

Proposal of a new removal pellicle structure

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Requirement of Removal pellicle

- **Desirable to prevent particle addition during inspection and handling of a mask**
- **Should be removed and attached just before and after exposure under vacuum environment**
- **Contacting a mask with other objects generates particles and it should be eliminated from mask handling**

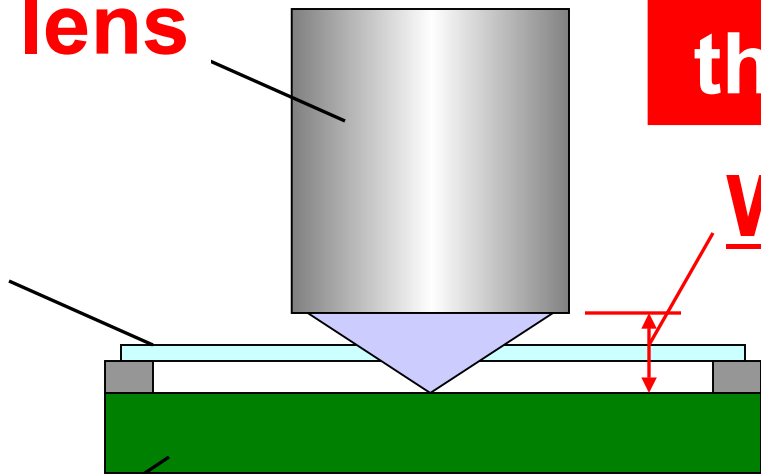
Requirement of low stand-off

During a mask inspection

Objective lens

Removal pellicle

Substrate



The lower WD,
the easier design.

Working Distance

Stand-off

< 2mm
is preferable.

Comparison of Pellicle type

	Thickness compensation of an objective lens
<u>Soft-pellicle</u>	Not necessary
<u>Hard-pellicle</u>	Necessary

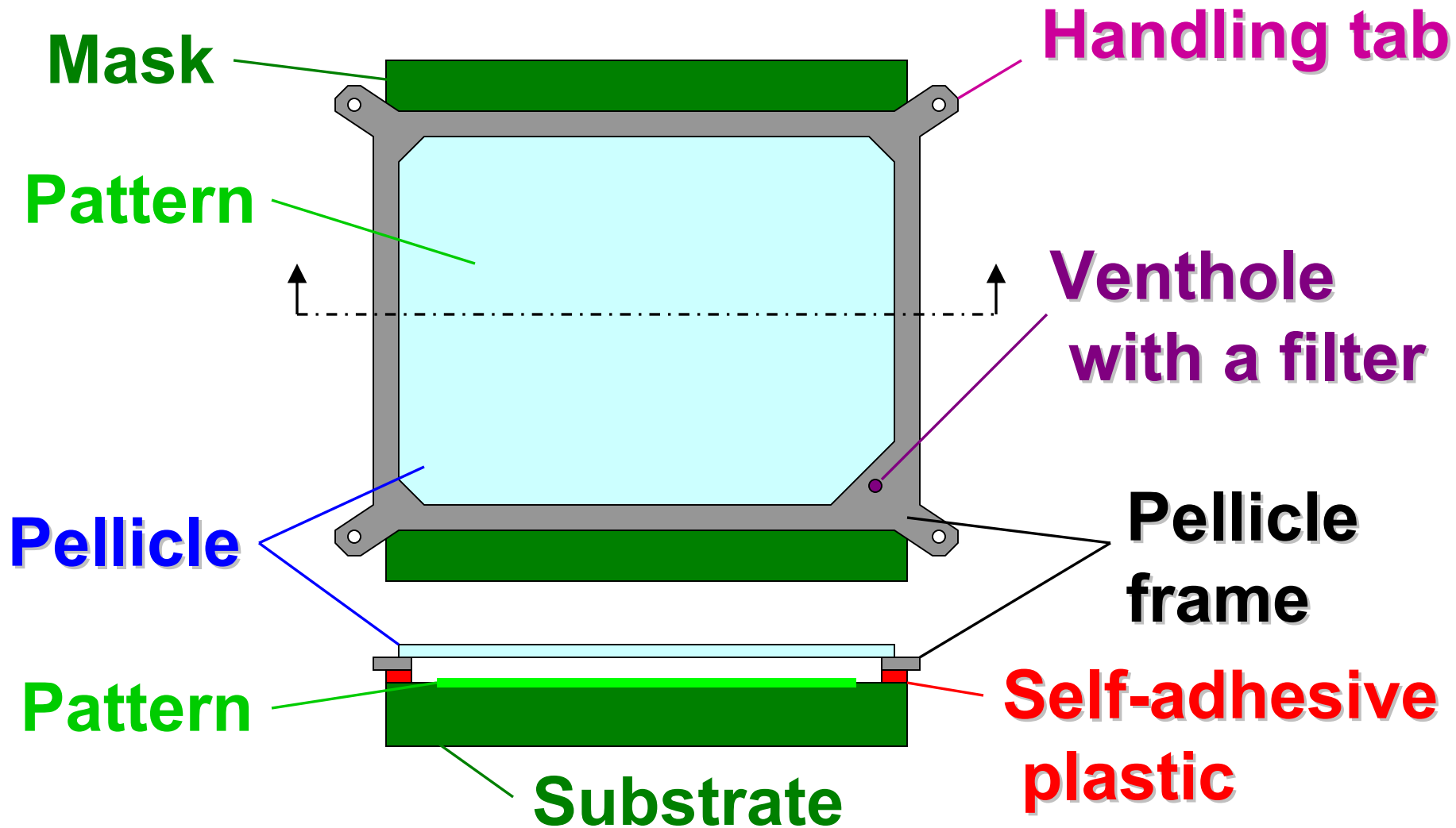
Features of Removal pellicle

- **Simple structure**

- **Easy to remove and attach**

- **Low outgas**
- **No particle generation**
- **Handling mechanism do not touch a mask directly**

A structure of Removal pellicle



A prototype of Removal pellicle



Pellicle

**Venthole
with a filter**

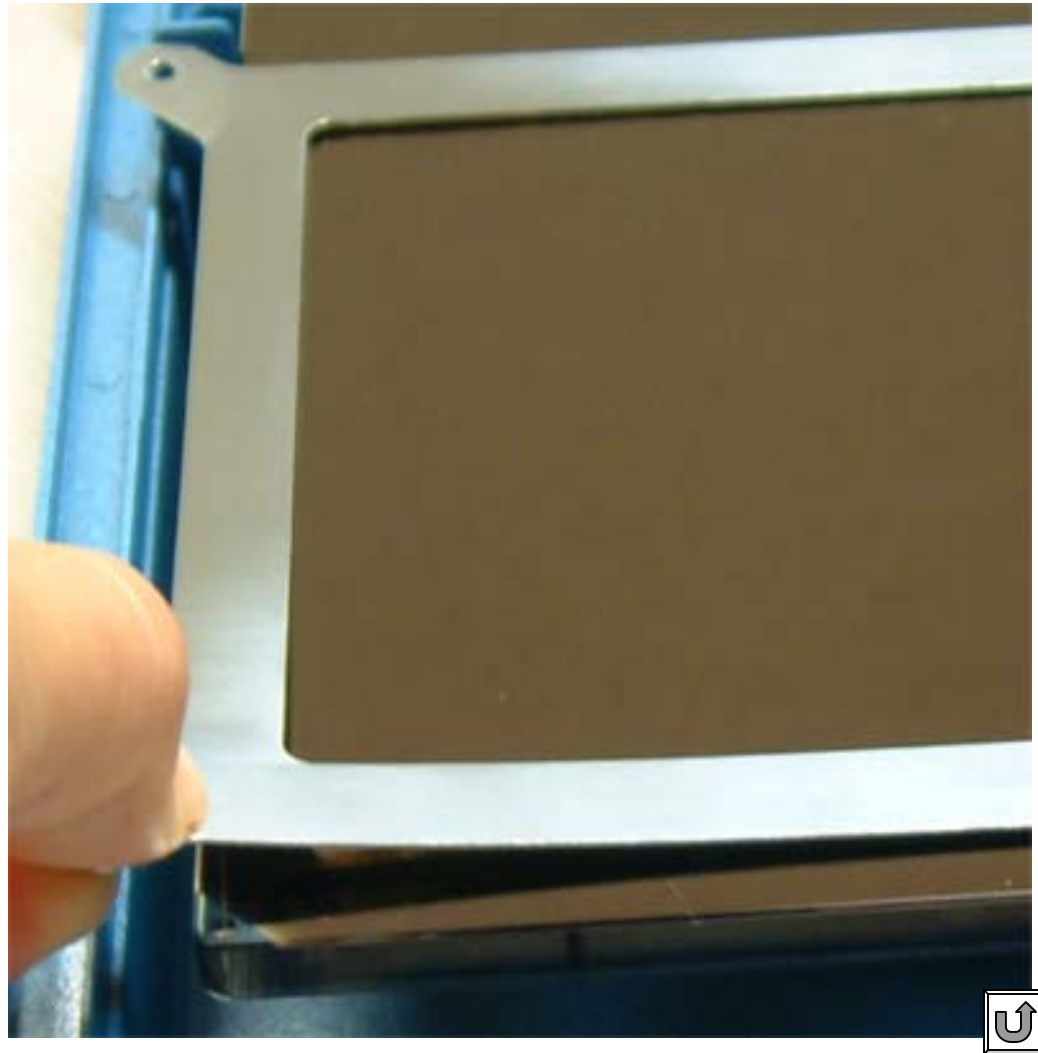
**Pellicle
frame**

Handling tab



Pellicle frame

- **Robotic finger pick handing tabs for mask transfer, pellicle removal, and pellicle attachment**
- **Stainless-steel**
- **Thin and Flexible**



Self-adhesive plastic

Backside

Handling frame

Self-adhesive plastic

**Molding is desirable
for mass production**

Self-adhesive plastic

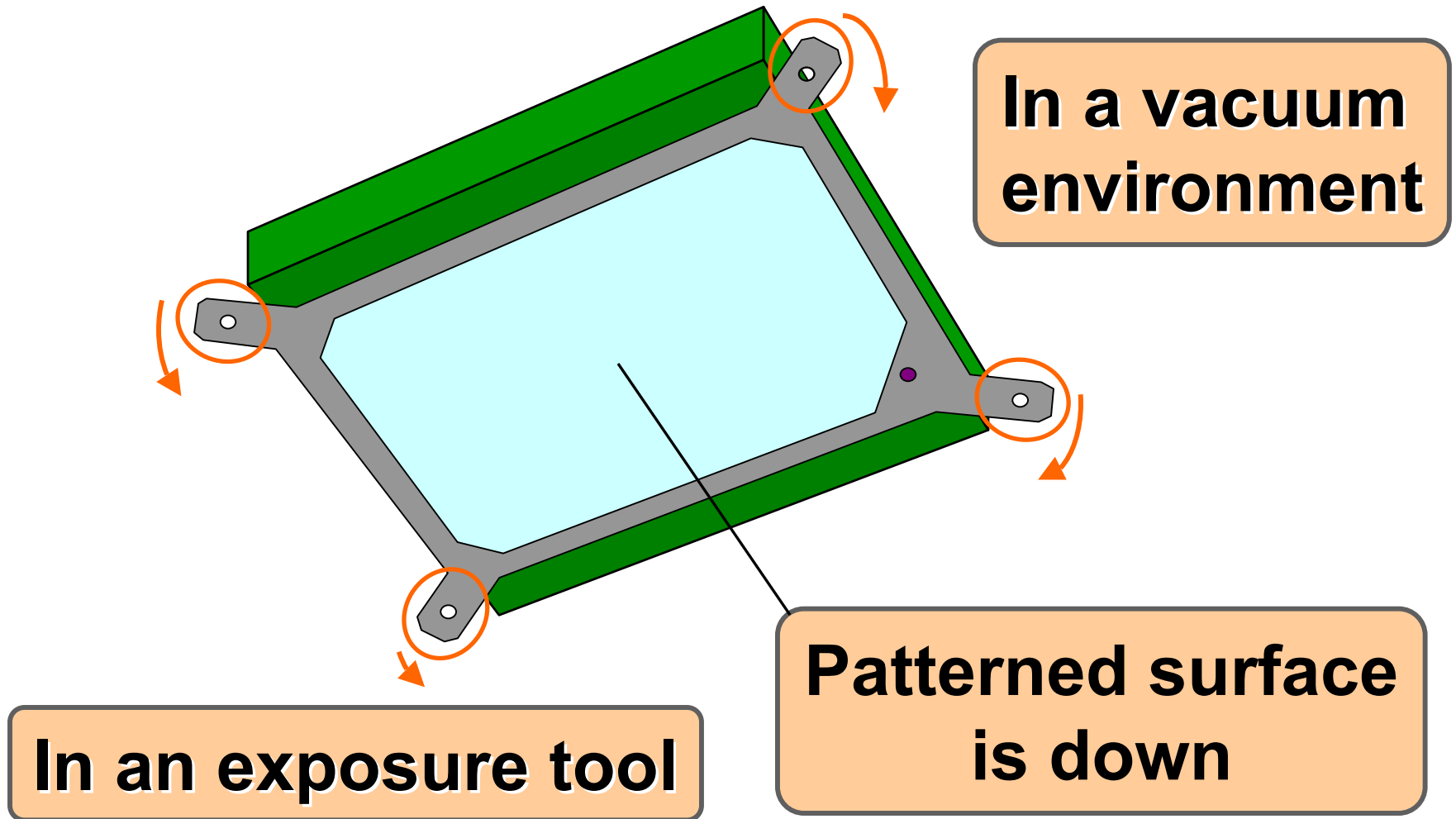
- **Material : Polyurethane**
- **Thickness : 1-2mm**
- **Adhesion is not too strong.
(Similar to Post-it™)**
- **There was no residue on the mask.
(We have checked using QSM400)**
- **Particle test to be done by M1350**
- **No plasticizer**
- **Low outgas**
- **Water washable
(Adhesion recover to initial level)**

Vent-hole with a filter

- **Release air pressure inside pellicle**
- **Air flow should be controlled by monitoring pellicle swelling and shrinking**
- **Porous film is attached for example**

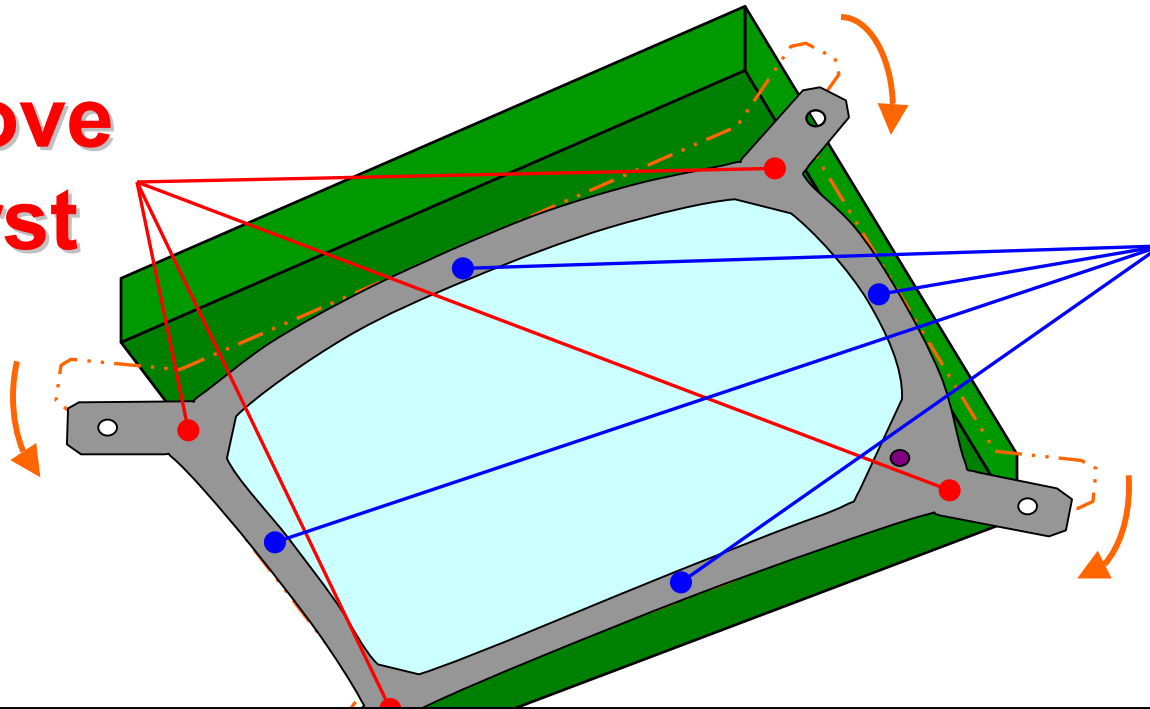


Method of removal



Method of removal

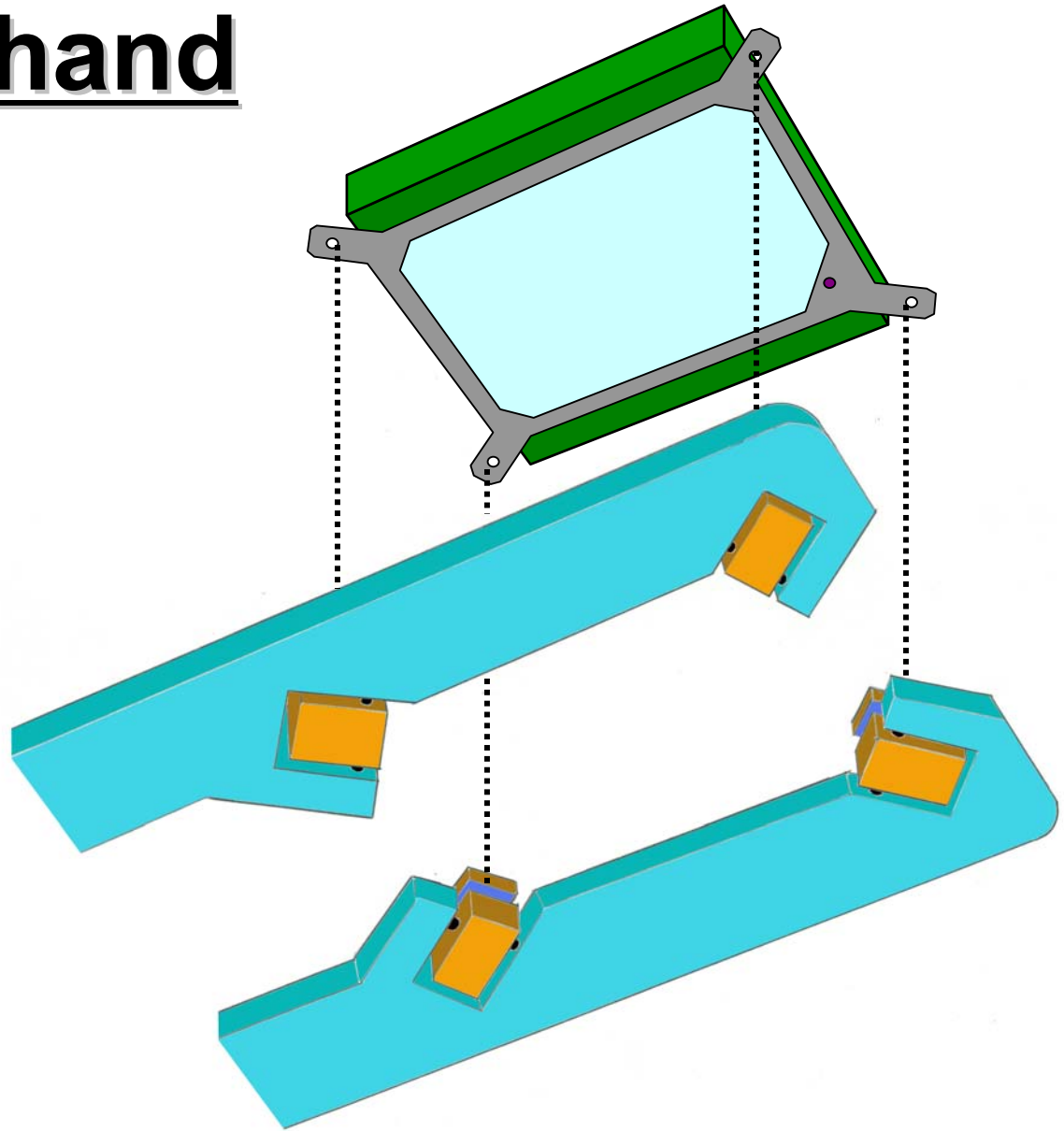
**Remove
at first**



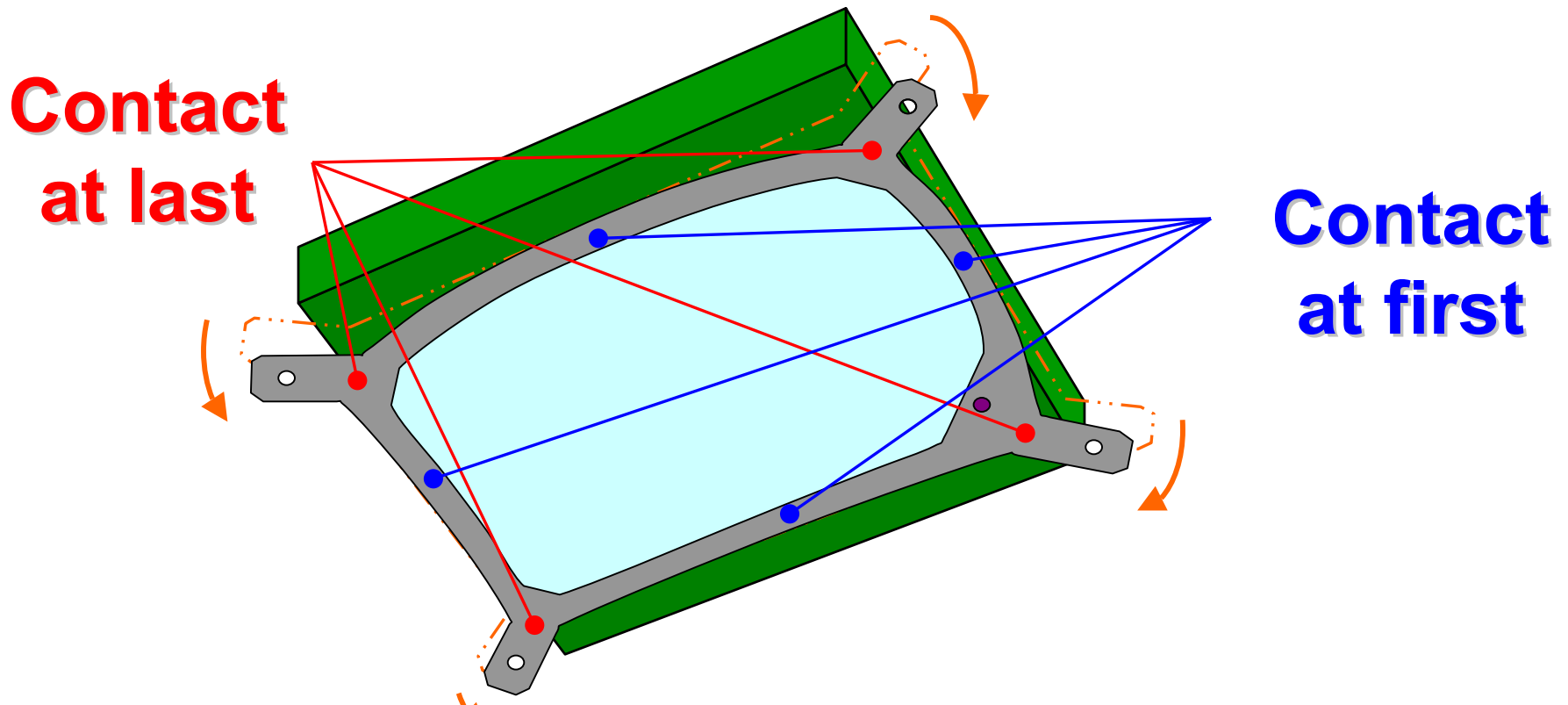
**Remove
at last**

- **Robotic hand touch only tabs**
- **Bending motion reduce pulling force**
- **Minimal particle generation**

Robotic hand



Method of attachment



- Flame bending makes enough contact pressure to reduce air leak path

Method of removal and attaching



Summary

- **Pellicle should stay on a mask during inspection and handling.**
- **Particle generation caused by contact between mask and handling mechanism should be minimized. Hard contact between mask and carrier may add particle during handling and require high sensitivity inspection tool for verification.**

Summary Continued

We have proposed a new type of removable pellicle with

- Simple structure**
- Easy to remove and attach**
- Minimal contamination by eliminating hard contact against mask**

Future tasks

- **Evaluate particle generation in operating condition**
- **Investigate outgases of self-adhesive plastic under vacuum environment**
- **Optimize the stand-off height**
- **Minimize and evaluate leak paths**