51st PROGRAM ADVISORY COMMITTEE (PAC 51)

July 24 – 28, 2023

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 14, 2023

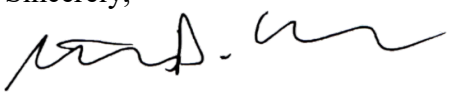
Dear Jefferson Lab Users,

It was a pleasure to see the new and exciting experimental proposals from our user community at the recent Program Advisory Committee (PAC51) meeting, held July 24-28, 2023. The exceptional quality of these proposals serves as a testament to the remarkable scientific opportunities that Jefferson Lab's CEBAF brings to our scientific community.

The committee received an unprecedented total of 37 submissions, which were categorized as follows: 14 new proposals, 7 jeopardy proposals, and 16 letters of intent. Of these, the PAC granted approval to 5 new proposals and confirmed its support for all jeopardy proposals. Notably, one jeopardy proposal saw an improvement in its grade, upgraded from B to A-.

The meeting was conducted efficiently and effectively, largely owing to the diligent contributions of the Chair, Markus Diehl, as well as Stephanie Tysor and Pamela Cole. I extend my gratitude to Markus and all the PAC members for their dedicated efforts in offering their expert insights to the Laboratory. A special commendation is also due to Bob McKeown for his exceptional guidance in overseeing the PAC process for the Laboratory over the past 13 years.

Sincerely,



Stuart Henderson
Laboratory Director

From the Chair

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

Newport News, 28 July 2023

Cynthia Keppel
Associate Director of Experimental Nuclear Physics
Jefferson Lab

Dear Thia,

This letter transmits the findings and recommendations of the 51st Jefferson Lab Program Advisory Committee (PAC51). The Committee met from July 24 to 28 and reviewed 14 new proposals, one proposal for a run group addition, and 7 experiments in Jeopardy. It also provided feedback on 16 letters of intent - as many as were received in the previous four years together.

Written reports on the proposals, letters of intent and experiments in Jeopardy were prepared and reviewed by the Committee before we adjourned. 5 proposals were granted full approval, one proposal was approved pending review by a future PAC (C2), 5 proposals were approved pending a technical review by the Lab (C1), and 3 proposals were deferred. The proposed run group addition was endorsed. All experiments in Jeopardy were recommended to stay active, and 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. For the first time, the JLUO Chair-Elect participated in all PAC sessions as well, with the intent to further strengthen user representation and to ease the transition from one year to the next. We feel that this is a very valuable addition to the Committee and hope it will become a tradition, too.

The TAC physics and theory reports provided to the PAC were a most valuable resource for our review. We thank all those involved in their preparation, which presented a particularly heavy workload this year.

Six out of 16 proposals and 5 out of the 16 letters of intent concern experiments with positron beams and cover a broad range of physics topics. This testifies to the increasing interest in a positron program at the laboratory. The Committee was pleased to see that work in the lab towards realizing positron beams has progressed and allowed to define a first set of likely beam parameters. This provides valuable orientation to both proponents and to this Committee. As in previous years, our recommendations in this report are

based on the hypothesis that it will be possible to deliver beams with the specifications given in the proposals. In this spirit, all approvals of proposals with positron beams are conditional, with a future review either by the laboratory or by the PAC.

Several experiments in Jeopardy have requested a substantial increase of their awarded beam time. After careful deliberation, the committee concluded that the format of a Jeopardy review does not provide a sufficiently sound basis for approving such an important modification of an experiment. It feels that additional beam time should instead be requested in a separate proposal, which permits a full and detailed PAC review. The PAC encourages the Lab management and the Users Organization to consider this issue and to revise the rules of the Jeopardy process accordingly.

The present Jeopardy procedure allows an experiment to present its update exclusively in the open session of the PAC meeting. The committee finds that this creates unfavorable conditions for a thorough review and requests that the submission of a written update document be made mandatory in future Jeopardy reviews.

The committee appreciates the amount of logistics behind such a meeting, and would like to extend its warmest thanks to Pamela Cole, Lorelei Carlson, and Stephanie Tysor for their tireless work ahead of, during, or after PAC week.

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
PAC51 Chair

Introduction

The Jefferson Lab Program Advisory Committee held its 51st meeting from July 24th through July 28th, 2023. The membership of the committee is given on page 50. In response to the charge (page 51) from the Associate Director, Dr. Cynthia Keppel, the committee reviewed 14 new proposals, 7 Jeopardy proposals, 1 run group addition, and 16 letters of intent.

PAC51 Results and Recommendations

NEW PROPOSALS

NUMBER	CONTACT PERSON	TITLE	HALL	DAYS REQ'D	DAYS AWARDED	SCIENTIFIC RATING	PAC DECISION	TOPIC
PR12-23-001	Nikos Sparveris	Measurement of the Generalized Polarizabilities of the Proton in Virtual Compton Scattering	C	62	62	A-	Approved	2
PR12+23-002	Eric Voutier	Beam Charge Asymmetries for Deeply Virtual Compton Scattering on the Proton at CLAS12	B	100	100	A-	C1	4
PR12+23-003	Dave Gaskell	Measurement of Deep Inelastic Scattering from Nuclei with Electron and Positron Beams to Constrain the Impact of Coulomb Corrections in DIS	C	9.3	9.3	A-	C1	5
PR12-23-004	Bogdan Wojtsekhowski	A Search for a Nonzero Strange Form Factor of the Proton at 2.5 (GeV/c)^2	C	45	45	A-	Approved	2
PR12+23-005	Bogdan Wojtsekhowski	A Dark Photon Search with a JLab positron beam	B	60			Deferred	6
PR12+23-006	Carlos Munoz Camacho	Deeply Virtual Compton Scattering using a positron beam in Hall C	C	137	137	A-	C1	4
PR12-23-007	David Ruth	A Measurement of the Proton g2 Structure Function at Intermediate Q2	C	33			Deferred	2
PR12+23-008	Axel Schmidt	A Direct Measurement of Hard Two-Photon Exchange with Electrons and Positrons at CLAS12	B	55	55	A	C1	2
PR12-23-009	Or Hen	Nuclear Charm Production and Short-Range Correlations in Hall D	D	100			C2	5
PR12-23-010	Holly Szumila- Vance	Color Transparency in Maximal Rescattering Kinematics	C	95	40	B+	Approved	5
PR12-23-011	Dipangkar Dutta	Precision Deuteron Charge Radius Measurement with Elastic Electron-Deuteron Scattering	B	40			Deferred	3
PR12+23-012	Michael Nycz	A measurement of two-photon exchange in unpolarized elastic positron–proton and electron–proton scattering	C	56	56	A-	C1	2

NUMBER	CONTACT PERSON	TITLE	HALL	DAYS REQ'D	DAYS AWARDED	SCIENTIFIC RATING	PAC DECISION	TOPIC
PR12-23-013	Florian Hauenstein	Measuring Short-Range Correlations with ALERT	B	17	17	A	Approved	5
PR12-23-014	Peter Bosted	Measurements of the Ratio R = sigmaL/sigmaT, p/d ratios, Pt dependence, and azimuthal asymmetries in Semi-Inclusive DIS pi0 production form proton and deuteron targets using the NPS in Hall C	C	7	7	A-	Approved	4

Abbreviations

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

Topic

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

PAC51 Results and Recommendations

JEOPARDY

NUMBER	CONTACT PERSON	TITLE	HALL	DAYS REQ'D	DAYS AWARDED	SCIENTIFIC RATING	PAC DECISION	TOPIC
C12-15-006	Dipangkar Dutta	Measurement of Tagged Deep Inelastic Scattering	A,C	60	27	A-	Remain active with C1 status	3
E12-13-011	Karl Slifer	The Deuteron Tensor Structure Function b1	C	47.4	41	A-	Remain active	3
E12-14-002	William Henry	Precision Measurements and Studies of a Possible Nuclear Dependence of R	C	22	22	A-	Change rating from B to A-	5
E12-15-005	Elena Long	Measurements of the Quasi-Elastic and Elastic Deuteron Tensor Asymmetries	C	52.8	45	A-	Remain active	5
E12-15-008	Satoshi N. Nakamura	An isospin dependence study of the Lambda-N interaction through the high precision spectroscopy of Lambda hypernuclei with electron beam	C	61	28	A	Remain active	5
E12-16-001	Marco Battaglieri	Dark Matter search in a Beam Dump eXperiment (BDX)	A	N/A	N/A	A	Remain active	6
E12-17-008	David Hamilton	Polarization Observables in Wide-Angle Compton Scattering at large s, t and u	C	46	46	A-	Remain active	2

PAC51 Results and Recommendations

RUN GROUP SUMMARY

NUMBER	CONTACT PERSON	TITLE	HALL	PAC DECISION	TOPIC
E12-16-010C	Timothy Hayward	Separation of the σ_L and σ_T contributions to the production of hadrons in electroproduction	B	Approved	4

PR12-23-001

Scientific Rating: A-

Recommendation: Approved for 62 PAC days in Hall C

Title: Measurement of the Generalized Polarizabilities of the Proton in Virtual Compton Scattering

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

Motivation: The proposal aims at systematic high-precision measurements of the generalized polarizabilities of the proton by means of the Virtual Compton Scattering (VCS) process in e p → e p γ. It follows the successful measurement that the collaboration performed with the experiment E12-15-001. The results obtained confirmed a puzzling structure in the electric polarizability, and they call for more precise measurements over a larger range of Q^2. The present proposal aims at performing the needed extension in Q^2 and in precision.

Measurement and Feasibility: The experiment will use both the SHMS and HMS spectrometers in Hall C to detect electrons and protons in coincidence from VCS off a hydrogen target for two incident electron energies (1.1 and 2.2 GeV) with beam currents up to 75 μA. Measurements will be made at seven values of Q^2 between 0.05 and 0.5 $(GeV/c)^2$.

Issues: N/A.

Summary: The physics case presented in the proposal is robust, the choice of the kinematics and settings well justified, and the document is very well-written. The PAC welcomes these high precision measurements and approves the proposal for 62 PAC days.

PR12+23-002

Scientific Rating: A-

Recommendation: Conditionally approved (C1) for 100 PAC days in Hall B

Title: Beam Charge Asymmetries for Deeply Virtual Compton Scattering on the Proton at CLAS12

Spokespersons: E. Voutier (contact), V. Burkert, S. Niccolai, R. Paremuzyan

Motivation: The goal is to measure the unpolarized and polarized Beam Charge Asymmetries (BCAs) of the $e\,p \rightarrow e\,p\,\gamma$ process on unpolarized hydrogen with CLAS12, using polarized positron and electron beams at 10.6 GeV. The DVCS cross section can be expressed in terms of Compton Form Factors (CFFs), which in turn may be written in terms of Generalized Parton Distributions (GPDs) using factorization. Accurate determination of both real and imaginary parts of the CFFs is essential for the analysis of hard exclusive processes and the determination of GPDs. To this end, it is proposed to measure

- the unpolarized beam charge asymmetry A^{c}_{UU}, which is sensitive to the real parts of CFFs,
- the polarized beam charge asymmetry A^{c}_{LU}, which is sensitive to the imaginary parts of CFFs,
- the beam-charge averaged beam spin asymmetry A^{0}_{LU}, which is sensitive to the products of real and imaginary parts of CFFs.

The combination of measurements with oppositely charged incident beams is theoretically the cleanest way to access the CFFs described above. It hence provides a highly attractive way to constrain GPDs. The kinematic range accessible with a 10.6 GeV beam on a proton target will allow one to investigate the Q^2 dependence at fixed Bjorken x.

Measurement and Feasibility: The measurements are planned with the CLAS12 spectrometer. To optimize systematic uncertainties of the different asymmetries, the collaboration plans to split production beam time equally between positron beams and secondary electron beams with comparable characteristics. The requested beam parameters are 10.6 GeV energy, 50 nA beam current, and at least 60% polarization.

Issues: The committee finds that all issues raised in the PAC48 report for C12-20-009 have been addressed satisfactorily.

Summary: The PAC recognizes the strong science case of this proposal in constraining the GPDs. It recommends conditional approval (C1) of the requested 100 PAC days. A C1 review by the Lab should be conducted at an appropriate time and verify that positron and secondary electron beams will be available with the parameters required for the experiment.

PR12+23-003

Scientific Rating: A-

Recommendation: Conditionally approved (C1) for 9.3 PAC days in Hall C

Title: Measurement of Deep Inelastic Scattering from Nuclei with Electron and Positron Beams to Constrain the Impact of Coulomb Correction

Spokespersons: D. Gaskell (contact), W. Henry, N. Fomin

Motivation: Coulomb corrections may contribute significantly to nuclear effects in DIS on nuclei. In particular, this complicates the interpretation of nuclear effects observed in measurements of $R_A - R_D$ in experiment E12-14-002, where $R = \sigma_L/\sigma_T$ in inclusive DIS. Comparison of R measurements with positron and electron beams will make it possible to identify and quantify effects from Coulomb acceleration.

Measurement and Feasibility: The measurement will use unpolarized positron beams and the E12-14-002 apparatus with gold and liquid deuterium targets in Hall C. The beam requirements stay within the specification recommended by the positron working group (beam current 1 μA).

Issues: It is proposed to combine the PR12+23-003 positron measurements with the earlier electron beam measurements from E12-14-002. The proponents note that systematic uncertainties in the double ratios of nuclear cross sections could be minimized by running an additional day of high intensity electron beam (60 μA). This can be made possible by reducing the time needed to switch between the two beams.

Summary: The PAC recommends conditional approval (C1) and suggests that the proponents work with laboratory staff to minimize the switchover time between positron and electron beams, so that the experiment can be run with both beams. A C1 review by the Lab should be conducted at an appropriate time and verify that positron beams will be available with the parameters required for the experiment.

PR12-23-004

Scientific Rating: A-

Recommendation: Approved for 45 PAC days in Hall C

Title: A Search for a Nonzero Strange Form Factor of the Proton at 2.5 (GeV/c)^2

Spokespersons: B. Wojtsekhowski (contact), R. Beminiwattha, D. Hamilton, C. Palatchi, K. Paschke)

Motivation: The experiment aims at measuring the strange quark contribution to the proton electromagnetic form factors. This is crucial for their flavor decomposition. The compelling physics case is motivated by recent progress in lattice QCD calculations and by phenomenological models, which highlight the potential of a measurement at large Q^2.

Measurement and Feasibility: The experiment proposes to measure the parity violation asymmetry in electron-proton scattering at $Q^2 = 2.5$ $(GeV/c)^2$. A beam with 6.6 GeV, 65 μA and 85% polarization impinging on a 10-cm-long liquid hydrogen target will be used. An NPS-type PbWO4-based electron calorimeter and an iron-scintillator-based proton calorimeter will be constructed in Hall C. The parity-violating asymmetry will be measured to a statistical precision of ± 6.2 ppm. The collaboration has well addressed issues raised by the PAC50 report and by the TAC report, and the experiment appears to be feasible.

Issues: As the TAC report pointed out, the results of the simulations in the proposal should be benchmarked with experimental data. Also, building a small prototype of the detector system that can be deployed parasitically during other experiments may help understanding the background better. This is a large installation experiment at Hall C. The PAC advises the proponents to communicate closely with the lab, and to take a step-by-step approach towards realizing the experiment.

Summary: The PAC finds the experiment scientifically well motivated, and the measurement appears to be feasible. The committee asks the proponents to take the above issues into account in their further planning. The PAC recommends approval of the requested 45 days.

PR12+23-005

Scientific Rating: N/A

Recommendation: Deferred

Title: A Dark Photon Search with a JLab positron beam

Spokespersons: A. Gasparian, N. Liyanage, B. Raydo, B. Wojtsekhowski (contact)

Motivation: The proposal aims at a search for the A′-boson in the mass range from 15 to 90 MeV using the missing mass method. The A′-boson is the kinetically mixed dark photon. Knowledge of the A' boson mass and its coupling to an electron (or an upper limit on this coupling) is of large interest to the dark matter research field. The proposed sensitivity might allow the collaboration to resolve the question whether there is a connection between the hypothetical X17 particle and the A'-boson.

Measurement and Feasibility: The proposed experiment is to be carried out in Hall B using detectors and equipment that have been employed with success in the PRAD experiment E12-11-106. A positron beam with energies of 2.2, 4.4 and 11 GeV and a current of 50 nA will impinge on the atomic electrons of the target material. The signal process is $e^+ e^- \rightarrow \gamma$ A' and the main background comes from $e^+ e^- \rightarrow \gamma \gamma$. The experiment will detect a single photon and search for the A' in the missing mass spectrum.

Issues: While some physics background has been simulated for the proposal, the committee feels that a full Geant4 simulation of the measurement is needed to assess the sensitivity of the experiment. This should include a study of how the foreseen veto will exclude possible signal events. In addition, a more detailed discussion of the reach in comparison to competing experiments is needed.

Summary: The PAC finds that the proposal presents an exciting and important search experiment. It encourages the proponents to resubmit this proposal after addressing the issues noted above.

PR12+23-006

Scientific Rating: A-

Recommendation: Conditionally approved (C1) for 137 PAC days

Title: Deeply Virtual Compton Scattering using a positron beam in Hall C

Spokespersons: C. Munoz Camacho (contact), M. Mazouz

Motivation: The goal of the proposed experiment is to cleanly separate the squared Compton amplitude, $DVCS^2$, from the DVCS-BH (Bethe-Heitler) interference term in the process $e\,p \rightarrow e\,p\,\gamma$ at large Q^2. This separation allows one to disentangle the real and imaginary parts of the Compton Form Factors (CFFs), which can be expressed in terms of Generalized Parton Distributions (GPDs) using factorization. An accurate determination of both real and imaginary parts of the CFFs is essential for the analysis of hard exclusive processes and the determination of GPDs.

The combination of cross sections for oppositely charged incident beams is the theoretically cleanest way to disentangle the contribution of the $DVCS^2$ term and its interference with the BH amplitude. It hence provides a highly attractive way to constrain GPDs.

Measurement and Feasibility: To achieve high precision, the experiment will use the High Momentum Spectrometer (HMS) of Hall C together with the Neutral Particle Spectrometer (NPS), which is a high-resolution PbWO4 electromagnetic calorimeter. It is proposed to measure the cross section of the DVCS reaction with unpolarized positrons on unpolarized protons in a wide range of kinematics, using beam energies of 6.6, 8.8 and 11 GeV. This will allow for several values of Q^2 at given values of Bjorken x.

To exploit the beam charge dependence of the cross section and separate the $DVCS^2$ from the DVCS-BH terms, these measurements will be combined with DVCS cross section measurements that use the existing CEBAF electron beam.

The proponents request 135 days of unpolarized positron beam with a current of 1 μA, plus 2 days of overhead. At the moment when the experiment could run, the experimental setup will have been used in several other experiments and should therefore very well understood. Therefore, there are no concerns about the experimental setup, and the committee is confident that the described measurements can be performed.

Issues: The committee finds that all issues raised in the PAC48 report on C12-20-012 have been addressed. In particular, the proponents have presented an impact study, and the positron beam required is within the specifications of the positron working group provided to the present PAC.

Summary: The PAC recognizes the strong science case of this proposal in constraining the GPDs. It recommends conditional approval (C1) of the requested 137 PAC days. A C1 review by the Lab should be conducted at an appropriate time and verify that positron beams will be available with the parameters required for the experiment.

PR12-23-007

Scientific Rating: N/A

Recommendation: Deferred

Title: A Measurement of the Proton g_2 Structure Function at Intermediate Q^2

Spokespersons: D. Ruth (contact), N. Santiesteban, K. Slifer, J.-P. Chen

Motivation: The experiment aims at making a high precision measurement of the first x-moments of the proton structure function g_2^p in the range $0.22 < Q^2 < 3.6$ GeV^2. These results will complement existing measurements of polarized structure functions, and they could test the Wandzura-Wilczek approximation, the Burkhardt-Cottingham sum rule, lattice predictions, and constrain the spin polarizability term of muonic hyperfine splitting. More generally, the results can be valuable to study the transition between hadronic and partonic physics in the region of intermediate Q^2.

Measurement and Feasibility: The experiment will require the baseline Hall C equipment, with the addition of the new 5T magnet for the transversely polarized target that is already foreseen for approved experiments in Hall C. The experiment will require polarized beams at 4.4 GeV and 8.8 GeV. Measurements of the g_2 structure function have been already performed in the past at JLab in different kinematic ranges.

Issues: The physics discussion in the proposal focuses on projected results for x-moments of the structure function at constant values of Q^2. However, the experiment will measure $g_2(x, Q^2)$ in a limited kinematic range. The proposal is missing a thorough discussion of the kinematic coverage of the measurements, how structure function moments will be reconstructed and how the full uncertainties on moments - including possibly large extrapolation uncertainties - will be quantified. The quantitative impact of g_2 (x, Q^2) measurements on the knowledge of the hyperfine structure transition in muonic hydrogen is not provided. A number of experimental questions raised in the TAC report require coordination with laboratory staff. This includes the design of the beam exit and the request for overhead time.

Summary: The PAC recognizes the significant importance of measurements of the fundamental proton structure function g_2 for the proton. However, the proposal focuses on moments of g_2 despite the limited x-range of the experiment and without describing analysis methods that will be used for extrapolation, including estimates for the resulting uncertainties. The PAC recommends considering for a new proposal whether to focus on the g_2 measurement and the x-dependence of the structure function or on moments of the structure function.

PR12+23-008

Scientific Rating: A

Recommendation: Conditionally approved (C1) for 55 PAC days in Hall B

Title: A Direct Measurement of Hard Two-Photon Exchange with Electrons and Positrons at CLAS12

Spokespersons: A. Schmidt (contact), J. Bernauer, N. Santiesteban, T. Kutz, I. Korover, E. Cline, V. Burkert

Motivation: The resolution of the discrepancy between measurements of G^p_E/G^p between the Rosenbluth separation technique and polarization transfer measurements continues to be an important topic. While expectations are that radiative hard two-photon exchange would resolve this, the measurements of two-photon exchange effects continue to be inconclusive. The comparison of positron-proton and electron-proton scattering for Q^2 above 3 $(GeV/c)^2$ is likely to be one of the best measures of this effect and is an important part of the motivation of the positron source for CEBAF. The proposed experiment would be an important part of that program, utilizing the large acceptance CLAS12 detector in Hall B. The ratio of the two cross sections is sensitive to the interference term between single and double photon exchange.

Measurement and Feasibility: A direct measurement of both electron-proton and positron- proton scattering will be used to produce the ratio of e^+p and e^-p cross sections. Because electrons and positrons are bent in opposite directions in the two magnets in CLAS12, the experiment will be run with four different magnetic field combinations to minimize differences in detector efficiency. This includes all four possible polarity combinations for the central solenoid and the forward toroidal magnets. While initial studies of the trigger scheme look very promising, this will need to be finalized.

To minimize systematic uncertainties, it is planned to split beam time equally between positrons and electrons with similar beam parameters and to minimize differences between the running conditions with the two beams. Unpolarized beams with energies 2.2, 4.4, and 6.6 GeV at a current of 60 nA are requested.

Issues: The PAC encourages the collaboration to follow through on their planned evaluation of the impact the multi-photon background processes, in particular, how these processes affect the systematic uncertainties and how they impact running scenarios.

Summary: This is an important measurement that needs to be performed. As proposed, it connects to existing measurements from both CLAS and OLYMPUS at lower Q^2 and extends data into the critical region where the discrepancy between Rosenbluth and polarization-transfer measurements becomes large. The collaboration is in a very good position to do this once positron beams become available. The experiment appears quite complementary to the Hall C proposal (PR12+23-012) also reviewed by this PAC.

The PAC recommends conditional approval (C1) for the requested beam time of 55 days. A C1 review by the Lab should be conducted at an appropriate time and verify that positron and electron beams will be available with the parameters required for the experiment.

PR12-23-009

Scientific Rating: N/A

Recommendation: Conditionally approved (C2)

Title: Nuclear Charm Production and Short-Range Correlations in Hall D

Spokespersons: O. Hen (contact), J. Pybus, D. Dutta, T. Kolar, A. Schmidt, A. Somov, H. Szumila-Vance

Motivation: This proposal builds on a successful run of the experiment E12-19-003 in Hall D, which used the GlueX apparatus to look at short-range correlations (SRC) in photoproduction. The preliminary results on reactions where a ρ meson is detected in coincidence with two protons provide interesting results relevant to SRCs. In addition, the previous observation of J/ψ photoproduction on ^{4}He opens up the possibility of a more extensive measurement. Finally, based on experience with the GlueX detector and the Hall D photon beam, an exploratory study of exclusive three-nucleon-SRC breakup in kinematics inaccessible to electron-scattering measurement may be possible.

Measurement and Feasibility: The collaboration has demonstrated its ability to measure the knock-out of two protons recoiling against either a ρ^- or a ρ^0 meson. The cross-section ratio connects directly to the ratio of proton-neutron to proton-proton pairs in ^{4}He. Its measurement allows a comparison of the abundance of proton-neutron and proton-proton pairs as a function of relative momentum within the pair and determination of the momentum-transfer dependence of the SRC proprieties.

The collaboration also showed (the first) observation of J/ψ photoproduction from ^{4}He. This opens up the possibility to measure the semi-inclusive reaction ^{4}He (γ, J/ψ *p) X* as a function of the beam energy, including the region below the threshold. Due to the quasi-exclusive nature of incoherent J/ψ photoproduction, it is possible to reconstruct the initial proton, which allows for a direct test of the differences between photoproduction on mean-field and SRC nucleons. The exploratory study of three-nucleon-SRCs is of interest as an add-on to the main physics goals of the proposal.

Issues: The proposed SRC experiment will be limited by systematic errors. The committee feels that publication of the results of E12-19-003 is needed to allow for more accurate estimates of the systematic uncertainties and of the beam time request for the high-precision measurement.

Summary: The proposed high-precision and high-statistics experiment could provide constraints on SRCs in ^{4}He. The measurement is very challenging. For a resubmitted proposal the PAC expects the collaboration to finalize and publish the results of the recent Hall D SRC-CT experiment E12-19-003, in order to estimate the systematic uncertainties with sufficient accuracy.

PR12-23-010

Scientific Rating: B+

Recommendation: Approved for 40 PAC days in Hall C

Title: Color Transparency in Maximal Rescattering Kinematics

Spokespersons: D.W. Higinbotham, H. Szumila-Vance (contact), S. Li, J. Rittenhouse West, C. Yero

Motivation: The phenomenon of color transparency (CT) is predicted by QCD in baryon or meson knock-out processes off nuclei at high four-momentum transfer. The experimental signal for CT is an increase in the transparency variable, defined as the ratio of nuclear cross section per nucleon to the free nucleon cross section, as a function of the four-momentum transfer. Some evidence for the onset of CT was found in π^+ and ρ^0 photoproduction measured at JLab and is consistent with model predictions. By contrast, data taken in the exclusive *(e,e'p)* reactions on deuteron, carbon and iron targets did not show any rise in transparency up to a squared momentum transfer of $Q^2 = 14$ GeV^2. The proposal aims to search for CT in the baryon sector using an observable that is predicted to be more sensitive.

Measurement and Feasibility: The experiment will measure the reaction *d (e, e'p)n* to search for the onset of CT, detecting the electron and proton in coincidence with the standard HMS and SHMS spectrometers in Hall C. The experiment will use a 25 cm liquid deuterium target with a beam of 11 GeV and 80 μA.
In the proposal the authors introduce a new variable: the ratio of the cross section at large neutron recoil momenta (300-600 MeV) with large final-state interaction (FSI) effects to the one at low neutron recoil momenta (50-150 MeV) with small FSI effects. This cross section ratio is predicted to be impacted by CT for squared momentum transfer Q^2 above 10 GeV^2. The requested beam time is 95 PAC days.

Issues: The proponents request 56 PAC days for the measurement at $Q^2 = 15$ GeV^2. The PAC is not convinced that this measurement would be significant, given that a point at 14 GeV^2 is also foreseen.

Summary: The experiment will measure the reaction *d (e, e'p)n* to search for the onset of CT, using a new variable defined as the ratio of cross sections in two kinematical regimes. The measurement is important and compelling and can provide important insight into the phenomenon of color transparency. Considering the limited impact and high cost of the proposed measurement at $Q^2 = 15$ GeV^2 the PAC recommends to perform the study up to squared momentum transfer of 14 GeV^2 within 40 PAC days.

PR12-23-011

Scientific Rating: N/A

Recommendation: Deferred

Title: Precision Deuteron Charge Radius Measurement with Elastic Electron-Deuteron Scattering

Spokespersons: D. Dutta (contact), A. Gasparian, N. Liyanage, H. Gao, F. Friesen, D. Higinbotham, E. Pasyuk, C. Howell

Motivation: The collaboration proposes a new high precision elastic ed scattering cross section measurement at very small scattering angles. This experiment aims to provide a more precise extraction of the deuteron charge form factor and radius than previously achieved in ed scattering.

Measurement and Feasibility: The methodology involves modifying the PRad-II (E12-20-004) experimental setup to include a low-energy Silicon-based cylindrical recoil detector within the windowless gas flow target cell, ensuring the elasticity of the ed scattering process. The proposal was deferred by PAC48 because of missing radiative corrections and of the overall weakness of the physics case. The PAC recognizes that significant progress has been made across all areas since then, and commends the collaboration for their efforts. The addition of the TUNL group strengthens the collaboration.

Issues: The PAC agrees with the collaboration that new reliable electron scattering data on the deuterium will be extremely valuable and that the PRad setup can be a unique instrument for this purpose.

Despite the progress made by the collaboration, the physics case presented in the proposal, as well as the resulting kinematics of the measurement are not yet compelling. In addition, fine tuning of Silicon detector development, procurement and construction — especially integration with the target — poses several technical and organizational challenges.

Summary: The PAC welcomes new precision measurement of ed scattering. However, the impact of a low Q^2 measurement on the inconsistencies between the radius extractions using electronic and muonic deuterium will be negligible. Therefore, the proposal is deferred Focusing on deuterium structure with this setup could offer a unique opportunity. To achieve this, re-optimization is necessary. The PAC suggest seeking advice from theory experts to determine the most suitable Q^2 range for measuring the form factor with the existing setup.

PR12+23-012

Scientific Rating: A-

Recommendation: Conditionally approved (C1) for 56 PAC days in Hall C

Title: A measurement of two-photon exchange in unpolarized elastic positron–proton and electron–proton scattering

Spokespersons: M. Nycz (contact), J. Arrington, N. Santiesteban, M. Yurov

Motivation: Two-photon exchange (TPE) remains the most likely source of the discrepancy between proton form factors extracted using Rosenbluth separation and polarization transfer measurements. The proposed experiment aims at measuring directly the TPE contributions by comparing electron-proton and positron-proton elastic scattering in the range $1.4 \leq Q^2 \leq 5.5$ GeV^2 and at different values of the variable ε. This is one of the best measures of this effect and constitutes an important part of the motivation of the positron source for CEBAF.

Measurement and Feasibility: The measurement will be performed using the HMS in Hall C and a hydrogen target in both e^-p and e^+p scattering. To measure G_E/G_M, the Super-Rosenbluth technique will be used, which involves detecting the struck proton. The ratio will be measured at ten Q^2 points. The positron data is expected to show the opposite discrepancy from the polarization transfer results as the electron data.
The proposal requests 41 PAC days for data taking with positrons and 14 PAC days for data taking with electrons, not necessarily in the same run period. The requested beam currents are 1 μA for positrons and 20 μA for electrons.

Issues: The proposal requests non-standard per-pass energies of 650 MeV and 730 MeV for positrons. Multiples of these energies are required to achieve the scientific goals of the experiment, and the collaboration has already started a discussion with the accelerator experts to make these configurations possible.

Summary: The PAC recognizes the strong science case of this important measurement, which may provide a definitive answer to the long-standing question of the role of TPE in form-factor extractions. To fully achieve the scientific goals of the experiment, it is essential to include measurements taken with non-standard positron beam energies. The experiment is complementary to the Hall B proposal (PR12+23-008), also reviewed by this PAC.
The PAC recommends conditional approval (C1) for the requested beam time of 56 days. A C1 review by the Lab should be conducted at an appropriate time and verify that positron beams will be available with the parameters required for the experiment.

PR12-23-013

Scientific Rating: A

Recommendation: Approved for 17 PAC days in Hall B

Title: Measuring Short-Range Correlations with ALERT

Spokespersons: F. Hauenstein (contact), O. Hen, L. Weinstein, A. Schmidt, M. Ouillon, E. Piasetzky

Motivation: The proponents have a strong track record of published short-range correlation (SRC) measurements using CLAS12 data, which have added new insights to the understanding of SRC dynamics. Adding to this collection of results, the experiment proposes to leverage a new addition to CLAS12, the ALERT detector, to gain a unique data set for examining the properties of SRC pairs in detail. Specifically, using a 6.4 GeV electron beam scattering off ^{4}He to provide a kinematically complete reaction channel will allow tests of the assumption that the two-body SRC wave function can be factorized from the residual nuclear system, and it will allow study of the transition from single nucleons in a mean field to SRC pairs in the nucleus. With 17 PAC days of running, each of these planned investigations will provide statistics that far exceed existing experimental constraints, thus moving from exploratory investigations to in-depth studies.

Measurement and Feasibility: The ALERT detector is currently under construction and scheduled to run in 2024 using an 11 GeV beam. This proposal would add an additional 17 PAC days of running with a 6.4 GeV beam on a ^{4}He target. To identify the $^4He(e,e'pd)n$ reaction, the proposed experiment will detect the scattered electron and proton in the CLAS12 forward detector using well-established identification techniques. What will be new is the detection of the low-momentum spectator deuteron in the ALERT detector, which will replace the standard CLAS12 central tracker in this upcoming run. Detecting the spectator deuteron will allow the SRC-partner recoil neutron to be reconstructed over a wider momentum range and the exact nuclear final state of the interaction to be determined. The ability to tag the deuteron with ALERT will also provide a unique experimental handle to suppress final state interactions in the SRC studies.

Issues: N/A

Summary: The proposed experiment is important in that it will produce a statistically significant and kinematically complete sample of short-range correlation (SRC) break-up events, to add to a successful history of such physics at Jefferson Lab. By studying $^4He(e,e'pd)n$ using the new addition of the ALERT detector to CLAS12, the experiment will provide tests of factorization and examination of the SRC onset, thus adding new information to the study of the reaction dynamics associated with SRC pairs. This is a compelling and creative initiative to leverage the addition of the ALERT detector for obtaining a significant and unique data set to advance the study of SRCs.

PR12-23-014

Scientific Rating: A-

Recommendation: Approved for 7 PAC days in Hall C

Title: Measurements of the Ratio R = $\sigma L/ \sigma T$, p/d ratios, $Ph\perp$ dependence, and azimuthal asymmetries in Semi-Inclusive DIS π^0 production form proton and deuteron targets using the NPS in Hall C

Spokespersons: P. Bosted (contact), R. Ent, H. Mkrtchyan, V. Tadevosyan, T. Horn, E. Kinney

Motivation: The experiment aims at measuring several observables in SIDIS neutral pion production: the ratio R = $\sigma L/ \sigma T$ of longitudinal to transverse cross sections; the ratios of deuteron to proton cross sections; the transverse momentum dependence of the cross sections; the spin- independent cos(φh) and cos($2\varphi h$) modulations; and the beam-spin-dependent sin(φh) modulations.

Measurement and Feasibility: The experiment will take place in Hall C and use the NPS spectrometer. Both proton and deuteron targets will be used. Most of the data will be collected simultaneously with the NPS electron-beam Run Group of approved experiments. The extra requested days will be necessary to reduce the systematic errors and to provide a good balance between statistic and systematic errors as well as between proton and deuteron targets. To separate the transverse and longitudinal structure functions, data will be taken at three beam energies (6.4, 8.5, and 10.6 GeV) for both targets.

Issues: The proposal mentions a long list of observables, which will require an appropriate amount of scientific workforce for the analysis. The proposal does not contain clear comparisons with state-of-the-art theoretical predictions, which would be useful to appreciate the impact of the new data. However, for the ratio R, which is the centerpiece of the present proposal, essentially no predictions are available.

Summary: The PAC finds the scientific motivation of the proposal highly interesting. The experiment is a valuable addition to the SIDIS measurements performed at the lab. The PAC recommends to study the comparison with available theoretical predictions. The proposal overlaps to a large extent with other approved experiments of the NPS Run Group (approximately 90 PAC days). The PAC appreciates the detailed and targeted justification of the requested additional 7 PAC days and recommends their approval.

C12-15-006

Recommendation: Remain active with C1 status

Title: Measurement of Tagged Deep Inelastic Scattering

Spokespersons: D. Dutta (contact), C. Keppel, R. Montgomery, P. King, N. Liyanage, B. Wojtsekhowski

Motivation: The TDIS experiment will probe the mesonic content of the nucleon via the Sullivan process, in which an electron scatters from the meson cloud of the nucleon. This effort would provide a unique extraction of quark distributions in the meson. This is important as there is evidence of mesons in the nucleon but few measurements to reveal their structure.

1) Is there any new information that would affect the scientific importance or impact of the Experiment since it was originally proposed?
The physics case remains strong. There is increased interest in the community in both pion and kaon structure. The recent global fits from the JAM collaboration are a good example of this. This recent JAM analysis additionally suggests that the signal in the TDIS experiment could be larger than what was originally assumed in the proposal.

2) If the experiment has already received a portion of its allocated beam time, the spokespersons should present the status of the analysis of the existing data and the projected result for the final complete data set. The goal is to show the physics impact of the beam time requested in the jeopardy update. N/A

3) What is the status of the collaboration in terms of institutes, committed staff, and prospective students?
With the addition of the two associated run group proposals, the number of spokespeople has grown to 13, and the TDIS collaboration now includes 20 institutions. TDIS has been endorsed as a Hall A and Super Big Bite collaboration experiment. As was presented to PAC51, new responsibilities for various aspects of the detectors and DAQ have since been taken on by the University of Tennessee, University of São Paolo, University of Virginia, and Jefferson Lab. Prospective Ph.D. students are expected from 5 institutions.

4) Should the remaining beam time allocation and experiment grade be reconsidered?
The PAC felt that the arguments provided were not sufficient to justify a doubling of the run request (which is a significant change in beam time) or an upgrade to the scientific grading of the experiment.

Summary: The physics case for measuring meson structure in TDIS is strong, and there is substantial community interest in this topic. The PAC also recognizes that substantial progress has been made towards the TDIS detector design. This commendably includes the adoption of a full GEANT4-based simulation including digitization, development of multiple prototypes, planning of test beam data to vet technical design choices, and incorporation of lessons learned from the experience of other experiments. The PAC encourages the proponents to finalize work towards a technical review of their final detector design to remove the C1 condition.

E12-13-011

Recommendation: Remain active

Title: The Deuteron Tensor Structure Function b_1

Spokespersons: K. Slifer (contact), J.-P. Chen, D. Keller, E. Long, O. Rondon, N. Santiesteban, P. Solvignon

Motivation: The experiment aims at making a precise measurement of the deuteron tensor structure function b_1 in the region $0.15 < x < 0.5$. This structure function is zero in scattering from a free static *pn* pair and thus uniquely sensitive to nuclear effects. The first pioneering measurement of b_1 at HERMES suggests a large negative value at $x = 0.45$, in contrast with available conventional models. The proposed experiment will be able to check this result and improve on it.

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

The experiment received a C1 approval by PAC40. Since then, no other experiment has measured the deuteron tensor structure function, and about a dozen theory papers have been devoted to the study of tensor polarization observables. There are plans to measure tensor polarized observables in hadronic collisions (at Fermilab and at future facilities at LHC and NICA) and in DIS at the EIC. The scientific case remains strong.
In August 2022, the collaboration demonstrated the ability to achieve the necessary target performance, albeit under optimal conditions, and consequently the C1 status was removed. The collaboration is working in close contact with the lab to finalize the target. These pioneering efforts may provide a foundation for new experiments at Jefferson Lab and elsewhere.

2) If the experiment has already received a portion of its allocated beam time, the spokespersons should present the status of the analysis of the existing data and the projected result for the final complete data set. The goal is to show the physics impact of the beam time requested in the jeopardy update. N/A

3) What is the status of the collaboration in terms of institutes, committed staff, and prospective students?

The collaboration counts more than 50 members from 14 different institutions. The collaboration has identified 10 PhD students from three different universities and 2 post-docs. It meets on a regular basis and recently organized an international workshop at ECT*. This level of personnel is in line with the requirements of past polarized target installations.

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

The PAC confirms the high scientific grade of the experiment and the original beam time allocation of 41 PAC days.

E12-14-002

Recommendation: Remain active with revised scientific rating A-

Title: Precision Measurements and Studies of a Possible Nuclear Dependence of R

Spokespersons: W. Henry (contact), S. Alsalmi, D. Gaskell, E. Christy, T. Hague, S. Malace, D. Nguyen

Motivation:

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

Recent results from JLab and SLAC suggest that nuclear effects in $R = \sigma_L/\sigma_T$ will be small but measurable. With the proposal PR12+23-003 (conditionally approved by this PAC), a pathway has been identified that will quantify contributions from Coulomb acceleration and allow for corrections to significantly reduce the associated uncertainty.
Theoretical interest in the A-dependence of nucleon structure has recently increased in anticipation of measurements expected in the near future from JLab, but also in response to results from p-A and AA collider experiments.

2) If the experiment has already received a portion of its allocated beam time, the spokespersons should present the status of the analysis of the existing data and the projected result for the final complete data set. The goal is to show the physics impact of the beam time requested in the jeopardy update.

N/A

3) What is the status of the collaboration in terms of institutes, committed staff, and prospective students?

The collaboration has the scientific and technical personnel needed to support data taking and analysis.

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

No changes in the allocated run time of 22 days are foreseen. In light of recent new data, recent progress in quantifying Coulomb corrections, and the increased theoretical interest in the A-dependence of nucleon structure, the grade originally given to the experiment should be reconsidered.

Summary: The PAC recommends the experiment to remain active with the originally awarded 22 PAC days, and to increase the scientific grade from B to A- given recent experimental results, additional results expected in the near future, the improved understanding of backgrounds, and the increasing theoretical interest.

E12-15-005

Recommendation: Remain active

Title: Measurements of the Quasi-Elastic and Elastic Deuteron Tensor Asymmetries

Spokespersons: E. Long (contact), S. Santiesteban, K. Slifer, D. Day, D. Keller, D. Higinbotham

Motivation: The motivation of the proposed experiment is to test many important aspects of deuteron models, including the strength of the short-range repulsion and tensor force in the nucleon-nucleon interaction. Measurements of the tensor asymmetries will directly access aspects of nuclear theory that are poorly constrained by unpolarized deuteron measurements and should greatly improve our knowledge of this most fundamental nucleus.

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

The experiment was conditionally approved (C1) by PAC 44.
Extensive progress has been made in the development of a tensor polarized target required for this experiment, which was demonstrated by the removal of the C1 conditional status in August 2022.
The collaboration is working in close contact with the laboratory to prepare the final target.
These pioneering efforts may provide a foundation for new experiments at JLab and elsewhere.

2) If the experiment has already received a portion of its allocated beam time, the spokespersons should present the status of the analysis of the existing data and the projected result for the final complete data set. The goal is to show the physics impact of the beam time requested in the jeopardy update. N/A

3) What is the status of the collaboration in terms of institutes, committed staff, and prospective students?

The Azz and b1 collaborations (respectively associated with the present experiment and with E12-13-011) have significant overlap and cooperate fully.
There are more than 50 active members, including a significant number of theorists, coming from 14 different institutions.
The collaboration has identified 10 PhD students from 3 different universities. There are 2 postdocs working on these experiments, with a commitment from the collaboration to support the experimental run with additional 2 post-docs.
This level of personnel is in line with the requirements of past polarized target installations.

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

The PAC confirms the high scientific grade (A-) of the experiment and recommends to maintain the original beam time allocation of 45 PAC days.

E12-15-008

Recommendation: Remain active

Title: An isospin dependence study of the Lambda-N interaction through the high precision spectroscopy of Lambda hypernuclei with electron beam

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

Motivation: The collaboration seeks to explore the isospin dependence of the three-body ΛNN interaction in ^{40}Ca ($^{40}_{\Lambda}$K) and ^{48}Ca ($^{48}_{\Lambda}$K). The team will measure the binding energy of both hypernuclei. This investigation should give insight into the ΛN-ΣN coupling in the ΛN interaction and the ΛNN three-body interaction.

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

Interest on hyperon-nucleon interactions has increased as people are more interested in two- solar-mass neutron stars and in the nuclear equation of state (EOS) inside a neutron star, where strangeness degrees of freedom play an important role. A microscopic understanding of the EOS in the neutron stars is desirable, and there are more and more theoretical investigations. Thus, the scientific importance of this experiment is getting even higher.
Due to the foreseeable schedule of Hall A, the lab has strongly suggested the migration of the experiment from Hall A to Hall C. The collaboration has adjusted the setup of the experiment accordingly, which includes a substantial increase of the requested beam time.

2) If the experiment has already received a portion of its allocated beam time, the spokespersons should present the status of the analysis of the existing data and the projected result for the final complete data set. The goal is to show the physics impact of the beam time requested in the jeopardy update. N/A

3) What is the status of the collaboration in terms of institutes, committed staff, and prospective students?

The collaboration is in good shape, including 10 faculty and 8 graduate students, and it has successfully performed hypernuclear experiments in both Halls A and C. More members of Hall A/Hall C will participate in preparation work. The collaboration has constructed a pair of magnets (PCS) and transported them to JLab in 2022.

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

The PAC recognizes that the beam time required for the measurement may change as a result of the migration of the experiment from Hall A to Hall C. However, the committee feels that an increase in awarded beam time requires a full proposal to a future PAC. Detailed discussion on the statistics, the background, the signal-to-noise ratio, and the systematics are expected in such a proposal.

Summary: The PAC recommends the grading and the beam time allocation should be kept at this time, with the already approved time of 28 PAC Days. The PAC recommends the proponents to submit a proposal for additional beam time to a future PAC.

E12-16-001

Recommendation: Remain active

Title: Dark Matter search in a Beam Dump eXperiment (BDX)

Spokespersons: M. Battaglieri (contact), A. Celentano, M. Bondi, M. De Napoli, G. Krnjaic, E. Smith, R. De Vita

Motivation: The experiment aims to achieve the most stringent limits (or to make the first discovery) of a class of dark matter particles.

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

In 2019-2020, taking advantage of the scheduled Hall-A low-energy operations, the BDX-MINI experiment provided the final proof of the proposed technique, covering some kinematics comparable with flagship experiments such as NA64. Considering the limited size of the BDX-MINI active volume this is a remarkable result, demonstrating the potential of the new generation of beam dump experiments in LDM searches. Results were recently published in two papers.

2) If the experiment has already received a portion of its allocated beam time, the spokespersons should present the status of the analysis of the existing data and the projected result for the final complete data set. The goal is to show the physics impact of the beam time requested in the jeopardy update.

N/A

3) What is the status of the collaboration in terms of institutes, committed staff, and prospective students?

Collaborating institutions remain strongly committed to this experiment. Moreover, there are now additional members of the collaboration that have joined from additional institutions.

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

No.

Summary: The PAC fully supports the BDX Experiment and recommends it to stay active.

E12-17-008

Recommendation: Remain active

Title: Polarization Observables in Wide-Angle Compton Scattering at large s, t and u

Spokespersons: D. Hamilton (contact), G. Niculescu, B. Wojtsekhowski, D. Day, D. Keller, J. Zhang

Motivation: Real Compton Scattering (RCS) off a proton is a fundamental and basic process which, at high energies and scattering angles, should be explained in terms of photon-quark interactions. The mechanism behind RCS in the regime of $\sqrt{s}$ = 5-10 GeV is not well understood. Measurements have shown that these data cannot be described by perturbative calculations involving the scattering of three valence quarks, but the dominant mechanism could be the handbag model with the photon scattering of a single quark. The proposed measurements aim at disentangling the existing handbag calculations that have been used to describe previously measured asymmetries. In particular the double longitudinal spin asymmetry K_{LL}, related to the helicity transfer from the photon to the scattered proton, has been found surprisingly large and stable with respect to the photon center-of-mass scattering angle.

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, the spokespersons should present the status of the analysis of the existing data and the projected result for the final complete data set. The goal is to show the physics impact of the beam time requested in the jeopardy update.

No.

3) What is the status of the collaboration in terms of institutes, committed staff, and prospective students?

The current collaboration is deemed sufficiently strong to carry out the experiment.

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

No.

Summary: The PAC recommends that this experiment remain active.

E12-16-010C

Title: Separation of the σ_L and σ_T contributions to the production of hadrons in electroproduction

Spokesperson: T. Hayward

Motivation: This proposal aims to measure SIDIS in order to investigate the ratio of the longitudinal to transverse cross section $R_{SIDIS} = F_{UU,L} / F_{UU,T}$. While moderately accurate measurements of this ratio exist for inclusive deep inelastic scattering, there have been no measurements of R for the SIDIS process. The present proposal will cover a wide kinematic range in x, Q^2, z, P_T and a variety of single- and di-hadron processes.

Measurement and Feasibility: This is an addition to Run Group K in Hall B and follows a similar approach to other approved SIDIS studies. The extraction of R_{SIDIS} will be done by combining the obtained results with those from Run Group A, conducted at a higher beam energy, and performing a Rosenbluth separation.

Issues: As the extraction of R will require measurements from different run periods, particular care should be taken to assess the systematic errors.

Summary: The PAC finds that the proposal is well motivated and complementary to other experiments, as it will extend the phase space of similar measurements planned in Hall C and consider different single- and di-hadron final states.

LOI1223+001

Title: Measurement of the Generalized Polarizabilities of the Proton with positron and polarized electron beams

Spokespersons: N. Sparveris (contact), H. Atac, M. Jones, M. Paolone

Motivation: The proton's Generalized Polarizabilities (GPs) can provide insights into its structure and dynamics. Previous experiments using an unpolarized electron beam have made significant progress, but there are theoretical challenges, especially in measuring the electric polarizability. This proposal aims to study the GPs of the proton via an alternative experimental approach.

Measurement and Feasibility: The Virtual Compton Scattering (VCS) process will be measured in $e\,p \rightarrow e\,p\,\gamma$ using a positron beam. Employing lepton beams of opposite charge and different polarizations allows for the extraction of new asymmetries, such as the unpolarized beam-charge asymmetry and the lepton beam-spin asymmetry. In a similar manner as is done for DVCS, the interference between VCS and Bethe Heitler could allow for a complete separation of the real and imaginary parts of the VCS amplitudes. This would significantly enhance sensitivity to the proton GPs. The required beam time for the experiment, which could span up to 10 weeks or more, will depend on the achievable positron current. Since the given projections are limited by systematic uncertainties, comprehensive studies of these uncertainties are necessary to determine the actual beam time request.

Issues: N/A

Summary: The physics case presented in the proposal is robust, and the document is very well-written. Feasibility concerns have not been identified, and the PAC encourages the proponents to proceed and submit a full proposal once in-depth studies to determine the most suitable kinematics, have been performed, as well as investigations of backgrounds and systematic uncertainties.

LOI12+23-002

Title: The Axial Form Factor of the Nucleon from Weak Capture of Positrons

Spokesperson: D. Dutta

Motivation: The weak axial form factor of the nucleon is not well-known, having been historically measured with typically large uncertainties in neutrino scattering, low energy pion electroproduction, and muon capture experiments. This proposed experiment would provide a new and unique experimental method for measuring the axial form factor of the nucleon using positron capture on deuterium, $e^+d \rightarrow pp\overline{\nu}_e$. It would provide measurements of the Q^2 dependence of $G_A(Q^2)$ over a range of Q^2 from 0.08 to 0.25 GeV^2, the axial charge radius r_A, and the weak axial coupling g_A. The proposed positron capture-based approach is completely new for this type of measurement. It will have a different set of systematics which may help in resolving existing discrepancies, for example, in measurements of g_A, neutron lifetime, and the CKM matrix element V_{ud}. Improving the precision of the axial form factor also has direct relevance to neutrino quasi-elastic scattering in neutrino oscillation experiments, muon capture rates, solar and reactor neutrino fluxes, and CMB anisotropies.

Measurement and Feasibility: $G_A(Q^2)$ will be measured by varying the positron beam energy and the angle of the recoil proton using a medium energy (2-6 GeV) polarized (60%) positron beam. The experimental setup will utilize a recoil proton detector such as the rTPC in BoNuS12, ALERT, or the mTPC proposed for TDIS. Rate and performance estimates in the LOI assume the TDIS mTPC. The proposed measurement is in principle feasible if an appropriate background level can be achieved and if systematics can be held under control.

Issues: Performance estimates should be evaluated for the chosen detector, including background estimates and the overall measurement accuracy. The feasibility of the proposed measurement should be assessed after a full evaluation of systematic uncertainties. This includes a quantification of the impact of nuclear wave function effects and final state interactions on the extraction of the nucleon form factor from a measurement on the deuteron.

Summary: The proposed experiment would provide an interesting and new way of measuring the axial form factor of the nucleon. Such a measurement is of course not without its challenges, as the proponents are well-aware. The PAC encourages the proponents to work toward a full proposal after the above issues are carefully considered and to explore if there are other interesting questions that could be addressed through the measurement of positron capture on deuterium in the proposed kinematics. Before submitting a proposal, the proponents should make an informed decision on which detector is best-suited for this measurement.

LOI12-23-003

Title: GluToNY: Gluon tomography in nucleons by gamma-polarimetry

Spokesperson: M. Defurne

Motivation: The proposed experiment aims to measure the degree of linear polarization of a photon produced in DVCS, using a newly designed photon polarimeter. This observable could provide valuable insights into the dynamics of DVCS and ultimately into the structure of the proton. Specifically, it may help constrain the GPD for linearly polarized gluons in a transversely polarized target, which is presently unknown.

Measurement and Feasibility:

The measurement would take place in Hall C and would require the use of the NPS calorimeter coupled to a pair polarimeter consisting of several layers of thin active radiator to ensure precise position measurements. For the detector technology, it is proposed to use the ALPIDE chip developed by the ALICE collaboration, which is currently successfully used in the ITS (Inner Tracking System) and MFT (Muon Forward Tracker) of ALICE.

Issues: In a future proposal, a few inaccuracies on the theoretical side should be fixed, and the theoretical framework to be used for interpreting the measurements should be spelled out explicitly. Most importantly, the double-helicity-flip amplitude could receive contributions also from twist-4 quark GPDs. This does not invalidate the plan for the measurement but implies that the theory interpretation may not be as rigorous and straightforward as presented.

On the technical side, it is important to determine the feasibility and the performance of the polarimeter and analyze how it could be integrated into the existing Hall C apparatus. The challenge of multiple scattering in the target material has been one of the major obstacles to implementing polarimetry with past and present pair-conversion γ-ray telescopes in astronomy. Achieving an effective solution to this obstacle will likely be the main issue to be addressed during the R&D phase of the polarimeter.

Summary: The proponents are encouraged to work toward a comprehensive proposal. Prior to that, it is essential to finalize the detector design and thoroughly evaluate its capabilities. To accelerate the initial steps in the development process, it is recommended that the collaboration reaches out to the relevant experts.
The PAC also encourages collaborating with theorists to improve the theoretical framework and also to identify additional measurements that require the use of the photon polarimeter, to broaden the proposal's scope and fully leverage the potential of the new detector.

LOI12-23-004

Title: A Measurement of Double-Polarization Photoproduction on Various Nuclei – The Real Gamma GDH Experiment on Nuclei, REGGEON

Spokespersons: M. Dalton (contact person), A. Deur, S. Sirca

Motivation: The European Muon Collaboration (EMC) published the observation of sizeable nuclear effects in the measurement of the nucleon structure function ratio $F_2^N(Fe)/F_2^N(D)$ in 1983. Forty years later, the mechanisms leading to the modification of nucleon parton structure in nuclei still lack quantitative understanding. The availability of high intensity beams and advanced nuclear targets at JLab, as well as high luminosity collider-based ion collisions have enabled new experimental studies and triggered significant theoretical interest. While the EMC effect might result from the modification of all nucleons in presence of the nuclear mean field, there is the possibility that nuclear modifications primarily arise for nucleons in short range correlations (SRCs). Several new experiments at JLab, including the current LOI, seek to distinguish between these possibilities. It has been proposed that flavor and spin observables may have good sensitivity to differentiate between the different mechanisms.

Measurement and Feasibility: The measurement will utilize apparatus and target used by the REGGE experiment E12-20-011 in Hall D to measure (truncated) GDH sum rule measurements for protons and neutrons. It is proposed to measure the GDH sum rule for several light nuclei. Most of the statistics will be taken with Li-7. This aims at the additional measurement of the double (target and beam) spin observable (called *E)* with the production of a correlated meson and nucleon pair in the final state. The detection of the nucleon pair allows correlating the magnitude of the observed spin asymmetry with SRC pairs. The feasibility of the selected light nuclei for nuclear polarized targets under beam load needs to be established

Issues: The experiment extends REGGE to nuclear targets. The target nuclei preliminarily considered are Li-7 (used in COMPASS), C-13, O-17 and F-19. The ability to achieve significant target polarization for all four nuclei needs to be demonstrated. Modelling of nuclear effects on spin observables is needed to project experimental sensitivities. The discussion in the LOI focuses on the modification of the sum rule, yet it will not measure the integrand over the full kinematic range.

Summary: Before the proponents proceed to a full proposal, careful projections for experimental sensitivities need to be given, and significant polarization needs to be demonstrated for the chosen targets in the relevant experimental environment. The proposal may benefit from shifting the focus of the discussion from the nuclear modification of truncated GDH integrals to the modification of the measured helicity dependent cross section difference, which is the primary deliverable of the experiment.

LOI12+23-005

Title: An Amplitude-level Search for a Dark Photon in Bhabha Scattering

Spokesperson: D. Mack

Motivation: The main physics goal is to do an amplitude level search in Bhabha scattering ($e^+e^- \rightarrow e^+e^-$) for a dark photon A' over the mass range of roughly 10-100 MeV/c^2.

Measurement and Feasibility: The LOI concludes that the best observable for a search over a broad mass range appears to be the cross section. Asymmetry-based searches are estimated to be more difficult, but may be useful in a discovery scenario.
Issues: The LOI provides few experimental details. At the level of information provided, the PAC has not identified any outstanding problems.

Summary: The idea put forward in this LOI appears attractive, but considerably more study will be needed to determine if it can be carried out experimentally.

LOI12-23-006

Title: Measurement of the N to Delta Transition Form Factors with the SoLID detector

Spokespersons: N. Sparveris, H. Atac, M. Paolone (contact)

Motivation: Transition form factors (TFF) complement information derived from ordinary elastic form factors. The $N \rightarrow \Delta$ TFF is of particular interest because of the close connection between the nucleon and Δ structure.

Measurement and Feasibility: The experiment will be performed at high Q^2 within the accessible kinematic range of the SoLID detector in its configuration for the J/ψ experiment E12-12-006.

Issues: The TAC theory report, while supportive of the group submitting a full proposal, highlights the importance of refining the physics case. The PAC concurs with this assessment. The measurement promises to run "parasitically", but it must still be proved that the additional trigger will not have an impact on data taking of E12-12-006. Additional action items have been indicated by the SoLID collaboration that require solution.

Summary: The PAC finds that several open issues need clarification. The proponents should argue what will be learned from the $N \rightarrow \Delta$ transition at high Q^2 beyond what has been already learnt from the nucleon from factors in that kinematic region. To strengthen the physics case, the group may want to enhance collaboration with theory groups. Additionally, certain feasibility and technical concerns raised by the SoLID collaboration should be carefully addressed.
The PAC recommends the proponents to proceed to a full proposal only after careful consideration of these issues.

LOI-12-23-007

Title: A path to the luminosity frontier in Hall D

Spokesperson: M. Shepherd

Motivation: Many of the interesting reactions for searches in GlueX have cross sections that are smaller than originally estimated. These not only include channels of interest for hybrid meson searches, but also rare η and η' decays. In addition, while photoproduction of the J/ψ near threshold has been measured by GlueX, other charmonium states such as ψ' and χ_c states have lower rates. Measurements of these other states are extremely limited in the current and approved data sets for GlueX. A significant increase in collected data statistics over that currently approved is needed to study these channels.

Measurement and Feasibility: The proposed measurement would yield a five-fold increase in statistics over the currently approved GlueX running. This will be accomplished by running with a photon flux roughly three times larger than what is currently used. The GlueX collaboration undertook rate studies in the spring of 2023 and demonstrated that with modest detector upgrades and trigger improvements, such running would be possible with only moderate loss in reconstruction efficiency.

Issues: To carry out these measurements, the photon tagger counters corresponding (roughly) to those above the coherent peak region in the detector will need to be replaced with higher-granularity counters. In addition, the central part of the forward time-of-flight system will also need to be replaced with a higher-granularity system. Exactly what the needed granularity is has yet to be specified. Finally, upgrades to the current GlueX trigger will be needed to accommodate the high rates and to support the rare η decay measurements.

It could be helpful if the programs described here were able to run concurrently with the one described in LOI12-23-010.

Summary: The suggested increase in collected data by GlueX at higher intensities are needed to achieve desired precision on many reactions and will open the door on a broader program of threshold charmonium photoproduction. It will also be relevant for any upgrade of the CEBAF energy. The proponents should develop a full PAC proposal spelling out this case.

LOI12+23-008

Title: Polarization Transfer in Positron-Proton Elastic Scattering

Spokespersons: A. Puckett (contact), J. Bernauer, A. Schmidt

Motivation: This LOI proposes to measure the polarization transfer from the initial lepton to the final proton in elastic positron-proton scattering $e + p \rightarrow e + p$ for a series of momentum transfers Q^2 and virtual photon polarizations ϵ where a large discrepancy exists between the proton form factor ratio G^p_E/G^p_M extracted from cross section and polarization transfer measurements. Comparing the proposed positron measurements to existing data with electron beams will allow a determination of the two-photon exchange (TPE) contribution to the polarization transfer observable. An ancillary measurement with electrons at $Q^2 = 3.4$ GeV^2 is envisaged as well.

Measurement and Feasibility: The polarization transfer in electron-proton scattering has been extensively measured at JLab, and the present LOI extends such measurements to a positron beam. Experimental details are not given.

Issues: The bulk of material presented in the letter relies on a previous study that assumed a higher beam current for polarized positrons than is currently foreseen. The PAC recommends to use the beam parameters specified by the positron working group as a baseline for a proposal.

Summary: The proposed measurement would be a valuable addition to the quantitative study of TPE effects in elastic scattering. A full proposal should include a detailed study of anticipated systematic and statistical uncertainties, along with theory predictions for the expected difference between the polarization transfer observable for positron and electron beams. The latter will be needed in order to assess the physics impact of the measurement.

LOI12-23-009

Title: Nuclear Color Transparency via *u*-Channel Electroproduction Observables

Spokespersons: Wenliang Li (contact)

Motivation: The proposed measurement is to investigate the exclusive electro-production reaction: $\gamma^* + A \rightarrow (A-1) + p + \pi^0$, where the π^0 is produced via a *u*-channel process and the scattered proton recoils in the forward direction with large momentum. The objective is to test the Color Transparency (CT) onset in the unexplored *u*-channel kinematics where a small transverse size proton is generated by the hard subprocess. There has been interest recently on CT phenomena. This experiment would add some information on this topic.

Measurement and Feasibility: The measurement is designed to be above the nucleon resonance region with an invariant mass $W \sim 3$ GeV of the proton-pion system. The Hall C spectrometers (HMS+SHMS) in the standard configuration will tag the scattered electron and the recoiling proton in coincidence.

Issues: The physics motivation needs to be spelled out clearly: what can one expect to learn about CT from this measurement, in particular, in light of the negative result obtained by E12-06-107 for color transparency of the proton at much higher Q^2. For the proposed measurement, because an additional meson is produced compared to elastic scattering experiments, the interpretation of final state interaction effects with or without CT will become much more complicated. To assess the physics reach, a future proposal should include the uncertainties in the theoretical predictions.

Summary: The PAC recommends the proponents to proceed to a full proposal only after the issues raised are carefully considered. In particular, the physics case has to be clearly demonstrated. This includes a discussion how to separate out the final state interaction effects of the meson production and the color transparency effects of the nucleon with the nuclear target.

LOI-12-23-010

Title: Charmonium Photoproduction with GlueX

Spokesperson: L. Pentchev

Motivation: The interest in threshold J/ψ photoproduction has shown a huge increase since the 2019 GlueX publication. Publications by E12-16-007 and by GlueX in 2023 have improved our information, but higher-statistics data sets would be extremely valuable. In GlueX, one of the limiting factors is the electron identification. The addition of a transition radiation detector downstream of the solenoid would significantly enhance e/π separation and enable a statistically significant improvement, as well as substantially reducing some of the largest systematic errors.

Measurement and Feasibility: The proposed measurement relies on construction and installation of a new transition-radiation detector that would significantly improve the e/π separation for forward going particles in GlueX, leading to a significant improvement of the systematic errors. Prototypes of this detector have been built and tested, and additional tests are planned. The measurement itself is based on already proven GlueX techniques, albeit with the newer detector.

Issues: The ability to use the proposed data to discriminate between models of charmonium photoproduction drives the needed precision of the measurement. The proposers should work with theory colleagues to achieve more realistic estimates of the uncertainty of theory predictions from both partonic and mesonic approaches, and to identify the discrimination power of the improved data quantitatively.

It could be helpful if the program described here were able to run concurrently with the one described in LOI-12-23-07.

Summary: The recent data on charmonium production at Jefferson Lab has led to a significantly enhanced community interest in heavy-quarkonium photoproduction near threshold. It could also provide opportunities to extract other fundamental quantities, such as generalized gluon distributions in the proton and gravitational form factors. The proponents are encouraged to work toward a full proposal, particularly with additional input from theory.

LOI12-23-011

Title: High-resolution spectroscopy of light hypernuclei with the decay-pion spectroscopy

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

Motivation: The Lambda binding energy represents one of the most fundamental quantities to describe the Lambda-N interaction and Lambda hypernuclear structure. The proposed experiment aims at measuring Lambda binding energies for s and p-shell hypernuclei with decay pion spectroscopy. The expected accuracy of the Lambda binding energies is about 10 keV, while it is several 10 keV or more in previous experiments. The expected results would lead to a better understanding of Lambda-N interactions, including the Lambda-N Sigma-N coupling and the hypertriton puzzle.

Measurement and Feasibility: The experiment aims at measuring decay pions as well as (e, e'K^+) reactions, using the Enge magnet as a pion spectrometer, the HKS for the kaon and the HES for the electron. The experiment is assumed to be carried out in the same campaign as E12-15-008. The target materials will be ^{6}Li, ^{9}Be, ^{12}C, Al, Ca, and Pb. There are spectrum simulations for Li, Be, and C targets but not for heavier targets.

Issues: Decay pion spectroscopy is basically appropriate for lighter nuclei, while the non-mesonic weak decay is the major branch for heavier nuclei. On the other hand, for heavier targets, the signal-to-noise ratio is expected to be worse. The LOI does not show the simulated spectrum for heavier targets (Al, Ca, and Pb), and the signal-to-noise ratio and the feasibility should be addressed.
The TAC theory report pointed out that, since this measurement uses a rather complicated reaction with at least four final-state particles, it is necessary to study/simulate how the Fermi motion and fission reaction kinematics affects the pion momentum distribution.
Estimates of rates and systematic uncertainties will have to be carefully documented in a proposal.

Summary: The PAC recommends the proponents to proceed to a full proposal after careful considerations of the issues raised above.

LOI12-23-012

Title: Measurement of Double Deeply Virtual Compton Scattering in the di-muon channel with the SoLID spectrometer

Spokespersons: A. Camsonne (contact), M. Boer, E. Voutier, Z. Zhao

Motivation: Exclusive electroproduction of a lepton pair, or so-called Double Deeply Virtual Compton Scattering (DDVCS), constitutes a unique access to generalized parton distributions (GPDs). The objective of this proposal is to extract Compton Form Factors (CFFs) depending on two longitudinal momentum variables, which are not accessible with the more familiar DVCS process. This will significantly help in constraining the ξ (skewness parameter) dependence of the GPDs, which is in particular essential for obtaining tomographic images of the proton. Therefore, the motivation of this experiment is strong, and the eventual measurements have a potential to have a significant impact on the GPD program at JLab and beyond.

The signal process of the proposal is $e^- p \rightarrow e^- p \mu^- \mu^+$, which has a simpler theory interpretation than $e^- p \rightarrow e^- p e^- e^+$ because there is no ambiguity between the produced lepton pair and the scattered beam lepton.

Measurement and Feasibility: The experimental requirements are the same as for the SoLID J/ψ experiment E12-12-006. It will use the SoLID spectrometer with a 3 μA electron beam on a 15 cm liquid hydrogen target. The proposed experiment is adding the muon detector and will run concurrently with E12-12-006, without requesting any additional beam time.

Issues: The PAC sees no major issue. However, to make a solid case, more simulations are needed to show the quality of the Compton form factor extractions from the proposed experiment. This is an important step beyond the projection of asymmetries (as shown in Figure 25 of the LOI). It may also be worthwhile to explore di-lepton production in kinematics not covered by the current LOI with the same experiment set-up. An example is time-like-Compton scattering, where the virtuality of the exchanged photon between the incoming electron and nucleon goes to zero.

Summary: The motivation of the proposed measurement is strong. The PAC encourages the proponents to proceed to a full proposal with above mentioned issues clearly addressed. In particular, the impact of these measurements on the global analysis of GPDs needs to be quantified.

LOI12-23-013

Title: Study of charge symmetry breaking in p-shell hypernuclei

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

Motivation: **C**harge symmetry breaking (CSB) in the Lambda-N interaction has been observed in a binding-energy difference for the s-shell iso-doublet of Lambda hypernuclei, $^{4}_{\Lambda}$He and $^{4}_{\Lambda}$H. This experiment aims at measuring the CSB effect on the binding energies for the p-shell hypernuclei.

Measurement and Feasibility: The ^{6}Li (e, e'K^{+})$^{6}_{\Lambda}$He, ^{9}Be (e, e'K^{+})$^{9}_{\Lambda}$Li, and ^{11}B(e,e'K^{+}) $^{11}_{\Lambda}$Be reactions will be measured with the same experimental setup as the E12-15-008 and E12-20-013 experiments, using the HES and the HKS in Hall C. The envisaged resolution of the binding energy is 70 keV. This resolution is enough to compare the data with those of the isospin partners, which will be measure at J-PARC with (π^{+}, K^{+}) reactions. The initial simulation shown in the LOI suggests that the experiment is feasible.

Issues: There is very little discussion on theories in the LOI. A full proposal should include a theoretical discussion of the Λ binding energy, of expected CSB effects for the p-shell hypernuclei, and of the impact on theory of this experiment with its proposed precision.

Summary: The PAC recommends the proponents to proceed to a full proposal after careful considerations of the issues raised above.

LOI12-23-014

Title: Recoil Nucleon Polarization in Deeply Virtual Compton Scattering and Neutral Pion Electroproduction in Hall C

Spokesperson: M. Defurne (contact)

Motivation: Deeply Virtual Compton Scattering (DVCS) is the main reaction for determining Generalized Parton Distributions (GPDs). It can be accessed through electroproduction of real photons, $ep \rightarrow ep\gamma$. Measuring the recoil nucleon polarization in DVCS provides sensitivity in particular to the GPDs *E* and *H-tilde*.
The proposed experimental setup will also allow to simultaneously study exclusive π^0 electroproduction, with the potential to provide more constraints on chiral-odd GPDs.

Measurement and Feasibility: The goal is to measure the polarization dependence for a DVCS recoil proton in Hall C. The scattered electron will be detected in the HMS and the photon in the NPS. The recoil proton will be analysed in an active polarimeter made of scintillating fibres, which needs to be developed. A preliminary design has been implemented in Geant4, providing preliminary results regarding efficiency and analysing power.

The current beam time estimate is 10 PAC days at 10 μA on a 15 cm-long LH_2 target. For a final beam time request, more work will be required to complete the polarimeter design and to improve the tracking algorithm.

Issues: The TAC theory report points out two issues:

- It is recommended to revisit the theory of QED radiative corrections in DVCS, which may need to be adjusted for the recoil polarization measurement.
- Other physics processes need to be considered for calibration of the recoil polarimeter, such as *ep* elastic scattering or exclusive pion production in kinematics with large known recoil polarization.

Summary: The proposed method of using recoil nucleon polarization for DVCS and the π^0 electroproduction is well motivated. Next steps are laid out, including the finalization of the polarimeter design and the development of a Machine Learning tracking algorithm.
The PAC recommends the proponents to proceed to a proposal taking into account the issues raised above.

It would be beneficial to have some kinematic overlap of the proposed measurement with the conditionally approved experiment C12-12-005 for DVCS on a transversely polarized target in Hall B.

LOI12+23-015

Title: Energy Dependence of Dispersive Effects in Unpolarized Inclusive Elastic Electron/Positron-Nucleus Scattering

Spokesperson: P. Gueye

Motivation: The proposed experiment aims to measure the magnitude of dispersive effects in electron and positron inclusive A(*e,e'*) elastic scattering around the first diffraction minimum. It foresees measurements for six different nuclei (^{12}C, ^{27}Al, ^{29}Cu, ^{48}Ca, ^{56}Fe, ^{208}Pb) and five incident beam energies (0.55, 1.2, 2.2, 3.3, and 4.4 GeV). Here, 'dispersive effects' refer to the impact of excited nuclear states in multi-photon exchange. Such a measurement program would be the first comprehensive study of the energy dependence of such effects. It would move beyond the ^{12}C-based measurements of the LEDEX experiments (E05-004 and E05-103). Such a dedicated program is important as the magnitude of dispersive effects near the first diffractive minimum of ^{12}C has been confirmed to be large with a strong energy dependence. In addition, dispersive effects could be important for nuclear radii extracted from parity-violating asymmetries measured near a diffraction minimum.

Measurement and Feasibility: The experiment will use both electron and positron beams to measure the magnitude of dispersive effects in A(*e,e'*) elastic scattering at a variety of energies and on a variety of nuclei. The proponents indicate that this measurement program could be completed in either Hall A using one of the two HRS spectrometers, or in Hall C using the HMS or SHMS spectrometer in a normal configuration with standard detector systems. There is no run time estimate provided in the LOI. The proponents are exploring the possibility to run together with the proposed Super-Rosenbluth experiment PR12+23-012 in Hall C to cover the needed beam energies for both sets of measurements.

Issues: In their LOI, the proponents have provided detailed calculations assuming ^{12}C, so that for moving forward it will be important to repeat these for the heavier nuclei foreseen. The LOI also mentions the use of polarized beams (page 8) but the rest of the discussion seems to refer to unpolarized beams – this needs to be clarified. In addition, an expanded discussion of how the experiment plans to make use of both the electron and positron beams would be useful as it is unclear what their respective roles are meant to be in the measurement. Explanation of what observables would be measured (e.g., cross sections at some fixed *t*, ratios, etc.) should be added. Expanding on the potential impact on parity-violating experiments would further strengthen the case. In a future proposal, it would also be interesting to see a comparison of the expected accuracy of the measurements compared to theory predictions.

Summary: This effort could produce measurements of dispersive effects, providing such information over a range of nuclei and out to higher energies than previously measured. The PAC encourages the proponents to proceed to a full proposal after the above issues are addressed. It encourages the use of a full Monte Carlo simulation to assess the feasibility of such an experiment in either Hall A or Hall C and either as a stand-alone experiment or in parallel with the conditionally approved Super-Rosenbluth experiment PR12+23-012. It seems advisable to coordinate with the lab before making a choice of experimental hall. The amount of run time needed to achieve the physics goals should also be made clear in a proposal.

LOI12-23-016

Title: Study of a triaxially deformed nucleus using a Lambda particle as a probe

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

Motivation: The experiment presented in this LOI aims at measuring the triaxial deformation of nuclei with a Lambda particle as a probe. The wave function of a Lambda particle in the p-orbit of a hypernucleus is sensitive to the triaxial deformation of the core nucleus, and energy levels are shifted depending on the deformation. The experiment intends to investigate the triaxial deformation of ^{26}Mg with the high-resolution spectroscopy of the ^{27}Al (e, e' K^+) $^{27}{}_{\Lambda}$Mg reaction.

Measurement and Feasibility: The experimental setup will be the same as for the E12-15-008 experiment. The PCS, HKS, HES magnets/spectrometers will be used.

Issues: In order to extract information on the deformation of the core nucleus, theoretical calculations are required. In the LOI, two theories are introduced; one is a hyper-AMD calculation and the other is a shell model with DWIA. Currently, the former cannot predict reaction cross section, and the latter cannot predict deformation. More theoretical efforts are required to connect the measured spectrum to the deformation of the core nucleus. Comparison between different models will be important in this context.
Experimental details are not discussed in the LOI. These need to be given in a full proposal, including simulations on the signal-to-noise ratio, etc.

Summary: If the proponents wish to proceed to a full proposal, the PAC recommends to carefully consider the issues raised above.

PAC 51 MEMBERS

ALESSANDRO BACCHETTA
Department of Physics
University of Pavia
Via Bassi 6, 27100 Pavia (PV), Italy
Phone: +39 340 7769998
alessandro.bacchetta@unipv.it

KEITH BAKER
D. Allan Bromley
Professor of Physics
Yale University
Yale High Energy Physics
217 Prospect St.
New Haven, CT 06511-4712
oliver.baker@yale.edu

MARCO CONTALBRIGO, JLUO CHAIR
INFN Ferrara
Via Saragat 1,
44122 Ferrara, Italy
Phone: +39 0532 974310
contalbrigo@fe.infn.it

MARKUS DIEHL, CHAIR
Theory Group
Deutsches Elektronen-Synchroton DESY
22603 Hamburg
Germany
Phone: 49 (0)40 8998 3447
markus.diehl@desy.de

BARBARA ERAZMUS
SUBATECH, IMT Atlantique
Université de Nantes
CNRS-IN2P3,
Nantes, France
barbara.erazmus@cern.ch

ALEXANDRA GADE
Professor of Physics
Facility for Rare Isotope Beams and Michigan State University
640 South Shaw Lane, East Lansing, MI 48824
(517) 908-7441
gade@frib.msu.edu

MATTHIAS GROSSE PERDEKAMP
Department of Physics
University of Illinois
469 Loomis Laboratory
Urbana, IL 61801
Phone: (217) 333-6544
mgp@illinois.edu

CURTIS A. MEYER
The Otto Stern Professor of Physics
Associate Dean for Research
Carnegie Mellon University
5000 Forbes Ave.
Pittsburgh, PA 15213
(412) 260-6290
cmeyer@cmu.edu

SHIN'YA SAWADA
KEK, High Energy Accelerator Research Organization Tsukuba, Ibaraki 305-0801 Japan
Shinya.sawada@kek.jp

CONCETTINA SFIENTI
Institute for Nuclear Physics
Johannes Gutenberg-Universität Mainz
Johann-Joachim-Becher Weg 45
D-55099 Mainz
sfienti@kph.uni-mainz.de

FENG YUAN
Lawrence Berkeley National Laboratory
Nuclear Science Division
1 Cyclotron Road, Mailstop 50B5239
Berkeley, CA 94720-8153
Phone: (510) 486-5626
fyuan@lbl.gov

GERALYN (SAM) ZELLER
Fermi National Accelerator Laboratory
Kirk and Pine Streets, MS 123
Batavia, IL 60510-5011
Phone: (630) 840-6879
gzeller@fnal.gov

MARCO RADICI
INFN - Sezione di Pavia
Via Bassi 6, I27100 Pavia - Italy
Phone: +39 0382 987451
marco.radici@pv.infn.it

Charge to PAC51

Review new proposals, previously conditionally approved proposals, jeopardy 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 jeopardy proposals (if revision is sought) and those 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.

List of Common Acronyms

ADC	Analog-to-digital converter
CDR	Conceptual Design Report
DAQ	Data Acquisition
DIS	Deep inelastic scattering
DVCS	Deeply virtual Compton scattering
EMC	European Muon Collaboration
GEM	Gas electron multiplier (detector)
GPD	Generalized parton distribution
NLO	Next-to-leading order (in perturbation theory)
NPS	Neutral Particle Spectrometer (in Hall C)
PAC	Program Advisory Committee
PDF	Parton distribution function/parton density
PMT	Photomultiplier tube
PVDIS	Parity violating DIS
SIDIS	Semi-inclusive DIS
SoLID	Solenoidal Large Intensity Device (planned detector in Hall A)
TAC	Technical advisory committee (for the PAC)
TCS	Timelike Compton scattering
TFF	Transition form factor
TMD	Transverse-momentum dependent PDF or fragmentation function