

coursework 2 - report

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1 Prep and Debug

1.1 shading space:

the world space. And I convert the normal vector from tangent space to world space by TBN matrix.

1.2 descriptor set layout and descriptor bindings:

descriptor set 0:

vertex shader:

```
1 layout(set = 0, binding = 0) uniform UScene
2 {
3     mat4 camera;
4     mat4 projection;
5     mat4 projCam;
6     vec3 lightPosition;
7     vec3 lightColor;
8     vec3 camPosition;
9 }uScene;
```

descriptor set 1:

fragment shader:

```
1 layout(set = 1, binding = 0) uniform sampler2D base;
2 layout(set = 1, binding = 1) uniform sampler2D roughness;
3 layout(set = 1, binding = 2) uniform sampler2D metalness;
4 layout(set = 1, binding = 3) uniform sampler2D normalmap;
```

1.3 uniform input data:

descriptor set 0:

```
1 struct SceneUniform {
2     glm::mat4 camera;
3     glm::mat4 projection;
```

```
4     glm::mat4 projCam;  
5  
6     glm::vec3 lightPosition;  
7     glm::vec3 lightColor;  
8     glm::vec3 camPosition;  
9 };
```

descriptor set 1:

binding = 0: base color texture

binding = 1: roughness texture

binding = 2: metalness texture

binding = 3: normal texture



Figure 1: Normal(n)

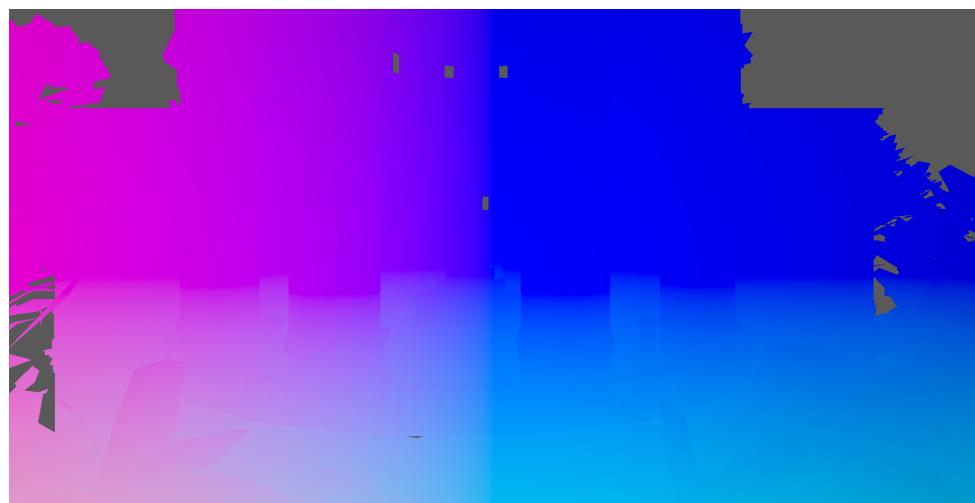


Figure 2: View direction(v)

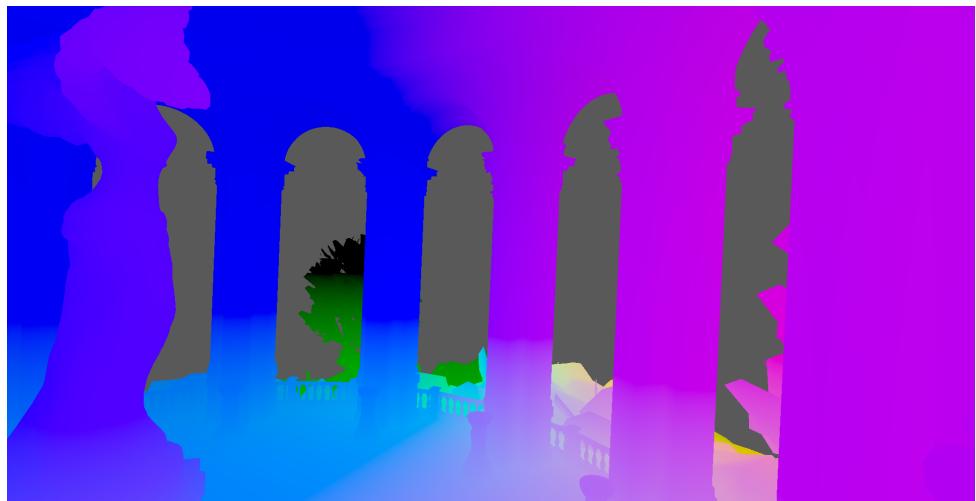


Figure 3: Light direction(l)

2 Lighting

Images are as expected.

Shading with the PBR model:



Figure 4: Overview



Figure 5: Shield

the normal distribution



Figure 6: D

the masking term

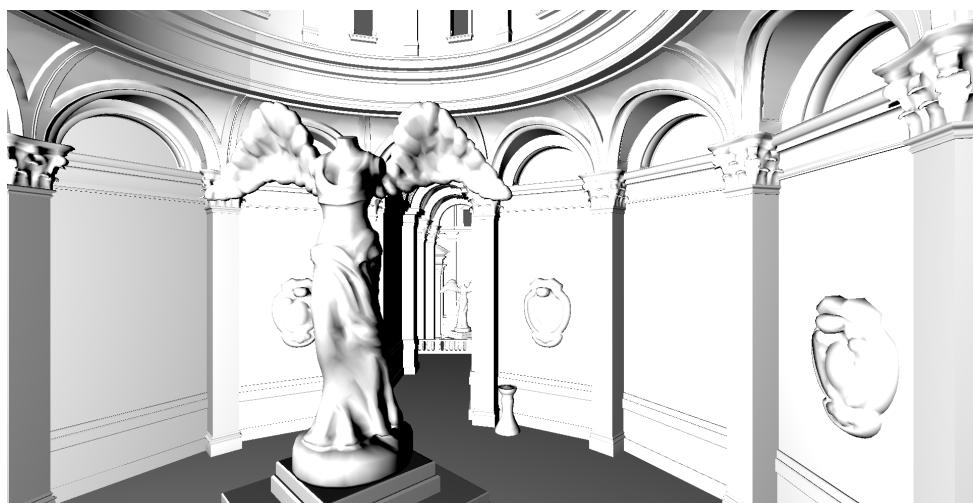


Figure 7: G

the Fresnel term



Figure 8: F

the PBR specular term



Figure 9: PBR specular term

3 Alpha Masking

I added second graphics pipeline to render materials with alpha textures. Then use the alpha value in fragment shader.

```
1  float alphaMask = texture(base, v2fTexCoords).a;  
2  if (alphaMask < 0.4 f) discard;  
3  ....  
4  fragColor = vec4(PBR, alphaMask);
```



Figure 10: Without Alpha Masking



Figure 11: With Alpha Masking

4 Normal mapping

Use VK_FORMAT_R8G8B8A8_UNORM format to create normal maps Image and Image view. Then use a “dummy” 1×1 normal map for objects that do not have normal maps.

4.1 visualization of the normals before and after:



Figure 12: Without Normal Maps

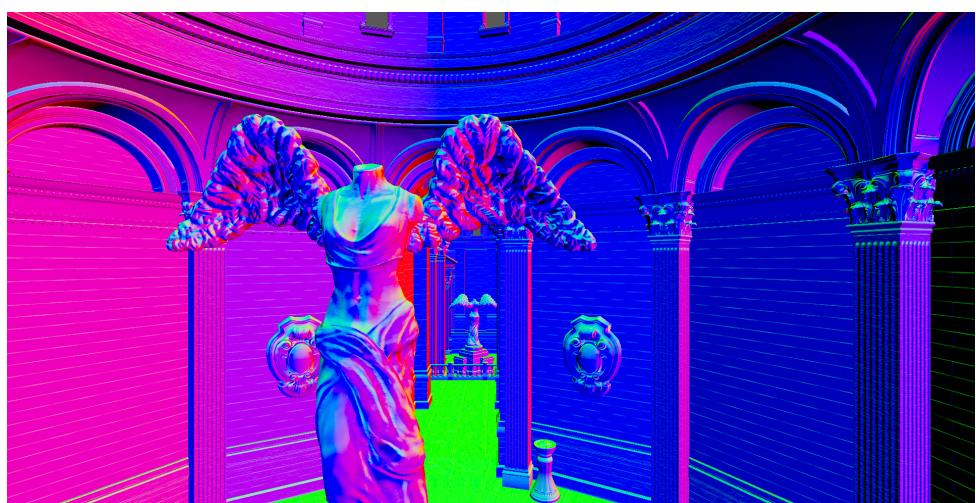


Figure 13: With Normal Maps

4.2 PBR model before and after normal mapping:



Figure 14: Without Normal Maps



Figure 15: With Normal Maps

The reason why use a `vec4` is to include the fourth component. This component helps ensure orientation of the tangent space, particularly when dealing with mirrored or flipped geometry.