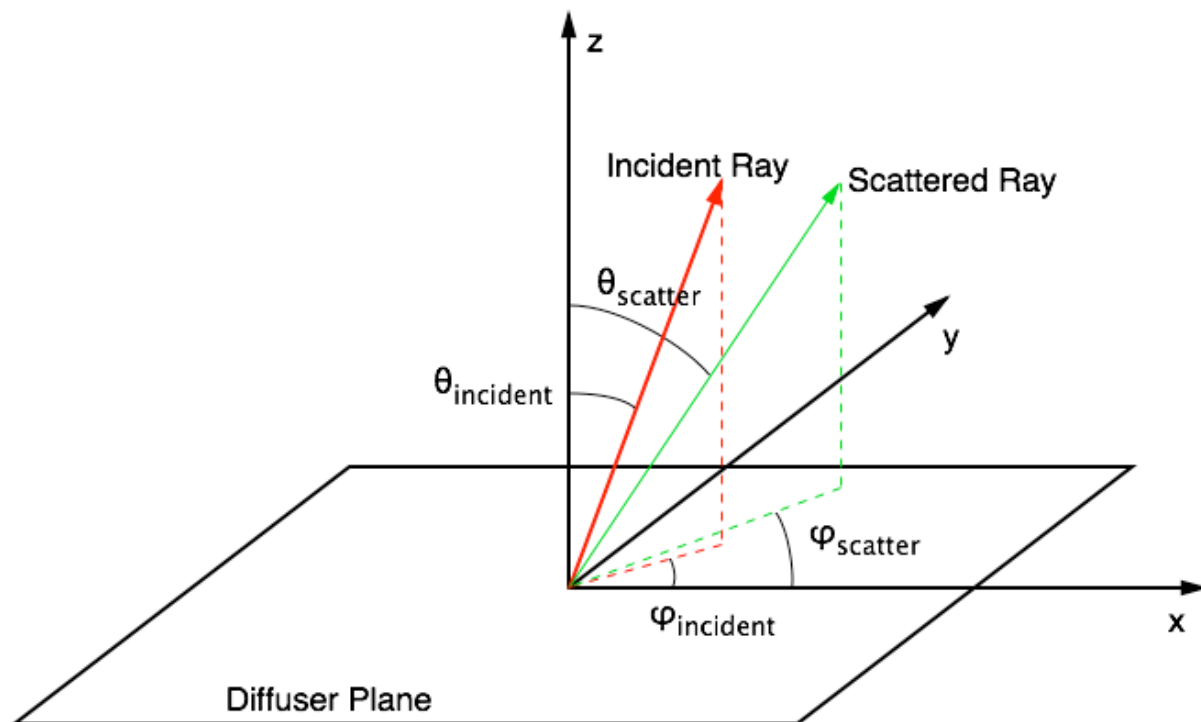# RPC Photonics, Inc.
BSDF Data Format for ASAP

The enclosed BSDF data files contain scatter data for various angles of incidence. The files are named with the diffuser type, incident polar angle and incident azimuth angle. For example, the file *EDC20 5-0.txt* contains data for the EDC20 diffuser with an incident angle of 5 degrees polar and 0 degrees azimuth. These files are formatted according the ASAP requirements, and can be read into an ASAP script using the $READ command. The first two lines of each file contain ASAP comments with the file name and the date the data was taken. The third line contains two numbers: the polar angle, $\theta_{incident}$, and the azimuth angle, $\phi_{incident}$, of the incident illumination. The remaining lines contain three numbers: the polar scatter angle, $\theta_{scatter}$, the azimuth scatter angle, $\phi_{scatter}$, and the BSDF value. The figure below shows the orientation of these angles.

This is a sample of the first few lines of data from the EDC20 data set:

```
!!EDC20 20-0      RPC Photonics      12/5/2013
!!BSDF Data
20.000      0.000
0.0000      0.0000      0.0326
0.0000      1.0000      0.0295
0.0000      2.0000      0.0234
0.0000      3.0000      0.0227
⋮
```

The BSDF data provided are from measurements of representative diffuser samples. Actual scatter distributions may vary from diffuser to diffuser.
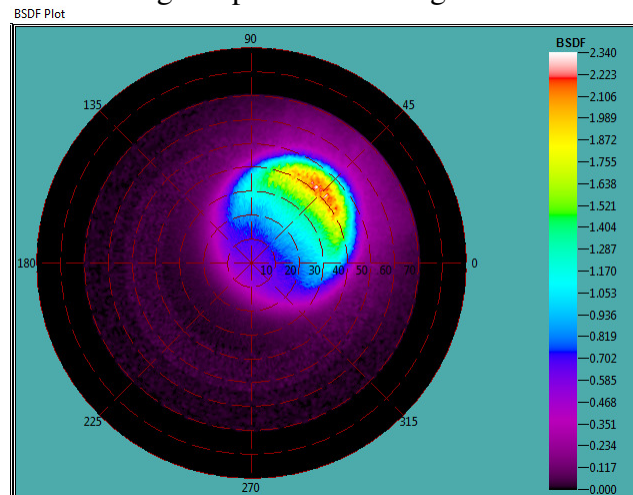
Isotropic Diffusers

ASAP has two options for using BSDF data. The first option is for use with symmetric or isotropic data such as the circular diffusers EDC20 and EDC50. In this case we need data only for various polar incident angles. So we have included BSDF data sets for 0, 5, 10, 15, and 20 degree polar incident angles at 0 degree azimuth. ASAP does the necessary interpolation for non-zero azimuth incident angles. The ASAP code for the symmetric/isotropic case with the EDC20 diffuser is:
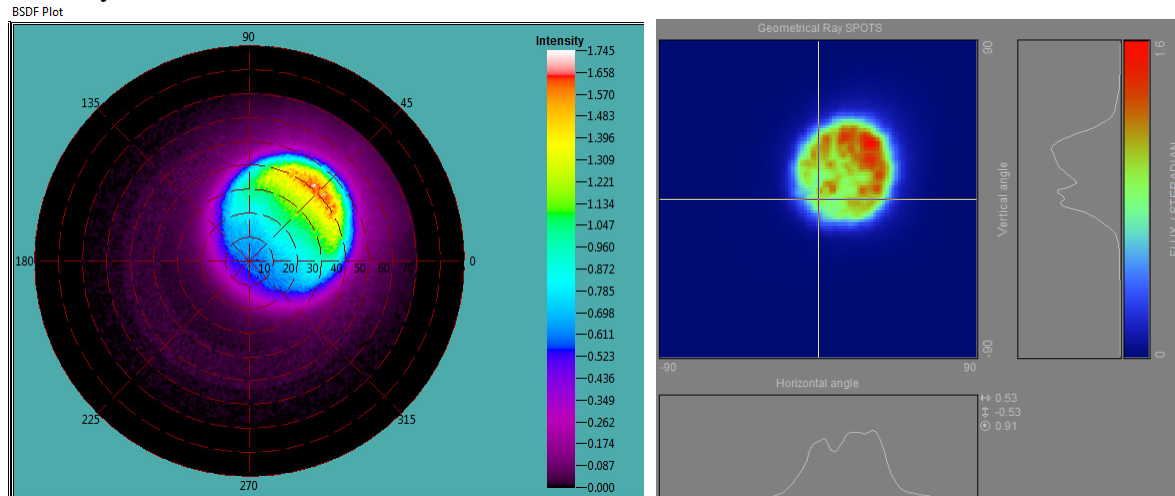
```
MODELS
  BSDFDATA ANGLES    !!PLOT

$READ "EDC20 0-0.txt"
$READ "EDC20 5-0.txt"
$READ "EDC20 10-0.txt"
$READ "EDC20 15-0.txt"
$READ "EDC20 20-0.txt"
```

An example of BSDF data for 20degrees polar and 45 degrees azimuth incident angle:

RPC Photonics, Inc., 330 Clay Road, Rochester, NY 14623585-272-2840; FAX: 585-272-2845

Intensity measurement and ASAP simulation

Anisotropic Diffusers

For the non-symmetric or anisotropic diffusers such as the EDS20 and EDS50 we require many more BSDF files to cover multiple incident azimuth angles. So for each polar incident angle other than zero we have 24 files for azimuth incident angles in increments of 15 degrees. This results in a total data set of 97 files for each diffuser.

The ASAP code for the anisotropic BSDF scatter model is:
```
MODELS
   BSDFDATA Y ANGLES    !!PLOT

$READ "EDS50 0-0.txt"
$READ "EDS50 5-0.txt"
$READ "EDS50 5-15.txt"
$READ "EDS50 5-30.txt"
$READ "EDS50 5-45.txt"
```

We use the "Y" option in the BSDFDATA command to indicate anisotropic scatter and properly orient the local surface coordinates to the global coordinates. This is described in the Breault technical publication on scattering, brotg0922_scatter.pdf.

This is an enormous amount of data to execute and may significantly slow ray tracing. We recommend using only the data sets necessary for the range of incident angles expected in your simulation. For example, if you anticipate polar incident angles of less than 5 degrees, then use

only the data sets for 0 and 5 degrees. If you require a wide range of incident angles up to ~20 degrees then you may want to conduct multiple simulations with narrower ranges of incident angles using only the BSDF files in that range, save the ray sets as dis files, then separately read in the ray sets and perform any other analysis or additional ray tracing.

An example .inr file is included with each data set.

Note to ASAP 2014 V1 and earlier version users:

ASAP 2014 V1 and earlier versions contain a bug that inverts the scatter distribution about the 45degree azimuth angle. To overcome this problem all azimuth files for any given polar angle must be read into the program. Version ASAP 2014 V1 SP1 resolves this problem.