Supplementary Material for "Faraday Cage Estimation of Normals for Point Clouds and Ribbon Sketches"

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1 Experiments with noise

To further demonstrate robustness of our method to point cloud artifacts/artifacts in the scanning process, we perform a series of noising experiments on 10 inputs: 5 sampled from clean, watertight surfaces in [Xu et al. 2023] and 5 "decimated" ribbon sketches from [Rosales et al. 2019], the latter of which contain interior structures and artifacts as discussed in §4.4. We consider two scenarios: one in which points sampled from the surface of each input are perturbed (as if they were scanned inaccurately), and one in which erroneous samples are added to the input. To model the former scenario, we perturb the coordinate of each point by sampling from a Gaussian distribution with $\mu = 0, \sigma = \alpha \cdot \beta$, where $\alpha \in \{0.0025, 0.005, 0.01\}$ and β is equal to the input's bounding box diagonal. To model the second scenario, we sample $\{500, 1000\}$ points uniformly and independently at random from the input's bounding box. Additionally, we perform these experiments on the method of [Lin et al. 2024], which features a "width" parameter $w \in \{l_0, l_1, l_2, l_3, l_4, l_5\}$ used for tuning the method to varying levels of noise. In each experiment, we select the "best" width for [Lin et al. 2024] in an empirical manner.

1.1 Perturb samples with Gaussian noise, $\sigma = 0.0025 \cdot \beta$

	WNNC (2024)			Ours		
Input	Align. %	Error, avg.	Error, std. dev.	Align. %	Error, avg.	Error, std. dev.
bunny	100	13.75	8.70	100	12.08	7.96
chair	100	10.69	6.73	99.98	13.09	8.74
fandisk	100	14.70	11.75	100	12.98	12.17
huapen	100	11.25	8.19	99.64	13.83	13.31
lion	99.38	20.45	16.53	99.34	21.24	16.61
piggy bank	90.57	26.27	41.44	99.57	16.82	14.94
teddy bear	89.8	30.15	39.71	97.96	22.60	22.51
toy horse	90.28	32.64	39.34	98.31	25.04	20.93
tree	95.88	22.97	27.73	93.4	27.97	34.48
walking teapot	92.83	25.91	36.45	98.07	22.24	21.75

Table 1. Results from our method and [Lin et al. 2024]. From left to right: percent of normals aligned with GT (positive dot product), average angle error (deg.), standard deviation of angle error (deg.). For [Lin et al. 2024], we set the "width" parameter $w = l_3$ (medium noise).

1.2 Perturb samples with Gaussian noise, $\sigma = 0.005 \cdot \beta$

	WNNC (2024)			Ours		
Input	Align. %	Error, avg.	Error, std. dev.	Align. %	Error, avg.	Error, std. dev.
bunny	99.76	15.26	11.55	99.7	18.50	13.14
chair	99.84	14.96	11.57	99.68	21.17	15.11
fandisk	99.94	16.77	14.20	99.54	19.26	16.03
huapen	99.86	17.82	14.99	98.66	21.48	18.95
lion	98.9	27.30	19.48	97.94	29.09	21.38
piggy bank	90.69	27.13	39.88	98.83	23.74	19.54
teddy bear	93.48	28.40	32.67	96.68	29.14	24.98
toy horse	91.81	32.76	33.65	96.77	32.04	24.26
tree	97.31	20.82	21.89	92.99	33.36	34.13
walking teapot	93.07	29.52	33.91	95.43	31.37	26.99

Table 2. Results from our method and [Lin et al. 2024]. From left to right: percent of normals aligned with GT (positive dot product), average angle error (deg.), standard deviation of angle error (deg.). For [?], we set the "width" parameter $w = l_5$ (heavy noise).

1.3 Perturb samples with Gaussian noise, $\sigma = 0.01 \cdot \beta$

	WNNC (2024)			Ours		
Input	Align. %	Error, avg.	Error, std. dev.	Align. %	Error, avg.	Error, std. dev.
bunny	93.02	37.33	30.35	98.34	27.23	20.29
chair	96.66	30.26	25.35	95.68	34.37	26.23
fandisk	95.3	33.29	27.62	98.36	27.94	21.14
huapen	97.96	28.39	22.74	95.26	33.30	26.75
lion	94.92	37.45	27.16	94.82	39.19	26.77
piggy bank	88.65	37.31	38.94	97.57	30.47	23.20
teddy bear	91	36.23	34.31	95.77	35.37	25.81
toy horse	89.8	40.54	34.34	93.11	41.82	28.52
tree	90.51	37.96	33.91	91.73	38.80	34.23
walking teapot	89.15	39.72	36.01	91.73	40.83	31.40

Table 3. Results from our method and [Lin et al. 2024]. From left to right: percent of normals aligned with GT (positive dot product), average angle error (deg.), standard deviation of angle error (deg.). For [Lin et al. 2024], we set the "width" parameter $w = l_5$ (heavy noise).

1.4 Additional white noise samples, $n = 500$

	WNNC (2024)			Ours		
Input	Align. %	Error, avg.	Error, std. dev.	Align. %	Error, avg.	Error, std. dev.
bunny	100	10.82	8.88	99.52	14.16	12.81
chair	100	9.01	6.59	100	15.97	9.94
fandisk	100	12.21	12.94	97.18	17.77	27.72
huapen	92.26	23.84	36.59	99.52	16.37	15.76
lion	99.24	24.42	18.77	99.40	21.13	16.26
piggy bank	90.07	25.01	43.28	99.20	15.60	16.59
teddy bear	91.92	27.89	34.66	97.19	22.47	25.74
toy horse	92.76	29.46	32.38	98.40	23.80	21.62
tree	97.33	18.42	21.38	89.51	32.30	44.07
walking teapot	93.08	26.71	35.59	97.45	20.64	24.65

Table 4. Results from our method and [Lin et al. 2024]. From left to right: percent of normals aligned with GT (positive dot product), average angle error (deg.), standard deviation of angle error (deg.). For [Lin et al. 2024], we set the "width" parameter $w = l_5$ (heavy noise).

1.5 Additional white noise samples, $n = 1000$

	WNNC (2024)			Ours		
Input	Align. %	Error, avg.	Error, std. dev.	Align. %	Error, avg.	Error, std. dev.
bunny	99.98	14.22	12.57	99.92	15.95	10.73
chair	100	10.01	7.15	100	19.00	10.40
fandisk	100	13.73	13.71	98.24	18.44	22.89
huapen	91.18	27.42	38.48	99.3	19.33	18.25
lion	99.18	25.56	19.08	99.38	23.36	16.81
piggy bank	89.16	27.54	45.01	99.36	16.52	16.04
teddy bear	85.39	35.68	44.64	97.36	23.86	24.83
toy horse	92.55	30.17	32.86	97.53	26.16	24.72
tree	96.43	20.29	24.48	88.68	34.00	45.14
walking teapot	93.75	25.70	34.65	97.63	20.50	23.44

Table 5. Results from our method and [Lin et al. 2024]. From left to right: percent of normals aligned with GT (positive dot product), average angle error (deg.), standard deviation of angle error (deg.). For [Lin et al. 2024], we set the "width" parameter $w = l_5$ (heavy noise).

2 Varying the number of linear external fields

In §3.3.2, we note that increasing the number of linear external fields in our solve leads to diminishing returns with regard to the quality of our results. Here, we run our method with a varying number of linear fields and report normal estimation metrics across four representative inputs.

	6 directions			21 directions			81 directions		
Input	AL	ME	SE	AL	ME	SE	AL	ME	SE
chair	100	7.98	5.94	100	7.99	5.93	100	7.99	5.94
knot	100	10.19	7.63	100	10.16	7.56	100	10.16	7.56
tree_decimated	93.16	24.66	35.95	93.31	24.56	35.85	93.29	24.55	35.83
walking_teapot_decimated	98.40	16.10	21.02	98.45	16.04	20.84	98.44	16.05	20.83

Table 6. Results from our method, varying the number of linear external fields used in computation. We obtain evenly-spaced directions via subdivision of the icosahedron. AL = percentage of correctly aligned normals (positive dot product), ME = mean angle error (deg.), SE = standard deviation of angle error (deg.)

3 Faraday cage sculpting: implementation details

Here, we elaborate on the interface for user specification of additional point charge/cage constraints. We first extract the 1-isosurface of E_{max} and present it to the user. Once the user clicks on the isosurface, their click is mapped to the closest point on the mesh that lies outside the isosurface (as determined via winding number). Our reasoning for choosing exterior points is that these better correspond to the intended region of interest in both cases given that such points are not obscured from the user by the isosurface. Depending on which option the user has selected, the *carving* tool will sculpt the isosurface inward in the vicinity of the selection, and the *shielding* tool will "pull" the isosurface outward towards the user-specified point. We reuse octree data structures from the 1-KNN search and perform winding number calculations in a local manner to make the selection process highly responsive. When the user presses "Update," we re-solve for the max. function by recomputing the linear external fields (if new cage vertices are specified) and the point charge field. Owing to the pre-factorization of the original linear system, this recomputation is responsive and can be performed in a matter of seconds for the inputs showcased in our results: see our supplementary video for a real-time demonstration.

4 Unabridged results

4.1 Misaligned point cloud scans

In the following experiments, we use inputs of roughly 20,000 points (downsampled from the synthetic scans). For WNNC, we set the smoothing parameter to l_0 (heavy noise). For our method, we filter interior points with $\alpha = 0.05$ (dense samples).

	iPSR (2022)		BIM (2024)		WNNC (2024)		Ours	
Input	PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR
abc_00800818	0.0001035	0.0000992	0.0001325	0.0001057	0.0001233	0.0000959	0.0001890	0.0000920
abc_00804293	0.0000894	0.0001170	0.0001066	0.0001248	0.0001162	0.0000949	0.0000778	0.0000854
banana0	0.0002931	0.0002683	0.0001212	0.0001775	0.0000646	0.0001318	0.0000605	0.0000803
battery8	0.0000306	0.0000502	0.0000406	0.0000578	0.0000522	0.0000786	0.0000328	0.0000386
bottle1	0.0002356	0.0002216	0.0000892	0.0001318	0.0000372	0.0000644	0.0000309	0.0000599
bottle46	0.0000932	0.0001284	0.0000891	0.0001570	0.0000417	0.0000676	0.0000494	0.0000721
can9	0.0000320	0.0000473	0.0000406	0.0000530	0.0000507	0.0000505	0.0000426	0.0000407
elephant13	0.0000252	0.0000532	0.0000499	0.0000824	0.0000326	0.0000527	0.0000430	0.0000429
hand0	0.0000647	0.0000891	0.0000849	0.0000974	0.0000791	0.0000752	0.0001023	0.0000739
pelvis	0.0001442	0.0001669	0.0000964	0.0001517	0.0000757	0.0000753	0.0000616	0.0000743
starfruit2	0.0000597	0.0001142	0.0000819	0.0001574	0.0001245	0.0001735	0.0000646	0.0000973
tape4	0.0000716	0.0001466	0.0001017	0.0002509	0.0001114	0.0001089	0.0001229	0.0002804
think10k113868	0.0000459	0.0000741	0.0000590	0.0000780	0.0000560	0.0000490	0.0000914	0.0001209
think10k242305	0.0002400	0.0002189	0.0002834	0.0002261	0.0002528	0.0002382	0.0002908	0.0002397
Average	0.0001092	0.0001282	0.0000984	0.0001323	0.0000870	0.0000969	0.0000900	0.0000999

Table 7. Chamfer distance, our method and [Hou et al. 2022; Lin et al. 2024; Liu et al. 2024]. We report metrics on our results without filtering interior points.

	iPSR (2022)		BIM (2024)		WNNC (2024)		Ours	
Input	PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR
abc_00800818	0.0046611	0.0011715	0.0037104	0.0012123	0.0055161	0.0014254	0.0163732	0.0011598
abc_00804293	0.0007367	0.0008643	0.0008767	0.0008335	0.0012441	0.0010098	0.0010086	0.0007885
banana0	0.0117388	0.0117895	0.0012240	0.0021815	0.0008259	0.0039272	0.0005561	0.0012779
battery8	0.0004481	0.0009152	0.0006940	0.0009560	0.0020549	0.0043839	0.0003500	0.0007882
bottle1	0.0138031	0.0137950	0.0017143	0.0016682	0.0016031	0.0016552	0.0002981	0.0017851
bottle46	0.0038702	0.0037331	0.0009111	0.0045396	0.0006101	0.0009456	0.0009251	0.0012615
can9	0.0004036	0.0007266	0.0010809	0.0009027	0.0005141	0.0005511	0.0003717	0.0004509
elephant13	0.0003754	0.0011006	0.0039495	0.0044580	0.0008562	0.0042542	0.0004390	0.0007150
hand0	0.0035515	0.0035008	0.0024350	0.0009256	0.0013452	0.0008357	0.0033974	0.0016764
pelvis	0.0033501	0.0032228	0.0011049	0.0026540	0.0012269	0.0009755	0.0006997	0.0009259
starfruit2	0.0012641	0.0017452	0.0009504	0.0033188	0.0029595	0.0049926	0.0004420	0.0029382
tape4	0.0007589	0.0013840	0.0009115	0.0038317	0.0008208	0.0012139	0.0006848	0.0038542
think10k113868	0.0005106	0.0010239	0.0007084	0.0009415	0.0006628	0.0010158	0.0006190	0.0054508
think10k242305	0.0083066	0.0071438	0.0077113	0.0070601	0.0060388	0.0061035	0.0082440	0.0069282
Average	0.0038414	0.0037226	0.0019987	0.0025345	0.0018770	0.0023778	0.0024578	0.0021429

Table 8. Hausdorff distance, our method and [Hou et al. 2022; Lin et al. 2024; Liu et al. 2024]. We report metrics on our results without filtering interior points.

4.2 Ribbon inputs (original sketches)

In the following experiments, 7500 samples are taken from each ribbon sketch via Poisson disk sampling. For WNNC, we set the smoothing parameter to l_0 (no noise). For our method, we filter interior points with $\alpha = 0.05$ (dense sampling).

	iPSR (2022)			GCNO (2023)			BIM (2024)			WNNC (2024)			Ours		
Input	AL	ME	SE	AL	ME	SE	AL	ME	SE	AL	ME	SE	AL	ME	SE
chicken	96.91	12.48	21.27	88.45	38.92	36.02	96.21	14.27	25.23	94.84	18.18	32.98	95.60	15.21	30.05
chili	97.64	14.03	22.75	98.67	15.31	18.53	98.81	12.95	16.10	97.12	18.86	26.23	99.72	12.40	11.60
couch	99.36	12.42	15.86	98.35	14.02	19.64	98.60	13.23	17.54	97.63	15.62	24.61	98.35	14.34	20.77
dolphin	94.53	20.55	31.81	63.23	77.64	36.29	95.68	19.92	27.48	93.21	23.46	36.12	99.44	14.05	15.83
heart	99.93	8.57	8.09	99.93	10.25	9.07	99.93	8.87	8.06	99.88	10.44	11.45	99.93	9.44	8.93
piggy_bank	91.27	21.51	40.83	94.19	18.77	32.05	93.53	18.40	32.64	90.15	24.20	45.13	99.91	11.64	12.71
pumpkin	99.51	9.13	11.40	64.29	76.96	38.24	99.64	9.63	10.73	99.52	11.09	13.15	99.96	9.04	7.97
teddy_bear	92.05	25.23	36.29	92.35	26.51	35.71	91.91	25.68	36.46	85.91	34.73	47.23	99.08	18.10	19.11
toyhorse	94.73	24.37	31.03	93.75	24.58	33.16	92.68	25.52	35.41	91.00	28.66	41.06	99.23	19.45	18.54
tree	92.52	24.93	34.02	95.35	22.40	30.52	92.79	24.75	33.71	91.24	29.87	38.87	92.56	25.94	37.45
turtle	96.91	19.30	24.41	95.88	23.24	27.32	96.81	19.22	24.00	95.40	25.57	28.57	98.67	19.20	20.14
walking_teapot	94.68	20.44	33.04	89.01	41.80	34.93	94.59	19.94	32.76	93.27	22.81	37.86	99.20	15.37	17.93
Average	95.84	17.75	25.90	89.45	32.53	29.29	95.93	17.70	25.01	94.10	21.96	31.94	98.47	15.35	18.42

Table 9. Normal estimation metrics, our method and [Hou et al. 2022; Lin et al. 2024; Liu et al. 2024; Xu et al. 2023]. We report metrics on our results without filtering interior points. AL = percentage of correctly aligned normals (positive dot product), ME = mean angle error (deg.), SE = standard deviation of angle error (deg.)

	S.B. (2019)	iPSR (2022)		GCNO (2023)		BIM (2024)		WNNC (2024)		Ours	
Input		PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR
chicken	0.0003187	0.0002038	0.0001432	0.0024588	0.0000619	0.0015276	0.0000656	0.0013429	0.0002538	0.0002238	0.0000734
chili	0.0000425	0.0000331	0.0000409	0.0000074	0.0000345	0.0000091	0.0000331	0.0000372	0.0000470	0.0000075	0.0000084
couch	0.0000766	0.0000372	0.0000147	0.0000423	0.0000274	0.0000576	0.0000155	0.0000384	0.0000499	0.0003356	0.0001703
dolphin	0.0000325	0.0000191	0.0000232	0.0004049	0.0002449	0.0000130	0.0000195	0.0000221	0.0000321	0.0000095	0.0000042
heart	0.0007725	0.0000158	0.0000217	0.0000165	0.0000215	0.0000148	0.0000217	0.0000188	0.0000233	0.0000155	0.0000220
piggy_bank	0.0004322	0.0001220	0.0001561	0.0000867	0.0000856	0.0000561	0.0001034	0.0001560	0.0001962	0.0000244	0.0000055
pumpkin	0.0007872	0.0000165	0.0000193	0.0030414	0.0001374	0.0000156	0.0000190	0.0000141	0.0000206	0.0000150	0.0000128
teddy_bear	-	0.0000985	0.0001653	0.0000446	0.0001488	0.0000440	0.0001242	0.0001674	0.0002679	0.0000269	0.0000088
toyhorse	0.0001975	0.0000393	0.0000502	0.0000369	0.0000492	0.0000530	0.0000594	0.0000548	0.0000678	0.0000408	0.0000110
tree	0.0007062	0.0005178	0.0007138	0.0005605	0.0006031	0.0006712	0.0006360	0.0006954	0.0006120	0.0008300	0.0002375
turtle	0.0000807	0.0000501	0.0000485	0.0000402	0.0000450	0.0000493	0.0000407	0.0000464	0.0000464	0.0001062	0.0000669
walking_teapot	0.0002795	0.0001102	0.0001528	0.0000493	0.0001154	0.0000859	0.0001504	0.0001179	0.0001783	0.0000393	0.0000285
Average	0.0003197	0.0001053	0.0001292	0.0005658	0.0001312	0.0002164	0.0001074	0.0002259	0.0001496	0.0001395	0.0000541

Table 10. Chamfer distance, our method and [Hou et al. 2022; Lin et al. 2024; Liu et al. 2024; Rosales et al. 2019; Xu et al. 2023]. We report metrics on our results after filtering of interior points due to the dense intersections produced by accessory components (legs, stems).

	S.B. (2019)	iPSR (2022)		GCNO (2023)		BIM (2024)		WNNC (2024)		Ours	
Input		PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR
chicken	0.0198259	0.0136927	0.0233797	0.0677432	0.0065396	0.0691838	0.0049444	0.0605224	0.0269848	0.0154521	0.0051665
chili	0.0067545	0.0047522	0.0056858	0.0001283	0.0050270	0.0002482	0.0045291	0.0056629	0.0063479	0.0002158	0.0004219
couch	0.0083902	0.0033655	0.0015315	0.0035633	0.0047479	0.0035501	0.0030352	0.0044242	0.0072897	0.0207773	0.0146716
dolphin	0.0026939	0.0016448	0.0023589	0.0072045	0.0071396	0.0008132	0.0020285	0.0016472	0.0027970	0.0003287	0.0001746
heart	0.0217724	0.0003796	0.0005393	0.0004060	0.0005135	0.0003599	0.0005507	0.0004830	0.0005381	0.0003610	0.0005150
piggy_bank	0.0146936	0.0091014	0.0110168	0.0092586	0.0119099	0.0055368	0.0058648	0.0110639	0.0130181	0.0011090	0.0002839
pumpkin	0.0158016	0.0019641	0.0053857	0.0356298	0.0036341	0.0010548	0.0053353	0.0013650	0.0063066	0.0009259	0.0003325
teddy_bear	-	0.0059040	0.0088852	0.0046263	0.0086690	0.0043605	0.0071744	0.0096041	0.0137985	0.0020027	0.0012783
toyhorse	0.0105535	0.0077063	0.0075997	0.0076099	0.0076172	0.0077832	0.0076025	0.0076160	0.0075921	0.0010128	0.0005200
tree	0.0154013	0.0200742	0.0363173	0.0270673	0.0274784	0.0232495	0.0308265	0.0236245	0.0267372	0.0216737	0.0136838
turtle	0.0057403	0.0022000	0.0027533	0.0014925	0.0026228	0.0024274	0.0021976	0.0020594	0.0028679	0.0039824	0.0029784
walking_teapot	0.0139582	0.0101970	0.0123728	0.0028156	0.0116086	0.0093860	0.0120579	0.0115882	0.0139636	0.0014437	0.0006906
Average	0.0118684	0.0067485	0.0098188	0.0139621	0.0081256	0.0106628	0.0071789	0.0116384	0.0106868	0.0057737	0.0033931

Table 11. Hausdorff distance, our method and [Hou et al. 2022; Lin et al. 2024; Liu et al. 2024; Rosales et al. 2019; Xu et al. 2023]. We report metrics on our results after filtering of interior points due to the dense intersections produced by accessory components (legs, stems).

4.3 Ribbon inputs (sparsified sketches)

In the following experiments, 7500 samples are taken from each ribbon sketch via Poisson disk sampling. For WNNC, we set the smoothing parameter to l_0 (no noise). For our method, we filter interior points with $\alpha = 0.01$ (samples with large gaps).

	iPSR (2022)			GCNO (2023)			BIM (2024)			WNNC (2024)			Ours		
Input	AL	ME	SE	AL	ME	SE	AL	ME	SE	AL	ME	SE	AL	ME	SE
chicken_decimated	95.47	14.41	24.81	-	-	-	92.89	16.94	37.60	92.16	19.10	41.08	92.85	18.63	37.73
chili_decimated	96.11	15.76	28.84	98.72	12.47	16.44	98.53	10.36	16.54	95.84	11.67	31.27	99.65	11.65	13.29
couch_decimated	98.77	13.39	18.50	98.73	13.98	17.53	91.31	22.70	41.68	96.97	12.66	27.52	94.52	19.94	35.45
dolphin_decimated	95.84	20.92	28.57	-	-	-	96.39	17.28	26.06	92.21	20.36	39.13	98.24	15.68	21.75
heart_decimated	99.95	8.69	9.00	-	-	-	99.57	6.94	10.00	99.95	4.75	7.57	99.85	9.21	10.21
piggy_bank_decimated	92.05	20.45	38.52	96.37	16.13	24.76	95.71	14.66	26.50	90.28	21.85	44.77	99.64	12.20	14.33
pumpkin_decimated	99.36	9.82	13.71	99.33	10.87	12.80	99.29	8.51	13.59	99.16	8.30	15.89	99.53	10.60	12.44
teddy_bear_decimated	89.48	28.80	42.68	89.76	38.79	34.14	93.13	22.05	35.54	85.48	31.03	51.16	97.96	18.59	23.64
toyhorse_decimated	93.16	27.55	33.71	93.65	24.96	33.60	94.80	22.98	29.48	89.81	29.22	43.39	98.99	20.12	19.34
tree_decimated	93.36	23.65	31.64	97.44	19.68	23.63	94.01	22.28	30.67	89.91	31.49	40.71	93.16	24.66	35.95
turtle_decimated	96.91	19.75	24.80	96.64	19.02	25.53	96.92	16.65	23.83	95.41	19.64	30.38	96.13	20.62	29.37
walking_teapot_decimated	93.37	23.31	36.29	84.67	51.10	35.53	96.75	17.34	25.70	91.13	23.50	42.31	98.40	16.10	21.02
Average	95.32	18.88	27.59	95.04	23.00	24.88	95.78	16.56	26.43	93.19	19.47	34.60	97.41	16.50	22.88

Table 12. Normal estimation metrics, our method and [Hou et al. 2022; Lin et al. 2024; Liu et al. 2024; Xu et al. 2023]. We report metrics on our results without filtering interior points. AL = percentage of correctly aligned normals (positive dot product), ME = mean angle error (deg.), SE = standard deviation of angle error (deg.)

	S.B. (2019)	iPSR (2022)		GCNO (2023)		BIM (2024)		WNNC (2024)		Ours	
Input		PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR
chicken_decimated	0.0035455	0.0002001	0.0002179	-	-	0.0001813	0.0003957	0.0002254	0.0004679	0.0001123	0.0000945
chili_decimated	0.0013762	0.0000454	0.0000543	0.0000191	0.0000457	0.0000167	0.0000459	0.0000560	0.0000642	0.0000140	0.0000287
couch_decimated	0.0022039	0.0000494	0.0000411	0.0000814	0.0000372	0.0011817	0.0004287	0.0000725	0.0000780	0.0009254	0.0003936
dolphin_decimated	-	0.0000180	0.0000246	-	-	0.0000238	0.0000233	0.0000325	0.0000553	0.0000151	0.0000211
heart_decimated	0.0082992	0.0000318	0.0000387	-	-	0.0000357	0.0000444	0.0000399	0.0000473	0.0000352	0.0000425
piggy_bank_decimated	0.0019054	0.0001128	0.0001470	0.0000348	0.0000262	0.0000407	0.0000492	0.0001512	0.0001972	0.0000319	0.0000225
pumpkin_decimated	0.0025847	0.0000207	0.0000299	0.0000270	0.0000286	0.0000212	0.0000336	0.0000274	0.0000367	0.0000217	0.0000189
teddy_bear_decimated	0.0019276	0.0001575	0.0001931	0.0000729	0.0000585	0.0000599	0.0001697	0.0001909	0.0002957	0.0000403	0.0000209
toyhorse_decimated	0.0010491	0.0000519	0.0000608	0.0000477	0.0000488	0.0000329	0.0000431	0.0000687	0.0000746	0.0000511	0.0000166
tree_decimated	-	0.0005308	0.0005981	0.0005101	0.0005429	0.0006979	0.0006095	0.0009668	0.0006924	0.0009300	0.0002321
turtle_decimated	0.0007570	0.0000639	0.0000686	0.0000637	0.0000699	0.0000736	0.0000634	0.0000701	0.0000779	0.0001189	0.0000906
walking_teapot_decimated	0.0040357	0.0001521	0.0001756	0.0002912	0.0003983	0.0000613	0.0002640	0.0001787	0.0002233	0.0000775	0.0001289
Average	0.0023428	0.0001195	0.0001375	0.0002445	0.0002194	0.0002022	0.0001809	0.0001733	0.0001925	0.0001978	0.0000926

Table 13. Chamfer distance, our method and [Hou et al. 2022; Lin et al. 2024; Liu et al. 2024; Rosales et al. 2019; Xu et al. 2023]. We report metrics on our results after filtering of interior points due to the dense intersections produced by accessory components (legs, stems).

	S.B. (2019)	iPSR (2022)		GCNO (2023)		BIM (2024)		WNNC (2024)		Ours	
Input		PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR
chicken_decimated	0.0417862	0.0258573	0.0294076	-	-	0.0136370	0.0352189	0.0115111	0.0291633	0.0121886	0.0055990
chili_decimated	0.0156790	0.0053861	0.0060046	0.0009043	0.0049852	0.0004457	0.0039843	0.0060417	0.0064465	0.0001835	0.0026383
couch_decimated	0.0573938	0.0043143	0.0049458	0.0048660	0.0028727	0.0307720	0.0142433	0.0055573	0.0080845	0.0320397	0.0218396
dolphin_decimated	-	0.0018035	0.0023261	-	-	0.0009836	0.0015704	0.0017906	0.0026776	0.0004900	0.0012765
heart_decimated	0.0776872	0.0010844	0.0007464	-	-	0.0011722	0.0006624	0.0007835	0.0006358	0.0013295	0.0009329
piggy_bank_decimated	0.0303599	0.0091261	0.0112146	0.0021577	0.0060410	0.0023642	0.0046124	0.0105064	0.0128547	0.0012612	0.0026451
pumpkin_decimated	0.0451623	0.0049034	0.0080042	0.0006994	0.0066982	0.0005075	0.0084002	0.0043657	0.0079232	0.0008744	0.0006603
teddy_bear_decimated	0.0270340	0.0096011	0.0109445	0.0024061	0.0076407	0.0036483	0.0107046	0.0101629	0.0142488	0.0020361	0.0013247
toyhorse_decimated	0.0207302	0.0077346	0.0076852	0.0075729	0.0075083	0.0014130	0.0072712	0.0076938	0.0076625	0.0015449	0.0008199
tree_decimated	-	0.0152538	0.0269628	0.0270342	0.0265911	0.0274784	0.0307917	0.0370596	0.0349854	0.0240293	0.0120508
turtle_decimated	0.0169720	0.0025053	0.0027153	0.0020015	0.0025091	0.0031363	0.0010733	0.0020633	0.0029745	0.0042190	0.0031122
walking_teapot_decimated	0.0463437	0.0121111	0.0133457	0.0058719	0.0136982	0.0009265	0.0141263	0.0138040	0.0154518	0.0015142	0.0127341
Average	0.0323616	0.0083068	0.0103586	0.0067215	0.0087957	0.0072071	0.0110549	0.0092783	0.0119257	0.0068092	0.0054694

Table 14. Hausdorff distance, our method and [Hou et al. 2022; Lin et al. 2024; Liu et al. 2024; Rosales et al. 2019; Xu et al. 2023]. We report metrics on our results after filtering of interior points due to the dense intersections produced by accessory components (legs, stems).

4.4 CAD objects with interior structures

In the following experiments, 7500 and 10000 samples are taken from the ModelNet and Thingi10k inputs respectively via Poisson disk sampling. We set the smoothing parameter for WNNC to l_0 (no noise). For our method, we filter interior points with $\alpha = 0.05$ (dense samples).

	iPSR (2022)		GCNO (2023)		BIM (2024)		WNNC (2024)		Ours	
Input	PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR
41216	0.0002130	0.0001905	0.0000808	0.0000784	0.0001092	0.0001897	0.0002147	0.0001854	0.0000453	0.0000111
98576	0.0000532	0.0000195	0.0044945	0.0068449	0.0001617	0.0000197	0.0000618	0.0000185	0.0000802	0.0000124
99478	0.0005381	0.0005224	0.0005754	0.0005818	0.0003238	0.0004736	0.0007963	0.0006966	0.0006902	0.0006040
102309	0.0002061	0.0001564	0.0002613	0.0001780	0.0001956	0.0001639	0.0001989	0.0001729	0.0001416	0.0000139
1396902	0.0000857	0.0000478	0.0293630	0.0198621	0.0001826	0.0000486	0.0003318	0.0000224	0.0004316	0.0003564
test_bed_0523	0.0003686	0.0002927	0.0008832	0.0003217	0.0003125	0.0003576	0.0002832	0.0002941	0.0001391	0.0000404
test_bed_0578	0.0005579	0.0002100	0.0007514	0.0003704	0.0010754	0.0002049	0.0010330	0.0001447	0.0010534	0.0003933
test_bed_0611	0.0004042	0.0002895	0.0002955	0.0002313	0.0012854	0.0004047	0.0002833	0.0002472	0.0012531	0.0010795
test_chair_0915	0.0007708	0.0006984	0.0032339	0.0013648	0.0008191	0.0006619	0.0008230	0.0004383	0.0009528	0.0004802
test_chair_0948	0.0000251	0.0000094	-	-	-	-	0.0000199	0.0000082	0.0000360	0.0000093
test_desk_0208	-	-	-	-	-	-	-	-	-	-
test_desk_0276	-	-	-	-	-	-	-	-	-	-
test_monitor_0123	0.0007101	0.0005426	0.0012441	0.0005038	0.0007038	0.0002236	0.0006930	0.0008659	0.0006207	0.0003244
test_monitor_0544	0.0000497	0.0000120	0.0000706	0.0000092	0.0004413	0.0000138	0.0001087	0.0000076	0.0000754	0.0000087
test_monitor_0562	0.0001743	0.0000914	0.0006650	0.0001390	0.0005274	0.0000968	0.0001948	0.0000907	0.0005536	0.0002512
test_night_stand_0212	0.0001030	0.0000260	0.0001130	0.0000264	0.0000916	0.0000257	0.0000502	0.0000230	0.0001255	0.0000276
test_sofa_0686	0.0000690	0.0001162	0.0001255	0.0001384	0.0000763	0.0001528	0.0000641	0.0001026	0.0000704	0.0000250
train_bathtub_0063	0.0001628	0.0002001	-	-	-	-	0.0001997	0.0002876	0.0000771	0.0000235
train_bed_0044	0.0005030	0.0001352	0.0006690	0.0001863	0.0006006	0.0001207	0.0006443	0.0001000	0.0004948	0.0001599
train_monitor_0465	0.0007359	0.0006639	0.0007112	0.0005066	0.0003505	0.0005074	0.0005534	0.0015997	0.0001966	0.0000587
train_night_stand_0143	0.0002034	0.0000413	0.0024063	0.0017859	0.0005016	0.0000782	0.0001029	0.0000341	0.0002884	0.0000491
train_sofa_0060	0.0006907	0.0007522	0.0002713	0.0007180	0.0002127	0.0007304	0.0005968	0.0008163	0.0000626	0.0000212
train_sofa_0356	0.0001646	0.0001043	0.0002437	0.0000830	0.0002091	0.0000952	0.0001951	0.0000876	0.0002593	0.0001168
train_table_0082	0.0002579	0.0001670	-	-	0.0002874	0.0001455	0.0003602	0.0000522	0.0000990	0.0002907
train_table_0089	0.0001579	0.0000605	0.0058083	0.0029203	-	-	0.0000561	0.0000136	0.0003017	0.0000519
Average	0.0003133	0.0002326	0.0026134	0.0018425	0.0004234	0.0002357	0.0003420	0.0002743	0.0003499	0.0001917

Table 15. Chamfer distance, our method and [Hou et al. 2022; Lin et al. 2024; Liu et al. 2024; Xu et al. 2023]. We report metrics on our results after filtering of interior points due to the dense interior structures (artifacts from CAD modeling) present in these inputs.

	iPSR (2022)		GCNO (2023)		BIM (2024)		WNNC (2024)		Ours	
Input	PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR	PSR	Sc. PSR
41216	0.0160832	0.0164356	0.0010688	0.0070906	0.0079189	0.0102748	0.0163148	0.0164140	0.0016950	0.0007222
98576	0.0070069	0.0028327	0.0376716	0.1579674	0.0179852	0.0028496	0.0072840	0.0028440	0.0086657	0.0019152
99478	0.0135897	0.0165562	0.0129287	0.0119850	0.0066588	0.0148813	0.0200180	0.0197091	0.0213292	0.0212362
102309	0.0089909	0.0047257	0.0107708	0.0047057	0.0099522	0.0047312	0.0092210	0.0047346	0.0077826	0.0013912
1396902	0.0016623	0.0014080	0.2136257	0.2423476	0.0073104	0.0011550	0.0112150	0.0007983	0.0100621	0.0091006
test_bed_0523	0.0021497	0.0020491	0.0146942	0.0020440	0.0024763	0.0090428	0.0016993	0.0037771	0.0028770	0.0021380
test_bed_0578	0.0229017	0.0032650	0.0199297	0.0069193	0.0409976	0.0030739	0.0448248	0.0025893	0.0268651	0.0097430
test_bed_0611	0.0027244	0.0027105	0.0027545	0.0021078	0.0058180	0.0044528	0.0040581	0.0034904	0.0055542	0.0050021
test_chair_0915	0.0857891	0.0825885	0.0719086	0.0315895	0.0870728	0.0837309	0.0860780	0.0843977	0.0834817	0.0805307
test_chair_0948	0.0003887	0.0001704	-	-	-	-	0.0002942	0.0001383	0.0004418	0.0001562
test_desk_0208	-	-	-	-	-	-	-	-	-	-
test_desk_0276	-	-	-	-	-	-	-	-	-	-
test_monitor_0123	0.0152215	0.0106066	0.0234481	0.0101647	0.0156146	0.0152914	0.0169097	0.0345481	0.0123316	0.0123424
test_monitor_0544	0.0013853	0.0005642	0.0021666	0.0004231	0.0102292	0.0006443	0.0032619	0.0003374	0.0024651	0.0003997
test_monitor_0562	0.0063334	0.0059092	0.0143094	0.0056413	0.0122309	0.0105025	0.0103989	0.0059868	0.0193981	0.0115661
test_night_stand_0212	0.0010770	0.0003598	0.0025311	0.0003683	0.0022377	0.0003726	0.0008145	0.0006104	0.0026825	0.0008161
test_sofa_0686	0.0061275	0.0051585	0.0063395	0.0052297	0.0066620	0.0050706	0.0062191	0.0049850	0.0056910	0.0049064
train_bathtub_0063	0.0078368	0.0078992	-	-	-	-	0.0053288	0.0078322	0.0011419	0.0023017
train_bed_0044	0.0232483	0.0044611	0.0118728	0.0079925	0.0248662	0.0021128	0.0270179	0.0021488	0.0212340	0.0038395
train_monitor_0465	0.0213407	0.0221822	0.0185315	0.0219266	0.0212589	0.0224641	0.0219256	0.0360989	0.0081277	0.0046996
train_night_stand_0143	0.0032394	0.0013859	0.0285008	0.0317085	0.0102907	0.0031263	0.0024264	0.0026201	0.0047140	0.0022697
train_sofa_0060	0.0092549	0.0083549	0.0074767	0.0082236	0.0069374	0.0083632	0.0083401	0.0083643	0.0053834	0.0029383
train_sofa_0356	0.0030841	0.0027179	0.0043755	0.0030614	0.0038615	0.0024764	0.0041783	0.0026043	0.0063119	0.0045758
train_table_0082	0.0036713	0.0028277	-	-	0.0200308	0.0054888	0.0203052	0.0032890	0.0042819	0.0108950
train_table_0089	0.0022672	0.0013654	0.1283350	0.0729121	-	-	0.0018216	0.0021999	0.0089175	0.0021948
Average	0.0115380	0.0089797	0.0316620	0.0317204	0.0160205	0.0105053	0.0143459	0.0108921	0.0118015	0.0085078

Table 16. Hausdorff distance, our method and [Hou et al. 2022; Lin et al. 2024; Liu et al. 2024; Xu et al. 2023]. We report metrics on our results after filtering of interior points due to the dense interior structures (artifacts from CAD modeling) present in these inputs.

4.5 Clean inputs

For the following, we sample 5000 points from each mesh with Poisson disk sampling. For WNNC, we set the smoothing parameter to l_0 (no noise). We do not filter interior points with our method (as these inputs contain none).

	iPSR (2022)			GCNO (2023)			BIM (2024)			WNNC (2024)			Ours		
Input	AL	ME	SE	AL	ME	SE	AL	ME	SE	AL	ME	SE	AL	ME	SE
82-block	99.98	12.89	13.98	99.98	14.03	12.55	99.92	11.95	12.69	99.98	8.81	11.08	99.98	12.04	12.51
chair	100.00	5.92	4.71	100.00	10.04	5.73	100.00	6.86	4.91	100.00	4.74	4.15	100.00	7.98	5.94
cup-22	100.00	4.33	6.34	100.00	7.72	6.68	99.50	9.77	12.39	100.00	2.64	3.04	99.30	6.95	12.41
cup-35	100.00	4.69	5.17	100.00	8.56	6.06	99.88	6.22	7.00	100.00	2.60	2.82	100.00	5.80	4.61
fandisk	100.00	10.11	13.71	99.98	13.65	12.34	100.00	10.22	11.96	100.00	6.28	10.57	100.00	9.65	11.97
holes	100.00	3.65	2.49	100.00	7.94	5.77	99.98	5.68	4.61	100.00	3.38	2.32	100.00	6.81	4.79
horse	99.92	8.56	10.06	99.86	12.91	11.11	99.86	8.71	9.35	99.96	5.68	7.39	99.90	8.47	8.94
huapen	100.00	9.09	9.44	100.00	10.48	8.73	99.86	8.89	9.70	100.00	5.70	5.09	99.82	10.30	11.23
kitten	99.98	4.47	6.42	100.00	9.91	7.88	99.94	6.14	6.74	100.00	3.13	5.47	99.98	6.32	6.17
knot	100.00	2.52	1.40	100.00	4.60	2.65	99.46	6.33	9.53	100.00	2.98	2.69	100.00	10.19	7.63
leaf	99.30	21.84	27.49	95.94	29.40	26.43	94.32	20.10	29.65	96.46	14.98	26.71	97.80	9.83	20.48
lion	99.50	19.07	16.56	99.62	17.90	14.14	99.60	16.90	15.34	99.76	13.80	13.47	99.52	17.15	15.14
mobius	100.00	17.42	19.04	100.00	17.35	14.29	99.24	13.90	16.03	100.00	10.83	11.39	100.00	11.01	13.04
mug	100.00	4.47	7.38	100.00	7.63	7.28	99.42	6.54	11.43	100.00	3.28	5.05	97.12	11.08	24.29
octa-flower	99.96	15.30	18.05	99.20	19.88	18.61	99.60	13.96	17.04	99.96	9.74	14.57	100.00	11.92	14.42
thin	100.00	5.43	11.58	100.00	8.03	9.90	99.98	7.93	11.02	100.00	4.34	9.49	100.00	4.52	6.86
torus	100.00	2.78	1.25	100.00	5.69	4.57	100.00	4.77	3.25	100.00	2.90	1.71	100.00	4.66	3.30
trimstar	100.00	9.80	12.09	99.94	13.10	11.84	99.86	9.80	11.22	100.00	6.43	9.20	99.56	12.02	15.10
Average	99.92	9.02	10.40	99.70	12.16	10.37	99.47	9.70	11.33	99.78	6.24	8.12	99.61	9.26	11.05

Table 17. Normal estimation metrics, our method and [Hou et al. 2022; Lin et al. 2024; Liu et al. 2024; Xu et al. 2023]. We report metrics on our results without filtering interior points. AL = percentage of correctly aligned normals (positive dot product), ME = mean angle error (deg.), SE = standard deviation of angle error (deg.)

Input	iPSR (2022)	GCNO (2023)	BIM (2024)	WNNC (2024)	Ours
82-block	0.0000092	0.0000093	0.0000086	0.0000069	0.0000087
chair	0.0000024	0.0000030	0.0000024	0.0000019	0.0000025
cup-22	0.0000031	0.0000037	0.0000048	0.0000015	0.0000049
cup-35	0.0000026	0.0000034	0.0000029	0.0000016	0.0000025
fandisk	0.0000088	0.0000092	0.0000083	0.0000067	0.0000081
holes	0.0000006	0.0000011	0.0000008	0.0000005	0.0000008
horse	0.0000033	0.0000041	0.0000033	0.0000025	0.0000031
huapen	0.0000069	0.0000072	0.0000067	0.0000048	0.0000076
kitten	0.0000022	0.0000031	0.0000023	0.0000017	0.0000024
knot	0.0000003	0.0000004	0.0000005	0.0000003	0.0000012
leaf	0.0000493	0.0000476	0.0000706	0.0001039	0.0000418
lion	0.0000084	0.0000076	0.0000076	0.0000062	0.0000077
mobius	0.0000097	0.0000071	0.0000046	0.0000023	0.0000044
mug	0.0000050	0.0000058	0.0000065	0.0000035	0.0000330
octa-flower	0.0000204	0.0000192	0.0000192	0.0000136	0.0000165
thin	0.0000028	0.0000020	0.0000030	0.0000021	0.0000022
torus	0.0000002	0.0000003	0.0000002	0.0000002	0.0000003
trimstar	0.0000074	0.0000079	0.0000069	0.0000055	0.0000081
Average	0.0000079	0.0000079	0.0000088	0.0000092	0.0000087

Table 18. Chamfer distance, our method and [Hou et al. 2022; Lin et al. 2024; Liu et al. 2024; Xu et al. 2023]. We report metrics on our results after without filtering interior points.

Input	iPSR (2022)	GCNO (2023)	BIM (2024)	WNNC (2024)	Ours
82-block	0.0003584	0.0003632	0.0003616	0.0002118	0.0002754
chair	0.0001090	0.0001038	0.0001039	0.0000772	0.0000962
cup-22	0.0004122	0.0004298	0.0007240	0.0001302	0.0007044
cup-35	0.0000858	0.0001109	0.0001052	0.0000537	0.0000742
fandisk	0.0003290	0.0004109	0.0003744	0.0003125	0.0003277
holes	0.0000129	0.0000175	0.0000120	0.0000096	0.0000143
horse	0.0007851	0.0011146	0.0008383	0.0007548	0.0007487
huapen	0.0003091	0.0002968	0.0004673	0.0002514	0.0006533
kitten	0.0004571	0.0006565	0.0004219	0.0003686	0.0006949
knot	0.0000018	0.0000030	0.0000042	0.0000018	0.0000376
leaf	0.0017783	0.0021718	0.0044876	0.0053526	0.0025789
lion	0.0011252	0.0011356	0.0010567	0.0011403	0.0010956
mobius	0.0002390	0.0001844	0.0000979	0.0000694	0.0001042
mug	0.0002386	0.0002764	0.0008799	0.0002049	0.0019839
octa-flower	0.0008964	0.0009946	0.0009362	0.0005383	0.0006066
thin	0.0001538	0.0001252	0.0001685	0.0001402	0.0001398
torus	0.0000024	0.0000031	0.0000023	0.0000021	0.0000084
trimstar	0.0003037	0.0002996	0.0002714	0.0002600	0.0003346
Average	0.0004221	0.0004832	0.0006285	0.0005488	0.0005822

Table 19. Hausdorff distance, our method and [Hou et al. 2022; Lin et al. 2024; Liu et al. 2024; Xu et al. 2023]. We report metrics on our results without filtering interior points.

5 Symmetries for linear external fields

Let us note some symmetries that help us reduce the range of linear fields that we consider. First, note that if u is a solution to Problem (1) in the main text, then a uniform shift $u + C$ for some $C \in \mathbb{R}$ is also harmonic, is equipotential on ∂C, and satisfies a shifted Dirichlet boundary condition $g + C$. Thus, we obtain the following:

Lemma 1. *If Dirichlet boundary condition g results in potential u, then a uniformly shifted condition $g + C$ for some $C \in \mathbb{R}$ results in potential $u + C$.*

As $\nabla u = \nabla(u + C)$, the resulting shielding effect remains the same. We can ignore the constant terms b in linear fields and regard them as being parameterized solely by the vectors $\vec{v}$.

Similarly, note that a scaled solution cu for some $c \in \mathbb{R}$ is also harmonic, is equipotential on ∂C, and satisfies a scaled Dirichlet boundary condition cg. Thus, we obtain the following:

Lemma 2. *If an imposed linear electric field $g(\vec{x}) = \vec{v}^T\vec{x}$ results in potential u, then a scaled field cg for some $c \in \mathbb{R}$ results in potential cu.*

As $\nabla(cu) = c\nabla u$, we see that the fields are simply scaled. As we are only interested in relative shielding effects, we may further limit our set of linear external fields by restricting to those of the same magnitude, and choosing $\vec{v} \in \mathbb{S}^2$. Lastly, note that $\vec{v}$ and $-\vec{v}$ result in fields ∇u and $-\nabla u$ with equivalent field strength everywhere. Thus, we can restrict ourselves to sampling linear fields from half of $\mathbb{S}^2$ (a hemisphere) or from the space of 1-dimensional subspaces $\mathbb{RP}^2$.

6 Effect of icosahedral refinement

In §3.2, we note that an icosahedral approximation of the sphere is used to construct the cage. Here, we demonstrate that refinement of the icosahedron to achieve a better approximation yields minimal quality improvement (outweighed by a significant performance penalty).

	20 faces				80 faces				320 faces			
Input	AL	ME	SE	Time	AL	ME	SE	Time	AL	ME	SE	Time
chair	100	7.98	5.94	0:31.55	100	7.76	5.67	1:48.13	100	8.39	5.82	8:50.60
knot	100	10.19	7.63	0:31:42	100	9.54	7.16	1:49.49	100	10.19	7.36	9:02.83
tree_decimated	93.16	24.66	35.95	0:47.15	93.29	24.57	35.87	2:43.78	93.28	24.73	35.10	13:36.70
walking_teapot_decimated	98.40	16.10	21.02	0:49.33	98.40	16.10	21.04	2:47.26	98.45	16.87	20.49	13:19.65

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