

**Final Report on the activity of Dr. Artem Ivanov**  
**Scuola di Dottorato in Scienze Della Natura**  
**Dottorato in Fisica ed Astrofisica, XXIX ciclo**

Dottorando: Artem Ivanov

Relatore: Prof. Daniele Panzieri

Corelatore: Dott. Bakur Parsamyan

Titolo della tesi:

*Study of various spin-phenomena at COMPASS experiment with SIDIS and Drell-Yan reactions*

**Dr. Artem** is a third-year graduate student of the Phd School in Physics and is expected to graduate under our supervision in few months with a thesis on aspects on Spin Physics.

During these three years Artem Ivanov has been a very good student. He followed all the foreseen courses:

- “Data Analysis Techniques”, prof. Ramello
- “Calorimetry in particle physics experiments”, prof. Arcidiacono
- “Hands-on Fitting and Statistical Tools for Data Analysis”, prof. Pelliccioni
- “Bayesian Statistics”, prof. Andreon
- “Advanced Laboratory”, prof. Bellan and prof. Amapane

and got good scores. He also attended several doctoral schools and workshops in the field of Spin Physics.

- Schools:

- “SUMMER SCHOOL on PARTICLE PHYSICS”, Miramare, Trieste, Italy, June 15-26, 2015
- “INTERNATIONAL SCHOOL OF NUCLEAR PHYSICS, 37th Course, Probing Hadron Structure with Lepton and Hadron Beams”, Erice, Sicilia, Italy, September 16-24, 2015

- Workshop:

- “IWHSSS 2015 - International Workshop on Hadron Structure and Spectroscopy”, Suzdal, Russia, May 18-20, 2015
- “The p-He cross section measurement: a physics case from cosmic rays”, Torino, Italy, July 6-7, 2015
- “COMPASS beyond 2020 Workshop”, CERN, March 21-22
- “IWHSSS 2016 - International Workshop on Hadron Structure and Spectroscopy”, Germany, Bavaria, Kloster Seeon, September 5-9, 2016
- “102 Congresso della Societa Italiana di Fisica”, Padova, Italy, September 26-30, 2016

His work focused on two major arguments: the analysis of 2007 and 2011 COMPASS SIDIS data collected with longitudinally polarized target and the analysis of 2015 COMPASS- Drell-Yan data collected with transversely polarized target. For the first item, he worked first on the MonteCarlo and the quality check of the data and then on the extraction of azimuth (in)dependent asymmetries. These asymmetries have been evaluated for positive and negative *unidentified* hadrons as a function of some kinematic variables. The final results have been compared with available data from HERMES and CLAS and with existing theoretical predictions. As second item, he worked on the analysis of the COMPASS 2015 Drell-Yan data, the first world data on a polarized target. He started with the MonteCarlo and the quality check of the data and then on the extraction of target spin (in)dependent azimuthal Drell-Yan asymmetries, using two different methods, the unbinned maximum likelihood techniques for spin-dependent asymmetries, and the two-dimensional method for the unpolarized ones. The asymmetries extracted by Artem are in good agreement with the results obtained by independent analyses done as a cross check of his results.

In his research activity, Artem Ivanov has shown a good potential, with a clear attitude to work autonomously and to keep suggestion and hints after discussion with the colleagues. He is really skill in computation that has been precious in his work of simulations and data analysis.

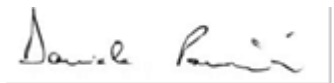
He has also contributed significantly to the life of the experiment (COMPASS at CERN), dedicating part of his time in these three years to HW aspects, in particular on the preparation of the Drell\_Yan data taking of 2015, in the data taking and in the patrol of the detectors (mwpc's and RichWall) that are under the responsibility of the Torino group, with long periods of permanence at CERN.

His publication record is good, and is in line with other cases for experiments similar to the one he has been involved.

Considering all his activities in these three years, we think that he is absolutely ready for graduating and we propose that he is given the possibility of defending his thesis in Spring 2017.

Torino, 9 December 2016

Daniele Panzieri  
Associate professor

A handwritten signature in black ink, appearing to read 'Daniele Panzieri', enclosed within a thin black rectangular border.

**Publications:**

- “The spin structure function  $g_1^p$  of the proton and a test of the Bjorken sum rule”, PLB 753 (2016) 18 (the material presented in the paper is part of the thesis)
- “Interplay among transversity induced asymmetries in hadron leptonproduction”, PLB 753 (2016) 406, CERN-PH-EP/2015-199, hep-ex/1507.07593
- “Resonance Production and  $\pi\pi$  S-wave in  $\pi^-+p\rightarrow\pi^-\pi^-\pi^++p_{\text{recoil}}$  at 190 GeV/c”, submitted to PRD, CERN-PH-EP/2015-233, hep-ex/1509.00992
- “Longitudinal double spin asymmetries in single hadron quasi-real photoproduction at high  $p_T$ ”, PLB 753 (2016) 573, hep-ex/1509.03526
- “Leading-order determination of the gluon polarisation using a novel method”, submitted to EPJC, CERN-PH-EP-2015-328, hep-ex/1512.05053
- “Multiplicities of charged pions and unidentified charged hadrons from deep-inelastic scattering of muons off an isoscalar target”, PLB 764 (2017) 001, CERN-EP/2016-095, hep-ex/1604.02695
- “Exclusive  $\omega$  meson muoproduction on transversely polarised protons”, submitted to NPB, CERN-EP/2016-157, hep-ex/1606.03725
- “Multiplicities of charged kaons from deep-inelastic muon scattering off an isoscalar target”, submitted to PLB, CERN-EP/2016-206, hep-ex/1608.06760
- “Azimuthal asymmetries of charged hadrons produced in high-energy muon scattering off longitudinally polarised deuterons”, submitted to EPJC, CERN-EP/2016-245, hep-ex/1609.06062
- “Sivers asymmetry extracted in SIDIS at the hard scale of the Drell-Yan process at COMPASS”, submitted to PLB, CERN-EP/2016-250, hep-ex/1609.07374