PR-08-001: *Investigation of the role of nuclear medium modifications in the* $^4\mathrm{He}(\vec{\mathrm{e}},\mathrm{e}'\vec{\mathrm{p}}) \rightarrow ^3\mathrm{H}$ *reaction in Hall C*

J. L. Goity, K. Tsushima

The properties of nucleons in a nuclear medium are expected to be modified, as there is evidence for instance in the EMC effect. Of particular interest is the medium modifications of form factors. The aim of this experiment is to make use of recoil polarization measurement of proton knock-out in the quasi-elastic $^4\mathrm{He}(\vec{\mathrm{e}},\mathrm{e}'\vec{\mathrm{p}}) \rightarrow ^3\mathrm{H}$ reaction, covering in a single experiment the Q^2 range of three separate earlier experiments. This will provide more precise data against which several different calculations can be tested.

The main assumption in the proposal is that the measurement using recoil polarization will allow to sort out more cleanly the in medium effects on the ratio $\mu G_E^p/G_M^p$. The measured super-ratio, consisting of that ratio in medium versus its value for the free proton is the quantity that will show in medium effects. There are, however, open issues concerning the detailed separation of other medium induced effects: MEC, FSI (especially charge exchange effects), Fermi motion, which must be understood in order to make possible a clear interpretation of the results from this experiment.

There is one general problem in the discussion of medium modifications, which has to do with the particular model being used to study a reaction such as the one in this experiment. Depending on the model, the medium modifications will be described and interpreted differently. Thus, to profit from the results of this experiment, further theoretical progress will be necessary. This experiment will help motivate and inspire theorists who work in this topic.

In summary, the experiment advanced in this proposal is valuable from the perspective that it will provide new data, which together with new theoretical progress can lead to a better defined picture of the medium effects on the proton's form factors.

PR-08-002: *Spectroscopic study of* Λ *hypernuclei* $\cdots$

F. Gross, M. Paris

This proposal requests 18 days of additional beam time to supplement that already approved (20 days) for the third generation $(e, e'K^+)$ experiment E05-115. This experiment studies hypernuclear states produced from ^{7}Li, ^{10}B, and ^{40}K targets using a spectrometer especially build for this purpose. The group has achieved a resolution of 300 KeV, the long term objective for the original hypernuclear program proposed as part of the original CEBAF proposal.

Study of Λ hypernuclei is one of the only ways to learn about the ΛN force, and new generations of microscopic calculations for nuclei with small A are now possible (at least in principal). The high resolution means that the nuclear states split by a small $L \cdot S$ ΛN interaction can now be resolved. In earlier measurements with pion beams the resolution was typically 10 times larger, making it difficult to separate closely spaced states. There seem to be no problems extracting the hypernuclei spectrum from this experiment, and the new spectrum should yield a lot of new information about hypernuclei. Finally, given the large experimental effort required to study a ^{40}Ca hypernucleus, the proposers should compare the expected excitation spectrum of this hypernucleus with that for the ^{52}Cr target that is replacing the ^{51}V in the approved E05-115, and describe the additional insight they hope to obtain.

PR-08-003: *The $\gamma p \to \pi^+ n$ Single Charged Pion Photoproduction*

A. Afanasev, D. Richards

It is proposed to measure the cross section of the reaction $\gamma p \to \pi^+ n$. The physics motivation is to study transition between the baryon resonance region and the dimensional scaling region. For this purpose, the authors intend to use a tagged photon beam in CLAS produced by a 5.7 GeV electrons, and map out the ranges of invariant masses $\sqrt{s}$=1.8 - 3.3 GeV and cms scattering angles θ_{cm}=50^o - 115^o.

The proposed experiment overlaps with a Hall A proposal PR-05-002 previously deferred by PAC27. One of the issues raised by PAC27 concerned proposed density of data points in $\sqrt{s}$ that did not look sufficient to resolve undulatory structures in the cross section. This issue is addressed in the present proposal, with fine enough binning in $\sqrt{s}$.

A new physics goal of this experiment is to map out the resonance-like structure around $\sqrt{s}$= 2.1 GeV that was already observed in related photoproduction reactions at CLAS, $\gamma n \to \pi^- p$ (g10 run) and $\gamma p \to \pi^0 p$ (g1c run). This goal is sound and well justified, with this new measurement being complementary to above single-pion production channels. However, our concern is that the proposed angular range is inadequate for the resonance studies, since forward and backward cms scattering angles are excluded from the analysis.

As for the proposed study of transition to scaling region, the main issue remains to be absence of theoretical interpretation. In particular, there is no clear framework for describing the data in this energy regime.

PR-08-005: *Measurements of the Target Single–Spin Asymmetry A_y in the Quasi–Elastic ^{3}He$\uparrow(e,e'n)$ Reaction*

Ch. Weiss, Ping Wang

The proposed experiment would measure the transverse (normal) target spin asymmetry A_y in quasi–elastic scattering $^3\mathrm{He}(e,e'n)X$ at $Q^2 = 0.75$ and $1\,\mathrm{GeV}^2$, with the aim of testing different models of the final–state interaction (FSI) at high momentum transfers. This information is to be used to refine the methods for extracting the neutron electric form factor from measurements with polarized ^{2}H and ^{3}He targets. The proposed experiment extends a previous measurement of the asymmetry at NIKHEF at $Q^2 = 0.2\,\mathrm{GeV}^2$ to substantially higher momentum transfers. It complements an approved Hall A experiment for measuring A_y in inclusive (e,e') scattering in the same kinematics and would run in parasitic mode.

The proposed measurement is well motivated and reflects the latest developments in the theory of quasi–elastic electron scattering from nuclei. The significance of neutron form factor measurements is obvious and does not need to be restated here. FSI effects are an important limitation in present extractions of the neutron form factor from quasi–elastic nuclear $(e,e'n)$ data. While at low momentum transfers the recently available non-relativistic Faddeev calculations provide an exact method for dealing with the FSI, at momentum transfers $Q^2 \sim 1\,\mathrm{GeV}^2$ one has to rely on approximate methods, which have to be tested experimentally. The transverse spin asymmetry A_y is zero in the plane–wave impulse approximation (no absorption/distortion) and represents a particularly sensitive observable for testing FSI models. The proposers have consulted the leading theorists in this field (Schiavilla; Glöckle *et al*; Sargsian *et al*; Laget) and are presenting a convincing case for extending the A_y measurements to higher Q^2. It should be noted that better theoretical control of the FSI in quasi–elastic nuclear scattering would help also with the analysis of processes other than elastic scattering, such as DVCS and meson production, in JLab kinematics.

PR-08-006: *The Neutron Electric Form Factor at* $Q^2 = 2.8$ ***and*** 4.3 GeV^2***...***

D.G. Richards, S. Ryan

This proposal seeks to extend the measurement of the electric form factor of the neutron in Deuterium from the current energy $Q^2 \leq 1.4$ GeV^2 to 2.8 and 4.3 GeV^2, using recoil polarization. The advantage of this technique is that it is sensitive to the *sign* of the form factor, in contradistinction to Rosenbluth separation, which is sensitive only to the square of the form factor. Given the possibility that the form factor crosses zero, this is clearly an important benefit of this methodology. This quantity is of such fundamental importance to our understanding of hadron structure, and in particular the distribution of current and charge in the nucleon, that the physics motivations for this experiment are strong.

The proposers use as an important motivation comparison with lattice calculations. As they note, most current precision calculations are of the isovector form factors - the difference in the proton and neutron form factors, and any comparison with lattice data should focus in the first instance on this quantity. The most extensive study of the form factors to date, by Alexandrou et al., used a form of the lattice action that has quite substantial discretization effects; as well as repeating the calculation at smaller values of the lattice spacing, enabling a higher Q^2 reach, new computations (by the group of Negele *et al.*) will have considerably smaller discretization uncertainties even at the currently employed lattice spacings.

PR-08-007: *Measurement of the proton elastic form factor ratio at low Q^2*

J. L. Goity, A. Accardi

The low Q^2 domain of the proton's electric and magnetic form factors is still unknown experimentally. Only at the photon point and extremely low Q^2 for G_E, from where the charge radius is extracted, are these form factors well established. This experiment aims at extending to very low Q^2 the measurement of the recoil polarization ratio P_x/P_z, which relates rather directly to the ratio $\mu G_E^p/G_M^p$. The Q^2 range in this experiment corresponds to distances between 0.3 fm to 1.6 fm. Since the charge radius is 0.87 fm, this experiment roughly corresponds to a journey from the inside to the outside of the proton, where interesting behaviors could occur, as several models predict. In fact, there are numerous different model predictions for the ratio $\mu G_E^p/G_M^p$, and, as a matter of our fundamental knowledge of the proton, it is very important to experimentally know the behavior of the ratio in that range of Q^2. For instance, the issue about the importance of the pion cloud for the form factors may be clarified by these measurements.

Form factors at low Q^2 also play a role in several important contexts, such as in the analysis of parity-violation experiments (e.g. Q_{weak}), the Zemach form factor that enters in calculations of the hyperfine splitting in H, or for testing the recently proposed Miller effect.

Combined with upcoming measurements of cross sections at low Q^2 at MAMI, the results of this experiment will allow for a determination of the form factors with relatively good precision down to $Q^2 \sim 0.07$ GeV^2

In conclusion, the results of this experiment are very important for determining the electromagnetic structure of the proton in a domain where it is not established empirically, and where, as models show, non-trivial effects can be significant.

PR-08-008: *Exclusive Study of Deuteron Electrodisintegration near Threshold*

J. W. Van Orden, Franz Gross

Threshold electrodisintegration is one of the classic experiments of nuclear physics and provided some of the first evidence of exchange currents. This proposal is for the measurement of this reaction at Q^2=12 fm^{-2} where the leading plane-wave contribution is minimized due to interference between amplitudes for transitions from the deuteron s- and d-waves to the $^1S_0$ final state. This experiment would use the azimuthal angular dependence of the cross section to extract the interference response functions and a Rosenbluth separation to separate the longitudinal and transverse response functions. Since the kinematics of threshold electrodisitegration is so close to those of elastic scattering, it would also be measured at the same time.

Elastic electron scattering has been well described by traditional nuclear physics models at this Q^2 provided that isoscalar exchange currents and relativistic effects are included. These calculations vary by about 10 percent for elastic observables. Deuteron electrodisitegration is sensitive to isovector exchange currents which are considerably larger that the isoscalar exchange currents. Availability of separated response functions with small bins in the invariant mass of the final state would provide substantial constraints of the modeling of this reaction and would greatly improve our understanding of the reaction dynamics.

PR-08-009: *Detailed Study of ^{4}He Nuclei through Response Function Separations at High Momentum Transfer*

A. Afanasev, V. Guzey

It is proposed to study a cross section of a coincidence reaction, ^{4}He(e,e'p), in several kinematic regions with a goal to constrain models of short-range structure of ^{4}He and reaction dynamics. The proposed measurement completes a series of experiments on light nuclei: Previous measurements were done on ^{3}He in similar kinematics (JLAB E89-044).

The missing momentum in the measurements will reach 1.2 GeV/c, and with proposed separation of response functions, the observables are demonstrated to be sensitive to different theoretical models. These include microscopic models, relativistic mean-field models, and final-state interaction effects.

This is a jeopardy proposal previously approved by PAC27 (PR-04-107). Over the past 3.5 years, several theoretical groups continued to develop realistic models that will be used for interpretation of the proposed experiment.

PR-08-010: *Measurement of the Coulomb quadrupole amplitude in the* $\gamma^* p \rightarrow \Delta(1232)$ *in the low momentum transfer region*

K. Orginos and M. Vanderhaegen

This is a Hall A experiment that proposes to measure the Coulomb quadruple amplitude of the $\Delta(1232)$ resonance. The experiment extends measurements to the low Q^2 region and bridges and validates results from other labs. The projected results seem to be sufficiently accurate and may be able to constrain various models. This is an interesting experiment to be pursued.

PR-08-011: $\vec{e}\,{}^{2}\mathrm{H}$ *parity violating deep inelastic scattering (PVDIS) at CEBAF 6 GeV*

A. Radyushkin, A. Accardi

The proposed experiment will measure the parity violating asymmetry in $\vec{e}\,{}^{2}\mathrm{H}$ scattering at 2 values of Q^2. The use of the deuterium target allows to access the combination $2C_{2u} - C_{2d}$ of weak quark couplings, which is poorly known at present and not accessible by other planned experiments such as APV or Qweak. At the same time, using the deuterium minimizes nuclear corrections. The aim is twofold: first to provide the first significant constraint on higher-twist (HT) effects in PVDIS using measurements at 2 values of Q^2; second to provide a very precise measurement of $2C_{2u} - C_{2d}$ with a factor of 5-6 improvement compared to present data. This would give a very stringent constraint on the determination of C_{2q} and thus a test of the Standard Model. Furthermore, the data can be combined with results from other experiments to yield a measurement of C_{3q}.

The interpretability of the proposed very precise measurement of $2C_{2u} - C_{2d}$ as a confirmation of the Standard Model or in terms of new physics is conditional to finding small higher twist corrections to the asymmetry ratio. Even though this is the expectation of the majority of model calculations, the possibility is open for large HT contributions. In this case, the measurement will provide a fundamental input for theory computations and for the interpretation of future similar measurements at the 12 GeV upgraded accelerator, but would not allow to directly use the result as a constraint on C_{2q}. More generally, the proposers should articulate how this experiment fits in an overall program to investigate PVDIS at both 6 and 12 GeV.

Finally, we recommend that, in order to strengthen the outcome of the experiment, the proposers quantitatively evaluate the impact of nuclear corrections to their measurement, even though these are expected to be small.

PR-08-012: *Study of light hypernuclei by pionic decay at JLab*

F. Gross, R. Schiavilla

This proposal requests 40 days for a new study of pion decay of hypernuclei produced by scattering from the targets ^{7}Li and ^{12}C. This experiment uses the spectrometer setup (currently in Hall C) especially built for the hypernuclear program. The measurements can obtain a resolution of 55 keV, and measure lifetimes 50 to 400 ps.

Study of Λ hypernuclei is one of the only ways to learn about the ΛN force, and new generations of microscopic calculations for nuclei with small A are now possible (at least in principal). The high resolution means that the nuclear states split by a small $L{\cdot}S$ ΛN interaction can now be resolved. Study of the pion decay will give new information about the lifetimes of ground state hypernuclei. This measurement complements the approved experiment E05-115, extended by the proposal PR-08-002.

PR-08-013: *Precision Measurement of the Neutron Magnetic Form Factor up to* $Q^2 = 8.0$ *(GeV/c)*^{2} *by the Ratio Method*

R. Edwards

This Hall A experiment proposes to measure the neutron magnetic form-factor from 3.5 GeV^2 up to 8.0 GeV^2. The form-factor will be extracted using the "ratio" method formed from the ratio of the differential quasi-elastic scattering cross-sections of $d(e, e'n)$ and $d(e, e'p)$ off of the deuteron. This method has been used successfully in Hall-B where G_M^n has been measured up to 4.5 GeV^2.

There is strong theoretical justification (and interest) for accurate measurements, as predicted in this proposal, of G_M^n up to high Q^2. Since the ratio method is already in use, the bulk of the proposal is spent on describing the experimental setup. A concern at high Q^2 is estimating and controlling systematic errors. There is an extensive discussion of resolving quasi-elastic and inelastic events along with other systematic errors (target windows, Fermi motion, etc.). However, it is not clear how well final state interactions are controlled. Presumably these effects might cancel in the ratio, but some discussion is warranted.

Besides final state interactions, the overall systematic error is claimed to be about a maximum of 3% at 5.25 GeV^2 and roughly half that at higher Q^2. With the amount of hours requested for beam-time, a statistical accuracy about this level is also predicted.

PR-08-014: *Three-nucleon short range correlations studies in inclusive scattering for* $0.8 < \mathbf{Q^2} < 2.8$ $(\mathbf{GeV^2})$

J. W. Van Orden, J. L. Goity

A simple model of the contributions of correlations to inclusive electron scattering from nuclei has been used to predict local scaling of the cross sections for correlated clusters of nucleons. This is seen in ratios of cross sections for heavy an light nuclei as a function for Bjorken x. The scaling is seen as flat plateaus in the ratios plotted as a function of x. Recent data from Hall B has shown convincing evidence of a plateau for two-nucleon clusters and indications of a possible plateau for three-nucleon clusters. This experiment would obtain cross section ratios for a number of nuclei with sufficient accuracy to determine whether the three-body plateau does indeed exist, and to allow studies of isospin dependence which can provide needed information for relating the size of the plateaus to the number of correlated two- and three-nucleon clusters. This is an interesting phenomenon and should stimulate theoretical developments in this area.

One issue is how well could the cross sections themselves, as opposed to cross section ratios, be determined, and could these place further constraints on the nuclear models.

PR-08-015: *Transverse spin effects in SIDIS at 6 GeV with transversely polarized target using the CLAS Detector*

K. Orginos, M. Schlegel

This experiment proposes to study the azimuthal spin asymmetries in SIDIS using polarized electron beam on transversely polarized HD-ice using the CLAS detector. This is the first transversely polarized target experiment in CLAS. It focuses on Transverse Target Single Spin asymmetries in order to access the Sivers function. Also Transverse Double Spin asymmetries will be studied giving access to the distribution of longitudinally polarized quark distributions in transversely polarized nucleons. The experiment will also extend the range in (x, Q^2) of g_2. This will give the ability to access the asymptotic Q^2 behavior of the polarizability γ_0 and of forward spin polarizability δ_{LT}.

This experiment is complementary to other experiments in the area. It extends results from COMPASS. It is also ideal for CLAS. The field is experiment driven, hence the proposed project is expected to have significant impact.

PR-08-016: *The Qweak Experiment*

W. Melnitchouk, J. Dudek

This is an important experiment designed to measure a fundamental parameter of the standard model, $\sin^2\theta_W$. Since the last review, the physics case for this experiment has not diminished; in fact, it has probably become stronger. This is partly due to the realization that the existing PV data can be used to put constraints on the mass scale of new physics beyond the standard model. It will be important to achieve the stated precision of the experiment, as a factor of two reduction in the precision will mean a $\sqrt{2}$ decrease in the limits reached on the mass scale.

In addition, recent work on two-boson exchange corrections to PV electron scattering by Zhou et al., arXiv:0708.4297 [hep-ph], and Tjon et al., arXiv:0711.0143 [nucl-th], has obtained improved estimates of the electroweak radiative corrections. It would be of interest to see how these may affect the extraction of $\sin^2\theta_W$ from the anticipated data, and whether they would introduce additional contributions to the error budget.

PR-08-017: *Polarization Transfer in Wide Angle Compton Scattering*

I. Balitsky, M. Schlegel

The results of JLab experiment E99-114 suggest that the one-constituent "handbag" mechanism of the wide-angle Compton scattering dominates over the three-constituent "pQCD" mechanism. This would mean that the three-constituent mechanism, being the correct approach in the highly asymptotic regime, fails to describe the exclusive processes at moderate momentum transfers where the pre-asymptotic "handbag" treatment seems to be relevant. To emphasize this statement that would make a profound effect on the whole range of high-t experiments at intermediate energies, it has to be tested experimentally at the kinematical points other than exploited by E99-114 experiment and that is where the proposed experiment may play a prominent role. The proposal is to measure the polarization transfer observables in wide angle Compton scattering and to check that the three-constituent "pQCD" asymptotics can be ruled out in favor of the one-constituent mechanism.

PR-08-018: *In medium properties of ρ, ω and ϕ mesons*

J.J. Dudek, K. Tsushima

Since a very similar proposal appeared as PR-06-102, we repeat here the comments presented by the PAC 30 TAC:

The search for medium modifications of meson properties has been a topic of interest for many years. In particular, some theoretical predictions of significant changes of meson masses and widths in a nuclear medium have strongly motivated numerous experiments. There are, however, profound disagreements between different experiments, which calls for definitive studies. This proposal addresses the in-medium modifications of the ρ meson through an analysis of the e^+e^- decay channel, where the interaction of the final state with the nucleus is minimized. One such experiment by the same collaboration has already been completed and the preliminary analysis shows small to insignificant medium effects. Carrying out the program to a new level of accuracy seems to be the natural progression as spelled out in this proposal, and will help settle the issue, at least for the ρ meson.

From the theoretical point of view, it is clear that experimental results will help constrain models and further help one to understand the general issue of nuclear medium effects on hadrons, a topic that is still wide open.

Recent experiments on the in-medium ω meson properties performed at KEK and CBELSA/TAPS, showed a downward-shift of the ω meson mass (and broadening of the width), which is different from that of the ρ meson, have triggered new theoretical discussions in the field. Since this proposal covers the measurements of the ρ, ω and ϕ mesons simultaneously it may potentially better differentiate the in-medium modifications of the ρ and ω meson.

One query we have is in regard to the subtraction of the contribution of ω and ϕ. This appears to rely upon the GiBUU model and it is not clear that the uncertainty associated with this subtraction is reflected in the results. This concerns also the $\rho - \omega$ mixing, which is confirmed experimentally in vacuum. The $\rho - \omega$ mixing in nuclear medium itself is a very interesting and uncovered challenging topic both in theory and experiment. The effect of this $\rho - \omega$ mixing, must be carefully taken into account in the analysis to draw a solid conclusion.

PR-08-019: *Measurements of the Deuteron, Proton and* ^{3}He *Magnetic Form Factors at Large Momentum Transfers.*

D.G. Richards, M.J. Peardon

The principle focus of this proposal is the measurement of the deuteron form factor $B(Q^2)$. This quantity is small, and can only be cleanly separated from the electric form factors at high Q^2 by measurements at backward scattering angles, as is proposed in this experiment. The interest in this quantity is its ability to discriminate between different models of deuteron structure, since the form of the diffractive dip at $Q^2 \sim 2\text{GeV}^2$ is very sensitive to the details of the model. Thus the emphasis of this experiment in precise measurements of $B(Q^2)$ that include this region is very well motivated.

The remainder of the proposal is to measure the form factors for the proton and for ^{3}He. The proposers note also that they might be able to explore the approach to pQCD at high Q^2; the applicability of pQCD for even the single-nucleon form factors is questionable in this energy regime, though the ratio F_2/F_1 do display the appropriate scaling behavior, as noted by the authors. It is worth remarking that lattice computations of the proton form factors are likely to encompass the range of energies explored in this proposal in the near future, and the isovector combination of magnetic form factors will permit the most precise comparison with the lattice measurements.

PR-08-020: *Exploring very high missing momenta in deuteron electro–disintegration*

Ch. Weiss, A. Afanasev

The proposed experiment would measure the cross section of deuteron electrodisintegration $D(e,e'p)n$ at $Q^2 = 3.5\,\mathrm{GeV}^2$ and $x_B = 1.3$, for missing momenta $p_m = 0.5 - 1\,\mathrm{GeV}$, with the aim of probing small–size configurations in the deuteron wave function (high–density fluctuations, short–range correlations). The measurement is done in a kinematic region where final–state interactions are relatively small and under theoretical control. This experiment extends a previous Hall A measurement at lower momentum transfer ($Q^2 = 0.67\,\mathrm{GeV}^2$), a more recent measurement at $Q^2 = 3.5\,\mathrm{GeV}^2$ and lower missing momenta $p_m < 0.5\,\mathrm{GeV}$ [E01-020], as well as the recent high–Q^2 measurement with CLAS.

The proposed experiment is well motivated and builds on the groundbreaking earlier studies of high–Q^2 deuteron breakup at JLab. Measurements of nucleon knockout at high energy and momentum transfer provide information about the high–momentum components of the nuclear wave function, short–range correlations between nucleons, and possibly the presence of non-nucleonic degrees of freedom in nuclei; they have the potential to connect nuclear physics with the short–distance description of strong interactions in terms of QCD. In general the information about the short–range structure in such processes is modified by final–state interaction (FSI) between the nucleons, which needs to be treated theoretically. At momentum transfers $Q^2 \sim$ several GeV^2 the Generalized Eikonal Approximation (GEA) is expected to work on theoretical grounds and was successfully tested in the analysis of the previous high–Q^2 experiments. The present experiment would explore the region of large missing momenta (up to $p_m = 1\,\mathrm{GeV}$), where the FSI is predicted to be dominated by rescattering effects. The kinematics was specifically chosen to minimize the magnitude and variation of FSI corrections and permit the most direct access to the elementary scattering process. Together with the data from the earlier Hall A measurement at $Q^2 = 3.5\,\mathrm{GeV}^2$, the proposed experiment would for the first time provide high–Q^2 deuteron breakup cross section data covering the complete range of missing momenta from 0 to 1 GeV, allowing for comprehensive studies of the short–range structure of the deuteron. Finally, we suggest that the proposers publish their data in a form that admits different theoretical analyses in the future.

PR-08-021: *Deeply Virtual Compton Scattering at 6 GeV with transversely polarized target using the CLAS detector*

A.V. Radyushkin, P. Wang

This proposal is a part of studies of generalized parton distributions (GPDs) using deeply virtual Compton scattering. The proposed measurements are essential for the study of "elusive" GPD $E(x, \xi, t)$. Unlike GPD $H(x, \xi, t)$, whose shape for $\xi = 0, t = 0$ is constrained by usual parton distributions, no information about $E(x, \xi, t)$ can be extracted from inclusive measurements. It should be emphasized that E-GPD enters on equal footing with H-GPD into Ji's sum rule for the nucleon momentum, hence the importance of the E-GPD measurements. The projected extraction of GPDs from the transverse target DVCS single-spin asymmetries and double spin asymmetries (assuming that the denominators in the asymmetries are sufficiently well known, e.g., from Hall A data on unpolarized cross section) is based on the well-developed formalism of Belitsky, Mueller and Kirchner.

PR-08-022: *Semi-Inclusive Spin Asymmetries on the Nucleon Experiment*

R. Edwards

This is a jeopardy proposal of the Hall C experiment "Semi-SANE" experiment. The theoretical justification for this proposal is still strong. The Theory Group was not aware of any recent theoretical progress that caused concern with the methods employed, or any other lack of justification. The fact that a double-spin asymmetry can be measured thereby precluding the need (at leading order) for fragmentation functions is still important. Also, the other pieces of this project are already scheduled for running in 2008 where parts of this experiment will be able to run in parallel.

PR-08-024: *Deeply Virtual Compton Scattering off ^{4}He*

I. Balitsky, R. Edwards

Being the first fully qualitative measurement of the DVCS from the nuclear target, the proposed experiment will pave the way for DVCS scattering from the nuclei. (It should be noted that due to the zero spin of ^{4}He target the usual complicated structure of the DVCS amplitude simplifies to just one non-forward parton distribution). The proposal claims to be able to distinguish between the coherent photon production (proportional to the off-forward nuclei GPDs) and the non-coherent production (determined by the usual forward parton densities) which dominates the cross section at small t. Comparing the results of this experiment to DIS from the nuclei on one hand, and DVCS from the nucleon on the other hand will enable us to test different theoretical models of the internal structure of the nuclei. Especially interesting is the connection to the famous "EMC effect" - the deviation of the structure function of the nuclei from the sum of corresponding nucleon structure functions. Despite almost 25 years of theoretical and experimental effort we do not yet have the comprehensive explanation, especially in the "anti-shadowing" ($0.1 < x_B < 0.2$) and the "EMC effect" ($0.2 < x_B < 0.7$) regions where the internal structure of the nucleon is believed to be essential. The proposed experiment suggests attacking this problem from the different angle by measuring the off-forward GPDs in the nuclei.

PR-08-025: *Measurement of the Deeply Virtual Compton cross–section off the neutron*

Ch. Weiss, A. Radyushkin

The proposed experiment would measure the cross section for exclusive scattering $D(e, e'\gamma)pn$ in quasi–free kinematics, with the aim of studying deeply–virtual Compton scattering (DVCS) from the neutron ($Q^2 = 1.9\,\mathrm{GeV}^2, x_B = 0.36$). Measurements at two different beam energies are planned in order to separate the Bethe–Heitler (BH) and DVCS interference from the $|\mathrm{DVCS}|^2$ cross section, and the neutron contribution is to be extracted by combining with the data from a similar experiment with proton target. The experiment will also produce first data on the coherent nuclear process $D(e, e'\gamma)D$, as well as data on exclusive π^0 production (including L/T separation). It extends a previous Hall A measurement of DVCS on the neutron, and complements the approved proton experiment in the same kinematics.

The proposed investigation is certainly well motivated. Measuring DVCS from the neutron is essential for constraining the Pauli form factor–type GPD E, needed to estimate the quark orbital angular momentum in the nucleon, and for the flavor separation of the GPDs. The previous Hall A measurements of the absolute $(e, e'\gamma)$ cross sections represent a considerable achievement and have stimulated numerous theoretical and experimental discussions. The observation of a large DVCS contribution to the $(e, e'\gamma)$ cross section should be followed up by a separation of the BH–DVCS and the $|\mathrm{DVCS}|^2$ terms, as in the approved proton experiment. An exploratory measurement of coherent DVCS on the deuteron would be an important first step toward the study of coherent exclusive reactions with nuclei, even if the present data will not suffice to separate the spin/flavor components of the deuteron GPDs. Finally, π^0 electroproduction in this kinematic region is not well understood at all (in either the GPD or the Regge approach), and L/T separated data would certainly help to clarify the reaction mechanism.

The necessary combination of deuteron and proton data requires good theoretical control of nuclear effects, in particular since it is also planned to combine data taken at different energies. We recommend that the proposers work with theorists to test, and possibly improve, the approximations made in the treatment of nuclear effects (corrections to the closure approximation, final–state interactions, *etc.*) in the future. Also, it is important that the data be preserved and published in a way which would allow theorists to refine the treatment of nuclear effects at some later time.

PR-08-026: *An updated high precision measurement of the neutral pion lifetime via the Primakoff effect*

J.J. Dudek, S. Ryan

The proposal concerns the decay rate for $\pi^0 \to \gamma\gamma$ which is one of the few quantities in QCD that can be confidently predicted from first principles. The experiment is an extension to one that ran in 2004 but which did not receive the full beam-time required for the desired accuracy of 1.4%. Achieving this accuracy would allow PrimEx to confront recent theoretical calculations of the decay rate from QCD sum rules and next-to-leading order chiral perturbation theory.

While the end result of $\Gamma(\pi^0 \to \gamma\gamma)$ is very simply defined, the method of extraction using the Primakoff effect is rather non-trivial. The large nucleus used provides a large electrical charge and hence a rather effective "photon target", but at the same time introduces competing physics processes that are rather less well understood than Primakoff's. At least two models of nuclear physics processes are mentioned and one would hope that an application of several models (each successfully describing independent processes), would give some insight into the model dependency of the extraction.

In case of future improvements in modeling of the nuclear physics processes it would be helpful if the collaboration ensure they publish acceptance-corrected differential cross-sections. In this way the data can still be useful to theorists long after the collaboration has disbanded.

PR-08-027: *A Measurement of g_2^p and the Longitudinal-Transverse Spin Polarizability*

W. Melnitchouk, V. Guzey

The physics case for measuring g_2^p and its moments has not diminished since PAC31, when this proposal was last submitted (and conditionally approved). There is a clear need to fill in the gaps in the data set on the g_2 structure functions of the nucleon, and this experiment aims to do just that. In strengthening the case for collecting the high-Q^2 data, the authors have made clear connections to the BC sum rule, which is an important test of our understanding of QCD, as well as the impact of their data on other analyses (e.g. from CLAS), which have previously had to make assumptions about g_2^p when extracting g_1^p data.

LOI-08-004: *First search for $\phi - N$ bound state*

M. Paris

QCD predicts residual (van der Waals) interactions between color-singlet objects due to multi-gluon (Pomeron) and other collective effects (like instantons). Using this mechanism, theory predicts (in various formalisms) the existence of a $\phi - N$ bound state. This *Letter* proposes to measure the semi-inclusive cross section for $\gamma + {}^{63}_{29}\mathrm{Cu} \to pK^+K^-X$.

The cross section for this process on a carbon nucleus has been calculated by Gao *et. al.* [PRC **63**, 022201 (2001)] in the impulse approximation, using harmonic oscillator wave functions for a shell model description of carbon and the ϕ production mechanism of Titov *et. al.* [PRC **60**, 035205 (1999)]. The total cross section is strongly peaked at the subthreshold region near $E_\gamma = 1.4$ GeV ($W = 1.9$ GeV). The model neglects coherent effects, nucleon correlations, final state interaction, and channel coupling of $\phi N \leftrightarrow \Lambda K^*$ effects. All of these mechanisms are likely to broaden the peak in total cross section, perhaps significantly.

The measurement of ϕ production from nuclei is nevertheless very interesting. Expectations for strong peaking should be tempered. The lack of a strong peak would not necessarily negate the existence of the putative $\phi - N$ state.