Jefferson Lab

49th PROGRAM ADVISORY COMMITTEE (PAC 49)

July 19 – 23, 2021

U.S. DEPARTMENT OF ENERGY

JSA

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From the Director

Jefferson Lab
Thomas Jefferson National Accelerator Facility
Exploring the Nature of Matter

August 3, 2021

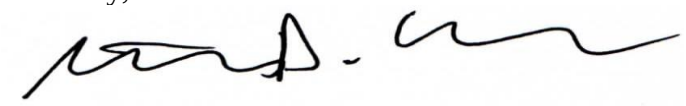
Dear Jefferson Lab Users,

It was a pleasure to see the new and exciting experimental proposals from our user community at the recent Program Advisory Committee (PAC49) meeting. The quality of these proposals is a testament to the tremendous scientific opportunities that Jefferson Lab's CEBAF enables for our scientific community.

The PAC reviewed 6 new proposals, 1 conditionally approved proposal, 1 run group addition and 4 letters of intent in addition to the 7 approved experiments that were subject to the Jeopardy process. Of the 7 proposals reviewed, 2 were approved, and 2 received conditional approval. The scientific motivation for all the jeopardy experiments remained relevant with one experiment receiving an improved grade.

The meeting was run very efficiently and effectively even in its remote format, thanks to the efforts of the Chair, Markus Diehl and the efforts of Pat Stroop and Susan Brown. I would like to thank Markus and all the PAC members for their efforts to provide expert advice to the Laboratory.

Sincerely,



Stuart Henderson
Laboratory Director

From the Chair

Markus Diehl
Theory Group
Deutsches Elektronen-Synchrotron DESY
22603 Hamburg
Germany

Hamburg, 26 July 2021

Robert D. McKeown
Deputy Director for Science
Jefferson Lab

Dear Bob,

This letter transmits the findings and recommendations of the 49th Jefferson Lab Program Advisory Committee (PAC49). The Committee met from July 19 to 23 and considered 6 new proposals, one conditionally approved proposal, one proposal for a run group addition, and 4 letters of intent. In addition, it reviewed 7 experiments in Jeopardy.

Written reports on the proposals, letters of intent and experiments in Jeopardy were prepared and reviewed by the Committee before we adjourned. Two proposals were granted full approval, two were approved pending review by a future PAC (C2), and three proposals were deferred. The proposed run group addition was endorsed. All experiments in Jeopardy were recommended to stay active, with no change to the previously recommended beam time. The PAC decided to revise the scientific grade of one experiment.

The chair of the Jefferson Lab Users Organization (JLUO) participates in all PAC sessions and is included in all communication between the PAC and the spokespersons of proposals. He represents the user community at all stages of the PAC review. We regard this as highly beneficial for both sides and would like to see this tradition continue.

The TAC physics and theory reports provided to the PAC were a most valuable resource for our review, and we thank all those involved in their preparation.

In the PAC48 report, the committee advised the proponents of experiments to provide sufficient details on their estimates of experimental and theoretical uncertainties. The PAC finds that the documents received this year show a positive development in this respect, and it strongly encourages future proponents to proceed further in this direction. In the deliberations of PAC49, theoretical uncertainties played a prominent role. When assessing the sensitivity of proposed experiments, uncertainties on theory predictions can be essential, and the committee recommends that such uncertainties be shown whenever available. In suitable kinematics, predictions based on the parton model often provide a valuable simple picture. For experiments aiming at high precision or the study of small effects, this picture may however be significantly modified by QCD radiative corrections. The PAC urges proponents to carefully evaluate which level of theory precision is required for establishing a solid physics case.

The EMC effect has long played a prominent role in the experimental program at CEBAF. Two proposals (PR12-21-002 and PR12-21-004) that aim at investigating its dependence on the quark flavor were received

by the PAC this year. The committee finds that JLab may have a unique opportunity to uncover the origin of the EMC effect, nearly 40 years after its discovery. To obtain a global picture and to optimize the prospects for success of this endeavor, the PAC encourages JLab management to convene a working group focused on the flavor dependence of the EMC effect. This group should include the proponents of the relevant approved or proposed experiments using inclusive DIS, SIDIS or parity violating DIS. It should identify optimal data-taking conditions for minimizing the systematic uncertainties and for obtaining a matching statistical precision. It should also provide a consistent comparison of their respective sensitivity. We feel that it will be critical to convince the committee and the wider community that the experiments are complementary to each other and can be combined into a consistent picture, and that their running conditions have been optimized. The committee requests that the working group submit its results to a future PAC, with an assessment of the complementarity between the different approaches, the possibilities for improving their statistical and systematic uncertainties, and their reach in sensitivity.

Owing to the circumstances, 2021 was the second year in which the PAC meeting was held fully online. This worked in a very smooth way, and we are grateful to the staff of Jefferson Lab and ORISE for setting up the required infrastructure and monitoring the sessions at all times. Our special thanks go to Susan Brown and Pat Stroop for their tireless work ahead of, during, and after the meeting.

The PAC is at your disposal for any other information or assistance we can give you. Congratulations to you, Jefferson Lab, and the user community on continued success.

With best regards,
Markus

Markus Diehl

PAC49 Chair

Introduction

The Jefferson Lab Program Advisory Committee held its 49th meeting from July 19th through July 23rd, 2021. The membership of the committee is given on pages 36 - 37. In response to the charge (page 38) from the JLab Science Director, Dr. Robert McKeown, the committee reviewed 6 new proposals, 1 conditional proposals, 1 run group addition and 4 letters of intent.

Recommendations

PAC 49 SUMMARY OF RECOMMENDATIONS								
Number	**Contact Person**	**Title**	**Hall**	**Days Req'd**	**Days Awarded**	**Scientific Rating**	**PAC Decision**	**Topic**
C12-19-002	T. Gogami	High accuracy measurement of nuclear masses of Lambda hyperhydrogens	A	14.5	14.5	A	Approved	5
PR12-21-001	N. Sparveris	Measurement of the neutron charge radius through the study of the nucleon excitation	C	9.5			Deferred	2
PR12-21-002	J. Arrington	First Measurement of the Flavor Dependence of Nuclear PDF Modification Using Parity-Violating Deep Inelastic Scattering	A	81			Deferred	5
PR12-21-003	A. Gasparian	A Direct Detection Search for Hidden Sector New Particles in the 3-60 MeV Mass Range	B	60			C2	6
PR12-21-004	L. Weinstein	Semi-Inclusive Deep Inelastic Scattering Measurement of A=3 Nuclei with CLAS12 in Hall B	B	58			C2	1
PR12-21-005	B. Wojtsekhowski	Double Spin Asymmetry in Wide-Angle Charged Pion Photoproduction	A	10	10	A-	Approved	4
PR12-21-006	X. Zheng	Measurement of the Asymmetry $A_d^{e^+e^-}$ between e^+ - ^{2}H and e^- - ^{2}H Deep Inelastic Scattering Using SoLID and PEPPo at JLab	A	104			Deferred	6

Topic*

1 The Hadron Spectra as Probes of QCD
2 The Transverse Structure of the Hadrons
3 The Longitudinal Structure of the Hadrons
4 The 3D Structure of the Hadrons
5 Hadrons and Cold Nuclear Matter
6 Low-Energy Tests of the Standard Model and Fundamental Symmetries

C1=Conditionally Approved w/Technical Review
C2=Conditionally Approved w/PAC Review

PAC 49 SUMMARY OF JEOPARDY RECOMMENDATIONS							
Number	**Contact Person**	**Title**	**Hall**	**Previously Approved Days**	**Days Already Rec'd**	**Days Awarded**	**PAC Decision**
E12-09-011	Tanja Horn	Studies of the L-T Separated Kaon Electroproduction Cross Section from 5-11 GeV	C	40	32	8	Remain active
E12-10-003	W. Boeglin	Deuteron Electro-Disintegration at Very High Missing Momentum	C	21	3	18	Upgrade Rating to A-
E12-11-002	S. Strauch	Proton Recoil Polarization in the 4He(e,e'p)3H, 2H(e,e'p)n, and 1H(e,e'p) Reactions	C	37		37	Remain active
E12-11-009	B. Sawatzky	The Neutron Electric Form Factor at Q^2 up to 7 $(GeV/c)^2$ from the Reaction d(e,e'n)p via Recoil Polarimetry	A	50		50	Remain active
E12-11-107	O. Hen	In Medium Nucleon Structure Functions, SRC, and the EMC effect	C	40		40	Remain active
E12-09-005	K. Kumar	An Ultra-precise Measurement of the Weak Mixing Angle using Moller Scattering	A	344		344	Remain active
E12-09-018	B. Wojtsekhowski	Measurement of the Semi-Inclusive pi and kaon electro-production in DIS regime from transversely polarized 3He target with the SBS&BB spectrometers in Hall A	A	64		64	Remain active
E12-06-121	B. Sawatzky	A Path to 'Color Polarizabilities' in the Neutron: A Precision Measurement of the Neutron g2 and d2 at High Q2 in Hall C	C	29	14	EXPERIMENT WITHDRAWN	
E12-10-009	B. Wojtsekhowski	Search for new Vector Boson A1 Decaying to e+e-	A	34	11	EXPERIMENT WITHDRAWN	
E12-11-112	J. Arrington	Precision measurement of the isospin dependence in the 2N and 3N short range correlation region	A	19	16	EXPERIMENT WITHDRAWN	

RUN GROUP ADDITION SUMMARY				
Number	**Contact Person**	**Title**	**Hall**	**Topic**
C12-15-006B	A. Tadepalli	TDIS-n: Tagged DIS Measurement of the Neutron Structure Function	A	3

Proposal Reports

C12-19-002

Scientific Rating: A

Recommendation: Approved

Title: High accuracy measurement of nuclear masses of Lambda hyperhydrogens

Spokespersons: T. Gogami (contact), P. Markowitz, J. Reinhold, S. N. Nakamura, L. Tang, T. Urciuoli, F. Garibaldi

Motivation: The hyperon-nucleon interaction is of fundamental interest in the non-perturbative regime of QCD and has implications for nuclear physics as well as astrophysical problems in the development of stars. Current theoretical calculations do not correctly predict the neutron star mass limit. This issue has received renewed attention in the community, partly due to the recent limits set by gravitational wave analysis from neutron star mergers. Existing baryonic force models must be refined, and the inclusion of a three-body repulsive force via hyperon interactions is important. The specific nature of hyperon-nucleon three-body forces is debated in the theory community. Experiments providing high precision information about few-body hyperon systems are needed for theorists to refine hyperon-nucleon forces (2- and 3-body) and to determine charge-symmetry breaking terms in those forces. This not only has consequences for the description of light hyperon systems, but will also influential in constructing the neutron equation-of-state.

Measurement and Feasibility: The proposal aims to make a precision measurement of the binding energy of $^{3}_{\Lambda}$He and $^{4}_{\Lambda}$He. The measurements require 14.5 days of 4.24 GeV, 50μA beam on gaseous targets. The binding energy is determined using the missing-mass technique, reconstructed from the scattered electron and K^{+} detected in the HRS and HKS respectively. The authors described the new target system that was developed in collaboration with the JLab Target Group, which was necessary to accommodate the restricted space at the target pivot and for compatibility with the E12-15-008 experiment. This addresses the issues raised by PAC48 about the incompatibility of the previous target with the geometry of the available space in the scattering chamber. The concerns raised by PAC47 regarding better simulations of the stated precision had already been addressed in the PAC48 review.

Issues: The PAC encourages the proponents to continue their collaboration with the Target Group in developing their new target.

Summary: The need for new, more precise data on the binding energies of $^{4}_{\Lambda}$He and the $1/2^{+}$ and $3/2^{+}$ states of $^{3}_{\Lambda}$He is well motivated, and data of this type are eagerly awaited by the theory community.

PR12-21-001

Scientific Rating: N/A

Recommendation: Deferred

Title: Measurement of the neutron charge radius through the study of the nucleon excitation

Spokespersons: N. Sparveris (contact), A. Camsonne, M.K. Jones, M. Paolone

Motivation: Present evaluations of the charge radius square $<r_n^2>$ of the neutron use low energy neutron scattering on diamagnetic materials (inverse kinematics). The various experiments agree rather well with each other, apart from a few outliers. However, as charge radius square measurements are often affected by unknown systematics, the authors of this proposal intend to use standard kinematics of electron-nucleon scattering and to derive $<r_n^2>$ from the slope of the electric form factor $G_E^2(Q^2)$ at $Q^2=0$.

Measurement and Feasibility: This proposal follows from LOI12-20-002. The experiment aims at determining the electric form factor $G_E^n(Q^2)$ at very small Q^2 from electric and Coulomb quadrupole transitions of the proton to the Δ. The reaction $e\ p \rightarrow e\ \Delta^+ \rightarrow e\ p\ \pi^0$ is reconstructed, using the double arm spectrometer in Hall C, running at a beam momentum of 1.3 GeV and reconstructing the π^0 through missing mass. The measurement technique builds on many similar measurements that were performed in the past at larger values of Q^2. Normalization is a key issue, as different Q^2 values require different settings of the magnetic spectrometers. Using asymmetries in the proton polar angle with respect to the virtual photon, the electric and quadrupole $p \rightarrow \Delta$ transition form factors can be extracted. From these, the electric form factor G_E^n is to be obtained using relations derived for the large-N_c limit of QCD, where N_c is the number of colors. The proponents claim an accuracy for the value of $<r_n^2>$ of 3.7% with little impact of the quoted theory uncertainties.

Issues: (1) The theory TAC report points out that the large-N_c relations just mentioned are valid only at tree level. In the language of chiral perturbation theory, they receive corrections from pion (and kaon) loops. These loop contributions could substantially modify the large-N_c relations in the region of very low Q^2, which is crucial to determine the slope of G_E^n at $Q^2=0$. The theory report also points out that the $N \rightarrow \Delta$ transitions can only constrain the isovector part of G_E^n and that additional assumptions are necessary to get the full form factor G_E^n. In this respect, the proponents misrepresent the assumptions made in obtaining this relation and its degree of rigor and generality. A reliable estimate of theoretical uncertainties of the proposed method to determine $<r_n^2>$ thus requires further studies. (2) The physics TAC report still points out technical issues related to the operation of the HMS spectrometer for low-momentum protons. These need to be definitely resolved by the proponents.

Summary: The PAC regards the proposed measurements of $p \rightarrow \Delta$ transition form factors at very small Q^2 as very interesting. However, the committee is very sceptic about the stringent extraction of the mean square charge radius for the neutron from such data and thus does not consider the scientific goal of the experiment to be achievable. The PAC recommends to change the emphasis

of the proposal and invites the proponents to submit a new proposal focusing on $p \rightarrow \Delta$ transitions. This also should be reflected in the title. Such a proposal should emphasize the transition form factor measurements and the direct physics impact they will have. We suggest to seek close contact with theorists when developing the science case for measuring the transition form factors.

PR12-21-002 - The PVEMC Experiment

Scientific Rating: N/A

Recommendation: Deferred

Title: First Measurement of the Flavor Dependence of Nuclear PDF Modification Using Parity-Violating Deep Inelastic Scattering

Spokespersons: J. Arrington (contact), R. Beminiwattha, D. Gaskell, J. Mammei, P. Reimer

Motivation: The origin of the nuclear effects observed first by the EMC collaboration at CERN in 1983 remains without conclusive explanation. The scientific interest is significant, for example, the original EMC discovery paper, Phys. Lett. B 123 (1983) 275 has been cited more than 1,400 times. Several future experiments at Jefferson Laboratory will provide information with regards to the dependence of nuclear effects on nucleon quark structure, including flavor asymmetries. These experiments will contribute to discriminating between different models that aim at explaining the EMC effect. The PVEMC experiment will measure parity violating asymmetries with longitudinally polarized beams off a ^{48}Ca target that are expected to have good sensitivity with regards to possible differences in the nuclear modification of up- and down-quark distributions.

Measurement and Feasibility: It is proposed to measure parity violating longitudinal spin asymmetries in inclusive DIS from a ^{48}Ca target using the SoLID detector. The experiment shares with the PVDIS-SoLID program all challenges of parity violating measurements for the beam, kinematics calibration, the GEM detectors, and the understanding of the backgrounds. The operation of a ^{48}Ca target under high beam currents has been demonstrated by CREX. It is planned to reuse the CREX target material. If this plan can be implemented successfully, only small additional amounts of ^{48}Ca will have to be purchased. There are no significant concerns with regards to the experimental feasibility.

Sensitivity studies have been carried out using a Quark Parton Model approach at leading order, and conclusions are largely based on the choice of a particular model for the nuclear modification (I. C. Cloët, W. Bentz, and A. W. Thomas, 2009). The combined impact of the proposed measurement with other experimental efforts constraining the EMC effect at JLab has not been analyzed quantitatively. Radiation studies have been carried out. However, the experiment will be performed after extensive earlier SoLID operations, and an analysis of the impact of the integrated radiation dose was not presented.

Summary: The PAC finds the scientific motivation strong and the experimental approach unique. However, the experiment requires significant resources in running time and will add significant radiation exposure to SoLID systems.

The PAC encourages the proponents to carry out a careful analysis of the experimental sensitivities, including, where possible, corrections at next-to-leading order (NLO). If possible, a model-independent evaluation of the experimental sensitivity should be presented to a future PAC: sensitivities for different levels of the nuclear isospin asymmetry and asymmetries with different

kinematic dependencies. The result of this study would make it possible to evaluate the overall impact of this proposal compared with complementary measurements of the flavor dependence of the EMC effect at JLab.

A robust assessment of the integrated radiation damage to the superconducting coil, the electronics and other equipment in the experimental hall should be conducted. It appears possible that there will be sizeable replacement costs subsequent to damage from the integrated radiation dose after running the proposed experiment.

PR12-21-003

Scientific Rating: N/A

Recommendation: Conditionally Approved (C2)

Title: A Direct Detection Search for Hidden Sector New Particles in the 3-60 MeV Mass Range

Spokespersons: A. Gasparian (contact), T. Hague, D. Dutta, C. Peng, H. Gao, N. Liyanage, R. Paremuzyan

Motivation: To search for a narrow resonance in the e^+e^- or $\gamma\gamma$ channels for an invariant mass in the 3-60 MeV range. This is motivated by dark matter with a light mediator particle, as well as by anomalies observed in ^{8}Be and ^{4}He nuclear transitions, which can also be used to explain the muon *g*-2 results. This hidden sector particle could be a fifth force carrier, which couples to electrons via kinetic mixing of strength ε with the Standard Model photon. The proposal estimates that a reach in ε^2 in the range of 10^{-9} to 10^{-7} can be achieved at 5σ significance level.

Measurement and Feasibility: 60 PAC days are requested, with 2.2 GeV and 3.3 GeV CW electron beams scattering on a 1 μm Ta foil target placed in front of the PRad setup, in order to perform a "bump hunt" in the e^+e^- (or $\gamma\gamma$) invariant mass for $e^- Ta \rightarrow e^- X A' \rightarrow e- X (e^+e^-$ or $\gamma\gamma)$. All three final state particles (the scattering electron, and the pair of e^+e^- or $\gamma\gamma$ from A' decay) will be detected, which provides a tight control of the experimental backgrounds. The experimental setup is based on the PRad apparatus, with a 1 μm Ta solid target placed on a target ladder, two planes of GEM detectors in front of the $PbWO_4$ calorimeter to provide tracking, and the $PbWO_4$ part of the HyCal calorimeter used for energy measurements.

Issues: (1) There are concerns about the background study presented in the proposal and subsequently in the responses of the proponents to the TAC review and in the public presentation. Results using two different simulation methods were presented, which differ by up to a factor of 5 in the relevant mass range. In particular, in the mass ranges in which the two estimations differ the most, the results of one of the simulations do not agree well with the existing carbon data from PRad. The PAC suggests the proponents to work on a better understanding of the difference between these background simulations and to present a reliable background estimation. It would also be good to cross check the background simulation with the existing carbon data taken by PRad.

(2) One advantage of this proposed experiment over existing and future dark photon search experiments is the ability to detect the $\gamma\gamma$ neutral decay channel. However, it is not discussed in the current proposal how to detect the $\gamma\gamma$ final states, and in particular how to suppress background when tracking information is not available. The PAC suggests the proponents to develop the $\gamma\gamma$ part of the proposal further.

(3) In the introduction and several other places in the proposal, there is confusion about the "dark photon" (the particle to be studied in this proposed experiment) and "dark matter". This needs to be cleaned up.

Summary: The scientific motivation of searching for a light dark photon in the MeV mass region is high. The experimental setup is clearly explained in the proposal. It seems feasible and cost effective to run the experiment using a PRad setup to be determined. Given the not fully understood background simulation, the PAC recommends conditional approval of this proposal, with return to a future PAC (C2).

PR12-21-004

Scientific Rating: N/A

Recommendation: Conditionally approved (C2)

Title: Semi-Inclusive Deep Inelastic Scattering Measurement of A = 3 Nuclei with CLAS12 in Hall B

Spokespersons: L. Weinstein (contact), D. Dutta, D. Gaskell, O. Hen, D. Meekins, D. Nguyen, J. Rittenhouse West, Z. H. Ye

Motivation: The origin of the EMC effect remains unknown. The current proposal aims at a precision measurement of ratios of charged pion electroproduction in Semi-Inclusive Deep Inelastic Scattering (SIDIS) from ^{2}D, ^{3}He and ^{3}H targets in order to test the flavor dependence of the EMC effect in the valence quark region.

Using ratios of cross sections on light nuclei allows one to decrease the nuclear uncertainties due to final state effects in hadronization. In addition the measurement of (e, e' π^{+}) and (e, e' π^{-}) cross sections as a function of x, Q^{2}, z, and p_{T} may allow one to extract unpolarized transverse momentum dependent distribution and fragmentation functions (TMDs).

The experiment can also provide information on ordinary parton densities (PDFs) and fragmentation functions (FFs) for u and d quarks, in particular on the u/d ratio.

Measurement and Feasibility: The standard configuration of the CLAS12 detector will be used with a 10.6 GeV beam incident on identical ^{2}D, ^{3}He and ^{3}H targets. The scattered electron and the produced pions will be detected in the forward detector.

To minimize the systematic uncertainty due to the different acceptance of positive and negative charged particles, the polarity of the CLAS12 torus will be regularly changed.
The same new target system will be installed as planned for the approved new CLAS12 Tritium-SRC experiment (E12-20-005). The new observables, proposed here and argued to be sensitive to the EMC effect, are the ratios of the sum of yields $Y(\pi^{+}) + Y(\pi^{-})$ and of the difference of yields $Y(\pi^{+}) - Y(\pi^{-})$ for the different nuclei relative to deuterium.

Issues: Currently the impact studies for the sensitivity of the measured observables to the physics quantities, i.e. PDFs, FFs, TMDs, need in all cases significant theoretical input to extract information. Unfortunately, the theoretical models used in the proposal are of very simplistic nature and do not include treatment of nuclear effects, higher order corrections, target mass effects and so on. Consequently, the interpretation of the data might be strongly model dependent. The proposal does currently also not address any of the challenges highlighted in the PAC 48 theory TAC report for SIDIS measurements at JLab, which might be enhanced in nuclear targets. We would like to ask the proponents to study the following topics before resubmitting the proposal.

1. The projections in the proposal are based on the cut $W^2 > 4$ GeV^2. The committee would like to see which kinematic coverage remains when applying stricter cuts like $W^2>10$ GeV^2, which may be more appropriate for A=3 targets.

2. The study of the flavour dependence of the EMC effect and of the 3D structure of A=3 nuclei would benefit from a synergy with complementary measurements at JLab. The proponents should detail clearly where the proposal is complementary to other experiments scheduled or proposed. They should also provide a clear assessment how one can extrapolate from what one learns from A=3 nuclei for the EMC in heavier nuclei.

3. Various observables may exhibit different sensitivity to the ingredients of theoretical calculations. The PAC therefore suggests to study how strongly extracted physics quantities depend on theoretical assumptions, regarding for instance QCD and QED radiative corrections and target mass effects.

Summary: The proposal addresses the fundamental question of the origin of the EMC effect. The physics programme is very rich, but the extraction of the underlying physics observables is very challenging. Therefore the PAC strongly encourages the proponents to reinforce their links with theory groups, in order to benefit from a more complete approach within a full QCD global analysis framework.

The proposal mentions further physics opportunities with exclusive measurements using the same setup and beamtime, and the PAC regards this as an attractive prospect. Once the issues spelled out above have been addressed, the PAC recommends a resubmission as part of a Run-Group Proposal, which will detail all the measurements (e.g. SIDIS, DVCS, exclusive meson production) to be done as part of the A = 3 Nuclei target program with CLAS12.

PR12-21-005

Scientific Rating: A−

Recommendation: Approved

Title: Double Spin Asymmetry in Wide-Angle Charged Pion Photoproduction

Spokespersons: B. Wojtsekhowski (contact), R. Montgomery, G. Cates, A. S. Tadepalli

Motivation: This experiment plans to measure the polarization transfer observable A_{LL} for π^- photoproduction in the wide-angle regime. The nature of the interaction mechanism for this relatively simple process is not yet well understood. Theoretical studies based on Generalized Parton Distributions (GPDs) suggest the dominance of twist-3 contributions and predict a sizeable and negative A_{LL}. The experiment plans to study also the θ and s dependence of this asymmetry, which is important for understanding the reaction mechanism.

Measurement and Feasibility: The measurement will take place at Hall A, using the apparatus of the polarized ^{3}He experiment E12-09-016, scheduled to run in 2022, with minor modifications. The proposal requests 10 PAC days. The result will be a measurement of the polarization observable A_{LL} and a check of the expected opposite sign of A_{LL} in comparison to the observable K_{LL}. The latter will be measured by E12-20-008, scheduled to run in 2021.

Issues: It would be interesting to have comparisons of the future data with more than one theoretical calculation, including the associated errors.

Summary: The PAC believes that the combination of data from this experiment and E12-20-008 will make it possible to check the theoretical prediction of opposite signs between the A_{LL} and K_{LL} observables, and contribute to the understanding of the basic mechanism of wide-angle pion photoproduction. The PAC recommends approval of the requested 10 PAC days.

PR12-21-006

Scientific Rating: N/A

Recommendation: Deferred

Title: Measurement of the Asymmetry $A_d^{e^+e^-}$ between e^+ - ^{2}H and e^- - ^{2}H Deep Inelastic Scattering Using SoLID and PEPPo at JLab

Spokespersons: X. Zheng (contact)

Motivation: The proponents seek to measure e^+e^- asymmetry for the DIS process as a function of Q^2 and x using the SoLID detector in PVDIS configuration. This quantity will then be converted to a measurement of the combination $2\,C_{3u} - C_{3d}$ of electron-quark couplings, and alternatively of the structure function $F_3^{\gamma Z}$. Little is known about these quantities, and the proposed data could reveal a sign of physics Beyond the Standard Model (BSM).

Measurement and Feasibility: SoLID is in the approval process; this is an advanced use of that detector. The positron beam at JLab is in the planning stage; this is a very advanced use of that beam.

Issues: The PAC is pleased to see such an interesting and far-reaching proposal. The proponents have carefully considered a variety of issues. In particular, their examination of systematic uncertainties is laudable. At the same time, the requirements on the accelerator and theory are both daunting.

The lab is actively investigating the possibilities for a positron beam; a process that will go on for some time. Unfortunately, this proposal expands the existing goals for equality of electron-positron beam energies and the time scale for switching between them. In particular, the lab currently envisages running positron and electron beams in alternate years, whereas the proposers seek changeovers every few weeks.

The accuracy of extracting $2\,C_{3u} - C_{3d}$ from the asymmetry needs to be estimated in a more comprehensive and transparent way. Problems include higher twist contributions, two photon exchange contributions, and QCD NLO corrections among a variety of concerns. The collaboration includes theoretical colleagues, and that is excellent. However, significant work is required from them before such a sophisticated measurement is feasible. At minimum, a realistic assessment of the theoretical uncertainties is needed. Expected backgrounds specific to e^+ beams might be better understood using data from previous experiments with positron beams at other facilities. In addition, some scenarios of BSM model predictions should be checked against the accuracy goals, to gauge the sensitivity of the measurement to BSM physics. The PDG notation of g_{AA}^{eq} etc. should be used for the weak neutral current couplings, to allow a direct comparison between different experiments, as well as a proper treatment of higher-order corrections.

Summary: This proposal will require a tour-de-force effort, and the PAC encourages the group to proceed with development. To allow the community better usage of the results, the proposal

should include estimates of asymmetry and cross section uncertainties. At this time, our concerns about the details of having the proper beam and the optimal theory extraction of the electron-quark couplings leads us to defer the proposal in its present form.

Jeopardy Experiments

E12-09-005

Title: An Ultra-precise Measurement of the Weak Mixing Angle using Moller Scattering

Spokespersons: K. Kumar (contact)

Motivation: The proponents seek to measure the parity violating asymmetry in the scattering of longitudinally polarized electrons off unpolarized electrons with high precision. This is directly related to the weak mixing angle, a fundamental quantity.

1) Is there any new information that would affect the scientific importance or impact of the Experiment since it was originally proposed?
The collaboration has gone through a variety of reviews. As a result, they have obtained funding through the NSF Physics Division Midscale program, from the Canadian Foundation for Innovation and from Research Manitoba, and as a DOE Major Item of Equipment. It has CD-1 approval from DOE. The collaboration has advanced designs of the apparatus.

2) If the Experiment has already received a portion of its allocated beam time and/or is on the presently published accelerator schedule, the spokespersons should provide an analysis of the existing data set, the projected result for any additional time on the published schedule, and the projected result for the complete data set including all remaining unscheduled time. The goal is to show the physics impact of the respective data sets.
No beamtime has been received.

3) Should the remaining beam time allocation and experiment grade be reconsidered?
No

Summary:
The PAC is pleased with the excellent progress that has been made for this important experiment. It is on schedule to be run within a few years.

E12-09-011

Title: Studies of the L-T Separated Kaon Electroproduction Cross Section from 5-11 GeV

Spokespersons: T. Horn (contact), G. Huber, P. Markowitz

Motivation: Hard exclusive processes such as the one studied in this experiment are part of a comprehensive scientific program of 3D imaging at JLab. The L/T separation of the Kaon electroproduction cross section is a unique opportunity in the $x_B - Q^2$ region of the experiment, and the scanning of its Q^2 dependence at given x_B plays an important role to understand the production mechanism. The strong scientific motivation of the original proposal remains.

1) Is there any new information that would affect the scientific importance or impact of the Experiment since it was originally proposed?
No.

2) If the Experiment has already received a portion of its allocated beam time and/or is on the presently published accelerator schedule, the spokespersons should provide an analysis of the existing data set, the projected result for any additional time on the published schedule, and the projected result for the complete data set including all remaining unscheduled time. The goal is to show the physics impact of the respective data sets.
The experiment has received 80% (32 PAC days) of its beam time, and the data have been taken in part of the kinematic region foreseen in the proposal. The experimental calibration is being carried out, and preliminary results are expected soon. The projections for the full data set remain the same as in the original proposal.

3) Should the remaining beam time allocation and experiment grade be reconsidered?
No.

Summary: PAC recommends allocation of the remaining 8 PAC days for the experiment.

E12-09-018

Title: Measurement of the Semi-Inclusive pion and kaon electro-production in DIS regime from transversely polarized ^{3}He target with the SBS and BB spectrometers in Hall A

Spokespersons: B. Wojtsekhowski (contact), G. Cates, E. Cisbani, B. Quinn, A. Puckett

Motivation: High statistics measurement of single spin asymmetries (SSAs) with a transversely polarized ^{3}He target utilizing the SBS-spectrometer in combination with the upgraded BigBite spectrometer. The goal is to collect data to constrain transverse momentum dependent (TMD) PDFs through SSAs in pion and kaon production. ^{3}He is used as an effective neutron target to constrain d-quark TMDs better.

1) Is there any new information that would affect the scientific importance or impact of the Experiment since it was originally proposed?
The experiment has not received any beam time yet. It could run as early as 2023. All detectors except for the refurbished HERMES RICH will be tested prior to E12-09-018 during the G_M^n (E12-09-019) data taking. The polarized ^{3}He target is the one to be used in the G_E^n experiment E12-09-016, with a few straightforward modifications. The experimental kinematics is fully complementary to the one for SoLID. The progress on the experimental setup is proceeding well. Like all the semi-inclusive DIS (SIDIS) experiments at JLab, E12-09-018 has the same challenges to ensure the produced hadrons are in the current fragmentation region and that a clean theoretical interpretation can be achieved. This holds especially if one does not apply a strict cut like $W^2>10$ GeV^2, which may be more appropriate for A>1 targets than $W^2>4$ GeV^2. The PAC suggests strongly that the proponents be in close contact with the theory community to develop the optimal analysis of the data, so as to have the highest sensitivity to TMDs with the least theoretical uncertainties.

2) If the Experiment has already received a portion of its allocated beam time and/or is on the presently published accelerator schedule, the spokespersons should provide an analysis of the existing data set, the projected result for any additional time on the published schedule, and the projected result for the complete data set including all remaining unscheduled time. The goal is to show the physics impact of the respective data sets.
N/A

3) Should the remaining beam time allocation and experiment grade be reconsidered?
No to both questions.

Summary: The PAC confirms the allocation of 64 PAC days for data taking.

E12-10-003

Title: Deuteron Electro-Disintegration at Very High Missing Momentum

Spokespersons: W. Boeglin (contact), M. Jones , C. Yero

Motivation: Deuterium electro-disintegration at high relative nucleon momenta might improve our current understanding of two-nucleon dynamics at short distances. Unfortunately, this possibility is hindered by the lack of experimental data beyond relative nucleon momenta of about 500 MeV. E12-10-003 aims at measuring D(e,e'p)n cross sections for missing momenta up to 1 GeV.

1) Is there any new information that would affect the scientific importance or impact of the Experiment since it was originally proposed?

PAC 36 graded the proposal with B+ because, even though the physics motivation was viewed highly, the foreseen impact of the result was judged to be limited. The results of the three days commissioning in April 2018, published in Physical Review Letters 125, 262501 (2020), exhibit an unexpected behavior when compared with theoretical calculations. Therefore, the expected impact of future data has increased.

2) If the Experiment has already received a portion of its allocated beam time and/or is on the presently published accelerator schedule, the spokespersons should provide an analysis of the existing data set, the projected result for any additional time on the published schedule, and the projected result for the complete data set including all remaining unscheduled time. The goal is to show the physics impact of the respective data sets.

The published cross-section uncertainties are statistically dominated. The commissioning was successful in keeping systematic uncertainties below 8%. In the Update to the original proposal, the remaining PAC days have been rearranged among the needed missing momentum settings. The overall goal is to obtain a relative statistical error of 10% in the range of 0.6 to 1.0 GeV, in order to better understand the observed differences with model predictions.

3) Should the remaining beam time allocation and experiment grade be reconsidered?

All remaining PAC days should be allocated, and the grade of the experiment should be changed to A- because of the potential impact of the future results.

Summary: The experiment E12-10-003 has obtained 3 days commissioning beam time and already achieved very good results. The data show a striking disagreement in the region of large relative momenta with all available models. A reduction of the statistical error down to 10% and the extension of the data up to 1.2 GeV missing momentum is crucial to guide future theory developments. In this context, the authors are encouraged to reach out to the theory community to provide updated predictions based on modern nuclear potentials.

E12-11-002

Title: Proton Recoil Polarization in the $^{4}He(e,e'p)^{3}H$, $^{2}H(e,e'p)n$, and $^{1}H(e,e'p)$ Reactions

Spokespersons: S. Strauch (contact), E. Brash, G. M. Huber, R. Ransome

Motivation: Nuclear effects impact nucleon PDFs (EMC effect) and may also affect observables in elastic scattering processes (form factors). Two measurements are proposed: polarization transfer at two Q^2 values and as function of the missing momenta for H, D and He targets. The measurement of double polarization ratios reduces systematic uncertainties. The experiment aims to contribute to the discrimination between different models describing the EMC effect.

1) Is there any new information that would affect the scientific importance or impact of the Experiment since it was originally proposed?
As signaled by the significant level of theoretical work, including work on the connection between Short Range Correlations (SRC) and the EMC effect, and by planning and preparation activities for new DIS experiments, the interest to explore the origins of the EMC effect remains high.

2) If the Experiment has already received a portion of its allocated beam time and/or is on the presently published accelerator schedule, the spokespersons should provide an analysis of the existing data set, the projected result for any additional time on the published schedule, and the projected result for the complete data set including all remaining unscheduled time. The goal is to show the physics impact of the respective data sets.
N/A

3) Should the remaining beam time allocation and experiment grade be reconsidered?
No, the PAC reaffirms the grade B+ and the 37 days of beam time approved by PAC 37.

Summary: Initial efforts to study nuclear effects in elastic scattering processes have started with experiments at JLab and MAMI. The proposed measurements will significantly reduce the statistical uncertainties and increase the kinematic range, resulting in good sensitivity to possible nuclear effects.

E12-11-009

Title: The Neutron Electric Form Factor at Q^2 up to 7 $(GeV/c)^2$ from the Reaction d(e,e'n)p via Recoil Polarimetry

Spokespersons: B. Sawatzky (contact), J. Arrington, M. Kohl, A. Semenov, W. Tireman

Motivation: It is proposed to measure the neutron elastic form factor ratio G_E^n/G_M^n up to a momentum transfer squared of $Q^2 = 6.88$ GeV^2, exploiting the recoil polarization technique, i.e. the polarization transfer from a longitudinally polarized electron beam to the recoiling neutron in d(e,e'n)p. The double-polarization technique is the method of choice, since it is much less susceptible to two-photon exchange corrections, which are believed to partially explain the experimental discrepancy between proton results obtained with "polarization" and with "Rosenbluth separation". Form factors reflect fundamental nucleon properties, and additional high precision data at higher Q^2 are important for constraining nucleon models.

1) Is there any new information that would affect the scientific importance or impact of the Experiment since it was originally proposed?
No

2) If the Experiment has already received a portion of its allocated beam time and/or is on the presently published accelerator schedule, the spokespersons should provide an analysis of the existing data set, the projected result for any additional time on the published schedule, and the projected result for the complete data set including all remaining unscheduled time. The goal is to show the physics impact of the respective data sets.
Not applicable

3) Should the remaining beam time allocation and experiment grade be reconsidered?
No.

Summary: The experiment should proceed as foreseen with the default neutron polarimeter as described in the proposal. The PAC assumes that any progress obtained from the RP-GEn experiment E12-17-004, which is scheduled to run first and may possibly show that the charge-exchange reaction $np \rightarrow pn$ leads to an enhanced efficiency and analyzing power for neutron polarimetry, would feed into a new proposal.

E12-11-107 - The LAD Experiment

Title: In Medium Nucleon Structure Functions, SRC, and the EMC effect

Spokespersons: O. Hen (contact), F. Hauenstein, N. Liyanage, E. Piasetzky, A. Schmidt, L. B. Weinstein, S. Wood

Motivation: The experiment will measure recoil proton Tagged DIS (TDIS) off a deuterium target and extract the medium modification of the structure function F_2 versus the spectator light-cone momentum fraction α_s. This observable has sensitivity to the correlation between the EMC effect and the density of nucleon pairs involving Short Range Correlations (SRC) in nuclei. E12-11-107 tests the hypothesis that the EMC effects results from nucleon modification in SRC pairs.

1) Is there any new information that would affect the scientific importance or impact of the Experiment since it was originally proposed?
See the summary.

2) If the Experiment has already received a portion of its allocated beam time and/or is on the presently published accelerator schedule, the spokespersons should provide an analysis of the existing data set, the projected result for any additional time on the published schedule, and the projected result for the complete data set including all remaining unscheduled time. The goal is to show the physics impact of the respective data sets.
N/A

3) Should the remaining beam time allocation and experiment grade be reconsidered?
No, the PAC reaffirms the 40 days of beam time and the grade B+ recommended by PAC38.

Summary: Interest in the EMC effect remains high, as signaled by the level of theoretical activity and by the active planning and preparation efforts for related experiments. The LAD experiment has made significant progress in preparing all needed systems and passed an experimental readiness review in July 2020.

Run Group Additions

C12-15-006B

Title: TDIS-n: Tagged DIS Measurement of the Neutron Structure Function

Spokespersons: A. Tadepalli (contact), J. Arrington, R. Montgomery, S. Li, E. Fuchey, C. Keppel, C. Ayebe

Motivation: It is proposed to use the existing set-up for the TDIS experiment (C12-15-006) to measure tagged scattering off the neutron using a deuterium target. The TPC being prepared for the TDIS experiment would serve as proton recoil detector. The measurement of the recoil proton would allow one to considerably improve the determination of the *en* scattering kinematics and thus correct for the Fermi motion within the deuteron. This allows for a set of measurements with improved or at least complementary systematic uncertainties compared with other running or approved experiments at JLAB. These concern the neutron and deuteron structure functions with emphasis on the interval $0.3 < x < 0.7$ of corrected Bjorken x, with about 7 times increased statistical accuracy compared with the BoNuS12 experiment. The data also allow for an exploration of deep inelastic scattering (DIS) in the resonance region with much superior mass resolution and statistics. Furthermore, tagging for elastic scattering, one can extract the neutron magnetic form factor $G_M^n(Q^2)$ in a double polarization experiment using a novel measurement technique, and also test for the EMC effect in the deuteron using the proton structure function obtained by TDIS.

Measurement and Feasibility: The measurement will use data taken with the standard running conditions of TDIS, such that no modification of the apparatus, trigger, target nor additional beam time is required. The feasibility thereby relies on the technical achievements for the operation of the new TPC, which is mandatory for the TDIS experiment itself. The proponents have demonstrated that the high backgrounds from competing processes leading to a high particle load in the TPC will not jeopardize the measurements.

Summary: The PAC welcomes this proposal to extend the use of data to be taken with the TDIS experiment.

Letters of Intent

LOI 12-21-001

Title: 3N Short-Range Correlations

Spokespersons: N. Fomin (contact), J. Arrington, S. Li

Motivation: Measuring the DIS cross sections on various nuclear targets at large x_B and Q^2 to investigate the three-nucleon correlations in nuclei.

Measurement and Feasibility: The proposed experiment will study quasi-elastic and deep inelastic scattering on various nuclear targets. Nucleon-nucleon (including 2N and 3N) correlations in nuclei can be analyzed through cross section ratios in the kinematic region of $x_B>1$. This is a standard measurement and has been comprehensively investigated at JLab. The 2N correlation has been established through these measurements. To explore the 3N correlations, one needs to go to higher x_B (>2). Previous experiments did not reach a definitive answer concerning 3N correlations in nuclei, which may be due to ambiguities in the theory interpretation for their kinematics. The proposed experiment aims at higher x_B and Q^2 and hopes to resolve these issues.

Issues: (1) The proposal needs a stronger theory support, in particular, with a quantitative comparison between model predictions and experiment. As noted in the TAC theory report, there should be a more robust treatment of the theoretical underpinning of the proposed measurements. (2) The PAC expects that the proposal will be more convincing if it includes the lessons learned from the results of the experiment E12-06-105. (3) A tritium target would require very significant efforts.

Summary: The PAC encourages submission of a full proposal and recommends that the proponents take into account the issues mentioned above. The PAC considers that the proposed measurements are very attractive even without a tritium target. Given the significant difficulty for realizing a tritium target, the PAC recommends a first proposal without tritium. Depending on the results of that experiment, a follow-up proposal could be considered that uses a tritium target to address the isospin dependence of the short range nucleon-nucleon correlations in the A=3 system.

LOI 12-21-002

Title: Measurement of the Tensor Observable A_{zz} using SoLID

Spokespersons: E. Long

Motivation: Study the D-wave component of the deuteron and understand the nucleon-nucleon potential.

Measurement and Feasibility: This experiment proposes to measure the tensor asymmetry A_{zz} in inclusive electron scattering from polarized deuterons in the region of $0.1 < x_B < 2.0$ utilizing the SoLID detector. The A_{zz} measurement is sensitive to the D-wave component of the deuteron wave function. The JLab/UVa polarized ND_3 target will be used, assuming a tensor polarization of 25%, although there is an active program to increase this number. Statistical error estimates are based on a request of 14+5 PAC days.

Issues: (1) The LoI has a strong overlap with the conditionally-approved experiment C12-15-005 (Hall C): a careful comparison between what can be achieved in the two cases should be presented, and the proponents should present a definite running scenario regarding both experiments. (2) The apparatus used for this measurement is the same as for LOI12-21-004. Different measurements with the same apparatus, but focused on different physics, can be more efficiently discussed within a Run Group proposal. (3) Status of theory support: there should be a stronger theory motivation for this measurement, which can attract a wider theory community. In addition, the proponents should convince the PAC that the same physics cannot be extracted from the existing data on the elastic T_{20} tensor analyzing power. (4) Efforts for improving the degree of tensor polarization should continue.

Summary: The PAC recommends a careful comparison with the conditional approved experiment C12-15-005. A definite running scenario has to be presented before the submission of a full proposal. A coherent scientific program for a deuteron target with high tensor polarization should also be laid out, including a strong theory motivation.

LOI 12-21-003

Title: Exploring fundamental properties of ^{3}He through the ^{3}He(e,e'd)p process in CLAS12

Spokespersons: D. Higinbotham (contact), D. Ngyen, S. Sirca, O. Hen

Motivation: Primary motivation for the measurement of the quasi-elastic ^{3}He(e,e'd)p process is the observed discrepancy for large energy transfer (away from quasi-elastic conditions) between the data obtained by E05-102 and theoretical calculations from the early 2000s. Specifically, it is proposed to study zero-crossings in a much wider region of Q^2 than previously covered, and it is hoped to gain additional insight into the structure of the ^{3}He system.

Measurement and Feasibility: The LOI intends to make use of the new polarized MEOP-based ^{3}He target being developed for use inside the CLAS12 spectrometer. In addition, transverse polarization inside the longitudinally oriented field of the CLAS12 solenoid is required. Although there are no obvious show-stoppers in the implementation, considerable R&D will be necessary. The experiment plans to use the polarized electron beam at 2.2 GeV and would expand the kinematic coverage of the ^{3}He(e,e'd)p two-body breakup covering a missing momentum from 0 to 0.8 GeV and a photon virtuality of Q^2 = 0.1 to 1.5 GeV^2.

Issues: It is not clear that these new measurements would lead to an "understanding" of the source of the observed discrepancies between theory and experiment. As argued in the LOI, these discrepancies are most evident in the three-body break-up, which is presumably more sensitive to the treatment of three-body forces. In addition, the calculations shown in the LOI date from the pre-chiral effective field theory era in which two- and three-nucleon forces were not consistently derived, nor were the corresponding electromagnetic currents. Although two- and three-body break-up can be calculated exactly, an estimate of the theory error due to the chiral expansion could prove useful in view of the precision of the experiment.

Summary: The measurement of the beam-target polarization asymmetries in the ^{3}He(e,e'd)p process to increase the kinematic coverage is interesting. However, to have impact on the understanding of the ^{3}He system, the authors are strongly encouraged to entice the relevant theory community to provide theoretical predictions based on modern chiral forces. For an understanding of the three-body force, it may be necessary to measure the three-body break-up process.

LOI 12-21-004

Title: Measurement of the Deuteron Tensor Structure Function b_1 with SoLID

Spokespersons: K. Slifer (contact), E. Long

Motivation: The LoI proposes to measure the structure function b_1, which is characteristic of tensor-polarized spin-1 targets. Previous measurements by the HERMES experiment showed some indications of large effects at low x_B, contrary to expectations. More data would be needed to understand if predictions based on conventional nuclear effects are compatible with the HERMES results, or if more exotic explanations are called for. Within adequate theory uncertainties, parton distribution functions in the deuteron can be extracted from the proposed measurement.

Measurement and Feasibility: The measurement will be carried out in Hall A with the SoLID detector, in the region $0.05 < x_B < 0.7$, for $0.8 < Q^2 < 6.5$ GeV^2 using 6.6 and 8.8 GeV incident beam energies. The JLab/UVa polarized ND_3 target will be used, assuming a tensor polarization of 25%, although there is an active program to increase this number. Statistical error estimates are based on a request of 17 PAC days.

Issues: (1) The LoI has a strong overlap with the conditionally-approved experiment C12-13-011 (Hall C): a careful comparison between what can be achieved in the two cases should be presented, and the proponents should present a definite running scenario regarding both experiments. (2) The apparatus used for this measurement is the same as for LOI12-21-002. Different measurements with the same apparatus, but focused on different physics, can be more efficiently discussed within a Run Group proposal. (3) The anticipated systematic errors (especially at $x_B < 0.2$) are very large, overshadow the very good statistical precision, and make the measurement less competitive and useful. Strong efforts should be made to reduce these errors. (4) Efforts in improving the degree of tensor polarization should continue. (5) To justify the significant effort required to realize a polarized target, the present measurement should be put into a broader perspective and possibly be combined with other measurements requiring a tensor polarized target. For instance, other structure functions should be investigated, and other processes beside inclusive DIS should be taken into consideration. (6) The possibility to perform multidimensional binning in x_B and Q^2 should be taken into consideration.

Summary: The PAC considers measurements involving tensor polarized targets of interest for the study of nuclear structure. Efforts should be made to increase the performance of these targets, reduce systematic errors, and identify further interesting measurements (possibly coordinating them into a Run Group proposal). The differences with conditionally approved experiments should be clearly pointed out.

Program Status

12 GeV Approved Experiments by Physics Topics

	Hall A	Hall B	Hall C	Hall D	Total
Hadron spectra as probes of QCD	0	219	11	740	**970**
Transverse structure of the hadrons	152.5	125	146	25	**448.5**
Longitudinal structure of the hadrons	42	170	211	33	**456**
3D structure of the hadrons	371	872	225	0	**1468**
Hadrons and cold nuclear matter	254.5	305	205	15	**779.5**
Low-energy tests of the Standard Model and Fundamental Symmetries	547	180	0	79	**806**
Total Days	**1367**	**1871.0**	**798.0**	**892**	**4928**
Total Days - (includes MOLLER)	**893**	**1871**	**798**	**892**	**4454**
Total Approved Run Group Days (includes MIE)	**1367**	**1066**	**755**	**692**	**3880**
Total Approved Run Group Days (includes MOLLER)	**893**	**1066**	**755**	**692**	**3406**
Total Days Completed	**256.5**	**323**	**173.0**	**206**	**958.5**
Days Removed by Jeopardy	**26**		**21**		**47**
Total Days Remaining	**610.5**	**743**	**561**	**486**	**2400.5**

12 GeV Approved Experiments by PAC Days

Topic	Hall A	Hall B	Hall C	Hall D	Total
Hadron spectra as probes of QCD	0	2	1	4	**7**
Transverse structure of the hadrons	7	4	3	1	**15**
longitudinal structure of the hadrons	1	3	7	1	**12**
3D structure of the hadrons	6.5	9	6.5	0	**22**
Hadrons and cold nuclear matter	10	6	8	1	**25**
Low-energy tests of the Standard Model and Fundamental Symmetries	3	1	0	1	**5**
Total	**27.5**	**25**	**25.5**	**8**	**85**
Total Experiments Completed	**9.0**	**9.7**	**7.3**	**1.5**	**27.5**
Experiments Removed by Jeopardy	**0.8**		**0.7**		**1.5**
Total Experiments Remaining	**17.7**	**15.3**	**17.5**	**6.5**	**56**

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Charge to PAC49

Review new proposals, previously conditionally approved proposals, and letters of intent for experiments that will utilize the 12 GeV upgrade of CEBAF and provide advice on their scientific merit, technical feasibility and resource requirements.

Identify proposals with high-quality physics that, represent high quality physics within the range of scientific importance represented by the previously approved 12 GeV proposals and recommend for approval.

Also provide a recommendation on scientific rating and beam time allocation for proposals newly recommended for approval.

Identify other proposals with physics that have the potential for falling into this category pending clarification of scientific and/or technical issues and recommend for conditional approval. Provide comments on technical and scientific issues that should be addressed by the proponents prior to review at a future PAC.