Beta Matching GUI

Scope

This graphical user interface (Fig. 1) for Matlab calculates the magnet settings to optimize transport of the beam downstream, minimizing emittance growth. The software uses the Twiss parameters measured by Emittance GUI and stored in PVs. A fitting routine adjusts magnet settings to minimize mismatch parameter (ξ), finding magnet settings which will change the measured Twiss parameters to the design or goal parameters.
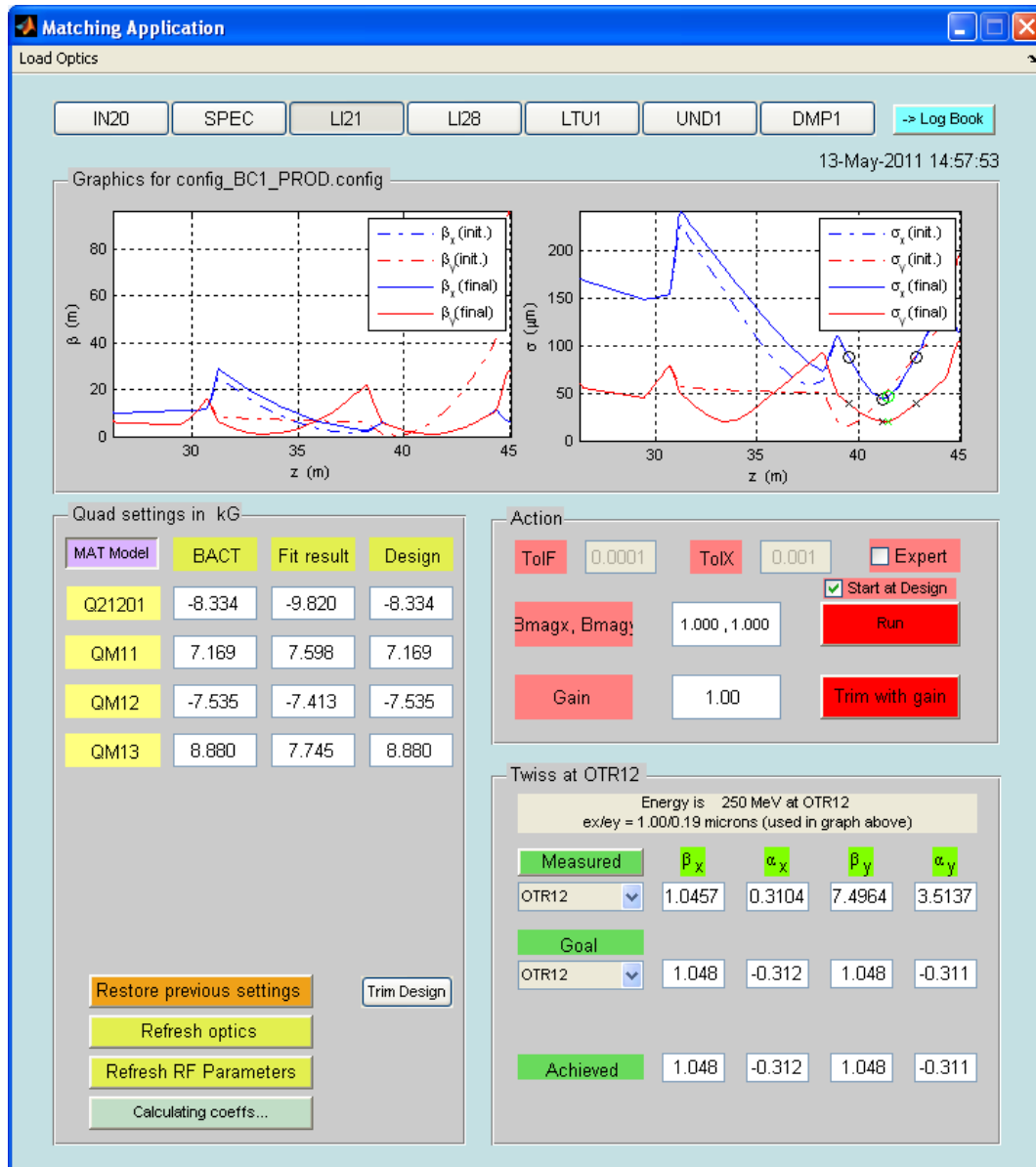
Figure 1: Graphical user interface for beta matching

Usage Procedure

1. Start program. For LCLS, on the LCLS Home Screen, open User Dev Displays and then select Beta Matching. For NLCTA, select Beta Matching from the NLCTA_guiLaunch screen. Alternatively (for either accelerator), type matching_gui from the command line in a Matlab session.
2. Select desired sector using radio button at top of GUI.
3. The BACT and Design magnet settings will automatically update.
4. Select the monitor that was used in the emittance measurements (profile monitor or wirescanner) using pulldown menu under Measurement. Select location(s) where to match the beam under Goal.
5. The alpha and beta values will automatically update. The values in the Goal row are determined from the design model. The values in the Measured row are read from PVs that stored the values determined by emittance GUI.
6. Click Start at Design to force fitting routine to use the design values of the magnets as seed values (otherwise BACT values are used).
7. Click Run to begin fitting.
8. The Fit Result magnet settings, Bmag values, and Achieved values will update continuously while fitting is in progress.
9. When fitting completes, graphs of initial and final values of beta and beam size are displayed.
10. When fitting completes, compare Achieved row to Goal row. Values should be nearly the same.
11. Examine the Fit Result magnet settings and compare to BACT values. IF the magnitude of the change is reasonable, click Trim with Gain.
12. If the magnitude of change seems too large, the change can be scaled with Gain parameter. For example, to apply only half of the calculated change in the magnets, set Gain to 0.5 and click Trim with Gain.
13. If after trimming magnets to new values it is determined that the initial values were preferable, click Restore Previous Settings to undo the change.
14. If magnets have been changed manually, click Refresh Optics.
15. If RF parameters have been changed (e.g. using Phase Scans GUI), click Refresh RF Parameters.
16. To trim magnets to design values, click Trim Design.
17. Clicking the Expert checkbox allows for changing of the tolerance conditions used by the fitting routine. TolX is the tolerance on the magnets, TolF is the tolerance on the quadrature sum of the mismatch parameters.
18. As an alternative to the Trim with Gain button, it possible to assign the fit values to a multiknob file, allowing the fit values to be progressively applied via turns of a knob.

19. Click the Create MKB File button. it will create the multiknob file and prompt you for the EPICS box and knob to which you wish to have it assigned.
20. The knob is scaled so 1 whole knob turn = 10% of the calculated match. 10 turns therefore puts in 100% of the match.