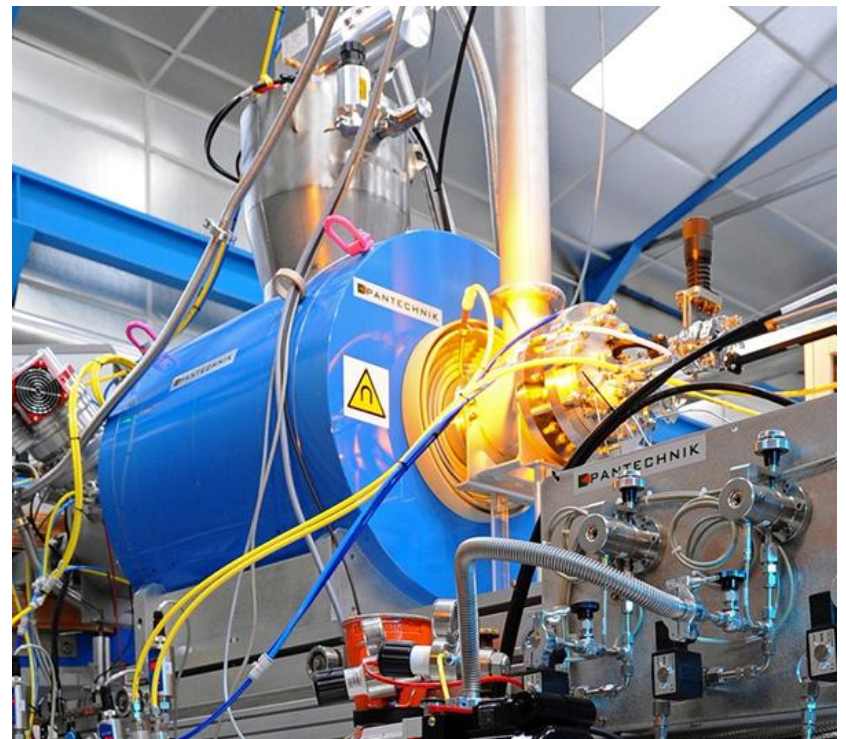


SIMION applied to ECR ion sources

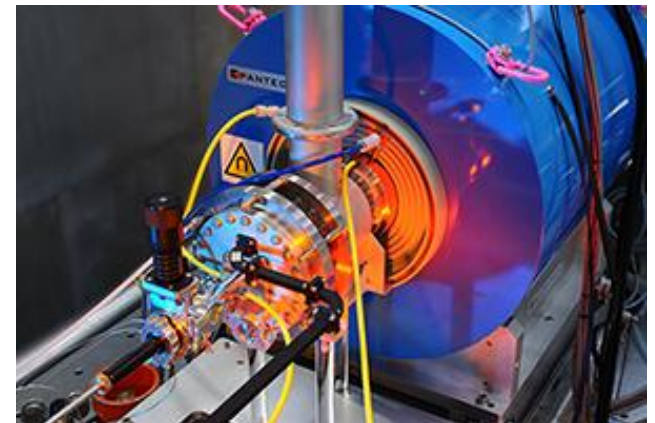
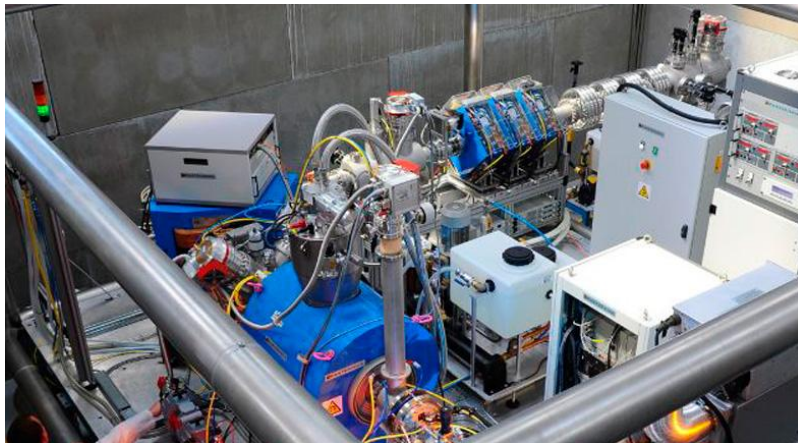
11-06-2015

Pierre SALOU



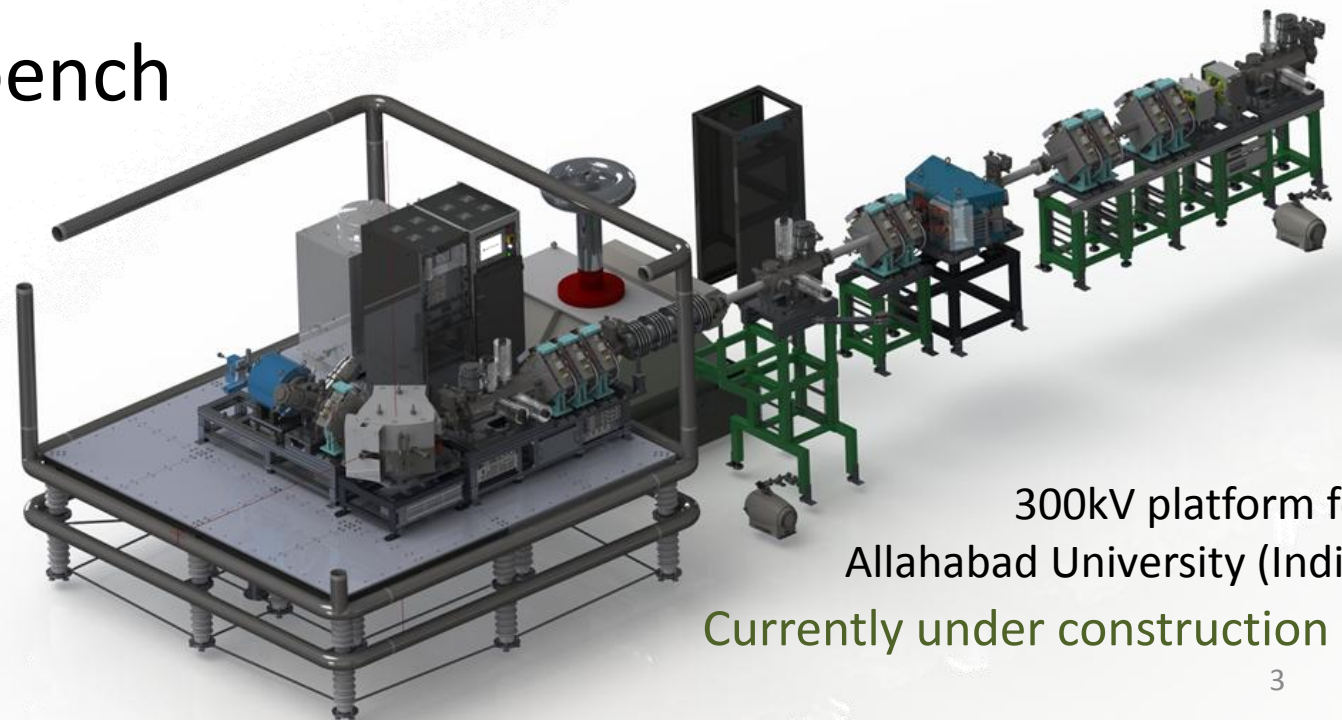
SIMION applied to ECR ion sources

- Pantechnik
- Source extraction : from CAD to Simion
- Magnetic field in Simion

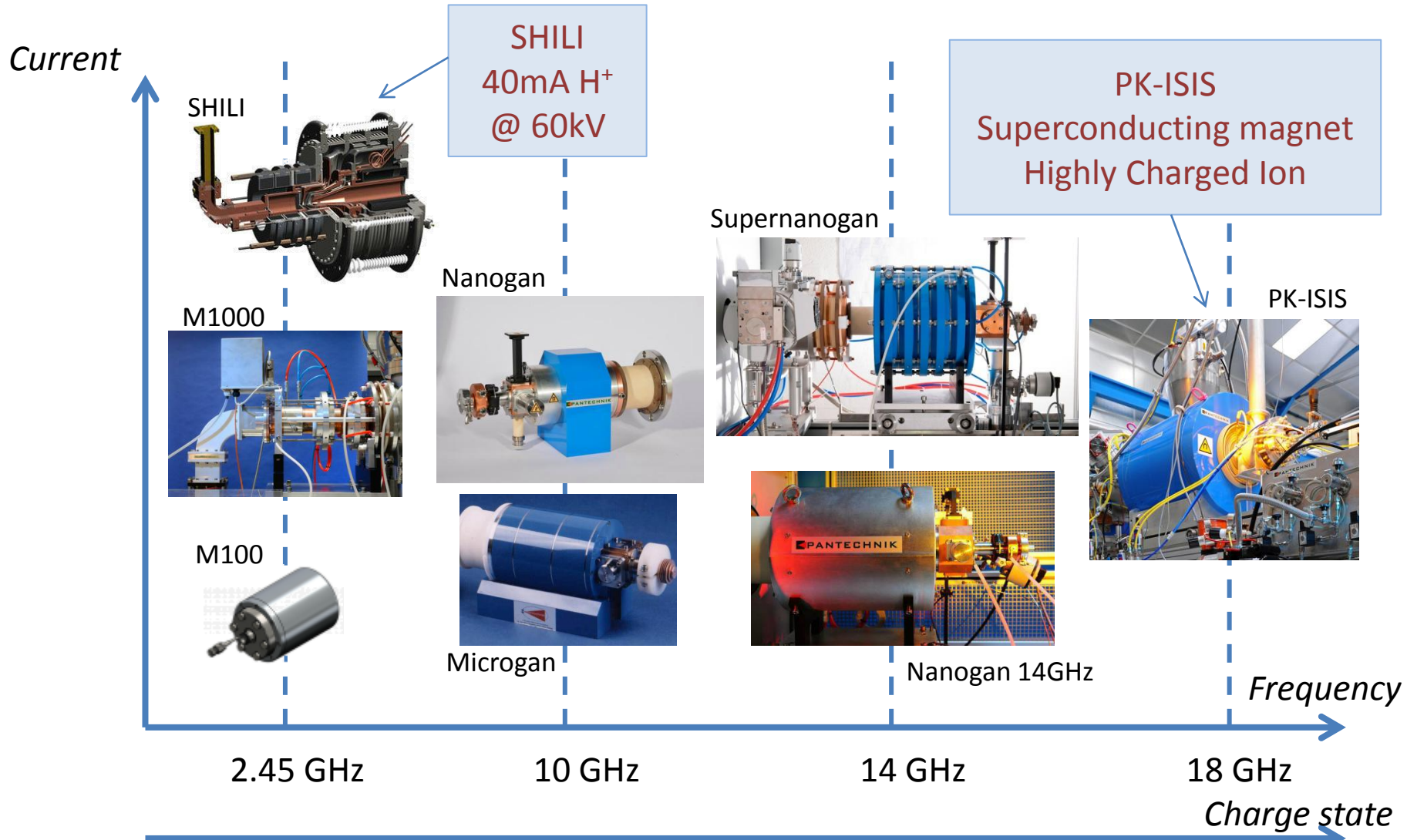


From individual parts to whole beam lines :

- ECR ion sources
- Beam diagnostics
- Turnkey bench

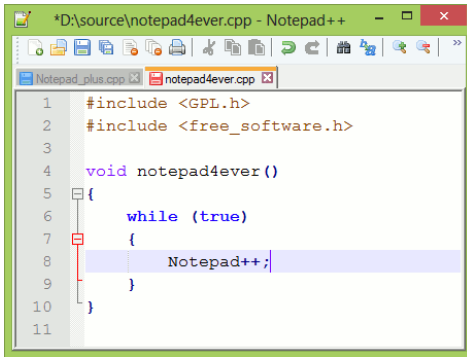


300kV platform for
Allahabad University (India)
Currently under construction



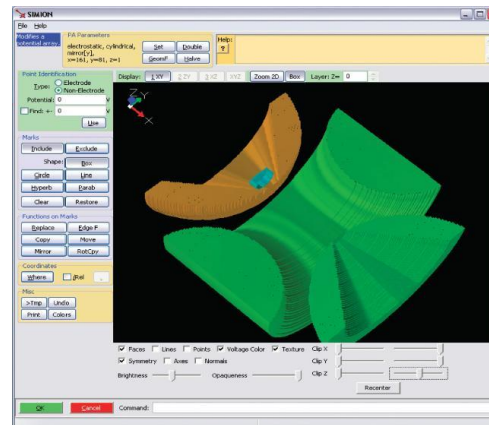
Source extraction : from CAD to Simion

.GEM File



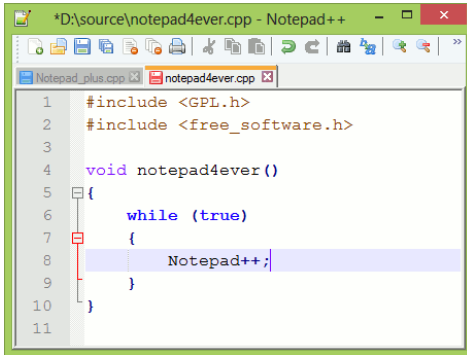
```
*D:\source\notepad4ever.cpp - Notepad++
Notepad_plus.cpp x notepad4ever.cpp x
1 #include <GPL.h>
2 #include <free_software.h>
3
4 void notepad4ever ()
5 {
6     while (true)
7     {
8         Notepad++;
9     }
10 }
11
```

.PA File

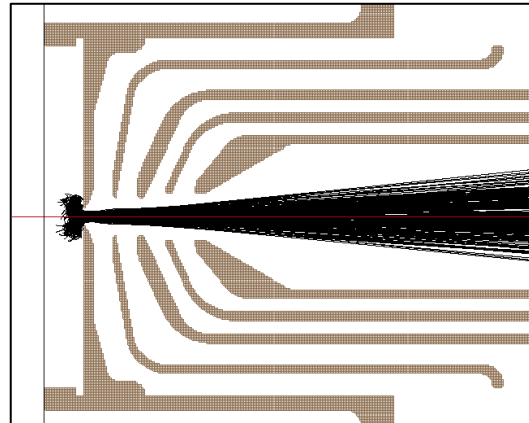


Source extraction : from CAD to Simion

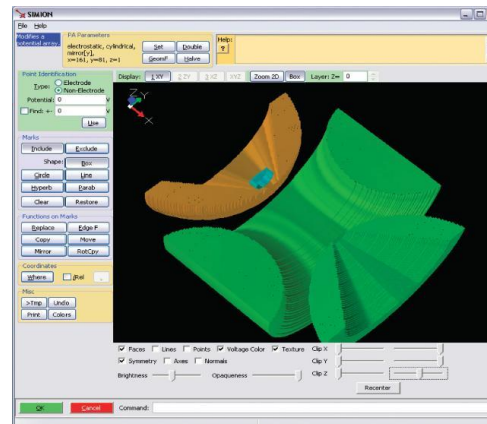
.GEM File



```
1 #include <GPL.h>
2 #include <free_software.h>
3
4 void notepad4ever ()
5 {
6     while (true)
7     {
8         Notepad++;
9     }
10 }
11
```



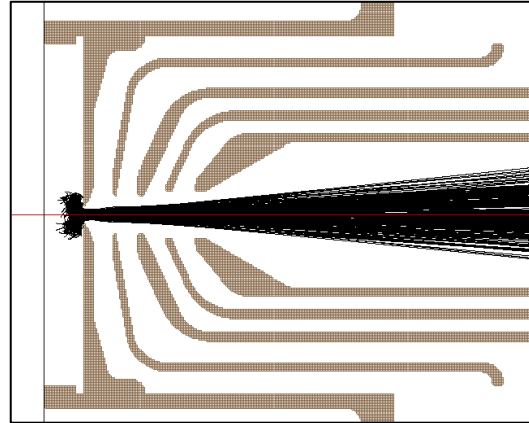
.PA File



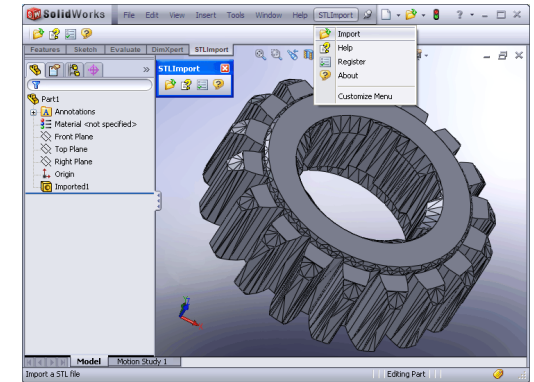
Source extraction : from CAD to Simion

.GEM File

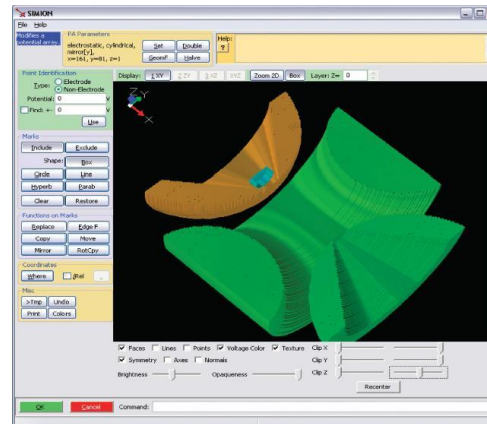
```
*D:\source\notepad4ever.cpp - Notepad++
Notepad_plus.cpp  notepad4ever.cpp
1  #include <GPL.h>
2  #include <free_software.h>
3
4  void notepad4ever ()
5  {
6      while (true)
7      {
8          Notepad++;
9      }
10 }
11
```



.STL File



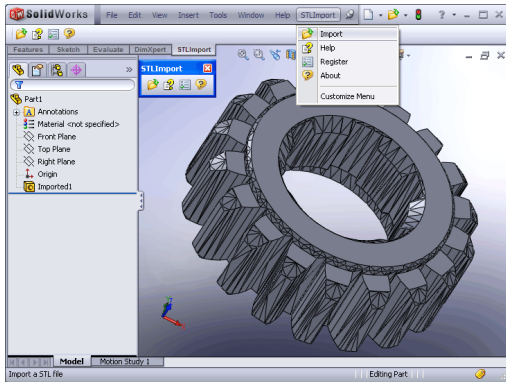
.PA File



SIMION's
SL_Tools

Source extraction : from CAD to Simion

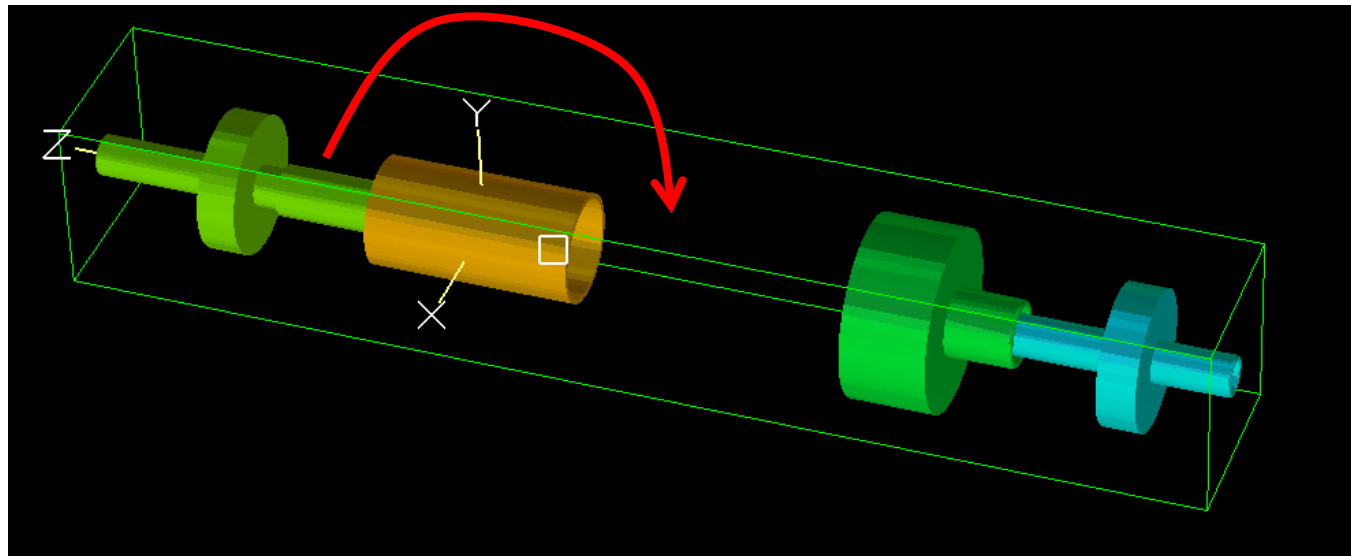
.STL File



Painful :

- Generate each electrodes separately
- Only 3D => not adapted for axis-symmetry

Fail !!!



Source extraction : from CAD to Simion

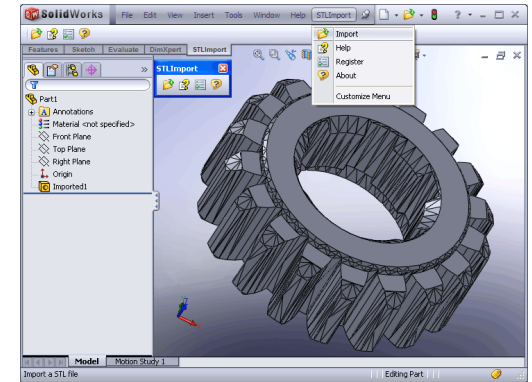
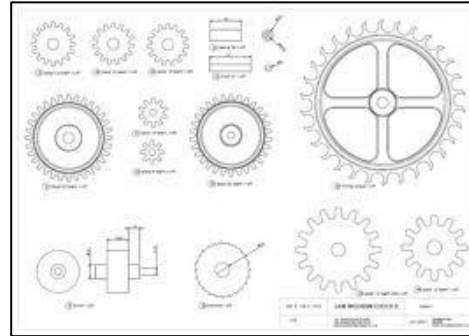
.GEM File

LUA script

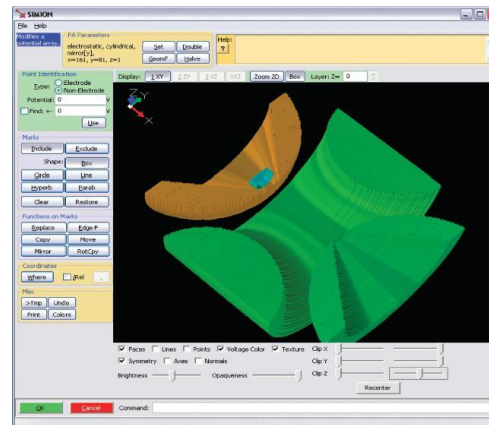
.DXF File

CAD File

```
*D:\source\notepad4ever.cpp - Notepad++
Notepad_plus.cpp
notepad4ever.cpp
1 #include <GPL.h>
2 #include <free_software.h>
3
4 void notepad4ever ()
5 {
6     while (true)
7     {
8         Notepad++;
9     }
10 }
11
```



.PA File



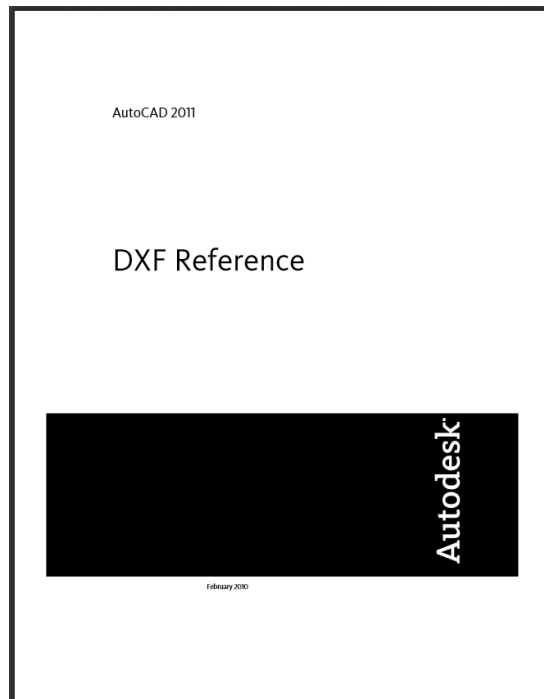
SIMION's
SL_Tools

Source extraction : from CAD to Simion

DXF = Drawing eXchange Format

ASCII file created by Autodesk

How to read it?

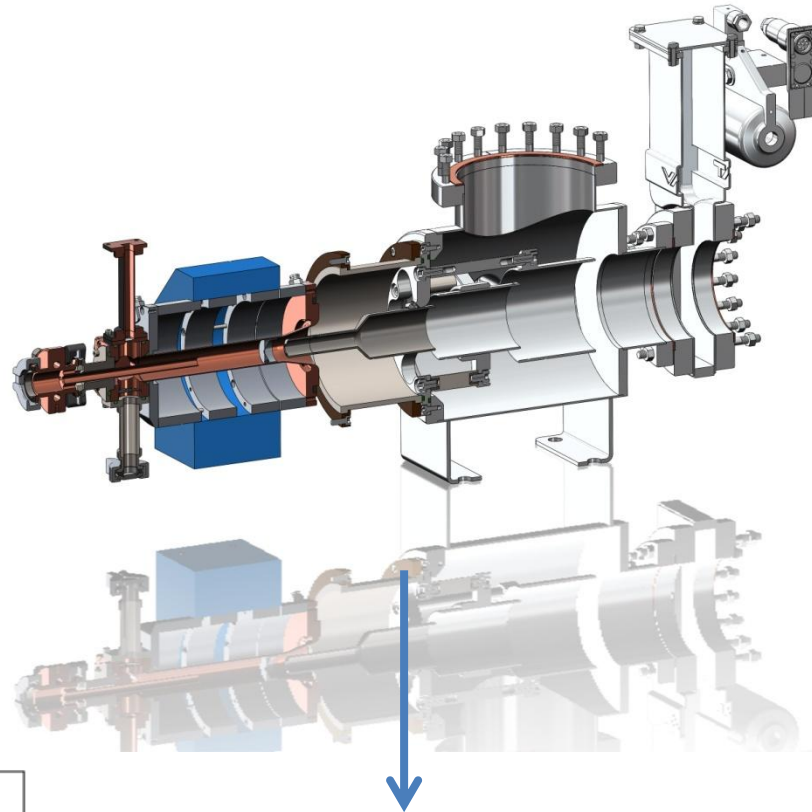


Example of .DXF file :

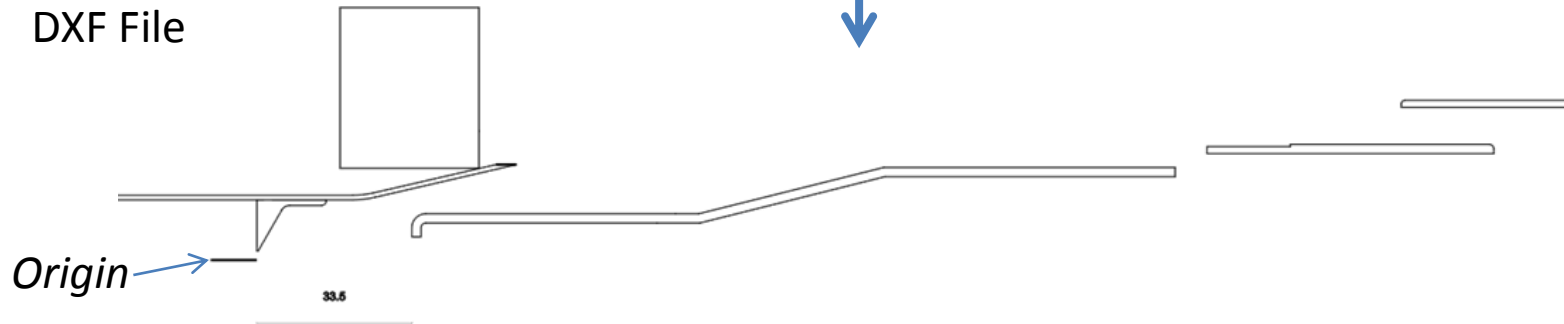
```
0  
SECTION  
2  
ENTITIES  
0  
CIRCLE  
10  
0.0  
20  
0.0  
30  
0.0  
40  
1.0  
0  
ENDSEC  
0  
EOF
```

Source extraction : from CAD to Simion

CAD File

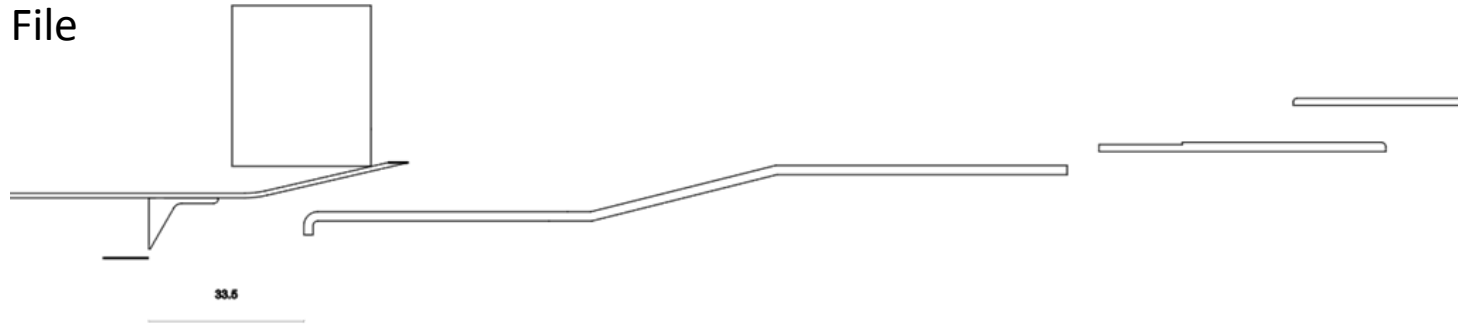


DXF File



Source extraction : from CAD to Simion

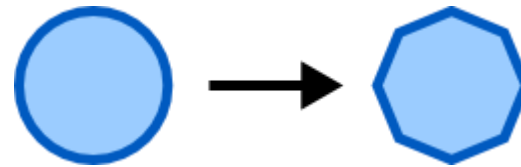
DXF File



The LUA script can only read straight lines!

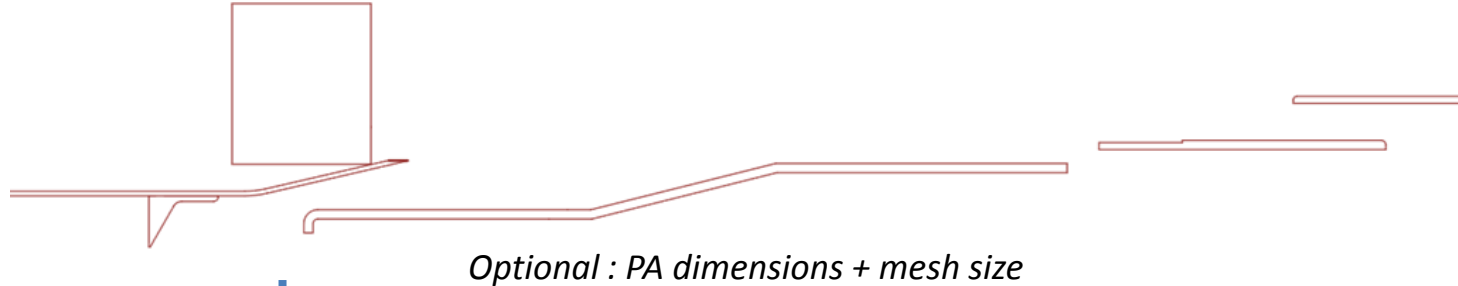
Solution :

Flatten curves of Bézier



Source extraction : from CAD to Simion

DXF File with only straight lines + cleaning

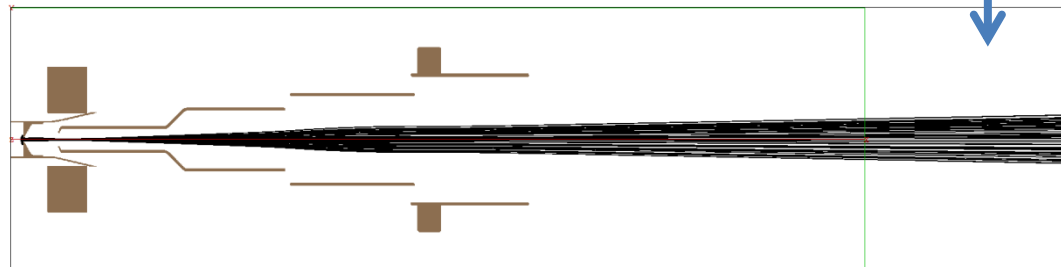


LUA script

- Reads and stores each individual lines
- Merges the closest lines to a polyline
- Sorts the polylines
- Generates the .GEM file

.GEM File

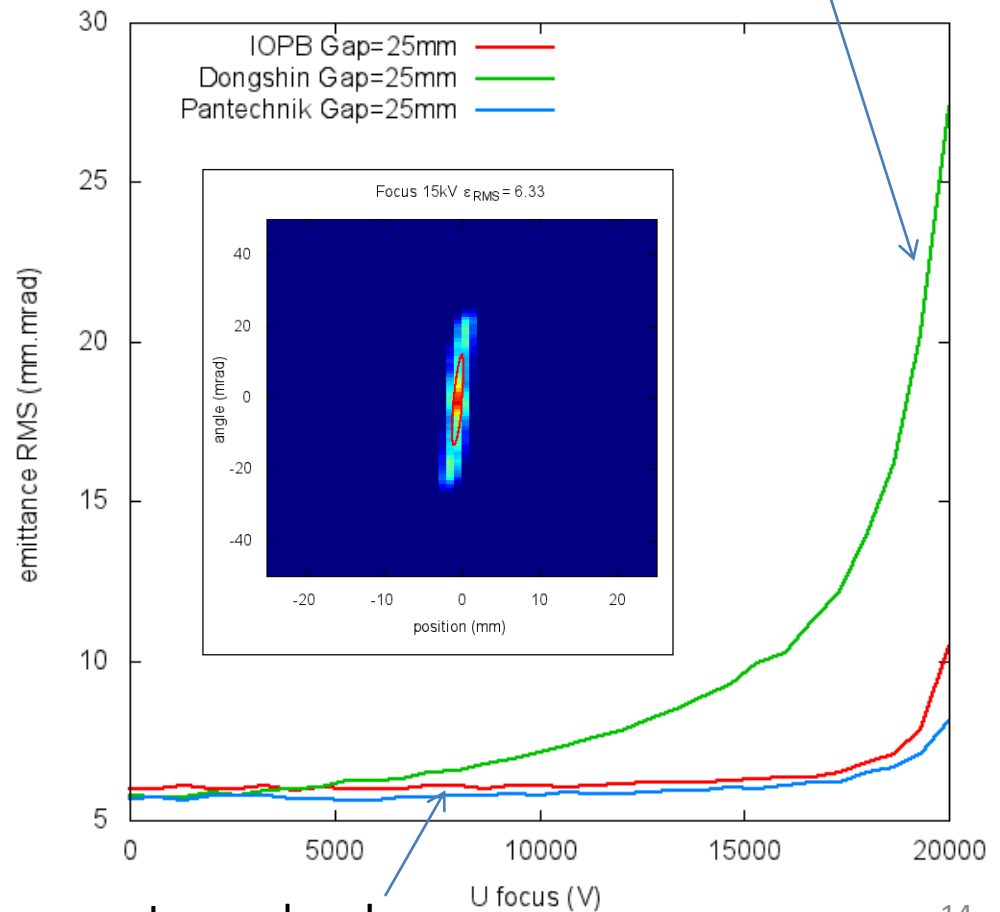
```
*D:\source\notepad4ever.cpp - Notepad++
1 #include <GPL.h>
2 #include <free_software.h>
3
4 void notepad4ever()
5 {
6     while (true)
7     {
8         Notepad++;
9     }
10 }
11
```



Source extraction : from CAD to Simion

Bad extraction !

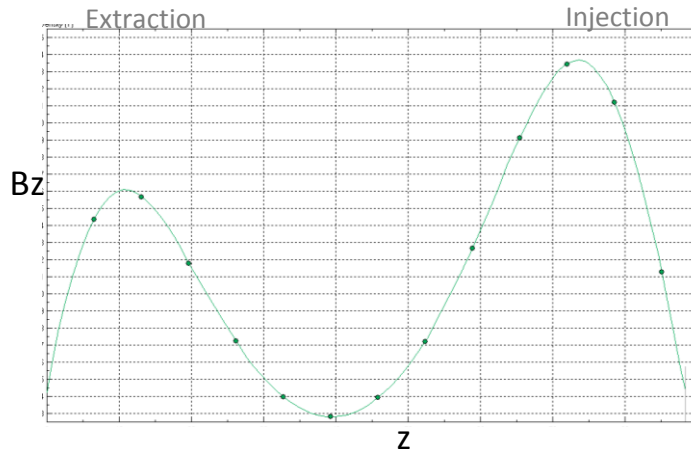
emittance RMS



Low values!

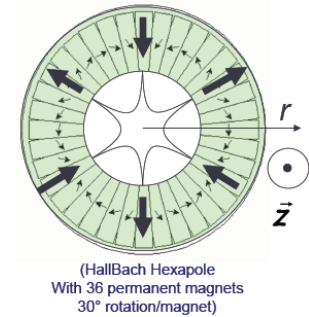
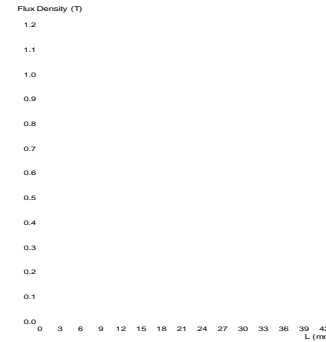
Magnetic field in Simion

Coils and/or Permanent Magnet

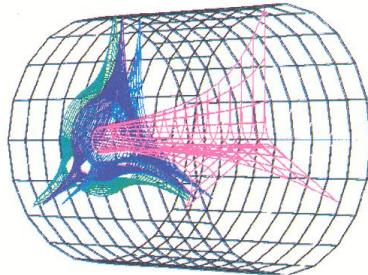


Radial magnetic structure
multipole

B_r

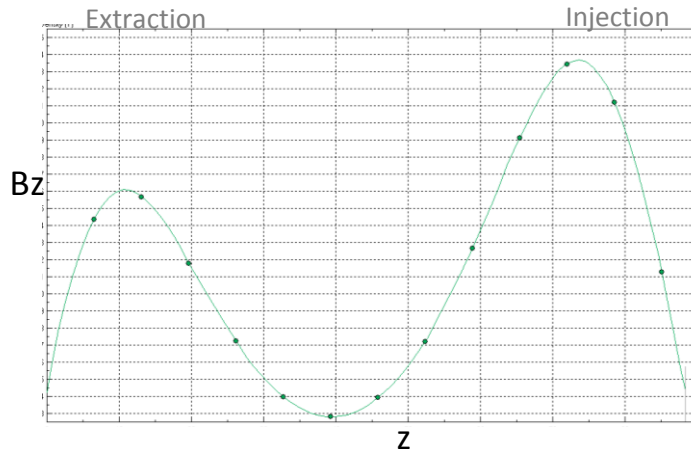


Magnetic bottle



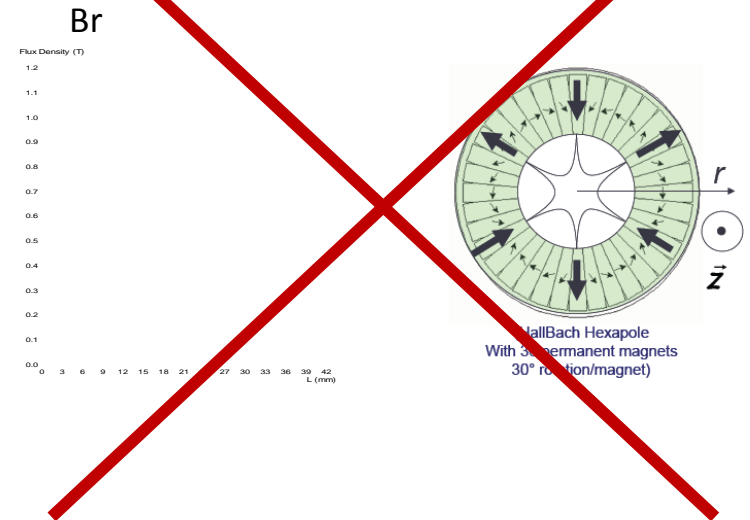
Magnetic field in Simion

Coils and/or Permanent Magnet

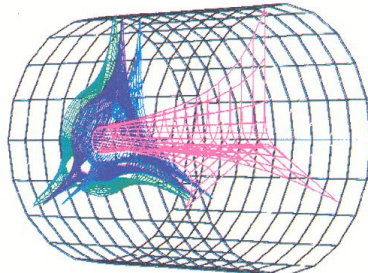


+

Radial magnetic structure
multipole



Magnetic bottle



Axis-symmetry ion source
-> SISR Project



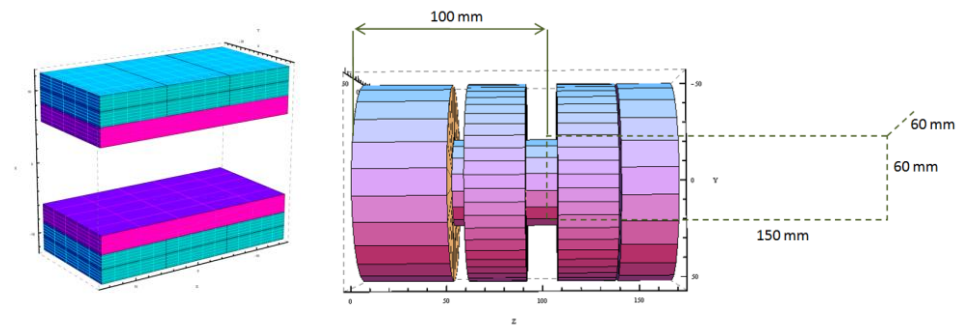
Magnetic field in Simion

Magnetic map calculation :

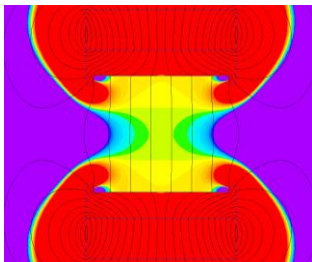
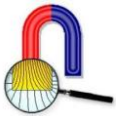
Simion :

- PA mag (only for simple configurations)
- Magnetic function (ex soleinoid, ...)

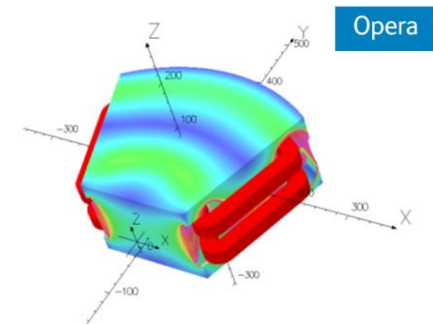
Mathematica + Radia



Quickfield (Only 2D)



Opera



Magnetic field in Simion

Procedure :

Bx, By, Bz .PATXT files



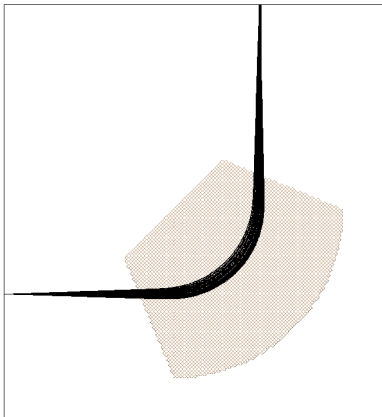
Bx, By, Bz .PA



Integrate in IOB



Apply the field with the
“fieldlib.lua” library

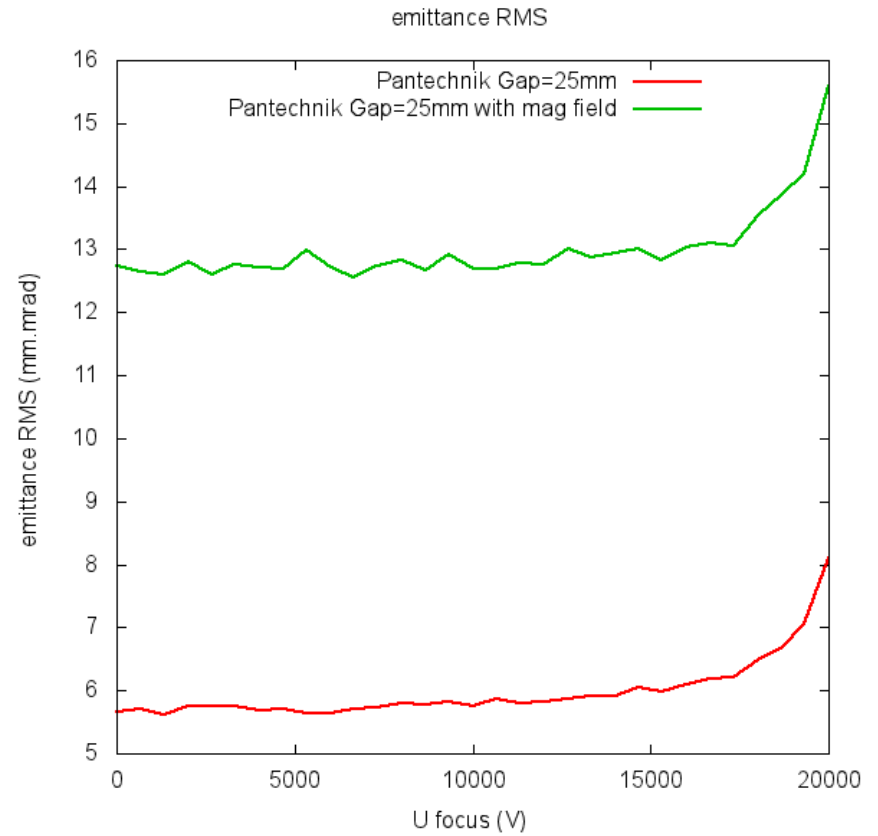
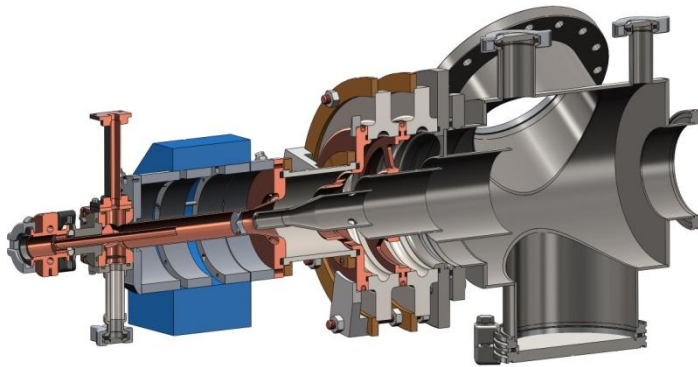


.PATXT format

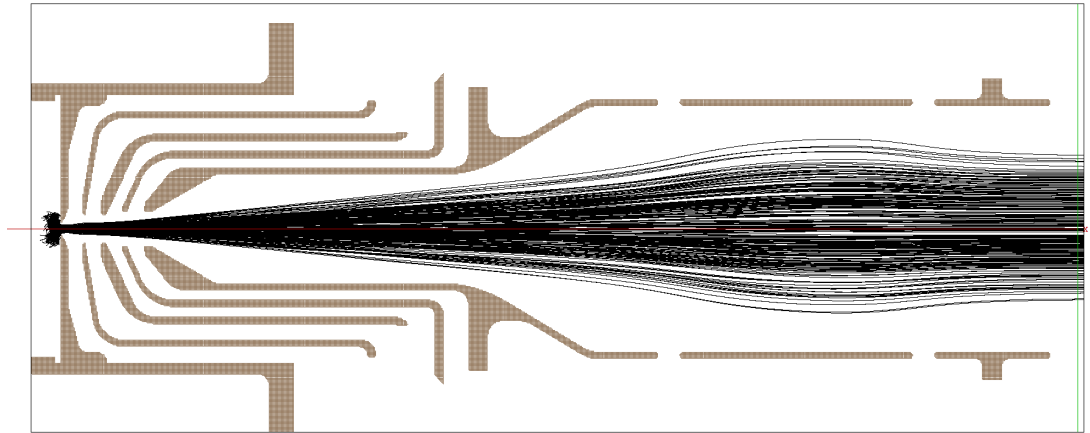
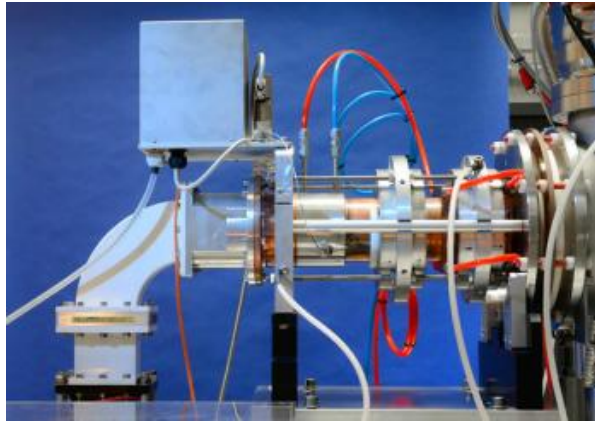
```
begin_potential_array
begin_header
mode -1
symmetry cylindrical
max_voltage 10000000
nx 87
ny 44
nz 1
mirror_x 0
mirror_y 1
mirror_z 0
field_type magnetic
ng 1
dx_mm 1
dy_mm 1
dz_mm 1
fast_adjustable 0
data_format x y z is_electrode potential
end_header
begin_points
0          0          0          0          -7465.77
1          0          0          0          -7472.81
...
```

See the example in the folder : “examples\field_array”

Magnetic field in Simion

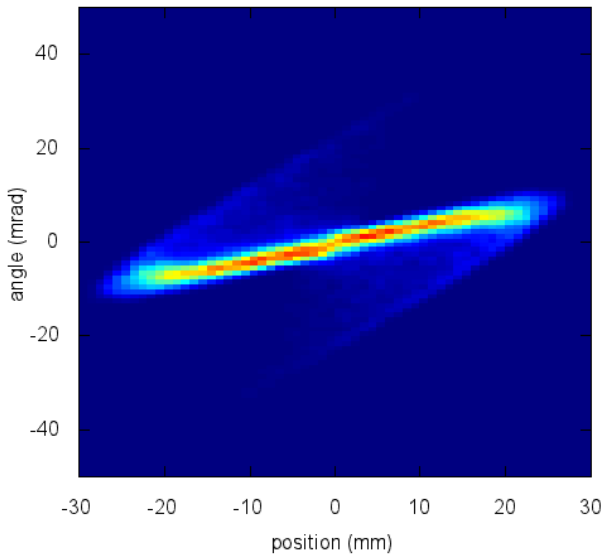


Magnetic field in Simion



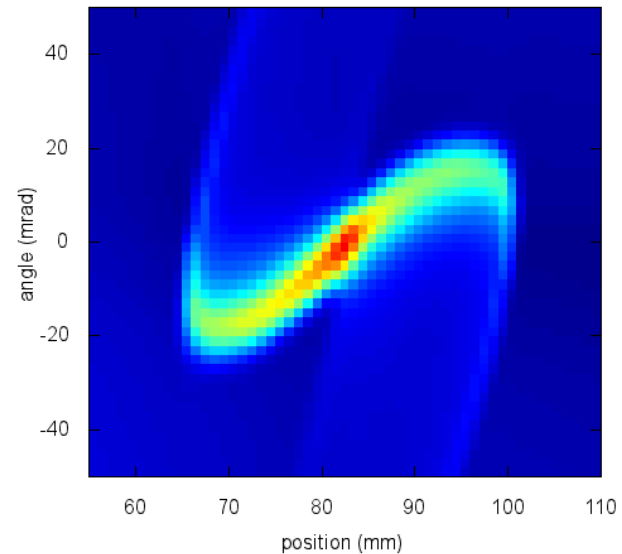
Simulation

source exit



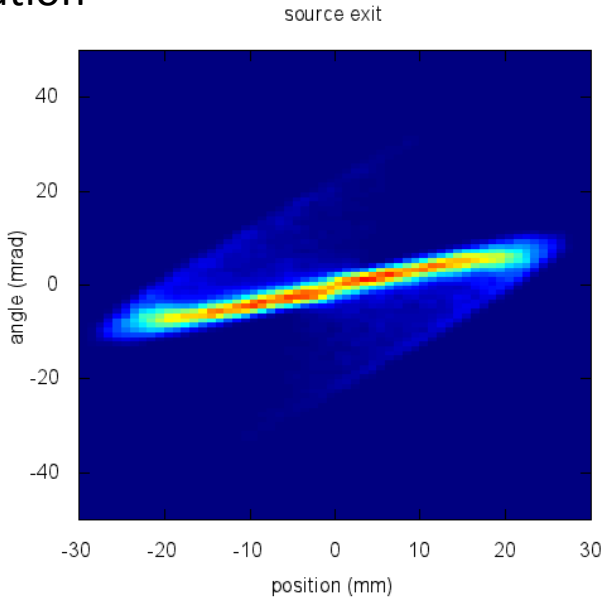
Measure

source exit

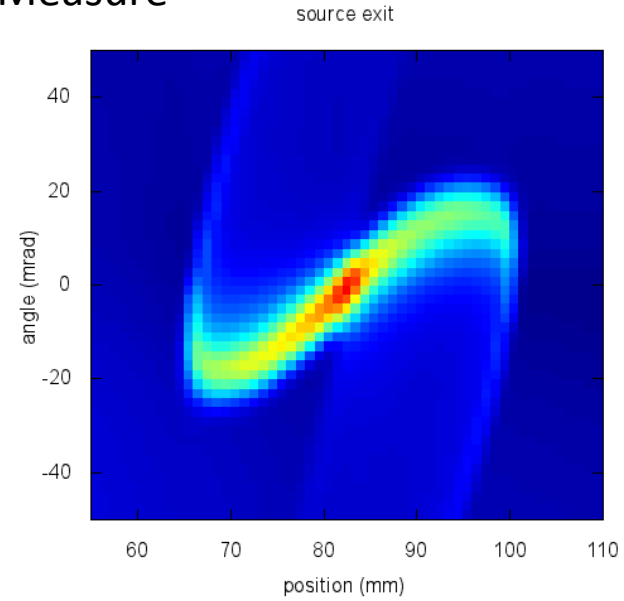


Magnetic field in Simion

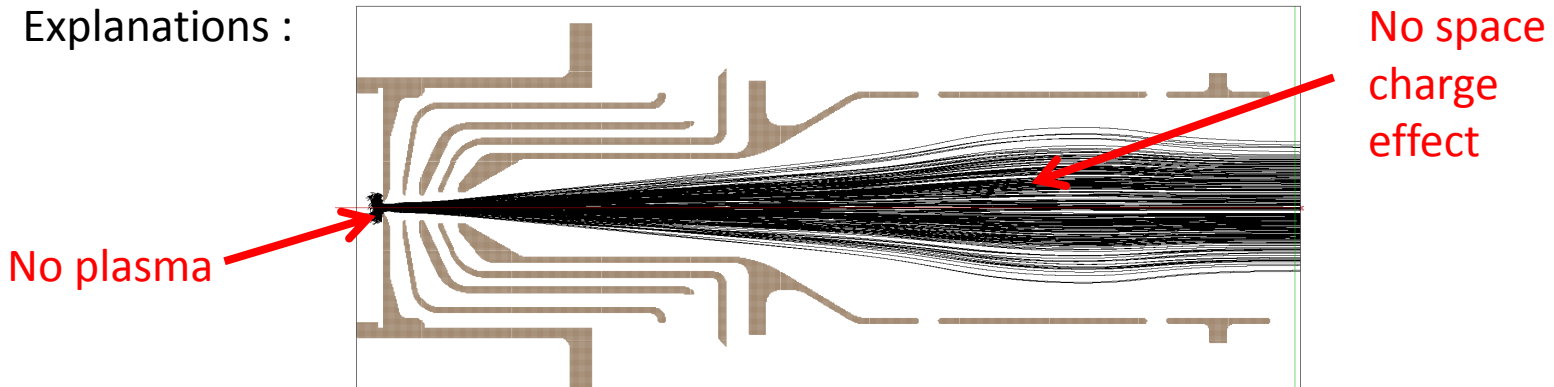
Simulation



Measure

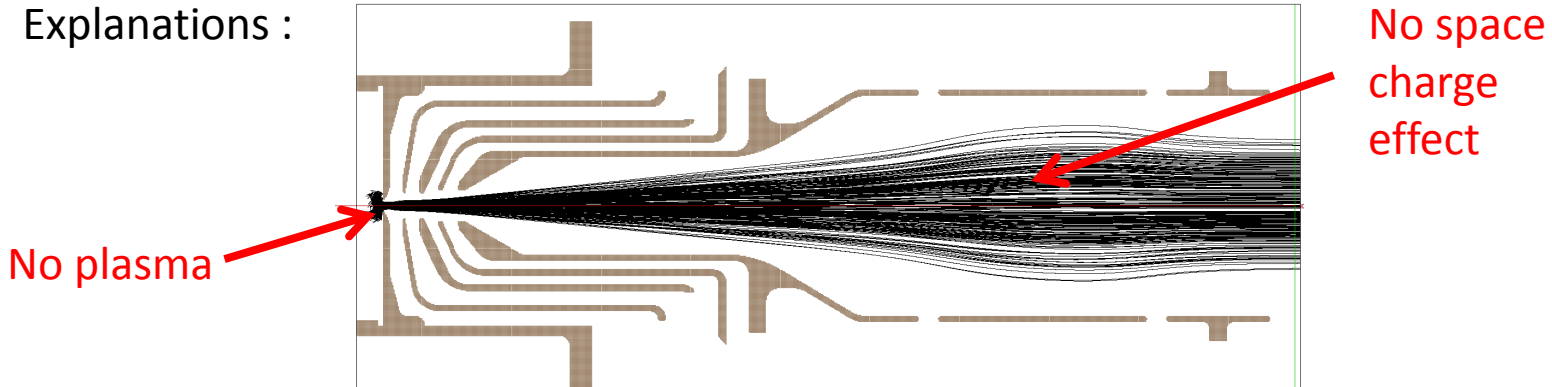


Explanations :

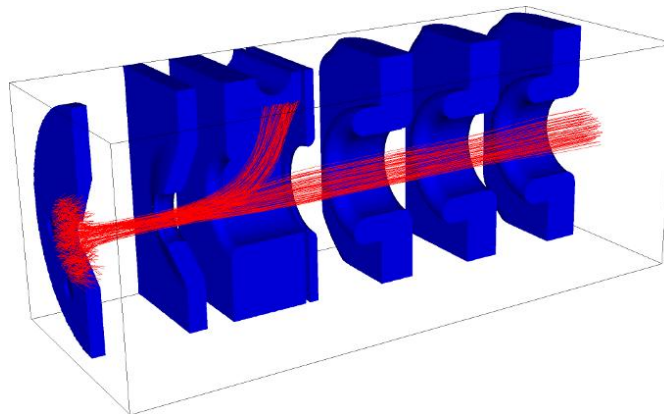
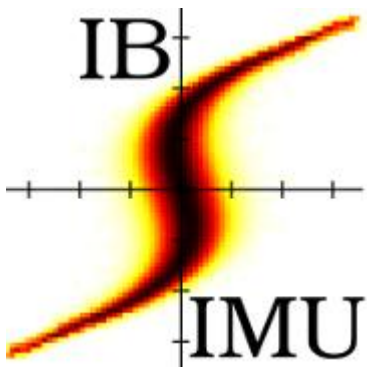


Next

Explanations :



Solution :



- Free and Open source
- Simulate the space charge effect and the plasma
- Not user-friendly

Conclusion

- .DXF -> .GEM : useful tool for axis-symmetry simulations
- Magnetic field added to the simulation
- The simulations can (always) be improved

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- .DXF -> .GEM : useful tool for axis-symmetry simulations
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- The simulations can (always) be improved

Thank you for your attention

