Analysis Progress

for the d_2^n analysis meeting

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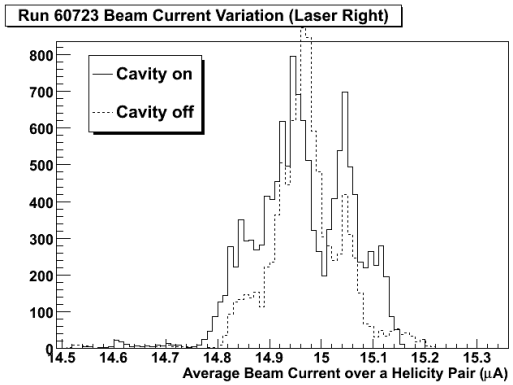
1. BB Optics
   - Tracking Problems
2. Compton
   - Beam Current Variation
   - L/R Discrepancies
3. BCM Calibration
   - Equipment
   - Calibration of EPICS Beam-Current Variable
   - Calibration of Injector Cavity 0L02
4. What's Next?

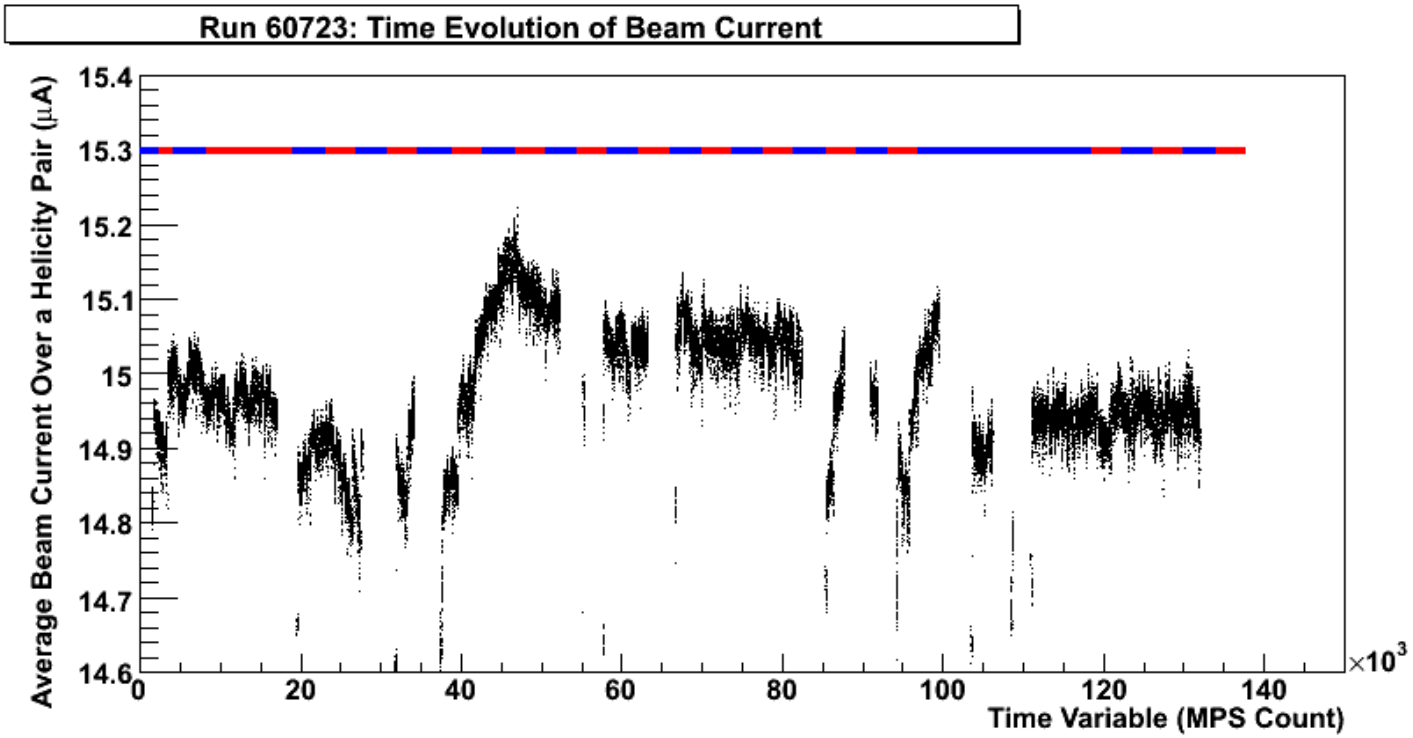
Tracking Problems

- When I started doing physics replays of BB optics runs, I noticed a slight problem: there were almost no tracks!
  - My replay: 198 tracks, total, out of 100,000 CODA events
  - Xin's replay of the same run: 138578+ tracks
- Matt and Dave see the same problem
- We'll need to figure this out before we can make further progress on optics

Beam Current Variation (i)

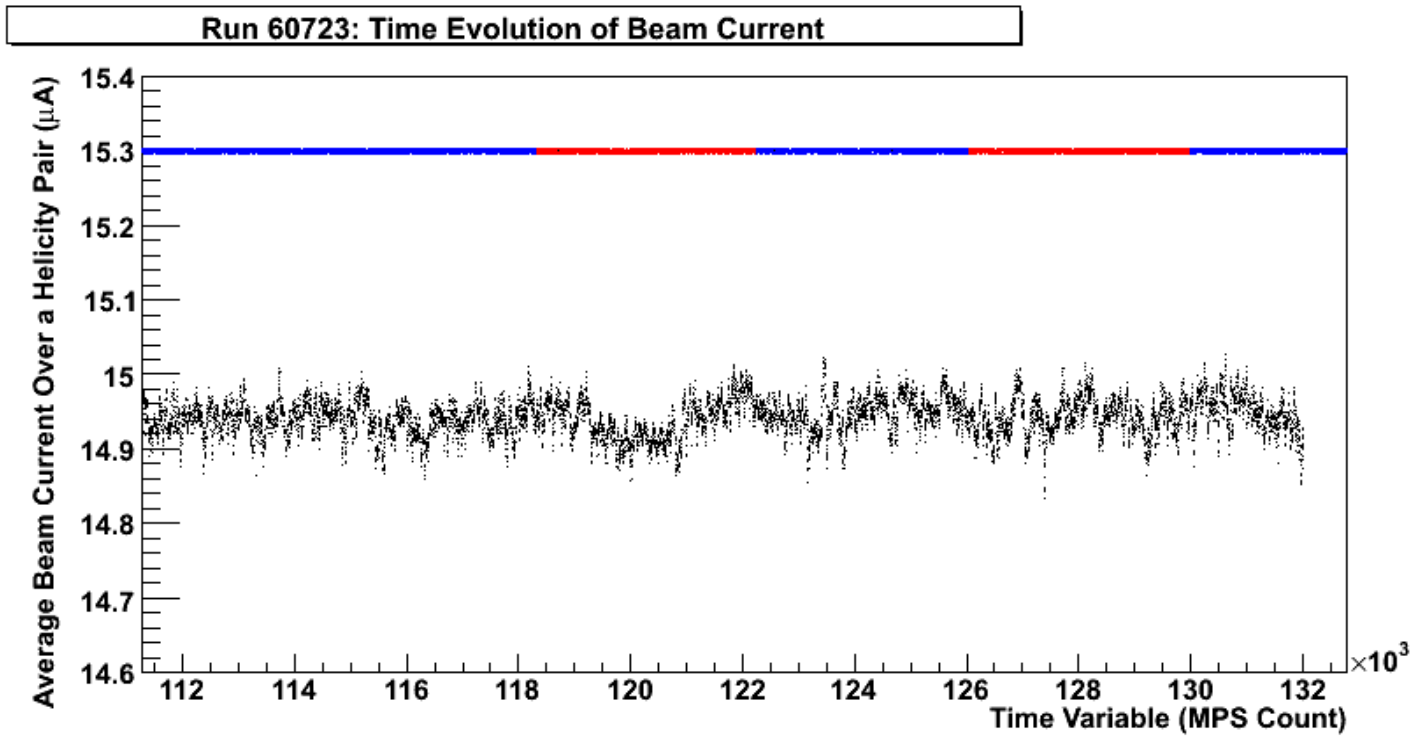
- In several Compton runs, the beam current distribution has a curious double-peaked structure
- Brad: could arise from a sinusoidal time variation



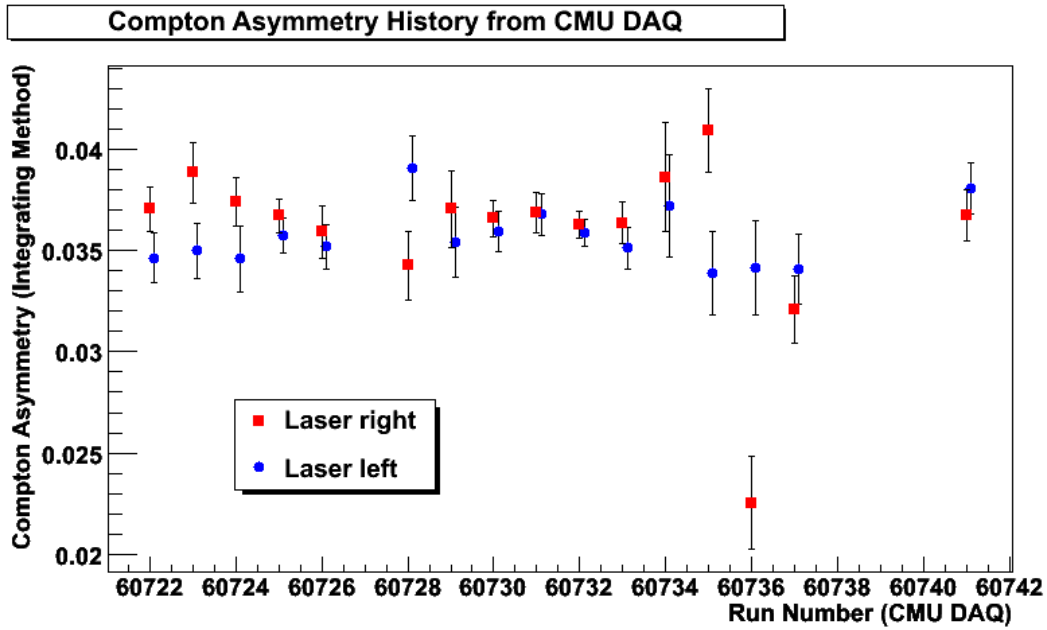


Beam Current Variation (ii)

- Let's zoom in to see the structure more clearly:



L/R Asymmetry Disagreement

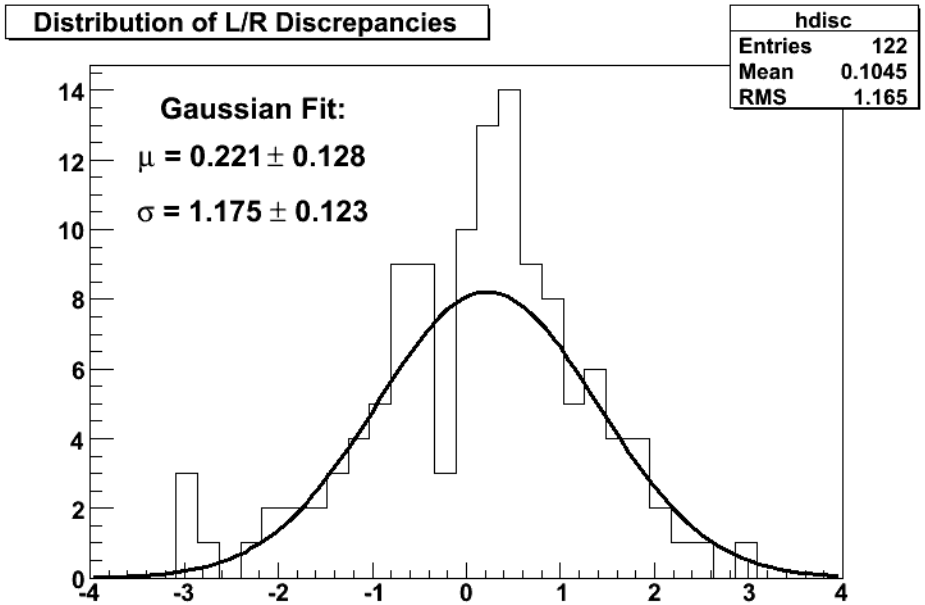


- Each Compton run gives two independent measurements of the Compton asymmetry (i.e. beam polarization):
  - Compton cavity on, laser right-circularly polarized
  - Compton cavity on, laser left-circularly polarized
- What do we do when these measurements disagree?

L/R Asymmetry Disagreement: Statistical Distribution

- Just checking for a discrepancy doesn't tell the whole story
- Statistically, we expect a certain amount of variation: some measurements will disagree
- Check: examine the disagreement over a large number of runs:

$$\Delta = \frac{A_R - A_L}{\sqrt{\sigma_L^2 + \sigma_R^2}}$$

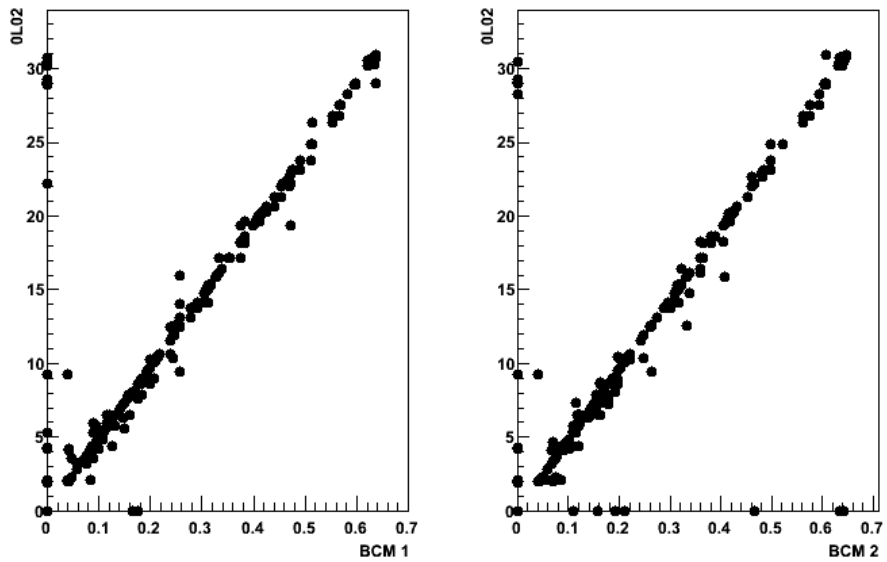


Beam Current Monitor Equipment

- At the injector:
  - OL02 cavity – measured every ~ 1 second
  - Faraday cup – optionally inserted after OL02 cavity
- In the Hall:
  - Two BCMS, 25 cm upstream of target
    - High-Q RF cavities
    - Output: Voltage level proportional to beam current $\rightarrow$ voltage-to-frequency converters
    - Three amplification levels available per cavity: x1, x3, x10
    - Read out in scalers in BigBite and LHRS DAQs
  - Unser Monitor – not used during d_2^n

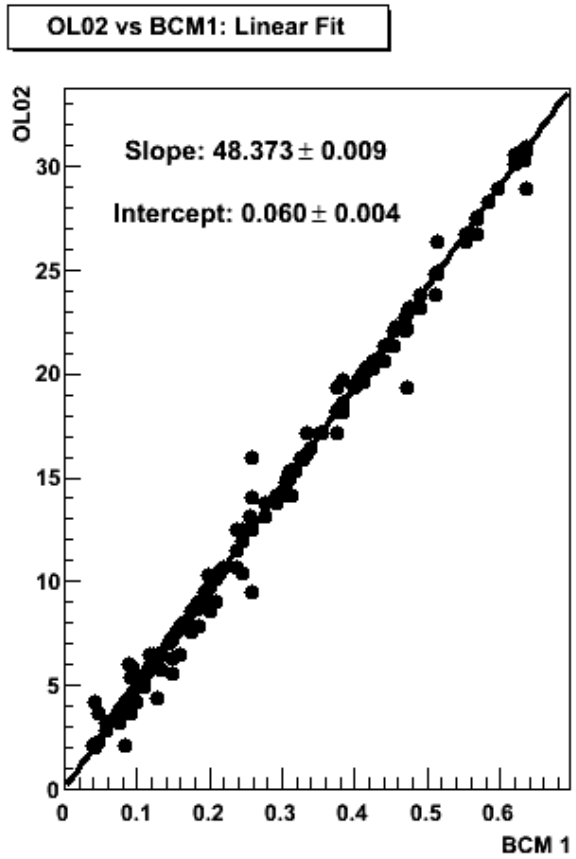
Calibrating BCMs to OL02 (i)

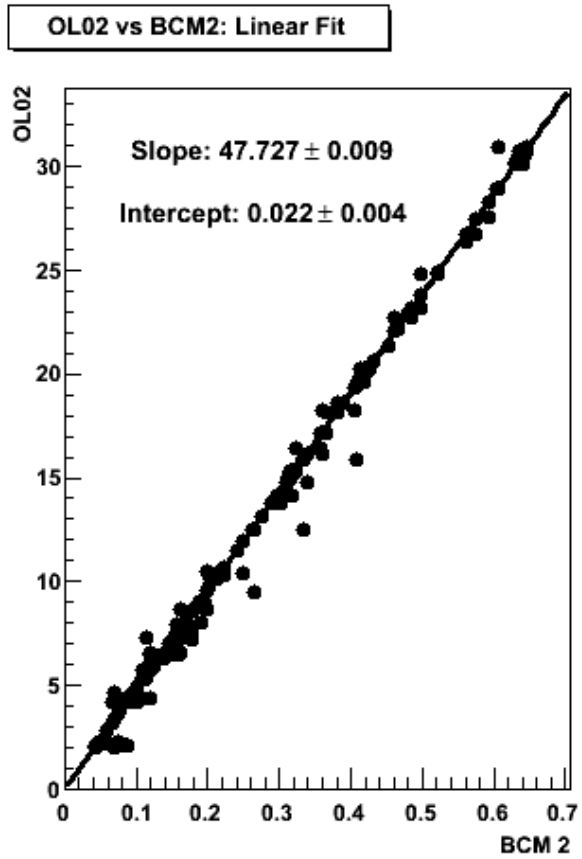
- During BCM calibration, a BCM log file records voltage levels on OL02 (injector) and BCM1 and BCM2 cavities



- Some points are clearly spurious (delay in OL02 readout?)
- Impose cuts: exclude OL02<0.5 or BCM1<0.01 or BCM2<0.01
- This cut removes 28% of our BCM run entries

Calibrating BCMs to OL02 (ii)



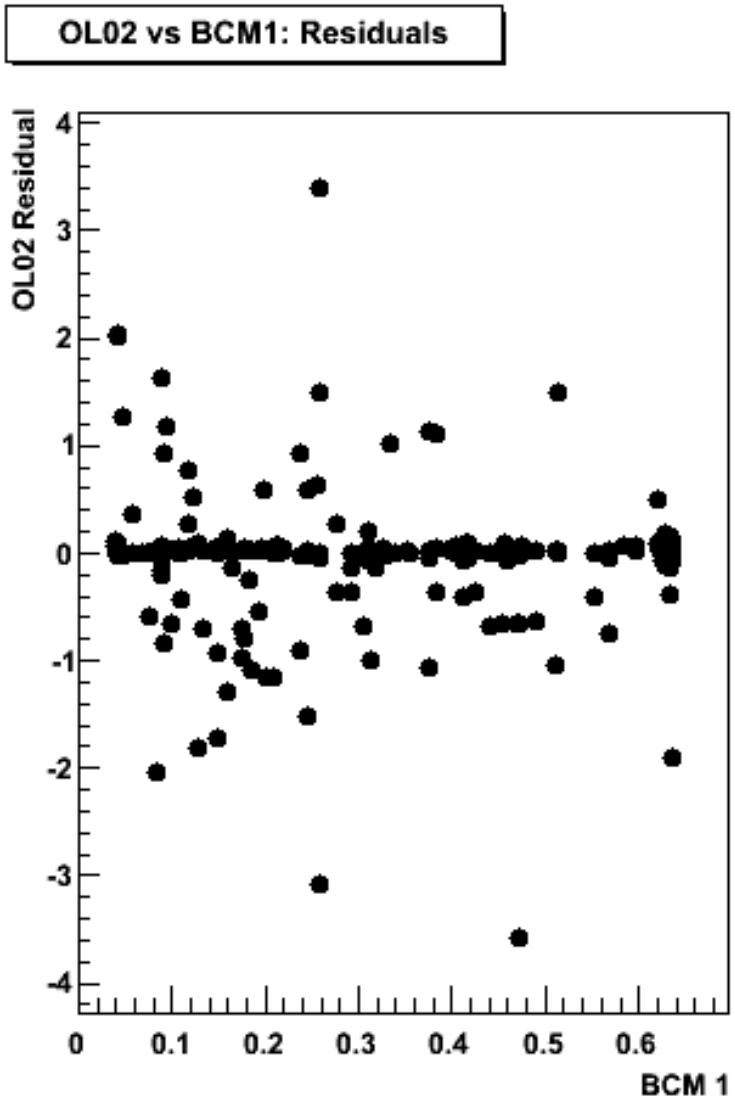


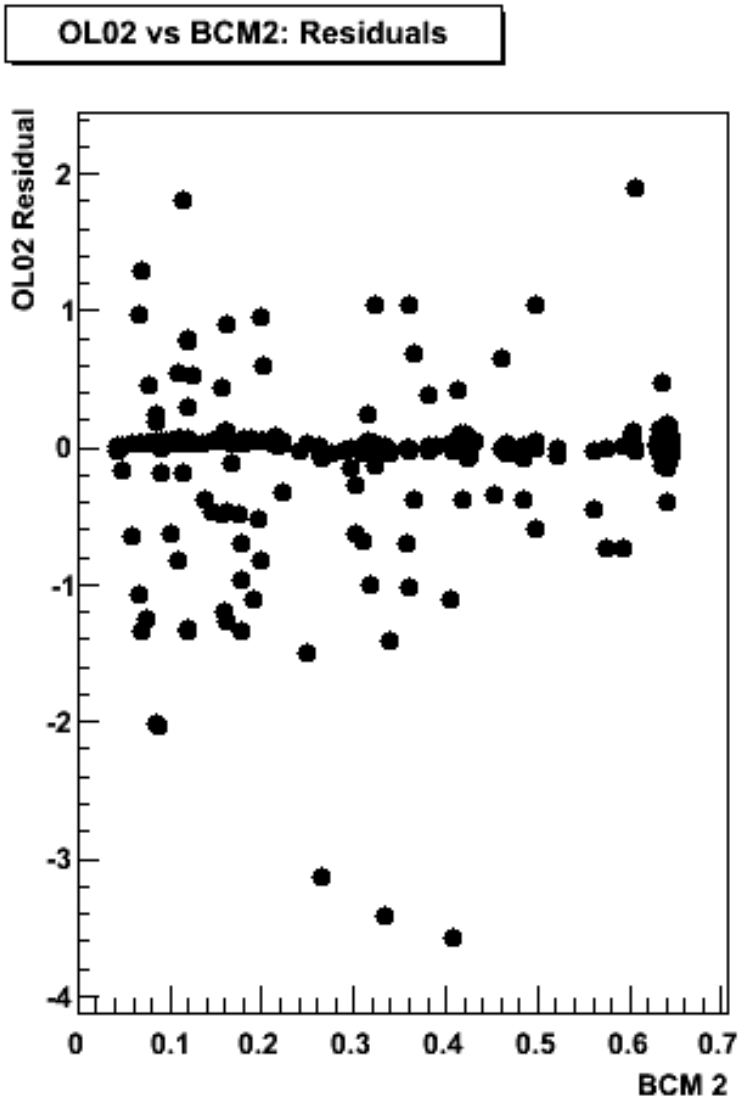
Agreement with Kalyan's March 2 HALOG post:

	Kalyan's BCM1	This BCM1	Kalyan's BCM2	This BCM2
Slope	48.260 ± 0.093	48.373 ± 0.009	47.757 ± 0.092	47.727 ± 0.009
Intercept	0.024 ± 0.031	0.060 ± 0.004	0.008 ± 0.030	0.022 ± 0.004

Calibrating BCMs to OL02 (iii)

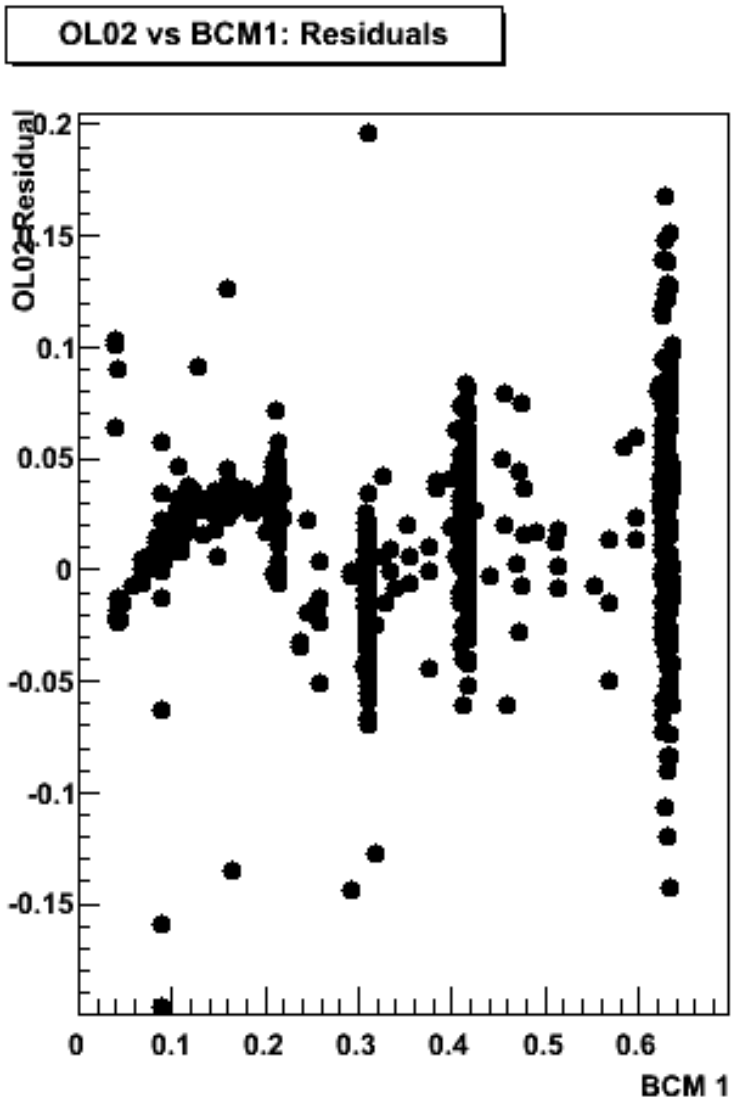
Residuals:

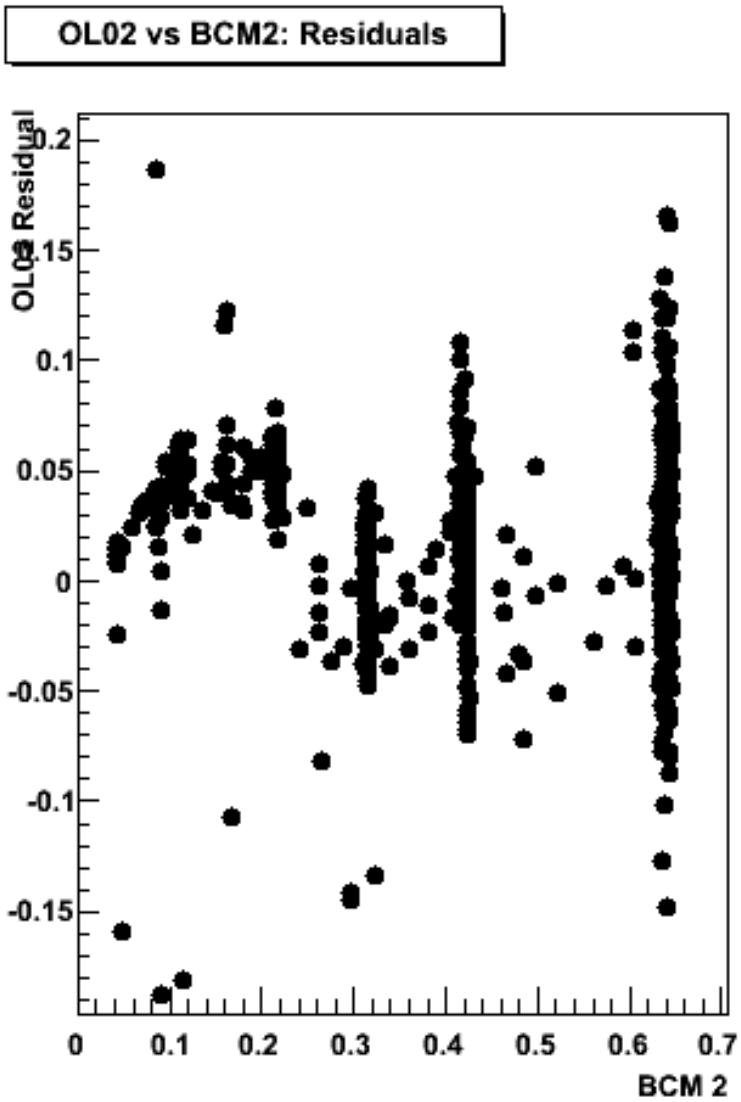




Calibrating BCMs to OL02 (iii)

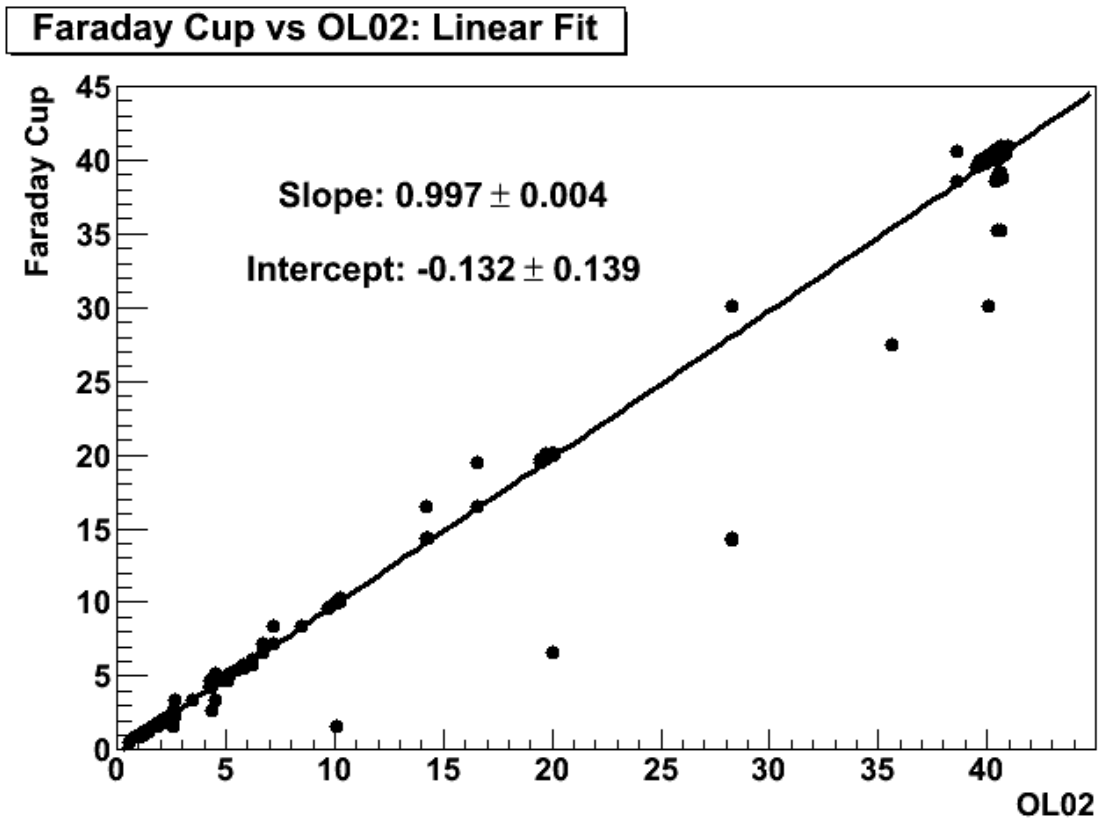
Residuals:



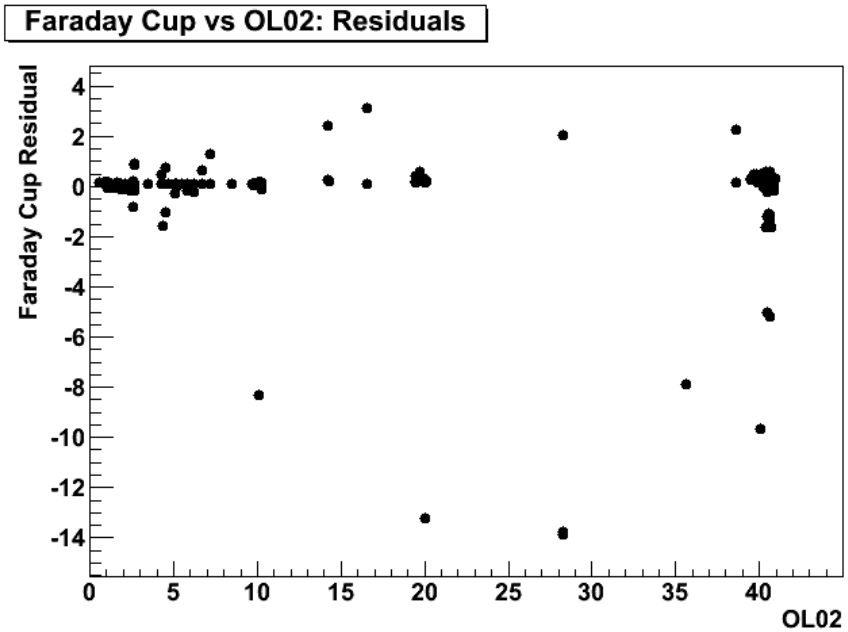


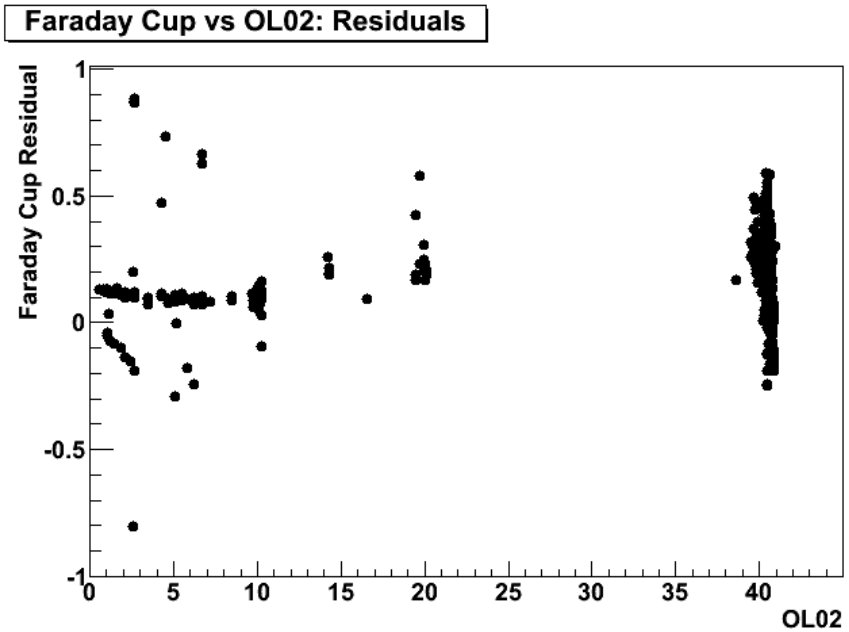
Faraday Cup Calibration (i)

- Took special Faraday cup run March 9 (no beam in hall)
- Rejected 18% of readouts
- OL02 reading appears to be slightly too high

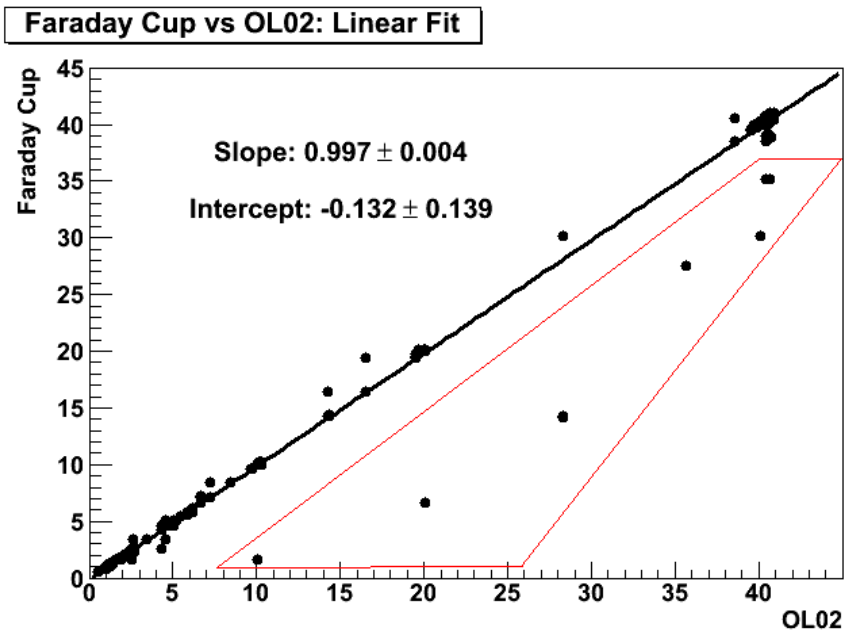


Faraday Cup Calibration (ii): Residuals





Faraday Cup Calibration (iii)



- What's going on with these 12 points?
  - Vince thinks they could represent timing glitches in variable readouts
  - Since this is a Faraday cup run (therefore no beam in the Hall), we can't use Hall A's BCMs or BPMs to help us diagnose
- How big a difference do these points make?

	Intercept	Slope
All Points Included	-0.131966 ± 0.138913	0.996898 ± 0.00409551
12 Points Excluded	0.0170898 ± 0.0103908	0.997142 ± 0.000306246

What's Next?

- BB optics
  - Track down those missing tracks ...
- Compton
  - More detailed BCM study
  - Stability studies
  - Analyzing power $\longrightarrow$ better comparison to Møller
- BCM Calibration
  - Calibrate BB, LHRS scalers to OL02 values
  - Update DB