He^3n$).

   Bachelor- or Masterthesis, measurement and data analysis, superviser: Dr. C. Regenfus