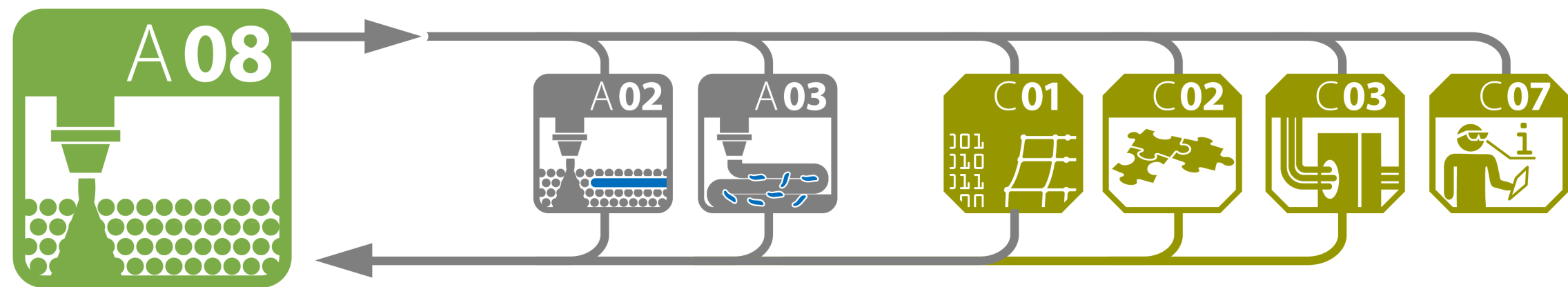


Structural Timber by Individual Layer Fabrication (ILF)

Dr.-Ing. Klaudius Henke
Dr. rer. nat. Frauke Bunzel

Chair of Timber Structures and Building Construction, TUM
Fraunhofer Institute for Wood Research, Wilhelm-Klauditz-Institut, WKI

Summary

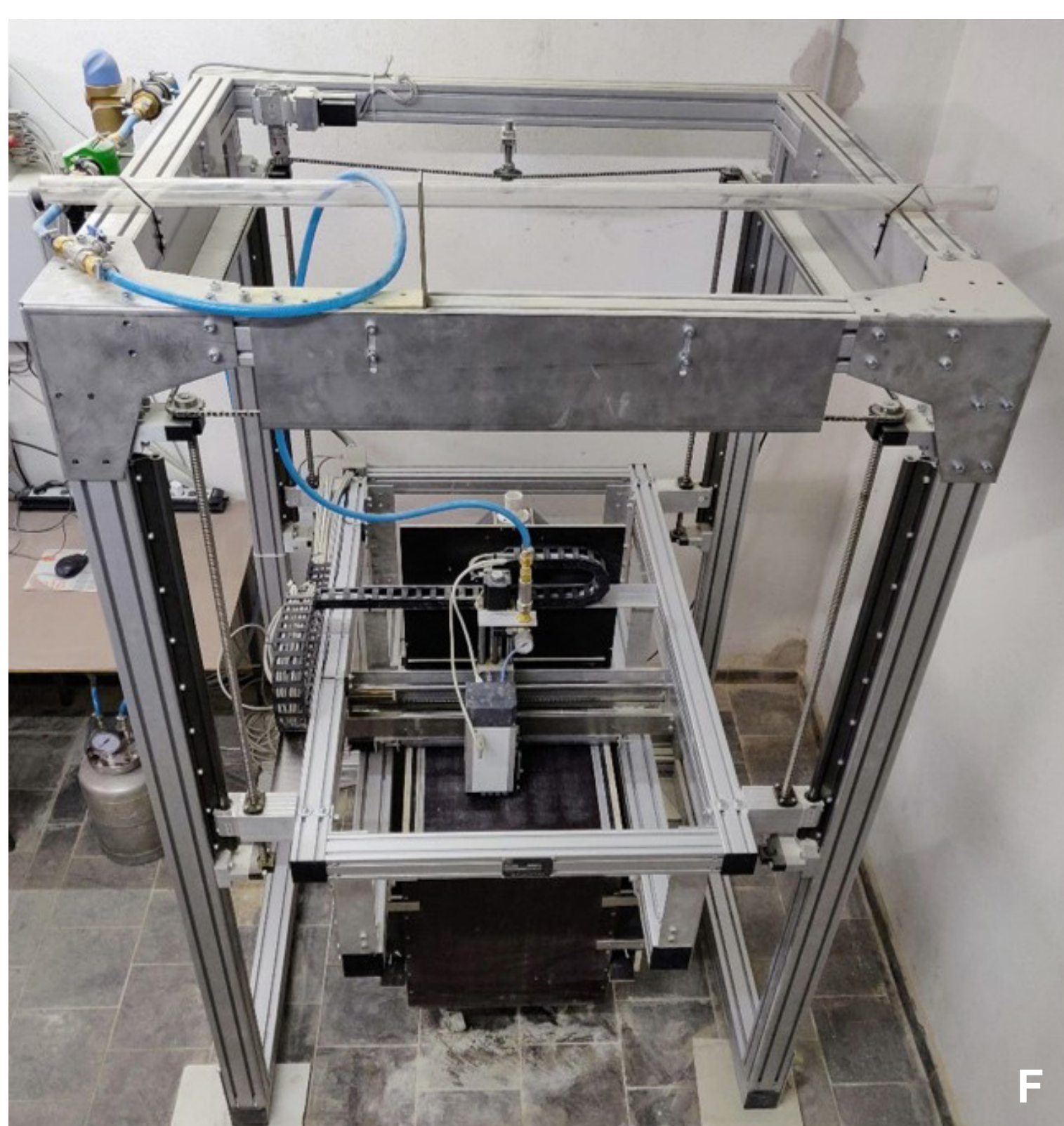
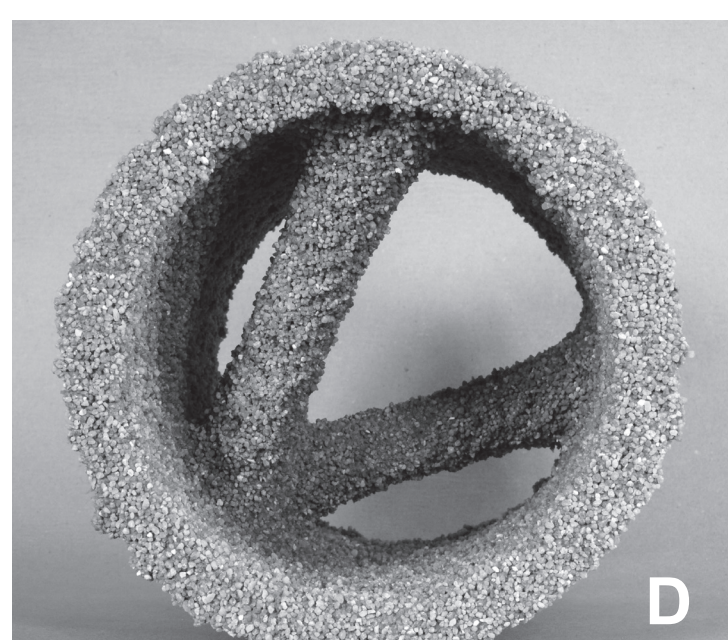
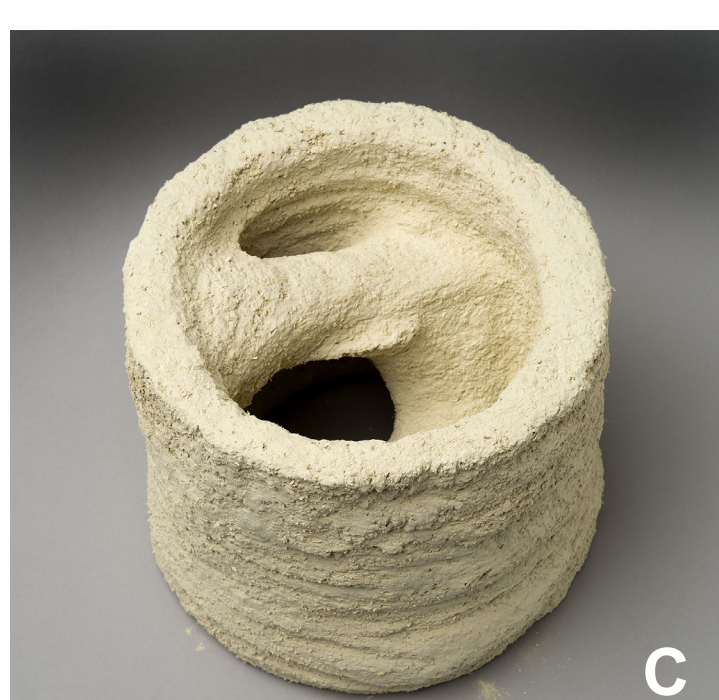


In project A08 a novel fabrication process is to be researched that allows the use of wood in the additive manufacturing of structural elements. In this process the parts are built up by laminating contoured panels of wood composites. The fabrication of the panels is realised by selective binding of wood particles by the use of

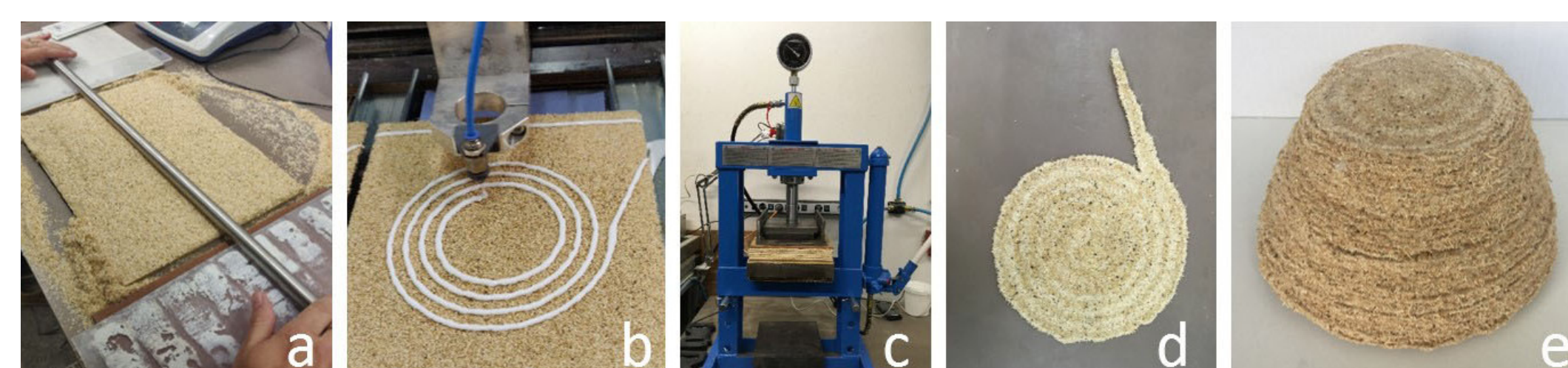
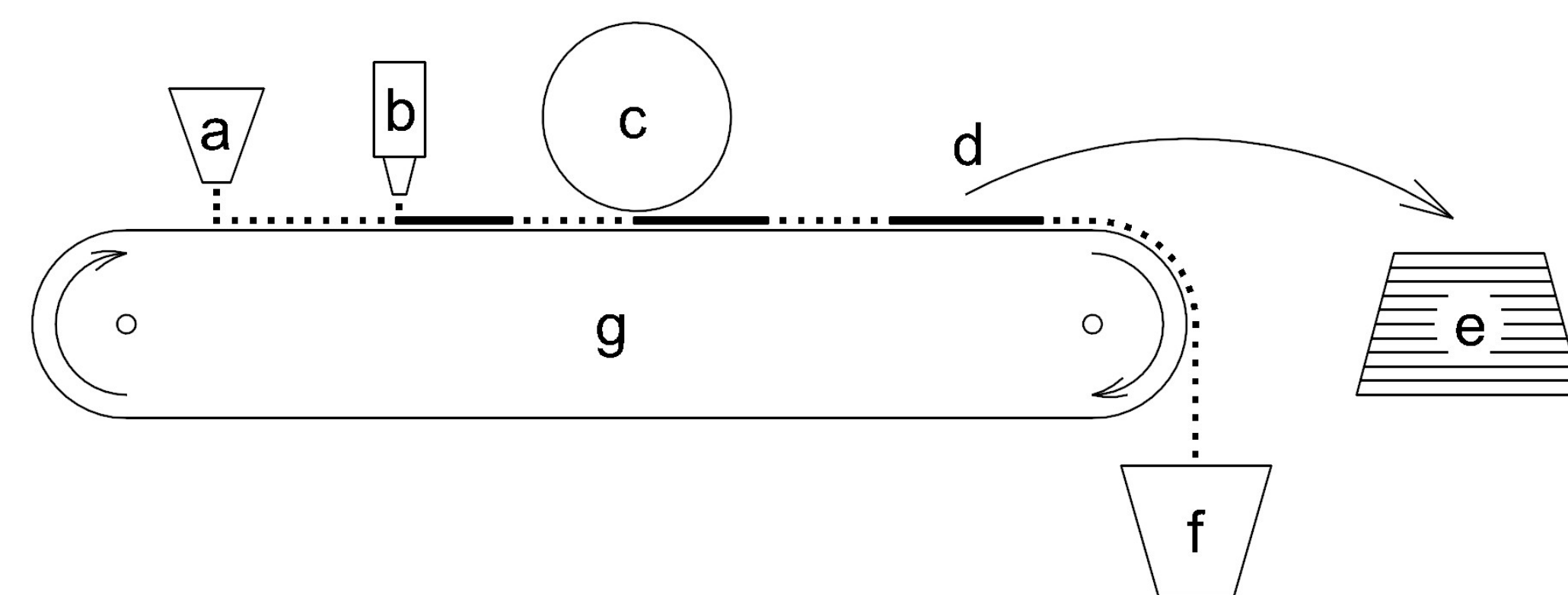
mechanical pressure. The work programme focuses on the investigation of materials and processes. In addition, the construction applications of the components produced in this way are to be examined.

Preliminary Work

Extrusion of wood concrete (A), extrusion of lightweight concrete (B), selective binding of wood particles with cement (C), selective cement paste intrusion (D), orientation of strands (E), selective cement activation (F)

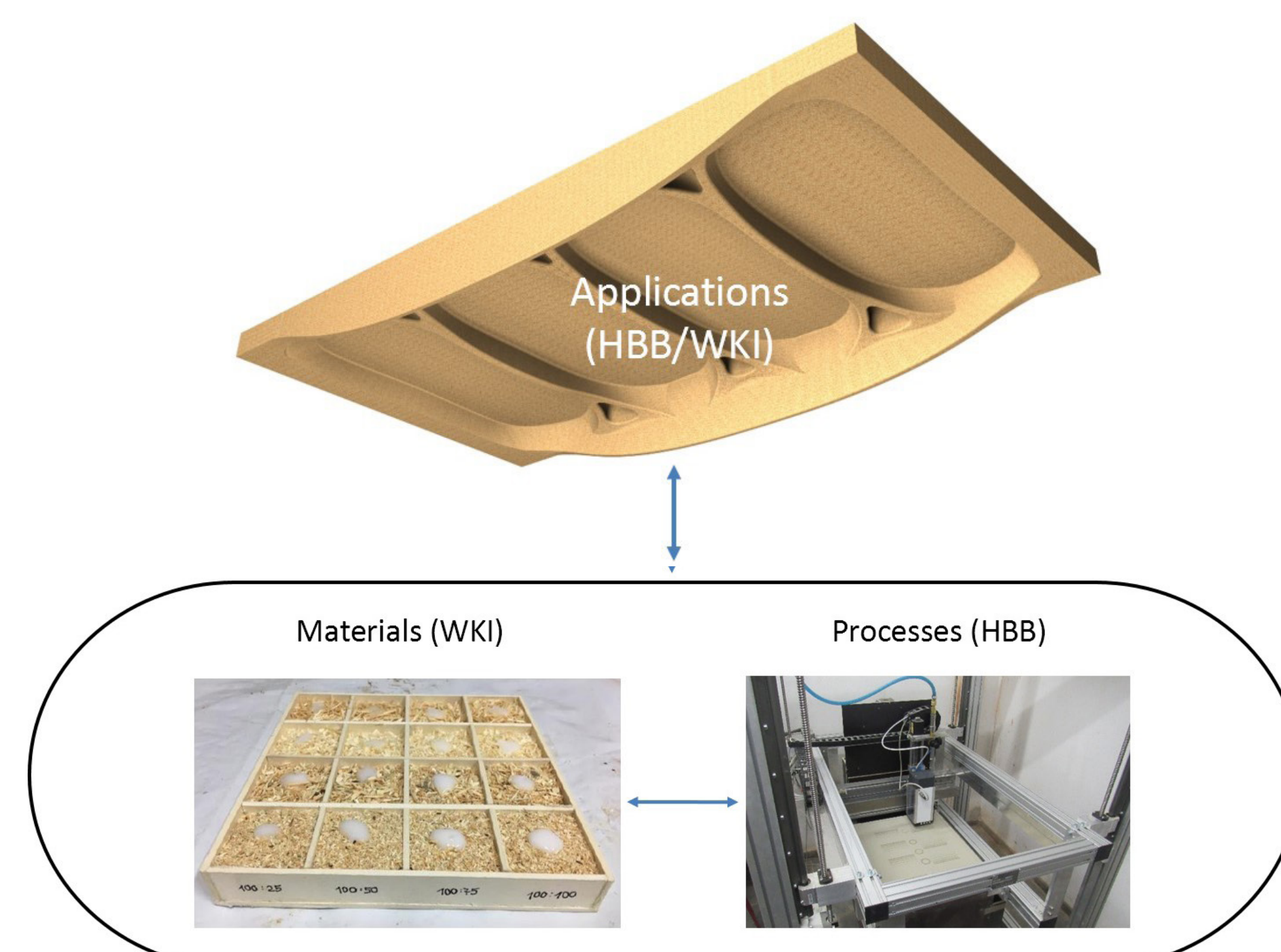


The ILF-Process



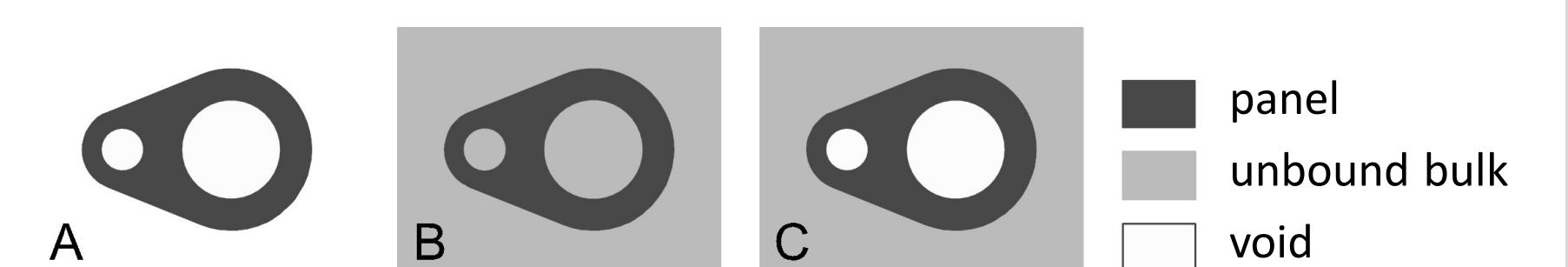
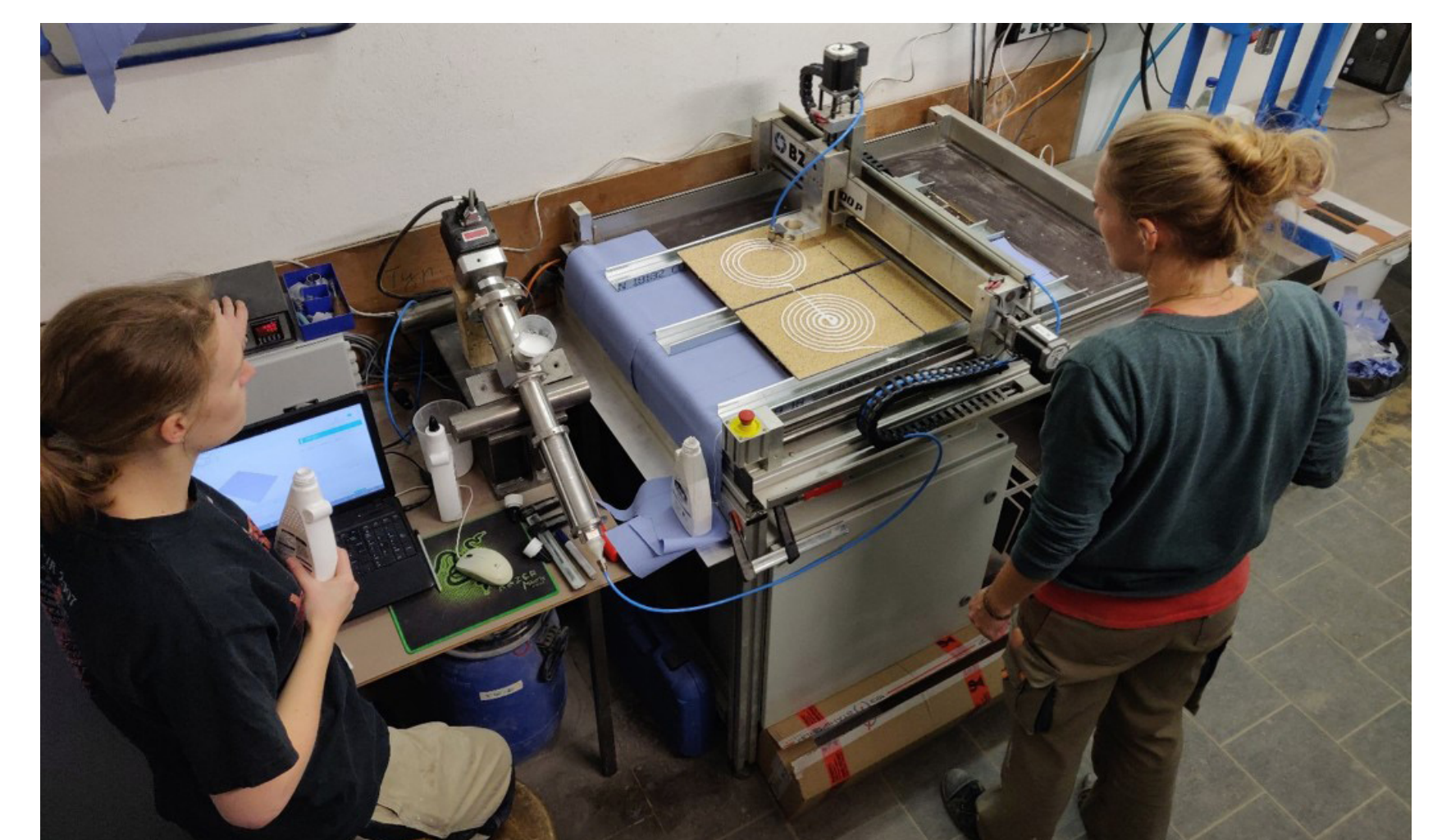
The process is organised as a continuous operation, e.g. by the use of a conveyor belt (g), consisting of several subsequent working steps: Particles are spread (a) by a scattering device; a valve or print head applies binder locally limited to those areas of the bulk that are intended to be bound (b); mechanical pressure is applied with a press (c), completing the fabrication of the individual layer; finally, the unbound bulk is removed (f) and the completed contoured panels (d) are picked and placed to be laminated to form the desired object (e).

Project Structure



Main Advantages

- renewable material
- possibility to reuse waste wood
- low adhesive content due to use of mechanical pressure
- strength values expected to be comparable to those of standard wood particle boards
- high geometric freedom characteristic for selective binding processes
- dimensional accuracy adjustable by subtractive post processing of individual layers
- unfilled closed internal cavities feasible
- continuous process
- building speed increasable by several parallel production lines



Variants of ILF: panel stacking (A), layer stacking (B, C)

Particular Challenges

- scattering of bulk (particle properties, particle orientation)
- controlled intrusion of fluid into the bulk (properties of adhesive, grain distribution, compaction of bulk)
- handling of (partly bound) layers
- laminating (application of adhesive, pressing)