What's New in Radiance for 2014

Greg Ward, Anyhere Software

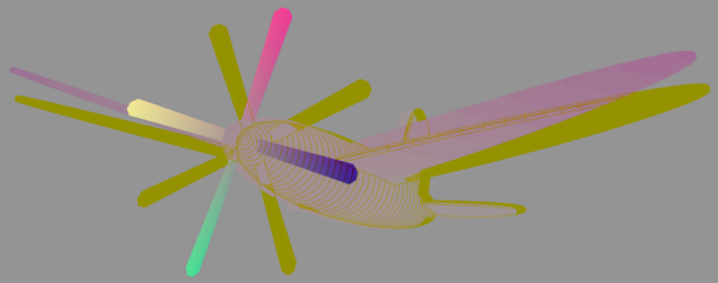
Highlights:

* Improved motion blur utility **pmblur2** for **ranimove**
* Added **gendaymtx** utility and updated **dctimestep** to do a year at a time
* Created **bsdf2klems** and **bsdf2ttree**
* More bug fixes for BSDFs

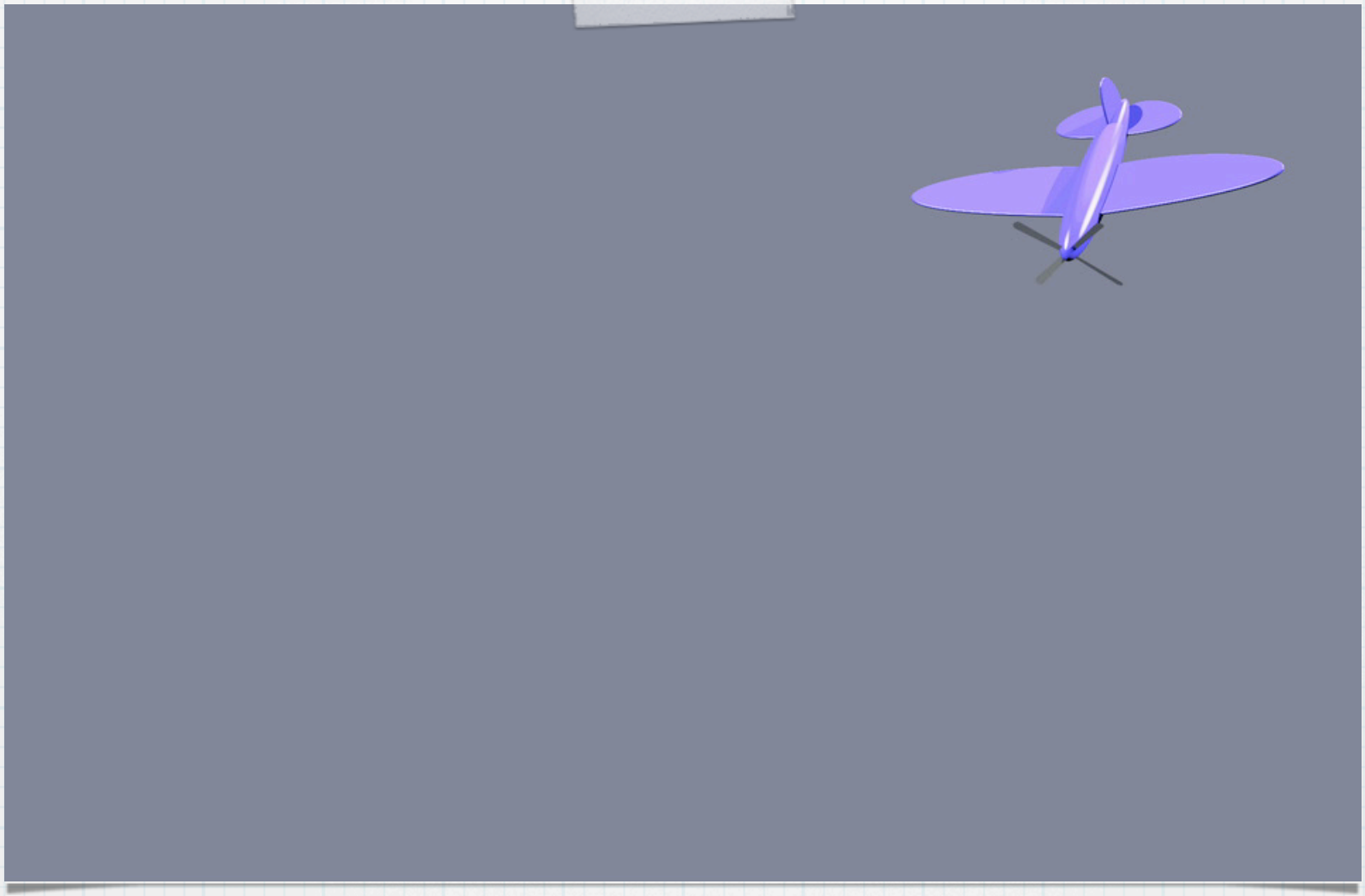
New pmblur2 utility

* Uses information generated by ranimove to simulate camera shutter
* Big improvement over built-in method
* Can be used to over-sample frame

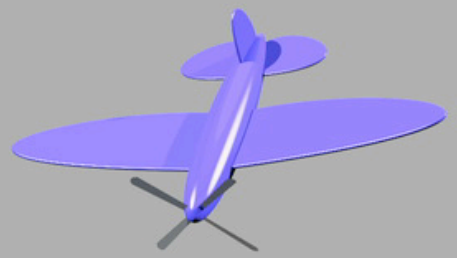
Motion Vectors per Pixel



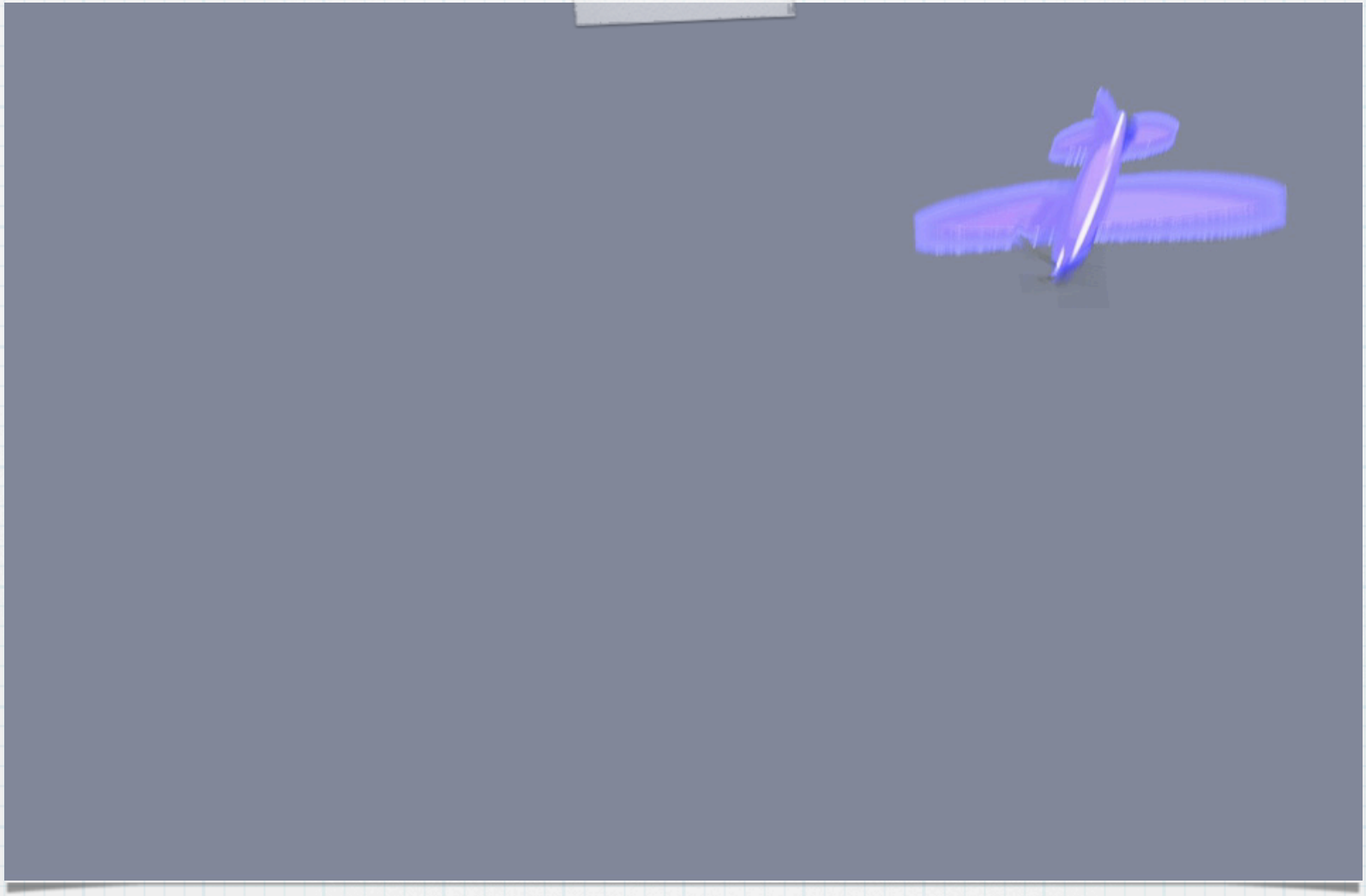
Info from ranimove



No motion blur



Default motion blur



pmblur2 blur

60fps oversampled

gendaymtx

* Computes Perez sky distributions from weather tape (.wea format)
* Supports Reinhart sky subdivisions
* Output may be sent to new dctimestep
* Based on Ian Ashdown's implementation
  * Sprenger-Wienold gendalit different

dctimestep update

* New -n option supports multiple steps
  * much faster than repeated calls
  * mainly added for gendaymtx
* Supports output of animation frames
* New options for binary sky data

Example Annual Calcs

* Annual simulation w/ Reinhart-4 sky:

```
gendaymtx -of -m 4 Denver.wea \
 | dctimestep -if -n 8760 DaylightCoef4.dmx \
 > result_matrix.txt
```

* Animation sequence using 3-phase:

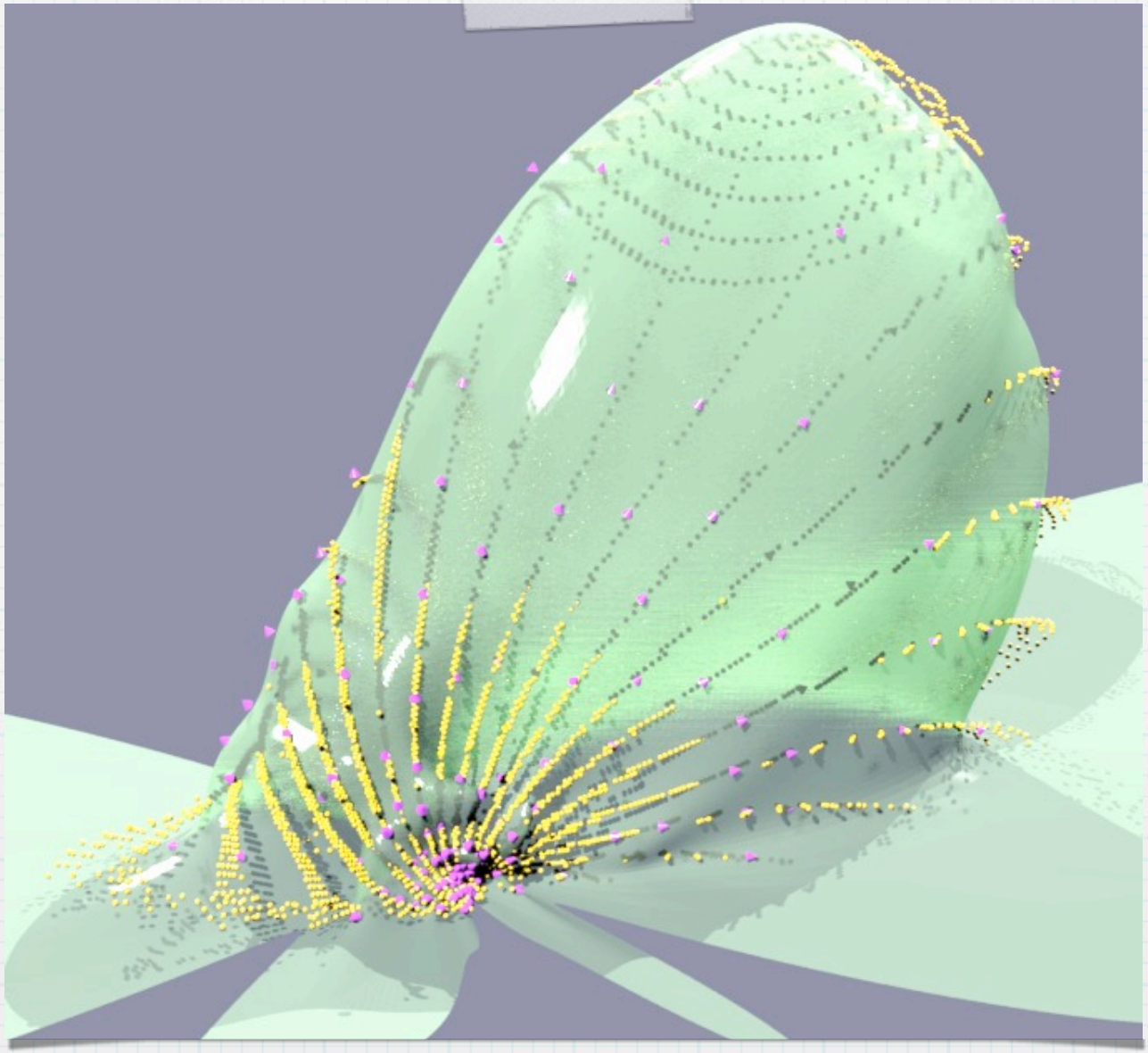
```
dctimestep -n 8760 -o frame%04d.hdr \
 comp/inter%03d.hdr blinds.xml ext.dmx Denver.ymx
```

bsdf2klems & bsdf2ttree

* Take BSDF interpolants based on measured data from PAB-opto or similar
* Produce XML files (Klems matrix or tensor tree representation)
* Support for procedural BSDFs as well

Overall BSDF Plan

- Measure BSDFs using PAB-Opto (pgII)
- pabopto2bsdf tool still in development
  - uses radial basis functions and mass transport displacement interpolation
- Combine measured BSDFs with genBSDF



Fit for one incidence

- bsdf2klems & bsdf2ttree are representation conversion tools
  - input interpolant or procedural BSDF
    - bsdf2klems accepts tensor tree
  - output is XML (Klems or tensor tree)
- Computes output by heavy sampling

bsdf2klems Examples

* Convert interpolants to Klems matrix:

```
bsdf2klems front_refl.sir front_trans.sir \
 back_refl.sir back_trans.sir > full_mtx.xml
```

* Functional BRDF to Klems matrix:

```
bsdf2klems +back -f wgmdaniso.cal wgmdaniso \
 > wgmda_mtx.xml
```

* Tensor Tree BSDF to Klems matrix:

```
bsdf2klems tensor_tree.xml > klems_matrix.xml
```

bsdf2ttree Examples

* BTDF measurements to tensor tree:

```
pabopto2bsdf inc*.dat | bsdf2ttree > trans_tt.xml
```

* Isotropic BRDF function to tensor tree:

```
bsdf2klems -t3 +back -f wgmdiso.cal wgmdiso \
 > wgmdi_tt.xml
```

* Full anisotropic BSDF function:

```
bsdf2klems -t4 +back +front -f aniso.cal aniso \
 > anisoBSDF_tt.xml
```

Example BSDF Function

```
{ Ward-Geisler-Moroder-Duer anisotropic BRDF model }

rho_d = 0.1;
rho_s = 0.4;
ax = 0.12;
ay = 0.25;

exfunc(hx,hy,hz) = exp(-(hx*hx/(ax*ax) + hy*hy/(ay*ay))/(hz*hz)) *
          (hx*hx + hy*hy + hz*hz) /
          (PI*ax*ay*hz*hz*hz*hz);

{ Note that we assume i and o vectors are normalized }

wgmdaniso(ix,iy,iz,ox,oy,oz) = if( -iz*oz, 0,
          rho_d/PI + rho_s*exfunc(ix+ox,iy+oy,iz+oz) );
```

BSDF VIEWER

Important Implication

- Any procedural BSDF model can now be used in Radiance
  - bsdf2ttree does presampling on function to tabulate distribution
  - renderers apply Monte Carlo
  - more efficient than other methods

More BSDF Bug Fixes

- Fixed bug in genBSDF tensor tree transmission
  - bad reciprocity calculation distorted BTDF distributions
- Fixed bug in isotropic tensor tree sampling at normal incidence
  - corner case floating point failure