



Beam-Ion Influence Simulation Code "DEBIICS"

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Problem

- Circulating electron beam produce ions from residual gas atoms.
- Produced ions interact with electron beam and cause so called ion instability.

Investigate electron beam motion taking into account ion influence.

Problem solution method

- To solve the problem by numerical simulation.

Simulation code goals

- To track the beam through magnetic lattice.
- To generate ions in vacuum chamber.
- To calculate Beam-Ion interact.
- Write out bunch centroid coordinates at each step.

Used models and methods

- Ion model
- Bunch model
- Lattice model
- Ion generation method
- Beam-Ion interaction calculation method
- Bunch tracking method

Models descriptions

- Ions are represented by 2 vectors
 - Ion position by coordinates (x,y,z)
 - Ion momentum by (P_x, P_y)
 - Bunch is represented by centroid (X, P_x, Y, P_y, Z) and transverse **rms** sizes.
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- Entire lattice is segmented to equal pieces.
 - The length of pieces depends on bucket length should be input before simulation start.
 - Code calculates one transference matrix for each segment.
 - Lattice input done by specific input file.

Methods descriptions

- Ions are generated on segment border.
- Number of ions to generate is calculated by λ parameter.
 - $\lambda = \sum nN_B$
- By transverse coordinates ions are generated by probability 2D Gaussian distribution.
 - Gaussian parameters are taken from bunch transverse **rms** sizes at current position.
- From segment to segment the bunch centroid is tracked using segment Transfer Matrix.
- Bunch **rms** sizes at the end of each segment are calculated from β -function.
- When there are ions inside the segment, then interaction is calculated by Bessetti-Erskine formula.

Simulation code status

- ✓ Code algorithm done.
- ✓ Code core source written.
- ✗ Code testing in progress.
- ✗ Code graphical interface in progress.