

# Wrap Board Steps After Jig Modification

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for the DUNE APA PCB Team

DUNE APA Consortium Meeting on 11th November 2024.

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University of  
Sheffield



# Head & Wrap Boards on an APA



# Head & Wrap Board Processing Labs

- University of **Cambridge (UK)**:
  - For Mill-Max pin insertion and QC on all **V, U and G layer head boards** for all UK and US APAs.
- University of **Sussex (UK)**:
  - For Mill-Max pin insertion and QC on all **X layer head boards** for all UK and US APAs.
- University of **Lancaster (UK)**:
  - For assembly and QC of all **U and G layer wrap boards** for **UK APAs**.
- University of **Sheffield (UK)**:
  - For assembly and QC of all **X and V layer wrap boards** for **UK APAs**.
- **William and Mary (US)**:
  - For assembly and QC of all **X, V, U & G layer wrap boards** for **US APAs**.

HEAD BOARDS

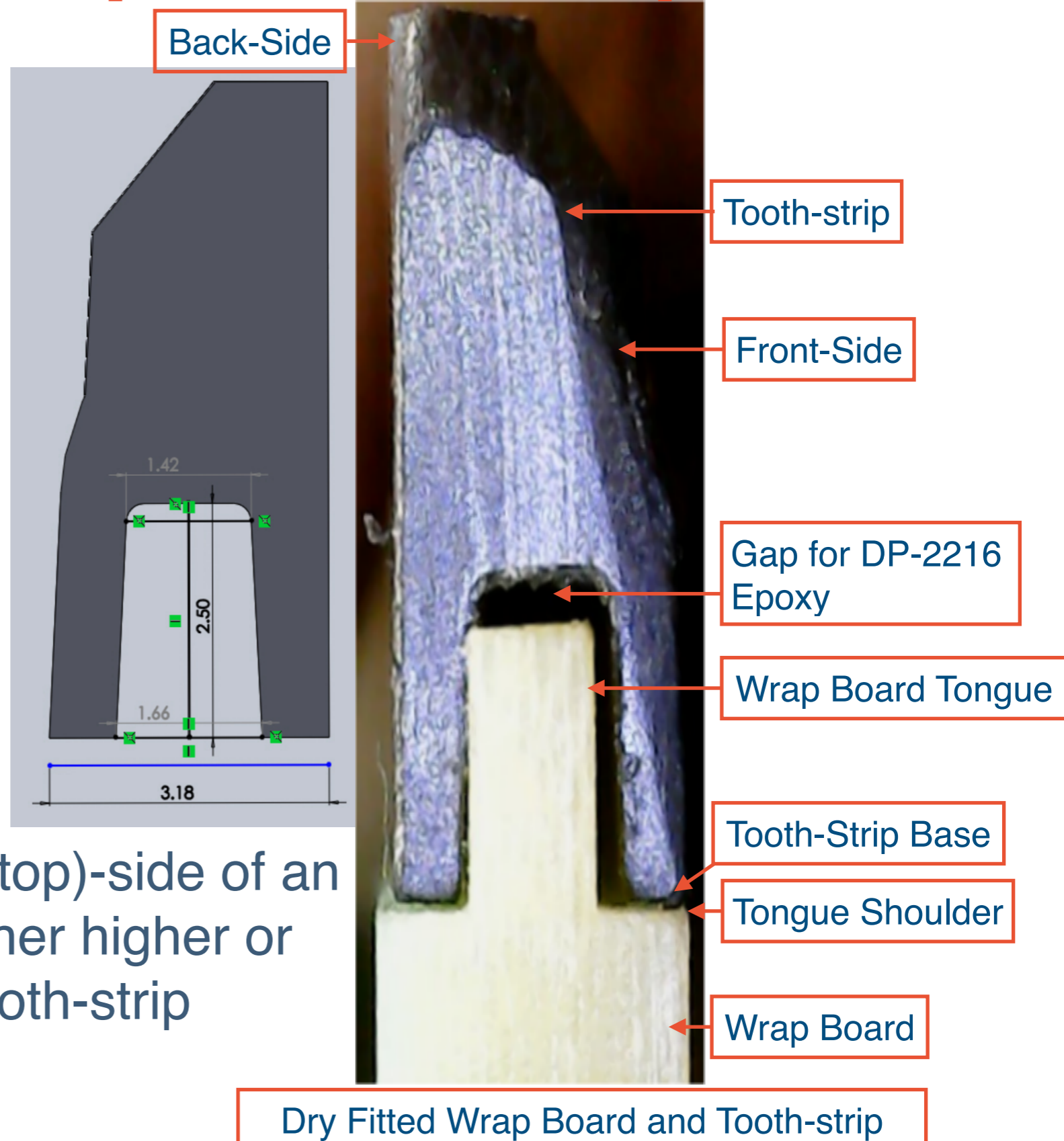
WRAP BOARDS

# Wrap Board Step Issue

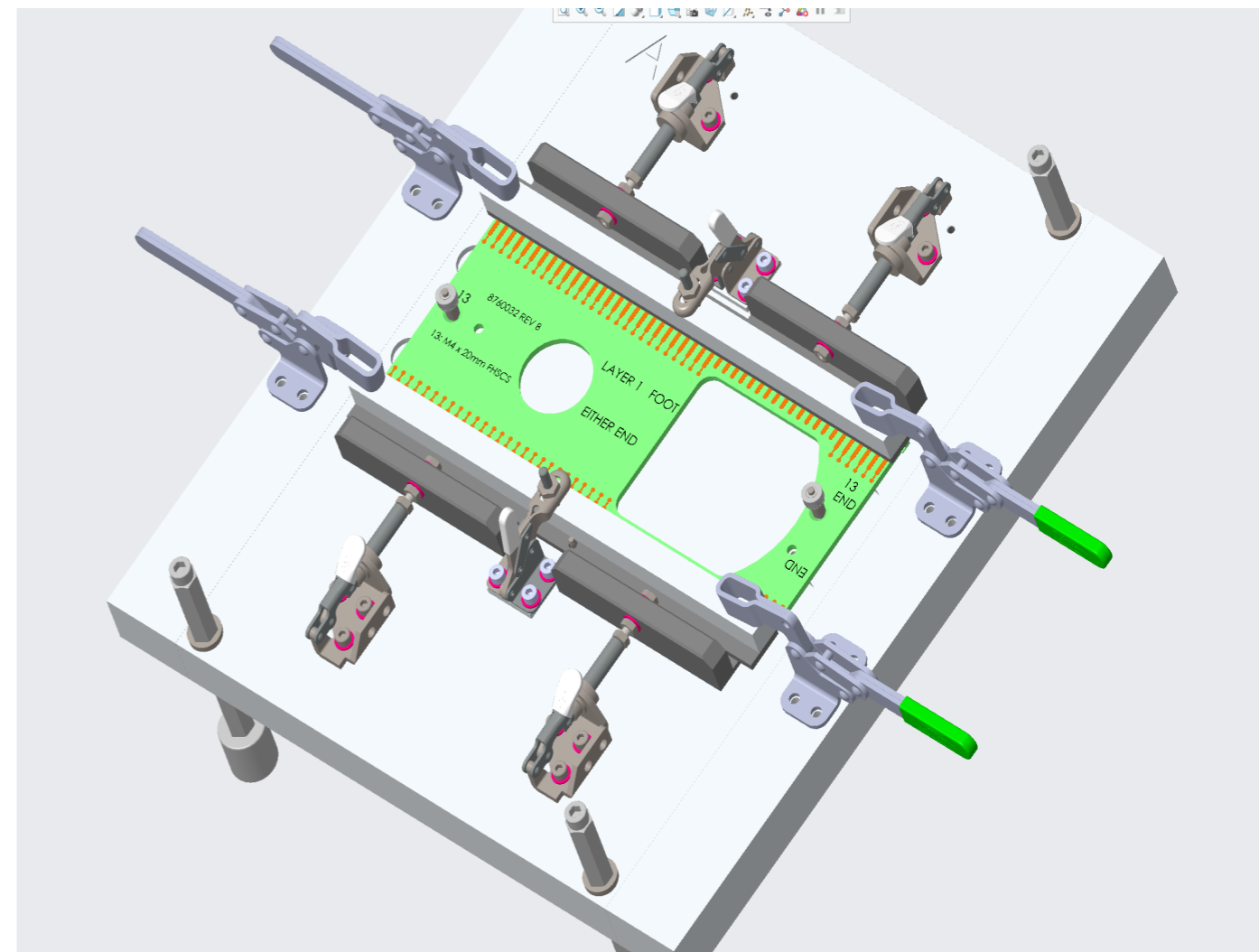
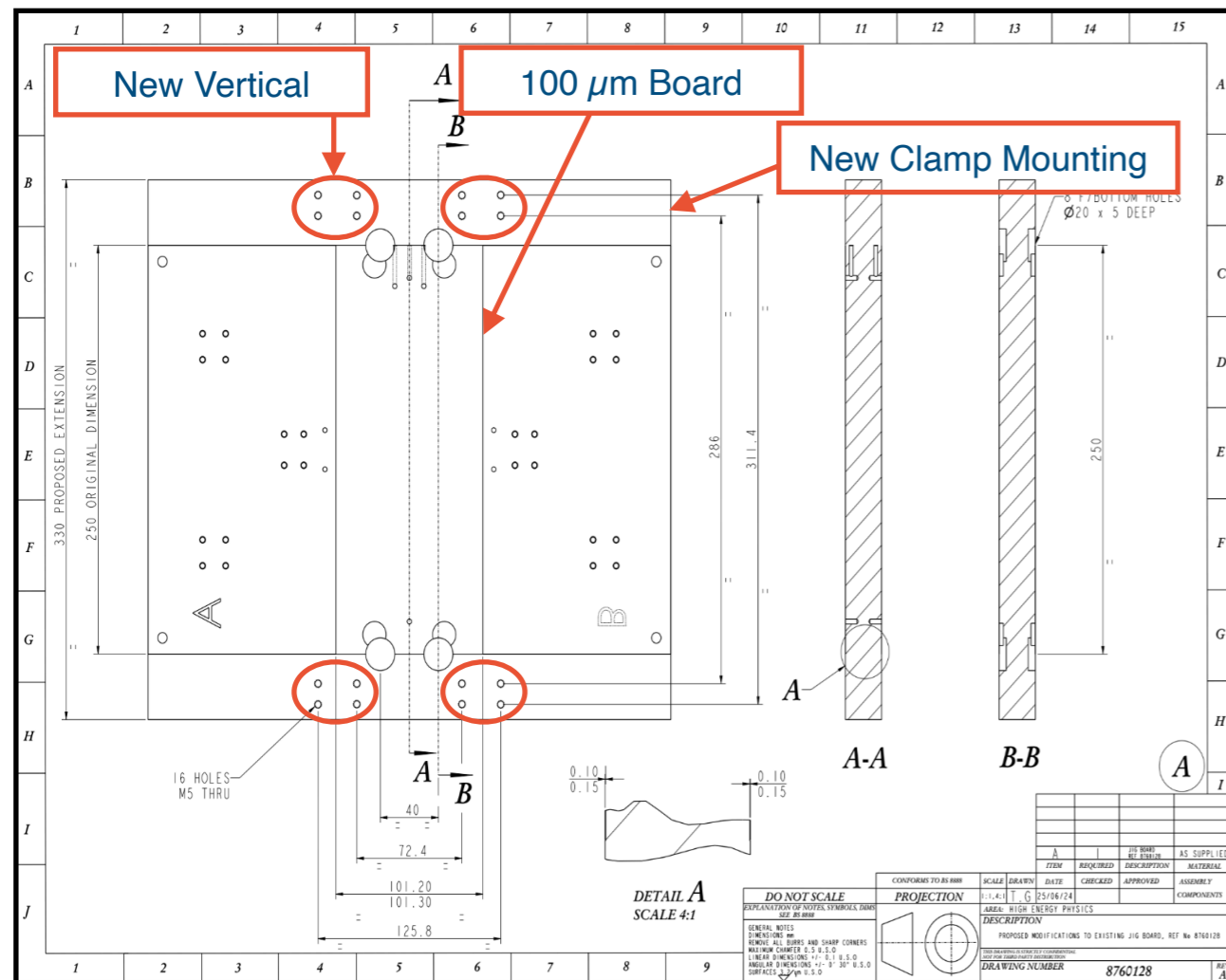
- PCB QC tolerances were discussed in the 18th December 2023 DUNE APA Technical Board Meeting.
- In that meeting, a Daresbury Engineer reported that the cause of a few broken wires on APAs at Daresbury were not understood.
- This raised a concern on whether  $>200 \mu\text{m}$  assembled **wrap board steps** could cause kinks on wires which leads to wire breakages.
- **Wrap board steps** are mismatch between assembled wrap board shoulder and glued tooth-strip base (see the next slide for an illustration).

# Assembled Wrap Board Step Issue

- The APA technical board reduced the tolerance on the top-side wrap board step in April 2024 from the initial design  $\pm 285 \mu\text{m}$  to  $\pm 200 \mu\text{m}$ .
- This change was a precautionary measure to minimise the risk of step induced kinks on tensioned APA wires.
- **Step** occurs when the front/(top)-side of an assembled wrap board is either higher or lower than the base of the tooth-strip width.



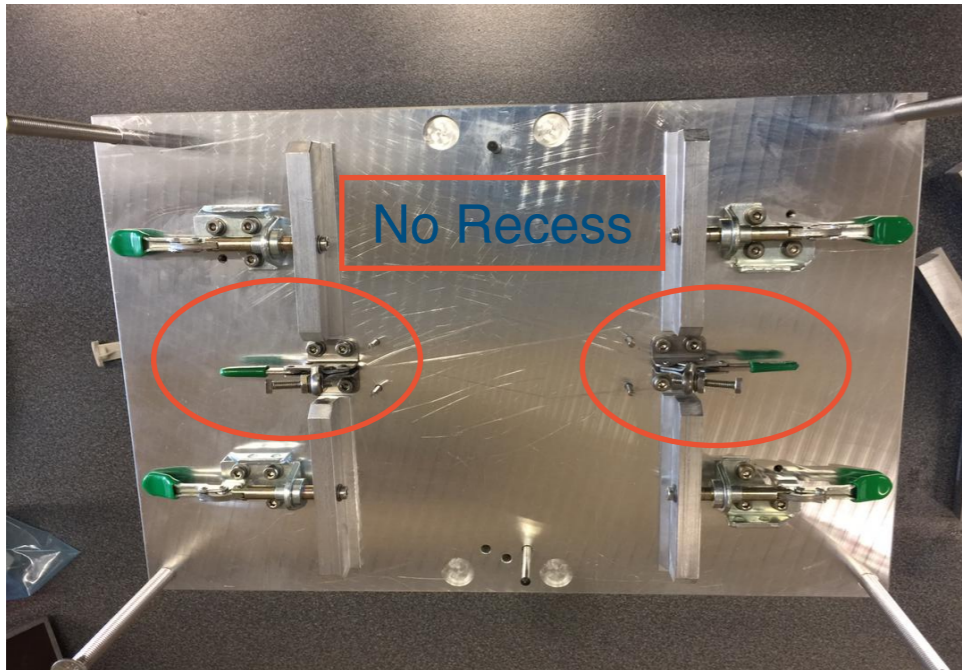
# Wrap Board Jig Modifications



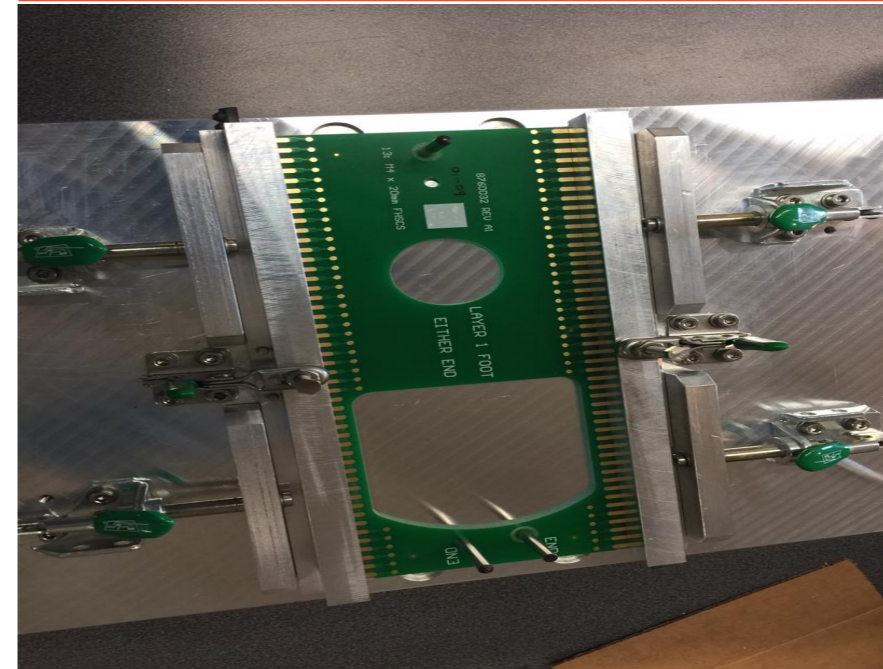
- Boards are usually higher than the tooth-strips.
- So the 100 μm recess on the jig transfers most of the board excess to the bottom side of a given wrap board.
- 4 new vertical clamps ensures a more uniform load distribution along the tooth-strip during the board curing process.

# Wrap Board Jig Modifications

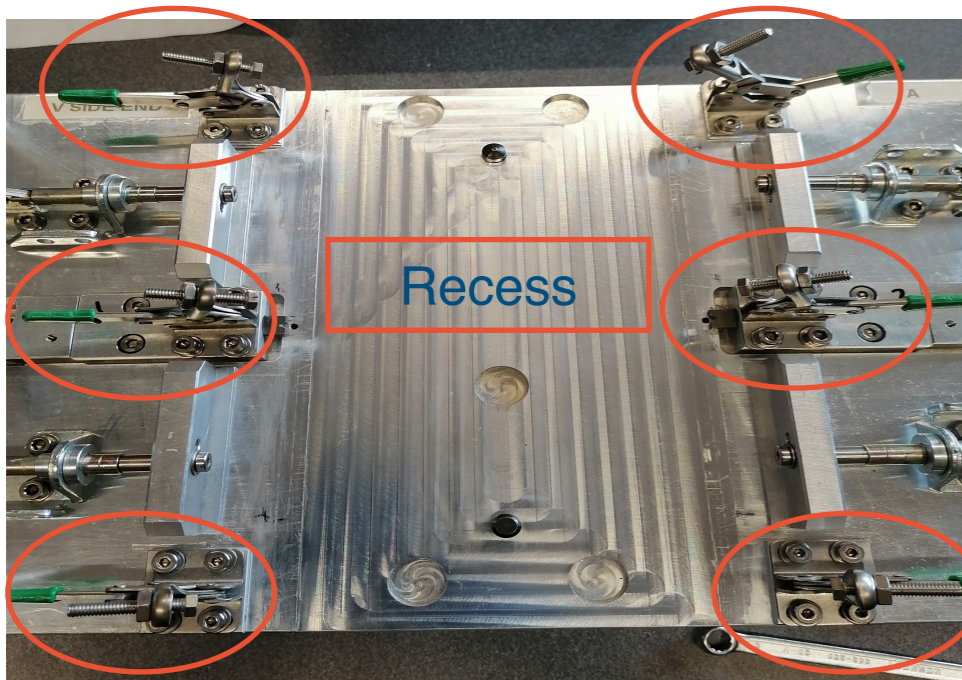
Old Bare Wrap Board Assembly Jig



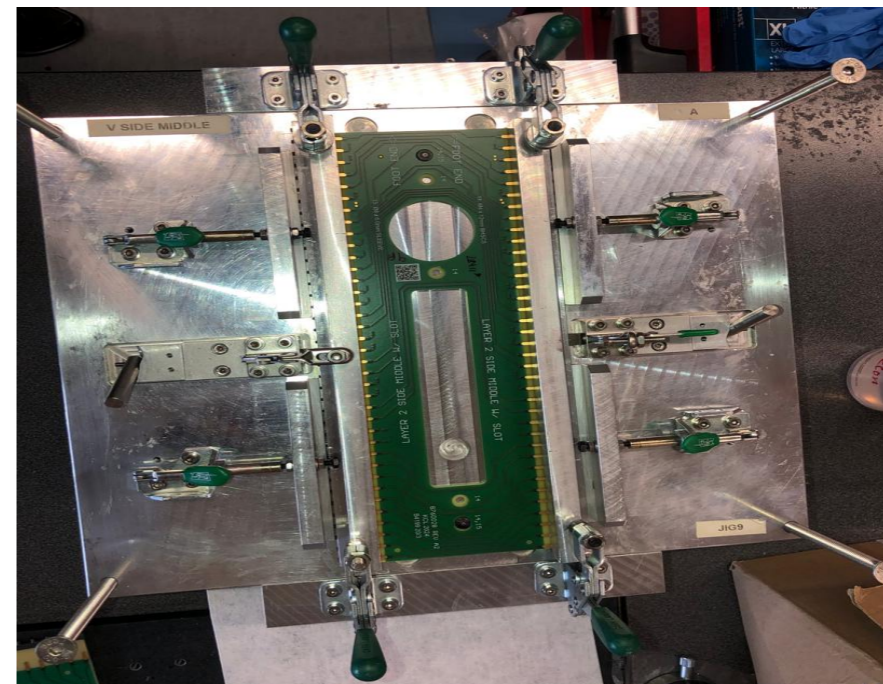
Old Wrap Board Jig With Board



OLD JIG



Modified Bare Wrap Board Assembly Jig with a board recess & 4 new clamps



Board on Modified Wrap Board Assembly Jig with recess

NEW JIG

# Steps on Wrap Boards Before Jig Modifications

- All assembled wrap boards that were assembled on old jigs but were not installed on any APA before the change to the new wrap board step tolerance have now been tested.
  - A total of 5,617 old wrap boards were tested and 4,645 (~82%) passed the new step requirement.
  - This includes all wrap board steps measured at Daresbury, Lancaster and Sheffield.
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- We have now assembled a total of 1,414 wrap boards on newly modified Lancaster and Sheffield wrap board jigs.
  - Results show that each of these new 1,414 wrap boards assembled on modified jigs pass the required new  $\pm 200 \mu\text{m}$  step tolerance.
  - This confirms that the modified jigs are working well.
  - Hence, we propose to stop further wrap board step measurements since the modified jigs has shown that they can hold the steps in tolerance.

OLD  
JIGS

NEW  
JIGS



# What Next?

- If there are no strong objections in this meeting, we will proceed and write a Procedure Change Request (PCR) for removal of the step measurement section from the current wrap board assembly procedure.
- We will then remove step measurements from the wrap board assembly procedure as soon as the PCR is approved.

# Thanks for listening!

