

## **Electron Beam Lithography NPGS Off-Line Training Note**

### **NPGS Software**

1. Install NPGS Software Version 9.0.
2. NPGS software is automatically loaded in C:\NPGS\Program.
3. When loading Design CAD LT 2000 be sure to load in C:\NPGS\DC2000LT.
4. Sample patterns and run files are located in C:\NPGS\Projects\Samples.

### **Create Project Folder in NPGS**

1. Open NPGS.
2. Select “NPGS:Project\Create New Project”.
3. Edit PG.sys file – highlight PG.sys and right click to select “System File Editor”.
4. Change the “mag scale” in PG.sys from 90000 to 216530 and save the file (magnification scale on Sirion SEM is 216.5 micron at 1000x magnification).

### **Pattern Design – Design CAD**

1. Open NPGS.
2. Start DesignCAD LT from NPGS and open a new file in DesignCAD.
3. Pattern Design – Filled Polygons (NPGS manual page 41).
4. Pattern Design – Lines (NPGS manual page 43).
5. Pattern Design – Circular Arcs and Circle (NPGS manual page 45).
6. Make Arrays – Use of Colors – test on exposure condition.
7. Make Arrays – Use of Layers – test on exposure time/spacing conditions.
8. Check “NPGS:maxmag” and move pattern to origin by select “o”. Take note of the maximum magnification and scale down 10% in runfile.
9. Save a file in DesignCAD using the “NPGS:save” command.

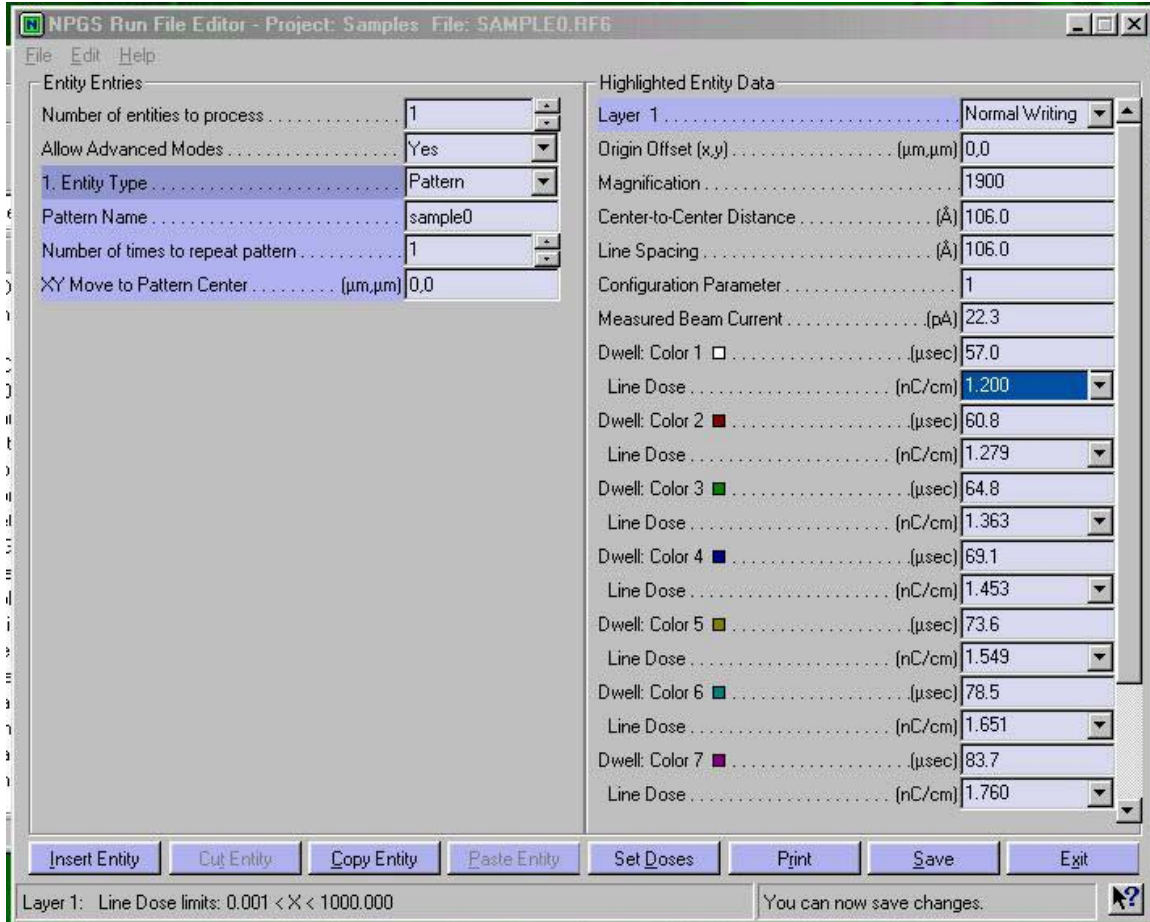
### **Run File Editor – NPGS**

1. From within the NPGS menu program, select “Run File Editor”.
2. Examples of run files are given in Appendices 1-2 for line and area dosages, respectively.
3. Save run file editor.

### **Time Test**

1. An example of run file for time test mode is given in Appendix 3.
  2. Go to NPGS software “Commands:Process Run File:Time Test Mode”.
- Adjust beam current, center to center distance, line spacing to control dwell time.

## Appendix 1. An NPGS Run File Example - Sample0.rf6 using Line Dose



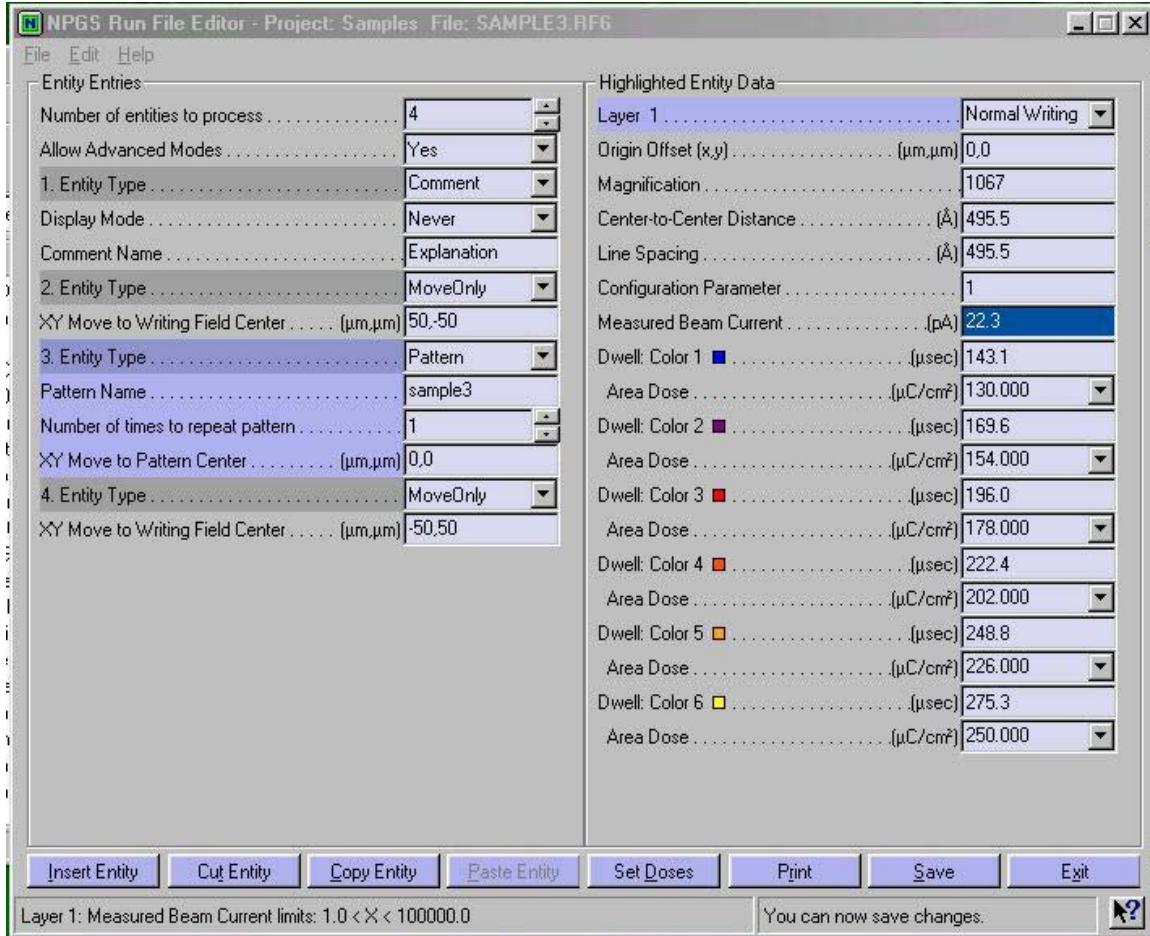
### \*Notes:

**Center-to-Center distance:** Horizontal distance between exposure points. 

- For writing high resolution features, this value should be approximately  $\frac{1}{2}$  of final line width.
- To generate an array of dots, this distance should be set at a high value so as to space the individual exposure points far apart.

**Line Spacing:** Same as center-to-center but in the vertical dimension. Typical values are same as center-to-center.

## Appendix 2. An NPGS Run File Example - Sample0.rf6 using Area Dose



### \*Notes:

Center-to-Center for area doses should be set to a small enough value to ensure sharp corners and edges. However, do not under estimate this value. Doing so will add unnecessary exposure points and increase writing time.

### Appendix 3. An NPGS Run File Example - Time Test Advanced Settings.

