
Software toll specialized for solving

■ Spalling of rolls

- prediction of maximum length of roll campaign
- proper grinding to prevent spalling
- design of BuR chamfers / tapers to prevent spalling

■ Flattness and profile problems

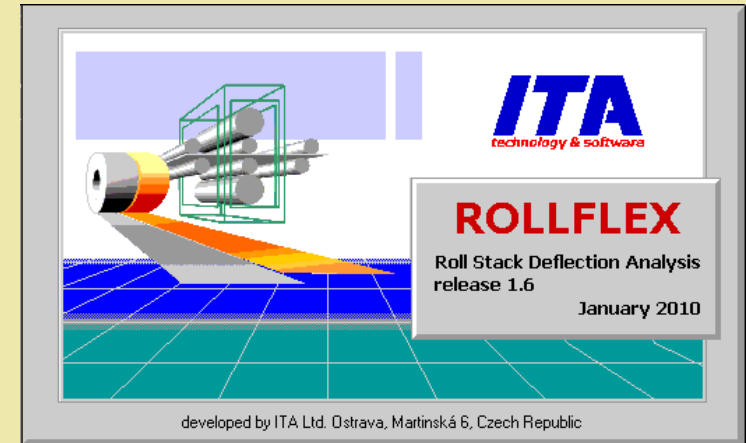
- proper grinding
- analysis of process
- control of WR – bending (WR - shifting)

Spalling of Rolls

ROLLFLEX

Fatigue Module of Rollflex

- Evaluates danger of BuR spalling
- Identifies the most dangerous parts of BuR surface
- Optimizes the length of roll campaign
- Optimizes the chamfers/tapers and other parameters

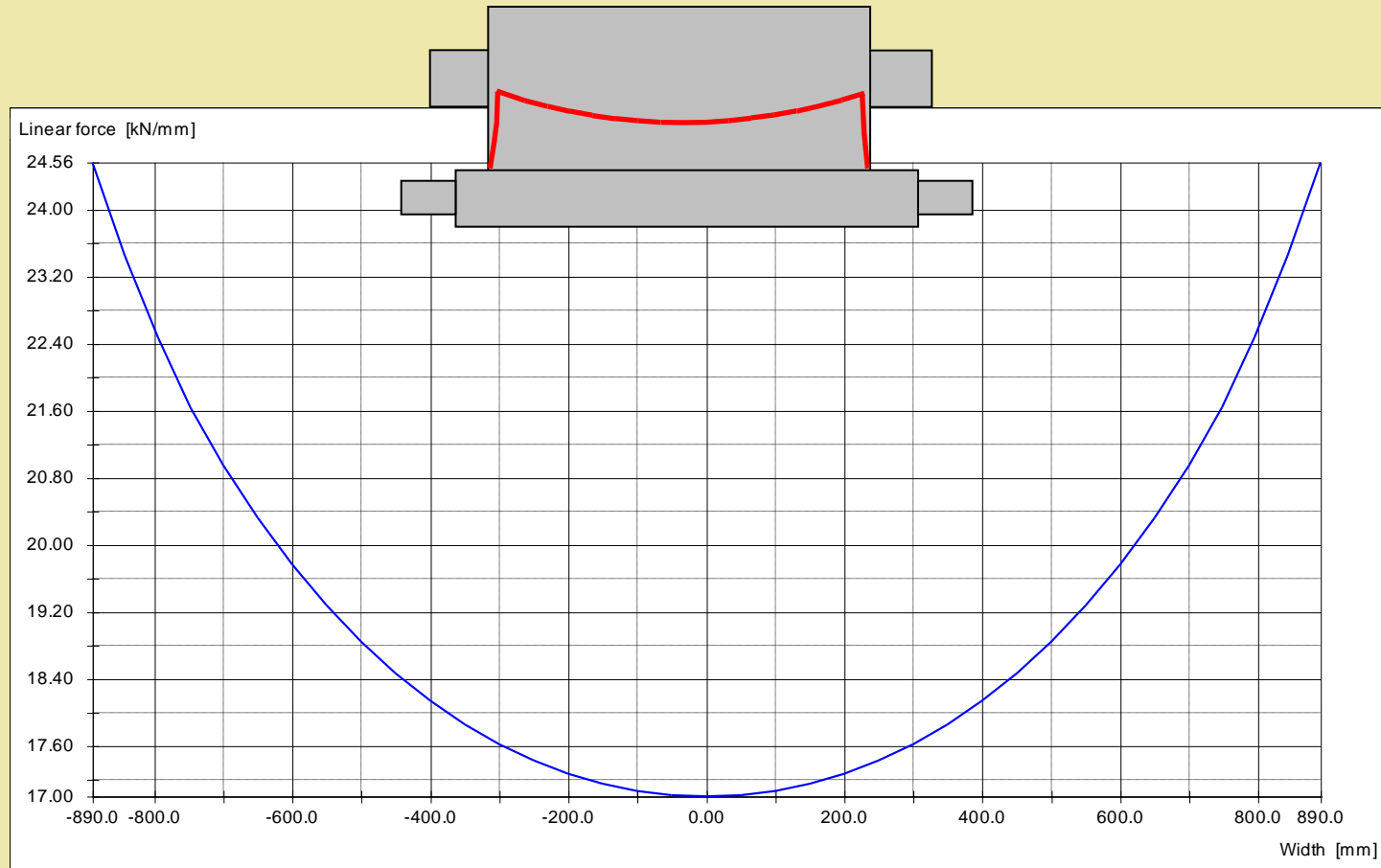


Surface Spalling or Cracking

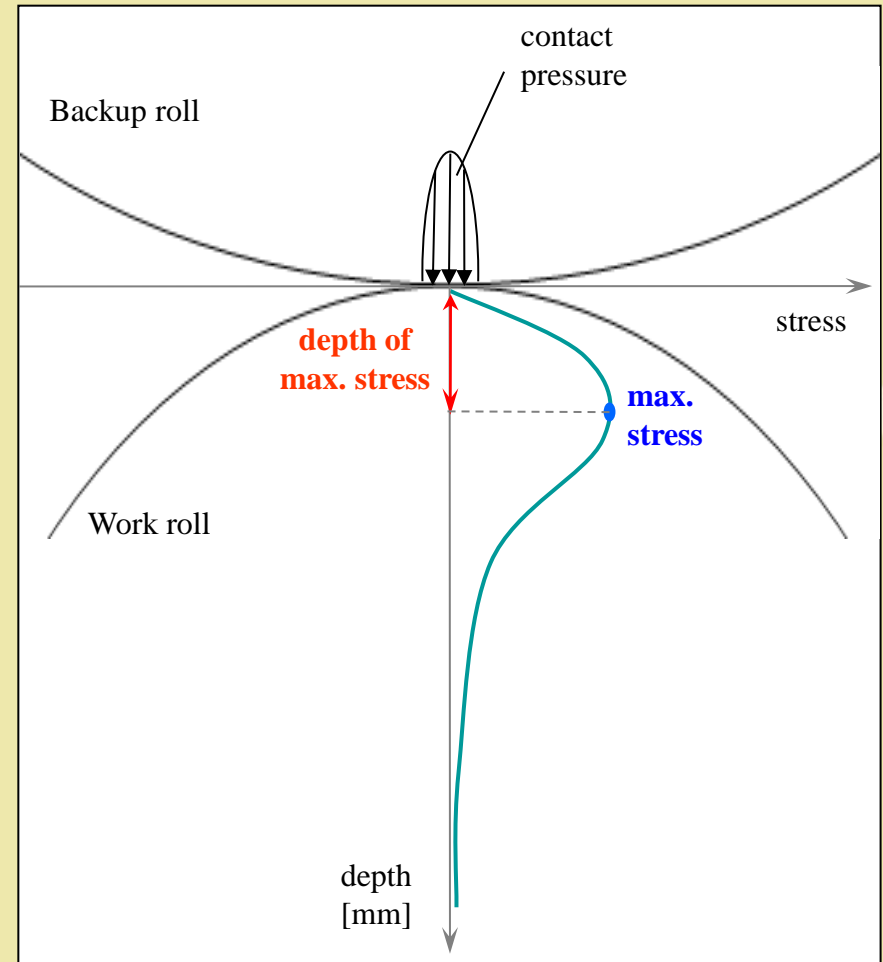
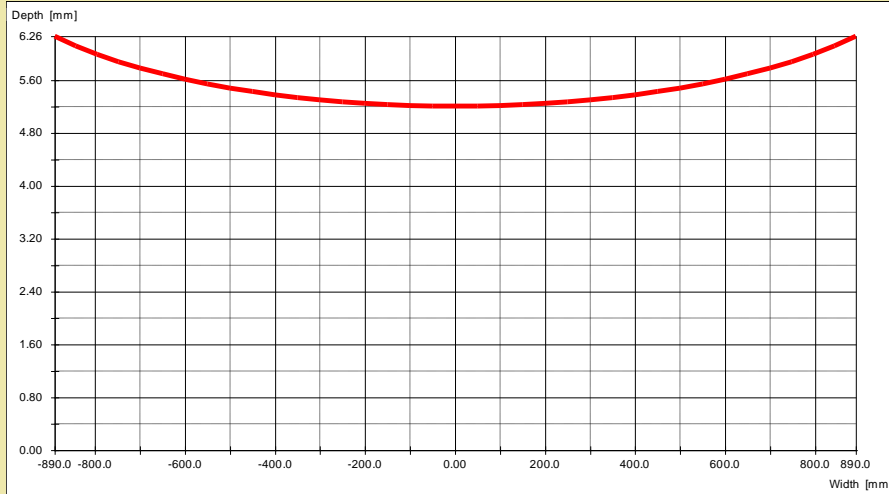
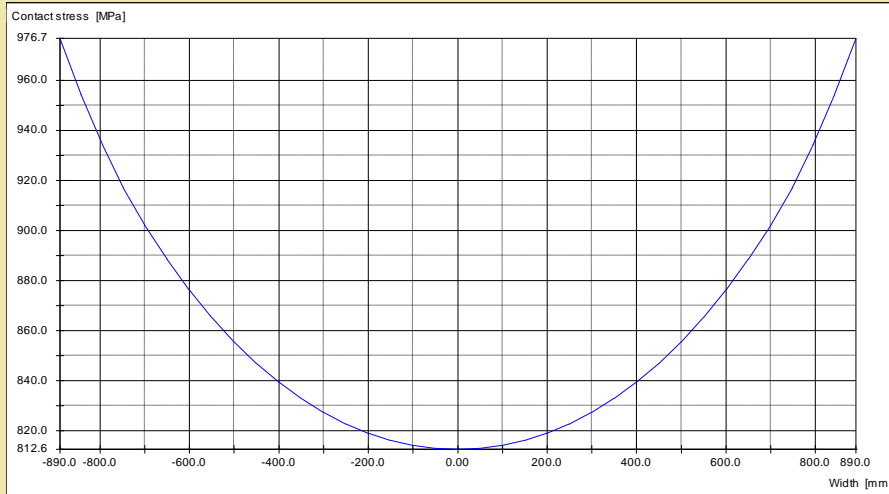
Loads and Stresses on Roll Surface

- Hertz contact stress
- Bending stress
- Residual stress (thermal treatment)

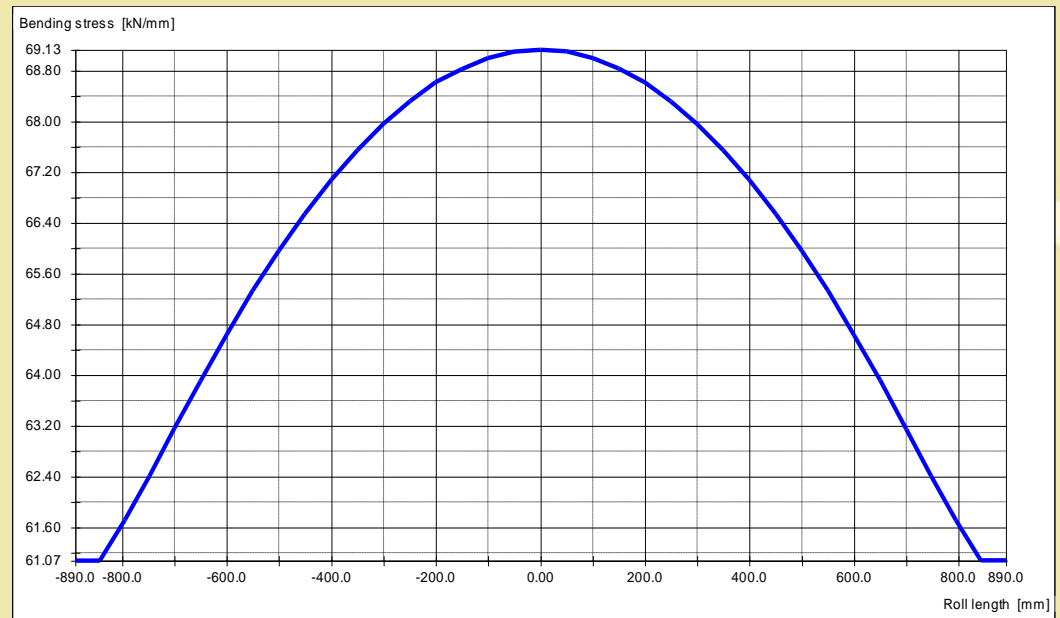
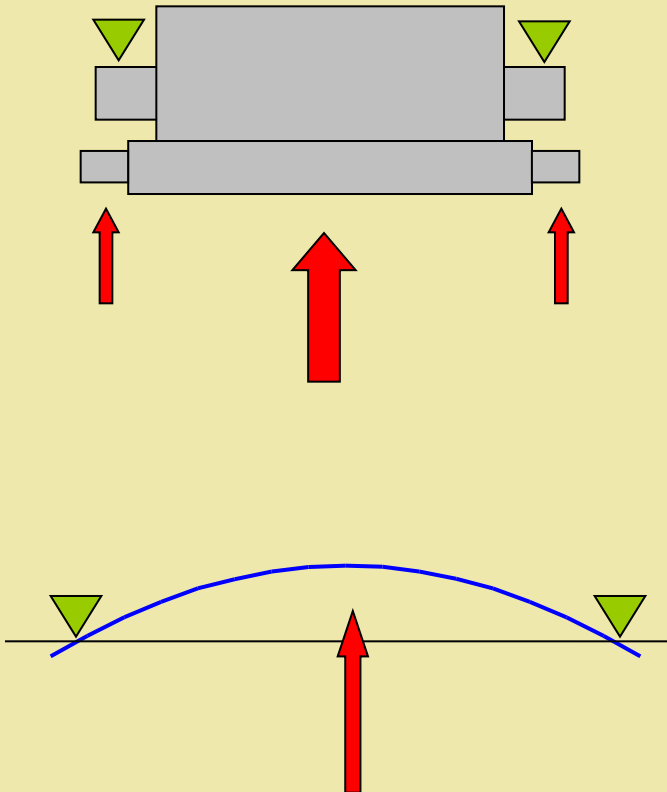
Herzt Contact – specific load



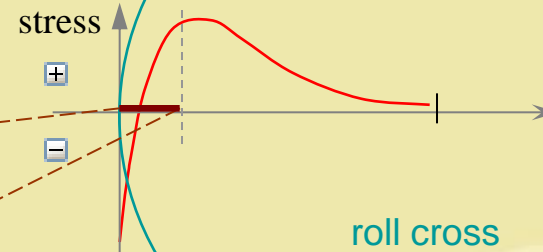
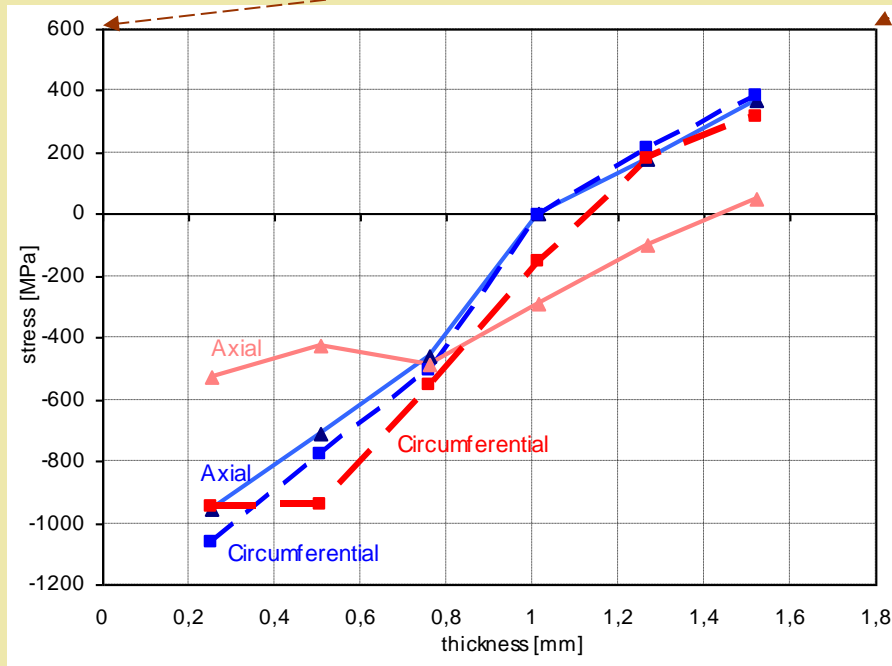
Herzt Contact – maximal Stress



Bending Stress



Residual Stress



Measured stresses on BuR surface

Smith' diagramm

prediction of possible loading cycles

Material Properties of rolls

Constants | **Fatigue** | Residual stress

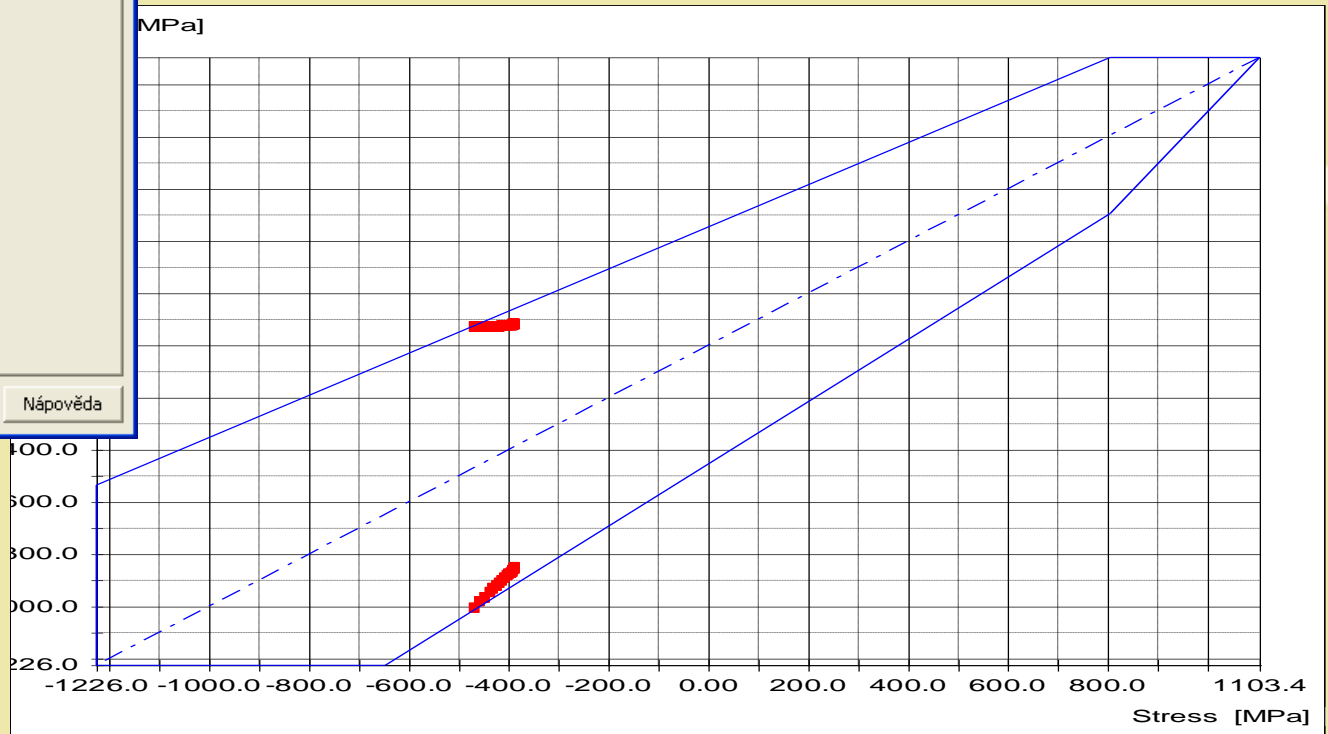
Hardness: [-]

Yield stress: [MPa]

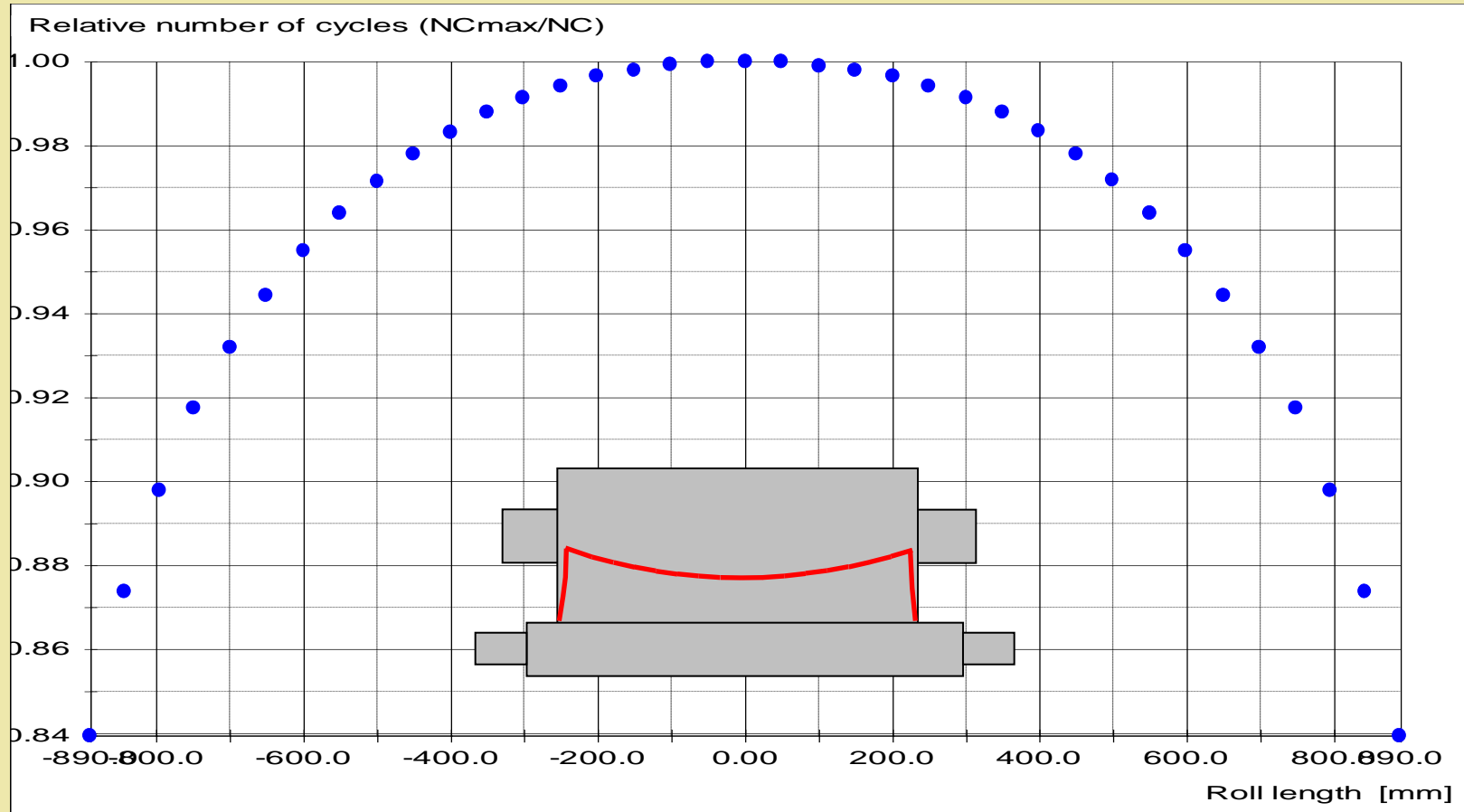
Tensile strength: [MPa]

Sigma C: [MPa]

Sigma HC: [MPa]



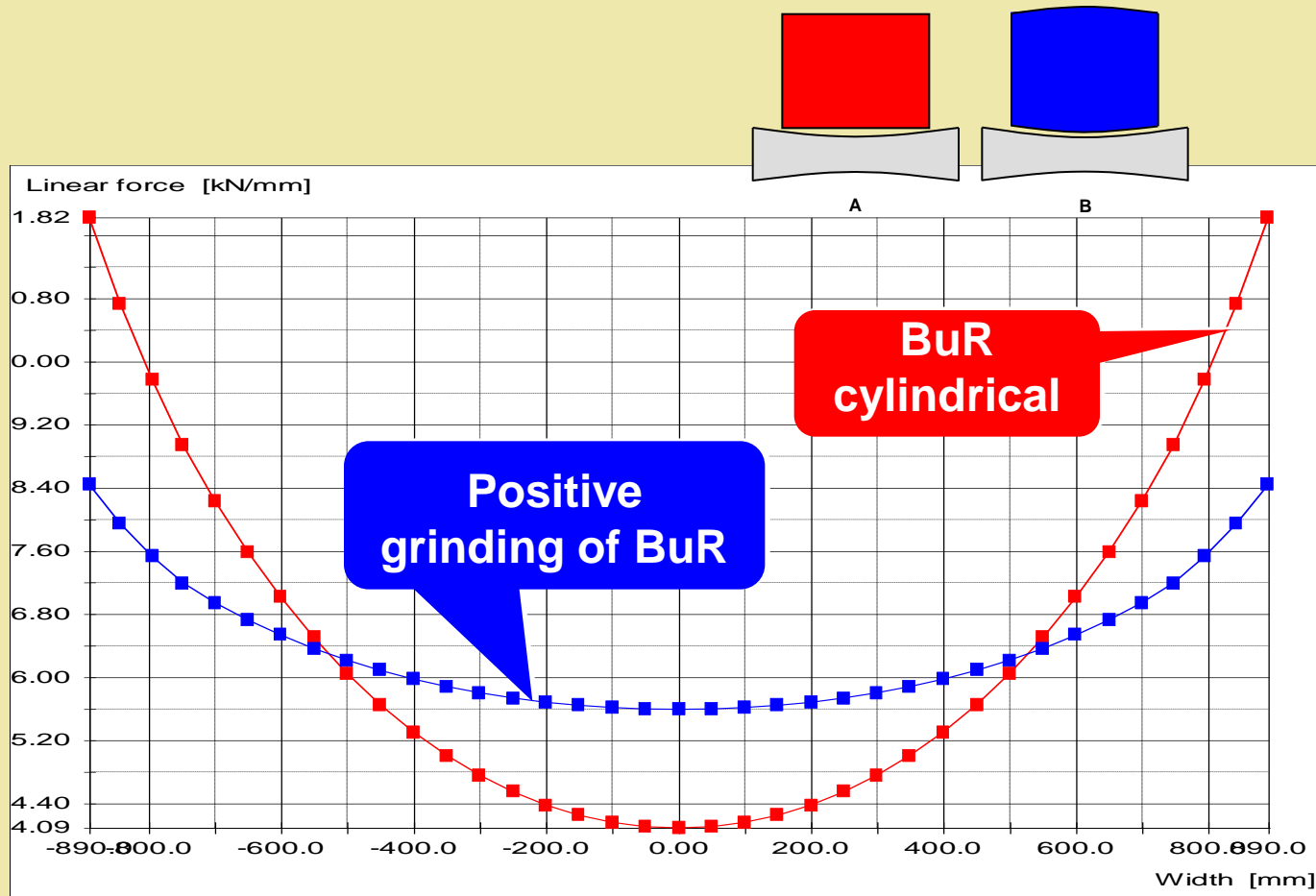
Relative number of cycles on roll surface



How to influence the length of BuR campaign

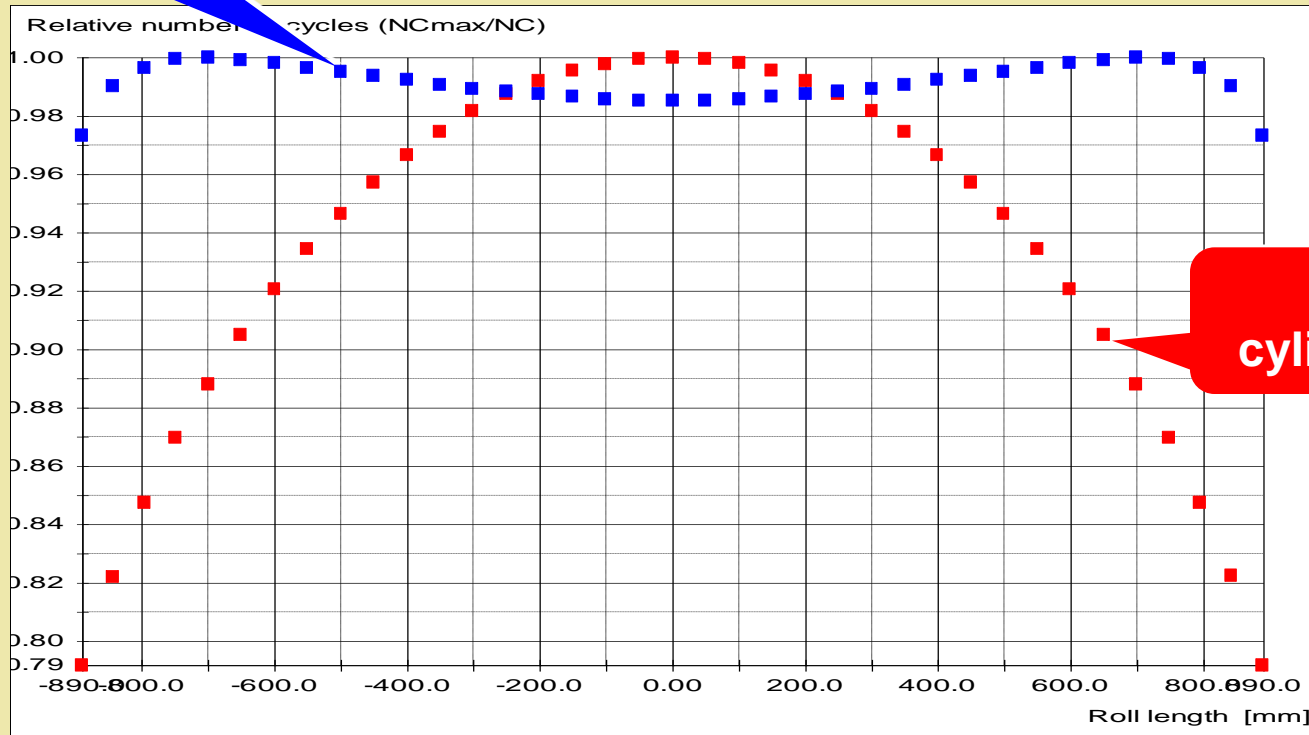
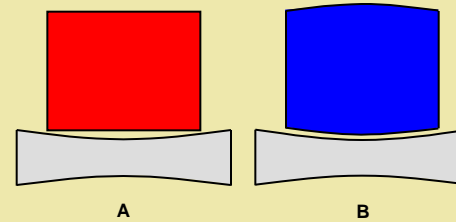
- Proper Design of Chamfers
- Positive Grinding on BuRs
- Proper Depths of Grinding
- Surface Testing

Optimalization of Roll Grinding



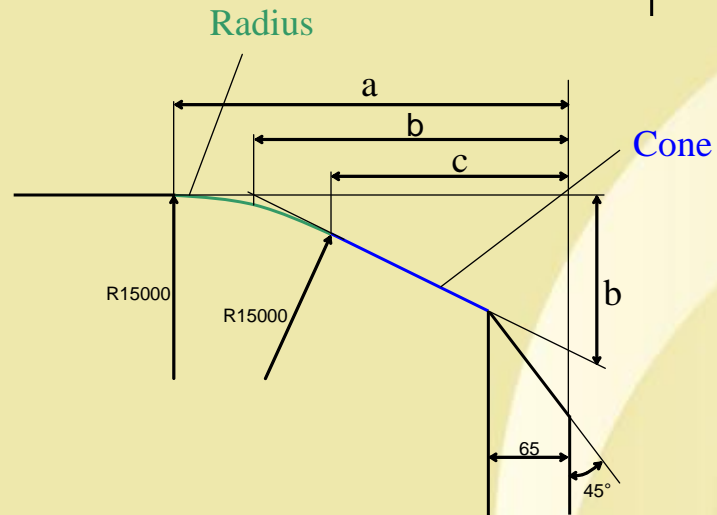
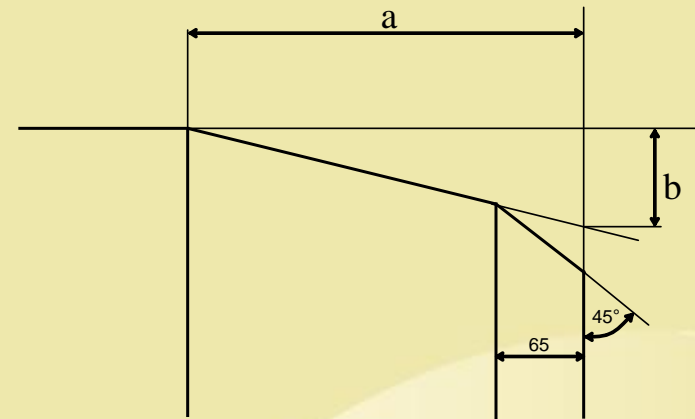
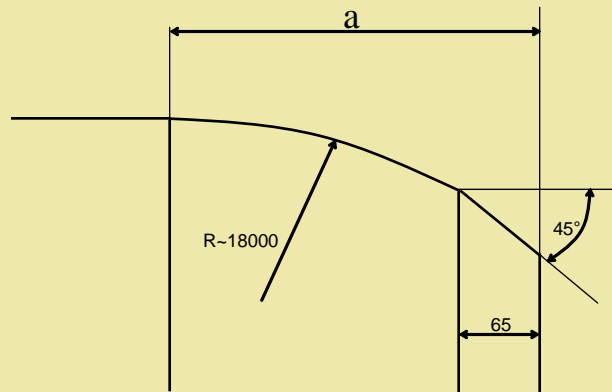
Optimalization of Roll Grinding

Positive grinding of BuR

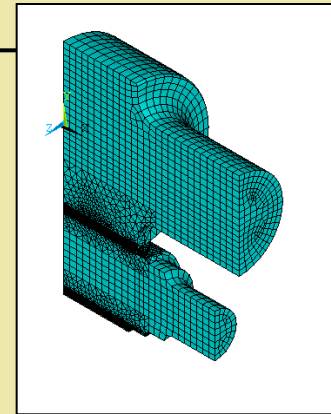
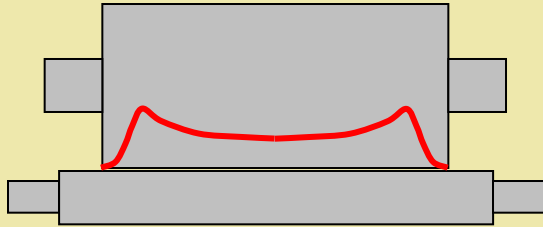


BuR cylindrical

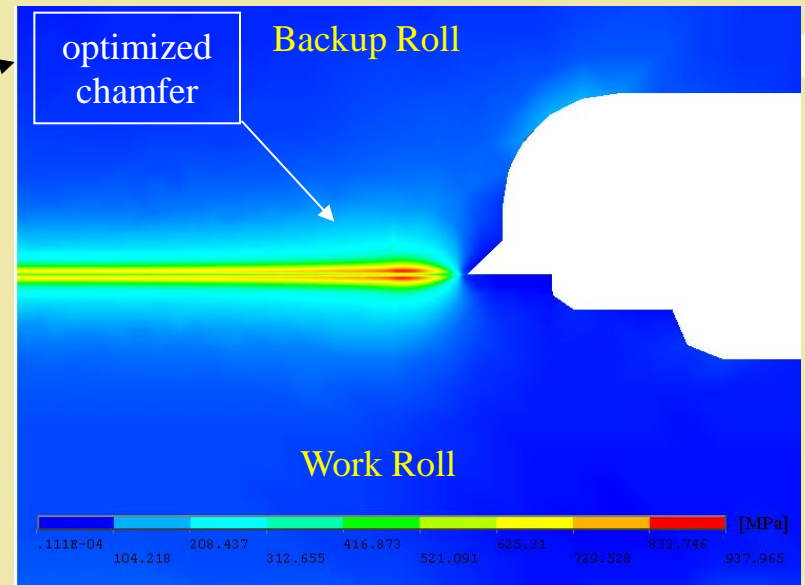
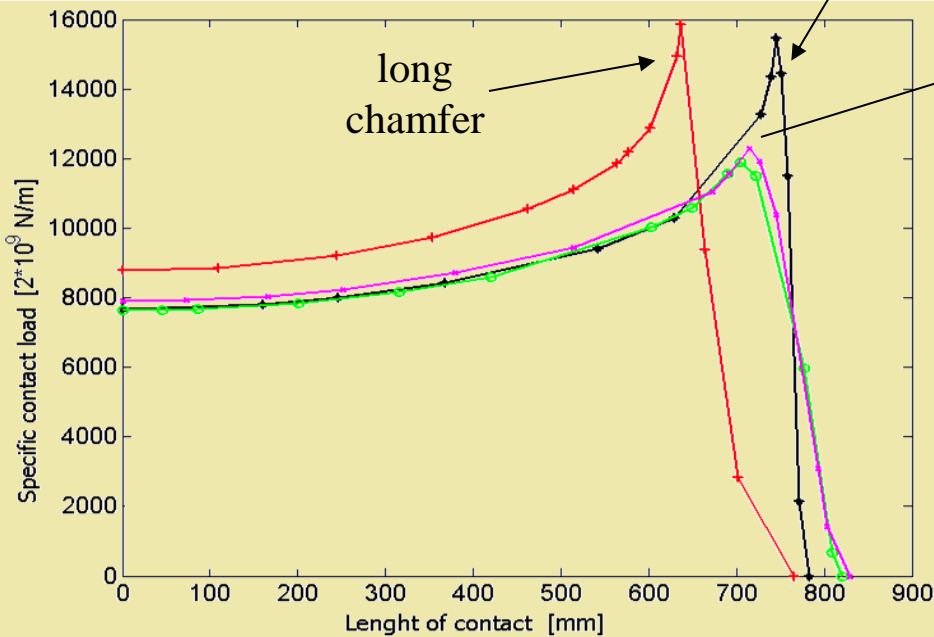
Design of Chamfer of BuRs



Design of Chamfers



deep
chamfer



It is possible
to improve BuR performance:

Specialized software Rollflex
makes those analysis quite simple !



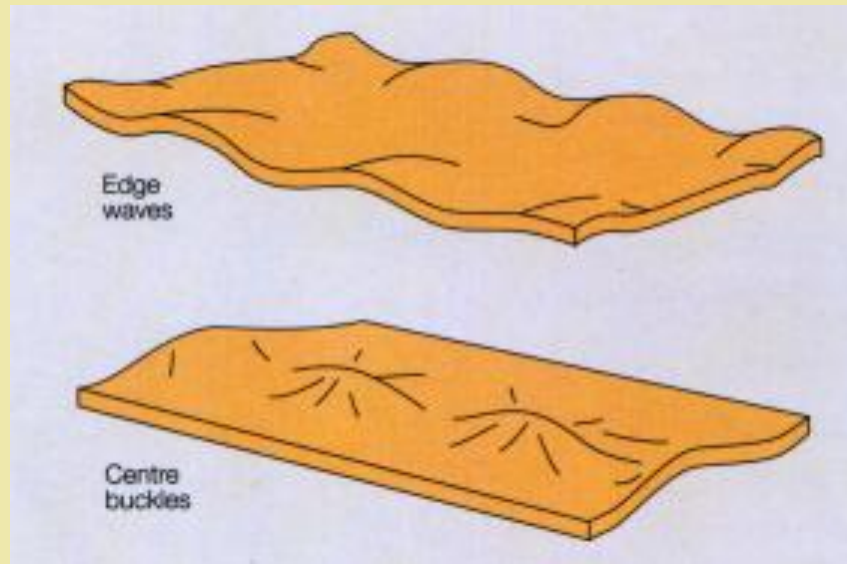
ROLLFLEX
Roll Stack Deflection Analysis
release 1.6
January 2010

developed by ITA Ltd. Ostrava, Martinská 6, Czech Republic

Rollflex **for strip profile** **and flatness**

Profile and Flatness

In today's market quality has become the dominant factor in competition of metal producers. The profile and flatness are the most important geometrical parameters of strips and sheets.

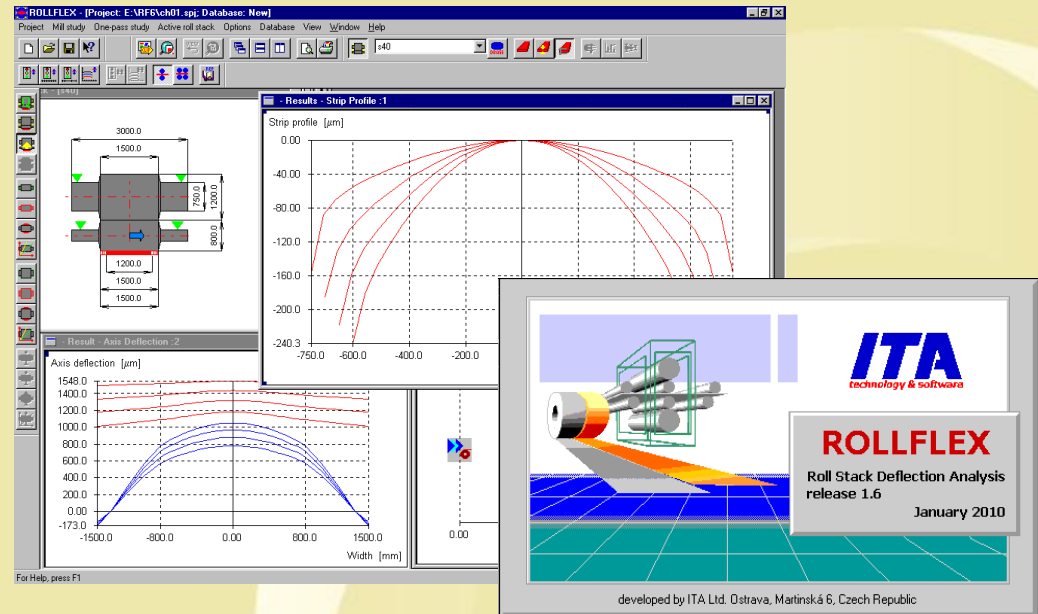


Rollflex for Flattness

- Flatness control is an integrated part of control systems of HSMs (Level 2)
- Rollflex can work in off-line and help to identify problems of current flatness control
- Rollflex can control Bending/Shifting (on-line)

Rollflex can optimize:

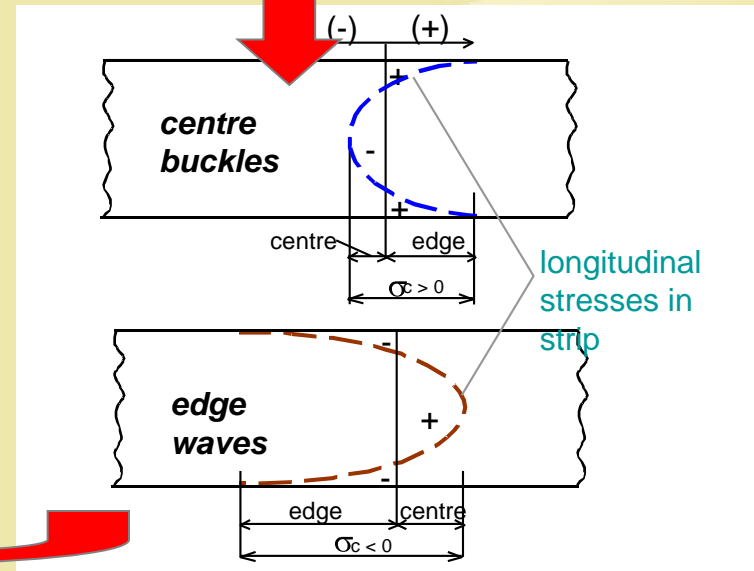
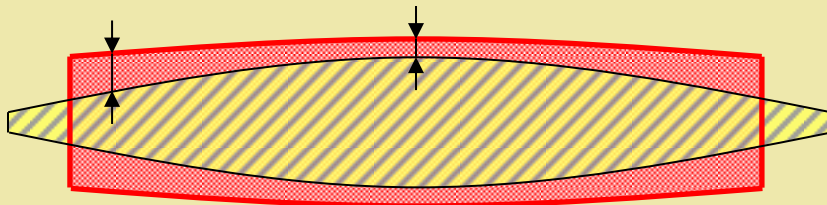
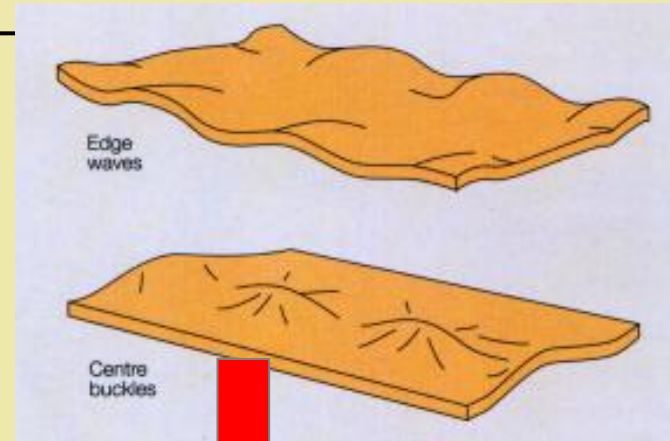
- Grinding of rolls to get target profile
- Optimize Bending, Shifting and Sheduling Strategies



Reasons of Waviness

Waviness is caused by negative longitudinal stresses in strip

The longitudinal stresses originate in changes of profile in particular passes

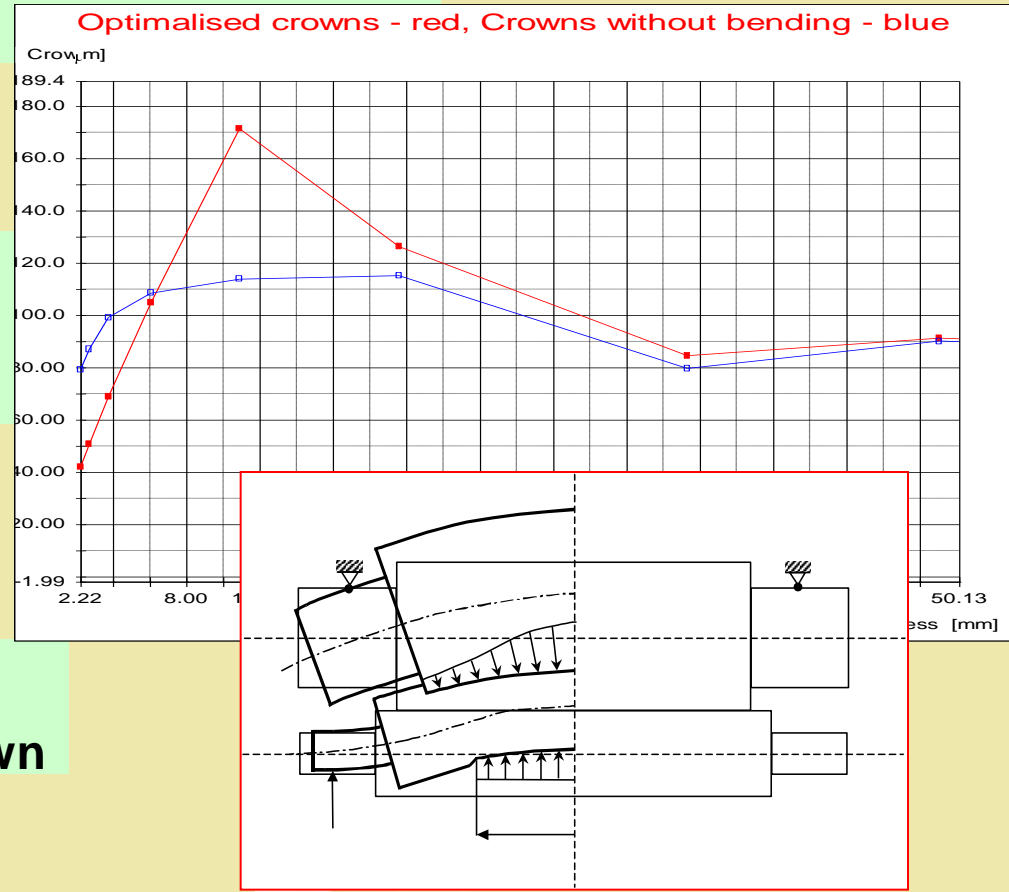


How to reach the strip flat?

Ensure the suitable change of crown (profile) in subsequent shape passes

Compute the sequence of crowns using roll stack deflection model

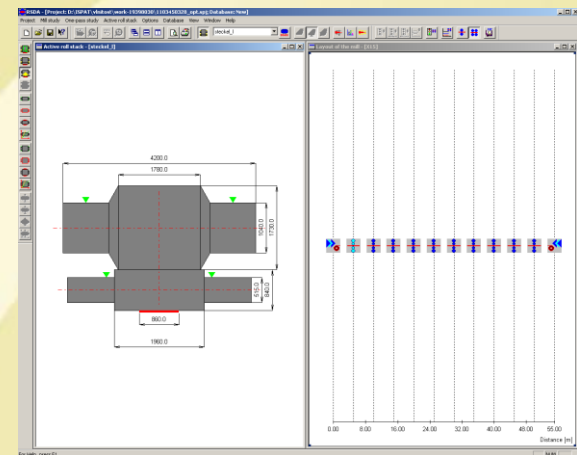
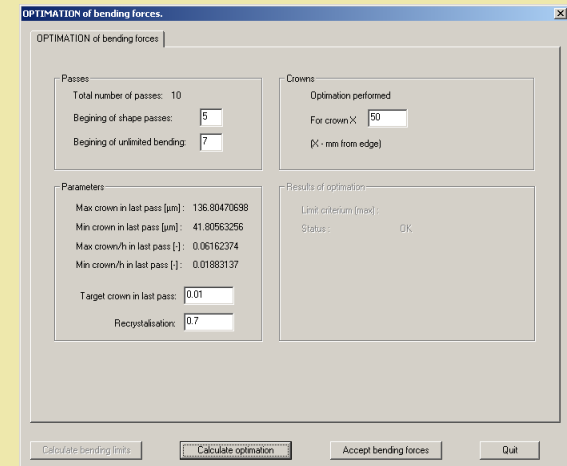
Compute suitable Bending (shifting) to produce the crown



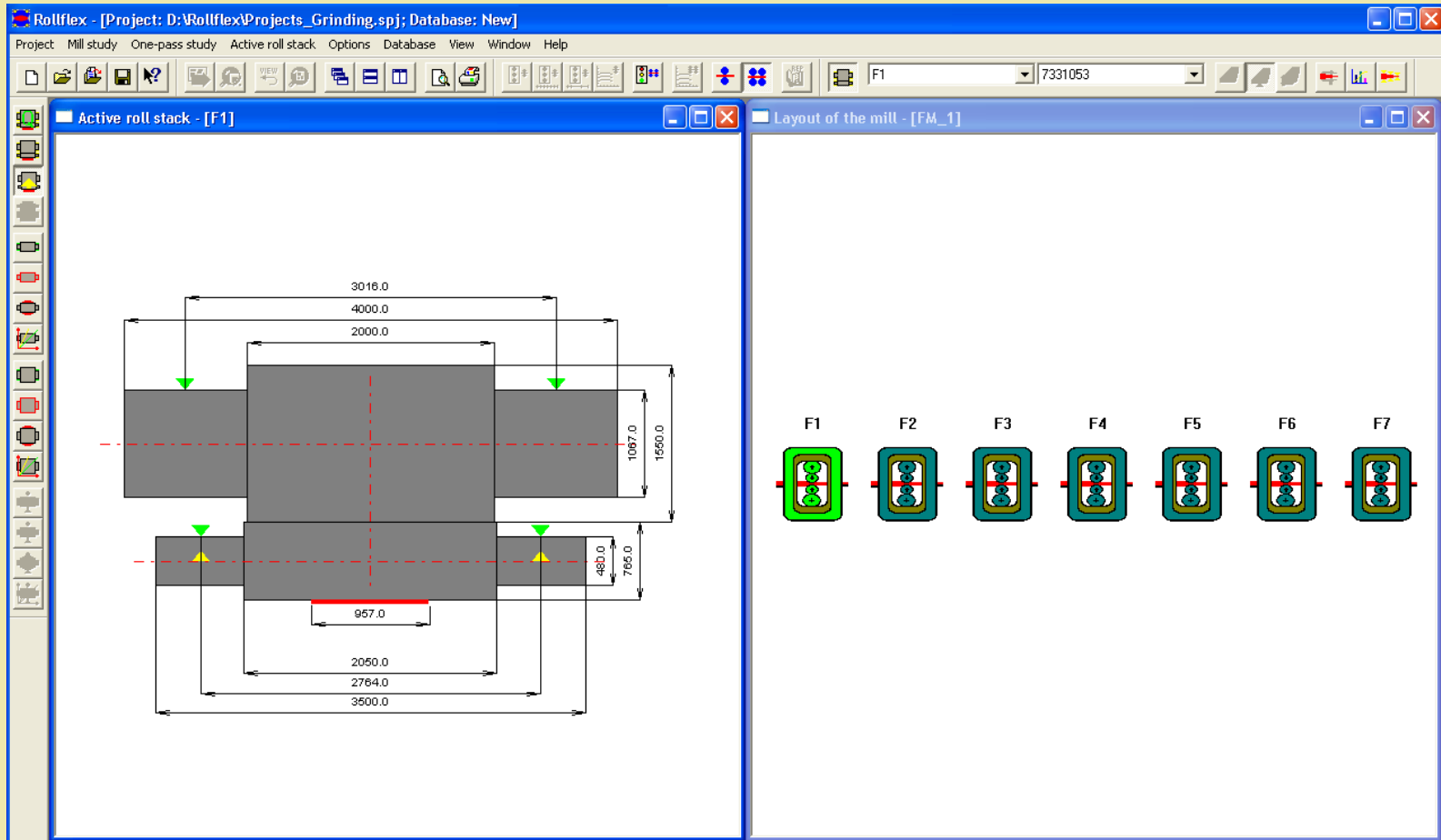
Calculation of optimal bending forces – off-line

Following parameters can be changed by user:

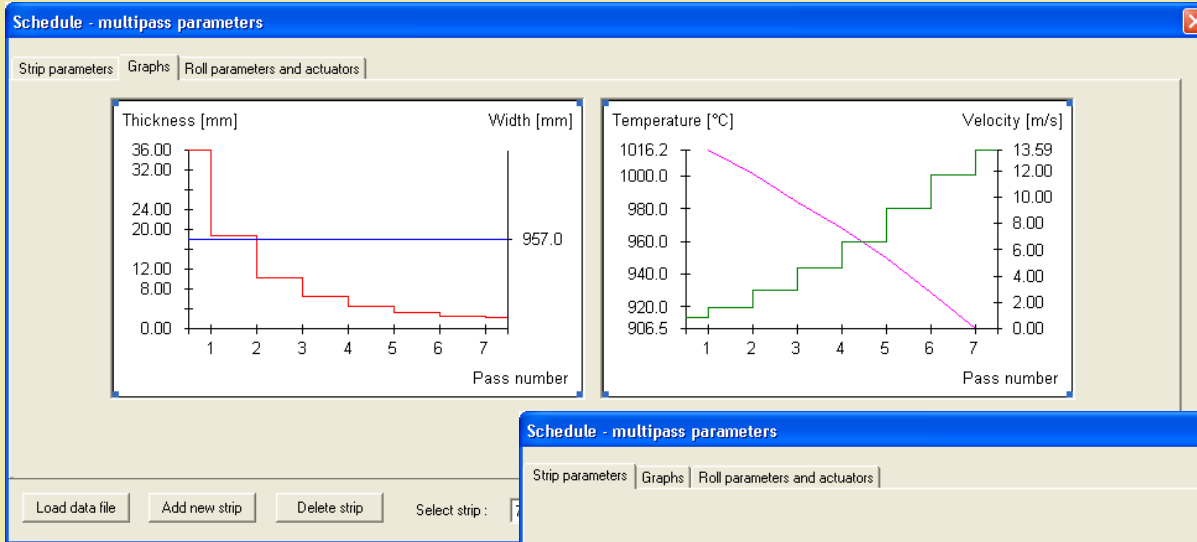
- number of shape passes,
- target crown,
- recrystallisation of material.



Example: 7 stand HSM



Example: 7 stand HSM



Schedule - multipass parameters

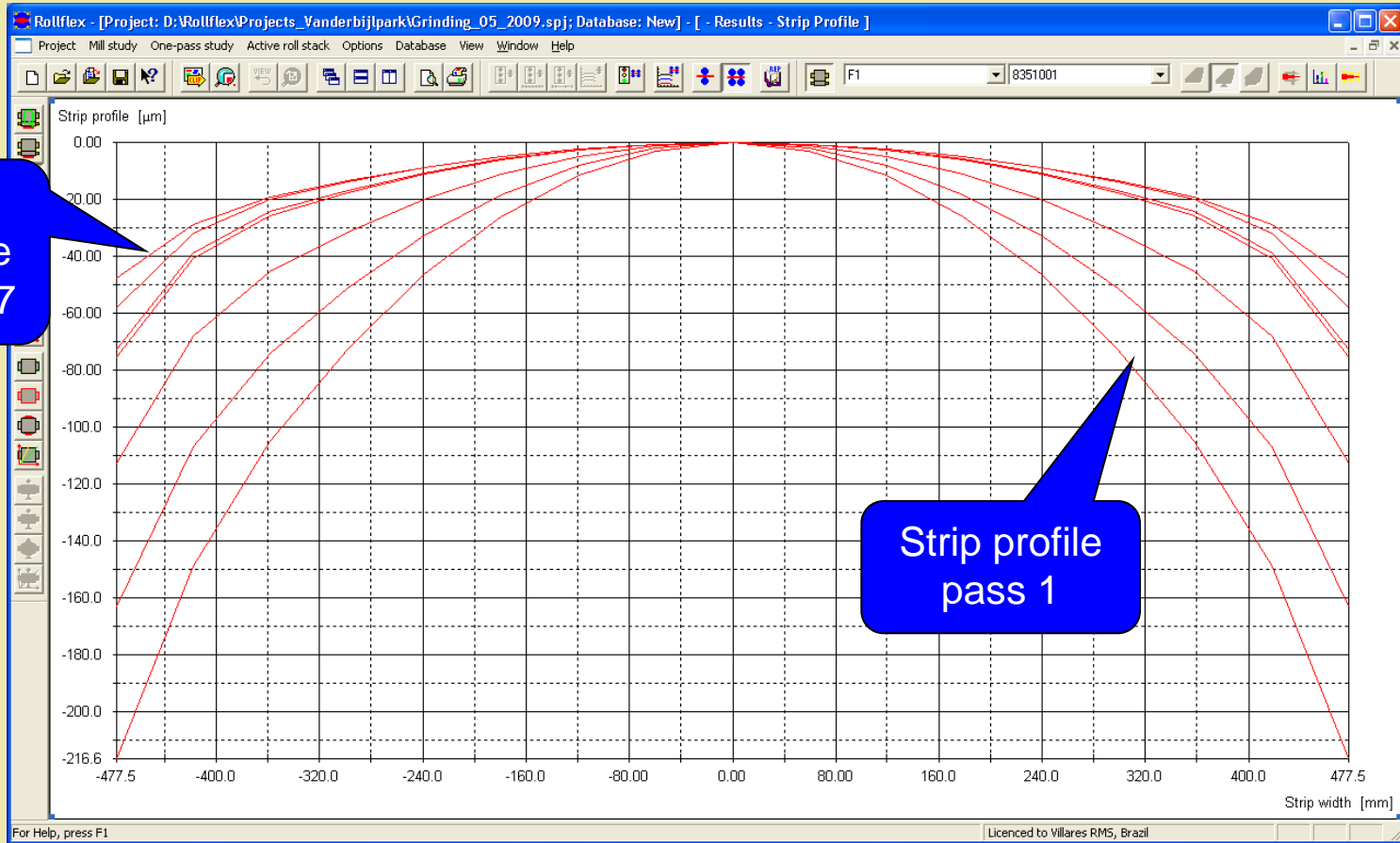
Strip parameters | Graphs | Roll parameters and actuators

Stand	Pass	Thickness [mm]	Profile h2 [mm]	Profile h4 [mm]	Width [mm]	Temperature [°C]	Velocity [m/s]	Force [kN]
F1	<input checked="" type="checkbox"/> 1	36.0	0.0000	0.0000	957	1016	0.84	14586
F2	<input checked="" type="checkbox"/> 2	18.8	0.0000	0.0000	957	1001	1.61	13276
F3	<input checked="" type="checkbox"/> 3	10.2	0.0000	0.0000	957	984	2.97	12013
F4	<input checked="" type="checkbox"/> 4	6.5	0.0000	0.0000	957	968	4.63	11023
F5	<input checked="" type="checkbox"/> 5	4.6	0.0000	0.0000	957	950	6.59	9745
F6	<input checked="" type="checkbox"/> 6	3.3	0.0000	0.0000	957	929	9.19	7530
F7	<input checked="" type="checkbox"/> 7	2.6	0.0000	0.0000	957	906	11.66	4963
Output	---	2.2	0.0000	0.0000	957	---	13.59	

Calculate widths | Calculate temperatures | Calculate velocities | Force from table

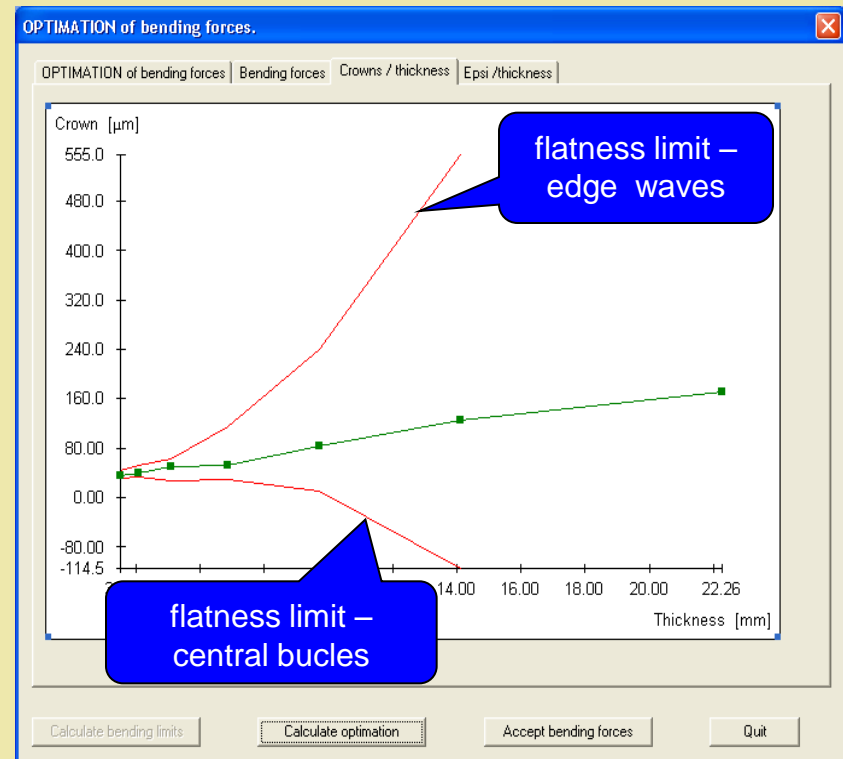
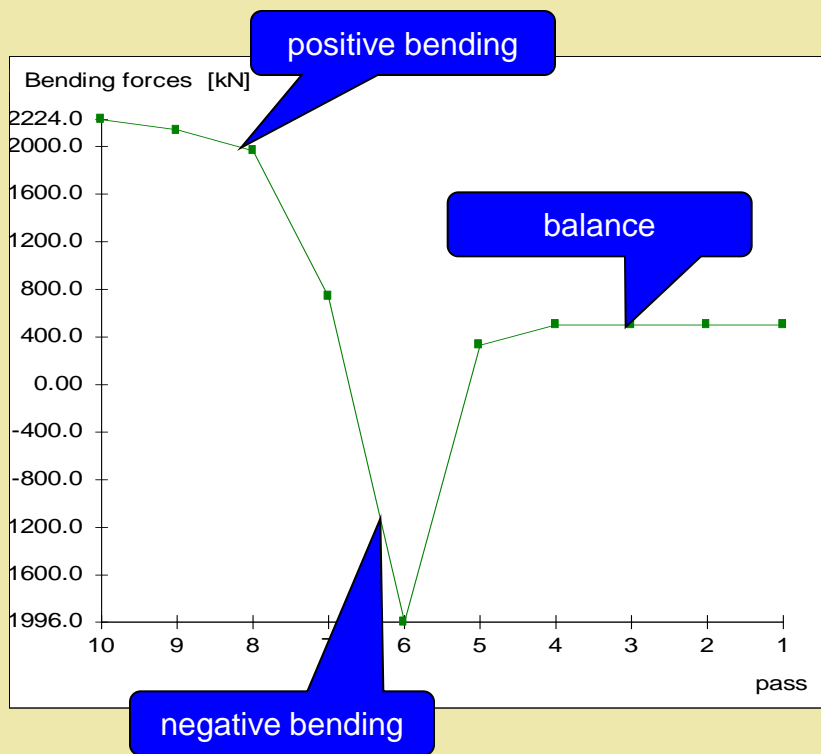
Load data file | Add new strip | Delete strip | Select strip: [7331053] | OK

Example: Strip profiles

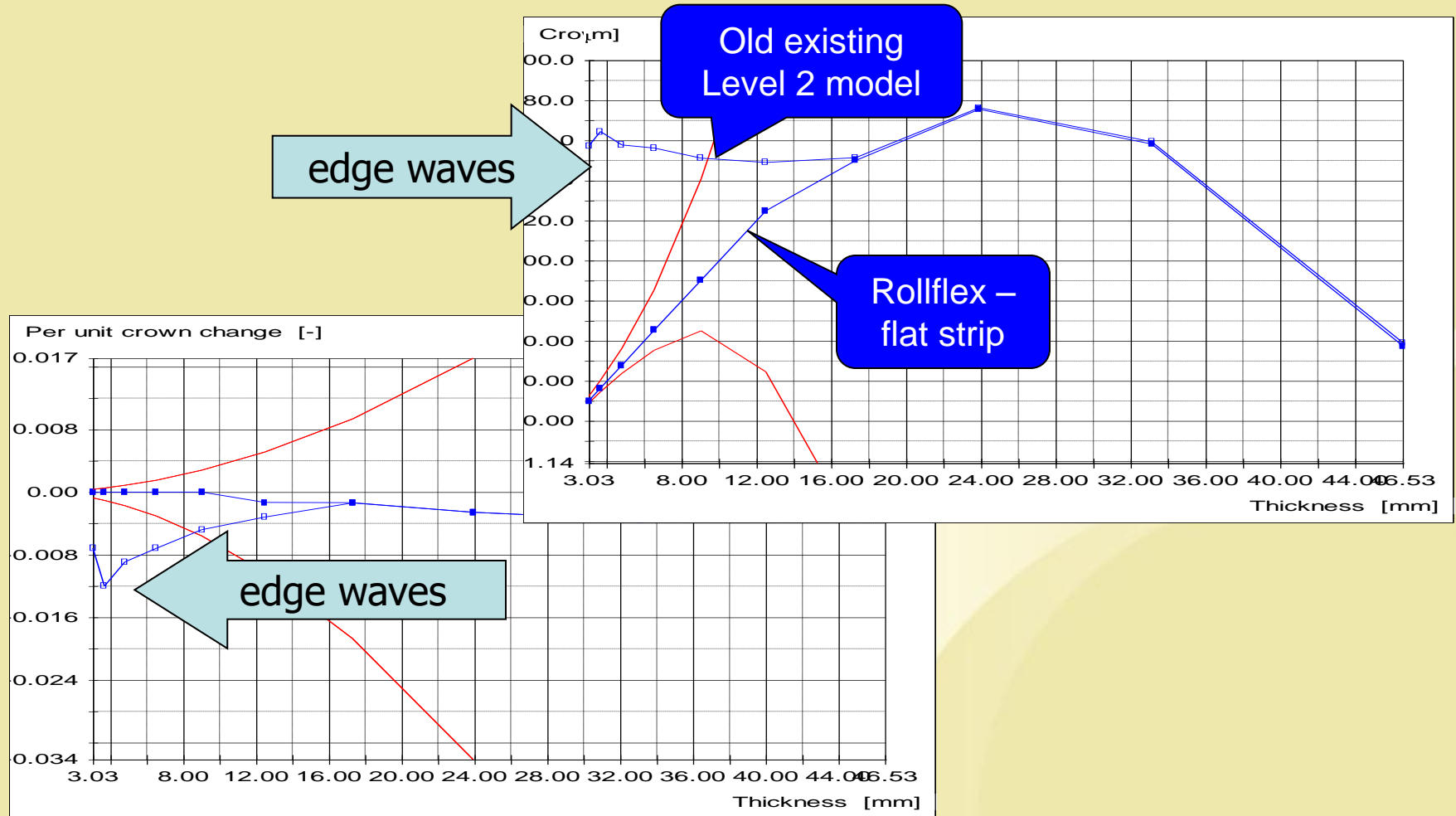


Calculation of optimal sequence of crowns

considering recrystallisation



Comparison of flatness model of an existing HSM and Rollflex



Software ROLLFLEX

complex tool for shape analysis of roll gaps
for 2-high, 4-high and 6-high mills

