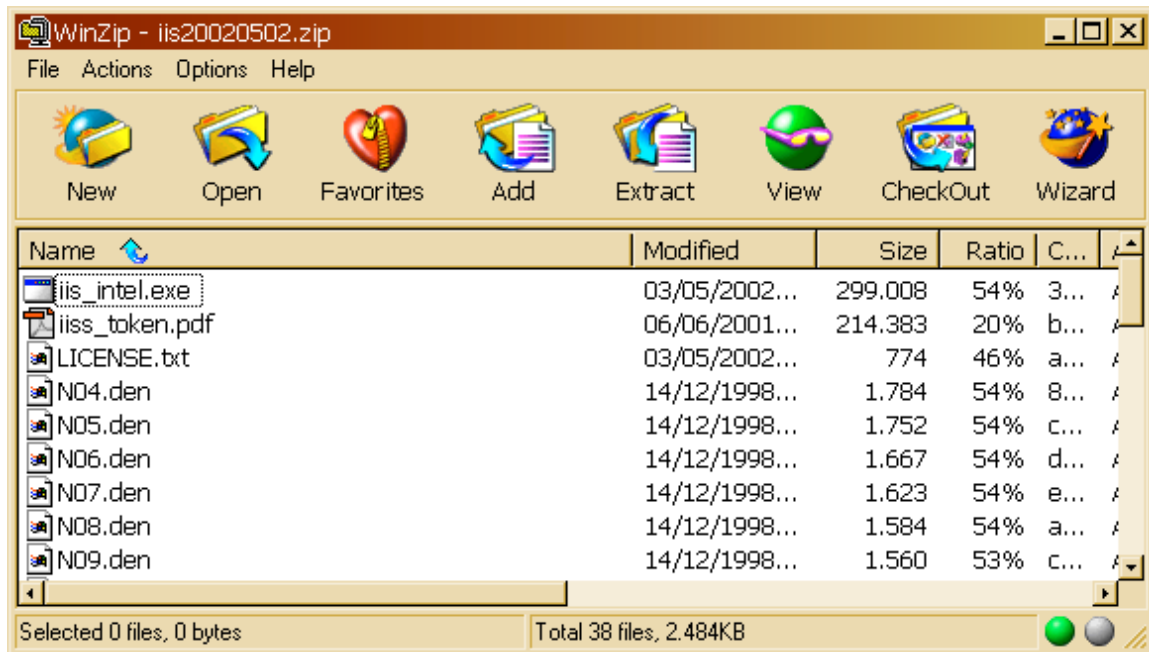


Instructions

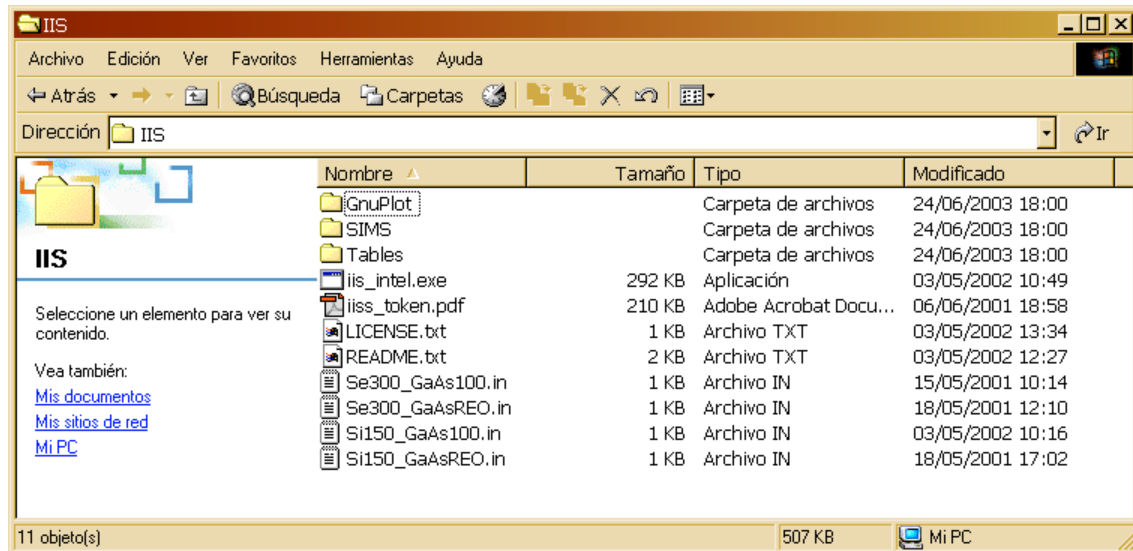
IIS (Ion Implant Simulator) from Windows.

Installation

Installation files are packed in .ZIP format. You must use WinZip-like unpacker in order to install (e.g: at C: \I I S).

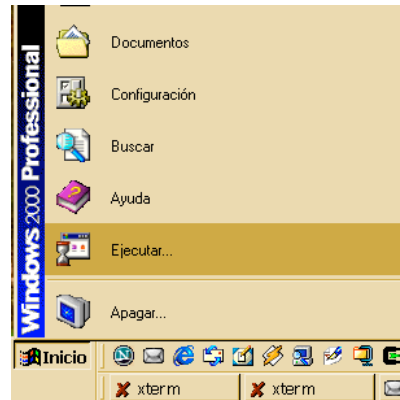


Directory will contain

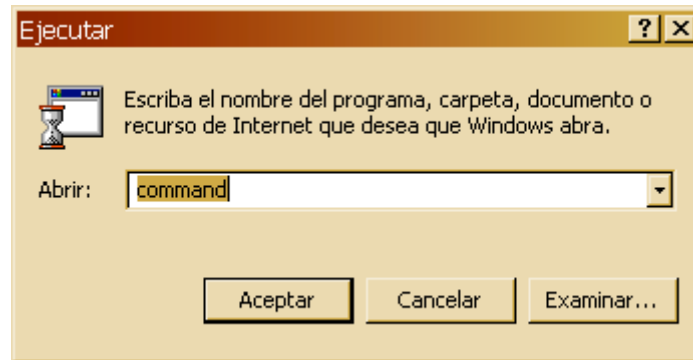


Execution of the simulator

You should open a command window. From the menu Start->Execute



Type in command



At this time you should change your working directory to where you installed the program. Then, the Simulator can be run : `iis_intel.exe input file:`

```
E:\WINNT\System32\command.com
Microsoft(R) Windows DOS
(C)Copyright Microsoft Corp 1990-1999.
E:\>c:
C:\>cd IIS
C:\IIS>iis_intel Se300_GaAs100.in
```

Program will start creating some three-dimensional electronic density tables that will be based on the superposition of isolate electron densities contained at Tables directory

```

E:\WINNT\System32\command.com
C:\IIS>iis_intel Se300_GaAs100.in
[IIS] Ion Implant Simulator (Version 2002.05.02)
Developed at the Electronics Department of the University of Valladolid, SPAIN
(C) Dr. Jesus M. Hernandez-Mangas

==> AMORPHOUS layer ( 0 to 15 ) A
LatticeParameter ( 5.6537, 5.6537, 5.6537 ) A
Angles ( 90, 90, 90 )
EDTFile ( , (old)

Atom 3 : FACE CENTERED( 0, 0, 0 ) 15 eV
Atom 2 : FACE CENTERED( 0.25, 0.25, 0.25 ) 15 eV

Cell volume = 180.717 A^3
Mean atomic radius = 1.75364 A
Theoretical density = 4.42682e+022 at/cm^3

# Error: EDT::ReadTable3D, File not found: ./Tables/EDT_AsGa
# Reading (N33.den) (./Tables/N33.den) ND = 98
# Reading (N31.den) (./Tables/N31.den) ND = 98
# Creating Isolate Atom Density Superposition in EDT_AsGa
104

```

The program will try to read another tables from the disk, and if they are not present they will be calculated as needed. These tables will be stored in Tables directory for later use speeding-up the calculation time.

```

Seleccionar E:\WINNT\System32\command.com
Angles ( 90, 90, 90 )
EDTFile ( , (old)

Atom 3 : FACE CENTERED( 0, 0, 0 ) 15 eV
Atom 2 : FACE CENTERED( 0.25, 0.25, 0.25 ) 15 eV

Cell volume = 180.717 A^3
Mean atomic radius = 1.75364 A
Theoretical density = 4.42682e+022 at/cm^3

# Error: EDT::ReadTable3D, File not found: ./Tables/EDT_AsGa
# Reading (N33.den) (./Tables/N33.den) ND = 98
# Reading (N31.den) (./Tables/N31.den) ND = 98
# Creating Isolate Atom Density Superposition in EDT_AsGa
# 153 seconds
# Binary 3D density table written (./Tables/EDT_AsGa.lit)

==> CRISTALLINE layer ( 15 to 1e+010 ) A
LatticeParameter ( 5.6537, 5.6537, 5.6537 ) A
Angles ( 90, 90, 90 )
EDTFile ( , (old)

Atom 3 : FACE CENTERED( 0, 0, 0 ) 15 eV
Atom 2 : FACE CENTERED( 0.25, 0.25, 0.25 ) 15 eV

Cell volume = 180.717 A^3
Mean atomic radius = 1.75364 A
Theoretical density = 4.42682e+022 at/cm^3

# 3D binary density table read
# (./Tables/EDT_AsGa.lit) 11239424/11239424
# Front surface at 0 A
# Back surface at 1e+010 A

==> Starting simulation

Ion      Depth (nm)      Stat weigth      Path (nm)
-----
# Generating nuclear stopping table Zel3433.dat
# Z1 = 34, Z2 = 33, W1 = 80, W2 = 74.921
# Index 71/ 71 calculated in 0.00 seconds
# Found ... ./Tables/Zel3433.dat
# Generating local inelastic stopping table, Z1 = 34, Z2 = 33 : 1000
# Generating non-local inelastic stopping table Z = 34
# Generating nuclear stopping table Zel3431.dat
# Z1 = 34, Z2 = 31, W1 = 80, W2 = 69.723
# Index 1/ 71 calculated in 0.00 seconds

```

After the table generation the simulator begin to implant ions until complete the simulation.

```

E:\WINNT\System32\command.com
4986      28.5255      1.0000      41.5663
4987      147.7126     1.0000     150.5331
4988      112.8096     1.0000     145.8358
4989      184.6498     0.5000     210.4866
4989      211.3423     0.2500     237.2825
4989      208.2349     0.2500     228.0316
4990      175.7177     0.5000     202.7630
4990      169.3475     0.5000     197.0475
4991      129.5423     1.0000     144.3341
4992      55.8678      1.0000     144.3376
4993      105.0599     1.0000     135.4212
4994      24.6073      1.0000      44.1390
4995      259.7517     0.2500     286.5562
4995      217.9350     0.2500     228.7855
4995      185.4898     0.5000     193.1232
4996      108.9615     1.0000     134.1427
4997      128.4205     1.0000     182.8072
4998      166.7199     0.5000     197.0238
4998      173.5484     0.5000     210.2353
4999      138.0363     1.0000     159.5095
5000      207.8962     0.2500     240.1437
5000      207.9673     0.2500     241.6896
5000      191.1060     0.5000     225.6979

C:\IIS>

```

Results processing

We need to install some plotting program like gnuplot for windows: wgnupl32.exe

```

E:\WINNT\System32\command.com
El volumen de la unidad C es WIN 98
El número de serie del volumen es: 8E89-0008

Directorio de C:\IIS
24/06/2003 17:59 <DIR>
24/06/2003 17:59 <DIR>
03/05/2002 10:16
24/06/2003 18:00 <DIR>
24/06/2003 18:00 <DIR>
03/05/2002 10:49
06/06/2001 18:58
03/05/2002 12:27
18/05/2001 12:10
24/06/2003 18:00 <DIR>
18/05/2001 17:02
03/05/2002 13:34
24/06/2003 18:18 <DIR>
24/06/2003 18:38
24/06/2003 18:31
9 archivos 531,592 bytes
6 dirs 2,078,769,152 bytes libres

C:\IIS>gnuplot\wgnupl32

```

gnuplot

File Plot Expressions Functions General Axes Chart Styles 3D Help

Replot Open Save ChDir Print PrtSc Prev Next

Type 'help' to access the on-line reference manual
 The gnuplot FAQ is available from
<http://www.ucc.ie/gnuplot/gnuplot-faq.html>

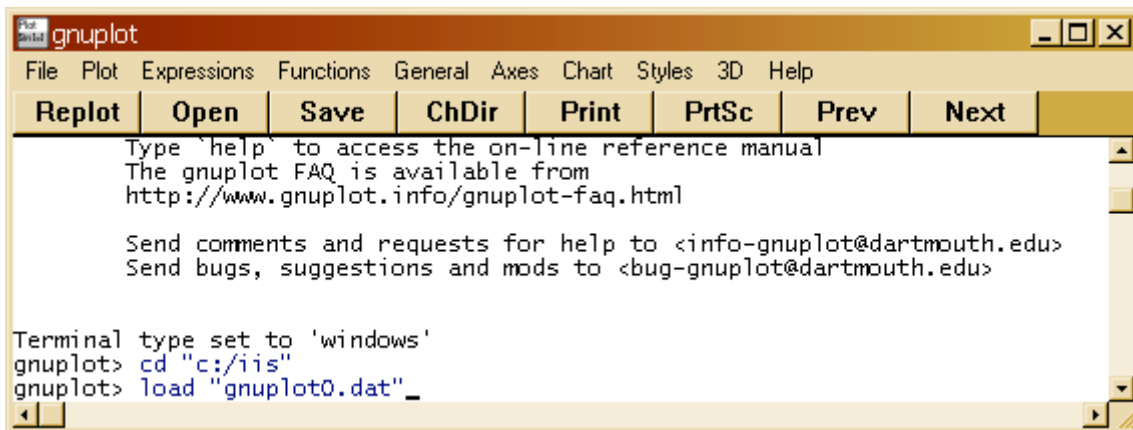
Send comments and requests for help to <info-gnuplot@dartmouth.edu>
 Send bugs, suggestions and mods to <bug-gnuplot@dartmouth.edu>

Terminal type set to 'windows'

gnuplot> _

The simulator will create a file named gnuplot0.dat that includes some commands for gnuplot in order to visualize some data.

We introduce some commands

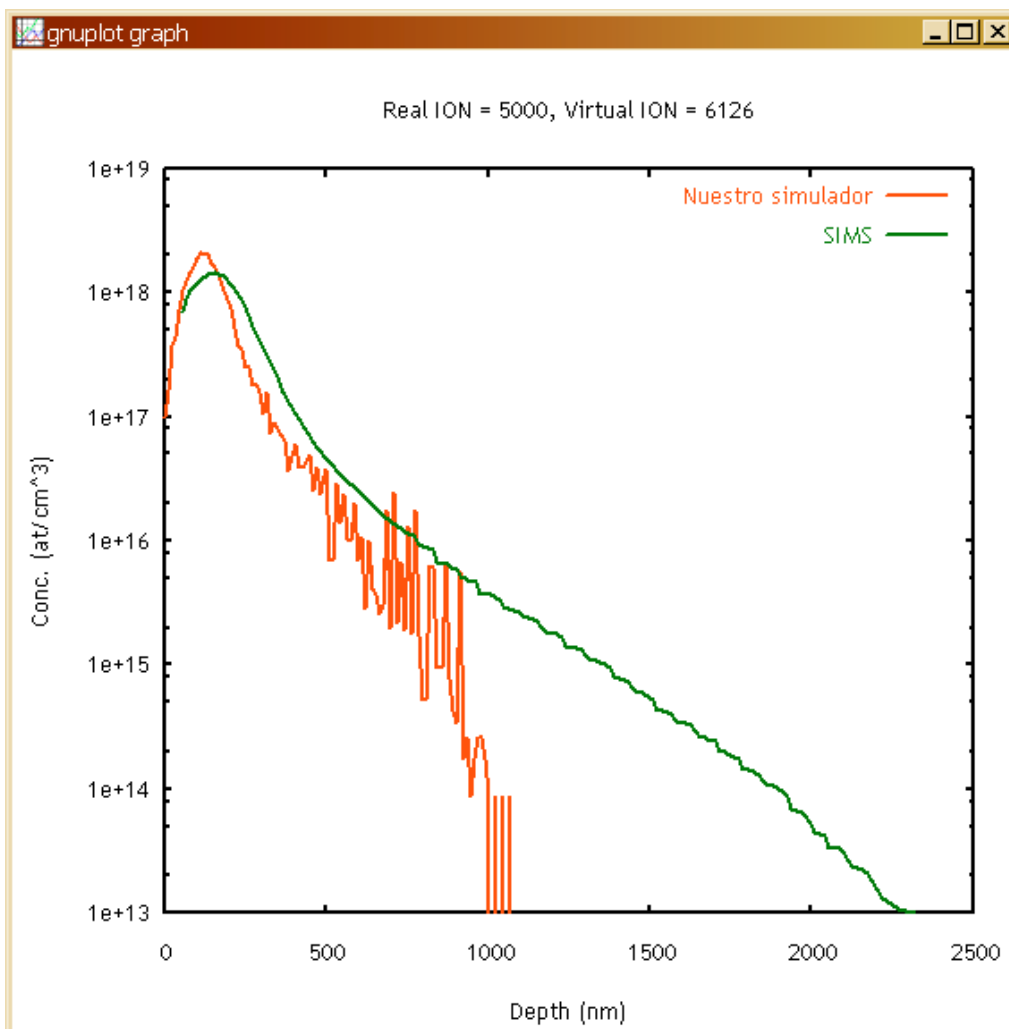


```
gnuplot
File Plot Expressions Functions General Axes Chart Styles 3D Help
Replot Open Save ChDir Print PrtSc Prev Next
Type 'help' to access the on-line reference manual
The gnuplot FAQ is available from
http://www.gnuplot.info/gnuplot-faq.html

Send comments and requests for help to <info-gnuplot@dartmouth.edu>
Send bugs, suggestions and mods to <bug-gnuplot@dartmouth.edu>

Terminal type set to 'windows'
gnuplot> cd "c:/iis"
gnuplot> load "gnuplot0.dat"
```

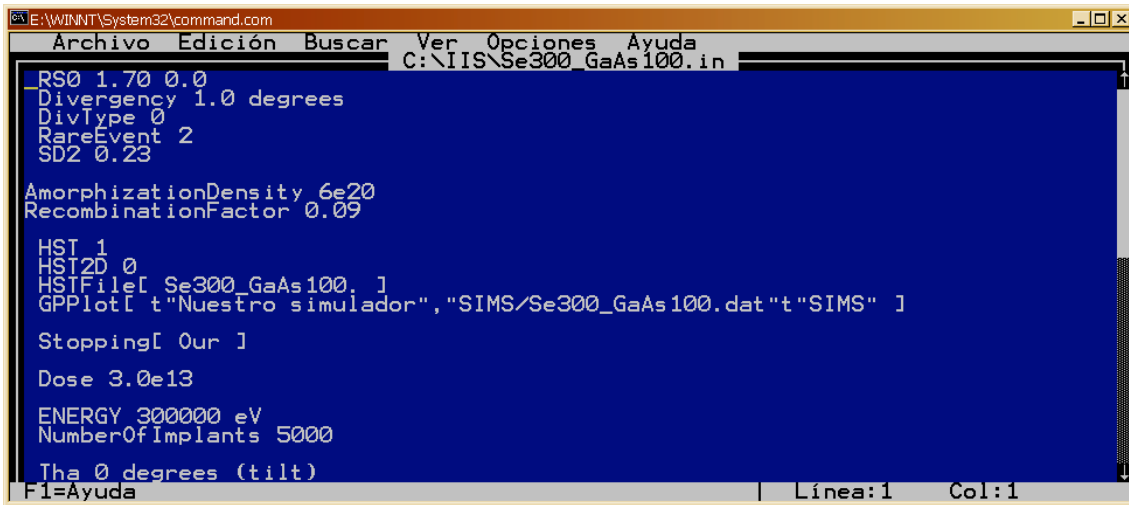
that will produce the plot below



We note a comparison between the simulator result and some experimental profiles previously digitized in the SIMS directory.

Input file

You can edit the input file with the DOS command `edit Se300_GaAs100.in` as shown below



```
E:\WINNT\System32\command.com
Archivo Edición Buscar Ver Opciones Ayuda
C:\IIS\Se300_GaAs100.in
RS0 1.70 0.0
Divergency 1.0 degrees
DivType 0
RareEvent 2
SD2 0.23

AmorphizationDensity 6e20
RecombinationFactor 0.09

HST 1
HST2D 0
HSTFile[ Se300_GaAs100. ]
GPPlot[ t"Nuestro simulador", "SIMS/Se300_GaAs100.dat"t"SIMS" ]

Stopping[ Our ]

Dose 3.0e13

ENERGY 300000 eV
NumberOfImplants 5000

Tha 0 degrees (tilt)
F1=Ayuda | Línea:1 Col:1
```

An example of input file is presented:

```
RS0 1.70 0.0
Divergency 1.0 degrees
DivType 0
RareEvent 2
SD2 0.23

AmorphizationDensity 6e20
RecombinationFactor 0.09

HST 1
HST2D 0
HSTFile[ Se300_GaAs100. ]
GPPlot[ t"Nuestro simulador", "SIMS/Se300_GaAs100.dat"t"SIMS" ]

Stopping[ Our ]

Dose 3.0e13

ENERGY 300000 eV
NumberOfImplants 5000

Tha 0 degrees (tilt)
Phi 0 degrees

ABC 1 0 0
FLAT 0 1 1

Therm 1
Temperature 300 kelvin

Atom Se 34 80.000 600.0 abundante al 49.61%
Atom As 33 74.921 360.0
Atom Ga 31 69.723 360.0

AtomP 1

LatticeParameter 5.6537 5.6537 5.6537
Angles 90.0 90.0 90.0
XTal 3 6 0.000 0.000 0.000 15 // Ga
XTal 2 6 0.250 0.250 0.250 15 // As
Amorphous 2
XMin 0.0 A
XMax 15 A

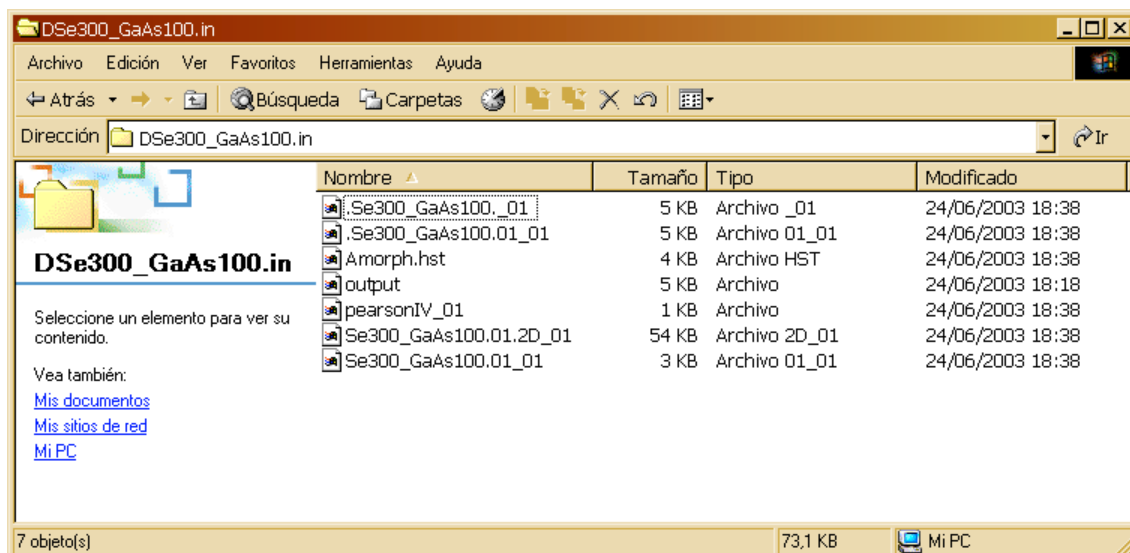
NextLayer

LatticeParameter 5.6537 5.6537 5.6537
Angles 90.0 90.0 90.0
XTal 3 6 0.000 0.000 0.000 15 // Ga
XTal 2 6 0.250 0.250 0.250 15 // As
```

Amorphous 0
 XMIn 15.0 A
 XMax 1e10 A

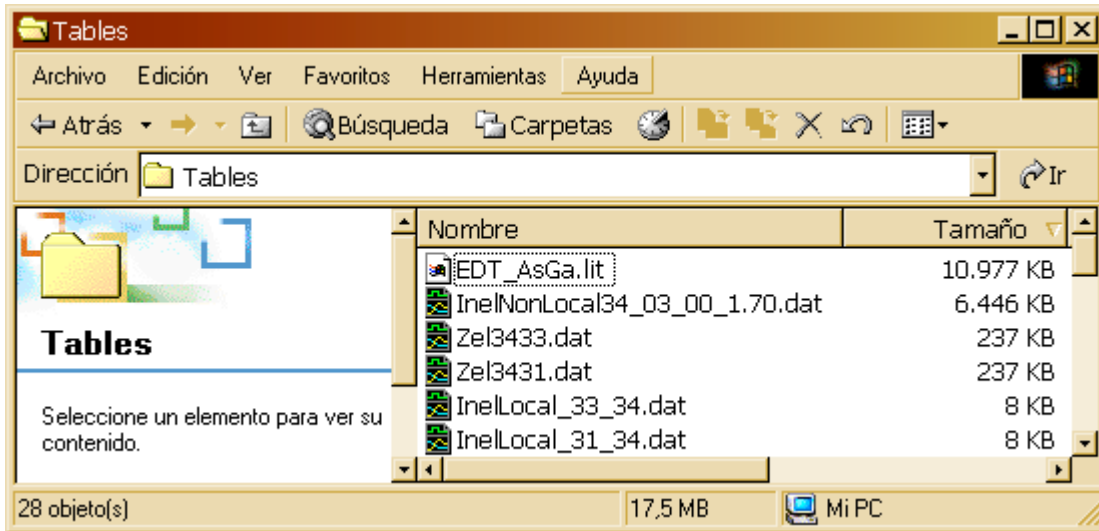
Output files

The output files will be stored in the DSe300_GaAs100. in directory:



Se300_GaAs100.01_01	1D doping profile. You can compare it with SIMS profiles
Se300_GaAs100.01.2D_01	2D projected doping profile
Amorph.hst	1D damage profile. Could be comparable with some RBS profiles
output	The parameters of simulation are stored in this file. It is useful to proof the simulator has understood the input file
pearsonIV_01	Only generated if solicited. Pearson IV profile adjusted to the simulated profile, if possible.
Files *. *	Temporary files

Some tables has been stored in Tables directory



We have

EDT_AsGa. l i t	3D electronic density for AsGa. It has been generated by using N33.den and N34.den files. Little endian (arch. Intel) binary format
Zel 3433. dat	Nuclear stopping table for Z1=34 and Z2=33 atoms using ZBL screening
Zel 3431. dat	Idem for Z1=34 and Z2=31
Inel Local _33_34. dat	Local inelastic stopping between Z1=33 and Z2=34 atoms
Inel Local _31_34. dat	Local inelastic stopping between Z1=31 and Z2=34 atoms
Inel NonLocal _34_03_00_1. 70. dat	Non local inelastic stopping (electronic stopping power) between Z=34 and the target material(AsGa) with our (03) stopping model and with a ZBL screening (00) and Rs0=1.70