



Project Page
& Dataset

<https://merl.com/research/highlights/assemblybench>



Code Repo

<https://github.com/merlresearch/AssemblyBench>

AssemblyBench: Physics-Aware Assembly of Complex Industrial Objects

Danrui Li^{1,2}; Jiahao Zhang^{1,3}; Bernhard Egger⁴; Moitrey Chatterjee¹; Suhas Lohit¹; Tim K. Marks¹; Anoop Cherian¹;

¹Mitsubishi Electric Research Laboratories (MERL)

²Rutgers University, ³The Australian National University, ⁴Friedrich-Alexander-Universität Erlangen-Nürnberg

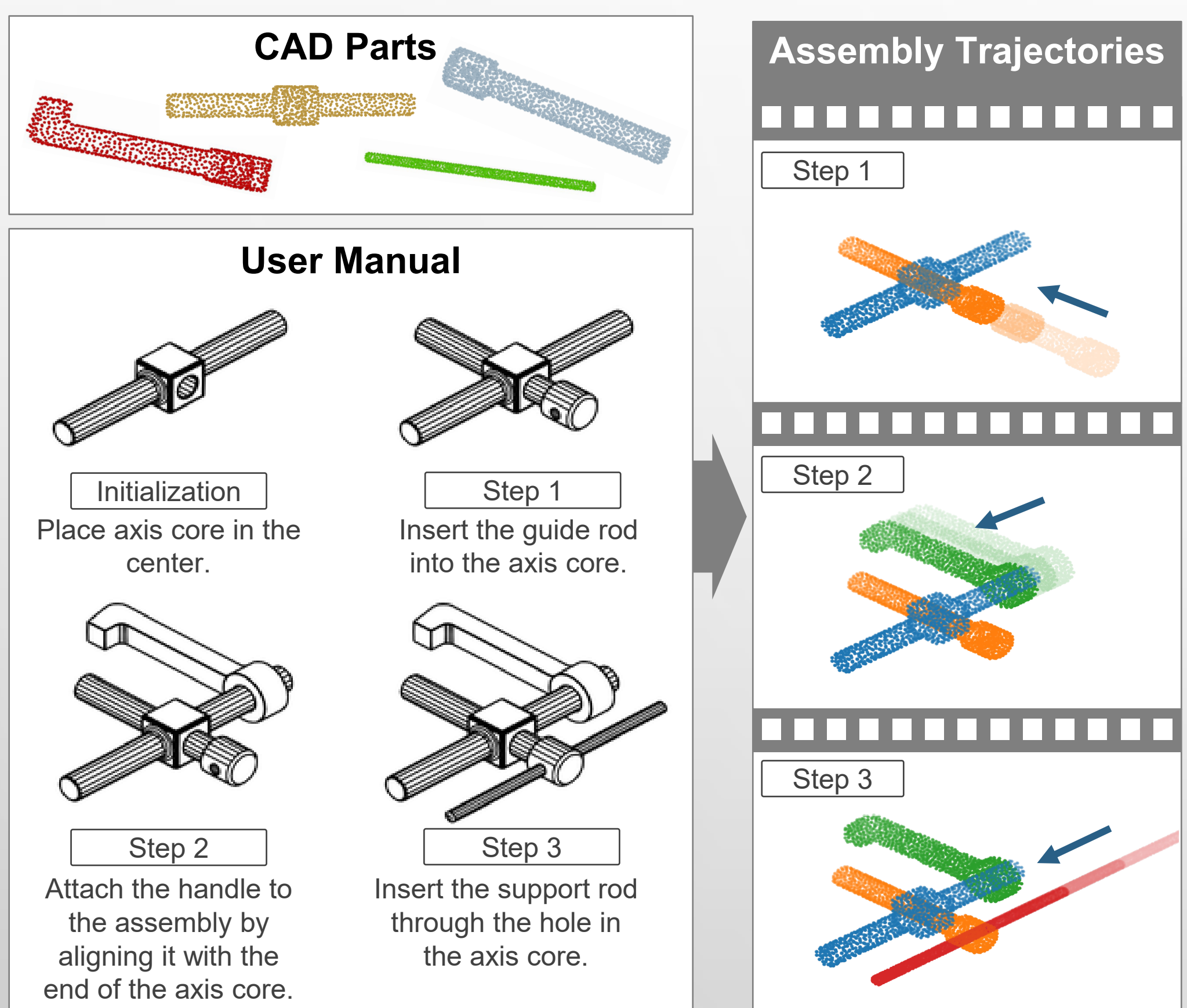
CVPR
JUNE 3-7, 2026



DENVER
COLORADO

Overview

Assembly is not just about placing parts in the right locations, it is about reasoning over the **motion, order,** and **physical feasibility** needed to bring the parts there.

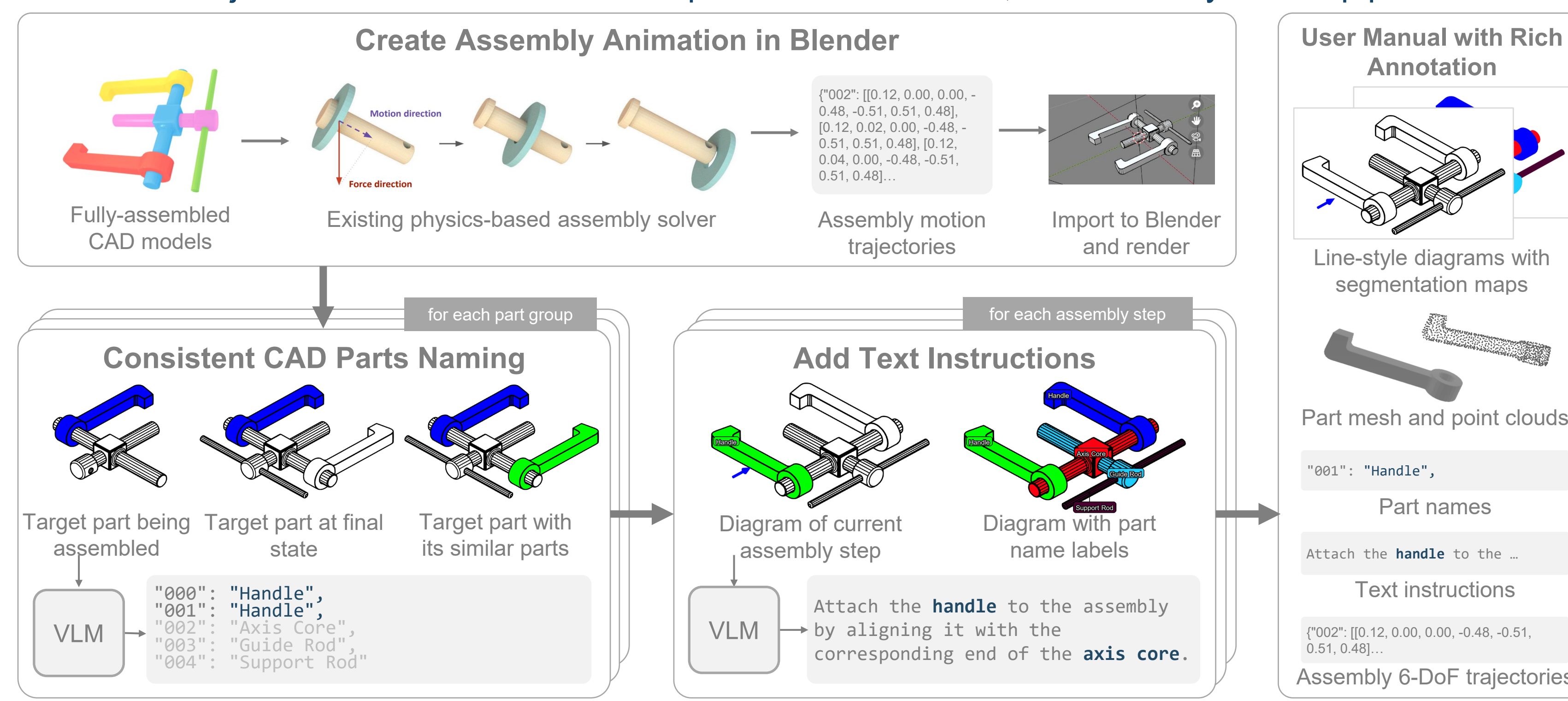


Contributions

- **AssemblyBench Dataset:** Complex industrial part assemblies with multi-modal user manuals and assembly trajectories, produced by a VLM-based generative pipeline.
- **AssemblyDyno Model:** Feed-forward model that takes in multi-modal user manuals and 3D part point clouds, predicting parts' assembly order with **6-DoF assembly motions**.
- **Physics-based Evaluation:** Assess the **physical feasibility** of predictions using a **physics-engine-based** protocol, where our work shows state-of-the-art results.

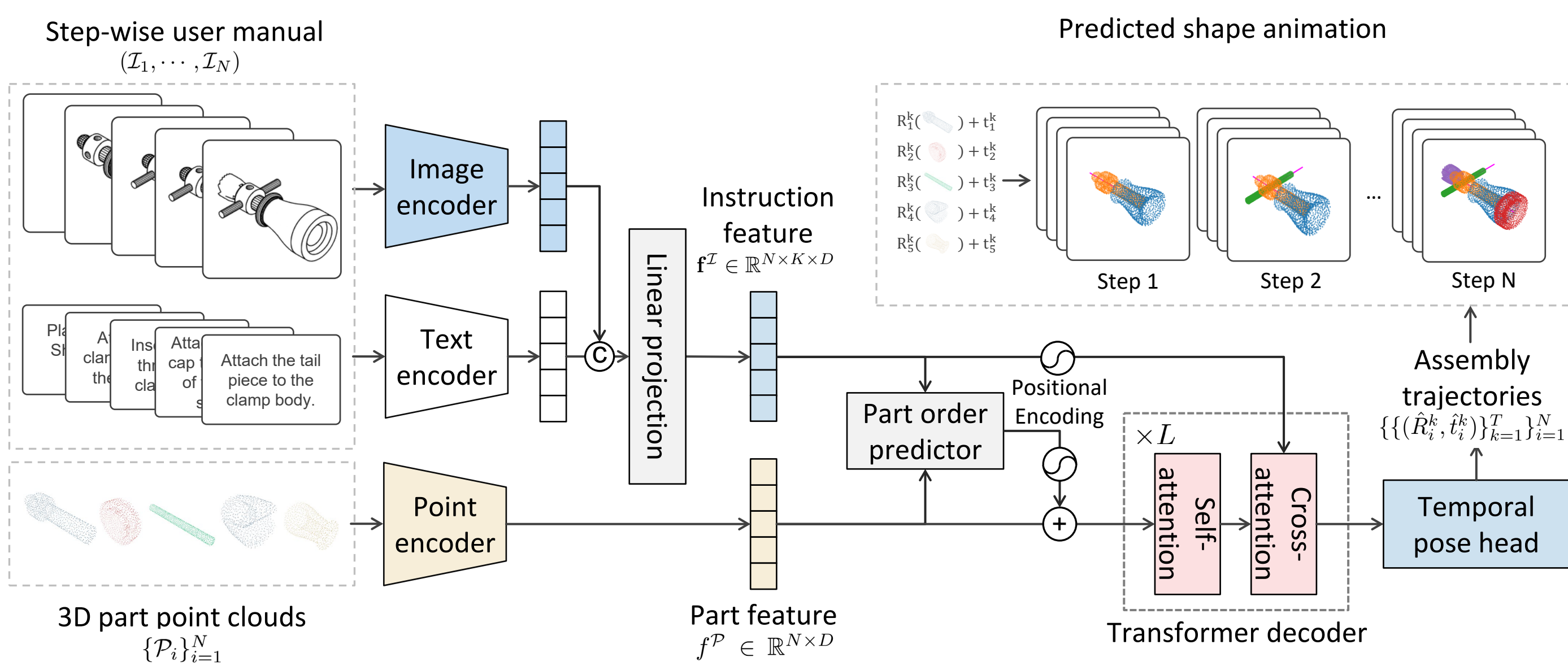
AssemblyBench Data Generation Pipeline Using VLMs

- We use assembly-by-disassembly approach to generate assembly trajectories.
- Trajectories are rendered into step-wise user manuals, annotated by a VLM pipeline.



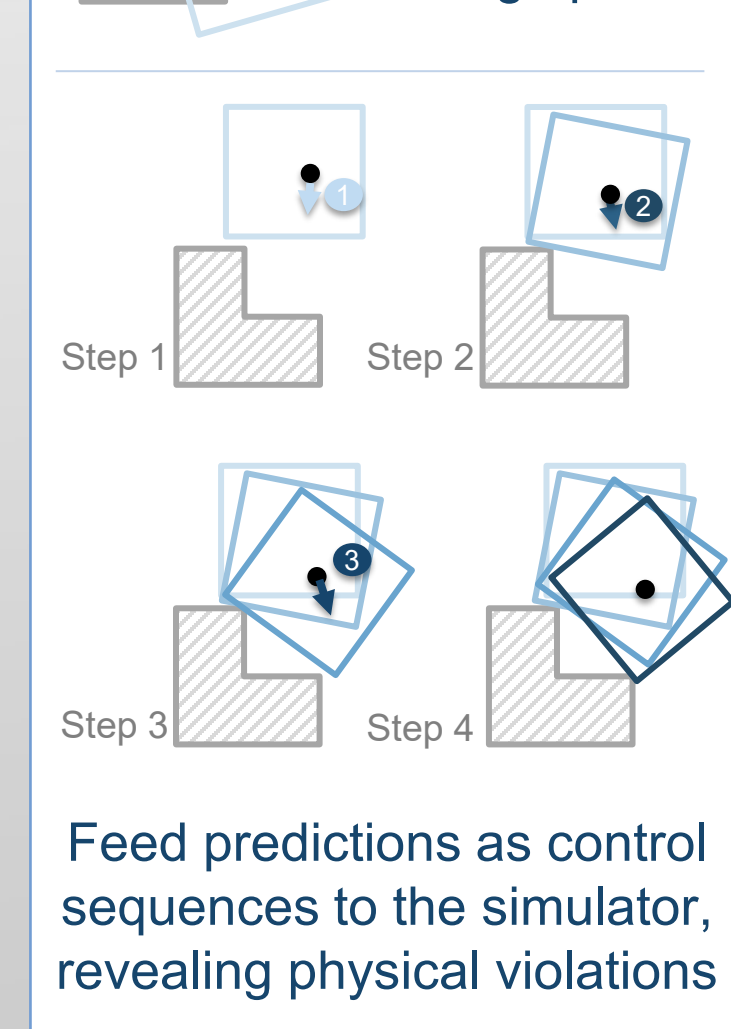
AssemblyDyno Model for Predicting Full Assembly

Our model predicts parts assembly order, final 6-DoF poses, and part motion trajectories in a single forward pass for all the parts jointly.



Physics-based Eval

Predicted trajectories may penetrate through parts



Experiments and Results

- Our new **simulator-agnostic, physics-based** protocol enables stringent evaluation of realistic assembly for complex parts.
- **Multi-modal** manual information is beneficial for challenging assembly tasks, such as the industrial objects in AssemblyBench.

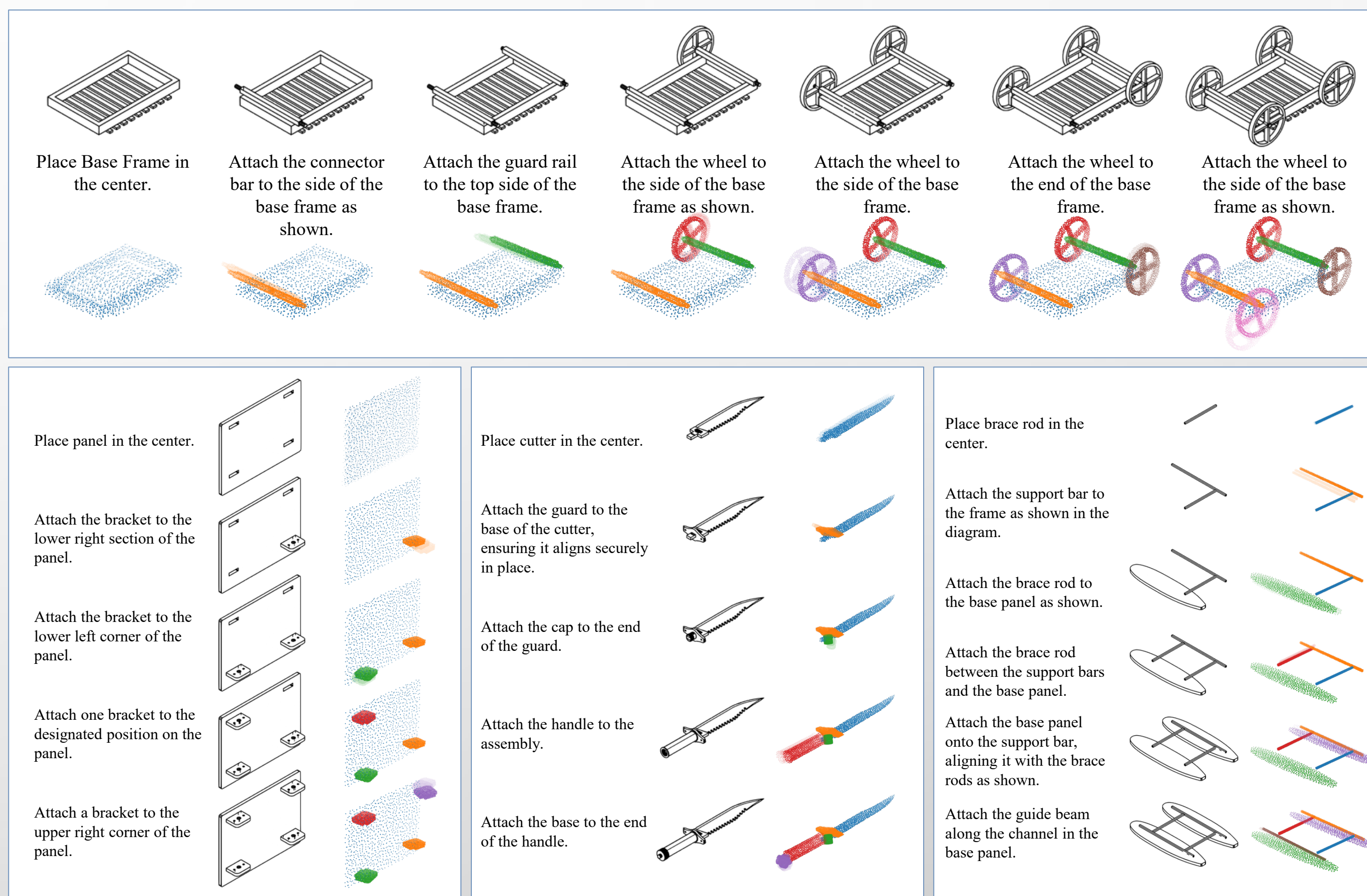


Table 2. Part assembly results on the test split of AssemblyBench. We bold the best results and highlight the second best results in blue.

Model	Ordering KD↑	Final Pose Estimate				Assembly in Physics Simulator						
		SCD(10^{-3})↓	PA(%)↑	SR(%)↑	ACD(10^{-3})↓			FCD(10^{-3})↓				
					25%	50%	75%	25%	50%	75%		
<i>Standard Setting</i>												
AssemblyDyno	0.819	3.91	71.21	34.64	6.95	34.77	156.74	3.31	15.97	110.30	42.76	13.57
w/o text	0.805	3.83	70.28	35.00	6.99	33.68	148.86	3.03	17.25	99.77	41.77	15.00
w/o trajectory	0.819	4.42	67.63	30.00	104.73	188.94	317.76	11.95	58.52	199.64	22.09	1.43
ManualPA [43] (ICCV'25)	0.788	4.24	70.04	33.57	104.66	192.79	325.50	11.75	56.04	209.09	23.24	1.79
<i>Use GT part orders</i>												
AssemblyDyno	–	3.87	79.69	44.29	3.23	9.97	29.74	1.50	4.43	12.41	70.15	33.57
w/o text	–	3.78	78.19	42.86	3.45	10.77	35.28	1.61	4.85	14.32	67.96	31.79
w/o trajectory	–	3.80	79.31	43.21	136.48	235.16	390.23	6.90	37.39	197.65	29.85	3.57
ManualPA [43] (ICCV'25)	–	4.15	77.40	39.28	142.32	230.52	382.62	6.02	35.00	196.51	31.33	2.14