

Report on the JSA Initiatives Fund Program project

# Workshop on 3D Parton Distributions and the LHC

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## Introduction

The knowledge of the structure of the proton, and in particular of Transverse Momentum Distributions (TMDs) of partons, which have been widely recognized as key objectives of the JLab 12 GeV upgrade, can be relevant for studies in proton colliders, even at the LHC energies. The transverse momentum dynamics may be very important at low  $x$ . It is manifested in very high energy hadronic collisions and is described by Unintegrated Gluon Distribution Functions.

The main goal of the Workshop on “3D Parton Distributions and the LHC” was:

- (a) Address unresolved issues of the physics of the transverse structure of the nucleon.
- (b) Define what unique insights the LHC data can offer to improve the knowledge of TMDs and, where the knowledge of TMDs can be necessary to achieve high-precision results demanded by the search for new physics.

## Workshop Organization

The workshop “3D Parton Distributions and the LHC” took place at Frascati Labs of INFN on Nov 29 December 2, 2016 (<http://www.lnf.infn.it/conference/2016/3DPDF/index.php>).

The organizing committee consisted of :

- H. Avakian (JLab)
- A. Bacchetta (Pavia University & INFN)
- W. Brooks (UTFSM)
- E. De Sanctis (INFN-LNF)
- A. Deshpande (Stony Brook)
- P. Di Nezza (INFN-LNF)
- A. Fantoni (INFN-LNF)
- K. Hafidi (ANL)
- F. Hautmann (University of Oxford)
- H. Jung (DESY)
- S. Liuti (Univ. Virginia)
- A. Metz (Temple University)
- M. Mirazita (INFN-LNF)
- S. Pisano (INFN-LNF)
- X.-N. Wang (Berkeley)

The workshop was attended by 58 participants from European and US universities, and world experts from other countries (Australia, China, Mexico). The workshop was organized into several topical sessions with 43 presentations. The scientific program is attached to this document.

## Budget Justification

Funds from the JSA Initiatives Fund Program (\$1500) were used to partially support expenses (registration fees for \$300) of five invited speakers:

- 1) ARTRU, Xavier, Universit de Lyon, CNRS/IN2P3, IPNL, 69110, FRANCE
- 2) BURKARDT, Matthias, New Mexico State University, Las Cruces, USA
- 3) COURTOY, Aurore CINVSTAV Mexico City MEXICO
- 4) MARQUES QUINTANS, Catarina, LIP - Lisbon, Portugal, Lisboa PORTUGAL
- 5) CHEREDNIKOV, Igor, SCK-CEN / Universiteit Antwerpen, Antwerp BELGIUM

The workshop organizers are thankful to Bob McKeown for the Jefferson Lab directorate support of the workshop in the amount of \$3500 (and also thankful for some support received from the INFN and UConn).

## Workshop Summary

The main focus of the workshop was on increasing theoretical and experimental support for the nucleon 3D PDF programs worldwide, identifying common interests of 3D PDF & LHC communities as well as pinning down the 3D structure of nucleon by combining ongoing efforts of experimental, lattice, and theory communities.

Main topics included:

- QCD issues associated with 3D structure.
- Essential observables, which will direct the future experimental effort..
- Framework for the extraction of 3D PDFs.
- Medium modifications of multidimensional PDFs across the wide range in  $x_B$ .
- Partonic Structure beyond Densities: Orbital motion, correlations, fluctuations.

Detailed list of talks is available from the conference web page <https://agenda.infn.it/conferenceTimeTable.py?confId=11545>

The workshop played an important role in building a bridge between JLab and LHC communities, exploring common interest in the physics program to study nucleon's 3D structure. The participating lead researchers in the field contributed to the success of the program, thereby increasing the international support for a multifaceted effort to study the fundamental structure of matter.

Bibliography:

[1] <http://www.lnf.infn.it/conference/2016/3DPDF/uploads/3D%20pdf%20at%20LHC.pdf>