

---

**NAME**

scatter - apply a scattering distribution to incoming photons

**SYNOPSIS**

scatter [*option=value*]

**OPTIONS**

Parameters for scatter.par

*input string*

Input photon stream in bpipe format. The string 'stdin' causes scatter to read from standard input.

*output string*

Output photon stream in bpipe format. The string 'stdout' causes scatter to write to standard output.

*logfile string*

Log file. The string 'stderr' causes scatter to write the log to standard error.

*seed1 integer*

The first seed for the random number generator. It must be in the range [1,214748339].

*seed2 integer*

The second seed for the random number generator. It must be in the range [1,214748339].

*block integer*

The random number block to start at. It must be in the range [1,1048575].

*scatter\_db string*

Database of scattering distributions. This is an RDB formatted file. See *FILES*

*mirror\_db string*

Database of mirror positions. This is an RDB formatted file. See *FILES*

*scat\_iter\_lim integer*

Maximum number of iterations to try to scatter a photon.

*in\_plane boolean*

Apply the in plane scatter.

*out\_of\_plane boolean*

Apply the out of plane scatter.

*min\_cumulative\_probability real*

Minimum cumulative probability.

*max\_cumulative\_probability real*

Maximum cumulative probability.

*shell integer*

Mirror shell number.

*surf\_no integer*

Mirror surface number; 1=P, 2=H.

theta *real*

Default value for theta, in arcseconds

phi *real*

Default value for phi, in arcseconds.

debug *string*

Print various types of debug information to *logfile* or enables non-standard operation. The strings listed below may be given singly or in a colon separated list.

angles

Prints photon id, in-plane, and out-of-plane scatter offsets.

extrapolated

Prints photon id, energy, random number, and sin of the incident angle.

offzone

Prints photon id and z position.

offzone2

Prints photon id, z position, and offset from nearest mirror section.

help *boolean*

Print brief usage information and exit.

usage *boolean*

Print usage information and exit.

version *boolean*

Print version and exit.

mode *string*

Mode of operation.

## DESCRIPTION

scatter takes an input bpipe photon stream and applies a offset to the photon direction. The offset is read from the *scatter\_db*, interpolated between values in the *scatter\_db*, or extrapolated from the *scatter\_db* depending on the situation.

Required fields in the input bpipe stream are position, direction, surface\_norm, energy, id, and surf\_missed.

The output bpipe stream has the direction field modified to include the scatter offset.

The log file contains output triggered by the various *debug* flags.

## NEW STYLE SCATTER

This behavior is triggered by the presence of the EsaLinAsym value in the scat\_alg field of the *scatter\_db* for a given zone. See *FILES*.

This style of scattering assumes that the scattering distributions in the *scatter\_db* cover the full range of possibilities. No extrapolation is performed. All values come from the table or from interpolating between

---

two values in the table.

## OLD STYLE SCATTER

This mode of operation is triggered by the presence of the value `EsaLinPowSym` in the `scat_alg` field of the `scatter_db`. See *FILES*.

This mode duplicates the older style scattering algorithm used in the pre 2004/08 time frame. Essentially the scattering distributions in the `scatter_db` file have lower and upper limits. So for random numbers that fall outside the limits, the scattering angle ends up being extrapolated from the distribution using a powerlaw.

## FILES

### SCATTER\_DB

The `scatter_db` provides a lookup table mapping scattering distribution files (FITS formatted) with mirrors and zones. It also influences which scattering algorithm **scatter** uses. A list of the columns required is given below:

mirror

Mirror name, i.e. p1, p3, p4, p6, h1, h3, h4, or h6.

zone

Mirror zone name.

zone\_geom

Zone geometry specifier, currently only a linear geometry along the z axis is handled. *ZLinear* is the specifier used for this geometry.

If *ZLinear* is specified, the following additional columns are required:

zmin

Z min of the zone for ZLinear geometry.

zmax

Z max of the zone for ZLinear geometry.

scat\_alg

Scattering algorithm specifier, `EsaLinPowSym` or `EsaLinAsym` are currently accepted.

`EsaLinPowSym` represents the algorithm developed by LVS.

`EsaLinAsym` represents the algorithm developed by Zhao.

scat\_file

FITS binary table containing scattering distributions.

### MIRROR\_DB

The `mirror_db` parameter provides a lookup table which contains, at least, the following columns:

mirror

Name of the mirror, i.e. p1, p3, p4, p6, h1, h3, h4, or h6.

z0

Z position of the mirror.

## **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>

## **AUTHOR**

tibbetts@head.cfa.harvard.edu