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Polarised Drell-Yan measurements at COMPASS-II

The spin structure of the nucleon including the Parton Distribution Functions (PDFs) is an important subject studied by the COMPASS experiment at CERN (SPS). The transverse momentum dependent parton distribution functions (TMD PDFs) of the proton and deuteron from Semi-Inclusive Deep Inelastic Scattering (SIDIS) have been studied so far. The Drell-Yan (DY) process is a complementary way to access the TMD PDFs, using a transversely polarised target. Studying the angular distributions of di-muons from the DY events produced in the scattering

of 190 GeV/c momentum negative pion beam off a transversely polarised proton target (NH₃) we are able to extract the azimuthal spin asymmetries, each containing a convolution of two PDFs, one from the target quark and one from the beam anti-quark. Disentangling the contributions from these two PDFs we can access four of the eight TMD PDFs needed to describe the nucleon structure at leading order QCD, like the Sivers and the Boer-Mulders functions. The opportunity to study, in the same experiment, the TMD PDFs from both SIDIS and DY processes is unique at COMPASS. Important QCD prediction - the expected sign change in Sivers and Boer-Mulders functions when accessed by DY and SIDIS - will be checked [1,2].

The COMPASS II Proposal [3] was approved by CERN for a first period of three years including one year for polarised DY; the beginning of the DY data taking with the proton target is scheduled for 2014 and it can be resumed for one more year after 2017. The feasibility of the measurement was proven by several beam tests done so far. One of the major goals of the COMPASS-II experiment is to perform the first ever polarised DY experiment.

References

1. J.C. Collins, Phys. Lett. B536, 43 (2002)
2. J.C. Collins, talk at LIGHT CONE 2008 Relativistic Nuclear and Particle Physics Workshop, July 7-11, 2008 Mulhouse, France
3. COMPASS Coll., "COMPASS-II proposal", CERN-SPSC-2010-014, SPSCP-340, 17 May 2010

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