

# Supported Features and Known Limitations

## Beta

- Arnold GPU is a **beta** feature, intended to give users an early look into what is coming and a chance to test Arnold GPU and provide feedback.
- Arnold GPU is **not** intended for use in production.
- Please use [Arnold Answers](#) if you have any technical problems, questions, or feedback on Arnold GPU.

## Quick Summary

- Arnold GPU supports complex shading networks, SSS, hair, atmospherics, instancing, and procedurals.
- With the same settings, GPU renders will currently be noisier than CPU renders, since GPU renders are "non-splitting" (i.e. one path per camera/AA sample). Accordingly, to achieve equivalent noise the AA sample count will need to be increased in GPU renders. Adaptive rendering is fully supported.
- Standard Surface, Standard Hair, and Standard Volume are supported, with some limitations (see the table below).
- OSL is supported, with some limitations currently (see below).
- OpenVDB volumes are supported, with some limitations currently (see below).
- Volume displacement is supported, with some limitations currently (see below).
- Floating point textures are converted to half-float. Filename attribute tags and mipmap bias are not supported.
- Light filters and light linking are not supported.
- Limited AOV support.
- Light groups, shadow groups, trace sets are not supported.

## OSL

Initial support for OSL has been added to the GPU renderer. As in the CPU renderer, you can mix and match OSL and Arnold shaders in the same shading network. Note that this initial support is still not complete and currently has a number of limitations as listed below.

## Closures

Supported closures include:

- Emission
- Diffuse
- Reflection
- Refraction
- Translucent
- Oren-Nayar
- Sheen
- SSS
- Metal & Microfacet (only GGX distribution is supported)

## Shading operations

Currently, there is limited support for shading operations, as follows:

- Some matrix operations are unsupported.
- Texture, transform, trace and string operations are currently unsupported.

## OpenVDB

Initial support for OpenVDB has been added to the GPU renderer. In this initial implementation, each VDB grid is loaded to GPU in a dense format. While this matches the CPU renderer visually quite well and is feature-complete, the memory consumption can be larger due to the lack of sparse representation. The rendering speed may be slower than CPU in cases with high opacity volumes, as the GPU implementation does not skip empty space as efficiently as the CPU version. The match with CPU will become increasingly good as the step-size parameter is reduced.

## Volume displacement

Initial support for volume displacement has been added to the GPU renderer. The rendering speed may be slower than CPU in cases with high opacity volumes, as the GPU implementation does not skip empty space as efficiently as the CPU version. The match with CPU will become increasingly good as the step-size parameter is reduced.

## Supported Features and Known Limitations

Feature	GPU Support	Notes
<b>Cameras</b>		
cyl_camera	Yes	
fisheye_camera	Yes	
ortho_camera	Yes	
persp_camera	Yes	uv_remap is not supported.
spherical_camera	Yes	
uv_camera	No	
vr_camera	Yes	Merge shaders are not supported.
<b>Color Managers</b>		
color_manager_ocio	Yes	
color_manager_syncolor	Yes	
<b>Drivers</b>		
cryptomatte_manifest_driver	No	
driver_deepexr	No	
driver_exr	Yes	
driver_jpeg	Yes	
driver_png	Yes	
driver_tiff	Yes	
<b>Filters</b>		
blackman_harris_filter	Yes	One single filter for all AOVs.
box_filter	Yes	One single filter for all AOVs.
gaussian_filter	Yes	One single filter for all AOVs.
triangle_filter	Yes	One single filter for all AOVs.
<i>All other filters</i>	No	Fallback to box filter. One single filter for all AOVs.
<b>Lights</b>		
cylinder_light	Yes	
disk_light	Yes	
distant_light	Yes	Light groups, light filters not supported.
mesh_light	Yes	Light groups, light filters not supported.
photometric_light	No	
point_light	Yes	Light groups, light filters not supported.
quad_light	Yes	Light groups, light filters not supported.
skydome_light	Yes	Light groups, light filters not supported.
spot_light	Yes	Light groups, light filters not supported.
<b>Operators</b>		
collection	Yes	
disable	Yes	
include_graph	Yes	
materialx	Yes	
merge	Yes	
set_parameter	Yes	
set_transform	Yes	
switch_operator	Yes	
options	Yes	
override	Yes	
<b>Shaders</b>		
abs	Yes	

add	Yes	
ambient_occlusion	Yes	Trace sets are not supported.
aov_write_float	No	
aov_write_int	No	
aov_write_rgb	No	
aov_write_rgba	No	
atan	Yes	
atmosphere_volume	Yes	
barndoor	No	Light filters are not supported.
blackbody	Yes	
bump2d	Yes	
bump3d	Yes	
c4d_texture_tag	Yes	
c4d_texture_tag_rgba	Yes	
cache	Yes	This is a no-op on GPU.
camera_projection	Yes	
car_paint	Yes	
cell_noise	Yes	
checkerboard	Yes	UV sets are not supported.
clamp	Yes	
clip_geo	No	
color_convert	Yes	
color_correct	Yes	
color_jitter	Yes	
compare	Yes	
complement	Yes	
complex_ior	Yes	
cross	Yes	
cryptomatte	No	
curvature	Yes	Trace sets are not supported.
divide	Yes	
dot	Yes	
exp	Yes	
facing_ratio	Yes	
flakes	Yes	
flat	Yes	
float_to_int	Yes	
float_to_matrix	No	
float_to_rgb	Yes	
float_to_rgba	Yes	
fog	Yes	
fraction	Yes	
gobo	No	Light filters are not supported.
image	Yes	All textures converted to half-float. Filename attribute tags and mipmap bias are not supported.
is_finite	Yes	
lambert	Yes	
layer_float	Yes	
layer_rgba	Yes	
layer_shader	Yes	
length	Yes	
light_blocker	No	Light filters are not supported.
light_decay	No	Light filters are not supported.
log	Yes	
matrix_interpolate	No	

matrix_multiply_vector	Yes	The matrix parameter is not linkable on GPU.
matrix_transform	No	
matte	No	
max	Yes	
maya_layered_shader	Yes	
min	Yes	
mix_rgba	Yes	
mix_shader	Yes	
modulo	Yes	
motion_vector	No	
multiply	Yes	
negate	Yes	
noise	Yes	
normal_map	Yes	
normalize	Yes	
osl	Yes	Some limited support for closures and shading operations.
passthrough	Yes	
physical_sky	Yes	
pow	Yes	
query_shape	Yes	
ramp_float	Yes	Connected colors and positions not supported.
ramp_rgb	Yes	Connected colors and positions not supported.
random	Yes	
range	Yes	
ray_switch_rgba	Yes	
ray_switch_shader	Yes	
reciprocal	Yes	
rgb_to_float	Yes	
rgb_to_vector	Yes	
rgba_to_float	Yes	
round_corners	Yes	Trace sets are not supported.
shadow_matte	No	
shuffle	Yes	
sign	Yes	
space_transform	Yes	Camera and screen spaces are not supported.
sqrt	Yes	
standard_hair	Yes	ID AOVs are not supported
standard_surface	Yes	ID AOVs are not supported. Diffusion SSS mode is not supported.
standard_volume	Yes	
state_float	Yes	
state_int	Yes	
state_vector	Yes	
subtract	Yes	
switch_rgba	Yes	
switch_shader	Yes	
toon	No	
trace_set	No	
trigo	Yes	
triplanar	Yes	
two_sided	Yes	
user_data_float	Yes	
user_data_int	Yes	
user_data_rgb	Yes	
user_data_rgba	Yes	

user_data_string	No	
utility	Yes	The wire, polywire, edgelenh, pixelerror, nlights color modes are not supported.
uv_projection	Yes	
uv_transform	Yes	
vector_map	Yes	
vector_to_rgb	Yes	
volume_sample_float	Yes	
volume_sample_rgb	Yes	
wireframe	No	
<b>Shapes</b>		
box	Yes	Light groups, shadow groups, trace sets are not supported.
cone	No	
curves	Yes	Light groups, shadow groups, trace sets are not supported. Oriented curves are not supported.
cylinder	No	
disk	No	
ginstance	Yes	Light groups, shadow groups, trace sets are not supported.
nurbs	Yes	
plane	Yes	Light groups, shadow groups, trace sets are not supported.
points	Yes	Light groups, shadow groups, trace sets are not supported.
polymesh	Yes	Light groups, shadow groups, trace sets are not supported.
sphere	Yes	Light groups, shadow groups, trace sets are not supported.
implicit	No	
volume_implicit	No	
alembic	Yes	Light groups, shadow groups, trace sets are not supported.
procedural	Yes	Light groups, shadow groups, trace sets are not supported.
volume	Yes	Light groups, shadow groups, trace sets are not supported.
<b>AOVs</b>		
AA_inv_density	Yes	
ID	Yes	
N	Yes	
P	Yes	
Pref	No	
RGBA	Yes	
Z	Yes	
albedo	Yes	
background	Yes	
coat	Yes	
coat_albedo	Yes	
coat_direct	Yes	
coat_indirect	Yes	
cputime	Yes	
diffuse	Yes	
diffuse_albedo	Yes	
diffuse_direct	Yes	
diffuse_indirect	Yes	
direct	Yes	
emission	Yes	
indirect	Yes	
motionvector	No	
opacity	Yes	
raycount	Yes	
shadow_matte	No	
sheen	Yes	
sheen_albedo	Yes	

sheen_direct	Yes	
sheen_indirect	Yes	
specular	Yes	
specular_albedo	Yes	
specular_direct	Yes	
specular_indirect	Yes	
sss	Yes	
sss_albedo	Yes	
sss_direct	Yes	
sss_indirect	Yes	
transmission	Yes	
transmission_albedo	Yes	
transmission_direct	Yes	
transmission_indirect	Yes	
volume	Yes	
volume_Z	No	
volume_albedo	No	
volume_indirect	No	
volume_opacity	No	