Photo Thermal Acoustic nano-Imaging (PTAI) makes use of a pulsed optical pump beam (typically a femtosecond laser) to thermally heat a sample surface. This heating results in a propagating stress field inside the material. These waves are reflected depending on the sub surface characteristics (e.g. layer boundaries and inclusions). The resulting reflected stress field contains information about the subsurface characteristics and is measured using a pulsed optical probe beam.

- TNO is developing a subsurface nano-imagine concept, so-called Photo Thermal Acoustics for nano-Imaging (PTAI). We have shown that imaging 50 nm feature buried 100 nm below the surface is feasible (TNO IP).
- Further analysis to determine the ultimate lateral and depth resolution is under study. With the use of high-end Finite Element Models (FEM) and optical simulations.
- A proof of principle test setup will be built to demonstrate the performance of the PTAI for subsurface nano-imaging.

**COMPETITIVE ADVANTAGE**
Non-destructive, high resolution 3D imaging solution for semiconductor industry, which directly measures the mechanical properties of the object.

**APPLICATION AREAS**
Semiconductor 3D metrology on the mechanical properties and as GHz excitation of samples in combination with AFM inspection.

**PROVEN SPECIFICATIONS**
we have shown the theoretical, simulated feasibility of resolving 50 nm features at a depth of 100 nm.

**TARGET SPECIFICATIONS**
Depth resolution of 10 nm with a lateral resolution below the optical diffraction limit of the pump and probe laser.
Top: Use case as simulated within the project. Bottom: A COMSOL simulation results showing the wave propagation inside the use case under consideration. The line ‘Cr-Si-Si-Cr-Cr’ describes the wave reflected on top of the Aluminum inclusion and reflected back to the sample surface.