

1. Read XY-distribution from bitmap file

1.1 SetXYdistbmp

```
setxydistbmp(set,filename,[xres,yres]) ;
```

Sets the xy-projection of the initial particle distribution based on a grayscale bitmap image

set	Particle set
filename	Name of a grayscale bitmap file
xres	Horizontal resolution [pixels/meter]
yres	Vertical resolution [pixels/meter]

This element sets the xy-projection of the initial particle distribution according to the specified grayscale bitmap image. Each pixel of the image is treated as a rectangular surface area with a uniformly distributed chance of emitting particles, given by the pixel color. Black pixels have zero chance of emitting particles, white pixels have maximum chance and grayscale values are interpolated in between. This element is very convenient for the simulation of an rf-potogun, where an actual image of the laser focus on the cathode plane can be used to set the initial particle distribution.

The **filename** must be a grayscale, 8-bit per pixel, uncompressed MS-Windows bitmap file, typically having extension bmp or dib. Reverse row order is supported, RLE compression is not. A variety of other image formats such as TIFF can easily be converted to grayscale MS-Windows bitmaps with image processing software such as Adobe Photoshop.

The dimensions, as stored in the bitmap file, can be overruled with the **xres** and **yres** parameters. The bitmap is placed with its center in the origin. The horizontal and vertical axes of the image are aligned with the x- and y-axis respectively. To move the center and/or change the alignment, please use the **settransform** element after **setxydistbmp**.

1.1.1 Example

We used Adobe Photoshop to create a 1000x1000 test bitmap of an elliptical bunch with checkerboard modulation, as shown in the left plot of Figure 1. The following GPT inputfile can be used to set the xy-projection of the initial particle distribution with 100k electrons based on this bitmap.

1. `setparticles("beam",100000,me,qe,0) ;`
2. `setxydistbmp("beam","test.bmp") ;`
3. `tout(0) ;`

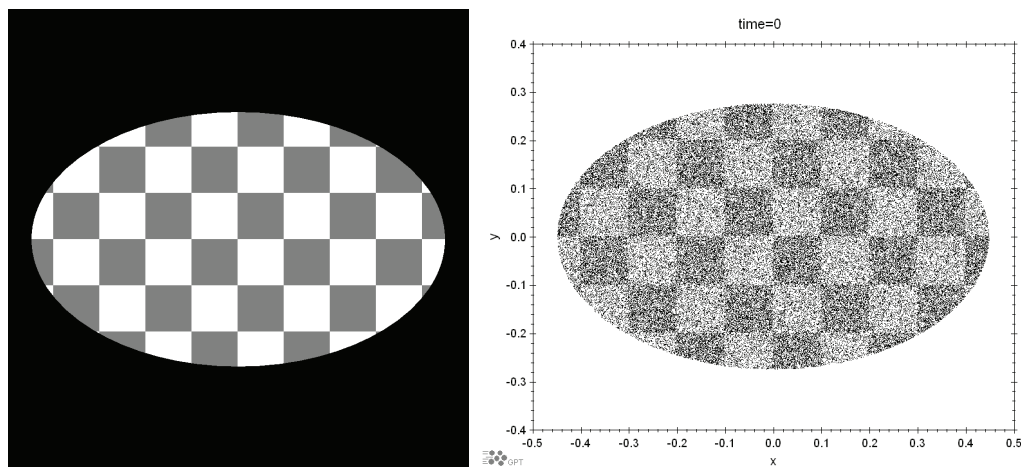


Figure 1 Left: Original test.bmp grayscale bitmap of an elliptical bunch with checkerboard modulation. Right: Corresponding GPTwin plot of the initial particle distribution with 100k particles. Because white pixels emit most particles but particles are shown in black in the right plot, the plots look like color-reversed versions of each other.



1.1.2 Technical notes

Grayscale bitmap files are essentially indexed-color images with 256 or less grayscale color entries. **setxydistbmp** does not use the 8-bit color-index to determine the particle density, but actually looks up the corresponding RGB pixel-color from the color table. This ensures correct results even in the case that the color-table is not filled with 256 monotonically increasing grayscale colors. An error message is produced if the red, green and blue values of any pixel in the image are not identical.

The newer V4 and V5 BITMAPINFOHEADER structures are recognized, but the added functionality is ignored because this only concerns color information.

1.1.3 Installation instructions

To install this new element in GPT versions 2.6x, 2.70 or 2.71, please:

- Copy the enclosed **setxydistbmp.c** file to the following folder:
c:\Program Files\General Particle Tracer\elems
(Please substitute the first part with your GPT installation folder when required).
- Start GPTwin and specify:
Elements/New.
Name: **setxydistbmp**
Filename: **setxydistbmp** (without extension)
DON'T create file
Finish

Elements/Compile GPT-Elements

Your new GPT executable should now be compiled with the new **setxydistbmp** element. If errors are encountered anywhere in the installation process, please notify us immediately.