



# IEEE SW Test Workshop

## Semiconductor Wafer Test Workshop

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### THE EVOLUTION OF A VERSATILE PROBE CARD LOADER-TRANSPORT TROLLEY



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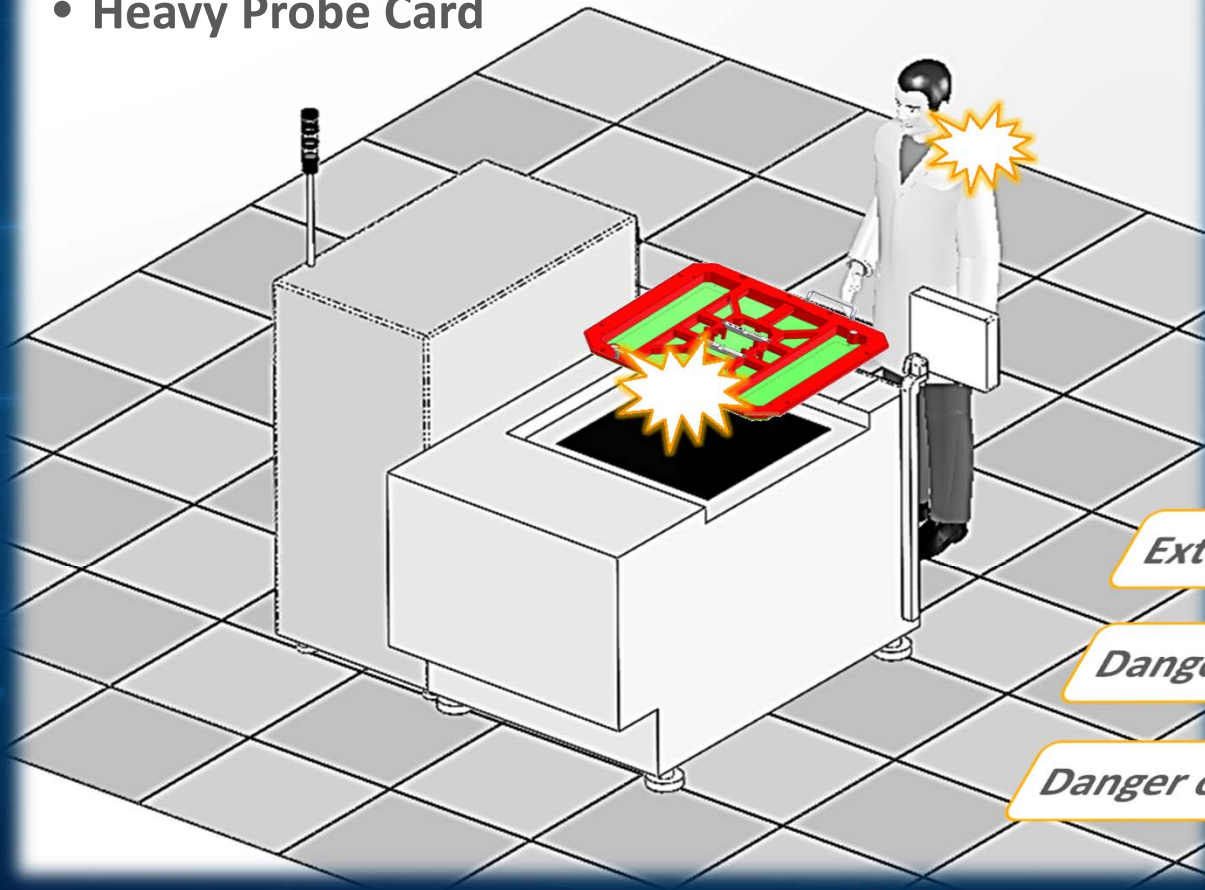
Product Manager - Germany

# Overview

- Problem Statement
- Prototype Concept
- Specification of Design Requirements
- Mission Statements
- Project Scope Redefined
- The Solution
- The Future
- Summary

# The Problem

- Oversized Probe Card
- Heavy Probe Card



*Extended reach by operator*

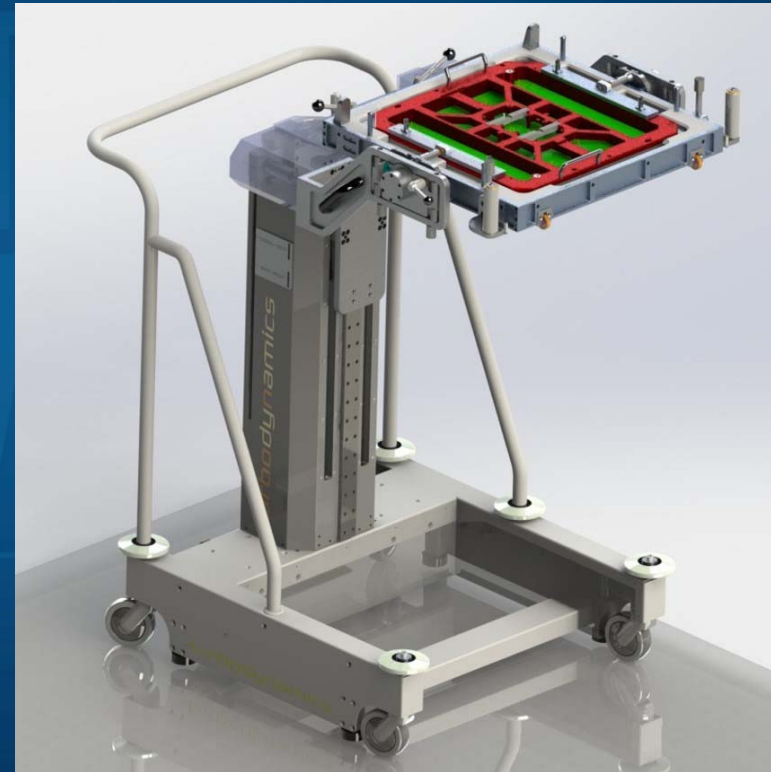
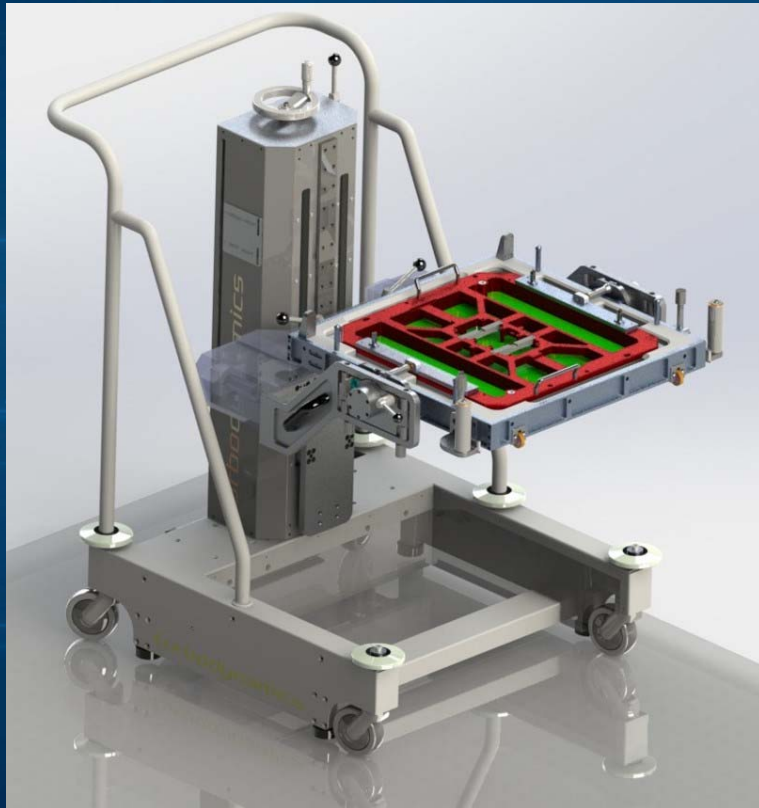
*Danger of operator injury*

*Danger of probe card damage*

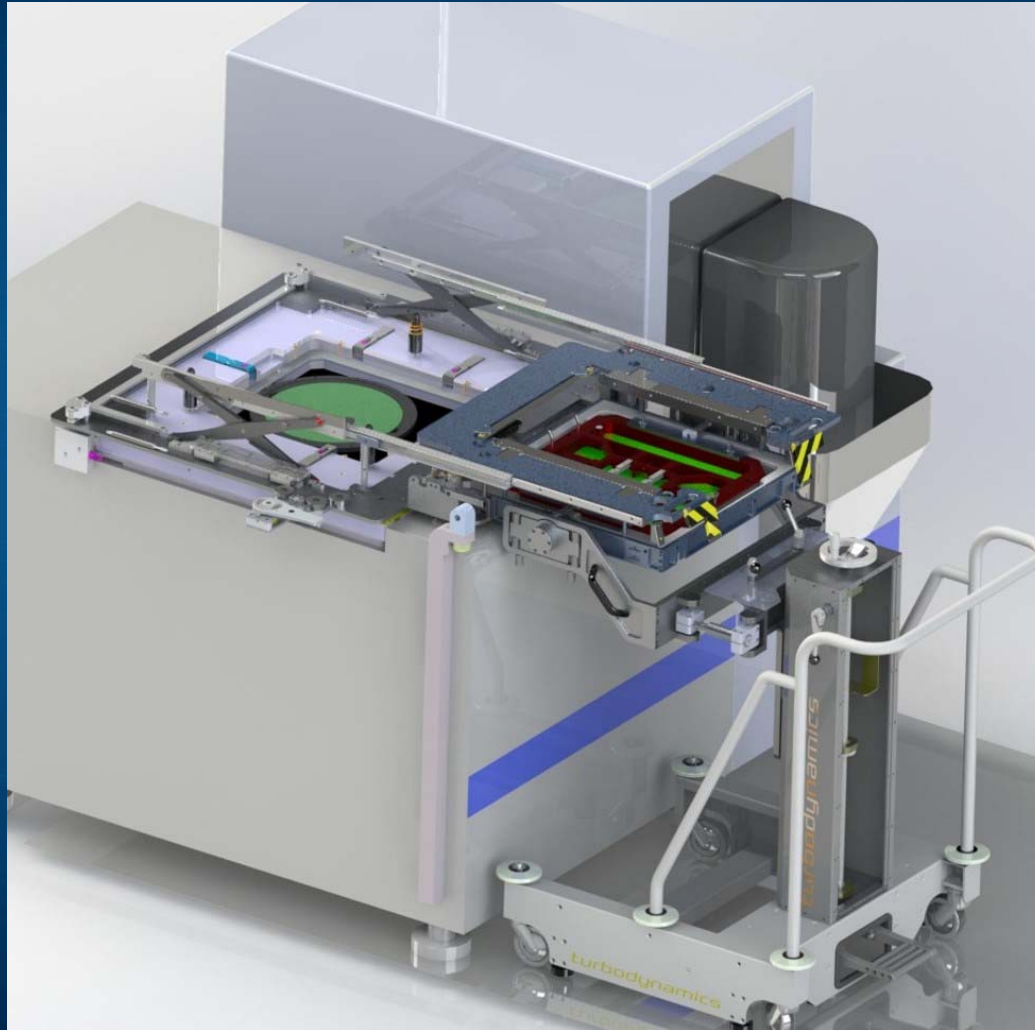
# Manual Loading Station



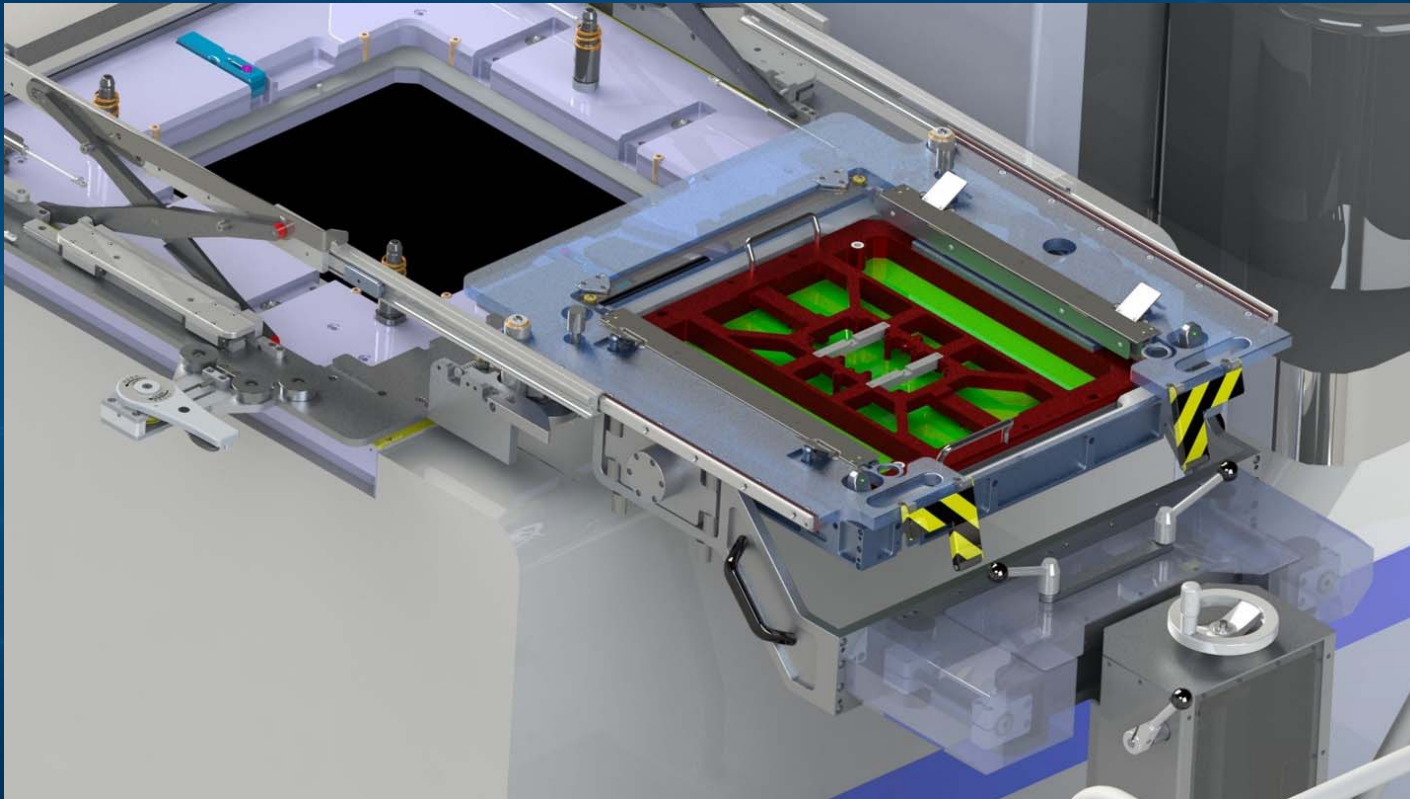
# Transport



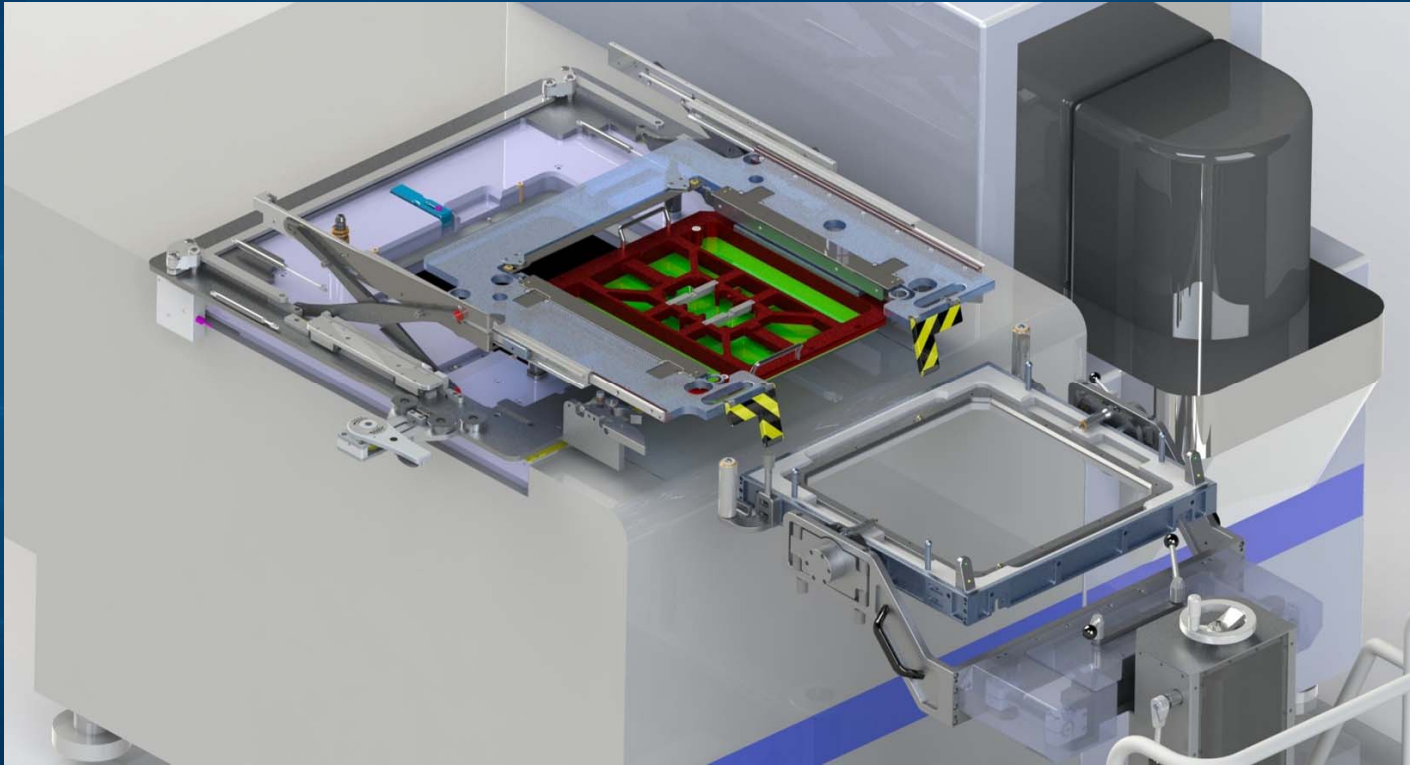
# Prober Introduction



# Handshake



# Drawer Closure



# Reset



# Specs

## Mechanical Requirements

1. Compatible with all applicable TI head stages and defined interfaces
2. Compatible with all Accretech 300mm probers (UF300, UF300A, UF3000, UF3000Exe, FP3000)
3. Compatible with Tesec 4170, Tesec 4380, and Rasco SO3000 Strip Handlers
4. Work with 12", 18" round probe cards and TI SQ/Strip stiffeners
5. Be able to maneuver between 42" min. wide aiseways while holding a probe card
6. Probe card pick-up and drop-off time < 3 minutes (Does not include travel time between pick up and drop off points)
7. Lift/Cart features can not extend underneath prober
8. Arm must self-align to probe card for pick-up from carrier (workstation) or head stage
9. Must be able to pick up probe card from probe card carrier box on table between 34" - 40" from floor
10. Must be able to pick-up and drop-off probe card to probers ranging in height of 27" - 51"
11. Arm holding probe card needs to self-align to head stage features
12. Must be able to lower probe card into head stage opening aligning to ring insert alignment features (auto-align)
13. Must be able to twist probe card from DUT down to DUT up (180 deg. to load onto analyzer)
14. Must be able to clear prober side docking hardware (REF 51")
15. Must be able to clear test head with DUT down in the max up manipulator position
16. Arm locks to prevent arm (probe card) from moving during transport

# Specs

## Cleanroom Protocol

1. These materials can not be used: Polyethylene
2. No contamination sources directly over opening of head stage

## Electrical Requirements

1. Rechargeable gel battery
2. Gel battery type with 12 hrs. of run time, 3 hrs. charge time
3. Charging system auto switching and compatible with all probe site power requirements
4. Cart must have capability to run off of direct power plug and be auto voltage switching
5. Manual operation (override) if power failure

## Ergo / Safety Requirements

1. Must meet Semi S2/S8 standards and TI ESH.
2. Meets tip spec with arm extended and 50 lb. load
3. Arm mechanism must have crush force of < 50 lbs.
4. One person operation (Male or Female)
5. Lift must be able to maneuver on 5 deg. ramp safely
6. If cart is motorized, can not exceed 4 mph
7. Wheel locks to prevent lift from moving during pick-up or release of probe card
8. Probe card latching mechanism must be user friendly, require no tools, and hold probe card securely
9. Must have safety device to prevent probe card from falling if latching mechanism should fail
10. If motorized, arm must maintain current position in case of power failure (auto-braking)
11. Arm can not be extended while cart is in motion
12. < 27 lbs. initial and < 10 lbs. to sustain push or pull of cart/manipulator

# Mission Challenges

- **Secure Transport of the Probe Card to the Prober**

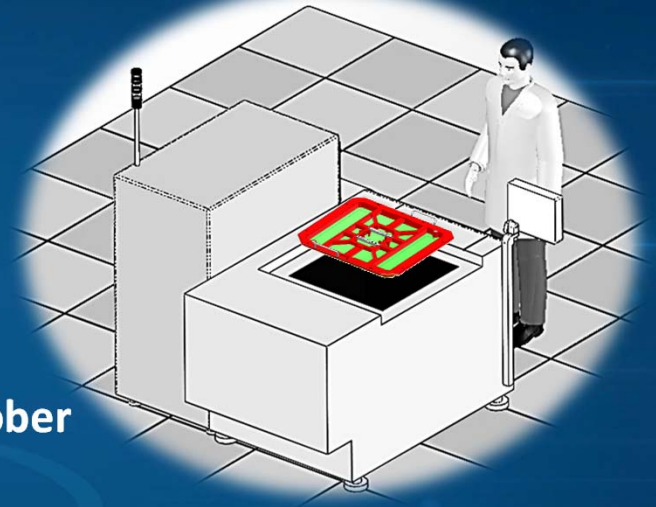
- Safe probe card pickup at the storage
- Follow test floor guidelines
- Achieve the technical machine directives (tilting, ...)

- **Exact Probe Card Positioning**

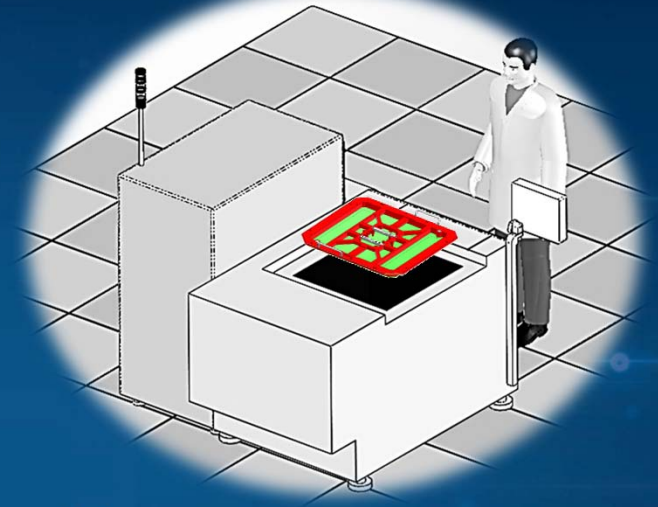
- Vehicle alignment and security to the prober
- Reference position to the probe card
- Repeatable positioning

- **Safe Probe Card loading into the Prober's Insert**

- Accessing the prober
- No interference with the prober head plate or periphery
- No accidental damage of the needles



# Mission Challenges



- **Fool Proof Operation**

- No accidental release of the probe card
- No accidental collision with environment or prober periphery
- Sequential tasks that require serial execution to avoid operator error

- **General**

- Easy handling for operators including those of small stature
- Universal for all kinds of probers and probe card types

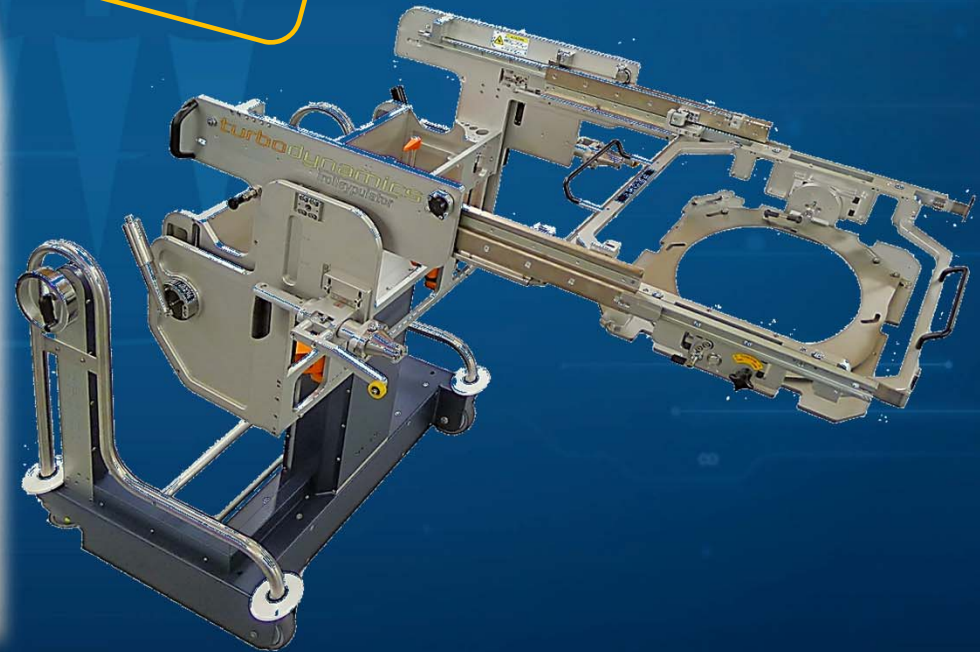
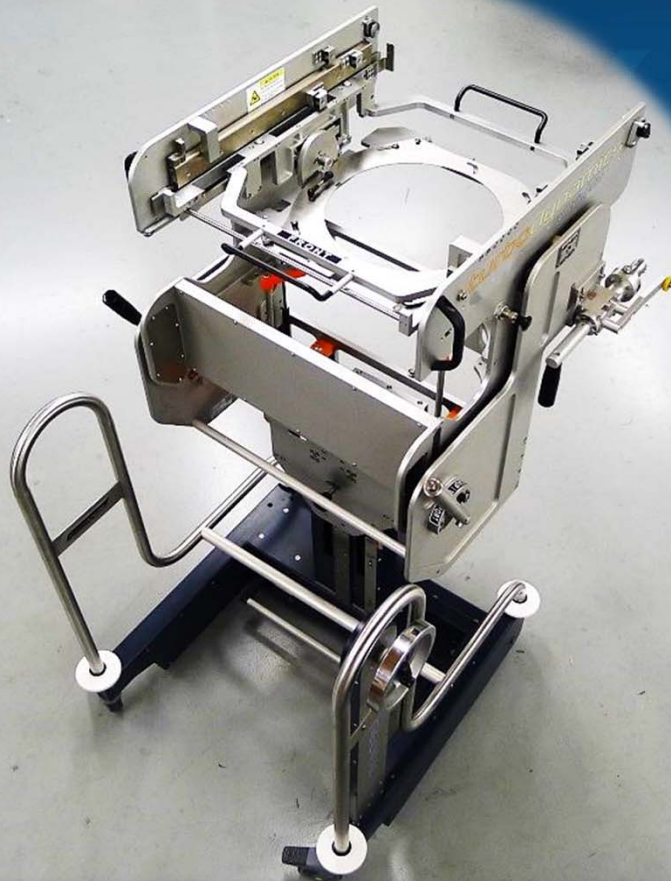
# PC Transport and Feeder in One

 Probe Card Pickup

 Transport Trolley

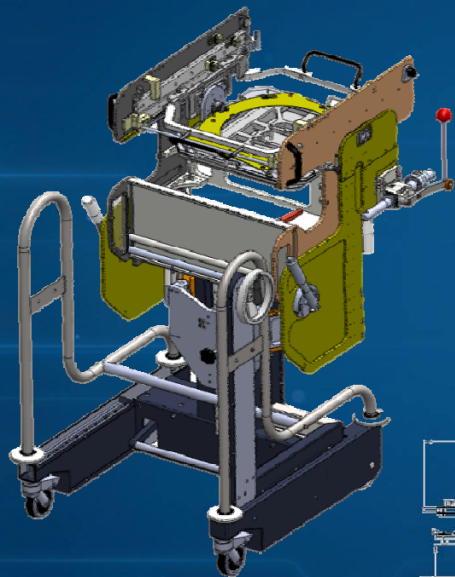
 Prober Loader

Patent  
Pending

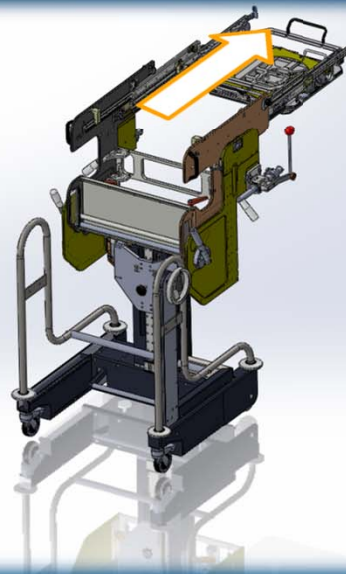
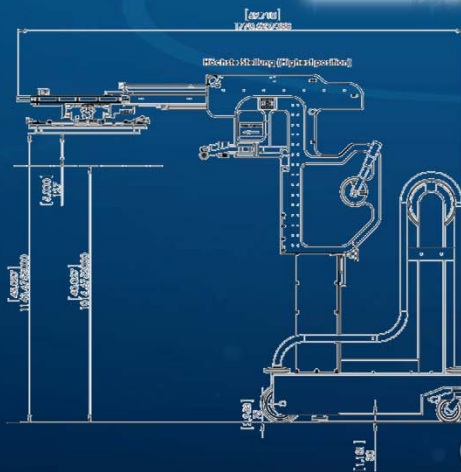


# Principle Function

Transport



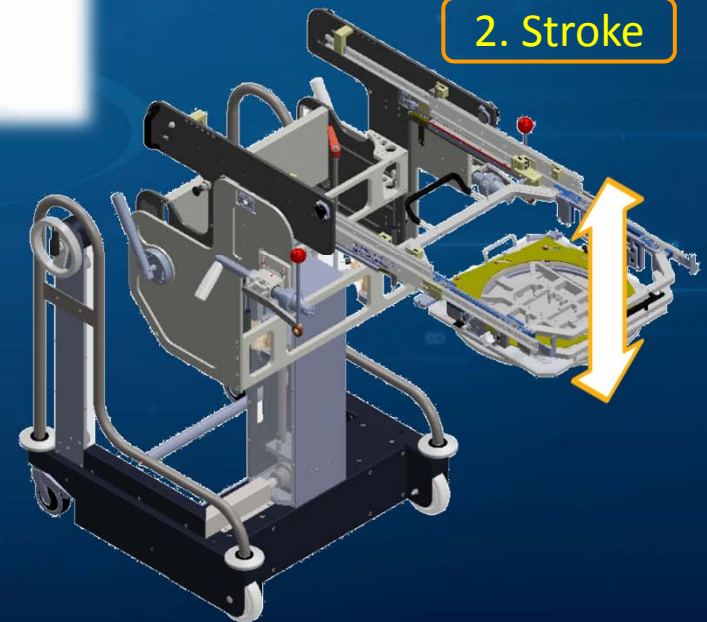
Patent  
Pending



1. Stroke

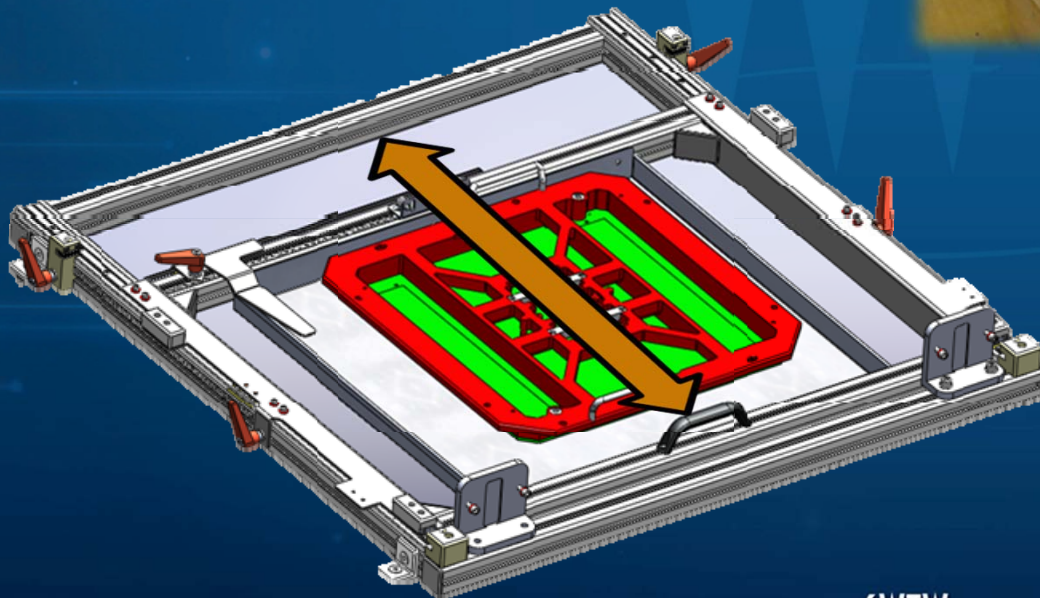
Pickup / Release

2. Stroke



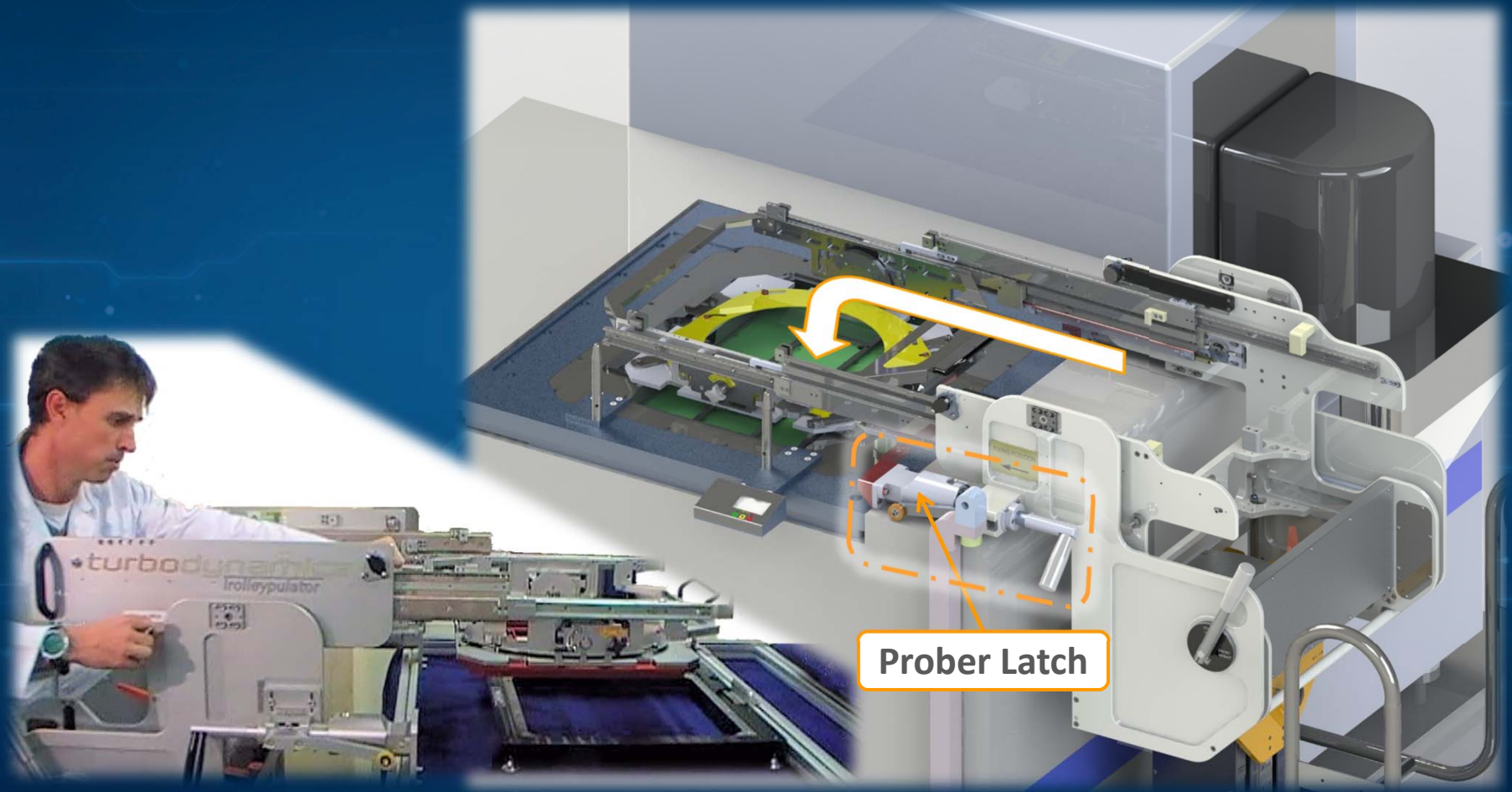
# Loading Station

Pickup position can be adjustable for different probe references

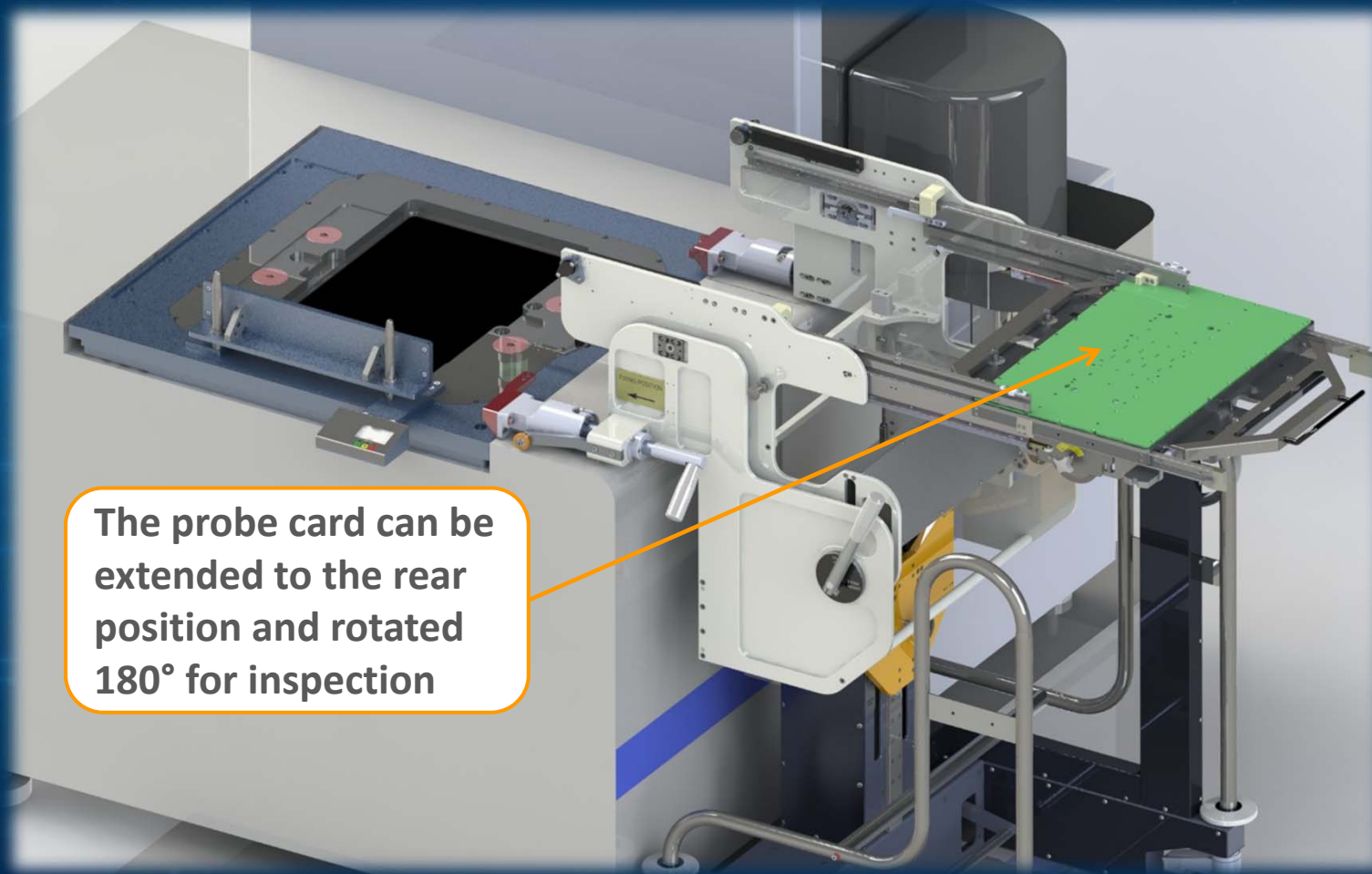


Pickup drawer slides forward for loading and unloading

# Prober Handshake

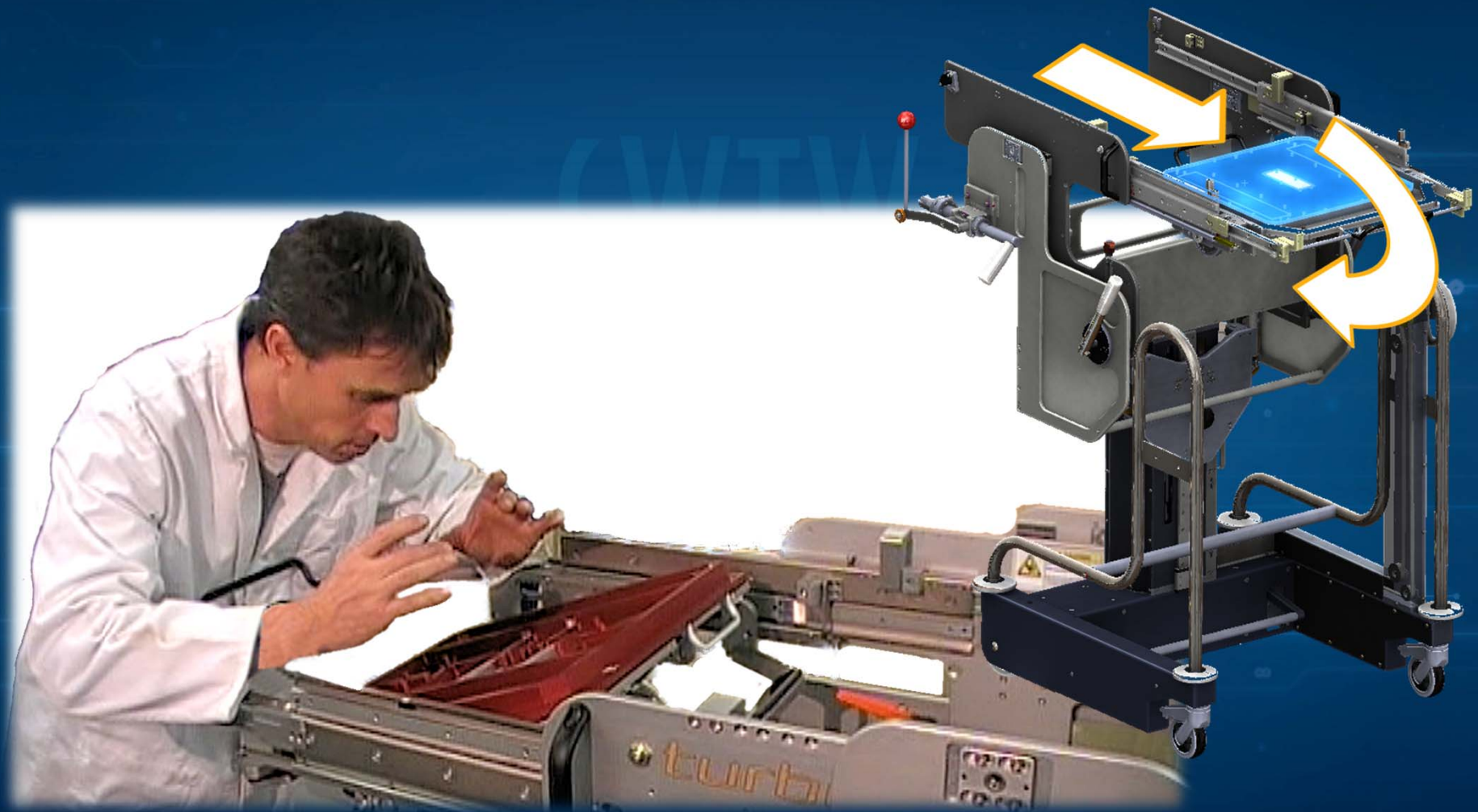


# Service Position



The probe card can be extended to the rear position and rotated 180° for inspection

# Analyze Probe Card

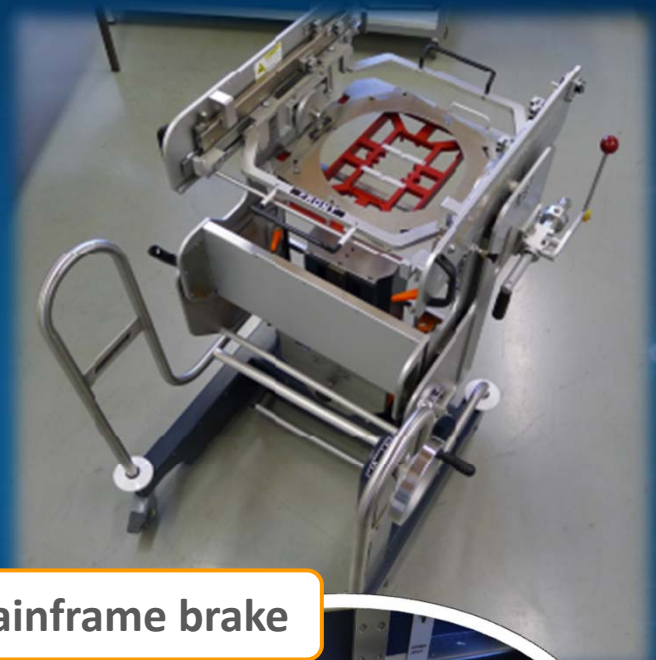


# Key Functions

Prober & Loading Station Latch



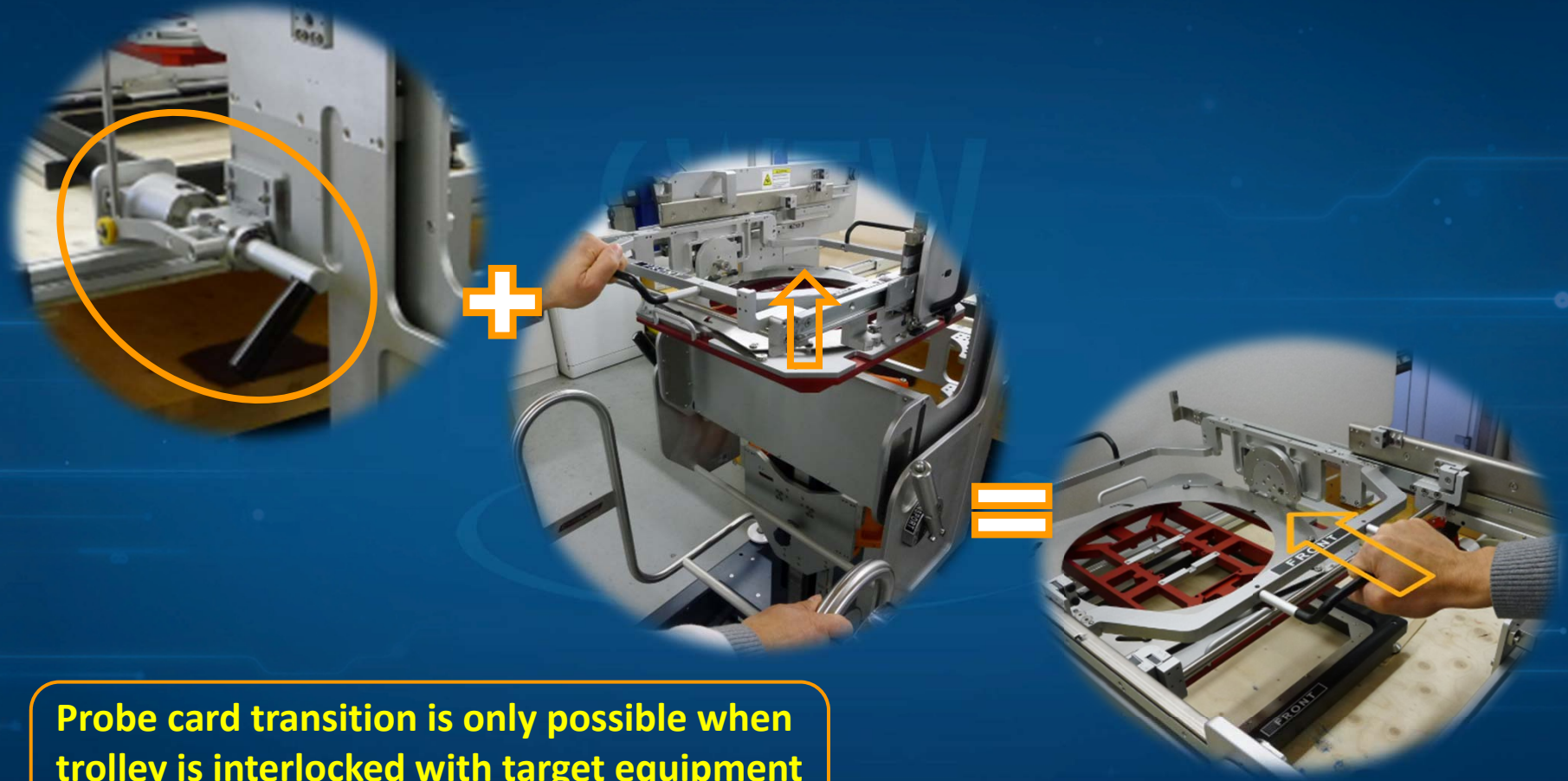
Mainframe brake



Frog-leg arms allow free turret float, X/Y & Theta

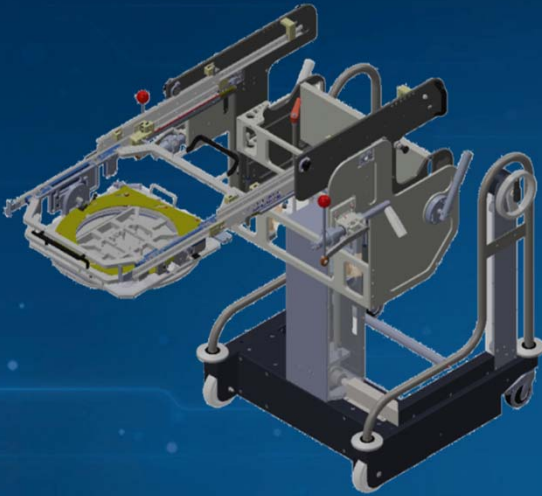


# Safety Features



**Probe card transition is only possible when trolley is interlocked with target equipment and turret is in upper position**

# Safety Features

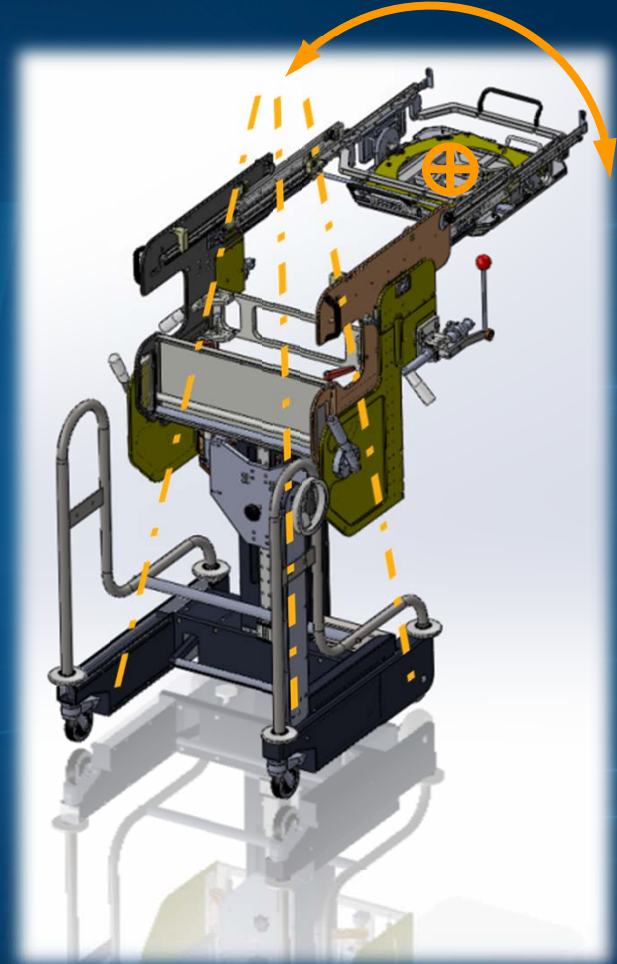


**Turret operation (probe card up/down)  
is only possible when the drawer has  
reached the extended position**

# Safety Features



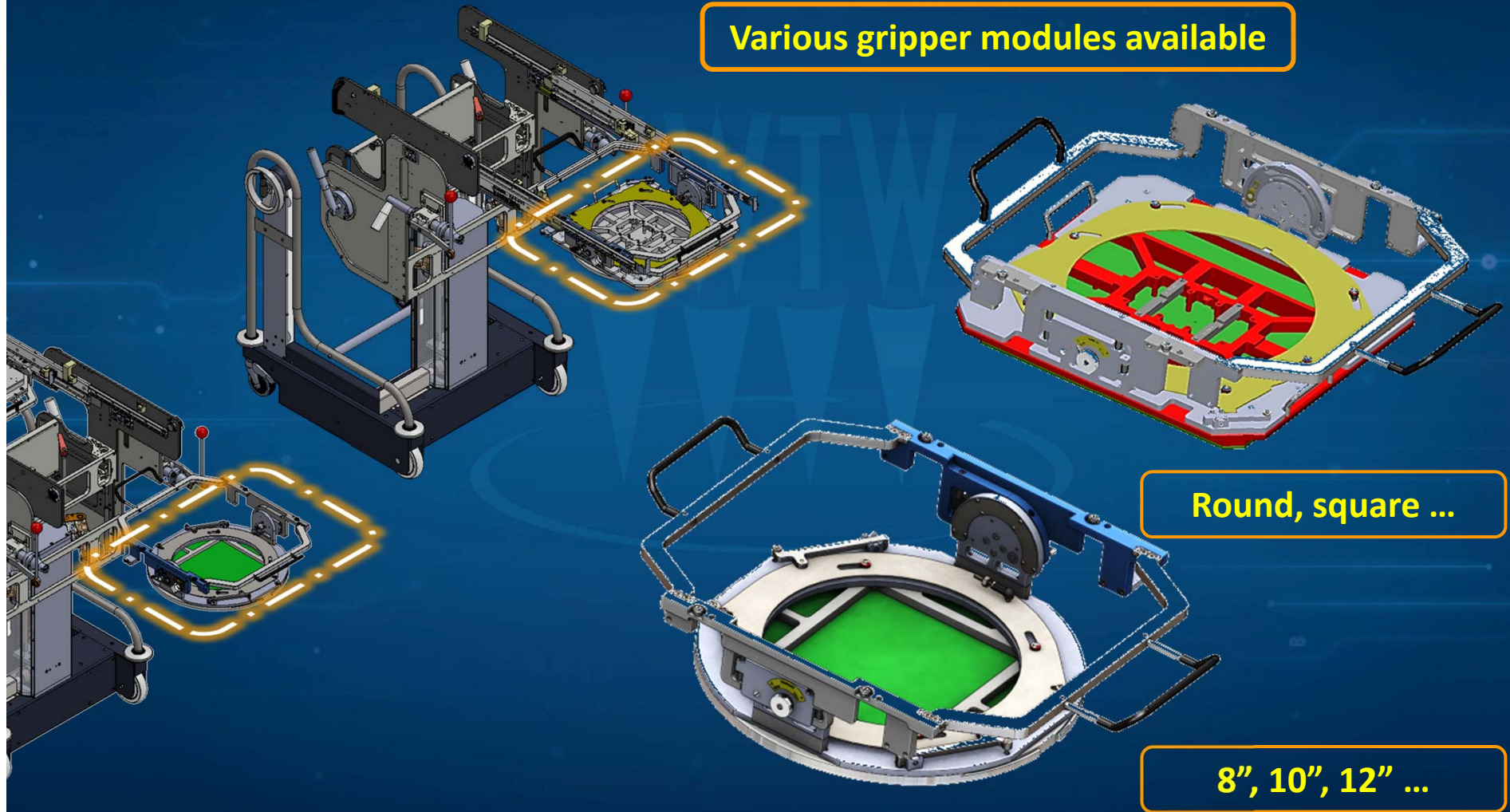
**Probe card can only be captured or released after reaching secure destination**



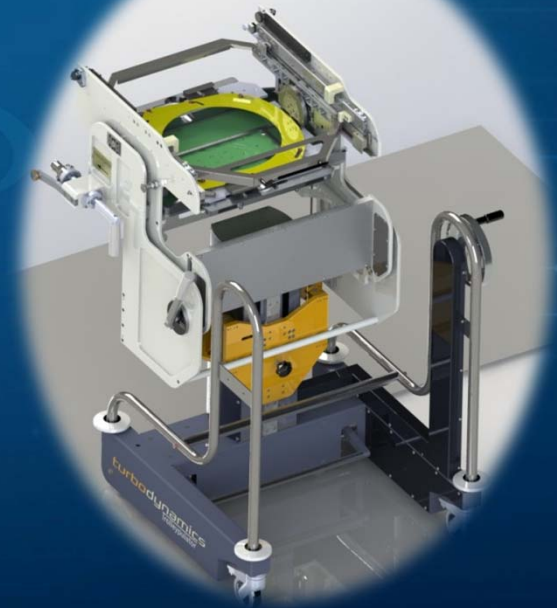
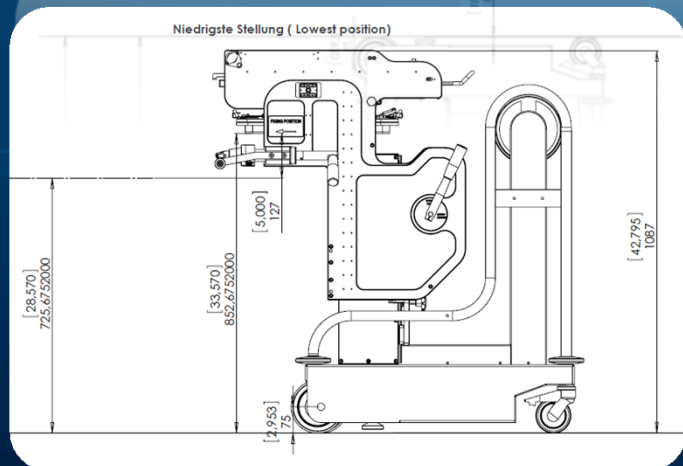
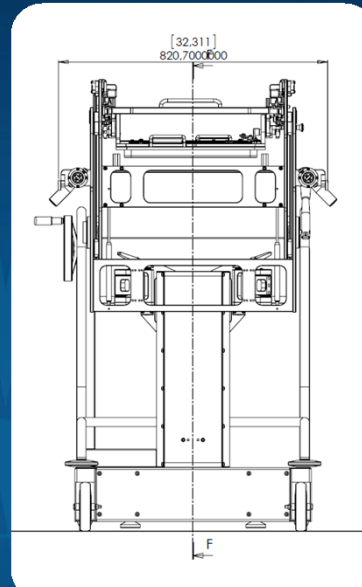
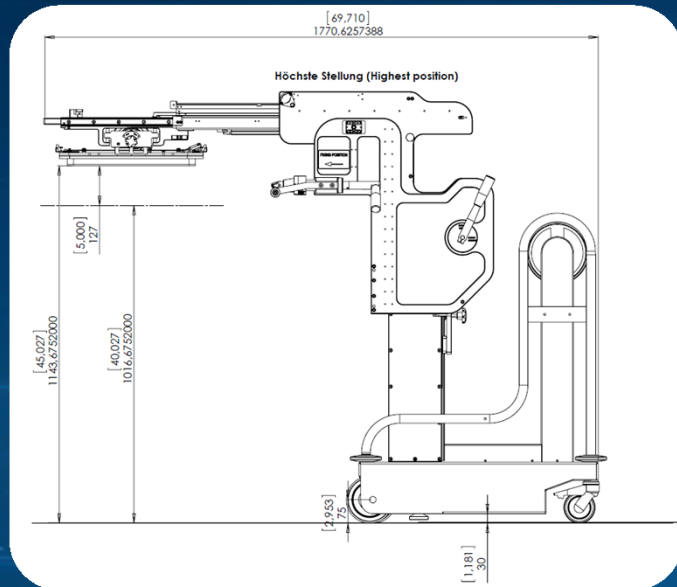
**Tilt Prevention**

# Modular Concept

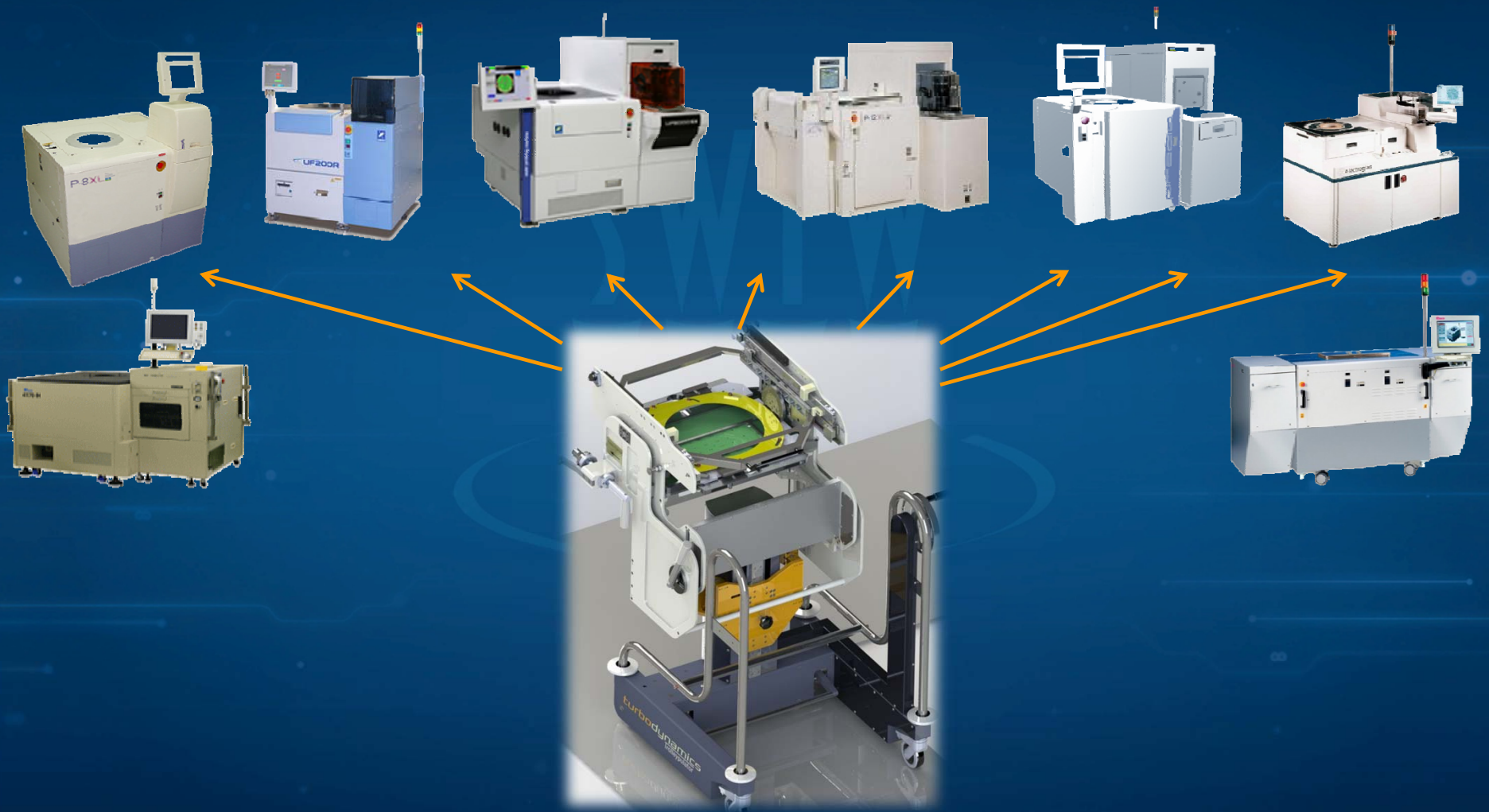
Various gripper modules available



# Specifications Acheived



# Versatile

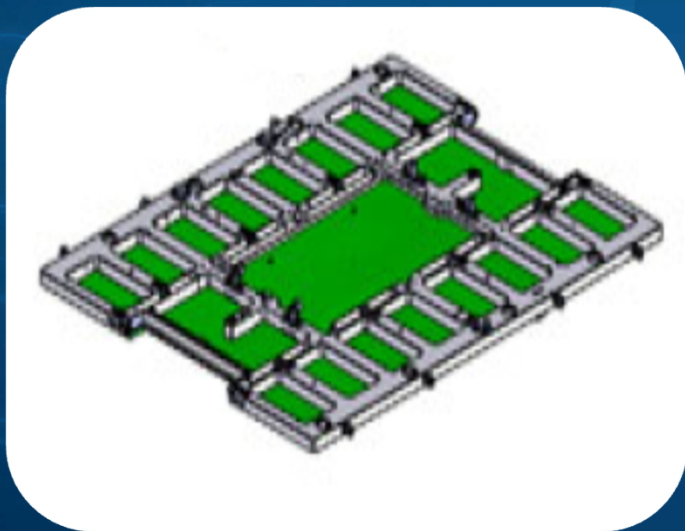


# Is “versatile” today... “universal” enough for tomorrow?



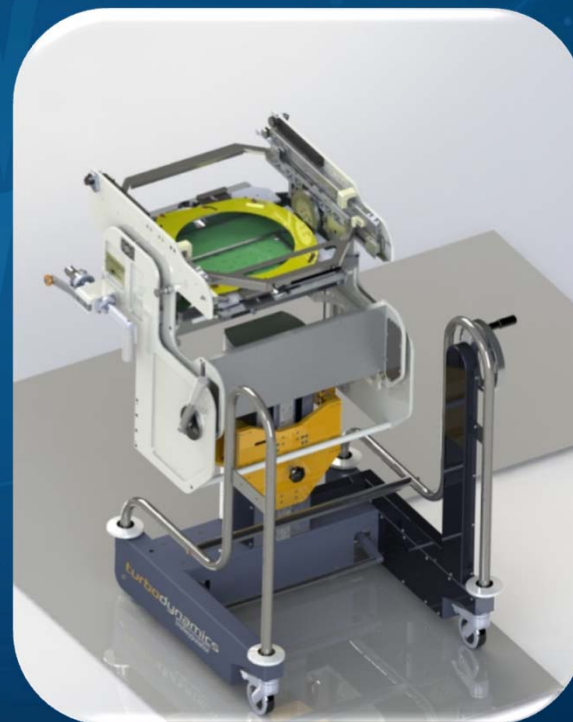
# Moving Forward

## Direct Probe



# Moving Forward

## Legacy Bottom Loaders



# Thank you for your Support!

- **Texas Instruments Team:**

Lorence Pareja

Dori Robissa

John Campbell

Kelly Daughtry

Kevin Kilpatrick

Kadir Dede

Sharlie Staab