

## Candidate presentation

Candidate: Jan Matoušek

Supervisors: Miroslav Finger, Charles University (CUNI), Prague  
Anna Martin, Trieste University

Research Title: Nucleon spin structure studies in Drell-Yan process at COMPASS

Jan Matoušek was a brilliant and strongly motivated student at the Charles University in Prague, strongly interested in COMPASS, a fixed target experiment at the CERN SPS.

Thanks to the excellent relationships between the Prague and the Trieste group in COMPASS, and the past collaboration in several projects, we decided to propose a cotutelle for his PhD work, dedicated to the measurement of the transverse spin effects in the Drell-Yan process. An ad-hoc agreement was correspondingly signed by the Charles University and by the University of Trieste.

The main topic of the PhD work of Jan Matoušek is one of the most important open problems in hadronic physics, namely the test of the so-called pseudo-universality of the Sivers function, the most famous of the recently introduced transverse momentum dependent parton distribution functions (TMD PDFs). This partonic distribution is "T-odd" and as such is expected to change sign when measured in a Drell-Yan reaction with respect to when it occurs in hadron production in semi-inclusive deep inelastic scattering (SIDIS). The COMPASS SIDIS results allowed to extract the Sivers function, which was found to be definitely different from zero, and unambiguously determine its sign. Consequently, the COMPASS Collaboration proposed to measure the Sivers function in a Drell-Yan reaction and test its pseudo-universality property. After a short test run in 2014, COMPASS measured the Drell-Yan reaction  $\pi^- p \rightarrow \mu^+ \mu^- X$  on a transversely polarized proton target in 2015, and Jan Matoušek had the opportunity to join this experiment from the very beginning and participate to the preparation, the data taking, the data analysis and the finalization and interpretation of the results.

During the first year of his PhD course (2013-2014), in addition to the educational activity at the Charles University, Jan Matoušek concentrated on the COMPASS apparatus and in particular on the sophisticated polarized target system, a central element of the spectrometer, working on its preparation for the data taking and developing part of the monitoring system software tools for its remote monitoring.

In the second year, he started working on the COMPASS off-line system and data analysis, studying the RICH detector response, contributing to the optimisation of the reconstruction code for the COMPASS Drell-Yan data, and carrying on analysis work on the SIDIS data collected with the transversely polarized proton target. In particular he himself extracted the transverse spin asymmetry in the  $J/\Psi$  production, which in some models is related to the Sivers function of the gluon, performing all steps, from event selection to systematic studies. The results, released by the Collaboration, have been presented at international conferences.

Since the third year he concentrated on the analysis of the Drell-Yan data collected in 2015

and performed an original extraction of the transverse momentum weighted Sivers asymmetry, which allows to avoid the convolution integrals over transverse momenta in the extraction of the Sivers function. This analysis was first done using the SIDIS data collected in 2010. Jan Matoušek performed the corresponding full analysis on the Drell-Yan data. In the last period, he extracted the Sivers function from the SIDIS results and calculated the weighted Sivers asymmetry in Drell-Yan in order to compare it with the measured asymmetry, an original work proposed by him. He presented the results of all this work, which are expected to be published soon, for the first time at the XVII Workshop on High Energy Spin Physics, DSPIN-17, in Dubna, on behalf of the COMPASS Collaboration. During all his PhD Jan Matoušek participated to the COMPASS data taking periods, taking a considerable number of shifts to become familiar with the many different systems in the spectrometer, and also acted as "week coordinator", namely as responsible for the data taking during one week periods.

At the end of his PhD, we must acknowledge that Jan has done an excellent work, has fulfilled all the assigned tasks, and has reached full professional maturity. He demonstrated to be very capable both in the more technical activities (hardware, programming, computing) and in reliably performing analyses. He learned quickly the relevant physics and enthusiastically carried on complete measurements, with original contributions. Thanks to the COMPASS rules, which foresee that all released results have to be cross-checked by people of different institutes and discussed at the different stages in the analysis group, he could also demonstrate capability in defending the work he was doing as well as his collaborative attitude.

Jan Matoušek has been an excellent PhD student, highly motivated, and very capable and successful in all the different aspects of the research activity in experimental particle physics. In summary, the candidate fully achieved the training and scientific targets set at the beginning of his Ph.D. program.

