Fabricating Translucent Materials using Continuous Pigment Mixtures (Supplemental Material)

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Table 1: *Error values for the 9 fabricated replicas using the local method with cosine concentration weights. The database includes the replicas generated using the global method. The first triplet of errors evaluates how well the fabricated replica matches the target. The second triplet evaluates how well our method believes it can match the targets appearance. The third triplet evaluates how well our method can predict the appearance of the replica given the local pigment parameters and the concentrations.*

	Target-Replica Error			**Target-Local Prediction Error**			**Local Prediction-Replica Error**		
	Total	ρ	Shape	Total	ρ	Shape	Total	ρ	Shape
silicone mixture 1	0.00031	0.00017	0.00014	0.00011	0.00000	0.00011	0.00037	0.00020	0.00017
strawberry yogurt drink	0.00063	0.00049	0.00015	0.00044	0.00032	0.00012	0.00027	0.00015	0.00012
white chocolate	0.00169	0.00142	0.00026	0.00207	0.00184	0.00023	0.00032	0.00007	0.00025
pink soap	0.00172	0.00155	0.00017	0.00088	0.00077	0.00012	0.00060	0.00035	0.00024
full-fat milk	0.00175	0.00083	0.00093	0.00068	0.00052	0.00016	0.00108	0.00026	0.00082
mocca yogurt drink	0.00311	0.00294	0.00017	0.00254	0.00228	0.00026	0.00052	0.00032	0.00020
blue fabric softener	0.00349	0.00314	0.00035	0.00385	0.00367	0.00017	0.00059	0.00050	0.00009
low-fat milk	0.00604	0.00567	0.00037	0.00038	0.00010	0.00028	0.00601	0.00547	0.00054
silicone mixture 2	0.00611	0.00607	0.00004	0.00073	0.00048	0.00025	0.00638	0.00628	0.00011
mean	0.00276	0.00248	0.00029	0.00130	0.00111	0.00019	0.00179	0.00151	0.00028
std	0.00213	0.00217	0.00026	0.00125	0.00124	0.00007	0.00251	0.00249	0.00024

Table 2: *Error values for the 9 fabricated replicas using the global method without local weights. The database includes the replicas generated using the global method. The first triplet of errors evaluates how well the fabricated replica matches the target. The second triplet evaluates how well our method believes it can match the targets appearance. The third triplet evaluates how well our method can predict the appearance of the replica given the local pigment parameters and the concentrations.*

	Target-Replica Error			**Target-Global Prediction Error**			**Global Prediction-Replica Error**		
	Total	ρ	Shape	Total	ρ	Shape	Total	ρ	Shape
silicone mixture 1	0.00090	0.00070	0.00019	0.00054	0.00005	0.00049	0.00140	0.00097	0.00043
strawberry yogurt drink	0.00098	0.00070	0.00029	0.00068	0.00049	0.00019	0.00078	0.00062	0.00016
pink soap	0.00146	0.00125	0.00021	0.00117	0.00105	0.00011	0.00037	0.00029	0.00007
white chocolate	0.00174	0.00150	0.00024	0.00262	0.00229	0.00033	0.00081	0.00023	0.00058
full-fat milk	0.00245	0.00113	0.00131	0.00032	0.00027	0.00004	0.00321	0.00091	0.00230
mocca yogurt drink	0.00298	0.00272	0.00026	0.00354	0.00292	0.00062	0.00149	0.00106	0.00043
blue fabric softener	0.00329	0.00299	0.00030	0.00409	0.00391	0.00018	0.00077	0.00064	0.00014
low-fat milk	0.00781	0.00752	0.00029	0.00022	0.00007	0.00015	0.00804	0.00739	0.00065
silicone mixture 2	0.03639	0.03565	0.00073	0.01747	0.01346	0.00402	0.03177	0.03004	0.00173
mean	0.00644	0.00602	0.00042	0.00341	0.00272	0.00068	0.00763	0.00691	0.00072
std	0.01142	0.01131	0.00037	0.00547	0.00425	0.00126	0.01672	0.01633	0.00077

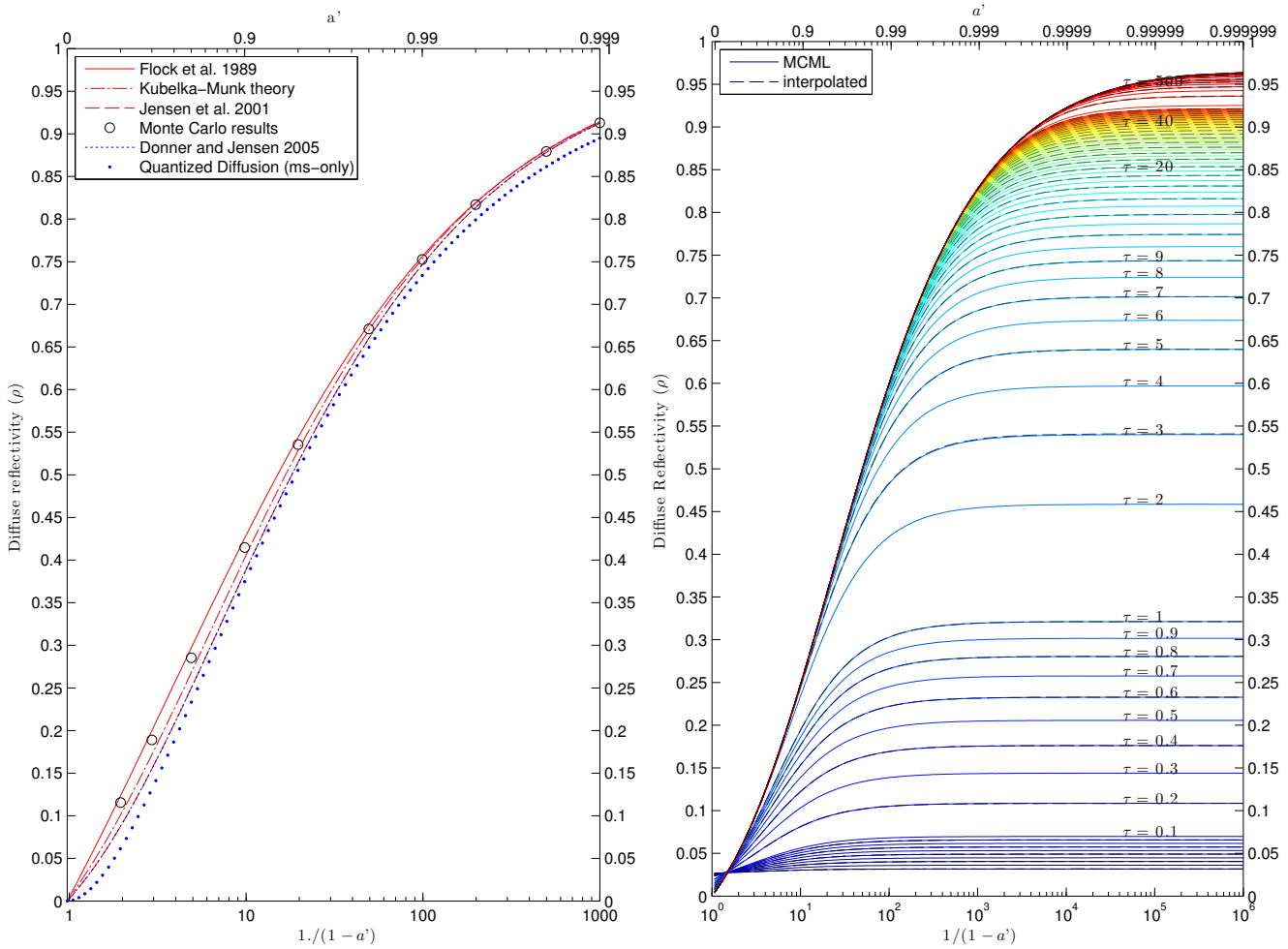


Figure 1: *Reflectance model investigation results. On the left we see reflectance plots for a semi-infinite index-matched homogeneous medium for various reduced albedo values. In total 5 reflectance models were plotted against Monte Carlo. The model that performs the best is the Flock model with a mean relative reflectance error of 2.3% followed by Kubelka Munk with a relative error of 3.31%. On the right we see the performance of our reflectance model against Monte Carlo for varying reduced albedo and optical thickness. The relative index of refraction here was set to 1.41 (silicone). To evaluate we removed half of the reduced albedo and optical thickness samples, effectively reducing the total number of samples to interpolate from by 4. Then for those missing samples we used our interpolation method to estimate reflectance. The mean relative reflectance error was found at 0.03% over the entire set of missing samples.*

Figure 2: *Photograph of the orange juice replica when illuminated by a fiber optic cable touching the top surface. The cable is connected on the other end with a white LED. We observe a color shift in the profile from white to red. We would like to emphasize that this image is a tonemapped HDR image and that the white region around the fiber optic cable is not over exposed.*

Table 3: *Reduced scattering and absorption coefficients used for generating the synthetic database and targets.*

	σ_s			σ_a		
	blue	green	red	blue	green	red
White	1100	900	800	0.001	0.002	0.002
Yellow	0	85	55	25	0.4	0
Red	2	0.01	170	500	1100	10
Green	0.01	220	0.001	25	20	270
Blue	50	0.01	0	40	140	1100
Black	0.1	0	3	350	360	340
Base	1e-4	2e-6	0	0.001	0.001	0.001

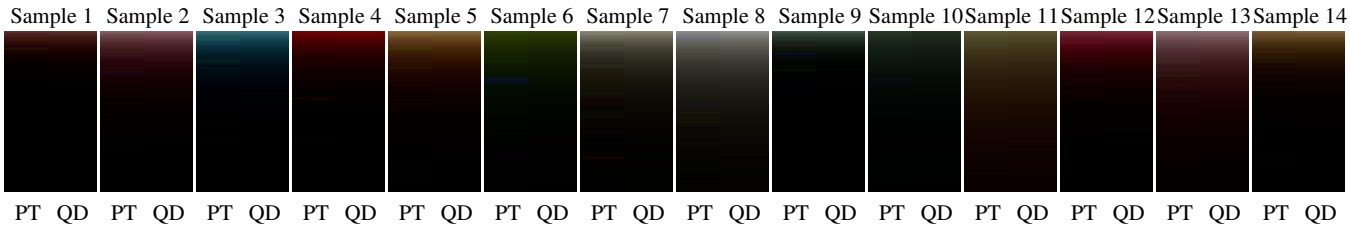
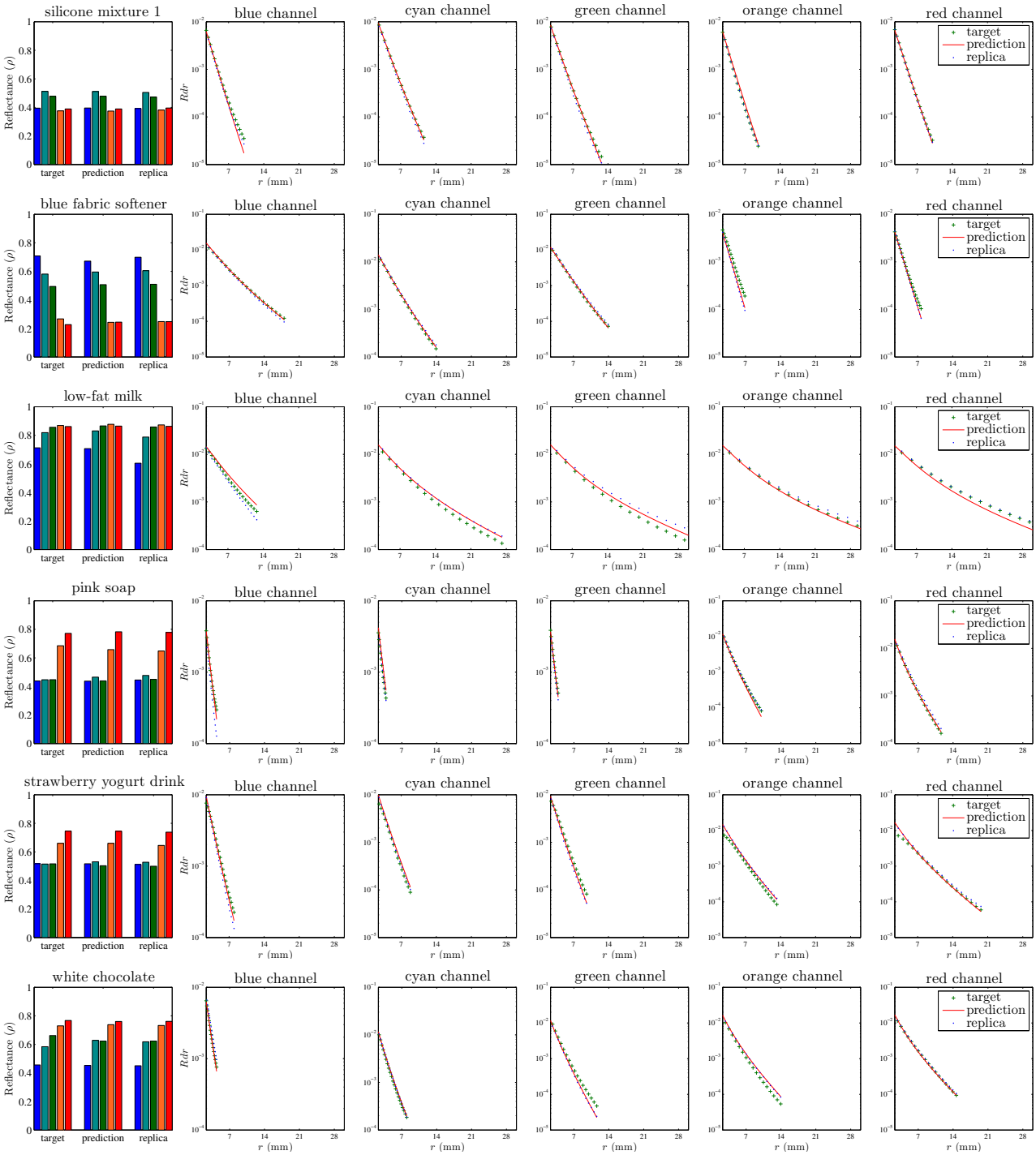


Figure 3: *Profile comparisons between two rendering methods. For each sample, path tracing was used to render the profile on the left, whereas a Quantized Diffusion fit on the path traced profile was used to render the profile on the right. Ignoring Monte Carlo noise, we observe a good match between the two methods in this set of samples.*


silicone mixture 1
blue channel
cyan channel
green channel
orange channel
red channel
blue fabric softener
low-fat milk
pink soap
strawberry yogurt drink
white chocolate
Reflectance (ρ)
target
prediction
replica
Rdr
r (mm)

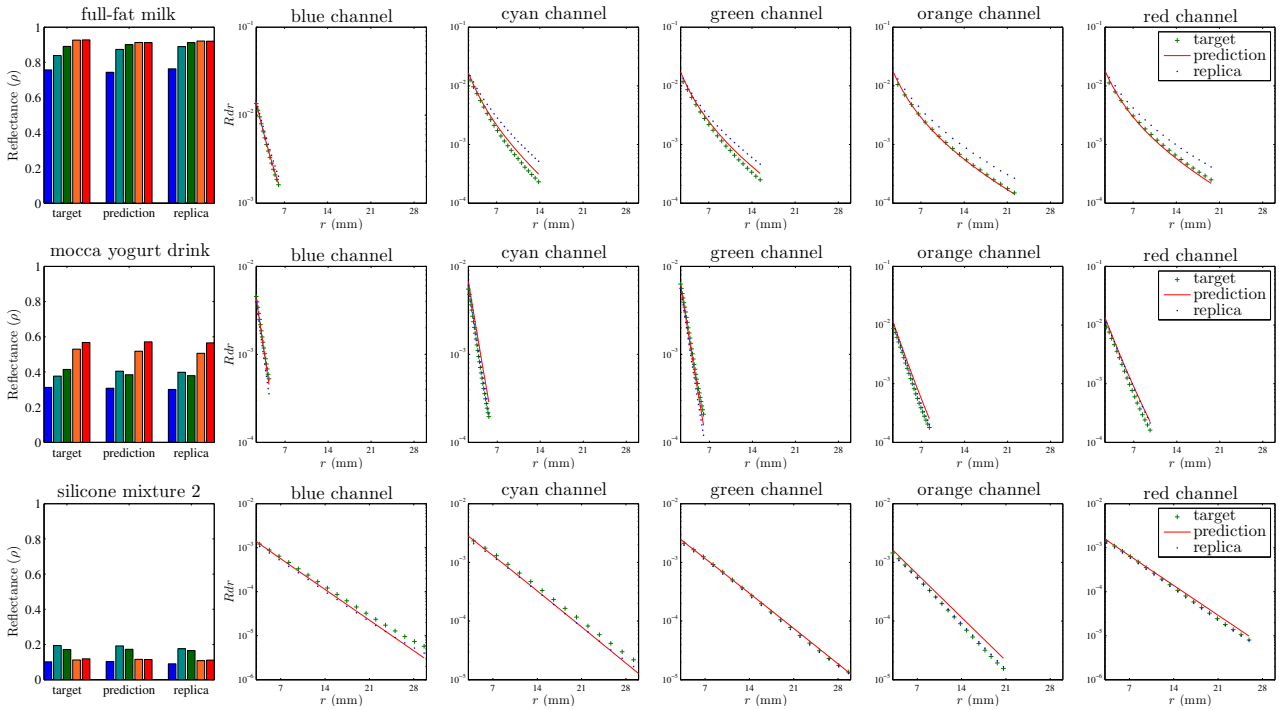
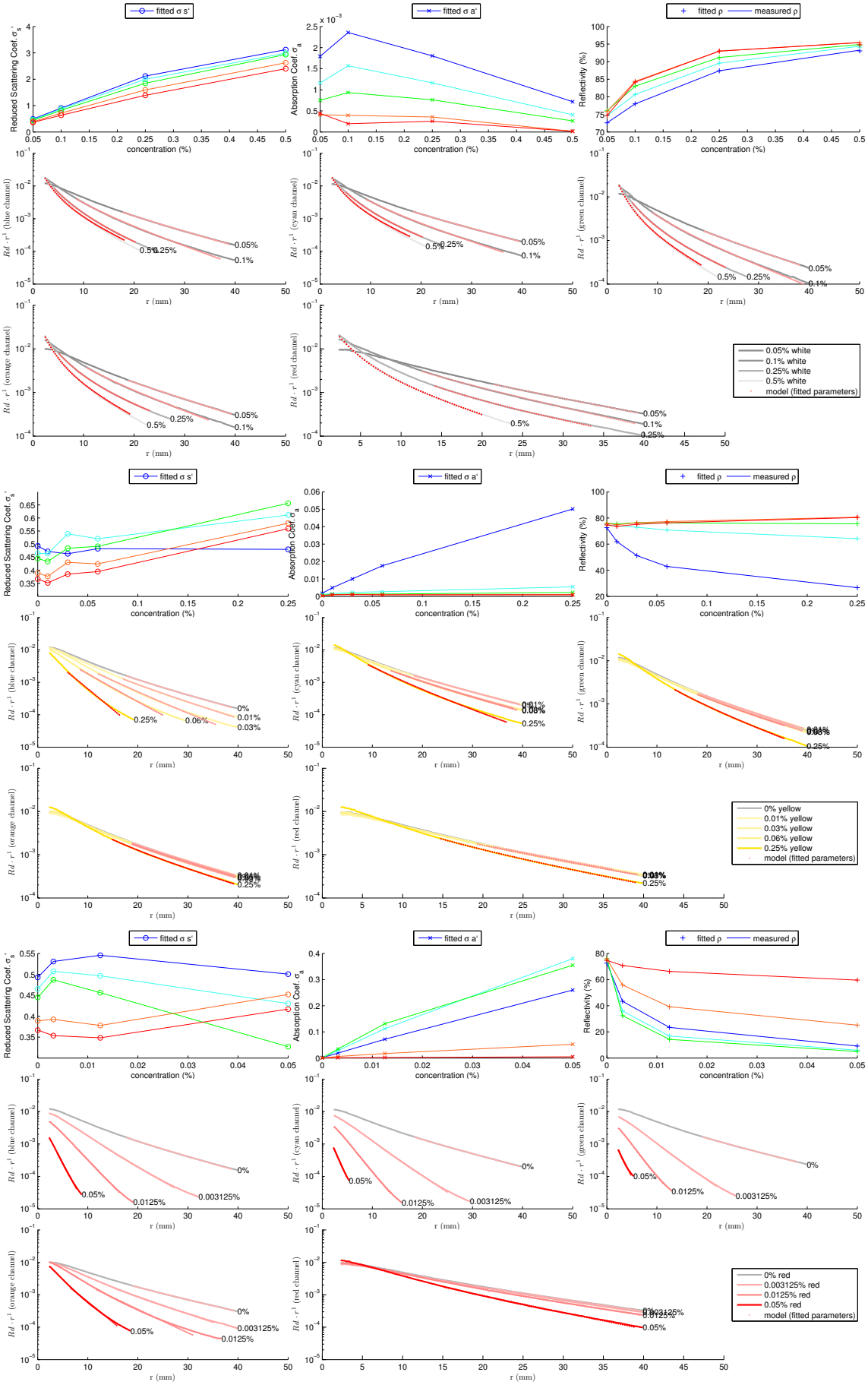


Figure 4: *Target Prediction Replica comparison plots for the local method.*


fitted σ s'
fitted σ a'
fitted ρ
measured ρ
Reduced Scattering Coef. σ s'
Absorption Coef. σ a
Reflectivity (%)
concentration (%)
Rd · r² (blue channel)
Rd · r² (cyan channel)
Rd · r² (green channel)
Rd · r² (orange channel)
Rd · r² (red channel)
r (mm)
0.05% white
0.1% white
0.25% white
0.5% white
model (fitted parameters)
0% yellow
0.01% yellow
0.03% yellow
0.06% yellow
0.25% yellow
0% red
0.003125% red
0.0125% red
0.05% red

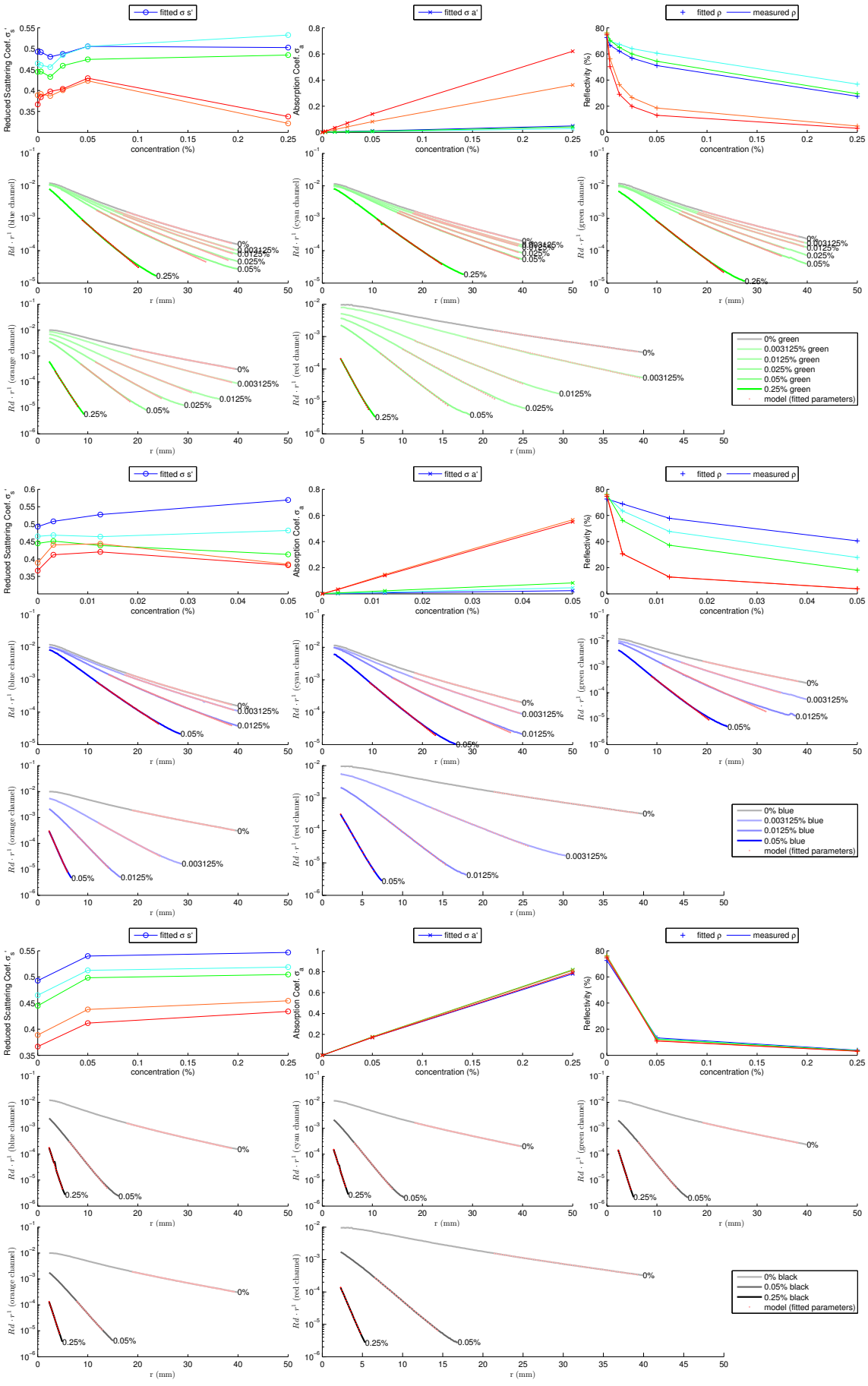


Figure 5: *The samples used in our database along with their forward model fits.*