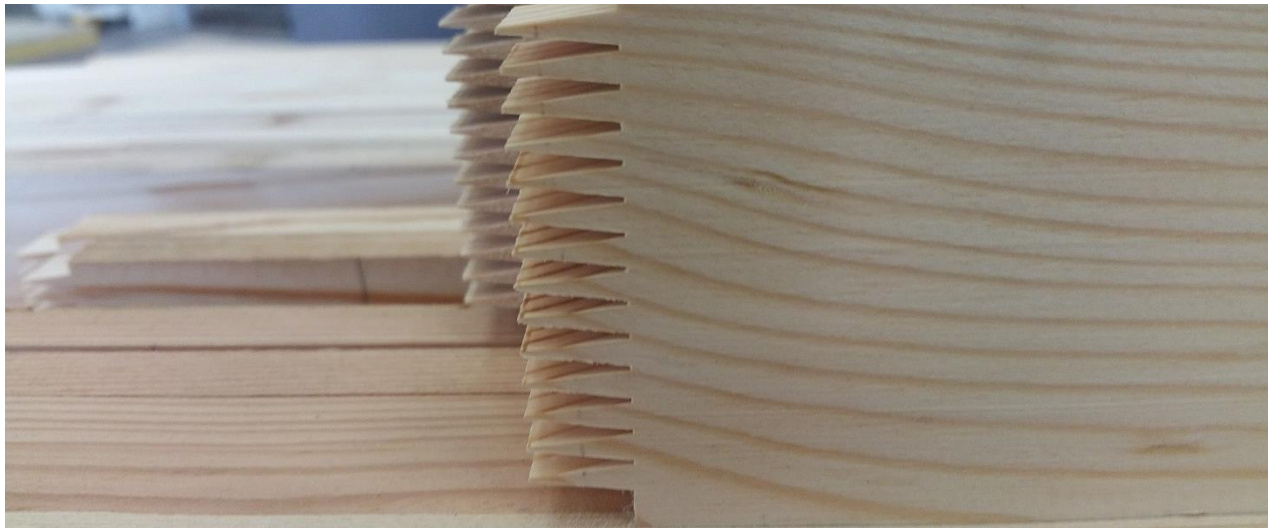
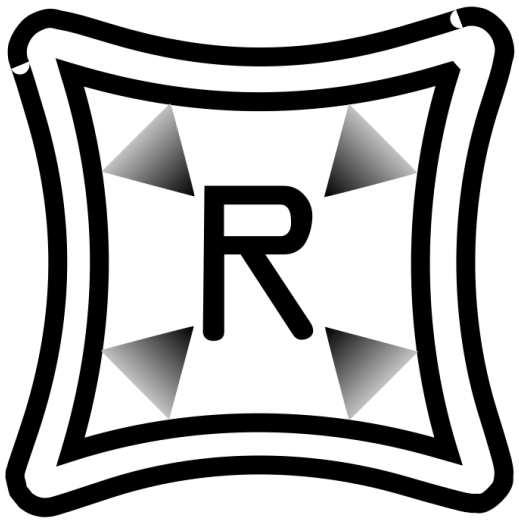
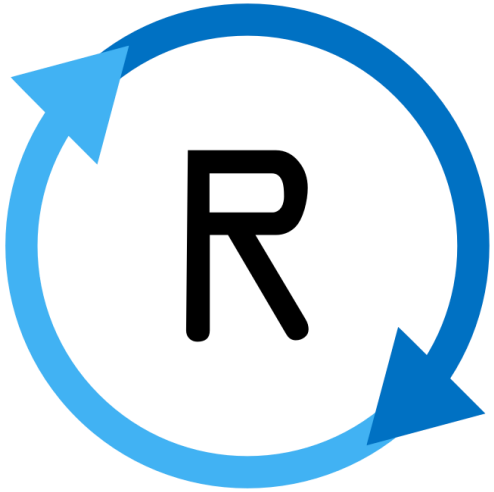
Enseignement – Recherche
Sciences & technologies du bois

Nantes,
23 Novembre 2017

Solid Wood Recycling via the CaReWood Process







Reduce Reuse Recycle

Cascading Recovered Wood

French recovered wood grades

- Class A
  - Clean
  - Packaging
- Class C
  - Preservative treated
- Class B
  - Everything else

A typical waste wood stockpile

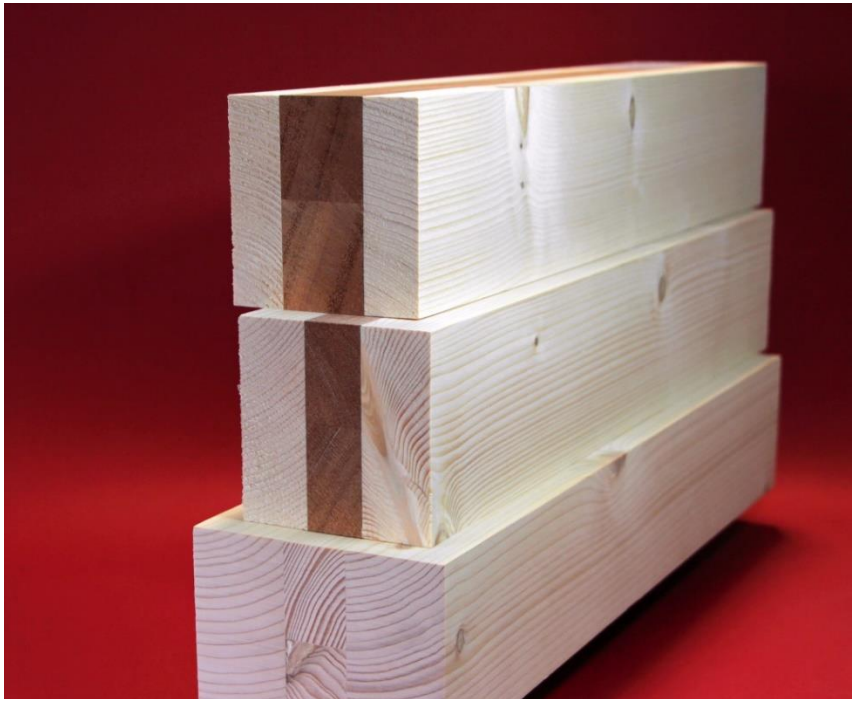
Typical process is chipping

- Particle uses:
  - wood-based panel manufacture; biomass energy generation; animal bedding; mulches; equine surfaces; pathways and coverings
  - low value relative to solid wood
- only 1 re-use (except for panels)

Is there a better way?

To go from here

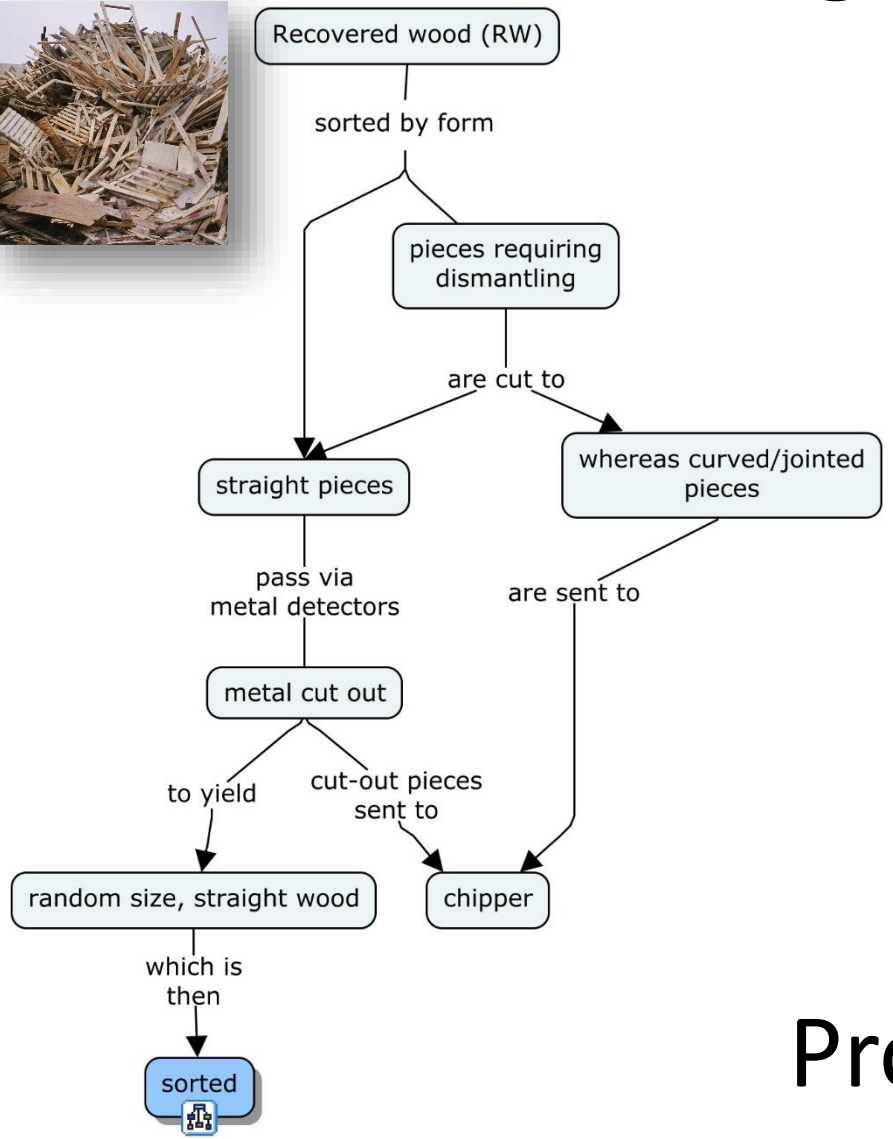
to here

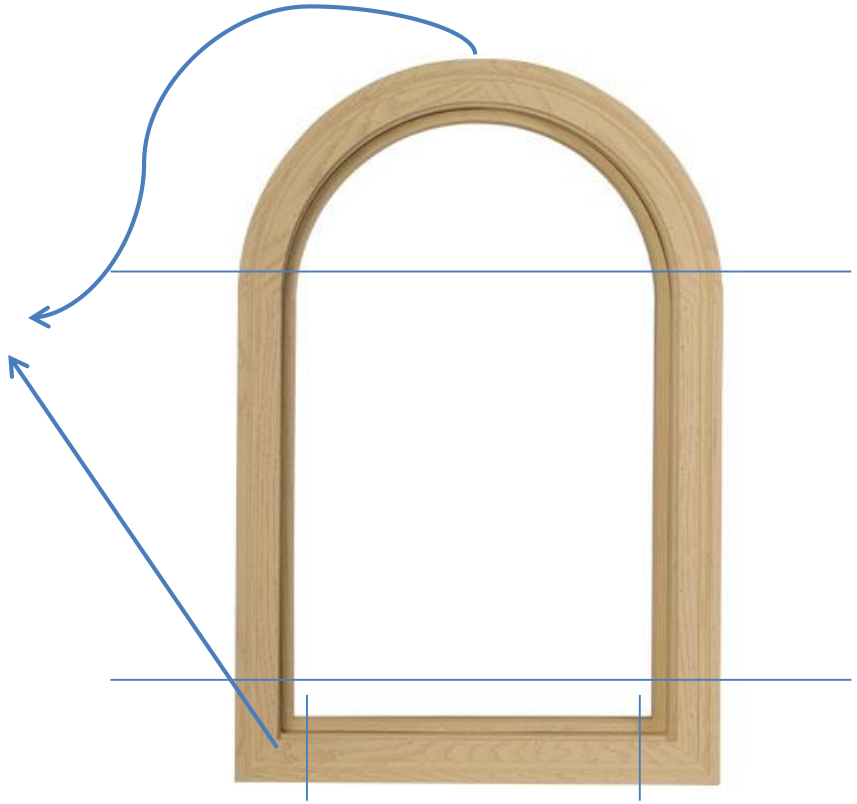


is easy to understand

but difficult to implement

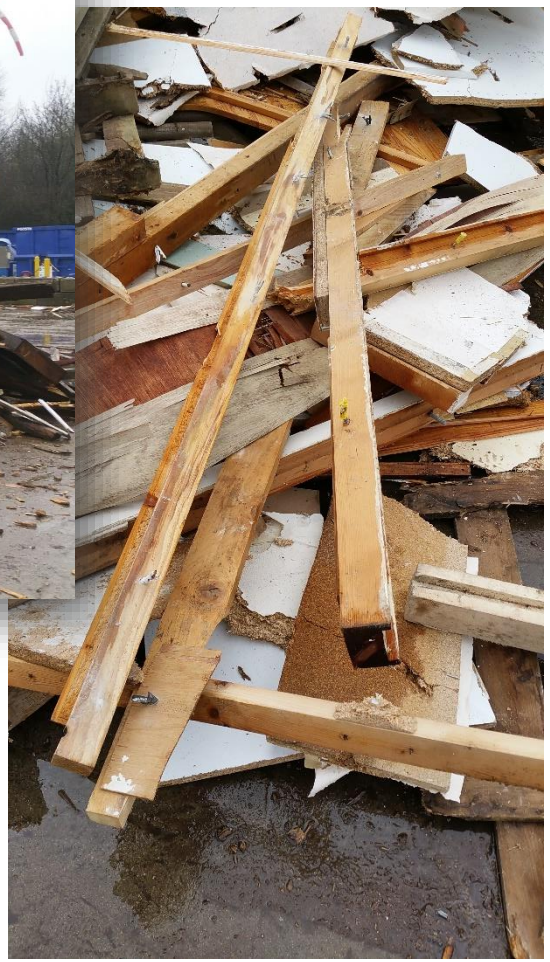
Dismantling?





Probably too expensive

An example of sampling

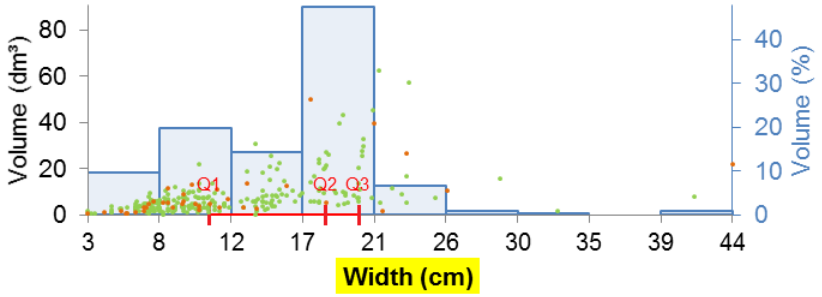


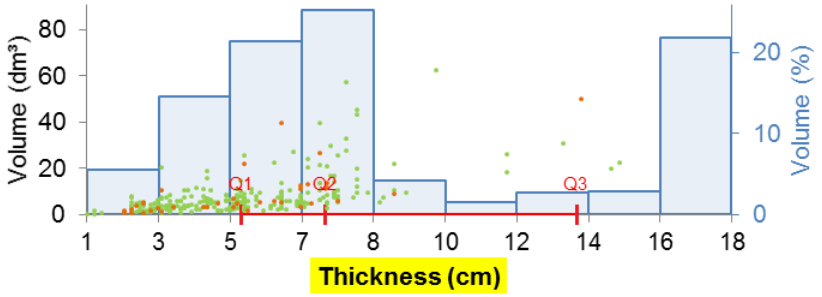
Initial measurements

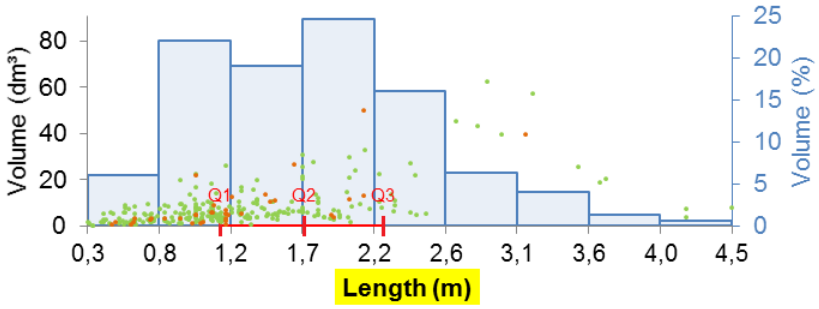
- Dimensions
- Weight
  - Average density
- Moisture content
  - Average

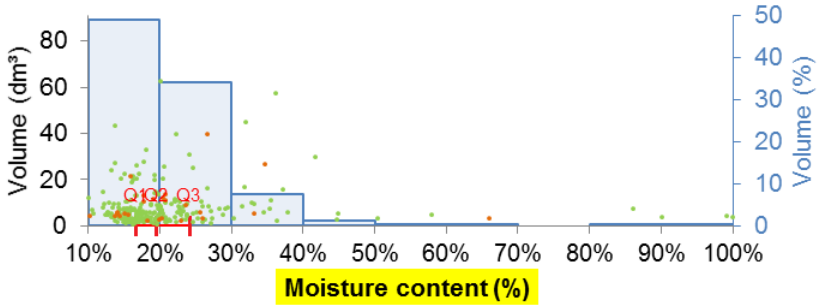
Characterization of recovered wood

Volume distributions based on 309 specimens

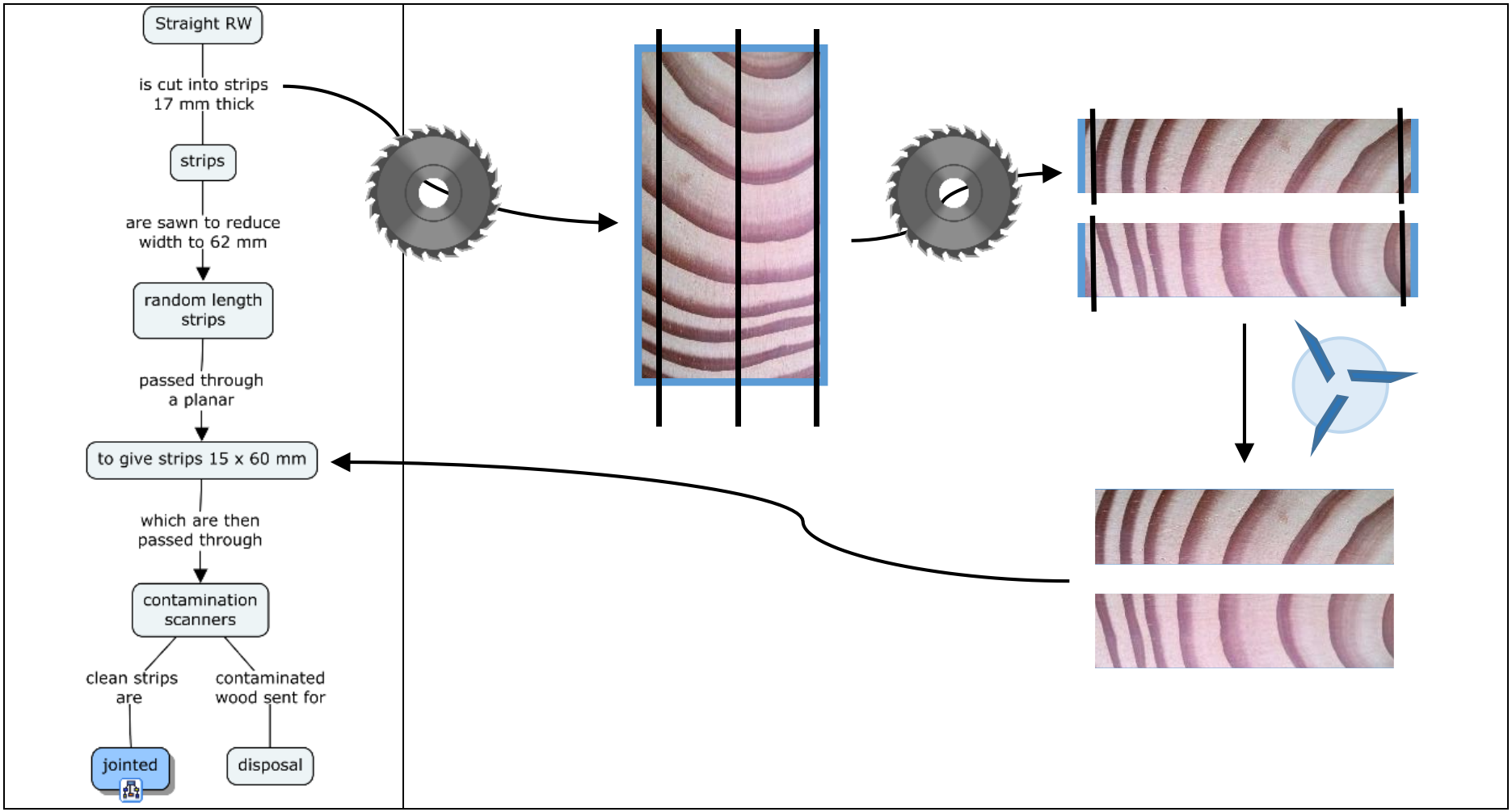






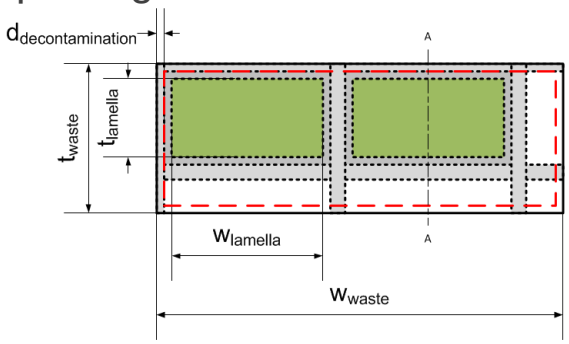


The CaReWood Process

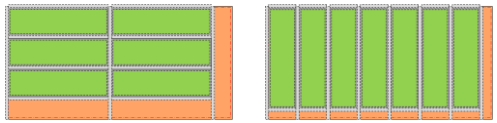


Process stages and material flows

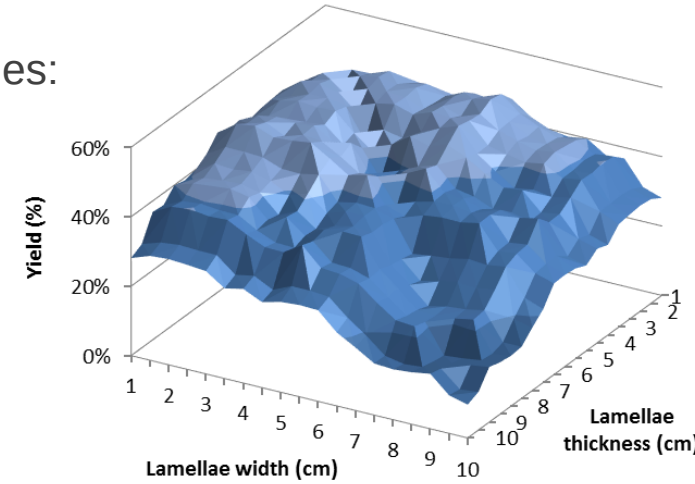
- Yield optimisation
  - Machining model: decontamination, sawing into lamellae, planing
    - Depth of decontamination: 2 mm
    - Saw kerf: 3 mm
    - Planing depth: 1 mm



  - Optimisation of the lamellae size
    - For each RW sample,
      - if $n_{\parallel\ lamellae} \geq n_{\perp\ lamellae}$, lamellae are cut ∥ to the RW sample
      - if $n_{\perp\ lamellae} > n_{\parallel\ lamellae}$, lamellae are cut ⊥ to the RW sample



  - Results when applied to 309 measured samples:
    - Best yield: 51% (2.0 × 6.0 cm lamellae)
    - Chosen: 50% (1.5 × 6.0 cm lamellae)



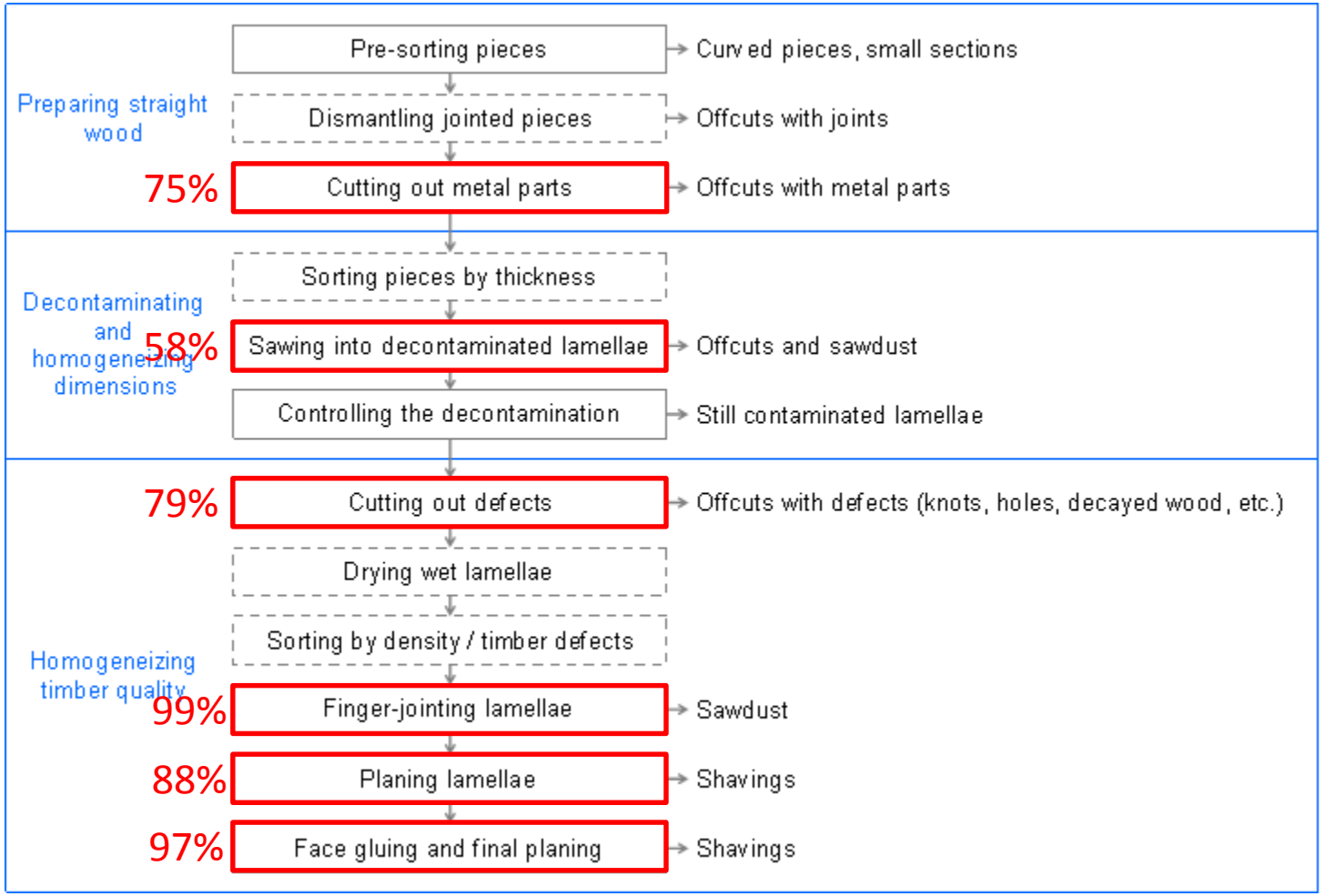
Reality: removing metal

- Cross-cutting to remove nails, screws and other fixings
  - Minimum length of 30 cm
- Some pieces rejected because nails along the length

Lamellae processing

- Sort on basis of
  - Density
    - 3 classes
  - Moisture content
    - 4 classes
- Batch drying
  - By density and MC class
- Enhancing quality
  - Eliminating
    - Large knots
    - Biodeteriorated wood
    - Holes
- Finger jointing to continuous lengths
- Laminating to larger dimension products

Process yield



Checking cleanliness

Efficacy of lamellae cleaning

Element	EPF limit (ppm)	Campaign 1		Campaign 2	
		Before cleaning	After cleaning	Before cleaning	After cleaning
As	25	0%	0%	1%	1%
Cd	50	0%	0%	1%	0%
Cr	25	14%	0%	1%	1%
Cu	40	2%	0%	8%	1%
Hg	25	0%	0%	1%	0%
Pb	90	5%	0%	7%	0%

Conclusion: scanning required to divert treated wood

Efficacy of lamellae cleaning

75 pieces assessed for surface contamination

		Ca	Fe	Zn	Ti
BEFORE	Mean conc. (ppm)	7124	1448	812	8304
	Median conc. (ppm)	2157	1258	51	251
AFTER	Mean conc. (ppm)	865	0	200	0
	Median conc. (ppm)	604		29	

XRF analysis of sawdust

Sawdust sample A

		Cu	Pb
SAMPLE 1	Mean	14	818
	SD	15	166
SAMPLE 2	Mean	9	925
	SD	13	79
SAMPLE 3	Mean	12	1105
	SD	20	87
SAMPLE 4	Mean	0	673
	SD	0	10
SAMPLE 5	Mean	40	964
	SD	5	143
SAMPLE 6	Mean	13	690
	SD	20	63
OVERALL	Mean	14.4	862.6
	SD	13.3	167.9

No Cd, Cr, As or Hg found

All data in ppm

Why high Pb levels?

- Sample 38: Painted areas indicate

>250,000 ppm

- Some highly contaminated wood pieces can contaminate high volumes of residues

Sawdust sample B

		Pb
SAMPLE 1	Mean	43
	SD	4
SAMPLE 2	Mean	46
	SD	8
SAMPLE 3	Mean	36
	SD	5
OVERALL	Mean	41.4
	SD	4.8

No Cd, Cr, Cu As or Hg found

All data in ppm

Conclusions

- The CaReWood process is technically feasible and makes products of high economic value
- The yield is about 29%
- About 15% of recovered wood volume present as individual pieces
  - Need alternative collection method

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GROUPE ESB

Cascading Recovered Wood

FCBA

Fraunhofer WKI

Thank you for listening

SORA
À chacun sa vision

Schumann - Analytics

RTT STEINERT

PTS
FIBRE based solutions