TexGaussian: Generating High-quality PBR Material via Octree-based 3D Gaussian Splatting

B. Xiong, J. Liu, J. Hu, C. Wu, J. Wu, X. Liu, C. Zhao, E. Ding, Z. Lian*
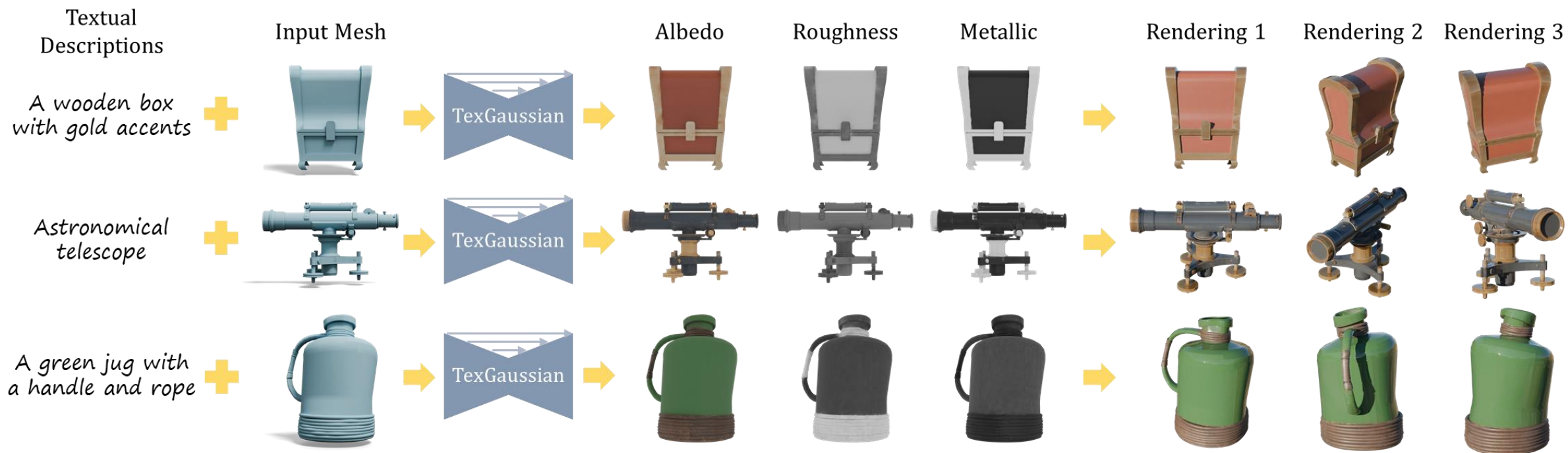CVPR 2025

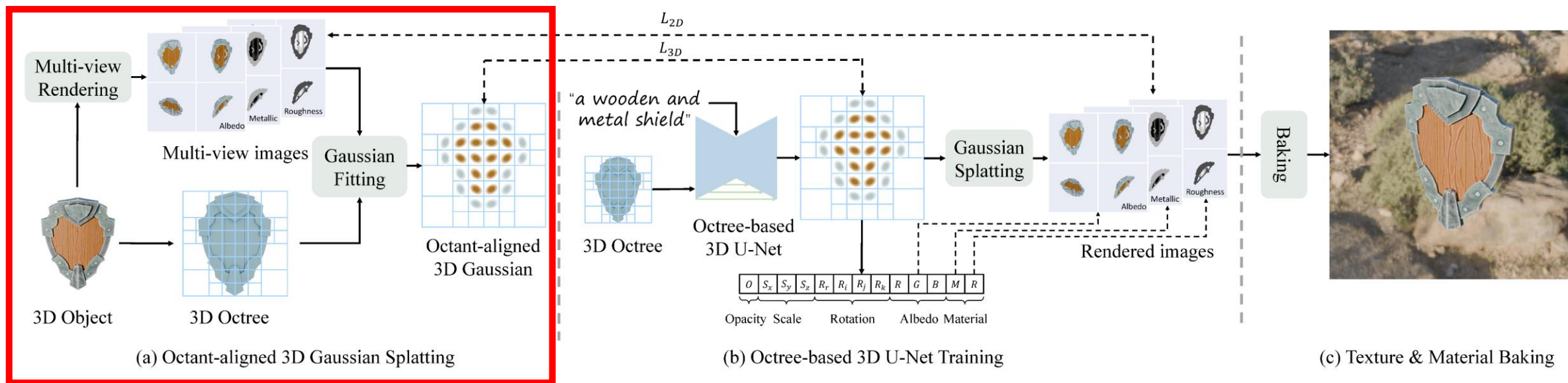Intelligent Graphics Computing Lab (IGCL), WICT, Peking University

Introduction

Method

- Octant-aligned 3DGS

(a) Octant-aligned 3D Gaussian Splatting
(b) Octree-based 3D U-Net Training
(c) Texture & Material Baking

Method

- Octree-based 3D U-Net

(a) Octant-aligned 3D Gaussian Splatting

(b) Octree-based 3D U-Net Training

(c) Texture & Material Baking
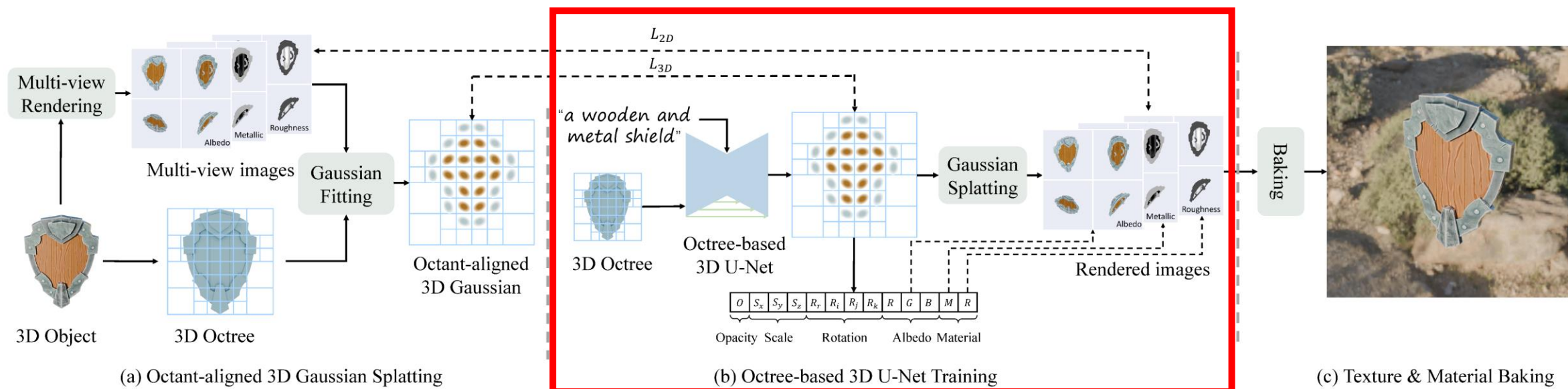
Method

- An overview of our PBR material generation framework.

L_{2D}

L_{3D}

"a wooden and metal shield"

Multi-view Rendering

Multi-view images

Gaussian Fitting

Octant-aligned 3D Gaussian

3D Octree

Octree-based 3D U-Net

Gaussian Splatting

Rendered images

Baking

3D Object

3D Octree

| O | S_x | S_y | S_z | R_r | R_i | R_j | R_k | R | G | B | M | R |

Opacity   Scale   Rotation   Albedo Material

Albedo   Metallic   Roughness

(a) Octant-aligned 3D Gaussian Splatting

(b) Octree-based 3D U-Net Training

(c) Texture & Material Baking

Experiments

- ShapeNet

Experiments

- ShapeNet

| Methods	Average		Bench		Car		Chair		Table		Time
	FID↓	KID↓	FID↓	KID↓	FID↓	KID↓	FID↓	KID↓	FID↓	KID↓	
Point-UV (1-Stage) [53]	88.43	5.78	64.96	1.44	186.10	17.57	46.23	1.93	56.42	2.19	39.92s
Point-UV (2-Stage) [53]	61.49	2.67	67.48	1.61	89.38	5.82	41.33	1.53	47.75	1.72	49.75s
TexOct [25]	59.45	2.60	60.46	0.97	90.10	6.11	37.70	1.36	49.52	1.97	17.44s
Ours	**49.76**	**2.07**	**46.37**	**0.44**	**80.20**	**5.22**	**29.96**	**1.09**	**42.52**	**1.54**	**11.02s**
TEXTure [40]	169.82	7.94	152.53	5.28	236.58	18.52	119.71	2.86	170.46	5.11	132.21s
Text2Tex [7]	156.62	6.68	154.95	5.79	188.60	15.06	125.34	3.11	157.57	2.77	1005.58s
Paint3D [54]	135.25	4.67	104.16	1.68	204.22	13.06	104.64	2.24	127.98	1.71	231.56s
Ours	**100.97**	**1.88**	**86.37**	**0.75**	**117.53**	**5.20**	**94.89**	**0.57**	**105.09**	**0.95**	**11.12s**

Experiments

- ShapeNet

Experiments

- Text-conditioned PBR material generation
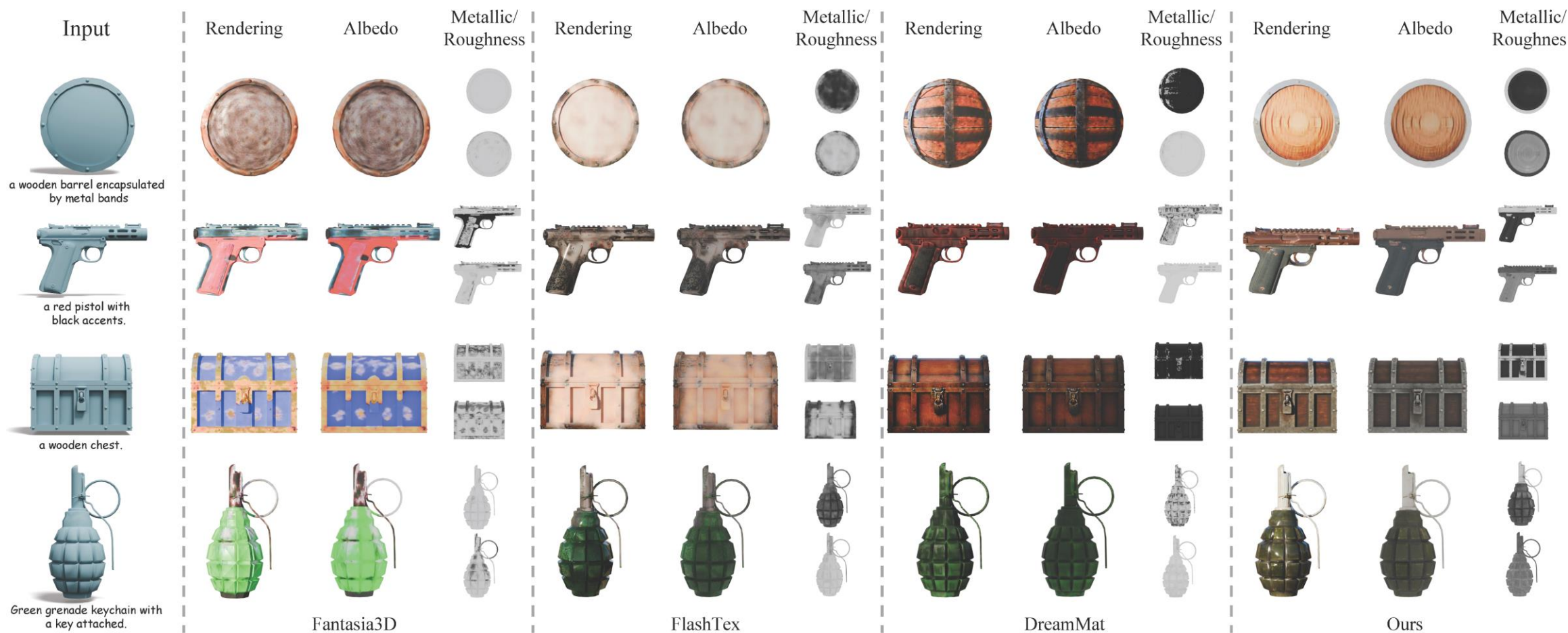
Experiments

- Text-conditioned PBR material generation

Methods	Albedo		PBR rendering		Time
	FID↓	KID↓	FID↓	KID↓	
Fantasia3D [8]	213.21	0.96	209.87	0.48	22.7mins
FlashTex [13]	185.24	1.13	186.82	0.42	20.3mins
DreamMat [58]	152.63	1.09	145.49	0.19	48.2mins
Ours	**123.72**	**0.20**	**129.52**	**0.02**	**21.04s**

Experiments

- Diversity

Albedo   Roughness   Metallic   Rendering1   Rendering2

A blue denim barrel

Albedo   Roughness   Metallic   Rendering1   Rendering2

A red barrel

Albedo   Roughness   Metallic   Rendering1   Rendering2

A steel barrel

Albedo   Roughness   Metallic   Rendering1   Rendering2

A wooden barrel

Albedo   Roughness   Metallic   Rendering1   Rendering2

A blue and silver box with white accents

Albedo   Roughness   Metallic   Rendering1   Rendering2

A green box with yellow accents

Albedo   Roughness   Metallic   Rendering1   Rendering2

A red box with gold accents

Albedo   Roughness   Metallic   Rendering1   Rendering2

A wooden box with yellow accents

Experiments

- More Results
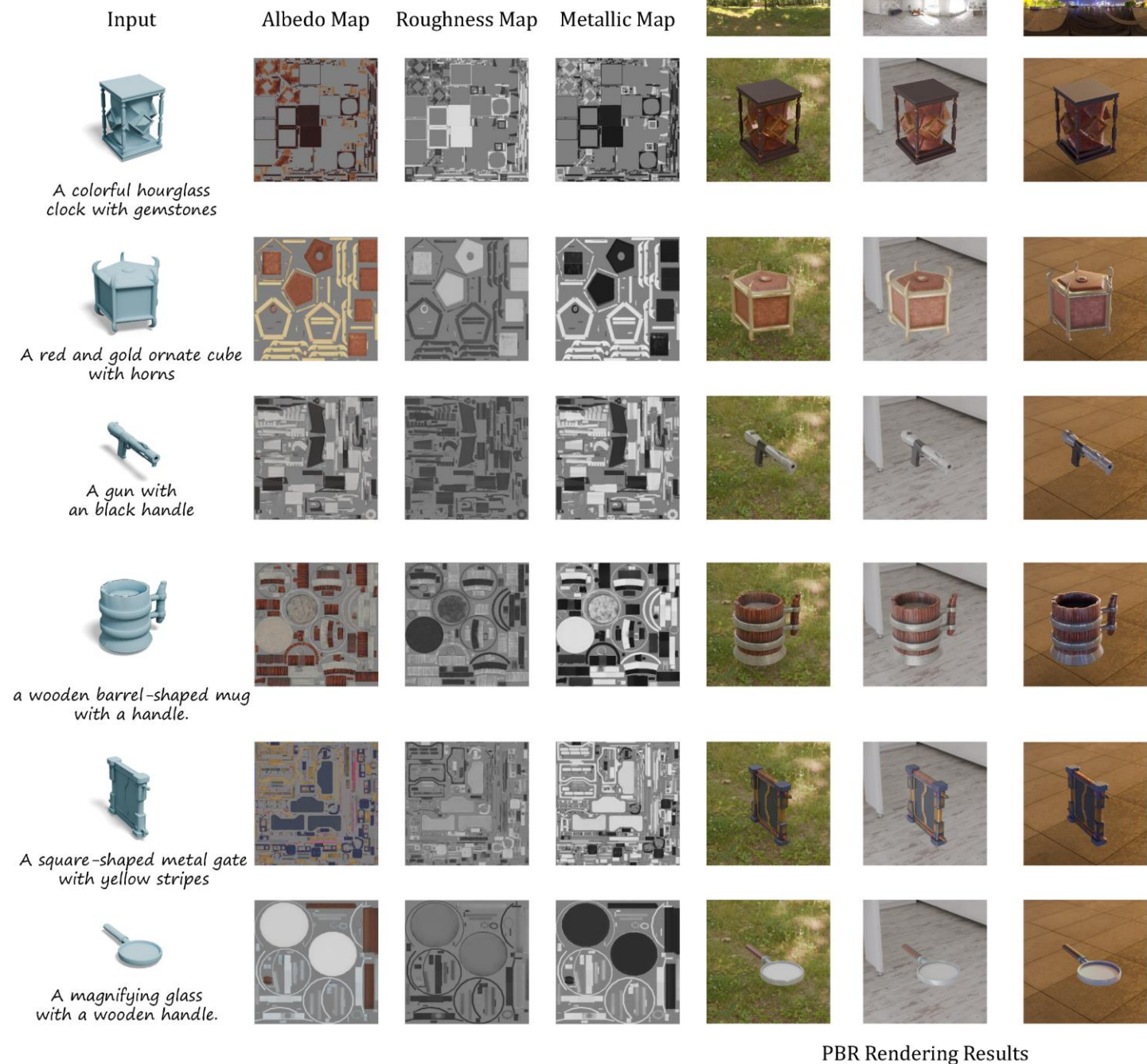
Ablation Study

- Essentials of Octree

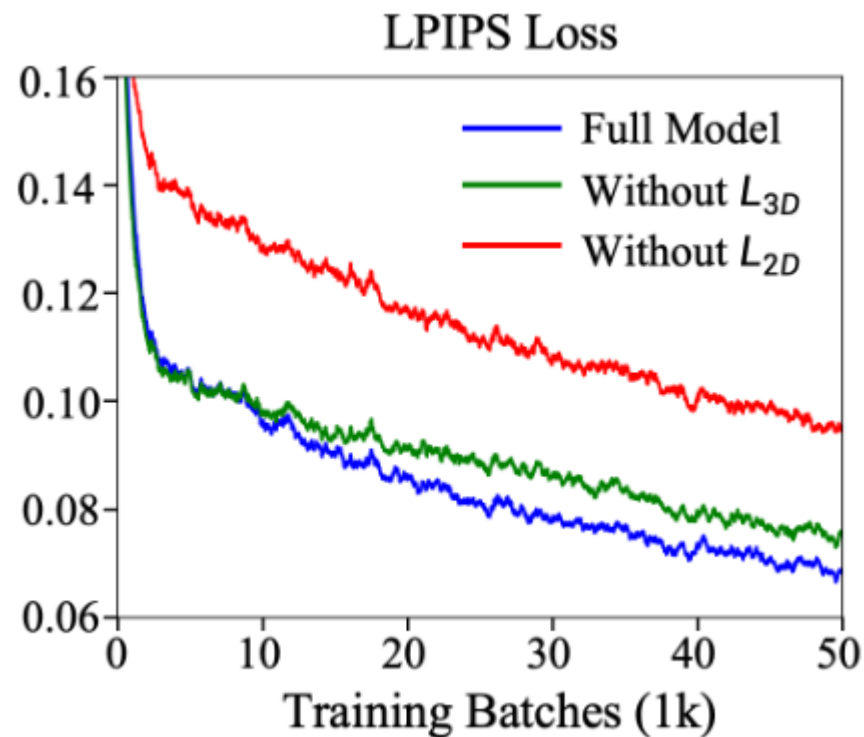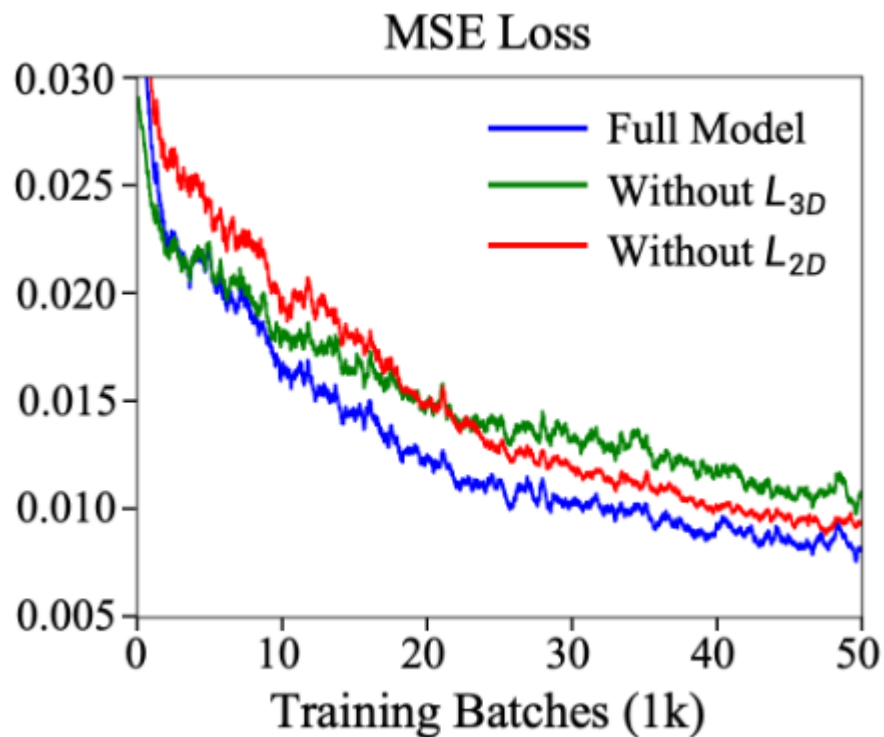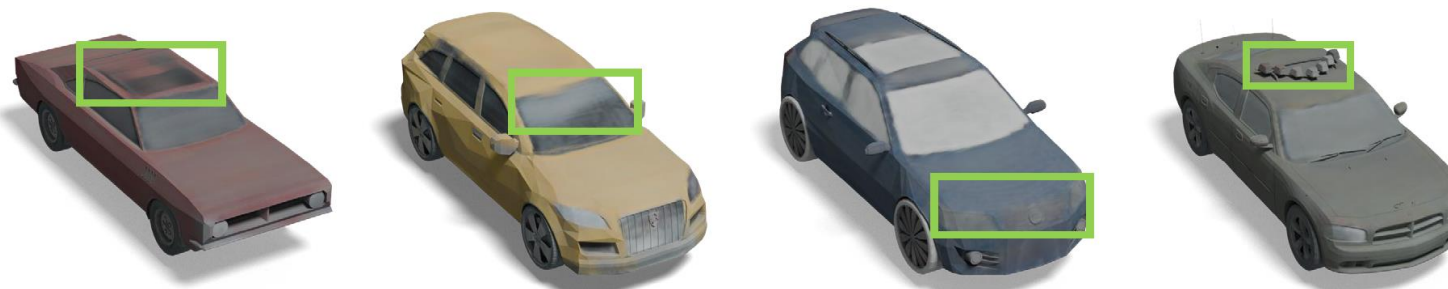| Method	PSNR ↑	LPIPS ↓	SSIM ↑	3D Gaussian Number
Full voxel aligned	23.75	0.17	0.92	16,777,216 (256^3)
Octant-aligned	**32.60**	**0.039**	**0.97**	**79,480**

Ablation Study

- Essentials of different losses

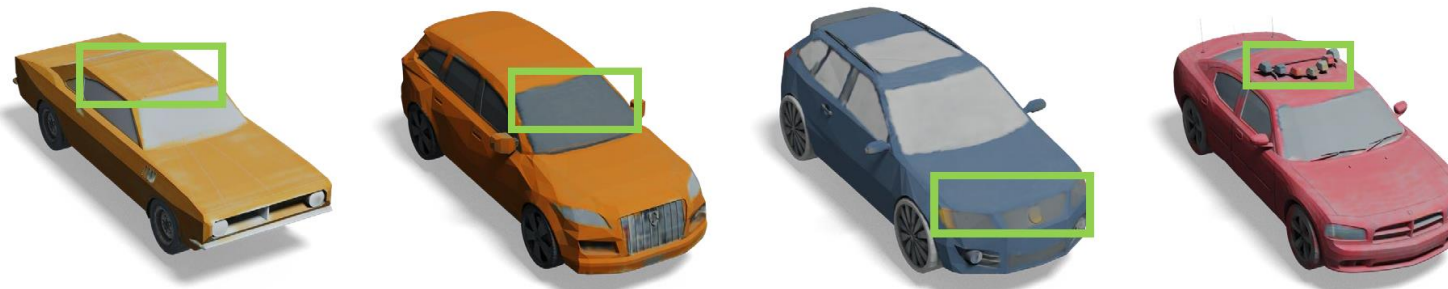# Ablation Study

- Essentials of different losses

w/o L_{2D}

Full Model

Thank You