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A Measurement of the Virtual Photon Structure Function*

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A Dissertation Presented

by

RICHARD. J. BELCINSKI

Submitted to the Graduate School of the

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Department of Physics and Astronomy

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ABSTRACT

A MEASUREMENT OF THE VIRTUAL PHOTON STRUCTURE FUNCTION

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Ph.D. UNIVERSITY OF MASSACHUSETTS AMHERST

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The structure function of a virtual photon, representing the physics of the hard scattering of an electron off a massive photon target resulting in a hadronic final state, has been measured in the kinematic range $1.5 \leq Q^2 \leq 5.5$ GeV^2, $0.1 \leq P^2 \leq 1.5$ GeV^2 and $2 \leq W \leq 20$ GeV. The measurement was done using the TPC/Two-Gamma detector facility and employs a heretofore unique method to determine the W of the final state by using information from both the visible mass of the final state as well as the mass reconstructed from the two lepton tags. The results are compared to a variety of models,

and are found to be consistent with an incoherent sum of the QPM and VDM models.

In addition, the structure function of the virtual photon has been measured in the kinematic range $10 \leq Q^2 \leq 50$ GeV^2, $0.1 \leq P^2 \leq 1.5$ GeV^2, a heretofore unexplored region. The results are somewhat high, though statistically consistent with being physically allowed. The results might indicate the presence of an interesting background, or perhaps physics that has not yet been accounted for in the comparison to model expectations.

TABLE OF CONTENTS

Page

ACKNOWLEDGEMENTS iv

ABSTRACT v

LIST OF TABLES x

LIST OF FIGURES xi

Chapter

1. INTRODUCTION 1

2. THEORY OF 2γ INTERACTIONS 14

2.1 Kinematic Considerations and Definitions 15

2.2 The General Cross Section 26

2.2.1 General Remarks on QFT Calculations 26

2.2.2 Calculating the Cross Section 30

2.3 The Photon Structure Functions 38

2.3.1 Quark Parton Model 46

2.3.2 VDM and GVDM 52

2.3.3 QCD 57

2.4 Approximations and MC Integration 61

3. THE EXPERIMENTAL APPARATUS 64

3.1 The Accelerator 64

3.2 The PEP Ring 66

3.3 The TPC/Two-gamma Detector 67

3.3.1 The NaI Calorimeters 71

3.3.2 The Shower Counters 79

3.3.3 The Forward Drift Chambers 82

3.3.4 The Time Projection Chamber 85

3.3.5 The Inner and Outer Drift Chambers 97

3.3.6 The Hexagonal Calorimeter 100

3.3.7 The Pole Tip Calorimeters 102

3.3.8 The Muon System 105

3.3.9 The Trigger System 109

3.4 Other SLAC Facilities 119

4. DATA ANALYSIS 120

4.1 Preliminary Filters 120

4.1.1 The Low Field Analysis Passes 122

4.1.2 The High Field Analysis Passes 128

4.2 Important Backgrounds 133

4.2.1 Radiative Bhabha Events 135

4.2.2 Two Photon e^+e^- Pairs 138

4.2.3 Two Photon Muon Pairs 139

4.2.4 Two Photon Radiative di-Muon Events 140

4.2.5 Two Photon Tau Pairs 142

4.2.6 Single Tag Events 144

4.3 Particle Identification 148

4.4 Event Selection Cuts 155
4.5 The Final Sample: Comparison to MC Calculations 170
5. RESULTS AND CONCLUSIONS 207
5.1 Unfolding 208
5.2 Improved W Measurement 218
5.3 The unfolding Result 221
5.3.1 Discussion of NaI-SHW results 224
5.3.2 Discussion of NaI-PTC Results 236
5.4 Discussion of Systematic Errors 240
5.4.1 Unfolding 242
5.4.2 Physics and Detector Simulation 244
5.4.3 Background Subtraction 245
5.4.4 Determination of the Luminosity 246
5.5 Conclusion 246
BIBLIOGRAPHY 248

LIST OF TABLES

2.1 MC Comparison 62

3.1 NaI Energy Resolutions 78
3.2 Drift chamber Z 84

4.1 Multiplicity cuts 182
4.2 Multiplicity cuts 183
4.3 High Field Triggers 184
4.4 Track link efficiency 185
4.5 HF Filter Statistics 185
4.6 Tag Scatter Plot 186
4.7 LF Filter Statistics 186

5.1 Model Normalizations 220
5.2 W_{vis} Corrections 222
5.3 W_{vis} Corrections 223
5.4 Model Normalizations 226
5.5 Bin to Bin Correlations 234
5.6 Fit Results 235
5.7 Fit Results 2 241
5.8 Unfolding Systematics 243

LIST OF FIGURES

1.1 $\gamma\gamma$ Interaction 5
1.2 2γ Resonance Production 8
1.3 2γ Continuum 9
1.4 Proton Structure 11

2.1 2γ Kinematic Diagram 16
2.2 W vs lepton p 18
2.3 W Angle 21
2.4 u quark production 22
2.5 Plot of $\delta W^2_{\gamma\gamma}/W^2_{\gamma\gamma}$ 23
2.6 W^2 Resolution Ratio 25
2.7 1γ exchange 27
2.8 QED 2γ Diagrams 30
2.9 2γ Graph - Feynman Ingredients 32
2.10 $e - p$ Scattering 41
2.11 F plot 50
2.12 F mass-dependence 51
2.13 NaI-PTC QPM-F 52
2.14 Basic VDM 54
2.15 GVDM 56
2.16 R. McNeil VDM 57

2.17 QCD F 60

3.1 SLAC Site 65
3.2 PEP Ring 67
3.3 Detector, Isometric View 68
3.4 Competing Experiments 72
3.5 NaI Detector 73
3.6 Forward Spectrometer 74
3.7 SHW Schematic 80
3.8 DC Module Schematic 83
3.9 TPC Schematic 1 86
3.10 TPC Schematic 2 87
3.11 TPC Schematic 3 88
3.12 TPC Track view 89
3.13 TPC Wire Pulse 92
3.14 TPC Shaped Pulse 93
3.15 TPC CCD Pulse 94
3.16 TPC Channel Gain 96
3.17 IDC Detector Schematic 98
3.18 ODC Detector Schematic 100
3.19 ODC Detector Schematic 101
3.20 PTC Schematic 1 103
3.21 PTC Schematic 1 105
3.22 ODC Detector Schematic 107
3.23 Central Muon Coverage 108
3.24 TPC End View 112
3.25 TPC Ripple 116

4.1 δ and A_2 Production 134
4.2 Radiative Bhabha Event 136

4.3 Acoplanarity Diagram 137
4.4 SHW—PTC event 138
4.5 SHW—PTC Acoplanarity 139
4.6 Radiative $\mu\mu$ event 141
4.7 Radiative $\mu\mu$ dE/dx 142
4.8 $\tau^+\tau^-$ W and C-M 144
4.9 MC particle Comparison 146
4.10 NaI—SHW Tag Distributions 147
4.11 dE/dx Theoretical curve 149
4.12 dE/dx Resolutions v. θ 151
4.13 Sample dE/dx 152
4.14 MU Chamber Efficiency 154
4.15 Fiducial cuts on NaI Hits 160
4.16 RNB3FE 163
4.17 North NaI P/E 166
4.18 North SHW P/E 167
4.19 North SHW P/E 168
4.20 Flat vs. Unit Structure 177
4.21 NS, Flat MC Multiplicity 181
4.22 NS, Flat MC TPC P,θ 187
4.23 NS, Flat MC Photons 188
4.24 NS, Flat MC Multiplicity 189
4.25 NS, Flat MC TPC P,θ 190
4.26 NS, Flat MC Photons 191
4.27 NS, Flat MC Kinematic Vars 192
4.28 NS, Flat MC Kinematic Vars 193
4.29 NP, Flat MC Multiplicity 194
4.30 NP, Flat MC TPC P,θ 195
4.31 NP, Flat MC Photons 196

4.32 NP, Flat MC Multiplicity 197
4.33 NP, Flat MC TPC P,θ 198
4.34 NP, Flat MC Photons 199
4.35 NP, Flat MC Kinematic Vars 200
4.36 NP, Flat MC Kinematic Vars 201
4.37 NS, QPM+VDM MC Multiplicity 202
4.38 NS, QPM+VDM MC TPC P,θ 203
4.39 NS, QPM+VDM MC Photons 204
4.40 NP, Flat MC Kinematic Vars 205
4.41 NS, QPM+VDM MC Linked 206

5.1 Ball-park Result 210
5.2 Resolutions of Kinematic Vars 1 211
5.3 Resolutions of Kinematic Vars 1 212
5.4 x Bias 213
5.5 B-splines 215
5.6 Unfolding Check 219
5.7 W_{corr} resolution estimate 224
5.8 W_{corr} to W_{true} scatter 225
5.9 NaI-SHW HF Result 227
5.10 NaI-SHW LF Result 228
5.11 NaI-SHW Combined Result 229
5.12 NaI-SHW Combined Result 230
5.13 NaI-SHW Combined Result 2 231
5.14 NaI-SHW Combined Result 232
5.15 W_{vis} unfolding 233
5.16 Prior Measurement 237
5.17 γ^* Hadronic Component 237
5.18 NaI-PTC Structure 239
5.19 NaI-PTC Structure 2 240