

# NEW PROGRAM FEFI FOR EASER CONSTRUCTION AND DEFINITION OF BOUNDARIES FOR IGUN

A.ZELENAK\*, FLNR, JINR, 141980 Dubna, RUSSIA

## Abstract

A program IGUN has been developed for simulation of the extraction of positive ions from a plasma and many users have used this program. Also has been developed a pre-processor GPED to IGUN for definition of the boundaries of extraction. GPED was written with FORTRAN a long time ago for MS\_DOS system and now it seems to be not too much comfortable device for users working on PC with Windows 95 and higher. And for this reason has been written a new program - FEFI on C++ that work on PC with Windows 95 and higher and offers to the users a gently ambient that is known from operating system Windows.

## 1 INTRODUCTION

The calculation of particle optic devices such as ion guns, lenses, deflectors, analysers etc. requires the calculation of trajectories under the combined action of static electric and magnetic field. A very popular program for this purpose, IGUN [1] has become a standard tool for such applications.

The boundary input method used for this program requires the declaration of the intersection points of the electrodes with a superimposed mesh. A fitting routine that relieves the user from calculating all intersection points by defining tree boundary points on a segment of a second order curve, has helped considerably to facilitate

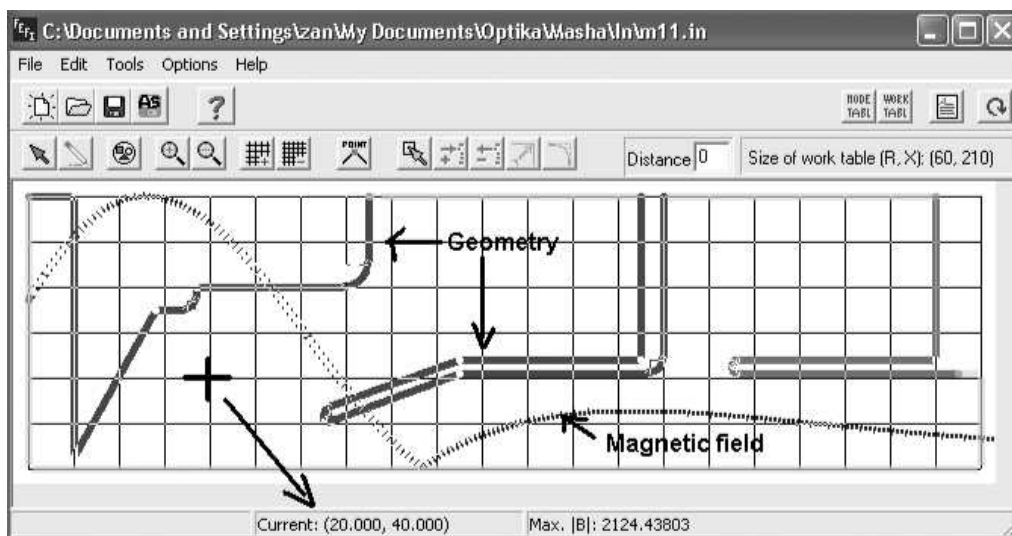
setting up a problem [2]. On the other hand, many users found this feature to be non-intuitive because certain rules needed to be obeyed.

As the alternative, the program GPED was written which accepted polygonal input of boundary data. By this, the intersections of straight and curved electrodes needed not be defined by user, but were calculated by the program. This program was written at the beginning of 90s for PC, which was worked on the system MS-DOS. In this time many users work on the PC with system Windows 95 and higher and GPED seems to be now not too much comfortable program for this system. At the moment don't exist the new version of GPED and for that I decided to write new one. FEFI program (File Editor For Igun) works on the PC with system Windows 95 and higher, and its the biggest advance is a pleasure cushiness and possibility to input all needed data to file directly.

## 2 FEATURES

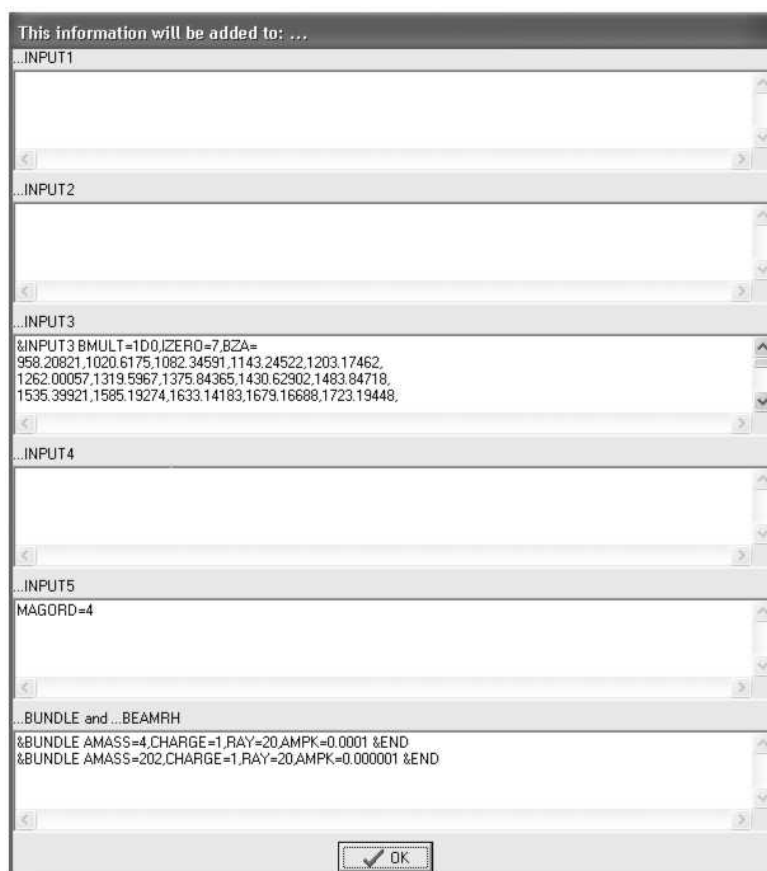
For definition of the contour of electrodes, the program FEFI uses the same definition of the cross section of the electrodes as program GPED.

To define the contour of the electrode labelled "n" ("n" should be from 0 to 8; 0 - means that the electrode is without potential), it has to be specified the coordinates of the electrode by mouse position, and by single click of mouse this position will be automatically written into the



**Figure 1:** Main window of FEFI program. There is shown extraction geometry of ion source with different potential (different colour of extraction electrodes), magnetic field ( $|B_{max}|$ ) and current position of mouse-cross. Size of mesh is 10x10mm.

\*FEI STU, KJFT, Bratislava, Slovakia  
Email: zan@host.sk



**Figure 2:** Window for editing of INPUT-s, BUNDLE and BEAMRH parameters. These data will be automatically added to the output file. The magnetic field is constructed from data of section INPUT3.

Work Table. Each point defines a polygonal point. By some mouse clicks user should construct very fast any geometry (electrodes) of project. A maximum number of defined electrodes with different potentials should be 8 (plus 0).

Any selected corner should be rounded and a point or the group of points should be deleted or moved at the same time. FEFI permits to insert any new point to the existing geometry and to move it. For seeing of any details, the geometry should be zoomed during the all time of the construction. FEFI permits also set-up the mesh of the work area with different size. The mesh should be used for automatically striking the arrow (cross) of the mouse to the mesh. This feature should be used for faster construction of the geometry. For easier orientation in the geometry there is a Point Viewer, which provides to change the potential number, radius or X position of selected point and at the same time it shows the investigated points of geometry. If any parameters are changed in Work Table or Mode Table, the project will be automatically refreshed and redrawn. The main window of FEFI program is shown at Fig 1.

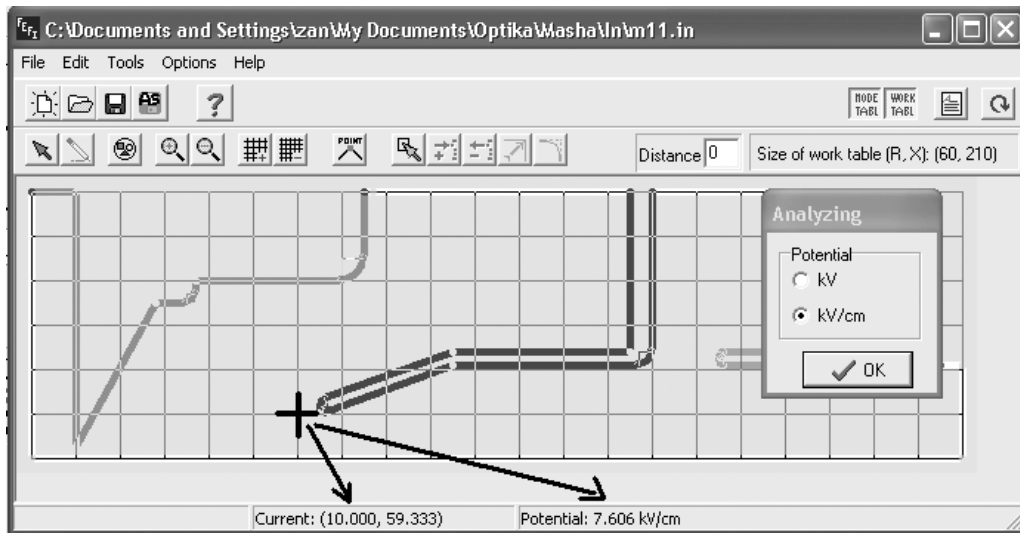
Program FEFI has also some new features:

- the inputs of the opened file should be directly edited (INPUT1, INPUT2, INPUT3, INPUT4, INPUT5, BUNDLE and BEAMRH) - see Fig 2
- if a magnetic field is defined in section of INPUT3, this field should be shown on the project (see Fig 1)
- it should be analysed a potential of solved geometry of electrodes (V or kV/cm – see Fig 3). To do that FEFI needs a potential file “\*.pot”, which is generated by IGUN during the simulation.

Over and about, it should be set up a pen width, the default size of the mesh and some other features of program.

### 3 CONCLUSION

As a pre-processor to IGUN, the program FEFI provides easy and fast definition of the boundaries of different geometry. FEFI uses a Windows attempt and permits to construct any geometry (simple or complicated) and to work with this geometry – allows moving of electrodes, stretching, magnifying and offsetting of input data. It permits also a editing of inputs, bundle and beamrh parameters of file; it should be shown the magnetic field defined in INPUT3 and the potential around the electrodes should be analysed in detail.



**Figure 3:** Here is shown the group of electrodes with different potential and the cross analyser. A potential should be shown in volts or kV/cm (if 1 point of mesh = 1 mm).

#### 4 REFERENCES

- [1] R.Becker, New features in the simulation of ion extraction with IGUN, Proc. Sixth European Particle Accelerator Conference (EPAC '98), June 22-26 1998, Stockholm, Sweden (1998), p.1165-1167
- [2] R.Becker, Easy boundary definition for EGUN, Nuclear Instruments and Methods in Physics Research, B42 (1989), p.162-164