Jefferson Lab

47th PROGRAM ADVISORY COMMITTEE (PAC47)

July 29, 2019

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 8, 2019

Dear Jefferson Lab Users,

It was a pleasure to see the new and exciting experimental proposals from our user community at the July 29-August 1 Program Advisory Committee (PAC47) meeting. The quality of these proposals is an indicator of the forefront scientific program that Jefferson Lab enables for its users, and this PAC was no exception.

The PAC reviewed 5 new proposals, 2 of which were new run group proposals. In addition, there were 7 Letters of Intent and 7 proposals returning for Jeopardy. The PAC approved 1 of the new proposals with a B+ and upgraded 1 of the Jeopardy proposals from A- to A.

The meeting was run very efficiently, as usual, thanks to the efforts of the Chair, Jim Napolitano, who rotates off the PAC this year. We are grateful for Jim's service to the laboratory as PAC Chair for the past 5 years. A new Chair will be announced. With the assistance of Susan Brown, the PAC was again able to produce its report in very short order following the meeting. I thank Jim and all the PAC members for their efforts to provide expert advice to the Laboratory.

Sincerely,

Stuart Henderson
Laboratory Director

From the Chair

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Aug 1, 2019

Robert D. McKeown
Deputy Director for Science
Jefferson Lab

Dear Bob,

This letter transmits the findings and recommendations of the 47th Jefferson Laboratory Program Advisory Committee (PAC47). The Committee met July 29-Aug 1, 2019. We considered five individual proposals for new beam time; three parallel run group additions; and seven letters of intent. We also considered the first round of six experiments for "Jeopardy" in the 12 GeV era.

Written reports on the proposals and letters of intent were prepared and reviewed by the Committee before we adjourned. The PAC maintains its position of adhering to highest standards for approving proposals. We approved one proposal for studying photo nuclear reactions using the GlueX facility. We conditionally approved, under the condition that they return to future PACs, two additional proposals. The remaining two proposals were deferred. The PAC endorsed all parallel run group additions, and recommend that all six Jeopardy proposals remain active.

As started at PAC45, the JLab User BoD Chair now has a special role in the PAC. Sitting in on all discussion, the BoD Chair is in a position to explain to the users how proposals are discussed and recommendations are reached. This procedure works well, and we would like to see it continue.

PAC46 asked that Hall D prepare a white paper that outlines their procedures for accepting proposals to use the Hall and the GlueX apparatus, and their plans for GlueX running into the future. We were mindful of the effort involved, but we believed that this documentation was necessary for us to evaluate proposals that would use the Hall. Indeed, the document they produced was a great help to us, and will continue to be helpful for future PACs. We hope that the collaboration found the exercise useful for themselves.

It is a pleasure for us to see CEBAF producing high quality, high energy electron beams for nuclear physics research, and the various collaborations delivering results already from the 12 GeV running. The PAC encourages all experiments to deliver their results in as timely a fashion as appropriate standards allow.

Finally, as this is my last time serving on the PAC, I want to thank you for the opportunity to contribute to the Jefferson Lab program. The laboratory and its users have an exciting future. I look forward to learning about new discoveries.

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.

Best wishes,

Jim Napolitano
PAC47 Chairperson
Professor and Department Chair
Temple University Physics
Professor and Department Chair
Temple University Physics

Introduction

The Jefferson Lab Program Advisory Committee held its 47th meeting from July 29th through August 1st, 2019. The membership of the committee is given on pages 28-29. In response to the charge (page 30) from the JLab Science Director, Dr. Robert McKeown, the committee reviewed, 5 new proposals, 3 run group additions, 7 Letters of Intent and 6 proposals returning for Jeopardy.

Recommendations

PAC 47 SUMMARY OF RECOMMENDATIONS								
NUMBER	**CONTACT PERSON**	**TITLE**	**HALL**	**DAYS REQUESTED**	**DAYS AWARDED**	**SCIENTIFIC RATE**	**PAC DECISION**	**TOPIC***
PR12-19-001	M. Amaryan	Strange Hadron Spectroscopy with Secondary KL Beam in Hall D	D	200			C2	1
PR12-19-002	T. Gogami	High precision measurement of Lambda hyperhydrogens	A	12			C2	5
PR12-19-003	O. Hen	Studying Short-Range Correlations with Real Photon Beams at GlueX	D	30	15	B+	Approved	5
PR12-19-004	H. Gao	Search for a $\phi-N$ Bound State from ϕ Production in a Nuclear Medium	B	45			Deferred	1
PR12-19-005	D. Snowden-lfft	Beam-Dump Dark Matter Search Utilizing a Low-Threshold, Directional Dark Matter Detector (BDX-DRIFT) at Jefferson Lab	A	285			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 Approve w/Technical Review
C2=Conditionally Approve w/PAC Review

PAC 47 SUMMARY OF JEOPARDY RECOMMENDATIONS								
NUMBER	**CONTACT PERSON**	**TITLE**	**HALL**	**DAYS REQUESTED**	**DAYS AWARDED**	**SCIENTIFIC RATE**	**PAC DECISION**	**TOPIC ***
E12-07-109	B. Wojtsekhowski	Large Acceptance Proton Form Factor Ratio Measurements up to 14.5 GeV2 Using the Recoil-Polarization Method	A	45		A-	Remain Active	2
E12-06-105	D. Day	Inclusive Scattering from Nuclei at x>1 in the quasielastic and deeply inelastic regimes	C	32		A-	Remain Active	5
E12-19-006 ~~E12-06-101~~ ~~E12-07-105~~	G. Huber	Study of the L–T Separated Pion Electroproduction Cross Section at 11 GeV and Measurement of the Charged Pion Form Factor to High Q2 ~~Update on E12-06-101: Measurement of the Charged Pion Form Factor to High Q 2 and E12-07-105: Scaling Study of the L–T Separated Pion Electroproduction Cross Section at 11 GeV~~	C	88		A	Remain Active	2
E12-06-107	D. Dutta	Hadron Propagation and Color Transparency at 12 GeV	C	17.5		B+	Remain Active	5
E12-06-114	C. Hyde	Measurements of the electron-helicity dependent cross sections of deeply virtual Compton scattering in Hall A at 11 GeV	C	50	35	A	Remain Active	4
E12-06-104	R. Ent	Measurement of the Ratio R=sigmaL/sigmaT in Semi-Inclusive Deep-Inelastic Scattering	C	40		A	Upgraded rating	3

RUN GROUP ADDITION SUMMARY				
NUMBER	**CONTACT PERSON**	**TITLE**	**HALL**	**TOPIC***
E12-16-113A	M. Hattawy	Neutron DVCS Measurements with BONuS12 in CLAS12	B	4
E12-06-121A	S. Barcus	Measurement of 3He Elastic Electromagnetic Form Factor Diffractive Minima Using Polarization Observables	C	5
E12-07-104A	F. Hauenstein	Quasi-Real Photoproduction on Deuterium, a Run-Group B proposal	B	1

Proposal Reports

PR12-19-001

Scientific Rating: N/A
Recommendation: C2

Title: "Strange Hadron Spectroscopy with a Secondary K_L Beam in Hall D"

Spokespersons: M. Amaryan (contact), M. Bashkanov, S. Dobbs, J. Ritman, J. Stevens, I. Strakovsky

Motivation: The spectroscopy of strange baryons and mesons, including their fundamental strong interactions, is the focus of this proposal. New and unique data can be obtained with an intense K_L beam aimed at a hydrogen/deuterium target, using the GlueX apparatus to detect final state particles.

Measurement and Feasibility: The most significant technical aspect of this proposal is the addition of a Compact Photon Source (CPS) in the beamline leading into Hall D, which will have significant attendant cost and will impose an estimated six months changeover time for alternate running of GlueX. It is also important to be sure that GlueX can handle the background rates from neutrons and other beam-induced contaminants. It seems quite feasible that the GlueX detector can manage to detect the final state particles with enough particle discrimination to meet the spectroscopy needs.

Issues: Several points of discussion concerned the PAC. A) the missing mass technique to replace the direct proton detection at very low values of $|t|$ was only presented in the open session and the details of the underlying simulations should be clarified; B) a realistic simulation including beam backgrounds is to be presented with details to be spelled out and documented thoroughly; C) A realistic project management plan needs to be developed to realize the experiment; D) The analysis and extraction of key physics parameters requires theory guidance, which is now included within the group of proposing authors and makes use of JPAC.

This facility will add a new physics reach to JLab, and the PAC is looking forward to see the idea being materialized, in conjunction with the plans for Hall D as spelled out in the white paper provided to us.

Summary: The collaboration should return to the PAC with a well documented proposal. Simulations addressing backgrounds and the low |t| region are necessary. Also, a well-formed plan is needed to build the beamline and prepare for data taking with GlueX.

PR12-19-002

Scientific Rating: N/A
Recommendation: C2

Title: "High precision measurement of the Λ hyperhydrogens"

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

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 has received renewed attention in the community 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 a promising candidate. Experiments providing high precision information about few-body hyperon systems are most desirable for theorists for refining hyperon-nucleon forces as well as determining charge-symmetry breaking terms in those forces. This not only has consequences for the description of light hyperon systems but will also be influential in constructing the neutron star equation-of-state.

Measurement and Feasibility: This proposal aims to make a precision measurement of the binding energy of $^{3}H_{\Lambda}$ and $^{4}H_{\Lambda}$. The measurements require 12 days of 4.5 GeV, 50mA 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 determination of the L decay point requires a magnetic optics analysis.

Issues: The PAC found the $^{4}H_{\Lambda}$ measurement the most compelling, given the implications for understanding charge symmetry breaking in light hypernuclei. These data are particularly useful for constraining the low energy constants that determine the ΛN and ΣN interactions, and feed directly into the construction of LN potentials. Because the measurement is systematics limited (±100 keV) it is imperative that the collaboration demonstrates the ability to meet this precision with existing data from the E12-17-003 experiment before allocating further beam time. A complementary JPARC experiment, which utilizes gamma-ray spectroscopy techniques to determine ΔB_{Λ} for the $0^{+}\rightarrow 1^{+}$ transition in $^{4}H_{\Lambda}$, is expected to be significantly more precise than the measurement proposed here, reinforcing the need to demonstrate that the stated precision can be achieved.

Similarly, the measurement of the $^{3}H_{\Lambda}$ binding energy is experimentally challenging and it is not clear that the necessary momentum resolution can be achieved to separate the $1/2^{+}$ and $3/2^{+}$ states. In light of the existing $^{3}H_{\Lambda}$ binding energy measurements the collaboration should also demonstrate the need for these new data and how they will further constrain ΛN models.

Summary: The need for new, more precise data on the binding energies of the $^{4}H_{\Lambda}$ and $^{3}H_{\Lambda}$ $1/2^{+}$ and $3/2^{+}$ states is well motivated and eagerly awaited by the theoretical community. The PAC encourages the collaboration to utilize existing data, especially that from E12-17-003, to demonstrate that the proposed

extraction techniques are successful. The motivation for the $^{3}H_{\Lambda}$ binding energy measurement needs to be strengthened, specifically the impact on ΛN models should be shown.

PR12-19-003

Scientific Rating: B+
Recommendation: Approve for 15 days

Title: "Studying Short-Range Correlations with Real Photon Beams at GlueX"

Spokespersons: Or Hen (contact), M. Patsyuk, E. Piasetzky, A. Schmidt, A. Somov, L.B. Weinstein

Motivation: Experiments with quasi-elastic electron scattering off nuclei have established that a sizable fraction of nucleons inside nuclei come in correlated pairs, in most cases np pairs. These pairs are characterized by their constituents having large relative ($k_{rel} > k_F$) but small total ($k_{cm} < k_F$) momentum. The theoretical analysis of the (e,e'NN) reaction is complex but has recently advanced to a factorized formalism in which the $eN \rightarrow e'N$ cross section is separated from the parts describing the abundance of correlated pairs in the nucleus and their center-of-mass and relative motions (the latter being sensitive to the tensor part of the NN interaction). An expectation from this formalism is that under suitable kinematic conditions a similar factorization should occur in the *photo-production* of knock-out pairs. Here it is the cross section for $\gamma N \rightarrow N\pi$ that should separate out. The proposed experiment will study signatures of short-range correlated pairs in photon-induced reactions, probing kinematics and dynamics different from quasi-elastic electron scattering. In addition, it is proposed to perform new studies of color transparency.

Measurement and Feasibility: The experiment would be run using the ~8.5 GeV Hall D photon beam on H, D, ^{4}He, and ^{12}C targets. In order to reduce neutron backgrounds (especially for the deuteron target), the photon flux will be reduced by a factor five relative to the nominal flux at GlueX. Neutron background overall does not appear to be an issue. The targets would need to be manufactured. Standard GlueX detection equipment would be used. Simulation shows that the average efficiency for $p+\pi$ detection is around 64%.

Issues: The PAC recognizes the science case for the study of short-range correlations and endorses exploratory photo-production measurements. The PAC was not satisfied by the rather qualitative nature of the description of the physics in the proposal, although communications with the proponents and the presentation to PAC did help significantly. At a quantitative level, the PAC remains concerned about the following points: (1) In contrast to the case of the cross section for $eN \rightarrow e'N$, little is known about the cross section for $\gamma N \rightarrow N\pi$ with an off-shell incoming nucleon. While it may be possible to take ratios or to consider normalized rates (in which the $\gamma N \rightarrow N\pi$ cross section is expected to cancel), this limits the ability to explore absolute predictions of the factorization formalism; (2) the intricacies of photo-production are well known in numerous other environments. In the present case, arguments may be made that meson exchange contributions and final-state interactions should be suppressed, but this has not been backed up by any detailed studies; (3) in a similar vein, the photon may interact as a hadron, converting to a ρ meson prior to the interaction. It may again be argued that such contributions are "parametrically" suppressed, but this requires further study.

Summary: The PAC was swayed to endorse the study of short-range correlated pairs in photo-production by the fact that uncharted territory will be entered and likely new insights into nuclear structure could emerge,

given the ability with GlueX to fully observe the final state particles. The PAC feels that the main objectives of the proposal could be addressed with a moderate amount of beam time. Additional measurements may be warranted at a later time, after it has been established that short-range correlation measurements with real photons can be interpreted theoretically. The PAC thus recommends exploratory studies with 15 days of beam time, ideally with the ^{12}C target. In addition, we encourage the GlueX collaboration and lab management to identify and pursue possible other uses of photon beams impinging on nuclear targets in Hall D.

PR12-19-004

Scientific Rating: N/A
Recommendation: Defer

Title: "Search for a Φ-N Bound State from Φ Production in a Nuclear Medium"

Spokespersons: Haiyan Gao, Tianbo Liu, Zhiwen Zhao, Nathan Baltzell

Motivation: The proposal aims at measuring quasi-real photo-production from a gold target to search for a Φ−N bound state, with an expected invariant mass of 1950 MeV and a 4 MeV width. If discovered, this would be of unique significance, as it would represent the first example of a light, hidden-strange pentaquark. If the state is not discovered, the experiment could still provide valuable information on sub-threshold production of ψ mesons from a heavy nuclear target.

Measurement and Feasibility: The experiment proposes to scatter a quasi-real photon off a nucleon in a gold target, producing a Φ-meson that interacts with a second nucleon to form the bound state. The theoretical model used in the proposal predicts that the main decay mode (46.5% branching ratio) of the bound state would be to pK^+K^-. It is proposed to use the CLAS12 main detector, the Forward Tagger (for the scattered electron), and the ALERT detector in Hall B for the measurement. The ALERT detector, already approved for a different experiment, needs to undergo some modifications: the end caps should be removed, a thin gold-foil target should be placed at the entrance, and a different gas should be used.

Issues: An LOI for a similar measurement was submitted to PAC45. At that time, the PAC recommended to address three main issues in a full proposal: 1) strengthening the case for a bound state by considering different models; 2) investigating the effect of nuclear interactions that could destroy the state or significantly modify it; 3) improving background studies. We find that the present proposal partially addresses issues 1 and 3, but fails to address issue 2.

The PAC considers the physics contained in the proposal to be very interesting. However, an assessment of the effect of nuclear interactions is essential. Measurements (also performed at JLab) as well as simulation tools (e.g., the GENIE event generator) exist that clearly show the modifications of resonances in a nuclear environment.

Summary: The PAC encourages the proponents to revise the proposal, including in particular the influence of nuclear interactions, and to reconsider the choice of target material to reduce nuclear effects.

PR12-19-005

Scientific Rating: N/A
Recommendation: Defer

Title: "Beam-Dump Dark Matter Search Utilizing a Low-Threshold, Directional Dark Matter Detector (BDX-DRIFT) at Jefferson Lab"

Spokespersons: D. Snowden-Ifft (contact), J. Harton, M. Battaglieri, E. Smith

Motivation: Dark matter scenarios with a light dark matter (LDM) in the mass range of MeV-GeV and a light force carrier has drawn significant attention in recent years. Large efforts have produced null search results in the dark matter direct detection, but conventional dark matter direct detection experiments have reduced sensitivity for light dark matter masses. Beam dump experiments at accelerators provide the unique opportunity to study light dark matter produced via a new light force carrier, as well as probe inelastic dark matter. The design gives sensitivity to only recoil nuclei, making it an excellent WIMP detector. The reach of LDM with DRIFT detector exceeds that of BDX-Calorimeter in $m_X >\sim 50$ MeV region. It also provides complementary information to the BDX-Calorimeter experiment with different detector technology, signal, backgrounds and systematics.

Measurement and Feasibility: BDX-DRIFT experiment detects the nuclear recoils from light dark matter produced in the downstream of Jefferson Lab Hall A beam dump with directional Recoil Identification from Tracks (DRIFT). A similar detector has been in use at Boulby Underground Lab (UK) for 20 years. The PIs developed and improved this detector, gaining long track records with this technology. The low pressure, negative-ion TPC technology has been proven to work well. The directional information is novel, which can play an important role in suppressing the backgrounds and increase the detection sensitivity.

The PIs also built a smaller version of the DRIFT detector and did background studies at SLAC ESA on surface and ESB 20 ft underground. The ESB study is important as a stand-in for the intended location at JLab. Rates in the detector were an order of magnitude lower underground and clearly due to cosmic rays. The measured backgrounds at SLAC agree well with the GEANT simulation, but also point to the need for some means of suppressing cosmic ray background.

The proposed DRIFT detector at BDX has 10 $1m^3$ modules. With the current configuration, the reach of BDX-DRIFT with 0 background is comparable to that of BDX-calorimeter. The reach of BDX-DRIFT exceeds that of BDX-Calorimeter in $m_X >\sim 50$ MeV region.

Issues: The PAC identified several points that need to be addressed.

1. A clear case needs to be made that DRIFT is the optimal technology for this mass range of Light Dark Matter (LDM) at this accelerator facility.
2. The size and composition of the detector was not fully determined. The PAC encourages the PIs to make a more firm design, although a basic design with options (such as increased pressure) would also be

acceptable. A full design would be optimized for the JLab location including a veto detector. It would include background studies and Monte Carlo studies of signal and background. An optimized design for the Underground Lab which will contain both BDX-Calorimeter and the BDX-DRIFT detectors and their supplementary services is needed.

3. Identification of cosmic rays as the primary background is attractive, and the PIs have started some work toward a veto system. More R&D is certainly needed to complete the detector design with proper coupling to the veto.
4. The electronics readout is under development, but also needs to be finalized.
5. The PIs should consider using Jefferson Lab for on-site background studies.
6. The PAC is uncertain whether the effects of beam spread on directional information have been considered.
7. When developing the revised proposal, a more detailed theory section is needed. Even though most of the physics motivation is the same as for the BDX-Calorimeter, there are certain differences. For example, the BDX-Calorimeter only utilizes the light force mediator A'-e-e coupling for both production and detection of the dark matter, while the BDX-DRIFT needs the A'-e-e interaction for production, and A'-q-q interaction for detection. Therefore, BDX-DRIFT is insensitive to the leptophilic type force mediator. Also, while the BDX-Calorimeter can detect inelastic dark matter with both scattering and decay process, the BDX-DRIFT would be only sensitive to the scattering channel. The current proposal has one reach plot that shows the sensitivity of BDX-DRIFT, in comparison with BDX-Calorimeter and other experiments. In the full proposal, it would be beneficial to work out the reach of BDX-DRIFT under several benchmark scenarios of LDM with a light force mediator.

Summary: The BDX-DRIFT uses the unique and mature technology of negative-ion TPCs to detect the nuclear recoil from light dark matter scattering, providing novel directional information for dark matter detection. Its sensitivity to light dark matter is comparable to that of BDX-Calorimeter and provides valuable complementarity. Work towards developing an appropriate detector design and a proper understanding of backgrounds so far is impressive, but not complete. The PAC strongly encourages the PIs to continue R&D work on the veto system and electronics, as well as more complete background studies and Monto-Carlo simulation. The PAC looks forward to a more fully developed proposal in the future.

Jeopardy Proposals

E12-19-006

Title: Study of the L–T Separated Pion Electroproduction Cross Section at 11 GeV and Measurement of the Charged Pion Form Factor to High Q2

~~**E12-06-101** Measurement of the charged pion form factor to high Q^2~~
~~**E12-07-105** Scaling Study of the L-T separated pion electroproduction cross section at 11 GeV~~

Spokespersons: D. Gaskell, T. Horn, G.M. Huber

Motivation: Measurements of the pion form factor at high Q^2 constitute a flagship of the physics program with the JLab 12GeV upgrade. Cross sections in exclusive pion electroproduction separated with respect to longitudinal (L) and transverse (T) photon polarizations are a cornerstone of the GPD program at the laboratory since they shed light on the mechanism that is most relevant for the reaction. Both the L and T parts may provide information on GPDs; if there is a sizable T component access to transversity GPDs could become possible. To obtain data for F_π and for L-T separated cross sections out to Q^2 values of at least several GeV^2 is a unique capability of JLab12.

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

E12-06-101 was first approved by PAC 30 in 2006 with later A (and high impact) rating. E12-07-105 was approved by PAC 32 in 2007 and is also rated A. Since the initial approval the case for the two experiments has become stronger in several ways: (1) Readiness for the proposed measurements in Hall C has been demonstrated, with HMS and SHMS operational; (2) The proponents have diligently worked on optimizing the use of beam time for the two experiments. The PAC greatly welcomes that with the new settings the full set of measurements now appears feasible with a more economical use of beam time; (3) It has been shown only in recent years that the transverse part of the pion electroproduction is not to be regarded as a "nuisance" but could rather serve as a valuable source of information on transversity GPDs; (4) A recent theory paper suggests that the Sullivan process can provide a reliable pion target even at virtualities $-t$ as large as 0.6 GeV^2. If true, this would allow extraction of the pion form factor from the high-Q^2 measurements to be carried out in this experiment by extrapolating the results obtained at high $-t$ toward the pion pole.

2) If the Experiment has already received a portion of its allocated beam time, the spokespersons should provide an analysis of existing data to demonstrate that the results are impactful, and that the additional time will provide substantial further impact.

The low-energy / lowest-Q^2 part of the experiment has run this summer. Given the vast experience that the proponents have acquired in related past work with 6 GeV running, we expect that they will succeed in extracting the form factor and the separated cross sections from the obtained data set. Still, since these are the first data taken for these observables after the upgrade, the analysis is expected to take some time. Experience gained from this first analysis at low Q^2 will be useful later for the analysis of the data to be taken at higher energies and Q^2.

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

The PAC recognizes the importance of the proposed measurements. It remains concerned about the fact that the extraction of the pion form factor at the highest Q^2=8.5 GeV^2 will rely on extrapolating down from rather large

values of $-t$. The extracted value for the form factor will likely remain highly model dependent. In addition, although a value of F_π at Q^2=8.5 GeV^2 would extend the coverage well into new territory, the PAC is not entirely convinced that the expected 10% experimental accuracy would suffice to distinguish between theoretical model calculations. On the other hand, the L-T separated cross sections at that Q^2 stand on their own merit in any case and will be valuable.

Summary: The PAC recommends allocation of the optimized beam time requested in the proposal and encourages the Lab to schedule the experiment accordingly.

E12-06-104

Title: "Measurement of the ratio $R = \sigma_L/\sigma_T$ in Semi-Inclusive Deep Inelastic Scattering"

Spokespersons: P. Bosted, R. Ent, E. Kinney, and H. Mkrtchyan

Motivation: The goal of the experiment is to obtain precise measurements of R=R(Q^2, z, p_T) in charged π- and *K*-SIDIS off H and D targets. R is needed as critical input for the study of nucleon structure in SIDIS experiments at JLab and elsewhere.

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

E12-06-104 was first approved by PAC 30 in 2006. Since the initial approval the 12 GeV SIDIS program at Jefferson Laboratory has started successfully. The R measurement is now of immediate high importance for the data analysis and interpretation of results from SIDIS experiments at JLab.

2) If the Experiment has already received a portion of its allocated beam time, the spokespersons should provide an analysis of existing data to demonstrate that the results are impactful, and that the additional time will provide substantial further impact.

E12-06-104 has not received beam time. However, the collaboration has been contributing to the tuning of the HMS and the SHMS in Hall C to achieve the high level of spectrometer performance needed for the E12-06-104 precision measurement of R. The collaboration also has evaluated the impact of changed experimental conditions on their requirement for integrated luminosity. A reduction of the beam RF from 500 MHz (assumed in 2006) to 250 MHz leads to higher detector occupancy forcing lower rates. However, this is compensated by a larger SHMS acceptance compared to the original proposal. The collaboration has determined that 40 days of running will be enough to reach all goals proposed in 2006.

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

Given the importance of the measurement for the overall SIDIS program, the PAC recommends the allocation of 40 days. The PAC increases the grade for E12-06-104 from A- to A.

Summary: The PAC recommends that this experiment remains active with the indicated change in status.

E12-06-105

Title: "Inclusive Scattering from Nuclei at x > 1 in the quasielastic and deeply inelastic regime"

Spokespersons: John Arrington, Donal Day, Nadia Fomin

Motivation: The goal of the experiment is to measure inclusive scattering from nuclei at x>1, sensitive to the momentum distribution of high-momentum nucleons and quarks at large values of Q^2.

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

Recent precision results suggest connection between 2N Short Range Correlations (SRCs) and the EMC effect. The kinematic settings and the choice of nuclear target is optimized for the study of isospin dependence of both effects.

A synergy has been created with the E12-10-008 experiment to combine the kinematic coverage using the same set of targets, approved by the experiment readiness review (ERR) in 2017.

Based on recent work, the proposal aims to make a first observation of the 3N SRC plateau with updated kinematics and high statistics ^{4}He data, limiting the number of additional targets to reduce the run time.

2) If the Experiment has already received a portion of its allocated beam time, the spokespersons should provide an analysis of existing data to demonstrate that the results are impactful, and that the additional time will provide substantial further impact?

The experiment has not received any beam allocation.

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

The PAC maintains the time allocation (32 days) and the experiment grade.

Summary: The PAC recommends that this experiment remains active with no change in status.

E12-06-107

Title: Hadron Propagation and Color Transparency at 12 GeV

Spokespersons: D. Dutta and R. Ent

Motivation: Measurements of pion nuclear transparency on ^{1}H, ^{2}H, ^{12}C, ^{63}Cu targets at high Q^2 (5-10 GeV^2) will allow for the confirmation of the onset of color transparency at low Q^2. The expected reduction of theoretical uncertainties at high Q^2 will also facilitate interpretation in the context of color transparency.

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

Experiment E01-107 published (PRC81: 055209 (2010), PRL99: 242502 (2007)) low Q^2 (1-5 GeV^2) data showing a significant reduction of nuclear transparency on ^{2}H,^{12}C,^{63}Cu,^{197}Au targets. This suppression demonstrates the expected scaling with Q^2 and A and agrees with theoretical calculations that include color transparency effects.

2) If the Experiment has already received a portion of its allocated beam time, the spokespersons should provide an analysis of existing data to demonstrate that the results are impactful, and that the additional time will provide substantial further impact.

E12-06-107 has received 8.5 of the requested 26 PAC days. This time was used to make proton transparency measurements in the Q^2 range 8-14.3 GeV^2. These data do not show an enhancement with Q^2 and do not agree with Glauber calculations that include color transparency effects. These new results directly contradict older BNL data that showed an enhancement in the same kinematic regime.

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

Signals consistent with the onset of color transparency at low Q^2 have already been measured in E01-107. The A dependence suggests that non-perturbative QCD effects are not the cause of the enhancements in nuclear transparency with Q^2. The motivation for higher Q^2 data is to confirm the effects seen at lower Q^2 and to collect data in a regime where theoretical errors are reduced and therefore more easily interpreted within the color transparency framework. The PAC recommends scheduling the ^{1}H, ^{2}H, ^{12}C target running and reserving ^{63}Cu running for a later time pending the analysis results from the lighter targets.

Summary: The PAC recommends that this experiment remains active with no change in status.

E12-06-114

Title: Measurements of the electron-helicity dependent cross sections of deeply virtual Compton scattering in Hall A at 11 GeV

Spokespersons: C. Hyde (contact), A. Camsonne, C. Munoz Camacho, J. Roche

Motivation: DVCS is a key process for investigating the 3D structure of hadrons. The experiment E12-06-114 measures the polarized DVCS cross section, which can provide the most detailed access to the Compton amplitude and thus to GPDs.

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

In the Jeopardy proposal, particular emphasis is put on measuring with different beam energies for given x and Q^2, which in the absence of a positron beam provides a unique opportunity to disentangle contributions from Compton scattering and the Bethe-Heitler process. The analysis of the experiment E07-007 has shown the significant potential of this 'Rosenbluth separation' method to discriminate between different scenarios for the Compton amplitude. This is particularly important in the presence of power-suppressed effects, whose importance in JLab kinematics has been highlighted by recent theory developments. The Rosenbluth method is also of great importance for future DVCS measurements at the EIC. In summary, the physics motivation for the proposed measurements is very strong and has even been strengthened by the recent developments in phenomenology and theory.

2) If the Experiment has already received a portion of its allocated beam time, the spokespersons should provide an analysis of existing data to demonstrate that the results are impactful, and that the additional time will provide substantial further impact.

The collaboration is preparing a publication of the data taken by the experiment in 2014 and 2016. It has obtained high quality results at x=0.36 and for two Q^2 points at x=0.6. By contrast, the data taken at x=0.48 suffers from large uncertainties, due to reduced beam time and instrumental problems during data taking.

The running scenario specified below will significantly improve the data situation at both x=0.48 and x=0.6 and provide kinematic points for a Rosenbluth separation. This adds significant physics value to the original proposal.

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

In the open presentation to the PAC, the collaboration proposes to convert the remaining beam time of 50 days for E12-06-114 into 35 days data taking in Hall C, using the same setup there as for E12-13-010 (approved by PAC 40). Compared with Hall A, this will allow the experiment to run at higher luminosity and, due to the higher momentum reach of the Hall C spectrometer, to measure with different beam energies at several points in x and Q^2. The PAC approves this running scenario.

E12-07-109

Title: Large Acceptance Proton Form Factor Ratio Measurements up to 14.5 GeV^2 using the Recoil-Polarization Method

Spokespersons: Evaristo Cisbani, Mark Jones, Nilanga Liyanage, Lubomir Pentchev, Andrew Puckett, Bogdan Wojtsekhowski

Motivation: The experiment intends to measure the ratio G_p^E/G_p^M in elastic electron proton scattering up to the highest possible momentum transfer of $Q^2 = 11.7$ $(GeV/c)^2$. The measurement of the polarization transfer to the recoiling proton provides direct access to the ratio of the electromagnetic form factors G_p^E/G_p^M at electron energies up to 11 GeV. The collaboration intends to use the SBS setup, with its magnet and beam line, the Hadron calorimeter, the Electromagnetic calorimeter, the Coordinate detector, and the 30-cm long liquid hydrogen target.

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

E12-06-104 was originally approved by PAC 32 in 2007. It received an allocation of 45 PAC-days by PAC 35 in 2010 and has been rated as "high impact" experiment by PAC 41 in 2013. Since the initial approval the SBS spectrometer setup received funding, has been built, is now almost finished and can be installed soon in Hall A at CEBAF. This enables the experiment to run with the SBS- setup in the near future.

2) If the Experiment has already received a portion of its allocated beam time, the spokespersons should provide an analysis of existing data to demonstrate that the results are impactful, and that the additional time will provide substantial further impact.

E12-07-109 has not received beam time.

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

Form factors of the proton and neutron, and their Q^2-dependence, are fundamental quantities and provide a test ground for our understanding of non-perturbative QCD. Their measurement is a key part of the JLab mission. The experiment will explore unknown territory for the ratio of the electromagnetic form factors and will clarify whether there is a zero crossing for the ratio and thus discriminate different model calculations. The electromagnetic form factors of the nucleon constrain measurements of GPDs and allow for an SU(2) flavor decomposition. Given the importance of the measurement for the overall form factor program, the PAC recommends to keep the allocation of 45 days.

Run Group Additions

E12-06-121A

Title: "Measurement of ^{3}He Elastic Electromagnetic Form Factor Diffractive Minima Using Polarization Observables"

Spokespersons: S.K. Barcus (JLab), D.W. Higinbotham (Jlab), S. Li (U. New Hampshire)

Motivation: The goal is to constrain the locations of the first diffractive minimum in the electric form factor of ^{3}He using double polarization observables. So far, all experimental data on the ^{3}He form factor minima come from electron scattering with unpolarized beams. They depend on either a Rosenbluth separation in the area of the diffraction minima or on fitting cross section data using a form factor parameterization with sharp diffractive minima. A double polarization measurement would constrain the location of the first diffractive minimum of the EM form factor without making assumptions or trying to perform a Rosenbluth separation.

Measurement and Feasibility: The proposal is fully endorsed by the collaboration as being straightforward. The proposed technique is very innovative and now possible due to a sufficiently high target polarization.

Summary: The PAC sees this as a very promising technique for determining the EM form factor. This run-group addition intends to be a proof-of-principle measurement to show that measuring the double polarization can be a superior technique for extracting form factor minima. The PAC recommends that the d^n_2 run group integrates this addition into their run.

E12-06-113A

Title: Neutron DVCS Measurements with BONuS12 in CLAS12

Spokespersons: M. Hattawy, S. Kuhn, R. Dupre

Motivation: DVCS on the neutron is an essential complement to proton DVCS. It offers a way to separate GPDs for u and d quarks and provides a rare opportunity to access the GPD E, which plays a privileged role in the study of the angular momentum carried by quarks in the nucleon. The Run group addition E12-11-003C proposes to measure neutron DVCS on a deuteron target with a tagged spectator proton. Such a measurement will be instrumental for developing and validating models for nuclear effects and final state interactions, which is uncharted territory in the context of exclusive processes like DVCS. Progress in this area would be of significant benefit for analyzing the results of the approved experiment E12-11-003, which will take high-statistics data on neutron DVCS on a deuteron without spectator proton tagging.

The beam polarization required for this measurement will provide opportunities for several other measurements of high physics interest, both in exclusive and in semi-inclusive channels.

Measurement and Feasibility: The measurement will be using the existing BONuS12 setup with the addition of a polarized beam. The main observable is the beam spin asymmetry A_{LU} in DVCS. This requires high beam polarization, given that the expected size of the asymmetry is in the few percent region.

Issues: None

Summary: The proposal presents a significant addition to the JLab DVCS program and, given the addition of beam polarization, to run group F as a whole. The PAC supports this run group addition.

E12-07-104A

Title: "Quasi-real Photoproduction on Deuterium"

Spokespersons: Florian Hauenstein (ODU), Stepan Stepanyan (Jlab), William Phelps (GWU)

Motivation: The goal is to revisit the searches for narrow resonances in $p\overline{p}$, $\pi^+\pi^-$, and K^+K^- final states. The technique is to use the quasi-free photon interaction with a deuterium target in CLAS12. High statistics spectra can be obtained using existing run time for the RG-B group.

Measurement and Feasibility: The proposal is fully endorsed by the collaboration. A small modification to the trigger is considered straightforward.

Summary: The experiment would make good use of the CLAS capabilities and promises to greatly improve the range and accuracy for charged hadron pair kinematics. This will allow better searches for narrow resonances.

Letters of Intent

LOI12-19-001

Title: Study of the charged current meson production in Bjorken kinematics

Spokesperson: M. Siddikov

Motivation: Deeply virtual meson production is an integral part of the 3D imaging program. It offers a large number of channels, in contrast to the more restrictive setting of Compton scattering. On the other hand, the theoretical interpretation of meson production is significantly more involved.

The LoI proposes to measure the exclusive charged-current reaction $ep \to \nu_e \pi^- p$. Unlike pion electroproduction, the charged-current process receives a contribution from the unpolarized GPDs H and E, which are arguably the largest GPDs in the nucleon. As a consequence, it is estimated that power corrections, which remain hard to quantify, are less important in the charged-current case.

The same holds for the so-called pion pole contribution, which in itself may be affected by large power corrections. Exclusive charged-current meson production can in principle provide complementary information to meson electroproduction and DVCS, since it depends on the same nonperturbative quantities but in different combinations.

Measurement and Feasibility: The envisaged measurement aims at detecting the pion and proton, imposing cuts on the missing mass and missing energy to identify the signal process and to reject background. A major technical challenge, not addressed in the LoI, is to find a suitable trigger, given the large number of background events in which the beam electron is scattered at low angle and remains undetected.

Issues: A strong limitation of the proposed channel is its low counting rate, which will make it difficult to measure differential cross sections and to achieve sufficiently high Q^2 for a GPD description to be valid.

Summary: The PAC acknowledges the principal interest of extending GPD studies to charged-current reactions. However, it finds that the serious rate limitations and anticipated experimental difficulties make JLab@12 GeV an unfavorable environment for such measurements. The PAC encourages the proponents to explore the potential of a corresponding program at the EIC.

LOI12-19-002

Title: "Measurement of the high energy contribution to the GDH sum rule"

Spokespersons: A. Deur, S. Sirca, J. Stevens

Motivation: The Gerasimov-Drell-Hearn sum rule relates the integral over the doubly-polarized spin-dependent photo-production cross section off a hadron to the anomalous magnetic moment of the hadron. It may be derived in dispersion theory, where it rests on fundamental concepts such as causality, unitarity, Lorentz and gauge invariance, as well as on a "no-subtraction'' hypothesis. Although the integral runs all the way to infinitely large photon energy, experimental studies at LEGS, MAMI, and ELSA have so far been limited to 2.9 GeV. The LOI proposes to extend the exploration of the high-energy regime to 12 GeV. This is well motivated and uniquely possible at JLab. An experiment planned for the 6 GeV program did not run.

Measurement and Feasibility: The experiment would run in Hall D with a circularly polarized photon beam generated by polarized electrons impinging on a radiator. It is planned to measure photo-production off protons as well as off deuterons, so that also the neutron GDH integral could be tested. Both the FROST and the HDice target designs are being considered, with the former preferred thanks to its easier operation and higher neutron polarization. A new version of the target would need to be built. The Hall D detection system is best suited for this measurement, thanks to its large solid angle.

Issues: The present study describes an expected uncertainty of the high-energy contribution to the GDH integral of about 6%. This comes about in roughly equal parts from uncertainties in beam and target polarizations, as well as from target dilution. Having Moller polarimetry on the electron beam line and lower target dilution would be beneficial. The corresponding investment would not be justified for a single 3-week experiment but could become an option if a full experimental program using a polarized target were to be developed in Hall D.

Summary: The PAC recognizes the science case for this LOI and recommends preparation of a full proposal with focus on the extraction of the actual value of the GDH integral at high energies. The PAC would be pleased to see the development of ideas towards a full program with a circularly polarized photon beam and a polarized target in Hall D.

LOI12-19-003

Title: "Measuring the Neutral Pion Polarizability"

Spokespersons: E. Smith and others

Motivation: Pion polarizability is a fundamental property and very poorly measured so far. A proposal for measuring charged pion polarizability (CPP) using a lead target with the real photon beam in Hall D is already approved for 20 days running. The same group is now investigating neutral pion polarizability. Chiral perturbation theory calculations (done by members of the collaboration) show that a measurement of the absolute cross section at low $\pi\pi$ invariant mass ($M_{\pi\pi}$ <0.7 GeV) with 1.5% accuracy will produce a ~10% accuracy for polarizability.

Measurement and Feasibility: The experiment would run in Hall D with a circularly polarized photon beam generated by polarized electrons impinging on a radiator. The polarizer will be tuned to the coherent peak for $\pi\pi$ Primakoff production. To date, the proponents have investigated the use of time allocated to the charged pion polarizability measurement and equipment planned for the CPP run. Preliminary simulations show that ~3000 events would be obtained in that time. Statistical uncertainty will therefore be much better than previous measurements. Backgrounds will be important and the proponents have started to investigate sources. The dominant backgrounds for CPP of rho decay and muon-proton misidentification are not present here. Instead, decays of f0(500) and f0(980) are considered. The proponents show that these contributions are small and kinematically separated. In addition, coherent eta photoproduction events have extra photons and can be suppressed.

Issues:

- Measurement of a cross section with <2% absolute accuracy with a real photon beam is difficult. A full proposal must have a detailed discussion of all the contributions to the estimated error – statistical, flux, and background. Furthermore, the extraction of the polarizability has uncertainties due to modeling issues, and these must be included.
- The CPP experiment is already approved, so compatibility with that experiment, including running times, needs to be delineated.
- The Theory report emphasizes the importance of modeling issues. This is an important consideration and should be discussed.

Summary: The PAC recommends preparation of a full proposal. A quality measurement of this fundamental property would be of great benefit.

LOI12-19-004

Title: "Target Helicity Correlations in GlueX"

Spokespersons: D. Keller (contact)

Motivation: This LOI proposes to measure a set of polarized observables for pseudoscalar and vector meson photo-production using circularly and linearly polarized beams on a longitudinally polarized target. Polarized observables exhibit very rich structure, providing additional information to be used to determine complete isospin amplitudes and assist in the search for exotic states.

Measurement and Feasibility: The proposed polarized observables include single-polarization and beam-target, target-recoil, and beam-recoil double-polarization asymmetries, as well as tensor polarized observables, and initial state helicity correlations in possible exotic state hadrons.

The LOI proposes to develop a polarized target (proton or deuteron) specialized for the GlueX configuration. The current LOI is an update to LOI 12-16-005, focusing on some of the longitudinally polarized target observables with KΛ channels.

The polarized target would be a frozen-spin hydrogen and deuterium target system, similar to the CLAS FROST target but optimized for the Hall D geometry, background field, and target length.

The proponents also did an estimation of the uncertainties of beam helicity asymmetry with 40 days of running.

Issues: The PAC identified several points that need to be considered.

1. Some of the issues identified by the previous PAC 44 report on LOI 12-16-005 still apply to this LOI. The physics motivations are very general and undeveloped and the kinematic reach of the proposed asymmetries is often not specified. PAC44 recommended the proponents work closely with theorists to make sure these channels can be interpreted within a theoretical framework. There is no evidence from the current LOI that the previous PAC44 comments and recommendations have been addressed.

2. As pointed out in the TAC theory report: "Many of the proposed measurements seem to be impractical on kinematical grounds. The prospects for meson spectroscopy are also not clearly presented." The PAC suggests the proponents to enlist the aid of a theorist expert in meson production modeling who might advise them on how polarized measurements could best be used.

3. Since the measurements proposed in this LOI use the GlueX detector, it is imperative that the proponents talk to the GlueX collaboration to see how these polarization measurements can fit into the future plan of GlueX. In particular, in the GlueX white paper that is publicly available, there are experiments proposed to use polarized targets as well.

Summary: Given the issues mentioned above, the PAC recommends the proponents investigate how to extract useful information from these measurements. The PAC suggests to focus on a few specific channels and polarized variables, and to present a clear case of the design, measurements, and interpretations. The PAC recommends that the proponents talk to the GlueX collaboration to see how this can fit into the future GlueX program. A proposal should not be submitted to future PACs until these issues are thoroughly addressed.

LOI12-19-005

Title: "Next Generation Tritium Experiments in CLAS12**"**

Spokespersons: D. Gaskell, D.W. Higinbotham, D. Meekins (Jlab), O. Hen (MIT), D. Dutta (Mississippi State), L.B. Weinstein (Old Dominion), Z. Ye (ANL), S. Sirca, M. Mihovilovic (U. Ljubljana)

Motivation: The letter proposes measuring precision ratios of charged pion electroproduction in Semi Inclusive Deep Inelastic Scattering (SIDIS) from d, ^{3}He, and ^{3}H to test the flavor dependence of the EMC effect in the valence region over a wide range of Bjorken-x ($0.2<x<0.6$) and large z ($z>0.4$). Data from the recent Hall A 12 GeV tritium measurements will already enable exploring the flavor dependence of the valence quark distribution in the nucleus and the isospin dependence of the nucleon structure modification in the $A\leq3$ nuclei. SIDIS measurements usually provide additional constraints on the flavor dependence of the anti-quark distribution in the nucleon, which inclusive data alone cannot distinguish. The full power of a SIDIS program with $A\leq3$ nuclei would be realized if one were to access the even smaller x-region, where sea quarks and gluons play a more prominent role.

Measurement and Feasibility: The maximum beam energy incident on identical target cells of d, ^{3}H, and ^{3}He is requested, detecting the scattered electron and the ejected pions in the CLAS12 forward detector. Target cells are expected to be similar to the successfully used Hall A cells. CLAS12 will give wide acceptance in Q^2, x, and z, and full coverage for small to moderate values of the perpendicular momentum of the outgoing pion. The CLAS12 vertex resolution will be used to eliminate events scattering from the target walls. Only pions detected in the common kinematical region where the $\pi+$ and $\pi-$ experimental acceptances are identical.

Issues: The main technical issue is the use of tritium in CLAS12 as target material. The highly successful program completed in Hall A was a logistical tour de force. The geometry of the CLAS12 detector will impose new constraints on the target design and operation. The LOI states that there will be cost savings since certain R&D efforts will not need to be repeated. However, those will be at least partially offset by new requirements needed for Hall B. As stated in the LOI, a new target cell that is better matched to the cylindrical symmetry of CLAS12 will have to be designed, engineered and tested. The TAC report lists issues that will need to be dealt with.

Summary: A program of SIDIS experiments on A=2 and A=3 nuclei would form a natural and important component of the JLab 12 GeV program on light nuclei. It would also fit in well into the framework of mapping the full 3D partonic structure of nuclei.

For a full proposal the physics motivation must be made stronger. It will be specifically helpful if more detailed theoretical work is included together with usual experimental details. The high-*x* SIDIS program will complement the analysis of data from the existing inclusive experiments, but a stronger case is needed in identifying observables in SIDIS that would **not** be possible to extract otherwise. This may include the possibility of detecting kaons in the final state as potential tag on the nuclear dependence of strange quark distributions in the nucleon.

LOI12-19-006

Title: “Charm Physics With Polarized Beams and Target at Je erson Lab 12 GeV”

Spokespersons: Z. Akbar and D. Keller

Motivation: This LOI is concerned with spin observables in threshold photo-production of charm (inclusive, exclusive open associate charm and exclusive hidden charm) aiming at gluon spin distribution in the nucleon, and the search for pentaquarks and characterization of the production process.

Measurement and Feasibility: The measurements are technically challenging and require significant changes to the radiator of the compact photon source, and the settings of the BigBite spectrometer and installation of the polarized target in Hall C.

Issues: The theoretical foundations for the measurements lack serious scrutinizing and are partly inconsistent with common knowledge. For example, ΔG extraction via PGF requires high energy kinematics. Even if the measurements on associated and hidden charm production were to stand by themselves, there are serious doubts about precision given, as the quoted cross sections seem overly optimistic and model dependent. Furthermore, the statistical uncertainties on spin asymmetries will suffer from the target dilution factor not taken into account in the LOI. Only simplistic background estimates have been done, but realistic background estimates and simulations are crucial owing to partial reconstruction of the final state. The measurements require major technical modifications and difficult installations.

Summary: The authors should not return to the PAC unless the comments of both the Theory and Physics TACs are clearly answered. This includes generation of a solid physics case for pursuing these measurements.

LOI12-19-007

Title: "A Measurement of ^{4}He Coherent J/Ψ Photo-production at threshold in Hall C at Jefferson Lab; Towards a determination of ^{4}He Gluonic Radius"

Spokespersons: W. Armstrong, I. Cloët, T.-S. H. Lee, S. Joosten, Z.-E. Meziani, M. Jones

Motivation: The letter proposes to measure near-threshold coherent photo-production of J/ψ on a gaseous ^{4}He target in Hall C. The experiment should be able to measure the t-dependence of the coherent differential cross section in the range $0.28\ \text{GeV}^2 \leq -t \leq 0.35\ \text{GeV}^2$. The goal of the experiment is to extract the gluonic form factor of the ^{4}He nucleus and determine its gluonic radius.

Measurement and Feasibility: The required photon beam will be generated from an 11.0 GeV electron beam traversing a 9% copper radiator and striking an existing 20 cm race track ^{4}He gas target with half the liquid He density and half the aluminum wall thickness. The decay pair from the produced J/ψ will be measured using the HMS and SHMS. The recoiling ^{4}He nucleus will be tagged by a third detector that needs to be designed. The LOI anticipates 14 days of beam time.

The extraction of the gluonic form factor requires a determination of the slope of the cross section to $t=0$ and a reliable QCD-based description of the reaction.

Issues: A ^{4}He detector needs to be designed. The feasibility of the target needs to be confirmed with the target group.

Simulations should be made with more realistic models that reproduce existing data on exclusive J/Ψ production. Using more than one model will be valuable.

The interpretation of the results in terms of the gluonic radius will strongly depend on extrapolations beyond the measured range and on a correct theory description of the reaction mechanism, which is presently not well established. Because of this, the determination of ^{4}He gluonic radius should not be presented as the goal of the experiment.

Summary: The PAC encourages the submission of a full proposal that addresses the above issues and clarifies the possible interpretations of the results, without overemphasizing them.

Program Status

12 GeV Approved Experiments by Physics Topics

Topic	Hall A	Hall B	Hall C	Hall D	Other	Total
The Hadron spectra as probes of QCD	0	2	1	3	0	**6**
The transverse structure of the hadrons	6	3	3	1	0	**13**
The longitudinal structure of the hadrons	1	3	7	0	0	**11**
The 3D structure of the hadrons	4.5	9	5.5	0	0	**19**
Hadrons and cold nuclear matter	8	5	7	1	1	**22**
Low-energy tests of the Standard Model and Fundamental Symmetries	4	1	0	1	2	**8**
Total	**23.5**	**23**	**23.5**	**6**	**3**	**79**

12 GeV Approved Experiments by PAC Days

Topic	Hall A	Hall B	Hall C	Hall D	Other	Total
The Hadron spectra as probes of QCD	0	219	11	540	0	**770**
The transverse structure of the hadrons	150.5	85	146	25	0	**406.5**
The longitudinal structure of the hadrons	19	230	211	0	0	**460**
The 3D structure of the hadrons	359	872	196	0	0	**1427**
Hadrons and cold nuclear matter	220	275	205	15	14	**729**
Low-energy tests of the Standard Model and Fundamental Symmetries	547	180	0	79	60	**866**
Total Days	**1318.5**	**1861**	**769**	**659**	**74**	**4658.5**

PAC "High Impact" Selection

PAC Days
Boldface = days designated High Impact
Parentheses = days not counting toward High Impact total

Row Color
Yellow = High Impact
Green = backup expt

Exp#	Exp Name	Hall	Run Group/Days	PAC Days	PAC Grade	Comments
			TOPIC 1: SPECTROSCOPY			
E12-06-102	GlueX: Mapping the Spectrum of Light Quark Mesons and Gluonic Excitations with Linearly Polarized Photons	D		(120) approved ★90	A	GlueX - assumed half commissioning/half physics ★plus (30) commissioning days
E12-16-007	A Search for the LHCb Charmed "Pentaquark" using Photoproduction of J/Psi at Threshold in Hall C at Jefferson Lab	C		11	A	
			TOPIC 2: FORM FACTORS			
E12-06-101	Measurement of the Charged Pion Form Factor to High Q2	C		52	A	Requires fully commissioned SHMS
E12-07-109	GEp/GMp: Large Acceptance Proton Form Factor Ratio Meas's at 13 and 15 (GeV/c)2 Using Recoil Polarization Method	A		45	A-	Requires SBS and high power cryo target
E12-11-106	High Precision Measurement of the Proton Charge Radius	B		15	A	Non-CLAS12 experiment, Prad
			TOPIC 3: PDFs			
E12-06-113	BONuS: The Structure of the Free Neutron at Large x-Bjorken	B	F/40	(40) approved ★21 ↓	A	Requires BONuS Radial TPC upgrade ★42 days High Impact for the experiment
E12-10-103	MARATHON: Measurement of the F2n/F2p, d/u Ratios and A=3 EMC Effect in DIS off the Tritium and Helium Mirror Nuclei	A	Tritium target group/61	↑ ★21 (42) approved	A	**that runs first; experiments are equally important & both are essential**
E12-06-110	A1n HallC–3He: Meas of Neutron Spin Asymmetry A1n in the Valence Quark Region Using an 11 GeV Beam and a Polarized 3He Target in Hall C	C		36	A	Requires high luminosity 3He
			TOPIC 4T: TMDs			
C12-11-111	TMD CLAS–HDIce: SIDIS on Transverse polarized target	B	G/110	110 concurrent	A	Requires transversely polarized HDIce with electron beam
C12-12-009	Dihadron CLAS-HDIce: Measurement of transversity with dihadron production in SIDIS with transversely polarized target	B	G/110	(110) concurrent	A	Requires transversely polarized HDIce with electron beam C1 Proposal
E12-06-112	TMD CLAS-H(Unpol): Probing the Proton's Quark Dynamics in Semi-Inclusive Pion Production at 12 GeV	B	A/139	(60) approved ★10	A	Hall B commissioning + 10 days ★plus (50) commissioning days
			TOPIC 4G: GPDs			

E12-06-114	DVCS HallA–H(UU,LU): Measurements of Electron-Helicity Dependent Cross Sections of DVCS with CEBAF at 12 GeV	A	Early: DVCS & GMp/62	(100) approved ★70	A	Hall A commissioning
C12-12-010	DVCS CLAS–HDIce: DVCS at 11 GeV with transversely polarized target using the CLAS12 Detector	B	G/110	(110) concurrent	A	Requires transversely polarized HDIce with electron beam C1 Proposal
E12-11-003	DVCS CLAS–D(UU,LU): DVCS on the Neutron with CLAS12 at 11 GeV	B	B/90	(90) approved	A	Requires D target; central neutron detector ready in 2016 ★Backup GPD-E meas if HDIce delayed

TOPIC 5: NUCLEAR

E12-13-005	Bubble Chamber: Measurement of 16O(³,±)12C with a bubblechamber and a bremsstrahlung beam	INJ		14	A-	Our guess: 2017
E12-11-101	PREx-II: Precision Parity-Violating Measurement of the Neutron Skin of Lead	A		35	A	Requires septum, Pb target, 1% Moller polarimetry
E12-06-105	SRC–hiX: Inclusive Scattering from Nuclei at $x > 1$ in the quasielastic and deeply inelastic regimes	C		32	A-	
E12-11-112	SRC–Tritium: Precision measurement of the isospin dependence in the 2N and 3N short range correlation region	A	Tritium target group/61	19	A-	
E12-17-003	Determining the Unknown Lambda-n Interaction by Investigating the Lambda-nn Resonance	A		12	A-	

TOPIC 6: FUNDAMENTAL SYMMETRIES

E12-11-006	HPS: Status of the Heavy Photon Search Experiment at Jefferson Laboratory (Update on PR12_11_006)	B	H/180	(155) approved ★39	A	Non-CLAS12 experiment, HPS ★25 pre-CLAS engr + 14 physics @ 4.4 GeV
E12-10-009	APEX: Search for new Vector Boson A1 Decaying to e+e-	A		34	A	

<<<SUMMARY of "HIGH IMPACT" DAYS>>>

by Topic	1	2	3	4GT	5	6	total post - commissioning
	101	112	78	190	112	73	666
Days Complete	20	15		50		15	
	81	97	78	140	112	58	566

by Hall	A	B	C	D	INJ	
	236	195	131	90	14	666
Days Complete	50	30		20		
	186	**165**	**131**	**70**	**14**	**566**

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Charge to PAC47

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.