Report of the January 29 - 31, 1996 Meeting of the CEBAF Program Advisory Committee

– PAC10 –

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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April 3, 1996

Dear Members of the CEBAF User Group,

The Accelerator is now routinely providing energies up through 4 GeV and experiments are running in Hall C. Hall A experimental installation is nearly complete and will receive its first beam this Spring. Hall B is at the peak of its installation activities and will receive its first beam this Autumn. CEBAF and its User Community can feel proud of these accomplishments and look forward to the rewarding flow of physics. As part of ensuring an excellent physics program, the January 29-31, 1996 Program Advisory Committee (PAC10) heard details on the progress of the Accelerator and all three Halls, discussed the initial plans for Hall A and B commissioning, and considered new and updated proposals and letters-of-intent.

Attached is the *Report of the January 29-31, 1996 Meeting of the CEBAF Program Advisory Committee*. Several members of the PAC, including PAC Chairman John Cameron, stayed beyond their regular terms to complete the scientific ratings of the entire scientific program. This was a major task and essential for the successful running of the program. I want to thank John and the members of the PAC for their efforts on behalf of CEBAF and its User Community and for the PAC's thoughtful deliberations and care in setting the physics program on a sound foundation.

To continue to keep to the schedules for installation and commissioning of equipment in Halls A and B and to keep the schedule for initial operations in Hall C, the next PAC meeting (PAC11) will be January 1997. The planned two PAC meetings per year as discussed with the User Group Board of Directors will occur as installation and commissioning efforts are completed.

I wish to thank you the Users for your efforts on the proposals, updates and letters-of-intent. I particularly wish to express my thanks for all of your hard work in launching the experimental physics program and initiating the harvest of scientific results.

Sincerely,

Hermann Grunder
Director

Report of the January 29 - 31, 1996 Meeting of the CEBAF Program Advisory Committee

Introduction

The CEBAF Program Advisory Committee held its 10th meeting on January 29-31, 1996, in CEBAF Center. The PAC 10 membership is given in Appendix A. In response to a charge from the Director, H. Grunder, the PAC reviewed five new proposals and one updated proposal. The PAC reviewed all of the Hall B proposals and assigned scientific ratings to those not previously rated. The PAC also provided comments on four letters-of-intent.

An update of the Hall A commissioning and first phase run plan was given. The committee was pleased with the modifications adopted since the first presentation and recommends that this new plan be adopted. The Hall B commissioning and first phase run plan were presented and discussed by the PAC. The committee believes that the overall plan and strategy will work well for the Hall B program and requests that an update be given at the next PAC meeting.

Concerns and General Recommendations

The PAC has now completed reviews of all experimental proposals presented to CEBAF, and has assigned scientific merit ratings to all which have been recommended for acceptance. A full listing of these ratings is attached as Appendix G. The PAC is pleased and excited by the quality and potential of the program now in place. It is clear from these ratings that the programs in all three halls contain some outstanding physics and that the overall standard of the accepted proposals in the three halls is remarkably uniform.

While much work remains to be done to reach full utilization of the facility, it is most heartening to note the important milestones of the past 12 months. Full beam energy of 4 GeV is now routinely available, and the beam current continues to be increased as confidence in Accelerator systems permits. The experimental equipment in Hall C is now in full use, while that in the other two Halls progresses according to plan. The PAC was pleased to note the timely solution of the LH_2 target problem mentioned in the last report.

The PAC again noted that some physicists appear on many proposals. It has commented on this concern in the past, and notes that it continues to make any reliable comments on the manpower impossible.

The reports and PAC recommendations for each of the proposals reviewed are given in Appendix D. The following tables summarize results from PACs 4-10:

Totals for PACs 4-10

	Experiments Recommended for Approval	Additional Experiments Recommended for Conditional Approval	Total
Experiments	80	16	96
Authors	599	37	636
Institutions	119	4	123
Countries	21		21

Totals of Approved Experiments by Physics Topic for PACs 4-10

Topic	Number	Hall A	Hall B	Hall C
Nucleon and Meson Form Factors and Sum Rules	10	3	3	4
Few Body Nuclear Properties	17	9	5	3
Properties of Nuclei	14	3	8	3
*N** and Meson Properties	25	3	20	2
Strange Quarks	14	2	8	4
Total	80	20	44	16

Scientific Ratings Summary of Experiments Recommended for Approval by PACs 4-10

Rating	A	A–	B+	B	B–	C
Hall A	2	3	6	4	4	1
Hall B	3	6	23	7	4	1
Hall C	3	3	4	4	2	
Total	8	12	33	15	10	2

A listing of experiments recommended for approval by physics topic for PACs 4-10 is attached to this report as Appendix H. One page summaries of experiments recommended for approval by PACs 4-10 are available on-line under: http://www.cebaf.gov. The PAC reports for PAC's 4-10 are also on-line at the same location.

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John Cameron

Chair, CEBAF Program Advisory Committee

Date:_____

Appendices

A. Charge to PAC10

B. PAC10 Membership

C. PAC10 Recommendations

D. Individual Reports for PAC10 Proposals

E. Scientific Rating Reports on Hall B Experiments

F. Individual Reports for PAC10 Letters-of-Intent

G. Summary Tables of Scientific Ratings

H. CEBAF Approved Experiments, PACs 4-10, Grouped by Physics Category

Appendix A
Charge to PAC10

Following is the charge to the PAC from CEBAF Director, Hermann Grunder:

CEBAF requests PAC10 to:

1) review proposals and updates and provide advice on,
   A) the scientific merit, technical feasibility, and manpower requirements,
   B) a recommendation for placement into one of four classes:
      a) approval,
      b) conditional approval status pending clarification of special issues,
      c) deferral, or
      d) rejection,
2) provide a scientific rating for all approved proposals and updates including all of the Hall B approved experiments which are currently without a rating,
3) make a beam time allocation for those experiments utilizing standard operating procedures,
4) provide comments on letters-of-intent,
5) comment on the start-up plans for Halls A and B.

Appendix B
PAC10 Membership

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Appendix C

PAC10 Recommendations

Class†-Days*			
A	**PR-94-019**	Hall B	Nuclear Transparency in Double Scattering Processes
A–15	**PR-95-001**	Hall A	Precise Measurements of the Inclusive Spin-dependent Quasi-elastic Transverse Asymmetry $A_{T'}$ from $^3\vec{\mathrm{H}}\mathrm{e}(\vec{e}, e')$ at low Q^2
A–7	**PR-95-002**	Hall C	Direct Measurement of the Lifetime of Heavy Hypernuclei at CEBAF
A	**PR-95-003**	Hall B	Measurement of K^o Electroproduction
D	**PR-95-004**	Hall B	Photon Asymmetry in $^3\mathrm{He}(\vec{\gamma}, \pi^+)^3\mathrm{H}$
R	**PR-95-005**	Hall C	Precision Measurement of the Nucleon Spin Structure Functions in the Region of the Nucleon Resonances

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

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

Appendix D

Proposal: PR-94-019, Hall B
Spokespersons: K. S. Egiyan, K. A. Griffioen, M. Strikman
Title: Nuclear Transparency in Double Scattering Processes
Scientific Rating: B+

Motivation:

It is proposed to measure the ratio of cross sections for the (e,$e'NN$) and (e,$e'N$) reactions in deuterium, ^{3}He, and ^{4}He targets. The process is studied as a function of the recoiling nucleon momentum. The motivation is to look for evidence of color transparency in the region $3 < Q^2 < 6$ (GeV/c)^2.

Measurements and Feasibility:

PAC believes that the measurements are feasible and will produce interesting data on final state interaction effects in novel kinematics at high Q^2 and high energy transfer.

Feasibility and Issues:

The focus in the proposal is on a speculative search for evidence of color transparency effects. The data will provide new information on the (e,$e'NN$) reaction mechanism on few body nuclei.

Recommendation:

Approval to run with E-94-102 for sixteen days.

Appendix D

Proposal: PR-95-001, Hall A

Spokespersons: H. Gao

Title: Precise Measurements of the Inclusive Spin-dependent Quasi-elastic Transverse Asymmetry $A_{T'}$ from $^3\vec{\text{H}}\text{e}(\vec{e}, e')$ at low Q^2

Scientific Rating: B

Motivation:

The experiment has two aims: 1) determine the magnetic form factor of the neutron in the 0.1 to 0.5 $(\text{GeV}/c)^2$ Q^2 range by measuring the inclusive quasielastic transverse asymmetry for longitudinally polarized electrons from a polarized ^{3}He target, and 2) test three-body calculations.

Measurement:

The measurement will use the electron HRS spectrometer for detecting the quasielastically scattered electrons and the hadron HRS spectrometer for detecting elastically scattered electrons to provide continuous monitoring of beam and target polarization.

Feasibility and Issues:

The experiment will require careful attention to systematic errors in order to attain the desired few percent level of accuracy on A_T. The PAC recognizes that a precise measurement of the spin dependent asymmetry in ^{3}He, extended to a wider transferred energy range around the quasielastic peak, can provide a good testing ground for few body calculations. The comparison of G_M^n values extracted from deuterium and ^{3}He targets at percent accuracy level will test the consistency of using few body systems to measure neutron properties.

Recommendation:

Approval for fifteen days.

Appendix D

Proposal: PR-95-002, Hall C
Spokespersons: L. G. Tang and A. Margarian
Title: Direct Measurement of the Lifetime of Heavy Hypernuclei at CEBAF
Scientific Rating: B

Motivation:

The goal of this experiment is to measure the lifetimes of several heavy hypernuclei. Determination of lifetimes of heavy hypernuclei provides information on $\Lambda N \rightarrow NN$ process in nuclei. CEBAF is well suited to carry out these precise lifetime measurements.

Measurements and Feasibility:

These experiments will use the SOS in Hall C to detect K^+'s in coincidence with fission fragments observed in detectors placed symmetrically around the target. The tagged K^+ will confirm the production of the hypernucleus and identify the beam bucket from which the reaction was initiated. By timing the fission fragment relative to the beam bucket, one obtains a direct measurement of the delayed fission and thus the decay time of the Λ within the nucleus.

Issues:

The results would be important for determining the total $\Lambda N \rightarrow NN$ within the nuclear medium; however they would not probe the interesting isospin structure of this interaction. The shape of the backgrounds from prompt fission needs to be understood in order to obtain the estimated lifetime uncertainties.

Recommendation:

Approval for seven days running on Bi only.

Appendix D

Proposal: PR-95-003, Hall B
Spokespersons: R. A. Magahiz
Title: Measurement of K^{o} Electroproduction
Scientific Rating: B+

Motivation:

Although K^{o} photoproduction has been investigated in several experiments, there are no published data on K^{o} electroproduction. The reaction $p(e, e'K^{o})\Sigma^{+}$ can play a role in developing an understanding of K electroproduction when the results are compared to those of K^{+} electroproduction. One goal of the experiment is to measure the $K^{*o}K^{o}\gamma$ transition form factor using the fact that the $K^{*o}K^{o}\gamma$ vertex is included in the leading t-channel contribution to the cross section.

Measurements and Feasibility:

Data will be taken at 2.4, 2.8, 3.2, and 4.0 GeV in CLAS simultaneously with the approved N^{*} program and data for studying K^{+} electroproduction. The simultaneous accumulation of both K^{o} and K^{+} data will reduce systematic errors in the comparison between the two. Events will be collected with a minimum bias trigger that should not compromise the N^{*} program, and there are no other special requirements during the data-taking period. Neutral kaons will be identified using the mass constraint of $K^{o}_{S} \rightarrow \pi^{+}\pi^{-}$ decay and separation of this vertex from the production vertex. The $p(e, e'K^{o})\Sigma^{+}$ reaction will be verified using kinematic constraints. With the utilization of these capabilities and the running time provided for the N^{*} program, a useful measurement of K^{o} electroproduction should be feasible.

Issues:

The experiment depends on the high resolution and large solid angle of the CLAS spectrometer, providing yet another motivation for rapidly achieving the technical goals of the CLAS detector. The PAC is confident that the experiment can provide information that will be useful in sorting out the mechanisms of K electroproduction, but it is not so confident that it will be possible to determine the $K^{*o}K^{o}\gamma$ transition form factor from these measurements.

Recommendation:

Approval for the proposed experiment to study K^{o} electroproduction to run concurrently with the approved N^{*} program in Hall B.

Appendix D

Proposal: PR-95-004, Hall B

Spokespersons: B. E. Norum and K. Wang

Title: Photon Asymmetry in $^3\mathrm{He}(\vec{\gamma}, \pi^+)^3\mathrm{H}$

Motivation:

This experiment primarily seeks to assess a possible medium modification of the elementary E_{1+} (Δ) amplitude in ^{3}He by a study of the isoelastic reaction $^3\mathrm{He}(\vec{\gamma}, \pi^+)^3\mathrm{H}$ using linearly polarized real photons with energies ranging from 300 to 650 MeV.

Measurement:

This measurement would require the development of a high-intensity Compton backscattered photon beam for Hall B. If the proposed intensities could be achieved, this would be a unique facility in the energy range up to 650 MeV with a strong physics potential.

However, the PAC is not convinced that the stated goal to isolate a medium modification of the single-nucleon $E_{1+}(\Delta)$ amplitude can be accomplished in kinematics where the cross section is dominated by two-body effects.

Feasibility and Issues:

Whereas the measurement of target and photon asymmetries of the proposed isoelastic reaction in principle holds the promise of interesting three-body physics, the PAC wishes to reiterate that a convincing presentation of a broader physics program is necessary to justify the substantial investments required to setup a Compton backscattered photon facility.

Recommendation:

Defer

Proposal: PR-95-005, Hall C

Spokespersons: O. Rondon-Aramayo

Title: Precision Measurement of the Nucleon Spin Structure Functions in the Region of the Nucleon Resonances

Motivation:

This experiment seeks to measure inclusive asymmetries in the resonance region on polarized NH_3 and ND_3 targets. Two values of Q^2 (1 and 5.5 $(GeV/c)^2$) would be studied. Physics goals include studying duality in spin observables, twist-3 processes via the transverse asymmetry and testing the pQCD prediction that $E_{1+}/M_{1+} \rightarrow 1$ for Delta excitation at high Q^2.

Measurements and Feasibility:

The experiment would use the existing UVa-Basel polarized solid state target in Hall C. This target will also be used in two other previously approved experiments. Electrons of 80% polarization at low current (100 nA) are requested. A magnetic chicane is necessary due to the high magnetic field in the target.

Issues:

There is a significant overlap with two Hall B experiments, E-91-023 and E-93-009. While this proposal could provide an important cross check on the Hall B measurements via somewhat different observables and technique, much of this will already occur in the Hall C experiment E-93-028. Indeed, the majority of the physics proposed here will be accomplished via E-91-023, E-93-009 and E-93-028.

Recommendation:

Reject

Appendix E

Experiment: E-89-004

Spokespersons: R. Schumacher

Title: Electromagnetic Production of Hyperons

Scientific Rating: B+

Electromagnetic production of hyperons from nucleons is poorly determined experimentally. The proposed photoproduction measurements in CLAS will better determine the $\gamma + p \rightarrow \Lambda + K^+$ cross section, extending measurements to 1.8 GeV and determining the polarization of the Λ. The $\Sigma^o + K^+$ channel will also be studied. These data will be valuable in partial wave decompositions of amplitudes, based on Born terms, backgrounds, and *s*-channel resonances.

Experiment: E-89-015

Spokespersons: H. Baghaei

Title: Study of Coincidence Reactions in the Dip and Delta-Resonance Regions

Scientific Rating: B

This experiment will study the (e,$e'pp$), (e,$e'pn$) and (e,$e'p\pi$) reaction channels on few-body and medium-mass nuclei. It seeks to elucidate the mechanisms by which nuclear systems absorb virtual photons. It should provide information on the composition of the quasielastic, Dip and Delta regions. Such a survey is an important first step towards more focussed studies. As a large number of physics ingredients (correlations, FSI, exchange currents…) may be simultaneously operative, the collaboration is again urged to study the feasibility of *L/T* separations.

Experiment: E-89-017

Spokespersons: R. Sealock

Title: Electroexcitation of the $\Delta(1232)$ in Nuclei

Scientific Rating: B

This experiment will use the CLAS to survey the dominant electromagnetic response in the $\Delta(1232)$ region at momentum transfers up to 0.8 $(\mathrm{GeV}/c)^2$ for different nuclear targets. It should provide information on the Delta-nucleus interaction and determine the Q^2 dependence of the form factor for Delta production in nuclei. The PAC supports this initial broad look at the electromagnetic response which is made possible by the unique capabilities of the CLAS detector.

Appendix E

Experiment: E-89-024

Spokespersons: G. S. Mutchler

Title: Radiative Decays of the Low-Lying Hyperons

Scientific Rating: B+

The proposed experiment will yield for the first time direct measurements of radiative decay widths of low-lying hyperons. Of particular interest is the $\Lambda(1405)$. Such data could have substantive impact on our understanding of baryon structure.

Experiment: E-89-027

Spokespersons: W. Bertozzi, W. Boeglin and L. Weinstein

Title: Coincidence Reaction Studies with the CLAS

Scientific Rating: B+

This survey experiment will measure cross-sections for a variety of $(e,e'x)$ reactions on ^{3}He, ^{4}He, ^{12}C and ^{56}Fe for $x = p, n, d, pp', pn, p\pi$ and multinucleon states using the CLAS detector and electrons with energies ranging from 600 to 2000 MeV. Only a part of the total (e,e') strength is observed in one-nucleon knockout reactions. Due to many-body currents, correlations in nuclear ground states and final state interactions, a substantial fraction of the strength is expected to contain two or more knocked out hadrons. The results of this survey will yield valuable information on the composition of the (e,e') inclusive response.

Experiment: E-89-031

Spokespersons: W. Hersman, R. Miskimen and J. Lightbody

Title: Study of Multi-Nucleon Knockout with the CLAS

Scientific Rating: B+

Although much has been learned about nucleon-nucleon correlations since this proposal was first presented, data of this type, particularly with the ^{3}He target, continue to be of interest. This committee felt that ^{3}He data with longitudinal separation would be of particular interest.

Experiment: E-89-032

Spokespersons: V. Gavrilov and G. Leksin

Title: Study of Local Properties of Nuclear Matter in Electro-Nucleus and Photon-Nucleus Interactions with Backward Particle Production Using the CLAS

Scientific Rating: B–

This experiment addresses hadron electro- and photo-production in kinematical regions forbidden for reactions on quasi-free nucleons. The space-time extent of the hadron-emitting region formed in high energy scattering may be determined by means of like-particle correlations at small relative momenta. The analysis can be performed for directions along and transverse to the momentum transfer vector.

PAC felt that the collaborators on this proposal should also address analysis of their data using the theoretical frameworks advanced by other members of the *E*2 group. The like-sign correlations will make strong demands on the two-track separation of the CLAS tracking system.

Experiment: E-89-036

Spokespersons: K. S. Egiyan

Title: Study of Short-Range Properties of Nuclear Matter in Electron-Nucleus and Photon-Nucleus Interactions With Backward Particle Production Using the CLAS Detector

Scientific Rating: C+

The ejection of fast nucleons in the backward direction may be sensitive to short-range correlations. However, this PAC finds this proposal to be lacking in detail on any of many of the topics introduced. Data can be obtained by running in conjunction with E-89-015, -017, -027, -031, and -032 and there are no major demands on other laboratory resources. Interpretation of the data will require considerable theoretical effort.

Experiment: E-89-037

Spokespersons: V. Burkert and R. Minehart

Title: Electroproduction of the $P_{33}(1232)$ Resonance

Scientific Rating: B+

This experiment will provide cross sections for the $\Delta(1232)$, resulting in extraction of the resonant transition multipoles, M_{1+}, E_{1+} and S_{1+}. The use of CLAS with its large acceptance will allow measurement up to $Q^2 = 4$ (GeV/c)^2 as well as full polar and azimuthal angle coverage. The experiment will also provide information on the nonresonant multipoles S_{0+}, E_{0+}, and M_{1-}. At least three reaction channels will be measured, yielding a complete isospin determination and full partial wave analysis. The experiment addresses topics such as possible quadrupole amplitudes in the $N \rightarrow \Delta$ transition.

Experiment: E-89-038

Spokespersons: V. Burkert, M. Gai and R. Minehart

Title: Measurement of $p(e,e'\pi^+)n$, $p(e,e'p)\pi^o$ and $n(e,e'\pi^-)p$ in the Second and Third Resonance Regions

Scientific Rating: B+

The measurement of the W and Q^2 dependence of the reactions $p(e,e'\pi^o)p$, $p(e,e'\pi^+)n$, and $d(e,e'\pi^+)X$ in the resonance region is an important component of the N^* program at CEBAF. The use of three independent reaction channels will enable a full isospin decomposition and provide high quality data involving resonant transition form factors in this region

Experiment: E-89-039

Spokespersons: S. Dytman and K. Giovanetti

Title: Amplitudes for the $S_{11}(1535)$ and $P_{11}(1710)$ Resonances from an $ep \rightarrow e'p\eta$ Experiment

Scientific Rating: B+

The PAC concurred with the earlier PAC that this experiment contains sound physics and that these measurements will be an important component of the N^* program in Hall B.

Experiment: E-89-042

Spokespersons: V. Burkert and R. Minehart

Title: A Measurement of the Electron Asymmetry in $p(e,e'p)\pi^o$ and $p(e,e'\pi^+)n$ in the Mass Region of the $P_{33}(1232)$ for $Q^2 < 2$ $(GeV/c)^2$

Scientific Rating: A–

As a key element of the N^* program, this experiment will provide important information for a multipole decomposition in the region of the delta resonance. Polarization observables will be used in this experiment to help constrain the amplitude of the S_0 and S_{1+} multipoles.

Experiment: E-89-043

Spokespersons: L. Dennis and H. Funsten

Title: Measurements of the Electro-production of the Λ(gnd), $\Lambda^*(1520)$ and $f_0(975)$ via the K^+ K^- p and K^+ π^- p Final States

Scientific Rating: A–

This experiment will study the reactions $p(e,e'K^+K^-)p$ and $p(e,e'\pi^+\pi^-)p$ using the CLAS. Analysis of the full angular decay distribution $W(\Theta,\phi,\Phi)$ for the electroproduction of Λ*(1520) will elucidate the production mechanism for this resonance. A coupled channel analysis of the $\pi^+\pi^-$ and K^+K^- channels in the vicinity of $f_0(975)$ may provide insight into the possible exotic nature of this state.

Experiment: E-89-045

Spokespersons: B. Mecking

Title: Study of the Kaon Photo-production on Deuterium

Scientific Rating: B+

This is an important experiment for the determination of the kaon photoproduction amplitudes on the neutron, as well as giving information on the Λ*N* interaction.

Experiment: E-91-002

Spokespersons: P. Stoler, V. Burkert and M. Taiuti

Title: The Study of Excited Barons at High Momentum Transfer with the CLAS Spectrometer

Scientific Rating: B

This experiment extends the *N** program to momentum transfers > 3 $(\mathrm{GeV}/c)^2$. It will study the Q^2 dependence of baryon transition form factors with particular emphasis on the E_{1+}/M_{1+} ratio of the Delta and the apparently anomalous behavior of the S_{11}. The $P_{11}(1440)$ will also be examined. However, compared to the significantly increased sensitivity to this resonance provided by polarization observables, the detection of backward π^+ to suppress Born terms is not compelling. A reasonable data sample on high Q^2 resonance production will be provided by parasitic running with other *N** experiments. The results obtained may motivate further dedicated studies.

Experiment: E-91-008
Spokespersons: B. G. Ritchie
Title: Photoproduction of η and η' Mesons
Scientific Rating: A–

Photoproduction of η and η' mesons with a hydrogen target will complement existing data for the η, while providing new data for the η'. These data could provide important new information on the nature of the $U(1)$ axial current.

Experiment: E-91-014
Spokespersons: C. Hyde-Wright
Title: Quasi-Free Strangeness Production in Nuclei
Scientific Rating: B–

The proposed measurements will determine cross sections for quasifree photoproduction of K^+ and K^0 in nuclei using tagged photons and CLAS to measure all outgoing charged particles. The motivations for the experiment include the study of photoproduction amplitudes within nuclei, determining charge-exchange final state effects through the A-dependence of the K^+/K^o ratio, and relating the quasielastic strangeness production response to that for $(e,e'p)$. The committee is not convinced that a close relationship to $(e,e'p)$ exists. It is also concerned that medium effects might be difficult to disentangle, given uncertainties in our understanding of the amplitudes for the nucleon.

Experiment: E-91-015
Spokespersons: D. I. Sober
Title: Helicity Structure of Pion Photoproduction
Scientific Rating: A–

The separation of the cross sections for single pion photoproduction into helicity 3/2 and 1/2 parts is an important first step towards understanding the contributions of individual channels to the Drell-Hearn-Gerasimov sum rule. This may help illuminate the observation that the value of the sum rule changes sign between photoproduction and high Q^2 electroproduction. The experiment fully utilizes the unique combination of resources that will be available in Hall B: a polarized electron beam, the photon tagging facility, a polarized target, and the large solid angle CLAS.

Experiment: E-91-023

Spokespersons: V. Burkert, D. Crabb and R. Minehart

Title: Measurement of Polarized Structure Functions in Inelastic Electron Proton Scattering using CLAS

Scientific Rating: A

The experiment uses a polarized beam and target to study inclusive electron scattering using the CLAS. The spin structure functions would be extracted and used to deduce the Q^2 evolution of the Drell-Hearn-Gerasimov sum rule. The PAC believes these measurements would have significant impact on our understanding of nucleon structure and the connection between the quark model at low energy and the spin structure function in the deep inelastic regime. The initial experiment was amended to use a 6 GeV beam which allowed an extension of the measurements to higher Q^2. In addition experiment E-93-009 was approved with very similar physics goals using a polarized ND_3 target. These latter measurements rely upon the results of this experiment to extract the spin structure functions of the neutron.

Experiment: E-91-024

Spokespersons: V. Burkert, H. Funsten, D. M. Manley and B. Mecking

Title: Search for "Missing" Resonances in the Electro-production of ω Mesons

Scientific Rating: B+

The experiment is part of a systematic search for a group of missing N^* resonances in the mass region around 2 GeV predicted by quark models, but not yet observed. In the ω N decay channel, the backward ω production cross section and the orientation of the ω decay plane are expected to be sensitive to resonant amplitudes. The CLAS appears adequate to detect these resonances if production and decay amplitudes are comparable to theoretical estimates.

Experiment: E-93-006

Spokespersons: V. Burkert and M. Ripani

Title: Two Pion Decay of Electroproduced Light Quark Baryon Resonances

Scientific Rating: B+

This experiment will study electroproduction of two pion states from protons and neutrons in deuterium. The differential cross section for $\pi\Delta$ and ρN production will be measured using energies up to 4 GeV and the CLAS detector. The motivation is to search for missing baryon resonances, which decay primarily to $\pi\Delta$ and/or ρN states. Recent photoproduction data on proton have indicated larger than expected strengths in channels with neutral pions.

Experiment: E-93-008

Spokespersons: M. F. Vineyard

Title: Inclusive η Photoproduction in Nuclei

Scientific Rating: B

The inclusive η photoproduction cross section in nuclei will be measured in order to investigate medium modification of $S_{11}(1535)$ and $P_{11}(1710)$ resonances and extract the ηN interaction cross section. Target mass dependence will be studied in ^{2}H, ^{3}He, ^{4}He and ^{12}C nuclei in the photon energy range between 0.8 and 1.5 GeV. Photoproduction of η mesons in ^{2}H and heavier nuclei has been measured at MAMI and ELSA. Data above 800 MeV, particularly on ^{3}He and ^{4}He targets, can still provide new information on final state interactions in η decay of S_{11} and P_{11} resonances, possibly leading to a determination of the ηN interaction cross section.

Experiment: E-93-009

Spokespersons: S. E. Kuhn

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

Scientific Rating: A

This proposal, together with E-91-015 and E-91-023, provides a coherent program for investigating the evolution of the Gerasimov-Drell-Hearn sum rule between photoproduction and high Q^2 electroproduction. Measurement of the sum rule in electroproduction on both protons and neutrons in the CLAS is a particular strength of this proposal and E-91-023.

Experiment: E-93-012

Spokespersons: M. V. Kossov

Title: Electroproduction of Light Quark Mesons

Scientific Rating: B+

This experiment provides a test of microscopic models of mesons through extraction of the $\pi\gamma \rightarrow M^*$ transition form factors (where M^* is ρ, ω, h_1, …, etc.). Until data are obtained, it is difficult to predict the reliability of the extraction of these form factors. The experiment will examine ρ-ω mixing, though the PAC notes that this needs to be re-examined in light of recent e^+e^- data that appear to provide a cleaner way of interpreting this mixing. This experiment runs concurrently with the N^* experiments in Hall B. Significant theoretical effort is required, and the group needs to extend its efforts to enlist theoretical support.

Experiment: E-93-017

Spokespersons: P. Rossi and E. De Sanctis

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

Scientific Rating: B+

This precision measurement of deuteron photodisentigration should allow stringent tests of theoretical models for this elementary process. Additionally, measurements of $d(\gamma,\Delta^o)p$ should provide complementary information on the energy dependence of a fundamental exclusive process.

Experiment: E-93-019

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

Title: Photoabsorption and Photofission of Nuclei

Scientific Rating: B–

This experiment studies quenching of nucleonic resonances and shadowing effects in nuclei and examines the energy dependence of photo-fission in several heavy nuclei. This experiment could serve to commission the photon tagging system in Hall B. It should not impede the construction schedule of the CLAS. In addition, the PAC notes that the collaboration has taken on the responsibility of providing the low intensity photon beams necessary for the flux calibration.

Experiment: E-93-022

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

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

Scientific Rating: B+

This experiment will provide the first systematic study of polarization in ϕ electroproduction. Measurement of the σ_L/σ_T ratio, using the angular distribution in $\phi \rightarrow K^+K^-$ decay, is a major focus of this program — there are essentially no data on this ratio. Comparison of the results of this experiment with those of E-93-031 will help to elucidate the relationship between photoproduction and electroproduction of vector mesons.

Experiment: E-93-030

Spokespersons: M. Mestayer and K. H. Hicks

Title: Measurement of the Structure Functions for Kaon Electroproduction

Scientific Rating: B+

This experiment will help to determine kaon electroproduction structure functions Σ_L, Σ_T, Σ_{TT}, and Σ_{TL} as a function of Q^2. Data will be obtained for beam energies of 2.4, 2.8, 3.2, and 4.0 GeV. The 2.4 and 4.0 GeV measurements will run concurrently with the approved N^* program. These data should be valuable in partial wave analyses of kaon photo- and electroproduction, and in providing production ratios for various hyperons.

Experiment: E-93-031

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

Title: Photoproduction of Vector Mesons at High t

Scientific Rating: A–

This experiment will significantly extend the momentum transfer, t, range in ϕ photoproduction. It should be able to observe the transition from diffractive to hard scattering and, if the K^+K^- continuum is not too large, could detect the minimum in the cross section predicted to occur around $-t = 2.2$ $(\mathrm{GeV}/c)^2$ from interference between two 2-gluon exchange amplitudes. Characterization of the level of the K^+K^- continuum as a function of t is an important component of this proposal. The experiment clearly benefits from running at the highest possible energy.

Experiment: E-93-033

Spokespersons: J. Napolitano

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

Scientific Rating: B+

This experiment will search for “missing” non-strange baryons with masses between 1.3 GeV and 2.3 GeV formed via $\gamma p \rightarrow p\pi^+\pi^-$ using the CLAS. The PAC likes the exploratory nature of this experiment with its potential for discovering something new early in the life of Hall B. However, the decomposition of the measured cross section into partial waves will undoubtedly be complex and limits the sensitivity of the search.

Experiment: E-93-036

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

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

Scientific Rating: B+

This experiment will measure spin asymmetries for exclusive pion production in the nucleon resonance region. The resulting data will provide three independent asymmetry ratios over a wide range of W and for Q^2 from 0.25 to 1.25 $(\mathrm{GeV}/c)^2$. The predicted asymmetries are large and sensitive to the presence and structure of any underlying resonances.

Experiment: E-93-043

Spokespersons: B. Quinn

Title: Measurement of the $\Delta\Delta$ Component of the Deuteron by Exclusive Quasielastic Electron Scattering

Scientific Rating: B

This experiment will seek the predicted ~0.5% Δ^{++} Δ^{-} component of the deuteron via detection of a spectator Δ^{++} in the backward direction in quasi-elastic kinematics for electroproduction on the deuteron. However, there exists significant background from competing processes, and isolation of this signal will require a complete calculation of such background processes that has yet to be done.

Experiment: E-93-044

Spokespersons: G. Audit, B. L. Berman and P. Corvisiero

Title: Photoreactions on ^{3}He

Scientific Rating: B

This survey experiment will study a variety of reaction channels for real photons on ^{3}He using the CLAS. The stated goals of this experiment are to search for the influence of the nuclear medium on resonance production, delta components in the nucleus and searching for effects of three-body forces. The PAC is concerned that each of this topics may be difficult to achieve and additional theoretical support should be sought.

Experiment: E-94-002
Spokespersons: P.-Y. Bertin, M. Kossov and B. M. Preedom
Title: Photoproduction of Vector Mesons Off Nuclei
Scientific Rating: B+
See the PAC9 Report for comments.

Experiment: E-94-005
Spokespersons: L. Elouadrhiri, D. Heddle, R. Hicks and Zh. Li
Title: Determination of the $N\Delta$ Axial Vector Transitions Form Factor $G_{\mathrm{A}}^{N\Delta}$ from the $ep \rightarrow e'\Delta^{++}\pi^{-}$ Reaction
Scientific Rating: B+
See the PAC9 Report for comments.

Experiment: E-94-008
Spokespersons: B. G. Ritchie
Title: Photoproduction of η and η' Mesons from Deuterium
Scientific Rating: B−
See the PAC9 Report for comments.

Experiment: E-94-015
Spokespersons: R. A. Miskimen
Title: Study of the Axial Anomaly using the $\gamma\pi^{+} \rightarrow \pi^{+}\pi^{o}$ Reaction Near Threshold
Scientific Rating: A−
See the PAC9 Report for comments.

Experiment: E-94-016
Spokespersons: A. R. Dzierba and J. Napolitano
Title: Measurement of Rare Radiative Decays of the Phi Meson
Scientific Rating: A
See the PAC9 Report for comments.

Experiment: E-94-017
Spokespersons: W. Brooks and M. F. Vineyard
Title: The Neutron Magnetic Form Factor from Precision Measurements of the Ratio of Quasielastic Electron-Neutron to Electron-Proton Scattering in Deuterium
Scientific Rating: B+
See the PAC9 Report for comments.

Experiment: E-94-102
Spokespersons: S. E Kuhn and K. A. Griffioen
Title: Electron Scattering from a High Momentum Nucleon in Deuterium
Scientific Rating: B+
See the PAC9 Report for comments.

Experiment: E-94-103
Spokespersons: W. J. Briscoe, J. Ficenec and D. Jenkins
Title: The Photoproduction of Pions
Scientific Rating: B
See the PAC9 Report for comments.

Experiment: E-94-109
Spokespersons: P. L. Cole, J. P. Connelly and R. R. Whitney
Title: Photoproduction of the ρ Meson from the Proton with Linearly Polarized Photons
Scientific Rating: B+
See the PAC9 Report for comments.

Experiment: E-94-117
Spokespersons: J. P. Chen, S. Gilad, Zh. Li and C. S. Whisnant
Title: Helicity Structure of Pion Photoproduction on Polarized Deuteron and the GDH Sum Rule for the Neutron
Scientific Rating: A−
See the PAC9 Report for comments.

Appendix F

Letter-of-Intent: LOI-95-001

Spokespersons: G. Huber, D. Mack and H. Blok

Title: Study of the π^+ Form Factor up to Q^2=3.5 (GeV/c)^2

The extension of measurements of the π^+ form factor to higher Q^2 addresses more interesting physics questions than those addressed in the experiment E-93-021. This extension is possible with the 6 GeV beam and the efficient use of the HRS spectrometers in Hall A. This would be an important data set and a full fledged proposal should be submitted. At the higher energy used here, detailed considerations of *t*-channel extrapolations involving possible Regge pole exchange will need to be considered in order to understand the uncertainties.

Letter-of-Intent: LOI-95-002

Spokespersons: D. Dale

Title: Nonexponential Decay of the Pion

Deviation of radioactive decays from an exponential form is expected, for times both short and long compared to the half-life. However, no experimental deviation in either domain has yet been detected and the point at which deviation might be observable remains an open question.

Studies of the short term domain could be interesting if the present limits would be significantly lowered. The proposal to use medium energy pion decay seems a reasonable place to push the limits. However, it does not appear that the electromagnetic production plays any role in the experiment and it is probable that a hadron facility would be a better environment.

Letter-of-Intent: LOI-95-003

Spokespersons: C. Hyde-Wright, A.M. Nathan and B. Wojtsekhowski

Title: Exclusive Compton Scattering on the Proton

The use of $p(\gamma,\gamma')p$ as a probe of nucleon structure and of the transition to hard scattering appears promising. The PAC encourages the development of a full proposal. Such a submission should present a careful study of backgrounds and, in view of the significant resources associated with this effort, should include arguments as to the importance of the real photon results as a complement to the already approved virtual Compton program.

Appendix F

Letter-of-Intent: LOI-95-004

Spokespersons: W. Brooks

Title: Investigation of the Onset of Coherence Phenomena in Production of Vector Mesons off (Polarized) Deuterons

The Committee recognizes the potential interest in the study of coherent production of vector mesons on deuterium at CEBAF. Independently tuning Q^2, ν, and t, the momentum transfer to the deuteron will allow selection of the internucleon distance to match either the vector meson formation length or its coherence length.The use of CLAS is appropriate to completely determine the corresponding multiparticle final state.

The committee recommends that the proponents

- enlarge the collaboration;
- investigate the complementary study of the coherent and break-up channels; and
- investigate ways of measuring the elementary amplitude $\gamma N \rightarrow VN$.

More quantitative arguments should be provided for the use of a polarized deuteron target. in the full proposal.

Appendix G

Summary Table of Scientific Ratings

Experiment	Hall	Scientific Rating	Physics Category Grouping
E-89-003	A	B–	Properties of Nuclei
E-89-004	B	B+	Strange Quarks
E-89-008	C	B	Properties of Nuclei
E-89-009	C	B+	Strange Quarks
E-89-012	C	A–	Few Body Nuclear Properties
E-89-015	B	B	Properties of Nuclei
E-89-017	B	B	Properties of Nuclei
E-89-019	A	B	Few Body Nuclear Properties
E-89-021	A	B	Few Body Nuclear Properties
E-89-024	B	B+	Strange Quarks
E-89-027	B	B+	Properties of Nuclei
E-89-028	A	B–	Few Body Nuclear Properties
E-89-031	B	B+	Properties of Nuclei
E-89-032	B	B–	Properties of Nuclei
E-89-033	A	B–	Properties of Nuclei
E-89-036	B	C+	Properties of Nuclei
E-89-037	B	B+	*N** and Meson Properties
E-89-038	B	B+	*N** and Meson Properties
E-89-039	B	B+	*N** and Meson Properties
E-89-042	B	A–	*N** and Meson Properties
E-89-043	B	A–	Strange Quarks
E-89-044	A	B+	Few Body Nuclear Properties
E-89-045	B	B+	Strange Quarks
E-91-002	B	B	*N** and Meson Properties
E-91-003	C	B+	Few Body Nuclear Properties
E-91-004	A	A	Strange Quarks
E-91-006	A	C	Properties of Nuclei
E-91-007	C	B–	Properties of Nuclei

Appendix G

Experiment	Hall	Scientific Rating	Physics Category Grouping
E-91-008	B	A–	*N** and Meson Properties
E-91-010	A	A	Strange Quarks
E-91-011	A	A–	*N** and Meson Properties
E-91-013	C	B–	Properties of Nuclei
E-91-014	B	B–	Strange Quarks
E-91-015	B	A–	*N** and Meson Properties
E-91-016	C	A–	Strange Quarks
E-91-017	C	A	Strange Quarks
E-91-023	B	A	Nucleon and Meson Form Factors and Sum Rules
E-91-024	B	B+	*N** and Meson Properties
E-91-026	A	B+	Few Body Nuclear Properties
E-93-006	B	B+	*N** and Meson Properties
E-93-008	B	B	Properties of Nuclei
E-93-009	B	A	Nucleon and Meson Form Factors and Sum Rules
E-93-012	B	B+	*N** and Meson Properties
E-93-017	B	B+	Few Body Nuclear Properties
E-93-018	C	B+	Nucleon and Meson Form Factors and Sum Rules
E-93-019	B	B–	Properties of Nuclei
E-93-021	C	B+	Nucleon and Meson Form Factors and Sum Rules
E-93-022	B	B+	Strange Quarks
E-93-024	A	B+	Nucleon and Meson Form Factors and Sum Rules
E-93-026	C	A	Nucleon and Meson Form Factors and Sum Rules
E-93-027	A	B+	Nucleon and Meson Form Factors and Sum Rules
E-93-028	C	B	*N** and Meson Properties
E-93-030	B	B+	Strange Quarks
E-93-031	B	A–	*N** and Meson Properties
E-93-033	B	B+	*N** and Meson Properties
E-93-036	B	B+	*N** and Meson Properties
E-93-038	C	A	Nucleon and Meson Form Factors and Sum Rules

Appendix G

Experiment	Hall	Scientific Rating	Physics Category Grouping
E-93-043	B	B	Few Body Nuclear Properties
E-93-044	B	B	Few Body Nuclear Properties
E-93-049	A	B+	Few Body Nuclear Properties
E-93-050	A	A–	*N** and Meson Properties
E-94-002	B	B+	*N** and Meson Propertie
E-94-004	A	B	Few Body Nuclear Properties
E-94-005	B	B+	*N** and Meson Properties
E-94-008	B	B–	*N** and Meson Properties
E-94-010	A	A–	Nucleon and Meson Form Factors and Sum Rules
E-94-012	A	B–	*N** and Meson Properties
E-94-014	C	B	*N** and Meson Properties
E-94-015	B	A–	*N** and Meson Properties
E-94-016	B	A	*N** and Meson Properties
E-94-017	B	B+	Nucleon and Meson Form Factors and Sum Rules
E-94-018	C	A–	Few Body Nuclear Properties
E-94-019	B	B+	Few Body Nuclear Properties
E-94-102	B	B+	Few Body Nuclear Properties
E-94-103	B	B	*N** and Meson Properties
E-94-104	A	B+	Few Body Nuclear Properties
E-94-107*	A	B+	Properties of Nuclei
E-94-109	B	B+	*N** and Meson Properties
E-94-117*	B	A–	Nucleon and Meson Form Factors and Sum Rules
E-95-001	A	B	Few Body Nuclear Properties
E-95-002	C	B	Strange Quarks
E-95-003	B	B+	Strange Quarks

* While E-94-107 and E-94-117 are conditionally approved, they were provided scientific ratings by the PAC as they do not need to go back before the PAC for approval.