
Daysim and Photonmapping

Jan Wienold

Fraunhofer Institute for Solar Energy Systems

Freiburg, Germany

Daysim – pmap - overview

- Introduction Photon mapping
- Current restrictions
- Implementation into daysim
- Header file
 - Structure of the header file
 - Important Keywords
 - Photon-mapping Keywords

Daysim – pmap - overview

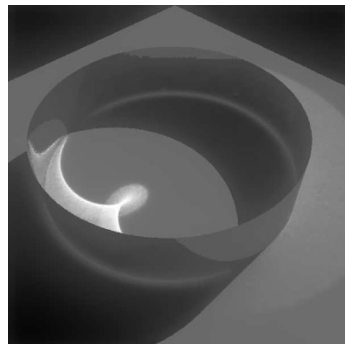
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pmap - Introduction

Why?

Calculation of caustics

Fast calculation of specular/mirror materials as geometry
(important also for glare evaluation)



pmap - Introduction

Two-pass method based on Monte Carlo

1. Forward pass emits photons from light sources, scatters/absorbs at objects, deposits on diffuse surfaces) mkpmap
2. Photon Gathering: Backward pass evaluates irradiance from photons using RADIANCE's ambient calculation

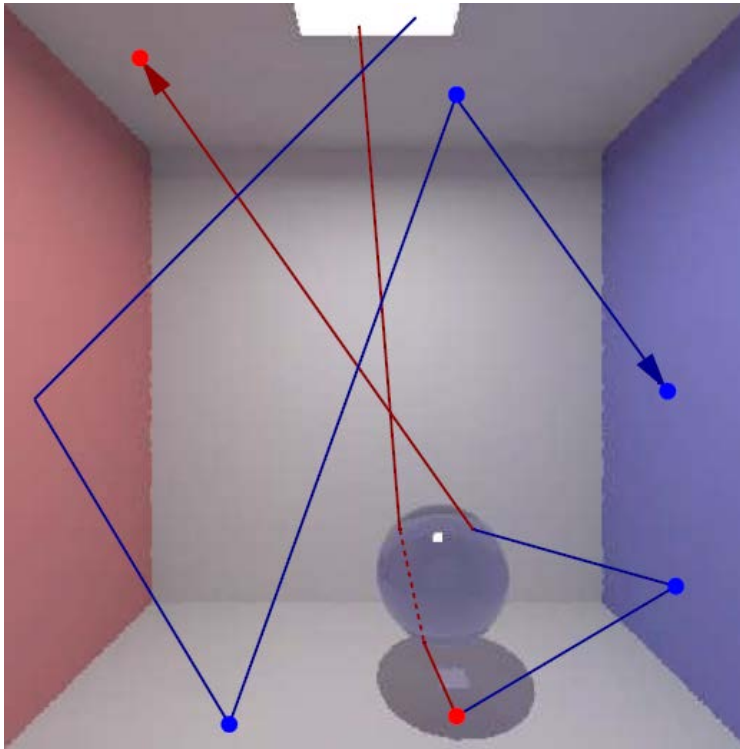
pmap - Introduction

Two-pass method based on Monte Carlo

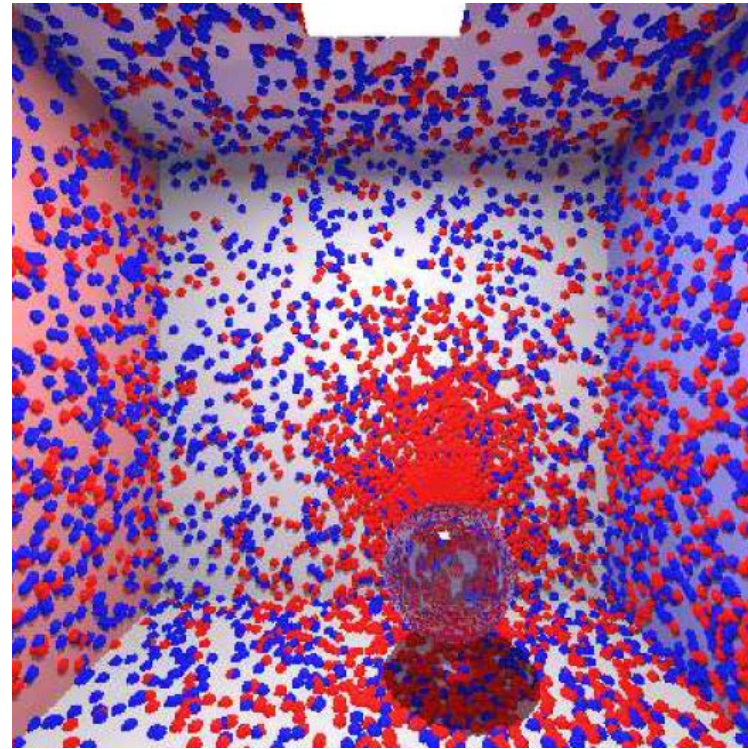
1. Forward pass emits photons from light sources, scatters/absorbs at objects, deposits on diffuse surfaces) mkpmap
2. Photon Gathering: Backward pass evaluates irradiance from photons using RADIANCE's ambient calculation

Photon-mapping: Forward pass

Emmission of Photons



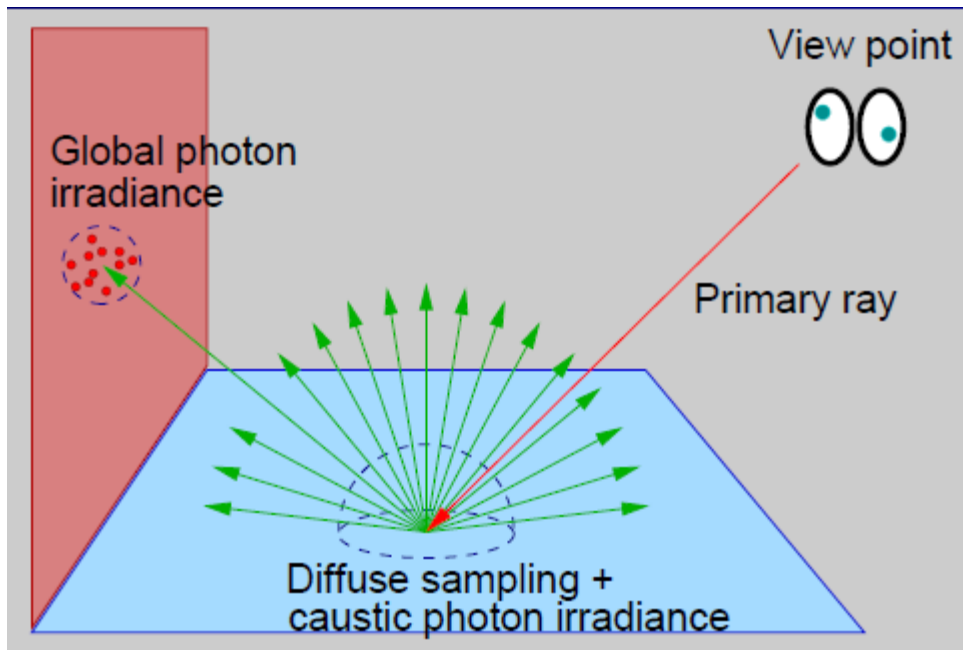
Storage of Photons in scene "photon-map"



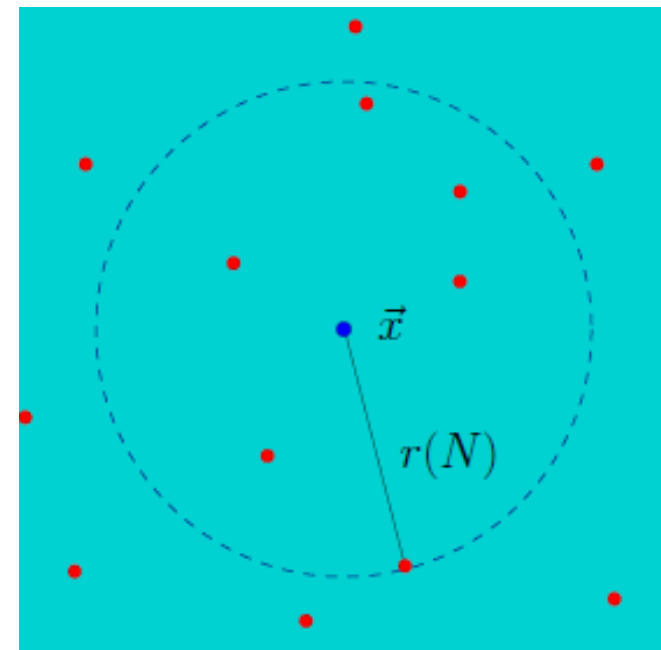
Source: Roland Schregle

Photon-mapping: Gathering

Gathering using one bounce backwards raytracing

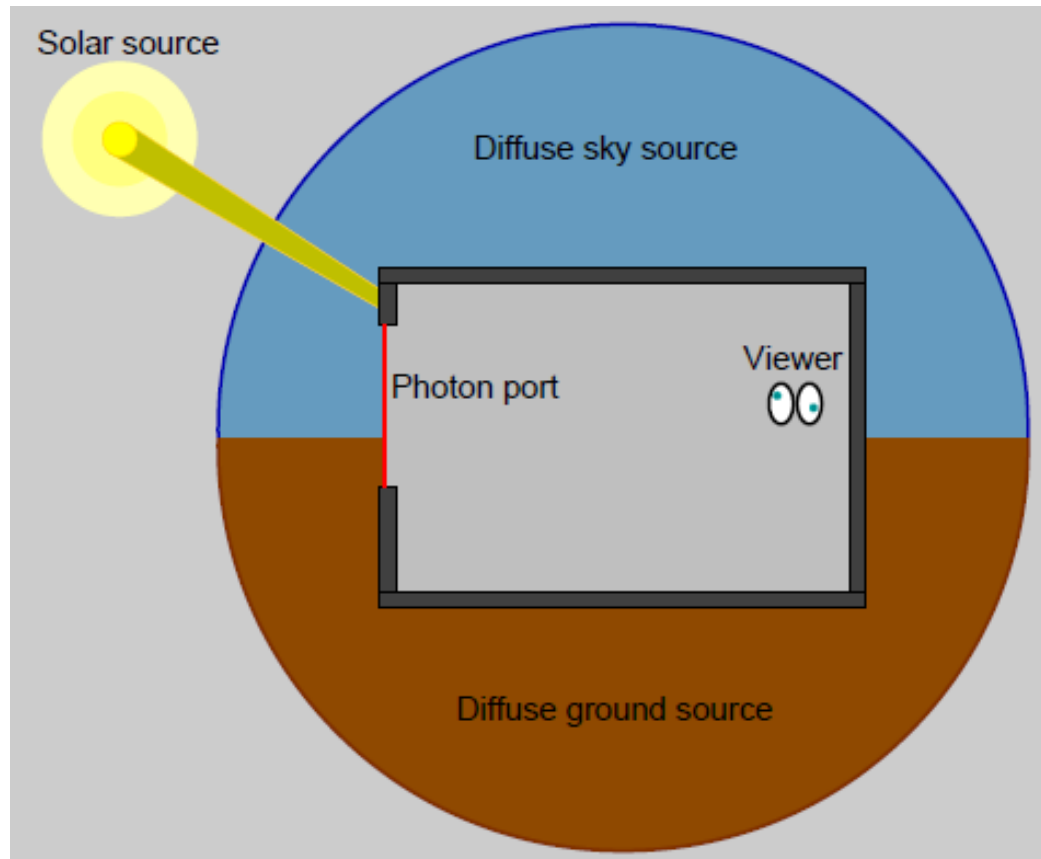


Density estimate



Source: Roland Schregle

Photon-mapping photonport: Increase efficiency of photon distribution



Source: Roland Schregle

Pmap - Implementation into RADIANCE

- mkpmap : emission of the photons and storage in file
- gathering with modified versions of
 - rtrace
 - rpict
 - rvu
 - rpiece
- When no pmap options are used -> common RADIANCE raytracing is used
- Based on Radiance code Dec. 2010 ("between 4.0 and 4.1")
- At the moment, package is only available for linux and cygwin, windows version will be available autumn 2012

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Photon mapping in Radiance and Daysim – current restrictions

- Illuminance/Irradiance calculation directly only on surfaces
- Glow material not reliable
- Photon port only without obstruction

-> will be solved until spring next year

- Windows version missing

-> solved within the next weeks

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Pmap - Implementation into daysim

- Calculation also in two steps, photon distribution with modified version of mkpmap gathering with modified version of rtrace_dc
- “Only” rtrace_dc is replaced, all other tools/functionalities are the same as “daysim classic”
- Fully boxed
- Only some few additional keywords in the header-file
- Pmap will be stored only for static shading option
- For advanced shading, pmap will be deleted between calculations

Pmap - Implementation into daysim

Process of complex fenestration

- 3-D geometric model of fenestration system
- Add few additional pmap parameters to header file
- Replace headerfile for gen_dc -dir call
- That's it!
- Easy to use

Daysim – the header file

- The headerfile contains all necessary configuration settings to run daysim
- Idea: *command headerfile -> result*
- Structure: *keyword value(s)*
- No keyword: default value

Daysim – the header file

```
#=====
# DAYSIM 2.1.P2header file
# Thu Jan 31 15:54:33 CET 2008
#=====
```

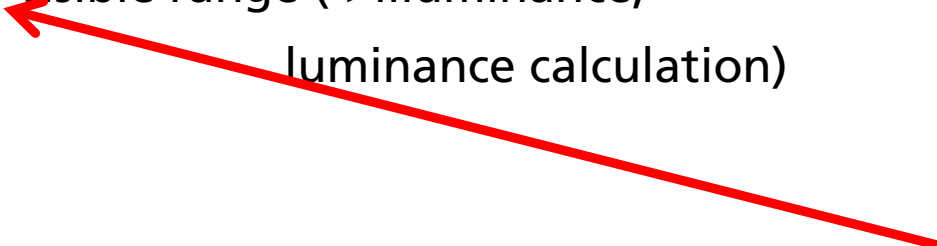
```
project_name          v005
project_directory     /paper_bsim2011/radiance/daysim/v005/
bin_directory         /usr/local/radiance/daysim/bin/
tmp_directory         /paper_bsim2011/radiance/daysim/v005/tmp/
material_directory    /paper_bsim2011/radiance/daysim/v005/

viewpoint_file        /paper_bsim2011/radiance/daysim/view.vf
```

Daysim – the header file

```
#####  
# site information  
#####
```

```
place Frankfurt  
latitude 50.1  
longitude -8.68  
time_zone -15  
site_elevation 125  
ground_reflectance 0.2  
wea_data_file frankfurt.wea  
wea_data_file_units 1  
first_weekday 1  
time_step 60  
wea_data_short_file wea_new/frankfurt.wea  
wea_data_short_file_units 1  
lower_direct_threshold 2  
lower_diffuse_threshold 2  
output_units 2
```

- 1: solar range (->irrad calculation)
 - 2: visible range (->illuminance,
luminance calculation)
- 

Daysim – the header file

```
#####  
# building information  
#####  
material_file materials.rad  
geometry_file v005_trans_0_0.rad  
sensor_file grid_illum_daysim  
shading 1  
static_system illum_v005_0_0.dc illum_v005_0_0.ill
```

1: Static shading:
Shading is included in model
Only 1 variant is calculated
per headerfile

Name prefix stored in tmp directory for
Direct dc, Diffuse dc

Merged dc file

Result illuminance file

Daysim – the header file

```
#####  
# RADIANCE parameters  
#####  
ab 5  
ad 8192  
as 4096  
ar 256  
aa 0.1  
lr 6  
st 0.1500  
sj 1.0000  
lw 0.002000  
dj 0.0000  
ds 0.0  
dr 2  
dp 512
```

Daysim – the header file the non default “hidden” options

Sun interpolation



0: Interpolation (default)

1: Nearest neighbour (deleted from daysim)

2: Shadow testing

coupling_mode 1

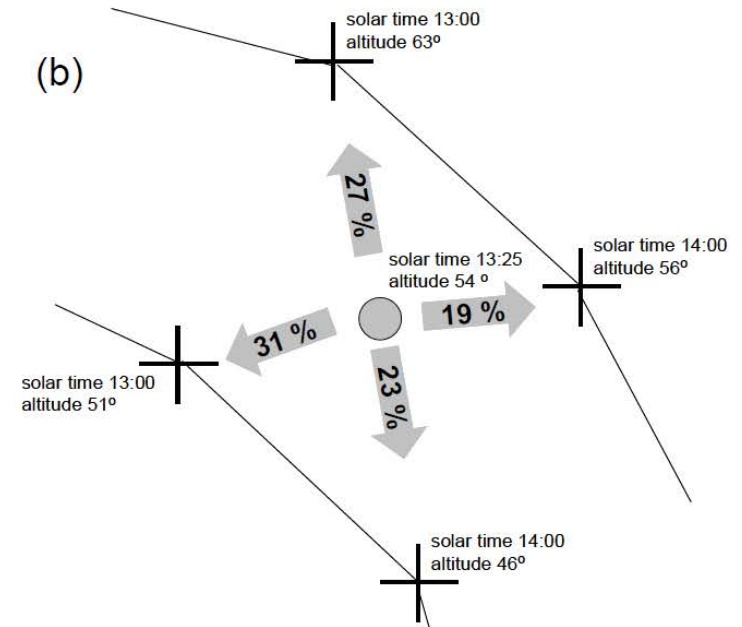
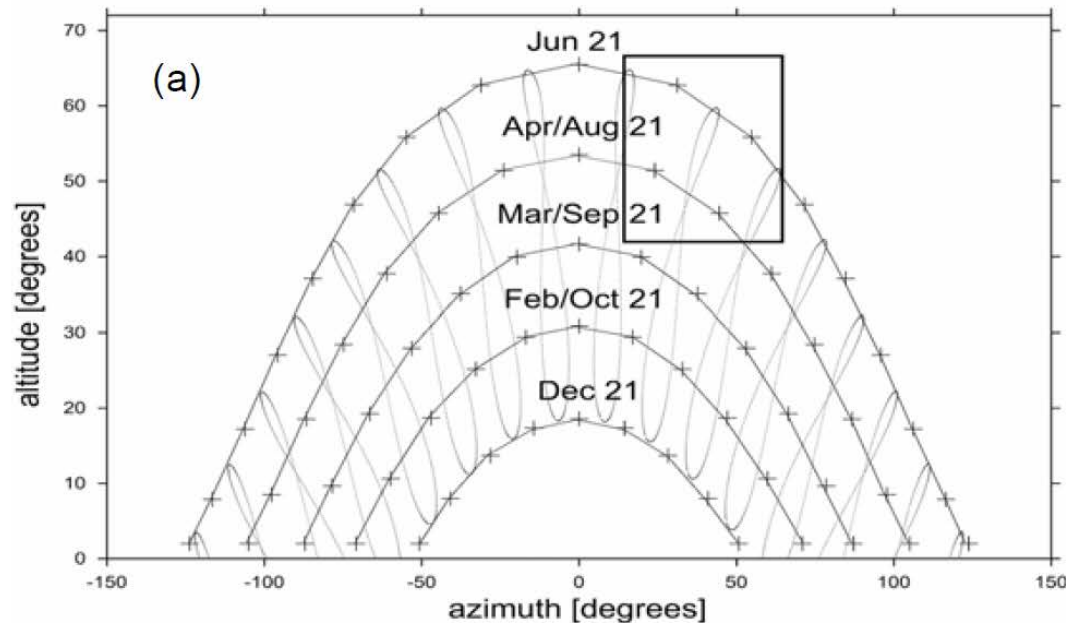
dgp_check_file path+prefix e.g. tmp/testing

dgp_image_x_size 800

dgp_image_y_size 800

Daysim – Direct calculation - interpolation

- Interpolation (default)
- Shadow testing
- Nearest neighbour



Daysim – the header file the photon mapping options

Switch photon mapping on ← `calculation_mode photonmap`

The photon-mapping files may be large!
(here around 2GB!)

`pmap_apg_file tmp/v005_0_0_pmap_daysim.gp`
`pmap_apg_nphotons 50000000`
`pmap_apg_bwidth 200`
`pmap_apD 2`
`pmap_apc_file tmp/v005_0_0_pmap_daysim.cp`
`pmap_apc_nphotons 50000000`
`pmap_apc_bwidth 200`

Daysim – sensors

Unit sensors

← `sensor_file_unit 0 1 2 3 0 0 0 0 0`

0: illuminance (lux)

1: luminance (cd/m²)

2: irradiance (W/m²)

3: radiance (W/m²sr)

No keyword -> all sensors treated as
illuminance sensor

If keyword, all units must be set!
(be careful when having large number of sensors)

Daysim – generate daylight coefficients: `gen_dc`

- Diffuse DC's:
`gen_dc headerfile -dif`
- Direct DC's:
`gen_dc headerfile -dir`
- Merge DC's together:
`gen_dc headerfile -paste`
- Apply DC to weather file
`ds_illum headerfile`

Daysim –photon mapping process

- Diffuse DC's use "standard" daysim, without photon mapping):

```
gen_dc headerfile_standard -dif
```

- Direct DC's use "pmap" daysim:

```
gen_dc headerfile_pmap -dir
```

- Merge DC's together:

```
gen_dc headerfile -paste
```

- Apply DC to weather file

```
ds_illum headerfile
```

Daysim – pmap - outline

- Linux/cygwin version available from Oct 1st 2012 on <http://www.ise.fraunhofer.de/radiance> (on email request also from today)
- Currently compiling under windows also, available this autumn
- Pmap update (to current radiance version, solve sensor issue, solve glow issue, solve photon-port issue) -> planned in spring 2013

Daysim – gen_dgp_profile

- Usage is easy:

gen_dgp_profile headerfile

- Process:

1. Step: *gen_dgp_profile* uses daysim to calculate the vertical illuminance at given viewpoint
2. Step: calculate a simplified image + dgp hourly

- output


hourly dgp-values (prefix.dgp)

- What you need:

viewpoint_file filename

- Special options:

gen_dgp_profile headerfile -d
calculates "only dgp (2. Step)" , no illuminance
calculation

A photograph taken from an elevated position looking out through horizontal window blinds. The blinds are partially open, creating a grid of light and shadow across the scene. Outside, a paved parking lot is visible with a dark-colored car parked in the distance. To the right, a portion of a light-colored building with a flat roof is visible. The overall lighting is bright, suggesting a sunny day.

Thank you for your attention!!