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1 Curriculum Vitae

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  - Name: Marcin Stolarski
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- **Education**
  - September 1993 - June 1997 Stefan Czarnecki Secondary School, Warsaw
    certificate: Matura (with award)
  - October 1997 - June 2002 Warsaw University
    Degree: Master of Science in Physics (with award) Title of Diploma thesis: "Study of multi-body decays of D^0 mesons in COMPASS Experiment at CERN" (in polish), supervisor prof. dr hab. Barbara Badelek

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- October 2002 - June 2006 PhD studies, Institute of Experimental Physics, Warsaw University Department of High Energy Physics. Title of PhD thesis: "Spin structure of the nucleon in low x and Q^2 range in COMPASS experiment at CERN"; supervisor prof. dr hab. Barbara Badelek

- **Employment**
  - July 2006 - December 2006
    short term contract worker
    Faculty of Physics, Warsaw University, Poland
    worked at CERN in COMPASS experiment
  - February 2007- September 2007
    Research Associate
    Physics Institute, Freiburg University, Germany
    worked at CERN in COMPASS experiment
  - October 2007- March 2010
    Fellow Associate
    CERN, Switzerland
  - April 2010 - March 2016
    Postdoc, grant from FCT the Portuguese Science Foundation working at LIP, the main Portuguese centre for particle physics. I worked mostly in COMPASS but also started related phenomenological studies.
  - April 2016 - present
    Postdoc, grant from LIP, the main Portuguese centre for particle physics.

2 Scientific Achievements

- My main scientific interest is the study of the spin structure of the nucleon. Most of my scientific work was connected with the COMPASS Collaboration. The COMPASS experiment for a long time was the only DIS experiment in the world taking data. Besides the collider experiments at RHIC, COMPASS is at the moment the only place which pursues a variety of nucleon spin studies. I am also interested in statistics and its application in physics as well as in new/novel methods of data analysis.

- I am author of one paper and co-author of 51 papers published in international peer review journals, with over 1900 citations in total according to Web of Science. The list of the 10 most important publication is given in section 2.1.

- I am a main author of 10 conference proceedings and 15 oral presentations at international conferences related to high energy particle physics. Out of these 15 talks, 5 were invited ones. I am co-author of 12 COMPASS internal notes and gave more than 60 talks at COMPASS analysis and collaboration meetings.

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- I have taken technical, analysis, and coordination responsibilities in the COMPASS collaboration.
  - I was solely responsible for the alignment of the COMPASS spectrometer in 2003-2004, co-responsible for the maintenance of front-end electronics 2006-2007, and of a set of drift detectors in 2008-2009.
  - I was deputy analysis coordinator of COMPASS in 2007.
  - I was analysis coordinator of COMPASS in 2009, coordinating the analysis efforts of the whole collaboration for a one year mandate.
  - In 2013-2017 I was a member of the COMPASS publications committee, a seven-members body responsible for the supervision of all scientific materials (publications, proceedings, transparencies) related to the experiment.

  More details concerning my work at COMPASS are given in section 2.2.
- Since June 2017 I'm also a member of ATLAS Collaboration at CERN.
- I was supporting supervisor of MSc Adam Szabelski (2013-2016), a PhD student from National Centre for Nuclear Studies, Warsaw, working on the measurement of Sivers asymmetry for gluons based on data of COMPASS.
- I was three times member of the organisation committee of the International Workshop of Hadron Structure and Spectroscopy. I was convener of the spin session in the XXI International Workshop on Deep-Inelastic Scattering and Related Subjects.

2.1 List of the 10 most relevant publications:

- COMPASS Collaboration, *"Leading-order determination of the gluon polarisation from semi-inclusive deep inelastic scattering data"* Eur. Phys. J. C 77 (2017) 209 (4 citations) Currently the world most precise direct measurement of the gluon polarisation in the nucleon, extracted at Leading Order (LO) pQCD. I had the leading role in the project and I'm the corresponding author of the paper. More details concerning this work is described in monograph *"Direct Measurement of the Gluon Polarisation in the Nucleon Using the All-p_T Method at the COMPASS Experiment at CERN"* published by Wydawnictwa Universytetu Warszawskiego in July 2017.
- COMPASS Collaboration, *"Leading order determination of the gluon polarisation from DIS events with high-p_T hadron pairs"* Phys. Lett. B 718 (2013) 922 (26 citations) Until 2017 the world's most precise direct measurements of the gluon polarisation in the nucleon, extracted at LO pQCD. For the first time the gluon polarisation was obtained in three bins of the nucleon momentum fraction carried by gluons. I had the leading role in the project. I developed the method of Neural Network (NN) used in the analysis, and coordinated the research group that included two PhD students.

- COMPASS Collaboration, *"Leading and Next-to-Leading Order Gluon Polarisation in the Nucleon and Longitudinal Double Spin Asymmetries from Open Charm Muoproduction"*, Phys. Rev. D 87 (2013) 052018 (24 citations)

  It is the first world extraction of the gluon polarisation in NLO pQCD from direct measurements. I was co-author of the method of NN application in the analysis, and performed studies of systematics.

- M. Stolarski, Comment on *"Reevaluation of the parton distribution of strange quarks in the nucleon"* Phys. Rev. D 92, (2015) 098101. (3 citations)

  The strange quark density in the nucleon is not well known. In addition in the spin sector the so called "strange quark polarisation puzzle" still remains unsolved. Therefore, I was very interested in the HERMES results presented in PLB 446, 666, claiming that the strange quark distribution has a very different shape from the non-strange sea, which was not expected. This observation was later confirmed by their newest paper Phys. Rev. D 92, (2015) 098101. I have decided to write a comment about these results where I gave several examples on why in my opinion the conclusions reached in the commented work are premature. One should add that more recent COMPASS analyses, in which I was quite involved, *Phys. Lett. B* 764 (2017) 1 and *Phys. Lett. B* 767 (2017) 133, also contradict the HERMES claim.

- COMPASS Collaboration, "Multiplicities of charged kaons from deep-inelastic muon scattering off an isoscalar target", Phys. Lett. B 767 (2017) 133

  These are precise measurements of kaon multiplicities obtained in semi-inclusive analysis of deep-inelastic muon scattering off a deuteron target. These measurements play a major role in the extraction of quark fragmentation functions in global Next-to-Leading order QCD fits. One should stress that the here obtained multiplicities are inconsistent with a previous experimental extraction from HERMES.

- COMPASS Collaboration, *"Spin asymmetry A_1^d and the spin-dependent structure function g_1^d of the deuteron at low values of x and Q^2"*, Phys. Lett. B 647 (2007) 330 (28 citations). The author's PhD thesis was the base for this paper. The obtained results of g_1 at low x and low Q^2 have 10–20 times better statistical and systematical errors than any previous measurement.

- COMPASS Collaboration, *"Quark Helicity Distributions from Longitudinal Spin Asymmetries in Muon-Proton and Muon-Deuteron Scattering"* Phys. Lett. B 693 (2010) 227 (94 citations);

  "The spin-dependent structure function of the proton g_1^p and a Test of the Bjorken Sum Rule" Phys. Lett. B 690 (2010) 466 (82 citations); *"The Deuteron Spin-dependent Structure Function g_1^d and its First Moment"*, Phys. Lett. B 647 (2007) 8 (200 citations)

  These are important papers concerning the quark polarisation in the nucleon. The author is a member of the sub-group, which shared responsibilities to coordinate and perform the analyses.

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- COMPASS Collaboration, *"Measurement of the Collins and Sivers asymmetries on transversely polarised protons"*, Phys. Lett. B 692 (2010) 240 (120 citations);

  The are crucial COMPASS measurements concerning transverse spin effects for quarks in the nucleon. The author was co-supervisor of a PhD student who was measuring transverse effects for gluons. The PhD thesis was defended in June 2016. The relevant paper was accepted for publication in Phys. Lett B.

2.2 Scientific Achievements in the context of my participation in the COMPASS Collaboration

I am a member of COMPASS since 2001, a Collaboration of about 200 physicists from 12 countries. COMPASS is a high-energy physics experiment at the Super Proton Synchrotron at CERN, Switzerland. The purpose of this experiment is the study of the spin structure of the nucleon and of hadron spectroscopy using high intensity muon and hadron beams.

- During 2001-2002 I studied in Monte Carlo generator a multi-body decay channel of D^0 mesons in view of the gluon polarisation extraction in the COMPASS experiment. The outcome of this study was that the channel would contribute up to about 10% to the figure of merit. In later years this channel was included in the analysis of gluon polarisation from open charm events in the PhD thesis of C. Franco (2011) from LIP, and followed by a COMPASS publication.
- In years 2003-2004 I was solely responsible for the difficult task of the software alignment of the COMPASS spectrometer. To fulfil this task I have spent in total 14 months at CERN. I became an expert in this field and in later years a few times I was teaching and advising younger colleagues who were responsible for the alignment.
- Between 2004 and 2006 I analysed the spin structure of the deuteron at low x and low Q^2 in a transition region between photo-production and the regime where perturbative QCD is no longer applicable. The measured double longitudinal spin asymmetry in deuteron was found to be consistent with zero. These studies were summarised in an aforementioned PhD thesis, and also published in Phys. Lett. B 647 (2007) 330. Currently, this analysis using data from proton target is the topic of the PhD thesis of A. S. Nunes from LIP institute. I unofficially help to supervise this analysis. Contrary to the deuteron case a positive asymmetry is observed for the proton target. These results were shown several times at recent international conferences and a COMPASS paper is in preparation.
- After finishing my PhD thesis, I came to CERN for the next 4 years to work directly on site at the experiment. In the year of 2006 I was co-responsible for the COMPASS front-end electronics maintenance. I was also performing online data quality studies (2006/2007). These studies proved to be important, namely when in the course of 2006 Run, they allowed to identify a loss of up to 50% of events in the region

crucial to one of the analyses, due to a modification introduced in the COMPASS setup. The problem in the apparatus was corrected for next years data-takings. In 2007 I was involved in the early stages of MC simulation for the future Generalised Parton Distribution measurement in COMPASS-II. The measurement is presently being performed, in this and next years. Also in 2007 I became deputy analysis coordinator of the COMPASS experiment.

- I was a CERN fellow in 2008/2009, responsible for the maintenance of the small angle spectrometer drift chambers system in COMPASS. This experience together with my previous work with front-end electronics gave me some knowledge on the more technical aspects of the experiment.
- In the same period I joined the gluon polarisation analysis group. The study of the gluon polarisation became the main topic of my research for the next years. In this context I developed an improved method of Neural Network usage for this type of analyses, which allowed event-by-event weighting, resulting in a large improvement of figure of merit. Namely, the statistical uncertainties were reduced by a factor of 3 with respect to the previously used method. These studies resulted in one paper already published and another one sent to publication. They were as well the topic of two COMPASS PhD theses. In later years I developed a novel method of gluon polarisation extraction taking advantage from previous developments of Neural Networks. With this method further reduction of the statistical and also the systematic uncertainties was achieved, by a factor more than 1.5 . As main conclusion of these studies, there is an indication (close to 3 sigma) of positive gluon polarisation in the nucleon. This observation is in line with the recently seen positive gluon polarisation at RHIC, USA. The latter results from indirect extraction via QCD fits of (difficult to interpret) *pp* collision measurements.
- The results of my work on the gluon polarisation in the nucleon are the subject of the monograph **"Direct Measurement of the Gluon Polarisation in the Nucleon Using the All-p_T Method at the COMPASS Experiment at CERN** " It is my DSc thesis, but it will be also helpful to anybody trying to perform such type of analysis in COMPASS or another experiment.
- The method developed for the gluon polarisation studies was also used in a study of the gluon Sivers effect by the PhD student A. Szabelski (from NCBJ, Poland), of which I was an official supporting supervisor.
- At the beginning of 2009 I became the youngest analysis coordinator of the COMPASS experiment, obtaining unanimous support from the COMPASS group leaders board. The analysis group comprised more than 20 diploma and PhD students and similar number of researchers organised in various physics subgroups. The one year term as analysis coordinator was coincident with my second year as CERN fellow.
- Starting my post-doctoral grant at LIP Lisbon in 2010, besides the gluon polarisation studies I was also involved in studies of hadron multiplicities in DIS reactions. These are important input to the so called fragmentation functions. In general,

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good agreement is found between COMPASS pion multiplicities and existing fragmentation function fits, but clear discrepancies are observed for kaons. In addition, in both cases there is a visible tension with the HERMES experiment results, the only other DIS experiment which studied pion and kaon fragmentation functions, although in a different kinematic region. These discrepancies lead me to start in 2014 a Next-to-Leading order analysis of fragmentation functions in view of future global fits, as well as to write a comment paper about the results of the HERMES experiment (published as PRD 92 (2015) 098101).

- I participated in almost all (10 out of 11) data taking periods of the COMPASS experiment. I also served six times as weekly coordinator during data taking by the experiment.
- Between 2013-2017 I was a member of the Publications Committee, a seven members body of the COMPASS Collaboration responsible for the COMPASS publication matters *i.e.* giving final judgement on the papers proposed to be published, reviewing abstracts, talks and proceedings of conferences.

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3 The Scientific Achievement

The scientific achievement which is presented to fulfil the requirement for the D.Sc. title is the monograph:

Direct Measurement
of the Gluon Polarisation in the Nucleon
Using the All-p_T Method
at the COMPASS Experiment at CERN
published by Wydawnictwa Uniwersytetu Warszawskiego, July 2017.

3.1 Introduction

The modern understanding of the nucleon internal structure is related to the pioneering work of M. Gell-Mann [1] and G. Zwieg [2] from 1964. The authors postulated that a nucleon is composed of 3 quarks, while mesons are composed from a quark-antiquark pair. Quarks were supposed to be point-like fermions with spin 1/2 and fractional electric charge ($\pm 1/3, \pm 2/3$).

Such a simple model predicted and explained a variety of the nucleon properties including the spin and the anomalous magnetic moment of the nucleon, see *e.g.* [3]. The latter one is of special importance as it directly related to the quark orientation inside the nucleon. The main problem of the model was that free quarks were never observed experimentally. Thus, in the middle of 60's they were considered as an interesting mathematical representation of nature. Before the end of the decade the first evidences of point-like objects in the nucleon were reported by SLAC [4, 5], but even then the existence of quarks was not fully recognised by the whole particle physics community until the 4th quark predicted by the theory [6], the charm quark, was observed in 1974 in the production of the J/Ψ meson in e^+e^- annihilation [7], [8].

In the year of the J/Ψ discovery an experiment at SLAC studied for the first time interactions of a polarised beam with a polarised target. The obtained results suggested that within (large) statistical uncertainties quarks could explain the spin of the nucleon [9, 10], as predicted in the simple model. Since in addition the model described rather precisely the anomalous magnetic moments of baryons the spin structure of the nucleon was believed to be rather well understood.

To the vast majority of the physics community the results of the EMC experiment came as a true surprise. Namely, the fraction of the proton spin carried by quarks, $\Delta\Sigma$, was measured to be $\Delta\Sigma = 0.12 \pm 0.10 \pm 0.14$ instead of the expected 1.0 . The next generation of experiments performed at CERN (SMC) [11], DESY (HERMES) [12], and at JLAB [13, 14, 15] confirmed the EMC discovery that the quark helicity is not enough to explain the nucleon spin.

One of the explanations to the EMC observation was that the gluon polarisation was not negligible, thus experiments like HERMES and SMC put the gluon polarisation measurement in their agenda. Moreover in a few newly planned experiments the gluon polarisation in the nucleon was considered as a flagship measurement, like the COMPASS at CERN.

COmmon Muon Proton Apparatus for Structure and Spectroscopy (COMPASS) is an experiment at the CERN SPS accelerator. It is the successor of the SMC (and EMC) experiments. One of its main goals is the study of the nucleon (spin) structure, and the aforementioned gluon polarisation measurements was there considered of a crucial importance. The COMPASS Collaboration consists of about 220 physicists from 26 institutes and 13 countries. The experiment was approved in 1998 and began data taking in 2002. The author joined the COMPASS Collaboration in 2001 before the first test run.

3.2 Gluon Polarisation measurements at COMPASS

The most model independent way of accessing the gluon polarisation in the nucleon is the measurement of the so called scaling violation of the spin dependent structure function g_1.

Unfortunately, so far the existing world data on the g_1 structure function cover only a limited kinematic range accessible for the fixed-target experiments. Therefore the extracted value of the gluon polarisation in this method has a large uncertainty, cf. Fig. 1.

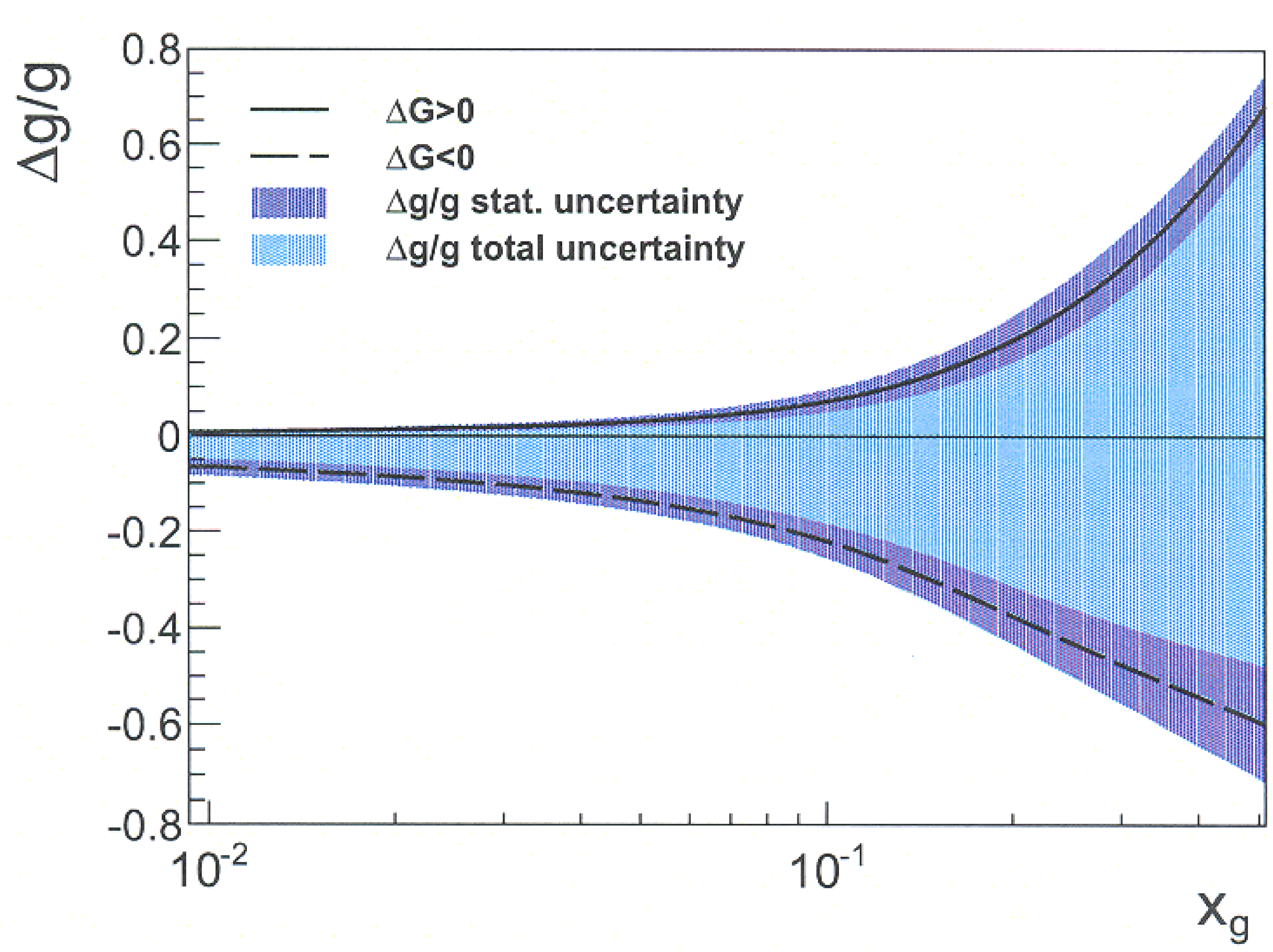

Figure 1: Gluon polarisation from COMPASS NLO QCD fit to the world g_1 data as a function of the fraction of the nucleon momentum carried by the gluon. Figure based on [17].

The limitation on the precision of $\Delta g/g$ obtained from the scaling violation were known in COMPASS. Therefore, the golden channel of the gluon polarisation measurement was the open charm meson production. Due to the large mass of the charm quark the latter are not initially present in the nucleon. Therefore, at leading order QCD, the production of charm mesons is related to the Photon-Gluon-Fusion (PGF) process. Most importantly the PGF is sensitive to the gluon polarisation in the nucleon. Thus, studies of open charm mesons provide a clean sample for the gluon polarisation measurements.

The main channel in which the studies were performed was a two body decay of $D^0 \rightarrow K\pi$. Unfortunately, on one side the heavy mass of the charm quark provides access to a PGF process in a clen way, but on the other hand the cross-section for the D^0 production is rather small. One of the first tasks of the author in COMPASS was a Monte Carlo study of the $D^* \rightarrow D^0\pi \rightarrow K3\pi\pi_S$ channel, in view of its possible inclusion in the analysis. This analysis was described in the author's diploma thesis. The main conclusion of the work was that the studied channel would contribute about 10% of Figure of Merit to the main sample. This channel was later included in the analysis.

In spite of the enormous effort of the COMPASS collaboration, and the inclusion of additional channels in the analysis, the final $\Delta g/g$ results have still large errors and do not allow for any definite conclusions. Namely, $\Delta g/g^{LO} = -0.06 \pm 0.21_{stat.} \pm 0.08_{syst.}$ at hard scale $\langle \mu^2 \rangle = 13$ GeV^2, and at a fraction of the nucleon momentum carried by the gluon $\langle x_g \rangle = 0.11$.

In view of the statistical limitation of the open charm method, other methods for the gluon polarisation extraction were searched for. One of the most promising was the study of events with hadrons produced at high transverse momenta. In the leading order photo absorption process (LP) the resulting hadron momentum is related to the intrinsic k_T of quarks in the nucleon and to additional transverse momentum acquired during quark fragmentation. Both are expected to be small, resulting in a small transverse momentum of hadrons related to the leading process. On the contrary, in the case of higher order processes, like QCD Compton (QCDC) scattering and the aforementioned PGF, the transverse momentum in the hard process can be large. Therefore, it is argued that by selecting events with hadrons at high transverse momenta one enhances the fraction of PGF in the obtained sample.

I joined the COMPASS analysis group responsible for the gluon polarisation measurement from events with hadrons produced at large transverse momentum in 2008 when I became a fellow at CERN. At the time the analysis had started a few years before and there were even some preliminary results presented at conferences. However, it was also the time when it was realised that with the increased precision of the obtained result the approximations previously made were too crude. To overcome this limitation a new formalism was introduced by dr hab. K. Kurek. One of his and prof. dr hab. E. Rondio suggestions was the possibility to use artificial neural networks (NN) in order to distinguish between signal (PGF) and background events (LP and QCDC). Such analysis of gluon polarisation using NN had been already performed in the SMC experiment in the PhD thesis of K. Kowalik performed under the supervision of prof. E. Rondio. After a few months of being introduced to Neural Network ideas and the NetMaker Toolbox by dr. R. Sulej from Warsaw Technical University I got the basic knowledge on it, but most importantly I realised that one could improve the way Neural Networks were used in the analysis.

Namely, based on the input parameters (like x Bjorken variable, negative four momentum transfer Q^2, transverse and longitudinal momenta of hadrons p_T, P_l) the NN was internally building a model and as output returned a number between 0.05 and 0.95. Higher numbers represented events which were more likely of the PGF type. A cut value based on e.g. *figure of merit* optimisation was found to select events. However, I have realised that one could instead use Neural Network in a mode where its output would not be just some number, but it would have a precisely defined interpretation namely the estimation of the fraction of PGF events in a given kinematic point defined by the input parameters of the Neural Network.

This allowed me to reformulate the analysis formalism proposed by K. Kurek to a "weighted" formalism, where events which have high probability of being PGF are more important in the analysis (have higher weight) than the ones where the estimated PGF fraction is low. The possibility that on an event-by-event basis one can estimate the probability for it to be PGF, QCDC or LP is a cornerstone of the analysis method proposed in the monograph.

Afterwards I analysed COMPASS data using the method proposed by me, in close collaboration with L. Silva and K. Klimaszewski, PhD students from LIP Lisboa and NCBJ, respectively. The first publicly shown results were presented in 2008 on the DIS conference. At the time only data of 2002–2004 were analysed. A MC with a good description of real including the newer set taken in 2006 was obtained 2 years later by the aforementioned PhD students.

In the mean time I became the analysis coordinator of the COMPASS experiment, and after the yearly mandate I became COMPASS responsible for the described $\Delta g/g$ analysis. With the new MC ready in 2010, the preliminary result of the analysis was presented by L. Silva in SPIN 2010 conference and the final results were published in [16].

Even if the published analysis [16] is correct, with passing time and increased experience I have realised that the analysis method could be further improved. Namely, one could less rely on the external inputs and instead obtain necessary information from the COMPASS data itself. As a result certain systematic uncertainties present in the analysis would be eliminated.

The main idea of the new proposed method is that instead of only analysing data with hadrons of high transverse momentum one can analyse the whole hadron p_T spectrum at once. In such analysis the low p_T events are mostly related to the Leading Process, while higher order processes are still dominant at high p_T. In the proposed analysis method one can simultaneously extract both leading process asymmetry related to the quark polarisation in the nucleon as well as the gluon polarisation in the nucleon. The mathematical formulation of the method was for the first time presented in a COMPASS internal note in 2011 and it is based on a modification of the formalism developed by J. Pretz and J.-M. le Goff for the COMPASS open charm analysis.

The simple analysis performed at that time was showing that not only certain uncertainties present in [16] are eliminated, as originally intended, but due to the simultaneous extraction of LP and PGF asymmetries, the uncertainties related to the stability of the spectrometer were also reduced. In addition one could also analyse in more detail the most important contribution to the systematic uncertainty in this type of analysis, namely the one related to Monte Carlo.

The proposed method was accepted by the COMPASS Collaboration I have started the data re-analysis working with dr K. Klimaszewski and at the beginning also with dr L. Silva.

I was COMPASS responsible for this analysis and participated in most of the aspects of it, *e.g.* writing computer codes for data selection and asymmetry calculation, preparing Neural Networks input to the analysis based on MCs provided by K. Klimaszewski, estimating systematic uncertainties and obtaining final results. The preliminary results of the analysis were publicly shown for the first time by myself in 2014 at the DIS conference in Warsaw. The final results were very recently published in Eur. Phys. J. C 77 (2017) 209. The obtained result $\Delta g/g = 0.113 \pm 0.038 \pm 0.036$, at hard scale $\mu^2 = 3$ GeV^2 and average nucleon momentum fraction carried by gluon $\langle x_g \rangle = 0.10$, suggests that $\Delta g/g$ is positive in the measured range x_g. This observation agrees with the recent NLO QCD fits which include data from polarised pp RHIC accelerator.

The obtained result decreased by factors 1.6 and 1.8 the statistical and systematic uncertainties, respectively as compared to the previously published [16]. The comparison of the two results in three bins of the nucleon momentum fraction carried by the gluon is presented on the left panel of Fig. 2. The obtained result prefers positive $\Delta g/g$ from the COMPASS NLO fit to world g_1 data as seen in the right panel of Fig. 2.

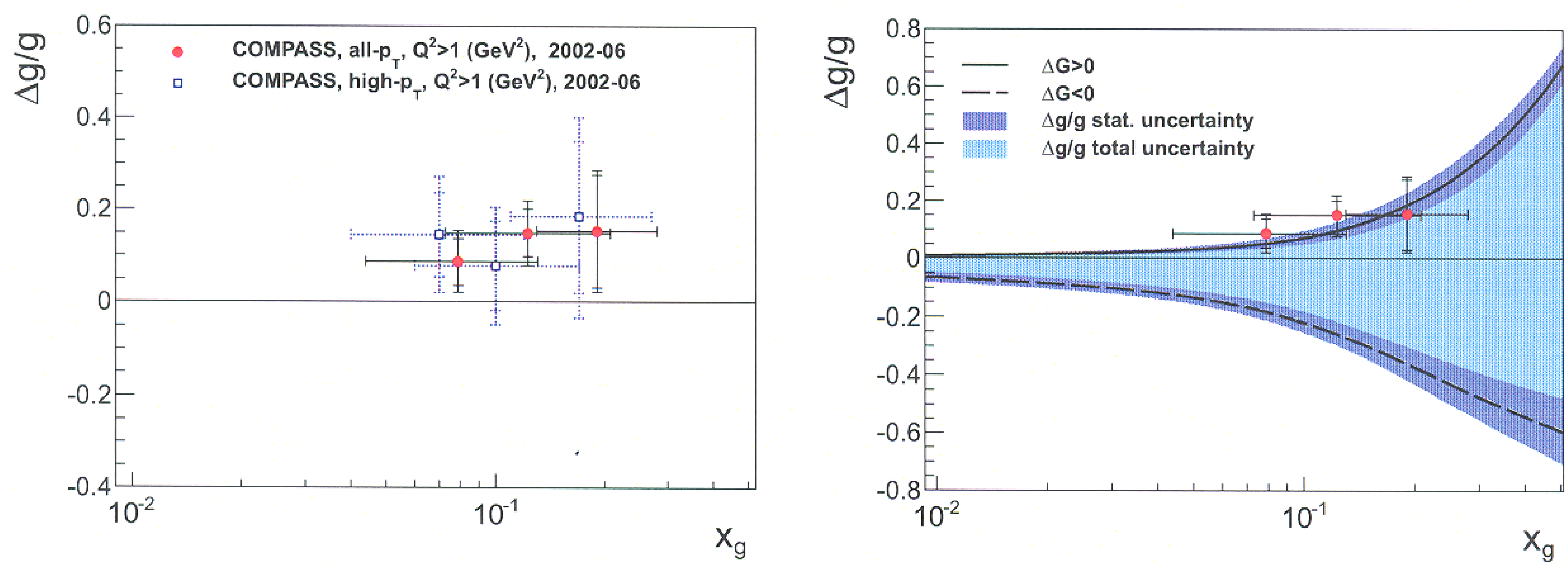

Figure 2: Left Panel: Comparison of the new $\Delta g/g$ results with the one published in [16]; Right Panel: Comparison of the new $\Delta g/g$ results with the results of the COMPASS NLO QCD fit to the world g_1 data [17].

In Figure 3, the comparison of the new result with the world analyses of gluon polarisation in the nucleon at LO in QCD is presented, a good agreement being found. However, it should be noticed that from all analyses the result obtained using the proposed method has the smallest combined statistical and systematic uncertainty.

The developed method can be used in other experiments, like *e.g.* experiments in the future Electron-Ion-Collider. It gives the important and interesting possibility of cross-checking with the results to be obtained from the scaling violation of the g_1 structure function. Both the method and the analysis are rather complex and this is one of the reasons why the analysis was performed by a team of post-docs. As a result the proposed method is not well documented due to the lack of e.g. PhD thesis on the subject. To fill this void the author decided to write the present monograph where more details concerning the method and analysis could be presented, as compared to that in a typical paper.

The organisation of the monograph is the following. Chapter 1 contains an introduction to the subject and chapter 2 describes the formalism of the deep inelastic scattering, as well as ideas

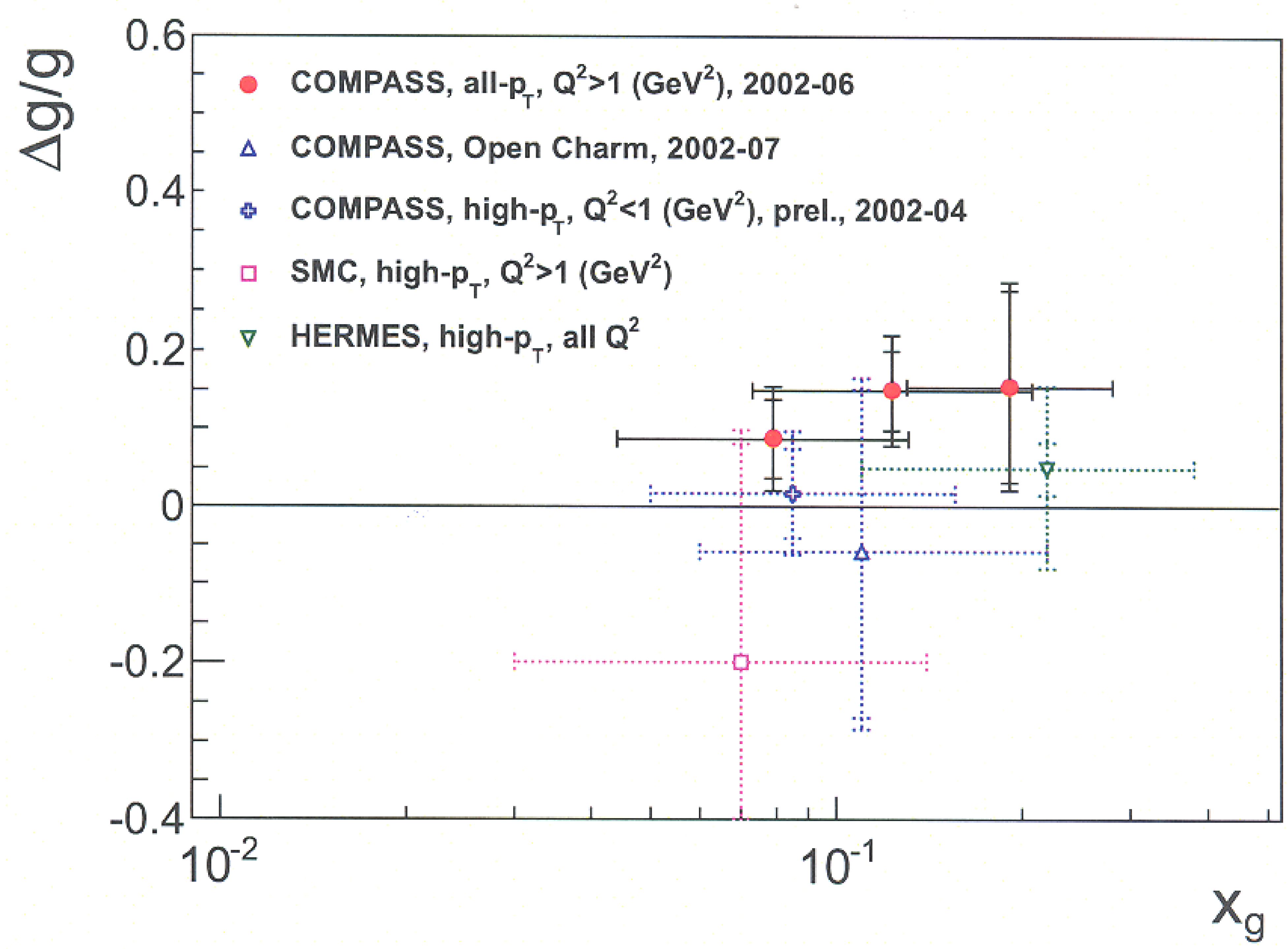

Figure 3: Comparison of the present $\Delta g/g$ results in 3 x_g ranges with world LO analyses of SMC [18], HERMES [19], and COMPASS [20, 21]. (For figure clarity the results published in [16] are not shown here.)

concerning the direct and indirect methods of ΔG extraction. The summary of results on ΔG obtained in previous measurements/experiments is presented in chapter 3. Chapter 4 describes the proposed method of $\Delta g/g$ extraction. In chapter 5 the COMPASS spectrometer is described and details concerning the data selection are described in chapter 6. Details concerning Monte Carlo models, parametrised by Neural Network, which are needed to relate the experimental observables with the gluon polarisation are described in chapter 7. In chapter 8 the systematic uncertainties are discussed. In chapter 9 the obtained results of the gluon polarisation in the nucleon using the proposed method are presented, including the one presented here. The results are compared with previous measurements and with the ΔG value extracted from global QCD fits. In the final chapter of the monograph, chapter 10, the summary of the work and outlook are presented.

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