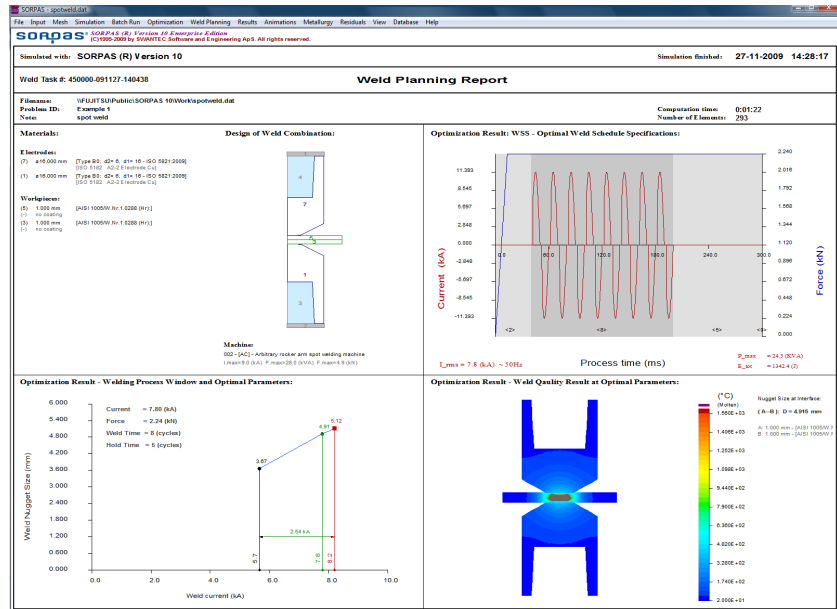


! Highlighting the Weld Planning, Multiple Welds, 3-Sheets, AHSS and Aluminum Alloys !

Through the past many months, all models and functions in the entire system of SORPAS® have been tested and improved based on many valuable feedbacks and requirements from users as well as our own tests and verifications. All known issues have been corrected.

Many new functions have been developed and implemented. For example, the new landmark Weld Planning function can automatically predict the fully optimized weld schedule specifications (WSS) including optimized weld current, weld force, weld time and hold time, simply according to user defined Weld Task Description (WTD) defining only the sheets, electrodes, type of weld machine and the desired weld quality.

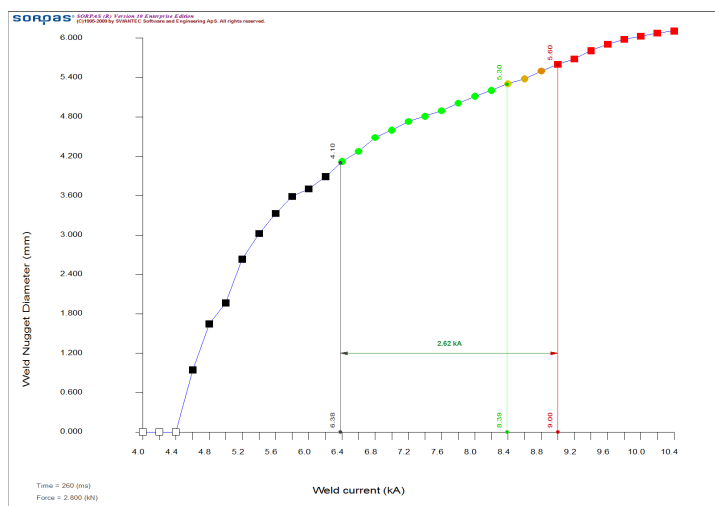


The important new updates comparing to previously released SORPAS® 9.0 are described below:

1. **Weld Planning** to predict the optimized weld force, time and current with the process window (see figure above).
 - a. **WTD** – Weld Task Description is the new input window for specifying a weld task. As the purpose of the Weld Planning is to find the optimal welding process parameters, the WTD will only need information about the sheets, electrodes, type of welding machine, and the desired weld quality.
 - b. **User preferences** is for user preferred planning strategy. The welding process window will be predicted by SORPAS®. The user can choose the weld current at a preferred percentage to the splash (expulsion) limit. Users have also freedom to give preferred input values to other parameters, for example to specify weld force, weld time, or number of pulse, or simply let SORPAS® to fully optimize by leaving the parameters at 0.
 - c. **WSS** – Weld Schedule Specifications is the result of the Weld Planning with the optimized welding process parameters and the welding process window as well as the weld quality results simulated with the optimal welding process parameters.

2. **Multiple welds** can be simulated now with continuous simulation of repetitive welding with the same electrodes but renewed sheets for every weld. The **Idle time** is introduced after Off-time (with possibility for using a larger time step) to speed up simulation of cooling between welds. The heating and cooling history in electrodes is continuously accumulated through all welds.

3. **Materials database** has been completely updated with extension of some new properties data.
 - a. For every material, a **SORPAS Classification Code** (not used for the time being but preparing for future material models) has been introduced with 6 numbers to define the following:
[Category] – [Class] – [Grade] – [Heat treatment] – [Surface condition] – [Batch number].
 - b. New data have been introduced for the mechanical properties at room temperature (yield strength, tensile strength, elongation at break and the n-value). These data are used as reference data for verifying the flow stress data. The “elongation at break” is also used in predicting the Cracking Risk Factors.
 - c. New data with weld strength factors are introduced to modify the SORPAS® calculated weld strengths, if the user has made test verifications on the calculated weld strengths.
4. **All aluminum alloys and all types of steels** are fully updated with all materials data. Complete checking and corrections have been made for all series of aluminum alloys and steels in order to obtain good simulation results for most of the commonly used aluminum alloys and steels.
5. **Electrode database** has been fully updated with the newly issued Standard ISO 5821:2009.
 - a. All new forms issued in the new Standard ISO 5821:2009 are included.
 - b. All electrodes are now implemented with water cooling as standard, but the User may exclude the water cooling by un-checking the Water Cooling in the Input Wizard or WTD.
6. **All numerical models** have been tested and improved including contact algorithms, coatings, dynamic forces and deformations etc. Many improvements have been made particularly for improving simulations of **3-sheet welding** applications with all types of steels and AHSS steels.
 - a. Through the Input Wizard, some automatic functions have been implemented to model the influence of the sheet stiffness (due to different thickness and hardness of sheets) in order to produce a better heat distribution, especially for welding 3 or more sheets. It is recommended to always start with the **Input Wizard** for spot welding simulations.
 - b. The modeling of force balance and dynamic deformation has been significantly improved. Sometimes more cycles may be needed in the squeeze time especially for simulation of welding with larger gaps between sheets.
 - c. As the accuracy of all numerical models has been increased, it may be noticed in some cases the computation time may be slightly longer for some steps of calculations.
7. **Block Model** is significantly improved for simulations of projection welding with components of asymmetric geometries such as nut welding, embossed projection welding, hot staking etc.
8. **Total number of elements** is increased to **5000**.
 - a. The total number of elements increased to 5000 is mainly for special applications. For normal spot welding applications, the total elements up to 2000 may be sufficient.
 - b. To keep better accuracy, the default element number in “Preferences” is changed to for each sheet instead of the total number of elements.
9. **Splash (expulsion)** prediction is further improved.
 - a. The splash prediction is further improved based on weld tests and some examples from customers.
 - b. Probability is introduced to the splash points by showing the weld points in yellow-orange color when a weld is within 5% near splash limit (weld current or nugget diameter).
 - c. A splash limit factor is introduced for the user to modify the SORPAS® predicted splash limit by moving the splash limit to lower current (with negative numbers) or higher current (with positive numbers).



10. **Weld nugget sizes** calculated and showed alternatively at weld interface or in each sheet.
- New function to show weld nugget size at each weld interface. The option is in the "**Preferences**". It is selected when "**Nugget Size at Interface**" is checked, and then the three options are activated for the choice of how to calculate the weld nugget size at the faying interface according to the nugget sizes of the two contacting sheets, i) smaller, ii) average, or iii) larger up to user preferences. If it is unchecked, then the weld nugget size in each sheet, as earlier versions, will be shown.
 - When showing the final weld result, the sheets are re-ordered from top to bottom in alphabetic A, B, C ... The position of the weld interface is indicated by connection bars "--". For example, (A--BC) indicates interface between A and B, while the weld strengths are obtained by pulling A from the fastened B and C.
 - The weld nugget sizes at interfaces are shown automatically in Weld Growth Curves and Weld Lobes after selection in "Preferences".
 - When showing the weld nugget size in each sheet, the nugget **diameter**, **height** and **volume** in each sheet will be calculated and showed in the final weld result.
11. More **dynamic memory management** has been implemented to cope with the increased total number of elements. So it needs less RAM to start SORPAS®. There are also some improvements on taking advantage of multiple processors, thus the computation speed is slightly improved.
12. A special function added for Batch simulation and Optimization to "**Continue from the latest simulated data file**", which will automatically find where the batch simulation was stopped and then continue from the un-finished simulation, regardless which file is currently opened. It is also possible to Continue from the currently opened data file as in earlier versions.
13. **Headers** are added in all text format result files such as Process Parameter Curves (.tot) and Nodal Value Curves etc.
14. New functions for editing the geometric input have been implemented such as **Duplicating** an object, **Moving objects with tools**, and **Merging objects** (most useful for users who prefer to make models manually for projection welding etc).
15. A new option is added to **hide electrodes** under the menu "**View**" to only show the work pieces in the display of graphical results.
16. Special functions have been implemented to model **electrodes with separated tapes and multiple coating layers**. These functions have been introduced especially for simulations of spot welding using the Fronius Deltaspot welding gun with electrode tapes.
17. More different controls for adding gap between sheets. For example uncheck **Clamping** will keep the gap between sheets but all sheet can move together in space (as in reality with separated weld coupons or welding with freely suspended guns) etc.
18. **Position number** is added to the weld current points (corresponding to data files) in the display of Weld Growth Curve and the Weldability Lobe to indicate the location of the data file.
19. A **log file** is saved for every simulation recording a brief history and the computation time etc.
20. **New graphical windows** automatically fit the available screen resolution on the PC.
21. **New Watcher** automatically starts when starting simulations with improved progress estimation for multiple welds and batch simulations. A status log is added to follow the brief history of the simulation.
22. Many other detailed improvements for graphical display and better presentation of the results.

