Preliminary Tooling Ideas

SCIPP

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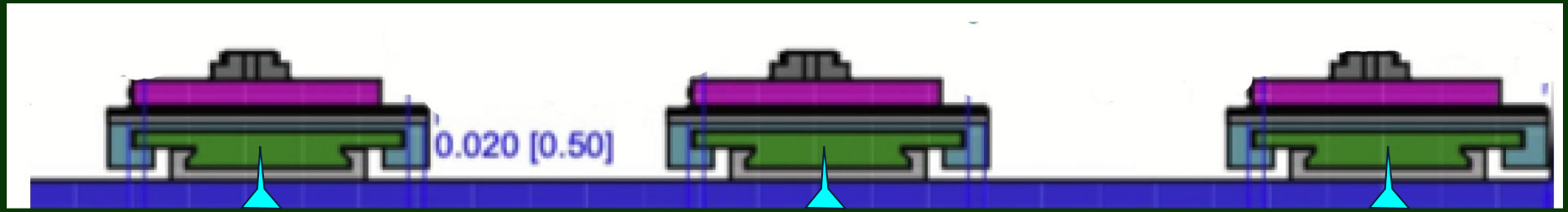
Constraints

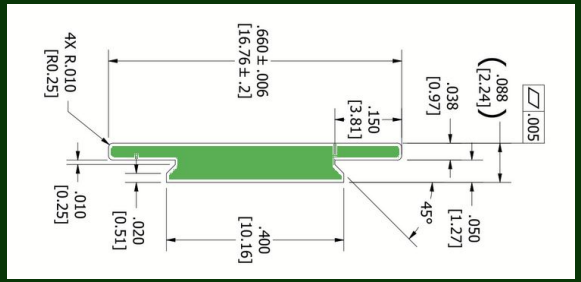
Each module assembly site will build ~10,000 modules in ~2.5 years.

Production Rate	24 modules per day assembled, wirebonded, and tested.
Working Space	Araldite 2011 has a long cure time and 2 separate gluing operations are done, one for the chips and one for the hybrid.
Storage Space	At any given time, we should expect to have at least 200 modules in process.

Storage Trays

Order many extra lengths of the Stave Array extrusion*, which can be cut down to 180mm lengths and screwed into ⅛” thk aluminum plates to create carrier/testing trays that will hold at several modules. Our cabinets easily fit 10 x 20” wide trays, which would hold 16 modules each. A storage box with slotted sides can be used to hold stacks of trays.





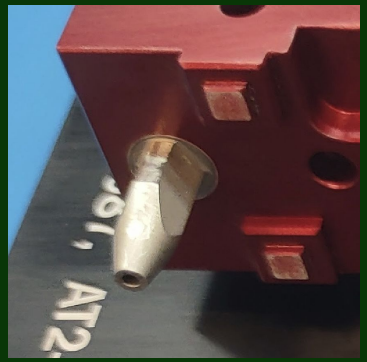
*(and either the Tray Slide extrusion or some 1mm thk aluminum strips to make up the height)

Special Materials

Metapor Aluminum

Metapor aluminum is porous to let air and moisture escape, which prevents bubbles and blemishes. These sheets must be milled to expose the pores; average pore diameter is 0.0006” with a total porosity of 15%. Available from McMaster-Carr.

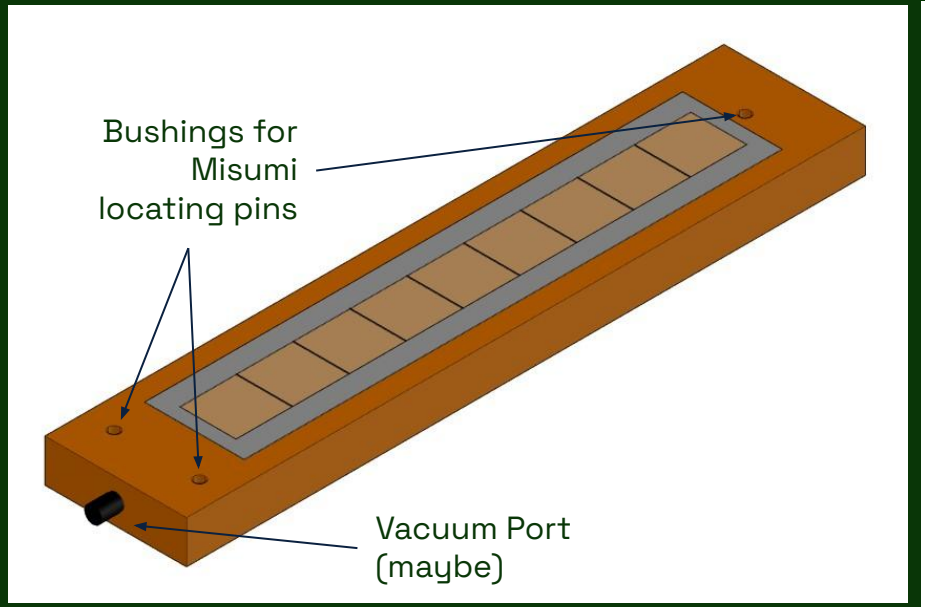
Misumi Pins

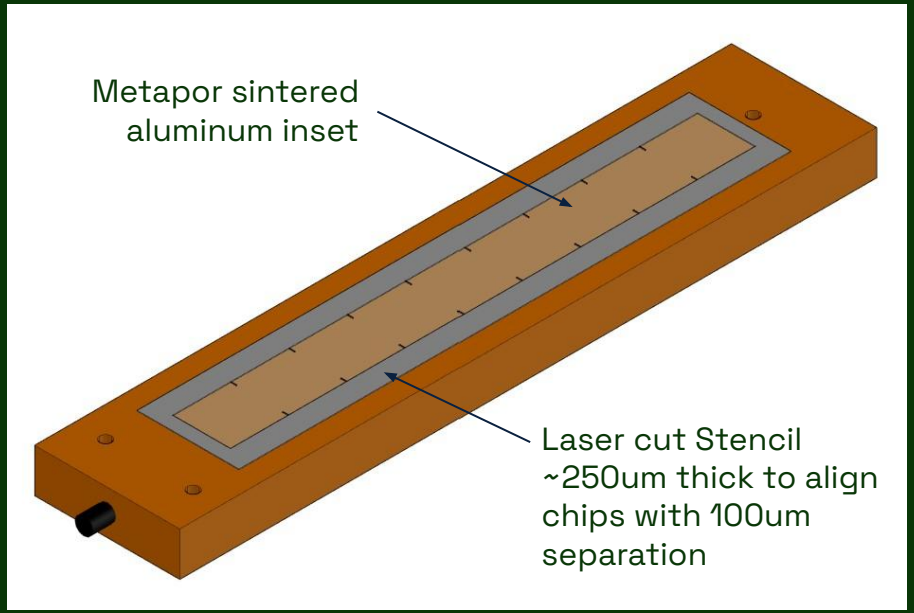


High precision hardened steel or stainless steel locating pins in both round and diamond head configurations, with matching bushings. Mounting features are machined into the shank, with options for press-fit, threaded, or tapped. Website

Chip Alignment Tray

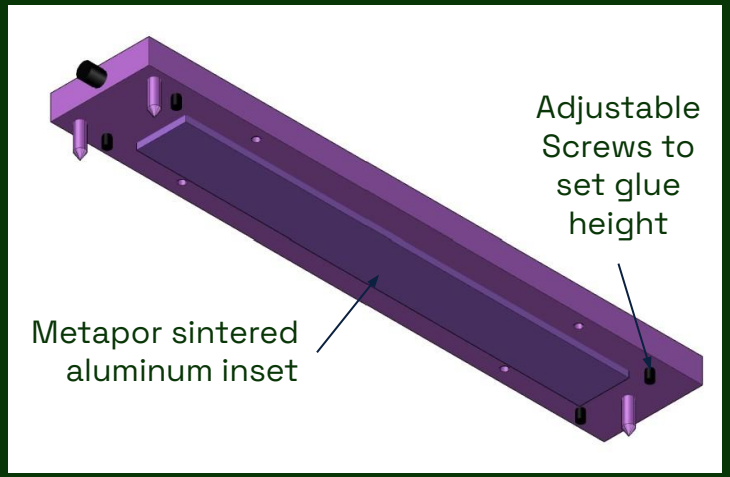
Chips are 20mm x 20mm x 500um thk, with dicing precision of +/10um and nominal spacing of 100um

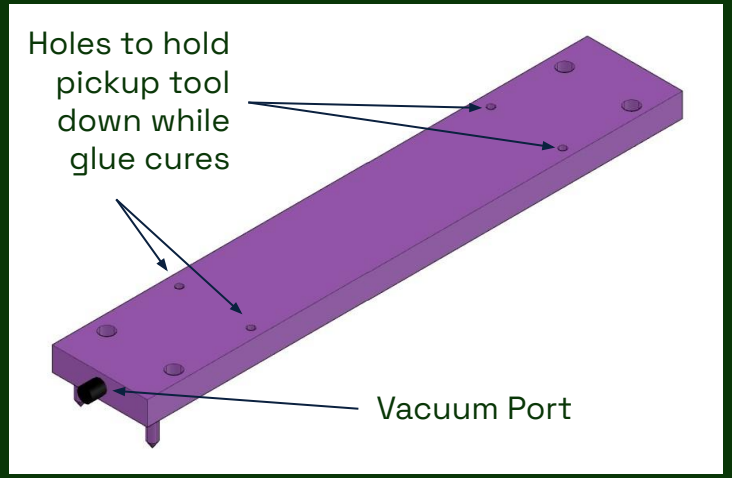


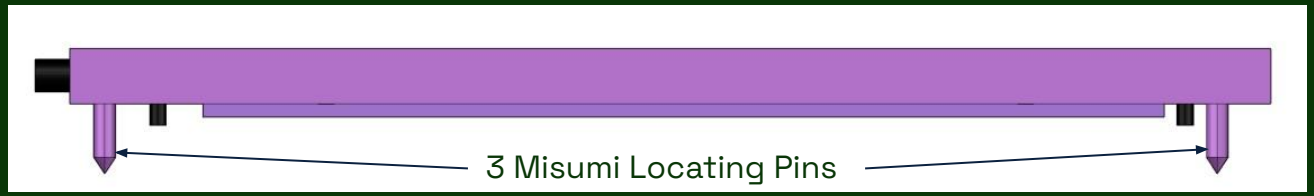


This alignment plate includes a laser cut stencil (~250-300um thk) fixed to the top surface to align chips with 100um separation before picking up *en masse* to place onto the aluminum extrusion.

Chip Pickup Tool



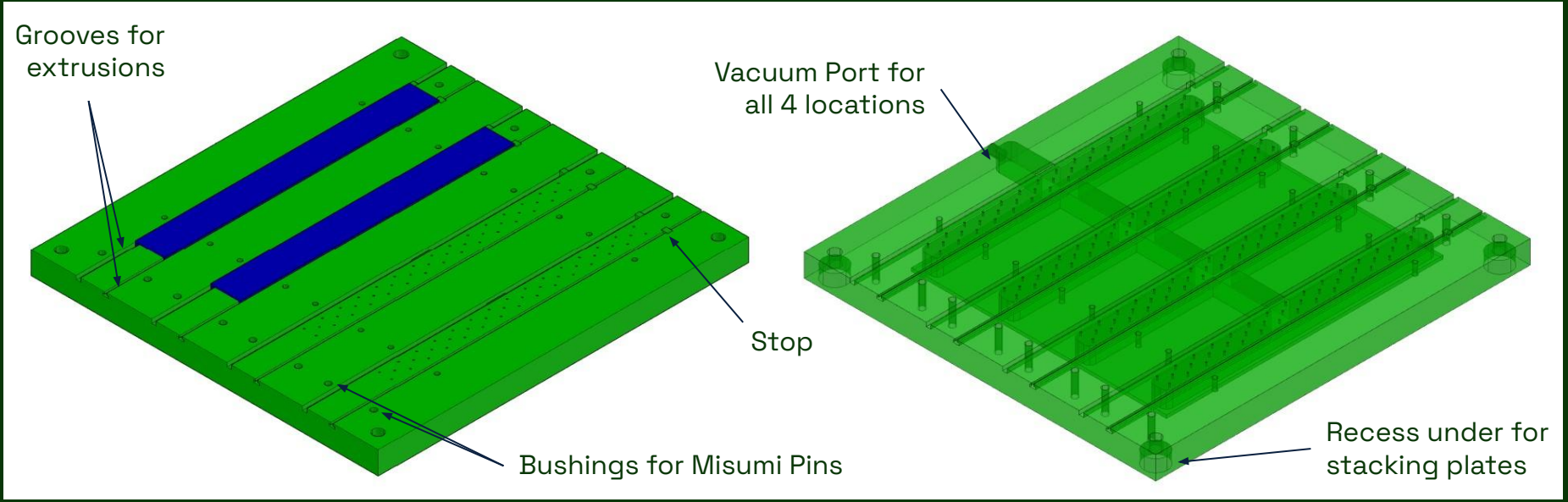




4 adjustable screws at the ends will set the height of the chips above the extrusion. Vacuum port on end of tool will help with routing of hoses and stacking. 4 additional holes (large tolerance!) in the pickup tool will be used to screw it into the gluing jig while the glue cures.

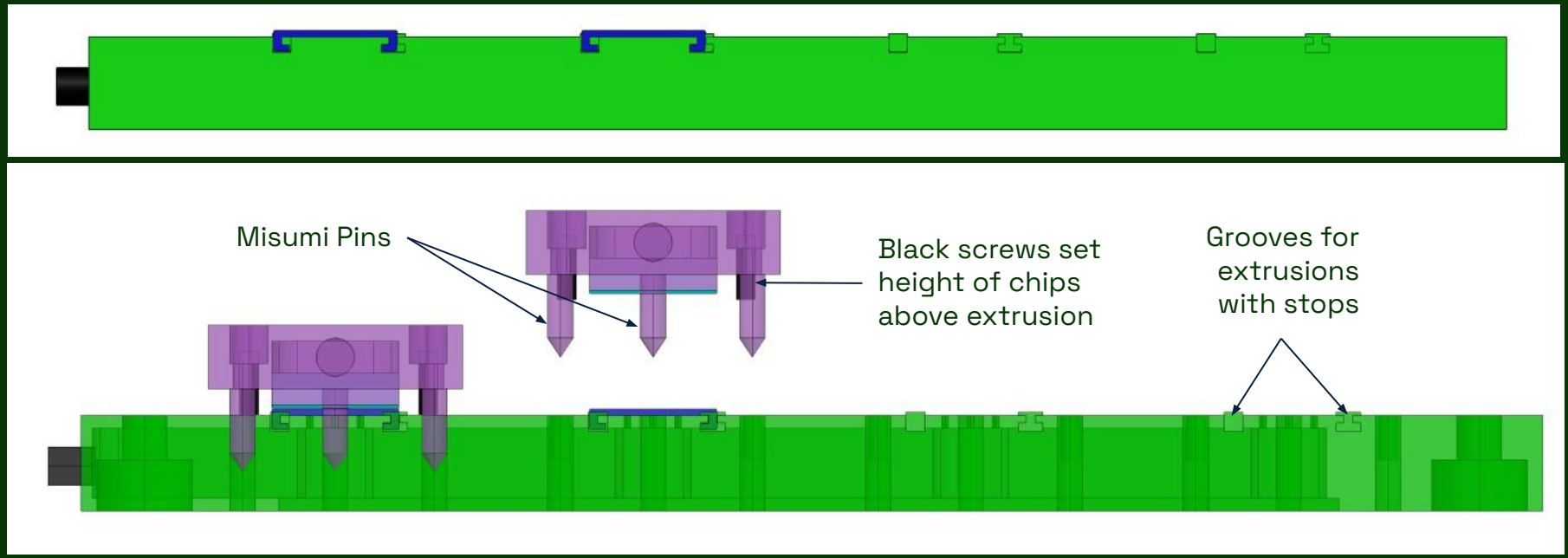
Chip/Hybrid Gluing Plate

First Gluing Step: Attach chips to aluminum extrusion
Second Gluing Step: Attach hybrid to chips



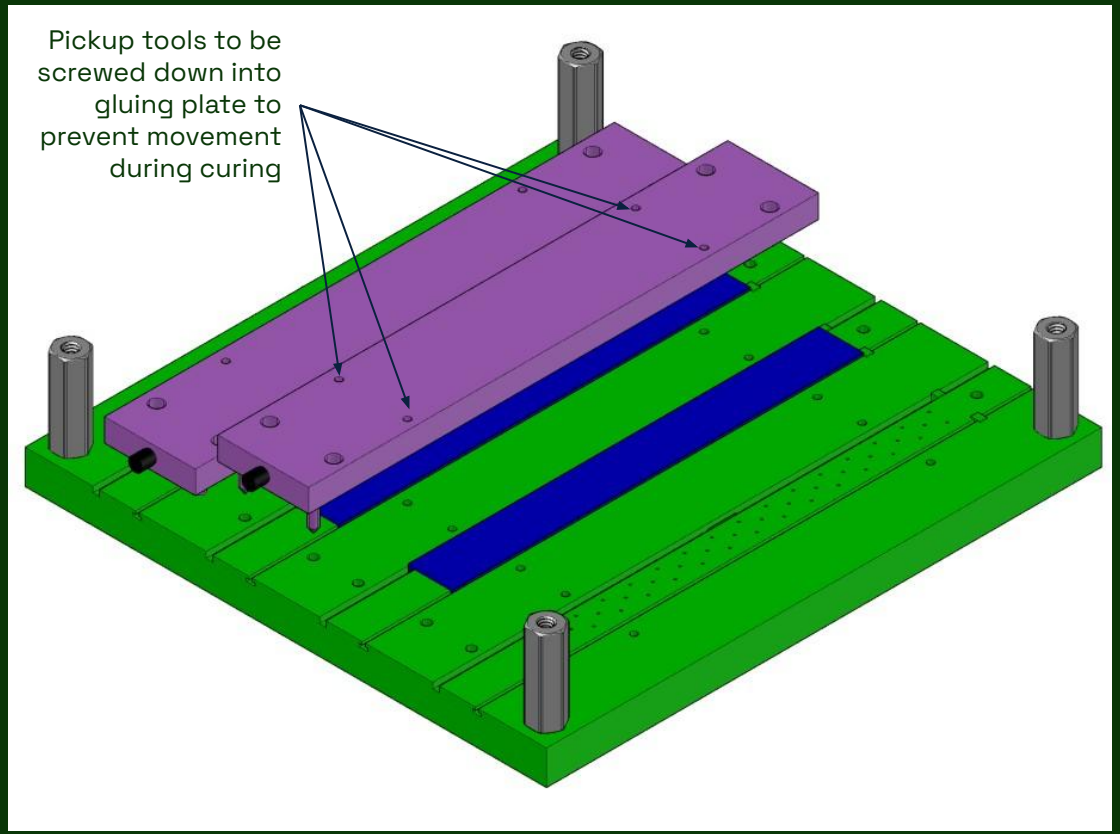
Each gluing plate will hold 4 modules in grooves cut to fit the extrusions. Alignment bushings are located such that plates can be used for both chip gluing and hybrid gluing. Each assembly site will need at least 14 plates (6 per glue step per day plus spares).

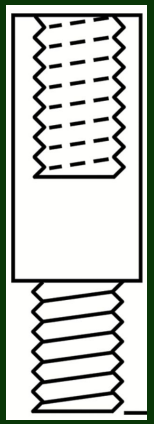
Chip/Hybrid Gluing Plate - side view



Aluminum extrusions are positioned onto plate and the vacuum is engaged. The chips are aligned in the chip tray and picked up. The locating pins on the pickup tool engage with the bushings in the gluing plate. Adjustable screws set the height of the chips above the extrusion. The pickup tools are screwed down into the gluing plate to keep them in place while the glue is curing (otherwise the vacuum hoses could make the tools tilt).

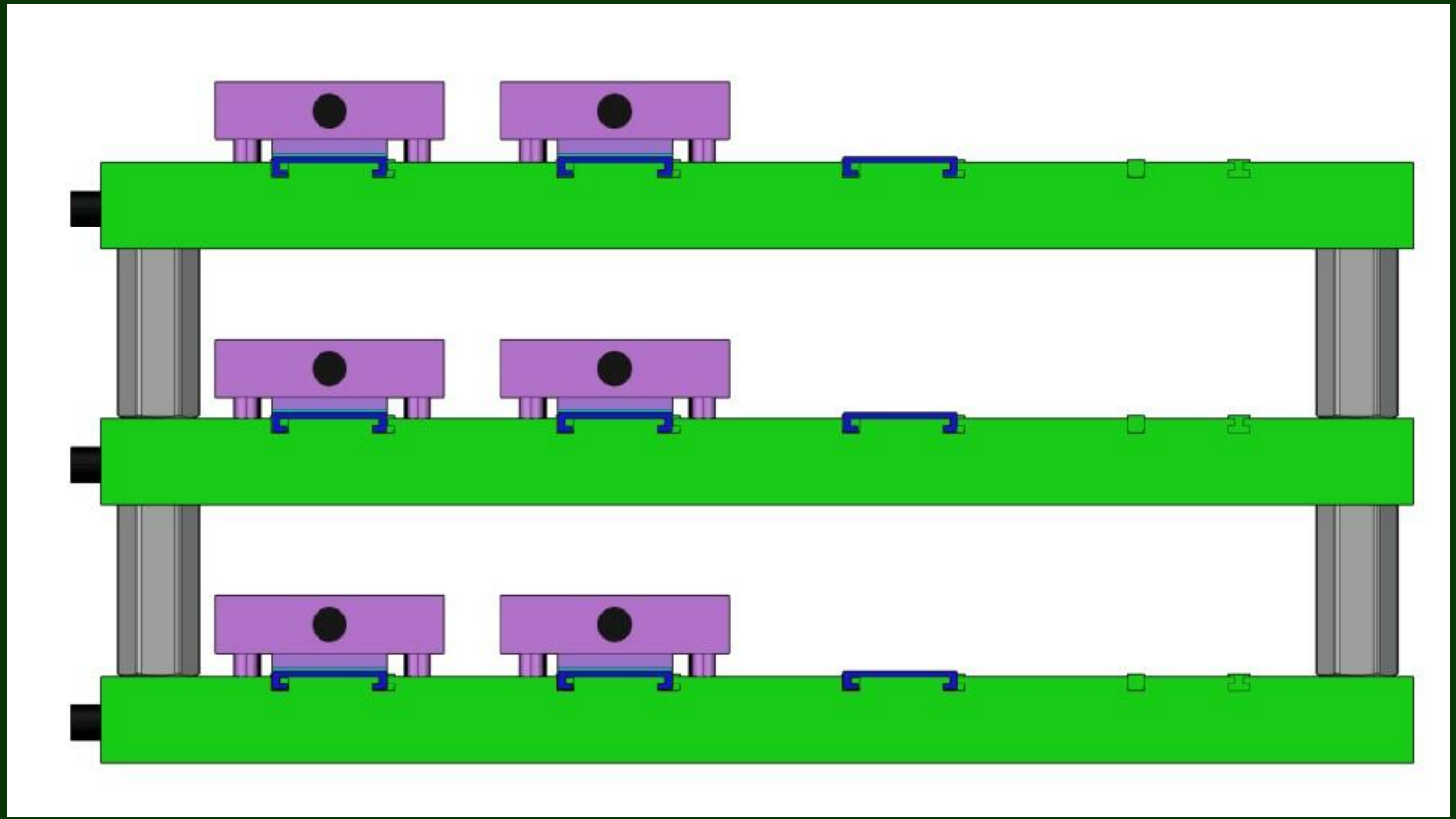
Stacking Chip/Hybrid Gluing Plate





4 large hex standoffs (off-the-shelf) are screwed into the corners of the plate after the pickup tools are secured

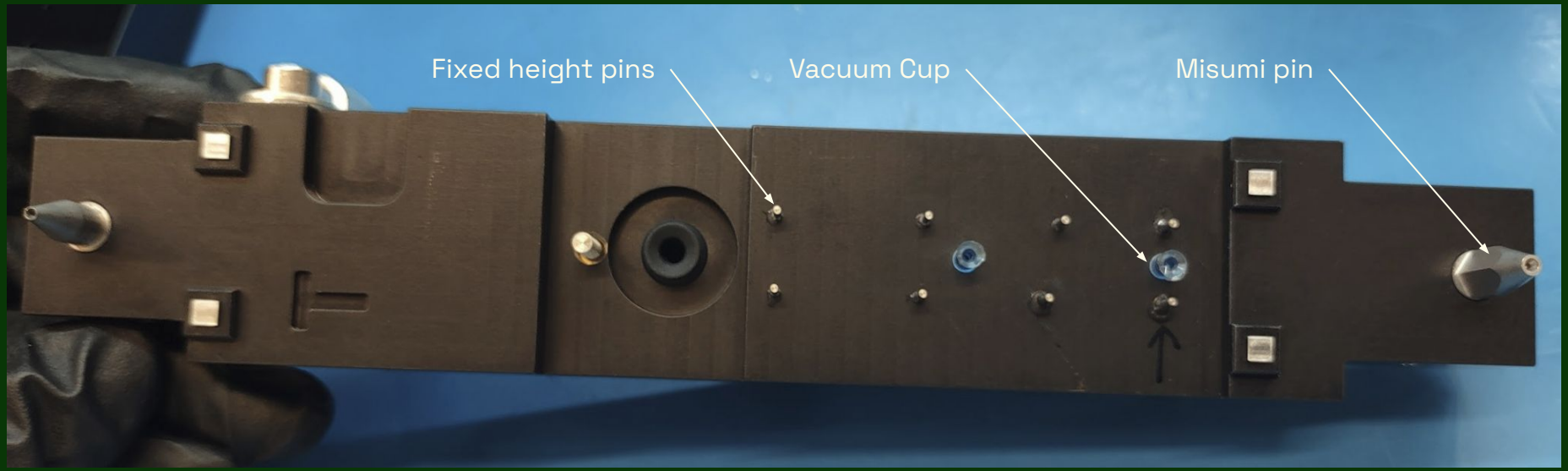
Stacking Chip/Hybrid Gluing Plate



A recess in the bottom of the gluing plate allows the standoffs to be connected to the standoffs below so that multiple plates can be stacked for curing.

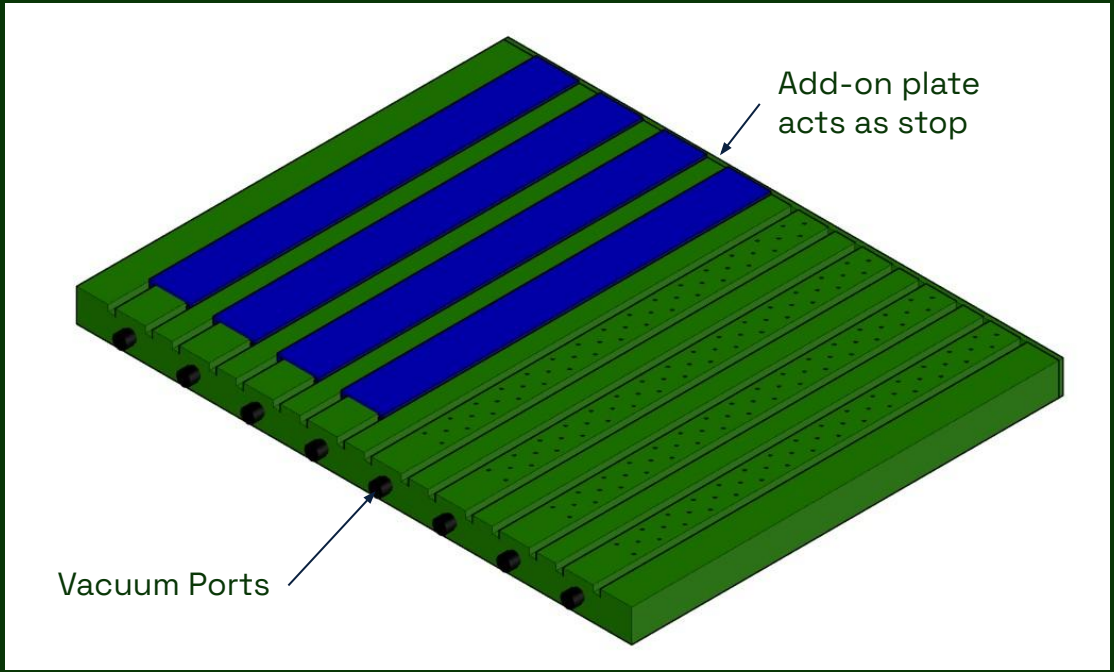
Hybrid Pickup Tool

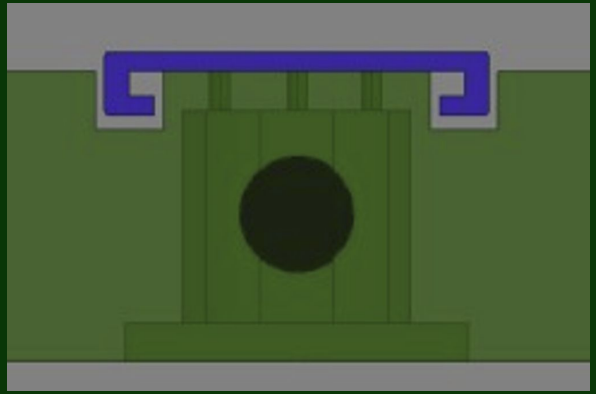
The hybrid pickup tool design is based on this ATLAS tool.
It will utilize vacuum cups and small fixed-height pins to pick up the hybrid, keep it flat, and place it on the gluing plate. We will need flat-ish spaces on the hybrid that are ~4mm dia. to locate the vacuum cups. In a perfect world, 7 or 8 vacuum cups would be ideal for holding the hybrid. They do not need to be centered.



Bonding Jig

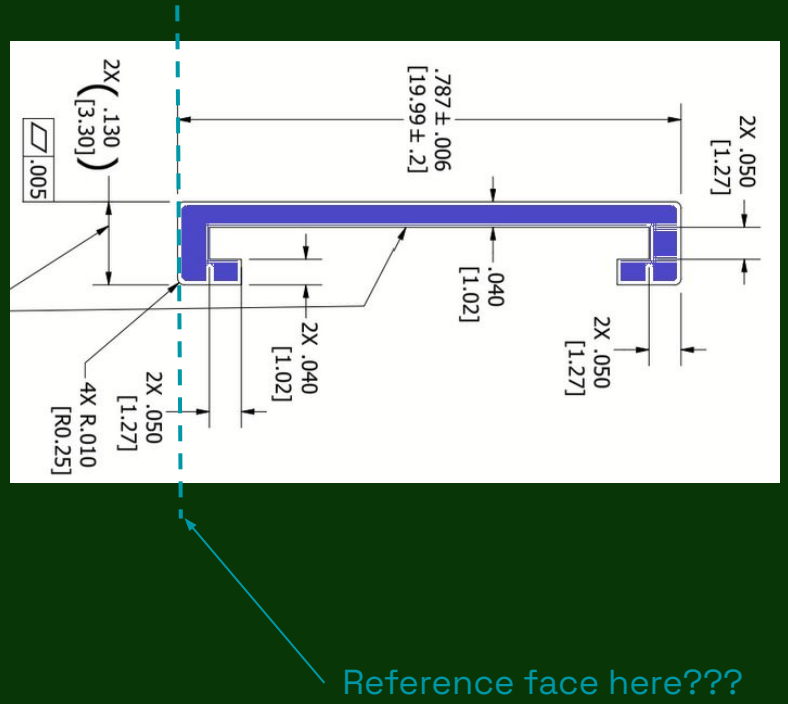
Wirebonding jig will hold 8 modules at once, with oversized grooves cut into the plate for the extrusion. For wirebonding, the alignment precision is +/-1000um for the feature finding to work, so larger grooves will make loading and unloading the plate faster. Modules can be placed closer together on the jig to save space.





Questions

- What is the coordinate system?
- What are the position precision requirements?
- What will be the precision of the aluminum extrusions?
- When can we expect samples of the extrusions?
  - Any bow along the length of the extrusions will cause them to bind
  - The extrusions need to be placed into the gluing plates with a precision better than 100um, so a reference face will need to be agreed upon.



Thank You