# SEMI AUX033-0617
# 450mm PIC Interoperability Report

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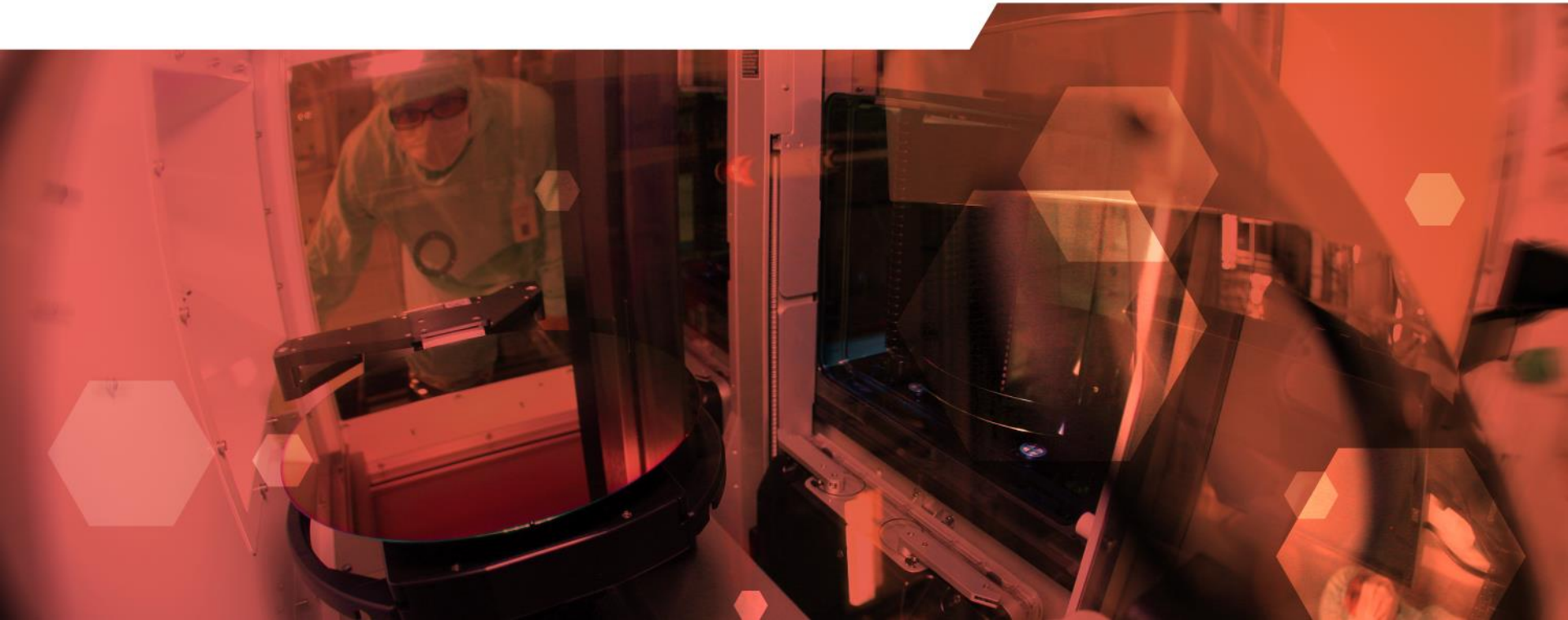
# 450mm PIC Interoperability Report

**International 450 mm PIC Task Force**

**PI&C Global Technical Committee**



# Contents

# 1. Overview

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The first version of major SEMI Standards related with 450 mm were published before 2011. Since then, production equipment compliant with those standards has been adopted and evaluated by some entities such as Global 450 mm Consortium (G450C) that started their activities in 2013. G450C has found some problems in the course of evaluation and reported them to the PIC global Technical Committee.

**This document is to provide our consideration of possible causes of *the following* problems and promote awareness of them so that similar problems would not occur*, not to provide solutions for them:***

1. ***Analysis results of the problem of interoperability between MAC and load port, and***
2. ***Analysis results of the problem reported between load port and PGV.***

Another purpose of this document, based on our experience with 300 mm production equipment, is to revisit the drop of the 300 mm carrier door which is not obvious yet with 450 mm carrier.

# 2. Problem Types and Root Cause

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The problems reported by G450C can be classified into *the following* 3 types:

A. Vacuum error for MAC door.
B. Difficulties for closing MAC door.
C. Particles shed from MAC found on LP during PGV operation.

# A. Root Cause Analysis: Vacuum error for MAC door

*Vacuum error when opening MAC door*

*Gap between MAC door and vacuum cup*

*Expansion of MAC door*

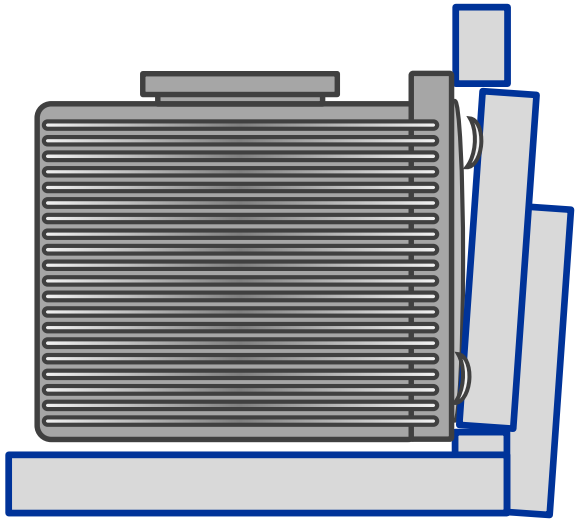
*No sliding of wafers*

*Wafer edge condition*

*Poor rigidity of LP door open/close mechanism*

*Poor MAC door rigidity*

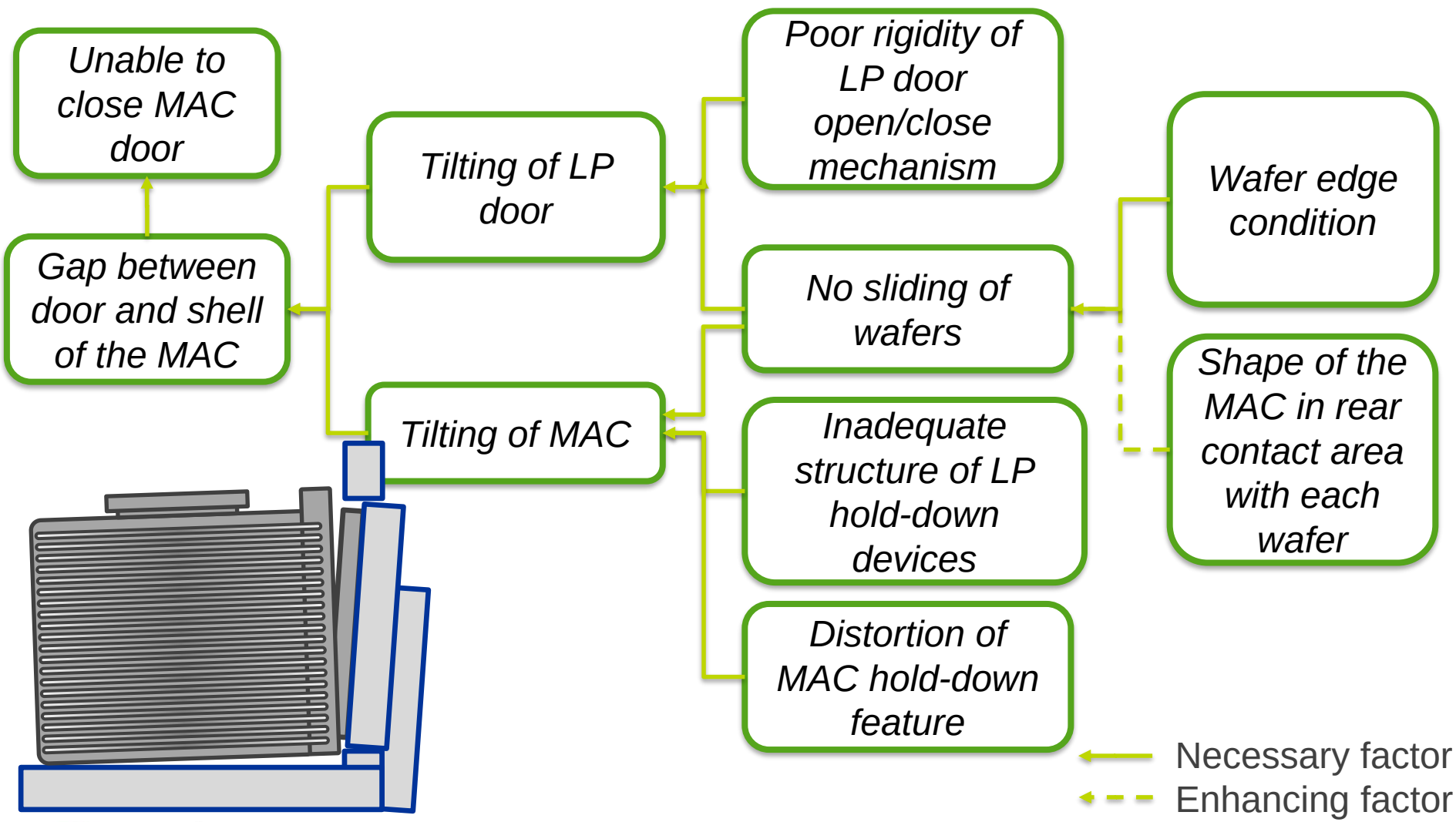
*Shape of the MAC in rear contact area with each wafer*



Necessary factor

Enhancing factor

# B. Root Cause Analysis: Difficulties for closing MAC door



# C. Root Cause Analysis: Particles shed from MAC found on LP during PGV operation

*Particles on LP*

*Friction between MAC bottom and LP hold-down devices when PGV was placing MAC on LP*

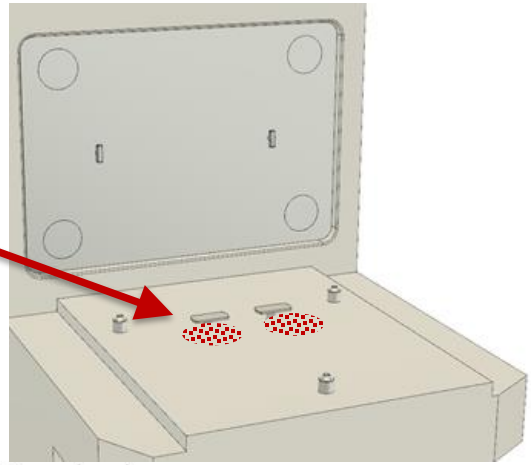
*Inappropriate shape of LP hold-down devices* (See Section *2-A.*)

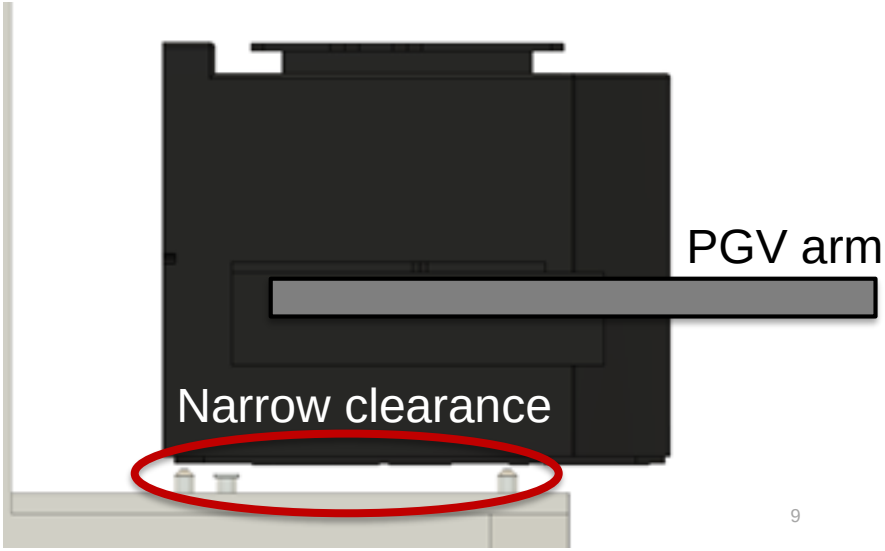
*Insufficient PGV Z-axis stroke*

*See E154/E158.*

Necessary factor

Enhancing factor



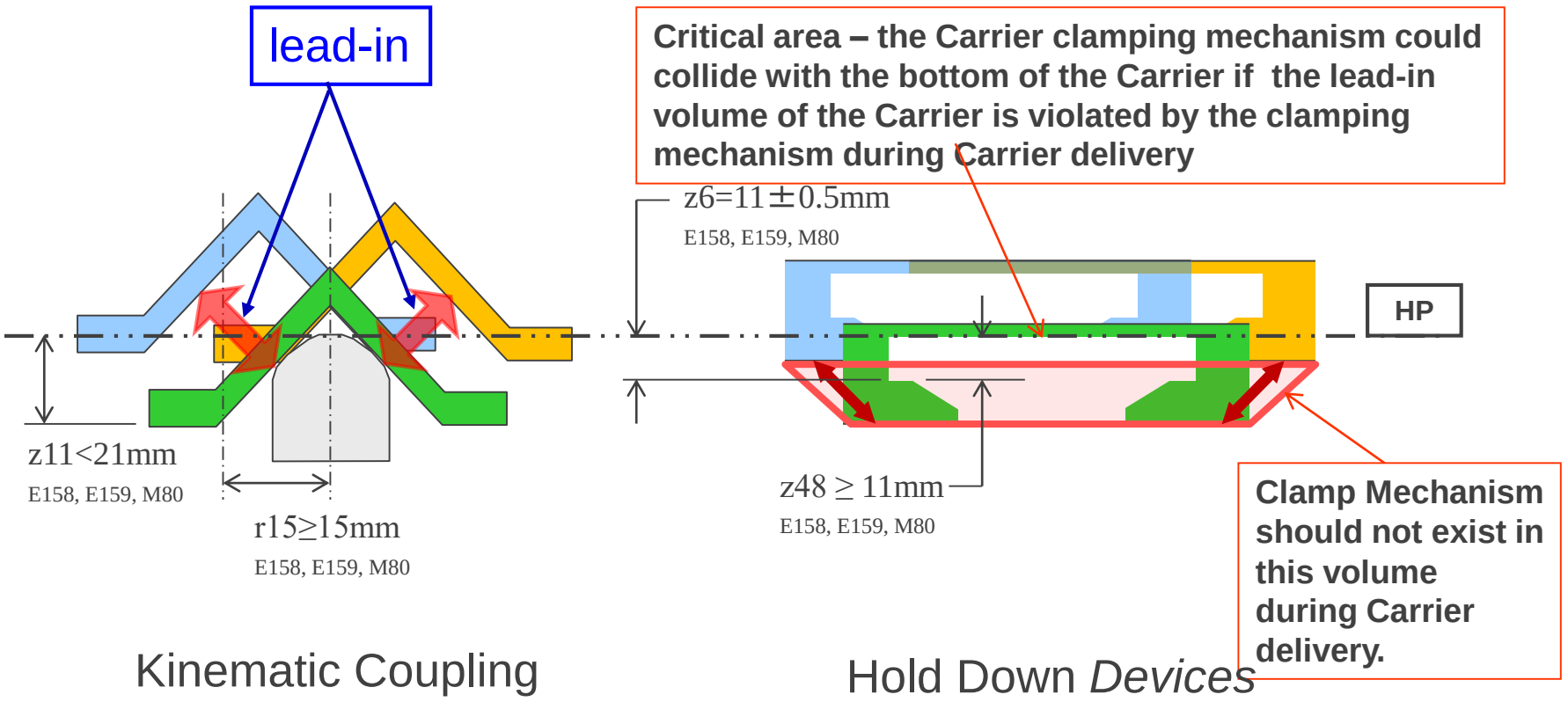
# 2-A. Kinematic Coupling Functionality

## Load Port: Interference Between *Hold-down Devices* and Kinematic Coupling Lead-in Grooves at the time of Carrier Delivery

- Requirement:
  - In order to avoid interference between Carrier and LP features except KC-pins, lead-in function should be considered.
- Related Standards:
  - E154, E158, E159 and M80
- Impact to Standards:
  - No change
- Application Note:
  - None.

- Background:
  - Features that extend above the imaginary plane created by the three kinematic pins have been found to compromise the function of the 10 mm lead-in provided by the kinematic coupling.
    - Critical area – the Carrier clamping mechanism must not collide with the bottom of the Carrier
- Approach:
  - Ensure that no equipment features compromise the lead-in function provided by the kinematic coupling mechanisms.
- Note:
  - The following page presents the interference issue described herein.

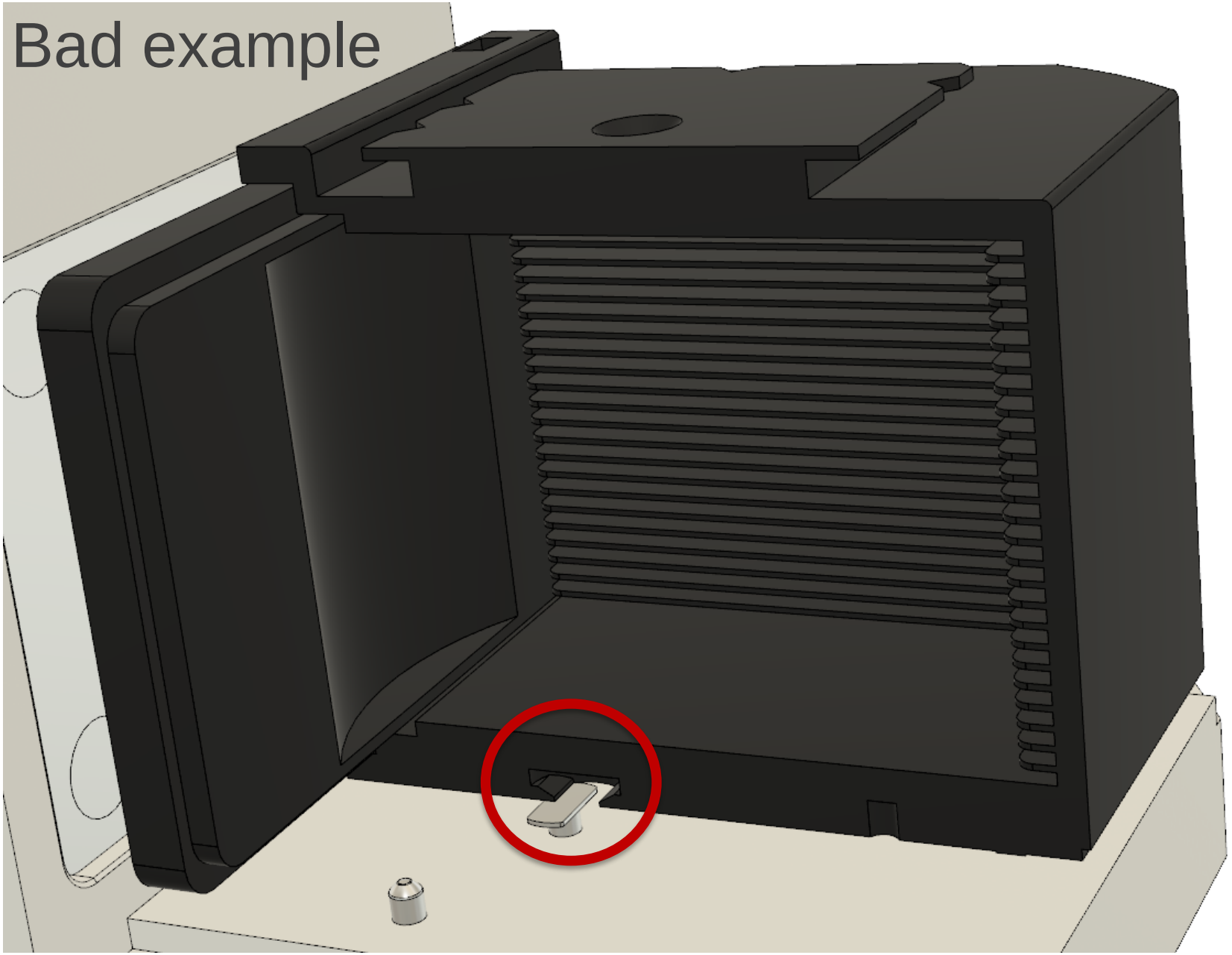
# Load Port: Interference Between Load Port Features and Kinematic Coupling Lead-in Grooves at the time of Carrier Delivery




Kinematic Coupling

Hold Down *Devices*

# Bad example



# 3. Revisit 300 mm Carrier Door Drop Prevention

# Root Cause Analysis (1/2)

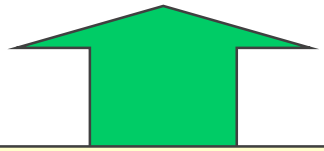
- Potential factors for Carrier Door drop

## Load Port

- **LP start latch action at incomplete door close position**
  - **Shortage of FIMS door closing force**
  - **Shortage of docking force**

## Carrier

- **Damaged Carrier**
- **Shortage of Carrier stabilities**
- **Carrier deformation by**
  - **High reaction force of :**
    - **Door seals**
    - **Wafer retaining**



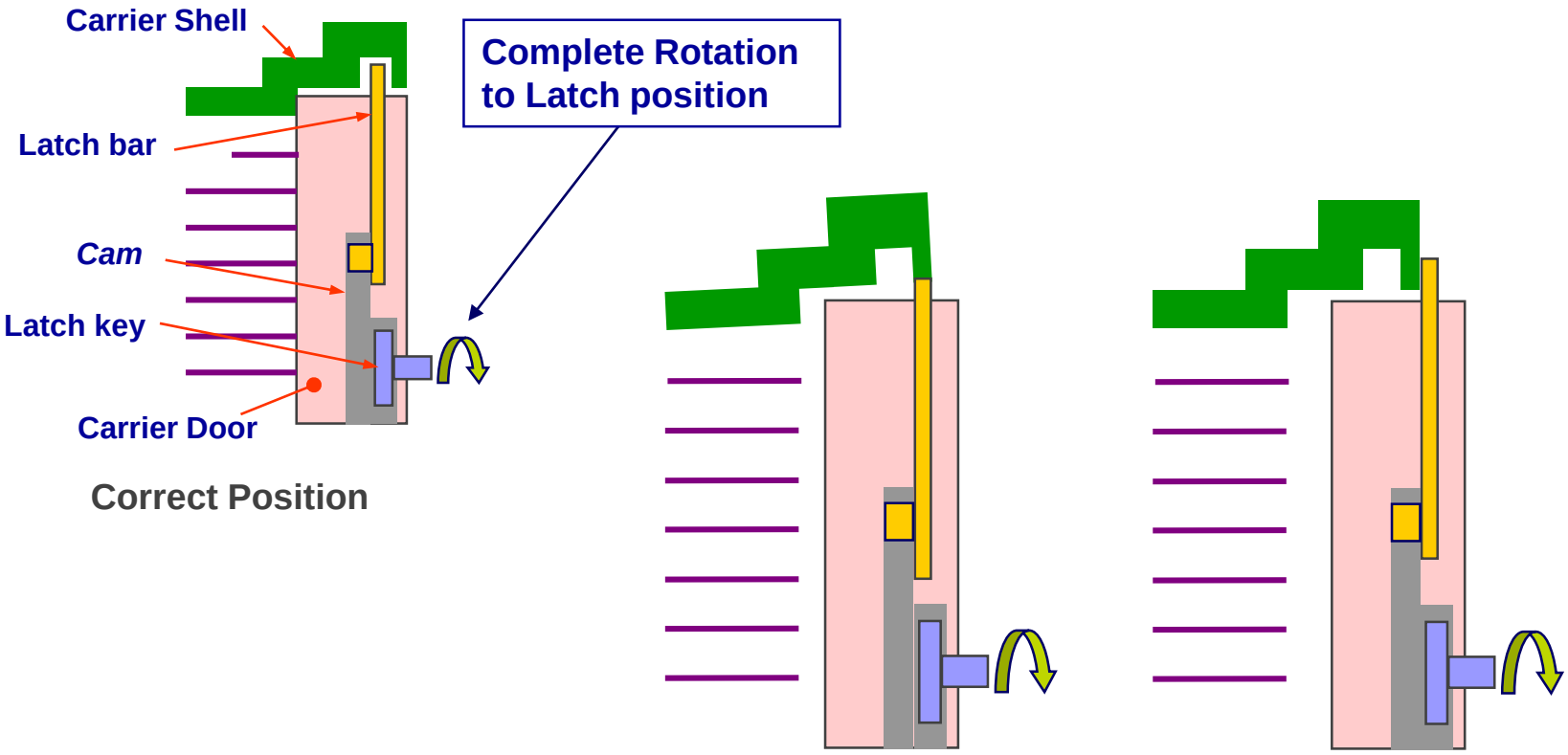
## Robot

- **incorrect wafer unloading position ( Door side )**

➔**Increase reaction force**

# Root Cause Analysis (2/2)

- Possible to detect latch key rotation only



# Loadport: Confirmation of proper Carrier door close

- Requirement:
  - To prevent Carrier door drop during Carrier transfer by AMHS, for secure FAB operation.
- Related Standards:
  - E154, E158, E159 and M80
- Impact to Standards:
  - No change
- Application Note:
  - None.
- Background:
  - Detection of latch-key rotational position is not enough to confirm proper Carrier door close.
- Approach:
  - Load port to confirm proper Carrier door close by at least following 2 steps.
    1. Locate and confirm the Carrier door to designed position.
    2. Rotate and confirm latch keys to designed position.
- Note:
  - Even with above 2 steps approach, complete confirmation of door close can not be realized, because latch bar insertion into Carrier shell can not be directly detected with current latch system.

# Carrier: Avoidance of intermediate state of door open/close

- Requirement:
  - To prevent Carrier door drop during Carrier transfer by AMHS, for secure FAB operation.
- Related Standards:
  - E154, E158, E159 and M80
- Impact to Standards:
  - No change
- Application Note:
  - None.

- Background:
  - Latch mechanism require many components to satisfy requirement.
  - Due to parts distortion and accumulation of parts allowance, latch bar may not be inserted into Carrier shell properly even latch key turned into correct position.
- Approach:
  - Carrier design to avoid staying at intermediate state of door open/close after latch key rotation.
- Note:
  - None.

# 4. Revision History

# Revision History

- First published - June 2017