Hall D Status

E. Chudakov$^1$

$^1$Hall D Group Leader

UGBOD meeting, January 2016
<table>
<thead>
<tr>
<th>Proposal/ experiment</th>
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<th>Beam days</th>
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<td>Workshop planned for 2016</td>
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The Hall D/GlueX collaboration

23 institutions; about 110 scientists

*Since the last UGBOD meeting in Jun 2015*

**Joined:**

- George Washington University
- GSI

**Scientific Staff: 14**

**New hires:**

- Postdoc position offered
• 12 GeV $e^-$ beam 0.05 – 2.2 $\mu$A
• 20 $\mu$m diamond: coherent <25 $\mu$rad
• Collimation $r < 1.8$ mm at $\sim 80$ m
• Coherent peak 8.4 – 9.0 GeV $\mathcal{P} \sim 40\%$
• $2.2 \mu$A $\Rightarrow 100$ MHz $\gamma$
• Energy/polarization measured:
  • $\sigma E/E \sim 0.1\%$ (tagger), 0.5\% (PS)
  • Pair spectrometer: spectrum $\Rightarrow \sigma \mathcal{P}/\mathcal{P} \sim 5\%$
  • Triple polarimeter $\sigma \mathcal{P}/\mathcal{P} \sim 3\%$
Hall D/GlueX Spectrometer and DAQ

**GlueX**

Resolutions

\[ h^\pm: \sigma p/p \sim 1 - 3\% \]
\[ \gamma: \sigma E/E \sim 6%/\sqrt{E} \oplus 2\% \]

Acceptance \(1^\circ < \theta < 120^\circ\)

Detectors

- CDC, FDC
- BCAL, FCAL
- TOF, ST

Plans to add

- 2017 L3
- 2018 DIRC

Photoproduction \(\gamma p\) 15 kHz for a 100 MHz beam

Beam 10 MHz/GeV: inclusive trigger 20 kHz \(\Rightarrow\) DAQ \(\Rightarrow\) tape

Beam 100 MHz/GeV: inclusive trigger 200 kHz \(\Rightarrow\) DAQ \(\Rightarrow\) L3 farm \(\Rightarrow\) tape

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Practically all the equipment for GlueX-I has been installed and commissioned at some level!

Still to be installed/replaced/commissioned:

- Tagger microscope: about 30% of the fibers have low efficiency - they will be replaced in summer 2016.
- Total absorption counter (for beam flux calibration) - not commissioned in the beam yet
- Triple polarimeter for the photon beam \((\gamma + e^- \rightarrow e^+ e^- + e^-)\): not fully commissioned yet
- Thin diamond radiators for the physics running (20 \(\mu\)m thick) still to be manufactured and installed (first item will be measured at CHESS in February 2016)
Solenoid Status

- 1500 A - nominal current (based on SLAC experience)
- 1350 A - optimal for GlueX

The magnet was not supposed to quench. However, it did, at:

- 1460 A May 2013
- 1300 A May 2015

Several reviews (last July 2015) and discussions with experts:

- Reviews: no clear explanation found. Most probably - a problem with the cooling system
- Oct 2015 - a SLAC expert found a difference between the SLAC and the JLab cooling implementations: JLab missed the thermosyphon effect

2015 Oct-Dec - modifications to the cooling system in order to reproduce the SLAC configuration. Expected to finish cooldown by Feb 5 2016.
Commissioning runs

2014 Fall

- 10 GeV, ~ 17 days of beam
- Initial commissioning of the beamline and detector

2015 Spring

- 5.5 GeV, ~ 5 days of beam
- Commissioning of the coherent Bremsstrahlung beam (0.05 mm diamond radiator)
- Progress with other systems

2015 Fall

- 12 GeV, ~ 2 days of beam
- Accelerator work on the beam instrumentation
- Some progress with the DAQ and trigger
Commissioning results from 2015: PID

Positively Charged Particles

Negatively Charged Particles

Incorrect RF Bunch

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Commissioning results from 2015: Signals

\[ \gamma p \rightarrow \gamma \gamma p \]

\[ \pi^0 \rightarrow \gamma \gamma \]

\[ \gamma p \rightarrow 4 \gamma p \]

\[ \gamma \gamma \text{ Invariant Mass [GeV/c}^2\text{]} \]

\[ \gamma^0 \text{ Invariant Mass [GeV/c}^2\text{]} \]

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\[ \omega \rightarrow \gamma^0 \]

\[ \omega \rightarrow \pi^+ \pi^- \pi^0 \]
Results from 2015: Linearly Polarized Beam

- Coherent bremsstrahlung peak has high degree of linear polarization.

\[ \gamma p \rightarrow \pi^+ \pi^- p \]

\[ \rho^0 \rightarrow \pi^+ \pi^- \]

\[ \frac{d\sigma}{d\psi} \propto (1 + P \cos 2\psi) \]

Polarization $P$ is preserved in $\rho$ production.
Run 2015 Fall: Progress

12 GeV-endpoint beam spectrum from the PS

Online monitoring spectra for BCAL

Other results

- DAQ: > 20 kHz readout rate achieved (needed for GlueX-I)
- Trigger: progress, close to the GlueX-I requirements
Plans for the 2016 Spring run

- **Schedule:** Feb 4 - Apr 13, 12 GeV
- **Accelerator:** finish the beam instrumentation (fast feedback) commissioning
- **Solenoid:** 1200 A
- **Commissioning of TAC, new diamond radiator, triple polarimeter**
- **Regular data taking:**
  - Finish the calorimeter calibration
  - Physics commissioning: aim at producing “early” results, mostly on various polarization effects, using the linearly polarized beam