

Entegris EUV pod testing and status update

Sematech TWG- SPIE 12 Feb 2012
Tom Kielbaso – Entegris, Inc.





Agenda

- **Current Status of EUV pod**
 - Manufacturing
 - Delivery
 - Next Generation product
- **Testing results**
 - Repeatability of Entegris metrology
 - Open/Close cycle testing
 - Long Term Storage/Haze testing
 - Simulated Shipping test results using Type A pod
- **Summary**

Current Status of EUV pod

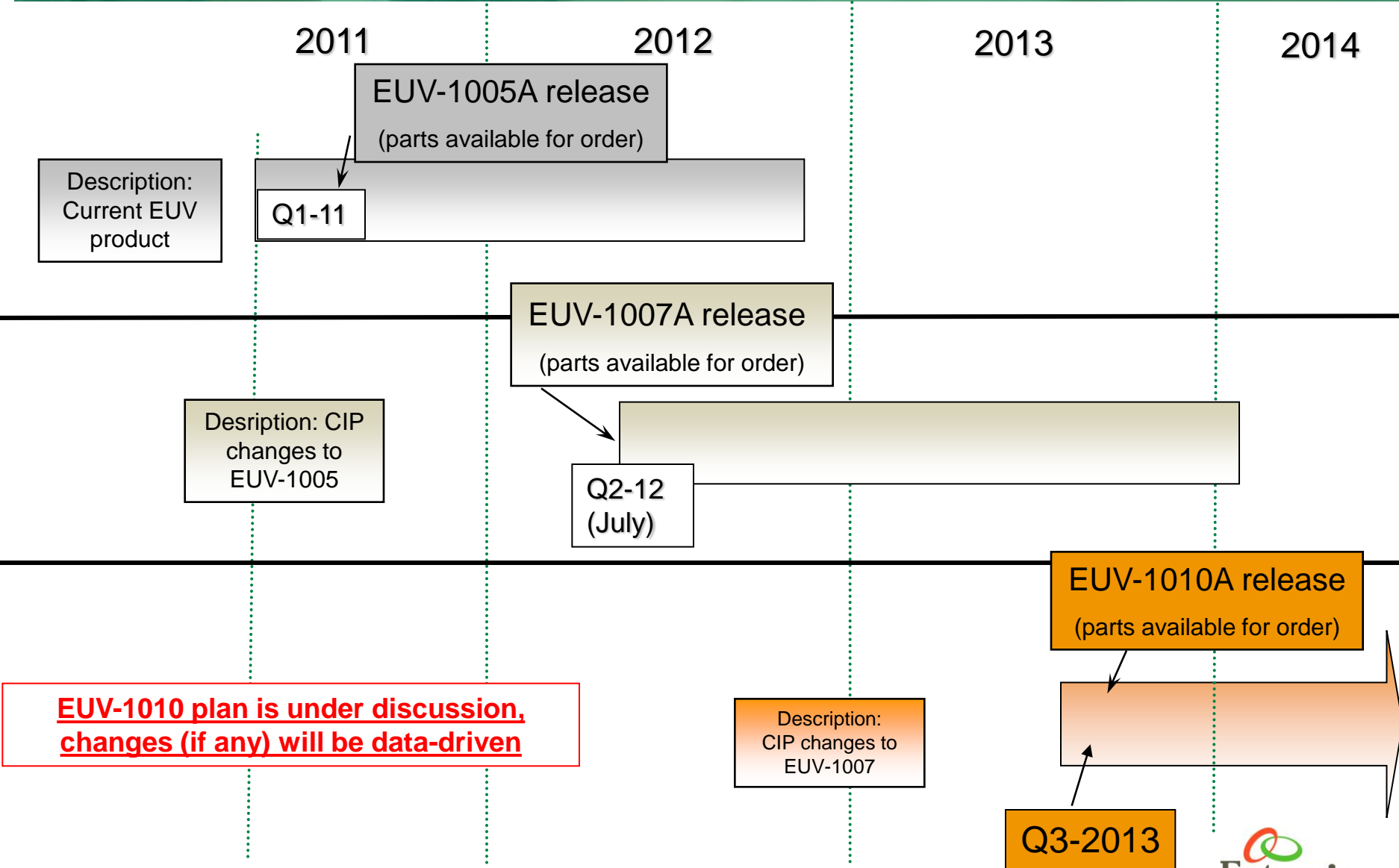
- **Manufacturing**
 - Product remains in pilot production
 - RTM schedule pushed to March '12
 - Final clean online in HVM

- **Delivery**
 - Constraints being relieved, capacities being increased to align with demand
 - Expect resolution to coincide with RTM

- **Next Generation product (EUV-1007) in development and testing**
 - Backwards compatible with EUV-1005
 - Product testing and release July '12
 - See roadmap next slide

- **Detailed updates and Next Generation details being shared with customers**

High Level Entegris EUV Type A Roadmap (DRAFT)



Testing Results- Background

- As reported at 2011 EUV symposium, Mask Blank Defect Inspection (MBDI) tool has arrived and is now on line in Technology Characterization Lab
- First results available
 - Correlates closely to historical data from others
 - No surprises
 - Continued testing planned to gain additional data points
- Utilized for performance characterization not for quality control

Continued investment into EUV

- Facilities
 - Advanced Technology Manufacturing Center announced May 2011
 - 40k square foot facility to house Entegris' most advanced wafer and reticle handling manufacturing
- Metrology
 - <100nm mask blank level particle detection operational early Q1-12
 - Used in R&D lab for performance and characterization testing
- Market Leadership
 - Standards
 - Published papers

Defect Map of Mask Blank

Press Release for Advanced Manufacturing Center

Entegris

Entegris EUV pod status and update- TWG Sematech SPIE-02-2012 | 4

Slide from 2011 EUV symposium

Testing Results- Set up and details

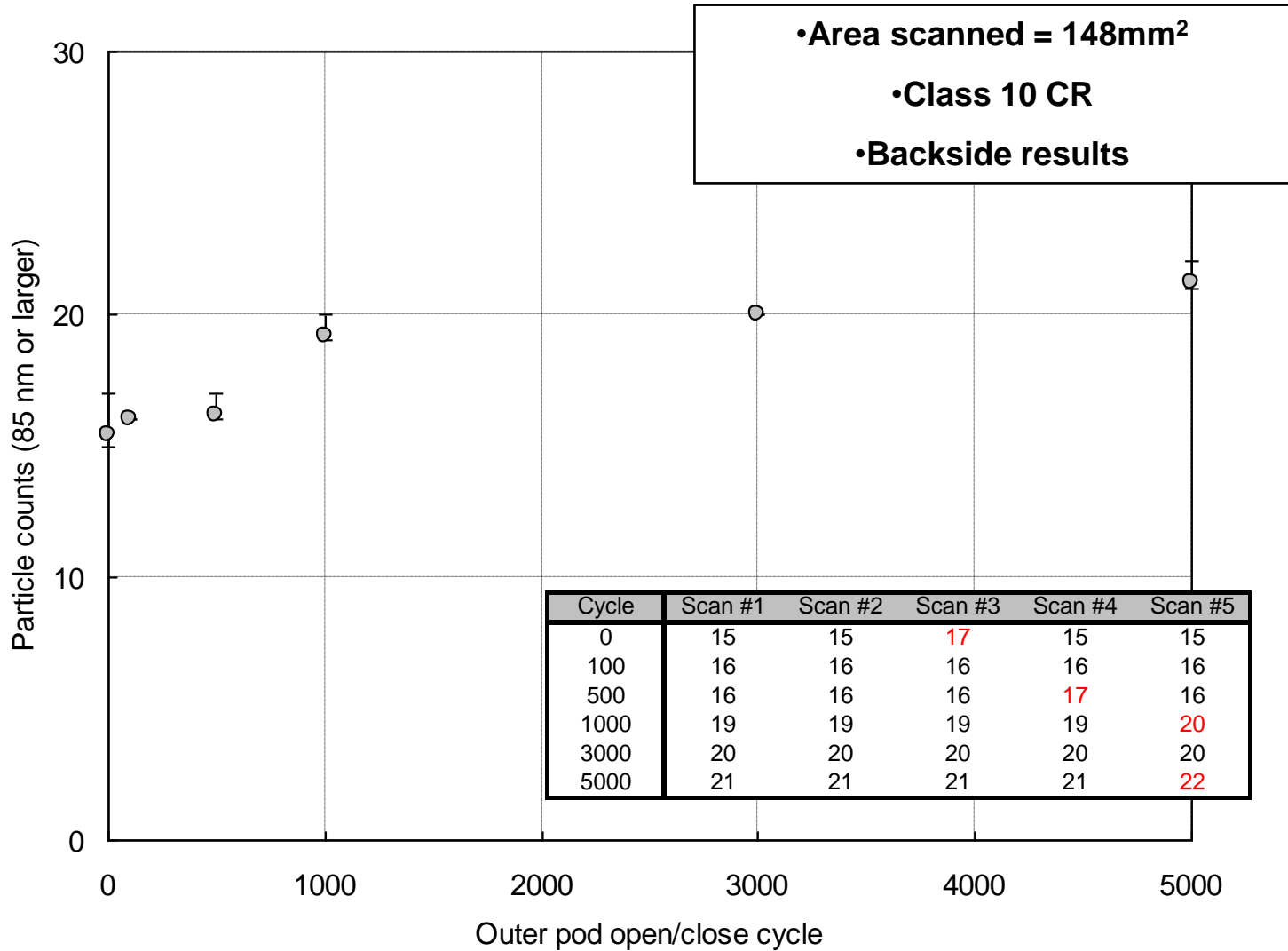
- Data on following slides collected under following conditions
 - Transfer to and from Metrology: Manual (<2 adders from manual handling)
 - Clean Room: Class 10
 - Pod Type: A pod/EUV-1005
 - All results reported are backside particle adders
 - Front side testing in process
 - 2 pods, 3 masks used
 - Results shown are from 1 mask, 1 pod
 - Particles scanned down to 81 nm

Partial Display from software

Reticle Size:	152
Edge:	2
Grade	Accepted
Peak haze	152
Total count	25
Particles density	0.138 p/cm ²
Scratches count	3
Scratches length	6.203 mm
Area count	0
Area total	0.000 mm ²
Peak haze	152
Particles * (5)	
0.081-0.108	8
0.108-0.118	3
0.118-0.125	0
0.125-0.131	1
0.131-Max	13

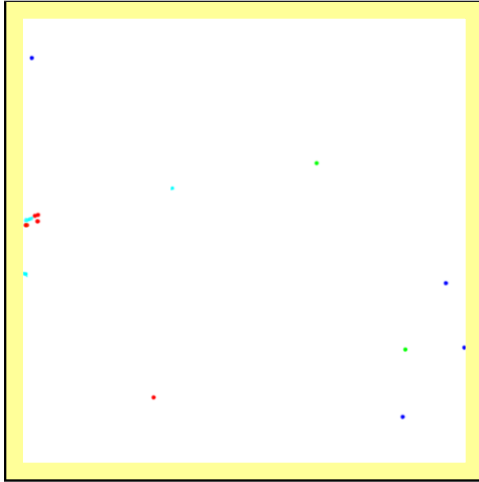
Testing Results- Latching Test in Cleanroom (1)

Latching test consists of latch/unlatch of outer pod on std 200mm loadport. Lowering door ~50mm, then returning door to outer dome. Mask was scanned 5x at each cycle interval without removal from inspection tool. Manual adders **not** subtracted.

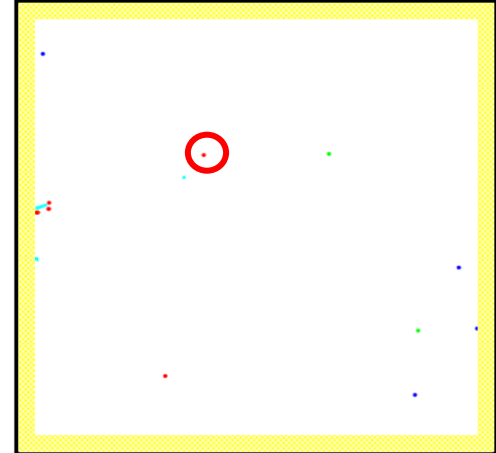


Testing Results- Latching Test in Cleanroom (2)

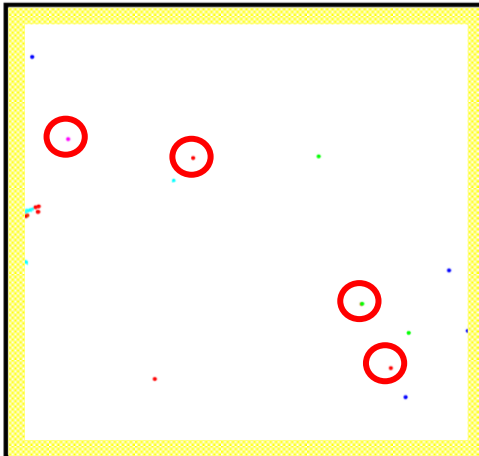
Pre-scan



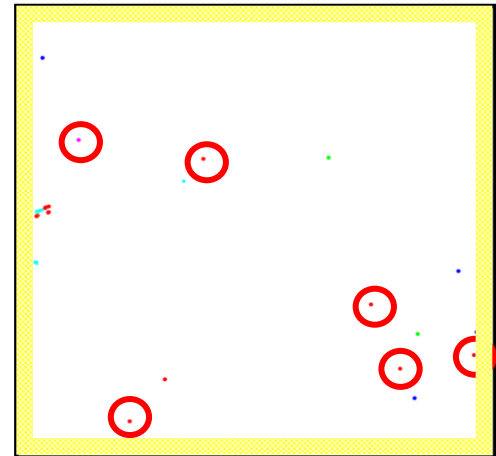
100 & 500 cycle



1,000 cycle



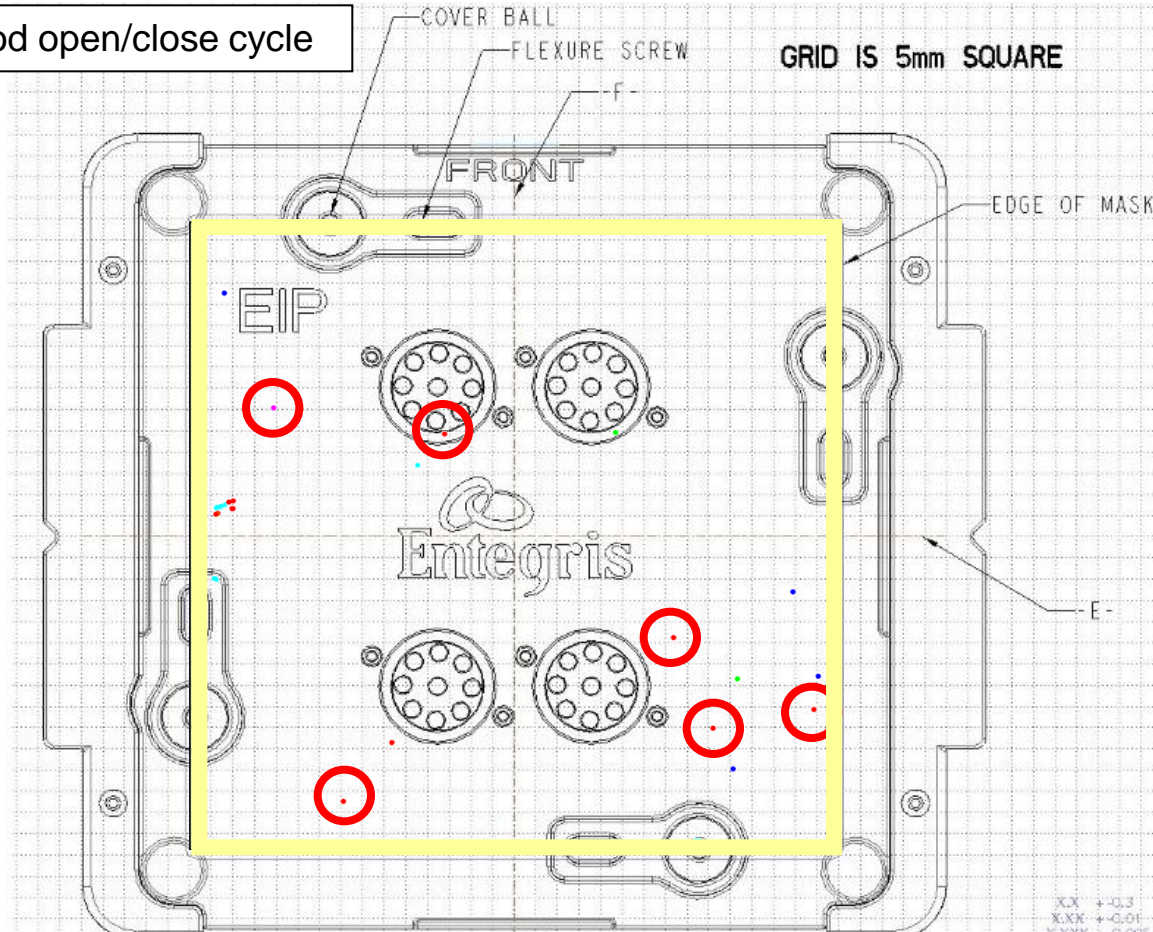
5,000 cycle



- * Scanned area: 148mmX148mm (2 mm Edge Exclusion)
- Adders are circled in Red (all >131nm)

Testing Results- Overlay showing particle location from Latch Test

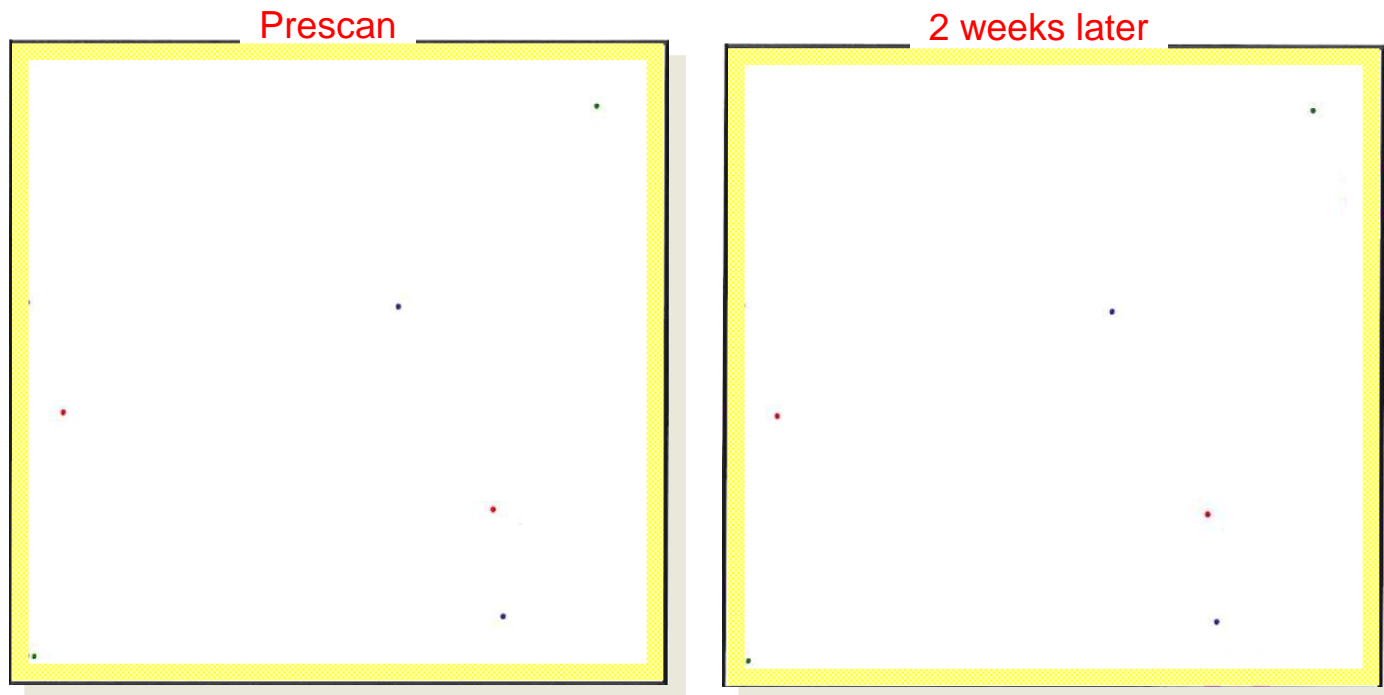
After 5,000 outer pod open/close cycle



- Particles detected at mask contact areas (outside Quality Area)
- .0012 adders per cycle, all reported adders >131nm
- Manual Adders not subtracted

Testing Results- Long term storage

- 2 weeks in clean room
- Zero Added particles in Quality Area (148mm x 148mm)
- Backside results



Simulated Shipping Test (ISTA 2A) – Vibration Profile

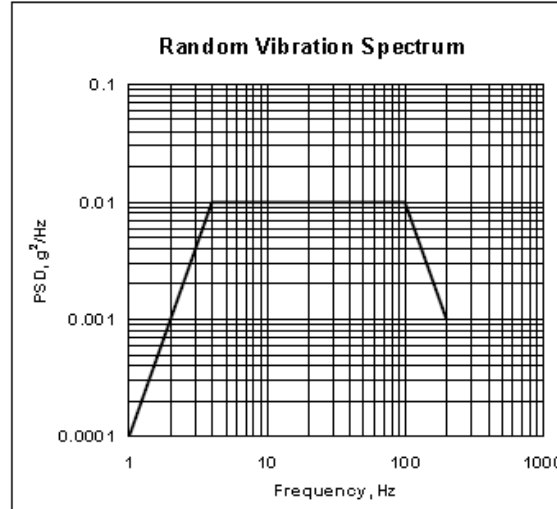


Packaged-Products 150 lb (68 kg) or Less

2A
2011

The following breakpoints shall be programmed into the vibration controller to produce the acceleration versus frequency profile (spectrum) below with an overall G_{rms} level of 1.15. The theoretical stroke required to run this vibration profile is 22.45 mm (0.884 in) peak to peak.

Frequency (Hz)	PSD Level, g^2/Hz
1.0	0.0001
4.0	0.01
100.0	0.01
200.0	0.001



Simulated Shipping Test (ISTA 2A) – Test System

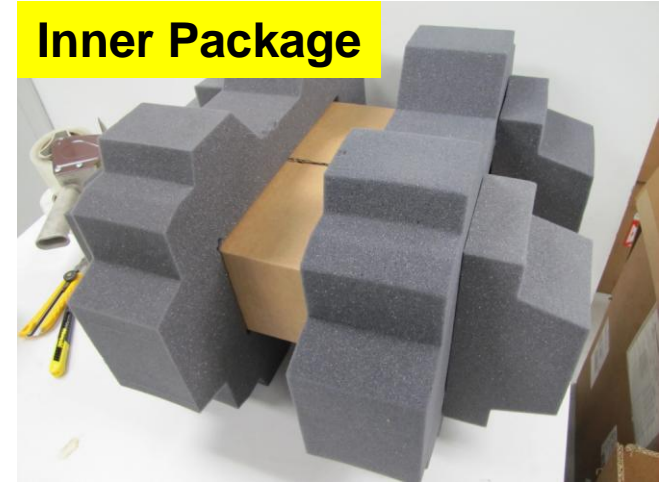
Standard Empty EUV pod packaging used. 20"x20"x14"

Drop Testing NOT performed

Vibration Table



Inner Package



Secondary Package

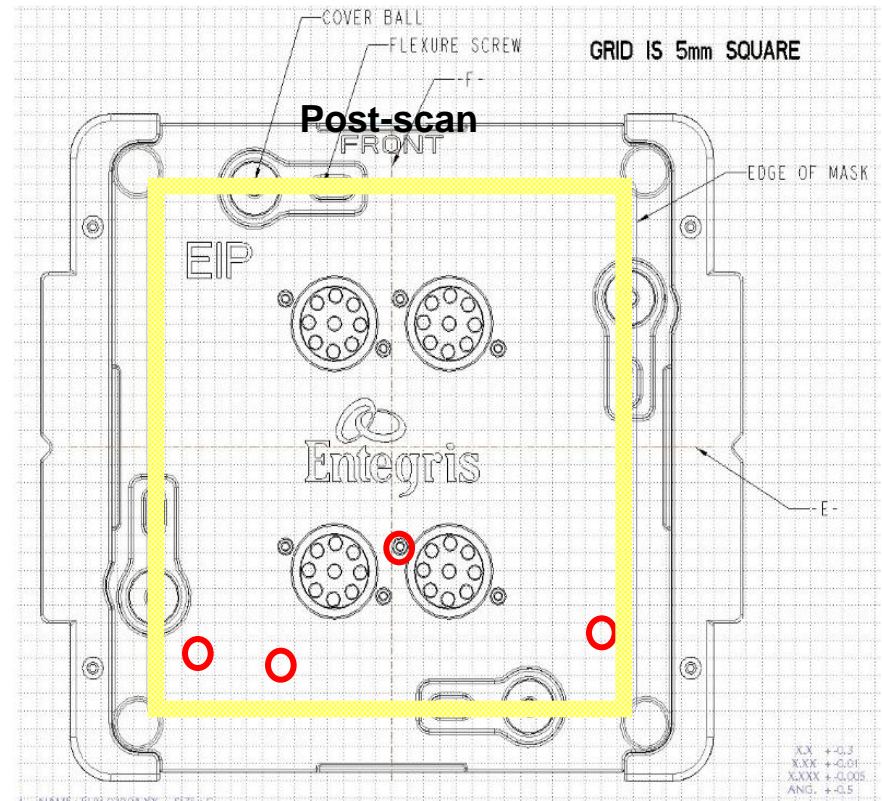
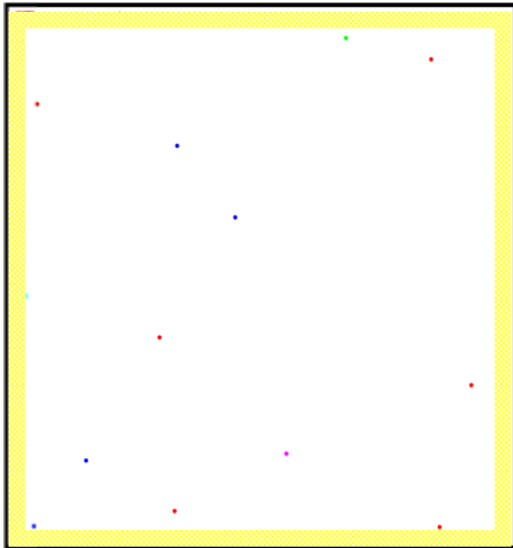


VIBRATION - RANDOM

STEP	ACTION	TESTING ORIENTATION	VIBRATION DURATION
1	Put the packaged-product on the vibration table so that face 3 rests on the platform.	Face 3 on table surface	30 minutes
2	Start the vibration system to produce the random vibration spectrum indicated in Before You Begin Vibration Testing.		
3	Stop the vibration system after the completion of 30 minutes. Invert the packaged-product so that face 1 (top) rests on the platform.		
4	Begin the vibration duration for this orientation.	Face 1 on table surface	10 minutes
5	Stop the vibration system after the completion of 10 minutes. Place the packaged-product so that either face 2 or 4 rests on the platform.		
6	Begin the vibration duration for this orientation.	Face 2 or 4 on table surface	10 minutes
7	Stop the vibration system after the completion of 10 minutes. Place the packaged-product so that either face 5 or 6 rests on the platform.		
8	Begin the vibration duration for this orientation.	Face 5 or 6 on table surface	10 minutes
9	Stop the vibration testing at the end of 10 minutes.		
10	Vibration testing is now complete. Go to TEST BLOCK 5 (Shock).		

Testing Results- Simulated Shipping (ISTA 2A)

Pre-scan



- Scanned area: 148mmX148mm (2 mm Edge Exclusion)
- 3 adders >131nm
- 1 adder 81-108nm
- Manual adders NOT subtracted



Summary

- RTM and delivery stabilized March '12
- Next Generation product under development and testing
- In house metrology results align with previously published data
- Further characterization testing planned

