

GHOST

OF TSUSHIMA

Procedural Grass











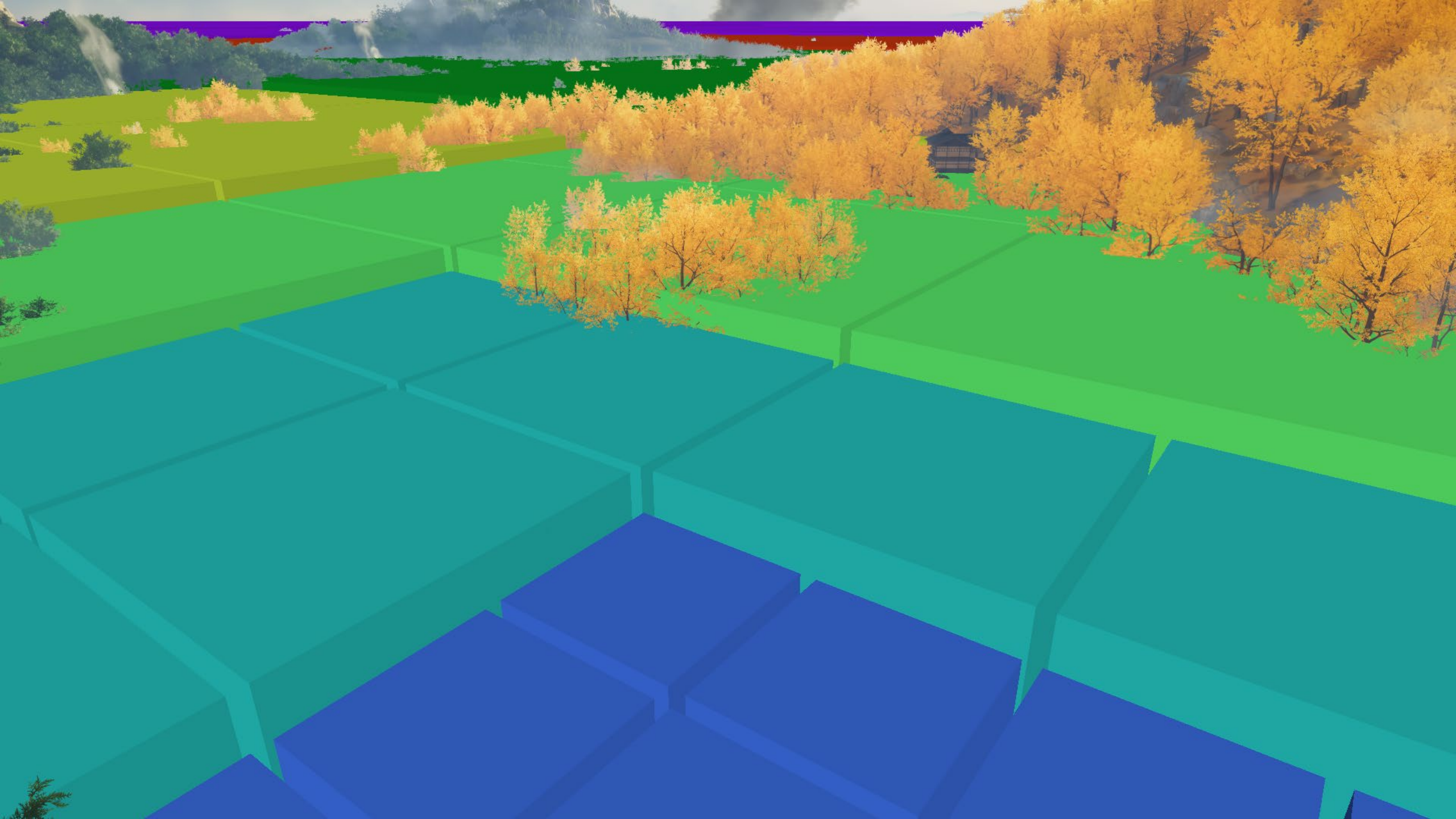


- Compute shader
- Data pipeline
- Vertex shader
- Pixel shader
- Miscellaneous



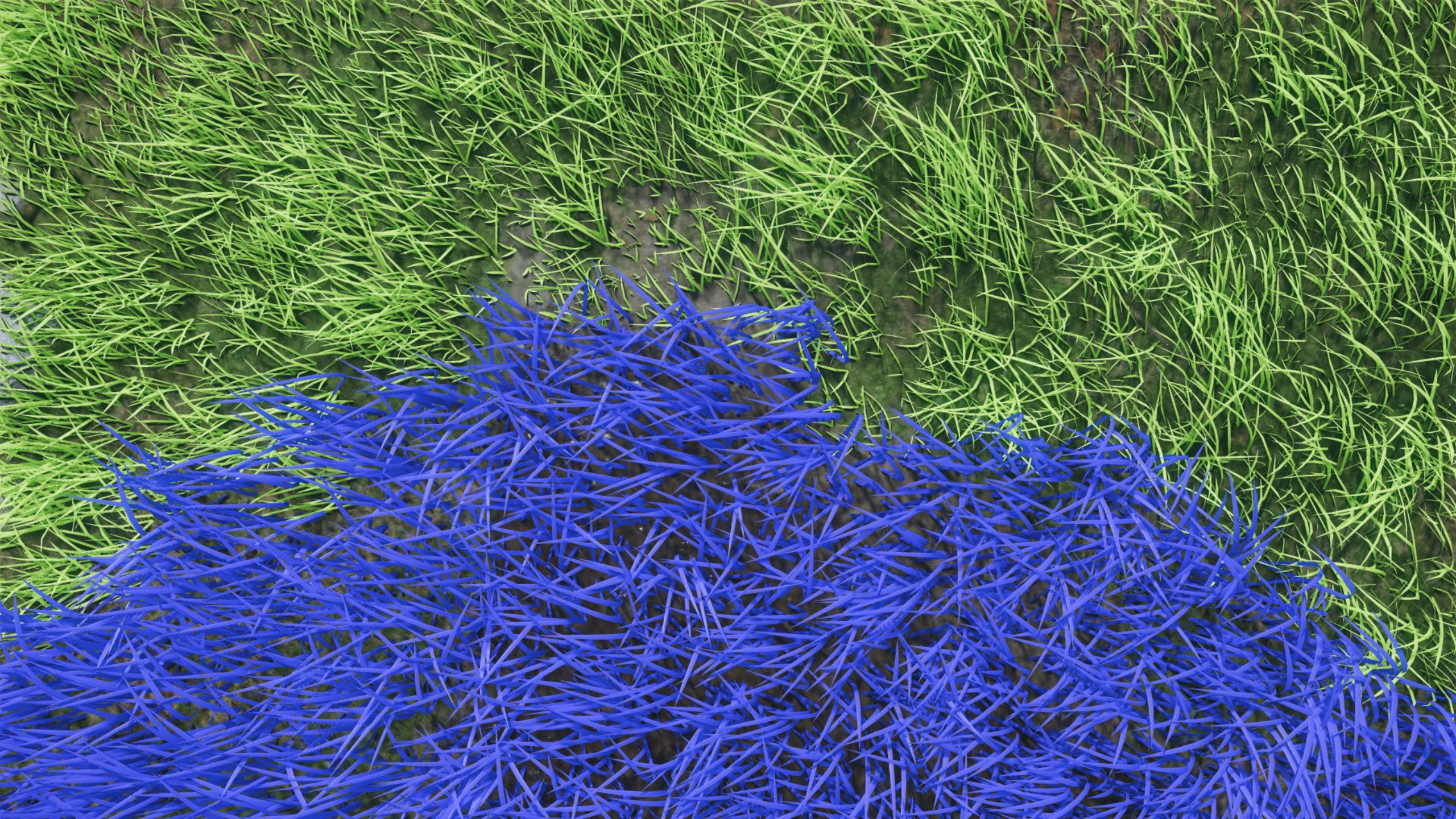


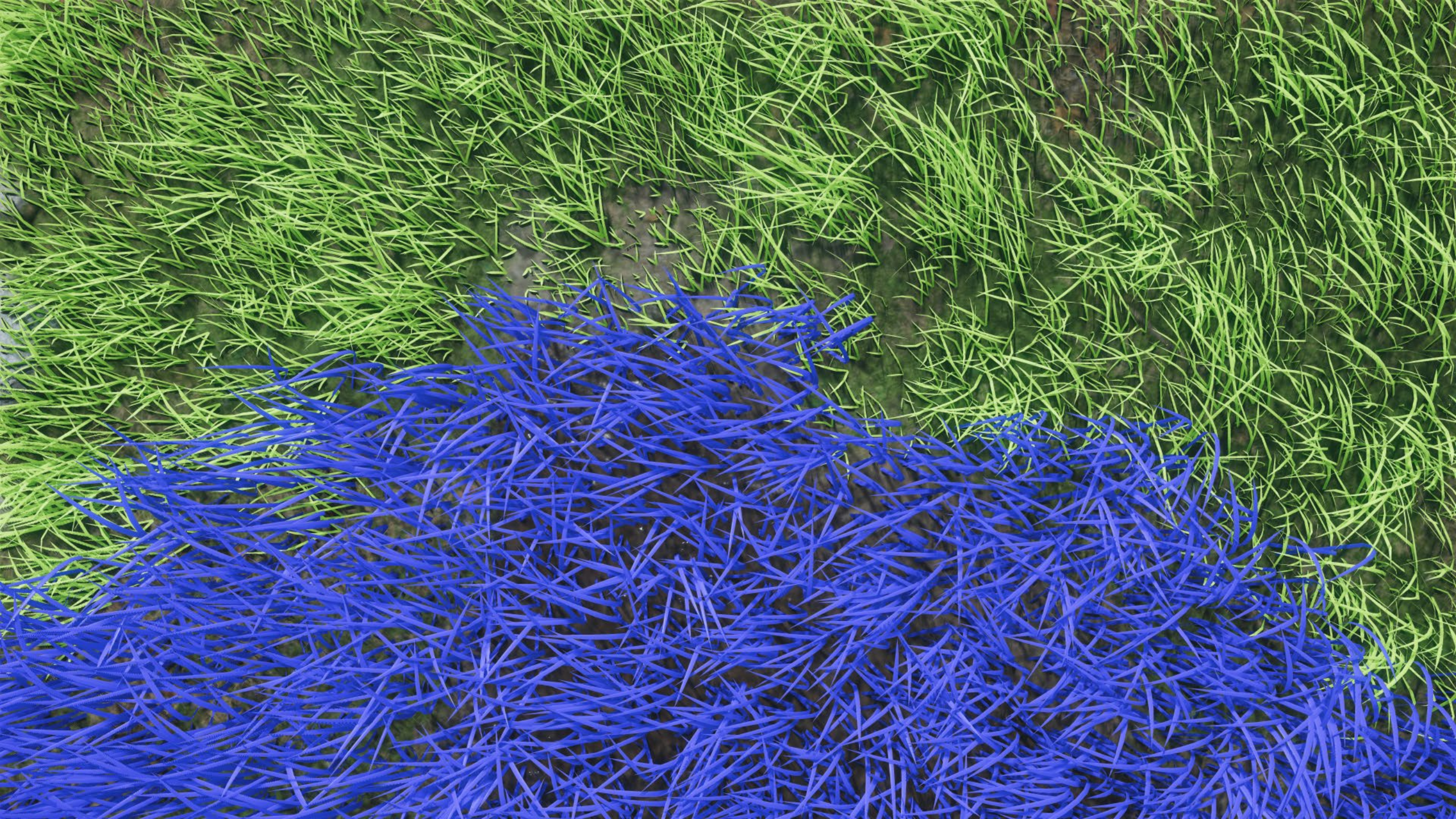




Placing a Grass Blade

- Turn lane ID into position on tile grid, jitter
- Distance culling and frustum culling
- Determine grass type and height from texture at position
- Drop lanes that don't have grass
- Occlusion culling

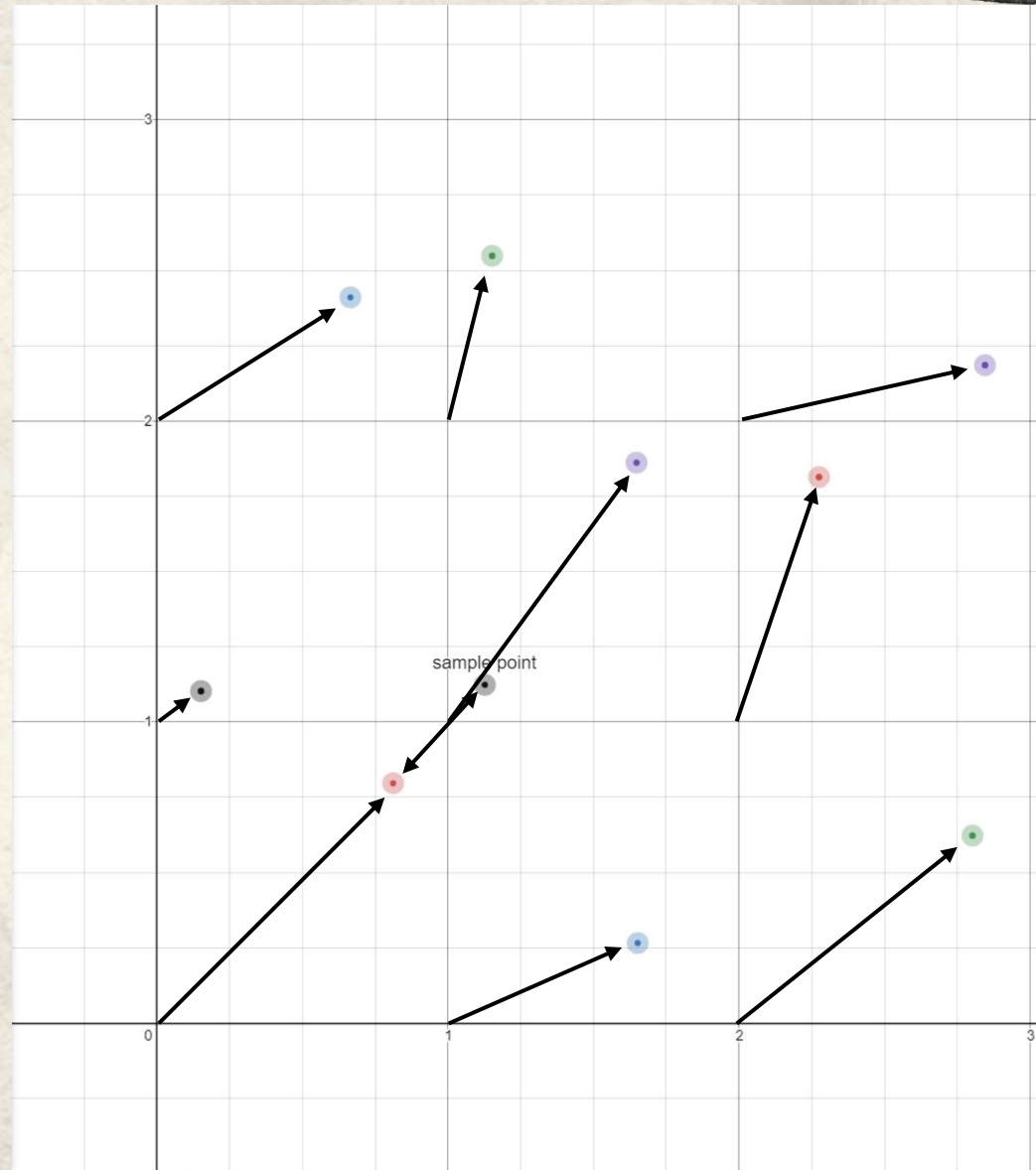




Generating a Grass Blade

- Position (3 floats)
- Facing (2 floats)
- Wind strength at position
- Per-blade Hash
- Grass Type
- Clump facing (2 floats)
- Clump color
- Height
- Width
- Tilt
- Bend
- Side Curve





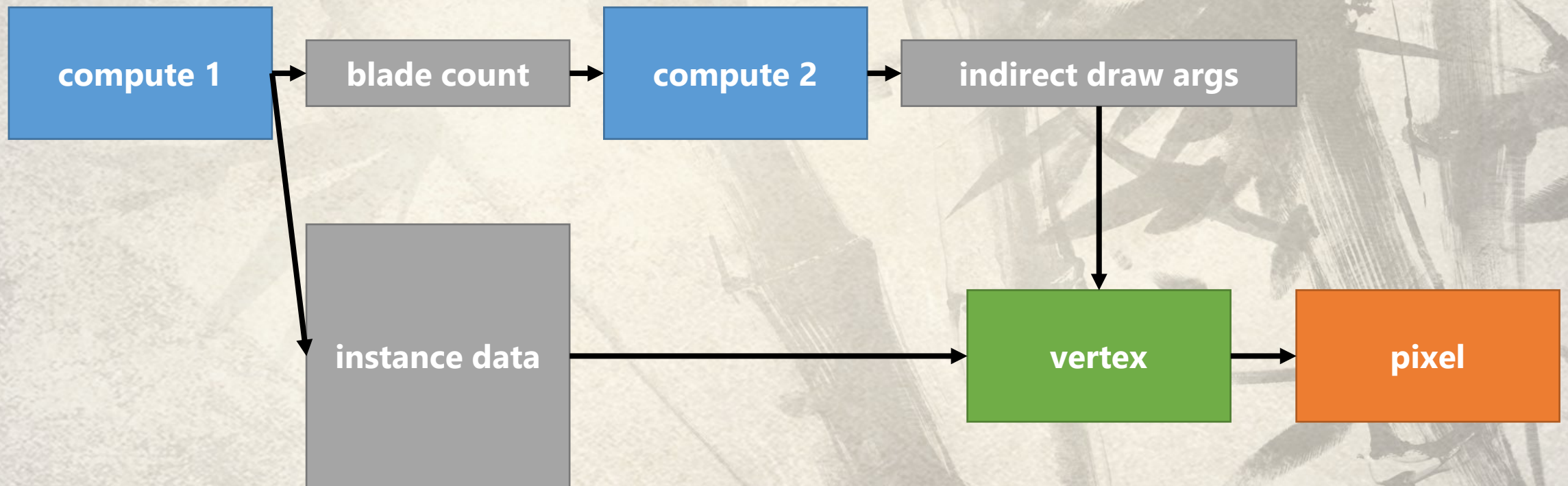




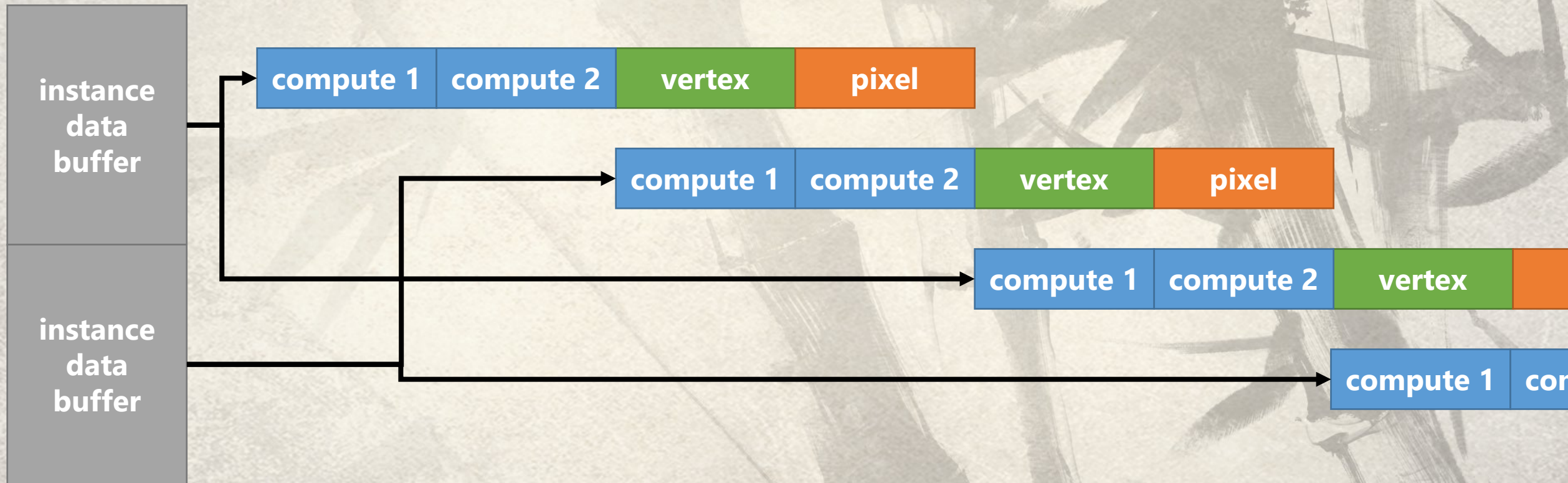








DATA PIPELINE



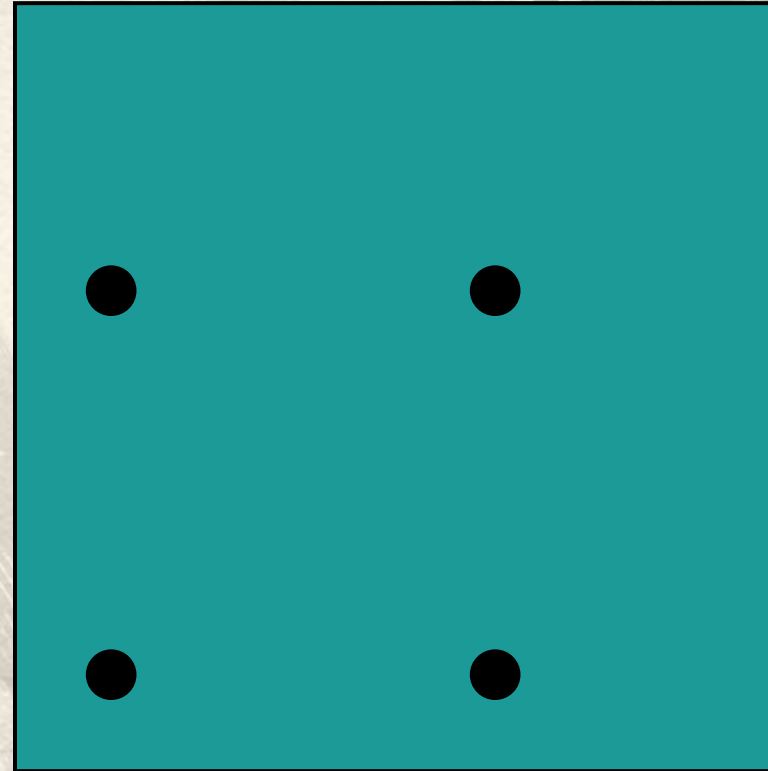
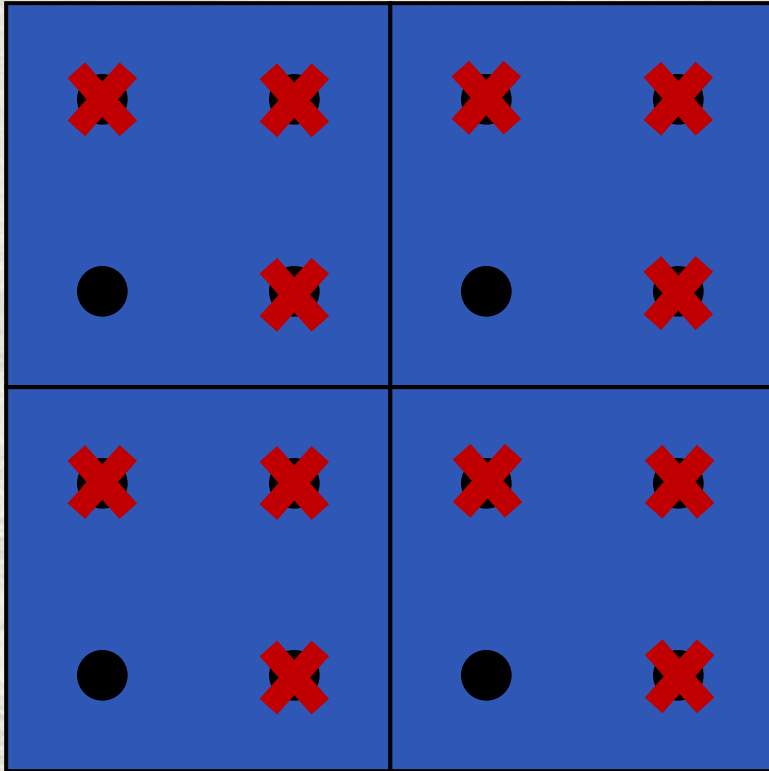
High LOD
15 vertices



Low LOD
7 vertices







High LOD
15 vertices

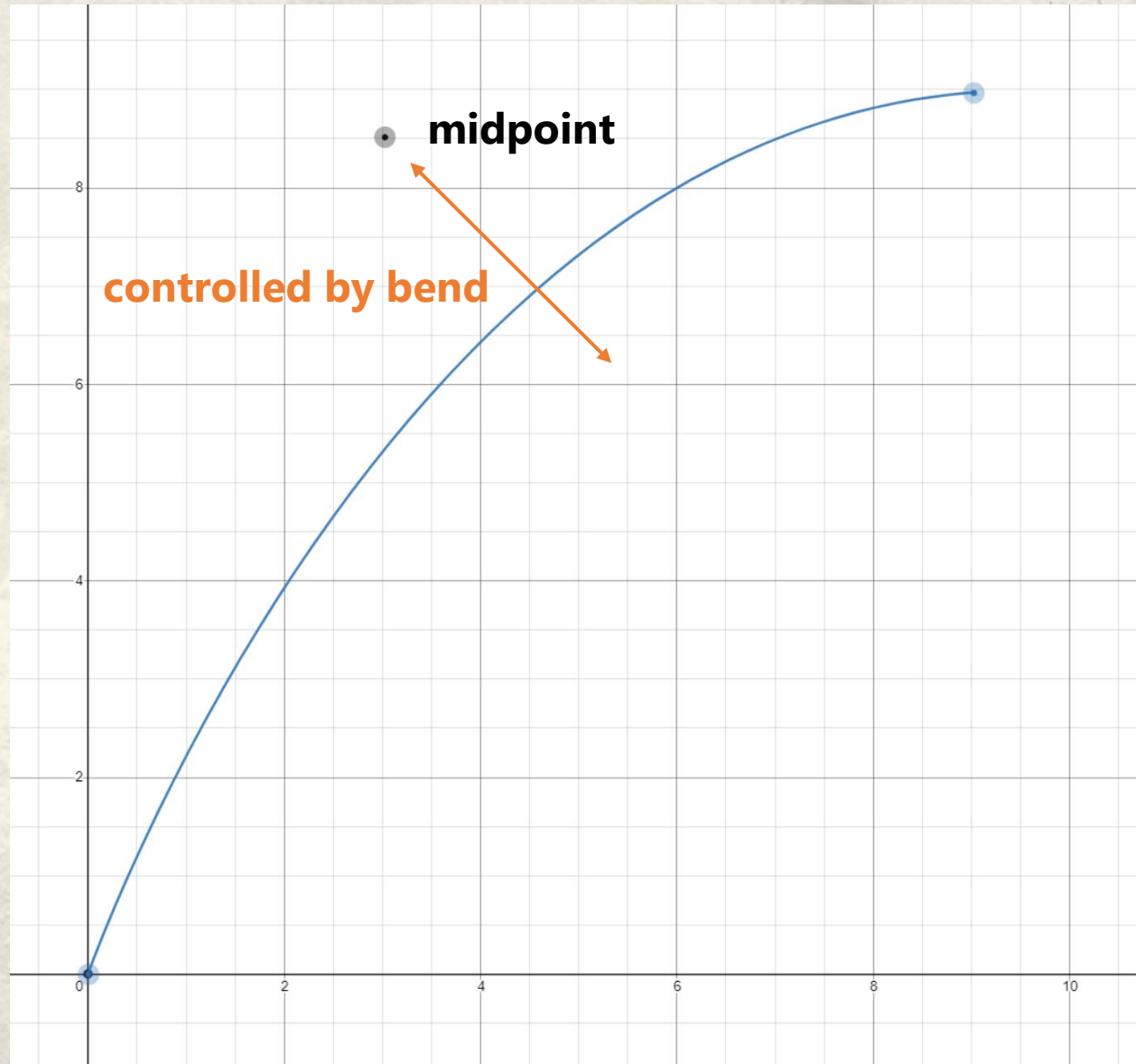


Low LOD
7 vertices

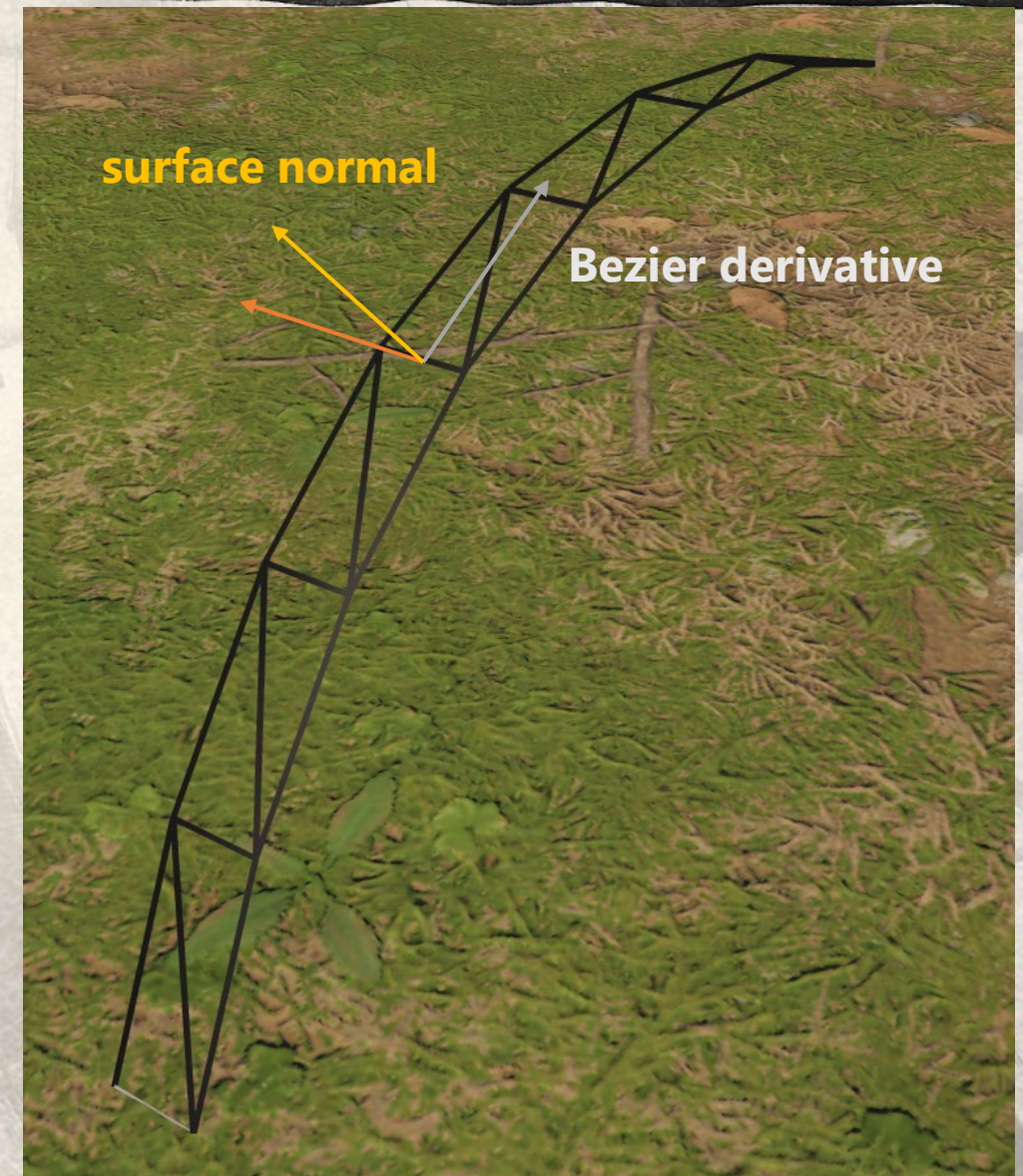


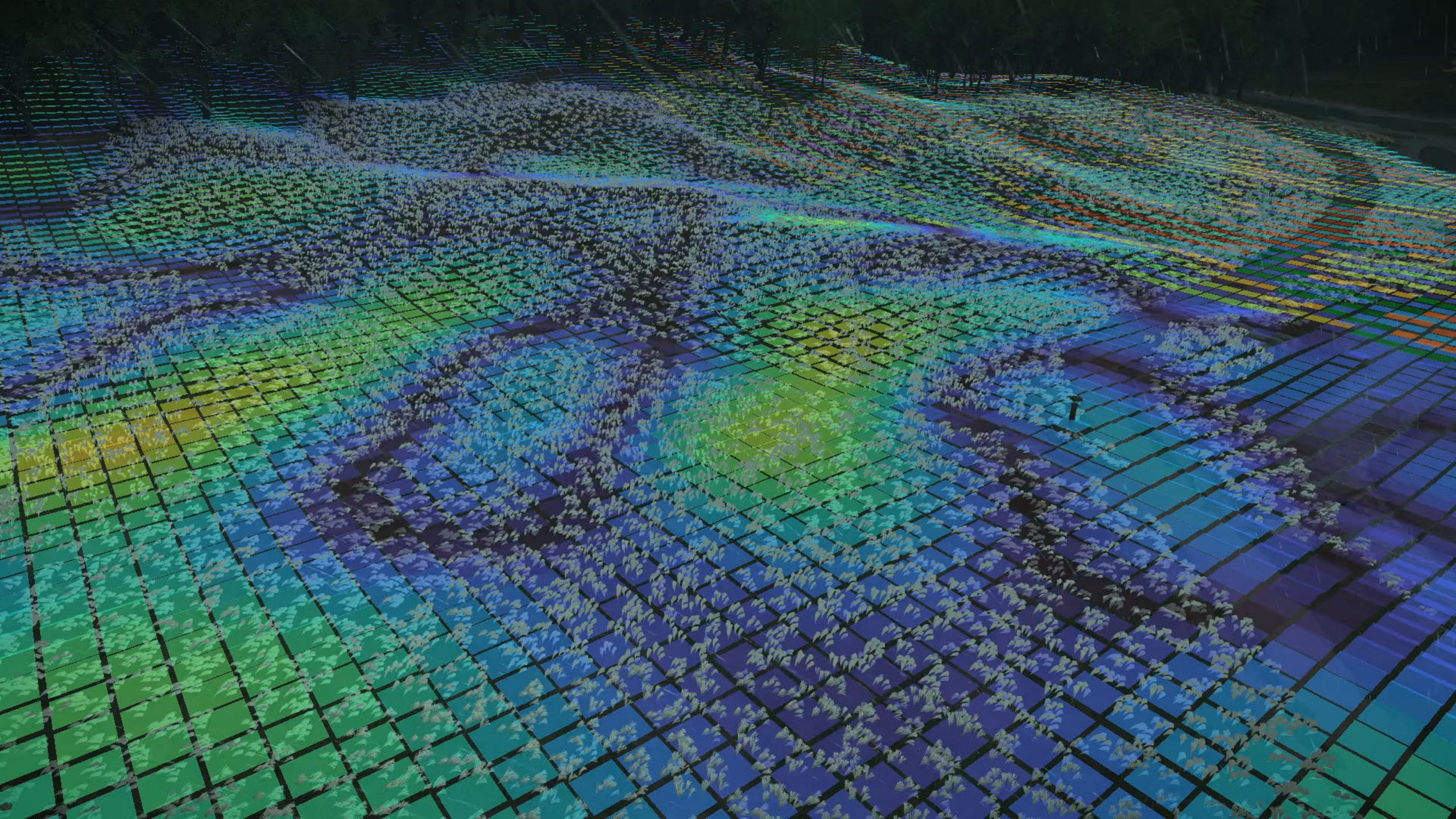
Cubic Bezier curve

- Position easy to calculate
- Derivative easy to calculate
 - Use derivative to find normal
- Moving control points changes blade shape
 - Useful for animation
 - Useful for varying appearance of grass

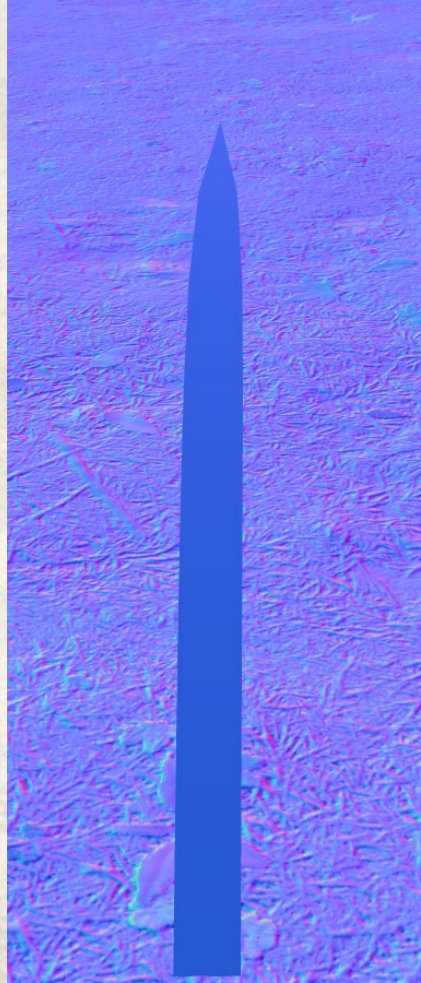


- Evaluate Bezier curve
- Get normal orthogonal to facing
- Step vertex in width direction
- Evaluate Bezier derivative curve

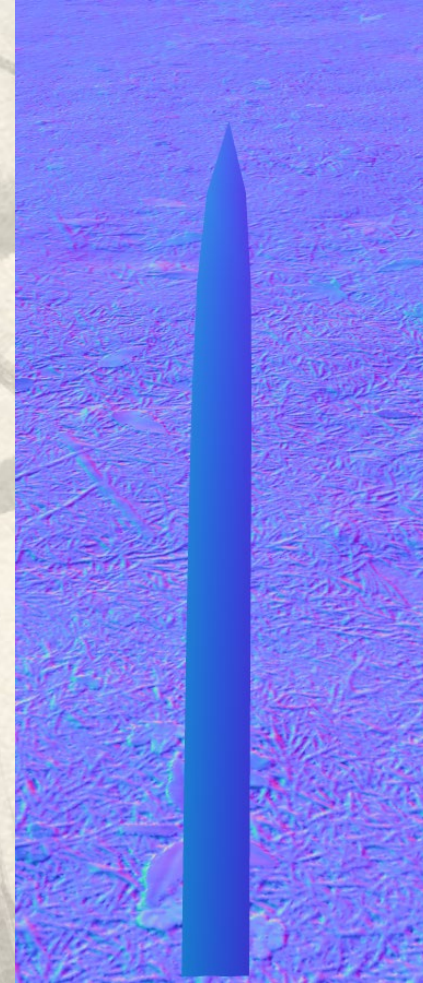




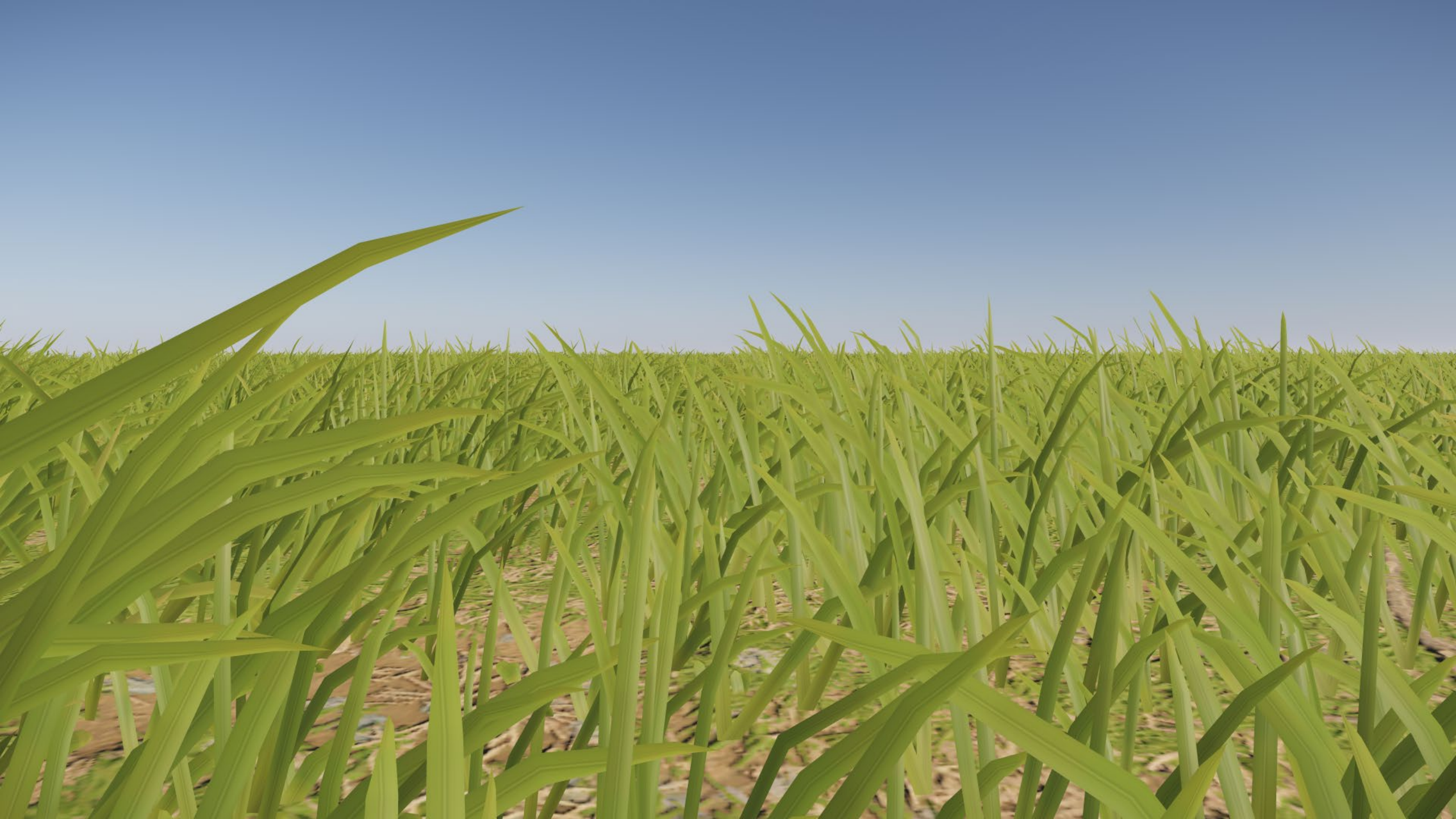
Flat
normals



Rounded
normals











- Output material data to G buffers
- Gloss- 1D texture
- Diffuse- Two textures
 - 1D texture for vein
 - 2D texture for color and alternate colors
- Translucency- Constant value
- AO- Constant value





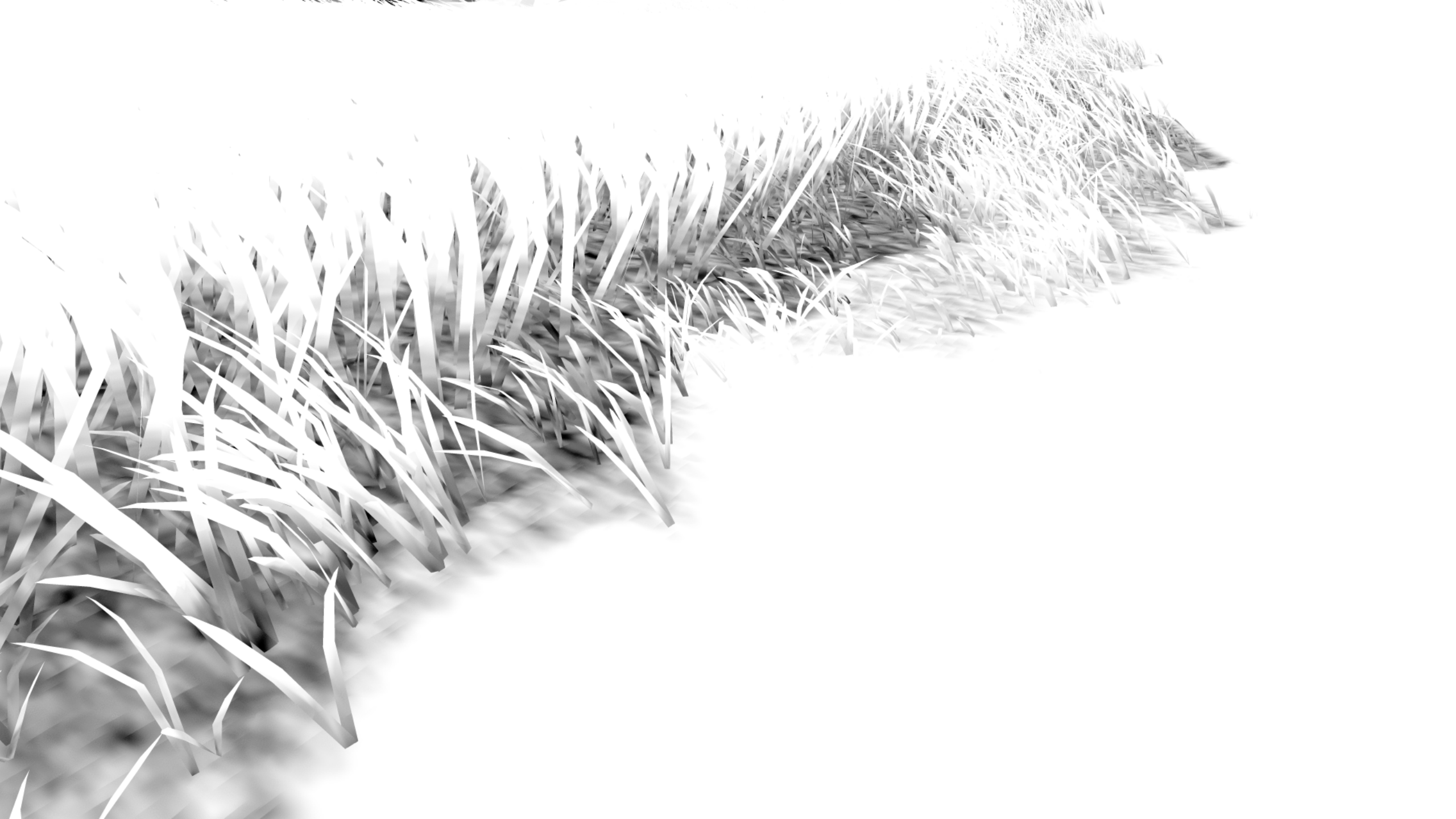










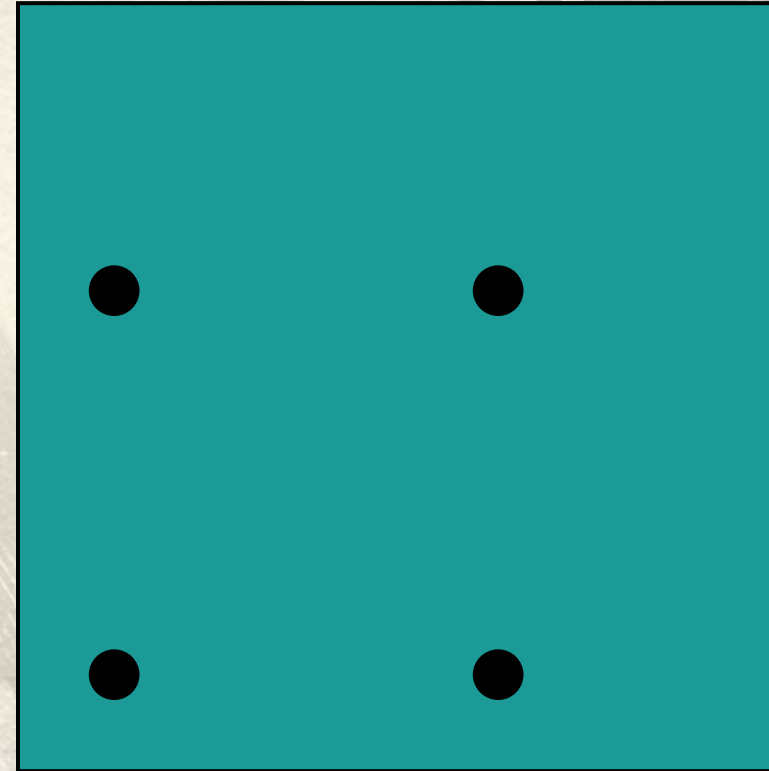
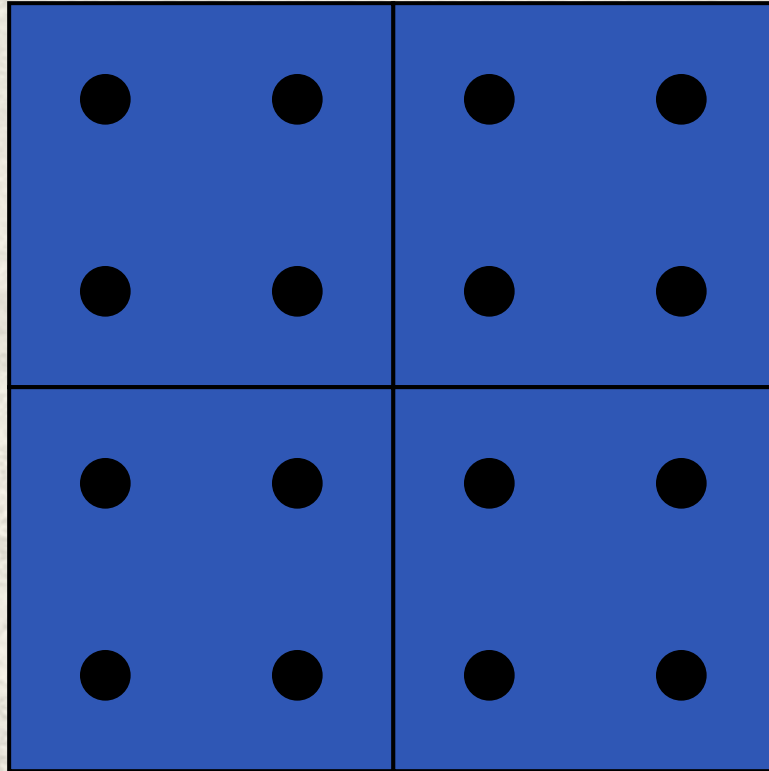














THANKS

Questions? @ericwoh



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WE ARE HIRING!

<https://jobs.suckerpunch.com/>



Outerra's 2012 blog post-

<https://outerra.blogspot.com/2012/05/procedural-grass-rendering.html>

