Asyst Vision for EUV Reticle Handling System

1. Start-to-Finish Automated Clean Handling
2. Comprehensive Environmental Control
3. Eliminate Relative Motion
4. Built on existing standards
5. Optimize Reticle Inspections

1. Start-to-Finish Automated Handling

- "Sand hill to Landfill" lifecycle must be considered
  - In order to approach zero particles in the life of the reticle on every EUV reticle
- Comprehensive automated handling
  - Pods throughout mask shop, shipping, & fab use
  - AMHS of pods throughout Fab
  - Minimized handling steps
  - Minimum vibration & shock in transport

2. Comprehensive Environmental Control

- Active Environmental Control in the carrier
  - Monitoring
  - Active Control
  - Parameters may include Temp, RH, Particles, Light, AMC, electrostatic charge, oxygen, pressure, carrier ID
  - Vibration monitoring during shipment
  - Space is provided for control devices to exist *and interface*
- Pod External ambient always class 1
  - Even during shipment
  - Pod within a Pod!
    - For External Cleanliness
    - For Shock Absorption

3. Eliminate Relative Motion

- Eliminate Relative Motion between contact points
  - Precise placement by robot
    - Use reticle fiducials to orient prior to gripping
    - Use Carrier fiducials to orient prior to placement
  - Charge-neutral transfers
  - No sliding required to retain reticle in carrier
- Well-defined, Well-Designed Contact points
  - Specific contact points for “Pick” and for “Nest”
  - Specific contact points for grounding(?)
  - Specific exclusion volumes for Pick and Nest
- Slow-Speed Reticle Motion
- Zero Human Handling
  - No Human movement of the Pod in the fab
  - One Reticle – One Carrier. For Life.
    - Eliminate variations from pod to pod for that reticle

4. Built on Existing Standards

- Built on, but not limited to, existing standards
- 200mm SMIF SEMI E19 for Mask Shop
- EUV Carrier
  - 150 or 200mm SEMI E19?
  - A larger carrier enables more space for active monitoring and control systems

5. Reticle Inspections Optimized

- A combination of Pre-process and Post-process inspections
  - Every reticle is assured to be defect free prior to exposure of production wafers
  - Some direct reticle inspections prior to exposure
  - Some exposure of test wafers and inspection of test wafers prior to exposure of production wafers
    - Integrated metrology in exposure tools in some

Backup

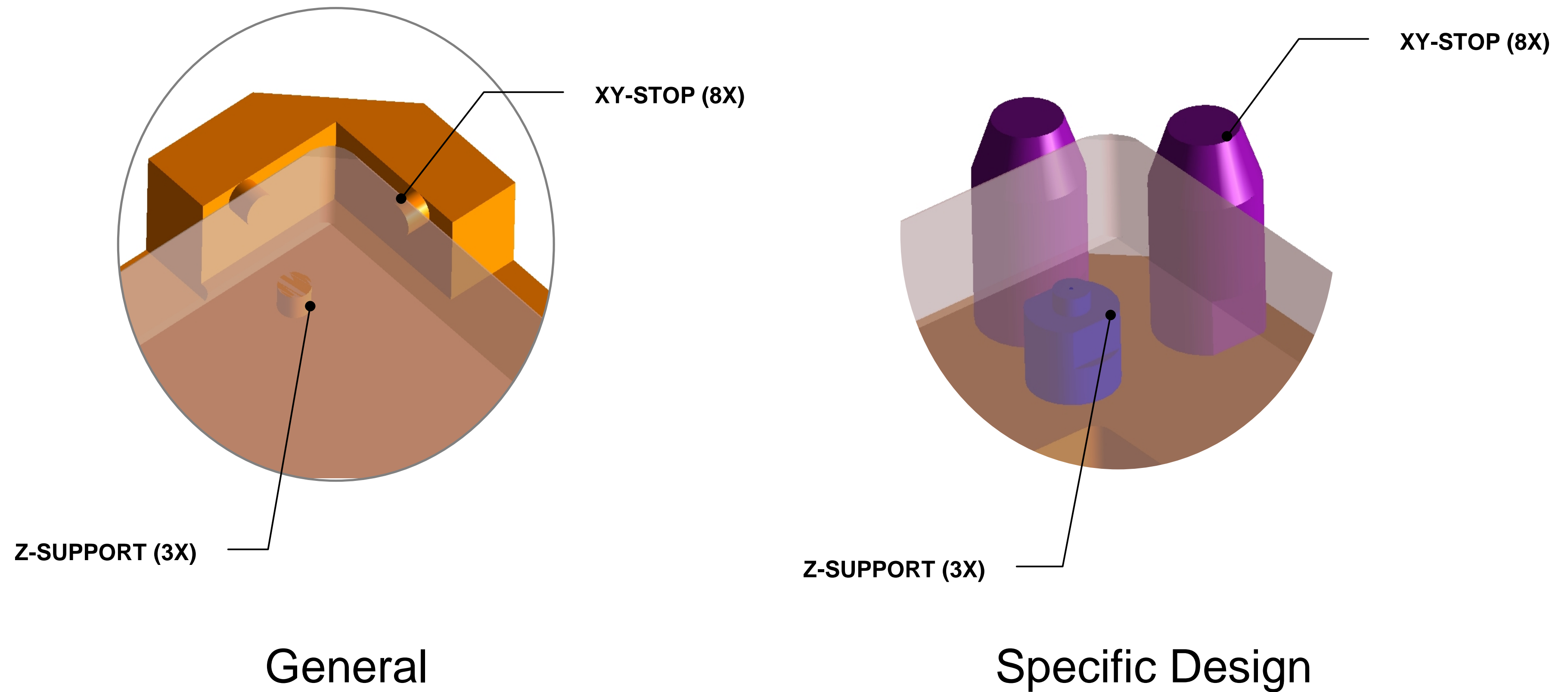
Preferred surface: standard EUV mask finishes, extended to sidewall

- Fewest added processes (no additional depositions or removals)
- Place burden of non-particulation on end effectors
- Ease of cleaning from different films?
- Sidewall should be front or backside material?
- Sufficient electrical conductivity?

Asyst Comments on ASML presentation on contact points

- Generally a sound concept
- No mention made for top contact
  - This focus is on fab carrier, not shipper
- Concept sketches still would allow relative motion
  - The system must enable *elimination* of relative motion between reticle and the nest contact points
- Contact points must be specified as reserved for robot “Pick” or reserved for carrier or tool “Nest” (P or N contact points)
- Proposal needed for standard fiducials
  - On the reticle, near contact points
  - On the carrier, near contact points
- Consider real estate for active particle control devices
  - Localized exhaust ports close to contact points

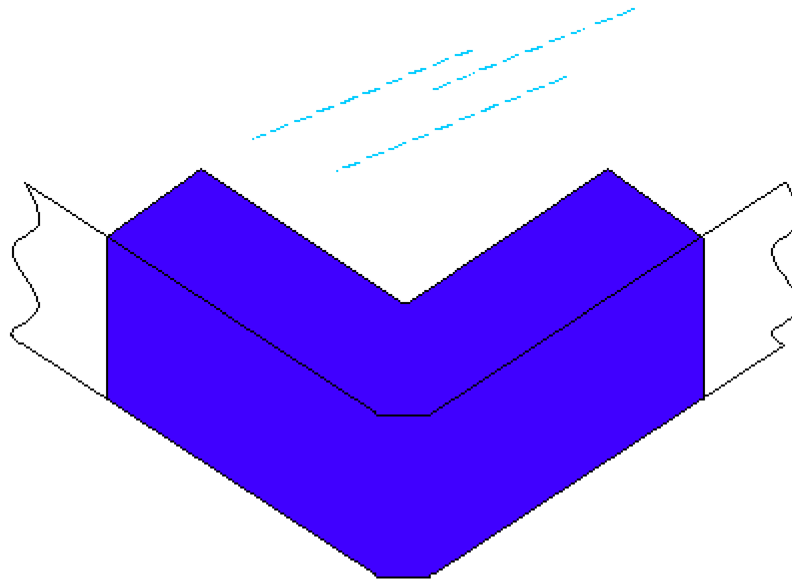
Corner contacting approach

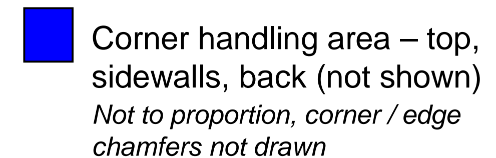


General

Specific Design

Corner contacting approach





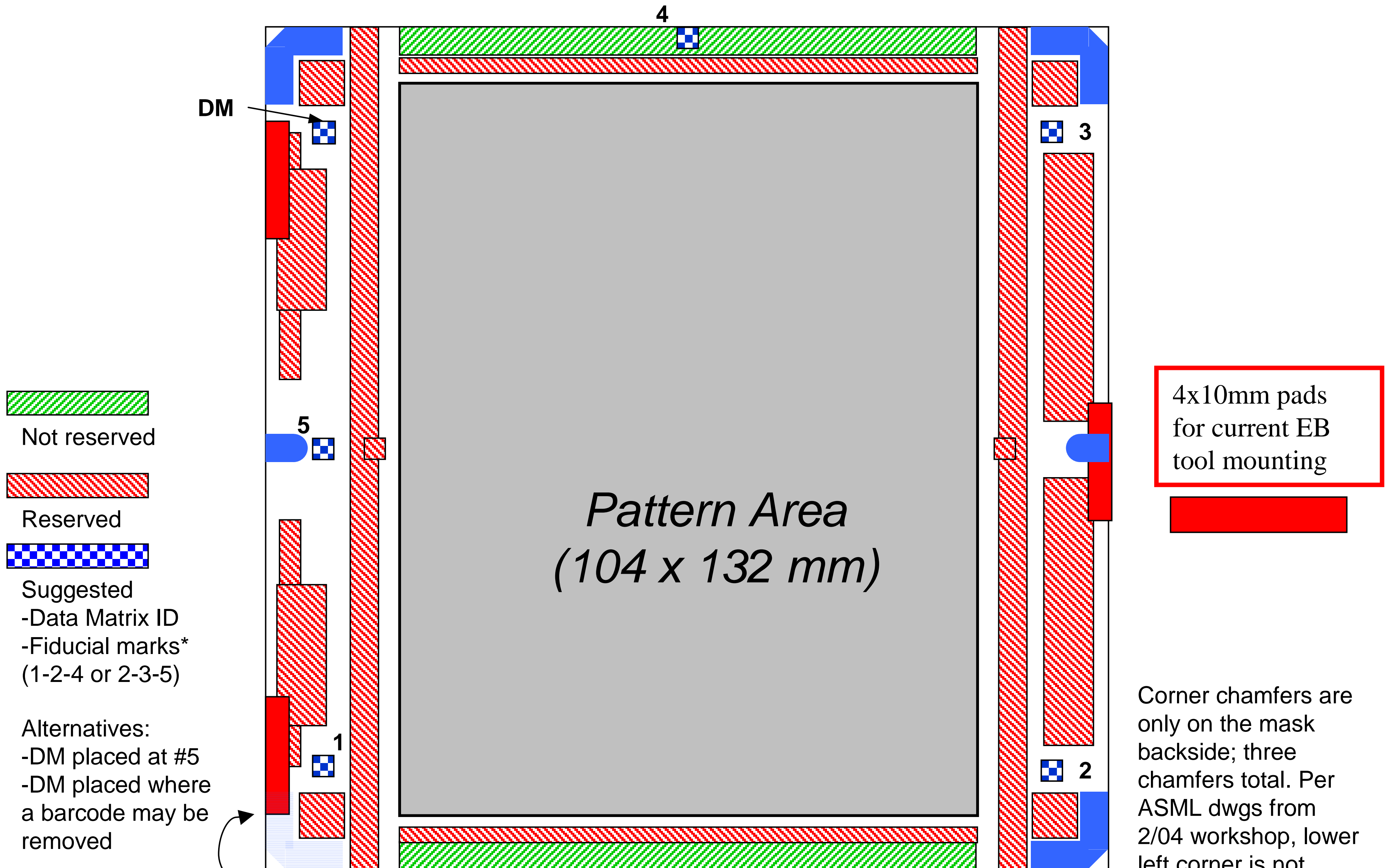
Proposed items for standardization:

- Number of contact areas/zones: 6
- Locations of areas: corners, side centers of non-scan axis
- Shapes of areas: as drawn; top, backside, sidewalls inclusive
- **NOT proposed**: surface finish or film in the areas.

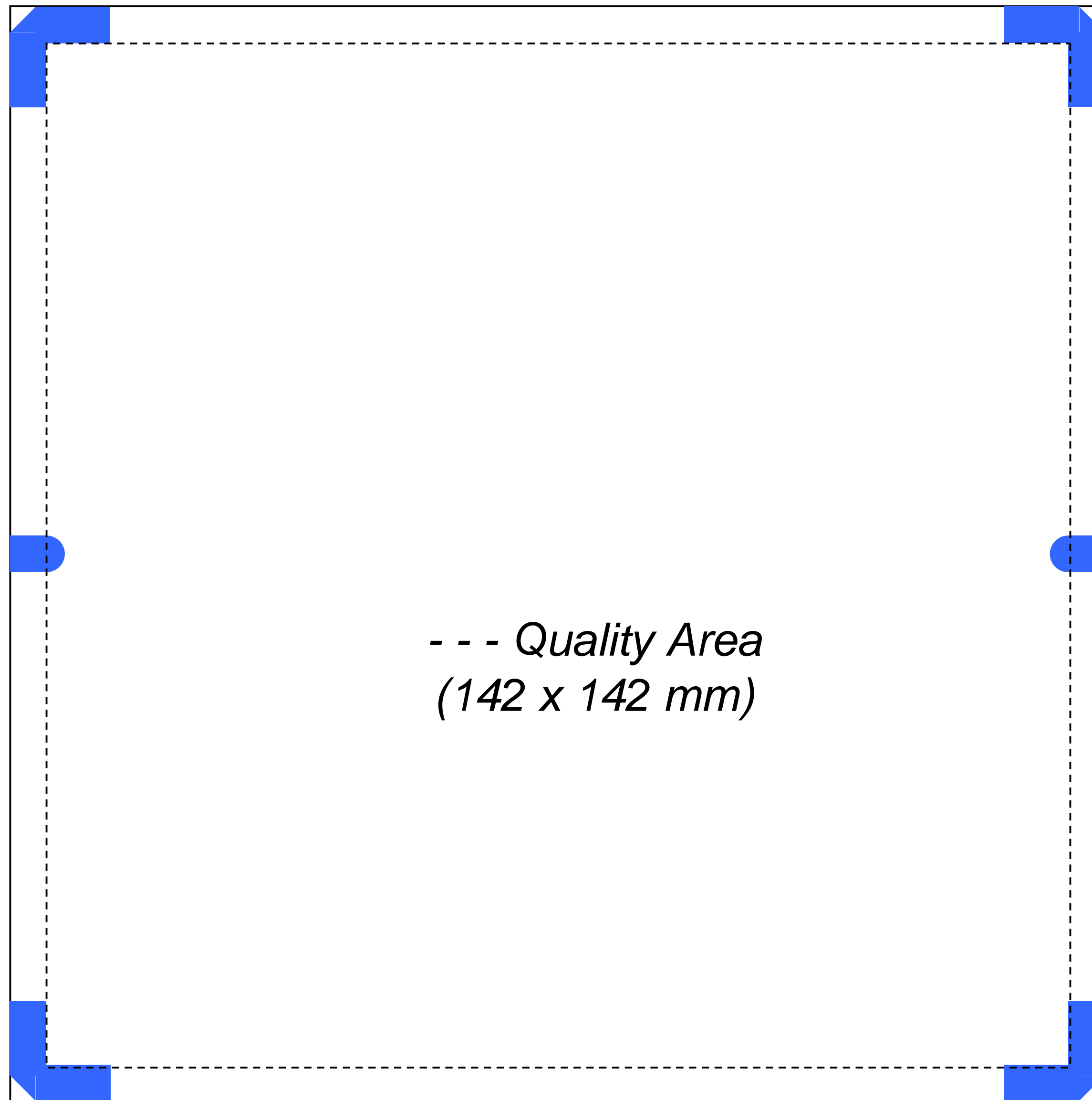
Questions:

- What material should sidewall be – pattern film or backside film?
- If conductivity in these areas is important (conduction may take place elsewhere), is there sufficient electrical conductivity?

EUV Mask Layout (area reservations for exposure tools, some writers) (work in progress)



EUV Mask Backside Layout



Corner contacting approach