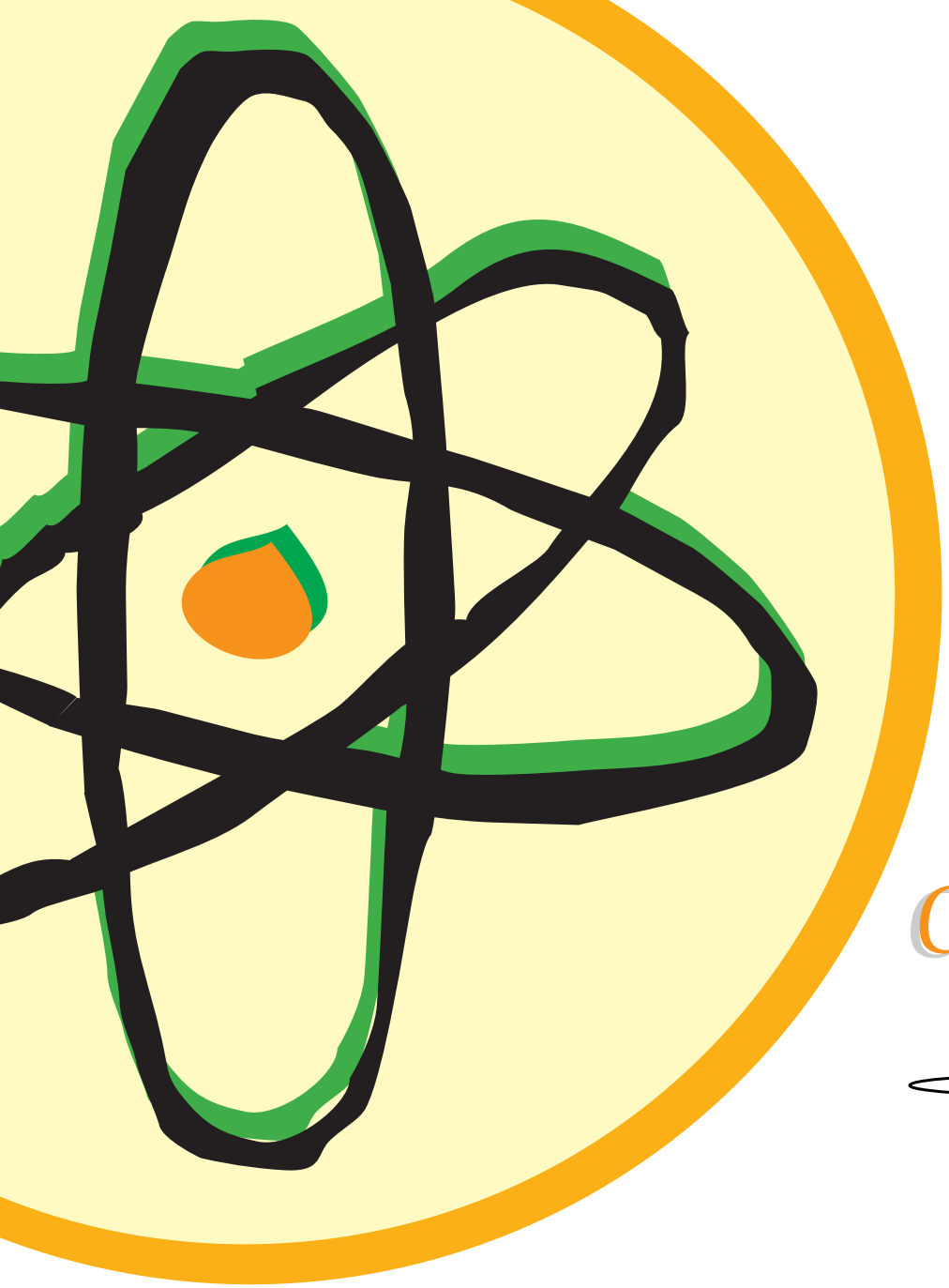

JLab Program Advisory Committee

Jefferson Lab

Report of the July 17-19, 2000

PAC 18

The Thomas Jefferson National Accelerator Facility (Jefferson Lab) is a national physics user facility managed by the Southeastern Universities Research Association (SURA), Inc., for the U.S. Department of Energy (DOE) under contract DE-AC05-84ER40150.

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Report of the
July 17-19, 2000
Meeting of the

Jefferson Lab
Program Advisory Committee

PAC 18

August 23, 2000

Dear Members of the Jefferson Lab User Group,

The physics program continues to become more productive due to the ongoing enhancements in beam quality. During a trial run in the beginning of August, the accelerator delivered a beam of 6.07 GeV. From our past experience, this will ultimately lead to routine and reliable operations at an energy which is 150% more than the original CEBAF design energy of 4 GeV. The polarized source has also been improved, a 75%, 108 μA beam was delivered to Hall A in June, a world's record!

The operations of all three halls have exceeded our goals during the first and second quarters, delivering a total of 27.1 weeks of useful beam time. This was made possible through steady improvements in the availability of the experimental equipment in each of the halls. Almost a quarter of the approved experiments has been completed, producing a steady stream of first class journal publications and papers presented at conferences. This includes the first Hall B published paper. A total of 57 PhDs have been awarded based on Jefferson Lab experiments, and the User Group Board of Directors, to honor thesis excellence, has now established an annual thesis prize.

Due to the hard work and enthusiasm of the user community we have made significant progress towards achieving our next goal of 12GeV. Five mini-workshops and two user group workshops were held over the last few months to determine the proposals that will be included in the white paper, "Jlab @ 12 GeV." PAC members, in conjunction with the PAC 18 meeting, participated in a workshop that reviewed the 12GeV proposal. They concluded that, "an outstanding scientific case has been identified which requires the unique capabilities of the JLAB 12 GeV upgrade." The white paper will be submitted for review at the upcoming NSAC meeting.

In addition to the success in the nuclear physics program, the FEL effort continues to improve on earlier achievements. A new record of 940 watts of laser power, at 3 and 6μm, was delivered to the FEL User Labs. FEL researchers now have a unique and powerful tool for scientific and industrial research. The FEL project also hosted the biannual Laser Processing Consortium Workshop on June 19-20. The workshop agenda included discussion of the upgrade capabilities, the results from the March 2000 FEL user run, and planning for the July 2000 FEL user run. I am pleased to report that both the March and July runs were very successful and that Dr. Gwynn Williams, from BNL, has now joined the FEL staff and is working to build the science case for the FEL.

I would like to take this opportunity to thank Don Geesaman and the members of the PAC and our user community for their work on behalf of Jefferson Lab. The PAC's thorough deliberations on the physics program and their review of the lab's upgrade proposals were invaluable. Particular thanks go to both the PAC and the User community for their participation in and effective use of the "jeopardy." This process ensures the high quality of the physics program while reducing the backlog of experiments to a more

reasonable interval of three to four years. A special thanks to Charles Prescott and Jacques Martino as they leave the committee after servicing the past six PACs. Finally, I am pleased to enclose the PAC 18 report.

Sincerely,

Hermann Grunder
Director

Report of the July 14-19, 2000 Meeting of the Jefferson Lab Program Advisory Committee (PAC18)

Introduction

The Jefferson Lab Program Advisory Committee held its 18th meeting on July 14–19, 2000. The first two days were spent in a comprehensive review of the general physics case and individual experimental programs for the 12 GeV upgrade proposal. The PAC concluded that an outstanding scientific case exists for the upgrade and reviewed this in detail in a separate report. The last three days of the meeting were taken up with the normal review of experiment proposals for the present facility. The membership of the Program Advisory Committee is given in Appendix A. In response to the charge (Appendix B) from the director, Dr. Hermann Grunder, the committee reviewed and made recommendations on eighteen new proposals and two letters of intent.

The PAC would like to acknowledge the efforts of the laboratory staff in support of the PAC meeting, especially those of Shauna Cannella.

This was the last opportunity for the PAC to work with Karen Hokansson, who is leaving the laboratory. Karen's efforts in support of the PAC, the laboratory and the user community have made a permanent mark on Jefferson Lab. Her can-do attitude and commitment made all our work better and we will sorely miss her. We wish her the best in her new endeavors.

General Overview

The PAC noted that the experimental program continues to proceed well. The number of weeks of beam delivered to experiments, combining the accelerator performance and the Hall multiplicity, exceeds the goals of the laboratory. High current (100 μA), high polarization (75%) polarized beam has been delivered to experiments with good cathode lifetime. We look forward to the demonstration of 6.0 GeV capability later this summer. [This was successfully demonstrated in early August.] We also note with pleasure the first submission of a physics publication from the CLAS collaboration. The PAC would like to reemphasize its encouragement of more complete archival publications of the results of each JLAB experiment. The experimenters have a responsibility to the community and the laboratory to make as much information as possible easily available.

Recommendations

The laboratory guidelines provided for the approval of 109 days of beam time in Hall A, 30 days of beam time in Hall B and 51 days of beam time in Hall C. These guidelines were established based on 30 days of new time to be available in each Hall plus 50% of the time from approved experiments returning to the PAC due to the jeopardy process.

This was the first PAC considering jeopardy proposals in Hall A. Due to the large number of such proposals they were spread over PAC 18 and 19. Nine Hall A proposals and three Hall C proposals under jeopardy were considered at this meeting. The PAC is allowed to exceed the laboratory guidelines if it believes the physics has sufficiently high priority, at the level of an A- rating or better, but the excess is then deducted from the allocation of the next PAC meeting. The high demand for beam time in Hall A at this meeting made the task of the PAC extremely difficult and it was necessary to defer several experiments that the PAC would like to see done. The PAC approved five experiments in Hall A for a total of 111 days, one experiment in Hall B for 0 additional days of beam time and three experiments in Hall C for a total of 35 days.

The reports and PAC recommendations for the reviewed proposals and the letters-of-intent are given in Appendices D and E. The tables on the following pages summarize the results from PAC 4-18.

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Donald Geesaman
Chair, Jefferson Lab Program Advisory Committee

APPENDICES

A. PAC18 Membership

B. Charge to PAC18

C. PAC18 Recommendations

D. PAC18 Individual Proposal Reports

E. PAC18 Letters-of-Intent

- Approved Experiments, PACs 4–18, Grouped by Physics Category
  (To access Appendix F, go to http://www.JLab.org/exp_prog/PACpage/)

Totals for PAC 4-18

	Experiments Recommended for Approval	Experiments Recommended for Conditional Approval	Totals
Experiments	121	11	132
Authors	820	49	869
Institutions	148	8	156
Countries	24		24

Approved Experiments Totals by Physics Topics

Topic	**Number**	**Hall A**	**Hall B**	**Hall C**
Nucleon and Meson Form Factors & Sum Rules	16	6	3	7
Few Body Nuclear Properties	23	12	6	5
Properties of Nuclei	23	5	10	8
N* and Meson Properties	40	6	26	8
Strange Quarks	19	5	11	3
TOTAL	**121**	**34**	**56**	**31**

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	12 / 2×.5 1×.67 1x.1	266.9	19.23	516.1	4
B	2 / 1×.88 2×.8 3×.76 4x.72 23x.5 6x.61 4x.27	237.8	29.11	278.29	5
C	13 / 1×.5 1×.25	247.5	16.75	400	2
Total	27 / ~26.41	752.20	65.09	1194.39	11

Appendix A

PAC18 Membership

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Appendix B

Charge to PAC18

Jefferson Lab requests that PAC18:

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 four actions on each proposal, extension or update:
   - Approval,
   - Conditional approval status pending clarification of science issues,
   - Deferral, or
   - Rejection.

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.

6) Review Jefferson Lab's plans for the 12GeV upgrade per the attached charge.

*Beginning with PAC15, previously-approved proposals that have not run within 3 years of approval or 3 years after the start of physics in the relevant hall (whichever is later) 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

PAC18 Recommendations

Class*/Grade/Days

A/B$^+$/12	E-00-101	A Precise Measurement of the Nuclear Dependence of Structure Functions in Light Nuclei
A/A$^-$/20	E-00-102	Testing the Limits of the Single Particle Model in ^{16}O(e,e'p)
D	PR-00-103	Deuteron Electrodisintegration at Threshold at Large Momentum.
R	PR-00-104	A Study of Longitudinal Charged Pion Electroproduction on ^{1}H, ^{2}H, ^{3}He, and ^{4}He.
D	PR-00-105	New Measurement of G_E/G_M for the Proton
D	PR-00-106	Measurement of Small Components of the ^{3}He Wave Function Using ^{3}He(e,e'p) in Hall A
A/A$^-$/11	E-00-107	Proton Polarization in Deuteron Photodisintegration to $E_\gamma > 3$ GeV at $\theta_{cm} = 90°$
A/B$^+$/20	E-00-108	Duality in Meson Electroproduction
R	PR-00-109	Channeling Radiation from GeV Electrons in Diamond
C/A$^-$/20	E-00-110	Deeply Virtual Compton Scattering at 6 GeV
D	PR-00-111	Measurement of G_E^p/G_M^p to $Q^2 = 9$ (GeV/c)^2 Via Recoil Polarization
A/B/0	E-00-112	Exclusive Kaon Electroproduction in Hall B at 6 GeV
D	PR-00-113	Measurement of Neutron (^{3}He) Spin Structure Functions in the Resonance Region.
A/A/30	E-00-114	Parity Violation from ^{4}He at low Q^2, A Clean Measurement of ρ_s
D	PR-00-115	Measurements of the Light Quark and Antiquark Distribution Ratios in the Nucleon Through Semi-Inclusive Reactions
A/B$^+$/3	E-00-116	Measurement of Hydrogen and Deuterium Inclusive Resonance Cross Sections at Intermediate Q^2 for Parton-Hadron Duality Studies
D	PR-00-117	Measurement of $R=\sigma_L/\sigma_T$ in the Nucleon Resonance Region
A/A$^-$/30	E-00-118	Elastic Electron Scattering off ^{3}He and ^{4}He at Large Momentum Transfers

* A=Approve, C=Conditionally Approve, D=Defer, R=Reject

Individual Proposal Report

Proposal: E-00-101

Scientific Rating: B^+

Spokesperson: J. Arrington

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

Motivation: The aim of the proposed experiment is to test models of the EMC effect using data for very light nuclei and to examine the systematic uncertainties in extracting neutron structure functions using data on nuclear targets.

Measurements: Inclusive electron scattering from ^{1}H, D, ^{3}He, and ^{4}He would be measured in the kinematic region $x>0.3$ for $1<Q^2<8$ $(GeV/c)^2$. A fraction of these data are in the classic DIS regime with $W^2 > 4$ GeV^2 and the data at the highest values of x generally have $W^2<2$ GeV^2. Ratios of precise cross sections for ^{3}He and ^{4}He to the deuterium cross sections would constitute the first EMC data for ^{3}He at large x and improve significantly on previous EMC data for ^{4}He. Neutron structure functions will be extracted by comparing the data on ^{1}H and D; these will be compared with similar data extracted from a comparison of ^{3}He and ^{1}H data, or ^{4}He and ^{3}He data. Proton structure functions can also be studied this way.

Feasibility and Issues: Data show that the EMC effect in ^{4}He may differ from that in heavy nuclei, and a recent calculation indicates that the shape of the EMC ratio as a function of x may be different for ^{3}He and ^{4}He. Thus new data would be very useful. If all the proposed data were in the DIS region, the experimental goals could be readily satisfied and the data would be of considerable interest. Extraction of neutron structure functions from data on nuclear targets involves substantial uncertainties, and the comparison of data obtained from several light nuclei should be a fruitful method of investigating the errors. The problem in the analysis is the fact that much of the data are in the resonance region, so that some kind of averaging technique or reliance on duality is required, as discussed in the proposal. Even if the averaging yields a smooth curve, it is not clear that the data will reflect the underlying parton distributions rather than properties of individual resonances. Still, an exploratory effort to examine EMC ratios and structure functions determined from nuclear data seems warranted.

Recommendation: Approve for 12 days.

Individual Proposal Report

Proposal: E-00-102

Scientific Rating:. A^-

Title: Testing the Limits of the Single Particle Model in $^{16}O(e,e'p)$: An Update to E-89-003.

Spokesperson: A. Saha, W. Bertozzi, L. Weinstein and K. Fissum

Motivation: It is proposed to study the relativistic single-particle description of valence proton knockout and the longitudinal component of the higher missing energy cross section, which is expected to be dominated by two-nucleon knockout.

Measurement and feasibility: The cross sections and left-right asymmetry A_{LT}, giving the R_{LT} structure function, will be measured in the $^{16}O(e,e'p)$ reaction for missing momenta p_m up to 550 MeV/c (with additional cross section points up to 800 MeV/c) for the bound $p_{1/2}$ and $p_{3/2}$ hole states and for the unbound $s_{1/2}$ hole state up to a missing energy E_m of 60 MeV. The continuum up to E_m = 150 MeV will be studied for p_m values up to about 350 MeV/c. These measurements extend greatly the range of data taken in E-89-003. The experimental set-up and method are well suited for this study, as has been demonstrated by E-89-003. Extensive modern relativistic bound state and DWIA calculations are available. The authors have also carefully investigated the experimental issues.

Issues: Although the effects of a relativistic description are mainly visible at high missing momenta, where the cross sections are small and several ingredients play a role, the presented calculations indicate that the LT data for p-knockout will have a real sensitivity to those relativistic effects. Apart from that this experiment will provide benchmark data for information on high-momentum components in the nuclear wave function for valence knock-out. There is some concern about the contribution of unresolved states close to the $3/2^-$ peak, which must be estimated. Studying the LT character of the continuum seems a fair first way to learn more about the mechanism of proton knock-out in this region, but was viewed to be of lesser importance.

Recommendation: Approve for 20 days.

Individual Proposal Report

Proposal: PR-00-103

Scientific Rating: N/A

Title: Deuteron Electrodisintegration at Threshold at Large Momentum Transfer

Spokespersons: J. Jourdan and G.A. Warren

Motivation: The goal of the experiment is to measure the differential cross section for electrodisintegration of the deuteron near threshold to the highest practical momentum transfer, limited only by the projected cross-section sensitivity of 9×10^{-42} $cm^2/(sr\ MeV)$.

Measurement and Feasibility: The experiment would be carried out with the high resolution spectrometer at 160 degrees in Hall A. Background from elastic scattering would be minimized and the energy resolution in the (n-p) system will be in the range of 0.8-1.5 MeV. This is at least an order of magnitude better than the SLAC experiment over a similar kinematic range and comparable to the Bates results at lower Q^2. The projected statistical errors are small, ranging from 3 – 18%. The measurements would extend to a maximum Q^2=95 fm^{-2}, beyond the existing SLAC data.

Issues: At present deuteron electrodisintegration appears to be a challenge for theory and not for experiment. It was not clear if the results would provide significant new information that could in turn motivate theoretical efforts for a better understanding of the deuteron. The high resolution Bates measurements have confirmed the SLAC results in the region of overlap. The proposed measurements do not significantly exceed the currently measured Q^2 range. The PAC would like to see a more extensive discussion of exactly how the new results would improve the comparison with various models and our understanding of deuteron structure.

Recommendation: Defer

Individual Proposal Report

Proposal: PR-00-104

Scientific Rating: N/A

Title: Update to Experiment E-91-003: A Study of Longitudinal Charged Pion Electroproduction on ^{1}H, ^{2}H, ^{3}He, and ^{4}He

Spokesperson: H.E. Jackson

Motivation: The aim is to determine the longitudinal cross section in parallel kinematics using a Rosenbluth separation, and to search for target-mass dependent effects, which are related to the nuclear sea-quark distributions. The intent is to improve the precision of measured nuclear ratios of σ_L from 10% to 5%. Knowledge of nuclear excess pion content is central to our understanding of nuclear physics.

Measurement and Feasibility: Previous measurements would be extended to higher values of W and to a ^{4}He target. Using larger values of W would simplify the analysis in several ways and the nucleus ^{4}He has the advantage of having a relatively large density. The PAC believed that the proposed measurements could be made to the desired accuracy.

Issues: At present there seems to be no clearly defined relation between the predicted excess pion density and the longitudinal cross section. The committee was not convinced that additional experimental data would clarify our understanding of the nuclear pion excess.

Recommendation: Reject

Individual Proposal Report

Proposal: PR-00-105

Scientific Rating: N/A

Title: New Measurement of G_E/G_M for the Proton

Spokesperson: R. Segel

Motivation: Recent focal plane polarimeter (FPP) measurements in Hall A (E-93-027) have found the very interesting result that G_E/G_M decreases steadily from ≈1.0 to 0.6 as Q^2 increases from 1 to 3.4 $(GeV/c)^2$. These observations are in disagreement with a body of earlier L/T separation data showing no significant reduction in G_E/G_M with increasing Q^2, although the L/T data are of much lower precision. The present proposal aims to measure G_E/G_M for the proton at 1.4 and 3.2 $(GeV/c)^2$ with precision sufficient to check the FPP results, using a new variation of the L/T separation technique in which only ratios of cross sections are used.

Measurement and Feasibility: The experiment would be done with two spectrometers, measuring cross sections at different Q^2 simultaneously, with data taken at several beam energies. A low Q^2 (0.5 $(GeV/c)^2$) point would serve as a common normalization to the data at 1.4 and 3.2 $(GeV/c)^2$. Ratios of the high to low Q^2 cross sections taken at different beam energies can be combined to yield a value for G_E/G_M that is less sensitive to many sources of systematic error than the traditional L/T separation measurements.

Protons would be detected in both spectrometers, rather than electrons, with several advantages for the reduction of systematic errors – notably, the kinetic energies of the recoil protons are the same for fixed Q^2 independent of beam energy, and the requirement for precise alignment of the spectrometer angles is 4 times less severe for protons than for electrons.

Issues: The PAC has several concerns about the readiness of the experiment, as presently proposed, to meet its stated precision goals, although several aspects of the technique look quite promising. The proponents have not definitely stated which hall would be optimal for the measurements and have not yet carried out a detailed simulation of the experimental conditions that would be encountered. Without a sufficiently detailed analysis of the systematic errors based on a realistic simulation, the committee cannot be convinced that the proposed measurements will serve as a meaningful check on G_E/G_M.

The collaboration is advised to focus its efforts on Hall A, where there are two identical spectrometers with large target acceptance. The committee encourages the proponents to prepare an improved case and resubmit this proposal at a future PAC meeting.

Recommendation: Defer

Individual Proposal Report

Proposal: PR-00-106

Scientific Rating: N/A

Title: Measurement of Small Components of the ^{3}He Wave Function Using ^{3}He(e,e'p) in Hall A

Spokesperson: F.W. Hersman

Motivation: This is an update of proposal E94-023, which was approved in 1997. This experiment was placed in jeopardy after three years because of scheduling difficulties with the polarized ^{3}He target.

Measurements and Feasibility: This experiment would measure polarized-beam polarized-target asymmetries that are sensitive to small components of the ^{3}He wave function. Such components depolarize the neutron and polarize the proton in polarized ^{3}He. Using parallel kinematics minimizes the number of contributing response functions, while selecting large momentum transfers and appropriate CM energies reduces the influence of final-state interactions, which might complicate the analysis. Three beam energies ranging from 2.4 to 4.0 GeV are required and a total of 24 days of beam are requested.

Issues: The calculations used to set the parameters of the experiment were limited in scope and did not actually identify a signature for the relevant wave function components. This experiment would require analysis by a theoretical group (such as the Bochum group) performing full Faddeev calculations in order to be useful in gauging small wave function components and to provide additional insight into the use of polarized ^{3}He as a polarized-neutron (unpolarized-proton) target. The PAC feels that the present theoretical situation makes this experiment premature.

Recommendation: Defer

Individual Proposal Report

Proposal: E-00-107

Scientific Rating: A^-

Title: Proton Polarization in Deuteron Photodisintegration to $E_\gamma > 3$ GeV at $\theta_{cm} = 90°$

Spokesperson: R. Gilman, R.J. Holt, Z.E. Meziani

Motivation: The goal is to extend the $\theta_{cm} = 90°$ deuteron photodisintegration recoil polarization data up to energies of $E_\gamma \sim 3.2$ GeV.

Measurement and Feasibility: Experiment E-89-019 showed the surprising feature that the normal component of the proton recoil polarization at $\theta_{cm} = 90°$ drops to zero at around 1 GeV, apparently following perturbative expectations. The measurement proposes points at 4 energies, in order to fill gaps in E-89-019 data and to verify whether this behavior persists at higher energy. The feasibility of this extension relies on 3 improvements: the use of a CH_2 polarimeter, an increase of the beam current up to 50 μA with 75 % polarization, and an improved analysis relying on the addition of electro- and photodisintegration data. The C_x polarization component and the angular distribution of cross sections will also be measured (except for the lowest energy point).

Issues: The PAC feels very positive about the experiment, and especially underlines the importance of high energy data, on which the experiment should focus. The PAC also feels that a cross check P_y measurement at lower energy with the foreseen CH_2 polarimeter is necessary. Finally, the PAC considers that the consistency of P_y in electro- and photodisintegration cross sections has already been proven by E-89-019 data, and can therefore be applied.

Recommendation: Approve for 11 days.

Individual Proposal Report

Proposal: E-00-108

Scientific Rating: B^+

Title: Duality in Meson Electroproduction

Spokesperson: R. Ent, H. Mkrtchyan and G. Niculescu

Motivation: The goal of the experiment is to study quark-hadron duality ("Bloom-Gilman duality") and factorization in semi-inclusive meson electroproduction. There are two main questions: (i) do the cross sections factorize at low energies and reproduce the fragmentation functions determined from high energy scattering? (ii) do nucleon resonances average around these high energy fragmentation functions?

Measurement and Feasibility: The experiment focuses on charged pion production from p and d targets. It requires a beam of 6 GeV or higher in order to access kinematics with adequate meson momentum in the final state ($p_\pi > 2$ GeV to avoid complications from π-N final state interactions). The x dependence at fixed z, and z dependence at fixed x, will be separately mapped.

Issues: Bloom-Gilman duality in inclusive scattering is established but not well understood. Exploring the extension of duality into semi-inclusive cross sections is interesting. The direct comparison of cross sections for $ep \rightarrow e\pi^+ + W'$ and $ep \rightarrow e\pi^- + W'$ as functions of x, Q^2 and the missing mass, W', of the remaining hadronic system has intrinsic interest; it can also test duality in these processes, whether or not factorization holds. Furthermore, these data can be used to test factorization. If factorization is found to hold, it can open up new lines of investigation into quark fragmentation and QCD at these kinematics**.**

Recommendation: Approve for 20 days

Individual Proposal Report

Proposal: PR 00-109

Scientific Rating: N/A

Title: Channeling Radiation from GeV Electrons in Diamond

Spokesperson: B. L. Berman and A. Aganyants

Motivation: This experiment proposes to study at CEBAF energies some of the properties of channeling radiation which is produced by electrons passing through thin single diamond crystals. Data in this energy range are presently sparse and a recent measurement at Yerevan at 4.3 GeV shows anomalously large photon angular divergence and small electron energy loss.

Measurement: This experiment would repeat the Yerevan measurement taking advantage of the excellent electron beam properties available at CEBAF and the goniometer, photon tagger and beam profile monitors (BPMs) installed in Hall B. The photons would be produced on a thin diamond crystal (100 - 500 μm) mounted on the goniometer. The beam divergence would be studied using the downstream BPM that provides a two-dimensional profile, and the electron beam energy loss would be measured by detecting the electrons deflected by the tagging magnet with a hodoscope. It is also proposed to study non-linear effects by varying the electron beam current from 1.5 to 150 nA and by focusing the electron beam on the diamond crystal. No measurement of the photon beam polarization has been proposed.

Issue: The PAC is not convinced of the physics interest of this measurement. The anomalous angular divergence observed at Yerevan has not been definitely related to any physical properties of the lattice structure. Non-linear effects are expected to be small and probably are not measurable. A previous experiment at lower energy has shown that the radiation intensity increases linearly over several decades of the beam current. Moreover at CEBAF energies, the broad shape of the photon energy yield would mask possible non-linear effects. While this technique, when used at much lower energies, can be used as a probe in solid state physics experiments, the PAC does not see any direct application at the proposed energies.

Recommendation: Reject

Individual Proposal Report

Proposal: E-00-110

Scientific Rating: A^-

Title: Deeply Virtual Compton Scattering at 6 GeV

Spokesperson: Y. Roblin and F. Sabatie

Motivation: The goal is to check whether the scaling regime is reached for the deeply virtual Compton scattering reaction (DVCS), e p$\rightarrow$e' p γ, and if so, extract skewed parton distributions from the imaginary part of the DVCS amplitude.

Measurement and Feasibility: DVCS (e p$\rightarrow$e' p γ) will be studied by means of measuring a beam helicity cross section difference in a triple coincidence experiment. This method uses the Bethe-Heitler radiation to enhance the DVCS signal. Data shall be taken at three Q^2 values (1.5, 2.0, 2.5 $(GeV/c)^2$) at a fixed x= 0.35. The scattered electron will be detected in HRS, the proton in a plastic scintillator array, still to be built, and the gamma in an electromagnetic Pb-glass calorimeter which is being constructed for a real photon Compton experiment.

Issues: The experiment is seen to be exploratory in both physics and experimental feasibility. There is concern that the proton and gamma detectors will stand the rates under the proposed conditions.

Recommendation: Conditionally approve for 20 days under the condition that adequate high rate performance of the detectors in question be demonstrated to the JLab management.

Individual Proposal Report

Proposal: PR-00-111

Scientific Rating: N/A

Title: Measurement of G_E^p/G_M^p to $Q^2 = 9$ $(GeV/c)^2$ Via Recoil Polarization

Spokesperson: C. Perdrisat

Motivation: Precision measurements of the electromagnetic form factors of the proton are of fundamental importance for our understanding of hadronic structure. This proposal aims to extend previous CEBAF measurements of G_E^p/G_M^p for the proton out to $Q^2 = 9$ $(GeV/c)^2$ using the focal plane polarimeter technique. The same collaboration has measured G_E^p/G_M^p at lower Q^2 with the FPP in Hall A (E93-027) and found a surprising trend that G_E^p decreases steadily with increasing Q^2, relative to G_M^p, down to a ratio of 0.6 at 3.5 $(GeV/c)^2$. These data are of much higher precision than older measurements which relied on the L/T separation technique and saw no significant decrease in G_E^p/G_M^p. The results have sparked great interest, both theoretically and experimentally, and have driven proposals to extend measurements in Hall A out to Q^2=5.6 $(GeV/c)^2$ (E-99-007), and now to continue with new instrumentation in Hall C out to $Q^2 = 9$ $(GeV/c)^2$, which is the highest momentum transfer practically accessible with a 6 GeV CEBAF beam.

Measurements and Feasibility: The collaboration has clearly demonstrated the effectiveness and precision of the FPP technique in its first Hall A experiment, E93-027, and has recently published the very interesting results noted above. The first extension to higher Q^2, E-99-007 will run in Hall A later this year. To reach 9 $(GeV/c)^2$, significantly different apparatus is required, and the collaboration proposes to mount a new campaign in Hall C. A new focal plane polarimeter would be installed in the HMS with a 120 cm CH_2 analyzer. Wire chambers for the new FPP would be constructed by either the Saclay or Dubna groups. In order to match the solid angle acceptance of the electron and recoil proton arms, a large lead-glass calorimeter would be assembled to detect the electrons. The feasibility of the new technique was investigated in two test runs in Hall A this spring with a small array of lead glass blocks and moderate momentum transfers. Test data reproduced the earlier results at 3.0 $(GeV/c)^2$ and looked very encouraging.

Issues: An extension of the G_E^p/G_M^p measurements to higher Q^2 is of great interest, both for the present CEBAF program and the possibilities that would open up with a 12 GeV accelerator upgrade in the future. To mount the proposed experiment in Hall C will require significant cost and effort on the part of the collaboration and the laboratory. The schedule outlined in the proposal indicates that the equipment could be ready for installation and testing in 2003-2004. The committee notes that while the measurements will be challenging, the optics of the Hall C spectrometer should be more favourable for the analysis of the spin precession than in Hall A, and agrees that the new experimental approach seems appropriate.

In view of the significant investment and timescale that will be associated with mounting a new experiment in Hall C, the committee is not convinced of the urgency to approve this proposal immediately. The PAC encourages the collaboration to continue to refine the design of the new apparatus with the aim of incorporating the capability to run eventually at the highest Q^2 that would be practical with a 12 GeV accelerator upgrade. The committee looks forward to the results of the new measurements that will run in Hall A later this year, and encourages the collaboration to present these together with a refined proposal for the higher Q^2 measurements at a future PAC meeting.

Recommendation: Defer

Individual Proposal Report

Proposal: E-00-112

Scientific Rating: B

Title: Exclusive Kaon Electroproduction in Hall B at 6 GeV

Spokesperson: D. S. Carman, K. Joo, G. Niculescu and B. Raue

Motivation: The goal is to provide detailed tests of non-perturbative QCD by extending the kinematic reach of the existing Hall B strangeness physics program both within and beyond the resonance region.

Measurement and Feasibility: A polarized electron beam and the self analyzing power of hyperon weak decays provide single and double polarization measurements that enable spin characteristics of the ep→eKY reactions to be determined. In the resonance region this provides sensitive tests of models of strong interaction dynamics, in particular, QCD-inspired quark models. Beyond the resonance region the measurements can help to understand the extent to which quark degrees of freedom control open strangeness production.

Issues: A strong feature of this proposal is the use of polarization (single and double) to provide a set of data that can severely constrain models. The physics issues are potentially interesting. The PAC was not convinced that increased statistics at this time were essential and would welcome a first set of data to demonstrate what is achievable. The L/T separation was viewed as marginal.

Recommendation: Approve for 0 additional days.

Individual Proposal Report

Proposal: PR-00-113

Scientific Rating: N/A

Title: Measurement of neutron (^{3}He) spin structure functions in the resonance region.

Spokesperson: J.P. Chen, N. Liyanage and S. Choi

Motivation: A precise extraction of g_1^n and A_1^n in the resonance region, using a polarized ^{3}He target, will provide a precision test of quark-hadron duality for the spin structure functions.

Measurement and Feasibility: The proposed experiment intends to measure the neutron spin structure function g_1 in the resonance region, for $1.5 < Q^2 < 10$ GeV^2, where no data exist. The experiment will use a polarized ^{3}He target. These data, combined with the soon to be available precise high-x data in the DIS region from Jlab experiment E-99-117, will provide a test of quark-hadron duality in a new sector, the spin structure functions. The neutron g_1^n and A_1^n data will extend up to x=0.84 (for the Δ resonance). The x values between 0.2 and 0.65 will be used to test duality. A beam of 15 μA, 80% polarization will scatter on a pressurized 10 atmosphere, polarized ^{3}He target expected to have at least 35% target polarization.

Issues: The PAC considers that the neutron spin structure is a very important place to study duality, and underlines the relevance of Δ resonance data because of its negative contribution to the neutron g_1. The PAC sees this experiment as one facet in a comparison of neutron and proton spin structure functions to study duality. However, due to the heavy pressure for beam time in Hall A, approval could not be recommended at this time.

Recommendation: Defer

Individual Proposal Report

Proposal: E-00-114

Scientific Rating: A

Title: Parity Violation from ^{4}He at low Q^2, A Clean Measurement of ρ_s

Spokesperson: D. Armstrong and R. Michaels

Motivation: This proposed experiment seeks to measure the leading strange charge coefficient ρ_s to an accuracy of +/- 0.5, where available models range from –3 to +3. The choice of ^{4}He for this study is driven by the theoretically clean 0^+ to 0^+ transition where only the strangeness vector form factor G_E^s can contribute. The ^{4}He measurement is planned for low $Q^2 = 0.1$ (GeV/c) ^{2}, where the form factor G_E^s can be simply related to ρ_s. The ^{4}He nucleus thus provides a clean measurement of ρ_s. Competing experiments on the proton, HAPPEX, HAPPEX II, and SAMPLE, are less straightforward, requiring separation of the additional form factors, G_M^s and G_A to measure G_E^s. The G_0 experiment is approved to measure $G_E^s(Q^2)$, but the precision with which G_E^s can be extrapolated to $Q^2 = 0$ is considerably less than in this proposal.

Measurement and Feasibility: Following the success of the HAPPEX experiment confidence is high for the control of the systematic effects in such measurements as proposed here. The ^{4}He parity violating asymmetry is 8.4 ppm at these kinematics, well above the value where systematic errors are a concern. The Hall A septum magnet is needed for these measurements, but will be also be needed for HAPPEX II and the Lead parity violation measurements. Improvements in the beam line optics and monitors will also come along as part of the Hall A parity violation program. There appear to be no serious technical issues standing in the way of a good measurement.

Issues: The goals of this proposal overlap with those of other parity violation measurements planned. The PAC regards these measurements as fundamentally very important, so measurements that provide overlapping or redundant results are therefore justified, and indeed may be particularly important to provide consistency checks. The PAC feels that the ^{4}He measurement at low Q^2 provides the cleanest measurement of the strange electric form factor. Therefore the PAC recommends the ^{4}He measurements to be done before the already approved low Q^2 run on the proton (HAPPEX II).

Recommendation: Approve for 30 days

Individual Proposal Report

Proposal: PR-00-115

Scientific Rating: N/A

Title: Measurements of the Light Quark and Antiquark Distribution Ratios in the Nucleon Through Semi-Inclusive Reactions

Spokespersons: X. Jiang and R. Ransome

Motivation: The aim is to measure the yield ratios for (e,e',$\pi^{\pm}$) on hydrogen and deuterium in the range $0.1<x<0.4$ and $1<Q^2<4$ GeV^2, $7.0<W^2<9.5$ GeV^2 with a 6 GeV electron beam. This is to obtain the ratios $(d + \bar{d})/(u + \bar{u})$ and $(d - \bar{d})/(u - \bar{u})$ within 1.25% and 0.5% statistical accuracy. This will be used to extract $\bar{d}/\bar{u}$ which would be very useful for our knowledge of proton structure.

Measurements and Feasibility: The experiment seeks to determine the semi-inclusive $\pi^{\pm}$ yields on proton and deuteron targets. Measurements at different values of z will be made to see if the ratios of the yields are independent of z. If this holds, the flavor dependence of the nucleon anti-quark distribution might be determined. The experiment will use one Hall A HRS with the septum magnet as the hadron arm. A new electron spectrometer needs to be assembled.

Issues: The extraction of the interesting quark distributions depends on the validity of factorization at 6 GeV. Whether or not this holds needs to be settled experimentally. Another experiment, E-00-108, will be investigating this question.

Assuming that factorization does hold, there is another issue. The committee was not convinced that the experiment, as presently envisioned, could determine the desired ratios $\bar{d}/\bar{u}$, at large values of x, with accuracy sufficient to provide new information.

The committee would like to see a new proposal once factorization is verified experimentally at the relevant energy. It would also be necessary for a new proposal to show that the error bars could be reduced from the presently projected ones.

Recommendation: Defer

Individual Proposal Report

Proposal: E-00-116

Scientific Rating: B^+

Title: Measurement of Hydrogen and Deuterium Inclusive Resonance Cross Sections at Intermediate Q^2 for Parton-Hadron Duality Studies

Spokesperson: **C.** Keppel

Motivation: This proposal would extend to high Q^2 the precision inclusive inelastic electron scattering cross section measurements in the resonance region $1<W^2<4$ GeV^2. Both hydrogen and deuterium targets would be studied. Previous data from earlier JLAB runs cover the range of Q^2 from .05 to 4 $(\text{GeV/c})^2$. With these measurements, the full range to 7 $(\text{GeV/c})^2$ would be measured.

The data will be used to study Bloom-Gilman duality for the nucleon resonances. The precision data possible at JLAB would be very desirable to characterize the behavior of the resonances down to low Q^2. These data would be used to further the understanding of duality, and to study the valence quark structure of the nucleon at high x. Moments of the structure functions will be extracted, and studies of higher twist effects are possible.

Measurement and Feasibility: The measurements are a straightforward extension of earlier successful measurements in Hall C.

Issues: Bloom-Gilman duality is a phenomenological statement about the rate of fall of the resonance cross sections as Q^2 increases. The scaling curve from deep inelastic scattering provides a good approximation to the cross section averaged over the resonances. The theoretical foundations for this phenomenon and indeed the statement of duality are not well defined. Precision data for the resonance production from the proton and neutron would be very useful to explore further the phenomenon, and to define better the range over which duality seems to be working.

An appropriate procedure for averaging over resonances needs to be defined and studied before precise studies using duality can proceed.

Recommendation: Approve for 3 days

Individual Proposal Report

Proposal: PR-00-117

Scientific Rating: N/A

Title: Phase II Update – Measurement of $R=\sigma_L/\sigma_T$ in the nucleon resonance region

Spokesperson: C. Keppel and E. Christy

Motivation: This proposal aims to extend the measurement of $R=\sigma_L/\sigma_T$ to higher Q^2. It represents the second phase of experiment 94-110. Higher Q^2 data will constrain electroproduction models, allow improved understanding of radiative corrections by providing a wider range of data, and will check the applicability of Bloom-Gilman duality to the longitudinal cross section.

Measurement and Feasibility: The measurements will be made in Hall C, using the SOS and HMS under well understood operating conditions. The measurements appear to be feasible. Understanding of the experimental errors will only be complete after seeing the Phase I results, which are expected to be available later this year.

Issues: The PAC discussed the optimal ways to proceed with the very interesting program of testing Bloom-Gilman duality at Jefferson Lab. Analysis and presentation of Phase I measurements will be a very important step in demonstrating the quality and use of the measurements proposed here. The PAC would like to see the Phase I data before reconsidering this proposal.

Recommendation: Defer

Individual Proposal Report

Proposal: E-00-118

Scientific Rating: A^-

Title: Elastic Electron Scattering off ^{3}He and ^{4}He at Large Momentum Transfers

Spokespersons: J. Gomez and G. G. Petratos

Motivation: The goal is to determine elastic electron scattering form factors of ^{3}He and ^{4}He to the largest momentum transfers possible at JLAB. A Rosenbluth separation will be used to separate the longitudinal and transverse form factors of ^{3}He. These data would extend the Q^2 range over which these form factors are known a factor of two. These measurements will test our understanding of the short-distance properties of nuclei.

Measurements and Feasibility: The recoil ^{3}He nuclei will be detected to ensure the complete separation of elastic and inelastic channels. This technique also provides a powerful rejection of background, such as cosmic rays. The ^{4}He measurements will involve both electron singles and recoil nucleus coincidence measurements. It is anticipated that the electron singles data will provide sufficient sensitivity, but the PAC supports the simultaneous coincidence measurements as a valuable check. The collaboration has done a good job in optimizing the experiment luminosity to achieve the largest possible momentum transfers.

Issues: The primary scientific issue is to identify the possible diffraction minima at large Q^2 that are expected in hadronic models of these helium isotopes. It appeared to the PAC that the scientific goals could be well accomplished with somewhat fewer data points, and possibly by omitting the highest Q^2 datum on each target. The large number of energy changes, especially for multi-pass running, will place a possibly unacceptable overhead on the experiment if it were to be carried out exactly as proposed. The collaboration needs to devise alternative run plans that could be more efficiently implemented. It is likely such a course would greatly enhance the probability of this experiment being scheduled propitiously.

Recommendation: Approve for 30 days.

Individual Letter of Intent Report

Proposal: LOI-00-101

Title: Auger Neutron Spectroscopy of Nuclear Matter at CEBAF

Spokesperson: A. Margaryan

This proposal is to perform precise spectroscopy of the deeply bound, single-particle levels in heavy hypernuclei. A tremendous improvement in precision is sought by measurement of the neutron decays between single particle states in neighboring hypernuclei, in analogy to the Auger process. Successful determination, with high energy resolution, of the 1s, 1d, 1f, 2p, 1g, 2d and 1h states in a heavy nucleus would truly be a major step in nuclear physics.

The measurements rely upon a novel RF timing system, as well as a new approach to neutron time-of-flight measurement using ^{235}U foils backed by low pressure MWPC's to detect the ^{235}U fission fragments. Design, development, and successful implementation of these systems represents a significant amount of R&D work.

The rate of background neutrons will be extremely high. The proponents plan to control the background via timing cuts, but the signal to background is likely to still be small. Extensive Monte Carlo studies or in-beam tests of backgrounds and approaches to reject them would be necessary to establish the feasibility of making the measurements. The PAC remained unconvinced that the stated energy resolutions would be achievable.

Furthermore, the PAC was concerned about energy spreading in the low-lying levels because of coupling to the many other occupied states. It must be demonstrated that this effect is sufficiently small that the sharp energy spectra expected from the decay neutrons remain well separated. Furthermore, the full spectrum of states from the parent and all daughters following the transitions must be studied.

Individual Letter of Intent Report

Letter of Intent: LOI-00-102

Title: Measurement of the ^{3}He Magnetic Form Factor in the Region of the First Diffraction Minimum Using Polarization Observables

Spokesperson: D.W. Higinbotham

Recent calculations of the charge form factor of ^{3}He are in good agreement with the global analysis of the world's data. The magnetic form factor calculations are in significantly worse agreement with that data, which has a substantial uncertainty in the region of the first diffraction minimum and beyond. Previous experiments used a Rosenbluth separation to decouple the charge and magnetic form factors.

It is intended to measure the polarized-electron polarized –^{3}He asymmetry in a configuration where it is proportional to the product of the charge and magnetic form factors, which avoids many of the possible systematic errors that can contribute in a Rosenbluth separation. This not only provides a direct determination of the zero crossing, but the magnitude of the magnetic form factor as well.

Using one Hall A spectrometer to measure asymmetries at momentum transfers near the diffraction minimum and the other to monitor small momentum transfers (where the form factors are well known) provides both a measurement of the product of beam and target polarizations and the desired asymmetry.

It is believed that 4 data points across the diffraction minimum (with appropriate uncertainties) could be obtained in 16 days of running at a beam energy of 1600 MeV.

This measurement would improve our knowledge of the ^{3}He magnetic form factor in the region of the diffraction minimum and just beyond. However since there is no reason to doubt the existing data, even given its substantial errors, it is less clear that this knowledge would be a major contributor to resolving the discrepancy between theory and experiment, which at this time would seem to be a theoretical problem.

Appendix F

Approved Experiments, PACs 4 –18, Grouped by Physics Category

Go to http://www.JLab.org/exp_prog/PACpage/