



PowerBonds: Enhancement of Fibre and Bond Strength Properties for Creating Added Value in Paper Products

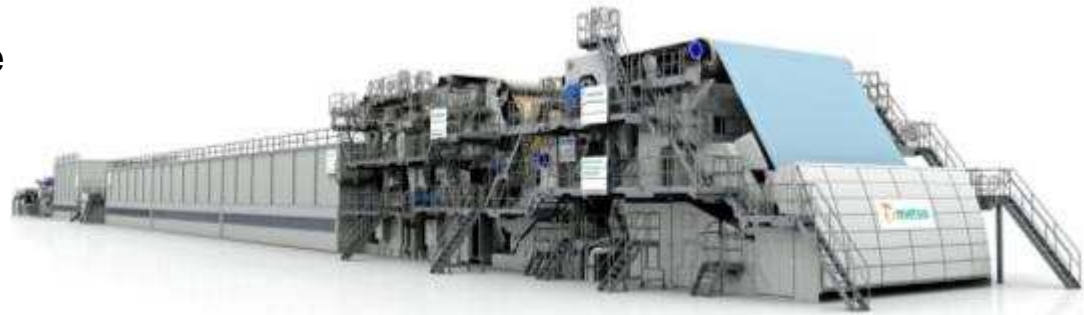
What and why?

Scientific goal

- gain better understanding on factors affecting paper strength









Industrial goal

- apply the gained understanding in papermaking to improve the production process and end-user properties of paper
 - Improve runnability
 - Reduce grammage





Who: Academic Partners?

Country	Organization	Role
Finland	Tampere University of Technology 	Coordinator; Leader WP0+WP2; mechanical characterization of fibers in microscale
	VTT Technical Research Centre of Finland 	Leader WP6; morphological characterization of fibers, bonds and sheets, bond models, network models
	Åbo Akademi University 	Leader WP1; fibre and pulp processing and chemical modification
Germany	Papiertechnische Stiftung 	Leader WP3; sheet production, bond models, fibre treatment, mechanical analysis of fibers
	OFFIS Institute for Information Technology 	Mechanical characterization of fibers in nanoscale
France	Grenoble INP-LGP2 	Leader WP4; morphological characterization of fibers and bonds
Sweden	Royal Institute of Technology 	Leader WP5; paper network models
Austria	Graz University of Technology 	Fibre bonding mechanisms



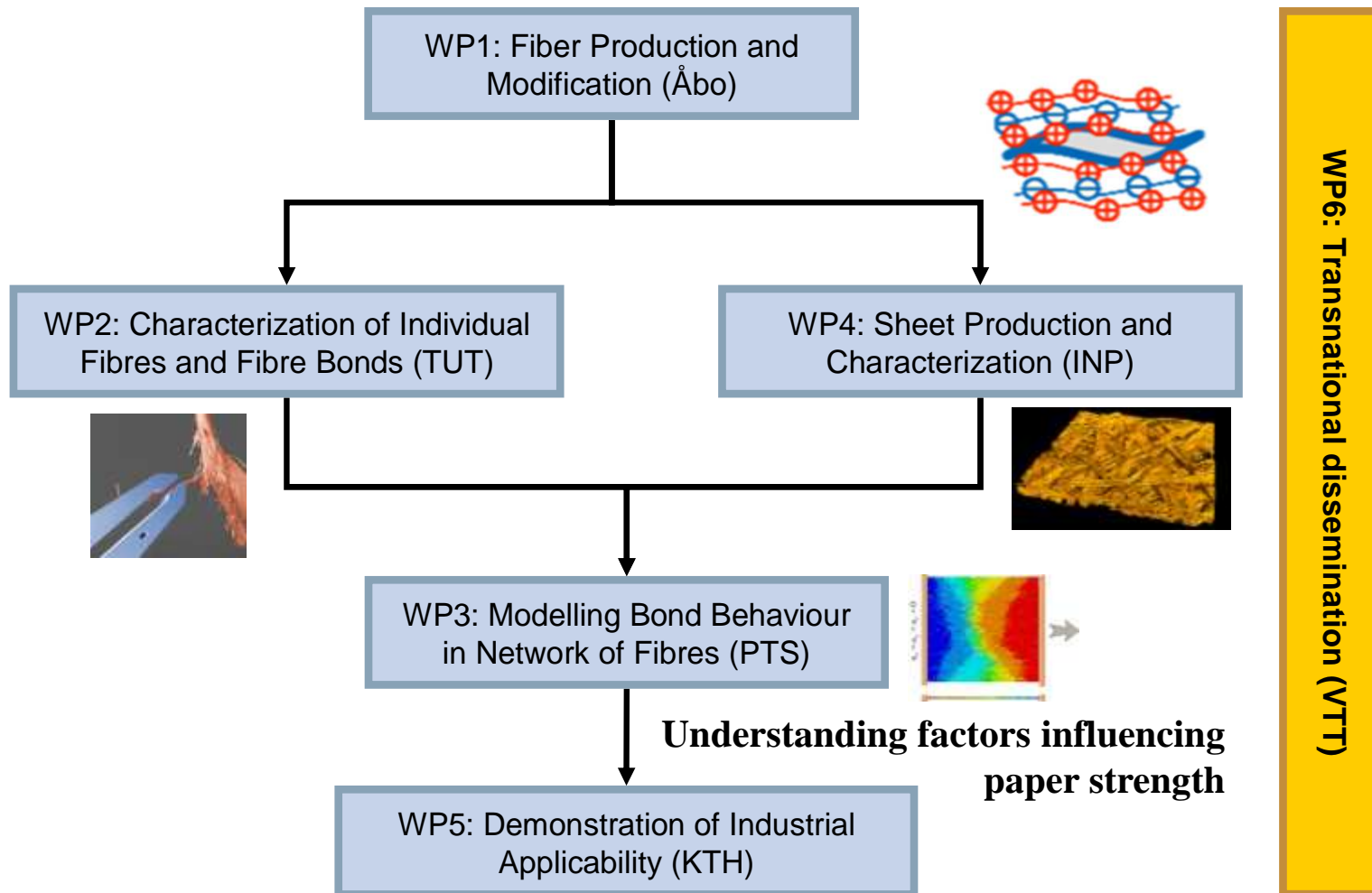


Who: Industrial Partners?

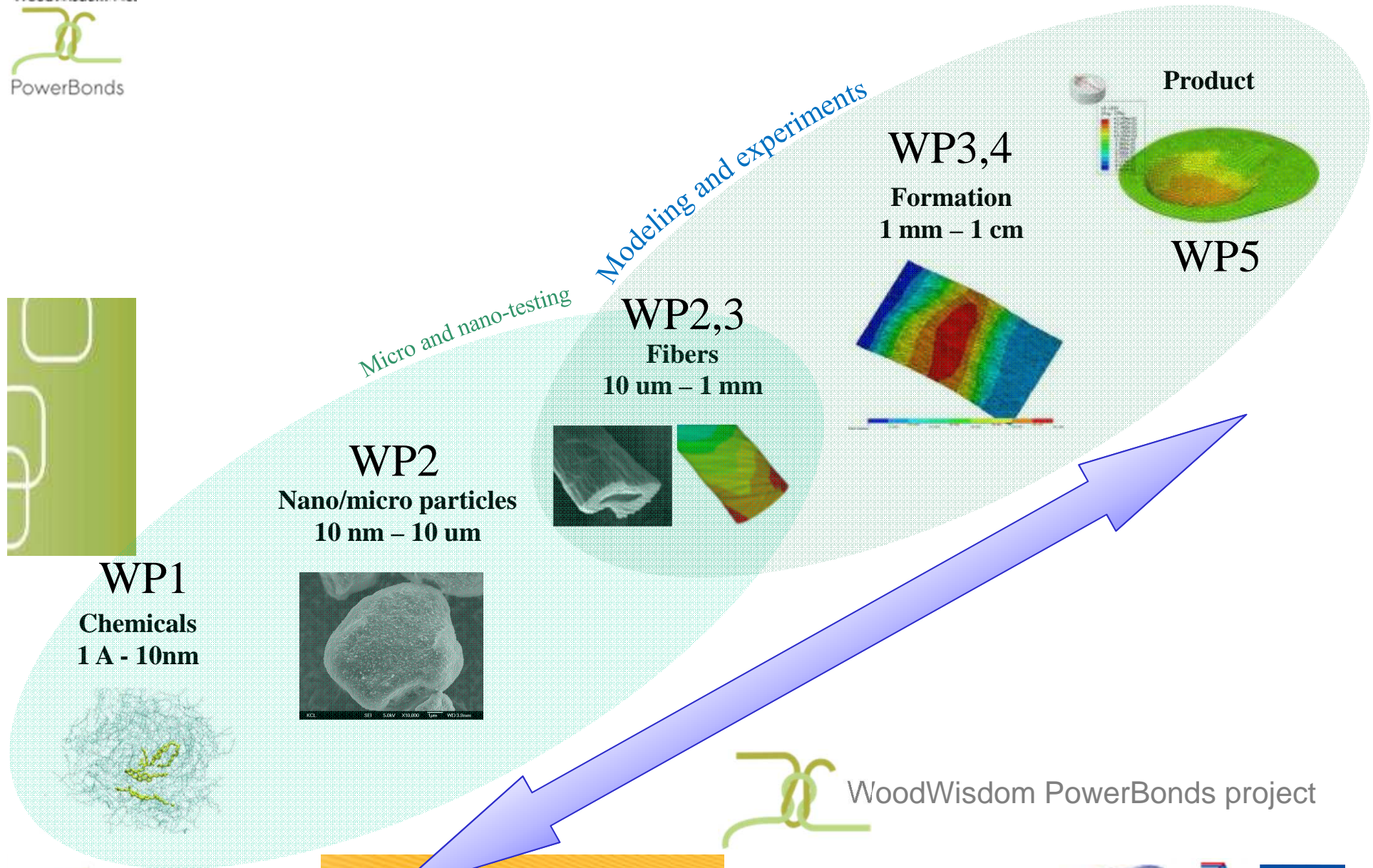
Country	Organization	Role
Finland	UPM-Kymmene	Applicability in printing papers and paper production
	Sappi Finland Oy	Applicability in printing papers and paper production
Germany	Innowep GmbH	Sheet characterization, fiber characterization
	Stora Enso Deutschland GmbH	Applicability in printing papers and board production
Sweden	Stora Enso AB	Applicability in printing papers and board production
France	Papeteries Emin Leydier	Applicability in printing papers and board production
	Munksjö Arches SAS	Applicability in printing papers and paper production
The Netherlands	De Nederlandsche Bank	Applicability in bank notes



Work Packages (WP Leaders)



How to combine the scales?



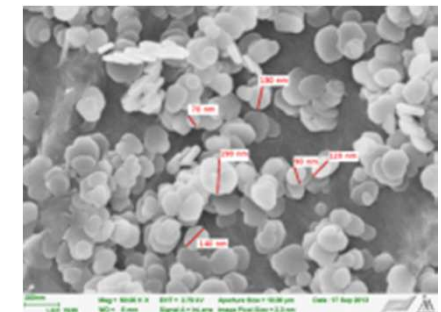
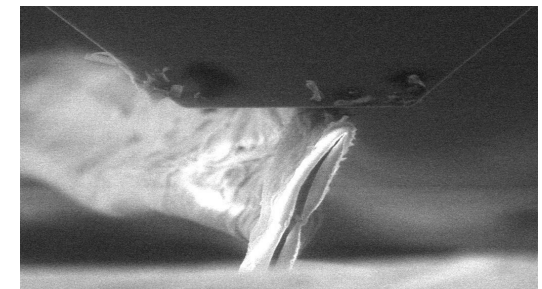
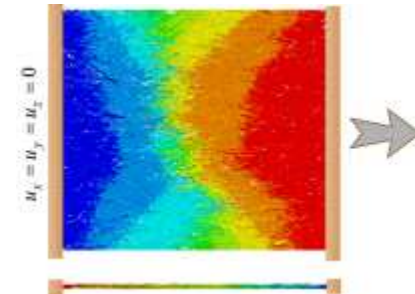
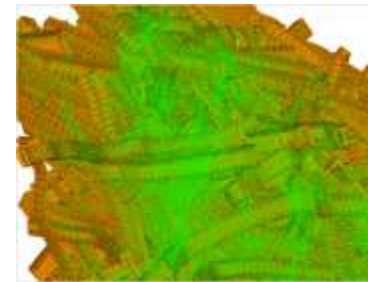
WoodWisdom PowerBonds project

Major achievements 1

Use Case Demonstrations

Presented in our industrial dissemination seminars!

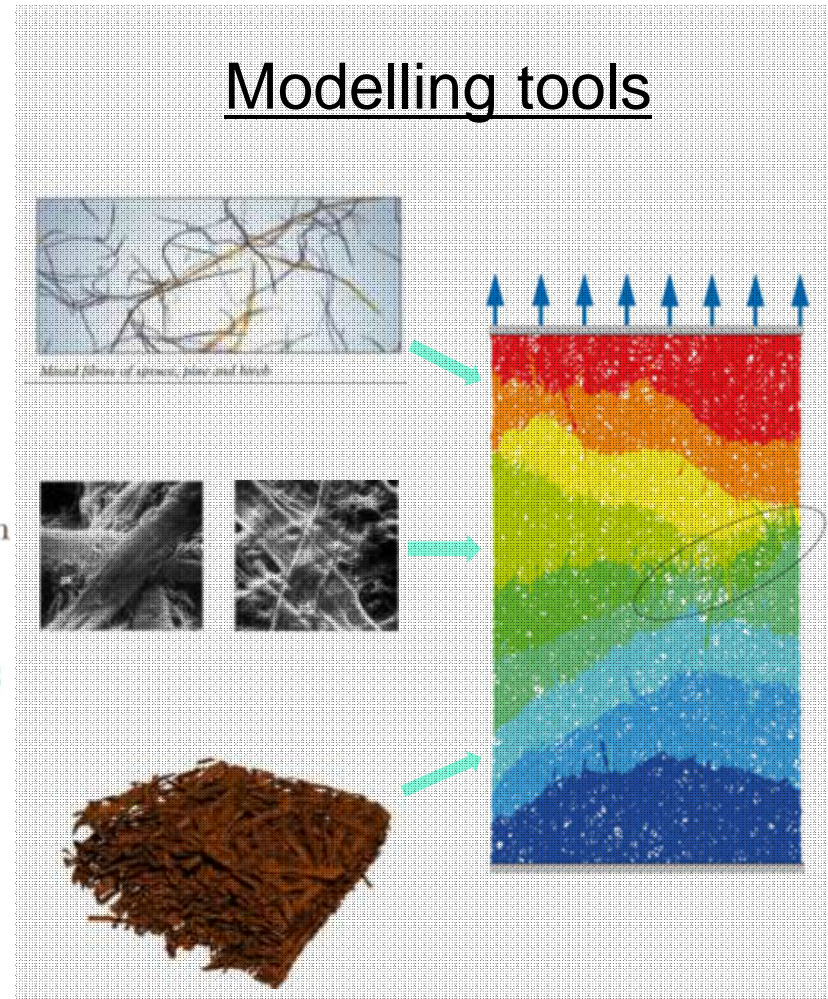
- Effects of strength additives
- Effect of refining
- Effects of furnish variation
- Initial wet strength
- Unknown breaks
- Moisture-fiber interaction
- Network Compression
- Fiber functionalization
- Bending stiffness in bank notes



Major achievements 2

Modelling Tools: No longer a “black box”!

Refining
Moisture contents
Time-scale
Firmish optimization
Strength additives
Fines
Unknown breaks

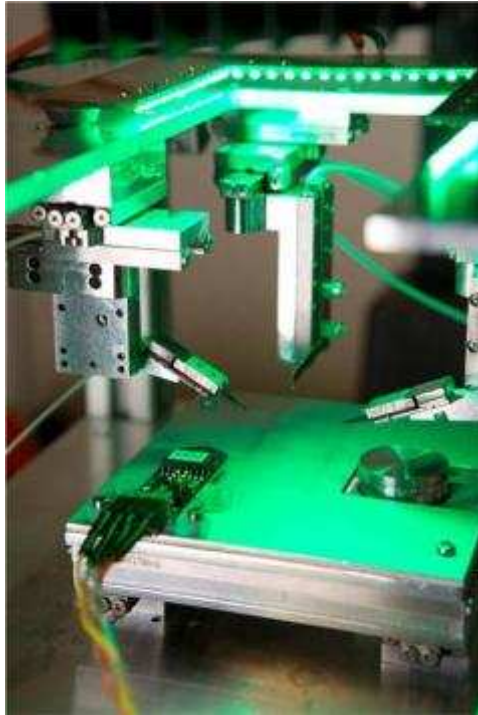


Important factors

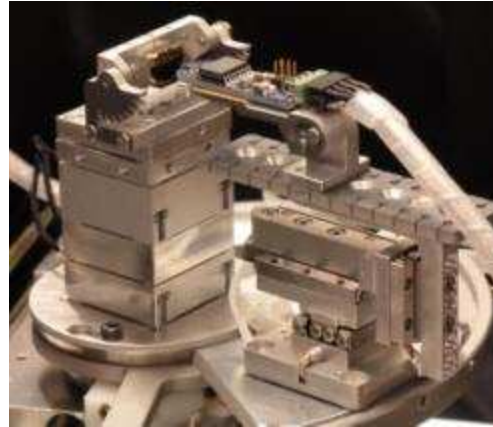
Validation Correlations
Size effect **Stiffness**
Strength Distributions
Stretch Failure mechanisms
Parametric studies

Major achievements 3

Novel Experimental Microrobotic Tools



Microrobotics with optical microscope: TUT, Finland



Nanorobotics with SEM: OFFIS, Germany



Micro-mechanical testing with ESEM: Grenoble INP-LGP2, France

Capabilities

- Bond strength
- Compressibility
- Flexibility
- Fibril angle
- Fiber length, fiber diameter, overlapping area
- Contact angle on fiber

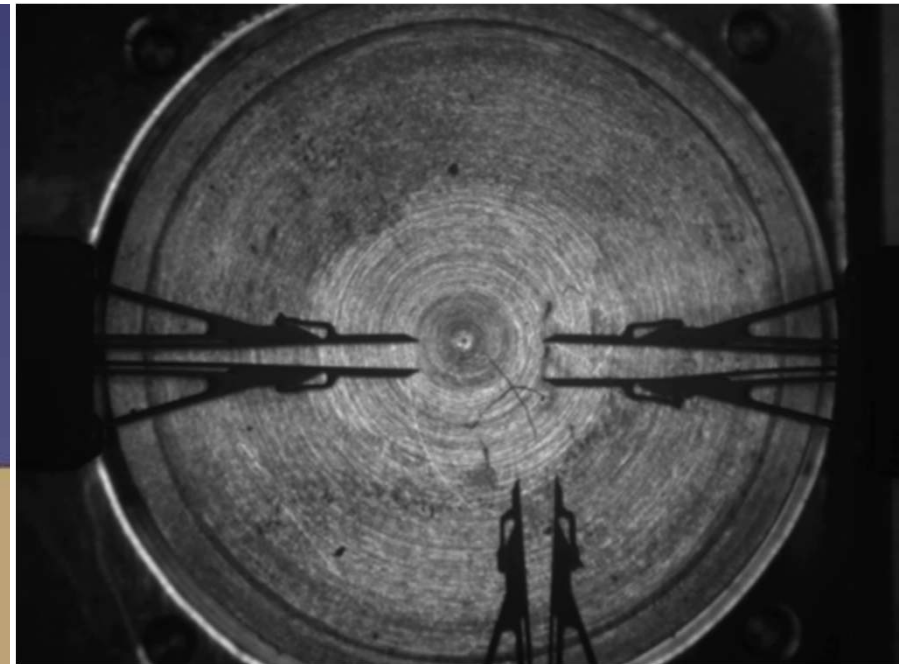
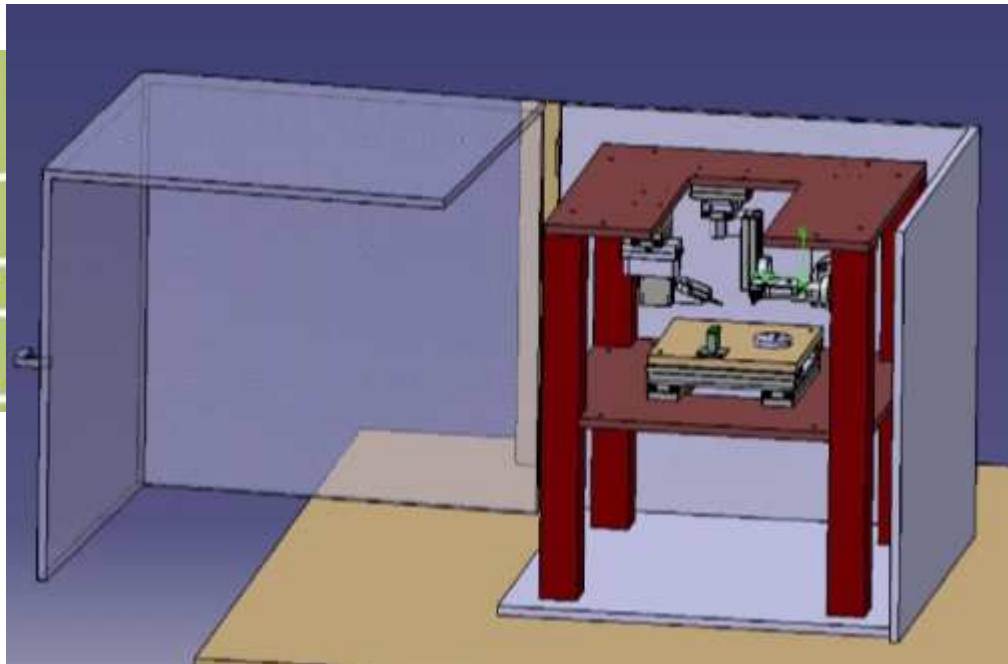


FINAL SEMINAR of the Joint Call on sustainable forest management and optimised used of lignocellulosic resources - Hanover 11 November 2014

Major achievements 3

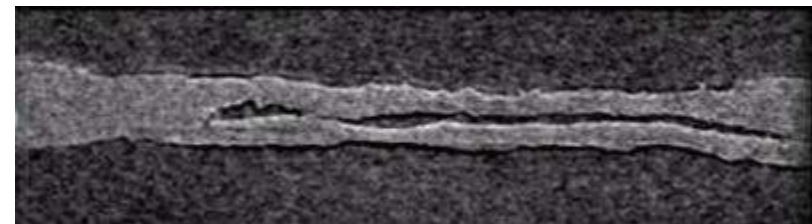
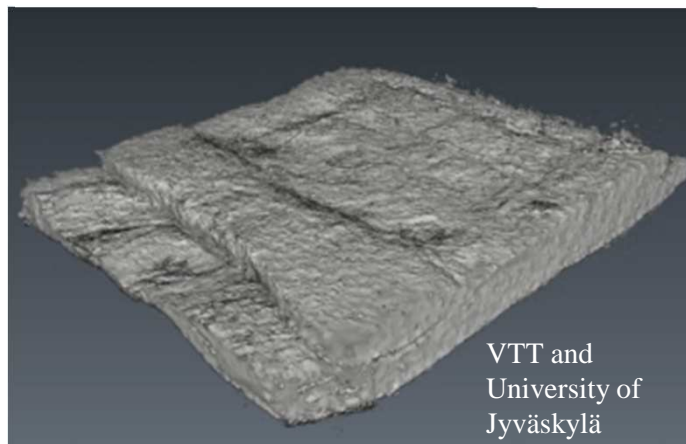
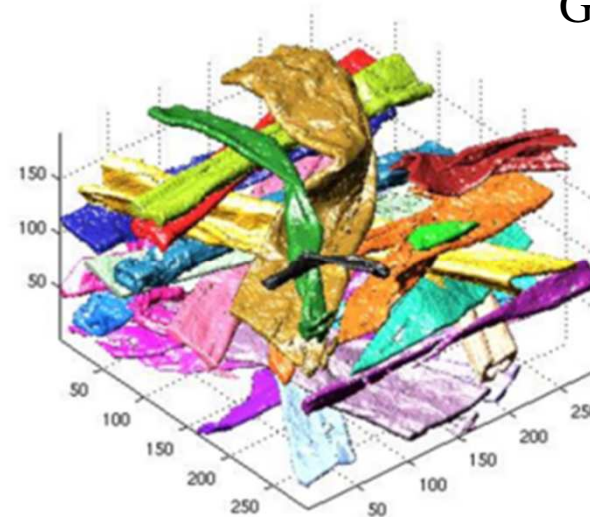
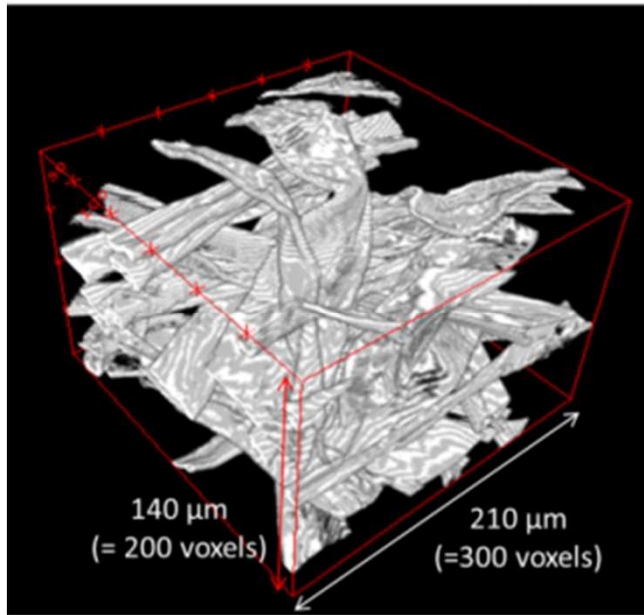
Novel Experimental Microrobotic Tools

Tampere University of Technology,
Finland



Major achievements 4: Novel Imaging Tools

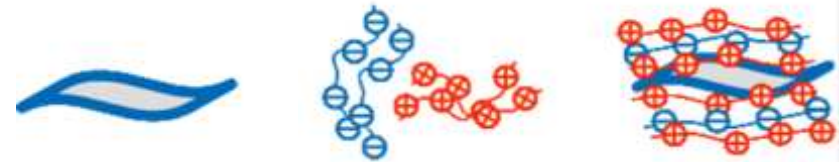
Grenoble INP-LGP2



Major achievements 5: Fiber Modification

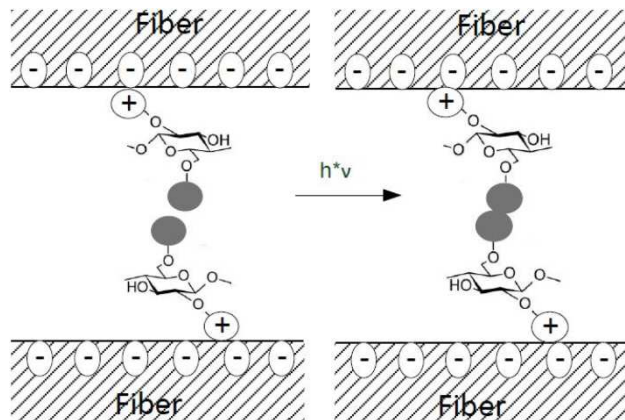
Papiertechnische Stiftung PTS, Germany

- **Polyelectrolyte Multilayering (PEM)**
 - Modified cationic/anionic starch
 - **Carboxymethylated cellulose (CMC)**

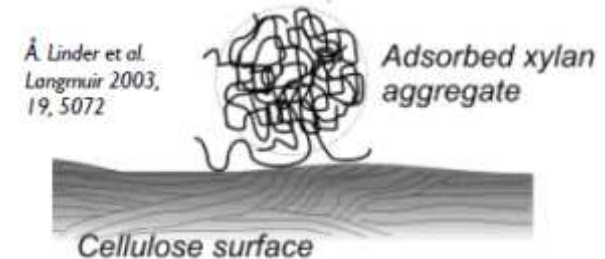


ÅBO Akademi University, Finland

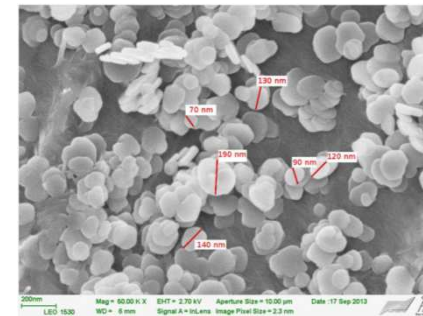
- Functionalized cellulose derivatives
Crosslinking via UV light irradiation



- Xylane adsorption



- Functional inorganic **LDH** particles
(layered double hydroxides)





Lessons learnt

Challenges:

How to activate industry?

Ask actively their needs: in our case “runnability interview” in face to face meetings + dissemination seminars to industry

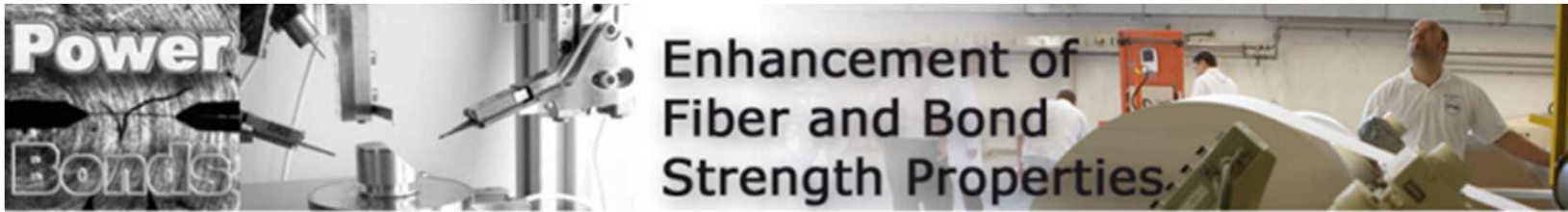
It is easy to continue working independently – i.e. several projects within a project. How to maximize synergy from collaboration?

Do not underestimate the need for face to face meetings and reserve **enough travel budget**

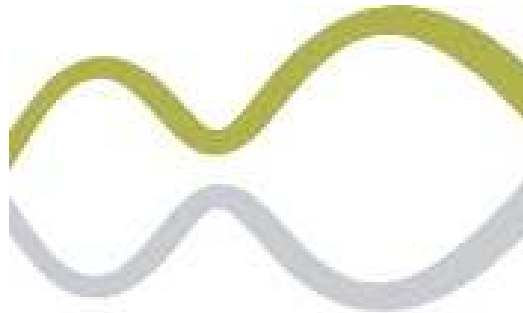
Define concrete joint demonstrators

Do not forget dissemination - already during the project!

Press releases and internet promotion in our case



Acknowledgement



WoodWisdom-Net

This work has been carried out within PowerBonds,
<http://www.wwnet-powerbonds.eu/>

a project funded by WoodWisdom-Net
www.woodwisdom.net

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