

Outer Layer Assembly Status

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of the Oxford Group



Ladder Assembly



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This we will see a lot of this in person on the lab tour later:

- Ladder assembly is relatively complex with many stages.
- I Will summarize over the next few slides to give an idea of process.
- Despite this we should be able to produce 1 or 2 ladders a day when running in production, depending on
 - tooling performance,
 - levels of testing,
 - workflow optimization,
- This is running significantly behind schedule due to delays in the tooling design. We have now completed the largest fraction of design effort and other departmental projects are being completed (eg LHCb RICH) freeing more design effort



Ladder Assembly Steps

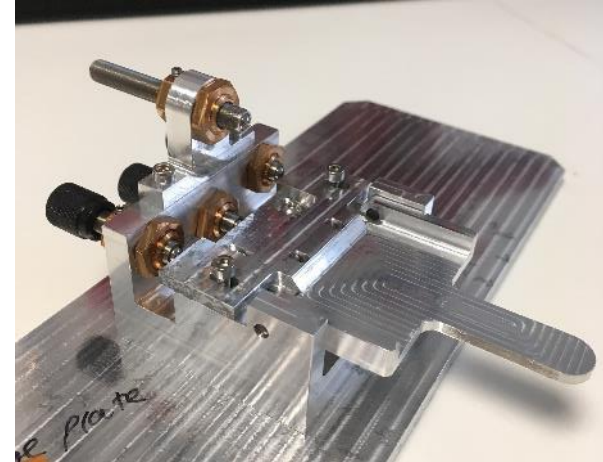


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0) Reception QC and testing, Interposer Flex Bending

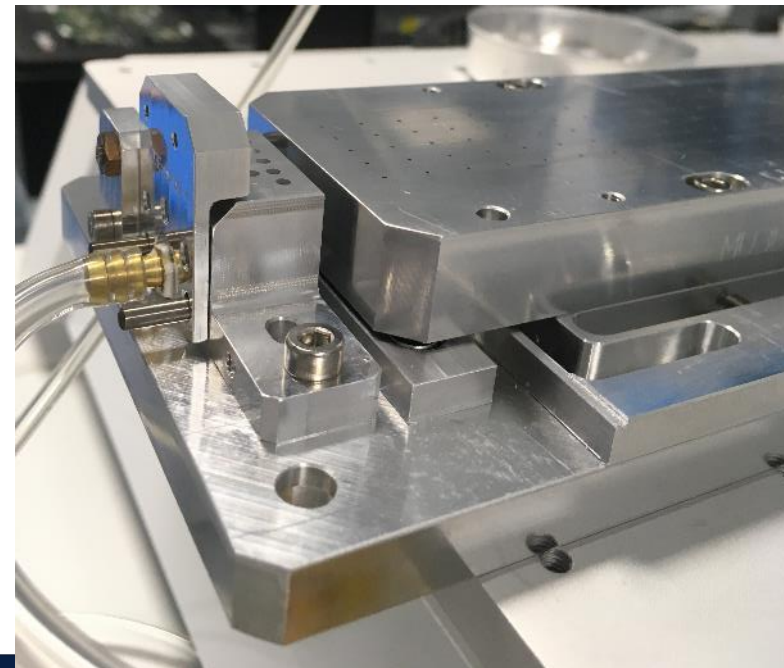
1) Interposer flex attachment:

- Interposer flexes placed on precision jigs and vacuum clamped,
- ladder flex placed vacuum clamped and
- Ladder flex aligned,
- glue applied with glue robot
- interposer flexes glued to ladder flex
- overnight cure



2) Interposer flexes tab bonding

- Alignment 'backs' taken off tooling to allow tab bonding
- Jig moved to bonding machine and tab bonding performed
- Combined flex clamped in ring frame
- Electrical continuity testing



Ladder Assembly Steps (cont)



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3) Chip Attachment

- Chips are placed with Robot on 'chip chuck' with better than 10um precision
- Chuck and chips moved to CMM and surveyed for alignment (vacuum stays on)
- Initial flex alignment performed (flex tuned over) and precision stops set
- Flex removed and glue deposited on glue robot (either on flex or chips)
- Flex placed and final alignment to tab pads completed
- Curing weight applied
- Overnight glue cure



Ladder Assembly (cont)



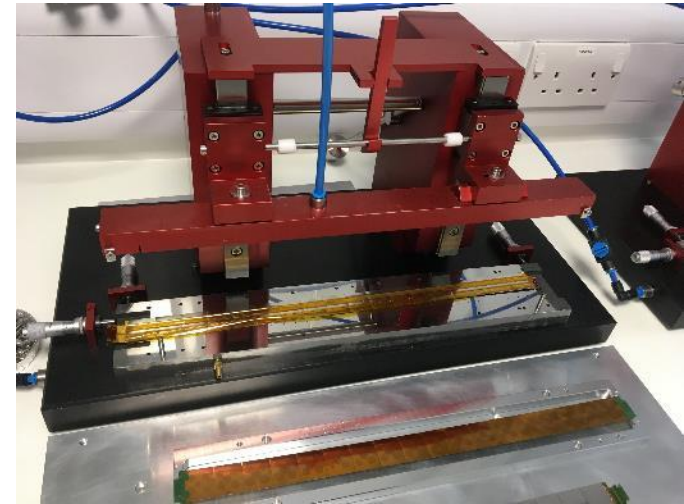
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3) Chip Tab Bonding

- Chip chuck with ladder is moved to tab bonder (vac and ring frame supported)
- Tab bonding completed (need at least two positions in bonder due to size)
- Electrical testing?

4) V-fold Gluing

- V-folds loaded into v-chuck using red linear stages from Heidelberg
- Ladder turned over onto flex chuck
- Glue deposited by glue robot (either on v-folds or chips)
- V-folds placed using red Heidelberg tools
- After 4 hrs Tool is removed and curing weight applied
- Overnight glue cure



5) Ladder final QC and testing



- We have been making tape heater ladders reasonably successfully and have some experience with the V-fold gluing process from this
- We have done some significant work on the robotic chip alignment and can get the 10um alignment.
- We are currently debugging the Si-Heater ladder tooling with mechanical parts, some mechanical tweaks needed.
- We should be building Si-Heater ladders by the end of the year
- SI Heater tooling will be 'fixed' to some extent in this process and final tooling will be made to slightly different geometry with lessons learned
- Still need to set up electrical testing and thin chip handling



Production Flow



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- Complex production flow, but all steps are reasonably short (30 to 45 mins).
- Will be working on 3 ladders concurrently due to overnight cure steps.
- Should still be able to get one ladder per day made
- Will anyway need L3 and L4 tooling so there is potential to increase rate to one of each a day.
 - Currently limited by availability of expert manpower (only one Alex)
 - Have previously developed SOP to make tape heaters and trained others, although this ladder is ~factor 5 more complex.
 - Would like to move away from depending completely on a single expert operator
 - May be able to make 1.5 a day
 - No reason can't produce L4 one day and L3 the next, but need to be careful not to confuse tools
- Hope to decouple chip testing from ladder building In production.
 - Chip testing can happen in parallel with good chips marked and stored in batches ready to use

Next Steps



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- Tooling debug and Si Heater production
- Mupix10/final Tooling design tweaks and fabrication (L4)
- Setup for Mupix probe testing
- Mupix10 ladder production
- Final Mupix tooling (L3) fabrication

