

# Parity Beam Tests

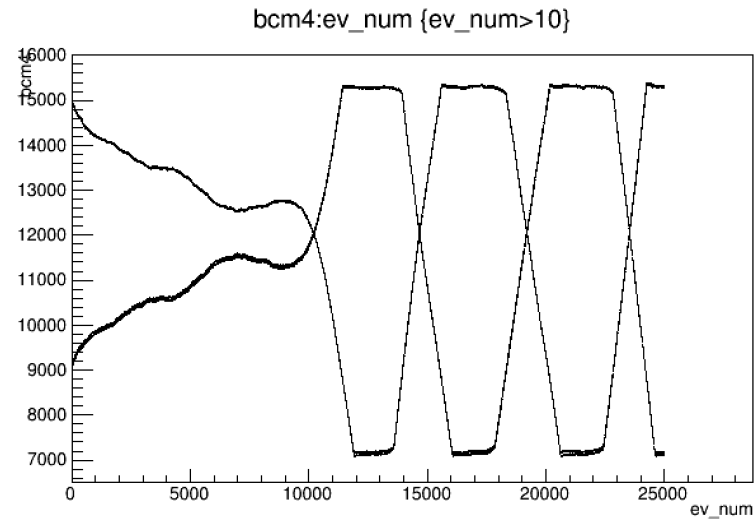
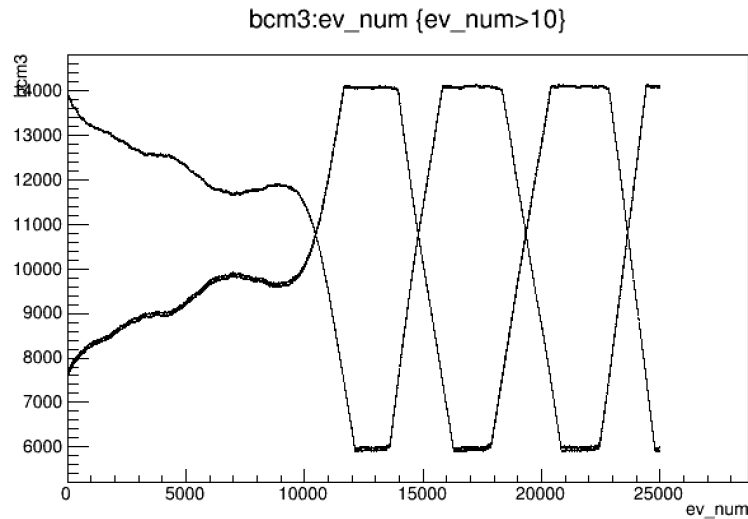
-Fall 2015-

Ciprian Gal, Kent Paschke UVa

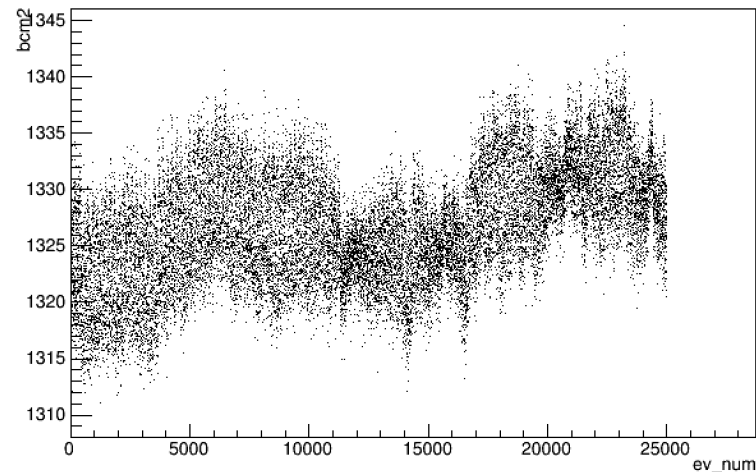
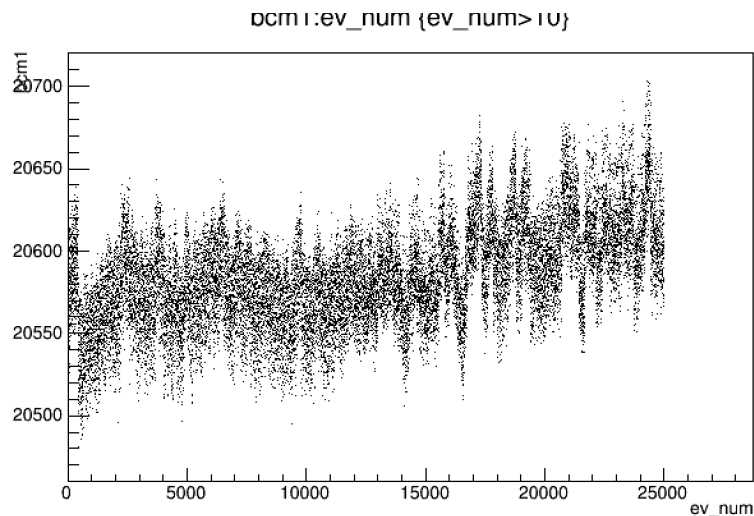
# Beam Test Progress

- DAQ (shake the rust off CH, injector still not tested)
- BCMs - noise issues (readout related?)
- BPMs - new pathology
- Halo monitor - detectors
- Small angle monitor

# BCMs: run 2159



1 MHz

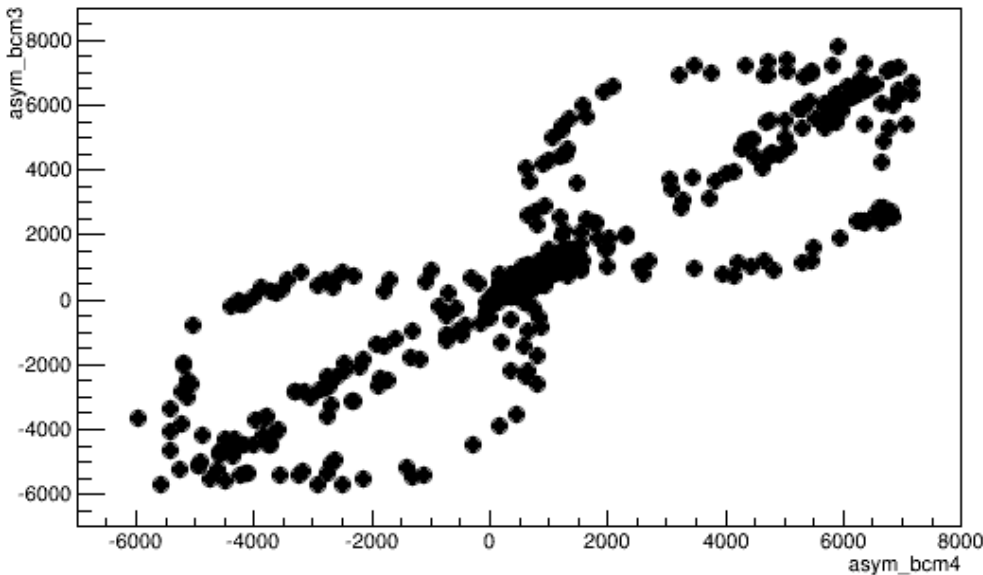


new Musson  
receivers

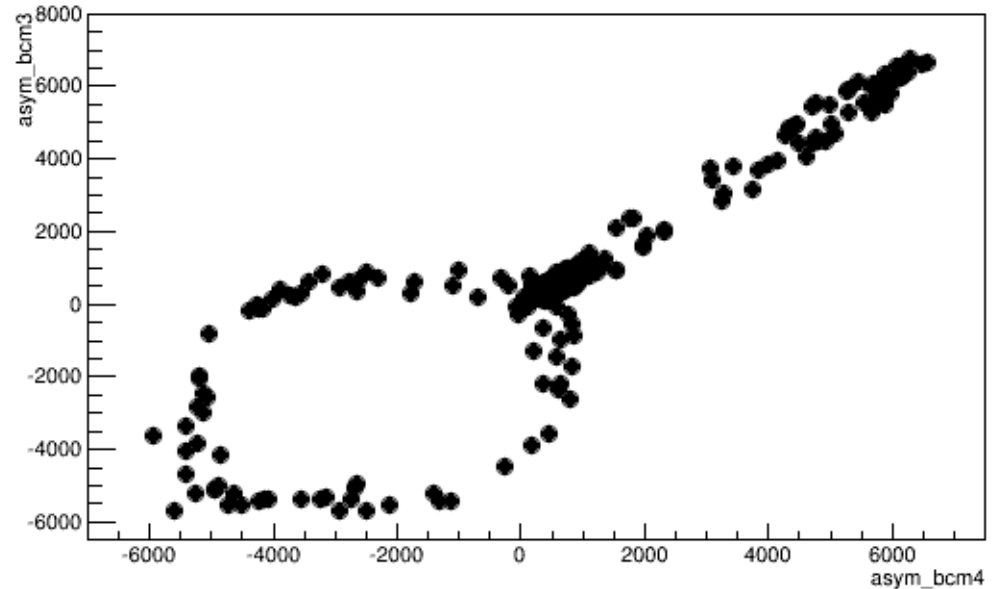
- This run was at  $\sim 40\mu\text{A}$  and 240Hz helicity flip rate
- While the new BCMs seems to show some stability they are considerably noisy

# BCMs: old 1MHz system

asym\_bcm3:asym\_bcm4 {ok\_cut&& m\_ev\_num>6000}



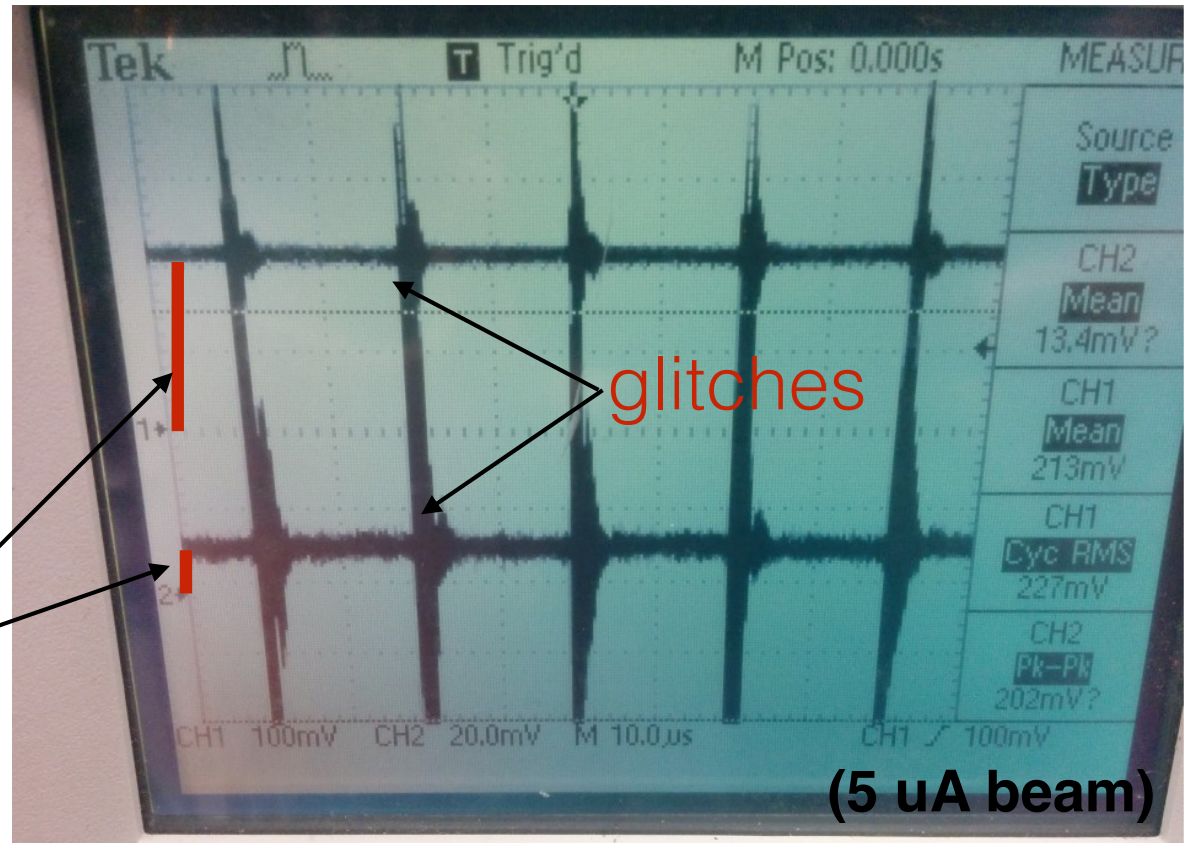
asym\_bcm3:asym\_bcm4 {ok\_cut&& m\_ev\_num>6000&& evt\_pairsynch[0]==0}



- This system showed some odd oscillations: <https://logbooks.jlab.org/entry/3368166> (older run)
- This was not studied in detail (they are in the data stream for all the runs)



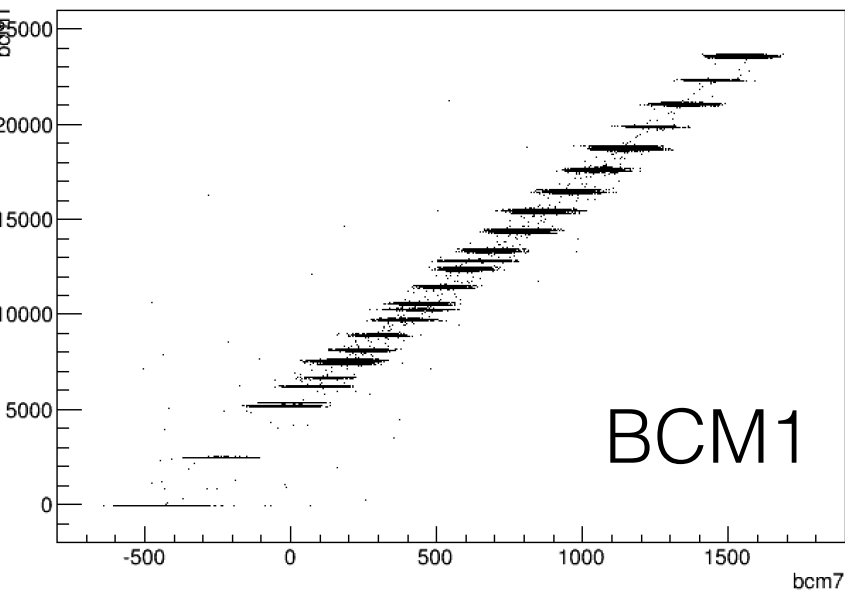
# BCMs: new Musson receivers



- The new cables are plugged into DAC outputs 1 and 3 from the receiver box (confirmed by JM to be correct)
- JM thinks that: *Looks like we have the right outputs, but need to lower receiver gain (we are clearly saturating). I will try to find the EPICS control screen over the weekend, and if there is a convenient access, perhaps i can inject a representative signal.*
- We should follow up with him to see if we can get this debugging done ASAP

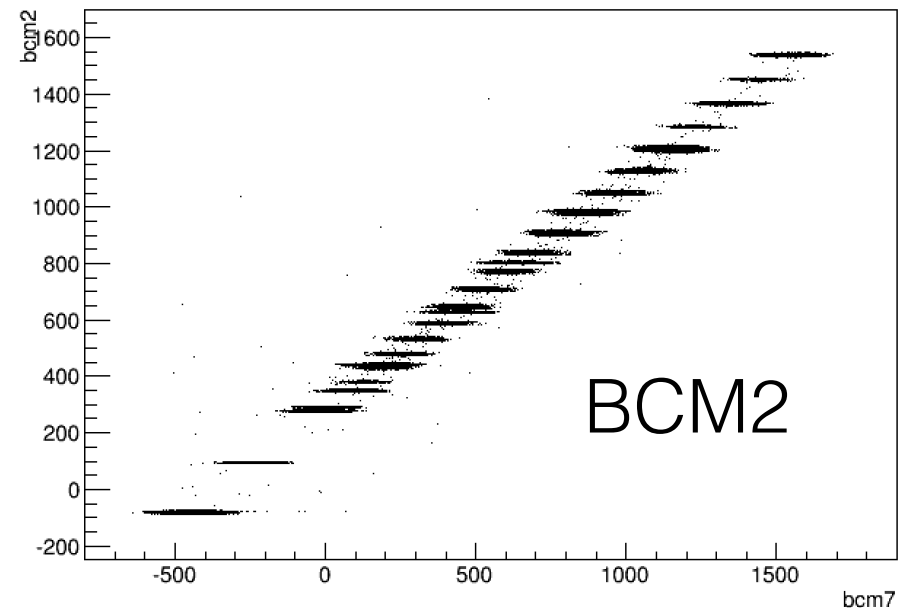
# BCMs: run 2122 - new receivers

bcm1:bcm7 {!cond\_startup && bcm1>-500}



~2 V  
@40  $\mu$ A

bcm2:bcm7 {!cond\_startup && bcm2>-500}



~120 mV  
@40  $\mu$ A

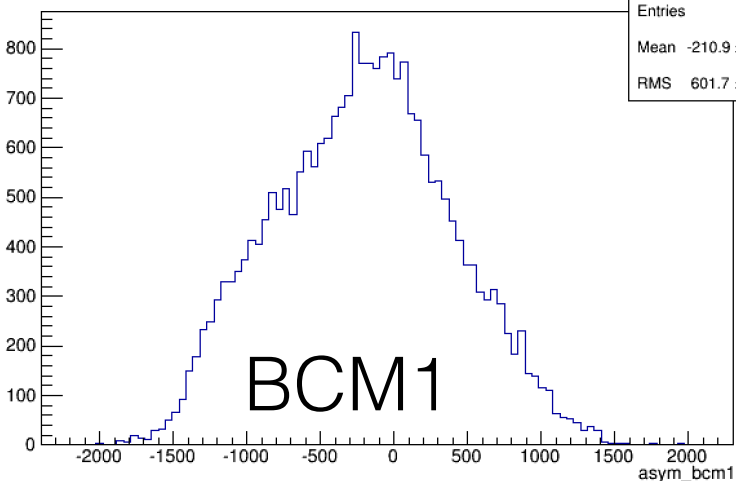
- even though JM said that we are saturating the receiver, the output from both BCMs is proportional with current

Signal size different between two bpms by ~10x

# BCMs: run 2159 - new receivers

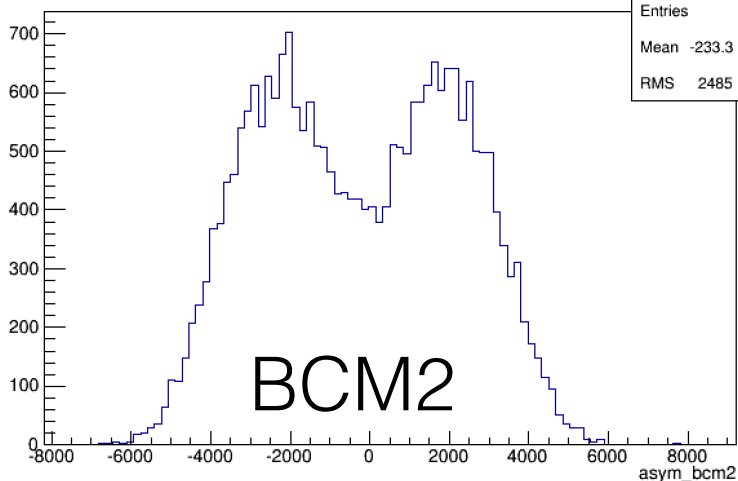
asym\_bcm1 {!cond\_startup && evt\_bcm1[0]>10000 && evt\_bcm1[1]>10000}

Entries 24978  
Mean  $-210.9 \pm 3.807$   
RMS  $601.7 \pm 2.692$



asym\_bcm2 {!cond\_startup && evt\_bcm1[0]>10000 && evt\_bcm1[1]>10000}

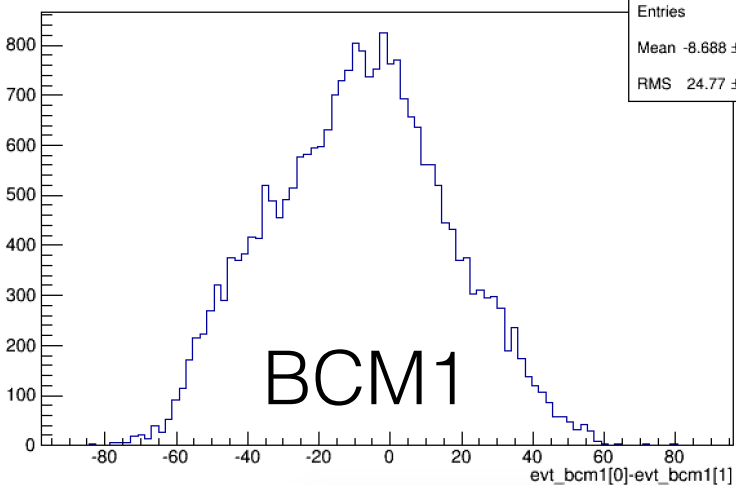
Entries 24978  
Mean  $-233.3 \pm 15.72$   
RMS  $2485 \pm 11.12$



asymmetry

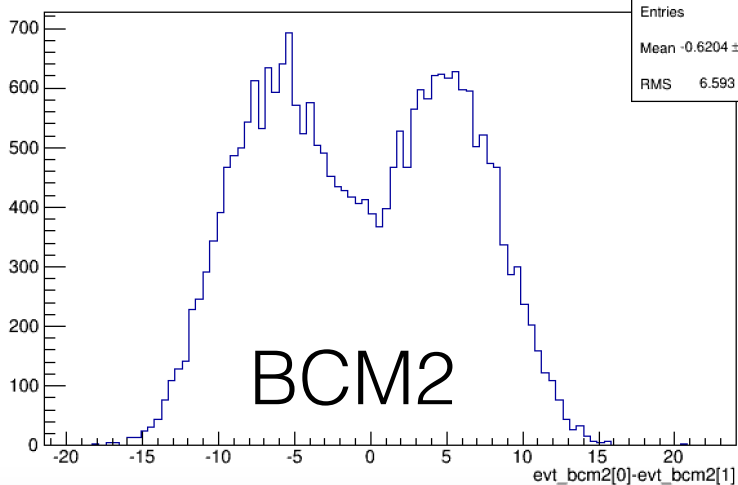
evt\_bcm1[0]-evt\_bcm1[1] {!cond\_startup && evt\_bcm1[0]>10000 && evt\_bcm1[1]>10000}

Entries 24978  
Mean  $-8.688 \pm 0.1567$   
RMS  $24.77 \pm 0.1108$



evt\_bcm2[0]-evt\_bcm2[1] {!cond\_startup && evt\_bcm1[0]>10000 && evt\_bcm1[1]>10000}

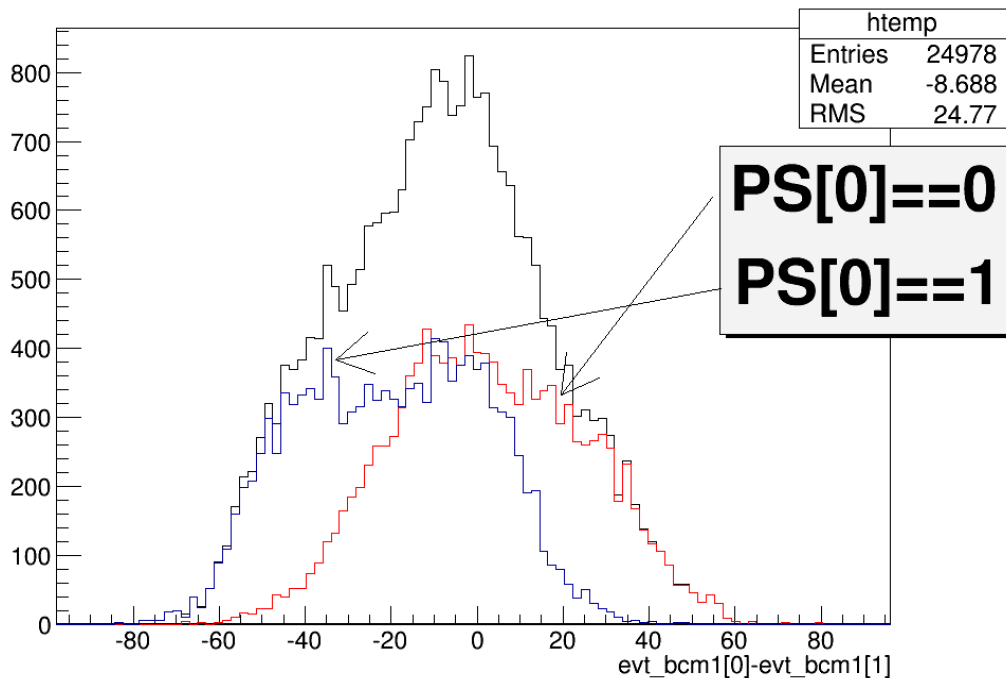
Entries 24978  
Mean  $-0.6204 \pm 0.04172$   
RMS  $6.593 \pm 0.0295$



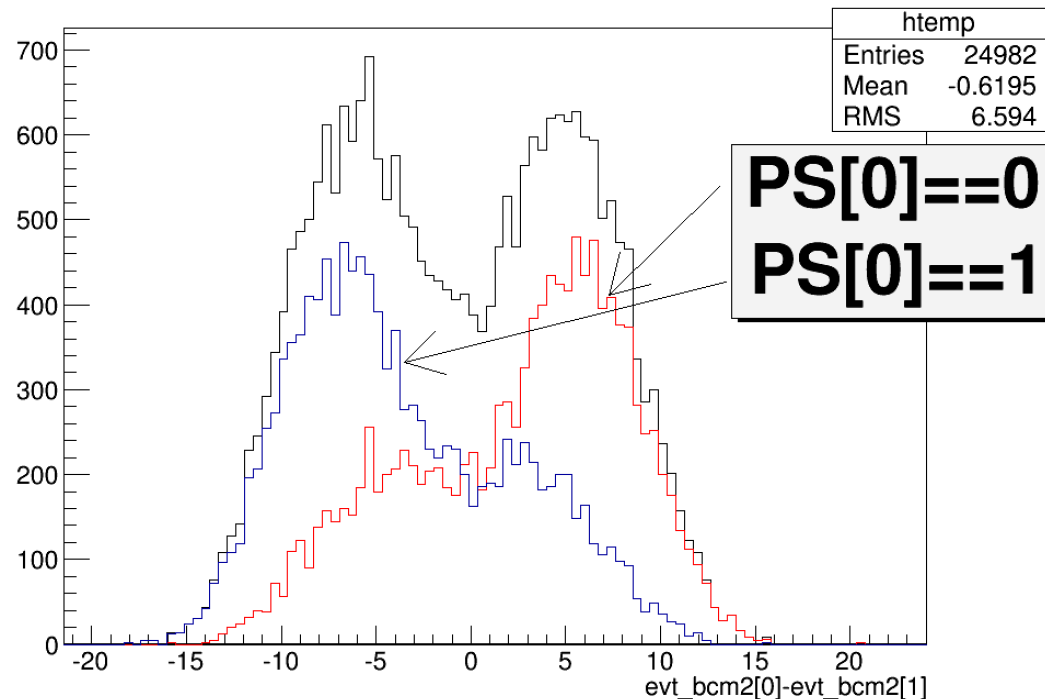
difference

# BCMs: run 2159 - new receivers

evt\_bcm1[0]-evt\_bcm1[1] {!cond\_startup && evt\_bcm1[0]>10000 && evt\_bcm1[1]>10000}



evt\_bcm2[0]-evt\_bcm2[1] {!cond\_startup && evt\_bcm2[0]>1000 && evt\_bcm2[1]>1000}

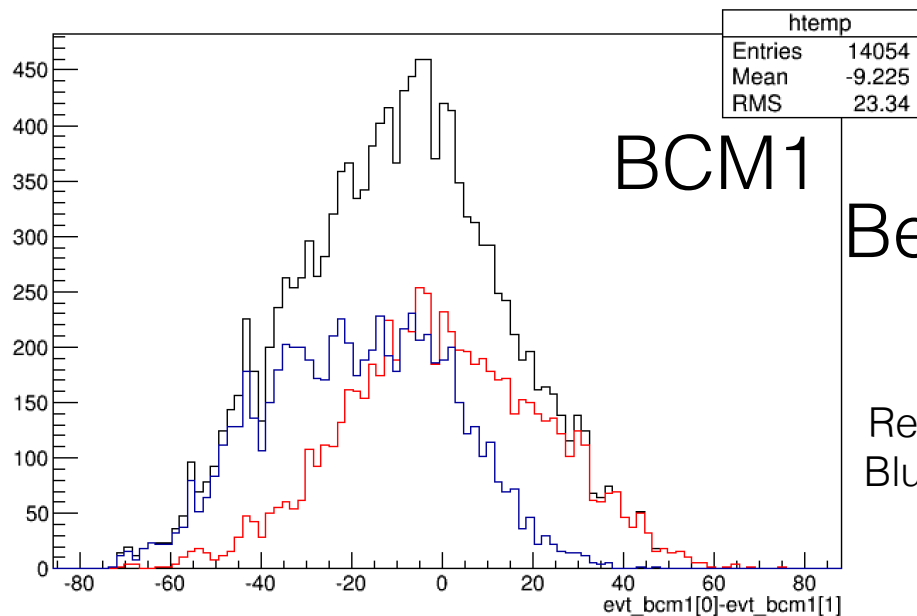


- The double peaking in BCM2 is present in BCM1 as well

**Double-peaking due to Pairsynch pickup?**  
**In our DAQ only, but then not constant in time?**

# BCMs: run 2158 - new receivers

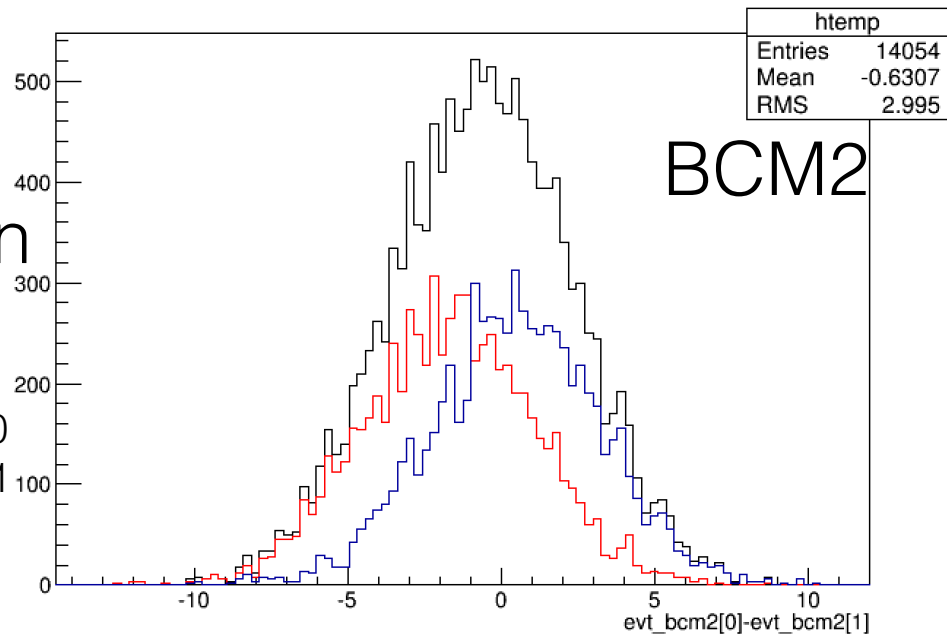
evt\_bcm1[0]-evt\_bcm1[1] {cond\_startup && evt\_bcm1[0]>10000 && evt\_bcm1[1]>15000}



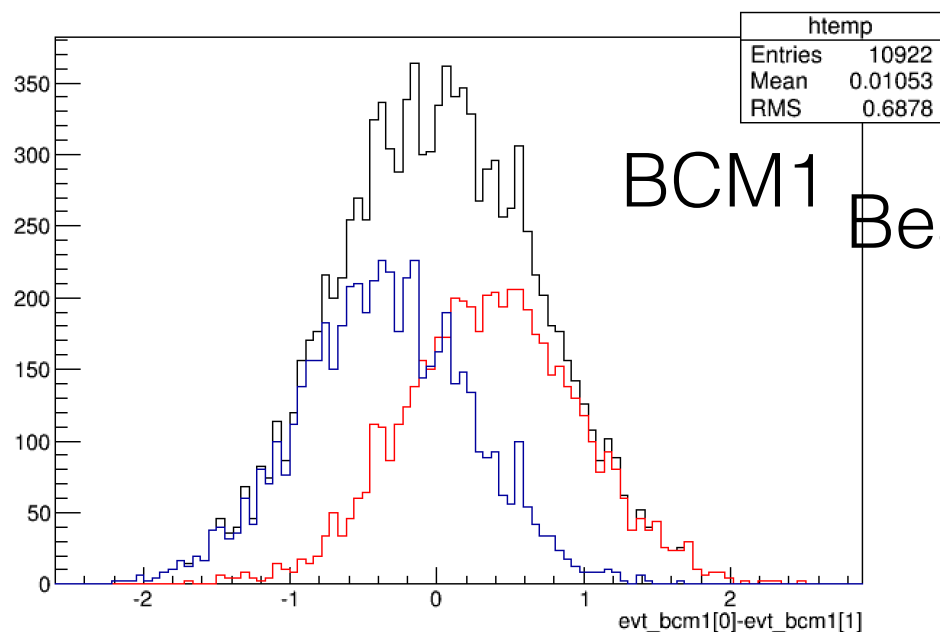
Beam On

Red PS[0]==0  
Blue PS[0]==1

evt\_bcm2[0]-evt\_bcm2[1] {cond\_startup && evt\_bcm2[0]>1000 && evt\_bcm2[1]>1000 && evt\_bcm2[0]>-100 && evt\_bcm2[1]>-100}

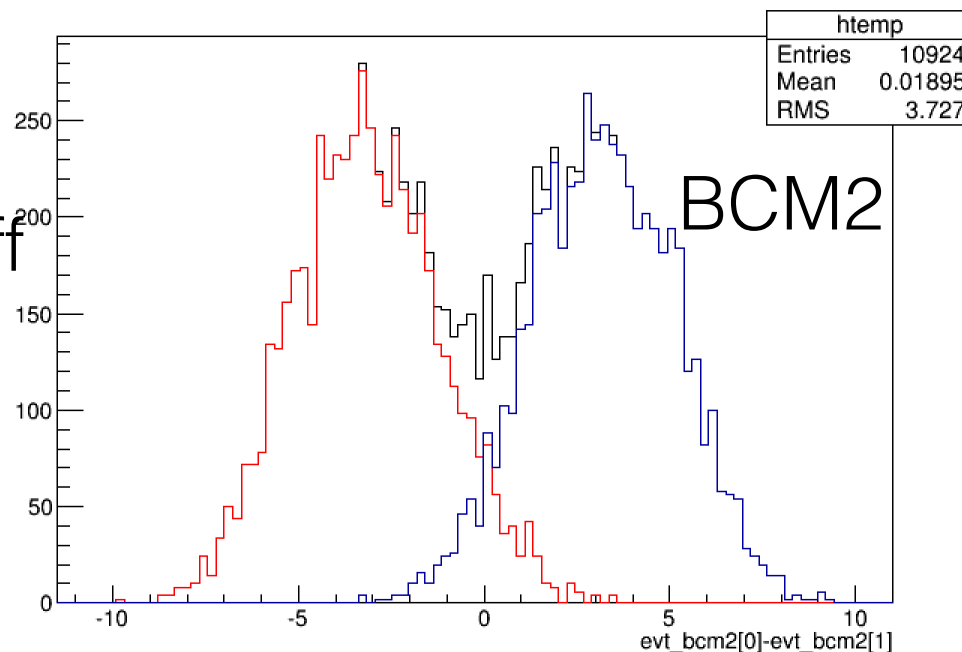


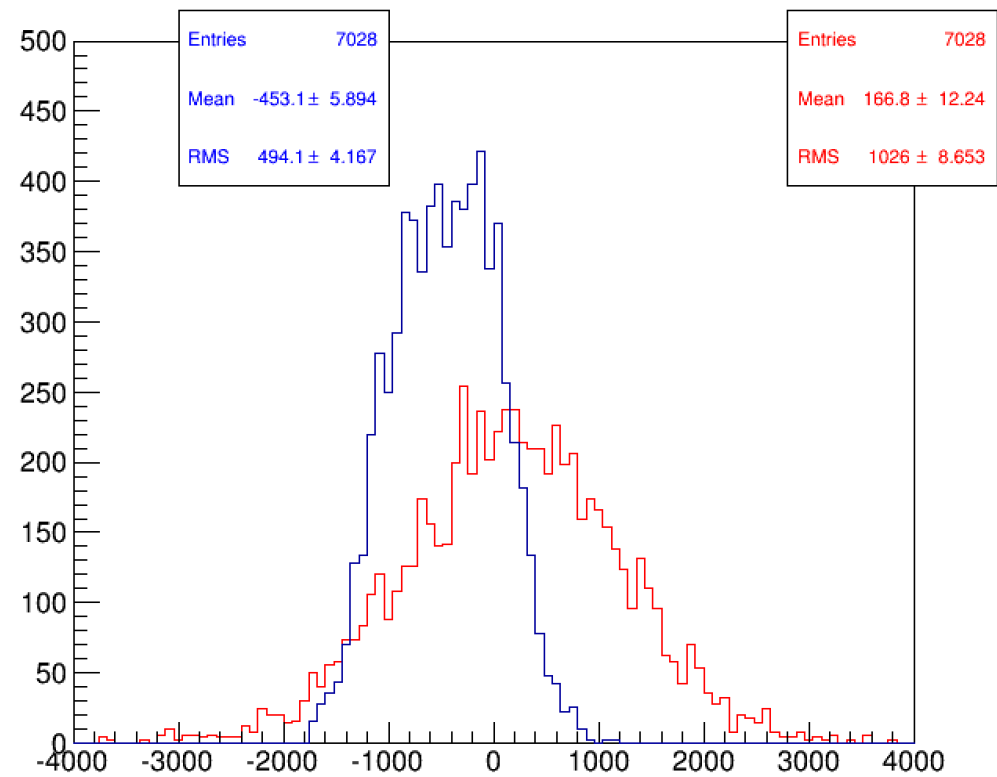
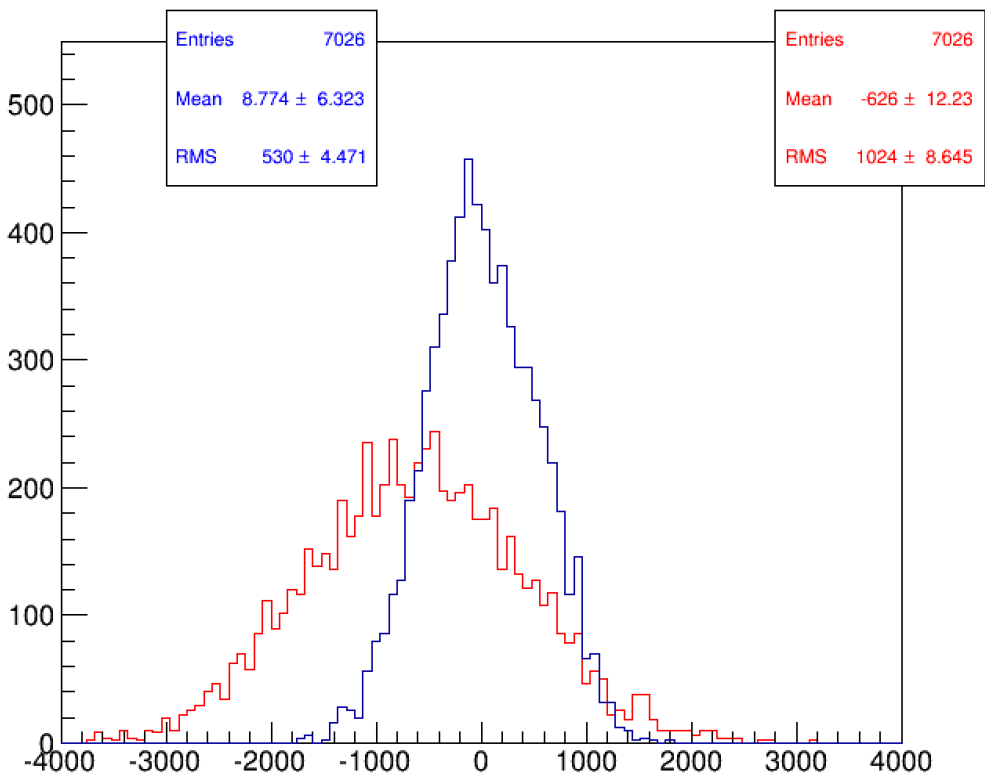
evt\_bcm1[0]-evt\_bcm1[1] {cond\_startup && evt\_bcm1[0]<5000 && evt\_bcm1[1]<5000 && evt\_bcm1[0]>-100 && evt\_bcm1[1]>-100}



Beam Off

evt\_bcm2[0]-evt\_bcm2[1] {cond\_startup && evt\_bcm2[0]<200 && evt\_bcm2[1]<200 && evt\_bcm2[0]>-100 && evt\_bcm2[1]>-100}

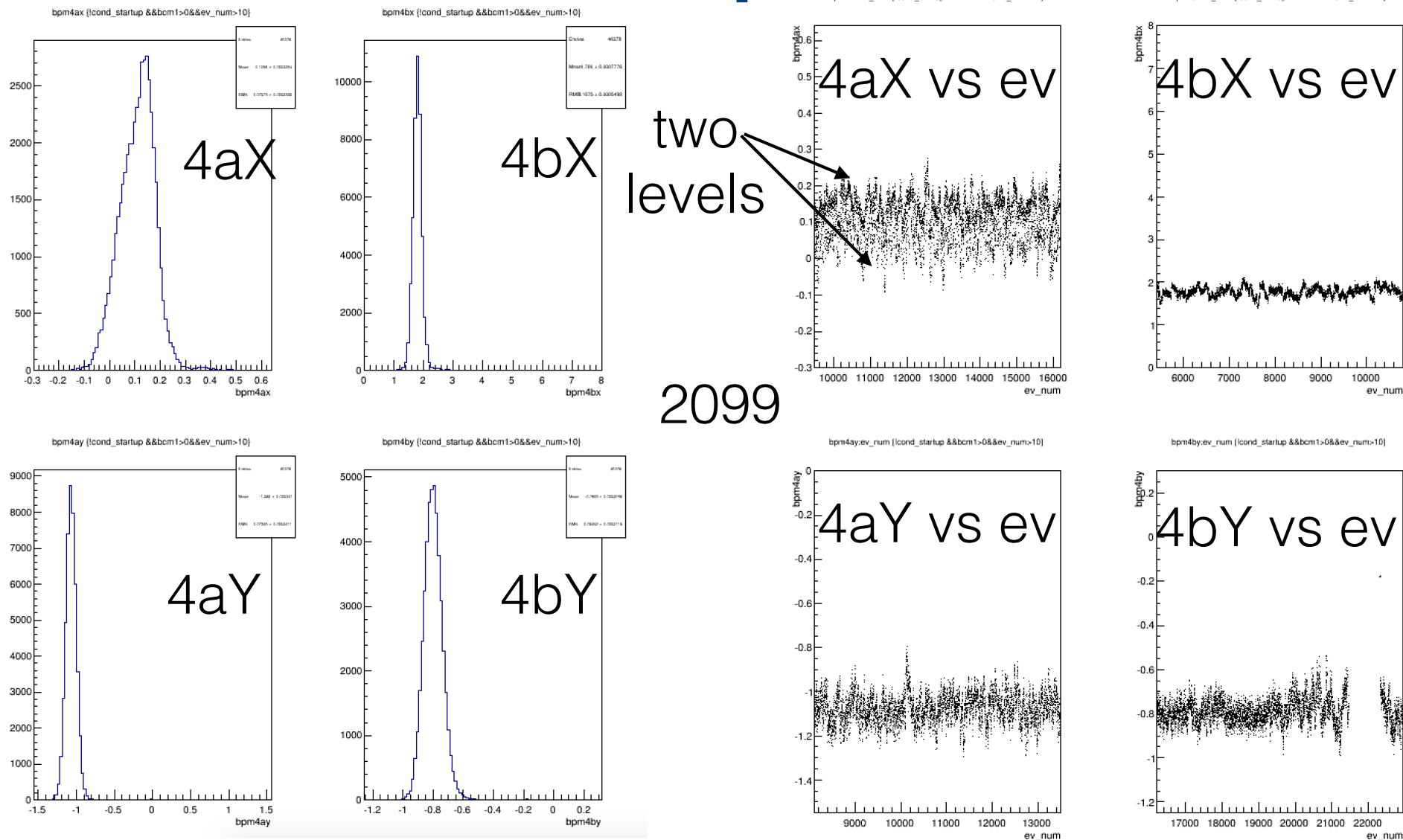




# BCMs: TODO

- The new Musson triplets were not working for this fall (they just required a firmware update and we hope to have them up and running for the spring)
- Understand what were the problems with the old 1 MHz system
- Make sure the noise on the new BCMs is not coming from our DAQ
  - measure the noise width without beam/without cable and compare to what we had during the run
- Work with Musson to make sure the new receivers get debugged before the spring run

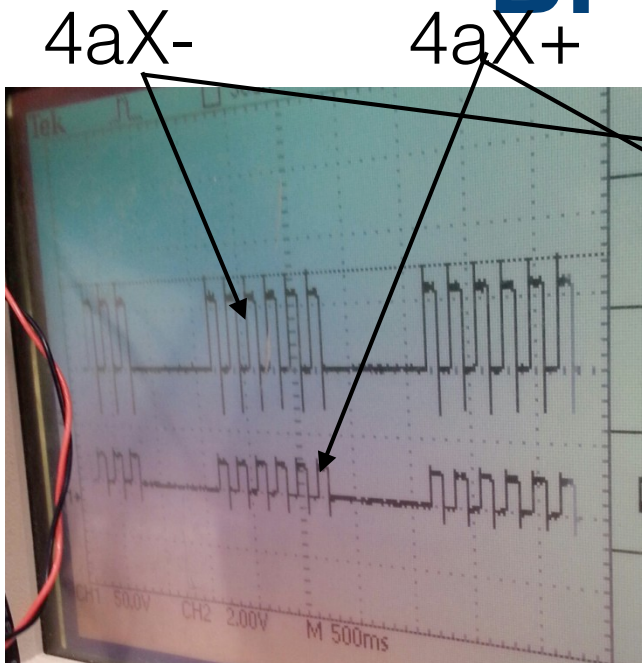
# BPMs: scoped signals



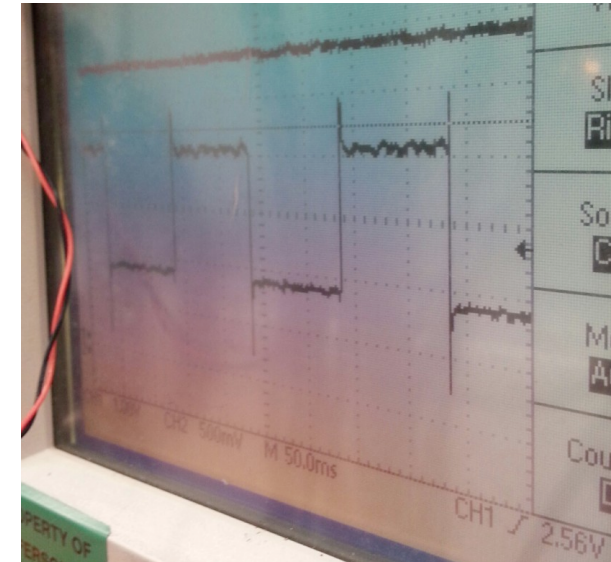
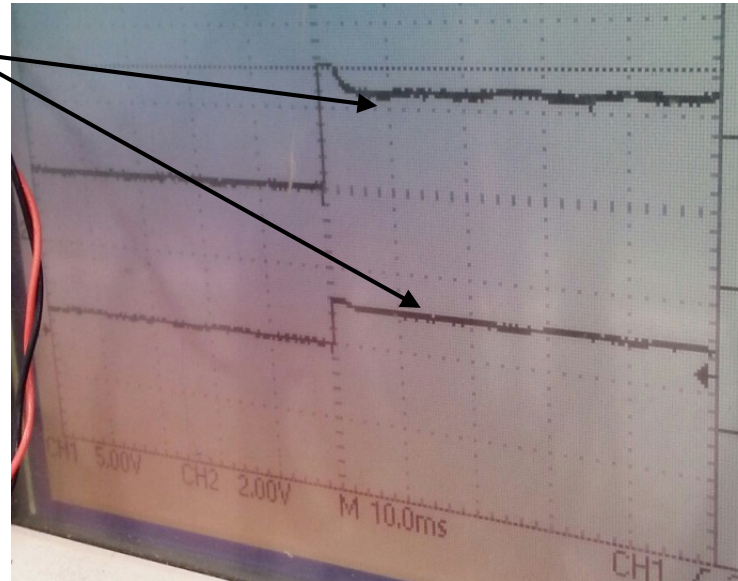
- Caryn and Paul did some preliminary analysis looking at early runs and saw some odd behavior



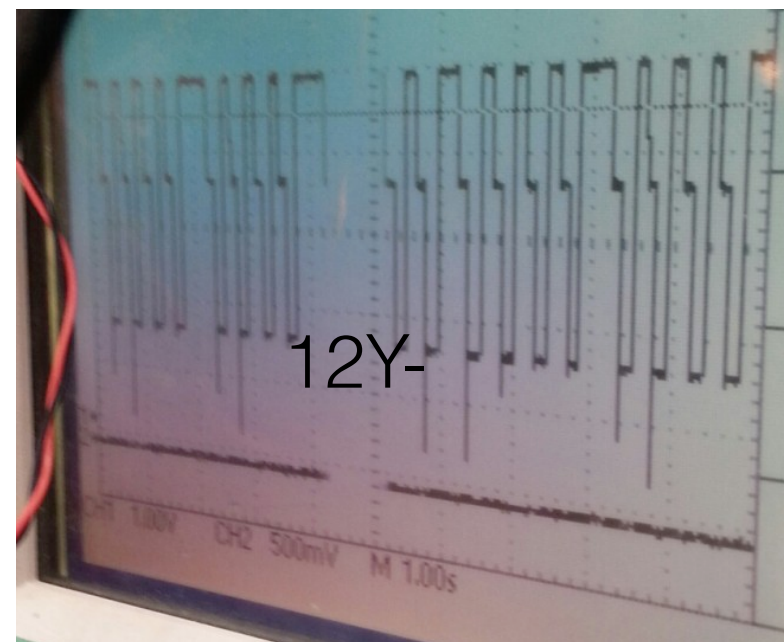
# BPMs: scoped signals



4bX showed similar behaviour



4b compare triggering on 4a

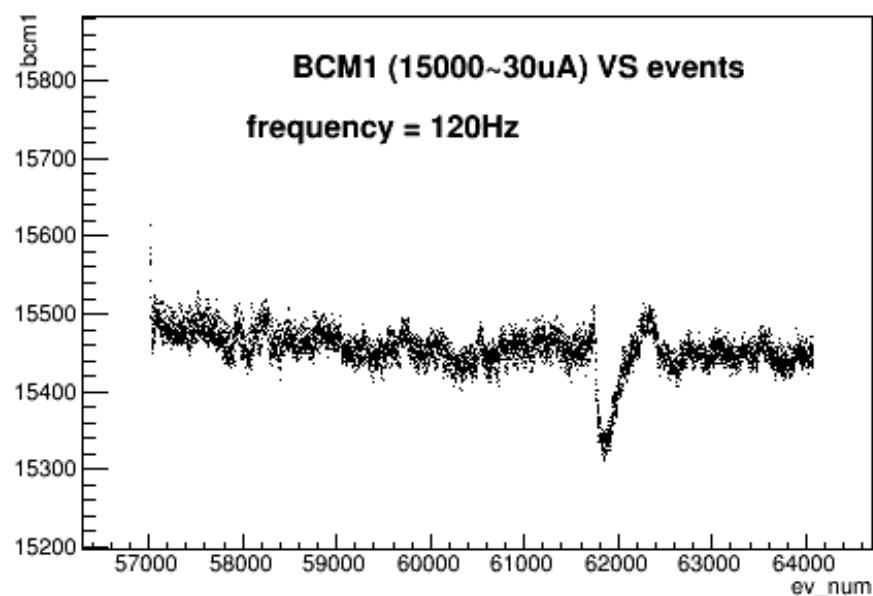


12Y-

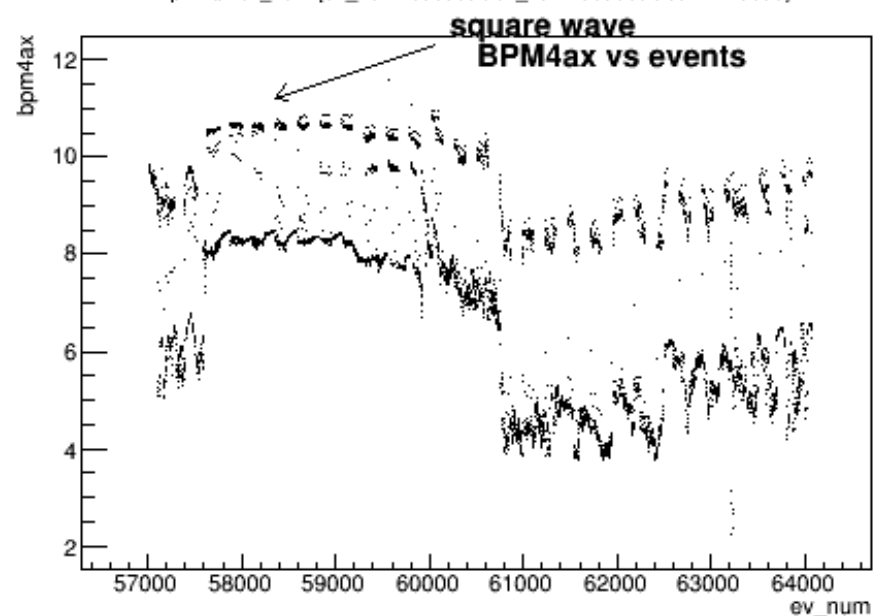
- looking at the signals on the scope we could indeed see two levels
- only this time 4b showed similar features
- looking at BPM 12 things looked significantly different

rest of 12 BPM channels looked the same

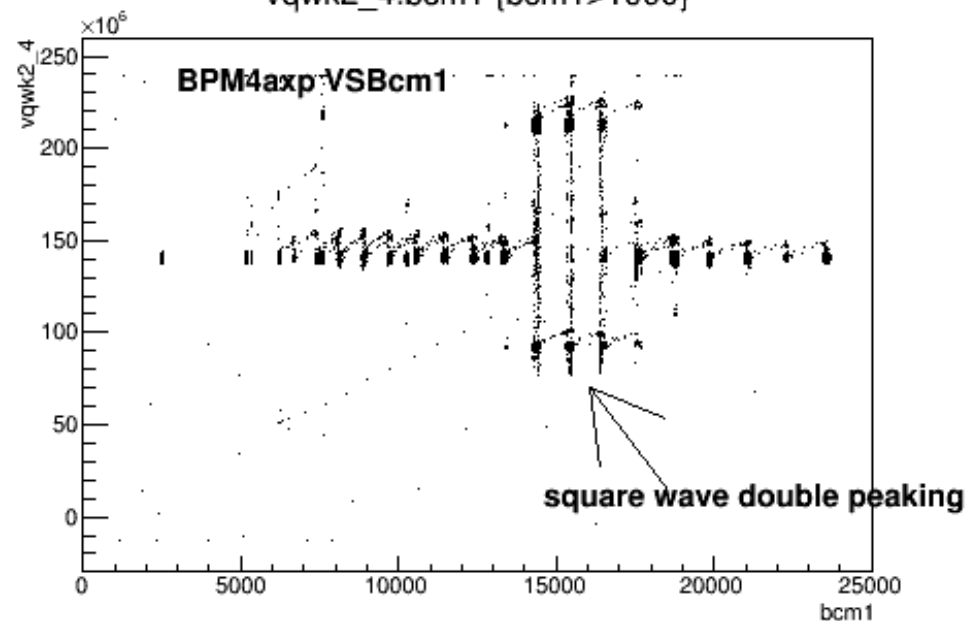
bcm1:ev\_num {ev\_num>56000&&ev\_num<68000&&bcm1>10000}



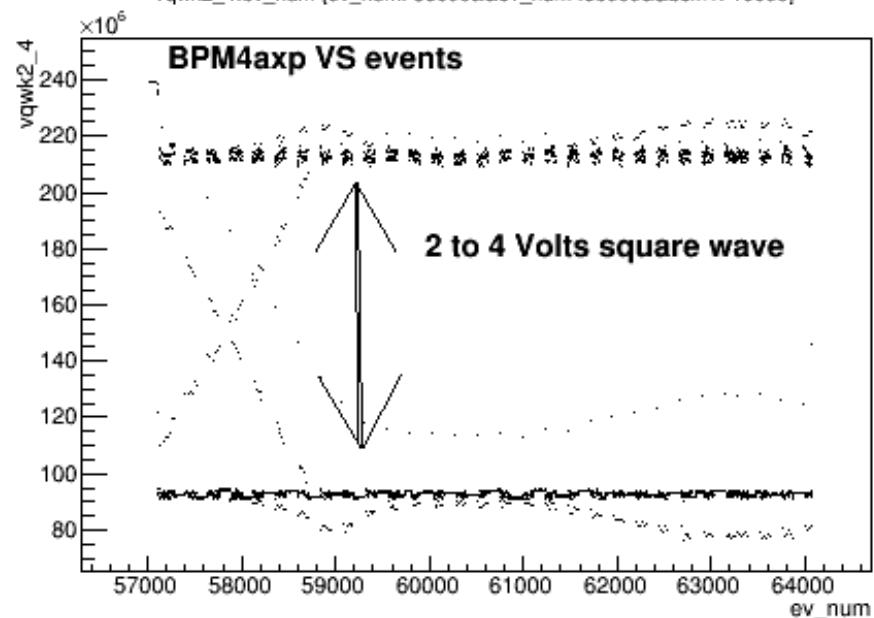
bpm4ax:ev\_num {ev\_num>56000&&ev\_num<68000&&bcm1>10000}



vqwk2\_4:bcm1 {bcm1>1000}

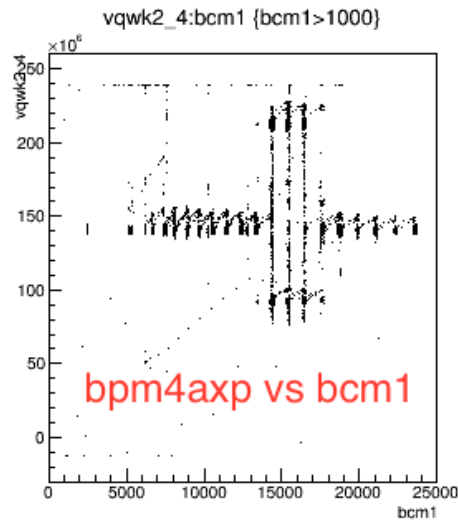


vqwk2\_4:ev\_num {ev\_num>56000&&ev\_num<68000&&bcm1>10000}

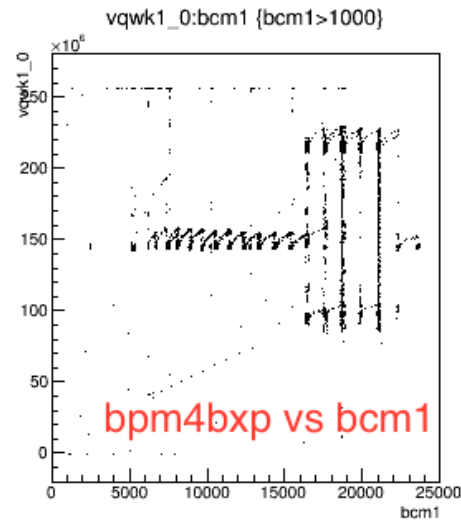


Run, during current ramp.

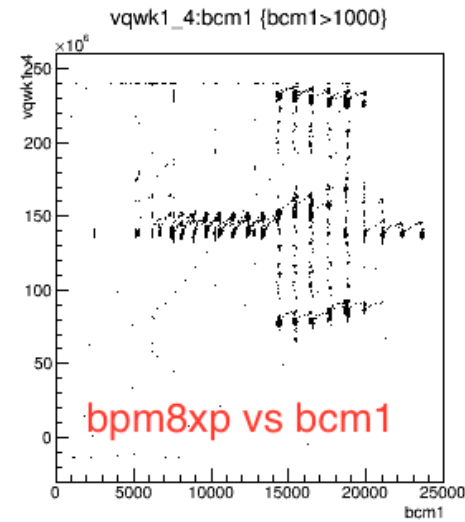
~25-28uA



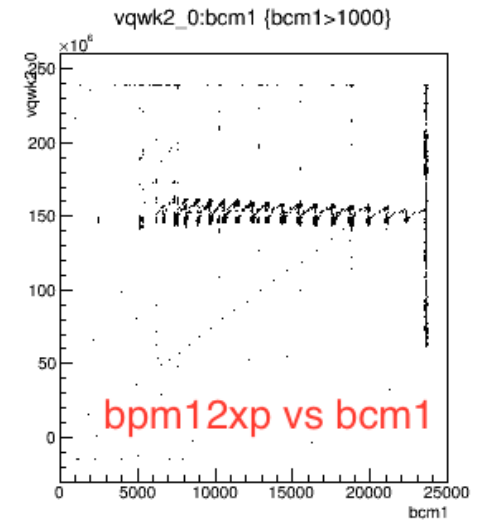
~25-32uA



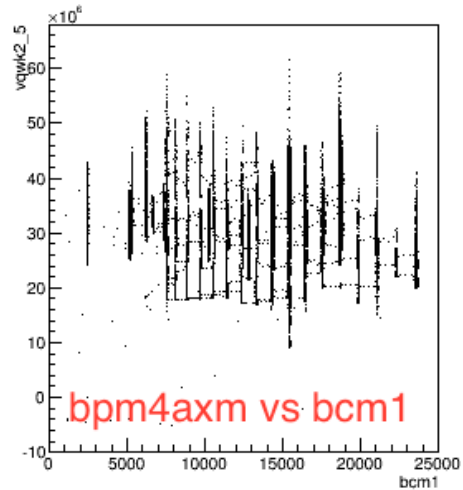
~25-32uA



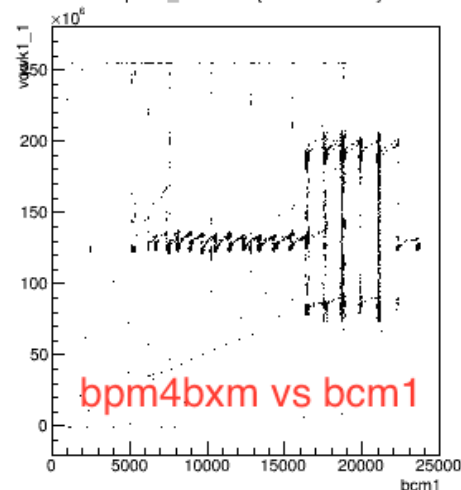
~40uA



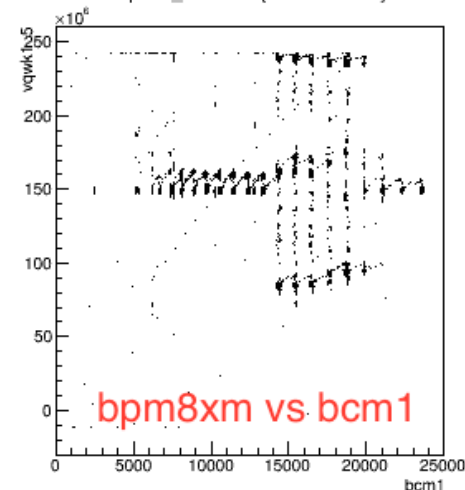
vqwk2\_5:bcm1 {bcm1>1000}



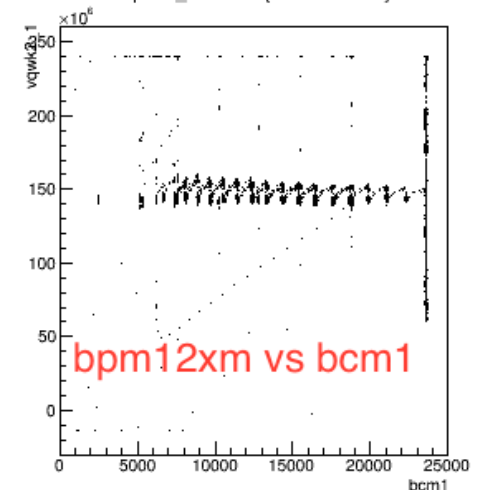
vqwk1\_1:bcm1 {bcm1>1000}

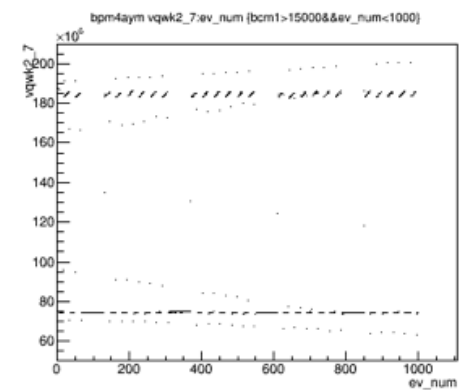
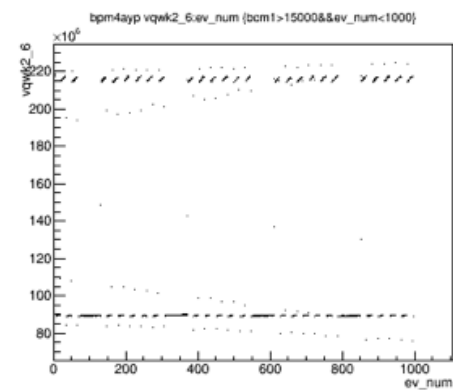
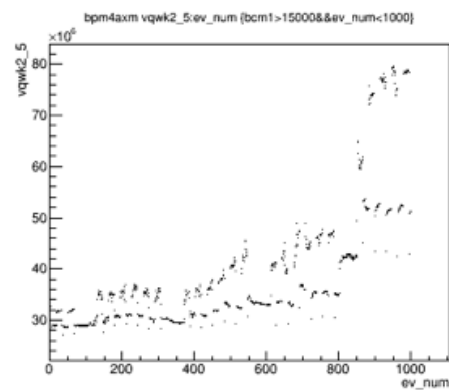
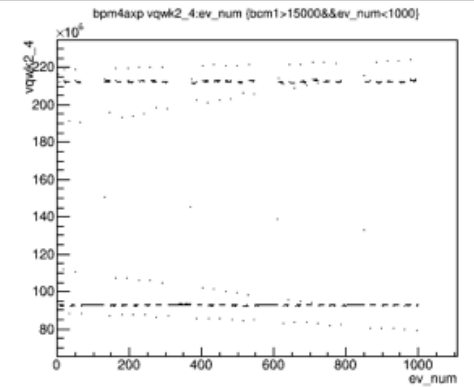
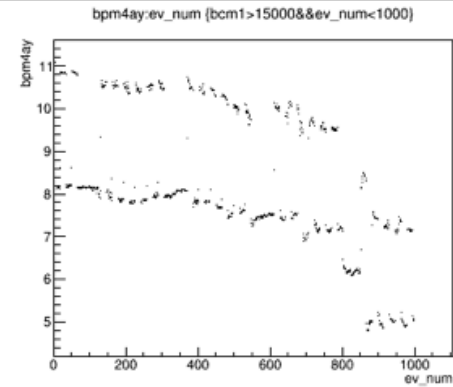
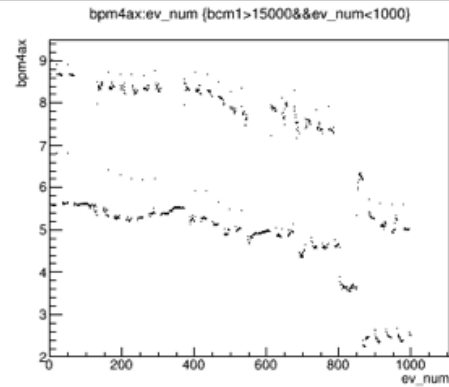
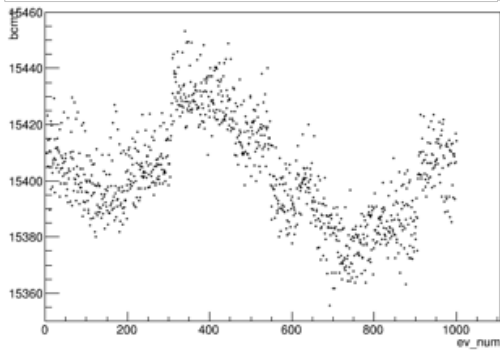


vqwk1\_5:bcm1 {bcm1>1000}



vqwk2\_1:bcm1 {bcm1>1000}





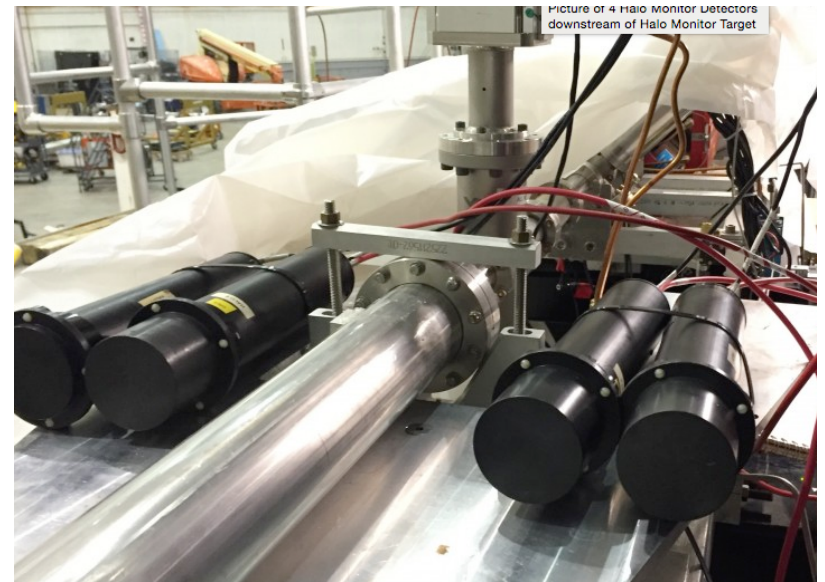
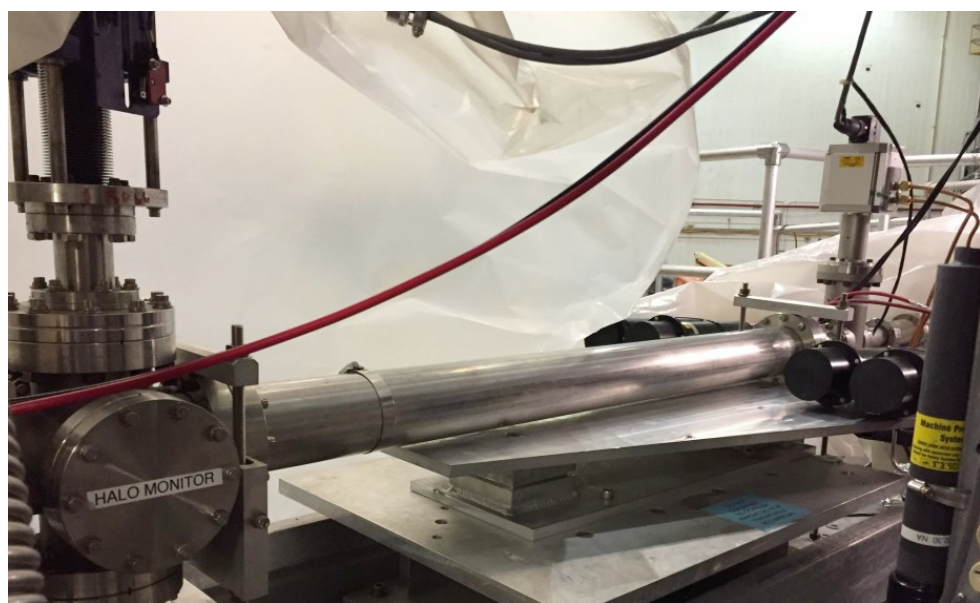
**note: 1h04a xm signal 2-7x smaller than 1h04a xp signal**

# BPMs: TODO

- Analyze all the data we have and see how the different settings for the beam change the output
- Different wires have different patterns on the scope signals — we need to understand where this comes from
  - We may want to check the other end of the BPMs and see how signals look there
- Autogain values for BPMs: <https://logbooks.jlab.org/entry/3368574> (Tyler took a run with forced gains and no beam which should be analyzed — run#??) — this should give us pedestal values for the BPMs

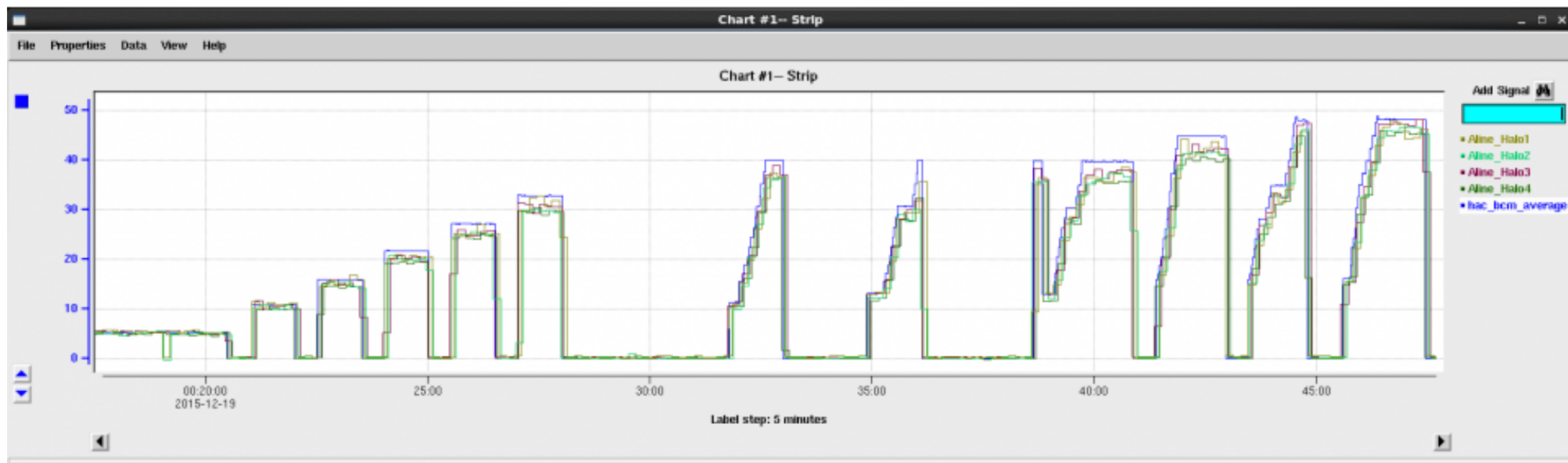


# Halo monitors

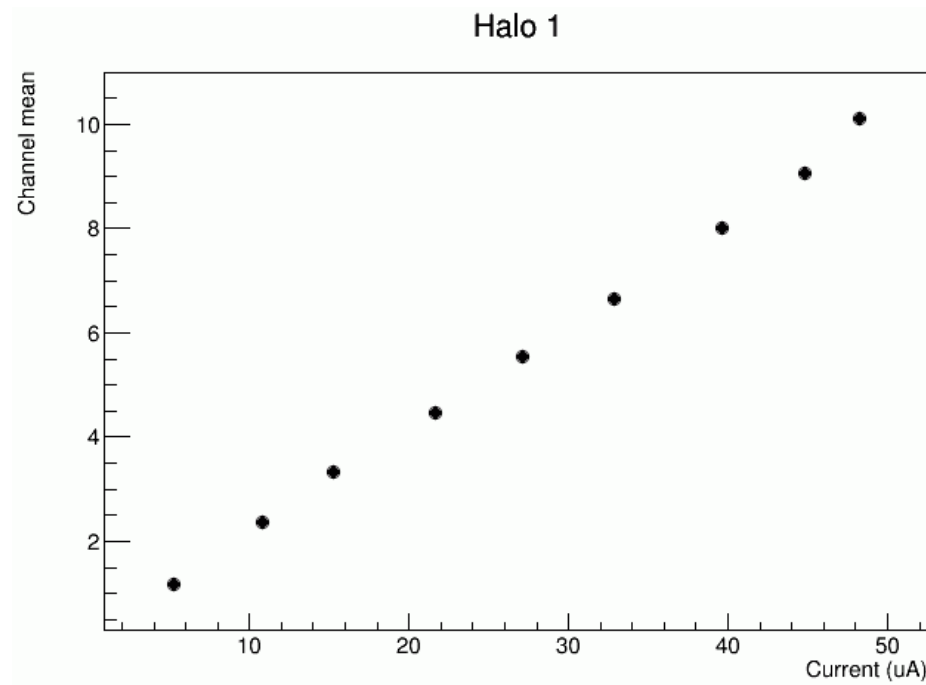


- The readout worked fine
  - we should look at the signals on a scope to make sure things look ok
- The readout of the scaler needs to be updated to be gated by the GMN
- We had the HV for these most of the time we had beam on and we saw significant signals
  - the dark current was at least 2 orders of magnitude lower than the signal
- Halo monitor target mechanism was not working

# Halo monitors



- We went through several beam current steps with MCC to get a BCM calibration run
- Tyler analyzed this run and plotted the Halo monitor signal vs beam current
- The other 3 look similar



# Halo monitors: TODO

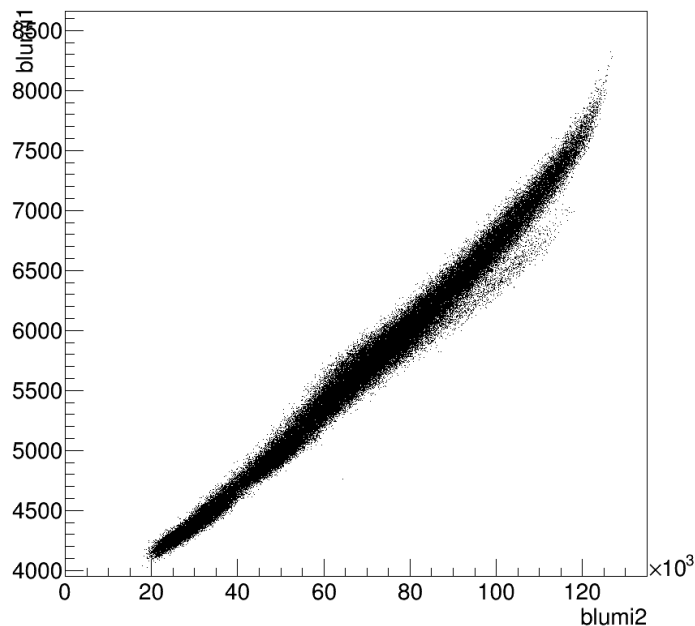
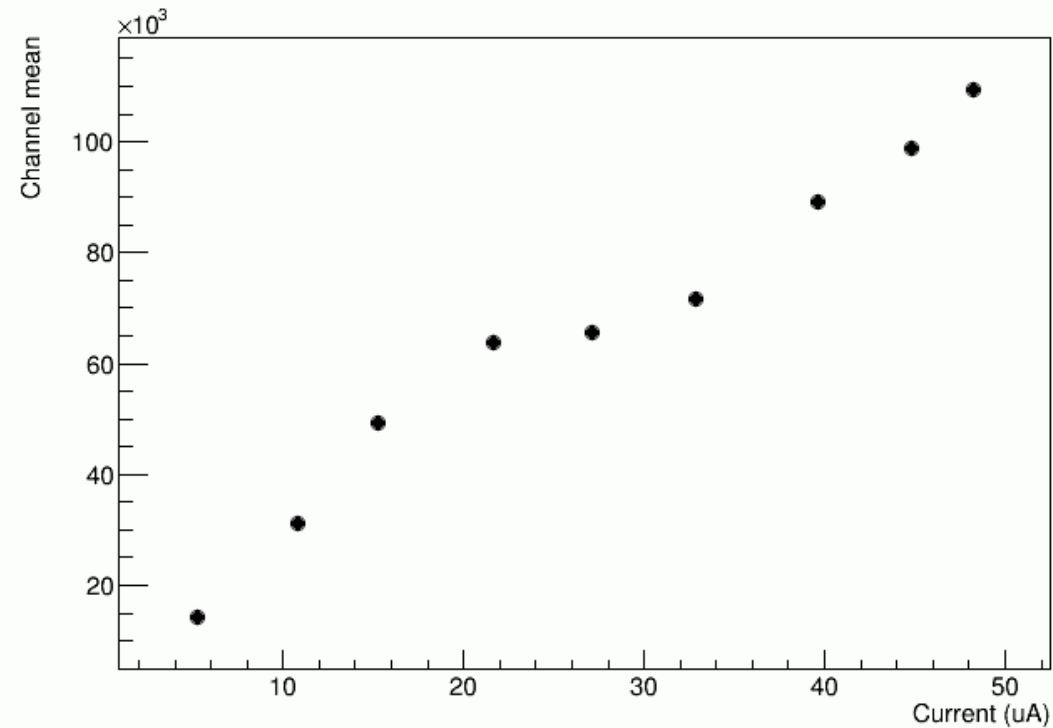
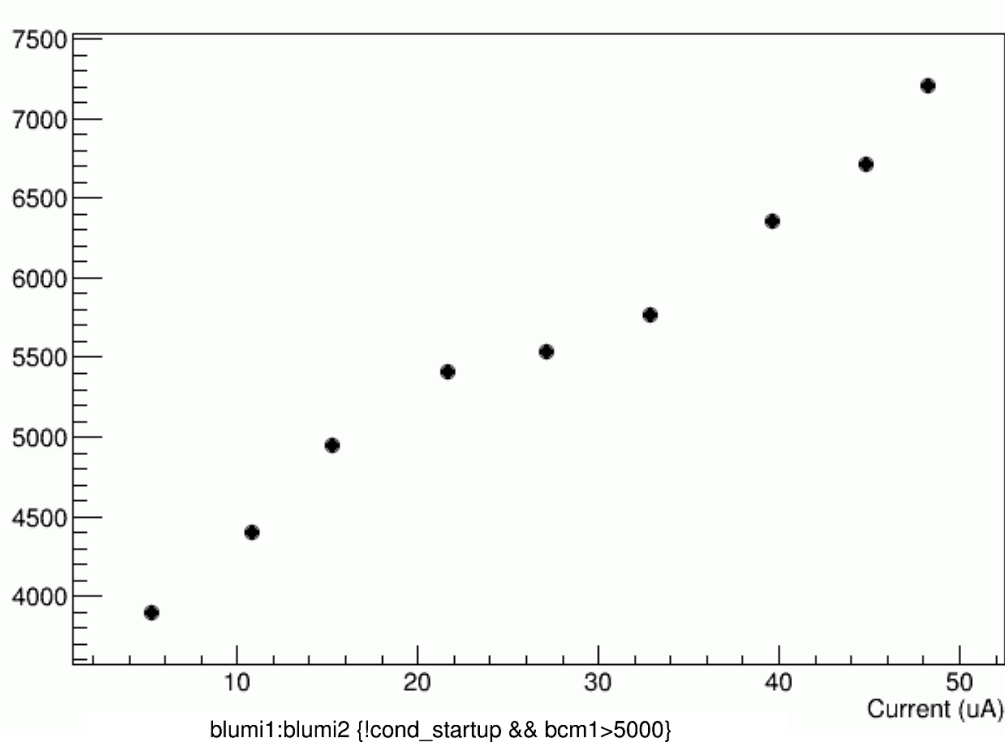
- Work out how to translate the DAQ output into a rate (this should be easy by following Bob's EPICS setup)
- Halo target mechanism now working: <https://logbooks.jlab.org/entry/3370050> so if we have some parasitic time it would be great to get some data with the target



# Small angle monitors (SAM)

Lumi 1

Lumi 2



- SAM signals (with no target), after working out kinks in readout
- Tyler also did a similar analysis as for the Halo monitors with the SAMs, however there is a plateau between 20 and 35 uA. Observed in all channels.
  - Non-linearity due to HV? Beam distribution vs current?
- The correlation between channels looks reasonable, but not perfect.

# Small angle monitors (SAM): TODO

- Dark box, test readout.
- configure HV/amp parameters to match expected signal
- Test linearity
- reduce readout noise

# Progress / Plans

- BCM
  - test system with injected signal
- BPM
  - Pete: reproduced problem with Hi/Lo gain toggling
  - further debugging? New problem?
  - monitor (parasitic) - functioning, resolution, beam correlations
  - Cavities - commission (parasitic?)
- Halo Monitor
  - Target mover working now (verify)
  - Put calibration test plan into AtLis
  - monitor with and w/o target (parasitic)
- SAM
  - Improve readout
  - verify signal, test linearity, measure variations and asymmetry (parasitic)
- Test plans
  - Halo Monitor
  - PITA or IA - tests for readout and detectors.