ITAC report for PAC45

B. Zihlmann (chair), J. Benesch, D. Higinbotham, D. Mack, S. Stepanyan

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Strange Hadron Spectroscopy with a Secondary K_L Beam at GlueX

Physics Reach

- Since the initial momentum of the K_L is not known very well above 2 GeV/c from TOF (see the realistic 300ps curve in fig. 21), it may be essential for high K_L momenta to detect all particles in the final state. The feasibility of inclusive measurements at higher K_L momenta will have to be determined on a case by case basis.

- Simulations show that the minimum recoil proton momentum detectable with the proposed target and current GlueX detector is about 0.5 GeV/c as shown in figure 45. This includes the full K_L momentum spectrum as shown in figure 16. It is not obvious that at low initial K_L momenta the proposed measurements can be exclusive and detect the recoiling proton which is essential for vertex reconstruction. Note that most events in figure 37 (low t) would be undetectable in an exclusive measurement.

- The K_L beam flux is assumed to be about $3 \cdot 10^4$ kaons per second. If this estimate assumes the full momentum range of K_L as shown in figure 16 the actual flux of "useful" K_L with momenta below 1.85 GeV/c (W=2.17 GeV/c^2) as used in section 11 will be about a factor of 10 smaller.

- Will a smaller initial electron beam energy generate a more optimal K_L momentum flux distribution? The relatively large fraction of high momentum K_L in figure 17 may not be so useful for a resonance program.

- 200 days of beam time are requested with 100 days on Hydrogen and 100 days on Deuterium (page 52). No simulation on physics results with a deuterium target are presented.

Compact Photon Source (CPS)

1. The existing tagger and permanent magnet in the electron/photon beam line are part of engineering safety measures to prevent any primary electron beam from entering Hall D. Any re-design of the electron/photon beam line needs to take this into account.
2. The combined length of the CPS and the permanent magnet (required for safety) may exceed the space that is available between the tagger magnet and the exit photon beam pipe. Note that the tagger magnet is part of the electron vacuum beam line.
3. Cooling of the electron dump is essential. With 5 μA the heat load is about 60kW. It needs to be part of the safety interlock system.
4. The electron beam is expected to be rastered when passing through the radiator into the beam dump. The Hall D beam line does not have any raster system. The heat dissipation in the dump depends on such a raster system.
5. The total weight of the CPS/electron beam dump may exceed the maximum floor loading.
6. Decommissioning of this dump needs to be considered at the early design stage. Taking it apart may not be possible after the experiment, and extracting the 8 m long CPS in one piece may be the only option to restore the Hall D tagger beam line.
7. The proposed use of Tungsten powder required additional safety measures depending on the granularity.

Electron Beam Characteristics

1. A 5 μA electron beam with a 15.6 MHz repetition rate as requested is not trivial. The currently installed lasers in the beam source are not capable of such a low repetition rate.

2. 5 μA of beam current at 15.6 MHz repetition rate is equivalent to 160 μA of beam current at 499 MHz repetition rate in terms of the expected charge per bunch. The space charge effects will be $32^2 \sim 1000$ times larger than a 160 μA beam at 499 MHz. This may require accelerator operations parameters that have not been yet achieved or shown to be compatible with the current apertures in the transport system.

$\mathbf{K}_L$ beam source

1. The contribution from the extended K_L source to the time resolution may become significant for the lowest K_L momenta. This should be included in any estimate of the overall time resolution and hence ΔW. A combination of Be and Carbon as K_L source may be favorable.

2. Parametric timing resolutions of the start counter below the currently quoted 280 ps may not be realistic. Any improvement in this number would require a thicker start counter and will increase the minimum detectable recoil proton momentum.

3. There is no information about the two collimators that are shown as part of the K_L beam line right after the sweeper magnet and upstream of the GlueX detector (fig.14,20). This second collimator is directly competing with the LH target for space on the upstream platform. No information about the collimator material, its dimensions, bore diameter and weight are available. This is important to determine the floor load, in particular on the upstream detector platform.

4. A simulation of K_L and other particle fluxes as a function of radius is not available. It is important to know the fluxes at the detectors as well as the target. The CDC straws would be very unhappy if they see a high muon flux along their lengths. We need these numbers to estimate the radiation damage to the BCAL SiPMTs as well.

LH/LD Target

1. The requested 6 cm diameter LH/LD target is a substantial increase in the transverse target thickness as compared to the nominal GlueX target. This will have an adverse effect on the average minimum detectable recoil momentum of the proton.

2. The use of a deuterium target may increase the neutron radiation dose in the Hall considerably, not only with regard to the total radiation dose at the site boundary but due to the adverse effect low energy neutron radiation has on the SiPMs that are the basis of the start counter readout and the Barrel Calorimeter readout.