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Report of the

Jefferson Laboratory
Program Advisory Committee

PAC 24

Meeting of June 16 – 19, 2003

Letter from the Director

July 7, 2003

Members of the Jefferson Lab User Group

Ensuring the highest quality science from Jefferson Lab's world-class facilities is paramount for the success and vitality of Jefferson Lab and is essential for continued leadership in our field. In the past several months JLab has seen its experimental results recognized in the popular media such as The Economist and the New York Times in addition to the scientific and technical publications. This type of visibility for our program is very gratifying and enhances the appreciation for what our users do here.

The Program Advisory Committee plays a critical role in setting the bar high for experiments at Jefferson Lab. PAC 24 has again done an excellent job as they examined 15 proposals with 7 approved, 4 deferred, and 3 deferred with regret. Our users continue to bring exciting and compelling science forward for consideration, and it is a difficult job that the PAC must do in assessing these proposals.

I want to thank the PAC Chair, Dr. Peter Barnes, and the rest of the PAC for their dedication to the best experimental program. Dr. Barnes has served for many years and this year he and Dr. Michel Garcon are rotating off the PAC. We will miss their perspective and guidance and hope they will continue to be a resource to our user community and to lab management through their involvement with the Jefferson Lab experimental program.

Sincerely,

Christoph W. Leemann
Director

Letter from the PAC Chairman

Introduction

The Jefferson Laboratory Program Advisory Committee held its 24th meeting on June 16 - 20, 2003. The membership of the Committee is given in Appendix A. In response to the charge (Appendix B) from the JLab Director, Dr. Christoph Leemann, the Committee reviewed and made recommendations for proposals and letters of intent submitted by JLab users.

General Overview

The PAC 24 meeting was especially intense, driven as it was by the large numbers of requests for beam time at CEBAF. For this six-month period, fifteen proposals and six Letters of Intent were evaluated and are discussed in this report for possible inclusion in the JLab 6 GeV physics program.

The overall JLab experimental program continues to show solid growth; it now consists of 133 approved experiments. To date, 96.6 experiments (equivalent) have been completed at JLab, up by six over the past six months. About 24 papers have been published or submitted to the Physical Review and Physical Review Letters over the past year, in addition to over 30 papers published elsewhere. A number of archival papers, dealing with the construction of the experimental facilities in the three halls, are also in the process of publication. The number of Ph.D. projects completed to date at JLab is 148 (up by eighteen in the past six months), with an additional 126 projects in progress. This represents about 30% of the U.S. production of PhD's in Nuclear Physics. All of this is indicative of a very strong and healthy physics research program at JLab.

The accelerator continues to perform at a high level; during the first three quarters of FY03 there were 25.8 weeks (equivalent) of physics delivered, based on 20 weeks of accelerator operation with 61% beam availability. The three hall availabilities ranged from 89% to 93%. Thus the hall multiplicity in this three quarter period was 2.32.

At this PAC 24 meeting, the new projects added to the JLab research program were very diverse in character. For example, the search for hadrons consisting of more than three constituent quarks has to date produced no solid candidates. CLAS will now follow up on recent measurements at LEPS/Spring-8, DIANA, and CLAS that provide evidence for a five quark state at about 1.54 GeV with positive strangeness and a very narrow width. The new measurement will increase the statistical significance by a factor of twenty and will permit investigation of the decay angular distribution, the isospin, and a systematic investigation of background processes.

In a measurement in Hall A, the beam helicity-dependent asymmetry and cross section difference in the reaction d(e,e′γn) will yield information on the Deeply Virtual Compton Scattering process on the neutron. This is a very important addition to similar experiments on the proton and is mostly sensitive to one of the GPDs, E, which is at present totally unknown and not accessible through measurements on the proton.

Measurement of the inclusive spin asymmetries A_1^p and A_2^p in the high-x_2, region where present DIS data suffer from large statistical uncertainties, will be performed in Hall C. The poorly known g_2^p structure function will be determined over a wide range of x and Q^2. This will allow the determination of the third moment, d_2, of a combination of g_1 and g_2, which is a measure of the quark-gluon correlations and which, in the Q^2 range of the proposed experiment, is related to the induced color electric and magnetic polarizabilities of the nucleon.

Several of the approved measurements, which require incident energies of 6 GeV, may be viewed as precursors of the future JLab program to be performed at 12 GeV.

Recommendations

The high demand for beam time at this meeting made the task of the PAC extremely difficult, as discussed below. Of the fifteen proposals received, only seven experiments were approved. Because of the high backlog in Hall A and Hall C and the consequent small new time allocation, the PAC found it necessary to "defer with regret" several attractive physics proposals that might have been approved in more normal circumstances. The PAC approved three experiments in Hall A for a total of 44 days, two experiments in Hall B for 48 days, and two experiments in Hall C for 37 days. The ratings for these seven proposals were one with A, two with A-, and four with B+.

The laboratory guidelines provided for the approval of 41 days of beam time in Hall A, 48 days of beam time in Hall B, and 37 days of beam time in Hall C. Starting with PAC 24, the formula for these guidelines has been modified, and is based on three components: 30/45/25 days of new time to be made available in Halls A/B/C, plus 100% / 100%/ 100% of the time recovered from approved experiments now required to return to the PAC due to the jeopardy process, and 50%/50%/50% of the days under target in each hall (applies only to Hall B at this time). The PAC is allowed to exceed the laboratory guidelines if it believes the physics has sufficiently high priority, that is at the level of an A– rating or better, but the excess would then be deducted from the allocation of the next PAC meeting.

The jeopardy process continues to evolve at JLab. At this meeting 16 days of approved time were under jeopardy status, all of them in Hall C. The backlog in Hall A is now about 4.8 years, while the backlog in Hall B is 3.4 years and that of Hall C, 4.5 years.

The backlog issue and the budget constraints on the physics production time available at JLab, were a serious constraint on the PAC 24 proposal evaluation and recommendation process. Three proposals (PR 03-107, PR 03-110, and PR 03-115) were judged worthy of approval by the PAC but were ultimately recommended for "defer with regret". They could not be fit into the beam time allocation for Halls A and C. In addition two proposals (PR 03-109 and PR 03-111) for Hall C addressed the determination of the third moment, d_2, of the combination of the proton g_1 and g_2 structure functions, but use different techniques. Because of the limited beam time available in Hall C, the PAC decided to only approve the PR 03-109 proposal because its kinematical range extends to larger values of Q^2. Several technical issues will have to be addressed as discussed in the individual report.

The proposal reports and the PAC recommendations for the reviewed proposals and the response to the letters-of-intent are given in Appendices D and E. The tables on the following pages summarize the status of the JLab commitments from PAC 4-24.

The PAC is very appreciative of the efforts of the Hall leaders and the Laboratory staff in support of the PAC meeting and review process. The enthusiastic and thoughtful contributions of Clara Perdue, Sue Ewing, and Suzanne Roseberry were especially effective in making the PAC process proceed gracefully and with high efficiency.

With the completion of this meeting, I will step down as the chairman of the JLab PAC. Over the past six meetings I have found the physics discussions very stimulating and the experience of working with the JLab community very rewarding. The scientific impact of the JLab program continues to grow and I am particularly in debt to all the members of the PAC during this period for their clear vision and their high standards. Finally, I would like to thank the JLab Director, Christoph Leemann, Larry Cardman, and all the members of the JLab leadership and community who have made this research program such a success.

Peter D. Barnes
Chairman, Jefferson Laboratory Program Advisory Committee

Tables

Totals for PAC 4-24

	Experiments Recommended for Approval	Experiments Recommended for Conditional Approval	Totals
Experiments	142	8	150
Authors	1096	36	1132
Institutions	184	3	187
Countries	30		30

Approved Experiments Totals by Physics Topics

Topic	Number	Hall A	Hall B	Hall C
Nucleon and Meson Form Factors & Sum Rules	24	11	4	9
Few Body Nuclear Properties	29	18	6	5
Properties of Nuclei	26	7	11	8
N* and Meson Properties	45	6	31	8
Strange Quarks	17	4	11	2
TOTAL	142	46	63	33

Approved Days and Conditionally Approved Experiments

Hall	Approved Experiments				Conditionally Approved Experiments
	# Expts Completed (full/partial)	Days Run	No. Exps in Queue	Days to be Run	
A	28 1x .15	502.60	21	356	3
B	35 /14×.85 3×.40 2×.76	418.50	28	270	2
C	18 / 1×.5 1 ×.33 1 x .65	435.9	17	255.7	3
Total	81 / ~23.00	1357	66	882.9	8

APPENDICES

A. PAC 24 Membership

B. Charge to PAC 24

C. PAC 24 Recommendations

D. PAC 24 Individual Proposal Reports

E. PAC 24 Individual Letters-of-Intent Reports

F. Approved Experiments, PACs 4-24, Grouped by Physics Category

(To access Appendix F, go to
http://www.jlab.org/exp_prog/PACpage/PAC24/ExpSum.pdf)

Appendix A

PAC 24 Membership

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Appendix B

Charge to PAC 24

Jefferson Lab requests that PAC 24:

1) Review both new proposals* and extensions† or updates‡ to previously-approved proposals, and provide advice on their scientific merit, technical feasibility and resource requirements.
2) Recommend one of five actions on each proposal, extension or update:
   - approval,
   - conditional approval status pending clarification of special issues,
   - deferral with regret,
   - deferral, or
   - rejection.

   (there are two types of conditional approval: conditional pending PAC review of open scientific questions; and conditional pending Jefferson Lab management review of open technical issues. In the later case, the PAC should recommend a beam time allocation.)
3) Provide a scientific rating and recommended beam-time allocation for all proposals recommended for approval.
4) Provide comments on letters-of-intent.
5) Comment on the Hall running schedules.

*Previously approved proposals that have not, within 3 years of PAC approval, been scheduled to run to completion are returned to the PAC for a fresh scientific review. For the purposes of these reviews, the "jeopardy" experiments are to be treated consistently with new proposals.

† Extension proposals are treated as new proposals, and the merits and status of the original proposal are considered only to the extent that they may bear on the relevance and merit of the extension proposal.

‡ In reviewing an experiment update, the PAC will treat the original proposal and any request for changes taken together as a single new proposal and treat the combination in a manner analogous to a previously-approved proposal undergoing a jeopardy review.

APPENDIX C

PAC 24 Recommendations

Class*/Grade/Days

A/B+/13	PR 03-101	Hard Photodisintegration of a Proton Pair
D	PR 03-102	Spin Structure of the Deuteron by Using $d(\vec{e},e'\vec{p})$
A/B+/10	PR 03-103	A Precise Measurement of the Nuclear Dependence of Structure Functions in Light Nuclei
A/B+/18	PR 03-104	Probing the Limits of the Standard Model of Nuclear Physics with the $^4He(\vec{e},e'\vec{p})^3H$ Reaction
A/B+/18	PR 03-105	Pion Photoproduction from a Polarized Target
C/A-/13	PR 03-106	Deeply Virtual Compton Scattering on the Neutron
DR	PR 03-107	Measurement of the Neutron d_2: Towards the Electric χ_E and Magnetic χ_B Color Polarizabilities
D	PR 03-108	PolarizationTransfer Measurements from $\vec{\gamma}\,p \to \phi\vec{p}$ Reaction
C/A-/27	PR 03-109	Spin Asymmetries on the Nucleon Experiment (SANE)
DR	PR 03-110	Measurement of $R = \sigma_L / \sigma_T$ on Nuclear Targets in the Nucleon Resonance Region
R	PR 03-111	Precision Measurement of the Spin Structure Function g_2 of the Proton at $Q^2 = 0.8$ and 2.0 $(GeV/c)^2$.
D	PR 03-112	Measurement of the Deuteron Magnetic Form Factor at Large Momentum Transfers
A/A/30	PR 03-113	Investigation of Exotic Baryons States in Photoproduction Reactions with CLAS
D	PR 03-114	Flavor Decomposition of Nucleon Spin Structure
DR	PR 03-115	Hadronization in Nuclei by Deep Inelastic Electron Scattering

* A=Approve, C=Conditionally Approve, D=Defer, DR= Defer with Regret, R=Reject

Appendix D

Individual Proposal Report

Proposal: PR 03-101

Scientific Rating: B^+

Title: Hard Photodisintegration of a Proton Pair

Spokespersons: R. Gilman and E. Piasetzky

Motivation: This proposal updates and extends the program outlined in PR 03-005. It was proposed to investigate the high energy photodisintegration of ^{3}He into pp-pairs emitted back-to-back. Beam time was requested to measure the energy dependence of the cross section at 90^o between 2.4 and 5.0 GeV and to sample the angular distribution at 3.2 GeV. The data should allow the study of the s^{-11} scaling of the cross section as seen in the deuteron disintegration, the reaction dynamics, and the validity of the impulse approximation. If the photodisintegration amplitude is found to factorize, it can be related to the NN scattering amplitude and the data could be compared with measurements on high energy pp-scattering. Recent theoretical developments are invoked to further support and extend this program. Additional time is requested for set up, calibration, and a measurement of both the cross section and the recoil polarization at 1.6 GeV photon energy. This would provide overlap with the anticipated Hall B data on $\gamma\ ^3\mathrm{He} \rightarrow \mathrm{pp} + \mathrm{n}$ and a comparison with the $\gamma\ \mathrm{d} \rightarrow \mathrm{p\ n}$ polarization data.

Measurement and Feasibility: As proposed in PR 03-005, a beam of untagged bremsstrahlung photons would be directed at a ^{3}He cryogenic gas target. The outgoing protons would be detected in coincidence by two magnetic spectrometers set to match the kinematical endpoint of the bremsstrahlung spectrum. For the measurement of the recoil polarization, the existing focal plane polarimeter would be used. The cross section data would be taken simultaneously. The experiment requires no new equipment or development time, and could run whenever the cryo-target is installed in Hall A.

Issues: The PAC concludes that a first exploratory measurement on hard pp-photo-disintegration is justified. In view of the uncertainty in the count rates and in the applicability of the impulse approximation, the experiment should first address the photon energy range up to 4.0 GeV and include the polarization measurements where appropriate.

Recommendation: Approve for 13 days in Hall A

Individual Proposal Report

Proposal: PR 03-102

Scientific Rating: N/A

Title: Spin Structure of the Deuteron by Using $d(\vec{e},e'\vec{p})$

Spokespersons: S. Gilad, O. Gayou, Z.-L. Zhou, and S. Širca

Motivation: Deuteron properties are a traditional testing ground for realistic nuclear models, defined either in a relativistic or non-relativistic framework. Double-polarization deuteron electrodisintegration, performed in quasi-elastic kinematics, can give access to observables that are related to the underlying spin structure of the deuteron. Therefore they are well suited to test theoretical models in hitherto unexplored ways. Calculations by Arenhövel et al. indicate that at high missing-momenta, p_m, the recoil-polarization components P_x' and $P_z'$are sensitive to the D-state component and hence to the choice of the NN-potential. On the contrary the p_m-dependence of P_y^o and of the ratio P_x'/P_z' turns out to be quite sensitive to (spin-dependent) final-state interaction effects, meson exchange, and isobar currents.

Measurement and Feasibility: It is proposed to measure the recoil-polarization components P_x', $P_z'$and P_y^o, as well as the differential cross section in parallel kinematics, at two beam energies, in the $^2H(\vec{e},e'\vec{p})$ reaction. The p_m-dependence of the recoil-polarization components will be determined up to p_m=350 MeV/c. The structure functions f_L, f_T and /f_{LT}^n, $f'_T{}^l$, $f'_{LT}{}^t$ will be separated up to missing momenta of 200 and 350 MeV/*c*, respectively. In this way tests of the ground-state wave function and the reaction dynamics can be performed. The experiment requires standard conditions and equipment: 70 μA polarized electron beam, 15 cm long LH_2 and LD_2 targets, HRSl and HRSr equipped with an FPP.

Issues: The PAC recognizes the importance of a detailed investigation of deuteron (spin) properties in order to facilitate the testing of state-of-the-art model calculations. However, the projected data set in combination with the theoretical predictions as presented does not make a compelling case. The sensitivity of the data to the NN-interaction used in the calculations turns out to be minor. In the high missing-momentum region spin-dependent effects, amplified by the deuteron's D-state, are predicted to become manifest. However, in this kinematical region the validity of the predictions by Arenhövel et al. is questionable, because the *np* center of mass energy reaches values as high as 700 MeV. This weakens considerably the interpretability of the data. The physics motivation for the study of recoil polarization components in the $d(\vec{e},e'\vec{p})$ reaction could be considerably strengthened by presenting predictions of other relativistic state-of-the-art calculations that are more applicable in the kinematics under consideration.

Recommendation: Defer

Individual Proposal Report

Proposal: PR 03-103

Scientific Rating: B^+

Title: A Precise Measurement of the Nuclear Dependence of Structure Functions in Light Nuclei

Spokespersons: J. Arrington

Motivation: The primary goal of the proposed experiment is the precise measurement of the EMC effect for a number of light and heavy nuclei. The experiment provides the opportunity to test the dependencies of current theoretical models on A and on the nuclear density. The examination of nuclear effects in light nuclei may lead to an improved understanding of the systematic uncertainties in procedures to extract the neutron structure function. For instance, this is of importance in understanding the ratio of the neutron and proton structure functions at large x.

Measurement and Feasibility: It is proposed to measure inclusive electron scattering off ^{1}H, ^{2}H, ^{3}He, ^{4}He, C, Cu, and Au over a range of x from 0.3 to 1.0 and for Q^2 up to 8 $(GeV/c)^2$. The ^{4}He data are expected to have statistics that are improved by a factor of 2 over existing measurements. The ^{3}He structure function will be measured at x larger than 0.5 for the first time. The proposed experiment uses standard equipment and is to be run at a beam energy of 6 GeV.

Issues: The PAC is not convinced that the proposed experiment on the heavy nuclei (C, Cu, and Au) will provide sufficient new insight into the EMC effect beyond what is already known from the SLAC E139 and the JLab E89-008 experiments. The proposed experiment should be focused on the four lightest nuclei and the highest values of Q^2 (i.e. on the largest two scattering angles). This is the cleanest case since accurate calculations of the nuclear effects are available and the complications due to resonance structure will be minimized. Here there is potential for gaining more insight into the physics of the EMC effect.

Recommendation: Approve for 10 days in Hall C

Individual Proposal Report

Proposal: PR 03-104

Scientific Rating: B^+

Title: Probing the Limits of the Standard Model of Nuclear Physics with the $^4He(\vec{e},e'\vec{p})^3H$ Reaction

Spokespersons: S. Strauch, R. Ent, R.D. Ransome, and P.E. Ulmer

Motivation: This proposal is motivated by the results of E93-049, in which the polarization transfer coefficients P_x' and P_Z' were measured on ^{4}He and ^{1}H at Q^2=0.5, 1.0, 1.6 and 2.6 $(GeV/c)^2$. The data, in the form of super ratios, are best described by a fully relativistic model calculation including medium modifications as predicted by a quark-meson coupling model. However, the limited data set, the scatter of the data and their uncertainties preclude ruling out the conventional meson-nucleon description of nuclei. Additional data at Q^2=0.8 and 1.3 $(GeV/c)^2$ with appreciably higher precision than obtained in the previous experiment, could more rigorously constrain theoretical models.

Measurement and Feasibility: It is proposed to take data at low missing momenta at two values of Q^2. The experiment requires standard conditions and equipment: 20-100 μA polarized electron beam, 10/15 cm long ^{4}He/LH_2 targets, HRSl and HRSr equipped with an FPP. The contribution of false asymmetries will be suppressed via dedicated calibration measurements. The reaction, the target nucleus, as well as the kinematics are optimized such that nuclear effects like MEC, FSI and channel coupling are theoretically under control. Since the experiment will be a continuation of a previous measurement the objective of achieving high precision data seems clearly feasible.

Issues: None.

Recommendation: Approve for 18 days in Hall A.

Individual Proposal Report

Proposal: PR 03-105

Scientific Rating: B^+

Title: Pion Photoproduction from a Polarized Target

Spokespersons: S. Strauch, N. Benmouna, G. V. O'Rielly, I. Strakovsky

Motivation: The aim of the experiment is to measure two single-polarization and three double-polarization observables in single-pion photoproduction using a polarized beam and a longitudinally and transversely-polarized target with the CLAS detector. These data will span $\cos \theta_{cm}$ from – 0.9 to 0.9 in a center-of-mass energy range from 1350 to 2150 MeV. They will greatly constrain partial-wave analyses and reduce model-dependent uncertainties in the extraction of nucleon resonance properties.

Measurement and Feasibility: The experiment will use the CLAS and the photon tagging facility in Hall B, together with the frozen spin target being built for E02-112. Transverse and circular beam polarization together with transverse and longitudinal target polarization are required. The program is a natural continuation of the measurements already made on pion photoproduction from the nucleon (E94-103). The partial-wave analyses programs are well-proven and inclusion of simulated data clearly shows the benefits which will accrue from the new data. The feasibility of the experiment and of the subsequent analysis is well established.

Issues: The PAC is able to allocate only 18 days at this time. As discussed with a representative of the collaboration, there are several options as to how best to utilize this time. As a general point, the PAC is concerned that the baryon spectroscopy program apparently lacks coherence with individual channels, for example π-N, η-N, K-Λ, being analyzed independently. It is strongly recommended that a laboratory-based analysis group be established to ensure best return on the high-quality data being produced.

Recommendations: Approve for 18 days in Hall B.

Individual Proposal Report

Proposal: PR 03-106

Scientific Rating: A^-

Title: Deeply Virtual Compton Scattering on the Neutron

Spokespersons: F. Sabatié, P. Bertin, C.E. Hyde-Wright, and E. Voutier

Motivation: This experiment will measure the beam helicity-dependent asymmetry and cross section difference in the reaction d(e,e′γn). These observables will yield information on the Deeply Virtual Compton Scattering (DVCS) process on the neutron. This is a very important addition to similar experiments on the proton, since the signal is mostly sensitive to the Generalized Parton Distribution (GPD) E, which is at present totally unknown and not accessible through measurements on the proton. Ultimately, a mapping out of E as a function of x, t, and Q^2 is necessary to evaluate the Ji sum rule, relating an integral over E and H to the total angular momentum carried by quarks, J_q. The proposed measurement is an important first step in this direction, since it will give an indication of the magnitude of the asymmetry and E.

Measurement and Feasibility: The measurement will use the experimental equipment under construction for the DVCS experiment on the proton in Hall A. Additional shielding and scintillator detectors to tag charged particles are planned to separate neutrons from protons. This method is basically sound, but the design has not yet been finalized.

It appears that effects from Fermi motion and finite resolution will not spoil a reasonable degree of exclusivity of the final state, allowing the proposers to extract the DVCS signal on the neutron from backgrounds such as π^0 decay, associated pion production etc.

Issues: The PAC is not yet convinced of the feasibility of doing an absolute cross section difference measurement with the claimed precision of 7%. In particular, the efficiency of the neutron detector (in the presence of a very high background rate) may not be known to the claimed 5% accuracy unless a direct measurement of this efficiency can be found. The beam helicity asymmetry is less sensitive to this uncertainty, but is less directly interpretable in terms of the GDPs of interest.

The PAC therefore recommends a more detailed and complete study of the performance of the neutron detector and a measurement of the neutron efficiency. The results of this study should be presented to JLab management as condition for full approval. The collaboration should also study in more detail background processes like photoproduction on the proton with subsequent charge exchange and similar FSI effects.

The PAC is concerned that one may not learn much from a comparison of two close-by points in x and recommends one measurement at x=0.36 (the same as for the already approved proton experiment). This will yield a first quantitative answer on the order of magnitude of the asymmetry and E.

Recommendation: Conditional Approval for 13 days in Hall A

Individual Proposal Report

Proposal: PR 03-107

Scientific Rating: N/A

Title: Measurement of the Neutron d_2:Towards the Electric χ_E and Magnetic χ_B Color Polarizabilities

Spokespersons: Z.-E. Meziani, S. Choi, and X. Jiang

Motivation: The aim of the experiment is a precise determination of moments of the neutron spin structure functions, namely the integral of g_2^n and the x^2-moment of a particular combination of g_1 and g_2, called d_2. In the framework of the Operator Product Expansion, the latter is sensitive to twist-3 quark-gluon correlations, and to electric and magnetic color polarizabilities. This quantity would be compared to lattice QCD predictions and to other model calculations.

Measurement and Feasibility: The measurement uses scattering of longitudinally polarized electrons from a polarized ^{3}He target, to measure longitudinal and transverse asymmetries, together with the unpolarized cross section, from which the spin structure functions $g_1(x)$ and $g_2(x)$ are extracted at fixed $Q^2 = 2$ $(GeV/c)^2$. The experiment is optimized to minimize the uncertainty on d_2, obtained by integrating $x^2(2g_1 + 3g_2)$ over the measured region (x from 0.24 to 0.8). Extrapolations to x=0 and x=1 are applied to cover the unmeasured regions. A correction to account for the difference between a polarized ^{3}He and a free polarized neutron is applied. The experiment uses existing equipment and proven techniques. It is judged feasible. It would complement the low Q^2 results obtained by E-94-010 and the (significantly less precise) SLAC determination of d_2^n at 5 $(GeV/c)^2$. Lattice QCD calculations performed at $Q^2 = 2$ $(GeV/c)^2$ should be available in the near future, enhancing the interest in the measurement.

Issues: The principal issue is that the measured integral is dominated by contributions in the resonance region, thus making the interpretation in terms of color polarizabilities doubtful. However, investigating whether the twist expansion breaks down in this region is of interest, and connected to the question of quark-hadron duality. Nuclear corrections seem to be under control for the moment being addressed, d_2^n.

The PAC would have liked to see this experiment performed, but due to limitations in the available beam time, the proposal cannot be accepted at this time.

Recommendation: Defer with Regret.

Individual Proposal Report

Proposal: PR 03-108

Scientific Rating: N/A

Title: Polarization Transfer Measurements in the $\vec{\gamma}p \to \phi\vec{p}$ Reaction

Spokespersons: H. Gao, J. Calarco, S. Nakamura, and K. Wijesooriya

Motivation: A number of experiments, such as deep inelastic lepton scattering, have uncovered evidence for an $s\bar{s}$ component in the nucleon sea. The present experiment proposes to search for a spin-singlet $s\bar{s}$ component in the proton wave function, manifested through knock-out with an $s\bar{s}$ emerging as a ϕ.

Measurement and Feasibility: The experiment proposes to measure beam-recoil double-polarization observables in the $p(\vec{\gamma},\vec{p}K^-)K^+$ reaction, with missing mass reconstruction in the Hall-C SOS and HKS spectrometers used to identify ϕ production. The measurement would utilize untagged circularly-polarized bremsstrahlung, with momentum detection of the p and K^- providing the minimum determination of 3-body kinematics. Three data points would be obtained, one at 1.9 GeV and two at 2.4 GeV. The proposed measurement appears feasible.

Issues: The physics case for this proposal rests with a set of calculations that predict sensitivities in the double-polarization asymmetries to a pre-existing $s\bar{s}$ pair, arising from an interference between $s\bar{s}$ knockout and diffractive Pomeron exchange. Since the latter cannot contribute directly to the asymmetry (rather only interferences contribute) the predicted asymmetries are sizeable (eg. $C_{x'} = 0.25$ for 0.25% $s\bar{s}$).

This proposal is a follow up to PR 98-103 which was deferred because of concerns that the reaction mechanism is not well established, making the interpretation of the results ambiguous. The present proposal plans a more complete kinematic reconstruction of events, with a small acceptance that suppresses three-body backgrounds. However, concerns remain that other small amplitude processes, not associated with $s\bar{s}$ in the proton but still leading to ϕp final states, may also interfere and contribute significantly to the measured asymmetries. A more complete theoretical effort is necessary to investigate potential effects arising from amplitudes such as f_2 exchange and π-Pomeron cuts, or diquark models and two-gluon exchange models.

Recommendation: Defer

Individual Proposal Report

Proposal: PR 03-109

Scientific Rating: A-

Title: Spin Asymmetries on the Nucleon Experiment (SANE)

Spokespersons: G. Warren and O. Rondon

Motivation: The goal of this proposal is to provide a measurement of the inclusive spin asymmetries A_1^p and A_2^p in the high-x region where present DIS data suffer from large statistical uncertainties. The poorly known g_2^p structure function will be determined in a wide range of x and Q^2. This will allow the determination of the third moment d_2 of a combination of g_1 and g_2, which is a measure of the quark-gluon interactions and which, in the Q^2 range of the proposed experiment, is related to the induced color electric and magnetic polarizabilities.

In addition, it will be possible to study the convergence of A_1 towards the limit at x=1. The Q^2 dependence and the quark-hadron duality of the inclusive spin asymmetries will be investigated as well.

Measurement and Feasibility: The experiment is proposed to run in Hall C with 4.8 and 6.0 GeV electron beams on an existing NH_3 polarized target. A new non-magnetic detector, BETA, is proposed to detect the scattered electrons. The HMS will be used to measure background rates and asymmetries which are expected to arise mainly from positrons. The BETA detector will require the construction of a gas Cherenkov counter, a Lucite Cherenkov counter and a Pb-glass calorimeter; the latter is presently under construction for the G_e^p/G_m^p measurement. The BETA project was presented in the previously deferred proposal PR 03-002. More detailed studies and changes in the detector scheme have been performed to better fulfill the requirement on pion rejection, on the limit of accidental coincidences and event pile-up, and on the identification of the scattered electron.

Monte Carlo simulations have also been performed to simulate the impact of the beam line background. Given the present expectations for the detector performance and for the background rate, the measurement should be feasible.

Issues: Due to the novel technique and to the uncertainties of the background in the measurement configuration, the PAC recommends that prior to the detector installation, experimental tests should be performed in order to verify the expected performances in terms of energy resolution and calibration, pion rejection and track reconstruction. In addition, the Collaboration should develop all the needed software and hardware tools to determine in the very early stage of the commissioning of the detector/polarized target set-up whether the background conditions and rates are in agreement with expectations.

Recommendation: Conditionally Approve for 27 days in Hall C

Individual Proposal Report

Proposal: PR 03-110

Scientific Rating: N/A

Title: Measurement of $R = \sigma_L \sigma_T$ (note: missing slash!) on Nuclear Targets in the Nucleon Resonance Region

Spokespersons: C. Keppel and A. Bodek

Motivation: It is proposed to measure the longitudinal and transverse structure functions from nuclear targets in the resonance region. The data should determine key ingredients for the analysis of running or planned neutrino experiments. Furthermore, the L/T-ratio would help in the study of resonance excitation in nuclei.

Measurement and Feasibility: It is proposed to integrate the program with the data taking of the approved experiment E 02-109 which performs a global survey of L/T-separated unpolarized structure functions on deuterium throughout the nucleon resonance region. It could thus be completed in only 5 additional days, because the time consuming beam-spectrometer settings including their calibration could be used. The analysis of the proton data from E94-110 shows that the desired precision in the separation is realistic and attainable.

Issues: The collaboration is encouraged to provide more quantitative evidence of the improvements in the neutrino analyses and to demonstrate clear examples for increased precision on resonance excitations in nuclei.

The PAC 24 would like to see this experiment performed, but due to limitations in the available beam time, the proposal cannot be accepted at this time.

Recommendation: Defer with Regret

Individual Proposal Report

Proposal: PR 03-111

Scientific Rating: N/A

Title: Precision Measurement of the Spin Structure Function g_2 of the Proton at $Q^2 = 0.8$ and 2.0 $(GeV/c)^2$

Spokespersons: S. Choi, D.G. Crabb, Z.-E. Meziani

Motivation: The primary goal of this proposal is to disentangle the spin structure functions g_1 and g_2. These data would allow for a test of the Burkhardt-Cottingham sum rule, and an investigation of higher-twist effects as quantified by d_2, the x^2 -moment of a linear combination of g_1 and g_2. The data, if combined with measurements at larger values of Q^2, may contribute to our understanding of the nature of g_2 within QCD.

Measurement and Feasibility: The proposed experiment uses standard techniques and is judged to be feasible. It would measure the inclusive scattering of polarized electrons off a transversely and longitudinally polarized NH_3 target at $W<2.5$ GeV and $Q^2 = 0.8$, 1.3 and 2.0 $(GeV/c)^2$. The data would be taken over a wide range of x at fixed values of Q^2, which would allow the calculation of the structure function moments.

Issues: The measurement of the spin structure function g_2 is important. However, there is a competing proposal (PR03-109) whose kinematical range extends to larger values of Q^2 which is more suitable for the purpose of studying the twist expansion of g_2. Due to the very limited available beam time, only one of these could be accepted by the PAC 24.

Recommendation: Reject

Individual Proposal Report

Proposal: PR 03-112

Scientific Rating: N/A

Title: Measurement of the Deuteron Magnetic Form Factor at Large Momentum Transfers

Spokespersons: G. G. Petratos, E.J. Beise, and J. Gomez

Motivation: The purpose of the experiment is to measure, up to $Q^2 = 5.5$ $(GeV/c)^2$, the deuteron magnetic structure function B and thus the magnetic form factor G_M. Calculations show a sensitivity of the behavior of B to small relativistic or isobaric components in the deuteron wave function, especially in the region of the predicted node of G_M and beyond. Within the framework of perturbative QCD, different prescriptions lead to a significantly higher ratio of magnetic to charge structure functions (B/A) than calculations based on nucleon and meson degrees of freedom. Finally, independent of any model interpretation, the proposed experiment would complete the goal to measure the three independent observables in elastic electron-deuteron scattering (A, B and t_{20}) up to the highest momentum transfers reachable at Jefferson Lab, thus providing the most extensive characterization of the deuteron electromagnetic structure. With a modest addition of time, the experiment would be able to measure the proton magnetic form factor as well, between 3.5 and 10.5 $(GeV/c)^2$.

Measurement and Feasibility: The experimental method consists in measuring elastic electron-deuteron scattering at 180 degrees, thus maximizing the fraction of the measured cross section due to the magnetic structure function B. The backward scattered electrons are focused and deflected onto a detector package on one of the HRS. The forward deuterons, after deflection in a dipole magnet, are detected in the other HRS. Each of the eighteen Q^2 points necessitates a given beam energy. This set-up implies the use of two adjustable chicanes for the beam, both upstream and downstream of the liquid deuterium target. The overall design is inspired by the successful SLAC experiment, which measured $B(Q^2)$ up to $Q^2 = 2.7$ $(GeV/c)^2$. Based on an extrapolation of the SLAC experiment performance, this experiment appears to be feasible.

Issues: The knowledge of the deuteron electromagnetic structure is of fundamental importance in nuclear physics and the experiment has the potential to complement in a very significant way the experiments already completed at Jefferson Lab. It was felt that the physics discussion put emphasis on the region of the minimum of $B(Q^2)$, where data already exists. The applicability of different model calculations to the whole region to be measured ($Q^2 = 2.5$ to 5.5 $(GeV/c)^2$) should be explored more systematically. A secondary concern addresses higher order processes such as two-photon exchange which could alter the precise determination of the node of G_M. It is realized however that the evaluation of such processes is beyond the scope of this experimental proposal.

On the experimental side, many issues should be addressed in a more systematic and quantitative way than in the present proposal. In particular:

1) The design of the magnetic arrangement should include a detailed list of components (magnets, power supplies, etc), with their characteristics and availability.

2) The mechanical arrangement of the whole set-up should be worked out in more detail with the Hall A management and engineering staff, in order to ensure no basic incompatibility with other Hall A equipment.

3) The optics of the magnetic transport should be studied at least to second-order, and the results applied to electron and deuteron trajectories coming from elastic scattering.

4) A complete simulation taking into account the target length and material, the magnetic transport lines, the detector packages and their resolutions should be performed. The mismatch between the electron and deuteron arms and the resulting acceptance should be quantified. With the help of this simulation, the relevance of the electron-proton measurement to check the electron-deuteron cross sections could be studied.

5) The fraction of elastic electron-deuteron events due to magnetic scattering should be given for each Q^2.

6) The losses due to radiative processes should be evaluated.

7) The ambient background in the electron hut should be estimated and the shielding requirement established.

8) The physical background due to $\gamma d \rightarrow \pi^0 d$ (and $\gamma d \rightarrow \gamma d$) should also be simulated, with reasonable assumptions as to the extrapolation of cross sections to the relevant energies and angles.

9) Systematic errors should be evaluated. In particular, the contribution from charge scattering, with its uncertainties (statistical and systematic errors on the elastic structure function A) will set a sensitivity limit in the value of B.

The PAC encourages the collaboration to address these issues and to submit a complete proposal.

Recommendation: Defer.

Individual Proposal Report

Proposal: PR 03-113

Scientific Rating: A

Title: Investigation of Exotic Baryons States in Photoproduction Reactions with CLAS

Spokespersons: K. Hicks and S. Stepanyan

Motivation: The search for hadrons consisting of more than three constituent quarks has a long history. Such states are compatible with QCD, but in general no solid candidates have been identified. Recent measurements at LEPS/SPring-8, DIANA, and CLAS have provided evidence for a state at about 1.54 GeV with positive strangeness and a very narrow width (<25 MeV). The statistical significance of each measurement is typically 4–5 standard deviations. This exotic object, labeled the Θ^+, cannot be an ordinary baryon made with three quarks since it must contain an $\bar{s}$ quark.

Measurement and Feasibility: It is proposed to confirm the existence of this state at CLAS using the tagged photon facility at 3 GeV. A high statistics run is proposed to study the reaction $\gamma + d \rightarrow p\, K^-\, \Theta^+ \rightarrow pK^-\, K^+\, n$. with a two charged particle trigger. The proposed measurement will increase the yield by a factor of 20 over the current CLAS results and would permit investigation of the decay angular distribution, the isospin, the excitation function, and a systematic investigation of background processes. The CLAS measurements give a clear demonstration of what can be achieved, and provide a firm basis for confirming the feasibility of the proposed measurement, the production rates, and mass width. Simulation studies have explored the impact of the acceptance of CLAS on measurement of the decay angular distributions and background processes. The PAC judges the measurement to be feasible.

Issues: The PAC agrees that the proposed high statistics measurement at CLAS is capable of testing the existence of the Θ^+, determining several of its quantum numbers, and measuring its excitation function. The role of possible singularities in the re-scattering process should also be investigated. In addition, the PAC regards measurement of the parity of the candidate system as a crucial feature in its interpretation and urges the collaboration to evaluate measurements that would address this important issue.

Recommendation: Approve for 30 days in Hall B.

Individual Proposal Report

Proposal: PR 03-114

Scientific Rating: N/A

Title: Flavor Decomposition of Nucleon Spin Structure

Spokespersons: X. Jiang, D. Day, and M. Jones

Motivation: From a measurement of the double spin asymmetry A_{LL} in semi-inclusive deep-inelastic scattering (SIDIS) off hydrogen and deuterium targets, a flavor decomposition of the nucleon spin structure was recently obtained by the HERMES collaboration. The goals of this proposal are to test the validity of factorization in polarized SIDIS at an electron beam energy of 6 GeV and to measure the polarized quark and anti-quark distributions in the region of $0.12 < x < 0.43$ with significantly improved statistical accuracy over previous experiments.

Measurement and Feasibility: The proposed measurement would use a 6 GeV polarized electron beam and longitudinally polarized NH_3 and LiD targets. The scattered electrons would be detected in a large lead-glass array equipped with a gas Cherenkov counter. Charged hadrons of momentum P, would be detected in coincidence, with particle identification over the momentum range of $1.8 < P < 3.5$ GeV/c. A Monte Carlo simulation of the expected background rate has been carried out and the experiment appears feasible.

Issues: A precise determination of the flavor dependence of the nucleon spin structure is of importance. However, the PAC has identified several issues of concern. The interpretability of the semi-inclusive data at this beam energy in terms of the parton distribution functions is not evident. The contamination of hadrons originating from the target fragmentation region needs further study. The systematic uncertainty caused by the partial ϕ-angle coverage of the HMS should be addressed. In addition, a detailed analysis of the expected systematic uncertainties for extracting the sea quark polarizations needs to be performed. Finally, the positron background in the calorimeter at a relatively low shower threshold of 0.5 GeV requires further study.

Recommendation: Defer.

Individual Proposal Report

Proposal: PR 03-115

Scientific Rating: N/A

Title: Hadronization in Nuclei by Deep Inelastic Electron Scattering

Spokespersons: K. Wang, B.E. Norum, and J.P. Chen

Motivation: The goal of this proposal is to study the process of the formation of hadrons through the semi-inclusive measurement of deep inelastic electron scattering from nuclei. Medium modification of the hadron formation process will be studied by comparing the hadron yield in a given kinematics to that in deuterium. This modification may occur at the partonic, pre-hadronic, and hadronic stage of the hadronization. Therefore, an accurate analysis performed as a function of different kinematical variables will be important.

Measurement and Feasibility: It is proposed to run the experiment in Hall A with a 6 GeV electron beam on an existing LD_2 target, as well as carbon, copper and tungsten foils. Electrons will be detected in HRSr while charged hadrons will be detected and identified in HRSl. Six detector settings are proposed to measure the dependence on z (1), on the charge of the hadron (2), on p_T (3 and 4), on Q^2 (5), and on ν (6). The experiment appears feasible as proposed.

Issues: Since in this field much data is now available from HERMES and new data will be generated by CLAS, E 02-104, the PAC regards a new measurement as critical only if the choosenkinematics will provide new and more accurate data. In this respect, the settings 1, 2 and 5 appear more relevant while the proposed ranges for the p_T and ν studies are too limited.

The PAC 24 would like to see this experiment performed, but due to limitations in the available beam time, the proposal cannot be accepted at this time.

Recommendation: Defer with Regret

Appendix E

Individual Letter of Intent Report

Letter of Intent: LOI 03-101

Title: Search for Evidence of Two-Photon Exchange: Measurement of the Recoil Vector Polarizations in Elastic Electron-Hadron Scattering

Contact Person: R. Suleiman and R. Gilman

This LOI addresses the longstanding question of the relative role of two-photon exchanges in electron scattering. This process is of general importance in electron scattering and might explain the observed discrepancy between the data on the charge form factor of the proton from Rosenbluth decomposition and polarization transfer from polarized electrons. The observable chosen is the induced polarization P_y in ep and ed elastic scattering, which vanishes for single photon exchange. The deuteron is included because the more rapid fall-off of its elastic form factors yields a larger signal. It is intended to measure simultaneously the vector polarization transfer ratio P_x / P_z for elastic scattering off the deuteron in order to provide independent checks on its form factors which also rely on Rosenbluth decomposition.

The polarization will be determined with an optimized Hall A focal polarimeter. The uncertainties in the measurement of $P_{y,}$, which are usually less important, are crucial here and must be brought under control. Additional calibration runs using pions are foreseen to check false asymmetries. The total amount of beam time required is of the order of 30 days. The PAC recognizes the importance of the physics question addressed and expects that the proposed method will deliver significant results. The collaboration is encouraged to submit a full proposal in due time. An interchange of the hadron and electron arms to reduce systematic errors should be explored.

Individual Letter of Intent Report

Letter of Intent: LOI 03-102

Title: Measuring Polarization Transfer from Electron to Lambda in Exclusive K* Electroproduction at CLAS.

Contact Person: M. Mestayer and D. Carman

CLAS has recently published the first measurements of spin transfer in the nucleon resonance region from a longitudinally polarized electron beam to the Lambda in exclusive K^+ Λ electroproduction. Using a semi-classical argument based on flux-tube breaking, it is suggested that the $^3P_0$ model, widely used to describe the decay of hadrons, fails to describe the observed Lambda polarization. In this approach it appears that the $s\bar{s}$ quark pair is produced with its spins predominantly anti-parallel. The same argument predicts that the direction of the Lambda's polarization should reverse when the recoil meson is a spin 1 K^{*+}. It is proposed to use CLAS to study polarization transfer in the electroproduction of K^{*+} Λ on a hydrogen target at a beam energy of 5-6 GeV.

The PAC does not encourage the submission of a proposal at this time. It is not obvious that a partonic approach to exclusive $K^+\Lambda$ electroproduction in this kinematical range is appropriate, and the situation is certainly less promising for $K^*\Lambda$ electroproduction. Nor is it clear that the $^3P_0$ model is an appropriate model for the creation of an $s\bar{s}$ pair in the context in which it has been applied. The $^3P_0$ model is not a fundamental theory. It is a largely successful phenomenology, but no more, and tests of it are best made in a clean environment, such as the decay of a well-defined state, which is not the case here. Alternative descriptions of the $K^+\Lambda$ electroproduction data should be explored to see if the conclusions on the $^3P_0$ model are robust. For example, there are hadronic models available which could be tuned to incorporate the new $K^+\Lambda$ results.

Individual Letter of Intent Report

Letter of Intent: LOI 03-103

Title: Helicity Asymmetry A_{LL} in π- Production from Polarized Neutrons by 4.3 GeV Photons

Contact Person: B. Wojtsekhowski, E. J. Brash, and A. J. Sarty

This LOI considers the measurement of the helicity asymmetry A_{LL} in π^- photoproduction on polarized ^{3}He target at large –t and large s. The primary goal is to test the handbag mechanism which describes a variety of hard exclusive processes in the framework of GPDs. This measurement is a logical extension of the Real Compton Scattering experiment recently carried out at Hall A.

The measurement of the helicity asymmetry for wide-angle pion photoproduction at a value of *s* above the resonance region would provide an interesting test of the handbag mechanism. Information obtained from such a measurement is important for the JLab GPD program. The PAC would encourage a submission of a full proposal. A careful evaluation of the nuclear effects on the helicity asymmetry should be carried out. Monte Carlo simulation, taking into account the Fermi motion in ^{3}He, is required to assess the performance of the spectrometers for identifying the signals. It would also be very helpful to have theoretical predictions for A_{LL} from several models of this double spin asymmetry in order to justify the required statistical accuracy.

Individual Letter of Intent Report

Letter of Intent: LOI 03-104

Title: The Longitudinal Photon, Transverse Nucleon, Single-Spin Asymmetry in Exclusive Pion Electroproduction

Contact Person: G. M. Huber, D. Gaskell, and G. Warren

This LOI describes a measurement of the target single-spin asymmetry in $ep \to e'\pi^+ n$ with a transversely polarized target. It is planned to use BETA, a lead glass calorimeter combined with Cherenkov detectors for electron detection, the HMS for the detection of the pion, and a polarized NH_3 target.

The experiment is extremely challenging since it requires first the isolation of a Fourier component of the polarized target cross section and then, by Rosenbluth techniques, the separation of the cross section for longitudinally polarized photons and transversely polarized protons. It is planned to take data over a large range of t at $Q^2 \approx 2$ $(GeV/c)^2$, W $\approx$ 2 GeV and x $\approx$ 0.4. It is claimed that the implied Rosenbluth separation is unique to JLab and is, for instance, not possible at HERMES.

The separation of the cross sections for longitudinally polarized photons from those for transversely polarized photons is an important step in the theoretical analysis of the single-spin asymmetry since factorization does not hold for transversely polarized photons in the deep virtual regime. Thus, there is a chance that the cross sections for longitudinally polarized photons will show scaling at values of Q^2 as low as 2 $(GeV/c)^2$ The measurement may allow for an extraction of further information on GPDs and is complementary to DVCS. Deep virtual electroproduction of pions is sensitive only to the GPDs $\tilde{H}$ and $\tilde{E}$; H and E do not contribute. Moreover, since the asymmetry requires proton helicity flip, the experiment may allow the extraction of E tilda, $\tilde{E}$ one of the two GPDs not constrained by knowledge of ordinary parton distributions. The measurement is therefore very important.

However, the PAC is concerned with the following issues: It should be demonstrated that the GPD contribution is dominant at $Q^2 = 2(GeV/c)^2$. Do other contributions, like the soft overlap discussed in Ref. [11], to a large extent cancel out in the ratio? How can one check that scaling holds at the given low Q^2?

Monte Carlo simulations are needed in order to demonstrate the feasibility of the extraction of the single-spin asymmetry given the limited angle resolution. The required exclusiveness should be tested with realistic non-exclusive channels.

For a valid LT separation a precise definition of the three-momentum transfer, q, is required both in absolute value and in angle, and therefore a precise measurement of the e´ momentum is indispensable. Whether BETA is adequate as an electron detector is not clear.

Individual Letter of Intent Report

Letter of Intent: LOI 03-105

Title: Probing QCD Symmetry Breaking Effects via the Parity Violating $N \rightarrow \Delta$ Asymmetry at Low Q^2

Contact Person: T. A. Forest, S. P. Wells, N. Simicevic, and K. Johnston

The proposed measurement is motivated by the observation that the parity-violating asymmetry in the radiative decay of polarized hyperons, such as $\Sigma^+ \rightarrow p\gamma$, is anomalously large. In the case of the Σ^+ decay, the experimental asymmetry is 6 standard deviations from predictions assuming conventional estimates of SU(3) symmetry breaking. This asymmetry is driven by an electric-dipole matrix element which also sets the scale of the parity-violating E1 $N \rightarrow \Delta$ transition. Assuming the dynamics in the strangeness-conserving $N \rightarrow \Delta$ process is the same as in $\Delta S=1$ hyperon decay, recent calculations predict an enhancement in the parity-violating $N \rightarrow \Delta$ asymmetry by a factor of about 100, corresponding to an asymmetry of about 4 ppm. The collaboration proposes to search for this asymmetry in inclusive inelastic scattering of longitudinally polarized electrons from hydrogen using the Q_{weak} spectrometer under development for Hall C.

In the proposed measurement, the field in the Q_{weak} magnet would be set about 15% lower than in the currently approved Q_{weak} experiment, E02-020, so that inelastic electrons corresponding to Δ excitations between the π-threshold and the 2π-threshold would be focused onto the detectors. The elastically scattered electrons would then be closer to the beam line and miss the spectrometer. All other aspects of the Q_{weak} operation would be the same.

This experiment would provide a measurement near the photon point at $Q^2 = 0.024$ $(GeV/c)^2$ with an apparatus designed to measure an order of magnitude smaller effect (0.3 ppm). The total systematic uncertainties from theory, from the beam polarization and from the Q^2 extrapolation to zero have been estimated to be 0.063 ppm. Seven days of running have been requested to bring the statistical error down to the same value, yielding a total uncertainty of 0.091 ppm or 2.3% of the expected asymmetry. If scheduled contiguous with the Q_{weak} experiment, calibration and setup time would be minimal (1 day).

The same asymmetry will be studied in the *G0* experiment, albeit at a higher Q^2 and with much lower precision (~25%). Nonetheless, this will provide some experience on backgrounds and a first look at the magnitude of the effect.

This experiment could potentially make an impact on an interesting puzzle in hyperon decay and may have consequences for the understanding of symmetry-breaking mechanisms. Given the large predicted asymmetry, it would seem that a factor of three reduction in statistics is more than adequate to access the applicability of the calculations. When combined with the projected systematic error, this would result in a doubling of the total uncertainty to 0.186 ppm, or 4.6% of the predicted 4 ppm asymmetry. The additional beam time required for this measurement would be 1 day for running + 1 day for calibrations. If this cannot be accommodated within the already approved Q_{weak} allocation, a formal proposal should be prepared. Such a proposal would be strengthened by specific comparisons to the *G0* effort and a consideration of the implications of non-resonant backgrounds.

Individual Letter of Intent Report

Letter of Intent: LOI 03-106

Title: $\vec{e} - {}^2H$ Parity Violating Deep Inelastic Scattering at CEBAF 6 GeV

Contact Person: X. Zheng

This LOI proposes to perform a measurement of the parity violating deep inelastic asymmetry of $\vec{e} - {}^2H$ at $Q^2 = 2$ (GeV/c)^2 with a 6 GeV beam.

The two Hall A HRS spectrometers will be used to detect the electrons scattered from a 15-cm liquid deuterium target. The deuterium target is chosen due to the isospin symmetry that relates u and d quark distributions in the proton and neutron.

A Compton polarimeter upgrade for a 1% precision of the beam polarization and a fast DAQ to handle rates of about 1 MHz will be needed for this measurement. These two specific requirements appear feasible but should be better investigated.

From the asymmetry measurement, the weak mixing angle $\sin^2\vartheta_W$ will be extracted to test the prediction of the Standard Model in a Q^2 domain between the present NuTeV results and the expected ones from SLAC-E158 and JLab-Q_{weak}. The accuracy of the present proposal will not be at the level of the approved JLab-Q_{weak} and not better than the NuTeV result.

In addition, the proponents would like to extract precise information on a combination of the poorly known weak V-A C_{2u} and C_{2d} couplings and on the possible higher twist effects in this Q^2 domain. Since the asymmetry will be dominated by the combination of the A-V C_{1u} and C_{1d} couplings, this extraction will be based on assumptions or on existing results at different Q^2. The implication of this procedure should be better investigated by the Collaboration. Also, the separation of higher-twist effects from deviations beyond the Standard Model should be addressed.

The success of the proposed experiment will depend on the precision of the knowledge of the beam polarization and on a series of corrections like the charge symmetry violation, the electro-magnetic, and electro-weak radiative effects which should be determined with high accuracy.

The PAC recognizes the importance of the proposed measurement but notices that a significant improvement in the test of the Standard Model will not be achieved. In addition, a more convincing case for the extraction of the V-A couplings is required.

Appendix F

Jefferson Lab Experiments, PAC 4-24, Grouped by Category

To access Appendix F, go to
http://www.jlab.org/exp_prog/PACpage/PAC24/ExpSum.pdf