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

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Business from technology

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

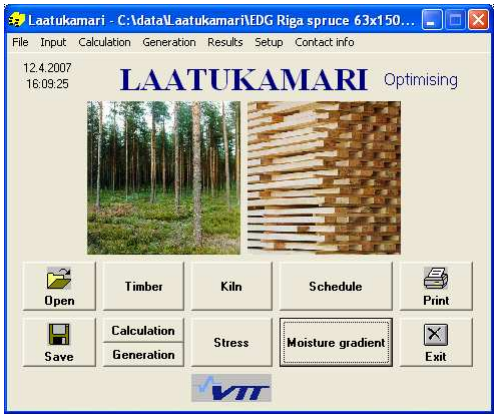
Drying simulation model - work process

- 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

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

Main window of LAATUKAMARI-PROGRAM "QUALITY DRYING PROGRAM"

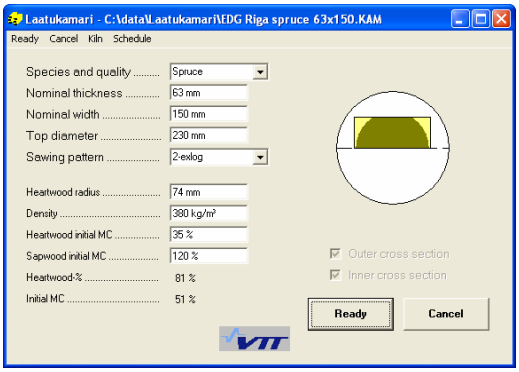


Input data

- 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

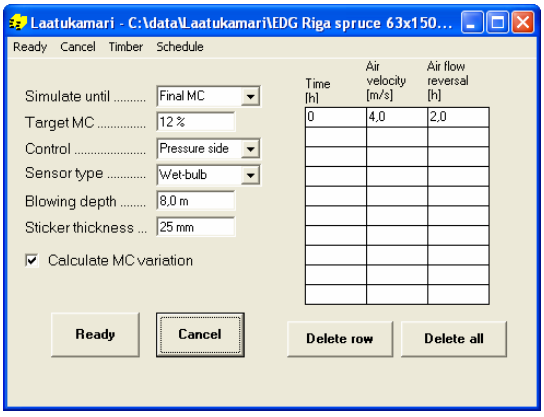
Input window for timber data

- 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



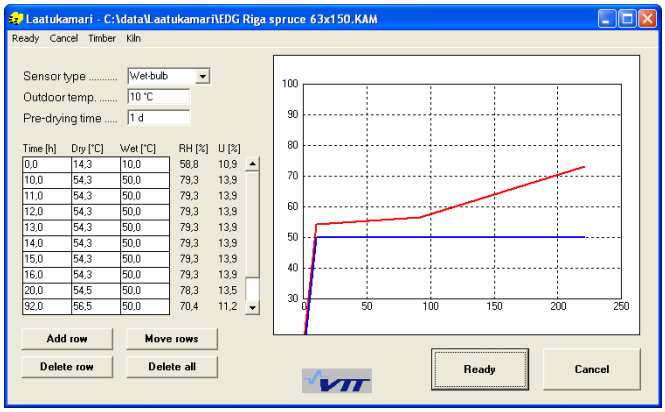
Input of kiln data

- 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



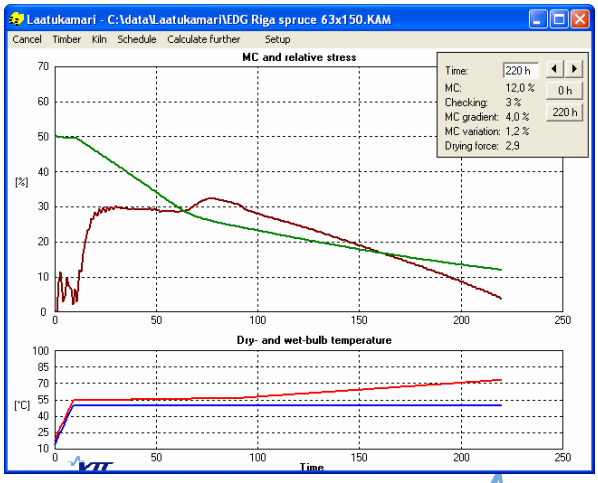
Input of drying schedule

- 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

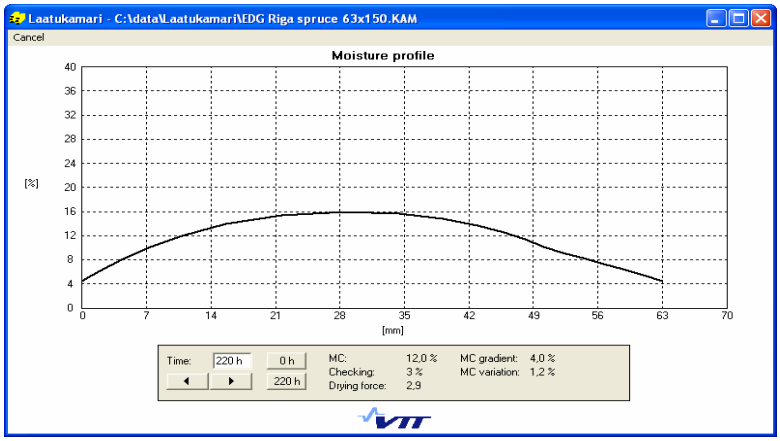


Output of drying simulation

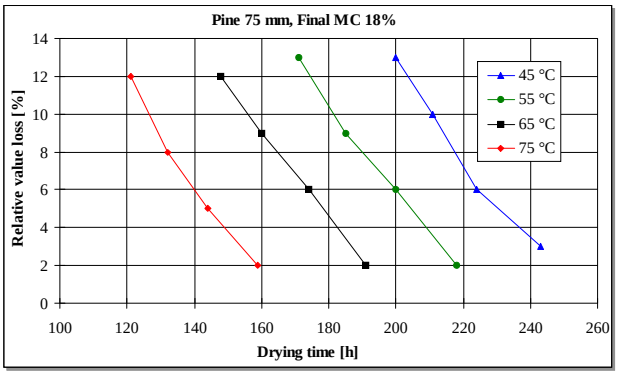
- maximal stress curve
- moisture curve
- drying schedule
- average MC
- checking
- MC gradient
- MC variation
- drying force



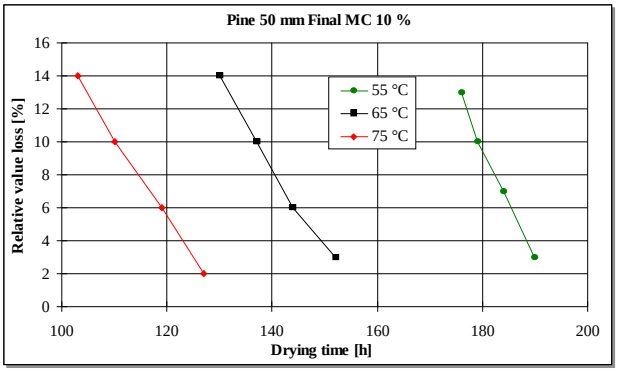
Moisture profile after drying



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



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



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

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!