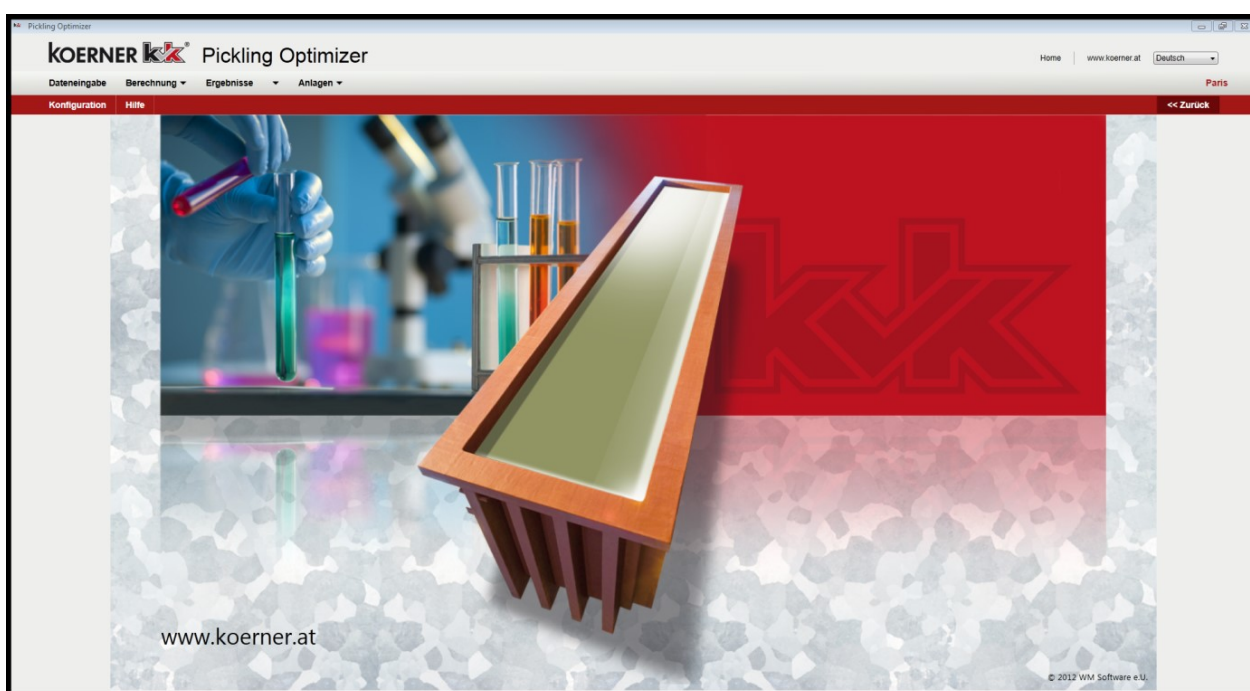


## Pickling Optimizer 2.0



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## **KOERNER KVK® PICKLING OPTIMIZER – OPERATING GUIDE**

### **Goals**

The first version of the KVK® PICKLING OPTIMIZER was developed to support mixing calculations for pickling processes. The main function of the program is the results-oriented calculation of the mixing processes for different multi-component liquids (fresh and used acid, fresh and rinse water, ferric chloride solution) in order to achieve optimum pickling conditions or the make the best possible use of existing resources.

However, there are other important issues when manipulating a pickling or stripping bath. Therefore, this useful tool was developed even further in order to make an indispensable, multifunctional pickling management assistant available.

### **Improvements**

With the new generation of the KVK® PICKLING OPTIMIZER, it is possible, for example, to perform calculations for all pickling and stripping baths of a facility at the same time. That way, it is very easy to determine the total demand for fresh acid or the total amount of used acid to be disposed of. The quality improvement of the rinses is also determined.

In terms of a high degree of user-friendliness, it is easily possible to print out calculation or results sheets for the individual pickling baths on which the necessary changes to quantity and height measurements are given.

An automatic calculation algorithm with the objective of having an "optimum pickling line" facilitates the execution of very efficient calculations that lead to tremendous time savings.

Two specific parameters are calculated and displayed both for the initial as well as target condition of the pickling baths: the pickling speed or alternatively pickling time and the optimum pickling temperature. Taking these indicators into consideration in such calculations is unique. By the way, this unique feature is also compatible for controlling KOERNER KVK® pre-treatment plants for hot dip galvanising.

The important indicators are calculated for stripping as well, i.e. the relationship between zinc and iron content and the stripping speed, which once again is unparalleled in the market.

A further improvement is the possibility to calculate a multitude of different plants simultaneously within the program. The calculations can be interrupted and saved at any time for any one of these plants.

The software can be operated in five different languages: German, English, Russian, Spanish and French. It can also choose between the international units system (SI) and common US units.

### **Installation, Activation**

The program can be downloaded from the KOERNER homepage (<http://www.koerner.at>) and installed. When the program starts for the first time, you will be prompted to copy the given key and send it to the KOERNER office by email. During office hours, you will be immediately sent an activation code by return email with which you can activate and use the program. A separate key is required for each computer. Multi-user licenses can also be purchased.

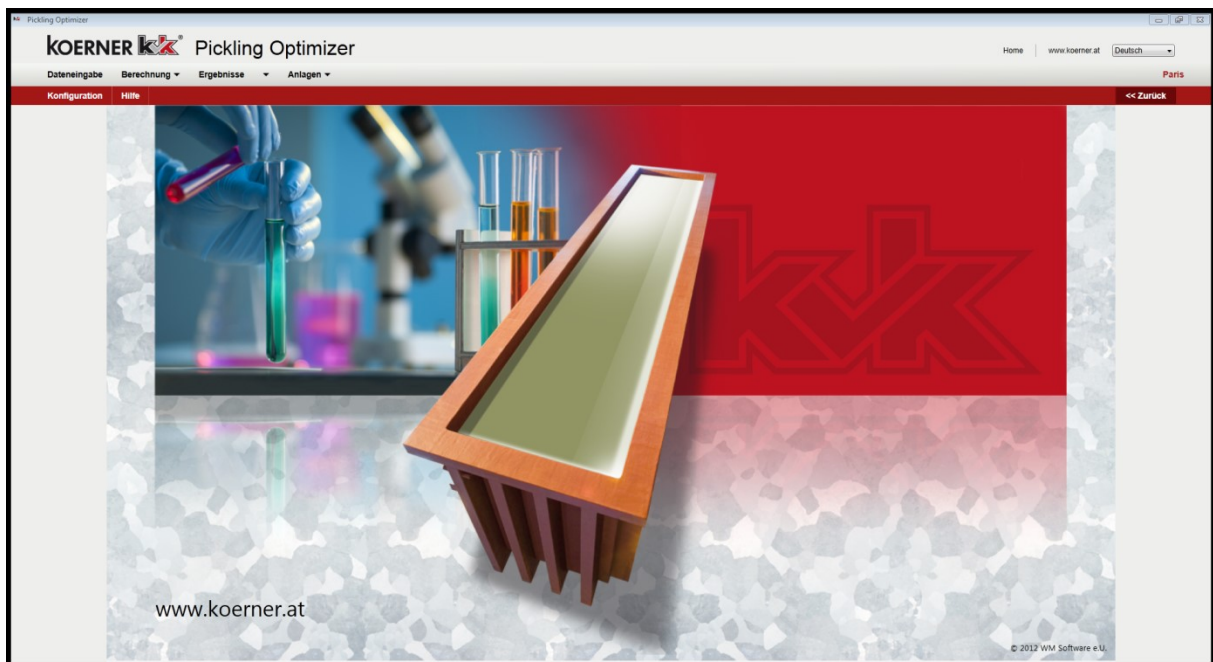
Please see our homepage for additional details and prices, or alternatively download the POv2 Installation Guide.

## Functions of the Different Program Levels

The program is divided into several functional levels, which can be accessed at any time by means of function keys or tabs. Values that are entered and calculation results can be saved, printed out or even exported for further processing in Excel, as documentation, or as instruction sheets for the operating staff.

The documentation here can be retrieved at any time by means of the Help button.

- Home level (see Home illustration)
  - Distribution function to the other program levels



Picture 1: Home

- Configuration level (see Configuration illustration)
  - Other plants can be defined and named here for the multi-plant mode functionality.
  - Dimensions and the number of pickling, stripping and rinsing baths can be defined and also changed at a later time.
  - It is possible to choose custom dimensions for each bath or set all baths to have the same dimensions.
  - Specific names can be assigned to the baths.

**KOERNER kk Pickling Optimizer**

Home | www.koerner.at | English | Paris

**Configuration** | Help | << Back

**name of unit**  
name: Paris

**Pickling Reference Point at 20°C**  
HCl: 42.27 g/gal  
Fe: 17.17 g/gal

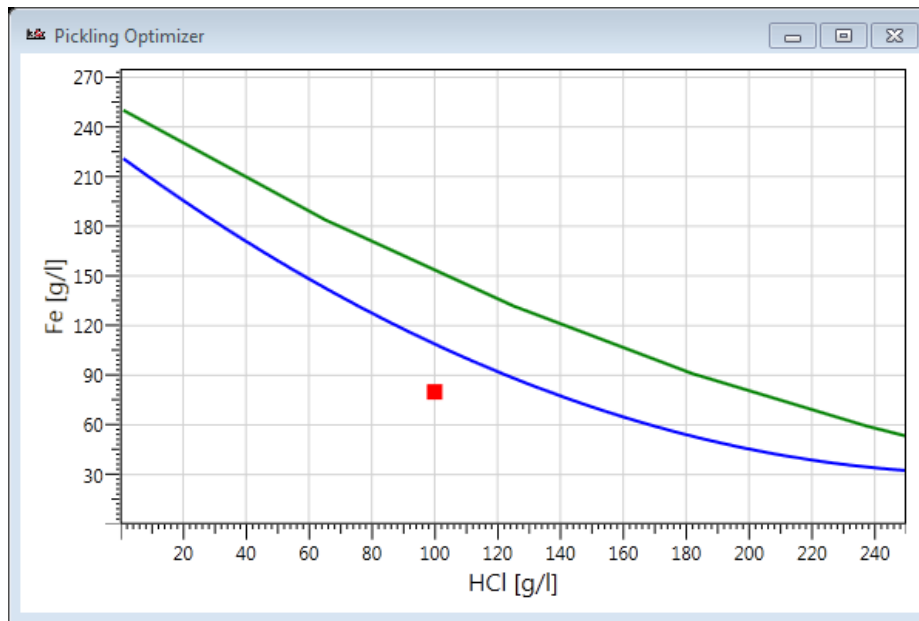
**Dimensions**  
Length: 393.7 in  
Width: 78.7 in  
max. Filling Height: 118.1 in

**Options**  
☒ Same dimensions for all baths  
Systems of unit: US unit

+ Pickling bath	+ Rinsing bath	+ Stripping bath	+ Rinsing bath after stripping bath
<b>Pickling 1</b> Length: 394 in Width: 79 in max. Filling Height: 118 in	<b>Pickling 2</b> Length: 394 in Width: 79 in max. Filling Height: 118 in	<b>Pickling 3</b> Length: 394 in Width: 79 in max. Filling Height: 118 in	
<b>Pickling 4</b> Length: 394 in Width: 79 in max. Filling Height: 118 in	<b>Pickling 5</b> Length: 394 in Width: 79 in max. Filling Height: 118 in	<b>Rinsing 1</b> Length: 394 in Width: 79 in max. Filling Height: 118 in	
<b>Rinsing 2</b> Length: 394 in Width: 79 in max. Filling Height: 118 in	<b>Stripping 1</b> Length: 394 in Width: 79 in max. Filling Height: 118 in	<b>Rinsing after Stripping 1</b> Length: 394 in Width: 79 in max. Filling Height: 118 in	

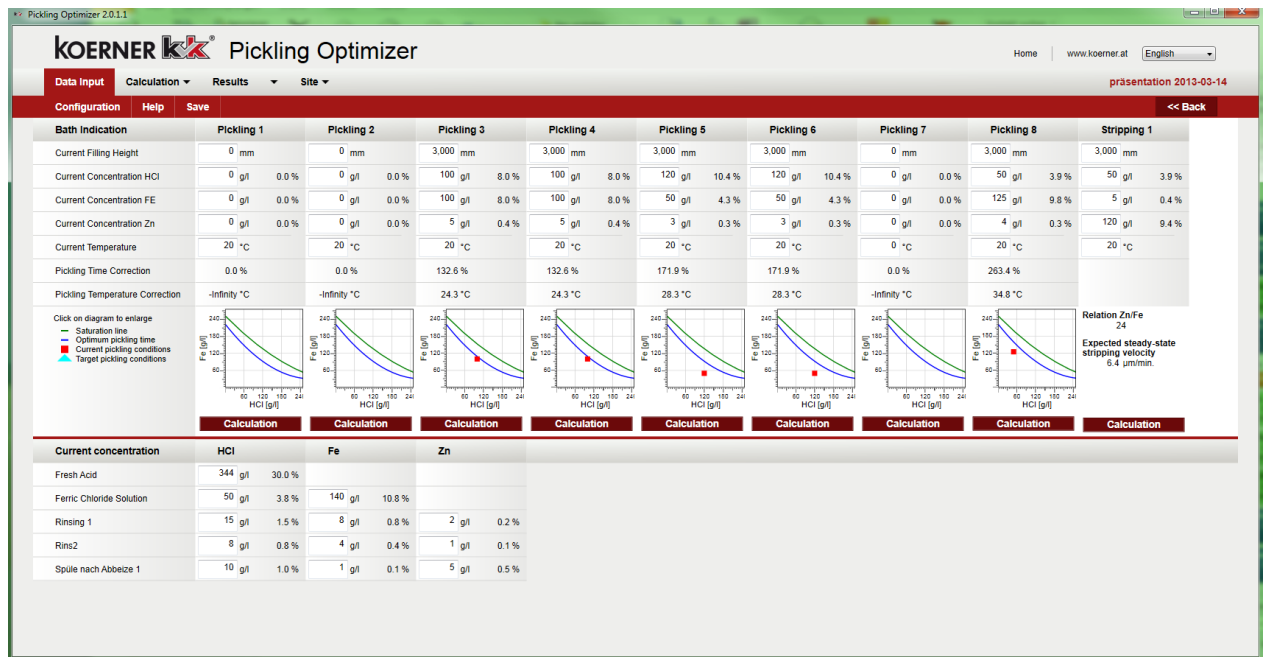
new unit | delete unit

Picture 2: Configuration



Picture 3: Diagram

- Date entry level (see Data entry illustration)
  - The current bath data is always entered here before calculations: fill level, temperature, concentrations.
  - Definition of the fresh acid and the ferric chloride solution, if it is to be used in the first batch.
  - The best thing is to use the tab key to enter the data quickly.
  - After restarting, all numbers in this level are set to 0, because the current bath data has usually been changed. When saved results are retrieved, the values that applied at the time of saving are inserted.
  - For pickling baths
    - The current operating point is shown in a freely scalable chart (Kleingarn chart - see chart in illustration) for the current concentrations.
    - In like manner, the relative pickling time and optimum pickling temperature are shown for the current concentrations.
  - For stripping baths
    - The zinc/iron relationship and the current stripping speed are shown for the current concentrations.
  - If all values have been entered for a bath and all mixable liquids, then the calculation can be executed at any time using the control button.
  - If the entries or calculations are interrupted, then the entries made up until that point can be easily saved and retrieved again next time when the program starts.



Picture 4: Data Input

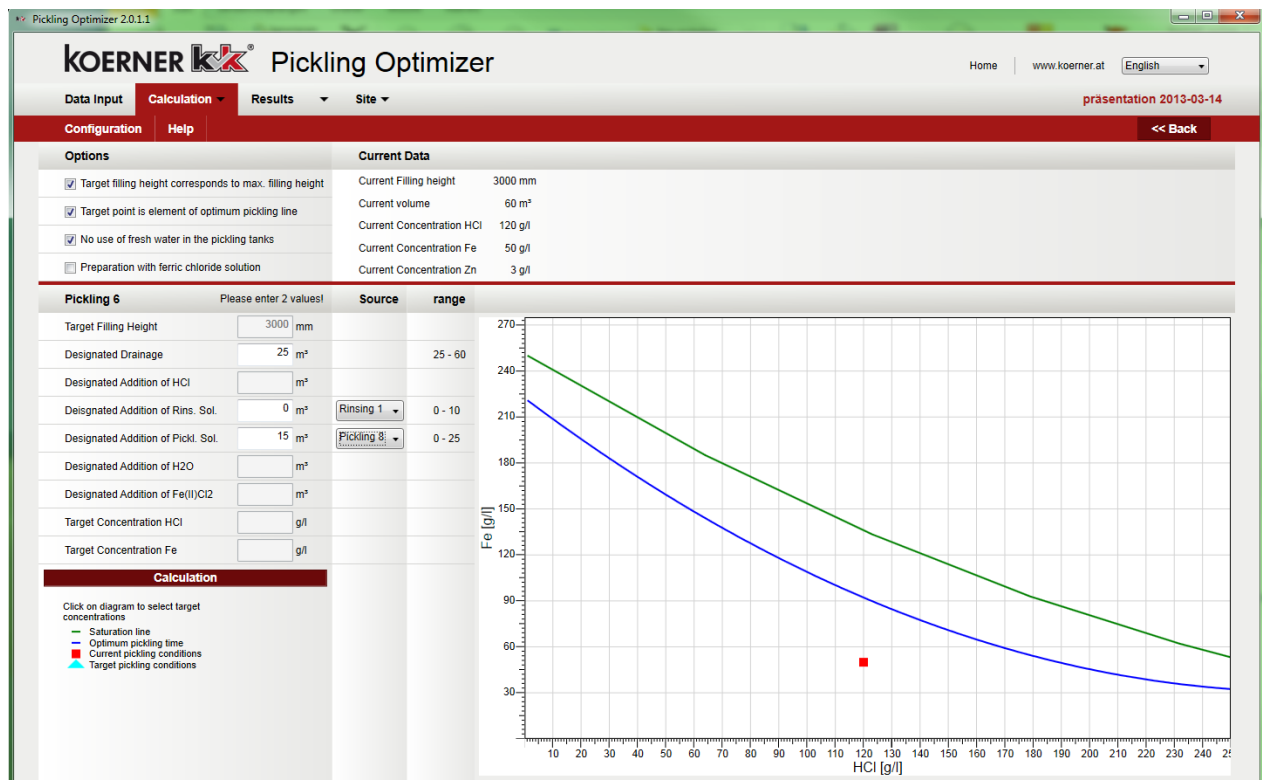
- Calculation level (see Calculation illustration)
  - Breakdown, functions
    - Options on which the calculations are based are shown on the top left. By default, the first three of these options are activated (see Options, current values illustration).
    - The current values of the bath to be calculated are shown to the right, beside the options (see Options, current values illustration)
    - The area for pre-selecting parameters for the calculation is below the options. Depending on which options are pre-selected, one or more parameters must be specified as target parameters for the calculation.
    - Depending on the specification of the options, individual parameters are inactive (the input field is highlighted grey and it is not possible to enter any numbers). After the specified number of parameters has been determined, all input fields that are still free will also become inactive, and the calculation button becomes active.
    - Before a calculation can be performed, the sources for the supply line for rinsing water and used acid must be defined without fail. This is indicated by red circles and explanation marks (see Important information illustration)

Zuleitung Spülwasser	<input type="text"/>	m³	<input type="text"/>	!	0 - 60
Zuleitung Altsäure	<input type="text"/>	m³	<input type="text"/>	!	0 - 60

Picture 5: Important notes

- The elements of the chart are indexed or explained below the calculation button.
- There is a graphical representation of the pickling curve with the following elements to the right, beside the parameters field that is highly magnified (also see Chart illustration).
  - Saturation line (green) ... only the area below the saturation curve is permissible for calculations
  - Optimum pickling line (blue) ... this represents the ideal working line on which the maximum pickling speed will be reached
  - Current pickling conditions (red square) ... starting point for the calculation of a pickling bath
  - Target conditions (blue triangle) ... target point or alternatively result for the calculation of a pickling bath.



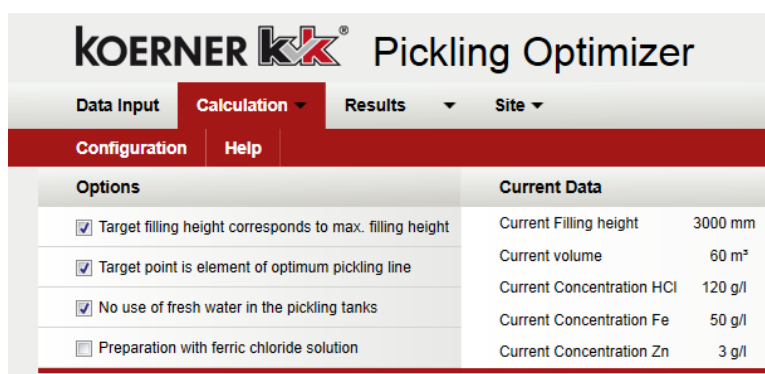


Picture 6: Calculation

### ○ Options

- The target filling height corresponds to the maximum filling height ... activated by default. For the calculation, it is automatically assumed that the tank is completely filled after the manipulation. If, as an exception, the tank cannot be filled completely, then this option can be deactivated. Then, the target filling height parameter must be given as well so that the calculation can be carried out.
- The target point is on the optimum pickling curve ... activated by default. Through this condition, the two target concentrations for HCl and Fe are linked, which means that for each HCl concentration, there is exactly one corresponding Fe concentration. In this calculation mode, the calculation should always follow the specification of the concentrations, because the predetermination of the supply quantities must have been very exact in order to be able to be on the optimum pickling line. Otherwise there is usually an error message: "The calculation cannot be performed!"
- Only rinsing water (no fresh water) ... activated by default. In the interest of optimum pickling efficiency (minimum consumption of fresh acid and fresh water), fresh water should never be used for pickling. Rather, the required water should be taken from the rinses. The water that is removed can be replaced later with fresh water, which in turn increases the cleaning performance of the rinsing baths (rinsing cascade principle). This option can be checked off for the first batch and in other exceptional cases. As a result, the fresh water field is activated and the rinsing water field is deactivated.

- First batch with ferric chloride solution ... deactivated by default. In order to have optimum pickling conditions right from the start of the service life of a pickling bath, there must be a certain content of iron in the pickling solution. This is reached by partly allowing used acid to be used in a new batch, or feeding it in from another pickling solution with high iron content. When a plant is filled for the first time (= first batch), a ferric chloride solution can be used instead of used acid, which naturally doesn't exist at that time. When this option is activated, the input filed for the ferric chloride solution is activated, and the one for used acid is deactivated.



KOERNER <b>kk</b> <sup>®</sup> Pickling Optimizer			
Data Input	Calculation ▾	Results ▾	Site ▾
Configuration		Help	
Options		Current Data	
<input checked="" type="checkbox"/> Target filling height corresponds to max. filling height		Current Filling height	3000 mm
<input checked="" type="checkbox"/> Target point is element of optimum pickling line		Current volume	60 m³
<input checked="" type="checkbox"/> No use of fresh water in the pickling tanks		Current Concentration HCl	120 g/l
<input type="checkbox"/> Preparation with ferric chloride solution		Current Concentration Fe	50 g/l
		Current Concentration Zn	3 g/l

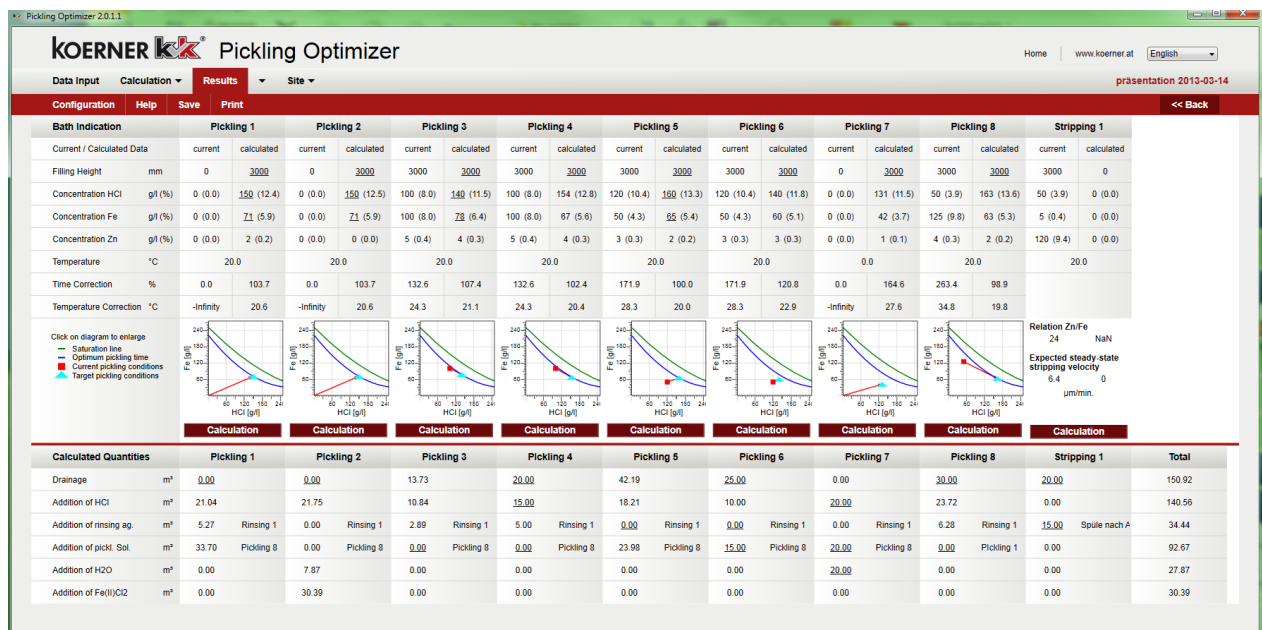
Picture 7: Options, current data

- Parameter selection
  - Depending on the calculation requests (e.g. specific delivered quantity of fresh acid, specific quantity to be disposed of, specific HCl concentration for optimisation of the pickling speed and/or emissions), any 'active' parameter fields can be filled with numbers.
  - As already mentioned above, for the optimum pickling curve pre-setting, one of the two concentrations should be selected. Because they are linked, the second concentration will also be defined automatically.
  - Target concentration of HCl and target concentration of Fe ... These two values can be determined via the input fields as well as by clicking the mouse in the chart. If you use the mouse to move the cursor over the chart, the values that are currently valid appear as numbers on the axes. If the optimum pickling curve pre-setting is active, the HCl value that is clicked is decisive. If pre-setting is deactivated, then any combination of the two concentrations can be selected by clicking the mouse.
  - When sufficient parameters have been entered, all free parameter fields become inactive and the calculation button can be pressed. You then go to the results level automatically.
  - The calculation button in the results level can be used at any time to re-execute the last calculation for a bath and change parameters for a new calculation.

Pickling 6	Please enter 2 values!	Source	range
Target Filling Height	<input type="text" value="3000"/> mm		
Designated Drainage	<input type="text" value="25"/> m³		25 - 60
Designated Addition of HCl	<input type="text"/> m³		
Designated Addition of Rins. Sol.	<input type="text" value="0"/> m³	Rinsing 1 ▾	0 - 10
Designated Addition of Pickl. Sol.	<input type="text" value="15"/> m³	Pickling 8 ▾	0 - 25
Designated Addition of H <sub>2</sub> O	<input type="text"/> m³		
Designated Addition of Fe(II)Cl <sub>2</sub>	<input type="text"/> m³		
Target Concentration HCl	<input type="text"/> g/l		
Target Concentration Fe	<input type="text"/> g/l		
<b>Calculation</b>			
Click on diagram to select target concentrations — Saturation line — Optimum pickling time ■ Current pickling conditions ▲ Target pickling conditions			

Picture 8: Parameters, sources, range

- Sources
  - As already mentioned above, you can choose from which rinse and from which of the other pickling solutions media is to be taken. This choice must always be made before the calculation. This is indicated by the red circles with explanation marks. Here it is important for values to have been entered in the data input for the selected baths!
- Value limits
  - A lower and upper value limit must be given for each active input parameter in order to execute meaningful calculations. If values outside those limits are entered (e.g. drainage > content), then an info symbol appears (red circle with exclamation mark).
- Results level (see Results illustration)
  - In this level, all pickling and stripping solutions in the initial and target situation are shown in the upper half of the window. The two points and the connecting arrow in the chart show the path of the calculation or alternatively those baths for which a calculation is still necessary. All the relevant parameters are calculated for each of the two states, for example the dilution of the zinc content in the pickling solutions.
  - Parameters selected for the calculation can be identified because they are underlined.
  - All stipulated and calculated quantities are shown in the lower half of the window. The totals across all baths are on the right margin, which, for example, simplify the calculation of the entire quantities of fresh acid that are to be delivered.
  - Different calculation results can be saved with the Save button. They are each given a time stamp and can be retrieved.
  - With the help of the Print button, the results can be sent directly to a printer or exported as files in different formats (pdf, Word, Excel). This creates a variety of possibilities for work instructions and documentation.



Picture 9: Results

Pickling Optimizer

Pickling 3

		current	calculated
Filling Height		3.000	3.000
Concentration HCl	g/l (%)	100 (8)	140 (11,5)
Concentration Fe	g/l (%)	100 (8)	78 (6,4)
Concentration Zn	g/l (%)	5 (0,4)	4 (0,3)
Temperature	°C	20,0	
Time Correction	%	132,6	107,4
Temperature Correction	°C	24,3	21,1
Drainage	m³	13,73	
Addition of HCl	m³	10,84	
Addition of rinsing ag.	m³	2,89	Rinsing 1
Addition of pickl. Sol.	m³	0,00	Pickling 8
Addition of H2O	m³	0,00	
Addition of Fe(II)Cl2	m³	0,00	

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Picture 10: Print, Export Data &amp; Results