

Runplan for Kicker & Wire-Target Commissioning

October 10, 2003

1 Pre-Checkout Stuff

- **Conditions:**

Kicker off. 10 μA CW beam. Target ladder retracted.

- **Procedure:**

1. Ask MCC for the fast-feedback off. This will hopefully give us a more “round” beam spot.
2. Take a harp scan to check beam profile (look at harps on 3C17).

2 Find the nominal wire-target and beam positions

- **Conditions:**

Kicker off. Low current (0.5 μA) CW beam. Initially, target ladder retracted.

- **Procedure:**

1. MCC will tune up the beam for the Møller in the usual way (i.e. steer the beam to within 0.5 mm of 0.0 at 3C16 and 3C17 and making sure all the BPMs downstream of 3C17 are within 4 mm of 0.0.)
2. Insert the “wire-target” (target position 1 – ask for beam off first!). Then ask for $\approx 0.5 \mu\text{A}$ beam.
3. Use the “jog” button to move the target horizontally, 1 mm at a time. Use the “scalerwatch” gui to check the rates in the calorimeters. Find the the left edge and then right edge of the opening of the wire-target. Set the target to the “central” position – this will be our nominal target position (write it down!).
4. Ask MCC to move the beam position “up” 0.2 mm - check for rate (or increased rate) in the Møller detectors. Repeat until we start seeing some counts, then ask MCC to lower the beam about 0.5 mm – this will be our nominal beam position for the wire-target running. Take a screen shot of the status of the BPMs.

3 Calibrate the Kicker

Determine Kicker Limits

- **Conditions:**

Kicker off. Low current ($2 \mu\text{A}$) CW beam. Wire-target “in” and beam at nominal “wire-target position”. All G0 targets out.

- **Procedure:**

1. Take note of the ion chamber readings at $2 \mu\text{A}$ and with the kicker off.
2. Ask MCC to turn on the kicker. At first, start with our best estimate for a kicker amplitude of 1 mm and at lowest frequency possible.

3. Ask MCC to turn on beam dump viewer - if we can see anything there (unlikely?) we can use this to get a rough estimate of kicker amplitude/calibration. If we have the same TV screen and monitor as last spring, the TV screen to dump-viewer position conversion is about 7/9 (i.e. 1 cm on the TV is 7 mm on the viewer).
4. Look at signals from Møller detectors on an oscilloscope. We should hopefully be able to discern each wire. Play with the kicker amplitude such that we see only 1 wire, 2 wires, and all 3 wires. This should give us a good calibration.
5. Take a quick Møller run with our best guess at the optimal kicker amplitude. Look at the histogram from the multi-hit TDC - if we're well positioned, we should get a good TDC spectrum with 3 peaks, equal counts in each peak. Iterate the kicker amplitude until we get a good TDC spectrum.
6. Once we have found the "good" kicker amplitude, gradually ramp up the current in steps of $5 \mu\text{A}$. At each step, note the ion chamber readings. Stop at $40 \mu\text{A}$.
7. Increase the kicker amplitude 1 mm and repeat the above. Keep an eye on the ion chambers. Keep increasing the kicker amplitude until we determine the point at which the ion chamber rates are unacceptable (i.e. we are in danger of tripping off the beam).

4 Determine Kicker Limits

- **Conditions:**

Kicker on (nominal amplitude from above). Low current ($2 \mu\text{A}$) CW beam. Wire-target "in" and beam at nominal "wire-target position". All G0 targets out.

- **Procedure:**

1. Once we have found the "good" kicker amplitude, gradually ramp up the current in steps of $5 \mu\text{A}$. At each step, note the ion chamber readings. Stop at $40 \mu\text{A}$.

2. Increase the kicker amplitude 1 mm and repeat the above. Keep an eye on the ion chambers.
3. Keep increasing the kicker amplitude until we determine the point at which the ion chamber rates are unacceptable (i.e. we are in danger of tripping off the beam).

5 Current and Frequency Dependence Tests

- **Conditions:**

Kicker off. Low current ($2\ \mu\text{A}$) CW beam. $4\ \mu\text{m}$ target “in” and beam at nominal “wire–target position”. All G0 targets out.

- **Procedure:**

1. Start with a measurement of the beam polarization using a standard foil, but with the beam at the “wire–target position”. Take two runs with better than 1% statistics.
2. Turn on the kicker to its nominal amplitude and take a run with the regular foil. Try a couple kicker frequencies.
3. Put the wire–target in. If the position asymmetry is small (one can check using the G0 daq), it may be possible to take a run on the wire target with the kicker off. If this is possible, take a run at the lowest current possible ($0.5\ \mu\text{A}$ or less)
4. Turn the kicker on (if it was off). Take a run at low current and high frequency (for highest rate). Based on the results of this run, reduce the frequency to the lowest possible frequency that will allow a relatively quick (20–30 min?) measurement.
5. Increase the beam current to $10\ \mu\text{A}$. This time, start at the lowest frequency (keep beam heating effects small) and increase the frequency of the kick to 1 kHz, 5 kHz and then 10 kHz.
6. Turn off kicker, put in $1\ \mu\text{m}$ foil, turn on Møller raster and take a run to cross-calibrate at this beam current ($10\ \mu\text{A}$).

7. Put wire–target back in, turn on kicker and take additional runs at $20\ \mu\text{A}$ and $30\ \mu\text{A}$. Take runs at the lowest and highest possible kicker frequencies and maybe two intermediate points. Keep an eye on “Herbert’s Paddle” to make sure rates in the Hall aren’t getting out of hand.
8. Finally, try a run at $40\ \mu\text{A}$ at the lowest kicker frequency.
9. In the end, we will hopefully have something like the table below:

Run	I (μA)	Kicker f (kHz)	Measured Polarization
	2	0.1	
	2	1	
	2	10	
	10	0.1	
	10	1	
	10	5	
	10	10	
	20	0.1	
	20	1	
	20	5	
	20	10	
	30	0.1	
	30	1	
	30	5	
	30	10	
	40	0.1	

6 Kicker Amplitude and Beam Position Tests

- **Conditions:**

Kicker on. 10–15 μA CW beam. Wire–target “in” and beam at nominal “wire–target position”. All G0 targets out.

- **Procedure:**

1. Take a run with standard conditions.
2. Reduce the kicker amplitude until we start seeing reduced counts in the top wire (i.e., the maximum kicker deflection is at the top wire position). Take a run.
3. Reduce the kicker amplitude until maximum kicker position is between top and middle wires - take a run.
4. Reduce the kicker amplitude until maximum kicker position is between bottom and middle wires - take a run.
5. Return kicker to nominal amplitude.
6. Ask MCC to steer the beam horizontally and take a series of runs. Move the beam left and right in steps of 1 mm, maybe out to ± 3 mm.

7 Wire–Target Saturation Tests

- **Conditions:**

Kicker on at low frequency. 5–10 μA CW beam. Wire–target “in” and beam at nominal “wire–target position”. All G0 targets out.

- **Procedure:**

1. Take a series of runs with the Møller solenoid at various fields. Start at 3 T and reduce the field in steps of 0.5 T to 0 T.
2. At 0 T take a rather long run – we need this measurement to check our false asymmetries, so we should make this as statistically significant as reasonably possible.
3. Lastly, increase the field to 3.5 T and then 4 T and take more runs.