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**Response to ERR Charge**

1. **What are the running conditions for the experiment? Please state clearly the target and beamline configurations and operation.**

We run with GlueX in standard configuration using the standard diamond radiator with the coherent peak at approximately 9 GeV (energy range 8.4 - 9.1 GeV), but we also note that we are flexible to run at somewhat lower energy and are not as precisely sensitive to the machine energy. We run at x2 lower luminosity than standard GlueX with 2x107 photons/s flux, corresponding to 140 nA of beam current. We plan to run for 7 days on carbon, 5 days on deuterium including empty target calibration running, and 1 day on 4He targets. The run plan of the SRC experiment is presented in Table I.

1. **What is the operational status/performance requirements of the target system needed by the experiment? If not completed, what are the completion/commissioning schedules, tasks and user commitment?**

We will run with a 30 cm-long cell that has a copper heat shield installed around the outside for both the deuterium and 4He running (both ~4% radiation length). We will run an 8-foil carbon foil target in total 7% radiation length (each foil is 0.24 cm). The carbon foils will span the 30 cm target length.

1. **Has the spectrometer, detector configuration been defined, including ownership, maintenance and control during beam operations?**

Spectrometer and detectors will be in standard GlueX configuration. Detector support will come from Hall D staff members and responsible parties have confirmed (see <https://halldweb.jlab.org/level-1/manpower.pdf>).

1. **What is the impact of the expected neutron radiation on GlueX detector components such as the SiPMs? Is any local shielding required? Are the radiation levels expected to be generated in the hall acceptable?**

Our radiation levels are expected to be acceptable in the Hall. We are working with the JLab Radiation Control Group to estimate the backgrounds from the targets using FLUKA and GEANT simulations. The neutron background is important to understand for the SiPM operation. Our photon flux is 5 times smaller than that proposed for GlueX design. FLUKA and GEANT simulations, evaluated for the proposed luminosity, show that the neutron background induced by the 4He target is about 4-5 times larger than the hydrogen target and therefore, should not present any issues as we run at x5 less flux. The estimated neutron dose equivalent rate in Hall D at the ceiling induced by the deuterium target is less than 0.1 mrem/h which is deemed acceptable by RadCon. Additionally, we’ve coordinated with RadCon to install TLDs close to the target and implement Bonner spheres to determine the energy spectrum of the neutrons close to the target. We will begin our running with carbon to check the rates. If rates become unacceptable, we will reduce luminosity. If the rates become a problem for deuterium, we can reduce current or skip deuterium and run with the remaining time on 4He.

1. **What is the expected data rate for the experiments?**

Nominal GlueX trigger rate at a photon flux of 5x107 photons/s, is a trigger rate of about 80 kHz, 90% live time, and a corresponding data rate of 1.1 GB/s. For our experiment, we will lower the ECAL and BCAL thresholds so that we are sensitive to minimum ionizing particles, and we will include the start counter in the trigger. This configuration was tested in Feb 2020 (see https://halldweb.jlab.org/level-1/src) with the 5x107 photon flux. The tested trigger required a hit in the start counter and reduced the energy thresholds in the BCAL and FCAL to 180 and 250 MeV, respectively. These thresholds are set below the minimum ionizing particle threshold so that we accept proton and pion final states. This configuration yields a trigger rate of 78 kHz, 90% live time, and a corresponding data rate of approximately 1 GB/s (albeit at nominal GlueX photon flux as stated above). Our experiment will run with a photon flux of 2x107, but our carbon target will be double the radiation lengths of the nominal hydrogen GlueX target. We expect that the hadronic backgrounds from the nuclear target will be smaller due to larger attenuation effects (scaling approximately as *A2/3*) and the electromagnetic backgrounds should scale with the radiation length.

1. **Are the responsibilities for carrying out each job identified, and are the manpower and other resources necessary to complete them on time in place?**

We have adequate manpower from our group to cover shifts, calibrations, and analyses (TAU/MIT/ODU/GWU). We invite the GlueX collaboration to join in shifts and analysis.

1. **Are the beam commissioning procedures and machine protection systems sufficiently defined for this stage?**

Yes. This is all standard GlueX calibration and procedures. All basic calibrations done with PrimEx prior to start of experiment.

1. **What is the simulation and data analysis software status for the experiment? Has readiness for expedient analysis of the data been demonstrated? What is the projected timeline for the first publication?**

We will use standard GlueX calibration and software, and analysis will be completed within the GlueX framework. Our group already has a dedicated Monte Carlo event generator. We anticipate that our first publication will be achieved within a year of data taking. Our group has an abundance of experience analyzing short range correlations with electron beams in other experiments and a strong track record of rapid publications. The strategy is to first analyze channels for np-dominance:

* γ + p → π0 + p and γ + n → π- + p: 2 particle final state, lowest cross section
* γ + p → ρ0 + p and γ + n → ρ- + p: 3 particle final state, highest cross section

1. **What is the status of the specific documentation and procedures (COO, ESAD, RSAD, ERG, OSP’s, operation manuals, etc.) to run the experiments?**

Assigned PDL is Lubomir Pentchev. Documents are initiated at https://halldweb.jlab.org/wiki/index.php/Experiment\_Readiness\_Review\_2020#ERR\_Agenda

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| --- | --- | --- | --- |
| **Condition** | **Scheduled Work**  **(Activities)** | **Total Time** | **Beam Conditions** |
| **Pre-experiment** | **Install C target** | **3 shifts** | **no beam** |
|  | Disassemble beam pipe.  Retract target.  Remove Start Counter (ST).  Remove vacuum snout.  Remove GlueX cell.  Mount carbon foils (survey). Attach vacuum snout.  Attach ST.  Target in place.  Assemble beam pipe.  Pump vacuum.\* Ramp magnet\* | 1 shift assembly  1 shift for survey & align  1 shift for pumping vacuum |  |
|  |  |  |  |
| **Detector checkout** |  | **2.5 shifts** | **140 nA** |
|  | Establish typical tagged photon beam, check/calibrate sub-detectors, Trigger, and DAQ  (some tests can be done during pumping vacuum) |  |  |
| **Run with C target** |  | **7 days** | **140 nA** |
| **Target change** | **Install liquid D target** | **3 shifts** | **no beam** |
|  | Ramp magnet down. Disassemble beam pipe.  Retract target.  Remove ST.  Remove vacuum snout.  Remove carbon foils.  Mount GlueX cell.  Survey. Mount heat shield (needed for helium).  Attach vacuum snout.  Attach ST.  Target in place.  Assemble beam pipe.  Pump vacuum\*. Ramp magnet.\* | 1 shift assembly  1 shift for survey & align  1 shift for pumping vacuum\* |  |
| **Run with empty target** |  | **0.5 days** | **140 nA** |
| **Target preparation** | Cool target\*. | **1 shift** |  |
| **Run with D target** |  | **4.5 days** | **140 nA** |
| **Target change** | Switch to liquid He target | **1.5 shifts** |  |
|  | Boil LD2\*.  Pump D2 from tanks.  Replace with helium.  Cool target\*. |  |  |
| **Run with He target** |  | **1 day** | **140 nA** |
|  |  |  |  |
| Total |  | **13 days**  **data taking**  9 shifts overhead |  |

Table I. Run plan of the SRC/CT experiment.

(\*) means Hall D can be in beam permit.