Advanced Vibration Isolation

Semiconductor FAB’s
Use Case

Active vibration isolation technology Smart products powered by AI/ML

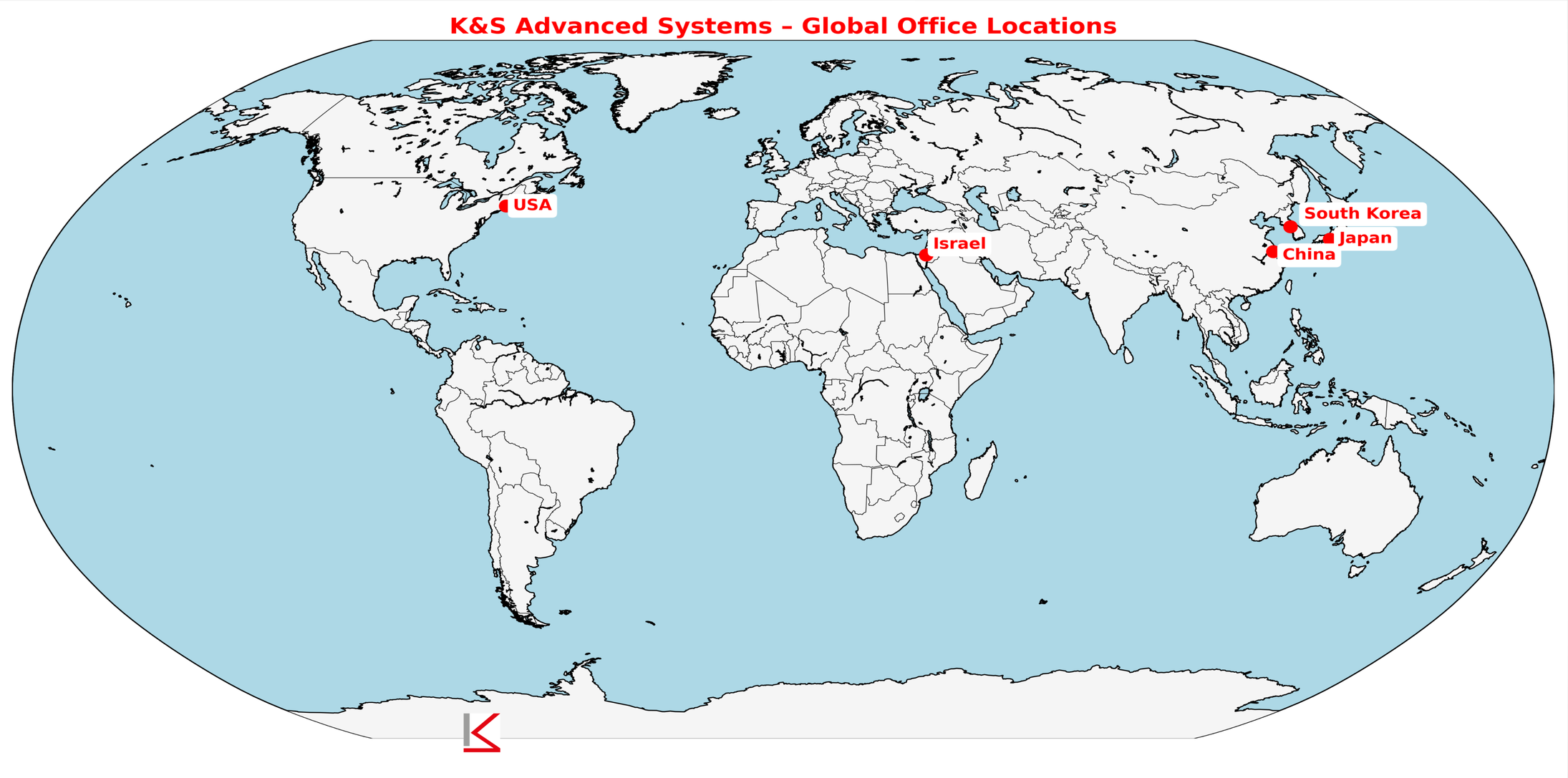
Vibration isolation

IoT

Artificial intelligence

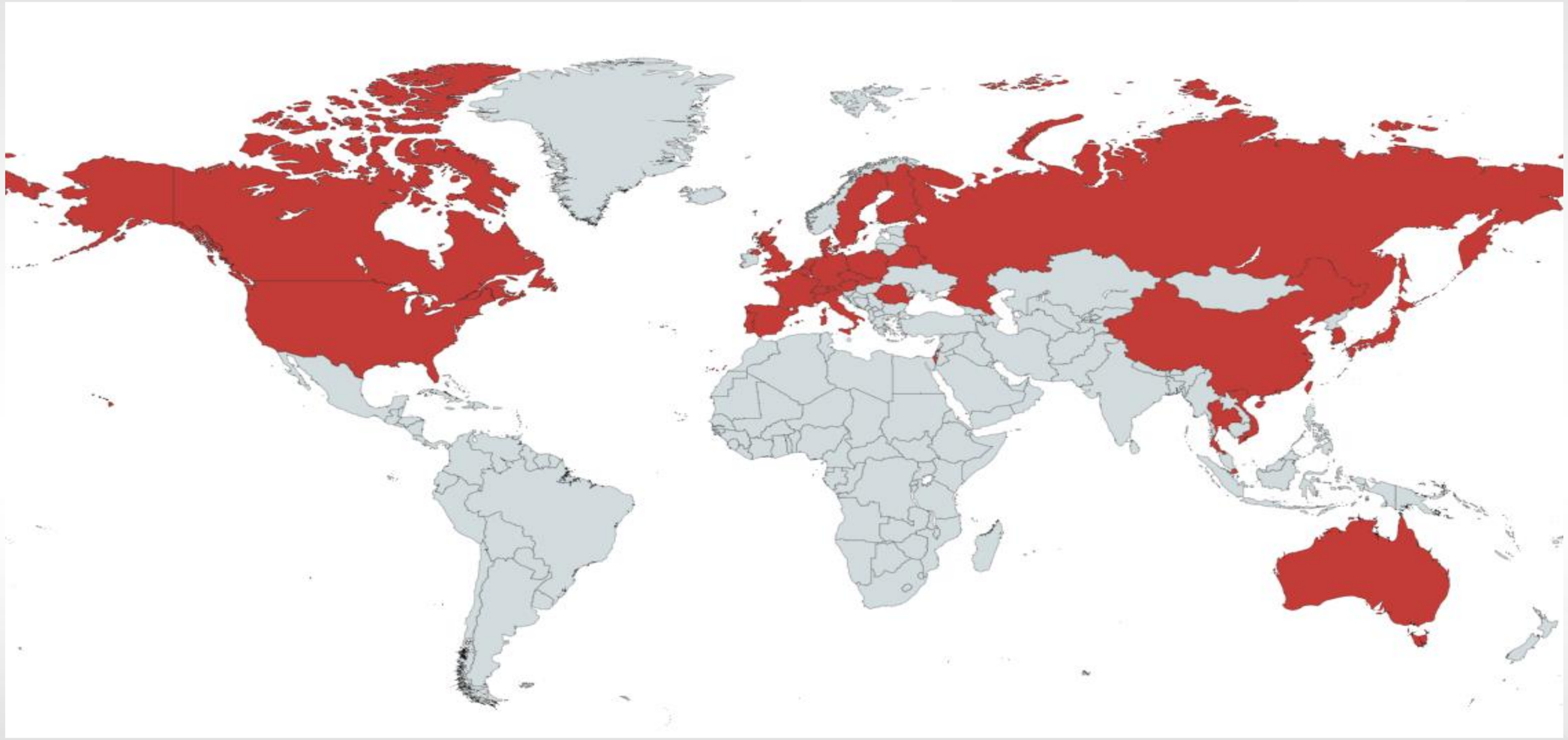
Sensing vibrations sources

K&S Offices World-Wide



Sales Territories

- Sales in more than 30 countries



Successful Track Record Serving International Market Leaders

Few Examples, using K&S ARISMD as active vibration control system

Bruker JVX7300 LSI Platform

KLA eDR7380 defect inspection and review system

Raith EBPG5150 100-kV e-Beam Lithography System

KLA IPRO X series

AMAT Provision series

Park AFM

Active Vibration Control Systems (AVCS) are critical in semiconductor fabrication facilities (FABs)

Metrology and Inspection

•**Measurement Accuracy**: Metrology tools measure critical dimensions and other parameters at the nanometer scale. Vibrations can introduce noise, affecting the accuracy and reliability of these measurements.

•**Defect Detection**: Inspection tools must identify defects at extremely small scales. Vibrations can obscure or distort the appearance of defects, reducing the effectiveness of defect detection processes.

Lithography

•**Feature Size**: Lithography machines define the smallest features on a chip. Even minute vibrations can cause misalignment, leading to defects in the chip patterns.

•**Alignment**: Maintaining precise alignment of masks and wafers is crucial. Vibrations can le misalignment, causing errors in pattern transfer.

How much FAB will be ready to pay to increase the Yield?

Advanced Technology Nodes

•**Scaling Down**: As semiconductor technology scales down to smaller nodes (e.g., 7nm, 5nm, and beyond), the sensitivity to vibrations increases. Advanced nodes require even more precise control over environmental factors, including vibrations.

Yield Improvement

•**Defect Reduction**: Minimizing vibrations helps reduce the introduction of defects during critical manufacturing steps, directly impacting the yield and overall productivity of the FAB.

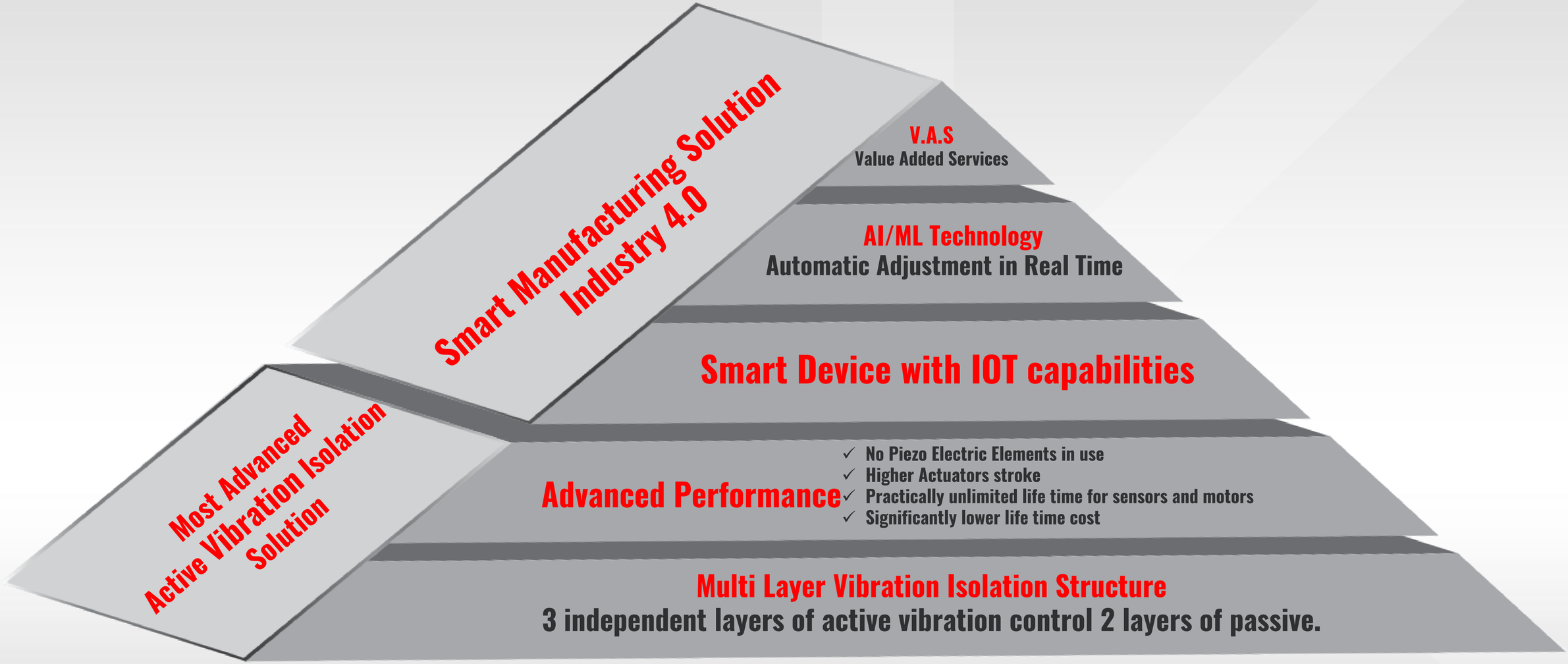
•**Process Control**: Better control over vibrations leads to more accurate process control, which is essential for achieving high yields in semiconductor manufacturing.

Process Stability

•**Consistency**: AVCS (Active Vibration Control Systems) help maintain a stable environment, ensuring that process conditions remain consistent. This consistency is vital for producing high yields and maintaining the quality of semiconductor devices.

•**Reproducibility**: In semiconductor manufacturing, reproducibility is key. Vibrations can lead to variations in process conditions, affecting the reproducibility of results across different batches.

High Level System Architecture



Technology Principle – Multilayer Vibration Isolation Structure (MVIS)

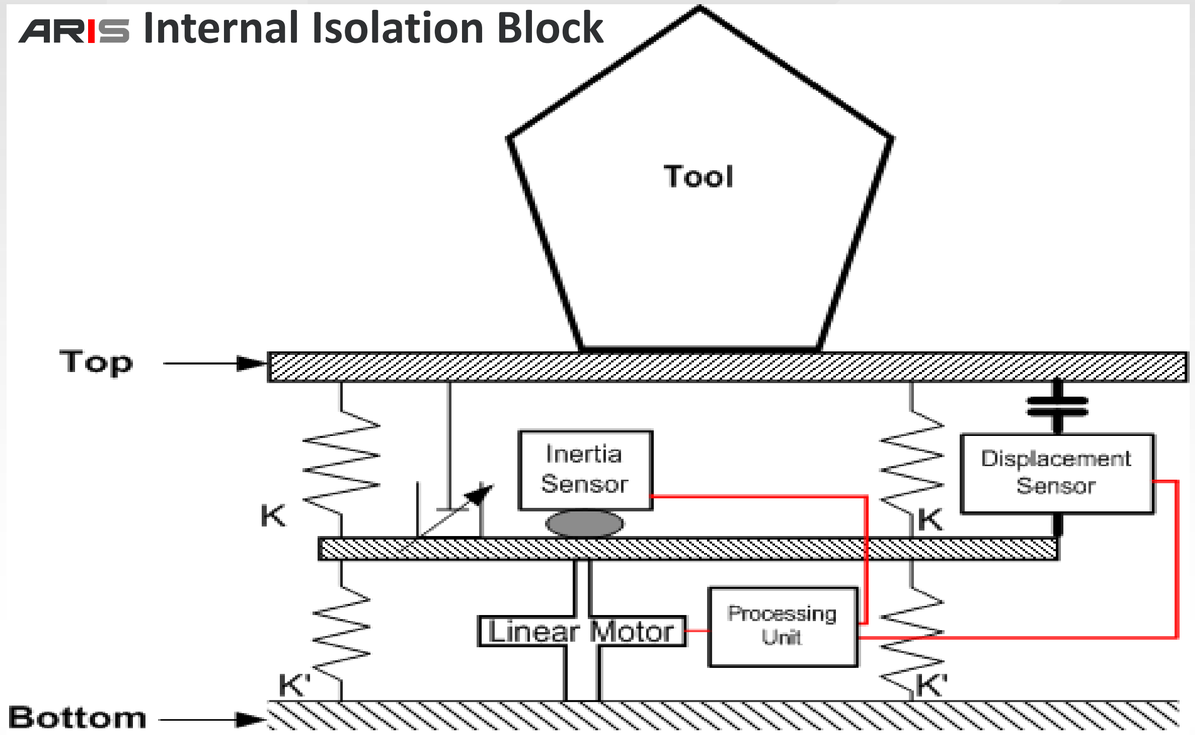
K&S active vibration isolation are based on advanced technology, that combines up to

- **4 independent layers of active vibration cancelation**
- **2 Passive Layers.**

The extensive flexibility of such system architecture allows K&S systems to get maximum performance in installations, especially in cases where the typical system would be impossible to use.

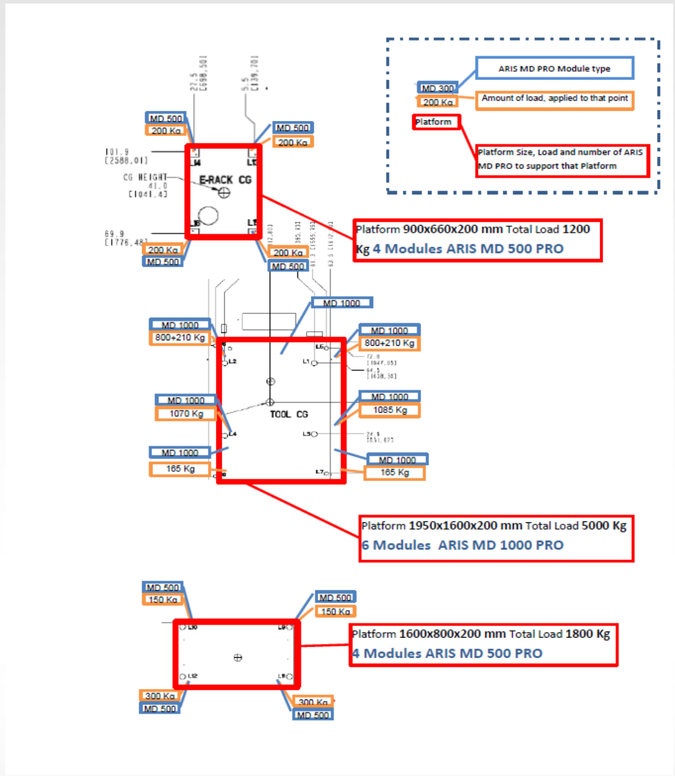
Each ARIS Isolator has up to 8 internal Isolation Blocks

- ✓ Up to 8 internal Sensors (X, Y, Z)
- ✓ Up to 8 internal Actuators

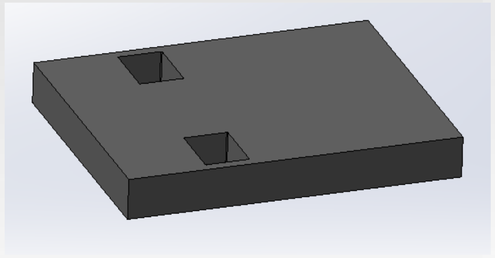


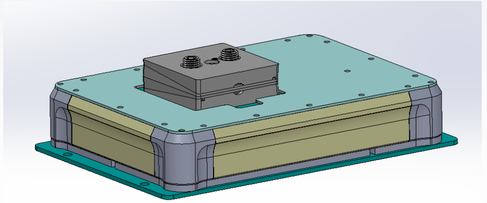
Simplified in FAB/Clean Room installation procedure

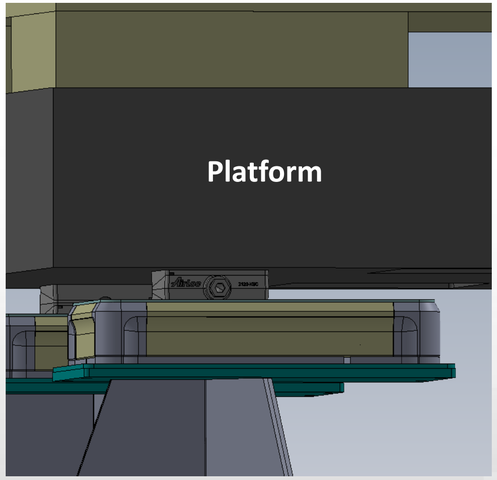
Global Planning



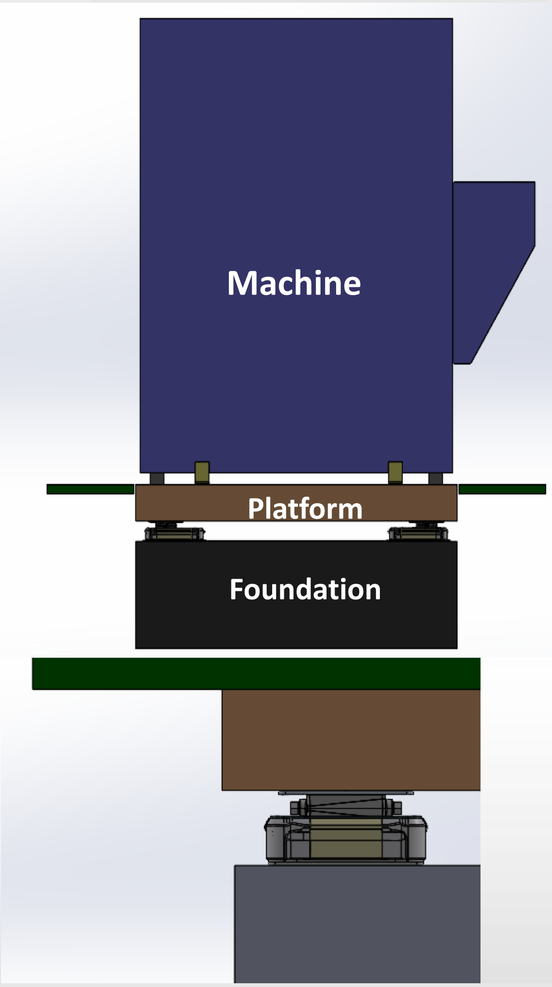
Detailed Planning

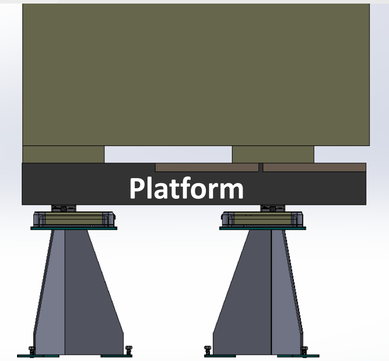


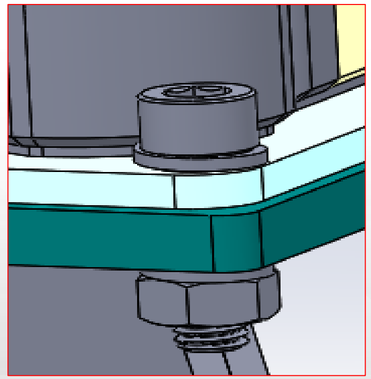




Detailed Design

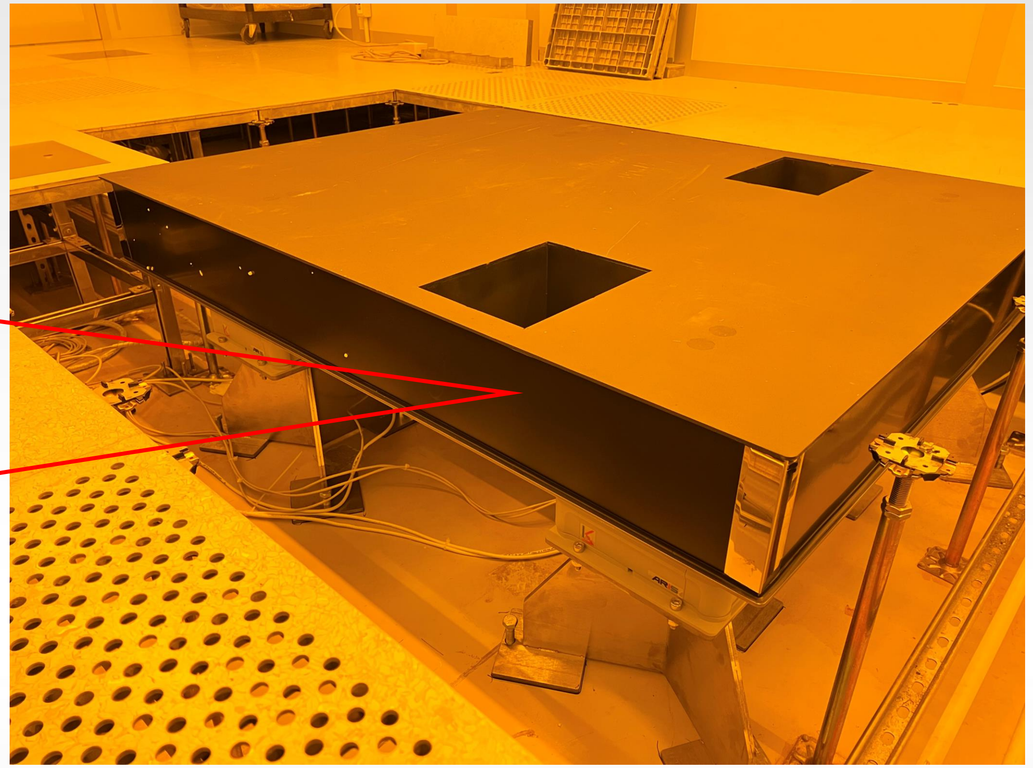




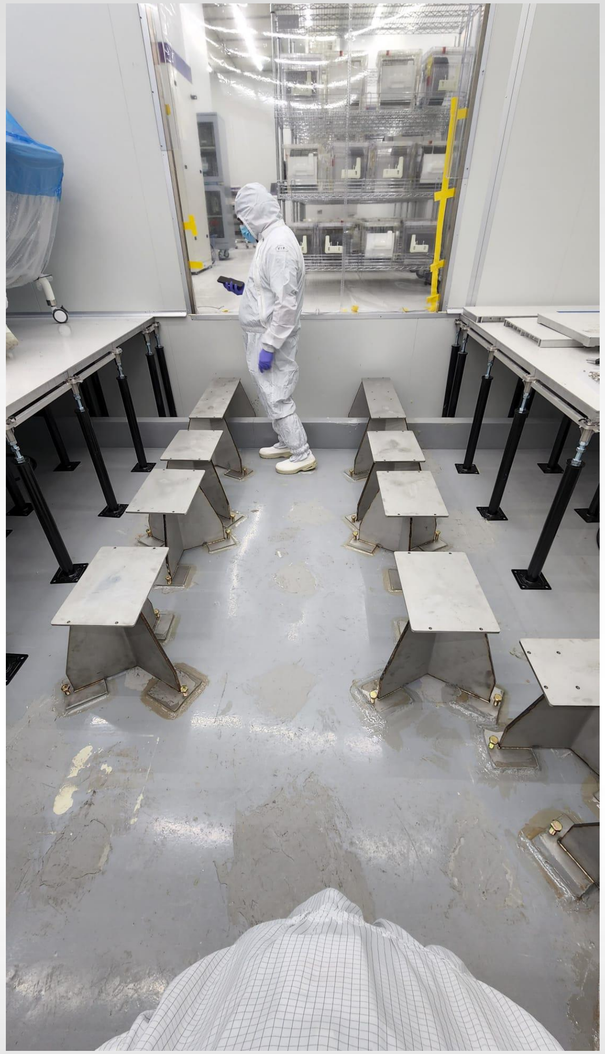


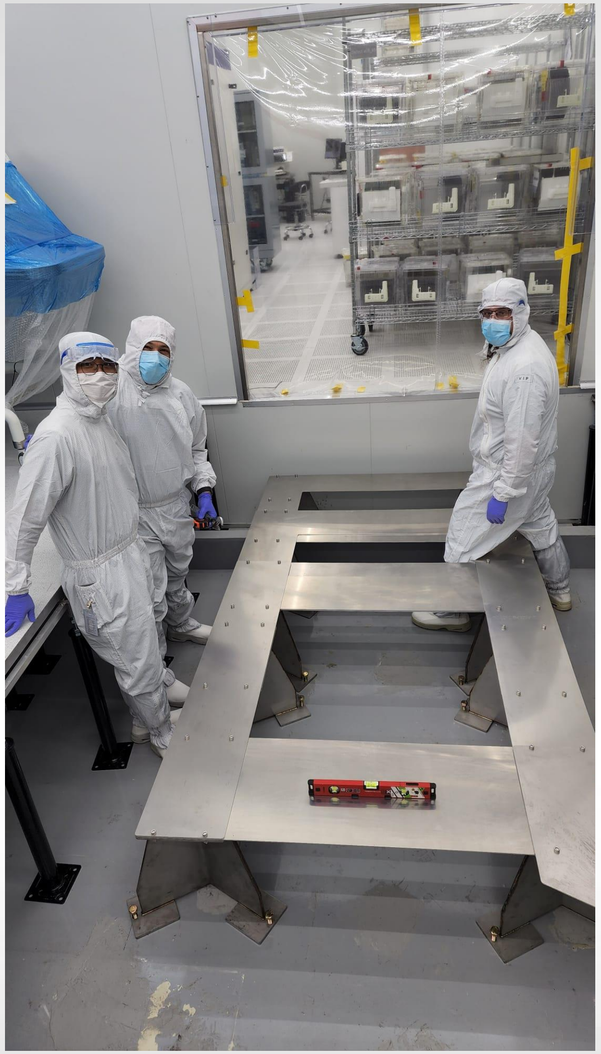
Honeycomb Platform – What it is?

Platform Internal Structure

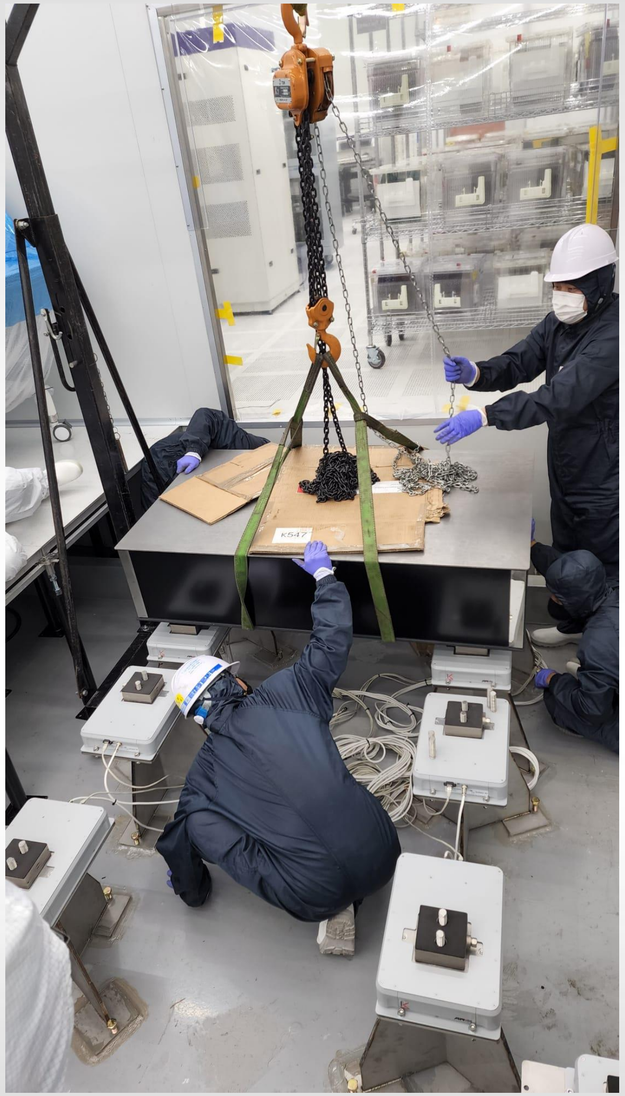


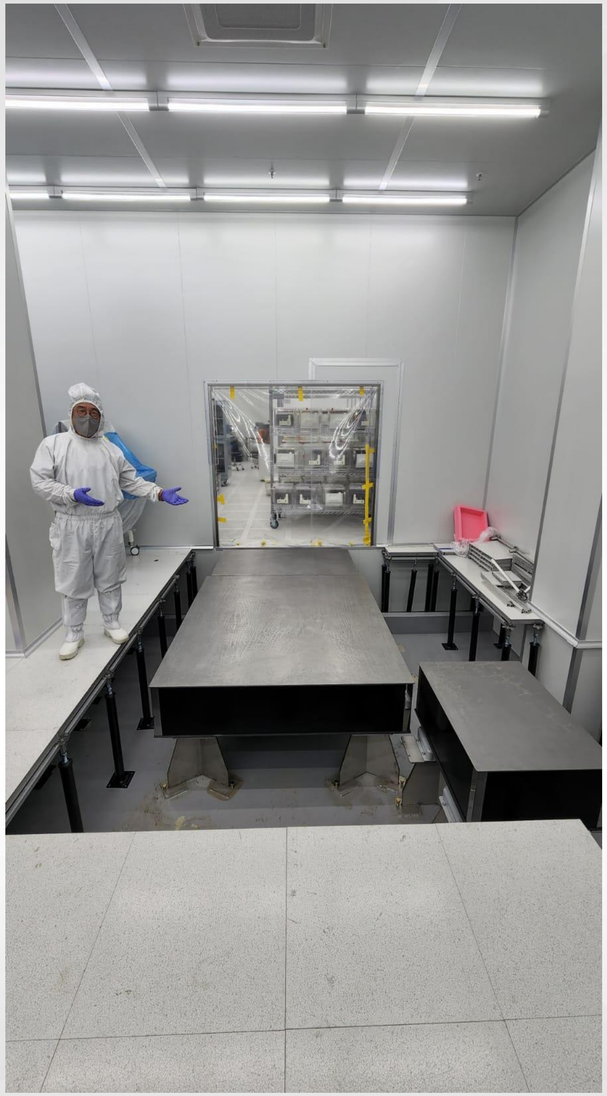
Active vibration control system –In FAB installation Step 1





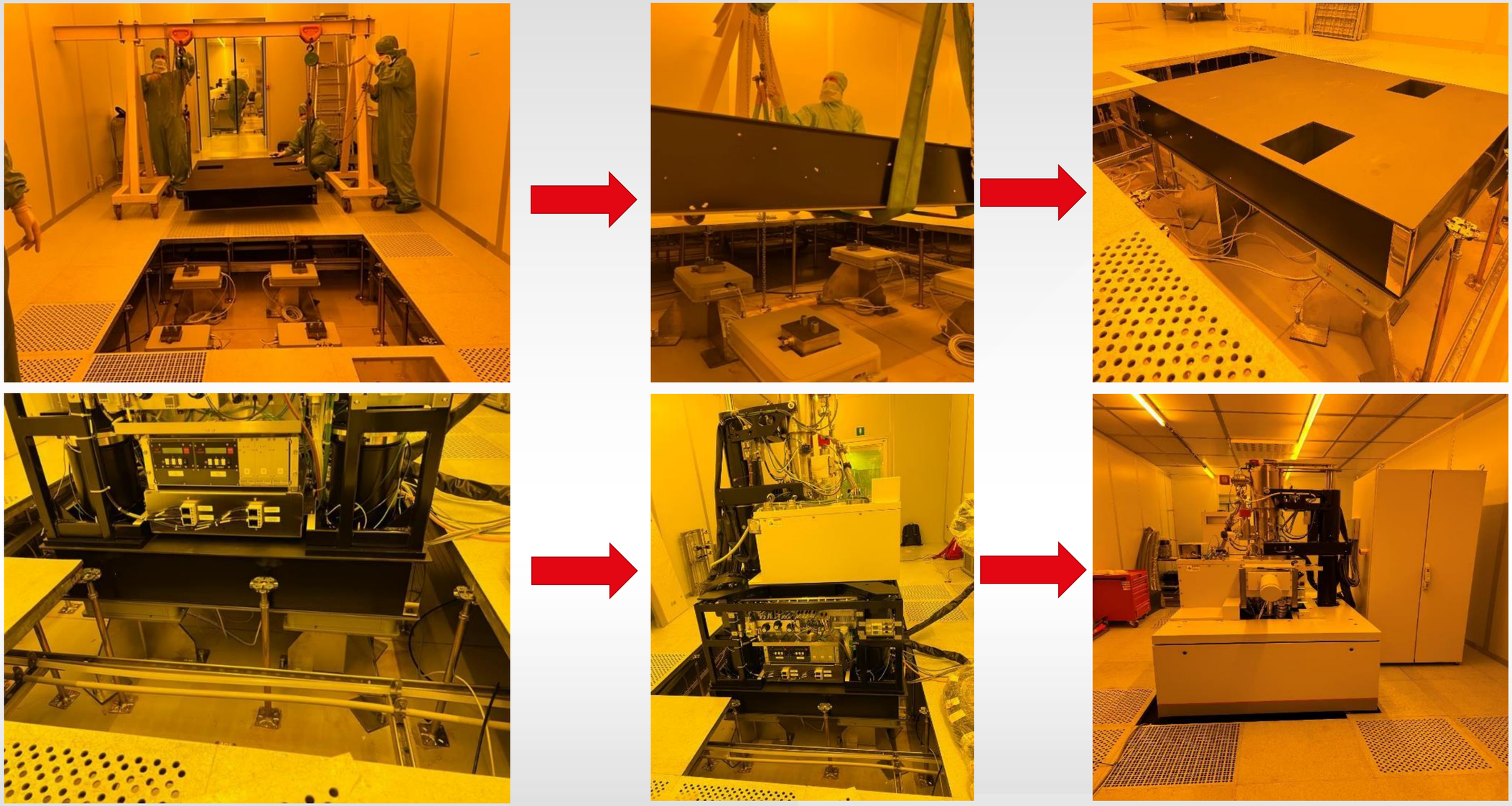
Active vibration control system –In FAB installation Step 2



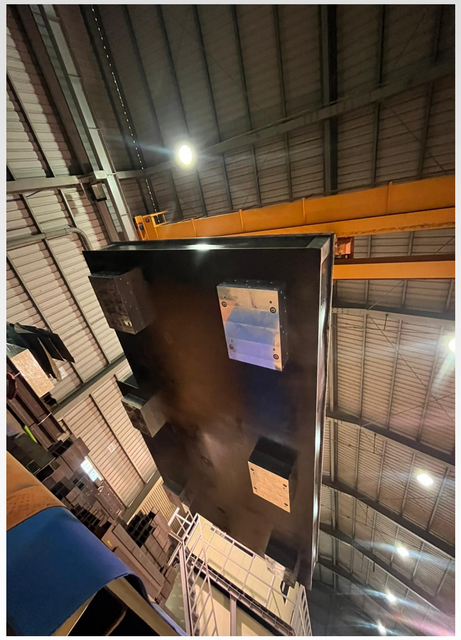


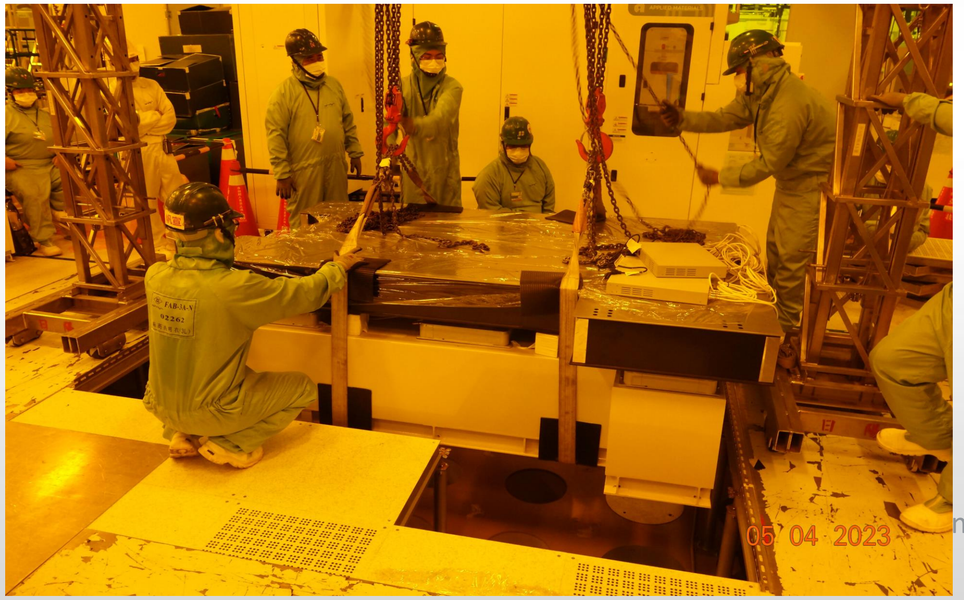
Active vibration control system –In FAB installation Step 3

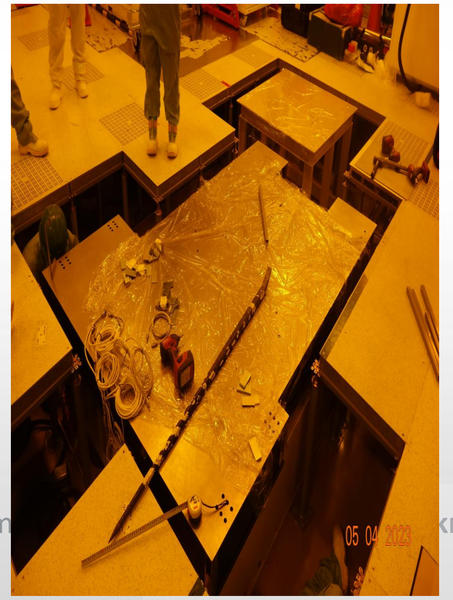
Active vibration control system – Example of In FAB installation. Tripods Using Example

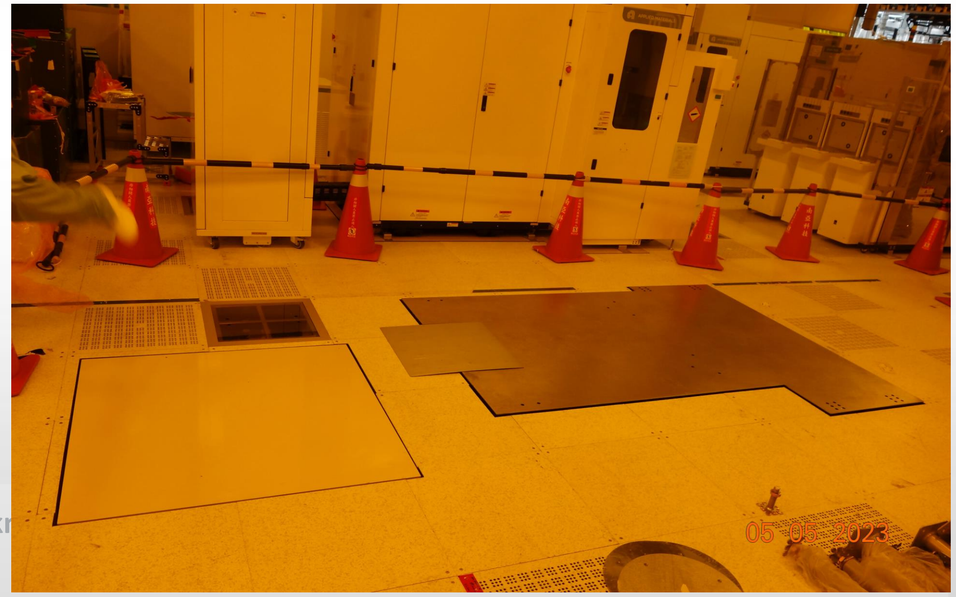


Active vibration control system – Example of In FAB installation. Concrete Foundation using example

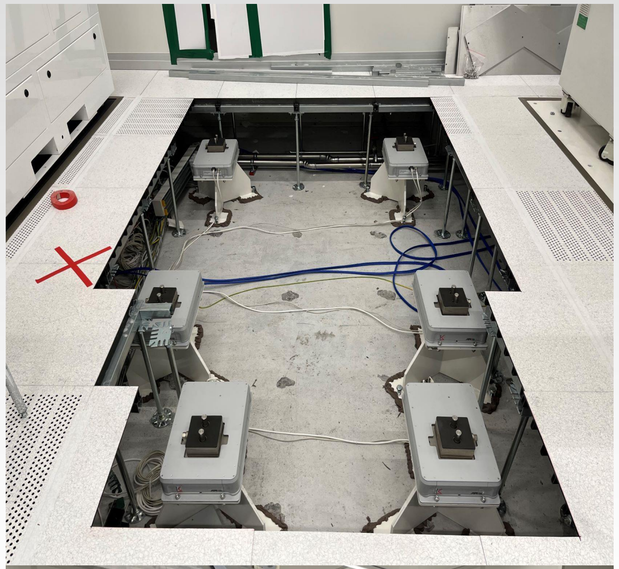


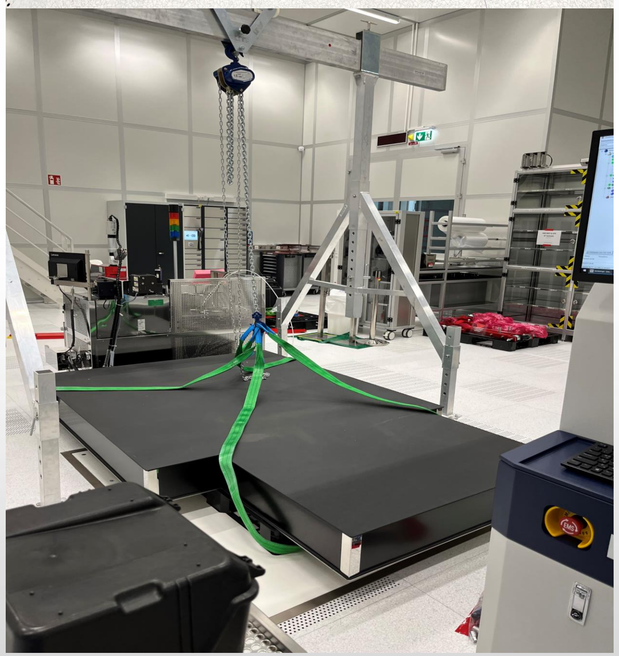


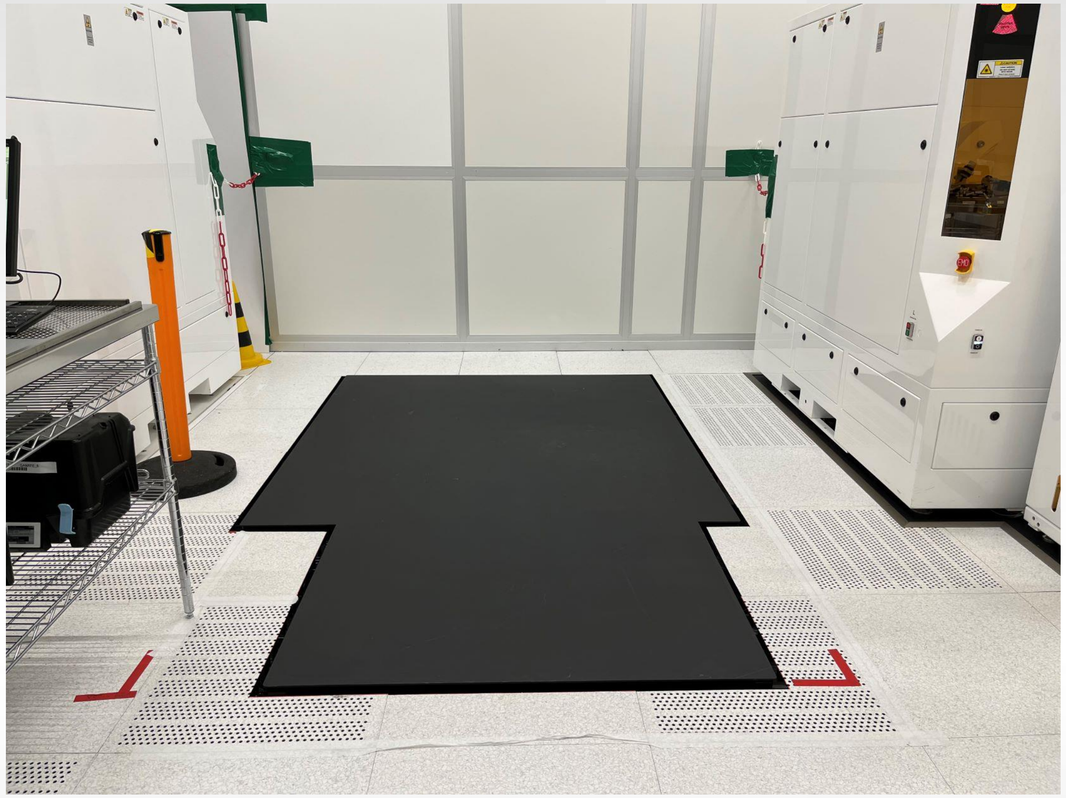




Active vibration control system – Example of In FAB installation







Active vibration control system – Example of In FAB installation

Directly under machine Foot

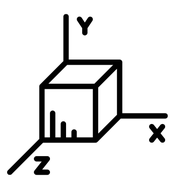
Proprietary Active Vibrations Control with Added Value Services

AI

Attaching to the Frame/Floor and Continuously Sensing Frame/Floor Vibrations

In Real Time

Continuously



In X, Y, Z axis

Sensing Vibrations **Amplitude**

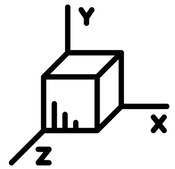
Sensing Vibrations **Frequency**

Machine Learning

Attaching to machine/instrument Payload and Sensing Payload Vibrations

In Real Time

Continuously



In X, Y, Z axis

Sensing Vibrations **Amplitude**

Sensing Vibrations **Frequency**

Integrated Frame base sensors
showing Input vibrations values before active vibration isolation

Integrated Top Payload sensors
showing vibrations values after and in parallel of active vibration isolation system functioning

Real Time Vibrations Monitoring and Control in FAB

Continuously

Vibrations Isolation

In Real Time

Communication Channel

Sensing Vibrations Amplitude

Sensing Vibrations Frequency

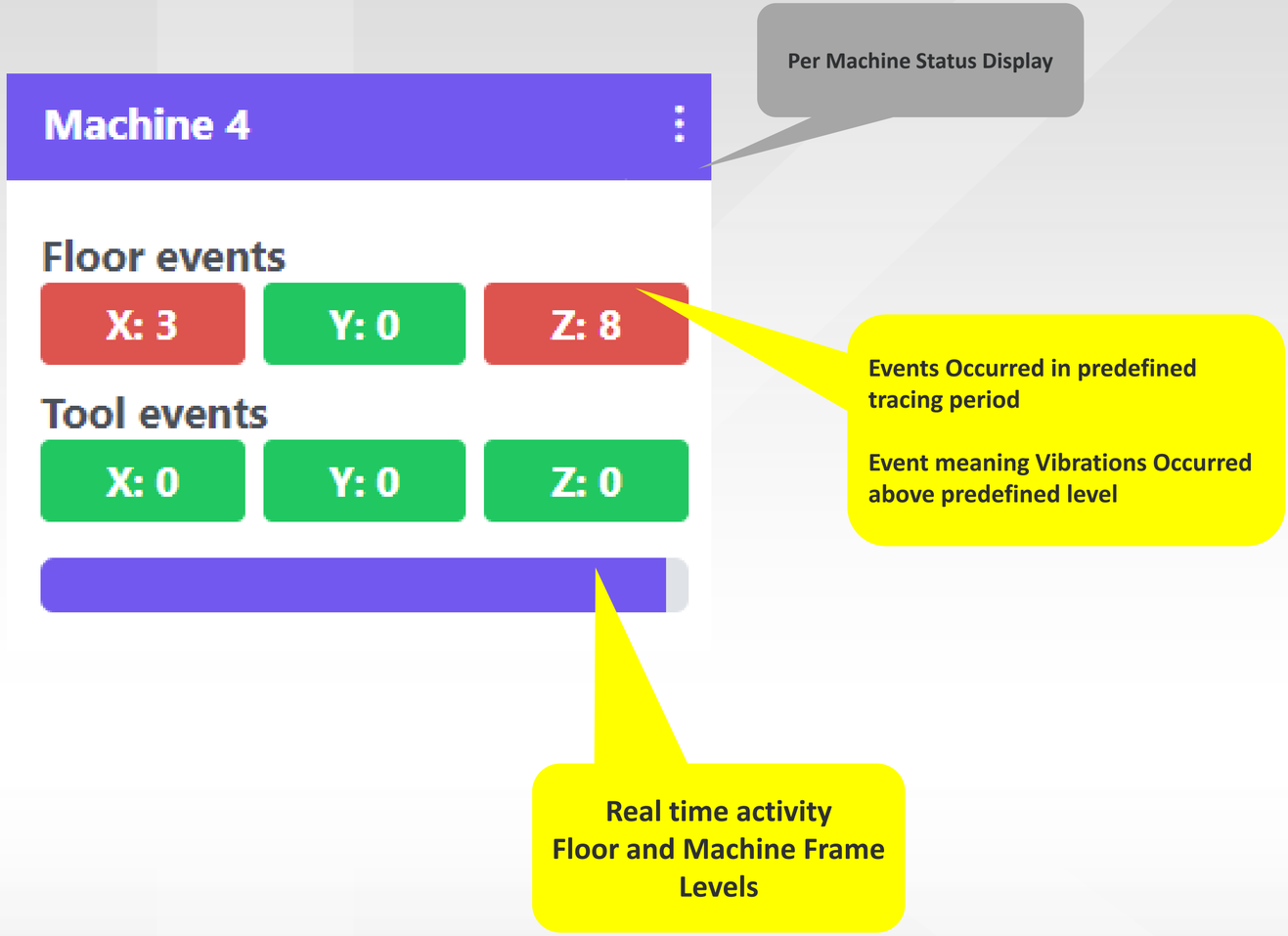
In X, Y, Z axis

SMU

- **Floor Conditions Monitoring**
  - ✓ Immediate indication on Event, where the Floor vibrations level crossing predefined VC value
- **Machine Frame Conditions Monitoring**
  - ✓ Immediate indication on Event, where the Machine Frame vibrations level crossing predefined VC value
- **Industry 4.0 - In FAB Smart Manufacturing**
  - ✓ Machine Preventing Maintenance
  - ✓ FAB Floor environmental conditions monitoring and alarming in real time
  - ✓ Ability to detect machines, which generating vibrations to the FAB floor.

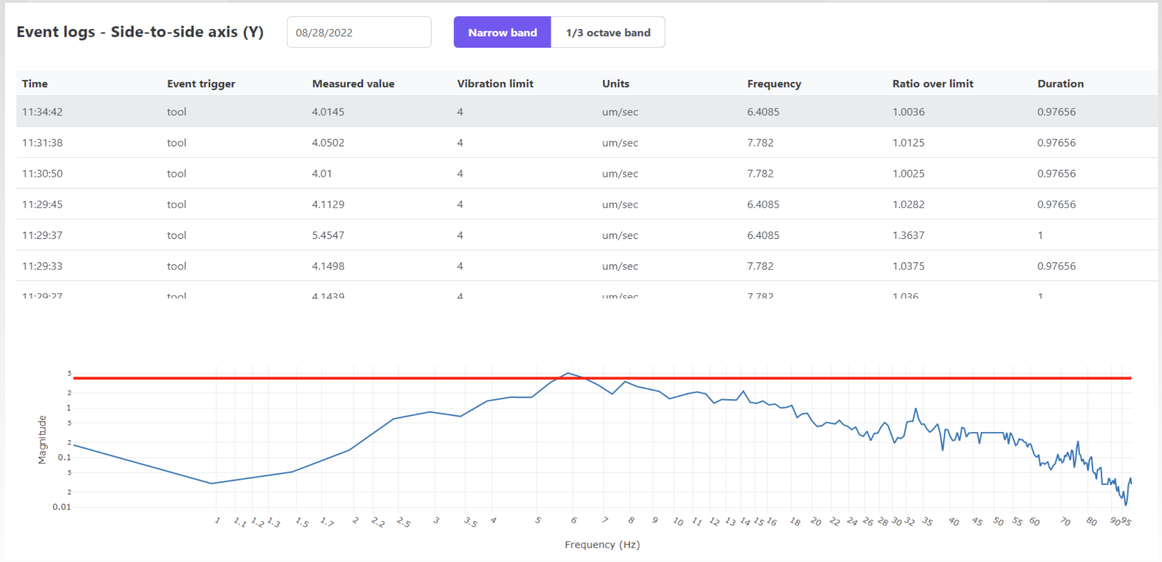
SMU Smart Manufacturing Utility – Simple and User Friendly

- Real time monitoring of Multiple machines
- Per Machine Monitoring
  - Floor Status
  - Machine Frame Status
- Artificial Intelligence (AI) and Machine Learning (ML) Algorithms learning floor and machine behavior.
- Automatically processing real time data from multiple sensors inside ARISMD system
- Calculating and Generating Events Log in resolution of:
  - Hours
  - Days
  - Weeks
  - Months
- Presenting Vibrations event Information in easily readable form
- Vibrations events charts

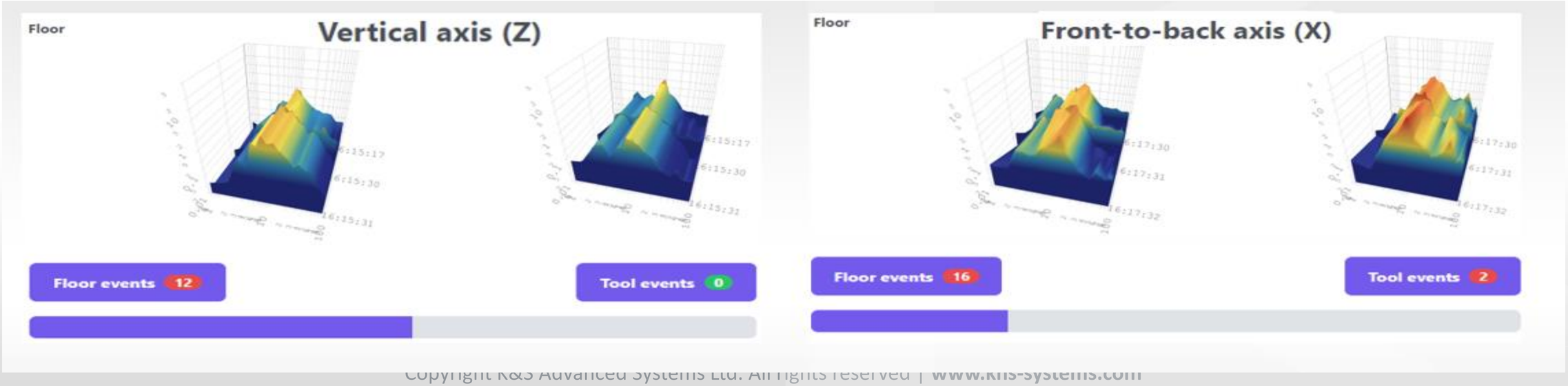


Smart Manufacturing Utility – Event Log

- Event Log – showing the list of Events per Machine
  - Date and Time Stamp
    - Number of dates to store data
  - Event trigger (machine or floor)
    - Frequency
    - Axis
    - Amplitude
  - Amplifications detected over predefined limit – Smart algorithm
  - Duration of event
  - E- Mail Notifications

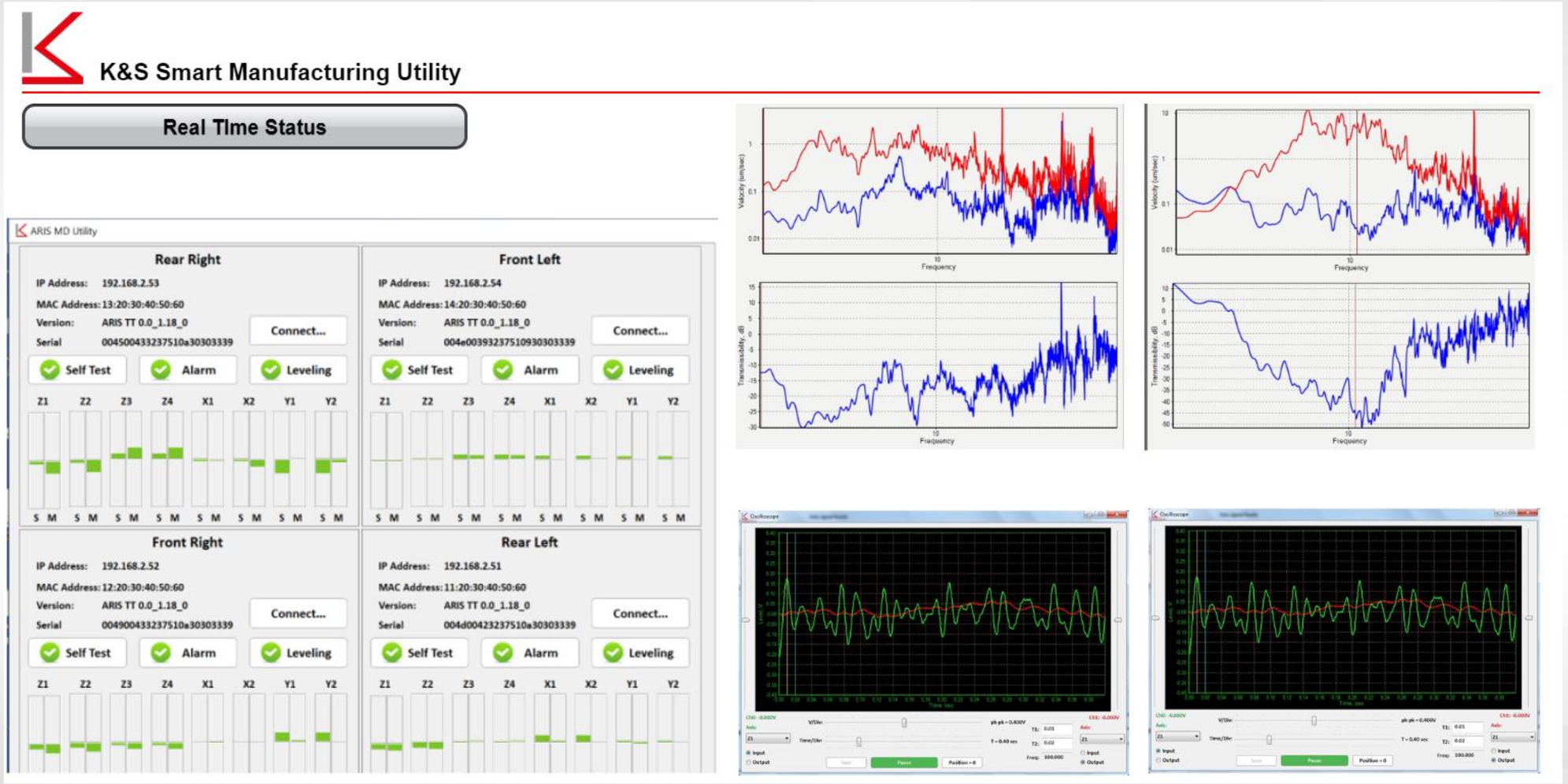


- Examples of event charts



ARISMD PRO - Real time system data

- ARISMD System Status
- Real time diagnostic
  - Spectrum Analyzer – Frequency domain
  - Oscilloscope – Real time domain



Advanced Vibration Isolation

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Thank you

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Comparison Analyzes: Dumped Honeycomb Platform Vs Concrete Foundation

Parameter	Concrete Base	Damped Metal Coil-Based Honeycomb Platform
Natural Frequency	Low (due to high mass), but may transmit low-frequency floor vibrations	**Tunable and often higher; optimized to decouple tool from low frequency building vibration**
Stiffness (static)	~ 10^9 N/m	**~10^8 N/m**
Cleanroom Compatibility	Needs epoxy coating, not reconfigurable for environments changes	**Cleanroom-ready (stainless steel), easy to install/move**
Tool-Specific Damping Design	Simple Concrete block under the tool	**Platform can be engineered to match tool's modal response**
Coupling to Floor Vibrations	Strong coupling—transmits building and structural vibrations	**Easily reconfigurable to add Decoupling devices to reduces floor transmission into the Tool**
Compatibility with Active Systems	Requires mounting interface and additional Platform	**Optimized to add Active Systems (e.g., K&S ArisMD)**
Resonance Amplification Risk	Can cause resonance peaks depending on foundation-tool interaction	**Engineered to avoid Low Frequencies structural resonance in sensitive bands**
Customizability	Difficult to modify once poured	**Highly modular—cutouts, cable trays, ports, leveling systems possible**
Installation Time / Cost	High (needs design, pouring, curing, anchoring)	**Lower (prefabricated, turnkey options)**
Use in Legacy FABs	Difficult to retrofit	**Ideal for legacy Fabs with vibration issues or floor compliance limits**
Use in Leading-Edge FABs	Common for various tools	**Increasingly preferred for modular tool**

Summary: Why Damped Stainless Steel Honeycomb Outperforms Concrete for Vibration Isolation

- ✓ **Custom Damping Behavior:**
  Stainless Steel honeycomb platforms can be tuned or selected with built-in damping or even **frequency-specific mass dampers**, targeting the **dominant vibration spectrum** of each tool.
- ✓ **Active System Integration:**
  Honeycomb platforms are **designed to work seamlessly with active vibration control systems**, unlike concrete pedestals that often require mechanical retrofitting.
- ✓ **Modular, Tunable, Scalable:**
  In dynamic environments like semiconductor FABs, **flexibility matters**. Honeycomb platforms allow **adaptive vibration control** while concrete is a "frozen" solution.