Proposal # **PR12-17-001** for **PAC45** **Hall: D**

Title: Strange Hadron Spectroscopy with a Secondary KL Beam at GlueX

Contact person: Moskov Amaryan (ODU)

Beam time:

Beam days requested: 200
Detector commissioning time included in request: not specified

Base Equipment

Beam parameters:

Energy:	~12 GeV	yes
Current:	5 μA	yes
Polarization:	N/A	yes
Emittance:	relaxed specs with respect to GlueX	yes
Bunch spacing	>60 ns	no
Radiator:	10%	no
Collimator:	Be target	no

Targets:

Nuclei:	Liquid ^{1}H, ^{2}D 6cm diameter	no

Spectrometers:

Hall D	standard	yes

Major modifications of the beamline:

1. **Accelerator**: The bunch spacing of >60 ns (15 MHz repetition rate) will require new injector equipment, estimated at about $100k. The bunch charge will be equivalent to 150 μA at the regular 500 MHz rate or 75 μA at 250 MHz, which is at the high end of the regular CEBAF operations. Running such a beam with another beam through one slit on the chopper (necessary for 4-hall operations) may cause a strong interference with the other hall.
2. **Compact Photon Source** (CPS) will be permanently installed in the tagger hall downstream of the tagger magnet. A conceptual design is under development in Physics Division, for use in Halls A/C for about 30 kW. The proposal contains little details on the CPS and the beam line arrangement. We assume that the CPS containing an electromagnet will be installed right downstream of the Tagger Magnet. The Tagger Magnet will be turned off during the operation of the kaon beam. The existing permanent magnet will be shifted downstream of the CPS. The CPS operations would likely require a fast raster of about 1mm on the radiator, in the vertical direction. The fast raster coils will be installed in the beam alcove upstream of the tagger magnet. The floor load from CPS weight may be limited to 100 t (a better assessment is required). The CPS would absorb 60kW,

matching the design of the tagger hall dump. The cooling system may need modifications. The CPS will be activated as the beam dumps are. The CPS would be used passively (without the radiator) for the regular photon beam operations. Once installed, it will not require significant efforts for switchover between the photon and kaon beams. The full cost of the CPS and the additional equipment has a large uncertainty at this moment, but most likely will exceed $1M. The disassembling of the CPS will require a long "cool down"

3. **Collimator Cave**: The cave was designed for high-intensity GlueX which would dump there about 5 W. The KL operations would dump about 6 kW. A preliminary estimate of the radiation levels outside of the radiologically controlled area found them acceptable by making a thick shielding around the Be target. A detailed analysis will be required in order to optimize the shielding.
   The switchover from photon to kaon beam and back would require major rearrangements of the collimator cave (on a scale of 6 months after the activation from the kaon operation drops to acceptable level). The additional elements needed (Be target, shielding) are a relatively "low-tech" equipment. No movable equipment or electromagnets are required in the cave for the KL beam operations.
4. New **liquid hydrogen/deuterium cryotarget**: 40cm long, 6cm diameter, will replace the existing, 30 cm long, 1.5cm diameter cryotarget. The new target system will have to withstand a higher pressure. The goals may be achievable with moderate modifications to the existing target system.
5. **New start counter** with a 150 ps timing resolution: I expect it to be a challenge. The existing counter has a 250 ps timing resolution.
6. The KL flux is supposed to be measured with the **Pair Spectrometer**, but no simulation has been done yet. It is not obvious that the existing pair spectrometer can do the job without modifications to the magnet (the gap size) and the detector system.

Summary:

Feasibility: The project appears to be technically feasible. Many elements require serious elaboration in order to evaluate the costs and schedule.

Interference with the photon beam program: Switchover between the KL and photon beam regimes may take about 6 months, mostly for removing/installing the equipment in the collimator cave and the beamline elements down to the Hall D solenoid. This time will depend on the design of the shielding of the Be target.

Radiation safety: The CPS will be stationary, and thus not much different from other beam dumps. The collimator cave shielding should be properly designed considering also the installation/removing procedures.