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LER INJECTION LINE B2/B4 STUDY

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Abstract

During the PEP-II LER commissioning run in July 1998 the beam profile in the tune up dump profile monitor just before LER injection showed an anomalous parbolic shape. The sextupole component of the field of bend magnets B2 and B4 in the beginning of the south injection tunnel (SIT) was thought to be the cause of this. An off-line model of the B2/B4 bend magnet field was created using DIMAD. Results of particle tracking simulated in DIMAD were compared with on-line lattice diagnostic data and observations of the beam profile on the tune up dump screen.

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LER Injection Line B2/B4 Study

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Abstract

During the Pep-II LER commissioning run in July 1998 the beam profile in the tune up dump profile monitor just before LER injection showed an anomalous parabolic shape. The sextupole component of the field of bend magnets B2 and B4 in the beginning of the south injection tunnel (SIT) was thought to be the cause of this. An off-line model of the B2/B4 bend magnet field was created using DIMAD. Results of particle tracking simulated in dimad were compared with on-line lattice diagnostic data and observations of the beam profile on the tune up dump screen.

I. INTRODUCTION

We carried out beam-based lattice diagnostics for the entire injection line to discover the cause of the parabolic beam profile on the tune-up dump screen just before the LER injection point (Fig. 1). The data revealed a possible optical error in the B2/B4 region. Grid scan data taken at the entry to B4 shows a sextupole component to the field that the beam sees (Fig. 2). Originally, B2/B4 was a single magnet designed to bend the 14 GeV Pep-I beams through a fairly shallow arc. Now B2/B4 is split into two separate C-magnets which bend the 3.11 GeV Pep-II beam through a much larger arc. (Fig. 3). The difference in sagita for the new configuration requires an 11 mm shift in the horizontal alignment. After re-alignment, the optical error revealed by grid scan data is greatly reduced. However, the swoosh shaped beam profile persisted even after re-alignment.

*Work supported by Department of Energy contract DE-AC03-76SF00515.

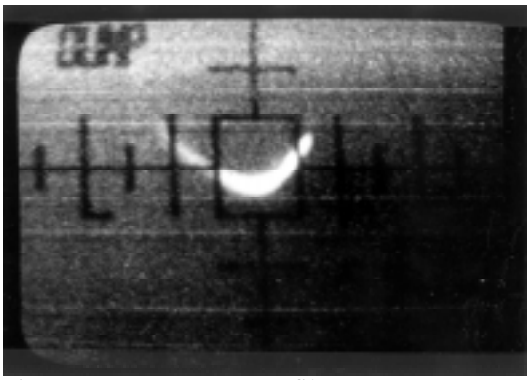

Figure 1: Dump screen profile.

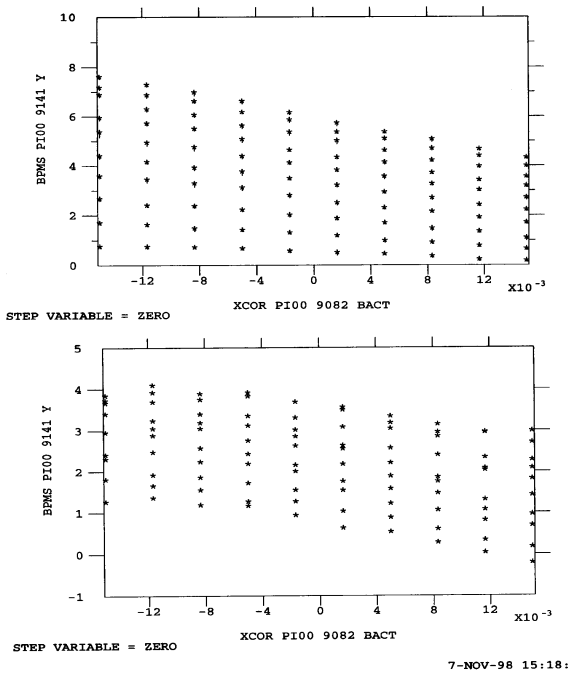

Figure 2: Grid scan data before and after re-alignment of B2 and B4.

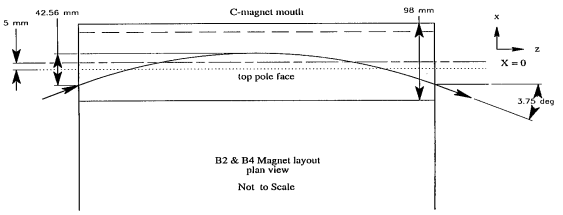

Figure 3: Beam trajectory through B4.

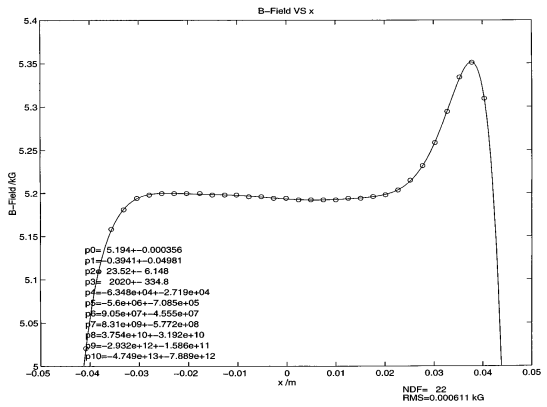

Figure 4: Measured field of B4.

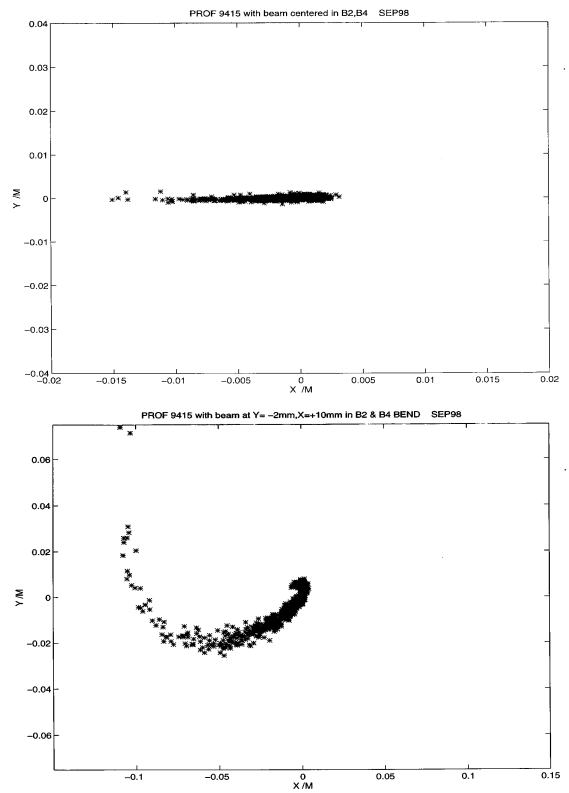

Figure 5: DIMAD simulation of beam profile with nominal B2&B4 (top) and with measured field and offset included (bottom).

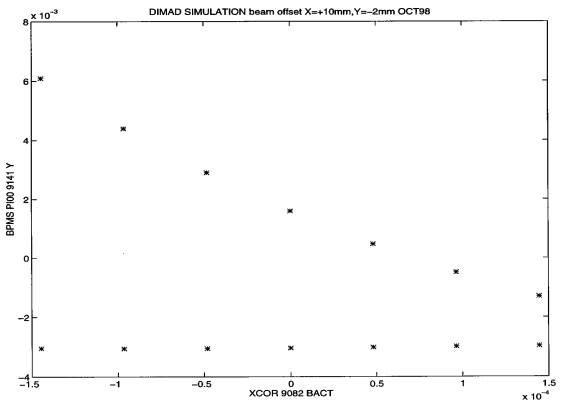

Figure 6: DIMAD simulation of grid scan.

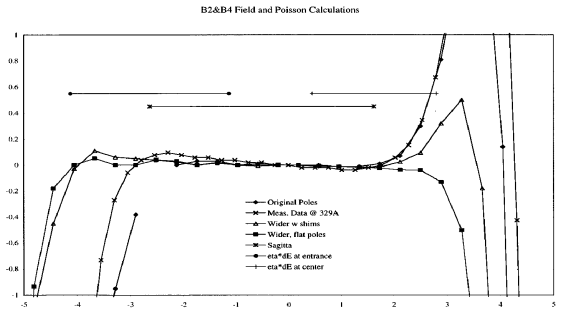

Figure 7: Poisson simulation of B4 field with different shims and pole tip extensions.

II.POSSIBLE EXPLANATION

The swoosh could be caused by the small size of the good field region of the B4 bend magnet. (Fig. 4). The dispersion at the entry to B4 is 2meters which creates a full width beam size of 30 mm in the horizontal plane. The beam path through this bend follows quite a large arc. So that a large portion of the bend's width is traversed (Fig. 8).

Off-line DIMAD-based model simulations show what the nominal beam profile should look like (Fig. 5 top). When measured B4 field and offset are included, the predicted beam shape and grid scan pattern correspond well with observation (Fig. 5 bottom, Fig. 6).

The effect of a dispersion error at the linac extraction point was calculated and proved to be much smaller than the effect from the anomalous field of B4.

III. PROPOSED FIX

Calculations based on Poisson show that the B4 field could be much improved by the addition of shims and pole-tip extensions. (Fig. 7). The B4 magnet will be modified before the Pep-II start-up in May 1999.

In addition, the beam size in regions of high dispersion can be reduced by minimizing energy spread. Decreasing the compressor klystron voltage in the South Ring To Linac (SRTL) line should help to reduce the energy spread [1].

IV. CONCLUSION

The correction of the B4 bend field with shims combined with reduced energy spread should produce a beam shape at the entry to the LER which has a much more normal elliptical shape. This should allow the capture efficiency for the LER to come up the 100% level that is the norm for the HER.

Acknowledgments

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References

[1]F.J.Decker,R.H.Iverson,H.Smith,M.S.Zelazny,SLAC, *The SLAC Linac During the Pep-II Era*, in these proceedings.