



WILLIAM & MARY  
CHARTERED 1693

# Tooth strip to board step measurements

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# outline

- Production procedures update
- Status to step measurements
- Production status and schedule projection



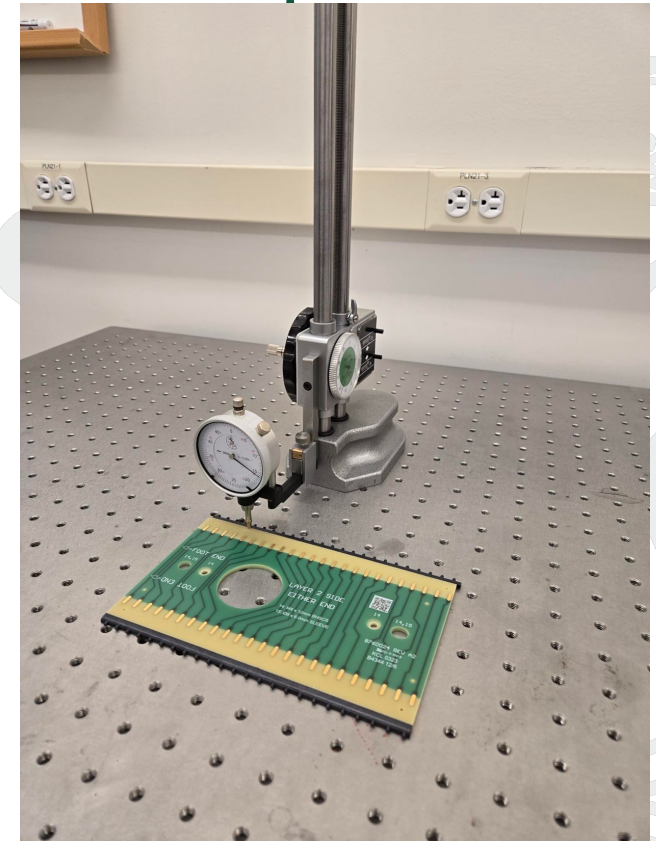
# Procedures update

- The US (W&M) group had been using a version of the UK's geometry board assembly procedures based on last summer
  - We make a version of that procedure updated for local conditions
    - Different tooth strip trimming – we do ours on a fixture on a CNC mill
    - Different epoxy application method
    - All other aspects meant to be the same
- They have made a number of updates in the UK over the last year
  - We knew of some but not others of these
    - Cleaning was done the same, for example
    - Measurements of step between board and strip was developed in parallel
    - Using a Dremel brush to remove excess epoxy was new to us
- Had a couple of productive sessions reviewing the UK procedures in detail
  - Led by Brian and Justin with QA office participating
  - When we get the revised UK procedure note will insert the US specific areas
  - Then we will again be working on a common procedure



# Step between board and tooth strip

- Specification of +/- 200 um (0.2mm) between top surface of the board and the top of the tooth strip
- Two measurement techniques
  - A machinist's dial indicator – for production (right)
    - Currently <https://www.mcmaster.com/20715A81/> with a 4mm tip
    - Moving to the UK's tip indicator with 1mm tip <https://www.zoro.co.uk/shop/measuring-and-test-equipment/dial-test-indicators-lever-type/dial-test-indicator-513-424-10t/p/ZT1025781P>
    - Moving from a lab bench to an optical table for production measurements
  - A precision profilometer – for testing precision of method
    - <https://www.bruker.com/en/products-and-solutions/test-and-measurement/stylus-profilometers/dektakxt.html>
    - 10s of nm precision, available for (shared) use in W&M's core labs
    - Cross calibration in progress

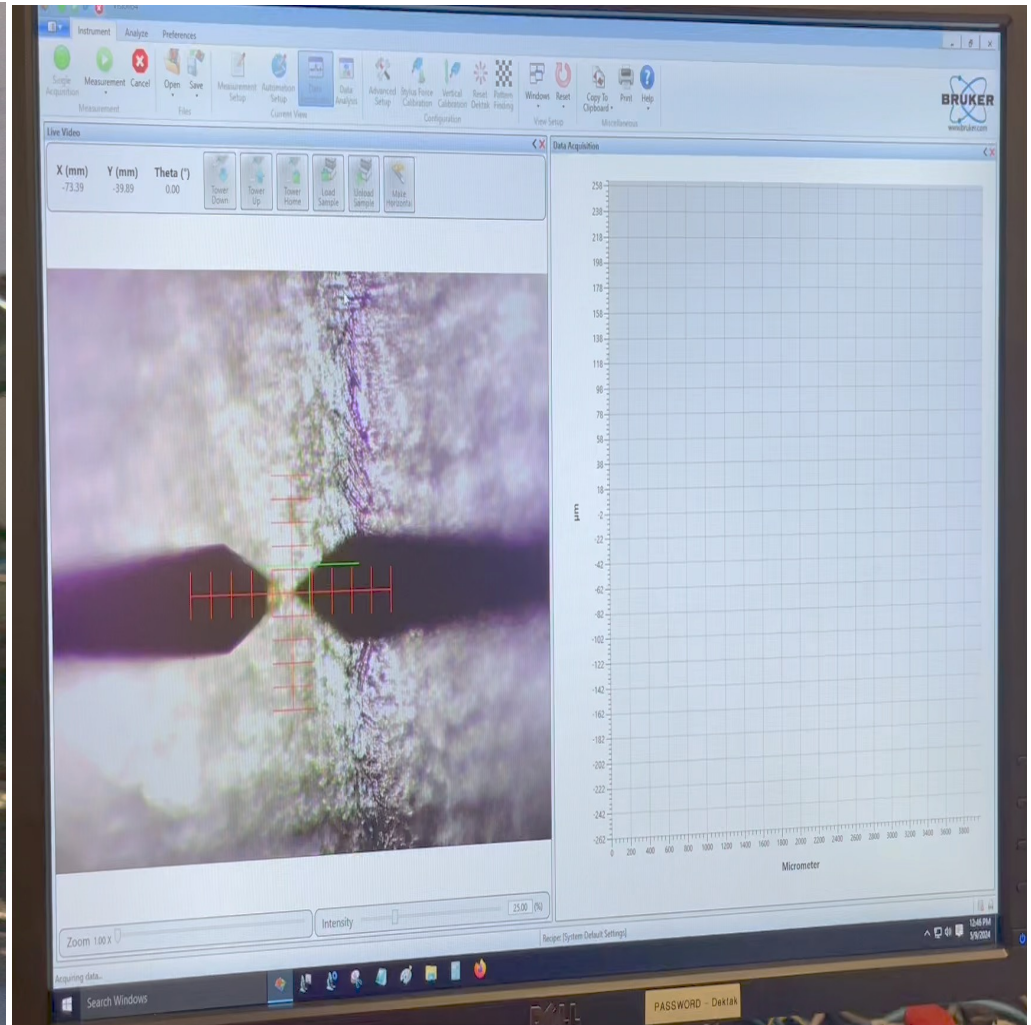


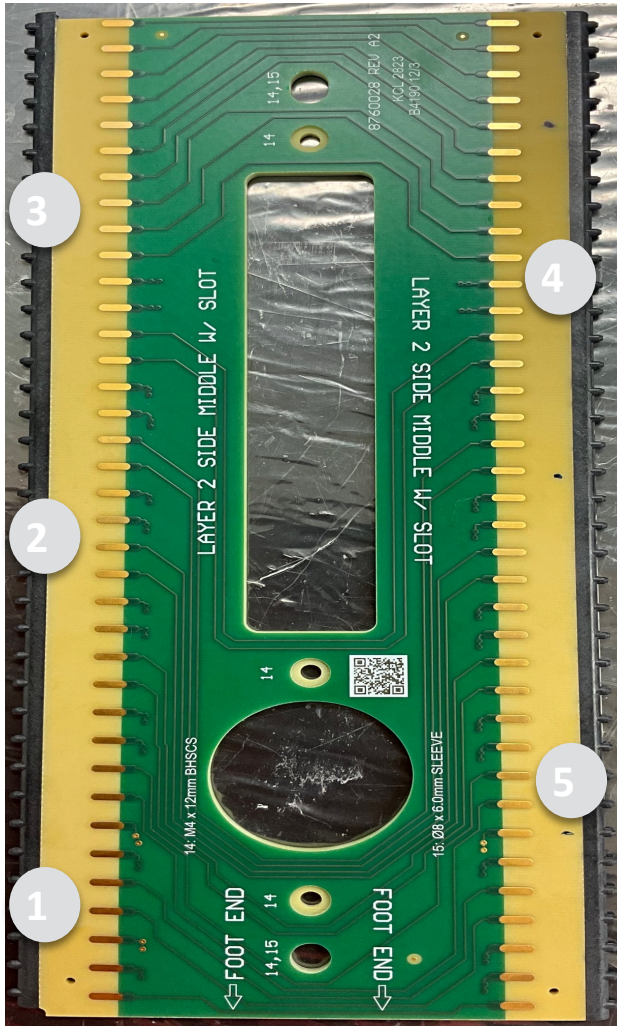
# Preliminary tests of 6 boards

- Dial indicator in a work bench
- All 36 measurements were within the 200um
- All but one point with the strip above the board



# Profilometer in action





## Assembled board foot step

8760040	Board is higher (microns)
1	112
2	129
3	117
4	47
5	104



## Assembled board foot step

8760038	Board is higher (microns)
1	82
2	103
3	83
4	32
5	83
6	130
7	55
8	60

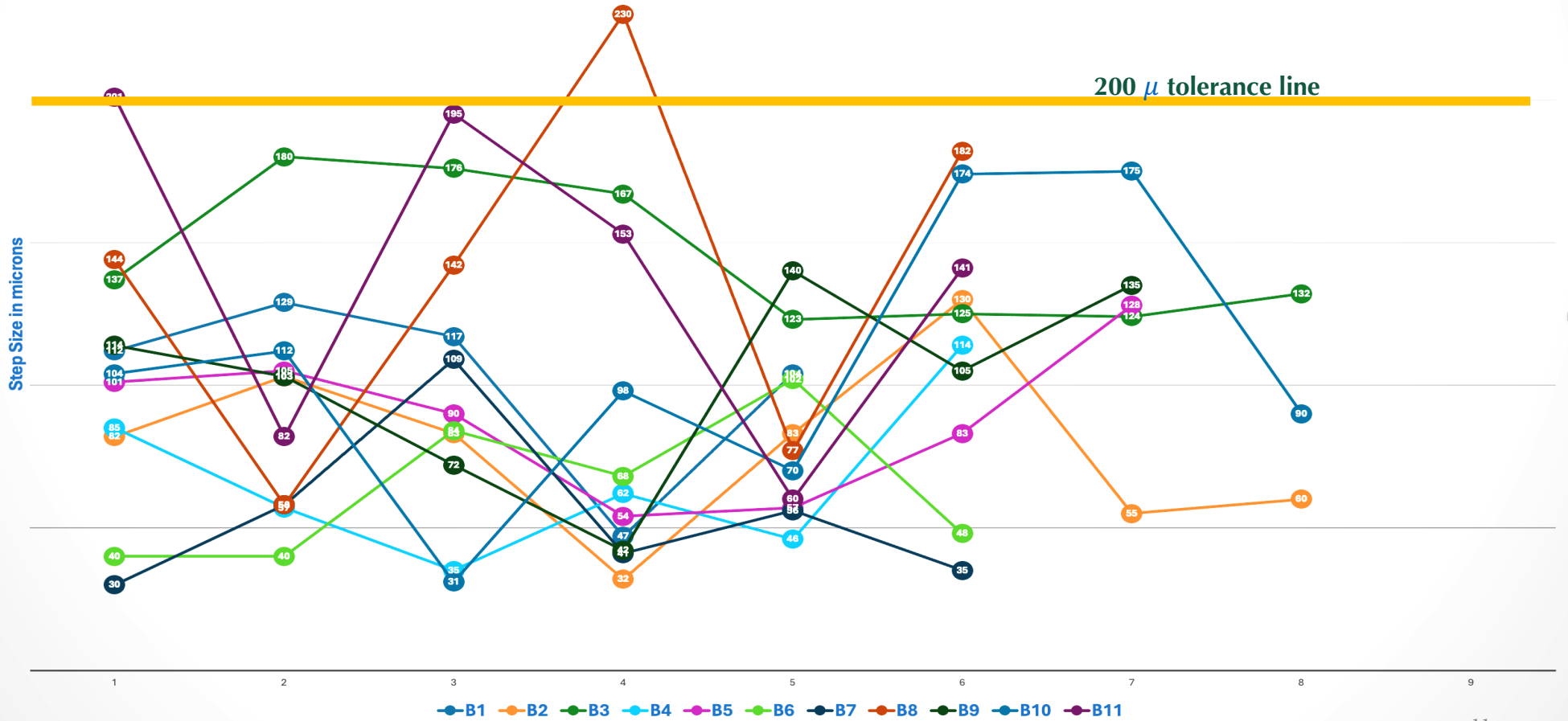






# Profilometer data

## Step size for different boards in microns



All are "board taller than strip" in this sample

# Observations

- We see larger variations in step away from the center of the board
  - UK's plan for adding 4 extra clamps near the corners is a good idea
  - When the updated drawings are ready, we will update the fixtures accordingly

## Precision?

- Initial cross check (1 board, 6 points) shows 20-30um RMS on the comparison of the two devices
- More correlated data on the way
  - This will be w/ new dial indicator + smaller ball + optical table
  - Will work through the current inventory to test and develop statistics
- Note time-motion test on these measurement add about 25% to the effort to produce a board

- Notes on status

# Status

- On a work stop
  - Pending plans, review, and (possible) site visit to W&M to address issues seen in delivered boards
- Recent issues
  - Main - older boards (before ~ Sept 2023) have adhesions problems at least in part due epoxy loading near the ends of the ends of the strips
    - Do not plan to use these boards unless there is an approved remediation method; not pursuing at this point
  - Epoxy on tooth strips and surface of some recent boards
    - New UK proc with Dremel tool will fix the issues on the strips
- Actions
  - Adding new QC checks at the end of production accordingly
  - Sent video of our assembly process for comment from the UK
  - Got useful feedback
  - After we have added the W&M-specific steps in the proc's to reshoot for feedback

- After reauthorization to start production, we could produce an APA's work each two weeks
  - Worked with Brian on a set of deliverable documentation
  - It is important to get the reject boards (their IDs too) from UC to track their status and make sure we understand the origin on these issues
  - Plan needs approval
  - Hope for this in early June



# Production status/schedule

- Have delivered acceptable boards for
  - APA 1 all layers
  - APA 2 x, v layers
- Currently we only have received U long side boards for 2.7 APAs
  - Some of those were in the bad-board era
  - Last delivery in January
  - Do not have enough currently to complete APA 2 u layer
  - These boards are the critical path – other board types assembled do not advance our completion date

- Backup slides









## Assembled board foot step

8760057	Board is higher (microns)
1	144
2	58
3	142
4	230
5	77
6	182





## Assembled board foot step

8760057	Board is higher (microns)
1	104
2	112
3	31
4	98
5	70
6	174
7	175
8	90





## Assembled board foot step

8760040	Board is higher (microns)
1	201
2	82
3	195
4	153
5	60
6	141