

CERN-2004-011
22 November 2004
Physics Department

ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
CERN EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

WORKSHOP ON FUTURE PHYSICS @ COMPASS

CERN, Geneva, Switzerland
26–27 September 2002

PROCEEDINGS

Editors: F. Bradamante, G. Mallot
and S. Paul

GENEVA
2004

Abstract

These Proceedings summarize the contributions to the Workshop Future Physics at COMPASS, dedicated to the NA58 experiment at CERN. The COMPASS Experiment (COMmon Muon and Proton Apparatus for Structure and Spectroscopy) comprises a deep inelastic scattering programme with muons and spectroscopy programme with hadron beams. The workshop focused on the latter programme, which has not yet started. The status of the experiment is outlined and future options for the muon programme are discussed at the end.



Future Physics @ COMPASS

CERN, September 26-27 2002



Scientific Advisory Committee

- G. Altarelli (CERN)
- F. Bradamante (Trieste)
- C. Detraz (CERN)
- M. Faessler (München)
- J. Felisse (CERN)
- S. Forte (Roma)
- M. Garcon (Saclay)
- W. Kühn (Giessen)
- E. Leader (London)
- E. Klempf (Bonn)
- A. Magnon (Saclay)
- G. Mallot (CERN)
- V. Mijat (Giessen)
- V. Obraztsov (Protvino)
- A. Olchevski (Dubna)
- A. Palano (Bari)
- S. Paul (München)

Nucleon Spin Structure

Transversity

DVCS

γ PT Tests

Exotics and Glueballs

Double Charmed Baryons



Local Organizing Committee

- F. Bradamante (Trieste)
- C. Detraz (CERN)
- F. Kunne (Saclay)
- M. Lamanna (CERN)
- G. Mallot (CERN)
- S. Paul (München)

<http://compass-cw2002.web.cern.ch/compass-cw2002/>

<http://compass-cw2002.web.cern.ch>

Preface

Five years after approval the COMPASS experiment started to take first data in 2001. The main objectives of the first years of data taking (until the shutdown in 2005) are the study of nucleon spin structure using deep-inelastic scattering of muons. The **gluon spin structure** will be investigated using open charm production on a polarized target as well as the production of hadrons produced at large transverse momenta. The flavour-decomposed **quark spin structure** on the other hand is studied by the analysis of the leading hadron flavour in such processes. In addition to the longitudinal spin structure COMPASS also investigates **transverse quark spin** structures using a transversely polarized target. These studies will give significant and important results in the first running periods for the COMPASS experiment, which are being pursued with a reduced setup compared to that of the original proposal. Owing to the significantly shorter running times than originally envisaged, these measurements will not, however, allow the precision originally proposed to be achieved and thus will be continued in later years.

In addition to the above-mentioned measurements, the approved COMPASS physics programme contains detailed studies of light hadronic states (glueballs, exotic mesons) in different production processes, the study of chiral perturbation theory by soft scattering processes, as well as charmed hadrons. For this purpose the COMPASS detector should be completed.

In the recent medium-term planning the CERN management expressed its strong interest towards a continuation of the COMPASS physics programme well beyond the shutdown in 2005, namely covering the period 2006–2010. The basis of the continuation is a very convincing physics programme based on the original COMPASS proposal. As this document dates back eight years, the CERN management (represented by the director of research C. Detraz) proposed to hold a workshop on Future Physics @ COMPASS and offered to host such a workshop at CERN. The purpose of this workshop was to review the physics programme outlined in the proposal and to possibly complement it by new ideas. It is in this spirit that the COMPASS group organized this discussion, which took place at CERN in September 2002.

The workshop was divided into several sections first outlining the present status of the experiment (both on hardware and analysis issues) and then the experiment framework for future measurements. These measurements focus on the study of hadronic systems using various hadron beams and which may only be addressed very briefly in the present running period. **New input** came from the consideration of photoproduction of exotics, thereby complementing efforts undertaken at JLAB for doubly charmed baryon studies thanks to recent measurements by the SELEX experiment at FNAL. In addition the field of deep-inelastic scattering has more recently been widely opened by theory by the developments of so-called generalized parton distributions allowing nucleon structure to be completely mapped, a project maybe as ambitious as the human genome project.

The organizers of this workshop are much indebted to their colleagues from COMPASS and to CERN in particular, which gave much help in the organization of this workshop. Last but not least we thank the members of the Scientific Advisory Committee and the Local Organizing Committee who prepared a very friendly and fruitful atmosphere.

Scientific Advisory Committee

G. Altarelli (CERN)
F. Bradamante (Trieste)
C. Détraz (CERN)
M. Faessler (München)
J. Feltesse (CERN)
S. Forte (Rome)
M. Garçon (Saclay)
W. Kühn (Giessen)
E. Leader (London)
E. Klempt (Bonn)
A. Magnon (Saclay)
G. Mallot (CERN)
V. Metag (Giessen)
V. Obraztsov (Protvino)
A. Olchevski (Dubna)
A. Palano (Bari)
S. Paul (München)

Local Organizing Committee

F. Bradamante (Trieste)
C. Détraz (CERN)
F. Kunne (Saclay)
M. Lamanna (CERN)
G. Mallot (CERN)
S. Paul (München)

Contents

Preface		v
Scientific Advisory Committee		vi
Local Organazing Committee		vi
S. Dalla Torre <i>INFN-Trieste</i>	The COMPASS Spectrometer: Status and Performance	1
A. Magnon <i>CEA-Saclay</i>	Prospects for the COMPASS ‘Muon’ Programme	26
S. Godfrey <i>Carleton Univ.</i>	The Phenomenology of Glueball and Hybrid Mesons	32
C. McNeile <i>Liverpool Univ.</i>	Exotics and Glueballs on the Lattice	44
W. Dünnweber <i>Univ. München</i>	Experimental Status of Exotics	53
S. Donskov <i>IHEP Protvino</i>	Central Production of Exotics	61
V. Dorofeev <i>IHEP Protvino</i>	Simulation of the $\eta\pi^-$ Diffractive Production and Detection at COMPASS	68
M. Moinester <i>Tel Aviv Univ.</i>	Hybrid Meson Production via Pion Scattering from Nuclear Coulomb Field	77
P. Cooper <i>FNAL</i>	Doubly Charmed Baryons	88
J.-M. Richard <i>ISN-Grenoble</i>	Double Charm Physics	90
L. Schmitt <i>et al.</i> <i>TU München</i>	Doubly Charmed Baryons in Compass	100

J. Gasser <i>Univ. Bern</i>	Recent Calculations in Chiral Perturbation Theory	113
M. Colantoni et al. <i>Univ. Torino-INFN</i>	Measurements of π and K Polarizability @ COMPASS	121
M. Anselmino <i>Univ. Torino-INFN</i>	Transversity and Λ Polarization	130
A. Kotzinian <i>Phys. Inst. Yerevan & JINR</i>	Λ Production in COMPASS	137
M. Diehl <i>RWTH Aachen</i>	Introduction to Generalized Parton Distributions	146
N. d'Hose et al. <i>CEA-Saclay</i>	Possible Measurements of GPDs at COMPASS	152
List of Participants		165