ASML

EUV Mask Protection & Carrier

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Particle Contamination Control

- Minimize number of contacts:
  - Use reticle frame; use materials that are low particle generators
  - Interface of reticle storage box with load lock is critical
- Prevent particle migration:
  - Thorough cleaning of all components is needed
  - Proper particle filters and vacuum valves are required
  - Exposure tool reticle movement and handling only in vacuum
  - Develop dedicated mechanics to avoid particle production (reticle release mechanism)
  - Unidirectional gasflow during pumping and venting is needed
- Validate concepts using test setups & FuMo before designing final Alpha Demo H/W, then continue testing

ASML Reticle Frame
- frame is used to minimize number of reticle contacts -

X

Y

Reticle in X and Y
0.6mm free from frame

Endpoints for reticle

Tolerance is 0.6mm

Contact
point
Reticle

reticle

Safety
Point

Contact
point
Reticle

Safety
Point

Reticle
frame

Contact
point
Reticle

V-groove
for
Gripper

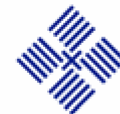
Gripper
Safety
hole

V-groove
for
Gripper

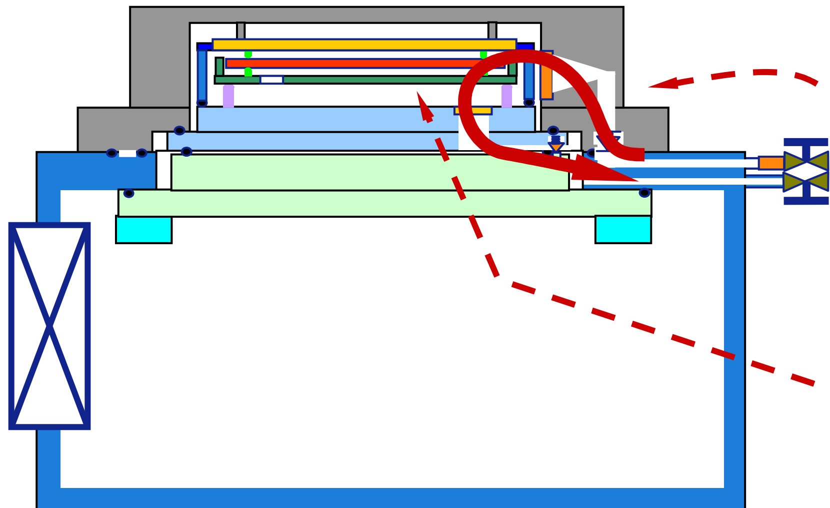
V-groove
for
Gripper

Rpas
Opening
for marker

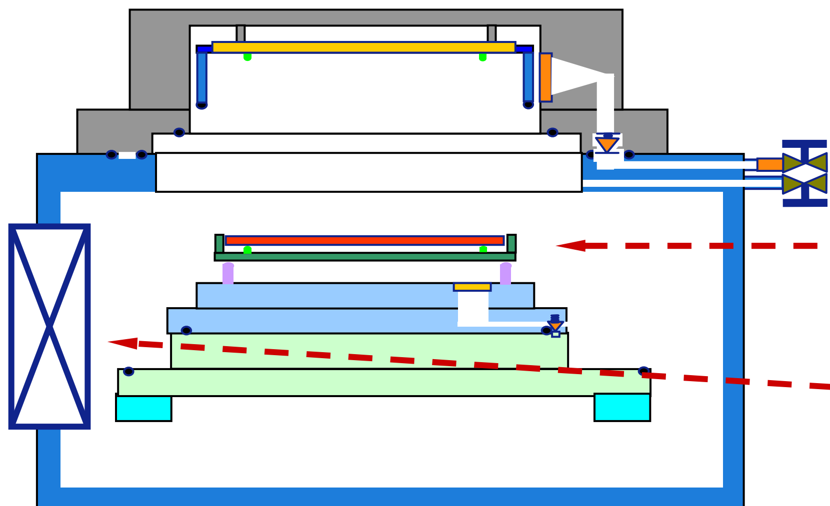
Barcode
window/
opening



ASML Storage Box and LL



- Gasflow directed away from pattern area
- Gasflow through filters in same direction during pumping and venting
- During pumping / venting a protective inner cover keeps reticle clean by making gasflow diffuse



- Movement of reticle only under vacuum conditions
- Use particle-free valve towards robot chamber and RS area

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Frame, loadlock and box for RH have been optimized and AD HW has been built based on FuMo results
(Testing done between July 2003 and Dec 2004)

ASML Storage Box – further efforts

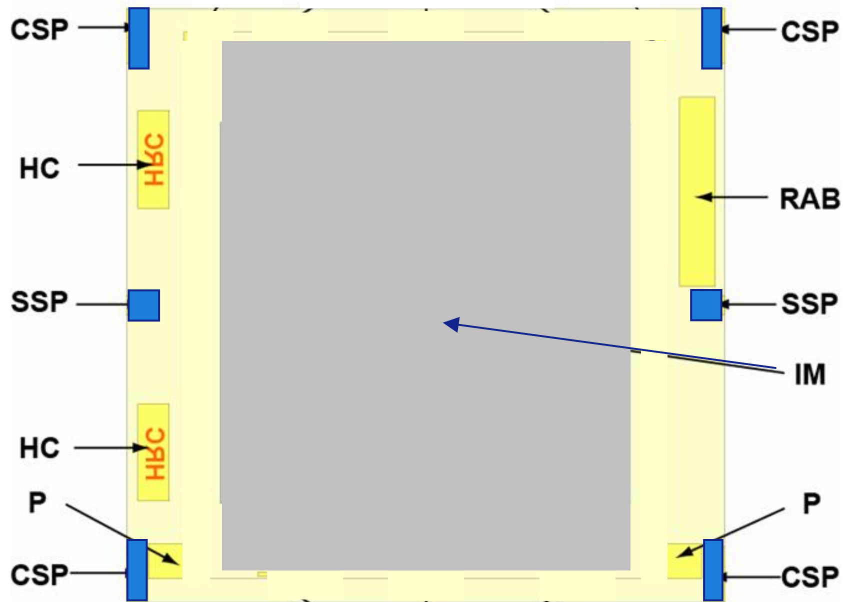
- ASML Storage Box was designed for in fab. use – handling in and around the exposure tool in the fab.
- ASML Storage Box was not designed for shipping: i.e. - transport from the mask shop to the fab. or “over the ocean” transport
- ASML has some ideas about modifications for the shipping transport conditions
- ASML plans to conduct shipping transport tests with modified designs later this year

Particle free reticle handling summary

- Material selection, hardware design, and environmental optimization have been done
- Extensive testing, pre- and post-integration on the first Alpha Demo tool including multiple cycle handling runs show essentially no particles added
  - Tests results include 6 manual handling steps, which is the likely source of the particle adders
- Testing will continue on the tool, including improved metrology, but the final proof of particle free reticle handling will be demonstrated during lithography

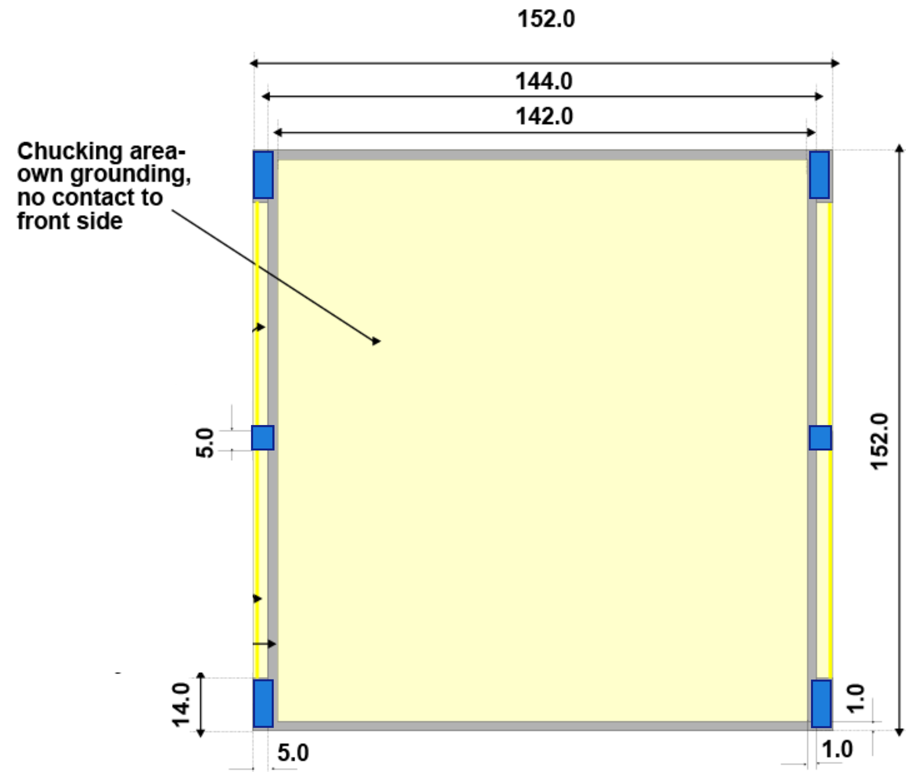
ASML Proposed Layout

Front or pattern side



P : RPAS mark
CSP : Corner support point
SSP : Side support point
IM : Image field
HC : Human readable code, reserved area
RAB : Reserved area barcode

Back or clamp side



Handling Zones