

TSMC Perspective on EUV Pellicle

Jack J.H. Chen

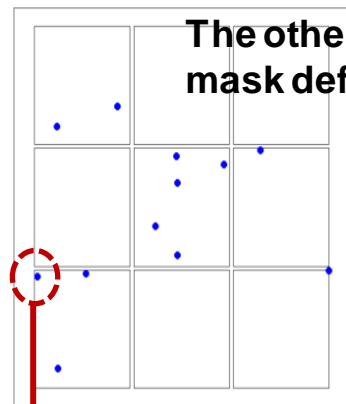
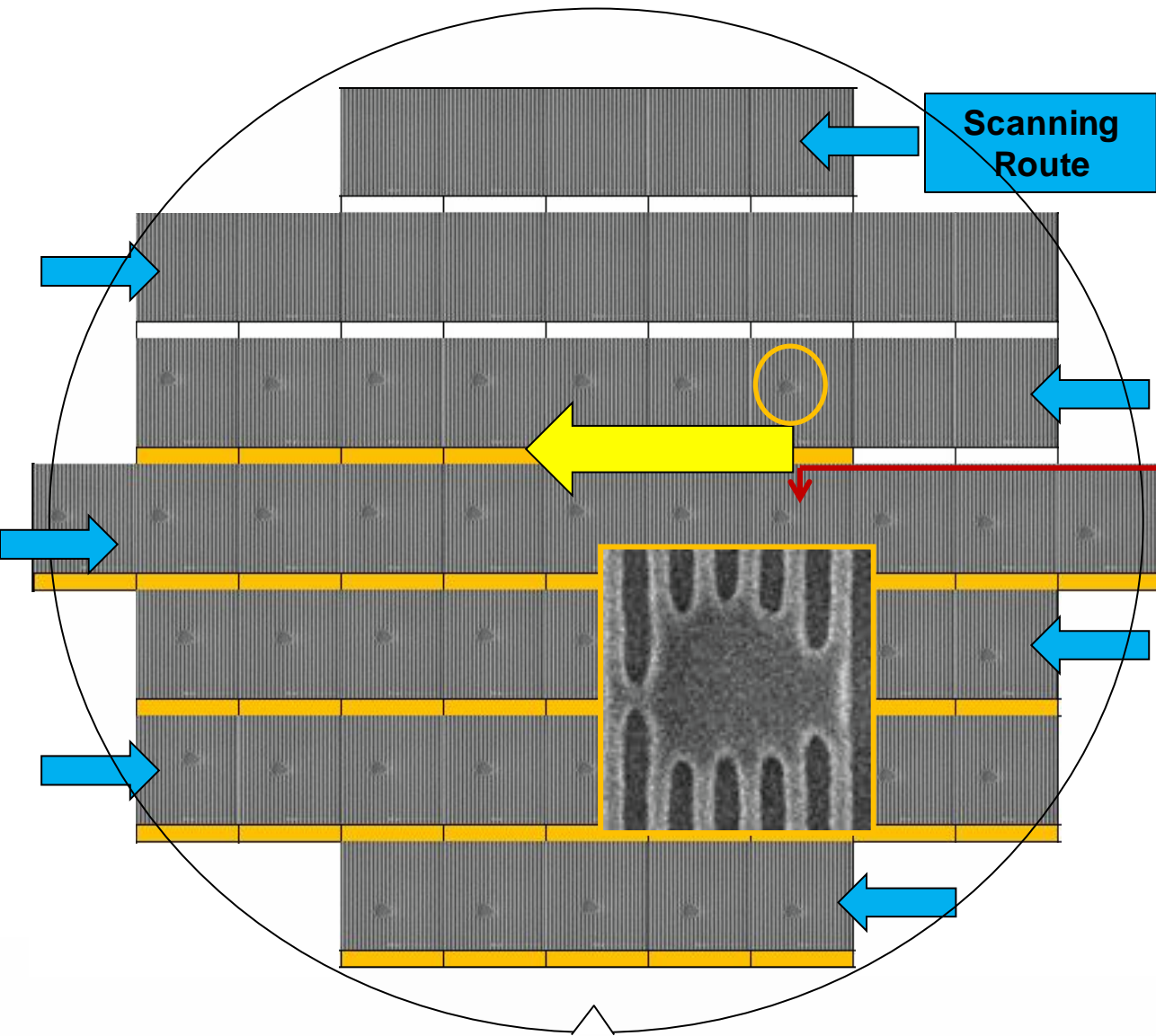
4th October 2015

Pellicle TWG, Maastricht

Fact of fall-on particles on mask

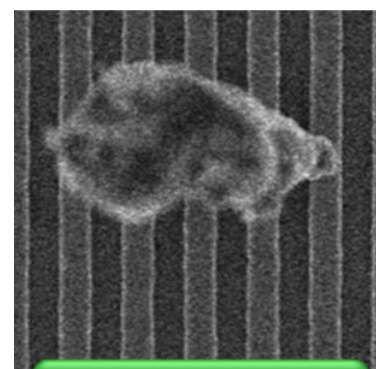
- **Dual reticle pod provides good protection for mask.**
- **However, fall-on particles were still observed in a period of exposure usage. Sources are yet to be identified and mitigated.**
- **We can not tolerate any fall-on particle due to no redundancy in Logic circuit!**
- **Pellicle is essentially required for EUVL production!**

Fall-on particles on mask impact all dies!



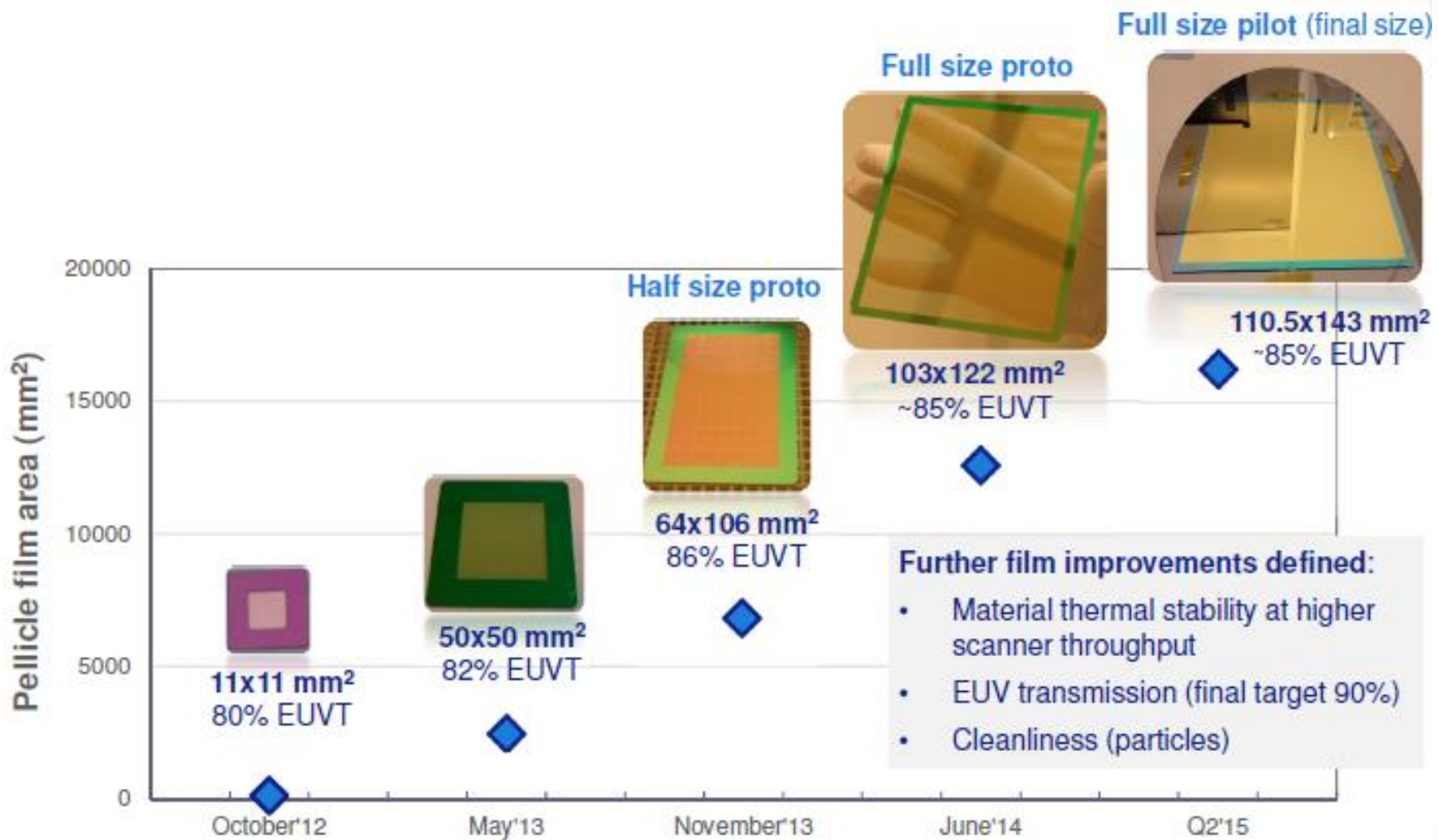
The others were mask defects.

Repeaters from wafer defect inspection



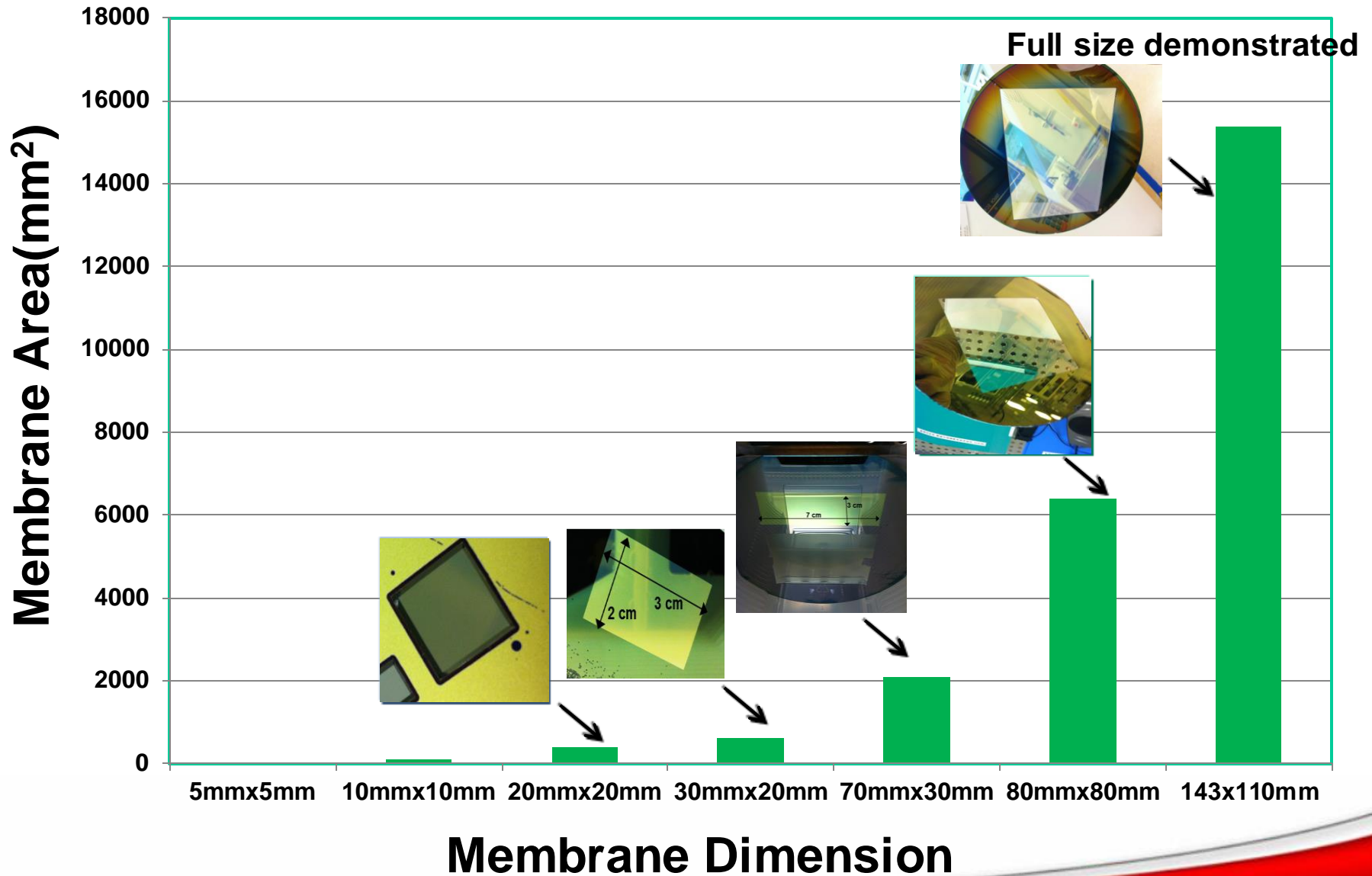
Fall-on particle on mask

Progress has been made on EUV pellicles



Courtesy of ASML

TSMC EUV Pellicle Development



TSMC perspective on EUV pellicle - I

- TSMC is developing the pellicle solutions and willing to become the membrane supplier for the industry, but needs partners for the rest.
- The proto EUV pellicle should be ready by end of 2015 for scanner test, and multiple useful pellicles per month will be required by mid 2016.
- Pellicle-less will anyhow put ourselves in risk and at high inspection loading! Nevertheless a minimized light loss solution is preferred if possible. After all, it's at additional cost of 20% productivity loss, assuming 90% transmission single pass.

TSMC Perspective on EUV Pellicle - II

● Membrane

- Containment plan is required for if membrane breaks inside scanner
- Life time and cost of pellicle should be economically reasonable
- Thermal stability (250W), transmission ($> \sim 90\%$), and cleanliness

● Frame

- No particle permeates through either filter or gap.
- Membrane deflection in safe range during pumping/venting/scanning.
- Adhesives compatible to scanner environment (EUV + H-radical).

● Mount / Demount

- Very low mount / demount force, while keeping strong adhesion.
- Adhesive can be cleanly removed by cleaning.

● Handling

- Safe shipping and storage of pellicle & pelliclized reticles.