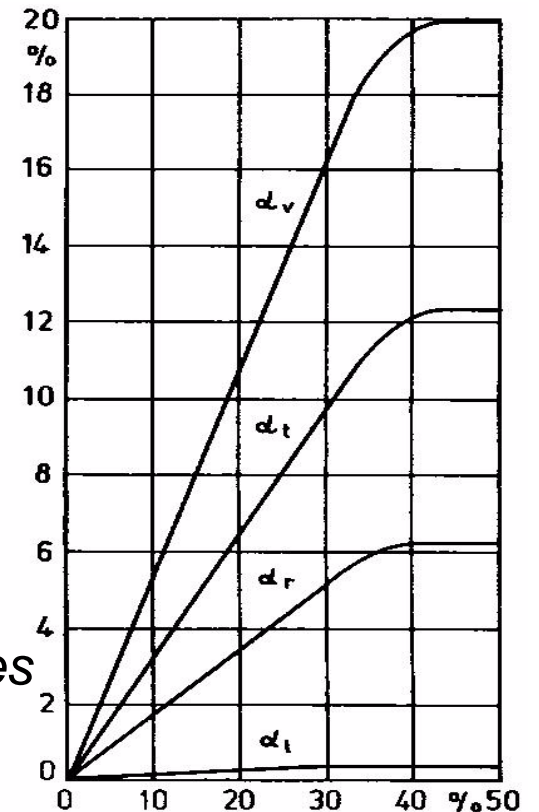


# Moisture content control by shrinkage behaviour of the wood

– first experimental results –

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# Content

- **Introduction**
- **Drying trials: material and method**
- **Results**
- **Conclusion**

# Introduction

**Why would you like to control a drying process ?**

- **To obtain the final moisture content**
- **To avoid cracks, distortions and discoloration**

# Introduction

**How do you control a drying process ?**

- **Moisture content measurements**
- **Moisture evaporation rate (drying rate)**
- **Strain measurements**

**Along the cross-section of the timber !!!!!!!!!!!**

# Introduction

## Common inline measurement systems for moisture content in a kiln ?

- **Electrical resistance probes**
- **Exceptionally: weighing the stack**
- **??????????**

**Prediction of water evaporation and moisture content by drying models !!!!!**

# Introduction

## Limitations of electrical resistance measurements ?

- **Moisture content above fibre saturation**
- **Temperature above 80°C**

# Introduction

**What about shrinkage ?**

**There is also a relationship between shrinkage and moisture content.**

# Drying trial

## Material

- Sitka Spruce from Scotland/UK
- 2500mm x 100mm x 50mm



- Initial moisture content 40% - 170%  
(50% of all boards higher 90%)
- Final moisture content required 15%±1
- 63 boards per trial

# Drying trial

## Sensors

**6 moisture probes in the timber**

**2 temperature sensors in the timber**

**2 relative humidity sensors in the kiln**

**2 temperature sensors in the kiln**

**2 shrinkage sensors at the timber stack**

**2 load cells for weighing the stack**



# Drying trial

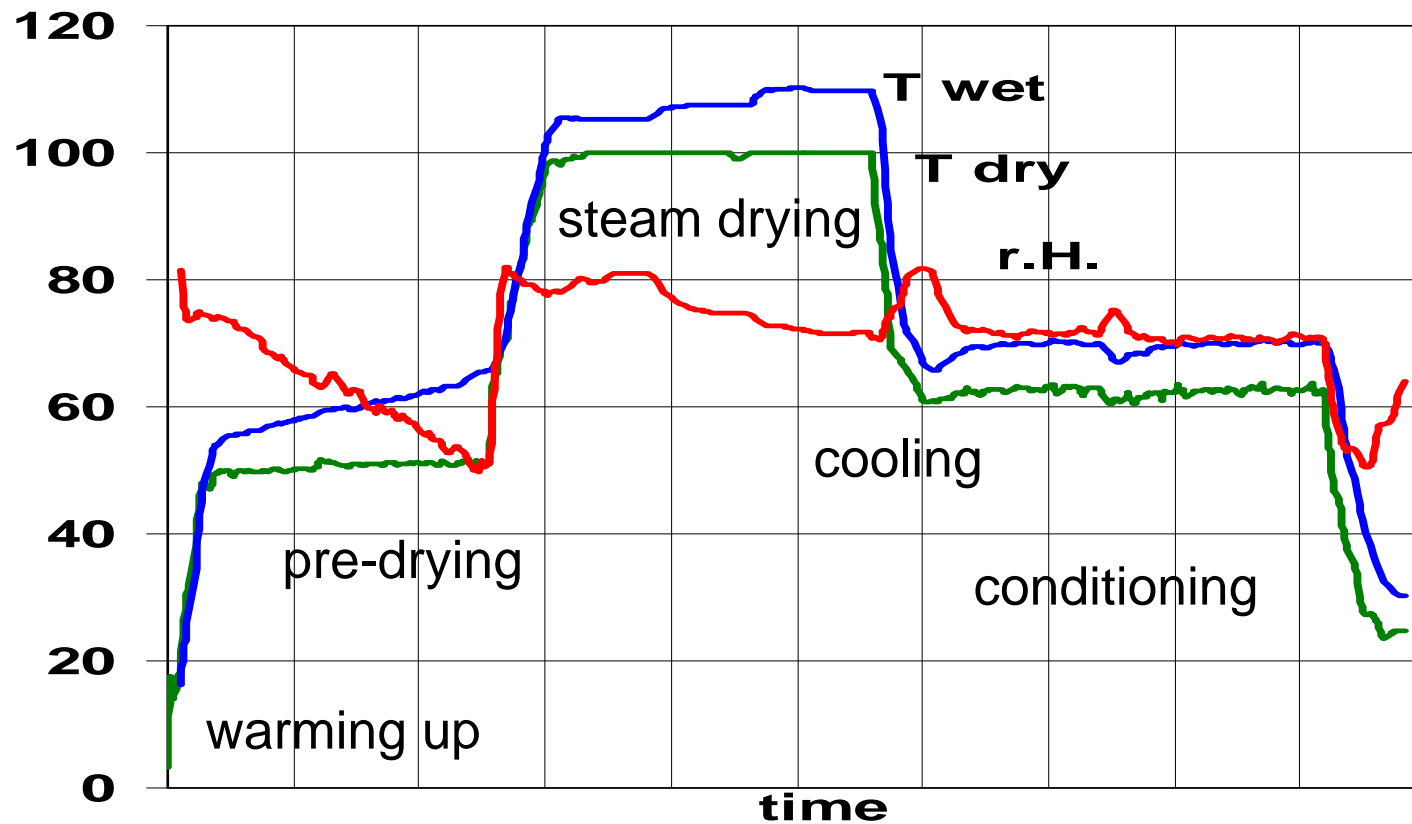
## Timber stack



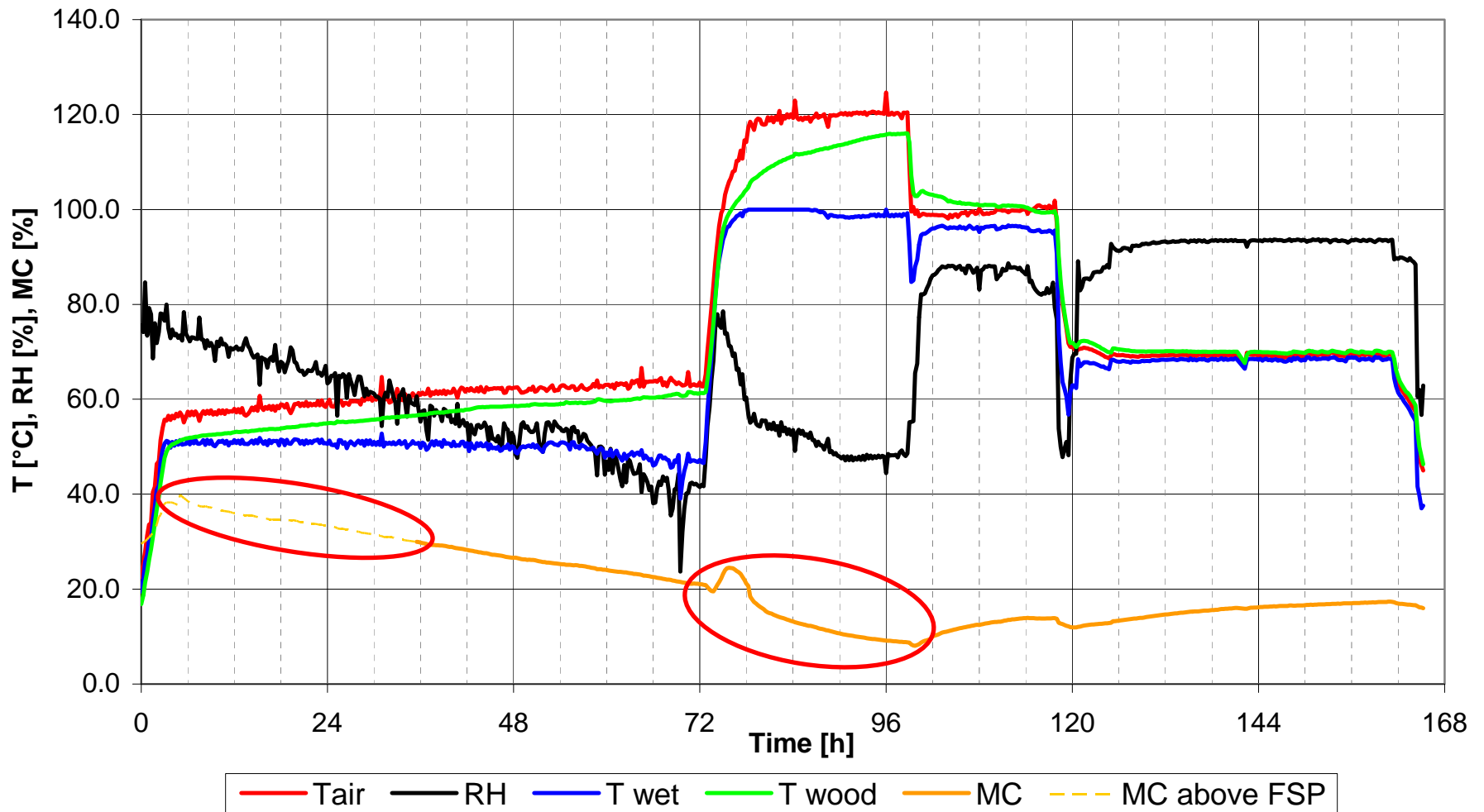
- Top load 500 kg/m<sup>2</sup>, to avoid deformation during drying
- Measuring online the decrease of thickness with a displacement sensor (LVDT)
- Measuring the decrease of the mass with a load cell

# Drying trial

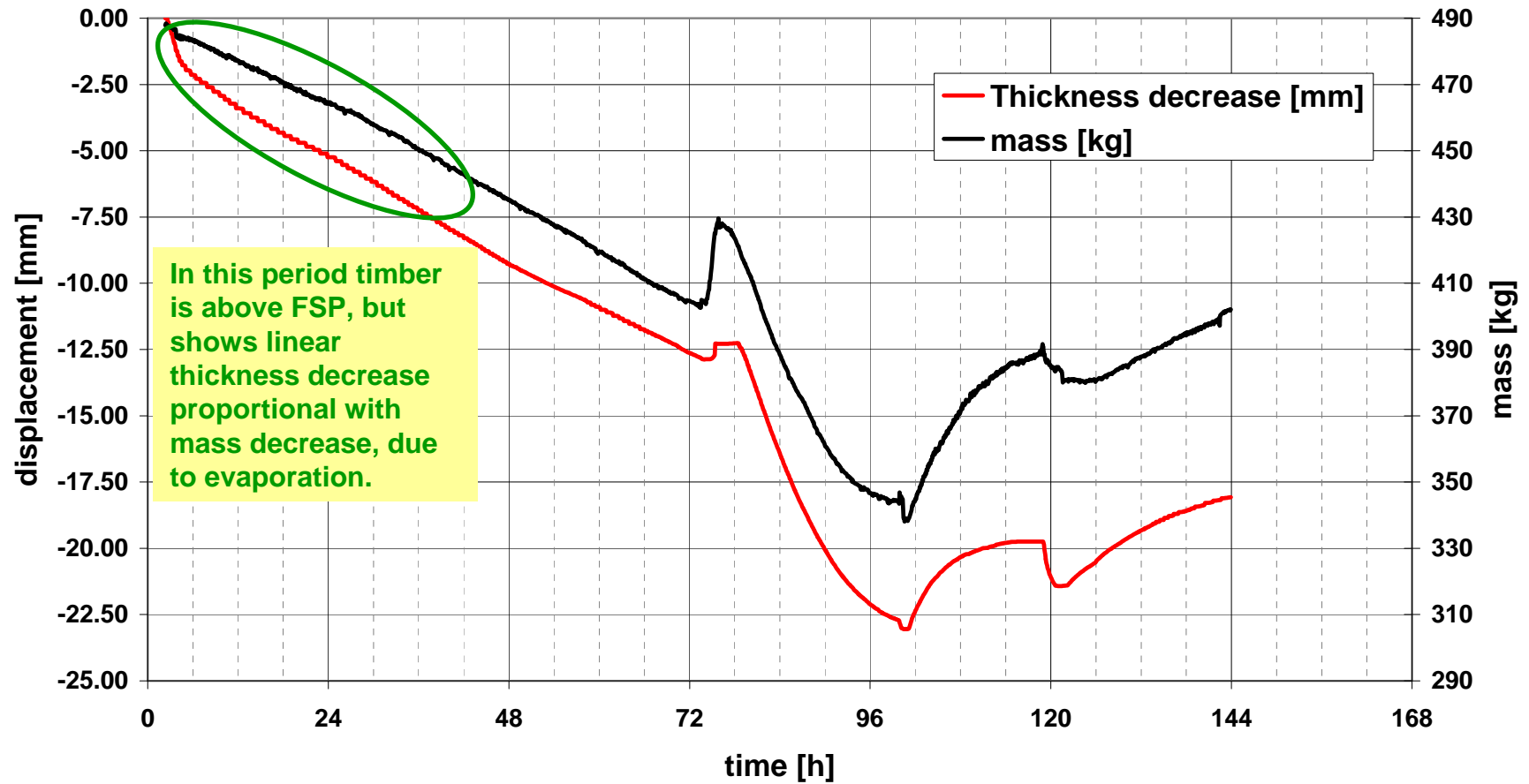
## Drying schedule



# Results



# Results



# Results

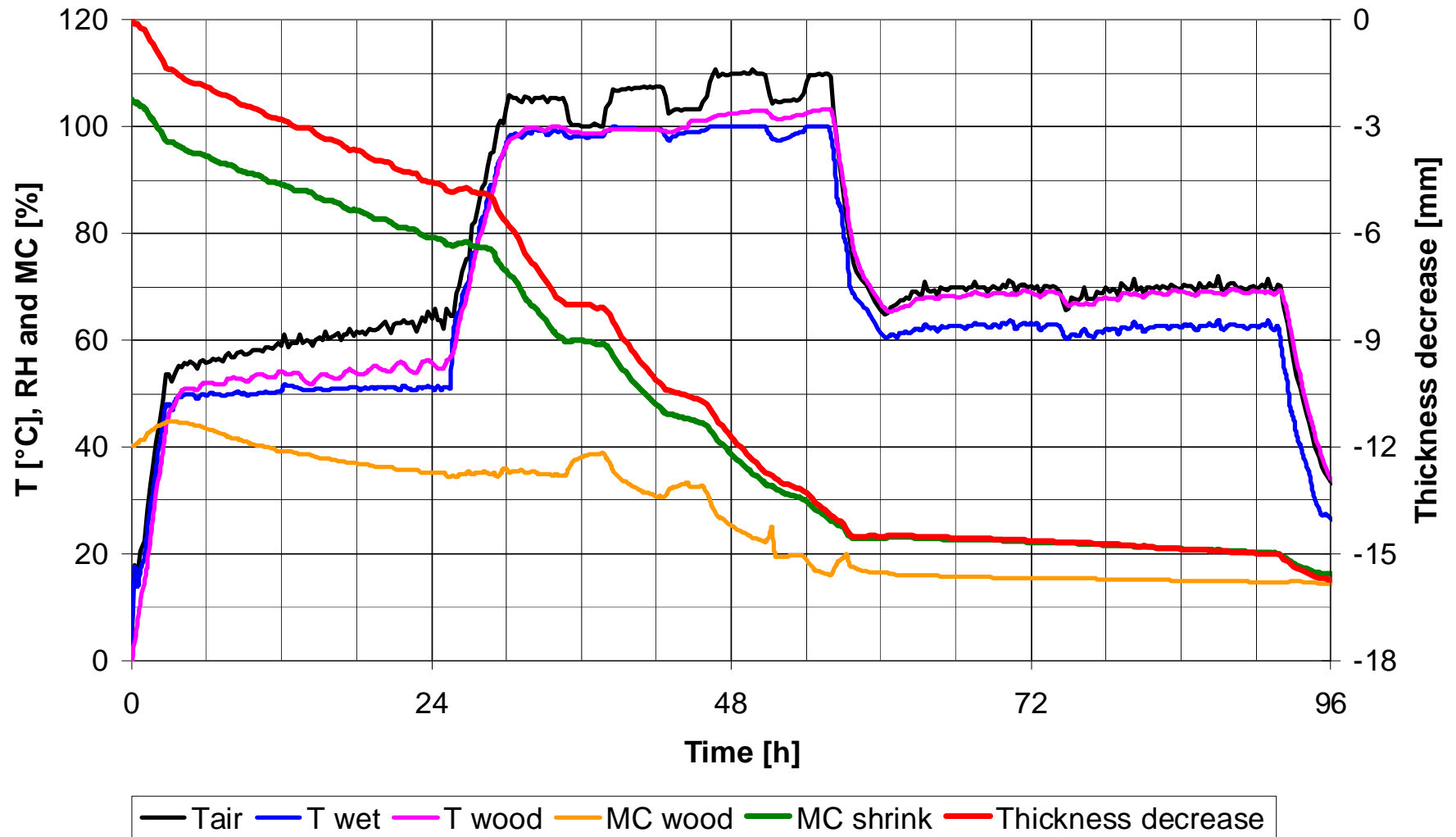
## Shrinkage parameters

- total thickness of the boards 350mm in the beginning of the drying
- total thickness decrease 17.7mm total shrinkage 5.0%
- final moisture content 14.5% (oven dry)
- assumed fibre saturation point 30%
- derived shrinkage coefficient 0.50% per % MC change



# Results

## Sitka spruce on industrial scale



# Conclusion of the first results

- With a displacement sensor we get information on the drying rate, which is especially in the early drying stages of Sitka very important for the drying quality.
- Displacement measurements are reliable at high temperatures ( $>100^{\circ}\text{C}$ ).
- There is a direct linear relation between thickness decrease and mass decrease due to drying.

Thank you very much  
for your attention !

