Report of the June 14-18, 1993 Meeting of the CEBAF Program Advisory Committee

– PAC6 –

CEBAF

The Continuous Electron Beam Accelerator Facility

The Continuous Electron Beam Accelerator Facility (CEBAF) 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 June 14-18, 1993 CEBAF Program Advisory Committee

Introduction

The CEBAF Program Advisory Committee (PAC) held its sixth meeting on June 14-18, 1993, at CEBAF Center. In response to its formal charge (Appendix A) from the Director, Dr. Hermann Grunder, the committee reviewed and made recommendations on 43 proposals, of which 11 were updates of previously submitted proposals. The PAC also received two proposals, one to use the injector at the 5 MeV location and another to use the injector at the 45 MeV location, which were transferred to another review process. A number of proposals and letters-of-intent requested the use of beam energies above 4 GeV for portions or all of their proposed experiments. This demonstrates the considerable interest in the community to have this enhanced capability available at CEBAF as soon as possible. Due to the very crowded schedule, aspects of proposals requiring energies greater than 4 GeV were not addressed by the PAC at this meeting. The PAC, along with the CEBAF Technical Advisory Committee (TAC), will be providing brief comments on 13 letters-of-intent. Note that the letters-of-intent and the PAC/TAC comments on them will not be circulated by the PAC or CEBAF.

In general the proposals reviewed by the PAC at this meeting were of high quality. They continue to build a strong physics program that will consume much of the running time available in the first three years of operation of each of the experimental Halls. Of particular note at this PAC meeting were the many proposals to measure form factors and other properties of free nucleons and of nucleons embedded in the nuclear medium using spin degrees of freedom.

The PAC was briefed by management on the status of the project. The facility is now about 90% complete and beam for the commissioning of the first experiments is expected in the last quarter of 1994. Procurement of experimental equipment for all Halls is well underway, and the Hall C spectrometers are now being installed. Some members of PAC also took a tour of the facility.

The PAC discussed briefly the potential for and the probability of conflict in the analysis and use of data taken with the CLAS detector in Hall B. The problem, already encountered in proposals, concerns the delineation of the many physics questions that may be addressed from the analysis of one set of data taken with an "open" trigger, and how these may be meaningfully separated. An expanded discussion of these issues is given in Appendix C.

The PAC held some preliminary discussions about the priority of experiments for early running in Hall C. It will be important for CEBAF and the community that the initial program include experiments that have the potential for very significant physics results. As the PAC did not review in depth the scientific priorities of the Hall C program at this meeting, it has no recommendation on this issue at this time. The PAC concurred with the suggestion of the Hall C Collaboration that experiments E-89-012 and E-91-013 be attempted first, as these will serve well for commissioning of various systems. The Hall C Collaboration proposed that experiments E-89-008, E-91-003, E-91-007, E-91-016, PR-93-018 and PR-93-021 be run during the first several (i.e. six or less) months following experiments E-89-012 and E-91-013. The PAC concurs that this be attempted and suggests that some special effort should be made in the first running period to mount at least one of the $(e,e'K)$ experiments included in this group.

The question of scientific priority, technical challenge, and facility demands will all affect the early running in each of the Halls. It is clearly important to the Users that decisions leading to the publication of a preliminary running plan for Halls C and A be made as soon as possible. While the PAC does not have all the information necessary to devise such plans, it recommends that scientific and technical reviews of all the proposals which have accepted and conditionally accepted status be carried out in the near future. The somewhat different charges to the various PACs have led to some non-uniformity in the fraction of the beam time allocated to complete the recommended experiments. There is also some concern that a few proposed experiments may have been superseded by activities at other laboratories. These and similar questions could be addressed at a meeting dedicated to reviewing the readiness and requirements for running those experiments on the accepted list. Note that this PAC accepted CEBAF's suggestion that the approved time for E-89-004, E-89-024 and E-91-008 be increased from 30 to 65 days and that the approved time for E-89-037, E-89-038, E-89-039, E-89-042, E-89-043, E-91-002 and E-91-024 be increased from 20 to 80 days, so that the PAC's new recommendations for Hall B are based on these "renormalized" times. Of immediate concern are some remaining technical issues about two different experiments, PR-93-026 and PR-93-038, to measure the neutron charge form factor, either of which could run early in the Hall C schedule. The PAC recommends that CEBAF hold a special technical review of the resources needed to mount and run these difficult experiments. Following this review a decision could be made on the order in which they will be performed.

As discussed elsewhere in this report, the PAC strongly endorses many of the new physics proposals to be carried out in Hall B. Several of these are seen as important surveys that would delineate the parameters for in-depth investigations which may be carried out later in Halls C and A. The PAC is concerned about the impact on the overall CEBAF program by the present schedule for completion of Hall B. It strongly encourages the management to consider all the means by which the schedule might be advanced. Obviously it would be particularly unfortunate if any further delays occur.

General Comments on Proposals.

The general high quality of the proposals and presentations to the PAC is commendable. The committee was particularly impressed by the standard of those proposals addressing research to be carried out using the CLAS detector in Hall B. Clearly much effort was put into the proposals and the task faced by the PAC was a difficult one.

Several proposals and letters-of-intent were considered which required the use of a high resolution, short orbit spectrometer operating in conjunction with the HRS in Hall A. As no definite plan has been accepted for the device, the PAC felt it most appropriate to treat all the submissions as a package and has written a note on the suitability of such a device for these applications.

The committee noted overlap of the physics contained in a few new proposals with that of proposals previously accepted. There were also cases where the physics is already being addressed at other facilities. The proponents appeared in some of these cases to be unaware of the competition. It may be useful to enter abstracts of all accepted proposals in a readily accessible library file at CEBAF. Some attempt might also be made to obtain similar information for the programs at other laboratories such as Bates, Bonn, HERA/HERMES, NIKHEF, Mainz and SLAC.

Summary of proposal recommendations

The four categories for recommendations of the proposals are given in the Charge to the PAC (see Appendix A). In addition to these four categories, the PAC chose to make special comments on several proposals. The time recommended for use of Halls B and C is somewhat greater than suggested in the Charge, while that for Hall A falls somewhat below that limit. The following tables summarize the results for this PAC and also provide some summary information from all of the PACs:

Summary of PAC 6 Recommendations

Hall	Proposals Presented	Approval	Conditional Approval	Defer	Reject	Special
A	16	3	2	4	4	3
B	16	13			1	2
C	11*	5	1	2*	3	
Totals	43	21	3	6	8	5

* Includes one experiment proposed for either Hall A or Hall C.

Summary of PAC 6 Recommendations (in percent)

Hall	Approval	Conditional Approval	Defer	Reject	Special
A	19	12	25	25	19
B	81			6	13
C	46	9	18*	27	
Totals	49	7	14	19	11

* Includes one experiment proposed for either Hall A or Hall C.

Totals for PACs 4, 5 & 6

	Experiments Recommended for Approval	Additional Experiments Recommended for Conditional Approval	Total
Experiments	55	11	66
Authors	374	66	440
Institutions	93	13	105
Countries	15	3	18

Days of Beam Time for Physics

Hall (Three Year Period, See Appendix A)	A (96+97+98)	B (97+98+99)	C (95+96+97)
Beam time available in first three years	480	500	420
Beam time recommended for approval by PACs 4, 5 & 6	251	453	307
Beam time recommended for conditional approval by PACs 4, 5 & 6 plus the currently deferred portion of beam time from approved experiments for first three year period.	280	30	139

The reports and PAC recommendations for each of the proposals reviewed are given in Appendix E.

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John Cameron

Chair, CEBAF Program Advisory Committee

Date:______________________________

Appendices

A. Charge to the PAC

B. PAC Membership and Reading Assignments

C. Hall B Collaboration Issues

D. Recommendation Summary Listing

E. Individual Reports

F. PAC Agenda

Appendix A

The following charge was given to the PAC by the CEBAF Director, Hermann Grunder:

Charge to the June 14-18, 1993 Program Advisory Committee (PAC6):

CEBAF requests PAC6 to review the proposals and provide advice on:

1) The scientific merit, technical feasibility, and manpower requirements of the proposals.
2) A recommendation for the proposal to be placed into one of the four classes:
   a) approval of the proposal
   b) conditional approval pending equipment or beam tests for special requirements, these conditional proposals being reviewed by the PAC (or by CEBAF management) at an appropriate time in the future.
   c) deferral for consideration at a later date pending clarification of physical or technical issues.
   d) rejection.

In addition, PAC6 is requested to comment on priorities for early experiments in Hall C, and to consider and comment on letters-of-intent relative to a 6 GeV upgrade.

The following two tables of information were also presented to the PAC on the beam time available during the first three years of operation of each experimental hall:

Projected Accelerator Beam Time Available
(Assuming 35 Weeks per Year Operation)

Calendar Year	Accelerator Availability	Days Available for Physics
94		~40
95	0.50	110
96	0.70	150
97	0.75	160
98	0.80	170

Days of Beam Time for Physics (days)

Hall		A	B	C
Beam time available in first three years		480	500	420
Beam time already awarded		185	340	148
Maximum beam time to be recommended by PAC6		148	80	136
Beam time proposed to PAC6	From previous conditionally approved experiments	56	0	101
	New proposals	504*	240	264*
Beam time not being presented to PAC6 requested by conditionally approved experiments plus the currently deferred portion of beam time from approved experiments.		260†	30	50†

* An additional 50 days of beam time is proposed for either Hall A or C (PR-93-003).

† An additional 25 days of beam time is conditionally approved for either Hall A or C (E-89-019).

Appendix B
PAC 6 Membership and Reading Assignments

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Appendix C

The Hall B Collaboration

The PAC had to deal with a number of Hall B proposals that required little or no additional beam time because the running time had already been approved for a previous experiment. This raises questions about the role of the PAC relative to the Hall B Collaboration. Earlier or presently functioning patterns for managing a large experiment/facility such as CLAS do not appear to be precisely appropriate for this facility at this time in the nuclear physics community.

Some familiar organizational patterns are:

- The Individual Experiment:
  A small group designs, constructs and installs an experiment. Installation and data-taking usually take a period measured in weeks or months. The group may use all or part of some laboratory facility and relies on laboratory infrastructure for large magnets, beamlines, power, water, etc. After data are taken the group analyzes the data at home and publishes the results. Although high energy physicists have generally moved away from this organizational pattern due to the complexity of modern experiments, this remains (conceptually at least) the pattern of nuclear physics.
- The Bubble Chamber:
  Bubble chambers were generally organized as large laboratory-run facilities. The actual operation of the bubble chamber was the responsibility of a technical support group which usually included physicists. Small individual groups of physicists came to the laboratory for short running periods to participate in tuning the beam and to validate the quality of the pictures being taken. The film was measured on devices with relatively standard output, massive (at that time) standard computer programs were available from a few central sources to reconstruct tracks from these measurements, and other programs were provided for kinematic fitting, histogramming, fitting parameters, etc. The small group that analyzed the film published the results without participation of others who were involved in the operation or utilization of the bubble chamber.
- The HEP Collider Detector Collaboration:
  A massive group of physicists is fully responsible for a large and complicated HEP collider detector. The group designs, constructs, and installs the detector; learns how to calibrate it; and develops software for reducing the raw data to usable kinematic quantities. Subgroups of individuals in the group are responsible for individual physics topics. Often two or more subgroups work on the same physics topic. Publications of results are the responsibility of the entire group and “everyone” in the collaboration appears on the author list. There are formal internal mechanisms to validate the results and adjudicate disagreements between multiple subgroups addressing the same physics topics with different techniques.

Currently, proposals from all three halls are presented to this Committee in a format corresponding to some combination of the Individual Experiment (IE) and/or Bubble Chamber (BC) pattern. After the spectrometers in Halls A and C have been fully understood and operate routinely, something like the BC pattern may be appropriate. It may be possible for modest support groups from the laboratory to operate the spectrometers and assist small individual groups in the manipulations necessary to acquire data. Programs for converting raw data to relevant kinematic quantities may be standard enough that the small group using the facility need not understand them much more than members of the group understand the operation of CEBAF itself. If these conditions are satisfied, the individual physicist could publish results alone with a clear conscience because the participation of the physicists in the facility group would have been no greater than it was in the BC pattern. Furthermore, since spectrometers must generally be set for momenta and angles corresponding to a particular reaction, there is little danger that the data taken by one group would scoop the results of another group that had proposed a different physics program with the same spectrometers.

The problem of ownership of data and results is much more complicated in the case of the CLAS facility, because:

- It is unlikely that operation of the detector and reduction of the data to kinematically useful quantities will ever be really routine. The complexity of CLAS is comparable to that of a typical Collider Detector (CD) and so far no CD collaboration has yet reached this state. Therefore, any group utilizing data from the detector will be required to understand the detector much better than would be necessary in a more ideal model. This depth of understanding is seldom possible without a large amount of concentrated collaborative effort!
- Due to the large aperture, a data sample taken with a set of trigger conditions focusing on one physics objective can often be utilized for other objectives. For example, tagged photon data with two or more charged particles in coincidence can be used to study a number of topics, including "missing" baryons, ρ and ϕ photoproduction, etc. In fact, a group looking at one process may be forced to study another because amplitudes will generally interfere. Therefore, once data are accumulated, reduced, and distributed, it is impossible to maintain control over the physics results that a group may obtain. In fact, tight control would be counterproductive and would certainly limit the production of original and exciting physics.

This Committee has received a large number of proposals in which very little or no beam time was requested due to the fact that data obtained for another proposal could be used for most of the physics objectives of the new proposal. It is no longer so clear:

- what the function of a PAC should be in this sort of situation;
- what sort of responsibility is being assumed by the group proposing the experiment; and
- what sort of support for the proposal will be required from or provided by the rest of the individuals in the CLAS collaboration.

This Committee has chosen to interpret the submission of a proposal by a group and the acceptance of it by the Laboratory to mean:

- the group *accepts responsibility* for the physics goals in the proposal, whether or not other groups in CLAS also study related physics or use the same beam time; and
- within the resources of the group and the framework of MOU's with the laboratory, the group will collaborate with the CLAS collaboration in the construction, installation, commissioning, and operation of the detector.

Appendix D

Hall A PAC 6 Recommendations

Rating†-Days		
C - (28)*	**E-89-046**	Study of Quasi-Particle Orbits in Closed Shell Nuclei
D	**PR-93-004**	Deuteron Photodisintegration by Linear Polarized Photons
MPS	**PR-93-005**	High-Resolution Electroproduction of Light Hypernuclei
R	**PR-93-010**	Study of *p-n* Correlations in the ^{3}He and ^{4}He with the $(e, e'd)$ Reaction
R	**PR-93-011**	The ^{3}He $(e, e'NN)$ Reaction
D	**PR-93-013**	The $p(\vec{e}, e'\vec{N})\pi$ Reaction with HARP
MPS	**PR-93-015**	High Resolution 1*p* Shell Hypernuclear Spectroscopy
A - 10	**PR-93-024**	Measurement of the Magnetic Form Factor of the Neutron at Large Momentum Transfers
A - 16	**PR-93-027**	Electric Form Factor of the Proton by Recoil Polarization
D	**PR-93-040**	Neutron Polarization Measurements in the $d(e, e'\vec{n})p$ Reaction Near Threshold
D	**PR-93-041**	In-Plane Separations and High Momentum Structure in $d(e, e'p)n$
R	**PR-93-046**	Separation of $(e, e'\pi)$ Response Functions versus Q^2 and A
MPS	**PR-93-047**	Determination of four Structure Functions of the Kaon Electroproduction Processes
R	**PR-93-048**	Studies of the $(e,e'p)$ Reaction at High Missing Energy
A - 12	**PR-93-049**	Polarization Transfer in the Reaction ^{4}He $(\vec{e}, e'\vec{p})$ ^{3}H in the Quasi-elastic Scattering Region
C	**PR-93-050**	Nucleon Structure Study by Virtual Compton Scattering
38 (66)*	**Total Days**	

† **A = Approve, C = Conditionally Approve, D = Defer, R = Reject**
MPS = Multi Purpose Spectrometer which has a special report

* When certain technical criteria are met, the CEBAF management is recommended to approve E-89-046 for 28 days.

Appendix D

Hall B PAC 6 Recommendations

Rating†-Days*		
R	**PR-93-001**	Search for Color Coherent Effects via the Observation of Double Scattering Events in CLAS
A - 0	**PR-93-006**	Two Pion Decay of Electroproduced Light Quark Baryon Resonances
A - 0	**PR-93-008**	Inclusive η Photoproduction in Nuclei
A - 40	**PR-93-009**	The Polarized Structure Function G_{1n} and the Q^2 dependence of the Gerasimov-Drell-Hearn Sum Rule for the Neutron
A - 0	**PR-93-012**	Electroproduction of Light Quark Mesons
A - 3	**PR-93-017**	Study of $\gamma d \to pn$ and $\gamma d \to p\Delta^{o}$ Reactions for Small Momentum Transfers
A - 8	**PR-93-019**	Photoabsorption and Photofission of Nuclei
A - 15	**PR-93-022**	Measurement of the Polarization of the $\phi(1020)$ in Electroproduction
N	**PR-93-029**	Search for $\Delta^{++}(1232)$ Components in the ^3He Ground State
A - 8	**PR-93-030**	Measurement of the Structure Functions for Kaon Electroproduction
A - 17	**PR-93-031**	Photoproduction of Vector Mesons at High t
A - 0	**PR-93-033**	A Search for Missing Baryons Formed in $\gamma p \to p\pi^+\pi^-$ Using the CLAS and CEBAF
A - 0	**PR-93-036**	Measurement of Single Pion Electroproduction from the Proton with Polarized Beam and Polarized Target Using CLAS
N	**PR-93-037**	Precision Measurement of the Ratio of the Electric & Magnetic Form Factors of the Neutron with Polarized ^3He Using CLAS
A - 16	**PR-93-043**	Measurement of the $\Delta\Delta$ Component of the Deuteron by Exclusive Quasielastic Electron Scattering
A - 6	**PR-93-044**	Photoreactions on ^3He
113	**Total Additional Days**	(The 8 days for PR-93-019 are to take place before the regular running of CLAS.)

† **A = Approve, C = Conditionally Approve, D = Defer, R = Reject, N = No Evaluation**

* Days for Hall B represents days in addition to already approved days from other experiments.

Hall C PAC 6 Recommendations

Rating†-Days		
D	**PR-93-003**	Measurement of the Deuteron Tensor Polarization at Large Momentum Transfer in D $(e, e'\vec{d})$
C	**PR-93-016**	Measurement of the Spin-Dependent Asymmetry in Quasielastic Electron Scattering from Polarized Tritium
A - 15	**PR-93-018**	Longitudinal/Transverse Cross Section Separation in $p(e,e'K^+)\Lambda$ (Σ) for $0.5 \leq Q^2 \leq 2.0$ $(\mathrm{GeV/c})^2$, $W \geq 1.7$ GeV, and $t_{\mathrm{min}} \geq 0.1$ $(\mathrm{GeV/c})^2$
D	**PR-93-020**	Measurement of the Momentum Transfer Dependence of Quasielastic $(e,e'p)$ Scattering at Large Momentum Transfer and Large Missing Energy
A - 9	**PR-93-021**	The Charged Pion Form Factor
A - 60	**PR-93-026**	The Charge Form Factor of the Neutron
A - 15	**PR-93-028**	Deformation of the Nucleon
R	**PR-93-034**	Measurement of the Differential Cross Sections for $\gamma p \rightarrow K^+\Lambda$ and $\gamma p \rightarrow K^+\Sigma$ Using the SOS Spectrometer in Hall C at CEBAF
R	**PR-93-035**	The $\Delta(1232)$ Form Factor at High Momentum Transfers
A - 60	**PR-93-038**	The Electric Form Factor of the Neutron from the $d(\vec{e}, e'\vec{n})p$ Reaction and The Magnetic Form Factor of the Neutron from the $d(\vec{e}, e'\vec{n})p$ Reaction
R	**PR-93-042**	A Measurement of the Fifth Structure Function via Quasielastic ^{12}C, ^{16}O $(\vec{e}, e'p)$
159	**Total Days**	

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

Appendix E

Proposal: E-89-046, Hall A

Spokesperson: B. Frois

Title: Study of Quasi-Particle Orbits in Closed Shell Nuclei

Motivation:

The goal of this experiment is to measure the proton momentum distribution up to 500 MeV/c for heavy nuclei. A precise determination of this quantity is of primary interest for the description of the nuclear wave function at short internucleon distances.

Measurement and Feasibility:

The experiment will use the two Hall A spectrometers with standard detecting equipment but requires full capability for spectrometer resolution (150 keV) and beam energy definition (10^{-4}). The initial measurement has been planned on ^{208}Pb.

Issues:

The PAC recognizes the relevance of the physics problem and points out the importance for the project to continue the work in close contact with Hall A collaboration to solve the technical problems related to the realization of this experiment.

Manpower:

Adequate

Recommendation:

Conditionally approved. Upon the achievement of the 10^{-4} energy definition and 150 keV spectrometer resolution required, it is recommended that the CEBAF management upgrade this proposal to approval status for 28 days.

Appendix E

Proposal: PR-93-004, Hall A

Spokespersons: P. V. Sorokin, V.B. Ganenko, R. Gilman

Title: Deuteron Photodisintegration by Linear Polarized Photons

Motivation:

The aim of this experiment is to measure the angular distribution of the polarized photon asymmetry in deuteron breakup at photon energies between 0.6 and 2.4 GeV. At present such asymmetries have been measured only up to 1 GeV. The physics to be addressed is described in terms of asymptotic scaling (which predicts $\Sigma \rightarrow -1$), or alternatively by phenomenological models involving isobaric and mesonic currents.

Measurement and Feasibility:

The experiment would be carried out by using linearly polarized photons produced as coherent bremsstrahlung from an aligned diamond crystal. Two variants are discussed, one experiment with and one without the separation of the γ and e beam. The recoiling protons would be detected in the HRS and the neutrons in one of the 3 neutron detectors available by that time. The Kharkov group has extensive experience in operating the diamond crystal radiator. However, the presentation of the proposal made it clear that some more careful planning of the remaining parts of the experiment will be necessary.

Issues:

Given the lack of credible theoretical calculations in the energy range of 1-2 GeV, the PAC did not see any urgency for performing the experiment.Generally, the PAC worries about the use of bremsstrahlung beams, which have given rise to normalization and other systematic errors in the past. In particular, the differential cross section for the deuteron disintegration has developed into a scatter plot of data from various laboratories, which has haunted the field of photonuclear physics for the past 50 years. The PAC is not confident that similar problems will not arise at a high precision laboratory like CEBAF. On the other hand, the PAC is aware that the existing tagging systems will not provide the high photon flux necessary at energies much above 1 GeV. The PAC therefore recommends that the interesting technical developments of the Kharkov group should be continued. The group should study, in particular, whether coherent bremsstrahlung could be used as an option for Hall B operation in a bremsstrahlung mode rather than a tagging mode. The outstanding capabilities of CLAS for particle identification over the full range of angles give another possibility, to “tag” the photon by overcomplete kinematics in few-body systems.

Manpower:

The manpower of the Kharkov group is judged to be adequate. The extensive experience of the group in the field of coherent bremsstrahlung could certainly be very useful at CEBAF. However, they should collaborate more closely with other groups working at CEBAF in order to work out an overall detailed and convincing proposal.

Recommendation:

Defer

Appendix E

Proposal: PR-93-005

Spokesperson: T. Saito

Title: High-Resolution Electroproduction of Light Hypernuclei

Letter to the spokespersons of the Multi-Particle Spectrometer (MPS) proposals

The PAC reviewed three proposals and two letters of intent for a program of measurements which would be carried out using the Multi-Particle Spectrometer (MPS) in Hall A. Since this spectrometer is not yet funded, the PAC did not feel it appropriate to approve any of these experiments at this time. However, the committee wishes to point out that CEBAF has a unique opportunity to study hypernuclear physics. We very strongly encourage the Laboratory and the interested scientists (who include these proponents and others who have approved time in Hall C) to pursue the funding for a high resolution kaon spectrometer.

Of the several physics topics proposed, the PAC believes that only the hypernuclear studies require the high-resolution capabilities of the MPS. For the other topics (kaon electroproduction, deuteron form factor) the MPS would be a valuable device, and could be used if it existed, but the committee believes that these physics topics can be addressed with equipment already existing at CEBAF or with less sophisticated spectrometers. However, as stated above, we believe that the high resolution hypernuclear spectroscopy is of sufficient scientific importance to justify the construction of such a device in either Hall A or C, if the technical issues discussed below can be addressed.

The study of hypernuclear states with high resolution is one of the topics which provided the original justification for the construction of CEBAF ten years ago. Today, much still remains to be learned and CEBAF is in a unique position to advance the field. Proposals 93-005 and 93-015 discuss several interesting initial possibilities for a hypernuclear program using a dedicated kaon spectrometer such as the MPS. The possibility of measuring unnatural parity states and deducing the spin-orbit splitting for the Λ-nucleon system is particularly interesting. The tentative identification of narrow Σ-hypernuclear states is also tantalizing and should be verified at CEBAF if possible.

Measurement and Feasibility:

At present, the cross sections for electroproduction of hypernuclear states are unknown. Furthermore, the kinematics require that the measurements be made at extreme forward angles for both the electron and kaon spectrometers where the background singles rates are very high and particle identification will be difficult. The feasibility of the proposed measurements is crucially tied to the magnitude of these cross sections.

Two experiments have been approved in Hall C (PR-89-009, PR-91-016) which will provide information on the production cross-sections and background rates. The PAC believes that the results from these two experiments will be crucial for the development of the scientific and technical case for a dedicated spectrometer of the kind discussed here. The PAC encourages collaboration between the proponents of this experiment and the Hall C experiments.

PR-93-005, Hall A

Appendix E

Proposal: PR-93-010, Hall A

Spokesperson: H. P. Blok

Title: Study of the *p-n* Correlation in the ^{3}He and ^{4}He with the *(e,e'd)* Reaction

Motivation:

(e,e'd) deuteron knock out reactions induced by high energy electrons have the distinct advantage that the reaction has only two body final states. If the non-negligible contribution of MEC can be disentangled by performing L/T separation, this channel may provide an alternative way to study *NN* correlations in nuclei.

Measurement and Feasibility:

It is proposed to measure the differential cross section by detecting the electron and the deuteron in coincidence using the two high resolution spectrometers in Hall A. Data would be taken for both ^{3}He and ^{4}He for values of q = 0.7, 1.0, 1.3 GeV/c in (q,ω) constant kinematics at two energies of the incident electron in each case.

Issues:

The PAC recognizes that the *(e,e'd)* cross section provides information on the high momentum components in ^{3}He which may be complementary to that obtained in the alternative *(e,e'np)* section. However, there are ongoing experiments at Bates and NIKHEF which address much of the physics. In light of this and of the substantial resources required, the PAC prefers to await the outcome of these experiments before considering an updated proposal.

Manpower:

Adequate

Recommendation:

Reject

Appendix E

Proposal: PR-93-011, Hall A

Spokespersons: Z. Papandreou, M.B. Epstein, R.A. Lindgren, G.J. Lolos, Z.E. Meziani

Title: The ^{3}He(*e,e'NN*) Reaction

Motivation:

The study of two nucleon knock out reactions ^{3}He(*e,e'pp*) and ^{3}He(*e,e'pn*) provides information on the two and three body absorption strength and short range correlations in nuclei. By choosing the kinematics properly, sensitivity to correlations and interpretability of data may be enhanced.

Measurement and Feasibility:

Antiparallel kinematics is chosen to minimize the effect of final state interactions and longitudinal/transverse separation is to be performed at fixed momentum transfer (1.24 GeV/c). The electron arm is planned at forward angles, the proton and the neutron should be detected by a scintillator array and by HARP respectively, both at backward angles to minimize backgrounds.

Issues:

PAC was not convinced that the proponents had identified the appropriate kinematics for these measurements. In particular, it appears that out-of-plane kinematics appear most appropriate. The PAC believes that CLAS is the optimal detector for this experiment for initial investigations. In addition, we note that measurements on ^{3}He are already approved for CLAS.

Manpower:

The manpower is judged to be sufficient

Recommendation:

Reject

Appendix E

Proposal: PR-93-013, Hall A

Spokesperson: J. J. Kelly

Title: The $p(\vec{e}, e'\vec{N})\pi$ Reaction with HARP

Motivation:

The goal of this experiment is to detect recoil nucleon polarizations in $p(\vec{e}, e'\vec{p})$ and $p(\vec{e}, e'\vec{n})$ at relatively low Q^2 but in the resonance region, W~1.2-1.4 GeV, as a measure of resonant production amplitudes and as a probe of possible structure, including the Roper resonance.

Measurement and Feasibility:

The measurement would be carried out using the High Acceptance Recoil Polarimeter (HARP) now being developed at NIKHEF and would take place in Hall A using an LH_2 target at a beam energy of 2.33 GeV.

Issues:

The use of W-dependence across the resonant regions should be explored as an additional means of identifying signal with respect to non-resonant background. More importantly, however, it is a strong concern of the PAC that a convincing case must be made that the HARP polarimeter will be able to function successfully at the small angle, high intensity environment which would be associated with CEBAF operation. The PAC recommends that consideration of this proposal be deferred until detailed information is obtained about performance of the HARP polarimeter.

Manpower:

The manpower is judged to be adequate.

Recommendation:

Defer

Appendix E

Proposal: PR-93-015

Spokespersons: S. Frullani, F. Garibaldi

Title: High Resolution 1*p* Shell Hypernuclear Spectroscopy

Letter to the spokespersons of the Multi-Particle Spectrometer (MPS) proposals

The PAC reviewed three proposals and two letters of intent for a program of measurements which would be carried out using the Multi-Particle Spectrometer (MPS) in Hall A. Since this spectrometer is not yet funded, the PAC did not feel it appropriate to approve any of these experiments at this time. However, the committee wishes to point out that CEBAF has a unique opportunity to study hypernuclear physics. We very strongly encourage the Laboratory and the interested scientists (who include these proponents and others who have approved time in Hall C) to pursue the funding for a high resolution kaon spectrometer.

Of the several physics topics proposed, the PAC believes that only the hypernuclear studies require the high-resolution capabilities of the MPS. For the other topics (kaon electroproduction, deuteron form factor) the MPS would be a valuable device, and could be used if it existed, but the committee believes that these physics topics can be addressed with equipment already existing at CEBAF or with less sophisticated spectrometers. However, as stated above, we believe that the high resolution hypernuclear spectroscopy is of sufficient scientific importance to justify the construction of such a device in either Hall A or C, if the technical issues discussed below can be addressed.

The study of hypernuclear states with high resolution is one of the topics which provided the original justification for the construction of CEBAF ten years ago. Today, much still remains to be learned and CEBAF is in a unique position to advance the field. Proposals 93-005 and 93-015 discuss several interesting initial possibilities for a hypernuclear program using a dedicated kaon spectrometer such as the MPS. The possibility of measuring unnatural parity states and deducing the spin-orbit splitting for the Λ-nucleon system is particularly interesting. The tentative identification of narrow Σ-hypernuclear states is also tantalizing and should be verified at CEBAF if possible.

Measurement and Feasibility:

At present, the cross sections for electroproduction of hypernuclear states are unknown. Furthermore, the kinematics require that the measurements be made at extreme forward angles for both the electron and kaon spectrometers where the background singles rates are very high and particle identification will be difficult. The feasibility of the proposed measurements is tied crucially to the magnitude of these cross sections.

Two experiments have been approved in Hall C (PR-89-009, PR-91-016) which will provide information on the production cross-sections and background rates. The PAC believes that the results from these two experiments will be crucial for the development of the scientific and technical case for a dedicated spectrometer of the kind discussed here. The PAC encourages collaboration between the proponents of this experiment and the Hall C experiments.

Appendix E

Proposal: PR-93-024, Hall A

Spokespersons: G. G. Petratos, J. Gomez

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

Motivation:

The goal of this proposal is to measure the magnetic form factor of the neutron up to $Q^2 = 6.5$ (GeV/c)^2 by inclusive quasifree electron deuteron scattering. Previous data from SLAC were limited to $Q^2 = 4$ (GeV/c)^2 by the luminosity and solid angle.

Measurement and Feasibility:

The high luminosity of CEBAF and the large solid angle tune of HRS will maximize the counting rate resulting in a 1% statistical precision within about 10 days of beam time. The dominant contribution to the systematic error is due to the modeling of the quasielastic process and of the inelastic background. The strong increase of the model dependence with Q^2 restricts the usefulness of this technique to the momentum transfers that can be achieved with the 4 GeV beam. The less model-dependent exclusive experiments, particularly with polarization degrees of freedom, are presently restricted to momentum transfer $Q^2 \leq 2$ (GeV/c)^2. Therefore, this experiment will provide a unique possibility to determine the magnetic form factor of the neutron at this range of Q^2.

Issues:

No significant issues are associated with this straightforward extension of previous work at SLAC. The experiment can be run at an early stage after the installation of the HRS in Hall A.

Manpower:

The manpower is judged to be adequate.

Recommendation:

Approval for 10 days of beam time in Hall A at 4 GeV.

Appendix E

Proposal: PR-93-027, Hall A

Spokespersons: C. F. Perdrisat, V. Punjabi

Title: Electric Form Factor of the Proton by Recoil Polarization

Motivation:

An accurate determination of the electric and magnetic form factors of the proton in the momentum transfer range between 0.5 $(GeV/c)^2$ and 4.5 $(GeV/c)^2$ is of primary importance for the description of the internal structure of the nucleon. Existing measurements based on Rosenbluth separations still have large statistical errors and show discrepancies.

Measurement and Feasibility:

The recoil polarization method is sensitive to the interference term between the electric and magnetic form factors without any change of energy and angle. The ratio G_E^p / G_M^p is independent of a knowledge of the absolute value of the beam polarization and polarimeter analyzing power. The experiment requires a hadron spectrometer equipped with a focal plane polarimeter with good performance up to 3.2 GeV/c. The predicted accuracy on G_E^p / G_M^p should be between 1.5% and 2.5% for 0.4 beam helicity.

Issues:

None

Manpower:

Adequate

Recommendation:

Approval for 16 days to run at Q^2=0.5 to 3.5 $(GeV/c)^2$, consideration of the two high Q^2 points is deferred until the accuracy of the technique is demonstrated.

Appendix E

Proposal: PR-93-040, Hall A

Spokespersons: A. Afasanev, R. Madey

Title: Neutron Polarization Measurements in the $d(\vec{e}, e'\vec{n})p$ Reaction Near Threshold

Motivation:

The goal of this experiment is to measure deuteron electrodisintegration near threshold for momentum transfer Q^2 between 0.6 and 1.2 (GeV/c)^2. In this region the reaction is dominated by the strong M1 transition from the ground state of the deuteron to the nearly bound $^1S_0$ state. The differential cross section at these values of Q^2 is extremely model dependent. As far as the conventional theories may be trusted at this large momentum transfer, rather uncontrollable details enter, such as the choice of Dirac vs. Sachs form factors in the meson exchange currents, the neutron form factor, unknown isobar admixtures, etc. Polarization degrees of freedom may help to provide more data to constrain the models. For this purpose the group proposes to measure the polarization of the recoiling nucleon normal to the reaction plane.

Measurement and Feasibility:

Although not fully explained in the presentation, there should not be any major obstacles to performing the experiment. The unpolarized electron beam impinges on an unpolarized liquid deuterium target. A neutron polarimeter measures the normal polarization component P_y of the neutron, and the HRS detects the scattered electron. A large shielding enclosure will be necessary for the polarimeter.

Issues:

The physics case has not been presented convincingly; it depended on the estimates within a single model with an arbitrary mixture of pseudoscalar and pseudovector pion-nucleon coupling. PAC strongly recommends that the model dependence of the cross sections should be studied in more detail, over the full range of available models. Since the cross section would be measured directly at threshold, it should also be worthwhile to express the cross sections directly in terms of the relevant multipoles. Furthermore, polarization observables are expected to be more sensitive to higher multipoles than the cross section. Such careful studies of the relevance of the planned experiment are absolutely necessary in view of the large amount of beam time required. Though the originally requested 67 days (plus 40 days of setup and removal time) have been reduced to about half, there must be an excellent physics case for that amount of beam time. Along the same lines the PAC recommends a more careful check of all options that could further optimize the experiment. There is also some concern about the accidental rates in the particular kinematics of the quasibound proton neutron system coming out in the direction of momentum transfer.

Manpower:

The manpower is adequate.

Recommendation:

Defer

Appendix E

Proposal: PR-93-041, Hall A

Spokesperson: P. Ulmer

Title: In-Plane Separations and High Momentum Structure in $d\,(e, e'p)\,n$

Motivation:

The goal of this experiment is to study the high momentum components of the proton in the deuteron. Previous $d\,(e, e'p)\,n$ experiments in the quasielastic region have determined the proton momentum distribution up to P_m = 300 MeV/c. Higher momentum components have been determined in the Delta resonance region where corrections to the impulse approximation are relatively large. The proposed experiment will separate the longitudinal and transverse response functions and will examine the Q^2 dependence between 0.23 and 3.4 (GeV/c)^2.

Measurement and Feasibility:

The proposed experiment would be a 10 cm liquid deuterium target and a beam intensity of 50 microamperes. The high resolution of the Hall A spectrometers is essential to control the systematic errors due to the reaction kinematics.

Issues:

This experiment requires a high precision to separate the longitudinal and transverse components of the structure functions. This is a very challenging experiment which will demand the most of the capabilities of the Hall A spectrometer system. Since the goal of these measurements is to provide definitive answers on the proton momentum distribution in the deuteron, some concern was felt about the size of experimental uncertainties and in particular the stability of the target density at high beam current. In addition, the issue raised by a previous PAC concerning energy determination and luminosity monitoring remain to be solved.

Manpower:

Adequate

Recommendation:

Defer

Appendix E

Proposal: PR-93-046, Hall A

Spokespersons: G. Huber, R. Gilman, C. C. Chang

Title: Separation of (e, $e'\pi$) Response Functions versus Q^2 and A

Motivation:

This experiment is designed to survey the ($e,e'\pi^+$) reaction on targets of A = 1, 2, 4, 9, 27 and 107 with L/T separation. Data at low Q^2 is aimed at studying the number of pions per nucleon as a function of A since theoretical calculations suggest a possible enhancement as A increases. The data at high Q^2 is intended to look for color transparency effects in both the longitudinal and transverse responses.

Measurement and Feasibility:

The measurements propose to use the twin spectrometers in Hall A and targets. L/T separations are proposed at Q^2 = 0.58, 2.00, and 3.50 (GeV/c)^2, on six target nuclei across the periodic table, p, d ^{4}He, ^{9}Be, ^{27}Al, and ^{107}Ag. Almost all the high Q^2 data needs beam energies significantly above 4 GeV and even the low Q^2 data would be count rate efficient only with energies above 4 GeV. The radiation length proposed for the Al and Ag targets are 8% and 15% respectively. Currently 3% rl targets are the limitation so that considerable increases in beam time would be required.

Issues:

Scientifically there is considerable uncertainty about the proposed physics. In the low Q^2 region there is no strong reason to expect the quasifree factorization of the cross section into F_π (Q^2) and a spectral function S_π (p, E) to be anything more than an intuitive guess at the actual physics. Though the pion energy lies above the resonance region the π^+ will still undergo strong final state distortions. This will make it extremely difficult to see the small enhancements from pion contents in the nucleus as A is increased. Since no DWIA calculations were presented it is difficult to assess the problem more quantitatively at this time. However, the Drell-Yan data for Fe/^{2}H from Fermilab suggest no evidence for pion enhancement at the level of n_π < 0.04. Similar difficulties are expected for color transparency analyses at the proposed Q^2.

Manpower:

Adequate

Recommendation:

Reject

Proposals: PR-93-047

Spokesperson: S. Frullani

Title: Determination of four Structure Functions of the Kaon Electroproduction Processes

Letter to the spokespersons of the Multi-Particle Spectrometer (MPS) proposals

The PAC reviewed three proposals and two letters of intent for a program of measurements which would be carried out using the Multi-Particle Spectrometer (MPS) in Hall A. Since this spectrometer is not yet funded, the PAC did not feel it appropriate to approve any of these experiments at this time. However, the committee wishes to point out that CEBAF has a unique opportunity to study hypernuclear physics. We very strongly encourage the Laboratory and the interested scientists (who include these proponents and others who have approved time in Hall C) to pursue the funding for a high resolution kaon spectrometer.

Of the several physics topics proposed, the PAC believes that only the hypernuclear studies require the high-resolution capabilities of the MPS. For the other topics (kaon electroproduction, deuteron form factor) the MPS would be a valuable device, and could be used if it existed, but the committee believes that these physics topics can be addressed with equipment already existing at CEBAF or with less sophisticated spectrometers. However, as stated above, we believe that the high resolution hypernuclear spectroscopy is of sufficient scientific importance to justify the construction of such a device in either Hall A or C, if the technical issues discussed below can be addressed.

The study of hypernuclear states with high resolution is one of the topics which provided the original justification for the construction of CEBAF ten years ago. Today, much still remains to be learned and CEBAF is in a unique position to advance the field. Proposals 93-005 and 93-015 discuss several interesting initial possibilities for a hypernuclear program using a dedicated kaon spectrometer such as the MPS. The possibility of measuring unnatural parity states and deducing the spin-orbit splitting for the Λ-nucleon system is particularly interesting. The tentative identification of narrow Σ-hypernuclear states is also tantalizing and should be verified at CEBAF if possible.

Measurement and Feasibility:

At present, the cross sections for electroproduction of hypernuclear states are unknown. Furthermore, the kinematics require that the measurements be made at extreme forward angles for both the electron and kaon spectrometers where the background singles rates are very high and particle identification will be difficult. The feasibility of the proposed measurements is crucially tied to the magnitude of these cross sections.

Two experiments have been approved in Hall C (PR-89-009, PR-91-016) which will provide information on the production cross-sections and background rates. The PAC believes that the results from these two experiments will be crucial for the development of the scientific and technical case for a dedicated spectrometer of the kind discussed here. The PAC encourages collaboration between the proponents of this experiment and the Hall C experiments.

PR-93-047, Hall A

Appendix E

Proposal: PR-93-048, Hall A

Spokespersons: W.Bertozzi, J.P. Chen, S. Gilad

Title: Studies of the (*e,e'p*) Reaction at High Missing Energy

Motivation:

The proposed experiment aims to analyze the high missing energy region of the reaction (*e,e'p*) on ^{3}He, ^{4}He and ^{12}C. The goal is to understand the nature of the correlations and the mechanism of the reaction responsible for the missing energy distribution. Existing experimental data indicate an excessive strength beyond the one nucleon process for nuclei with A>3, particularly for the transverse response at low q.

Measurement and Feasibility:

The measurement would use the standard set up of the Hall A spectrometers with Cerenkov and shower counter in the electron arm and the focal plane instrumentation in the hadron arm. Except for the L/T separation at low-Q^2 there are no stringent requirements on either the energy or the angular resolution.

Issues:

These physics questions most probably involve multi-nucleon processes which will be studied in a survey experiment in Hall B. It is expected this survey will also provide some information on L/T separation. Depending on the outcome of the Hall B experiment a strongly focussed proposal to use other spectrometers may be appropriate.

Manpower:

The manpower is judged to be adequate.

Recommendation:

Reject

Appendix E

Proposal: PR 93-049, Hall A

Spokespersons: J.F.J. van den Brand, R. Ent, P. Ulmer

Title: Polarization Transfer in the Reaction $^{4}He\ (\vec{e}, e'\vec{p})\ ^{3}H$ in the Quasi-elastic Scattering Region.

Motivation:

Recent *(e,e'p)* experiments on light and medium nuclei and in particular on ^{4}He have observed a significant difference between the longitudinal and transverse response functions. At present there is no satisfactory interpretation of these results. One of the proposed explanations is a modification of the nucleon form factor in the nucleus. The goal of the PR-93-049 proposal is to measure the spin transfer coefficients of the reaction $^{4}He(e,e'p)^{3}H$ at an incident energy of 4 GeV in Hall A. To the extent that the spin transfer coefficients are insensitive to final state interactions and meson-exchange current effects, the measurement of the ratio of the polarization components p_z^1 and p_x^1 is a direct measurement of the ratio of the magnetic and electric form factor of the proton G_M^p / G_E^p in the ^{4}He nucleus.

Issues:

The committee agrees that the spin transfer coefficients may not be sensitive to final state interactions and meson-exchange current effects in certain kinematic conditions.

Manpower:

Adequate

Recommendation:

Approve 12 days of beam time in Hall A at 4 GeV.

Appendix E

Proposal: PR-93-050, Hall A

Spokespersons: P. Bertin, G. Fournier

Title: Nucleon Structure Study by Virtual Compton Scattering

Motivation:

This experiment proposes to measure the heretofore unobserved virtual Compton scattering reaction $p\,(e,\,e'p)\,\gamma$ in the resonance region $\sqrt{s}$ ~ 1.4 GeV and Q^2 from 0.2 to 3.5 $(\mathrm{GeV/c})^2$, as well as in the hard scattering region Q^2=1 $(\mathrm{GeV/c})^2$ and s<5 GeV^2. The goal in principle would be to learn about resonant structure and about the transition to hard scattering.

Measurement and Feasibility:

The experiment would take place in Hall A using an LH_2 target and using the HRS spectrometers in order to detect the scattered electron and proton in coincidence.

Issues:

A convincing physics case was not presented that would justify unconditional approval of this proposal at this time, although the PAC believes that the technique appears viable and that such a case can be generated. Therefore a more detailed and convincing discussion should be presented to a future PAC of the physics to be obtained in the resonance region and its extraction from the data which would be forthcoming from 4 GeV running. Undertaking the hard scattering aspect of the proposal should await the 6 GeV option.

Manpower:

The PAC encourages the various proponents of virtual photon scattering to form as strong a collaborative effort as possible.

Recommendation:

Conditionally approve the resonance region component of this experiment for Hall A.

Appendix E

Proposal: PR-93-001, Hall B

Spokesperson: K Sh. Egiyan

Title: Search for Color Coherent Effects via the Observation of Double Scattering Events in CLAS

Motivation:

It is proposed to search for color coherent effects at intermediate values of Q^2 by studying recoiling protons in CLAS. Some calculations indicate a possible sensitivity to color transparency effects.

Measurement and Feasibility:

The measurements are challenging with count rates in some kinematics as low as 2 counts per day. It is not clear that any baseline calculational framework is available on which to base a possible claim of new physics.

Issues:

The approved measurements in Hall C to search for color transparency effects will be carried out within several years. If there are interesting results it might then be appropriate to consider further measurements of the type proposed here in Hall B.

Manpower:

Adequate

Recommendation:

Reject

Appendix E

Proposal: PR-93-006, Hall B

Spokespersons: M. Ripani, V. Burkert

Title: Two Pion Decay of Electroproduced Light Quark Baryon Resonances

Motivation:

A number of baryon resonances are predicted by the quark model but have not been seen. Theoretical estimates indicate that their $N\pi$ widths could be small enough that they would have escaped detection in πN phase shift analyses. On the other hand, their $N\pi\pi$, $\Delta\pi$ and $N\rho$ decay widths and their γp entrance channel widths may be large enough that they can be detected in electroproduction. CLAS is proposed for this search since the large aperture would allow:

- the detection of the hadronic decay products in coincidence with the scattered e^-, and
- measurement of the Δ and ρ decay angular distributions, which are sensitive to resonance contributions.

This provides an opportunity for discovery of new particles at CEBAF. Finding these "missing" baryons or establishing that their decay widths to resonant and non-resonant $N\pi\pi$ channels are much smaller than theoretical predictions would be a substantial contribution to understanding baryon spectroscopy in the quark model.

Measurement and Feasibility:

CLAS with a CW electron beam from CEBAF is the most natural arena for this method of searching for these "missing" baryons. The measurement appears to be feasible within the proposed running time, which substantially overlaps the running time requests of the full N^* program.

Issues:

Disentangling the different contributions will be a major effort in data analysis and interpretation. Many resonant and non-resonant contributions (including those as apparently different as $\Delta\pi$ and $N\rho$) will overlap and interfere, requiring sophisticated and careful interpretation of the data. The large-angle calorimeter proposed by Frascati and Genova will be a valuable upgrade of CLAS for this and other proposed experiments.

Manpower:

The N^* program is a major emphasis of the CLAS group and a substantial fraction of the CLAS group is involved in this proposal. Therefore if manpower is wisely utilized, it should be adequate for this analysis.

Recommendation:

Approval as an important component of the N^* program.

Appendix E

Proposal: PR-93-008, Hall B

Spokesperson: M. F. Vineyard

Title: Inclusive η Photoproduction in Nuclei

Motivation:

This experiment would provide new high accuracy data for inclusive η production on nuclei using the CLAS spectrometer. The *A* dependence would be used to determine the η*N* cross section for a range of η energies. The energy dependence of the η*N* cross section would in turn provide a test of models of the fundamental interaction.

Measurement and Feasibility:

CLAS seems ideally suited for this type of measurement. It will be necessary to run CLAS for the primary experiments 89-045 and 91-014 with a neutral trigger

Issues:

New data on a wide range of targets are now available from Mainz and the *A* dependence appears to be in good agreement with the model calculation of Carrasco. Model dependence is likely to make the extraction of the cross section for the η N interaction quite ambiguous. While the present experiment could still extend this information to higher η energies, the emphasis might better be moved to the proposed investigation of medium modifications of the S_{11} and P_{11} resonances.

Manpower:

Adequate

Recommendation:

Approval that initially data taken on targets up to mass 12 at energies above 800 MeV be analyzed. This could provide useful information on the questions concerning medium modifications. A new proposal should be made after this first phase is complete to justify the extra time which might be needed for the heavier targets.

Appendix E

Proposal: PR-93-009, Hall B

Spokesperson: S. E. Kuhn

Title: The Polarized Structure Function G_{1n} and the Q^2dependence of the Gerasimov-Drell-Hearn Sum Rule for the Neutron

Motivation:

The proposed experiment would measure the asymmetry in inclusive scattering of longitudinally polarized electrons from polarized deuterium in the low Q^2 region and over a wide range of energy. When combined with the corresponding quantities measured in the already approved experiment 91-023 this would provide values for the polarized structure functions A_{1n} (ν, Q^2). This would provide essential input to the dispersive integral relevant to the $Q^2 \rightarrow 0$ Drell-Hearn-Gerasimov sum rule for the neutron.

Measurement and Feasibility:

The proposed measurement would be carried out at four energies in Hall B using the CLAS detector and using a polarized cryogenic ND_3 target.

Issues:

The validity of the DHG sum rule---the variation with Q^2 and the connection with its Ellis-Jaffe and Bjorken analogs---is of utmost interest to both particle and nuclear physicists alike, so that an early CEBAF measurement would be guaranteed to generate considerable attention in both communities. The completion of this important measurement should be given very high priority in the development of the Hall B program.

Manpower:

The manpower is judged to be adequate.

Recommendation:

Approval for 40 days running in Hall B with polarized electrons.

Appendix E

Proposal: PR-93-012, Hall B

Spokesperson: M. V. Kossov

Title: Electroproduction of Light Quark Mesons

Motivation:

To measure $\pi\gamma \to M^*$ transition form factors where M^* is p, ω, h_1. . . etc. These form factors are a good test of microscopic models of meson structure.

Measurement and Feasibility:

Measurements of the reaction (e,e'M^*) would be made at beam energies of 1.6, 2.4, 3.2 and 4.0 GeV on H_2 and D_2 targets. The CLAS detector allows detection of at least three charged hadrons (e.g., $p\pi^+ \pi^-$) in the final state. One residual neutral hadron (e.g. π^0) can be detected if both gammas are detected by the electromagnetic calorimeter. The range of Q^2 is different for each beam energy and the data is constrained to $-t < (M^*)^2$ so that the one pion exchange mechanism is emphasized. The data at 1.6, 2.4, and 4.0 GeV can be obtained concurrently with the N^* approved experiments. The 3.2 GeV data would require an additional 200 hours of beam time for the H_2 target plus 100 hours more if both H_2 and D_2 targets are measured.

Issues:

Until actual data is obtained, it is difficult to assess how reliable the extraction of $\pi\gamma \to M^*$ form factors will be. Although this proposal does not discuss extrapolation procedures, the data available in this experiment contains small t - values so that final state interactions could be reduced by extrapolating to the OPE pole. The recent e^+e^- data on ρ–ω mixing needs to be considered relative to this experiment since it appears that the e^+e^- data represent a cleaner way of interpreting ρ–ω mixing.

Manpower:

Appears to be adequate, although the theoretical support needs to be identified better.

Recommendation:

Approve at beam energies of 1.6, 2.4, and 4.0 GeV and defer the request for new beam time at 3.2 GeV until a real need is demonstrated by the data taken at the other energies.

Appendix E

Proposal: PR-93-017, Hall B

Spokespersons: P. Rossi, E. De Sanctis

Title: Study of $\gamma d \rightarrow pn$ and $\gamma d \rightarrow p\Delta^{o}$ Reactions for Small Momentum Transfers

Motivation:

The photo-disintegration of the deuteron is an important fundamental process in electromagnetic nuclear physics. CEBAF is in a position to provide high quality data which are certainly needed given the spread in the existing data and the availability of many model calculations. Many of these measurements were made with untagged photon beams and the system proposed here should improve the situation considerably. The PAC is also very interested in the possibility of measuring additional channels such as $\gamma d \rightarrow p\Delta^{0}$ using the unique capabilities of CLAS. The PAC strongly encourages the collaboration to pursue this and other accessible exclusive channels.

The PAC is concerned that there is an overemphasis on the quark-gluon-string model and encourages the collaboration to compare the data with all available models.

Measurement and Feasibility:

The experimental problems are challenging but appear to be well understood. The PAC believes that the experiments are feasible and that CEBAF is in a position to provide very high quality data.

Issues:

Photo-disintegration measurements are planned at other high duty-factor facilities such as those at Mainz and Bonn. The PAC believes that the topic is of sufficient interest that measurements in more than one laboratory are desirable. However, it is clear that the final run plan should be made taking into account the quality and quantity of data then existing from other laboratories.

Manpower:

The manpower is adequate. The PAC is pleased to see the participation of the Frascati and Genova groups in the Hall B program. They have considerable experience in this field which will benefit the whole tagged photon program.

Recommendation:

Approval of the experiment to run in parallel with experiment PR-89-045, plus 3 days of additional beam time are approved to allow the extension of the tagged photon measurements to lower energies.

Appendix E

Proposal: PR-93-019, Hall B

Spokespersons: N. Bianchi, B. Berman, V. Muccifora

Title: Photoabsorption and Photofission of Nuclei

Motivation:

The goal of this experiment is to study the quenching of nucleonic resonances in nuclei and shadowing effects by measuring the total photoabsorption cross section. Very little photoabsorption data for complex nuclei exist in the energy region between 1.2 and 2 GeV. These data may also be used to study the *A* dependent behavior of the generalized GGT sum rule.

Measurement and Feasibility:

The experiment makes use of the photon tagging system in Hall B, a hadronic detector system and fission detectors to be used with the Th, Np and U targets. Radiation resistant Pb-glass detectors will be used to measure the incident photon intensity. These techniques have been used extensively by the collaboration and appear feasible. However, the low-intensity photon beams probably cannot be achieved by simply turning down the beam current by two or three orders of magnitude.

Issues:

This is an attractive experiment for commissioning the photon tagging system in Hall B. It appears that the photofission experiments could be performed at the standard tagging rate of 5×10^7 photons/s. However, the calibration of the photon beam intensity must be performed at low intensity, approximately 5×10^4 to 10^5 photons/s. These low intensities will be extremely difficult to achieve early in the CEBAF program. The collaboration should not permit this experiment to impede the development of the CLAS program in any way. Also, the collaboration should not expect CEBAF operations to provide the low-intensity photon beams necessary for the flux calibration. The production of these low intensities are the responsibility of the collaboration.

Manpower:

This is an international collaboration with extensive experience in total photoabsorption experiments in the GeV energy range. It appears that the manpower is adequate to perform these studies.

Recommendation:

Approve for 8 days of running in Hall B with the condition that the experiment must not impede the construction schedule of CLAS.

Appendix E

Proposal: PR-93-022, Hall B

Spokespersons: P. Rubin, H. Funsten, E. Smith

Title: Measurement of the Polarization of the $\phi(1020)$ in Electroproduction

Motivation:

The group proposes to measure the polarization of electroproduced ϕ mesons by measuring the angular correlations in $\phi \rightarrow K^+K^-$ decay. This polarization is a sensitive probe of the production mechanism. The CLAS detector is to be used because its large aperture is required for measurements of these decay correlations. The ultimate goal is to search for the strangeness components in the proton $q\bar{q}$ sea.

Measurement and Feasibility:

The technique of utilizing vector meson decay angular distributions to unravel details of the production mechanism is well-established. The CLAS detector is the natural device for these measurements.

Detection of ϕ mesons and discrimination against background appears to be adequate when K identification using ToF is combined with kinematic rejection of background and utilization of the narrow width of the ϕ.

Issues:

Running CLAS at half-field is a major component of this program; this would allow important measurements to be made at low Q^2. This is necessary to provide a large number of ϕ's in the low-Q^2 region to provide precision data and to study the region in which the ratio σ_L/σ_T in ρ electroproduction is increasing toward saturation. Although there are no other proposals for half-field running at this time, there is every reason to believe that others will follow the approval of this one.

This experiment is closely related to and complementary to the corresponding photoproduction experiment, proposal PR 93-031. Understanding how ϕ electroproduction extrapolates to ϕ photoproduction can be an important contribution of this proposal.

Manpower:

The group is fully integrated into the CLAS group so judicious utilization of resources will result in sufficient manpower for this proposal.

Recommendation:

Approval. The scheduling of the half-field running must be integrated into the overall CLAS program. The recommendation is for 15 days of running in Hall B with 4 GeV electrons.

Appendix E

Proposal: PR-93-029, Hall B

Spokespersons: H. Baghaei, W. Hersman

Title: Search for $\Delta^{++}(1232)$ Components in the ^3He Ground State

The PAC notes that the physics has already been endorsed by a previous PAC, with the conditional approval of PR-91-020, on which many of the present proposers are named as collaborators. Since the conditional approval was granted on the basis of the development of a suitable polarized ^3He target and since the primary difference between the '91 and '93 programs is in the different proposed targets, the PAC does not believe that is advantageous to pursue two parallel programs at this time. It is expected that target developments will continue, and at some appropriate time that the entire collaboration will agree on the best possible target that will meet the requirements of the experiment. If agreement within the collaboration cannot be achieved with regard to target choice, then a technical review should occur at CEBAF to resolve the issue. The physics program which will evolve after the choice of the target and its associated requirements is settled should be pursued by a single group.

Appendix E

Proposal: PR-93-030, Hall B

Spokespersons: K. H. Hicks, M. Mestayer

Title: Measurement of the Structure Functions for Kaon Electroproduction

Motivation:

Using the nearly 4π solid angle coverage of the CLAS detector allows the determination of the four structure functions σ_T, σ_L, σ_{TT}, σ_{TL} over a range of Q^2. The goal is to measure the magnitudes and kinematic dependencies of coupling constants and form factors. This reaction is a basic production mechanism which is required for hypernuclear physics using heavier targets. Additional interest is provided from measurements of i) the isospin dependence of the L/T ratios for recoiling Λ versus Σ, ii) production ratio of various hyperons, Λ, Σ, $\Lambda(1405)$, $\Sigma(1385)$ and $\Lambda(1520)$ as a function of Q^2, and iii) polarization of the Λ.

Measurement and Feasibility:

Data taking is planned to be at beam energies of 2.4, 2.8, 3.2, and 4.0 GeV. The data at 2.4 and 4.0 GeV is compatible with the existing approved N^* program. An additional 200 hours of beam time is needed for the 2.8 and 3.2 GeV beam energies. Both the electron and K^+ are detected and a minimum bias trigger requiring an electron candidate track be accompanied by at least one positively charged track. The ranges of Q^2 and W are 1.0 to 2.5 $(\mathrm{GeV}/c)^2$ and 1.6 to 2.3 GeV respectively. Good acceptance over the azimuthal and polar angles (ϕ^* and Cos (θ^*)) for the K^+ leads to anticipated measurements of L/T to 20% and σ_{LT}, σ_{TT}, to 5% accuracy.

Issues:

Several independent structure functions describe the reaction with a number of theoretical diagrams being simultaneously important. Considerable theory support is needed to effectively analyze and interpret the data. There appears to be adequate theory support to accomplish the goals. The electroproduction data is complementary to proposed photoproduction data where only transverse photon polarizations occur.

Manpower:

Adequate manpower (theory and experiment) appears to be available.

Recommendations:

Approval of 4 days of running in Hall B at each of 2.8 and 3.2 GeV for a total of 8 days.

Appendix E

Proposal: PR-93-031, Hall B

Spokespersons: J. M. Laget, M. Anghinolfi, C. Marchand

Title: Photoproduction of Vector Mesons at High *t*

Motivation:

This proposal aims to measure ϕ photoproduction at high t in the nucleon and few-body nuclei, in order to study two-gluon exchange mechanisms and search for a dip in $d\sigma/dt$ near t = -2.3 (GeV/c)^2. The dip is thought to arise from the interference between a pair of two-gluon amplitudes, one in which both gluons couple to a single s quark in the ϕ and the other in which one gluon couples to the s quark and the other to the $\bar{s}$ quark. A rather more speculative goal is searching for evidence of "hidden color" states.

Measurement and Feasibility:

The Committee agrees that the measurement of ϕ photoproduction on nucleons at high t in the CLAS spectrometer is feasible. This measurement is certainly the first step in the program to understand the subject in few-body nuclei.

Detection of a dip near t = -2.3 (GeV/c)^2 appears to be possible in the proposed 400 hours of proposed γp operation with the CLAS spectrometer. The data can be accumulated along with the data for the N* experiment. In fact, the trigger is identical; the analysis differs in the selection of the final state. Detection of ϕ mesons and discrimination against background appears to be adequate when K identification using ToF is combined with kinematic rejection of background and utilization of the narrow width of the ϕ.

Issues:

The role of "hidden color" in QCD is theoretically very uncertain since the proposed color states can be expanded in terms of colorless states. On the other hand, it may be possible to study the role of two-gluon mechanisms using the fact that these mechanisms should be short-distance. The existence of a dip in the t distribution would be evidence for these hard contributions. Extension of the measurements to few-body nuclear systems is relevant only if these hard processes are found in photoproduction on the nucleon.

The interpretation of the experiment becomes cleaner at higher energies so this experiment will always seek to utilize the highest energy available at CEBAF.

This experiment is closely related to and complementary to the corresponding electroproduction experiment, PR-93-022. In particular, this group must study many of the same angular correlations which are the principal concern of the other experiment.

Manpower:

Manpower appears to be adequate for this measurement.

Recommendation:

Approval of 17 days of running with CLAS at E_e=4 GeV for the proposed studies on the proton.

Appendix E

Proposal: PR-93-033, Hall B

Spokesperson: J. Napolitano

Title: A Search for Missing Baryons Formed in $\gamma p \rightarrow p\pi^+\pi^-$ Using the CLAS at CEBAF

Motivation:

This experiment is a search for missing non-strange baryons in the mass range 1.3 to 2.3 GeV. The strategy is to photo-excite the baryons in a proton target and look for two-pion emission in CLAS. Many resonances expected in this energy region are predicted to have small N-π widths, but substantial widths for $\Delta\pi$ and N-ρ channels. Thus, there is good reason to provide high quality angular distribution data to search for these resonances. This experiment is complementary to experiment 93-006, which searches for two-pion decay of electroproduced non-strange baryon resonances.

Measurement and Feasibility:

The measurement makes use of tagged photons on a LH_2 target in CLAS. The luminosities, resolution requirements and particle identification appear to be adequate for this experiment. The experiment also requires no significant additional beam time.

Issues:

The central question is whether one can identify new resonances in a region where there could be overlapping levels. Also, the strong diffractive process in the $p(\gamma,\rho)N$ process may mask rather weak resonances. However, the expected high quality of the data should either permit extraction of resonant amplitudes or give an indication of strength beyond the t-channel process.

Manpower:

Since the data will be recorded concurrently with experiments 89-004, 89-024 and 91-008, which involve the CLAS collaboration, the manpower for the experiment is adequate.

Recommendation:

Approval of concurrent running in CLAS with experiments 89-004, 89-024, and 91-008.

Appendix E

Proposal: PR-93-036, Hall B

Spokespersons: H. Weller, R. Chasteler, R. Minehart

Title: Measurement of Single Pion Electroproduction from the Proton with Polarized Beam and Polarized Target Using CLAS

Motivation:

This activity of the *N** group is part of a larger program to investigate the resonances of the nucleon. An experiment to study the inclusive scattering of polarized electrons on polarized protons has already been approved by PAC5 (PR-91-023). The newly proposed measurement of single pion electroproduction with CLAS will not require any further beam allocation. The data will provide three independent asymmetry ratios over a wide range of W and Q^2. The predicted asymmetries are large and are sensitive to the underlying resonance structure, particularly in the region of the Roper resonance. As an example, the data could give important information on whether the Roper is a 3 quark state or a hybrid of quarks and gluons.

Measurement and Feasibility:

The request for running time, beam energies, currents and targets is identical to that assigned to PR-91-023. The new experiment on asymmetries will be the basis for all future investigations using polarization degrees of freedom at CLAS.

Issues:

The operation of the CLAS detector in the presence of the high target magnetic field should be established before embarking on a long range program involving such targets.

Manpower:

The manpower is judged to be adequate.

Recommendation:

Approval for this experiment to be performed concurrently with PR-91-023 in Hall B.

Appendix E

Proposal: PR-93-037, Hall B

Spokespersons: W. Hersman, T.P. Smith

Title: Precision Measurement of the Ratio of the Electric & Magnetic Form Factors of the Neutron with Polarized ^{3}He Using CLAS

The PAC notes that the physics has already been endorsed by a previous PAC, with the conditional approval of PR-91-020, on which many of the present proposers are named as collaborators. Since the conditional approval was granted on the basis of the development of a suitable polarized ^{3}He target and since the primary difference between the '91 and '93 programs is in the different proposed targets, the PAC does not believe that is advantageous to pursue two parallel programs at this time. It is expected that target developments will continue, and at some appropriate time that the entire collaboration will agree on the best possible target that will meet the requirements of the experiment. If agreement within the collaboration cannot be achieved with regard to target choice, then a technical review should occur at CEBAF to resolve the issue. The physics program which will evolve after the choice of the target and its associated requirements is settled should be pursued by a single group.

Appendix E

Proposal: PR-93-043, Hall B

Spokesperson: B. Quinn

Title: Measurement of the ΔΔ Component of the Deuteron by Exclusive Quasielastic Electron Scattering

Motivation:

While it is widely believed that excited baryons must contribute to the ground state wavefunction of nuclei, no direct observations have yet been made. The proposed use of the CLAS detector holds promise of increasing the sensitivity of the search for a ΔΔ component of the deuteron by a significant factor. The threshold for detection would then be below that predicted by several calculations which predict a ΔΔ content between 0.25 and 0.5%.

Measurement and Feasibility:

The experiment would be carried out using a deuterium target, a 4 GeV incident electron energy and operation of CLAS at full field strength in the reversed direction.

Issues:

The extraction of the signal from the considerable combinatorial background may be difficult. Indeed the final sensitivity attained will depend on the accuracy with which models can predict the background effects. Consideration should also be given to the possibility of interference with the background terms which could lead to enhanced sensitivity to a ΔΔ component.

Manpower:

Manpower is judged to be adequate.

Recommendation:

Approval for 16 days of CLAS running at 4 GeV and reversed full field with a deuterium target in addition to concurrent running with the N^* program at 2 GeV and 3 GeV.

Appendix E

Proposal: PR-93-044, Hall B

Spokespersons: B. L. Berman, G. Audit, P. Corvisiero
Title: Photoreactions on ^{3}He

Motivation:

The proposal describes a wide-ranging program which could be accomplished using a tagged photon beam incident on a ^{3}He target in CLAS. The PAC finds many of the topics presented interesting and supports this general program which can run in parallel to the physics already approved by PAC 5 for experiment PR91-014.

It is unlikely that the collaboration will be able to address all the possible topics with the same level of effort in this first phase of operation. Among the topics presented, the PAC finds the 3-body physics most important and encourages the collaboration to give high priority to preparation for this particular part of the data analysis. The PAC agrees that ^{3}He is a good system to search for effects of three body forces but believes that much theoretical work remains to be done on the extraction of unambiguous information on the three body force.

Other topics such as the search for pre-existing Δ resonances and the investigation of the suppression of the D_{13} and F_{15} resonances were felt to be interesting but of lesser initial priority because it is anticipated that there will be difficulties in pulling out clear signatures.

Measurement and Feasibility:

The PAC believes that the measurements are feasible with the CLAS system.

Issues:

Issues of compatibility with experiment PR91-014 have been addressed. The committee sees no particular technical problems. However, the analysis of any of the topics presented will be a real challenge and the collaboration is encouraged to continue its high level of effort in preparation for the experiment.

Manpower:

The manpower is adequate.

Recommendation:

Approval for running in conjunction with PR 91-014 for a total of 23 days with the tagger threshold lowered to 0.5 GeV. The additional 6 days will provide the necessary integrated luminosity for PR 91-014.

Appendix E

Proposal: PR-93-003, Hall A/C

Spokespersons: S. Kox, E.J. Beise

Title: Measurement of the Deuteron Tensor Polarization at Large Momentum Transfer in D $(e, e'\vec{d})$

Motivation:

The primary goal of the proposed experiment is to separate the charge and quadrupole form factors of the deuteron in the momentum transfer range of 4.4 to 6.2 fm^{-1}. This momentum transfer range is particularly interesting since the charge form factor goes through zero in this region; and consequently it is very sensitive to the deuteron wave function, isoscalar meson exchange current and relativistic effects.

Measurement and Feasibility:

The measurement makes use of electron scattering from a high- power (500W) liquid deuterium target and a novel polarimeter technique. The Hall C cryotarget must be upgraded from a 250-watt capability to accommodate this experiment. No target upgrade is necessary if the experiment is scheduled for Hall A. The polarimeter must be calibrated with tensor polarized deuterons at Saturne II. From measurements of efficiency and analyzing power, it appears that this new polarimeter has the highest figure of merit of any deuteron tensor polarimeter in the few hundred MeV energy range. However, the in-line geometry, lack of redundant particle identification, and the requirement of an absolute efficiency measurement in a high-background environment make this a very difficult experiment. Complete simulations need to be performed so that the feasibility of the method can be fully assessed.

Issues:

There is clear physics interest in this proposed measurement. There needs to be an optimization of the target, deuteron channel and choice of beam energy, plus full simulations of the backgrounds.

A QQD channel will be used to focus deuterons onto the polarimeter. This channel must be matched to either the HRS (Hall A) or the HMS (Hall C). The PAC was not convinced that the deuteron channel was optimized for this measurement. For example, the highest electron energy proposed was 2 GeV rather than 4 GeV. If a deuteron channel could be matched to the electron spectrometer for a 4 GeV incident beam, a factor of 4 improvement in figure of merit could be realized. The proponents should consider a possible optimization scheme for a 4 GeV beam. Complete background simulations are necessary. Experience with deuteron tensor polarimeters indicates that the figure of merit can be seriously compromised by unexpected background rates in various detectors. The collaboration should provide a complete simulation of possible backgrounds to ensure that the figure of merit of the experiment is achievable.

Manpower:

The collaboration consists of an international collaboration with extensive experience in polarization measurements and electron scattering experiments.

Recommendation:

Defer

Appendix E

Proposal: PR-93-016, Hall C

Spokesperson: C.E. Jones

Title: Measurement of the Spin-Dependent Asymmetry in Quasielastic Electron Scattering from Polarized Tritium

Motivation:

The goal of this experiment is to measure the inclusive quasielastic scattering cross section $^3H(\vec{e}, e')$ at incident energies 0.96, 1.5 and 1.9 GeV for momentum transfers Q^2 = 0.2, 0.5 and 0.8 $(GeV/c)^2$. The asymmetry measurement is proposed to contribute to unravel the spin structure of the three-nucleon system and to reveal possible effects of medium modification of the proton electromagnetic form factors.

Measurement and Feasibility:

The experiment will be performed in Hall C using the SOS and HMS spectrometers. The polarized target is a closed cell using only 1 curie of tritium. ^3H and ^1H would be mixed in the target to use hydrogen as a calibration. The experimental technique presents some interesting challenges.

Issues:

The PAC was concerned by the emphasis of this proposal on the possible medium modification of the proton electromagnetic form factors. Measurements of spin dependent electron scattering from polarized tritium will provide stringent tests of exact calculations in the three nucleon system. This experiment will require significant resources for development of the tritium target.

Manpower:

Adequate

Recommendation:

Conditional approval on successful demonstration of a polarized tritium target suitable for these measurements.

Appendix E

Proposal: PR-93-018, Hall C

Spokesperson: O. K. Baker

Title: Longitudinal/Transverse Cross Section Separation in $p(e,e'K^+)\Lambda$ (Σ) for $0.5 \leq Q^2 \leq 2.0$ (GeV/c)^2, $W \geq 1.7$ GeV, and $t_{min} \geq 0.1$ (GeV/c)^2

Motivation:

This is an update of proposal PR-91-022 which was conditionally approved by PAC5. The goal of the experiment is to study kaon electroproduction in the range of momentum transfer Q^2 from 0.5 to 2 (GeV/c)^2. It is proposed to separate the 4 structure functions, in particular the transverse and longitudinal ones, and to determine the kaon form factor by extrapolating the differential cross section to the kaon pole. Both Λ and Σ hyperons will be identified, and the individual structure functions for these two reactions will be studied over a large range of momentum transfer. This separation will provide new and interesting information on strangeness production.

Measurement and Feasibility:

The HMS and SOS spectrometers in Hall C are uniquely well suited to detect the scattered electron and the produced kaon in coincidence. The SOS will be centered on the direction of the virtual photon for three values of the transverse polarization. In this way it will be possible to separate the longitudinal and transverse response functions. The estimated coincidence and accidental rates should be adequate to provide a 5% accuracy within 2 weeks of beam time.

Issues:

In response to the recommendations of PAC5, the group has added some new collaborators, performed simulations of the spectrometer acceptances, and redefined some of the spectrometer requirements. The PAC is pleased to see that there exist now theoretical calculations for the kinematics of the proposed experiment. The PAC considers this first separation of the structure functions to be an important goal by itself. There is some skepticism, however, that the proposed extrapolation to the kaon pole will lead to a convincing result. Concerning the separation of all four structure functions, proposal PR-93-030 will be in a much better position due to the full coverage of polar and azimuthal angles with CLAS. Therefore, highest priority in this project should be given to achieve the longitudinal/transverse separation at forward angles and small values of t.

Manpower:

Adequate

Recommendation:

Approval for 14 days in Hall C.

Appendix E

Proposal: PR-93-020, Hall C

Spokesperson: R. Ent

Title: Measurement of the Momentum Transfer Dependence of Quasielastic (*e,e'p*) Scattering at Large Momentum Transfer and Large Missing Energy

Motivation:

The authors proposed to measure the (*e,e'p*) cross section at large missing energies as a function of A and Q^2 up the highest Q^2 attainable at CEBAF. Recent experimental data and theoretical studies have shown the existence of strength at large missing energy distribution in the quasielastic (*e,e'p*) reactions.

Measurement and Feasibility:

The measurement would be done in Hall C for four target nuclei, ^{2}H, ^{4}He ^{12}C and ^{58}Ni for momentum transfers between 1.9 and 8.7 $(GeV/c)^2$. The experiment would use SOS to detect the electrons and HMS for the knocked-out protons.

Issues:

The PAC believes that detailed studies of the strength distribution at large missing energy in (*e,e'p*) reactions are of great interest. However, the experiment is essentially an extension of experiments 91-007 and 91-013, which examine a series of nuclei through the (*e,e'p*) reaction. Although, the authors propose to measure that part of the missing energy region not covered by 91-007 and 91-013, the PAC feels the proposed extension should not be pursued at this time because a complete analysis will require beam energies up to 6 GeV.

Manpower:

Manpower was judged adequate.

Recommendation:

Defer

Appendix E

Proposal: PR-93-021, Hall C

Spokesperson: D.J. Mack

Title: The Charged Pion Form Factor

Motivation:

The pion plays a central role in our understanding of hadron structure and precise knowledge of its form factor is desirable. PAC6 views the proposed determination of the pion form factor by measurement of charged pion electroproduction from the proton in the momentum transfer region of 0.5-5 $(GeV/c)^2$ as an interesting experiment. In particular, new more precise data from CEBAF at higher momentum transfers (approximately 2-5 $(GeV/c)^2$) will provide information in the transition region where the quark counting rules appear to be in agreement with other hadron form factors.

Measurement and Feasibility:

From a technical point of view a precise determination of the pion form-factor will require careful attention to systematic errors. The CEBAF machine and Hall C experimental equipment can provide the necessary precision. However, the proposed experiment involves a difficult L/T separation and so uncertainties in the following quantities must be minimized: target thickness in the presence of beam; spectrometer acceptances; integrated charge; and radiative corrections. Most of this work can only begin once the CEBAF accelerator and Hall C are operational. Further, a dedicated program of measurements to realize the proposed 3% systematic error is required. CEBAF's unique contribution to the pion form factor will be to provide high quality data at high momentum transfers and here the minimization of errors is crucial to success.

Issues:

The proposed Phase I measurements can improve the existing experimental information on the pion form-factor at low Q^2 but do not address the most interesting physics questions. The Phase II measurements require a 6 GeV beam.

Manpower:

PAC6 recommends that the collaboration seek additional manpower for this important and challenging measurement.

Recommendation:

Approval for the 9 days at 4 GeV.

Appendix E

Proposal: PR-93-026, Hall C

Spokesperson: D. Day

Title: The Charge Form Factor of the Neutron

Motivation:

The magnetic and charge form factors of the neutron and proton are fundamental properties of the nucleons and provide a critical testing ground for QCD models. At the present time the charge form factor of the neutron is the least well known. The authors propose to extract the charge form factor of the neutron by measuring the spin-dependent part of the quasi-elastic *e-n* cross section. They will detect quasielastically scattered electrons from a longitudinally polarized electron beam incident on a polarized deuterium nucleus in deuterated ammonia ($^{15}ND_3$). The determination of the asymmetry in the cross section for two opposite orientations of the beam or target will yield the product $G_E^n \bullet G_M^n$. A precise measurement of G_M^n will be available from other experiments.

Measurement and Feasibility:

Quasielastic scattering events from the neutron will be identified by detecting the recoil neutron in coincidence with the scattered electron. The neutron detector will consist of an array of scintillators which form a continuous wall. The front of the detector will be covered by a layering of ΔE detectors for identification of protons.

Issues:

The authors have carefully considered all aspects of this measurement and have addressed concerns expressed by previous PACs. The target will run at 1°K and the use of ^{15}N will lessen concerns about contributions from polarized neutrons in nitrogen. However, technical issues have yet to be resolved. There will be contributions to the measured asymmetry due to the tensor polarization in the target which have to be estimated and eventually subtracted. The operation of the accelerator in the single user mode at 40na will require operations to install some mechanism to monitor the beam under these conditions. The availability of high polarization beam as a stable operating mode is not expected to be operational at the very earliest until late 1995. The target polarization of 45% is considered to be somewhat optimistic.

Manpower:

Manpower is judged adequate.

Recommendation:

Approval for 60 days of running in Hall C with 40na and a polarization of 80%.

Appendix E

Proposal: PR-93-028, Hall C

Spokesperson: J. Jourdan

Title: Deformation of the Nucleon

Motivation:

The goal of this experiment is to study the L=2 strength in the $N\Delta$ transition in the nucleon wave function by measuring the asymmetry in the inclusive reaction of polarized electrons on polarized protons. The PAC believes that the physics is very important.

Measurement and Feasibility:

The measurement will be done in Hall C using an electron beam with a planned polarization from 0.5 to 0.8 and a cryogenic NH_3 target, whose effective polarization will be 0.9. The Q^2 ranges from 0.21 to 1.4 $(GeV/c)^2$. The required beam current is 100 nA.

Issues:

The interpretation of the data is expected to be highly model-dependent, as it requires a realistic estimate of the underlying non-resonant background. More effort will be necessary to establish the theoretical uncertainty on the non-resonant background. On the experimental side the issue of delivering low current beam is not yet resolved. We recommend that the experiment take data with a strained GaAs source to achieve higher polarization.

Manpower:

The manpower is judged to be adequate.

Recommendation:

Approval for 15 days of running in Hall C with 100 na and a polarization of 80%.

Appendix E

Proposal: PR-93-034, Hall C

Spokesperson: J. Napolitano

Title: Measurement of the Differential Cross Sections for $\gamma p \to K^+\Lambda$ and $\gamma p \to K^+\Sigma$ Using the SOS Spectrometer in Hall C at CEBAF

Motivation:

The main motivation is the investigation of structures in the γp$\to K^+\Lambda(\Sigma)$ cross section possibly related to undiscovered baryon resonances weakly coupled to the π-N channel.

Measurement and Feasibility:

Kaons would be measured using the SOS Hall C spectrometer and identified from the large π and p background using TOF and Cherenkov detectors. Angular distribution would be measured at 4 beam energies between 1.6 and 4.0 GeV.

Issues:

The PAC is concerned with the quality of the experiment which makes use of a continuous bremsstrahlung beam from a thick radiator. Also the ability of the measurement to identify a meaningful signal in the presence of very significant resonant amplitude backgrounds was not demonstrated.

Manpower:

Adequate

Recommendation:

Reject

Appendix E

Proposal: PR-93-035, Hall C

Spokespersons: P. Stoler, J. Napolitano

Title: The Δ(1232) Form Factor at High Momentum Transfers

Motivation:

The proposed experiment plans to study the transition amplitudes of the Δ(1232) resonance at Q^2=4 $(\mathrm{GeV/c})^2$ by measuring the cross section of the reaction $p(e,e'p)\pi^0$. The experiment aims to obtain information on the relative importance of the amplitudes M1+, E1+ and S1+ at high Q^2.

Measurement and Feasibility:

The measurement would be done in Hall C using the SOS to detect the electrons and HMS for the recoiling proton, and the emitted neutral pions will be identified by missing mass reconstruction. About 10 angle-central momentum settings would be necessary to measure a 4π angular distribution.

Issues:

The PAC believes that the physics is of high interest. However, the approved experiment PR-89-037 in Hall B will in part cover the same physics and the PAC prefers to await the results of this survey before deciding if and where more detailed measurements might be justified.

Manpower:

The manpower listed in the proposal would be adequate.

Recommendation:

Reject

Proposal: PR-93-038, Hall C

Spokesperson: R. Madey

Title: The Electric Form Factor of the Neutron from the $d(\vec{e}, e'\vec{n})p$ Reaction and The Magnetic Form Factor of the Neutron from the $d(\vec{e}, e'\vec{n})p$ Reaction

Motivation:

Measurement of the neutron charge distribution to a precision of order 0.01 in the momentum transfer range 0.2 - 2 $(\mathrm{GeV/c})^2$ is a high priority for the field of electromagnetic nuclear physics. It is a fundamental quantity needed for the understanding of both nucleon and nuclear structure. The feasibility of the proposed technique to measure the polarization transfer to the recoil neutron in quasielastic $(e,e'n)$ scattering from deuterium has been demonstrated experimentally by this collaboration at Bates. Further, this technique has been studied theoretically and extraction of G_E^n appears to be largely free from ambiguities. The CEBAF machine and Hall C experimental equipment seem to be well suited to the proposed measurement of G_E^n . A high precision (total error in G_E^n better than 0.01) measurement of G_E^n early in the life of the new facility would have a significant impact on the field and would demonstrate the potential of CEBAF. A high precision measurement of the neutron magnetic form-factor at the same kinematics should provide a consistency check on both the measurement technique and the extraction of G_E^n .

Measurement and feasibility:

To carry out this experiment the following capabilities must be in place: a) beam energy of at least 1.6 GeV, b) 100 microamps of 40% polarized beam, c) 100% duty factor, d) cryogenic deuterium target with power dissipation capability of 250 W, e) beam current monitoring at 100 microamp intensity to about 1%, f) better than 4% measurement of beam polarization, g) better than 4% calibration of neutron polarimeter, h) acceptance of the HMS known to better than 5%, i) 1400 tons of shielding.

Issues:

1. PAC6 is not convinced that the detector configuration is sufficiently optimized. Particular care must be taken to construct a neutron polarimeter which is optimally matched to the electron spectrometer in both size and position. Optimization will increase precision for a given running time.
2. Only a precision experiment as proposed is acceptable. PAC6 is of the opinion that in the initial data taking run increasing the precision at a limited number of Q^2 points should have higher priority over extending the Q^2 range of the measurements.

Manpower:

The experiment is challenging and obtaining the required precision will require dedication and single mindedness from the collaboration over an extended period of time from preparation, setup, checkout, production running through data analysis. The collaboration should ensure that it has strong commitments from its large, multi-institutional membership.

Recommendation:

Approval for 60 days of running at 100μA in Hall C.

Appendix E

Proposal: PR-93-042, Hall C

Spokespersons: W. Kim, J. Napolitano, C.N. Papanicolas, S.E. Williamson, S. Wood

Title: A Measurement of the Fifth Structure Function via Quasielastic ^{12}C, ^{16}O $(\vec{e}, e'p)$

Motivation:

The motivation for this measurement in Hall C lies in the use of the out-of-plane capability of the SOS to investigate final state interactions (FSI). The fifth structure function (f'_{01}) is the imaginary part of the transverse-longitudinal interference response which vanishes in the plane wave limit. Effects of meson exchange and delta currents appear to be small compared to FSI. DWIA calculations shown in this proposal indicate small but measurable values for f'_{01} .

Measurement and Feasibility:

Measurements of the electron helicity asymmetry A_e for ^{12}C and ^{16}O $(\vec{e}, e'p)$ reactions over the quasielastic region will be carried out at Q^2 of 0.25, 0.6 and 1.0 (GeV/c)^2. A_e is related to f'_{01} and vanishes in parallel kinematics so that out-of-plane measurements of the proton in the SOS at 20^{o} are planned. The electron is detected in the HMS. The measurements appear to be quite feasible within the current equipment plans.

Issues:

Scientifically the stated goal of using f'_{01} measurements to study FSI was not adequately justified in this proposal. The evidence presented did not show that f'_{01} is sensitive to any particular feature of the FSI. The model calculations presented used FSI's which appeared to be inappropriate for this specific experiment. In particular, it was not established that f'_{01} would provide new information on FSI's if the interactions were constrained to fit the relevant data for the outgoing proton. Even if this were the case, it is not clear that this knowledge can be used in conjunction with other measurements to help uncover other more interesting physics.

Manpower:

Adequate

Recommendation:

Reject