ASIPP

Design and Preliminary Realization of Virtual Installation based on Binocular Vision

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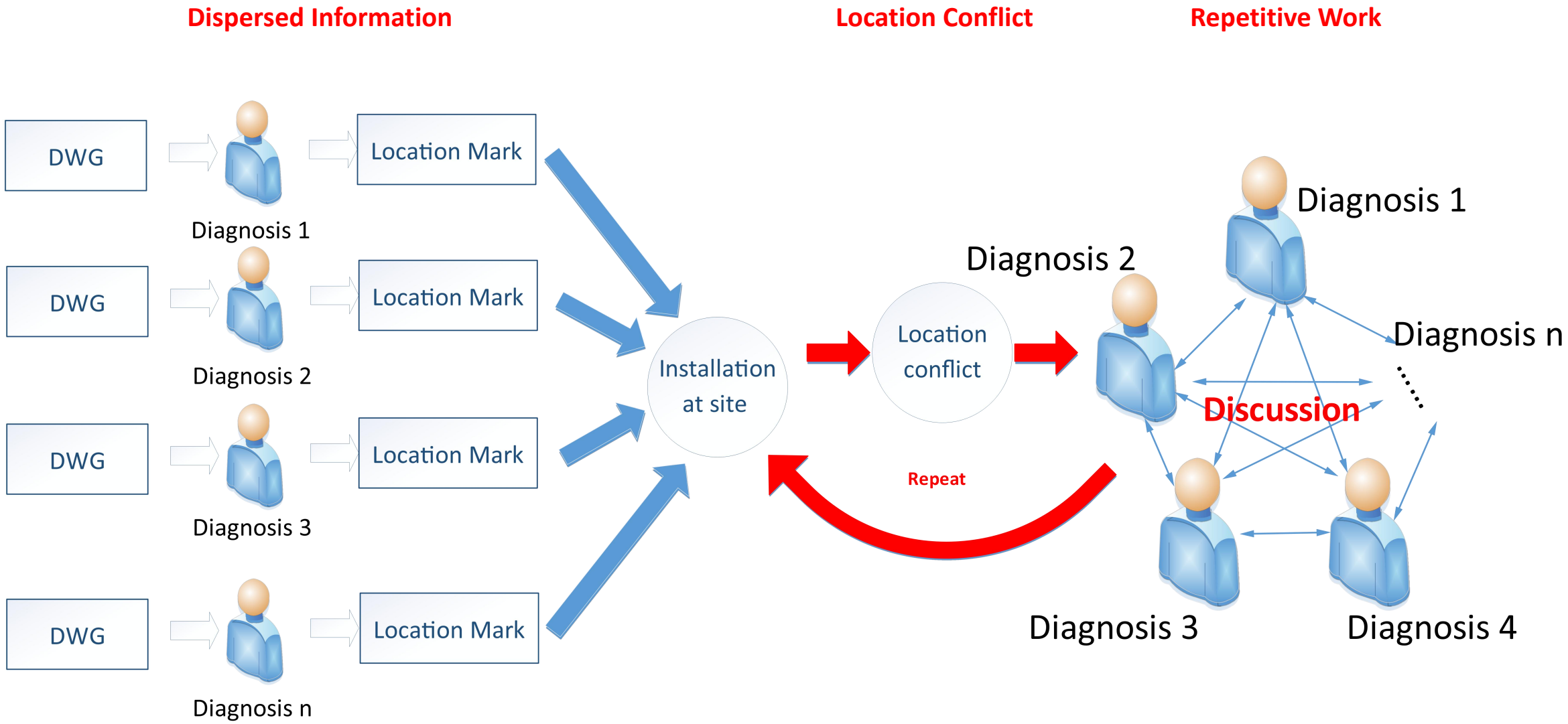
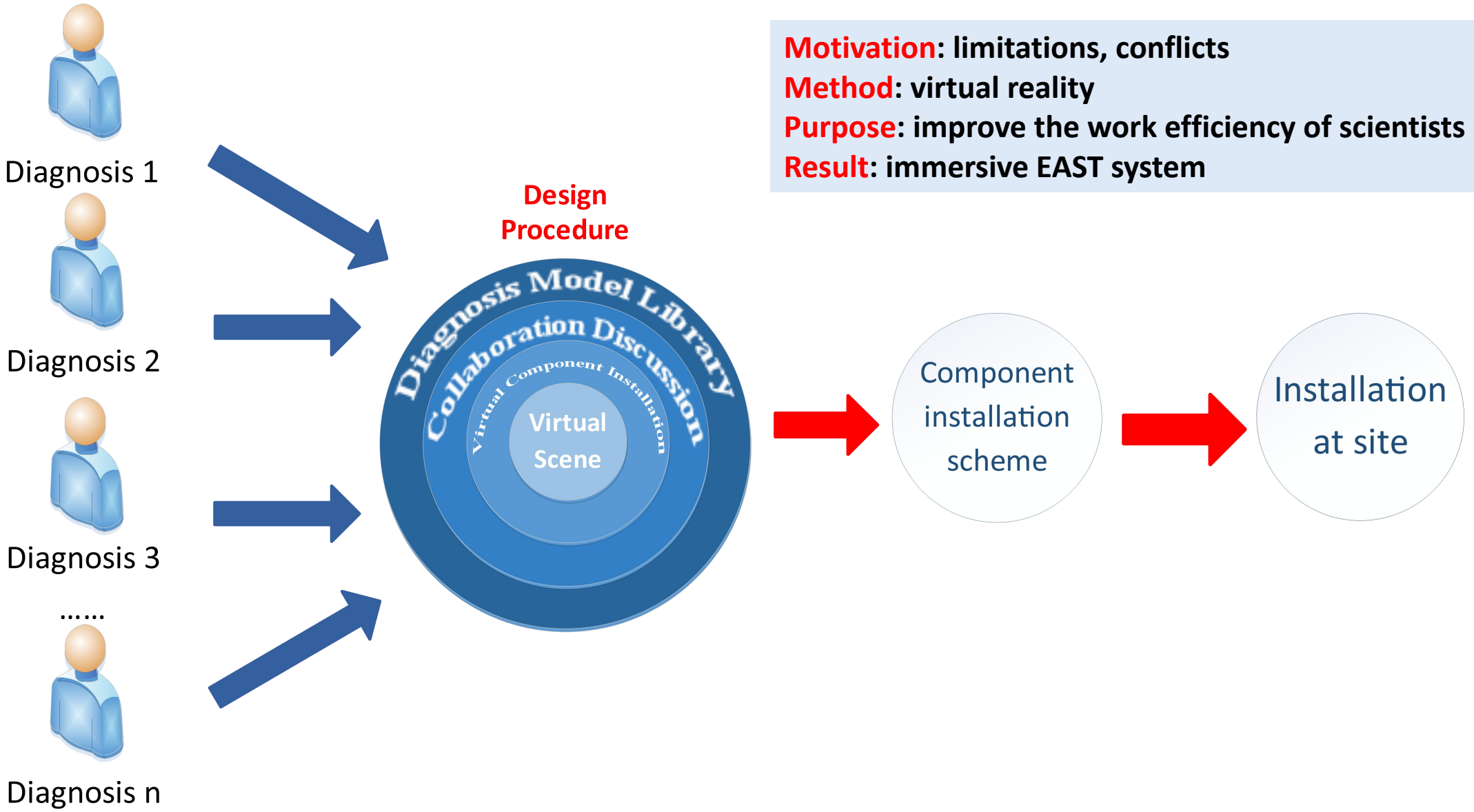
Outline

- **Motivation**
  - Traditional Installation
  - Virtual Installation
  - Virtual Installation System V1
  - Discussion
- **System Architecture**
- **Function List**
- **System Implementation**
  - 3D Printing
  - Binocular Vision Camera
  - Point Cloud Generation
  - Auxiliary Measurement Tool
- **Summary**

Traditional Installation

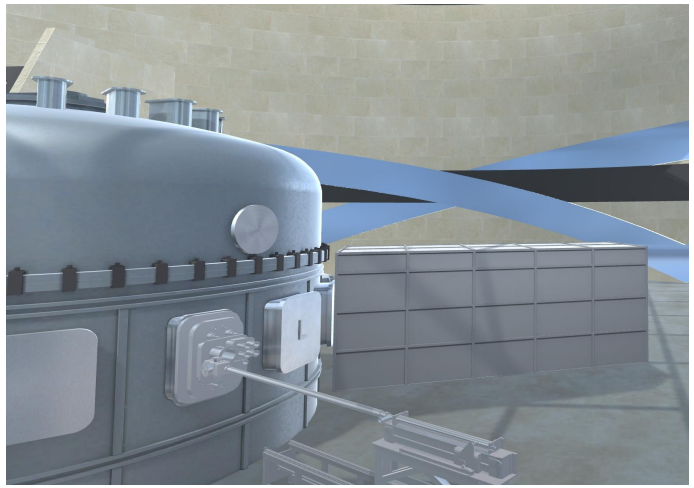


Virtual Installation

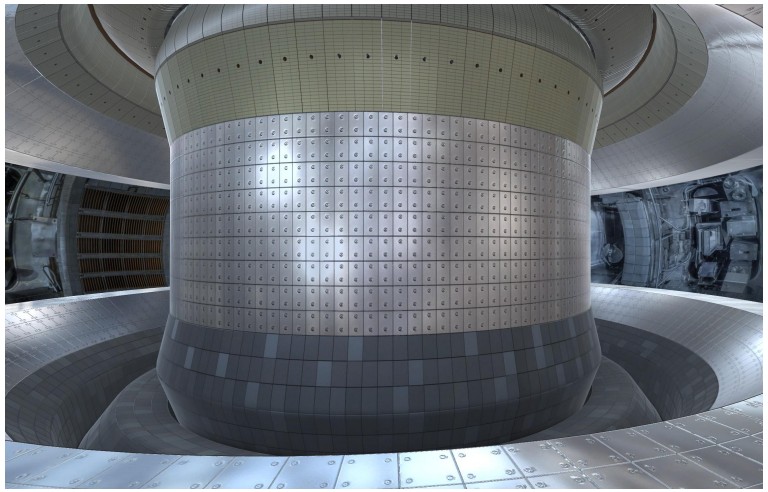


Motivation: limitations, conflicts
Method: virtual reality
Purpose: improve the work efficiency of scientists
Result: immersive EAST system

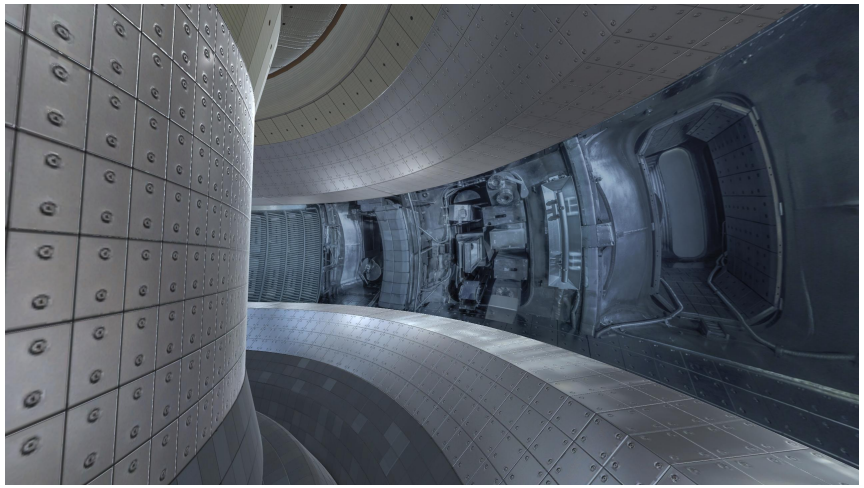
Virtual Installation System V1



EAST host model

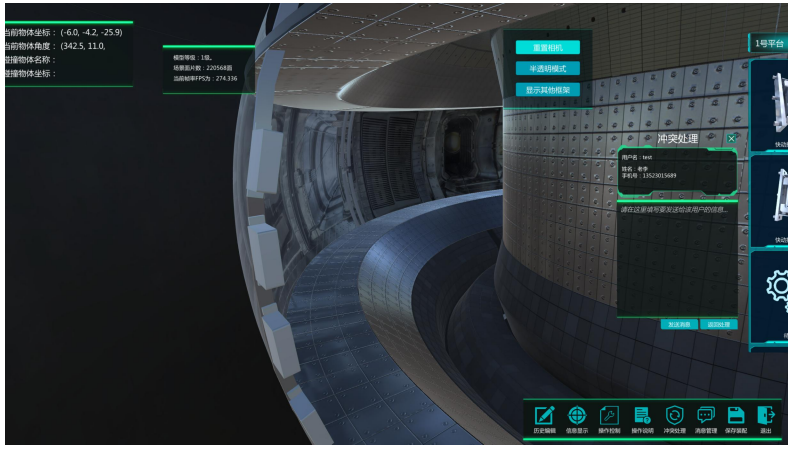


EAST vacuum model reconstruction

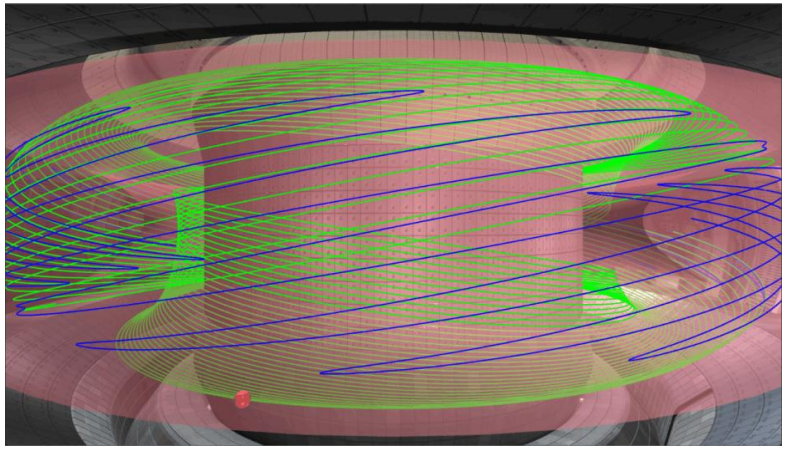


Window map

Magnetic probe virtual installation



Installation in realistic scene



Data visualization

Discussion

- Virtual installation system plays a crucial role in:
  - **Gathering dispersed information**
  - **Visualizing the EAST device**
  - **Understanding complex data**
  - **Communicating installation scheme and location conflict effectively**
  - **Simulating real installation**
- Some problems that need to be improved:
  - **Model reconstruction is complicated and inefficient**
  - **Detailed model is not accurate enough**
  - **Collision detection lacks of pre-warning**
  - **Application functions need to be extended**

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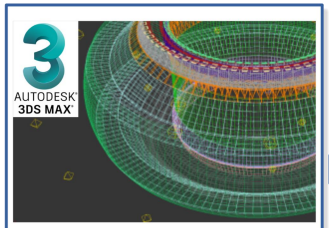
System Architecture

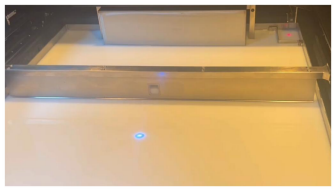
SLA 3D printer



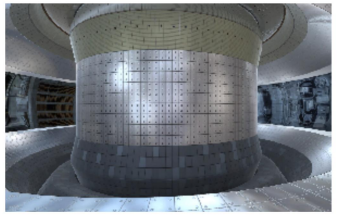
Model construction

Binocular video image sensor

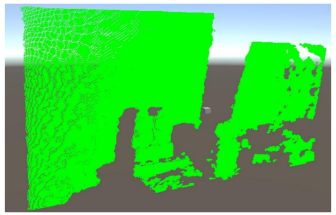
Modeling Tools



3D printing



.fbx model



Point cloud data

Scenarios

Test environment

Virtual environment

Stereoscopic environment

Environment

Hardware debug

Virtual installation

Remote installation

Target identification

Customized Application

Stereoscopic display

Client

Operator

Workstation

Virtual glasses

Terminal

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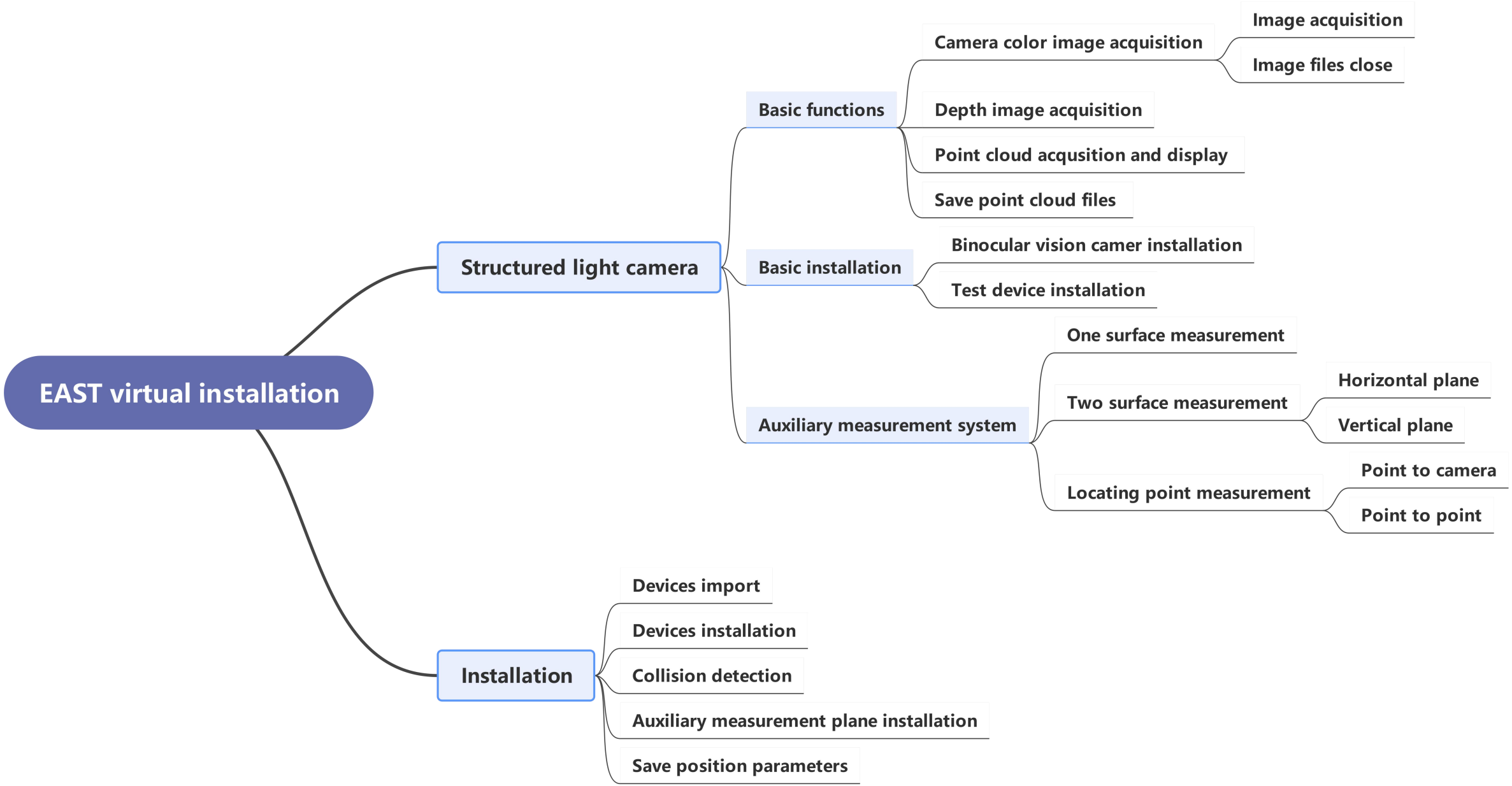
Function List



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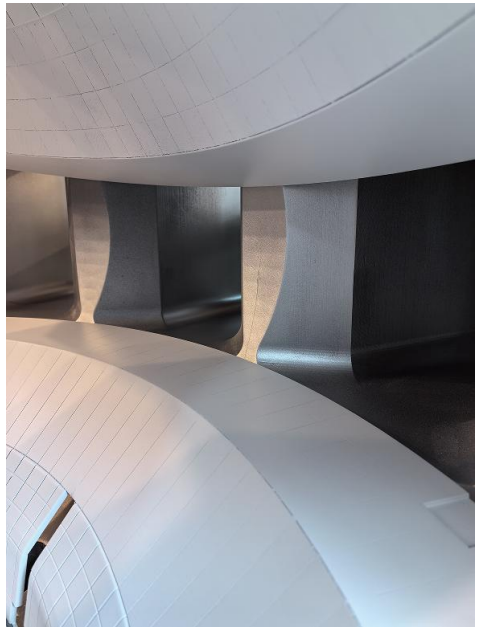
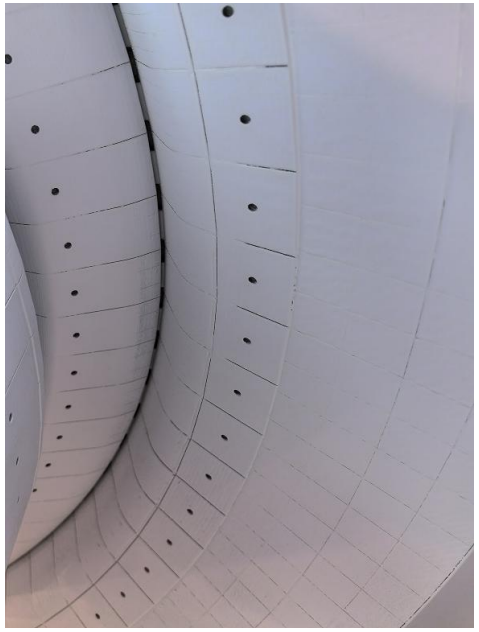
3D Printing

SLA(Stereo Lithography Appearance)

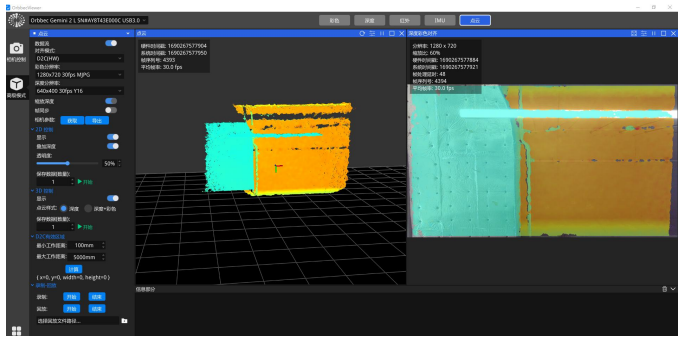
- less variety of materials
- high equipment operation and maintenance costs
- high level of automation
- smooth surface
- fine feature details

Binocular Vision Camera

Parameters:

- Maximum operating range: 0.4-20m+
- Global shutter for RGB and IR cameras
- Wide Field of View at 91° horizontal and 66° vertical
- Deep technology: Structured light enhanced binocular
- Depth image resolution: 1280 x 800
- OrbbecViewer: View depth streams, visualize point clouds, record and play back data streams, configure camera Settings.
- Orbbec SDK: Include code that access the camera into application, such as color streams, depth streams, point clouds, alignment, recording.

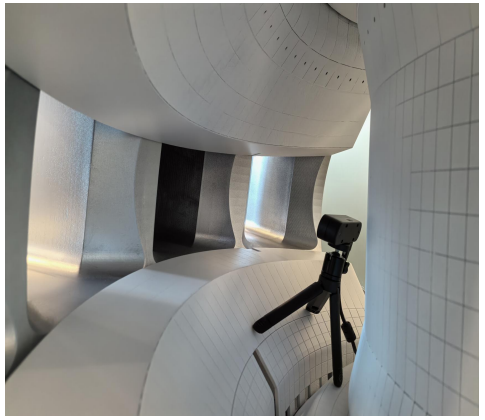


Orbbec Gemini 2XL

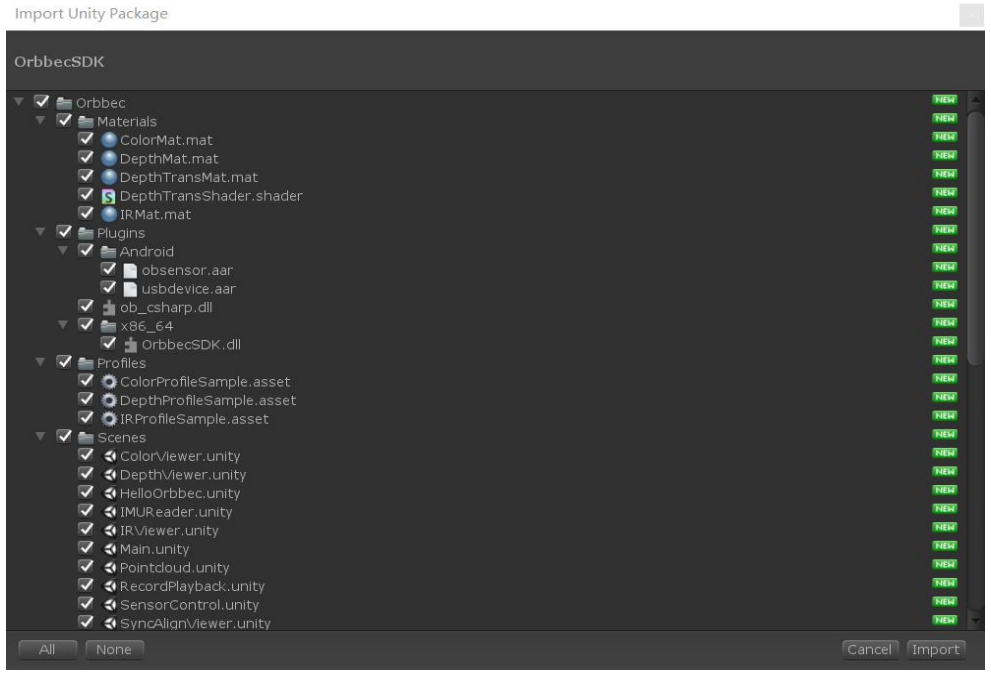
Use the SDK to include code that access the camera into your application.

C/C++ Android ROS OpenNI2

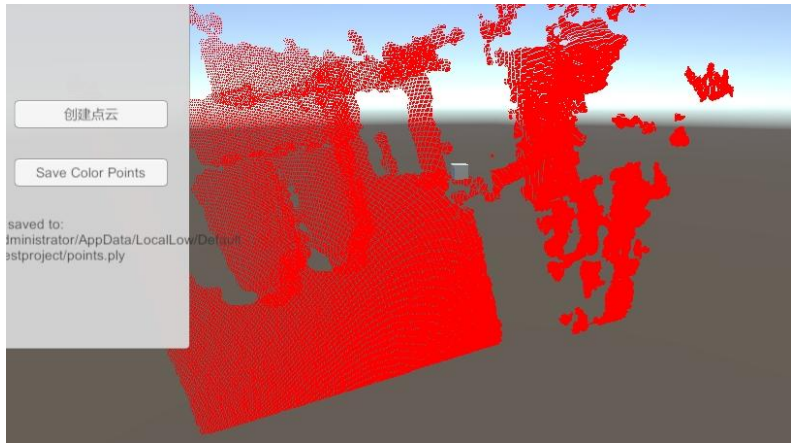
Azure Kinect Python Unity

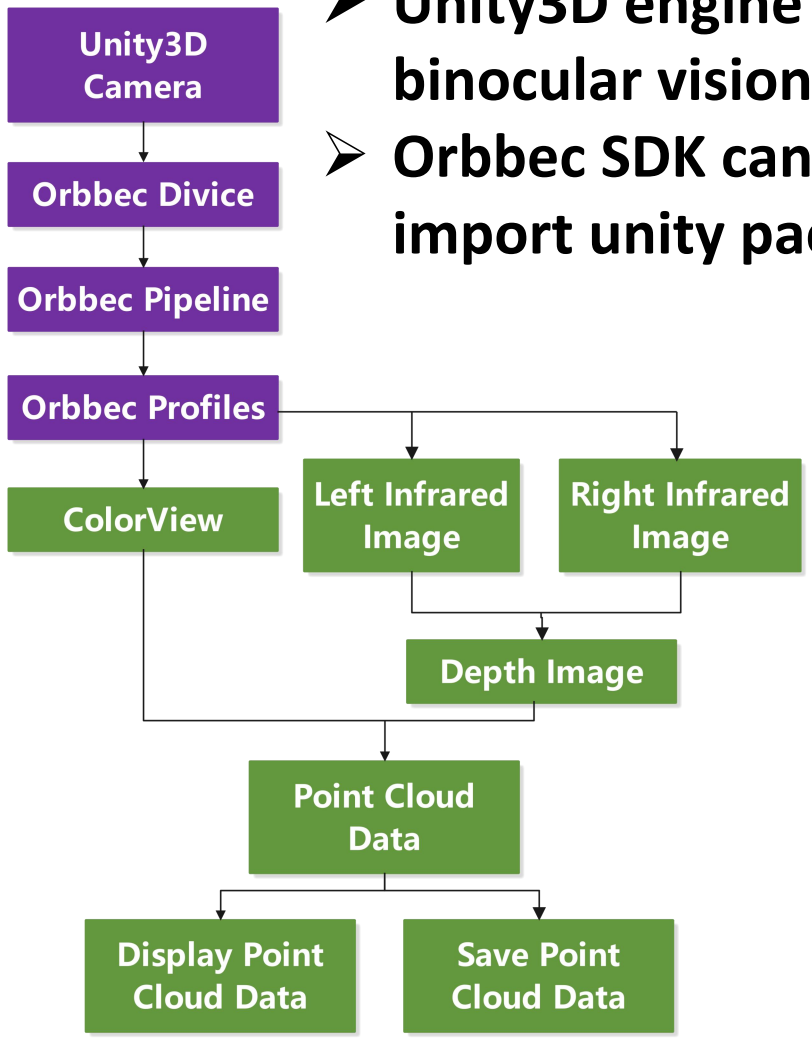


Point Cloud Generation



Import unity package

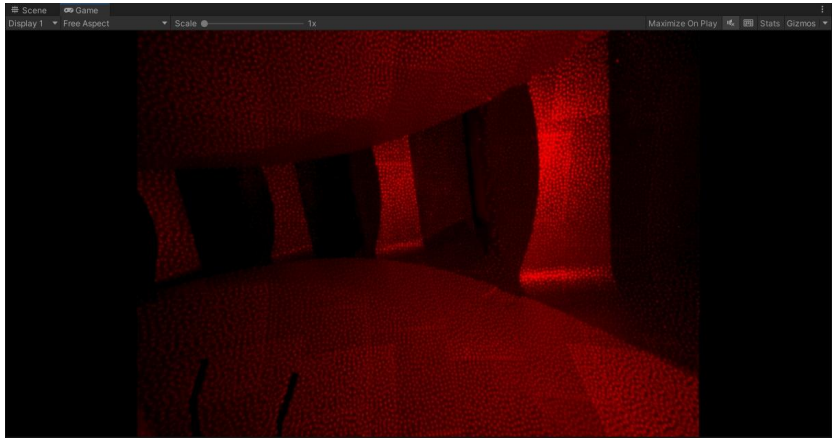




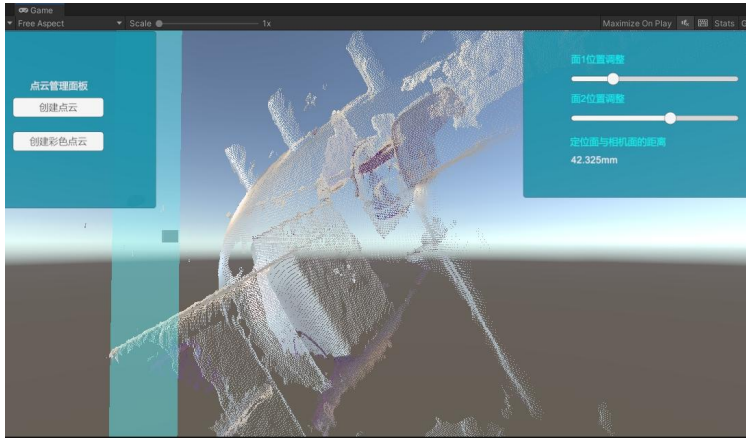
- Unity3D engine is used to realize the binocular vision system.
- Orbbec SDK can support users to import unity package.

Auxiliary Measurement Tool

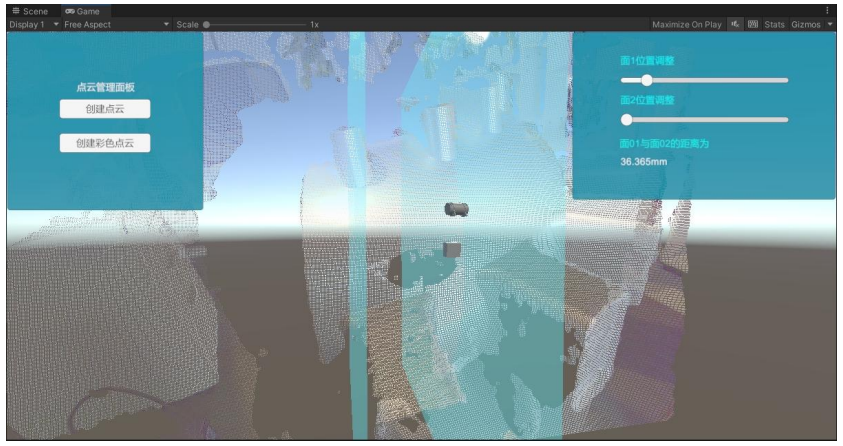
- **One surface measurement:** measure the distance between the plane and the camera plane.
- **Two surfaces measurement:** measure the horizontal or vertical distance of two points.
- **Locating point measurement:** measure the distance between any two points, and determine the precise value of the critical space.



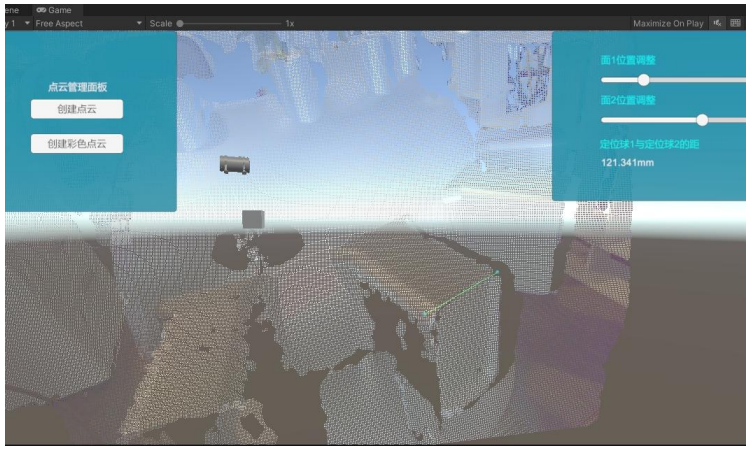
Infrared Image



One surface measurement



Two surfaces measurement



Locating point measurement

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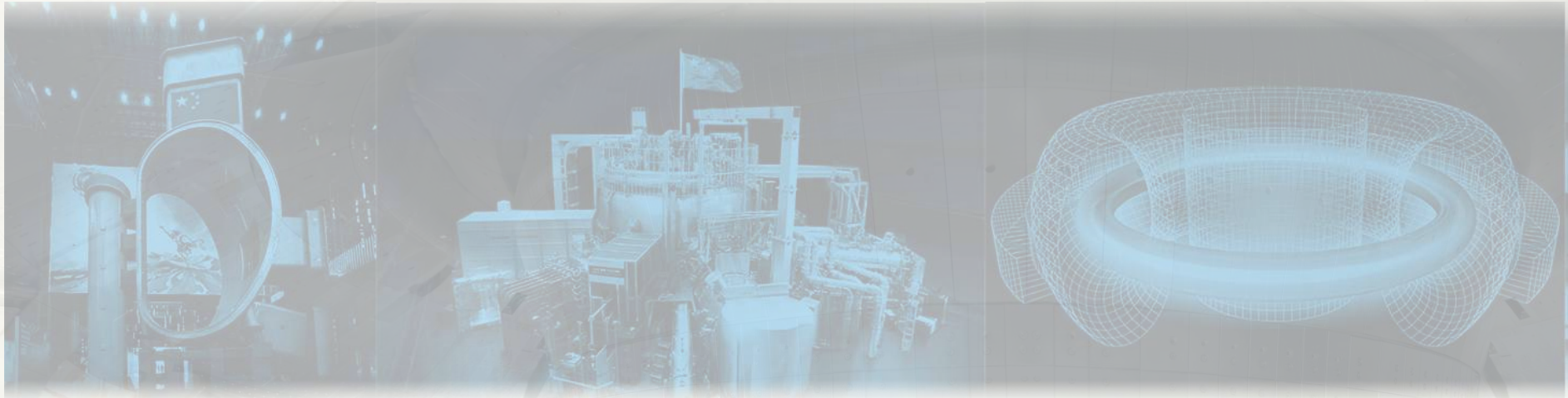
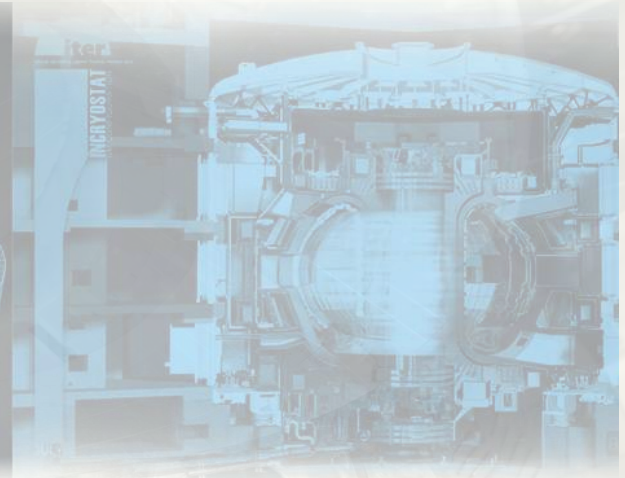
Summary

- Model reconstruction and component installation are realized in the previous version.
- 3D printing experimental environment is completed.
- Binocular vision camera is deployed and software environment is configured by importing SDK into Unity3D and rewriting code.
- EAST point cloud data is generated, the performance of point cloud will be improved by multi-angle shooting and stitching.
- Various distance calculation methods are implemented.
- Virtual installation test code is completed and proves the method is available.

Thank you !