

## **A Measurement of the Virtual Photon Structure Function \***

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A MEASUREMENT OF THE VIRTUAL PHOTON  
STRUCTURE FUNCTION

A Dissertation Presented

by

RICHARD. J. BELCINSKI

Submitted to the Graduate School of the  
University of Massachusetts Amherst in Partial fulfillment  
of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 1994

Department of Physics and Astronomy

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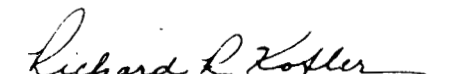
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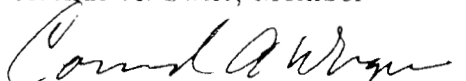
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## ABSTRACT

# A MEASUREMENT OF THE VIRTUAL PHOTON STRUCTURE FUNCTION

MAY 1994

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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  $1.5 \leq Q^2 \leq 5.5 \text{ GeV}^2$ ,  $0.1 \leq P^2 \leq 1.5 \text{ GeV}^2$  and  $2 \leq W \leq 20 \text{ GeV}$ . 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  $10 \leq Q^2 \leq 50 \text{ GeV}^2$ ,  $0.1 \leq P^2 \leq 1.5 \text{ GeV}^2$ , 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.

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