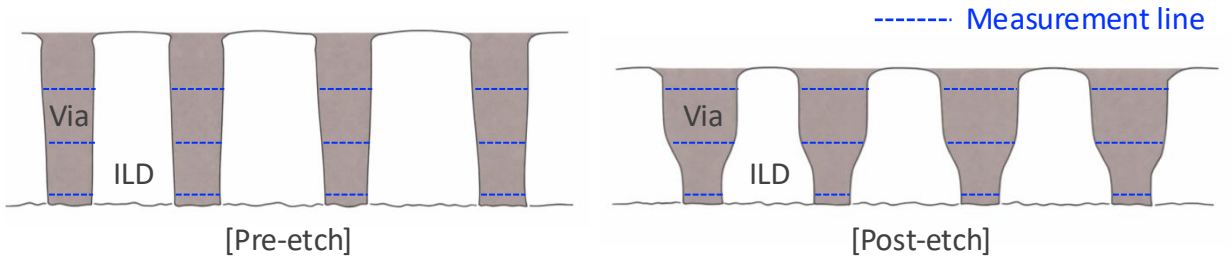
Reduced TEM analysis time by 97%, enabling data-driven process optimization

Background

- Via etch process development
  - Increase via metal volume through etch profile control
  - Evaluate etch performance with **TEM-based profile analysis**



[Pre-etch] [Post-etch]

Motivation

- Time-intensive manual analysis
  - ~6 minutes per image using ImageJ or Quartz PCI

Process condition evaluation requires:
- ❑ 3 via locations
- ❑ 2 cuts: X, Y
- ❑ 3 images per cut/location → **18 images total (~108 min)**

- Inconsistent measurement
  - Results vary by person due to:

- ❑ Reference line placement
- ❑ Measurement line/ROI selection
- ❑ Pixel interpretation and click accuracy

- Throughput bottleneck
  - DOE generates a large number of images:

One demo involves 20-25 conditions
→ Total analysis time: ~36-45 hours

Approach

- Develop a Python-based automated TEM profile analysis workflow to:
  - Automate measurement for **consistency and speed**
  - Provide **structured data** for comparison and trend analysis
  - Generate annotated images for **traceability and outlier detection**
  - Enable **custom measurement** rules on IP-controlled images

Outcome

- Reduced analysis time

Manual measurement
~6 minutes per image
One condition (=18 images) → **~108 min**

Automated measurement
~30 seconds per image
One condition (=18 images) → **~3 min**

- Quantified etch profiles