Image-Based Remapping of Material Appearance

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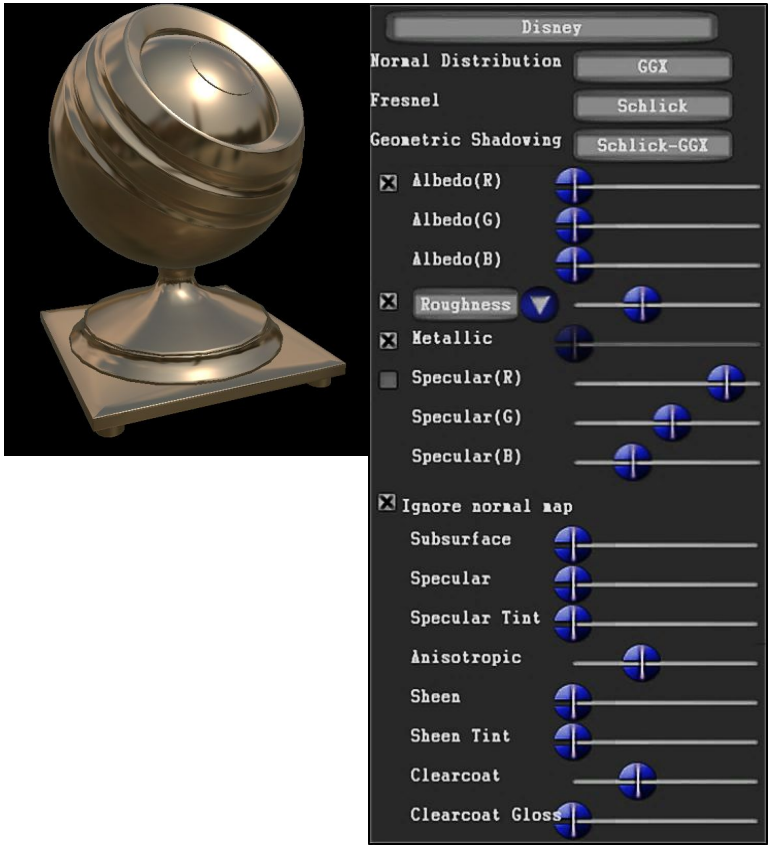
Eurographics Workshop on Material Appearance Modeling – Helsinki 2017

Computer Graphics Charles University

DiSTRO

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No 642841.

Material authoring



[Retrieved from Unity forum]

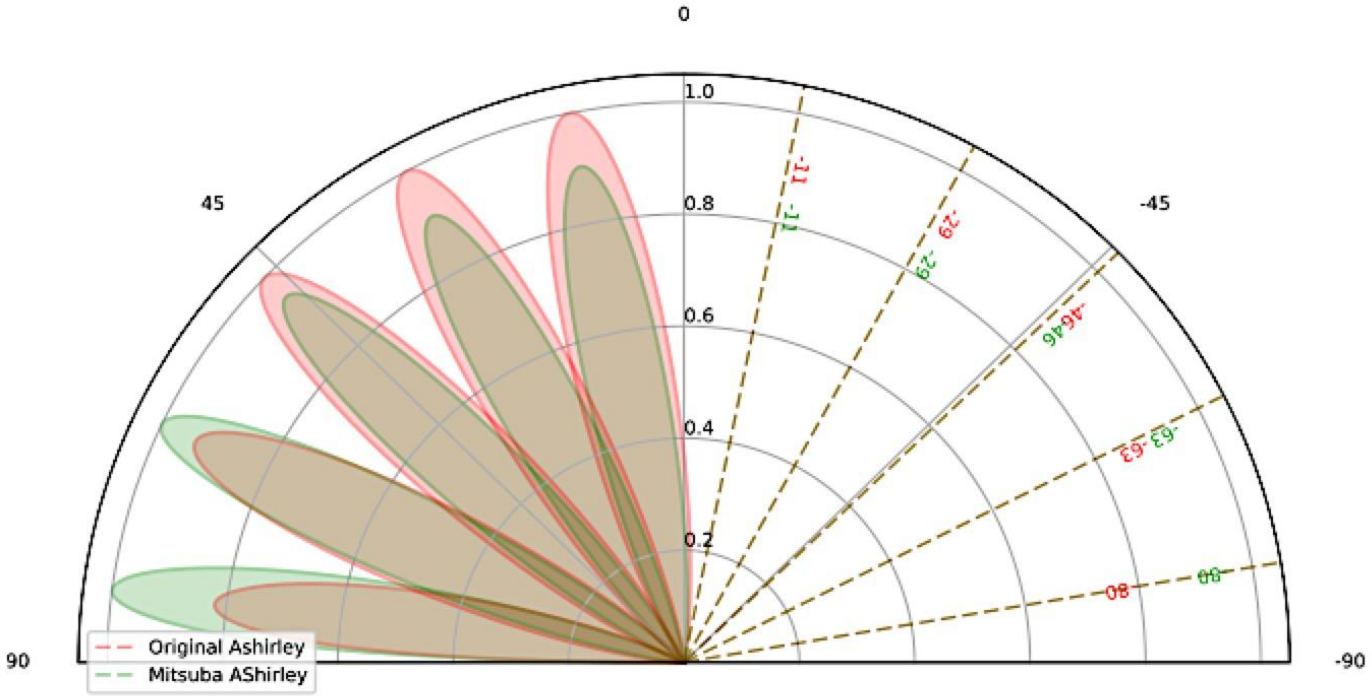
SUBSTANCE DESIGNER

Unity

allegorithmic

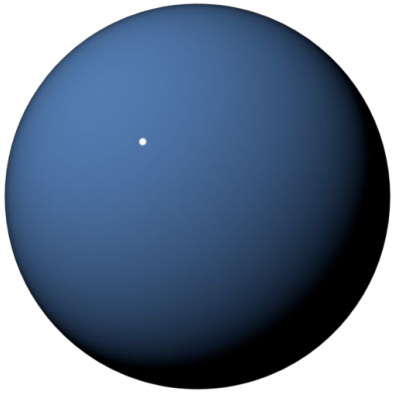
Model incompatibility

1. Different BRDF models used by different softwares
2. No clear way to translate between models
3. We usually don't have access to the implementations
4. and they change between renderers

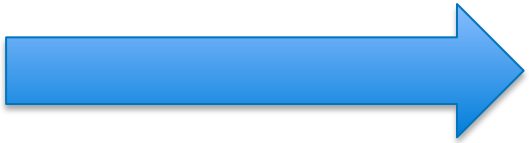


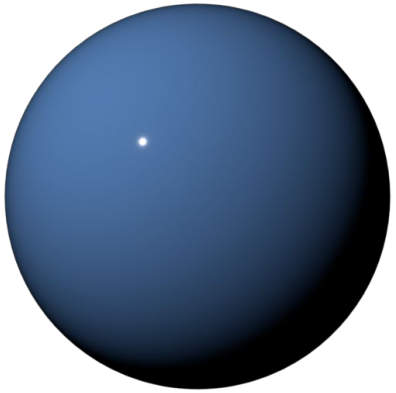
BRDF remapping

Reference BRDF model



External BRDF model
(initial condition)

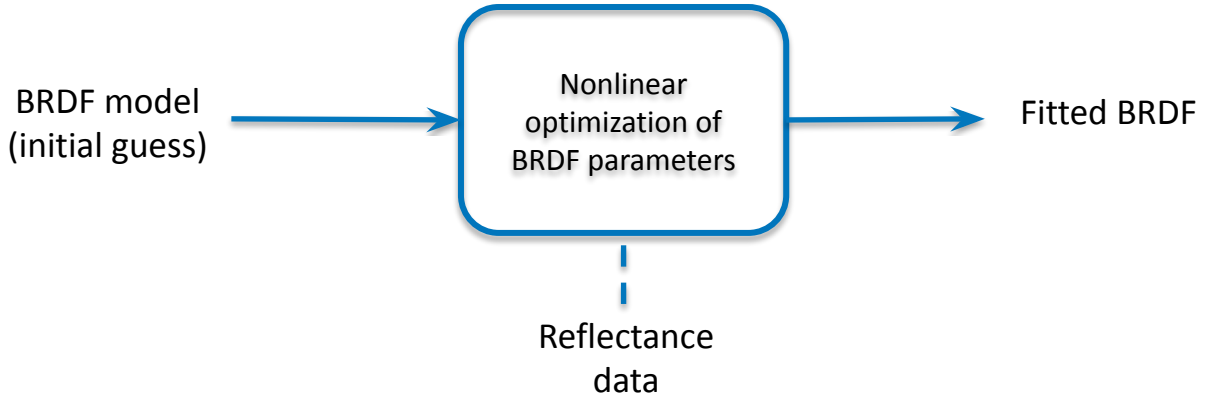




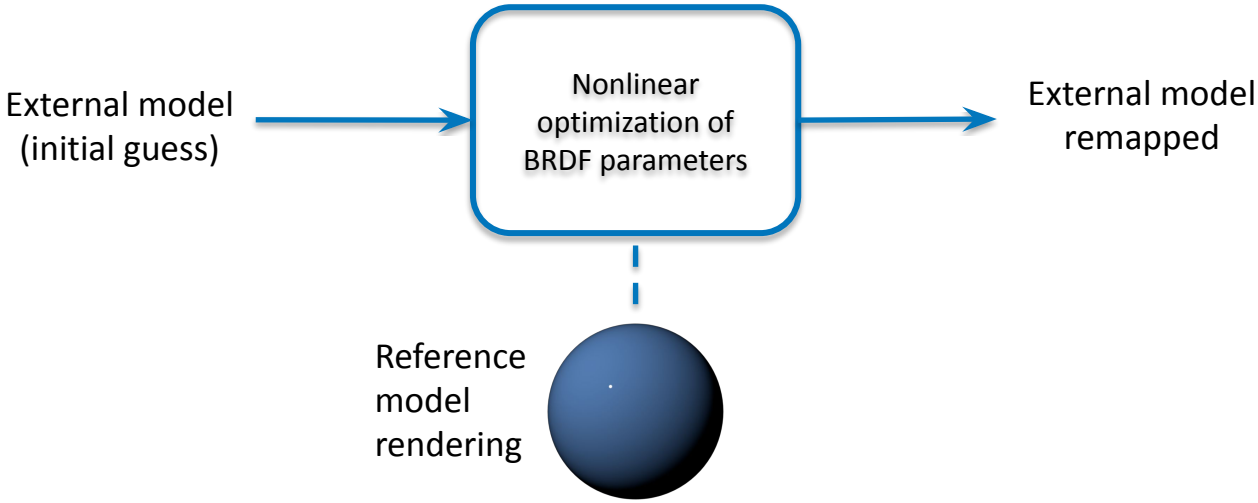
External BRDF model
(after remapping)

BRDF remapping

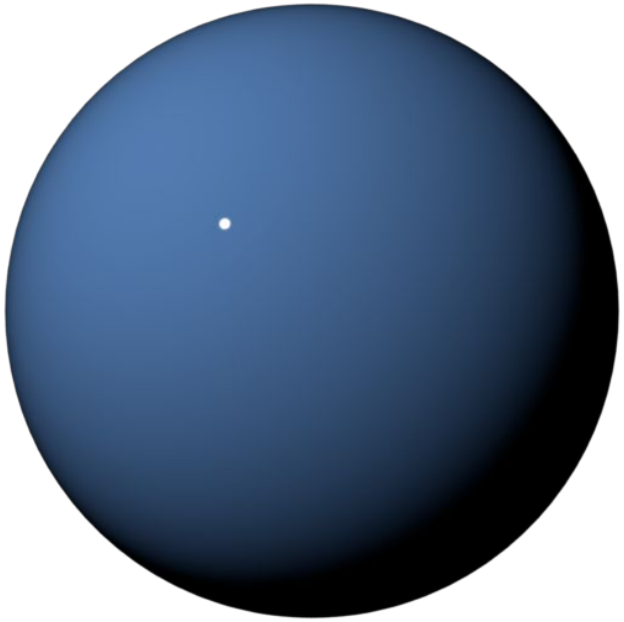
BRDF fitting



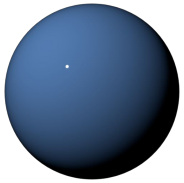
BRDF remapping



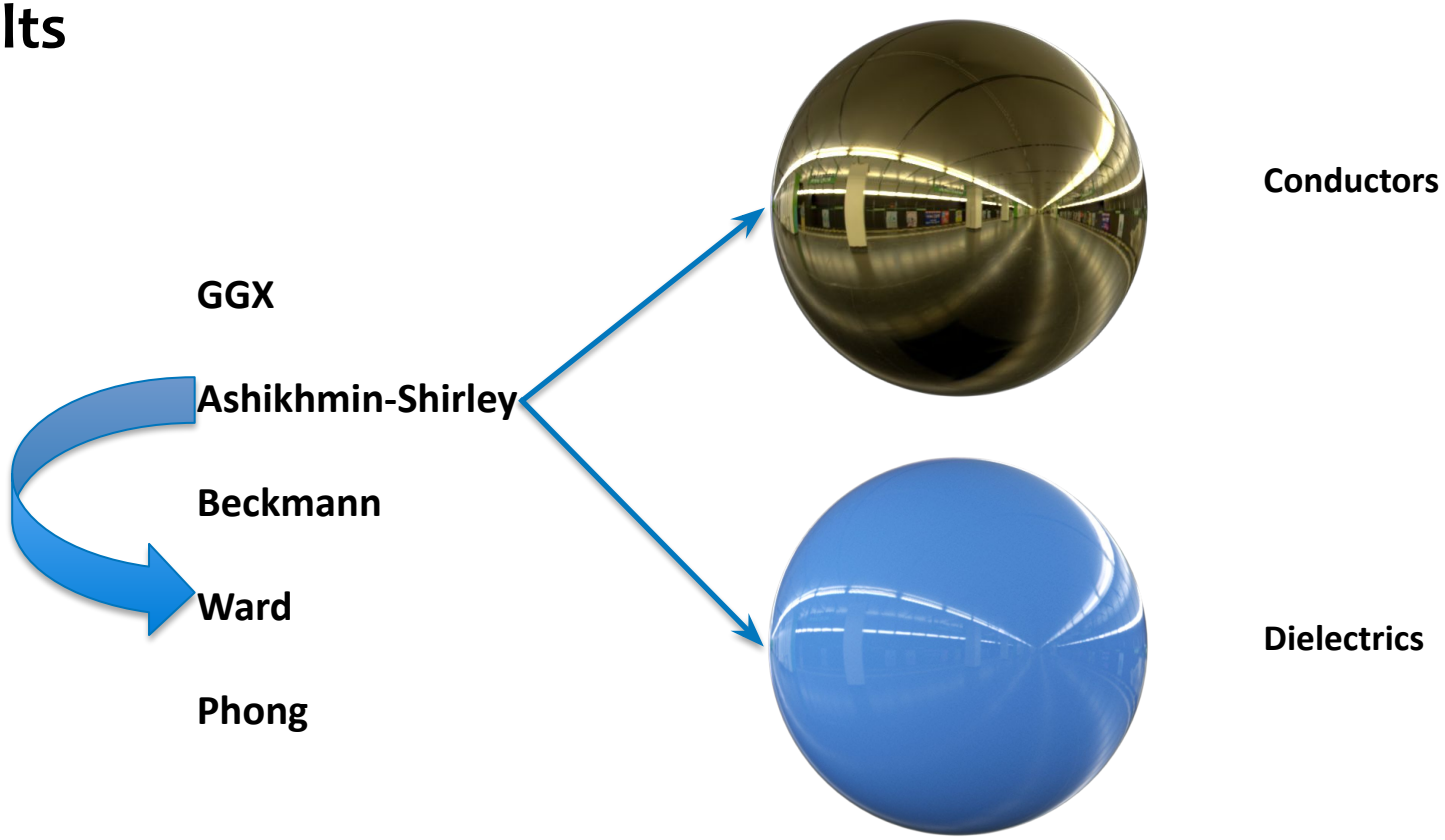
Appearance comparison



- **Spherical geometry**
- **Point light illumination**
- **L_2 metric for comparison**
- **Nonlinear optimization with TRF**



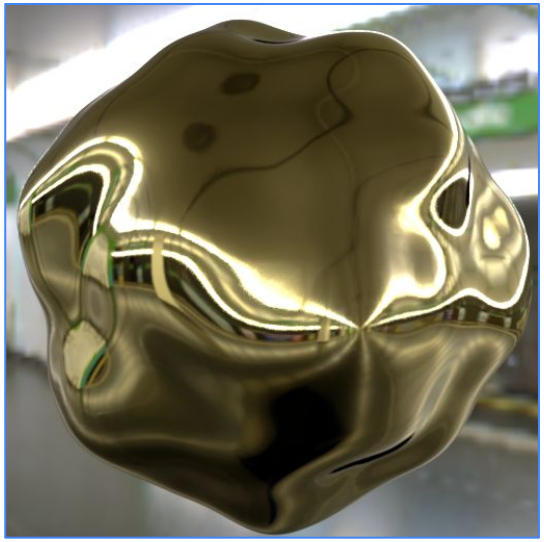
Results


GGX
Ashikhmin-Shirley
Beckmann
Ward
Phong
Conductors
Dielectrics

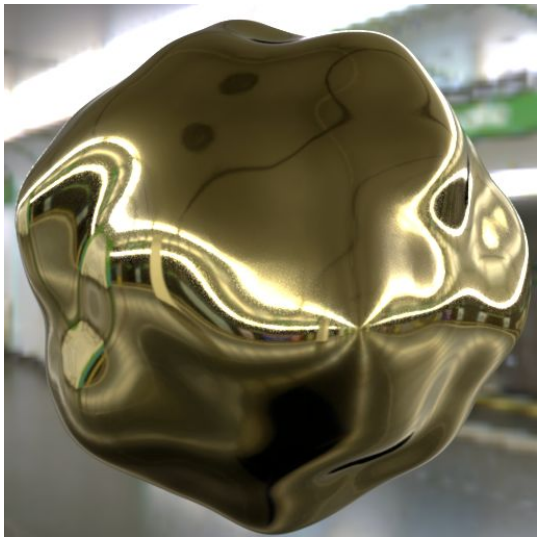
Results: conductors

Ashikhmin-Shirley
- RGB Reflectivity
- Roughness

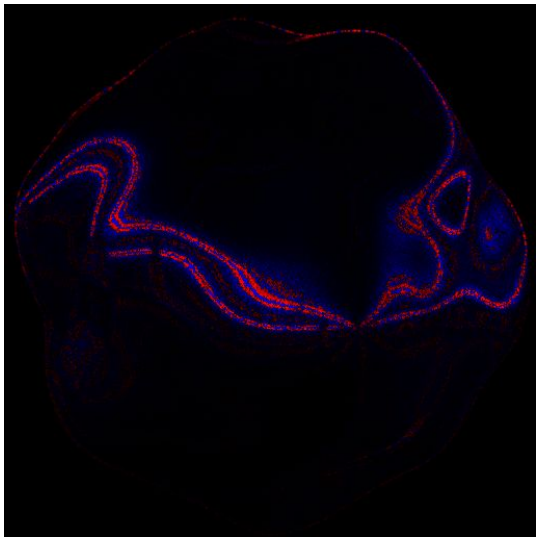
Ward
- RGB Specular reflectance
- Roughness



Reference Ashikhmin-Shirley BRDF



External Remapped GGX BRDF

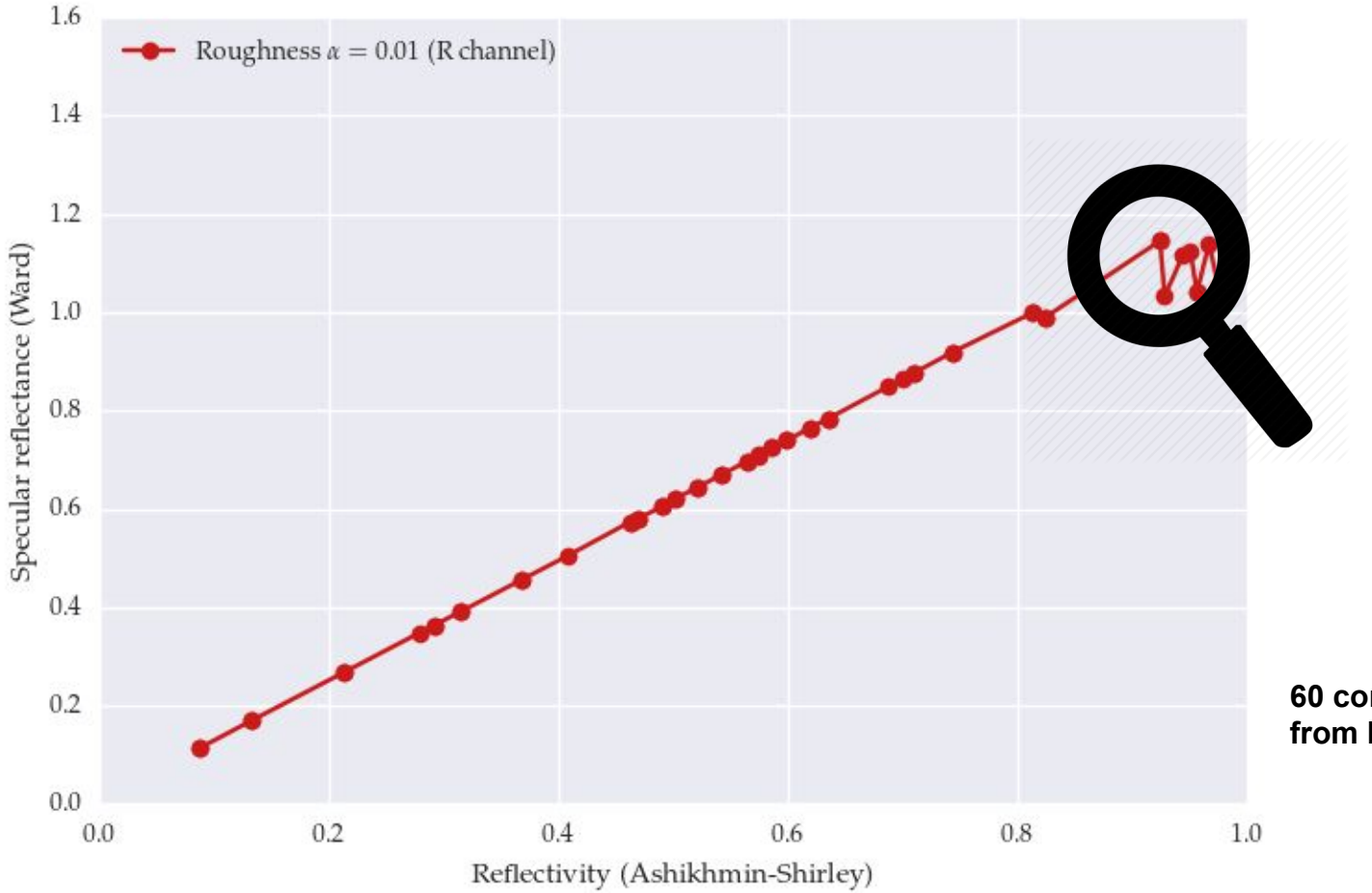


Error

Results: remapping of conductors

Ashikhmin-Shirley
- RGB Reflectivity
- Roughness

Ward
- RGB Specular reflectance
- Roughness

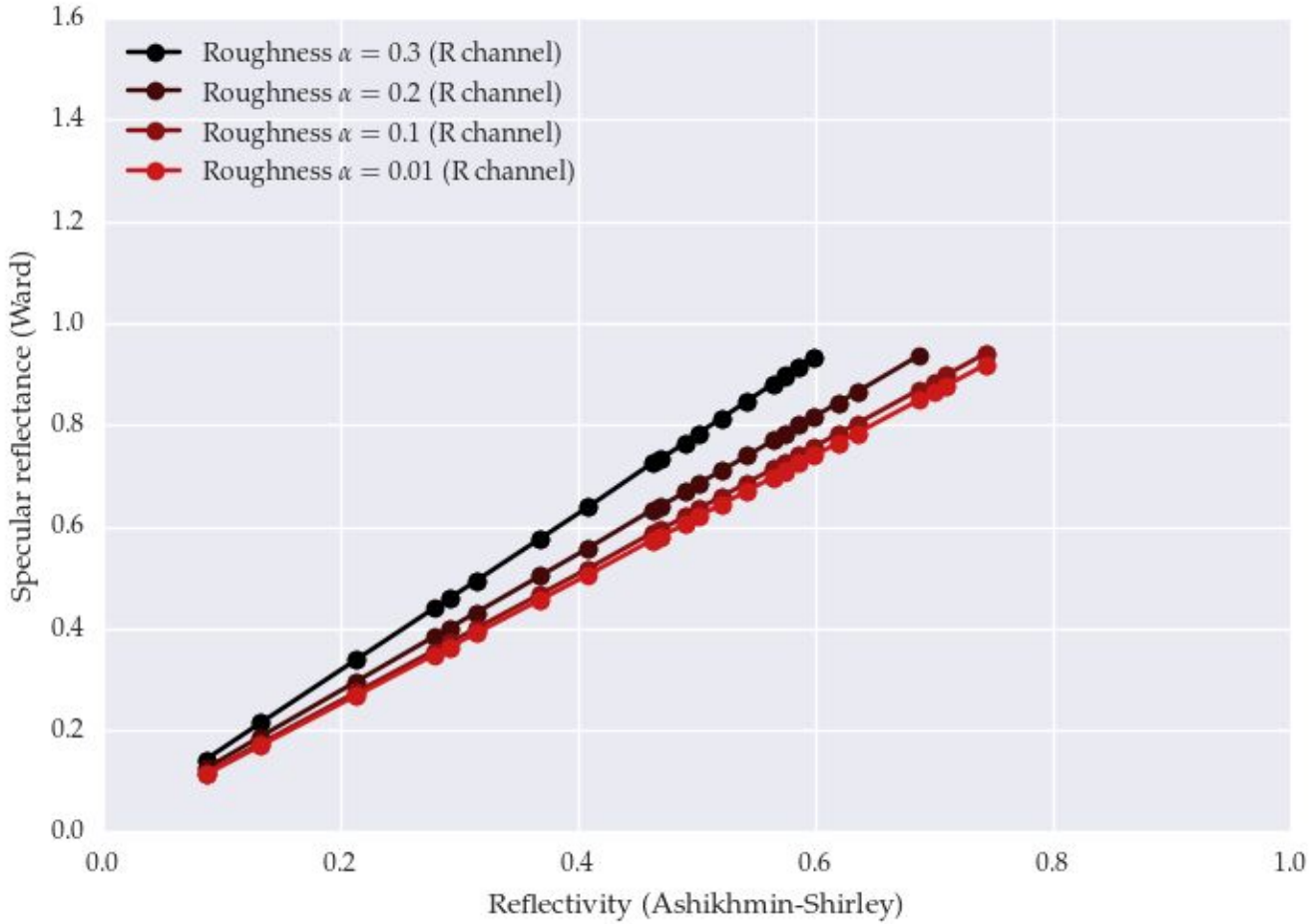


60 conductors from Mitsuba's DB

Results: remapping of conductors

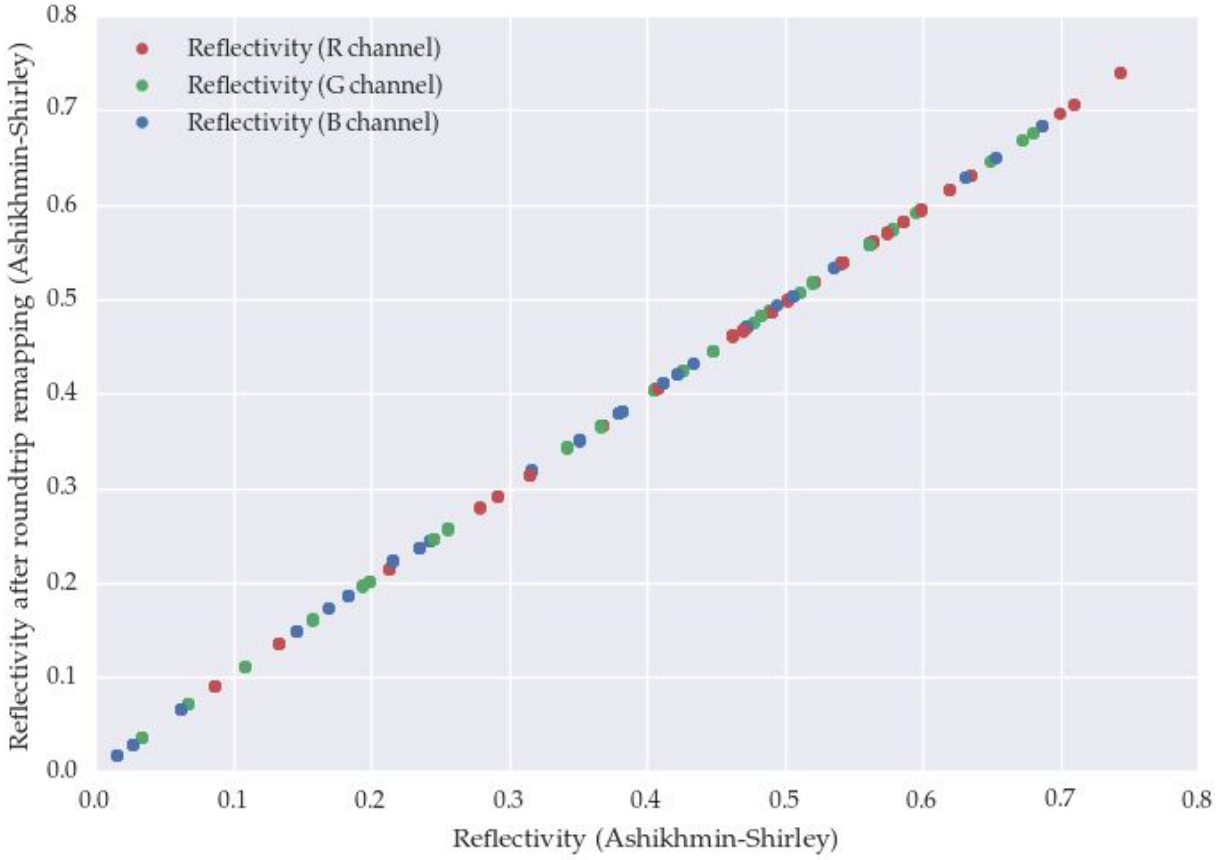
Ashikhmin-Shirley
- RGB Reflectivity
- Roughness

Ward
- RGB Specular reflectance
- Roughness



Results: remapping of conductors (roundtrip)

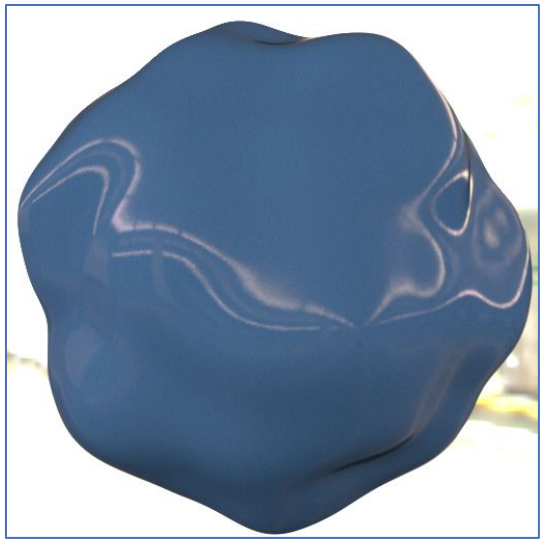
Ashikhmin-Shirley → Ward → Ashikhmin-Shirley



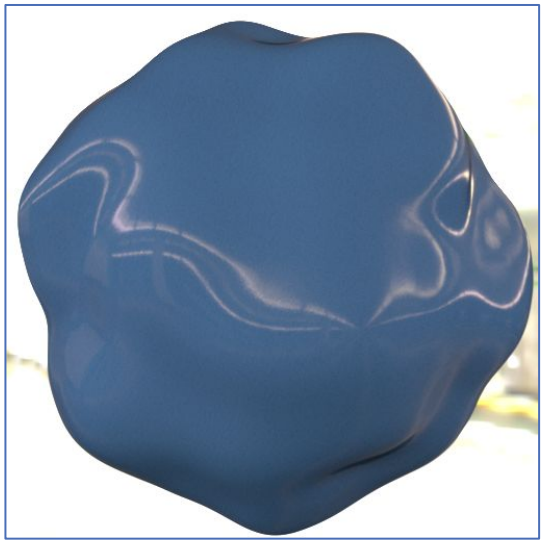
Results: dielectrics

Ashikhmin-Shirley
- RGB Diffuse reflectance
- IOR
- Roughness

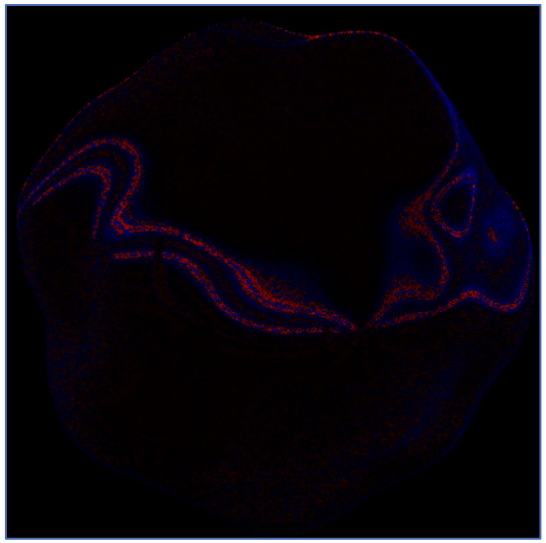
Ward
- RGB Diffuse reflectance
- RGB Specular reflectance
- Roughness



Reference Ashikhmin-Shirley BRDF.



External Remapped GGX BRDF



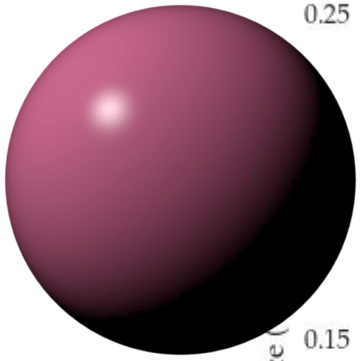
Error

Results: remapping of dielectrics

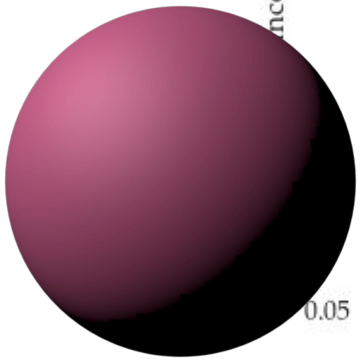
Ashikhmin-Shirley
- RGB Diffuse reflectance
- IOR
- Roughness

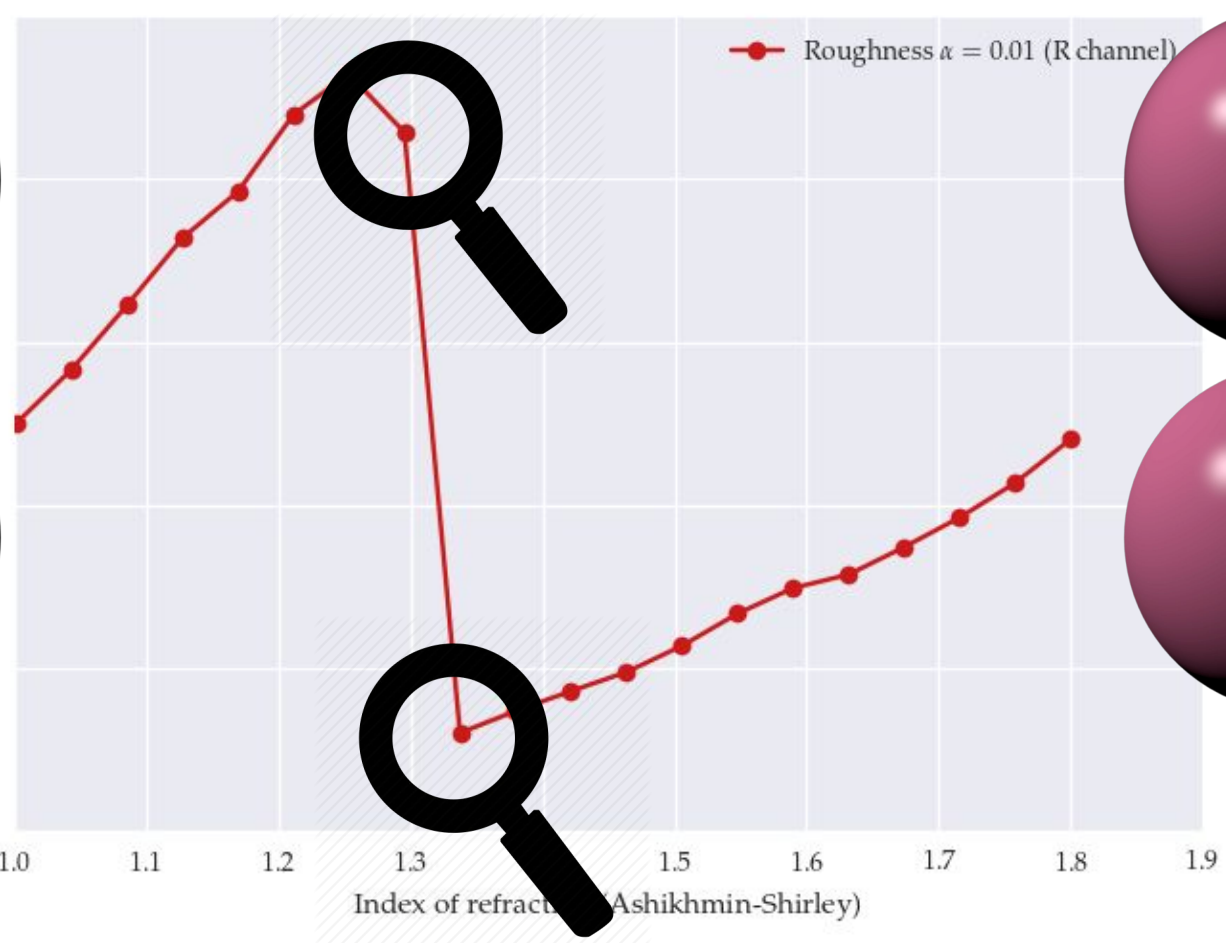
Ward
- RGB Diffuse reflectance
- RGB Specular reflectance
- Roughness

[Ashikhmin-Shirley]

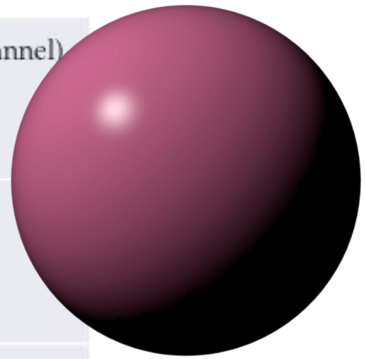


[Ward]

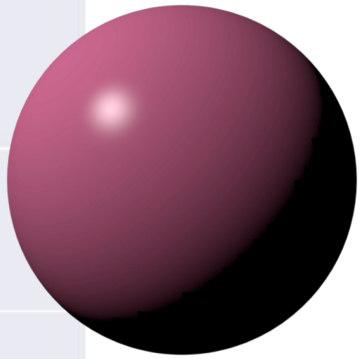




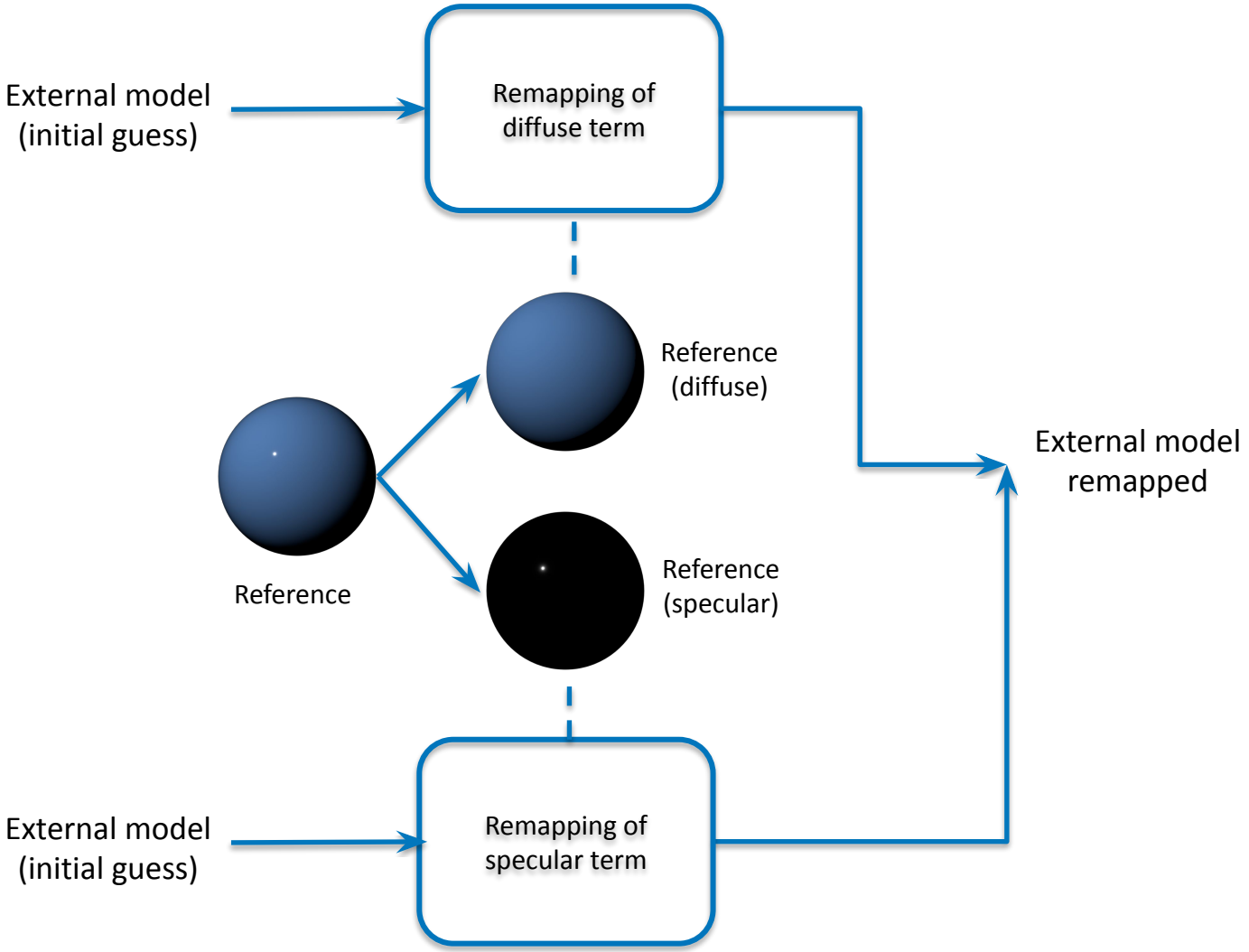
[Ashikhmin-Shirley]



[Ward]



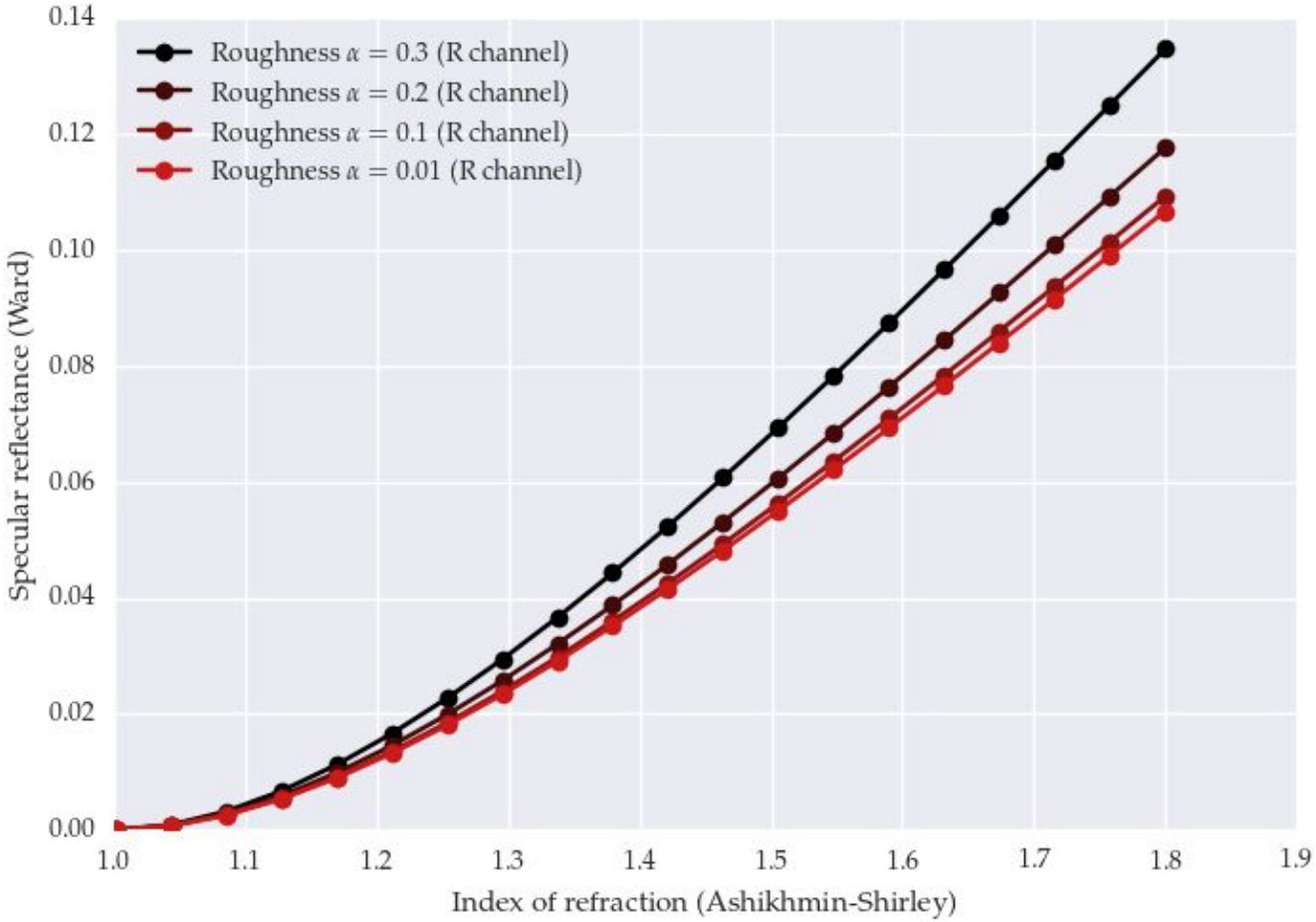
Remapping in two stages



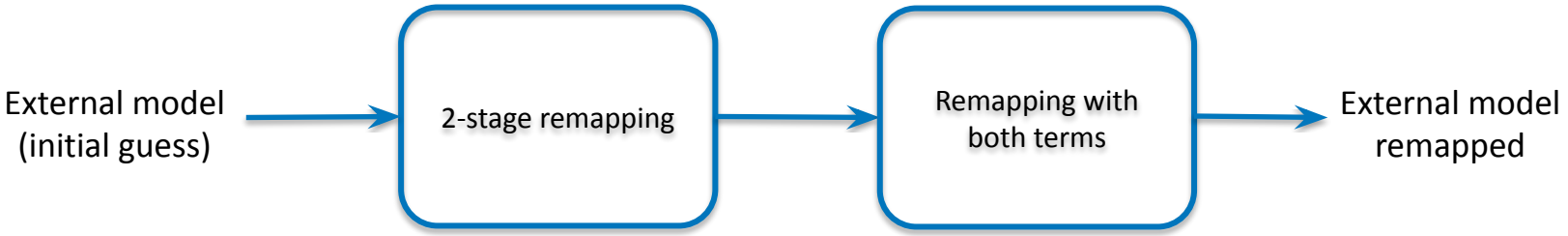
Results: 2-stage remapping of dielectrics

Ashikhmin-Shirley
- RGB Diffuse reflectance
- IOR
- Roughness

Ward
- RGB Diffuse reflectance
- RGB Specular reflectance
- Roughness



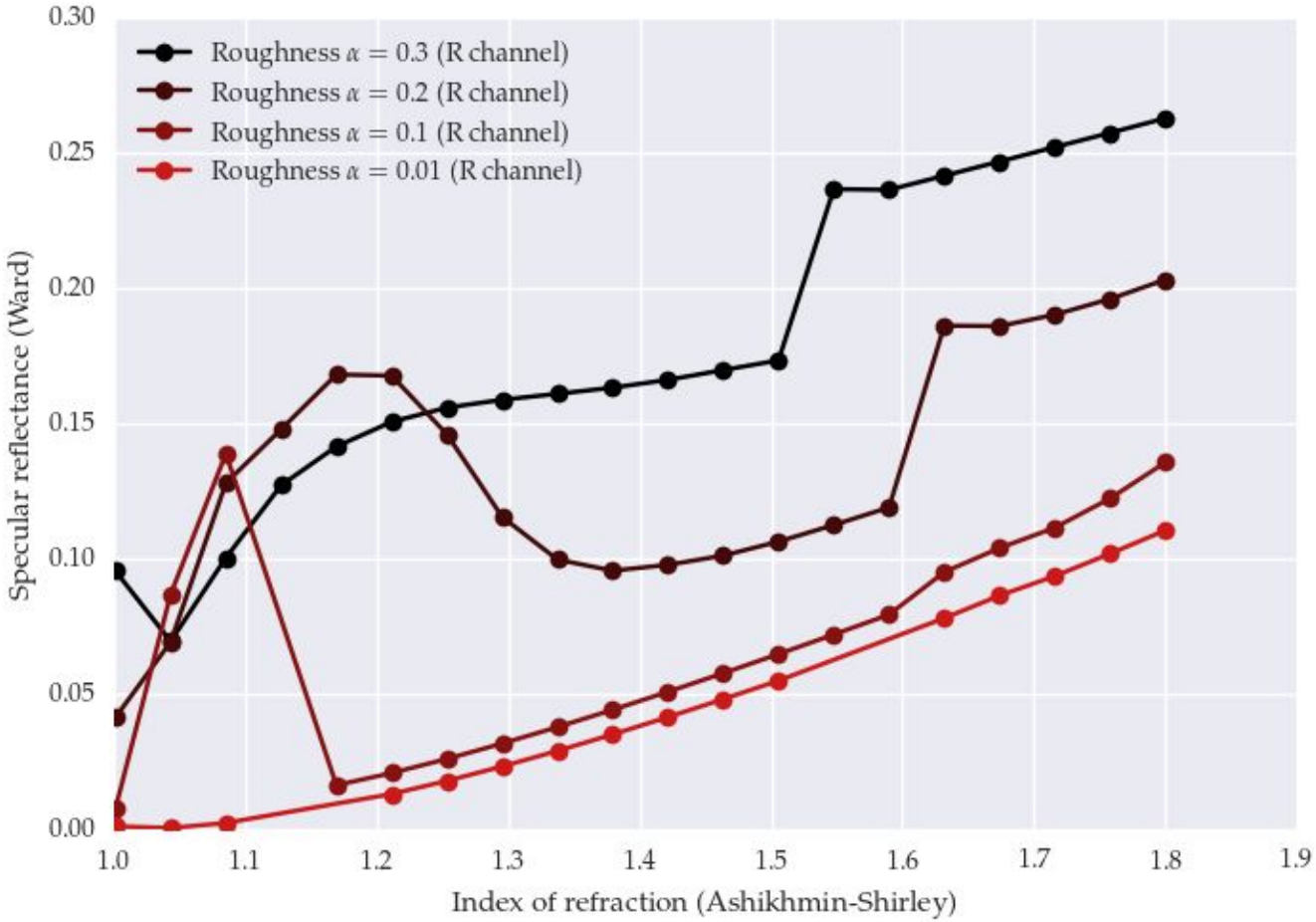
Remapping in three stages



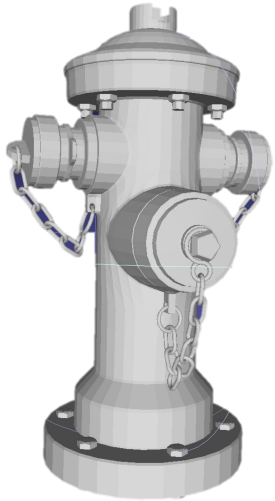
Results: 3-stage remapping of dielectrics

Ashikhmin-Shirley
- RGB Diffuse reflectance
- IOR
- Roughness

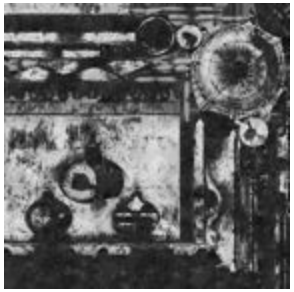
Ward
- RGB Diffuse reflectance
- RGB Specular reflectance
- Roughness



Current work: SVBRDF remapping



Diffuse map



Glossiness map

Specular map

Conclusions

- We presented a scheme for automatic remapping of uniform BRDFs without access to the BRDF implementations.
- The remapping procedure has been tested with both dielectric and conductor materials and with multiple BRDF models. Overall the transformation between models is robust, and in the cases where we find instabilities, these are generally located in a well-defined area of parameter space.
- When dealing with materials with both diffuse and specular terms, both need to be remapped independently to avoid instabilities.

Thank you!

*We would like to thank **Cyrille Damez** from **allegorithmic** for his contribution to the project.