# Photon Map Integration in *Radiance* 5.0

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# PMAP History

- Photon-map has been available as a *Radiance* add-on since Roland Schregle's Ph.D. at ISE in 2004, but...
  - Implemented as a set of `#ifdef`'s in source code
  - Not fully compatible with standard tool function
  - Updates generally followed official release by months to years depending on demand & Roland's availability
- Effort to integrate with main distribution began at HSLU approx. two years ago
- Currently in CVS HEAD, will be part of *Radiance* 5.0 release later this year

# To Map or Not To Map...

- Photon mapping is valuable in cases where:
  - Caustics (reflection & refraction) from curved, specular surfaces such as mirrors or lenses
  - Complex optical systems lacking simple input & output apertures
  - Concentrated secondary sources (scattered by diffuse or glossy surfaces)
- What about compatibility with other *Radiance* tools & options?

# PMAP Compatibility

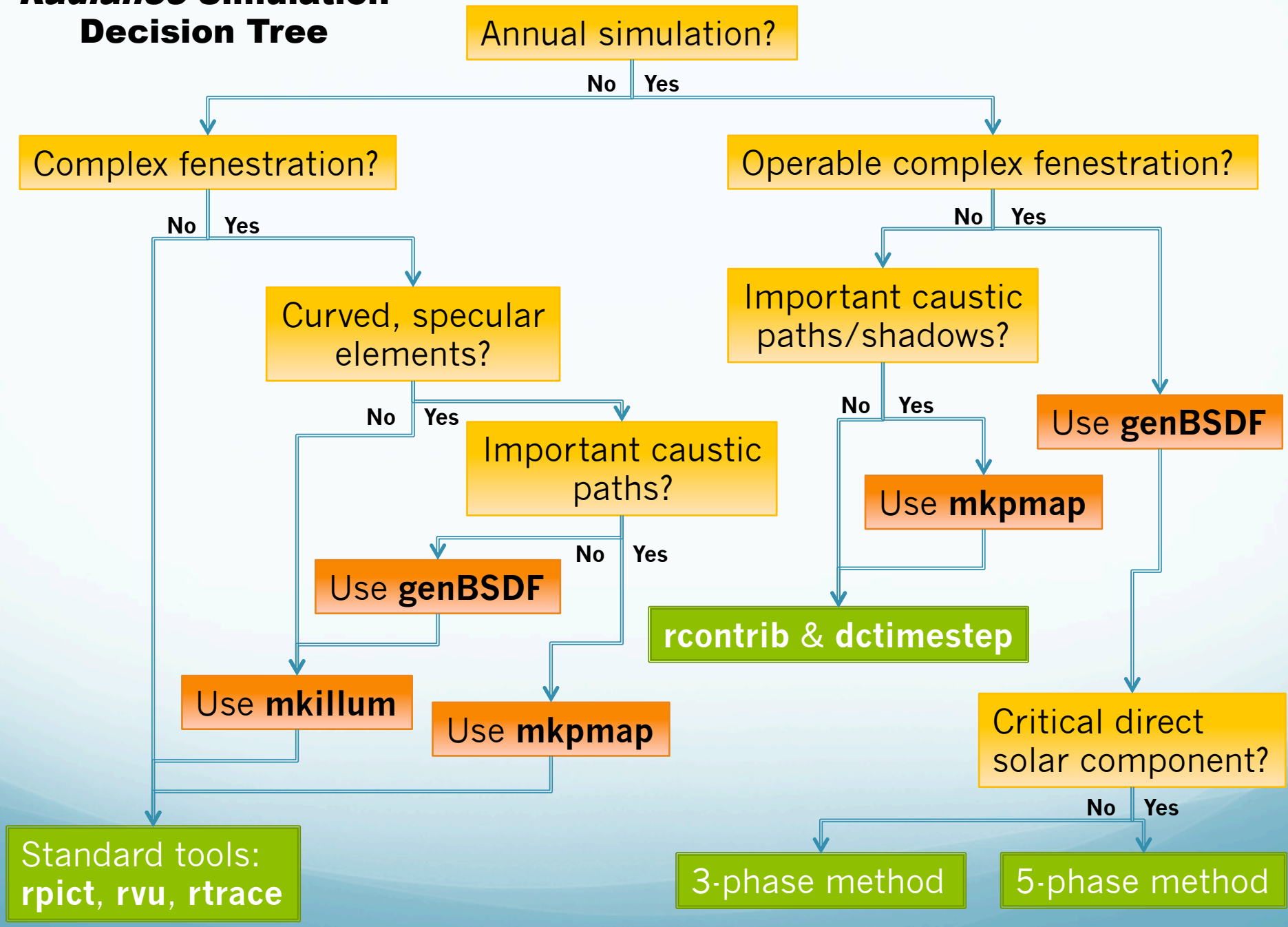
| Photon mapping compatible with: | PMAP not compatible with: |
| --- | --- |
| **rtrace**, **rpict**, **rvu**, **rsensor**, **rpiece** and **rcontrib*** | **mkillum**† or **genBSDF** |
| daylight coefficient method | 3-phase, 5-phase methods |

How do we decide which method(s) to apply?

*Can improve contribution calculations for caustics and strong secondary light sources

†Incompatible more in concept than actual function

# *Radiance* Simulation Decision Tree



# PMAP Integration Process

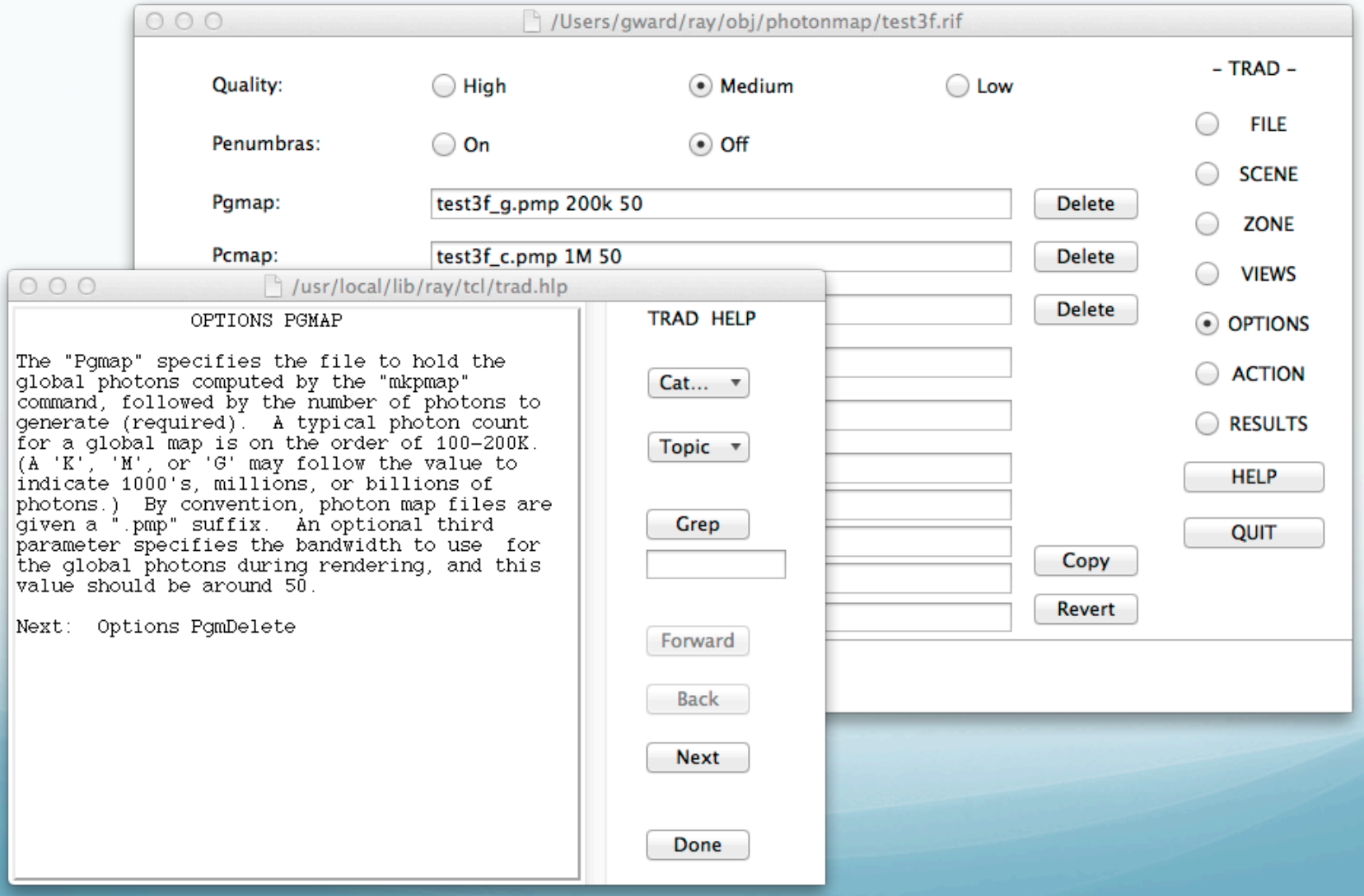
- Moved PMAP calls to 15 independent modules
- Convert photon mapping from compile-time to run-time option
- Added photon map support to **rad** & **trad**
- Tests & validation to check for consistent behavior
- Added support for **rcontrib** & BSDF materials
- Bug fixes for Windows™*

*Tragic Mistake

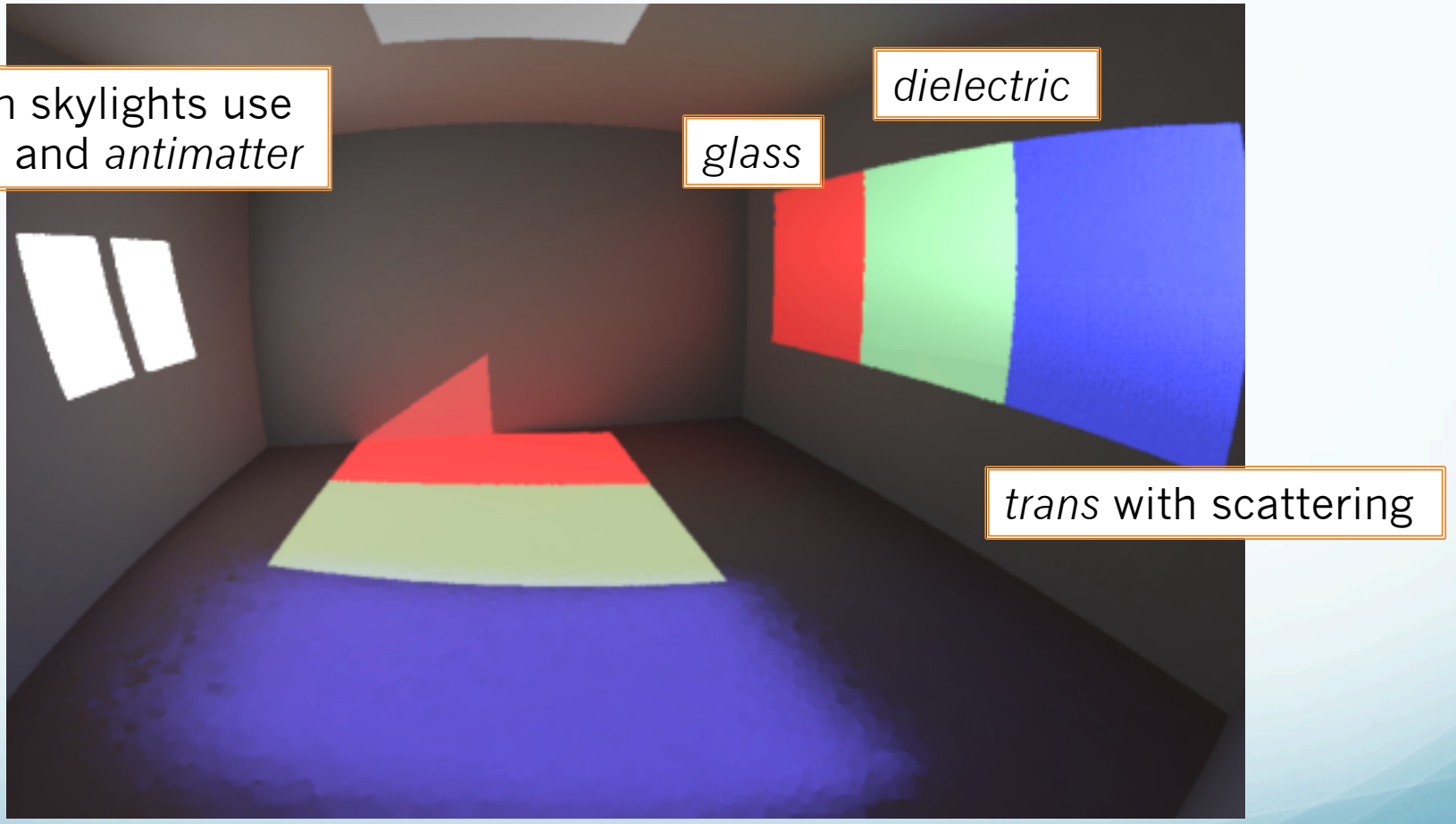
# Support for PMAP in **rad**

- New settings: `PGMAP`, `PCMAP`, and `mkpmap`
  - `PGMAP` and `PCMAP` specify file, # photons and bandwidth for global and caustic maps
  - `mkpmap` specifies additional options
- **rad** runs **mkpmap** after scene changes before rendering
- PMAP can be combined with **mkillum**, but as we said, this is probably not useful

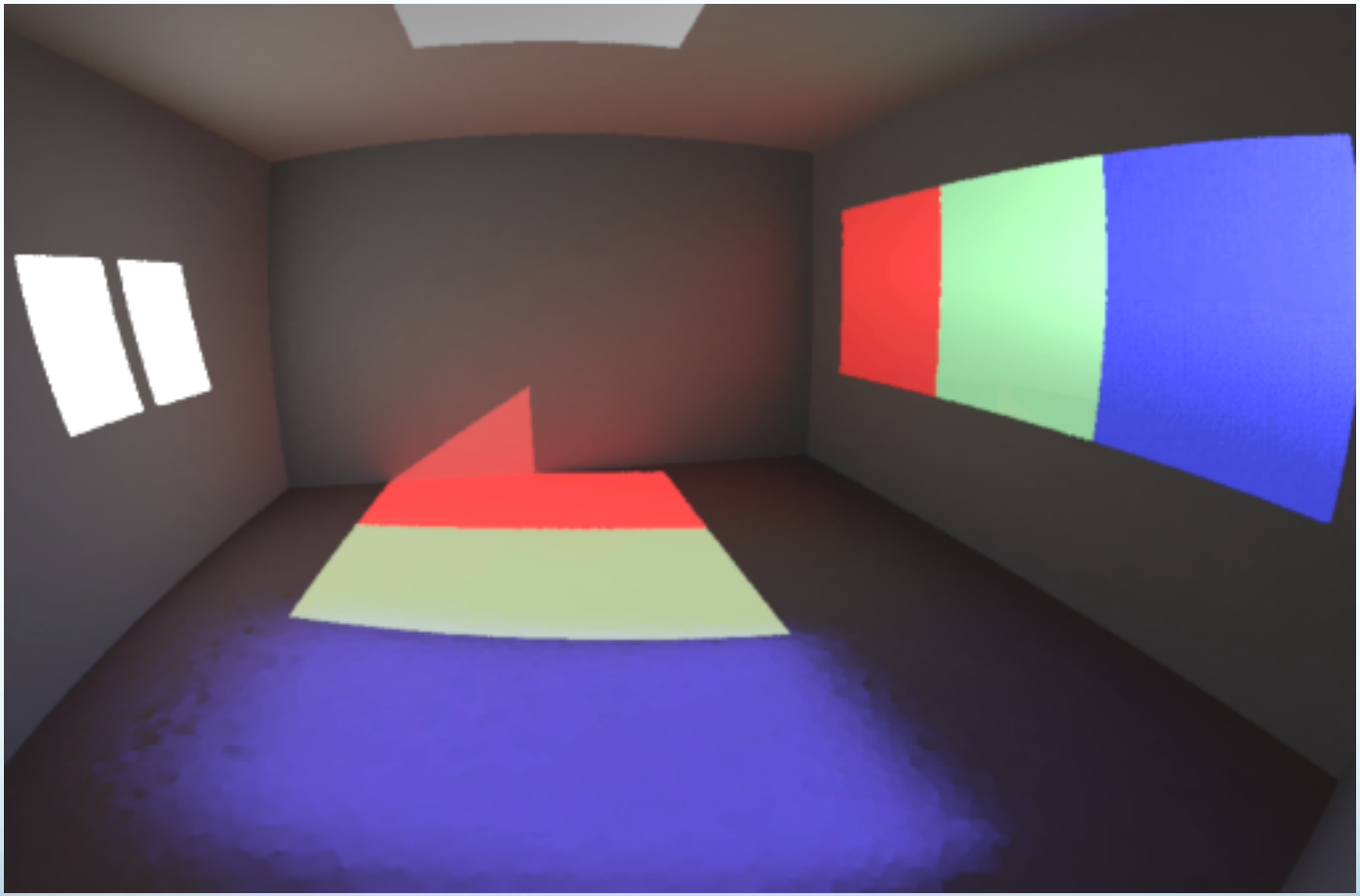
# Support for PMAP in **trad**



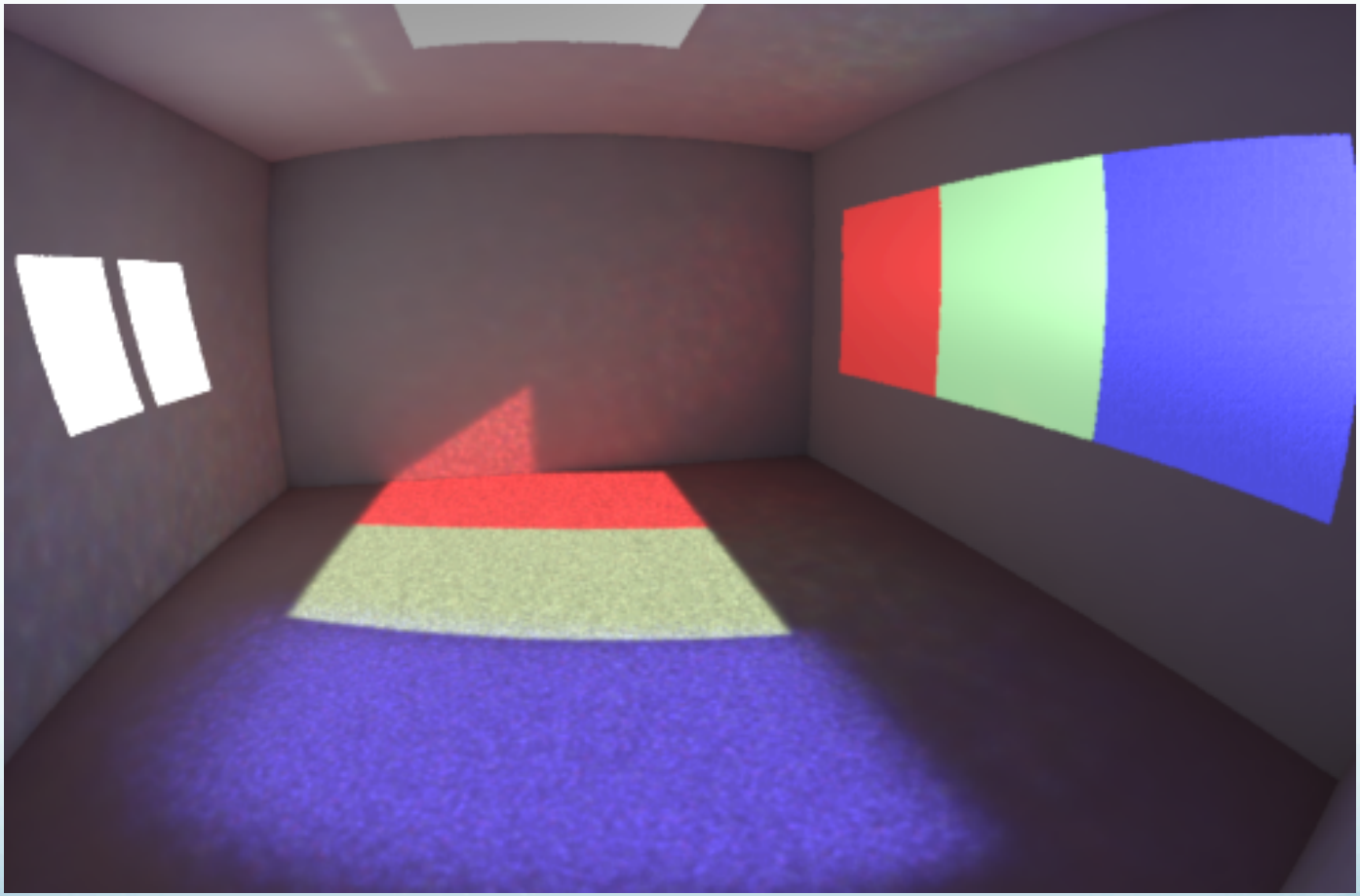
# Photon Mapping Tests



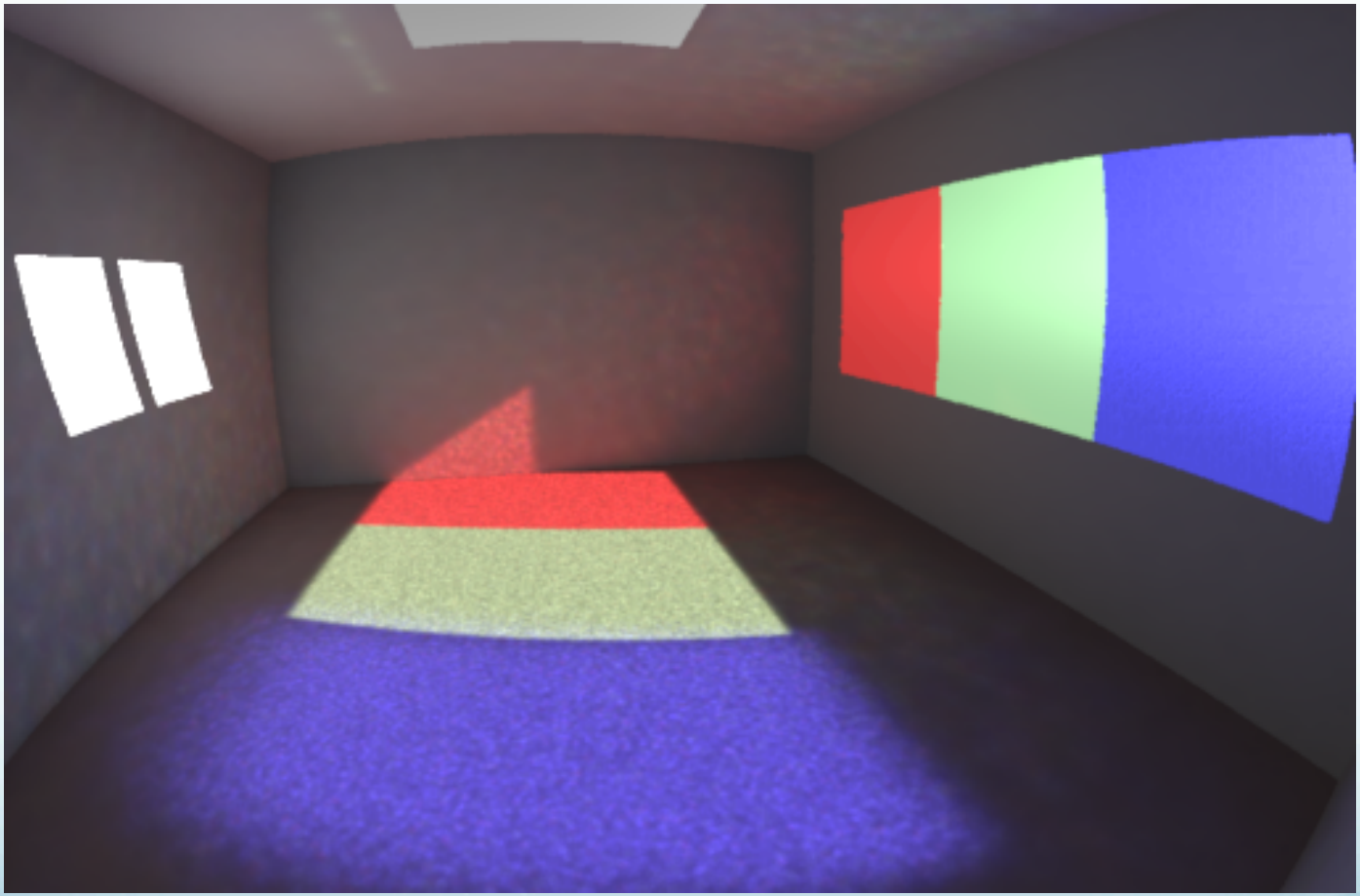
# “Classic” *Radiance*



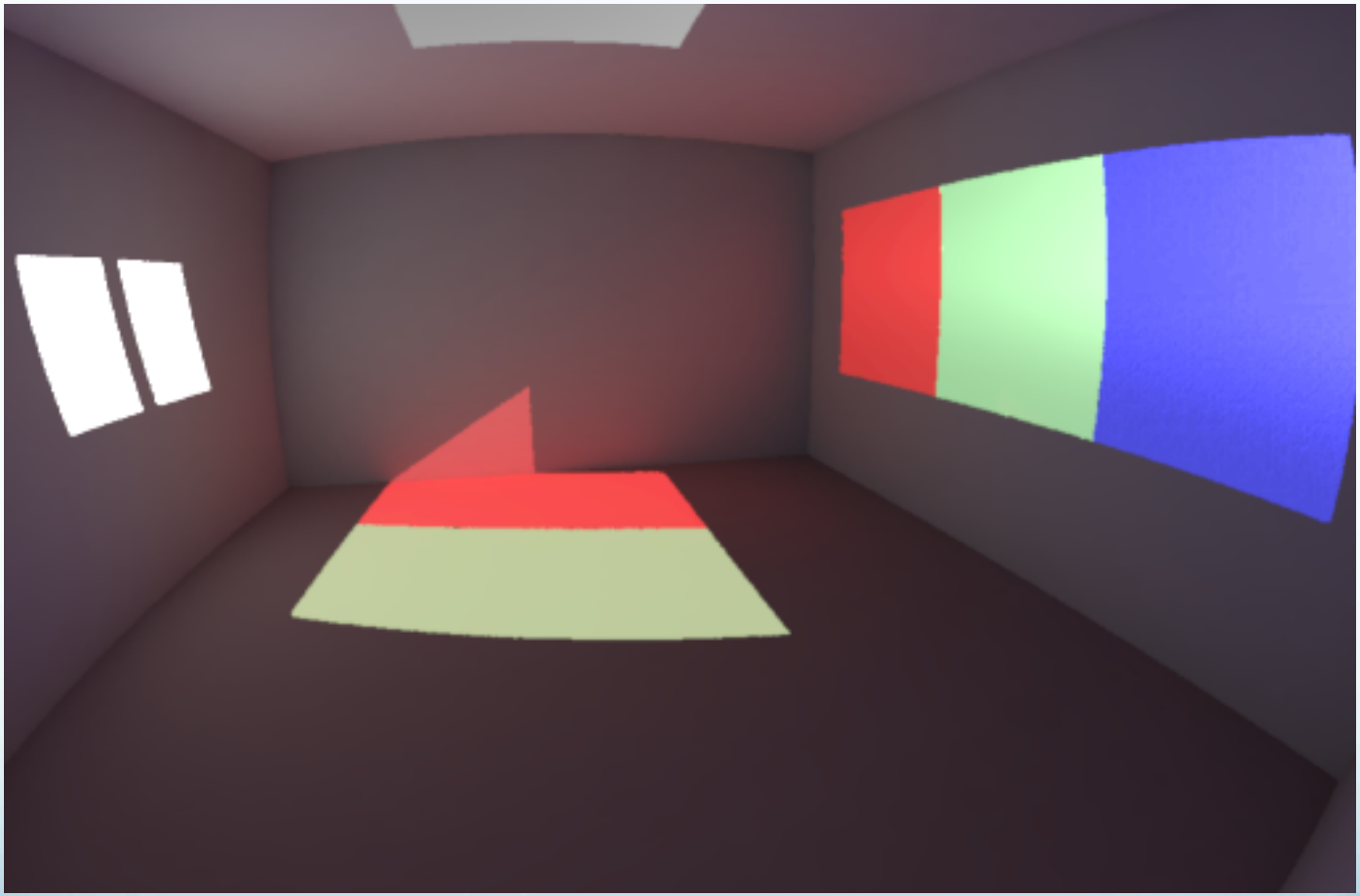
# Global & Caustic Maps



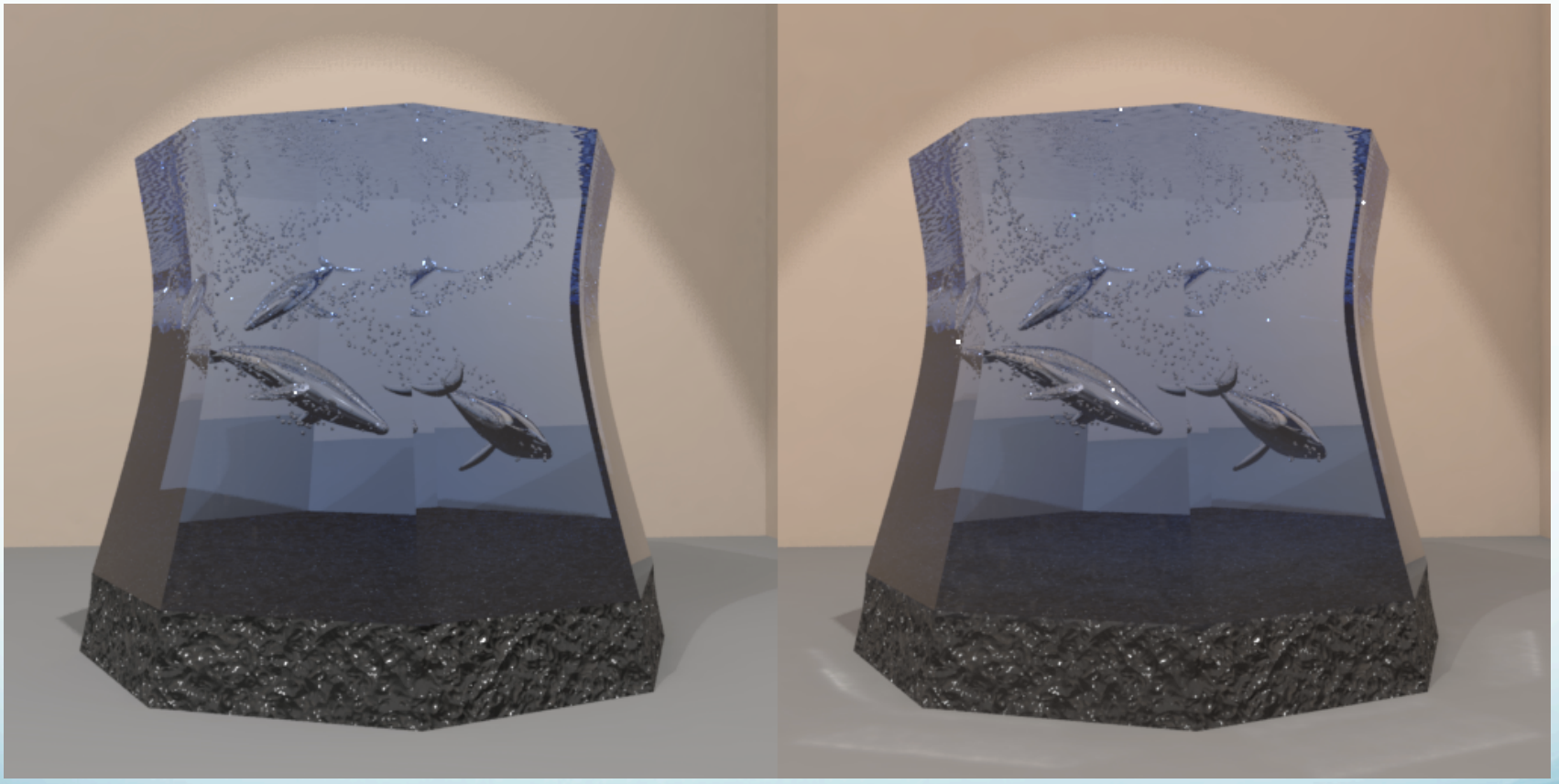
# Caustic Map Only



# Global Map Only



# More Interesting Example



*Radiance* Classic

Photon Mapping

# Funding & Credits

- Fraunhofer Institute for Solar Energy Systems in Freiburg (Germany) funded Roland's original research & validation
- Roland himself donated countless hours of personal time to maintain & update code over years
  - Lars, Carsten & others have kept interest alive
- Current effort funded by Swiss National Science Foundation through HSLU
- US Dept. of Energy providing in-kind funding at LBNL for integration effort