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OF EXCELLENCE  
OF FOREST-BASED  
INDUSTRY

# Implementation of break-through technologies for increasing added value in wood and paper processing

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**National Forest Centre – Forest Research Institute**

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# Presentation focus

- Forest bioeconomy development in Slovakia
- Policy and strategy supporting forest bioeconomy
- Position of Forest-based industry
- Centre of excellence LignoSilva: Implementation of breakthrough technologies for increasing added value in wood and paper processing

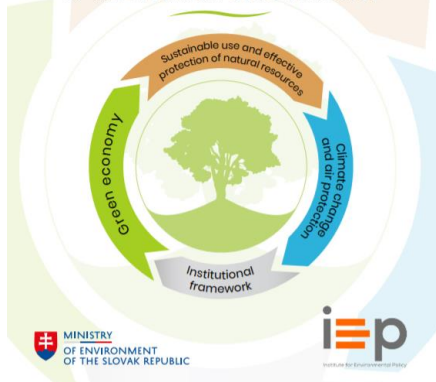
# Bioeconomy development in Slovakia

BRATISLAVA BIOECONOMY CONFERENCE  
**BBEC2016**



**Greener  
Slovakia**

STRATEGY OF THE ENVIRONMENTAL POLICY  
OF THE SLOVAK REPUBLIC UNTIL 2030



## Slovak Presidency of the Council of the EU

Bratislava Bioeconomy conference

Re-Industrialisation of the European Union conference

T2gE – Transition to the Green Economy conference

Strategy of the economic policy of the Slovak Republic until  
2030 (Ministry of Economy of the Slovak republic, 2018)

Environmental strategy of the Slovak Republic until 2030  
(Ministry of Environment of the Slovak republic, 2019)

# Policy and strategy supporting forest bioeconomy in Slovakia

Smart Specialisation Strategy – RIS3 SK (2013-2020)

Smart Specialisation Strategy – RIS3 SK (2021-2027)

**Domain 1: An innovative industry for the 21st century**

Domain 2: Mobility for the 21st century

**Domain 3: Digital transformation of Slovakia**

Domain 4: Healthy society

**Domain 5: Healthy food and the environment**

Priority Area 1-2: Processing of raw materials into products with higher added value

Priority Area 1-3: Advanced technologies and materials

Priority Area 1-5: Efficient waste management

Priority Area 5-2: Circular production systems based on biomass

Priority Area 5-4: Sustainable natural resources (soil, water, biodiversity, ecosystems)



**Draft Smart Specialisation Strategy of the  
Slovak Republic for the period 2021-2027**

Supporting the transformation of the Slovak economy by increasing  
its innovation performance

 **MINISTRY**  
OF INVESTMENTS, REGIONAL DEVELOPMENT  
AND INFORMATIZATION  
OF THE SLOVAK REPUBLIC



# Policy and strategy supporting forest bioeconomy in Slovakia

## National Forest Programme 2021-2030 „Forest for society“

**Process:** transition of society from fossil to green economy, redefining the position of FBS in a new conceptual framework: **Bioeconomy-Resilience-Multifunctionality-Governance.**

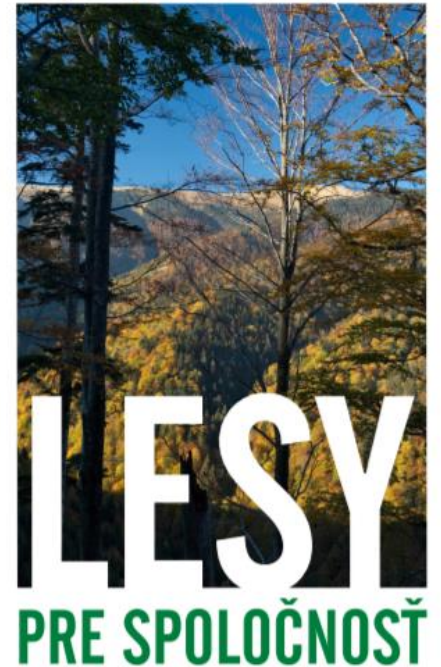
**Objective:** to maintain the competitiveness of the FBS, the need for innovation and investment in new products and services, the need for synergies among sectors.

**The problem of FBS:** seize the opportunity and manage the process of structural change to a sector with higher added value. It requires:

- Securing financial resources supporting R&D, completion of research infrastructure, prototyping, pilot production (*ESIF, Circular Bio-based Europe Joint Undertaking, HORIZON EUROPE*)
- Creation of an institutional environment and critical mass of skills: mobility, incentive system of remuneration, recruitment system for top and young researchers, trained support staff, clearly defined organizational goals and performance parameters.



Národný lesnícky program Slovenskej republiky 2021 – 2030



VSTUPNÁ SPRÁVA

Ministerstvo pôdohospodárstva a rozvoja vidieka SR  
Sekcia lesného hospodárstva a spracovania dreva  
Odbor lesníckej politiky a ekonomiky lesného hospodárstva

BRATISLAVA • DECEMBER 2019

# Forest-based sector – transformation goals

**Forestry:** Implementation of the concept of close to nature forest management to support their multifunctionality and resilience; Growth of added value from ecosystem services. Increasing and diversifying production through combined agroforestry production.

**Wood processing industry:** Increasing added value through new products (composite and agglomerate materials) and greater use of energy-efficient, modular wooden buildings and flexible housing structures.

**Pulp and paper industry:** Value-added increase through new products as biodegradable packaging, smart packaging, processing of pulp into textile fibres, and developing technologies to reduce the carbon footprint and lower of energy consumption.

**Bioenergetics:** Valorisation of logging and new technologies of wood residues processing with higher energy efficiency; developing „advanced“ biofuels based on lignocellulosic materials.

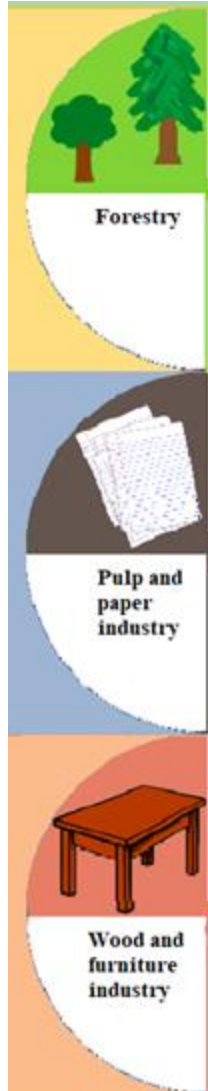
**Cross-sectorial trends:** Transformation to „zero-waste, circular society“: implementation of cascade, recycling, composting and reuse technologies.

Digital transformation – digitisation, robotics based on implementation technologies as Cloud solution, Big data, IoT, machine learning, Artificial Intelligence, Virtual reality.

Wood traceability, connecting and sharing data through value chain: from forests to wood-based products.



# Position of forest-based sector



**Revenue:**

~ 4 mld. €

**FBS added value:**

~ 1.2 mld. €

**FBS share to GDP:**

~ 1.5 %

**Employment:**

~ 50 ths.

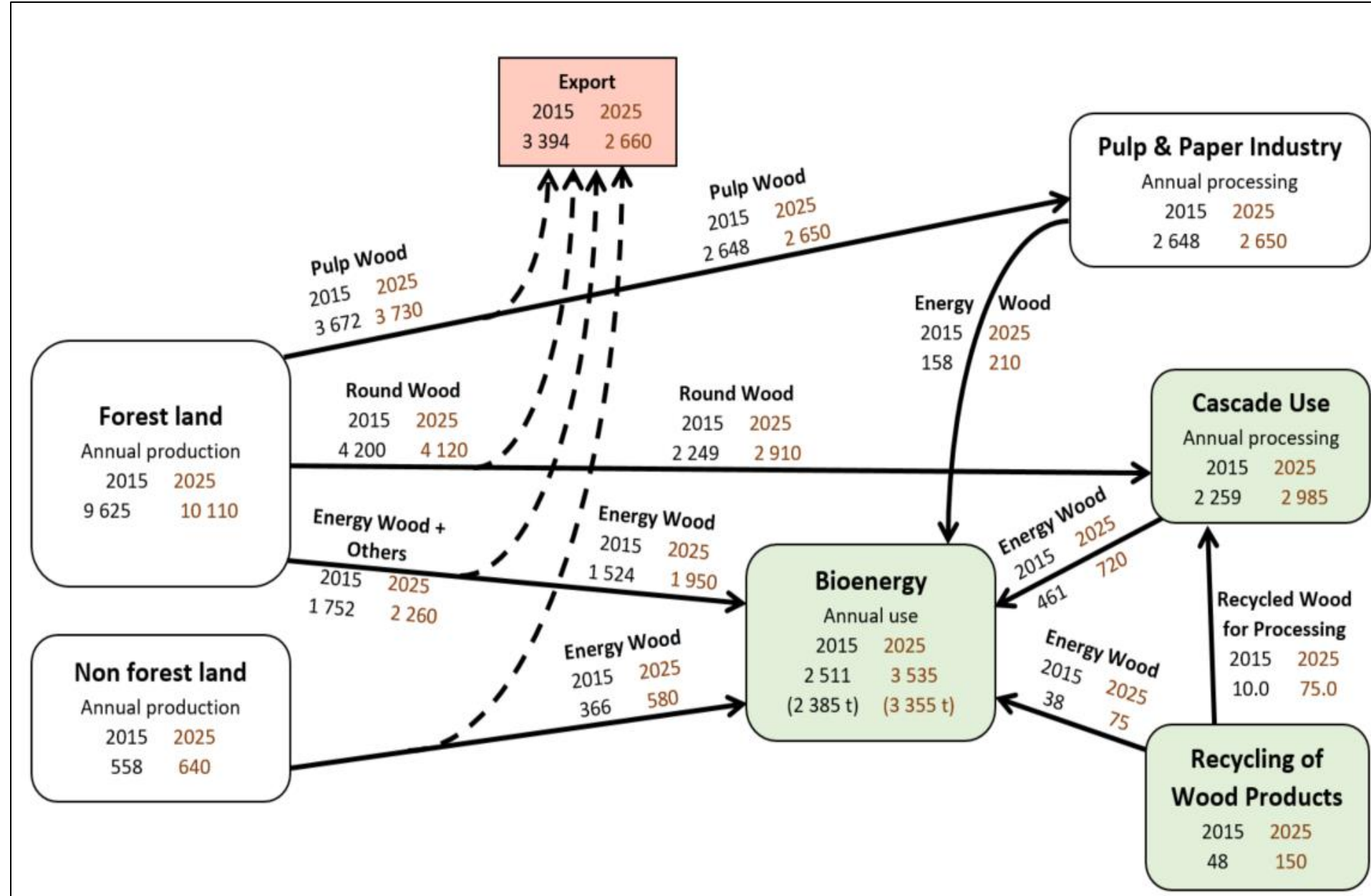
Sawmill	Location	Annual processing capacity [m <sup>3</sup> ]
Rettenmeier Tatra Timber	Liptovský Hrádok	800,000
PRP	Veľký Krtíš	300,000
Amico Drevo	Oravský Podzámok	120,000
P.F.A.	Lozorno	90,000
Pilex Slovakia	Podolíneč	84,000
Kamwood	Lučenec	60,000
Wood-based panels manufacturer	Location	Chipboards, agglomerated wood [tons]
KronoSpan	Zvolen	350,000 (planned 450,000 recycled wood)
Pulpmill	Location	Sulfate pulp production[tons]
Mondi SCP	Ružomberok	474,000
Bukóza Holding	Henovce	126,000
MetsaTissue Slovakia	Žilina	Recycled paper
SHP	Harmanec	

# Expected scenario of dendromass flow in 2025 in comparison with 2015 in ths. m<sup>3</sup> (ths.t)

## Export reduction

## Increase domestic wood processing

- Products with higher added value
- New products
- Cascading use of wood
- Recycling, reuse





# Centre of Excellence LignoSilva



**CoE LignoSilva** is a specific example how research organisations can contribute to the acute need for structural transformation of the society from fossil to green economy based on domestic renewable material - wood biomass.

**LignoSilva** connects the research capacities of the **National Forestry Centre** and the **Pulp and Paper Research Institute** in Bratislava with relevant wood production and wood processing business entities.



EFI

2014 - 2016	2016	2017	2018 - 2023	2020
EU Horizon 2020 CSA project phase 1	EU Horizon 2020 CSA project phase 2	Ministry of Agriculture Research project	Research agency Infrastructure project	Institutionalize of the Centre of Excellence
467 tis. €	Seal of Excellence	120 tis. €	9.88 mil. €	

# Centre of Excellence LignoSilva

LignoSilva excellent research is ensured by the integration of already existing laboratories and the completion of european unique infrastructures, namely:

- **Mobile terrestrial laser scanning & computer tomography scanning technologies** for research on the use of 3D data in the forest inventory and forest stand assortment, detection of wood defects, sharing data for optimizing wood flow, and increasing yield from wood processing.
- **Universal pilot plant paper machine** for research of special papers and biodegradable and compostable packaging based on paper and paperboard.

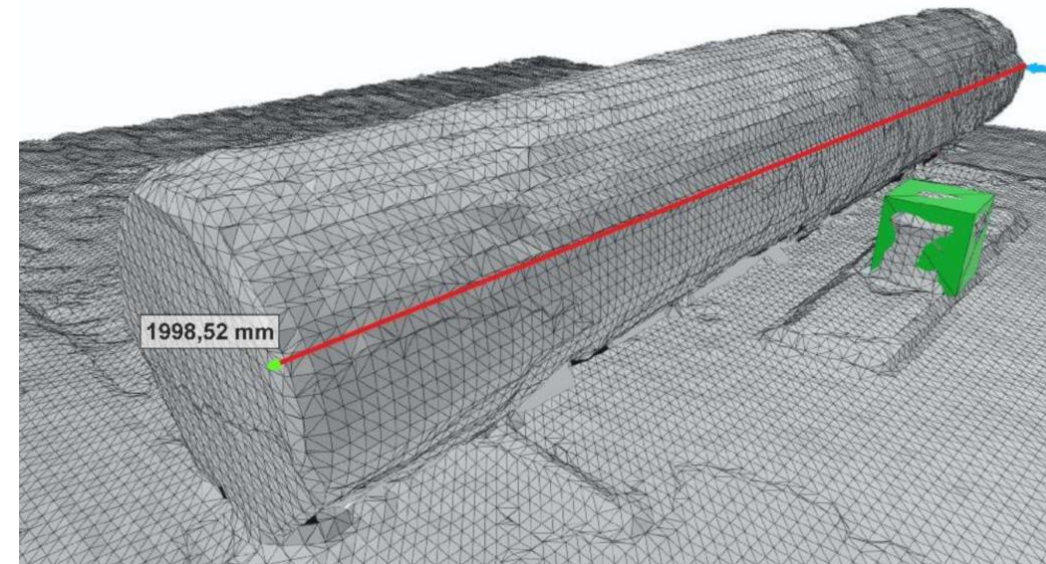
# Wearable, mobile 3D Laser Scanner in Forest Inventory and Assortment

## Research challenges:

- Development of algorithms for automated determination of  $h$ ,  $d_{1.3}$  and stock estimation
- Detection of external log defects (knots, cracks, rot and decay, log shape)
- Modelling internal knot distribution using external log features and new assortments models
- Connection & sharing data, methods and standards between foresters and wood processors -> FORESTRY 4.0 & SAWMILL 4.0



From left to right:  
Case, prism, tablet  
device, sensor system,  
4 batteries with charging  
dock, external converter





# 3D Computer Tomography scanner – breakthrough technology in wood processing

Connectivity and sharing of Forest  
Inventory and CT scan data to optimise:

LOG BUCKING

LOG GRADING

INDUSTRIAL WOOD PROCESSING

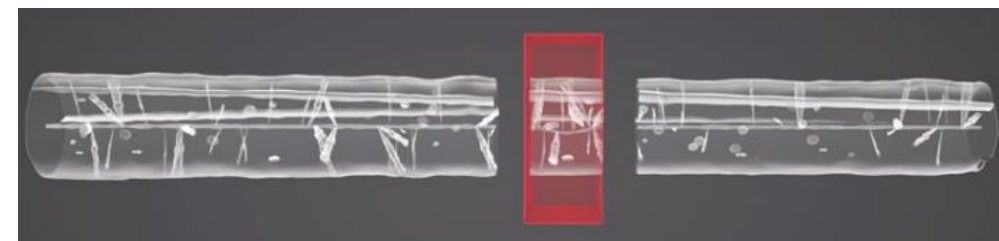
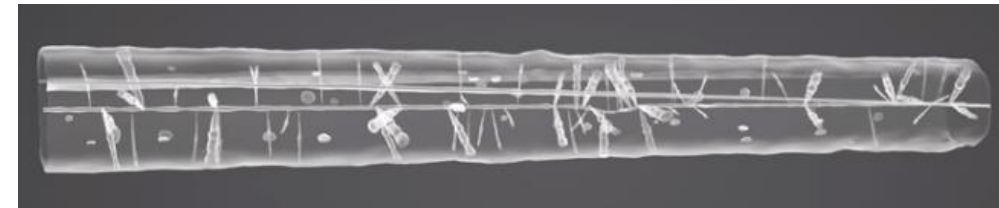
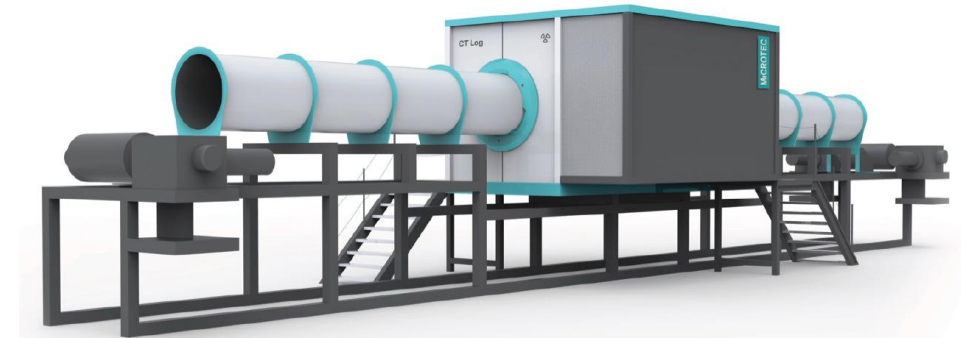
TRACEABILITY „DIGITAL FOOTPRINT“

CUSTOMISATION, FLEXIBLE PRODUCTS



## CT LOG SOLUTION

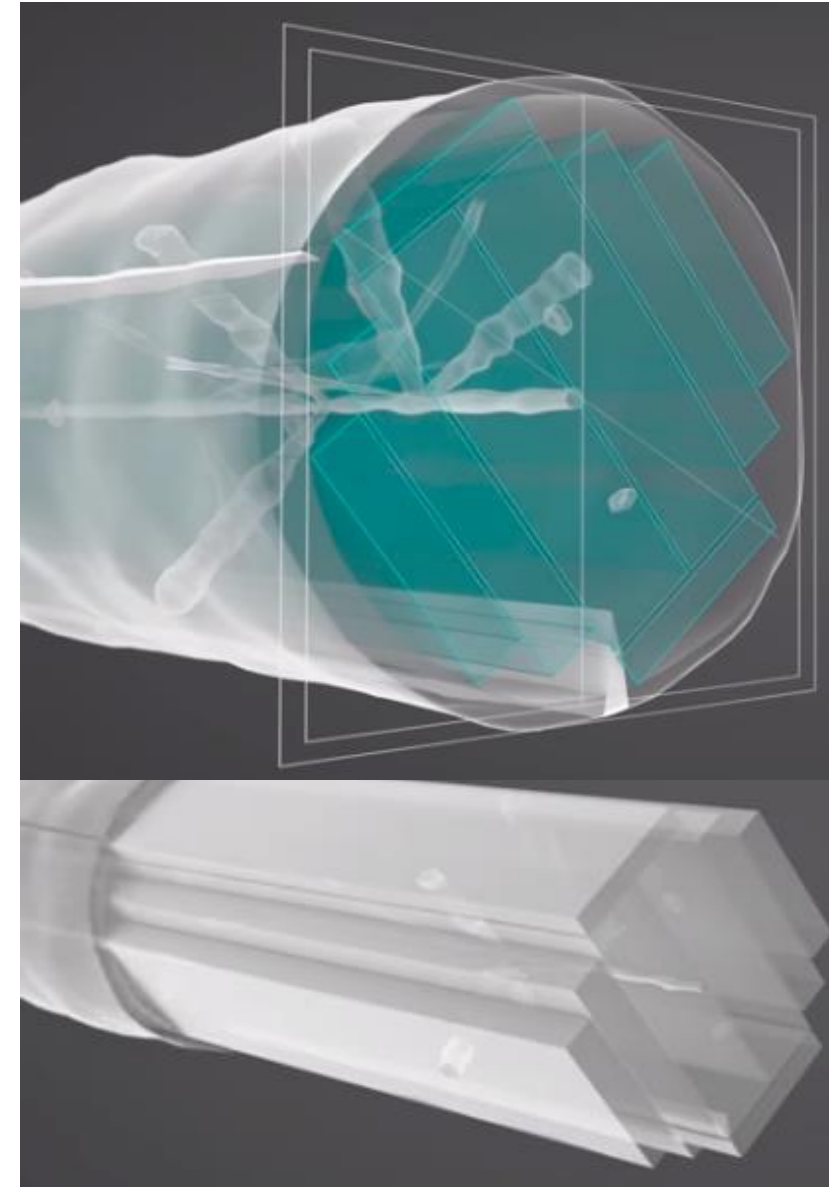
X-RAY COMPUTER TOMOGRAPHY FOR DEFECT DETECTION AND QUALITY EVALUATION ON LOGS





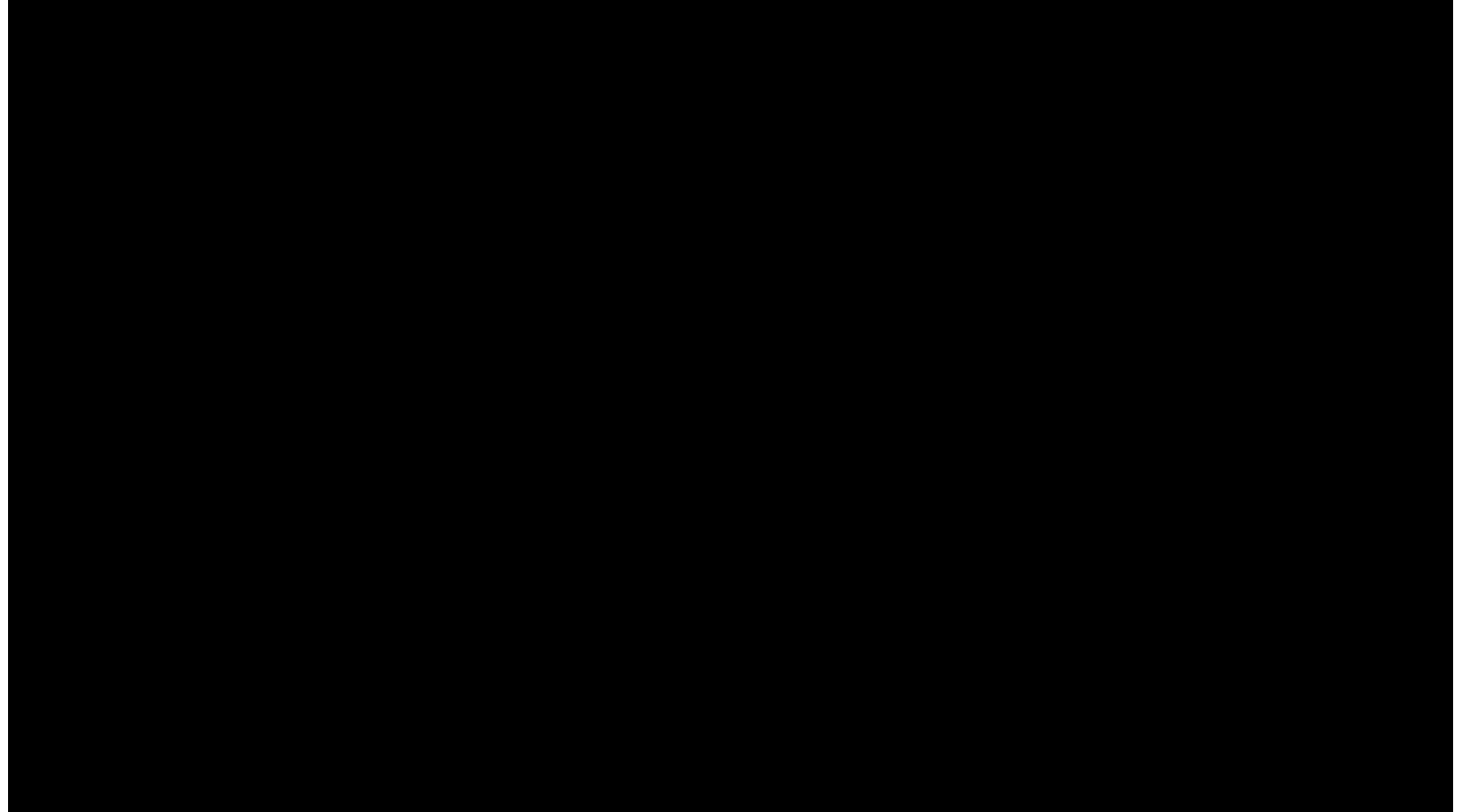
# 3D CT scanner – breakthrough technology in wood processing

- Scanning of wood logs for the purpose of:
  - Defining the exact volume of a log
  - Defining the exact shape of the log
  - Qualitative classification - external defects / internal defects of wood
  - Wood flow tracking - digital trace of each piece of log, assortment, lumber, product
  - Automation in the wood processing chain / production line
  - (records → acceptance → cutting plans → sorting → production → storage → packaging)
- The result is higher added value of wood utilization and reduction of production costs.



# 3D Computer Tomography scanner - optimization of the sawing process

- 1 .Real log scan
- 2.Defects detection
3. Generation of virtual boards for the given sawing parameters.
4. Cutting plan draft
- 5.Optimization of the cutting plan taking into the consideration the defects, required outputs



# Pilot paper plant – upgrade of unique technology



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## *Pilot paper machine – paper production*

### Research priority:

- Paper and combined biodegradable packaging based on paper and bio-based plastics with special barrier properties
- SMART packaging

### Benefits:

- The substitution of plastic packages with biologically degradable and compostable packaging materials based on paper and corrugated boards.
- Increase of recyclability of packaging materials







## Specification:

- Universal pilot plant paper machine with three head boxes for up to three-layer papers with on-line size press
- Pilot universal machine Anger (coating and laminating) with a working width of 600 mm and maximum temperature of drying 190 °C
- Pilot plant supercalender Kleinewefers with a working width of 600 mm

### *Pilot Plant Coating/Laminating Machine – Surface Treatment*





# Open collaboration platform

## 3D CT pilot line

- Unique technology for development and testing of algorithms for automatic detection of wood defects
- only 1 CT logs in the world open for R&I cooperation
- Availability in the Zvolen locality (central Slovakia)

## Paper pilot line

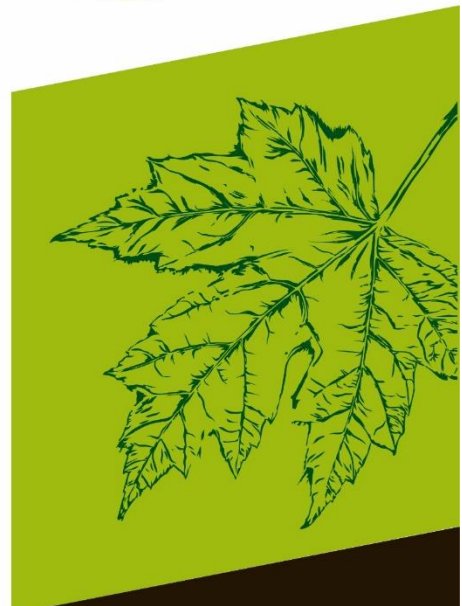
- Unique technology for research of special paper production and on-line non-destructive testing
- only 1 in the Central Europe open for R&I cooperation
- Availability in the Gabčíkovo locality (near Bratislava)





<http://lignosilva.nlcsk.org/>

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EUROPEAN UNION  
European Regional Development Fund  
OP Integrated Infrastructure 2014 – 2020



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# Thank you for your attention



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