RELEASE OF MARYLIE 3.0*

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1 INTRODUCTION

The latest version of MARYLIE 3.0 is being released along with a 750 page User's Manual [1]. MARYLIE 3.0 is a 3rd-order charged-particle beam transport code that exploits the power of Lie-algebraic map methods to treat the full 6-dimensional phase including all possible linear and nonlinear transverse and longitudinal couplings. A serial version is available for ordinary computers, and a parallel version is available for the 512 processor CRAY. A Multi-Platform Graphic User Interface version, designed to facilitate all operations and comparisons between various codes, is also being released [2].

The current version of MARYLIE models approximately 30 different kinds of beamline elements. In addition there are about 40 simple commands and another 40 advanced commands. Many of these commands work with and exploit the maps associated with the various beamline elements. There are also commands for input and output, the production of various kinds of plots, and the production of geometrical information including floor-plan layout drawings. Finally, there are approximately 20 procedures and fitting and optimization commands to facilitate system design. All together, the MARYLIE 3.0 main program and approximately 500 subroutines comprise approximately 37,000 lines of FORTRAN 77 code.

MARYLIE can be used to generate particle distributions, including linearly and nonlinearly matched distributions. These distributions can then be tracked using element-by-element maps, lumped maps, or full-turn maps. Maps can also be applied to functions and moments.

In addition to fast tracking studies, MARYLIE can be used to design and analyze lattices for both single-pass systems and circulating storage rings. Analysis commands include the calculation of all aberrations through third order; tunes and anharmonicities and first and second-order chromaticities; first, second, and third-order phase-slip factors; first, second, and third-order dispersions and all other linear lattice functions and their energy dependence through second order; nonlinear lattice functions; nonlinear phase-space distortion; transfer map normal forms; nonlinear resonance driving terms; nonlinear invariants; and moment data including eigenemittances and all moments through 4th order.

The User's Manual contains numerous examples ranging from the simple to the complex including sextupole corrected electron microscopes having sub-Angstrom resolution, 3rd-order achromats, the SLAC Final Focus Test Beam facility, and the Fermilab Tevatron. Figures from some of these examples are displayed below.

2 EXAMPLES

Figure 1 shows a MARYLIE generated ray plot for a simple quadrupole spot–forming system. The quadrupoles occupy the shaded areas.

Figure 2 shows a sextupole corrected electron microscope, and figure 3 shows the focal spot pattern for this system.

Figures 4 and 5 show the predicted final beam spot for the SLAC Final Focus Test Beam facility. Three different energies are displayed.

Figures 6, 7, and 8 show Tevatron tracking data when strong distortion sextupoles are powered.

Figures 9 and 10 show MARYLIE generated graphic data for the Los Alamos Proton Storage Ring.

3 REFERENCES

[1] A.J. Dragt, D.R. Douglas, F. Neri, C.T. Mottershead, E. Forest, L.M. Healy, R.D. Ryne, P. Schutt, J. van Zeijts, MARYLIE 3.0 User's Manual, University of Maryland Physics Department Report (1999).

[2] G.H. Gillespie et al., Using MARYLIE with the Particle Beam Optics Laboratory, these proceedings, 3 pages (1999).

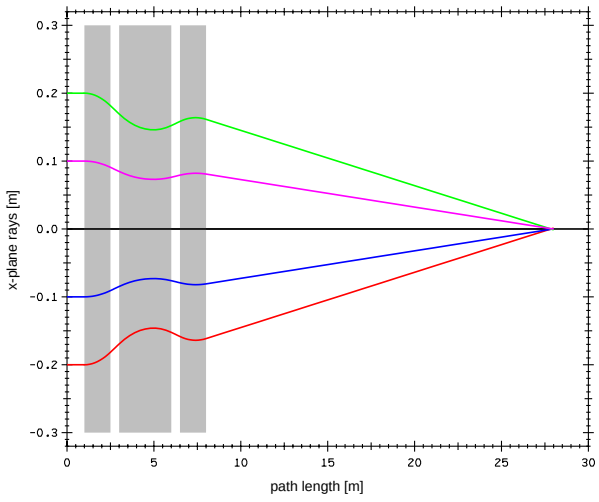

Figure 1: Horizontal plane ray plot for a simple quadrupole spot-forming system.

* Work supported in part by U.S. Department of Energy grant DEFG02-96ER40946.
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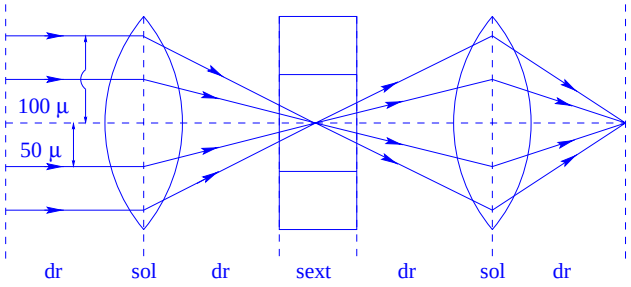

Figure 2: A simple electron microscope spot-forming system consisting of two solenoids and suitably chosen drifts.

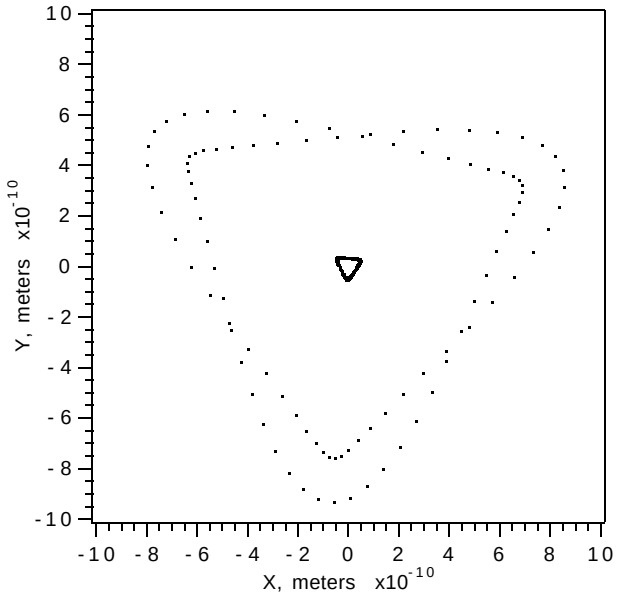

Figure 3: Focal spot pattern for sextupole corrected electron microscope.

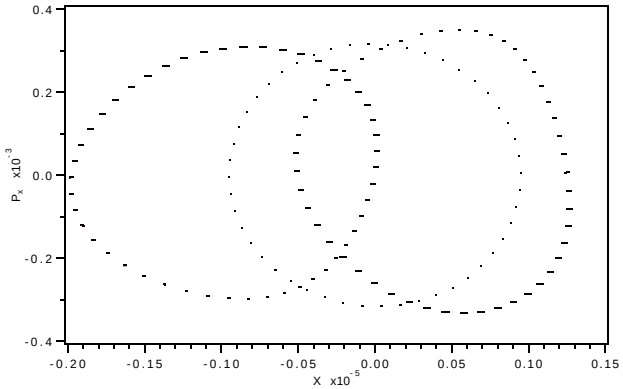

Figure 4: Horizontal projection of phase-space final conditions for SLAC Final Focus Test Beam facility.

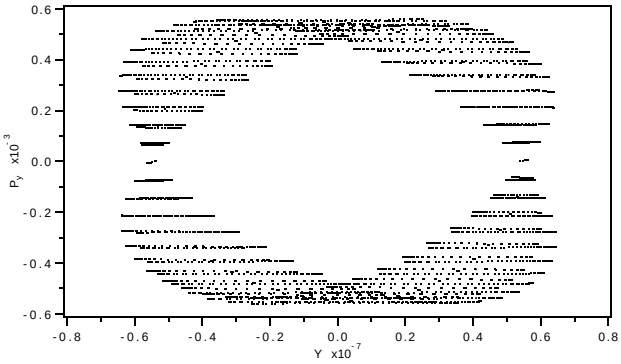

Figure 5: Vertical projection of phase-space final conditions for SLAC Final Focus Test Beam facility.

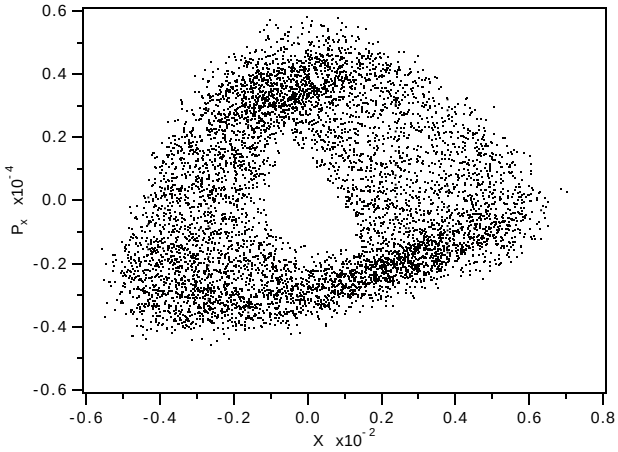

Figure 6: Horizontal projection of lump-by-lump phase-space tracking data for Tevatron with strong distortion sextupoles.

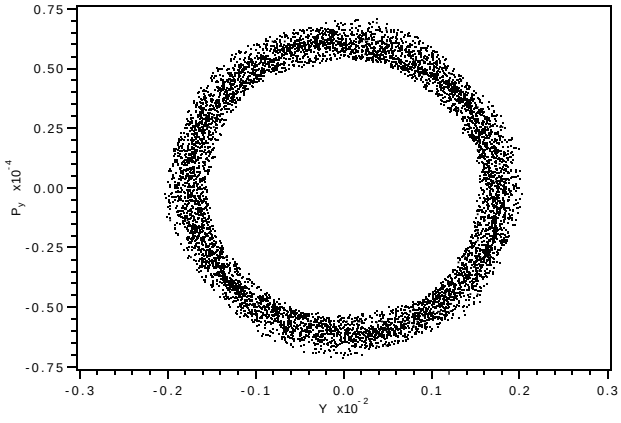

Figure 7: Vertical projection of lump-by-lump phase-space tracking data for Tevatron with strong distortion sextupoles.

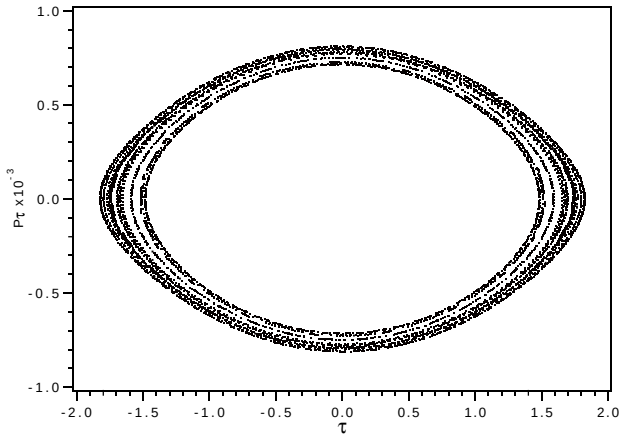

Figure 8: Temporal projection of lump-by-lump phase-space tracking data for Tevatron with strong distortion sextupoles.

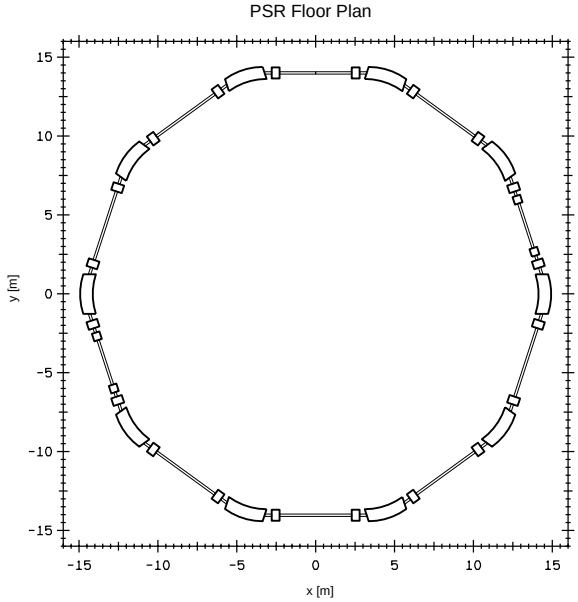

Figure 9: Floor-plan layout drawing for the Los Alamos Proton Storage Ring.

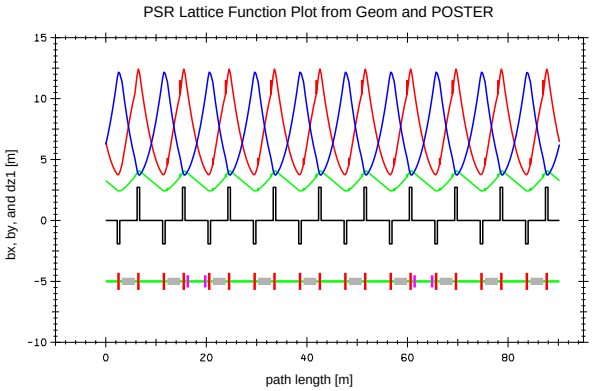

Figure 10: Lattice function plots for the Los Alamos Proton Storage Ring.