

**NAME**

genphot – generate test rays

**SYNOPSIS**

**genphot** *parameters*

**DESCRIPTION**

**genphot** generates parallel rays from two dimensional geometric sources oriented in the  $X$ - $Y$  plane. The rays share an arbitrary direction vector. The rays are written in **bpipe** format.

The shape of the filled area is specified with the **geo** parameter. The center of the area is specified by **x** and **y**; the area may be rotated, with rotation angle specified by **phi**.

The area may be filled with a grid of rays, or randomly (uniformly) filled. This is specified with the **dist** parameter. If random filling is used, the **seed1**, **seed2**, and **block** parameters must be specified. If grid filling is used, the **nx** and **ny** parameters must be specified.

The energy distribution of the rays may be specified with the **spectrum** parameter. The bins must not overlap, all values of counts must be non-negative, and the minimum energy for a bin must always be less than the maximum energy. If **spectrum** is set to “none” or omitted, the energy of the ray is specified by the **energy** keyword. The way that the spectrum is sampled is specified by the **energy\_dist** parameter. Note that several of the options for the latter will override the **photdens** parameter.

**ARGUMENTS**

**genphot** uses an IRAF-compatible parameter interface.

**output**

The destination for the output rays. If it is the string **stdout**, it writes to the standard output stream. It writes **bpipe** formatted rays.

**geo** The geometric form that the rays may fill. See “OUTPUT SHAPES” for more information.

**dist**

The ray pattern used to fill the geometric area. It is one of **uniform**, **grid**.

See “RAY DISTRIBUTION” for more information.

**photdens**

The parameter regulates the number of rays output. For points, it is the number of rays. For one dimensional shapes, it is the number of rays/mm. For two dimensional shapes it is the number of rays/mm<sup>2</sup>.

If the ray distribution (**dist**) is **grid**, it is ignored.

**seed1**

The first random number seed. It can range from 1 to 2147483562, inclusive. used only if **dist** is **uniform**.

**seed2**

The second random number seed. It can range from 1 to 2147483398, inclusive. used only if **dist** is **uniform**.

**block**

The starting block in the random number stream. It can range from 0 to 1048575, inclusive. used only if **dist** is **uniform**.

**x** The  $X$  coordinate of the center of the field to fill.

**y** The  $Y$  coordinate of the center of the field to fill.

**z** The  $Z$  coordinate of the rays.

**phi** The rotation angle of the field, in degrees.

**ray\_theta**

The spherical coordinate elevation angle of photon direction in degrees

**ray\_phi**

The spherical coordinate azimuthal angle of photon direction in degrees

**height**

The height of the rectangle. Used only if **geo** is `rect-peri` or `rect-fill`.

**width**

The width of the rectangle. Used only if **geo** is `rect-peri` or `rect-fill`.

**maj**

The major axis of the ellipse. Used only if **geo** is `ellipse-fill`.

**min**

The minor axis of the ellipse. Used only if **geo** is `ellipse-fill`.

**radius**

The radius of the circle. Used only if **geo** is `circ-peri`.

**ri** The inner radius of the annulus. Used only if **geo** is `annulus-fill`.

**ro** The outer radius of the annulus. Used only if **geo** is `annulus-fill`.

**nx** The number of grid sites in the X direction. Used only if **dist** is `grid`.

**ny** The number of grid sites in the Y direction. Used only if **dist** is `grid`.

**spectrum**

A file containing the energy spectrum to sample, in RDB format. If it is `stdin`, the spectrum is read from the standard input stream.

The columns are *emin* (the minimum energy in the bin), *emax* (the maximum energy in the bin), and *counts* (the number of counts within the bin). If the spectrum is either not specified or is specified as `none`, the energy will be read from the parameter file.

**energy\_dist**

How the spectrum specified by the **spectrum** keyword is sampled. It may be one of:

**sample**

Sample the spectrum according to the relative probability of the input bins. After a bin is selected, an energy is uniformly sampled from within the bin's limits.

**picket**

Sample the spectrum according to the relative probability of the input bins. The output energies are the minimum energies of the bins.

**min**

The energies will be the minimum energies of the bins. This option also limits the number of photons output to be equal to the number of bins. It thus overrides the **photdens** parameter. The only column required in the RDB table is *emin*.

**max**

The energies will be the maximum energies of the bins. This option also limits the number of photons output to be equal to the number of bins. It thus overrides the **photdens** parameter. The only column required in the RDB table is *emin*.

**ave**

The energies will be the averages of the bin limits. This option also limits the number of photons output to be equal to the number of bins. It thus overrides the **photdens** parameter. The only columns required in the RDB table are *emin* and *emax*.

**energy**

the energy to assign to the ray. used only if **spectrum** is "none" or not specified.

**debug**

A list of debug flags. None are presently defined.

**help**

Print some documentation and exit.

**version**

Print the version and exit.

**OUTPUT SHAPES**

**genphot** can fill a variety of output shapes. This is controlled by the **geo** parameter, which can have the following values:

**rect-peri**

The perimeter of a rectangle. See the **height** and **width** parameters.

**p=item rect-fill**

A filled rectangle. See the **height** and **width** parameters.

**ellipse-fill**

A filled ellipse. See the **maj** and **min** parameters.

**circ-peri**

The perimeter of a circle. See the **radius** parameter.

**annulus-fill**

A filled annulus. See the **ri** and **ro** parameters.

**point**

A point. In this case, the **photdens** parameter specifies the number of photons to generate.

**RAY DISTRIBUTION**

How the rays fill the desired output shape is controlled by the **dist** parameter.

It can have one of the following values:

**uniform**

Fill the space uniformly (randomly).

**grid**

Place rays on a grid. The **nx** and **ny** parameters control the grid spacing within the smallest rectangle which encloses the output shape. The actual number of rays output depends upon how much of the rectangular grid is within the output shape.

**COPYRIGHT & LICENSE**

Copyright 2006 Smithsonian Astrophysical Observatory

This software is released under the GNU General Public License. You may find a copy at

<http://www.fsf.org/copyleft/gpl.html>

**VERSION**

This documents version 1.2.2 of **genphot**.

**AUTHORS**

Diab Jerius <djerius@cfa.harvard.edu>

Ivan Stern

David Grumm