

EDG WOOD drying conference
COST E53 WG2 workshop

"Wood drying - vision of tomorrow"

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Optimising the kiln drying with VTT's kiln
simulation program LAATUKAMARI



Business from technology

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Introduction

- VTT started drying simulation development in beginning of 1990
- the aim
 - to improve the quality of sawn timber drying
 - to optimise the drying schedules
 - to increase drying capacity
 - to analyse the drying condition
 - to create a tool (simulation model) to determine the drying quality



Drying simulation model - work process

- calculate moisture in the board, when the drying process is known
 - the water flow
 - the internal moisture distribution
 - water flow speed
- cracks
 - calculate drying stresses caused by shrinkage in the board

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Drying simulation model

- 2 models of version 2.0
 - basic model
 - optimising model
- Windows-version
 - Summary of drying results can be printed
 - drying results can be analysed with Excel
- Program
 - written in Visual Basic
 - languages: Finnish, Swedish, English, German

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Main window of LAATUKAMARI-PROGRAM "QUALITY DRYING PROGRAM"



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Input data

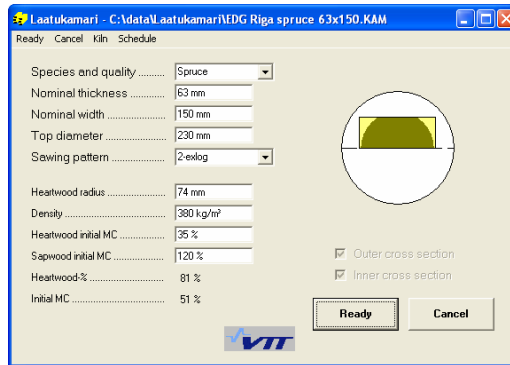
- Laatukamari is an easy-to-use simulation program (the program gives automatically default values to input data)
- the most important input data are
 - timber
 - kiln
 - drying schedule

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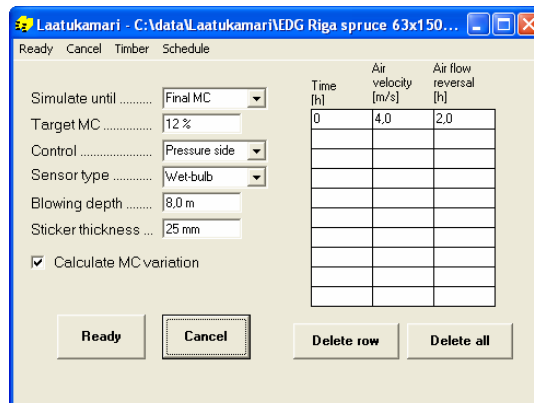
Input window for timber data

- species (spruce, pine)
 - timber dimension
 - thickness max 100 mm
 - width max 300 mm
 - top diameter of log (max 400 mm)
- sawing pattern
 - 1 - 4 exlog, side board, free
- density
- heartwood radius



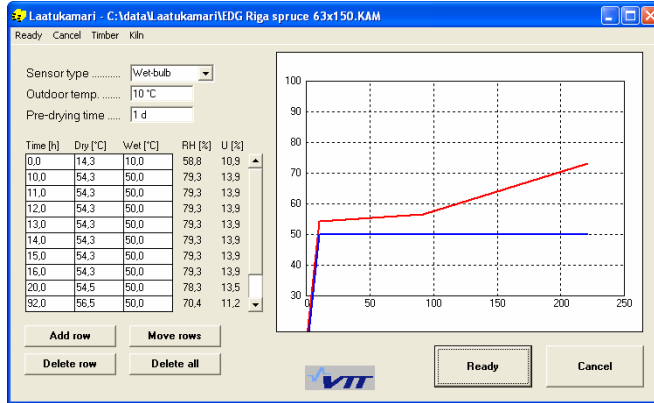
Input of kiln data

- simulation
 - to a certain target MC or
 - a certain drying time
- steering with
 - pressure side climate or
 - average of pressure and outlet side climate
- sensor type
 - wet-bulb
 - RH-sensor
- blowing depth (max 15 m)
- sticker thickness (max 50 mm)
- air velocity (from 1 to 10 m/s)
- air flow direction reversal period



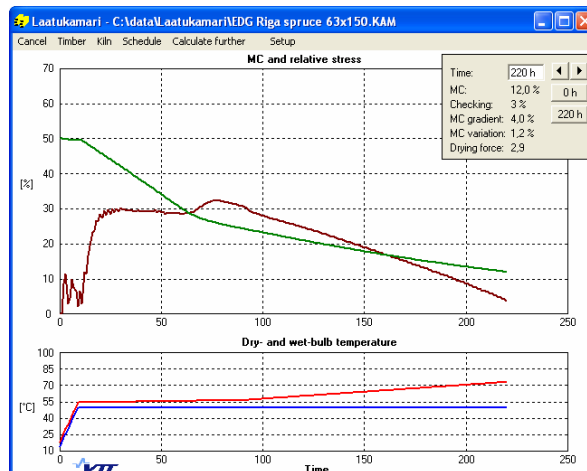
Input of drying schedule

- Sensor type
 - wet-bulb
 - RH-sensor
- pre-drying
 - outdoor temperature
 - time
- drying schedule
 - time
 - Dry bulb temperature
 - Wet bulb temp or RH
 - max 2 000 steps

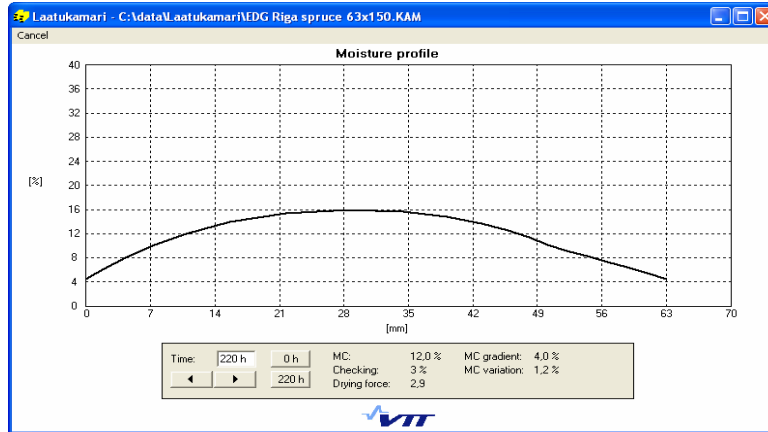


Output of drying simulation

- maximal stress curve
- moisture curve
- drying schedule
- average MC
- checking
- MC gradient
- MC variation
- drying force



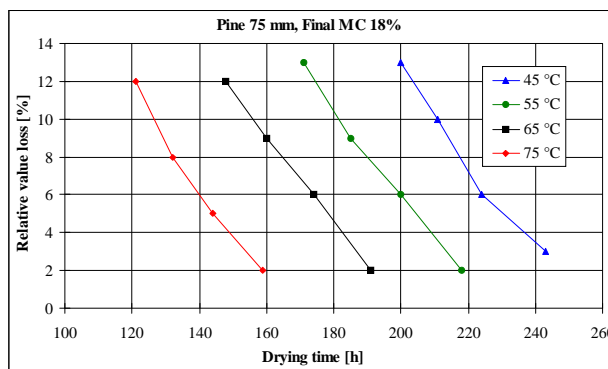
Moisture profile after drying



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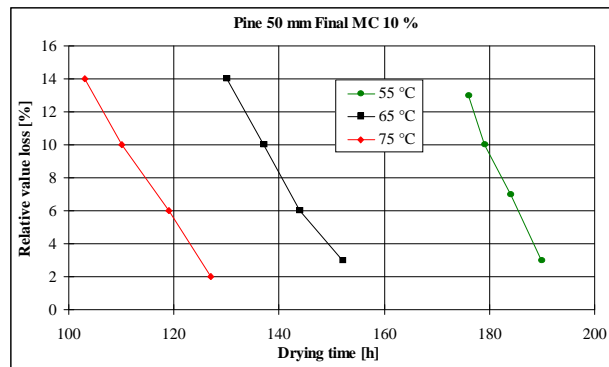
Analysis of drying costs Drying at different temperature levels Pine 75 mm, final MC 18 %



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Analysis of drying costs Drying at different temperature levels Pine 50 mm, final MC 10 %



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Experiences

- Individual schedules for every kiln type
- Own schedules for different timber dimension
- Optimal schedules for different quality classes
- Modification and analysis of used drying schedules
- Better understanding of the drying theory
- Checking of kiln conditions
- Analysis of drying costs
- Increasing of drying capacity
- Investment decisions of new kilns

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Conclusion

- A comment from sawmill
"Drying simulation model Laatukamari is the best tool to improve the drying quality of sawn timber"

Thank you for your attention!