Abstract: A new technique for simulating the beam halo in circular e+e- colliders. Simulated beam halo has been compared with experimental results. The simulation results are in good agreement with the experimental data. This technique can be used to study the beam halo in various e+e- colliders.

Simulation of the Beam Halo from the Beam-Beam Interaction

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The axis in the figure are the longitudinal, horizontal, and vertical dimensions, so we have chosen the ellipsoid shown in Figure 1 as the boundary because it retains particles with large longitudinal amplitudes. The boundary is determined independently of $M$, $W$, or $W'$, and $a$, $b$, $c$, $A$, $A'$, and $A''$. The longitudinal boundaries $b'$ and $b''$ are the same as $b$ and $b''$, respectively. The boundary parameters are found as follows: 1) find an $n$-dimensional plane that intersects the boundary, 2) find $n$-dimensional plane that intersects the boundary, 3) define a linear transformation that maps the plane to a plane in $n$ dimensions, 4) apply the transformation, and 5) find the intersection of the resulting plane with the ellipsoid.

The simulation starts with 1000 particles that are Gaussian distributed in $n$-dimensional space. These particles are released through the boundary and upgrade to the $e$-dimensional beam. The initial beam is a uniform distribution of particles in energy and momentum. The beam distribution is then converted to a Gaussian distribution of particles in energy and momentum. The beam is then propagated through the boundary, and the particles are absorbed or reflected. The boundary is then updated to reflect the new distribution of particles. The process is repeated until the simulation is complete.

For the next step, the beam is propagated through the boundary, and the particles are absorbed or reflected. The boundary is then updated to reflect the new distribution of particles. The process is repeated until the simulation is complete.
Synchronization of beam motion

well as the strong beam stops at those positions, are modulated by
the strong beam positions of the beam beam kicks as

increase decompound beam stops in the strong beam, and

The position of strong beam positions is necessary for bunch bunch

position in strong beam can be shown in 3.5. of the receive position.
The bremsstrahlung and

The appearance of the result is evaluated using a "soft approximated"

that appears in the formula of (b) of (a) to "soft" the formula. The

appear in the section of bremsstrahlung. The formula is electrically

in the first dimension, and the beam beam interaction is calculated using

all of these dimension, and the beam beam interaction is calculated using

is the soft bremsstrahlung. The strong beam is assumed to be

is written in standard FORTRAN. The tracking algorithm

III. THE PROGRAM

Example

boundaries are plotted for simplicity, and these boundaries are used in this

Figure 2 shows an illustration of the simulation process. Two-dimensional

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Figure 3: Program flow chart.

End

Calculate the mean & standard deviation of the particle positions
At each step, perform this calculation
Final reading loop

Yes

Last boundary?

No

Lower boundary

Final reading loop

Transfer particles if there is a new crossing

Set figure loop

Start

Input
Figure 4. Particle distribution contours in amplitude space.

In the electric-field resonance were expected, this is discussed more in the next section. The resonance is seen in curves and particles following from the graph to the right. The contour resonance fields are within the high-order rotating resonances. The first 4 particles chosen such that two parameters: these are listed in Table 1. The labels are the beam power, the beam, and the beam beam and the beam beam to verify the method. The first comparison was with a single beam beam.

Comparisons were made between this program and conventional tracking.

In this test, the first tracking loop:

The loss rate and lifetime can be calculated from the number loss and the noise.

If there were been lost in their weak in amplitude, then, therefore, would have been lost if there were in an amplitude that amplitude. Therefore, those particles. Even amplitude during the period of the tracking loop. Those particles with this information that can then the number of particles that exceeds any amplitude of each particle. In the last tracking loop are recorded. The amplitudes of each particle as the beginning of the last tracking loop and the amplitudes can be estimated for various purposes. To do this, the

alpha = \alpha \cdot \frac{\phi}{\exp(-\alpha \cdot \phi)}

Figure 4 shows the distribution contours. The number of particles in the

Section A.

Comparisons were made between this program and conventional tracking.
The core distribution and complicate boundary-crossing information in the cell. It reflects the statistics of the sampling process used in obtaining the core points. The core is shown in the core and uses to the 0.1-0.9 level for most of the random seeds are used to estimate the relative error. The points also, where N is the total number of particle runs. In each case, the difference

\[ \frac{1}{N} \sum_{i=1}^{N} y(x_i) = \frac{1}{V} \int_{V} y(x) \, dx \]

as the vertical unit for selecting for 4, 6 and 9 damping times. The cell is defined by the vertical unit for selecting the length of the cell. The most important issue is the length of the simulation interval. We have studied the sensitivity to parameters of the simulation itself.

The parameters, \( x \) and \( y \), are the horizontal and vertical multipliers function at the intersection point.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Beam Parameter</th>
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<tbody>
<tr>
<td>0.05 cm</td>
<td>1.5 cm</td>
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<tr>
<td>0.5 cm</td>
<td>0.375 m</td>
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<tr>
<td>1 m</td>
<td>0.5 m</td>
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<tr>
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between contour lines.

and (q) by the new method. The particle density changes by a factor of 0.4, as generated by conventional technique. Includes the synthetic model. (a) was generated by conventional technique. Figure 5. Particle distribution contours in amplitude space. Simulation Figure 5. Particle distribution contours in amplitude space.
defined in eq. (1). At vertical axis is $\gamma/1$. The fraction of particles beyond a certain amplitude as vertical tail. Vertical tail distribution with different settling times. The
Damping actually increases the vertical amplitude and can transport a particle more quickly. A decrease of $Ax$ can result in an increase of $Ay$. Radiation $p$ and $n$ are positive, a decrease of $Ap$ can result in an increase of $Aq$. Oscillation center shifts this locus, and for some resonances where both $p$ and $q$ are integers, the effect of damping is to move the satellite the resonance condition.

$$\text{satisfy the resonance condition...}$$

satisfying the resonance condition oscillate around the resonant center with a locus in the $Ax$-$Ay$ plane. These particles drive parts into nonlinear resonances. These particles nonlinear resonances. A third possible phenomenon is resonance scattering (8.9).

A second proposed phenomenon is diffusion. Particles starting at high amplitude... number of interactions, providing a quadratic-amplitude resonance increases with energy be more important for large energy oscillation. Interaction strength is expected to number and reaching large amplitudes (13). Resonance overlap is expected to leading to chaotic motion with particles moving from one resonance to another and reaching high amplitudes (13). Higher-order resonances are wide enough that, close enough, they can overlap. When nonlinear interaction is based on the Chirikov criterion (12). When are different phenomena that could lead to beam losses. These particle losses give a good lifetime estimate.

V. UNDERSTANDING PHYSICS

In this particular case for a 10% beam lifetime, 5x10^11 equivalent

$\text{bounds...}$
Resonance screening shows that the method is not biased against it.

The simulation of a beam distribution known to be determined by several effects in the resonance feedback shows that the resonance is less prominent in the 2-D system.

The feedback resonances are affected by resonances. The transverse resonances

Longitudinal resonances arise from the phase points of the beam and the bunch distribution are different for the three parts of the beam and the bunch. The resonances near 27 = 0.523, 4 = 0.67, and 5 = 0.88 are shown in Figure 6. The resonances are the same as those for resonances 5.7. The resonances arise from a mechanism in a realistic, simple example. Figure 6 shows the results of such a mechanism. For a mechanism, the beam and beam-beam field are not considered, and therefore, the PEP-II parameters are used in the optimization. The mechanism for the resonances in Figure 6 is plotted in Figure 6 with two parameters and two resonances.

Figure 4 shows the results of one such test. The distribution in Figure 4

Our program is designed to explicitly simulate the beam halo without quickly to large amplitudes. In this case, the halo depends on the resonance
Resonances selected because of their appearance in the full formation. No plot order in (c), (d), and (e) is a 10th order to 30th order, and data are shown as solid lines. The dashed line in (c) is a 10th order to 30th order. The arrows in (d) indicate resonances up to 0.125 cm/s

Figure 9. Resonance lines and beam distributions for $q = 0.5$ cm/s.

We conclude that the most important role for order $e$ is to determine the beam lifetime for a collider with the PE-IP-II parameters and phase conversion model. We conclude that this mechanism would play a crucial role in general, but small to explain the particle motion observed. However, our observations are consistent with the resonance scheme and not the phase conversion model. Hence, we can explain the particle motion by near-collisional explanation. However, the resonances can have locations determined from higher-order parameters associated with the structure in the beam distribution and a second-order resonance $2q^{-y} + 2p^{-x}$, which complicates the kinetic.

The most prominent resonance is $2q^{-y} + 2p^{-x}$, which is not shown in Figure 3. However, it is not as strong in Figure 4. The resonance is $2q^{-y} + 2p^{-x}$, which is not shown in Figure 5.

The most prominent resonance is $2q^{-y} + 2p^{-x}$, which is not shown in Figure 6. The resonance is $2q^{-y} + 2p^{-x}$, which is not shown in Figure 7. The resonance is $2q^{-y} + 2p^{-x}$, which is not shown in Figure 8. The resonance is $2q^{-y} + 2p^{-x}$, which is not shown in Figure 9.

References:
