



TNO Semicon & Quantum Introduction

**Harm van Leeuwen
June, 2023**

About TNO

- Dutch institute for Applied Scientific Research
- Established in 1932
- Independent of public and private interest
- 580 MEURO turnover with 3,500 FTE
- 10 locations in the Netherlands
- 25 offices/representation world wide

Mission

TNO connects people and knowledge to create innovations that boost the sustainable competitive strength of industry and wellbeing of society.



Collaboration with CUSTOMERS & PARTNERS



TNO Services and Competences for Semicon

Equipment (and process) R&D for the semiconductor industry:

- Concept studies
- Proof of principal/concept
- Design
- Prototyping
- Qualification
- Consultancy: design review, trouble shooting, etc.

Core competences:

- Opto-mechatronics with micro and nanometer precision
- Contamination control (molecular, particles)
- Extensive lab with state of the art (in house build) lab-tools

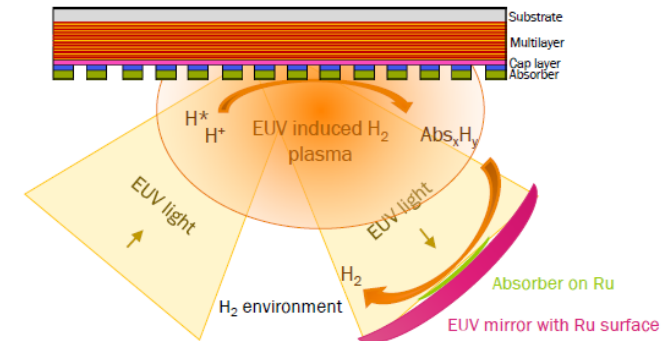


EUV Optics Qualification Program

- EUV Optics lifetime
- EUV Reticle absorber qualification
 - Chemical outgassing
 - H₂ plasma test
 - Molecular outgassing
 - Accelerated EUV exposure test
- EUV pellicle qualification



Schematic of an EUV reticle with absorber stack exposed to EUV light in hydrogen environment leading to chemical outgassing (etching) and redeposition on a mirror.



H* = hydrogen radicals
H⁺ = various hydrogen ion species
Abs_xH_y = volatile reaction product(s) of absorber and hydrogen

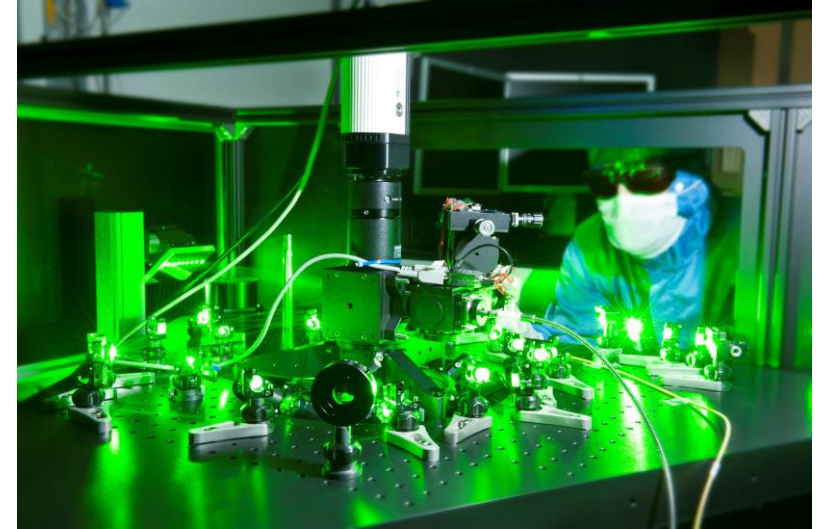
TNO objectives for Japan

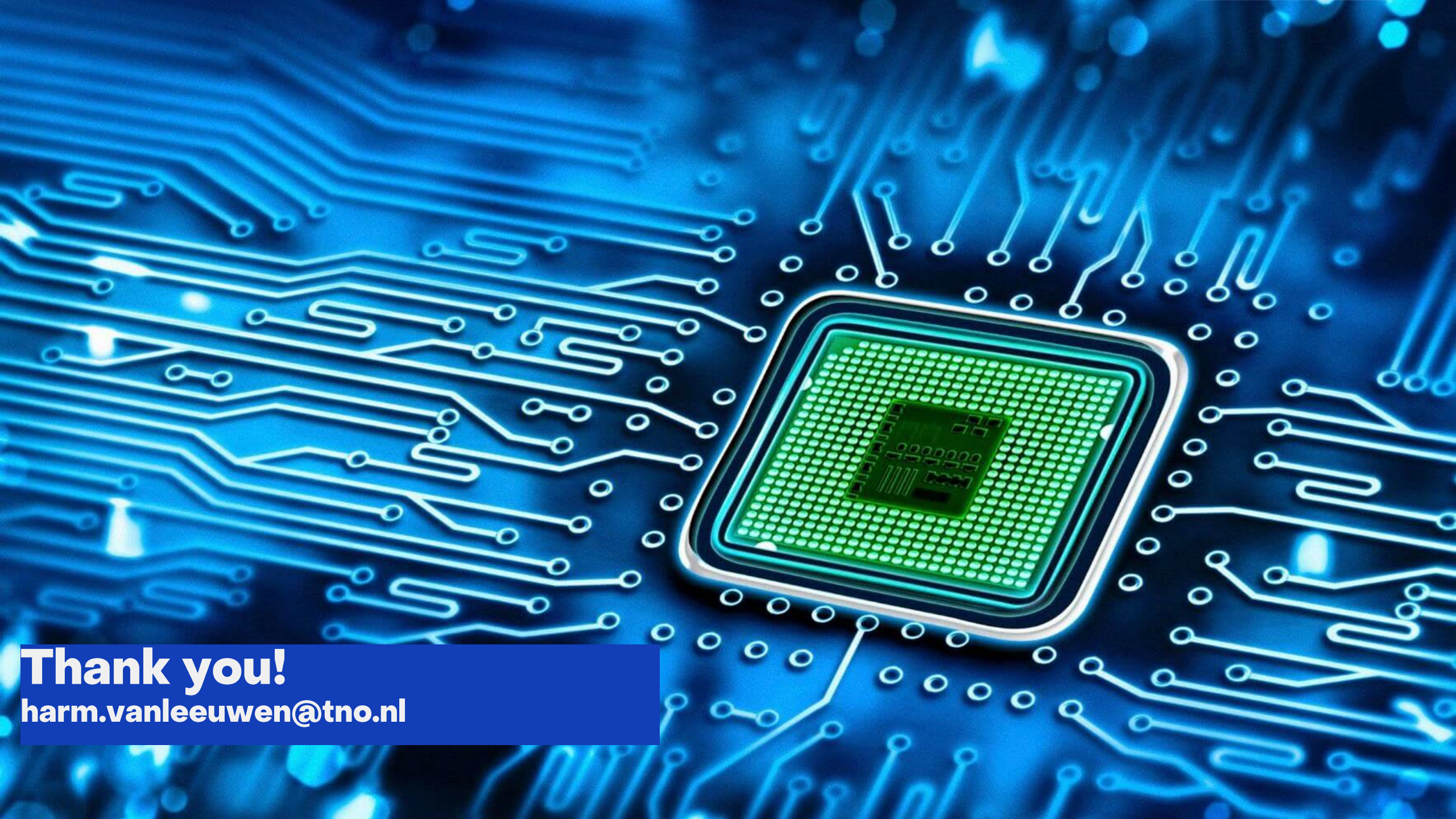
Maintain relationship with existing customers

- 4 customers for EUV reticle and pellicle qualification
- Metrology concepts for several OEM's

Seeking for new customers in the field of Semicon Equipment

- Novel metrology concept, for example:
 - Acoustic metrology
 - Semicon material research using IR-AFM
 - Quantum sensing
- Contamination control (molecular, particles)





Thank you!
harm.vanleeuwen@tno.nl