Session 9 - Lab on User Programs

Files: C:\Advanced SIMION Class\09. User Program Introduction\Lab

Using an Existing User Program

The best way to start programming is to steal, steal, steal.

1. Remove all PAs From RAM
2. Use New to create a new array using EINZEL.GEM from directory **C:\Advanced SIMION Class\09. User Program Introduction\Lab**
3. Save the array as EINZEL.PA# and ***then*** Refine it.
4. Remove all PAs From RAM
5. Use View to load EINZEL.IOB (EINZEL.FLY loads automatically)
6. Fly the ions and see that they focus properly.

7. Now exit View and click on the GUI file manager button
8. Select the file named **RANDOM.PRG**, click the Other button and rename the file to **EINZEL.PRG.**
9. Return to the main SIMION menu.
10. Notice that the **Test & Debug Selected PA's User Progs** button is unblocked. SIMION has recognized that there is now a user program associated with the EINZEL.PA0 potential array. Click the Test & Debug button to access the user program development system (just a quick look).
11. Click the Compile button and the program will be compiled. If you want a cross reference listing depress the Show Xref Listing button and then click the Compile button again. If you want to look at this cross reference listing, scroll the view using the window's lower right hand corner button.
12. To examine the user program file with EDY click the Edit: EINZEL.PRG button. Look at the listing. Exit EDY by the following keystrokes: **ESC Q N**.
13. Click the Compile button again to verify everything is OK. Now click the Quit key to return to the main menu.
14. Re-enter View and fly the ions. SIMION will compile the user programs and display the adjustable variables. Click the E Fmt button to switch from E to F format display. Now fly the ions with the default settings. What a mess!
15. You can turn off the user programs for a single run. Click Fly'm and then Click the On button to turn the user program off, and then fly the ions.
16. Re-Fly the ions with various adjustable variable settings and see what happens. Are the results reasonable?
17. Perhaps you would like to change the starting values for the adjustable variables in the user program. Click the PAs tab and then the Debug button to access the user program development screen. Now click the Edit button to access the user program file with EDY. Change the starting values of the adjustable variables. Now save the file and exit from EDY: **ESC Q Y**. Click the Compile button to check for compile errors. Now click the Quit button to return to View. Re-Fly the ions to confirm that the changes in initial value have been made successfully

Adding a User Program Segment

User programs generally develop by evolution. In this can we would like to exert some user control from the keyboard. The object is to create a marker every time a keyboard key is pressed. This is really a very simple task.

1. Click the PAs tab and then the Debug button to access the user program development screen. Now click the Edit button to access the user program file with EDY.
2. Add the following two lines at the bottom of the file:

```
seg other_actions
        key? x!=0 mark
```

The first line defines the start of an Other_Actions program segment. The second line has three commands:

key? — Tests for keyboard input and returns a non-zero key code if you hit a key

x!=0 — Tests the return value from key? for a non-zero value (you hit a key)
If the value is non-zero the next instruction will be executed (do if true) else it will be skipped and the program segment will exit without doing anything.

mark — This command creates a single marker. It uses the currently selected marker color and can be used as a trigger event for data recording. The mark command is executed if the x!=0 test is true.

3. Now save the changes and exit EDY: ESC Q Y. Test compile your efforts. If you have an error fix it with EDY. Keep trying until it compiles OK. Now click the Quit button to return to View.
4. Fly the ions as dots with the speed slider to the center to slow the ions down a bit. Hit the spacebar and watch for markers. Can you create markers anywhere? What is the problem? ***Remember, an array's user program will only be called when ions are actually within its instance's array volume***.

Additional Challenges

1. Modify the user program to output the ion's x, y, and z position in workbench coordinates (mm) when you hit a key. Hint: The **MESSAGE**, **LBL**, **GTO**, and **EXIT** commands might be helpful.
2. Change this program to output x, y, and z in 3D array coordinates and then in absolute array coordinates.
3. For a real challenge calculate and display the ion's KE when you hit a key. Hint: The **>P3D** and **>KE** transforms might be helpful.