Simultaneous Source Acquisition Design Wizard – SimWiz

Contents

Overview

SimWiz is an interactive GUI based wizard, for the generation of JobPro/SIPMAP skeletons, as part of the simultaneous source modelling and blending workflow (Kuvshinov et al., 2020; Figure 1). This workflow contains three key elements:

1) A Python tool for interactive acquisition design (written by Boris Kuvshinov),
2) A Python tool for SIPMAP/Jobpro skeleton construction (written by Chris Willacy); and
3) A SQSAF Slang library used by the wizard (written by Chris Willacy).

This user manual covers the use of the wizard, which is composed of the following main functional steps:

- Conversion of SPS to SAF formats
- Create a merged acquisition geometry
- Generate SSF traces for forward modelling
- Updating of trace idents post modelling
- Adding random noise or wavelet processing (optional)
- Blending of the data
- Automatic Jobpro partition building (Linux only)
- Data QC.

The workflow is schematically illustrated in Figure 1.

SimWiz is not a JobPro wizard implementation. Its main purpose is to provide a simple means to generate the skeletons for the pre- and post-modelling acquisition design workflow. SimWiz does not use survey3D files and instead stores any metadata in wizard csv files.

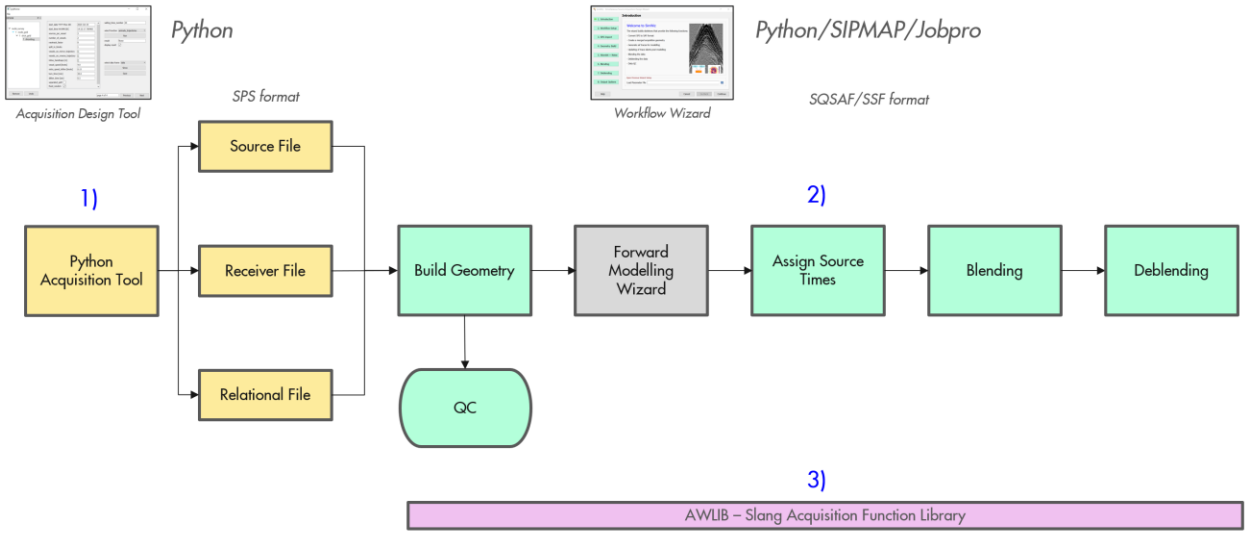


Figure 1. Overview flowchart for the simultaneous source modelling workflow.

Installation Instructions

SimWiz – Python wizard for generating the SIPMAP/Jobpro skeletons necessary to run the acquisition design workflow.

- Download the latest version from github (Releases · cwillacy/SimWiz · GitHub)
    - On Linux
        - In the installation directory run the script ./RUNME_LINUX.sh.
        - This will use a private version of Anaconda so no need to install it.
    - On Windows:
        - Make sure you have an installation of Anaconda on your pc (Anaconda | The World's Most Popular Data Science Platform)
        - Run Spyder and open and execute the script awiz.py from the SimWiz installation directory.

AWLIB - Slang module library used by SimWiz for Jobpro skeleton execution

- This library is already pre-installed in Houston at /glb/am/siep_inc/seis/sgs_jpprojects_1/sitebpss/acqlib.

The python wizard is called SimWiz and will run on any platform where there is a suitable python interpreter installed, e.g., Windows, Linux or MacOS. To invoke SimWiz, the user can launch the application from the command line (on Linux) e.g., on the command line either:

./RUNME_LINUX.sh

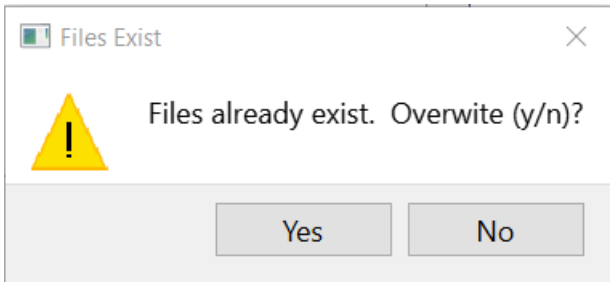
or

/apps/sss/Anaconde3/5.0.0/bin/python3 awiz.py.

Alternatively, for Linux, Windows and MacOS, the application can be launched from a Python IDE like Spyder, for example. In this case the user needs to open the awiz.py file in the editor and select to run the application from the IDE.

Wizard Execution

SimWiz is easy to use. The user may move freely forwards and backwards to each page in a linear fashion by selecting the 'Continue' or 'Go Back' buttons. The 'Cancel' button will quit the wizard without the parameters being saved. One deviation from these options is presented on the final page where the 'Continue' button changes to 'Done'. At this point if 'Done' is selected the wizard will exit and the user can no longer return to previous pages. If the skeleton files already exist on disk, from a previously invocation of the wizard, then the user is warned with the following dialogue,



to cancel without overwriting, select 'No' otherwise 'Yes' will overwrite the previous files.

The following guides the user through running the wizard step by step.

Introduction

Open Previous Wizard Setup

If SimWiz has been previously run, the parameters for the GUI will have been saved to the *user* directory, which is in the SimWiz root directory. This parameter file is a CSV (comma separated variable) formatted file and can be reloaded for a new invocation for the wizard. To do this, either enter the full path to the configuration file within the text box on the introduction page or select the file from the file dialogue, which can be access by clicking the open folder icon (Figure 2).

If this is a new workflow then no previous loading is necessary.

Description

A plain text box is made available for user comments. These comments will be saved into the wizard parameter file.

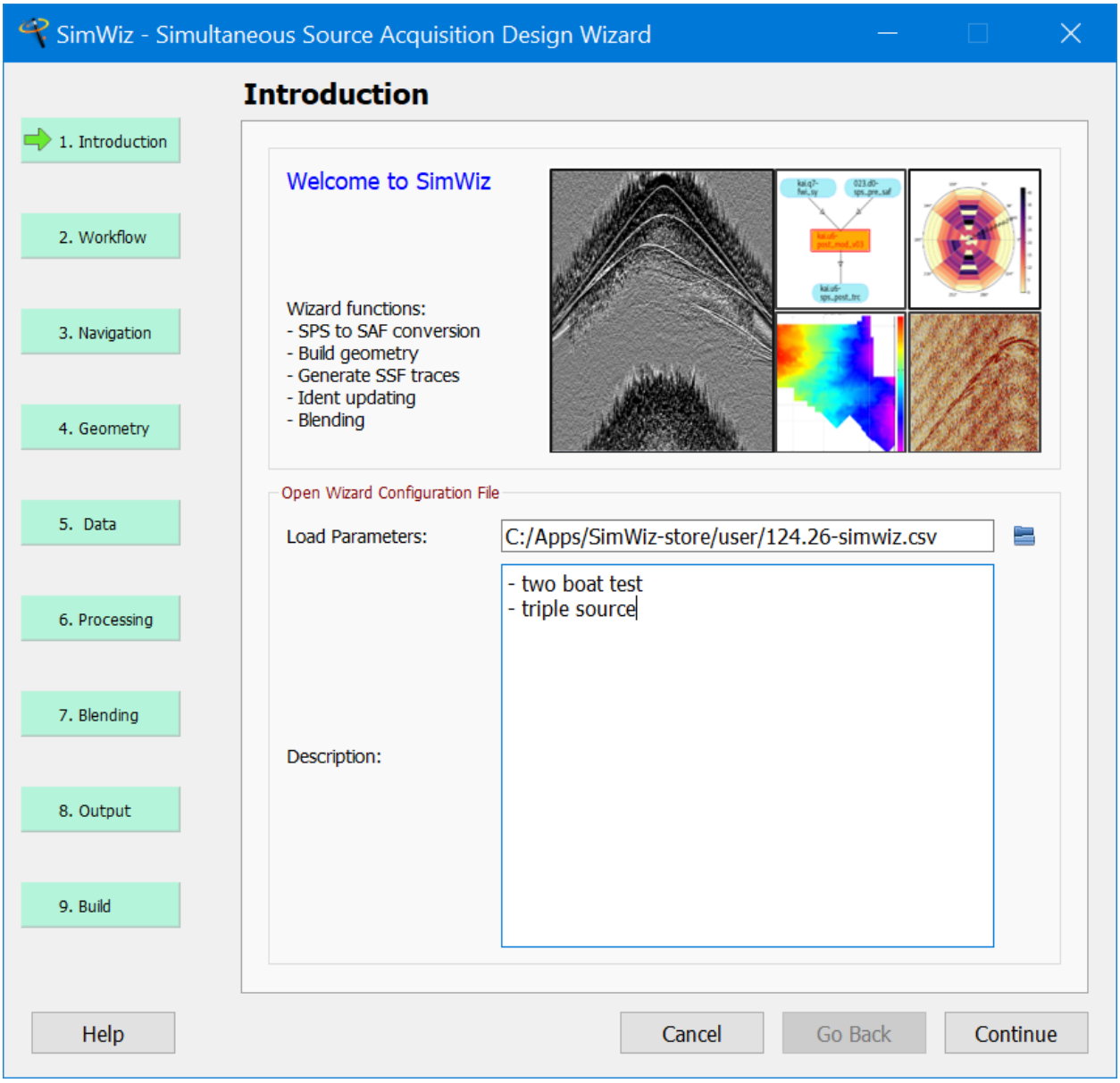


Figure 2. Introduction page showing selected configuration file.

Workflow

The workflow setup page defies the parameters required to select the appropriate workflow type and some necessary users input for the JobPro wizards that are to be built.

Acquisition Type

Currently only the OBN acquisition workflow is implemented. Workflows for land and marine streamer acquisition may be added in the future if there is interest.

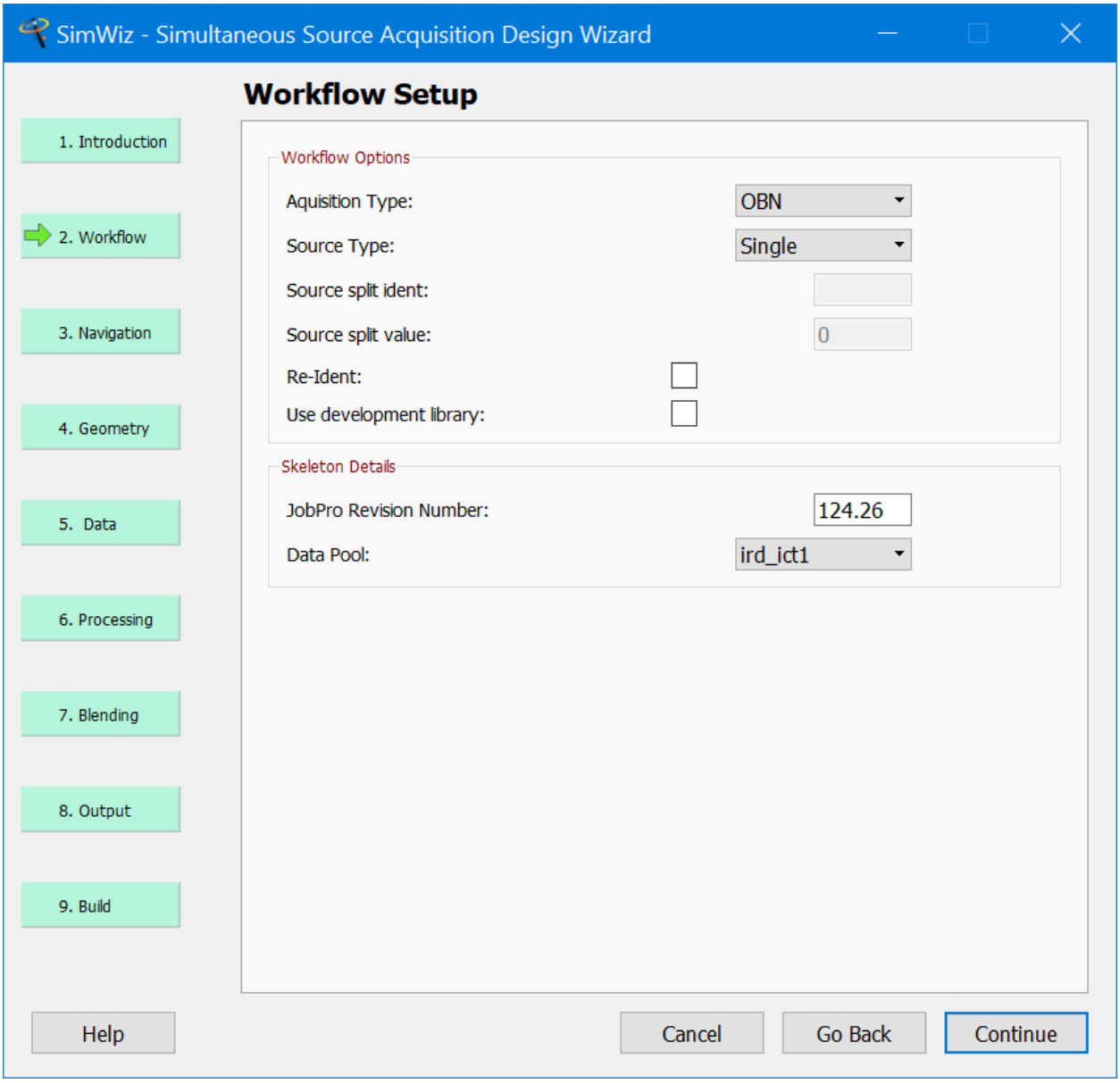


Figure 3. Workflow setup page showing parameters for a single source type workflow.

Source Type

Two workflows are available for the modelling workflow. The first 'Single' will generate a workflow for a single source wavelet. This is the default option. If a survey design is required that uses two seismic wavelets, then the 'Mixed' option can be used. Note that the mixed source type workflow requires two separate modelling instances, one for each source type.

If the mixed source type workflow is selected, then the use must enter a shot code value (SHTCOD ident) that defines the second source type. All other SHTCOD values are assumed to be associated with the first source type.

Re-Ident

The re-identing option will try to re-calculate the key idents SHTLIN, SHTPT, RECLIN, RECPT from the input data. Idents are updated based on the position of the source and receiver coordinates of the survey. Caution is needed when using this option and careful qc should be performed on the output geometry to ensure that it is as intended.

Use Development Library

By default, SimWiz will use the current version of the AWLIB library which is set by the 'cur' pointer in the Jobpro sitebpss directory e.g., /glb/am/siep_inc/seis/sgs_jpprojects_1/sitebpss/acqlib. However, the user can force the wizard to use the unreleased development version (dev) by selecting this check box.

JobPro Revision Number

When the workflow skeletons are created, they are all labelled with the JobPro revision number at the beginning as is the requirement for JobPro. The revision number follows the usual 3 dot 2 format e.g., 123.45 or abc.de.

Data Pool

The output from the skeletons will be saved to a user specified data pool which can be selected from the pull-down menu in the interface.

Navigation

SPS Files

The wizard supports the SPS file format (Shell Processing System) for the definition of the acquisition geometry. Three SPS files are required, which correspond to the source grid (.s), the receiver grid (.r) and the relational database file (.x). These files are generated in Boris Kuvshinov's Python design tool. For details of the design tool use and exporting the SPS files the reader is referred to the Shell report (SR.20.01313). Alternatively, externally created SPS files may be used, however, some vendors may not adhere strictly to the SPS standard, so some customization of the run decks may be required.

Coordinate Translation

A bulk coordinate translation can be performed on the source and receiver coordinates. To do this select the check box in the interface and add an X coordinate (X0) or Y coordinate (Y0) value to shift the data by (Figure 4). The units are assumed to be the same as the input data coordinates.

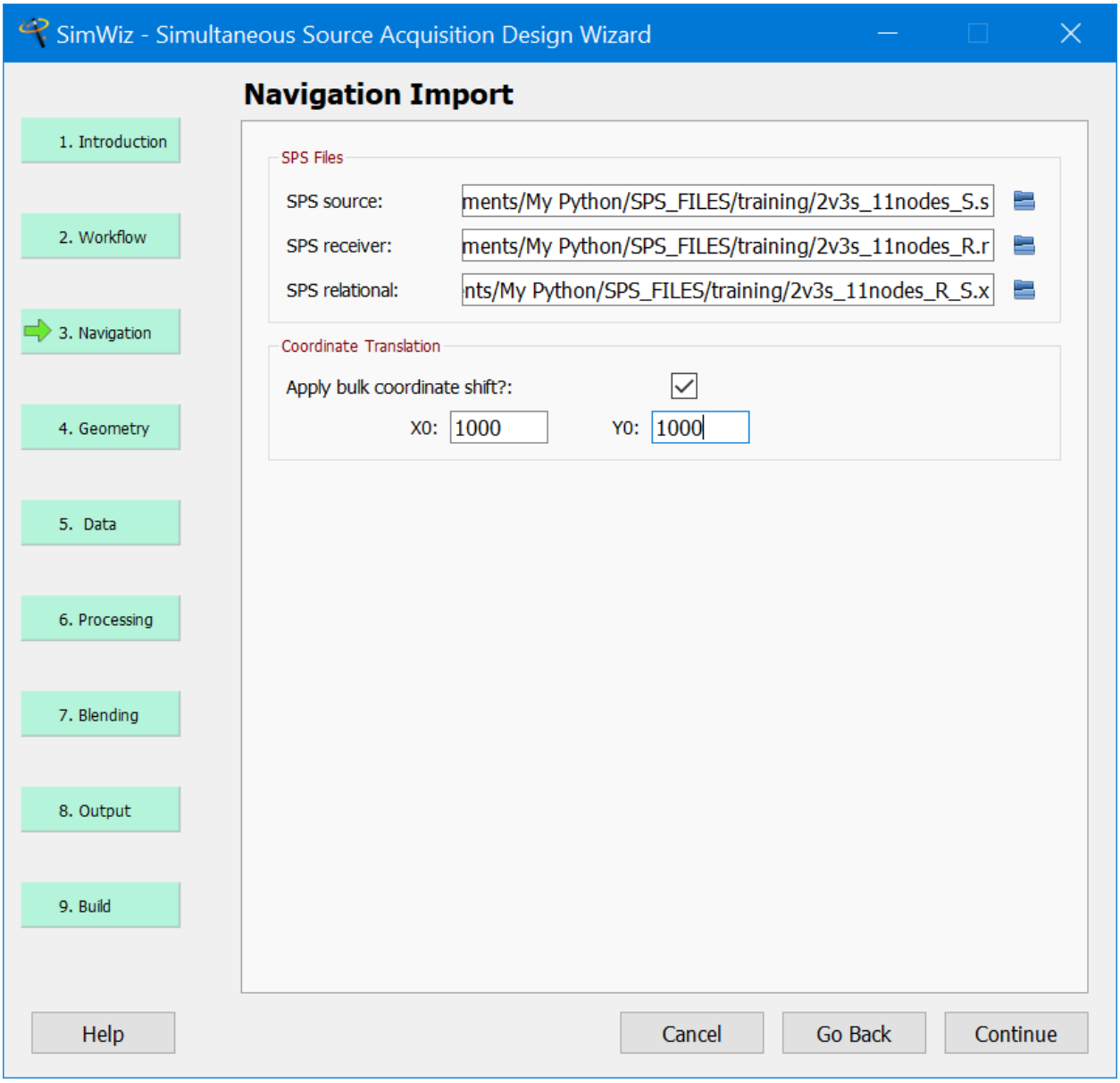


Figure 4. Import page which includes SPS file selection and coordinate translation options.

Geometry

Some advanced options are available for your modelling workflow on this page:

Create mirror geometry?

Select the check box if you wish to create a mirror geometry for your survey (Figure 5). This option will re-datum your vertical depths to add an extra depth shift which can be defined by the 'Mirror depth shift' entry. Note that this does not prepare your velocity model, which needs to be shifted separately in Smart or other software.

Apply reciprocity?

The user can apply reciprocity (swap source for receiver locations and vice-versa) by selecting this option. This would be the default for an OBN geometry, which typically has more sources than receivers, so applying reciprocity would reduce the overall modelling effort.

Interpolate node depths?

The true receiver depths maybe extracted from an interpretation pick of the water bottom depth volume via the selection of a saf file. This saf file must contain the idents XREC, YREC, ZREC.

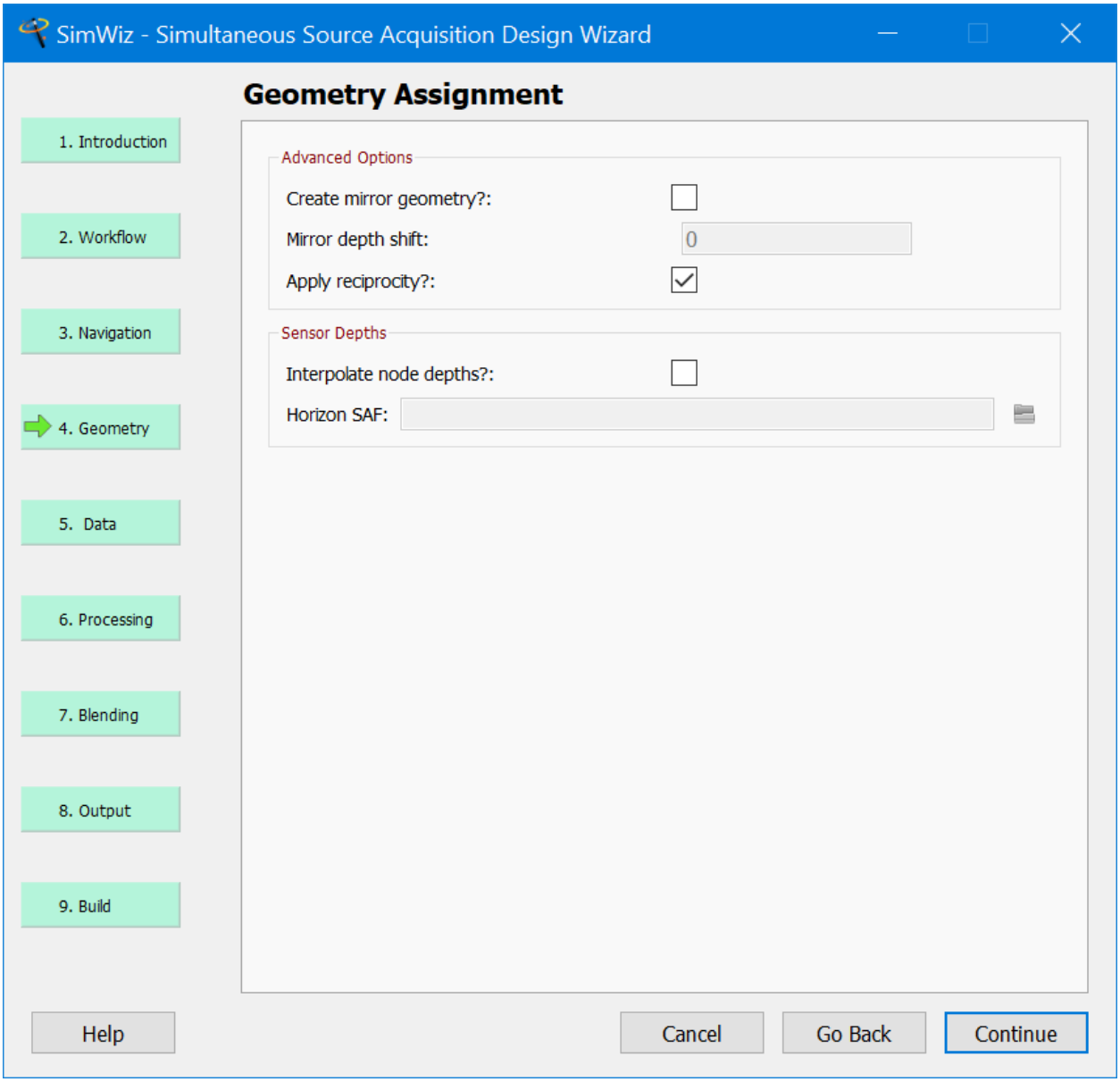


Figure 5. Geometry build page contains some advanced options for the desired acquisition geometry.

Data

The first few pages of the wizard cover the acquisition design skeleton parameterization. It is assumed that the next step in the workflow will be either forward modelling to create the synthetic traces or loading already created SSF trace data. Several JobPro wizards already exist for building the forward modelling skeletons. These could via the FWI wizard or RTMIG wizard in Jobpro. The user is referred to the JobPro wizard documentation for information on how to use those wizards. To select trace data either type the Jobpro dataset name in the text box provided or click on the open folder icon to select the appropriate file (Figure 6).

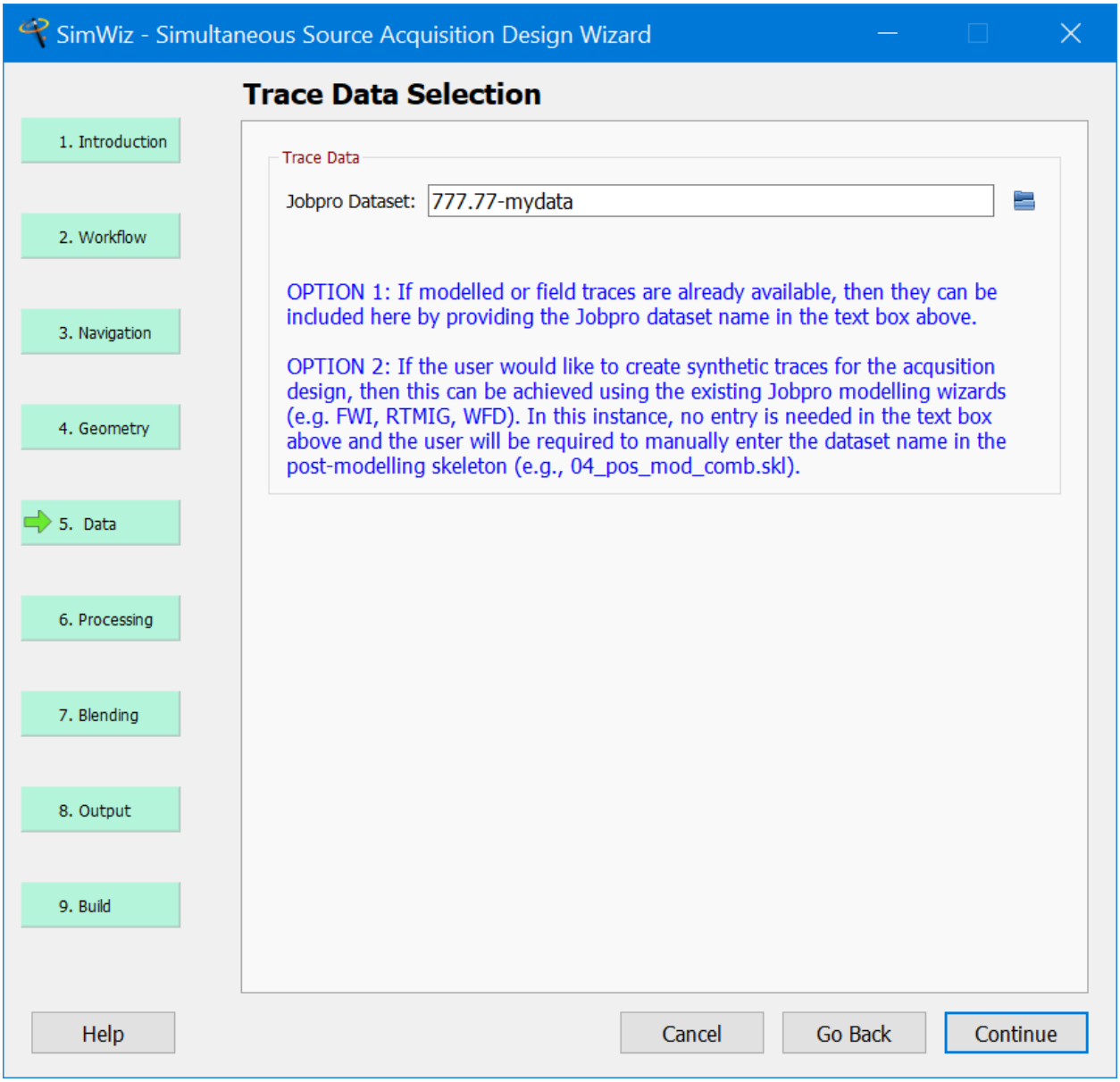


Figure 6. Trace data selection to use for blending.

Processing

Following modelling some additional steps may be performed. These include options to convolve the data with a filter (in WAVSAM format) or add random noise to the data (Figure 7).

Convolve data with a wavelet?

Select the checkbox and enter a WAVSAM formatted file to perform post-modelling wavelet convolution to you modelled dataset.

Add noise to output?

Random noise maybe added to the modelled traces via the use of the SIPMAP operation NOSADD. Noise may be added either before blending (pre) or after blending (post). Key parameters for NOSADD include the noise mode and parameters faclev, flow, iorlow, fhigh and iorhig. Details of these parameters and their use can be found in the online SIPMAP documentation.

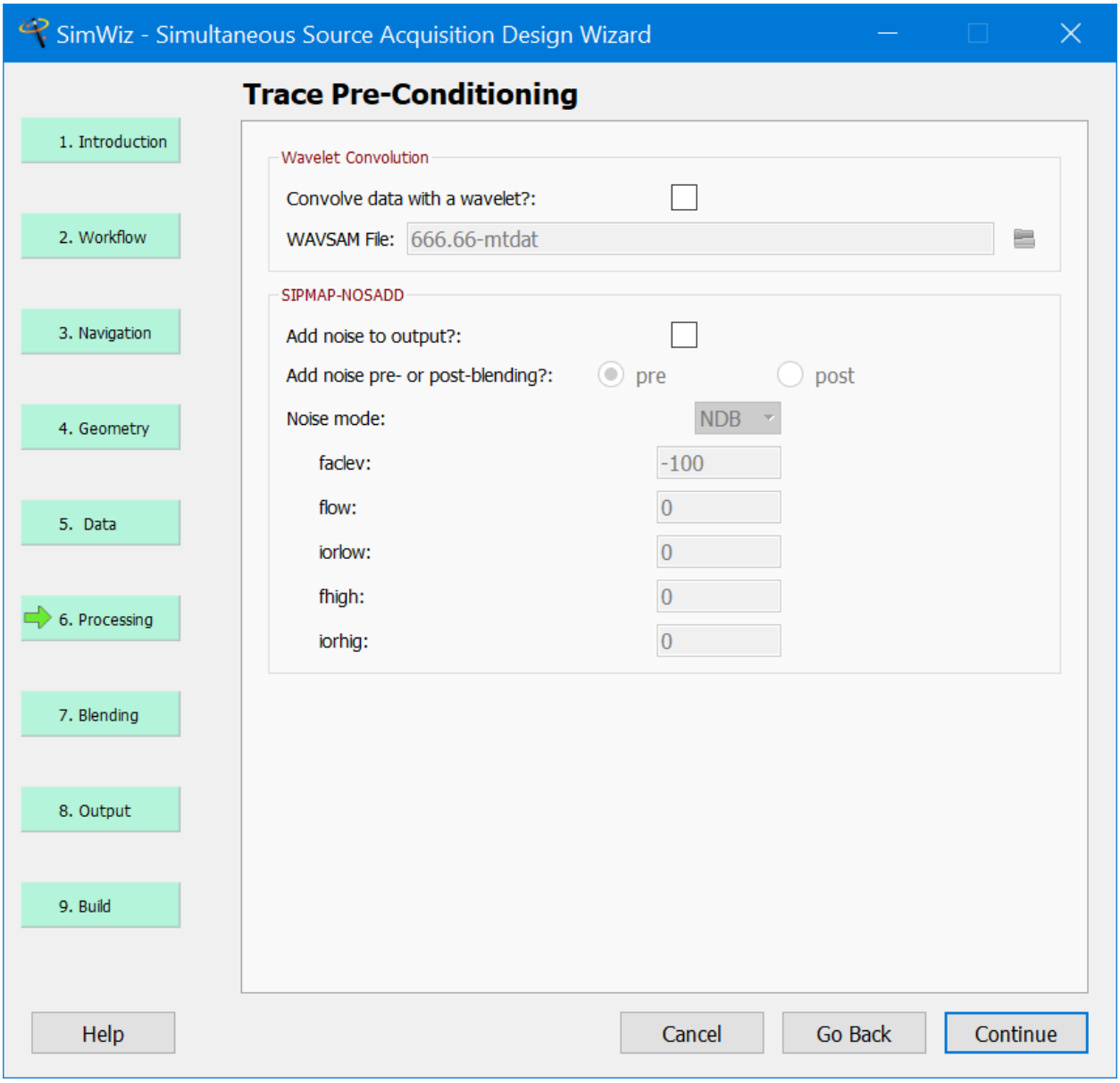


Figure 7. Trace processing options to apply prior to blending.

Blending

Data blending requires that the user specifies the modelled trace length, sample interval and the desired output trace length. The latter value must be a multiple of 1000ms. If the start time of the data has been altered then this can be defined by entering 'Start time of wavelet', which is assumed to be zero by default (Figure 8).

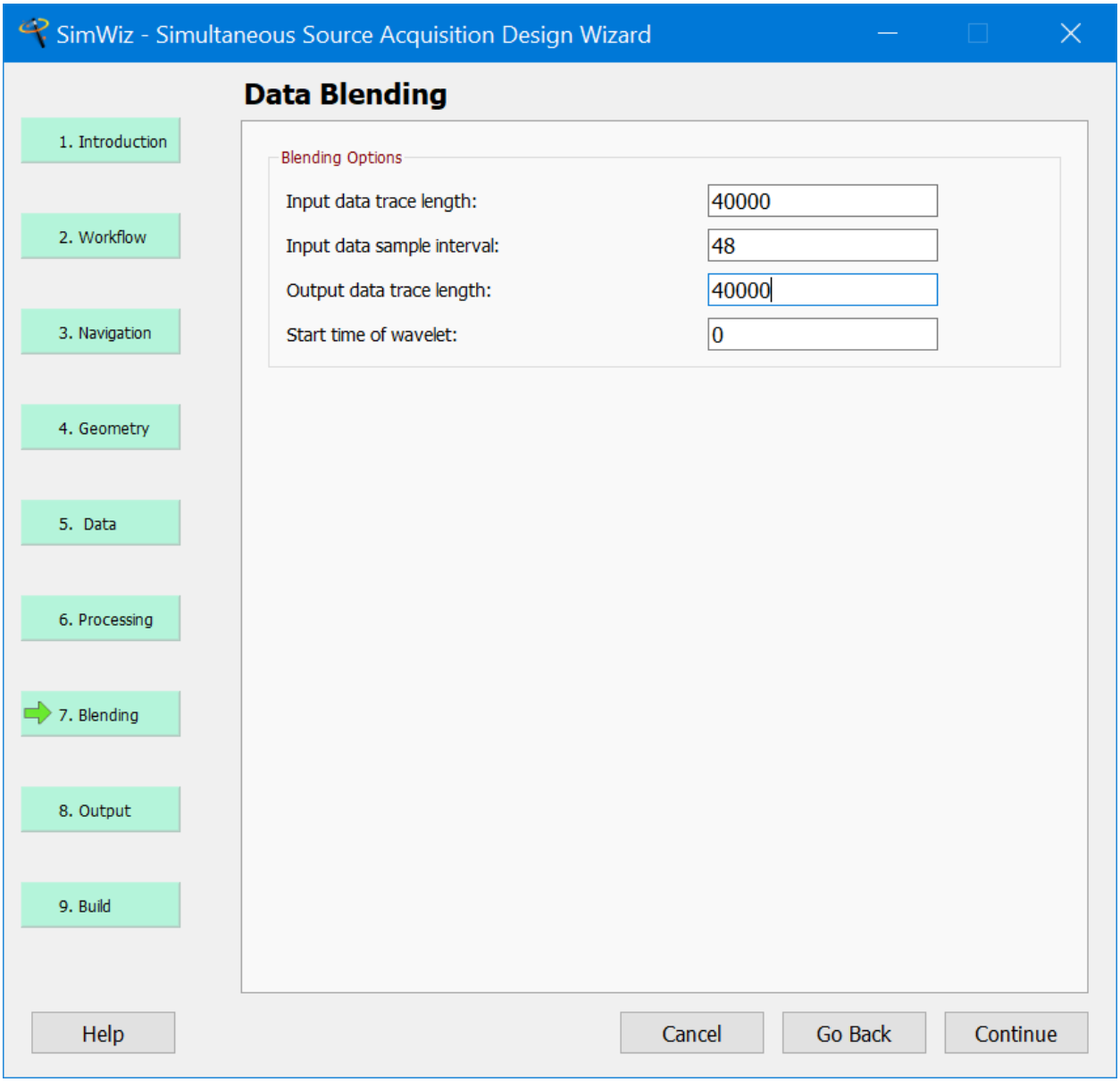


Figure 8. Blending parameters.

Output

JobPro Library

The user can select the Jobpro library where files will be created by selecting the library from the pull-down menu (Linux only) (Figure 9).

JobPro Project

The user can select the Jobpro project where files will be created by selecting the project from the pull-down menu (Linux only).

JobPro Partition

A base name should be supplied for creating the workflow partitions. By default, this is set to 'model'. Two partitions will be created model_ad1 and model_ad2. The first partition will include the first skeleton of the workflow, which performs the SPS conversion. The second partition will include all the remaining skeletons which may be split over several different job segments based on the definition of the ident ranges.

Output skl directory

By default, the skeletons are generated and stored in the Jobpro skl directory for your project. However, you may prefer not to use the JobPro directory to store the files, in which case the output skl directory can be specified here. If no directory is specified, then the wizard will save the files in the SimWiz-Store folder which is located at home_directory/SimWiz-Store/skl (on Linux) or C:\apps\Sim-Store\skl on windows.

Generate SSF trace?

Option to generate or not SSF traces on output for the modelling geometry input. By default, this is always the case and is only included as an option for quick debugging purposes where you want to test the workflow without generating trace files.

QC displays

Options are provided to output qc displays for the coordinate geometry, shot timing and sensor depths. Each option will generate a sperate skeletons containing operations to build qc images using GNUPLT. These images will be output to the 'qcimages' directory in your JobPro data directory folder after the qc skeletons have been run. Examples images of typical qc displays can be seen in Figures 10-13.

Sort Size

For large datasets, the default SQSORT maxrec and SRTALL maxsize parameters may need to be increased within the skeletons. To make this convenient, the values can be entered in the two text boxes provided.

Ident Ranging for Multi-Segment Partitions

The skeletons can be configured to use some input ident ranging as provided by up to 3 custom idents. At present only ident1 is enabled and additional testing is needed before additional idents can be used.

The ident entries required are ident name, first ident number, last ident number and ident number increment. The default is set to SHT and 1 shot point. So, to create 10 job segments with the partition the entries would be SHT, 1, 10, 1. A non-unary increment can be used e.g., 1, 20, 2.

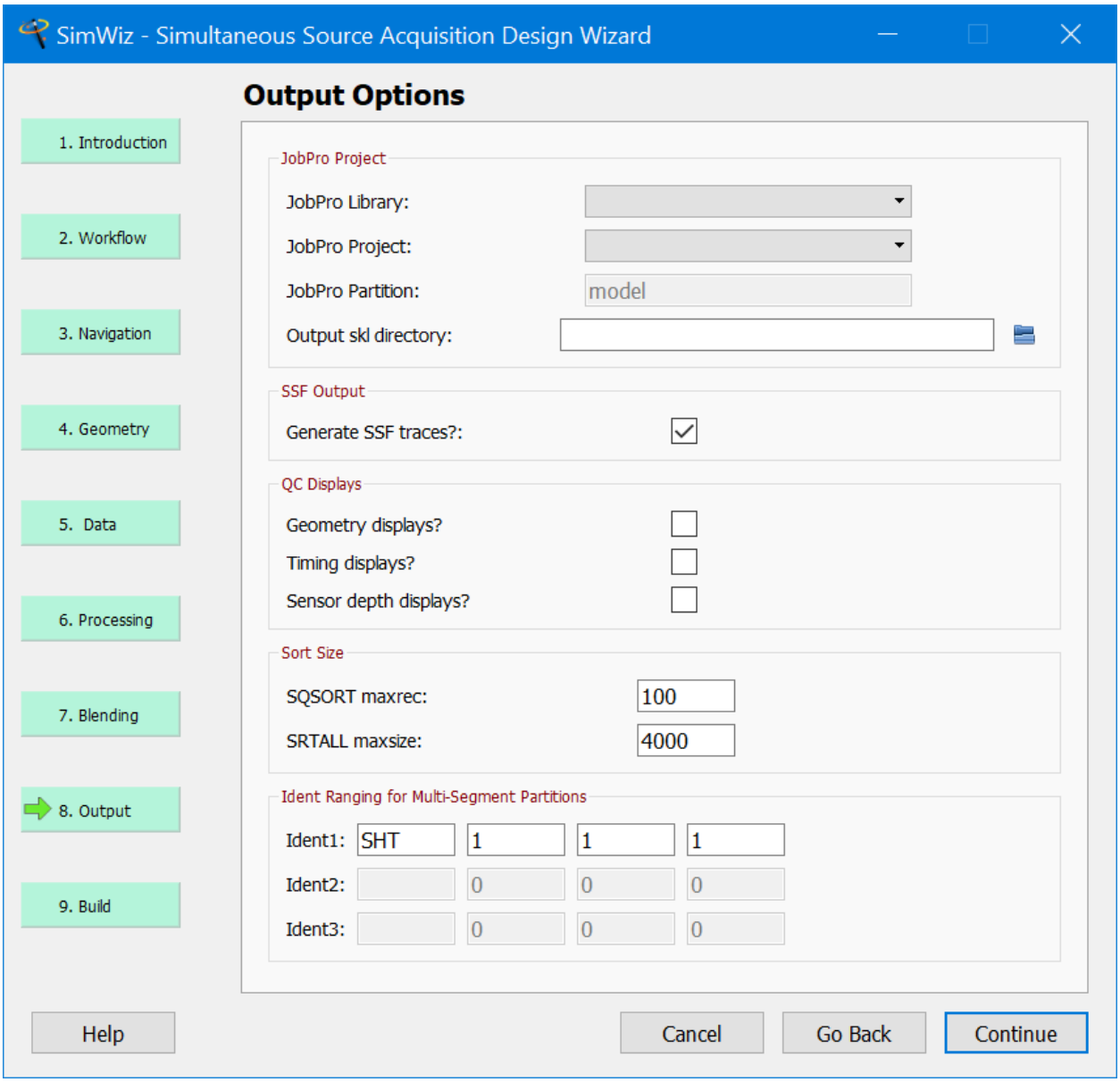


Figure 9. Output options page.

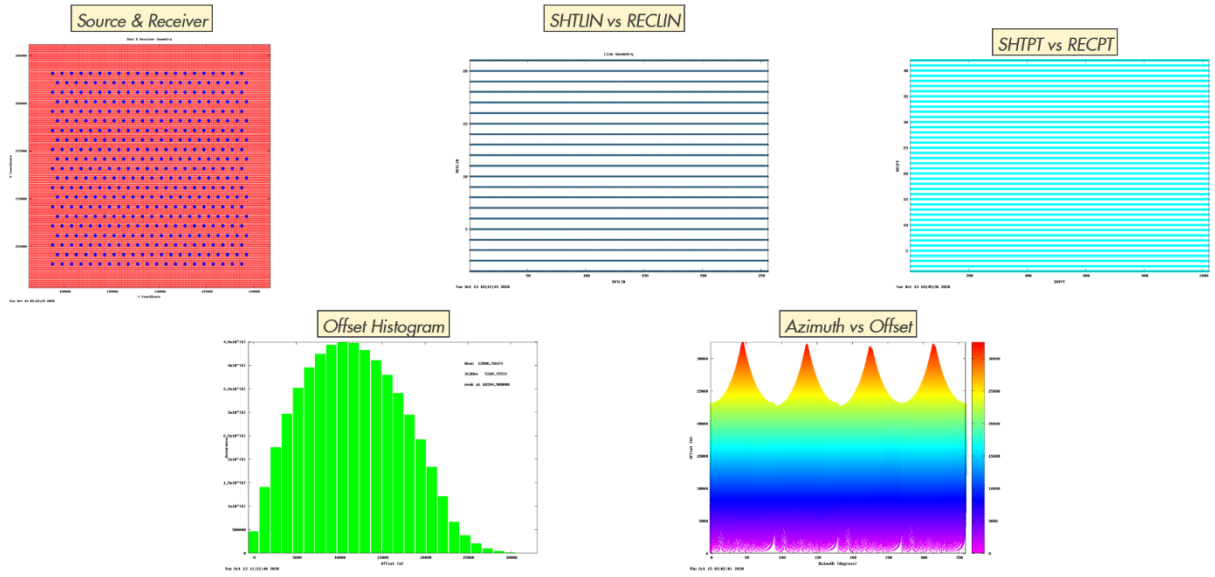


Figure 10. Example coordinate and offset geometry qc images.

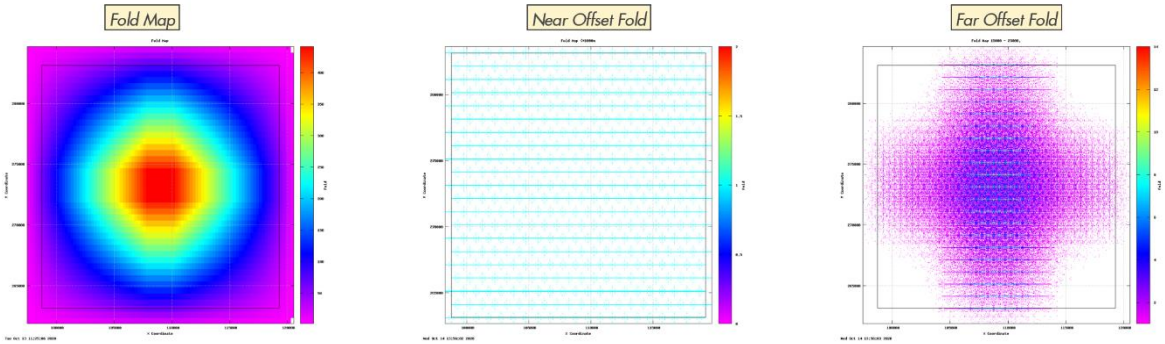


Figure 11. Example offset geometry qc images.

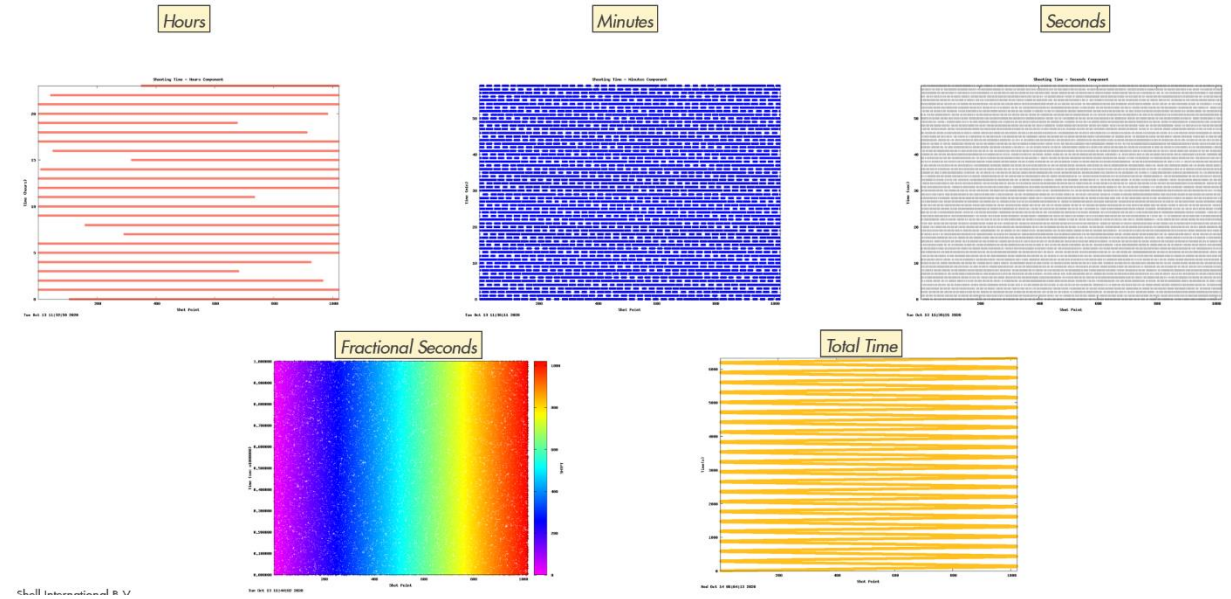


Figure 12. Example shot timing qc images.

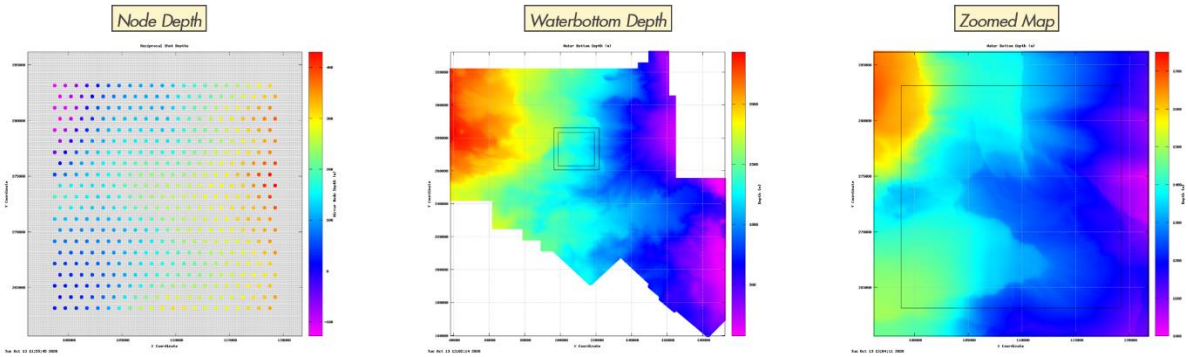
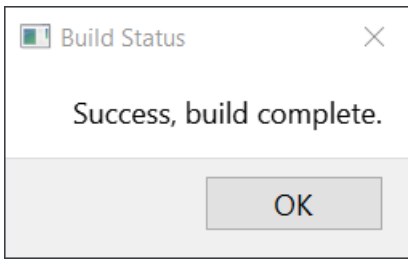


Figure 13. Example node depth and water bottom qc images.

Build

The final step of the workflow enables the user to execute the skeleton and partition building (Figure 14). Once all entries are made the skeletons can be built by pressing the execute icon located to the left to the progress bar (indicated by red arrow in Figure 14). Output from the build process will then appear in the 'Build Log' text box. When all actions are completed, the user is presented with the dialogue shown below. All wizard parameters are automatically saved on exit once the 'Done' button is pressed.



If successful, the Jobpro project will be updated with the new partitions and jobsets (Figure 15). If the partition base name is unique within the Jobpro project, then new partitions will be created for each run. However, if you retain the same base name from a previous run, then any new jobsets will be added to the previously created partitions.

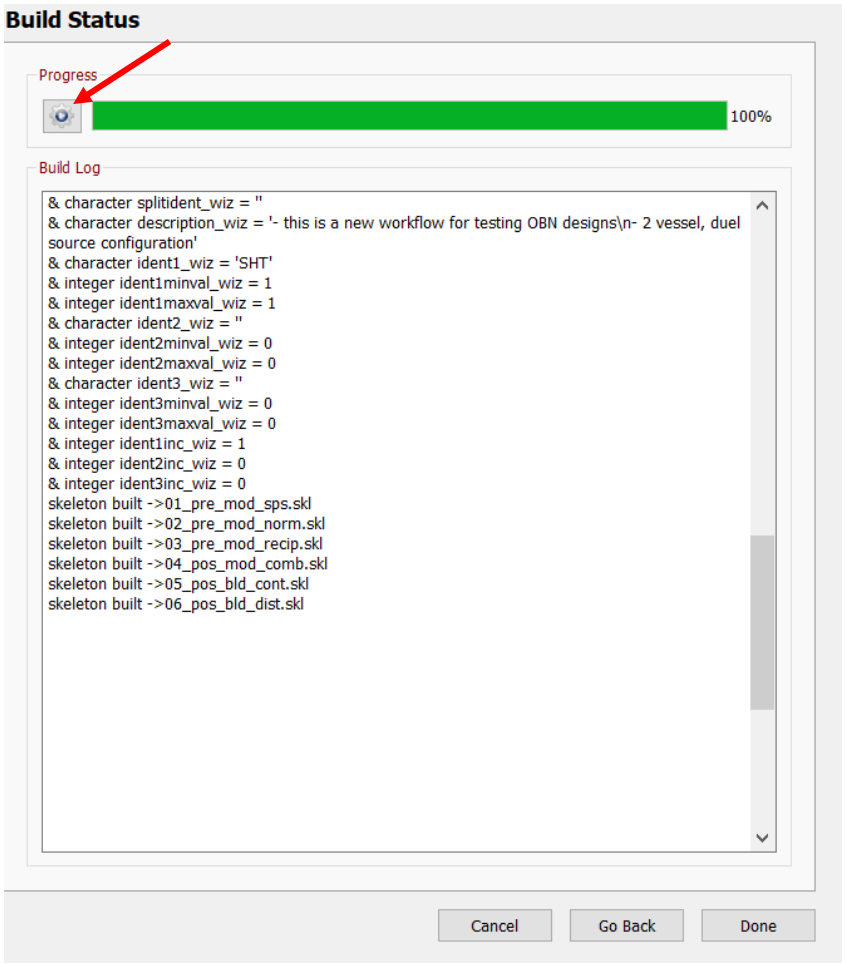


Figure 14. Build status page.

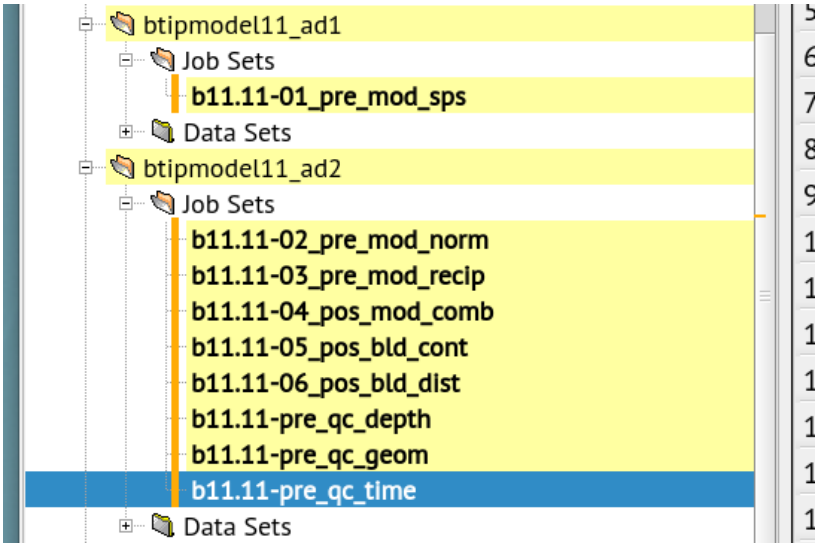


Figure 15. Partitions and jobsets added to Jobpro.

References

Kuvshinov, B., C. Willacy and D. Chavan, 2020, Simultaneous Source Acquisition Design Modelling – Synthetic Seismic Data Generation. Shell Report, SR.20.01313.

Contacts

SIPMAP/Jobpro/SimWiz – Chris Willacy (christopher.willacy@shell.com)

Acquisition Design Tool – Boris Kuvshinov (Boris.Kuvshinov@Shell.com)