Jay Benesch comments on PAC 45 proposals for use by TAC, with some contributions from Arne

PR12-17-001 K-long in Hall D

The CPS will require a long "decay in place" period before it can be safely disassembled with material handling equipment which fits in the tagger vault. This period need not impact use of the coherent bremsstrahlung photon beam if the tungsten radiator in the CPS could be removed with minimal disturbance to the shielding. This might be accomplished by the simple method of having it captured rotationally above a recess and held in vertical position by an externally accessible threaded rod. When the experiment is complete, unscrew the rod from the radiator, allowing it to drop from the photon beam path into the shielded recess. Credit: Alan Gavalya's PREX-II system.

The cost estimate for the CPS is far too low. It will cost at least half an order of magnitude more than the $500K reported and could easily cost an order of magnitude more. It should be designed to be assembled and disassembled with remote handling gear, with assembly guaranteeing that disassembly will be possible. "Decay in place" for a decade may not be possible. Cooling water must be connected to the existing heat exchanger and primary loop so activated water does not reach the stormwater system. Changes to external earhworks might be required to insure accidental discharge does not occur. I'm sure there are lots of other expensive engineering details.

What temperature will the permanent magnet reach? Is the field likely to be reduced by radiation dose? The neutrons must have some effect on the domain alignment.

5 μA at 499/32 MHz has the same bunch charge as 160 uA at 499 MHz. Delivering this bunch charge to the Hall D tagger building will be challenging. Even when Ops can routinely deliver 80 μA at 249 MHz to halls A and C, the additional synchrotron radiation in arc 10 and the optics necessary to prepare the electron beam at the radiator will make the extra km tough. Since Hall D will share a slit with another hall for the foreseeable future, bleedthrough from the big D pulse to the other hall may be an issue.

Including contingency, I guesstimate that the TPC will be closer to $10M than the ~$1.5M on page 79.

Arne's comments: P12-17-001 proposes a new configuration for the Hall-D tagger vault which is in the conceptual stage. The issues that need to be resolved in progressing from concept to preliminary design include:

- The CPS removes the active tagger magnet as the electron beam sweeper and relies solely a (the?) permanent magnet. This changes the nature of permanent magnet from a credited controlled device to active device. It changes the error analysis from two devices failing (tagger magnet & permanent magnet) to one device failing in preventing the electron beam from propagating forward into the collimator/Hall-D proper.
  - The survivability of the permanent magnet has to be established. Permanent magnets degrade in the presence of radiation and thermal excursions.
  - The impact of this change on the FSAD/ASE needs to be evaluated
- The CPS geometry results in a direct or nearly direct line of sight with Hall-D, this suggests the need for extensive background simulation. There is some in the proposal, however the comment on page 32: "However, due to their high penetration (muons), it **might be important** for shielding purposes" (emphasis added), does not lead to a conclusion that this proposal is ready for the PAC.
- Is the tagger vault floor capable of dealing with the load on a 1m sphere of Tungsten?
- Would it not be easier to remove the tagger hodescope and electronics, install a steel wall in the location of the hodescope, and place the W radiator upstream of the tagger?

At present this proposal seems a bit premature for the PAC.

PR12-17-002 Lorentz invariance

Due to synchrotron radiation, δE/E is NOT 1E-5 at 11 GeV in hall A; it's an order of magnitude larger. If by δE/E the proposers mean the variation of the mean energy, the best CEBAF has been able to deliver is ~200 keV, ~2E-5.

Personal irritation: since the work by Benesch, Franklin, Quinn and Paschke is discussed extensively, https://journals.aps.org/prab/abstract/10.1103/PhysRevSTAB.18.112401 should have been included in the references.

Arne's Comments:

- PhysRevSTAB.18.112401 should have been referenced
- Beam Requirements List is blank
- Energy spread specification cannot be met
- Energy stability at 5-pass is crucial: The proposal has not addressed:
  - At 5-pass, simple diurnal changes in machine length will change the pathlength, resulting in changes in machine energy
  - If FFB is invoked, how well do we know that the energy lock does not have a small position term, resulting in the lock changing energy?

PR12-17-003 Lmbda-n-n Tritium

Given that 30 weeks of tritium running in FY18 is unlikely it would be helpful if PAC were to provide priorities among this and the four approved tritium experiments. If PAC feels the completion of the four (five) warrants storing the tritium target at JLab over a very long summer 2018 down it could so state.

Arne's Comments:

- *What is the energy spread requirement for this experiment?*

PR12-17-004 GEn/GMn by double polarization

(JLab use only) My analysis of a file Bogdan provided so I could make a presentation at the GMn ERR suggested that the downstream correctors need 38 kAT to null net steering along the beam line to the dump for 1.54 Tm field integral. Add 10% for 1.7 Tm quoted in proposal. I do not know if the corrector package has been evaluated at this field level; it's 2.3x the level in Bogdan's file.

Arne's Comments: None

PR12-17-005 CaFe

I saw nothing untoward.

Arne's Comments:

- *Lots of spectrometer/target changes.*

PR12-17-006 Electrons for neutrinos

Given the need for one non-standard energy (1.1 GeV) and four standard, the collaboration should be asked if those two pieces of the experiment can be widely separated in time or if calibration drifts or other effects in CLAS preclude this. If the two must be done in a unified time span, the 1 GeV run should be single-user to Hall B to minimize time required to set up one pass at 1 GeV then restore five pass at 11 GeV. At least one PAC day should be added for this evolution.

Arne's Comments:

- *Nothing to add*

PR12-17-007 probing QCD with D/He/C/Ca targets at GlueX

In section 3.4, page 25, the photon flux required is said to be one fifth of the normal GlueX flux. Per email from Or Hen, the "normal flux" is the design 5 μA, not the current at which CEBAF has been delivering beam to Hall D or even the current at which DAQ tests were done in FY17. If the experiment can run at 1 μA CEBAF diagnostics may work as intended. Intensity control could be an issue if D runs through a shared slit and currents are well below 1 μA.

Arne's Comments:

- *Nothing to add*

PR12-17-008 polarization observables in WACS

Reference 22 https://arxiv.org/abs/1704.00816 does not to this reader show concensus on the design of a compact photon source as implied in the proposal page 30. Since the details of the sources in previous WACS proposals were the reasons they were deferred and the reference 22 workshop held, the proposal is ingenuous on this matter. If a concensus has been reached, say so and sketch it. If concensus is still lacking ....

The end of the Hall C beam line has a vertical chicane to raise the beam 2 cm to the pivot location (original construction misunderstanding). Two BCMs and the Unser current monitor are between the two 1m vertical dipoles. This is followed by a 1m horizontal dipole in case pre-bending is needed to counteract effects of SHMS stray field, not relevant here. The last item in the line is a 5 m diagnostic girder. The photon source is described as a 3m cube. Either the three 1m magnets or the diagnostic girder have to go to make room for it. If the target and detectors can be lowered 2 cm so the change in electron beam height isn't needed, the chicane can be stored and the diagnostic girder moved upstream to create the needed space for the photon source. If the target and detectors can't be lowered most of the diagnostic girder will have to go. Perhaps a person-month each to make the space before the experiment and to restore the beam line afterwards.

No time is allocated for the change from fourth to fifth pass. If a kinematic change (4h) can be made without access to the hall, dedicated pass change time may be omitted. If access is required, the pass change should be allocated beam time. 1104 hours = 46 days exactly. Eleven weeks at 60% effectiveness.

Ops software will have to be changed to allow a 1 mm vertical raster without horizontal raster.

Arne's Comments:

- *Why Hall-C?*

PR12-17-009 D radius

The table in front of the proposal sums to 38.5 hours. Pages 46-47 including table 3 sum to 39 days. From the text on page 46, days is correct. Perhaps the table template should be changed to require days.

In the likely event ~200 MeV/linac can be obtained from the old cryomodules at 4.5K, this could be run during the summer with 1.22 and 2.022 GeV beam, third and fifth pass. RF power draw would be cut by using the mod anodes, not done during the recent tests. DC power draw would be down to ~10% of usual. Running only one 4K cold box cuts over 10 MW from usual draw. Whether the big dipole power supplies will regulate well at ~20% of design current is another matter.

Arne's Comments:

- *Nothing to add*

PR12-17-010 Photoproduction of vector mesons on nuclei GlueX

On page 19 of the proposal there is a statement that the photon flux will be reduced a factor of 12 compared with GlueX at high luminosity. Table II on page 21 makes it clear what this means, 180 nA . It would be helpful if all Hall D proposals included beam current as well as photon flux.

Arne's Comments:

- *Nothing to add*

PR12-17-011 Parity violating PDF

I saw nothing untoward.

Arne's Comments:

- *Nothing to add*

Update to JEF PR12-14-004

I saw nothing untoward.

Arne's Comments:

- *Nothing to add*

Update to Beam Dump Exp. PR12-16-001

Nice plan to show plausibility.

Arne's Comments:

- *Conflict of Interest prevents me from stating that this is an excellent proposal.*

PR12-17-012 Hall B run group ensemble: ALERT
E12-12-001A LHCb pentaquark run group addition

I leave these to the CLAS collaboration and Hall B management

E12-10-006B Deep exclusive pi- production in SolID (run group)

I saw nothing untoward in the proposal.

(JLab use only) The inside length of the end cap cylinder and its wall thickness have now been fixed. Stresses and displacements modeled by W. Seay are OK. I await his check on displacements of the downstream coil collar under the gravity load of 28" of return steel before iterating my magnet model. Perhaps a month after this ME result I'll have a "final" field map that can be used in lieu of the Poisson map in simulation. Or two field maps, one with eight-fold symmetry and one which has the cut-out in the return steel for the turret, hence no symmetry.

C12-15-006A Kaon structure function through tagged DIS

I saw nothing untoward.

LOI12-17-001 J/Psi photoproduction off deuteron (Hall B run group B)

I leave this to Run Group B collaboration and Hall B management

LOI12-17-002 Seach for phiN bound state in Hall B

Does the gold target run into the DOE precious metals regulations or is the quantity too small?

LOI12-17-003 Lambda interactions with Pb208 (Hall A)

HKS spectrometer is cited as the hadron arm at the bottom of page 7. Installation and removal time will be a scheduling issue. Five PAC weeks of beam time.