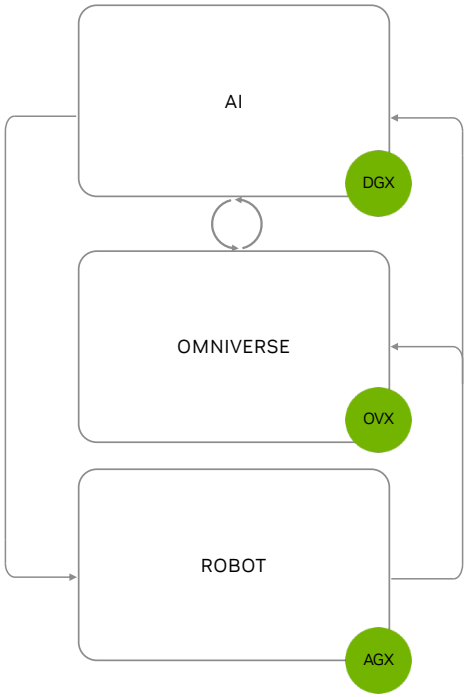
OpenUSD： Physical AI在智能制造领域的应用探索与思考

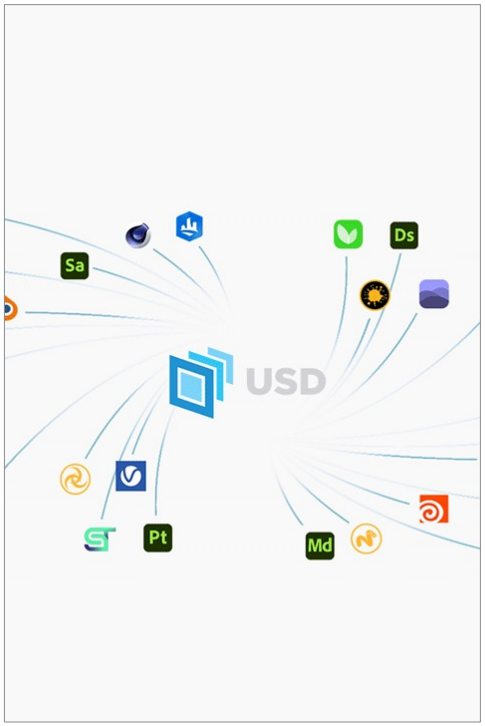
Vigor Cao

Generative AI Enters the Physical World

3 Computers Required



The Next Era of Digitalization Relies on Key Technologies



OpenUSD

RTX Technology

Accelerated Computing Available Everywhere

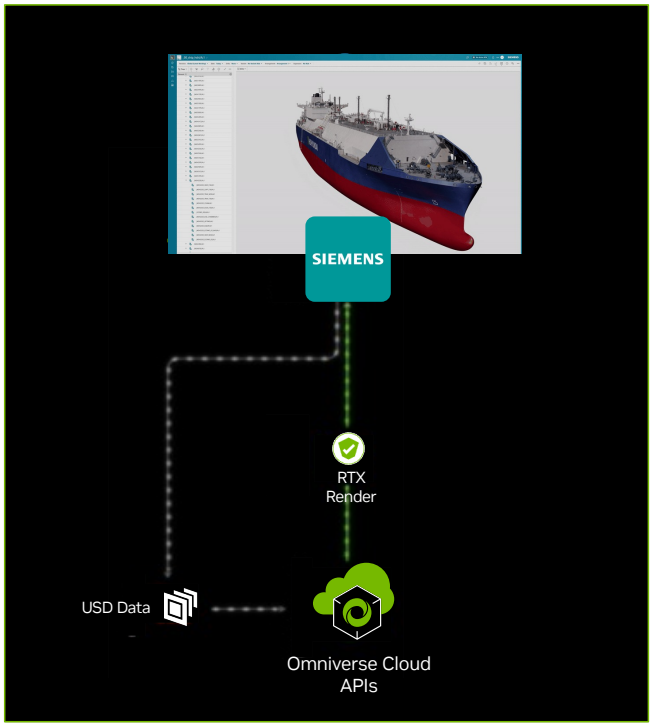
Generative AI, Computer Vision Revolution

Develop A New Era of 3D Apps & Workflows

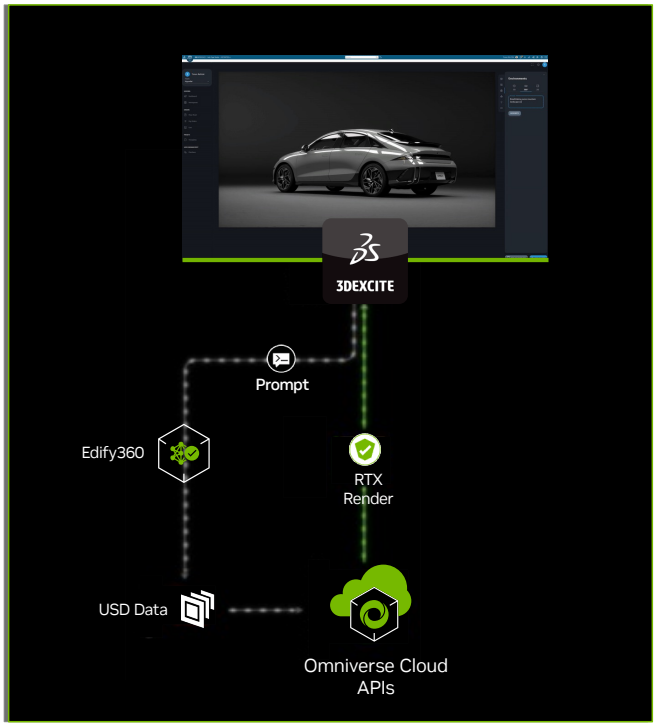
Physically Based Visualization

Real-Time Collaboration

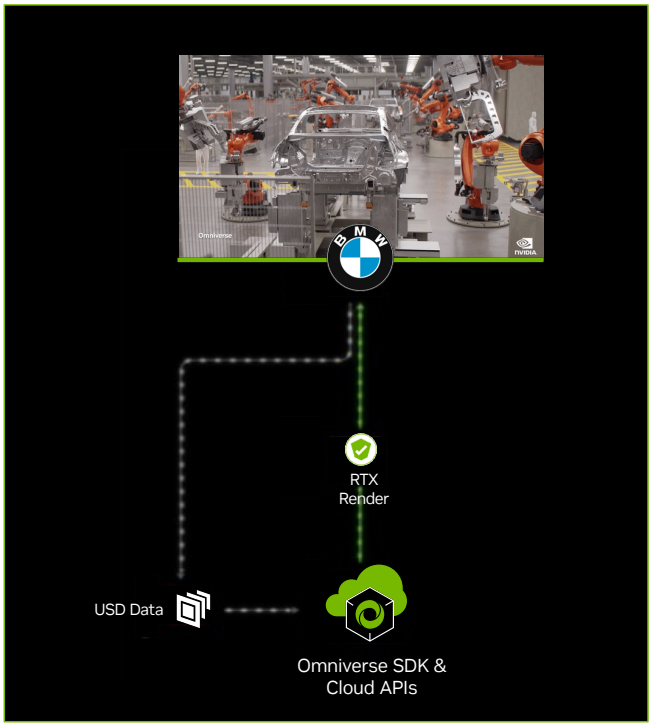
Develop AI-Enabled Digitalization Applications



Siemens Digital Industries



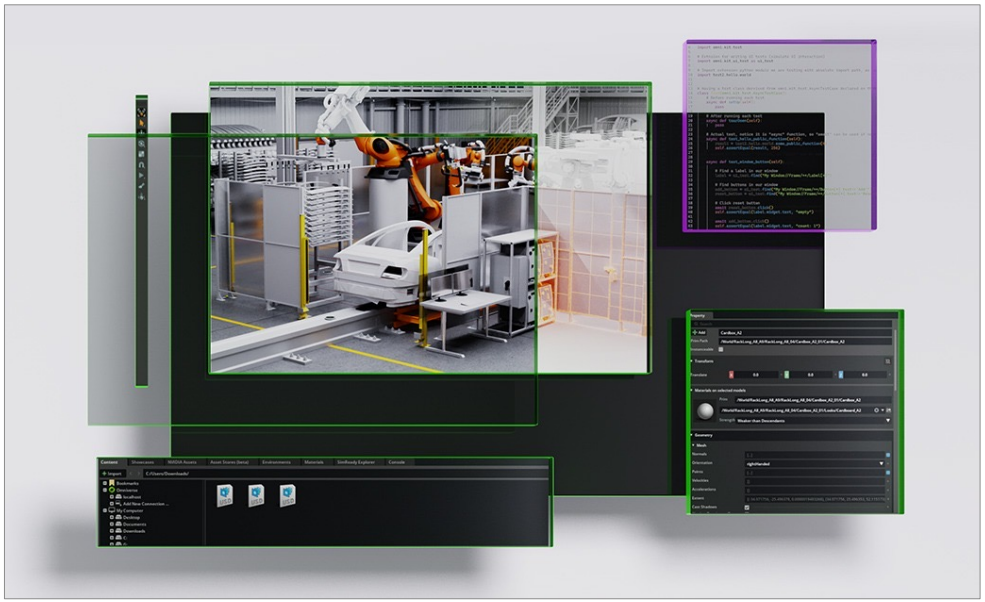
3DEXCITE, Dassault Systemes



BMW Group

Omniverse Kit App Repository & Templates

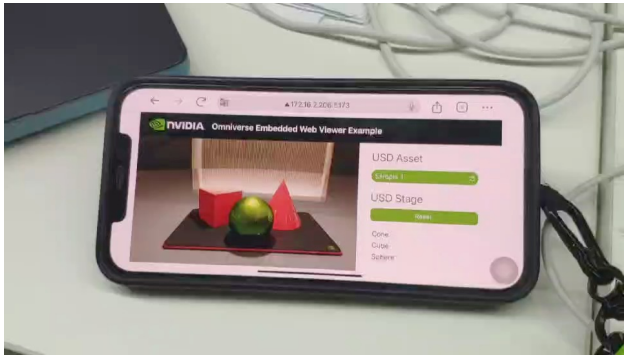
Standardized Templates to Bootstrap Development



- Quickly stand up a fully functional Kit-based application with standardized templates
- Tooling enables easy creation, naming and deployment with just a series of questions

Available now on GitHub

Get started on omniverse.nvidia.com



Omniverse Kit App Templates – Available Now

- Base Editor
- Service
- USD Composer
- USD Explorer
- USD Viewer

Coming Soon

- Embedded Web Viewer

NVIDIA NIM Microservices for OpenUSD LLM, 3D, Physics and Materials Generative AI

Generative AI for OpenUSD

Available on NVIDIA API Catalog

Coming Soon

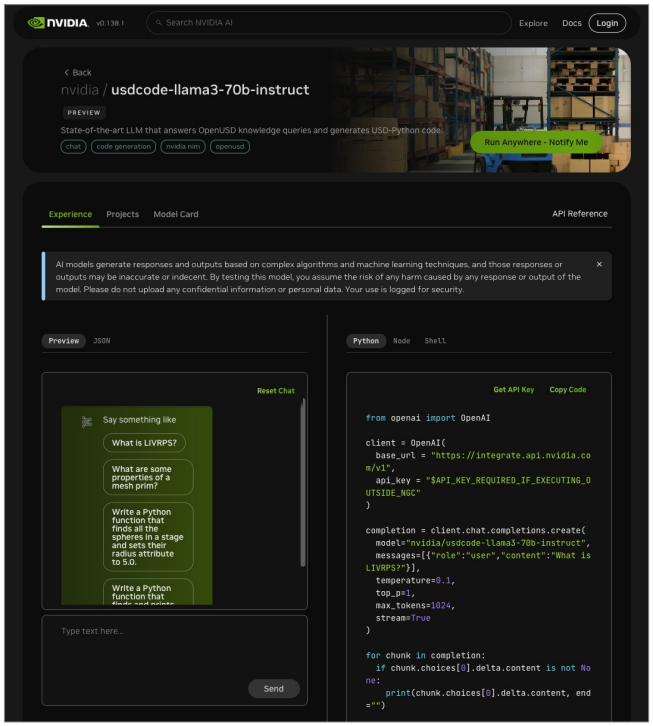
OpenUSD for New Industries

Robotics
OpenUSD to URDF

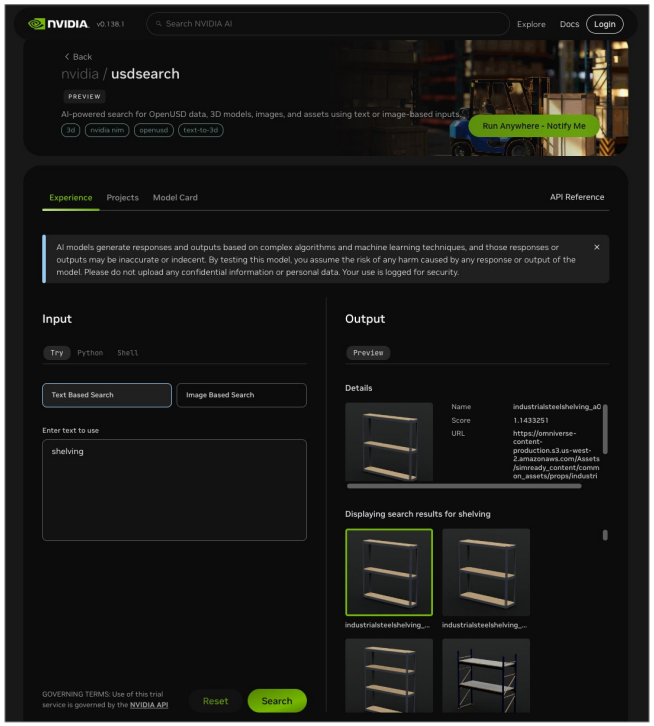
Industrial Design & Engineering
Computational Fluid Dynamics rendering with OpenUSD

NVIDIA NIM for OpenUSD Generative AI Models

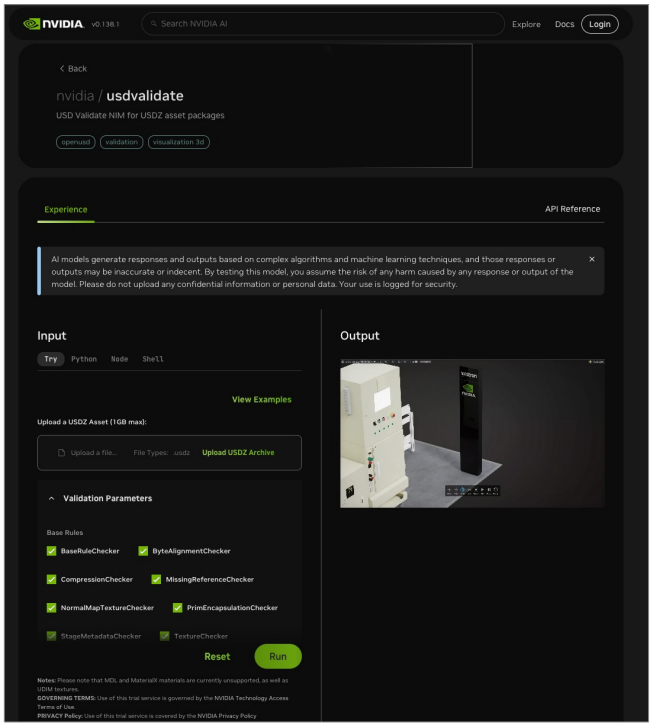
Available in Preview on NVIDIA API Catalog



USD Code



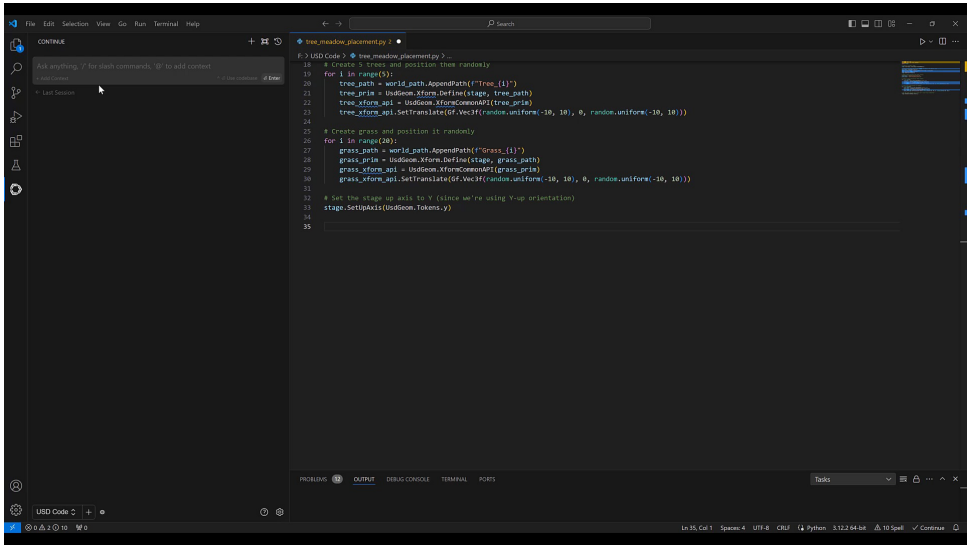
USD Search

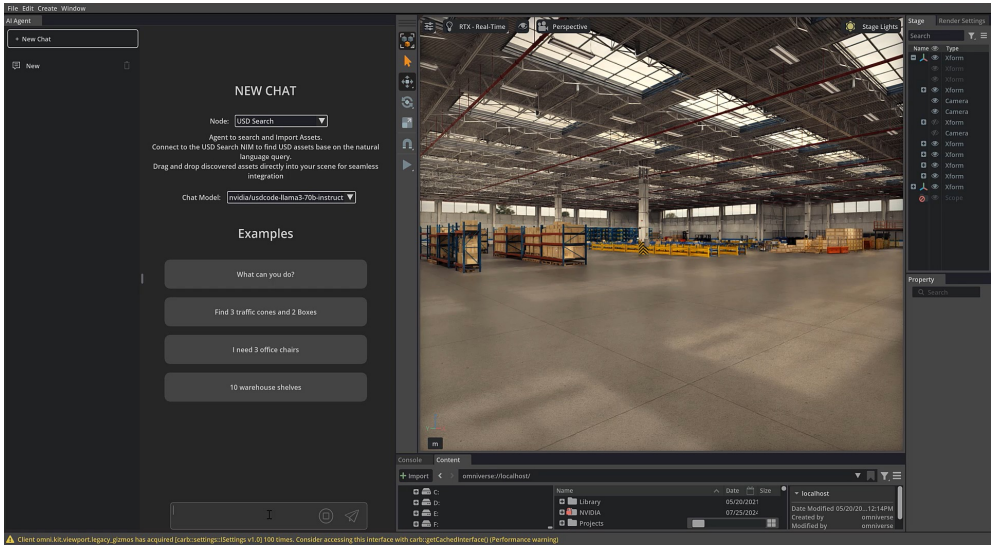


USD Validate

Accelerated Digital Twin Development with Generative AI

Streamline your development workflows with NVIDIA USD NIM Inference Microservices





USD Code

Quickly answer OpenUSD knowledge queries and generate USD Python code

Try on NVIDIA API Catalog

USD Search

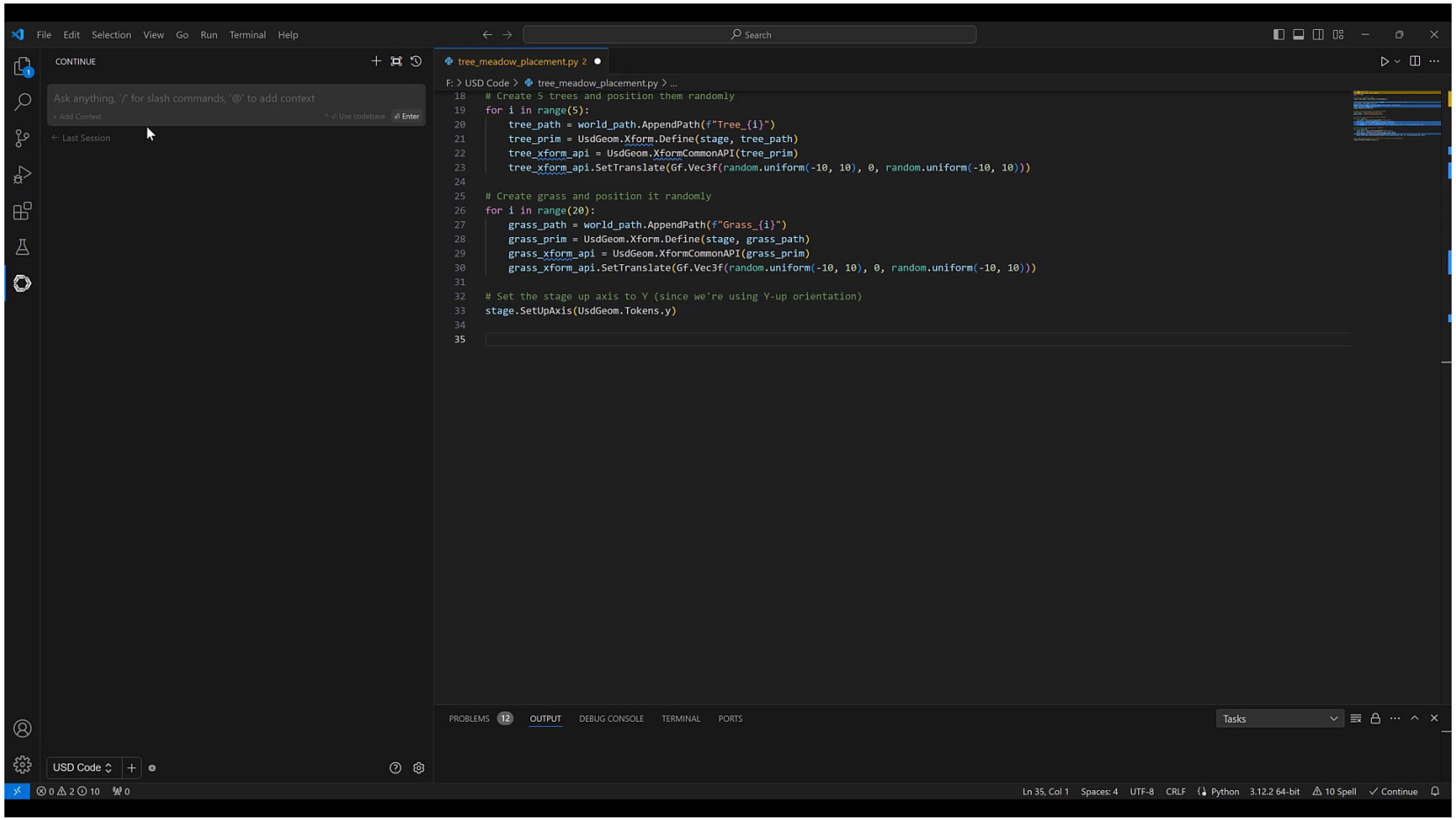
Leverage AI-powered search for OpenUSD data, 3D models, images, and assets

Try on NVIDIA API Catalog

NVIDIA

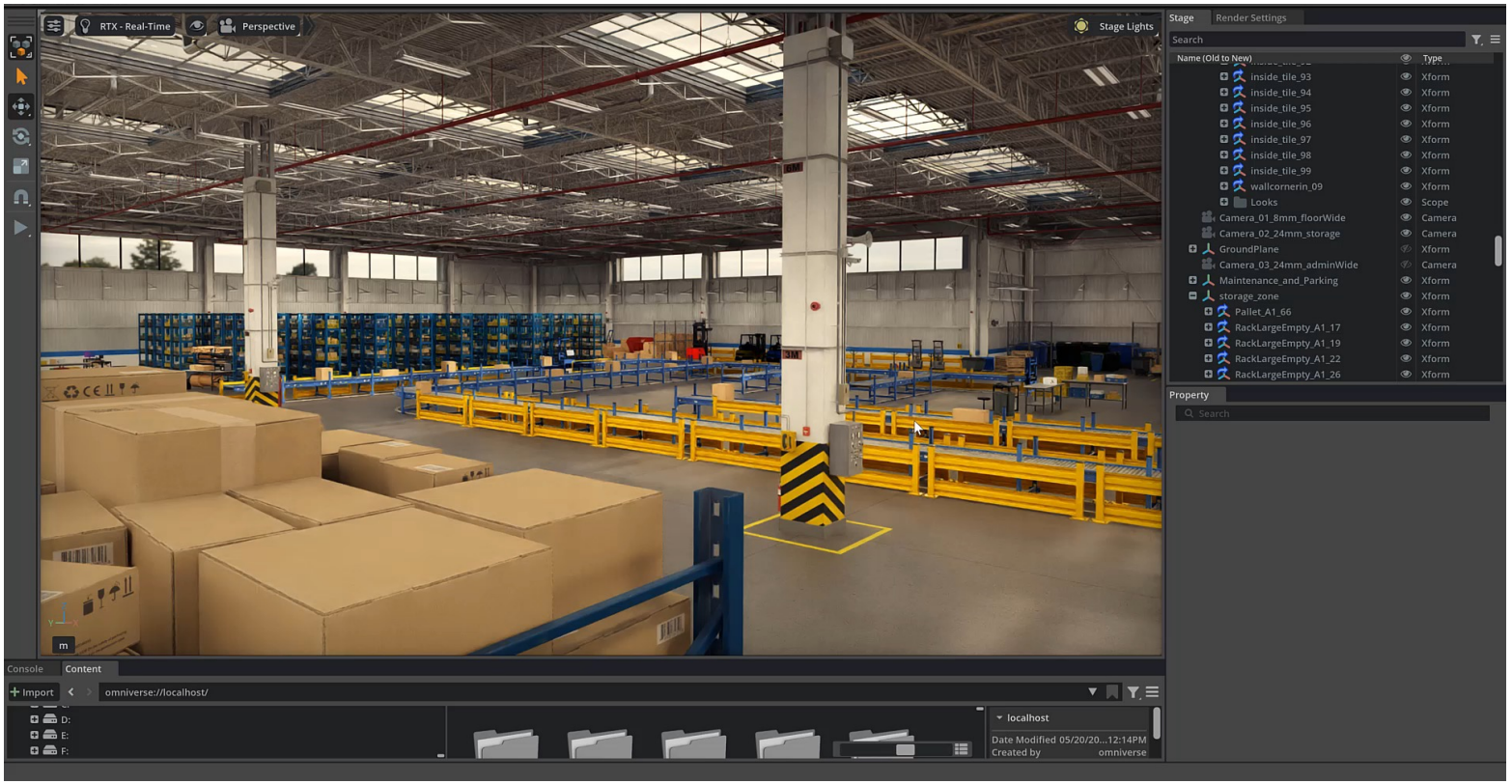
Use Case 1: Code Generation (Python USD)

Simplify development workflows with USD Code



Use Case 2: Search Assets, Write Python Code

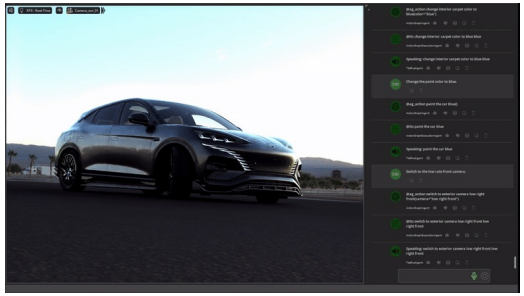
Simplify development and synthetic data generation workflows with USD Search, USD Code



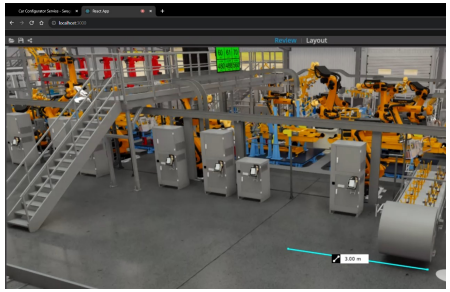
Omniverse connects AI to the physical world

NVIDIA Omniverse

NVIDIA NIMs



RAG Virtual Salesbot
NVIDIA NeMo, Omniverse Cloud APIs, ChatUSD



RAG Virtual Assistant
NVIDIA NeMo, Omniverse Cloud APIs, ChatUSD

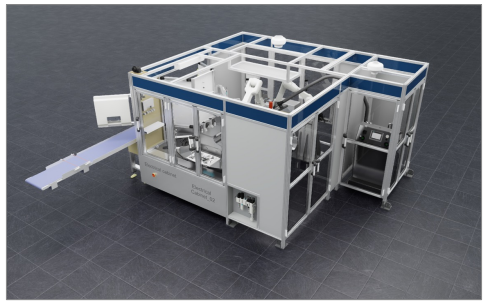
Llama2B NIM in Omniverse
Llama2B, Omniverse Kit Extension, ChatUSD

Virtual Factory Integration

Factory Digital Twins

Amazon Robotics

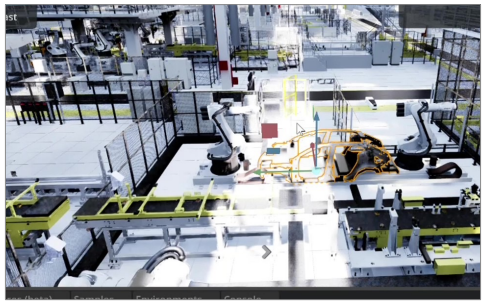
BMW Group



Continental AG

Delta Electronics

Foxconn



Lotus Cars

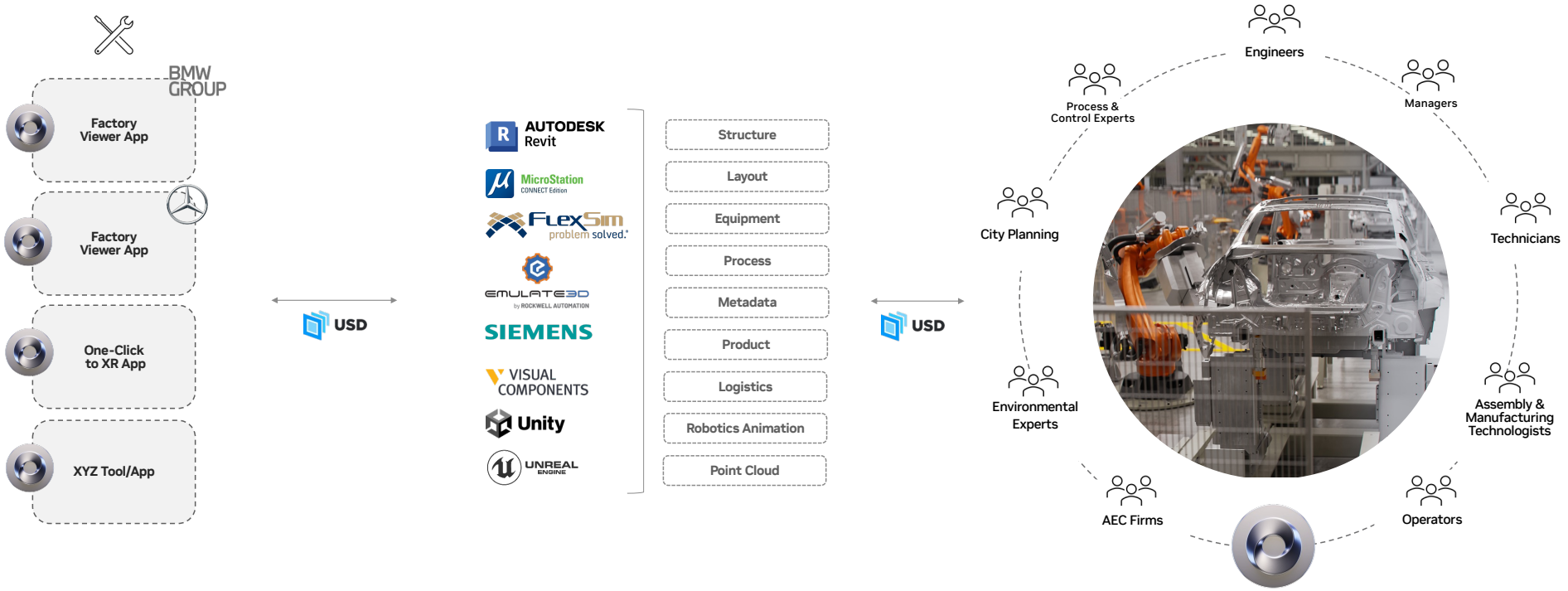
Toyota

Wistron

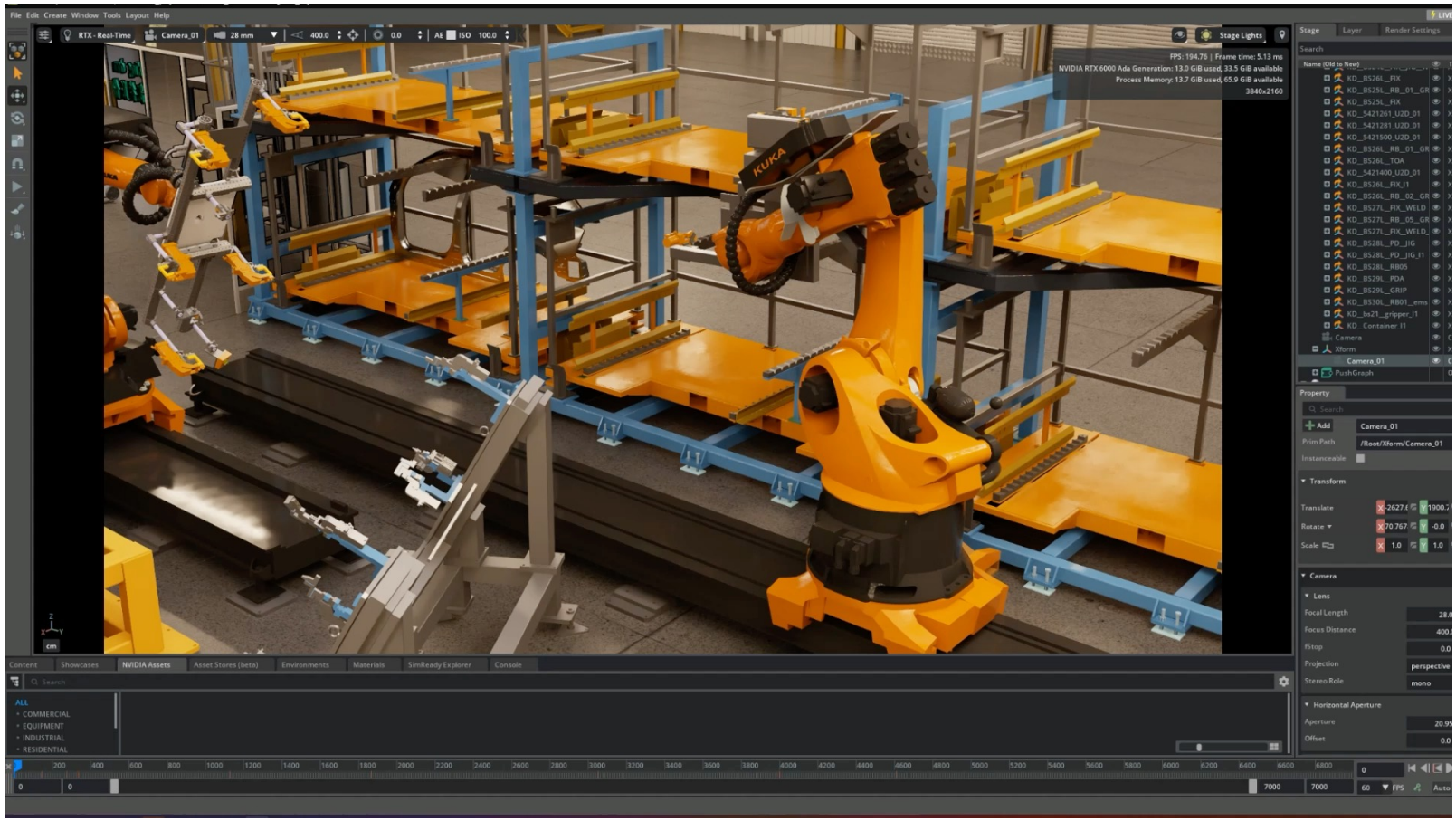
Develop Tools, Apps, Workflows for Virtual Factory Integration

Unify industrial CAD, design, datasets, and review, interact and navigate in RTX real time

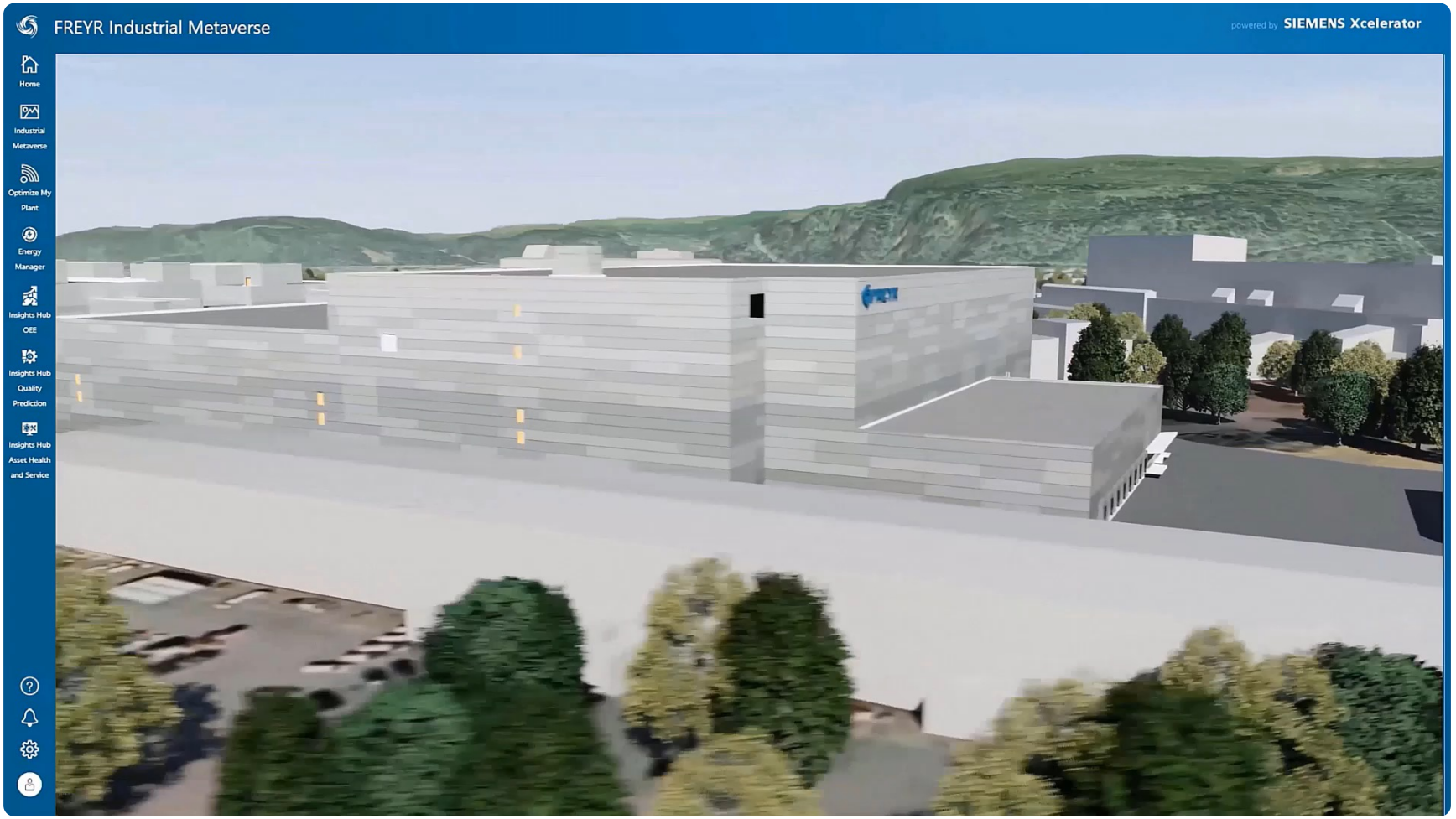
1 **Develop Tools, Apps** → 2 **Connect Existing Tools, Data** → 3 **Enable New Workflows, Experiences**



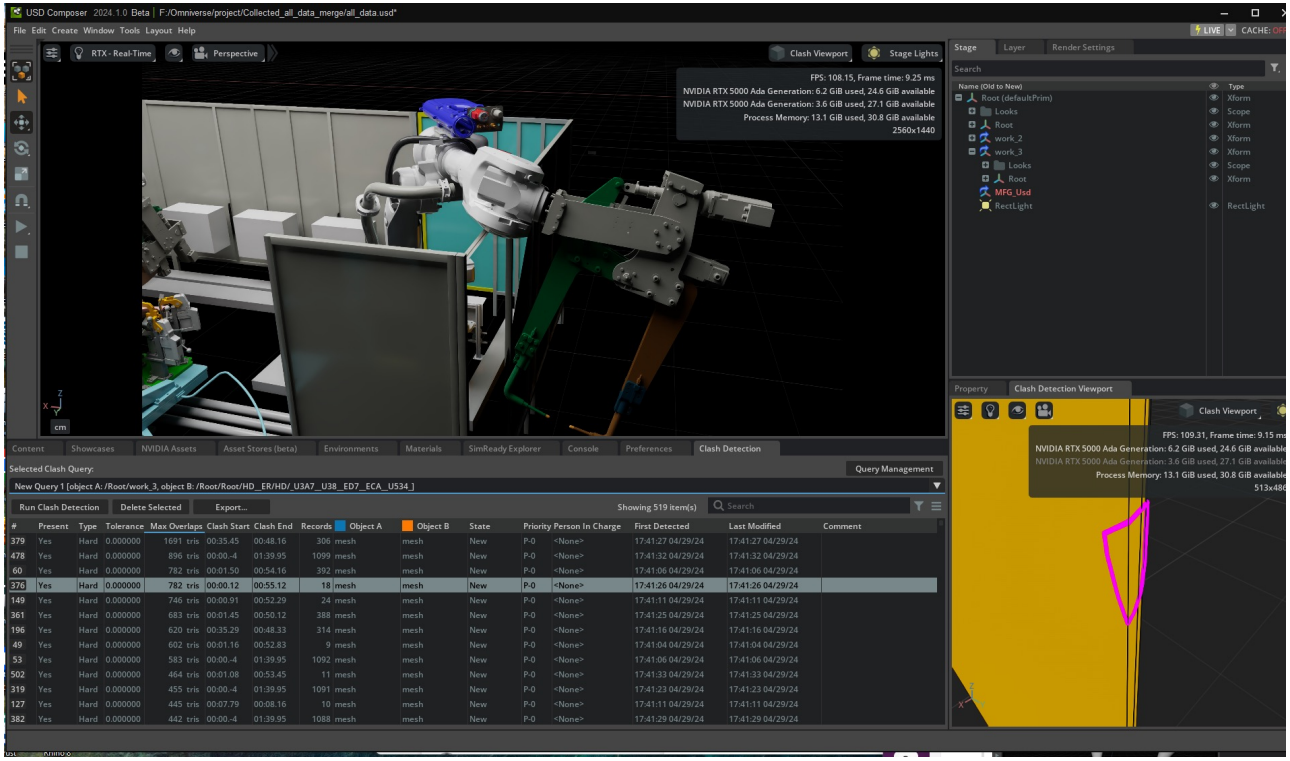
High Fidelity Animation

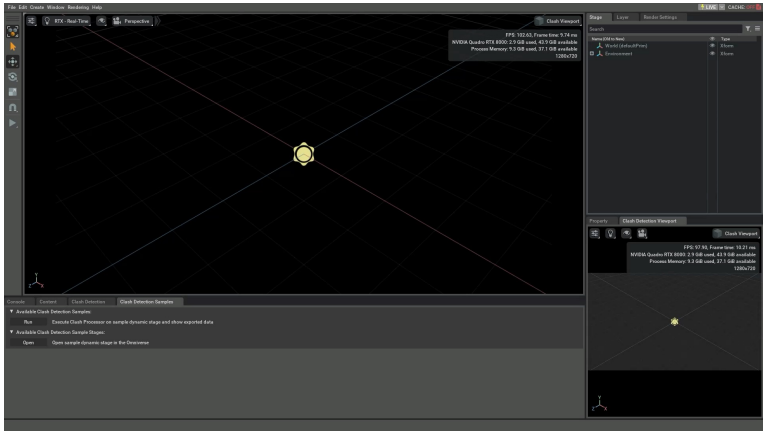


APP STREAMING IN WEB PAGE



CLASH DETECTION

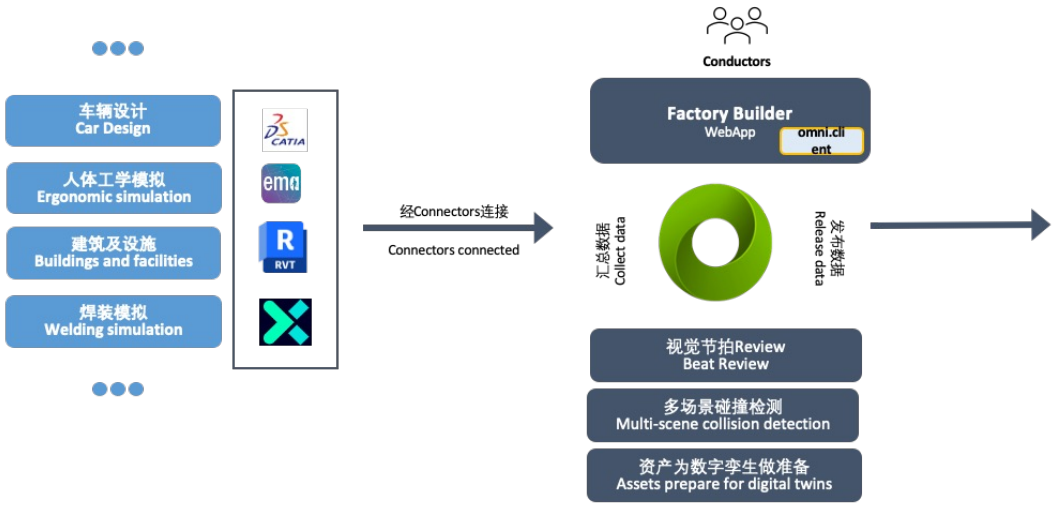


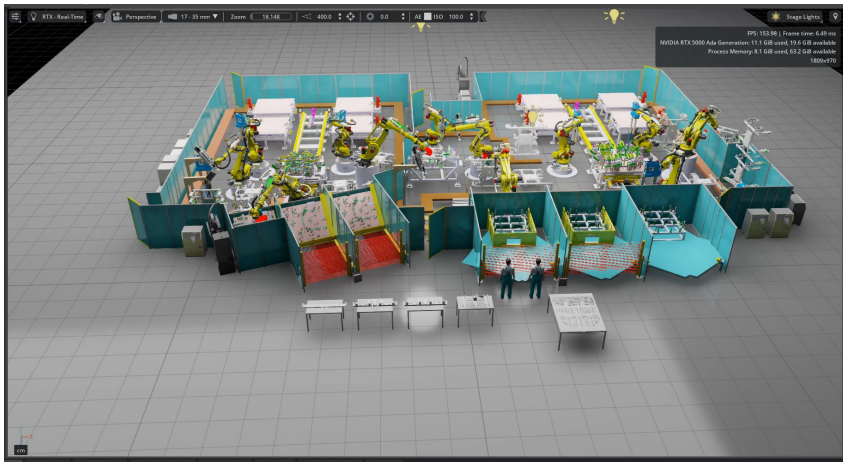


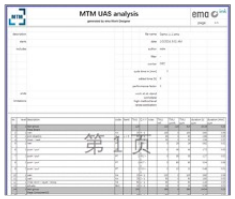
https://docs.omniverse.nvidia.cclash-detectionom/extensions/latest/ext_.html

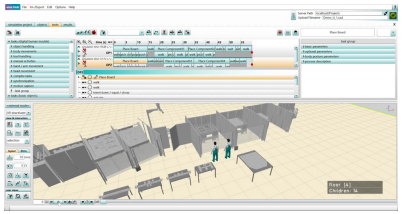
OpenUSD Ecosystem in Virtual Factory

- 人体节拍仿真与机械臂仿真融合



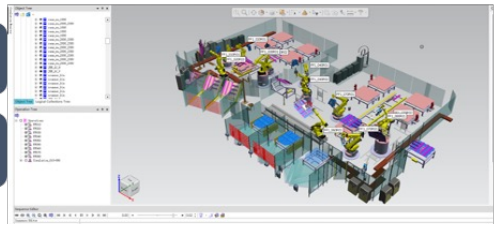






科学计算工时
Scientific time calculation

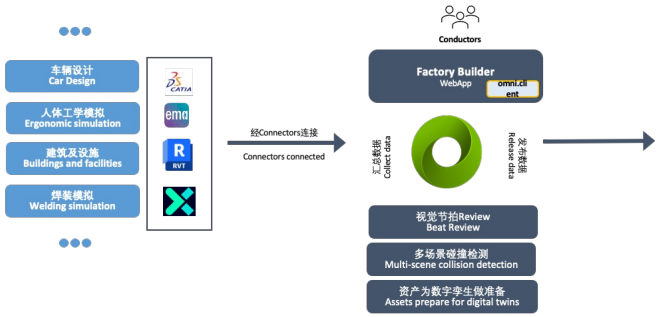
实时验证和调整
Real-time verification and adjustment



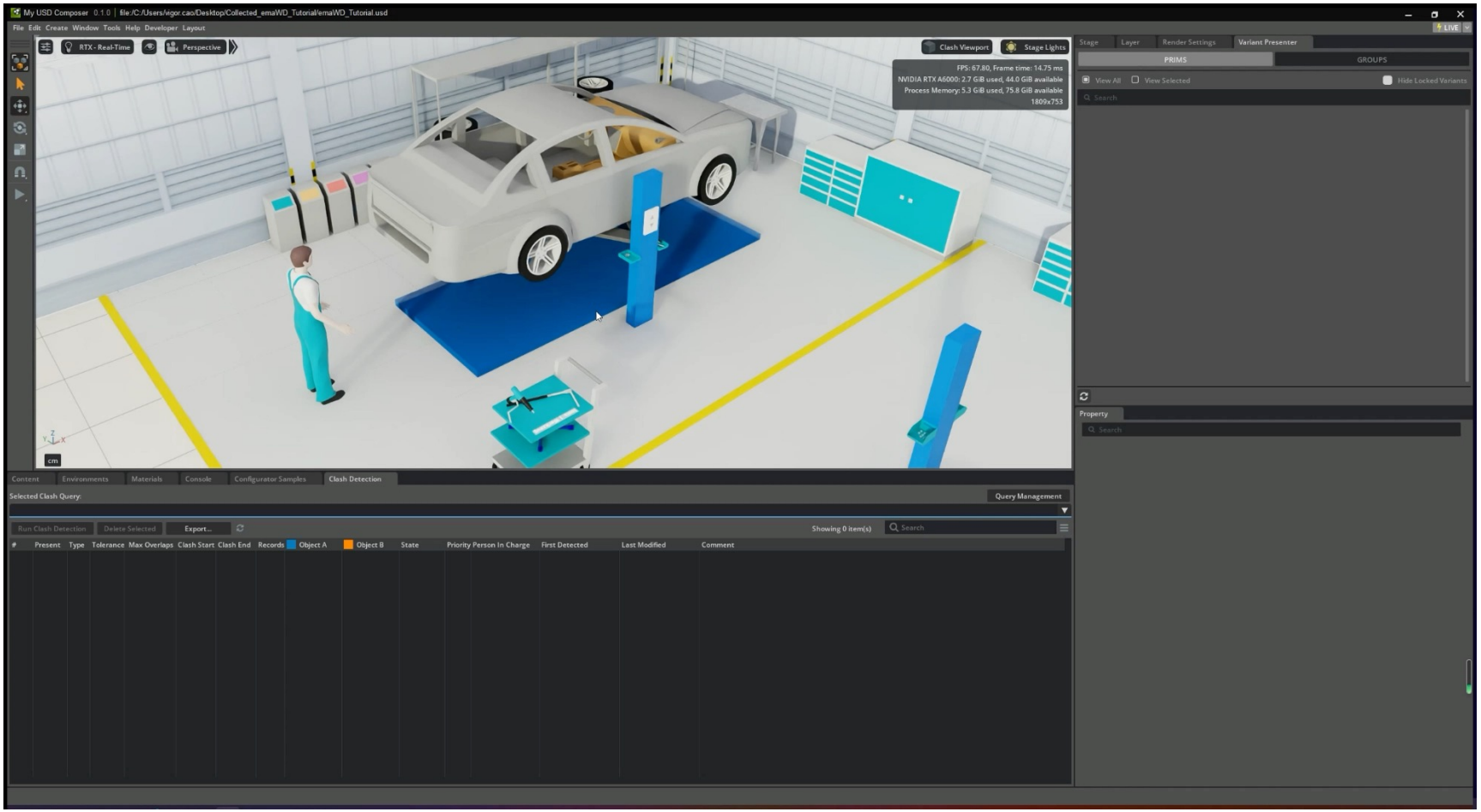
机械臂干涉模拟
Mechanical arm interference simulation

PLC虚拟调试
PLC virtual debugging

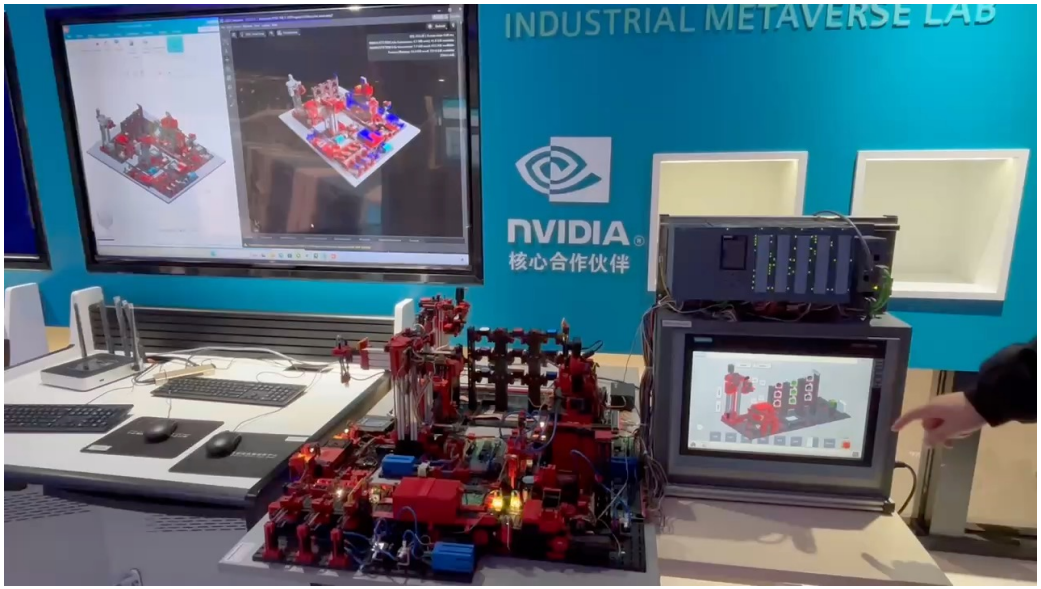
The Result of Human Simulation in Omniverse



Clash Detection in Multi-Software

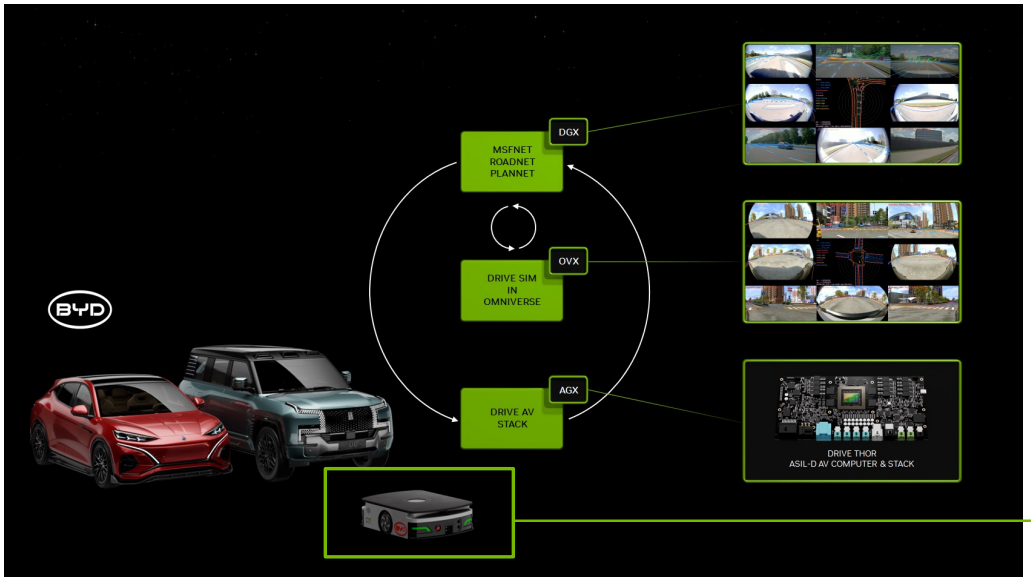


PLC Live Sync with Omniverse

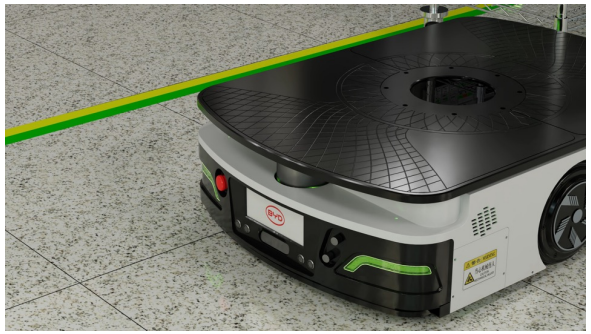


The Phase Result of AMR

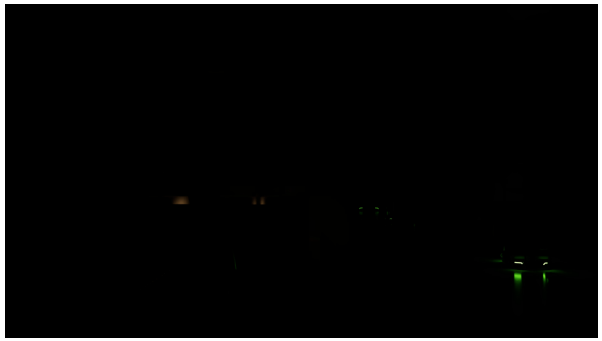
- Using Omniverse's features, digitize the scene and provide the accuracy of the visual AI algorithm for the car in simulation mode



Reconstruction of AMR

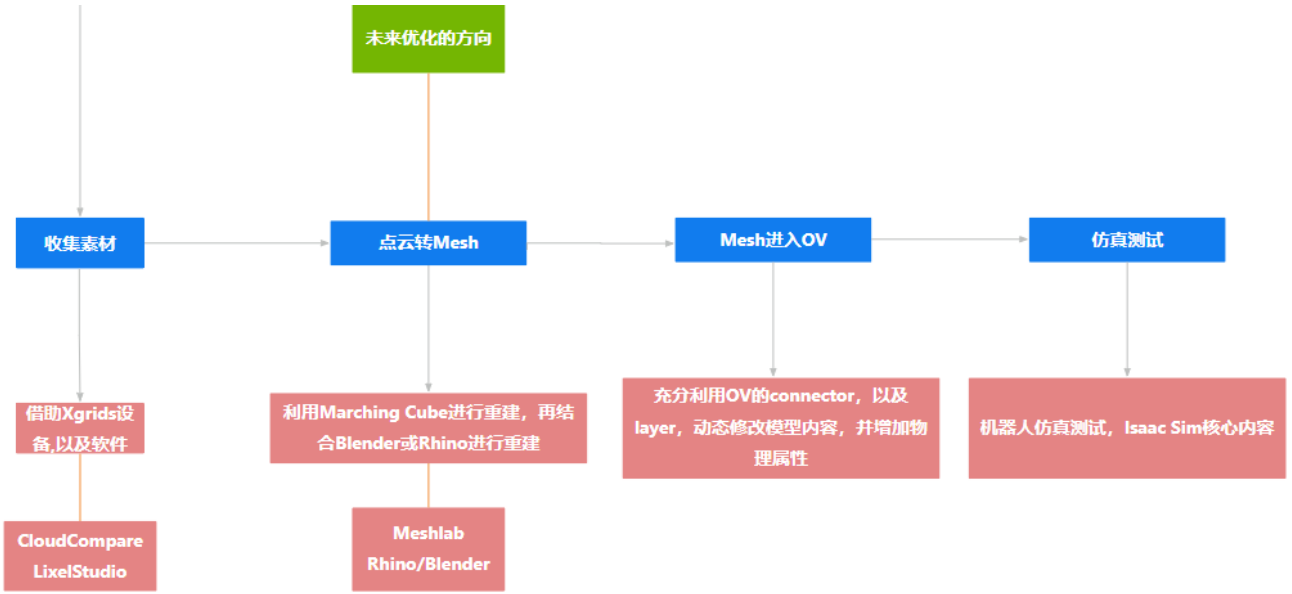


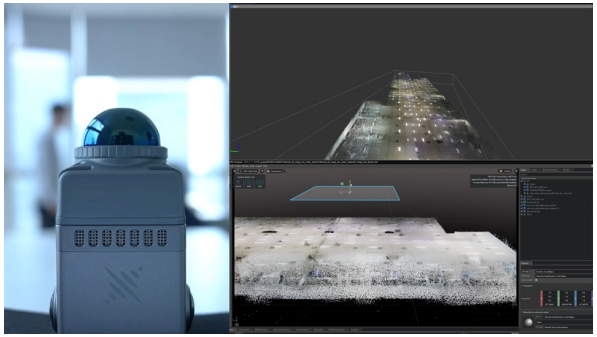
Reconstruction of Factory

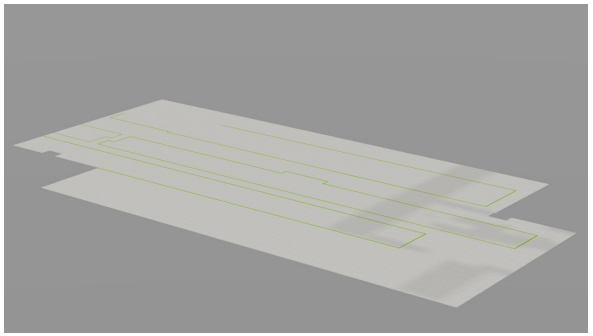


The Phase Result of AMR

- The workflow of The PoC

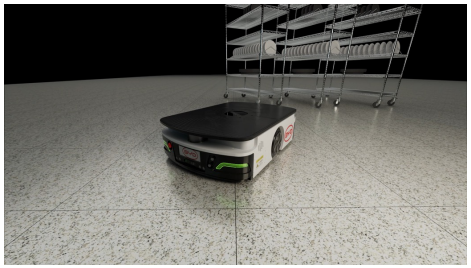


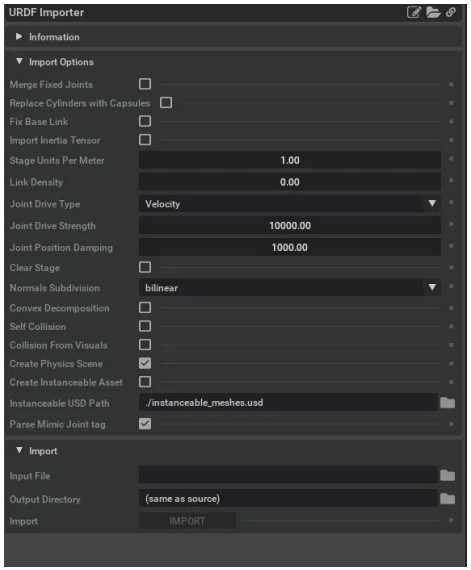


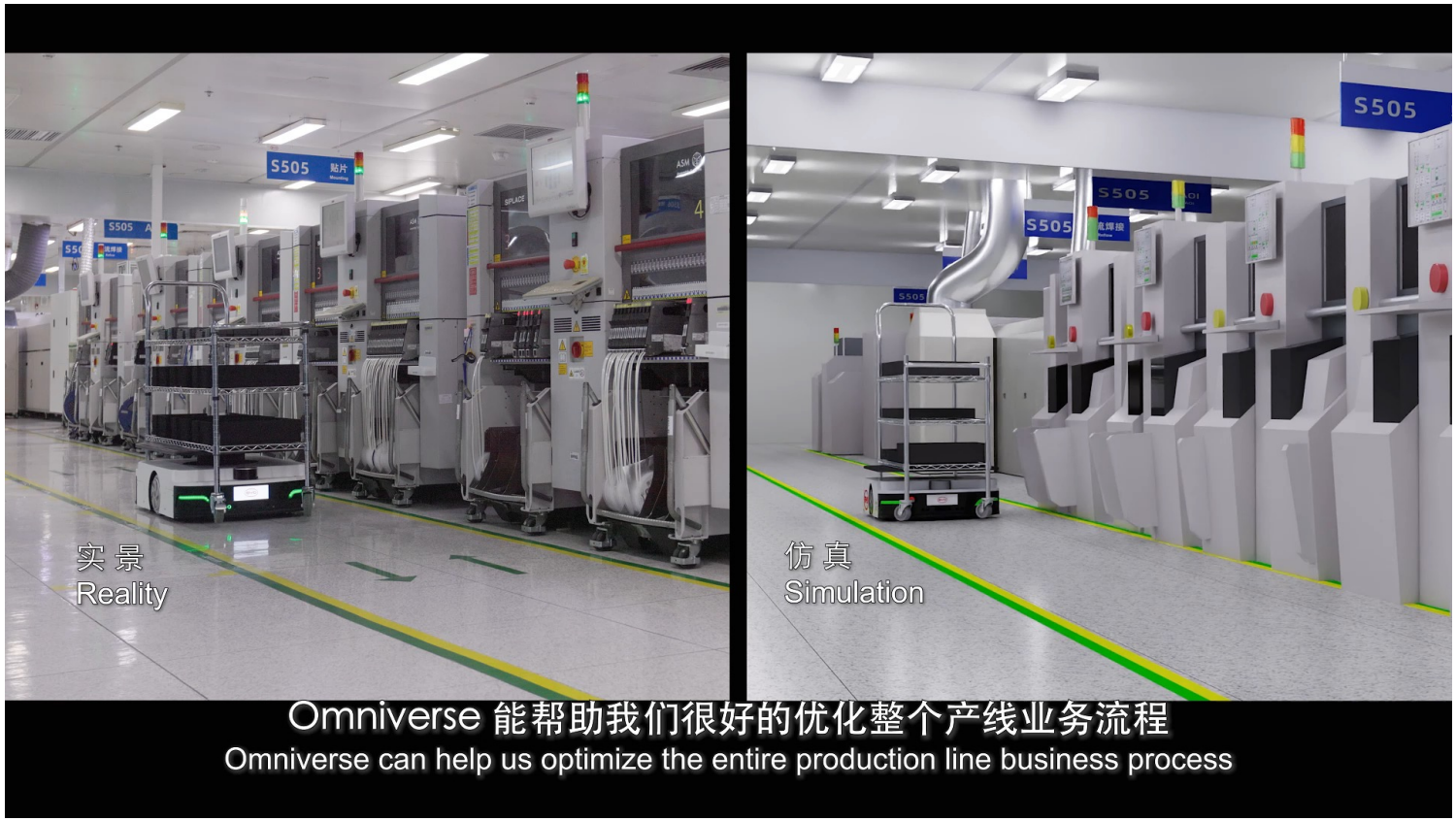


AMR仿真阶段性成果

- 仿真的目的：是为了更好提高AMR小车实际工作的效率。







NVIDIA Metropolis

Development platform for building AI-powered Infrastructure

AI Agents

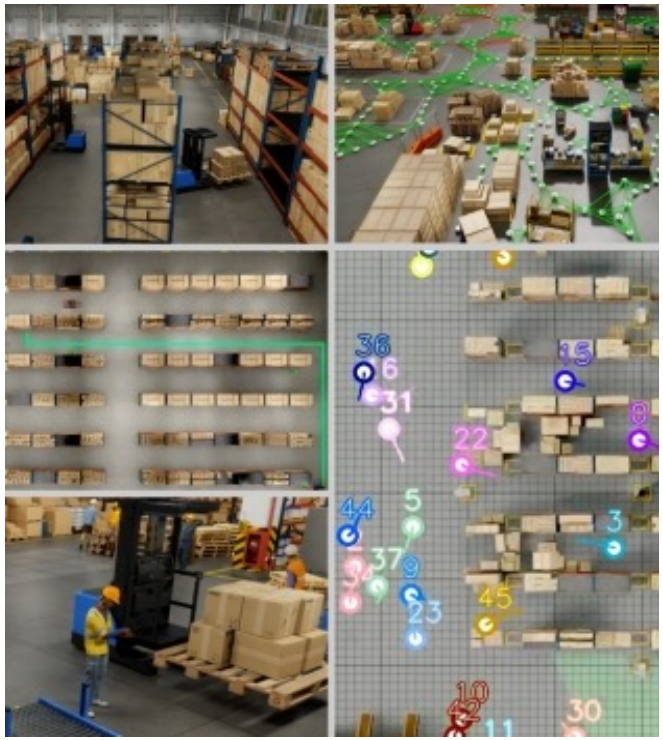
For operations managers

Multi-Camera

For worker safety & factory efficiency

Automated Visual Inspection

For production-line Quality Assurance

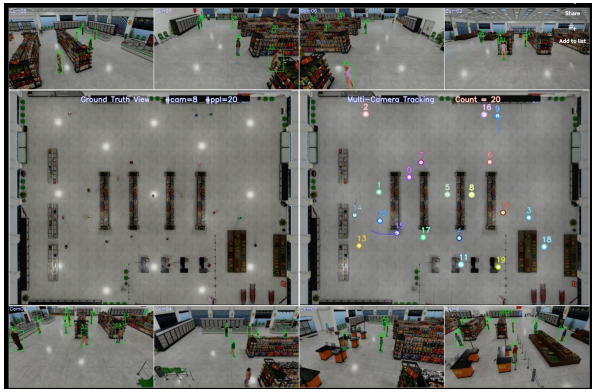


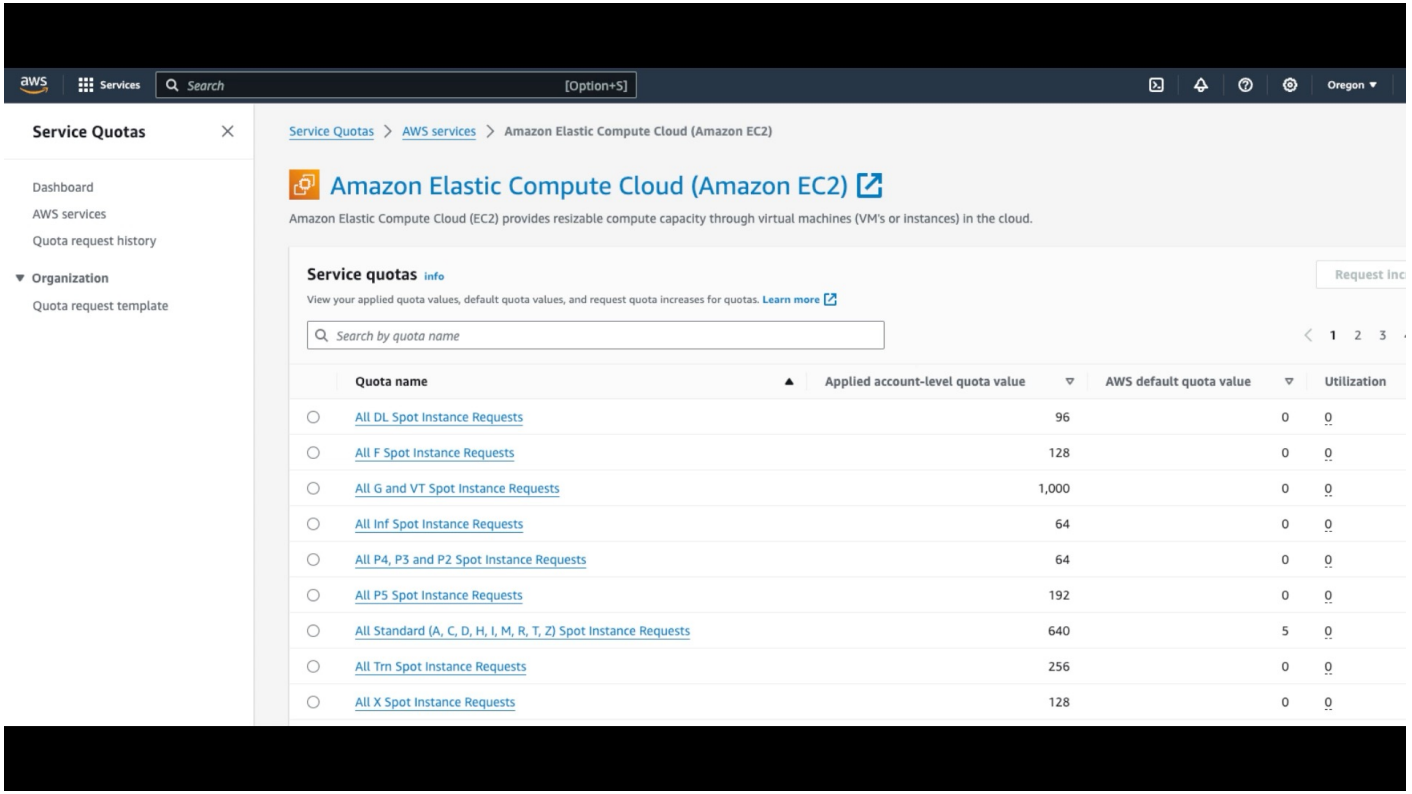
NVIDIA

人体工程监控预测

AI+Monitor

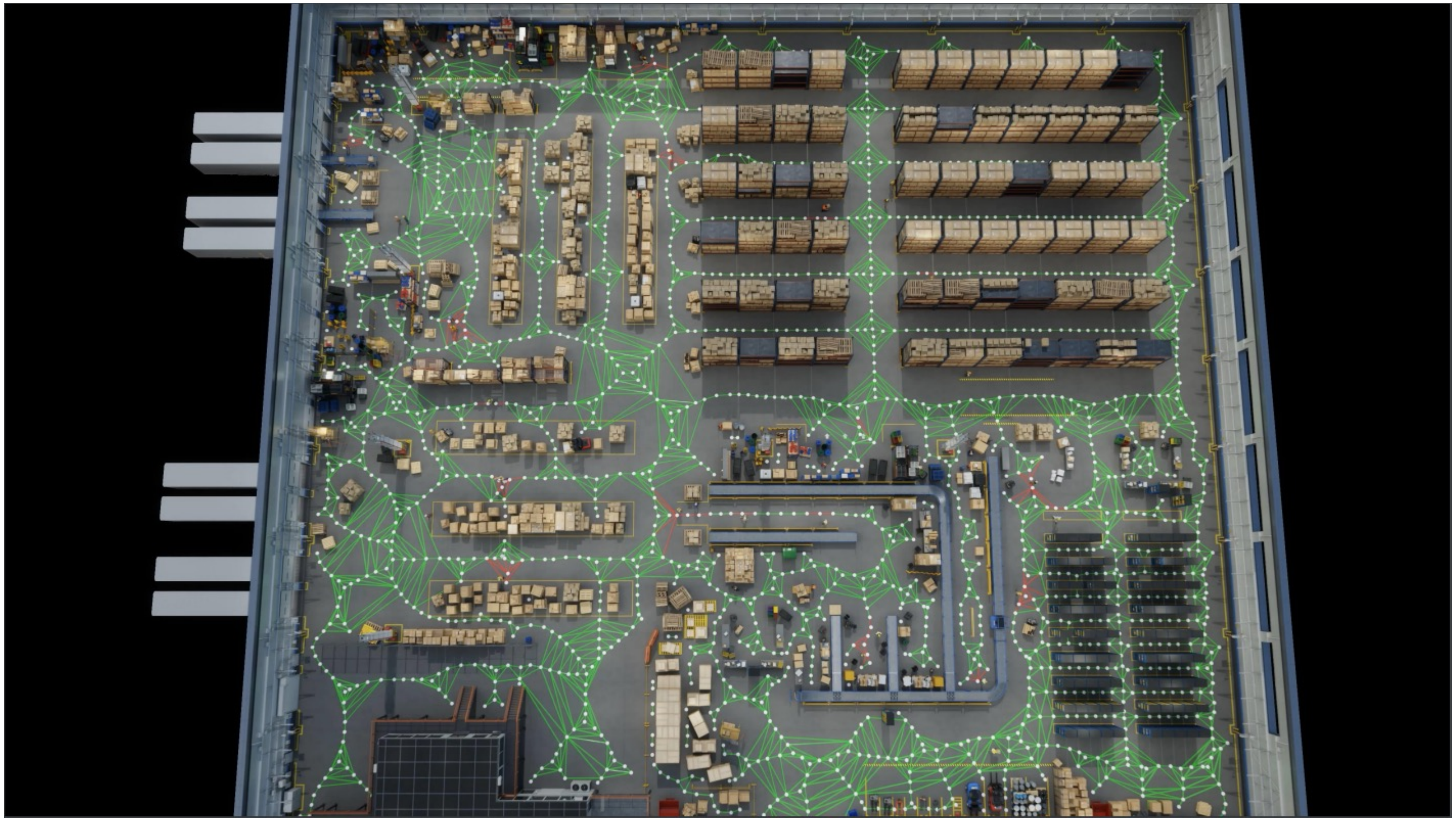
- https://www.nvidia.com/en-us/on-demand/session/other2024-dtwintracking/?playlistId=playList-62b777fa-766f-4773-8ae4-a70e564d7848



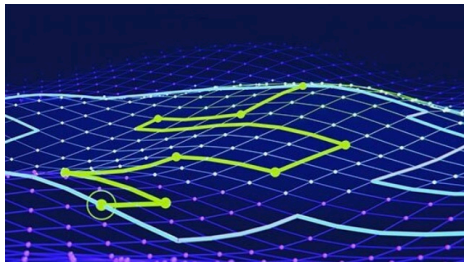


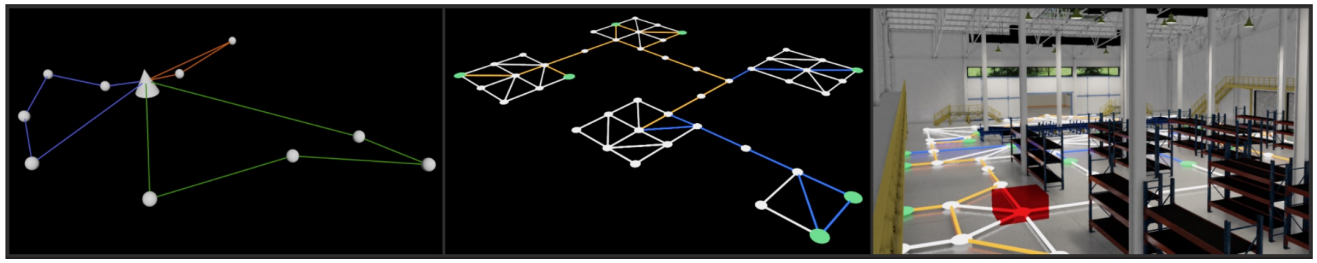
NVIDIA Metropolis

Development platform for building AI-powered Infrastructure

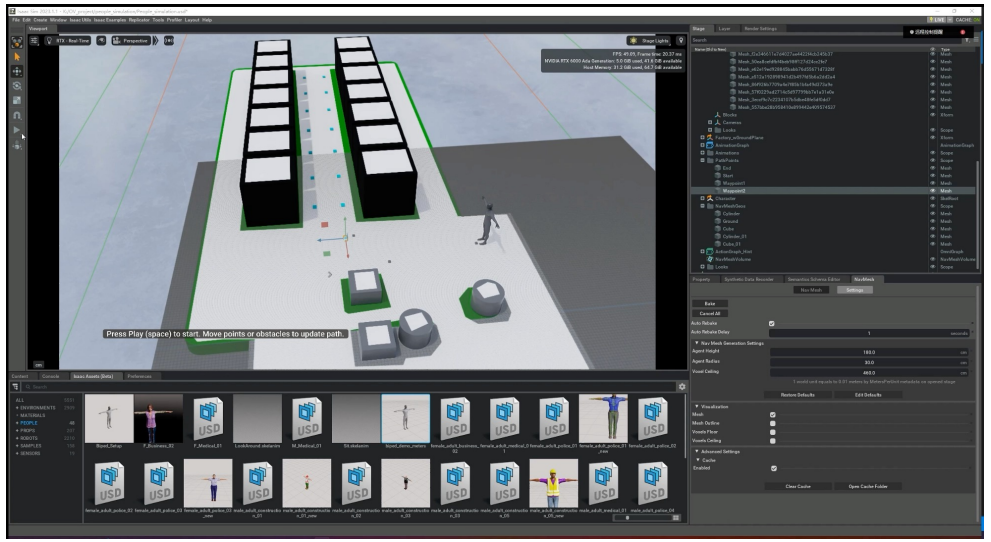


Cuopt与Navigate Mesh的工作流





- Cuopt algorithm from NVIDIA NGC

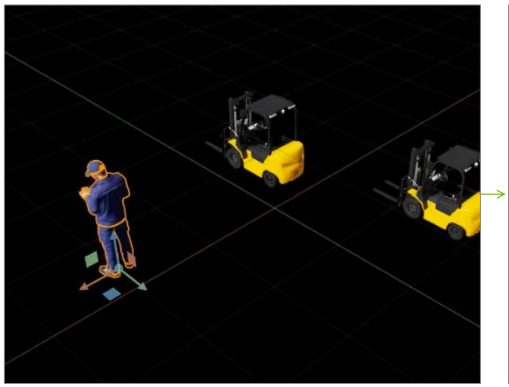


- Navigate Mesh in Omniverse

SDG

Synthetic Data Generation (SDG)

Using NVIDIA Omniverse replicator extension



Scene Creation

Build-realistic scenes in Omniverse to begin data generation

Domain Randomization

Randomize lighting, materials, colors, positions, and more to help the AI train on relevant information

Ground Truth Annotation

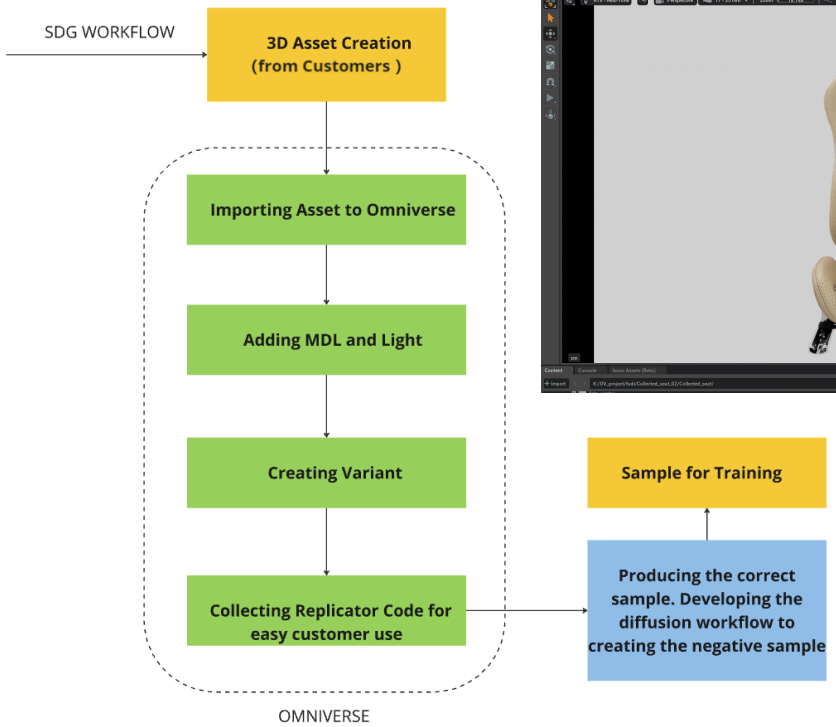
Perfectly labeled image for model training

Data Generation and Output

Output data in the right format to seamlessly work with TAO toolkit and streamline the training workflow

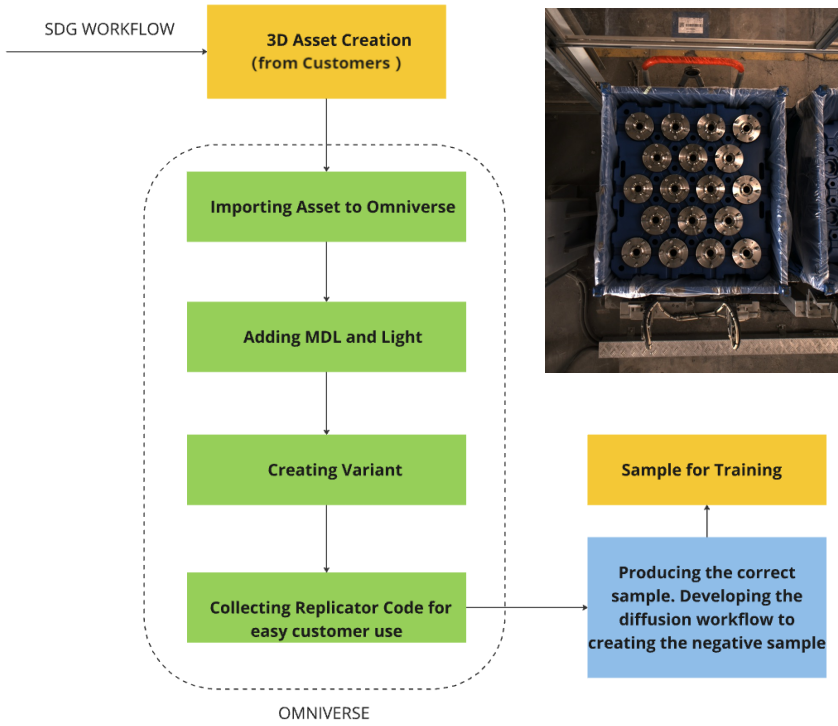
NVIDIA Omniverse for Synthetic Data Generation

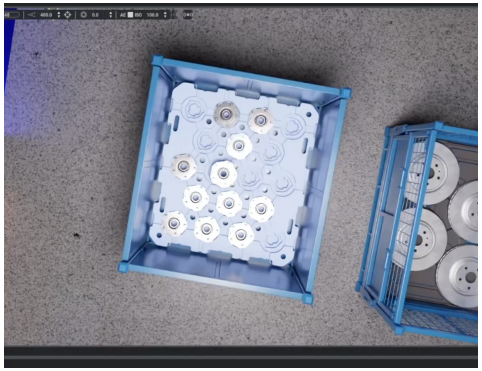
Generative AI-enabled synthetic data generation pipeline for Seat Scenario

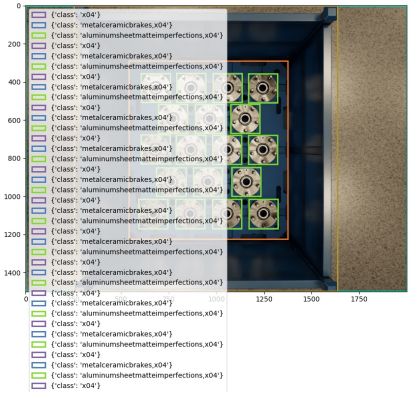


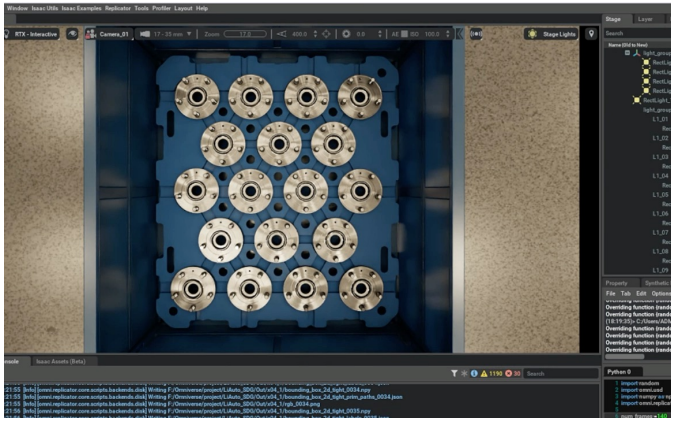
NVIDIA Omniverse for Synthetic Data Generation

Generative AI-enabled synthetic data generation pipeline for Seat Scenario







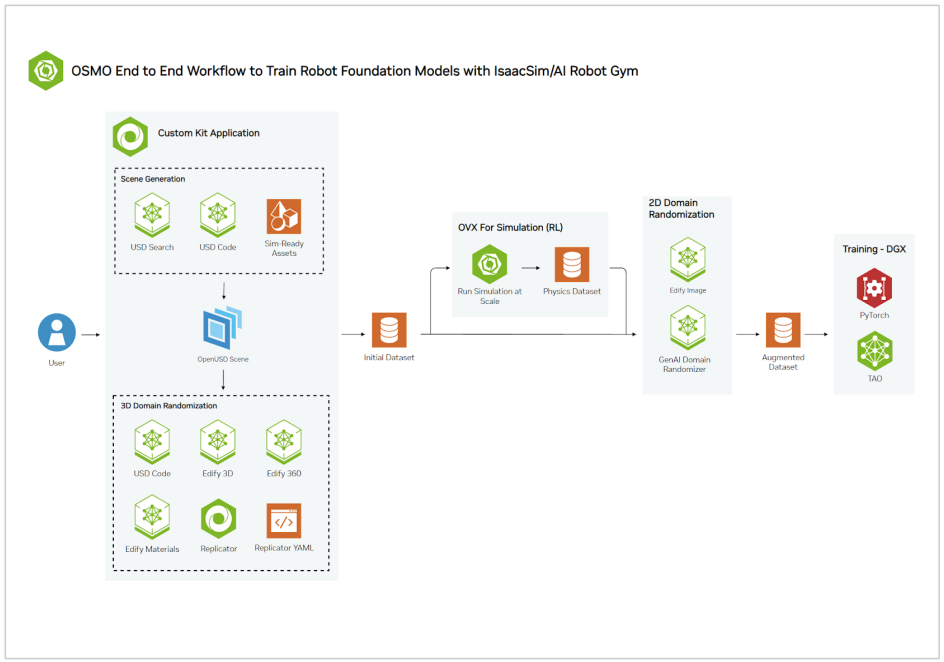


https://confluence.nvidia.com/display/~vcao/SDG+Working+flow

NVIDIA Omniverse and NIM for Synthetic Data Generation

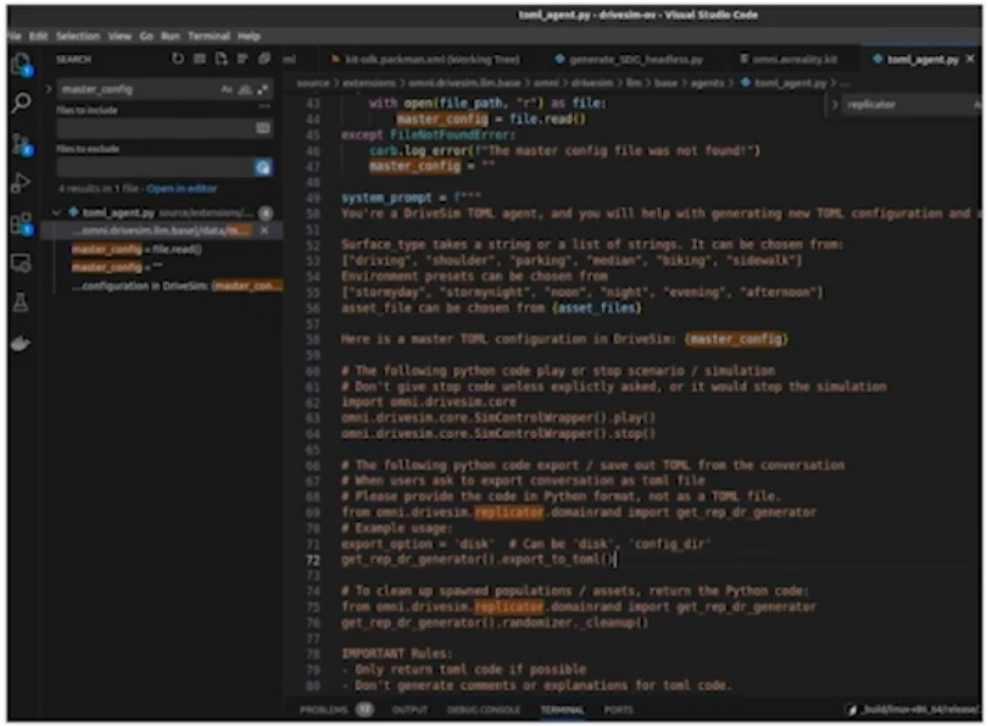
Generative AI-enabled synthetic data generation pipeline for perception robot models

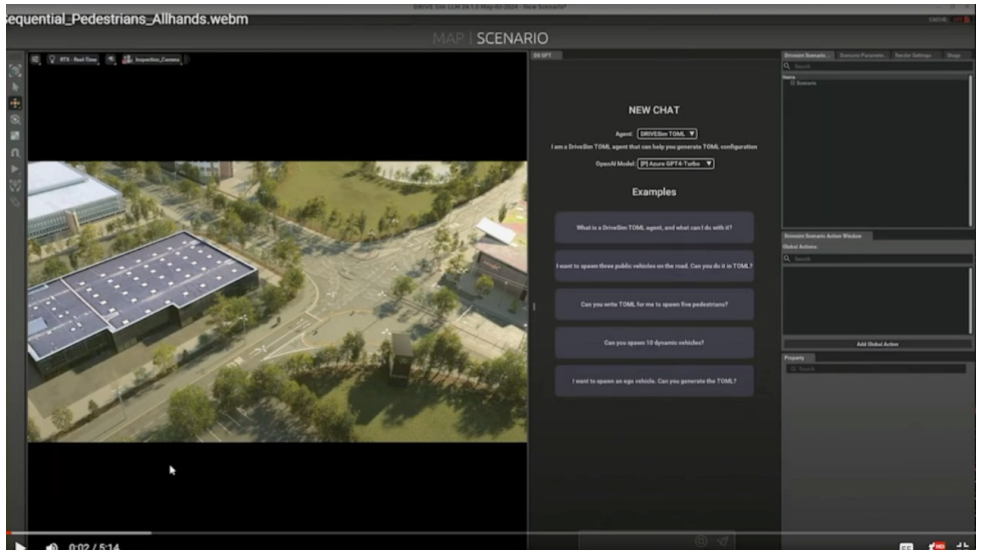
Omniverse, Isaac Sim, USD NIM, SDXL NIM



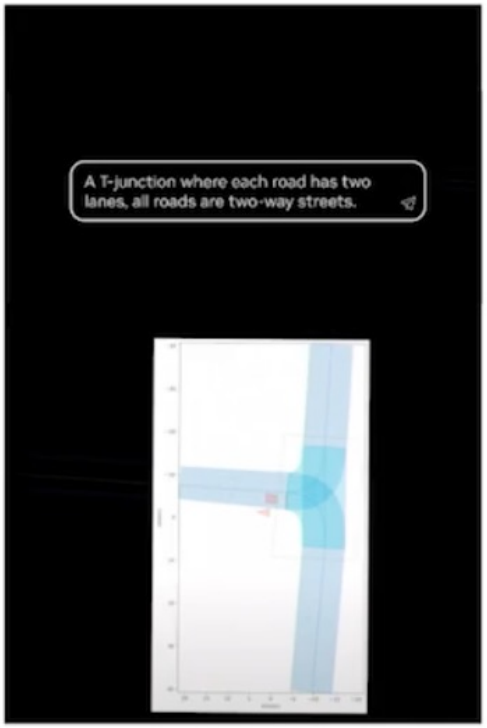
Generative AI Scenario

LLM2Scenario：How we use generative AI to scale up scenario creation





Scaling SDG with 4 Pillars: Content



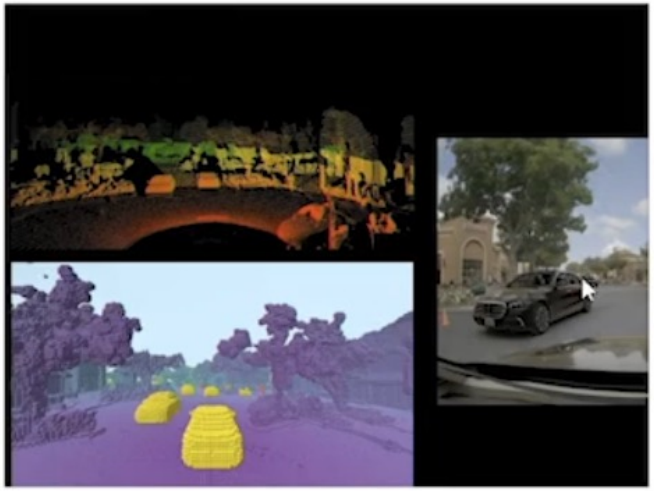
LLM-Generated Maps

Content API via OpenUSD

SDG GTs with NeRF

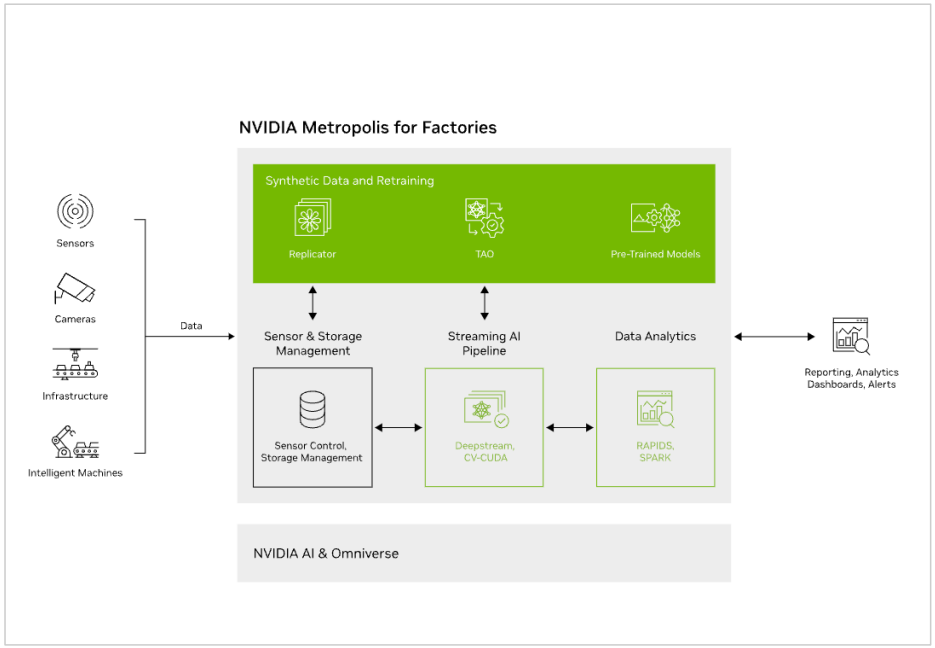
NeRF with SDG GTs

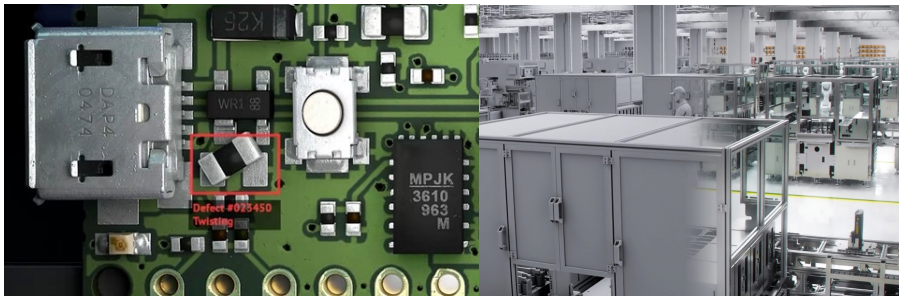
- Occupancy Voxels, built on top of fVDB
- 3D boxes
- Freespace



Automated Optical Inspection

Metropolis & Omniverse VFI

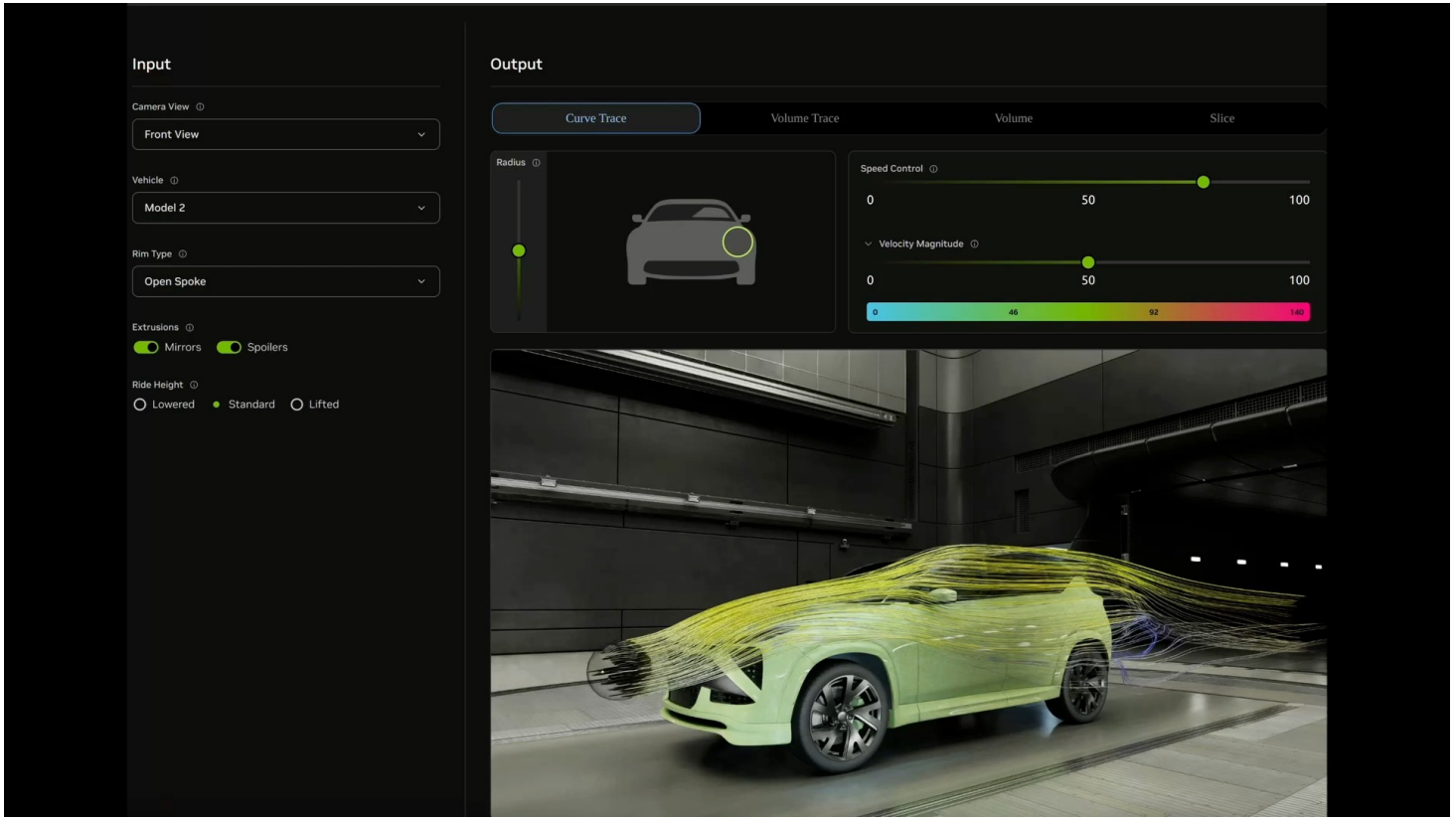




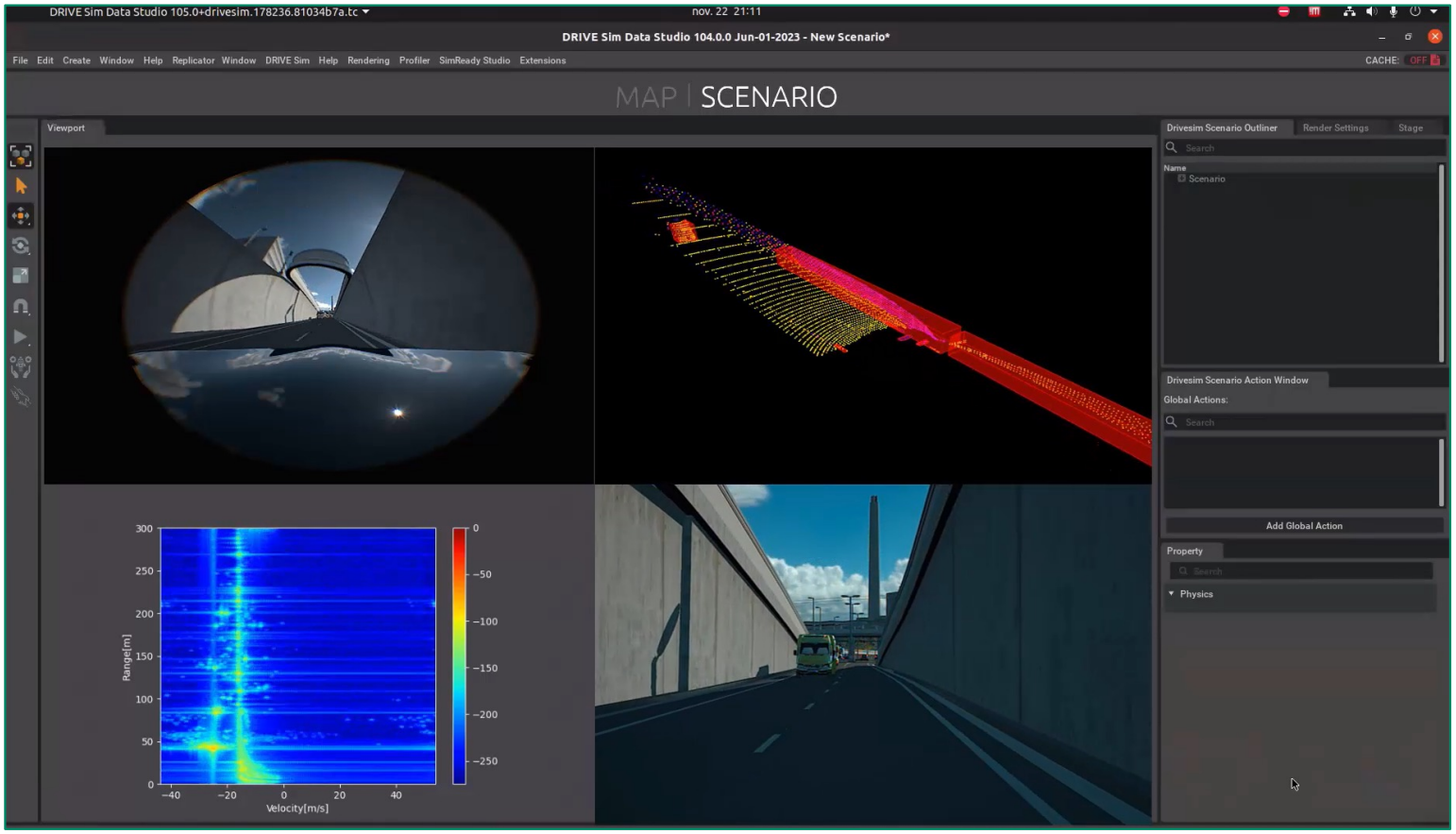
- Webpage
- Early Access Link
- Explainer Blog
- GPU Genius Hub

CAE Simulation

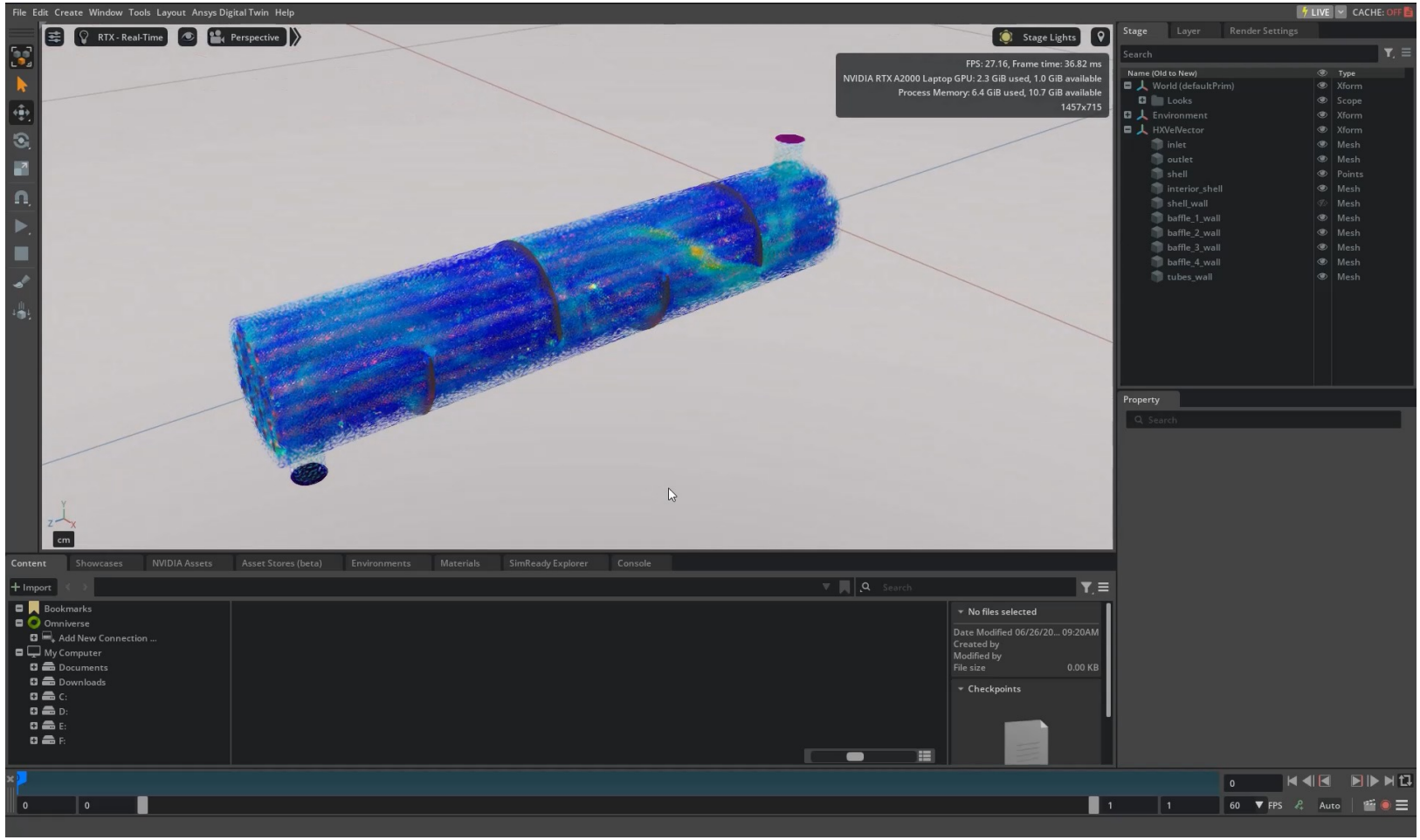
Modulus Simulation Display in Omniverse



Augmenting Drive Sim with Ansys Avxcelerate Physics



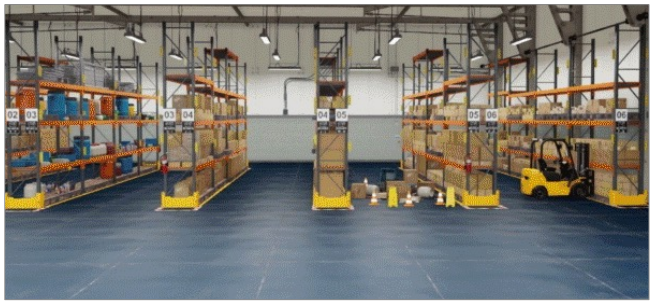
Particle System Display

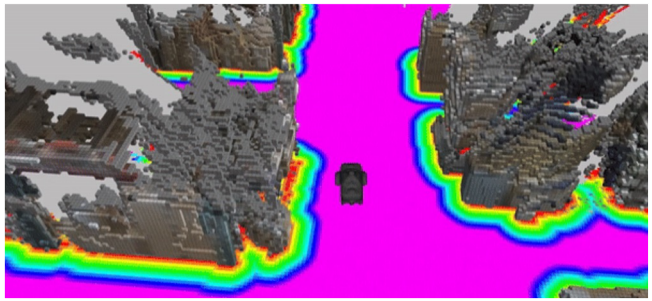


Robotics & Physical AI

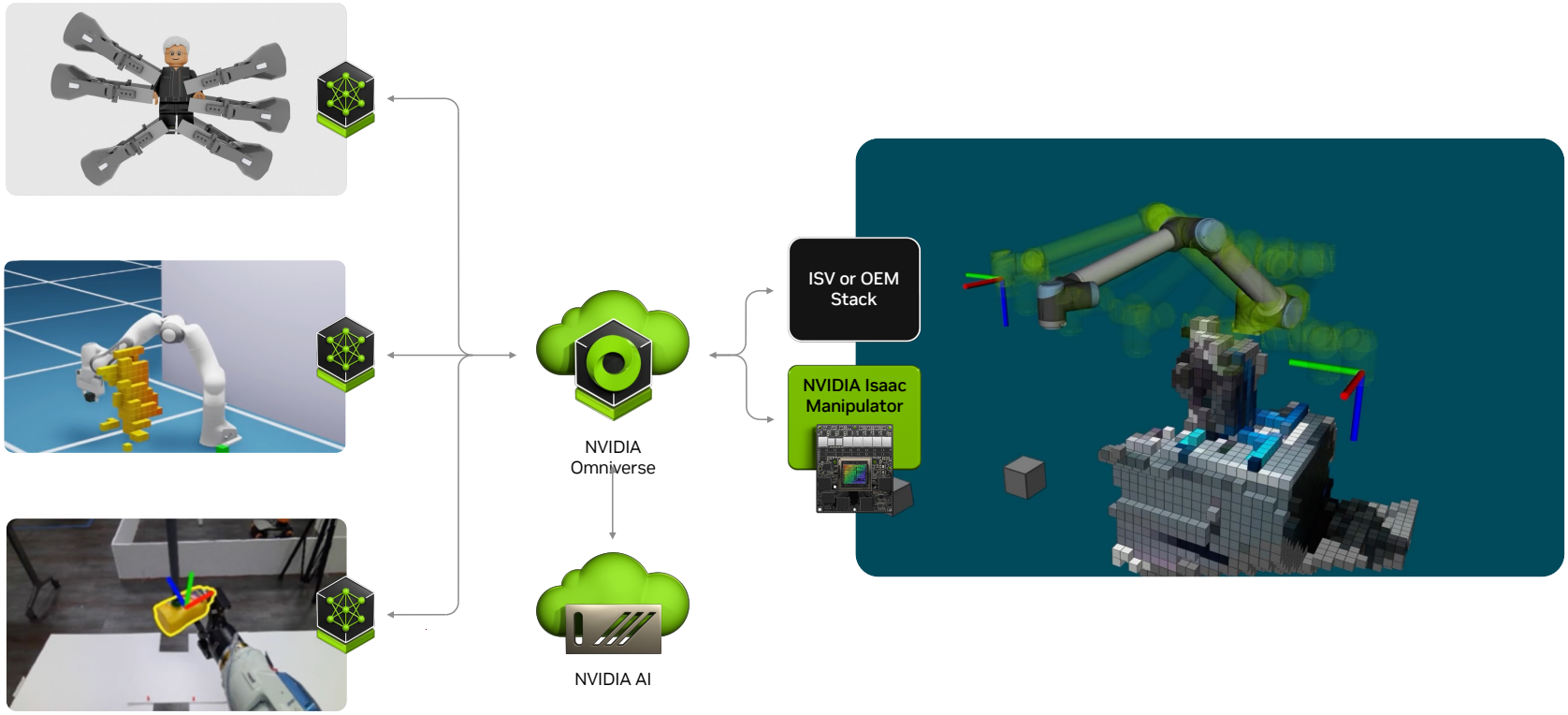
Digital Twins are Where Robots Learn to be Robots

Virtual training grounds for simulation, testing, synthetic data generation



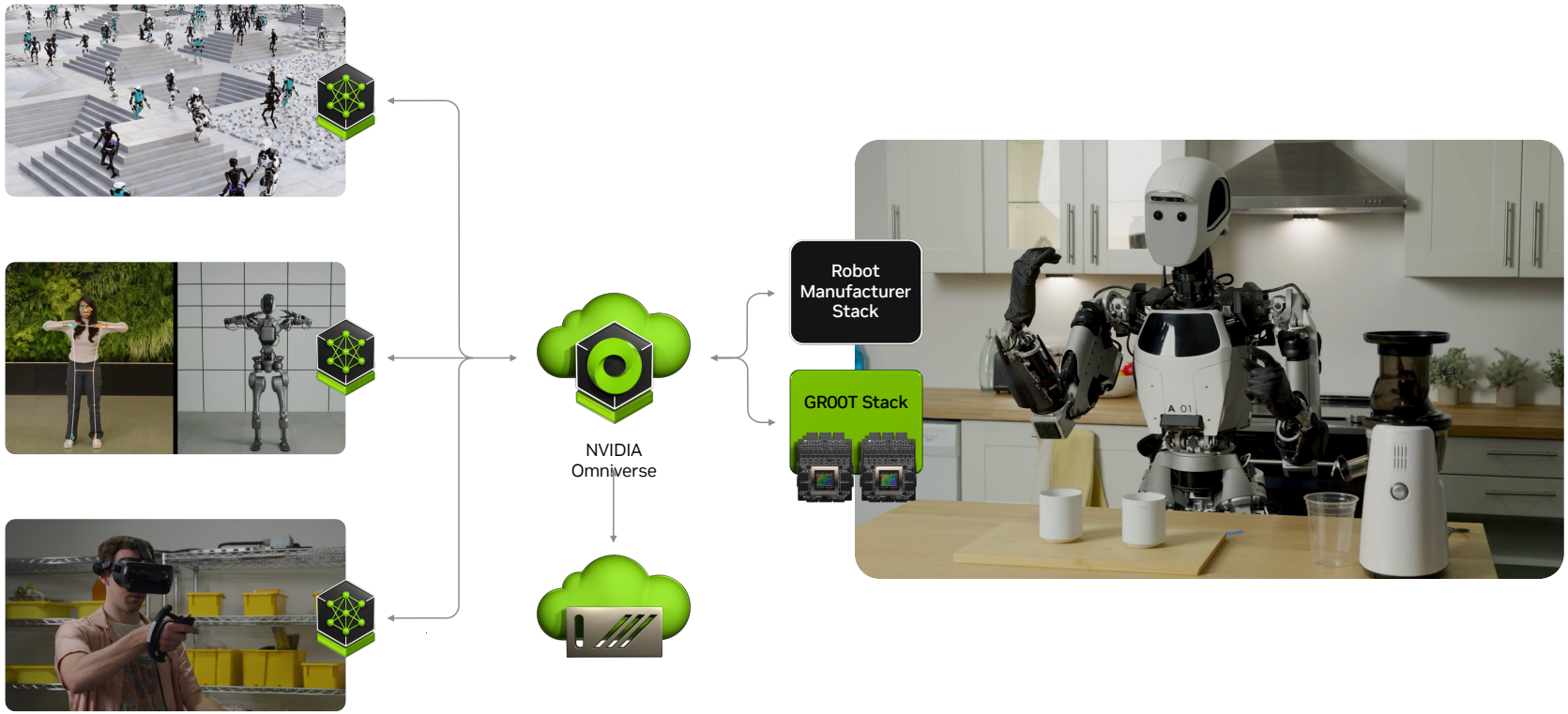


Integrating Isaac Manipulator into our Ecosystem



intrinsic SIEMENS IMR VENTION

Integrating Isaac & Project GR00T into our Ecosystem

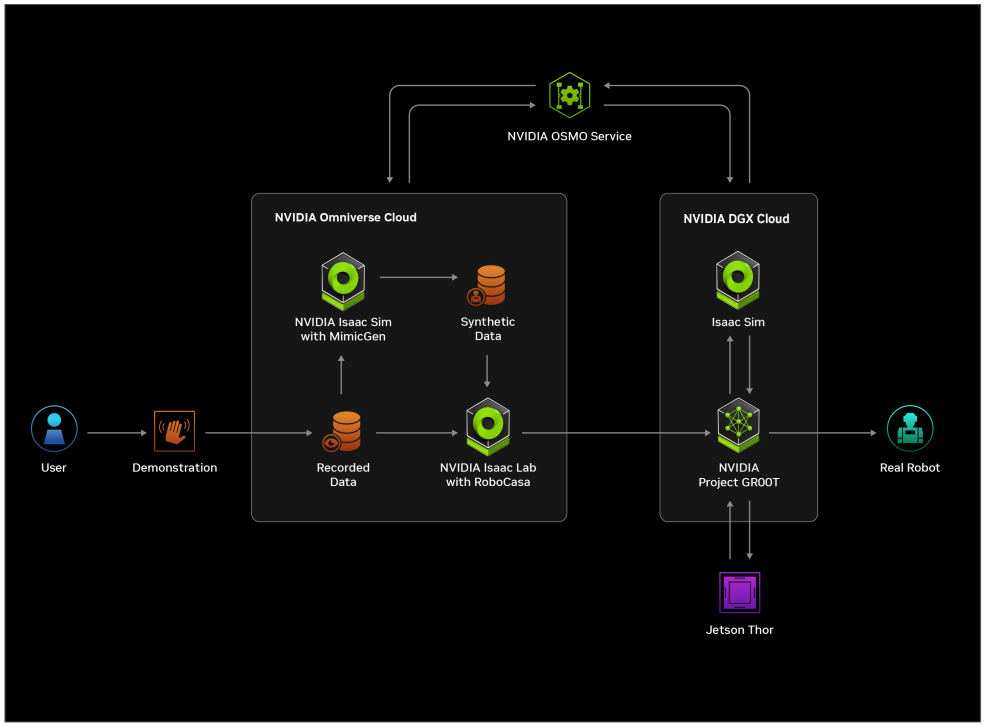


NVIDIA Accelerates Humanoid Robotics Development

MimicGen

Robocasa

NVIDIA Accelerates Humanoid Robotics Development

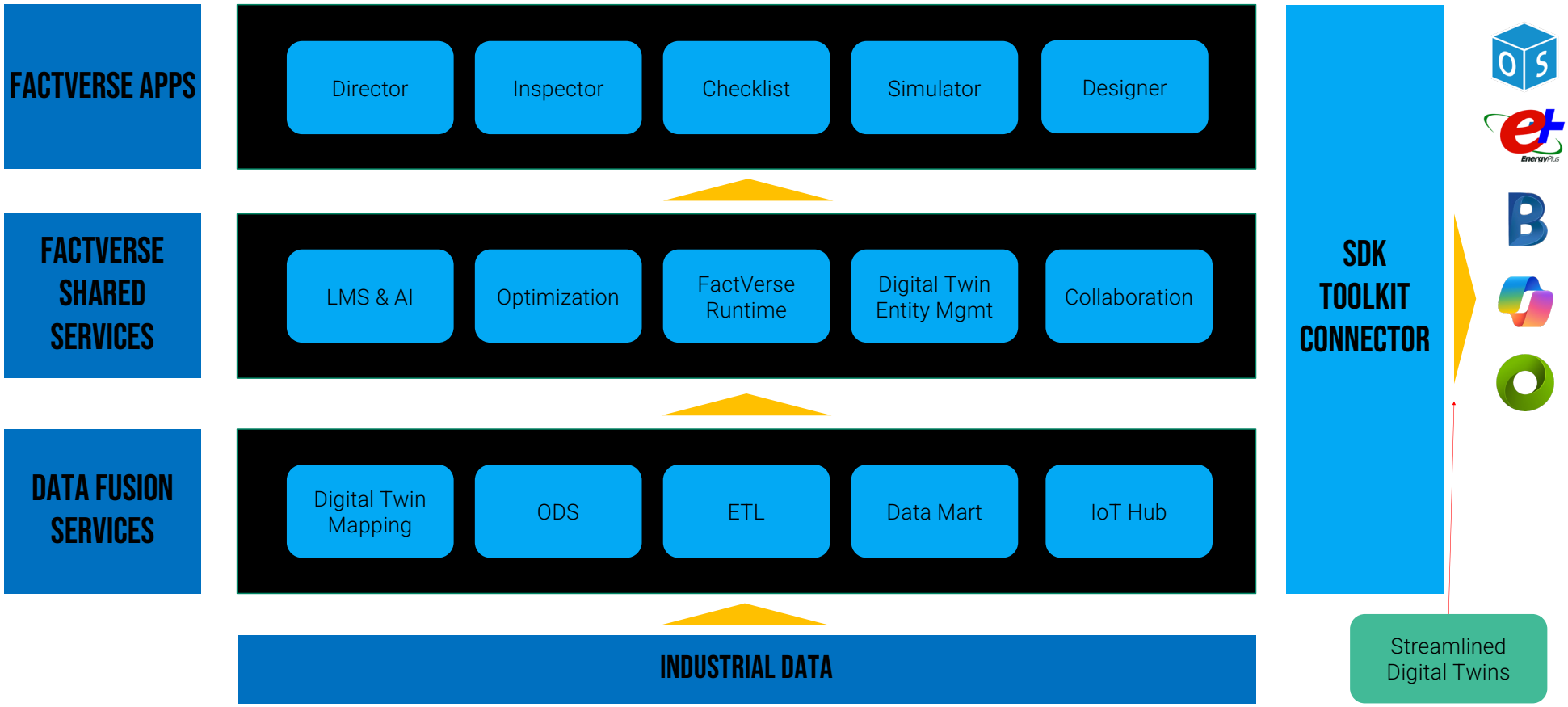


Ecosystem

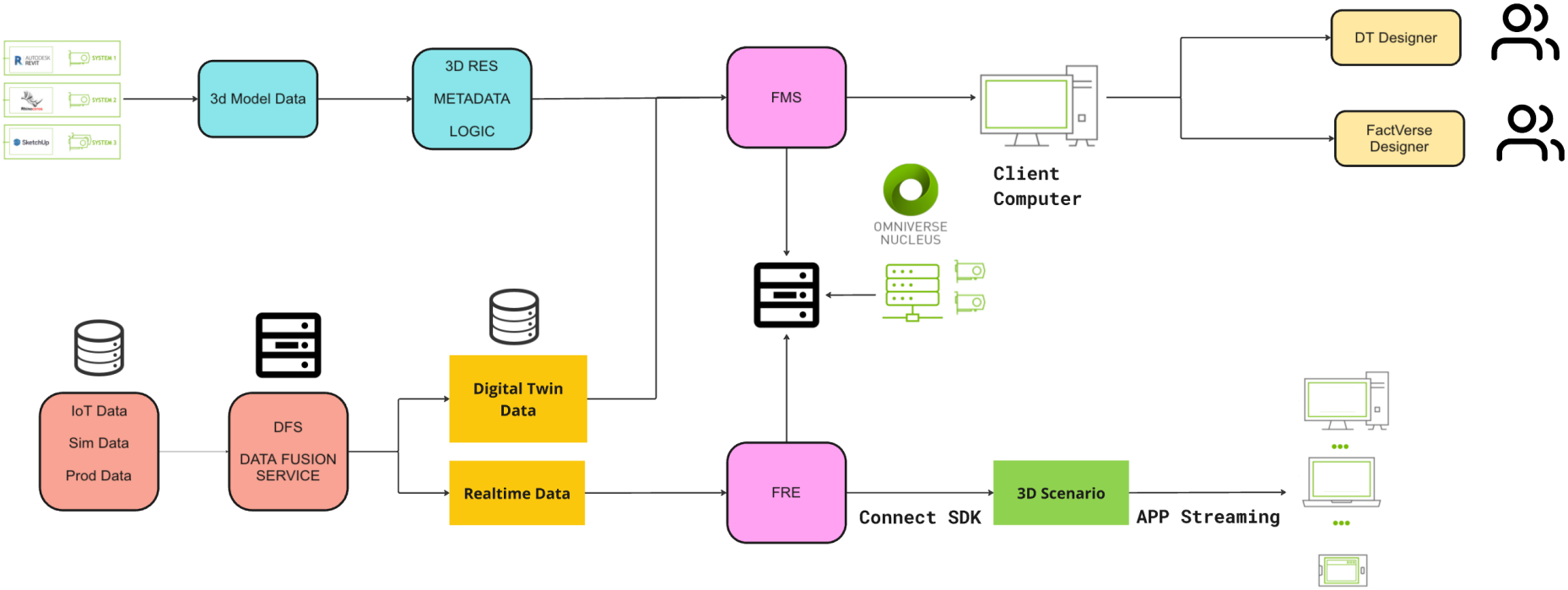
DATAMESH FACTVERSE

基于仿真级数字孪生（SDT）的技术驱动，优化改进业务流程中的难点问题

FACTVERSE PLATFORM AND APPS(DATA MESH)



THE WORKFLOW IN BETWEEN DATAMESH AND OMNIVERSE



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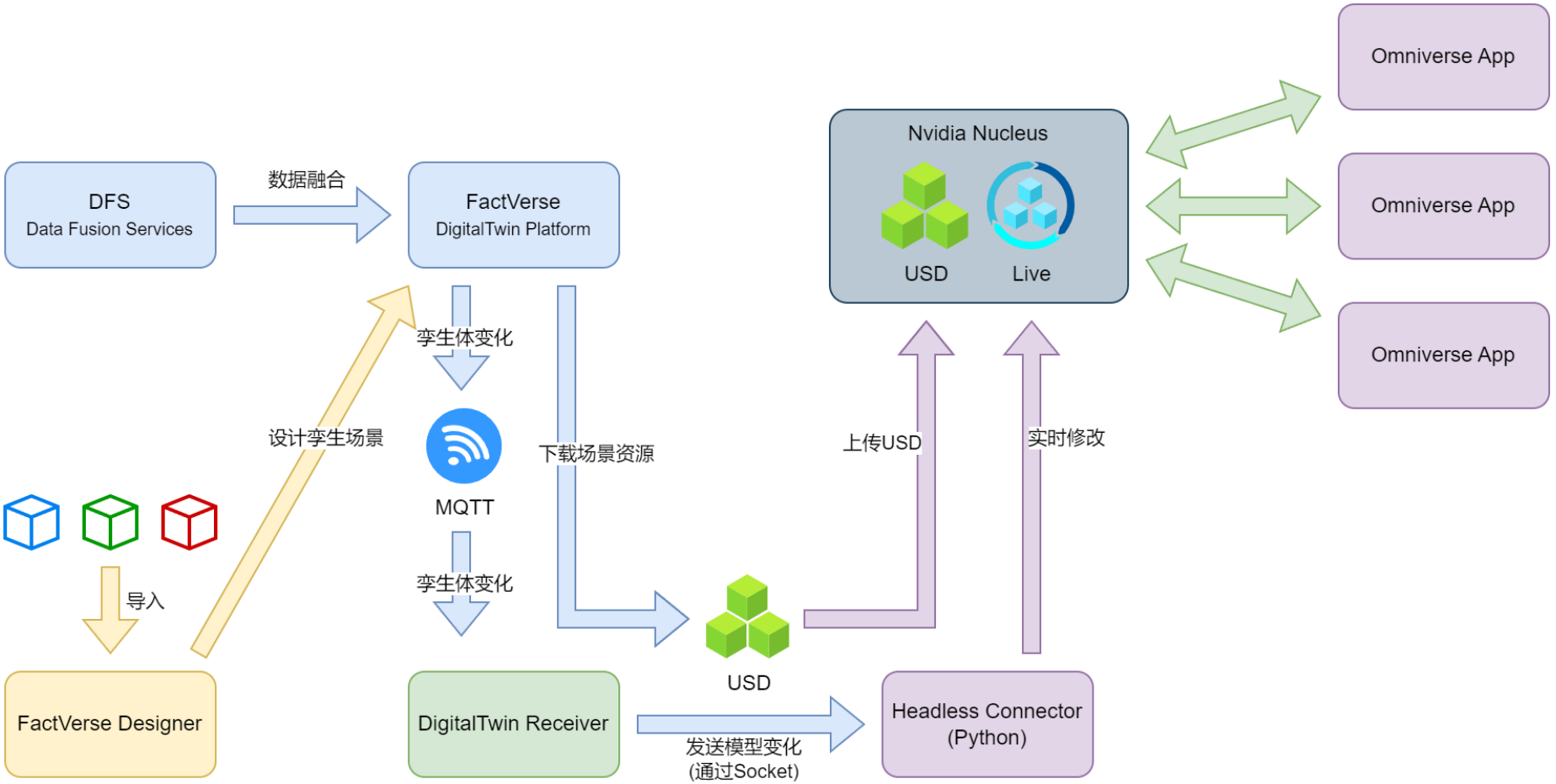

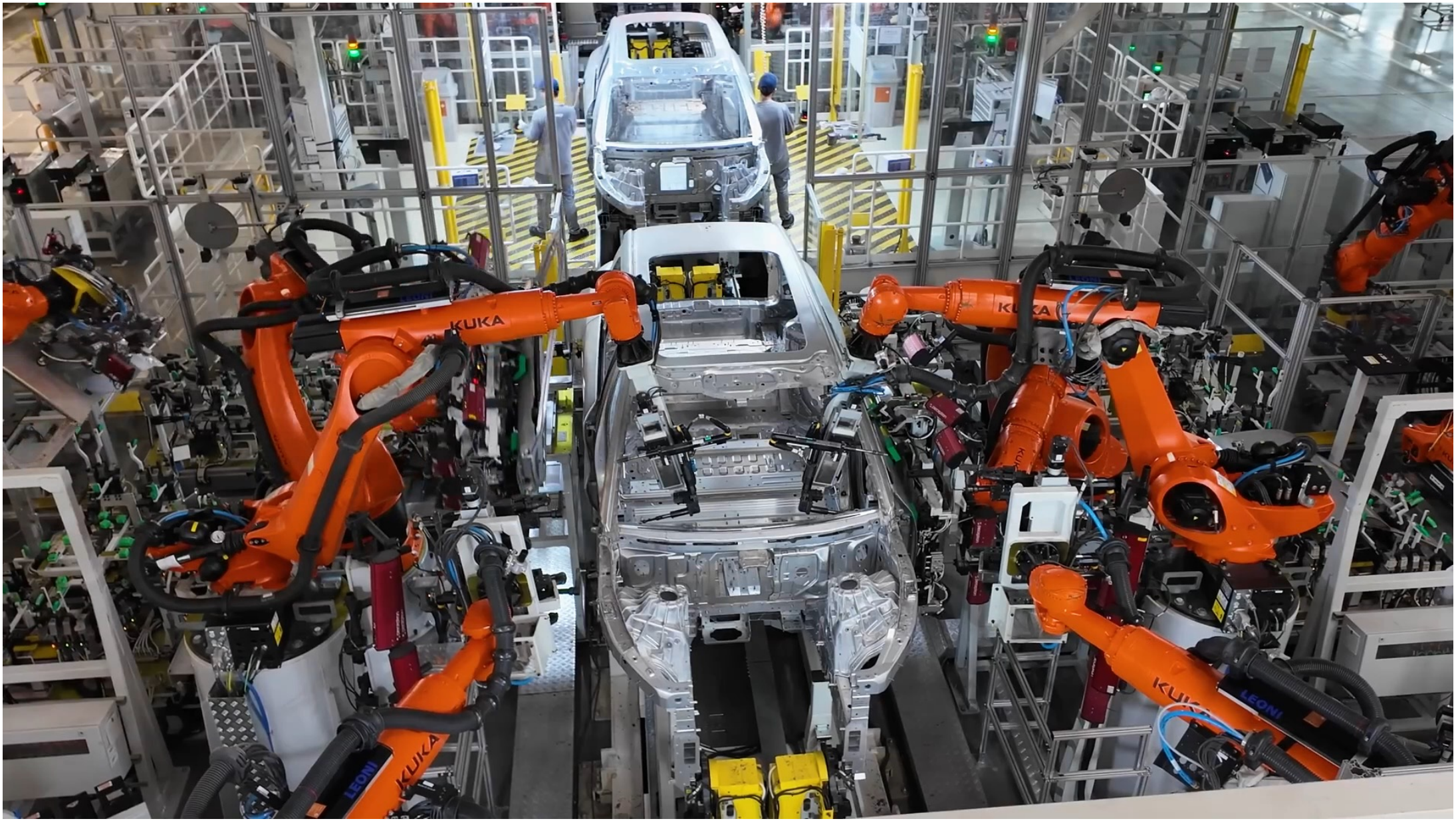
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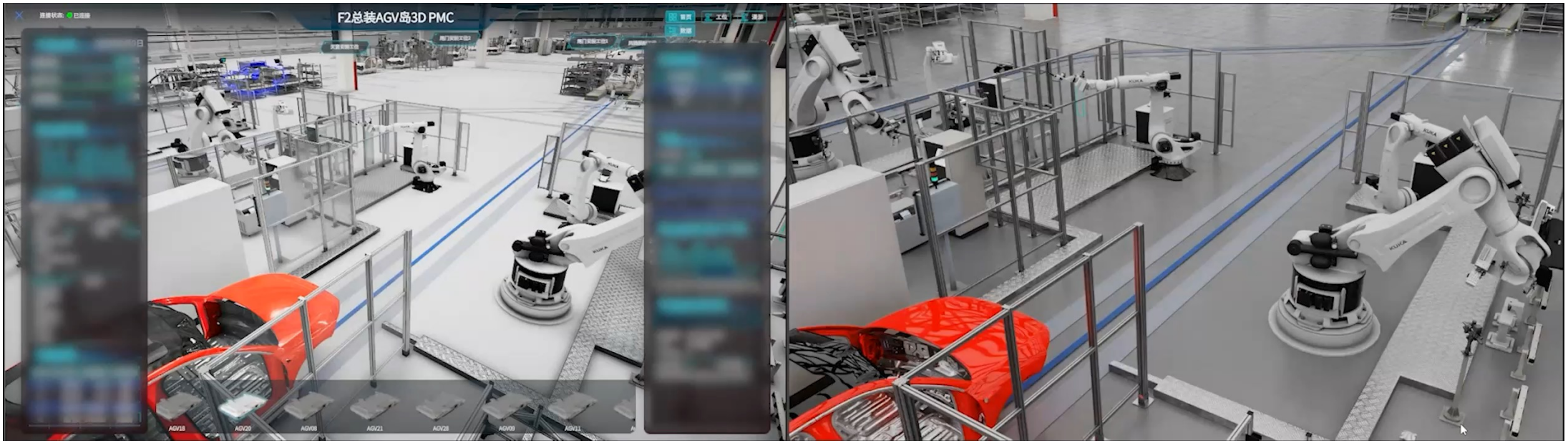
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