Analysis Progress

for the d_2^n analysis meeting

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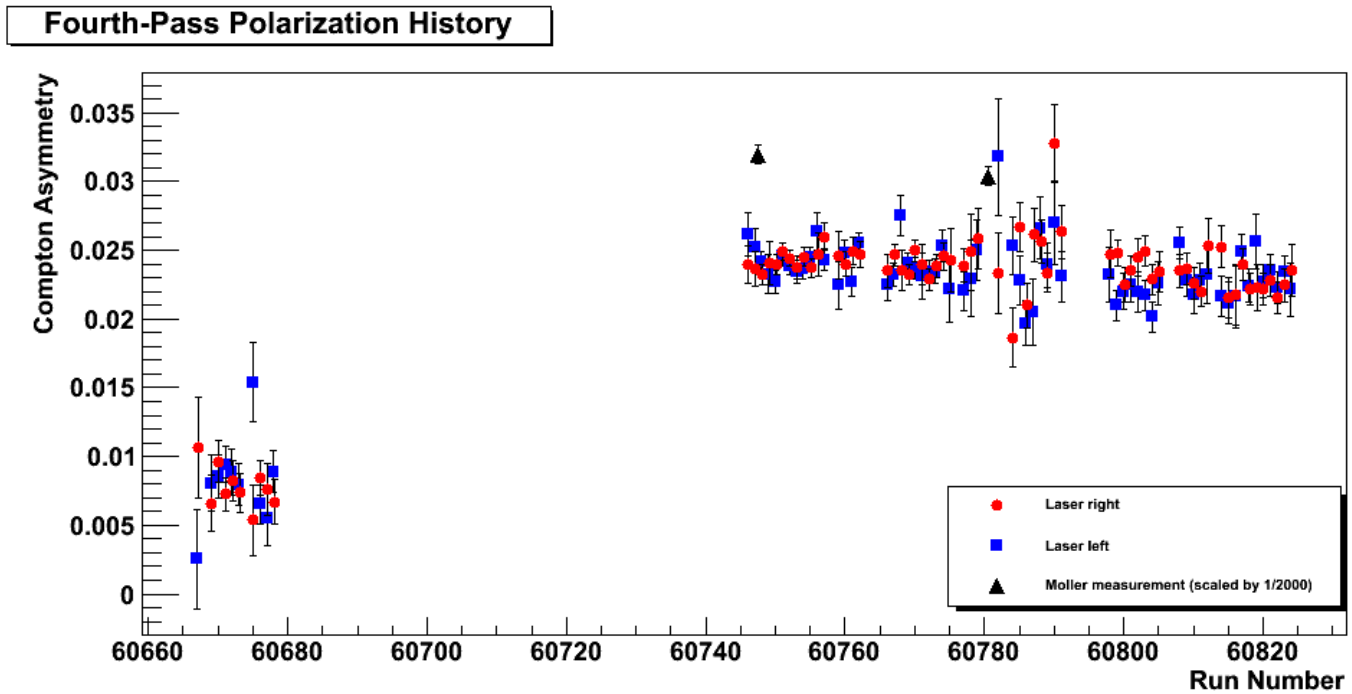
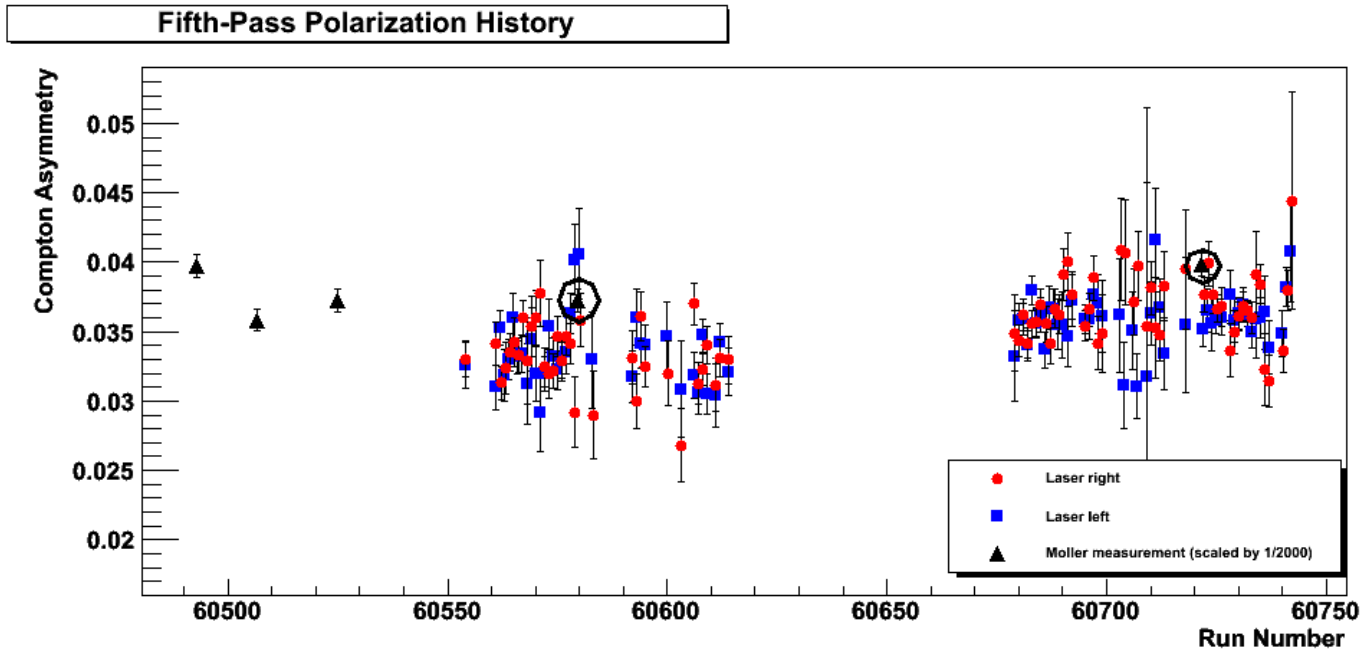
Rough Comparison to Møller (i): Four Pass

- Compton asymmetry $\propto$ beam polarization (measured by Møller)
- We can't make any absolute comparisons without the analyzing powers
- By applying an arbitrary scale factor ($\frac{1}{2000}$) to the Møller results, we CAN make a relative comparison for each beam energy



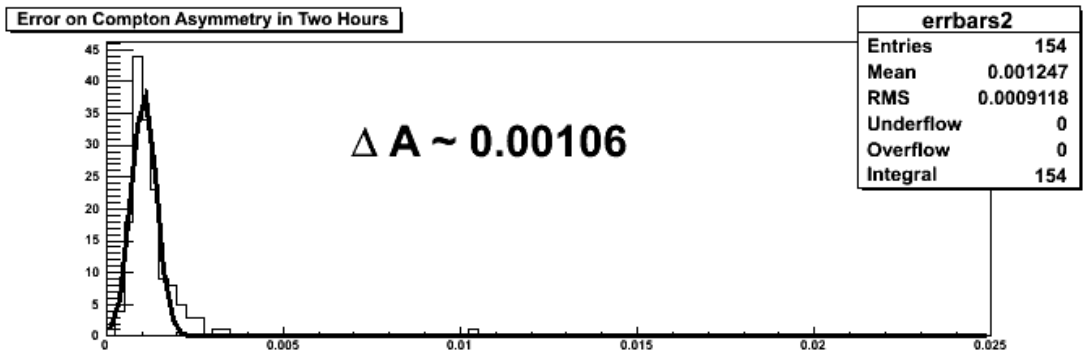
Rough Comparison to Møller (ii): Five Pass

- Difference in analyzing power means that our scaled Møller measurements land in a different spot relative to Compton data
- Early Møller runs were before CMU DAQ was in final working state



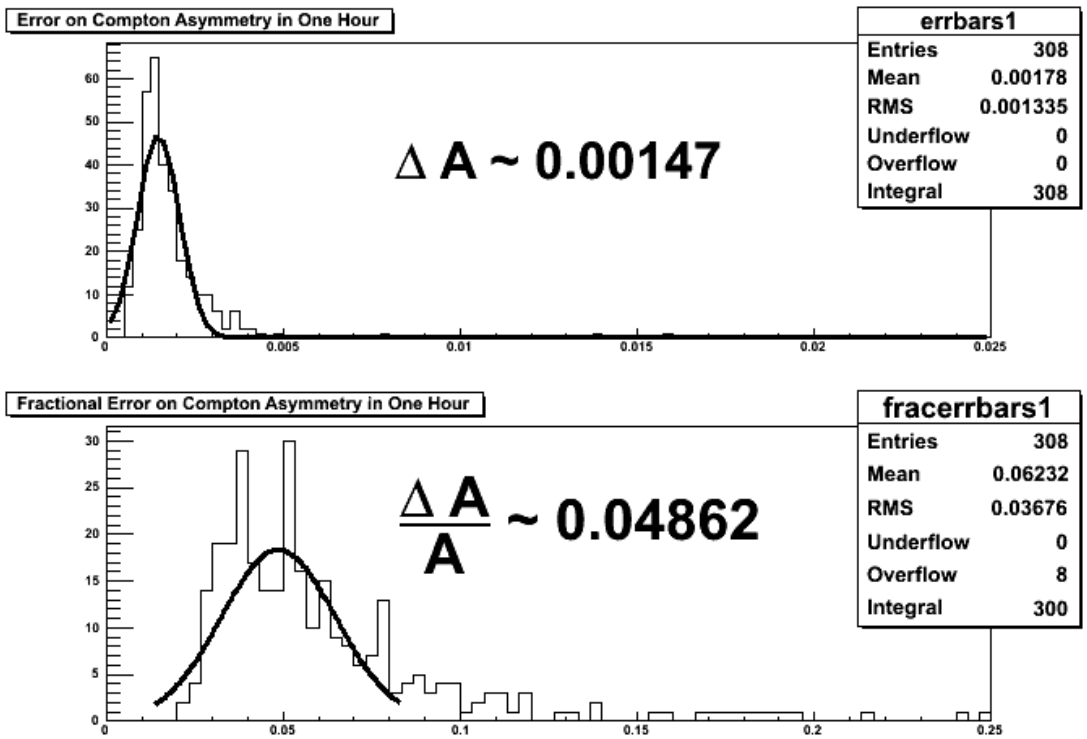
Compton Statistical Errors (i)

- Rough check on the statistical errors on the Compton asymmetries
- Most runs lasted about two hours
  - Some were much shorter (e.g. beam troubles)
  - A couple were much longer



Compton Statistical Errors (ii)

- The history plots I've been showing split the runs into left and right modes
- Each represents about one hour of running
- These statistical errors are shown below:

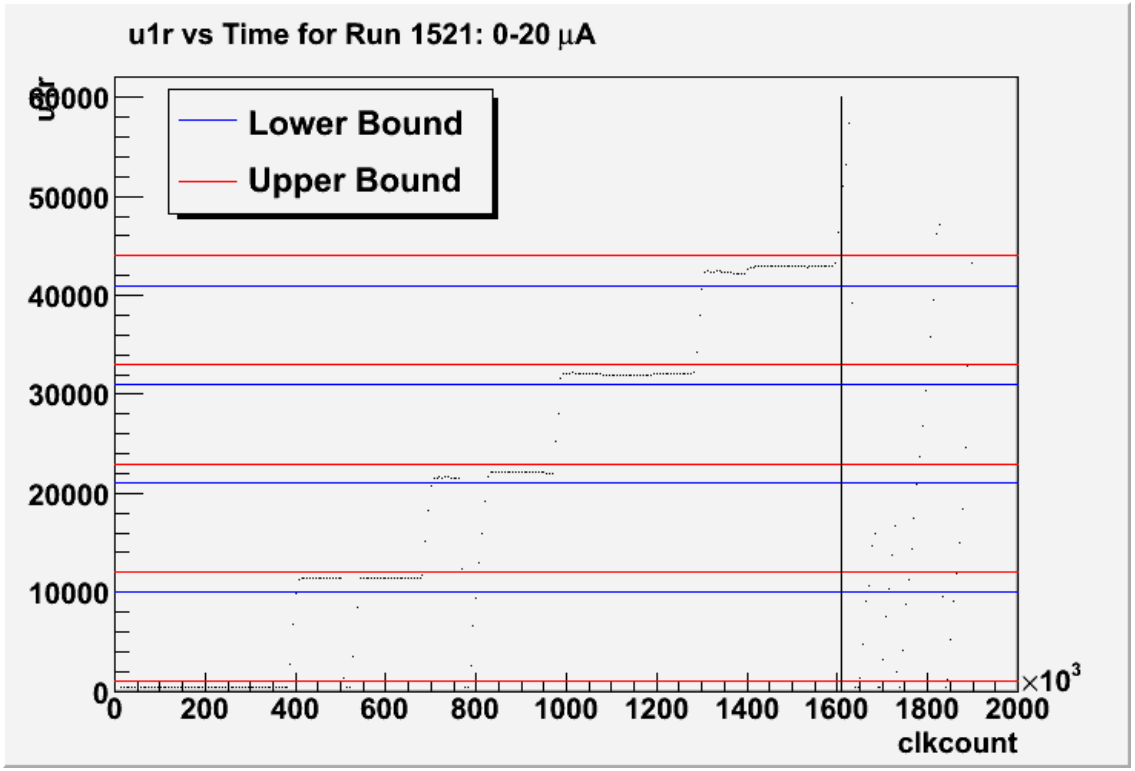


Beam Charge Calibration: Basics

- **U**pstream and **D**ownstream BCMs send output to VtoF converters with x1, x3, x10 multiplication
- We read these six beam-current signals into scalers in both arms
- Final step: Calibrate counts in beam current scalers to actual beam current in μA
  - Calibrate BCM scalers to OL02 cavity (at injector)
  - Calibrate OL02 cavity to Faraday Cup (at injector)
  - With OL02 as intermediary, can calibrate scalers to FC

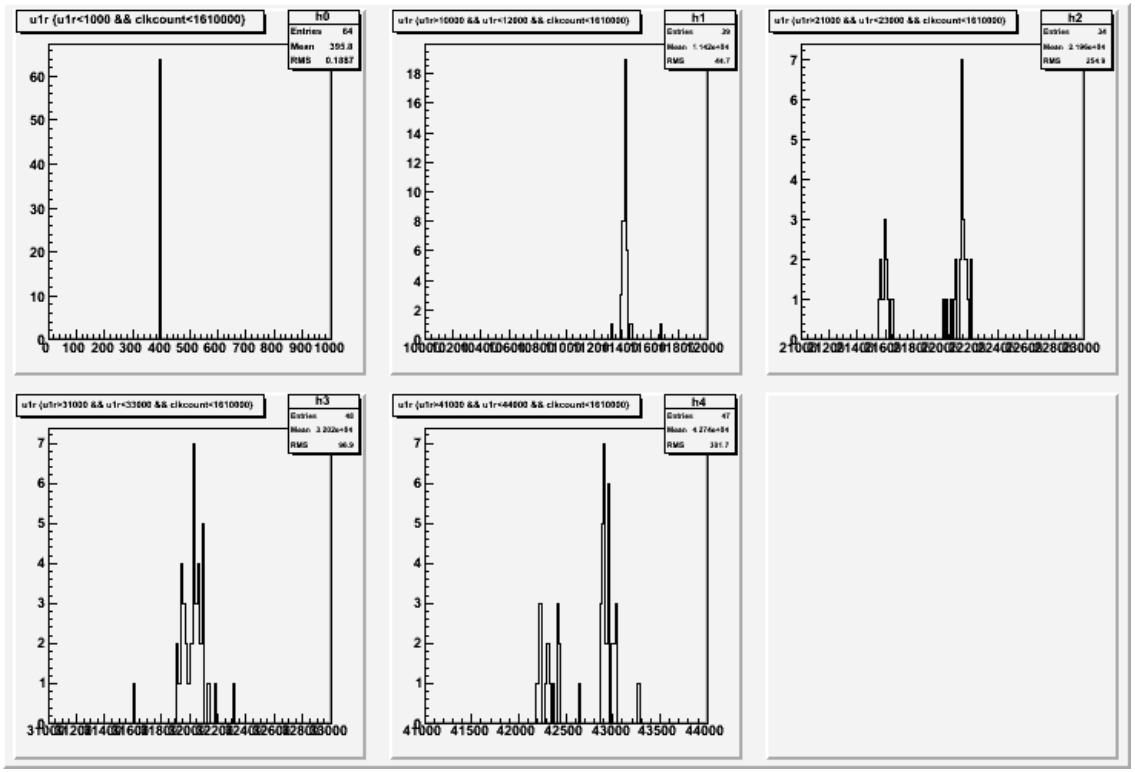
BCM Scaler Calibration Strategy (i)

- We have two beam charge calibration runs:
  - 1521/20227 (0-20 μA)
  - 1522/20228 (30 μA)
- The second run is relatively simple, but in the first run we need to isolate each of the beam current set points:



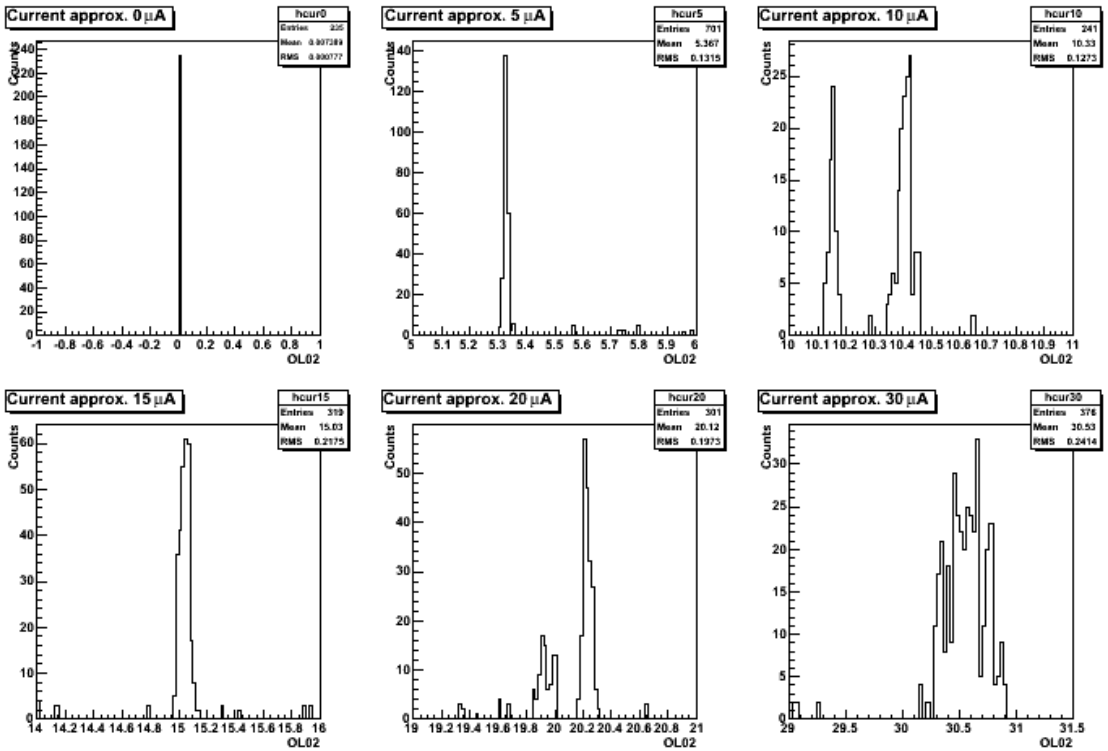
BCM Scaler Calibration Strategy (ii)

- For each beam current set point (0, 5, 10, 15, 20, and 30 μA):
  - Generate 1d histogram of scaler rate
  - Gaussian fit to locate central value
  - (Two peaks for 10 and 20 μA set points)
  - Repeat for each of the six scalers ...



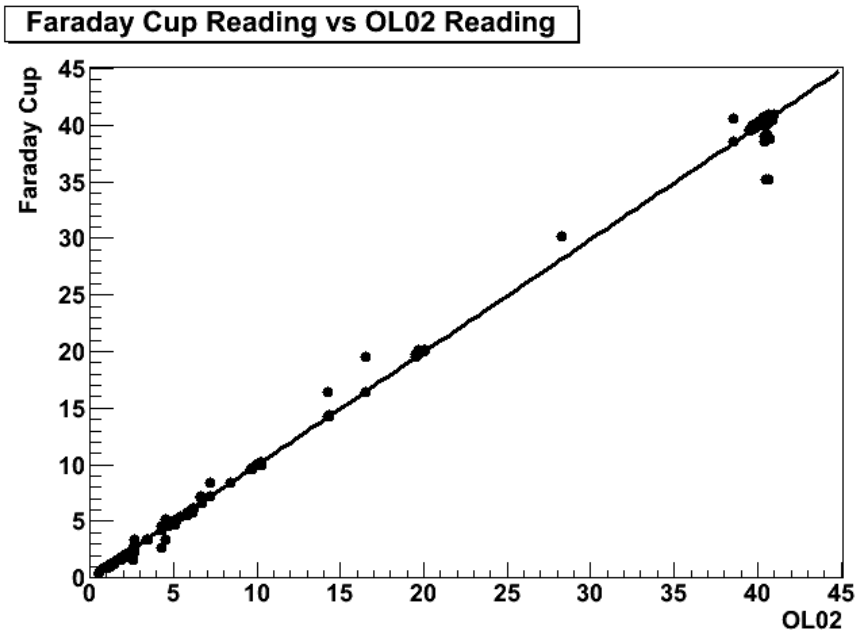
BCM Scaler Calibration Strategy (iii)

- We can repeat this process for the OL02 readouts
- The OL02 readings are from the same beam current scan as the scaler readings, so we have the same six set points (and eight central values)
- These OL02 values can be converted to a beam current in μA...



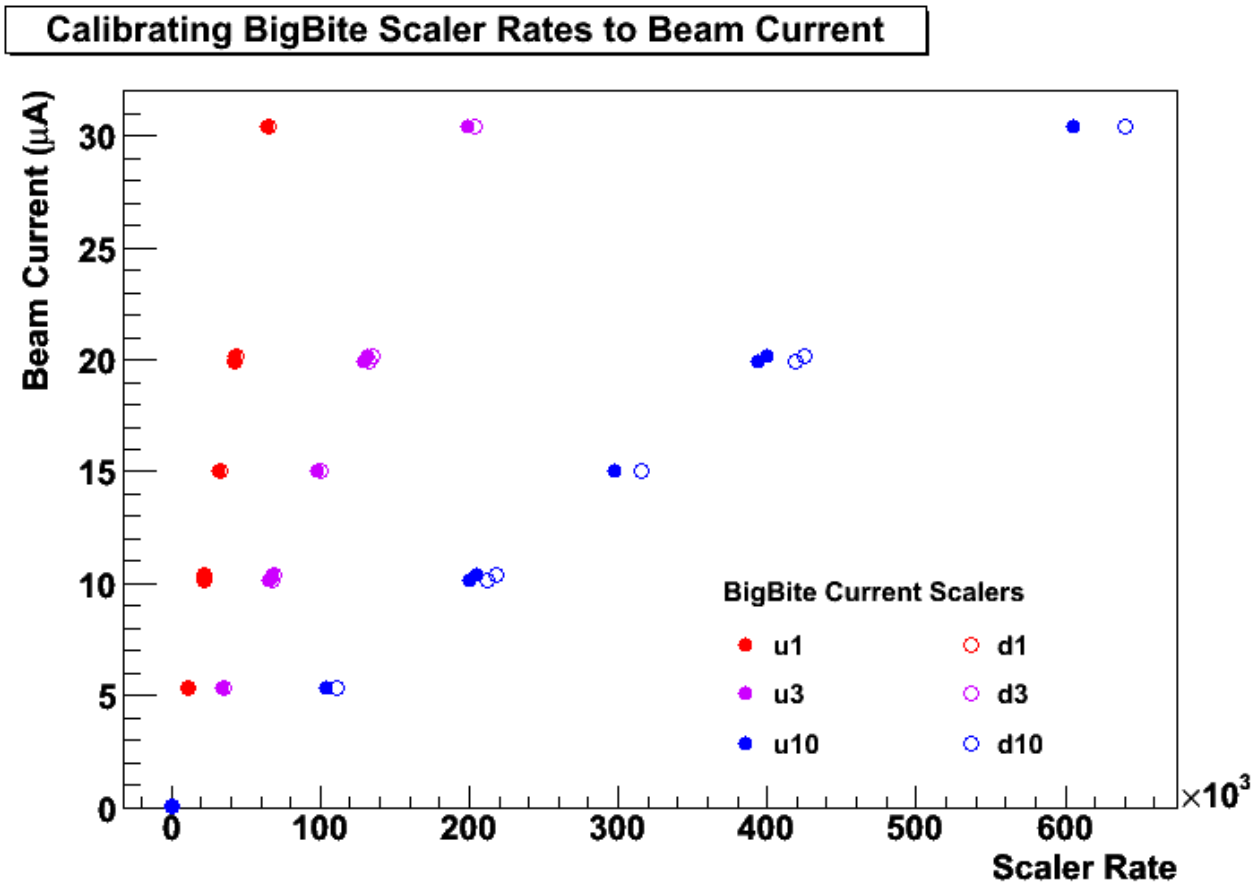
OL02 Calibration Strategy

- We can calibrate OL02 to Faraday Cup in separate run
- Linear fit allows us to say what the actual beam current (i.e. Faraday Cup reading) would be for a given value of OL02
- Results: m = 0.9967, b = 0.0078
- Error matrix: $\begin{pmatrix} 1.1867 \times 10^{-4} & -3.0587 \times 10^{-6} \\ -3.0587 \times 10^{-6} & 1.0282 \times 10^{-6} \end{pmatrix}$



Results for BigBite Arm (i)

- Relationship between the six scalers looks reasonable
- Downstream BCM shows slightly higher count rate $\longrightarrow$ slightly higher voltage readout



Results for BigBite Arm (ii)

- Fit a straight line to each scaler to get a calibration constant
- Actual Beam Current (μA) = $m\times$ (Scaler Rate) $+b$

Scaler	$m(\mu$A/count)	b (offset in μA)	$1/m$ (counts/μA)
u1	4.78239×10^{-4}	-1.64020×10^{-1}	2091.0
d1	4.66269×10^{-4}	-4.73131×10^{-2}	2144.7
u3	1.55279×10^{-4}	-5.28190×10^{-2}	6440.0
d3	1.50729×10^{-4}	-3.80298×10^{-3}	6634.4
u10	5.11383×10^{-5}	-3.11689×10^{-2}	19554.8
d10	4.77707×10^{-5}	1.27715×10^{-3}	20933.3

What's Next?

- BB Optics
  - BPM calibration ...
- Compton
  - Analyzing-power work ongoing
    - Real comparison to Møller soon?
  - Systematics
- Beamline calibrations
  - BPM
  - BCM: Confirm LHRS scalers show same behavior as BB scalers
  - BCM: DB update