

Mike Williams

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• Current Position and Education

– Carnegie Mellon University

- * Post-doctoral research associate with the Experimental Medium Energy Physics Group, Dec. 2007 - present
- * Ph.D. in Physics, Nov. 2007.
Thesis Title: Measurement of Differential Cross Sections and Spin Density Matrix Elements along with a Partial Wave Analysis for $\gamma p \rightarrow p\omega$ using CLAS at Jefferson Lab
Adviser: Curtis A. Meyer
- * M.S. in Physics, May 2003

– Saint Vincent College

- * B.S. in Mathematics and Physics, May 2001.

• Research Interests and Skills

My primary research interests are in the closely related fields of experimental particle physics, computational physics and phenomenology. My current research focuses on testing QCD by studying baryon spectroscopy using partial wave analysis. This problem is multi-faceted and has led me to develop experience in almost every aspect of off-line data analysis (including effective field theory calculations). I am now interested in applying my skills to new challenging problems in experimental particle physics.

My skills include:

- Languages: C/C++, Ruby, XML, Fortran, Perl, HTML, PHP, Python
- Fitting routines — developed both unbinned maximum likelihood and binned χ^2 routines for various applications, also ported MINUIT to the Ruby language
- Developed several large software projects used by multiple institutions
- Developed the kinematic fitting routine used by the CLAS collaboration
- Parallel Programming using MPI
- ROOT — extensive experience, including compiling specialized template classes into CINT, compressing CLAS data files by creating ROOT compatible data storage classes, etc. . .

• Awards

- **Jefferson Lab**, JSA Thesis Prize, 2007
Awarded each year for the best thesis related to Jefferson Lab physics
- **Carnegie Mellon University**, Guy C. Berry Graduate Research Award, 2006
Awarded to one graduate student in the Mellon College of Science — Mathematics, Biology, Chemistry and Physics departments — each year for excellence in research
- **Saint Vincent College**, Academic Excellence in Mathematics Award, 2001
Awarded to one undergraduate student each year by the Department of Mathematics
- **Saint Vincent College**, Academic Excellence in Physics Award, 2001
Awarded to one undergraduate student each year by the Department of Physics

- **Talks and Presentations**

- **APS and HEDP/HEDLA (Invited Talk)**, April 2008, St. Louis, MO.
Partial Wave Analysis Results for $\gamma p \rightarrow p\omega$ using Data from CLAS at Jefferson Lab.
- **APS Topical Group on Hadron Physics**, Oct. 2007, Newport News, VA.
Measurement of $d\sigma/d\cos\theta$ and $\rho_{MM'}^0$ along with a PWA of $\gamma p \rightarrow p\omega$ using CLAS.
- **APS Topical Group on Hadron Physics**, Oct. 2006, Nashville, TN.
A PWA of ω Photoproduction using CLAS.
- **CMU PWA Workshop**, Feb. 2006, Pittsburgh, PA.
PWA Formalism.
- **NSTAR 2005**, Oct. 2005, Tallahassee, FL.
The Carnegie Mellon University program for studying baryon resonance photoproduction using PWA.
- **CMU Undergraduate Colloquium**, April 2004, Pittsburgh, PA.
The Missing Baryons Problem
- **CLAS Meetings**, Nov. 2003 - present, Newport News, VA.
I have given approximately 20 presentations to the CLAS collaboration on software development, detector studies and physics analyses.

- **References**

- **Professor Curtis A. Meyer**
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- **Professor David J. Tedeschi**
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- **Professor Reinhard Schumacher** (auxiliary reference)
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- **Professor Roy Briere** (auxiliary reference)
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- **Teaching Experience**

- **Carnegie Mellon University**, Aug. 2001 - present
 - * I have supervised several graduate students while at CMU. Zeb Krahn obtained his Ph.D. at the end of 2007 and is now a post-doc at the University of Minnesota. Mike McCracken will be defending his thesis in Aug. 2008 and has been hired as a professor at Washington and Jefferson College. I am also currently working with two students, Biplab Dey and Brain Vernarsky, on their thesis projects.
 - * I also mentored an undergraduate student, Douglas Applegate, for several research projects (spanning 3 years), he is now a graduate student in physics at Stanford University.
 - * Teaching assistant (Aug. 2001 - May 2002) for Physics I. I ran recitations and tutoring sessions (group and private) and was responsible for grading exams, quizzes and homework.
- **Saint Vincent College**, Aug. 1999 - May 2001
Teaching assistant responsible for setting up labs for the freshman physics courses along with grading homework.

- **Selected Publications and Papers**

- **Partial Wave Analysis of $\gamma p \rightarrow p\omega$ and the Search for Nucleon Resonances**
M. Williams *et. al* (The CLAS Collaboration), currently in internal review (Target Journal: Phys. Rev. D)
- **First High-Precision $\rho_{MM'}^0$ Measurements in ω Photoproduction**
M. Williams *et. al* (The CLAS Collaboration), currently in internal review (Target Journal: Phys. Rev. Lett.)
- **Differential Cross Sections and Spin Density Matrix Elements for $\gamma p \rightarrow p\omega$**
M. Williams *et. al* (The CLAS Collaboration), currently in internal review (Target Journal: Phys. Rev. C)
- **Differential Cross Sections for $\gamma p \rightarrow p\eta$ and $\gamma p \rightarrow p\eta'$**
M. Williams *et. al* (The CLAS Collaboration), currently in internal review (Target Journal: Phys. Rev. C)
- **Numerical Object Oriented Quantum Field Theory Calculations**
M. Williams, arXiv:0805.2956 [hep-ph] (Submitted to Comp. Phys. Comm.)
- **Separating Signals from Non-Interfering Backgrounds using Probabilistic Event Weightings**
M. Williams, M. Bellis and C. A. Meyer, arXiv:0804.3382 [physics.data-an] (Submitted to NIM).
- **Search for the Θ^+ pentaquark in the reactions $\gamma p \rightarrow \bar{K}^0 K^+ n$ and $\gamma p \rightarrow \bar{K}^0 K^0 p$**
By the CLAS Collaboration (R. De Vita *et al.*), Phys. Rev. D **74**, 032001 (2006), arXiv:hep-ex/0606062
- **Search for Θ^{++} pentaquarks in the exclusive reaction $\gamma p \rightarrow K^+ K^- p$**
By the CLAS Collaboration (V. Kubarovsky *et al.*), Phys. Rev. Lett. **97**, 102001 (2006), arXiv:hep-ex/0605001
- **Search for the Θ^+ pentaquark in the reaction $\gamma d \rightarrow p K^- K^+ n$**
By the CLAS Collaboration (B. McKinnon *et al.*), Phys. Rev. Lett. **96**, 212001 (2006), arXiv:hep-ex/0603028
- **The Carnegie Mellon University program for studying baryon resonance photoproduction using partial wave analysis**
M. Williams, D. Applegate, M. Bellis, C. A. Meyer and Z. Krahn , *Prepared for International Workshop on the Physics of Excited Baryons (NSTAR 05), Tallahassee, Florida, 10-15 Oct 2005*
- **The nonrelativistic frequency-dependent electric polarizability of a bound particle**
M. A. Maize and M. Williams, Am. J. Phys. **72** (5), May 2004

- **CLAS Analysis Notes** (collaboration documents related to physics analysis)
Documents on η, η' cross sections, hyperon decays and several pentaquark studies (4 documents, <http://www.jlab.org/Hall-B>).
- **CLAS-Notes** (collaboration documents related to calibrations, systematic studies, software, etc.)
Documents on kinematic fitting, energy and momentum corrections, detector resolution, studies of systematic uncertainties and signal-background separation (5 documents, <http://www.jlab.org/Hall-B>).
- **GlueX-Documents** (documents for the GlueX experiment to be built in Hall-D at Jefferson Lab)
Documents on kinematic fitting, PWA formalism and gas composition studies for the straw tube chamber in the GlueX detector (5 documents, <http://portal.gluex.org>).

• **Other CLAS Collaboration Publications**

- **Measurement of $ep \rightarrow epp\pi^0$ beam spin asymmetries above the resonance region**
By the CLAS Collaboration (R. De Masi *et al.*),
Phys. Rev. C **77**, 042201 (2008).
- **Polarized Structure Function $\sigma_{LT'}$ for $p(\vec{e}, e'K^+)\Lambda$ in the Nucleon Resonance Region**
By the CLAS Collaboration (R. Nasseripour *et al.*),
arXiv:0801.4711 [nucl-ex].
- **Deeply Virtual Compton Scattering Beam-Spin Asymmetries**
By the CLAS Collaboration (F. X. Girod *et al.*),
arXiv:0711.4805 [hep-ex].
- **Cross sections and beam asymmetries for $\vec{e}p \rightarrow en\pi^+$ in the nucleon resonance region for $1.7 \leq Q^2 \leq 4.5(\text{GeV})^2$**
By the CLAS Collaboration (K. Park *et al.*),
arXiv:0709.1946 [nucl-ex]
- **A Bayesian analysis of pentaquark signals from CLAS data**
By the CLAS Collaboration (D. G. Ireland *et al.*),
arXiv:0709.3154 [hep-ph]
- **Search for medium modification of the ρ meson**
By the CLAS Collaboration (R. Nasseripour *et al.*),
Phys. Rev. Lett. **99**, 262302 (2007) [arXiv:0707.2324 [nucl-ex]].
- **π^0 photoproduction on the proton for photon energies from 0.675-GeV to 2.875-GeV**
By the CLAS Collaboration (M. Dugger *et al.*), Phys. Rev. C **76**, 025211 (2007),
arXiv:0705.0816 [hep-ex]
- **Q^2 Dependence of the $S_{11}(1535)$ Photocoupling and Evidence for a P-wave resonance in eta electroproduction**
By the CLAS Collaboration (H. Denizli *et al.*), Phys. Rev. C **76**, 015204 (2007),
arXiv:0704.2546 [nucl-ex]
- **First measurement of coherent ϕ -meson photoproduction on deuteron at low energies**
By the CLAS Collaboration (T. Mibe *et al.*), Phys. Rev. C **76**, 052202 (2007),
arXiv:nucl-ex/0703013
- **Cascade production in the reactions $\gamma p \rightarrow K^+K^+(X)$ and $\gamma p \rightarrow K^+K^+\pi^-(X)$**
By the CLAS Collaboration (L. Guo *et al.*), Phys. Rev. C **76**, 025208 (2007),
arXiv:nucl-ex/0702027
- **Experimental study of exclusive H-2(e, e' p)n reaction mechanisms at high Q^2**
By the CLAS Collaboration (K. S. Egiyan *et al.*), Phys. Rev. Lett. **98**, 262502 (2007),
arXiv:nucl-ex/0701013

- **Cross sections for the $\gamma p \rightarrow K^{*0}\Sigma^+$ reaction at $E_\gamma = 1.7\text{-GeV} - 3.0\text{-GeV}$**
By the CLAS Collaboration (I. Hleiqawi *et al.*), Phys. Rev. C **75**, 042201 (2007),
arXiv:nucl-ex/0701036
- **Separated structure functions for the exclusive electroproduction of $K^+\Lambda$ and $K^+\Sigma^0$ final states**
By the CLAS Collaboration (P. Ambrozewicz *et al.*), Phys. Rev. C **75**, 045203 (2007),
arXiv:hep-ex/0611036
- **First measurement of beam-recoil observables $C(x)$ and $C(z)$ in hyperon photoproduction**
By the CLAS Collaboration (R. Bradford *et al.*), Phys. Rev. C **75**, 035205 (2007),
arXiv:nucl-ex/0611034
- **Quark-hadron duality in spin structure functions $g_1(p)$ and $g_1(d)$**
By the CLAS Collaboration (P. E. Bosted *et al.*), Phys. Rev. C **75**, 035203 (2007),
arXiv:hep-ph/0607283
- **Measurement of the $N \rightarrow \Delta(1232)^+$ transition at high momentum transfer by π^0 electroproduction**
By the CLAS Collaboration (M. Ungaro *et al.*), Phys. Rev. Lett. **97**, 112003 (2006),
arXiv:hep-ex/0606042
- **Measurement of deeply virtual Compton scattering with a polarized proton target**
By the CLAS Collaboration (S. Chen *et al.*), Phys. Rev. Lett. **97**, 072002 (2006),
arXiv:hep-ex/0605012
- **Measurement of the x - and Q^2 -Dependence of the Asymmetry A_1 on the Nucleon**
By the CLAS Collaboration (K. V. Dharmawardane *et al.*), Phys. Lett. B **641**, 11 (2006),
arXiv:nucl-ex/0605028
- **Search for the Θ^+ pentaquark in the $\gamma d \rightarrow \Lambda n K^+$ reaction measured with CLAS**
By the CLAS Collaboration (S. Niccolai *et al.*), Phys. Rev. Lett. **97**, 032001 (2006),
arXiv:hep-ex/0604047
- **η' photoproduction on the proton for photon energies from 1.527-GeV to 2.227-GeV**
By the CLAS Collaboration (M. Dugger *et al.*), Phys. Rev. Lett. **96**, 062001 (2006),
Erratum-ibid. **96**, 169905 (2006), arXiv:nucl-ex/0512019
- **Electron scattering from high-momentum neutrons in deuterium**
By the CLAS Collaboration (A. V. Klimenko *et al.*), Phys. Rev. C **73**, 035212 (2006),
arXiv:nucl-ex/0510032
- **Search for $\Theta(1540)^+$ pentaquark in high statistics measurement of $\gamma p \rightarrow \bar{K}^0 K^+ n$ at CLAS**
By the CLAS Collaboration (M. Battaglieri *et al.*), Phys. Rev. Lett. **96**, 042001 (2006),
arXiv:hep-ex/0510061
- **Differential cross sections for $\gamma p \rightarrow K^+ Y$ for Λ and Σ^0 hyperons**
By the CLAS Collaboration (R. Bradford *et al.*), Phys. Rev. C **73**, 035202 (2006),
arXiv:nucl-ex/0509033
- **Beam-helicity asymmetries in double charged pion photoproduction on the proton**
By the CLAS Collaboration (S. Strauch *et al.*), Phys. Rev. Lett. **95**, 162003 (2005),
arXiv:hep-ex/0508002
- **Measurement of 2- and 3-Nucleon Short Range Correlation Probabilities in Nuclei**
By the CLAS Collaboration (K. S. Egiyan *et al.*), Phys. Rev. Lett. **96**, 082501 (2006),
arXiv:nucl-ex/0508026

- **Measurement of the deuteron structure function F2 in the resonance region and evaluation of its moments**
By the CLAS Collaboration (M. Osipenko *et al.*), Phys. Rev. C **73**, 045205 (2006),
arXiv:hep-ex/0506004
- **Measurement of the polarized structure function sigma(LT') for pion electroproduction in the Roper resonance region**
By the CLAS Collaboration (K. Joo *et al.*), Phys. Rev. C **72**, 058202 (2005), arXiv:nucl-ex/0504027
- **Deeply virtual and exclusive electroproduction of ω mesons**
By the CLAS Collaboration (L. Morand *et al.*), Eur. Phys. J. A **24**, 445 (2005), arXiv:hep-ex/0504057
- **Radiative decays of the $\Sigma(1385)^0$ and $\Lambda(1520)$ hyperons**
By the CLAS Collaboration (S. Taylor *et al.*), Phys. Rev. C **71**, 054609 (2005),
Erratum-ibid. C **72**, 039902 (2005), arXiv:hep-ex/0503014
- **Complete measurement of three-body photodisintegration of He-3 for photon energies between 0.35-GeV and 1.55-GeV**
By the CLAS Collaboration (S. Niccolai *et al.*), Phys. Rev. C **70**, 064003 (2004), arXiv:nucl-ex/0409013
- **Exclusive photoproduction of the Cascade (Ξ) hyperons**
By the CLAS Collaboration (J. W. Price *et al.*), Phys. Rev. C **71**, 058201 (2005), arXiv:nucl-ex/0409030
- **Exclusive ρ^0 meson electroproduction from hydrogen at CLAS**
By the CLAS Collaboration (C. Hadjidakis *et al.*), Phys. Lett. B **605**, 256 (2005),
arXiv:hep-ex/0408005
- **Measurement of the polarized structure function sigma(LT') for p(e(pol.),e' pi+)n in the Delta(1232) resonance region**
By the CLAS Collaboration (K. Joo *et al.*), Phys. Rev. C **70**, 042201 (2004), arXiv:nucl-ex/0407013
- **Proton source size measurements in the $eA \rightarrow e'ppX$ reaction**
By the CLAS Collaboration (A. V. Stavinsky *et al.*), Phys. Rev. Lett. **93**, 192301 (2004),
arXiv:hep-ex/0405064
- **Survey of A(LT') asymmetries in semi-exclusive electron scattering on He-4 and C-12**
By the CLAS Collaboration (D. Protopopescu *et al.*), Nucl. Phys. A **748**, 357 (2005),
arXiv:nucl-ex/0405021