

An Adaptive Parameterization for Efficient Material Acquisition and Rendering

Supplemental Material: Parameterization Validation on the MERL Database

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Unity Technologies

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This supplemental material is a validation of our parameterization using the MERL database of measured BRDFs [MERL]. In order to provide an evaluation of our parameterization in terms of data compression, we also compare some renderings against the raw data and the current state-of-the-art best fitting algorithm (NPF) [NPF].

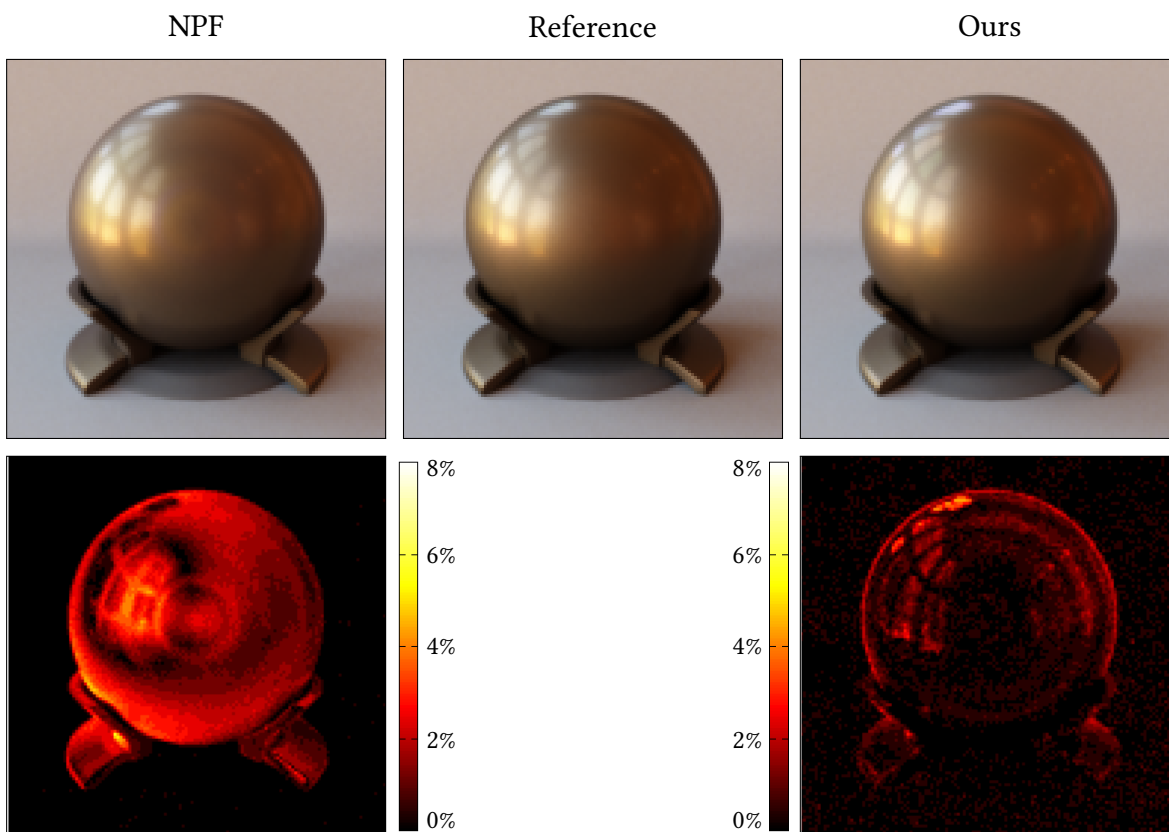
The images of the top table are rendered at a 128×128 resolution, using 4096 samples per pixel. We compute the NPF images based on the author’s reference implementation, although we rely on a microfacet NDF extracted from power iterations to importance sample the material efficiently without bias. The lighting is due to an HDR environment map, and all images are tonemapped the same way.

References

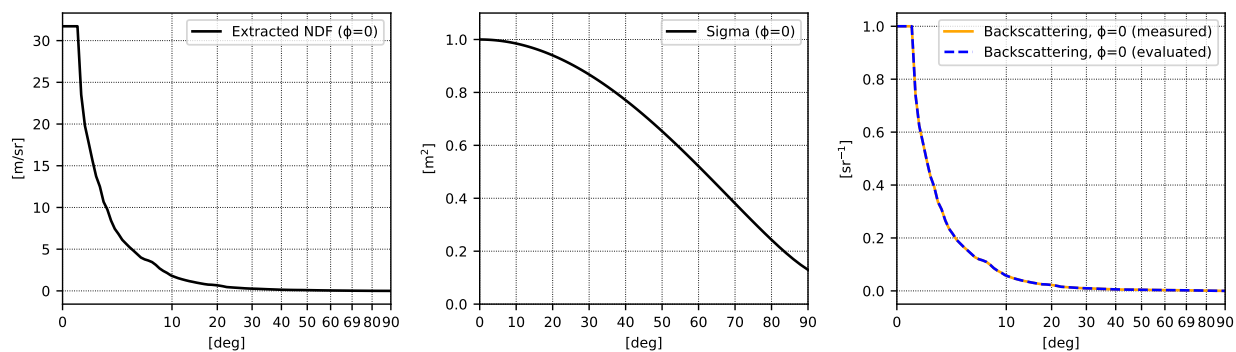
- [MERL] Wojciech Matusik, Hanspeter Pfister, Matt Brand, and Leonard McMillan, 2003, “A Data-Driven Reflectance Model”, *ACM Transactions on Graphics*, 22 (3), 759-769. ([document](#))
- [NPF] Mahdi M. Bagher and John Snyder and Derek Nowrouzezahrai, 2016, “A Non-Parametric Factor Microfacet Model for Isotropic BRDFs”, *ACM Transactions on Graphics*, 35 (5), 1509-1518. ([document](#))

1 alum-bronze

Renderings and CIE dE00



Plots

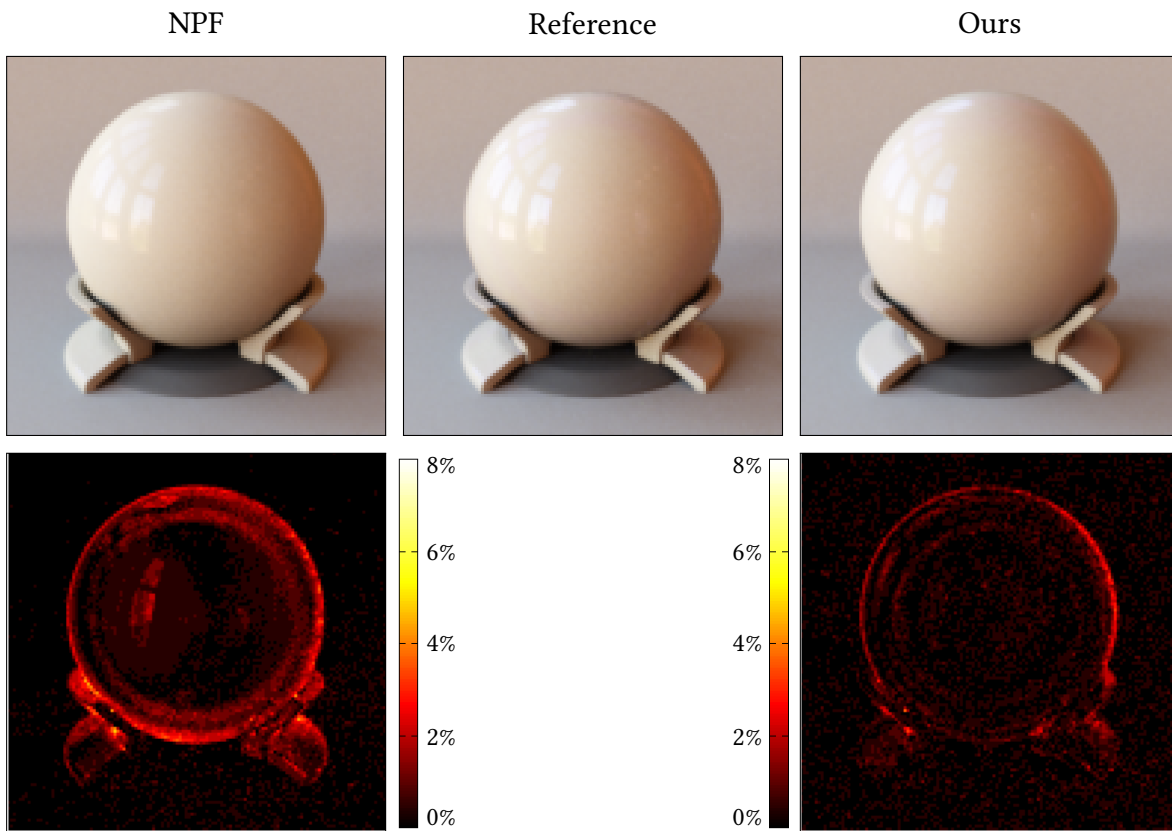


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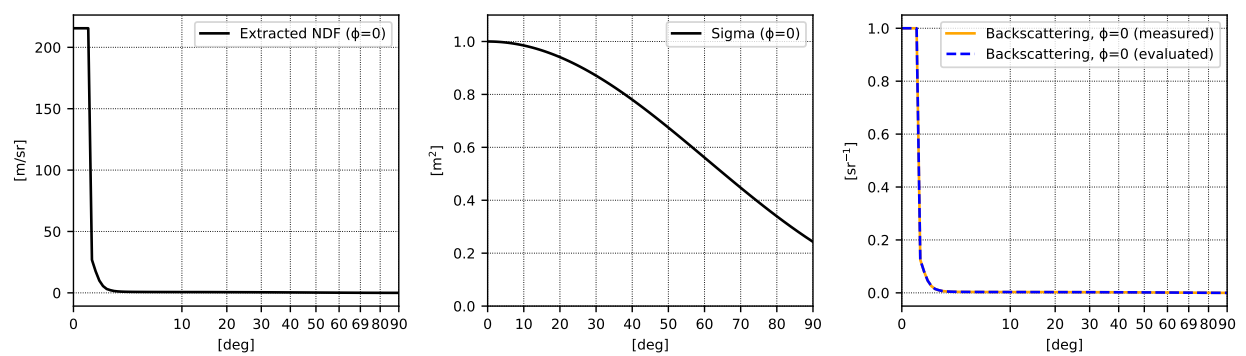


2 alumina-oxide

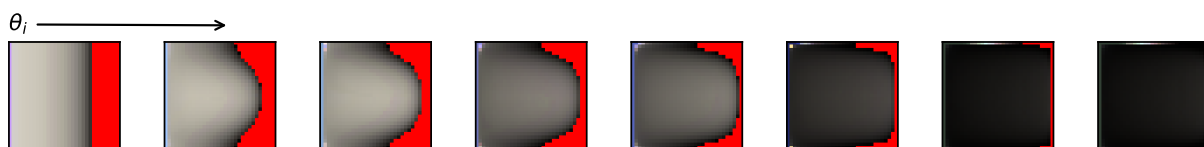
Renderings and CIE dE00



Plots

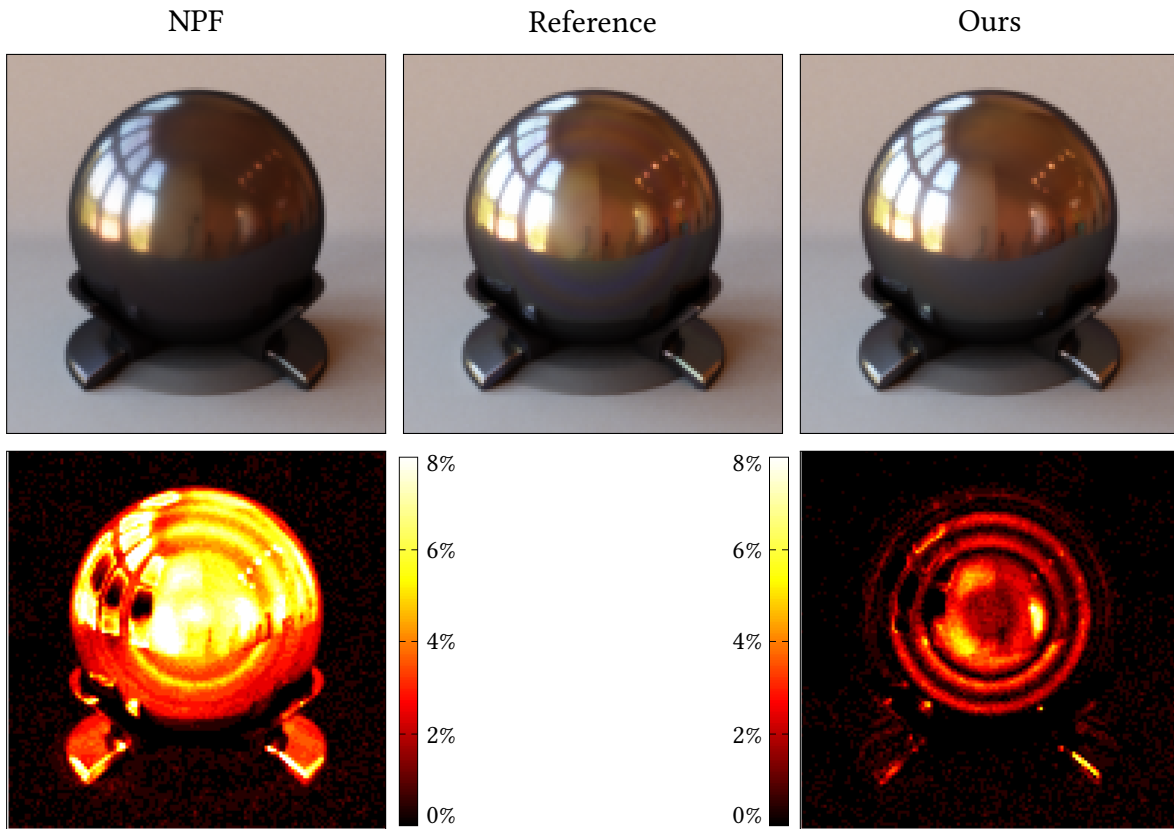


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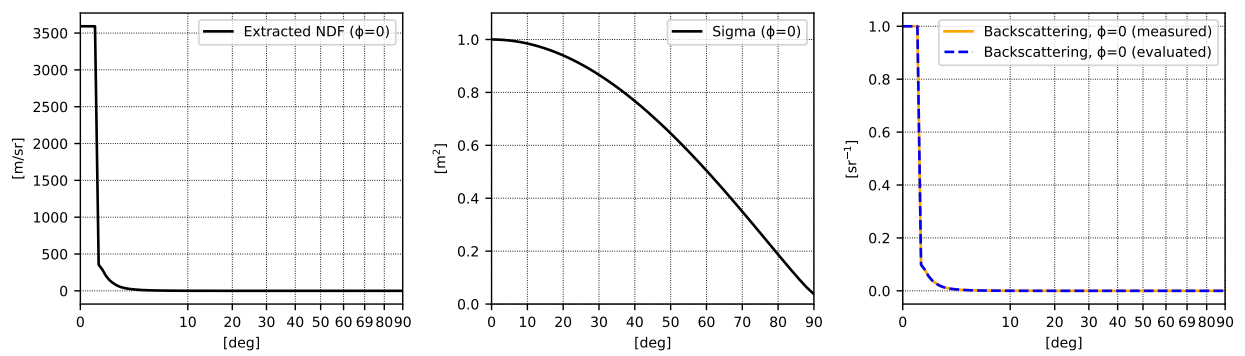


3 aluminium

Renderings and CIE dE00



Plots

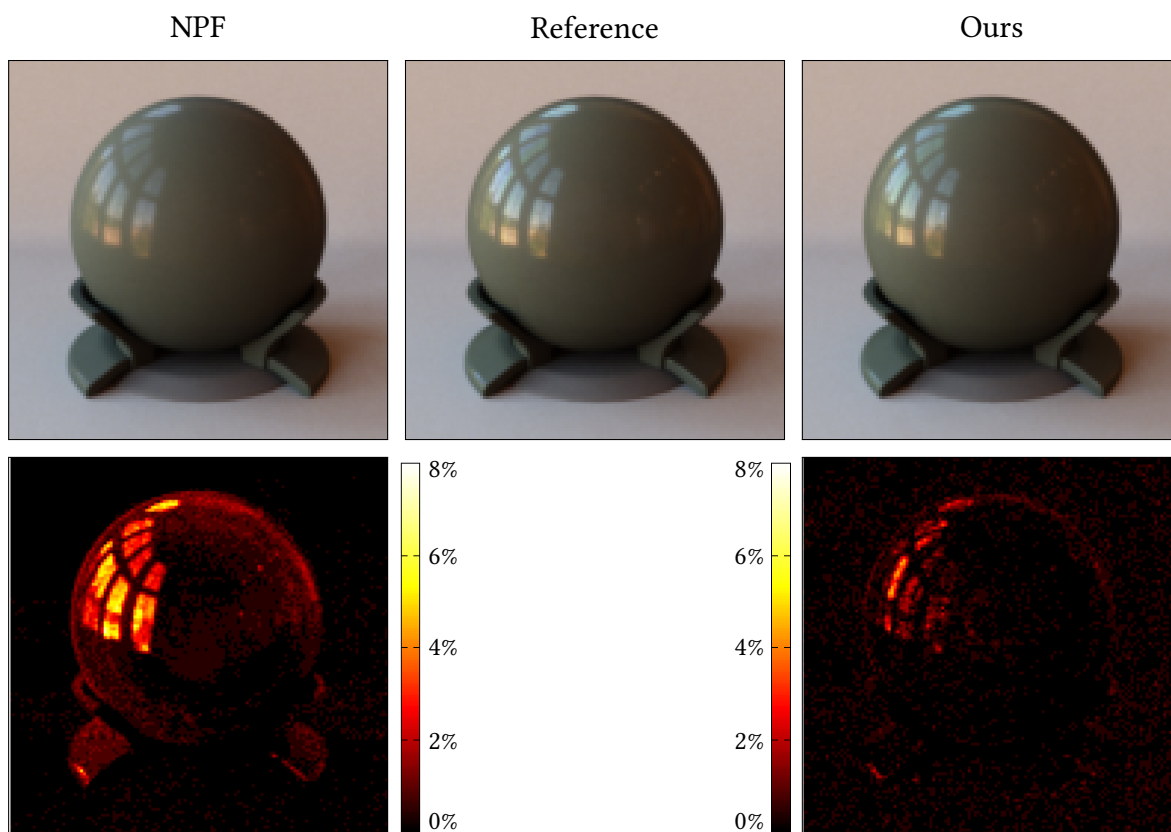


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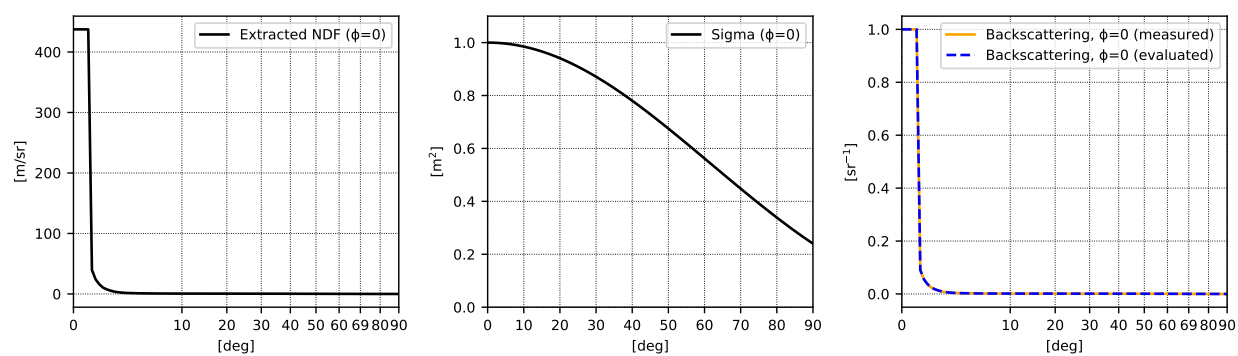


4 aventurnine

Renderings and CIE dE00



Plots

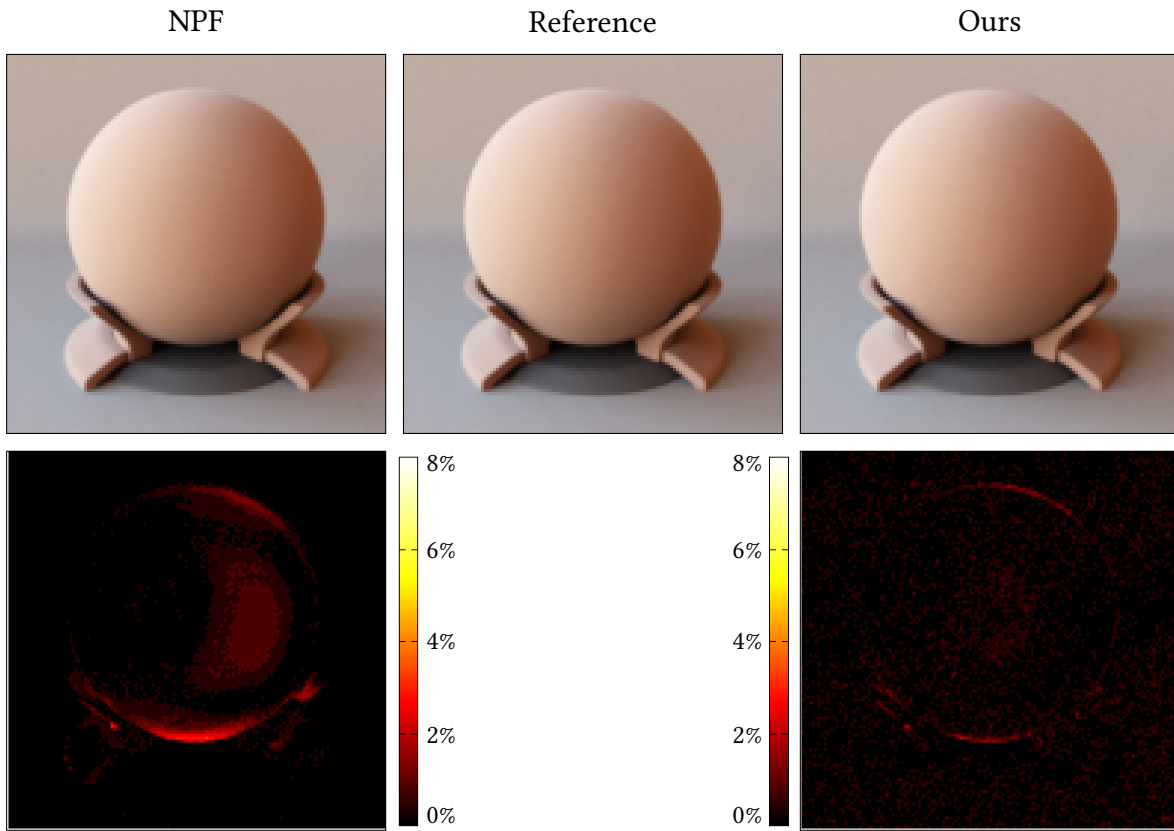


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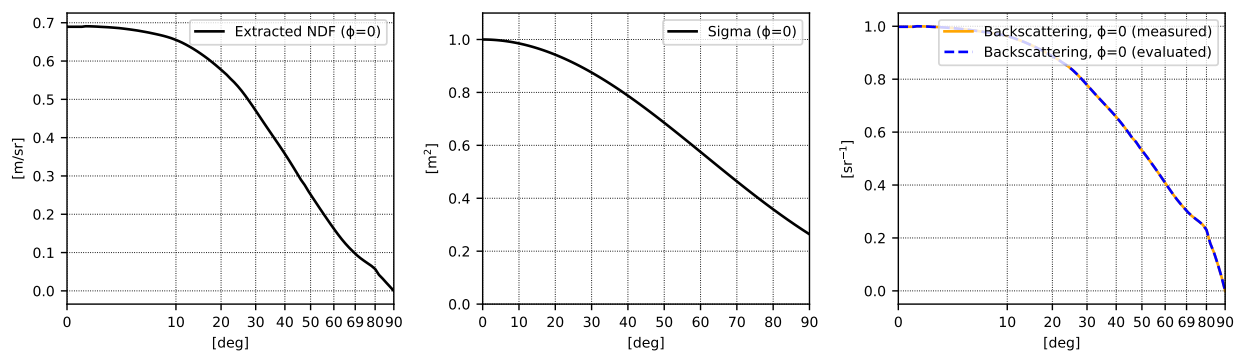


5 beige-fabric

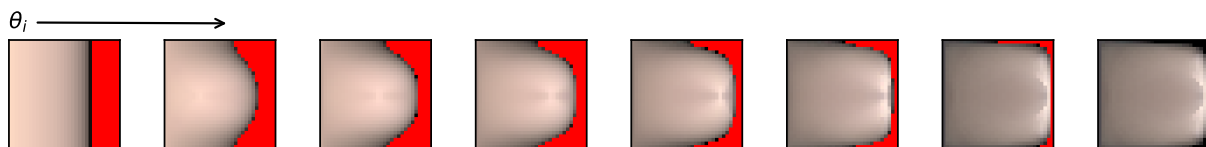
Renderings and CIE dE00



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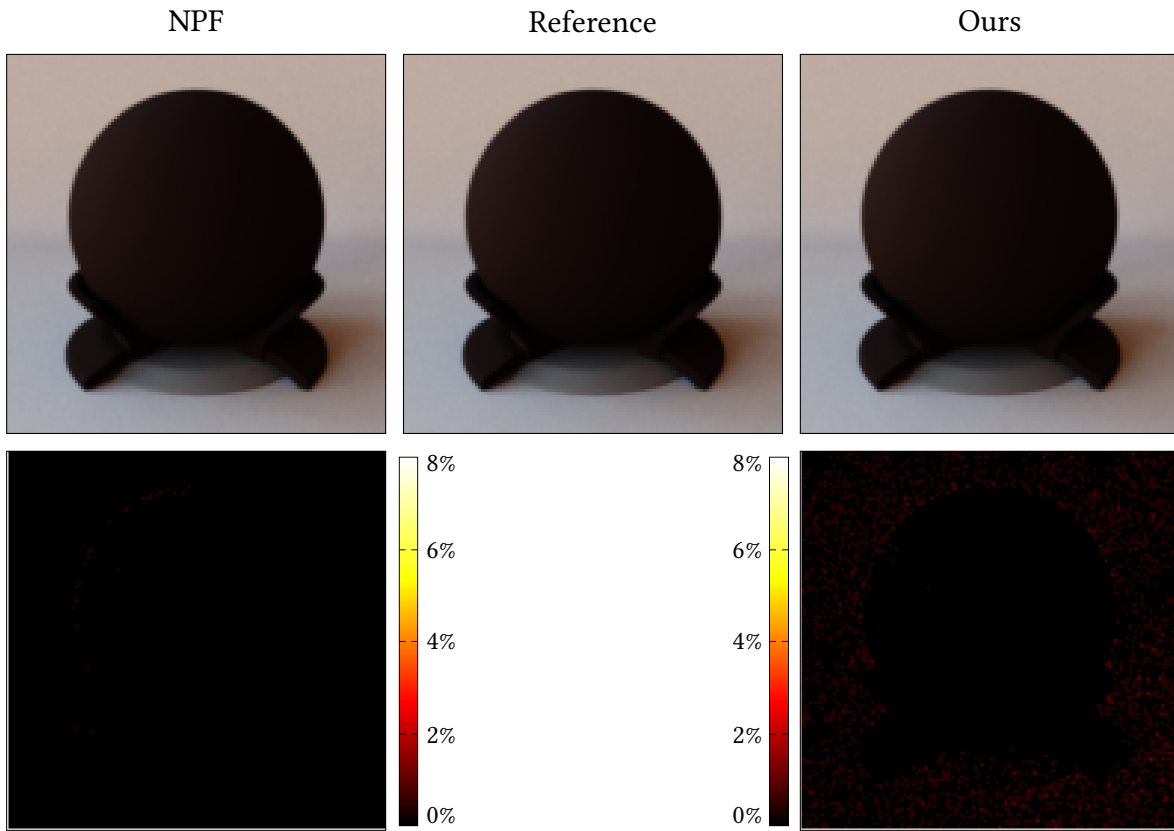


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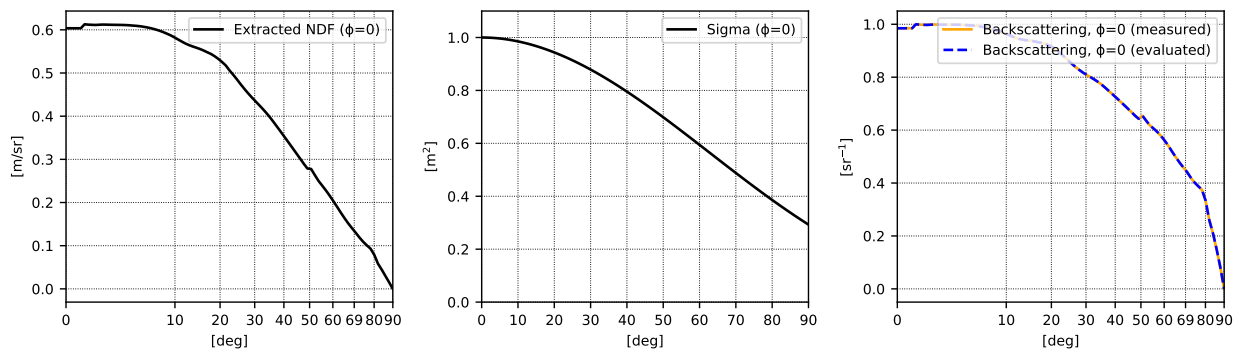


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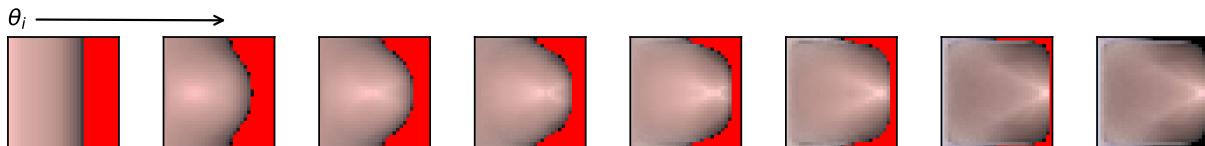
Renderings and CIE dE00



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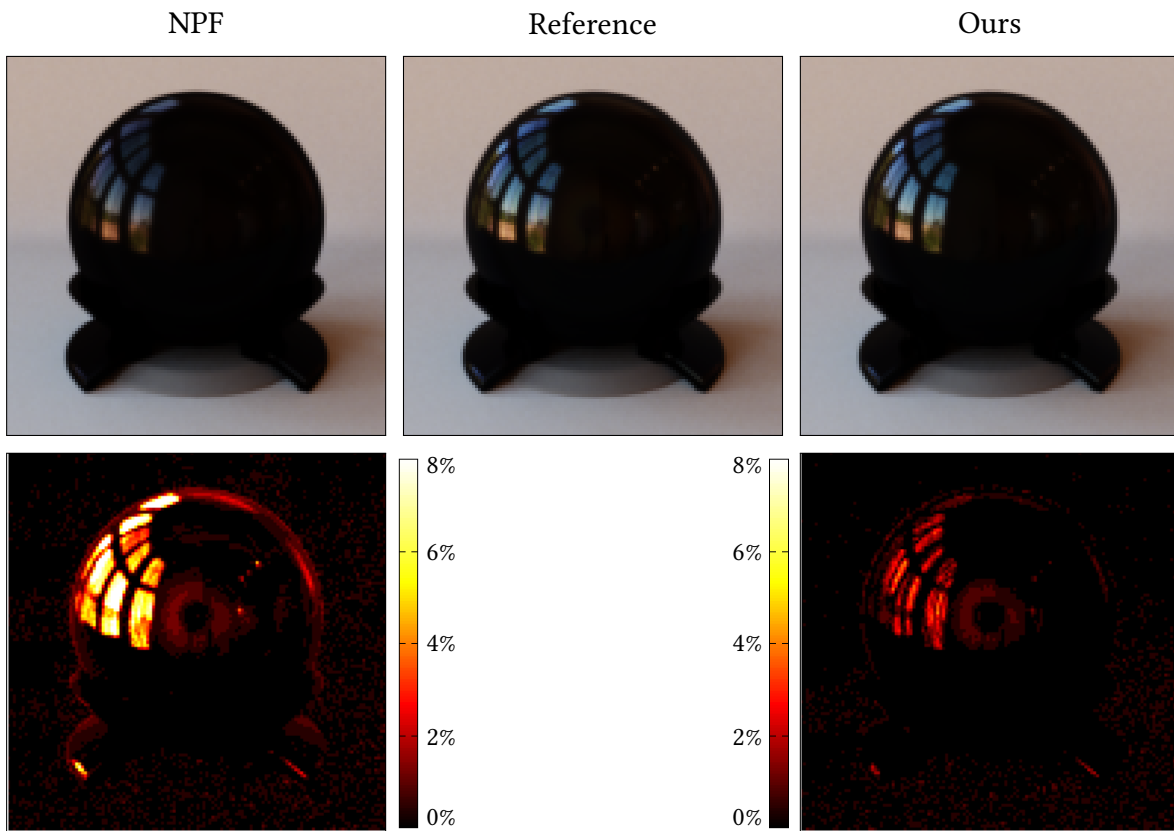


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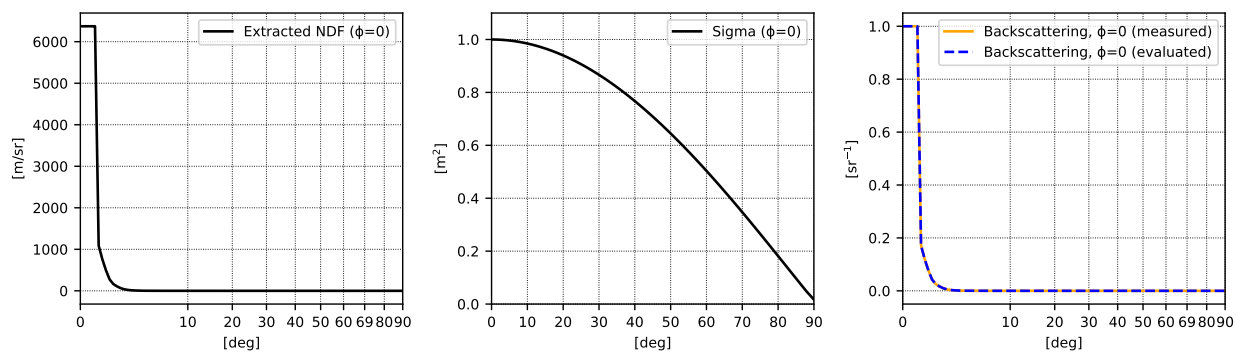


7 black-obsidian

Renderings and CIE dE00



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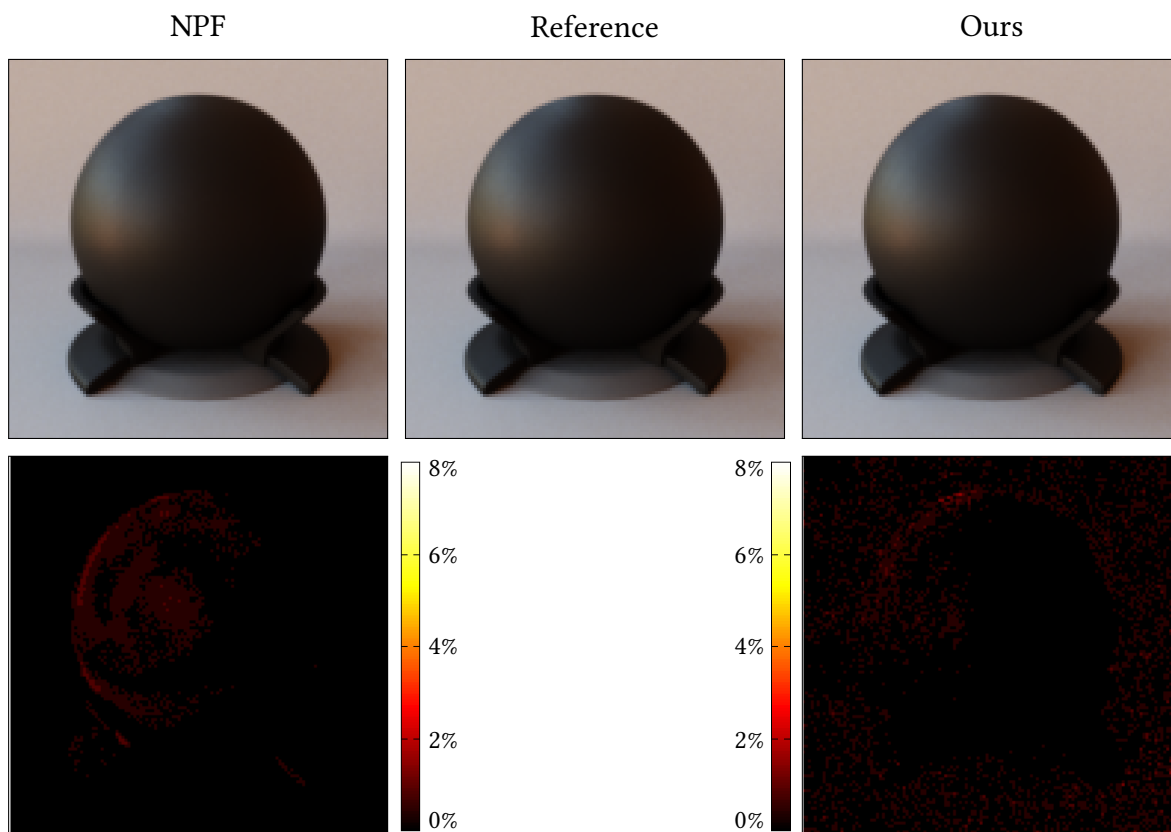


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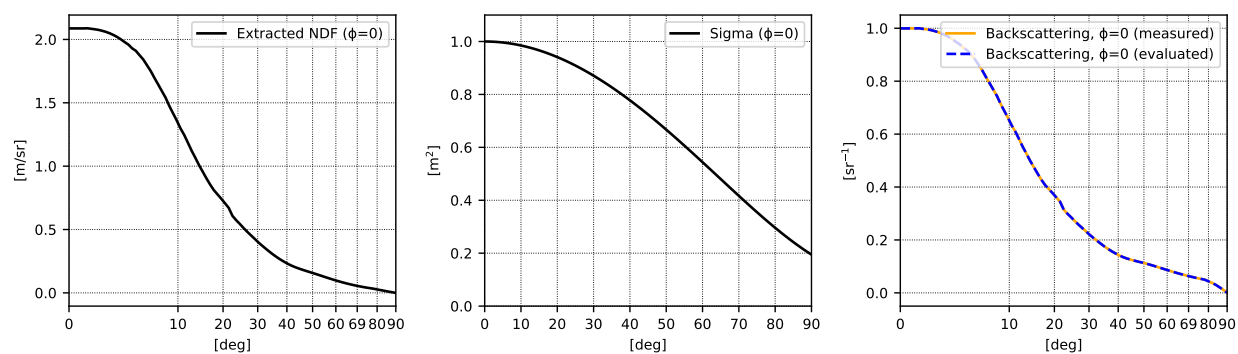


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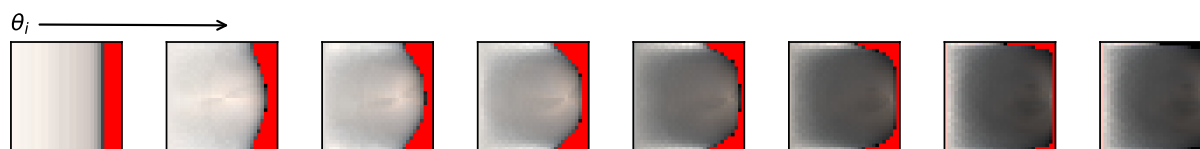
Renderings and CIE dE00



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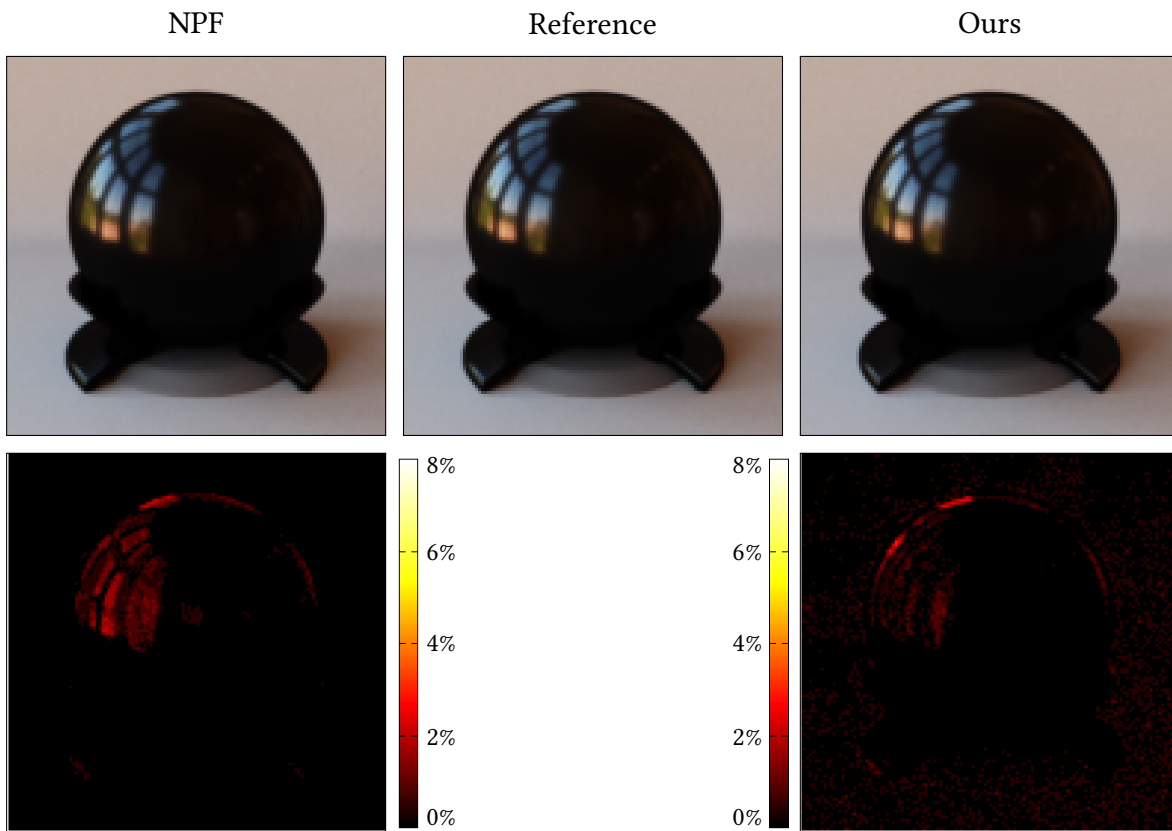


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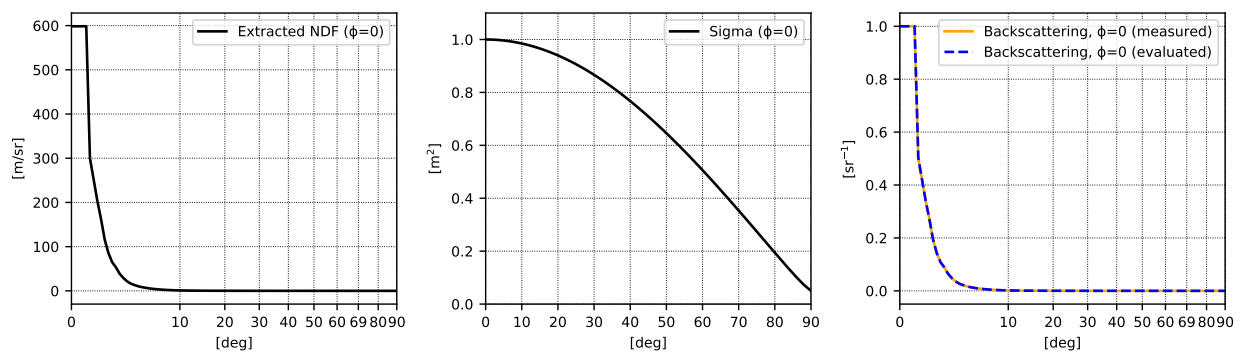


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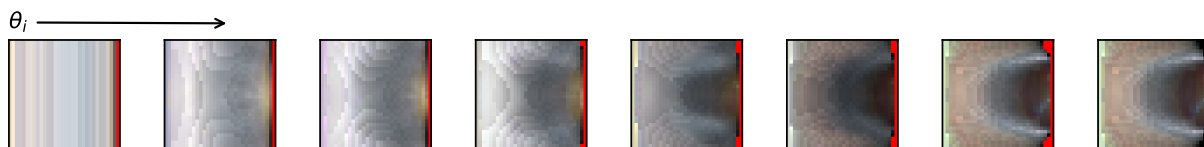
Renderings and CIE dE00



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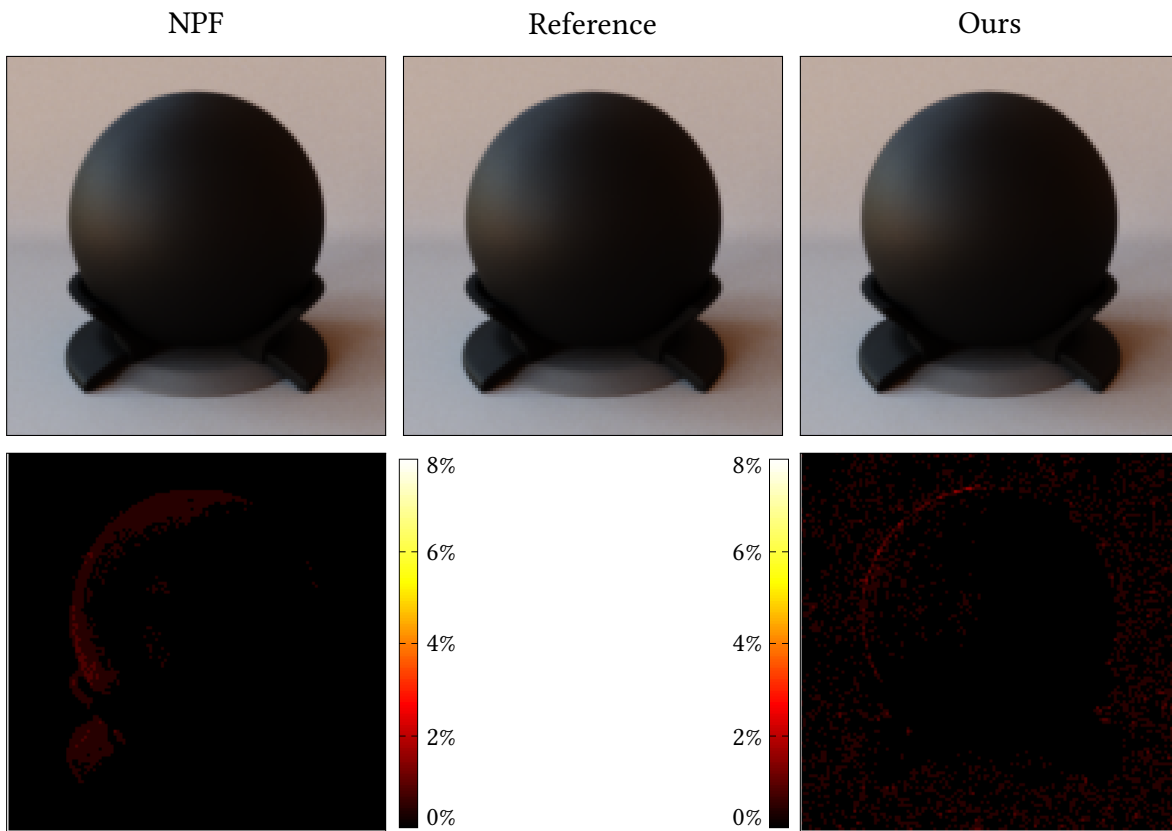


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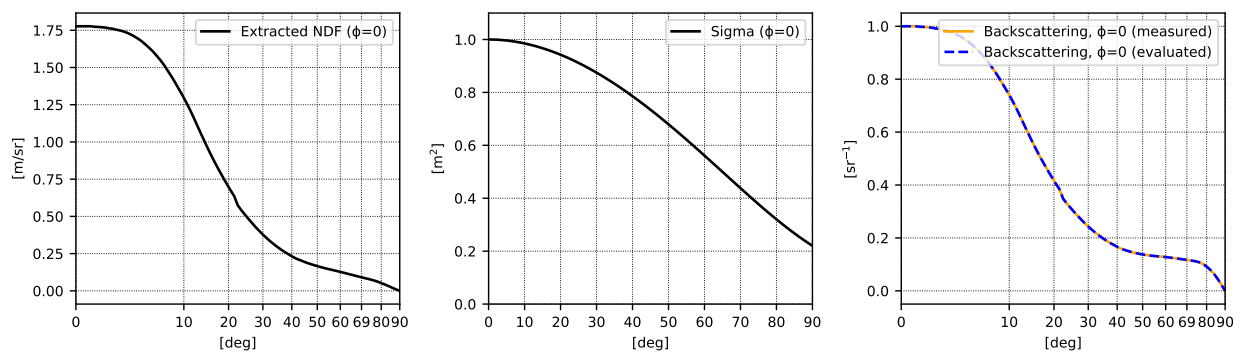


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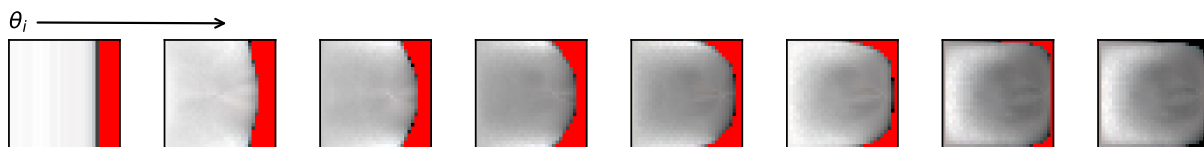
Renderings and CIE dE00



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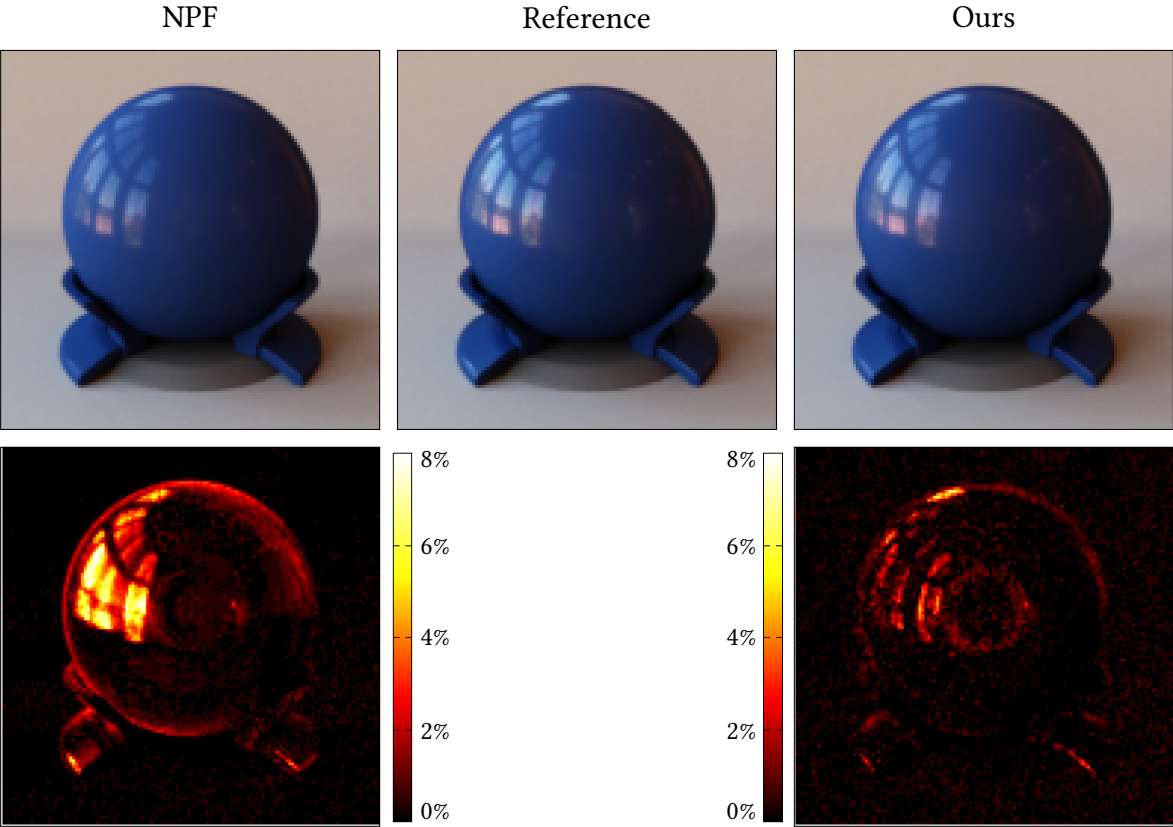


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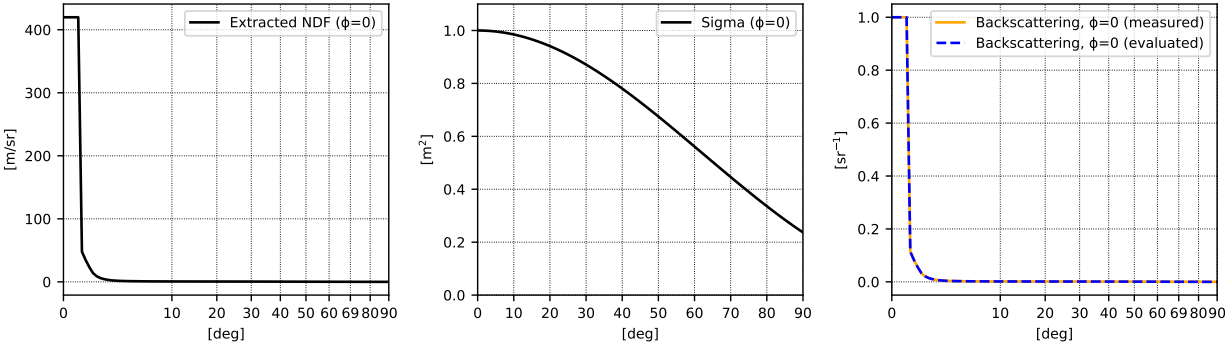


11 blue-acrylic

Renderings and CIE dE00



Plots

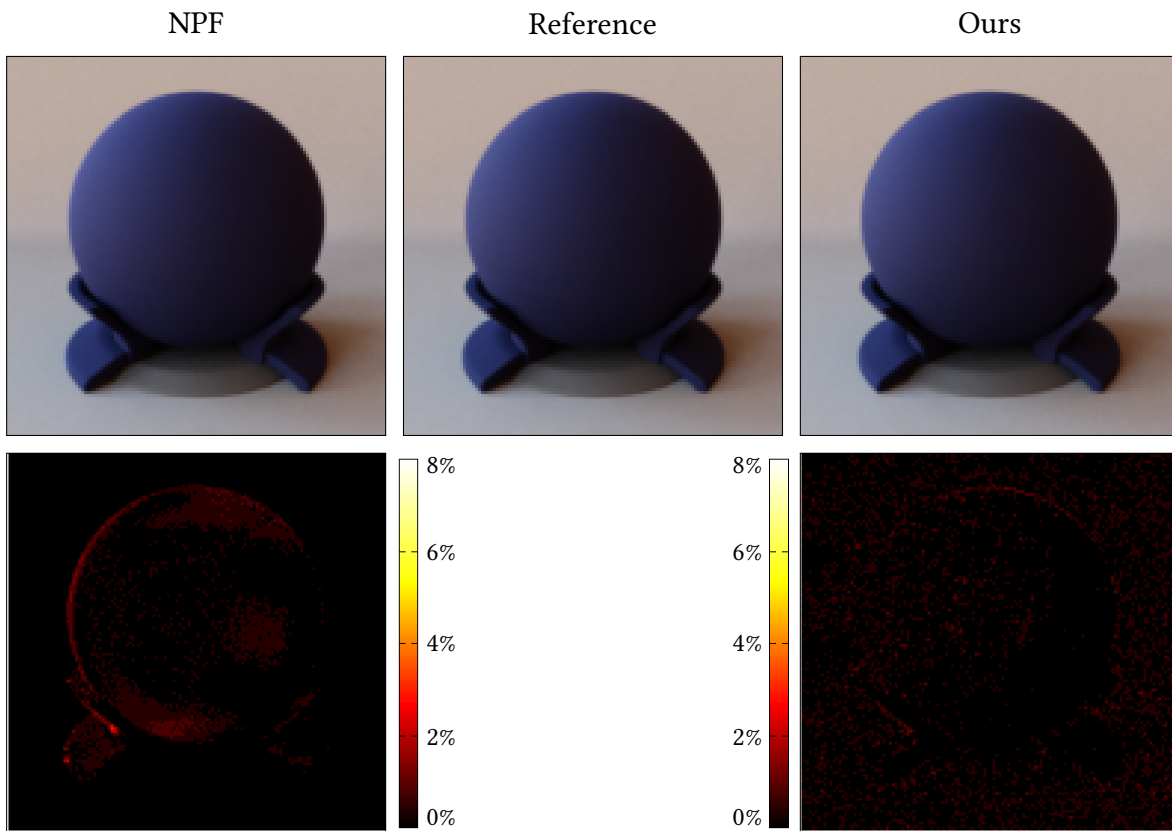


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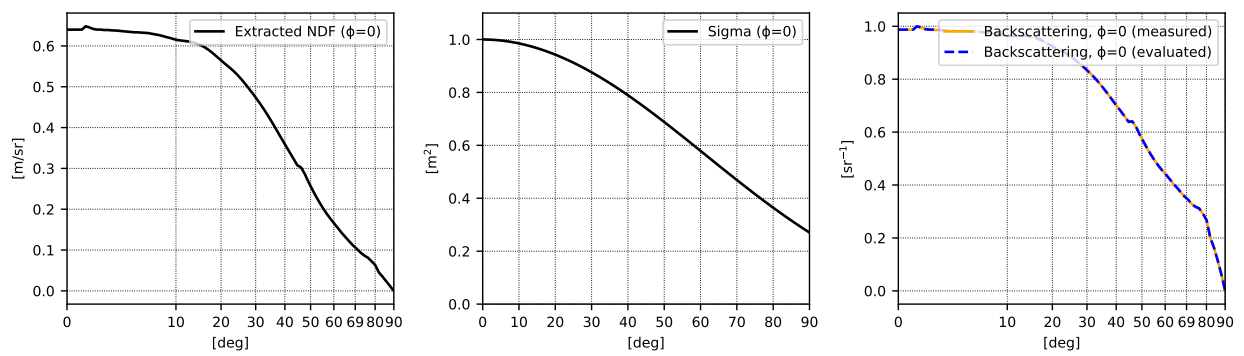


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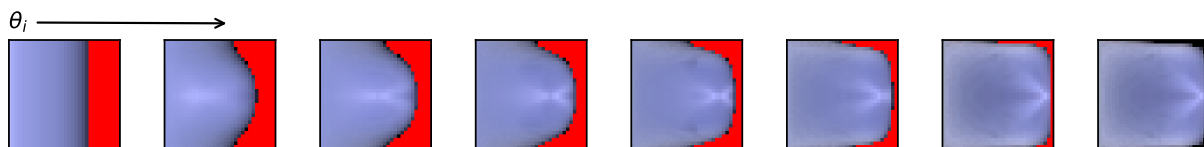
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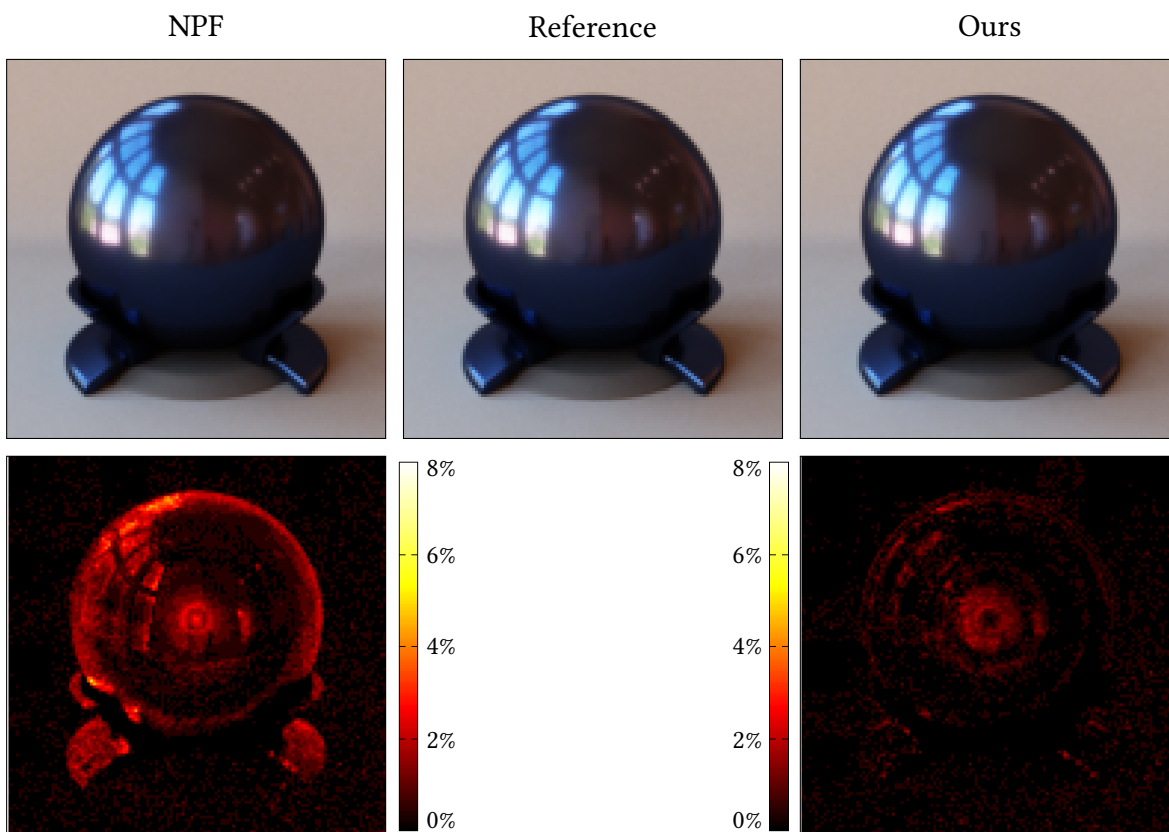


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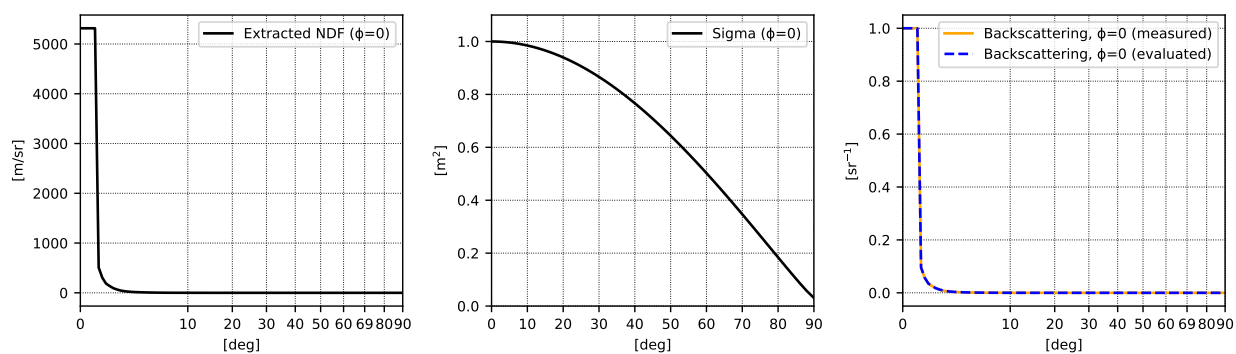


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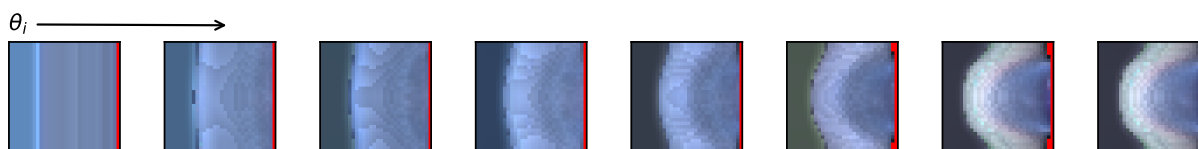
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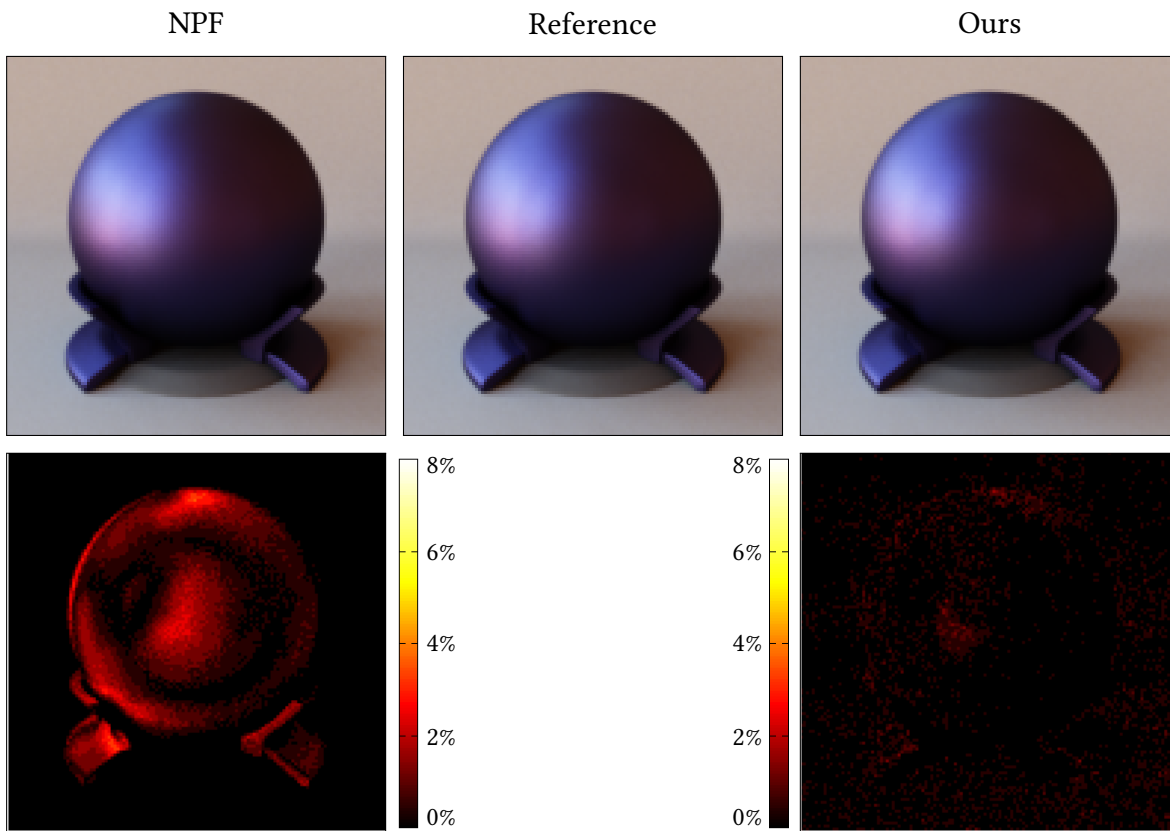


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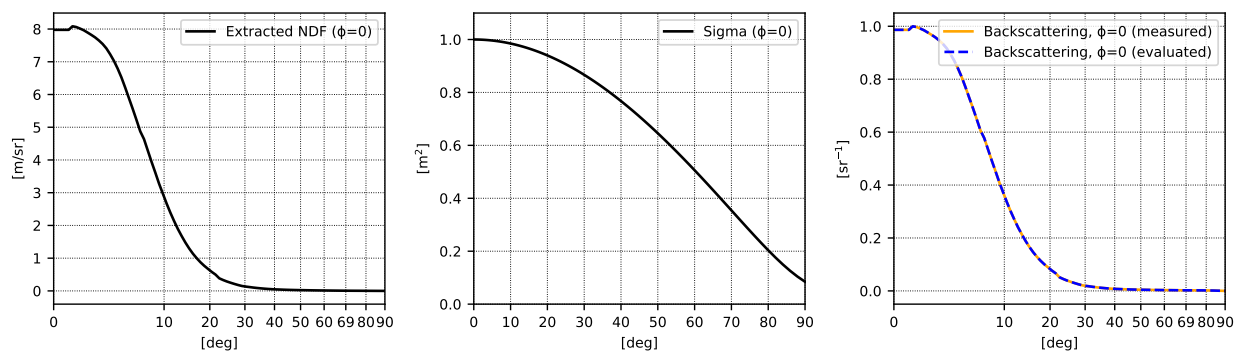


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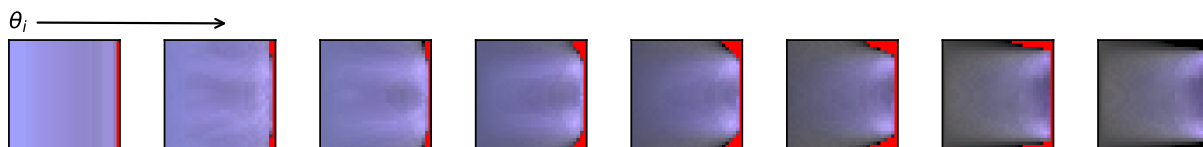
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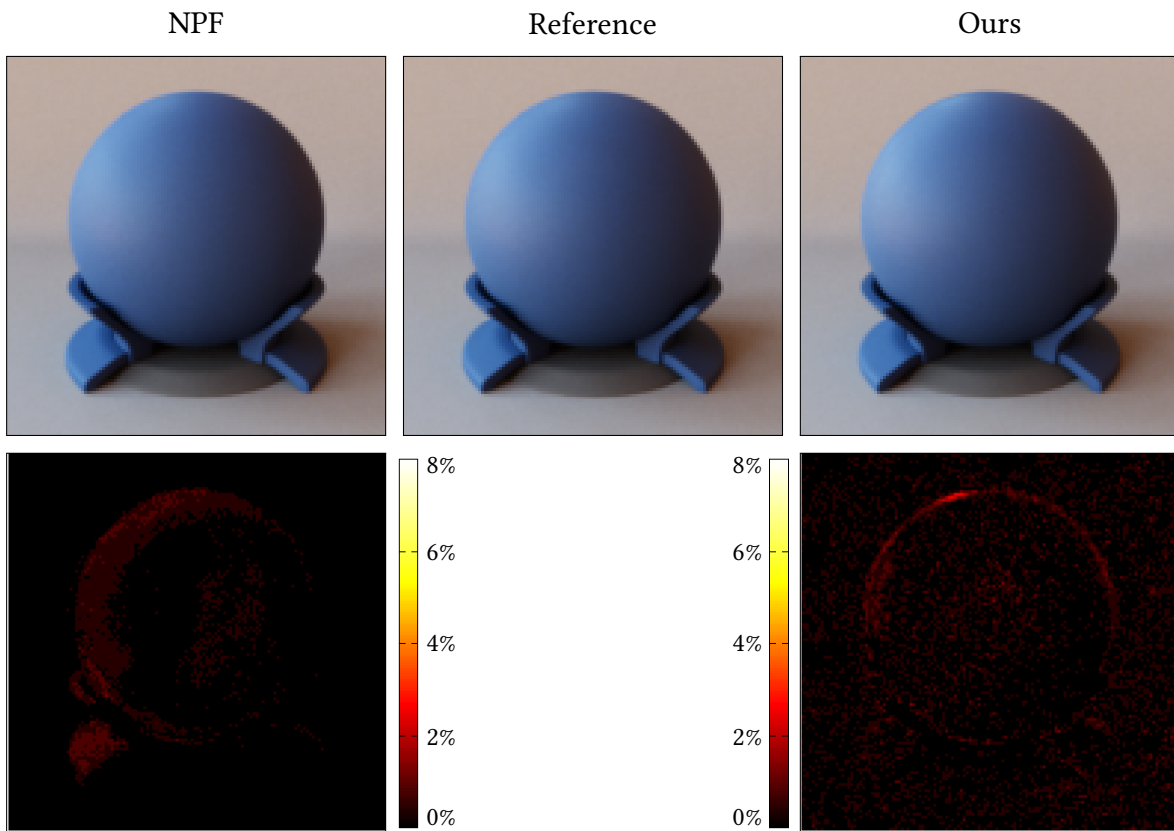


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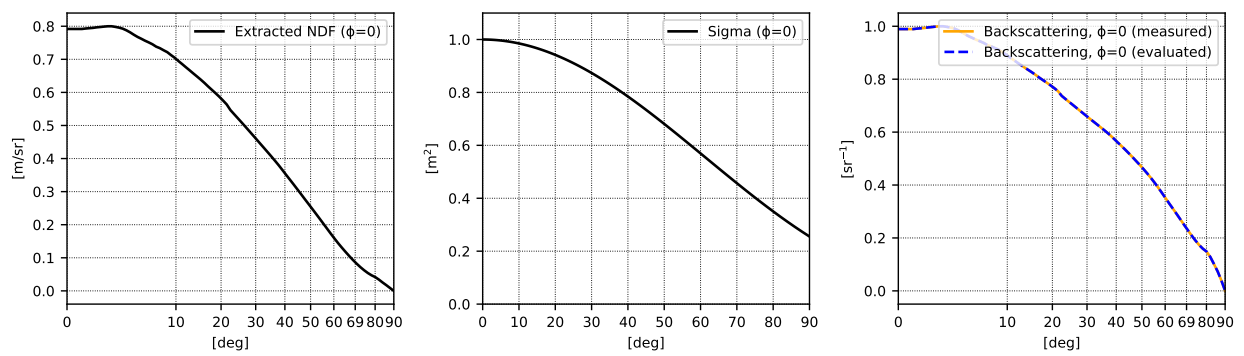


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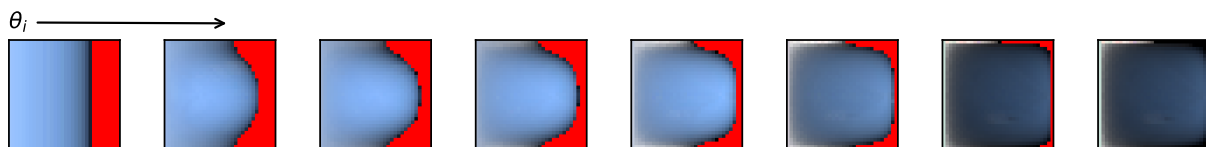
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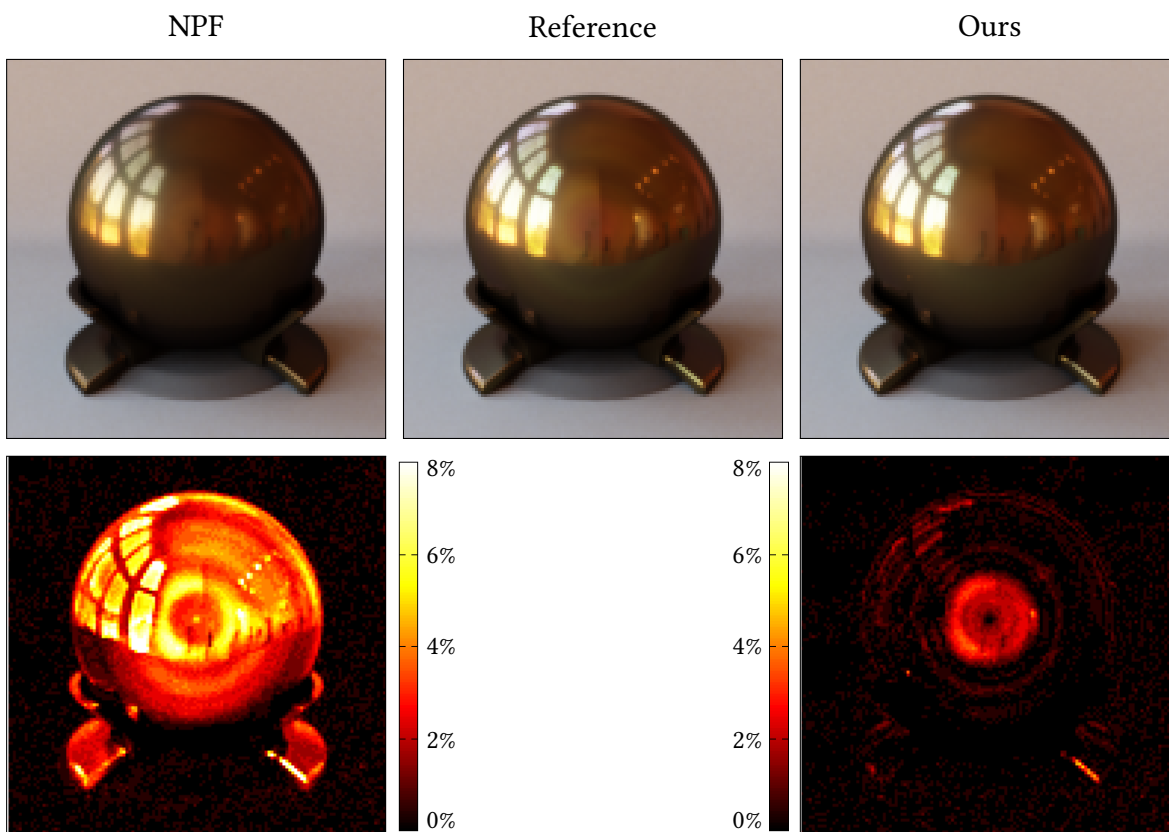


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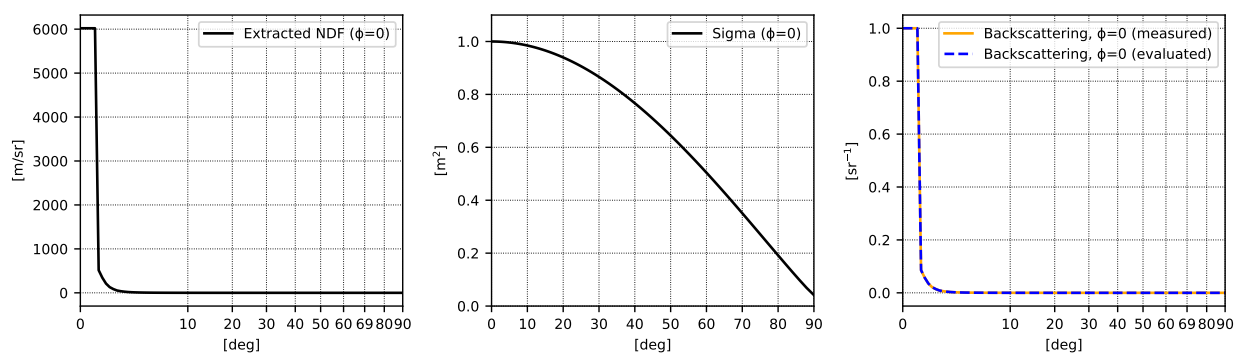


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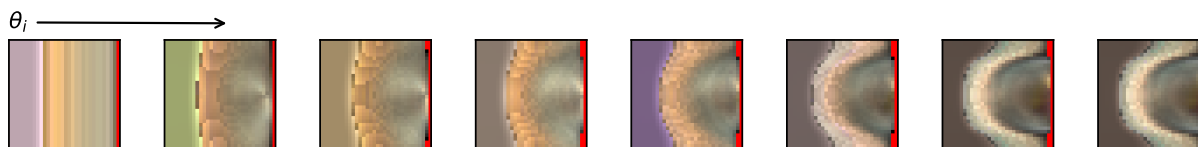
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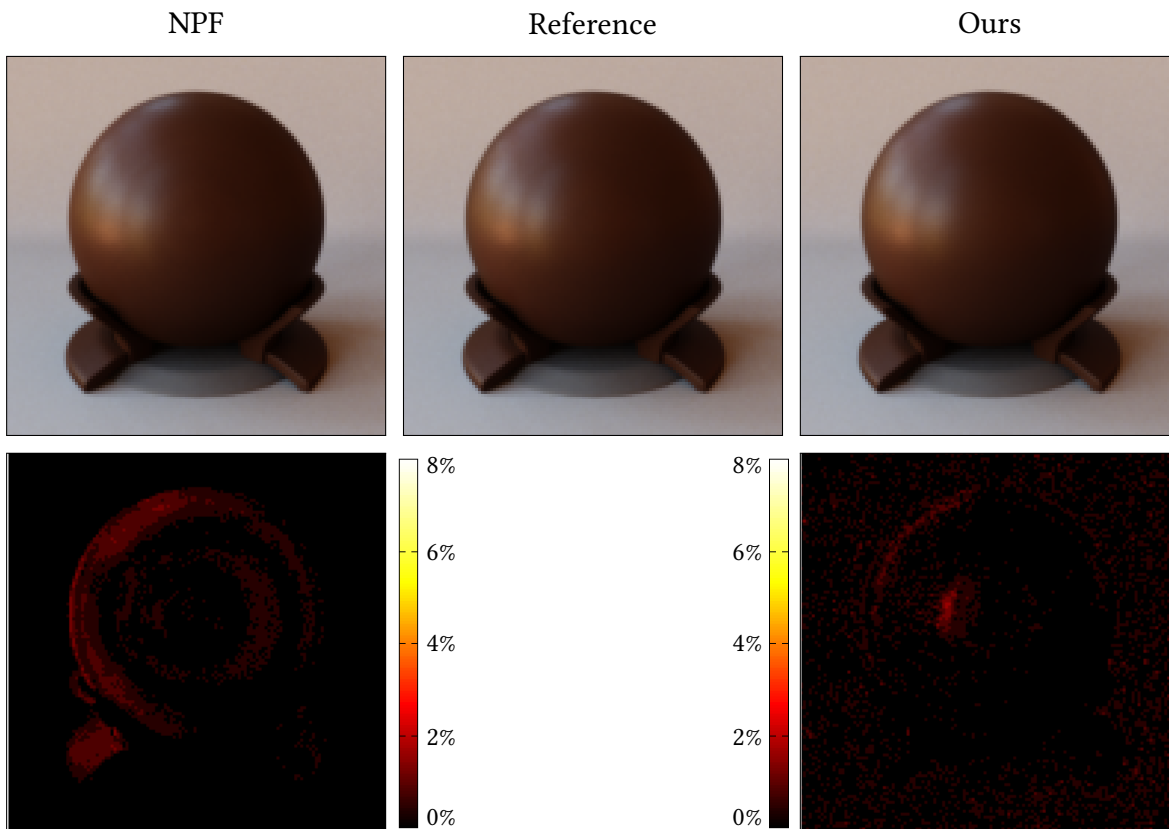


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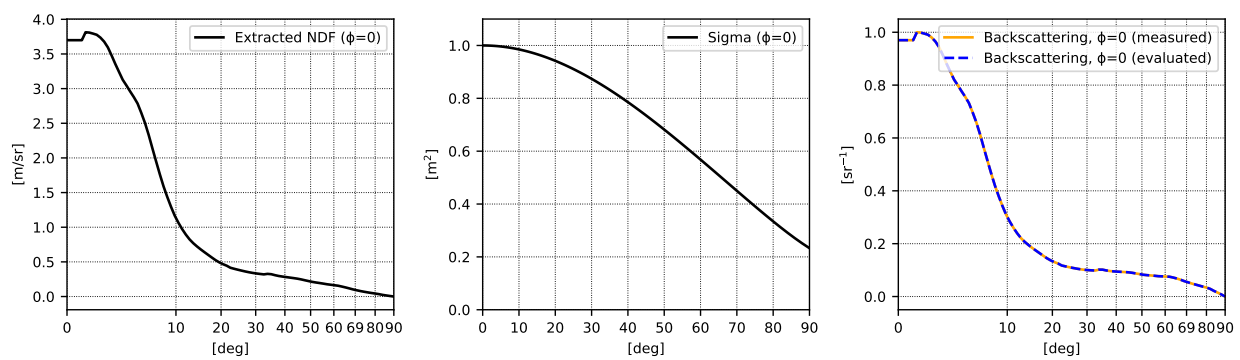


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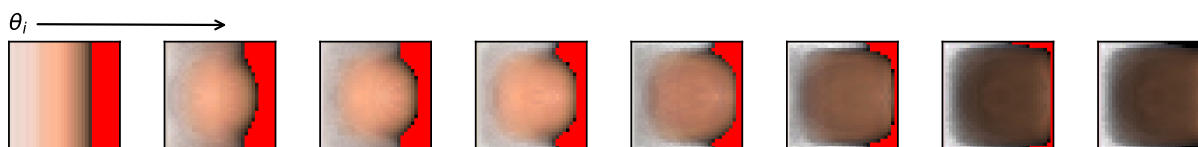
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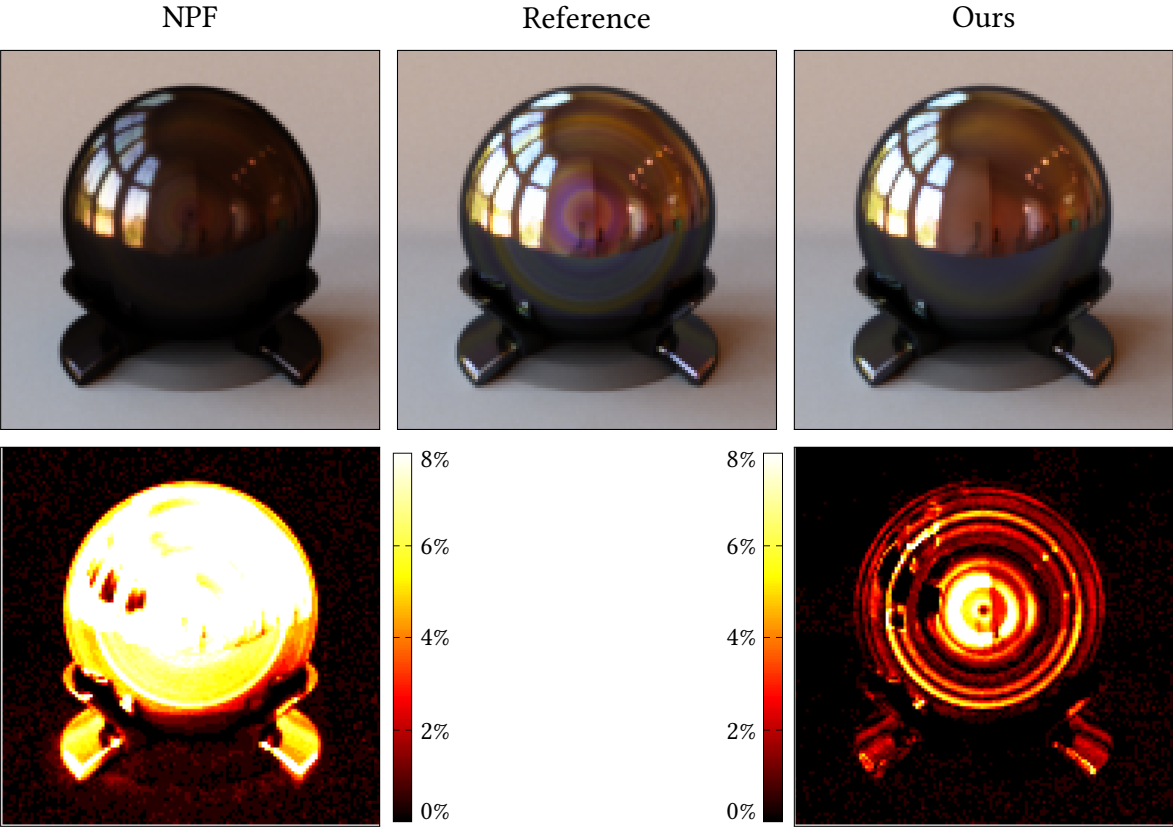


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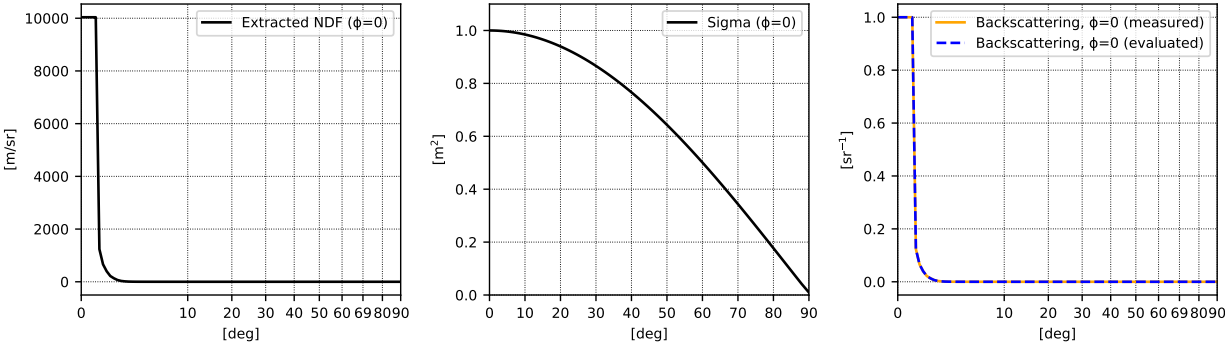


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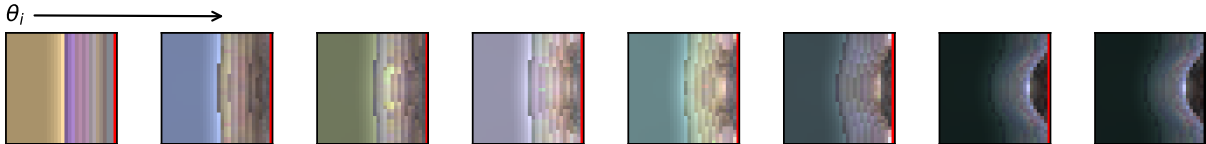
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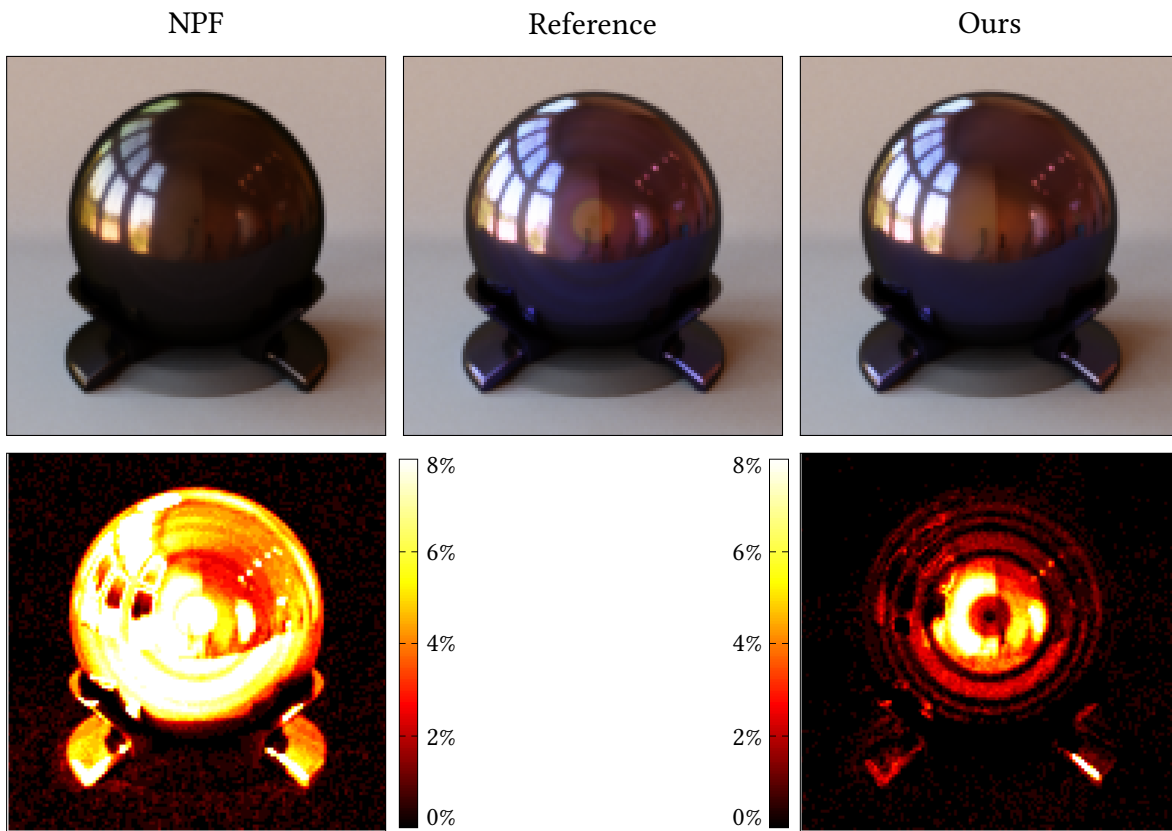


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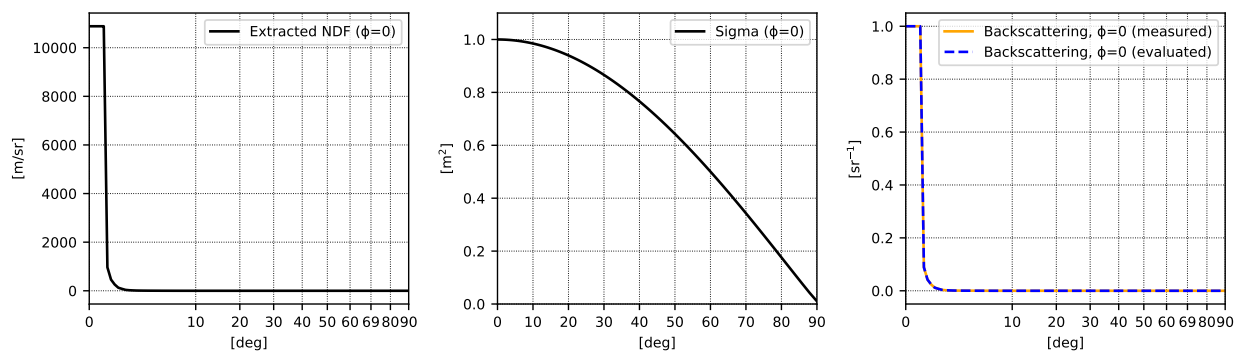


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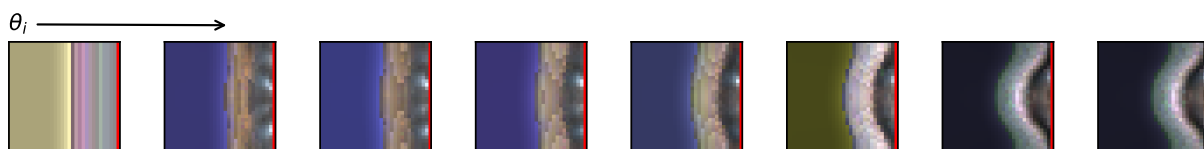
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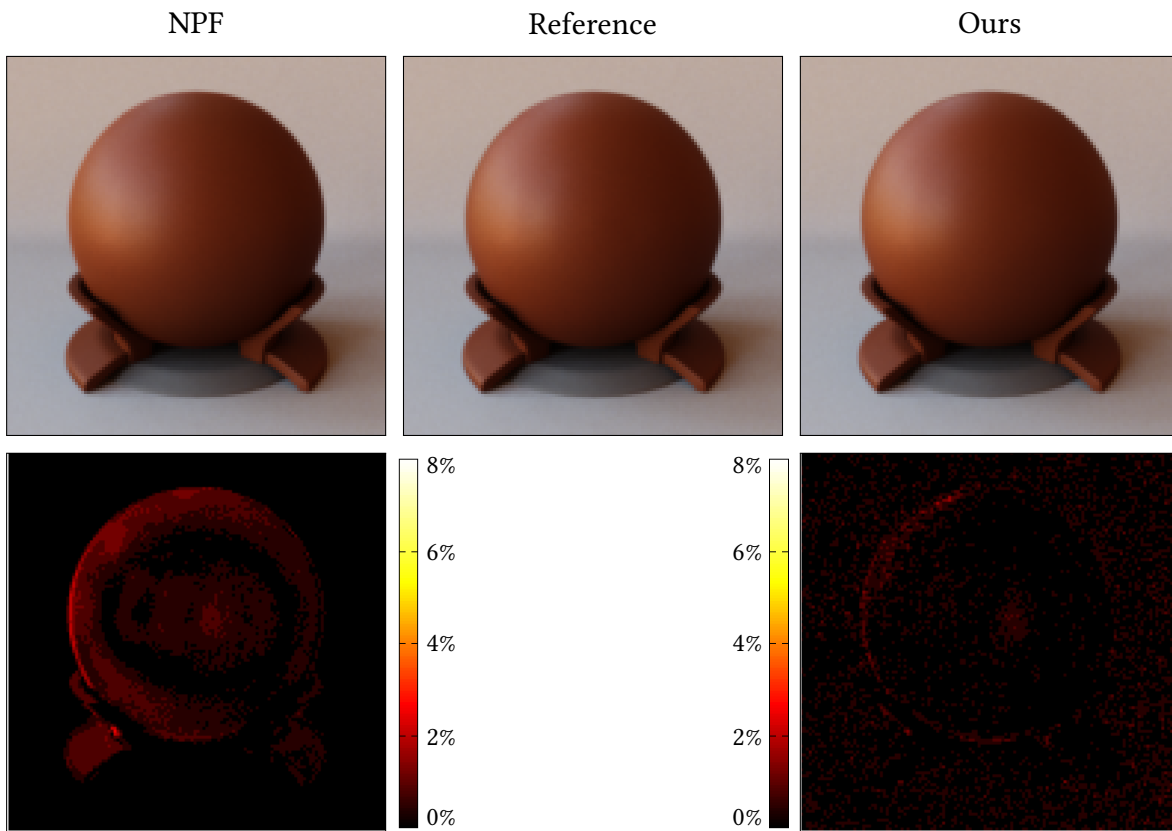


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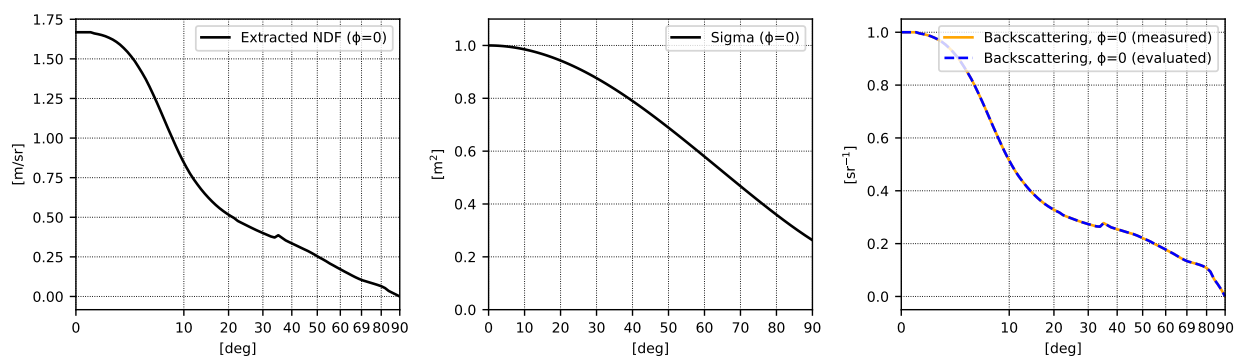


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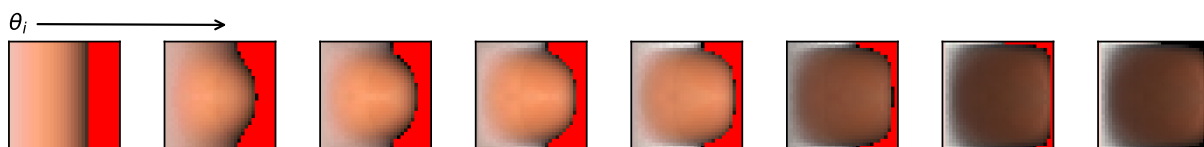
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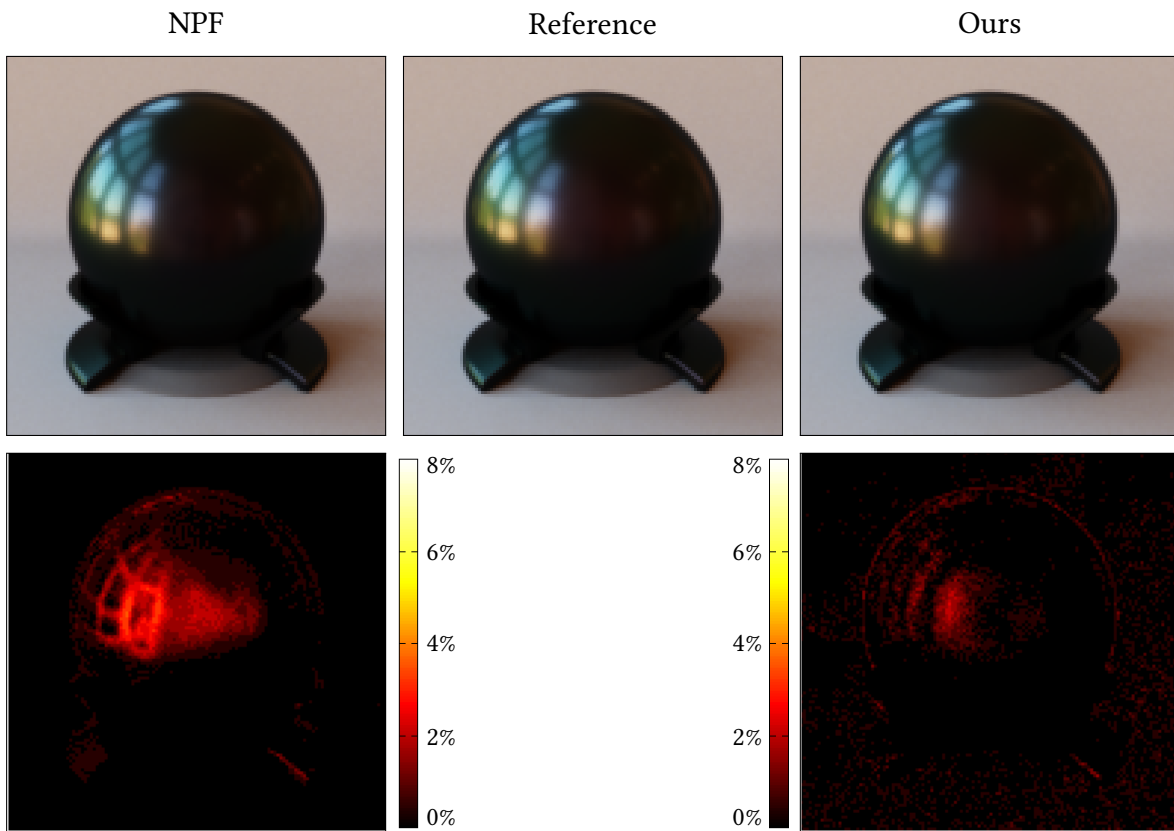


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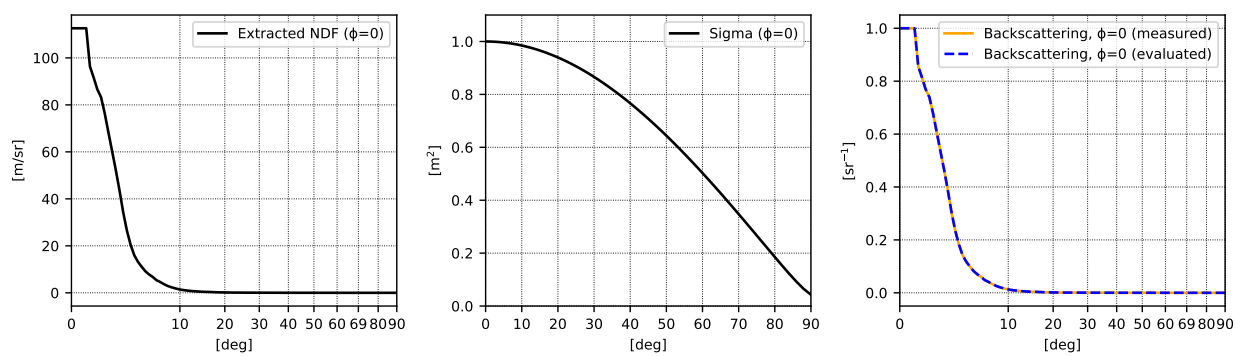


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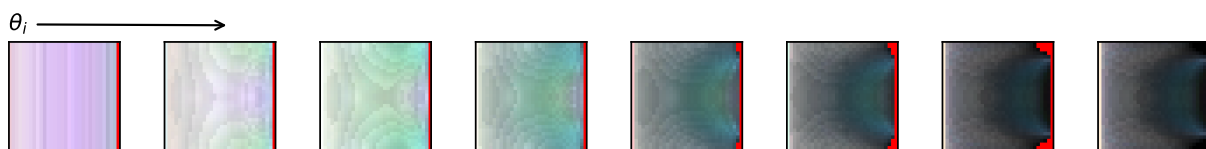
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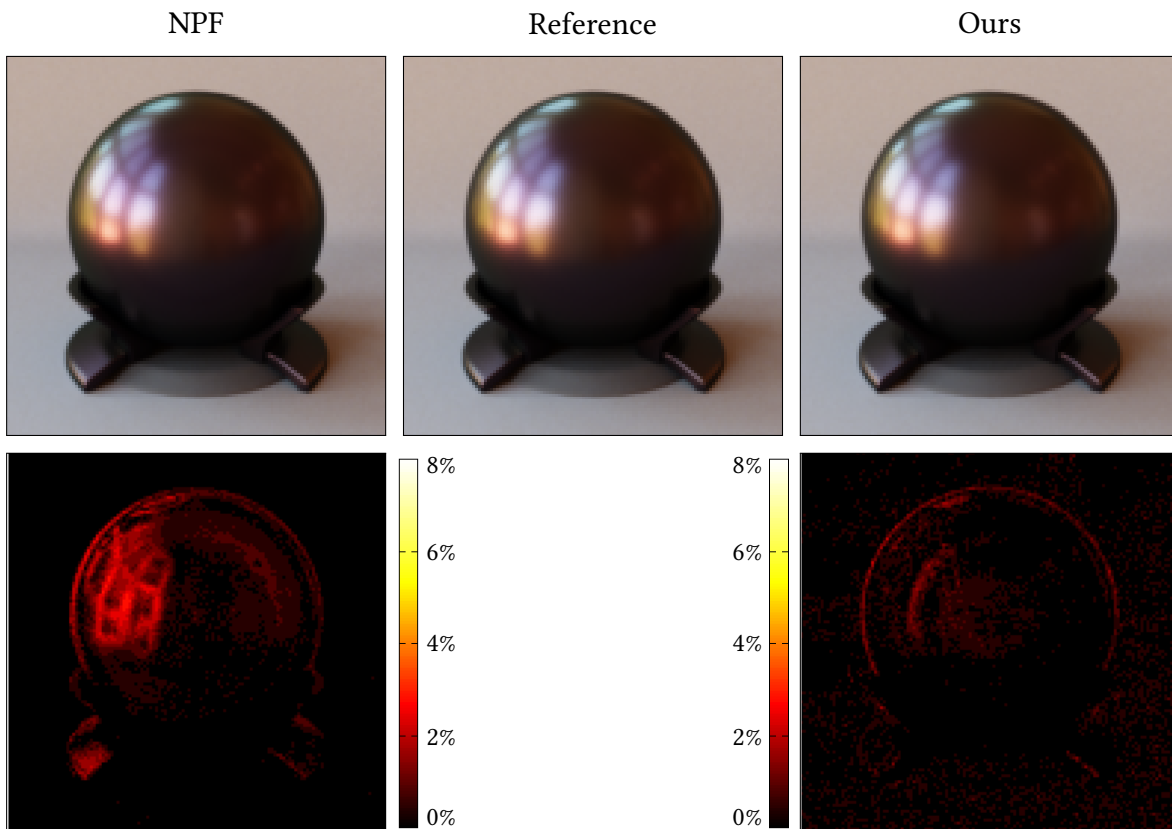


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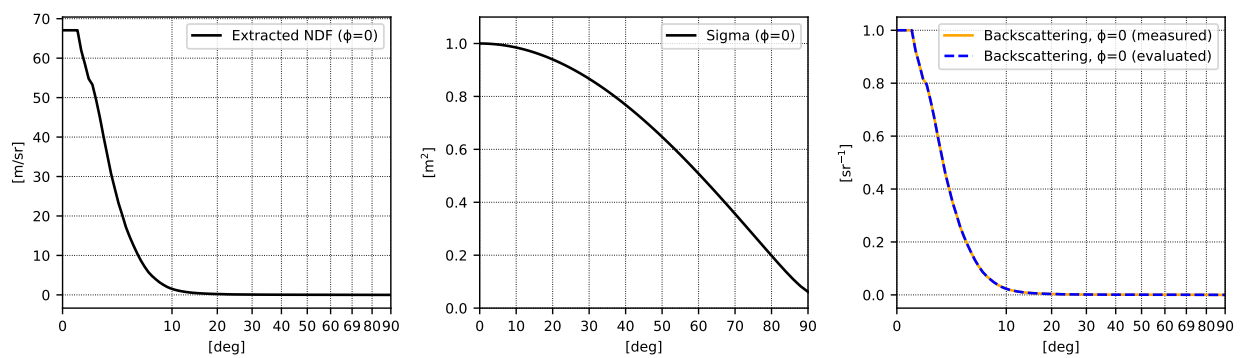


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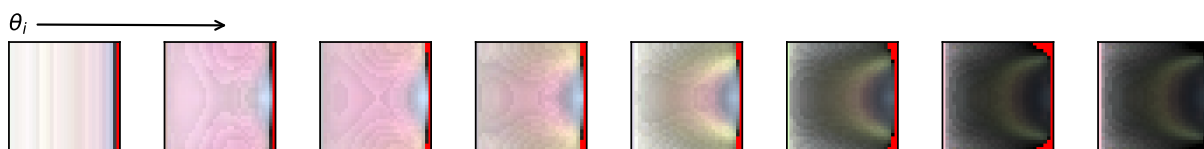
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Plots

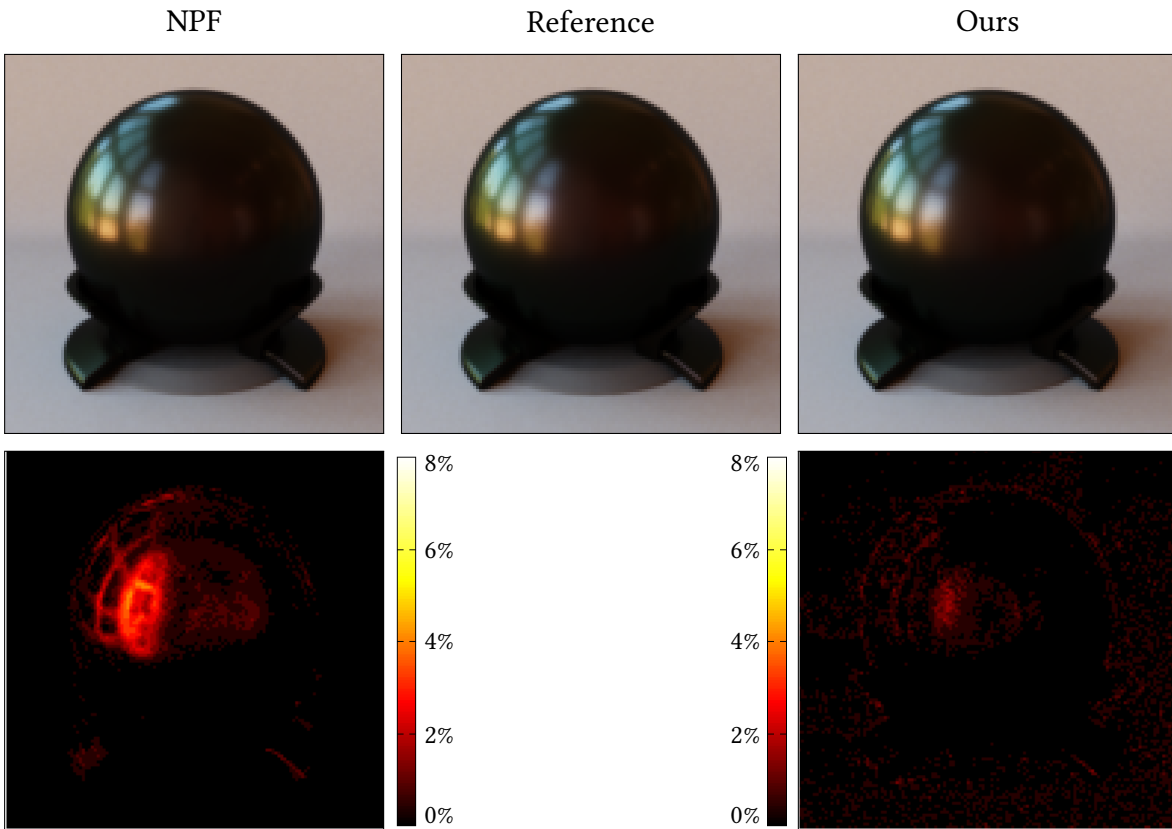


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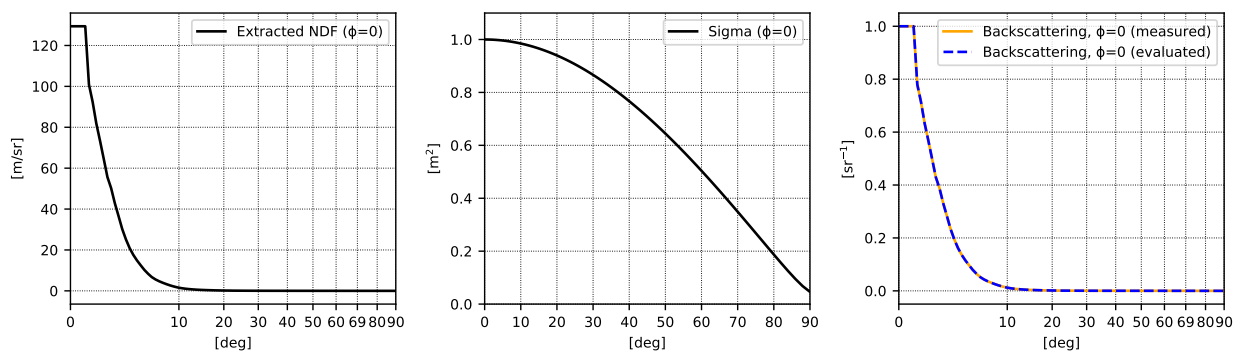


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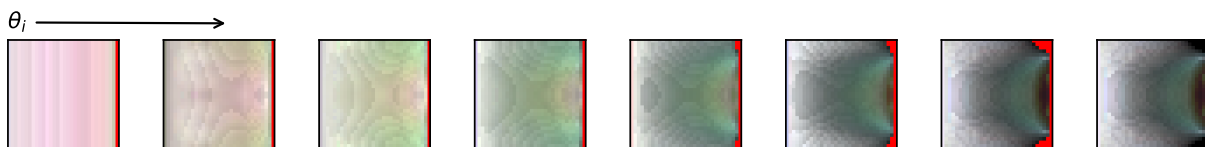
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Plots

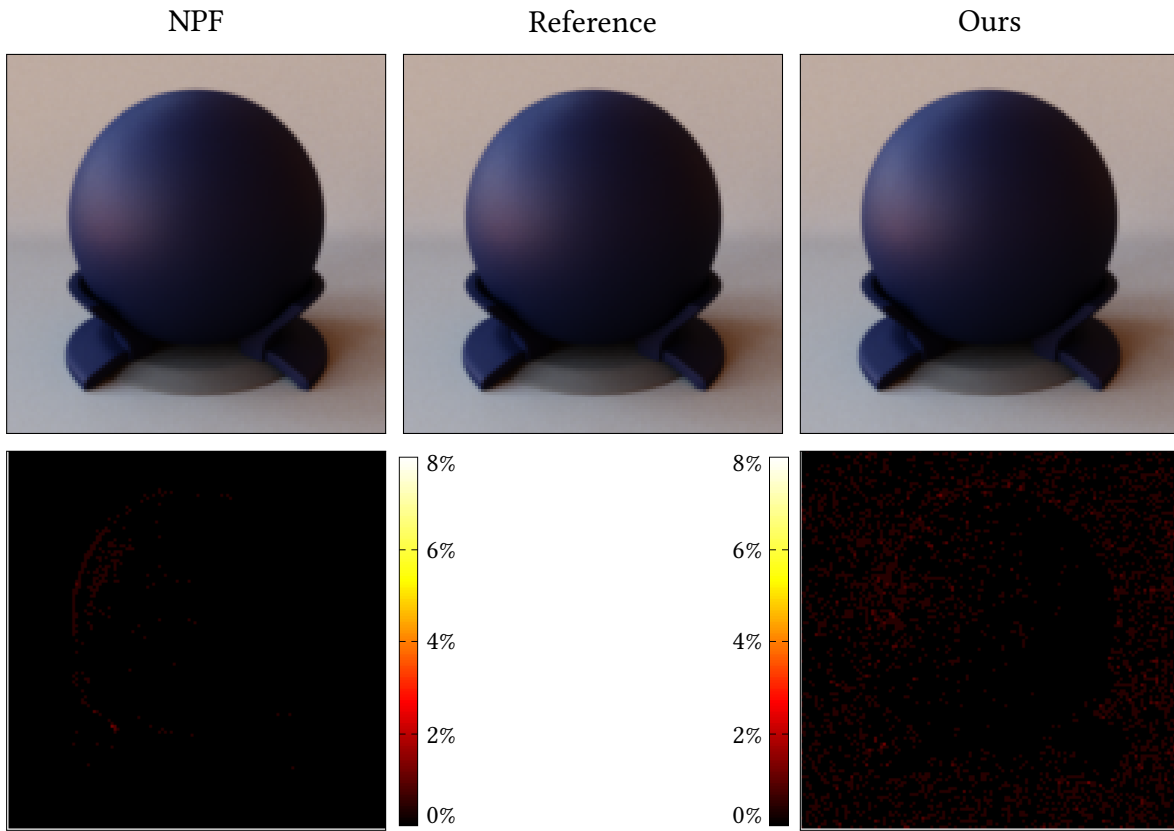


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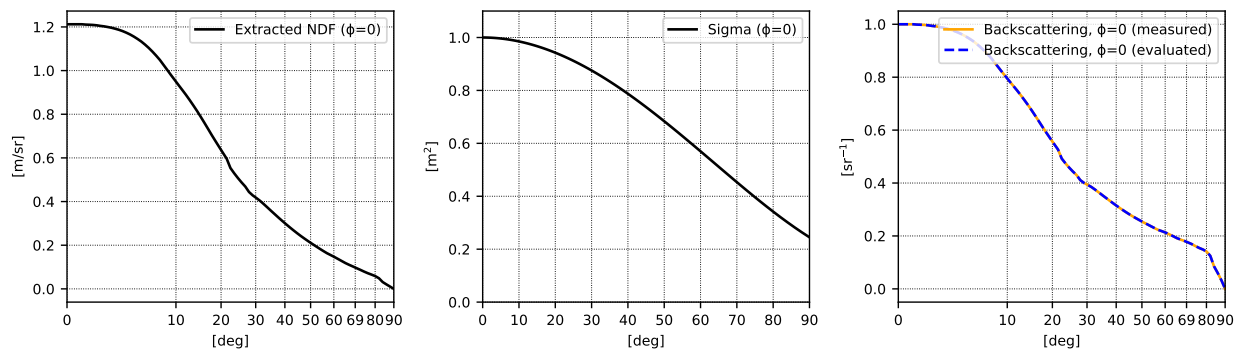


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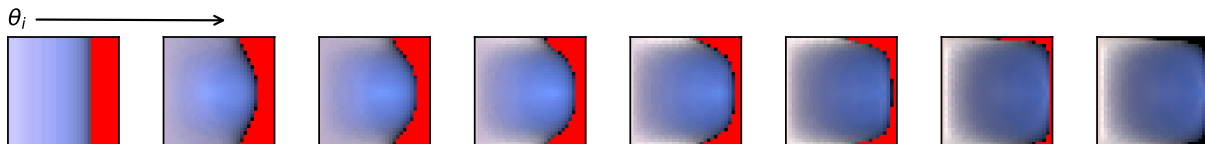
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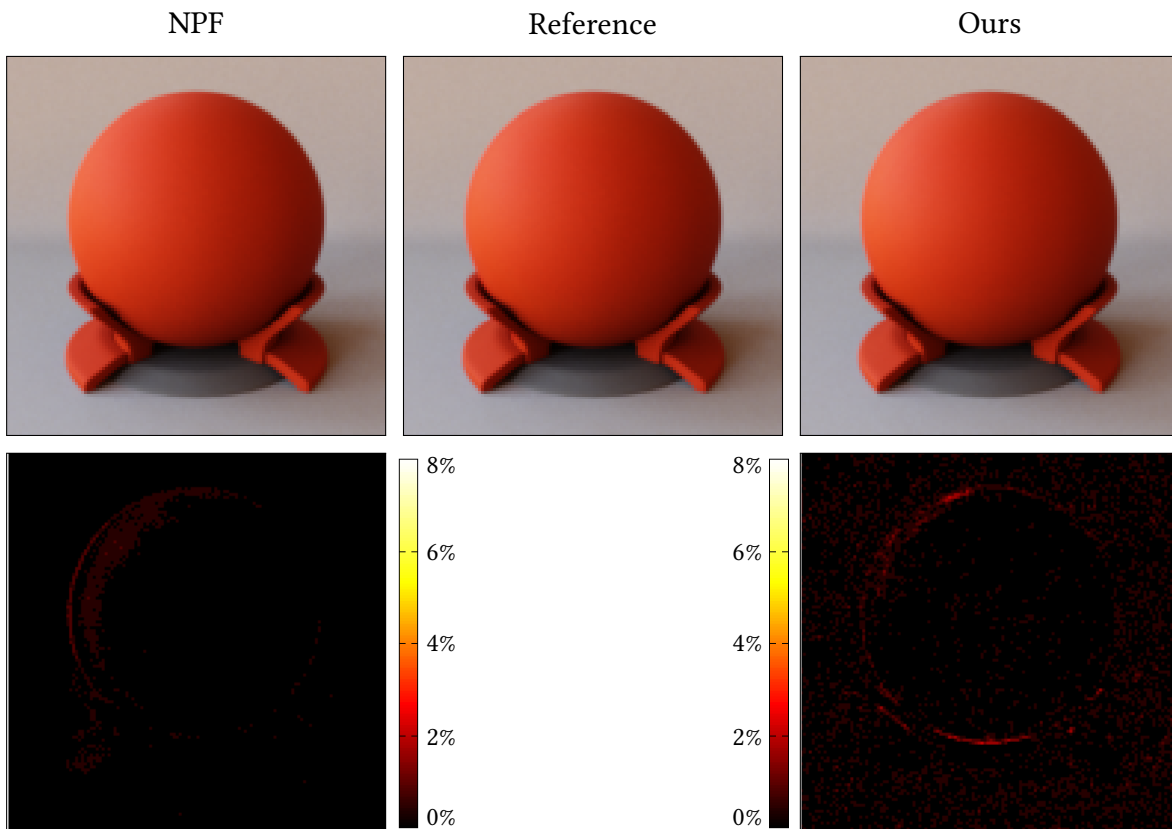


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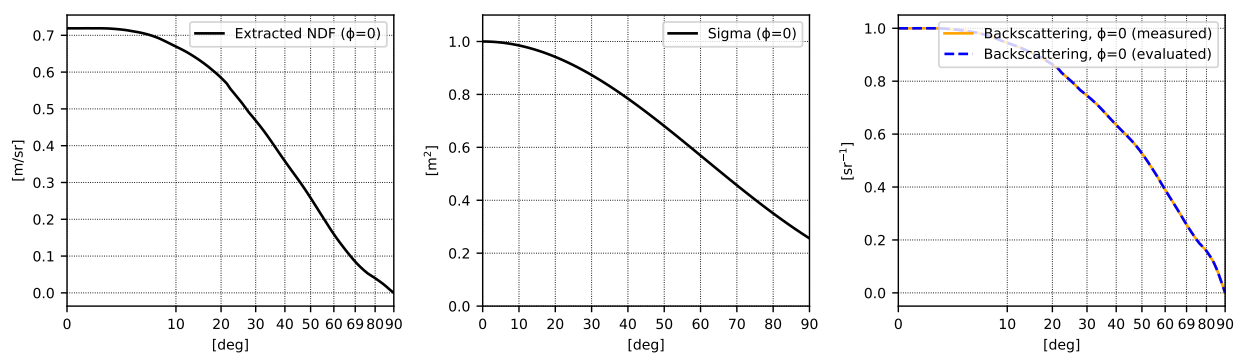


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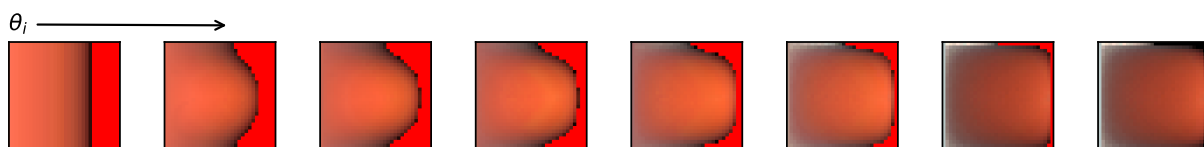
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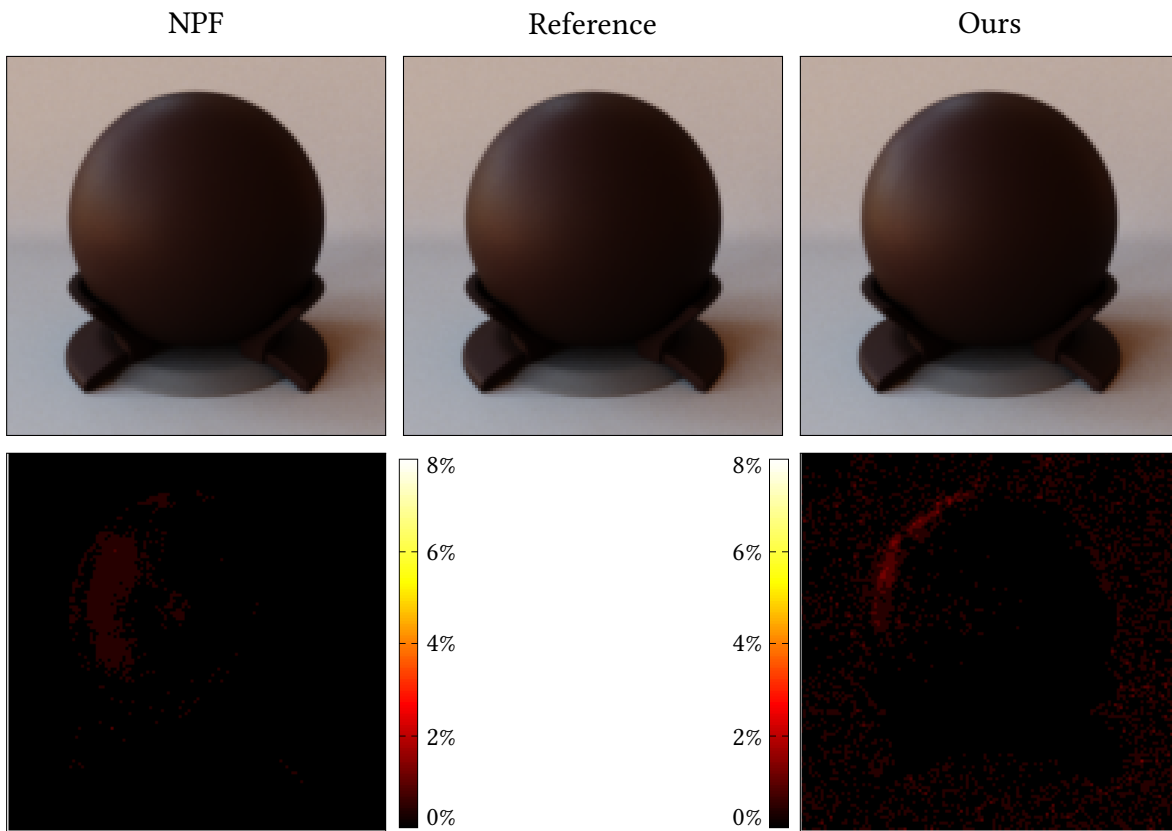


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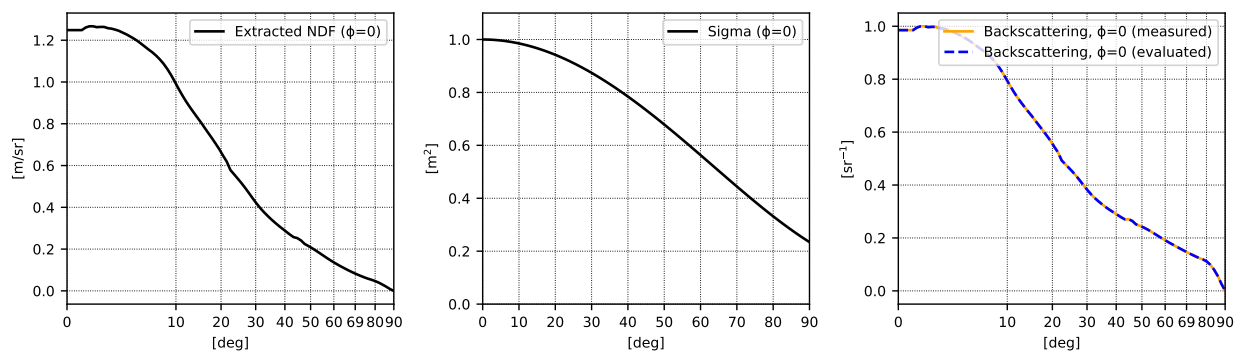


26 dark-specular-fabric

Renderings and CIE dE00



Plots

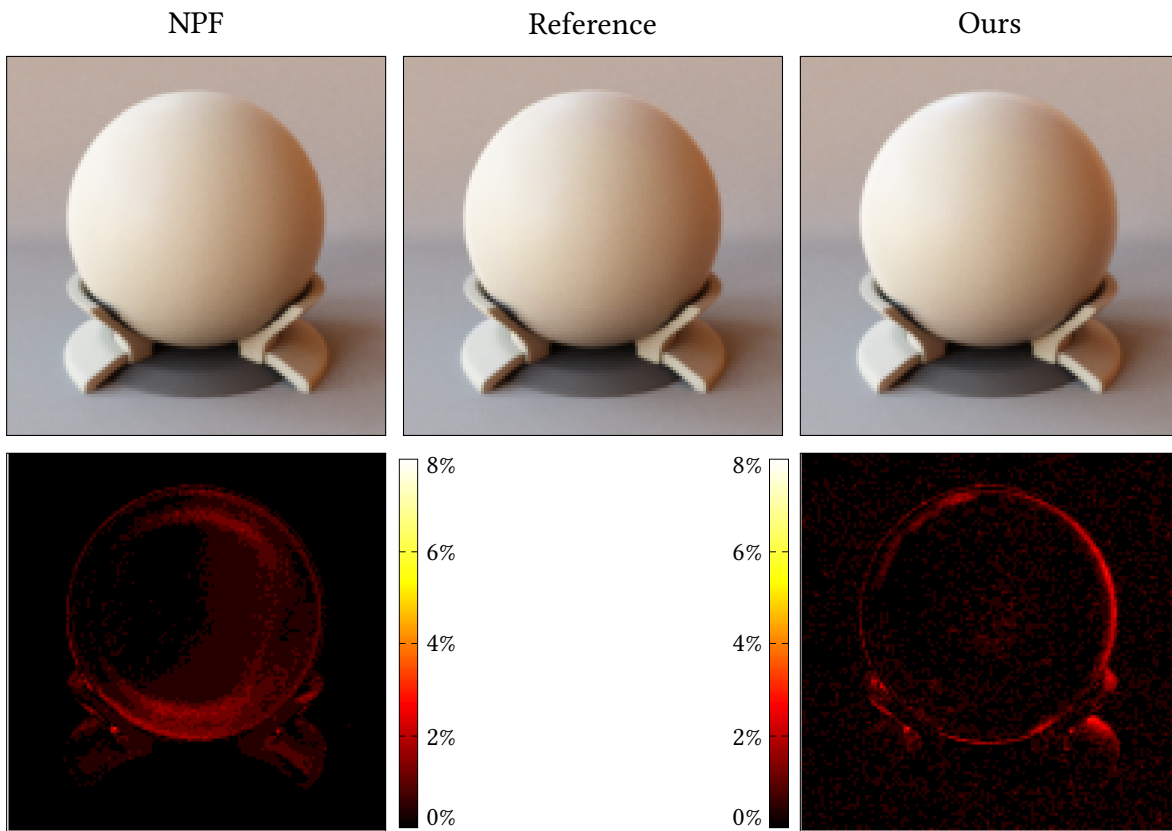


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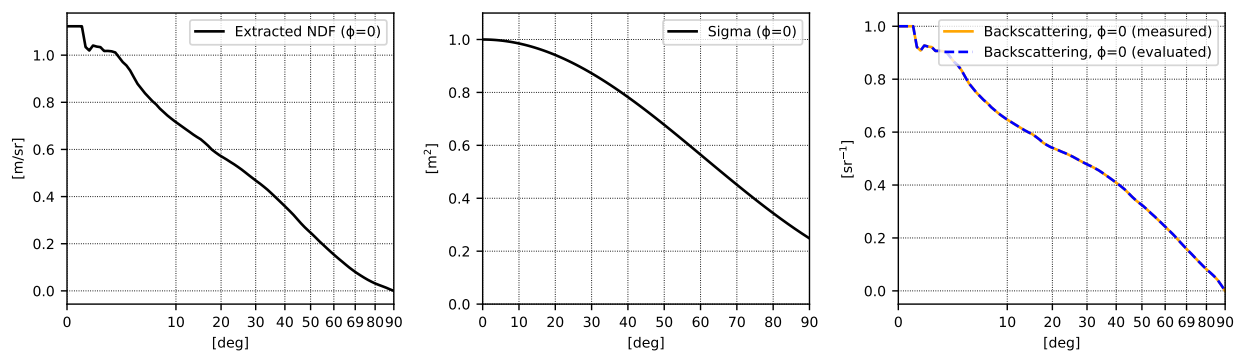


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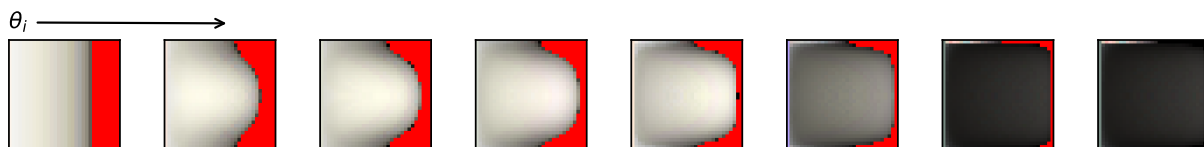
Renderings and CIE dE00



Plots

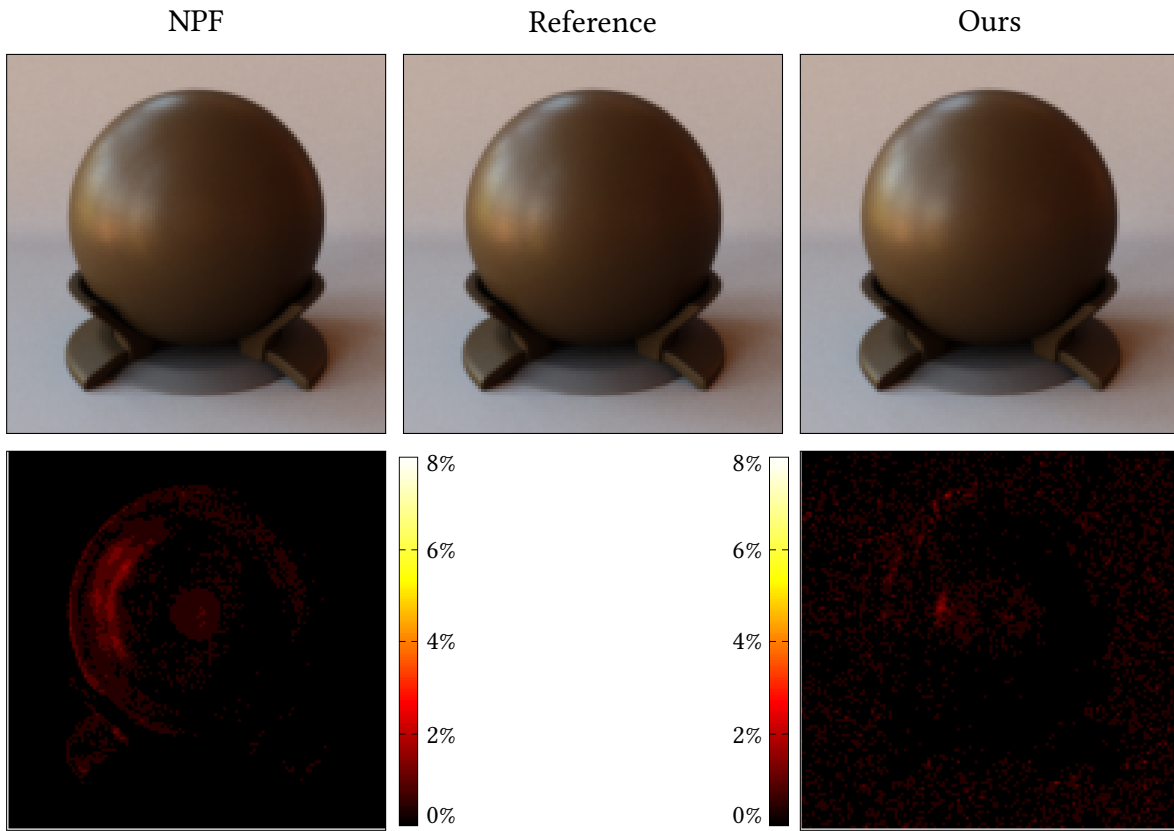


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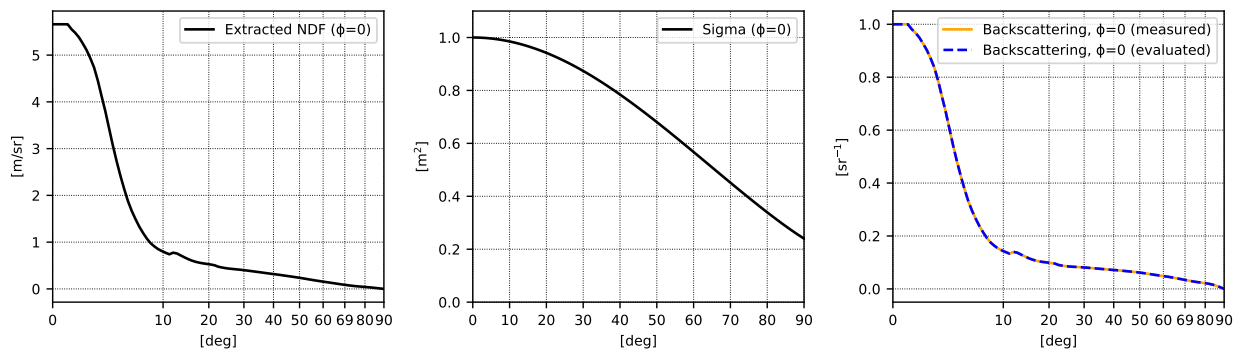


28 fruitwood-241

Renderings and CIE dE00



Plots

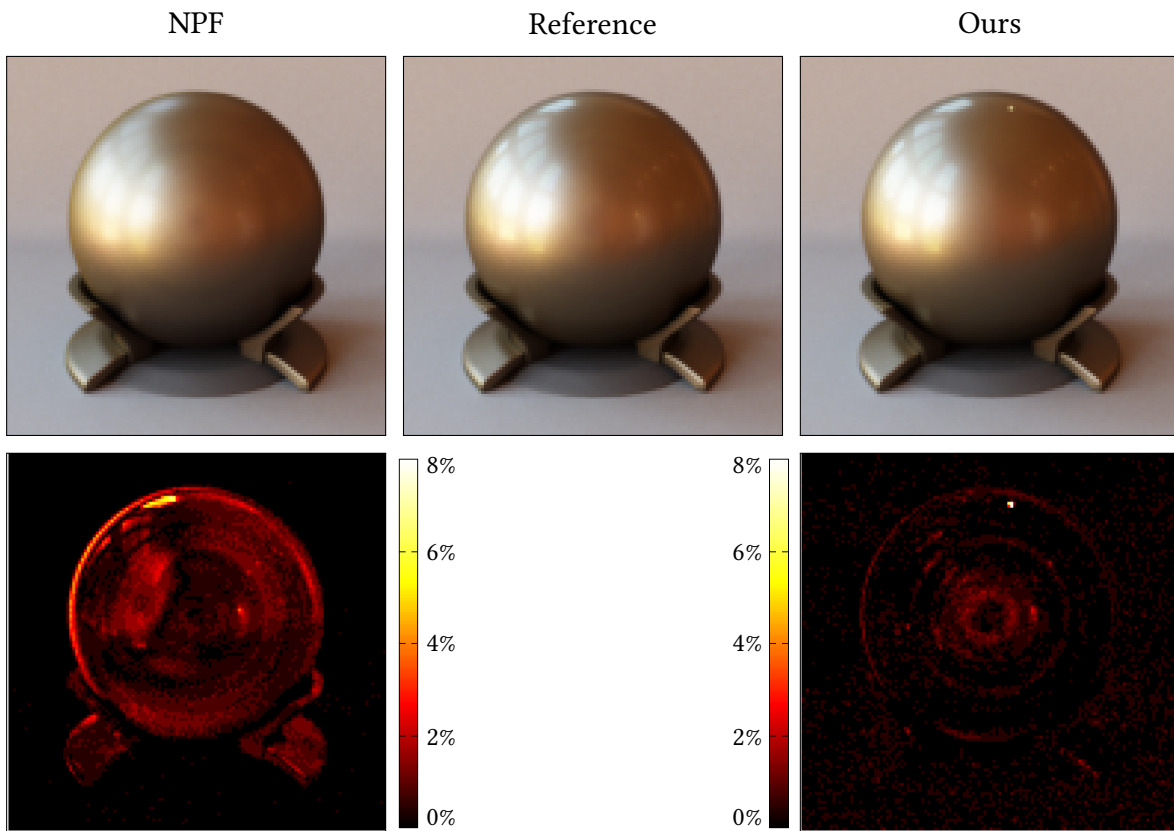


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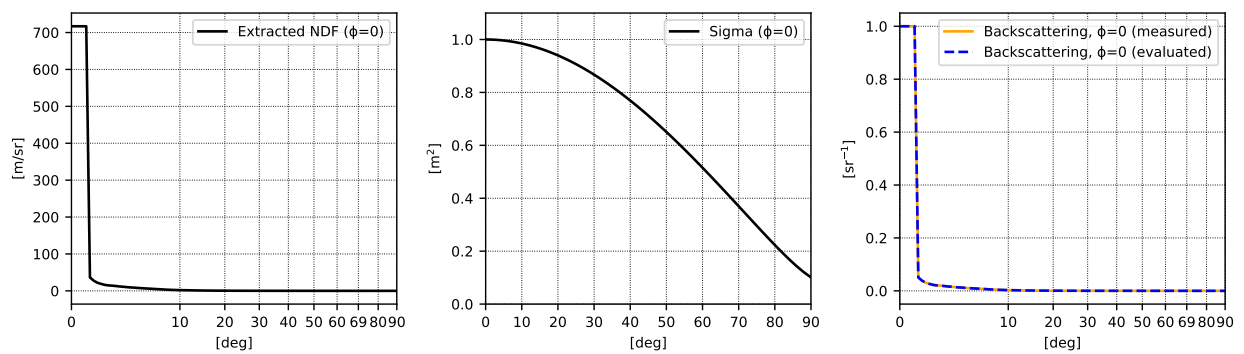


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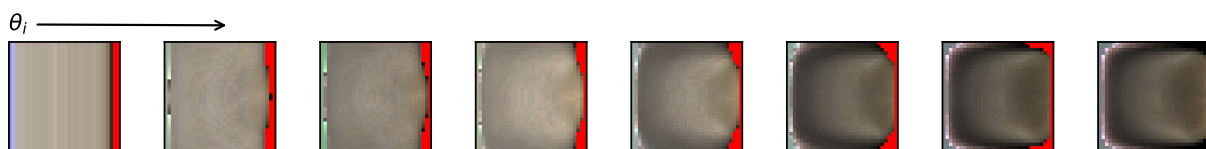
Renderings and CIE dE00



Plots

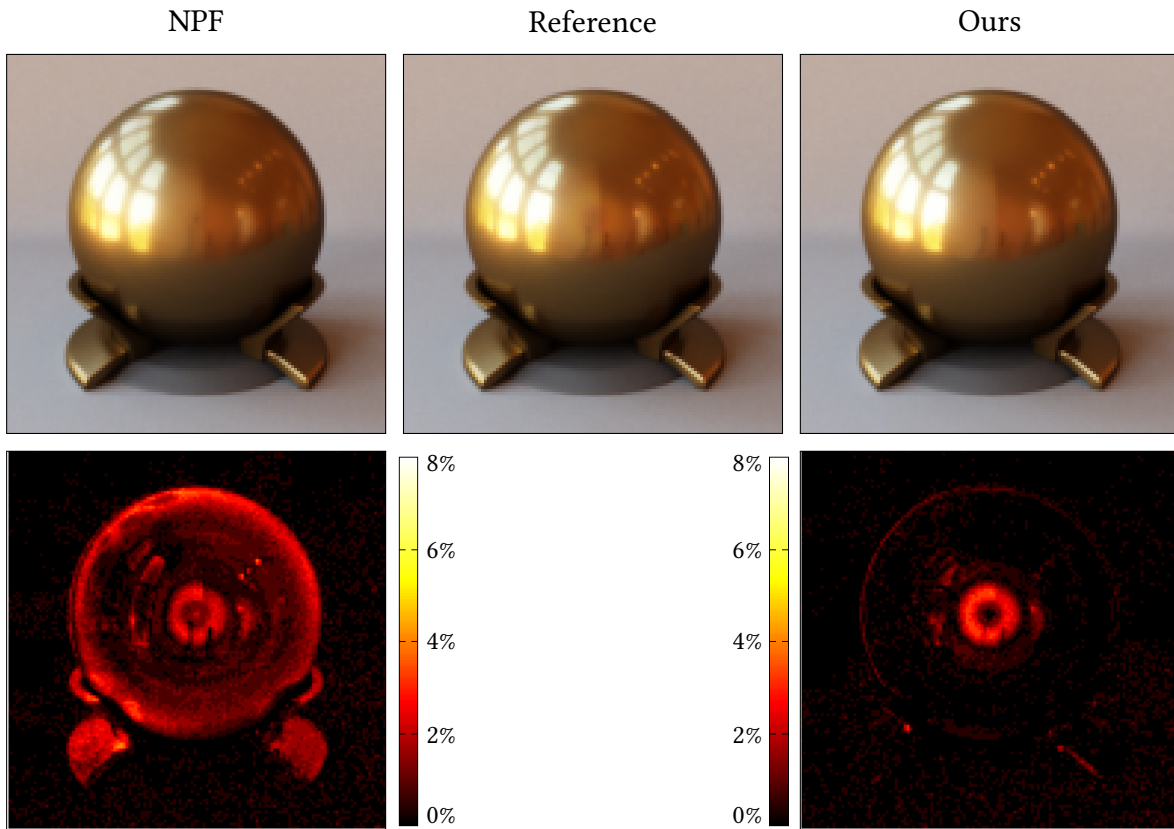


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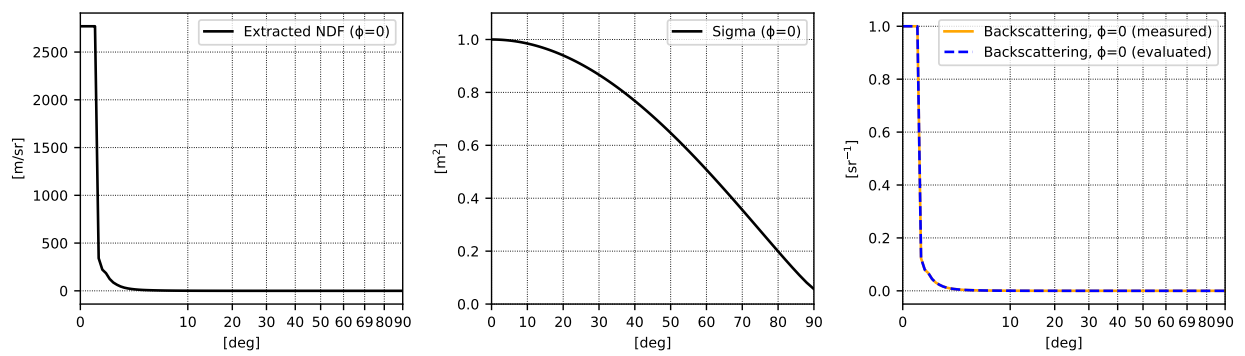


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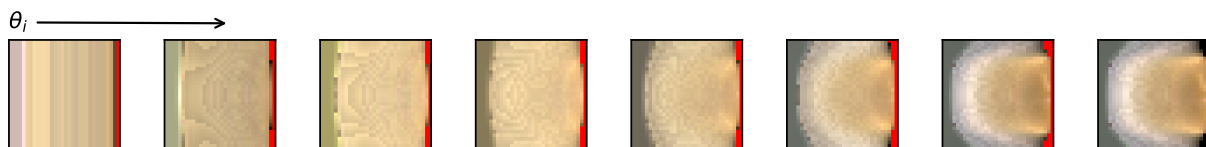
Renderings and CIE dE00



Plots

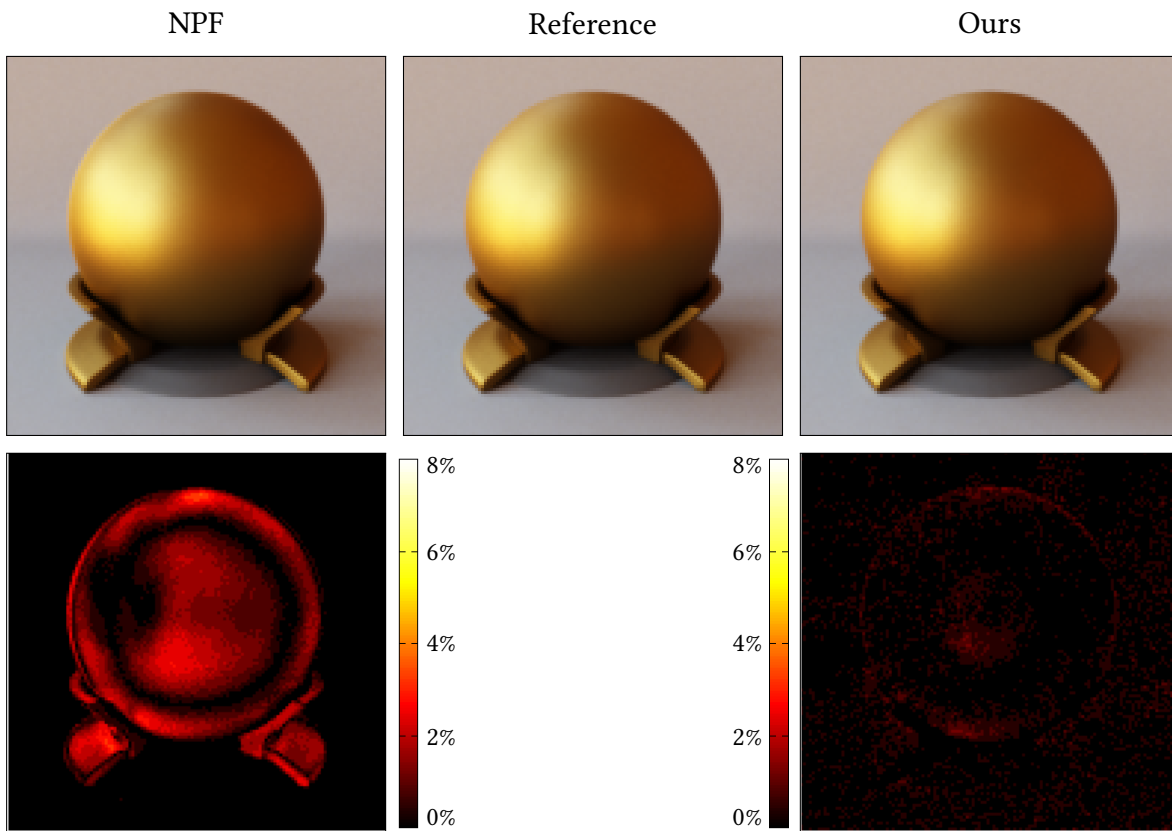


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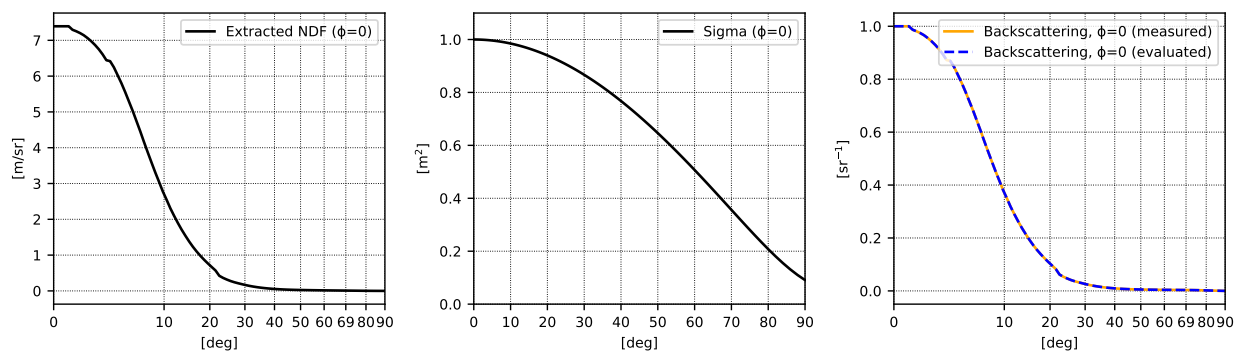


31 gold-metallic-paint

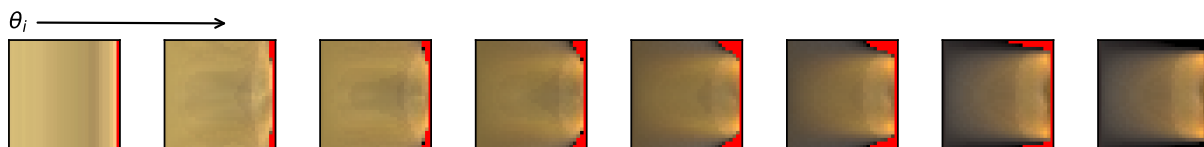
Renderings and CIE dE00



Plots

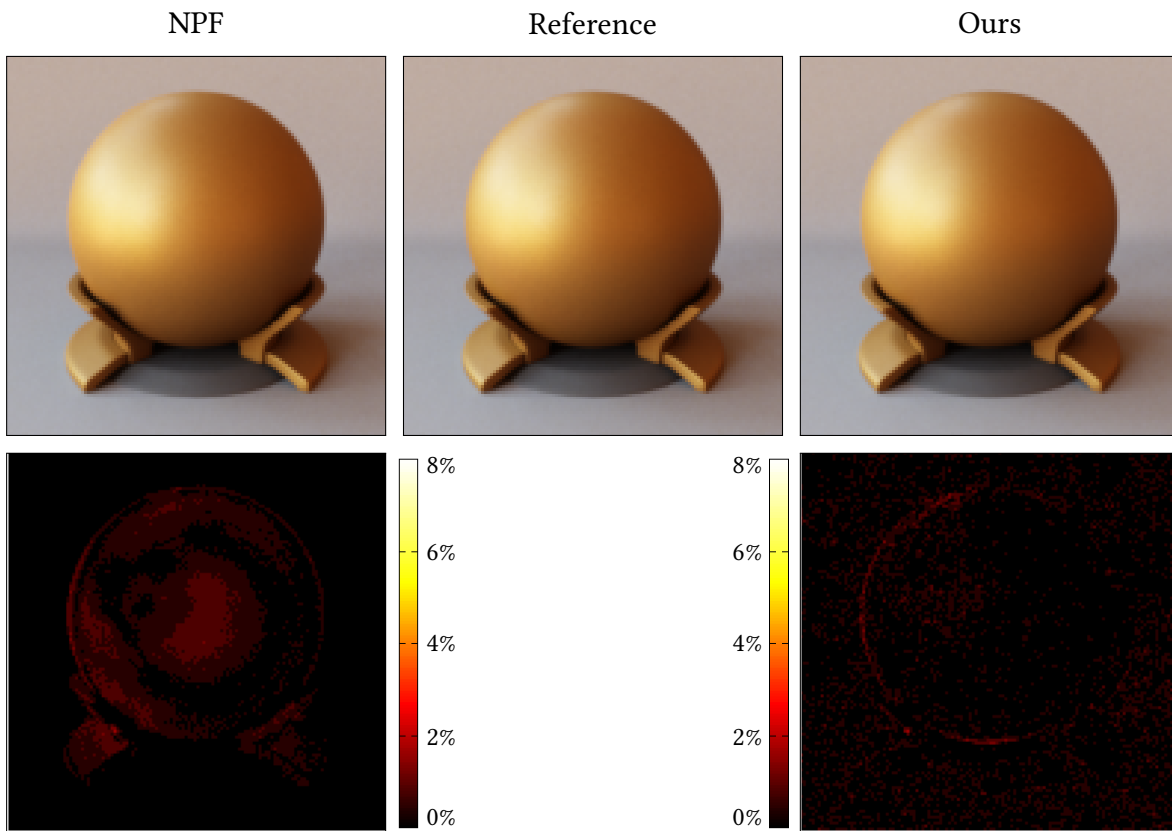


Slices

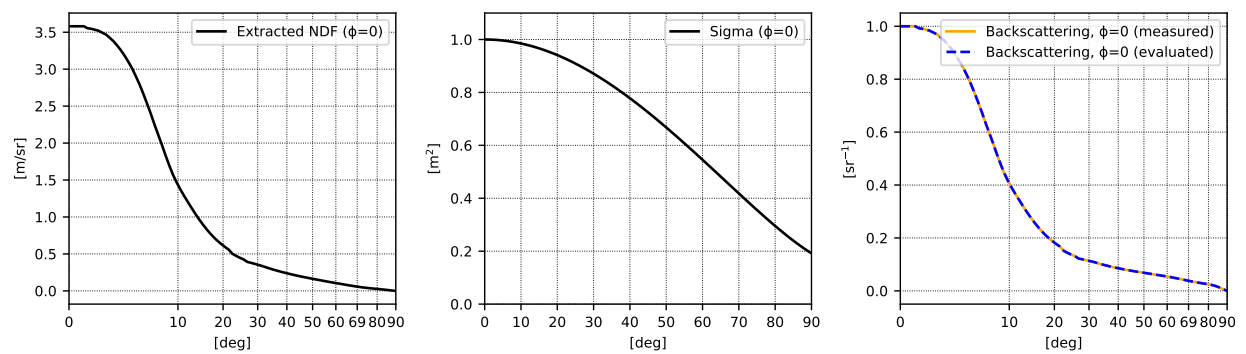


32 gold-paint

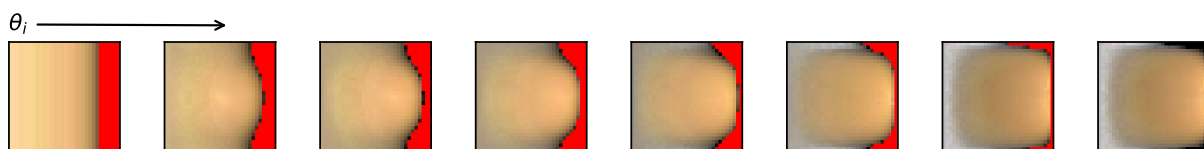
Renderings and CIE dE00



Plots

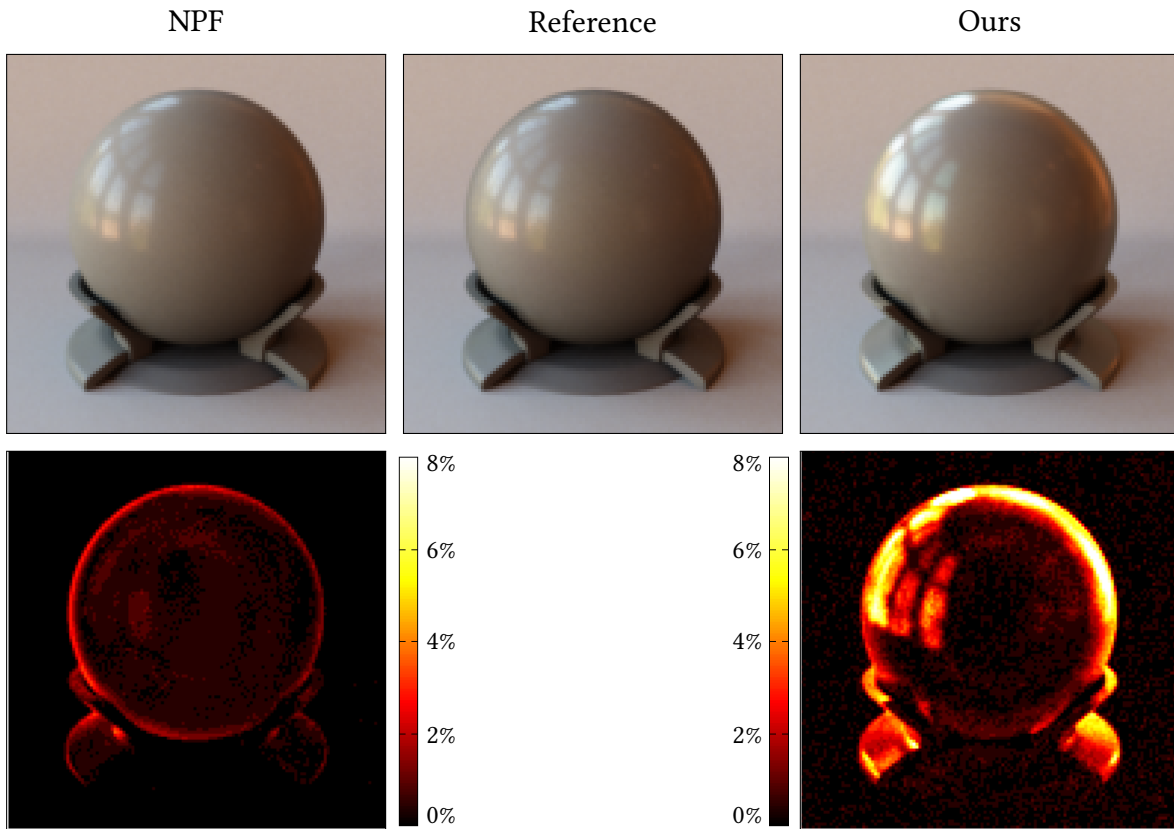


Slices

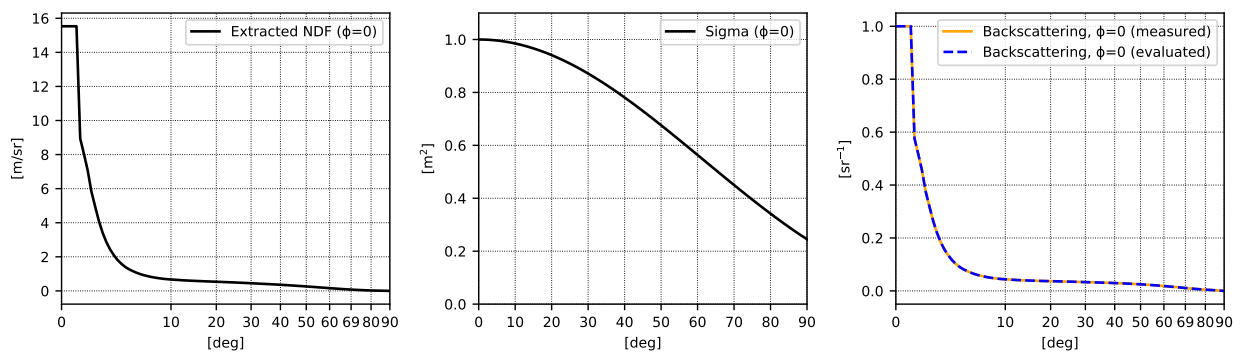


33 gray-plastic

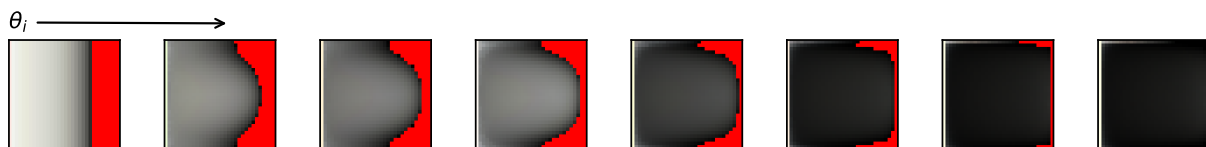
Renderings and CIE dE00



Plots

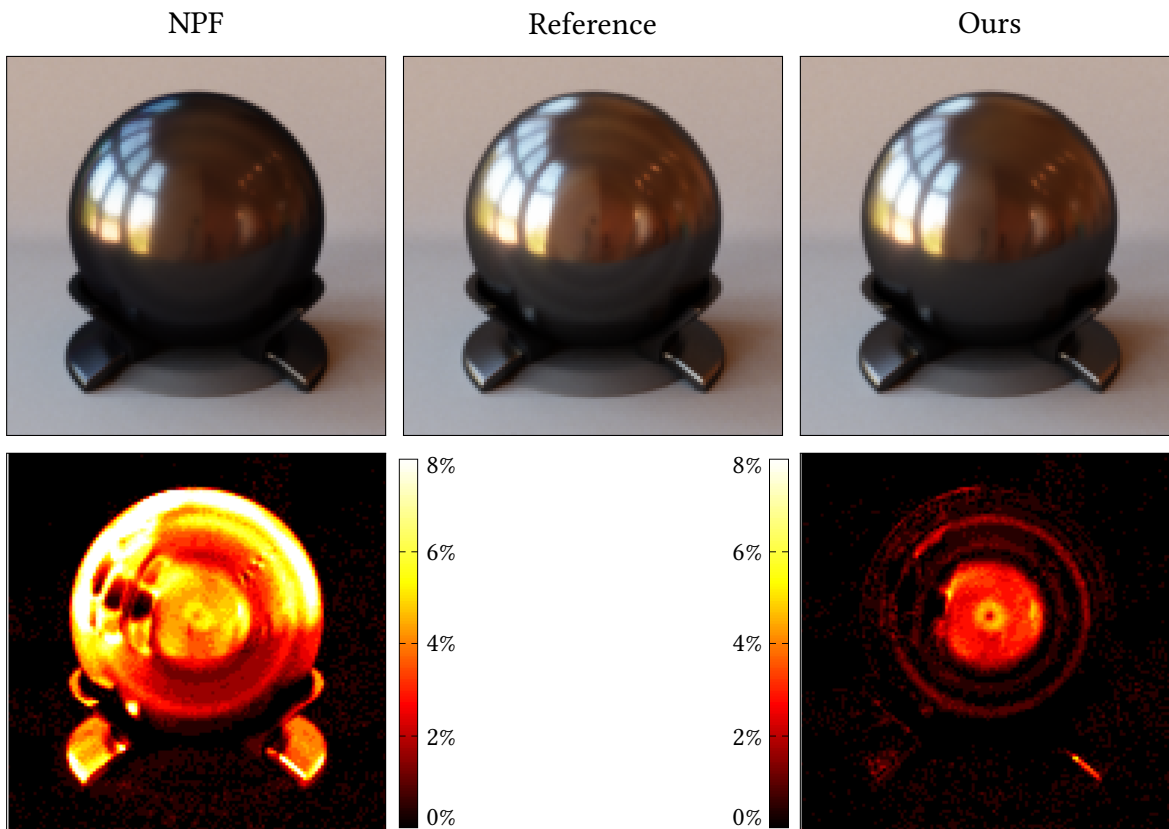


Slices

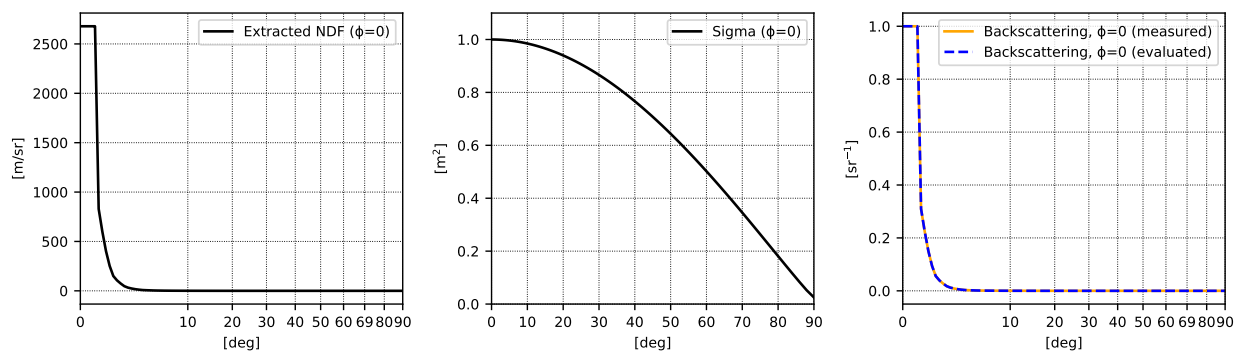


34 grease-covered-steel

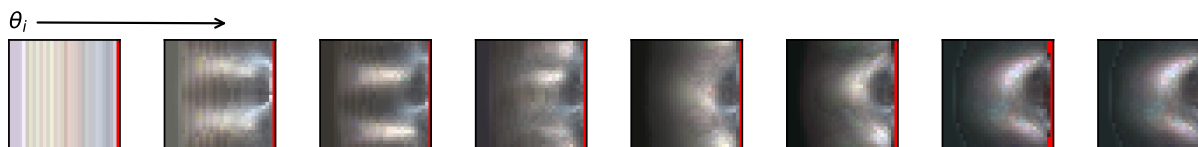
Renderings and CIE dE00



Plots

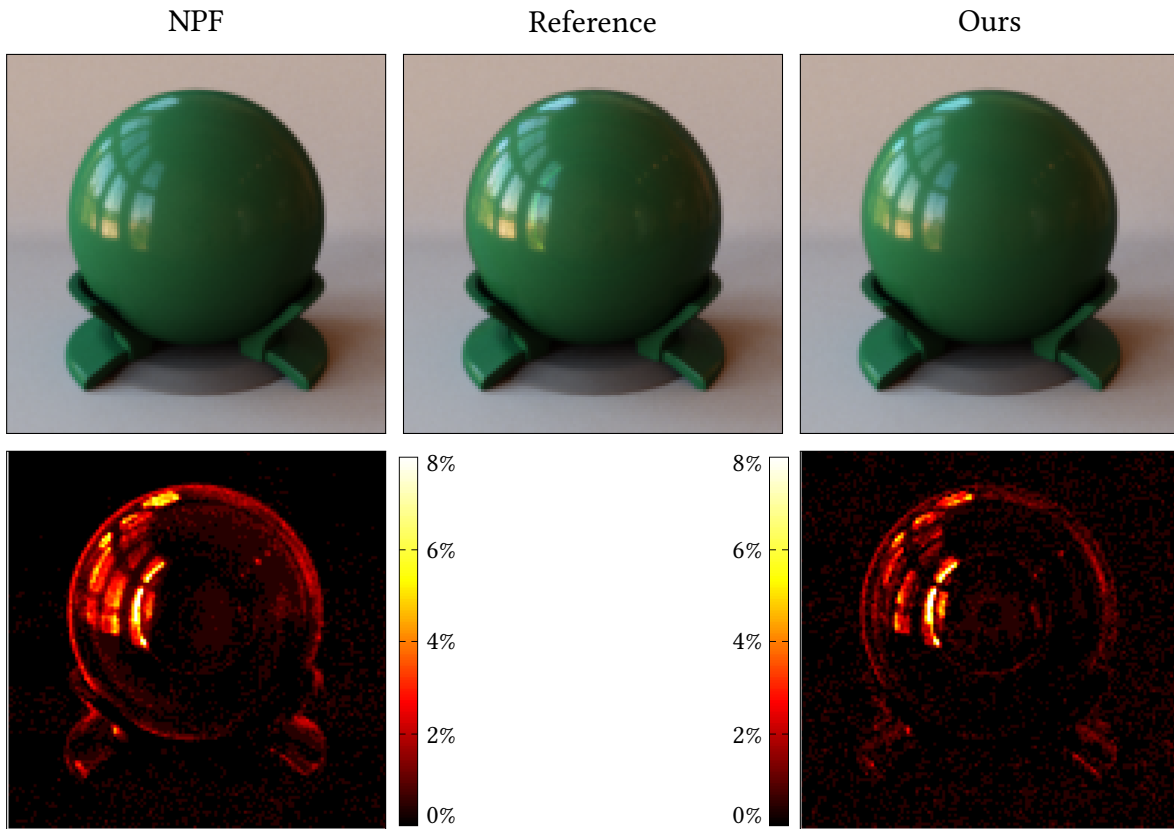


Slices

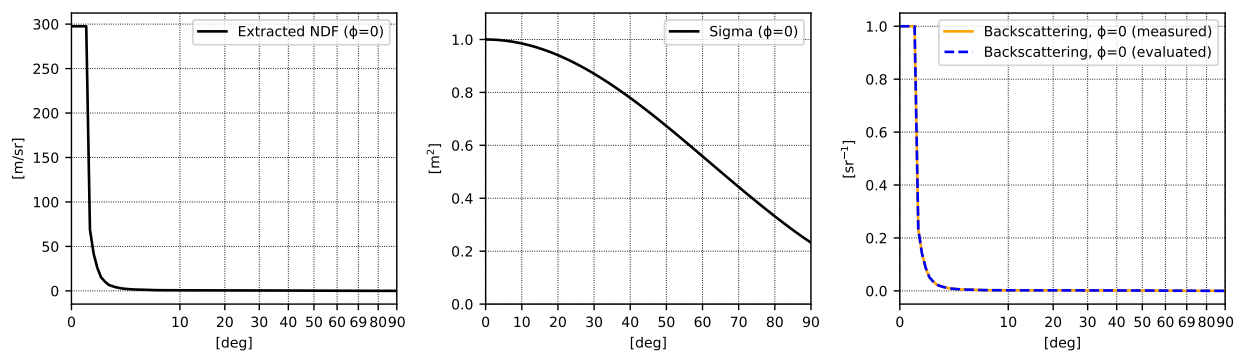


35 green-acrylic

Renderings and CIE dE00



Plots

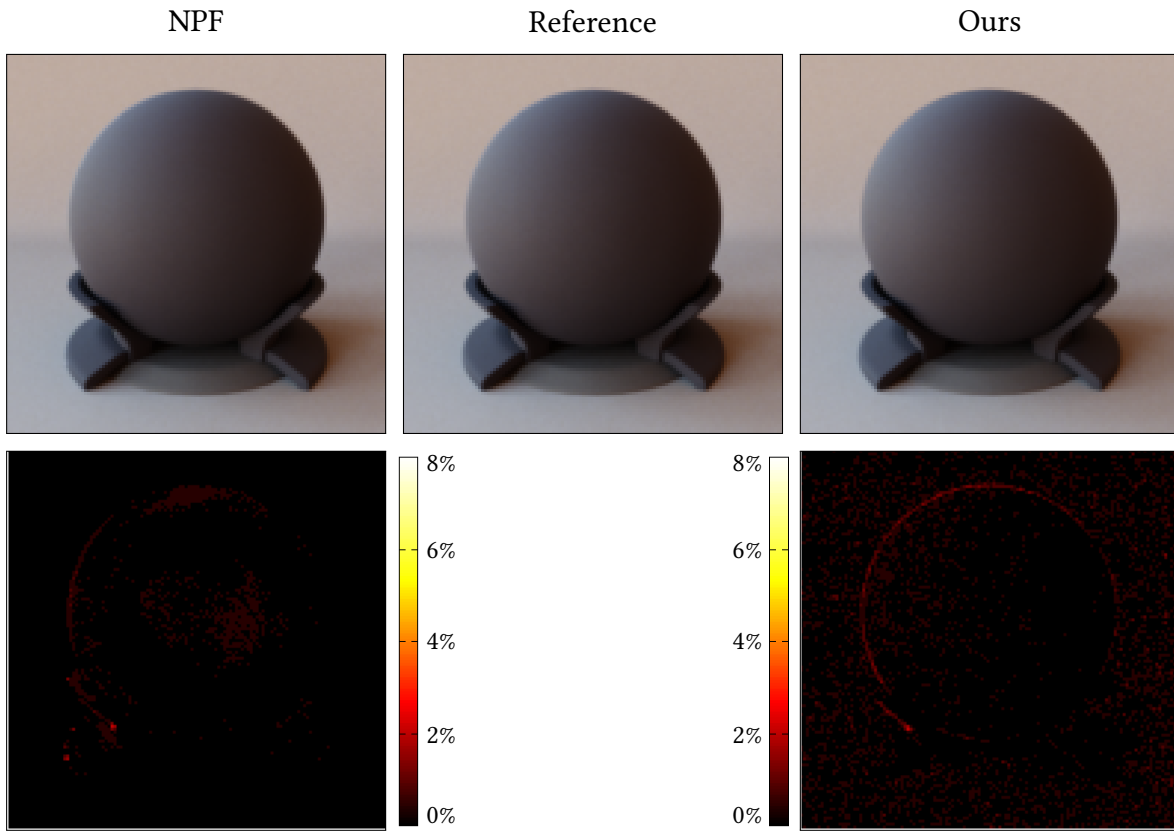


Slices

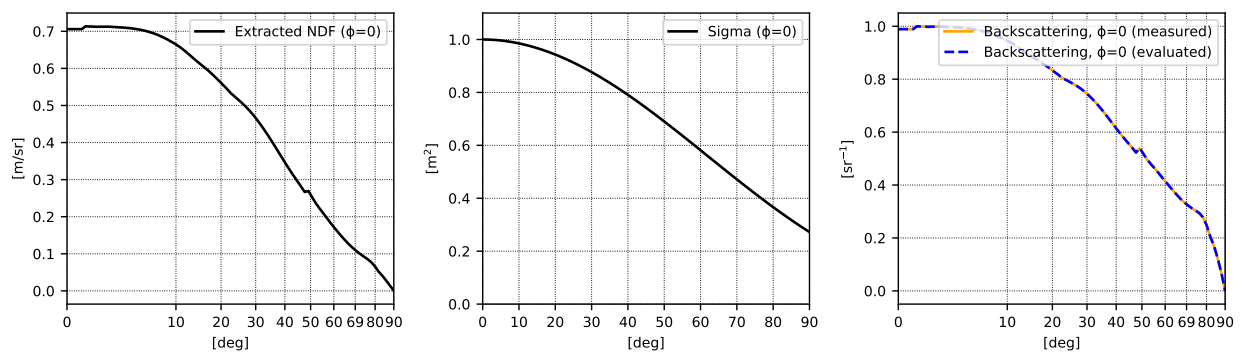


36 green-fabric

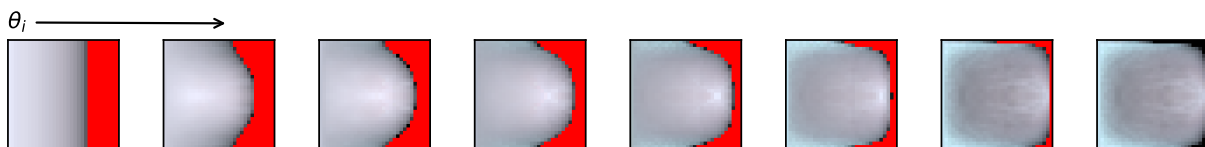
Renderings and CIE dE00



Plots

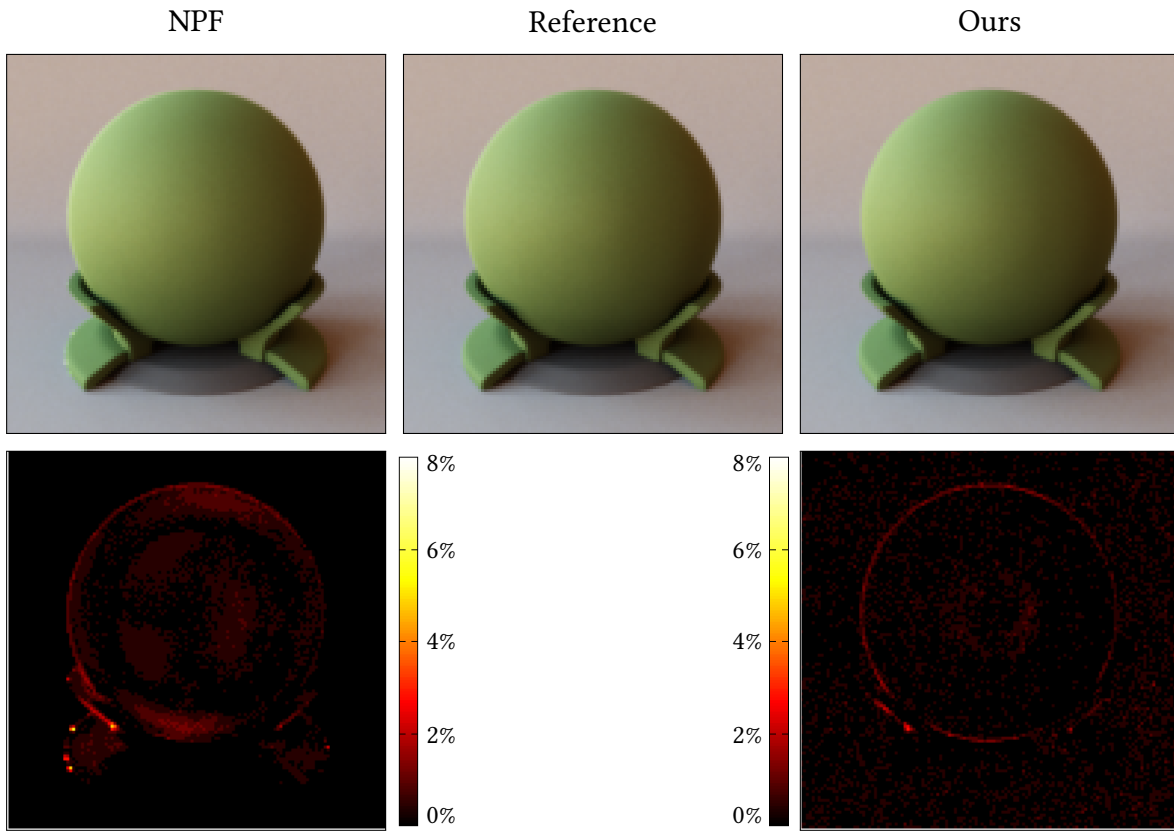


Slices

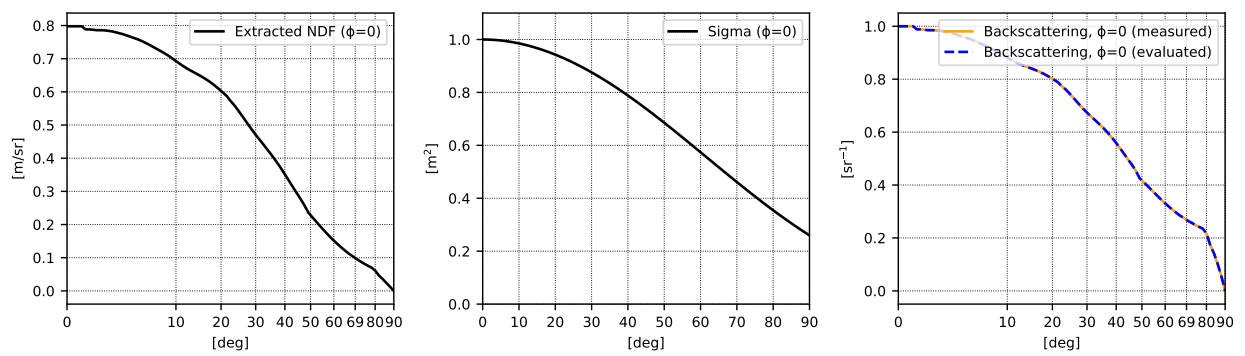


37 green-latex

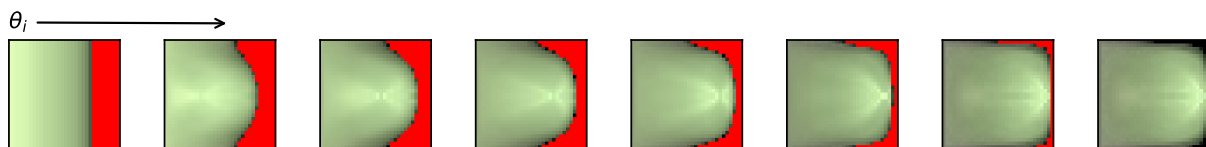
Renderings and CIE dE00



Plots

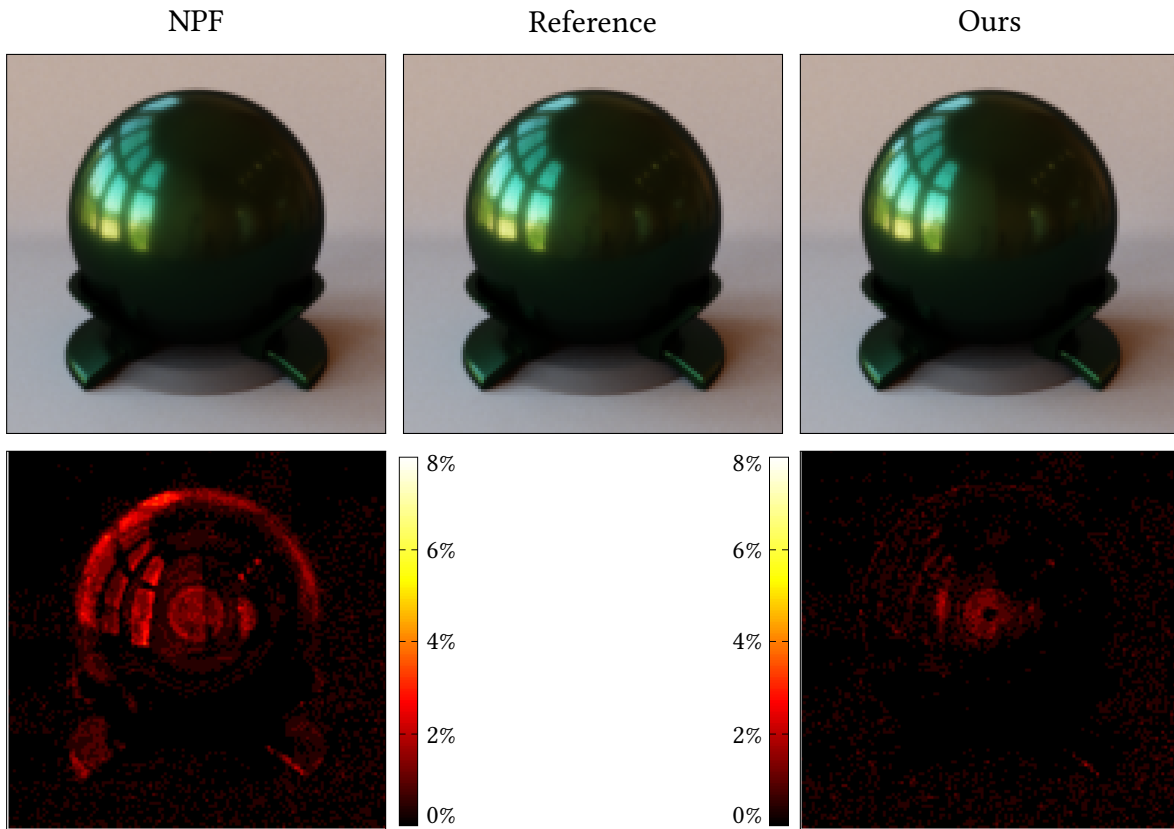


Slices

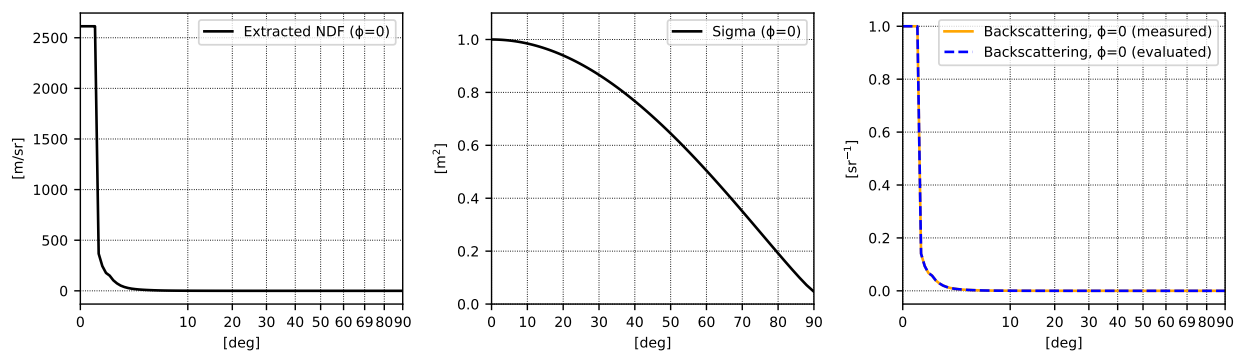


38 green-metallic-paint2

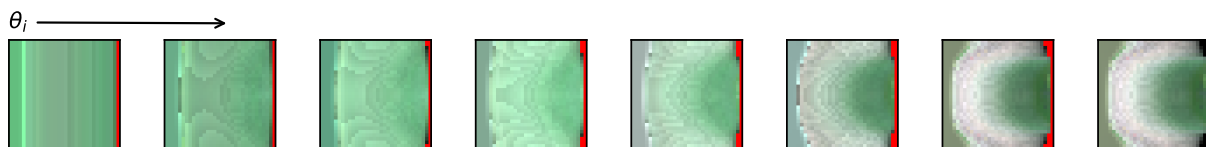
Renderings and CIE dE00



Plots

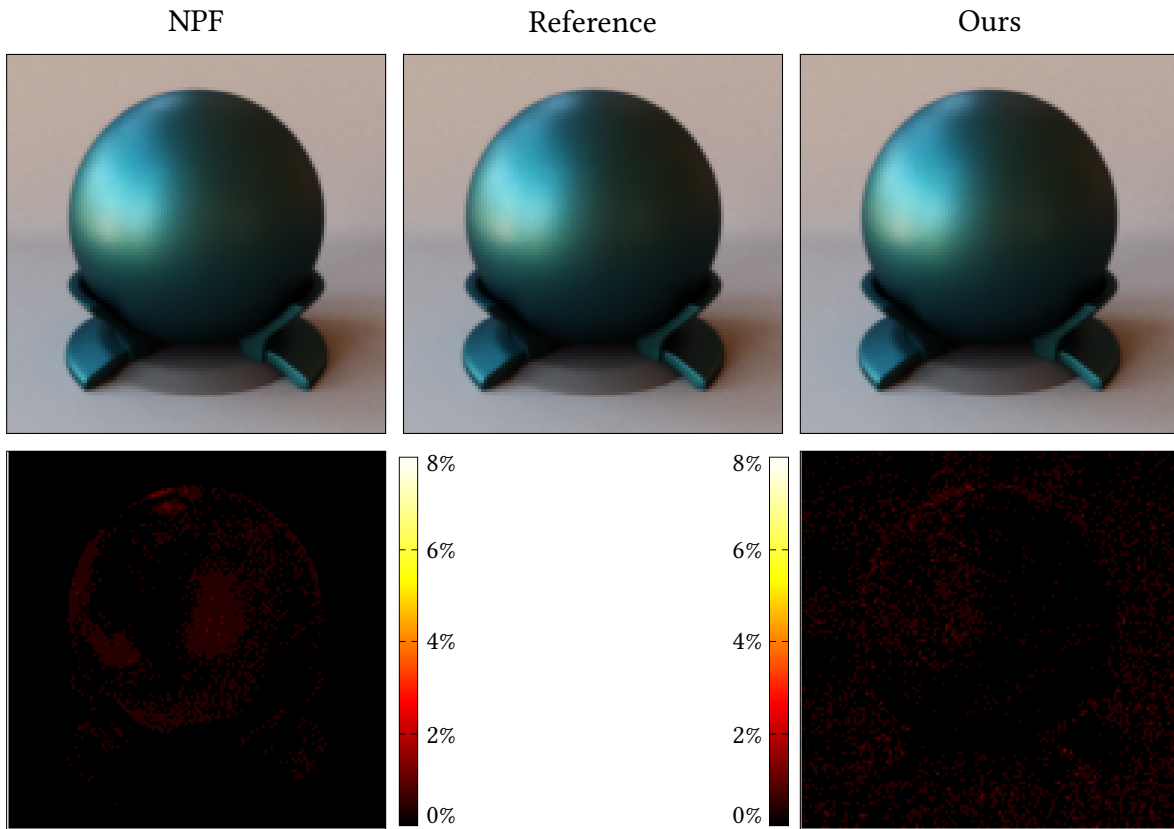


Slices

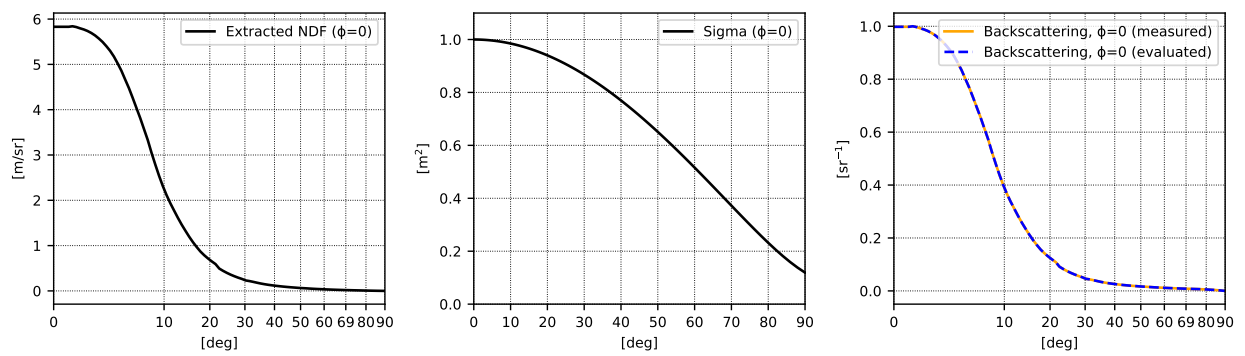


39 green-metallic-paint

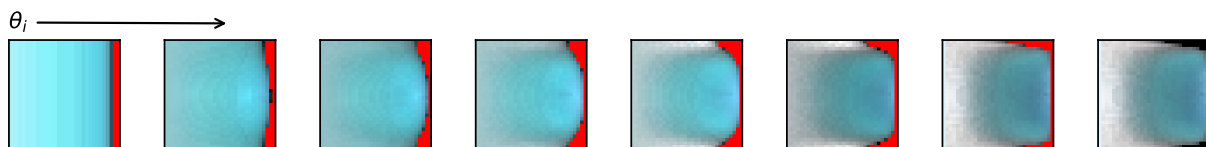
Renderings and CIE dE00



Plots

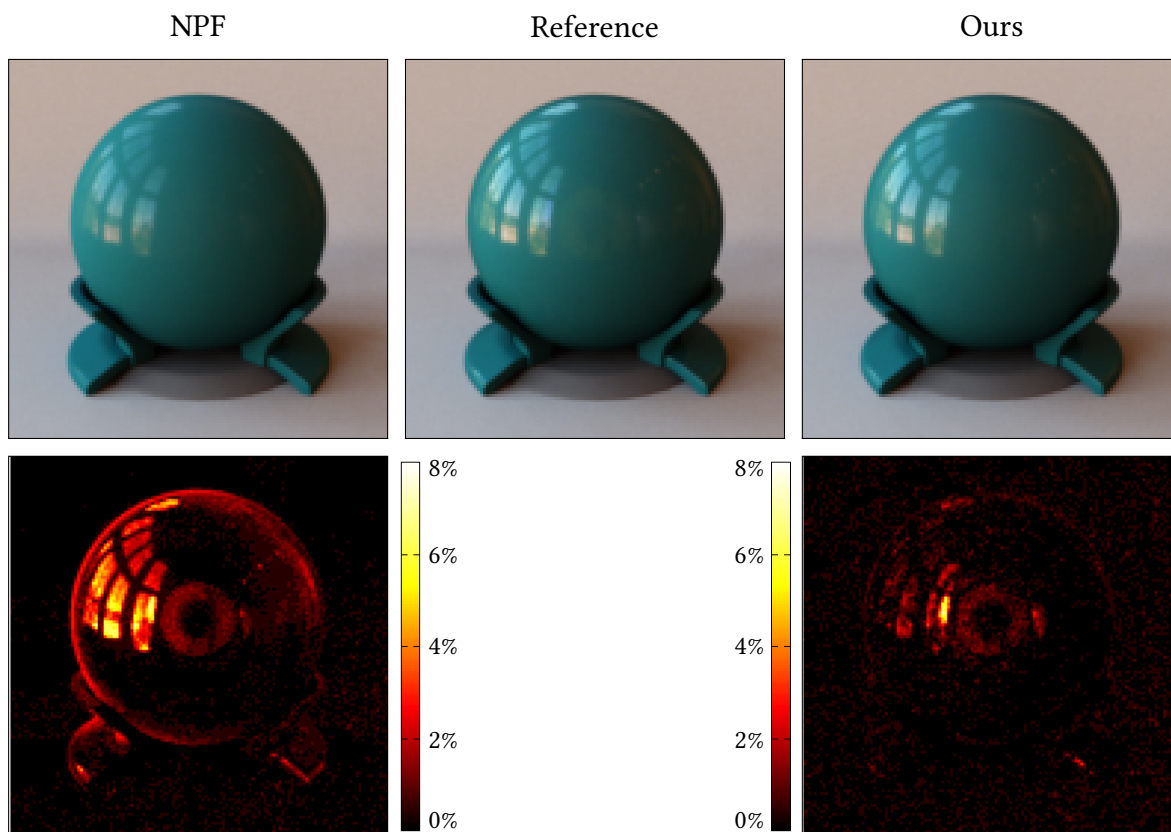


Slices

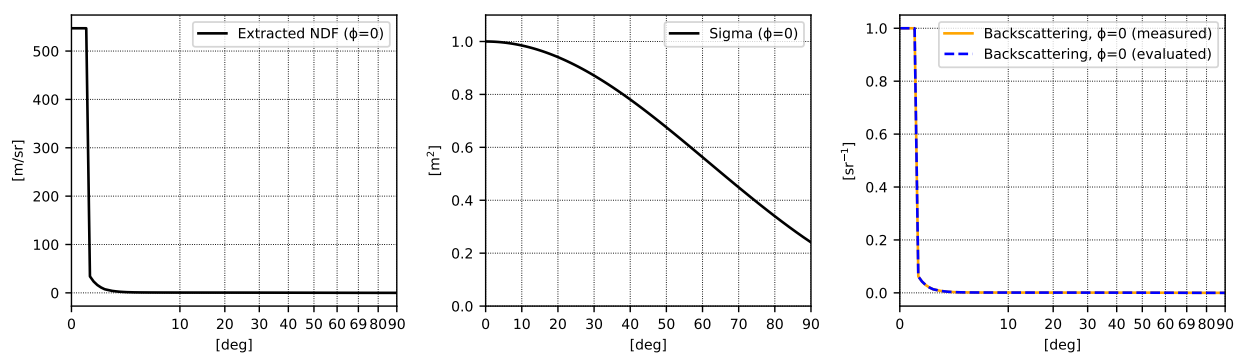


40 green-plastic

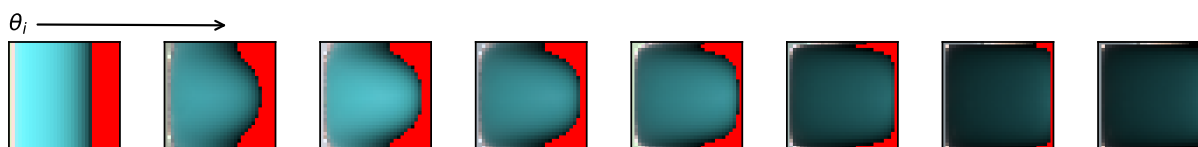
Renderings and CIE dE00



Plots

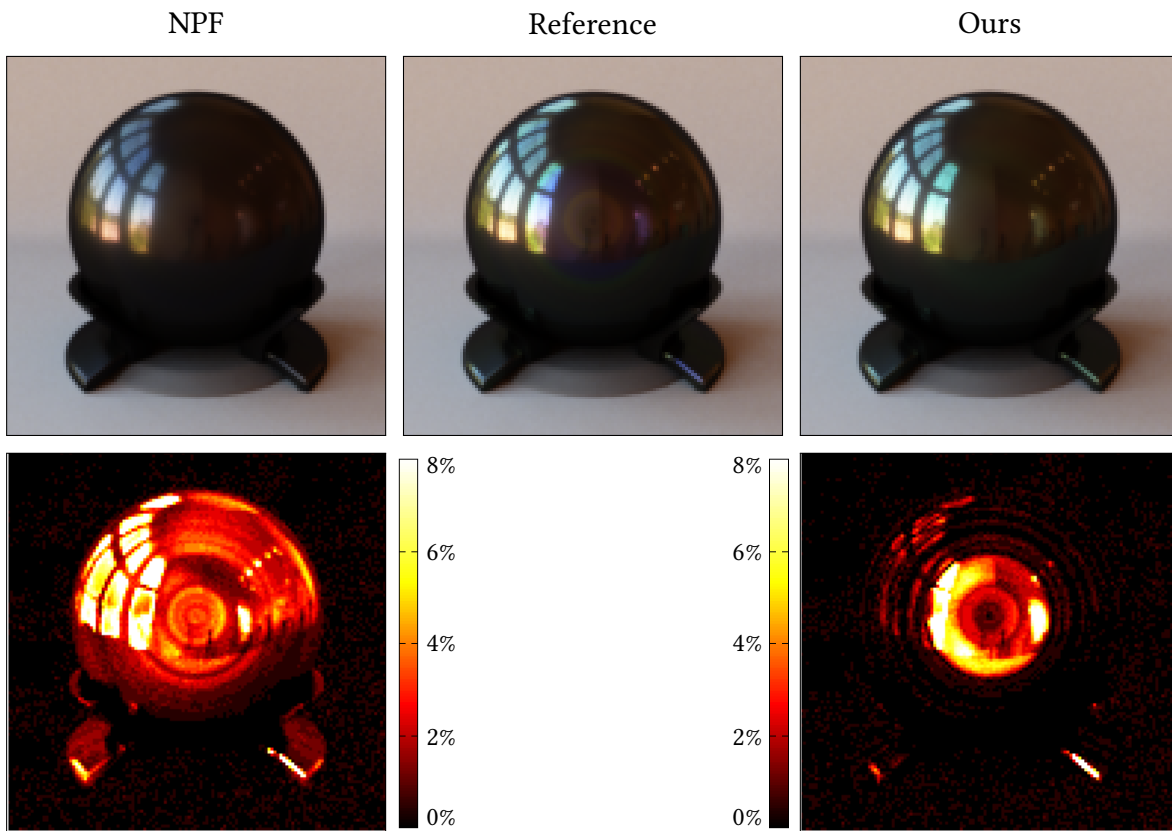


Slices

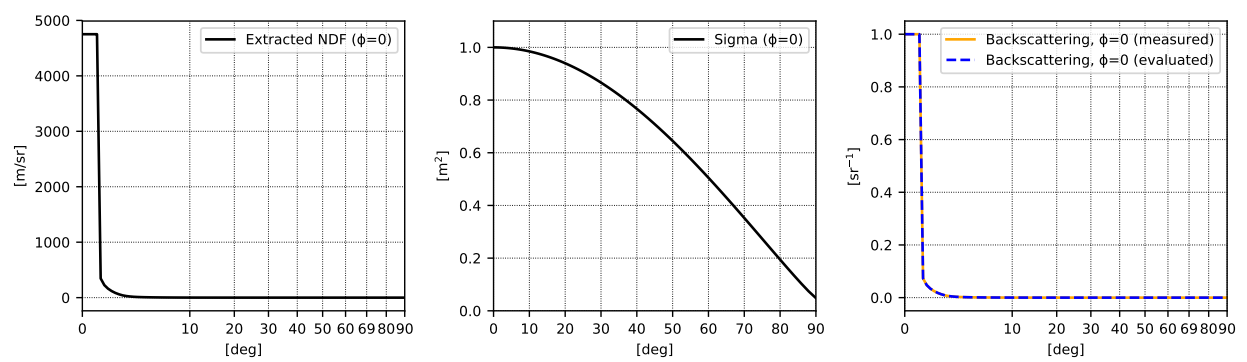


41 hematite

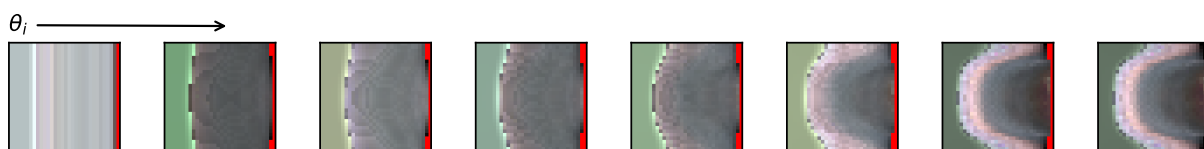
Renderings and CIE dE00



Plots

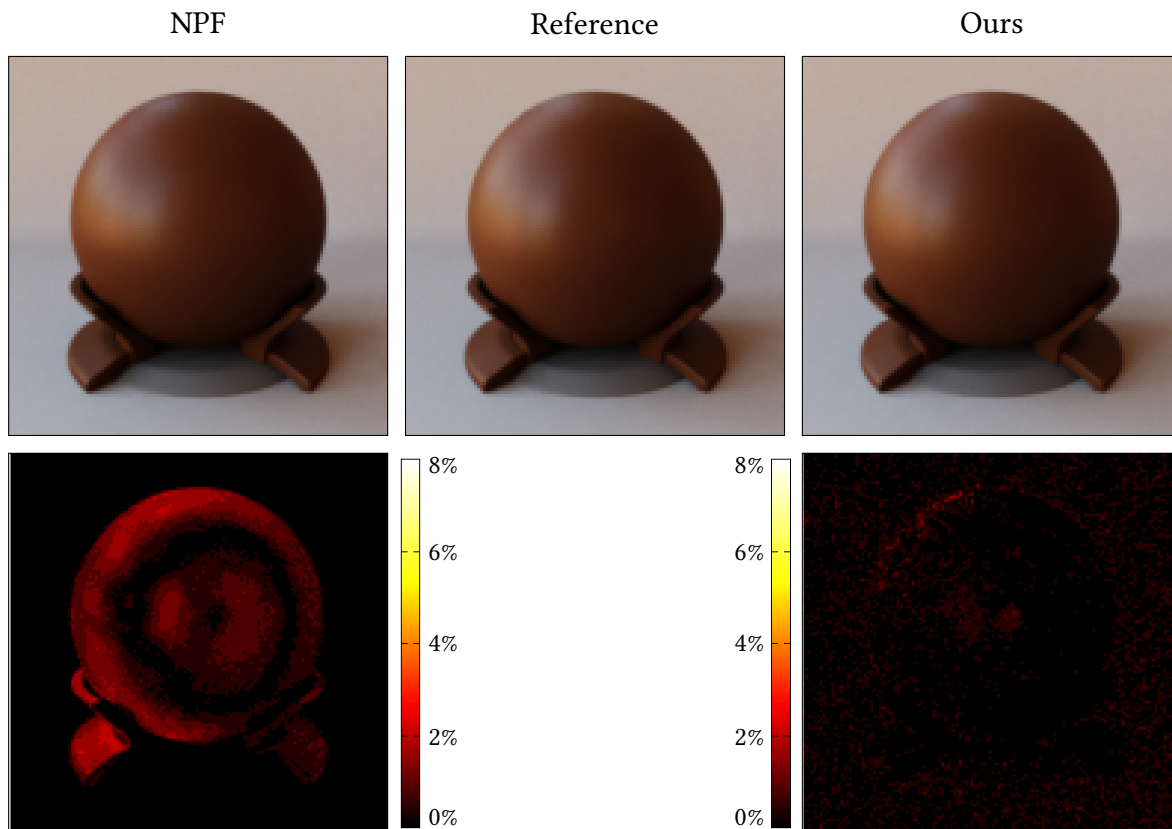


Slices

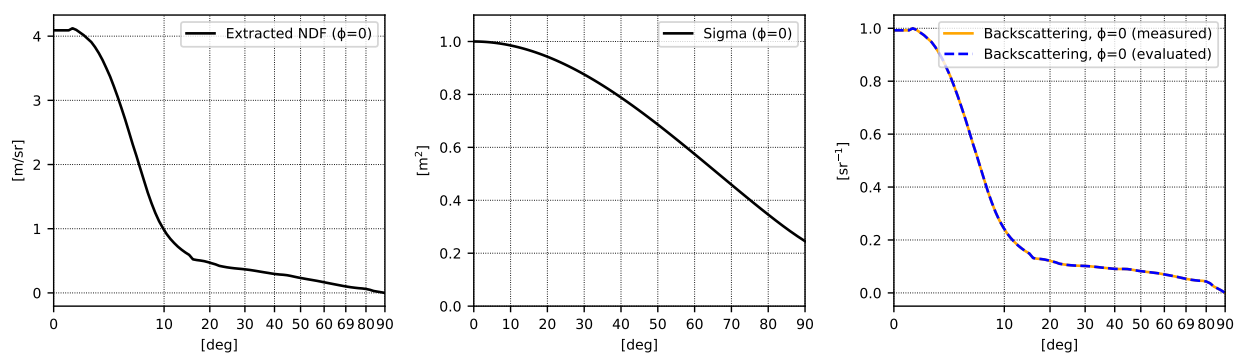


42 ipswich-pine-221

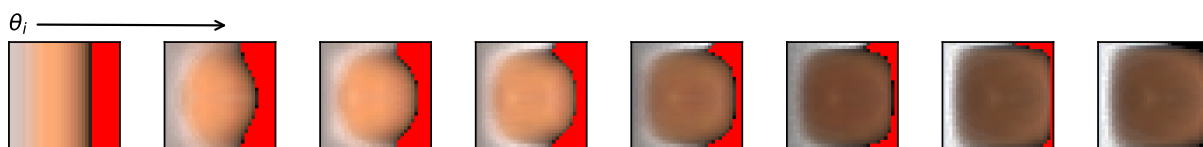
Renderings and CIE dE00



Plots

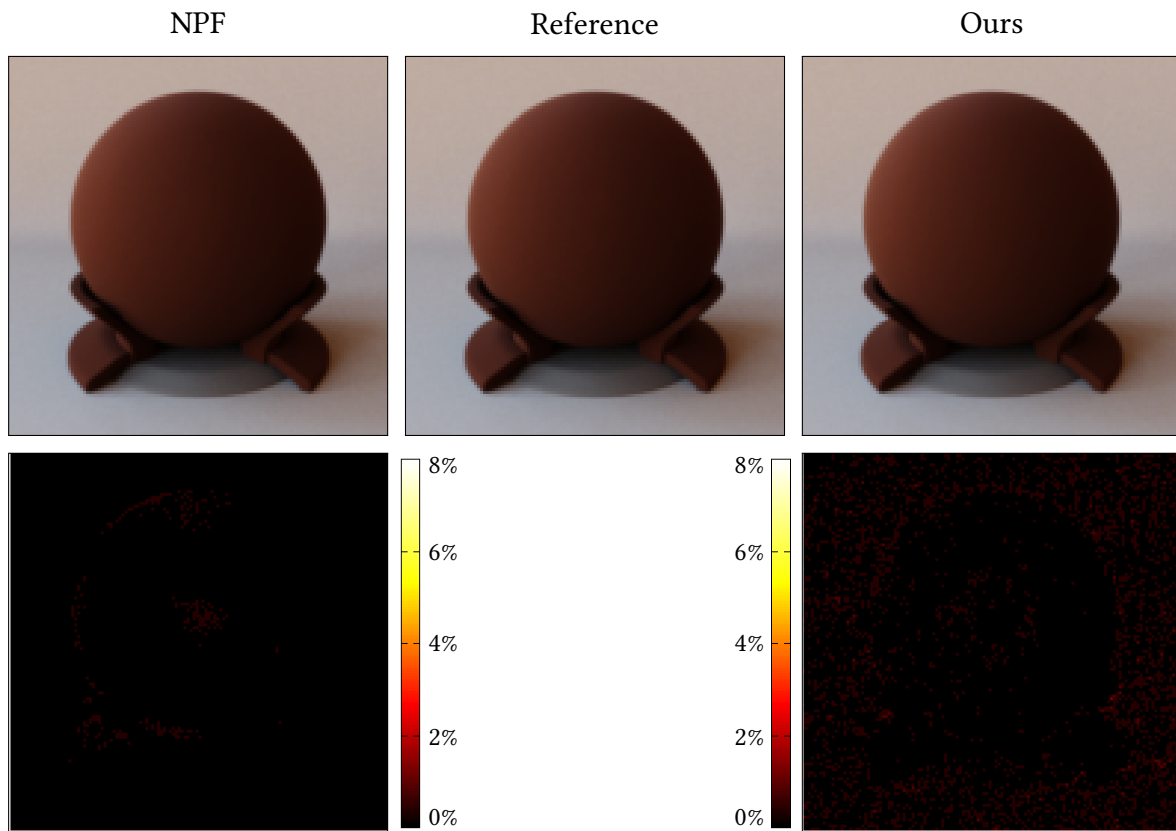


Slices

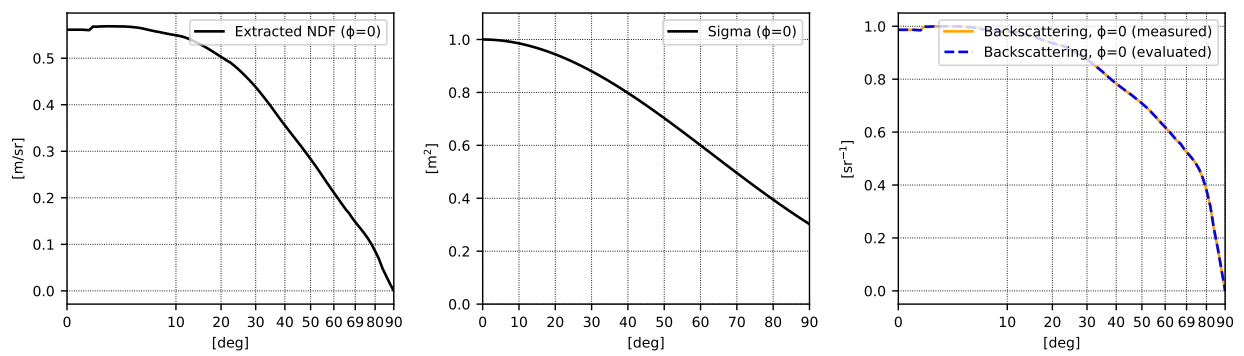


43 light-brown-fabric

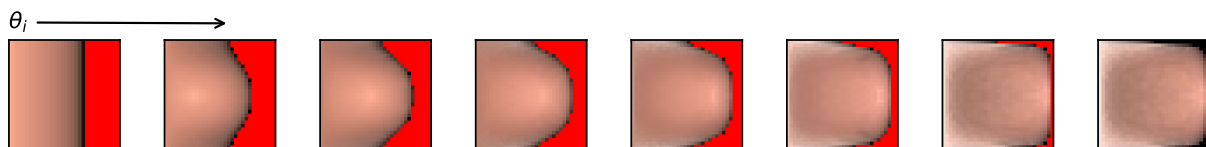
Renderings and CIE dE00



Plots

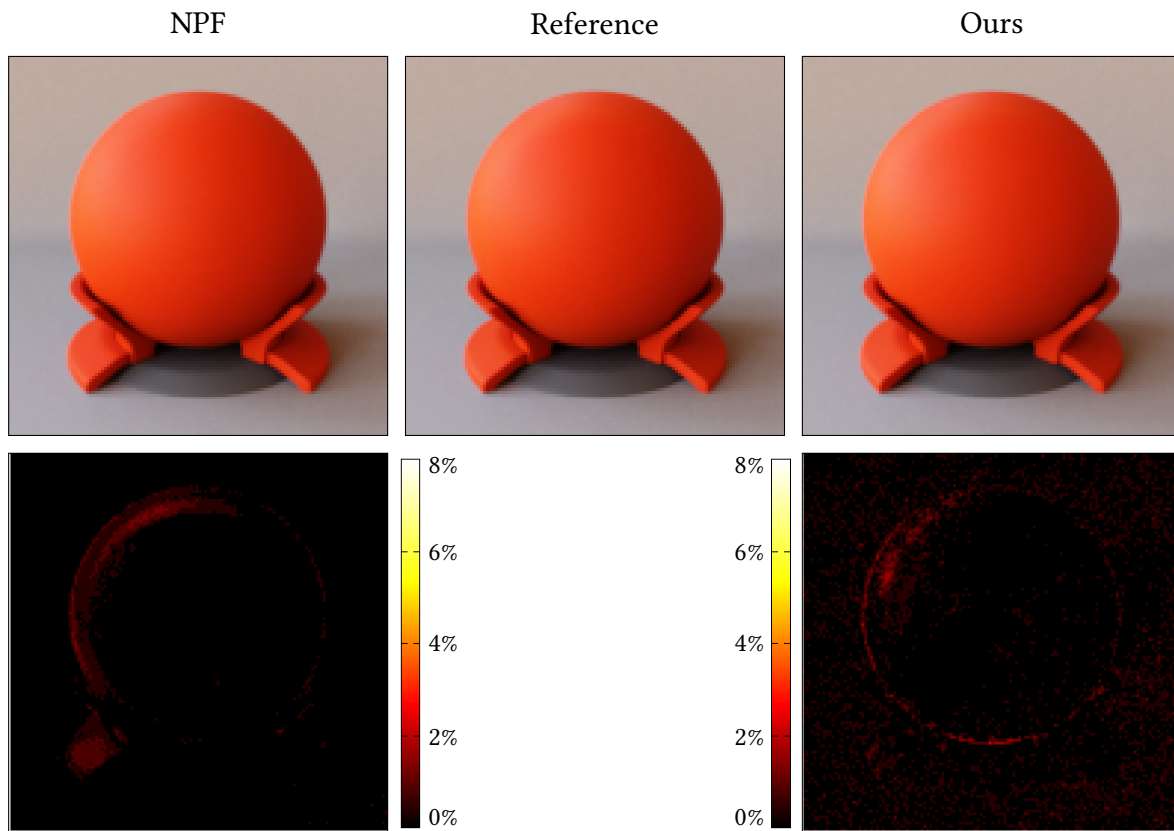


Slices

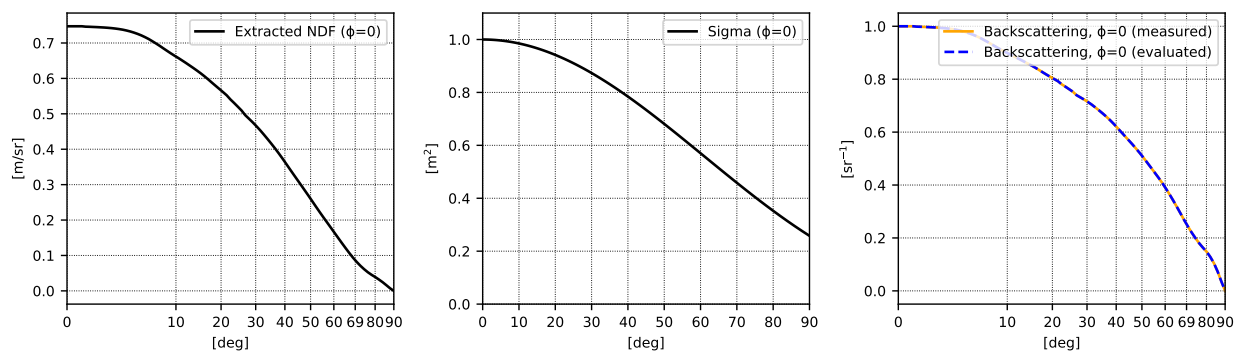


44 light-red-paint

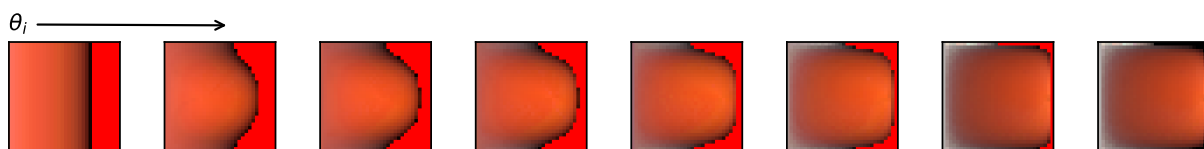
Renderings and CIE dE00



Plots

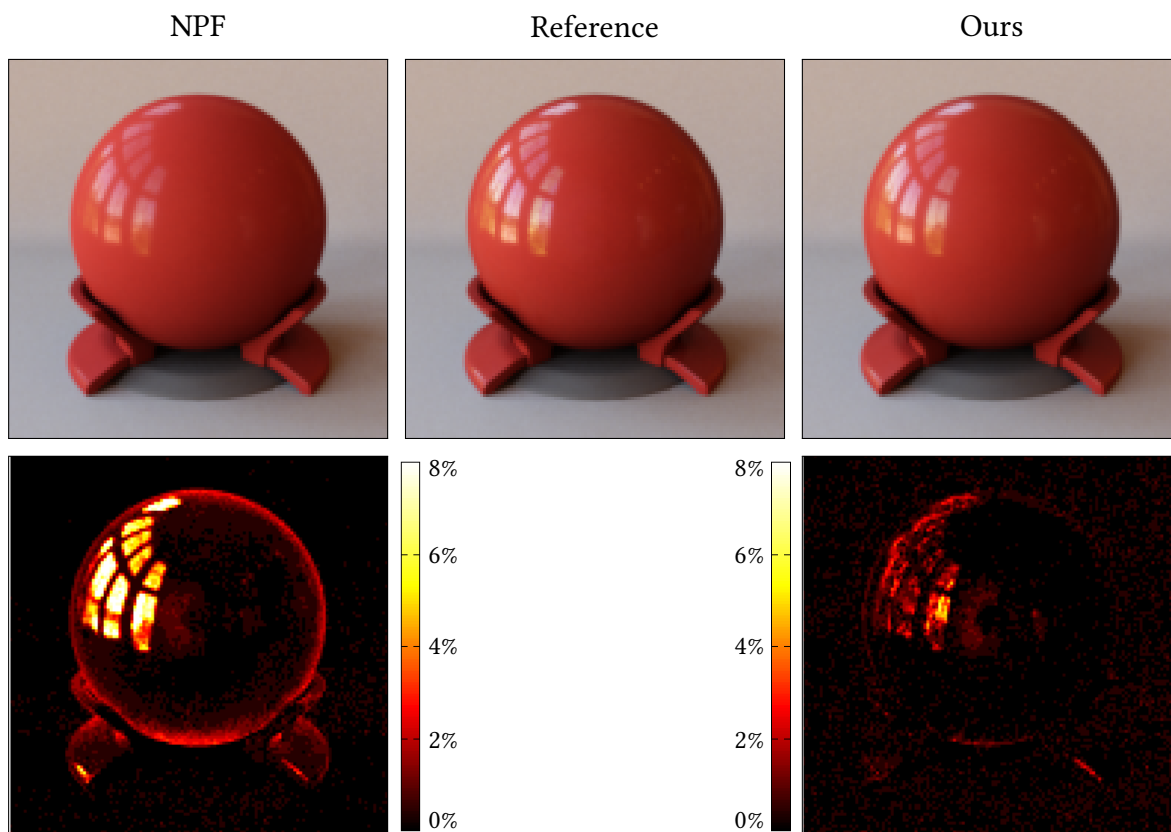


Slices

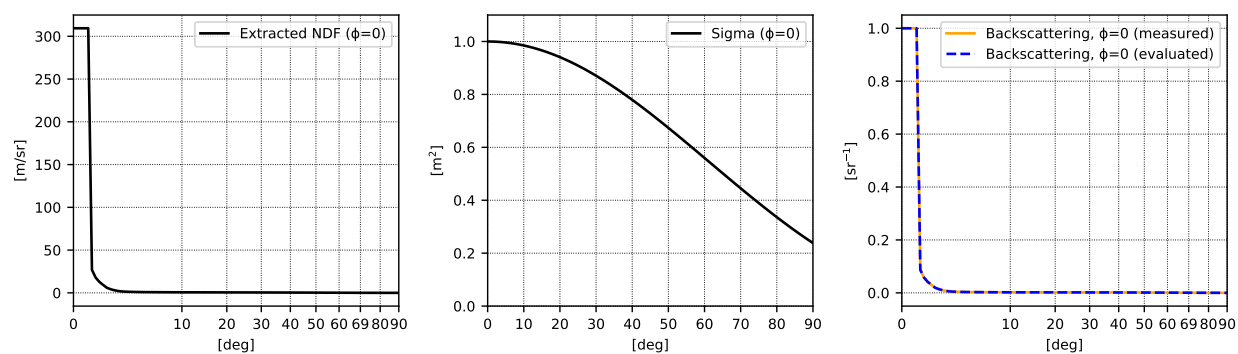


45 maroon-plastic

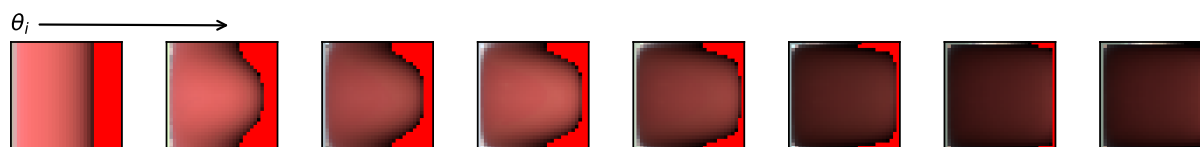
Renderings and CIE dE00



Plots

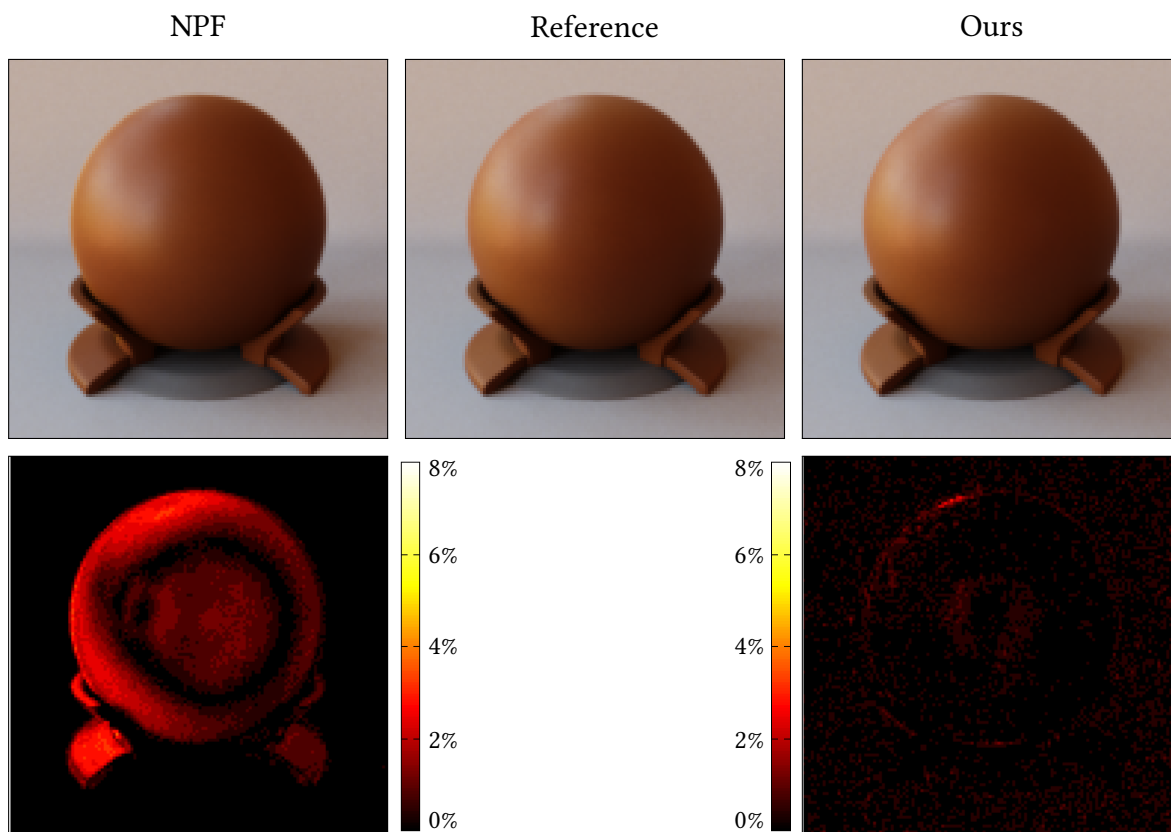


Slices

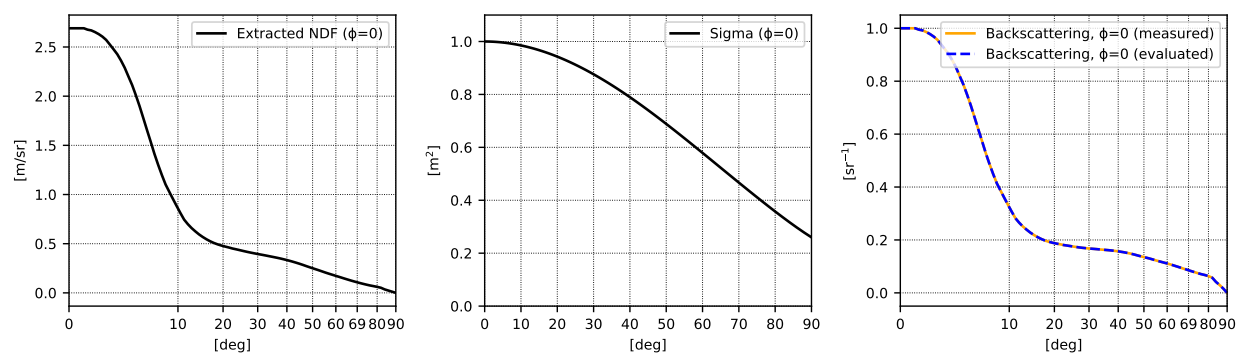


46 natural-209

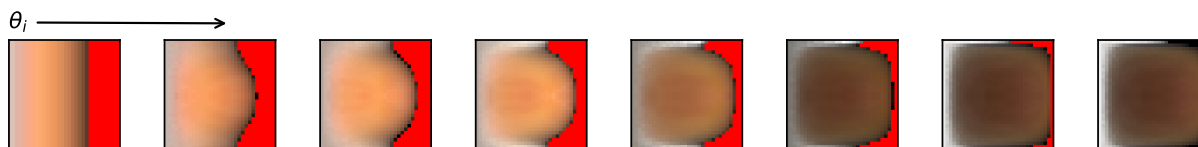
Renderings and CIE dE00



Plots

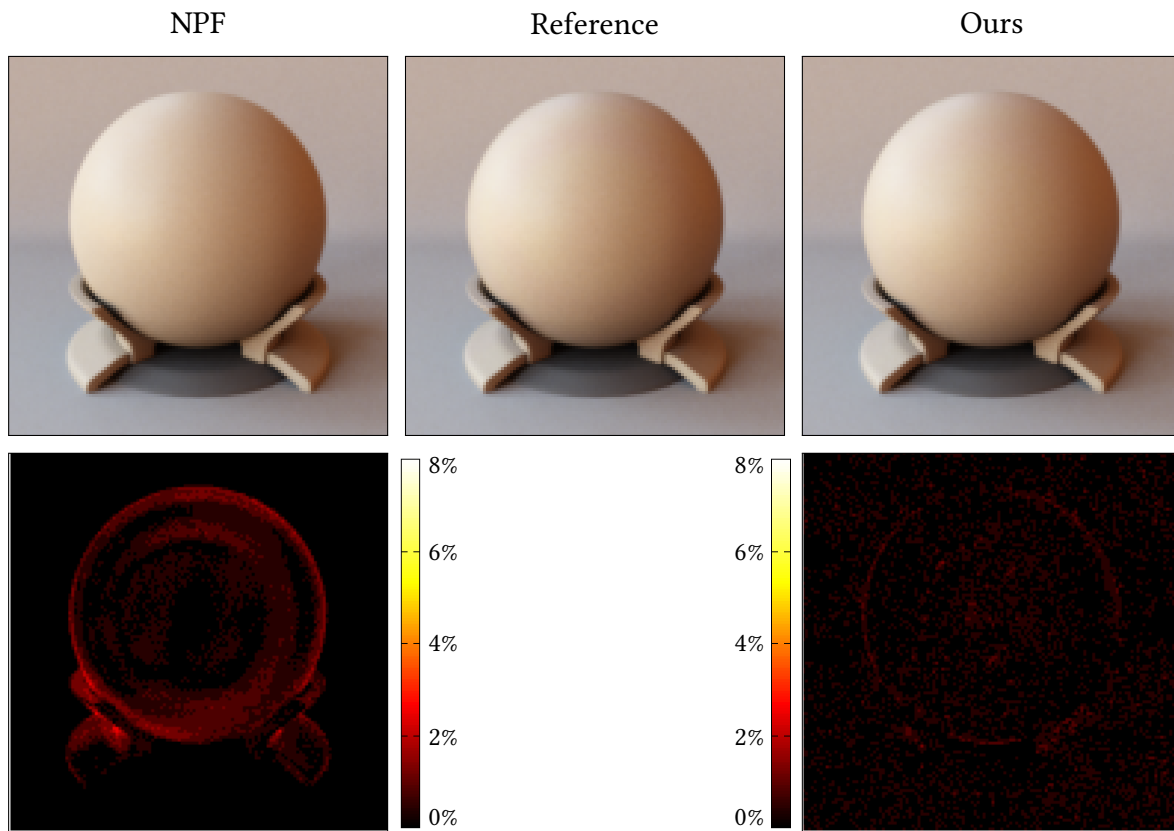


Slices

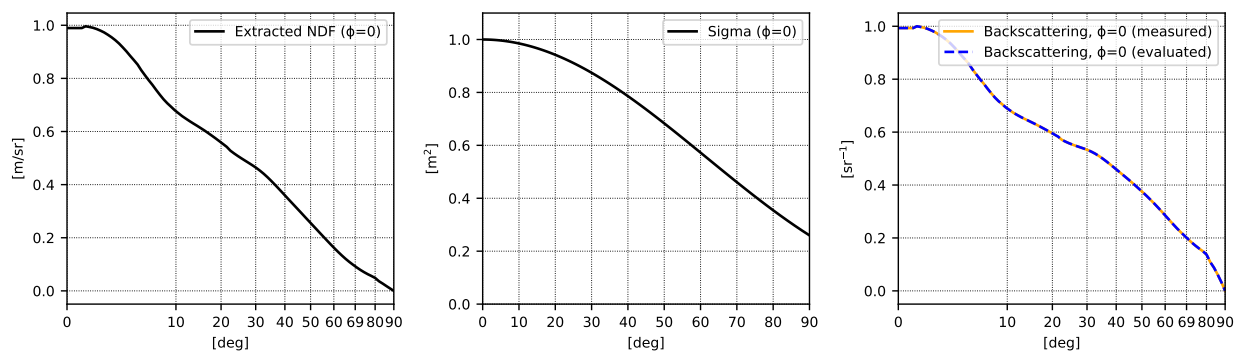


47 neoprene-rubber

Renderings and CIE dE00



Plots

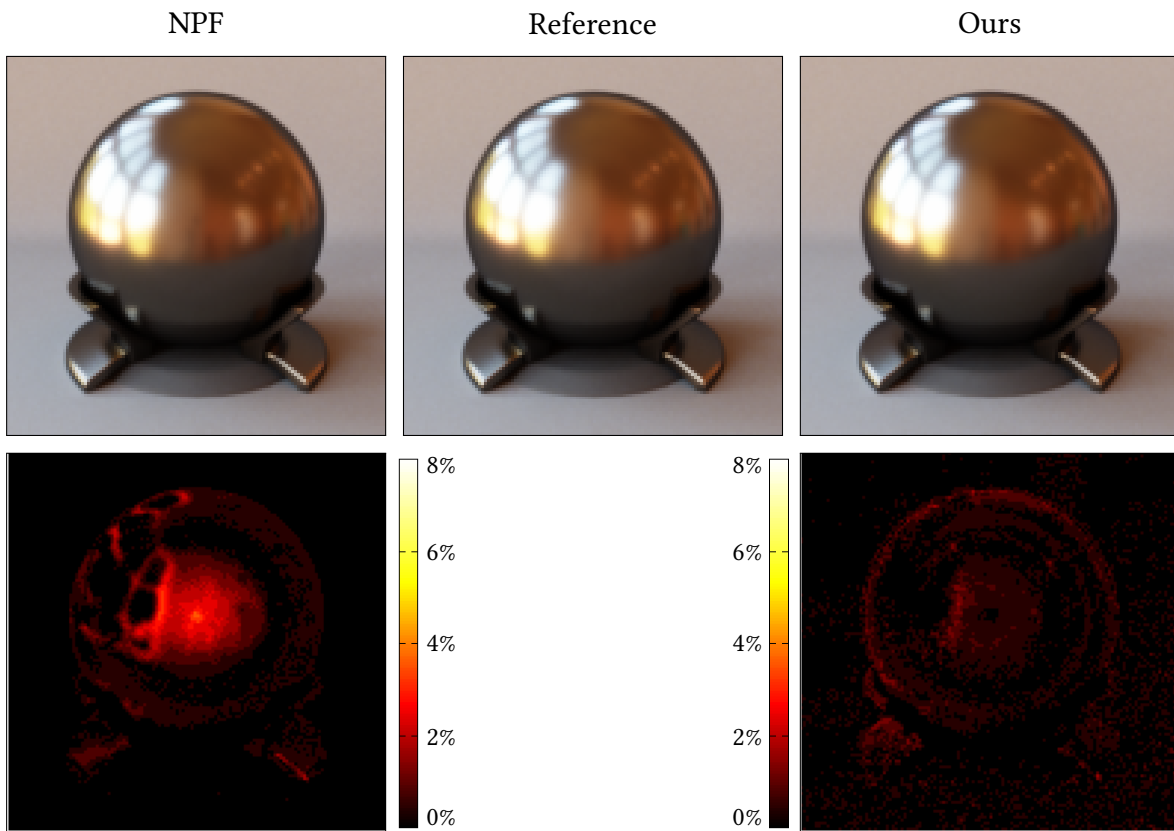


Slices

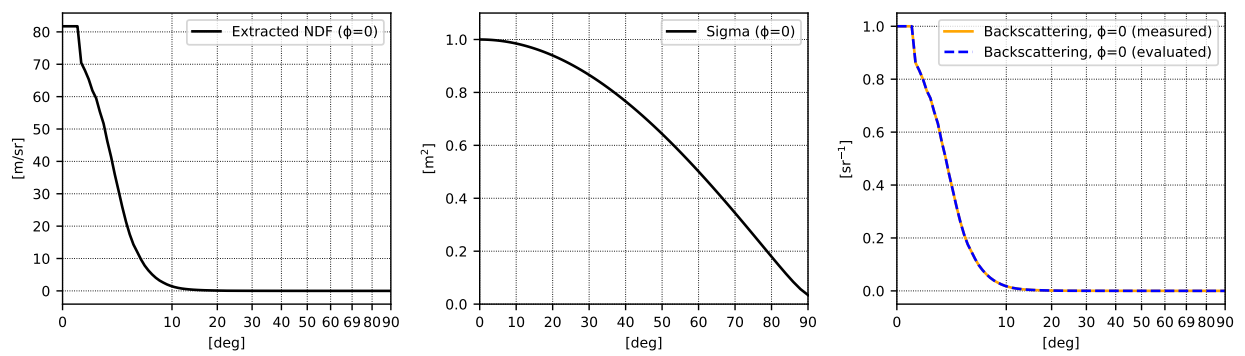


48 nickel

Renderings and CIE dE00



Plots

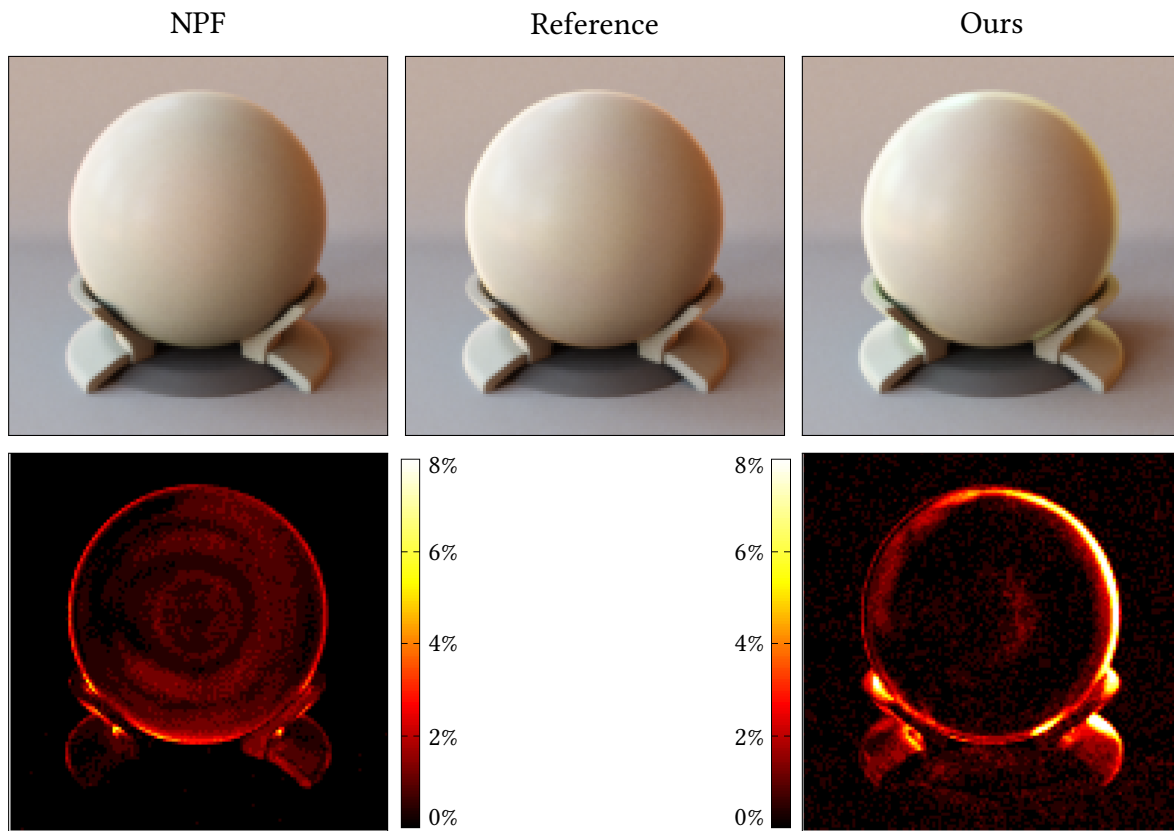


Slices

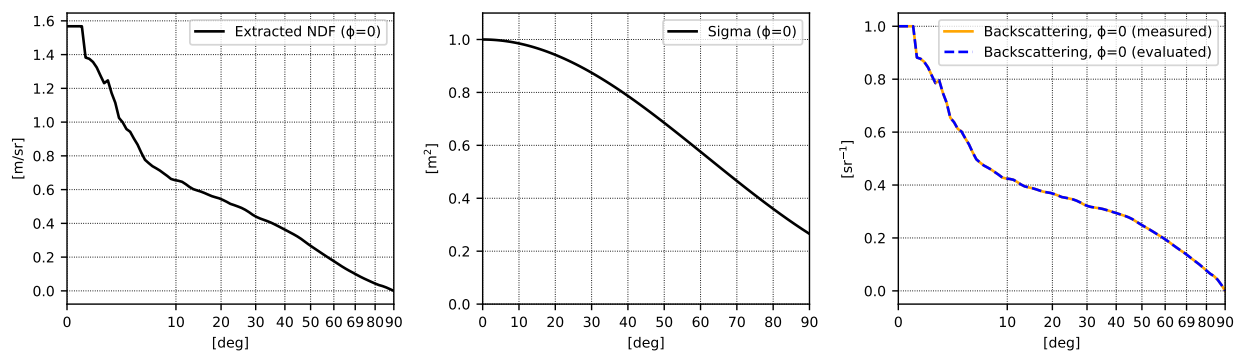


49 nylon

Renderings and CIE dE00



Plots

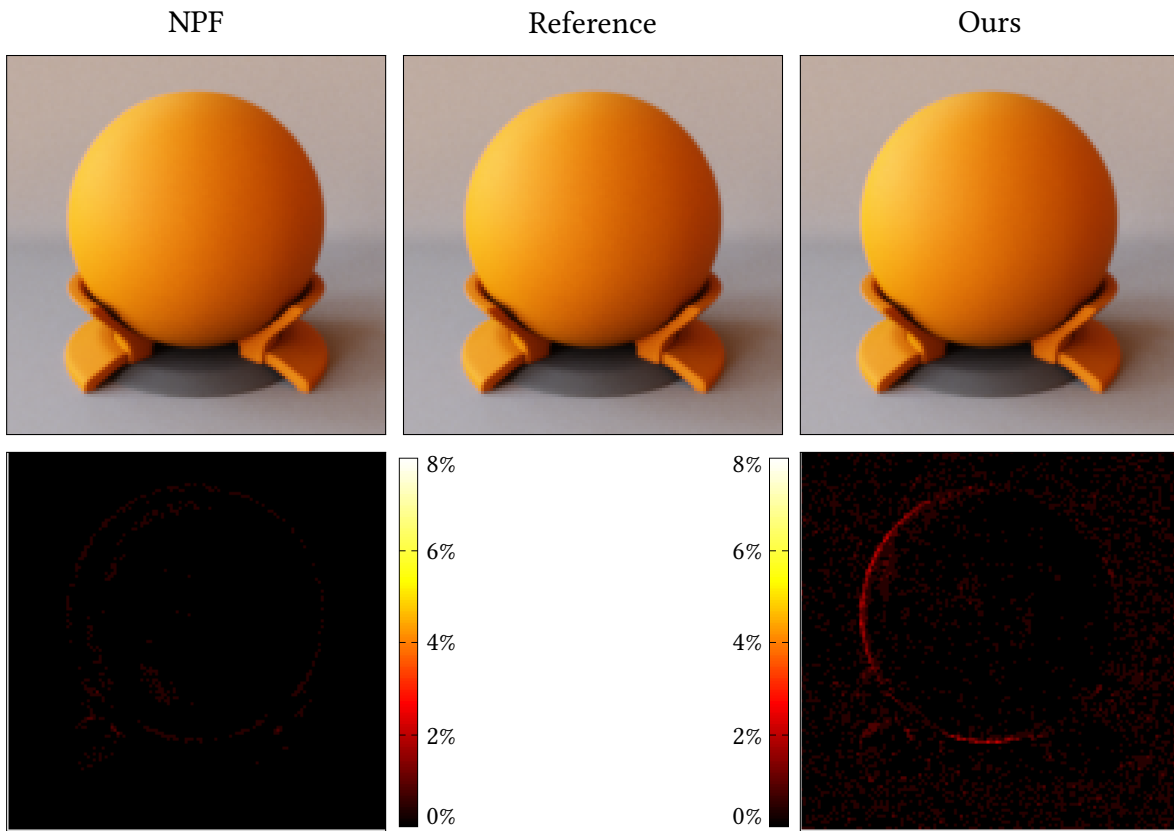


Slices

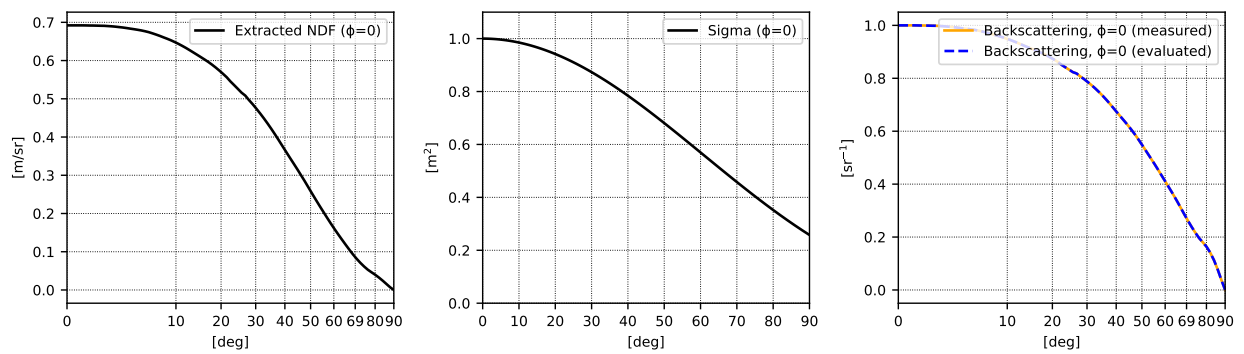


50 orange-paint

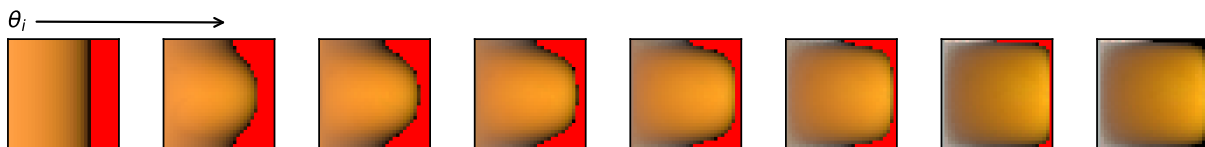
Renderings and CIE dE00



Plots

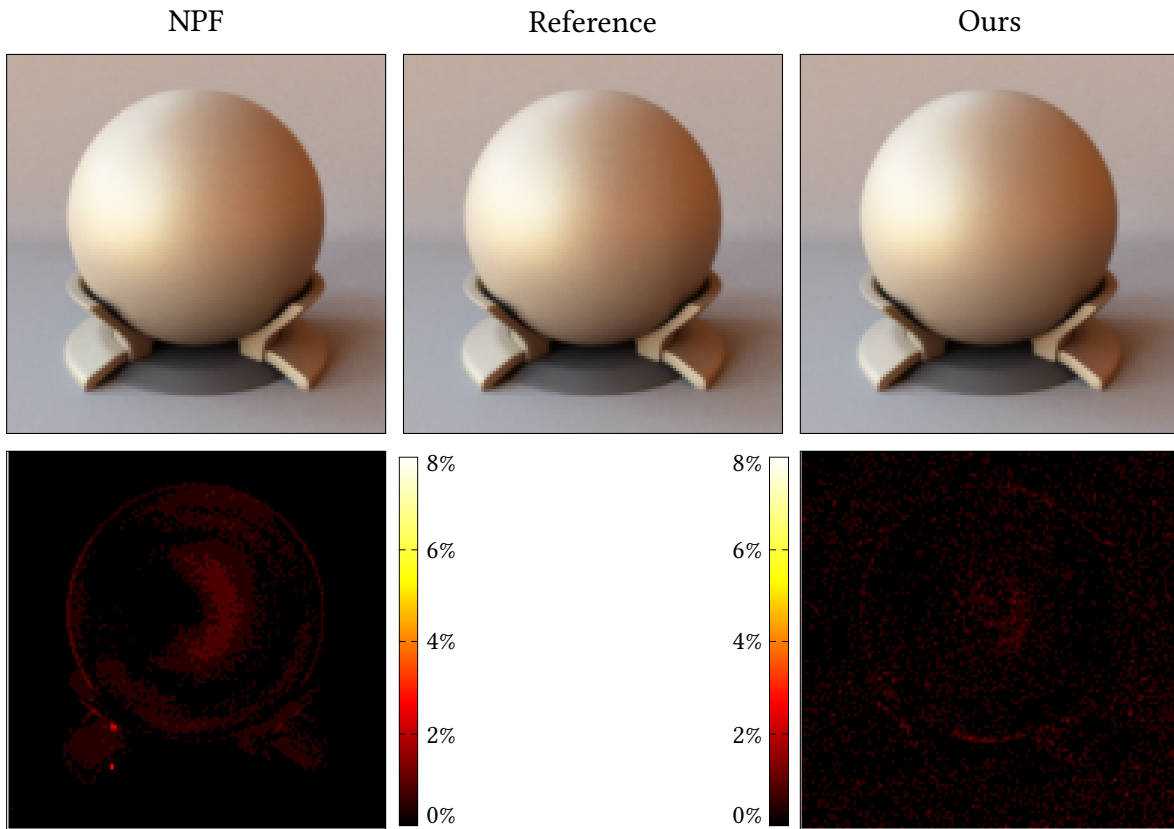


Slices

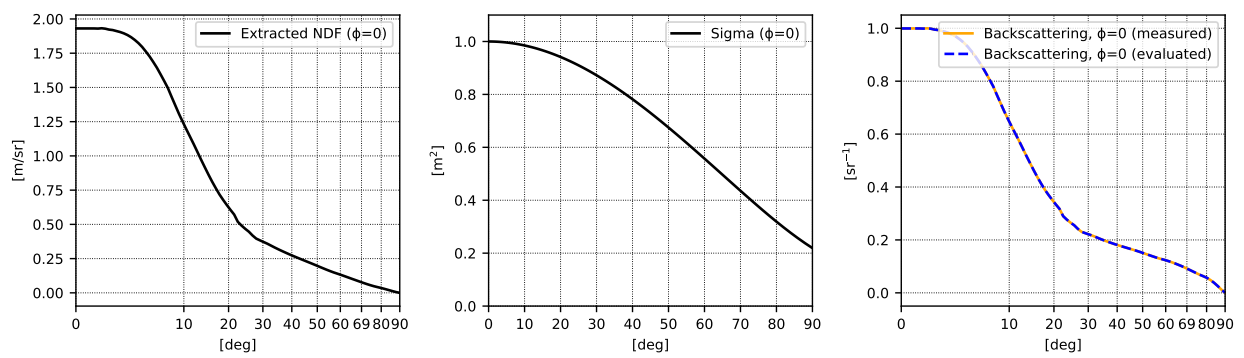


51 pearl-paint

Renderings and CIE dE00



Plots

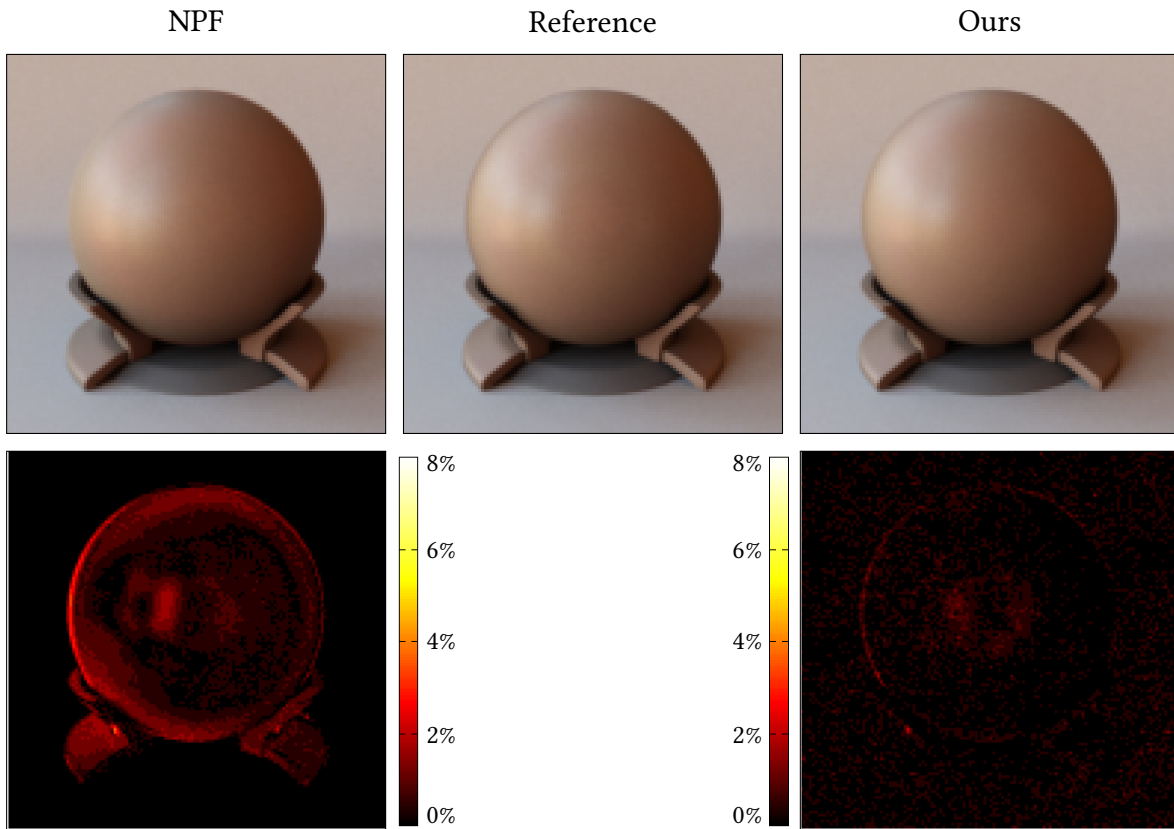


Slices

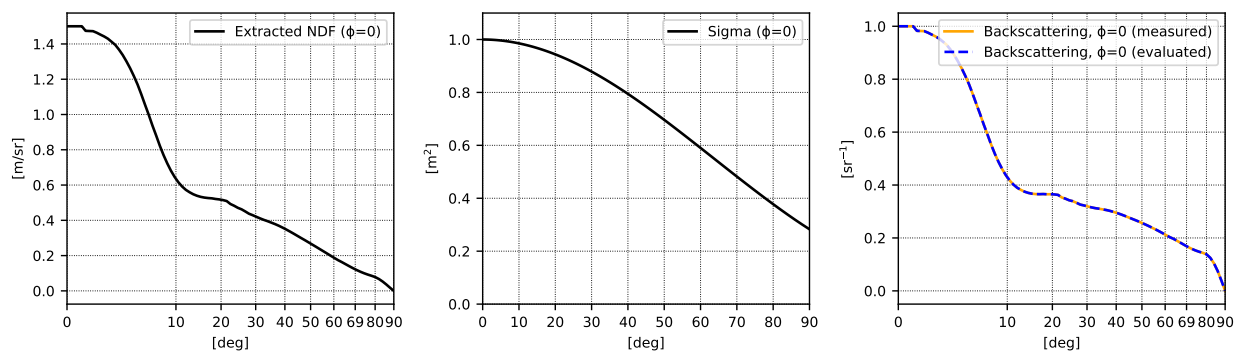


52 pickled-oak-260

Renderings and CIE dE00



Plots

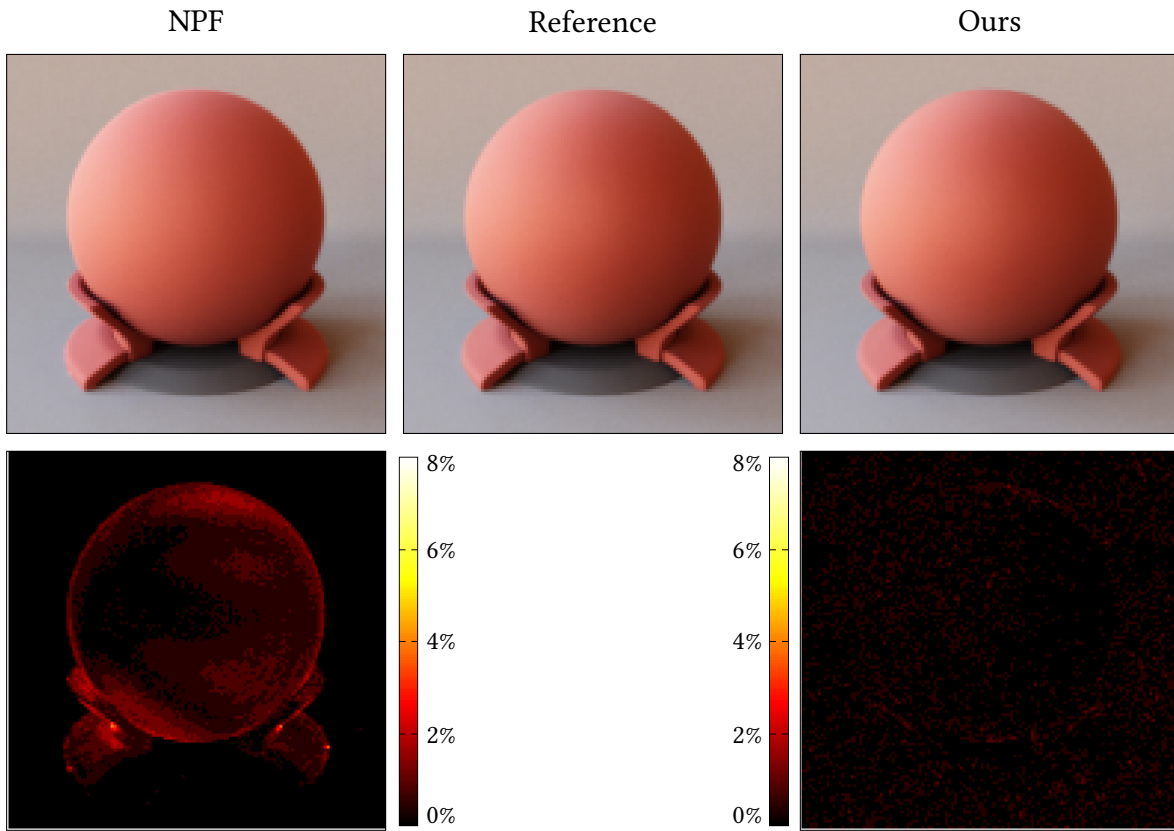


Slices

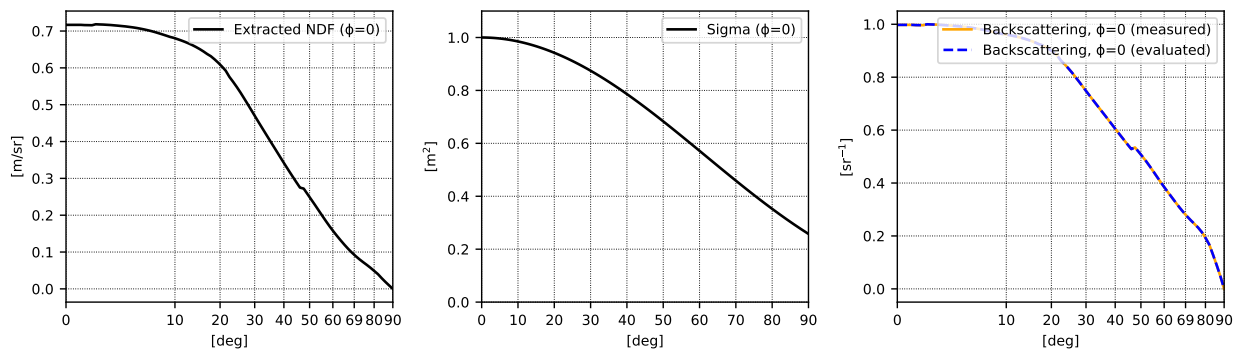


53 pink-fabric2

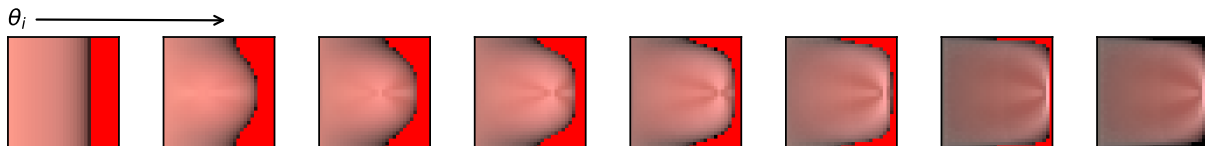
Renderings and CIE dE00



Plots

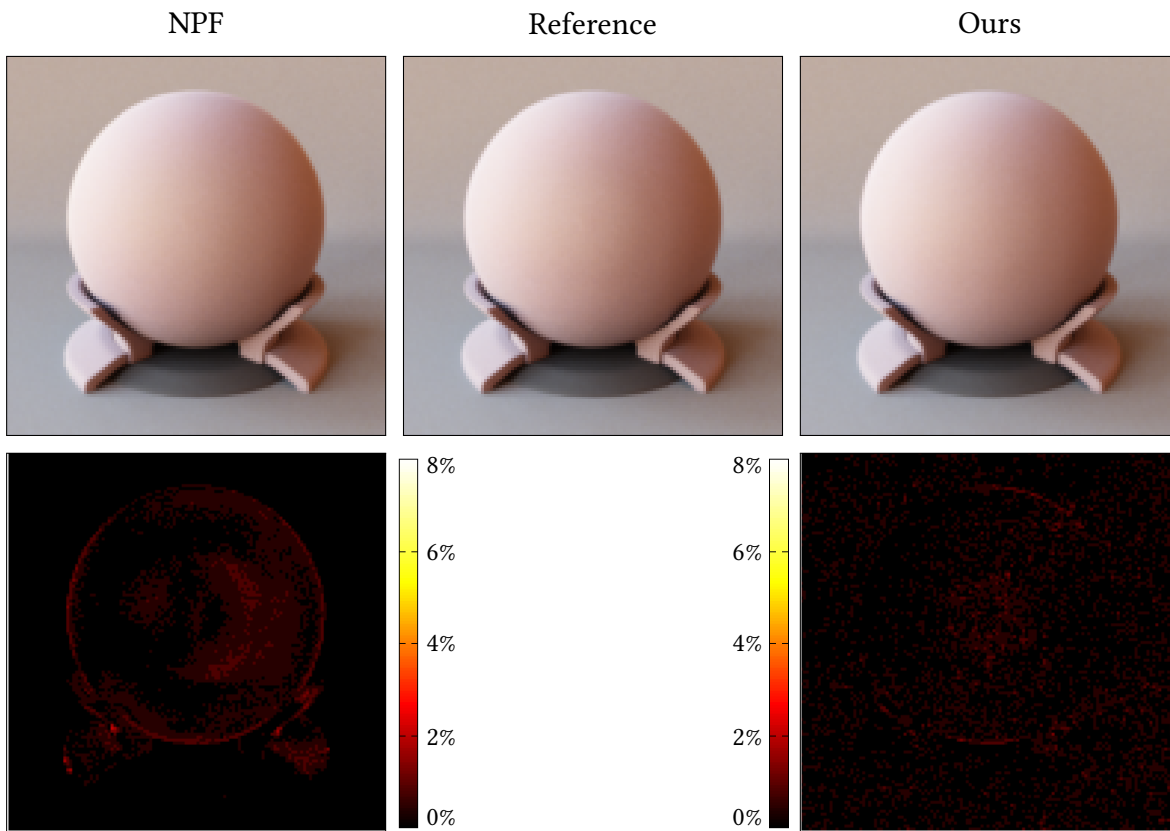


Slices

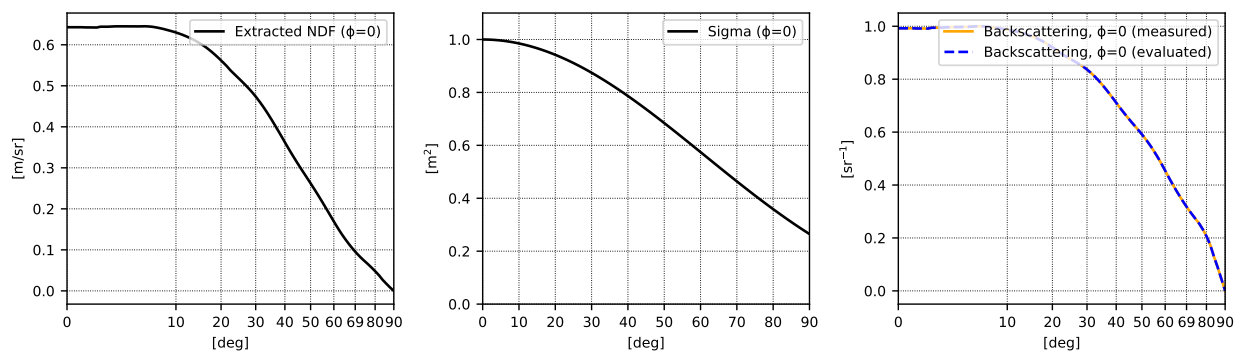


54 pink-fabric

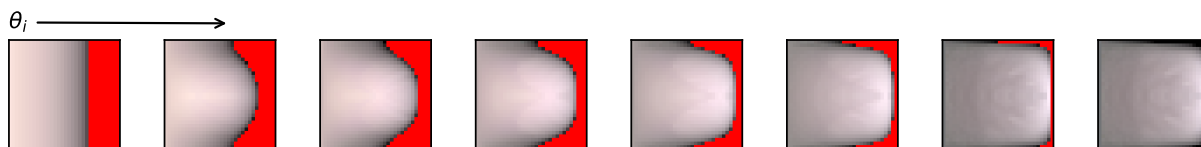
Renderings and CIE dE00



Plots

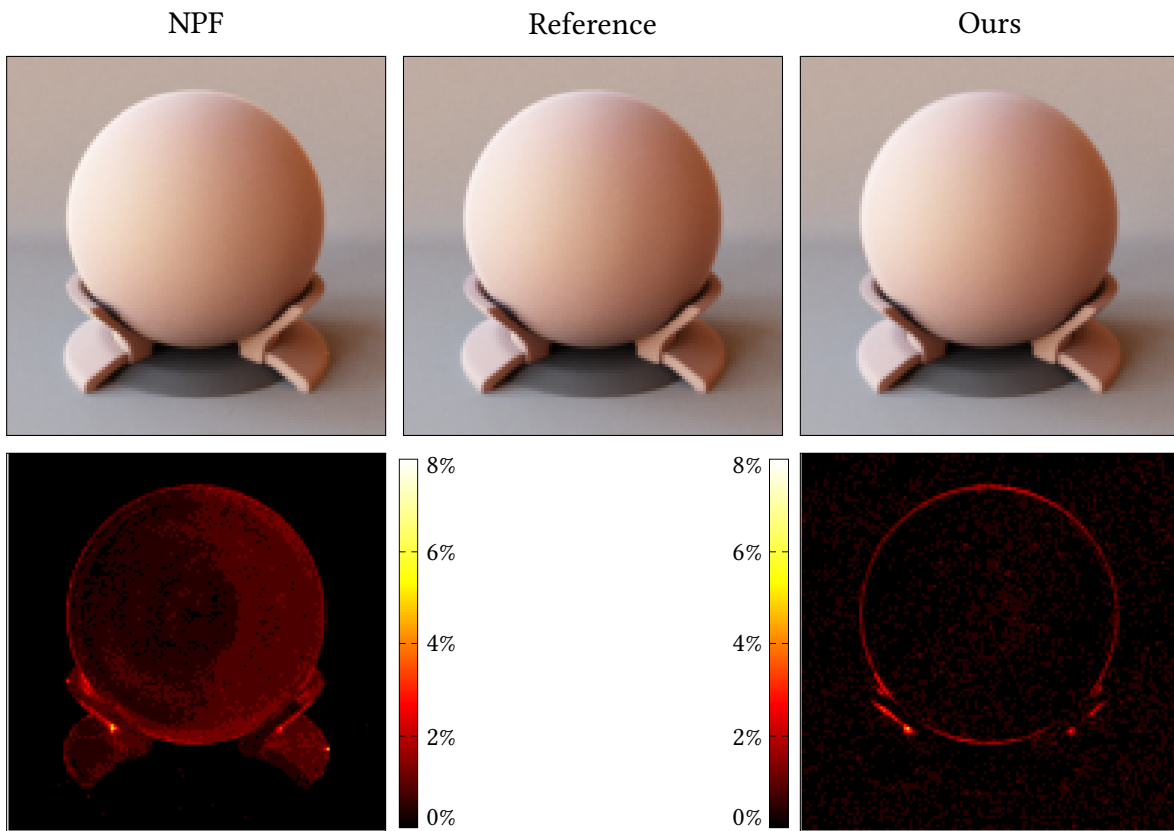


Slices

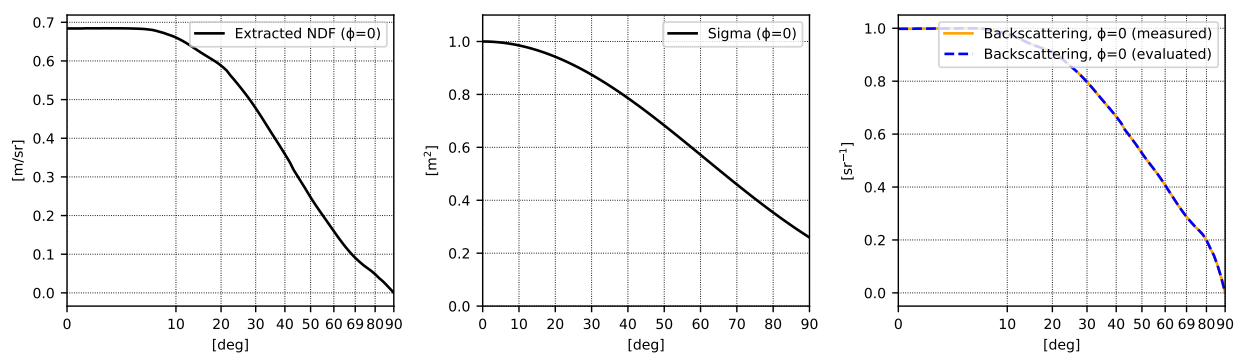


55 pink-felt

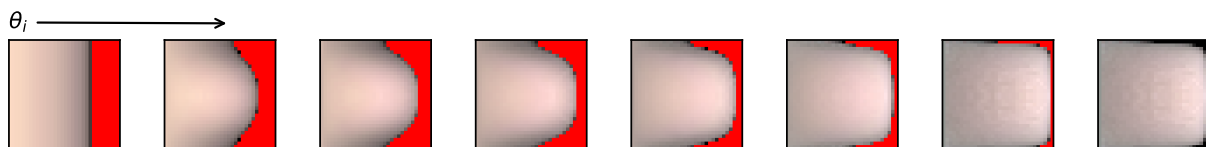
Renderings and CIE dE00



Plots

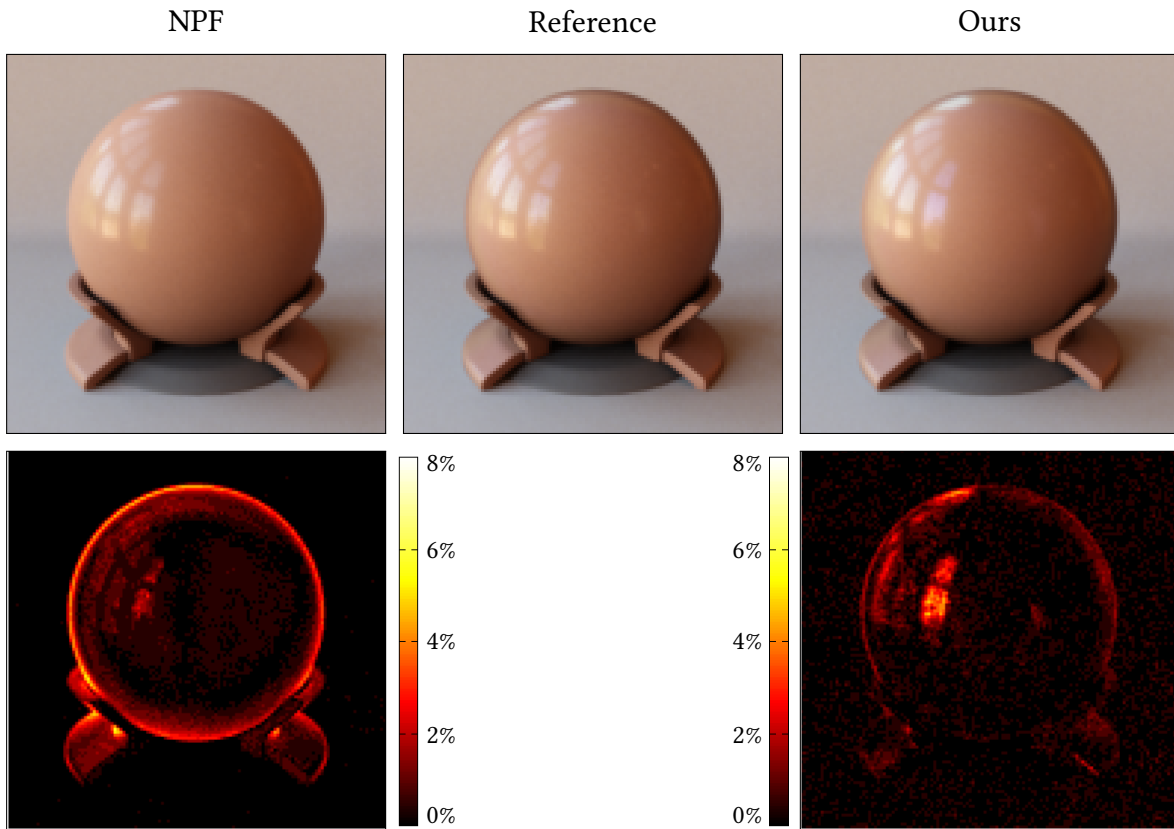


Slices

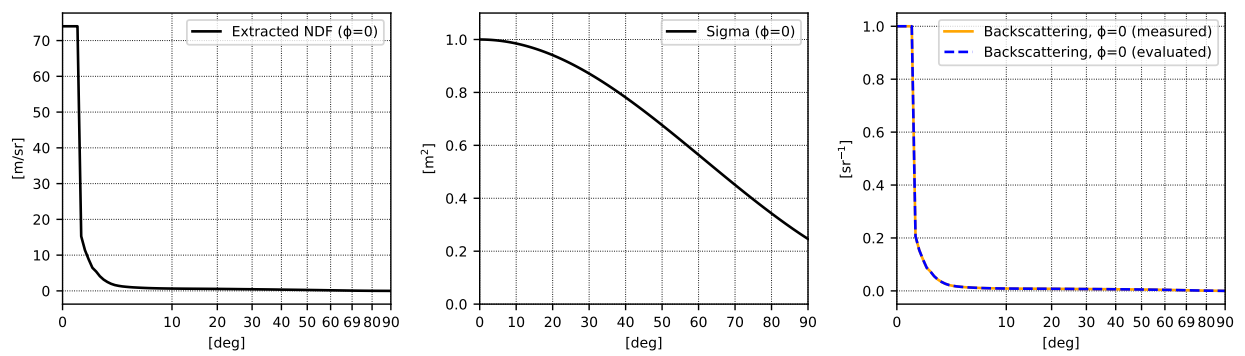


56 pink-jasper

Renderings and CIE dE00



Plots

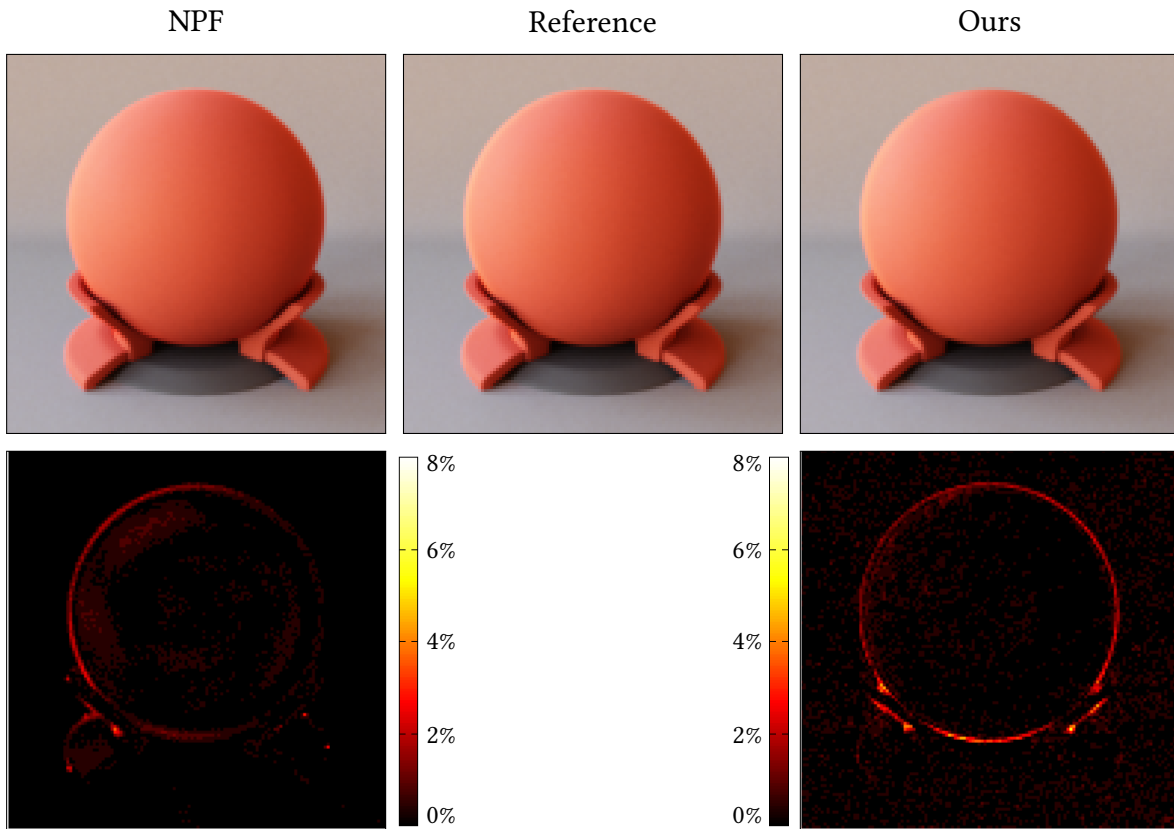


Slices

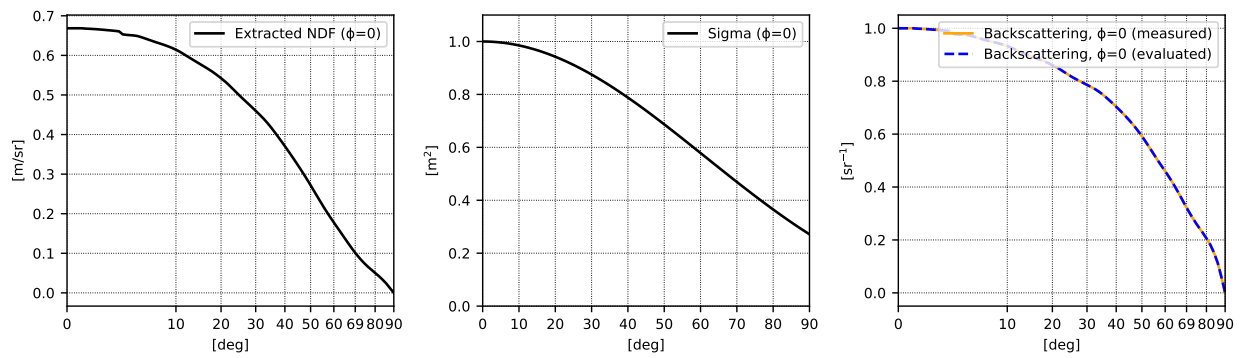


57 pink-plastic

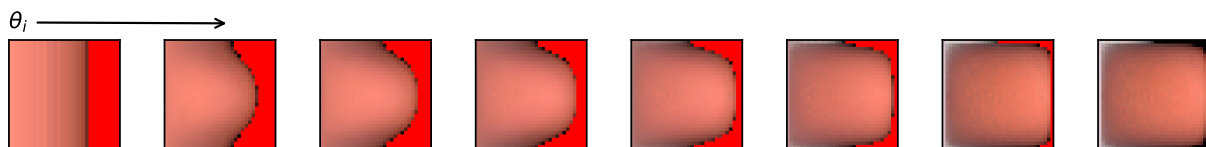
Renderings and CIE dE00



Plots

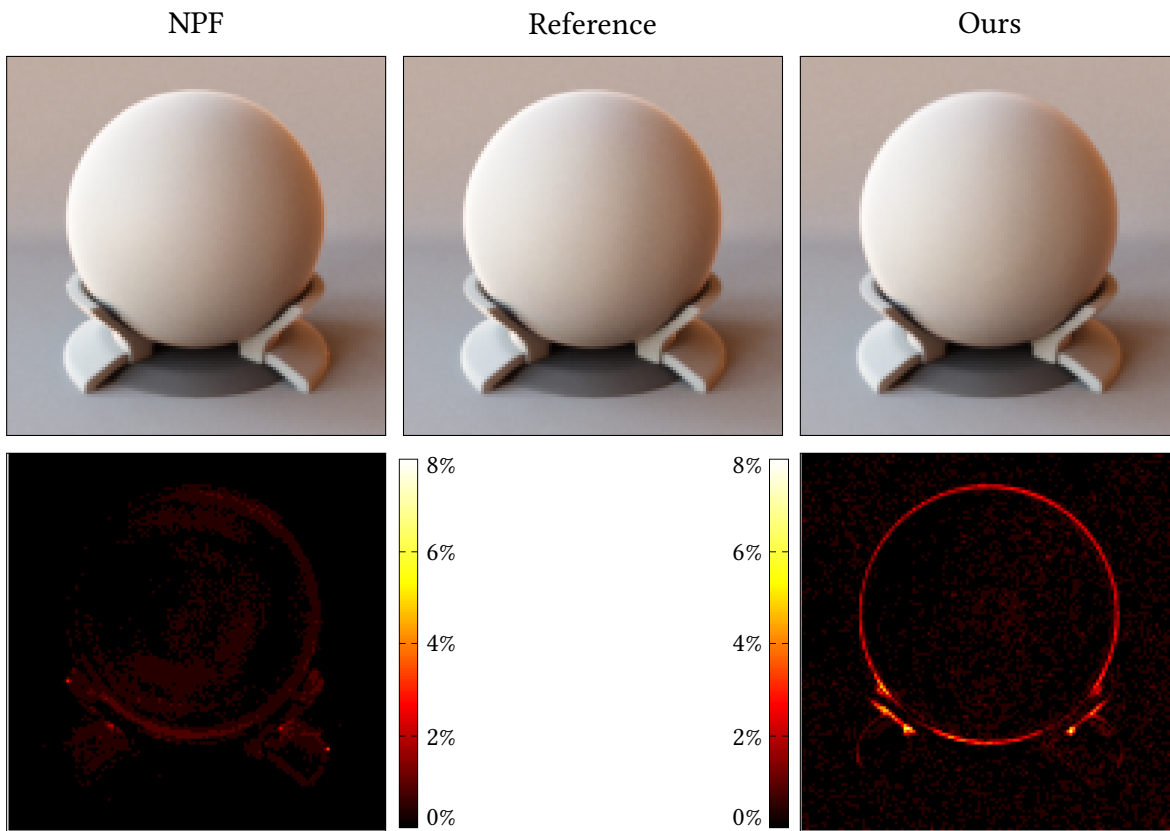


Slices

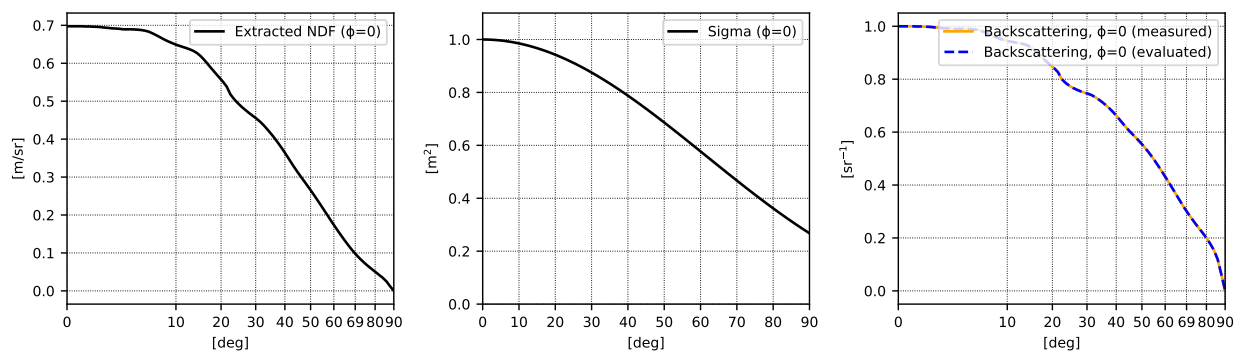


58 polyethylene

Renderings and CIE dE00



Plots

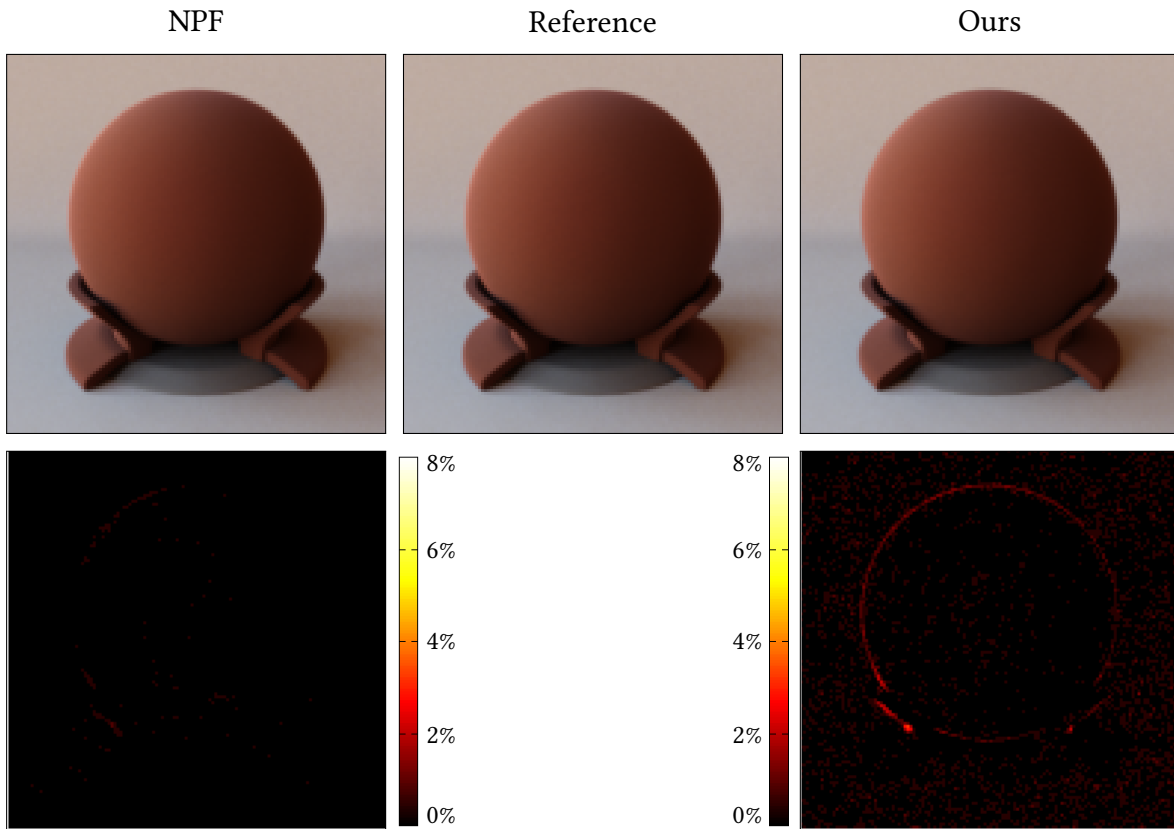


Slices

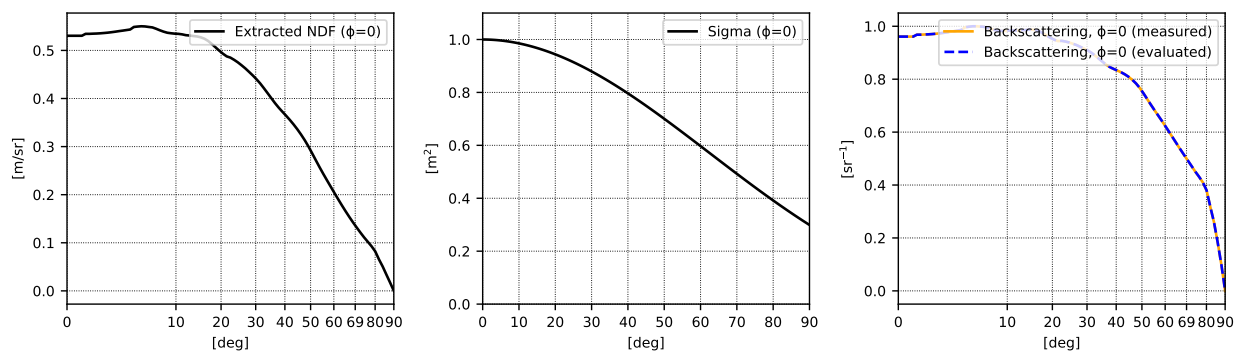


59 polyurethane-foam

Renderings and CIE dE00



Plots

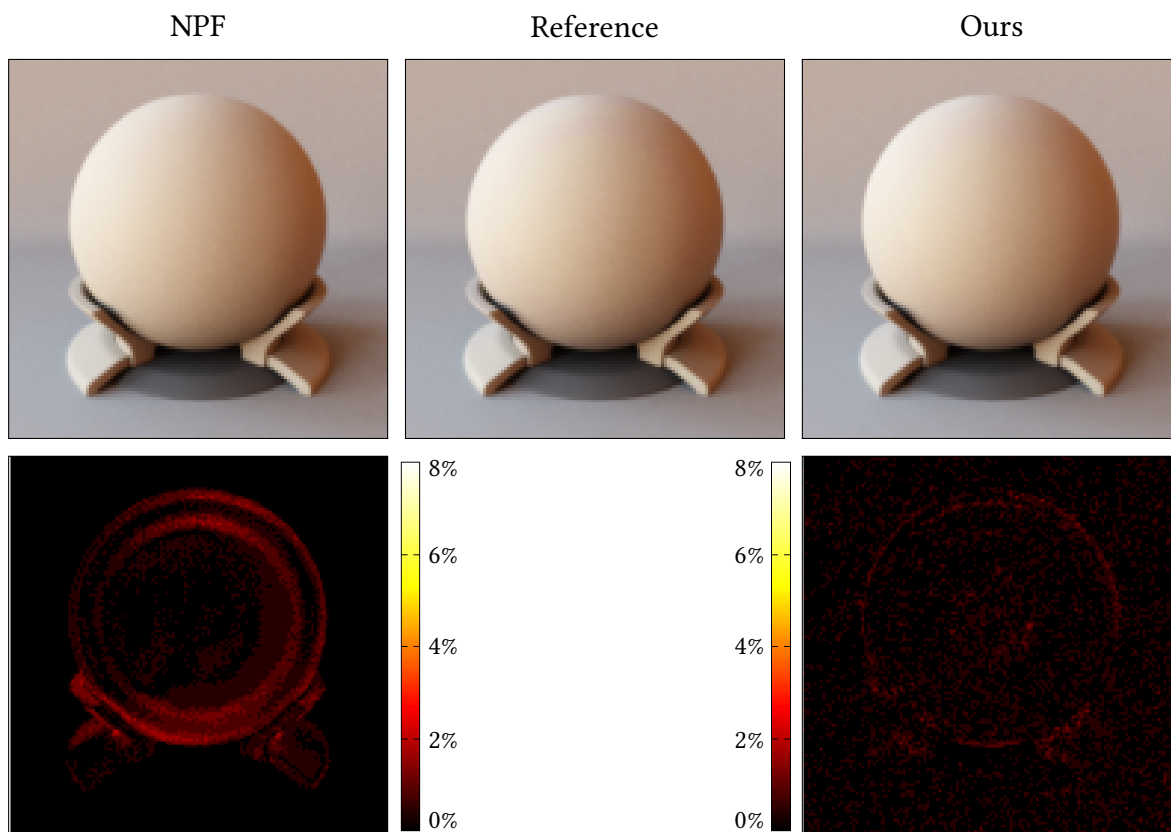


Slices

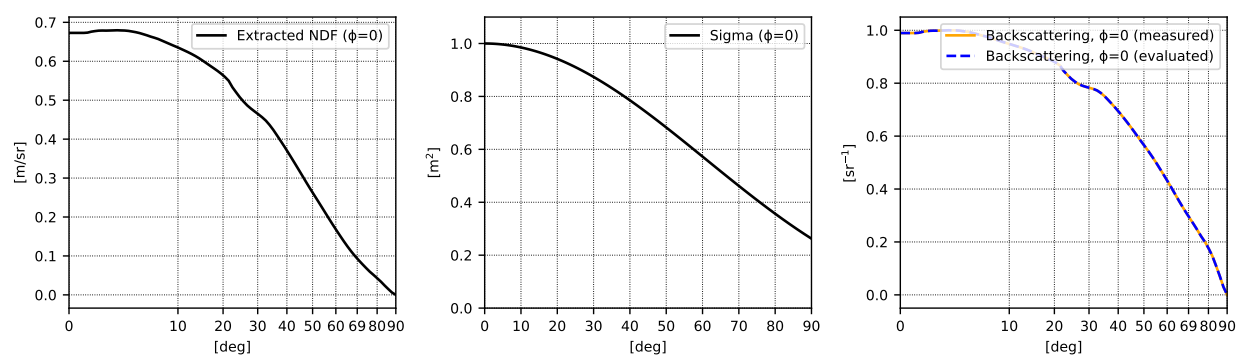


60 pure-rubber

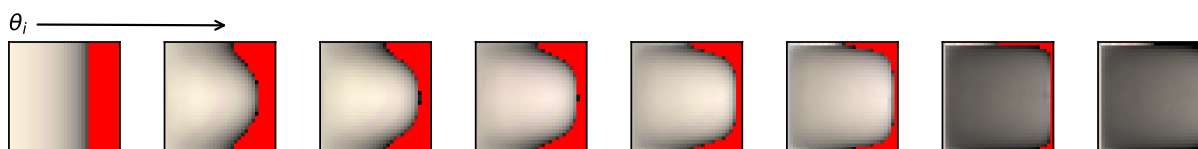
Renderings and CIE dE00



Plots

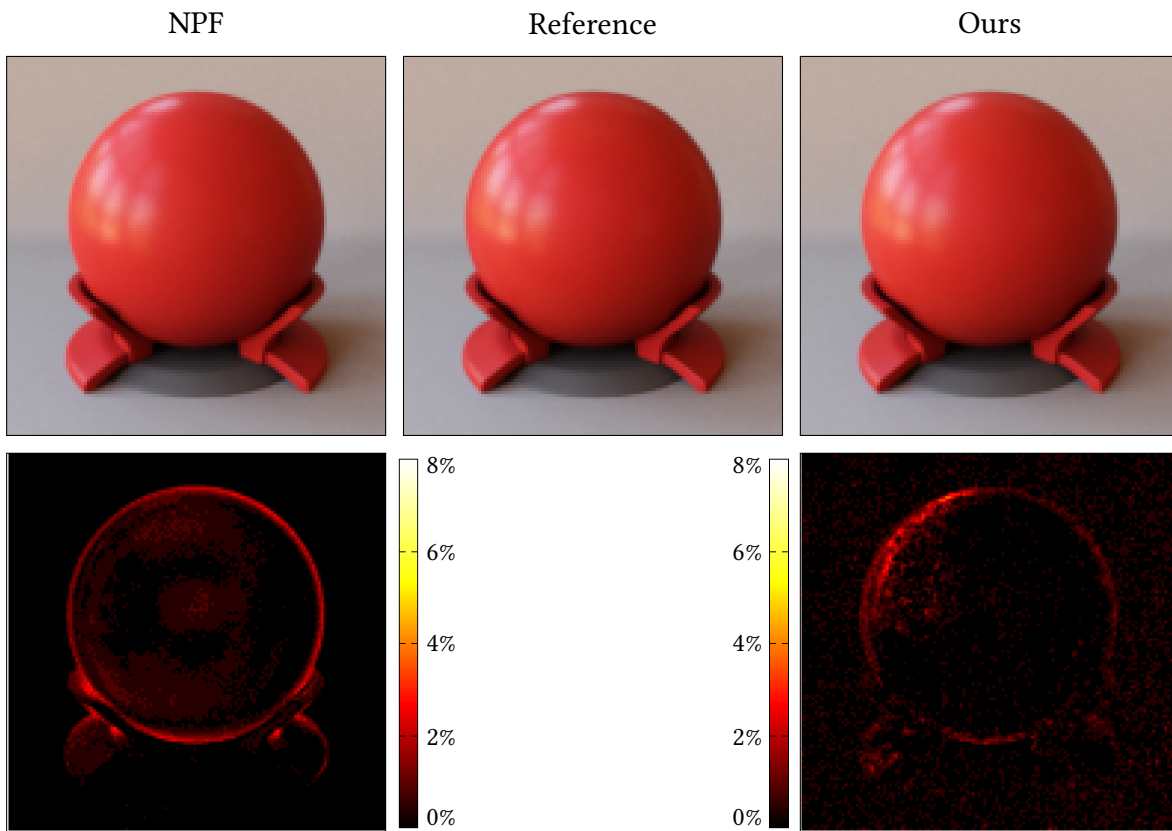


Slices

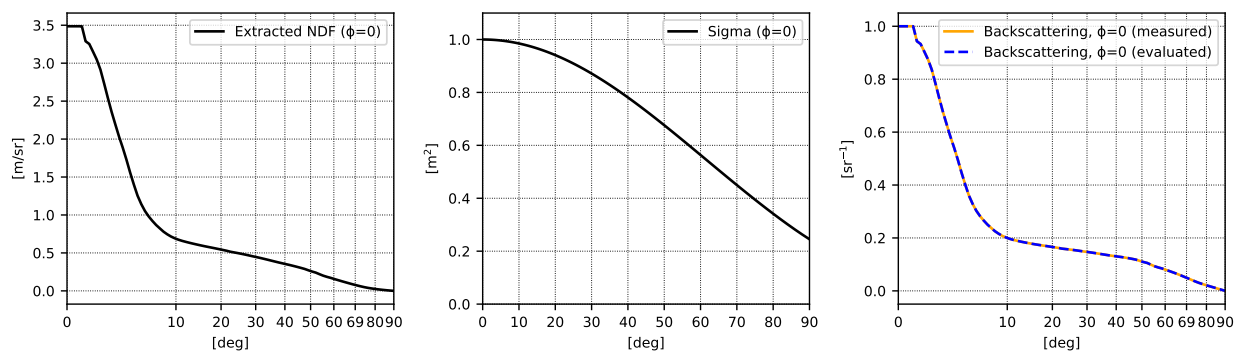


61 purple-paint

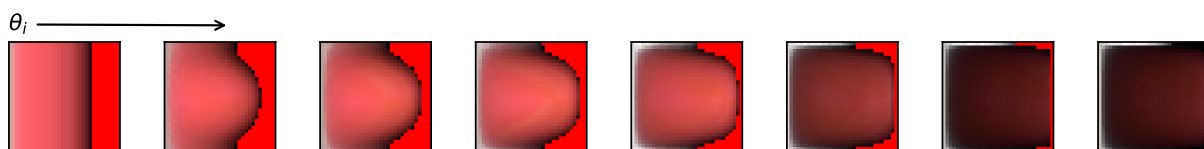
Renderings and CIE dE00



Plots

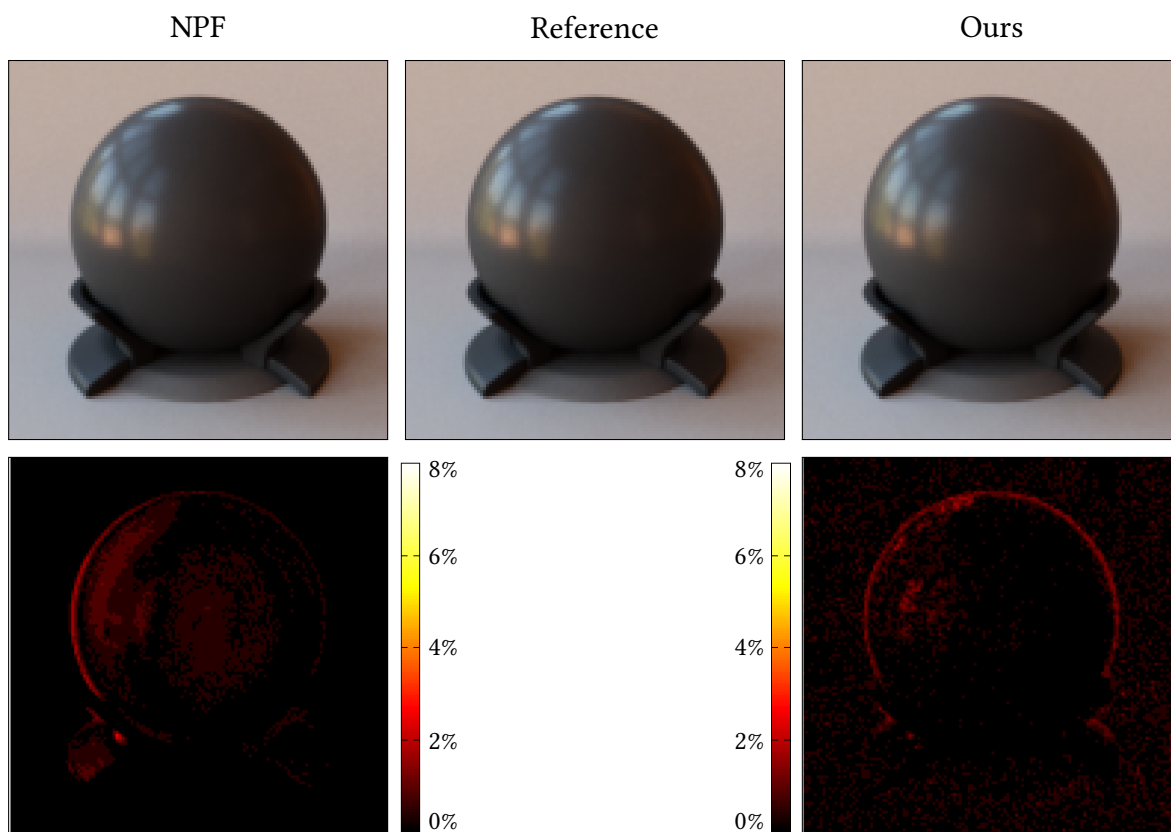


Slices

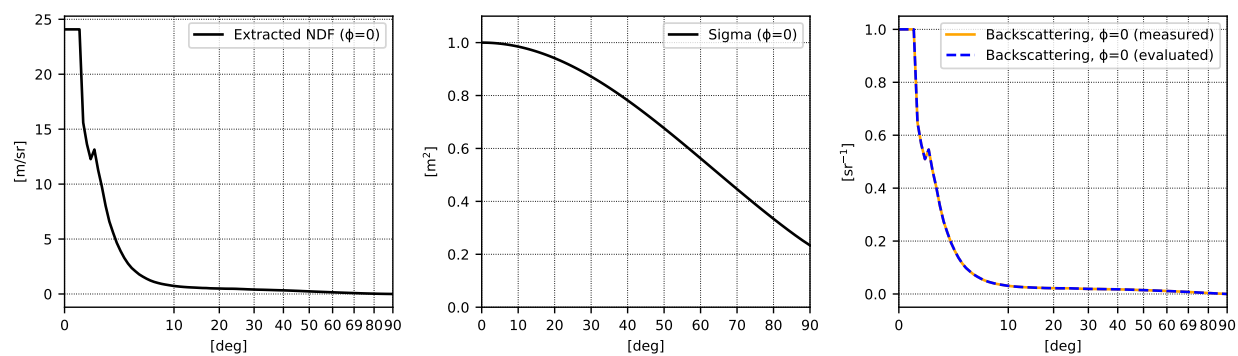


62 pvc

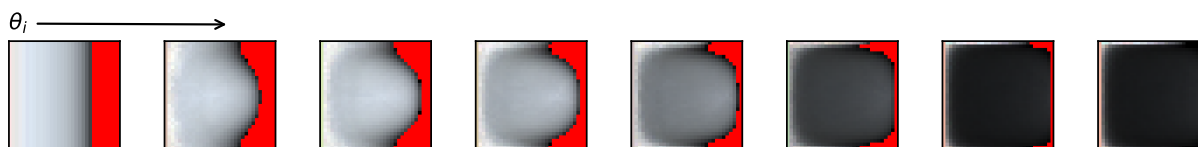
Renderings and CIE dE00



Plots

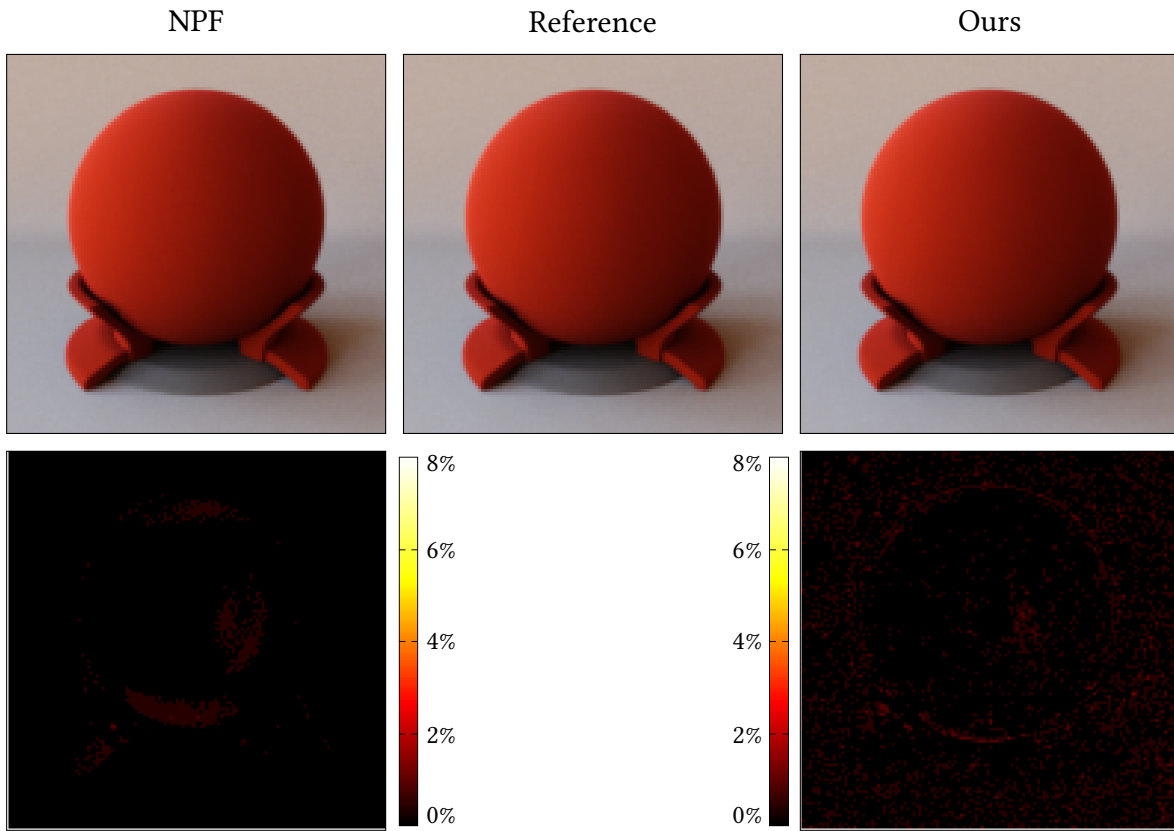


Slices

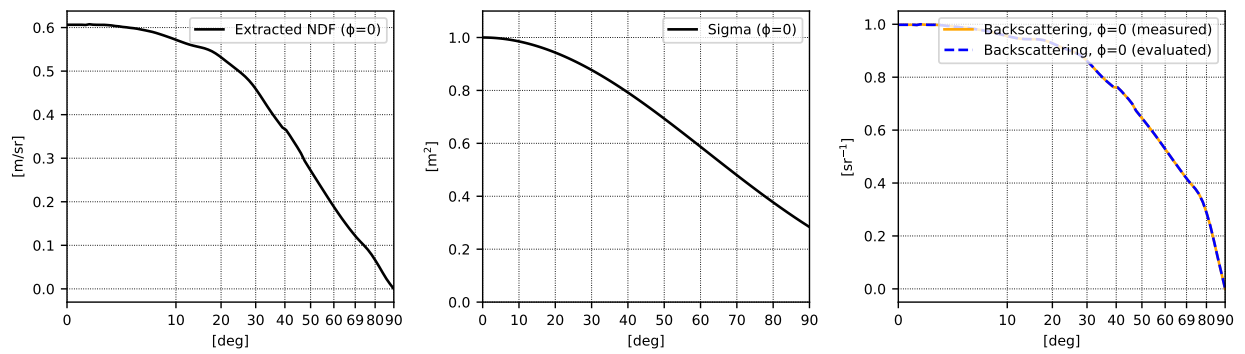


63 red-fabric2

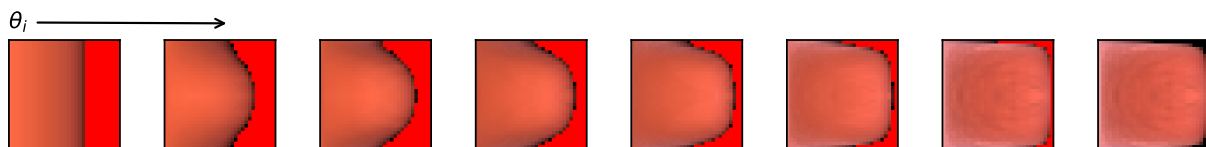
Renderings and CIE dE00



Plots

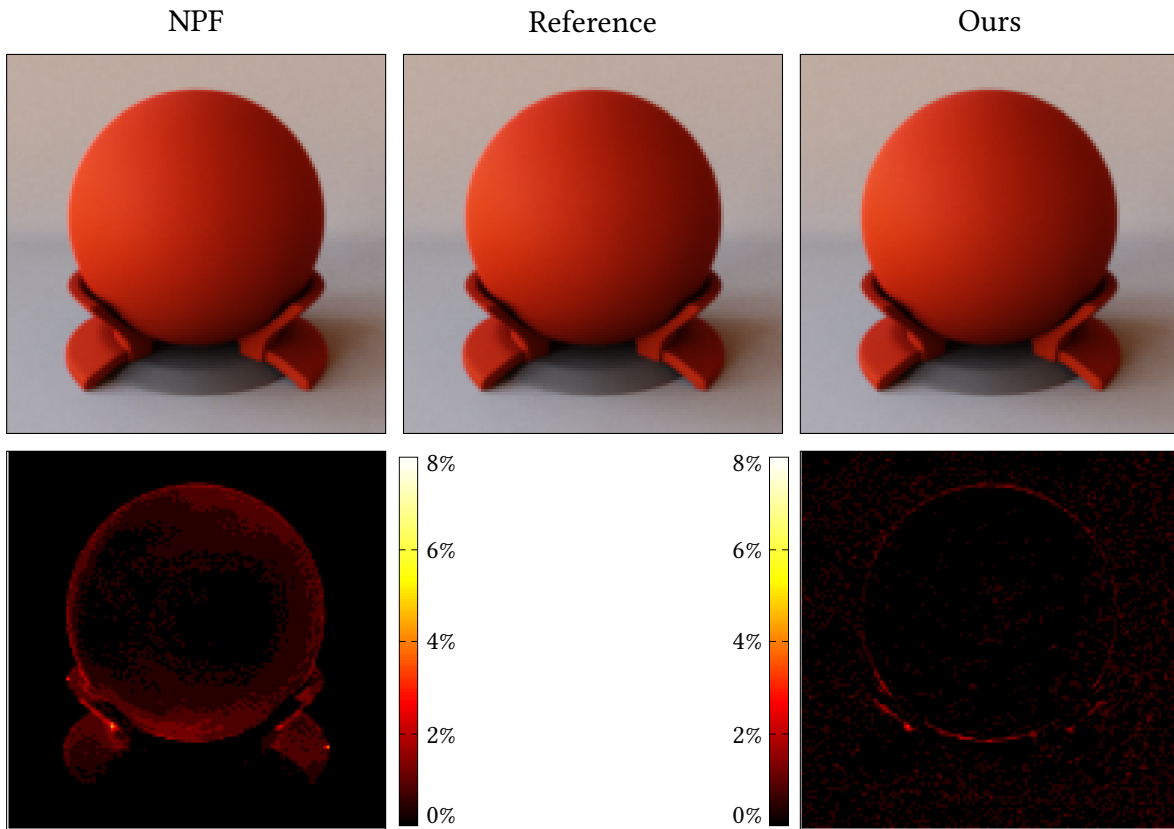


Slices

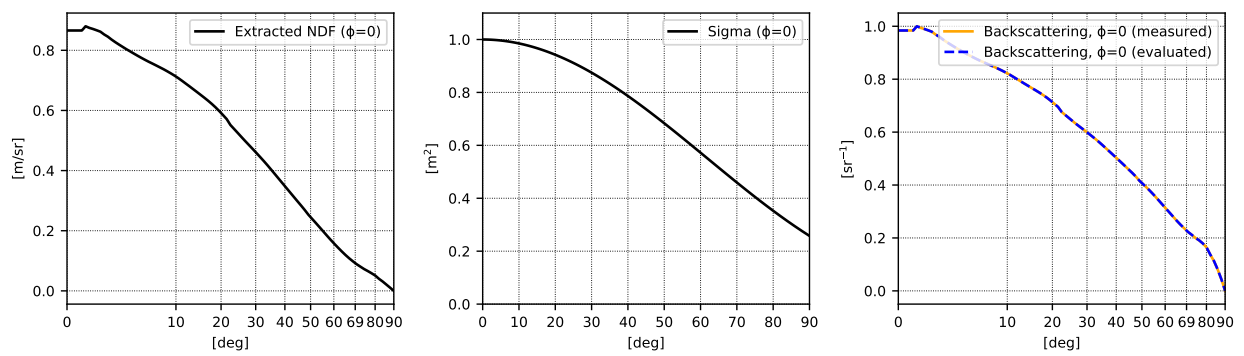


64 red-fabric

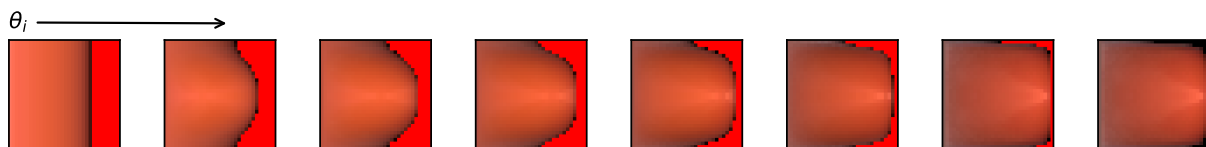
Renderings and CIE dE00



Plots

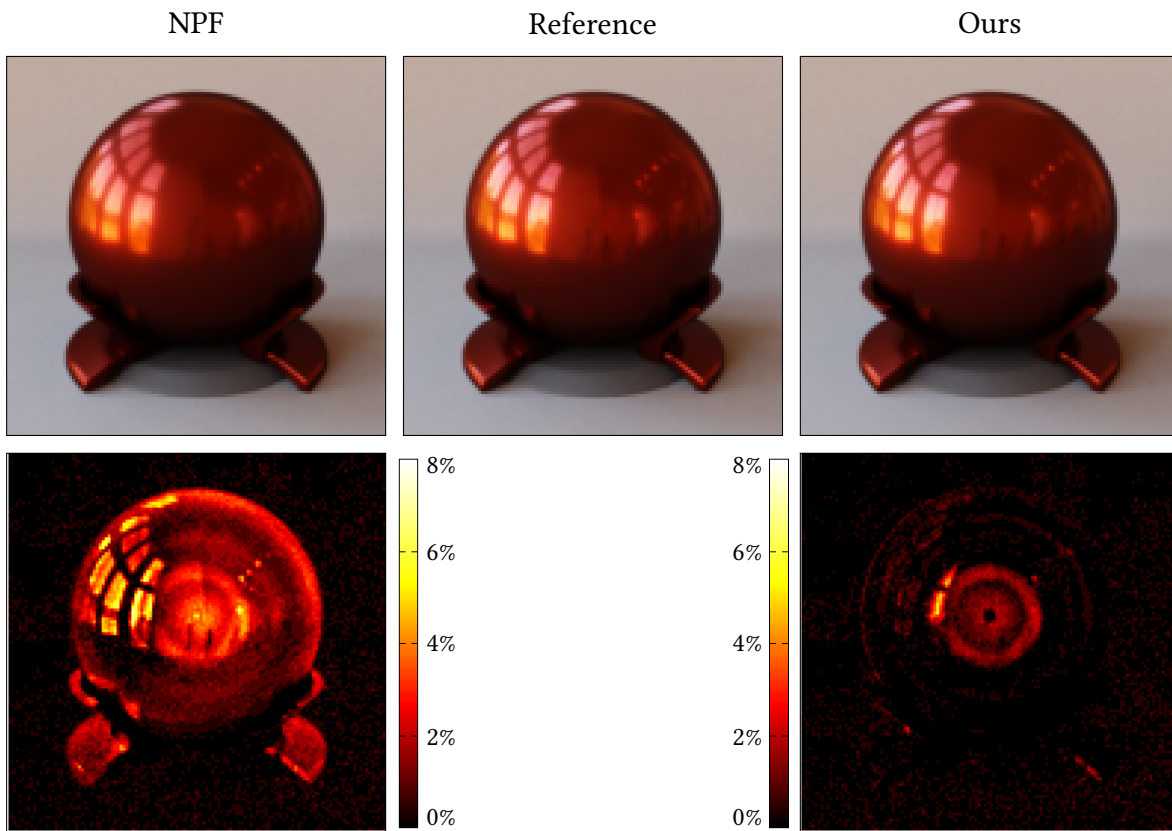


Slices

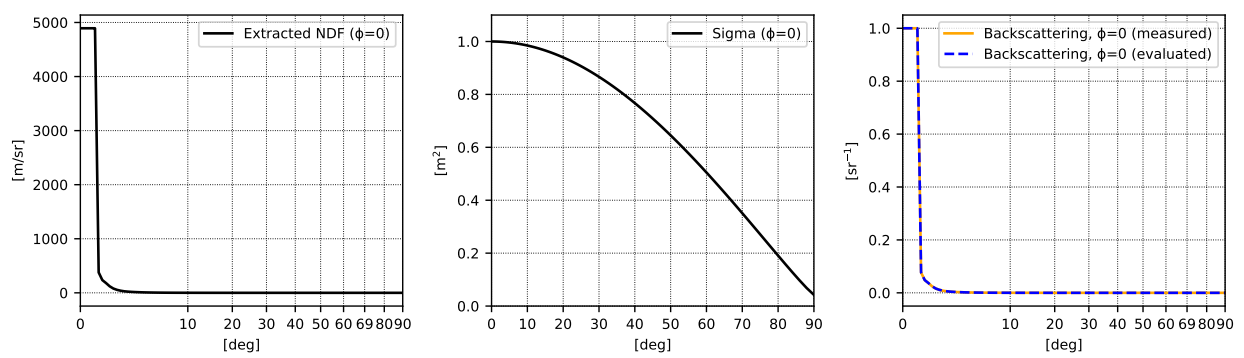


65 red-metallic-paint

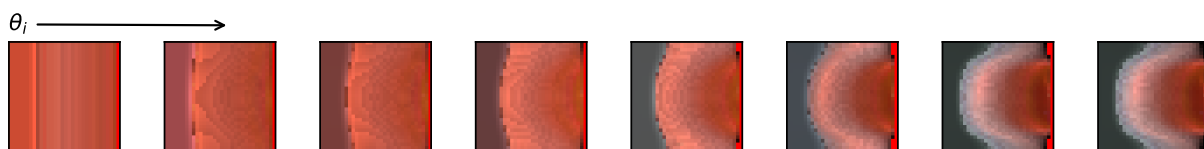
Renderings and CIE dE00



Plots

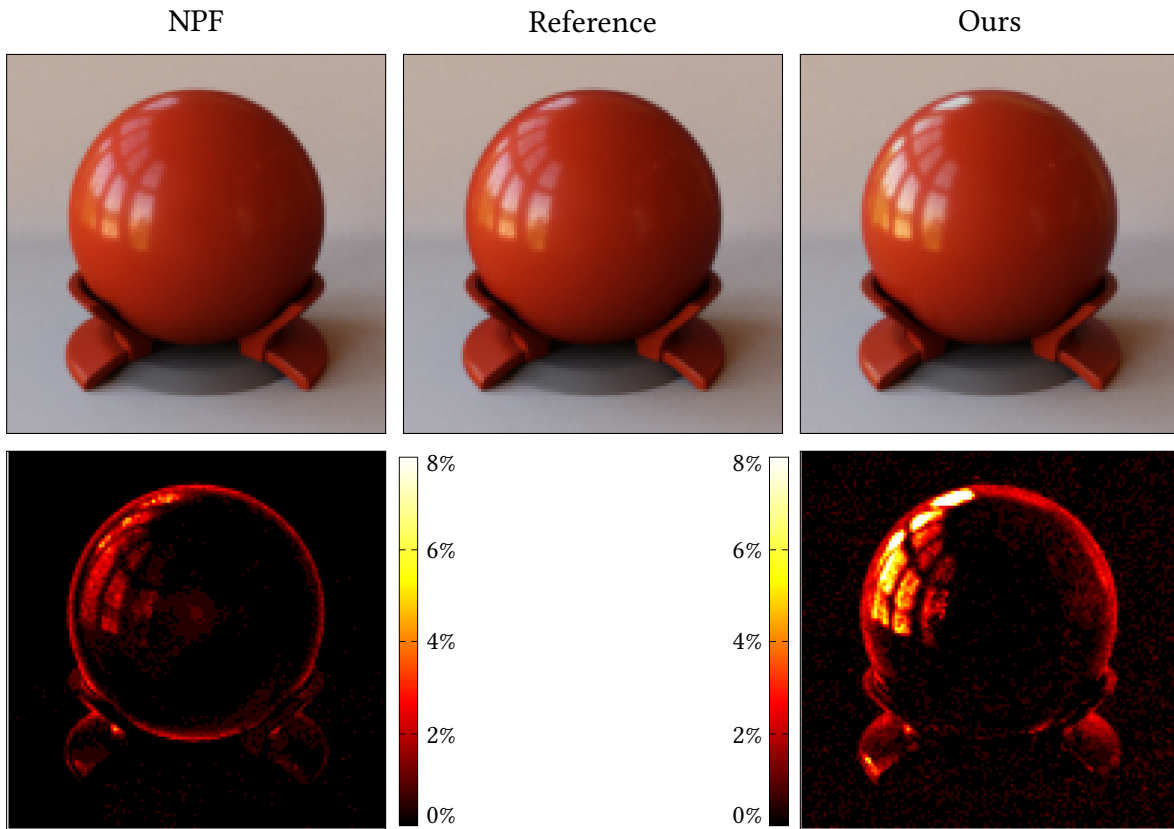


Slices

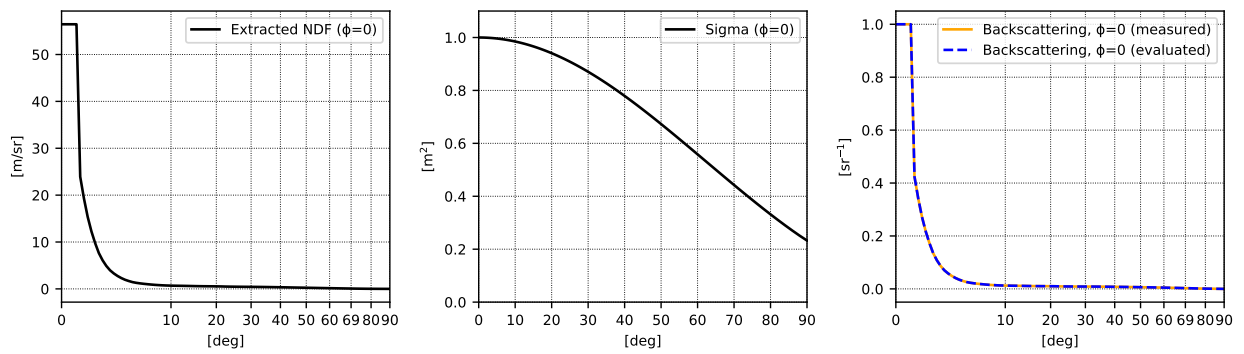


66 red-phenolic

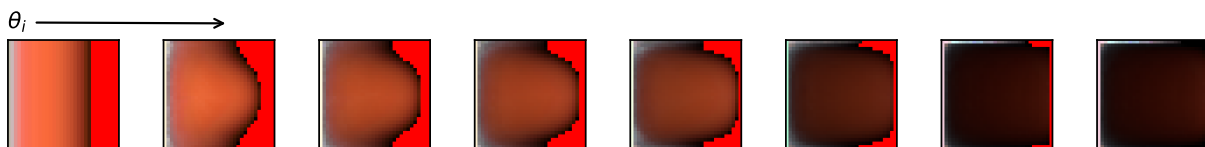
Renderings and CIE dE00



Plots

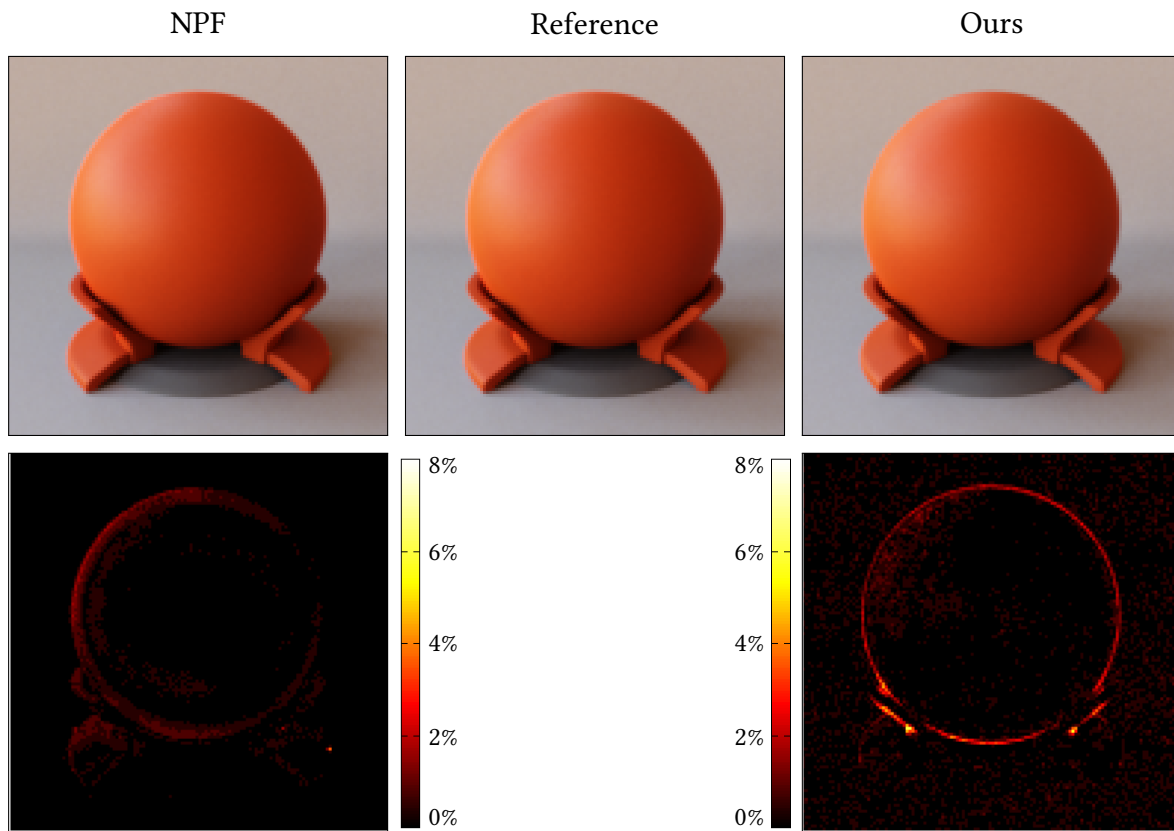


Slices

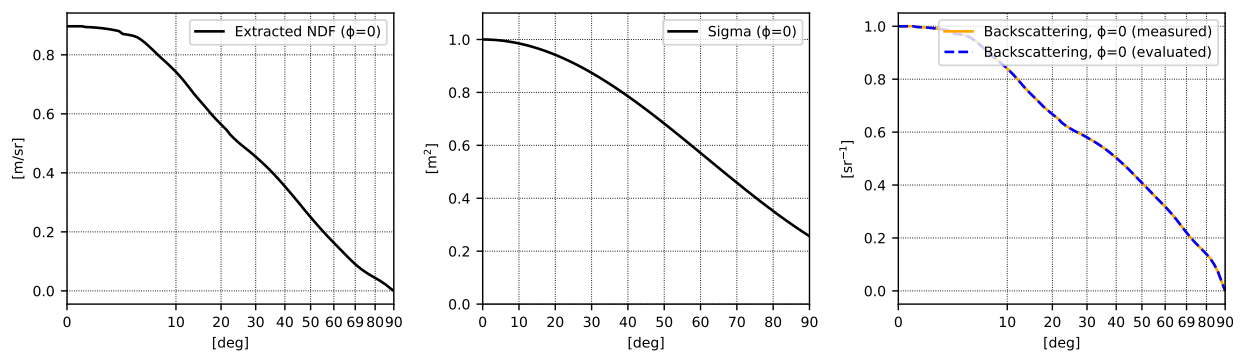


67 red-plastic

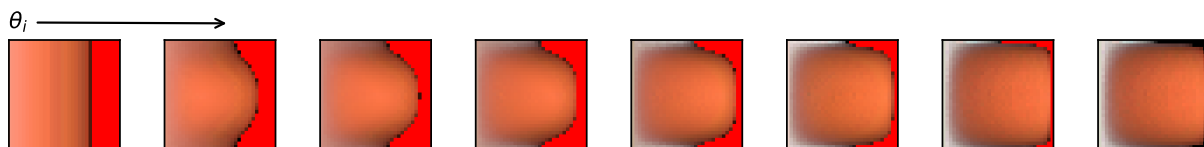
Renderings and CIE dE00



Plots

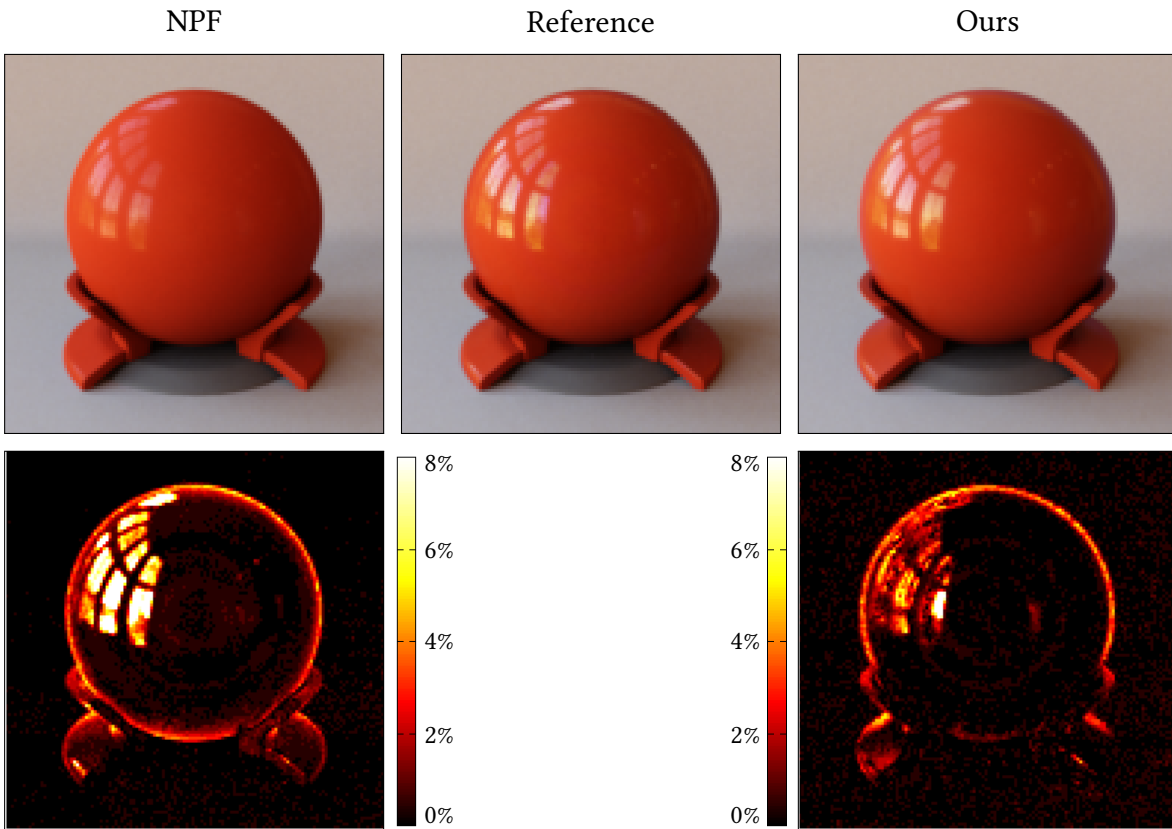


Slices

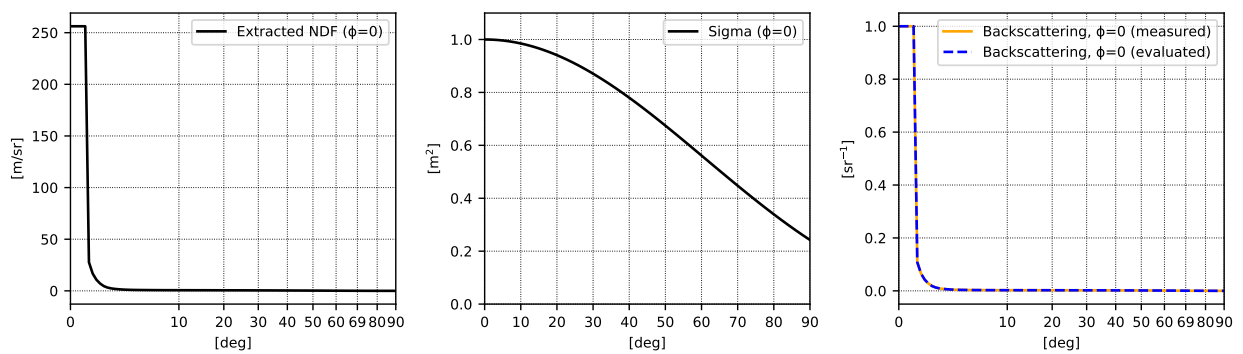


68 red-specular-plastic

Renderings and CIE dE00



Plots

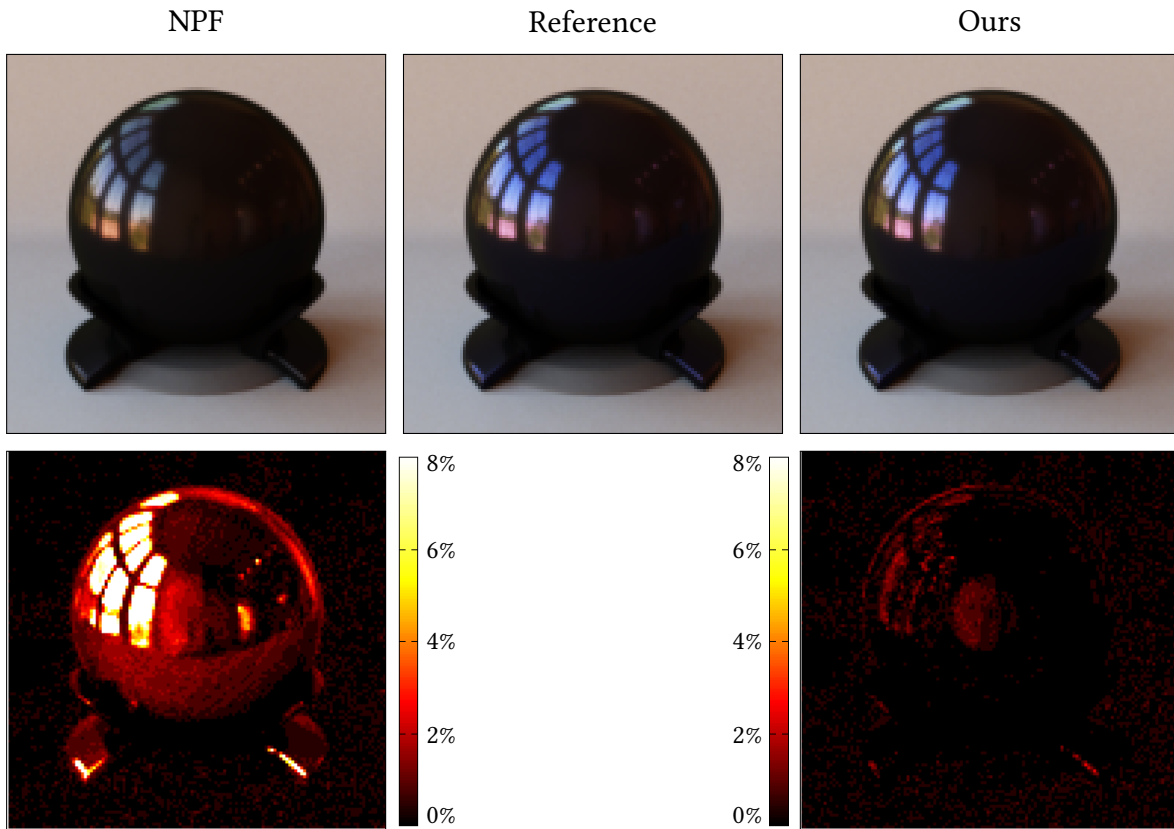


Slices

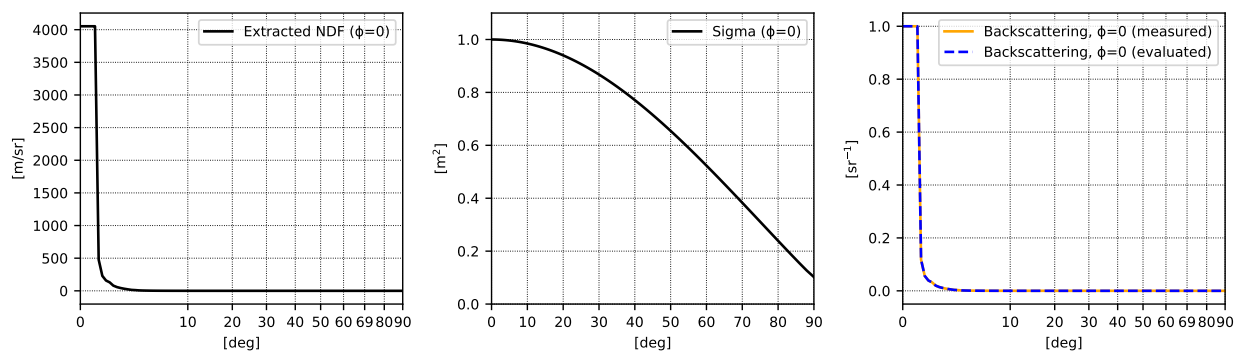


69 silicon-nitride

Renderings and CIE dE00



Plots

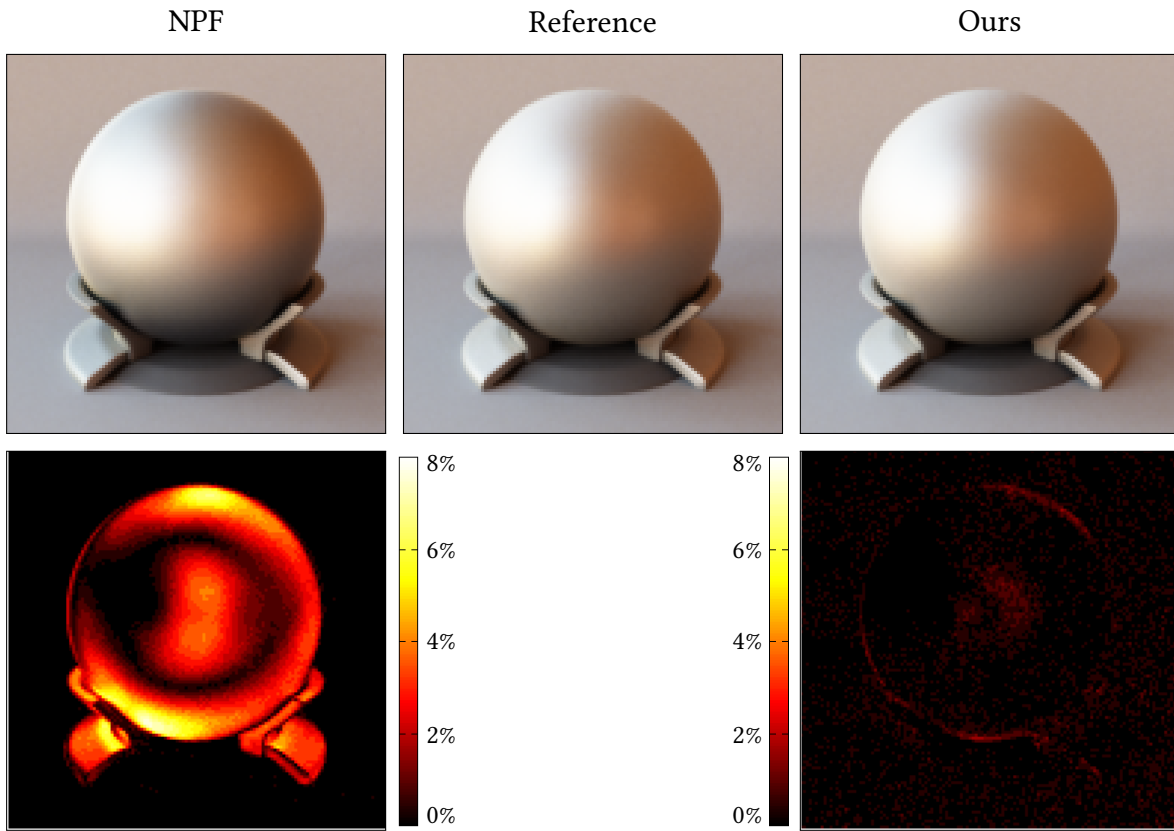


Slices

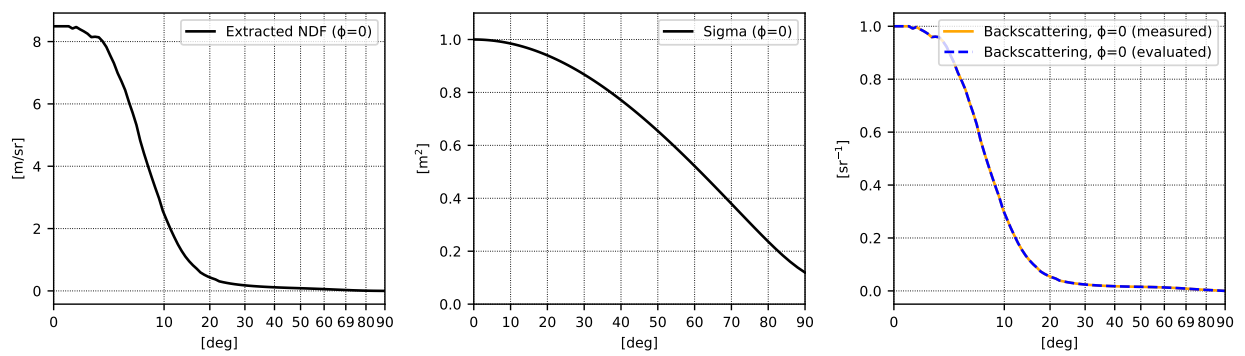


70 silver-metallic-paint2

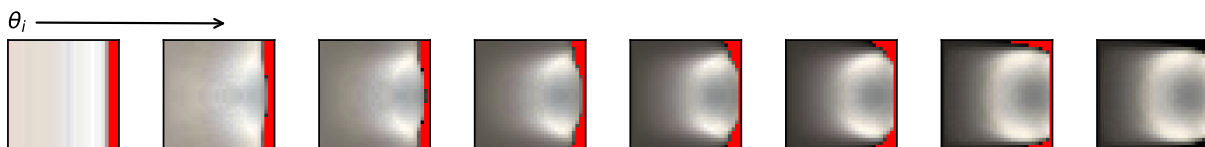
Renderings and CIE dE00



Plots

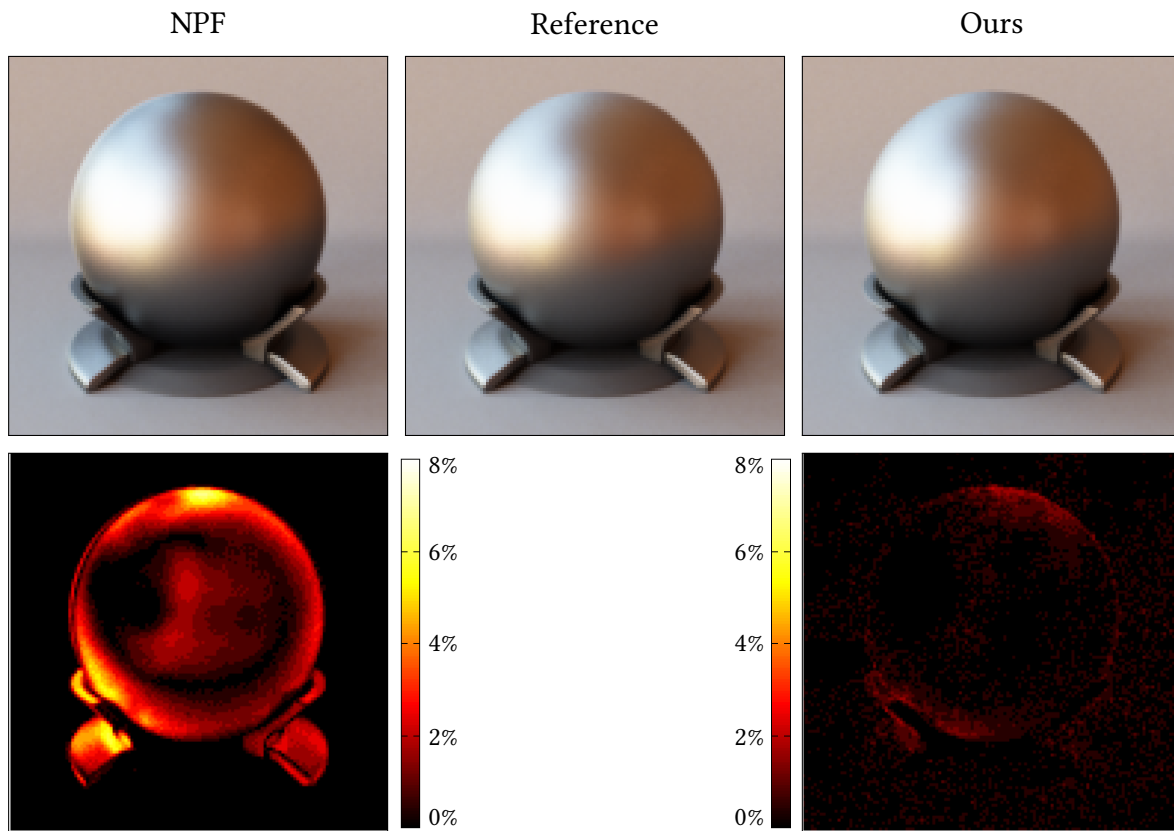


Slices

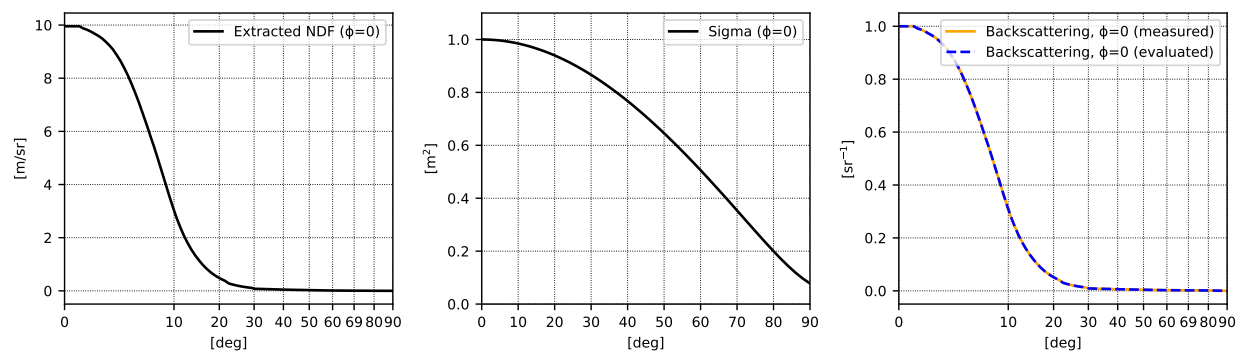


71 silver-metallic-paint

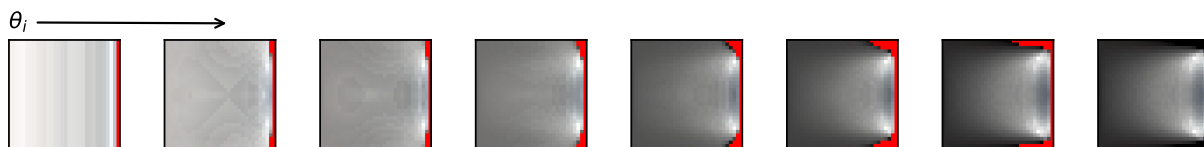
Renderings and CIE dE00



Plots

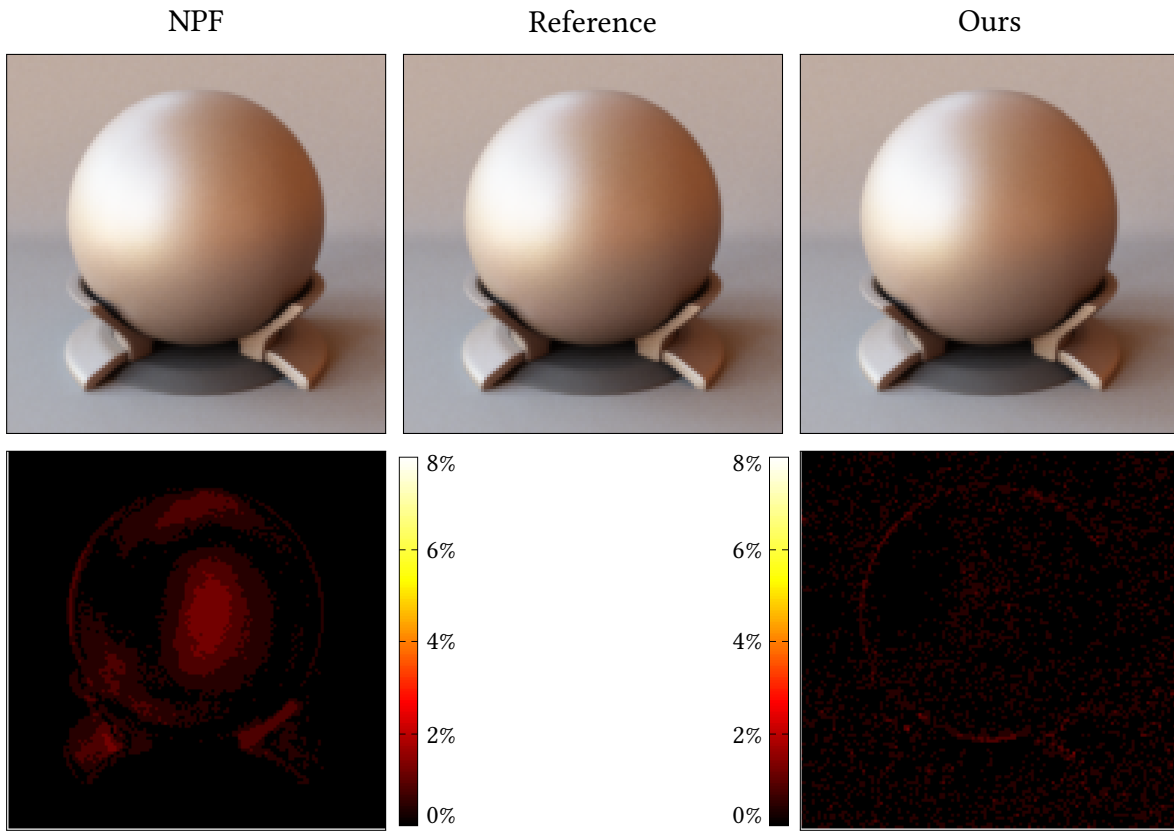


Slices

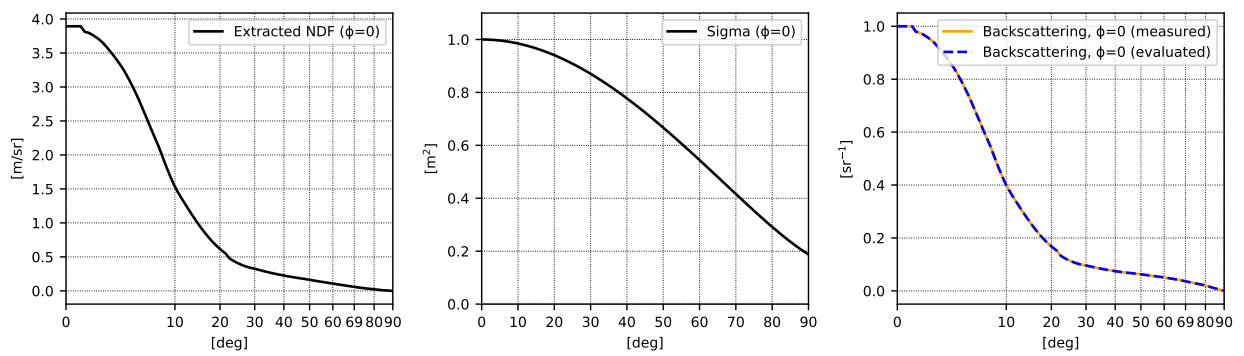


72 silver-paint

Renderings and CIE dE00



Plots

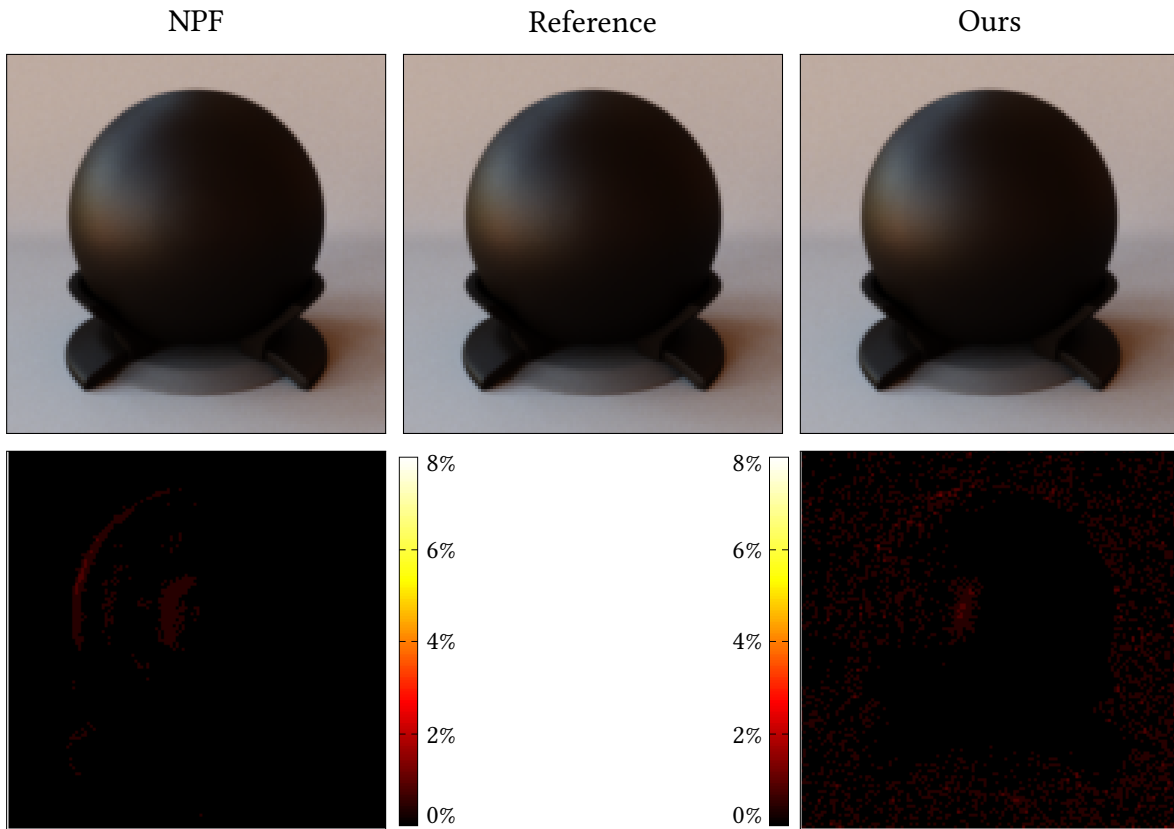


Slices

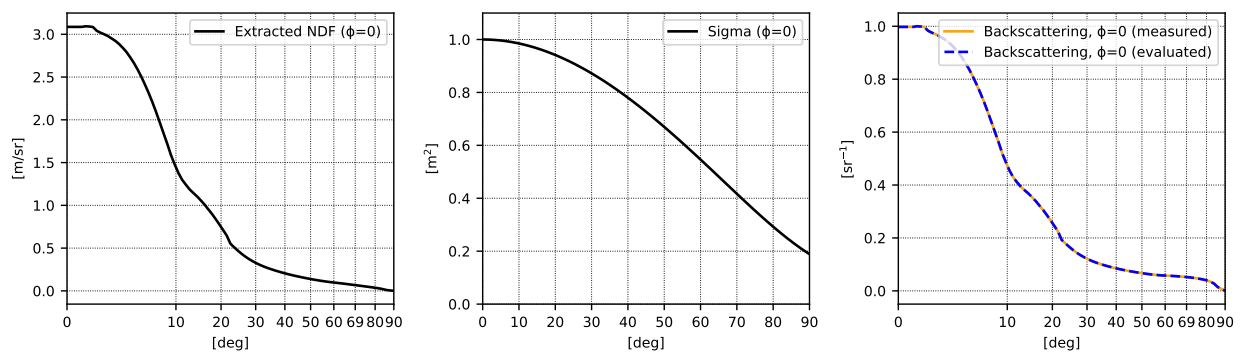


73 special-walnut-224

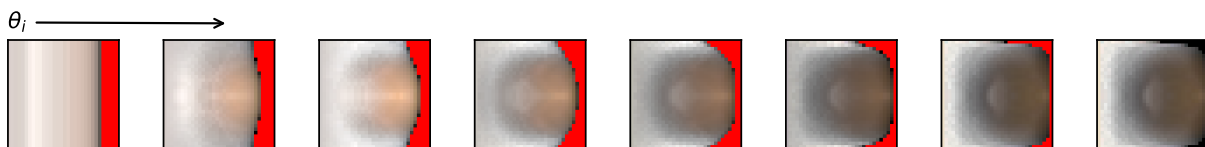
Renderings and CIE dE00



Plots

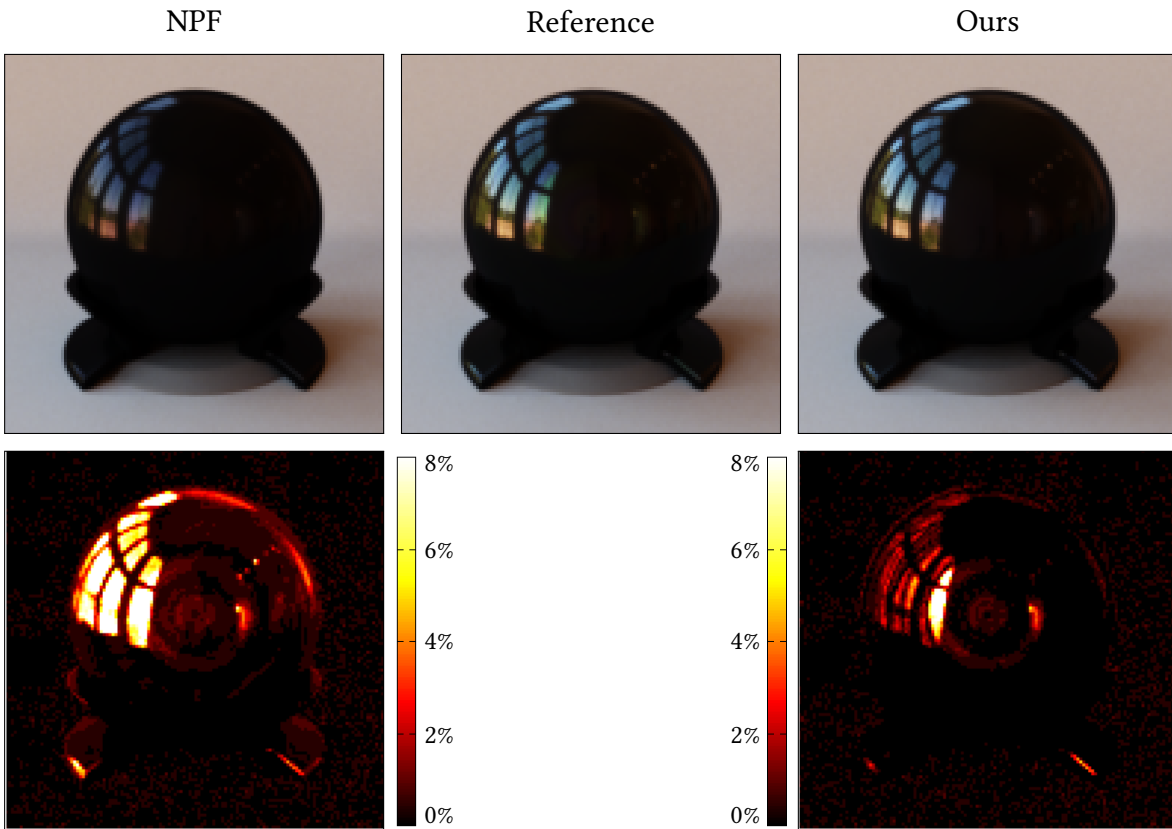


Slices

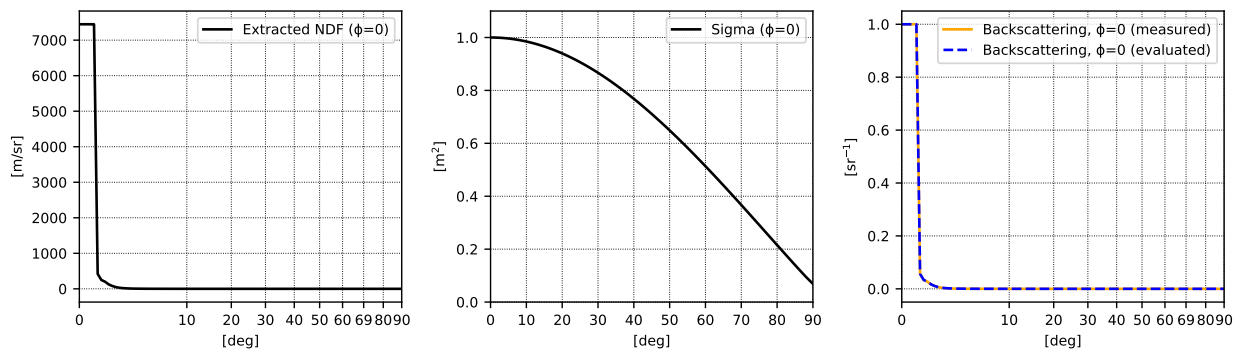


74 specular-black-phenolic

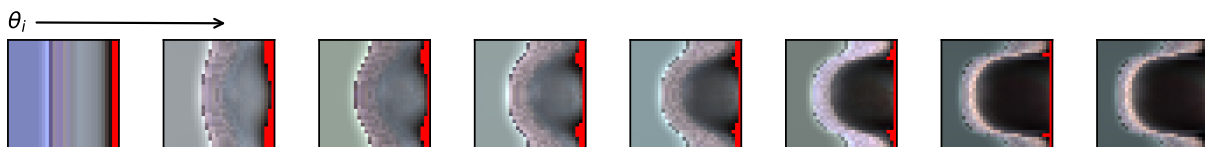
Renderings and CIE dE00



Plots

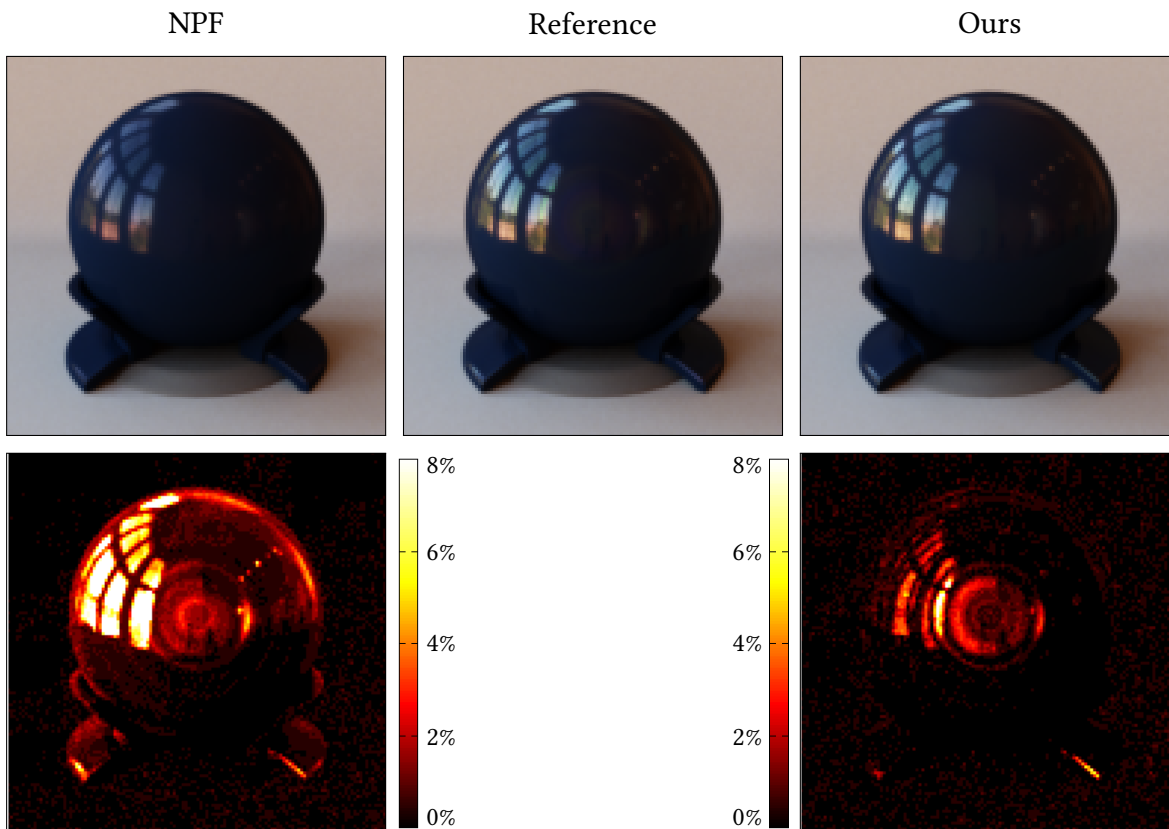


Slices

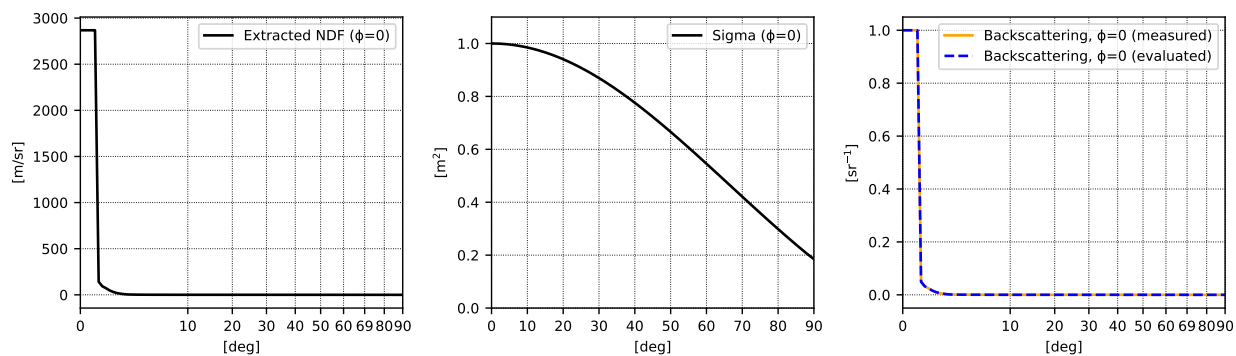


75 specular-blue-phenolic

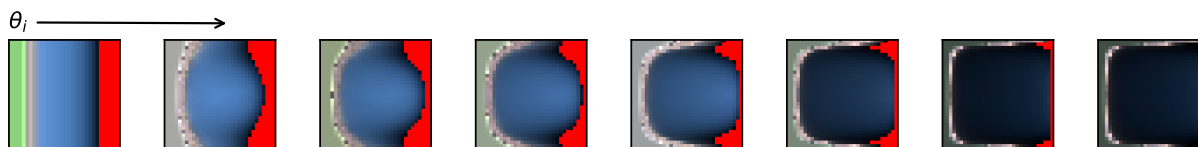
Renderings and CIE dE00



Plots

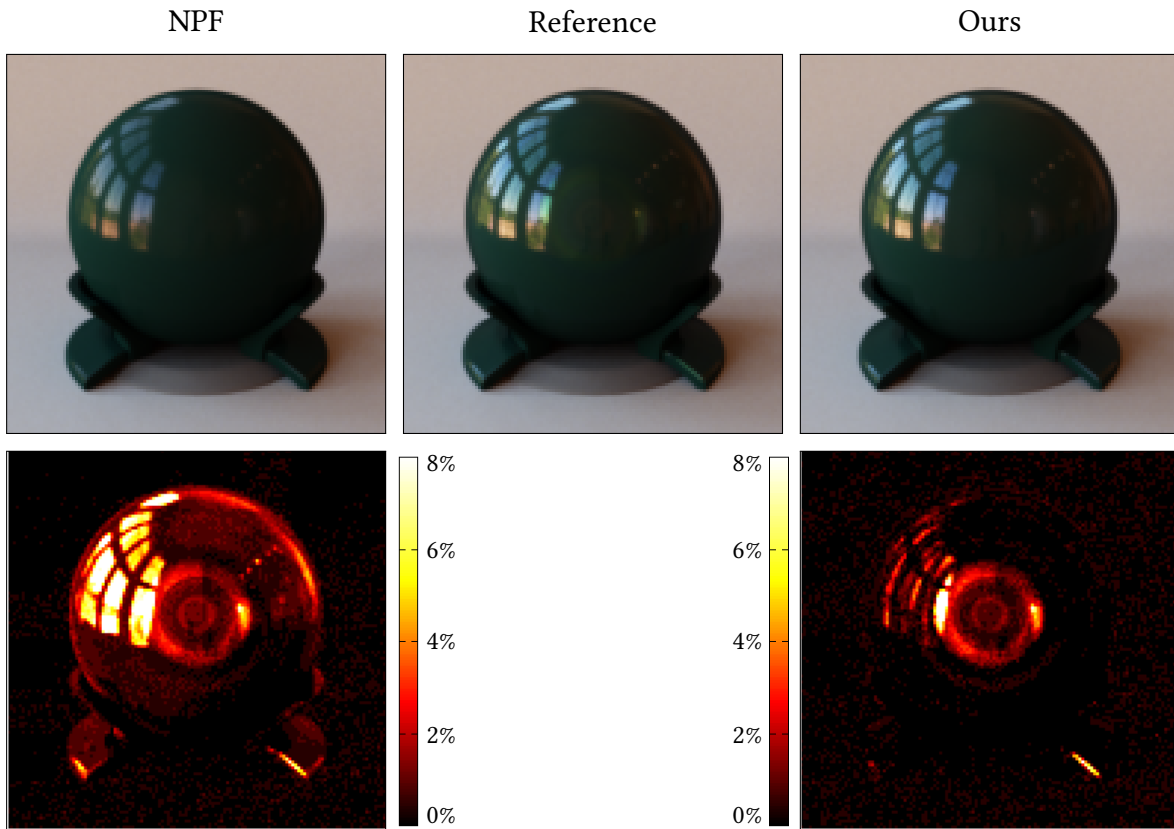


Slices

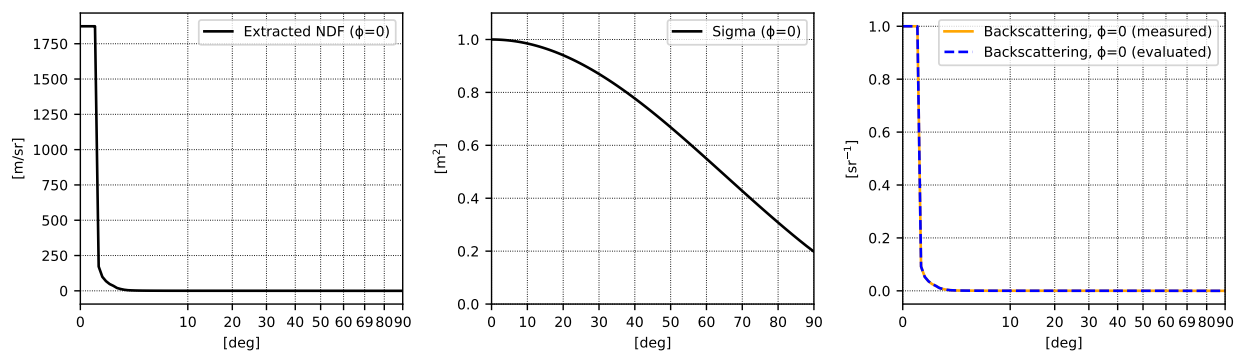


76 specular-green-phenolic

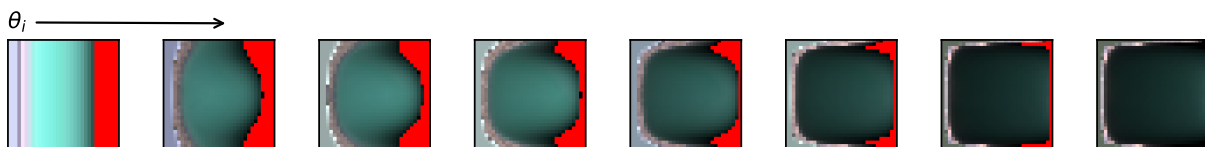
Renderings and CIE dE00



Plots

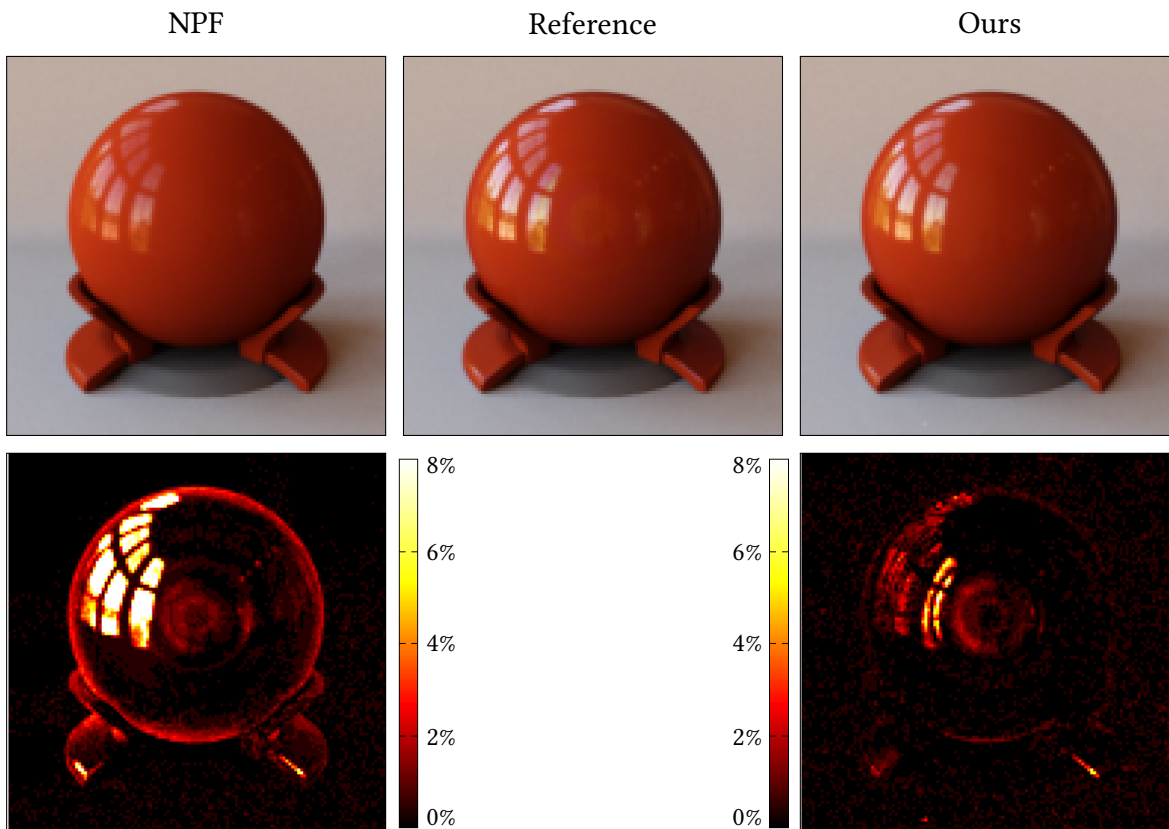


Slices

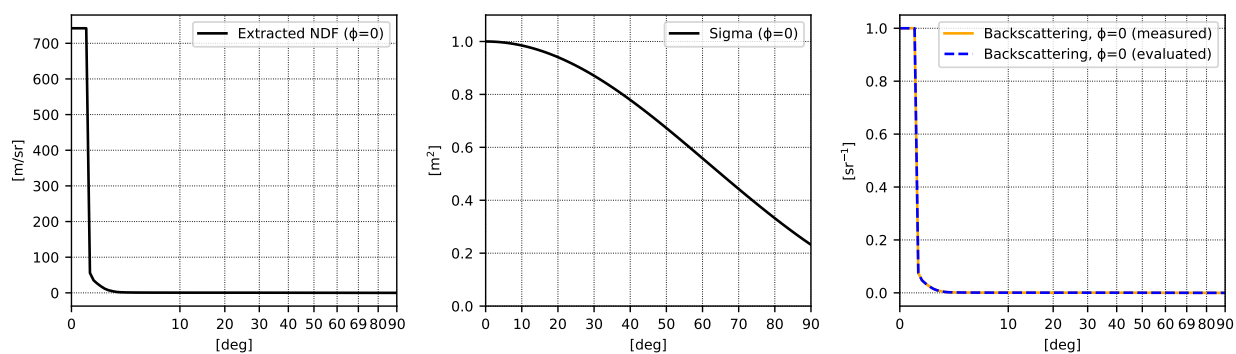


77 specular-maroon-phenolic

Renderings and CIE dE00



Plots

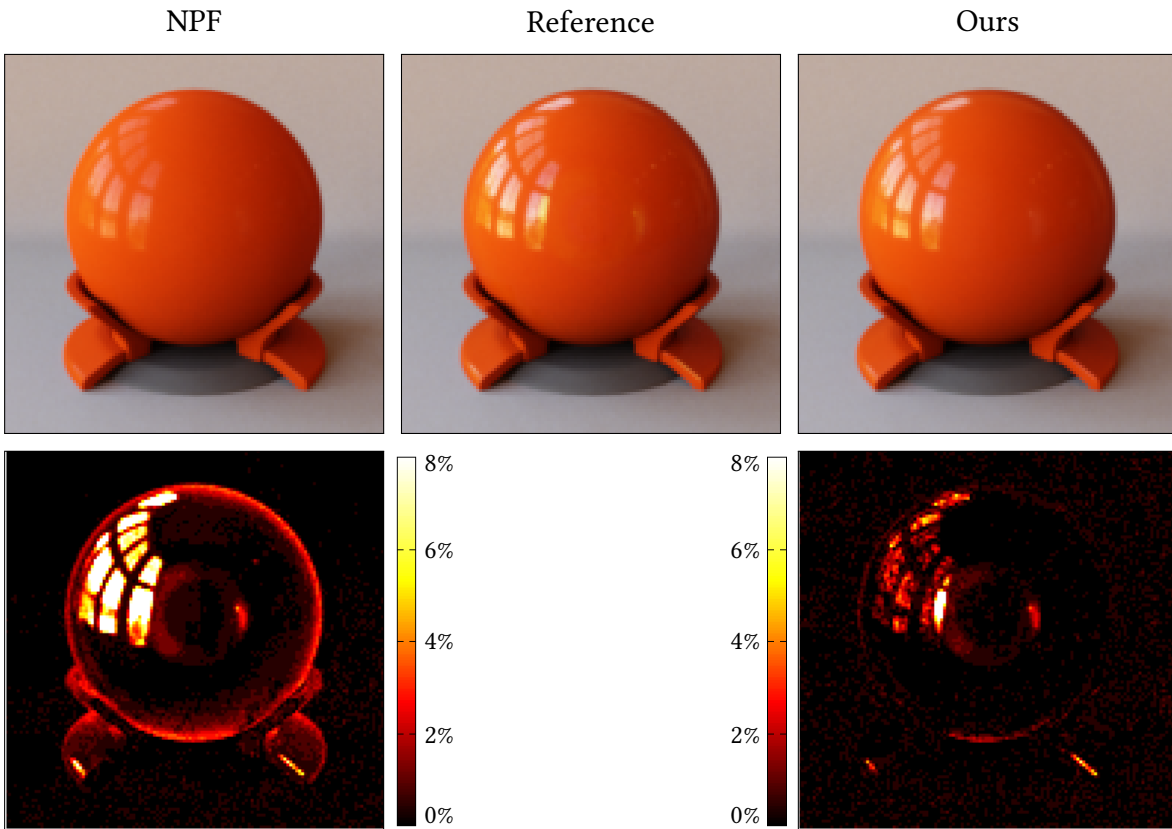


Slices

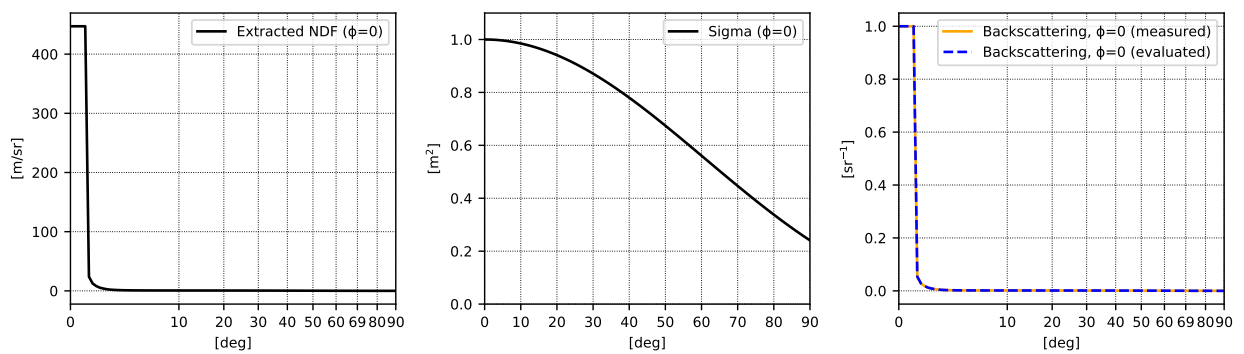


78 specular-orange-phenolic

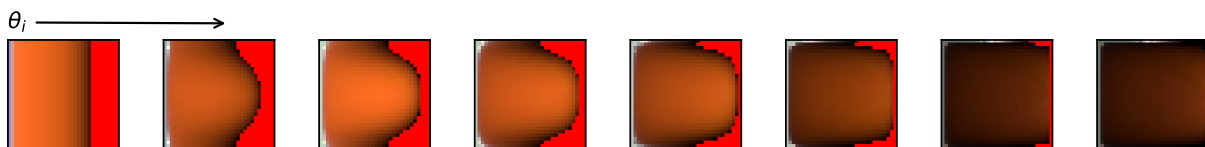
Renderings and CIE dE00



Plots

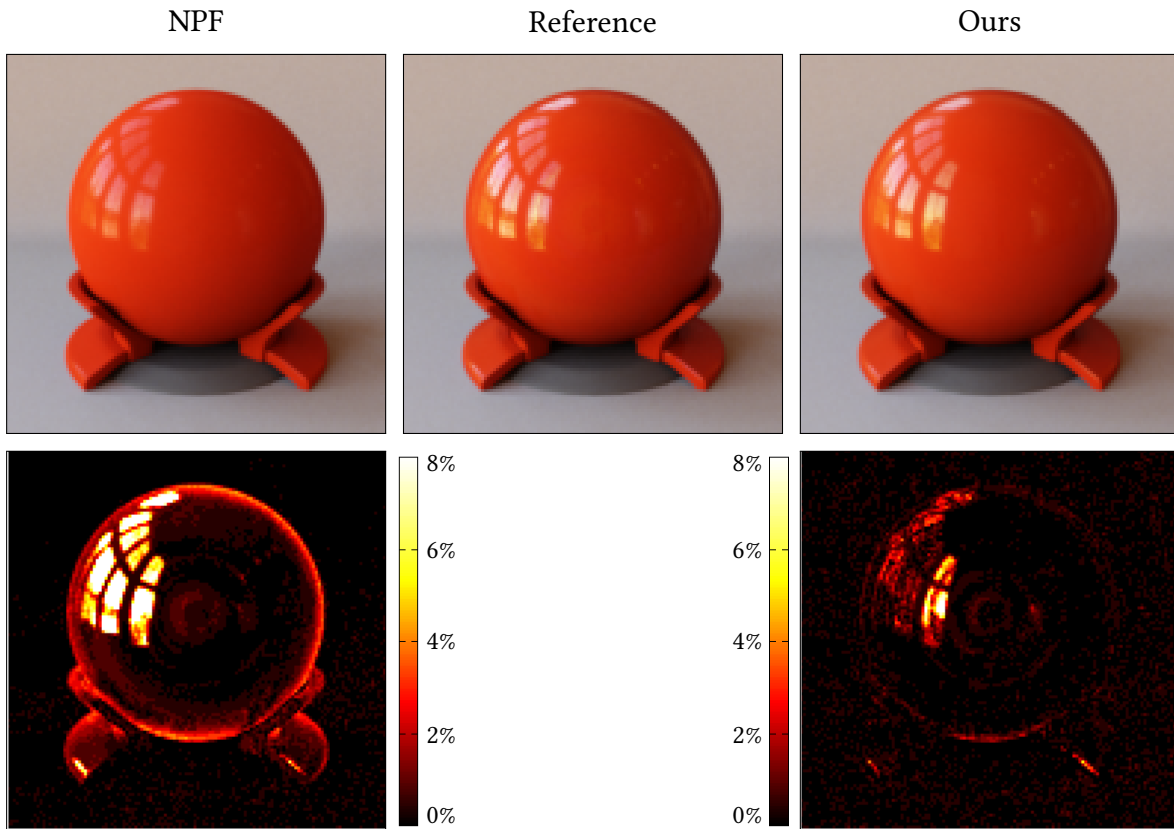


Slices

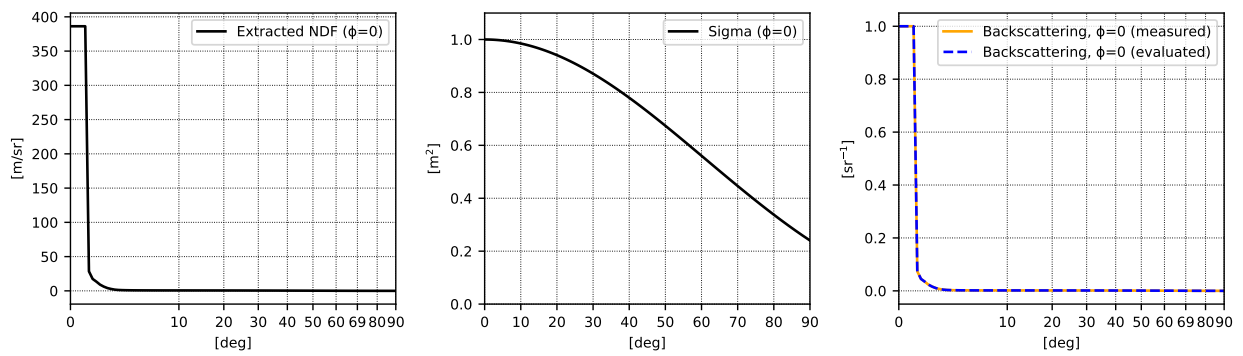


79 specular-red-phenolic

Renderings and CIE dE00



Plots

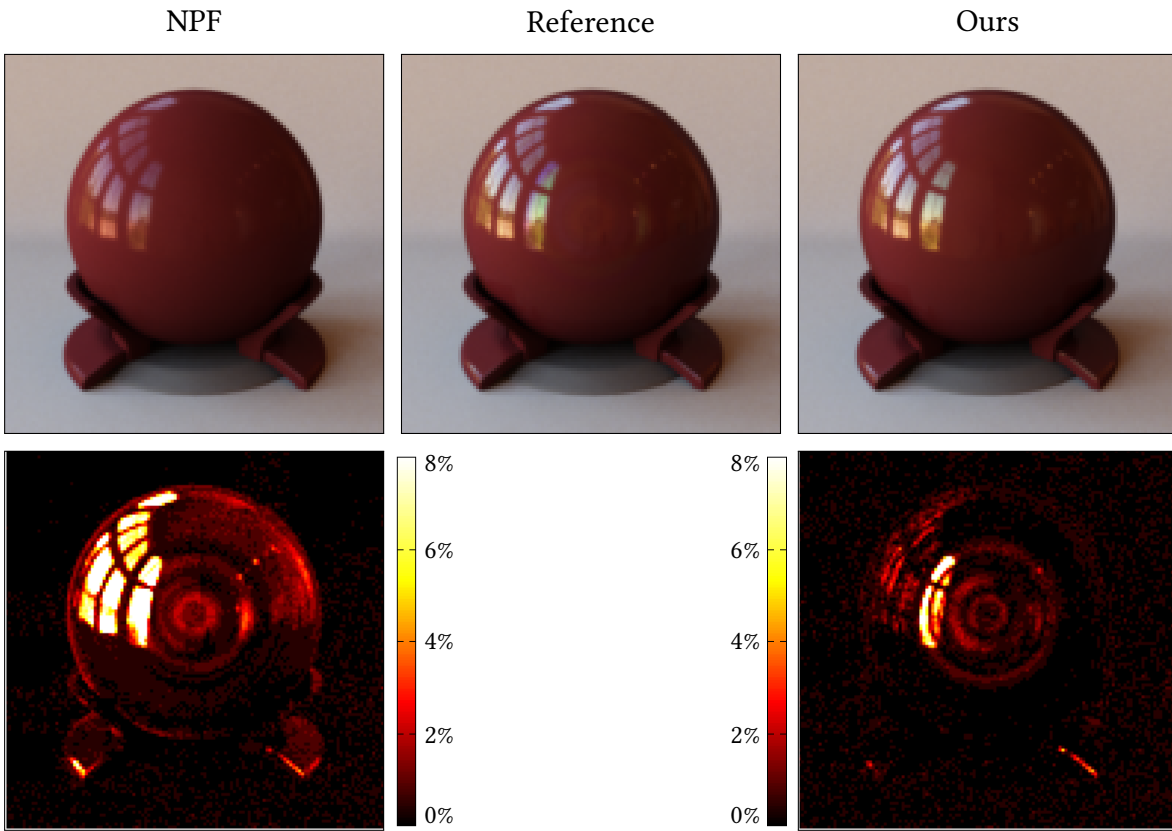


Slices

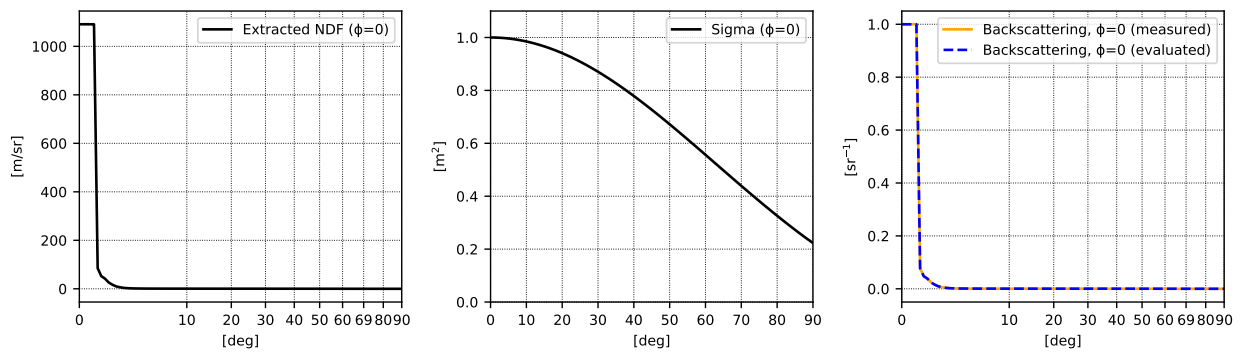


80 specular-violet-phenolic

Renderings and CIE dE00



Plots

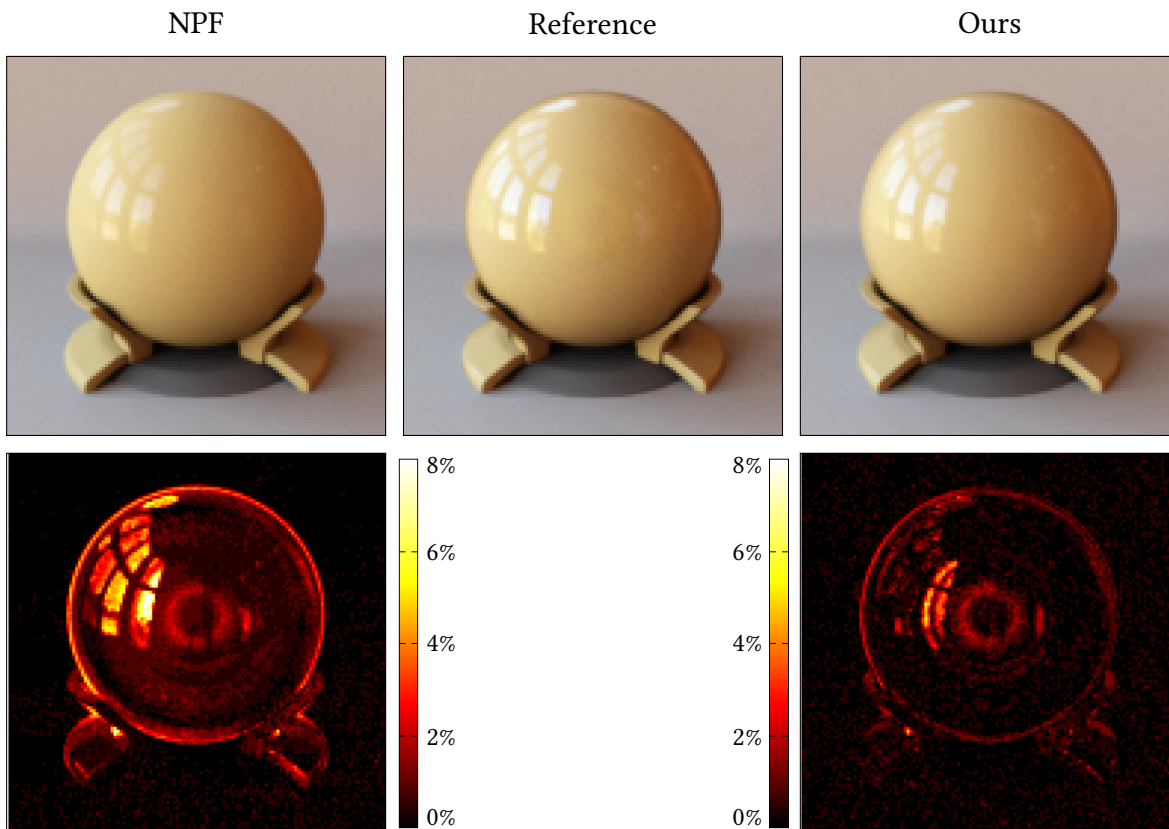


Slices

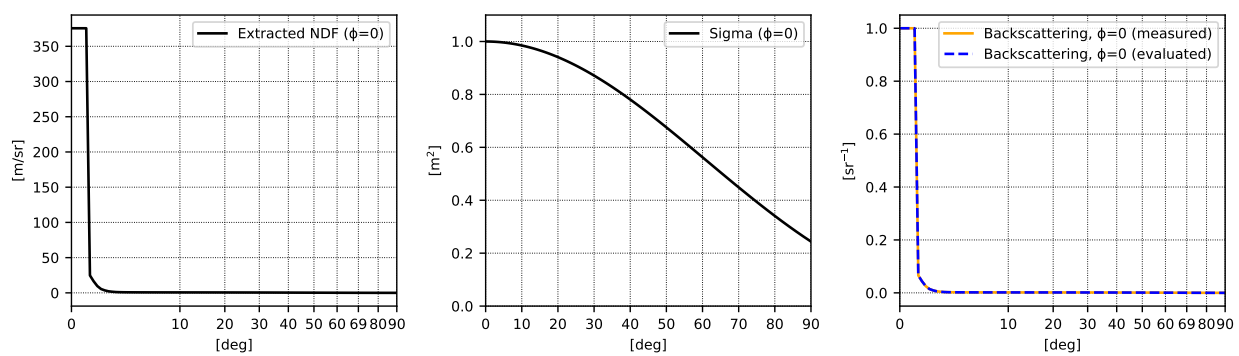


81 specular-white-phenolic

Renderings and CIE dE00



Plots

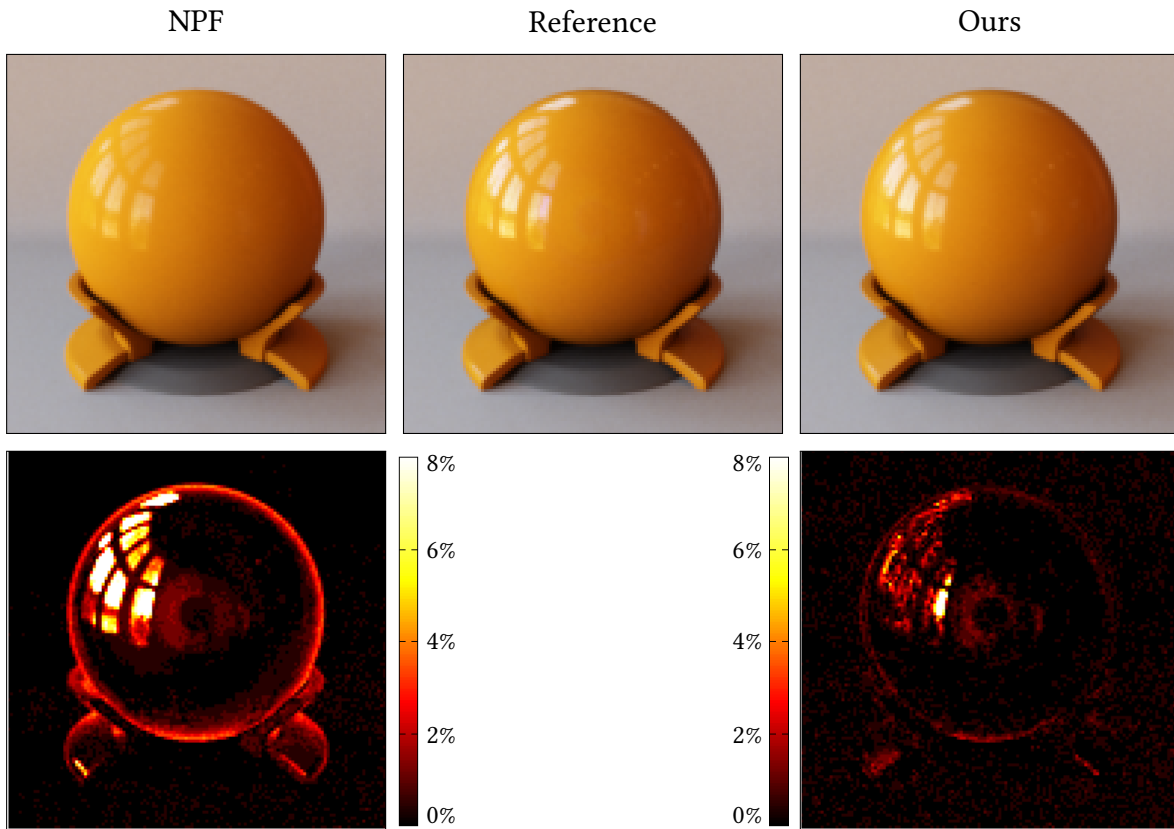


Slices

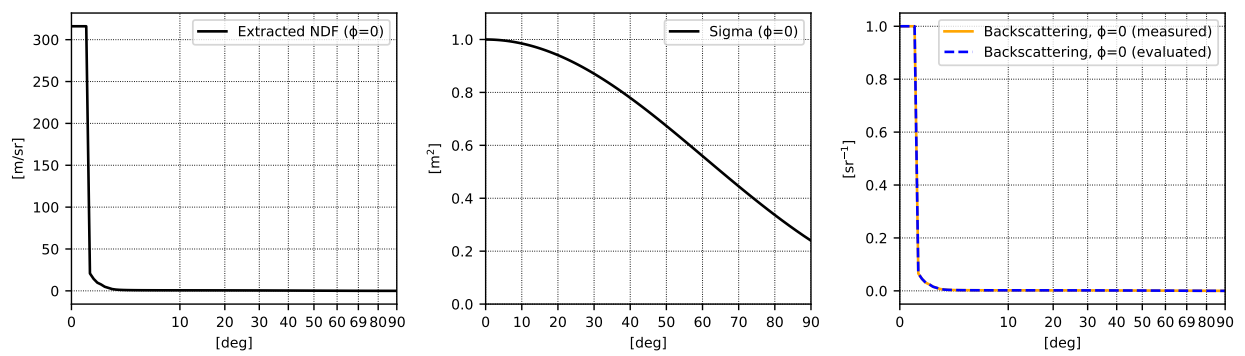


82 specular-yellow-phenolic

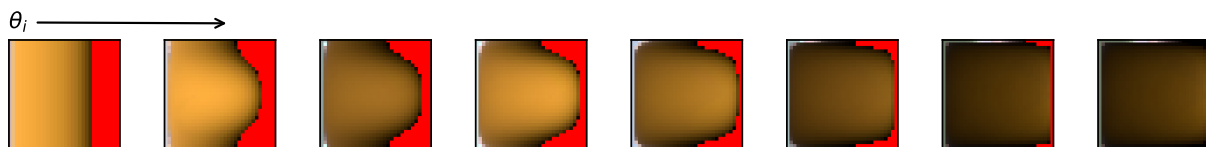
Renderings and CIE dE00



Plots

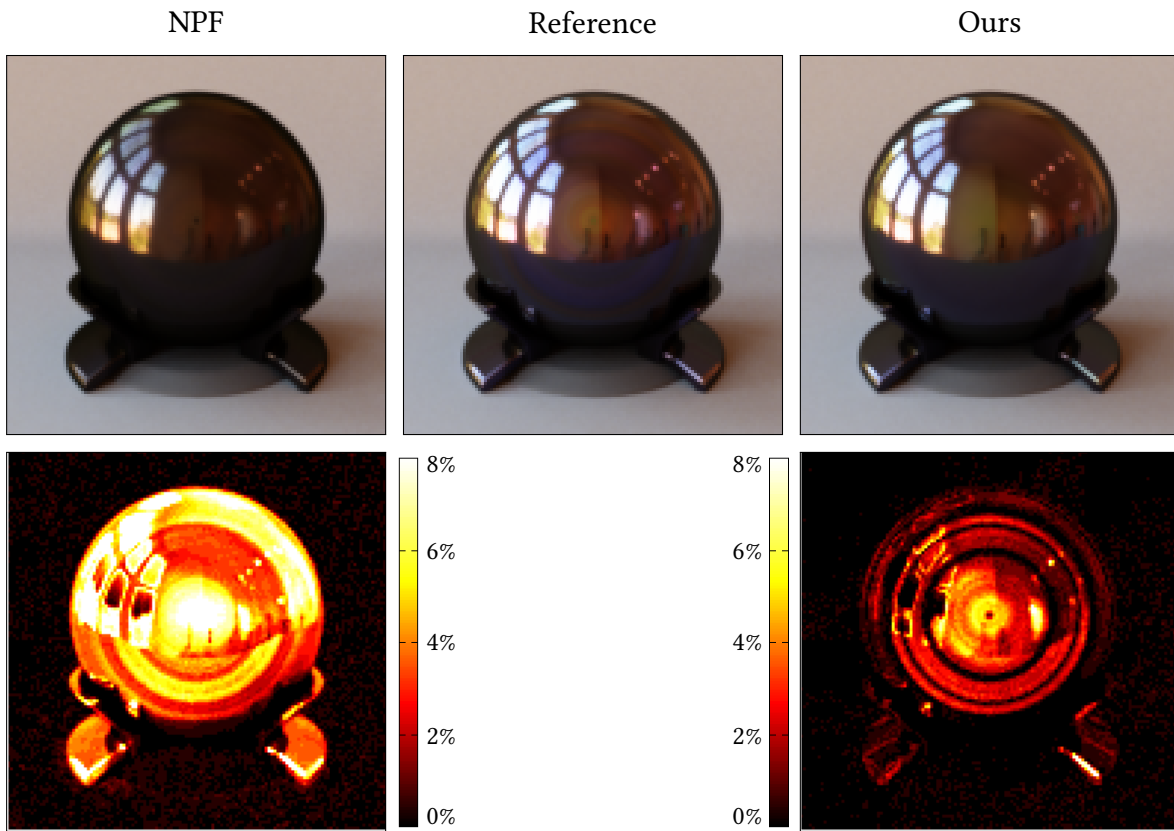


Slices

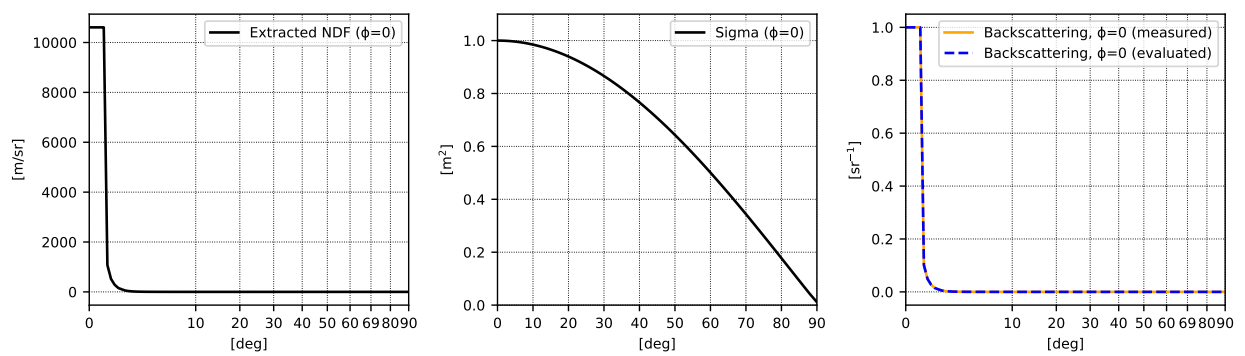


83 ss440

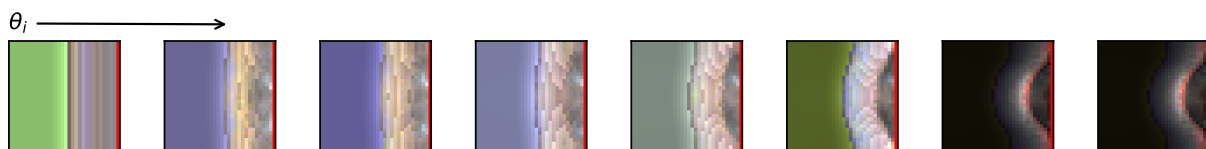
Renderings and CIE dE00



Plots

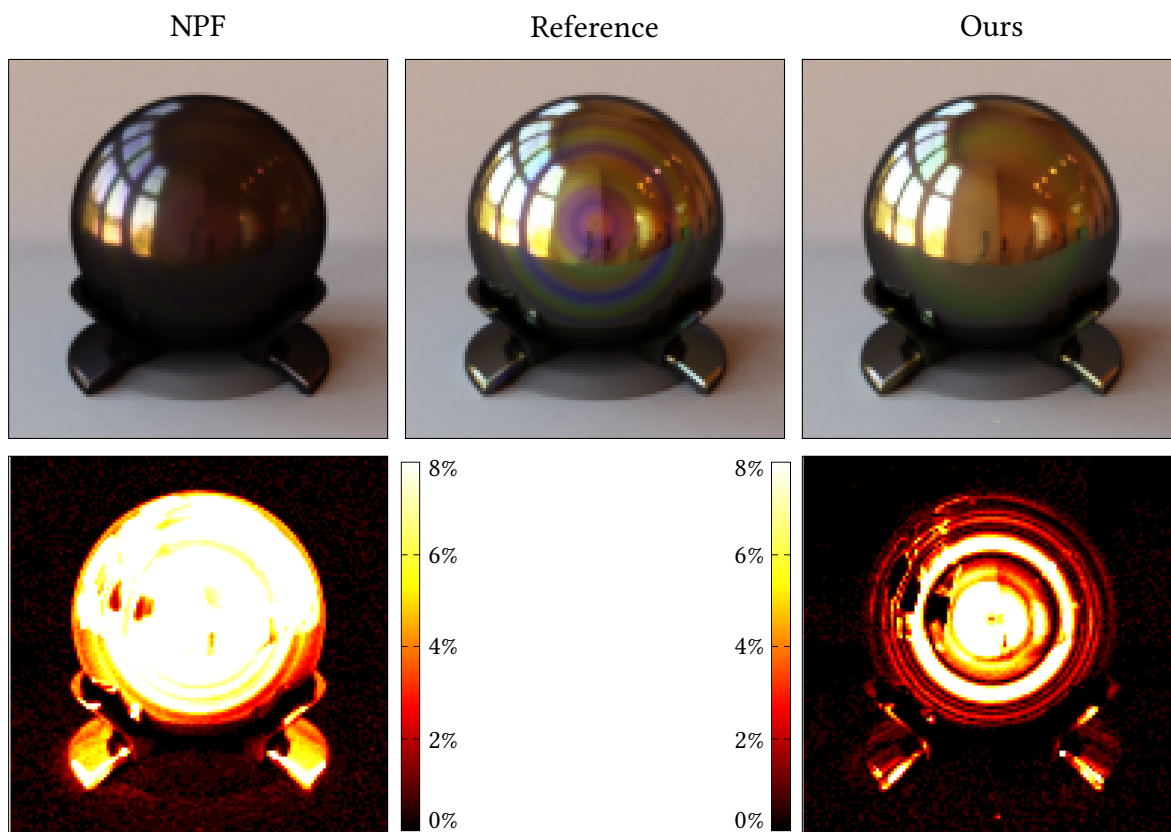


Slices

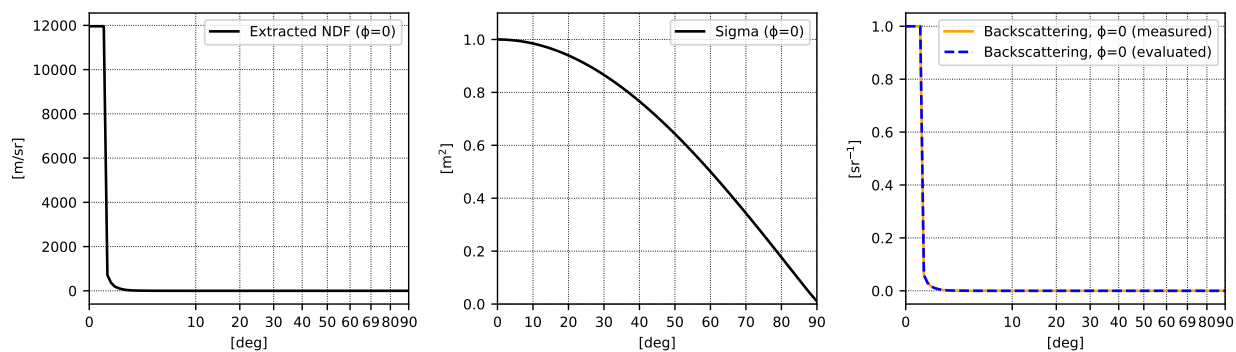


84 steel

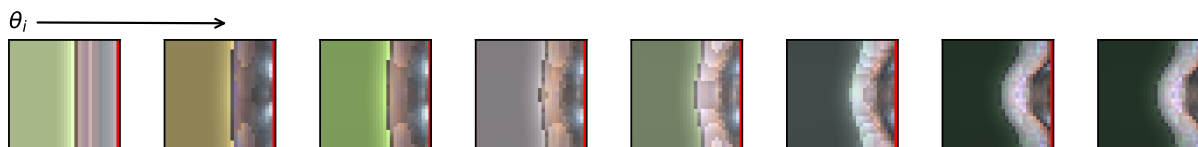
Renderings and CIE dE00



Plots

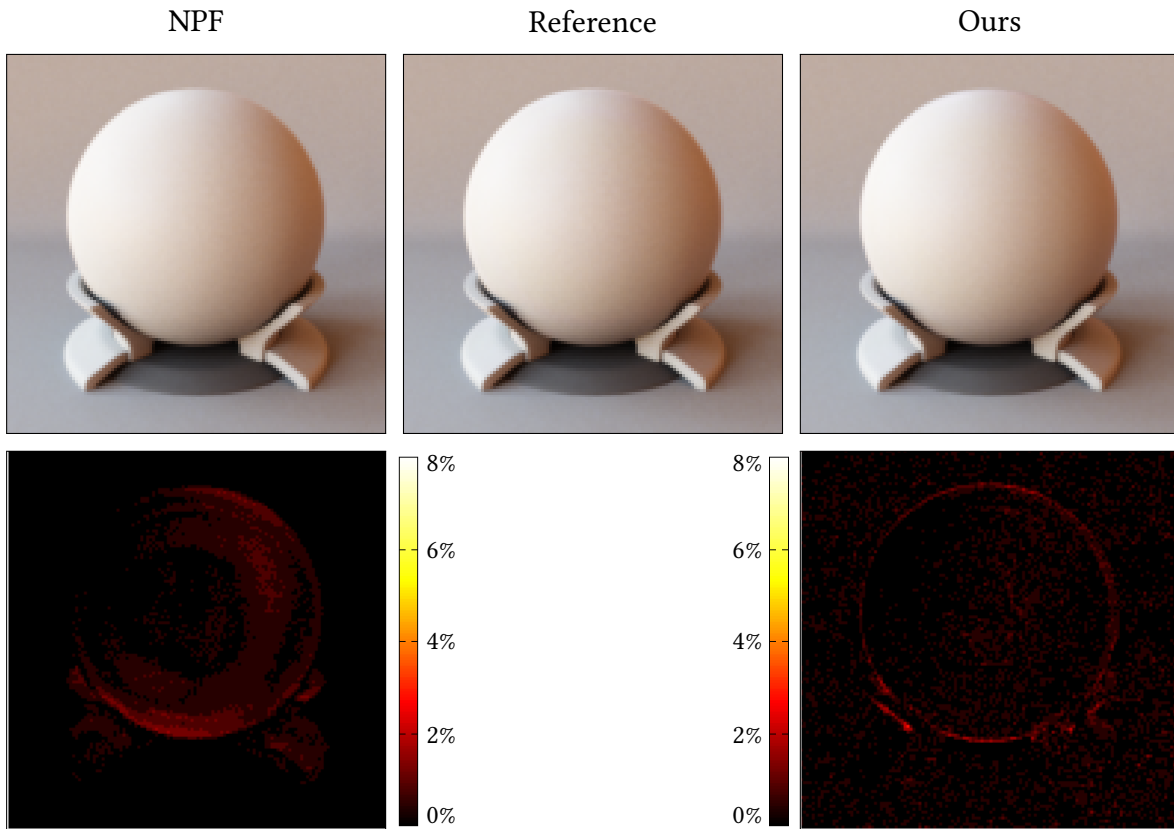


Slices

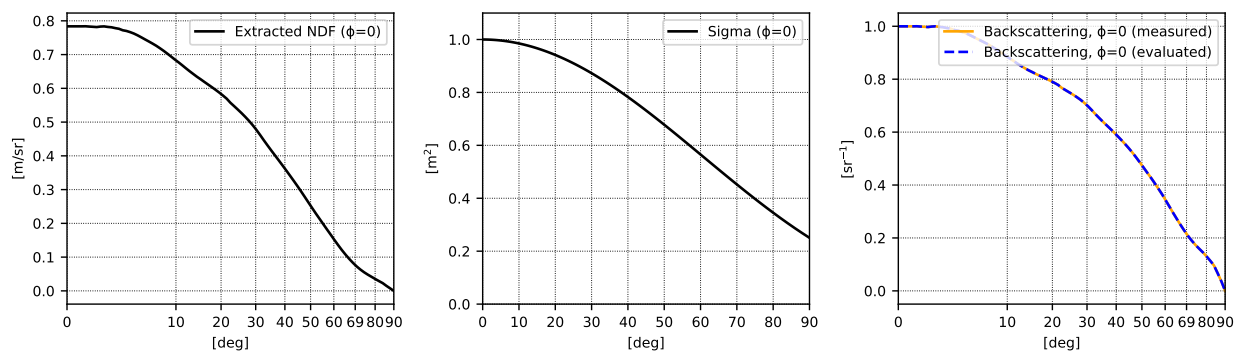


85 teflon

Renderings and CIE dE00



Plots

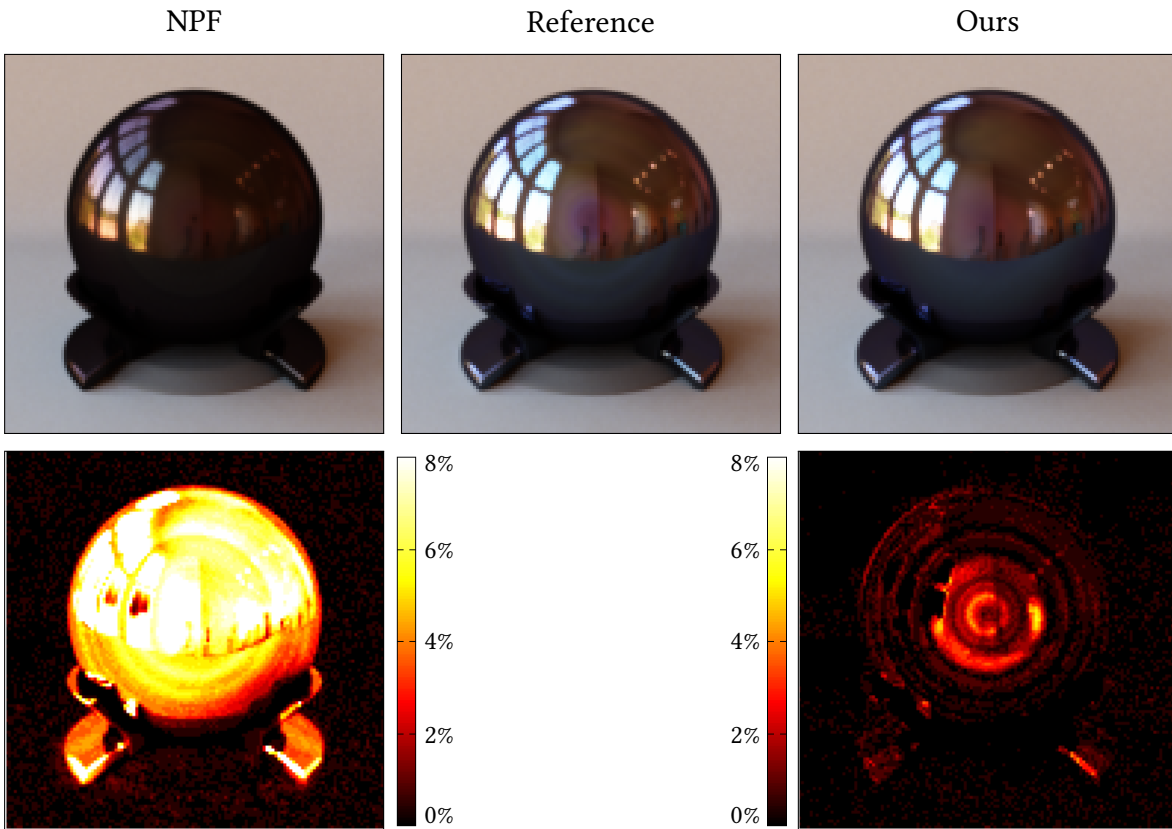


Slices

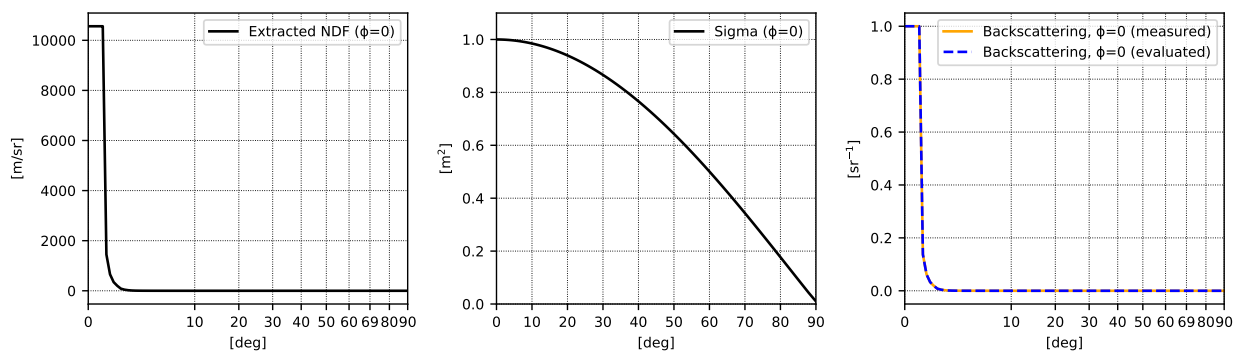


86 tungsten-carbide

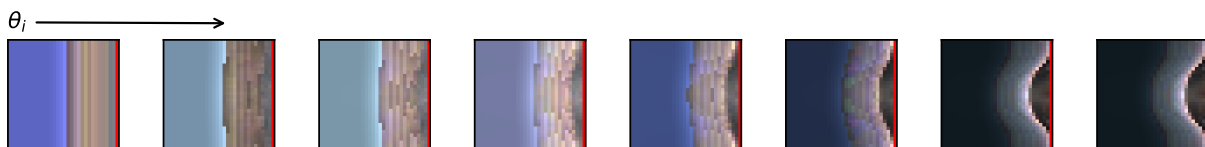
Renderings and CIE dE00



Plots

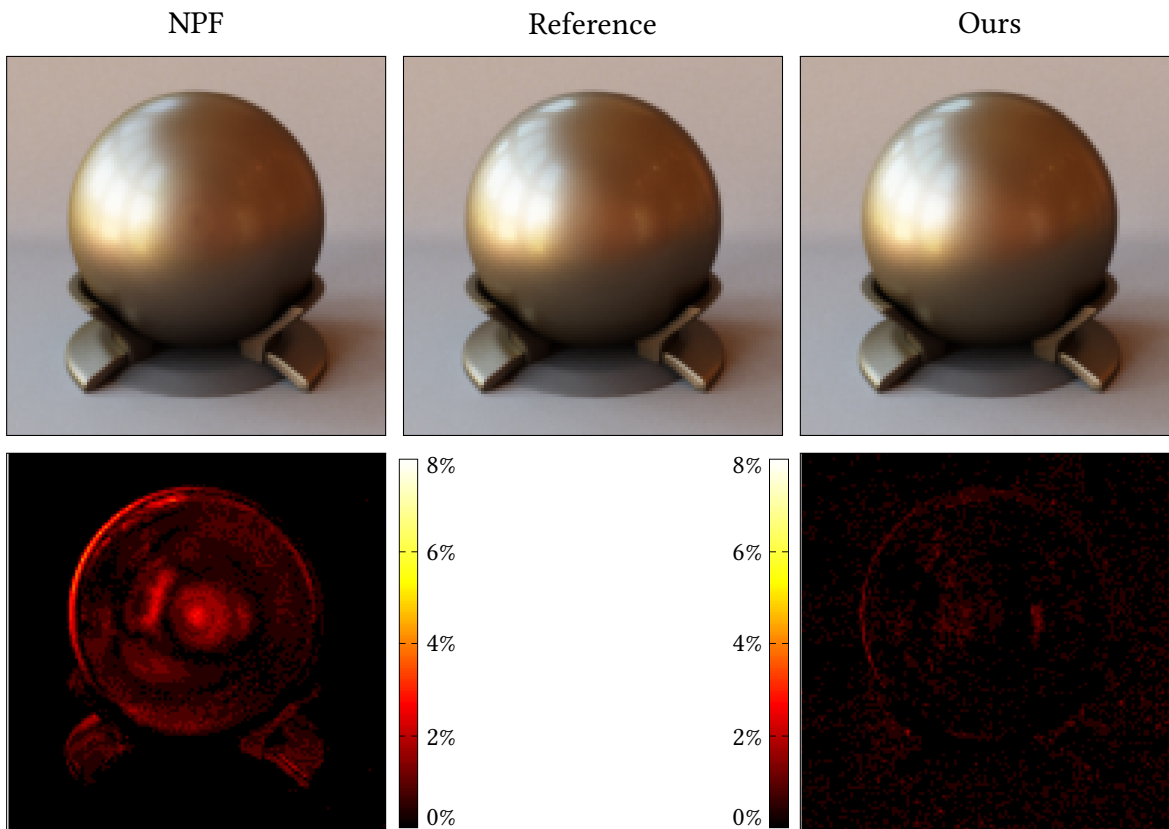


Slices

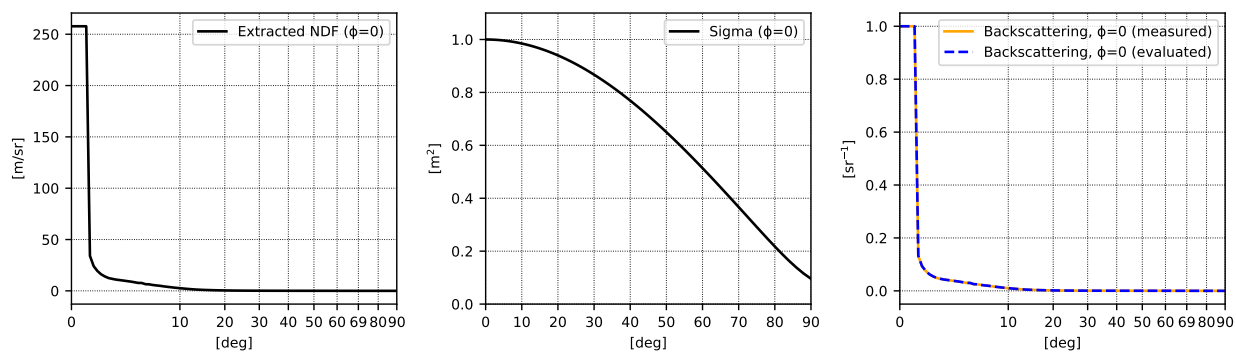


87 two-layer-gold

Renderings and CIE dE00



Plots

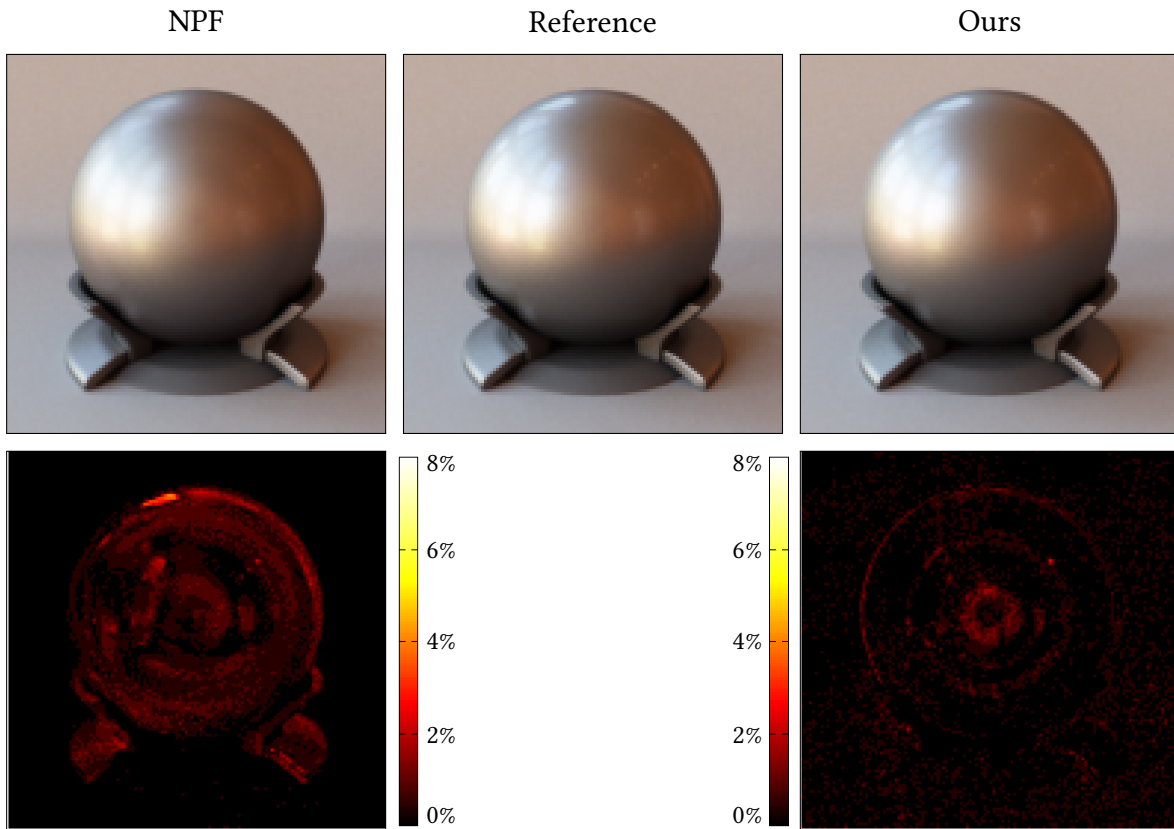


Slices

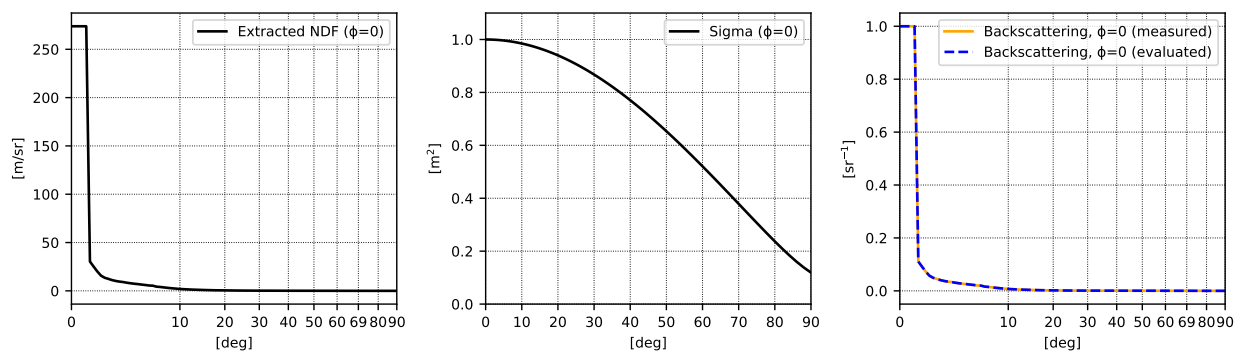


88 two-layer-silver

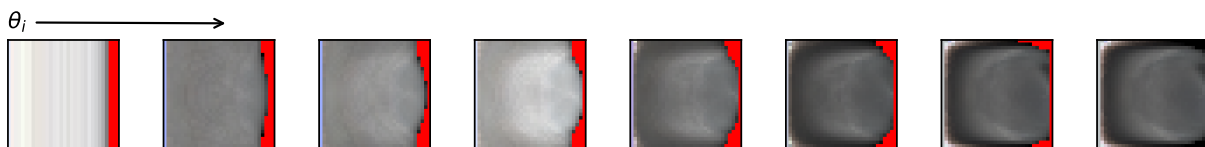
Renderings and CIE dE00



Plots

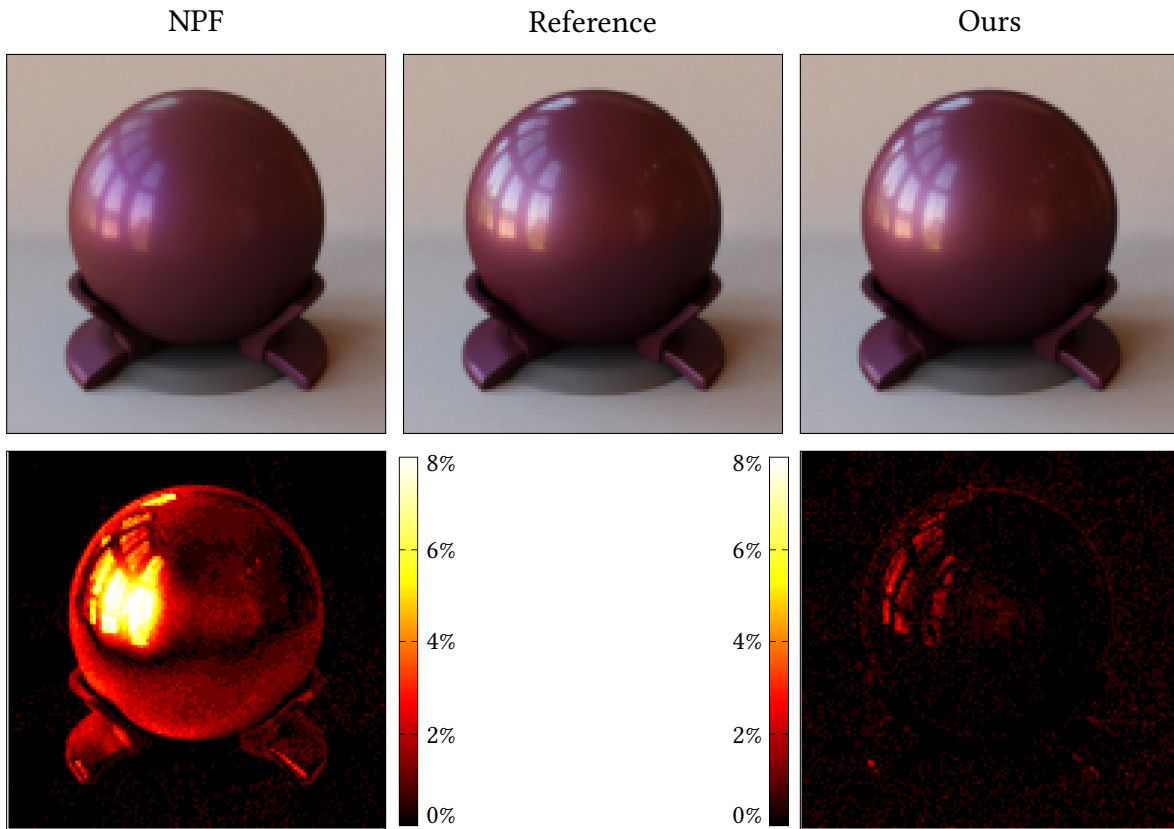


Slices

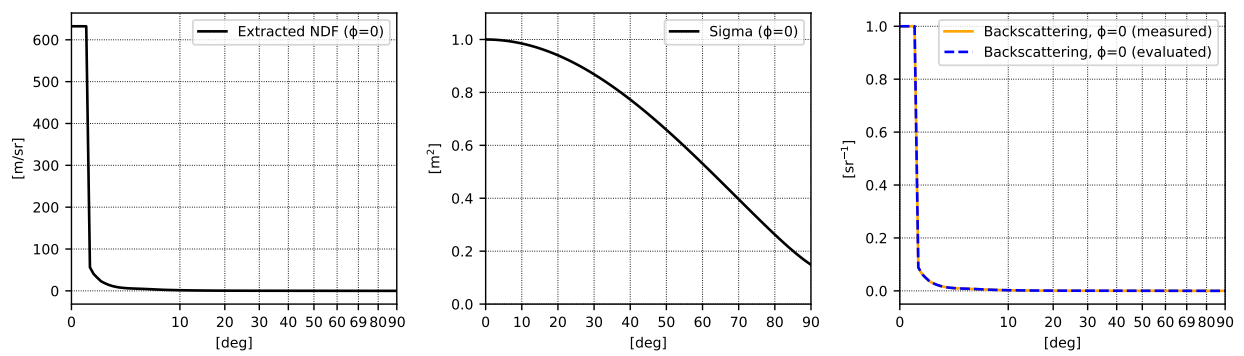


89 violet-acrylic

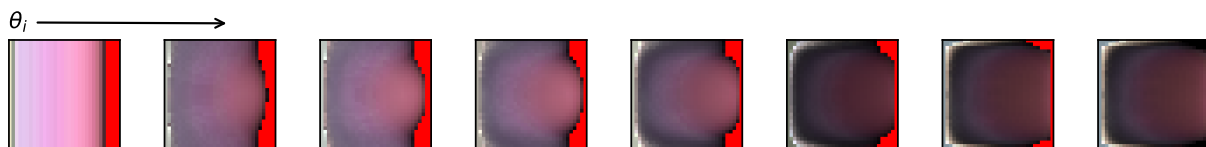
Renderings and CIE dE00



Plots

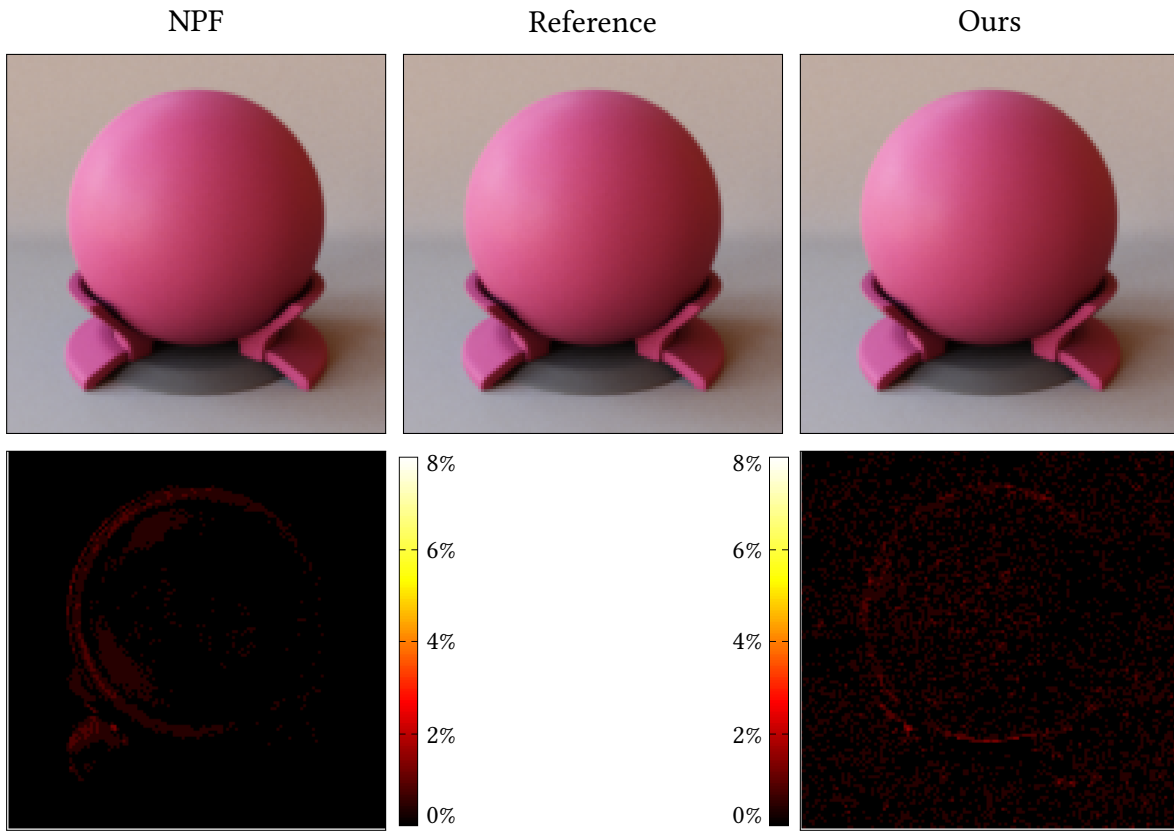


Slices

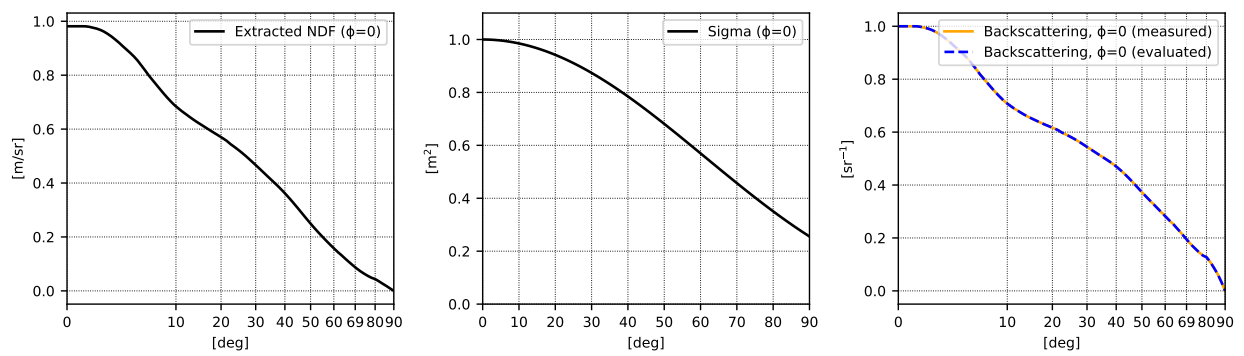


90 violet-rubber

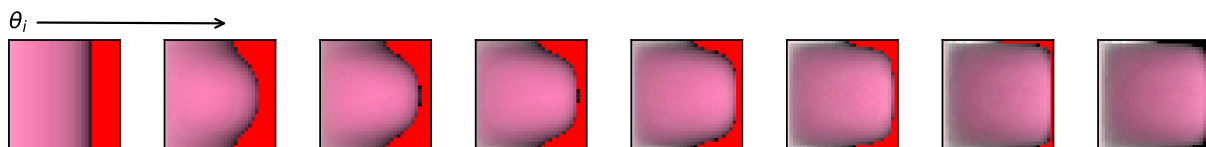
Renderings and CIE dE00



Plots

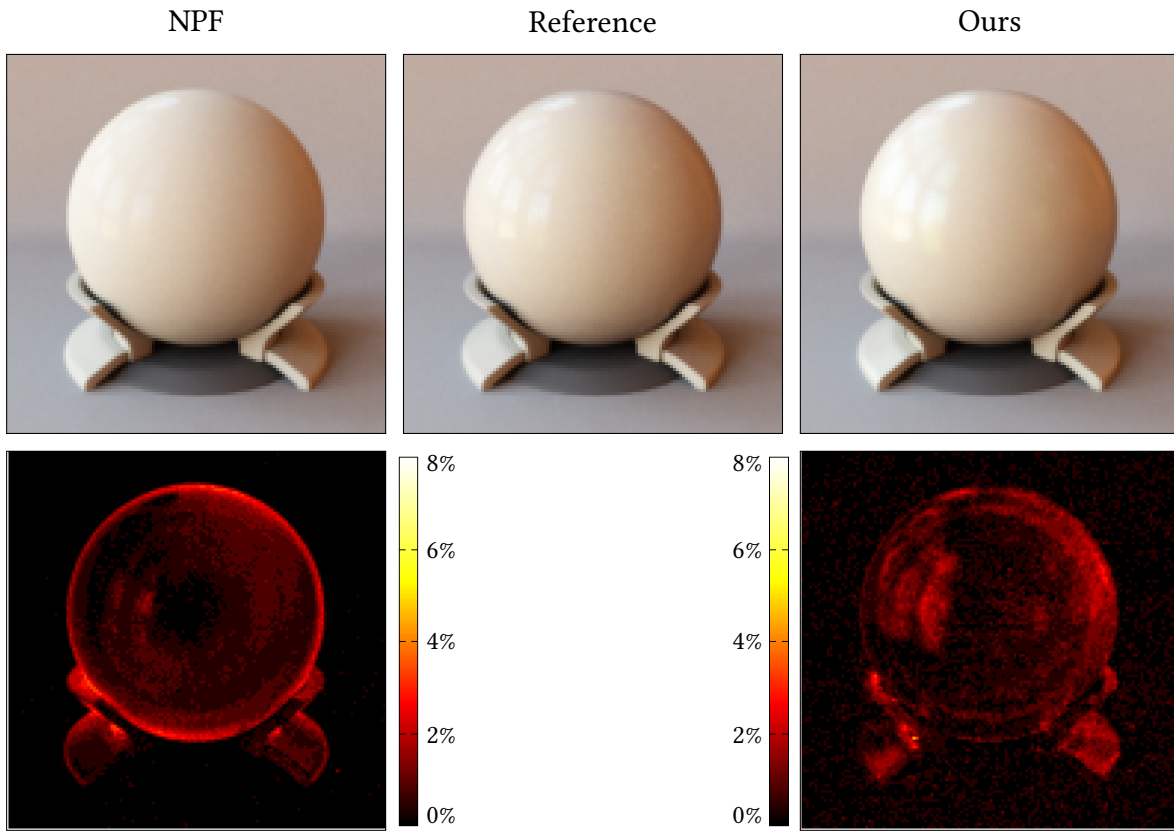


Slices

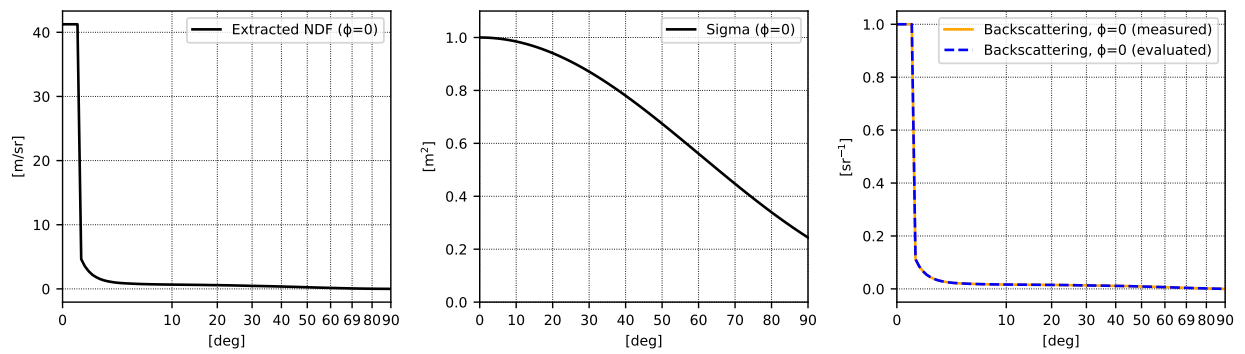


91 white-acrylic

Renderings and CIE dE00



Plots

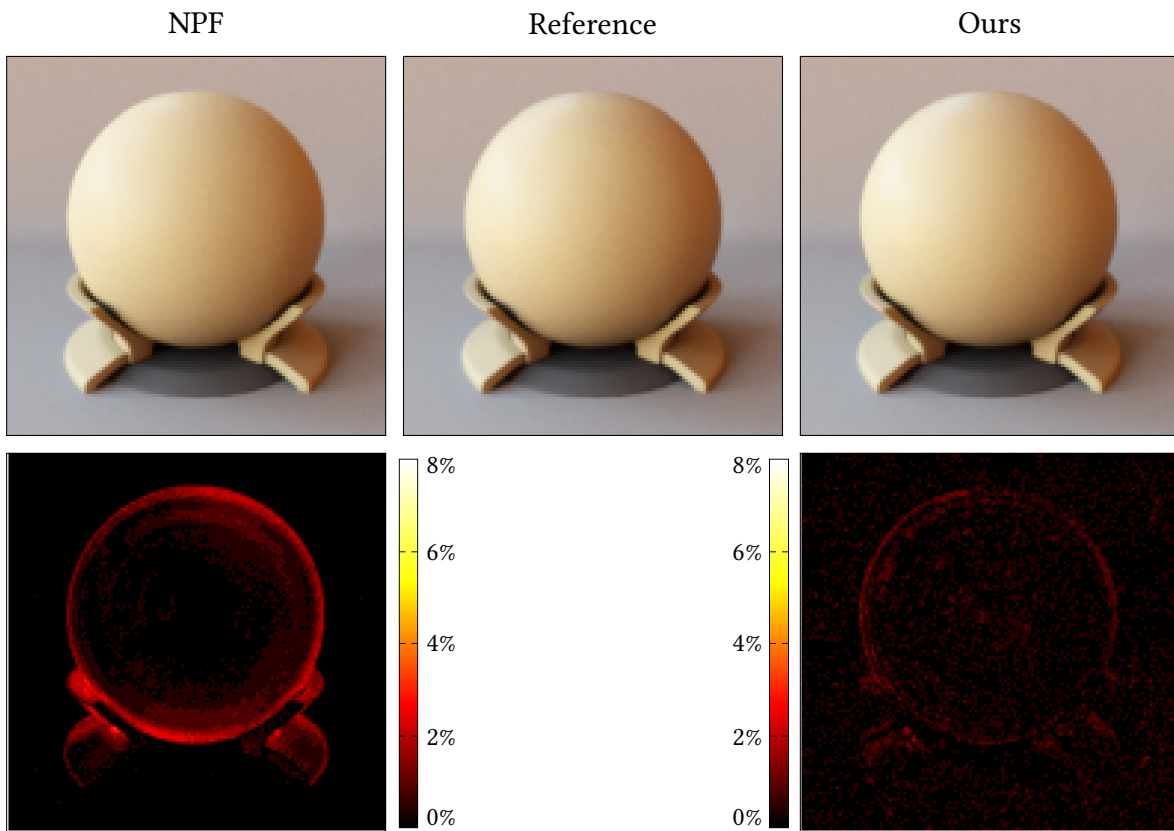


Slices

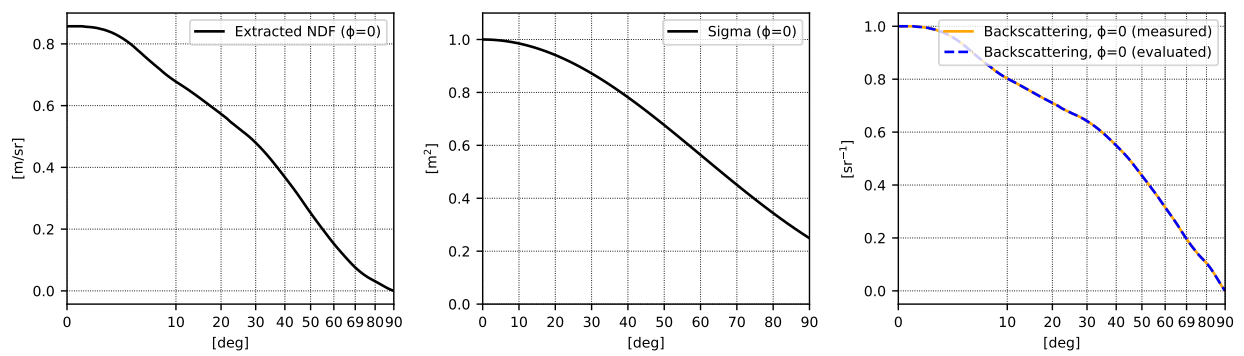


92 white-diffuse-bball

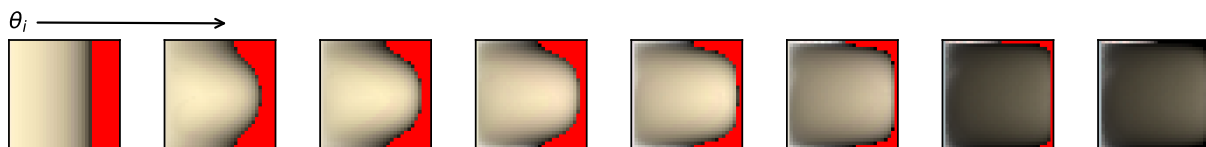
Renderings and CIE dE00



Plots

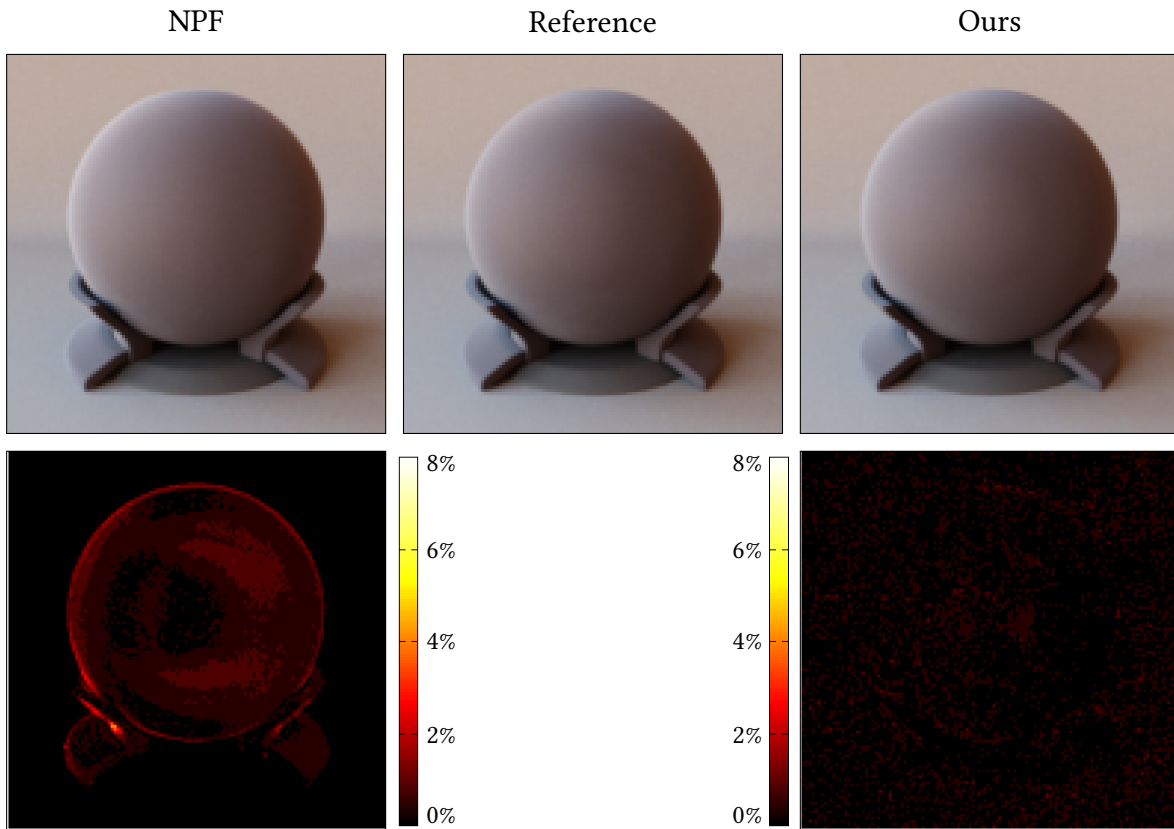


Slices

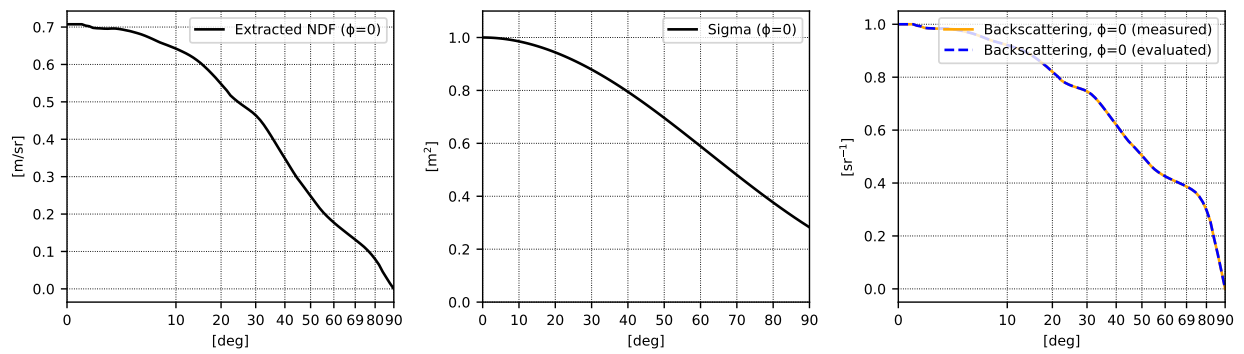


93 white-fabric2

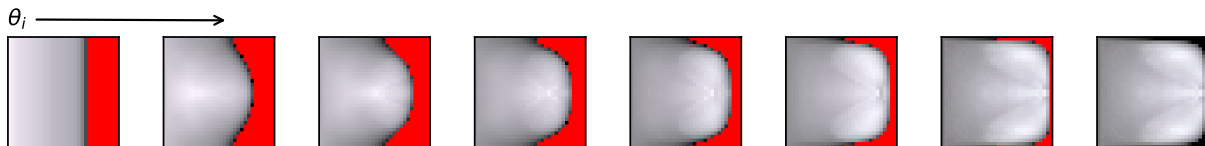
Renderings and CIE dE00



Plots

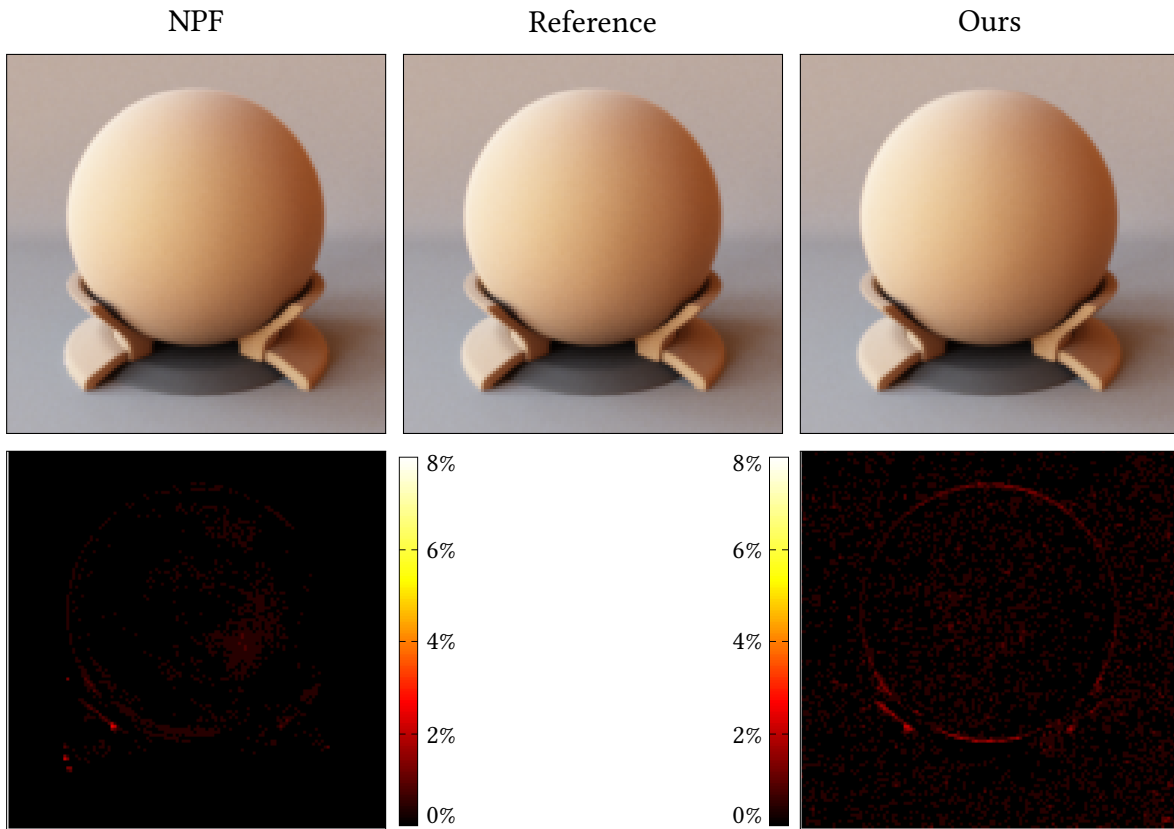


Slices

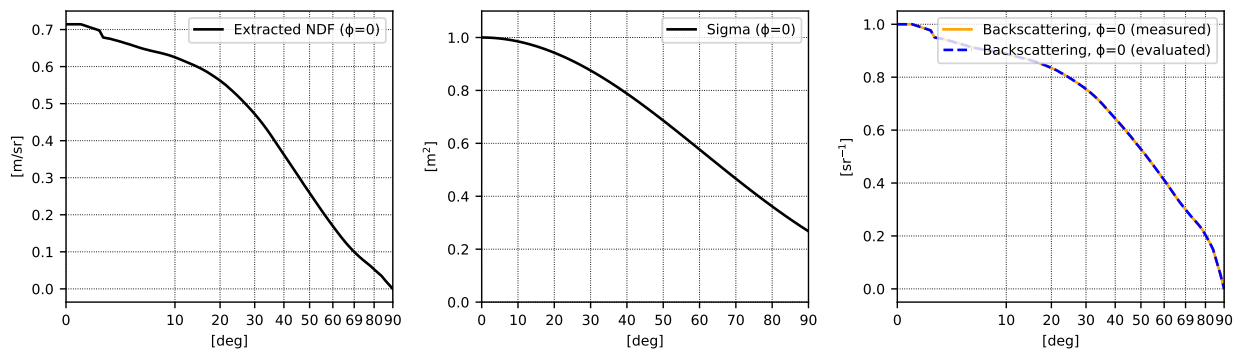


94 white-fabric

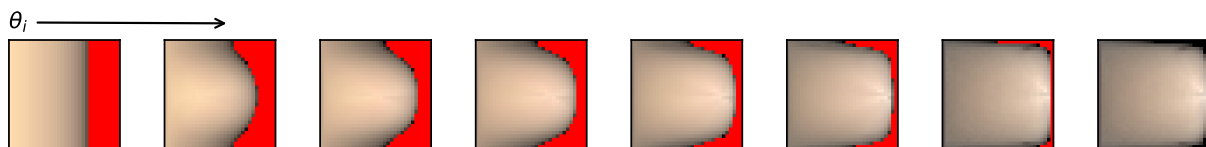
Renderings and CIE dE00



Plots

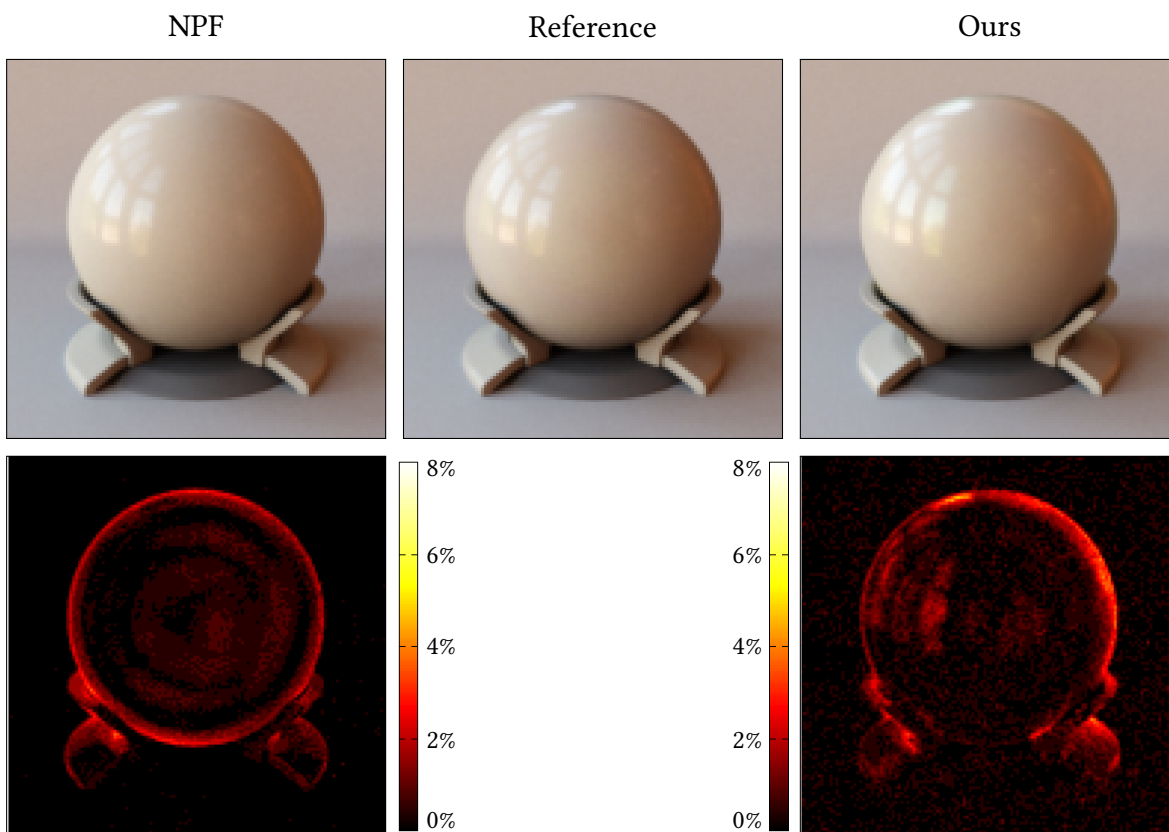


Slices

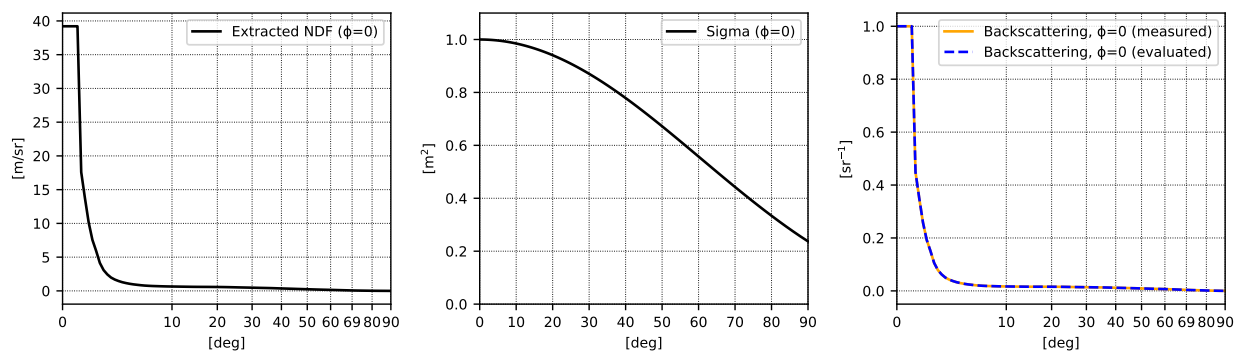


95 white-marble

Renderings and CIE dE00



Plots

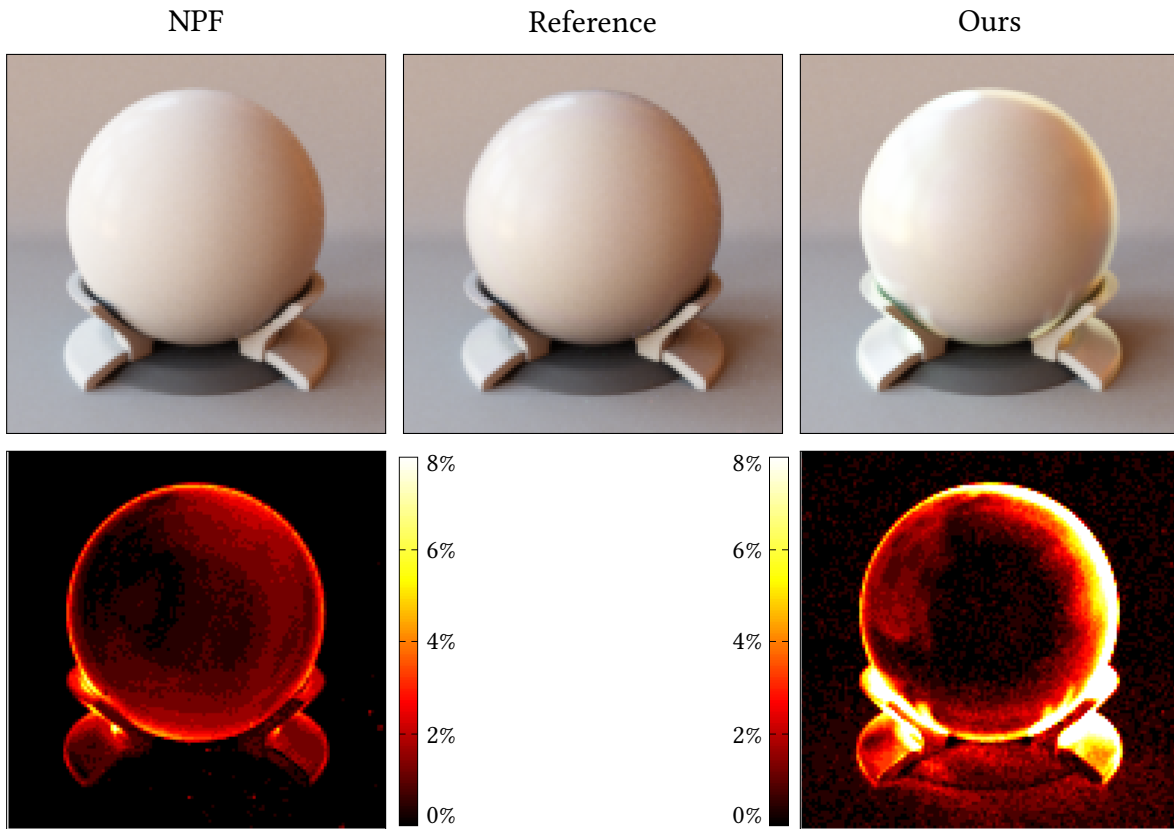


Slices

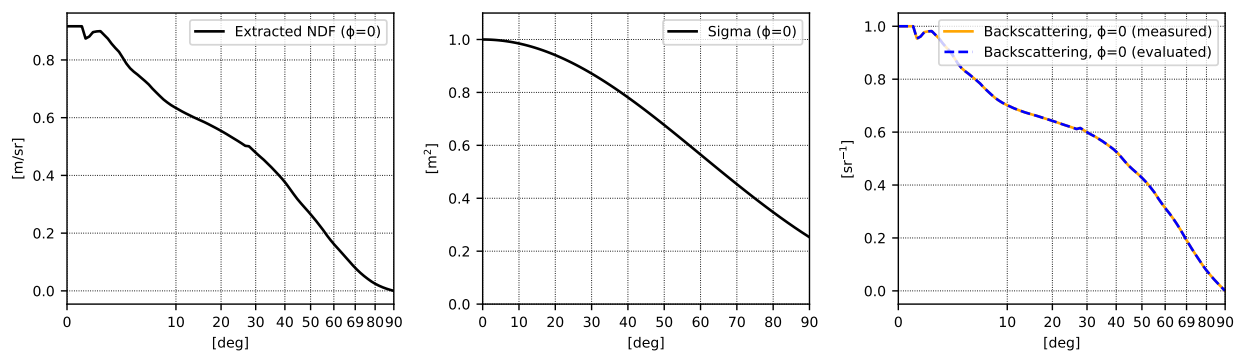


96 white-paint

Renderings and CIE dE00



Plots

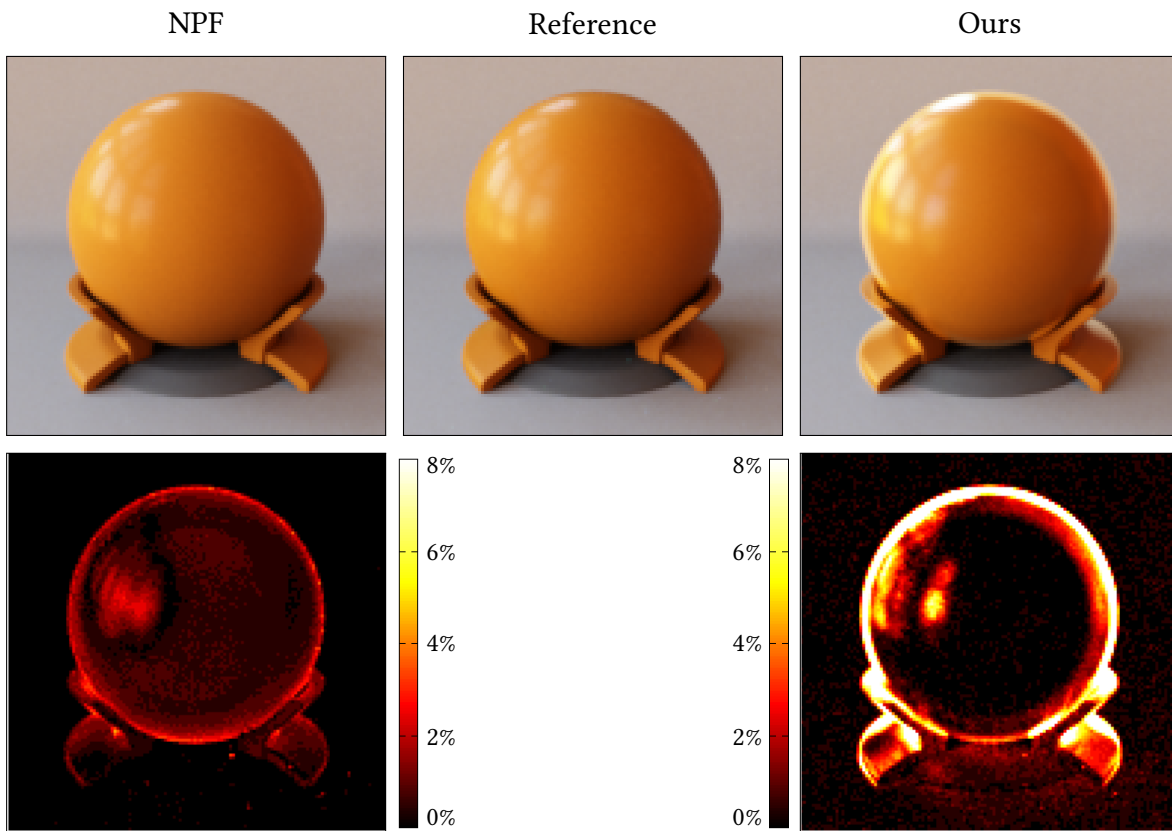


Slices

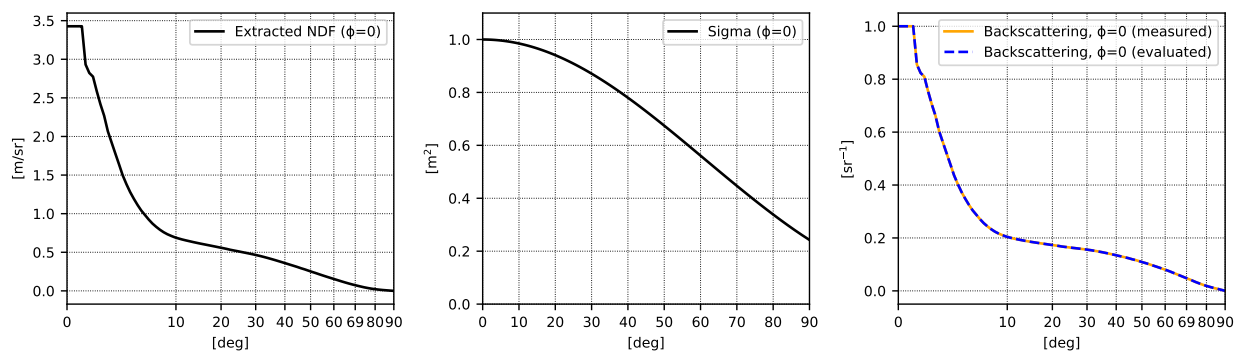


97 yellow-matte-plastic

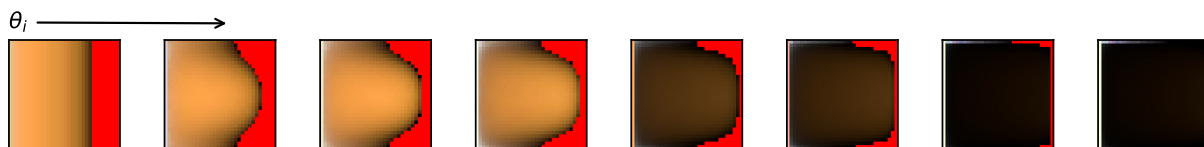
Renderings and CIE dE00



Plots

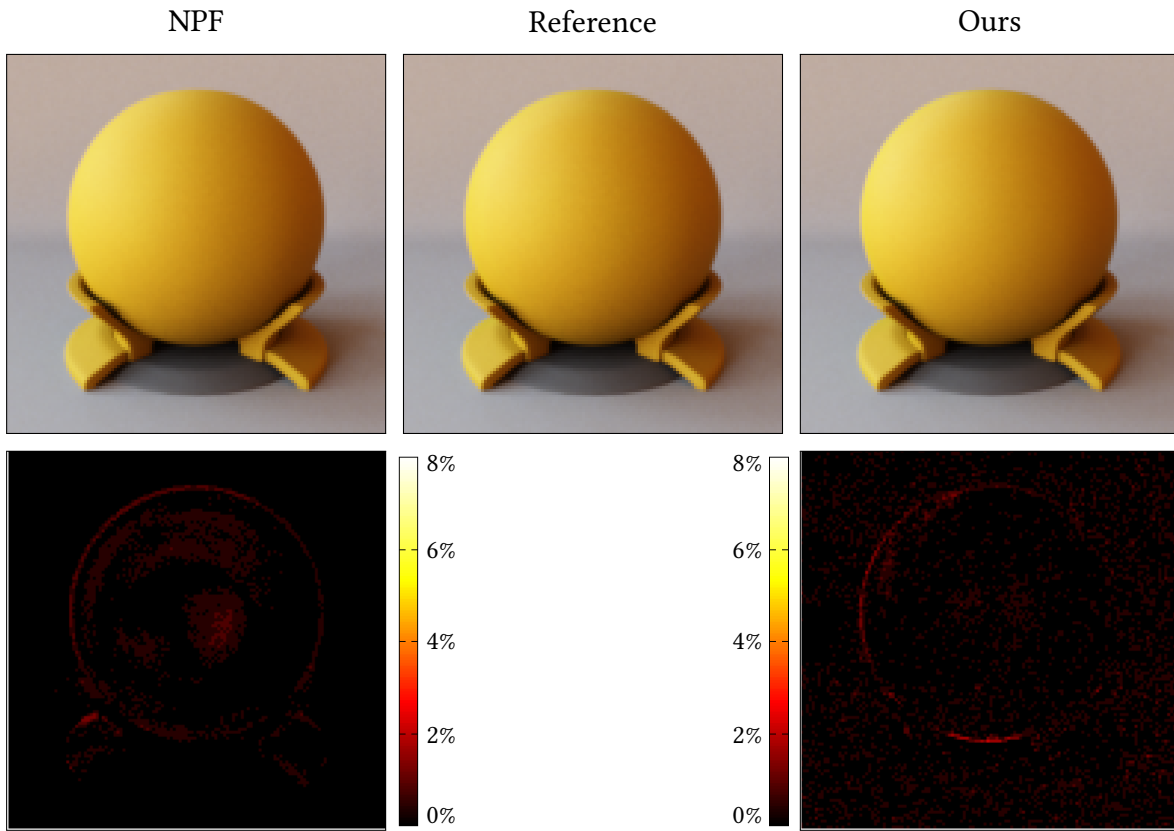


Slices

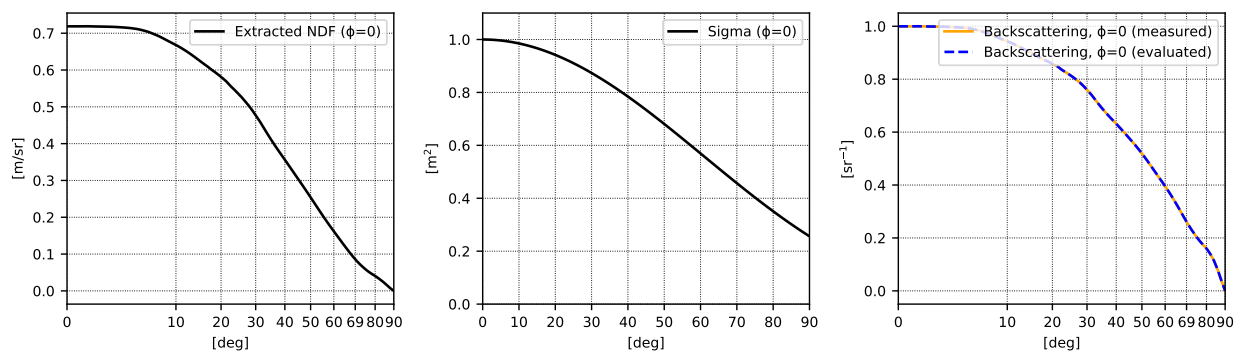


98 yellow-paint

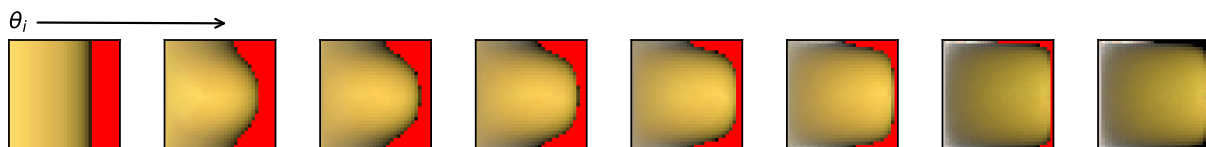
Renderings and CIE dE00



Plots

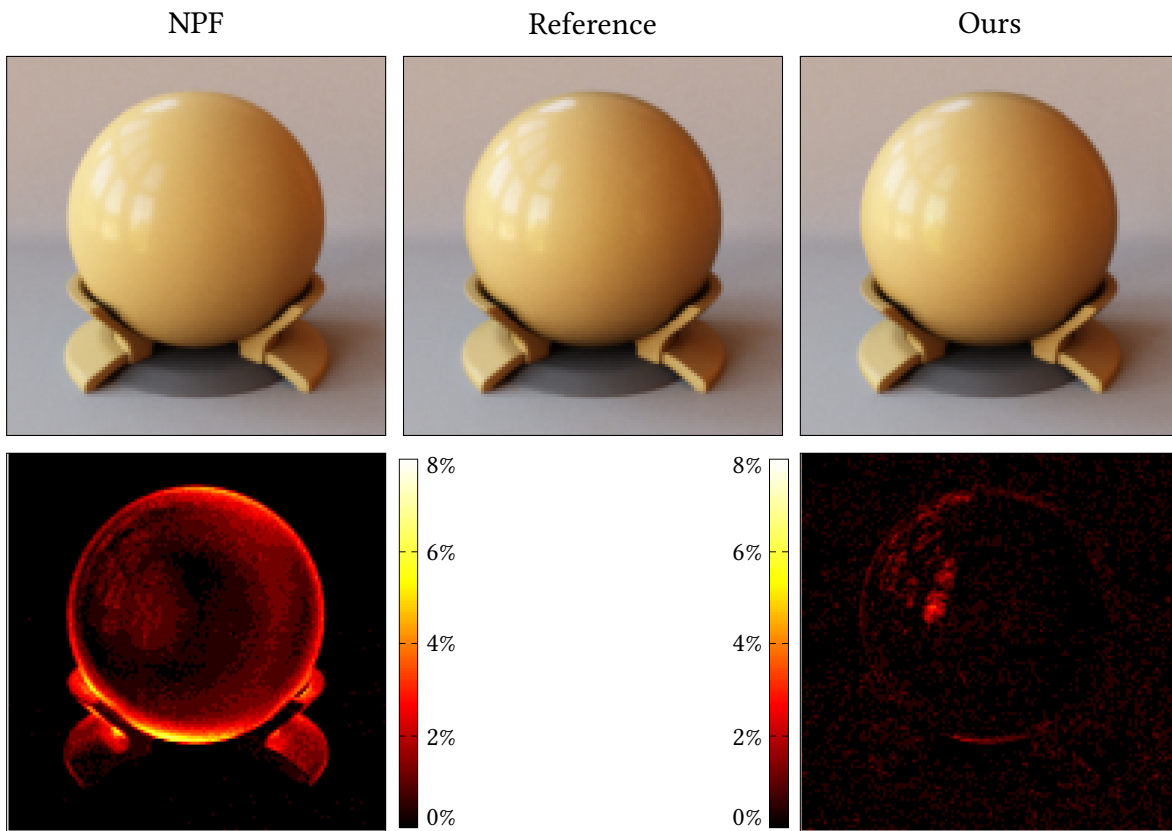


Slices

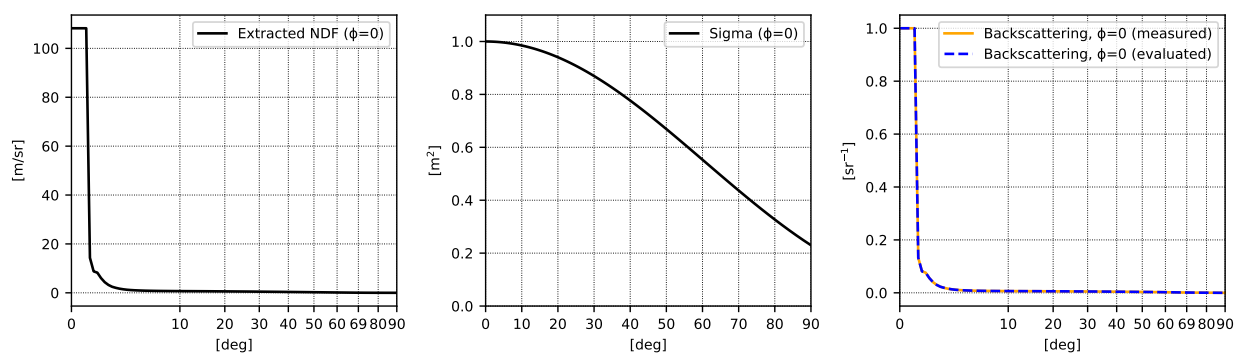


99 yellow-phenolic

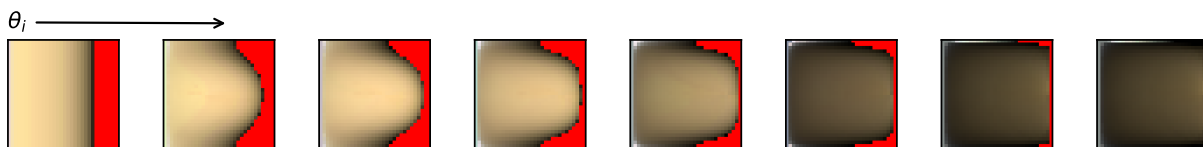
Renderings and CIE dE00



Plots

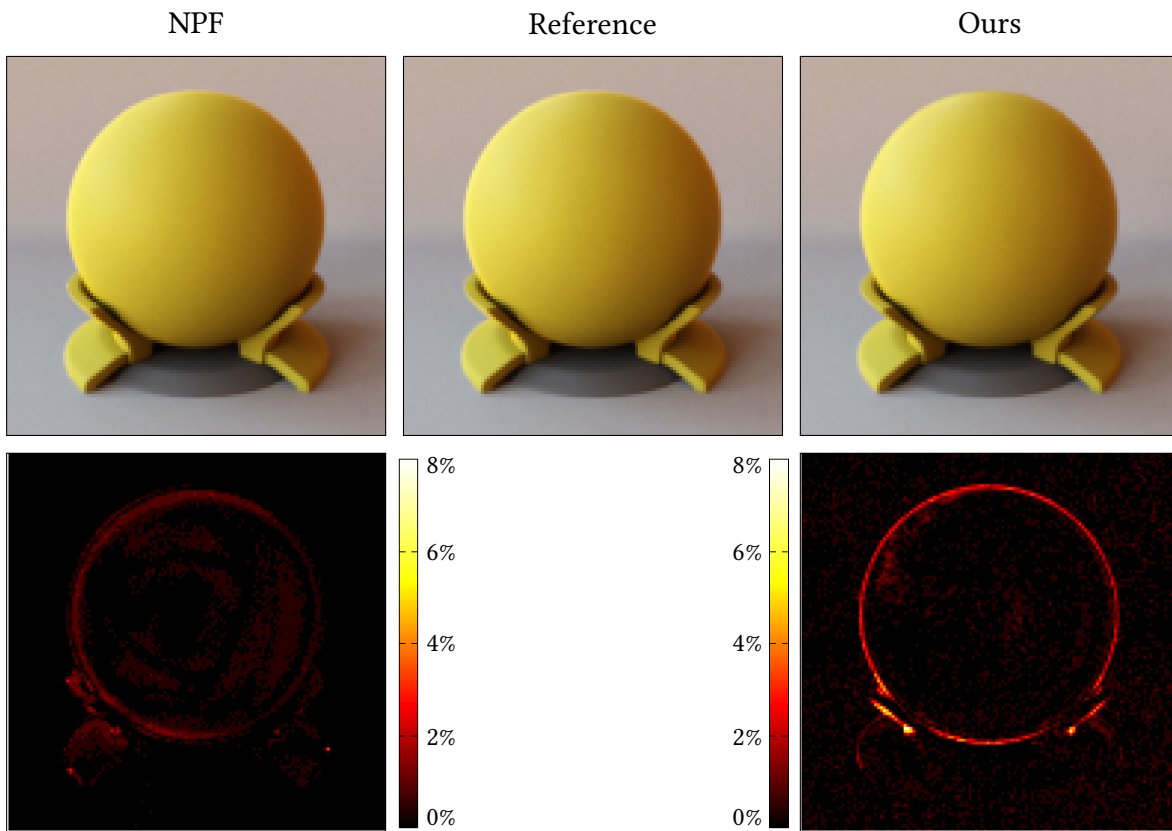


Slices

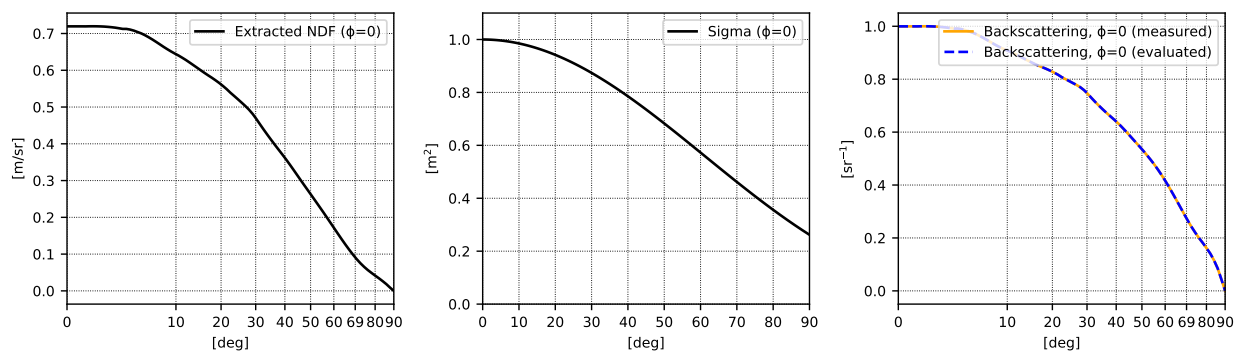


100 yellow-plastic

Renderings and CIE dE00



Plots



Slices

