



Report on
E12-07-108: (GMp)
Precision Measurement of the
Proton Elastic Cross Section
at High Q^2

Vincent Sulkosky
Massachusetts Institute of Technology

Hall A Weekly Meeting
September 25th, 2012



Hall A Projected Experiment Schedule (8/2012)

	February - May	August - December	February - June	August - December	February - June	September - December
2014	GMp / DVCS - I (APEX)	GMp / DVCS - I				
2015			$^3\text{H}/^3\text{He}$ (A_1^n)	PREX (APEX)		
2016					A_1^n (SBS) (DVCS-II) (APEX)	SBS (A_1^n) (DVCS-II) (APEX)

Experiments in parentheses represent potential schedule changes

SBS



MOLLER,
SOLID...?....

Slide from C. Keppel



GMP Collaboration Meeting

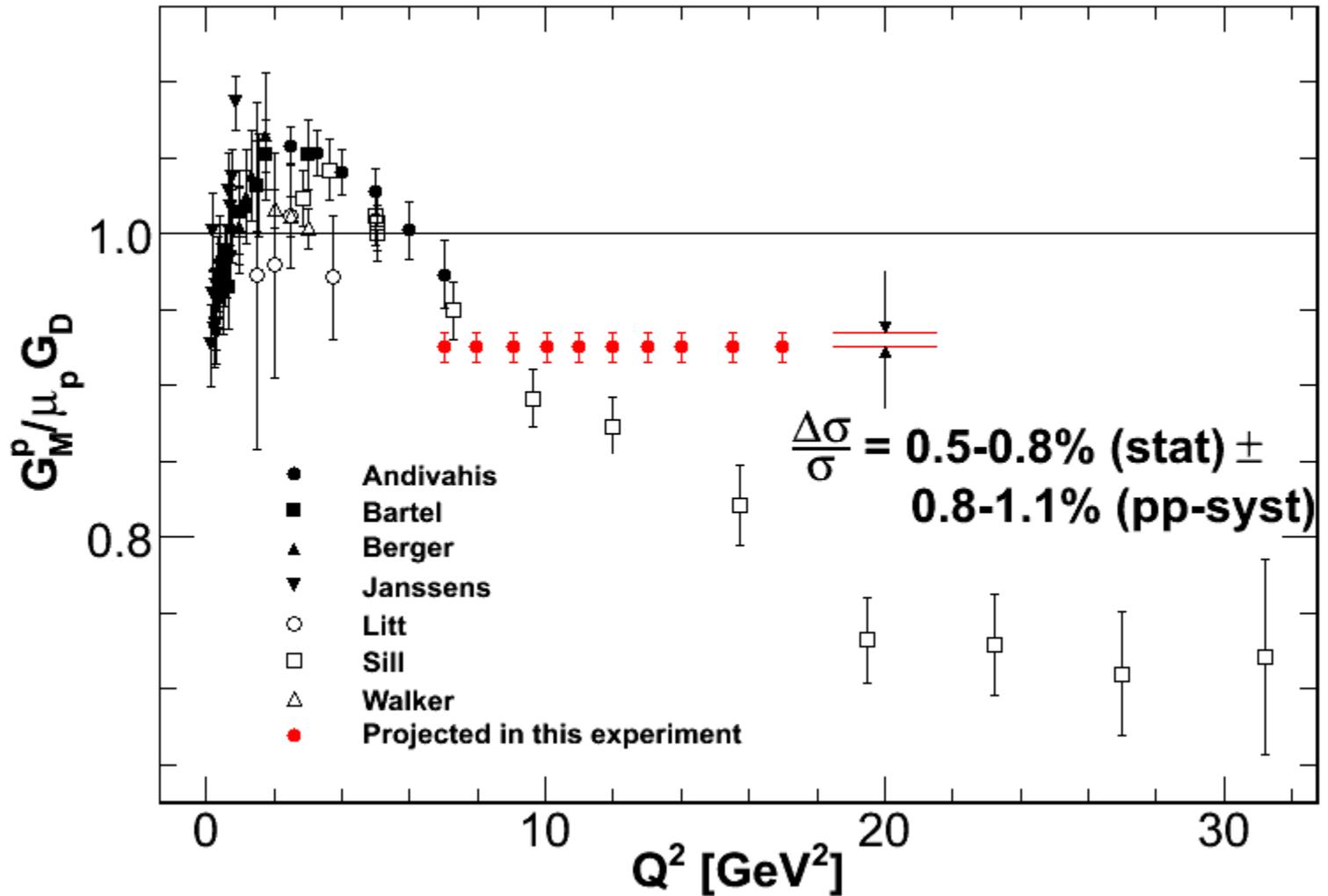
- Expected beam delivery in early 2014
- Collaboration meeting held on Sept. 24
- Details on the agenda and talks at

https://hallaweb.jlab.org/wiki/index.php/GMp_collab_meeting_Sept_2012

Goals of GMp

- Accurately measure e-p elastic cross section in kinematics similar to other JLab form factor measurements
- Improve accuracy of the cross section by as much as a factor of 4 (**< 2%**) over previous measurements
- Provide measurement of power scaling for GMp in the range $Q^2 = 7-14 \text{ GeV}^2$
- Approved for **24 PAC days**

Expected Precision



GMP Systematics

Source	$\Delta\sigma/\sigma$ (%)
Point to point uncertainties	
Incident Energy	<0.3
Scattering Angle	0.1–0.3
Incident Beam Angle	0.1–0.2
Radiative Corrections*	0.3
Beam Charge	0.3
Target Density Fluctuations	0.2
Spectrometer Acceptance	0.4–0.8
Endcap Subtraction	0.1
Detector efficiencies and dead time	0.3
<i>Sum in quadrature</i>	<i>0.8–1.1</i>
Normalization uncertainties	
Beam Charge	0.4
Target Thickness/Density	0.5
Radiative Corrections*	0.4
Spectrometer Acceptance	0.6–1.0
Endcap Subtraction	0.1
Detector efficiencies and dead time	0.4
<i>Sum in quadrature</i>	<i>1.0–1.3</i>
<i>Statistics</i>	<i>0.5–0.8</i>
Total (Scale+Rand.+Stat.)	1.2–1.7

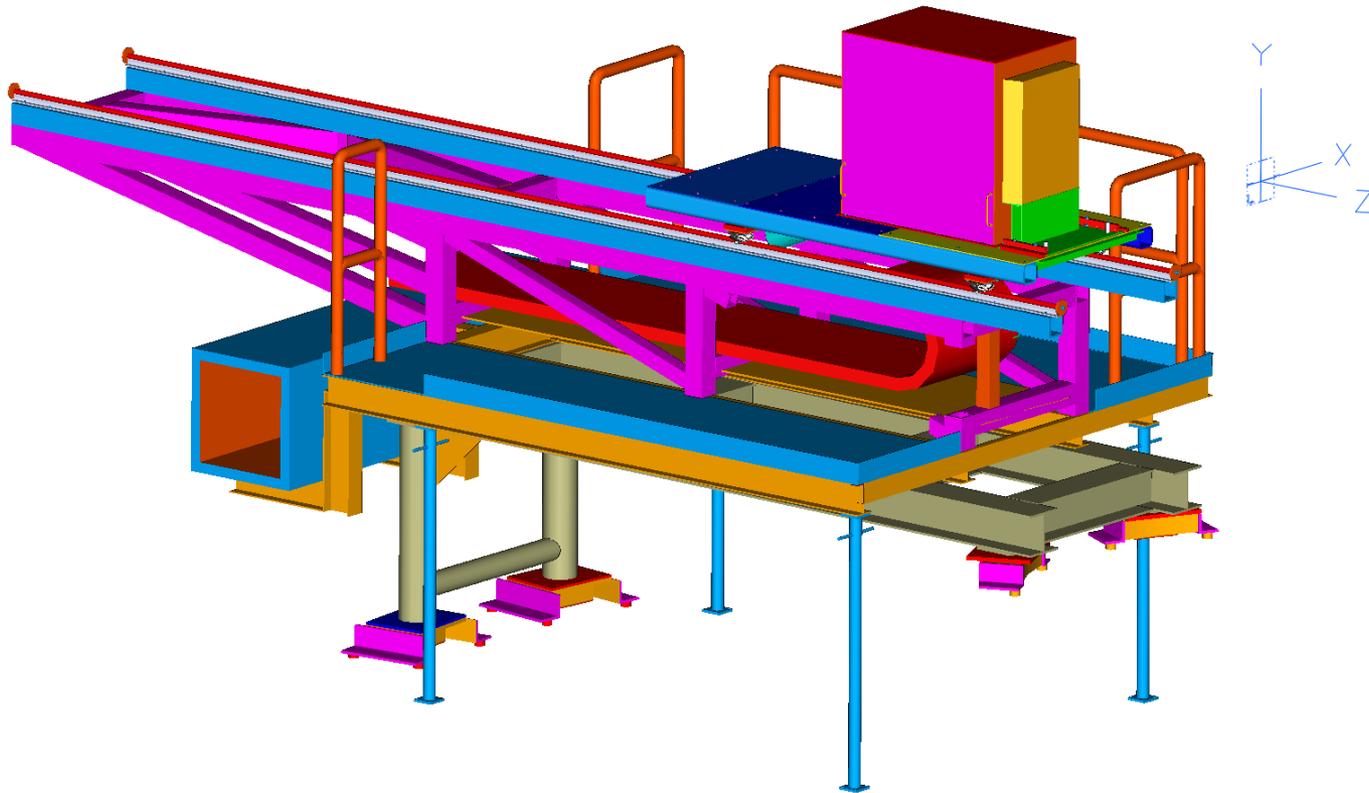
Three models:

Slide from C. Hyde

- Independence
 - GMP installs and runs first ~1 PAC month
 - Full operation of both HRS for GMP, no Luminosity limits from DVCS
 - **One month shutdown for DVCS installation**
 - DVCS runs ~3 PAC months
 - **No modification to scattering chamber needed**
- Cooperation
 - GMP and DVCS install together (except DVCS Calo.)
 - **GMP runs independently**
 - Restrictions on HRS angles from vacuum chamber and DVCS stand
 - Restrictions on HRS movement from DVCS cables and stand,
 - HRS movement needs manual assistance
 - **One week shutdown to install DVCS Calo.**
 - DVCS runs ~3 PAC months
 - **GMP acquires parasitic data in HRS-R at large angles.**
- Symbiosis
 - GMP and DVCS fully install together
 - GMP and DVCS running is interlaced (circa weekly)
 - Maximum luminosity is $25\mu\text{A} \times 15\text{ cm LH}_2$ (radiation limit for DVCS Calo.)
 - Beam in Compton Chicane
 - Restrictions on HRS angles and movement
 - **GMP acquires “unlimited” parasitic data in wide angle HRS-R**
 - Luminosity is correlated with beam energy: 10^{37} @ 6.6 GeV, of $10 \cdot 10^{37}$ @ 11 GeV
 - **GMP angles < 40° only accessible with HRS-L**
 - DVCS Calo parked in “safe mode” at 5.5 m from target at 15°

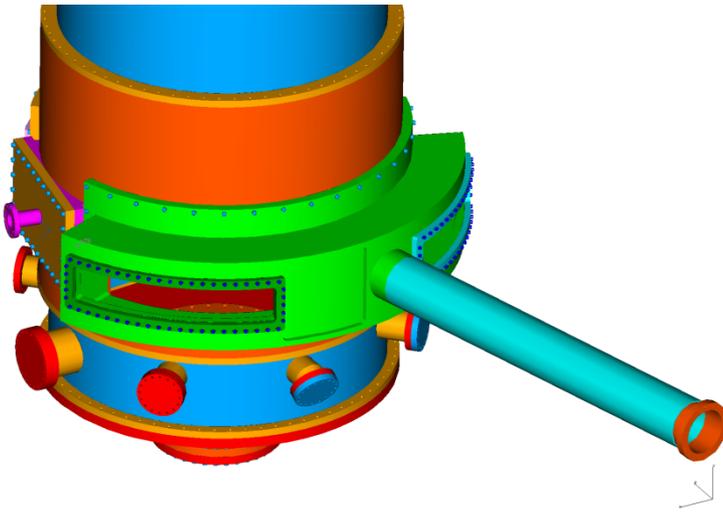


Modifications to Calorimeter Support

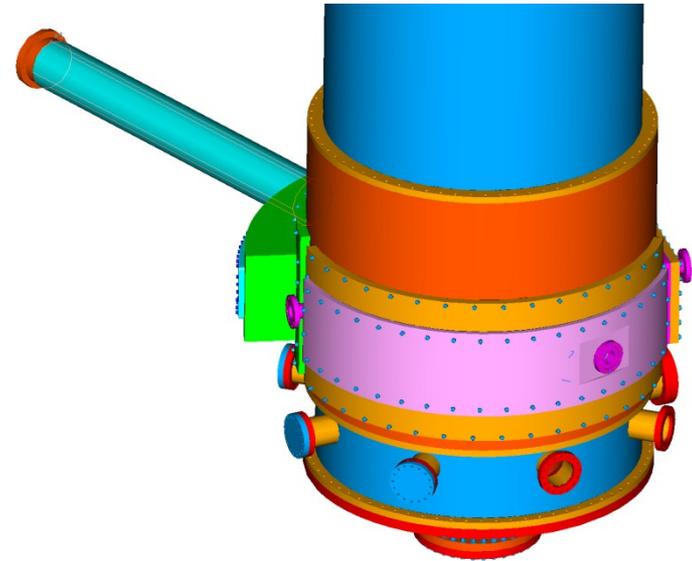


Slide from A. Gavalya

Modifications to Scattering Chamber



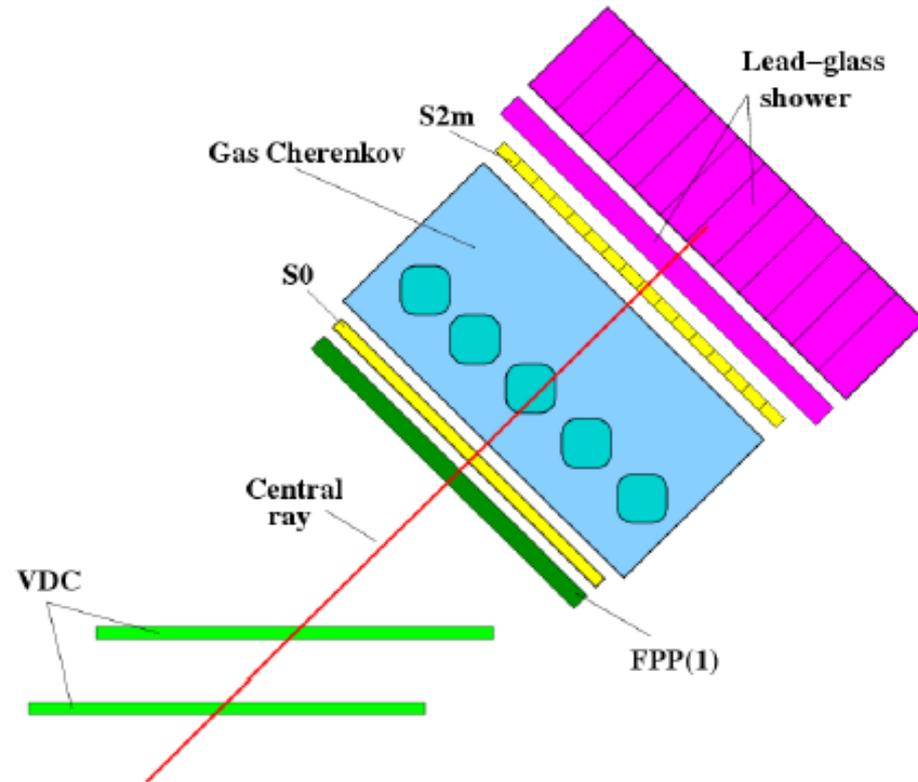
Down Stream Modification



Up Stream Modification

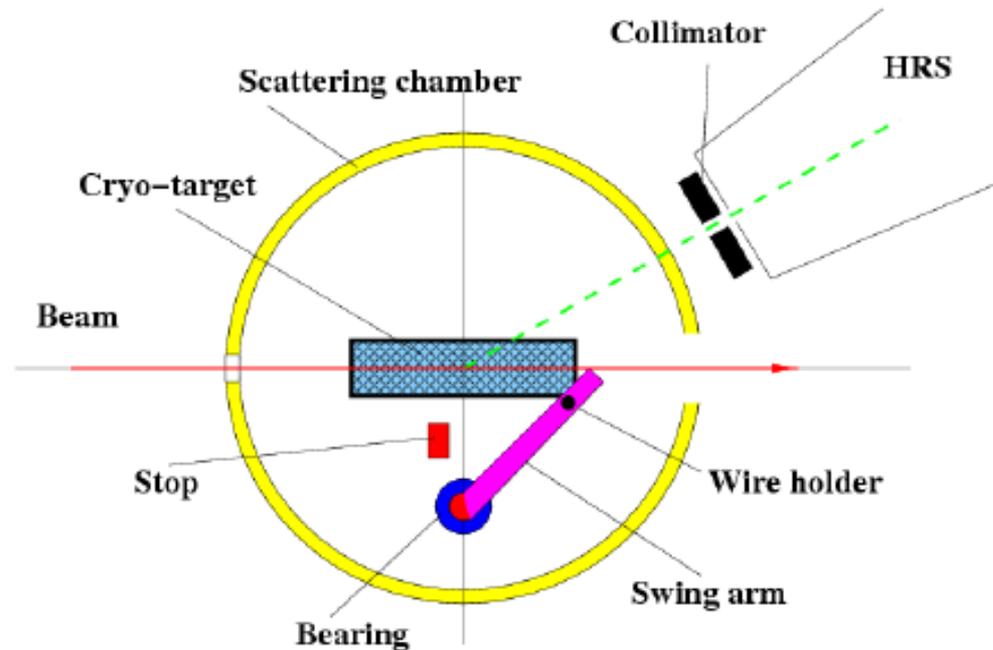
Slide from A. Gavalya

HRS Detector Stacks



Use standard detectors including one plane of FPP for additional tracking

HRS Optics and Angle



Wire target on swing arm, reproducibility of 100 microns sufficient, 20 microns is likely achievable

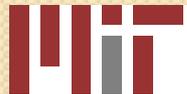
Tasks & (Un)known Commitments

Tasks	Commitments
Scattering chamber design	JLAB – Al Gavalya
Swing wire target for HRS	Hall A – 2-3(?) months of JLAB designer
HRS preparations – VDC, FPP(?)	Hall A – 1.5 FTE
Trigger and analysis software	JLAB – Alex, Ole
LH ₂ Target	JLAB – Dave Meekins, JP
Beam line	Hall A – Doug, Bob
Refurbish Gas Č counter (replace mirrors, PMTs)	
Modify trigger to include S2•S0•GČC	Hall A - Alex?
Commissioning Run Plan	HU - Eric



Tasks & Commitments (cont.)

Tasks	Commitments
Simulations for absolute x-sections (tracking, acceptances, optics, background)	
Sieve-slit and collimators	
Shifts (long run!)	
Data analysis	



Summary

- Collaboration meeting was just an initial step in preparation for running GMp and DVCS
- Organization of collaboration in progress:
 - Will begin monthly meetings soon
 - Create web page/wiki and mailing list
- The DVCS luminosity \times HRS-R solid angle (**1/8 of GMp proposal**) and restricted angle range of HRS-R still allows for some parallel running of GMp during DVCS data taking
- Collaborators are welcome to participate; much work is required before 2014