MVTX – Fixtures (assembly and bonding)

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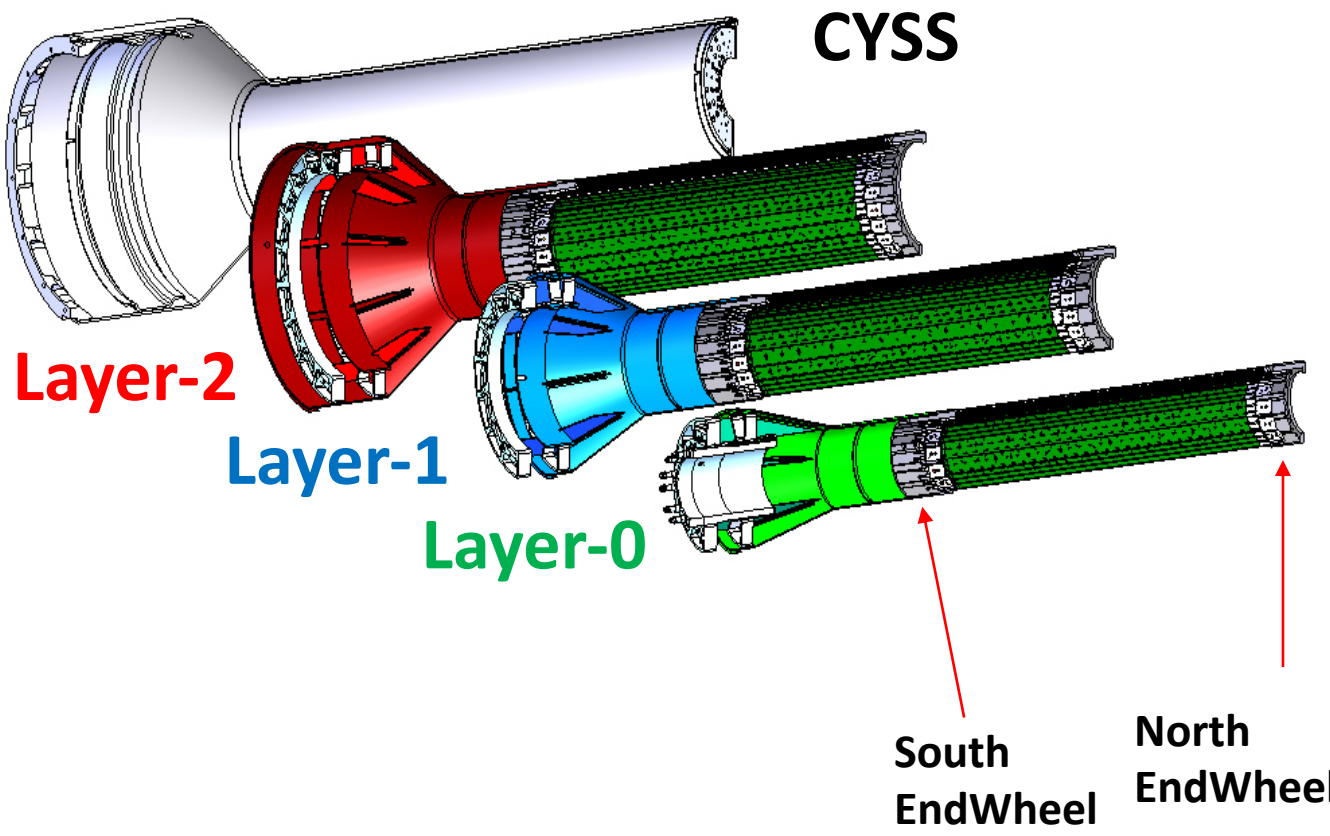
12/09/2020

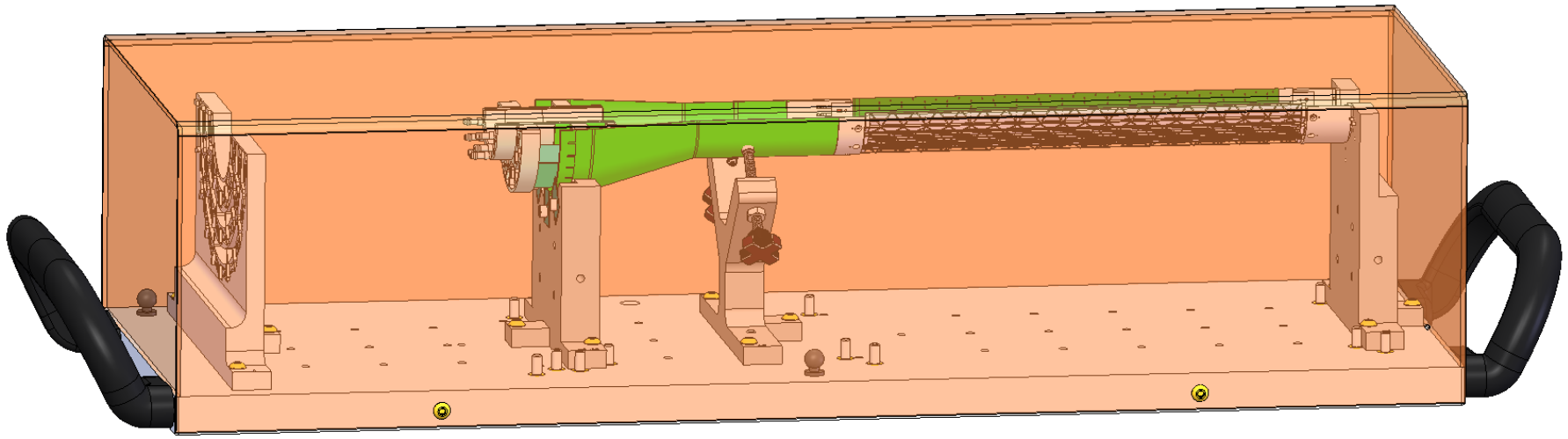
This talk: assembly of one-half layer

1. **Fixtures**
    1. Starting point: ALICE fixtures for ITS
    2. LBNL feedback

2. **Assembly steps**



Design considerations



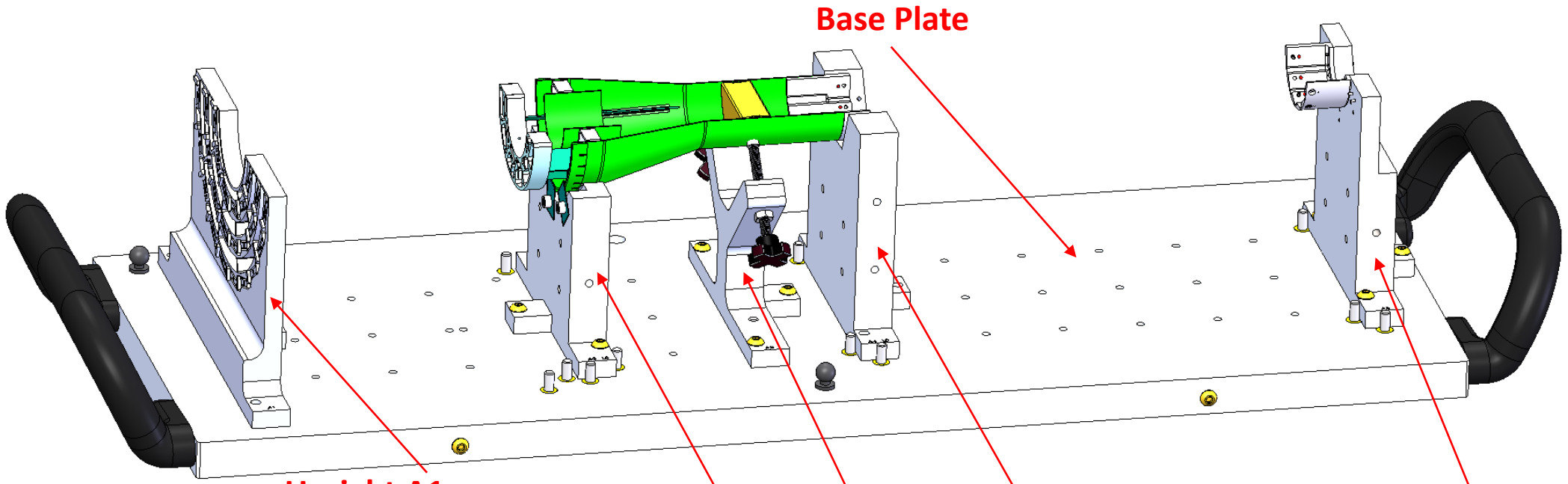
1. Technical type:

1. Key tolerances to be kept: proper positioning and angle of the staves.
2. Fixturing repeatable: assembly removed for test fitting and reinstalled in fixture for stave installation and testing.
3. CMM will be used to ensure all alignments are correct, in turn ensuring Stave fitment into the assembly.

2. Practical type:

1. Maneuverability: assembled weight <100lbs (boundaries in LBL, and eliminates need for lifting crane), handles
2. Protection: cover, moisture-control

Main components

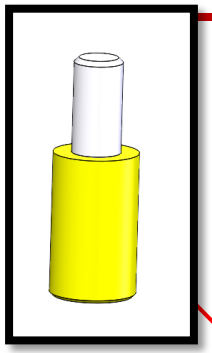


Materials:

- Baseplate: 6061-T6 Aluminum
- Uprights: 6061-T6 Aluminum
- Handles: Coated Metal

Assembled weight of Fixtures is roughly 60lbs.

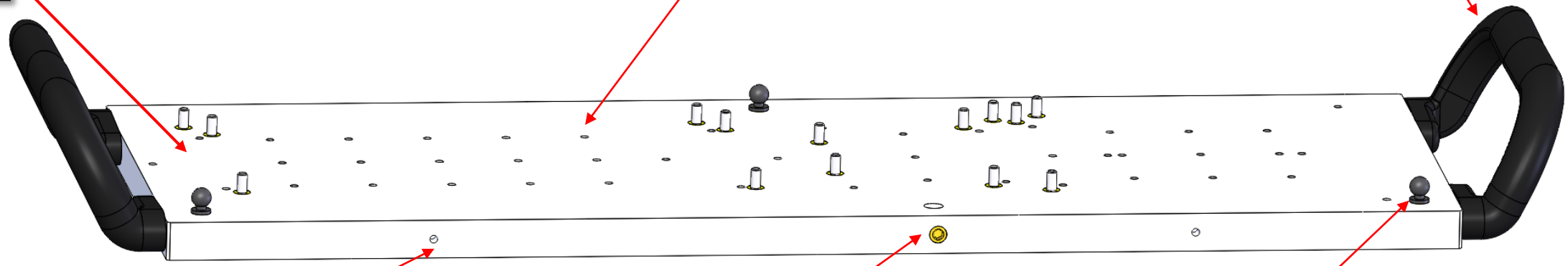
Main components: Base plate



¼” Drill Bushings (14)
with
¼” Dowel Pins
(for shimming purposes)

Rows of ¼-20 threaded holes.
(for attaching various items during bonding/assembly/CMM)

(2) Lifting Handles



(4) Threaded holes
(to attach Dust Cover)

Dry Air inlet
(shown plugged w/ Brass - NPT plug)

(3) Tooling Ball locations
(to establish a repeatable baseline for CMM)

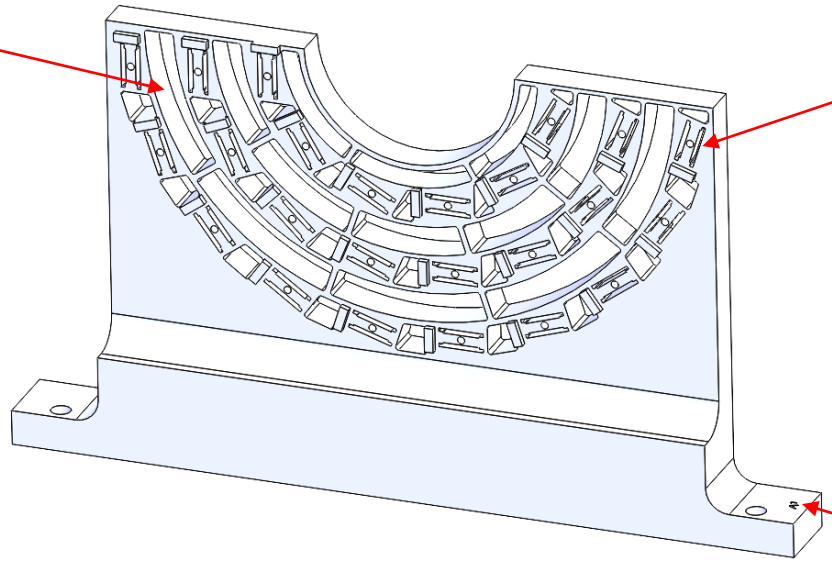
Base Plate

- same for all fixtures;
- 39.3in Long X 12in Wide , 8-1/8” tall(with lifting handles)
- assembled weight (Layer0): 45lbs.

Main components: Upright A1

Pass through holes for cooling tubes.

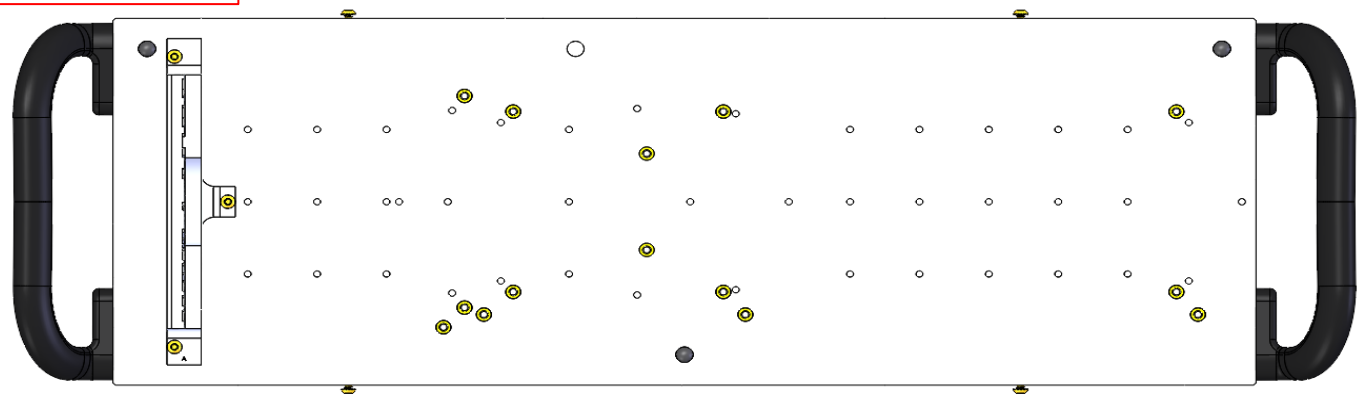
Pass through holes for circuit boards



Upright marked with its identification

A1 upright:

- Same for all layer
- 3D printed
- Installed right before stave installation

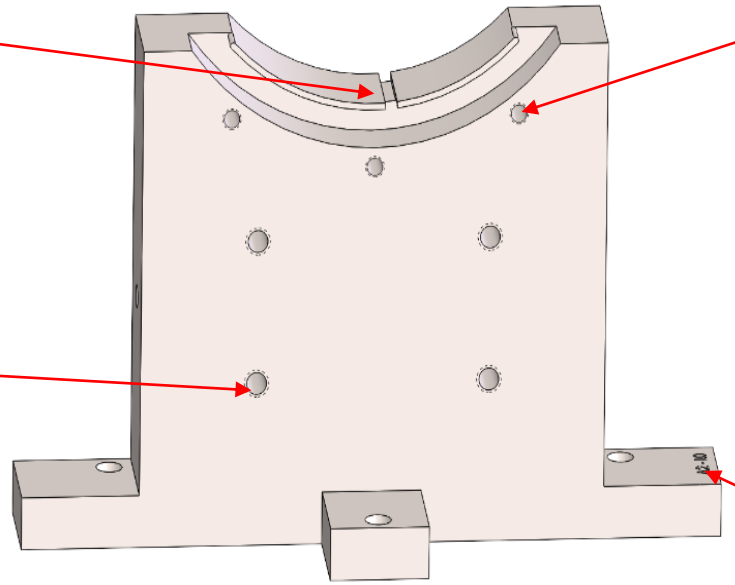


Main components: Upright A2

Engagement slot
(engages w/ pin from det. layer)

(3) # 10-32 threaded holes for attaching springs

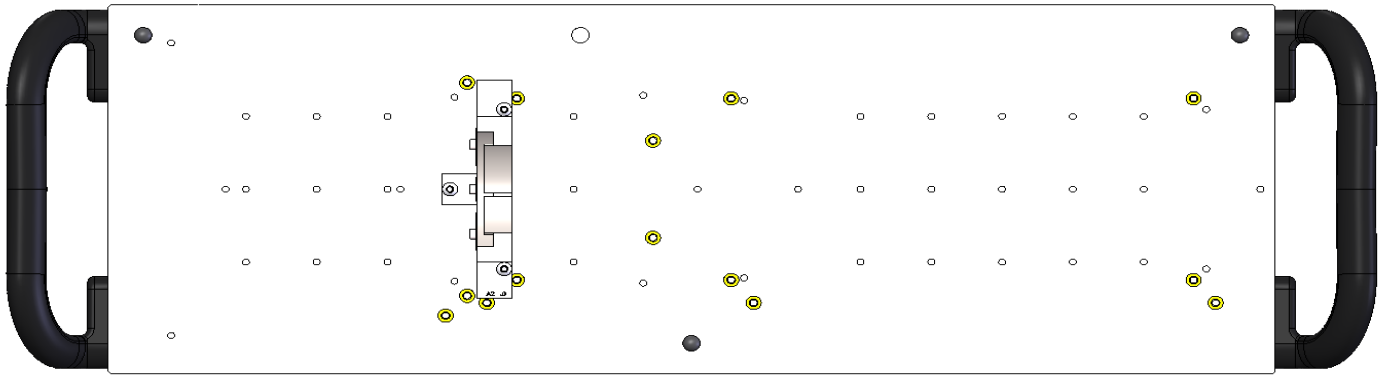
Utilitarian ¼-20 threaded holes



A2 upright:

- specific to each layer (radius on top machined to individual layer-radius)

Upright punch marked with its identification

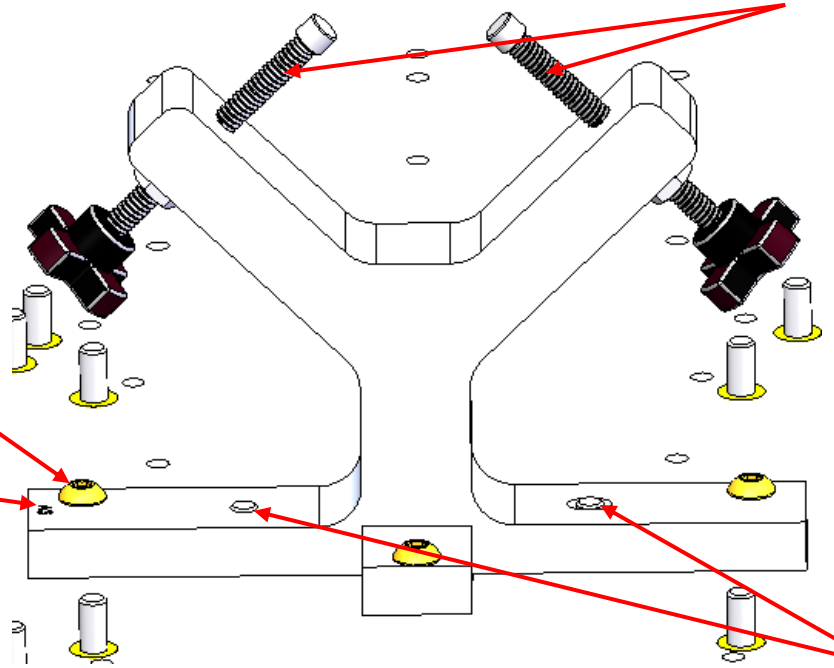


Main components: Upright A3

(3) Brass screws
(to bolt A3 to baseplate)

(2) Height adjusters w/ Jam nuts

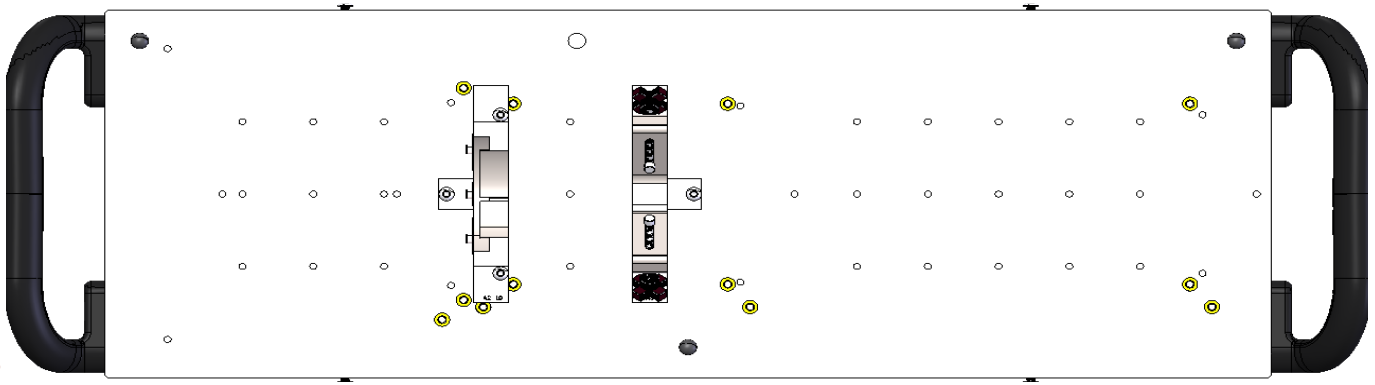
Punch marking



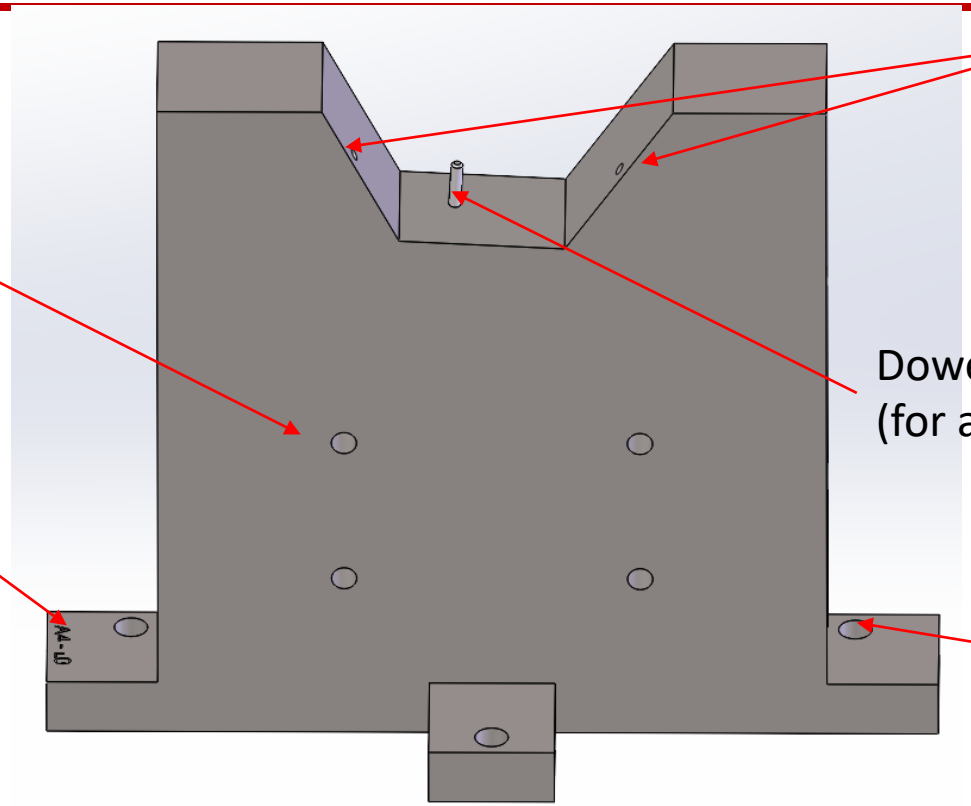
Dowel Slot and Dowel Hole
(to align w/ Dowel Pins on baseplate)

A3 upright:

- Same for each layer

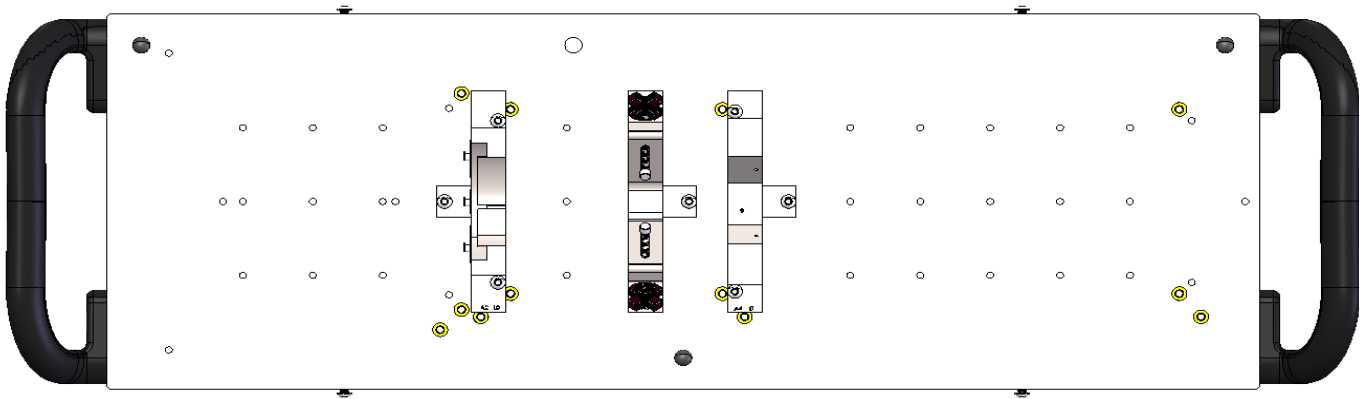


Main components: Upright A4



A4 upright:

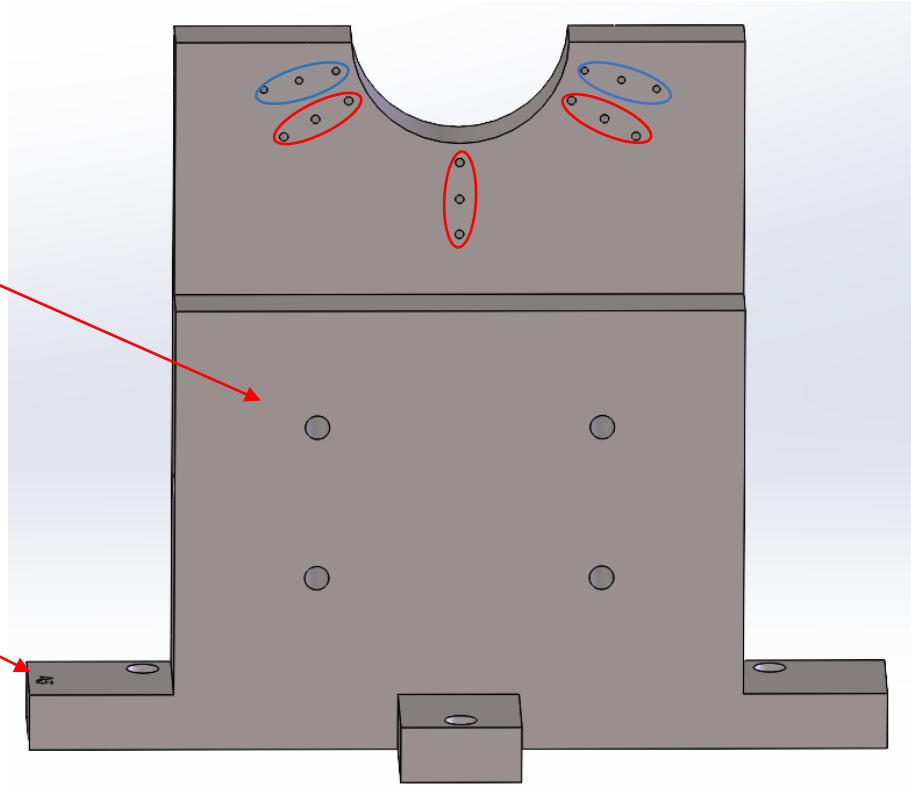
- specific to each layer



Main components: Upright A5

Utilitarian ¼-20 threaded holes

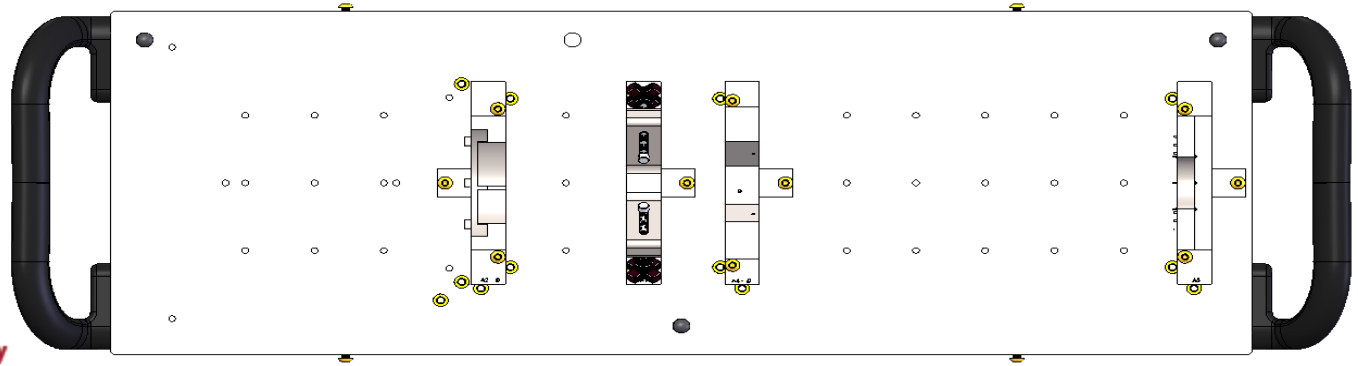
Punch marking



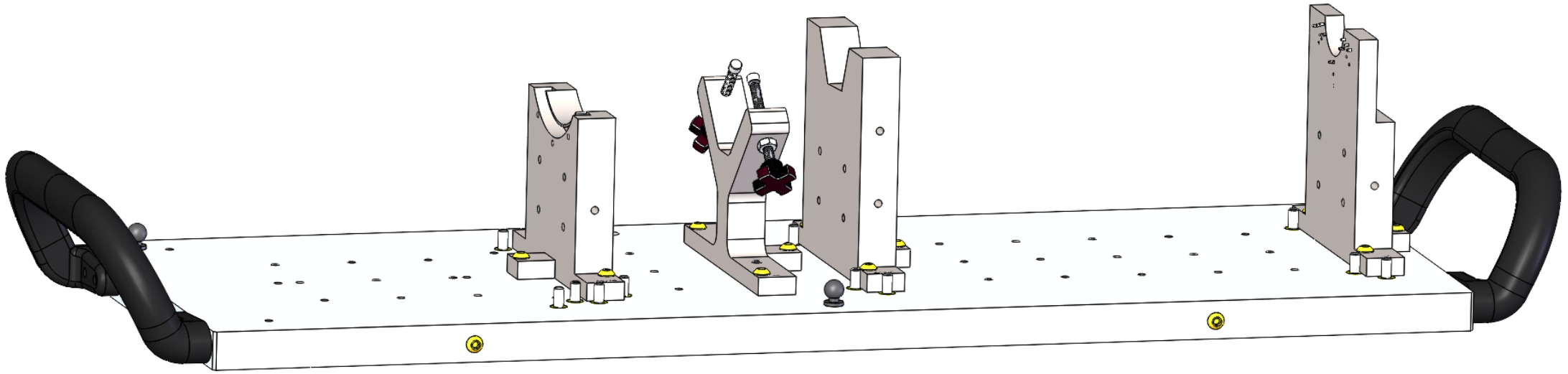
(9) 1.6mm Clearance holes

(6) 1.5mm Dowel Pins
(to align NorthEnd Wheels w/ the 3 layers)

A5 upright:
- Same for all layer



Main components: READY TO START ASSEMBLY



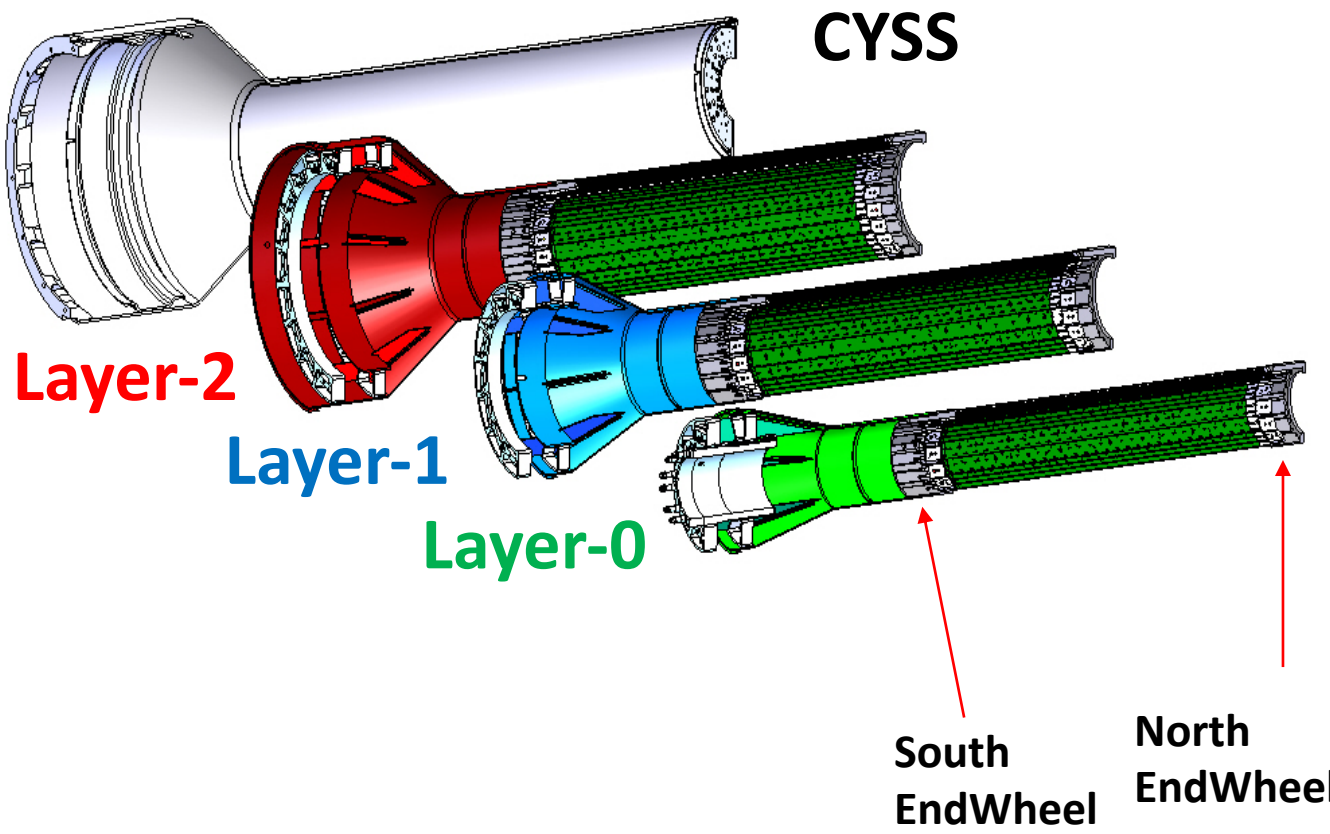
After A2 → A5 installed: ready to begin MVTX installation

Note: detailed installation steps in the Manual prepared

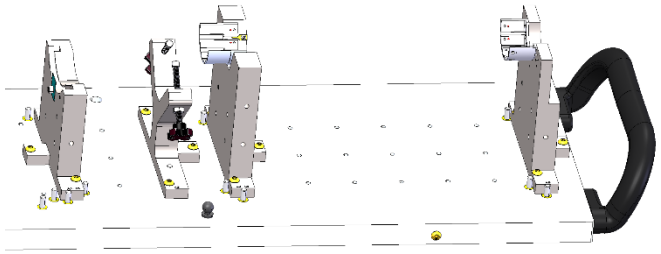
This talk: assembly of one-half layer

1. Fixtures

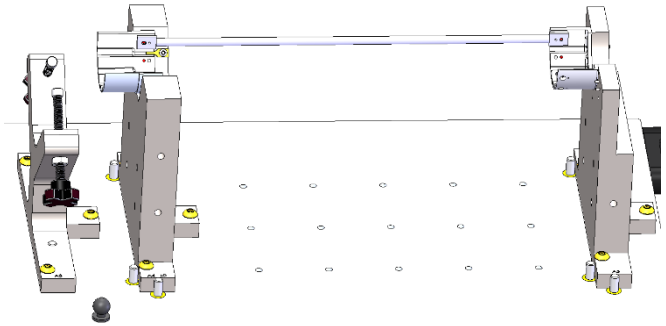
2. **Assembly steps**
   1. Details available in the manual (pdf)



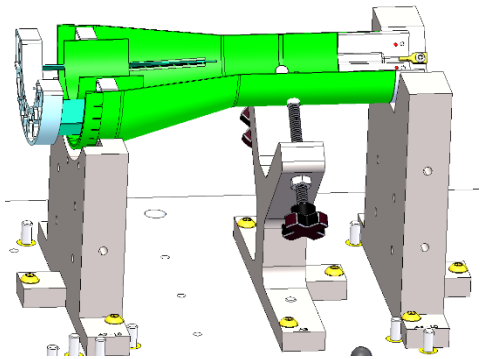
Simplified half-layer assembly



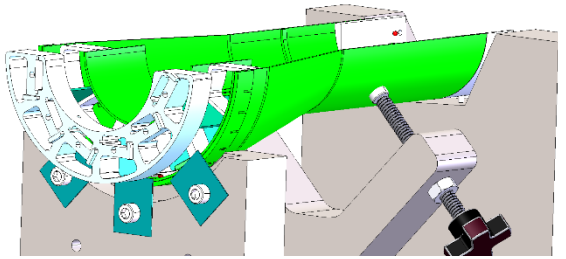
1) Install North & South EndWheel in A5 and A4



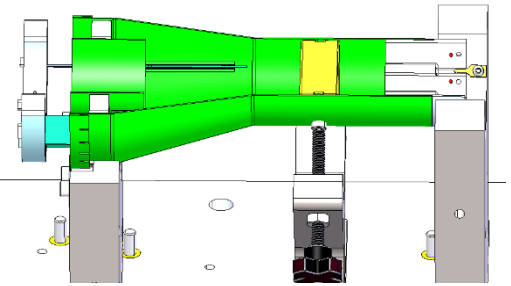
2) Check alignment w/ CMM & testing also w/ a dummy stave



3) Install Carbon Fiber cone, and align into place

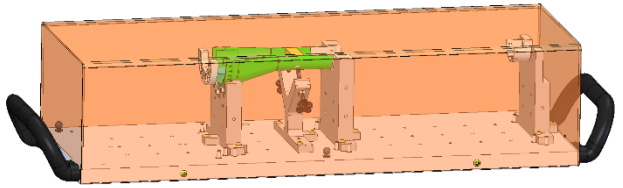


4) Install springs to lock cone in z

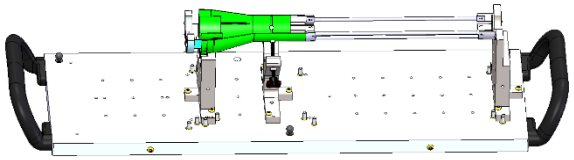


5) Install fixture weight

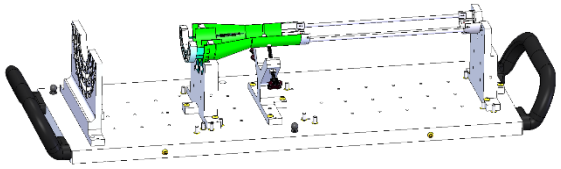
6) Reverse: 5, 4, 3
7) Applying epoxy for bonding
7) Repeat: 3,4,5



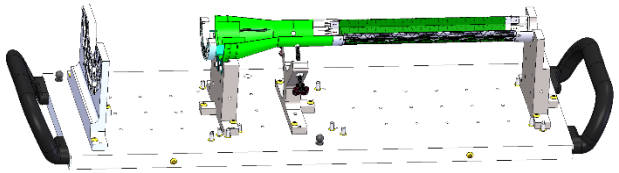
8) Cover and allow epoxy to fully cure before proceeding



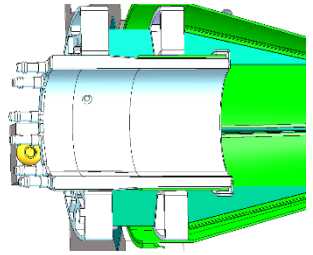
9) Install dummy staves
10) Remove from fixture
11) Test-fit into next layer



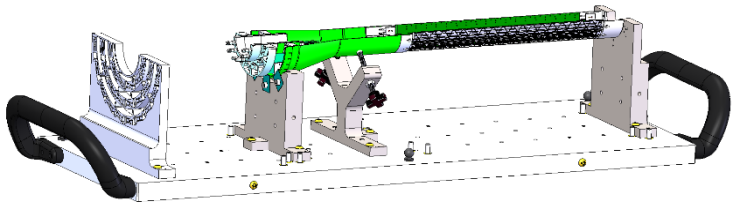
12) Install A1
13) Install back in Fixture



14) Replace Dummy Staves with Staves – Testing as you go



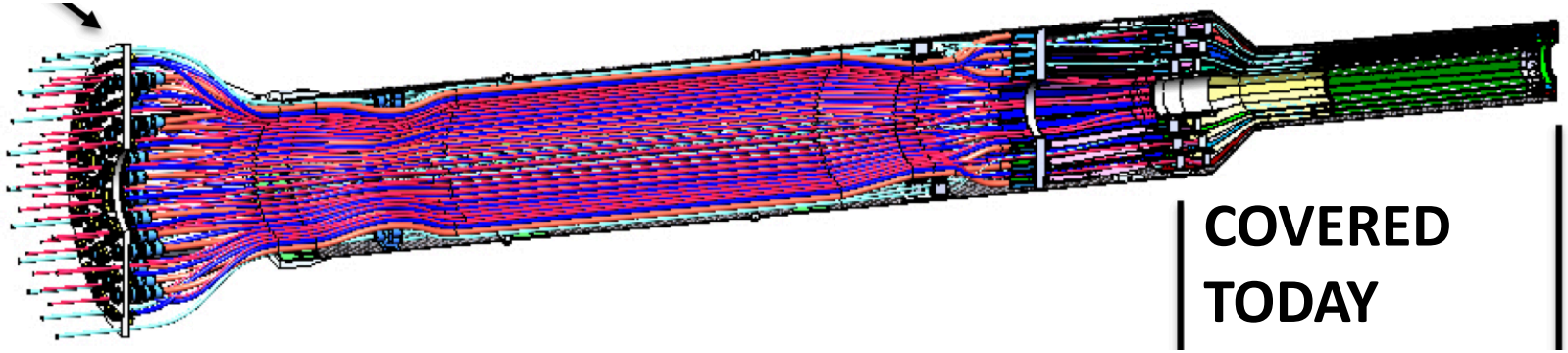
14) Install cooling lines on Air Manifold



16) Test all Staves again
17) Ready to install

Summary

- **Fixtures:**
  - Quasi-final design (we think)
  - 3 vendors contacted: France (~11K EUR / 1 fixture , price driven by the tolerances, +~2.5K shipping), NM, and MA
- **Assembly procedure**
  - Manual: v1 in place → to be further revisited w/ input from LBNL (and this meeting)
  - Contributing factor in determining the final assembly strategy/sequence: cost
    - E.g.: 6 fixtures (1 for each layer, for both halves), or 3 (1 for each layer for 1 half) , or 1 …?
- **Next:**
  - Expanding the manual, with adding a section for assembling the full detector
    - Here: just layers into CYSS
    - Next: cyss+SB+patch-panel3 (no special fixtures needed)

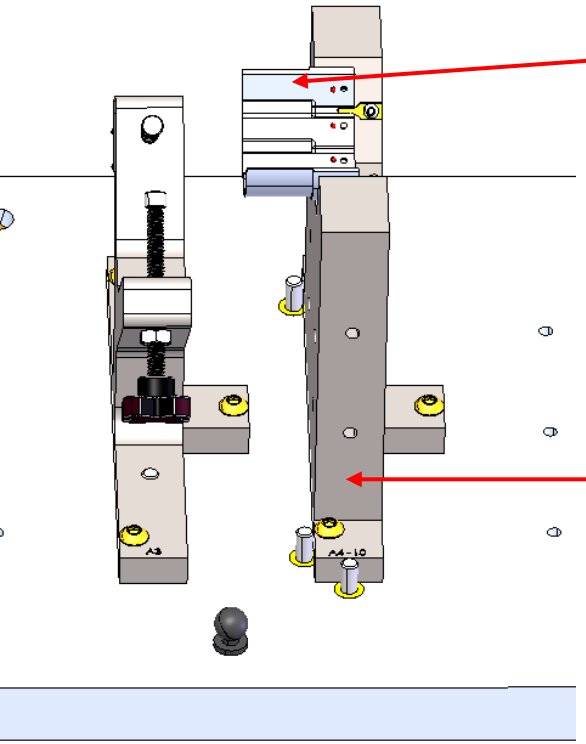


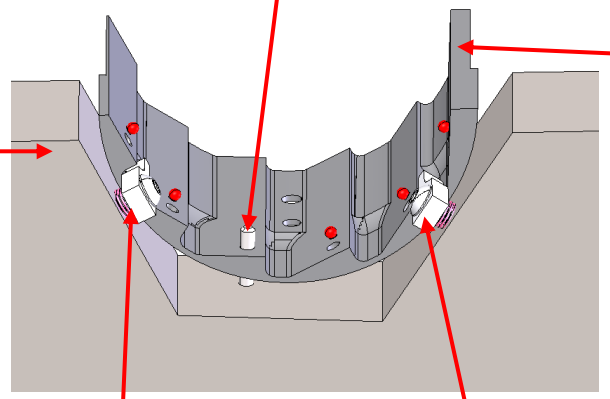
COVERED TODAY

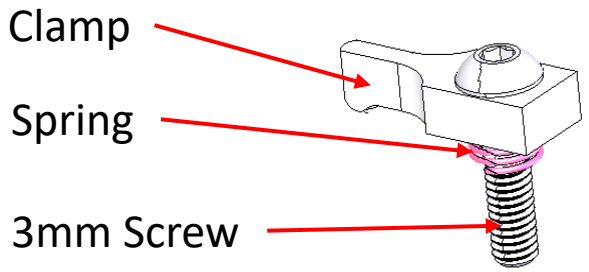
Done!

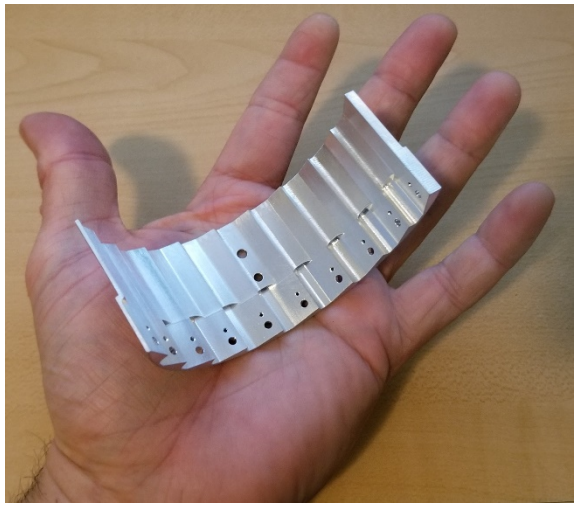
A4 role in more detail:

- Show A4 is used to hold the South EndWheel into the right position, phi-angle, tile-angle etc.
  - could also use one 1-piece photo for illustration, and a zoom-in of the 1st step figure from the last slide





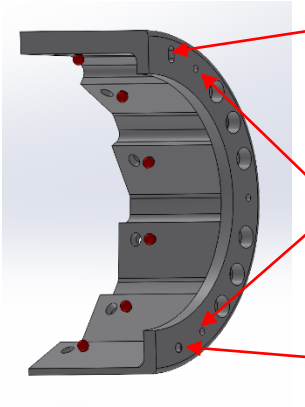




A5 role in more detail:

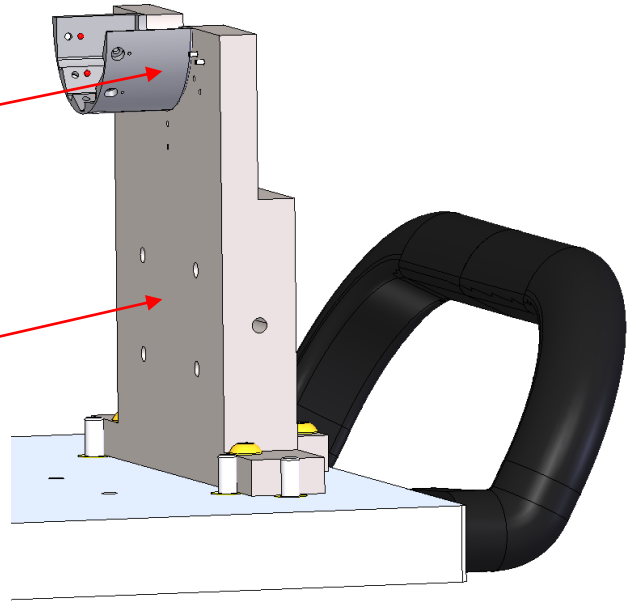
- Show A4 is used to hold the South EndWheel into the right position, phi-angle, tile-angle etc.

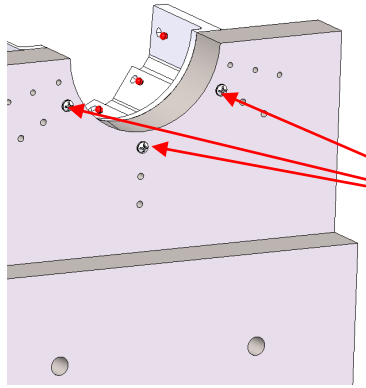
Mount the L0 Aluminum North EndWheel Assembly onto Upright A5, By aligning The two Dowel pins on A5 with the Dowel Hole, and Dowel Slot in the North End Wheel Assembly. Which correctly sets its clocking.



L0 (Alu.) North EndWheel Assembly

A5





Back Side Of A5

(3) M1.6 Brass screws pass through Clearance holes in A5, and thread into the L0 Aluminum North End Wheel. (torque to 19.2 in.lb)