New Features in DIMAD

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Abstract

This paper presents the new features that have been introduced recently in DIMAD. [1]

The first is a simplified (not self consistent) simulation of transverse space charge effects. This simulation can be used in conjunction with all the tracking operations of DIMAD.

The second is a new accelerating cavity, in which the accelerating field can be a function of the longitudinal coordinate.

The third is the translation capability of the MAD input format to a COSY compatible input.

The fourth is the creation of a COSY input file for lattices with alignment and field errors and subsequent corrections.

I. SPACE CHARGE SIMULATION FEATURE

The space charge effect simulated is that of the transverse distribution only. The distribution is assumed to remain elliptical in the transverse plane x-y. It is also assumed to remain Gaussian. Results provided by the program indicate if these assumptions are reasonable.

The simulation installed in DIMAD is a derivation inspired from the approach of G. Parzen [4]. U. Wienands and G. Wellman [5] improved the method introduced by Parzen. However some problems occurred in the fitting procedure of the matched beam under space charge conditions. The solution we adopted uses only one reference particle instead of 4 (G. Parzen) or 8 (U. Wienands). This avoids introducing some incorrect geometrical assumptions about the shape of the matched beam.

The simulation is first run for some number of turns to allow the distribution to stabilize around an elliptical shape. Then any other tracking routine of DIMAD can be used. All particles are subjected to the space charge forces defined by the reference particle. At all times the reference particle continues to be tracked and the space charge distribution is updated regularly.

II. CEBAF TYPE ACCELERATING CAVITY

David Douglas of CEBAF developed a formalism for simulating the tracking of particles through an accelerating cavity whose longitudinal accelerating electric field varies with the longitudinal coordinate. [6] This option was used successfully in simulating the behaviour of the CEBAF superconducting cavities. The simulation results agreed reasonably well with the measurements on the CEBAF linac.

Those interested in using this feature for other types of cavities should contact David Douglas at CEBAF.

III. COSY INPUT FORMAT GENERATION

Two COSY input generations have been implemented in DIMAD. The first one is within the standard input reading modules. It simply translates the Standard (Mad) input [3] into a COSY compatible format. [2] Only the element and beam line definitions are translated. The variable links used in the standard input are lost. Only the resulting numerical values are translated.

The second input is within the DIMAD operation stream. It can appear at any position in that stream. The currently used lattice, in its final status when the translation is required, is translated. The translation thus will include any misalignment and field errors and also corrector values as set by DIMAD. Since COSY operates in canonical variables, the symplectic option of DIMAD has to be set before invoking the translation.

IV. REFERENCES

[1] R. Servranckx, K. Brown, L. Schachinger, D. Douglas, *Users Guide to the Program DIMAD*, SLAC report 285 UC-28 May 1985.

[2] M. Berz, *COSY INFINITY Version 5 , User's Guide and Reference Manual*, Technical report MSUCL-811, December 1991.

[3] D.C. Carey, F.C. Iselin, *Standard input Language for Particle Beam and Accelerator Computer Programs,* 1984 Summer Study on the Design and Utilization of the Superconducting Super Collider, (Snowmass, Colorado, 1984).

[4] G. Parzen, *Space Charge Limits in Proton Synchrotrons*, (submitted to Nucl. Instrum. and Methods)

[5] G.F. Wellman, Transverse Space Charge Simulation in DIMAD, In collaboration with U. Wienands. TRI-DN-89-K84.

[6] D. Douglas (private communication).