PR12-18-002

Date: May 22, 2018

For Proposal for JLab PAC46

Strange Hadron Spectroscopy with Secondary K_L Beam at GlueX

List of New Equipment and of Changes in Existing Setup Required

The following major changes to existing equipment are summarized below.

- The high intensity photon beam will be produced by a Compact photon Source (CPS), very similar to the one designed by the JLab CPS Collaboration Working Group for Halls C/A. A rough cost estimate for Halls C/A was found to be significant $2.7M where the tungsten is a dominating part.
  - The CPS will be located downstream of the tagger magnet. The tagger alcove has more space than that available in Halls C/A, so positioning and shielding placement are simplified.
  - A 30 kW CPS has been designed for Halls C/A. The CPS Collaboration Working Group intends to provide the design for a 60 kW device for Hall D.
  - The beam power can reach 60 kW (the beam current less than 5 μA at 12 GeV). The ceiling shielding of the Tagger hall above the CPS position is the same as it is above the existing 60 kW dump. No radiation increase at the site boundary is expected with respect to 60 kW operations using the existing dump.
  - The floor in the area can hold a 100 t CPS.
  - Different length/field magnet. Shielding may differ.
  - If one uses a 2nd raster system for Hall D to compensate for the initial 1 mm raster, this can be an equivalent essential design.
- Modifications of the beamline from the beginning of the collimator cave to the cryogenic target, which includes the Be-target assembly (its weight is 15.5 t), the shielding, etc. The scenario is to use smaller pieces of shielding and keeping (but moving) the current sweep magnet and not removing Pair Spectrometer magnet. All else is removed from the collimator enclosure and the upstream platform. Materials and equipment: $1.12M. A breakdown of the hardware as follows
  - Beryllium/tungsten target 6 cm diameter and 40 cm long: $11K Be + 17K lbs for $990K w = $1M.

- Lead sheets - use existing 2" sheets in lead shed: \$6K to cut to size and paint.
- Borated poly sheets (5 %): \$8K.
- Target rail/support system for moving in and out of beamline: \$20K.
- Vacuum beam line and valves: \$16K (assumes current gauging and pumps reused, 10E-6 torr vacuum requirement).
- Concrete shielding Labyrinth: \$20K (\$10K if we use small blocks plus support wall (\$4K) but more labor required).
- Water Cooling for target: \$20K.
- New concrete/steel collimator on US platform: \$6K.
- Reinforcement beams for US platform: \$5K.
- New collimator stand: \$6K.

The manpower for design and installation are

- Remove existing equipment from beamline - Technician Labor - 0.5 FTE year, 52 calendar days.
- Install new equipment - Technician Labor - 1.1 FTE year, 110 calendar days.
- Engineering - 0.52 FTE year, 1.3 years (assumes 1 engineer working 40 % for a 1.3 years).
- Designer - 1.38 FTE year, 1.3 years (assumes one designer working 75 % for a 1.3 years and a second designer 40 % for a year.
- Scientist check out of reinstalled equipment and electronics is not included in FTE, equipment cost or calendar time. This should be added.

- The KL flux monitor is being designed by the Edinburgh Univ. team and will cost about \$700k. In case of the approval of the proposal at the current PAC meeting, the Edinburgh team will apply for a grant to build this device using UK financial support. Additional charge is for Flux monitor cooling system: \$5K and electrical power infrastructure: \$3k. The flux monitor will be located downstream the Pair Spectrometer magnet and upstream pair spectrometer shielding wall. Its weight is 1.1 t and it does permit legs for the flux monitor stand. Assume flux monitor delivered to JLAB ready for install and only power and cooling needed. Assume all JLab labor and use existing tools for the job. Assume 5 day/1 shift work week. Also the assumption is that all new equipment is in hand when the installation begins. Engineering time assumes requirements are known at the start of the design.

- The upgrade of the LH_2/LD_2 cryogenic target (a rough cost estimate is about \$30k).

- In order to build up a beamline delivery system for the secondary K_L beam a rough estimate is for about \$10k the pulse picking system and about \$50k for the laser amplier.

The total cost of the project is estimated to be on the order of \$4M plus \$700k which is UK responsibility.