COMPASS 2005–201x

COMPASS has a rich programme of Hadron Structure and Spectroscopy as laid out in the proposal. The original programme was set out for about 5 years of running at 150 days/year and e.g. with $2 \cdot 10^8$ muons every 14.4 s equivalent to about 10^{19} protons/year. Already in the proposal it was pointed out, that these period would only cover an initial round of experiments. If everything goes perfectly well in 2004 we will have had an equivalent beam time of about 1.5 proposal years, leaving the major part of the programme still to be performed.

Our prime incentive is to complete the original physics programme focusing first towards obtaining the accuracy claimed in the proposal on gluon polarization. Up to now, no data were taken with muon beam and a proton target. For the flavour separation of both, the longitudinal and transverse parton distribution functions, it is indispensable to analyse both, neutron (deuteron) and proton data. The transversity experiments will largely benefit from the new polarised target magnet, which will be tested toward the end of this year. The hadron programme of COMPASS has not yet started and there will be certainly a focus on this physics after 2005. Here the major interest is in glueball and exotics search. The establishing of their spectra would have a major impact on the understanding of non-perturbative QCD. This is in particular of interest in the context of improved predictive power of the lattice calculations already now but even more so in the time range of interest for Cogne. Key to many of these measurements is the electromagnetic calorimetry. COMPASS has constructed the huge frame of ECAL1 and the instrument should be operational with pipelined read-out from 2006. In the longer range an enlarged ECAL2 and a second RICH detector are planned pushing the pion/kaon separation toward 100 GeV. Another part of the programme aims at studying the decay mechanisms of charmed mesons and baryons. Further in the future we would like to search for doubly charmed baryons. This programme would need the full power of the DAQ system with trigger rates up to 100 kHz followed by a powerful software trigger. Given the recent SELEX results, which indicate a much larger cross section than anticipated, first results could be obtained earlier.

The understanding of the internal structure of the nucleon relied for many years on two distinct observables: the elastic form factors providing the spatial distributions of matter and the parton distributions yielding the momentum space distributions. Now new observables, the Generalised Parton Distributions (GPDs) seem very promising as they allow us to study the correlated quark motion in the spatial and momentum spaces. Moreover the GPDs will help to unravel the nucleon spin puzzle since they allow, through a sum rule, a determination of the total angular momentum contribution of the quarks to the nucleon spin. Experimentally the GPDs can be accessed in exclusive processes such as Hard Exclusive Meson Production and Deeply Virtual Compton Scattering (DVCS) ($\ell\,\mathrm{p} \to \ell\,\mathrm{p}\,\gamma$). We propose to use the high energy muon beam at CERN to study these reactions during 2 extra years after the present COMPASS programme is achieved. Most promising is a measurement of the DVCS Beam Charge Asymmetry using μ^+ and μ^- beams of 100 GeV and a long liquid hydrogen target together with the COMPASS spectrometer, additional EM calorimetry and recoil detector. A first test of the concept was already performed in the COMPASS environment in 2002. European funding is provided to build a prototype recoil detector.

A central point is the availability of beam time and flux after 2005. With the present proposal by the AB department for the machine cycle to accommodate the CNGS neutrino beam and the filling of LHC only a SPS operation over the full year could provide the beams needed for most of the programme outlined above.