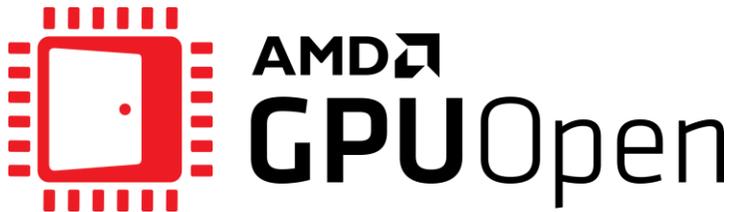
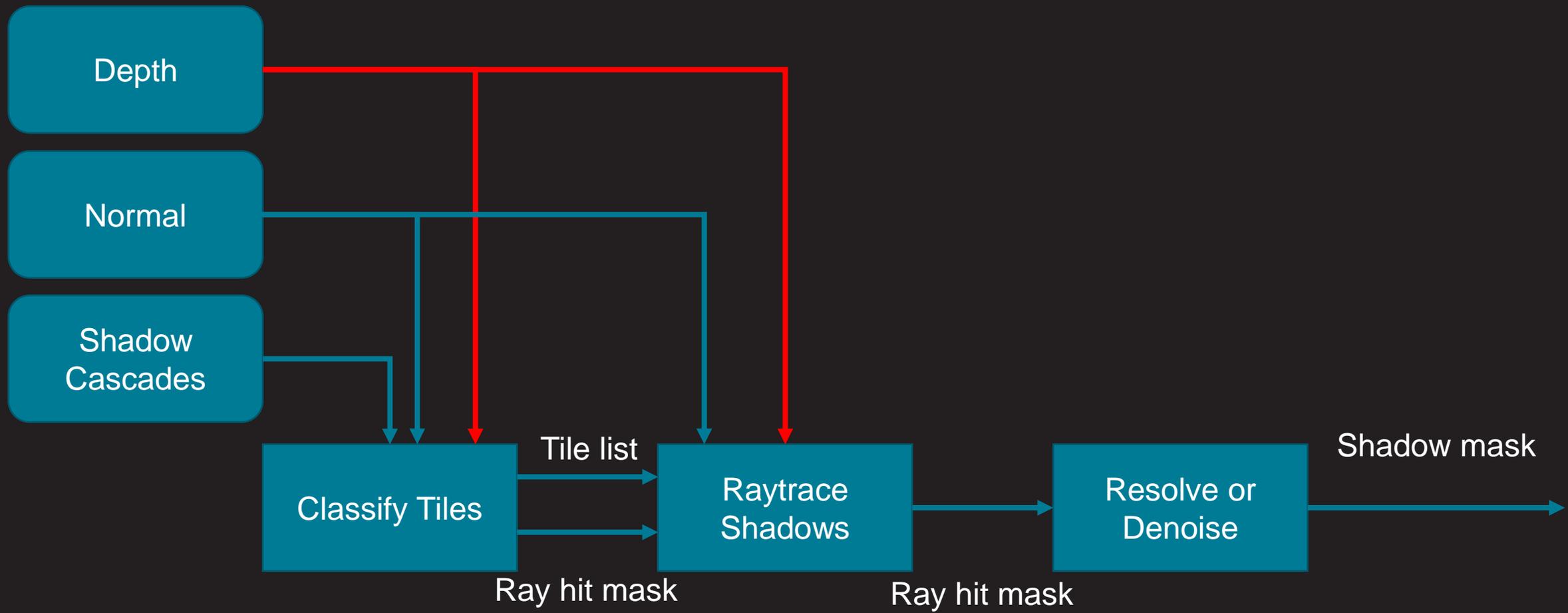


HYBRID SHADOWS

JORDAN LOGAN



DATA FLOW



CLASSIFY INPUTS

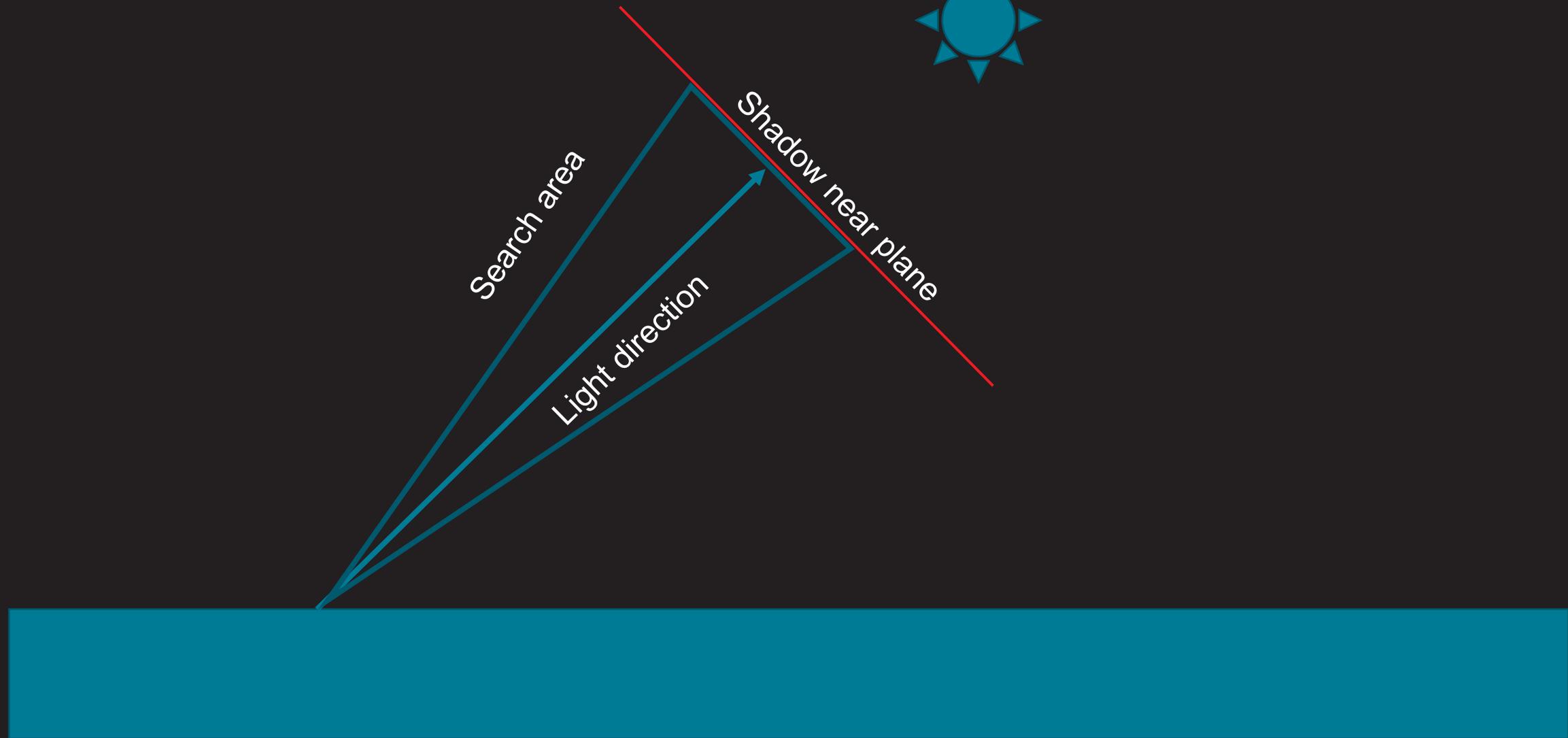
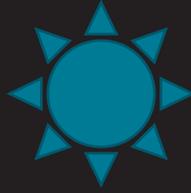
- Depth buffer
 - Used to reconstruct world position
 - Used to reject sky pixels
- Normal buffer
 - Used to reject pixels that don't face the sun.
- Cascaded shadow maps
 - Used to reject pixels that don't need raytracing

CLASSIFY OUTPUTS

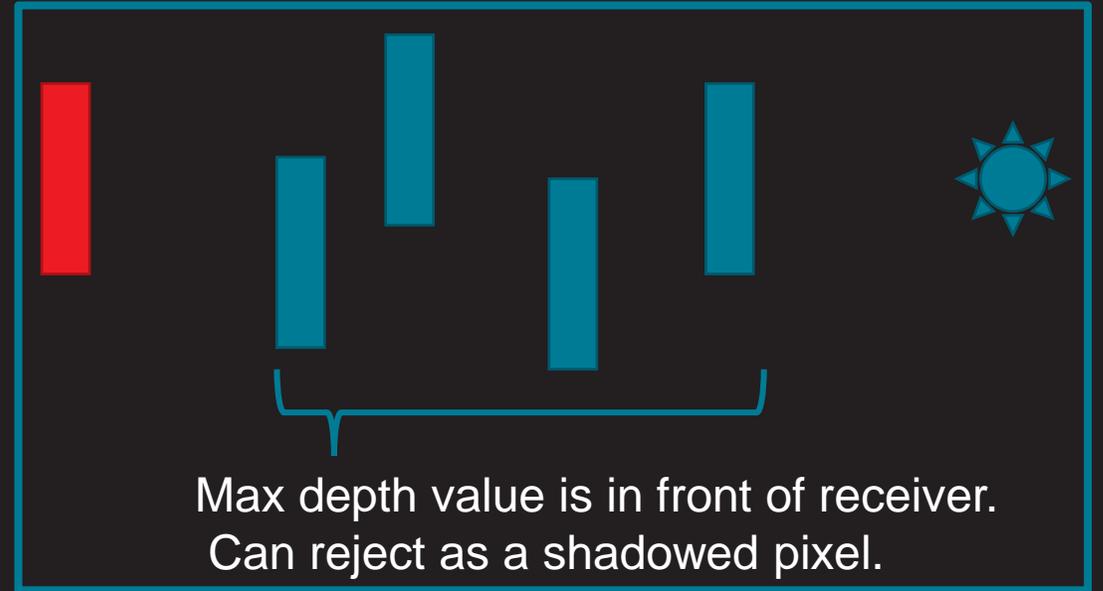
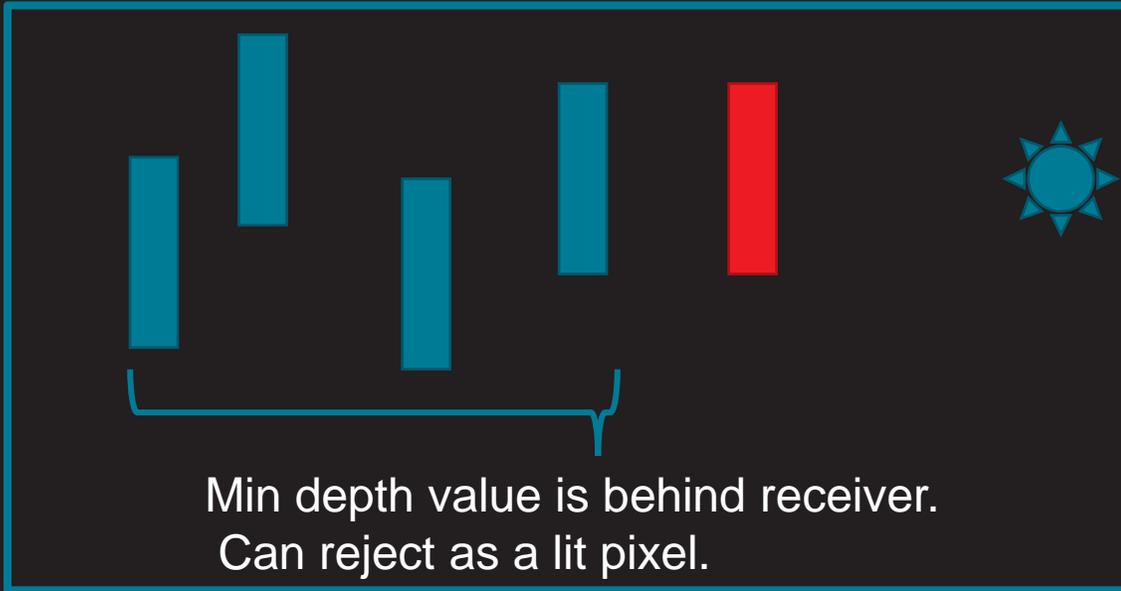
- Tile list
 - List of all 8x4 tiles that need to ray trace
 - Each tile has a mask of which pixels in the tile need raytracing.
 - Each tile also has min and max ray length.
- Ray hit mask
 - uint mask for each 8x4 tile.
 - Preloading with results of the cascaded shadow map blocker search.

BLOCKER SEARCH

- Need to check if there are any blockers between our pixel and the shadow near plane.
- Use light space depth to scale the sun size to the shadow near plane.
- Use Poisson disc samples to uniformly sample the search area.
- Use the max and min depth values from the shadow map to decide if we can reject a pixel.
- Can calculate the ray interval from the shadow maps.



PIXEL CLASSIFICATION



Receiver
Blocker

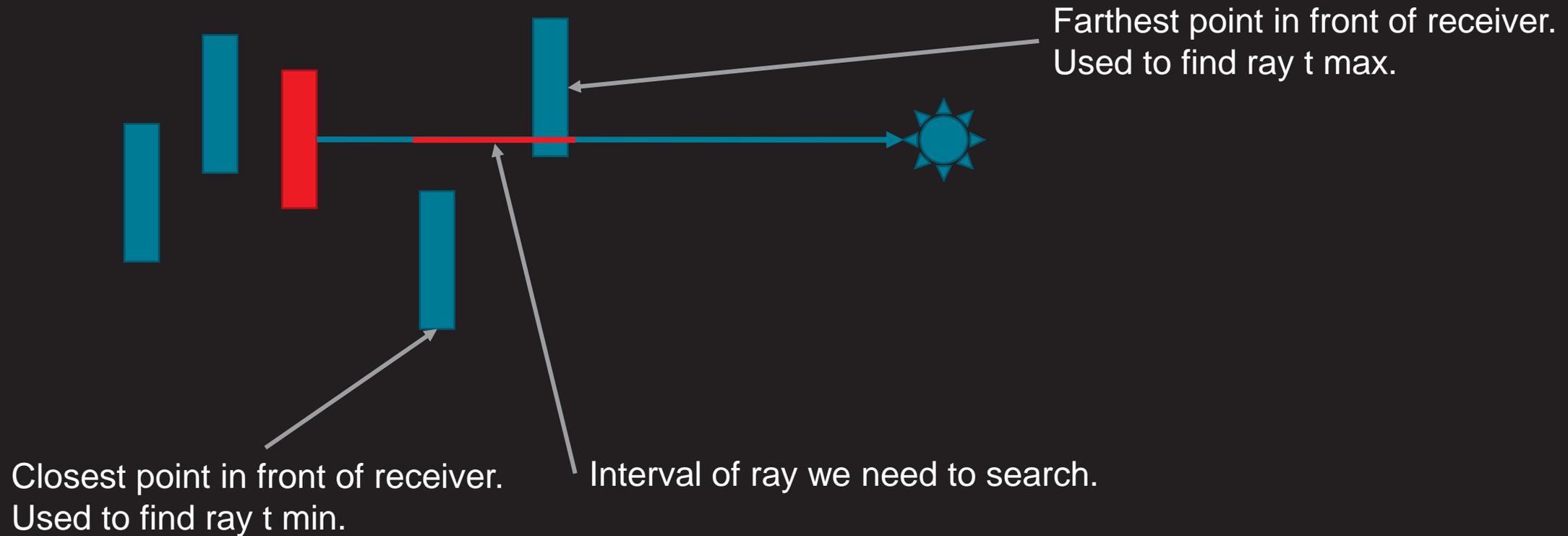
PIXEL CLASSIFICATION



Max is behind and min is in front of receiver.
Needs more data from raytracing.

Receiver
Blocker

RAY INTERVAL OPTIMIZATION



Receiver
Blocker

RAY TRACE INPUTS

- Depth buffer
 - Used to reconstruct world position
- Normal buffer
 - Offset ray along pixel normal.
- Tile list
 - Used to decide what pixel to fire a ray from.

RAY TRACE OUTPUTS

- Ray hit mask
 - uint mask for each 8x4 tile.
 - Combining ray hit results with the prefilled mask.

RAY TRACE

- Use tile data from classify to set up a workgroup to work on a 8x4 tile, one wave32.
- Sample blue noise to create a new ray to fire.
- If using depth interval, the ray can be reversed to trace from the sun to the surface for faster traversal through the acceleration structure.

RESOLVE/DENOISE

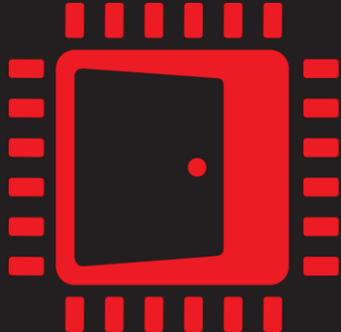
- Either decompress the ray hit results into a shadow map or use the Fidelity-FX shadow denoiser.

OPTIMIZATIONS USED

- Wave active mask.
 - Using a uint to store the results of the blocker search allows a 32:1 reduction in the amount of memory needed to store.
- Ray hit mask.
 - With one ray per pixel, the hit result buffer's memory size can be reduced by 32:1.
- Replace samples with image loads.
 - Loads are faster at moving data from the cache to the shader core on RDNA.

DEALING WITH ARTIFACTS

- Use reverse depth buffer to improve accuracy of the reconstructed world space.
- Change depth offset used in blocker search.
 - High values will create light leakage and peter panning.
- Change number of Poisson disc samples.
- Change ray min t push off value.
 - High values will create light leakage and peter panning.
- Increase shadow map resolution and/or cascades.



AMD 
GPU Open



RADEON



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