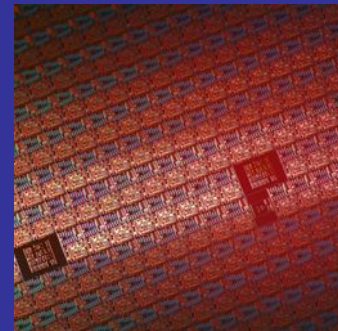




Accelerating the next technology revolution

IEUVI Mask TWG – EUV Pods

George Huang, SEMATECH



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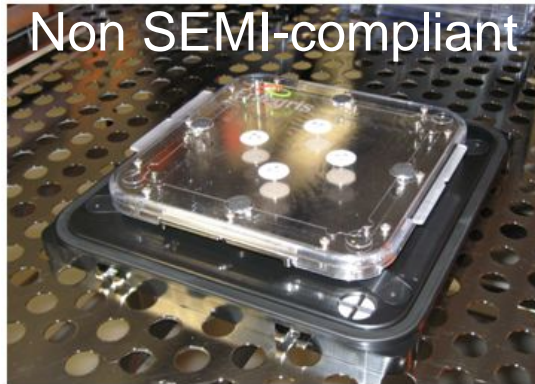
Outline

- SEMI-COMPLIANT EUV PODS
 - SEMI-Compliant Production Inner Pod
 - SEMI-Compliant Outer Pod
- TEST RESULTS OF SEMI-COMPLIANT EUV PODS
 - Robotic Handling with SEMI-Compliant Outer Pod Prototype
 - Storage Test with SEMI-Compliant Outer Pod Prototype
 - Shipping with SEMI-Compliant Outer Pod Prototype
- PRE-PRODUCTION OUTER POD
- TEST RESULTS OF PRE-PRODUCTION OUTER POD
 - Robotic Handling Test with Pre-production Outer Pod
 - Storage Test with Pre-production Outer Pod
 - Preliminary Shipping Test with Pre-production Outer Pod
- SUMMARY

SEMI-COMPLIANT EUV PODS



- SEMI-Compliant Production Inner Pod

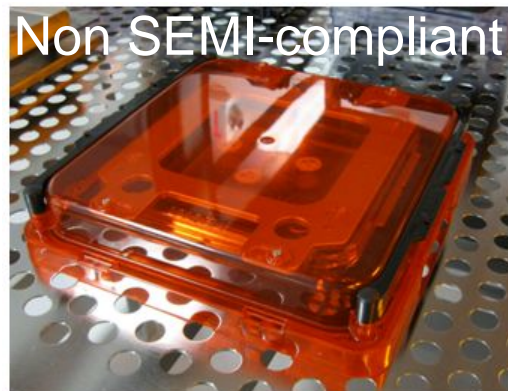


sPod1 (on the outer pod door) is mostly made of plastic material

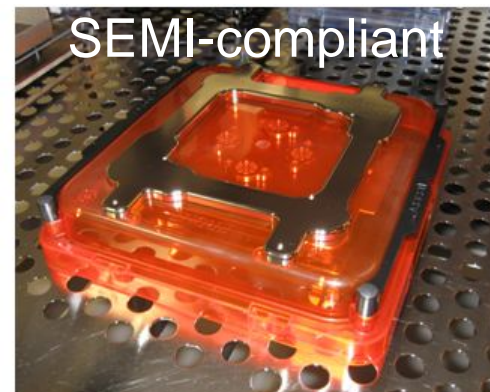


sPod3 (on the outer pod door) is basically made of aluminum material

- SEMI-Compliant Outer Pod



The previous outer pod with previous inner pod (sPod1) inside



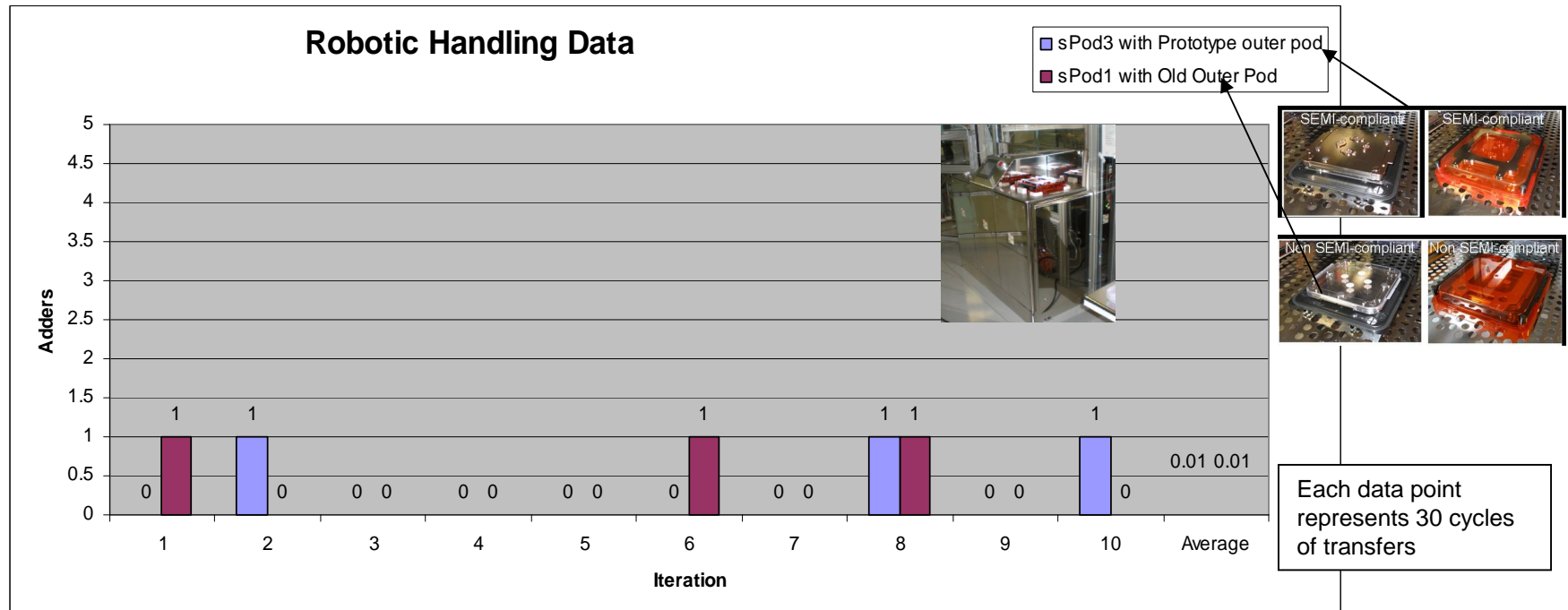
Prototype of the SEMI-compliant outer pod with the production inner pod (sPod3) inside

TEST RESULTS OF SEMI-COMPLIANT EUV PODS



Inspection sensitivity: 53 nm polystyrene latex (PSL) equivalent;
inspected area: 142 mm x 142 mm

- Robotic Handling with SEMI-Compliant Outer Pod Prototype



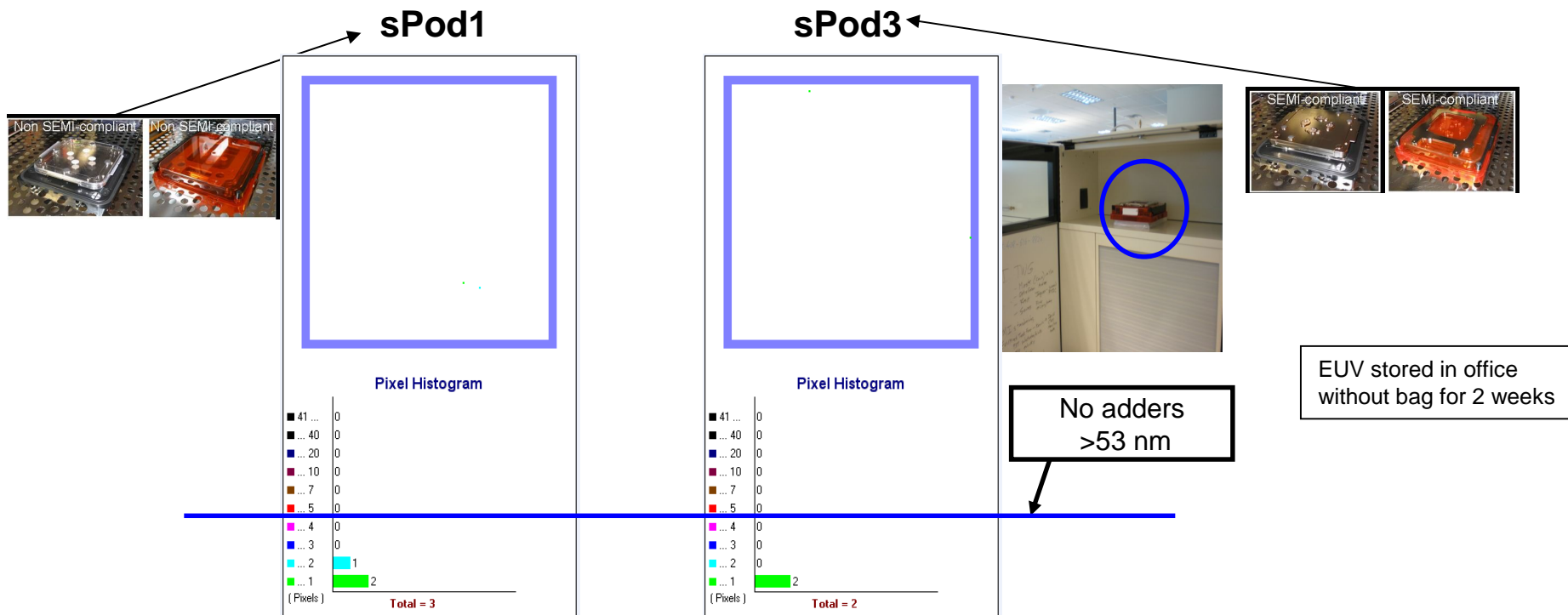
- The sPod3 inner pod with the prototype outer pod has particle protection capability comparable to the sPod1 with the previous outer pod based on the 10 iterations of the 30-cycle robotic handling.

TEST RESULTS OF SEMI-COMPLIANT EUV PODS



Inspection sensitivity: 53 nm polystyrene latex (PSL) equivalent;
inspected area: 142 mm x 142 mm

- Storage Test with SEMI-Compliant Outer Pod Prototype



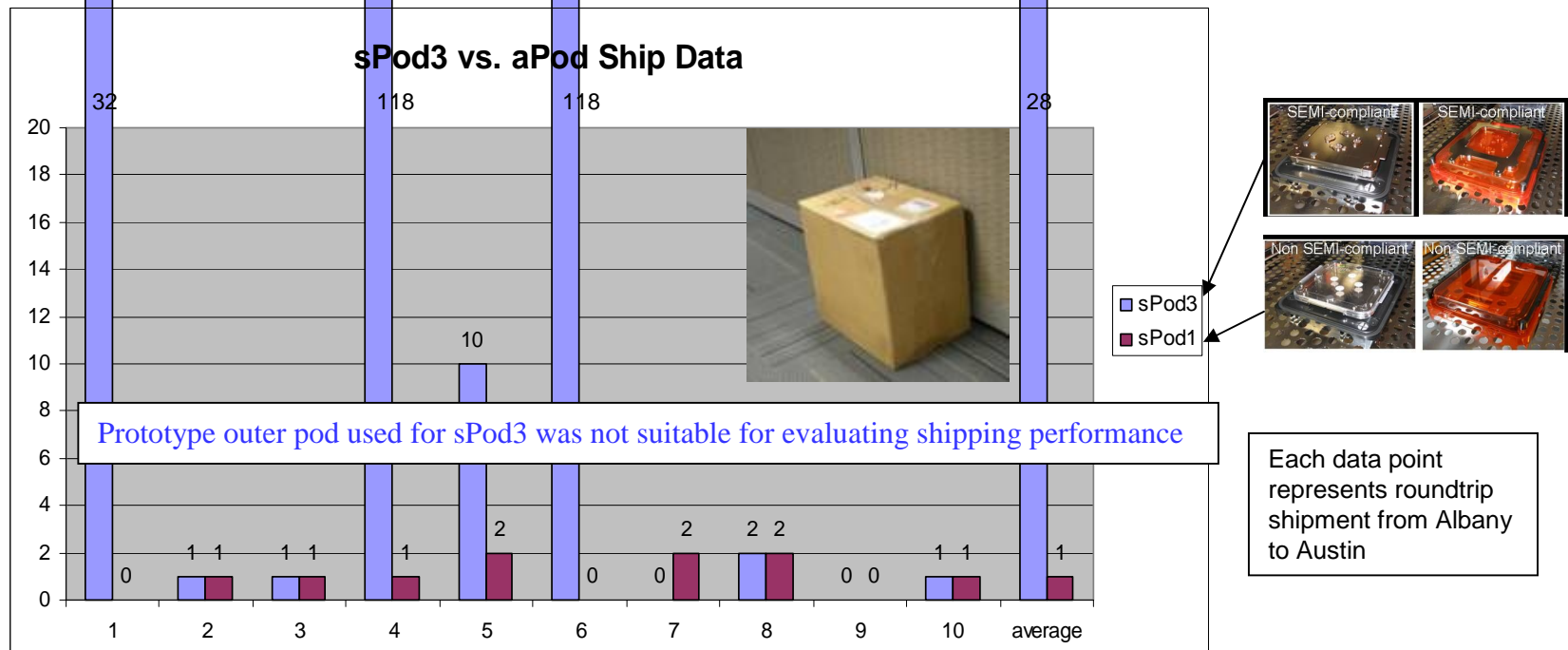
- Test results with zero particle adders on both the sPod1 and sPod3. The data suggest that the sPod3 with the prototype outer pod has excellent particle protection capability during storage, similar to the sPod1.

TEST RESULTS OF SEMI-COMPLIANT EUV PODS



Inspection sensitivity: 53 nm polystyrene latex (PSL) equivalent;
inspected area: 142 mm x 142 mm

- Shipping with SEMI-Compliant Outer Pod Prototype

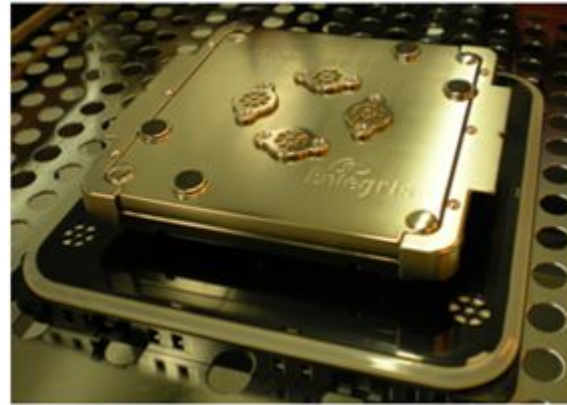


- This test result and a study done by Entegris suggest that the prototype outer pod is not optimized for shipping. Therefore, the prototype outer pod was not suitable for evaluating shipping performance of the SEMI-compliant dual pod.

PRE-PRODUCTION OUTER POD



Pre-production outer pod



Pre-production outer pod with shell removed and sPod3 inner pod on the door of outer pod

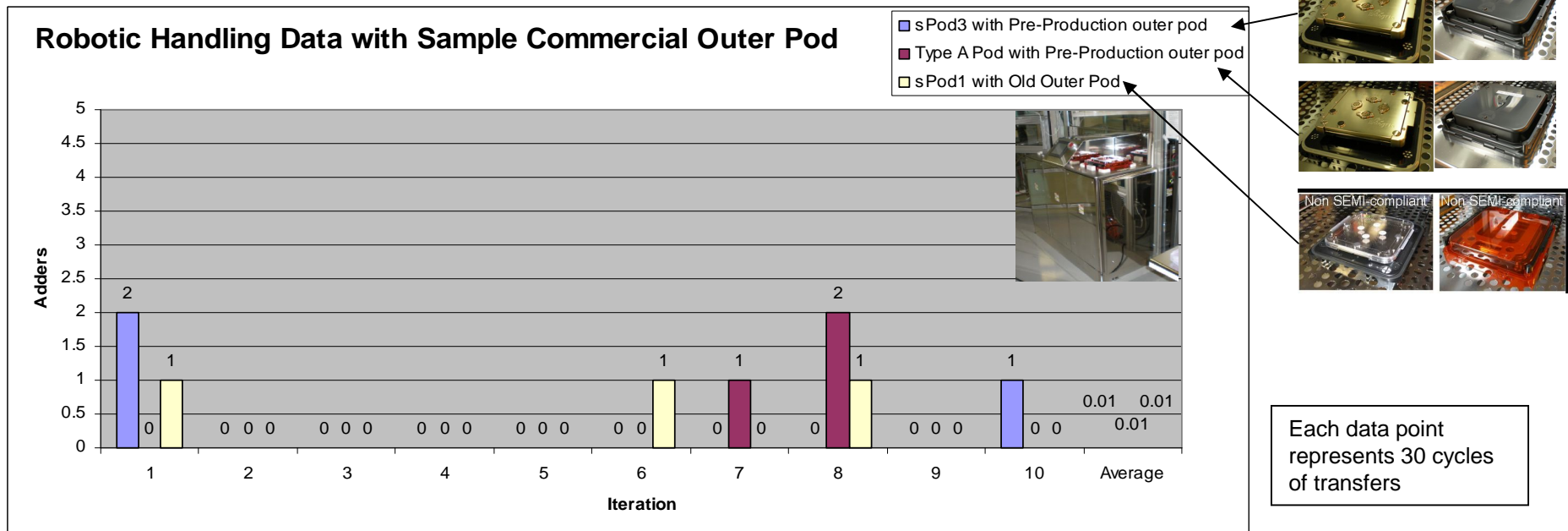
- Side handles comply with automation requirements
- Equipped with Card holder slots and a frequency (RF) tag
- A top robotic flange is an option for overhead transportation
- Polycarbonate (PC) with carbon additive provides excellent outgassing performance and electrostatic static discharge (ESD) control
- Improved kinetic design improves particle protection capability

TEST RESULTS OF PRE-PRODUCTION OUTER POD



Inspection sensitivity: 53 nm polystyrene latex (PSL) equivalent;
inspected area: 142 mm x 142 mm

- Robotic Handling Test with Pre-production Outer Pod



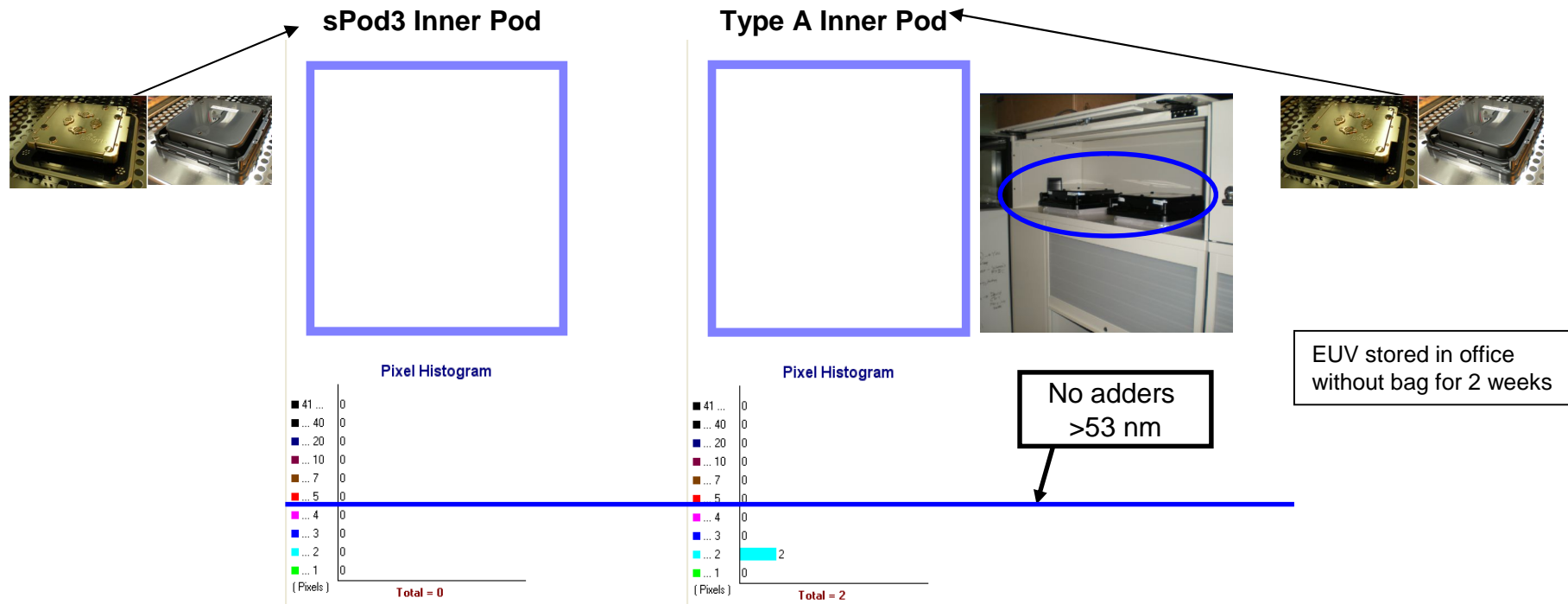
- Throughout the 10 iterations of this 30-cycle transfer test, 0.01 particle adders/cycle were reported on all tested EUV pods, including the control sPod1. In other words, both the sPod3 and type A inner pods with the pre-production outer pods can provide the same level of particle protection capability as the previous sPod1.

TEST RESULTS OF SEMI-COMPLIANT EUV PODS



Inspection sensitivity: 53 nm polystyrene latex (PSL) equivalent;
inspected area: 142 mm x 142 mm

- Storage Test with Pre-production Outer Pod



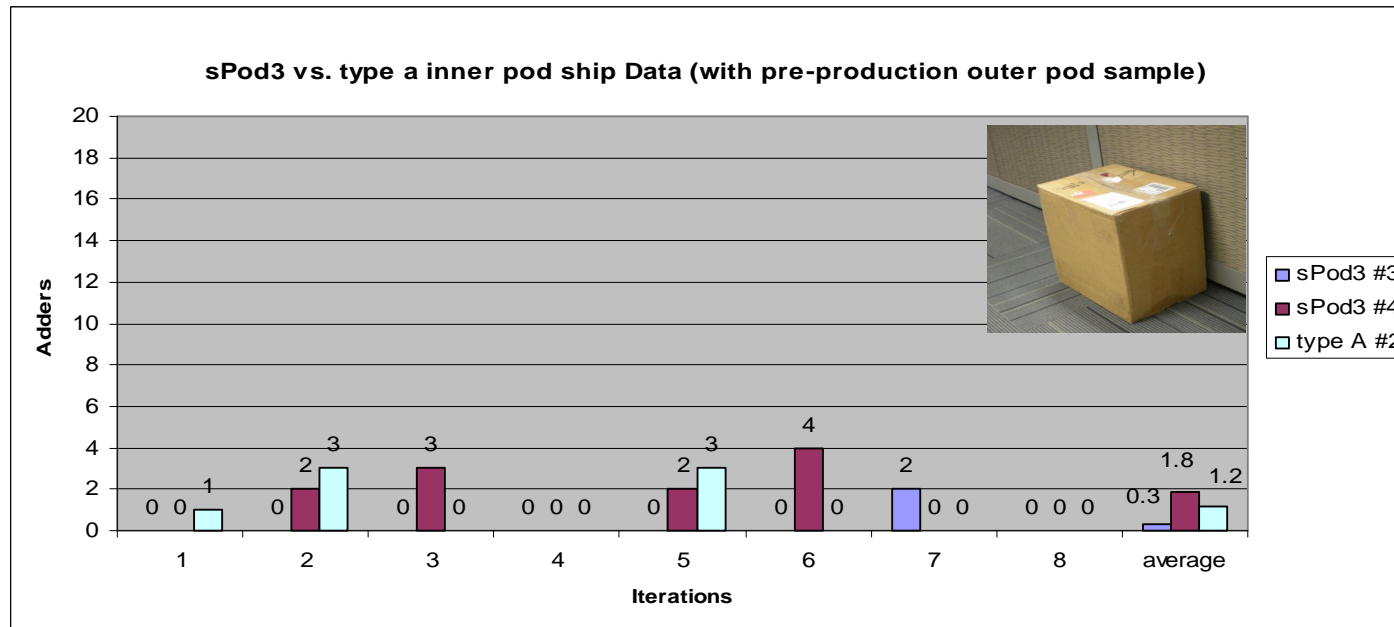
- The new pre-production outer pod in conjunction with both the sPod3 and type A inner pods can provide excellent storage particle protection capability under very severe office environment conditions even without a bag for protection.

TEST RESULTS OF SEMI-COMPLIANT EUV PODS



Inspection sensitivity: 53 nm polystyrene latex (PSL) equivalent;
inspected area: 142 mm x 142 mm

- Preliminary Shipping Test with Pre-production Outer Pod



Each data point represents roundtrip shipment from Albany to Austin

- Average adders from all test samples are less than 2 per shipment.
- sPod3 #3 has 6 defect-free data points out of 7 shipments.
- The pre-production outer pod in conjunction with the production inner pod has the potential to reach a zero defect level on the shipment test based on this preliminary data.

SUMMARY



- SEMI-compliant EUV Reticle pods
 - The inner pods were SEMI-compliant and commercially available, while the outer pods were prototypes of SEMI-compliant pods.
 - Particle protection capabilities during robotic handling and storage tests are equivalent to the previous non-compliant sPod1 carriers.
 - However, the prototype outer pod design had not been optimized for shipping. Therefore, the shipping results were not considered valid.
- Pre-production outer pods
 - Preliminary test results from the pre-production outer pods show improved particle protection performance.
 - These results suggest that the EUV industry can expect to have a commercially available production type EUV Reticle pod for use in EUV pilot line production this year and later in high volume manufacturing.