SUSTAINABLY SMART

Designing an iameco D4R tablet for FabLab Level Production

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GMIT Letterfrack

MicroPro™ Computers

Objectives

1. Achieving a **regenerative design paradigm** for the iameco D4R tablet, that can achieve:

- Reduction in consumption of raw materials and reduction in generation of e-waste by using renewable materials (wood) and by extending the lifetime of the product.
- Reduction of embedded energy and of energy consumed in manufacture and operation and end-of-life

2. Achieving a **localised manufacturing approach** that allows the commercialisation of the iameco D4R tablet in a financially sustainable way by MicroPro.

MicroPro Computers

- SME, based in South Dublin
- 30 years experience of retail and repair of computers
- 20 years experience of design and manufacture of green computers
- The iameco V3 integrated desktop was commercialised in 2010 and secured the World's First European Eco-Label for integrated desktop computers.
- The iameco D4R laptop was prototyped in 2014, winning various awards.
- Previous Partner in 4 EU Projects, under the LIFE II, FP7 and H2020 Programmes.

Iameco D4R tablet

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Design a D4R tablet that will:

- Draw on lessons from previous iameco models
- Be easy to disassemble and repair, even on DIY basis
- Have extended life for housing and components (e.g battery)
- Be reliable and robust
- Be adequate for manufacture in a FabLab environment.

Summary of Progress

28.02.17 (Month 18) - Produced the **Alpha Prototype** (AP) met most of the requirements of DoA, but agreed to carry out further improvements and produce a Beta Prototype to incorporate these.

30.10.17 (Month 27) – Produced the **Beta Prototype (BP)** complete with functional electronics, building and improving on AP version, as far as housing design. TRL 4 demonstrating integration of functional electronics parts, as well as other aspects of the completed Deliverable.

28.03.18 (Month 36) – Produced the Kappa Prototype (KP) re-designed to correct problems in previous prototypes, and manufactured in a local digital fabrication workshop at GMIT Letterfrack.

30.09.18 (Month 43) – Replaced temporary frame with metal frame as well as making design improvements to the KP. Also, preliminary contact has been made with FabLab Berlin, to explore the viability of manufacture of the KP in their workshops (including the metal frame), with follow up in Jan. 2019.

Alpha Prototype

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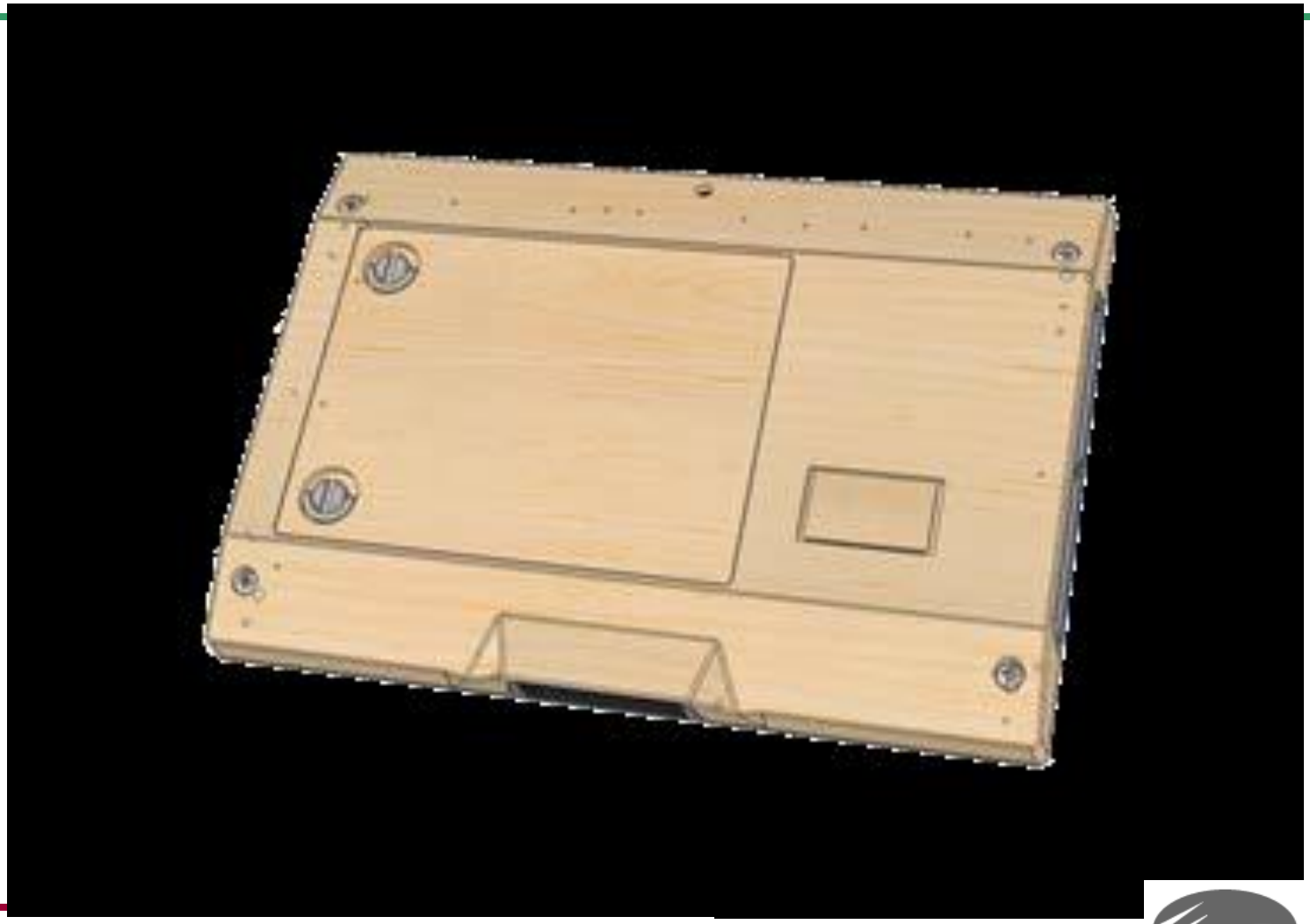

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Beta Prototype

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Kappa Prototype

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GALWAY-MAYO INSTITUTE OF TECHNOLOGY INSTITIÚID TEICNEOLAÍOCHTA NA GAILLIMHE-MAIGH EO
A GMIT / CONNEMARA WEST PARTNERSHIP
The Furniture College

National Centre for Excellence in Furniture Design and Technology

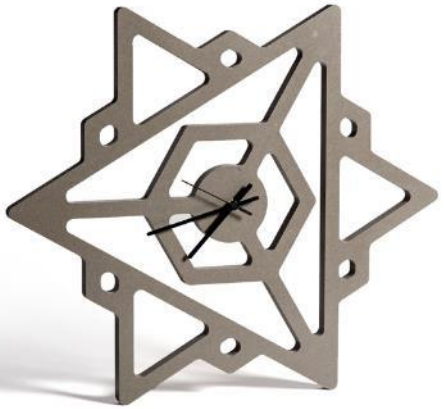
- Established in 1987
- Quality-centred approach
- Programmes aligned with industry

Bachelor programmes

- Furniture Design and Manufacture
- Furniture & Wood Technology
- Teacher Education

Graduate skills

- Craft – Design and cabinetmaking
- Technology – CNC/ Laser / 3D printing
- Automation – CAD/CAM/Robotics
- Management – Operations / Lean / Project Management



Role of GMIT (Letterfrack)

1. Re-engineer housing to make production more efficient without compromising overall aesthetic
2. Make design improvements to wooden housing where necessary
3. Reduce machine time (energy / o/h costs)
4. Limit post-processing time (labour costs)
5. Improve ease of disassembly

Design for Manufacture

Machinery

- Homag Venture 3M CNC
- Epilogue Fusion Laser

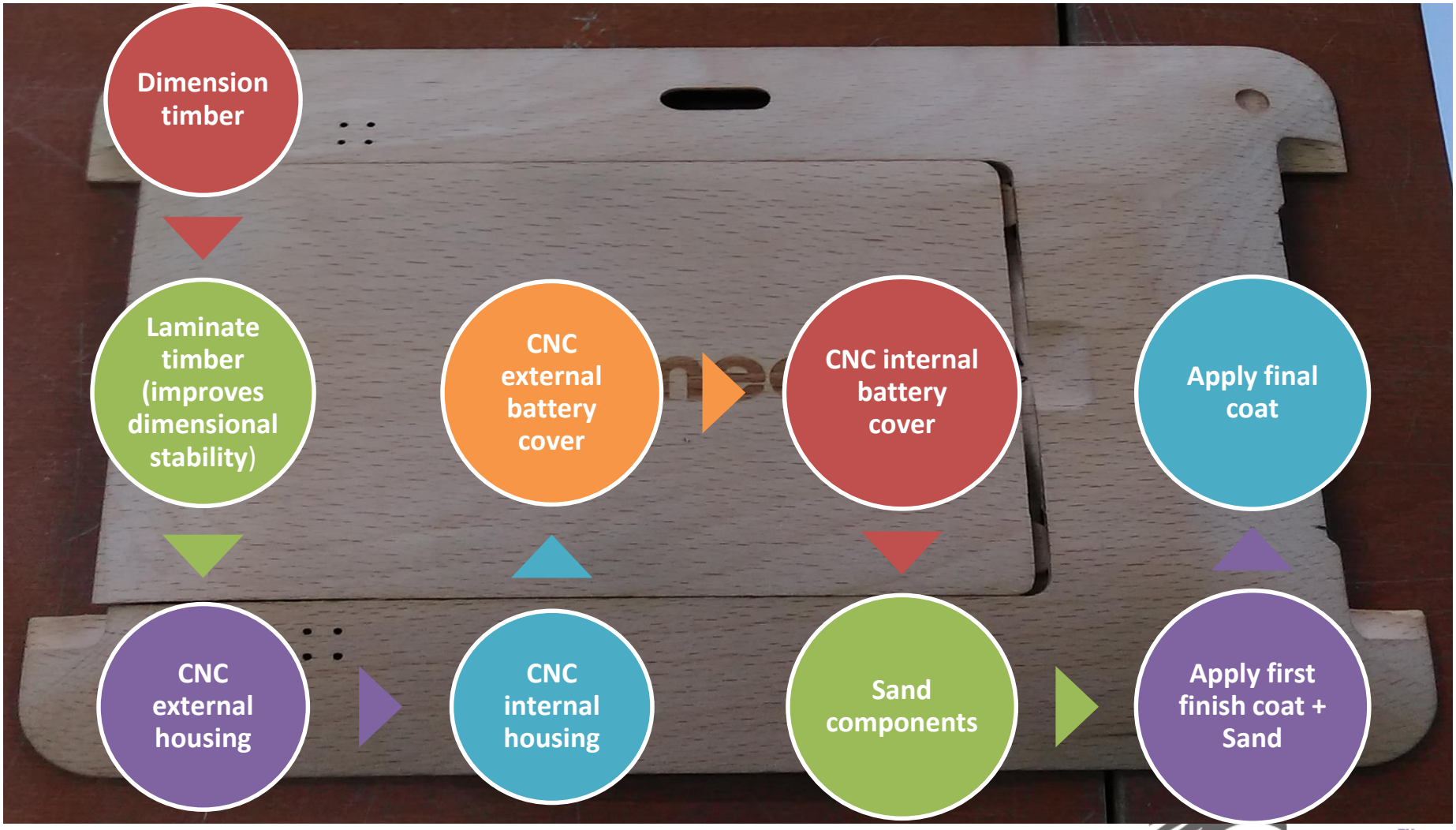
Software:

- CAM: Alphacam & Woodwop
- CAD: Autodesk Inventor

Materials

- FSC Certified timber – Beech, Walnut

Process diagram



3.3.4 Designing an iameco D4R Tablet for Fab-Lab

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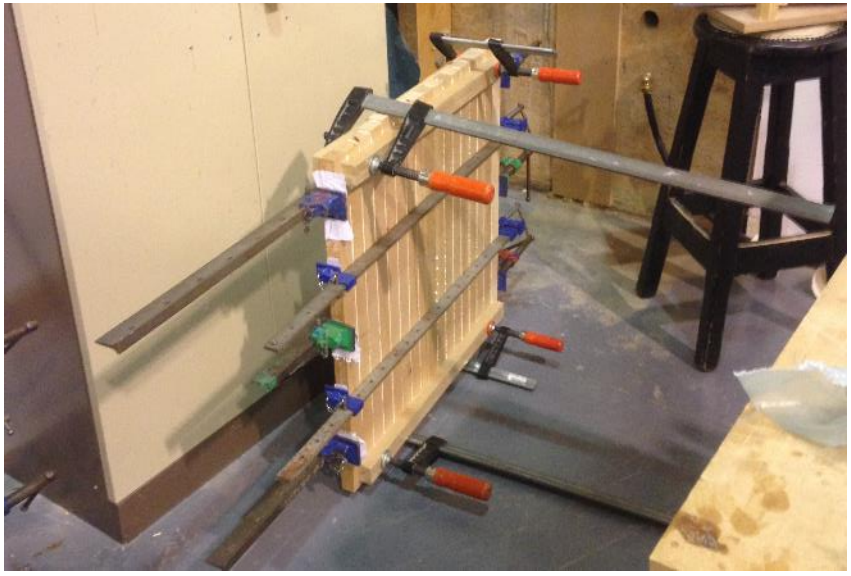
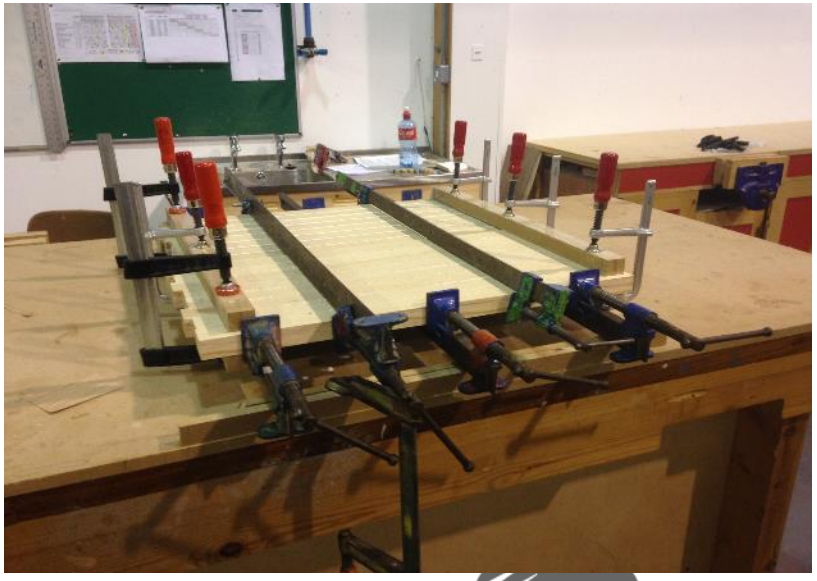
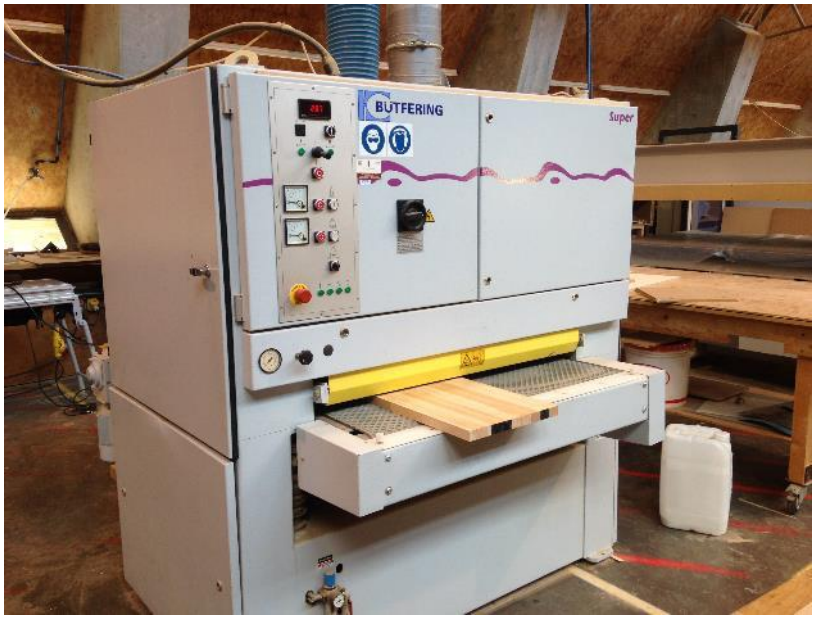




3.3.4 Designing an



3.3.4 Designing an iameco D4R Tablet for Fab-Lab

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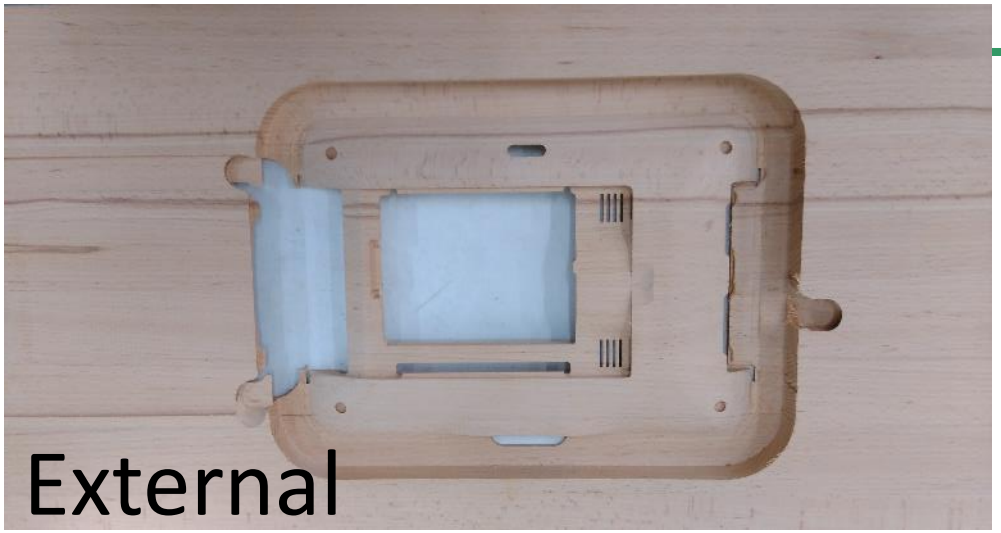
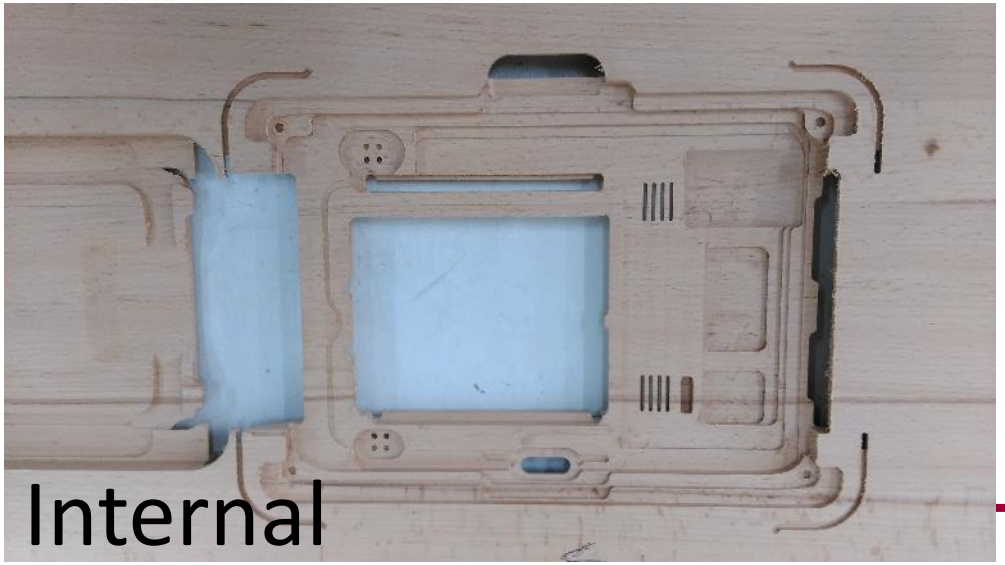
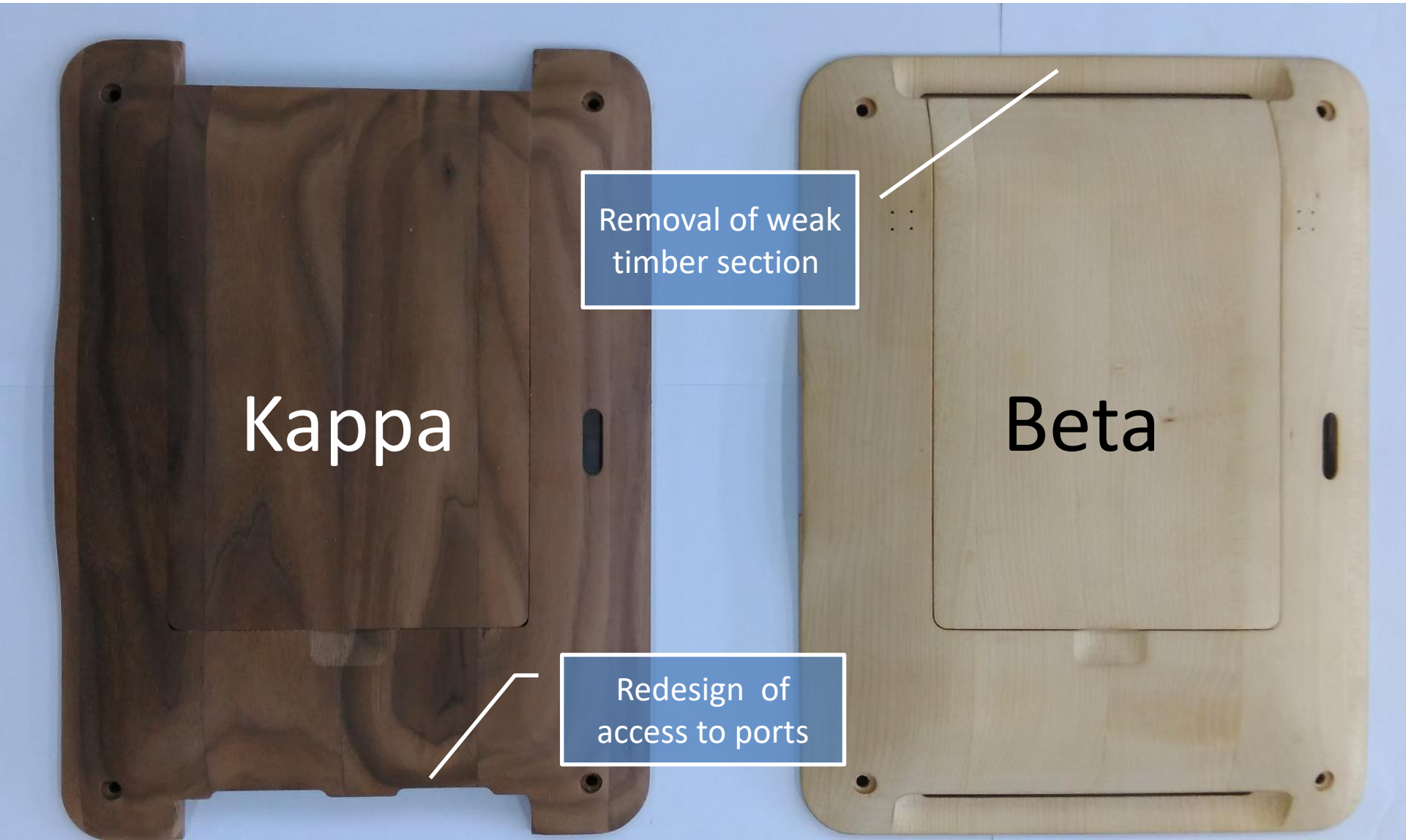
Machining Strategy



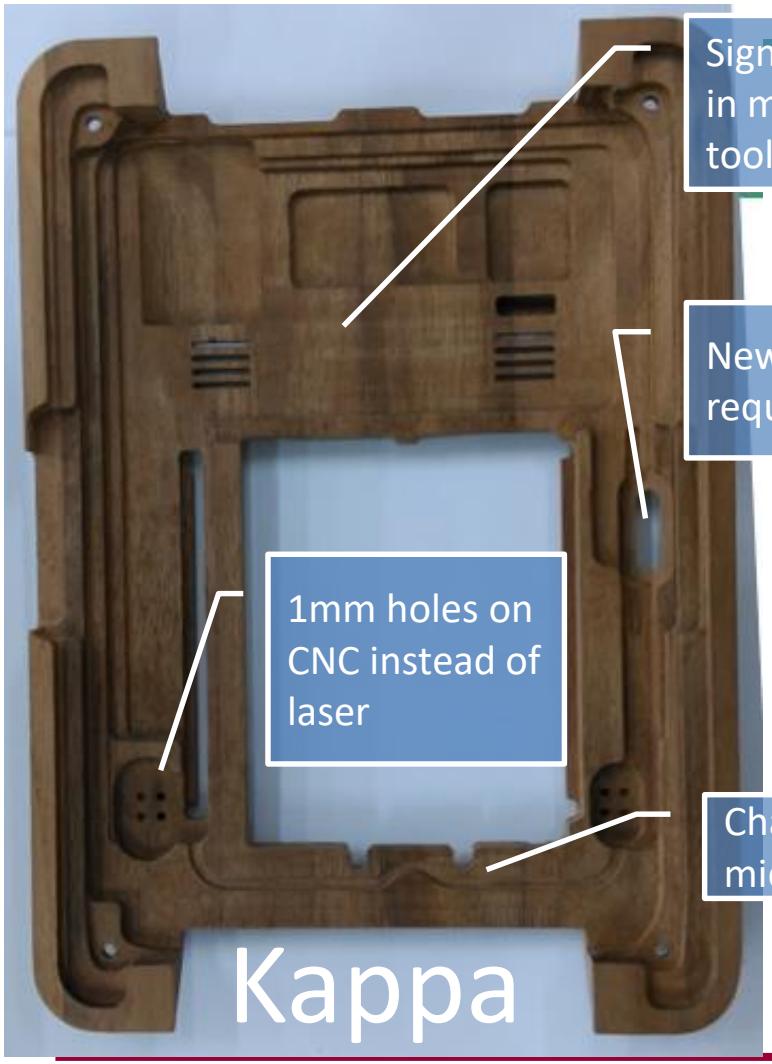


- Entire housing capable of being machined from one mpr file drawing
- Requires just two placements of material

Design improvements - External Housing



Design improvements - Internal Housing



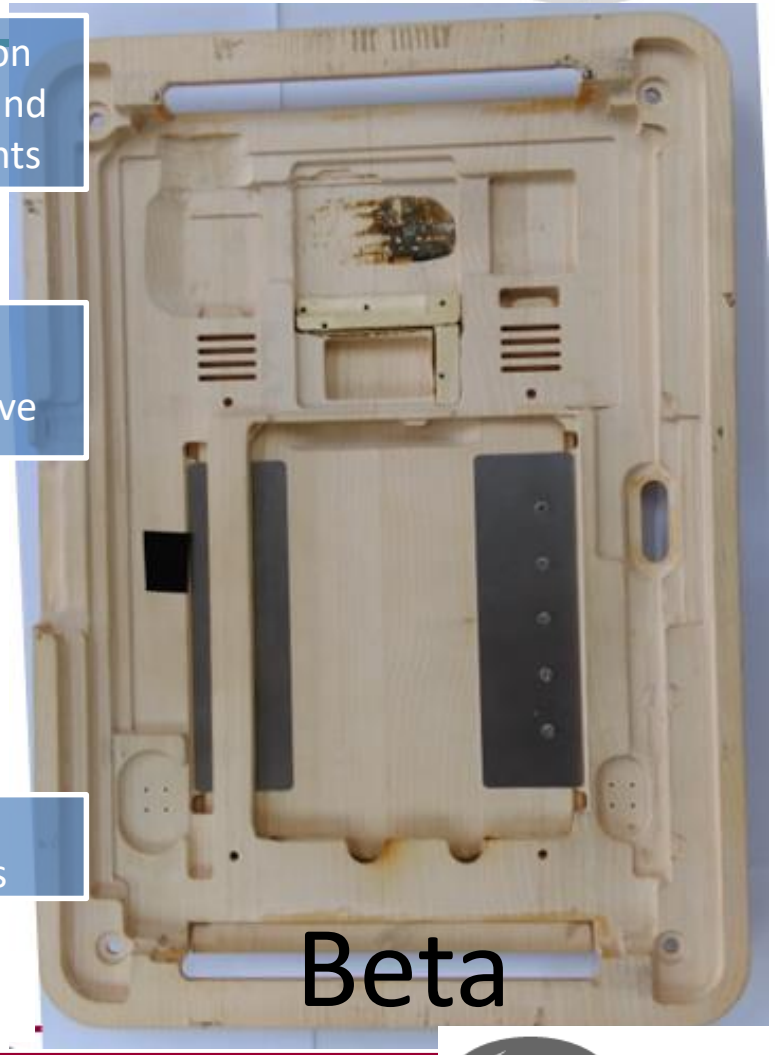
Significant reduction in machine paths and tooling requirements

New lens fitting requires no adhesive

1mm holes on CNC instead of laser

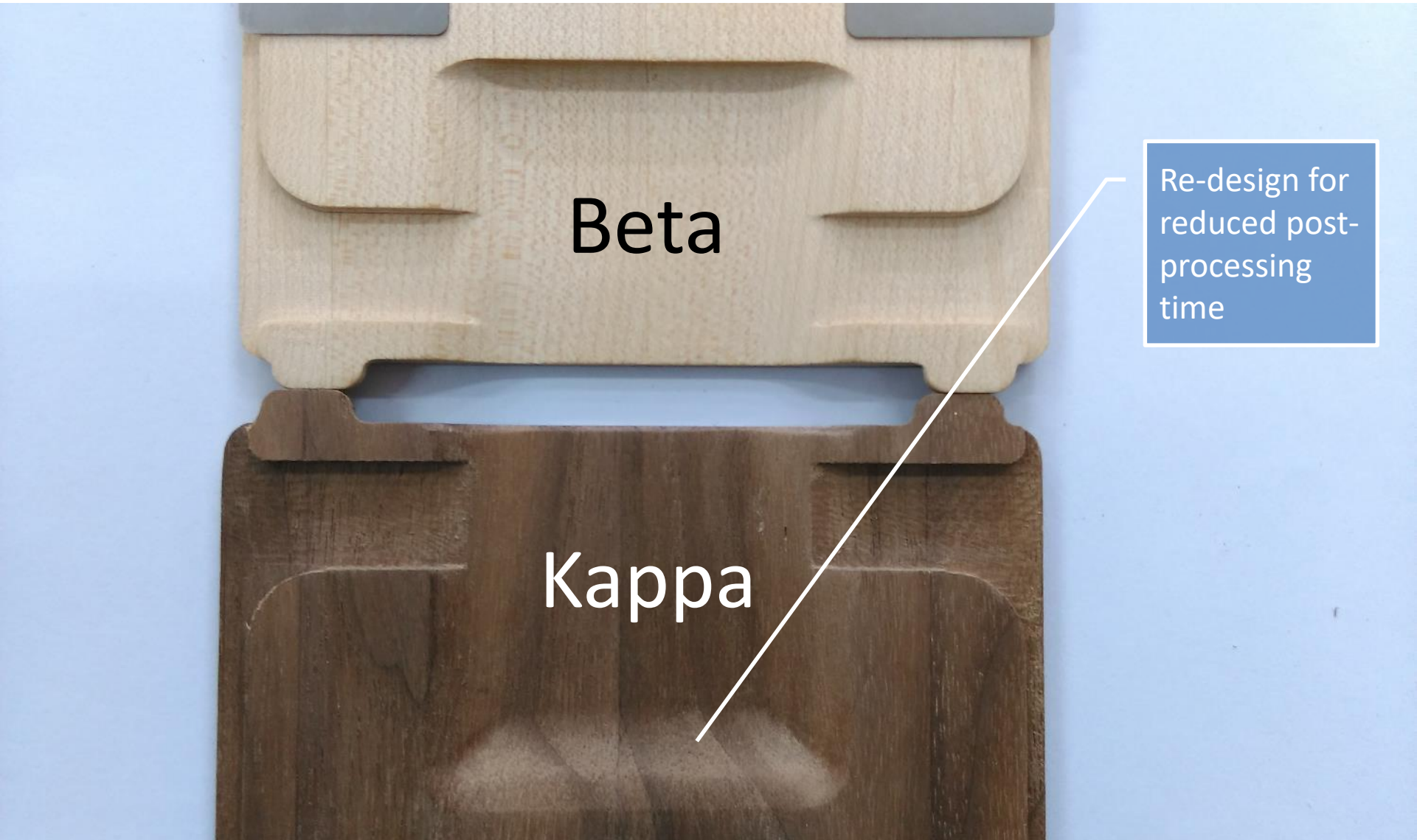
Channels for microphone wires

Kappa

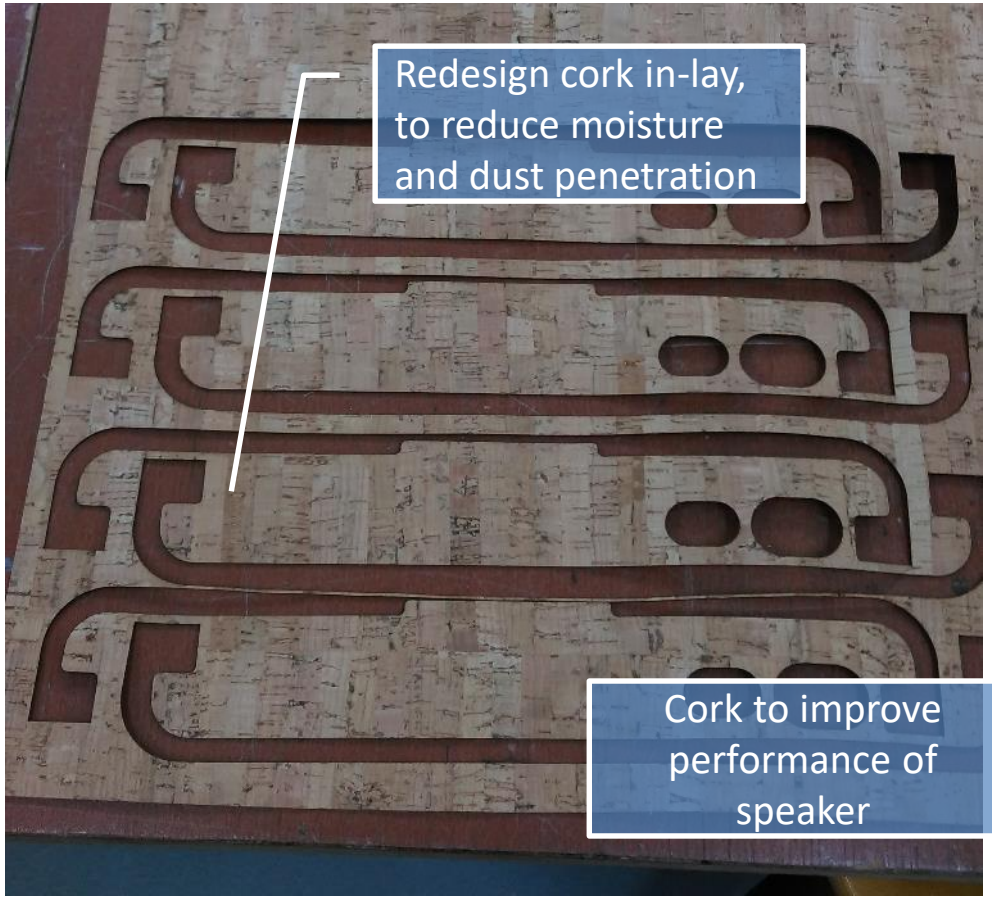


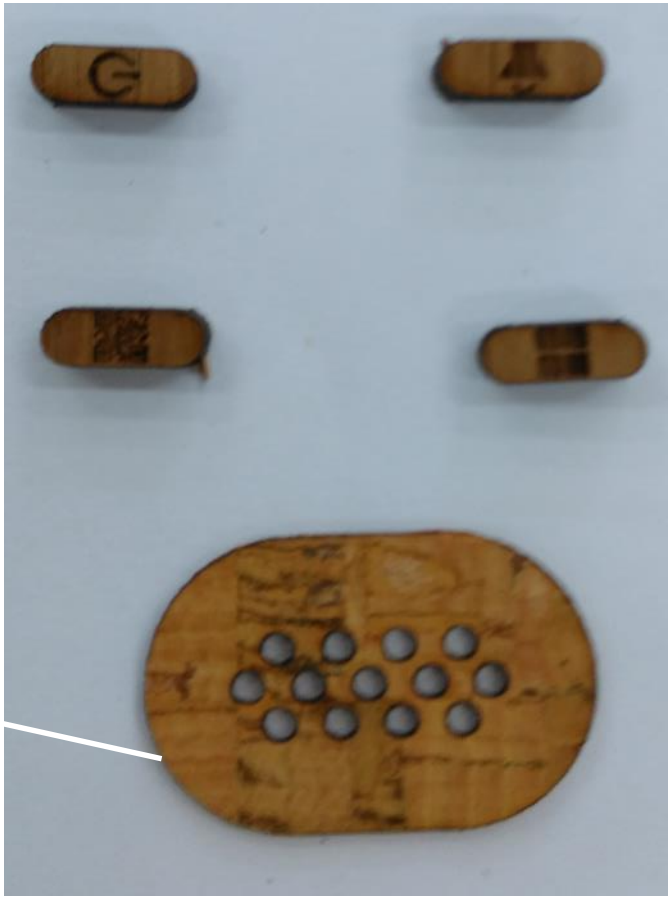
Beta

Design improvements
- battery cover



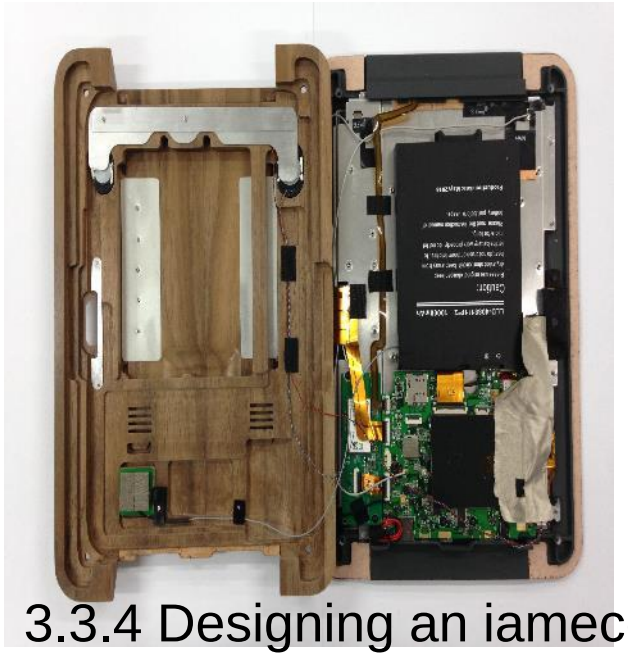
Laser cut components





Results

- Single Prototype production times: External – 54 mins, Internal - 64 mins
- Entire housing now capable of being machined from one mpr file drawing
- Minimise number of tool changes (time saving)
- Quality of prototype improved
- Elimination of glues for assembly



3.3.4 Designing an iameco D4R Tablet for Fab-Lab

Considerations - Timber utilisation

Properties - different mechanical and physical properties in each species

Quality – consistency important

Natural – no two pieces the same

Hygroscopic - moisture varies with environment

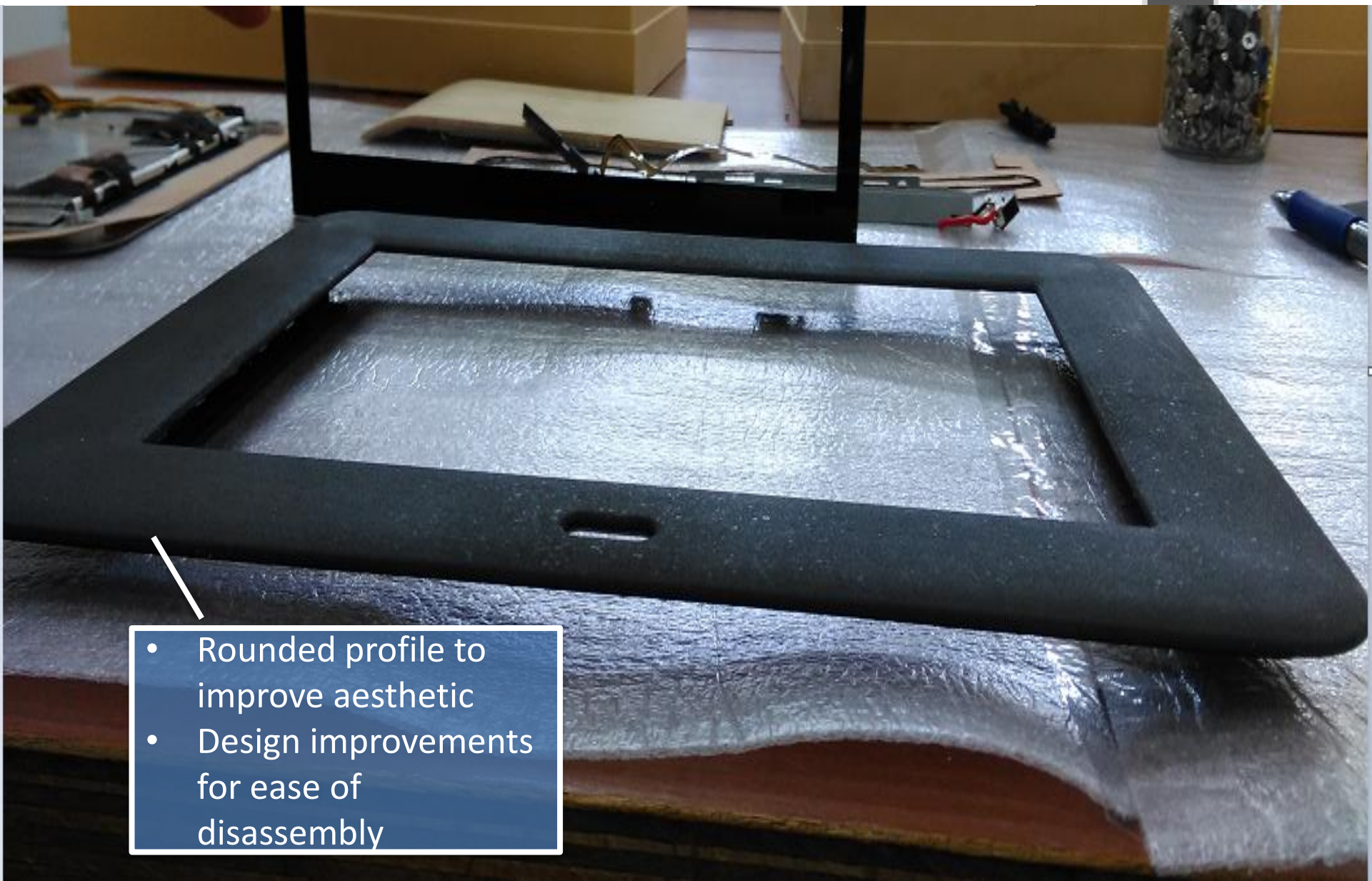
Aesthetics – Grain pattern, colour, lustre etc.

Finish – improves in-service performance

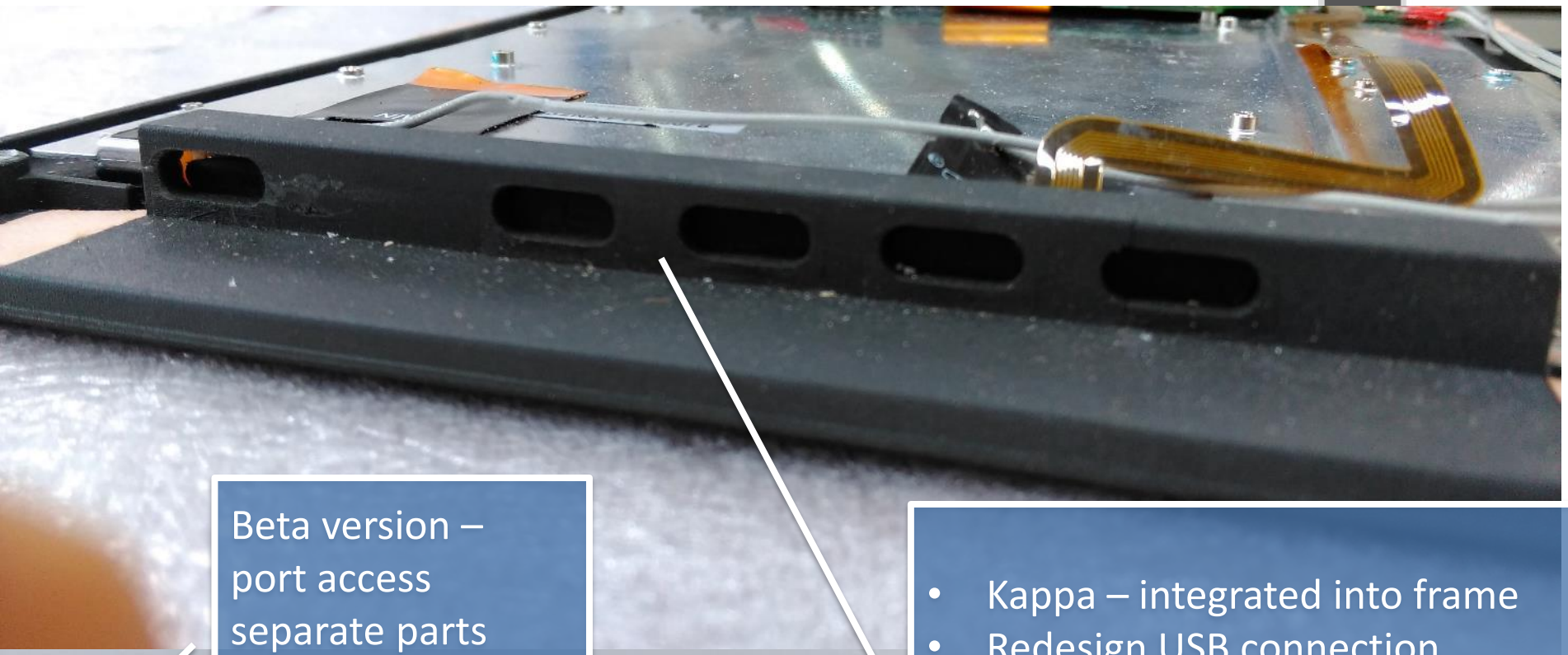
Sources - Sustainability / non sustainable forests

Affinity – people 'connect' with timber

Design Improvements - Frame



Design Improvements - Frame



Beta version – port access separate parts

- Kappa – integrated into frame
- Redesign USB connection interface
- Incorporates ports for USB / DC power etc.
- Positioning and alignment of screws / fixings resolved
- Frame secures electronics board

iameco D4R tablet metal frame

iameco D4R tablet wooden housing

iameco D4R USB interface

MA research by GMIT

- Further improvements to machine strategy (reduce time of machining)
- Application of DFSS (Design for Six Sigma)
- Time and motion study of production
- Attain accurate production costs
- Explore optimisation for batch production
- Research optimum species
- Research optimum finish

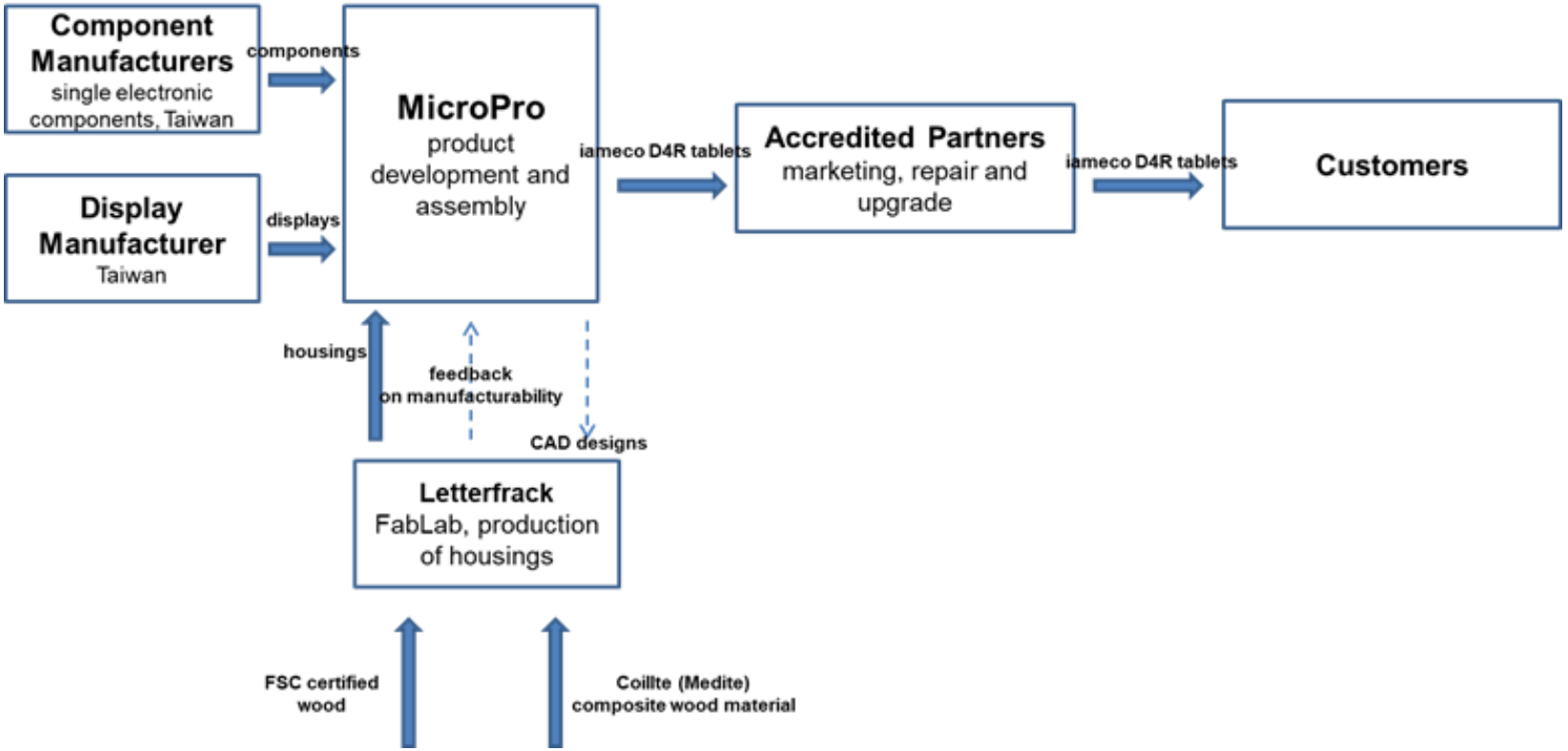
Electronics in Kappa Prototype

- Intel Quad Core 1.83GHz, 10.1” with 4G/128G
- WiFi - 802.11B/G/N/AC wireless 2.4G/5GHZ
- 1*MicroUSB, 1*USB2, 1*TF CardSlot, 1*HDMI, 1*Earphone jack,1*SimCardSlot
- Built in 4.0 Camera: front 2.0 MP, rear 5.0 MP
- Modular GPS and Kill switch - optional
- Modular fingerprint sensor - optional
- Docking Station, Additional Battery, Handheld Belt
- Software: Android or Microsoft

Materials used in Kappa Prototype

- Chassis: recycled aluminium
- Back cover: walnut (or any other wood)
- Seals: cork
- Protection lens of camera: acrylic glass
- 3D Printed parts: ABS/PLA (plastic)
- Screws: phillips galvanized steel
- Small quantity of steel including flat panel

Proposed production model



Outlook

- Finalise testing of Kappa Prototype by Grant4Com, iFixit, Fraunhofer IZM
- Carry out MA research (Letterfrack College) into optimised design and production of KP in their (SME/FabLab-equivalent) workshop and other commercial and non-commercial environments.
- Review capacities of Berlin FabLab (and possibly other FabLabs) to support fabrication of iameco D4R tablet.
- Develop business plan model.
- Possible follow-on H2020 Project.

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Q&A

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