Science at the Luminosity Frontier: Jefferson Lab at 22 GeV

Report of Contributions

https://agenda.infn.it/e/39742

Contribution ID: **1** Type: **not specified**

Overview of the CEBAF Accelerator Upgrade

Friday, December 13, 2024 9:25 AM (20 minutes)

Extending the energy reach of CEBAF up to 22 GeV within the existing tunnel is being explored. Proposed energy upgrade can be achieved by increasing the number of recirculations, while using the existing CEBAF SRF cavity system. Presented scheme is based on an exciting new approach to accelerate electrons efficiently with multiple passes in a single FFA (Fixed Field Alternating Gradient) beam line. Encouraged by recent success of the CBETA Test Accelerator, a proposal was formulated to raise CEBAF energy by replacing the highest-energy arcs with Fixed Field Alternating Gradient (FFA) arcs. The new pair of arcs configured with FFA lattice would support simultaneous transport of additional 6 passes with energies spanning a factor of two, using the non-scaling FFA principle implemented with Halbach-derived permanent magnets - a novel magnet technology that significantly saves energy and lowers operating costs. One of the challenges of the multi-pass (11) linac optics is to provide uniform focusing in a vast range of energies, using fixed field lattice. Here, we propose a triplet lattice scaled up with increasing momentum along the linac. This would provide a stable periodic solution covering energy ratio of 1:33. The current CEBAF configured with a 123 MeV injector, makes optical matching in the first linac virtually impossible due to extremely high energy span ratio (1:175). Therefore, we envision replacement of the current injector with a 650 MeV 3-pass recirculating injector based on the existing LERF facility. Finally, the 22 GeV CEBAF would promise to deliver in 10-passes a beam with normalized emittance of 80 mm·mrad and with a relative energy spread of 1.5×10−3. Further recirculation beyond 22 GeV is limited by large, 974 MeV per electron, energy loss due to synchrotron radiation.

Primary author: BOGACZ, Alex

Presenter: BOGACZ, Alex

Session Classification: Summaries and Path Forward

Contribution ID: **2** Type: **not specified**

The SoLID-SIDIS Program at 22GeV

Monday, December 9, 2024 2:55 PM (20 minutes)

The Solenoidal Large Intensity Device (SoLID) is a forward-scattering spectrometer situated in Hall-A at Jefferson Lab. With its large acceptance and full azimuthal angular coverage, SoLID can effectively manage high luminosities ranging from 10^{37} to 10^{39}/cm2/s utilizing both polarized and unpolarized targets. The detector leverages the full capabilities of the JLab 12 GeV upgrade and is designed to support a variety of research programs, including studies of 3D nucleon imaging through semi-inclusive deep inelastic scattering (SIDIS). Several high-rated SIDIS experiments have been approved with the goal of extracting transverse momentum dependent parton distribution functions (TMDs) with unprecedented precision. The proposed 22 GeV upgrade will enable SoLID's unique high intensity and wide acceptance to extend the study of high-precision TMDs from valence quarks to sea quarks across a significantly broader kinematic range. In this presentation, we will introduce the SoLID detector, discuss its current status, and provide updated projections for the SIDIS program using both 11 GeV and 22 GeV beams.

Primary authors: Dr JIA, Shuo (Duke University); Dr KHACHATRYAN, Vlad (Indiana University); Prof. YE, Zhihong (Tsinghua University)

Presenter: Prof. YE, Zhihong (Tsinghua University)

Session Classification: Partonic structure and spin

Contribution ID: **3** Type: **not specified**

Study Quark Structures with eA Scattering at 22GeV

Thursday, December 12, 2024 12:25 PM (15 minutes)

In this talk I will discuss the physics opportunities of studying quark structures w/ 22GeV electrons scattering off nuclei, mainly focusing on investigation of the unpolarized EMC effect, anti-shadowing effect, the 3D nuclear structure and other dynamics nuclear medium effects.

Primary authors: KE, Weiyao (Central China Normal University); Prof. YE, Zhihong (Tsinghua University)

Presenter: Prof. YE, Zhihong (Tsinghua University)

Session Classification: Nuclear Dynamics

Contribution ID: **4** Type: **not specified**

Future hypernuclear studies at J-PARC and JLab

Wednesday, December 11, 2024 12:20 PM (15 minutes)

At J-PARC, a project to extend the Hadron Experimental Hall is underway, where various nuclear and hadron physics experiments will be conducted. Among them, the precision spectroscopy of Λ hypernuclei stands as one of the flagship experiments. Recently, at JLab, new Λ hypernuclear experiments using electron beams have been approved, and hypernuclear spectroscopy will be vigorously pursued in the future at JLab Hall-C.

In bridging nuclear forces and the strong force based on QCD, it is essential to extend nuclear forces to baryonic interactions, and hypernuclear precision spectroscopy plays a crucial role in this endeavor. The hypernuclear spectroscopy studies using pion beams at J-PARC and the precision spectroscopy of hypernuclei using electron beams at JLab can complement each other, and both are indispensable for the precise study of charge symmetry breaking in hypernuclei. Moreover, hypernuclear precision spectroscopy is extremely important for resolving the hyperon puzzle, which relates to the mystery of heavy neutron stars.

This talk will focus on the extension project of the J-PARC Hadron Experimental Hall, with an emphasis on hypernuclear spectroscopy experiments, and discuss the physics that will be explored in conjunction with complementary studies at JLab.

Primary author: Prof. NAKAMURA, Satoshi N. (the University of Tokyo)

Presenter: Prof. NAKAMURA, Satoshi N. (the University of Tokyo)

Session Classification: Spatial Structure, Mechanical Properties, and Emergent Hadron Mass

Contribution ID: **5** Type: **not specified**

Exotic states at 22GeV era kaon beams

Monday, December 9, 2024 12:05 PM (15 minutes)

The KLF project aims to discover many new particles in the strange quark sector, elucidate the interaction of strange-quark containing baryons (hyperons) with nucleons and, through the unprecedented Kaon flux of 1 billion Kaons per day enable searches for rare KL decays at new limits. Alongside the hadron physics impact KLF can deliver key data for fundamental astrophysics including a deeper understanding of neutron star composition and of the early universe during the transition from deconfined plasma to hadrons through the strange epoch.

Existing 12GeV KL-Facility is mostly concentrated on low-energy kaon beams to look for single and double-strange hyperons, however there are several topics which require high energy neutral kaon beams, and where an extension of the JLab to 22GeV might be beneficial.
In this talk we will discuss the benefits of JLab upgrade and the use of high energy kaon beams for the Ω-baryon spectrum explorations.
The other topic which will be addressed is a strange-hidden-charm tetraquarks and pentaquarks production with kaon beams. Many of Zcs (Zcs ->J/Ψ K)and Ps (Ps ->J/Ψ Λ) states are considered to be of a molecular or dynamically-generated nature. For such states a strong dependence on production mechanism is expected. To address such questions in a non-strange sector a dedicated pion beam programme is considered at J-PARC, however similar states with strangeness would require the use of a strange beam, with the neutral kaon at KLF to be an interesting option realisable at 22GeV JLab facility.

Primary author: BASHKANOV, Mikhail (University of York)

Presenter: BASHKANOV, Mikhail (University of York)

Session Classification: Spectroscopy

Contribution ID: **6** Type: **not specified**

Meson and Nucleon Form Factors

Monday, December 9, 2024 4:25 PM (20 minutes)

Meson and Nucleon Form Factors are fundamental hadron structure observables which give much information on QCD's transition from strong to perturbative scales as the probing interaction becomes increasingly hard. The interest in charged pion and kaon form factors is due to their relatively simple *qbar-q* valence structure and their status as Goldstone bosons of QCD. The measurement of the proton's electric to magnetic form factor ratio via the polarization transfer technique remains the most highly cited of all publications resulting from JLab research. Projections of what may be possible using existing and upgraded detectors, and with electron beams of energy up to 22 GeV will be presented.

Primary authors: PUCKETT, Andrew (University of Connecticut); HUBER, Garth (University of Regina)

Presenter: HUBER, Garth (University of Regina)

Session Classification: Partonic structure and spin

Contribution ID: **7** Type: **not specified**

Exploring SIDIS kinematics regions at Jefferson Lab 22 GeV

Tuesday, December 10, 2024 2:30 PM (15 minutes)

Exploration of regions of hadron production in SIDIS depends strongly on the energy span and the luminosity of experimental measurements. In this talk I will present the future opportunities at Jefferson Lab upgrade
at 22 GeV on the basis of the "affinity" to each relevant kinematic region (TMD, central, collinear). One of the key aspects of the
experimental program of Jefferson Lab is the exploration of the three-dimensional structure of the nucleon encoded in the TMD distribution and fragmentation functions and the corresponding factorization at low transverse momenta of the produced hadrons. The study of "affinity" shows that the proposed energy, doubled with respect to the existing
upgrade, is going to enable a thorough mapping of the collinear and TMD regions of hadron production as well as the central region, which embeds the transition from one to the other.

Primary author: Prof. BOGLIONE, Mariaelena (Istituto Nazionale di Fisica Nucleare)

Presenter: Prof. BOGLIONE, Mariaelena (Istituto Nazionale di Fisica Nucleare)

Session Classification: Hadronization and Transverse Momentum

Contribution ID: **8** Type: **not specified**

Prospects of Medium Modification Studies at JLab 22

Thursday, December 12, 2024 9:00 AM (20 minutes)

The study of nuclei in terms of quark and gluon degrees of freedom remains a rich frontier in nuclear physics. Jefferson Lab is at the luminosity frontier and is the leading facility to explore the explicit role of QCD in nuclei, where several new discoveries are possible with an energy of 22 GeV. This talk will explore some of the opportunities to study QCD in nuclei at JLab 22 GeV, and discuss the associated insights into quark and gluon dynamics in nuclei.

Primary author: CLOET, Ian

Presenter: CLOET, Ian

Session Classification: Nuclear Dynamics

Contribution ID: **9** Type: **not specified**

Medium modifications of quark propagation and hadron formation observables

Thursday, December 12, 2024 11:45 AM (15 minutes)

The main focus of the Jefferson Lab physics program of 6 GeV and 12 GeV era, which are now proposed to be extended here to 22 GeV, is to determine the mechanisms of confinement in hadron formation. A significant amount of information has been collected on understanding confinement through hadron spectroscopy. Another approach was introduced through the string-breaking mechanism studied via deep-inelastic scattering off nuclei. It has been considered the pioneering process in investigating medium modifications of quark propagation and hadron formation observables. Those observables, reflected in hadronic multiplicity ratios and transverse momentum broadening, are multidimensional in nature for which reason a high-dimensional analysis is necessary to disentangle dependencies on Q2, nu, z, pT2 kinematical variables. In this talk, I will survey of the most relevant data and its potential interpretation that will be followed by description of feasible measurements at Jefferson Lab 22 GeV.

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Presenter: Ms MINEEVA, Taisiya (CCTVaL, UTFSM)

Session Classification: Nuclear Dynamics

Contribution ID: **10** Type: **not specified**

Spectroscopy experiment of charmed and multi-strange baryons using hadron beam at the J-PARC hadron facility

Monday, December 9, 2024 12:25 PM (15 minutes)

Understanding hadron formation is one of the fundamental goals of hadron physics. It is essential way to investigate the effective degrees of freedom of hadrons such as the quark-quark correlation, namely the diquark correlation. Spectroscopic observations of charmed and multi-strange baryons can provide a unique opportunity to study diquark correlation. Systematic studies of charmed and multi-strange baryons are expected to reveal effective degrees of freedom for describing hadron structures. The hadron experimental facility at J-PARC aims at revealing hadron structures using the world's most intense meson beam. The J-PARC high-intensity and high-momentum beams can provide many opportunities to investigate the structure of hadrons, in which charm and strange quarks play an important role. High-momentum beam line, called the pi20 beam line, is under construction, and the charmed baryon spectroscopy experiment is planned. In the future, the Hadron Experimental Facility are extended to include beam lines with special capabilities. Dedicated high-momentum beam line called the K10 beam line, which can provide separated negative kaon beam up to 10 GeV/c, is planned to be constructed. Hadron beams are an essential tool for studying the excited states of charmed and strange baryons.

Primary author: Dr SHIROTORI, Kotaro (Research Center for Nuclear Physics (RCNP), Osaka University)

Presenter: Dr SHIROTORI, Kotaro (Research Center for Nuclear Physics (RCNP), Osaka University)

Session Classification: Spectroscopy

Contribution ID: **11** Type: **not specified**

Continuing the search for 3N SRCs

Thursday, December 12, 2024 9:50 AM (15 minutes)

Much has been learned about 2N short-range correlations in JLab's 6 and 12 GeV eras, with more still coming up. However, a successful observation of 3N SRCs still eludes us. Based on predictions, the current kinematic reach at JLab is right on the edge of where 3N SRCs should start to dominate and an observation is possible, but not inevitable. We will discuss planned and soon to be proposed studies with 12 GeV and explore the landscape of possible searches at 22 GeV.

Primary author: FOMIN, Nadia (University of Tennessee)

Presenter: FOMIN, Nadia (University of Tennessee)

Session Classification: Nuclear Dynamics

Contribution ID: **12** Type: **not specified**

Affinity tool. Comparison between JLab12 and JLab22

Tuesday, December 10, 2024 4:53 PM (10 minutes)

I will present the resent extension of the AFFINITY numerical tool that allows experimental data to be connected to the corresponding theoretical framework. More specifically, I will focus on the affinity to the TMD region as predicted for the upgraded JLab22 kinematics in comparison with the existing JLab12 and the planned EIC experiments.
Affinity projections show that the high increase in statistics achieved by the JLab22 upgrade will offer an unprecedented insight on the "TMD"region, which is the kinematic region where transverse-momentum-dependent effects are mostly visible and non-perturbative physics dominate.

Primary authors: BOGLIONE, Mariaelena (Istituto Nazionale di Fisica Nucleare); Prof. ALEXEI, Prokudin (Penn State University and Jefferson Lab); YUSHKEVYCH, Tetiana (University of Torino, Physics Department, via Giuria 1, 10125 Torino (Italy))

Presenter: YUSHKEVYCH, Tetiana (University of Torino, Physics Department, via Giuria 1, 10125 Torino (Italy))

Session Classification: Hadronization and Transverse Momentum

Contribution ID: **13** Type: **not specified**

Nonperturbative approach towards emergent hadron structure and mass at JLab 22

Wednesday, December 11, 2024 10:55 AM (20 minutes)

Understanding the strong interaction dynamics, which triggers the emergence of hadron mass (EHM), presents a challenging problem within the Standard Model of particle physics. Experimental extraction of electromagnetic and transition form factors of mesons and baryons for increasingly larger virtual photon four-momentum squared (i.e., photon virtuality,) as well as their more complete three-dimensional image provides a unique opportunity to improve our understanding of the intricacies and working of the EHM. Significant progress in the use of continuum Schwinger function methods offers opportunities of making testable predictions for charting out the large Q^2 evolution of these form factors and the generalized parton distributions for the 22 GeV upgrade of the Thomas Jefferson National Accelerator Facility. I would present a brief overview of some of the progress in this direction.

Primary author: Prof. BASHIR, Adnan (University of Michoacan and University of Huelva)

Presenter: Prof. BASHIR, Adnan (University of Michoacan and University of Huelva)

Session Classification: Spatial Structure, Mechanical Properties, and Emergent Hadron Mass

Contribution ID: **14** Type: **not specified**

Isolated meson electroproduction at high transverse momentum with 22 GeV electrons

Tuesday, December 10, 2024 11:40 AM (15 minutes)

With 22 GeV electrons striking a fixed proton or nuclear target, there is a regime where the highest momentum pion or rho meson electroproduction proceeds by a perturbatively calculable process. The process is not the leading twist fragmentation one but rather a higher twist process that produces kinematically isolated mesons. Our calculations demonstrate, in particular, that an energy upgrade from 12 GeV to 22 GeV in a high-luminosity experimental setup, as may be expected at JLab, will significantly broaden the kinematic region for the perturbative QCD mechanism of meson production. This semiexclusive data can teach us more about parton distribution functions of the target at high Bjorken x and about the meson distribution amplitudes. In addition, there is a connection to generalized parton distribution calculations of exclusive processes in that the perturbative kernel is the same.

Primary author: CARLSON, Carl (William & Mary)

Co-author: Prof. AFANASEV, Andrei (George Washington University)

Presenter: CARLSON, Carl (William & Mary)

Session Classification: Hadronization and Transverse Momentum

Contribution ID: **15** Type: **not specified**

Probing light dark particles with η and η' decays

Thursday, December 12, 2024 5:05 PM (15 minutes)

Hadronic and radiative decays of light meson decays offer a privileged environment to test QCD and search for physics beyond the Standard Model. A new generation of precision experiments in hadron physics will soon offer new data that will provide sensitive probes to test potential New Physics including searches for dark photons, light scalars and axion-like particles, complementing worldwide efforts to detect new light particles in the MeV-GeV mass range. In this talk, I will give an update on the theoretical developments and discuss the experimental opportunities in this field, paying particular attention to the sensitivity of the η and η' mesons to dark bosons and ALPs at JLab.

Primary author: GONZALEZ-SOLIS, Sergi (University of Barcelona)

Presenter: GONZALEZ-SOLIS, Sergi (University of Barcelona)

Session Classification: QCD confinement, Fundamental Symmetries and BSM

Contribution ID: **16** Type: **not specified**

Towards Pixel-Based Imaging of Transverse Momentum Distributions

Tuesday, December 10, 2024 2:50 PM (10 minutes)

In this talk, we introduce a new approach for parameterizing Transverse-Momentum Dependent PDF (TMDs). By treating TMDs as multidimensional images or tensors, we propose a pixel-based representation. This novel perspective offers a versatile framework for analyzing and manipulating TMDs, enabling us to leverage a wide range of image processing techniques.
We will demonstrate the effectiveness of our new approach by applying it to extract TMD-PDF and TMD-FF from Compass Multiplicities in Semi-inclusive DIS. We will present initial results, showcasing its potential to enhance our understanding of hadron structure. Additionally, we will discuss the benefits of this method, such as its flexibility, and computational efficiency. By treating TMDs as images, we unlock new possibilities for research and analysis in hadron physics.

Primary authors: AVAGYAN, Harut (Jefferson Lab); ZACCHEDDU, Marco (Jefferson Lab); SATO, Nobuo (Jefferson Lab)

Presenter: ZACCHEDDU, Marco (Jefferson Lab)

Session Classification: Hadronization and Transverse Momentum

Contribution ID: **17** Type: **not specified**

Accessing gluon polarization with high-P_T hadrons in SIDIS

Tuesday, December 10, 2024 4:40 PM (10 minutes)

A recent global QCD analysis of jet production and other polarized scattering data has found the presence of negative solutions for the gluon helicity distribution in the proton, Δg, along with the traditional $\Delta g > 0$ solutions. We consider polarized semi-inclusive deep-inelastic scattering for hadrons produced with large transverse momentum as a means of constraining the dependence of Δg on the parton momentum fraction, x. Focusing on the double longitudinal spin asymmetry, we identify the kinematics relevant for future experiments at Jefferson Lab which are particularly sensitive to the polarized gluon channel and could discriminate between the different Δg behaviors. We find that a ~ 20 GeV beam at the high luminosity Jefferson Lab may be especially well-suited for discriminating between the positive and negative solutions.

Primary authors: SATO, Nobuo (Jefferson Lab); WHITEHILL, Richard (Old Dominion University); MELNITCHOUK, Wally (Jefferson Lab); ZHOU, Yiyu (University of Turin)

Presenter: ZHOU, Yiyu (University of Turin)

Session Classification: Hadronization and Transverse Momentum

Contribution ID: **18** Type: **not specified**

Pseudoscalar Mesons and Emergent Mass

Thursday, December 12, 2024 2:30 PM (20 minutes)

When discussing the Standard Model and the origin of mass, the Higgs boson often comes to mind. However, the majority of the mass in the visible universe arises from the nuclear strong interactions governed by quantum chromodynamics. In this presentation, we will explore how the study of pseudoscalar mesons can shed light on the origin of mass within the Standard Model and enhance our understanding of the hadronic structure. We will delve into recent progress in the study of form factors and parton distributions, which provide crucial insights into the internal structure of hadrons. We'll review key advancements from the past decade and offer perspectives on future research directions.

Primary author: RAYA, Khepani (University of Huelva)

Presenter: RAYA, Khepani (University of Huelva)

Session Classification: QCD confinement, Fundamental Symmetries and BSM

Contribution ID: **19** Type: **not specified**

Spectroscopy at e+e- machines in the JLab 22 era

Monday, December 9, 2024 9:20 AM (30 minutes)

In the last 20 years, multiple exotic hadron candidates were discovered in experiments around the world. Electron-positron annihilation experiments have played a big role in those discoveries, starting from the initial discovery of the X(3872), and covering the charged bottom- and charmonium-like Zb and Zc states, and exotic vector meson candidates in both charmonium and bottomonium. Today, with BESIII and Belle II there are two running experiments in the charmonium and bottomonium regions, with a potential Super Tau-Charm Factory discussed as a successor experiment to BESIII. Here, I will review some recent results on XYZ-states from e+e- experiments, discuss the open issues that can be addressed with e+e- machines in the future, and why some of these open issues will benefit from an independent production process at JLab.

Primary author: HÜSKEN, Nils (JGU Mainz)

Presenter: HÜSKEN, Nils (JGU Mainz)

Session Classification: Spectroscopy

Contribution ID: **20** Type: **not specified**

Anti-Shadowing Exploration Opportunities with CEBAF at 22GeV

Thursday, December 12, 2024 12:45 PM (10 minutes)

An upgrade of CEBAF at Jefferson Lab to around 22 GeV will open up key science that is not possible to access at 12 GeV. One kinematic regime where this is most possible is in the "middle" Bjorken x regime around 0.1, where the available momentum transfers at 12 GeV have limited or precluded several exciting measurements. Here, the long-standing mystery of anti-shadowing may now be probed for the first time in decades. The strange sea could hence be measured with minimal theoretical bias using parity-violating electron scattering. As a result, the interplay of the valence and sea regimes may be better disentangled. Also, novel tagged measurements may provide access to meson structure and the role of mesons in nuclei. All of these measurements leverage the unique luminosity and precision capabilities possible at Jefferson Lab in the EIC era. This presentation intends to identify exciting new opportunities afforded in this middle x regime via experiments that initially utilize largely existing or already-planned Hall equipment.

Primary author: KALANTARIANS, Narbe (Virginia Union University)

Presenter: KALANTARIANS, Narbe (Virginia Union University)

Session Classification: Nuclear Dynamics

Contribution ID: **21** Type: **not specified**

Probing the Transverse Momentum of Longitudinally Polarized Quarks

Tuesday, December 10, 2024 4:02 PM (10 minutes)

In this talk, I present the recent results from the MAP Collaboration on the extraction of the quark transverse-momentum-dependent helicity distribution (helicity TMD), which will offer insights into the difference between the three-dimensional motion of quarks with polarization parallel or antiparallel to the longitudinal polarization of the parent hadron. By analyzing experimental data of semi-inclusive deep inelastic scattering off longitudinal polarized targets, we extract the helicity TMD at next-to-next–leading logarithmic (NNLL) perturbative accuracy in the Collins-Soper-Sterman approach.

Primary author: Dr CERUTTI, Matteo (Christopher Newport U. and Jefferson Lab)

Presenter: Dr CERUTTI, Matteo (Christopher Newport U. and Jefferson Lab)

Session Classification: Hadronization and Transverse Momentum

Contribution ID: **22** Type: **not specified**

Meson parton distributions at 22 GeV

Monday, December 9, 2024 4:50 PM (15 minutes)

To obtain a clearer picture of QCD itself, it is important to study a wide range of structures in various color confined systems. In recent years, we have made considerable progress in understanding the structure of pions, the lightest of all hadrons, through Drell-Yan (DY) and leading neutron (LN) electroproduction data. However, kinematic overlap between these experiments is limited, and additional large-x_π data is needed to test universality. At current energies, a measurement complementary to LN, called tagged deep inelastic scattering (TDIS), has been approved at Jefferson Lab. However, the pion's unmeasured resonance spectrum appears to largely overlap with current kinematics at small W_π^2. At 22 GeV, much larger values of W_π^2 can be reached, allowing for safer studies of the pion structure at the luminosity frontier.

Primary authors: JI, Chueng-Ryong (North Carolina State University); SATO, Nobuo (Jefferson Lab); BARRY, Patrick (Argonne National Lab); MELNITCHOUK, Wally (Jefferson Lab)

Presenter: BARRY, Patrick (Argonne National Lab)

Session Classification: Partonic structure and spin

Contribution ID: **23** Type: **not specified**

The EMC effect of light-nuclei within the light-front Hamiltonian dynamics

Thursday, December 12, 2024 9:30 AM (15 minutes)

We present the description of the structure of light-nuclei (H2, H3, He3 and He4) in impulse approximation within the Light-Front approach [1,2], retaining nucleonic dof, only. In particular, the latter has been applied to investigate the reaction mechanism of polarized and unpolarized deep inelastic scattering (DIS) on nuclear targets, in the valence region and in the Bjorken limit [3,4,5]. In this framework, Poincaré covariance is preserved as well ass macroscopic locality, number of particles and momentum sum rules. The main theoretical ingredient of our calculations is the LF nuclear spectral function properly related to the relative momentum distribution. This quantity has been used to realistically evaluate the structure functions, of light nuclei. The spin independent structure functions have been used to predict the European Muon Collaboration (EMC) effect. For the He3 target, our results are in good agreement with data [3,6,7]. For He4 a sizable effect has been found [4] but our calculation overestimate the data. Results, in the valence region, are found to be rather independent with respect to the use of different parametrizations of the nucleon DIS structure functions and that of nuclear two- and three-body potentials [3,4]. Finally, in Ref. [5] the spin dependent He3 Structure functions have been calculated and results compare very well with data. These results are fundamental for the experimental programme of the present and future experiments, such as the Electron Ion Collider.

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Primary author: RINALDI, Matteo (Istituto Nazionale di Fisica Nucleare)

Co-authors: PROIETTI, Eleonora (Istituto Nazionale di Fisica Nucleare); PACE, Emanuele (ROMA2); FORNETTI, Filippo (Istituto Nazionale di Fisica Nucleare); SALME', Giovanni (Istituto Nazionale di Fisica Nucleare - Roma); VIVIANI, Michele (Istituto Nazionale di Fisica Nucleare); SCOPETTA, Sergio (Istituto Nazionale di Fisica Nucleare)

Presenter: RINALDI, Matteo (Istituto Nazionale di Fisica Nucleare)

Session Classification: Nuclear Dynamics

Contribution ID: **25** Type: **not specified**

Unveiling the Collins-Soper kernel in inclusive DIS at threshold and implications at Jlab 22

Tuesday, December 10, 2024 3:03 PM (10 minutes)

abstract: Factorization of deep inelastic scattering (DIS) cross sections is revisited to highlight the importance of tracking off-lightcone effects in the proof of collinear factorization theorems. In inclusive DIS at large Bjorken x, particle production develops around two opposite near lightcone directions just like in transverse momentum dependent processes, and the Collins-Soper kernel emerges as a universal function in the rapidity evolution of the relevant parton correlators. This new factorization analysis clarifies outstanding issues regarding the role played by soft radiation and the treatment of rapidity divergences, and offers a solid framework for phenomenological analyses. The 22 GeV upgrade of Jefferson Lab will be crucial for investigating the endpoint kinematics, where the differences between standard and off-lightcone factorization can be tested. A sound and solid factorization framework, such as the one presented here, is crucial in order to match the accuracy of phenomenological analyses with the expected experimental precision from 12 GeV and 22 GeV inclusive DIS data sets.

Primary author: SIMONELLI, Andrea

Co-authors: ACCARDI, Alberto (Hampton U. and Jefferson Lab); SIGNORI, Andrea (Istituto Nazionale di Fisica Nucleare); COSTA, Caroline (Jefferson Lab); Dr CERUTTI, Matteo (Christopher Newport U. and Jefferson Lab)

Presenter: SIMONELLI, Andrea

Session Classification: Hadronization and Transverse Momentum

Contribution ID: **26** Type: **not specified**

MAPTMD24: First Global Flavor Dependent TMD extractions

Tuesday, December 10, 2024 3:42 PM (15 minutes)

In this talk, we report the latest results from the MAP Collaboration on the extraction of unpolarized quark Transverse-Momentum-Dependent Parton Distributions (TMD PDFs) and Fragmentation Functions (TMD FFs) based on global fits to Drell-Yan and Semi-Inclusive Deep-Inelastic Scattering (SIDIS) datasets. Specifically, we examine the impact of incorporating flavor dependence in the nonperturbative models.

Primary authors: BACCHETTA, Alessandro (Istituto Nazionale di Fisica Nucleare); SIGNORI, Andrea (Istituto Nazionale di Fisica Nucleare); BISSOLOTTI, Chiara (Argonne Laboratory); DELCARRO, Filippo (Istituto Nazionale di Fisica Nucleare); BOZZI, Giuseppe (University of Cagliari and INFN, Cagliari); ROSSI, Lorenzo (Istituto Nazionale di Fisica Nucleare); RADICI, Marco (Istituto Nazionale di Fisica Nucleare); Dr CERUTTI, Matteo (Christopher Newport U. and Jefferson Lab); Dr BERTONE, Valerio (CEA Paris-Sclay)

Presenter: ROSSI, Lorenzo (Istituto Nazionale di Fisica Nucleare)

Session Classification: Hadronization and Transverse Momentum

Contribution ID: **27** Type: **not specified**

Impact of JLab22 on unpolarized PDFs at large x

Tuesday, December 10, 2024 9:25 AM (20 minutes)

We present a first analysis by the CTEQ-JLab (CJ) Collaboration of the potential impact of data from a 22 GeV upgrade of Jefferson Lab on parton distribution functions (PDFs) in the large-momentum fraction (large x) region. Using Monte Carlo pseudodata generated for the kinematic coverage of Hall C, we examine the constraints that these new data could provide on PDFs, Higher-Twist (HT) corrections, and nuclear nonperturbative corrections with a deuteron target. Such new constraints at large x could significantly improve our understanding of hadron structure and address limitations in current models, opening new avenues for both experimental and theoretical research.

Primary author: Dr CERUTTI, Matteo (Christopher Newport U. and Jefferson Lab)

Co-authors: ACCARDI, Alberto (Hampton U. and Jefferson Lab); KEPPEL, Cynthia (Thomas Jefferson National Accelerator Facility); OWENS, Joseph (Florida State University); PARK, Sanghwa (Stony Brook University); Dr LI, Shujie (Lawrence Berkeley National Laboratory)

Presenter: Dr CERUTTI, Matteo (Christopher Newport U. and Jefferson Lab)

Session Classification: Partonic structure and spin

Contribution ID: **28** Type: **not specified**

Studying the tensor-polarized deuteron system in the 22 GeV era

Thursday, December 12, 2024 10:10 AM (15 minutes)

The deuteron is a spin-1 system, and its tensor properties continue to be elusive in experimental measurements due to the complexity of the polarized target. Recently, there has been an increase in interest in the physics of the tensor components of this system due to advances in target technology. This talk will discuss the implications of studying semi-inclusive deep inelastic scattering (SIDIS) reactions with a longitudinally polarized tensor target to investigate the transverse momentum-dependent distribution functions (TMDs) in order to understand the complex partonic correlations in multiple-nucleon light nuclei. We will also discuss the sensitivity to the S-wave by using tensor deuteron electro-disintegration, a unique measurement that is more interesting the larger the missing momentum of the nucleon. All of this discussion will be framed within the 22-GeV context.

Primary author: SANTIESTEBAN, Nathaly (University of New Hampshire)

Presenter: SANTIESTEBAN, Nathaly (University of New Hampshire)

Session Classification: Nuclear Dynamics

Contribution ID: **29** Type: **not specified**

Study Light Sea in Intermediate-x Region with SIDIS at JLab22 in SoLID and Hall C

Monday, December 9, 2024 2:30 PM (20 minutes)

JLab22 allows precision study of light sea at intermediate-x region. Studies are being performed on SIDIS measurements in Hall C to extract information on unpolarized light sea quark distributions and with SoLID for polarized case.

Primary author: CHEN, Jian-ping (Jefferson Lab)

Presenter: CHEN, Jian-ping (Jefferson Lab)

Session Classification: Partonic structure and spin

Contribution ID: **30** Type: **not specified**

Determination of α_s with JLab at 22 GeV

Monday, December 9, 2024 4:05 PM (15 minutes)

We will discuss how data from JLab@22GeV, combined with expected low-x measurements from the EIC, can determine the QCD coupling α_s with an accuracy comparable to that of all current world data combined. Furthermore, this approach represents the first extraction of α_s directly sensitive to effects beyond its leading-order evolution, offering a novel test of perturbative QCD at a fundamental level. Additionally, it opens a possible new window for probing physics beyond the Standard Model, as non-QCD contributions affect the evolution α_s at the next-to-leading order, rather than leading-order level where α_s has been tested to date.

Primary author: DEUR, Alexandre (Jefferson Lab)

Presenter: DEUR, Alexandre (Jefferson Lab)

Session Classification: Partonic structure and spin

Contribution ID: **32** Type: **not specified**

Resonance Electroexcitations at High Momentum Transfers with Jefferson Lab at 22 GeV

Wednesday, December 11, 2024 10:10 AM (20 minutes)

On behalf of the CLAS Collaboration

Studies of nucleon resonance electroexcitation amplitudes are providing insight into many facets of strong QCD dynamics. These amplitudes have become available from the analyses of exclusive electroproduction experiments at Jefferson Lab with CLAS in the range of momentum transfers up to 5 GeV^2 and are currently extended to momentum transfers up to 10 GeV^2 by measurements with CLAS12. A 22-GeV upgrade of CEBAF at Jefferson Lab will offer unique opportunities to explore momentum transfers up to 30 GeV^2 corresponding to the full range of distances where nucleon resonance states are generated in strong QCD. These studies can shed light on the emergence of the dominant part of hadron mass.

Primary author: ACHENBACH, Patrick (Jefferson Lab)

Presenter: ACHENBACH, Patrick (Jefferson Lab)

Session Classification: Spatial Structure, Mechanical Properties, and Emergent Hadron Mass

Contribution ID: **33** Type: **not specified**

Searching for Color Transparency effects at 22 GeV

Thursday, December 12, 2024 11:25 AM (15 minutes)

Searching for the onset of Color Transparency (CT) is a vibrant experimental effort to observe hadrons in a small color-neutral transverse size configuration in the nucleus. The observation of the onset of CT lies at the intersections between the quark-gluon degrees of freedom and the nucleonic descriptions of nuclei. CT is fundamentally predicted by perturbative quantum chromodynamics and is expected to be observable in exclusive scattering as a reduction of final state interactions (FSI) of the point-like hadron with the nuclear medium. Experimentally, this would yield a rise in the measured transparency of the point-like hadron with increasing four-momentum transferred.

Recent experiments in the Jefferson Lab 12 GeV program have explored the onset of CT for protons in Hall C with a null observation, and the analysis of CT effects in rho-mesons in the Hall B CLAS12 detector is currently underway. Near-term future experiments in the 12 GeV program will extend the Q2 range of the transparency measurements of pion electroproduction in Hall C, and another experiment will seek to enhance the signal for observing CT for protons in Hall C by measuring protons from rescattering in deuterium.

A 22 GeV upgrade at Jefferson Lab would enable improved precision and higher accessible Q2 for extending the above-mentioned experiments in Halls B and C examining the CT in rho-mesons, pions, and protons with the current experimental equipment. This talk will discuss these measurements and will explore other experimental prospects to search for the CT effects at 22 GeV.

Primary author: SZUMILA-VANCE, Holly (Florida International University)

Co-authors: DUTTA, Dipangkar (Mississippi State University); EL FASSI, Lamiaa (Mississippi State University)

Presenter: SZUMILA-VANCE, Holly (Florida International University)

Session Classification: Nuclear Dynamics

Contribution ID: **34** Type: **not specified**

Double Deeply Virtual Compton Scattering (DDVCS) at 22 GeV

Wednesday, December 11, 2024 12:40 PM (15 minutes)

One of the main challenges in the extraction of Generalized Parton Distributions (GPDs) from the currently available experimental data is that experimental observables can access only two of three variables, x, ξ, and t, that define the GPDs. The variable is integrated over in the DVCS and TCS amplitudes due to the loop in the "handbag"diagrams. The only information that can be accessed in spin asymmetries is GPDs at the = ± point. The Double Deeply Virtual Compton Scattering (DDVCS) process, where both the incoming and outgoing photons have large virtualities, allows for independently mapping the GPDs along all three variables (, , and t). In this talk, I will discuss the possibilities of DDVCS measurements at JLab and the importance of such measurements with 12 GeV and 22 GeV electron beams.

Primary author: PAREMUZYAN, Rafayel (Jefferson Lab)

Co-author: STEPANYAN, Stepan (Jefferson Lab)

Presenter: PAREMUZYAN, Rafayel (Jefferson Lab)

Session Classification: Spatial Structure, Mechanical Properties, and Emergent Hadron Mass

Contribution ID: **35** Type: **not specified**

Tree level matching relations for next-to-leading power transverse momentum dependent distributions with mass corrections

Tuesday, December 10, 2024 12:20 PM (15 minutes)

Sub-leading twist contributions to scattering processes, such as semi-inclusive DIS (SIDIS), are gaining increased attention as they provide valuable insights that complement leading-twist contributions in probing the proton structure.
In this talk I will present the results for the matching relations of twist-3 transverse momentum dependent distributions (TMDs) onto collinear distributions of twist-3. After a brief introduction to twist 3 TMDs, their relevance in the SIDIS angular modulations and the computational technique that we used to obtain the matching relations with the complete series of mass corrections, I will discuss the results and their implication for the SIDIS cross section.

Primary authors: ALVARO, Alessio Carmelo (Università di Pavia); PASQUINI, Barbara (Istituto Nazionale di Fisica Nucleare); RODINI, Simone

Presenter: ALVARO, Alessio Carmelo (Università di Pavia)

Session Classification: Hadronization and Transverse Momentum

Contribution ID: **36** Type: **not specified**

Study of Tagged Processes with 4He and ALERT at 22 GeV

Thursday, December 12, 2024 12:05 PM (15 minutes)

Decades after the discovery of the European Muon Collaboration (EMC) effect, theorists and experimentalists are still working to unravel its origin and deploy new methods to understand the in-medium modifications of nucleon structure. One novel way to probe the EMC effect is to study the fundamental structure of light nuclei, such as ^{2}H and ^{4}He, via the deeply virtual Compton scattering (DVCS) process, enabling access to their three-dimensional (3-D) distributions through generalized parton distributions (GPDs). The forthcoming CLAS12 experiment will use the newly built a low energy radial tracker (ALERT) to study tagged DVCS on ^{4}He with an 11 GeV beam via the detection of low-momentum recoil fragments such as ^{2}H, ^{3}H, ^{3}He, ^{4}He, and protons in a wide kinematic range for the momentum transfer squared, 1 < Q^2 < 7 GeV^2, as well as the Bjorken-x, 0.1 < x_B < 0.7.

The measurement of beam spin asymmetry (BSA) in coherent DVCS on ^{4}He is a critical observable in ALERT-type studies as it offers a way to investigate the partonic spatial distributions and thus probe the 3-D tomography of nuclei. Combining this coherent nuclear BSA data with free proton DVCS results will better distinguish various competing theories on medium-stimulated effects. Extending the study of nuclear DVCS on ^{4}He at 22 GeV, using the TOPEG event generator, CLAS12 GEant4 Monte-Carlo package, and the Forward Tagger improves detection of photons at low polar angle, enhancing DVCS acceptance. The 22 GeV beam energy and luminosity upgrade will enhance the statistical precision and broaden the kinematical coverage in Q^2, allowing access to lower x_B region (0.08 < x_B < 0.15) for detailed x_B-dependence studies. Preliminary results on the phase-space coverage and BSAs from DVCS on ^{4}He will be presented for coherent and incoherent DVCS.

Primary author: OUILLON, Mathieu (Mississippi State University)

Co-authors: EL FASSI, Lamiaa (Mississippi State University); DUPRÉ, Raphaël (IJCLab - CNRS - Univ. Paris-Saclay)

Presenter: OUILLON, Mathieu (Mississippi State University)

Session Classification: Nuclear Dynamics

Contribution ID: **37** Type: **not specified**

Impact of future experiments on TMD extractions

Our knowledge of the three-dimensional structure of nucleons in terms of structure functions, will be soon improved by measurements at recent and future planned experiments. In this talk I will discuss the impact of measurements at SoLID and EPIC on the uncertainties of polarized and unpolarized TMDs.

Primary author: DELCARRO, Filippo (Istituto Nazionale di Fisica Nucleare)

Presenter: DELCARRO, Filippo (Istituto Nazionale di Fisica Nucleare)

Session Classification: Hadronization and Transverse Momentum

Contribution ID: **38** Type: **not specified**

Inclusive electron scattering in the resonance region at high Q^2

Wednesday, December 11, 2024 11:40 AM (15 minutes)

Using Thomas Jefferson's National Accelerator Facility's 10.6 GeV beam
and the CLAS12 large solid angle spectrometer, inclusive electron proton cross sections were measured over a wide kinematic range from the pion threshold up to an invariant mass W of 2.55 GeV, for ten Q^2 bins between 2.5 and 10.4 GeV^2. These results were validated against existing world data set in the overlap region and compared with
the resonant contributions deduced from exclusive meson electroproduction data measured with the CLAS at Q^2<5.0 GeV^2. Resonance-like structures are seen in the range of Q^2<10 GeV^2 in the CLAS12 inclusive electroproduction data.

This new data set indicates the opportunity to extend the information on the Q^2 evolution of the nucleon electroexcitation amplitudes to Q^2~ 10 GeV^2 and, looking forward to the JLab energy upgrade, even towards larger values of Q^2.

Primary author: NICULESCU, Gabriel (James Madison University)

Presenter: NICULESCU, Gabriel (James Madison University)

Session Classification: Spatial Structure, Mechanical Properties, and Emergent Hadron Mass

Contribution ID: **39** Type: **not specified**

Probing the EMC effect thru the measurement of super-fast quarks in nuclei

Thursday, December 12, 2024 11:00 AM (20 minutes)

The microscopic origin of the EMC effect remains a mystery, with new observables proposed in recent years to elucidate its origin including measurements of the spin and flavor dependence of the EMC effect, the A dependence in light nuclei, and tagged measurements of DIS in the deuteron. A new possibility, enabled by a JLab energy upgrade, would maintain the clean interpretation of the inclusive measurements while providing unique sensitivity to several classes of models.

Extracting nuclear pdfs at x>1 requires much higher energy, but allows the extraction of the super-fast quarks (the highest-x quarks in very high momentum nucleons). In this region, the pdfs fall very rapidly in a simple convolution model, providing dramatically enhanced sensitivity to models of the EMC effect that provide additional non-nucleonic contributions at large x or to explanations that are connected to off-shell effects in the high-momentum nucleons.

Primary author: ARRINGTON, John (Lawrence Berkeley National Laboratory)

Presenter: ARRINGTON, John (Lawrence Berkeley National Laboratory)

Session Classification: Nuclear Dynamics

Contribution ID: **40** Type: **not specified**

Refined Simulations of Double Pion Electroproduction for CLAS22

Wednesday, December 11, 2024 11:20 AM (15 minutes)

This presentation covers recent advancements in the refined simulations of double pion electroproduction for CLAS22. Double pion production provides a valuable probe of baryon structure, requiring accurate simulations for proper interpretation of experimental data. The presentation addresses the feasibility of extending the kinematic coverage beyond CLAS12, discussing resolution and acceptance in terms of detector coverage and reconstructed simulation. Sufficient resolution is necessary for precise identification and isolation of exclusive and missing particle (proton, $\pi+$, and $\pi-$) topologies. These simulations aid in current data analyses and provide a foundation for future experiments with CLAS22 at Jefferson Lab, ultimately leading to a deeper understanding of the baryon structure.

Primary author: OSMOND, Alexis (University of South Carolina)

Presenter: OSMOND, Alexis (University of South Carolina)

Session Classification: Spatial Structure, Mechanical Properties, and Emergent Hadron Mass

Contribution ID: **41** Type: **not specified**

Experimental expectations for XYZs at GlueX

Monday, December 9, 2024 11:35 AM (25 minutes)

In this talk we will present prospects and studies to facilitate spectroscopy of XYZ states in the charmonium mass region with the GlueX spectrometer in Hall-D and 22GeV of CEBAF electron beam energy. The current state of simulations for signal and background contributions will be shown and we will discuss the complementarity of this program with respect to the program proposed for measurements at the EIC.

Primary author: ALBRECHT, Malte (Ruhr-Universitaet Bochum)

Co-author: ALBRECHT, Malte (Jefferson Lab)

Presenter: ALBRECHT, Malte (Ruhr-Universitaet Bochum)

Session Classification: Spectroscopy

Contribution ID: **44** Type: **not specified**

Welcome from the organizers

Monday, December 9, 2024 9:00 AM (10 minutes)

Presenter: ROSSI, Patrizia (Istituto Nazionale di Fisica Nucleare)

Session Classification: Welcome

Contribution ID: **45** Type: **not specified**

Welcome from the LNF director

Monday, December 9, 2024 9:10 AM (10 minutes)

Presenter: GIANOTTI, Paola (LNF)

Session Classification: Welcome

Contribution ID: **46** Type: **not specified**

Theoretical Overview of Heavy Meson Spectroscopy in Photoproduction

Monday, December 9, 2024 9:55 AM (30 minutes)

Presenter: WINNEY, Daniel (Universität Bonn (HISKP))

Session Classification: Spectroscopy

Contribution ID: **47** Type: **not specified**

(Meson) Spectroscopy with quasi-real photoproduction from CLAS12 to the EIC

Monday, December 9, 2024 11:00 AM (30 minutes)

An abundance of candidates for hadronic exotic states have been discovered over the last 20 years. Details of the exact structure of many of these are still incomplete. In this presentation we will examine the potential for quasi-free photoproduction of mesons, at possible future Jefferson Lab and EIC facilities, to enhance our understanding. Quasi-free photoproduction is essentially equivalent to real photoproduction but uses virtual photons with low Q^2 from electro scattering experiments. It can provide well understood polarisation degrees of freedom to extract more information from the processes. We will review some previous experiments then, using amplitudes from the JPAC collaboration, demonstrate the feasibility for future experiments to measure these states.

Presenter: GLAZIER, Derek Ian

Session Classification: Spectroscopy

Contribution ID: **49** Type: **not specified**

Experiment: Parity violating DIS for c-odd pdfs and BSM

Monday, December 9, 2024 3:20 PM (20 minutes)

Presenter: NYCZ, Michael (University of Virginia)

Session Classification: Partonic structure and spin

Contribution ID: **50** Type: **not specified**

Role of QED effects

Tuesday, December 10, 2024 9:00 AM (20 minutes)

Presenter: QIU, Jianwei (Jefferson Lab)

Session Classification: Partonic structure and spin

Contribution ID: **55** Type: **not specified**

Discussion: Partonic structure and spin

Monday, December 9, 2024 5:10 PM (30 minutes)

Session Classification: Partonic structure and spin

Contribution ID: **56** Type: **not specified**

Vector mesons

Tuesday, December 10, 2024 10:10 AM (15 minutes)

Presenter: AVAGYAN, Harutyun

Session Classification: Hadronization and Transverse Momentum

Contribution ID: **57** Type: **not specified**

The role of multi-D approach in TMD studies: COMPASS experience

Tuesday, December 10, 2024 9:50 AM (15 minutes)

From 2002 to 2022, the COMPASS collaboration performed a series of nucleon spin structure measurements employing high-energy muon beams impinging on polarized targets.
Over the years, the experiment has become a pivotal contributor to the investigation of parton transverse momentum-dependent (TMD) phenomena.
This presentation will focus on selected highlights of the COMPASS TMD programme, with particular emphasis on aspects that require a multi-dimensional approach.

Presenter: PARSAMYAN, Bakur (Istituto Nazionale di Fisica Nucleare)

Session Classification: Hadronization and Transverse Momentum

Contribution ID: **59** Type: **not specified**

SIDIS MC including polarization effects

Tuesday, December 10, 2024 11:00 AM (15 minutes)

Monte Carlo event generators are foundational to the simulation of a high-energy physics experiment. Pythia, a general-purpose event generator commonly used for Semi-Inclusive Deep Inelastic Scattering (SIDIS) studies, is highly configurable and provides the option to allow user program code to modify the event generation procedure. The String+$^3P_0$ model shows promise in describing the spin effects in the hadronization process, especially with the recent inclusion of vector meson production; this model has been interfaced with the Lund String Model implementation in Pythia as a program called StringSpinner. This presentation summarizes the status of testing StringSpinner with CLAS12; since it is the first study that uses Pythia version 8, whereas all other Pythia studies at CLAS12 have been with version 6, most of the effort so far has been focused on tuning the version 8 parameters. Although the tuning is still in progress, we present the status and kinematic comparisons to data, focusing on the SIDIS dihadron production process, as well as a look at the beam spin asymmetries generated by StringSpinner. With a reasonable parameter tune, this event generator may be used for spin asymmetry impact studies for CLAS at 22 GeV.

Presenter: DILKS, Christopher (Jefferson Lab)

Session Classification: Hadronization and Transverse Momentum

Contribution ID: **60** Type: **not specified**

Polarized collisions at LHC

Tuesday, December 10, 2024 11:20 AM (15 minutes)

Presenter: DI NEZZA, Pasquale (Istituto Nazionale di Fisica Nucleare)

Session Classification: Hadronization and Transverse Momentum

Contribution ID: **61** Type: **not specified**

Hadron mass corrections

Tuesday, December 10, 2024 12:00 PM (15 minutes)

We briefly review the (not abundant) literature on hadron mass corrections in SIDIS, and numerically evaluate their impact on calculations of pT-integrated cross sections at 22 GeV. Even though power suppressed as 1/Q^2, these corrections are not negligible for pion production and large for kaon production. This calls for renewed theoretical and phenomenological community efforts, especially for TMD cross sections that have received little attention so far.

Presenter: ACCARDI, Alberto (Hampton U. and Jefferson Lab)

Session Classification: Hadronization and Transverse Momentum

Contribution ID: **62** Type: **not specified**

Back-to-back SIDIS

Tuesday, December 10, 2024 3:16 PM (10 minutes)

In semi-inclusive deep inelastic scattering (SIDIS), when a second hadron produced from the target remnant is detected in coincidence with the primary hadron produced in the current an entire suite of new transverse-momentum dependent (TMD) observables becomes accessible. These observables are known as fracture functions and can be linked to each of the more well known TMDs, such as the helicity or transversity distributions, through momentum sum rules. Simultaneously, they can provide leading-twist access to objects whose interpretation are not accessible in traditional SIDIS, such as the leading twist beam- and target-spin asymmetries which are sensitive to fracture functions describing longitudinally polarized quarks in an unpolarized nucleus and vice versa. Interestingly, in addition to these possibilities, the detection of the second hadron in coincidence with the first also provides the opportunity to cleanly remove the contributions of non-factorizable diffractive vector-meson production which strengthens the interpretation of the back-to-back SIDIS results. These features will all be briefly highlighted.

Presenter: HAYWARD, Timothy

Session Classification: Hadronization and Transverse Momentum

Contribution ID: **63** Type: **not specified**

Kaon SIDIS

Tuesday, December 10, 2024 3:29 PM (10 minutes)

Presenter: VALLARINO, Simone (Istituto Nazionale di Fisica Nucleare)

Session Classification: Hadronization and Transverse Momentum

Contribution ID: **64** Type: **not specified**

J/psi: JLab22, SoLID, EIC

Wednesday, December 11, 2024 9:00 AM (20 minutes)

The charmonium photo/electro-production close to threshold can be used, under certain assumptions, to study the the gluon properties of the nucleon such as gluon form factors, mass radius of the proton, and the anomalous contribution to the proton mass. I will present analysis of the existing JLab J/psi data discussing the possibility of extracting gluon form factors based on some general theoretical assumptions. At the same time such analysis demonstrates the need for more precise data including also threshold production of higher-mass charmonium states. The CEBAF energy upgrade offers unique opportunities for such comprehensive studies. For the GlueX experiment we estimate significant increase in the Figure of Merit allowing not only precise cross-section but also polarization measurements. The future SoLID experiment with its high luminosity would complement such studies including also electro-production.

Presenter: PENTCHEV, Lubomir (Jefferson Lab)

Session Classification: Spatial Structure, Mechanical Properties, and Emergent Hadron Mass

Contribution ID: **65** Type: **not specified**

EIC for exclusive processes in the region of large x>0.05

Wednesday, December 11, 2024 9:25 AM (20 minutes)

The future Electron-Ion Collider (EIC) will be a powerful tool for studying the internal structure of nucleons and nuclei at low x, where gluons dominate and current knowledge remains limited. Investigating exclusive reactions, such as Deeply Virtual Compton Scattering (DVCS) or Deeply Virtual Meson Production (DVMP), will enable access to the Generalized Parton Distributions (GPDs) of nucleons in this low-x region.

The EIC kinematic coverage will also extend into the x>0.05 range, overlapping with measurements from Jefferson Lab. This overlap will be invaluable for cross-checking results and gaining deeper insight into the transition from the gluon-dominated regime to the quark-dominated regime in the three-dimensional structure of protons and neutrons.

In this presentation, I will outline the x-Q2 coverage of exclusive reactions at the EIC and highlight key projections for higher xvalues.

Presenter: MUNOZ CAMACHO, Carlos

Session Classification: Spatial Structure, Mechanical Properties, and Emergent Hadron Mass

Contribution ID: **66** Type: **not specified**

Meson structure

Wednesday, December 11, 2024 9:50 AM (15 minutes)

This talk will discuss upcoming tagged deep inelastic scattering (TDIS) measurements at Jefferson Lab, which will directly probe the elusive mesonic content of the nucleon. The TDIS experiment will measure low momentum recoiling (and spectator) hadrons in coincidence with deep inelastically scattered electrons from hydrogen (and deuterium) targets. Through use of a recoil detector, a tagging technique will enhance deep inelastic scattering from partons in the meson cloud (also known as the Sullivan process). TDIS aims to extract the pion and kaon structure functions (SF) in the valence regime. Existing world data on light meson structure is extremely sparse and the TDIS measurements will be crucial for shedding light on such topics as emergent hadron mass. A 22GeV beam at JLab would offer the opportunity for an extended phase space for the TDIS SF measurements, which would vastly increase the data available above the resonance region and resultantly strengthen the impact which TDIS data could have for meson PDF extractions. Furthermore a 22GeV beam would unlock the opportunity to perform SIDIS on the pion via the Sullivan process, for the first time, which would allow for pion TMD studies. TDIS with a 22GeV beam would also unlock the opportunity for pion DVCS via the Sullivan process, which is also not possible with an 11GeV electron beam.

Presenter: MONTGOMERY, Rachel (University of Glasgow)

Session Classification: Spatial Structure, Mechanical Properties, and Emergent Hadron Mass

Contribution ID: **68** Type: **not specified**

Probe QCD Confinement via pi^0, eta and eta'

Thursday, December 12, 2024 2:55 PM (20 minutes)

Presenter: KAMPF, Karol (Charles University)

Session Classification: QCD confinement, Fundamental Symmetries and BSM

Contribution ID: **69** Type: **not specified**

Overview of Sub-GeV Physics in the Dark sector (theory side)

Thursday, December 12, 2024 3:20 PM (20 minutes)

Presenter: DARME, Luc (IP2I - Lyon 1 University)

Session Classification: QCD confinement, Fundamental Symmetries and BSM

Contribution ID: **70** Type: **not specified**

Experimental overview of Sub-GeV Physics in the Dark sector

Thursday, December 12, 2024 3:45 PM (20 minutes)

Presenter: BONDI, Mariangela (Istituto Nazionale di Fisica Nucleare)

Session Classification: QCD confinement, Fundamental Symmetries and BSM

Contribution ID: **71** Type: **not specified**

The BDX experiment

Thursday, December 12, 2024 4:10 PM (15 minutes)

Presenter: SPREAFICO, Marco (Istituto Nazionale di Fisica Nucleare)

Session Classification: QCD confinement, Fundamental Symmetries and BSM

Contribution ID: **72** Type: **not specified**

AI for BSM physics searches

Thursday, December 12, 2024 4:45 PM (15 minutes)

Presenter: MORAN, Patrick (The College of William & Mary)

Session Classification: QCD confinement, Fundamental Symmetries and BSM

Contribution ID: **73** Type: **not specified**

spectroscopy

Tuesday, December 10, 2024 5:30 PM (1 hour)

Session Classification: Parallel Sessions

Contribution ID: **74** Type: **not specified**

Partonic Structure and Spin

Tuesday, December 10, 2024 5:30 PM (1 hour)

Session Classification: Parallel Sessions

Contribution ID: **75** Type: **not specified**

Hadronization and Transverse Momentum

Tuesday, December 10, 2024 5:30 PM (1 hour)

Session Classification: Parallel Sessions

Contribution ID: **76** Type: **not specified**

Spatial Structure, Mechanical Properties and Emergent Hadron Mass

Thursday, December 12, 2024 5:30 PM (1 hour)

Session Classification: Parallel Sessions

Contribution ID: **77** Type: **not specified**

QCD Confinement, Fundamental Symmetries and BSM

Thursday, December 12, 2024 5:30 PM (1 hour)

Session Classification: Parallel Sessions

Contribution ID: **78** Type: **not specified**

Nuclear Dynamics

Thursday, December 12, 2024 5:30 PM (1 hour)

Session Classification: Parallel Sessions

Contribution ID: **79** Type: **not specified**

Charmed pentaquark production at the EicC and JLab 12 to 22 GeV

Friday, December 13, 2024 11:00 AM (20 minutes)

Presenter: GUO, Feng-Kun (Institute of Theoretical Physics, Chinese Academy of Sciences)

Session Classification: Summaries and Path Forward

Contribution ID: **80** Type: **not specified**

Gravitational Structure of the Nucleon

Friday, December 13, 2024 9:00 AM (20 minutes)

The proton's internal structure has been probed through electromagnetic and weak interactions for over 70 years and very precise data on the electromagnetic and electroweak form factors have been determined. About the protons gravitational structure and mechanical properties, we have very little information albeit theoretical investigations were conducted already in the early 1960's. There was however no way of using gravity to probe the mechanical properties because of the extreme weakness of the gravitational interaction. It took over 3 decades before an indirect way of probing the gravitational structure of particles was proposed and another 25 years before the first experiment-based information about the internal distribution of pressure and forces inside the proton were published in 2018. In this presentation I will briefly review
the early findings, discuss the status and projections for the proposed 22 GeV energy upgrade of the CEBAF accelerator at Jefferson Lab.

Presenter: VOLKER, Burkert (Jefferson Lab)

Session Classification: Summaries and Path Forward

Contribution ID: **81** Type: **not specified**

Spectroscopy: summary

Friday, December 13, 2024 11:25 AM (10 minutes)

Presenter: STEVENS, Justin (William & Mary)

Session Classification: Summaries and Path Forward

Contribution ID: **82** Type: **not specified**

Partonic Structure and Spin: summary

Friday, December 13, 2024 11:35 AM (10 minutes)

Presenter: SATO, Nobuo (Jefferson Lab)

Session Classification: Summaries and Path Forward

Contribution ID: **83** Type: **not specified**

Hadronization and Transverse Momentum: summary

Friday, December 13, 2024 11:45 AM (10 minutes)

Presenters: AVAGYAN, Harutyun; SATO, Nobuo (Jefferson Lab)

Session Classification: Summaries and Path Forward

Contribution ID: **84** Type: **not specified**

Spatial Structure, Mechanical Properties, and Emergent Hadron Mass: summary

Friday, December 13, 2024 11:55 AM (10 minutes)

Presenter: HUBER, Garth (University of Regina)

Session Classification: Summaries and Path Forward

Contribution ID: **85** Type: **not specified**

QCD Confinement, Fundamental Symmetries and BSM: summary

Friday, December 13, 2024 12:05 PM (10 minutes)

Presenter: BATTAGLIERI, Marco (Istituto Nazionale di Fisica Nucleare)

Session Classification: Summaries and Path Forward

Contribution ID: **86** Type: **not specified**

Nuclear Dynamics: summary

Friday, December 13, 2024 12:15 PM (10 minutes)

Presenters: EL FASSI, Lamiaa (Mississippi State University); SARGSIAN, Misak

Session Classification: Summaries and Path Forward

Contribution ID: **87** Type: **not specified**

Positron workshop summary

Friday, December 13, 2024 9:50 AM (20 minutes)

Presenter: BATTAGLIERI, Marco (Istituto Nazionale di Fisica Nucleare)

Session Classification: Summaries and Path Forward

Contribution ID: **88** Type: **not specified**

Realizing JLab 22 GeV: Project Planning

Friday, December 13, 2024 10:15 AM (20 minutes)

Presenter: LUNG, Allison (Jefferson Lab)

Session Classification: Summaries and Path Forward

Contribution ID: **89** Type: **not specified**

Discussion and Path forward

Friday, December 13, 2024 12:25 PM (20 minutes)

Presenter: KEPPEL, Cynthia (Thomas Jefferson National Accelerator Facility)

Session Classification: Summaries and Path Forward

Contribution ID: **90** Type: **not specified**

Complementary insights into the pseudoscalar meson and baryon structure from Amber

Wednesday, December 11, 2024 12:00 PM (15 minutes)

Presenter: DENISOV, Oleg (Istituto Nazionale di Fisica Nucleare)

Session Classification: Spatial Structure, Mechanical Properties, and Emergent Hadron Mass

Contribution ID: **91** Type: **not specified**

Closeout

Friday, December 13, 2024 12:50 PM (10 minutes)

Presenter: ROSSI, Patrizia (Istituto Nazionale di Fisica Nucleare)

Session Classification: Summaries and Path Forward