Fall 17-Spring 18 BCM Overview and Parameter Recommendations

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Feb 7, 2019

Summary

- We started Hall C physics while commissioning the BCMs. There were problems with the BCM hardware, problems with interaction with the newly agile accelerator frequency, problems getting the accelerator to “high” currents, etc.

- Customers should use BCMs which are labelled in the Hall C analyzer that period as BCM4A (1st choice) or BCM4B (2nd choice) or BCM17 (3rd choice).

  (BCM1 or BCM2 were unusable for physics since they were too unstable.)

- Using Deepak’s wire calibration and Deb’s global bcm calibration, we can achieve consistency on cut charge to 1%. The final error bar on BCM4A charge will probably be between 1% and 2%.

- None of the recommended BCM channels worked flawlessly. Using the Hall C analyzer names from the 17-18 period:

  i. The on-line default for charge was BCM4A . That was a good choice, **but be aware it saturates above 75 muA** .

  ii. BCM4B was noticeably noisier than the other channels. That extra noise mostly goes away after a few minutes of integration.

  iii. BCM17 had a stuck tuner, so it might show some percent-scale drifts on few minute time scales. It also has some atypical nonlinearity (0.5%) below 20 muA.

Hall C Analyzer Name That Run Period	True Name of Cavity Patched In	Electronics Setup	RF Cable Setup	Follow up done after the run:
BCM4A	**BCM4A**	Digital receiver	½" heliax (tempco marginal)	Add 2-3dB of attenuation to the input to the DR. (In winter 2018, this channel saturated around 75 muA.)
BCM4B	**BCM4C**	Digital receiver	½" heliax (tempco marginal)	Has 1%/√Hz uncorrelated noise wrt all other channels. Still useful after a little integration, but it would be nice to fix this.
BCM17	**BCM4B**	Digital receiver	½" heliax (tempco marginal)	*Stuck tuner was repaired in Summer 2018. Thanks. (*We expected the gain of this channel to be a little more unstable than the other two DR's, but it wasn't noticeable during Winter 2018.)
BCM1	**BCM1**	Analog receiver, gain setting 3	7/8" heliax	For Mack: Debug instability. Needs bottoms up check. Could be LO, tight filters, rad-damaged cables, DC block, etc.
BCM2	**BCM2**	Analog receiver, gain setting 3	7/8" heliax	For Mack: Debug instability. Blah blah blah

Use these

Do not use these

Deb's Global fit of the 4 BCM calibration runs:

Hall C analyzer name	Chi2/ndf	P1 (Hz/muA)	dP1 (Hz/muA)	Gain Error (%)		P0 (Hz)	dP0 (Hz)	dP0 (muA)		Calculated Beam Off Offsets (muA)
~~BCM1~~	~~21.3~~	~~4926~~	~~7.03~~	~~0.14%~~		~~2.479E+05~~	~~209~~	~~0.042~~		~~0.4~~
~~BCM2~~	~~34.8~~	~~4232~~	~~6.04~~	~~0.14%~~		~~2.478E+05~~	~~180~~	~~0.043~~		~~0.5~~
BCM4A	1.51	1.302E+04	18.6	0.14%		432.4	553	0.042		0.4
BCM4B	0.97	6233	8.88	0.14%		377	265	0.043		1.1
BCM17	2.2	2053	2.93	0.14%		397.6	87.2	0.042		1.1

The advantage of using Deb's global fit is

- better precision
- better average gain and offset over the entire run (as opposed to using only the oddly 1.5% high March calibration).

Deb already checked in the global fit result for BCM4A for F2:

gBCM_Gain = 4795.0, 4092.0, 4000.0, 13020.0, 2042.0, 6238.0
gBCM_Offset = 250300.0, 250200.0, 393000.0, 432.4, 204.9, 127.8

You can start with the above, then include his global fit results for BCM4B and BCM17 as well (the name order for the 17-18 run period was bcm1,2,Unser,A,17,B):

gBCM_Gain = 4795.0, 4092.0, 4000.0, 13020.0, 2053.0, 6233.0
gBCM_Offset = 250300.0, 250200.0, 393000.0, 432.4, 397.6, 377.0

Extras

BCM Calibration	Number of points	Current Range	Comment
December	18	2.5-20	Single ramp
January	9	5-65	Single ramp
March	18	2.5-60	Two ramps
May	16	2.5-60	Two ramps

For a detailed list of BCM related hclog entries during this run period, including run numbers for the bcm calibrations, see other documents at this location:

https://hallcweb.jlab.org/doc-private/ShowDocument?docid=968 .

BCM Stuff Done for Fall17 – Spring18

What	Hall A	Hall C
Tie down RF cables	Done	Done
Put DR's on UPSs and Test	Done	Done
Replaced failed Unser UPS	Done (Thanks, Chuck)	n/a
Procure/Test/Install new Isources	Done	Done (Thanks, Deepak)
Install x10 amp on Unser to achieve 40 mV/muA	Done	n/a?
RF signal generator sweep	Done (with Nathaly)	Not Done
Computer control of new Isources	Done (Thanks, Nathaly, Doug, Software)	n/a
Find Unser FEE boxes in Halls	Done	Done
Install DMM in rack	n/a	Done
Install o-scope in rack	Done (Thanks, techs)	n/a
Get old Isource repaired	Done (Thanks, Chuck)	n/a
Unser wire calibrations	Done (Thanks, Nathaly)	Done (Thanks, Deepak and Debitwa)
Updated diagrams of BCM electronics with RF power budgets	Not Done	Not Done
Summarize BCM events that were reported in Elog	n/a	Done
List tweaks needed to bcm channels	n/a	Done