MITRANSIENT: Transient light transport in Mitsuba 3

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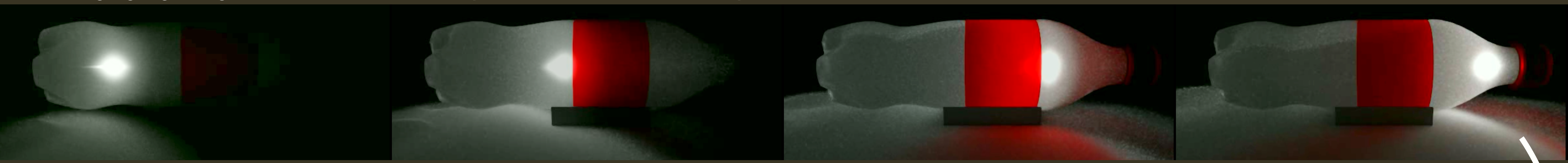
Pulse of light going through a bottle at one trillion frames per second (Camera Culture Group, MIT Media Lab)



Our recreation of the bottle scene, rendered using MITRANSIENT

MITRANSIENT is a physically-based light transport tool for time-gated and time-resolved cameras, and more

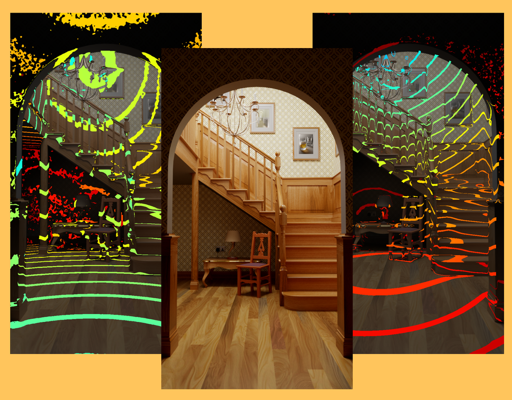
Imaging hardware

Main features

- Implemented in Mitsuba 3
- Foundation ready to use
- Python-only package
- Support for NLOS setups

And many more!

- Spectral rendering
- Volumetric rendering
- Transient polarization
- Transient derivatives for inverse rendering
- Spatiotemporal filters
- Tools for NLOS setups
- Visualization utilities



Check it out

Project page / Tutorials

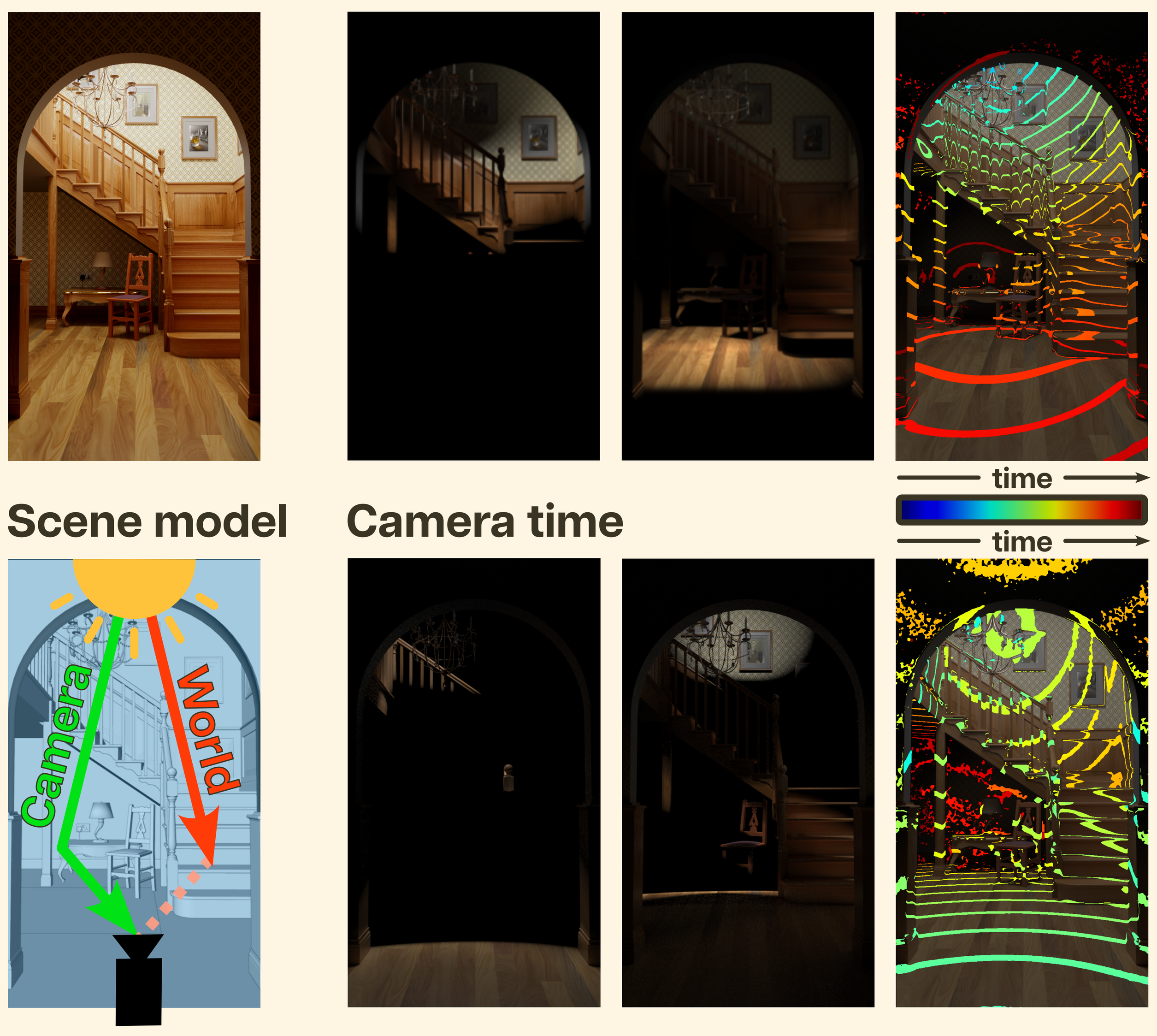
Coca-cola light / Full video

github.com/diegoroyo/mitransient

```
$ pip install mitransient
```

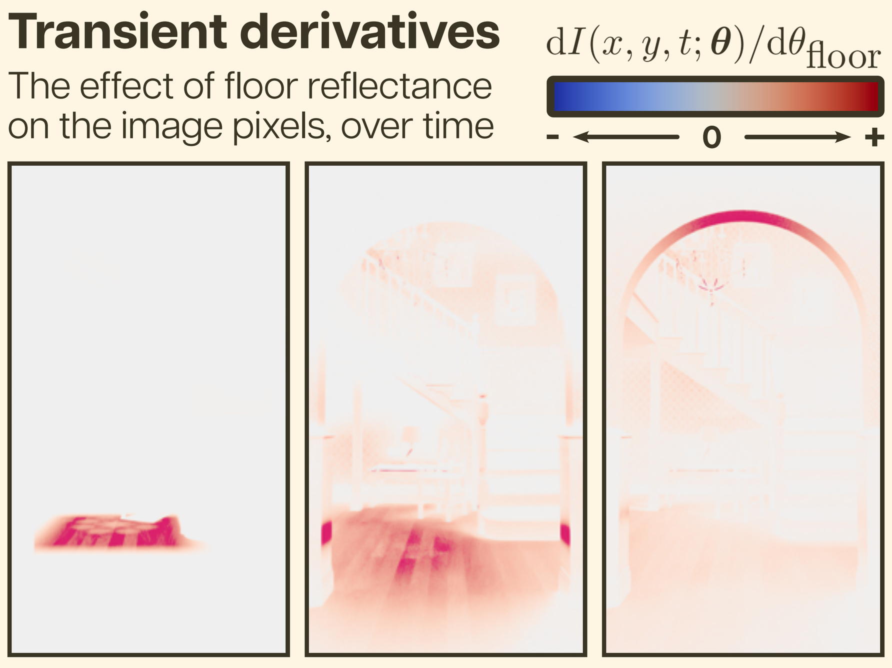
mitransient.readthedocs.io

Example: Staircase scene



Transient derivatives

The effect of floor reflectance on the image pixels, over time



Time-resolved estimator
`transient_path`

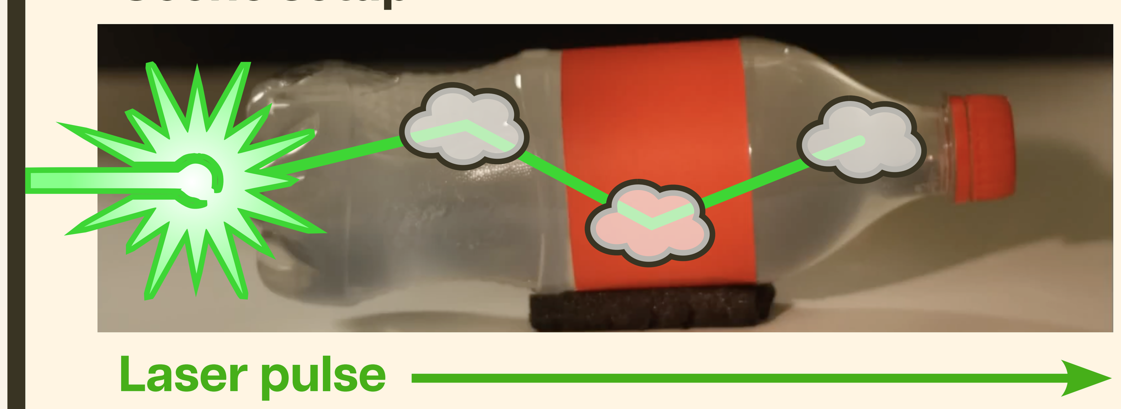
```xml
<integrator
 type="transient_path">
  <bool
   name="camera_unwarp"
   value="true"/>
  <integer
   name="max_depth"
   value="15"/>
  <string
   name="temporal_filter"
   value="gaussian"/>
</integrator>
```

Video result
`transient_hdr_film`

```xml
<film
 type="transient_hdr_film">
  <integer
   name="temporal_bins"
   value="450"/>
  <float
   name="bin_width_opl"
   value="0.02"/>
  <float
   name="start_opl"
   value="0.0"/>
</film>
```

Volumetric rendering: Coca-cola light scene

Scene setup



Volumetric integrator
`transient_prbvolpath`

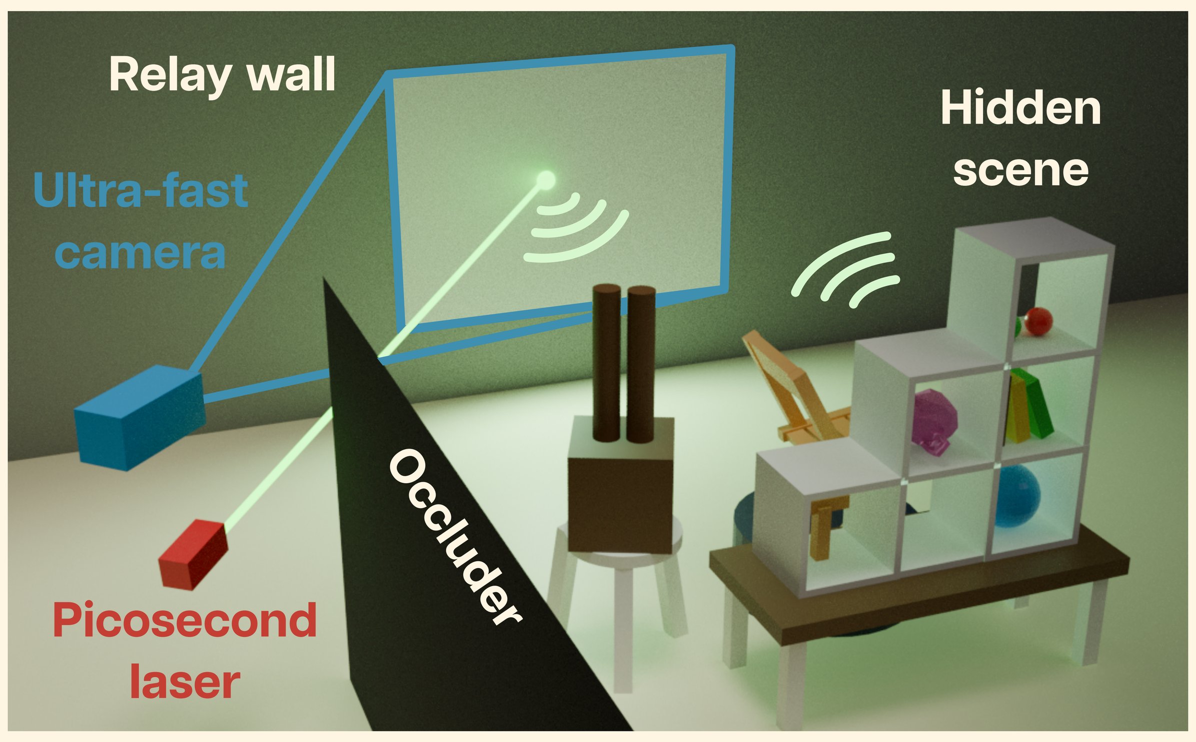
```xml
<integrator
  type="transient_prbvolpath">
  <bool
    name="camera_unwarp"
    value="false"/>
  <string
    name="temporal_filter"
    value="gaussian"/>
  …
</integrator>
```

Homogeneous medium
`homogeneous`

```xml
<medium type="homogeneous">
  <float name="albedo"
         value="0.4"/>
  <float name="sigma_t"
         value="0.3"/>
  <phase type="hg">
    <float name="g"
           value="0.7"/>
  </phase>
</medium>
```

Non-line-of-sight imaging: office scene

Goal: reconstruct hidden scene using indirect light



Running is easy with our tool Y-TAL

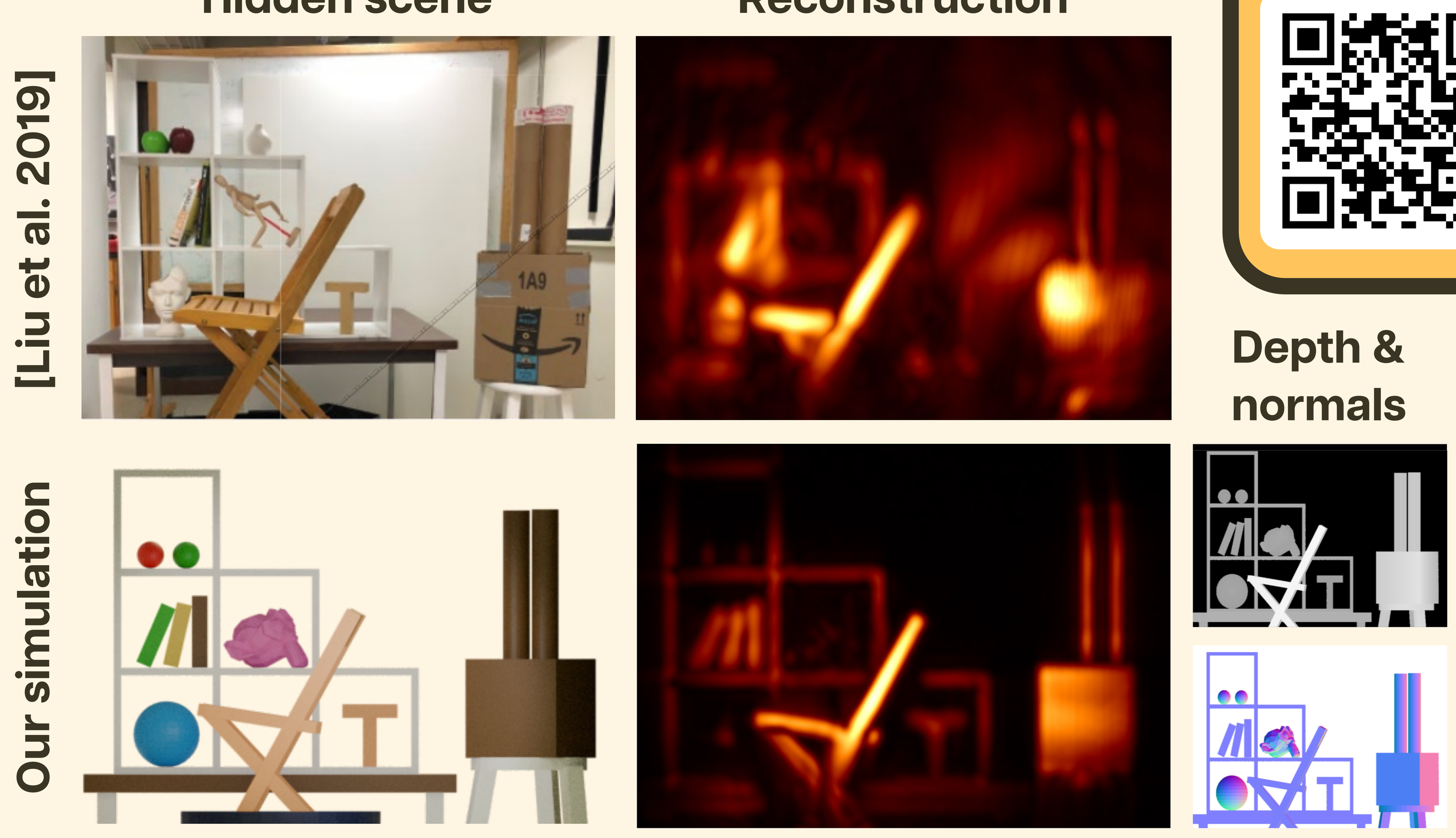
```
$ tal render office
```

`office/office.yaml`

```yaml
num_bins: 3000
bin_width_opl: 0.003
start_opl: 0.0

scan_type: single
sensor_width: 180
sensor_height: 130
laser_lookat_x: 90
laser_lookat_y: 65

geometry:
- mesh:  # hidden scene
    type: obj
    filename: office.obj
- mesh:  # relay wall
    type: rectangle
```



Get Y-TAL

ICCP 2024
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