Pros and Cons of Path Tracing vs REYES

With *3Delight* you have the option to choose between two rendering engines: ***Path Tracing*** (default) and ***REYES***. This is done though the simple *Render Mode* menu option in the *Render Engine* group of attributes of the *Render Settings*. Note that using REYES does not preclude from using ray tracing, which will still be used on top of REYES for any secondary rays.

Here is a brief discussion of the advantages and disadvantages of each options.

> As of version 7.0.13 of *3Delight for Maya* (and *3Delight Studio Pro v.11*), ***Path Tracing*** is the default rendering engine.

> It is important to outline that in 3Delight, the very same RSL shading framework can be used for both Path Tracing and REYES.

Path Tracing

Pros:

- Efficient at rendering densely tessellated geometries and dense scenes (forests, crowds, etc).
- Massive instancing allows for memory efficient rendering of trees/crowds and other redundant scene elements.
- Shading is usually "sharper" because shading is performed at each sub-sample (and not per pixel as in REYES). Although it is possible to obtain similar result with REYES by increasing the *Shading Rate*, it is usually avoided as it affects performance. One example of this sharpness benefit is in higher quality outlining.
- Scales better than REYES with increased number of cores.
- Supports *Multi-Light* output.
- Supports geometrical camera projections.

Cons:

- Slower with displacements.
- Need more samples to render smooth (noise free) motion blur and depth of field. This happens because it is actually more precise than REYES and there are more details in the motion blurred effect, but this also induces more noise.
- Increasing pixel samples (to reduce aliasing and noise) has a direct impact on performance (though does not affect sampling of indirect illumination).

REYES

Pros:

- Extremely efficient rendition of curved surfaces of average to large size — surfaces covering more than a few pixels on the image.
- High quality motion blur and depth of field are extremely fast. This is because the shading calculation is decoupled from hiding calculation.
- Displacements are rendered at a lesser cost than in path tracing (micro-polygons).
- Efficient at rendering fluids because of screen space under-sampling.
- Efficient rendering of millions of particles.
- Performance almost independent of oversampling (pixel samples). This makes it easy (and fast) to render images without noise and without aliasing.
- More efficient than Path Tracing at simultaneous multi-camera rendering (as in the case of 3D stereo rendering).
- Ability to efficiently distribute rendering of a single image across multiple machines.

Cons:

- Looses performance when rendering densely tessellated geometries (i.e. objects with a density of hundreds or thousands of surfaces covering just a few pixels).
- Not suited for rendering scenes with high "pixel complexity" (e.g. a crowd seen from afar).
- Motion blur shading is an approximation. For example, a spinning wheel will have its specular highlight blurred along with other details on the wheel, whereas the highlight should remain sharp.
- Takes more memory when used alongside ray tracing (for GI for example). This happens because both ray tracing and REYES data structures need to be maintained.