JLab experiment E12-09-016

Measurement of the Neutron Electromagnetic Form Factor Ratio GEn/GMn at High Q^2

Preparation and SBS GEn run plan

Edited by T. Averett, G. Cates, and B. Wojtsekhowski, September 21, 2022

The second SBS run is focused on GEn. The GEn experiment aims to measure the electric form factor of the neutron at large momentum transfer from 2.9 up to 9.7 $(\mathrm{GeV/c})^2$ with relative precision of 10-20% or better.

This writeup provides a list of considerations for the experiment preparation and data taking for:

- The beam line
- The He-3 target system
- HV controls
- AC power for the BigBite and SBS electronics
- Plans for the moves during beam time
- DAQ electronics and software
- Data analysis software
- DC power for the all magnets
- Signal and HV cable lines
- Gas supply and gas lines
- The HCal detector
- GEM chambers of BigBite
- The alarm control display
- BigBite instrumentation
- Safety documentation
- The experiment web page
- Experiment shifts and RCs

1 Manpower

The contact persons for the subsystems of the project are:

- Physics Division Liaison - S. Malace
- Hall A beam line - S. Malace & I. Skorodumina
- The He-3 target - G. Cates, A. Tadepalli, T. Averett
- The BB, SBS and beam line equipment - J. Butler
- The Moller polarimeter - D. Jones
- The DAQ bunkers - J. Segal
- The LeCroy HV crates controls - S. Wood & R. Michaels.
- The DAQ electronics and readout software - A. Camsonne & M. Jones
- The data analysis software - A. Puckett
- DC power for the spectrometers and SBS corrector magnets - J. Segal
- Gas supply for the GEM chambers and GRINCH - J. Segal
- HCAL detector - J. Poudel
- BigBite DAQ and calorimeter analysis - M. Jones
- BigBite GEM chambers - N. Liyanage & H. Szumila-Vance
- BigBite shower/preshower hardware&front-end - A. Tadepalli
- BigBite hodoscope - R. Montgomery
- BigBite Gas Cherenkov - T. Averett
- SBS GEM chambers - E. Cisbani & N. Liyanage
- SBS run group-2 polarized target safety - J.P. Chen
- SBS web page and shifts schedule - W. Tireman
- GEn run coordinators - D. Jones

There are a number of groups contributing in this project:

- Hall A/C technical and engineering groups

- Hall A/C spectrometer support group
- Hall A/C physics staff
- SBS collaboration and Hall A users
- GEn and WAPP-ALL spokespeople
- He-3 target experts
- Moller polarimeter experts

2 Preparation list

The beam line components - S. Malace The following beam line items (including software) will be used in this experiment:

1. Beam position monitors
2. Beam charge monitors (the Unser monitor and BCMs)
3. Helicity gated BCM readout (with P. King)
4. HARPs (with I. Skorodumina)
5. Beam steering magnets (with I. Skorodumina)
6. Beam rastering magnets

The He-3 target - G. Cates The team includes T. Averett, JP. Chen, A. Tadepalli. The target is located inside the double-wall magnetic box and will have the following items:

1. A He-3 filled polarized cell (20 mm diameter, 60 cm long)
2. A reference cell which will be filled with H_2 or N_2 during the run.
3. A carbon foil (0.125 mm) for optics (located in the middle).
4. Two foils with holes for beam position check
5. Eight carbon foils (0.125 mm) for optics (in 7.5 cm spacing along the beam).
6. A path for beam through open space.

Magnetic field - A. Tadepalli

1. Power supply for H coils and additional adjustment coils
2. Magnetic field measurement equipment (with V. Nelyubin and B. Wojtsekhowski)

Laser power - J.P. Chen

1. Laser in laser room and fiber system
2. Optics system at the target
3. Laser wave length control
4. Laser power monitor

Target motion and heaters - E. Becker & A. Tadepalli

1. Target lifter mechanism
2. Target high temperature oven
3. Target temperature monitors
4. Heater for gas convection
5. Cell window cooling jets

Møller polarimeter - Donald Jones The team includes E. King and F. Chahili. The dry run need to be completed before 9/21 (test of all components including readout and analysis). The Moller polarimeter measurement is needed for each of three kinematics in GEn. A nominal 3% or better precision on the measured beam polarization is assumed. We also assume that the full Møller measurement can be completed in one 8-hour shift with the necessary precision. Complete checkout of the Moller hardware and DAQ need to be performed before beam delivery.

The HV controls - S. Wood & Bob Michaels The experiment will use LeCroy and CAEN HV power supply:

1. HCAL - LeCroy, two crates, negative 1461N
2. BigBite Shower - LeCroy, two crates, 27 modules, negative 1461N
3. BigBite GEMs. The configuration includes four UV-type, and one large UVa GEMs
4. SBS GEMs. The configuration includes two XY INFN GEMs and five XY UVa GEMs

5. BigBite Timing Hodoscope - CEAN HV crate
6. BigBite gas Cherenkov - GRINCH LeCroy, four modules, positive 1461P

AC power for SBS electronics - Jack Segal There will be several locations which require AC power:

1. The main bunker with BigBite, HCAL relay racks, total 75 kW
2. The HCAL mezzanine, 10 kW
3. The HCAL DAQ in main bunker, 10 kW
4. The SBS GEM bunker, 10 kW
5. The BigBite front-end, 10 kW
6. The BigBite DAQ (weldment) in the main bunker, 10 kW
7. The BigBite GEM bunker, 10 kW

Plan for the equipment moves prior to the beam time - Jessie Butler There are a number of big items to move. A time line and space allocation in Hall A are needed.

1. The SBS spectrometer per GEn run plan
2. The BigBite spectrometer per GEn run plan
3. The He-3 target
4. The beam line magnetic shielding for configuration 2 in four locations of BB and three for SBS

The DAQ electronics and software - A. Camsonne & M. Jones & R. Michaels The DAQ needs several powerful computers, very fast internet links, and a large number of CPUs in VME. Specifically:

1. VME DAQ computers: ??
2. CPU: ??
3. Internet system: ??

The DAQ components will be located in three shielded bunkers:

1. The main DAQ bunker is located on the left side of Hall A in the large angle area. This bunker will be used for most of the DAQ electronics and all HV supplies.

2. The small bunker near BigBite (on the large angle side) will be used for the VME based GEM readout.
3. The midsize bunker on the large angle side of SBS for the VME based GEM readout of a large tracker system.

The DAQ software needs to be developed and ready for readout for the following detectors:

1. The BigBite Shower, Hodoscope, GEM, GRINCH
2. The SBS HCAL
3. The SBS GEM

The data analysis software - A. Puckett Team includes R. Dotel. The analysis of BigBite momentum will use the tracker and energy/PID using the shower and HCAL. The software should also allow us to do the following:

1. On-line displays for coincidence data
2. Track-finding in BigBite.
3. Track momentum determination.
4. Optics of BigBite calibration.
5. Projecting q-vector to HCal (for neutron and proton).
6. BigBite Shower calibration, and HV settings optimization.
7. HCal cluster-finding with fADC and timing information.

The analysis of the proton energy and coordinates in HCAL includes the following:

1. HCAL cluster selection.
2. Amplitudes - energy coefficients using elastic protons.
3. Input for HV settings optimization.

WAPP-ALL will need a specialized track reconstruction for pion-proton events.

DC power for the spectrometer magnets - Jack Segal The SBS magnet considerations are:

1. A 2.2 kA power supply with a remotely controllable polarity switch.
2. Some of the flat coils will not be connected for the GEn run.
3. Four power supply units for two dipole correctors with remote polarity flip.

The BigBite magnet considerations are:

1. A 0.75 kA power supply.
2. Central ray angle survey and calibration of all positions in advance
3. Magnet and detector angles measurement by collaboration (in addition).
4. Fast disconnection of all detectors prior to HCAL efficiency calibration.
5. Multiple changes of the spectrometer angle and distance from the target.

There will be multiple lines for HV and signals cables between front-end and the DAQ bunker.

1. Cable trays and movable carts
2. 13 multi wire HV cables (75-meters 0.5" diameter) and 4 RG59 HV lines to HCAL.
3. 600 100-meter long RG58 signal lines between HCAL and DAQ.
4. A fast and short cable line for the trigger signal from HCAL.
5. 243 RG59 HV lines to the BigBite shower.
6. 4 multi (48 each) wire HV cables for BigBite timing hodoscope.
7. 4 multi (24 each) wire HV cables for BigBite Cherenkov counter.
8. 16 RG59 HV lines for GEM chambers.

There will be multiple ethernet lines from the main bunker to BigBite and HCAL

1. 23 optical fibers for GEM MPDs to the front-end bunkers

Gas supply for GEM chambers - Jack Segal The system of gas mixing and distribution is under design/construction by DSG. The team includes Marc McMullen and H. Szumila-Vance There will also be a large number of long 0.25" diameter gas lines for the GEM chambers:

1. To the BigBite a total of 16 pipes.
2. To the SBS a total of 46 pipes.

HCAL detector - Jiwan Poudel The team includes S. Seeds and R. Dotel. The HCAL considerations are:

1. The 288-channel detector includes four segments stacked one above another.
2. For the cosmic trigger, two scintillator counters will be placed above the HCAL.
3. Clean air flow will be provided to each HV base to push out the He contamination.
4. The detector mounted on the platform which can be moved within the steel floor area.
5. The front-end electronics located in three relay racks on the mezzanine behind HCAL.
6. The LED pulser system will be used for a fast check of the detector operation. Slow control of LED was developed by CMU group.
7. The DAQ electronics and HV supply are located in the DAQ bunker.
8. The HV and signal lines will be in movable cable tray carts.

Shower detector of BigBite - A. Tadepalli The team includes P. Datta. The shower considerations are:

1. The 244 channel lead-glass calorimeter
2. Shower electronics in the front-end relay racks
3. The HV crates in DAQ weldment
4. Two sets of long cables for the signals and HV.
5. The two-layer detector provides a trigger signal to DAQ and off-line PID.
6. The shower center location serves as a key element of the track search.
7. Calibration of the blocks will start with cosmic rays and will be finalized with elastic electron scattering from a proton with the recoil proton detected in HCAL.

Timing hodoscope detector of BigBite - R. Montgomery The team includes R. Marinaro. The hodoscope considerations are:

1. The highly segmented hodoscope provides a precision timing for the TOF measurement
2. The 2x2x60 cm paddles are viewed by two PMTs
3. The front-end NINO cards with low threshold of 2 mV
4. The level translators are between front-end and DAQ
5. The VME based TDC with 50?? ps time resolution

GRINCH detector of BigBite - T. Averett The team member is C. Gayoso and M. Satnik.

The gas Cherenkov counter considerations are:

1. The 510 PMT array
2. The HV distribution and cabling to LeCroy supply located in BigBite DAQ weldment
3. The front-end NINO cards with LV power
4. The level translators are between front-end and DAQ
5. The VME based electronics for the signal time measurement
6. The VME based ADC for PMT gain measurement.

The GEM chambers of BigBite - H. Szumila-Vance and N. Liyanage The team includes Xinzhan Bai, A. Rathnayake and S. Jeffas.

The UVa GEM considerations are:

1. The U/V strip orientation in a single module of 40 cm by 150 cm
2. A large UVa chamber of four modules (each 60 cm by 50 cm)
3. The gas distribution for all GEM chambers of BigBite
4. The VME readout for all GEM chambers

The GEM chambers of SBS - H. Szumila-Vance and N. Liyanage The team includes Xinzhan Bai, A. Rathnayake, E. Wertz, J. Boyd

The GEM considerations are:

1. Two INFN chambers with X/Y strip orientation in the three modules each of 40 cm by 50 cm
2. A large UVa chamber of four modules (each 60 cm by 50 cm)
3. The gas distribution for all GEM chambers of SBS
4. The VME readout for all GEM chambers

Electronics and DAQ software of BigBite - Mark Jones and Alex Camsonne The team includes J. Poudel.

1. The DAQ weldment with VME and DAQ computers
2. Software for readout of all detectors and on-line analysis
3. Software for Shower, GRINCH, Hodoscope, GEMs
4. Calibration of the detector package on cosmic rays
5. Calibration of the spectrometer tracking and optics
6. Coincidence event displays

BigBite spectrometer - Mark Jones and B. Wojtsekhowski The team includes the following persons:

A. Tadepalli (for the Shower array), T. Averett & C. Gayoso (for the Gas Cherenkov counter), R. Montgomery (for the Timing hodoscope), N. Liyanage & H. Szumila-Vance (for the GEM chambers), and A. Puckett (for DAQ analysis software).

The BigBite considerations are:

1. BigBite dipole magnet (max current is 700 A).
2. BigBite sieve slit for optics calibration.
3. The 243-block two-layer shower calorimeter.
4. Five planes of the GEM chambers.
5. The 510-channel gas Cherenkov counter.
6. A relay rack for a set of LVDS-to-ECL convertors located 80 feet from the detector.

7. Front end electronics located at the detector and two relay racks.

8. The DAQ weldment located in the main DAQ bunker.

9. The GEM electronics in the local shielded bunker.

3 Run Plan

3.1 Pre-beam commissioning - B. Wojtsekhowski

The team includes the contact person subsystems.

For timely realization of the run plan, every item of the experiment (presented in this document) needs to be planned, fully tested and calibrated with pulsers and cosmic rays. The results of the tests need to be shown using the event displays and scaler display. The experiment will have daily RC (or PIs) meetings starting one week prior to beam start.

Run coordination proper will start Wednesday Sept 21 five days before scheduled hall lock down on Sept 26. There will be a regular daily meeting as deemed necessary beginning on the 21st. Calendar links to the meeting agendas are on the wiki `https://sbs.jlab.org/wiki/index.php/Daily_Meetings#RC_Meetings`. Meeting connection information is provided below.
Time: Daily at 3:00pm
Location: Counting house conference room and virtual

Join ZoomGov Meeting
`https://jlab-org.zoomgov.com/j/1619032184?pwd=aWhTVWxya1ZZQzA1K2ZPSTd2ZXZ2QT09`
Meeting ID: 161 903 2184
Passcode: 260715
Dial by your location +1 669 254 5252 US (San Jose)
+1 646 828 7666 US (New York)
+1 551 285 1373 US
+1 669 216 1590 US (San Jose)
833 568 8864 US Toll-free
Find your local number: https://jlab-org.zoomgov.com/u/acj3pTicMx

3.2 Time table of the run

The contact person is B. Wojtsekhowski. The table 1 below provides a summary of the time allocation detailed in specialized sections. Total time is 135 days (including the beam tune and reconfigurations) which accounts for 0.5 efficiency and available beam current and beam polarization value.

step #	task	Q^2 GeV^2	θ_{BB} / θ_{SBS} degrees	SBS field	Time hours	Work time
1a see table 2	beam line		47.5 / 34.7	as needed	24=3x8	
1b see table 3	BigBite	1.7	47.5 / 34.7	100%	24=3x8	
1c see table 4	HCAL	1.7	47.5 / 34.7	0-100%	24=3x8	
1d see table 5	H(e,e'p)	1.7	47.5 / 34.7	0-100%	172	
1e per Moller plan	Moller test	-	47.5 / 34.7	0	8	
2a energy change to 4.2 GeV	beam			100%	16	
2b move BB only	spectr-s		29.5 / 34.7	100%	8	8
2c see table 6	production	2.9	29.5 / 34.7	100%	192+12	
3a energy change to 6.3 GeV	beam			100%	16	
3b move BB&SBS&HCAL	spectr-s		35.9 / 22.1	100%	32	16
3c see table 7	production	6.6	35.9 / 22.1	100%	720	
4a energy change to 8.4 GeV	beam			100%	16	
4b move BB&SBS&HCAL	spectr-s		35.0 / 18.0	100%	32	16
4b see table 8	production	9.7	35.0 / 18.0	100%	1944	
Beam in Hall					3168	
					132 days	
Re-configuration					72	
					3 days	
Total					3240	
					135 days	

Table 1: The time table of the GEn run.

3.3 Commissioning of the beam line

The contact person is S. Malace. The dry run need to be completed before 9/21 (test of all components including readout and analysis). The total allocated time for this work is 24 hours in three 8 hour periods. We will do the following:

- With BigBite and all SBS magnets currents set to zero, deliver a pulsed beam to the beam dump.
- Obtain BPM information and perform HARP scans for BPM calibration.
- Test rastered beam operation and test BPM readout with CODA.
- Send CW beam and increase the current to 60 μA.
- In the pulsed beam mode, check impact of the BigBite magnet current (700 A) on the beam position at the dump.
- In the pulsed beam mode, ramp up SBS correctors with SBS current increased up to 2100 A.
- Send CW beam, increase the current to 60 μA and calibrate ion-chamber readings.
- Put the ladder to C-holes position and perform a scan of beam position in X and Y (with the raster OFF) using the BB trigger with lowest threshold. Use the BB rate on a scaler with EPIC. Adjust vertical target position if needed to have it centered in the Carbon target hole. Set the raster ON (2 mm diameter), collect the data - rate vs. x/y in new SPOT++. Repeat with raster ON (6 mm diameter) - observe the hole and the ring in SPOT++.

item		Beam	Target	Beam	Time	BB angl/dist.	SBS angl/dist.	BB/SBS	HCAL
#		GeV		μA	hour	deg. / meter	deg. / meter	Currents	dist. m
1		2.1	empty, C-hole	1-60	8	47.5 / 1.63	34.7 / 2.80	as needed	17
2		2.1	empty, C-hole	1-60	8	47.5 / 1.63	34.7 / 2.80	as needed	17
3		2.1	empty, C-hole	1-60	8	47.5 / 1.63	34.7 / 2.80	700/2100	17

Table 2: The beam time and other parameters of the beam line commissioning. Total allocated time is of 24 hours.

3.4 Commissioning of the BigBite

The contact persons are B. Wojtsekhowski & Mark Jones. The dry run need to be completed before 9/21 (test of all components including readout and analysis). The total allocated time is of 24 hours in three intervals each of 8 hours. The following is the plan:

- Magnet positions as for 1.7 GeV^2 kinematics (47.5 deg, 1.63 m from the pivot), see 1a in table 1.
- Beam is 2.1 GeV (one-pass), current is 1 μA.
- Target at a single C foil (located just below He-3 cell).
- BigBite magnet current set 700 A.
- HV is ON for all detectors per cosmic calibration and GMn results.
- Measure the shower detector trigger rate. Expected of 3-10 Hz.
- Increase beam current to 60 μA for 1000 Hz trigger rate from electrons.
- Collected data with the Shower signals as a trigger.
- Collect data with GEM information for parallel studies.
- Use event display for raw data with large shower signal.
- Replay GEM data for track search correlated to the shower cluster.
- Plot shower/pre-shower correlation, select electrons.
- Calculate momentum for selected electrons.
- Calculate shower blocks coefficients and HV corrections.
- Repeat shower study and equalize coefficients with optimum HV set.
- Collect 1M events GEM calibration.
- Find GEM efficiency and coordinate resolution for all planes vs. coordinates.
- Set the SBS magnet at 100% (2100 A).
- Collect 1M events. Find coincidence quasi-elastic events.
- Calculate change of BigBite Shower PMTs gain change.
- Put the target at a multi foil position (below the foils with the hole).
- Collect 1M events for optics analysis. Expected rate is 5000 Hz.

- Insert a sieve slit, collect 1M events in BB.
- Put the target at a reference cell filled with H2 at 10 atm. The target has 30 mg/cm^2.
- Remove the sieve slit. Prepare DAQ with coincidence trigger.
- Collect 1M events. Expected rate is 500 Hz.
- GRINCH data analysis in parallel, HV tune, data display, PID vs Shower.

item		Beam	Target	Beam	Time	BB angl/dist.	SBS angl/dist.	BB/SBS	HCAL
#		GeV		μA	hour	deg. / meter	deg. / meter	Currents	dist. m
1		2.1	C-foils, ref. cell	1-60	8	47.5 / 1.63	34.7 / 2.80	as needed	17
2		2.1	C-foils, ref. cell	1-60	8	47.5 / 1.63	34.7 / 2.80	as needed	17
3		2.1	C-foils, ref. cell	1-60	8	47.5 / 1.63	34.7 / 2.80	700/2100	17

Table 3: The beam time and other parameters of the BB commissioning. Total allocated time is of 24 hours.

3.5 Commissioning of the SBS-HCAL

The contact person is Jiwan Poudel. The dry run need to be completed before 9/21 (test of all components including readout and analysis). The total allocated time is three intervals each of 8 hours.

The following is a plan:

- SBS magnet current set to zero.
- BigBite sieve slit is removed.
- Target is reference cell filled with hydrogen.
- HCAL at 17 m from the target.
- DAQ trigger is the BigBite shower.
- HCAL HV is ON per cosmic calibration.
- Increase the beam current to get 500 Hz BigBite trigger rate.
- Collect 10M events for HCAL study.
- Use event display to see correlated electron-proton.

- Apply angular correlation to observe and select clean elastic events.
- Calculate HCAL blocks gain coefficients, find corrections for HV.
- Repeat HCAL study with optimum HV set to the level of 5% or better.
- Set the SBS magnet at 2100 A.
- Readjust BigBite Shower HV setting using clean e-p events.
- Collect 1M events for proton deflection with SBS magnet OFF and ON.
- Calculate elastic proton deflection angles in a grid over SBS acceptance.
- Collect 1M “e-p” events with coincidence BigBite+SBS trigger.

item #		Beam GeV	Target	Beam μA	Time hour	BB angl/dist. deg. / meter	SBS angl/dist. deg. / meter	BB/SBS Currents	HCAL dist. m
1		2.1	reference cell	1-60	8	47.5 / 1.63	34.7 / 2.80	as needed	17
2		2.1	reference cell	1-60	8	47.5 / 1.63	34.7 / 2.80	as needed	17
3		2.1	reference cell	1-60	8	47.5 / 1.63	34.7 / 2.80	700/2100	17

Table 4: The beam time and other parameters of the HCAL commissioning. Total allocated time is of 24 hours.

3.6 Commissioning of the coincidence regime

The contact persons are M. Jones & J. Poudel. The dry run need to be completed before 9/21 (test of all components including readout and analysis). The total allocated time is 180 hours. The following is a plan:

- SBS magnet current set to 2100 A.
- BigBite sieve slit is removed.
- Target is a reference cell filled with hydrogen.
- HCAL at 17 m from the target.
- HCAL HV is ON per prior calibration.
- Beam current set to give 1 kHz BigBite+HCAL trigger rate.
- Collect “e-p” events with clean BigBite+SBS trigger.

- Beam current set to give 1 kHz BigBite+HCAL trigger rate.
- Collect “e-N” events with clean BigBite+SBS trigger.
- Target is a reference cell filled with nitrogen.
- Beam current set to give 1 kHz BigBite+HCAL trigger rate.
- Collect “e-N” events with clean BigBite+SBS trigger.

item		Beam	Target	Beam	Time	BB angl/dist.	SBS angl/dist.	BB/SBS	HCAL
#		GeV		μA	hour	deg. / meter	deg. / meter	Currents	dist. m
1		2.1	reference cell	1-60	72	47.5 / 1.63	34.7 / 2.80	as needed	17

Table 5: The beam time and other parameters of the elastic regime commissioning. Total allocated time is 180 hours.

3.7 GEn production parameters for 2.9 GeV^2 kinematics

The total allocated time is 228 hours. The contact person is T. Averett.

The following is a plan:

- Beam energy is 4.2 GeV.
- Have SBS at 34.7 deg and 2.80 m from the pivot.
- Set the SBS magnet current at 2100 A.
- Have BigBite at 29.5 deg and 1.63 m from the pivot.
- Set the BigBite magnet current at 700 A.
- Measure the beam polarization.
- The target is polarized He-3 and H2 filled reference cell.
- HCal at 17 meters.
- Get beam current according to the table 6.
- Set raster size 2mm diameter.
- Set DAQ trigger from the BigBite+SBS, others pre-scaled for 10% or total rate
- Take the data according to the table 6 with the pol. cell replacement as needed.

item	Q^2	Beam	Target	Beam	Time	BB angle/dist.	SBS angle/dist.	SBS	HCAL
#	GeV^2	GeV		μA	hour	deg. / meter	deg. / meter	Bdl T-m	dist. m
1	2.9	4.2	He-3	60	156	29.5 / 1.63	34.7 / 2.80	1.58	17
2	2.9	4.2	C-foils	1-60	8	29.5 / 1.63	34.7 / 2.80	1.58	17
3	-	4.2	Moller	1	8	35.0 / 1.63	18.0 / 2.80	1.58	17
4	2.9	4.2	H2	60	12	29.5 / 1.63	34.7 / 2.80	1.58	17
5	2.9	4.2	C+sieve	1-60	8	29.5 / 1.63	34.7 / 2.80	1.58	17
6	2.9	4.2	H2+sieve	1-60	12	29.5 / 1.63	34.7 / 2.80	1.58	17

Table 6: The beam time and other parameters of the 2.9 GeV^2 run. Total 204 hours of the beam on target. Total allocated time is of 228 hours.

3.8 GEn production parameters for 6.6 GeV^2 kinematics

The total allocated time is 768 hours. The contact person is G. Cates.

The following is a plan:

- Beam energy is 6.3 GeV.
- Have SBS at 22.1 deg and 2.80 m from the pivot.
- Set the SBS magnet current at 1575 A.
- Have BigBite at 35.9 deg and 1.63 m from the pivot.
- Set the BigBite magnet current at 700 A.
- Measure the beam polarization.
- The target is polarized He-3 and H2 filled reference cell.
- HCal at 17 meters.
- Get beam current according to the table 7.
- Set raster size 2mm diameter.
- Set DAQ trigger from the BigBite+SBS, others pre-scaled for 10% or total rate
- Take the data according to the table 7 with the pol. cell replacement as needed.

item	Q^2	Beam	Target	Beam	Time	BB angle/dist.	SBS angle/dist.	SBS	HCAL
#	GeV^2	GeV		μA	hour	deg. / meter	deg. / meter	Bdl T-m	dist. m
1	6.6	6.3	He-3	60	664	35.9 / 1.63	22.1 / 2.80	1.58	17
2	6.6	6.3	C-foils	1-60	8 x 2	35.9 / 1.63	22.1 / 2.80	1.58	17
3	6.6	6.3	H2	60	12 x 2	35.9 / 1.63	22.1 / 2.80	1.58	17
4	-	6.3	Moller	1	8	35.9 / 1.63	22.1 / 2.80	1.58	17
5	6.6	6.3	N2	20	8	35.9 / 1.63	22.1 / 2.80	1.58	17

Table 7: The beam time and other parameters of the 6.6 GeV^2 run. Total 720 hours of the beam on target. Total allocated time is of 768 hours.

3.9 GEn production parameters for 9.7 GeV^2 kinematics

The total allocated time is 768 hours. The contact person is B. Wojtsekhowski.

The following is a plan:

- Beam energy is 8.4 GeV.
- Have SBS at 18.0 deg and 2.80 m from the pivot.
- Set the SBS magnet current at 2100 A.
- Have BigBite at 35.0 deg and 1.63 m from the pivot.
- Set the BigBite magnet current at 700 A.
- Measure the beam polarization.
- The target is polarized He-3 and H2 filled reference cell.
- HCal at 17 meters.
- Get beam current according to the table 7.
- Set raster size 2mm diameter.
- Set DAQ trigger from the BigBite+SBS, others pre-scaled for 10% or total rate
- Take the data according to the table 8 with the pol. cell replacement as needed.

item	Q^2	Beam	Target	Beam	Time	BB angle/dist.	SBS angle/dist.	SBS	HCAL
#	GeV^2	GeV		μA	hour	deg. / meter	deg. / meter	Bdl T-m	dist. m
1	9.7	8.4	He-3	45	1848	35.0 / 1.63	18.0 / 2.80	1.58	17
2	9.7	8.4	C-foils	up to 45	16 x 2	35.0 / 1.63	18.0 / 2.80	1.58	17
3	9.7	8.4	H2	45	24 x 2	35.0 / 1.63	18.0 / 2.80	1.58	17
4	-	8.4	Moller	1	8 x 2	35.0 / 1.63	18.0 / 2.80	1.58	17

Table 8: The beam time and other parameters of the 9.7 GeV^2 run. Total 1944 hours of the beam on target. Total allocated time is of 1992 hours.