xBSM Setup Procedures Rev 3:

Initial Line Alignment [6 hours]:

1. Flatten orbit to previous bumped orbit
2. Record set, route and feedback settings
    a. Check for shaking OFF
3. Load machine with 9 trains of 1 bunch of 1 mA each (~evenly spaced)
4. Verify all motor locations, using the last known good position
    a. Box has been surveyed into position via approved procedure
5. Place detector into nominal slow diode position
6. Initial scans with white beam to verify light is reaching detector
    a. TADETZ scan, if necessary bump beam to center of detector
    b. Verify that the signal levels are consistent with established levels
    c. Horizontal box scan sanity check
        i. Note many previous scans required the box to be located XXX above lower edge
7. Insert pinhole optic to last known good position and width
    a. TADETZ scan, record
    b. TADETX scan, record
    c. Vertically bump beam to center of detector, using TADETZ scan to monitor results
    d. Horizontally bump beam to center of detector , using TADETX scan to monitor results
    e. NOTE, gap might not be in the optimal position, if it is way off, revert to nominal detector position. The optimal position of the pinhole may have to be adjusted…seek guidance! The pinhole may have to be opened fully.
    f. Iterate c and d as needed
    g. Record set, orbit and store in route
8. Perform LET tuning cycle
    a. Repeat step 7
9. Repeat step 6 with white beam and record
10. Pinhole optic scan (TASZ) and record
11. Optics Scans
    a. Move box horizontally to align with optics chip
    b. Insert optics chip and remove pinhole optic
    c. FZP scan using TAAP, record
    d. CA scan using TAAP, record
    e. Whole chip scan, using TAAP, record
    f. Proof of existence scan high energy optics chip
    g. Record the optimal positions for all optics
    h. Record saveset, route and orbit
12. Dump (WA) all motor positions

Fine optic alignment (Fast readout only) [30 minutes]:

1. Determine relative location of wide component in CA fast acquisition image
2. Move CA (TAAP) to center wide component
3. Move detector (TADETZ) to center on CA image (total motion should be ~3.4 times the motion in step 2)
4. Record TAAP and TADETZ for optimal optic position
5. Repeat procedure for FZP

NOTE: for beam dynamics shifts the fine optic alignment needs to be done. It does NOT need to be done for the LET shifts.

Pinhole Optic Width Setup [2 hours]:

Note: Historically Cline = 4.55 @ 2.1 GeV, smaller width = dec TASGAP, 0 width = 3.9 TASGAP
Note: Historically Dline = 3.35 @ 1.8 GeV, smaller width = inc TASGAP, 0 width = 4.8 TASGAP (measured at 4 GeV)
Note: Historically Dline = 3.45 @ 2.1 GeV, smaller width = inc TASGAP, 0 width = 4.8 TASGAP (measured at 4 GeV)
Note: Historically Dline = 4.59 @ 4.0 GeV, smaller width = inc TASGAP, 0 width = 4.8 TASGAP
Note: The pinhole optic width should be set low within the apparent broad minimum because the observed shape is influenced by the finite beam size at the time of calibration

1. Load machine with T1B1, 1 mA under optimized LET conditions (smallest beam possible)
2. Record set, route and feedback settings
   a. Check for shaking off
3. Pinhole optic in and at nominal position
4. Fast readout scans

   Note: TASGAP is adjusted and recorded along with beam current, image width and image height in an iterative fashion. TAAP adjustments may be necessary for large adjustments in TASGAP.

   a. Starting at nominal and decreasing pinhole width (refer to motion of TASGAP) in steps of 0.2 to find 0 width (closed). If the width does not increase as we approach 0 width, we must increase the granularity of scan and repeat.
   b. Starting at nominal and increasing the pinhole width (refer to motion of TASGAP) in steps of 0.4 with the goal of seeing the width double. The width may saturate and the intensity will continue to go up, this is also a valid end point for scan.
   c. Analyze recorded data and determine a preliminary minimum. Look at total transmission (width x height), should be linear in TASGAP.
   d. Perform a finer scan with a TASGAP window of 0.5 around recorded preliminary minimum.

Horizontally Limiting Slit Width Setup [2 Hours]:

Notes:

The horizontally limiting slits (HLslit) were inspected 20111101.

Both TABLDN and TABLDS move North in the (+) direction. Thus, TABLDN moves to open in the (+) direction while TABLDS moves to close in the (+) direction.

The HLslit width was measured with shim stock. However, the measurements are clouded by the burrs on the shim stock. The best estimate is that the slits were closed for the combination: TABLDN=-0.200 and TABLDS=+1.490. Thus, the equation is HLSwidth= 1.690+TABLDN-TABLBS.

The hysteresis on both TABLDN and TABLDS were set to finish closing; the overshoot is on opening, not closing.

Basic plan:

Hold TABLDN fixed. Tune HLslit width adjusting TABLDS and using slow readout scans of TASLITX. Tune HLslit position using slow readout scans of TASLITX. Check relative tilt of HLslit to detector. Verify attenuation by measuring with HLslit "in" and "out" with slow readout scan of TADETZ and with fast readout.

1. (Previously, with box open,) record HLslit position, relative to detector, for recorded TALITX and TASLITZ. Move HL slit to non-obstructing position.
2. (Now, at start of tune-up,) beam can be about 10mA, with or without optics.
3. Set HLSwidth=0.4mm.
4. Set TASLITZ to a position that roughly centers the HL slit of the detector.
5. Scan full range of TASLITX to establish the locations of the HLslit, the material boundaries, and a "slit-out" region. (Verify that TASLITX (+) moves the stage to the North.)
6. Set TASLITX to the lower limit of the transmission through the HLslit as determined in (*previous step*).
7. Perform a series of slow readout scans of TASLITX. The independent variable is TABLDS. Use progressively increasing values of TABLDS (decreasing values of HLSwidth). Record TABLDS, expected HLSwidth, average TASLITX, width TASLITX, peak height, beam current.
8. Look at the slow scan distribution. Verify that the diffraction is visible at the edges. It is not necessarily symmetric. But, if the diffraction is not visible, the beam is not clean enough for this procedure.
9. Select a setting of TABLDS that provides the target attenuation, from the results of the series of slow scans.
10. Set TABLDS and TASLITX for target attenuation and centering the illumination of the detector. Note that we do not know yet the readout side of this particular slow diode. The final TASLITX adjustment will be done with the fast readout.
11. Verify the relative tilt of the HLslit. Perform a series of slow readout scans of TASLITX while varying TASLITZ through positions: -1.6mm, -0.8mm, 0.0, +0.8mm, +1.6mm, relative to the nominal TASLITZ position. Record TASLITZ, average TASLITX, width TASLITX, peak height, beam

current. Verify that the width and transmission are consistent. Measure the tilt of the HLslit from the values of average TASLITX.

12. Change to fast readout and beam without optics.
13. Perform a fast readout with HLslits in “out” position.
14. Perform a series fast readout scans with varying TASLITX. Move TASLITX +/- 0.3mm in steps of 0.03mm (or less). Establish values of TASLITX that illuminate the left and right edges of the detector and the middle.
15. Record the refined nominal positions for TASLITZ, TABLDS, TABLDN, TASLITX (“in” and “out”), and the attenuation.
16. If you are not satisfied with the attenuation, adjust TABLDS and go back to 13.
17. (End) Restore TASLITX as required for next operation.

DAQ Timing Setup [2 hours]:

1. Record set, route and feedback settings
2. Load machine with T1B1 1, mA in a 14 nS configuration
3. White beam on detector
4. Verify motor positions
5. Load last known good timings into daq
6. Scan each channel for gross timing (peak in 14 nS window)
7. Trim timings for all channels
8. Write timing file
9. Put second bunch in machine and scan both bunches
10. Repeat for the 4 nS setup
11. Record latest filenames and conditions

DAQ Timing Trim [30 minutes]:

1. Record set, route and feedback settings
2. Load machine with T1B1 1 mA in a 14 nS configuration
3. White beam on detector
4. Verify motor positions
5. Load last known good timings into daq
6. Trim timings for all channels
7. Review for large excursions
8. Repeat if necessary
9. Write timing files
10. Repeat for the 4 nS setup
11. Record latest filenames and conditions

DAQ Based Detector Calibration [10 minutes]:

1. Record set, route and feedback settings
2. Load machine with T1B1 1 mA in a 14 nS configuration
3. White beam on detector
4. Verify motor positions
5. Look at pass1 plot to see that the beam is reasonably well centered
6. Collect 1000 turns of raw data
7. Analyze raw data and generate a calibration file
8. Record latest filenames and conditions

DAQ Based Pedestal Collection [10 minutes]:

1. Record set and route
2. Close beam stops
3. Collect pedestal data
4. Record latest filenames and conditions.

DAQ Linearity Check [2 hours]:

1. Record set, route and feedback settings
2. Load machine with T1B1 1, mA in a 14 nS configuration
3. White beam on detector
4. Insert pinhole optic
5. Verify motor positions
6. Load last known good timings into daq
7. Collect 1000 turns and verify basic functionality
8. Collect linearity data:
    a. Starting at 0 mA collect 1000 turns of data, incrementing the current in 0.5 mA steps.
    b. Adjust gain at each step in order to maximize signal level.
    c. Record final setting and data file
    d. Plot bunch channel 16 and look for signs of saturation
    e. Repeat 7a-d up to 10 mA