

**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*

Minumum cumulative probability.

*max\_cumulative\_probability real*

Maxumum 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 handles. *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.

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## **VERSION**

This documents version 1.3.7 of **scatter**.

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