Parameterization of Tabulated BRDFs

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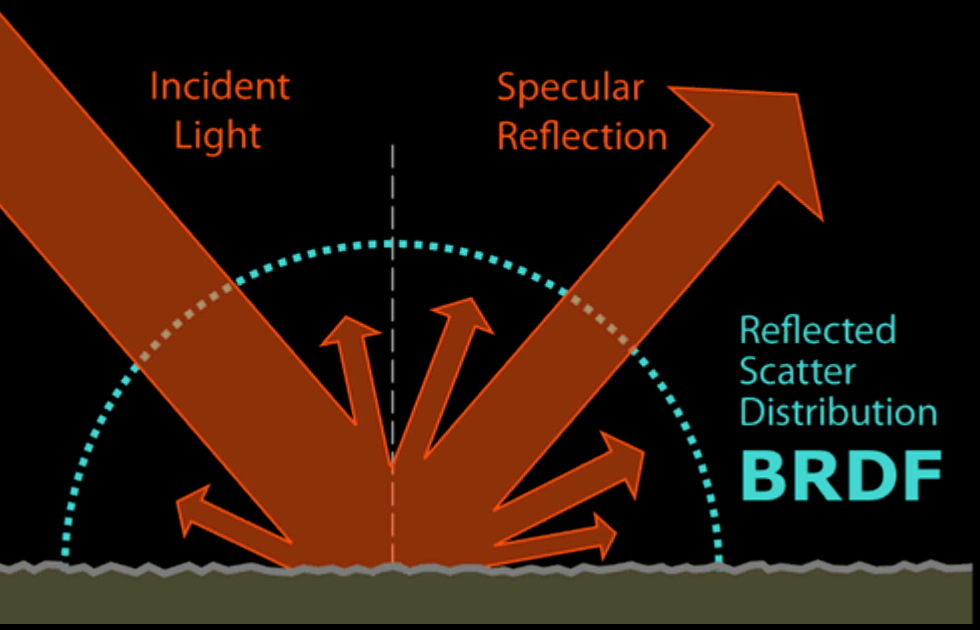
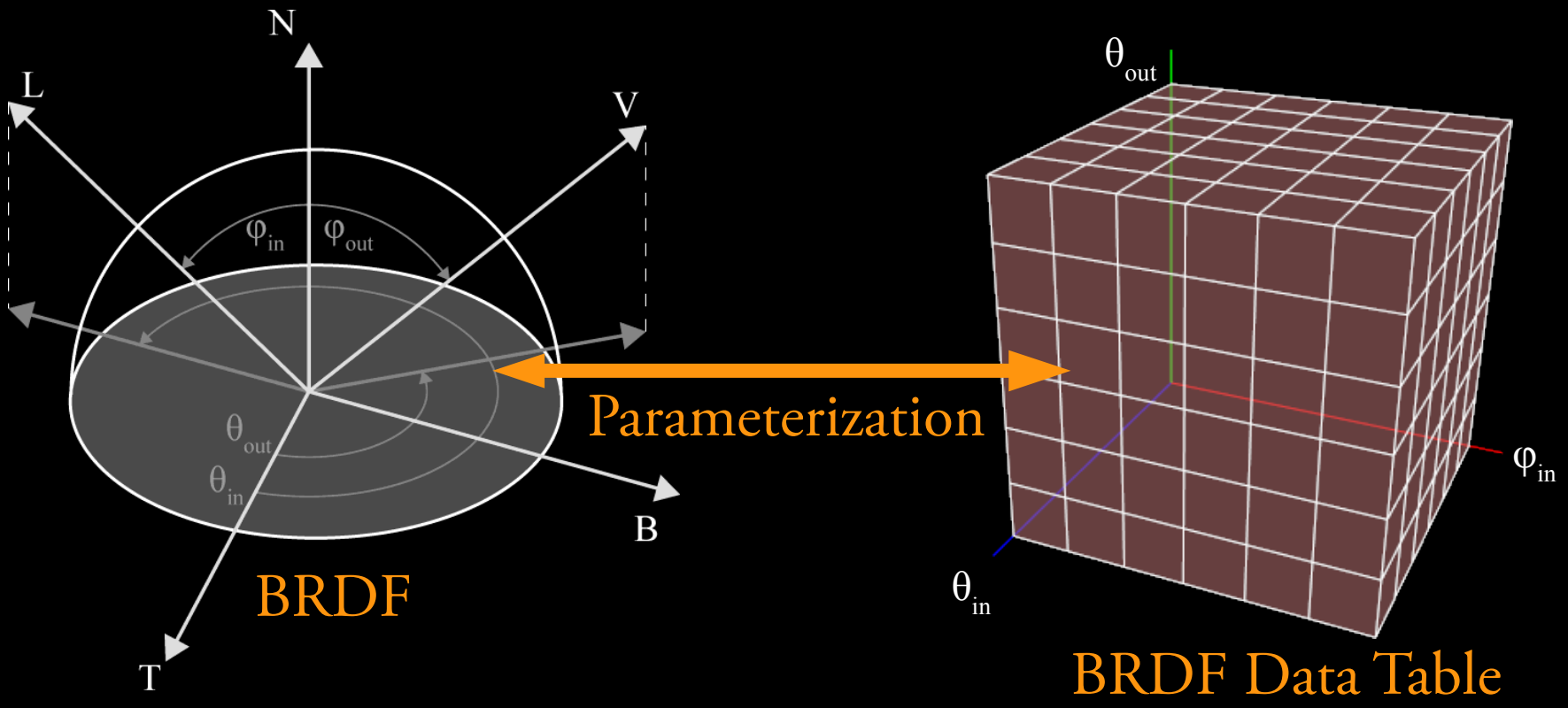
Background / Motivation



- BRDFs describe light scattering
- Extremely important to realism
- Measured data is realistic
  - e.g. Matusik et al. 2003

Background / Motivation

- What parameterization (mapping of data to BRDF's angle space) should we use?



Background / Motivation

- Literature lacks general methods to compare and generate parameterizations!

Contributions

1. Framework to generate and evaluate parameterizations

2. Provide example parameterization and analysis

3. Discuss related technical and theoretical issues

Mathematical Framework

- Want parameterization to importance-sample BRDF:

$$\frac{d\,\gamma}{d\,s} \propto BRDF(\gamma)$$

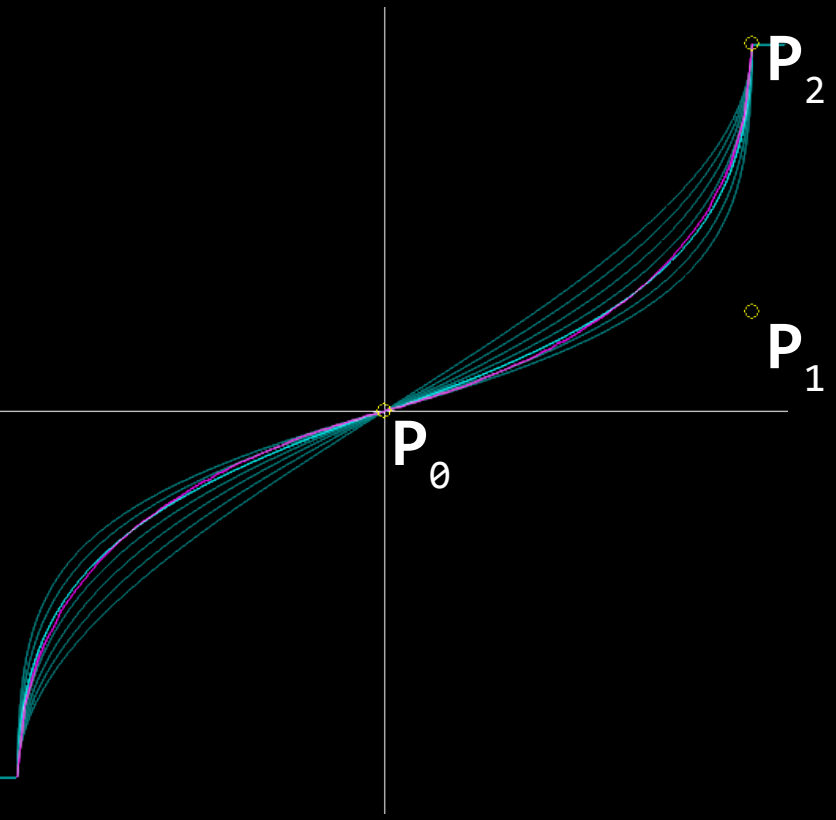
γ is angle state vector $(\theta_{in},\varphi_{in},\theta_{out},\varphi_{out})$

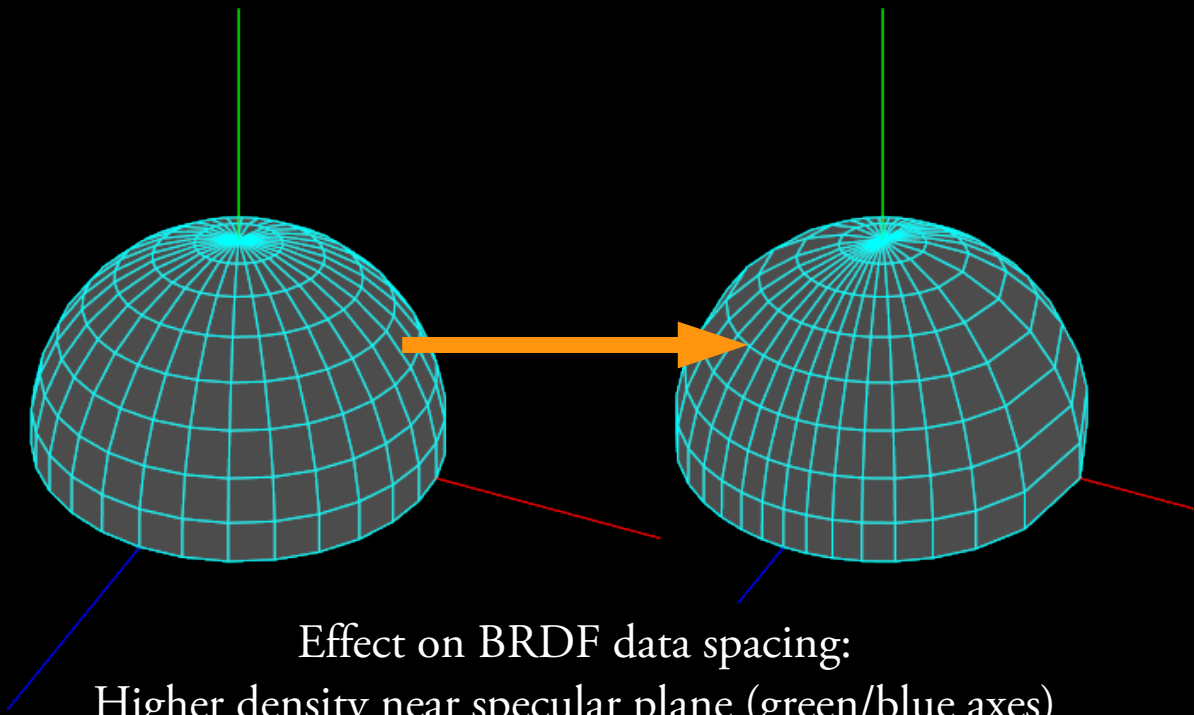
s is parameter vector $(s_{\theta in},s_{\varphi in},s_{\theta out},s_{\varphi out})$

- We describe how to formulate this in the paper

Example Parameterization

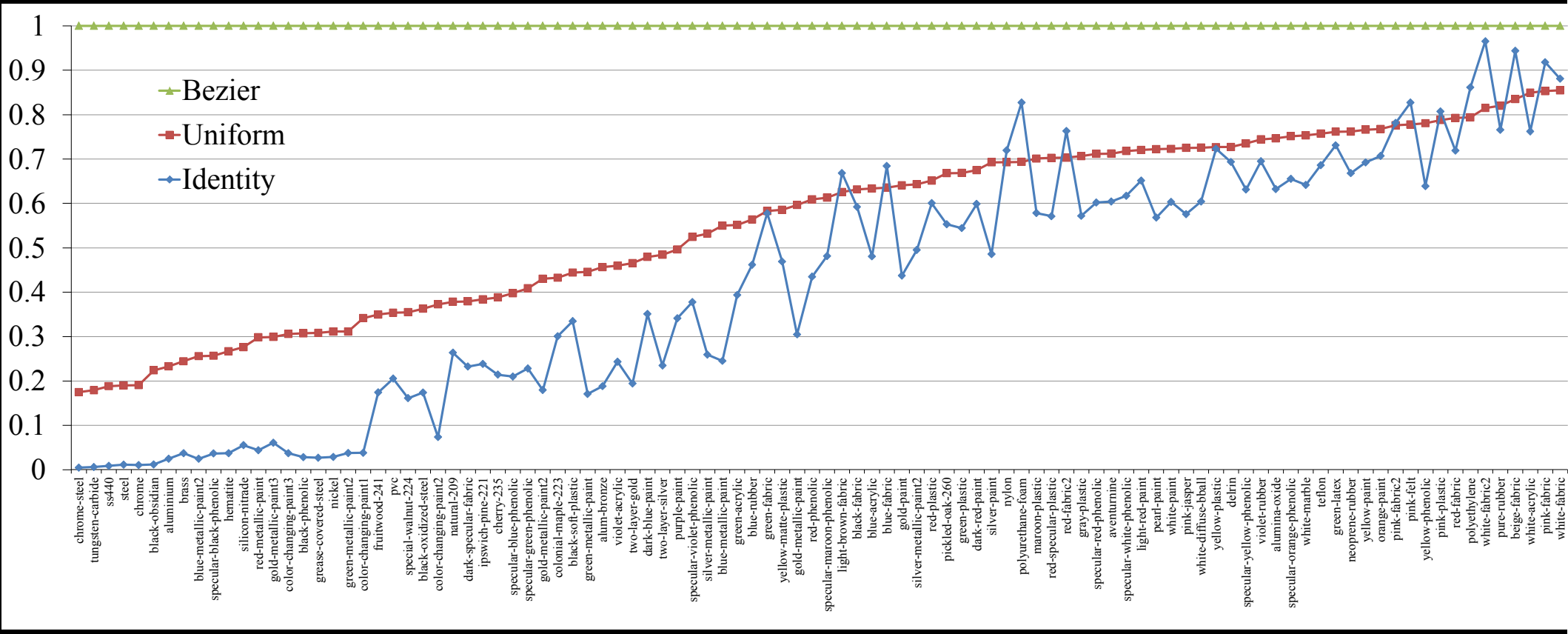
- Fit a quadratic Bézier curve for each table axis





Effect on BRDF data spacing:
Higher density near specular plane (green/blue axes)

Example Parameterization



Example Parameterization

- More examples in paper . . .

Higher-Order Reconstruction Filtering

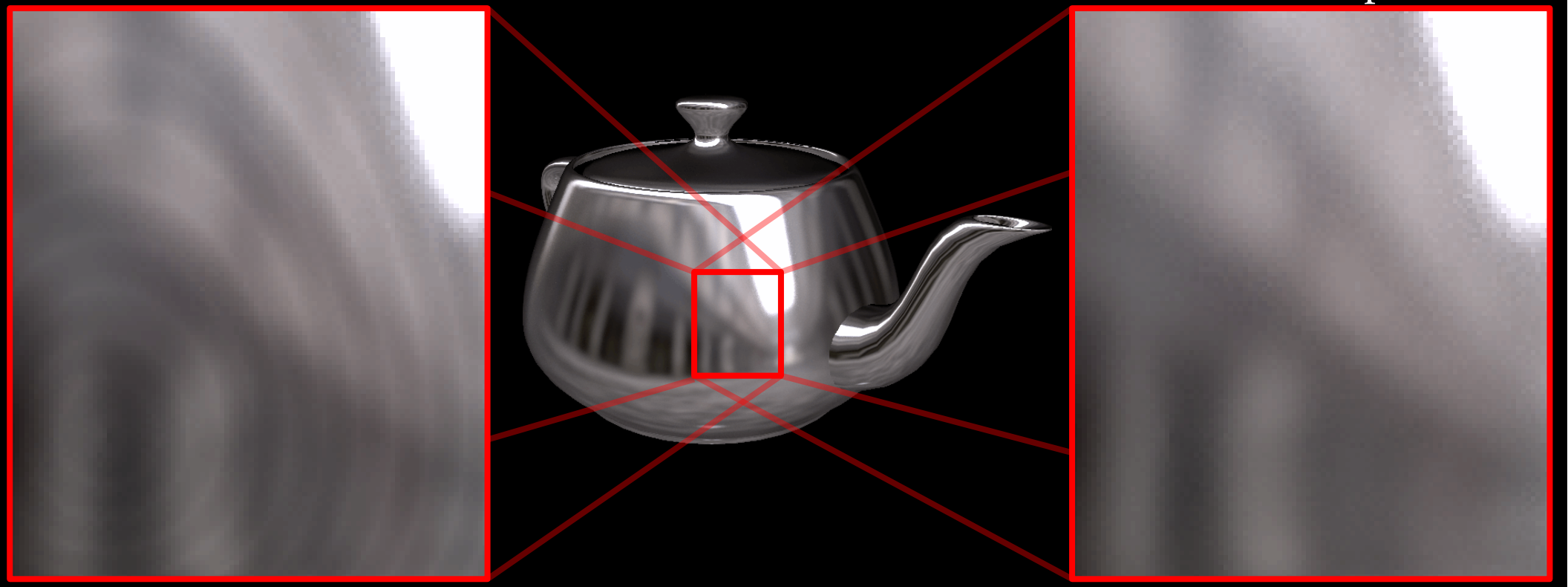
- Important for measured data

- We suggest cubic B-spline
  - Good results
  - Efficient GPU implementation (Sigg and Hadwiger 2005)

Higher-Order Reconstruction Filtering

Linear Filter

Higher-Order Filter (Cubic B-spline)



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Conclusion

- Propose new mathematical framework to generate and analyze parameterizations
- Validate our approach by generating and analyzing an example parameterization
- Discuss higher-order filtering for measured BRDFs

Questions

External Image Sources

- BRDF picture: Derived from https://en.wikipedia.org/wiki/Bidirectional_scattering_distribution_function#/media/File:BSDF05_800.png
- BRDF diagram: remade from http://cybertron.cg.tu-berlin.de/rapid_prototyping_11ws/rp_brdf/img/reflection_t.png
- University of Utah and CGI images adapted from respective websites