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OB Mechanics and Integration

19 December 2025

UK EIC SVT Working Meeting, University of Oxford

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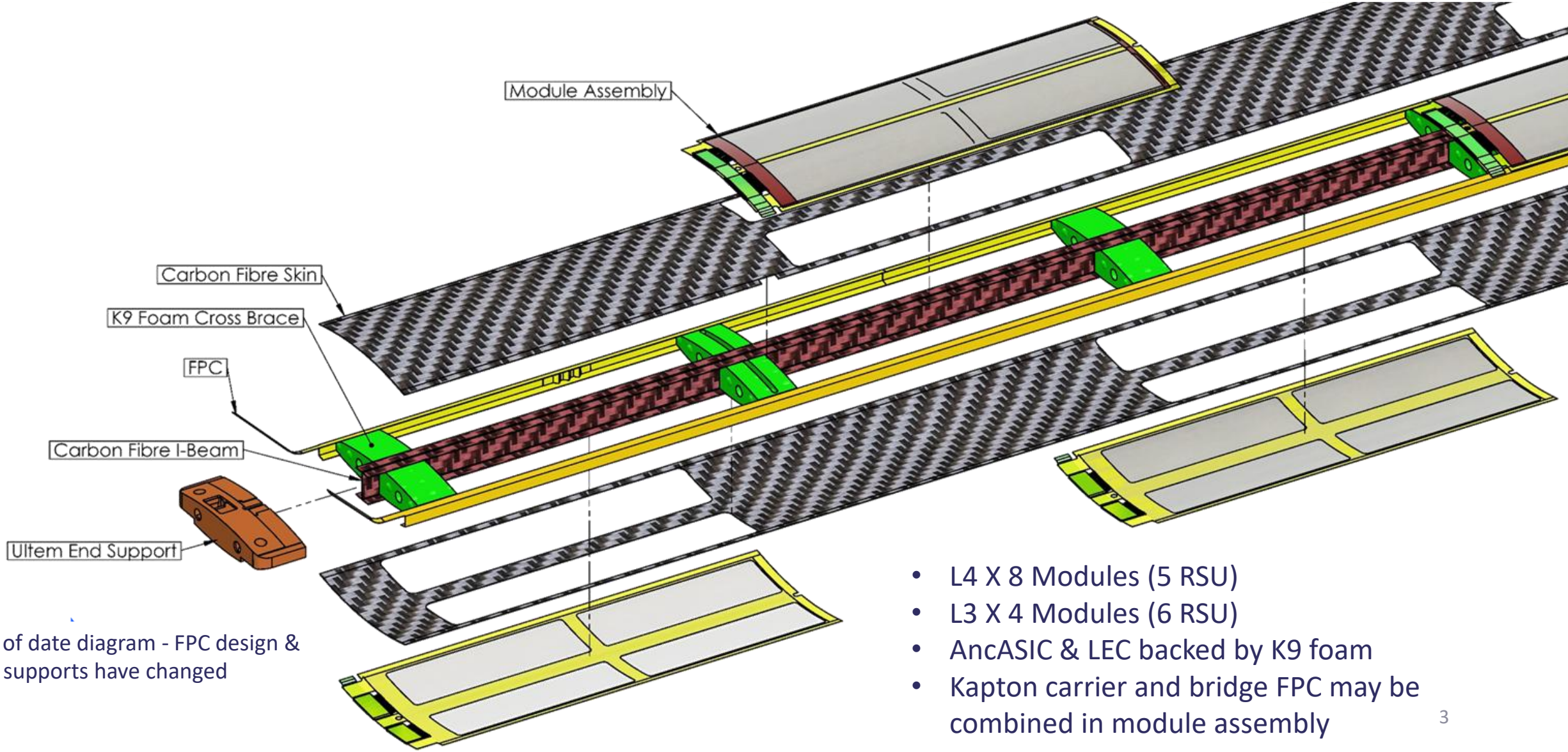
    - Dimensions / Counts / Overlaps
  - Support Cone Interface

- FPC/FIB/Module mechanical considerations
  - FPC width limitations
  - Module Alignment
  - FIB pre-attachment to FPC

Overview of OB Stave Construction



Out of date diagram - FPC design & end supports have changed

- L4 X 8 Modules (5 RSU)
- L3 X 4 Modules (6 RSU)
- AncASIC & LEC backed by K9 foam
- Kapton carrier and bridge FPC may be combined in module assembly

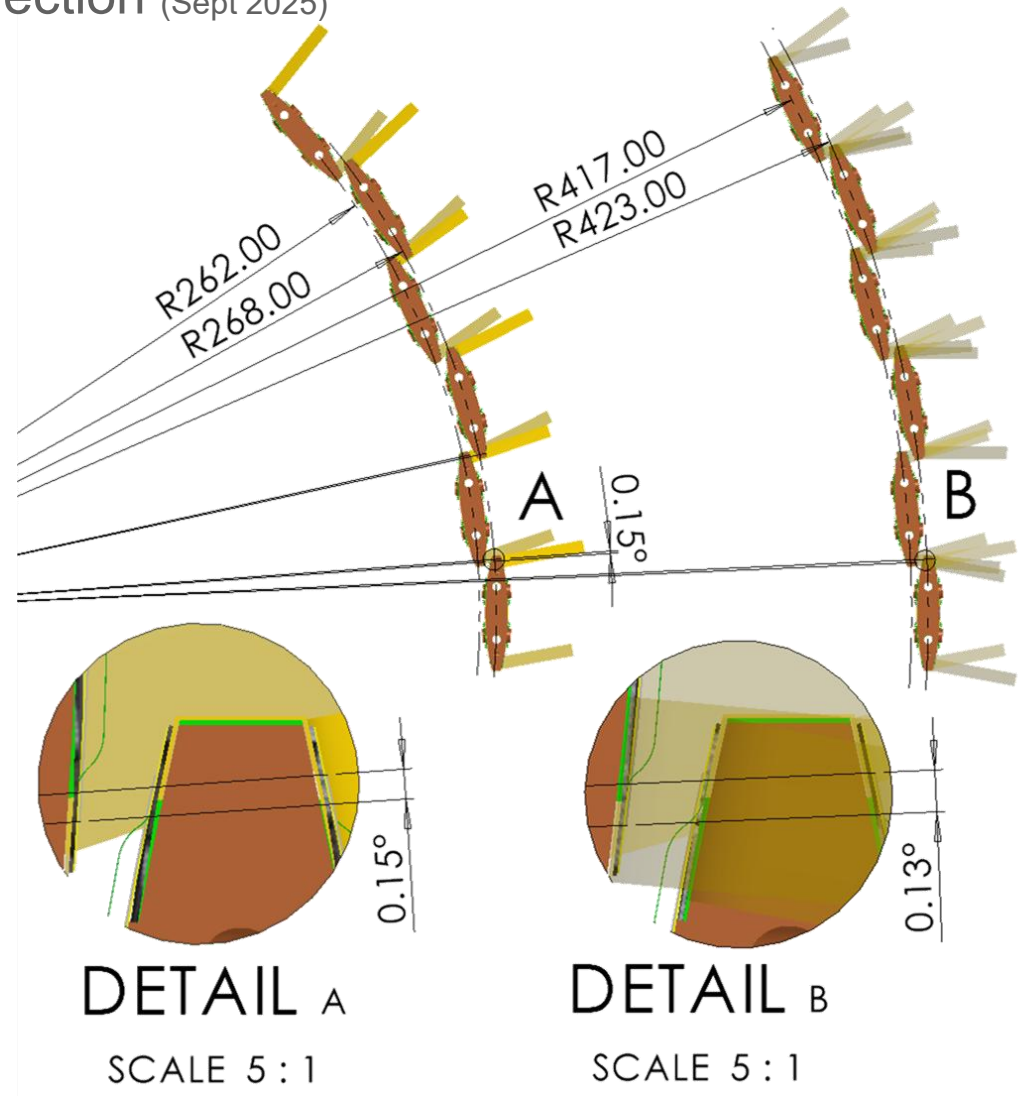
OB Layout and Stave Counts

- L3 radius reduced (by 5 mm) to give overlap in azimuthal direction (Sept 2025)
  - Radii now 262 mm & 268 mm
  - **44** Staves shown in figure, gives similar overlap to L4
  - Active length reduced by 10 mm (Z overlap 5.7 mm)
  - Overall length now **550** mm (active length 503 mm)
- L4
  - Radius 417 mm & 423 mm
  - 70 Staves
  - Overall length 840 mm (active length 793 mm)

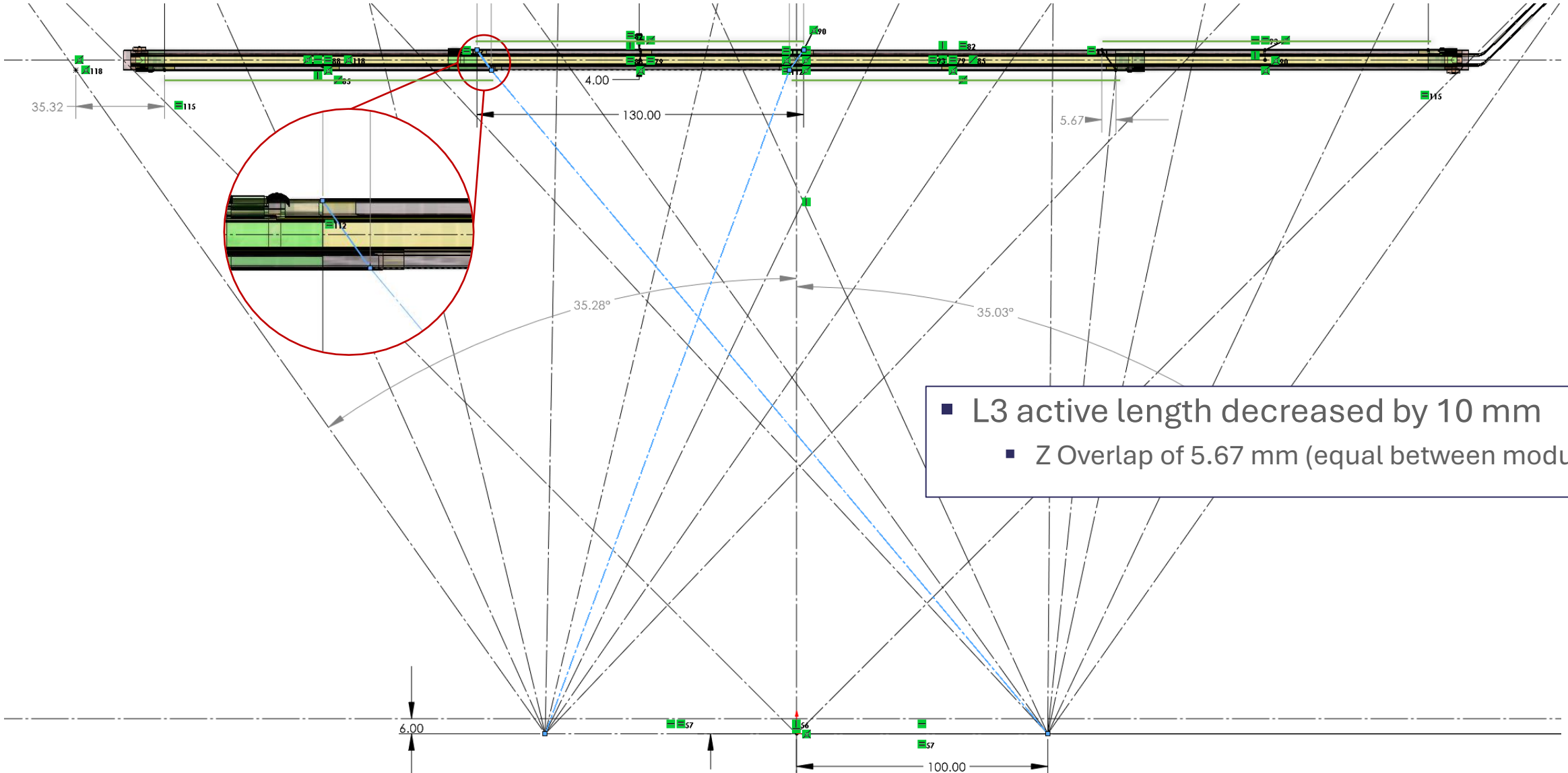
Table 6.2: Nominal outer barrel layer parameters.

Layer	nominal radius [mm]	nominal length [mm]	target X/X_0
L3	270	540	0.25%
L4	420	820	0.55%

Figure 6.5: Polar overlap for L3 and L4.



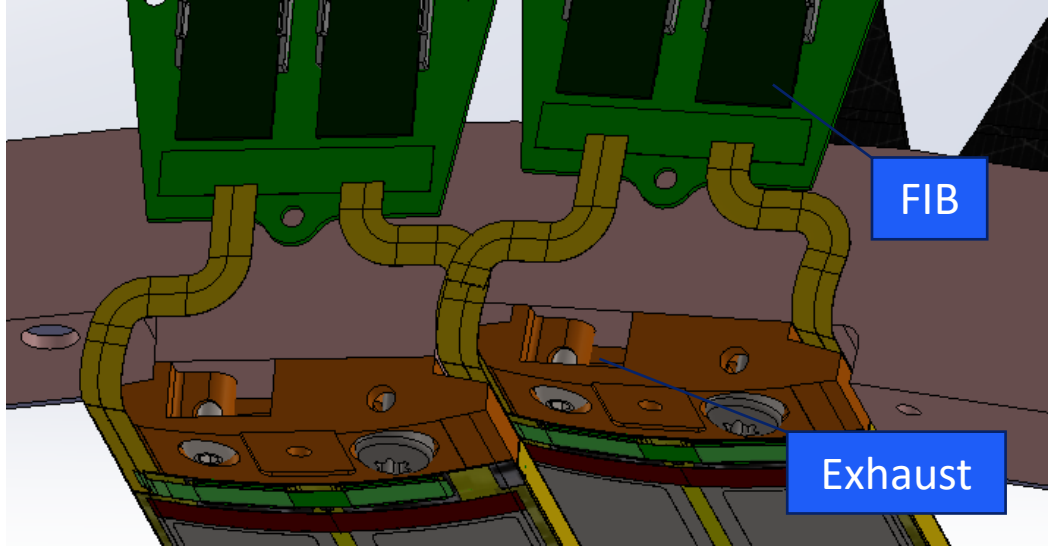
Overlap L3

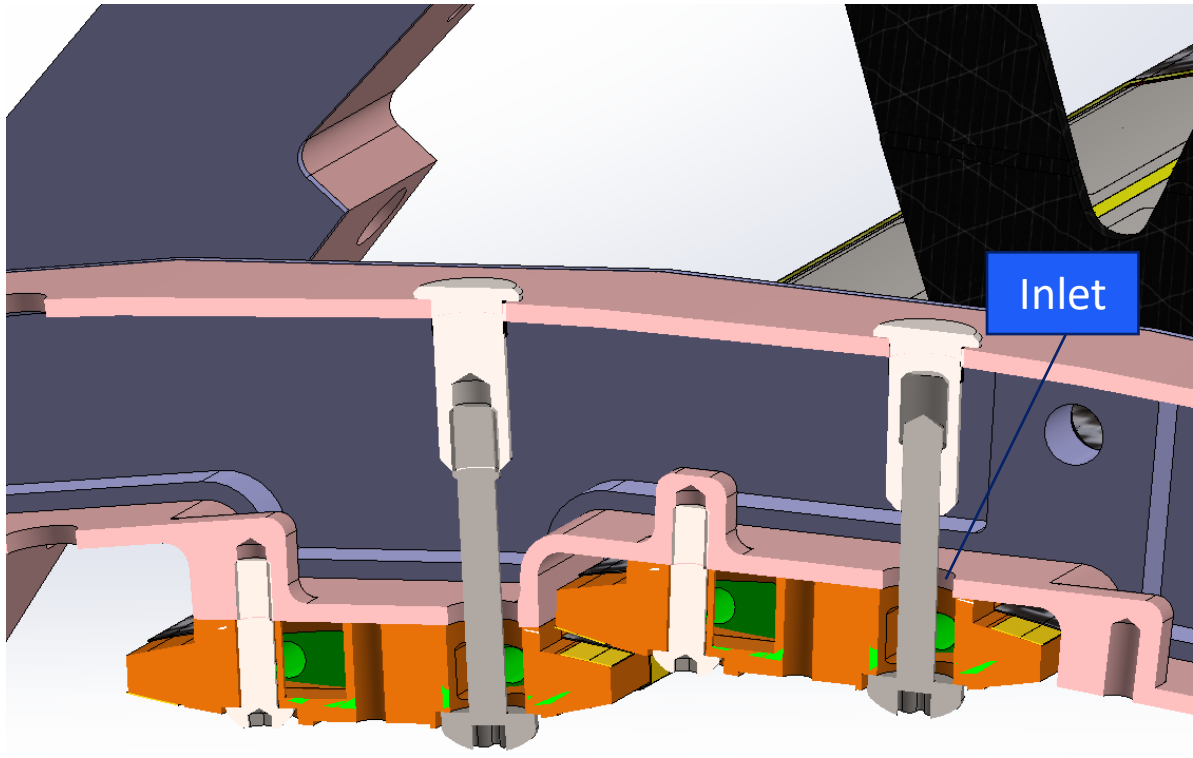


- L3 active length decreased by 10 mm
  - Z Overlap of 5.67 mm (equal between modules)

Global Integration – Stave End Support

- Stave end has been redesigned to suit half barrel manifold
  - End support interface flattened
  - Annular flow gap around mounting screw for air inlet
    - Area ratio of 1:4 between inlet and stave cross section
    - Typical flow velocity at inlet around 40 m/s
  - End support set up for counter current flow
  - Outlet exhausts in Z direction
    - Sufficient room at stave end for flow redirector/diffuser
    - Could flow exhaust gases in the direction of the VTRX+ to provide some basic forced convection





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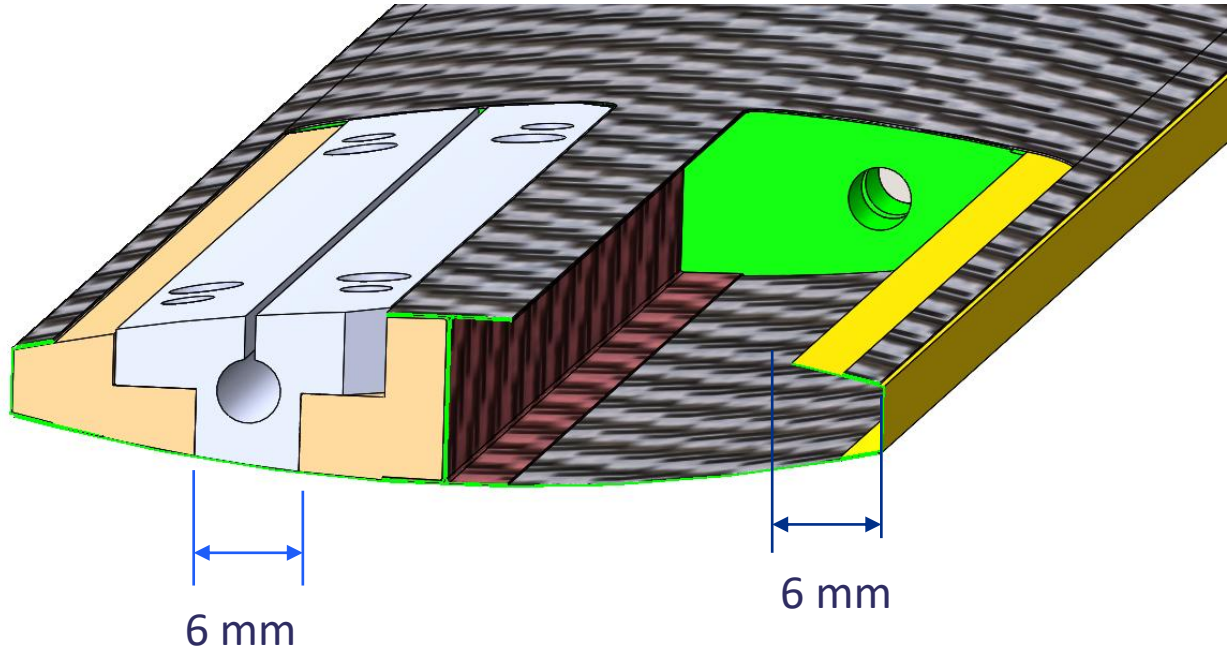
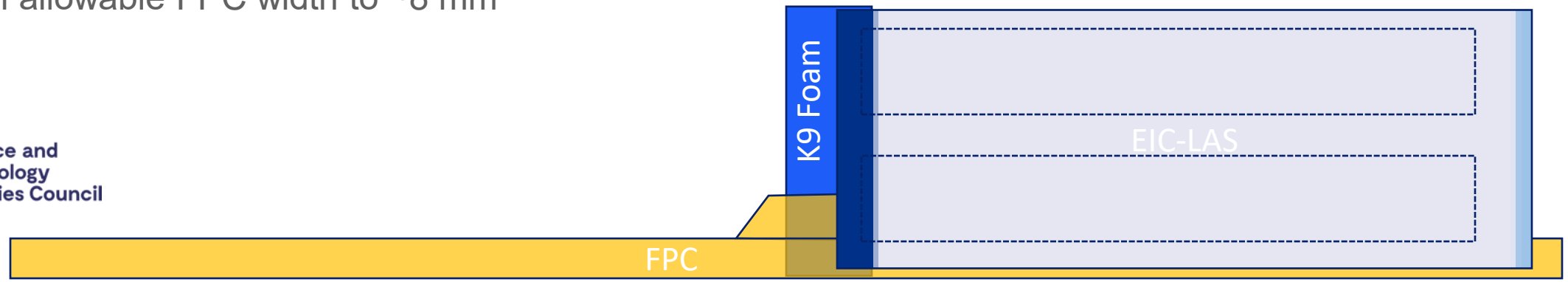
Stave Internal Layout – FPC Considerations

- Hollow structure achieved through interlocking internal tooling segments
- Current mechanical FPC prototypes differ from electrical FPC prototypes
- Internal tooling design limits the maximum internal overhang & width of the FPC to 6 mm
- Limitation applies only in region with tooling removal aperture (under EIC-LAS RSU), FPC can be wider where bridge FPC bond pads mount
- Design refinement could increase the maximum allowable FPC width to ~8 mm





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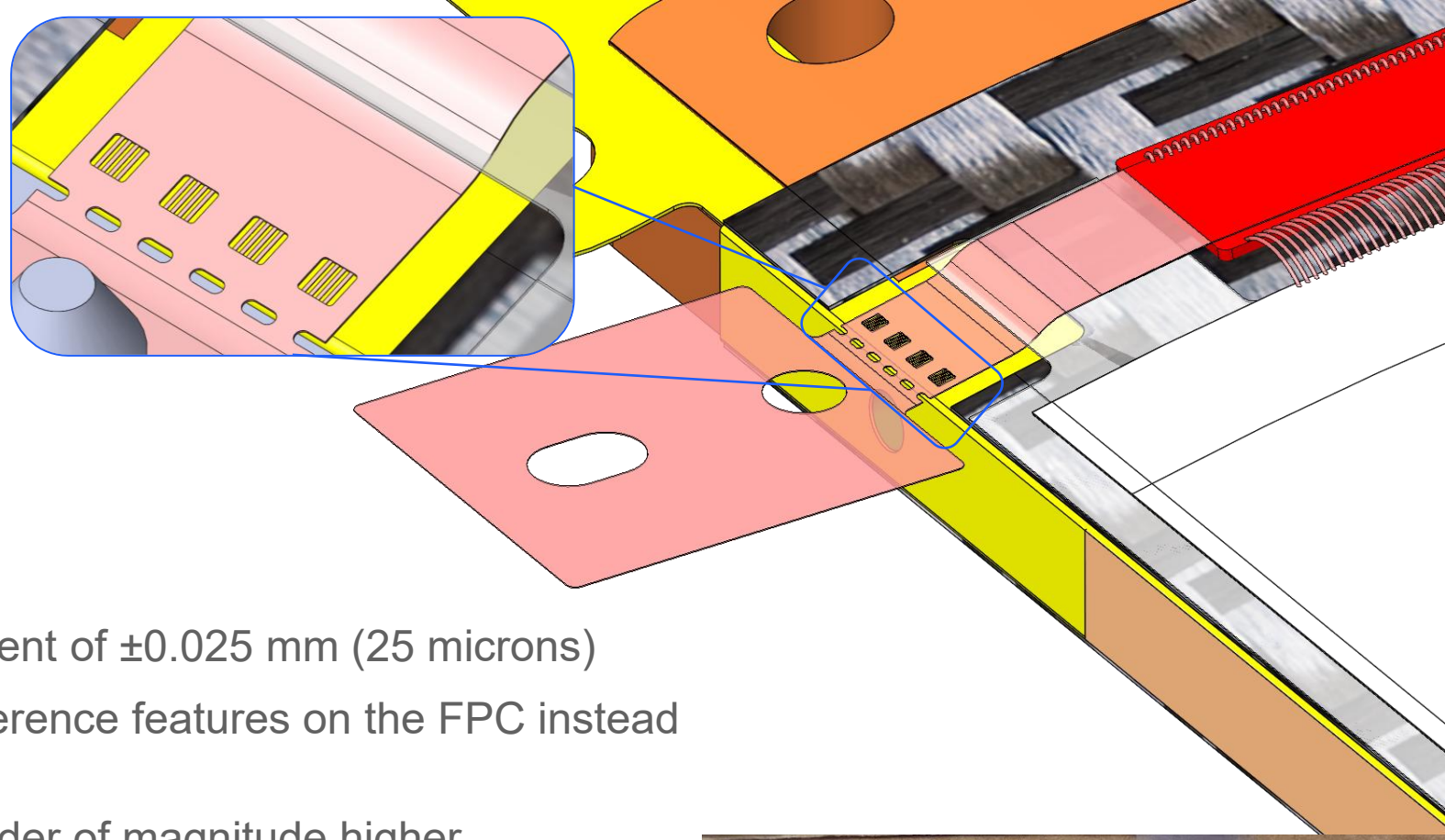
FPC to Module Alignment



- spTAB require FPC to bridge FPC alignment of ±0.025 mm (25 microns)
- Module will be aligned based on local reference features on the FPC instead of a global module alignment
- Module positional tolerance may be an order of magnitude higher
- Prototypes for FPC have alignment pins on the side aligned in Z with the FPC bond pad locations, tooling will align the bridge FPC sacrificial alignment features to the FPC

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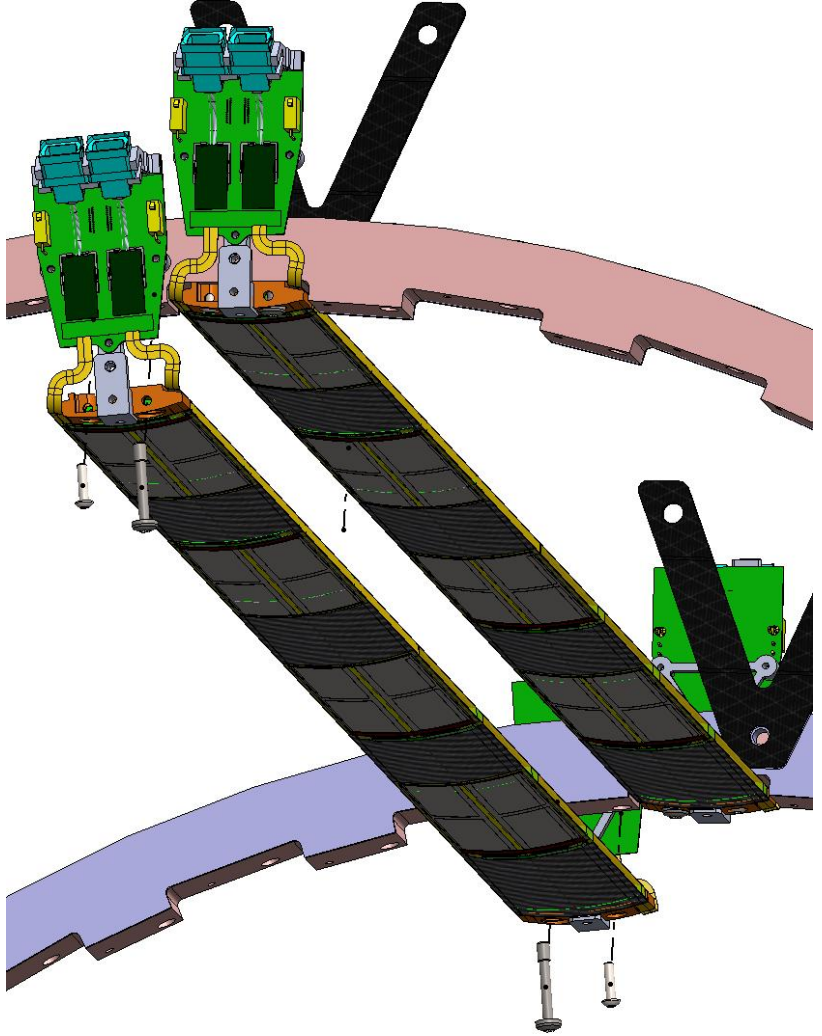
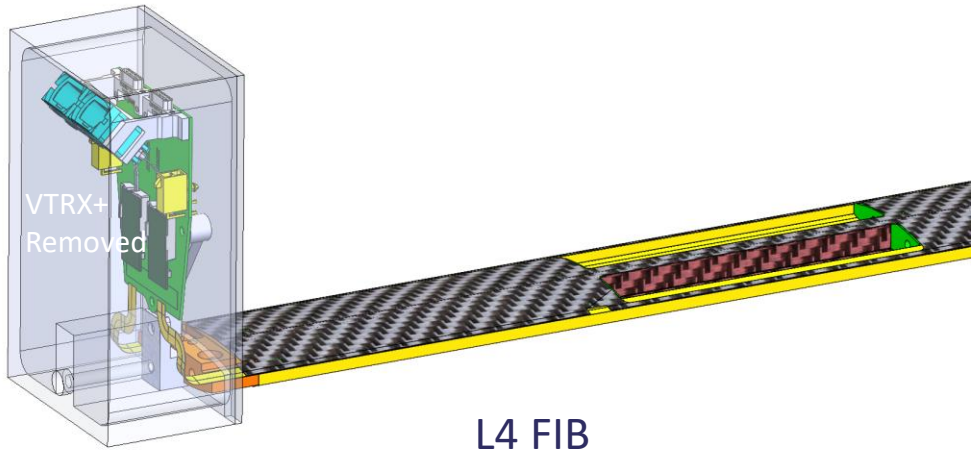
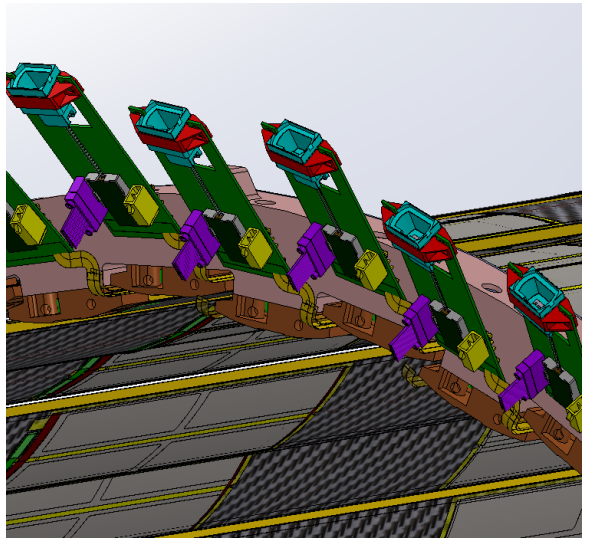
FIB/FPC Interface

- FPC will be pre-attached (soldered) to FIB before stave structure
- FIB will be held in its final position relative to the stave during the autoclave cure & installation
  - Enclosure protects FIB during whilst in autoclave
  - Load transfer from tooling to manifold during installation





L4 FIB



L3 FIB

Questions

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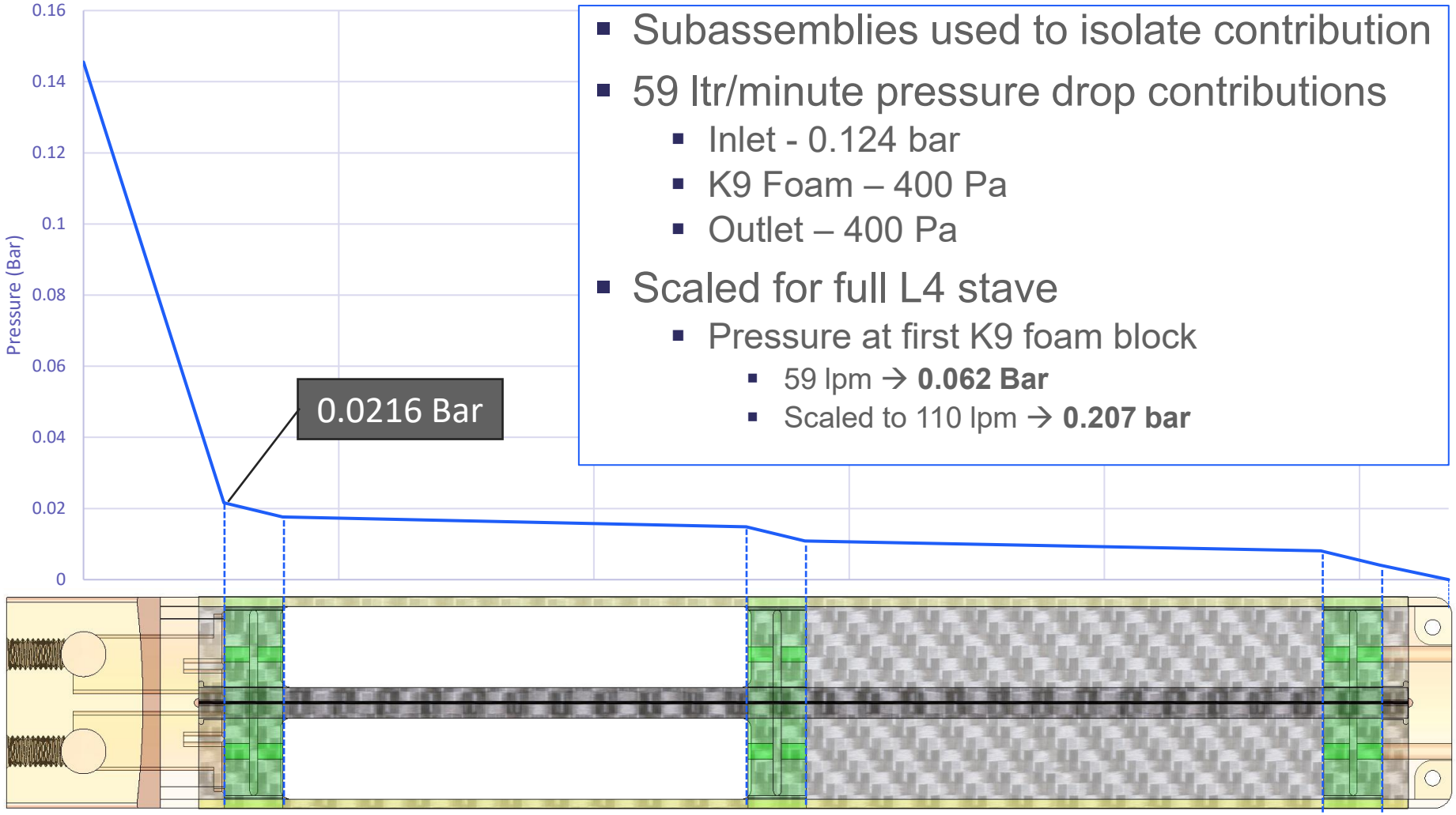
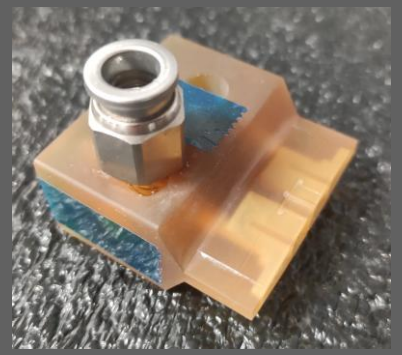
Additional Slides

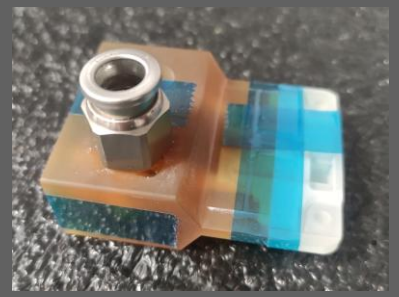
Pressure Loss Contributions



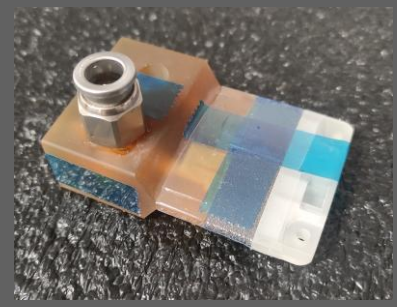
- Subassemblies used to isolate contribution
- 59 ltr/minute pressure drop contributions
  - Inlet - 0.124 bar
  - K9 Foam – 400 Pa
  - Outlet – 400 Pa
- Scaled for full L4 stave
  - Pressure at first K9 foam block
    - 59 lpm → **0.062 Bar**
    - Scaled to 110 lpm → **0.207 bar**



Inlet Block

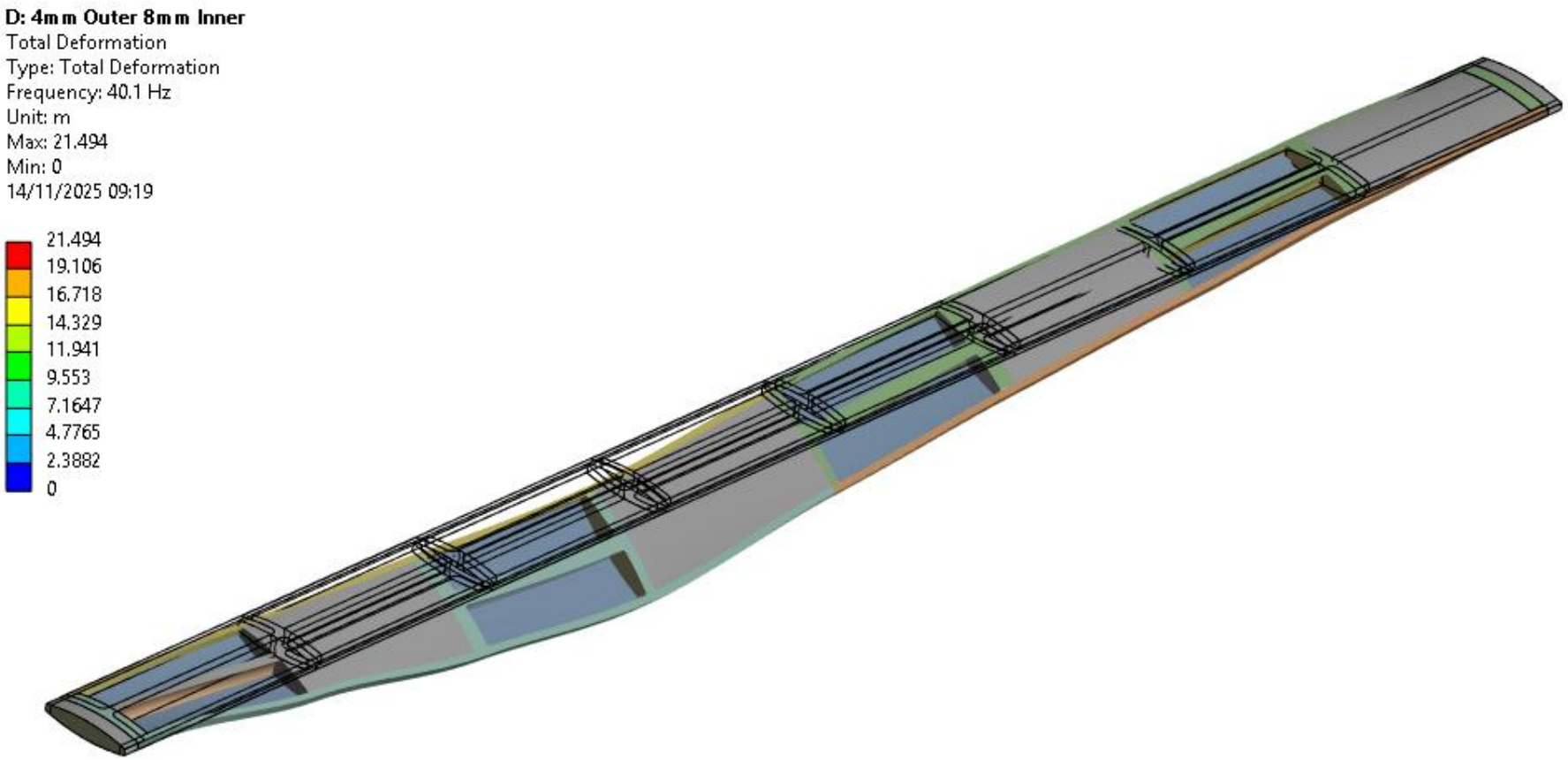


Inlet & Outlet Blocks



Inlet, Outlet & K9

Modal Analysis – Open Structure 0.1mm face sheet



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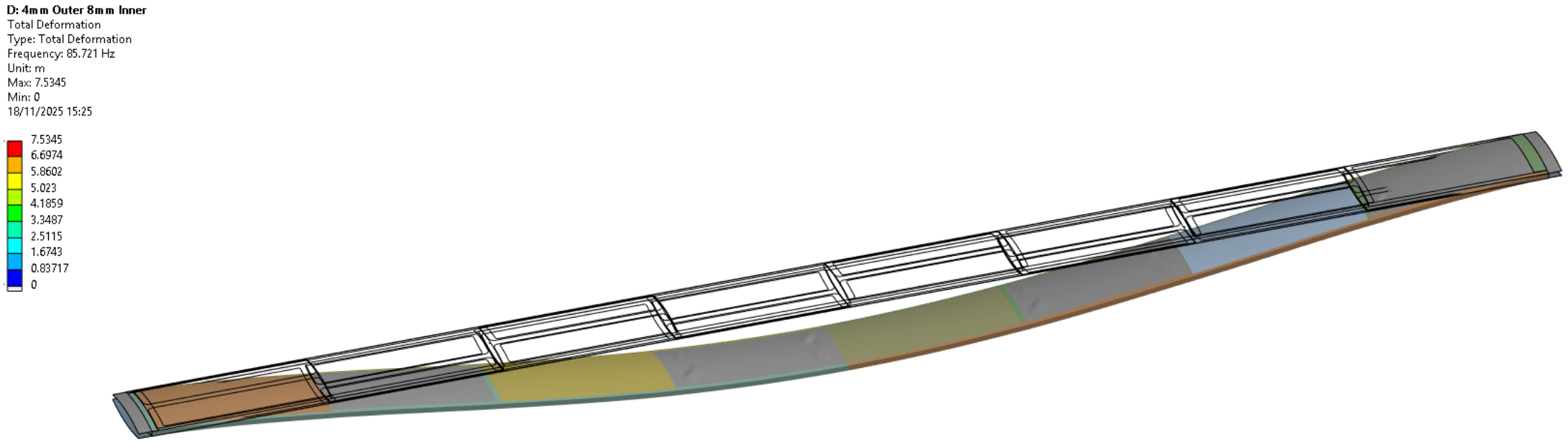
Modal Analysis – Closed Structure 0.1mm face sheet



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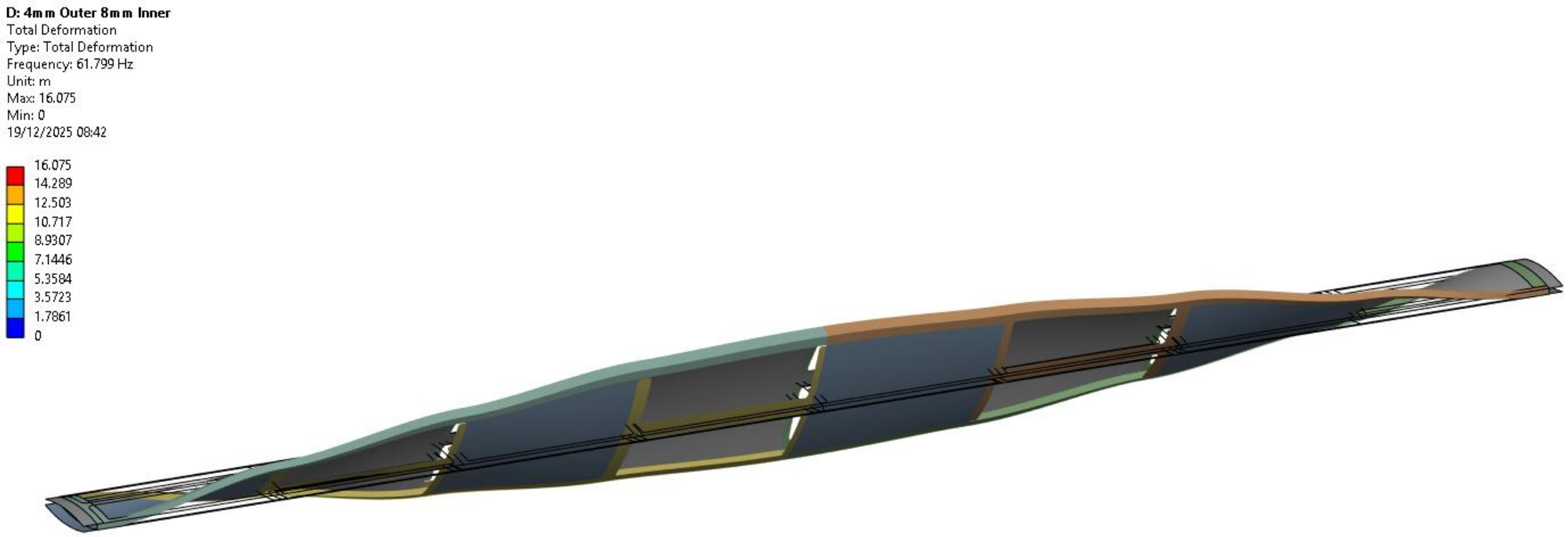
Modal Analysis – Open Structure 0.15mm face sheet



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Mass & Radiation Length

ITEM NO.	PART NUMBER	Material	DENSITY(kg/m^3)	MASS(g)	QTY.	TOTAL VOLUME	TOTAL MASS (g)	X0(cm)	X/X0
1	Cross Brace	K9 Carbon Foam	200	0.41	9	1.85E-05	3.69	260.82	0.02%
2	Longerons	8% Rel Vol Aluminium Foam	216	1.66	1	7.69E-06	1.66	296.5666667	0.01%
5	Mid Brace	3% PRV Foam	45	0.10	8	1.78E-05	0.8	644	0.01%
6	Carbon Top Plate	Carbon Fibre	2000	4.14	2	4.14E-06	8.28	19.32	0.07%
7	ALICE SENSOR ASSEMBLY	Silicon	2330	0.50	8	1.70E-06	3.961072	9.37	0.06%
9	Kapton FPC - 2-4	Kapton	1420	0.85	2	1.19E-06	1.693468	28.57	0.01%
10	MirrorLongerons		216	1.66	1	7.69E-06	1.66	296.5666667	0.01%
11	Kapton FPC - 1-3	Kapton	1420	0.70	2	9.86E-07	1.4	28.57	0.01%
12	Stave End Gas Feed	Ultem	1280	0.84	1	6.56E-07	0.84	28.57	0.01%
13	Stave End Gas Feed	Ultem	1280	0.92	1	7.19E-07	0.919726	28.57	0.01%

Total Mass	**24.90**	**Total Radiation Length**	**0.21%**

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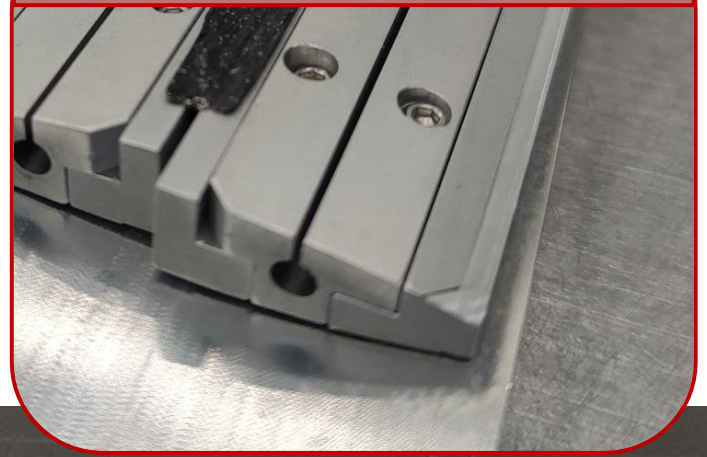
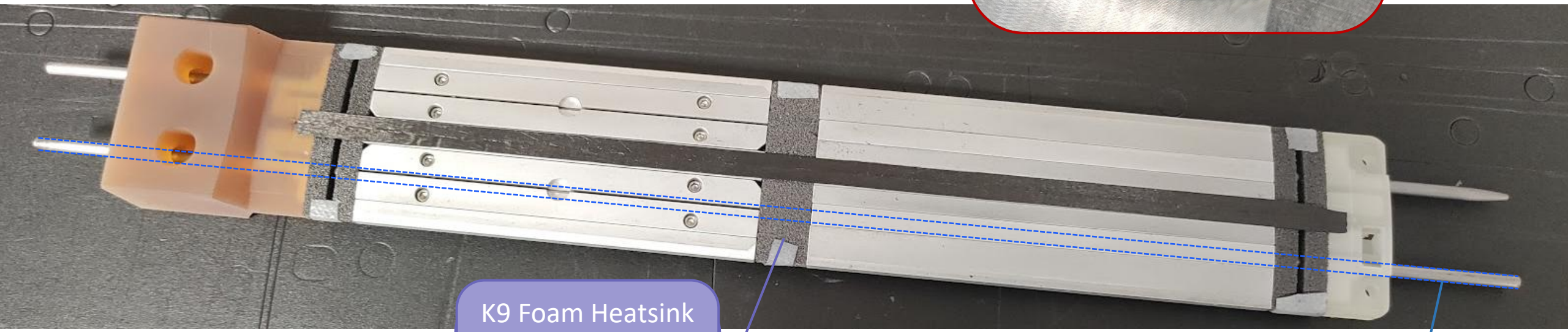
EXCLUDES CONTRIBUTIONS FROM FPC,BRIDGE FPC OR ASIC

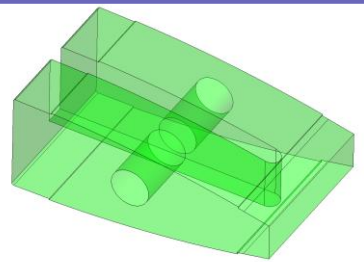
Stave Inner Structure

Aluminium Internal Formers





K9 Foam Heatsink



ø 3 mm Silver Steel rods

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