ArcReactor manual

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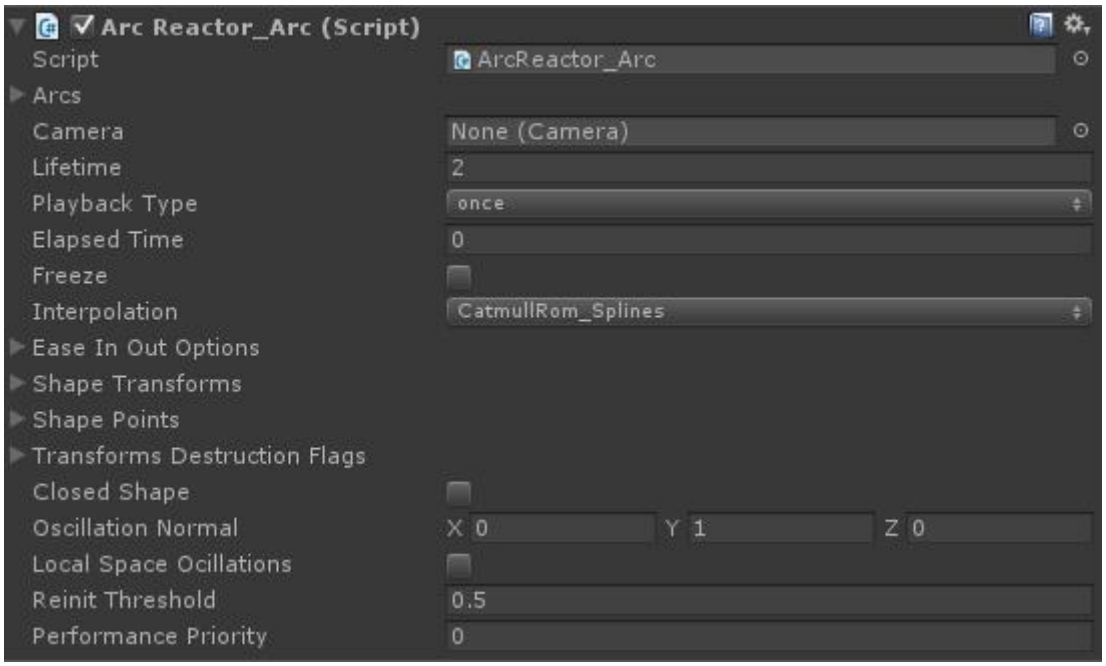
ArcReactor_Arc script

This is the main component of ArcReactor system that controls appearance of the rays.

To create your first arc, create empty game object (“Game object” -> “Create empty”) and drag “ArcReactor\Scripts\ArcReactor_Arc” script to it. Alternatively, you can add “Rays system” component from “Arc Reactor Rays” menu.

You should see arc settings in the Inspector:



Main settings of component:

Lifetime: how long 1 cycle of system takes.

Playback type:

- ***Once*:** system will play 1 cycle and destroy itself after that.
- ***Loop*:** system will jump to start of the cycle after finishing it.
- ***Pingpong*:** system will bounce between forward and backward playing of cycles

Elapsed time: At what point on lifetime this system is. Can be manipulated through editor or scripts at runtime if you need more complex playbacks.

Freeze: If toggled on, system will stop progressing along lifetime. All other effects will still be active (such as randomizations and oscillations). Use this to achieve continuous rays.

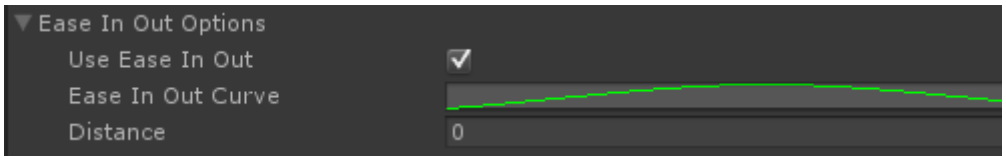
Shape Transforms & Shape point: Transforms and Vector3's that define shape of the system. If there are less than 2 transforms or Vector3, system will disable itself at start and generate error message. Transforms have higher priority than Vector3, so if there's both Transform and Vector3 with index=3 in their respective arrays, Transform will define 3rd point of system shape.

Closed shape: If checked, system shape will be looped from last transform to first.

Interpolation: How general shape of system interpolated. ***CatmullRom_Splines*** look much better that ***Linear***, but require a bit more CPU time.

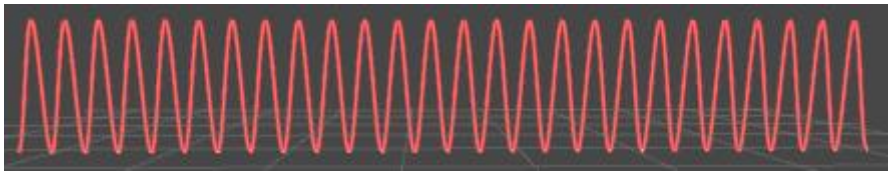
Transform Destruction Flags: If ***flag*** with index N set to true, then ***Shape Transform*** with index N will be destroyed at the end of system lifetime. It should be used when you create temporary transforms to define specific shape.

Ease In Out Option:

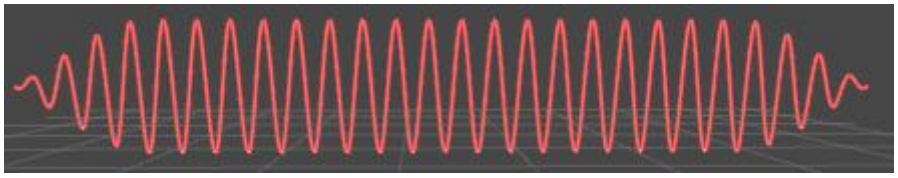


This option enables smooth transition of noise and oscillations from point source to full amplitude.

Ease In Out disabled:



Ease In Out enabled:



Oscillation Normal and Local space oscillations:

If your system arcs use oscillation(like in the picture of EaseInOut), you should define normal to the default oscillation plane. For games like shooters etc. vector of (0,1,0) should be enough. For more complex systems you should minimize occurrences of your arc direction being parallel to the oscillation normal. **Local space oscillation** defines whether defined oscillation normal calculated in global or local(current gameObject's transform) space.

Reinit threshold:

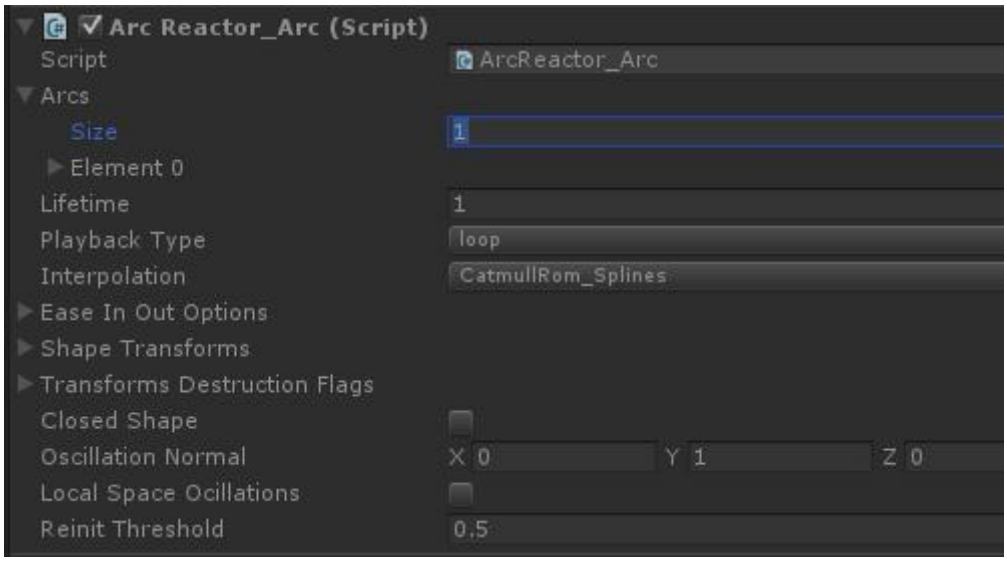
If your shape changes during lifetime of the system (for example you are moving your shape transform through scripts or physics), this threshold defines at what stretch or shrink point should system recalculate number of segments and other parameters that depend on length of the system's shape.

Arcs settings

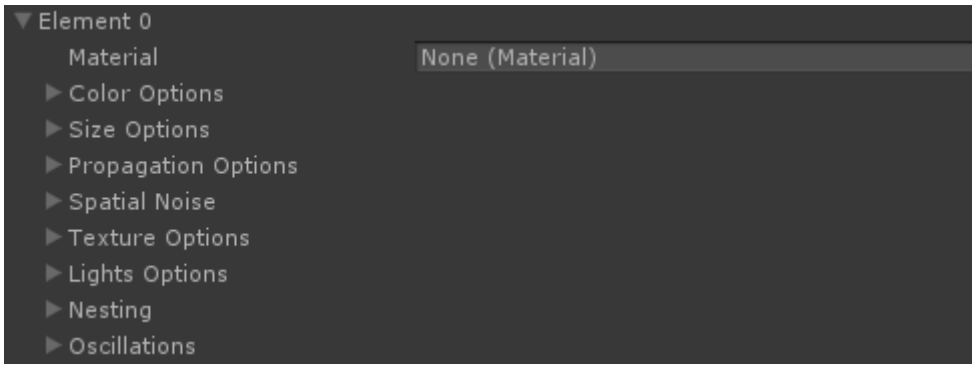
Arcs are what defines visualization of your system.

System can contain any number of arcs, limited only by how fast your hardware are.

To create arc, go to the “arcs” setting and set Size to 1.

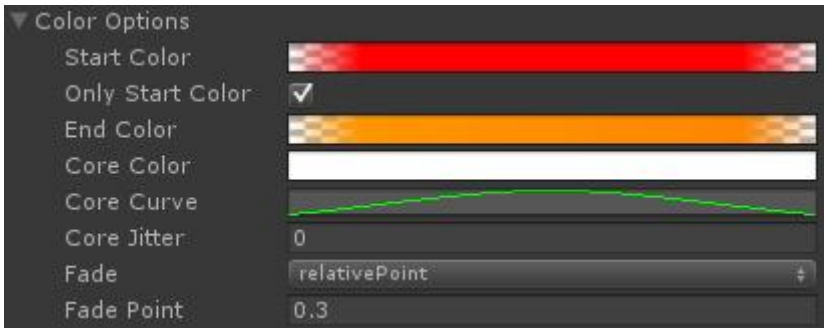


Open “Element 0” and you will see arc settings:



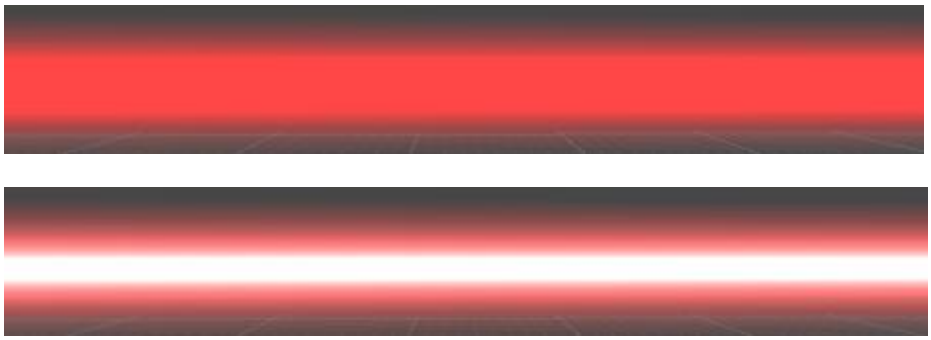
Material: defines material used to render this arc. If none selected, default material will be set at runtime. ArcReactor comes with custom shader for rendering additive rays and 2 materials using that shader(folder “ArcReactor\Materials”). Although you can use your own materials, some functionality such as core highlight and texture noise will be unavailable.

Color options:



Start & end colors: color gradient defining colors at the beginning and end of the arc. Colors In between will be interpolated. X axis of the gradient defines lifetime of the system.

Core highlight:



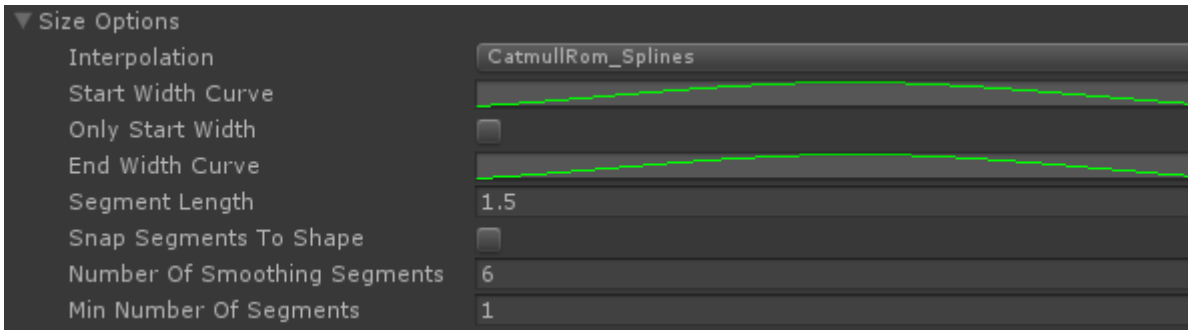
Core highlight simulates bright core of the beam. Although you can use any color as **core color**, it's recommended to use white. **Core curve** defines core highlight power during lifetime of system. **Core Jitter** defines random oscillations of core highlight power.

Fade:

Fade options allow rays to smoothly fade out to transparency.
Fade types:

- ***RelativePoint*** – fade point is calculated as a fraction of total ray length. E.g., with fade point = 0.12, last 12% of ray length will be faded.
- ***WorldspacePoint*** – fade point is calculated as absolute length of faded segment. E.g., with fade point = 1.4, last 1.4 meters of ray will be faded.

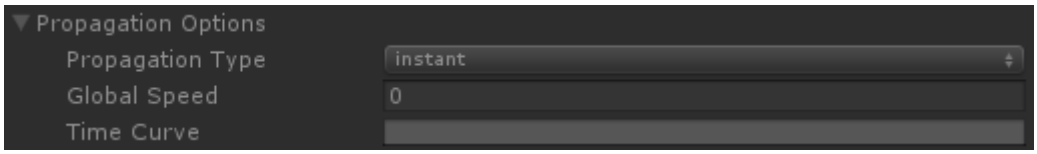
Size options



Although arc follows system shape defined by shape transforms, size options give more control of the size and shape of arc.

Interpolation defines interpolation used for smoothing vertices of the arc.
Width curves define width of the beam. Time axis correspond to lifetime of the system.
Segment length defines length of arc segments. It's mainly used in spatial noise generating (noise affects first and last vertices of segments).
Snap segments to shape – if enabled, the vertexes of this ray closest to shape transforms will snap to transforms exact positions. Use it to make good-looking reflective rays.
Number of smoothing segments defines number of vertices in segments. These smoothing vertices affected only by oscillations but not by spatial noise.
Min number of segments defines minimum number of main segments that arc will consist of. Note that no matter what arc will always consist of minimum 2 segments.

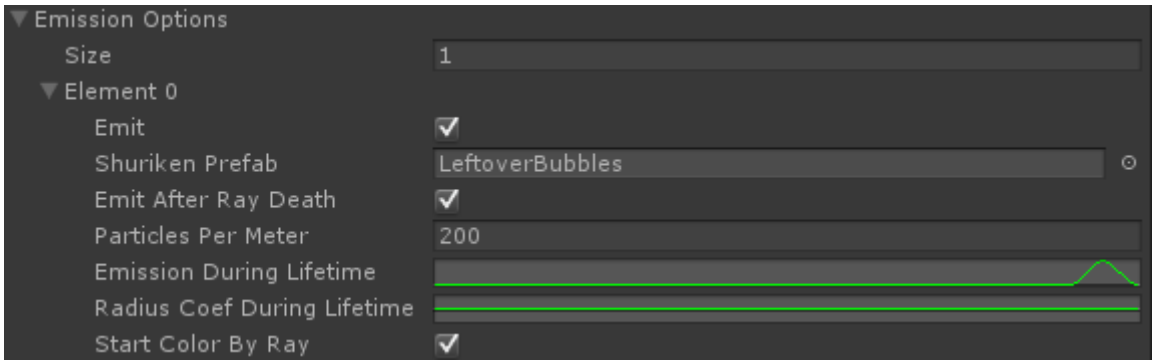
Propagation options



Propagation defines how this arc will move along system shape.

- ***Instant*** – arc will always at full length
- ***GlobalSpaceSpeed*** – **Global Speed** parameter will be used to define speed of the arc's end point along shape.
- ***LocalTimeCurve*** – **Time Curve** will be used to calculate arc's end point along shape.

Emission options



ArcReactor can emit particles from ray shape. To do that, you need to prepare prefab that contains Particle System. Note that emit shape and emit rate of particle system will not affect results since emission is handled by ArcReactor. All other particle system settings will work.

Emit – toggle that control emission. You can access it at runtime to enable and disable particle emitting.

Shuriken Prefab – prefab containing Particle System.

Emit after ray death – if disabled, particle system will be destroyed as soon as ray is destroyed, regardless if there's still particles playing. Generally good idea to enable this option (it comes at slight CPU performance cost)

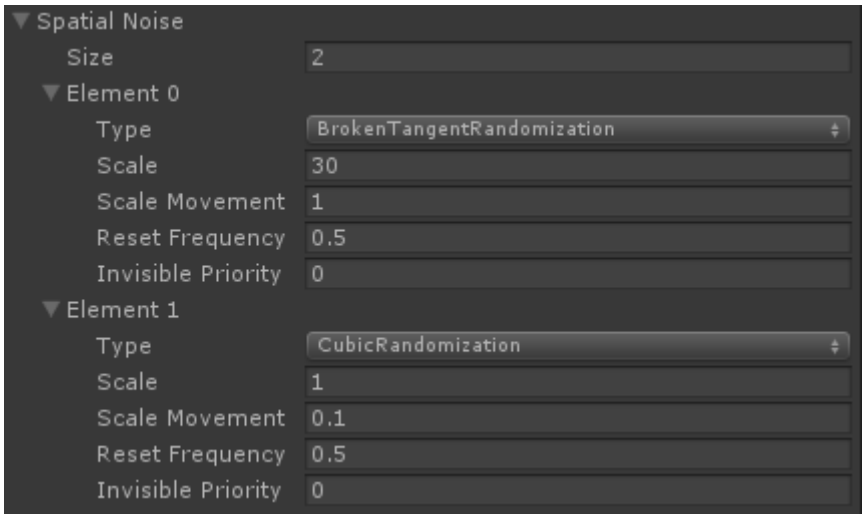
Particles Per Meter - how many particles will be generated per meter of shape length (per second).

Emission during lifetime – Curve that manages emission during lifetime of ray.

Radius coef during lifetime – usually particles are emitted from within ray width. This curve allows to affect emitter width in regards to ray width.

Start color by ray – of toggled on, start color of particles will be determined by ray color.

Spatial noise



Spatial noise used to randomize position of arc segments.

You can set up multiple spatial noises in single arc, they will add up to a final noise.

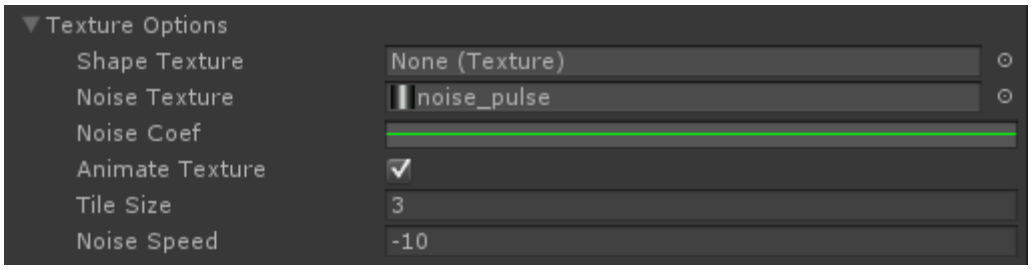
Reset frequency defines how many times per seconds on average randomization begins anew.

TangentRandomization: Tangents used for smoothing according to splines algorithm will be randomized for up to **Scale** degrees. During lifetime they will shift randomly up to **Scale movement** degrees per frame.

BrokenTangentRandomization: Same as TangentRandomization, but two tangets in the same point will not have to be aligned with each other. (It will make your arc look “zigzagged”)

CubicRandomization: arc segment will be placed randomly inside cubes with center at corresponding shape position and size of **Scale** * 2. During lifetime this position will shift randomly up to **Scale movement** per frame.

Texture options



Texture option allows control of noise mask that's applied to main ray texture.

Shape texture – main ray texture. If none selected, main texture of material will be used.

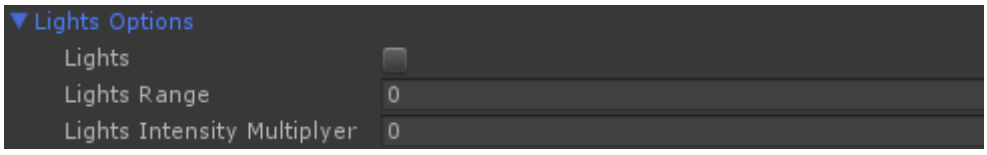
Noise texture – noise texture that will be added to the shape texture.

Noise coef – curve that defines multiplier of noise along system lifetime. For example, if that multiplier = -1, noise texture will be substracted from shape texture.

Tile size defines what length along system shape one instance of noise mask takes.

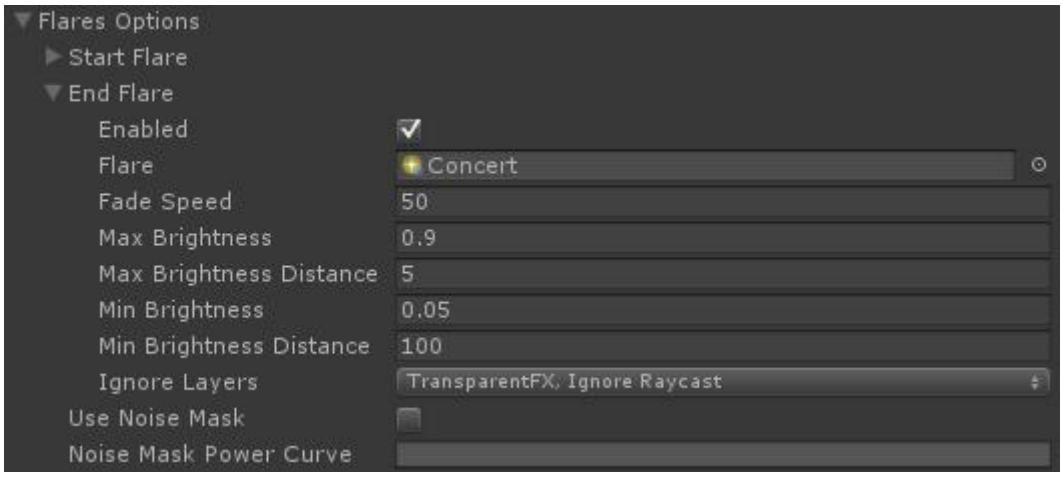
Animate texture allows moving noise along ray with speed defined by **Noise Speed.**

Lights options



Arcs can generate point lights along its way to simulate single shaped light source. **Lights range** defines range of the point lights and frequency of placement along system shape. **Light intensity modifier** sets lights intensity.

Flares Options



ArcReactor can generate standard Unity flares at each end of your arc, and manage its intensity and color depending on status of the arc and viewing distance.

Fade Speed – how fast flare will disappear after being blocked from view by collider. Usage of high values (around 50) is recommended.

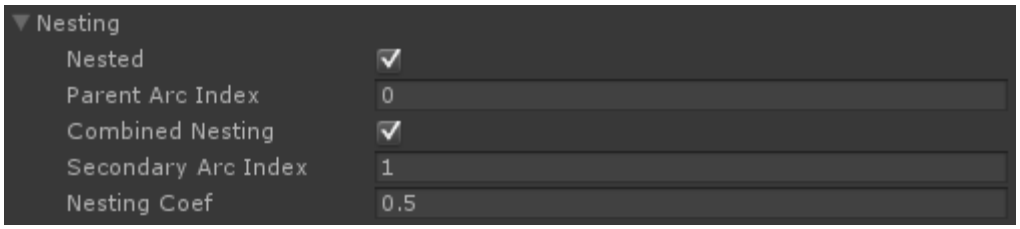
Max Brightness – brightness of the flare when it's viewed from **Max Brightness Distance** or closer.

Min Brightness – brightness of the flare when it's viewed from **Min Brightness Distance** or farther.

Ignore layers – colliders from what layers considered transparent.

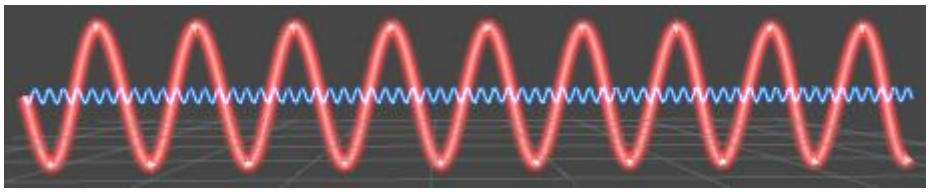
Use Noise Mask – if enabled, flare will change its intensity according to **Noise Mask Power Curve** and texture animation options (see SimplePulseLaser prefab for example of how it works)

Nesting

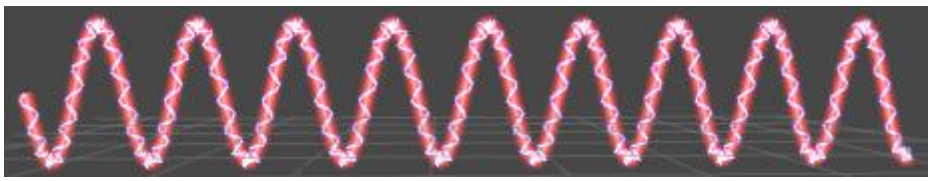


Nesting allows this arc to follow not the system shape, but shape of the other arc.

2 non-nested arcs with oscillations:



Blue arc nested to red arc:

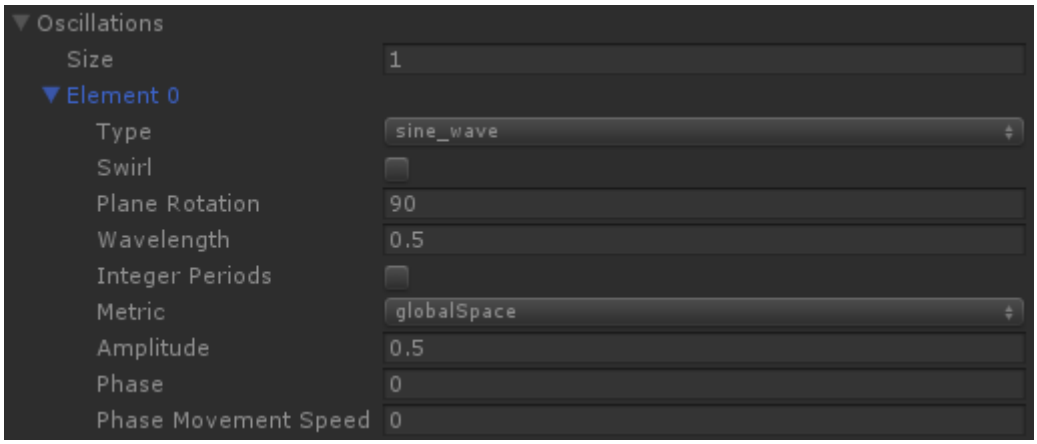


Note that oscillation wavelength calculated based on system shape length, and parent arc length can vary greatly from it, so set wavelength of child arc accordingly.

Also note that it's recommended that parent arc index will be lower than child arc index due to vertex caching algorithm.

Combined nesting allows arc to follow 2 arcs instead of one, with **Nesting Coef** defining in what proportion each parent arc influence resulting shape. NestingCoef = 0.5 makes child arc place itself in between parent arcs.

Oscillations



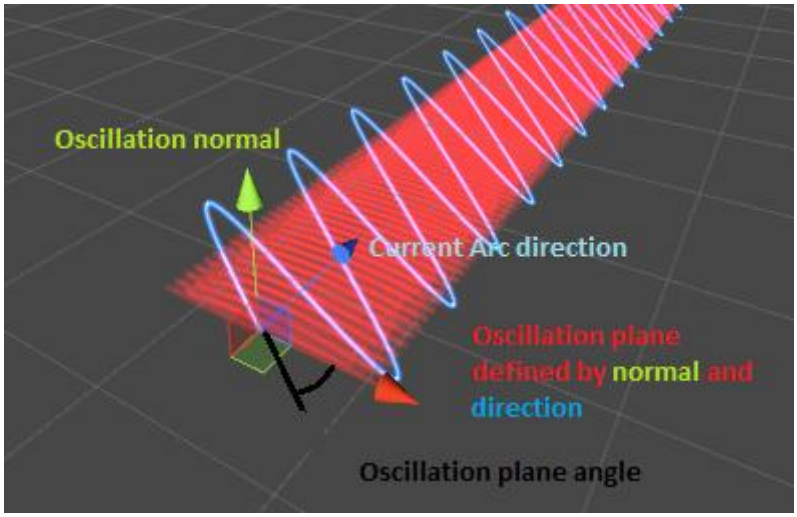
Periodic oscillations are a great way to liven your system. One arc can contain any number of oscillations, every one of them will be summed to final complex wave.

Note that all angles are set in degrees , NOT radians.

Type defines waveform. ***Sine wave, rectangular and zigzag*** available at the time.

Swirl allows 3-dimensional spiral to form based on oscillation parameters. In fact, all it does is duplicates current oscillation with phase and plane rotation rotated 90 degrees. Only ***sine_wave*** gives spiral effect.

Plane Rotation defines rotation of arc oscillation plane around default oscillation plane(red on illustration)



Wavelength – length of oscillation period along system shape

Integer periods – wavelength will be changed to closest wavelength that allows for whole number of periods along system shape. This comes in handy on closed-shape systems.

Metric defines units in which wavelength is set

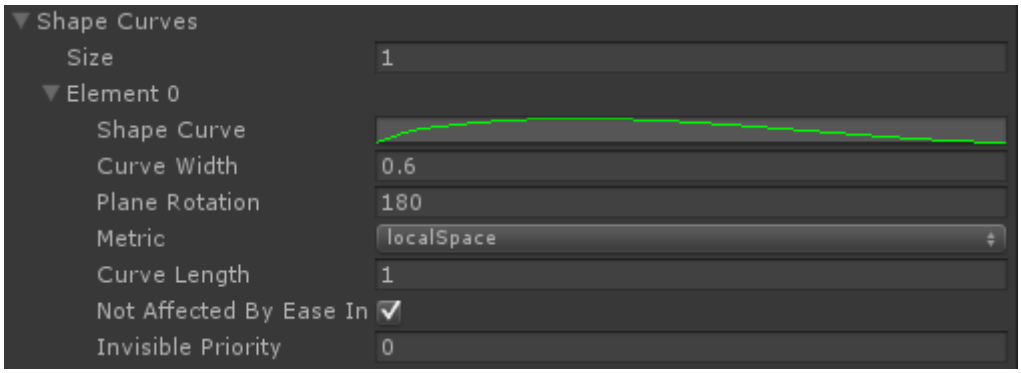
- **globalSpace** – wavelength set in unity units
- **localSpace** – wavelength set in part of system shape length(for example, wavelength = 0.2 will set wavelength to 1/5 of overall system length)

Amplitude defines maximum deviation of oscillating arc from its original shape.

Phase defines period shift of oscillation.

Phase movement speed lets you animate oscillation by moving wave periods along arc.

Shape curves



Shape curves behave much like oscillations, except shape of the ray shift is defined by **Shape Curve**.

Curve width – Curve will be multiplied by this number before being applied to the final ray shape.

Plane Rotation – see **Oscillations** above.

Metric – see **Oscillations** above. (Curve length is defined depending on this)

Curve Length – Length of (0,1) x-axis segment of the curve on final ray shape, counting from start of the ray.

Not affected by Ease In Out – If toggled on, Ease In Out options will not affect final curve shift.

General notes

Look at warning and error messages in editor console, component self-checks main settings at startup and will inform you of any problems.

If your system isn't visible, check the following:

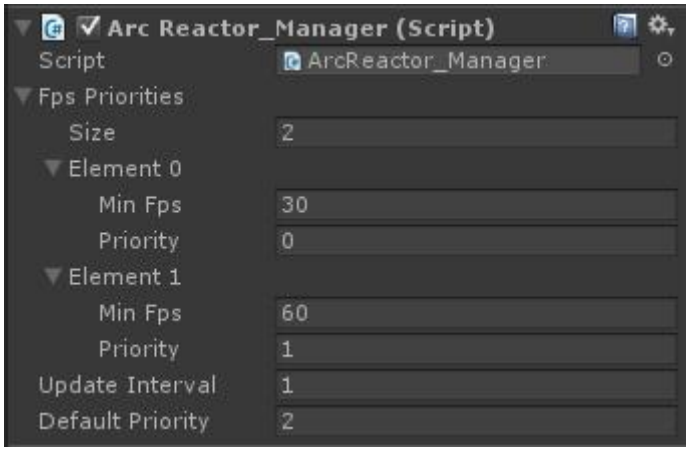
1) There are minimum two of Shape Transforms

2) Lifetime isn't zero

3) You assigned at least Start Color gradient

4) You assigned at least Start Width curve

ArcReactor_Manager performance manager script.



To enable performance manager simply put one instance of this script onto any object on your scene.

Then you have to set up a table of priorities. Manager will set global priority according to this table, using lowest fps setting in table that's higher that current FPS. If no priorities table record satisfies that requirement, **Default Priority** will be used.

(In the above example screenshot, priority will be set to 0 when FPS in the 0-30 range, to 1 in 30-60 range and to 2 in 60+ range).

If you want your manager affecting your arcs, you will need to set up priorities in the part of the arc you want to be affected by FPS. For example, if you put Lights Priority = 2 in your arc, and global priority according to manager becomes lower than 2, your lights will be turned off.

For now SpatialNoise (when not visible), Lights and Oscillations (when not visible) are available for performance managing.

Note that you can disable performance manager and set **Performance Priority** of each arc by your own script.

ArcReactor_Launcher helper script

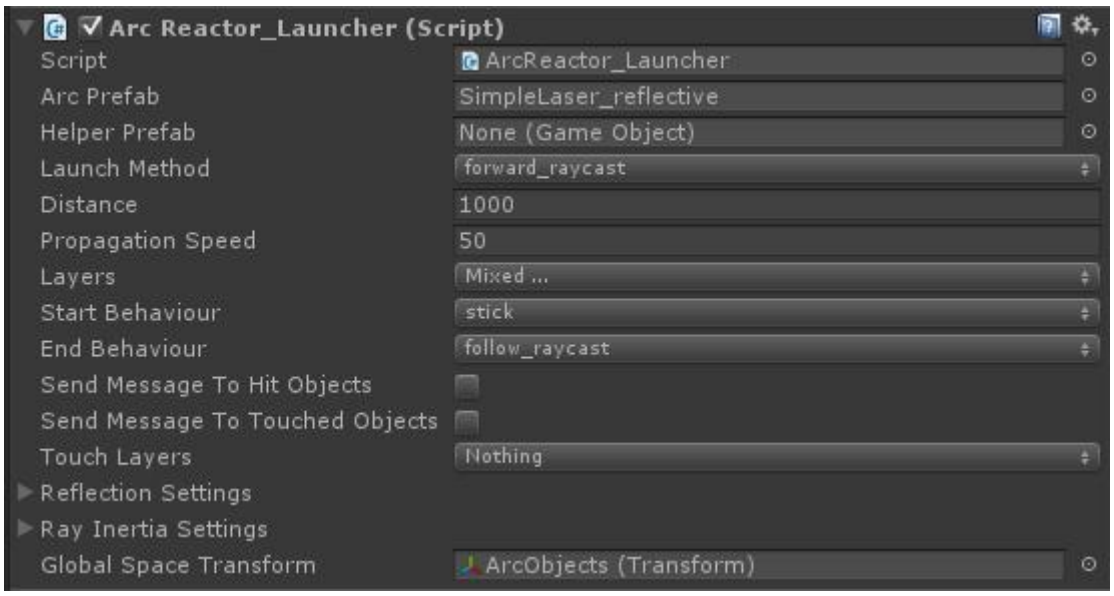
This script provides simple interface for integrating ArcReactor in your project.

To use it, prepare prefab with ArcReactor_Arc component that you need (for example, laser ray or lighting arc) and place it into “Arc prefab” parameter. You can use one of the default prefabs that comes with the package.

By invoking “Launch” method (either by direct access or SendMessage method), Launcher component will create needed shape, instantiate prefab and will control it shape through its lifetime.

It can be used by parenting it to a gun in a shooter game and adding invoking “Launch” method of ArcReactor_Launcher in your shooting script.

Additional settings:



Helper prefab – this prefab will be instantiated with arc system prefab and will be aligned along it. Use it, for example, to generate particles along your rays.

Launch method – defines how start and end point of arc system will be determined at the moment of launch.

Distance – defines maximum raycasting distance

Propagation speed – defines speed at which raycasting distance increases (per second). Can be used if you want propagation to handle events correctly. Set to a really big number if you want your rays to raycast instantly to **Distance**.

Layers – defines raycasting layers.

Start and end behaviors – defines behavior of start and end points of arc system shape. For guns, use **StartBehavior** = “stick” and **EndBehavior** = “follow_raycast”.

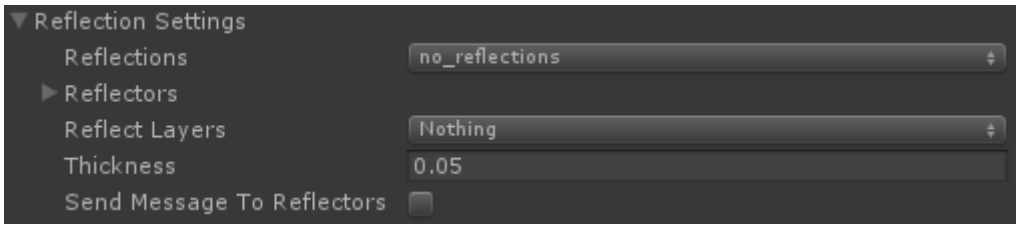
Send message to hit objects – Launcher will invoke a “ArcReactorHit” function in objects hit by rays. This is done via SendMessage method. Not that reflectors are processed separately, this message goes only to the object that blocked the ray.

Send message to touched objects – Same as hit objects, except touched objects don’t block the ray. Set up **touch layers** beforehand.

Ray inertia setting allows generating additional shape transforms and applying crude intertia algorithm to arc. For smoother results, use transforms with physics enabled(rigidbodies, colliders and joints).

Global space transform will be parent for all generated transforms except those that stuck to surfaces according to behavior settings.

ArcReactor_Launcher reflection setup



Any launcher can launch rays that will reflect off surfaces, and any ray system can be made reflective.

To do so, you must switch **Reflections** parameter to the **“reflect_by_layer”** or **“reflect_specified_objects”** mode. The difference between them is what objects will reflect rays launched by this launcher.

reflect_by_layer: any objects with colliders within “reflect_layers” will reflect your rays.

reflect_specified_objects: only objects placed in “reflectors” array will reflect your rays. Note that they still need to be within “reflect_layers”.

“Thickness” determines the distance of reflection point from the reflective surface.

Send message to reflectors – similar to hit objects, this parameter enables SendMessage to the objects that reflected ray. It invokes “ArcReactorReflection” function.

Recommendations for ray systems:

Systems with big spatial randomization usually look bad reflecting. If you use a bunch of rays “dancing” randomly around main ray, use the max random distance as reflection thickness.

For hard reflections (such as laser beams), check “**snap segments to shape**” option for better results.

Script reference

If you want to further integrate ArcReactor to your scripts, this information will help you understand public properties of ArcReactor components.

ArcReactor_Arc:

float ArcReactor_Arc.ShapeLength

Returns length of system shape defined by shape transforms. Note that length calculated using Linear interpolation regardless of interpolation settings due to performance optimization.

Vector3 ArcReactor_Arc.CalcShapePoint(float point)

Returns global coordinates of point on system shape. Point=0 corresponds to start point of shape, Point = 1 – to end point.

You can use this propery to, for example, move some object along arcs.

Vector3 ArcReactor_Arc.GetArcPoint (float point,int arcIndex)

Returns global coordinates of point on arc. This method is faster than CalcShapePoint due to vertex caching, but it could cause errors if you provide point that arc hasn’t reached yet(if arc propagation options not set to instant).

Vector3 ArcReactor_Arc.GetArcEndPosition (int arcIndex)

returns global coordinates of last vertex of arc.

Vector3 ArcReactor_Arc. GetArcEndPoint (int arcIndex)

returns relative point of arc’s end point. 0 corresponds to start point of system shape, 1 – to end point of system shape. Use in conjunction with GetArcPoint.

void ArcReactor_Arc.ResetArc(int arcIndex)

recalculates shape of the arc and re-randomizes spatial noise if enabled.

ArcReactor_Launcher:

```
public class RayInfo
	{
		public ArcReactor_Arc arc;
		public Transform[] shape;
		public GameObject startObject;
		public GameObject endObject;
	}
```

Contains information about ray launched by component that's currently active. To get list of current rays, use
RayInfo[] ArcReactor_Launcher.Rays

Hit and reflect messages:

Launcher can send messages to objects that's been hit by rays it launched. It also provides hit info by this class:

```
class ArcReactorHitInfo
{
	ArcReactor_Launcher launcher;
	ArcReactor_Launcher.RayInfo rayInfo;
	RaycastHit raycastHit;
}
```

Examples of usage in your script:

```
public void ArcReactorReflection(ArcReactorHit hit)
{
	//Do something
}

public void ArcReactorHit(ArcReactorHit hit)
{
	//Do something
}

public void ArcReactorTouch(ArcReactorHit hit)
{
	//Do something
}
```

For example of generating particle system on hit, see *ArcReactorDemo3Mirror* script in Demo folder.