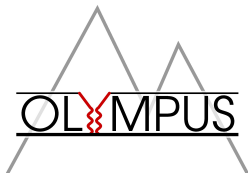


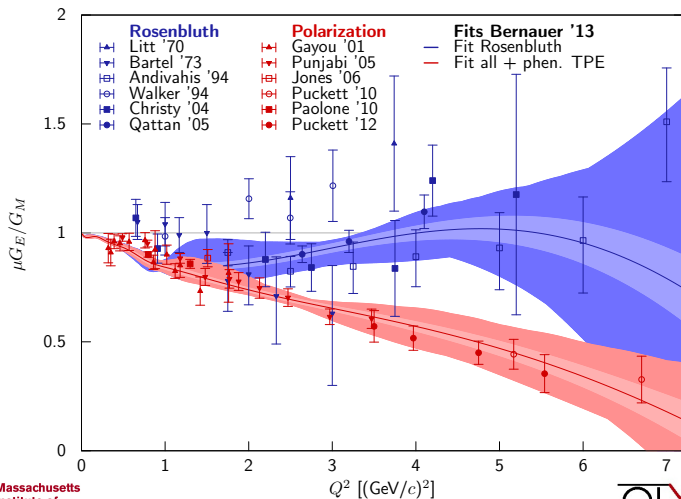
# RESULTS FROM THE OLYMPUS TWO-PHOTON EXCHANGE EXPERIMENT

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Colton O'Connor  
APS April Meeting  
January 28, 2017

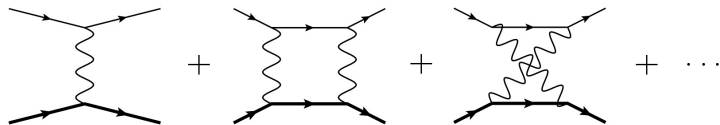
# MOTIVATION



# EXPLAINING THE DISCREPANCY

There is an effect that is suppressed in polarization transfer measurements but must be handled explicitly in Rosenbluth analyses.

Cross section calculations must extend beyond the Born approximation:



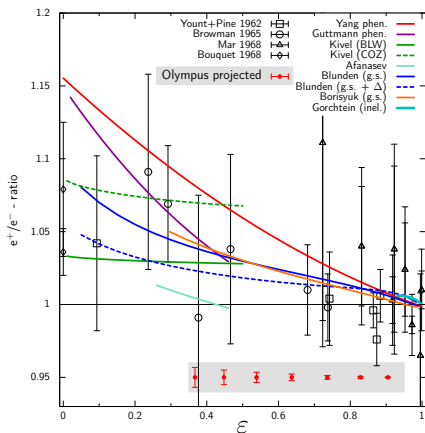
# PRINCIPLE OF MEASUREMENT

Next-to-leading order QED gives an interference term from two-photon exchange:

$$\sigma_{e\pm p} = |\mathcal{M}_{1\gamma}|^2 \pm 2\Re\{\mathcal{M}_{1\gamma}^\dagger \mathcal{M}_{2\gamma}\} + \dots$$

Experiments access this term through a ratio:

$$\frac{\sigma_{e^+p}}{\sigma_{e^-p}} \approx 1 + 4 \frac{\Re\{\mathcal{M}_{1\gamma}^\dagger \mathcal{M}_{2\gamma}\}}{|\mathcal{M}_{1\gamma}|^2}$$



**All together, 45 physicists and 10 graduate students**

Arizona State University, USA

Deutsches Elektronen-Synchrotron, Germany

Friedrich Wilhelms Universitt Bonn, Germany

Hampton University, USA

Instituto Nazionale di Fisica Nucleare Bari, Italy

Instituto Nazionale di Fisica Nucleare Ferrara, Italy

Instituto Nazionale di Fisica Nucleare Rome, Italy

Johannes Gutenberg Universitt Mainz, Germany

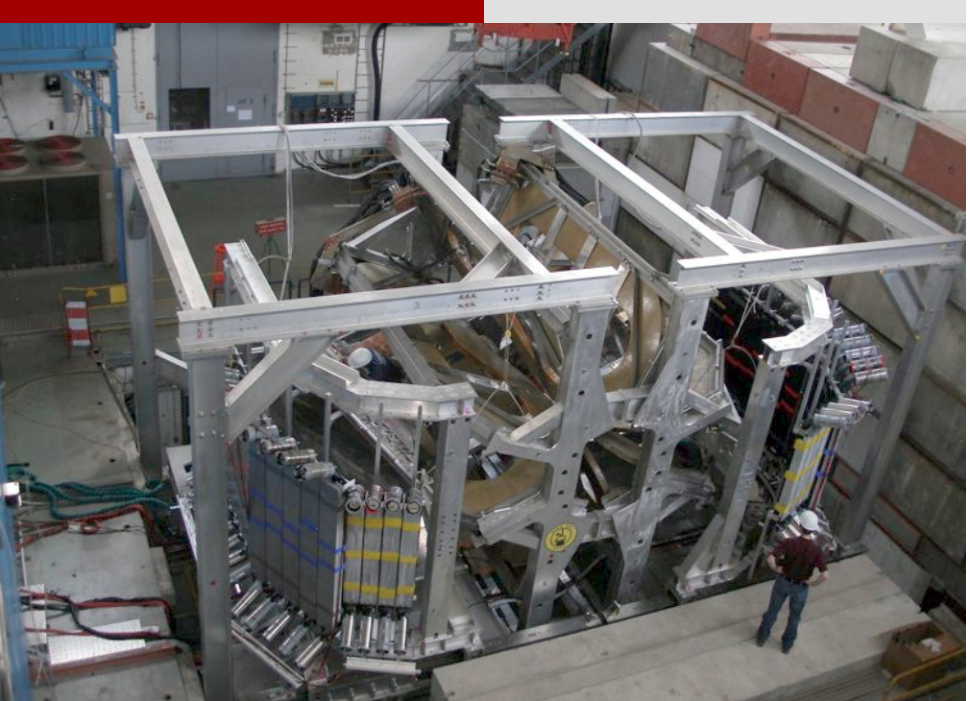
Massachusetts Institute of Technology, USA

Petersburg Nuclear Physics Institute, Russia

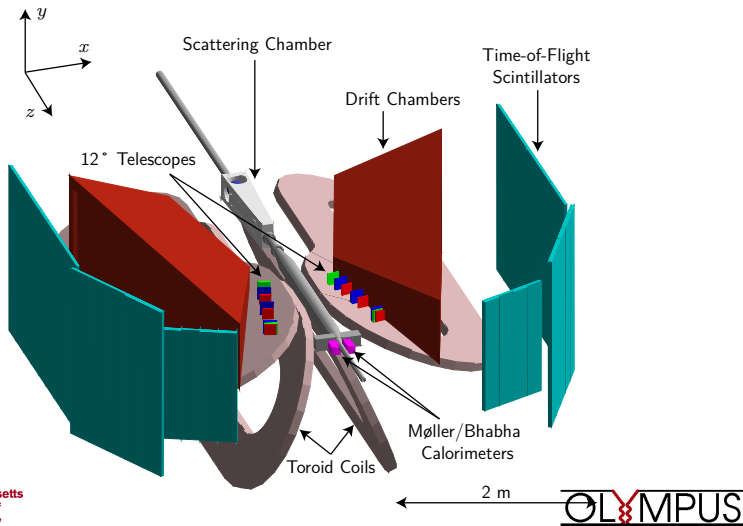
University of Glasgow, UK

University of New Hampshire, USA

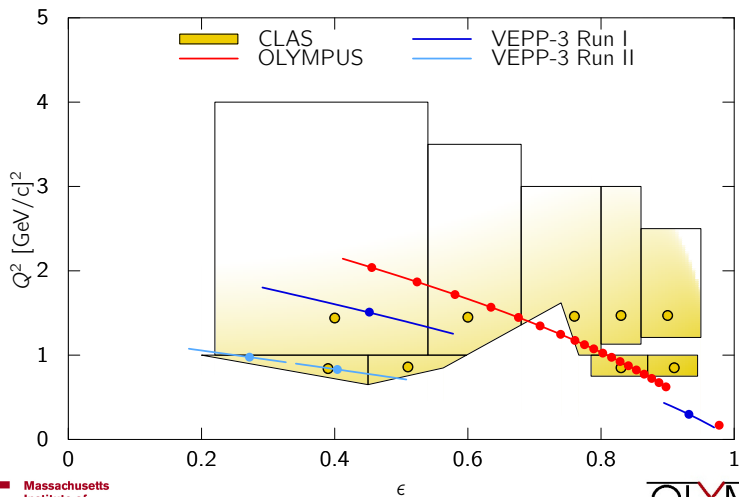
Yerevan Physics Institute, Armenia



# DETECTOR APPARATUS

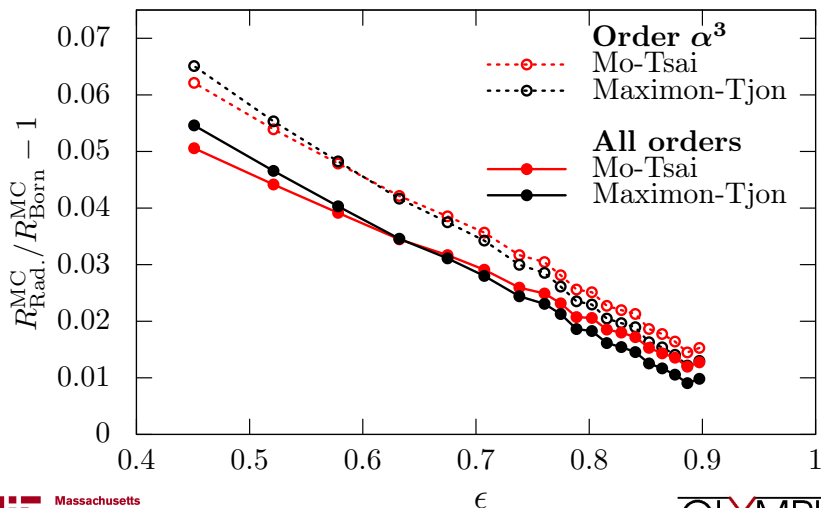


# EXPERIMENTAL REACH VS. PEERS

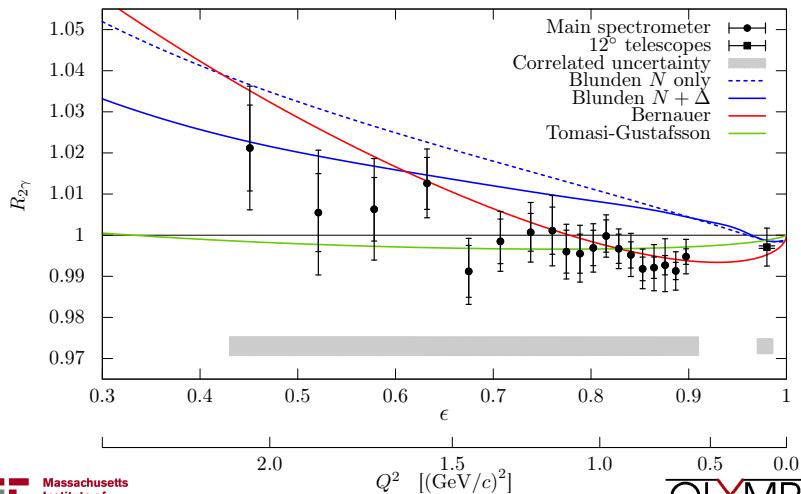




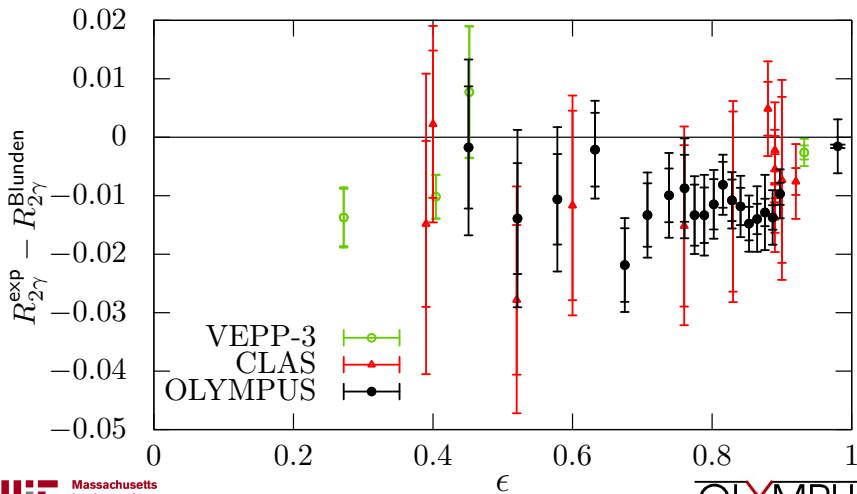
# RADIATIVE CORRECTIONS



# RESULTS



# “APPLES-TO-APPLES” COMPARISON



# CONCLUSIONS

Thank You!

OLYMPUS IS SUPPORTED BY FUNDING FROM...

*The United States Department of Energy*

# Backup Slides

# EXPERIMENTAL DATA

## OLYMPUS

arXiv:1611.04685 [nucl-ex]

Accepted for publication in *Phys. Rev. Lett.* (2017)

## VEPP-3 AT NOVOSIBIRSK

I.A. Rachek et al., *Phys. Rev. Lett.* 114, 062005 (2015)

## CLAS AT JLAB

D. Adikaram et al., *Phys. Rev. Lett.* 114, 062003 (2015)

# THEORETICAL AND PHENOMENOLOGICAL CURVES

## BERNAUER

J. C. Bernauer et al. (A1), Phys. Rev. C90, 015206 (2014)

## BLUNDEN

P. Blunden, Private communication. (2016)

## TOMASI-GUSTAFSSON

Kuraev et al., Phys. Rev. C 78, 015205 (2008)