SLAC MEMORANDUM July 18, 1996

To: FFTB/E144/SLC Ops
From: Glenn Horton-Smith
Subject: E144 β-match procedure for August '96 run

This procedure is based entirely on Spencer Hartman and PT's note from March 1995.

Note: If the beam matrix is not to be measured, then load your trial config immediately and do just the tail minimization step below, then skip ahead to the "Verify the beta match" section.

I Minimize linac tails

a. Before doing anything, make sure there is something to use as a reference orbit after linac steering and/or beta match implementation.

b. Eliminate tails on linac tail monitor. Minimize the physics variable "E" at sector 28. Strive for emittances of 2.5 by 0.20 "SLC units" – emittances better than 3.0 in X, 0.3 in Y are expected and required.

c. Scan any and all available FFTB wires. If gaussians are asymmetric, then OPS have more tail-elimination to do.

II Load Measurement configuration, double-check linac tails

a. Before stopper 62 is inserted, make sure there is something to use as a reference orbit after linac steering and/or beta match implementation.

b. OPS: Turn off beam, insert ST62, get up video for profile monitor.

c. OPS: Do a "load partial" for CB00 LGPSes from FFTB magnet config NORMAL 116. Go ahead and activate, *but* before trimming, re-enter previous BDES values for LGPS 1070 (e.g. using BACT to BDES function). Then trim CB00. Turn on the beam and zero the difference orbit in CB00.

d. OPS: Double-check tails on linac tail monitor.

e. With measurement config now loaded, scan WS1 with 7 μm wire for horizontal and vertical spot. If gaussians are asymmetric, then OPS have more tail-elimination to do. Sector 11 bumps are suggested.

f. Repeat tail-checking/correction with Q5 at each endpoint of the scan we're about to do.

III Measure projected TWISS parameters and emittance

Use thick lens mode for quad emit calculations!

[see PT and Spencer's procedure for detailed steps]

IV Measure full beam matrix (4-D quad emit)

[see PT and Spencer's procedure for detailed steps]

V Select waist position: KEK, WS6A, ORSAY, E144-IP1

a. The waist positions can be obtained by doing a partial load of the CB02 LGPS magnets. The configurations are

KEK	NOR 183
WS6A	NOR 215
Orsay	NOR 189
E144-IP1	NOR 291

b. Once a configuration is loaded and trimmed, the waist position should be within the tuning range of the quadrupole knobs.

Note: The upstream β-match does not depend on the waist position selected, but it is considered a good idea to pick where you want the waist to be ahead of time.

VI Calculate the beta match

a. Using the measured twiss parameters, desired waist position, desired size of beta functions, etc., calculate the proper settings of Q5, Q6, QA0, QA1, and QA2 using offline MAD, SAD, DIMAD, or whatever. Load and trim the CB00 magnets.

b. Do BDES to KMOD, run model (DBASE DIMAD), and put it in the database. This will allow knob calculations to come out right.

VII Verify the beta match

a. First, predict the spot sizes at WS2, WS3, WS6B, and IP1 using offline MAD, SAD, DIMAD, or whatever.

b. If WS2 and WS3 are available, measure the spot sizes at WS2 and WS3. For best results, do a SKEW scan of each wire. (If WS2/WS3 are not available, proceed to WS6B and IP1 wires.)

c. If the measured spot sizes do not agree with the offline predictions to within a few percent, then set SF1 BDES to 3000, and scan waists using Irwin knobs from WS2/WS3 tuneup panels. (Note that for 30 mm by 10 mm beta*, the X waist at WS2 is 80 cm long, and the Y waist near WS3 is a whopping 250 cm long, so there may be little point in scanning the Irwin waist knobs.) Then proceed to the Irwin magnification knobs.

d. Check the spots at WS6B and IP1. Use appropriate magnification knobs (i.e. Koffas' knobs) to fix WS6B, and then scan waist at IP1 if neccessary. Note that the Y waist at IP1 is some meters long in any practical E144 config, so any Y spot size problem is likely to be something other than Y waist position.

VIII Cleanup and good housekeeping

(This section could also be called "Things to make right before going home when everything seems good/ things to make right before panicking when everything seems bad.")

a. Sextupoles back at nominal value?

b. Orbit recovered to proper reference? (see steps I.a and II.a)

c. Linac LEM/tails/emittance all still okay?

d. Have you "saved the world" lately?