


Using Different Reference Quantities in ArtemiS

With ArtemiS, the analysis of audio files can be performed versus a range of different reference quantities. Many analyses are calculated and displayed versus time, e.g. level vs. time, FFT vs. time etc. However, for many applications it is also important to examine the changes with respect to other quantities. The most common case – besides the representation versus time – is the representation versus rotational speed (RPM). In addition, ArtemiS also offers the possibility to display analysis results versus any analog channel contained in the file. That way, it is possible to show the dependency of other signal levels such as force or temperature.

Selecting the Reference Quantity

In ArtemiS, reference quantities are selected in the Source Pool, either for individual files or for entire folders. The data that can be used as reference quantities in ArtemiS can be stored in the file in two different ways. The first possibility is that RPM information is stored in a digital channel in the form of pulses. From these pulses, ArtemiS then calculates RPM. The other possibility is to select any of the analog channels of the file as the reference quantity.

This selection is done in the Properties dialog of the file or folder. Figure 1 shows two examples of such Properties dialogs. The left picture shows the Properties dialog of a single file, the right one shows that of a folder in the Source Pool.

In the Properties dialog of an individual file, you can select either a digital pulse channel or an analog channel in the “Reference quantity” field. In the list, the digital pulse channels are listed above the analog channels. The desired channel can be identified by means of the channel number or the channel name. If an analog channel is selected as reference quantity, this channel is marked with a little arrow in the Source Pool .

In the Properties dialog of a folder, you can first choose whether a digital pulse channel or an analog channel of the folder should be used as the reference quantity. This is done in the “Pulse Channels” section of the dialog. In the field located to the right of this selection, you can then enter the channel number of the desired channel. This selection is applied to all files assigned to this folder in the Source Pool of the project.

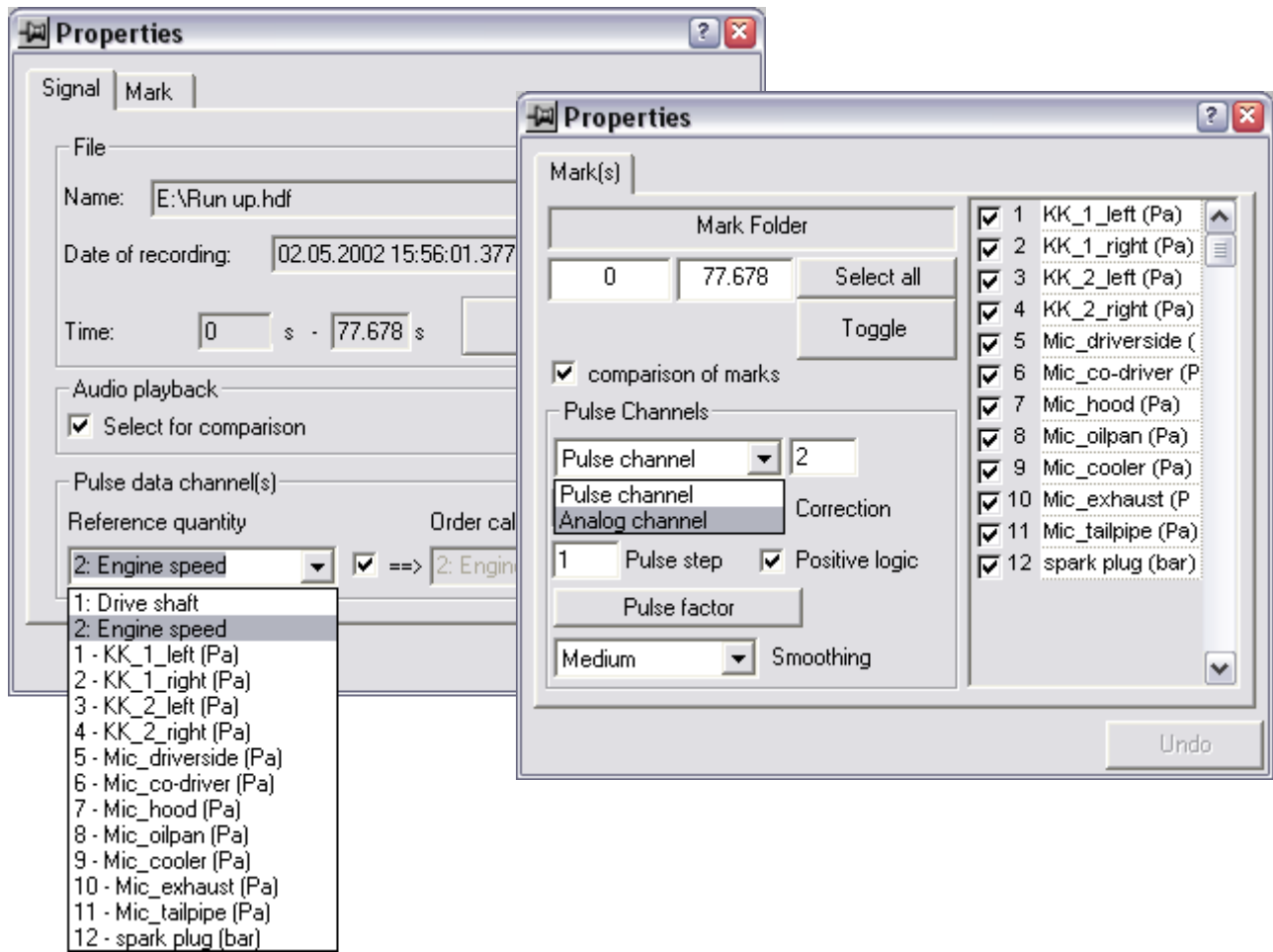


Figure 1: Properties dialogs for selecting the reference quantity

Analyzing Against a Reference Quantity

ArtemiS provides several analysis functions in the Analysis Pool. Functions that are calculated and displayed against time are labeled with the suffix “vs. time”. Analyses with the suffix “vs. RPM” are calculated against the reference quantity specified in the Properties dialog of the file. This can be an RPM channel (as the suffix suggests), but also any other analog channel of the file. This means that if, for example, a pressure curve has been recorded in an analog channel, the analysis called “Level vs. RPM” can be used to display the dependency of the signal level on pressure.

In the Properties dialog of these analyses, the step width for the analysis can be configured. Depending on the reference quantity, this parameter does not necessarily refer to the unit RPM, but may also refer, for example, to force, so a different step width can be required. The step width should bear a reasonable relation to the range of values of the reference quantity. The step width for an analysis versus RPM with a range from 1000 to 6000 rpm can be considerably greater than the step width for an analysis versus a force curve with a range from 300 to 800 Newton.

Simultaneous Representation of Different Reference Quantities

In the default setting of ArtemiS, the analysis “RPM vs. Time” and the Mark Editor only provide the display of the pulse channel being selected under “Reference quantity” in the Properties dialog of the corresponding sound file (see figure 1). If different channels with reference quantities are included in a file, these channels can be displayed simultaneously by changing the ArtemiS settings.

The settings are changed as follows: Select menu “Options” and open “Settings”. Now select rider “Miscellaneous”, go to “Mark Editor /RPM vs. Time” and select “All pulse data channel(s)” instead of “Only Reference quantity” (see figure 2).

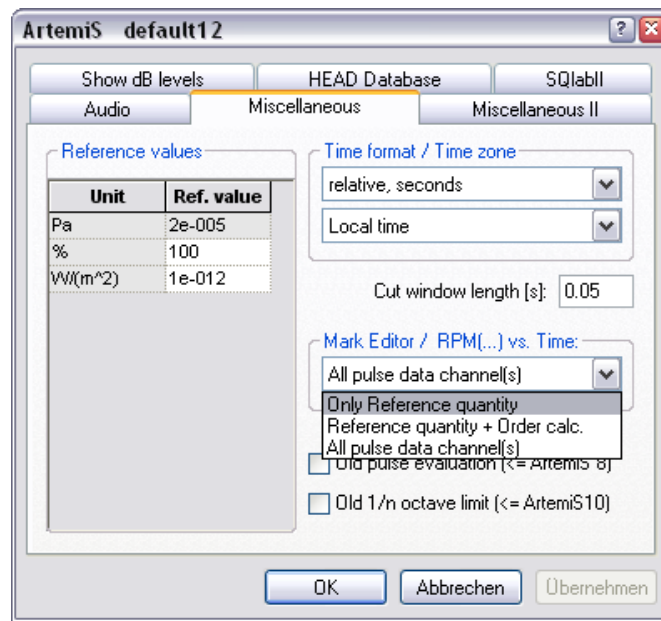


Figure 2: ArtemiS Settings

Thus, all pulse channels of a file can be displayed by means of the analysis “RPM vs. Time” and in the Mark Editor (see figure 3).

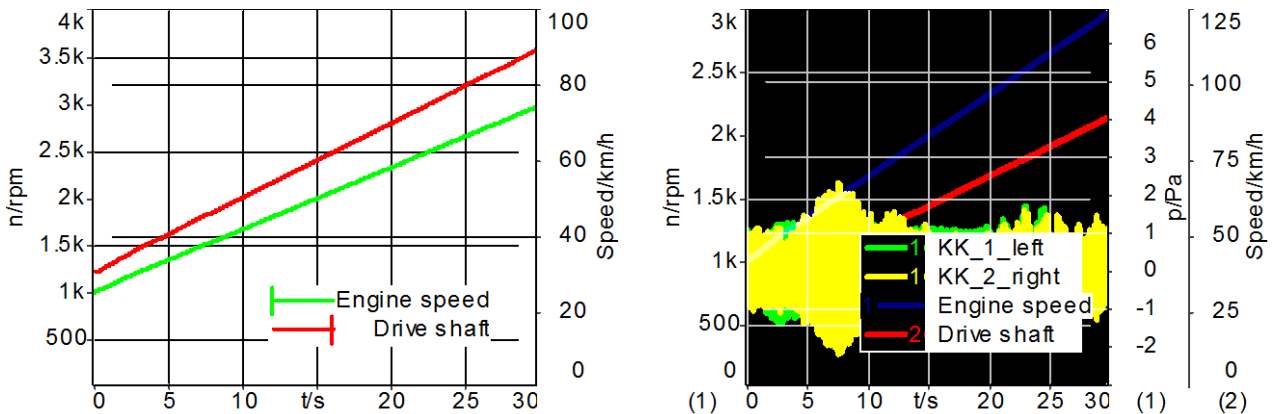


Figure 3: Simultaneous representation of different reference quantities by means of the analysis “RPM vs. Time” (on the left) and in the Mark Editor (on the right)

Special Cases

Different Reference Quantities for Calculation and Display

With ArtemiS, it is possible to perform an order calculation versus RPM and to display the analysis results versus a different reference quantity. That way, for example, an order analysis can be calculated versus engine RPM, but displayed, for example, versus force. In order to perform such a calculation, a quantity for the order calculation must be specified in the Properties dialog of the sound file in addition to the reference quantity. If the checkbox to the right of the "Reference quantity" field is checked, the same reference quantity is used for both calculation and display. Once the box is unchecked, an additional quantity can be specified for the calculation. The quantity specified in the left field is used for display, the one in the right field must be RPM and is used for the order calculation.

Figures 2 and 3 show an example of these different display modes. Each of the diagrams shows an order analysis. In the first case, the orders are calculated and displayed versus RPM. In the second case, the analysis was calculated versus engine RPM, but displayed versus speed of the drive shaft.

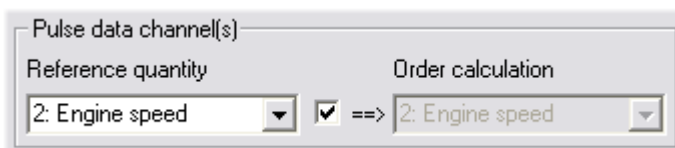


Figure 4: Calculation and display versus engine RPM

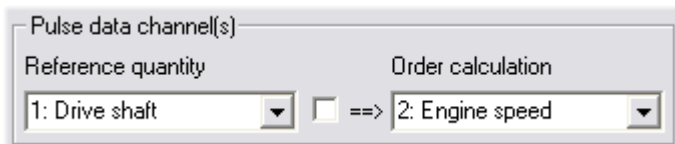
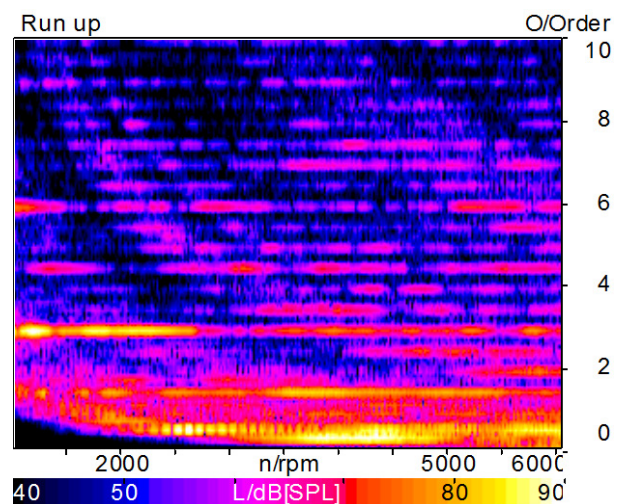
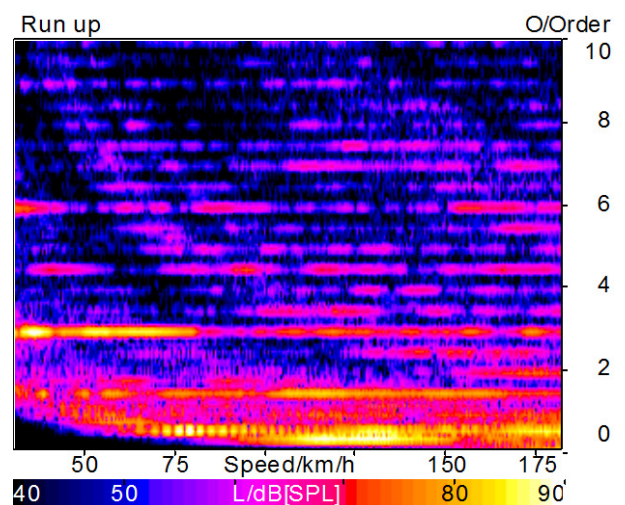


Figure 5: Calculation versus engine RPM, display versus speed of the drive shaft



Converting Digital Pulse Channels into Analog Channels

RPM curves that are to be examined with statistic operations in ArtemiS must be provided as analog channels. For this purpose, RPM information stored in a digital pulse channel must first be converted into an analog channel.

That way, for example, the rotational speeds of the right and the left wheel, which have been recorded as pulse channels, can be converted into analog channels and compared by means of subtraction. A subsequent analysis displayed versus this difference yields valuable information for improving the generated noise.

For converting a digital pulse channel, the Statistics Pool of ArtemiS provides the “Add Speed Channels” item. To save the sound file with the additional channel, a File Export item must be inserted into the Destination Pool. With the function “Feed: Time signals -> Source Pool”, see figure 4), which can be activated in the Properties dialog of the File Export item, the exported time domain signal with the additional analog channel is directly inserted back into the Source Pool.

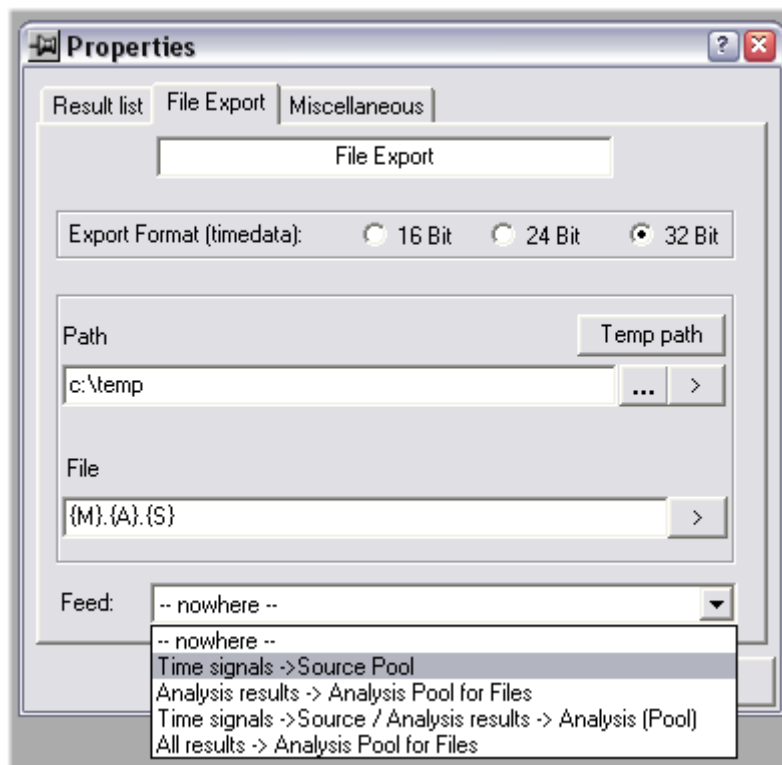


Figure 6: Properties dialog of the File Export item

When using the “Add Speed Channels” function, it is important to make sure that no analysis is active in the Analysis Pool, as this function can only process time domain signals.

The “Add Speed Channels” function can also be used for converting digital pulse information for data export, so it can be evaluated by other software products. Microsoft® Excel®, for example, is unable to interpret digital pulse information. After converting the pulse information into an analog channel with ArtemiS, the data can be further processed without problems.

Processing Analog Channels with Pulse Information

If RPM data is available in the form of pulses for a recording, but the frontend does not provide a dedicated pulse input, it is also possible to record the pulses to an analog channel and later use them for determining RPM in ArtemiS. Pulse information recorded to an analog channel can be used as a reference quantity in the usual way by creating an additional pulse channel of the type "Trigger signal". To do so, proceed as follows:

1. Open the Properties dialog of the signal.
2. While pressing the [Shift]-key click on the "Dataset Info" button.
3. Click on the "Digital channel attributes" tab.
4. Open the context menu by right-clicking on the upper left field of the table (see figure 4). In this menu, select "New digital channel".

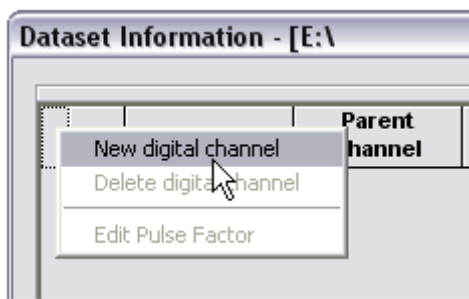



Figure 7: Adding a new digital channel

5. In the new digital channel, select the analog channel with the recorded pulse data as the "Parent Channel".
6. Under "Type", change the setting from "Pulse rate" to "Trigger signal" with a mouse click. Configure the other settings, such as pulse factor and smoothing.
7. Click on the "OK" button to quit the dialog and to save your changes.
8. In the Properties dialog of the file under "reference quantity", select the newly created digital channel, and close the Properties dialog by clicking on the  button.¹

Using the Pulse Wizard

If no RPM information has been recorded, but it turns out afterwards that an analysis versus RPM would be useful, the Pulse Wizard in ArtemiS provides the possibility to add a digital RPM channel to an existing file. In order to add such a digital pulse after a recording, requires some knowledge regarding the approximate RPM range of the file.

Figure 6 shows a screenshot of the Pulse Wizard. The Pulse Wizard can be started via the context menu of the sound file that the channel is to be added to.

¹ Several digital channels can be applied to the same parent channel. Thus, defining different pulse factors e.g. allows to define one digital channel for the speed in "km/h" and another digital channel for the speed in "mph", both referring to the same parent channel.

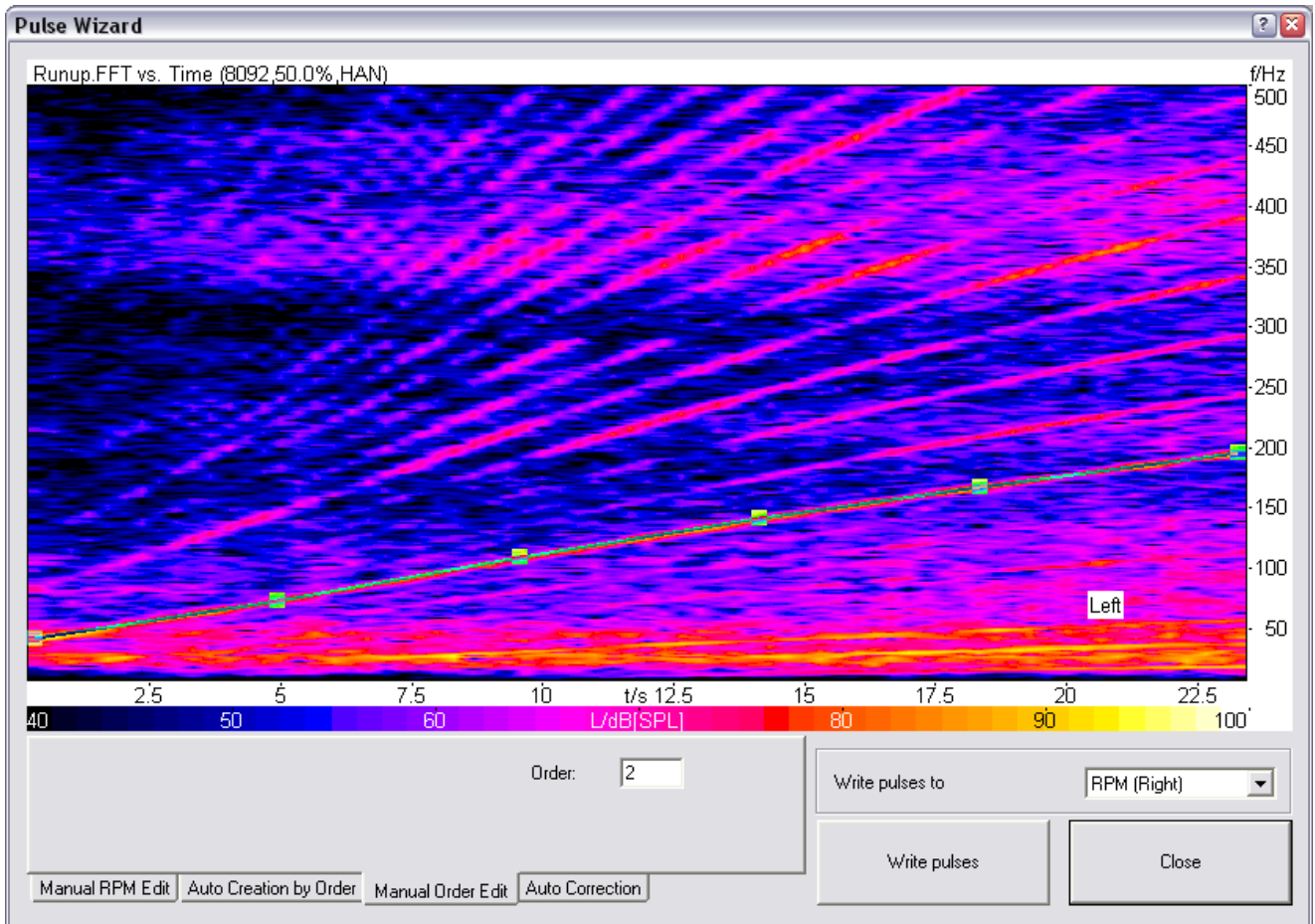


Figure 8: Screenshot of the Pulse Wizard

The Pulse Wizard offers four different methods for generating the pulse data:

- Manual RPM Edit: With this function, the user can enter an RPM curve numerically or draw it on the diagram by hand.
- Auto Creation by Order: The pulse information is generated automatically from a given engine order upon specification of an RPM value range.
- Manual Order Edit: The curve of a selected order, e.g. in a spectrogram, is marked manually for creating the pulses (as shown in the screenshot above).
- Auto Correction: With the automatic correction, missing or double pulses can be corrected, after which the RPM curve is rewritten.

A detailed introduction on how to use the Pulse Wizard can be found in the ArtemiS online help, which can be opened by pressing the F1 key.

Do you have questions for the author? Contact us at imke.hauswirth@head-acoustics.de. We look forward to your feedback!