

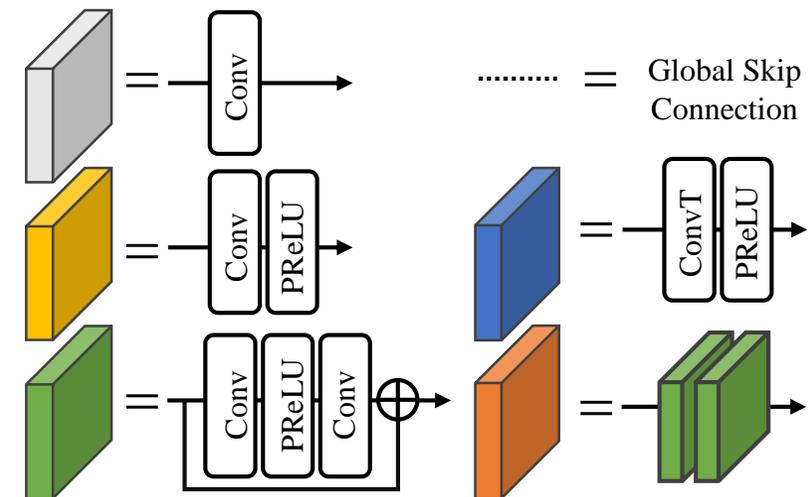
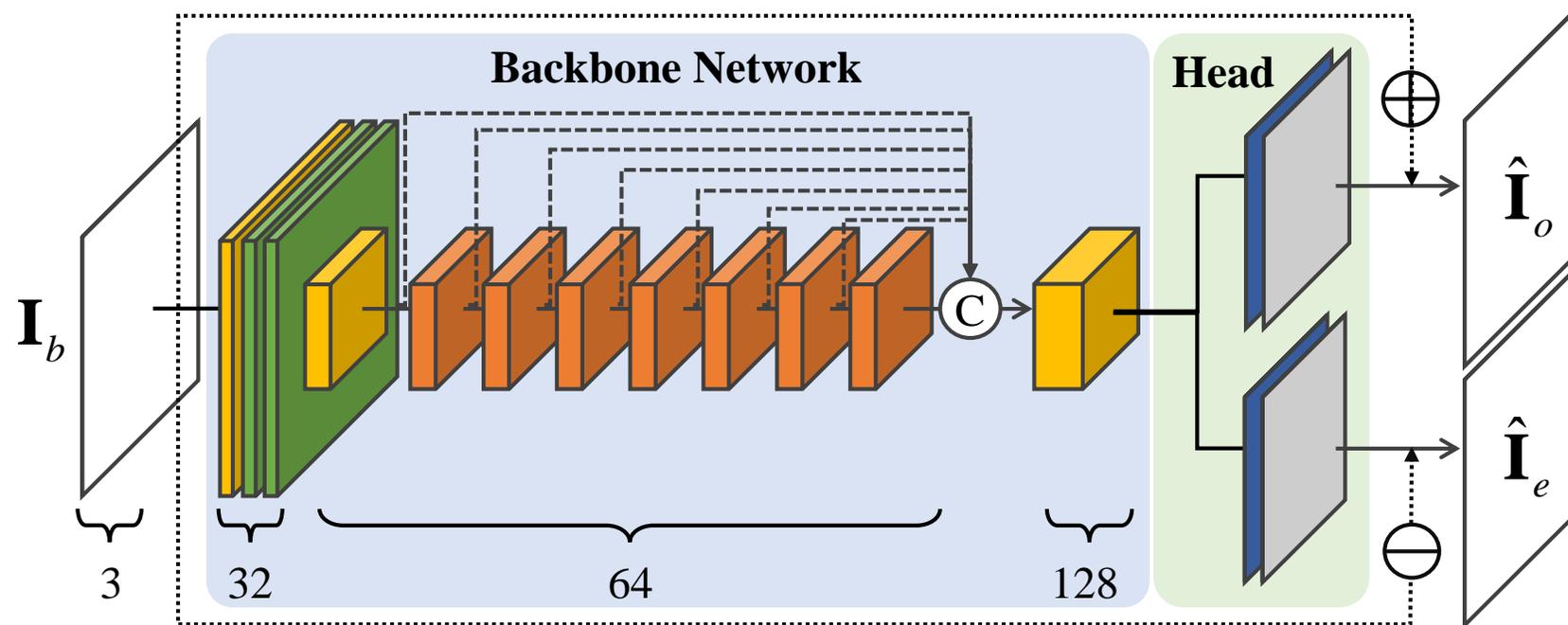
High-Quality Stereo Image Restoration from Double refraction

CVPR 2021

Hakyeong Kim Andreas Meuleman Daniel S. Jeon Min H. Kim

KAIST

Network Architecture

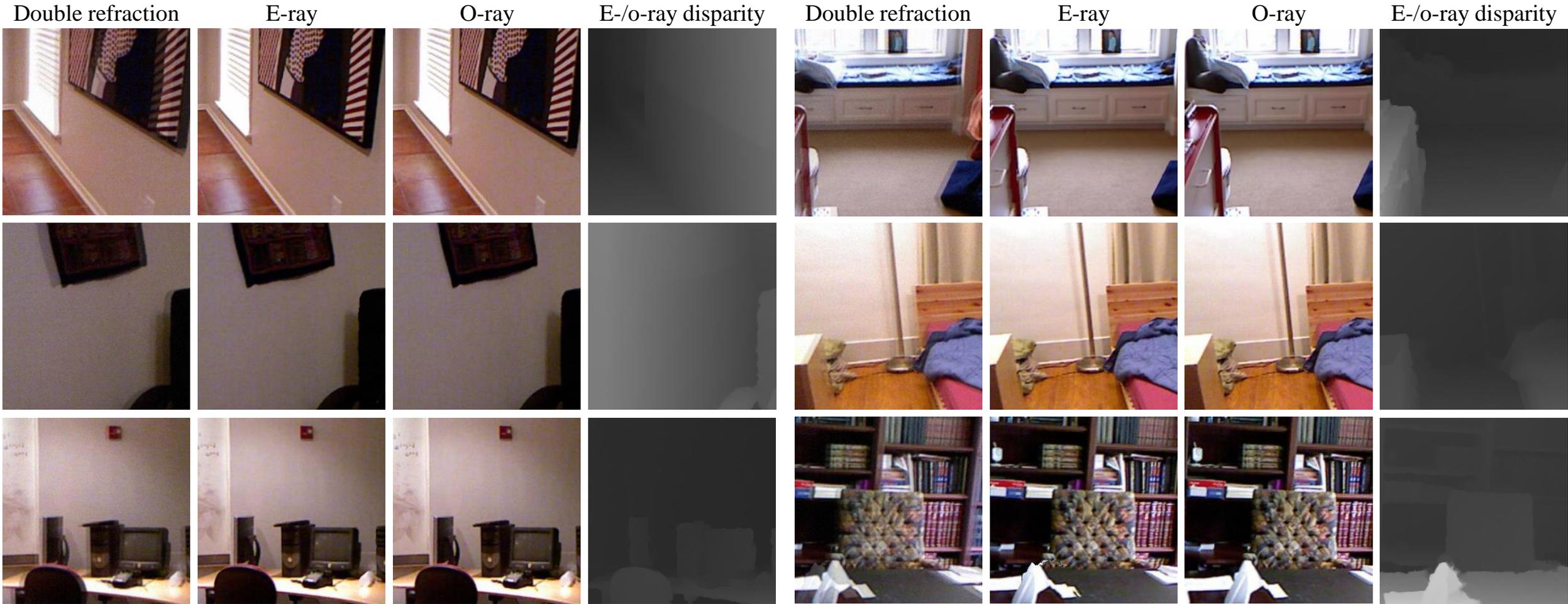


Network Architecture

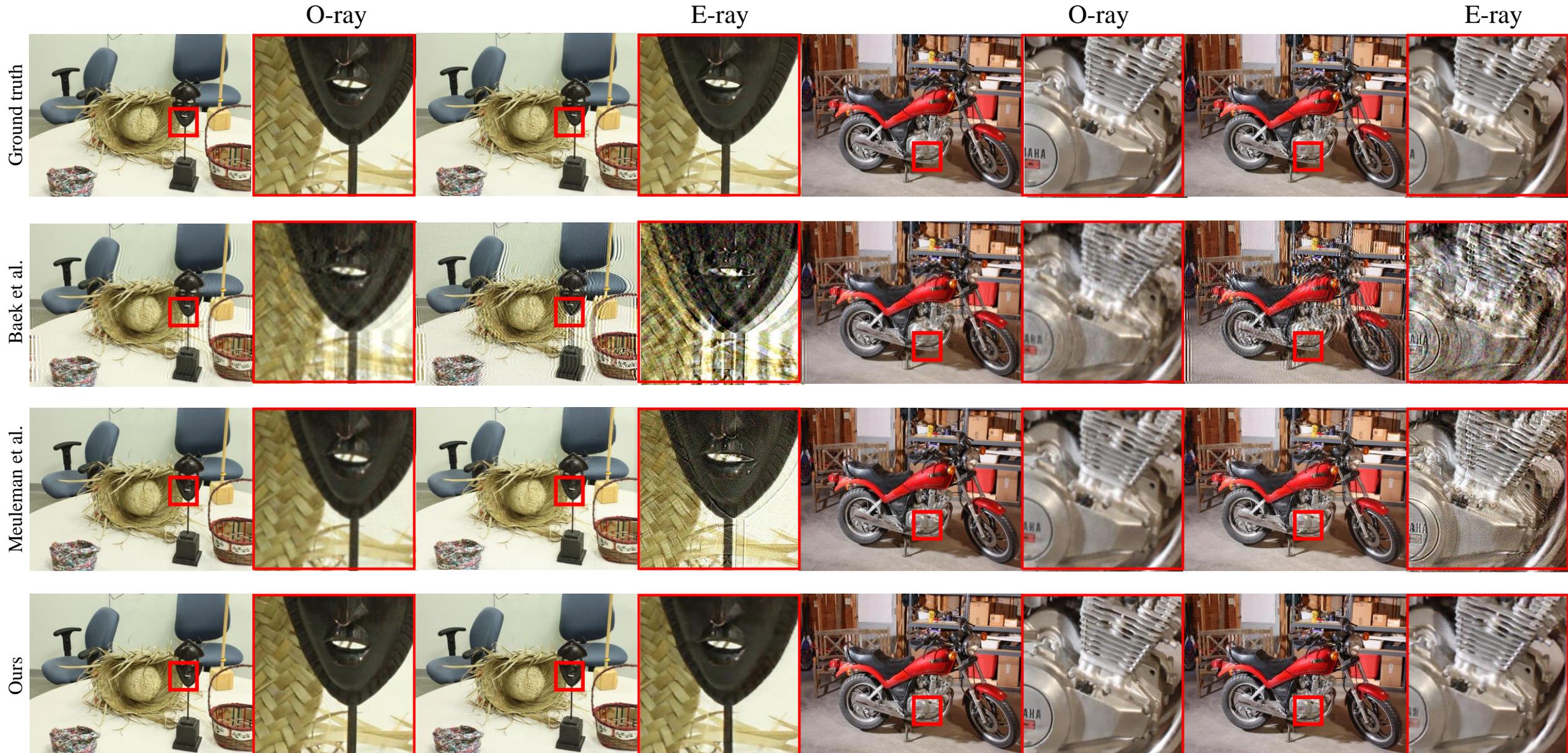
	Layer name	Input	Layer operation	Activation	(channels , kernel size, stride, dilation)	Output name (size)
Backbone Network	conv0_0	RGB image ($3 \times H \times W$)	Conv2d	PReLU	(32, 3, 1, 1)	out0_0 ($32 \times H \times W$)
	conv0_1	out0_0	ResBlock $\begin{bmatrix} 3 \times 3, 32 \\ 3 \times 3, 32 \end{bmatrix} \times 2$	PReLU	(32, 3, 1, 1)	out0_1 ($32 \times H \times W$)
	conv0_2	out0_1	Conv2d	PReLU	(64, 3, 2, 1)	out0_2 ($64 \times \frac{H}{2} \times \frac{W}{2}$)
	block1	out0_2	ResBlock $\begin{bmatrix} 3 \times 3, 64 \\ 3 \times 3, 64 \end{bmatrix} \times 2$	PReLU	(64, 3, 1, 1)	out1 ($64 \times \frac{H}{2} \times \frac{W}{2}$)
	block2	out1	ResBlock $\begin{bmatrix} 3 \times 3, 64 \\ 3 \times 3, 64 \end{bmatrix} \times 2$	PReLU	(64, 3, 1, 1)	out2 ($64 \times \frac{H}{2} \times \frac{W}{2}$)
	block3	out2	ResBlock $\begin{bmatrix} 3 \times 3, 64 \\ 3 \times 3, 64 \end{bmatrix} \times 2$	PReLU	(64, 3, 1, 1)	out3 ($64 \times \frac{H}{2} \times \frac{W}{2}$)
	block4	out3	ResBlock $\begin{bmatrix} 3 \times 3, 64 \\ 3 \times 3, 64 \end{bmatrix} \times 2$	PReLU	(64, 3, 1, 1)	ou4 ($64 \times \frac{H}{2} \times \frac{W}{2}$)
	block5	out4	ResBlock $\begin{bmatrix} 3 \times 3, 64 \\ 3 \times 3, 64 \end{bmatrix} \times 2$	PReLU	(64, 3, 1, 1)	out5 ($64 \times \frac{H}{2} \times \frac{W}{2}$)
	block6	out5	ResBlock $\begin{bmatrix} 3 \times 3, 64 \\ 3 \times 3, 64 \end{bmatrix} \times 2$	PReLU	(64, 3, 1, 1)	out6 ($64 \times \frac{H}{2} \times \frac{W}{2}$)
	block7	out6	ResBlock $\begin{bmatrix} 3 \times 3, 64 \\ 3 \times 3, 64 \end{bmatrix} \times 2$	PReLU	(64, 3, 1, 1)	out7 ($64 \times \frac{H}{2} \times \frac{W}{2}$)
	branch	[out0_2, out1, out2, out3, out4, out5, out6, out7] ($512 \times \frac{H}{2} \times \frac{W}{2}$)	Conv2d	PReLU	(128, 3, 1, 1)	$feat_{backbone}$ ($128 \times \frac{H}{2} \times \frac{W}{2}$)
Head Network (E)	head_e_0	$feat_{backbone}$	ConvTranspose2d	PReLU	(3, 3, 2, 1)	tconv_e
	head_e_1	tconv_e	Conv2d	-	(1, 3, 1, 1)	image_e
Head Network (O)	head_o_0	$feat_{backbone}$	ConvTranspose2d	PReLU	(3, 3, 2, 1)	tconv_o
	head_o_1	tconv_o	Conv2d	-	(1, 3, 1, 1)	image_o

Example Thumbnails of Our Training Dataset

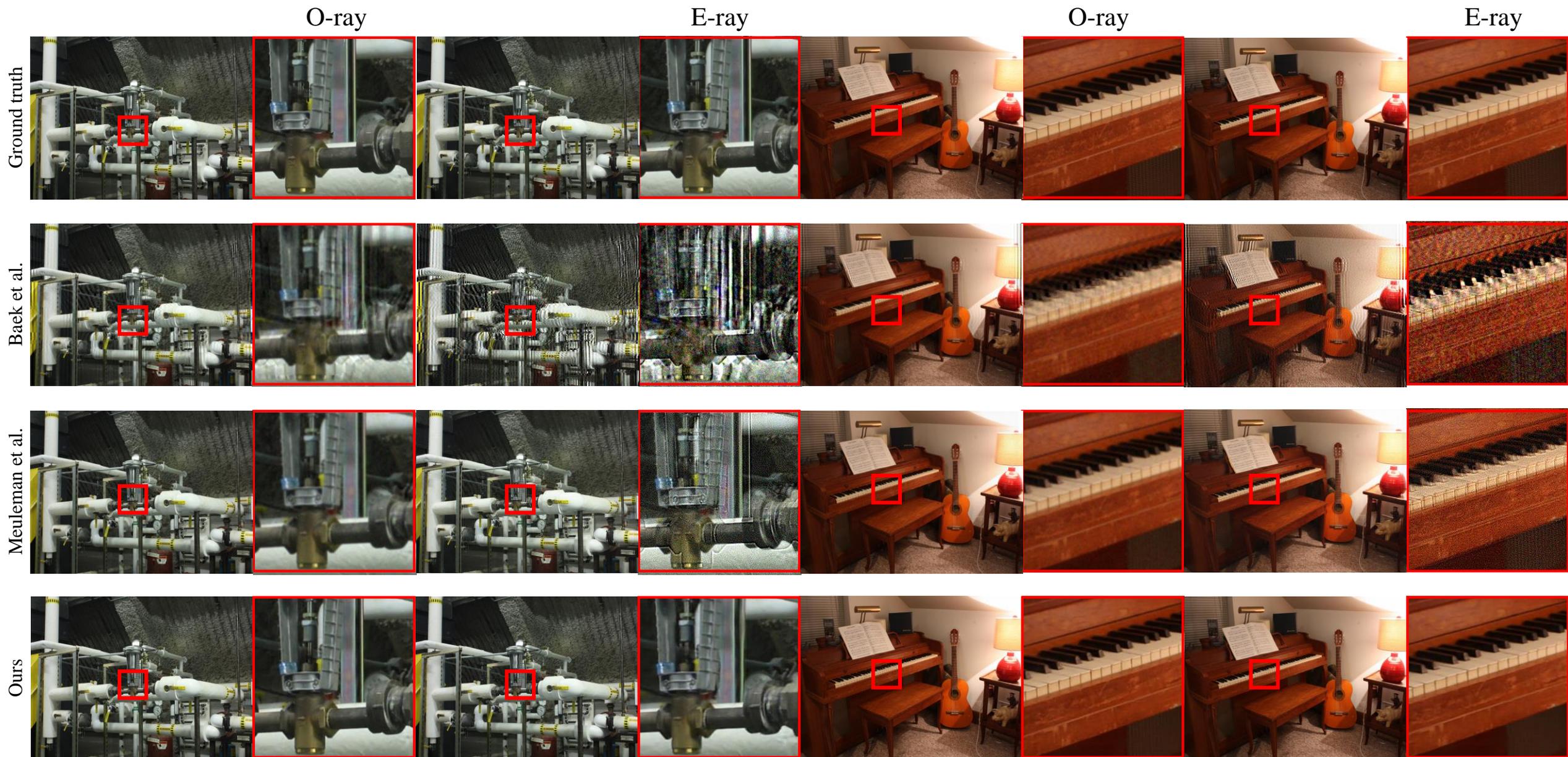
(Synthesized from labeled NYU-Depth v2 Dataset)



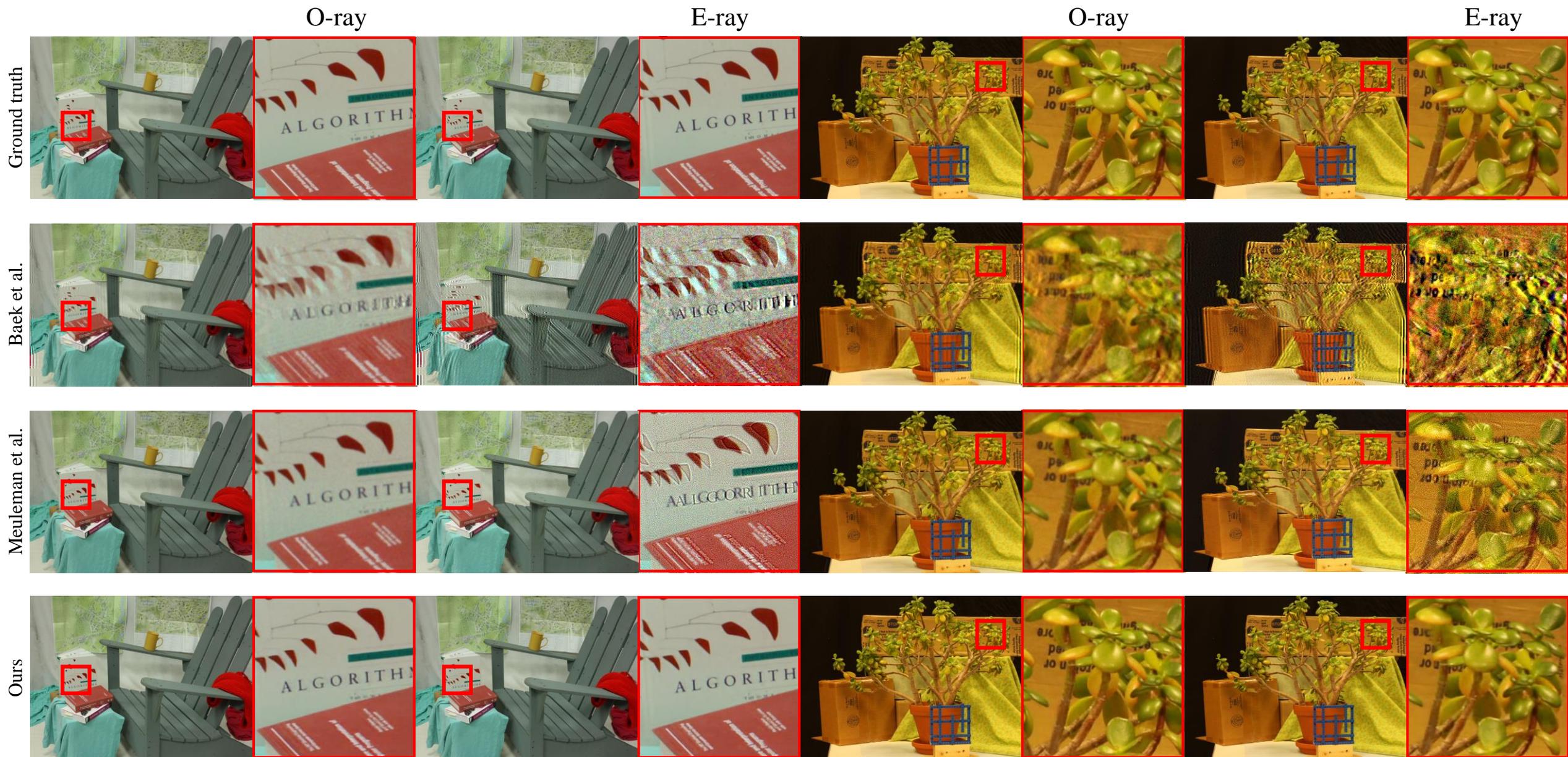
Comparison of Stereo Image Restoration Results (Synthetic Test Dataset)



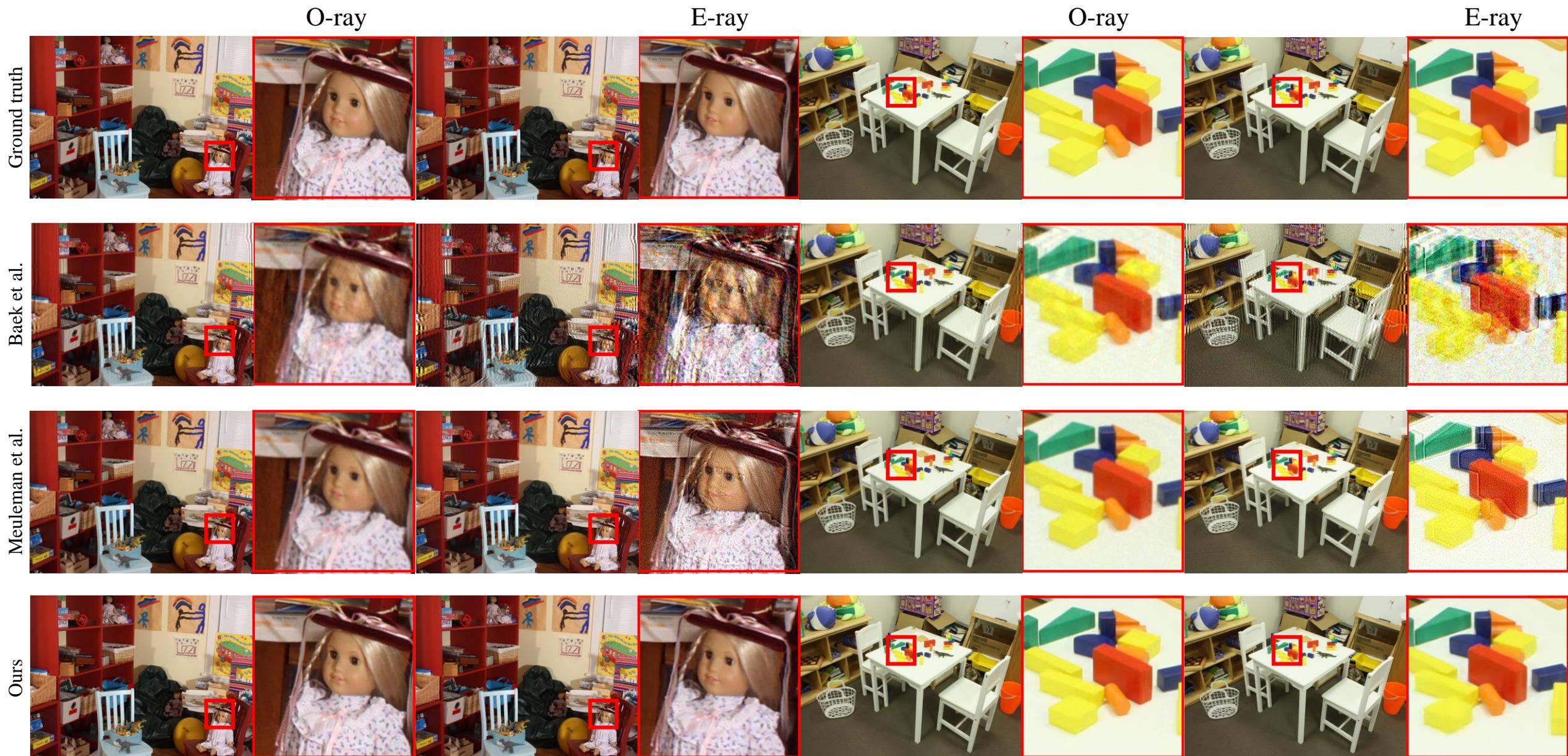
Comparison of Stereo Image Restoration Results (Synthetic Test Dataset)



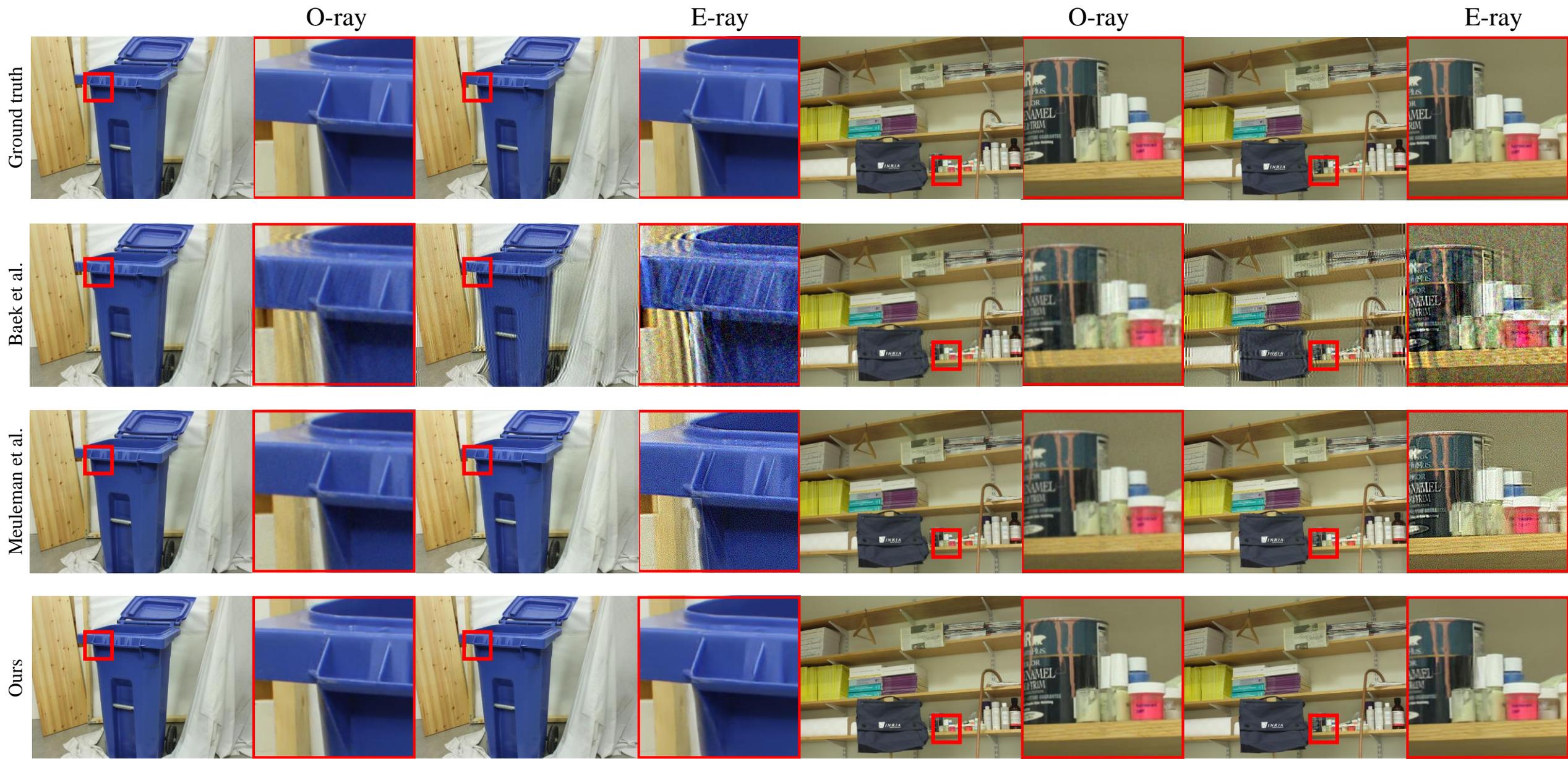
Comparison of Stereo Image Restoration Results (Synthetic Test Dataset)



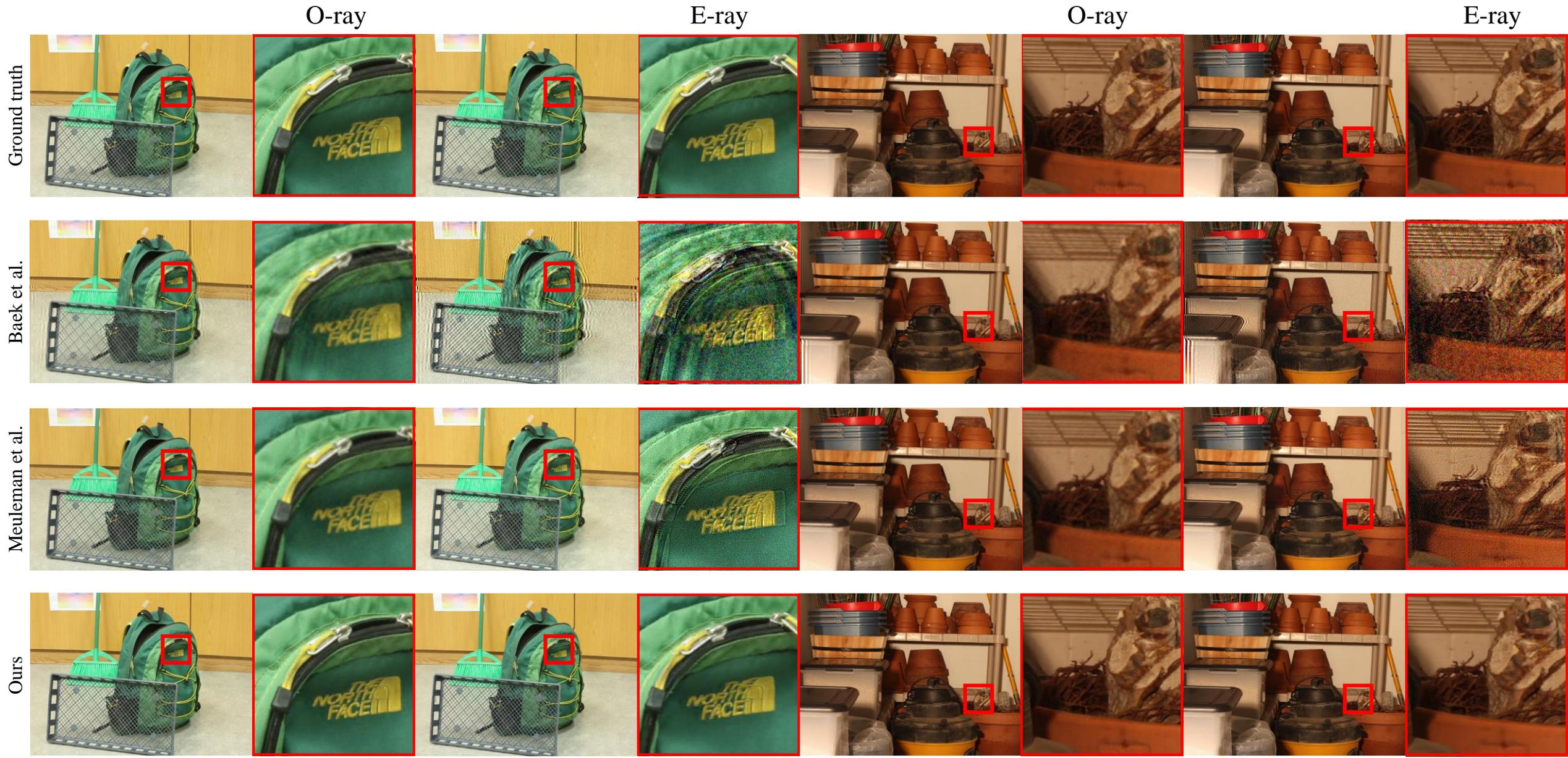
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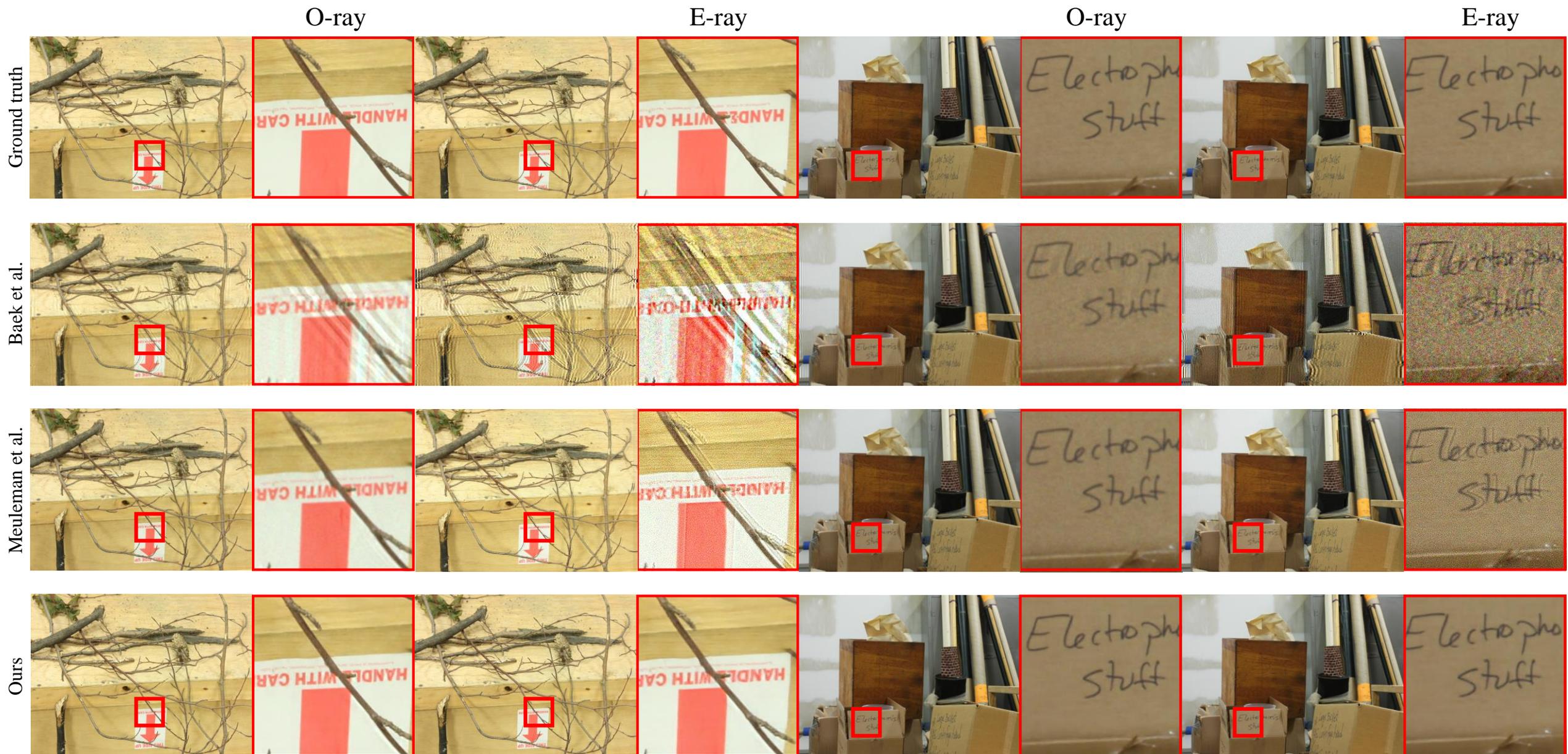
Comparison of Stereo Image Restoration Results (Synthetic Test Dataset)



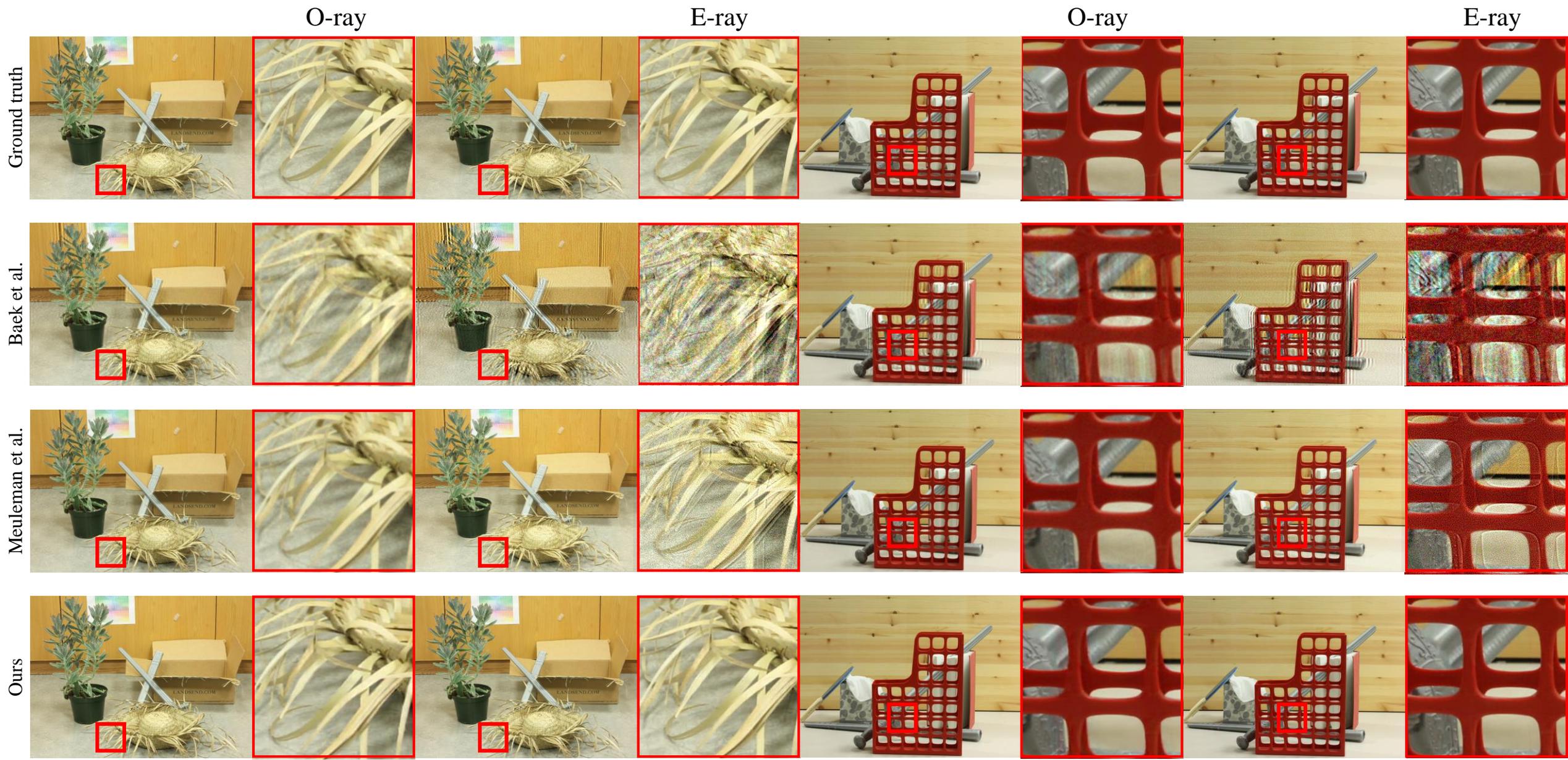
Comparison of Stereo Image Restoration Results (Synthetic Test Dataset)



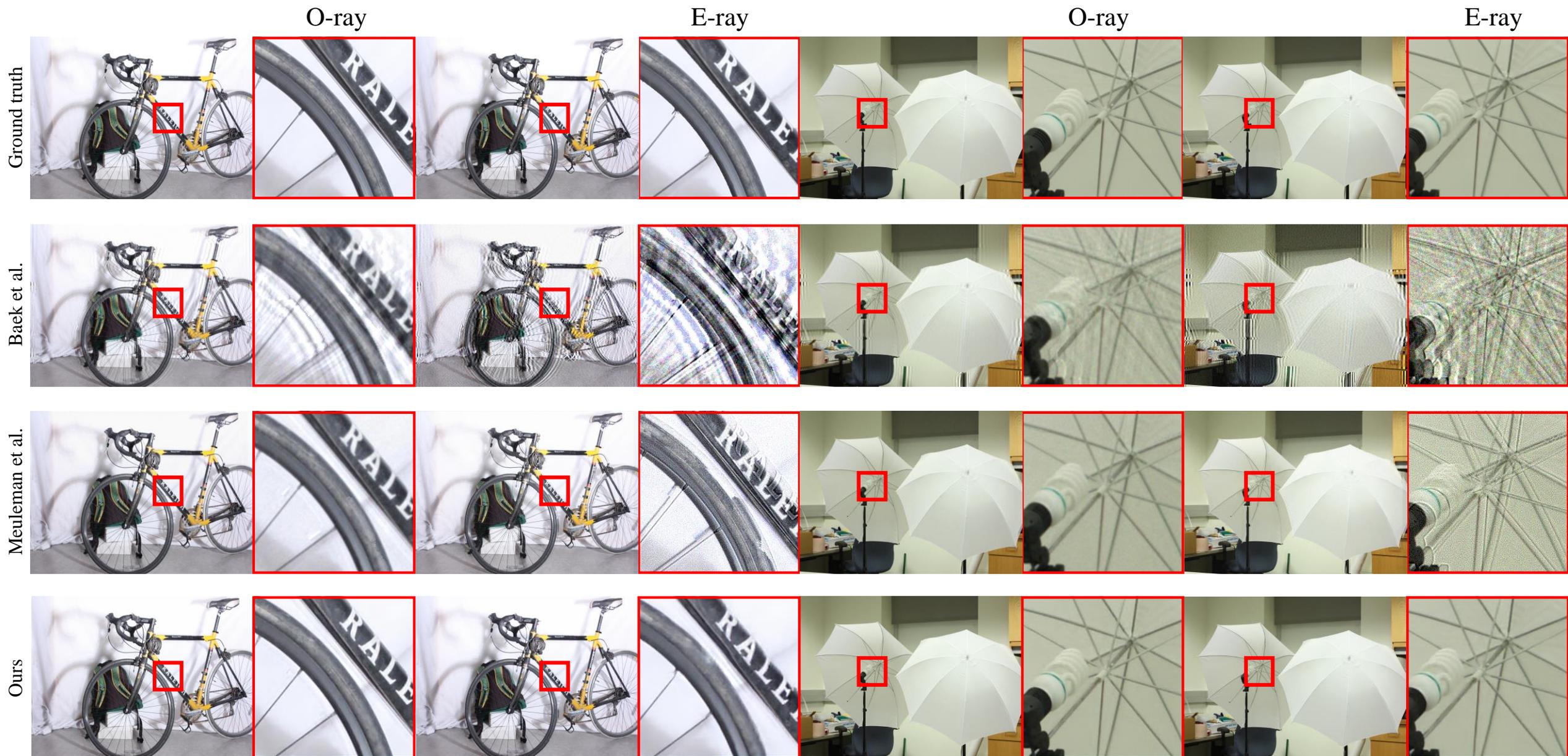
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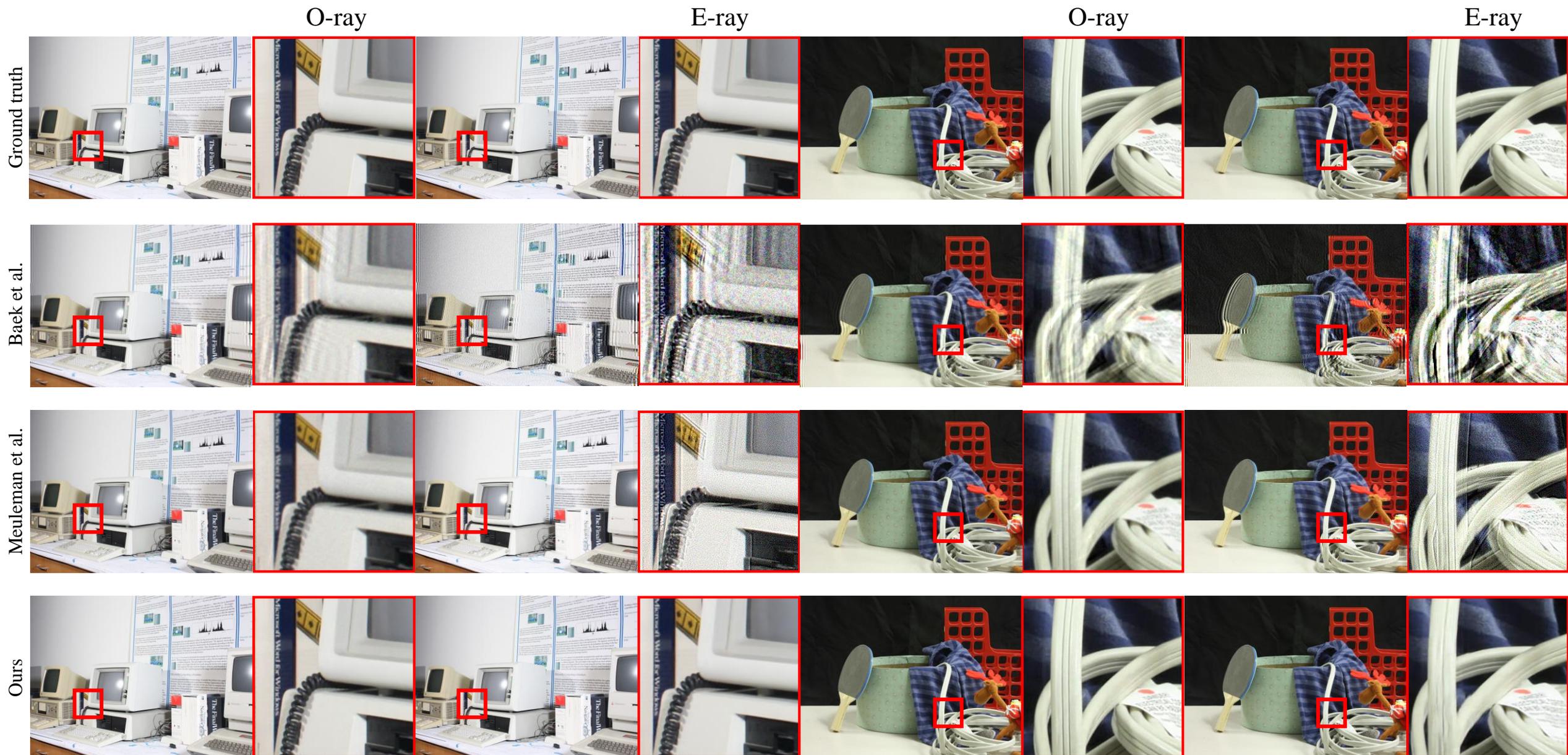
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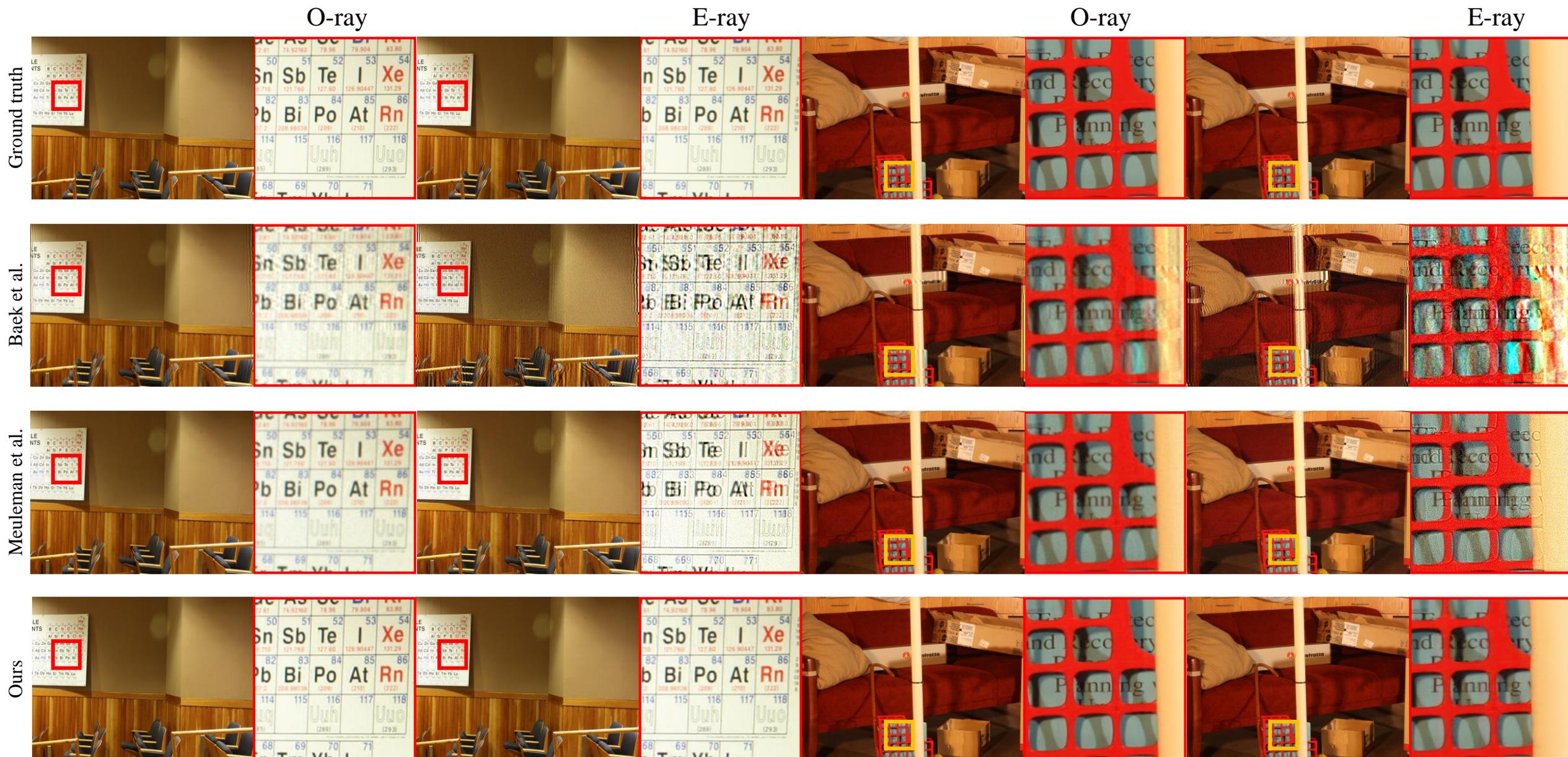
Comparison of Stereo Image Restoration Results (Synthetic Test Dataset)



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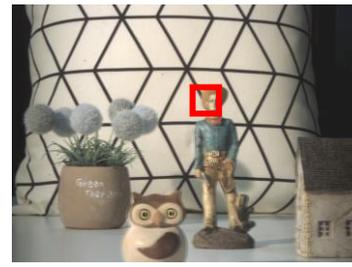


Comparison of Stereo Image Restoration Results (Synthetic Test Dataset)

Image ID	Baek et al.				Meuleman et al.				Ours			
	PSNR (dB)		SSIM		PSNR (dB)		SSIM		PSNR (dB)		SSIM	
	O-ray	E-ray	O-ray	E-ray	O-ray	E-ray	O-ray	E-ray	O-ray	E-ray	O-ray	E-ray
0	26.19	14.64	0.7797	0.1261	32.44	19.51	0.9115	0.2192	38.37	31.90	0.9638	0.9343
1	25.80	14.36	0.7881	0.1566	31.99	19.28	0.9176	0.2683	36.71	28.76	0.9589	0.9128
2	26.53	14.85	0.7640	0.1301	33.50	19.92	0.9155	0.2456	38.38	31.93	0.9611	0.9252
3	28.18	16.06	0.8147	0.1095	35.24	20.65	0.9134	0.1885	39.89	36.59	0.9575	0.9379
4	28.75	16.26	0.8215	0.1105	35.65	20.50	0.9207	0.1849	40.81	36.91	0.9643	0.9481
5	27.19	15.35	0.7919	0.1219	34.38	20.33	0.9119	0.2243	38.67	32.96	0.9556	0.9154
6	26.99	15.17	0.8050	0.1393	33.96	20.08	0.9222	0.2348	39.13	33.13	0.9671	0.9431
7	28.08	15.97	0.7738	0.1469	33.70	20.03	0.8966	0.2383	38.80	34.98	0.9564	0.9314
8	32.75	18.22	0.8443	0.1064	36.13	20.53	0.9250	0.1602	42.61	39.32	0.9715	0.9633
9	29.17	16.64	0.8259	0.1275	34.03	20.15	0.9113	0.1933	39.42	33.22	0.9629	0.9233
10	28.08	15.99	0.7966	0.1388	33.02	19.73	0.9120	0.2466	37.59	31.07	0.9501	0.8956
11	27.74	15.61	0.8454	0.1325	36.08	20.65	0.9251	0.1944	42.02	39.02	0.9698	0.9632
12	29.39	16.74	0.8045	0.1416	33.95	20.01	0.9178	0.2420	39.26	34.79	0.9560	0.9375
13	30.18	17.01	0.8287	0.0975	36.61	20.63	0.9275	0.1671	42.38	37.52	0.9710	0.9561
14	29.91	17.05	0.8066	0.1321	33.88	20.00	0.9132	0.2210	39.21	34.49	0.9556	0.9273
15	29.81	16.86	0.8221	0.1144	35.56	20.40	0.9259	0.1801	41.71	35.82	0.9705	0.9567
16	26.52	15.12	0.7913	0.1454	31.38	19.45	0.9216	0.2422	38.63	30.58	0.9723	0.9406
17	29.21	16.50	0.8232	0.0929	35.24	20.27	0.9220	0.1464	43.45	39.64	0.9765	0.9695
18	26.28	14.92	0.7707	0.1265	30.92	19.03	0.9027	0.2251	38.44	32.47	0.9741	0.9468
19	27.95	15.77	0.8141	0.1123	34.87	20.28	0.9162	0.1833	40.76	35.83	0.9645	0.9516
20	28.08	15.98	0.8159	0.1156	34.02	20.20	0.9098	0.1823	40.28	35.49	0.9614	0.9399
21	28.58	16.31	0.8001	0.1107	35.21	20.64	0.8991	0.1778	39.59	35.34	0.9435	0.9165
22	29.06	16.45	0.8164	0.1113	34.52	20.06	0.9254	0.1988	39.35	32.00	0.9679	0.9350
Average	28.28	15.99	0.8063	0.1238	34.19	20.10	0.9158	0.2072	39.80	34.51	0.9631	0.9379

Comparison of Real-Image Results (using Our Prototype)

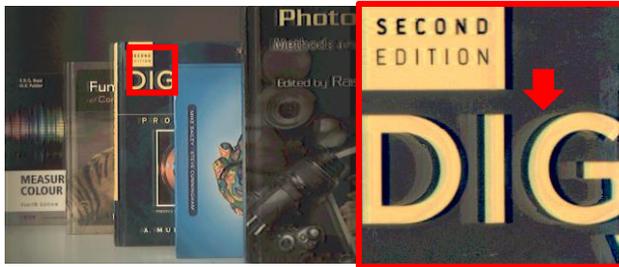
Double refraction



O-ray



E-ray



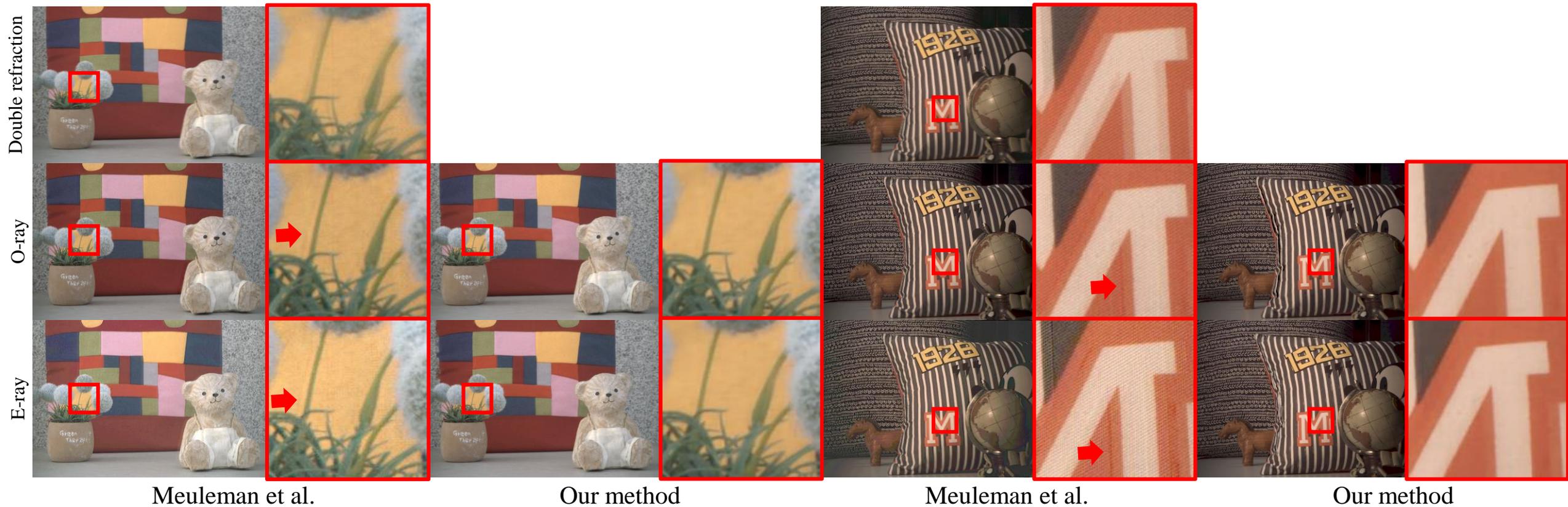
Meuleman et al.

Our method

Meuleman et al.

Our method

Comparison of Real-Image Results (using Our Prototype)



Robustness

