

Hall A Beamline Plans Update

Mark Pitt, Virginia Tech July 2, 2015

Activities since June 4 meeting:

- Mark and Roger met right after that meeting with John Musson to clarify various questions
- Hall A Beamline plan/request for FY15/16 was prepared and submitted to Thia on June 16; she responded on June 24 indicating it was exactly what she needed and check back in ~2 weeks on status
- Roger met with Ed Folts in Hall A to scout out locations for the old G0/Qweak cavity monitor coffin and the Qweak Halo Monitor ladder

Some Points from Discussion with John Musson

- No advantage for parity to replace “conventional” M15 stripline “wire” BPMs with the new machined versions; the new versions actually have less output signal (-74 dBm @1uA for old vs. -80 dBm @ 1 uA for new)
- The new digital receiver electronics switches at 1 MHz (compared to ~ 100 kHz (?) for the style of SEE we currently use?) So definitely worth testing this with existing stripline BPM hardware to assess the differences.
- The digital receiver electronics is actually two physical boxes; one is a small amplifier/multiplexer that sits near to the hardware. There is a separate version for 4 channel striplines (X+, X-, Y+, Y-) and cavity assemblies (X,Y,Q). Each has two outputs that go to the digital receiver. For XYQ, it can be configured so that the Q is being read with 100% duty cycle.
- Musson’s group can build new BCM cavities if we request them at ~ \$10k/cavity (much cheaper than we had originally thought)
- Late in June, Musson confirmed via email that the coffin sitting on Hall A floor is in fact XYQ (not QQQ)

Hall A Beamline plan, slide 1

Prioritized list of instrumentation for remainder of FY15 and FY16 for parity development in Hall A

All items on this list assume that the Hall A parity DAQ has been re-instated. Contact people for this are Bob Michaels and Ciprian Gal.

Discussion Points:

- Do Bob and Cip have time to re-instate the parity DAQ in Hall A by ~ October 2015?

Hall A Beamline plan, slide 2

For FY2015 (ie. to complete during the summer/fall 2015 down)

1. Reinstatement of Hall A beam modulation system

* Contact people: Yves Roblin and Kent Paschke

* Analyzing data from system: Kent Paschke and students

* Details: This involves re-installing the Hall A beam modulation system (air-core coils and associated control/drive electronics) that was used in PREX-I. All of the hardware exists. Having this in place and fully recommissioned is a must for PREX-II and CREX.

Discussion Points:

- Do we still need location information to be provided for the coils in the Hall A line?
- Is the work in the BSY electronics racks as simple as swapping the cables going to Hall C back to Hall A?
- Is there further software controls work to be done? (was done by Scott Higgins last time)

Hall A Beamline plan, slide 3

2. Qualification of BCM (beam charge monitoring) to standards needed for PREX-II and CREX
- * Hardware needed: Two "new-style" Musson digital receivers = \$10000
 - * Contact people: Roger Carlini, Mark Pitt, Kent Paschke
 - * Analyzing data from system: Mark Pitt and students, Kent Paschke and students
 - * Details: Given that the old 1 MHz analog system is failing, reliable charge monitoring to parity specifications needs to be established with the newly available digital receivers. This can be done during the upcoming running period by using the BCMs that are currently unused in the XYQ microwave cavity assemblies near the Hall A target. These can be instrumented with the new Musson receivers and read out and analyzed with the parity DAQ, without any interference with the running experiment. Having reliable beam charge monitoring with charge resolutions at least as good as obtained for Qweak is a must for PREX-II and CREX.

Discussion Points:

- Presumably we want these receivers sitting in the Hall A counting house? I noticed I didn't make that clear in this request. --- I may have missed the cost of cabling these up here...

Hall A Beamline plan, slide 4

3. Installation of third cavity monitor "coffin" assembly on the Hall A beamline

* Contact people: Roger Carlini and Mark Pitt

* Analyzing data from system: Mark Pitt and students, Kent Paschke and students

* Details: This request continues the process of installing the cavity monitor "coffin" that was obtained from the old G0/Qweak girder. It currently is on the Hall A floor and Ed Folts has a space allocated for it on the Hall A beamline. If cabling can be provided with FY2015 funds, then this can be tested during the next run with occasional use of one of the digital receivers requested above.

* Hardware needed:

** Solid State Relay and temperature control = \$1000

** Cable run from beamline to Hall A counting house (three signal cables and one control cable): \$5000

Discussion Points:

- As discussed later in this talk, from Roger's discussion with Ed it sounds like this coffin can go on the Hall A instrumentation girder between the other two existing XYQ coffins.

Hall A Beamline plan, slide 5

4. Qweak halo monitor

* Contact people: Roger Carlini, Yves Roblin, and Mark Pitt

* Analyzing data from system: Mark Pitt and students

* Details: This would involve moving the Qweak halo target chamber to the Hall A beamline in a spot Yves Roblin found ~ 2 meters upstream of the Hall A target. It would be instrumented with existing Qweak halo monitor PMTs. A new target would have to be made, but that is a simple piece of aluminum with holes. The goal is to provide a reliable quantitative measurement of the amount of halo on the high energy beam.

It is important to note that this assembly was farther from the target during Qweak. With the presently proposed location, halo measurements could probably only be done with the Hall A target out. But this would be a good starting point, and it could be relocated later.

* Hardware costs:

** There would be some cost associated with the cabling, but we have not estimated it yet.

Discussion Points:

- As discussed later in this talk, from Roger's discussion with Ed it sounds like this could go on a sturdy girder near the hall entrance (suitable for lead shielding for the halo monitor detectors) much further from the target than I envisioned above (ie. no need for the relocation mentioned here)

Hall A Beamline plan, slide 6

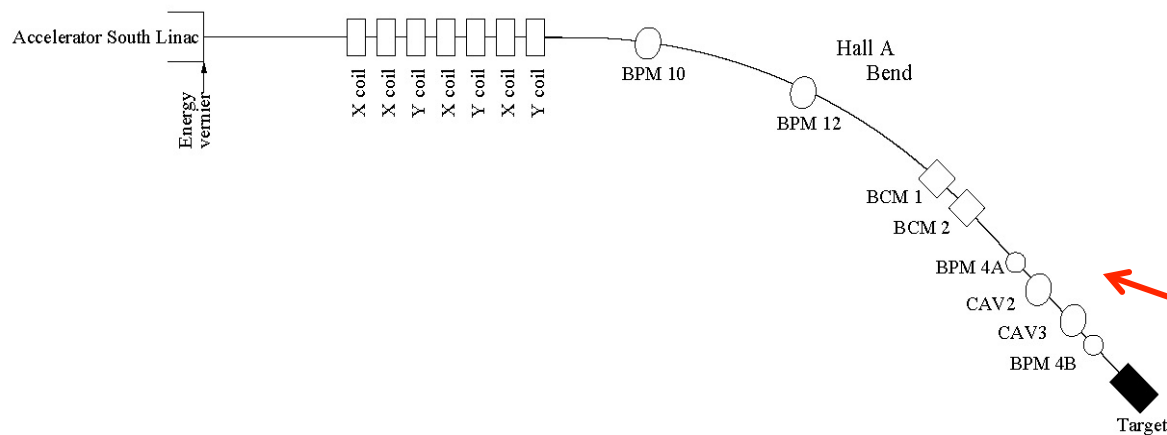
For FY2016 (for installation during the next down after this one)

1. Complete installation and or purchase of any items from the above list
2. Equip the newly installed coffin on the beamline with three beam charge monitors. This will allow definitive charge resolution studies (with no concerns about interfering apertures) which is important for both PREX/CREX and MOLLER. Having a three BCM cavity coffin (QQQ) was very useful for Qweak.
The installation and costs are:
 - ** Remove (and save) the two cavity position monitors from the existing XYQ cavity. The coffin would need to temporarily be moved to John Musson's lab where he could install two new BCM cavities.
 - ** Cost estimate from conversation with John Musson on 6/4/2015:
 - *** Two new BCM cavities: $\$10,500 \times 2 = \$21,000$(Note: it is assumed here that at least one new Musson digital receiver (\$5000), the Solid State Relay and Temperature Control (\$1000), and the cable run from the beamline to Hall A counting house (\$5000) were already complete when requested earlier in the list).

Discussion Points:

- In the currently proposed configuration (see later in this talk), the above may not be necessary because the new configuration will give us three BCMs all on the same girder with no(?) small apertures in between.

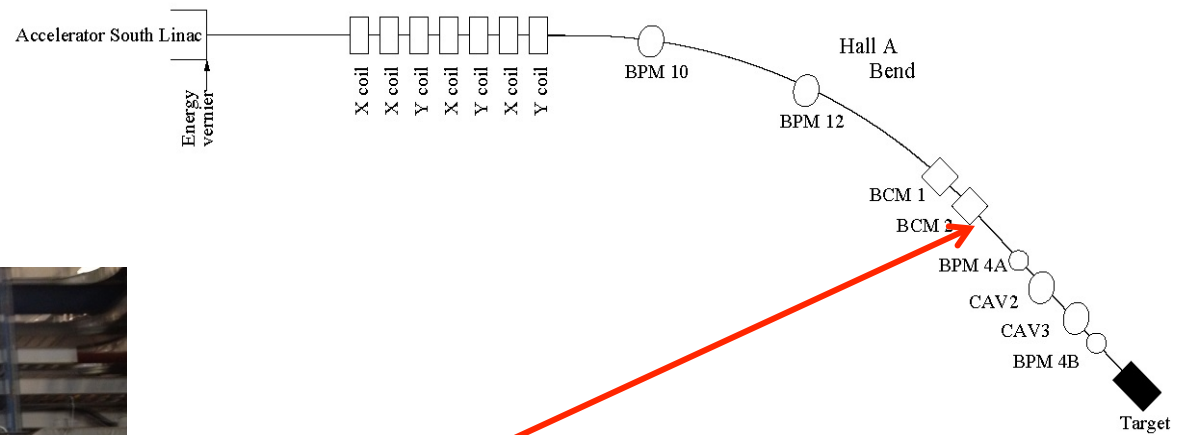
Roger/Ed discussion, slide 1



Roger/Ed discussion: The XYZ cavity coffin on floor of Hall A could go in between the existing two XYQ assemblies (CAV2 and CAV3) on the Hall A instrumentation girder upstream of target

- Involves removing the unused tungsten calorimeter
- Many upsides: no steering elements in between things, two striplines (BPM 4A/4B) for cross comparison; three BCMs in a row; three XY cavities in a row for resolution measurement (it would be good to get details on the spacing of the monitors)
- Any downsides?

Roger/Ed discussion, slide 2



Qweak halo monitor target ladder and halo detectors could go here, just downstream of BCM2 and about 15 feet from the entrance to the Hall

Adequate support for lead shielding for the halo detectors; good distance (from the target; much further than we had during Qweak

Where is fast raster in Hall A? (Mark's question)