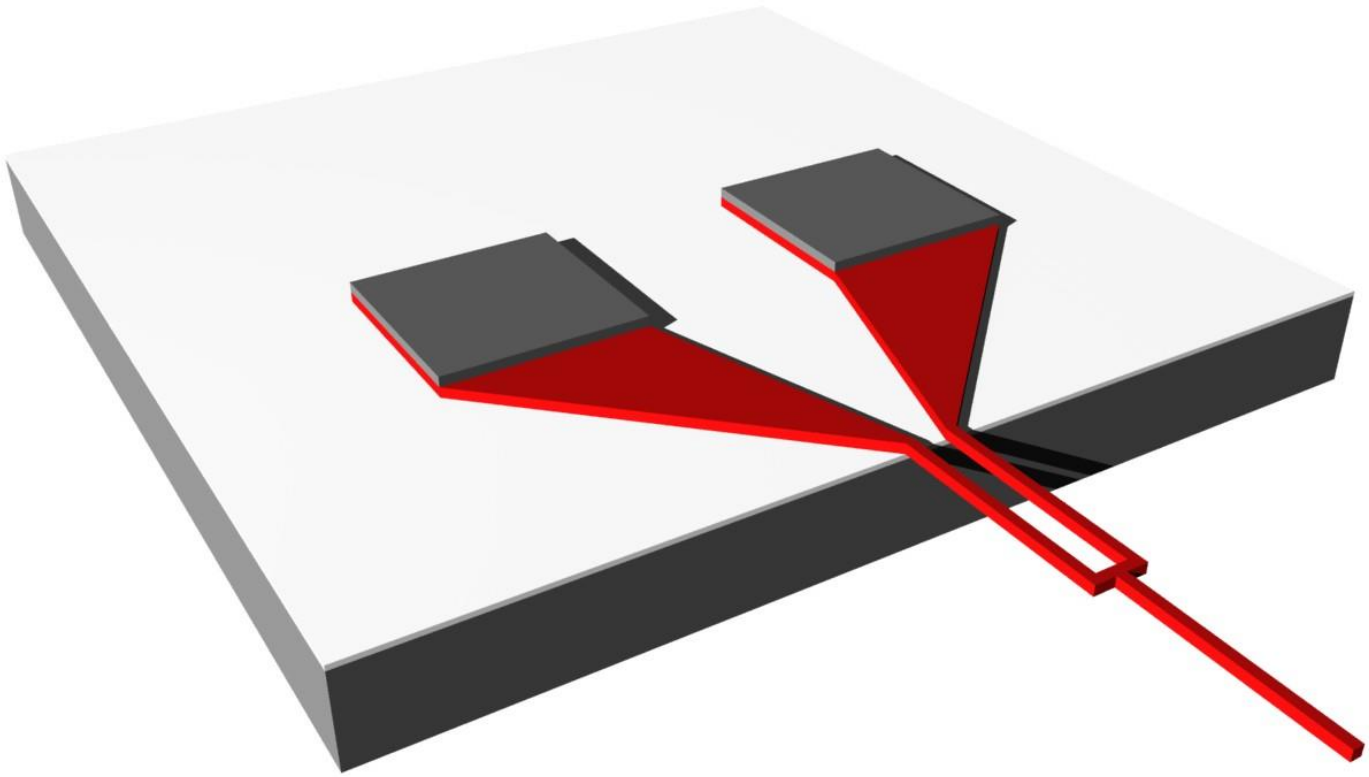
Worm Touch Update

Joey, 10/1/08

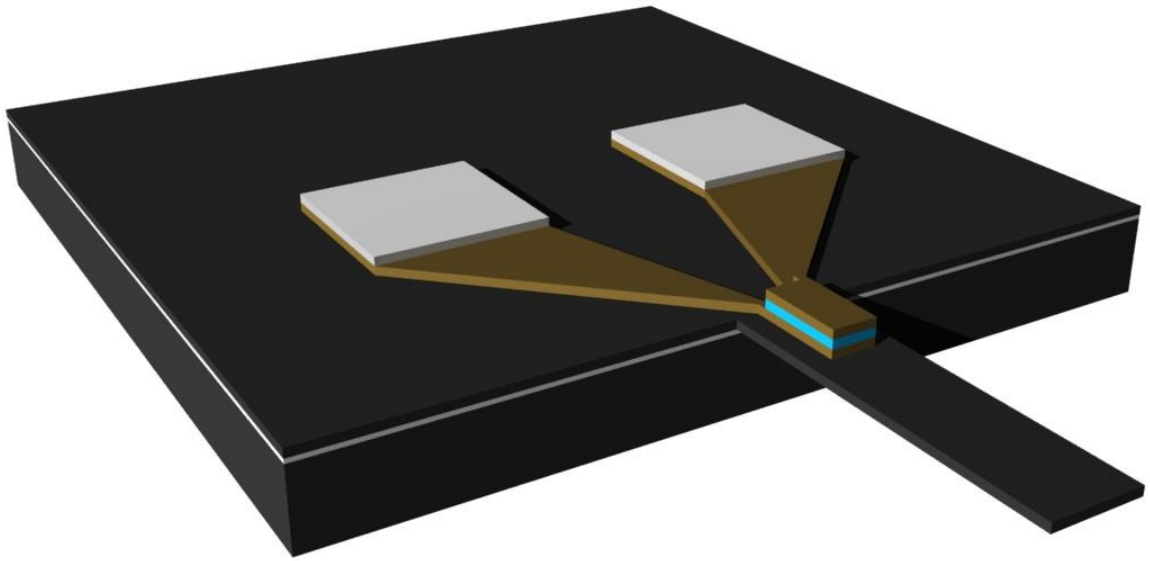
Status Updates

- Zurich Worm Data Analysis
  - Still ongoing, reworking code
- Microfluidic Devices with Shana
  - Bonding sorted out
- Cantilever fabrication

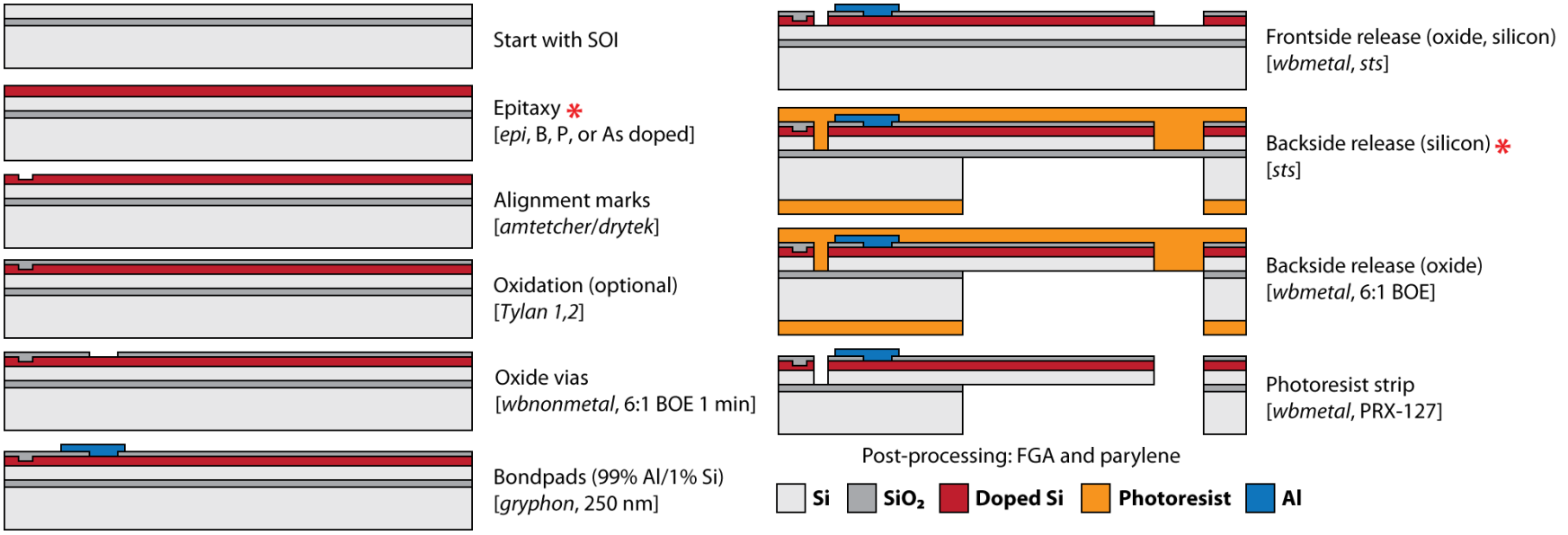
Piezoresistive Cantilever



Piezoelectric Cantilever



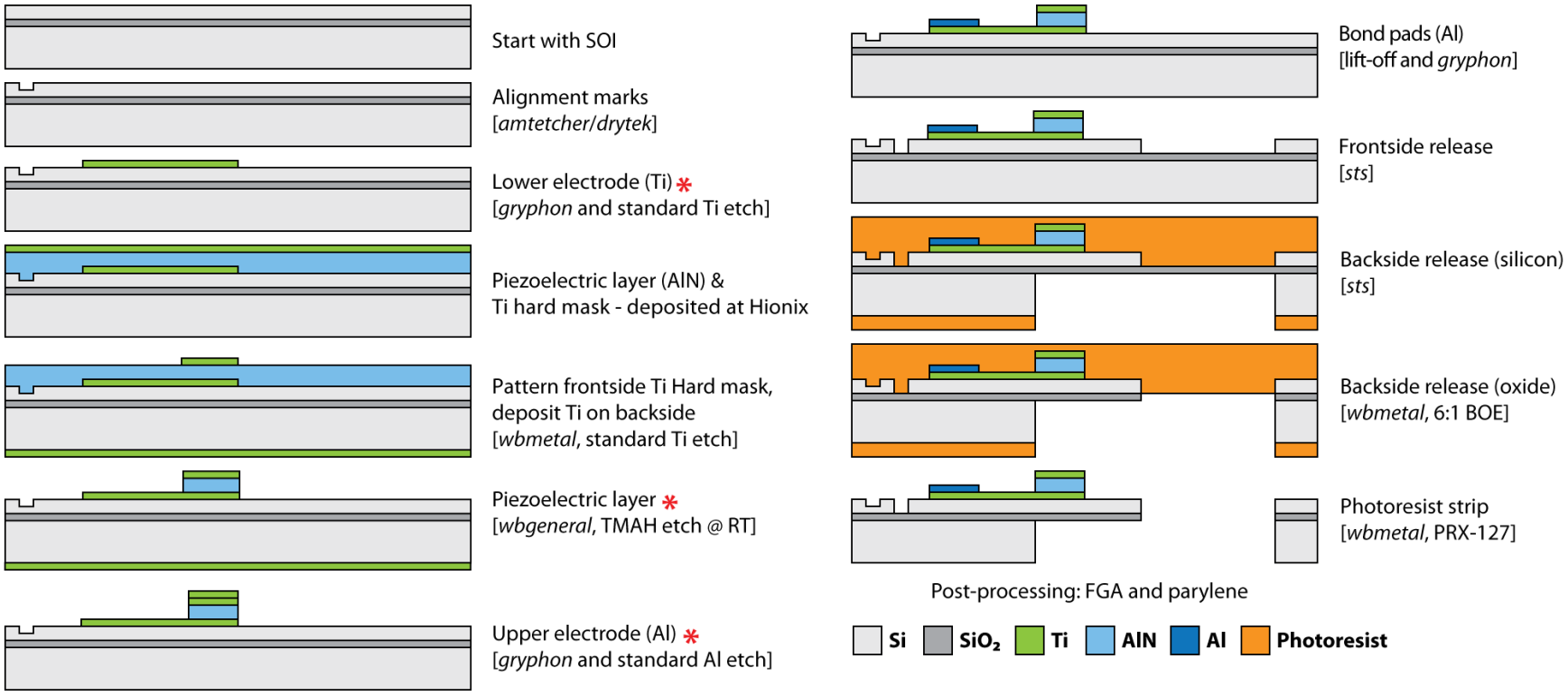
Piezoresistor Only



Issues

- Frontside wafer protection on backside lithography step
  - No photoresist allowed in contact with ASML vacuum chuck
- Oxide protection
  - Oxide not required for operation or low noise (using parylene), but depositing LTO after epi/diffusion might help to protect piezoresistors
- Buried oxide etch for cantilever release
  - Metal on wafers so no HF vapor release
  - Combination BOE and AMT has been used
- Oxide stress
  - Silicon (few um) comparable to BOX (500nm)
  - Yield issues, added crack propagators
- Junction Spiking
  - Bondpads on 0.5-1.0um thick (or less) epi layer
  - Using 99%/1% Al/Si, but FGA may be touchy. Testing on primes with shallow junctions should identify any issues early on.

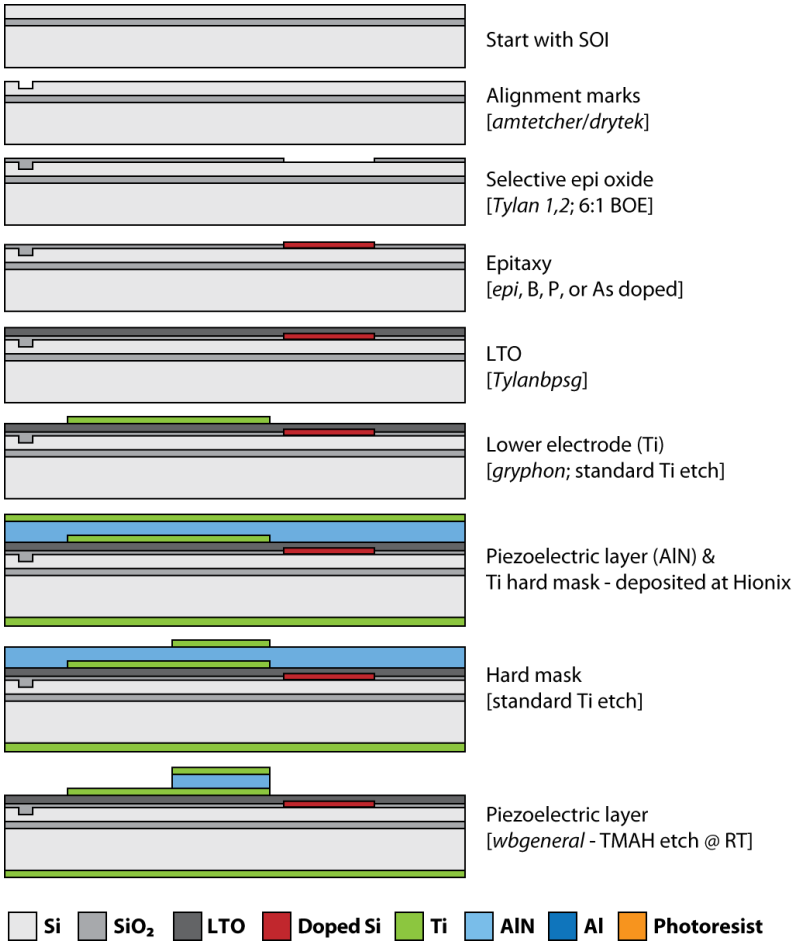
Piezoelectric Only

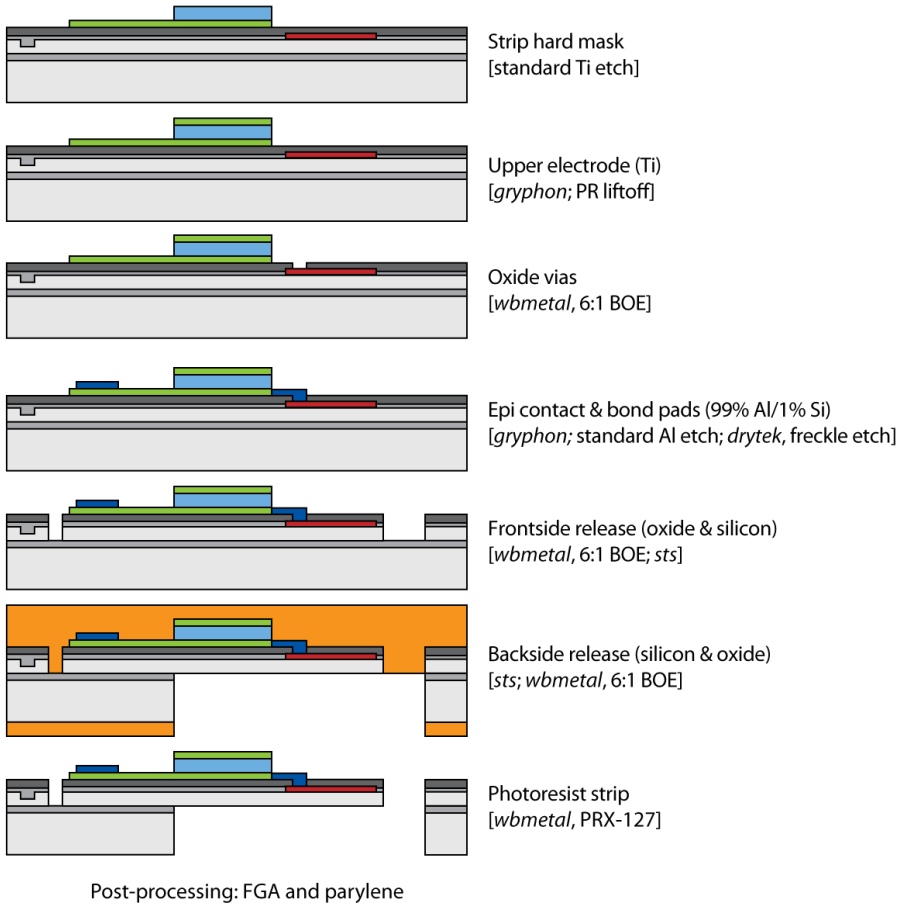


Issues

- Aluminum nitride etch
  - Using 25% TMAH at room temperature, planning on using metal hard mask because Ti already on wafer. AlN not attacked by standard Al etch.
  - AlN covered by photoresist in subsequent development steps, should be okay
- Aluminum nitride and metals
  - If top electrode = Ti, then we need to pattern it with lift-off because etch back would attack bottom electrode. Bondpads can be patterned with etch back.
  - If top electrode = Al, then we can pattern it and etch back without attacking Ti bottom electrode. But we'll need to pattern bondpads with liftoff rather than etchback. **(preferred)**
  - Current reticle was designed for positive photoresist etchback, so could either use negative photoresist for liftoff or change the image on the reticle.
- Overlay
  - AlN extends beyond top, bottom electrodes to prevent shorting. Need to pattern bottom electrode before aluminum nitride to take advantage of this.
  - However, preferrable to deposit AlN immediately after Ti under vacuum to avoid oxide forming

Piezoresistor and Piezoelectric





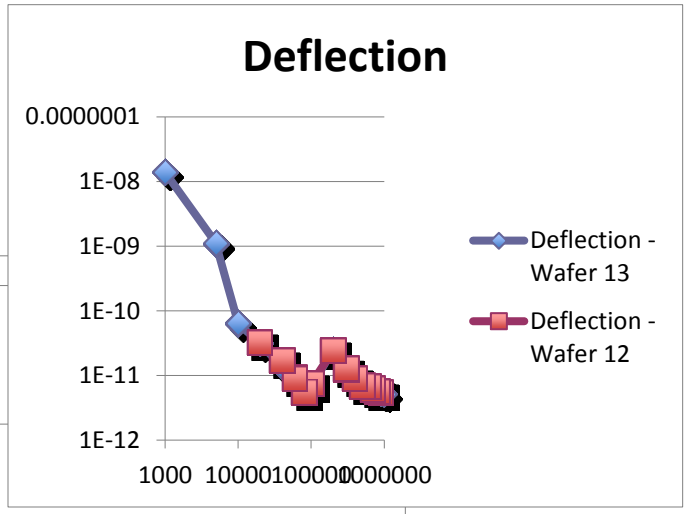
Post-processing: FGA and parylene

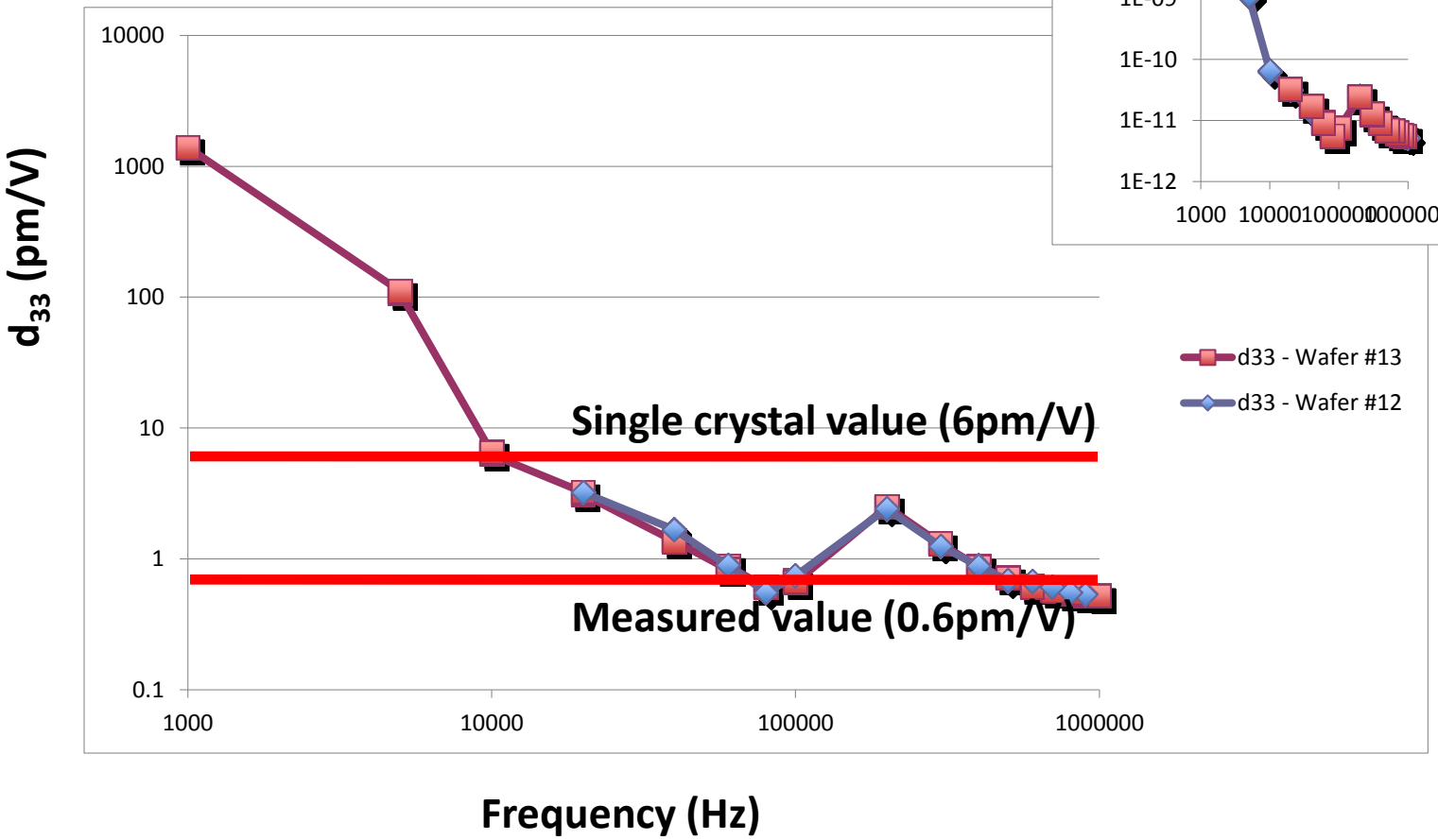
Status So Far

- Aluminum nitride films deposited by vendor
  - Characterization with XRD, AFM, LDV
- Have been testing epitaxy, diffusion. Diffusion working well and forming very shallow juctions. Epi quality has been suboptimal
- Currently fabricating SSP primes to test noise, frontside processing

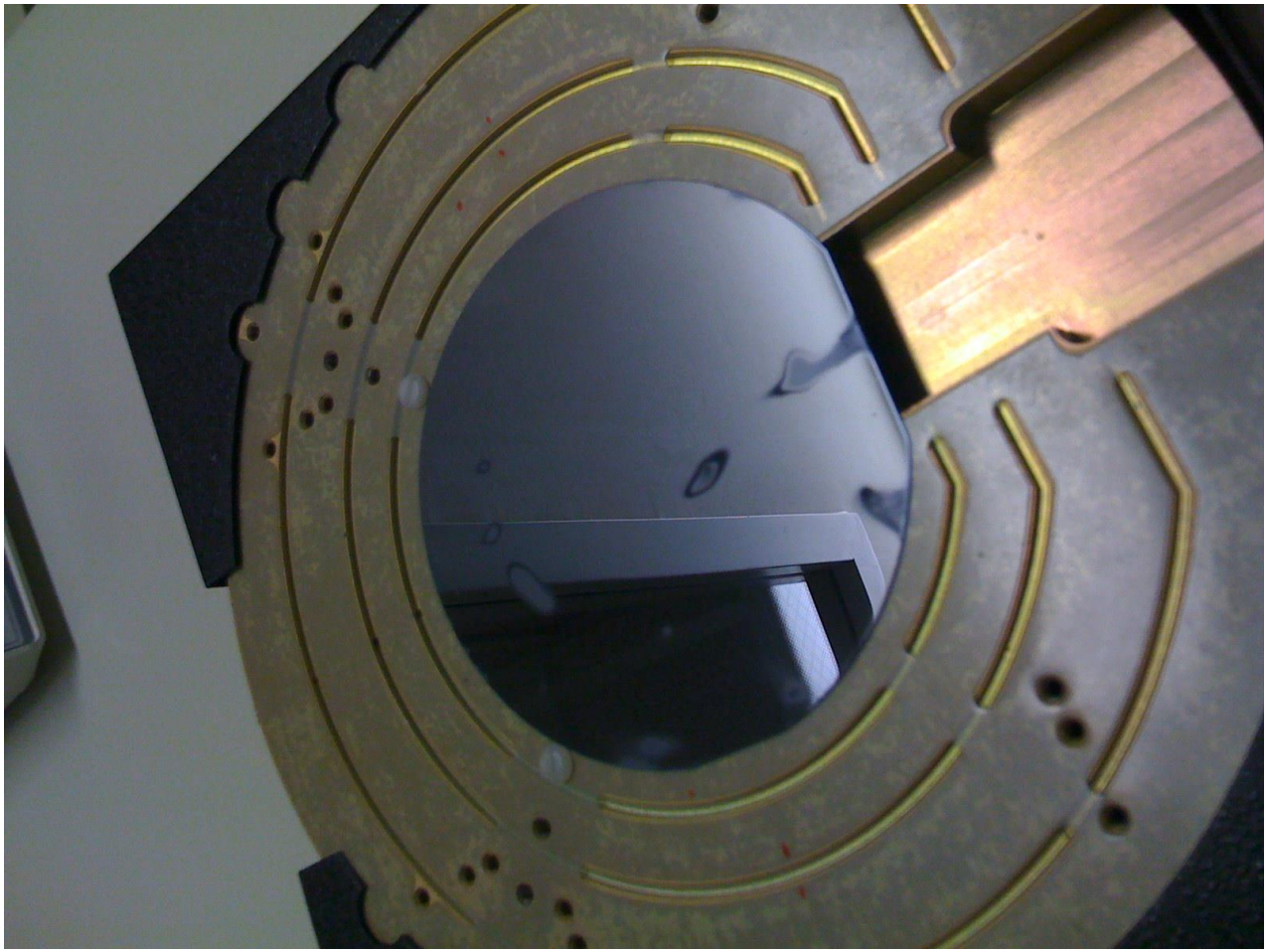
Measuring d_{33}

- 6” wafer, voltage applied across film
- Deflection measured with LDV
- Aluminum nitride natural frequency in 3 GHz range

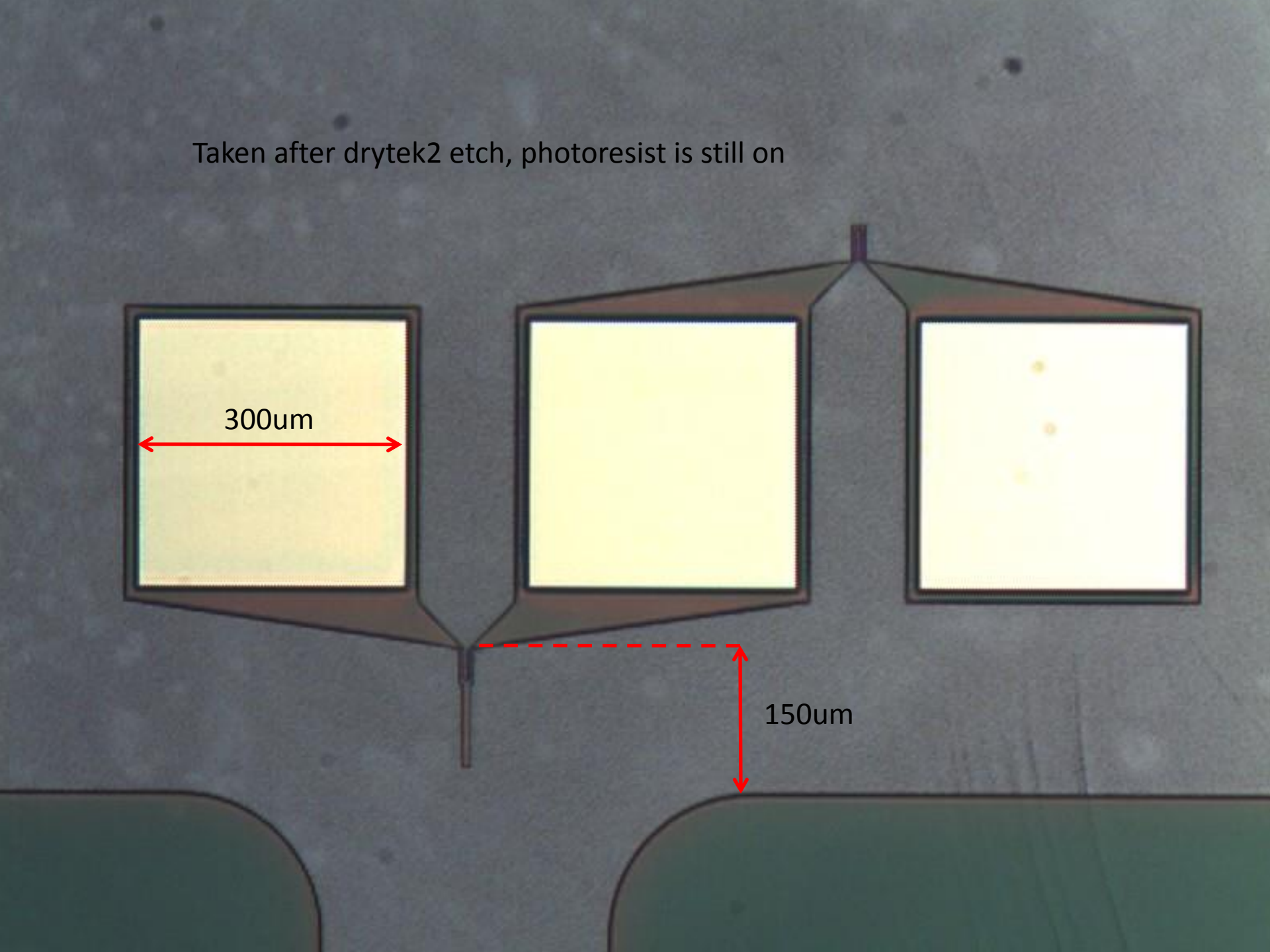


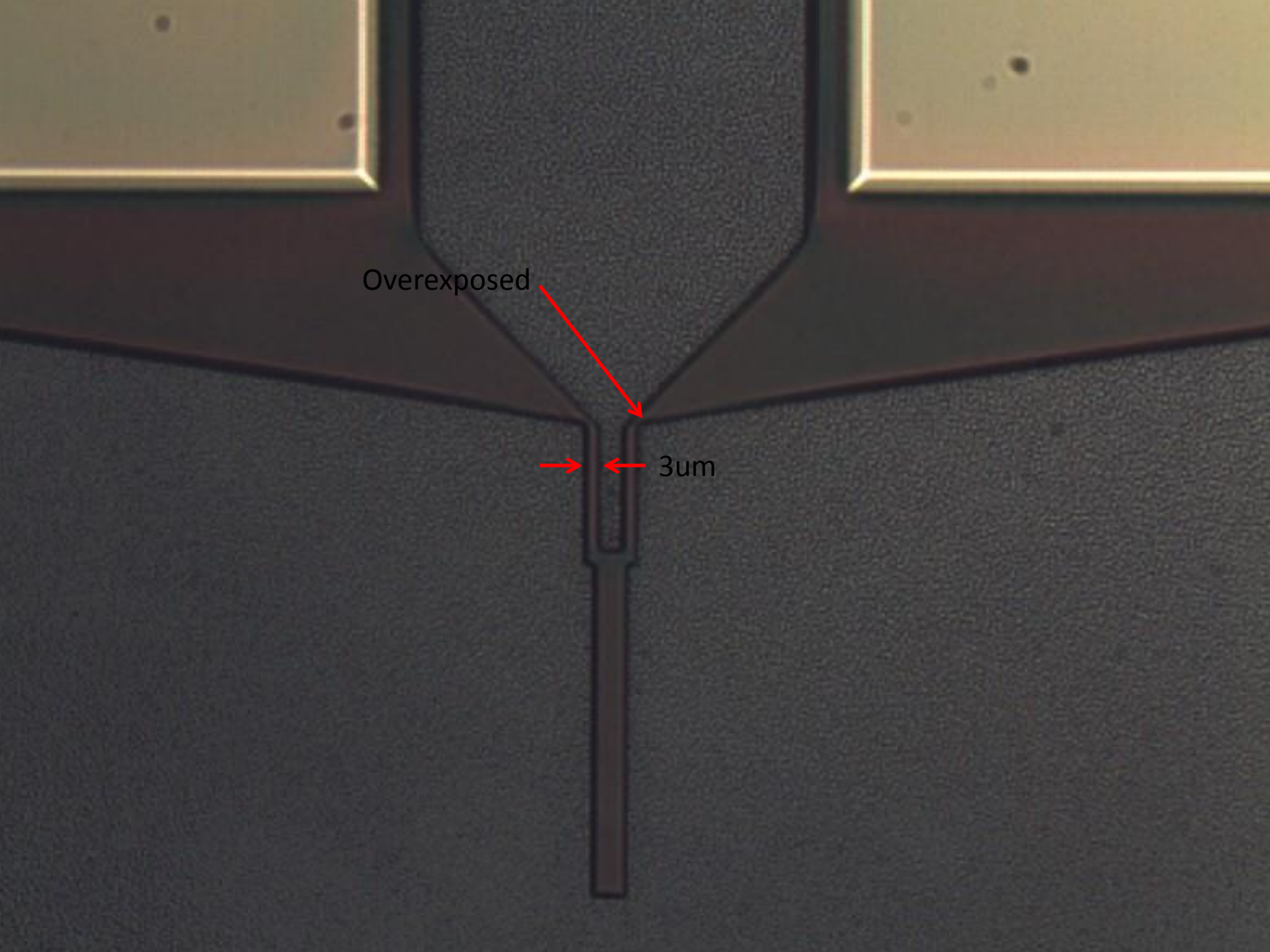


Epi Quality



Taken after drytek2 etch, photoresist is still on




Overexposed
3um

Next Time

- Zurich Data analyzed (MMB deadline!)
- Data from released piezoresistive, piezoelectric cantilevers