E12-17-004 GEn
ERR Report Status
Aug 6, 2019

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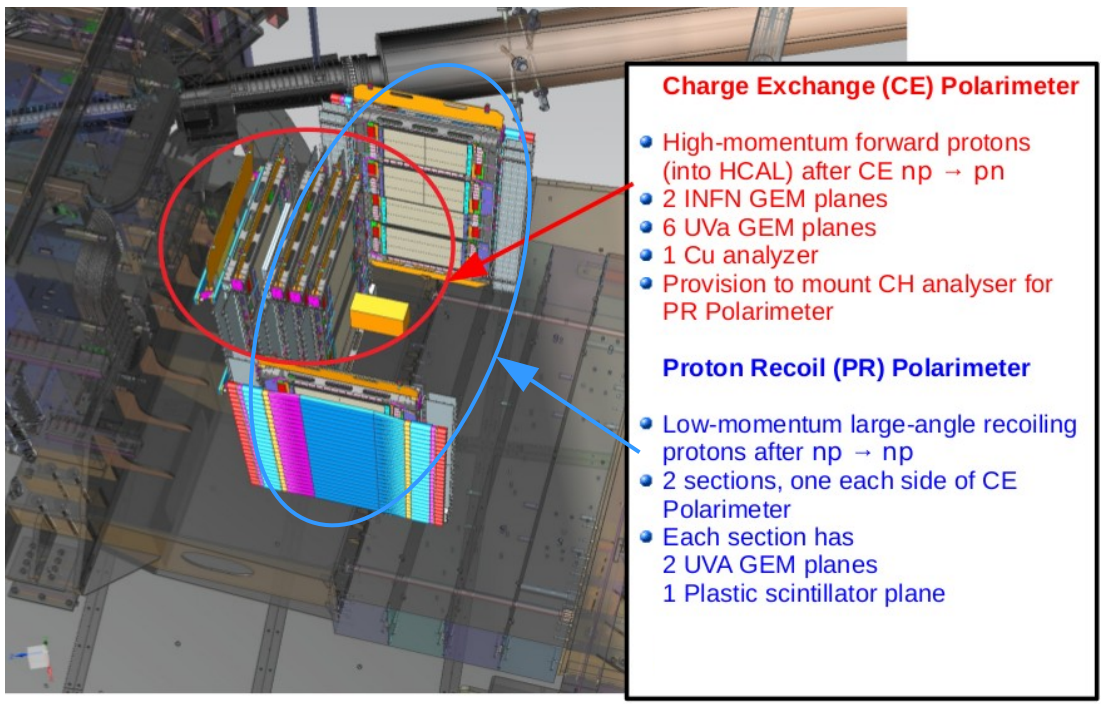
Ver. 1

Physics / Experimental Approach

- E12-17-004 will measure GEn/GMn using two recoil pol. techniques
  - → "GMn" beam, beamline, target, BB
    - » Beam: ~11 GeV/c, ~40 μA
      - P_{beam} = ~80%
    - » Target: 10cm LD2 (unpolarized)
  - → Charge-Exchange np → pn channel (primary goal)
    - » Copper analyzer (passive)
    - » GEM tracking + HCAL measure forward protons
  - → Conventional np → np (secondary goal)
    - » Plastic analyzer (active)
    - » Large-angle recoil protons → Side detectors (GEM + hodoscope)
    - » Forward neutron → HCAL

- Approved for 108 PAC hours
  - → ~ 9 Calendar days



E12-17-004 GEn ERR Charge (Summarized)

GEn ERR date: May 29, 2019

→ Report received May 31

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- Experiment Overview
  - → Impact and integration with GMp (E12-09-019) run plan
- Outline Hardware Changes
  - → Identify new equipment beyond E12-09-019
  - → Outline SBS frame modifications
  - → Integration into DAQ and Slow Controls
- For the New Equipment:
  - → Description / Design
  - → Ownership / Responsibility
  - → Completion and Commissioning Schedule
    - » Personnel assignments
  - → Radiation Considerations
  - → Safety Docs / Procedures

ERR Comments

- Comments
  - → Noted some uncertainty about scope of existing SBS/GMn documentation
    - » We understand updates will be needed to cover add'l GEMs, and likely some new OSPs for hodoscopes and active analyzer.
  - → Suggested all remaining procurements be collected into an internal document for tracking purposes
    - » Done.

- Comments (cont'd)
  - → "It would be a good idea to formulate a high rate test with the MPD and SSP DAQ hardware to fully test these devices as close as possible to the simulated rates of the experiment."
    - » Covered in response to Recommendation #5 (touch on this later)

ERR Recommendations

- There were 5 Recommendations:
  1) Outline a plan and schedule to pursue realistic simulations of high-rate tracking performance in the presence of anticipated backgrounds, and to take advantage of any opportunities to validate the simulations using real data.
  2) Update simulation geometries to the latest CAD model of the final installation and include fringe magnetic fields.
  3) Obtain a written agreement with E12-09-019 which includes a high-level schedule showing how installation and deinstallation of all experiment hardware interleave with the run plans of the two experiments.
  4) Provide an evaluation of the expected INFN GEM performance or present a plan for using alternate detectors.
  5) Provide updated reports and expected performance evaluations for both UVa and INFN GEM detectors based on the most recent test results. Present a plan that assures the availability of detectors having suitable performance for the experiment.

Recommendation 1

- Outline a plan and schedule to pursue realistic simulations of high-rate tracking performance in the presence of anticipated backgrounds, and to take advantage of any opportunities to validate the simulations using real data.

- Extended response highlighting
  - → Tracking algorithms that are already implemented
  - → Simulation work already completed
  - → Identifying existing cases where simulation has been verified against data
    - » PRad, UVa x-ray tests, etc
  - → Discussed existing simulations in more detail.
    - » SBS/BB sim
    - » GEn sim (Glasgow)
    - » GEn sim (NMU)

Recommendation 2

- Update simulation geometries to the latest CAD model of the final installation and include fringe magnetic fields.

- Geometry updates are complete
  - → No major changes to code
  - → No major changes in results

- Some ongoing work integrating updated fringe field into models

Recommendation 3

- Obtain a written agreement with E12-09-019 which includes a high-level schedule showing how installation and deinstallation of all experiment hardware interleave with the run plans of the two experiments.

DRAFT

1 Installation

The G_M^n and G_E^n collaborations plan to have all components of the G_E^n polarimeter installed on the SBS carriage prior to beam operations.

1.1 Work/installation plans prior to taking beam

We plan to install and test these components in-situ on the SBS carriage prior to the run.

- All SBS GEM layers will be installed, cabled, and tested
- Both the right and left Recoil Proton detectors will be installed, cabled, and tested (GEM layers + hodoscope arrays)
- Glasgow active analyzer array will be installed, cabled and tested.

The following components only need to be "test fit" at some point during the pre-beam installation schedule, but will *not* be present for the start of G_M^n beam operations. Note that the test fit needs to be done with an SBS hardware configuration and angle that will be representative of the state during the mid-run gmn to G_E^n transition so any interference / installation challenges can be identified and addressed well prior to beam.

- SBS *rear* field clamp
- Copper analyzer plate

1.2 Components to be removed prior to taking beam

The following G_E^n related hardware will be removed prior to the start of G_M^n beam operations. It should remain "staged" in the Hall so it can be efficiently reinstalled during the G_M^n to G_E^n transition period.

- SBS *rear* field clamp (if still present after test fit)
- Copper analyzer plate (if still present after test fit)
- Glasgow active analyzer array (cables will disconnected and left coiled on the carriage for rapid reconnection during the G_M^n to G_E^n transition).
- SBS GEM MPD cards (cabling will be left in place for rapid reconnection during the G_M^n to G_E^n transition).
- NOTE: Gas flow to all SBS GEMs will be maintained at a some level to help keep the GEM humidity levels stable.

1.3 Note on impact of G_E^n RP detectors on G_M^n minimum SBS angle

Both the right and left Recoil Proton detectors will be left in place on the SBS carriage. This limits the SBS angle setting to $> 24°$ until after the G_E^n program is complete. Organizing the run plan to accommodate this is covered in the **Run Plan** section that follows.

Recommendation 3 ... cont'd

- Obtain a written agreement with the E12-09-019 which includes a high-level schedule showing how installation and deinstallation of all experiment hardware interleave with the run plans of the two experiments.

DRAFT

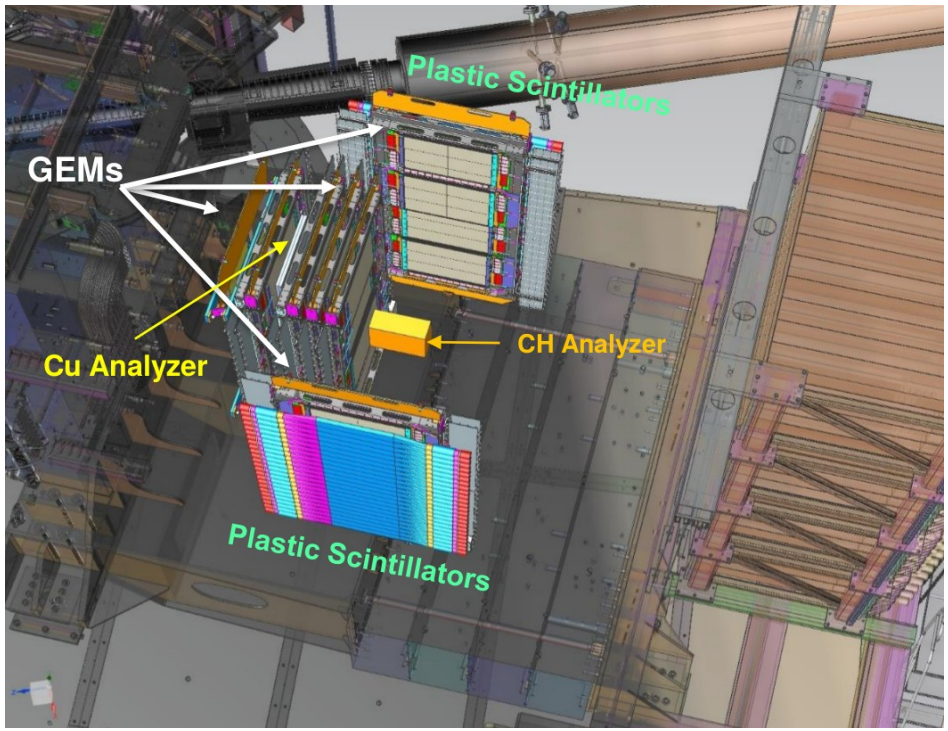
2 Run Plan

E12-17-004 has been approved for 120 PAC hours, or a nominal 10 calendar days at the typically assumed 50% efficiency. Of those 120 PAC hours, 12 PAC hours (or a nominal 3 calendar shifts) have been allocated to overhead associated with G_E^n-related configuration changes.

1. G_M^n Begin G_M^n production with kin X, Y, Z at angles a, b, c.
   - Final kinematic in this subset will match the G_E^n $Q^2 = 4.5(\mathrm{GeV}/c)^2$ configuration.
2. Install the GEn specific components **(nominal 1 shift)**
   - Install shielding in the beamline dipole cutout (if this is not already in-place).
   - Install field clamp.
   - Install Copper analyzer plate.
   - Install Glasgow analyzer as needed.
3. Run GEn measurement **(96 PAC hours; 9 calendar days)**
4. De-install GEn components **(nominal 1 shift)**
   - Remove field clamp (Techs, crane).
   - Remove Copper analyzer plate (Techs, crane).
   - Remove Glasgow analyzer (Collaboration).
   - Disconnect cables from the beamline side (left) Recoil Proton detector assembly (Collaboration).
   - Remove beamline side (left) Recoil Proton detector from SBS stand (Techs, crane).
   - The right-side RP detector can remain or be craned off as desired.

Recommendation 4

- Provide an evaluation of the expected INFN GEM performance or present a plan for using alternate detectors.



- Two fallbacks to be explored, if needed:
  - → Evaluate veto efficiency of "as-is" 3 layer (INFN+INFN+UVa) upstream triplet.
    - » Do not need tracks, just a charged veto for GEn.
  - → Shuffle one or more GEM UVa layers from RP assemblies into upstream triplet instead.
    - » No tracks from side GEMs alone, but will still augment x,y coord from hodoscope
    - » Vertex provided by segmented active analyzer

Recommendation 5

- Provide an evaluation of the expected INFN GEM performance or present a plan for using alternate detectors.
- Provide updated reports and expected performance evaluations for both UVa and INFN GEM detectors based on the most recent test results. Present a plan that assures the availability of detectors having suitable performance for the experiment.

- Extended response has been drafted by Nilanga, Kondo, Michael, et al.
  - → 2-page summary in ERR response document
  - → Complete report will be included as an Addendum
  - → Too much to discuss here
    - » See dedicated GEM talks and final report

Still to be done...

- Remove “Draft” from a few items
  - → ie. *Installation/Run-plan agreement* letter
  - → Fill in a few minor details tagged in ERR response document.
- Finalize GEM report for Appendix
- **Timeline (ASAP)**
  - → Beam Request Submission deadline: Aug 16
    - » ERR Committee sign-off is a prerequisite
  - → Response must be submitted to ERR Committee this week
    - » Hoping for Wednesday, Aug 6

Backup / Misc. Slides