Introduction to Seismic Data Loading and Management in the Landmark® Environment

Volume 1

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Halliburton | Landmark
10200 Bellaire Blvd., Houston, Texas 77072-5206, USA
P.O. Box 42810, Houston, Texas 77242-2810, USA
Phone: 281.575.3000, Fax: 713.839.2015
Internet: https://www.landmarksoftware.com

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Introduction to Seismic Data Loading and Management in the Landmark Environment: Volume 1

Chapter 1
Introduction

The Introduction to Seismic Data Loading and Management in the Landmark Environment class is designed for people who have little or no experience loading seismic data.

In this course, you will learn how to load navigation data for both 3D and 2D seismic data, how to use the Landmark SEGY Analyzer utility to view and analyze SEG-Y data, and how to use PostStack Data Loader, and SEG Y Import to load seismic trace data from disk into a format that can be read by Landmark applications used to display and interpret seismic data.

You will also learn how to manage 3D and 2D seismic, horizon and fault data using Seismic Data Manager and Seismic Tools.

Course Overview

Topics covered in this class include:

- R5000 Project Overview
- The Landmark seismic data formats
- Loading 2D and 3D navigation data
- Analyzing SEG-Y data using SEGY Analyzer
- Loading 2D and 3D seismic data using the PostStack Data Loader
- Loading 2D and 3D seismic data using SEG Y Import
- Management tools and utilities for seismic data

About this Manual

The remaining chapters in this manual contain the following information:

Chapter	Contents
Chapter 2: *R5000 Basics*	• OpenWorks project overview • Directory structure • District concept • Environment configuration • File locations • OpenWorks data model considerations for seismic • OpenWorks windows • Interpreter ID creation and management
Chapter 3: *Data Loading Overview*	• Overview of SEG-Y formatted data • Landmark 3D seismic data formats • Landmark 2D seismic data format • Overview of tools used for seismic data loading • Overview of the PostStack Data Loader • Overview of SEG Y Import
Chapter 4: *Loading 3D Seismic Data*	• 3D loading workflow • OpenWorks project organization • Gathering background information • Selecting an OpenWorks project • Creating a 3D seismic survey and 3D seismic data storage areas • Quality check of navigation data • Analyzing SEG-Y seismic data using SEGY Analyzer • Load 3D seismic data using PostStack Data Loader • Load 3D seismic data using SEG Y Import • Optional 3D Workshops

Chapter	Contents
Chapter 5: *Loading 2D Seismic Data*	• Gathering project background information • Creating 2D survey • Creating 2D seismic data storage areas • Loading 2D navigation data with Data Import Wizard • Quality check 2D navigation data • Analyzing SEG-Y seismic data using SEGY Analyzer • Loading 2D data using PostStack Data Loader • Loading 2D data using SEG Y Import • Quality check data in SeisWorks • Scaling and clipping Options • Trace balancing • Optional 2D Workshops
Chapter 6: *Seismic Data Manager Tools*	• Introduction to Seismic Data Manager • Seismic Data Manager Window • Tools in Seismic Data Manager
Chapter 7: *Seismic Tools*	• Seismic Line Lists • Creating and Modifying Interpretation Projects • Interpretation Data Manager • SeisWorks Data Transfer • PDT – Project Data Transfer • OpenWorks Backup and Restore • Copying an Existing Oracle Project to Local Project using SQLite
Chapter 8: *Seismic Tools and Utilities/Managing Horizon and Fault Data*	• Seismic Tools and Utilities • Managing Horizon Data • Managing Fault Data • Data Import/Export Wizard for Fault Data • Seismic Converter • Command Line Utilities

Chapter	Contents
Appendix A: *Data Loading Flow Charts*	Generalized flow charts for 2D and 3D data loading using PostStack Data Loader
Appendix B: *Binary and Trace Header Records*	•Contents of 400-byte binary reel identification header •Contents of trace identification header
Appendix C: *Prebuilt Session in PostStack Data Loader*	List of Landmark supplied sessions
Appendix D: *Creating an OpenWorks Project Database*	Steps for creating a project database using Project Administration
Appendix E: *Project Status Tool*	Steps for selecting and changing projects in OpenWorks sessions
Appendix F: *vi Editor Survival Kit*	Summary of basic *vi* commands
Appendix G: *Common UNIX commands*	Summary of basic *UNIX* commands

Before You Begin

During this class, you enter information and access programs and options using five different methods:

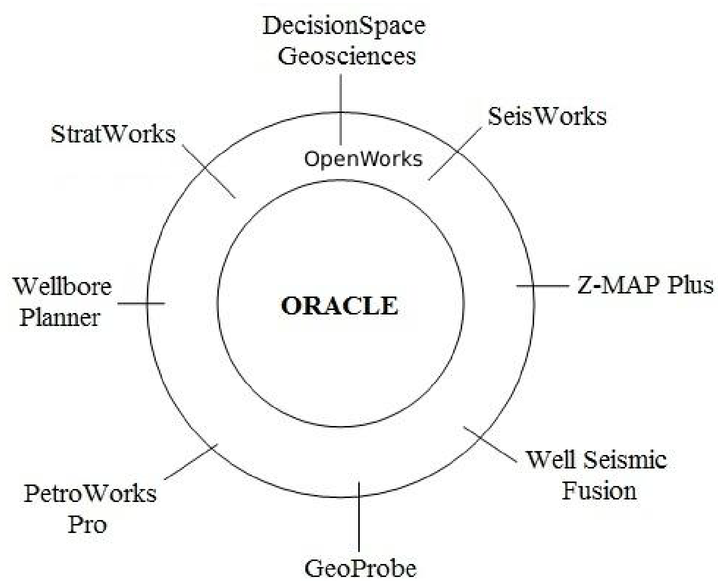
- selecting programs from the OpenWorks command menu
- entering information into windows that use the Motif or Common Desktop Environment user interface
- typing Unix commands at a prompt in an xterm window
- typing text files using a text editor
- selecting commonly used options from icons rather than from the menus

This class assumes that you are familiar with the first four methods.

This class mainly uses SeisWorks and DecisionSpace Geosciences to check the data loads. The Horizon Image Map option in SeisWorks is a quick way to check that the 3D navigation data has been loaded correctly, and the Seismic View option is used to display seismic data for a visual check. For reference, an overview of some commonly used SeisWorks icons is included at the end of this chapter.

OpenWorks® Software Command Menu

OpenWorks refers to the group of programs that serves as the framework for the Landmark geologic and geophysical interpretation programs.



Among other things, the OpenWorks software provides:

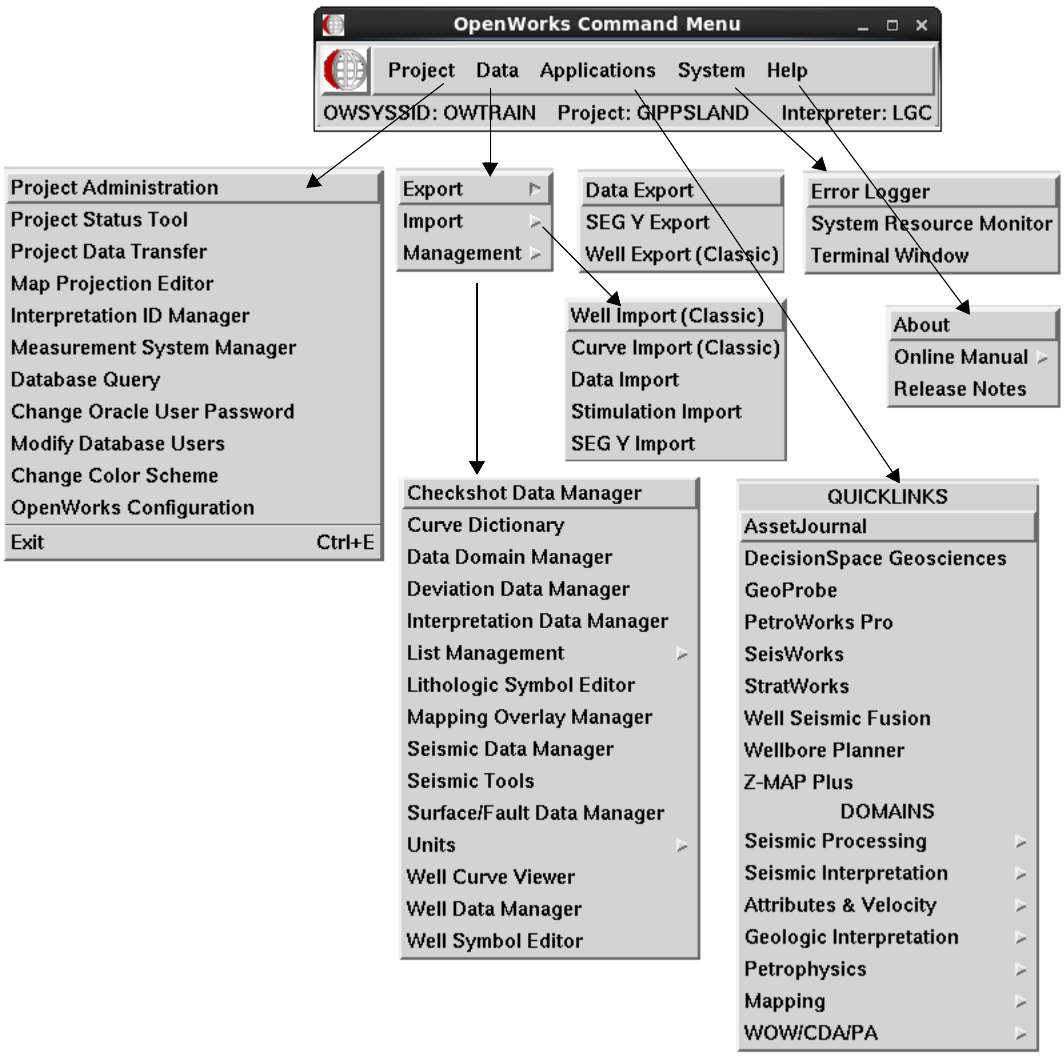
- a command menu from which you select programs for loading navigation data and for interpreting the data
- a number of directories that contain control files for the interpretation software
- the OpenWorks database, which is used for storing many types of data, including well, curve, fault, navigation for seismic surveys, as well as 2D horizon interpretation
- OpenWorks Utilities

The workshops in this manual assume you have the OpenWorks software running on your workstation. The OpenWorks software is running if you see the OpenWorks command menu on the screen.

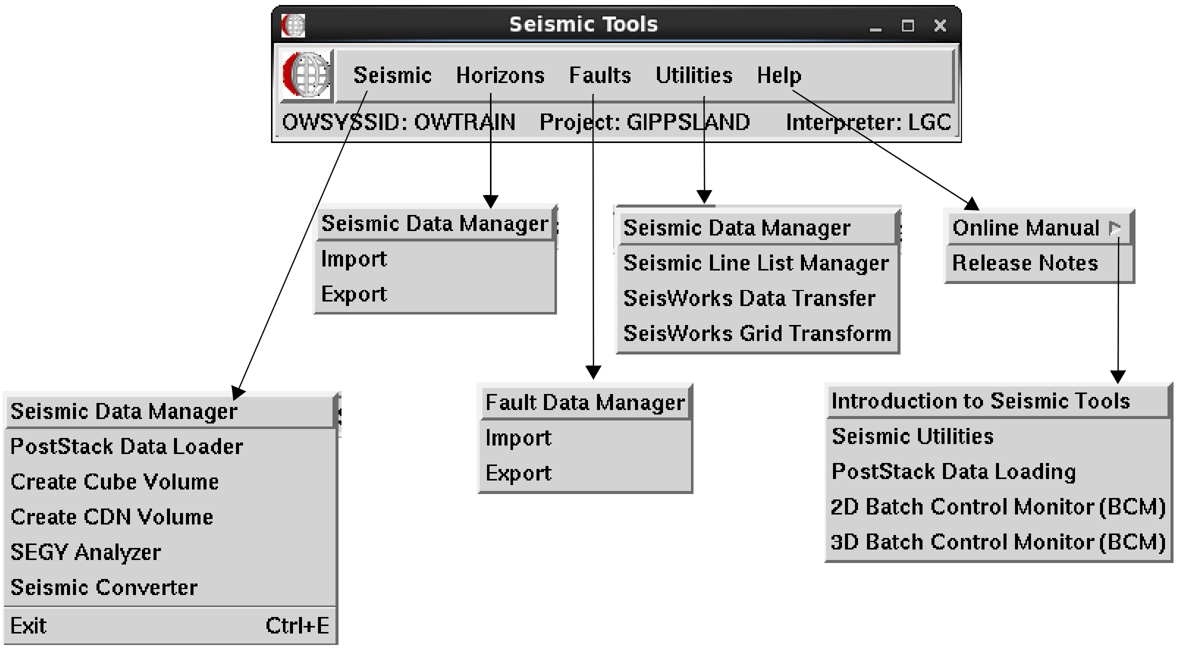
The procedure to start the OpenWorks software may vary at different locations. Your instructor will provide the necessary instructions to start the OpenWorks software for your training location.

Features of the OpenWorks command menu and utilities accessed through Seismic Tools are shown on the following pages.

The utilities that you will use the most in this class are marked with large arrows.



To access Seismic Tools, select **Data > Management > Seismic Tools** from the OpenWorks command menu. Many of the utilities that you will use in this class are accessed through the Seismic Tools.



SeisWorks Icons

SeisWorks is used in this class to display seismic data and navigation data for quality control purposes. A few of the icons for commonly used options in SeisWorks displays are illustrated below. You will use some of these icons in this class when you display data you have loaded.

Icon	Description
Data Display Icons	
Areal Zoom Point Zoom Unzoom	Map View: click on **Areal Zoom**, press MB-1 to anchor corner of zoom rectangle, drag cursor to expand zoom rectangle over area to zoom, press MB-2 to complete zoom. Seismic View: click on **Areal Zoom**, locate cursor over seismic data, press MB-3, select Zoom option. Position zoom rectangle over area to zoom in on and press MB-1. Map View: click on **Point Zoom**, press MB-1 when cursor is centered on map area to zoom. **Unzoom** turns Zoom off.
	Redraw. Use to redraw display. **Reinitialize and Redraw.** Click MB-2 for the application to reread well, seismic, and horizon data; regenerate the fast file cache; and then redraw the display.
	Toggle Background Color. Changes the background in the Map View between black and white.
	Contents. Click on the Contents icon to see the Contents dialog box.
	Color Control. Click on the Color Control icon to bring up the color bar. The arrow in the **Color Control** icon indicates the view in which color control changes will be shown.

Icon	Description
Data Display Icons cont'd	
Midpoint Point to Point Loop Zig Zag Time Slice Chair-3D	**Select from Map.** The appearance of the icon is based on the most recently chosen selection type. By default, icon is set to **Midpoint**. Click on the Midpoint icon to select a seismic line from the map with the midpoint method. To change to another selection method, select **Seismic** → **Select from Map** from the Seismic View menu. Choose a selection method. The icon changes to reflect the new selection method.
	Parameters. Click on this icon to bring up the Seismic Parameters dialog box.
	Horizons. Click on this icon to select horizons for display in Map View.
	Frame Control. Click on this icon to bring up the Frame Control dialog box.
	Viewing Angle. Select this icon to rotate the Perspective View.
	Respecify Scale. Press this icon and then use MB-1 to change the scale of the Perspective View.
	Reselect Range. Select this icon to change the time/depth display range in a Perspective View.

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Support information is available on the Landmark Support internet page located at:

http://css.lgc.com/InfoCenter/index?page=home

If you need an expert to look at your data with you to help determine the most efficient and accurate interpretation approach, the Landmark technical consultants are available to come into your office and work with you on your specific project.

Chapter 2
R5000 Project Basics

This chapter covers basic R5000 project structure details and activities that are necessary before projects can be accessed.

Course Overview

In this chapter you will learn about:

- OpenWorks project structure overview
- Directory structure
- District concept
- Environment configuration
- File locations
- OpenWorks data model considerations for seismic data
- OpenWorks windows
- Interpreter ID creation and management

R5000 Project Overview

What is an OpenWorks Software Project?

The following sections explain the concept of projects, and how they are used in Landmark applications.

A project is any logical set of data to be used together on your system. The amount of data is limited only by the disk space available. This project is called the OpenWorks project database.

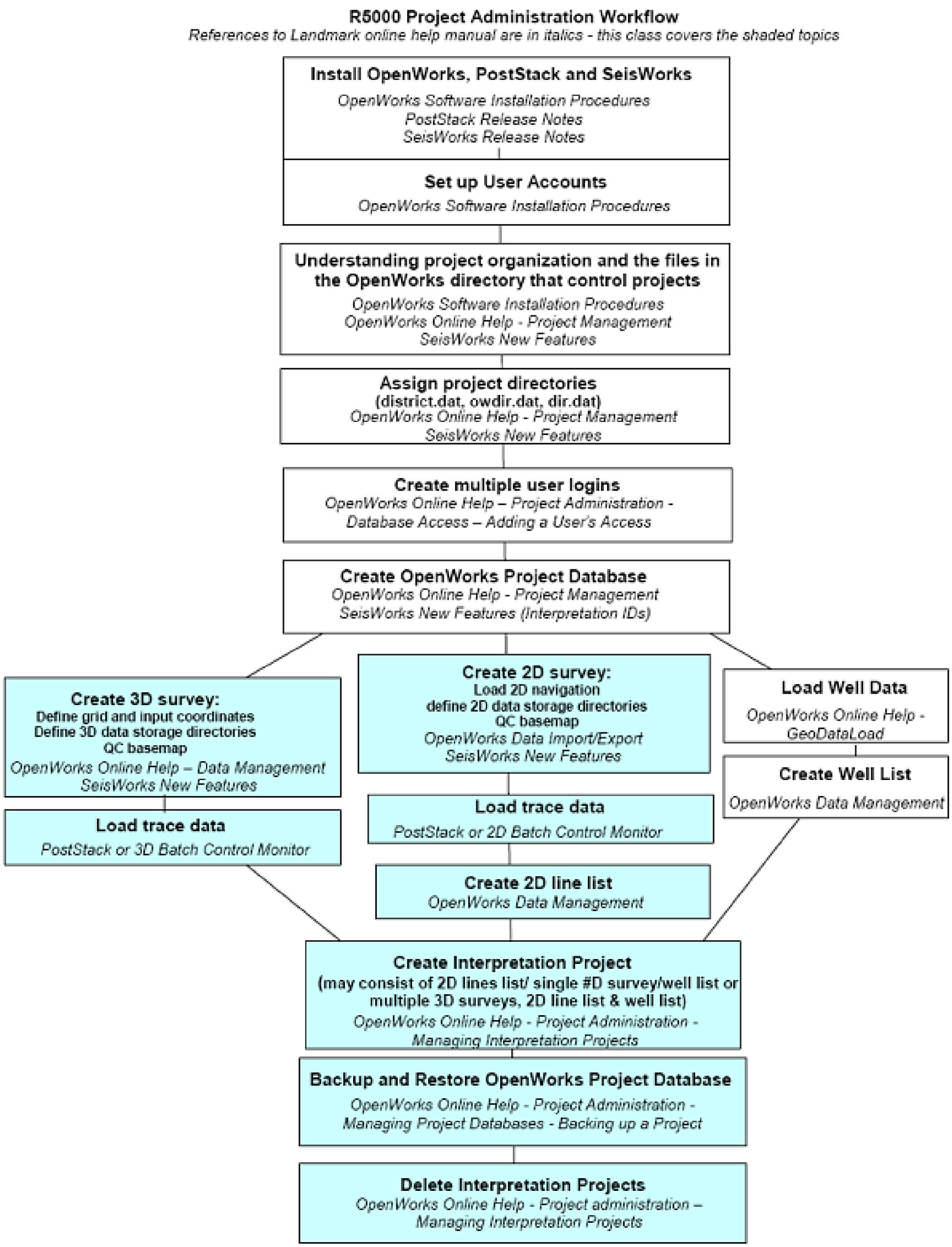
In most cases, interpreters will want to work with only a small subset of the available data – for example, certain well logs in a particular field, reservoir data for particular horizons, or parts of different seismic surveys. A subset of the project database, called the interpretation project, provides the key to accessing data that is of interest to you. When you are working in an interpretation project, by definition, you are using a certain set of wells, interpreters, and other data. For this reason, you may need to modify or change interpretation projects from time to time if you want to start working with a different set of data.

Project administration on Landmark systems can be classified as below:

- Set up OpenWorks project directories
- Create an OpenWorks project database
- Create seismic surveys: create 3D grids for 3D surveys, load 2D navigation data for 2D data, and define data storage directories
- Load well data
- Load seismic data into the project database
- Create interpretation projects (can be done before/after loading seismic data. Data should be loaded into the project database)
- Maintain OpenWorks database/interpretation projects (modifying, backing up, and restoring)

Complete workflows for project administration are presented on the next page. Highlighted functions are covered in this manual.

R5000 Project Administration Workflow

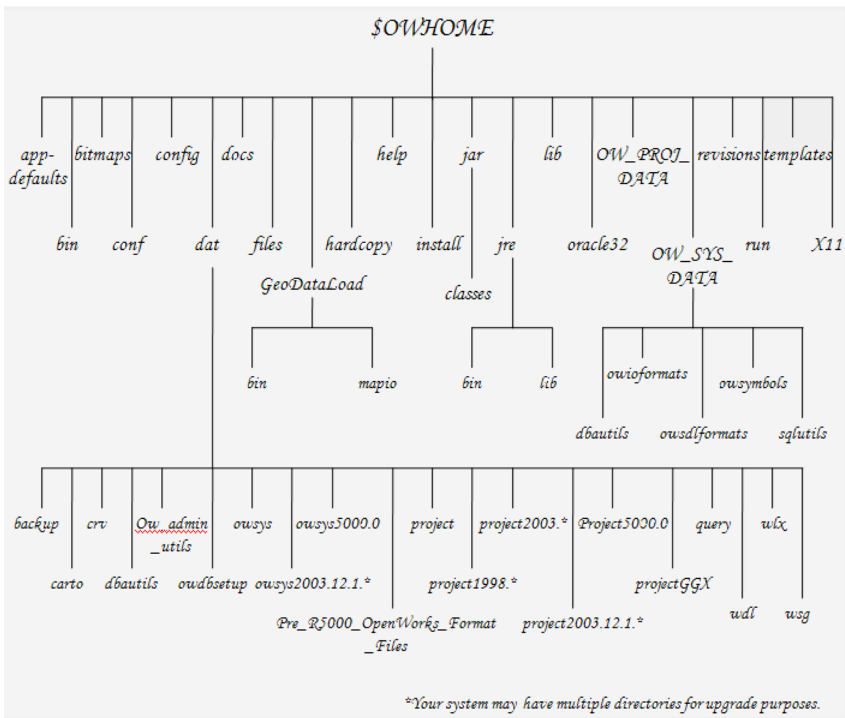


Directory Structures

The OpenWorks R5000 software default installation creates an OpenWorks directory on your system. This system is referred to as the *OpenWorks runtime directory* or the *OpenWorks home directory (OWHOME)*.

The OWHOME directory is the home directory for the OpenWorks software installation where all the applications reside.

The contents of your OpenWorks directory will be similar (although not identical) to the example shown below.



In addition, there will be an entry for each additional OpenWorks application installed. This may be a symbolic link, depending on where the application is installed.

Listed below is a summary of some of the subdirectories and their contents.

Subdirectories Under $OWHOME

Subdirectory	Contents
app-defaults	All application defaults.
bin	All the OpenWorks runtime application binaries.
bitmaps	All cursor and icon bitmaps used by the OpenWorks runtime application files.
conf	User configuration files including customized environment variables.
config	Default OpenWorks configuration files including default environment variables.
dat	ASCII support files for the OpenWorks software.
docs	The OpenWorks Online Help files in hypertext, and the manuals related to the OpenWorks utilities in PDF format.
files	The files directory used by the Oracle software.
GeoDataLoad	The GeoDataLoad™ software provides several data loading and export utilities.
hardcopy	All hardcopy support.
help	All hypertext help support files used to link the online help documents with the application.
install	All OpenWorks software installation scripts and files.
jar	All the OpenWorks jar files and libraries.
jre	All the java libraries required for the OpenWorks runtime.
jre64	All the java libraries required for the OpenWorks runtime on 64-bit systems.
Lib	All the OpenWorks libraries.

Subdirectories Under $OWHOME

Subdirectory	Contents
lib64	All the OpenWorks libraries for 64-bit systems.
lib64rh5	All the OpenWorks libraries required for RedHat Enterprise Linux 64-bit systems.
oracle32	Link to the installation directory of the Oracle 32-bit software.
oracle64	Link to the installation directory of the Oracle 64-bit software.
OW_PROJ_DATA	Location of files external to the project data in the OpenWorks database instance.
OW_SYS_DATA	Contains a number of files used by each instance of the OpenWorks software, such as color, format, symbol, and header files. The path for OW_SYS_DATA is located by the value in the OW_SYSDATA_DIR environment variable. As a default, the OW_SYSDATA_DIR variable is set in lgcenv.cf located in OpenWorksHome/conf; however, the variable can be set in a user's initialization script or set separately in the user's environment. Note that the OW_SYSDATA_DIR value can be overriden. Subdirectories within the OW_SYS_DATA directory can include the owioformats, owwlxformats, owsdlformats, and owsymbols folders. The environment variables for the location of the format files (OWIOFORMATS environment variable) and the well and lithologic symbols (OWSYSMBOLDIR environment variable) can be set in a user's environment too.
revisions	The OpenWorks software revision information.
run	Log messages produced when running OpenWorks applications. These logs can be used to report problems to Landmark customer support.
templates	User-environment template files used to install user accounts that are to be installed with the OpenWorks environment.

Subdirectories Under $OWHOME

Subdirectory	Contents
query	OpenWorks saved query.
Uninstall_Landmark_Openworks	Files required uninstalling the OpenWorks software.
X11	The XKeysymDB file used by X-based applications.

Subdirectories Under $OWHOME/dat

Subdirectory	Contents
backup	Contains the testdataOra.bk file used as test dataset for installation; can be removed post-install.
bmap	Culture data used in project and world basemap.
carto	Holds datum shift files required for CRS support.
crv	Pre-defined curve loading formats.
ow_admin_utils	Scripts used by the OpenWorks administrative utilities.
owsys	OWSYS tablespace template for current OpenWorks release.
owsys2003.x	OWSYS tablespace template for OpenWorks 2003 releases.
owsys5000.0	OWSYS tablespace template for OpenWorks 5000.0 release.
project	Contains OpenWorks backup project dmp file that is used when creating an OpenWorks project with the Project Admin tool; also contains additional templates for the current release of the OpenWorks data model.
project1998.x	Template data models for OpenWorks 1998.x releases.
project2003.x	Template data models for OpenWorks 2003.x releases.

Subdirectories Under $OWHOME/dat

Subdirectory	Contents
project5000.0	Template data model for OpenWorks 5000.0 release
projectGGX	Template data model for GeoGraphix® program tables
sdl	Pre-defined formats for the Seismic Data Loader (obsolete)
wdl	Pre-defined formats for the Well Data Loader
wlx	Pre-defined formats for the Well Data Export
wsg	Pre-defined formats for the Well Symbol Generator
owdbsetup	OWDBsetup will allow administrators to install an OpenWorks R5000 instance on a Unix or Linux host running Oracle database without installing the OpenWorks runtime. This install contains the scripts and files required to create OpenWorks R5000 schemas and objects in the existing Oracle instance

You should be familiar with the district.dat, dir.dat, and owdir.dat files in the conf subdirectory to properly manage seismic data. These files are discussed later in this chapter.

Environment Configuration

Configuring OpenWorks software is done with the use of environment variables to define important parameters and configuration files to allow the database to communicate with the surrounding Linux, Solaris, or Windows operating systems.

The following are some of the important environment variables and their purpose:

OWHOME	Locates the home directory for the OpenWorks software installation where all the applications reside.
OW_CONF_DIR	Locates the conf directory.
ORACLE_HOME	Links directly to the main Oracle installation directory.
OW_HOME_DIR	Variable that links to a user's home directory. Equivalent to the standard Linux variable $HOME. Required to pinpoint the location of the Oracle Wallet folder for password storage and verification.
OW_SYSDATA_DIR	Locates the system directory (OW_SYS_DATA) for the OpenWorks software. The OW_SYS_DATA directory contains a number of files such as color, format, symbol, and header files.
ORACLE_SID	Specifies the Oracle system ID indicating the location of the database server for Oracle installations. Specify this variable when you install the OpenWorks software using the installation program. On Linux, you can modify this variable, if required, in $HOME/.lgcprofile for Bourne (/bin/sh) and Korn (/bin/ksh), or in $HOME/.lgclogin for C shell (/bin/csh). On Windows, you can modify it in the *Environment Variables* dialog box, in the user variables group box.
OW_DBTYPE	Type of the OpenWorks database, such as Oracle.
OW_DEFAULT_DISTRICT	Sets the default district. For example, when this variable is set, and Project Status is started to select a project, the district is already set.
OWSYSSID	The OWSYSSID (OpenWorks database SID name) variable defines the name of the node containing OWSYS for this installation. OWSYS contains information about a shared group of projects, such as names and locations, valid users, and default map projections.

Most of these variables are set during either the operating system start-up process or when entering the OpenWorks software environment or by a DBA during the initial install and configuration. If the environment is configured incorrectly, it can lead to severe problems with OpenWorks software and Landmark's other G&G applications.

Location of OpenWorks Configuration Files

The OpenWorks configuration subdirectory ($OWHOME/conf) contains a number of files that are important for loading and managing seismic data. The default location of the OpenWorks configuration files is determined by an assignment of the OW_CONF_DIR environment variable in lgcenv.cf (this file is located in the conf subdirectory).

However, you can redefine value of the OW_CONF_DIR environment variable in your environment. Such a redefinition allows you (or a set of users) to have an OpenWorks configuration different from other users. It also allows you to have different definitions of OpenWorks environment variables, separate set of districts, and other locations to store files external to the database.

OpenWorks configuration files are located in the conf directory in the OpenWorks home directory. Among these files are district.dat, owdir.dat, and the dir.dat. These files determine where the OpenWorks software will store project and seismic files external to an OpenWorks instance in an Oracle database.

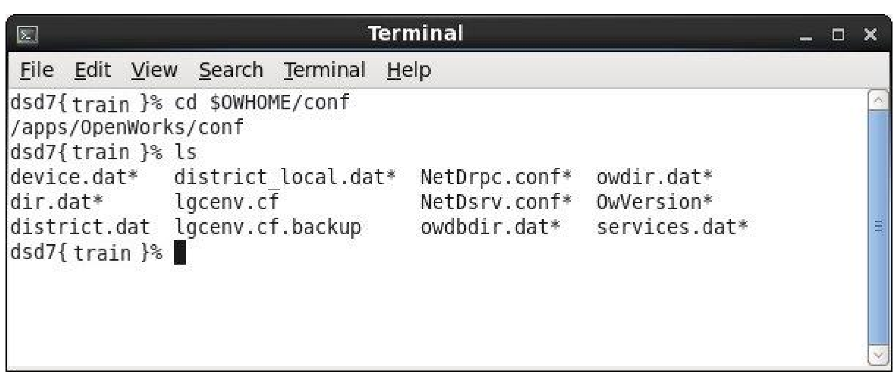
To navigate to the location of the conf directory, in a terminal window, type:

```
cd $OWHOME/conf
```

In this example, the full path to the conf directory is /apps/OpenWorks/conf.

To see a list of the files in the directory, in a terminal window, type:

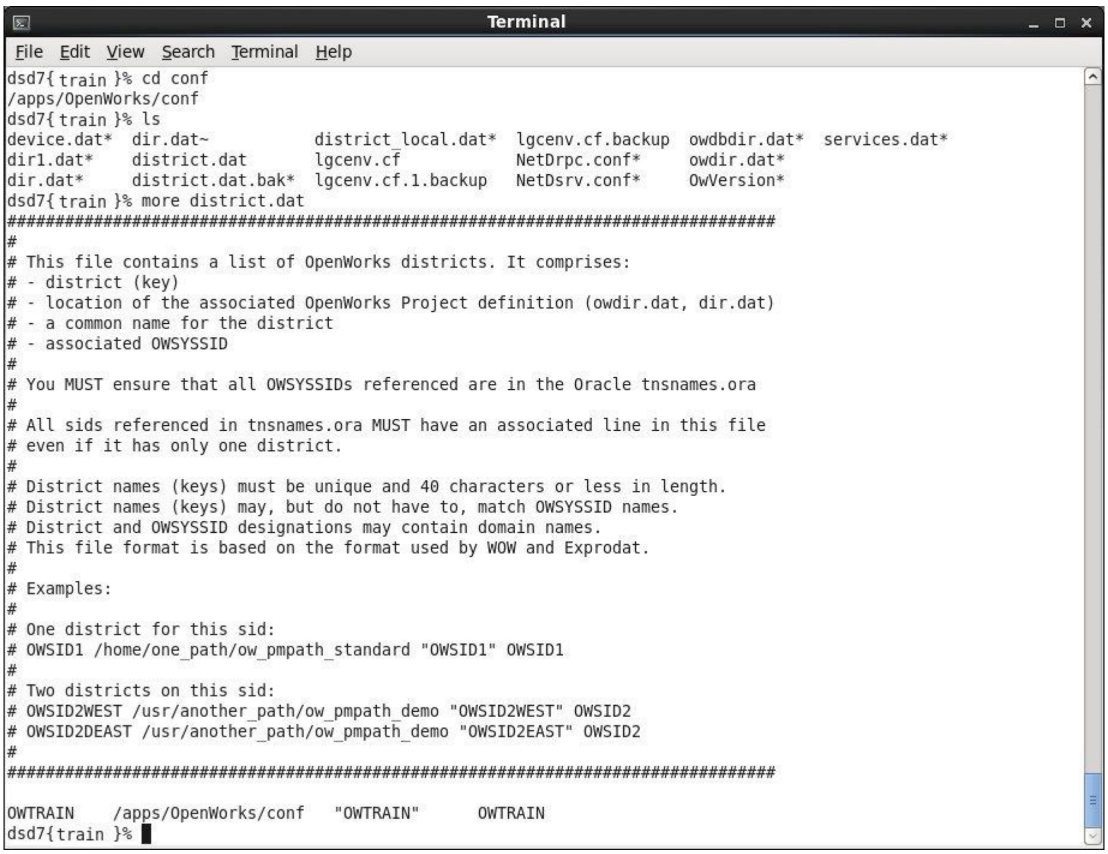
```
ls
```



Important files in the conf directory:

- **district.dat** - Defines the names of the districts, the location path to each district's dir.dat and owdir.dat, a small comment about each district, and the Oracle system identifications (OWSYSSID) of the OpenWorks instances indicating where each district's OpenWorks projects are found.

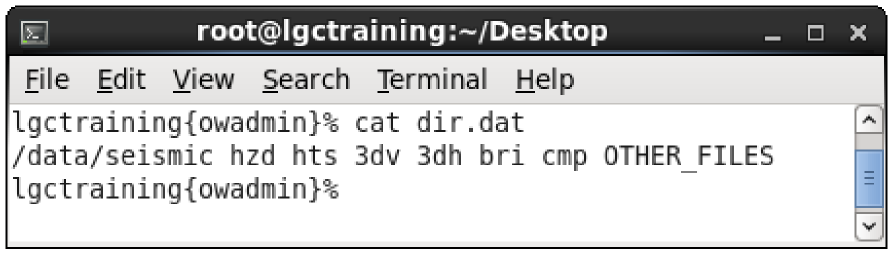
  By selecting a district, OpenWorks software immediately knows which database to check for existing projects, where to store external files, and where to store seismic data.



```
Terminal
File  Edit  View  Search  Terminal  Help
dsd7{ train }% cd conf
/apps/OpenWorks/conf
dsd7{ train }% ls
device.dat*  dir.dat~          district_local.dat*  lgcenv.cf.backup  owdbdir.dat*  services.dat*
dir1.dat*    district.dat      lgcenv.cf            NetDrpc.conf*     owdir.dat*
dir.dat*     district.dat.bak* lgcenv.cf.1.backup   NetDsrv.conf*     OwVersion*
dsd7{ train }% more district.dat
################################################################################
#
# This file contains a list of OpenWorks districts. It comprises:
# - district (key)
# - location of the associated OpenWorks Project definition (owdir.dat, dir.dat)
# - a common name for the district
# - associated OWSYSSID
#
# You MUST ensure that all OWSYSSIDs referenced are in the Oracle tnsnames.ora
#
# All sids referenced in tnsnames.ora MUST have an associated line in this file
# even if it has only one district.
#
# District names (keys) must be unique and 40 characters or less in length.
# District names (keys) may, but do not have to, match OWSYSSID names.
# District and OWSYSSID designations may contain domain names.
# This file format is based on the format used by WOW and Exprodat.
#
# Examples:
#
# One district for this sid:
# OWSID1 /home/one_path/ow_pmpath_standard "OWSID1" OWSID1
#
# Two districts on this sid:
# OWSID2WEST /usr/another_path/ow_pmpath_demo "OWSID2WEST" OWSID2
# OWSID2DEAST /usr/another_path/ow_pmpath_demo "OWSID2EAST" OWSID2
#
################################################################################

OWTRAIN    /apps/OpenWorks/conf   "OWTRAIN"      OWTRAIN
dsd7{train }%
```

- **dir.dat** - Defines where seismic data files are stored. The file types listed in dir.dat are associated with the seismic data of 3D surveys and 2D lines, and associated with the horizon data of 3D surveys.

Users can specify file systems and assign seismic data types to store in that location. The type of data stored on a specific file system depends on the extensions of the data files (3dv, 3dh, 2v2_glb, bri, cmp, OTHER_FILES, fusion_seismic, fusion_horizon). In the example below, 2D seismic trace data (2v2_glb) would be saved in /data/seismic marked OTHER_FILES. Any files with the fusion_seismic or fusion_horizon extensions would also be stored in /data/seismic for this particular example.



- OW_PROJ_DATA: Location of files external to the project data in the OpenWorks database instance. One or more directory names should be assigned this option. When more than one directory has this option, and when an application is searching for a file, it will search in each directory until it finds the file.

  The files for a project are stored in a subdirectory with the project's name. For example, if the project name is DEMO, and if owdir.dat has a line like the following:

  ```
  /data1/ OW_PROJ_DATA
  ```

  Then the files associated with the DEMO project would be stored in the following location:

  ```
  /data1/OW_PROJ_DATA/DEMO
  ```

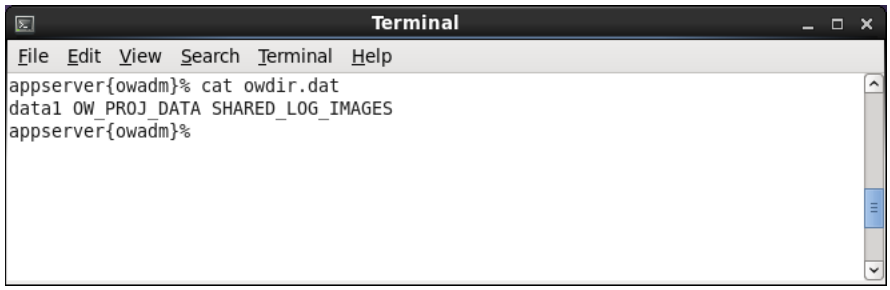
- SHARED_LOG_IMAGES: Location for sharing files of depth registered images of log data and their data files. Zero or more directory names can be assigned to this option. These locations are shared among the OpenWorks projects, and are from where applications can access images of log data and their data files. The Data Import tool must create a reference to the files in an OpenWorks project before other applications can access the files.

  The image files (usually Tagged Image File Format, or TIFF, files) are stored in the project directory for the OpenWorks project or in one of the SHARED_LOG_IMAGES directories.

Each image file has a data file associated with it, and when the image is imported into an OpenWorks project, the data file must be stored in the same location as the image file. The data files have the following formats: SIF (from A2D Technologies), DRA (from GeoGraphix software), and REG (from MJ Systems). The data from these files are recorded in the OpenWorks project.

The files associated with the DEMO project would be stored in the following location:

```
/data1/OW_PROJ_DATA/DEMO/log_images
```



These configuration files are vital to a working OpenWorks R5000 software installation.

Districts

OpenWorks R5000 formally supports the concept of districts. Depending on the company, districts might be called by various names, such as region, asset, or business unit.

Districts are created:

- To subset OpenWorks projects and their seismic data.
- To allow a business unit or other group to focus on only the projects the business unit is using.
- To provide additional security for the data in a project.

As a default, at least one district must be created for each OpenWorks database. To create a new district or to modify an already created district, you can edit the district.dat configuration file (by default, it is located in *$OWHOME/*conf), and you can create or edit the dir.dat and owdir.dat files for the district. A component of the entry in district.dat points to the location of the district's dir.dat and owdir.dat.

Other components of an entry for a district include the name of the district, comments about the district, and the name of the associated OpenWorks database.

Districts function under the following principles:

- A district can be associated with only one OpenWorks database.
- An OpenWorks database can be associated with many districts.
- A project database can be associated with only one district.
- All interpretation projects for a project database belong to the same district as the project database.
- When a project database is created or restored, it is assigned to a district.
- OpenWorks Project Administration allows you to modify a project database and change its association with a district on the same OpenWorks database.

Location of System Files

In previous versions, owdir.dat defined the location of one or more locations for project data and defined a location for system files. System files are files containing well and lithologic symbols, and files describing file formats for importing or exporting data.

The location of the following system directories do not change when changing a district: OW_SYS_DATA, owioformats, and owsymbols. However, the location of each of these directories can be changed by setting an environment variable.

The OW_SYS_DATA directory is located by the value in the OW_SYSDATA_DIR environment variable. As a default, this variable is set in lgcenv.cf located in $OWHOME/conf; however, the variable can be set in a user's initialization script or set separately in the user's environment.

The environment variables for the location of the format files (OWIOFORMATS environment variable) and the well and lithologic symbols (OWSYSMBOLDIR environment variable) can also be set in a user’s environment.

Seismic and Horizon File Locations

The OpenWorks software stores most of its project data in the OpenWorks instance. The OpenWorks software stores some system and project data as files on the OpenWorks server. Data from other application from Landmark software are stored as files on the server and may only have references in the database. Some seismic data, specifically seismic and horizon data, may be stored in the database or stored as files and only referenced from the database, depending on the type of data. Below is a table describing some data types and their storage location.

SeisWorks Data Type	Storage Location
2D Horizons	In database
3D Horizons	dir.dat determined. Cataloged in the database, but stored as a file.
Pre-stack Seismic	dir.dat determined. Cataloged in the database, but stored as a file. Note: The OpenWorks software only catalogs some pre-stack data used by seismic processing applications from Landmark software. For more information about how pre-stack data can be cataloged in the OpenWorks instance, see the documentation of the applications.
Post-stack Seismic	dir.dat determined. Cataloged in the database, but stored as a file.
Other SeisWorks Files (such as color maps, format definitions, plotting and picture files)	dir.dat determined. Cataloged in the database, but stored as a file.

When a Landmark application looks for an already created file, it will look in any file system listed in dir.dat, but it will only create files in a location allowed by dir.dat and by the read-and-write permissions of the user running the application.

OpenWorks Software Data Model Considerations for Seismic Data

OpenWorks data model considerations for seismic data:

- 2D horizon data is stored in the OpenWorks database
- 3D horizon data is stored in files defined in the dir.dat
- 2D and 3D seismic data volumes are stored in files defined in the dir.dat
- 2D and 3D seismic data volumes and horizons are managed through Seismic Data Manager
- Seismic and horizon data is catalogued in the database and can be given metadata
- Seismic and horizon data can have processing history recorded (inputs, output, parameters, and process information)
- Processing history can be viewed in Seismic Data Manager in either a textual format or a graphical format
- Pre-stack seismic data is catalogued in the database and can be given metadata
- Pre-stack processing history, as well as metadata and relationships between pre-stack data and its post-stack data, can be recorded
- Version information can be recorded for interpretation data (such as fault or horizon attributes) and seismic data (such as seismic or pre-stack seismic attributes)

  The version information allows you to group data together.
- A structure horizon and its attribute horizon can be related

- Multiple 2D line and multiple 3D survey interpretations are supported as a default
- Horizon data can support multiple lines and multiple surveys
- Notes and interpretation sets can be stored in the OpenWorks database
- Remark fields limit is characters
- Long remarks are added to allow you to create remarks or comments of practically any length

OpenWorks Software Menus

Understanding Menu Conventions

This section uses Seismic Data Manager to demonstrate typical window and menu behaviour in all R5000 OpenWorks software applications. Some applications have not changed from the R2003 release and they continue to function in exactly the same manner as before.

A window has the following parts:

- Title bar
- Menu or menubar
- Toolbar
- Various panes
- Sections or tabs
- Status bar
- Icons

Seismic Data Manager has upper and lower panes. The lower pane is further divided into two panes. Each pane, depending on the data displayed within that pane, may have:

- Only a search function
- A search function and a toolbar

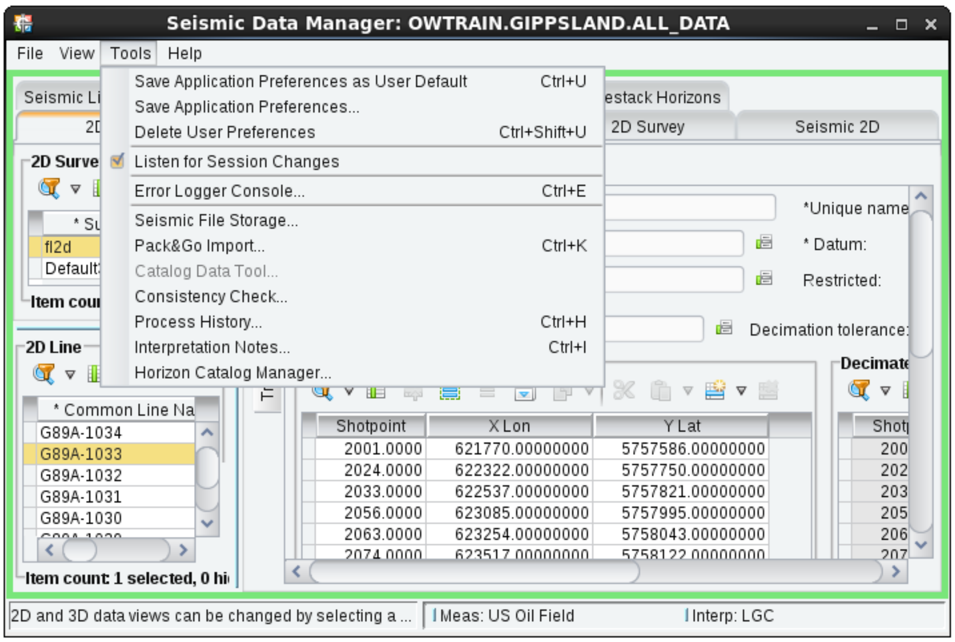
Many of the OpenWorks software applications in R5000 have been enhanced in terms of usability and increased functionality. Each application window allows users to perform related tasks in a single window and navigate easily through a specific workflow. Some panes may have a message line at the bottom indicating the number of items selected, hidden, and displayed in the table.

Menu Options

Select a menu option to reveal its submenu. Menu items can be followed by:

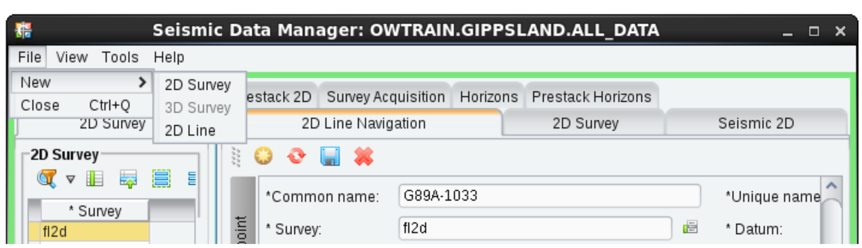
Ellipses

An **ellipsis** (**…**) after a menu option, for example, in ***Seismic File Storage***... indicates that a dialog box appears if you select this option.



Arrows

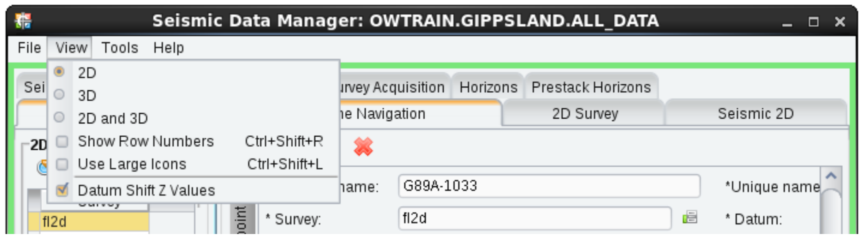
An **arrow** (►) after a menu option, for example, *File > New* ► *2D Survey* from the File menu, indicates that additional cascading menu options appear if you select this option.



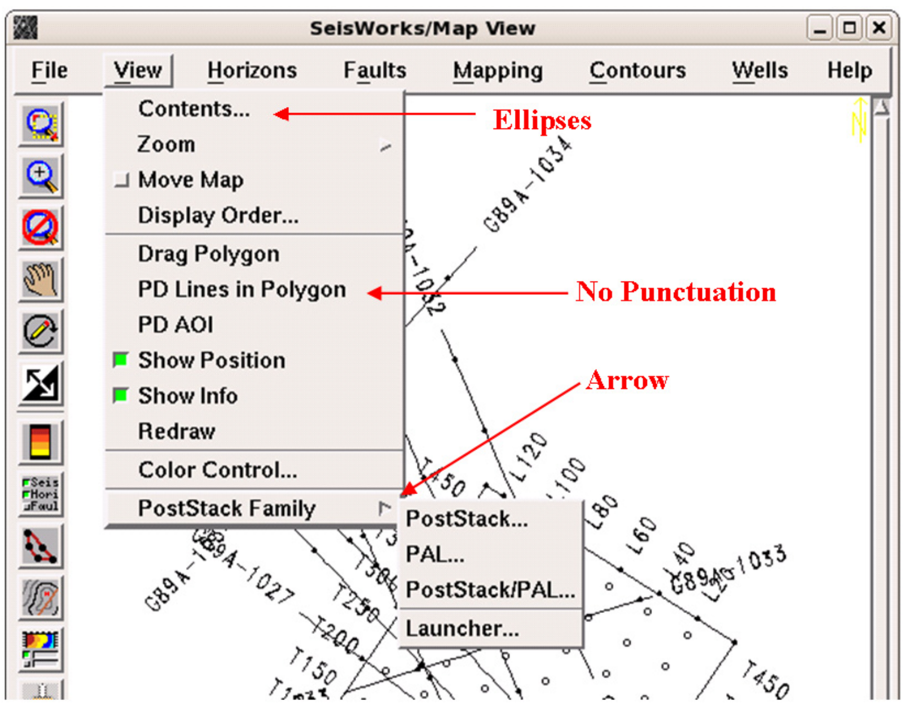
Dot, Tick Marks, or No Punctuation

Menu options with a dot (●), tick marks (√), or no punctuation perform the specified task immediately or put you in the required mode to perform the specified task.

For example, if you select **2D and 3D** from the View menu in the dialog below, all the 2D and 3D seismic surveys display immediately in the window.



Classic applications, such as SeisWorks, use similar menu options:



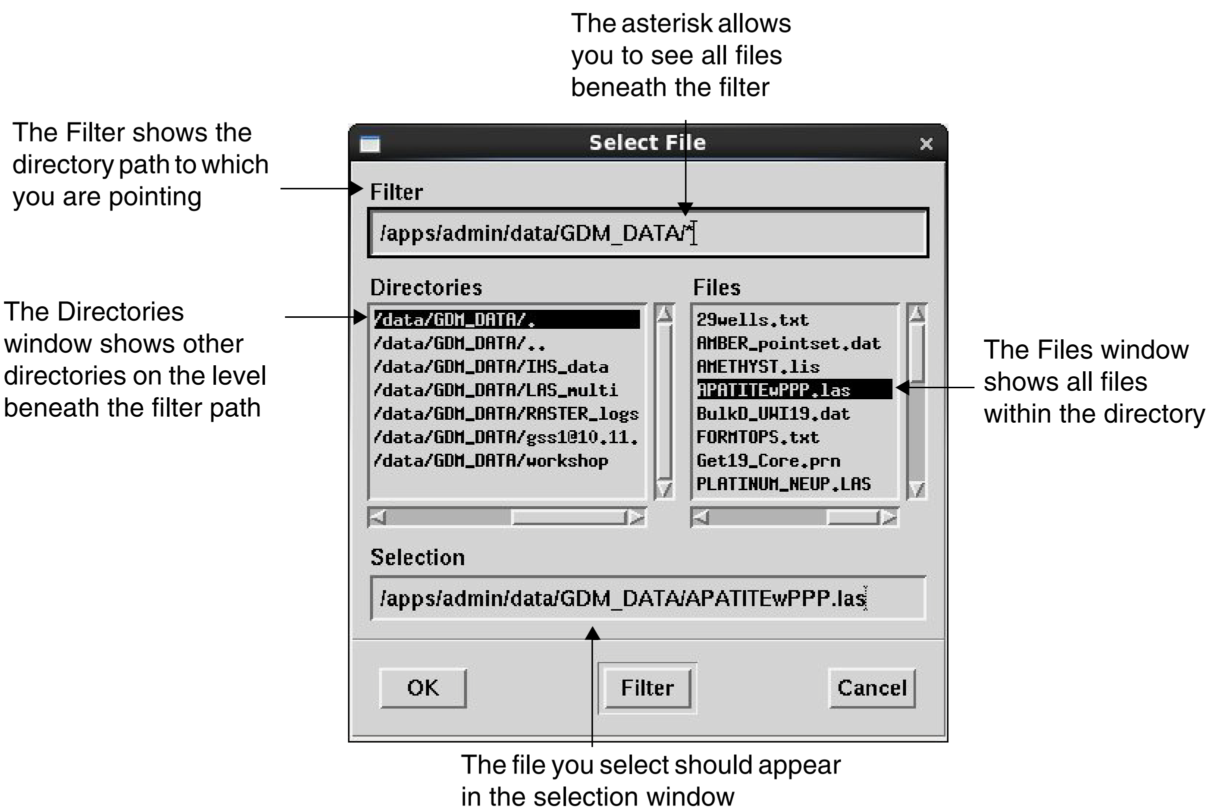
Application Appearance, Functionalities and Icons

Selecting Files

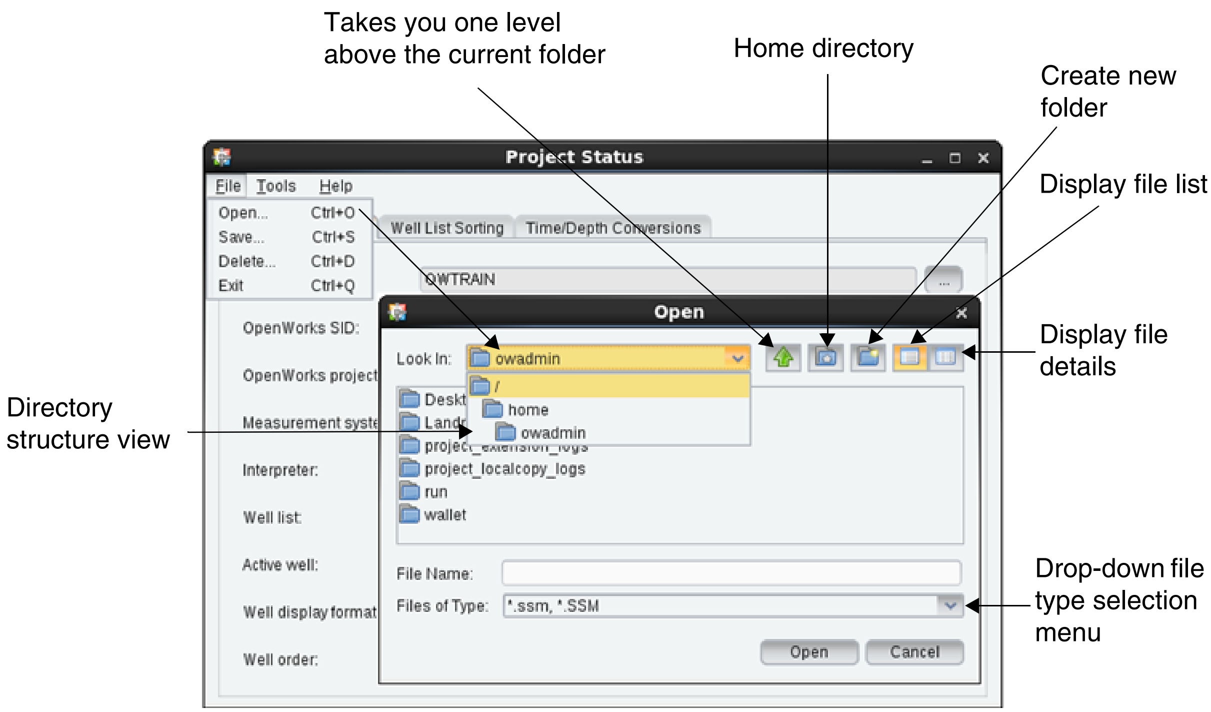
The *Select File* dialog box allows you to filter directories to locate the file you need.

In classic applications, if you select a directory name from the Directories list box in the dialog, you must double-click or click the Filter button for that directory to become a part of your filter path. After the directory becomes a part of the filter path, you can view files and directories within the directory.

The asterisk found at the end of the path in the Filter text box allows you to view all fields beneath the filter. To view fields of a certain extension, a *.<*extension*> should appear at the end of the filter path.



The file selection process in newer applications employs a Windows-based approach to file selection.



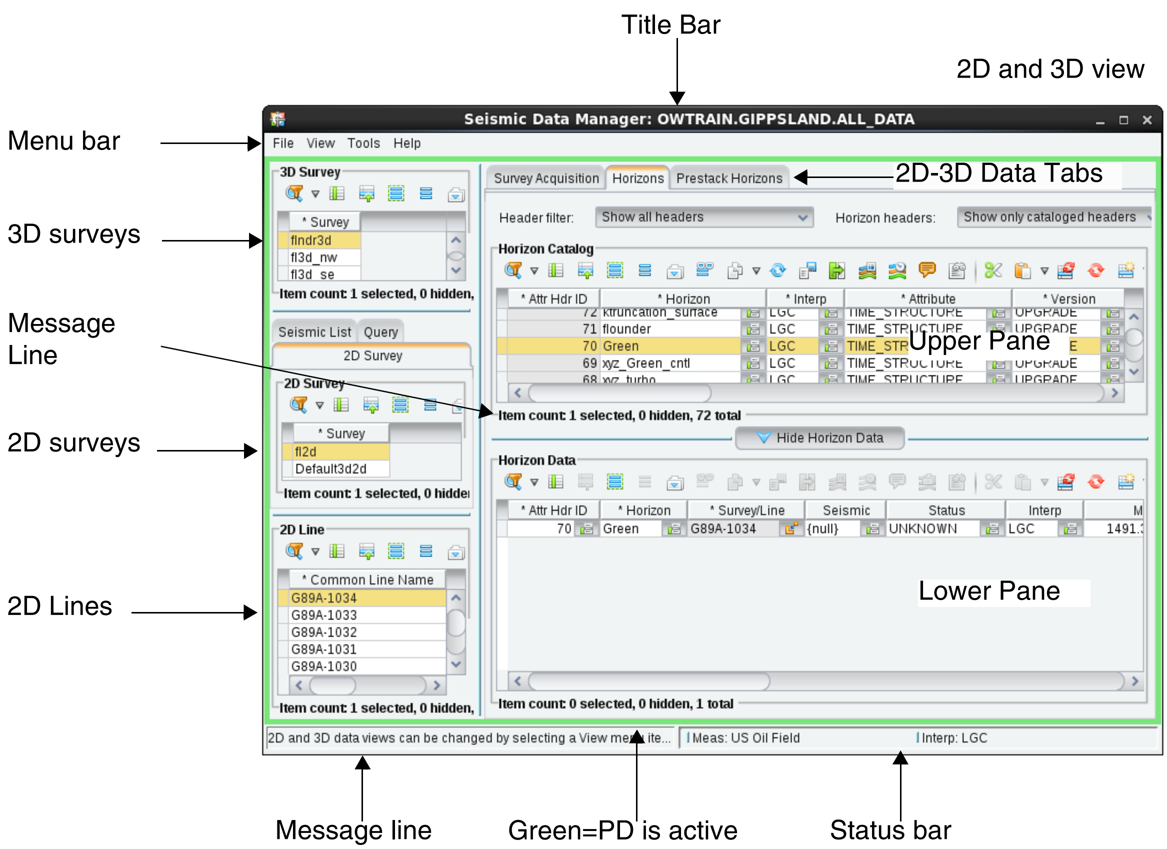
Viewing Data

In the Well Data Manager, Seismic Data Manager, Data Domain Manager, and Curve Dictionary, you can now view the main data and its associated data in a single application window.

To view the main data, click to select a row in the data table. The associated data displays in a separate panel in the same application window.

Seismic Data Manager is a tool for all seismic data management tasks including managing navigation (from seismic surveys), seismic data volumes (PostStack and Pre-Stack) and horizon data.

Window structure of Seismic Data Manager (SDM)



Exchanging Messages among Applications

The OpenWorks software uses Oracle Advanced Queuing (AQ) to broadcast data change notifications. Oracle AQ integrates a message queuing system with the Oracle database. This functionality ensures that messages are delivered to any application using the project anywhere on the network.

Other benefits of the AQ system are:

- No special configuration is required to receive messages. You can receive data change messages immediately.
- Messages are forwarded to all the interpretation projects that share data. For example, if you change well information in one interpretation project, all listeners for that well is notified.

- New messages are broadcast to define transaction boundaries. A receiver has the flexibility to update the display at the end of a transaction.

This mechanism simplifies the workflow of monitoring real-time data updates across multiple machines on a network. PD software is still used for client-side communication.

You can:

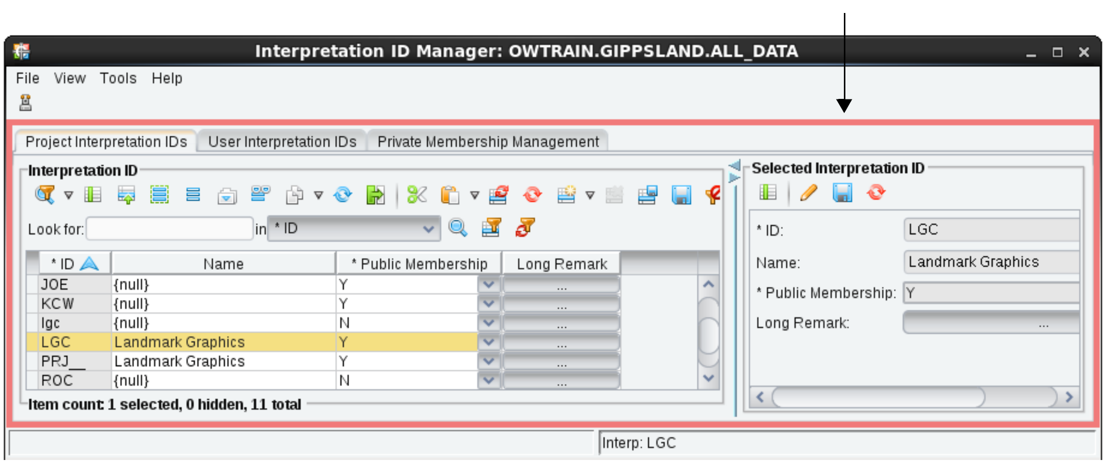
- Easily transfer data among applications running in the OpenWorks software environment
- Receive information and direct it to all listening applications OpenWorks software

Applications with the PD software are always capable of sending data, but they must be in listening mode to receive data. The window's border colour indicates the listening mode.

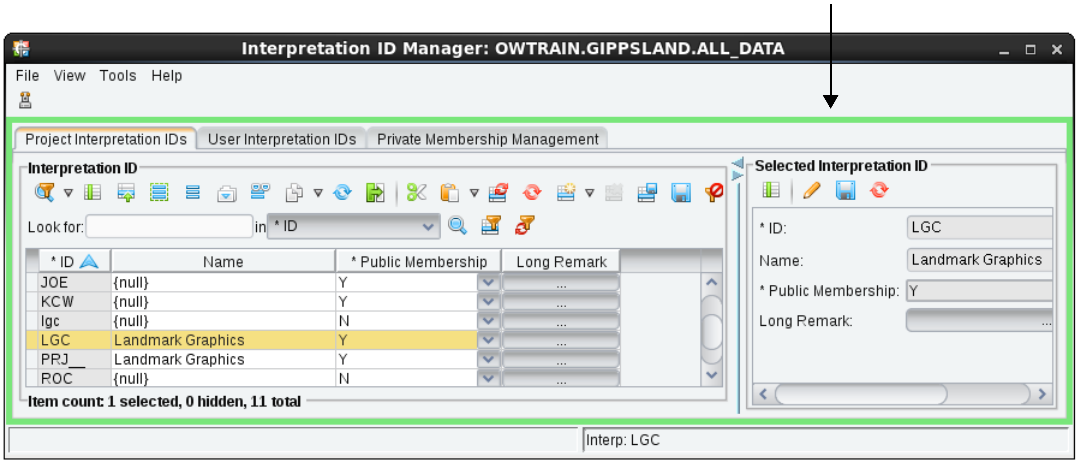
Border Color	**Listening Mode**
Green	Listening
Red	Not Listening

Click **MB1** on the color border to toggle between modes.

Not Listening:



Listening:



Using Icons

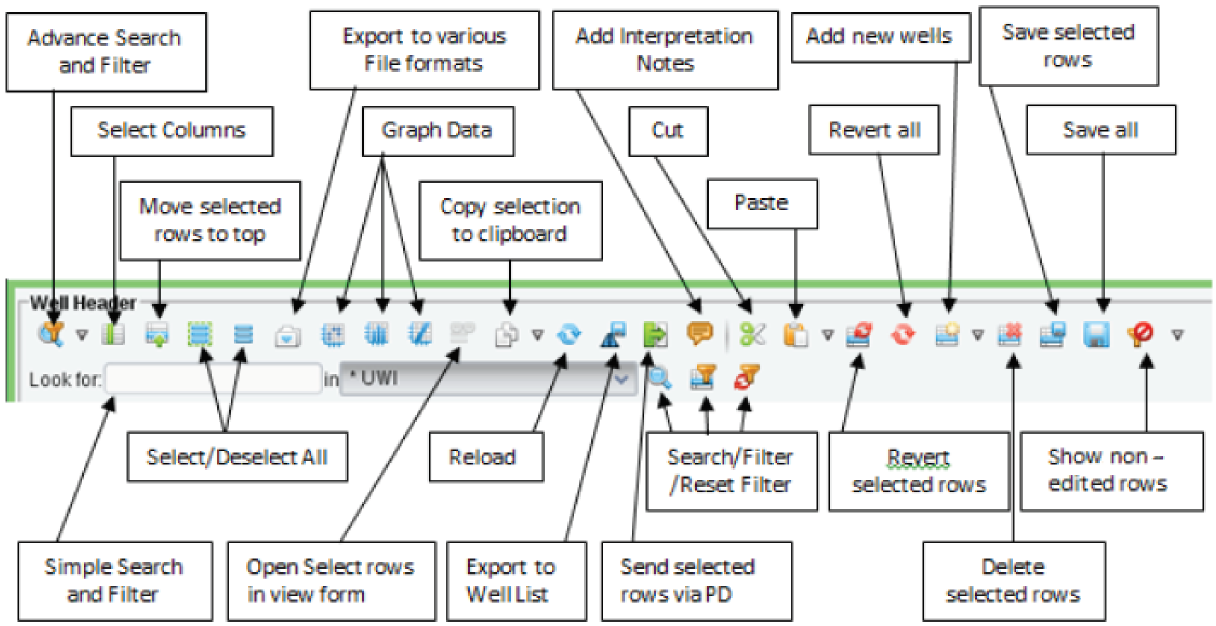
Icons are available in every application window to provide quick access to frequently used options. The most common icons in OpenWorks software allow you to perform various tasks in the data window, such as:

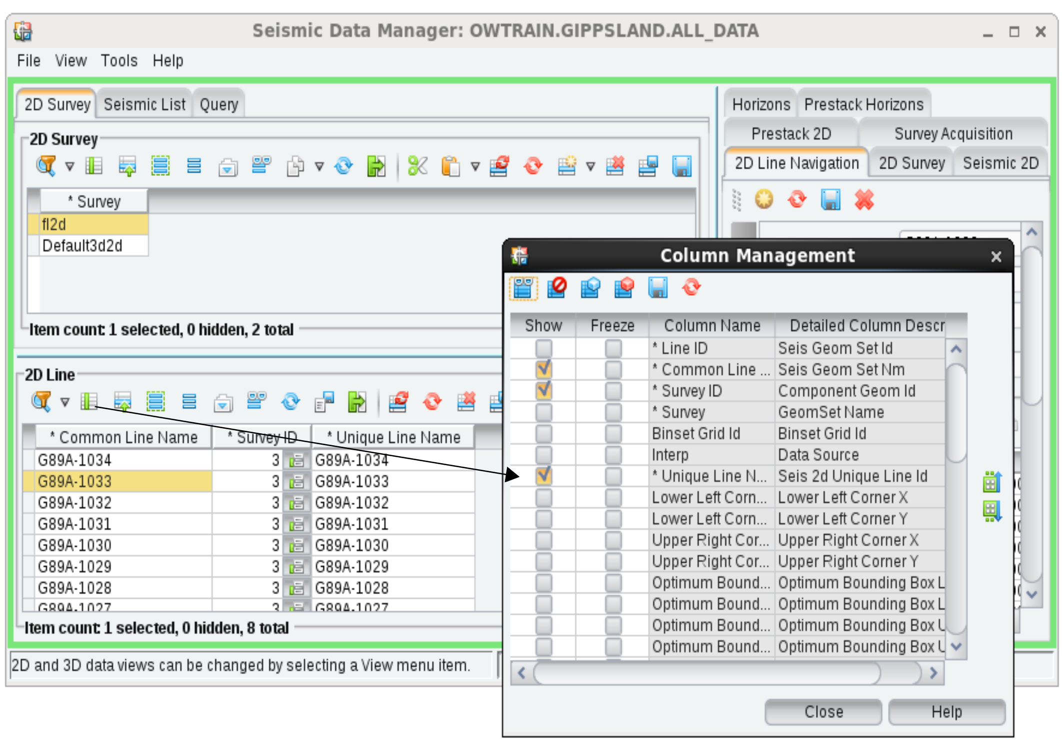
- Search
- Add
- Copy
- Delete
- Export
- Save

Some application windows have additional icons that perform specific tasks for that particular application.

Some of the new icons introduced in OpenWorks software R5000 are common to many windows and are described in the following diagram.

Common R5000 Window Icons



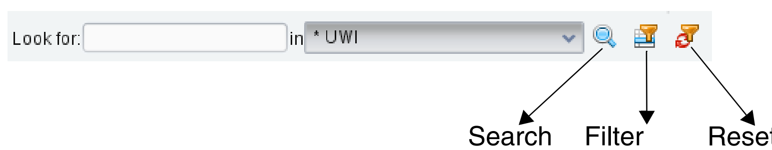


Using Simple Search and Filter, Search Column, and Advance Search and Filter

Simple search and filter - search or filter data based on data in one column in a table

The Simple Search and Filter function is displayed in a horizontal row above the data table. *If you do not see this option, you can select Filter Working Data from the File menu or select the Simple Filter from the toolbar.* This function allows you to search or filter data based on data in one column in a table.

To use this function, enter a value in the text box; select a column to search using the drop-down menu. Click the Search button to select rows in the table where the values in the column match the criteria, or click the Filter button to hide rows where the values in the column do not meet the criteria.

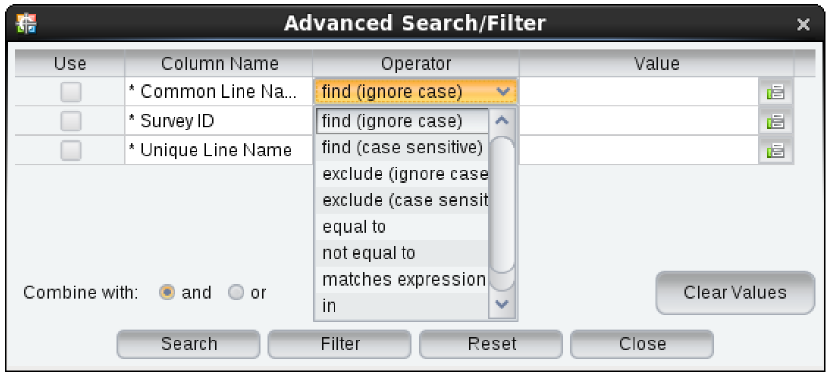


Selecting the Search option displays data as a highlighted row in the data window, while the Filter option removes all other data that does not meet the search criteria, and displays only the specified row in the data window.

Advanced search and filter - Opens the Advanced Search/ Filter window.

You can specify search details specific to a data table.

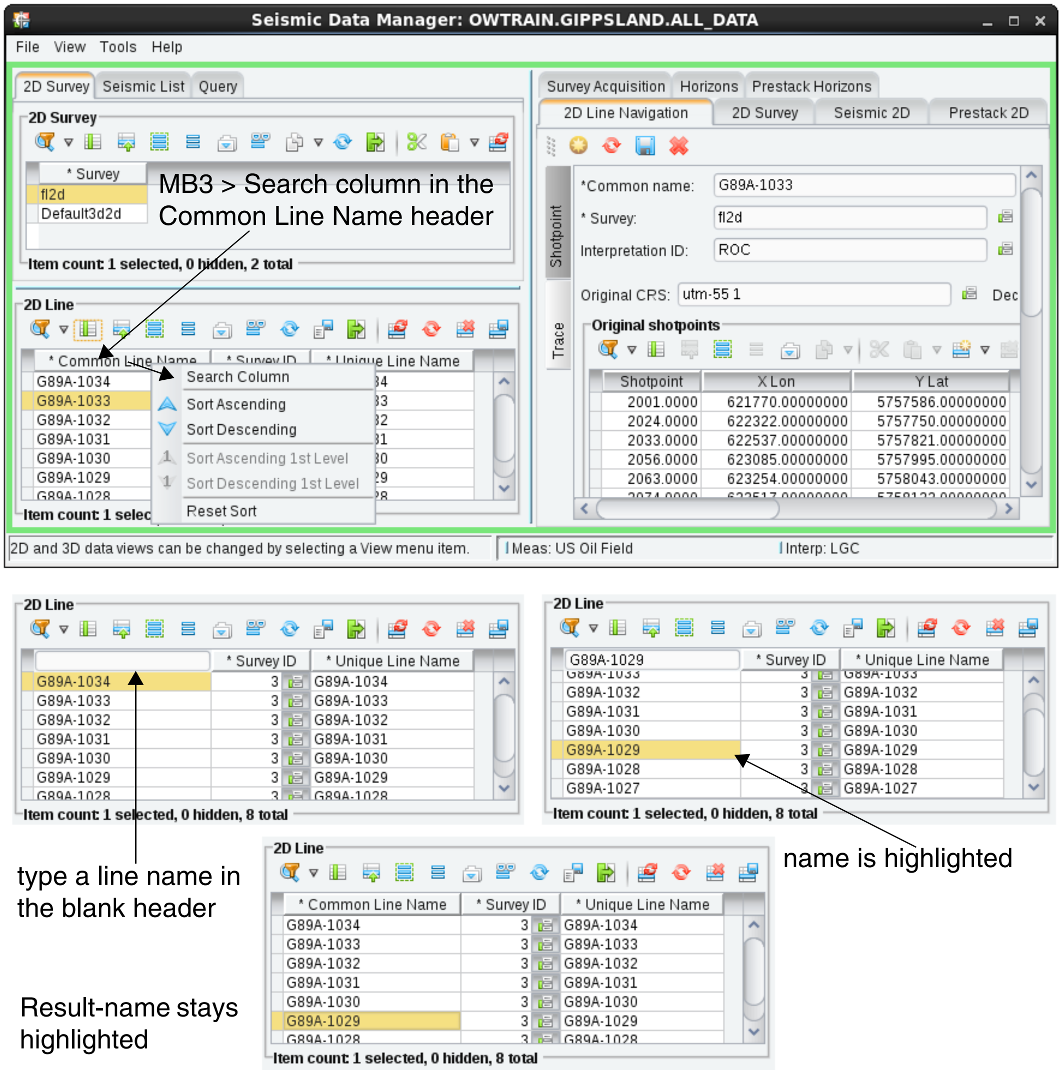
The Advanced Search and Filter window allows you to enter search criteria for all columns currently displayed in the table. A search can be performed for a single attribute or for a combination of attributes.



A minimum of one search criterion must be specified in this window to perform an advanced search.

The Simple Search and Filter does not support operators like greater than or between, while the Advanced Search and Filter does.

You can search in a column using Search column by pressing **MB3** (in the column header) > **Search Column**. The header will blank out. Type the exact name (case sensitive) you are searching for in the header. The selection will automatically highlight.


Seismic Data Manager: OWTRAIN.GIPPSLAND.ALL_DATA
MB3 > Search column in the Common Line Name header
Search Column
Sort Ascending
Sort Descending
Sort Ascending 1st Level
Sort Descending 1st Level
Reset Sort
2D and 3D data views can be changed by selecting a View menu item.
type a line name in the blank header
name is highlighted
Result-name stays highlighted

Accessing Data in Projects

Landmark applications access the data in a project by selecting an OpenWorks project database or an interpretation project.

Data from an entire region is typically loaded into an OpenWorks project database. All the typical types of data stored in a database is stored in this one database, and can be accessed by selecting the *Project database name* and the *<All Data>* option in Project Status Tool, or by selecting an ugh an *interpretation project* that subsets the data (instead of *<All Data>*).

Interpretation projects can be thought of as a subset or view of the project database and are created based on the interpreter's needs instead of the requirements of the database, its data model, or other considerations. Any new interpretation data is stored in the related project database, eliminating the need for database storage redundancy. Many interpretation projects can be created from one project database. When an application opens the interpretation project, it will access whatever data has been included in that project.

The access to a project is also limited based on whether a user is granted access to an OpenWorks database. User access to project data is ultimately controlled by the creator or restorer of the OpenWorks project database who grants other users access to the project. This system helps centralize the control over all data in a project, including seismic data and horizon data, not just what might have been classically termed OpenWorks data.

Appendices for creating and modifying OpenWorks project databases and interpretation projects are included in this manual.

Users, Interpretation IDs, Sources

This section discusses the users' access options to OpenWorks software R5000 and the management of interpretation IDs.

Users—Project Access Levels

The user is the login account.

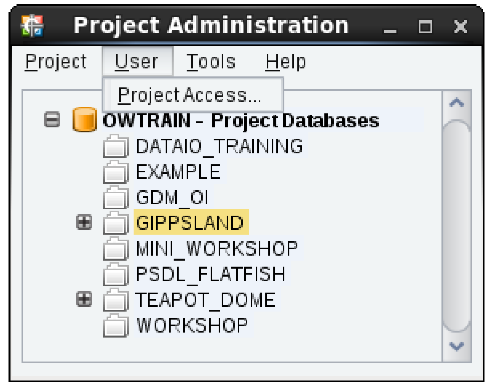
Users are given browse, interpret, limited interpret, or manage access by the project manager. The user must first be granted access to the project before the user is granted access to interpretation IDs.

- **Browse** - may view, but not create, edit, or delete any data.
- **Interpret** - may view any data, and may create, edit, and delete one's own data only.
- **Limited Interpret** - similar to interpret role above, but may only create, edit, or delete data in a subset of tables normally used for interpretation. The end user's administrator can alter the list of tables for this access level.
- **Manage** - may create data and view, edit, or delete any other user's data. May perform project management functions only if the OW_ADMINISTRATOR role is also granted.

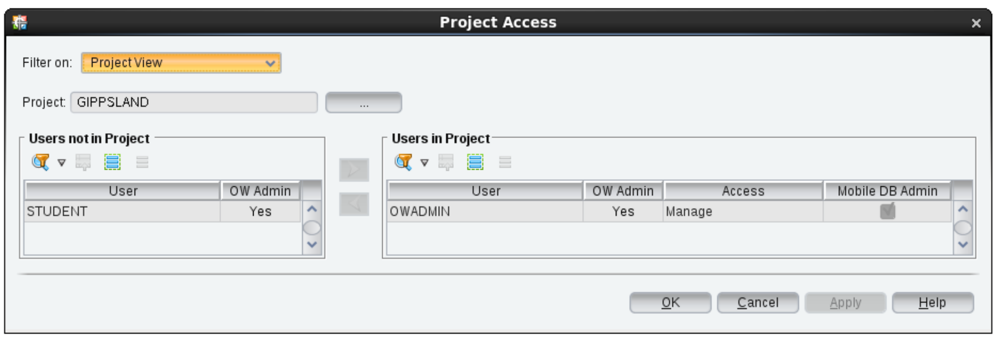
To view projects and access level for a particular user:

1. From the OpenWorks Command Menu, select **Project > Project Admin**.

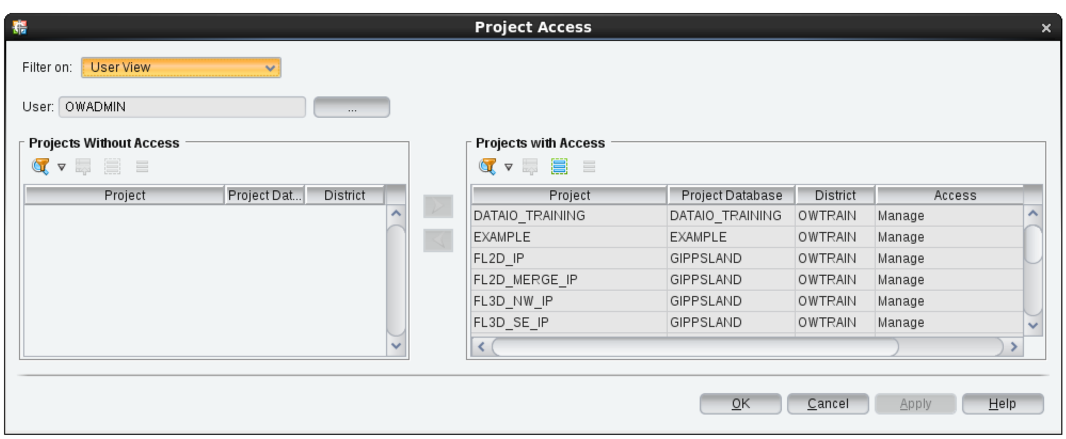
2. From Project Administration window, select **User > Project Access**.



3. Filter on **Project View** to display all users in a project.



4. Filter on a **User View** and select a user from the Select User list to display all projects that can be access by user.



Interpretation IDs

Interpretation IDs are a fundamental part of OpenWorks software. Every user is required to use an interpretation ID when interacting with the database. IDs are owned by the users that created them, but, new in R5000, Landmark introduces the shared/private ID. This new functionality adds to the individual (single user) and public (all users) interpreters by allowing a single ID to be used by multiple specifically assigned users.

An interpretation ID is:

- A label assigned to an OpenWorks software data type that represents a particular version of an interpretation.

- Set so that several users can access the same project and use each other's data without overwriting it.

The OpenWorks software assigns interpretation IDs to data such as:

- Well picks
- Fault profiles
- Gridded surfaces
- Contour sets
- Processing history
- Polygon sets
- Well log curves
- Horizons
- Seismic data

Tagging has three advantages. It allows:

- The same events/horizons to be picked by different interpreters or groups and managed separately, if desired

- Individuals or groups to experiment with different interpretations, classifying each interpretation with a different label

- Individuals to label data loaded from outside the system

Each time you start an interpretation application, the OpenWorks software requires you to set an interpretation ID if one has not already been selected. Interpretation IDs can be set in the Interpretation ID Manager, the Project Status Tool, or during an interpretation application initialization.

Types of interpretation IDs

You can create the following interpretation IDs in the OpenWorks software.

- **User** - allows interpretation to be performed only by the owner.
- **Private** - allows interpretation to be performed by specific individuals. These individuals are provided access by the owner; created when a user ID is expanded to allow use by users other than the owner. The ability to modify a private ID is also dependent on a user's project access level.
- **Public** - allows interpretation to be performed by any of the user, regardless of the login ID used.

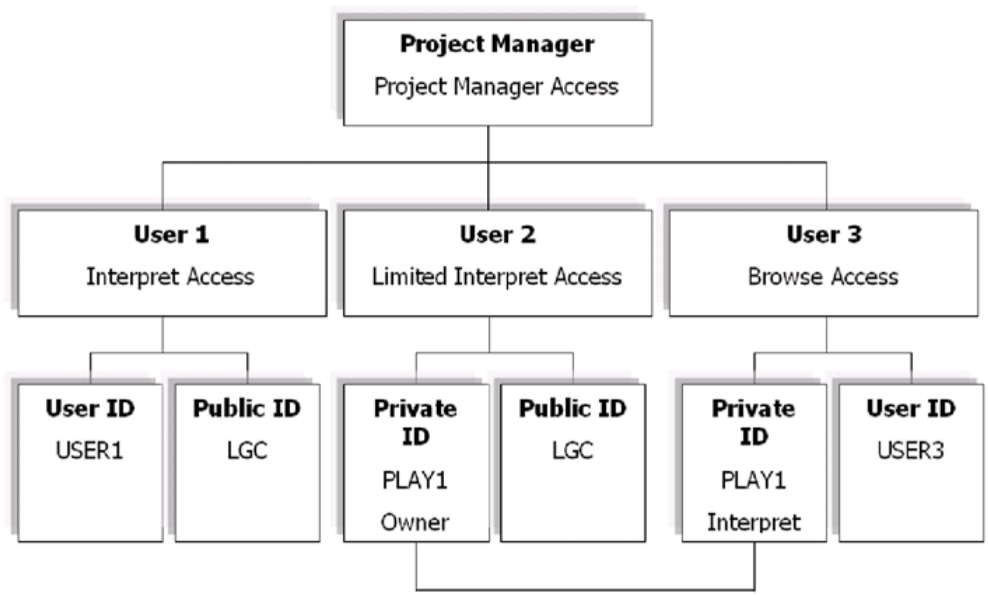
Security Levels for Private Interpretation IDs

Different users have different security levels to shared (private) interpretation IDs. Security levels for an interpretation ID are completely separate from manage, interpret, limited interpret and browse classifications assigned to users to designate project access described in "Users – Project Access Levels" in the beginning of this section.

- **Owner** - the user who created the interpretation ID and has complete manage access to the ID
- **Manage** - can add users, change other user's security level (except owner), and edit metadata about the ID - they cannot remove the owner or delete the ID
- **Interpret** - can set the ID as the session interpreter and create data as that interpreter, but cannot alter the configuration of the interpretation ID

The relationship between the project owner, users and user access, and interpretation IDs is illustrated in the following hypothetical project scenario.

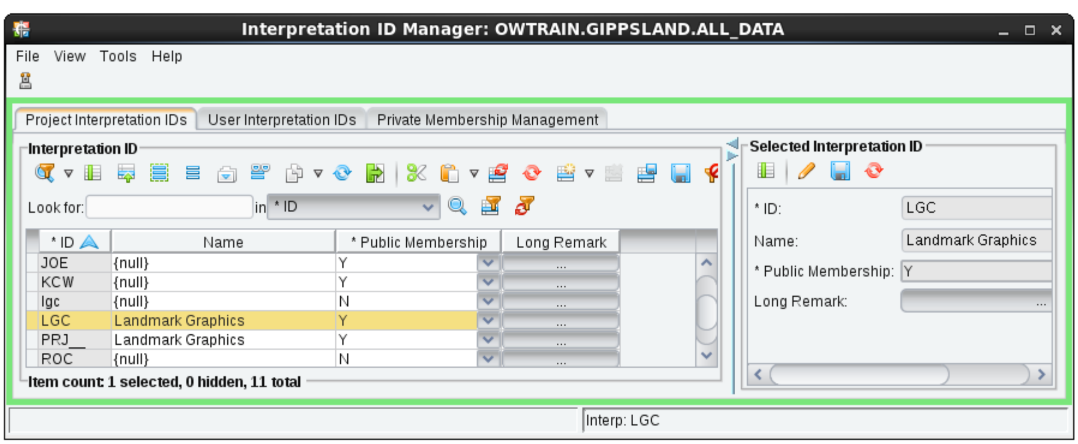
The diagram illustrates that User 2 created a shared interpreter ID (Play1) and User 3 have been granted interpret access that ID. The private ID access levels are independent of the user's access level.



Relationship between the Project Manager, Users and Interpretation IDs

Interpretation ID Manager

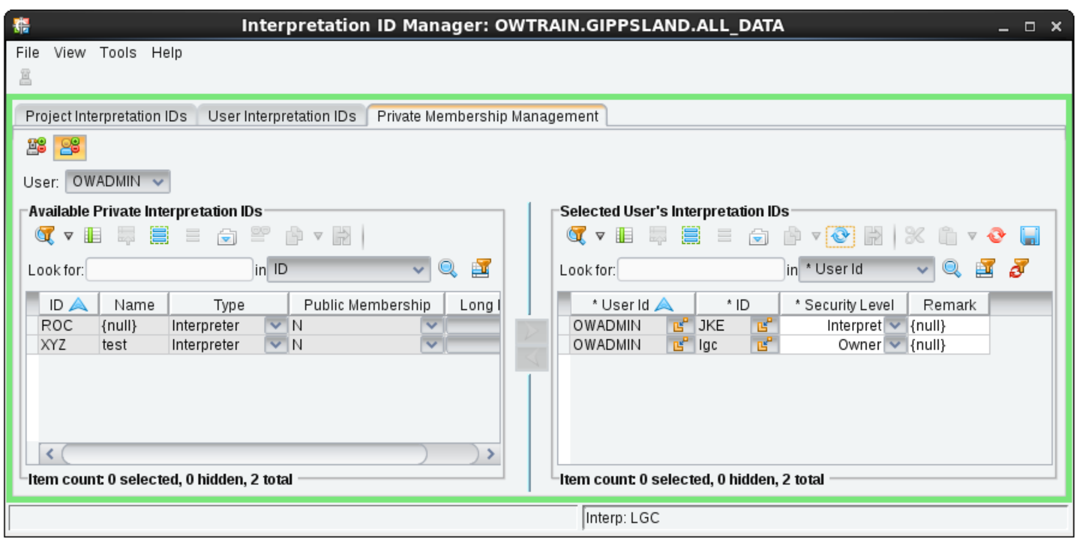
This utility offers a simple interface with a customizable display.



The Interpretation ID Manager:

- Builds and maintains a list of interpretation IDs to track interpreted data

- Allows users to add, modify, and delete interpretation ID data
- Uses 3 tabs to make interpretation ID management easier:
    - — **Project Interpretation IDs** - Displays all interpretation IDs in the project listing the ID, name, public marker, and long remark (description)
    - — **User Interpretation IDs** - Only displays the interpretation IDs accessible by the current user
    - — **Private Membership Management** - Displays all the users who have access to a specific selected interpretation ID
- Allows users to set a session interpretation ID or change the current session interpretation ID

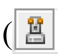


The interpretation model allows an interpretation team to work together on the same interpretation without coordinating multiple interpretation IDs. Some of the benefits of this model are:

- Enhanced data security because multiple users can be assigned to the same interpretation ID without making the ID public
- Ability to capture lengthy remarks about interpretation IDs, thus allowing users to provide a rich description on an interpretation version

- Intuitive creation/management of interpretation IDs for asset teams

Some additional information about the Interpretation ID Manager is described below:

- An interpretation ID can have a maximum of five characters.
- The Name and Type are optional fields.
- A detailed explanation of an interpretation ID can be provided in the Long Remark field. These explanations are stored in vector format, thus eliminating size limitations.
- An owner or manager of a private interpretation ID can specify who can use the ID.
- The Delete selected Interpretation ID icon () removes the selected interpretation ID from the list of IDs. However, any data the interpretation ID added to the database is not deleted. You can add the deleted interpretation ID again to regain access to that data.
- The Set session interpretation ID icon () changes the selected interpretation ID to the session interpretation ID.

Interpretation ID Manager

Creating an Interpretation ID

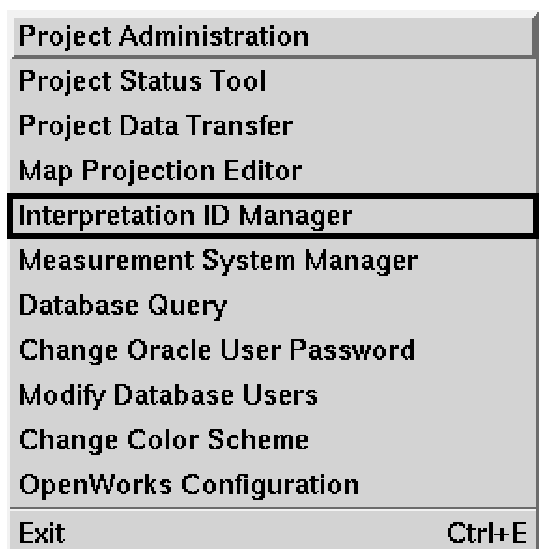
An interpretation ID can be added to a project database by importing data with data source (or owner) associated with it, or by creating an ID in Interpretation ID Manager.

To open Interpretation ID Manager, you must select a project and interpreter ID. If you have never been in the project before, you will need to select a valid interpreter ID before you can create your own. Remember to change the session interpreter after creating your new ID.

To create an interpretation ID, do the following:

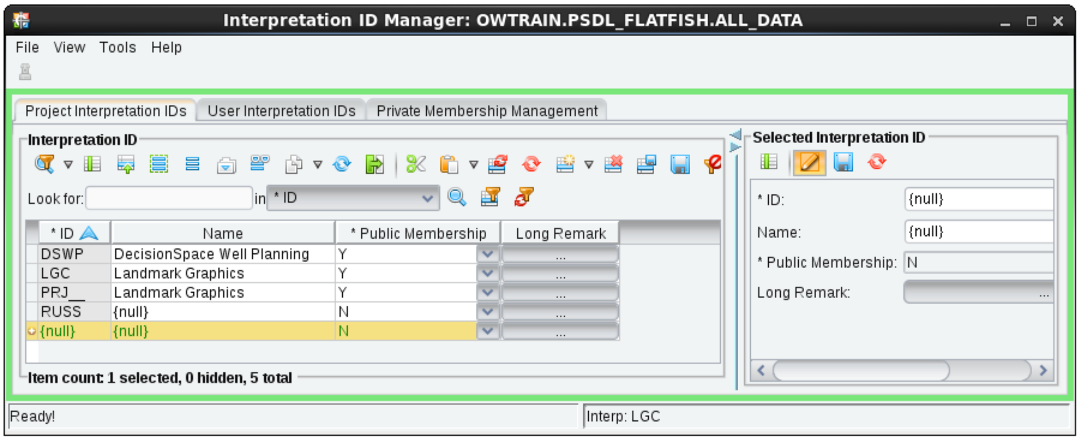
1. Launch Interpretation ID Manager.

In the OpenWorks Command Menu, select **Project > Interpretation ID Manager**.



2. Select **Project Interpretation IDs** or **User Interpretation IDs** tab.

3. Click the **Add new Interpretation ID** toolbar icon ( ). A new row appears in the table.



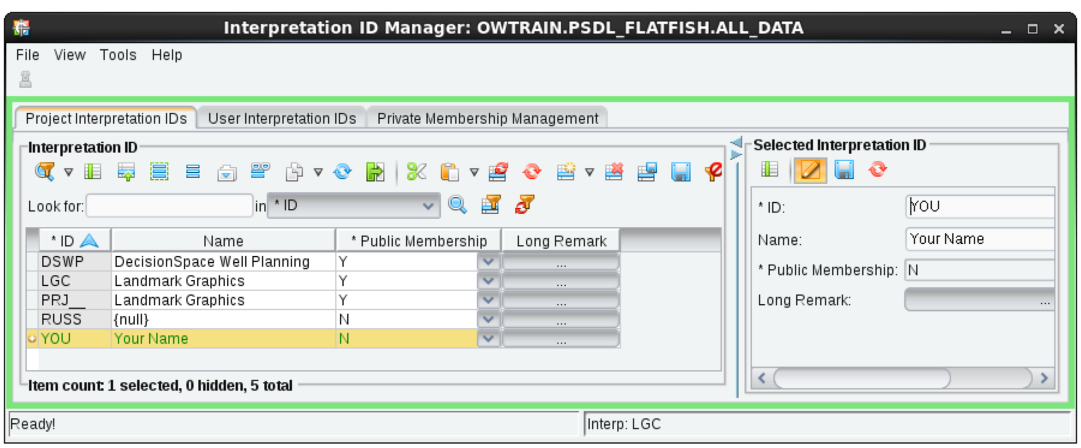
4. Highlight the new row.

5. In the **ID** cell (required), type up to five characters. The characters must be capital letters or digits. If a character is incorrect (such as a lowercase letter or space), the characters in the cell will become red to indicate that the ID has at least one unacceptable character.

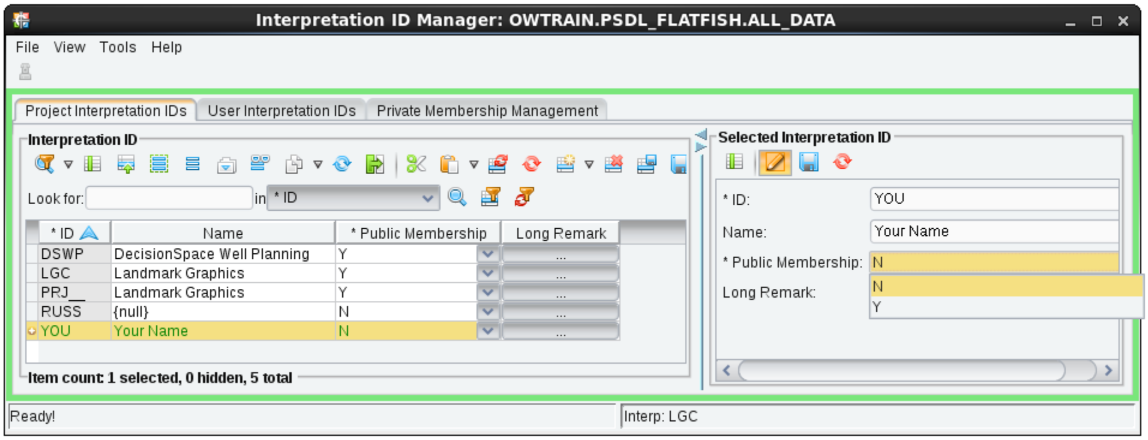
   The sequence of characters for the ID must be unique among all interpretation IDs in the project database.

   You are not allowed to change the contents of the ID field after you have saved the interpretation ID to the OpenWorks database instance.

6. In the **Name** cell (not required), type up to 32 characters for a name. This name is typically an expansion on the ID.



7. In the **Public Membership** cell (required, defaults is N), click the Down Arrow button. A drop-down list displays.



8. Select one of the following in the drop-down list:

   - **N** (the default): the ID is private. Unless you add other OpenWorks users to the ID, only you (the owner or creator) can use the ID.

   - **Y:** the ID can be used by anyone who has access to the project database.

9. Next to the **Long Remark** field (not required), click the ellipses button, and then:

   - Type a note about the ID in the text box.

- Click **OK** to close the box.

10. Save the new ID to the database: select the row with your new ID, and click the Save selected rows toolbar icon ( ); or to save changes in all rows, whether selected or not, click the Save all rows toolbar icon ( ).

    If an ID is a private ID, and if you want to add members to the ID, add them on the Private Membership Management tab.

    The ID is created and can be set as the session interpreter.

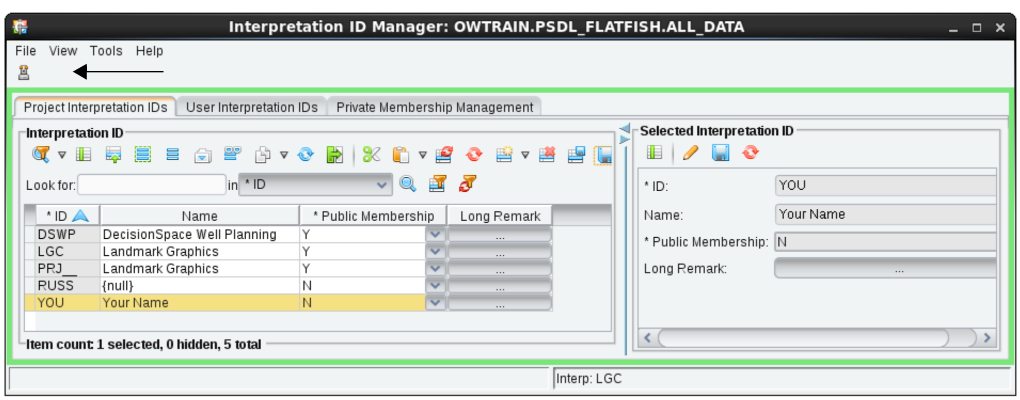
11. To set a session interpreter, in the Interpretation ID table of the Project Interpretation IDs or User Interpretation IDs tab, highlight desired interpretation ID for your session, either a public ID, or a private ID in which you are a member.

    Cannot Use Some Private Interpretation IDs:

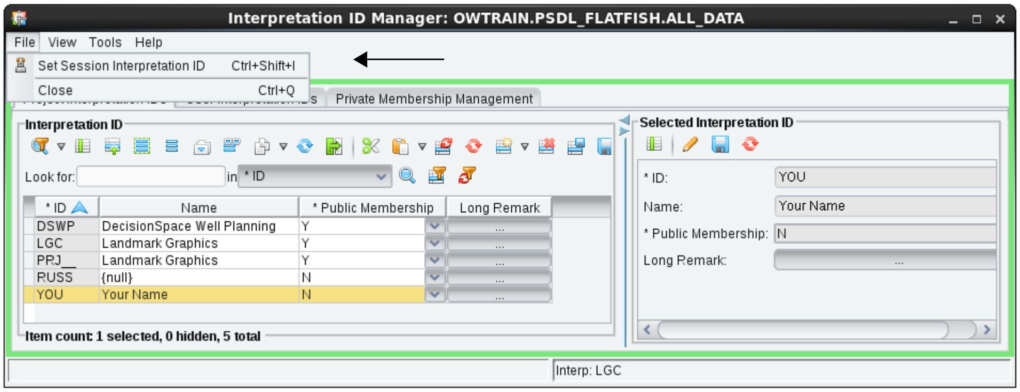
    You are able to select an ID in the Project Interpretation IDs tab even If your user ID has not been included as a member in a private interpretation ID; however you are not able to set the ID as the interpretation ID for the session.

    The Project Interpretation IDs tab shows all of the IDs in a project database, whether you can use the ID or not, but the User Interpretation IDs tab lists only public and private IDs that you can use.

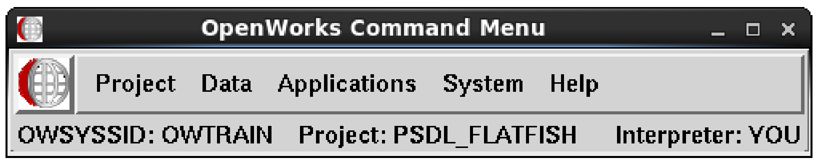
12. Click the **Set session interpretation ID** toolbar icon ( ),



or select **File > Set Session Interpretation ID**.



The interpretation ID changes for the OpenWorks session.



If the interpreter ID has been previously created, the session interpreter may be set using Project Status Tool.

To set a session ID with Project Status Tool:

1. Start Project Status Tool by selecting the following:

   OpenWorks Command Menu > Project > Project Status

2. Next to the Interpreter text box on the Project Parameters tab, click the **Browse** button (**…**). The *Interpreters* dialog box displays. The List of interpreters displayed contains the same interpretation IDs that you can see in the User Interpretation IDs tab from Interpretation ID Manager.

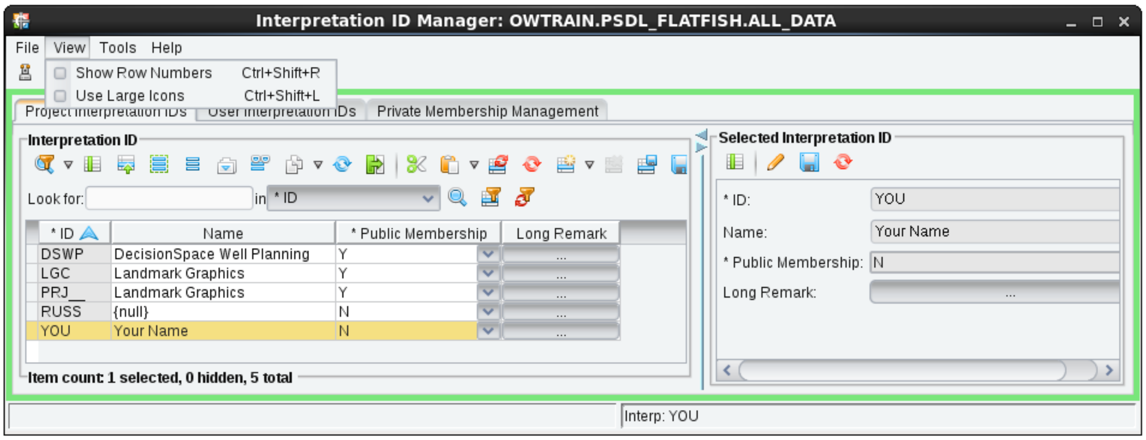
3. Select an ID from the List of interpreters.

4. Click **OK**. The interpretation ID changes for the session.

5. To close Project Status Tool, select **File > Exit**.

Large Icons in a Toolbar

The Use Large Icons option in the View menu allows you to display an application's toolbars with 16 pixel icons (the default) or with 24 pixel icons (Use Large Icons).



Displaying Large Icons

To use large icons (24 pixel icons instead of 16 pixel icons) in the toolbars of an application, do the following in the application:

1. Check the **View > Use Large Icons** menu option. The *Restart Required* dialog displays, indicating that you must restart the application for the new preference to take effect.

2. Click **OK** in the *Restart Required* dialog box.

3. Select **Tools** > **Save Application Preferences as User Default**.

4. Select **File > Exit** to close the application.

5. Restart the application.

Displaying Default Icons

To use default icons (16 pixel icons instead of 24 pixel icons) in the toolbars of an application, do the following in the application:

1. Uncheck the **View > Use Large Icons** menu option. The Restart Required dialog displays, indicating that you must restart the application for the new preference to take effect.

2. Click **OK**.

3. Select **Tools > Save Application Preferences as User Default**.

4. Select **File > Exit** to close the application.

Restart the application.

Modify/Changing an Interpretation ID

The OpenWorks software allows you to change the name, type, public membership, and long remark fields of an interpretation ID, but it does not allow you to change the ID itself.

To change an attribute of an ID:

1. Launch **Interpretation ID Manager**.

2. In the Project Interpretation IDs or User Interpretation IDs tab, double-click the field that you want to change, and either type new text or select an item in the drop-down list.

3. Click the **Save selected rows** toolbar icon () to commit your change to the OpenWorks database instance.

Deleting an Interpretation ID

The OpenWorks software allows you to delete an interpretation ID if you are the owner (or creator) and if it is not the interpretation ID currently selected in your OpenWorks session.

When you delete an interpretation ID, OpenWorks will search for and, upon confirmation, delete any dependent data. A dialog listing the dependent information displays, giving you the option to continue with the deletion with *Delete All*, or *Close* the dialog and use the revert ( ) option in the Interpretation ID Manager.

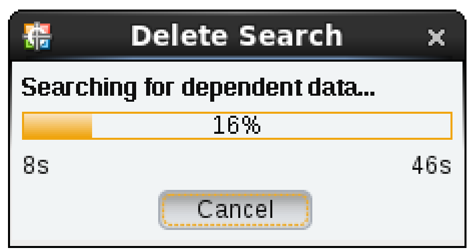
To delete an ID that you own and is not the current ID in the session:

1. Launch **Interpretation ID Manager**.

2. In the Project Interpretation IDs or User Interpretation IDs tab, select a field in the ID that you want to delete.

3. Click the **Delete selected Interpretation ID** toolbar button ( ). The row is prepared for deletion.

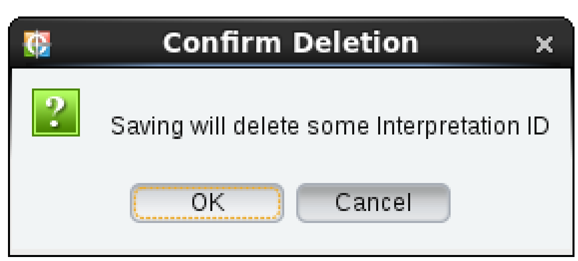
   A dialog displays if there is dependent data associated with the interpreter ID.



If you wish to delete the interpreter ID and the data, select *Delete All*. Click *Close* if you don't want to delete the data and interpreter ID.

If you selected *Close*, or if you selected the wrong ID for selection, you can reverse the ID selection. With the interpreter ID still selected in the row, click the Revert selected rows toolbar button ( ). Repeat steps 2 and 3 to select another interpreter ID.

4. Click the **Save selected rows** toolbar button ( ) to commit your change to the OpenWorks database instance. The *Confirm Deletion* dialog displays.



5. Click **OK** in the confirmation dialog box.

To display Online Help, go to **Help > Online Manual > OpenWorks Online Help**.

Chapter 3
Data Loading Overview

Data loading, as discussed in this course, is taking data in SEG-Y data and loading it into a format that can be read by SeisWorks® software and other Landmark interpretation software.

Landmark currently supports several 3D seismic data formats (.3dv, .3dh, bricked, and compressed) and one 2D seismic data format (.2v2_glb).

The PostStack™ software Data Loader is one of the tools that you may use to load seismic data into a Landmark format. This application is packaged with SeisWorks and is accessed from the Seismic Tools management utility. All functionality that is part of the PostStack Data Loader can also be found in the full version of the PostStack/PAL application.

Another option, SEG Y Data Import, can be used on both Linux and Windows platforms to load 2D and 3D navigation data, 2D and 3D SEG-Y, 2D and 3D SEG-Y VSP, Prestack 3D SEG-Y, Prestack 3D ProMax and Prestack 3D JavaSeis data on the disk (no tape input).

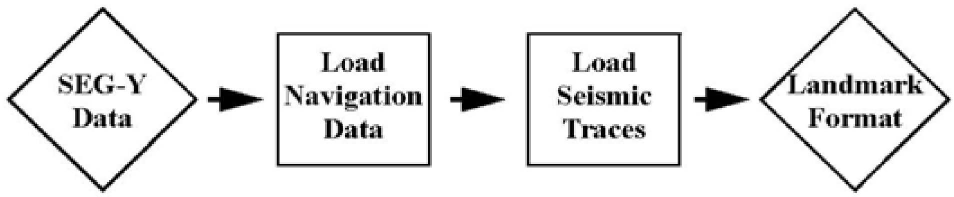
Overview

This chapter provides an overview of:

- Loading seismic data
- SEG-Y data
- Landmark formats
- PostStack Data Loader
- SEG Y Import

Seismic Data Loading

Seismic data loading is the process of taking processed seismic data, usually in SEG-Y format, and converting it into a format that can be read by Landmark's interpretation software.



The conversion from SEG-Y data to Landmark format requires that you load the navigation data and the seismic trace data separately.

The chapter provides more detailed information about SEG-Y data and Landmark seismic data formats.

This chapter also contains a brief overview of the tools used to load navigation data and seismic traces; these two areas are covered in detail in subsequent chapters.

Appendix A provides a summary of the steps required to load 3D and 2D seismic data.

Overview of SEG-Y Formatted Seismic Data

The trace data that you load is generally in SEG-Y format and typically delivered on tape or disk. Common tape formats include LTO (Linear Tape-Open) or DLT (Digital Linear Tape). Disk data might be supplied on a USB hard drive, or, for smaller datasets, DVD or CD ROM.

SEG Y Import, or PostStack Data Loader are used to convert seismic data that is in SEG-Y format into one of Landmark's formats for use in Landmark applications.

Seismic Tape Formats

A SEG-Y tape or file contains a variety of information, including the seismic traces. Different types of information are written in different formats. The following data formats are commonly found on SEG-Y tapes.

Format	Characteristics
Binary	• Base 2 • Essentially an On/Off switch; values are either 0 or 1 • bit = binary digit, the smallest unit of storage • byte = 8 bits • word or full word = 4 bytes or 32 bits • half word = 2 bytes or 16 bits
Hexadecimal	• Base 16 • Computer can easily convert "hex" numbers to binary • Both integer and floating point numbers may be stored in hex format
EBCDIC	• Extended Binary Coded Decimal Interchange Code • Stores 256 characters, including numbers, lower and upper case letters, and some symbols
ASCII	• American Standard Code for Information Interchange • Stores letters, numbers, and symbols • Landmark's default for text files • Rarely found in SEG-Y data

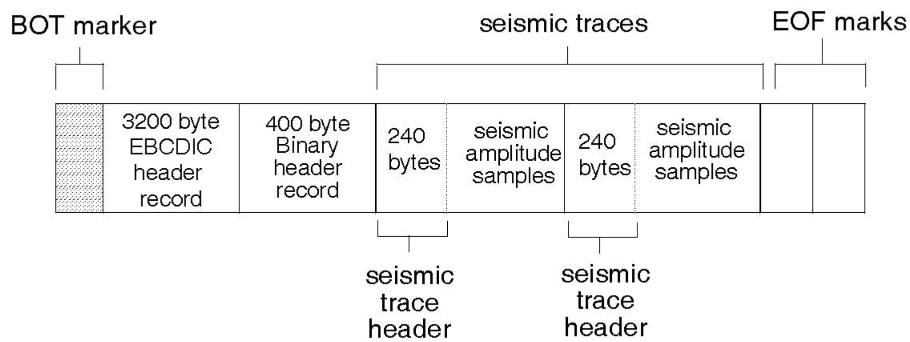
SEG-Y Overview

The SEG-Y tape format standard was developed by the Technical Standards Committee of the Society of Exploration Geophysicists (SEG) in 1975. It was designed to meet current needs and provide flexibility for expansion as new technology and new ideas emerge.

The detailed specifications of the SEG-Y standard are described in the booklet Digital Tape Standards, published by SEG.

In this section, we will provide a brief overview of the SEG-Y format, highlighting those issues that have the greatest impact on how you load seismic data in the Landmark environment.

The contents of a typical seismic data tape or file in SEG-Y format are described below and on the following pages.



Parts of a SEG-Y Formatted Tape

BOT

The beginning of tape (BOT) marker is a silver stripe on the tape. This is read by the tape drive as the beginning of the tape write area.

EBCDIC Header Record

This is a text header record that generally contains shooting parameters and processing history. It is made up of 40 lines with 80 characters each and is 3200 bytes in length. This record may be empty.

Binary Header Record

After the EBCDIC header comes the binary header record, which consists of 400 bytes of binary information. The first 60 bytes are assigned to specific purposes; the other 340 bytes are provided for optional use. Some of the key byte assignments in the 400-byte binary header are listed below. See *Appendix B* for a complete listing.

Byte Numbers	Description
3205-3208	Line number
3217-3218	Sample interval in microseconds
3221-3222	# of samples per data trace
3225-3226	Data sample format code

Trace Data Blocks

The trace data blocks follow the EBCDIC and binary header records. Each trace data block consists of a fixed 240-byte trace identification header followed by the actual seismic trace data. There is no physical divider between these two parts.

Seismic Trace Header

The seismic trace header contains fields to store a variety of numeric information about the seismic trace. Some of the key byte assignments in the 240-byte trace identification header are listed below. See *Appendix B* for a complete listing.

Byte Numbers	Description
1-4	Trace sequence number
9-12	Original field file ID
21-24	CDP ensemble number
73-76	Source X coordinate
77-80	Source Y coordinate
81-84	Group X coordinate
85-88	Group Y coordinate

Most of the fields are defined as 4-byte integer (32-bit) units (= full word). Some fields are defined as 2-byte integer (16-bit) units (= half word). While standard field definitions exist, data processors may define and use these fields as they see fit.

Floating point numbers may also be written in the trace header area. These are always stored in 4-byte (32-bit) units, but are decoded using a different method than integer numbers.

Seismic Amplitude Samples

Trace data samples may be written in any of four standard SEG-Y data sample formats or in several nonstandard formats that have emerged over the years. Landmark's data-loading products have the flexibility to read all of the following tape sample formats:

Trace Sample Format	Description
SEG-Y Standard Formats	
IBM Float	32-bit floating point
Integer 4-Byte	32-bit fixed point
Integer 2-Byte	16-bit fixed point
Integer Fixed Point with Gain	32-bit fixed point with gain (loaded by PostStack only)
Non-standard Formats	
IEEE Float	32-bit IEEE floating point
Float 2-Byte	16-bit floating point (loaded by PostStack only)
Integer 1-Byte	8-bit fixed point

The possible amplitude ranges for the most common trace sample formats are shown below.

Format	Size	Amplitude Range
Floating point	4 bytes (32 bits)	-5.4E+79 to 7.2E+75
32-bit integer	4 bytes (32 bits)	-2.14E9 to 2.14E9
16-bit integer	2 bytes (16 bits)	-32768 to 32767
8-bit integer	1 byte (8 bits)	-128 to 127

EOF Marks

The end of data on a SEG-Y tape is usually denoted by two EOFs in a row marking end-of-volume. Single end-of-file marks may be present between seismic lines, but this is more common in 2D data than in 3D.

SEGY rev 1 Support

SEGY rev 1 is a new version of the existing SEGY format that has several key extensions:

- Extended SEGY text headers (extra 3200-byte EBCDIC headers)
- Blocked tape (multiple traces blocked into a single tape record)
- New data formats (IEEE float and 8-bit integer)
- New data trace header fields

Limited support for these extensions is included in SeisWorks for seismic data loading tools and SEG-Y data analysis tools.

Extended SEGY Text Headers

- **SEGY Analyzer**—Modified to handle tape/disk files with extended headers. The analyzer will report how many extended headers are present, but you cannot view their contents.

Blocked Tapes

- **SEGY Analyzer**—Modified to support blocked tapes.

New Data Formats

- **SEGY Analyzer**—Modified to support new data formats.

New Trace Header Fields

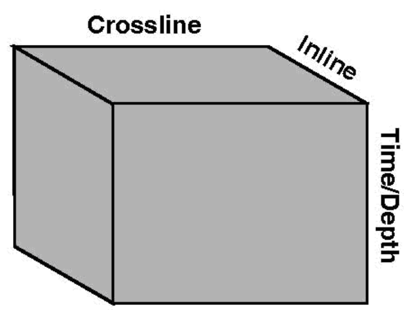
- **SEGY Analyzer**—The Interactive SEGY Analyzer was modified to display the new trace header fields.

Landmark 3D Seismic Data Formats

Landmark applications read several 3D seismic data formats, .3dv, .3dh, bricked (.bri), compressed (.cmp), and cube data (.cd). Depending upon your needs, Landmark offers you the flexibility to easily handle your data. This added versatility is particularly valuable as seismic data volumes become larger and larger.

Bricked (.bri) Seismic Data Files

In the *bricked* format file, seismic data is grouped into three-dimensional "bricks" of data, allowing users to optimize display performance along any single dimension or to normalize display performance across several dimensions.



Each brick contains data for a user-specified number of crosslines by inlines. Time or depth makes up the third dimension.

Brick Dimensions

The Landmark seismic data loader (PostStack) and Seismic Converter utility allow users to create bricked data volumes whose individual brick dimensions can be designed to suit the end user's environment and workflow needs. The brick dimension selected, along with the order that the bricks are written to the file, determine the direction of best display performance.

For example, if you work primarily with inlines during interpretation, you can create a bricked volume that optimizes inline display by designating a small dimension in the inline direction. On the other hand, if you work equally with inlines, crosslines, and arbitrary lines, you can create a bricked volume where display times for all vertical sections are normalized. This type of volume would have equal dimensions in the inline and crossline directions and would be larger in the time/depth dimension.

Landmark provides four standard choices for creating bricked volumes (also see the diagram on the next page):

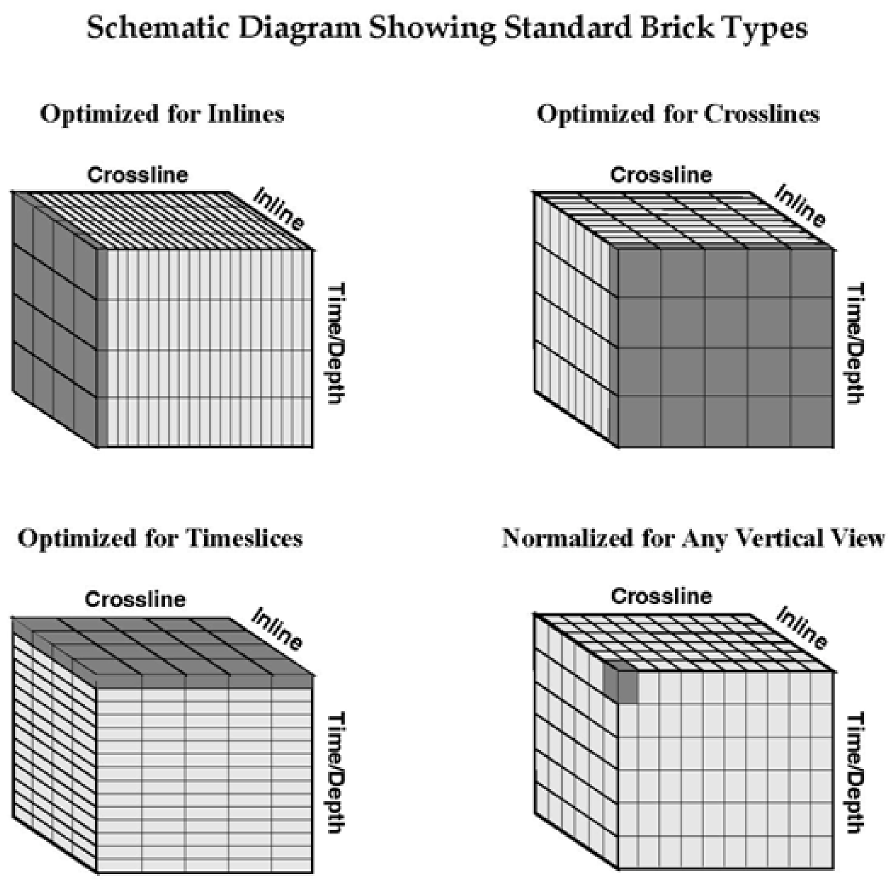
- **Inline**—optimized for inline displays
- **Crossline**—optimized for crossline displays
- **Horizontal**—optimized for timeslice displays
- **Any Vertical**—display performance is normalized for any vertical view (good performance for retrieval of lines (inlines), traces (crosslines), and arbitrary lines.

Each of these choices maps to a set of predefined brick dimensions, listed below, which are used to create the appropriate bricked volume.

Dimensions for Default Brick Sizes

Volume type	Inlines Across	Crosslines Deep	Time/Depth Samples
Inline optimized	1	32	32
Crossline optimized	32	1	32
Horizontal optimized	32	32	1
Vertical access normalized	8	8	16

For horizontal optimized files, Landmark recommends using the command line utility *Brickreorder* to improve display performance. See the online manual (**Seismic Tools > Help > Online Manual > Seismic Utilities**, then select *Brickreorder* from the list of bookmarks) for instructions. The workflow is also covered in this class in Chapter 4 (Workshop 2).



In addition to these 4 choices, an expert option (**User Defined**) allows users to create volumes of any brick dimension.

Advanced brick dimensions are three integer values describing the following:

- Number of inlines across
- Number of crosslines deep
- Time/depth dimension

Bricked File Output Sample Formats

Bricked seismic data can be created using any of five different sample formats:

- **Float32**—maintains original input sample values using a 32-bit floating point format.

- **Float16**—input samples are converted to 16-bit integers (-32,768 to 32,767) on a brick-by-brick basis. The values for the group of samples within each brick are biased such that the range is arranged equally about a zero value. Next, each sample is scaled and stored.

  The scalar and bias values can be applied to the scaled sample value to approximately reconstruct the original sample value. The maximum difference between the original sample value and the reconstructed sample value is the *dynamic range of the original samples in the brick* divided by 65535. For example, if the dynamic range of the original samples in the brick is -1000 to 1000, the maximum difference between an original sample and the reconstructed sample would be 2000/65535 or roughly 0.030518.

- **Float8**—input samples are converted to 8-bit integers (-128 to 127) on a brick-by-brick basis. The values for the group of samples within each brick are biased such that the range is arranged equally about a zero value. Next, each sample is scaled and stored.

  The scalar and bias values can be applied to the scaled sample value to approximately reconstruct the original sample value. The maximum difference between the original sample value and the reconstructed sample value is the *dynamic range of the original samples in the brick* divided by 255. For example, if the dynamic range of the original samples in the brick is -1000 to 1000, the maximum difference between an original sample and the reconstructed sample would be 2000/255 or roughly 7.84314.

- **Int16**—equivalent to the 16-bit .3dv file format. Input samples are converted to 16-bit integers by clipping the data to a user-defined range and then scaling these values to the range -32,768 to 32,767. Data stored in this way cannot be restored to the original 32-bit floating point values.

- **Int8**—equivalent to the 8-bit .3dv file format. Input samples are converted to 8-bit integers by clipping the data to a user-defined range and then scaling these values to the range -128 to 127. Data stored in this way cannot be restored to the original 32-bit floating point values.

Filenames in R5000

There are two names associated with a dataset, the physical file name and the user supplied name. Starting in Release 5000.0.0, users no longer have control over the actual name of the seismic dataset (called the physical file name) on disk. However, datasets are still selected in applications using the user supplied dataset and version name.

Bricked Filenames

The physical bricked files have a .bri suffix that is automatically appended to the file name. The user-supplied file name and version name can contain up to 40 characters each, but these names are not part of the physical file name. The physical file name is generated by OpenWorks software when the file is created.

> **Note**
>
> Do not specify the .bri extension when specifying a name.

The convention that the OpenWorks software uses for generating the physical file name is:

S_<Project database name>_<OpenWorks generated number>.bri

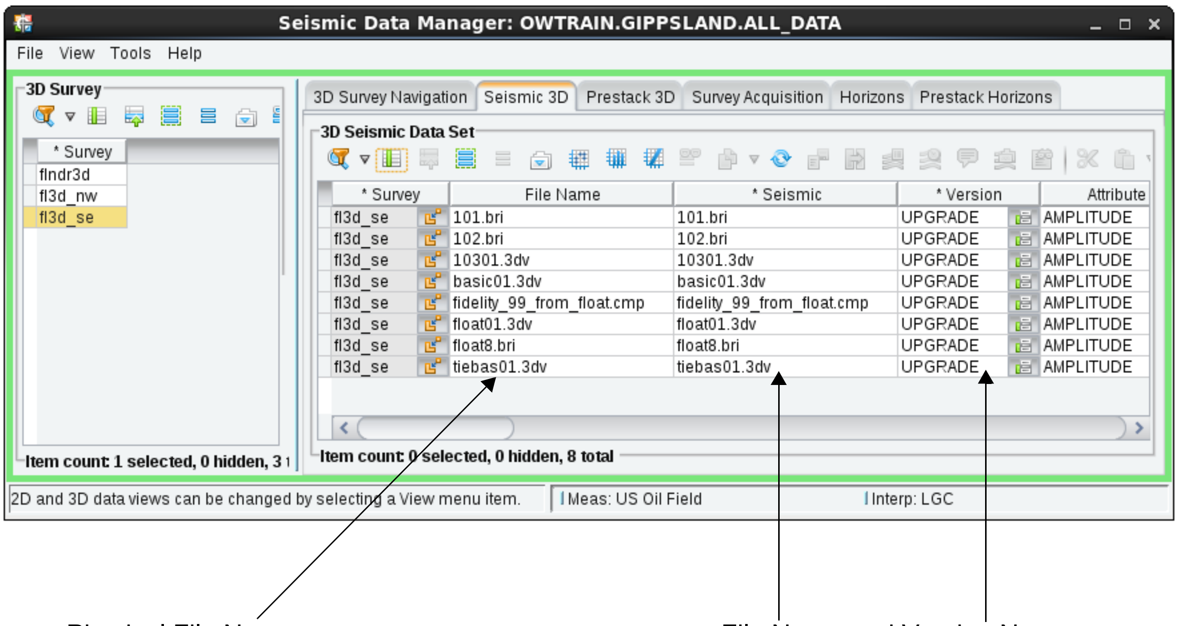
- For example, a bricked filename might be S_ MY_PROJ_110.bri, where MY_PROJ is the Project database name.

- As additional extents are needed, a five digit number is appended to the physical file base name.

- For example, the second extent of a file with the OpenWorks database name of:
  S_ MY_PROJ_110' will be S_ MY_PROJ_11000001.bri

- A total of 100,000 extents are allowed for each seismic volume. The user specified extent size is from 500 MB to 200000 GB.

Landmark applications list the user supplied name for seismic data file selections, allowing the user to specify meaningful names. For data management purposes, Seismic Data Manager can be used to see the relation of the physical file name to the user-defined name. In Seismic Data Manager, select for display the File Name field in the Column manager. This action displays the Dataset name and Version name along with the name of the physical file.



Physical File Name

(Assigned by the OpenWorks software

File Name and Version Name

(User-supplied)

Upgraded Data

Seismic volumes created prior to R5000 and run through the Landmark upgrade procedure have the following differences:

- Name: <original file name>.bri
- Version: UPGRADE
- Physical file name: same as the Name

For upgraded data (data created prior to R5000) an ASCII metadata file that describes the contents of the bricked file exists. A *.meta* extension is appended to the filename of the first extent (such as *mig_gulf_32float.bri.meta*). The file includes fields for ZSTART, SAMPLE_RATE, and DOMAIN. This file is required to upgrade data in order for Landmark applications to successfully read the bricked data, but once the data has been upgraded, the file is no longer necessary and can be deleted.

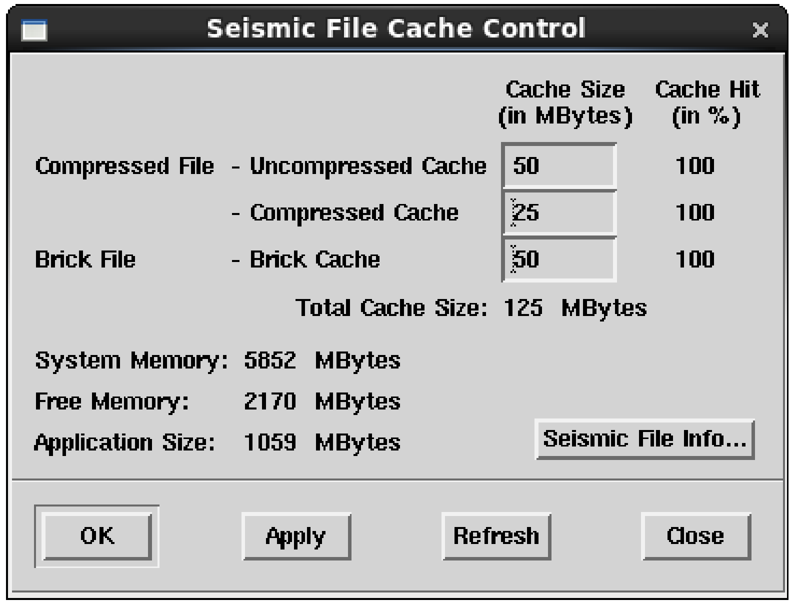
In Seismic Data Manager you can view both the physical file name and the user-supplied file name and version. SeisWorks Seismic Parameters dataset details can also display both the physical file name and the user-supplied names.

Bricked Volume Cache

The SeisWorks environment provides a bricked volume cache for use during the reading and writing of bricked data. When data is requested by the application, SeisWorks first examines the bricked cache. If the data is not there, it will retrieve the necessary data from the source file on disk. This process takes place on a brick-by-brick basis.

SeisWorks allows users to set the bricked cache size. To access the Seismic File Cache Control, select **Default** > **Seismic** > **Cache** from the

SeisWorks main menu. The Seismic File Cache Control window will open.



You have the option of leaving the cache size at its default value. The cache size value represents the maximum size to which the cache can grow. Until data is requested, the actual cache size will be 0. For example, if you are only accessing bricked data, the Uncompressed and Compressed Cache will remain at 0, even if values greater than 0 appear in the adjacent text box.

The frequency in which data is pulled from cache is recorded in the **Cache Hit** column. This number starts at 100% since all requests (0) have been initially satisfied. Once bricked or compressed data begins to be accessed, the numbers decrease since the data for the first request will not be in cache. *In general, the higher the cache hit%, the better the performance.*

System Memory lists the amount of physical memory available on the local machine.

The **Free Memory** listing is also for the local machine and indicates the amount of unused physical memory. This is only an estimate; free memory can vary significantly as the system uses and reclaims memory from process activity.

Application Size refers specifically to SeisWorks. This number may increase as more SeisWorks processes are invoked, but it will not decrease as processes end. In order for that memory to be made available to other processes on the system, SeisWorks must be closed and reopened.

When choosing new values for the Brick Cache Size, there are a number of factors that should be considered:

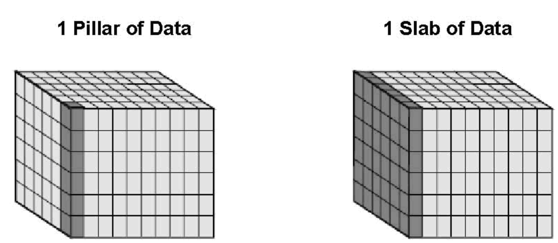
- System Memory

  The amount of memory on the machine on which you are running is important in determining the cache size. The Seismic File Cache Control box shows the System Memory and the current Free Memory. Application Size refers to SeisWorks only.

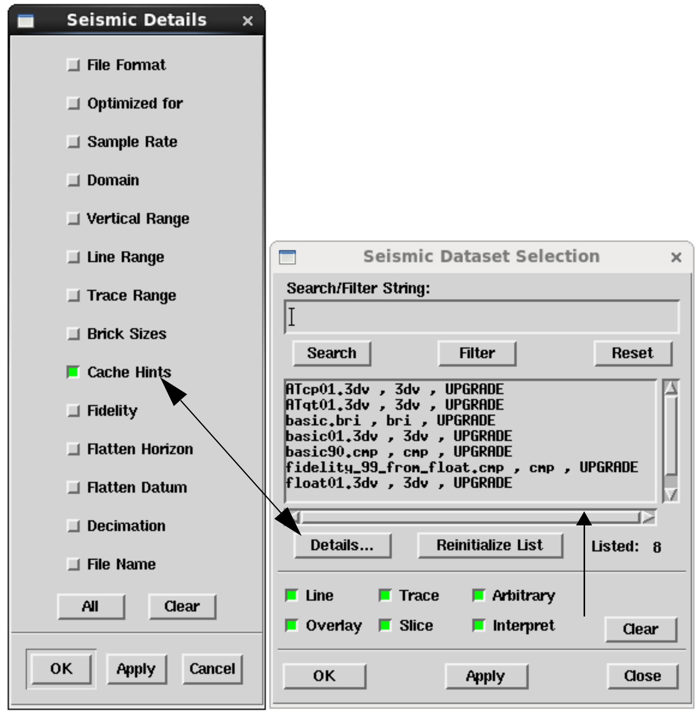
  In general, the more local RAM, the more value there is in increasing the cache size. However, you do not want to set your cache larger than your RAM. It is also important to leave enough RAM so that other applications in use do not page out and degrade performance.

- Seismic Data Volume Size

  The size of data volume is important because performance increases significantly when a whole pillar of data can be placed in cache. Another performance jump occurs when one or more slabs of data can be stored in cache.



  Information on pillar and slab sizes can be obtained by pressing the **Seismic File Info** button in the *Seismic File Cache Control* dialog box.



Click **Details** in the Seismic File Selection box, toggle on **Cache Hints**. The display lists the necessary cache size in megabytes to place one slab of lines (L#), one slab of traces (T#), one slab of timeslices (or depthslices) (S#), or one pillar of data (P#) in cache.

- Workflow

Some workflows would benefit from an increase in cache size. For example, if using Frame Control to move progressively through a compressed data file at five line increments, a cache size large enough to hold a slab of lines would improve performance (assuming enough RAM). However, performance will probably not be enhanced by an increase in cache when successively selecting varying orientations or moving large distances across the survey.

For some applications, such as PostStack, the most appropriate cache size can easily be calculated. Thus, the application sets the cache size; there is no user option for these applications.

Compressed (.cmp) Seismic Data Files

The compressed seismic data format was developed to improve display performance when dealing with large seismic datasets. By providing amplitude-range-preserving compression ratios of 20-to-1 or greater, the compressed seismic file makes storage and management of large original and attribute volumes practical.

Compressed volumes are also bricked; however, the dimensions are not user-specified. All bricks in compressed volumes have the dimensions of 8 x 8 x 8 samples.

Controlling Compression

Compression ratios are not specified directly. Instead, a **fidelity factor** is specified by the user when the compressed volume is created.

The fidelity factor controls the amount of compression by specifying how closely, on average, the compressed data must match the original data.

The equation:

Fidelity = (1 - (RMS Error) / (RMS Original)) x 100

specifies the minimum acceptable ratio of RMS (root mean square) amplitude error to original RMS amplitude that can be introduced during compression.

By specifying fidelity, the RMS is indirectly indicated. The higher the fidelity, the lower the RMS Error; the actual fidelity is typically higher (and the RMS Error is lower) than the specified value.

Fidelity values can range from 1 to 99, where 99 is the highest degree of fidelity that can be specified. In general, higher fidelity values correspond to lower compression ratios.

Choosing Compression Fidelity Factors

The best choice of fidelity factor will depend on the characteristics of the dataset, type of work being done with the volume (such as production work, large-scale structural interpretation, stratigraphic plays, and so forth), and the comfort level of the interpreter.

It is important to evaluate the effect of compression on your dataset before making a determination of the best fidelity factor to load the entire volume.

Below are some observations that might be helpful when beginning the evaluation process.

- The greatest rate of change in file size for most datasets occurs between the fidelity factors of 99 to about 90. As fidelity decreases below this point, changes in file size become significantly smaller.
- For many datasets, data compressed with fidelity of 95 or higher was deemed suitable for any type of work.
- Early users doing regional structural interpretations on very large datasets were, on average, comfortable with data compressed with fidelity of 80 (and sometimes with lower fidelity factors).

Compressed Volume Size

Since each dataset compresses differently, it is not possible to determine what the final file size will be. The greatest reduction in file size occurs at fidelity factors of 95% or greater.

Filenames for Compressed Seismic Data

Compressed files have a .cmp suffix that is automatically appended to the physical file name. Like bricked files, compressed files have a user-supplied file name and a computer generated physical file name (the physical file name is the actual name of the file stored on disk). The user-supplied file name and version name can each be up to 40 characters long but are not part of the physical file name.

The compressed physical file name is generated by the OpenWorks software when the file is created.

The convention that the OpenWorks software uses for generating the physical file name is:

S_<Project database name>_<OpenWorks generated number>.cmp

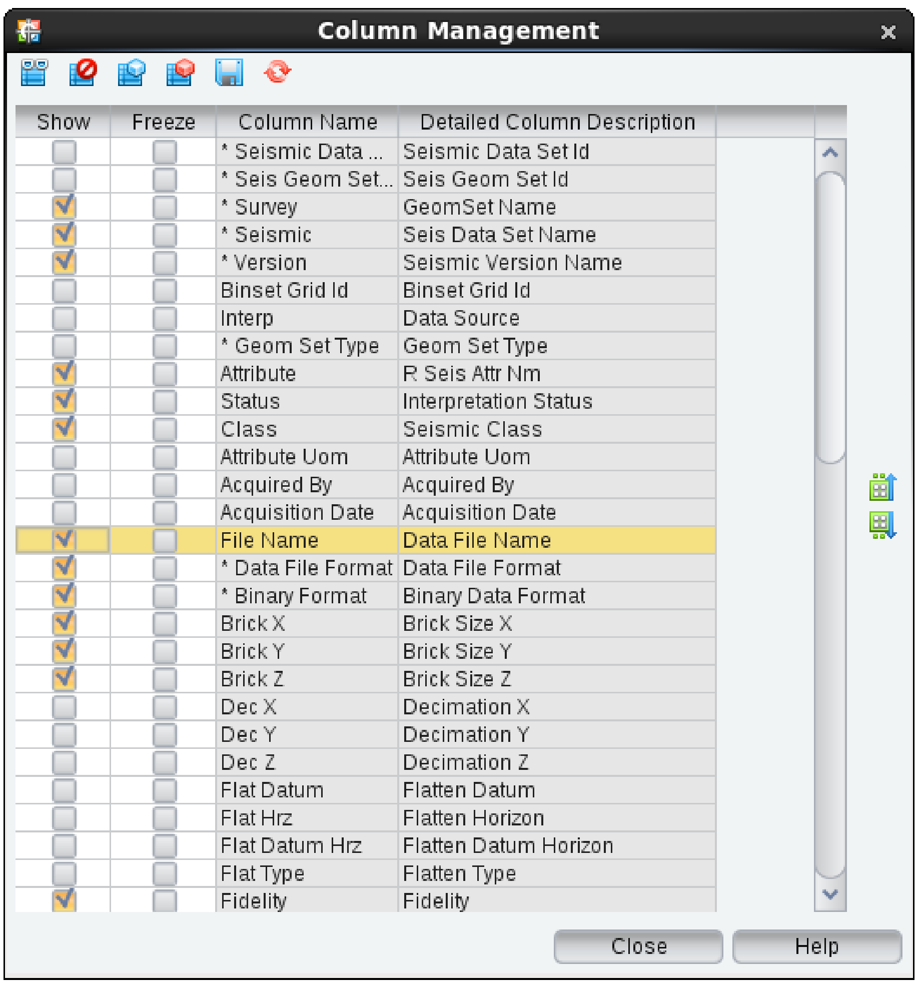
An example name is S_MY_PROJ_110.cmp

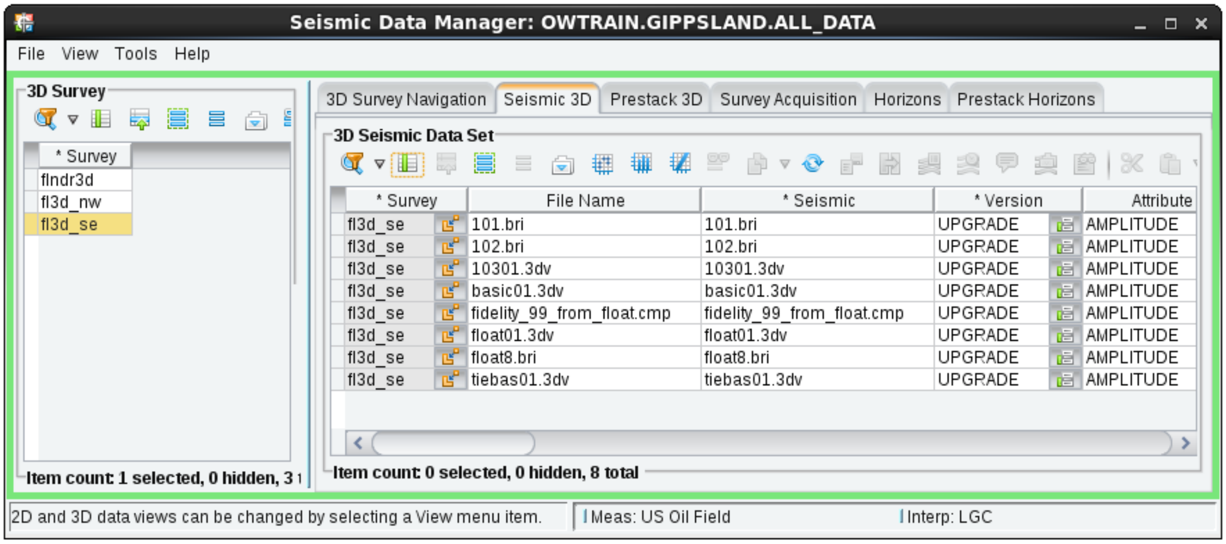
- As additional extents are needed, a five digit number is appended to the basename.
- For example, the second extent of a file with the OpenWorks database name of:

  S_MY_ PROJ_110’ will be S_MY_ PROJ_11000001.cmp

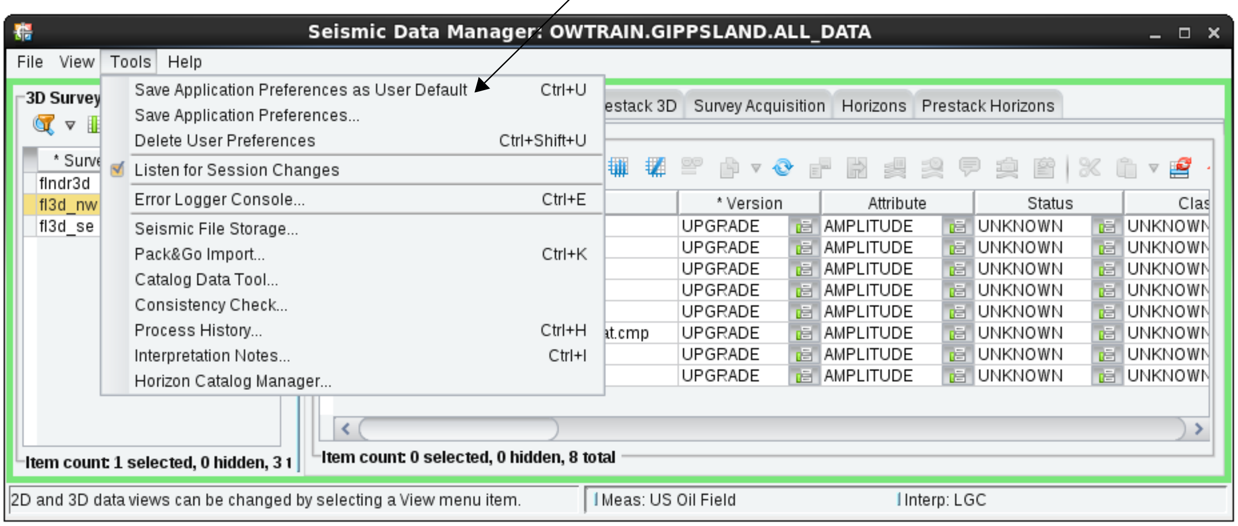
- A total of 100,000 extents are allowed for each seismic volume. The user specified extent size is from 500 MB to 200000 GB.

Seismic Data Manager can be used to see the relation of the physical file name to the user-defined name. In Seismic Data Manager, select the File Name in the Column manager. The dataset and version names display along with the name of the physical file.





Use **Tools > Save Application Preferences as User Default** to customize the column display. The File Name (or any other changes you made) will appear when you open the Seismic Data Manager in future without having to select it again.



Upgraded Data

Seismic volumes created prior to R5000 and run through Landmark's upgrade procedure have the following differences (by default):

- Name: <original file name>.cmp
- Version: UPGRADE
- Physical file name: same as the Name

An ASCII metadata file that describes the contents of the compressed file is also created whenever a compressed seismic volume is created. A .meta suffix is appended to the filename of the first extent (for example, *mig32_95fidelity_converter.cmp.meta*). The file includes fields for ZSTART, SAMPLE_RATE, and DOMAIN. This file is required to upgrade the data, but is not necessary once the data has been upgraded.

Compressed Volume Cache

The compression toolkit manages two caches during the reading and writing of compressed data: *an uncompressed cache* and a *compressed cache*. The figure below shows the order in which the two caching areas are accessed. Note that this process takes place on a brick-by-brick basis.

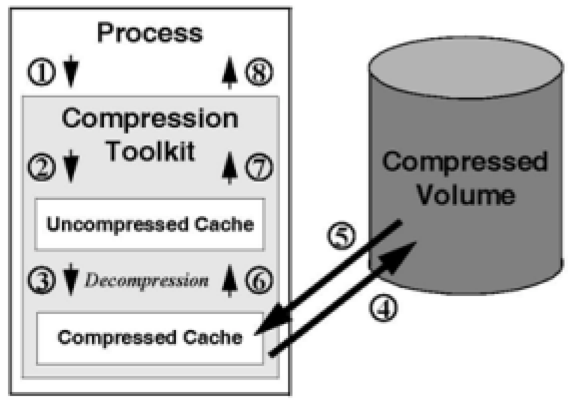
- When data is requested by the application ① , the compression toolkit will first examine the uncompressed cache ② .

- If the data is not in the uncompressed cache, the compression toolkit will next check the compressed cache for the necessary data ③ .

- If the data is not in the compressed cache, the compression toolkit will finally go to the compressed volume and extract part of the data ④ , placing it in compressed cache ⑤ .

- Part of that data will be uncompressed and placed in the uncompressed cache ⑥ .

- The required data will then be extracted from the uncompressed cache ⑦ and sent to the application to complete the desired process request ⑧ .



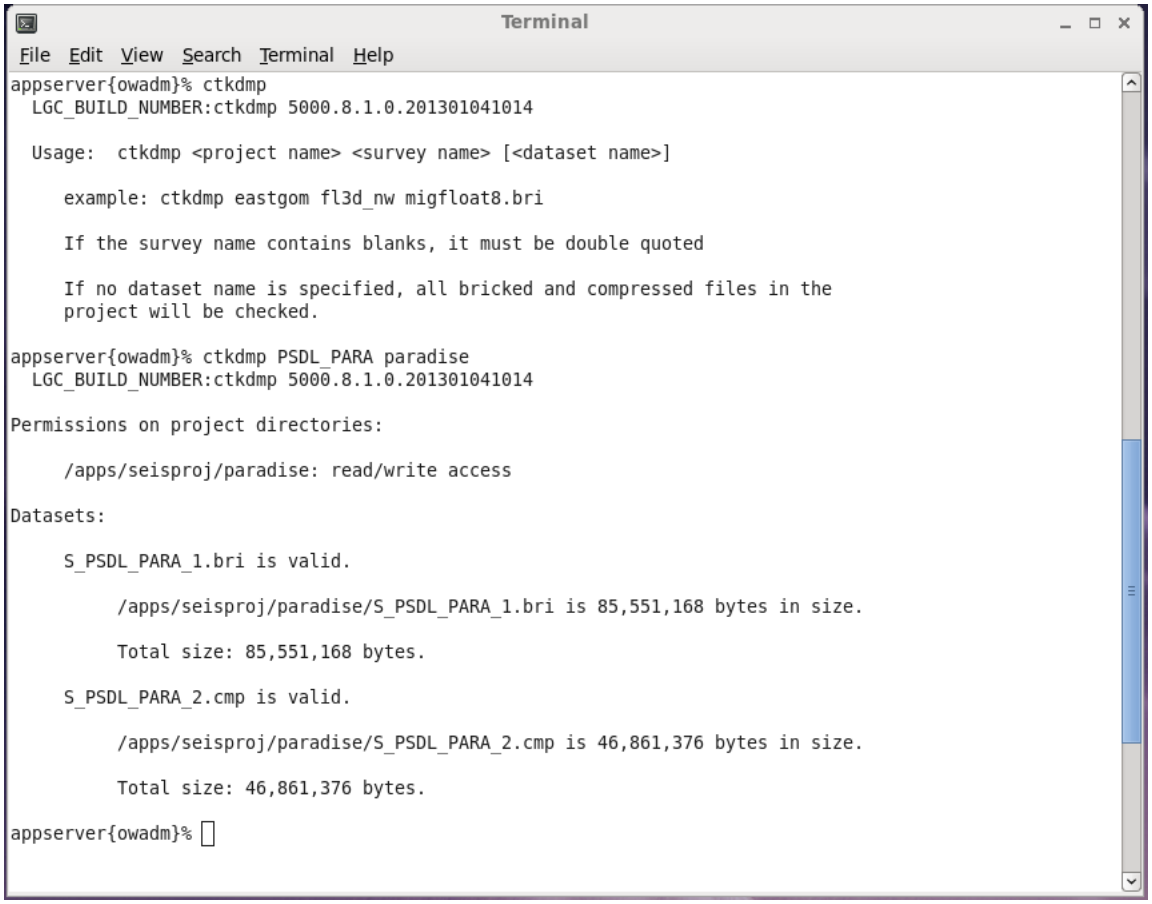
Validity and Accessibility Reports of .bri and .cmp Files

The command line utility *ctkdmp* provides a report of the validity and accessibility of bricked (.bri) and compressed (.cmp) datasets created by the compression toolkit (CTK). If you are having trouble accessing a file, you can run *ctkdmp* to determine the source of the problem.

The utility will report on your permissions for each of the project directories for the project you have specified. Many access problems can be traced to the directories being searched, or to users' permissions to access these directories. For each bricked or compressed file reported on, *ctkdmp* will tell you that the dataset is valid or that there is a problem accessing the dataset. In addition:

- Permissions on each file comprising the dataset will be checked, along with the structural integrity of each file.
- The utility can report on a single bricked or compressed file or all bricked and compressed files in a project.
- If a dataset name is specified, *ctkdmp* will report on that file only.
- If no dataset name is specified, *ctkdmp* will report on every bricked and compressed file in the project.

All output from *ctkdmp* appears on your terminal screen.



You can also redirect the output to a file. For instance, the following will write the contents of the report to a file called *paradise.rpt* in the current directory:

```
ctkdmp PSDL_PARA paradise > paradise.rpt
```

.3dv/.3dh Seismic Data Files

Earlier releases of SeisWorks only read .3dv seismic data files for vertical displays and .3dh files horizontal displays (timeslices or depthslices). For these formats, all of the data for the seismic traces is contiguous in a file. The location of each trace is maintained in an index.

These classic formats are still available to use, though the newer bricked and compressed formats are generally more optimal for storage and display of seismic data.

Seismic data loaded into .3dv/.3dh files use one of the four formats listed below.

Format	Range of Values
32-bit floating point	-5.4E+79 to 7.2E+75
32-bit integer	-2,147,483,648 to +2,147,483,647
8-bit integer	-128 to +127
16-bit integer	-32,768 to +32,768

8-bit data requires about 1/4 of the disk space required by 32-bit data. 16-bit data requires about 1/2 of the disk space required by 32-bit data.

File Naming Conventions

Landmark seismic formats require both name and version specifications. The name and version specified by may contain up to 40 characters each. The actual physical file name that is written is generated by the OpenWorks software and will reflect the Project database name but not the user defined file name.

Seismic Data Manager can be used to see the relation of the physical file name to the user defined name. In Seismic Data Manager select for display the File Name field in the *Column Management* dialog (click the Select columns icon () in Seismic Data Manger to access this dialog). The dataset name, version name and the physical file name are displayed.

An example of the relationship between the user supplied name and version, and physical file name for .3dv and .3dh files is shown below.

For the user supplied name and version:

Name: mig_32float

Version: CALCUALTED

and with and a Project database named FLOUNDER, the physical file name will follow the convention (if loading as a .3dv vertical file):

S_FLOUNDER_<OpenWorks assigned number>.3dv

or (if loading as a .3dh horizontal file):

S_FLOUNDER_<OpenWorks assigned number>.3dh

The general format for the physical file name for 3D seismic data is:

S_<Project database name>_<OpenWorks assigned number>.file extension

When selecting this file in applications, the list of seismic volumes displays with the user-supplied name (or, in this case, selection would be *mig_32float* for the name and version *CALCULATED*).

Extent Files

The 3D vertical (.3dv) and timeslice (.3dh) files have one or more parts, called "extents."

The 01 extent contains the header information for the seismic file, and includes the reference information as to the total number of extents in the file, their sizes and revision status. The 01 extent then uses the rest of the space it has available to hold traces.

If the seismic data exceeds the space available for the 01 extent, another file is created, which will have a 02 extent. Additional disk files are created as required. All of the filenames for these additional "extent files" are the same, except that the number of the extent increases by one for each new file.

For example:

S_FLOUNDER_1301.3dv - trace header information and trace data

S_FLOUNDER_1302.3dv - trace data

S_FLOUNDER_1303.3dv - trace data

When you archive or restore your files, you must save and restore all of the extents together.

Upgraded Data Naming Conventions

Data loaded prior to R5000 and upgraded to R5000 will by default have a physical file name the same as the user-supplied pre-R5000 name appended with an extension based of the volume type (.3dv, .3dh, .bri, .cmp). The version name will be UPGRADE.

Seismic File Size Limits

Each SeisWorks/3D .3dv or .3dh file can have a maximum 32 extents for each file. Extent size defaults to 20GB.

Calculating .3dv and .3dh File Size

To get an approximate estimate of how much space will be required for a .3dv file, use the formula:

(# lines) x (# traces) x (# samples/trace) x N

where N is the storage factor.

Data Format	Storage Factor (N)
Floating Point	4
32-bit Integer	4
16-bit Integer	2
8-bit Integer	1

To calculate the space required for a .3dh file, use the formula:

(# lines in input .3dv) x (# traces in input .3dv) x
[(total time to be sliced, in ms)/ (time slice sampling interval)] x N

Selecting the Appropriate 3D Seismic Data Format

The best format choice for a dataset is a function of many factors, including the size of the volume, data quality, type of work to be done with the volume, interpreter's workflow preferences, system configuration, available hardware, plus those factors that are site-specific. In general, there is a need to balance disk space needs, display performance in Landmark applications, and data quality when determining the best seismic data format.

Since there will be differences in the factors listed above from site to site, along with differences in how these factors are prioritized, it is not possible to give a set of rules for choosing seismic data formats. Rather, a listing of observations for each of the seismic data formats is listed below to help in the decision-making process.

Please note that any observations regarding display times are conservative generalizations. Since display times are a function of variety of factors, actual results vary.

Bricked Seismic Volumes

Advantages

- Can access any seismic view from a single volume.

- Float16 and Float8 are displayed as 32-bit floating point data in the SeisWorks software.

- Volume optimization for the intended workflow can result in an overall faster workflow, particularly when frequently changing between inline, crossline, and arbitrary line displays

Compressed Seismic Data

Advantages

- Can significantly reduce the size of datasets.
- Does not clip or scale when data is loaded.
- Requires only one volume to access all seismic views.

Disadvantages

- Introduces random errors into the data during compression.
- Decompression is CPU-intensive.
- Requires adequate RAM to enable effective cache utilization.

.3dv/.3dh Format (classic formats)

Disadvantages

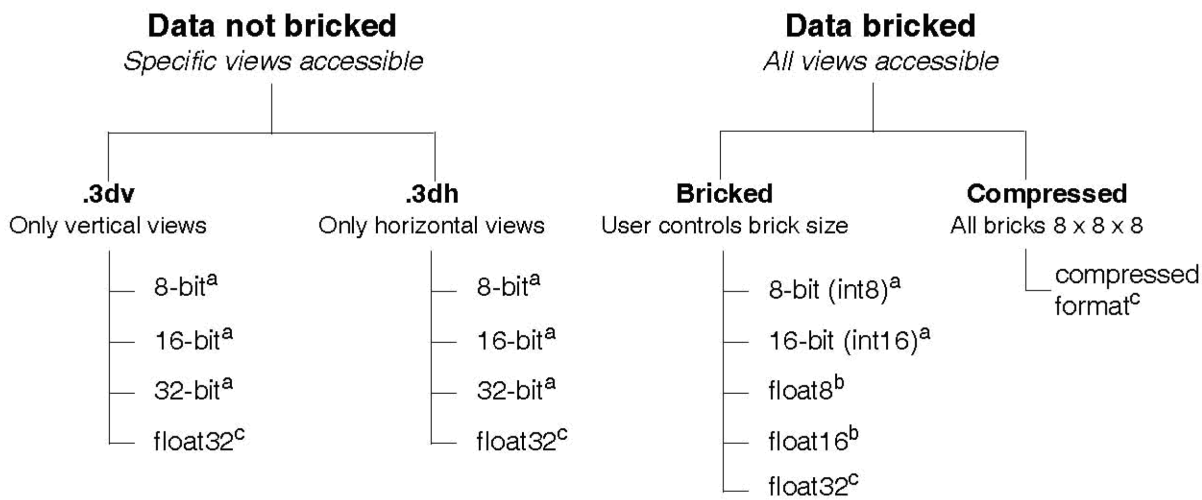
- Need two volumes to see both vertical and horizontal views of the seismic data

- Crossline and arbitrary line display times are slow for inline-optimized .3dv files. Similarly, inline and arbitrary line displays are slow for cross-line optimized .3dv files.

- Permanent loss of amplitude data due to scaling and clipping when data is loaded in 16-bit integer and 8-bit integer formats

Summary of 3D Seismic Data Formats

The diagram below summarizes the Landmark 3D seismic data formats commonly used in data loading.



a. data may require scaling and clipping before loading to this format; data displayed at same scale as stored

b. scale and bias factor determined automatically and stored with data; data displayed as float32

c. data displayed as float32

Landmark 2D Seismic Data Format

There is only one available format for 2D seismic data: 2v2_glb format.

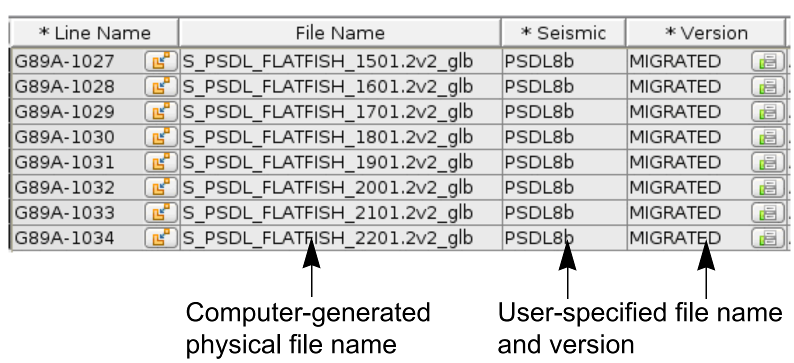
Seismic data loaded into 2v2_glb files uses one of the four sample formats, which are listed below.

Format	Range of Values
32-bit floating point	-5.4E+79 to 7.2E+75
32-bit integer	-2,147,483,648 to +2,147,483,647
8-bit integer	-128 to +127
16-bit integer	-32,768 to +32,768

8-bit data requires about 1/4 of the disk space required by 32-bit data. 16-bit data requires about 1/2 of the disk space required by 32-bit data.

File Naming Conventions

The user is required to specify a filename and version when loading 2D data. The file and version name can contain 40 characters each. A physical file name (name on disk) is generated by the OpenWorks software and reflects the project name but not the user- defined file name. The computer generated physical file name will have a .2v2_glb extension.



For 2D data, each line will have a unique physical file, but the user supplied name and version can be the same as other lines, which makes it convenient for data selection in OpenWorks applications.

Extent Files

All 2D seismic files have one or more parts, called "extents."

The 01 extent contains the header information for the seismic file. This includes reference information as to the total number of extents in the file, their sizes, and revision status. The 01 extent uses the rest of the space it has available to hold trace data.

If the seismic data exceeds the space available for the 01 extent, another file is created, which will have a 02 extent. Additional disk files are created as required. All of the filenames for these additional "extent files" are the same, except that the number of the extent increases by one for each new file.

When you archive or restore your files, you must save and restore all of the extents together.

Tools Used for Seismic Data Loading

Landmark provides a variety of tools to facilitate the process of converting SEG-Y data to Landmark-formatted data. Some of the tools are used with 2D or 3D data exclusively. Others can be used with both 2D and 3D seismic data, but their use is dependent on other factors.

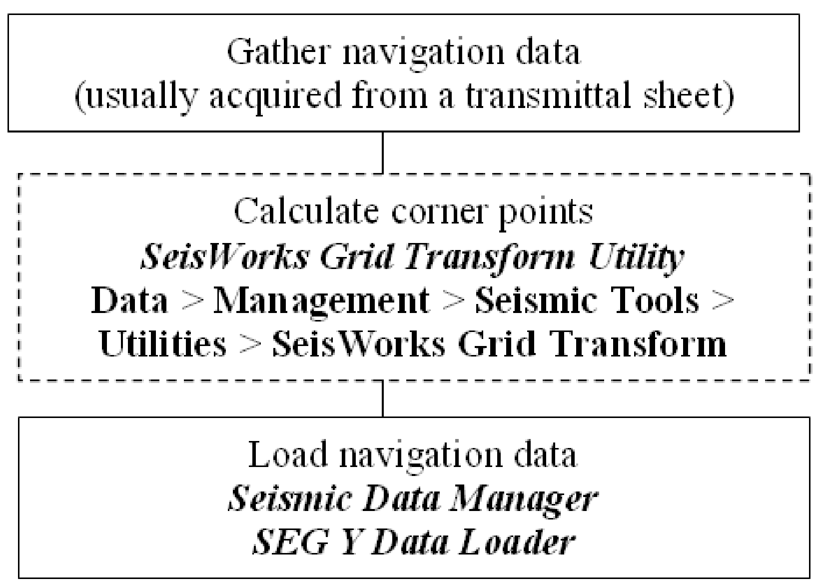
Tools for Loading Navigation Data

Navigation data is different for 2D and 3D seismic data; thus, different tools are provided for the two different data types.

3D Navigation Data

Navigation data for 3D data consists of inline (line) and crossline (trace) increments and ranges, plus x, y coordinates for four corner points of the seismic survey (if you have three corner points, Seismic Data Manager will compute the fourth). This type of information is loaded using the Seismic Data Manager utility. An optional step using the SeisWorks Grid Transform Utility is required if the corner points of the survey are unknown. SEG Y Import may also be used to load navigation (and seismic trace) data.

Tools for Loading 3D Navigation Data



2D Navigation Data

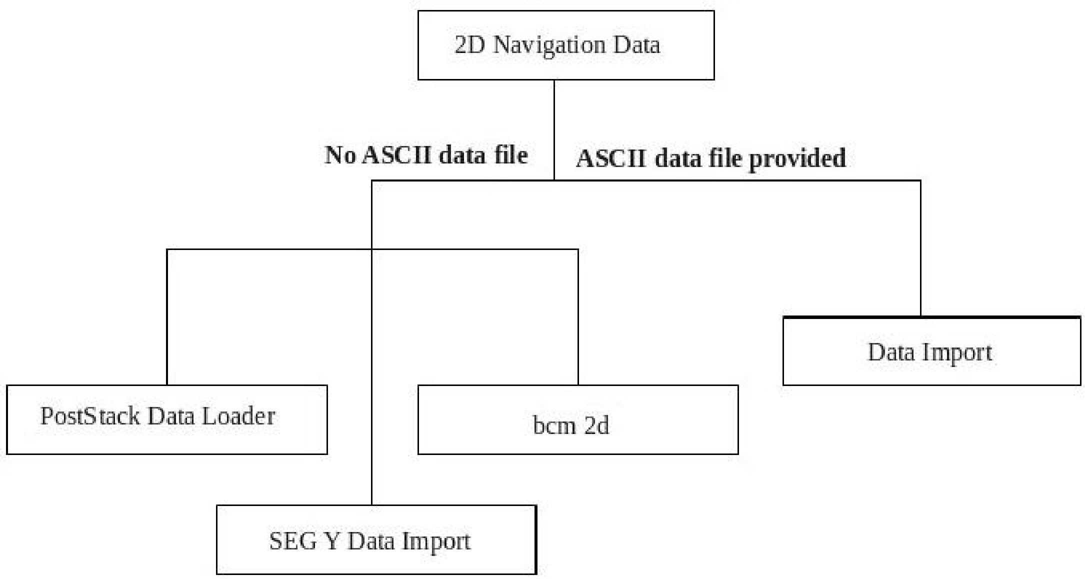
Navigation data for 2D data consists of line name, trace range, shotpoint to trace ratio, and x, y coordinates. Sometimes this data is provided in a separate ASCII file. In this case, the navigation data is loaded using the Data Import Tool.

In other cases, a special file is not provided and the navigation data for each trace must be loaded from its trace header. This can be done while loading traces using PostStack Data Loader.

In this course, we describe how to use the Data Import Tool to import ASCII file navigation data and how to use PostStack Data Loader to load navigation data from trace headers.

Another option to load 2D navigation (and seismic trace) data is SEG Y Data Import.

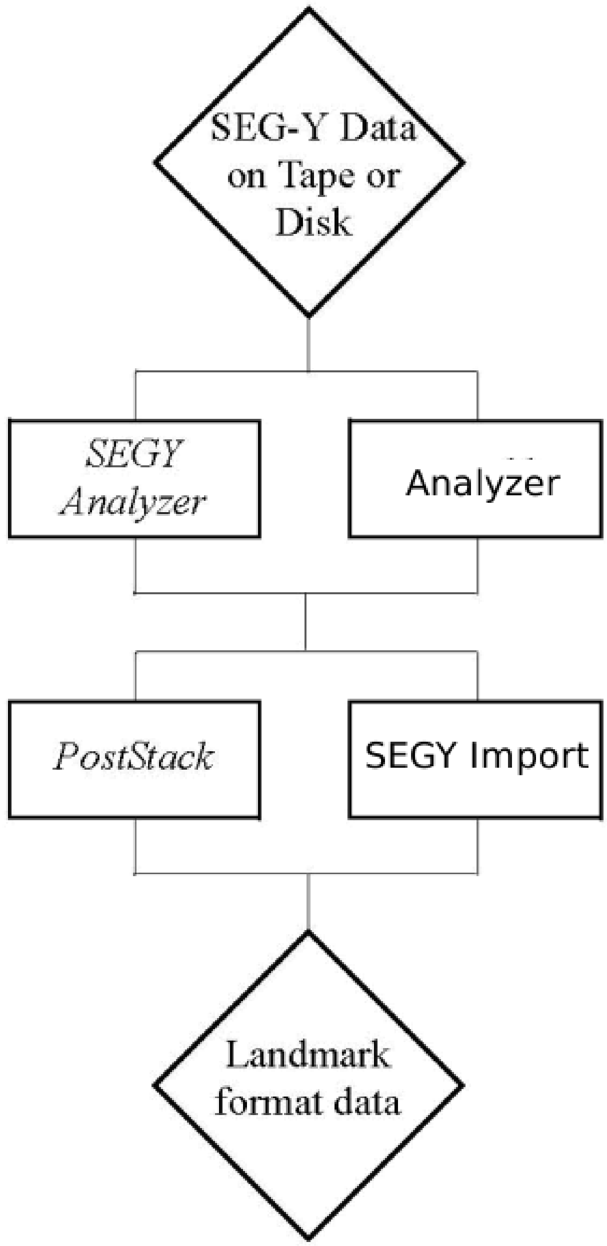
Tools for Loading 2D Navigation Data



Tools for Loading Seismic Trace Data

Seismic trace data for both 3D surveys and 2D lines can be loaded using PostStack Data Loader, or SEG Y Import Utility. In order to load the trace data using any of these applications, you need to collect certain pieces of information about the data format first. Landmark provides *SEGY Analyzer* to extract the necessary information from the data tapes.

If the SEG-Y data is being loaded from tape or disk, you may use SEGY Analyzer to gather required information and PostStack Data Loader to load the trace data.



SEG Y Import works on Linux and Windows platforms, but may only be used if the input is a SEG-Y disk file.

In this manual, we explain how to analyze SEG-Y data using SEGY Analyzer and how to load seismic traces using PostStack Data Loader and SEG Y Import Utility.

Overview of PostStack™ Software Data Loader

The Seismic Tools provides a special version of the PostStack software called PostStack Data Loader to load SEG-Y data into a Landmark format without tying up a fully licensed version of PostStack. It is only necessary to learn a small part of PostStack to load seismic data and lay the groundwork for the interpreter.

The basic procedures for setting up and running a PostStack job include:

- Starting PostStack from the Seismic Tools.
- Specifying the input data.
- Selecting a format and location for the output data.

To access PostStack Data Loader, from Seismic Tools select **Seismic > PostStack Data Loader**. After selecting a seismic survey and launching PostStack, the main dialog box, shown on the next page, appears.

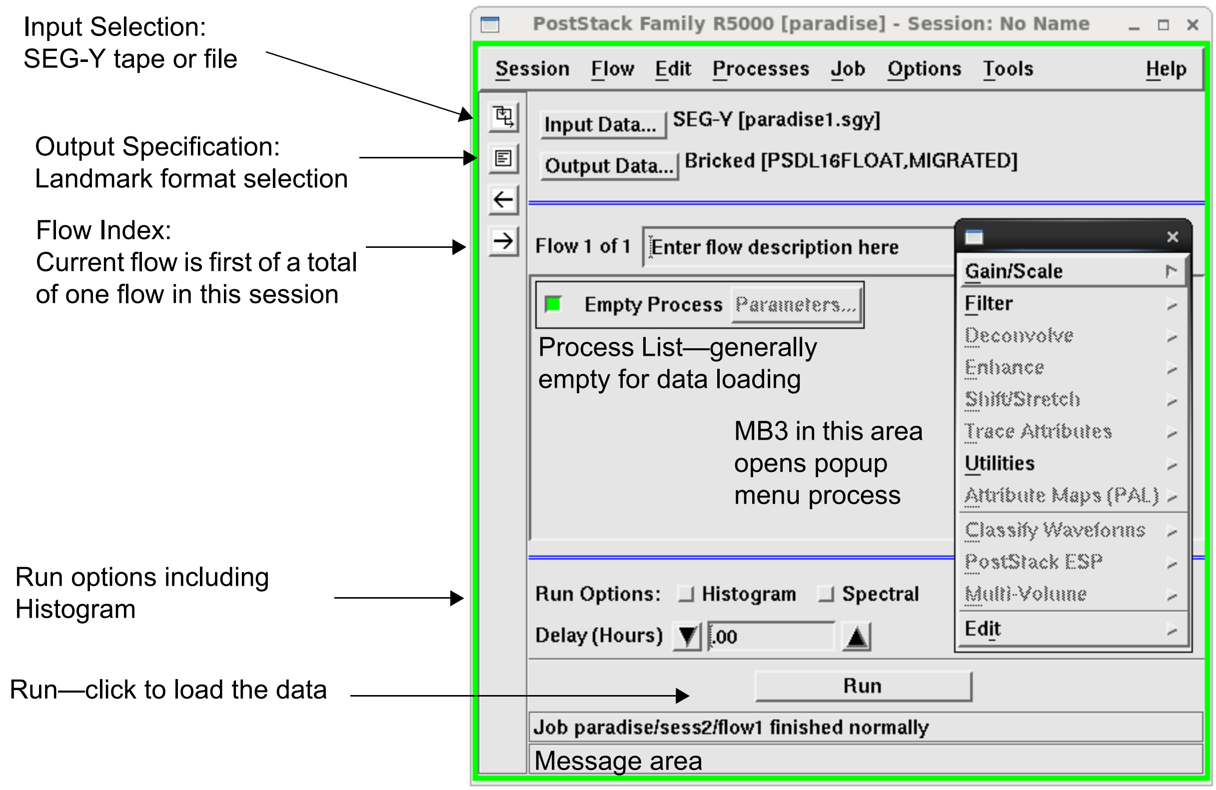
When loading SEG-Y data into Landmark format it is usually only necessary to specify the input data, the output desired.

Most of the time, the process list will be empty unless there is a need to apply some processing option (such as a trace balancing process) to the data.

A histogram of the seismic amplitudes is generated by toggling on Histogram in Run Options. The histogram will be saved automatically with the process history and is often a useful tool for both the data loader and the interpreter.

Once the input, output and options have been specified, simply click **Run** at the bottom of the dialog box to load the data.

PostStack™ Software Main Dialog Box



For ease of use, the MB3 popup menu repeats all the options available from the menu bar under **Edit** and **Processes**. The check boxes by each processing step allow you to toggle off individual processes if you want to run a job using only certain steps in the flow.

Input Data

The PostStack software supports the following disk or tape SEG-Y input formats:

- **Auto-Detect Rev0/Rev1 -** this option looks for a Rev1 incantation in the first card image header and then checks if binary reel header bytes 301-302 contain the Rev 1 incantation 0X0100
- **Standard Rev1 -** fixed trace length
- **Standard Rev0**
- **Variable Length Trace Rev1 -** variable trace length

- **Variable Length Trace Rev0**

If the file is Rev1 and has extended textual file headers, these are stripped off and printed to the *job.output* file, but are not otherwise used.

You set parameters for extracting time range and sample rate from the SEG-Y headers. You also describe the data and header formats so that the PostStack Data Loader can convert the data from SEG-Y format to the format required for internal processing.

Alternatively, you can provide the PostStack Data Loader with a SEGY Analyzer template.

The PostStack Data Loader is designed to meet the majority of data loading requirements, where tape formats and seismic trace header mappings are relatively standard.

Output Data

The PostStack Data Loader will output the data in the following formats:

- Bricked file *(.bri*)
- Compressed file (*.cmp*)
- Vertical section file *(.3dv*)
- Timeslice file (*.3dh*)

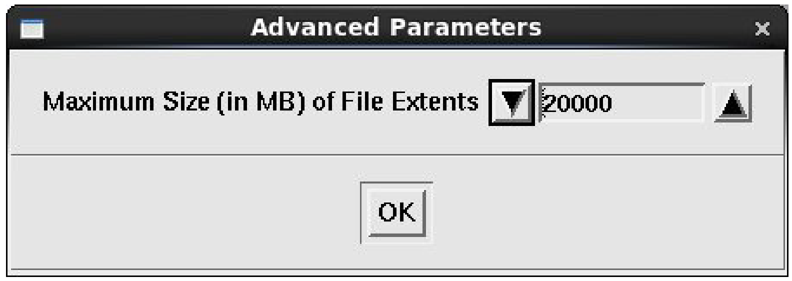
Other output options:

- Cube Data (CD)
- SEG-Y

The PostStack Data Loader allows you to create a new output file or merge data output with an existing file.

Large 3D seismic files may span several disks. Default PostStack Data Loader settings limit each extent to 20000 MB.

The default can be changed if you need to adjust the size of the extents. To change the default extent size, click the **Advanced…** parameters button and specify the desired size.



Bricked (.bri) and compressed (.cmp) can have up to 100,000 extents. Vertical (.3dv) and horizontal (.3dh) files can have up to 32 extents.

File Initialization Parameters

There are several parameters that are specified on the first load job that cannot be changed. For .bri files, these parameters include time range and brick dimensions. For .cmp files, these parameters are time range and fidelity factor. For a .3dv or a .3dh file, these parameters include the sample rate, sample format, total time, line and trace range and the data index organization (line or trace).

Once set, these parameters cannot be changed for a given seismic file. Thus, you cannot correctly load data into an existing .3dv file that has a different sample rate or sample format from the data you wish to load or which lies outside the original time range. Nor can you load data into an existing .bri file using different brick dimensions or into an existing compressed file using a different fidelity factor.

Flow

A flow is a sequence of processes that you want to perform on the seismic data. You build a flow by selecting the desired processes and setting parameters for them.

You can create multiple flows within a single PostStack session and then recall that session and use or edit any of those flows as desired.

Detailed instructions to create and use flows are provided in the PostStack online manual. Simply select **Help > User Guide** in the *PostStack* dialog box.

Session

A session is a collection of all the processing flows you build and save under that session name. Specifications for input data and output data are *not* saved in the session file unless specifically selected to be saved when saving the session, so you can open a session and use the flows with any seismic data.

Several prebuilt sessions are supplied with the PostStack Data Loader. Six of them each offer multiple flows for a particular processing category: amplitude scaling, filtering, deconvolution, data enhancement, data flattening, or extracting data attributes. Another session contains a three-step flow involving trace mixing, bandpass filtering, and trace equalization.

Detailed instructions to create and use sessions are provided in the PostStack online manual. Simply select **Help > User Guide** in the *PostStack* dialog box.

Run Options

The PostStack Data Loader offers two run options.

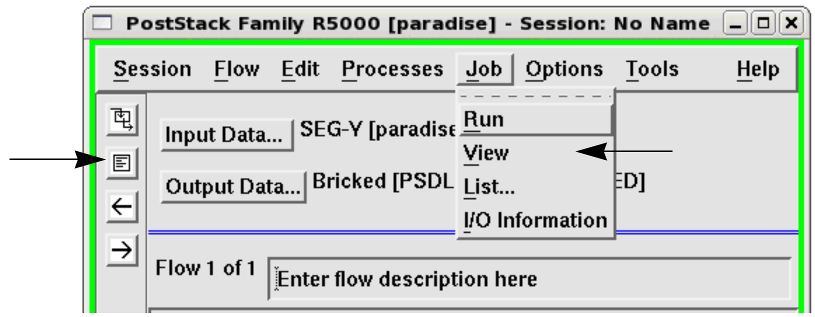
- **Histogram** creates a frequency distribution report in the *job.output* file. Click **Job > View** on the main menu bar to view the Histogram results on the Output from Flow window. This option is useful for determining scaling factors to be used to interactively scale seismic data.

- **Spectral** computes and displays a spectral estimate of frequency and phase for a single subset. This option allows quick display of seismic data without having to access the SeisWorks software.

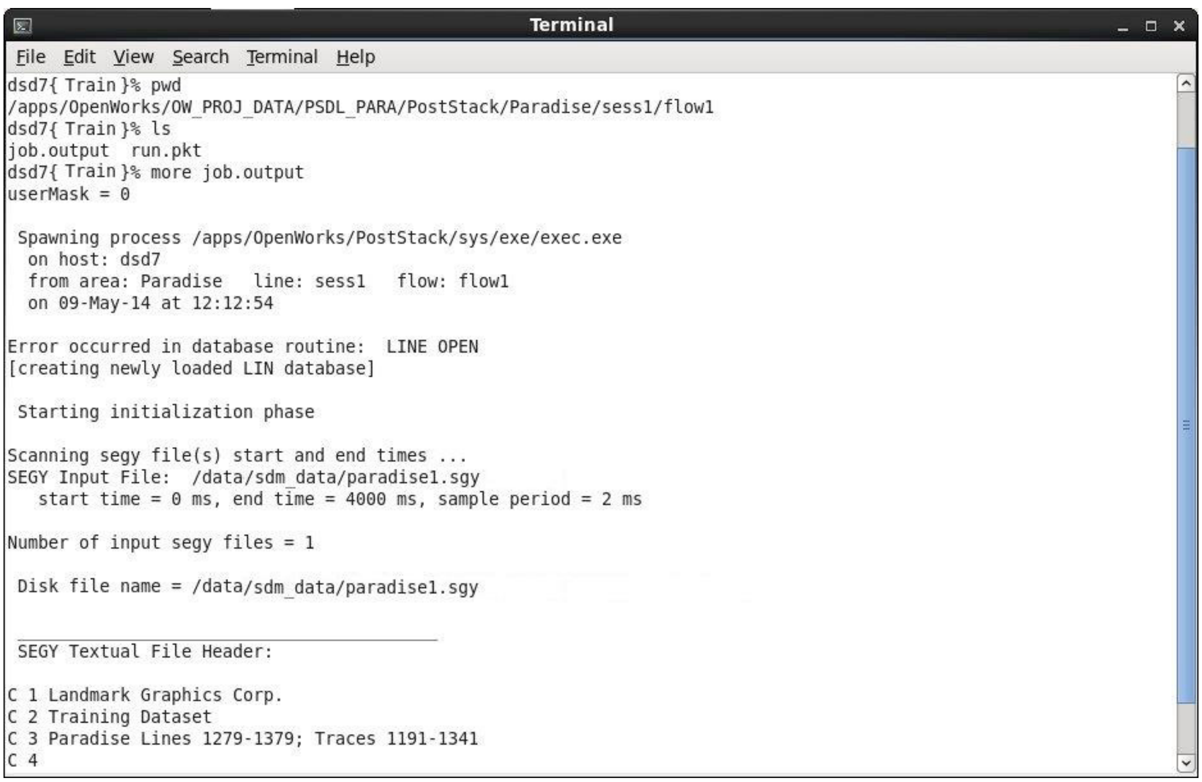
Process History

The job output from PostStack Data Loader can be viewed in several places:

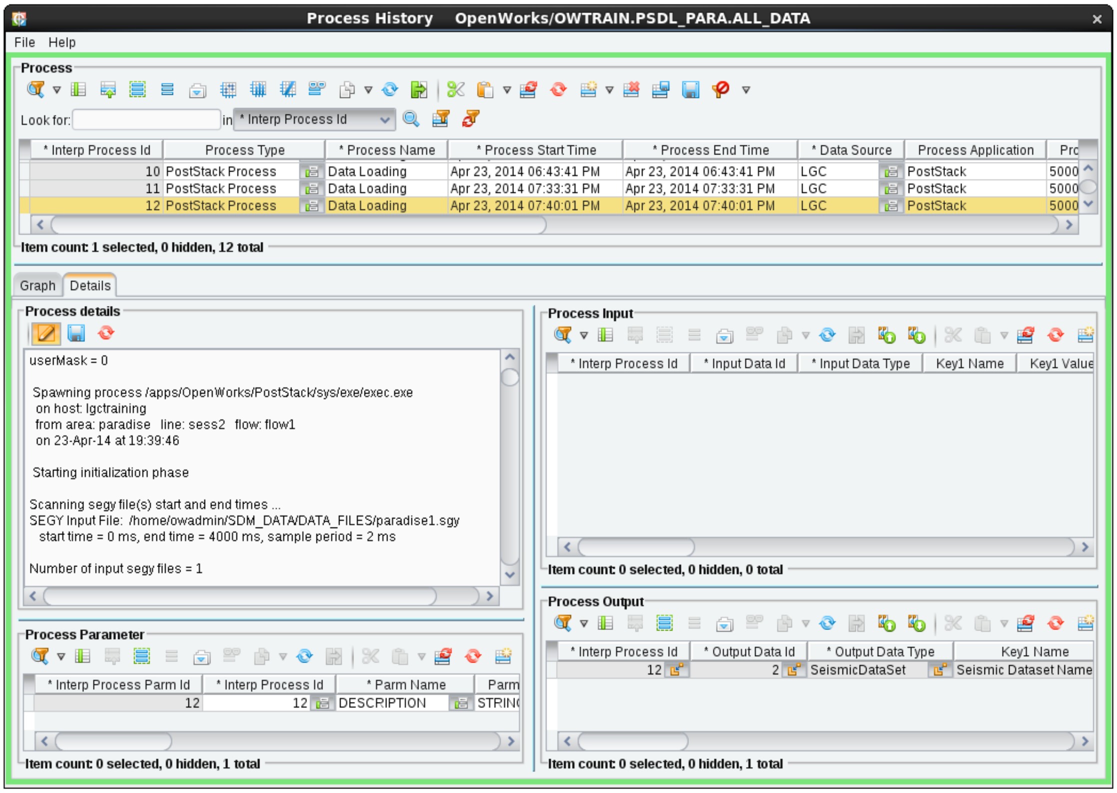
- In the Job Log window in PostStack (icon  or **Job > View**)



- In a file you can view in an xterm (`more job.output`)

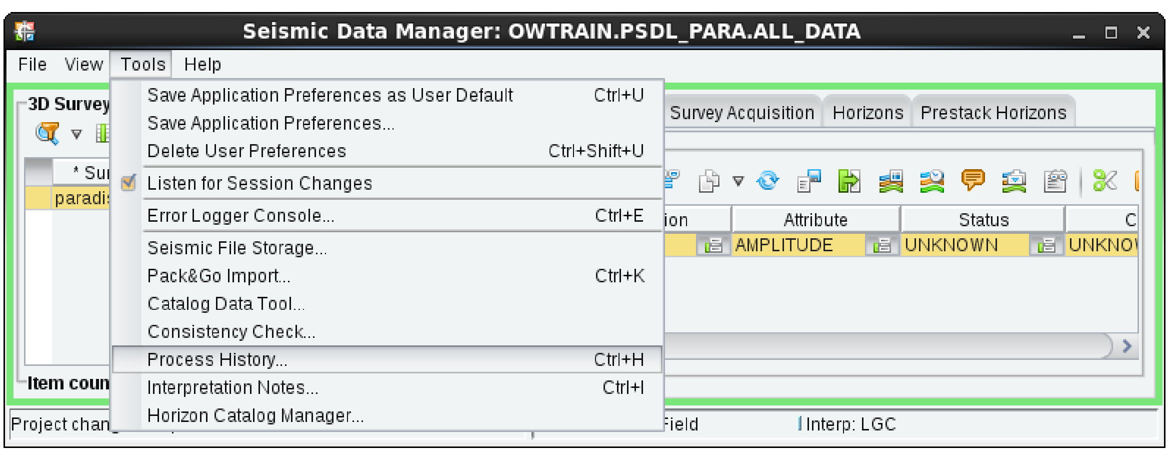


- If the PostStack job completes, the job log is permanently stored in the database and can be viewed in Seismic Data Manager (**Tools** > **Process History** > **Details** tab)



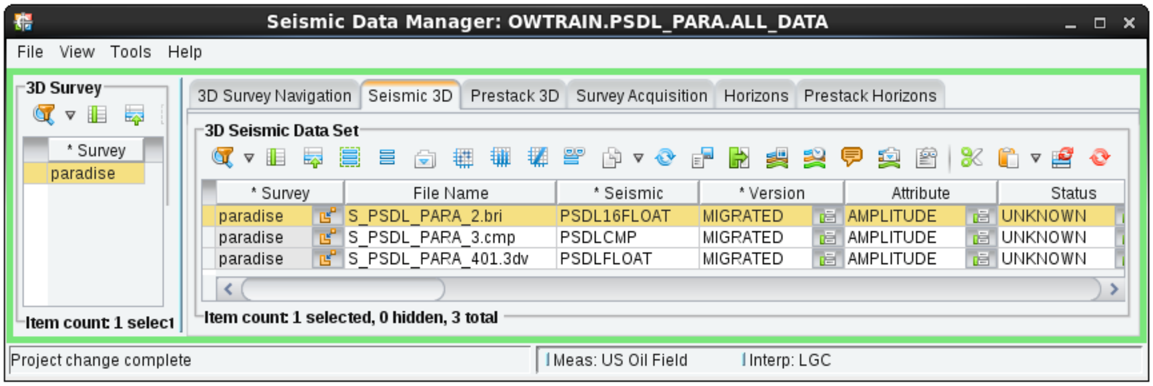
To access the process history, either:

- Select Process History from the dropdown menu, then select the dataset you want view from the process list



or

- Highlight a dataset and click the Show process history icon ()



The advantage to using the icon is that you only see the process history for the highlighted dataset.

Overview of SEG Y Data Import

SEG Y Data Import is a utility for loading the following data from disk:

- 2D and 3D navigation data
- 2D and 3D SEG-Y data
- 2D and 3D SEG-Y VSP data
- Prestack 3D SEG-Y, Prestack 3D ProMax and Prestack 3D JavaSeis data

Into .2v2_glb format for 2D data or brick (.bri), compressed (.cmp) and vertical (.3dv) format for 3D data.

Limits:

- Input data must be on disk (no tape input)
- No Process History saved

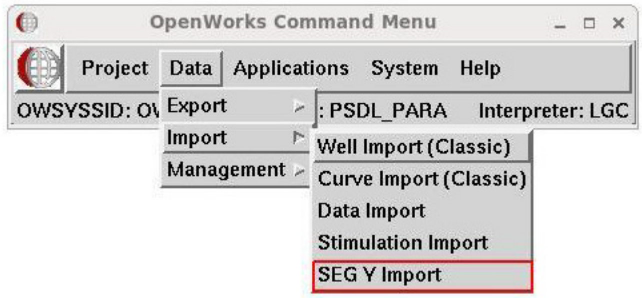
Advantages:

- SEG Y Data Import can be used in both Linux and Windows systems
- Creates a 3D survey, analyzes SEG-Y data and loads the data from one utility

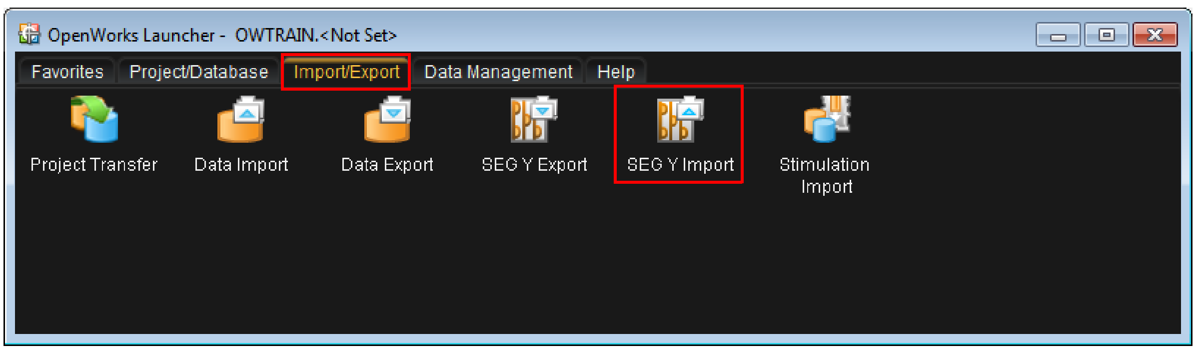
The following OpenWorks session parameters must be set in order to use SEG Y Import Tool:

- OpenWorks project
- Measurement system
- Session Interpreter

For Linux systems, this utility is launched from the OpenWorks Command Menu by selecting **Data > Import > SEG Y Import**.



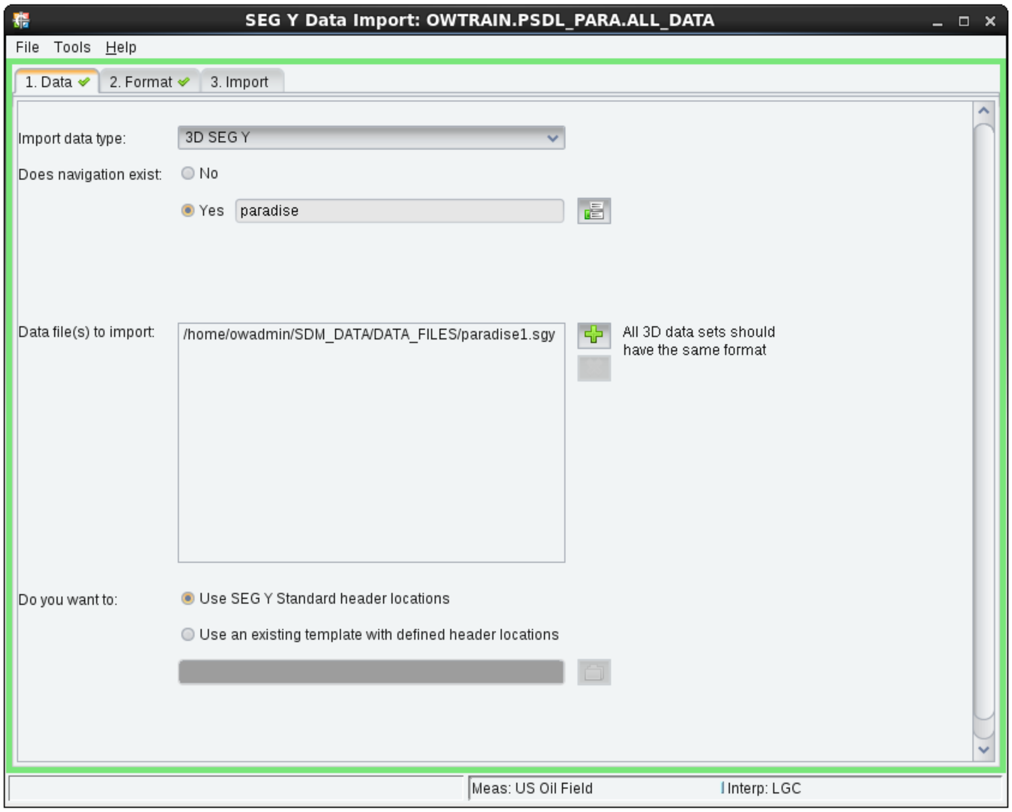
For Windows systems, launch the utility by selecting **Programs > Landmark > OpenWorks > Data Import > SEG Y Import**.



The SEG Y Import is composed of three main tabs: Data, Format, and Import. In certain cases, another tab, Navigation will also be available.

- Data—The Data tab is composed of sections. Address each of the following:

- Data Type: Select the data type to be imported



- Navigation: Indicate whether the navigation data already exists in the OpenWorks Project, or whether it will be loaded

- Data Files: Select one or more data files containing the data to import

- Template: Indicate the file that defines the location of the header information and the format values

When you have completed the selections for the tab, a green check ( ) will appear in the label of the tab, and you can then proceed to the next tab.

- Format - The Format tab allows you to:

  - Review the SEG Y binary, textual, and trace headers.

  - If not SEG Y Revision 1 standard, modify the locations of the headers. The modifications can be saved as a template for current

The tab has three basic tasks:

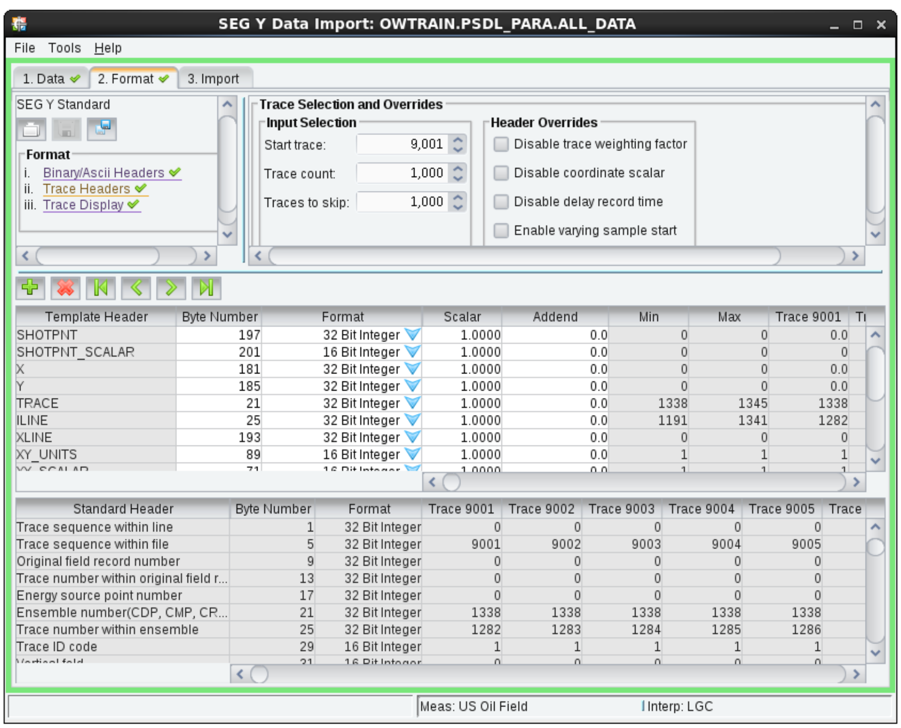
- Verify the Binary/ASCII Headers
- Verify the Trace Headers
- Verify the Trace Display

If the header mappings fit the SEG Y Revision 1 standard, or if they fit a template, you can just select through the three steps, and proceed to the next tab, depending on your data, the Navigation tab or the Import tab.

After reviewing the binary, ASCII, trace headers, and seismic display, the Navigation or Import tab becomes active. Any modifications to the header overrides and to scaling will carry forward to the Import tab. Any modification to the headers and formats will be applied to the imported SEG Y data.

Note

If 2D SEGY was selected as input, Analyzer is listed in the SEGY Standard group box.

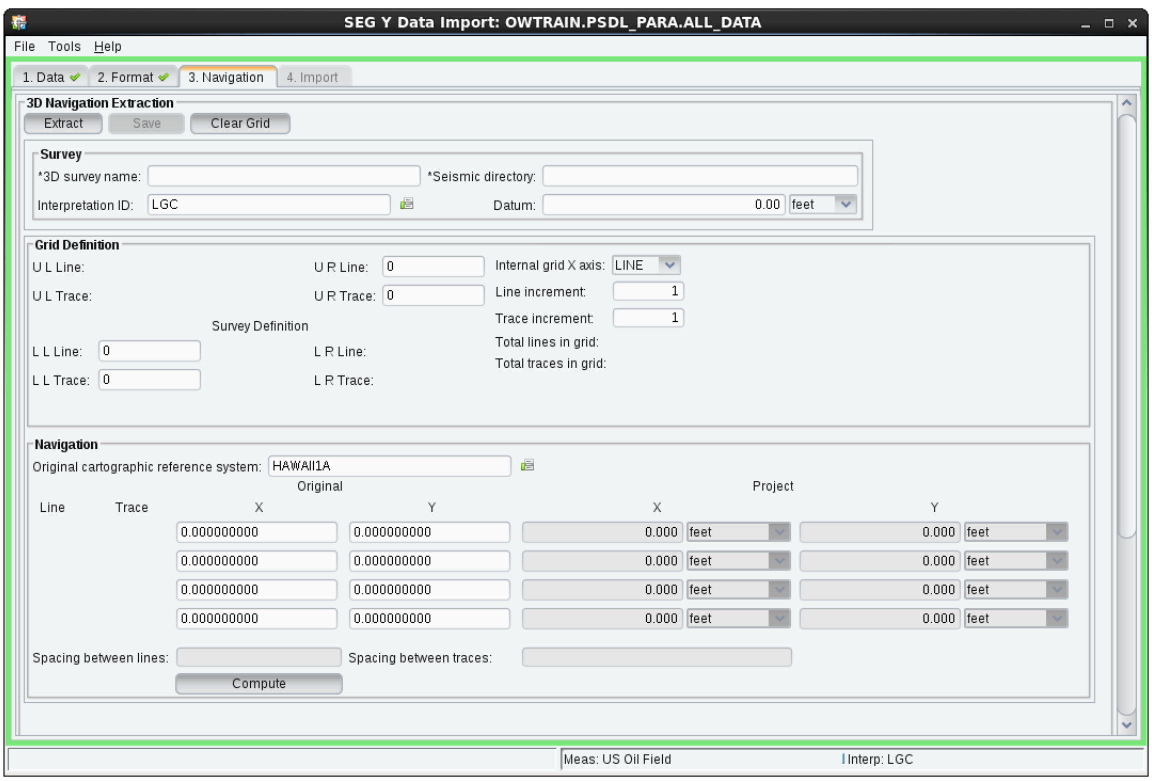


- Navigation — This tab appears in SEG Y Data Import when you select No in the Does Navigation Exist section of the Data tab. The Navigation tab becomes active after you have completed both the Data and Format tab. A green check mark ( ) appears in the tab label when it is complete.

The Navigation tab provides some similar functionality to that found in Seismic Data Manager. Depending on whether you chose the 2D SEG Y or 3D SEG Y data type, the Navigation tab will have different settings.

- 2D Navigation Settings: Allows you to extract the 2D line navigation information from the SEG Y file and create the 2D line with navigation in an OpenWorks project.

- 3D Navigation Settings: Allows you to enter the grid corner points and coordinates of a 3D survey and save them to an OpenWorks project.



- Import — After the SEG Y format and header locations of the data files have been reviewed and reconciled with the SEG Y Revision 1 standard or a template, and if required, after the navigation data has been extracted from the SEG Y data and loaded to the project, the Import tab becomes active. When the SEG Y data is imported into an OpenWorks project, the data is put into files of a Landmark format: for 2D data, the 2v2 vertical file format; and for 3D data, the brick (bri), compressed (cmp), and vertical (3dv) formats. The files are then stored in subdirectory of a directory determined by the configuration of dir.dat Configuration File.

When the data is imported, the project in the database instance contains references to the seismic files in the Landmark format. The data in these files are then accessed in the DecisionSpace Geosciences and other Landmark applications through the references in the project.

The tab has six basic tasks:

- Import Parameters Section: Allows you set the Data Set Name, Version and 3D Survey.

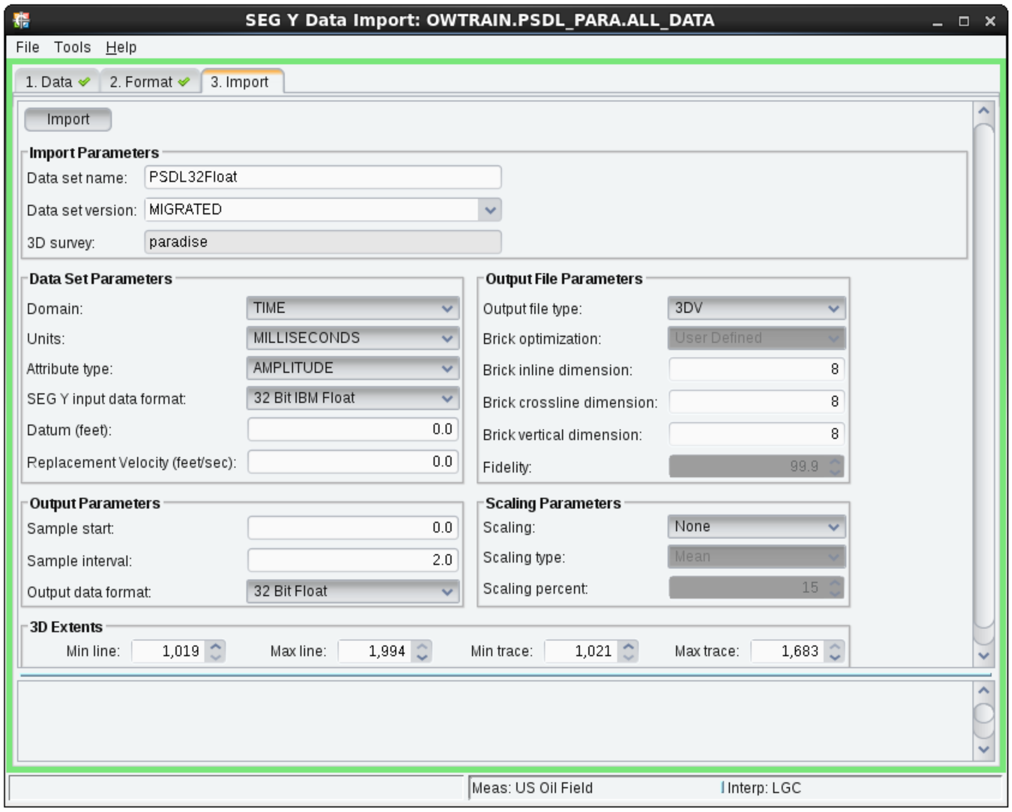
- Data Set Parameters Section: Allows you to change key SEG Y binary header values.

- Output Parameters Section: Allows you to set the sample start and sample interval extracted from the input file and set the possible data formats for the project file, these are based on the output file type selected in the Output File Parameters section.

- Output File Parameters Section: Allows you set the file types of the project data file as brick (bri extension), 3DV (3dv extension), compressed (cmp extension) or Indexed SEG-Y. Depending on your selection in the Output File Type drop-down list, a set of the parameters in the Output File Parameters section and parameters in other sections are enabled or disabled.

- Scaling Parameters Section: Allows you to set the parameters in this group to be the same as the ones that were set in the Scaling section of the Format tab.

- 3D Extents: Allows you limit the 3D extents.



Chapter **4**

Loading 3D Data

Loading 3D data includes loading grid and coordinate information (navigation data), evaluating SEG-Y data, and then loading the SEG-Y data into a Landmark format. In this chapter, you will work through several data loading examples and learn to work through commonly encountered data loading scenarios.

Detailed exercises follow the description of each data loading task. In addition, you will have the opportunity to improve your skills by loading several sets of data during self-paced exercises.

Overview

In this chapter, you will learn about:

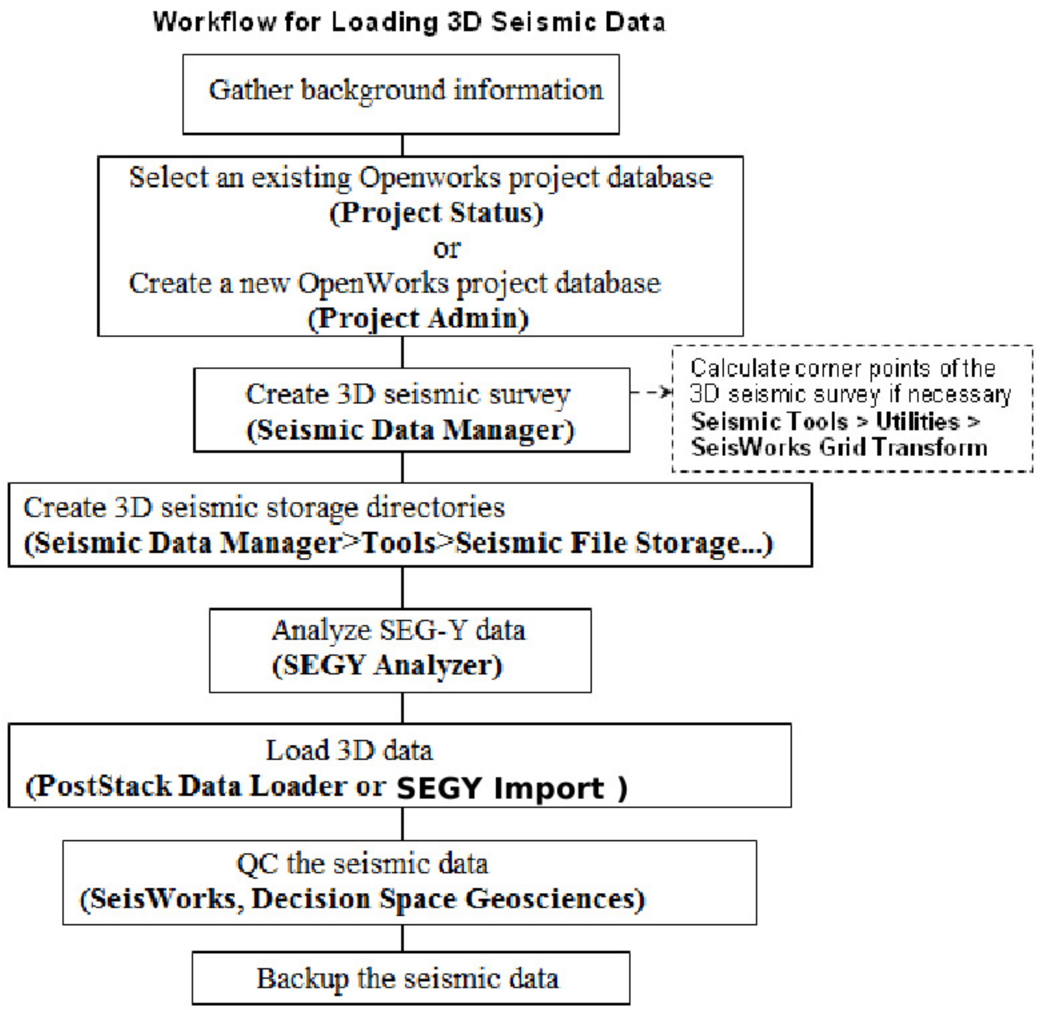
- OpenWorks® software projects
- Creating a 3D seismic navigation survey in the OpenWorks software
- Defining seismic storage directories
- Analyzing SEG-Y data using the SEGY Analyzer utility
- Loading 3D seismic trace data with PostStack™ software Data Loader
- Loading 3D seismic trace data with SEG Y Data Import

In addition, there are optional workshops for practice that illustrate some options for loading 3D data:

- Workshop 1: PSDL—Loading a Compressed Volume into the paradise survey
- Workshop 2: PSDL—Complete 3D Workflow, including navigation definition
- Workshop 3: PostStack/SEG Y Data Import—Challenge Load

Workflow for Loading 3D Seismic Data

The diagram below is a simplified workflow for general 3D data loading into Landmark formats.



Project Organization Overview

All interpretation using Landmark software is performed with projects. There are two types of OpenWorks projects: **project databases** and **interpretation projects**.

Before interpretation can begin, an OpenWorks project database must be created and appropriate data loaded. Interpretation projects, or customized views of the project database, are then created by selecting all or part of the data associated with the project database, allowing the interpreter to access only the data that is pertinent for his/her work.

Project Database

A project database is a grouping of data in an OpenWorks instance. Most Landmark applications and utilities access the data in an OpenWorks instance by referring to a project.

When creating a project database, you specify:

- Database server to use for storing the project data (if you have access to multiple databases) and associated district
- Cartographic reference system (CRS) to use for storing map coordinates in the database
- Default units of measure
- Replacement velocity (velocity used in shifting time and depth values)
- Datum elevation
- Size of the project

These settings determine how the OpenWorks software will store the data, and they are **default settings** that all applications will use unless other settings are specified in the application. You can improve the accuracy and performance of a project by selecting a set of defaults that best matches the data that will be imported and created in the project.

Once a project database is created, data, such as well, curve, seismic navigation data, and seismic trace data may be loaded into the project. Once data is loaded into the project, interpretation projects may be created, allowing access to the specific data needed for a particular user, area, or workflow.

Interpretation Projects

Interpretation projects are working views of selected data in a project database.

An interpretation project allows a user to access any type of data relevant to the interpreter or purpose, but not necessarily all the data in the project database. As an interpretation project is only a view of the data and not a data store; there is **no data duplication** no matter how many interpretation projects are created within a project database.

When creating an interpretation project users must define:

- Interpretation project name
- Project database for data selection
- CRS—can be different than the project database
- Measurement system—inherited from the project database, cannot be changed
- Datum—can be different than the project database
- AOI (area of interest)
- Data selection—can select well data, 2D seismic data, and 3D seismic data

> **Note**
>
> When working in an interpretation project it will only be possible to create data on the wells or surveys included in the interpretation project.

- Auto-refresh rate—refers to how often lookup tables are updated to pick up alterations of displayed information stored in the project database, including newly loaded information.

Because the interpretation project is a view of the project database, it creates several lookup tables to reference the information it contains. These are static lists created when the interpretation project is made.

It is important to load seismic data into the project database in order to fully manage your seismic data in R5000. Data loaded into the project database becomes a part of the project database and is potentially available to any interpretation project in the project database.

However, some data created in the interpretation project are only available in the interpretation project, such as lists of data (such as fault, grid, horizon, well, and seismic lists) and interpretation sets (references to other project data). To get a complete list, refer to **OpenWorks Online Help > Project Management > Project Administration > Managing Interpretation Projects > Data in Interpretation Projects** from the OpenWorks main menu.

When an interpretation project is deleted, only these types of data are deleted, but the geological, geophysical, and reference data loaded into the project database or created in the interpretation project remains. When a project database is deleted, all of its data, including interpretation projects are deleted.

It is important to note that interpretation projects should be considered an evolving entity. The data associated with them can be changed at any point by using **Project > Project Admin** from the OpenWorks main menu; **Project > Interpretation Project > Modify** from the Project administration menu.

Gathering Background Information

3D Data Loading Task List

- *Gather background information*
- *Create/Select an OpenWorks project database*
- *Create 3D seismic survey*
- *Create seismic storage directories*
- *Check base map (compare SeisWorks® software Map View to Horizon Image Map)*
- *Analyze SEG-Y data*
- *Load Data*
- *Check data load (view seismic in appropriate application)*
- *Backup*

You must know certain facts about your 3D survey before you can begin the data loading process. Information that you need to know include:

- x and y coordinates for four corners of your survey
- line (inline) and trace (crossline) increments
- line and trace spacing
- most appropriate CRS (cartographic reference system) for your project

Possible sources of this required information include:

- information from the processor that was provided with the survey
- a detailed base map of the 3D survey
- information found on the SEG-Y tape

An example of a 3D survey form with spaces for all of the necessary information can be found on the next page. Many companies use formats similar to this one. Completing this form before beginning the data loading process will help you load the data accurately and efficiently.

Date: ____________________

Interpreter(s): ____

Project Name: ____

Area: ____

Blocks: ____

Cartographic Reference System ____

Project Measurement System ____

Upper Left Line = ______
Upper Left Trace = ______
X: ______________________
Y: ______________________

Upper Right Line = ______
Upper Right Trace = ______
X: ______________________
Y: ______________________

Lower Left Line = ______
Lower Left Trace = ______
X: ______________________
Y: ______________________

Lower Right Line = ______
Lower Right Trace = ______
X: ______________________
Y: ______________________

Line increment: _______
Trace increment: _______

Line spacing: ______ feet/meters
Trace spacing: ______ feet/meters

Zone of interest for timeslice generation: _____ ms to_____ ms (every ___ ms)
Zone of interest for scaling data: ____ ms to ____ms

Geophysicist: ______________________
Date: ______________________

The completed 3D survey specification form for the first 3D data load is shown on the next page.

Note that there are only three corners specified. Seismic Data Manager will compute the fourth corner for you if you only have three corners. If you don't have at least three corners, there is a grid transform utility (SeisWorks Grid Transform) in Seismic Tools that will compute all four corners if you have two coordinate location points along a single line and one other coordinate point from anywhere in the survey.

Projection: HAWAII1A
Datum: 0.0 feet
Spheroid:
Units: Feet

Upper Left Line = 1994
Upper Left Trace = 1021
X:
Y:

Upper Right Line = 1994
Upper Right Trace = 1683
X: 305422.93
Y: 1342131.64

Extra Point; Line = 1600
Extra Point; Trace = 1298
X: 261435.30
Y: 1300480.38

Lower Left Line = 1019
Lower Left Trace = 1021
X: 228513.44
Y: 1237806.39

Lower Right Line = 1019
Lower Right Trace =1683
X: 301249.24
Y: 1234950.45

Line increment: 1
Trace increment: 1

Line spacing: 110 feet
Trace spacing: 110 feet

Zone of interest for timeslice generation: 1000 ms to 3000 ms (every 100 ms)
Zone of interest for scaling data: 500 ms to 3000 ms

Geophysicist: D. J. Oil
Date: 7/12/99

Selecting or Creating an OpenWorks Software Project

3D Data Loading Task List

- *Gather background information*
- *Create/Select an OpenWorks project database*
- *Create 3D seismic survey*
- *Create seismic storage directories*
- *Check base map (compare SeisWorks Map View to Horizon Image Map)*
- *Analyze SEG-Y data*
- *Load Data*
- *Check data load (view seismic in appropriate application)*
- *Backup*

After you complete the data loading form, the next step is to select or create an OpenWorks project to be associated with your 3D data. There are several factors to consider in making this decision:

- Does an existing database cover the same area? Do you want to use the well and/or fault information in that database?

- Will you be interpreting with other 3D or 2D surveys in the area? If so, all surveys will need to share the same OpenWorks project database.

- Is this a stand-alone project? Will outside personnel be interpreting this survey? If so, you may wish to create an OpenWorks database just for this project.

- What CRS system should be used for the database? What CRS system is used to define the seismic coordinates?

In making this decision, you should consult with the person or group who handles your well data loading or OpenWorks system administration and with the project geoscientist(s).

The SeisWorks software requires a Cartographic Reference System (CRS) with x, y coordinates.

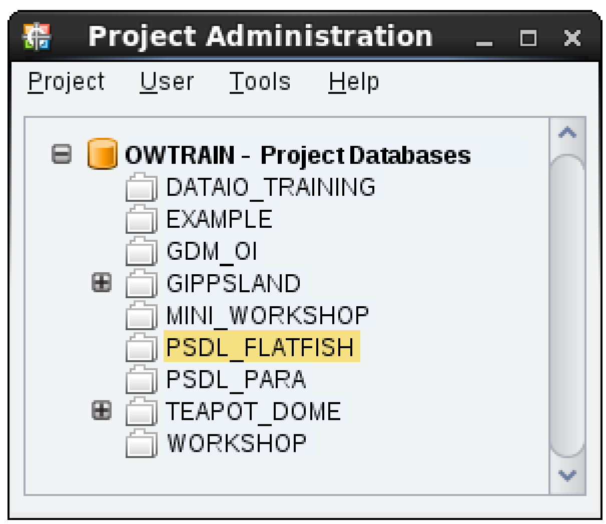
You must use an x, y projection coordinate system with the SeisWorks software. A projection system using latitude and longitude will not work with the SeisWorks software.

Seismic navigation data does not have to correspond to the OpenWorks CRS.

If the navigation data to be entered does not correspond to the OpenWorks project CRS, your data can be entered by specifying the CRS of the navigation data. The OpenWorks software maintains both the original data as loaded and converts the data to the OpenWorks project's cartographic system.

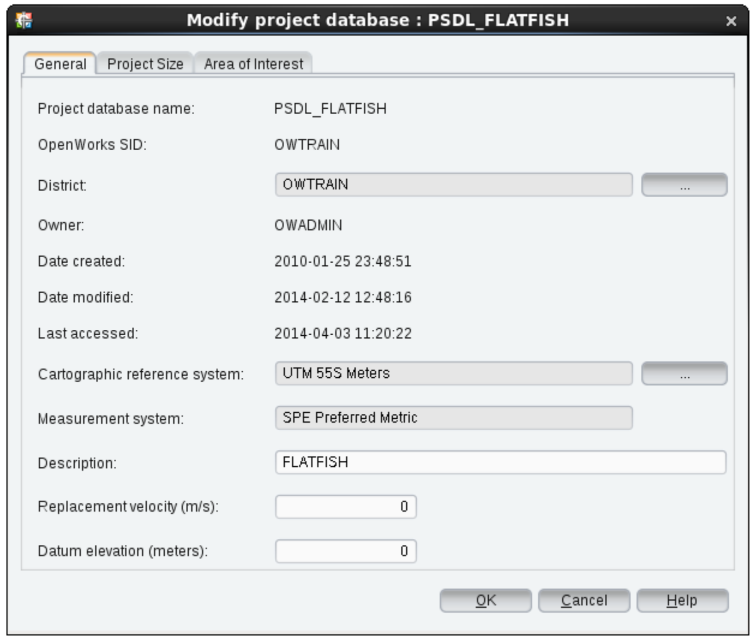
The original data can be in either a Projection or Geographic coordinate system. It is recommended that you first perform a conversion test using the Map Projection Editor.

There are several ways to find out information about an existing OpenWorks project. One way is through OpenWorks Project Administration. To open Project Administration, select **Project > Project Admin** from the OpenWorks Command Menu.

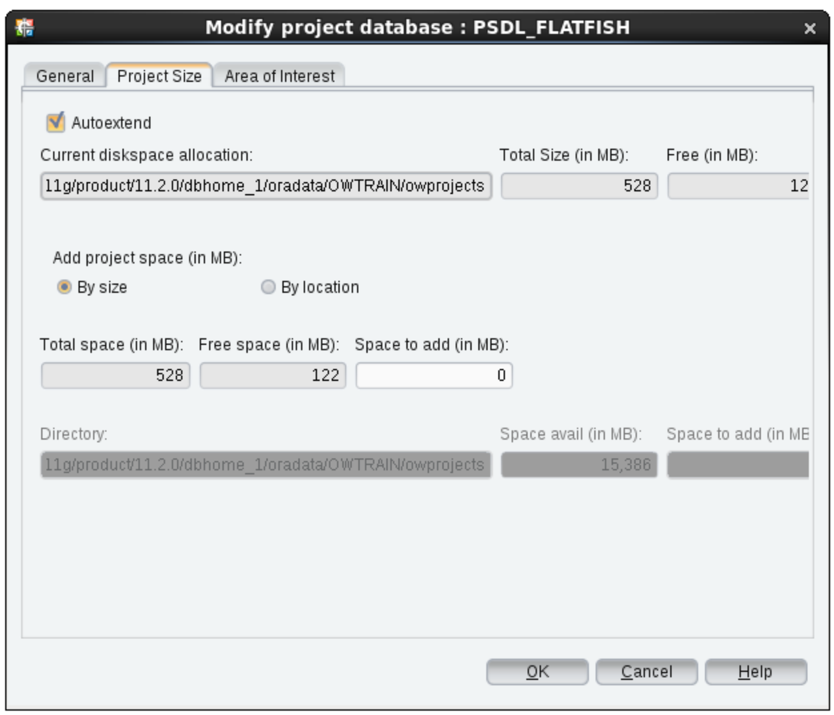


After selecting the project of interest, go to **Project > Project Database > Modify** or use **MB3 > Modify** (click MB3 on the highlighted project line).

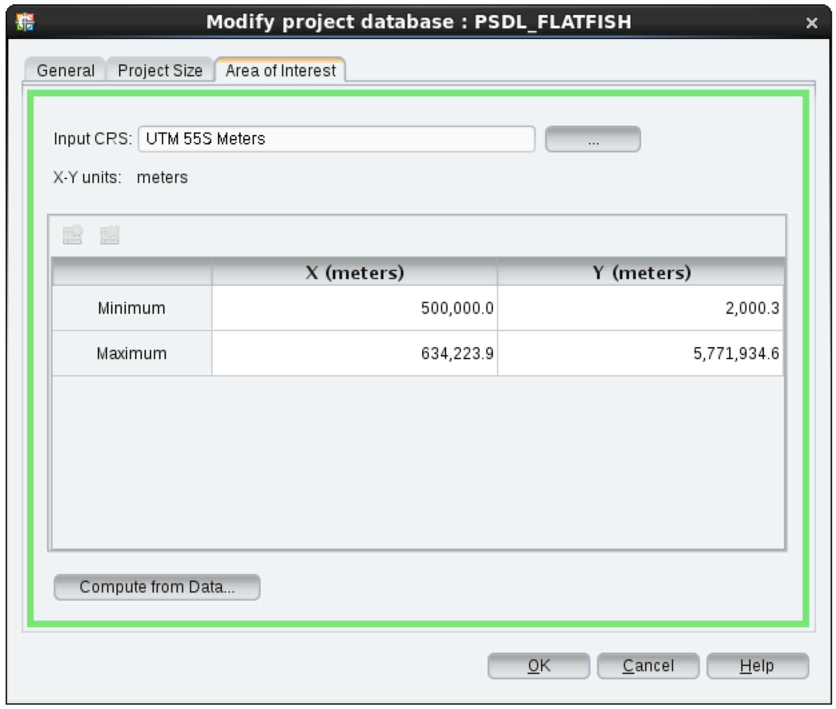
To see information such as the measurement system, cartographic reference system and project owner, click the **General** tab.



Click the **Project Size** tab to get information on the data files, the size of project.



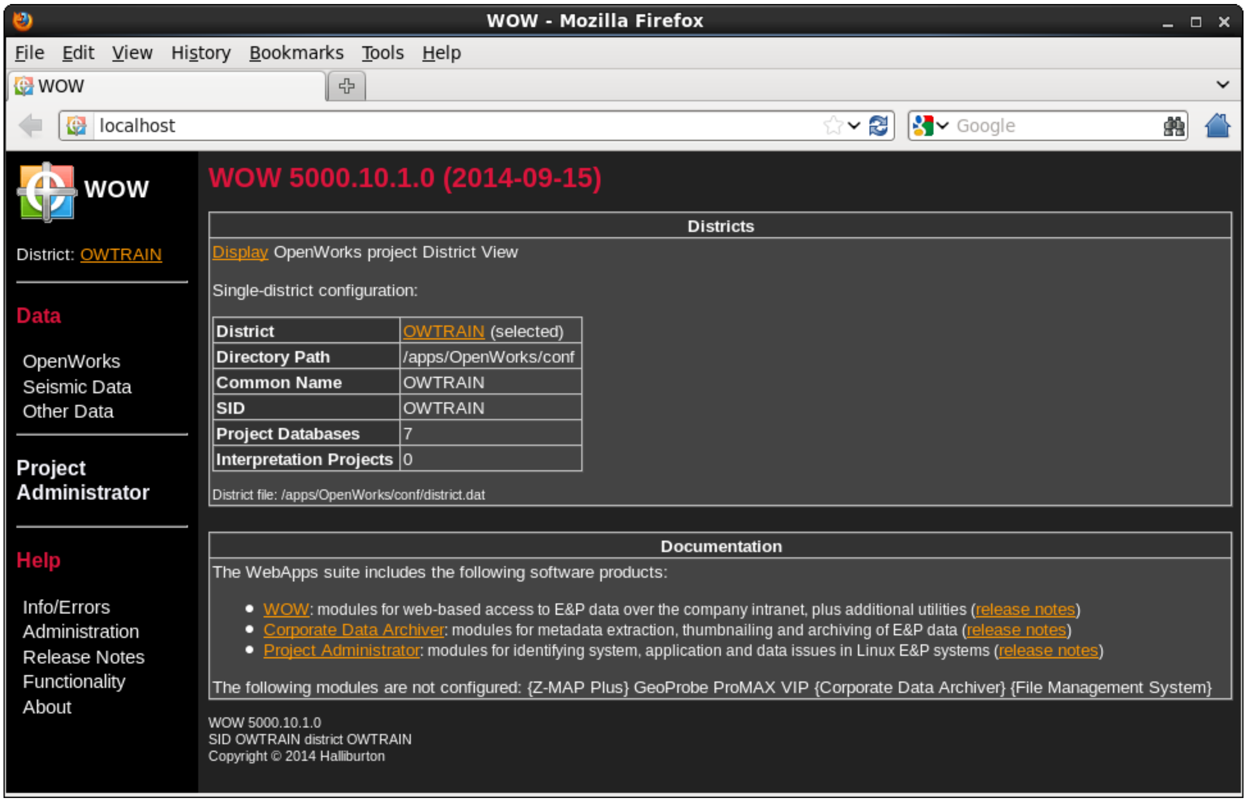
Click the **Area of Interest** tab to view coordinates for the extent of the project. If data are loaded outside the current coordinate range, the project area of interest coordinate range will expand to include all the data loaded.



You can also view OpenWorks projects in the Web OpenWorks software (WOW™ software). To do this open a web browser and type the following in the address bar:

```
http://<your machine name here>/
```

In the WOW window click OpenWorks in the sidebar on the left. A list of OpenWorks projects displays in the pane that opens next to the sidebar; click the project of interest. Summary information about the selected project displays.



For a step-by-step example of how to create an OpenWorks project, see Appendix D.

Exercise 1: Select an OpenWorks Software Project Database; Add and Set an OpenWorks Software Interpreter for the Selected Project

The first set of exercises use PSDL_PARA as the OpenWorks project database.

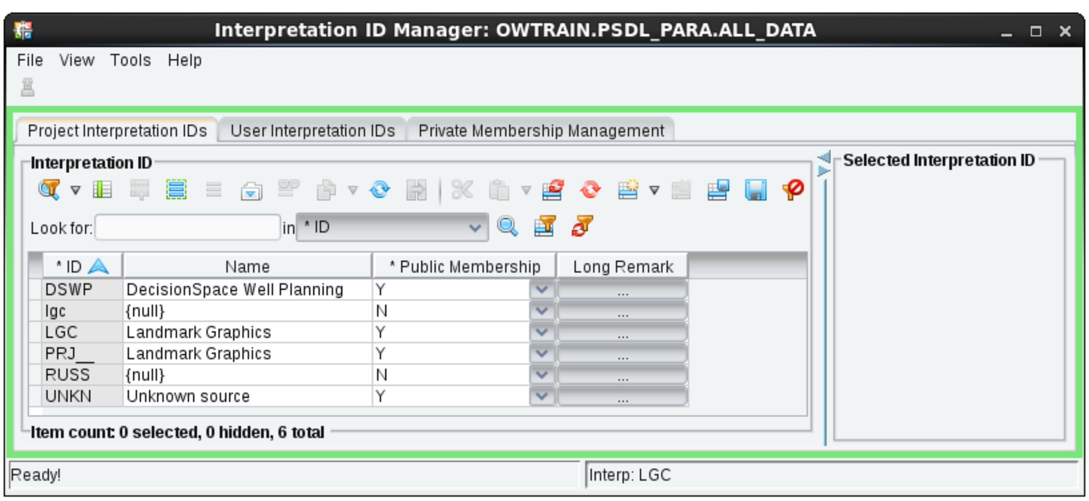
In this exercise you will set PSDL_PARA as your current OpenWorks project, create a unique Interpreter ID for that project, and set it as the session interpreter.

1. From the OpenWorks command menu, select Project > Project Status.

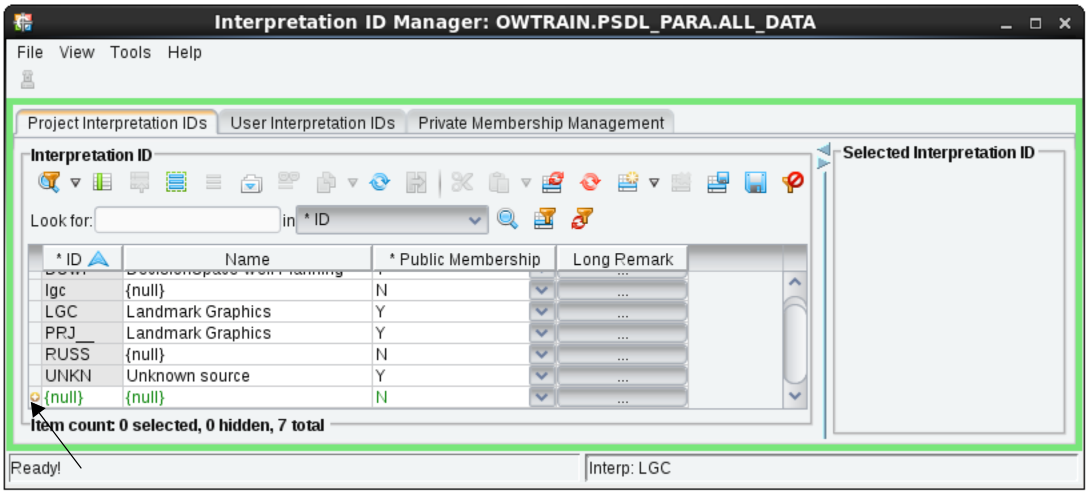
    - Select **OWTRAIN** as the district (if OWTRAIN is not listed, ask your instructor for the appropriate district).
    - Select **PSDL_PARA** as the OpenWorks project.
    - Select **US Oil Field** as the session measurement system.
    - Select **LGC** for the interpreter (an interpreter must be selected in order to enter Interpretation ID Manager to create an interpreter ID).
    - Close the Project Status window by selecting **File > Exit**.

2. Select **Project > Interpretation ID Manager** from the OpenWorks command menu.

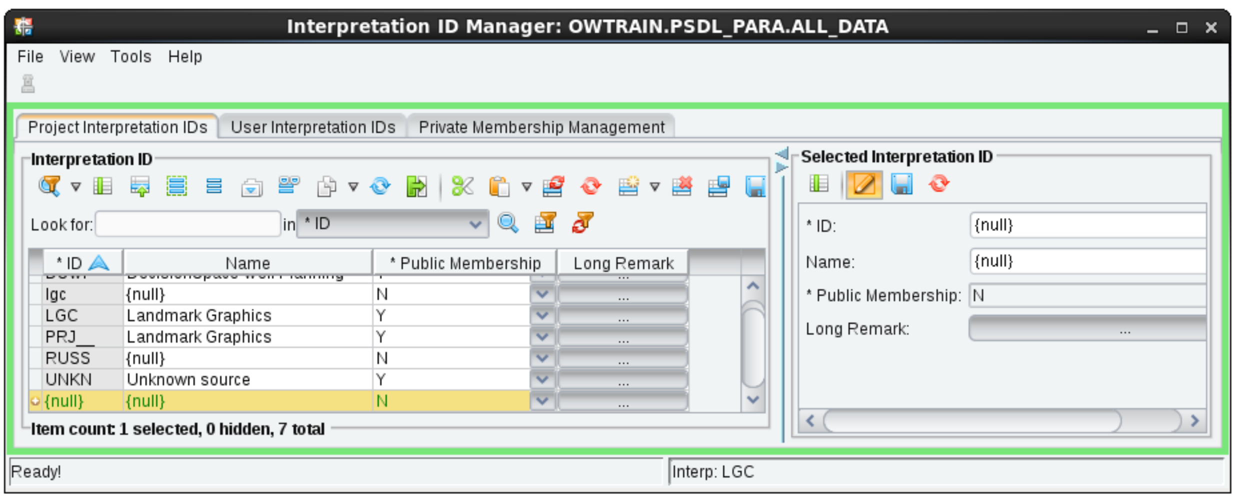
    The Interpretation ID Manager opens:



3. Click the **Add new Interpretation ID** icon ( ) and highlight the new line that appears in the Interpretation ID list (click the box at the beginning of the line) to add your ID to the list of project interpreters.



Definition parameters display in the Selected Interpretation ID pane.



4. In the Selected Interpretation ID pane type `<your initials>` in the ***ID** text box (use upper case letters), press the enter key on your keyboard, and let the ***Public Membership** default to **N**.

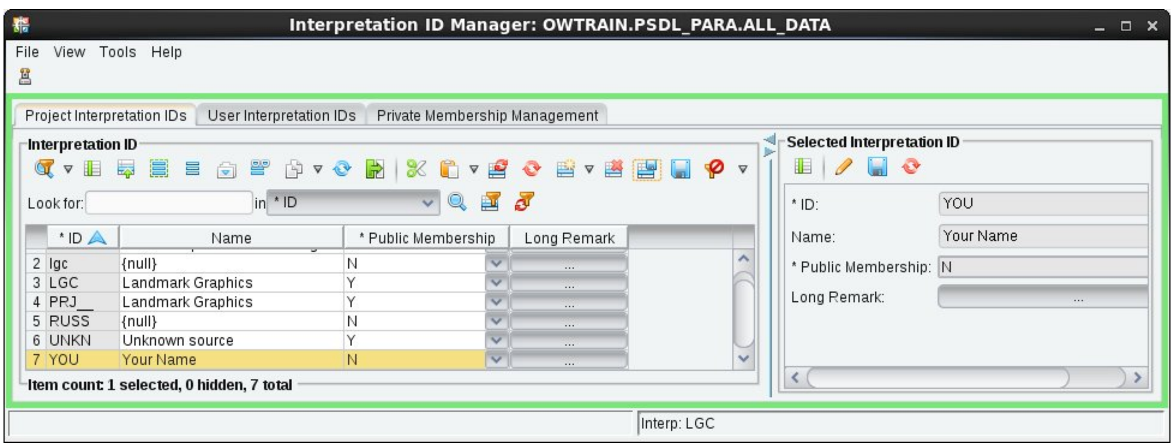
   This ID becomes your private ID associated with your user—no one else can use it.

Optional:

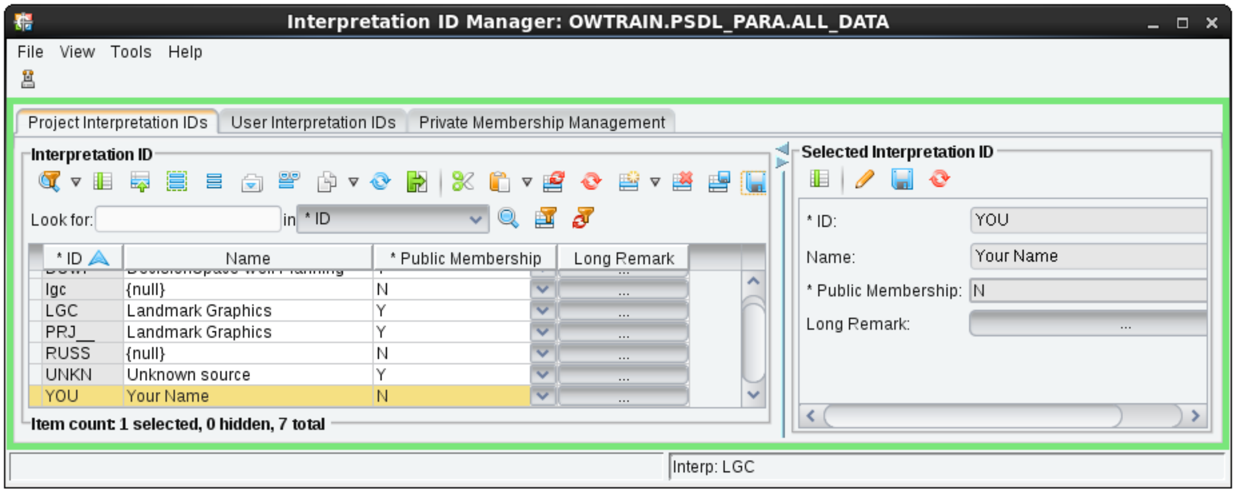
- Enter `<your name>` in the **Name:** box.

- Add a remark (any information you want associated with this interpreter ID for reference) by clicking the Long Remark ellipses button and typing desired information. Click **OK**.

5. Click the **Save selected rows** icon ( ) to add your ID to the PSDL_PARA project.



6. Click the **Set session interpretation ID** icon ( ) to set your new ID as the session interpreter.



7. Close the Interpretation ID Manager by selecting **File > Exit**.

The OpenWorks Command Menu should now list your current OpenWorks project and current session interpreter. Exercise 1 is completed and you are now correctly set up for Exercise 2.

Setting up a 3D Survey and Creating Seismic Storage Directories

3D Data Loading Task List

- *Gather background information*
- *Create/Select an OpenWorks project database*
- *Create 3D seismic survey*
- *Create seismic storage directories*
- *Check base map (compare SeisWorks Map View to Horizon Image Map)*
- *Analyze SEG-Y data*
- *Load Data*
- *Check data load (view seismic in appropriate application)*
- Backup

SeisWorks 3D seismic navigation information is stored in the OpenWorks software by survey. The information you need to define the survey includes:

- Survey name
- Datum
- Upper right line and trace number
- Lower left line and trace number
- Line and trace increment
- X axis (which controls the orientation of time slices and horizon image maps)
- x and y coordinates of the four corner points of the survey, and the CRS for these coordinates

There are additional categories of optional acquisition information that may be entered for a 3D survey:

- Nominal Seismic Geometry
- Seismic Receiver Information
- Seismic Source Information
- Seismic Streamer information
- Seismograph Information

Survey Name

Survey names can be up to 40 characters. Any combination of upper case or lower case letters, numbers, and spaces is acceptable.

Datum

Set to the seismic datum (depth at time 0). The survey datum may be updated after data has been loaded.

The OpenWorks software stores a datum elevation and a replacement velocity for each project (project databases and interpretation projects). The datum associated with a project is called the project datum.

The OpenWorks software also stores two other datum values (called the storage datum and the working datum) for some data types, including 2D and 3D seismic surveys. The storage datum is the datum under which the data were created. The working datum is the used when viewing the data in an application. If the working datum is not set, the OpenWorks software uses the project datum as the working datum.

Z-values associated with these data types are calculated in relation to a datum. The Z-values are calculated and stored in the database using the storage datum. When viewing the data, if a difference exists between the project datum and the storage datum, the software calculates the Z-values in relation to the working datum, automatically shifting the Z-values of the data.

For viewing data, Z-values in the time domain are shifted according to the following formula:

```
CorrectionAmount=((WorkingDatum - StorageDatum)/(ReplacementVelocity/1000)) * 2

WorkingZValue = StorageValue + CorrectionAmount
```

For viewing data, Z-values in the depth domain are usually shifted relative to sea level, or may be shifted according to the following formula:

```
CorrectionAmount = WorkingDatum - StorageDatum

WorkingZValue = StorageZValue + CorrectionAmount
```

Line and Trace Numbering and Increment

Refer to your 3D survey specification form or a detailed project base map for these values. This information may also be stored in the EBCDIC header records of the SEG-Y file. Caution: EBCDIC headers often contain incorrect information.

Defining the X Axis

The selection of the X Axis affects the SeisWorks software (time slice and horizon image map displays) and the GeoProbe® software. These displays are seismic data oriented displays. This means they are displayed squarely in the window.

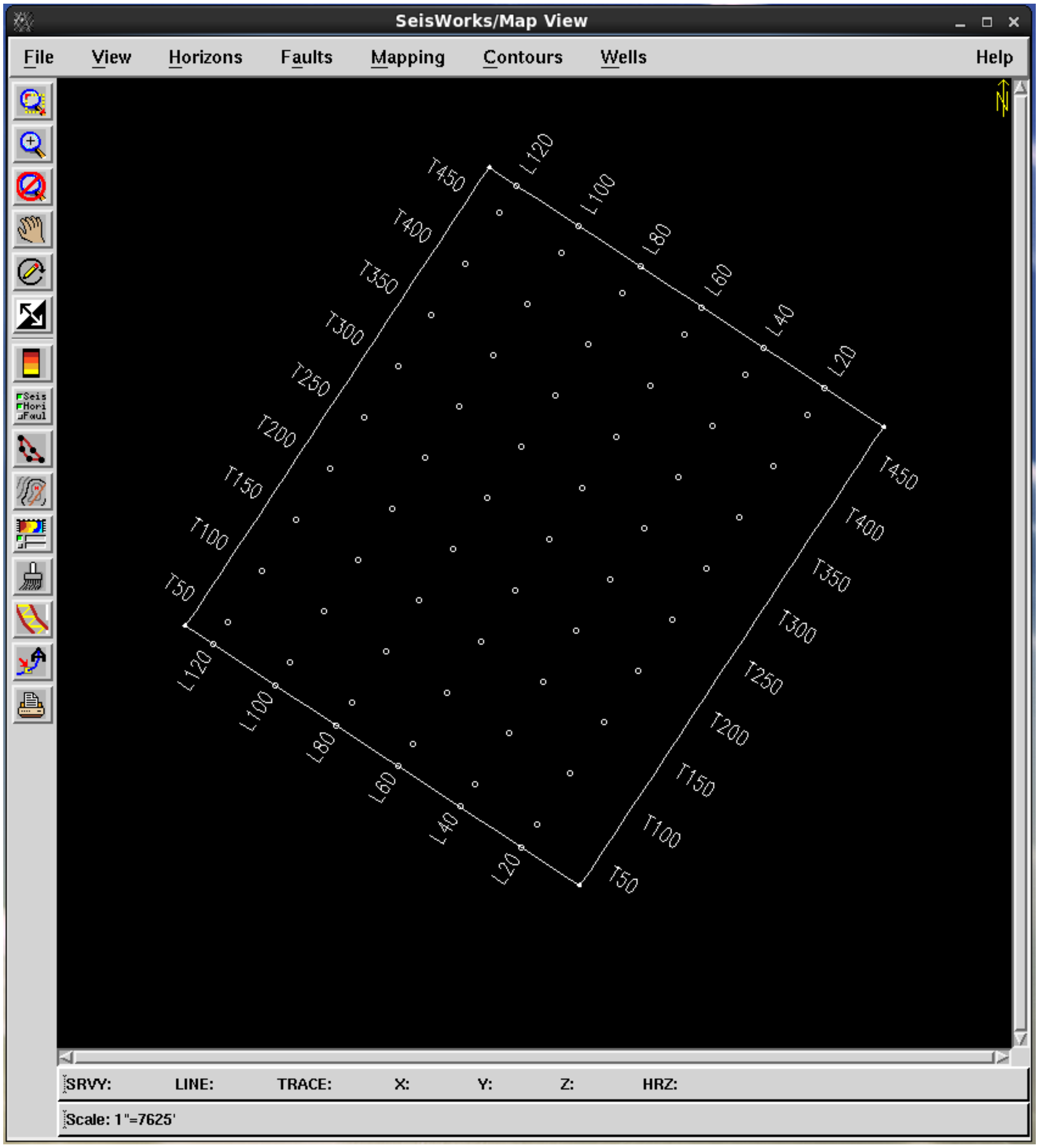
For surveys with lines running predominantly north/south, set the X Axis to Line. If your lines run predominantly east/west, set the X Axis to Trace.

When you select Line as the X Axis, time slices will display with lines running north/south (line numbers are changing along the X axis). When you select Trace as the X Axis, time slices will display with lines running east/west (trace numbers are changing along the X axis).

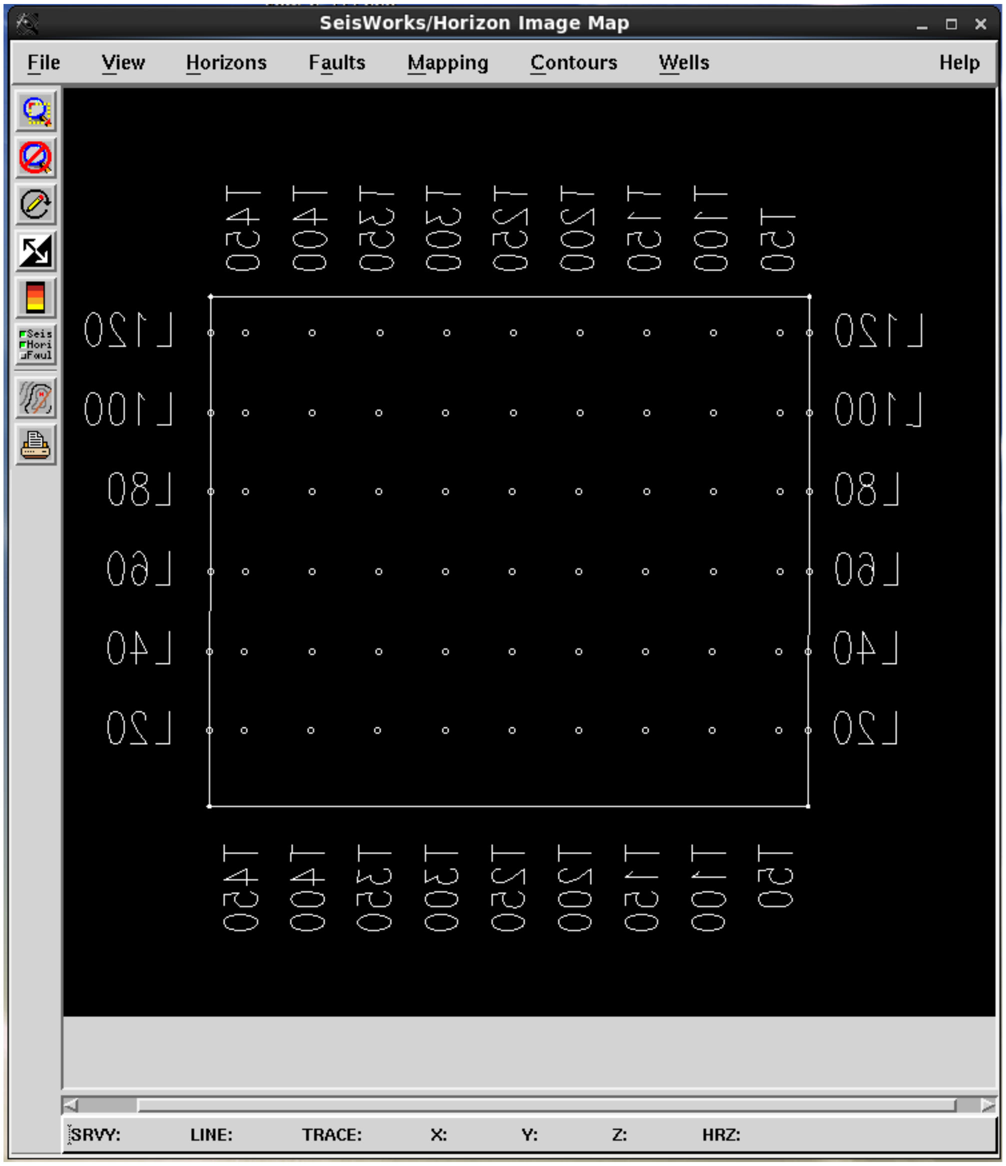
If you do not select the proper corner when defining your survey's lower left corner, your time slice and horizon image map displays will appear inverted. Use the SeisWorks software to compare Map View and Horizon Image Map for a quick check to see if the corners were selected correctly for the defined X Axis. If there is an error, the Horizon Image Map will appear flipped (annotation backwards). To fix this problem, go back and redefine the lower left corner or X Axis choice.

This example of a comparison between Map View and Horizon Image Map is what you might expect to see if you chose the wrong X axis for the LL and UR corners.

Map View:

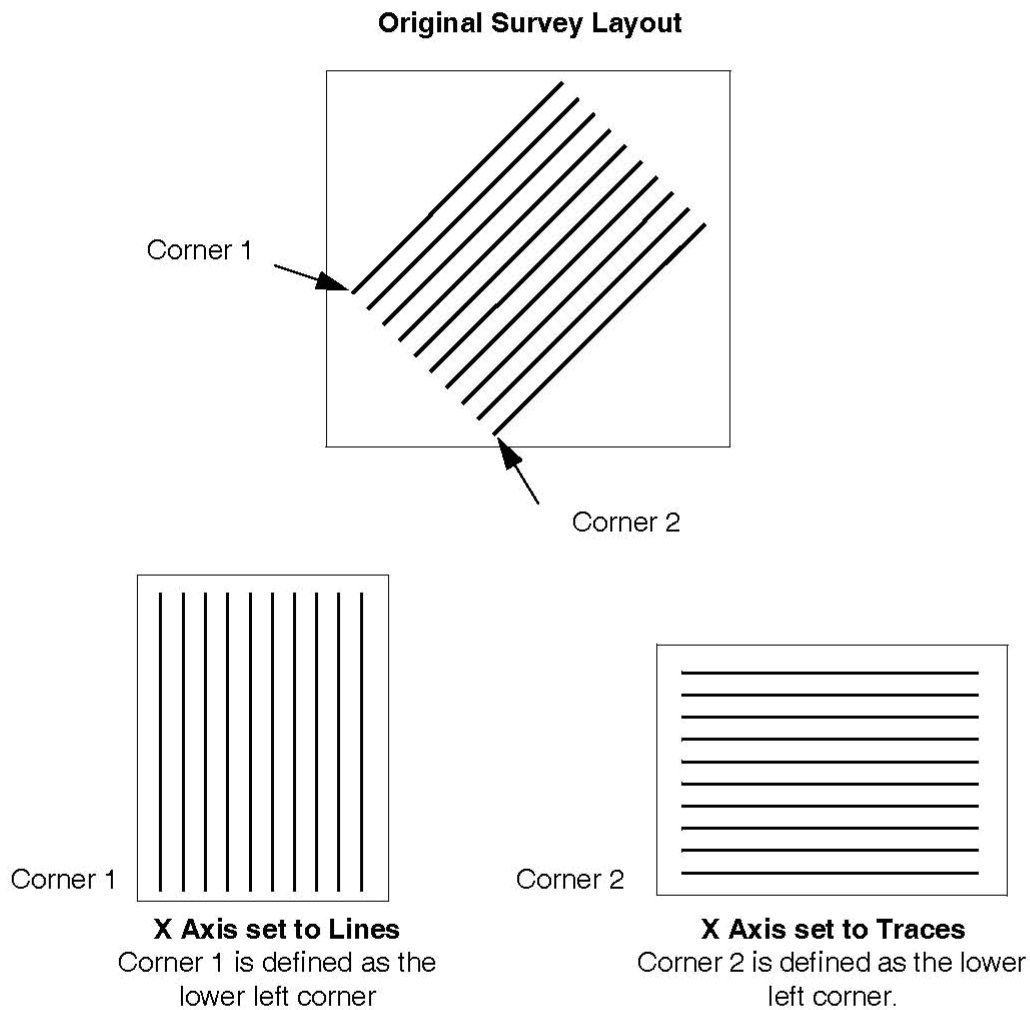

SeisWorks/Map View
File
View
Horizons
Faults
Mapping
Contours
Wells
Help
T450
L120
L100
L80
L60
L40
L20
T400
T350
T300
T250
T200
T150
T100
T50
SRVY:
LINE:
TRACE:
X:
Y:
Z:
HRZ:
Scale: 1"=7625'

Horizon Image Map:



In addition to the inverted numbers, the cursor tracking would not align (trace and line numbers would not match when dragging the cursor in one view and following it in the other).

For tilted surveys, you must choose one of the orientations.



In this example, you would set the X Axis to Lines if the sections that the interpreter is most interested in run SW-NE. Corner 1 would be used to define the lower left corner in this case. If the more interesting sections run NW-SE, you would set the X Axis to Traces, and Corner 2 would then be used as the lower left corner.

In general, it is best to check with the interpreter before deciding how to rotate a tilted survey.

X and Y Corner Coordinates

To define your 3D survey, you must have x and y coordinates for the four survey corners. If you only have three corners, Seismic Data Manager will compute the fourth corner.

If the corner points are not available, a grid transform utility accessed from Seismic Tools calculates corner points from three other know points in the survey (two points must be on the same line).

The best source for obtaining coordinate information is an accurate project specification form. Occasionally 3D seismic data contain x, y coordinates in the trace headers, but these values may be unreliable.

Exercise 2: Create a 3D Survey

In this exercise you will create a new 3D survey using Seismic Data Manager with the information provided on the survey specification sheet shown below.

Projection: HAWAII1A
Datum: 0.0 feet
Spheroid:
Units: Feet

Upper Left Line = 1994
Upper Left Trace = 1021
X:
Y:

Upper Right Line = 1994
Upper Right Trace = 1683
X: 305422.93
Y: 1342131.64

Extra Point; Line = 1600
Extra Point; Trace = 1298
X: 261435.30
Y: 1300480.38

Lower Left Line = 1019
Lower Left Trace = 1021
X: 228513.44
Y: 1237806.39

Lower Right Line = 1019
Lower Right Trace =1683
X: 301249.24
Y: 1234950.45

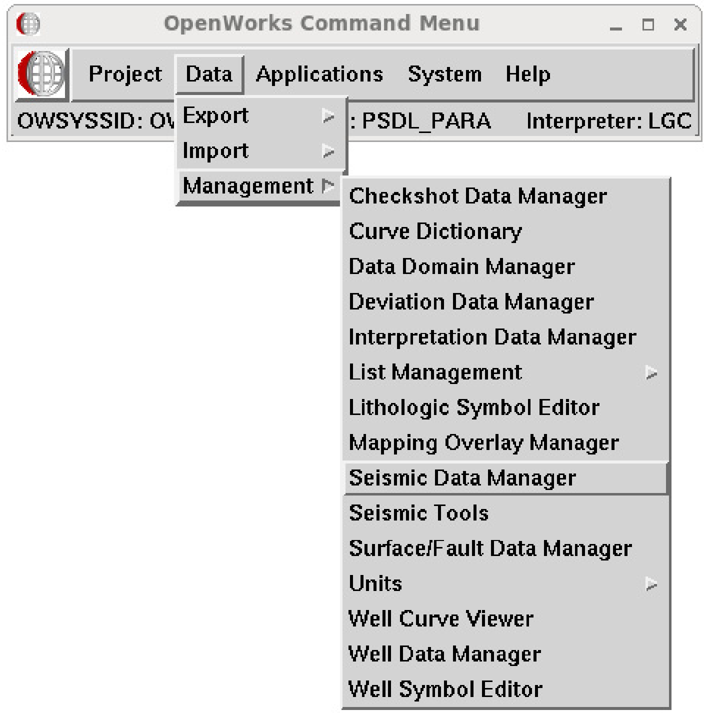
Line increment: 1
Trace increment: 1

Line spacing: 110 feet
Trace spacing: 110 feet

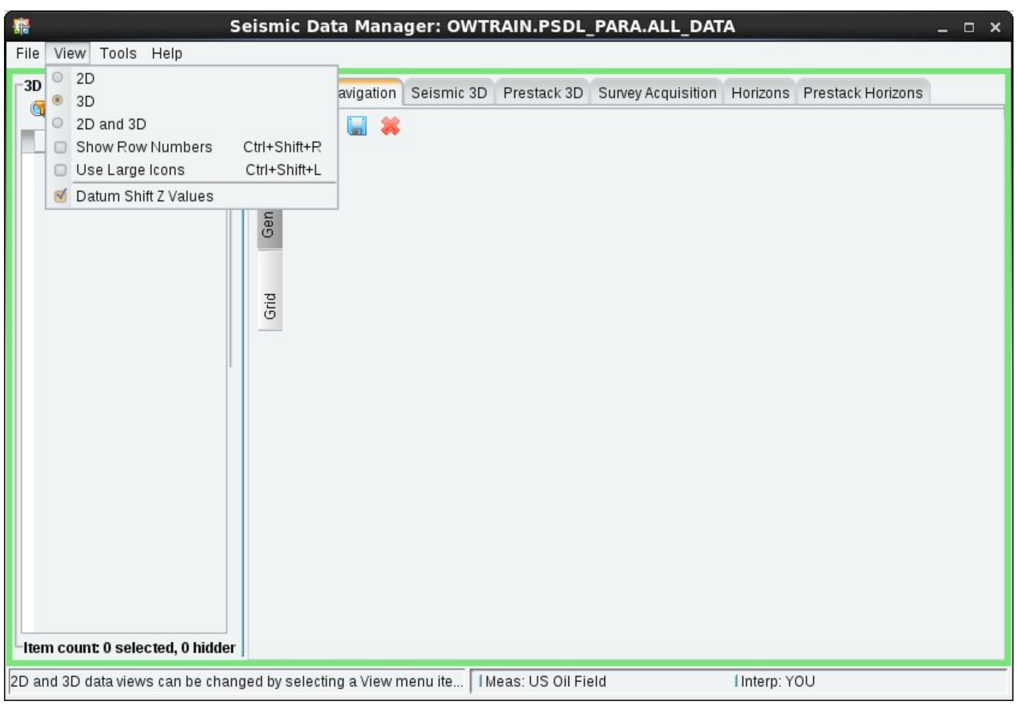
Zone of interest for timeslice generation: 1000 ms to 3000 ms (every 100 ms)
Zone of interest for scaling data: 500 ms to 3000 ms

Geophysicist: D. J. Oil
Date: 7/12/99

1. Select **Data** > **Management** > **Seismic Data Manager**.

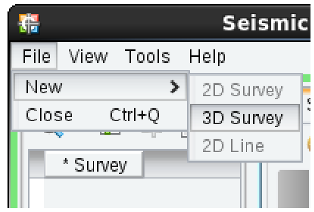


2. The Seismic Data Manager main window displays. The View defaults to 2D. To change to 3D, click **View** > **3D**.

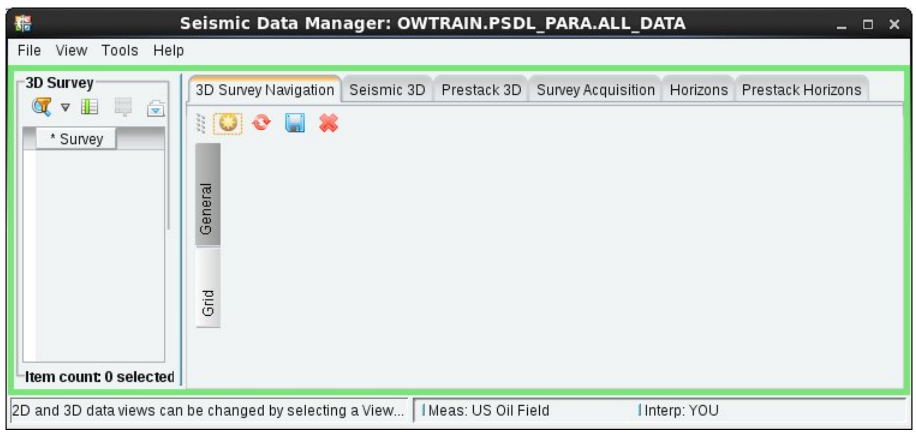


3. There are two ways to start the survey creation process—pick one of the following options to name the survey:

- Select **File > New > 3D Survey**.



- Click the **Create new survey** icon ( ).

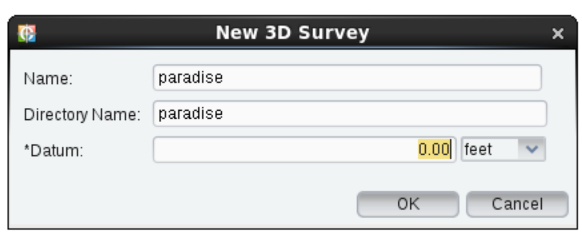


4. Complete the three fields required for the survey name:

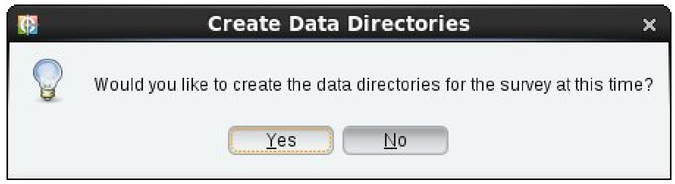
- **Name**: Supply the name for the 3D survey name. For this exercise, type **paradise**.

- **Directory Name**: Supply a name for the directory name where the seismic data volumes and 3D horizon interpretation must be stored for this survey. For this exercise, type paradise.

- **Datum**: Supply the datum under which the data was created and the unit type.

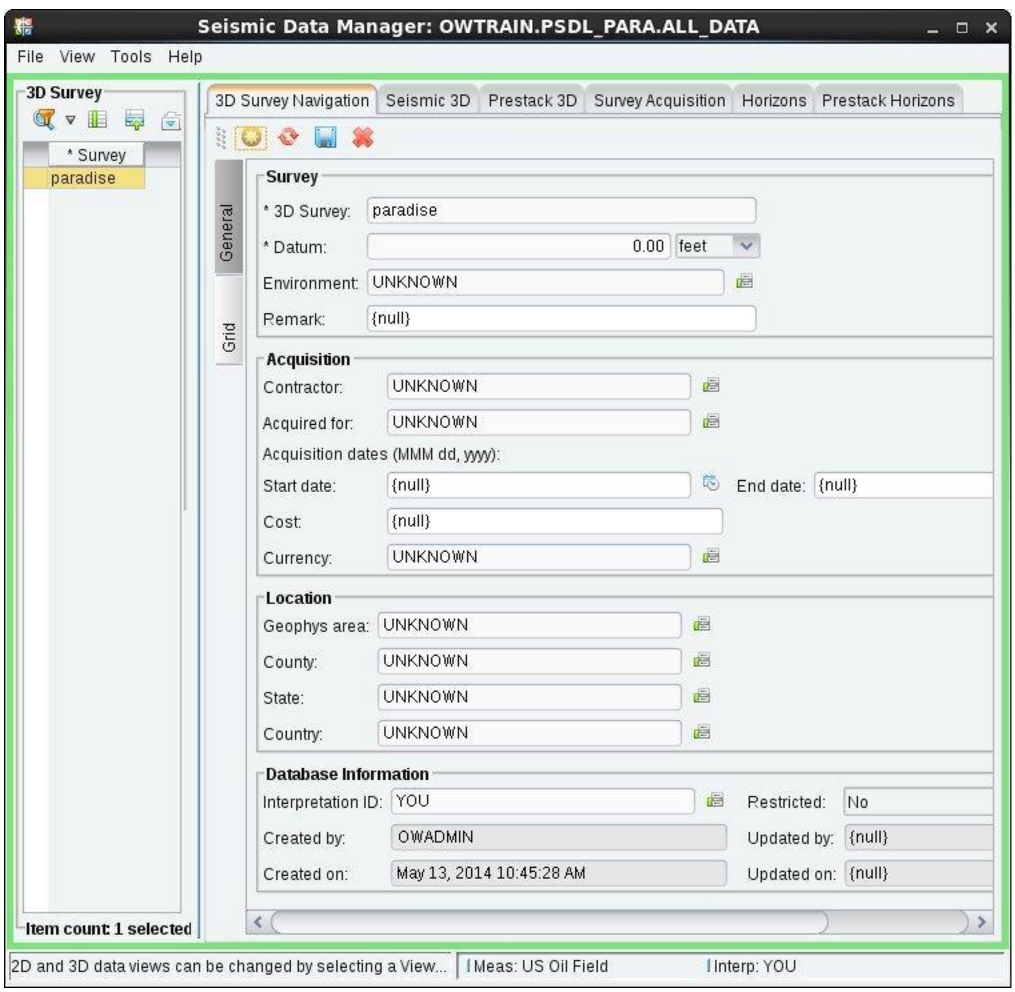


There are two options to create storage directories. The automatic way is to select ‘yes’ at this point. The other way is to select ‘no’ and use **Tools > Seismic File Storage** to create the directories later. This exercise uses the *select no* method and then details how to create then in the *Seismic File Storage* dialog box. Either method produces the same results.



5. Select **No**.

The new survey name is added to the Survey list in the Seismic Data Manager window, and should automatically be highlighted.



Seismic Data Manager displays several tabs at the top of the window. These tabs are used to view and manage seismic and horizon data associated with a particular survey.

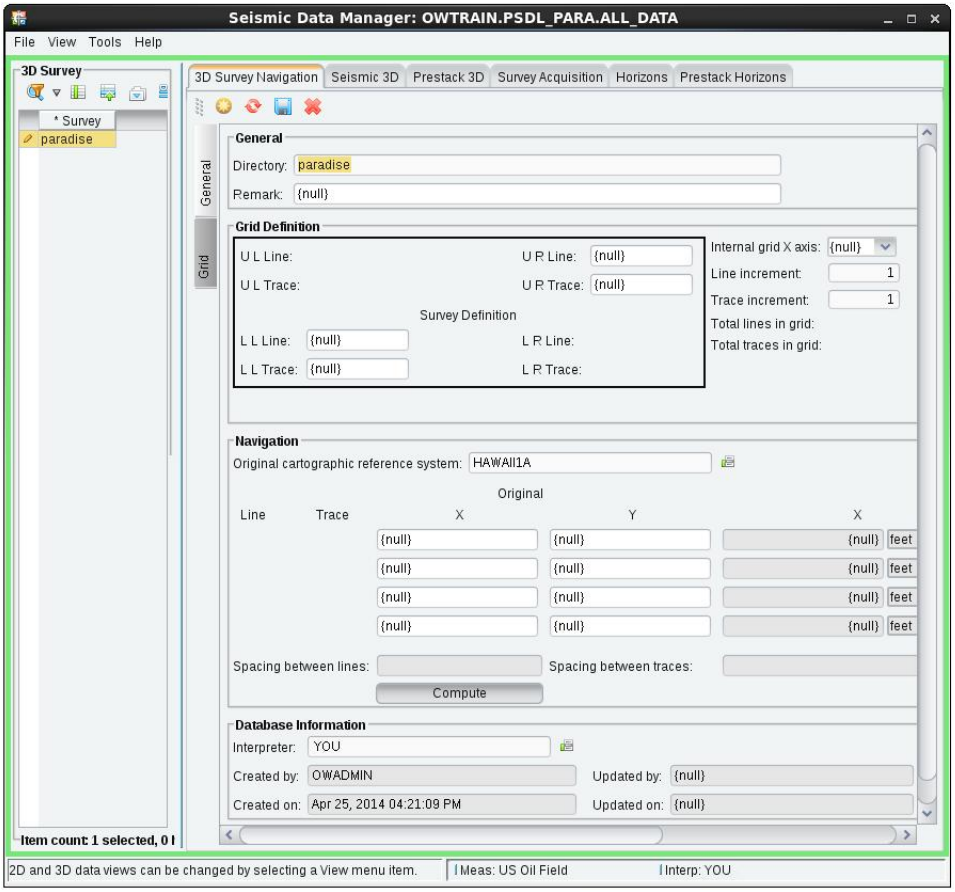
In the 3D Survey Navigation tab, there are two more tabs, General and Grid. The General tab displays optional details about the survey, acquisition and location. Information on this tab is optional and may be added if known.

6. Add the following detail in the Survey section:

- Click the Environment **List…** button
- Select **Land**.
- Click OK.

Use the scroll bar on the right of the frame to scroll to the bottom of the General Information box (or enlarge dialog box to see all the parameters). Notice that you can enter acquisition and location information for your survey. Database information (at the bottom of the General tab) displays who created the survey and if there have been any changes (updates) and the time creation/editing was done. This information automatically generated is useful for managing survey data. Let these parameters default for this exercise.

7. Click the **Grid** tab. The Grid Geometry window displays. For 3D data, navigation parameters are entered here.



The Grid tab is divided into four sections:

- General (directory and remark)
- Grid Definition (lower left and upper right corners and X Axis)
- Navigation (four corner coordinates of the survey and CRS that matches these coordinates)
- Database Information (survey creation and update information)

8. Enter the values for the Grid as shown in the table below. These values are determined from the information provided on the project specification sheet.

Corner	**Line**	**Trace**
Upper Right	1994	1683

Corner	Line	Trace
Lower Left	1019	1021
Increment	1	1

- Select the **Trace** to designate it as your X Axis.

The choice of corner and the X axis are important for the orientation of time slices and also for the GeoProbe software. In a following exercise, you will check that these values are correct using SeisWorks Map View and Horizon Image Map.

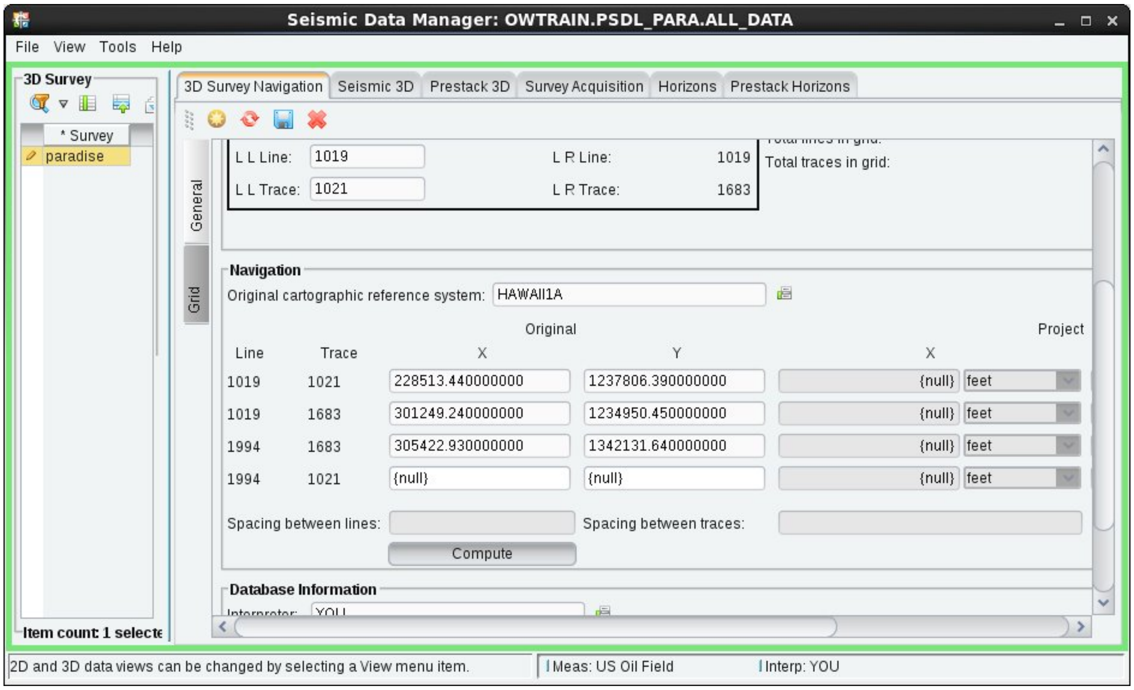
9. Use the scroll bar to see the entire Navigation section. Based on the survey information sheet, the CRS of the corner coordinates is HAWAII1A.

   By default bring the actual CRS used in the project, if you need to change the Original Cartographic Reference System to HAWAII1A:

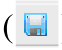
   - Click the **Popup pick list** icon ().
   - Select **HAWAII1A** from the Projected Coordinate Systems list.
   - Click **OK**.

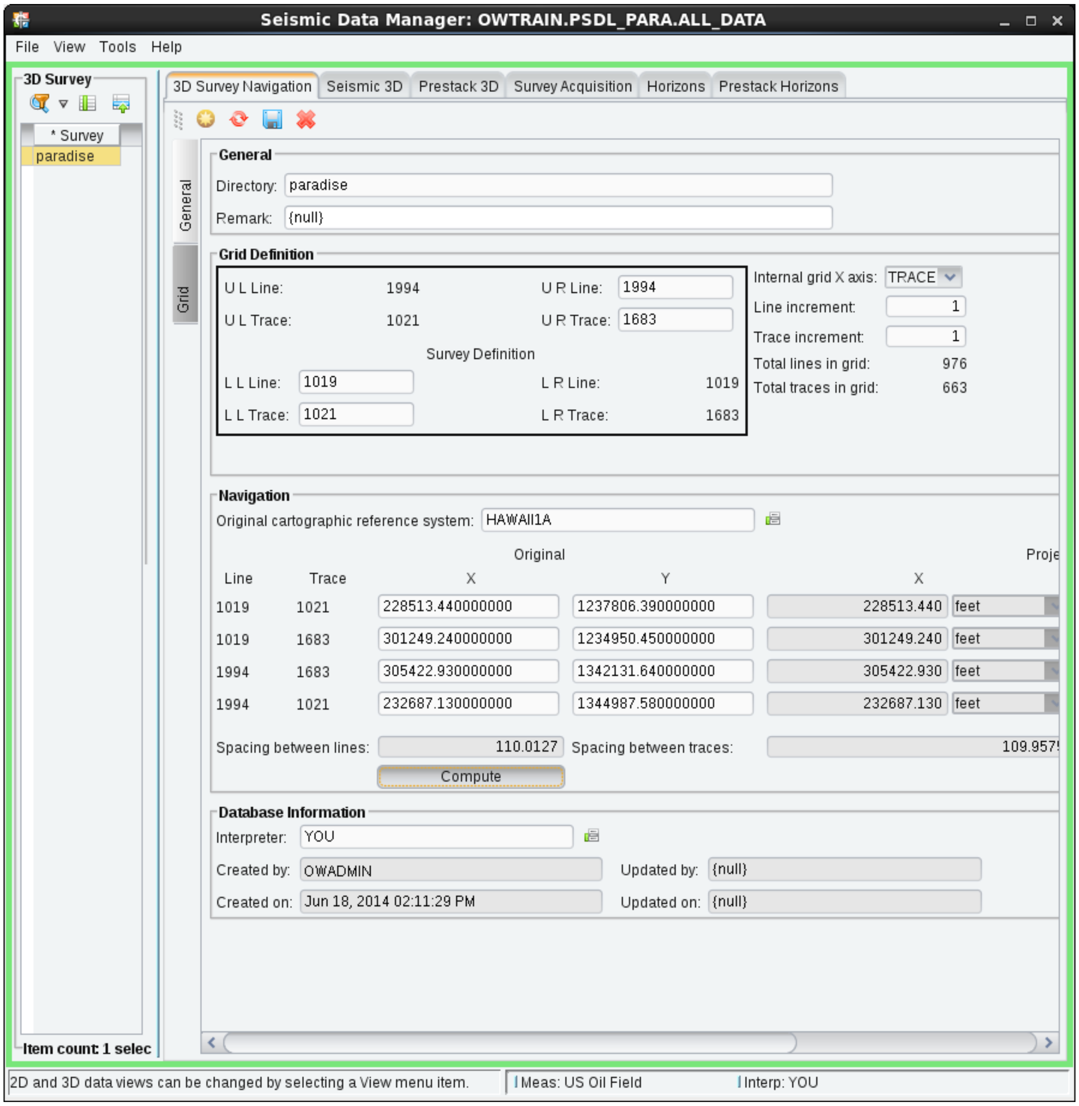
10. Type in the coordinate values for the appropriate corner point locations from the 3D survey information sheet. There are three

points available: lower left, upper right, and lower right. Click **Compute** to calculate the fourth corner.



11. Verify that the reported values for spacing between lines and between traces are correct. These values, computed for the coordinates, may not exactly match the data loading sheet value, but they should be very close.

12. Click the **Save survey** icon () when you have finished entering and checking all the grid information.



The *Seismic Datum* (reference depth at time 0) may be set or edited at any time for a 3D survey.

The next part of this exercise shows how to create seismic storage directories when the automatic option to create the storage directories is set to *no* (see Step 5). If you had set automatic option to yes, you would skip the first step in Exercise 2a. The remaining steps would have been done at the time you set the option to yes.

Exercise 2a: Creating Subdirectories for a 3D Survey

Subdirectories to set the location for storing seismic data volumes and 3D horizon interpretation must be created for each survey.

The available directory paths are defined in the dir.dat. Remember that a directory path in the dir.dat can be assigned a specific type of data to help with data management.

The dir.dat for this class is shown below:

```
Terminal
File  Edit  View  Terminal  Tabs  Help
trn43{student}% pwd
/data/openworks/conf
trn43{student}% ls
device.dat*         lgcenv.cf*         owdir.dat*      services.dat.upg*
dir.dat*            lgcenv.cf.backup*  OwVersion*      wgenv.conf*
district.dat*       lgcenv.cf.upg*     prjsld.ini*
district.dat_good*  NetDrpc.conf*      README.txt*
IndexLocations*     NetDsrv.conf*      services.dat*
trn43{student}% more dir.dat
/data/seismic OTHER_FILES
/data/seismic/SWKINT hts
/data/seismic/SWKVOL bri cmp 3dv 3dh 2v2_glb
trn43{student}% 
```

At least one directory path for OTHER_FILES must be created. Creating paths for the other two options in the dir.dat will allow better management of the data. 3D horizon data would be stored on the /data/seismic/SWKINT path and all 2D and 3D seismic trace data would be stored on the /data/seismic/SWKVOL path.

There are two options to create subdirectories for 3D surveys in Seismic Data Manager. Both methods are listed below. This exercise details Method #2.

After creating a new survey name, a Create Data Directories query will display. Choices are **No** and **Yes**.

Method # 1:
To automatically create subdirectories for a 3D survey in Seismic Data Manager when creating a survey name:

Select **Yes**.

The *Seismic File Storage* dialog box immediately opens. Proceed with step 2 as indicated below.

If you choose **No**, the directories for the survey must be created from **Tools > Seismic File Storage…** in order to load seismic data as described below.

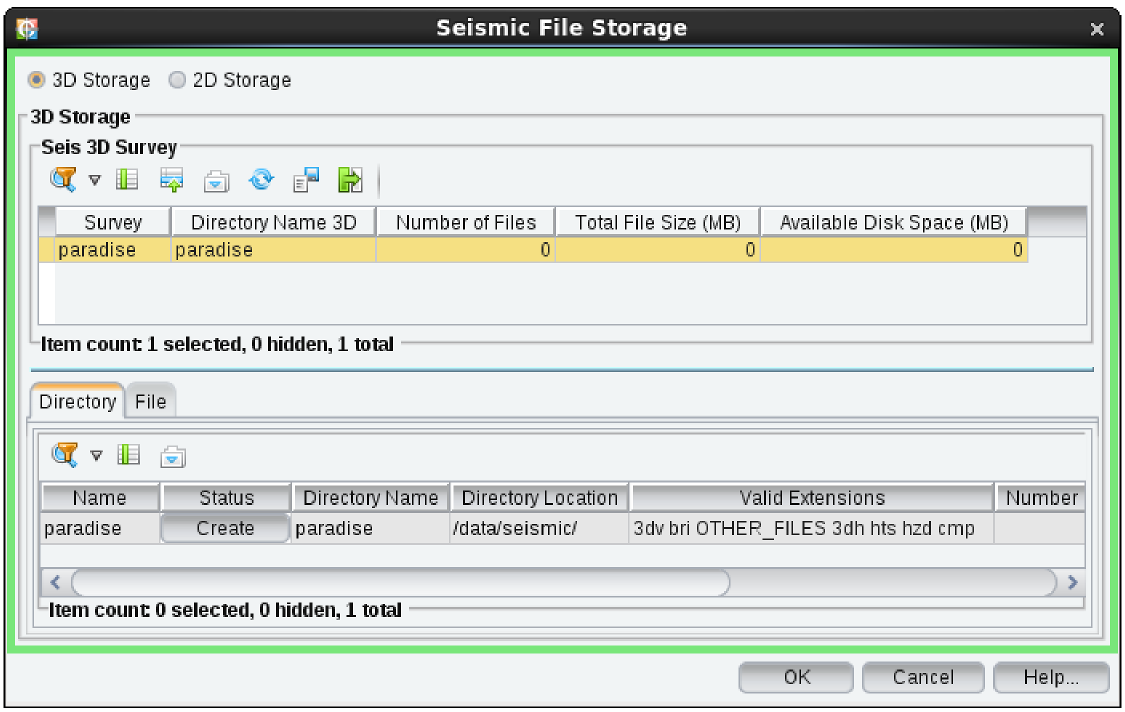
Method # 2:
To create subdirectories for a 3D survey in Seismic Data Manager:

(Follow these next steps for this exercise.)

1. Select **Tools > Seismic File Storage…** from the Seismic Data Manager main menu.

2. Select the **3D Storage** button if not already selected.

3. Highlight **paradise** in the Seis 3D Survey table in the upper pane (click the square box at the beginning of the row to highlight).



4. Select the **Directory** tab in the lower pane (should be already selected). The directories and file systems listed in the table are listed in the dir.dat.

   If no directory names are listed, listed below are some tips, should you encounter either of these two conditions:

   - **No Directory Listed:** If you do not see any directories displayed for the survey, check to see if you have the Read permission to the directories listed in the dir.dat. If a subdirectory has already been created for the survey in a directory listed in dir.dat, and if no directories are displayed in the Directory tab, check the permission of the subdirectory also.

- **Survey Has a Null 3D Directory:** If the survey has an empty (or null) Directory Name 3D column, see the online help **Seismic Data Manager > Help > Online Help > SDM Tools > Seismic File Storage > Creating a 3D Directory Name for a Survey**, and then follow this procedure.

5. In the Status column, click the **Create** button in order to create the directory where you want to store files for the survey..

6. Click **Ok** and then click **Save** button.

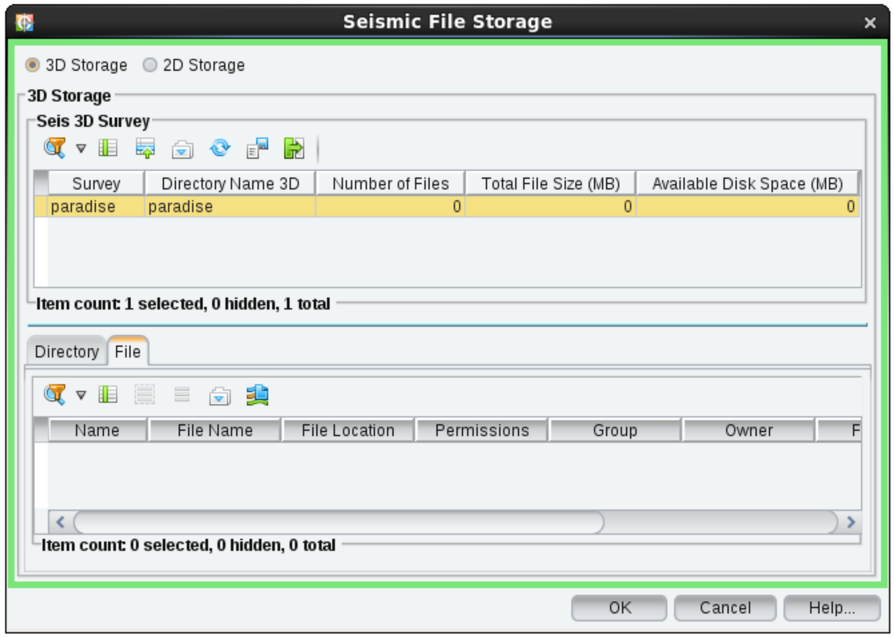
Notice that Status changes to **Created** and the following path was created:

/data/seismic/paradise

As you load data for this survey, information is reported for number of files, total size and available disk space for each directory path.

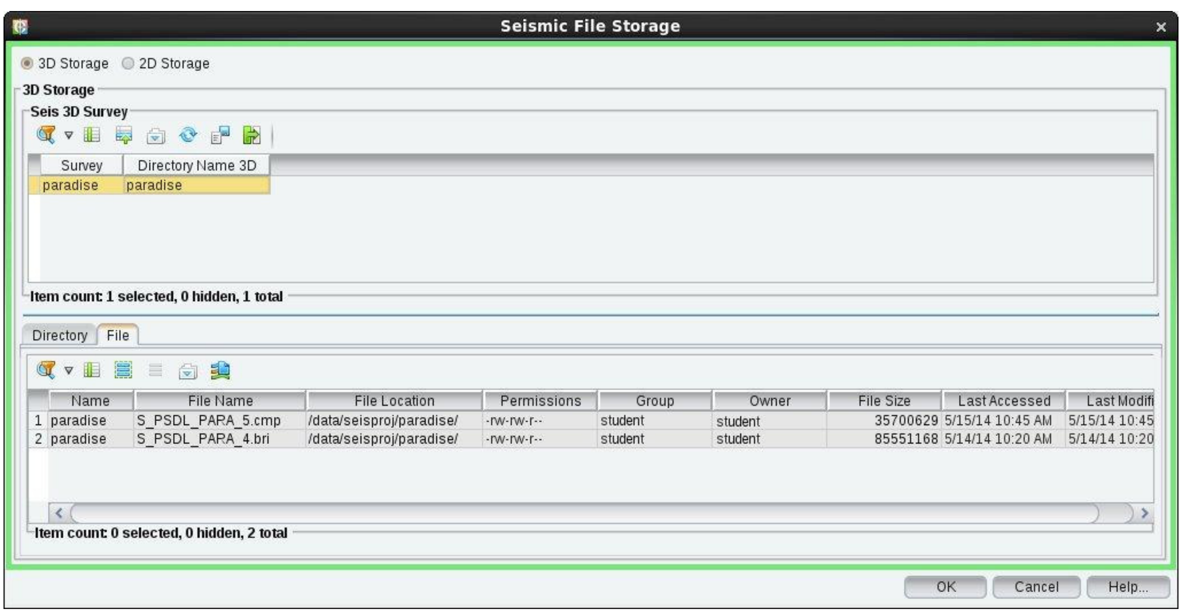
7. To check the details files within directory, highlight the directory and click the **File** tab. Since the storage directory is new you will

not see any files. Once data is loaded, this information will be reported.



8. Click **Cancel** to close the dialog box.

The example below shows what the File tab view would look like after some seismic data is loaded:



In Exercise 2 you created a 3D survey by giving it a name, entering information about the survey, defining survey coordinates. In Exercise 2a you created directory paths for storing the data you will load and where the 3D horizon data will be stored when the survey is interpreted.

The next exercise focus is an important quality control step to verify that the navigation data has been entered correctly.

Checking the Base Map

3D Data Loading Task List

- Gather background information
- Create/Select an OpenWorks project database
- Create 3D seismic survey
- Create seismic storage directories
- Check base map (compare SeisWorks Map View to Horizon Image Map)
- Analyze SEG-Y data
- Load Data
- Check data load (view seismic in appropriate application)
- Backup

When the survey was setup in Seismic Data Manager, the grid was defined using navigation data for the 3D survey.

In order to verify that your settings are correctly entered, you need to display your survey in a map.

- Use Map View in the SeisWorks software to verify the general setup.
- Use Horizon Image Map in the SeisWorks software to verify the correct definition of the X Axis.

Exercise 3: Checking the Seismic Survey Base Map

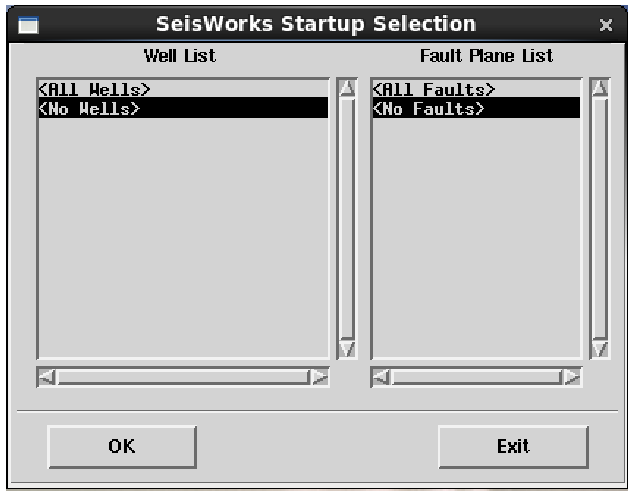
In this exercise, you display your survey in SeisWorks Map View and compare this view with SeisWorks Horizon Image Map.

Checking Seismic Survey in SeisWorks Map View:

1. From the OpenWorks main menu, select **Applications > SeisWorks**.

2. In the SeisWorks software, select **Session > New (Time)**.

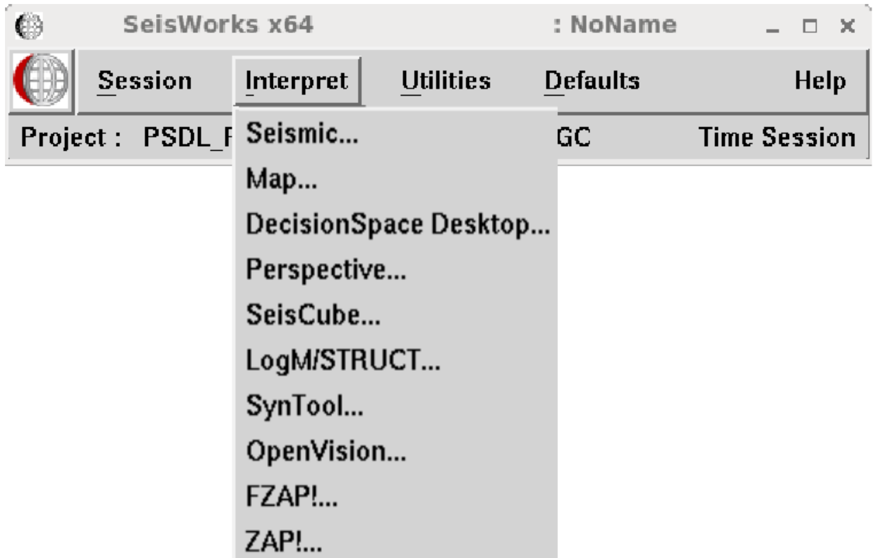
3. The *SeisWorks Startup Selection* dialog box appears. Select **No Wells** and **No Faults**. Click **OK**.



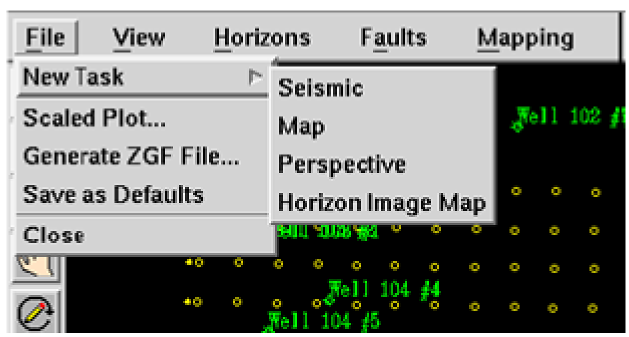
When you start a new session, SeisWorks displays a Map View and a Seismic View by default. You will work with the displayed Map View and open a Horizon Image Map for this exercise.

About SeisWorks View selection:

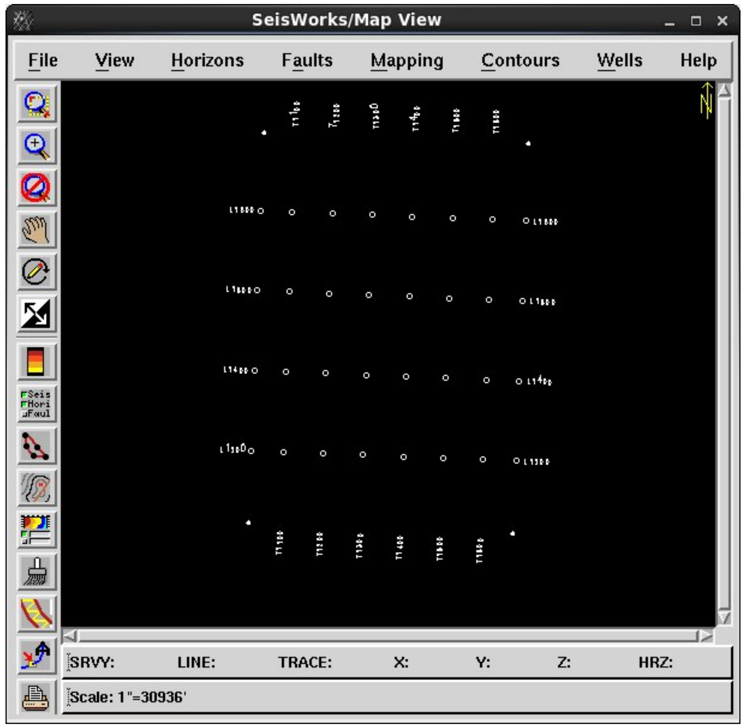
In SeisWorks, you can work with multiple views at the same time. New views may be added to your session by selecting **Interpret > Map…**, or **Interpret > Seismic…**from the SeisWorks main menu.



Another way to add a new view is by selecting the **File > New Task** option from any open view.



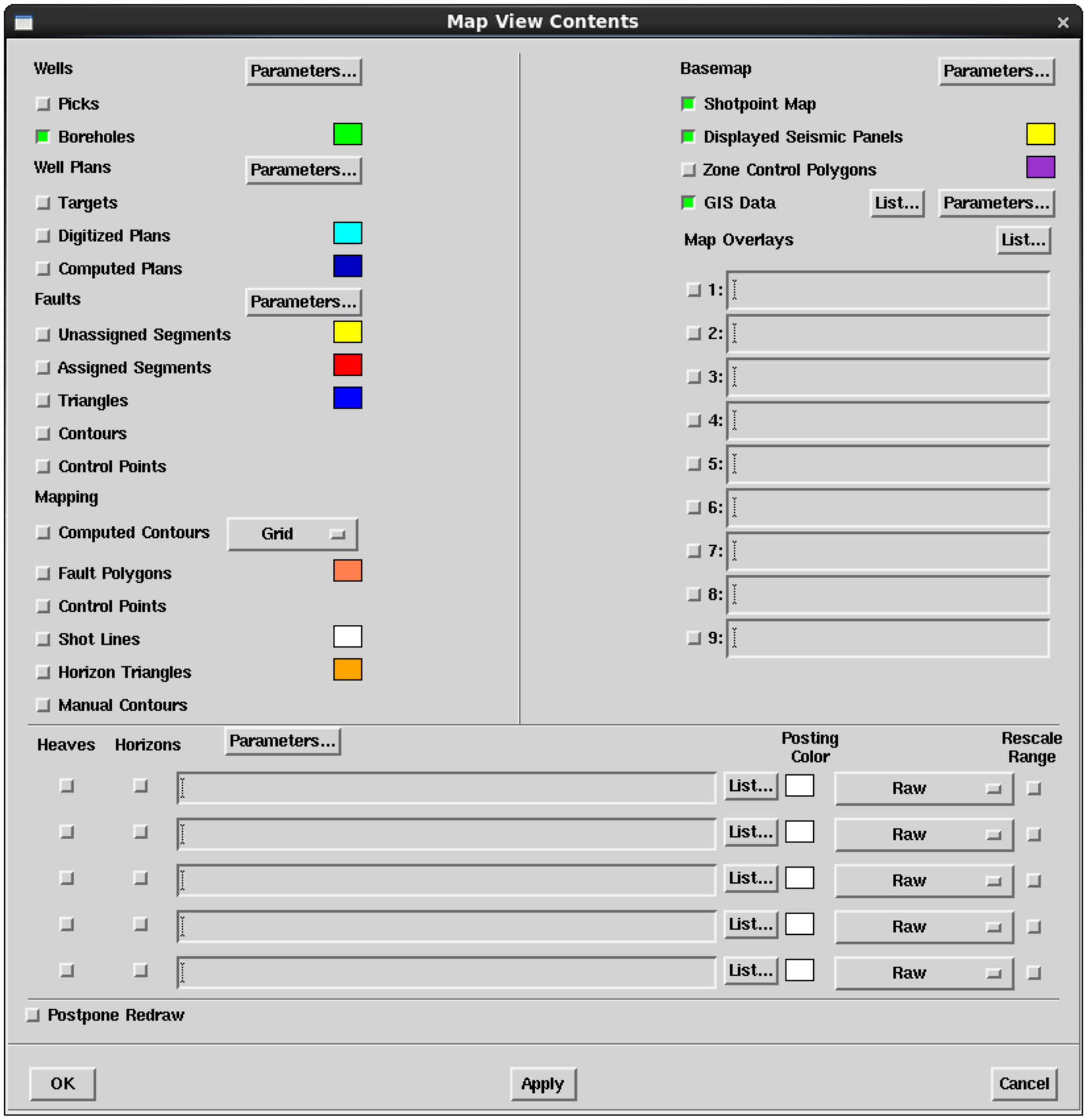
4. Continue working in the Map View that displayed when you started your SeisWorks session.



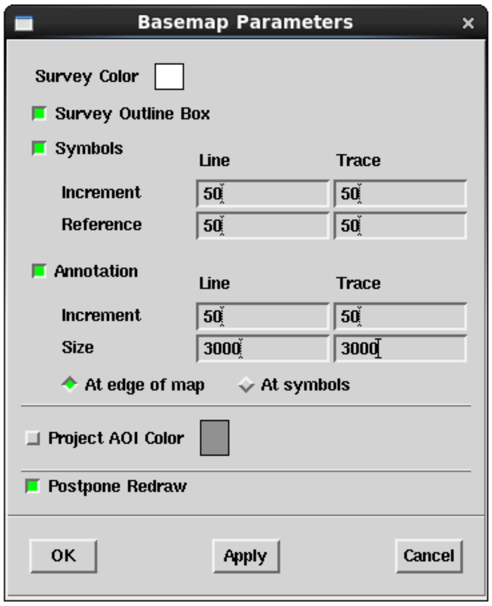
In order to set more appropriate values for your data set, you will customize the settings for the Line and Trace symbol and annotation increment, and the text size parameters.

5. Click the **Contents** icon (), or select **Select View > Contents…**.

This dialog box lists the features that can be displayed on a map in the SeisWorks software.



6. Click the **Parameters…** button next to Basemap.



7. Click the color box next to Survey Color. The *Select Symbol Color* dialog box displays.

If you like the default color, click **Close** to dismiss the box.

To change the survey color, click the color of your choice (the selection box closes automatically).

8. In the *Basemap Parameters* dialog box, toggle *on* the Survey Outline Box.

9. Verify that the check box next to Symbols is toggled on.

10. Use the following values in the Symbols data entry fields:

Data Entry Field	**Value**
Line Increment	50
Line Reference	50
Trace Increment	50
Trace Reference	50

Starting with line 50, a symbol will be posted every 50th line. Starting with trace 50, a symbol will be posted every 50th trace.

11. Use the following values in the Annotation data entry fields:

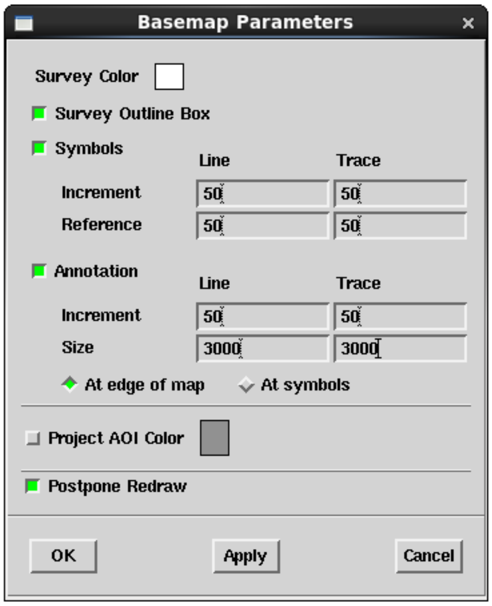
Data Entry Field	**Value**
Line Increment	50
Trace Increment	50
Text Size—Line	3000
Text Size—Trace	3000

12. Every 50th line and every 50th trace will be annotated. Verify that the checkbox next to Annotation and the radio button next to At Edge of Map are both selected. The annotation will appear on the edge of the map.

13. Toggle off Postpone Redraw.

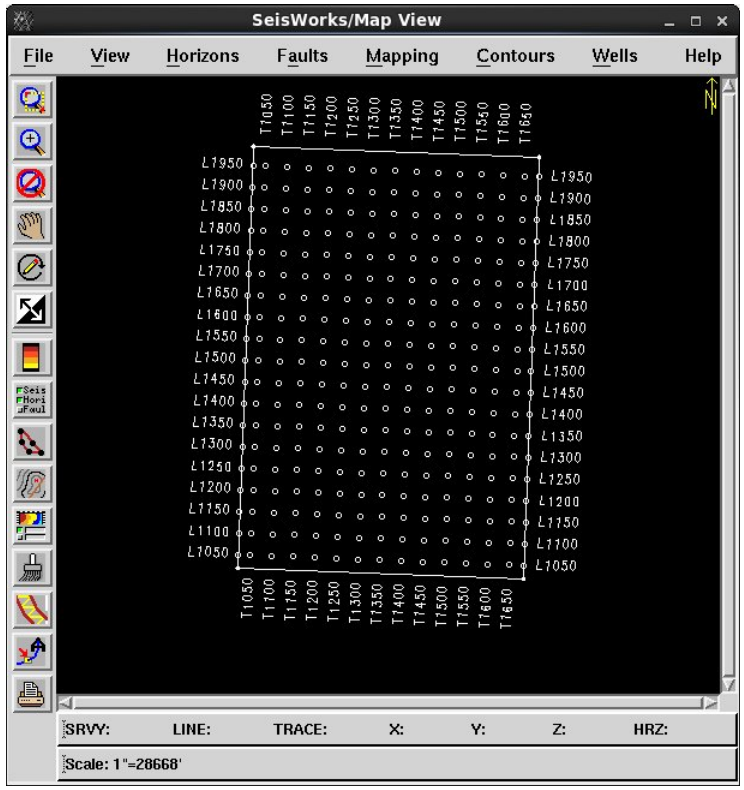
    - allows implementation of changes in dialog boxes without having to click the Redraw icon in Map View

    - allows implementation of changes in sub-dialog boxes without having to click apply in all the dialog boxes



14. Click **Apply** in the *Basemap Parameters* dialog box. The Map View display shows the changes.

When you click **Apply**, the changes are applied to your base map, but the dialog box stays open. You can continue to change values and apply the changes until you are satisfied with the appearance of your base map. Click **Cancel** to dismiss the dialog box—there is no need to click **OK** once you have applied the desired changes. **OK** implements the changes and closes the dialog box.



15. Click **Cancel** in the *Basemap Parameters* dialog box to close the dialog box.

16. Click **Cancel** in the *Map View Contents* dialog box.

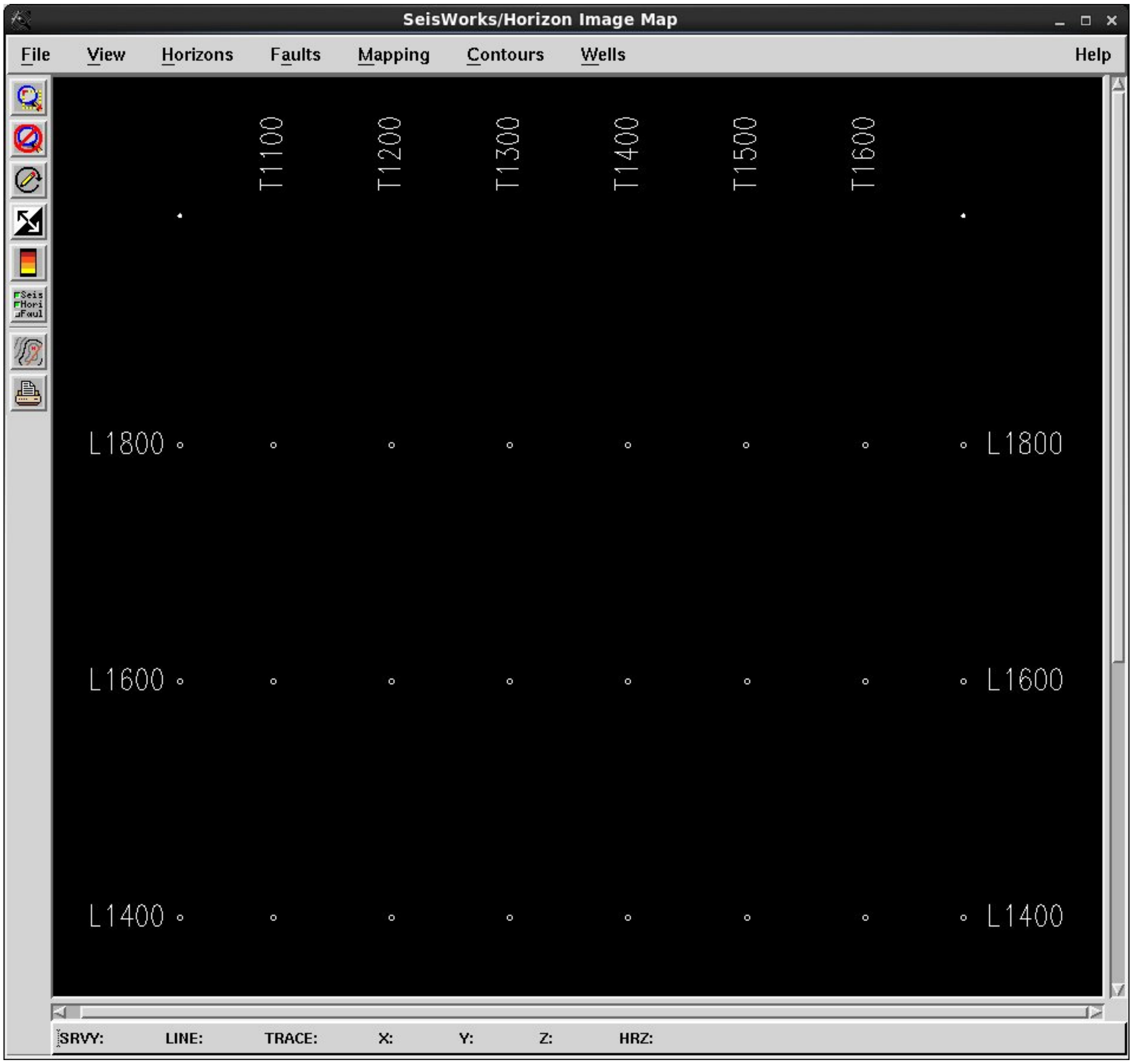
17. To save the parameter definitions as default settings for this session, select **File > Save As Defaults** from the Map View menu.

Exercise 3a: Checking Seismic Survey Using Horizon Image Map

1. Select **Interpret > Horizon Image Map…** from the SeisWorks main menu. The *Horizon Image Map* window appears.

   - Click the Redraw icon if the map is blank.

To see more of the map, use the scroll bars.



Horizon Image Map displays data in a line/trace domain where data is oriented along the axes of the Horizon Map Image window. In Map View, data in oriented along the survey's master grid. The next steps set display parameters in Horizon Image Map to resemble those just set in Map View.

2. Click the **Contents** icon () or select **View > Contents…**. The *Horizon Image Map Contents* dialog box displays.

3. Click the **Parameters…** button next to Basemap.

4. In the *Basemap Parameters* dialog box, toggle on the Survey Outline Box.

5. Verify that the button next to Symbols is selected.

6. Use the following values in the Symbols data entry fields:

Data Entry Field	Value
Line Increment	50
Line Reference	50
Trace Increment	50
Trace Reference	50

Starting with line 50, a symbol will be posted every 50th line. Starting with trace 50, a symbol will be posted every 50th trace.

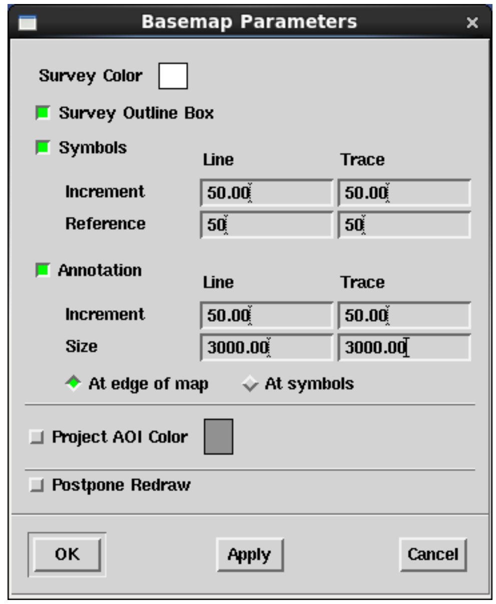
7. Check that the buttons next to **Annotation** and **At Edge of Map** are both selected.

8. Use the following values in the Annotation data entry fields:

Data Entry Field	Value
Line Increment	50
Trace Increment	50
Text Size—Line	3000
Text Size—Trace	3000

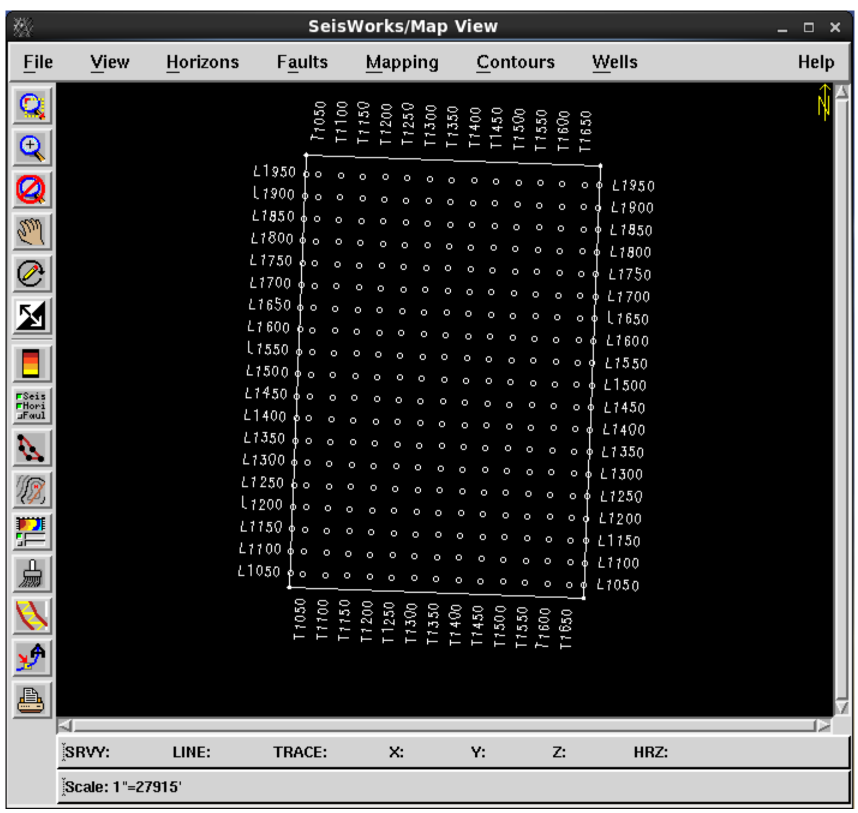
Every 50th line and every 50th trace will be annotated. The annotation will appear on the edge of the map.

9. Toggle *off* Postpone Redraw.

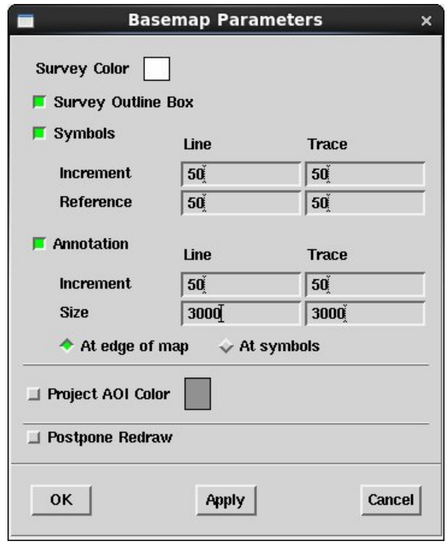


10. Click **OK** in the *Basemap Parameters* dialog box and **Cancel** in the *Horizon Image Map* Contents dialog box.

The Horizon Image Map will appear similar to that shown below.



11. To change the display scales of the Horizon Image Map to approximate the same scale as that of the Map View, select **View > Display Scales…**. Use the slider bar to change both the Line and the Trace value to -1. Click **OK**.



12. Track the cursor diagonally across the survey.

    If your survey is set up properly, the tracking should be identical in both views. If your survey is set up incorrectly, the tracking in the Horizon Image Map will be reversed of that in the Map View. The annotation in the Horizon Image Map will also be reversed.

    The most common cause of this error is incorrect selection of the X Axis and associated corner coordinates.

    If you make a mistake defining your line and trace numbers, correct the grid corners and/or X axis choice in Seismic Data Manager and save the survey. Check the Map View and Horizon Image Map in a new SeisWorks session to verify that the problem has been corrected.

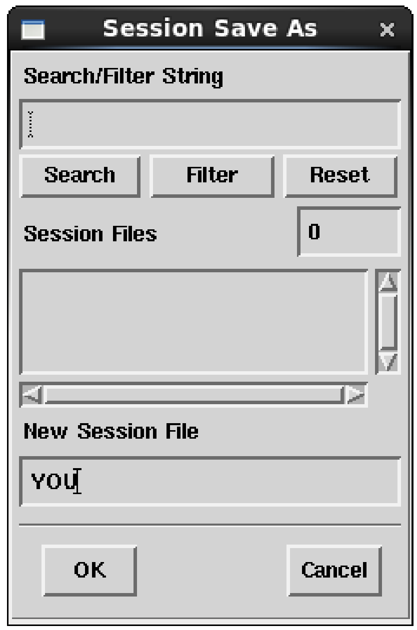
13. From the Horizon Image Map View, select **File > Close**. You will not need to use this view again. Keep the Map View window open.

14. To save the SeisWorks session, from the SeisWorks main menu, select **Session > Save As…**.

    A session file is a file that saves the placement, contents, and parameters of SeisWorks windows for quick recall. You can save the SeisWorks set up by typing a name of your choice in the New Session File box. After you save a session, you can recall that session anytime you start the SeisWorks software for this project. This saves time by restoring the SeisWorks window environment automatically.

The Current Sessions list is empty because you have not yet saved any sessions. When you do have several sessions in your list, you can view the list to keep from typing a name that is already in use.

15. Type <*your initials*> in the New Session field and click **OK**.



SeisWorks sessions are saved in the SWDATA directory, located by the following directory structure:

<*path*>/OW_PROJ_DATA/<*OpenWorks project*>/SWDATA

In the path structure listed above, *OpenWorks project* refers to the name of the project database if you are working in the project database (<ALL_DATA>), or the name of the interpretation project if you are working in an interpretation project. The sessions are stored as <*session_name*>.t.sSf.

> **Note**
>
> Future references to this directory path may be shortened to OW_PROJ_DATA/SWDATA in the rest of this manual.

Since the session name was saved as your initials, your session file is saved as <*your initials*>.t.sSf.

When you start a subsequent SeisWorks session, you can choose to restore the complete session environment (windows and parameter settings) that you saved or just the parameter settings.

16. From the SeisWorks main menu, select **Session > Exit…** to exit the SeisWorks software.

Exercise 3b: Checking Seismic Survey Using Web OpenWorks Software (WOW™ Software)

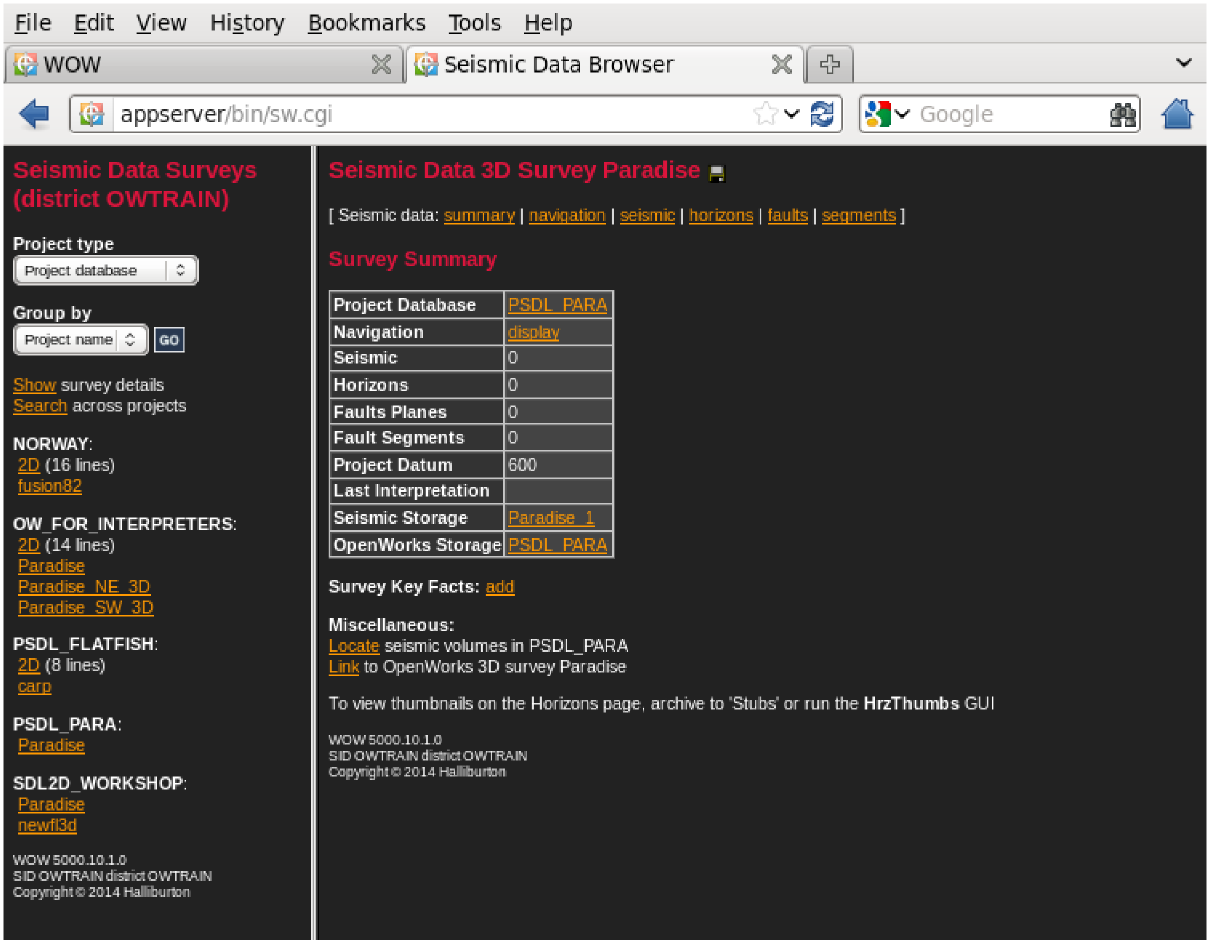
The WOW software provides another way to check the navigation survey Basemap, although there is no option for checking the X axis/ corner coordinate choice as with SeisWorks Horizon Image Map.

1. Open a web browser and type in the address bar http://<your machine name here>/ to check the base map using Web OpenWorks. Try http://localhost/ for the machine name or ask your instructor (may be different at different training sites).

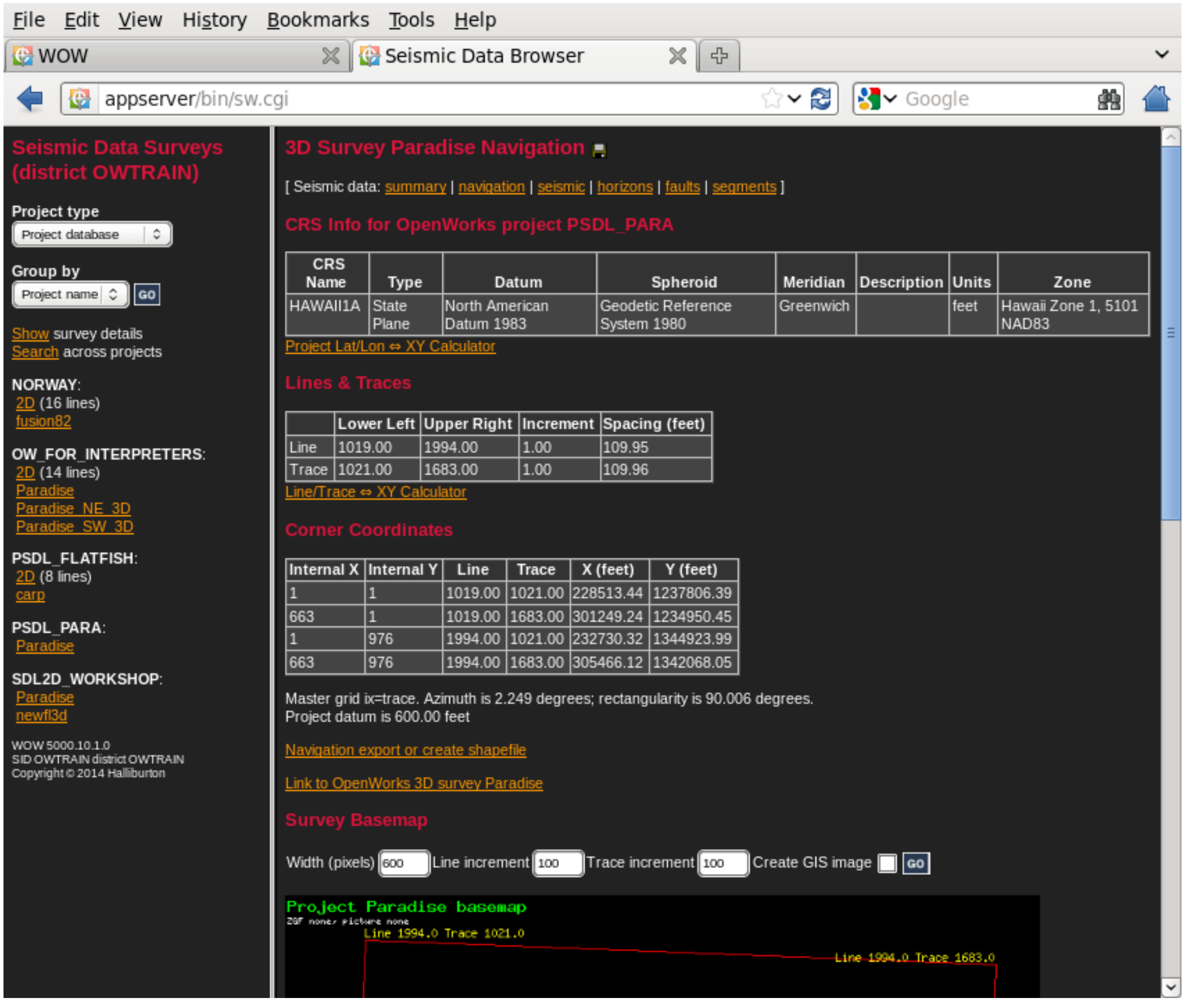
2. Click **Seismic Data** in the sidebar on the left.

3. Select **Project database** as the OW project type and click **GO**.

4. Click **paradise** under **PSDL_PARA** project.



5. Click **display** in the row labeled Navigation to see the navigation data entered and a view of the base map. The navigation data tables are pictured below. An outline of the project base map is also displayed (scroll down to view the entire base map).



The WOW software provides another way to check the navigation data and base map. You only need to check the navigation in one application—either Seismic Data Manager or WOW—but you should check SeisWorks Map View and Horizon Image Map to be sure the correct X axis and corner coordinates have be input.

6. Minimize the WOW software.

You will continue to use the WOW software throughout this class. These WOW exercises show another way to access data in an OpenWorks database and associated seismic and Unix file data, such as the SEG-Y files. All of the WOW exercises can be considered optional.

The 3D navigation survey has been loaded and checked. In the next exercise, you will analyze the SEG Y data in preparation for loading it into a Landmark format.

Analyzing SEG-Y Seismic Data

3D Data Loading Task List

- Gather background information
- Create/Select an OpenWorks project database
- Create 3D seismic survey
- Create seismic storage directories
- Check base map (compare SeisWorks Map View to Horizon Image Map)
- Analyze SEG-Y data
- Load Data
- Check data load (view seismic in appropriate application)
- Backup

Before loading trace data, you need to know a number of things about the data on the SEG-Y formatted tape. The necessary information can be gathered using SEGY Analyzer. This utility allows easy analysis of SEG-Y data files from tape or disk.

In SEGY Analyzer, you can analyze SEG-Y header records and trace headers, then send a format template to the PostStack Data Loader to use for previewing, amplitude analysis, and loading.

SEGY Analyzer has a graphical user interface, and can be launched from Seismic Tools and also from PostStack Data Loader, and can be used for most 3D data loading.

SEG Y Data Import can also be used to interactively view SEG-Y disk files, but has no graphing capabilities.

This class will use SEGY Analyzer for the exercises. SEG Y Import Tool will also be used.

Information Required for 3D Data Loading

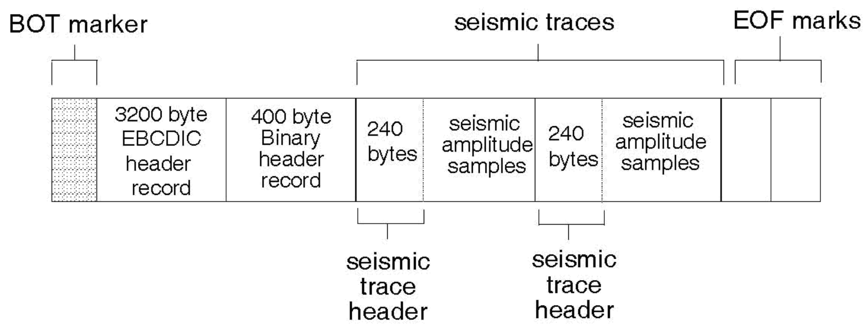
Before you can load trace data, you need to have information about tape format, data format, and about the location of several key pieces of information in the trace header.

Media (Tape or Disk) Format Questions

You must know the answer to the following questions in order to load trace data:

- How many header records are at the beginning of the tape?

  According to SEG-Y standard, there should be two: the EBCDIC header and the binary header. Non-standard tapes may be different.



Parts of a Standard SEG-Y Formatted Tape

- Are there End-Of-File (EOF) markers between the lines?

  Most 3D tapes do not have EOFs between lines, but some do. You need to use bcm3d to load 3D data with EOFs between lines.

- Do header records follow between-line EOFs? If so, how many?

  Sometimes EOF markers are followed be header records. These may be repeats of the EBCDIC and binary records at the beginning of the tape or disk, or they may contain new data. You might have an EBCDIC record, a binary record, or both.

Data Format Questions

You need to answer the following questions about the seismic trace data, generally found in the binary header record:

- What is the trace data format?
- What is the sample rate?
- What is the number of samples per trace?

Trace Header Information Questions

In order to load the data, you must be able to answer the following questions:

- What are the byte location and the format of the 3D Line Number?
- What are the byte location and the format of the 3D Trace Number?

Summary of Information Required for 3D Data Loading

- How many header records are at the beginning of the tape?
- Are there EOF marker(s) between seismic lines?
- Are there header records between lines? If so, how many?
- What is the sample format?
- What is the sample rate?
- What is the number of samples per trace?
- Where is the line number in the trace header and what is its format?
- Where is the trace number in the trace header and what is its format?

SEGY Analyzer

Features

The SEGY Analyzer consists of a set of tools for examining SEG-Y header records and trace headers to see whether the information you expect is actually present and formatted correctly in these files. To aid in the analysis process, you can build "seismic templates," which describe the differences between the format of the seismic data being examined and standard SEG-Y format. Seismic templates allow you to read, analyze, copy, and load data that is not in standard SEG-Y format. The result of the analysis is displayed in spreadsheet format.

The SEGY Analyzer tools allow you to perform the following tasks:

- **Batch analysis from tape or disk.** Batch Analysis allows you to see if data is in standard SEG-Y format (or if it conforms to a template, which may also be specified) and can therefore be loaded by the PostStack Data Loader without further analysis.

- For each tape being analyzed, analysis information is written to a log file and summary information is posted in the utility's main window.

  Tapes may be mounted on local or remote machines. You can analyze up to 300 individual tape or disk files at one time. Most 3D data does not have EOF markers between seismic lines, but if you have EOF markers between your 3D seismic lines, you can select non-sequential tape files to analyze.

- **Copy tape to disk.** The copy tape to disk option allows you to easily copy seismic data from tape to disk. This feature is more commonly used for analyzing individual 2D seismic lines.

  You must copy the data from tape to disk if you want to interactively analyze the data. You can use this option to copy part of a 3D seismic tape to the disk to use for interactive analysis, or you may want to get all the SEG-Y data you want to load off of the tape so there are no tape I/O problems during loading.

- **Create a histogram.** The histogram in the SEGY Analyzer provides a convenient way to generate a distribution curve for seismic data in selected SEGY files.

- **Interactive analysis** of seismic data on disk allows you to examine SEG-Y id, trace headers, and data samples. The interactive analysis tool allows you to display a trace header graph that shows how the trace values change from trace to trace. You can view the SEG-Y id and trace headers in a variety of formats.

- **SEGY template definition.** This feature allows you to define any differences between the format of the seismic data being examined and standard SEG-Y format, as well as do math on the trace headers. You can define seismic templates while you are interactively examining data, or before you examine any data. Templates can be saved and reused.

- **Write Navigation Data to ASCII Files.** You can choose to have the SEGY Analyzer write navigation data from trace headers to ASCII files through the *Output Navigation* dialog box found in the Tools pull-down menu.

- **Send a list of the tape/disk files to the PostStack software.** The SEGY Analyzer allows you to send a list of tape or disk files (and their seismic templates) to the PostStack Data Loader. Once in the PostStack Data Loader, you can preview the data, generate an amplitude histogram, and load the data into landmark formats.

Batch Analysis

There are two batch analysis options: one for analyzing data on tape and one for analyzing data on disk. While both options allow you to analyze up to 300 files at a time, most 3D data is written in a "single" file format. This means that individual 3D seismic lines are written to tape or file sequentially, one line after another, without EOF marks separating the lines. Two EOFs commonly are written at the end of the data indicating the end of the volume.

As the 3D seismic data is analyzed, information about the text, binary headers, and other file information (such as number of traces and trace number length) is written to a log file. Some summary information is posted in the spreadsheet area of the SEGY Analyzer main window. The main window also displays the name of the file currently being examined. Batch analysis may be interrupted at any time.

You can use a seismic template during batch analysis. For example, the template may indicate that the line number is in a non-standard format. Batch analysis will then extract the line number using the format specified in the template.

The spreadsheet area has the following columns when you choose one of the batch analysis options:

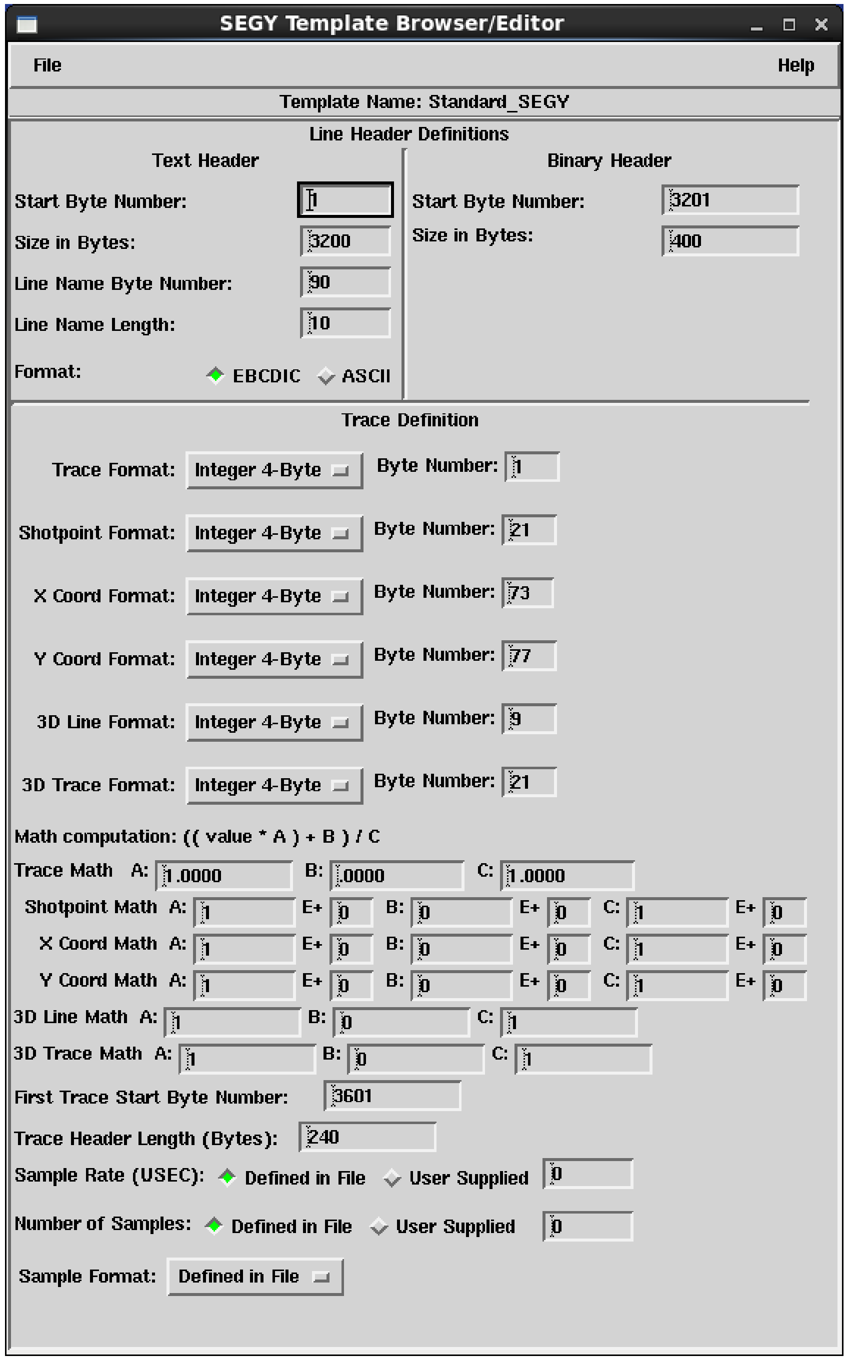
- Disk file name (if disk analysis)
- Tape file sequence number (if tape analysis)
- Template name
- Line name
- Number of tape records read (if tape analysis)
- *Sample format
- *Sample rate
- *Start time
- *End time
- *Start trace number
- *End trace number
- *Trace number increment
- *Start shotpoint number
- *End shotpoint number

- *Shotpoint number increment
- *First x coordinate
- *Last x coordinate
- *First y coordinate
- *Last y coordinate

Columns marked with an asterisk (*) are non-editable; the software posts the summary information in these columns.

Standard SEGY Template

A default template called Standard_SEGY is provided with the SEGY Analyzer.



You cannot change the standard SEG-Y template. However, you can save it under another name and use it as your baseline template.

Exercise 4: Analyzing SEG-Y Data

You will analyze data in the SEG-Y disk file call paradise1.sgy. This file contains data for lines 1279-1379 and traces 1191-1341. You will start by creating a histogram that will generate a distribution curve for the seismic data you are about to load. This histogram displays the amplitude range for the seismic data and can be used as a visual reference, or for scaling purposes should you need to scale the data.

Part 1: Use WOW software to preview SEG-Y data

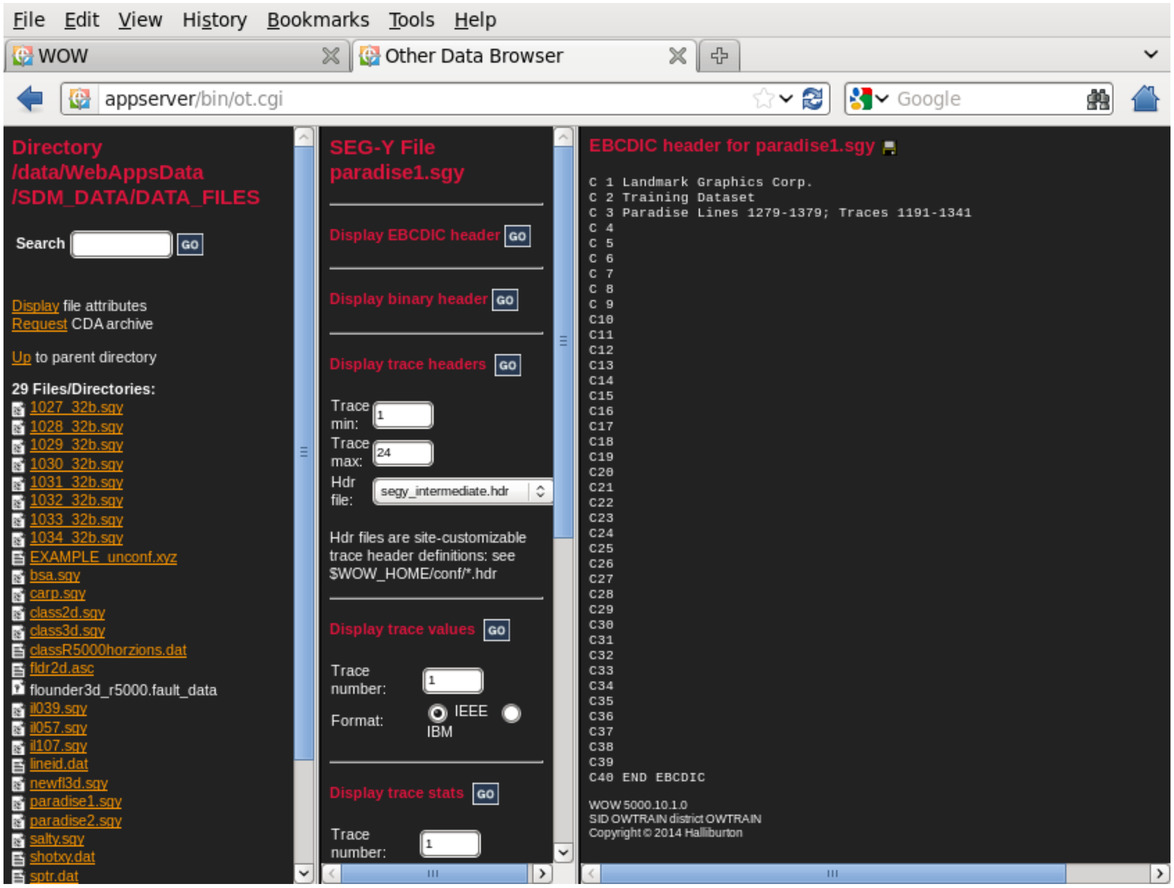
The WOW software is a tool you can use to view information from the SEG-Y file. You can look at the EBCDIC and binary headers and also get some information about the range of amplitude values.

This procedure may vary slightly at different locations.

1. Open the WOW software by clicking the WOW button on the bottom of your screen if you minimized it in the last exercise, or access by typing http://<*your machine name here*>/ in the address bar.

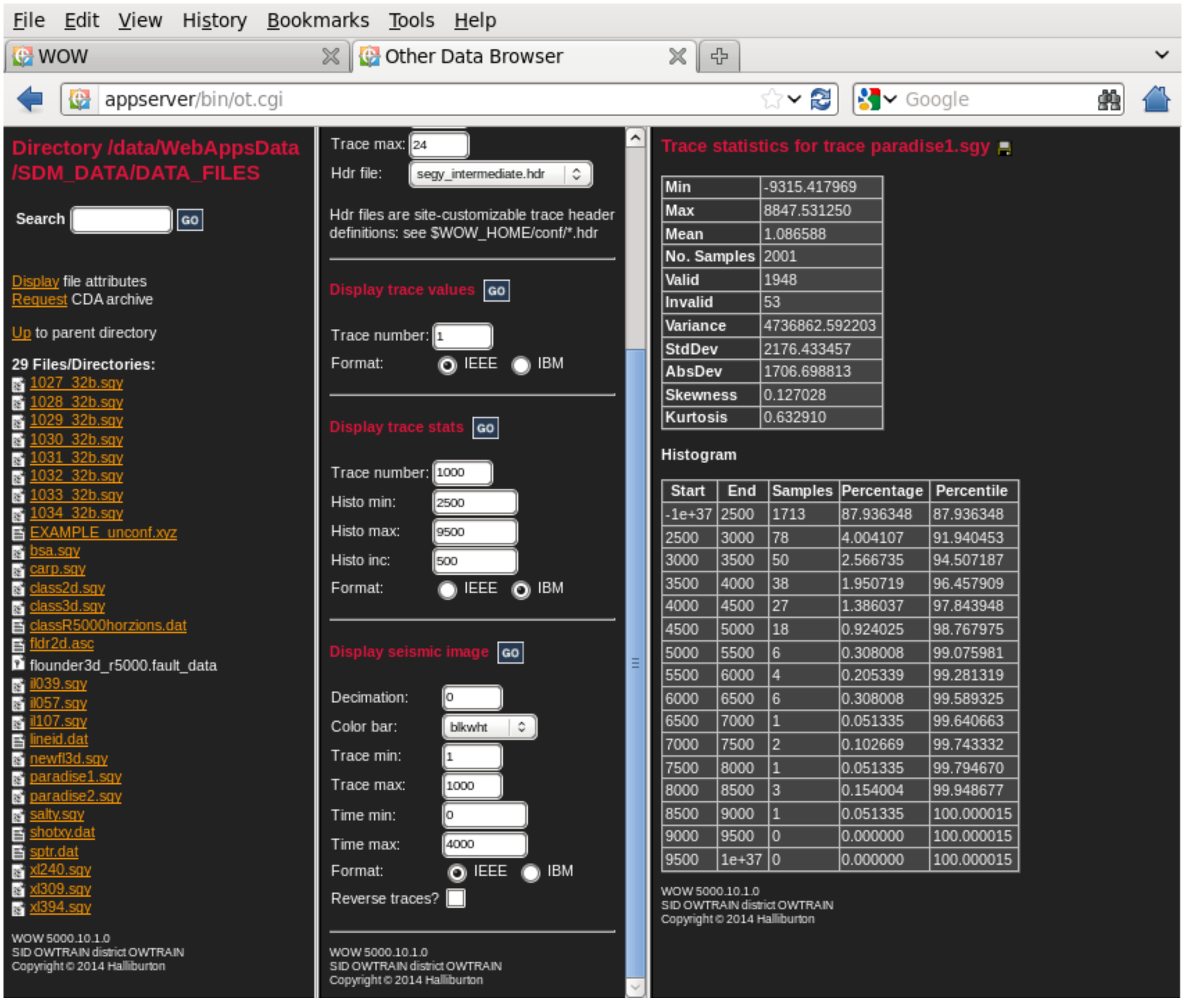
2. Click **Other Data**, in the sidebar on the left and click **SDM_DATA** and then click **DATA_FILES** in the Directory listing pane that opens.

3. Click **paradise1.sgy**.



4. Scroll down to Display trace stats.

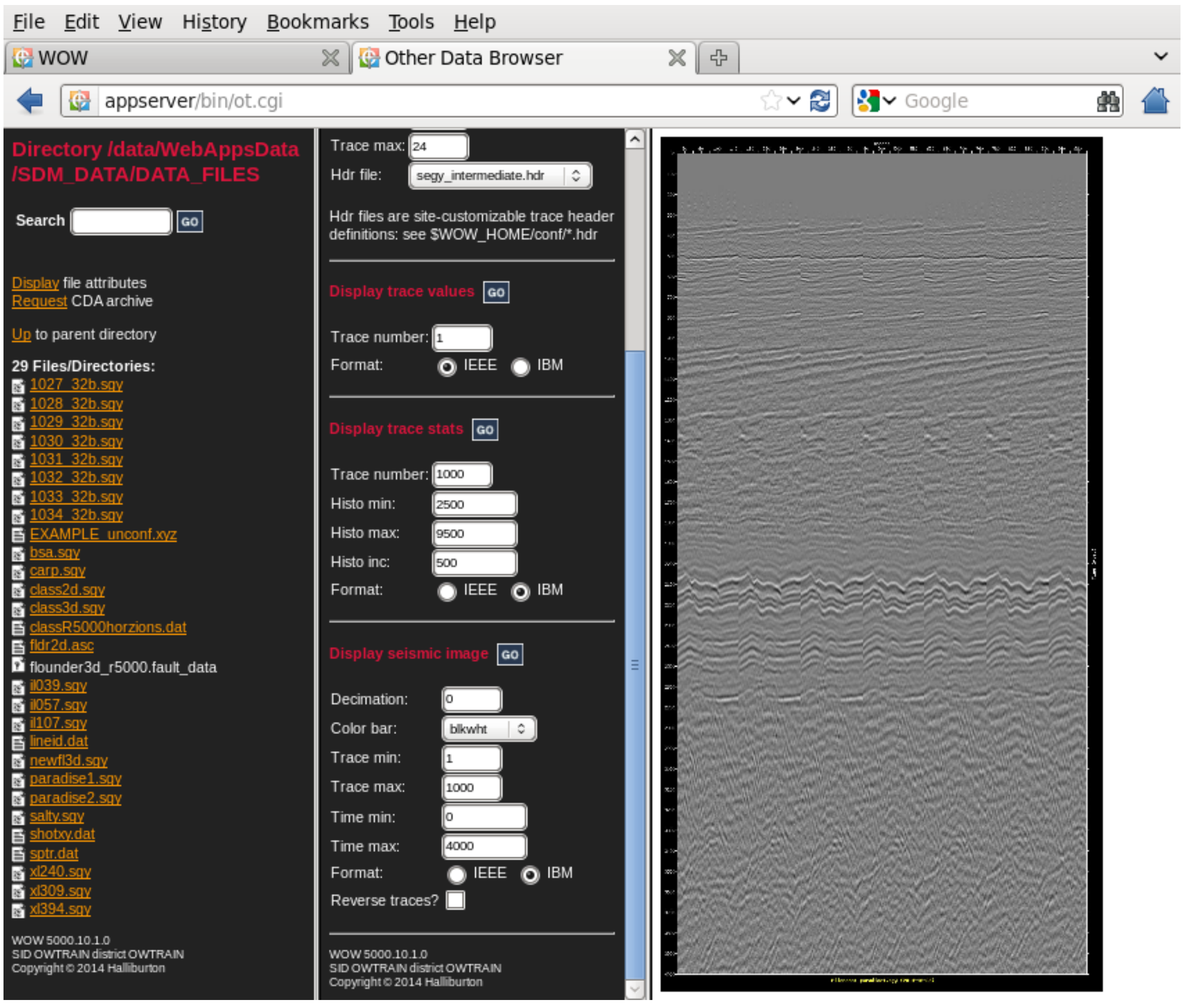
- Fill out the fields according to the screen below.
- Click **GO**.



The WOW software displays trace information for one trace at a time. You can use the WOW software to check various traces in the survey to give you an idea of amplitude ranges in the SEG-Y file. In Part 2 of this exercise, you will create a histogram in SEGY Analyzer using all of the data.

5. View some of the data in the SEG-Y file.

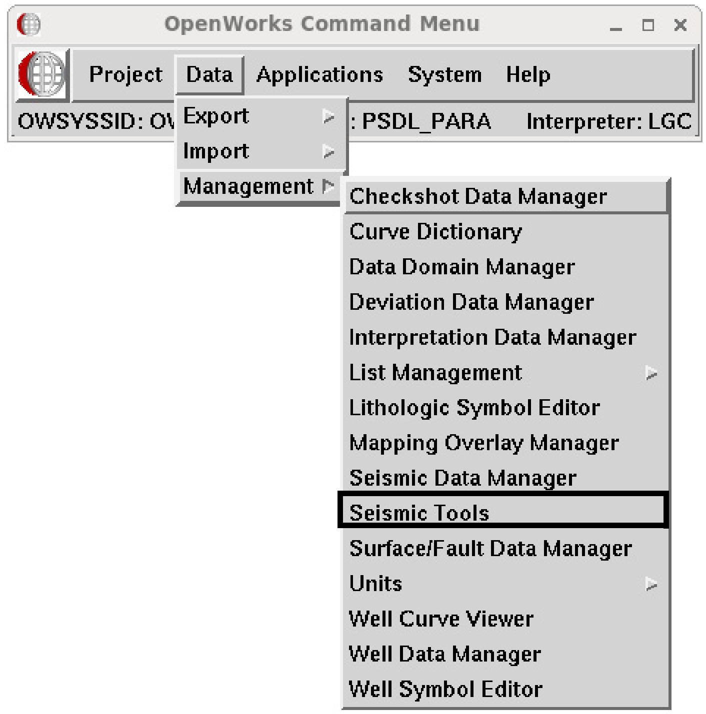
   - In the Display seismic image, section select IBM format.
   - Click **GO**.



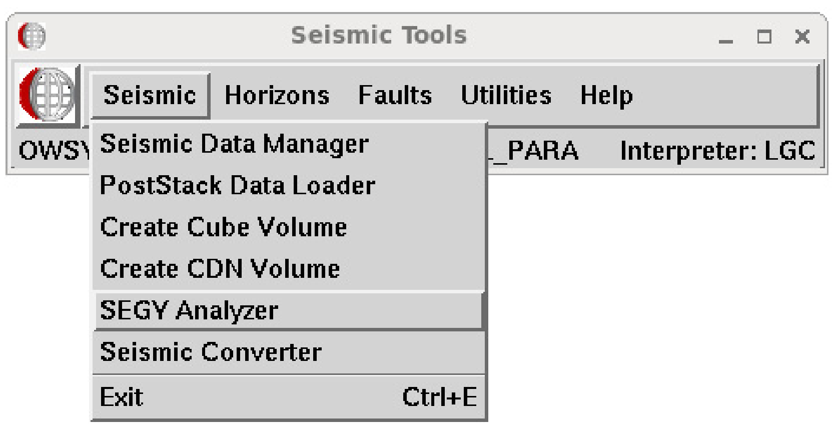
6. Minimize the WOW software.

Part 2: Creating a histogram

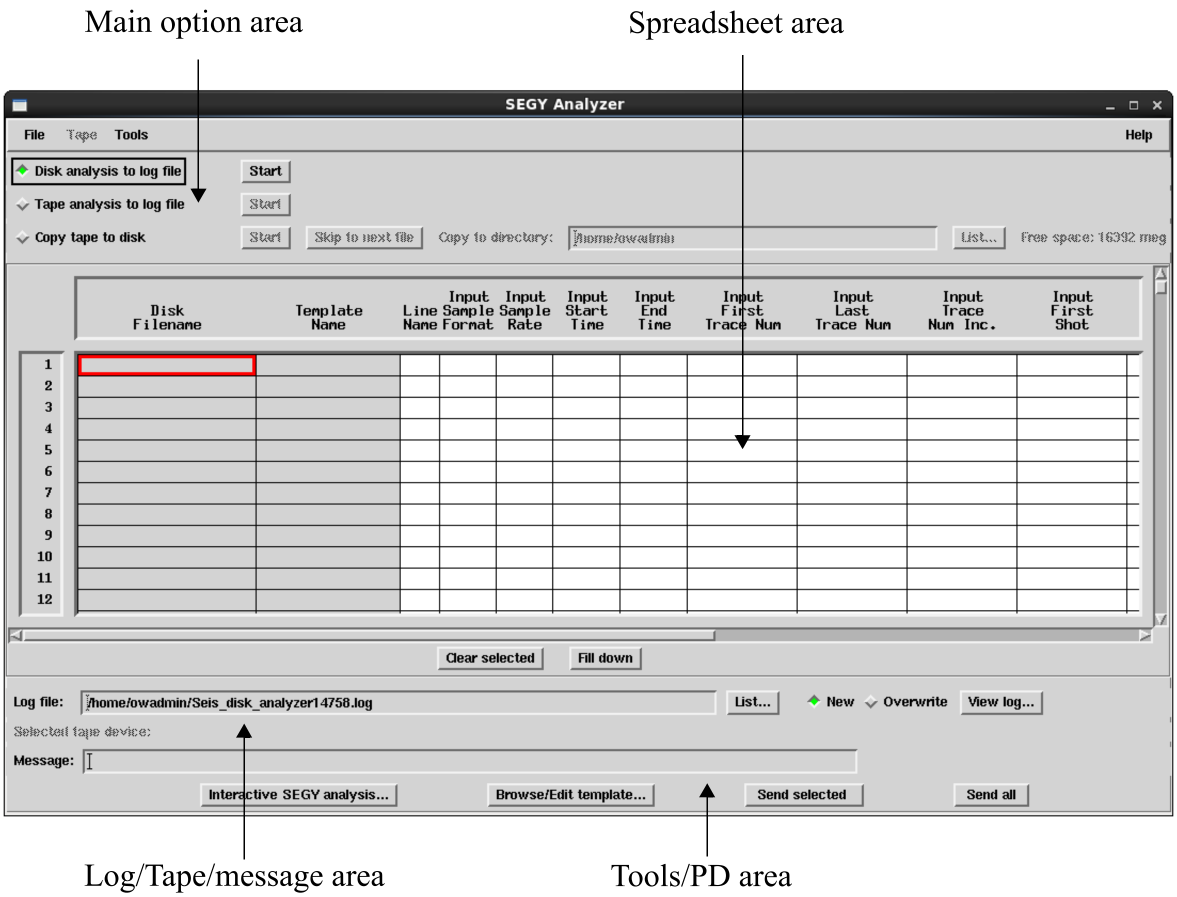
1. From the OpenWorks menu, select **Data > Management > Seismic Tools**.



2. From the Seismic Tools menu, select **Seismic > SEGY Analyzer**.



The SEGY Analyzer main window opens, as shown below.

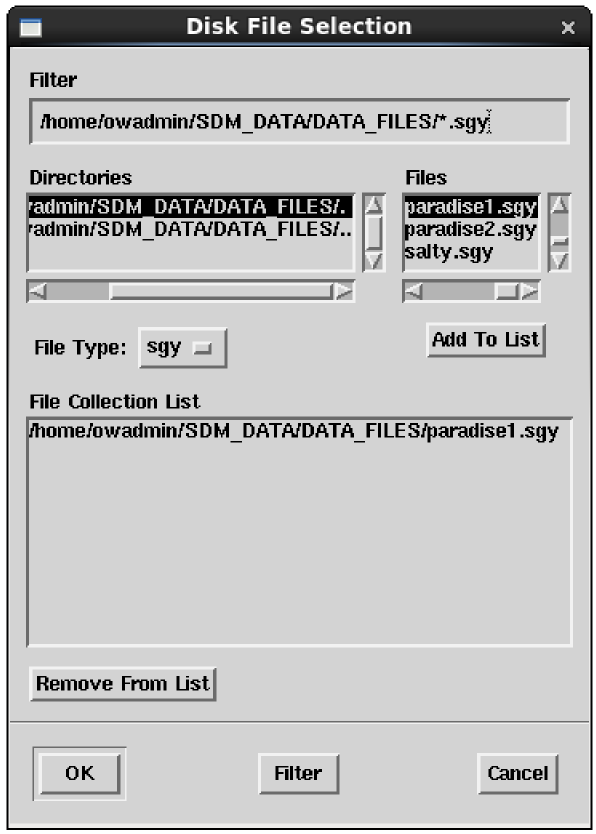


3. Verify that the **Disk analysis to log file** radio button is selected.

4. Use *one* of the following two methods to enter the full path name for paradise1.sgy in the Disk Filename column.

Method #1:

- Choose the file from a list of files by clicking **File > Select…**. The *Disk File Selection* dialog box opens. Navigate to the directory where the data reside—your instructor will provide this directory path. Highlight the file you want to use (*paradise1.sgy*) and click **Add To List**. The file is posted in the File Collection List area.



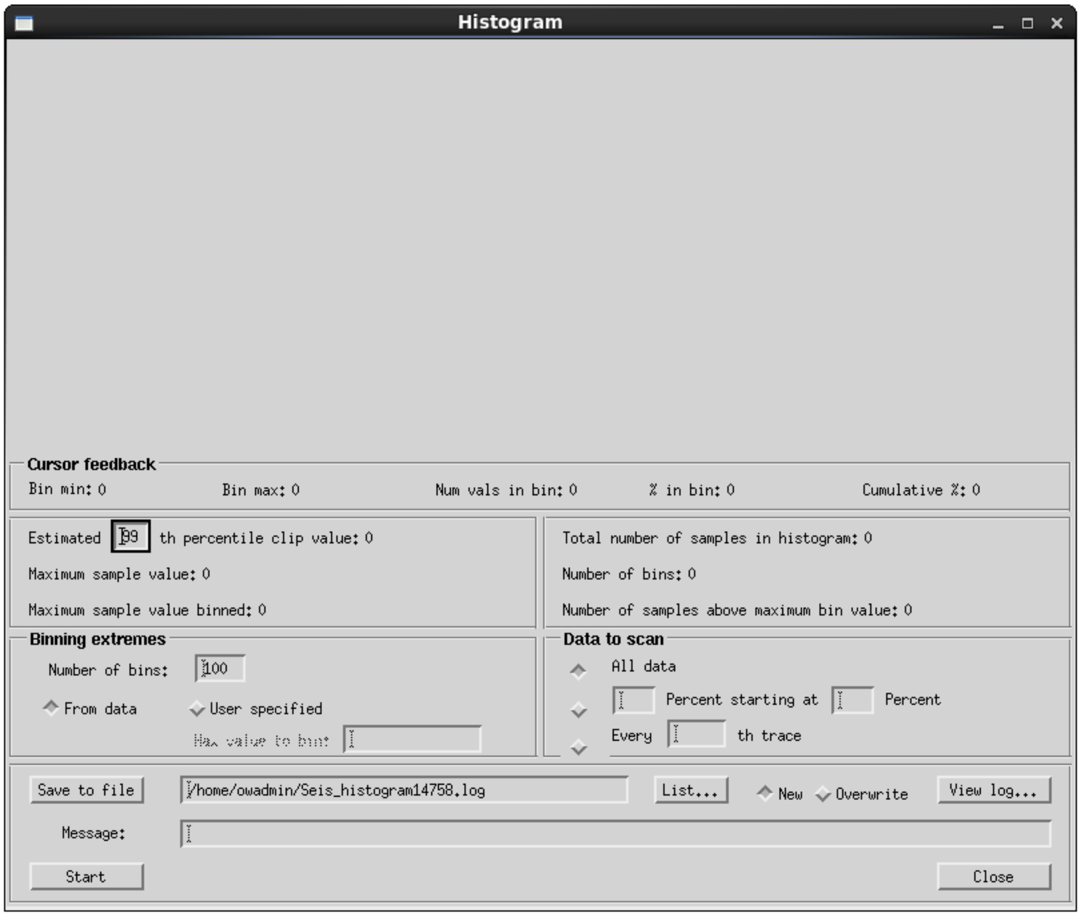
If you add the wrong file you can remove it by highlighting it, then clicking the **Remove From List** button.

When you have the correct file in the list, click **OK**.

Method #2

- Click once in the Disk Filename cell and type the full path name of the SEG-Y file. The cell turns red to show that it is selected. When you have completed typing in a cell, click **MB1** in a different cell or press **Tab** or **Enter** to get out of "edit" mode.

5. In the SEGY Analyzer menu, select **Tools > Histogram…**.



6. In the SEGY Analyzer, click the row (should be row 1) in the Disk Filename column that holds the pathname for paradise1.sgy to designate it as the file for analysis in the histogram. The row will be highlighted in red.

> **Note**
>
> The *Histogram* dialog box can generate a single histogram from more than one file. If you select multiple SEGY files, you should select ones from the same acquisition since they are likely to have similar amplitudes.

7. In the *Histogram* dialog box leave the default settings.

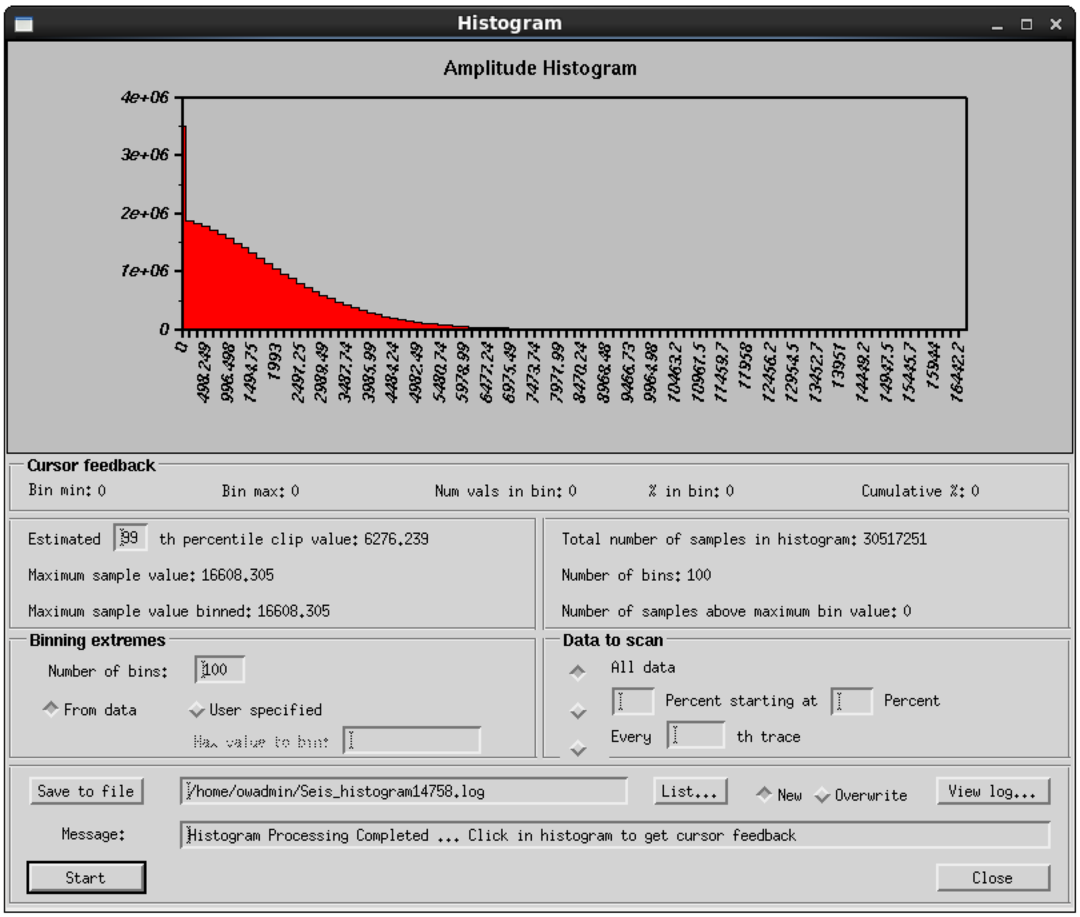
   Verify that **Estimated Nth percentile clip value** is 99, **Number of bins** is 100, the radio button **From data** is toggled on, and the **All data** radio button is selected under Data to scan.

For additional information on these options, see **Using the Histogram** in the **SEGY Analyzer** section of the online help.

Click the **Start** button.

As the Histogram analyzes data it will show its progress in the Message text field at the bottom of the dialog box. Note that the **Start** button change to **Stop** while the process is running. You can stop the process at any time, but if stopped, no histogram will appear.

When the process is completed, the histogram will appear at the top of the window.



By positioning your cursor over the graph and clicking **MB1**, you can display the information about the bin at any point in the **Cursor feedback** area.

You can re-run the Histogram at any time by reselecting the files in the SEGY Analyzer, reselecting options, and clicking the **Start** button.

8. Save the histogram information to the log file specified by clicking the **Save to file** button. Note that you can change the default location and name of the histogram either using the **List…** button or by directly typing over the log file name.

   Leave the Histogram open for the next exercise.

Part 3: Analyzing SEG-Y data

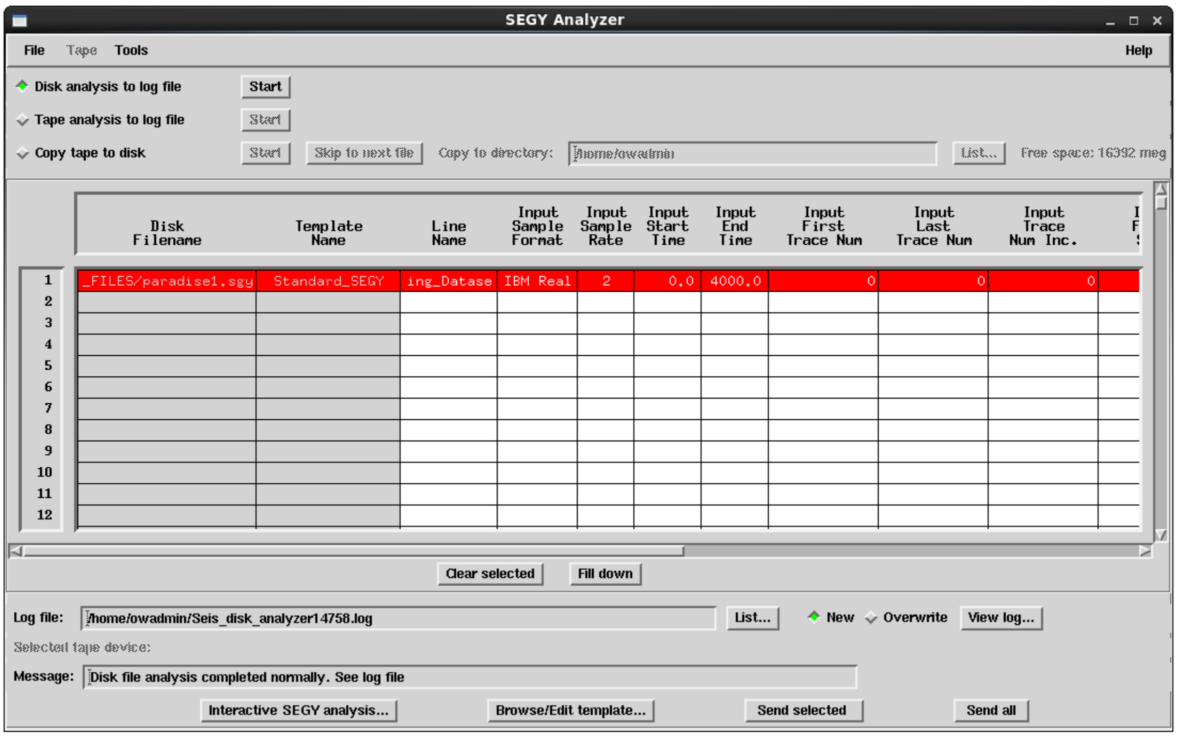
SEGY Analyzer writes a log file of the data it processes. By default, this log file is written to your home directory. The software automatically names the log file using the following syntax (similar to the histogram option above):

<*option name*><*process id*>.log

This default location and name may be changed to something more meaningful if desired. If you want change the log file name or location, in the SEGY Analyzer, click the **List…** button and change the path name of the log file to a more appropriate one for your data, or simply type desired name, including directory path, in place of the default name in the Log file cell.

Let the log file name default for this exercise.

1. Start the batch analysis by clicking the **Start** button located next to the Disk Analysis to Log File option. The button changes to **Stop** so that you can interrupt the analysis when you are satisfied with the samples already read. As the data is read, the software posts status messages in the Message area of the main window. The columns in the spreadsheet become populated. Use the horizontal scroll bar to view all of the populated cells in the spreadsheet.



Note that if no template name is selected, the Standard_SEGY template is automatically used to decode the SEG-Y data. Most often seismic data is not in this standard format. The best approach to data loading is to verify this information, even if the analysis using the Standard_SEGY template appears to be correct, rather than assuming that data are in standard format and loading incorrectly.

There appear to be inconsistencies in the spread sheet analysis. Note that Trace Num cells are all zero (corresponding to crossline for 3D) and Shot cells may or may not be correct (corresponding to inlines for 3D). The values are in the range of the transmittal sheet Line values, but they are also in the range of the Trace (crossline) values. SEGY Analyzer has a graphing tool to help you determine the inline and crossline which you will use later in this exercise.

For 3D data, you are concerned with the inline and crossline byte position and format found in the trace headers. Also, from the list of questions for loading 3D data, you need to find out the data sample format, sample rate and samples per trace. Usually these three values are found in the binary header.

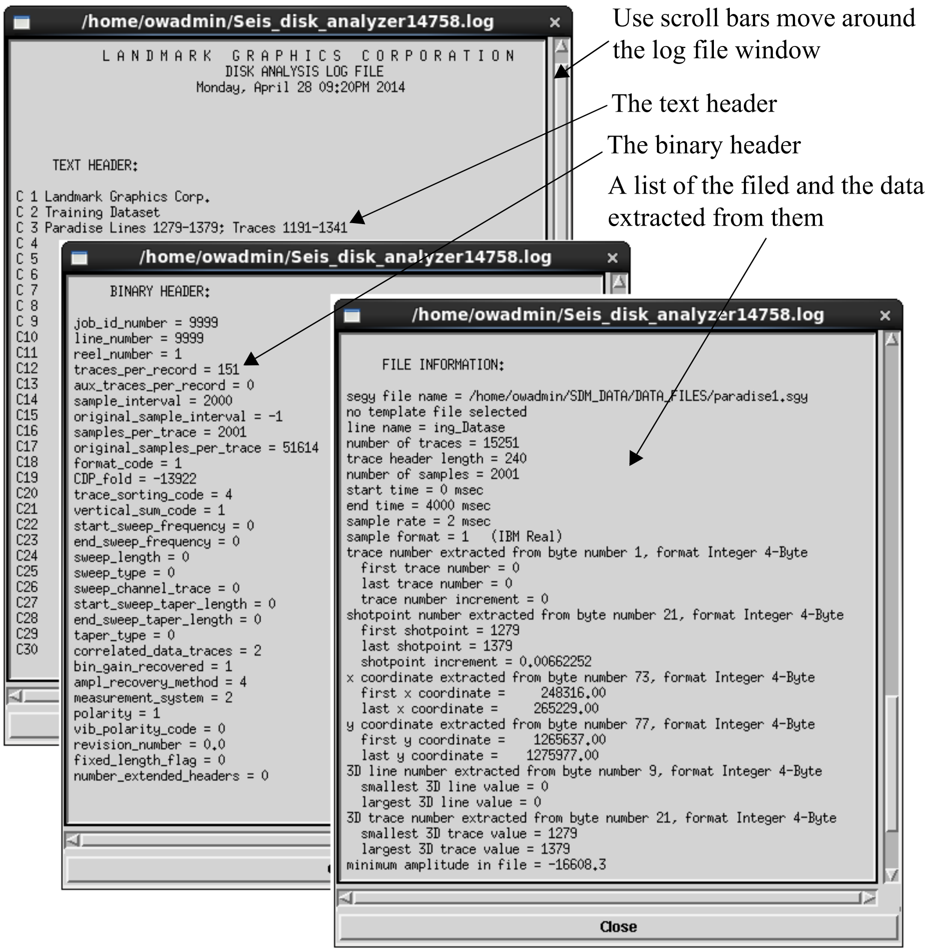
The batch spreadsheet reports IBM Real for the sample format, 2 ms for the sample rate and 0.0 to 4000.0 milliseconds of data (samples per trace would then be 2001). These appear to be reasonable values. They are extracted from the binary header. Both the complete EBCDIC and binary headers can be displayed in SEGY Analyzer by viewing the log and also in the Interactive SEGY analysis option.

2. To view the log, click the **View log…** button in the Tools/PD area for the SEGY Analyzer main window. Use the scroll bar to see the following information, which is written to the log file:

- Date and time the analysis was performed
- Complete SEG-Y text (EBCDIC or ASCII) header
- Complete SEG-Y binary header
- Disk file name or Tape file sequence number
- Template name
- Line name extracted from SEG-Y file
- Number of traces
- Trace header length
- Number of samples
- Start and end times
- Sample rate and format
- Byte number the trace number was extracted from and the trace number format
- First and last trace numbers and trace number increment
- Byte number of the shotpoint number was extracted from and the shotpoint format

- First and last shotpoint numbers and shotpoint increment
- Byte number of the x coordinate was extracted from and the x coordinate format
- First and last x coordinates
- Byte number of the y coordinate was extracted from and the y coordinate format
- First and last y coordinates
- Byte number of the 3D line number was extracted from and the 3D line number format
- Smallest and largest 3D line values
- Byte number of the 3D trace number was extracted from and the 3D trace number format
- Smallest and largest 3D trace values
- Minimum and maximum amplitudes in the file (Note—these values are not always correct)

The following example shows the log file produced from the analysis of *paradise1.sgy*:



3. Examine the information in the log file. You should have answers to the following media and format questions.

   - How many header records are at the beginning of the tape?

     From the log information, there appear to be 2 headers: an EBCDIC header followed by a binary header.

   - What is the sample format?

     Under File Information, the sample format is listed as 1 (IBM Real), which is the same as IBM floating point. The number 1 is also listed in the binary header next to format_code.

Refer to Appendix B or the table below for information on binary data format codes.

Binary Header Data Format Sample Codes	
Code	*Format*
1	Floating Point (4 bytes)
2	Fixed Point (4 bytes)
3	Fixed Point (2 bytes)
4	Fixed Point with Gain Code (4 bytes)

- What is the sample rate?

  Under File Information, the sample rate is listed as 2 milliseconds.

- What is the number of samples per trace?

  In the binary header, the number of sample_per_trace is listed as 2001.

  You can now calculate the total time in seconds using the equation:

  Total Time = (sample/trace - 1) x sample rate (ms) x .001

  For this data, Total Time = (2001-1) x 2 x .001 = 4 seconds

4. The next set of required information comes from the trace headers. To look at the trace headers, use the following steps:

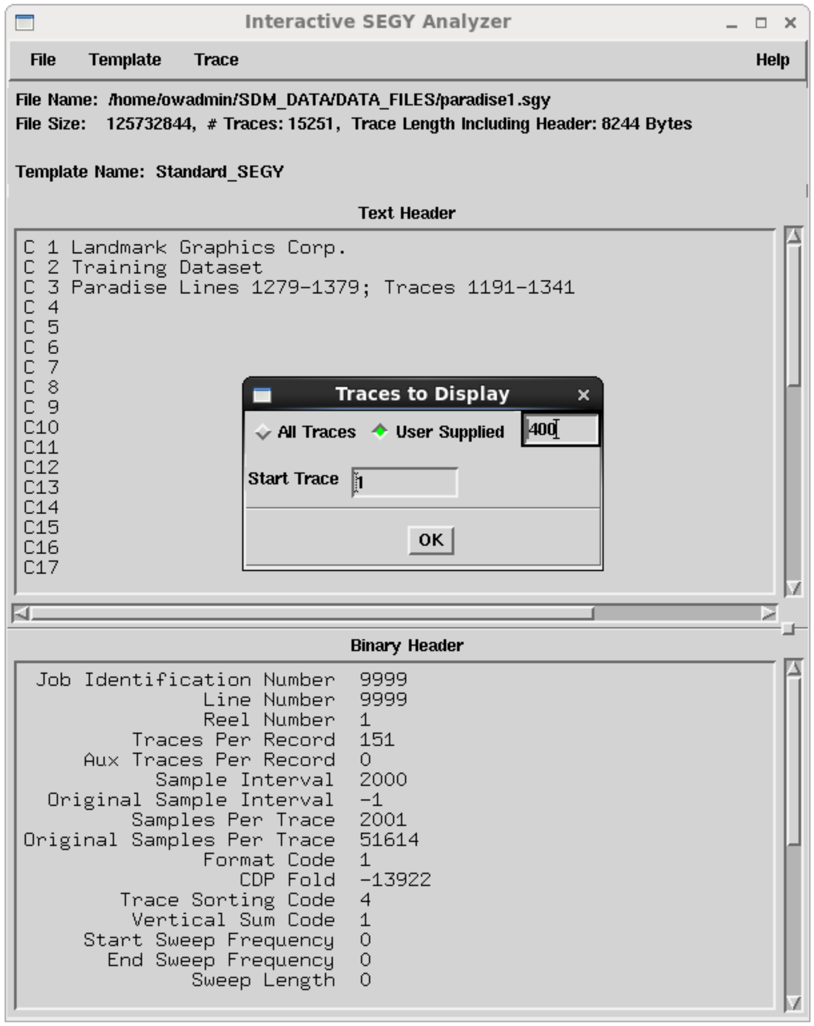
- Click the *<pathname>/paradise1.sgy* in the first column. It will be highlighted red.

- Click **Interactive SEGY analysis…** at the bottom left of the SEGY Analyzer window.

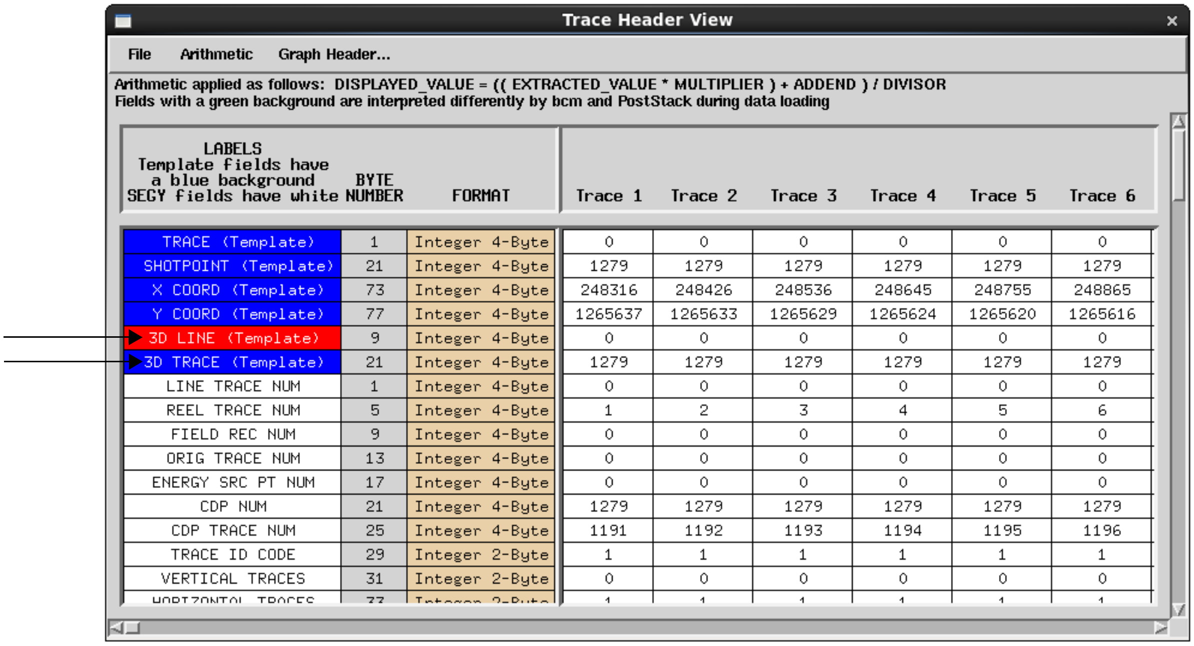
  Notice that you can view the Text Header (EBCDIC) and Binary Header here as well as in the log file.

- From the Interactive SEGY Analyzer menu bar, select **Trace > Header View…**.

- In the Traces to Display window select the radio button for **User Supplied**. Since each line is 151 traces across (see binary headers traces per record), you will want to view data for more than 151 traces because you want to see what happens when the lines change. Enter 400 in the text box. Leave the **Start Trace** at 1 and click **OK**.



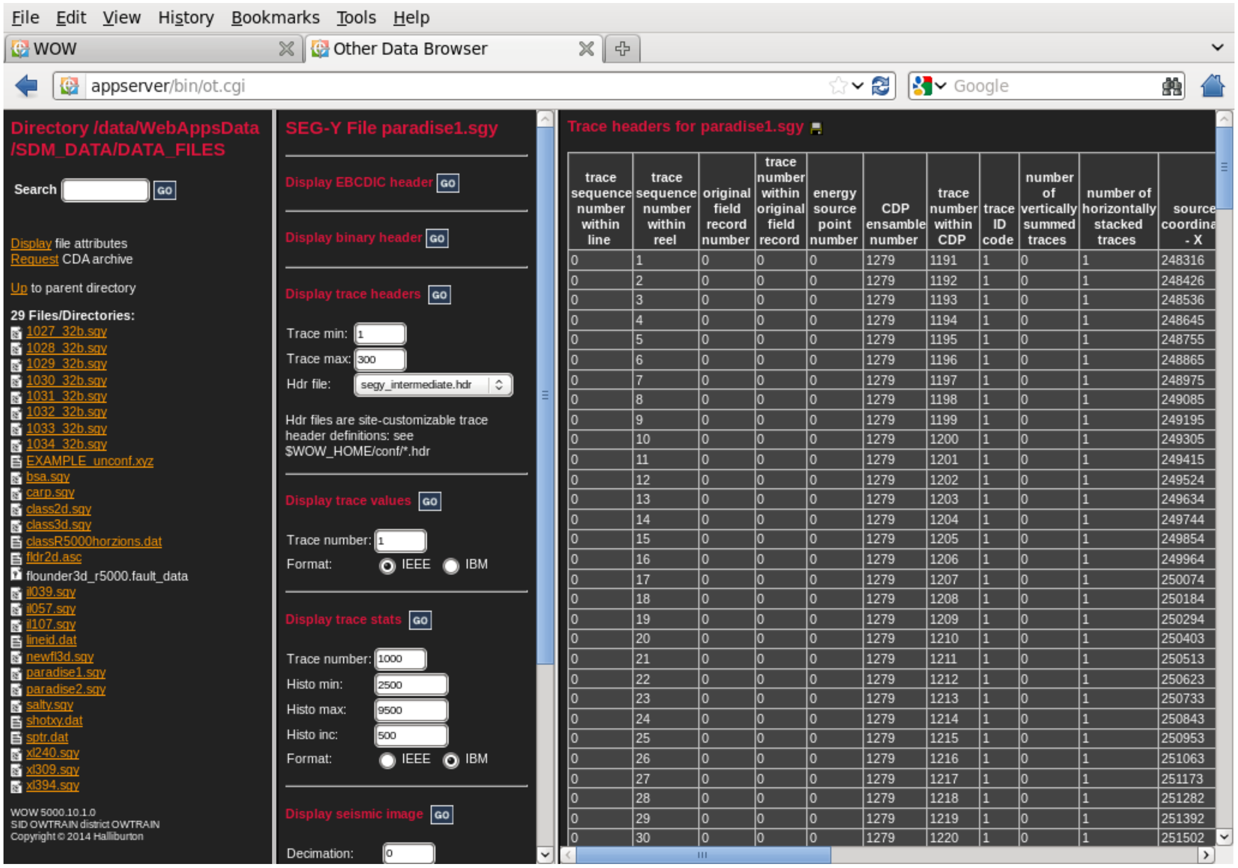
The Trace Header View window displays.



5. Display the trace headers in the WOW software as well (optional). Bring up the web browser that you opened earlier to the paradise1.sgy file.

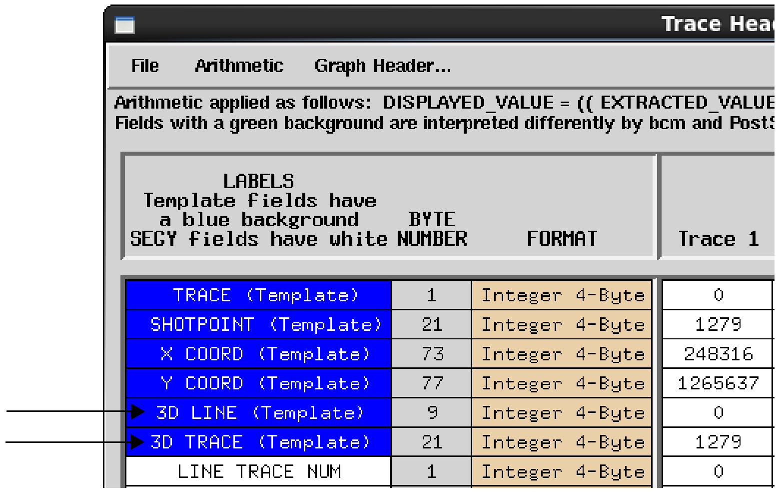
   - The EBCDIC header should be displayed as it is the first option.
   - Click **GO** under the binary header to view the binary header.

- Change the Trace max under Display trace headers to 300 and click **GO**.



- Return to the Trace Header View in SEGY Analyzer and use the information in the WOW software as a reference while completing the following steps.

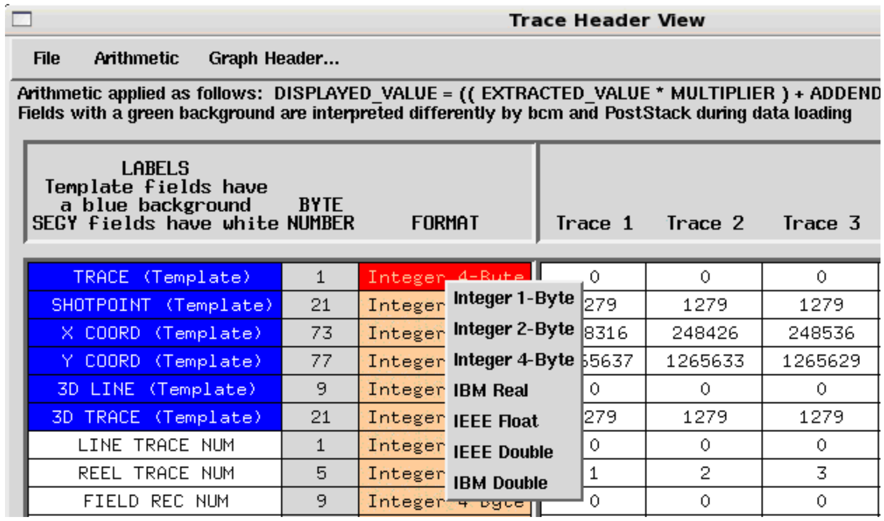
6. There are two fields that are of interest for 3D data: 3D LINE and 3D TRACE. Examine these fields to determine if the information displayed is consistent with the background information.



Notice the blue highlighted cells at the top of the Trace Header View. These are the important pieces of information needed for 3D and 2D data loading. They have been placed at the top of this dialog box to make it easier for you to see if the data are in standard SEG-Y format. All of the SEG-Y fields are then listed in order below the highlighted cells.

It is easy to see that the 3D Line values of 0 are not correct. The 3D Line information may be in another field or may have been recorded in a different format (from the standard SEG-Y format, the field is displayed in Integer 4-Byte).

If you suspect that a format is incorrect, you can interactively change that format by clicking MB3 in the appropriate buff colored Format field. A popup menu will appear which will allow you to choose an alternative format. The values in the row will reflect a change in format.



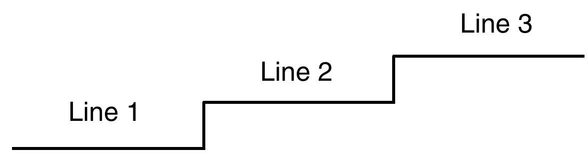
When the Trace Header data does not match the location of the template, there are two different ways to proceed when you discover the correct location and format of the fields of interest:

- record the byte locations and formats for the fields of interest to enter manually in the PostStack software
- make a new template with correct definitions for these fields to update the template in the PostStack software

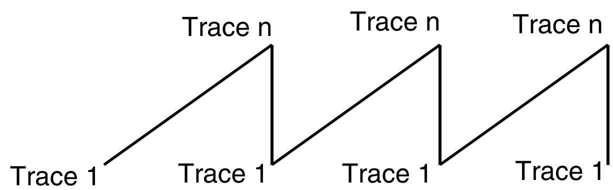
For this data load, examine the trace headers and record the information for 3D Line and 3D Trace. Workshop 1 includes the procedure to create a new template.

Graphing the trace headers will help determine the correct information for the 3D Line and 3D Trace.

The header for the 3D Line should remain constant for a record and then increment (usually by one), remaining constant until the next record, and so on. This behaviour graphs as a stair-step pattern.



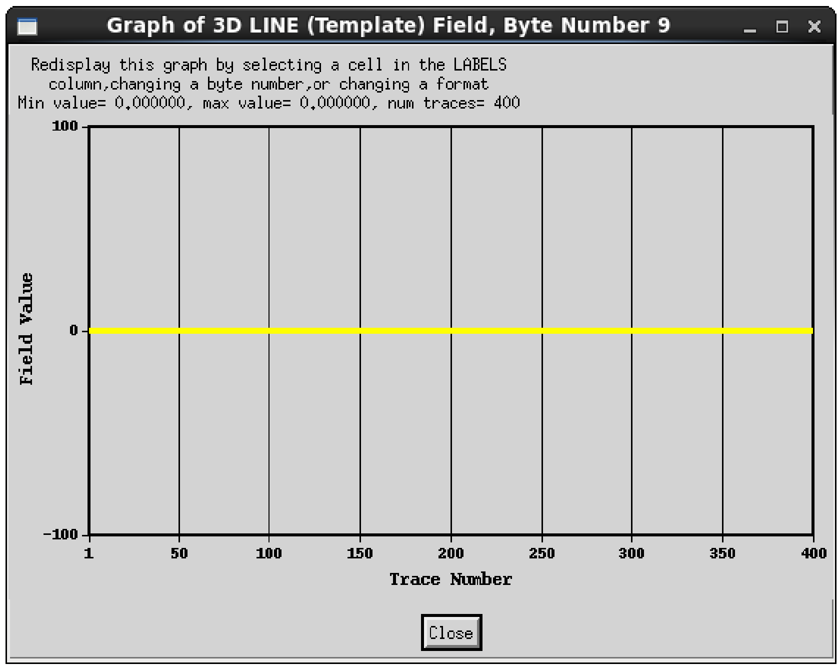
On the other hand, for 3D Trace, the header will increment (usually by one) until the end of the record and then start over. This behaviour graphs as a saw-tooth pattern.



For 3D data, you are looking for these patterns in trace headers that have values that correspond to the line and trace ranges.

7. Use the Trace Header Graph to display how the trace header values change from trace to trace. To set up the trace header graph, do as follows:

   - In the Trace Header View, click the **3D LINE** cell in the **LABELS** column to select it.
   - Select **Graph Header...** from the Trace Header View main menu.



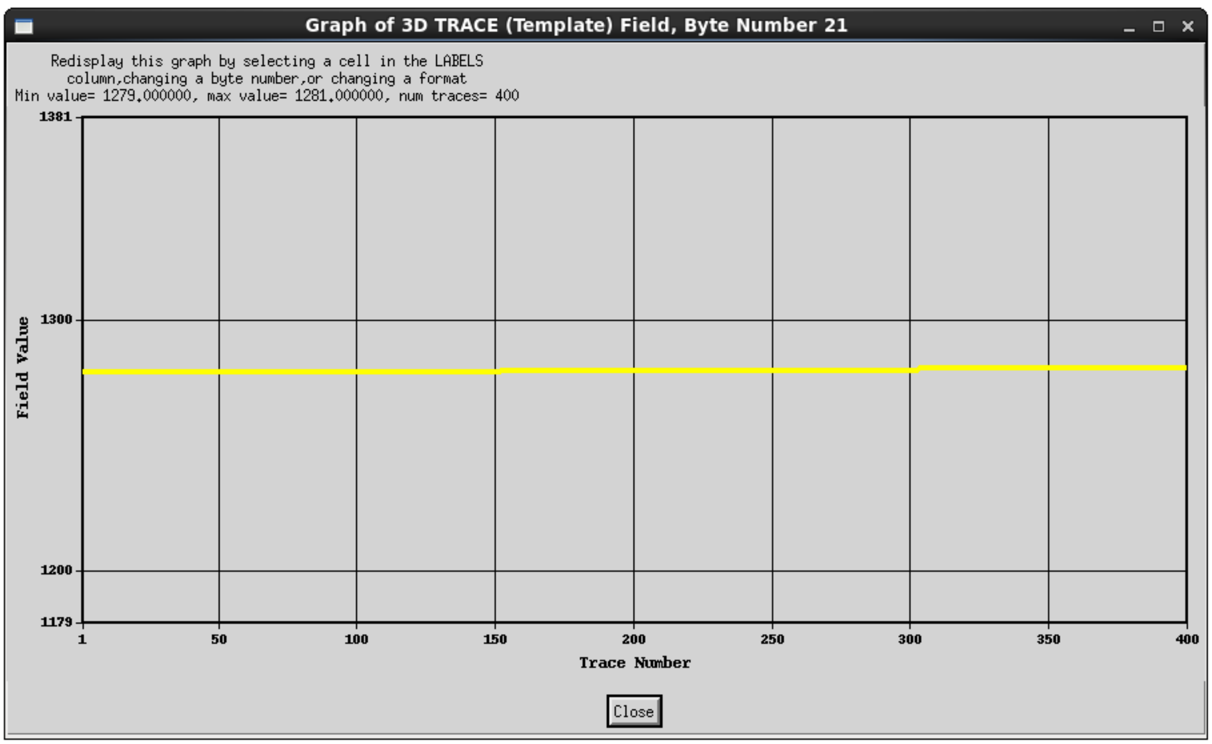
A graph of the 3D LINE trace header field is displayed from the given byte number and format defined for that field. The graph shows only the number of traces that are displayed in the Trace Header View. It also gives the trace header minimum and maximum values.

Notice that the graph runs straight along the x axis confirming that the value is 0 from trace for all 400 traces. This spares you the effort of scrolling (in the Trace Header View) through all of the traces.

- Click the **3D TRACE** cell in the **LABELS** column in the Trace Header View. The graph will automatically update to display the traces for this field.

> **Note**
>
> The graph will update if you change either the byte number or the format of the displayed trace header field.

Below is the graph of the 3D TRACE header. The graph is behaving more like what you would expect from a line (in a stair-step manner). From this graph and the corresponding values, it appears that what is labelled 3D TRACE (CDP NUM in the Standard SEGY format) actually contains the correct inline information, or what should be 3D LINE for this data.



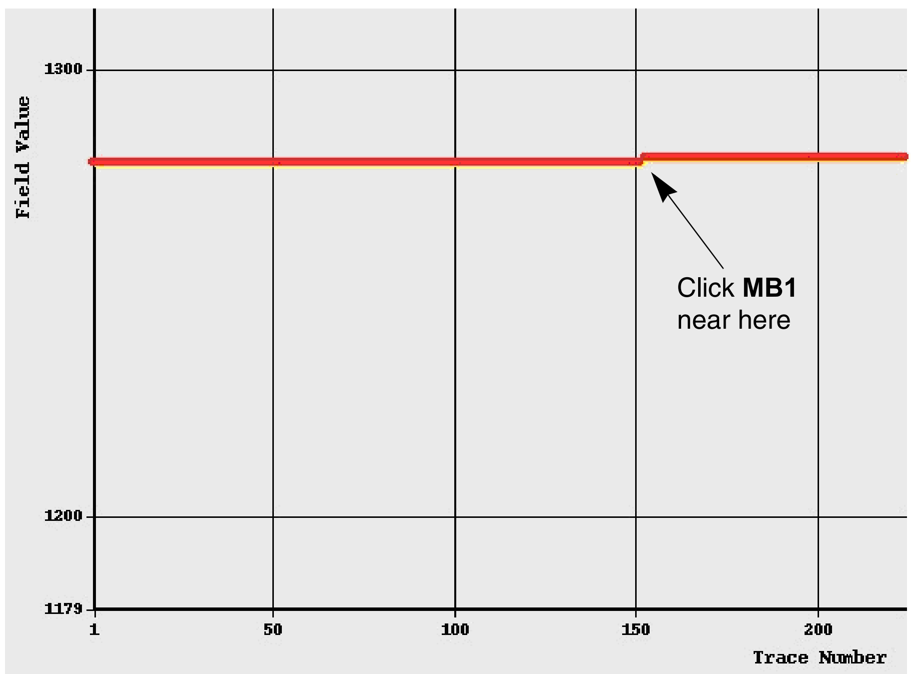
The data format, Integer 4-Byte is correct because the numbers correspond to the survey values for the lines. Seismic data in a SEG-Y file may not contain the entire 3D survey line range, but the values in the traces headers should be within the survey range.

8. Record (write down) the information for paradise1.sgy to use when the data is loaded. The header information to record for Line is:

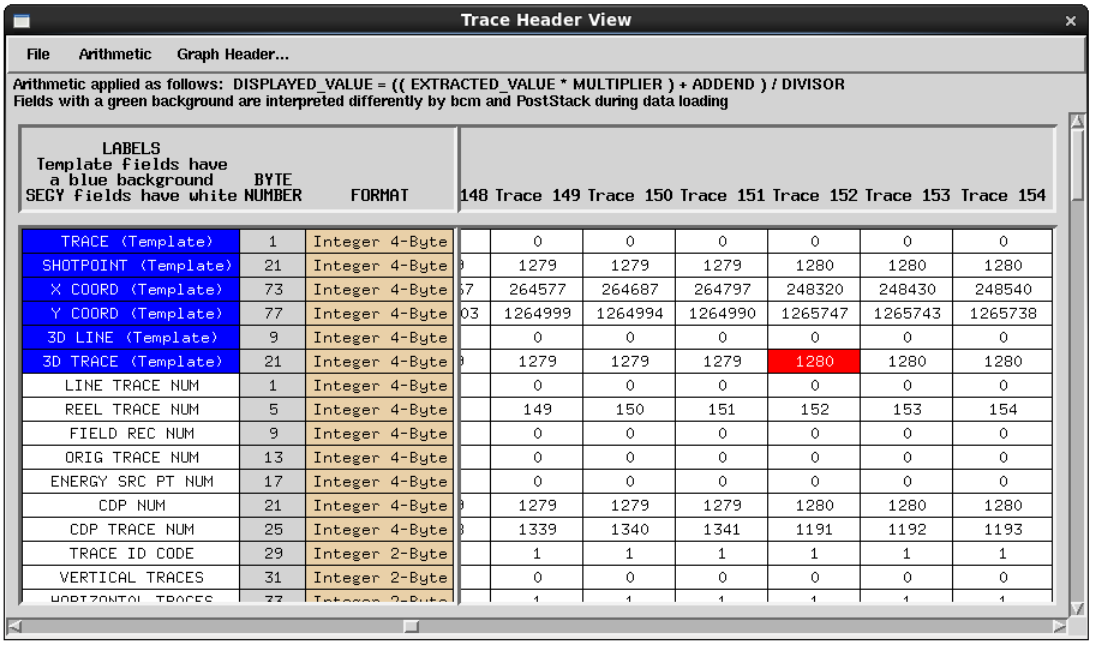
- Input Format _______
- Starting Byte_______

The Line information has been found, but not the Trace (crossline). Look through the trace headers where the line number changes to see if you can find a header position that might be the correct value for Trace. Try graphing these fields—the pattern to look for is a saw-tooth pattern, the trace number increasing along a line until the line number changes, at which time the pattern will start over.

9. Place your cursor over the spot where the graph increments (near trace 152) and press **MB1**. The Trace Header View will scroll to that trace number. You can use this functionality to quickly jump to the trace header that interest you, such as an area where the step in value changes dramatically.

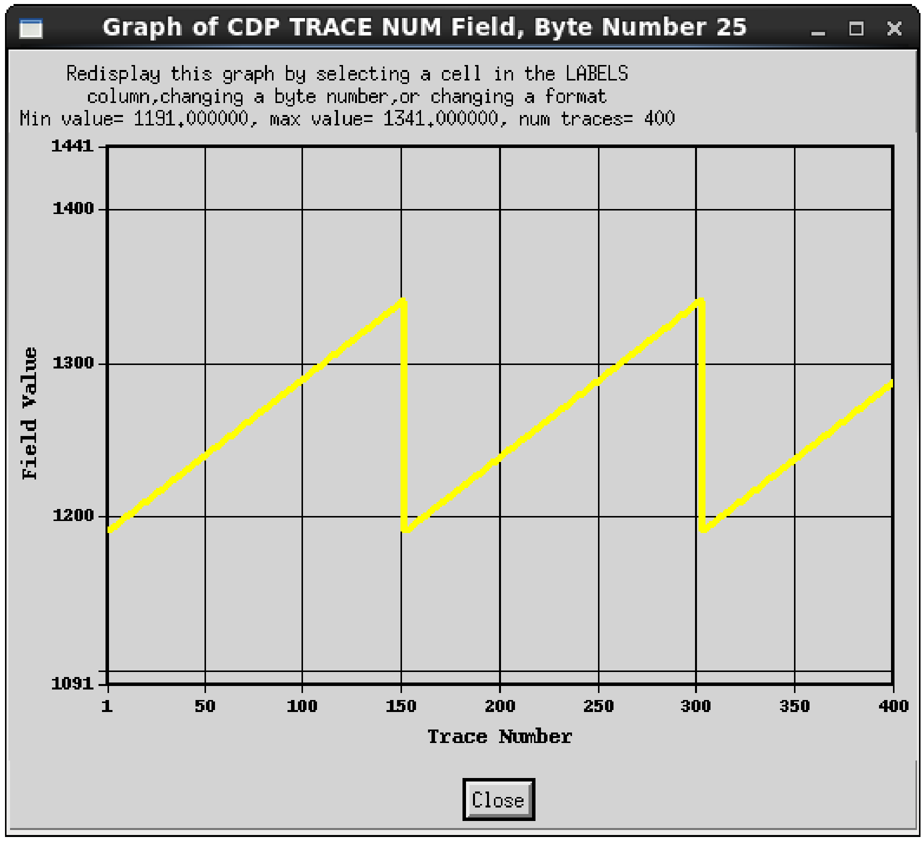


Look through the trace headers at this location where the line number changes.



LABELS Template fields have a blue background SEGY fields have white	BYTE NUMBER	FORMAT	Trace 149	Trace 150	Trace 151	Trace 152	Trace 153	Trace 154
TRACE (Template)	1	Integer 4-Byte	0	0	0	0	0	0
SHOTPOINT (Template)	21	Integer 4-Byte	1279	1279	1279	1280	1280	1280
X COORD (Template)	73	Integer 4-Byte	264577	264687	264797	248320	248430	248540
Y COORD (Template)	77	Integer 4-Byte	1264999	1264994	1264990	1265747	1265743	1265738
3D LINE (Template)	9	Integer 4-Byte	0	0	0	0	0	0
3D TRACE (Template)	21	Integer 4-Byte	1279	1279	1279	1280	1280	1280
LINE TRACE NUM	1	Integer 4-Byte	0	0	0	0	0	0
REEL TRACE NUM	5	Integer 4-Byte	149	150	151	152	153	154
FIELD REC NUM	9	Integer 4-Byte	0	0	0	0	0	0
ORIG TRACE NUM	13	Integer 4-Byte	0	0	0	0	0	0
ENERGY SRC PT NUM	17	Integer 4-Byte	0	0	0	0	0	0
CDP NUM	21	Integer 4-Byte	1279	1279	1279	1280	1280	1280
CDP TRACE NUM	25	Integer 4-Byte	1339	1340	1341	1191	1192	1193
TRACE ID CODE	29	Integer 2-Byte	1	1	1	1	1	1
VERTICAL TRACES	31	Integer 2-Byte	0	0	0	0	0	0

10. Notice that when this value changes, byte position 25 also changes pattern (it was increasing). Graph this byte position by clicking the **CDP TRACE NUM** cell.



The graph appears start over when the line number changes in the manner you would expect traces to change. Data values are the expected trace values, so you have now found the other piece of necessary information to load the paradise1 SEG-Y file.

11. Record (write down) the information for 3D Trace here:

- Input Format______
- Starting Byte______

When finished, exit SEGY Analyzer. You are ready for the next exercise in the workflow.

Batch Analysis from Tape

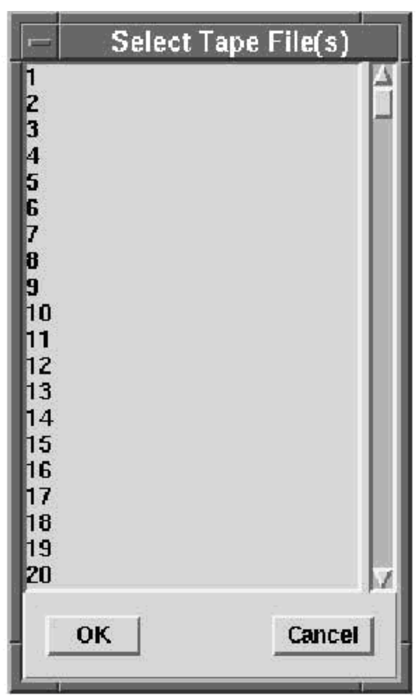
Below are the modifications to the exercise process in case you are analyzing data directly from tape.

In the SEGY Analyzer main window, click **Tape analysis to log file**. The spreadsheet columns change slightly to reflect the medium.

If your 3D tape has EOF markers between lines and more than 300 seismic lines, you must define which lines to analyze from the tape. SEGY Analyzer considers each seismic line to be a file and assigns a sequential file counter to each seismic line. The first line on tape will be assigned 1; the second line will be assigned 2, and so on. You define which file numbers to read from tape using one of two ways:

- You can enter the number(s) in the Tape File Number cells by clicking once in each cell and typing the numbers. The cell turns red to show that it is selected. When you have completed typing in a cell, click **MB1** in a different cell or press **Tab** or **Enter** to get out of "edit" mode.

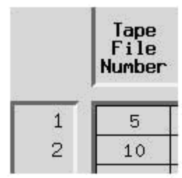
- You can choose one or more files from a list of files. Choose **File > Select…**. The *Select Tape File(s)* dialog box opens.



For each line (file) on the tape that you want to read, select it using **Ctrl-MB1**. To deselect a selected file, simply press **Ctrl** and click on the file.

You do not have to select the files in order; the software will list the files sequentially in the spreadsheet.

After you have selected the appropriate files, click **OK**. The files are posted in the Tape File Number column of the spreadsheet.



Change the log file pathname if you prefer at different location.

Click the **Start** button next to **Tape analysis to log file** and continue analyzing the data as shown in the previous exercise, starting from Step 2.

Tape Device Definition Files

SEGY Analyzer uses the same tape device definition file (device.dat) used by the OpenWorks software. However, if you are copying from a remote device, SEGY Analyzer checks another tape device definition file, rmttape.dat.

The rmttape.dat file resides in the host machine's $OWHOME/conf directory and points to the rmtspc.exe file on the remote machine. rmtspc.exe resides in the $OWHOME/GeoDataLoad/bin directory of the remote machine.

To illustrate, say that you are running on host machine **sauron**, but wish to use the tape drive on remote machine **castor**. The rmttape.dat file on **sauron** must be edited so that it contains the full path to the rmtspe.exe file on **castor**.

For example:

castor:/pe/OpenWorks/GeoDataLoad/bin/rmtspc.exe

Loading 3D Seismic Data with PSDL

3D Data Loading Task List

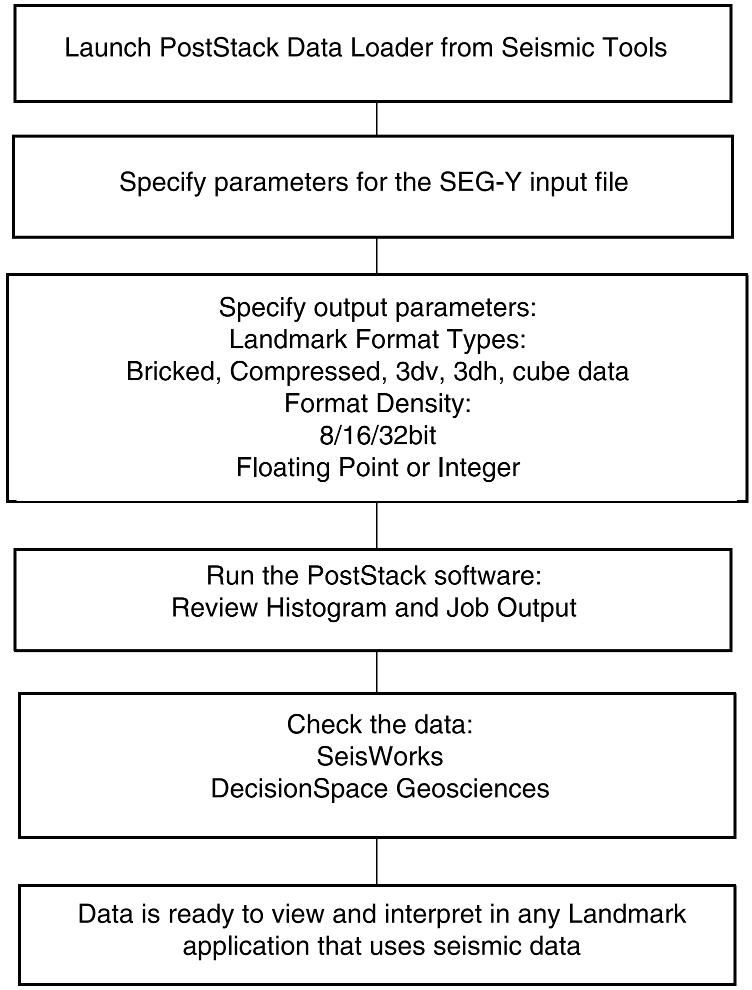
- Gather background information
- Create/Select an OpenWorks project database
- Create 3D seismic survey
- Create seismic storage directories
- Check base map (compare SeisWorks Map View to Horizon Image Map)
- Analyze SEG-Y data
- Load Data with PostStack Data Loader
- Check data load (view seismic in appropriate application)
- Backup

Seismic Tools allows you use the PostStack Data Loader to load SEG-Y data to a 2D or 3D interpretation project without tying up a fully licensed version of the PostStack software. This approach means that whoever is responsible for performing data loading tasks only needs to learn a small part of the PostStack software to do useful work and lay the groundwork for the interpreter.

The basic procedures to set up and run a PostStack Data Loader job are:

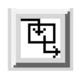
- Start the PostStack Data Loader from the Seismic Tools
- Specify the input data
- Specify a format and volume name for the output data

Workflow for Loading SEG-Y Data into a Landmark Format Using PostStack™ Software Data Loader



PostStack™ Software Icons

Four icons on the *PostStack* dialog box make it easy for you to navigate through flows as well as run and check jobs.

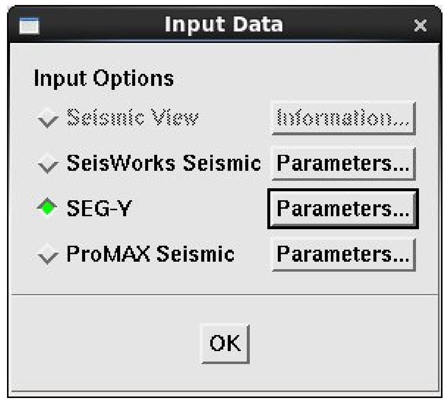
Icon	Function & Menu Equivalent
 Submit Job	Places the current flow in the job queue if Run Current Flow is toggled on. Processes a subset of the data if Test Current Flow is toggled on. **Job . Run**
 Job Log	Displays a log of the current processing job allowing you to monitor job status and identify any problems. **Job . View**
 Flow Previous	Displays the previous flow in the session. **Flow . Previous**
 Flow Next	Displays the next flow in the session. **Flow . Next**

For most data loading, you usually would not select any processes, though you may want to trace balance, scale of filter your input data for a final load. There is no need to create different flows for general data loading. PostStack processing, attribute, waveform, and ESP options and flows are covered fully a separate PostStack class.

The Submit Job and Job Log icons are the only ones needed for the exercises in this class.

PostStack Software Input Options

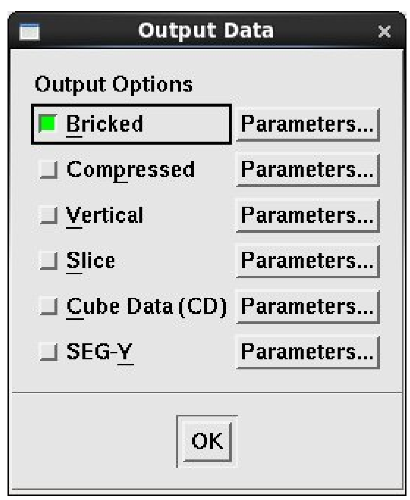
PostStack Data Loader expects SEG-Y tape or disk input, but you can also input Landmark formatted seismic volumes that have already been loaded and also ProMAX data sets (ProMAX is the Landmark seismic processing software).



Click **Parameters...** to specify input file or tape and to specify the correct inline and crossline format and location for SEG-Y input

PostStack Software Output Options

Output options for 3D include Bricked and Compressed formats, also the Landmark classic Vertical (.3dv) and Slice (.3dh) formats, as well as a Cube Data output (for performance improvement in the GeoProbe software and ZAP) and SEG-Y output. Each option has its own output parameters dialog box with the selection choices based on the output type.



PostStack Software Sessions

Sessions may be saved in the PostStack software if desired. Saving a session is useful if you have a processing sequence you want to use for several data sets. Since each data loading exercise is unique we will not used saved sessions, except for this exercise, so you can see how and where sessions are saved. For the rest of the class, saving PostStack sessions is optional.

Sessions are saved in one of three places:

- Current Project
- User Library
- System Library

The choice of option will determine:

- where the session files are saved
- who can access the sessions

Current Project - available in the current project: **Session > Save As…**

- Saved in OW_PROJ_DATA/<OpenWorks_Project_Name>/PostStack/<survey_name>

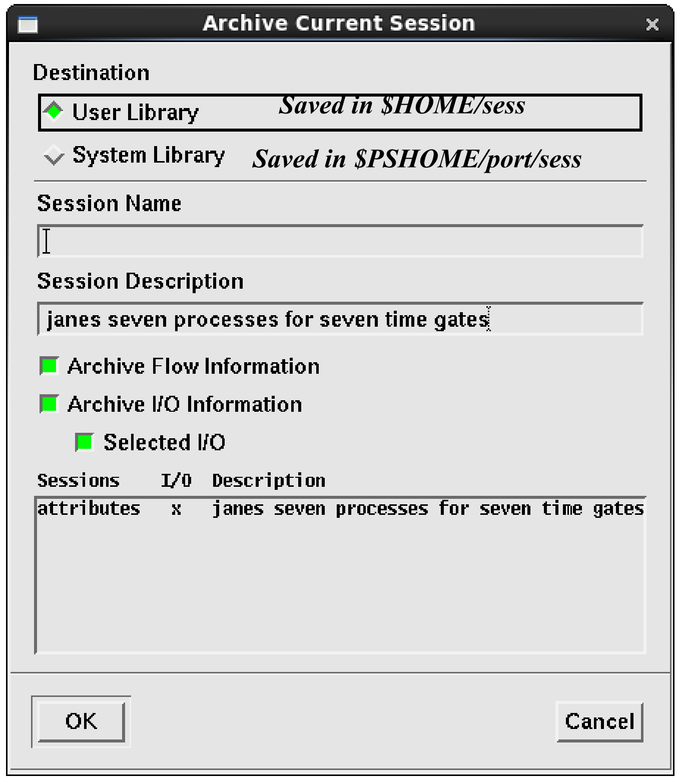
User Library - available to the user in different projects: **Session > Archive…**

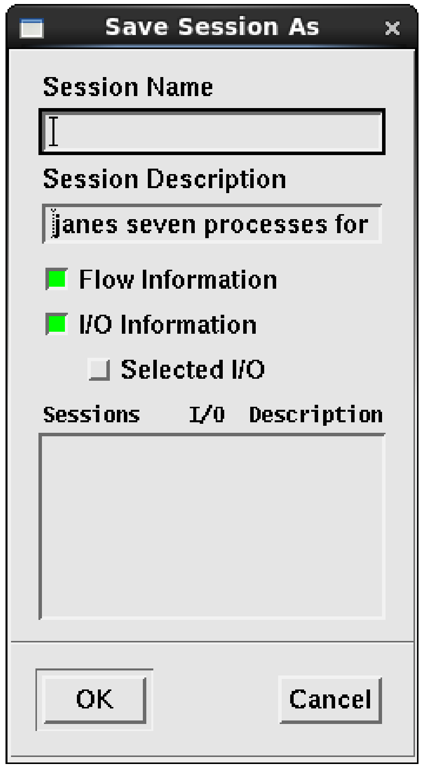
- Saved in $HOME/sess

System Library - available to the other users in different projects: **Session > Archive…**

- Saved in $PSHOME/port/sess

In the PostStack software main dialog box, select **Session > Save As…** or **Session > Archive…**





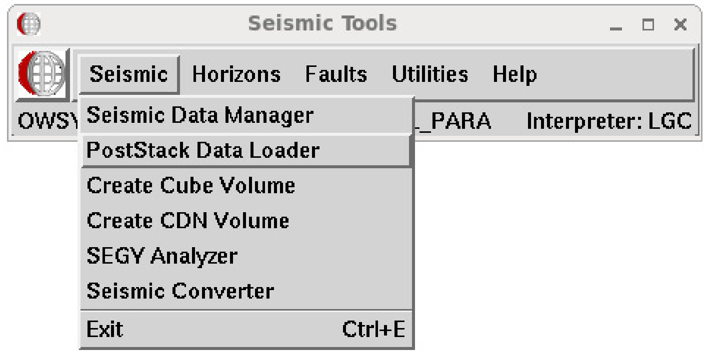
Saved in OW_PROJ_DATA/ <OpenWorksProjectName>/PostStack/ <survey

Exercise 5: Using the PostStack Software Data Loader to Load 3D Seismic Data

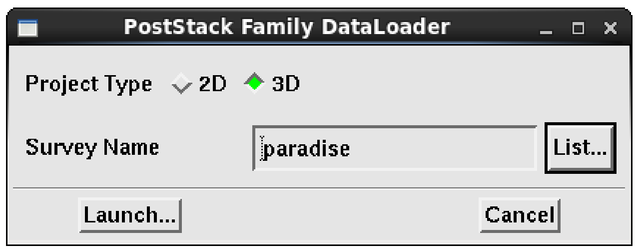
In this exercise, you will load your 3D survey in the original floating point format.

Although you can run the SeisWorks software and the PostStack Data Loader concurrently, for data loading purposes, this is not necessary. You start the PostStack Data Loader directly from the Seismic Tools without tying up a SeisWorks license. If you start the SeisWorks software later, the two applications will establish communications.

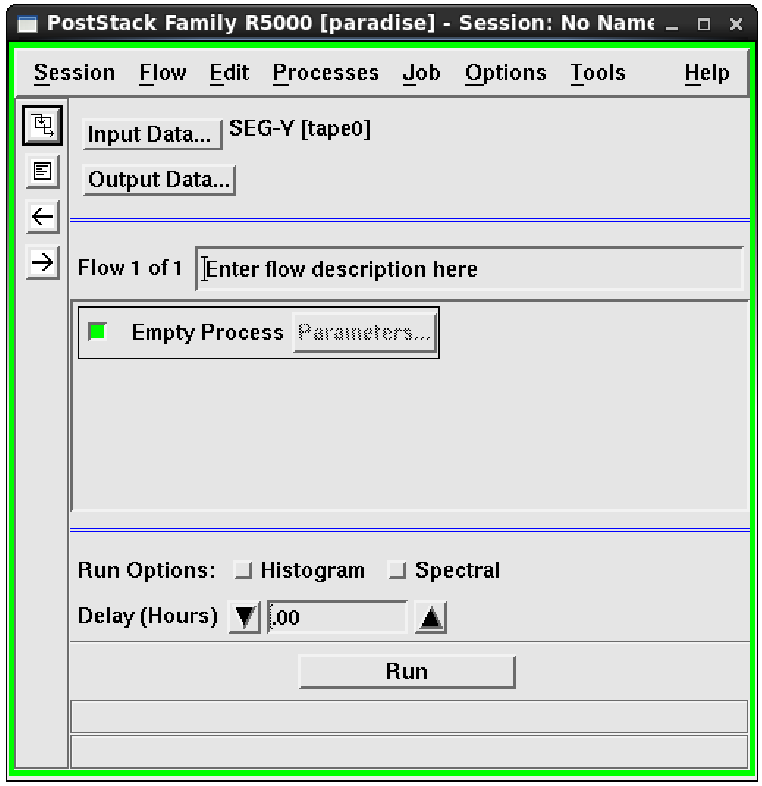
1. To launch the PostStack Data Loader from Seismic Tools, select **Seismic > PostStack Data Loader**.



2. Click the survey **List…** button. Select the 3D survey *paradise*.

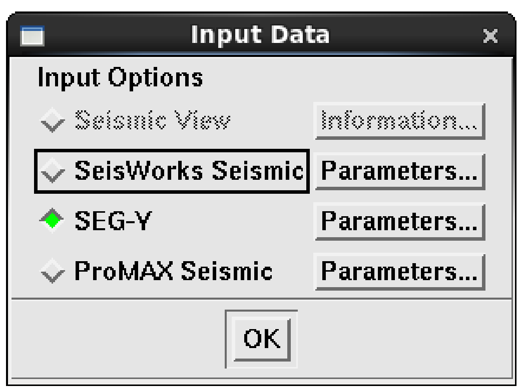


3. Click **Launch…**.

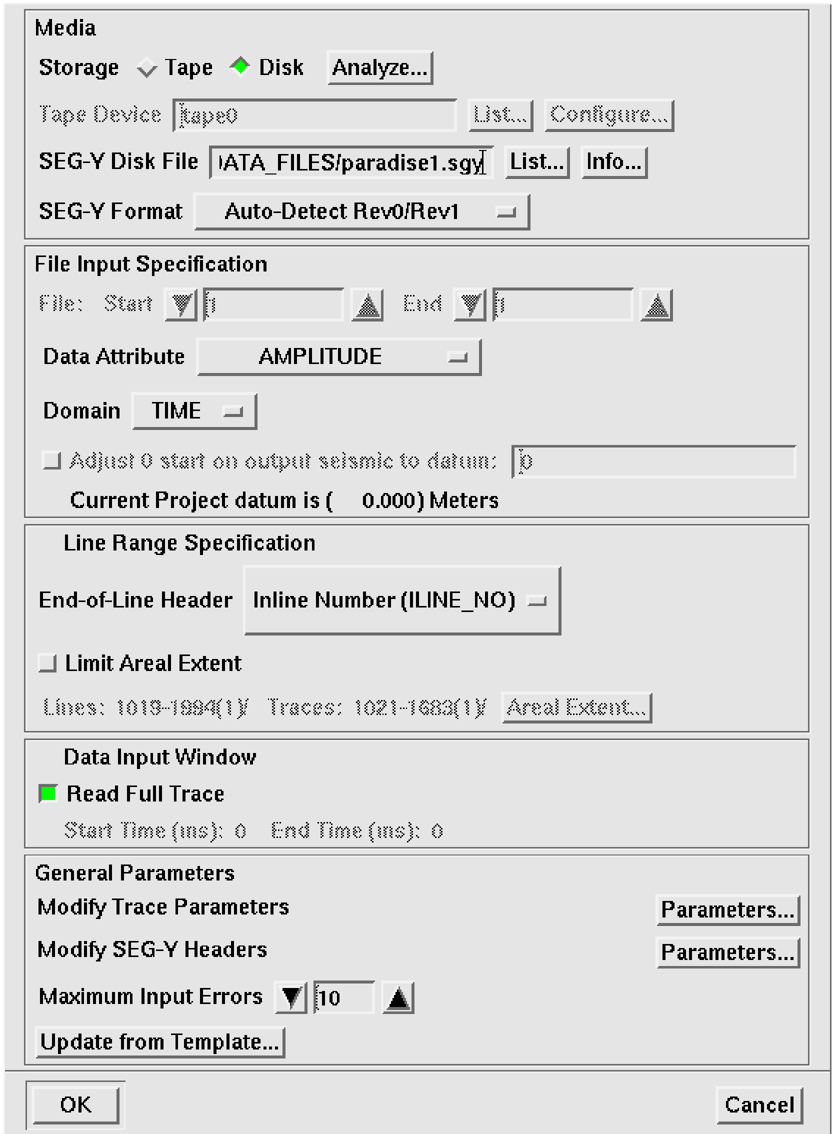


In the PostStack Family window, click the **Input Data…** button.

4. Set the Input Option to **SEG-Y**.



5. Click **Parameters…** to open the *SEG-Y Data Input* dialog box.



The Media section is where you specify the input SEG-Y data.

6. Select **Disk**.

For future reference, the Analyze… button next to Disk launches SEGY Analyzer. As we have already analyzed the SEG-Y data, there is no need to launch it here.

7. Select the SEG-Y Disk File by clicking on **List…**. Use the file filter to specify the path for the data name paradise1.sgy.

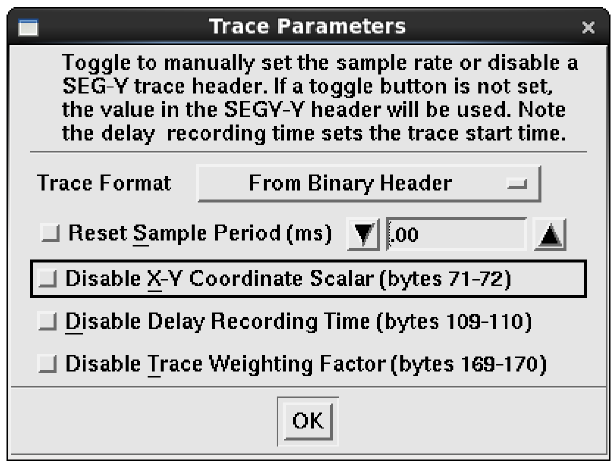
8. Click **Info…** to view the EBCDIC and important information from the binary header. This information is displayed in the SEG-Y File window that opens.

9. Leave the SEG-Y Format option set to the **Auto-Detect Rev0/Rev1** default.

   The other SEG-Y format options are standard and variable length trace Rev0 and Rev1. See online manual for more information on these format options. If Rev1 has extended headers, they are stripped off and not used.

   File Input Specification is used for tape input that contains more than one file or volume (greyed out in this window).

10. Click the **Parameters…** button next to Modify Trace Parameters.

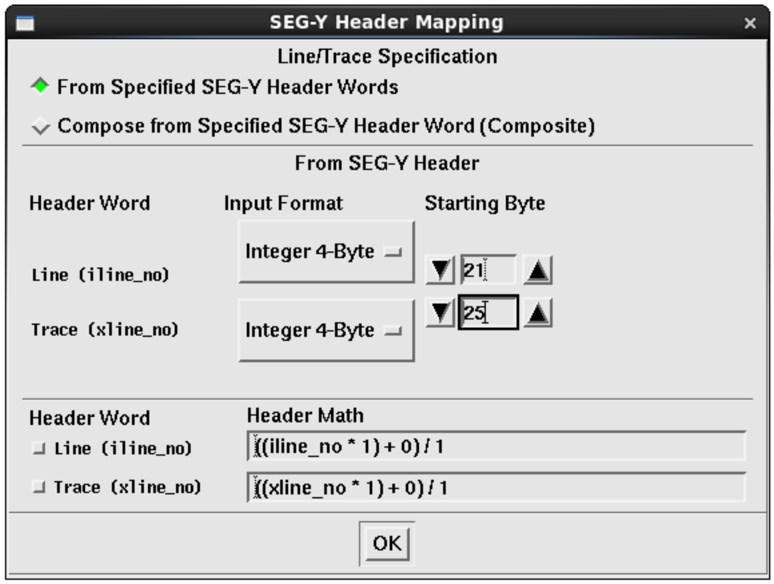


Since the values in the binary header are the ones that should be used during loading, there is no need to change anything.

- Click **OK** to dismiss the *Trace Parameters* dialog box.
- Click the **Parameters…** button next to Modify SEG-Y Headers.

The values for the input format and starting byte position of the line and trace numbers come from the template Standard_SEGY and are incorrect for the paradise1.sgy data set.

11. Enter the correct values in the **From SEG-Y Header** area for Line (3D LINE) and Trace (3D TRACE) and click **OK** to close the *SEG-Y Header Mapping* dialog box. Use the values you recorded in the SEGY Analyzer exercise.

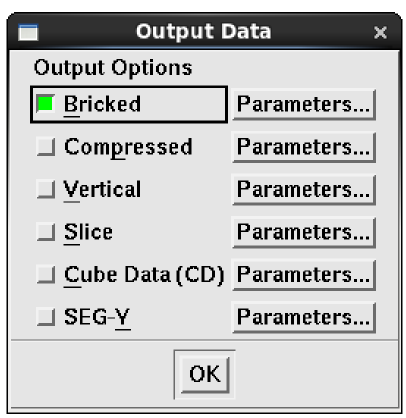


12. Close the dialog boxes:

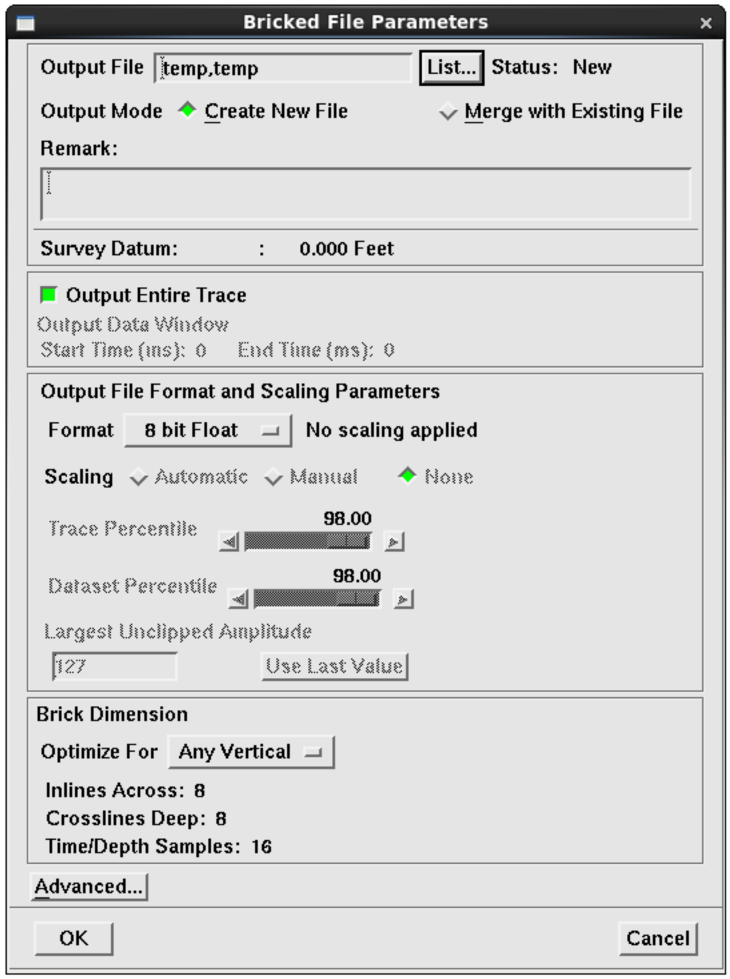
- Click **OK** to close the *SEG-Y Data Input* dialog box.
- Click **OK** in the *Input Data* dialog box.

13. In the *PostStack* main dialog box, click **Output Data…**.

14. For the output data, use the default **Bricked** option. Other output options will be used in the 3D Data Loading Workshops.



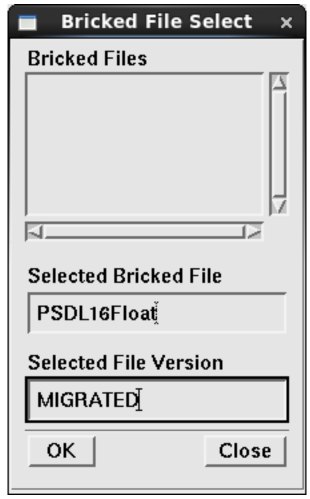
15. Click the **Parameters…** button next to Bricked to open the *Bricked File Parameters* dialog box.



16. Click the **Output File List…** button. In the Bricked File Select box type `PSDL16Float` for the Selected Bricked File and `MIGRATED` for Selected File Version.

    The .bri suffix will be automatically added to the name when the PostStack software generates the file.

Remember that 40 characters (each) are allowed for the name and version specification, allowing great flexibility to use meaningful information in the data set names.



17. Click **OK**.

18. Leave **Output Entire Trace** toggled on.

    If you wish to limit the time range of the output data, you must toggle off **Output Entire Trace** and enter the desired **Start Time** and **End Time**.

    If you wish to extend the time range, use **Processes > Utilities > Trace Length** from the *PostStack* main window and click on **Parameters…** to pad the data to the extended range.

19. In **Output File Format and Scaling Parameters**, specify the format for the output file by clicking on the option button and choosing **16 bit Float** from the menu.

    Processed data comes in many different densities. Remember the histogram from SEGY Analyzer? The maximum amplitude for this data is 16608.305, which fits in the 16 bit range. For the class, we will choose the 16 bit floating point for the output file, which will preserve the amplitudes but still save disk space (instead of loading as 32 bit).

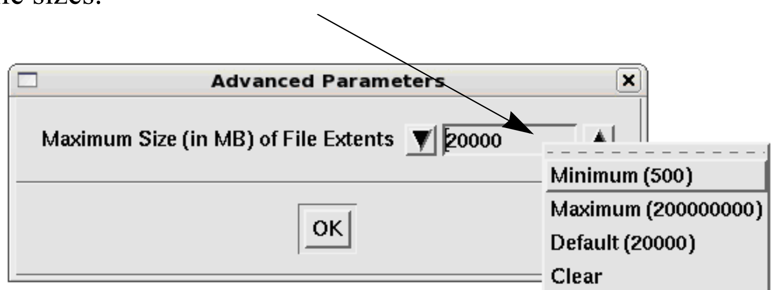
    If the amplitude range was greater than -32,768 to +32,768, you should probably load the data as 32 bit floating point, depending on computer resources and interpretation workflow.

There may be times when you would want to output the seismic data at a lower bit density and apply a scaling factor depending on specific system considerations and interpretation needs. Scaling options are discussed in depth in the 2D data loading portion of this class, but are applicable to 3D data as well. When you output data at lower bit densities, you save space and may improve performance, but sacrifice resolution, which may be a critical factor for some interpretation workflows.

20. Default the Brick Dimension to **Any Vertical**.

    This parameter is used for display optimization. Any Vertical creates a volume that takes about the same amount of time to generate inlines, crosslines, and arbitrary lines. Should your workflow require it, the Brick Dimension may be optimized for Inline, Crossline, or Horizontal (time slice) display or they may be user-defined.

21. Click the **Advanced…** button in the lower left corner of the *Bricked File Parameters* dialog box. This parameter sets the maximum size for file extents and can range from 500 to 200000000 MB. Click **MB3** in the value field to see the acceptable file sizes.



    Click **OK** to accept the default extent size and close the dialog box.

22. Click **OK** in the Bricked File Parameters dialog box and click **OK** in the *Output Data* dialog box to close the boxes.

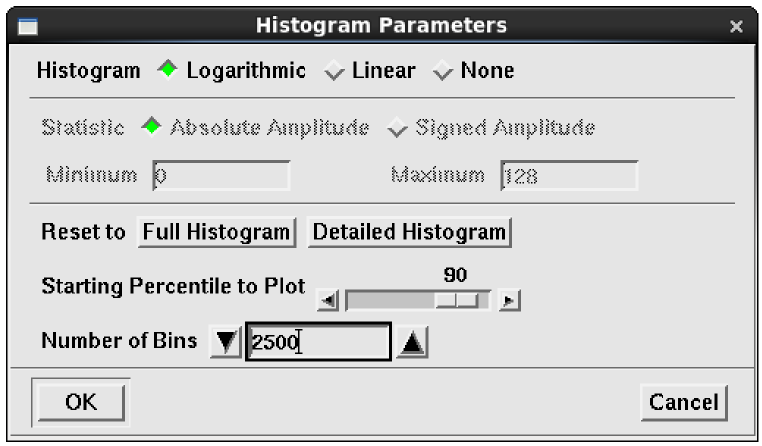
23. In the *PostStack* main dialog box, set up a histogram using the following steps:

- Toggle on **Histogram** in Run Options to create frequency distribution amplitude report in the job.output file.

- Press **MB3** while your cursor is on the Histogram option and select **Parameters…**.

- Select **Logarithmic**. Click **Detailed Histogram**.

- Change the Number of Bins to **2500**.

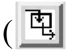


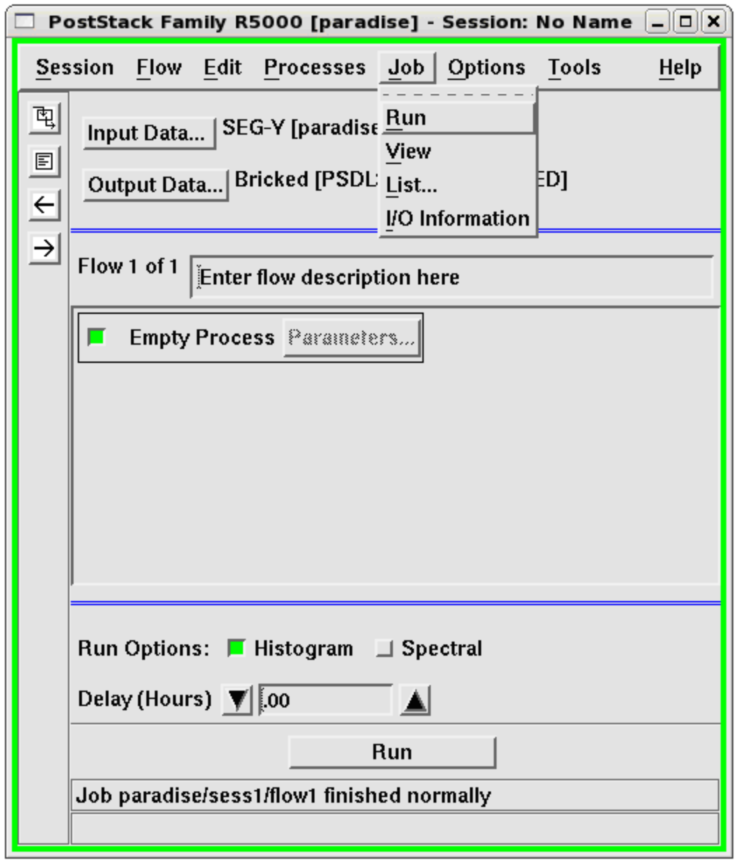
- Click **OK**.

These histogram parameters are chosen to examine in detail the highest positive and negative amplitudes in the data and to display a compact, easy to read histogram plot in the job.output file.

There are various ways to start the data load.

24. To submit the job, choose *one* of these methods:

- Click the **Submit Job** icon ().
- Click Run at the bottom of the dialog box.
- Select **Job** > **Run** from the menu bar.



Status information in the message bar at the bottom of the dialog box reports when the job is initiated and if it ended successfully.

A beep sounds and a *PostStack Message* dialog box appears when the job is completed.

- Click **OK** in the message dialog box.

25. Click **Job** > **View…** or the **View Job** icon () to view the job as it runs, along with the Histogram results.

From the **Output from Flow** menu bar, select **File** > **Monitor** so that this window updates as the job executes.

When the job is completed, turn off the monitor by again selecting **File > Monitor**. This will stop the window from jumping to the end of the file every three seconds.

Scroll through the output file. It contains a lot of information about the data you just loaded.

26. Use **File > Exit** to close the job view.

    The job.output file is automatically written to a disk file and is also saved in the process history for the bricked file just loaded and may be viewed in Seismic Data Manager and a variety of other places. The next part of the exercise shows some of the other ways to view the job.output file.

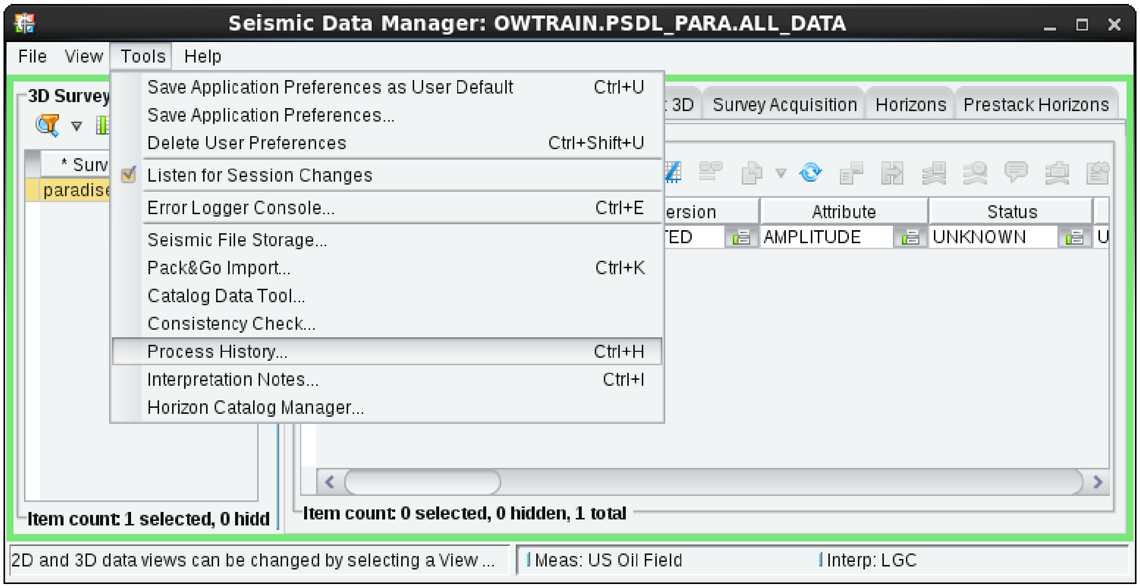
Viewing the Process History in Seismic Data Manager

The entire job.output file information is saved for you in the database. Think of this file as meta data attached to the volume you just loaded. Seismic Data Manager will display the job.output file (using **Tools > Process History…**), as well as accessed through other applications, such as in the SeisWorks software by selecting **Seismic View > Seismic > Info…**.

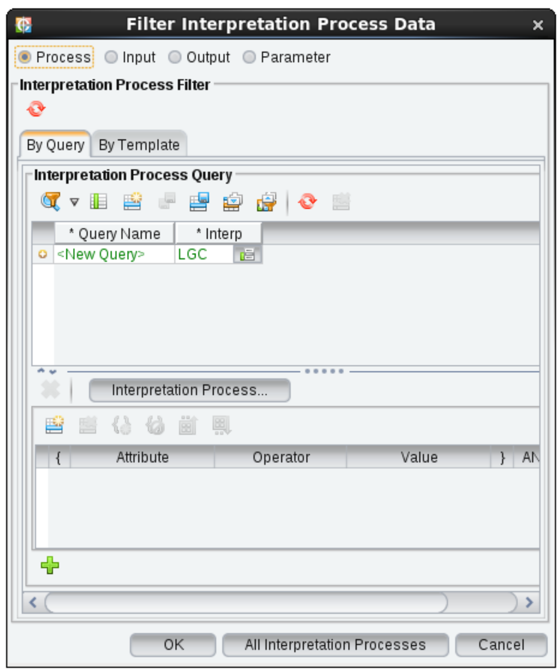
27. Select **Data > Data Management > Seismic Data Manager** from the OpenWorks main menu to open Seismic Data Manager.

28. Select **View > 3D**; highlight **paradise**, and click the **Seismic 3D** tab.

29. Select **Tools > Process History….**



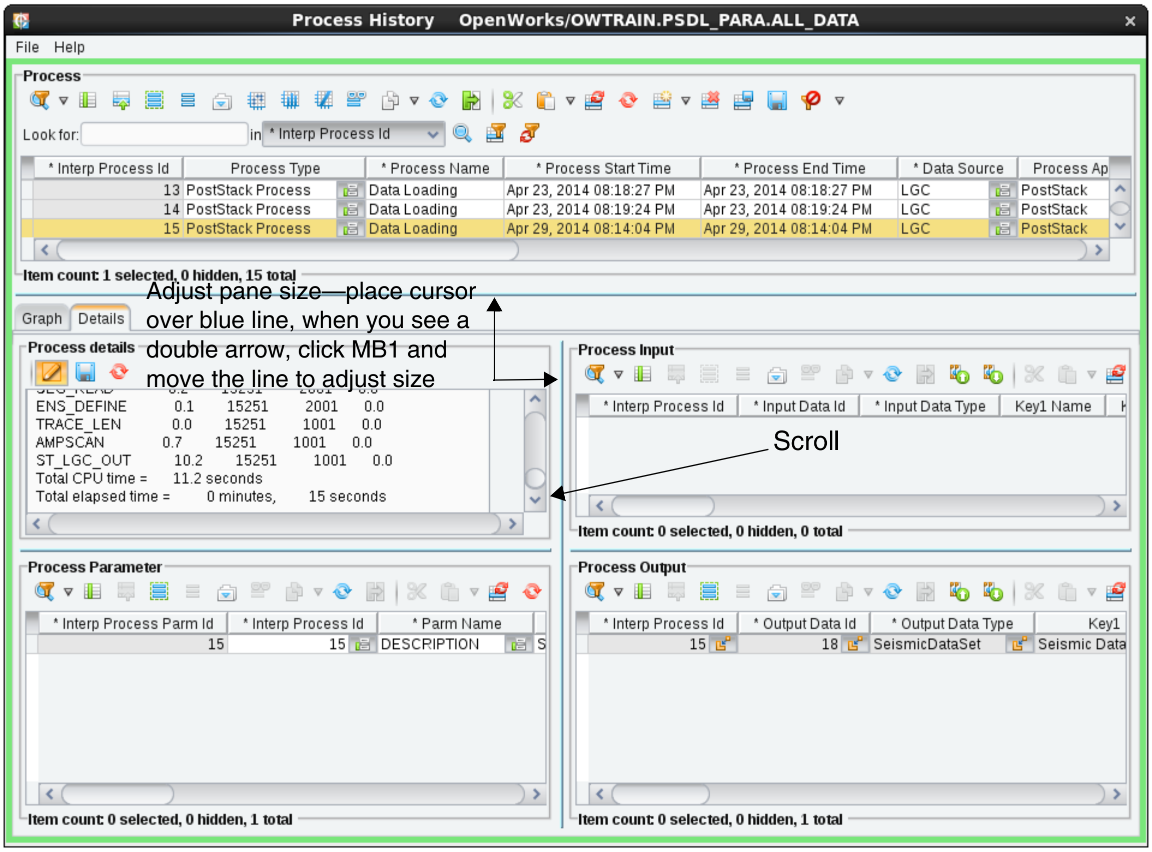
30. Click **All Interpretation Processes** in the filter selection window.



The *Process History* window is divided into two sections, a list of data at the top, and Graph and Details tabs below.

31. Highlight the seismic volume—a workflow graph displays.

32. Click the **Details** tab—the job.output file is in the Process details portion. Adjust the window panes and scroll through the Process details.



33. Select **File > Exit** to close Process History.

34. Close Seismic Data Manager (**File > Exit**).

Viewing the job.output File in a Unix Directory

The job.output file is written to a disk file and is also saved in the process history for the bricked file just loaded and may be viewed in Seismic Data Manager. The file is located in a path on the OW_PROJ_DATA directory, and can be a little difficult to find.

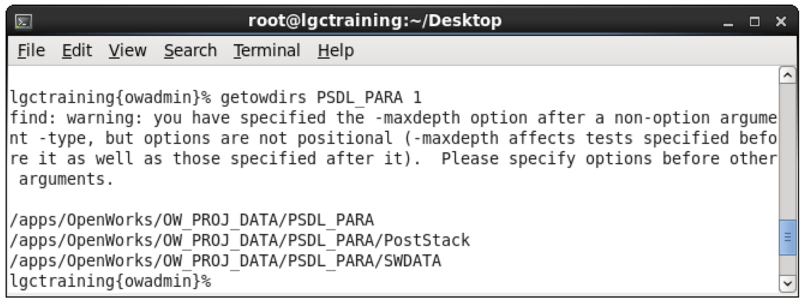
In general, the location the can be found using the following path description:

<*path*>/OW_PROJ_DATA/<*projectdatabase*>/PostStack/<*survey*>/sess#/flow#

Find the location of the OW_PROJ_DATA using the command line utility *getowdirs*.

- In an xterm, type:

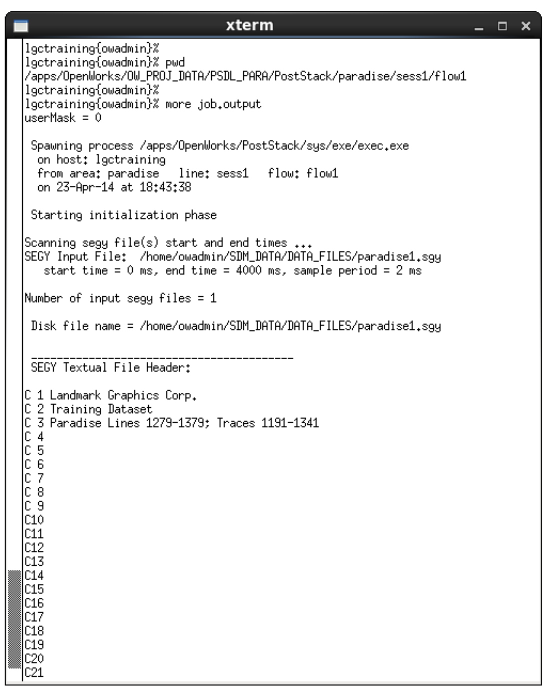
```
getowdirs PSDL_PARA 1
```



The job.output file for the paradise1.sgy data load is shown below.

35. To view this file:

    - Open a terminal window (**OpenWorks > System > Terminal Window**)
    - cd to this directory path (see example)
    - Type **more job.output**



- Scroll to the bottom of the file to see statistics for the amplitude in this data and the histogram, as well as how long the job took to execute.

xterm

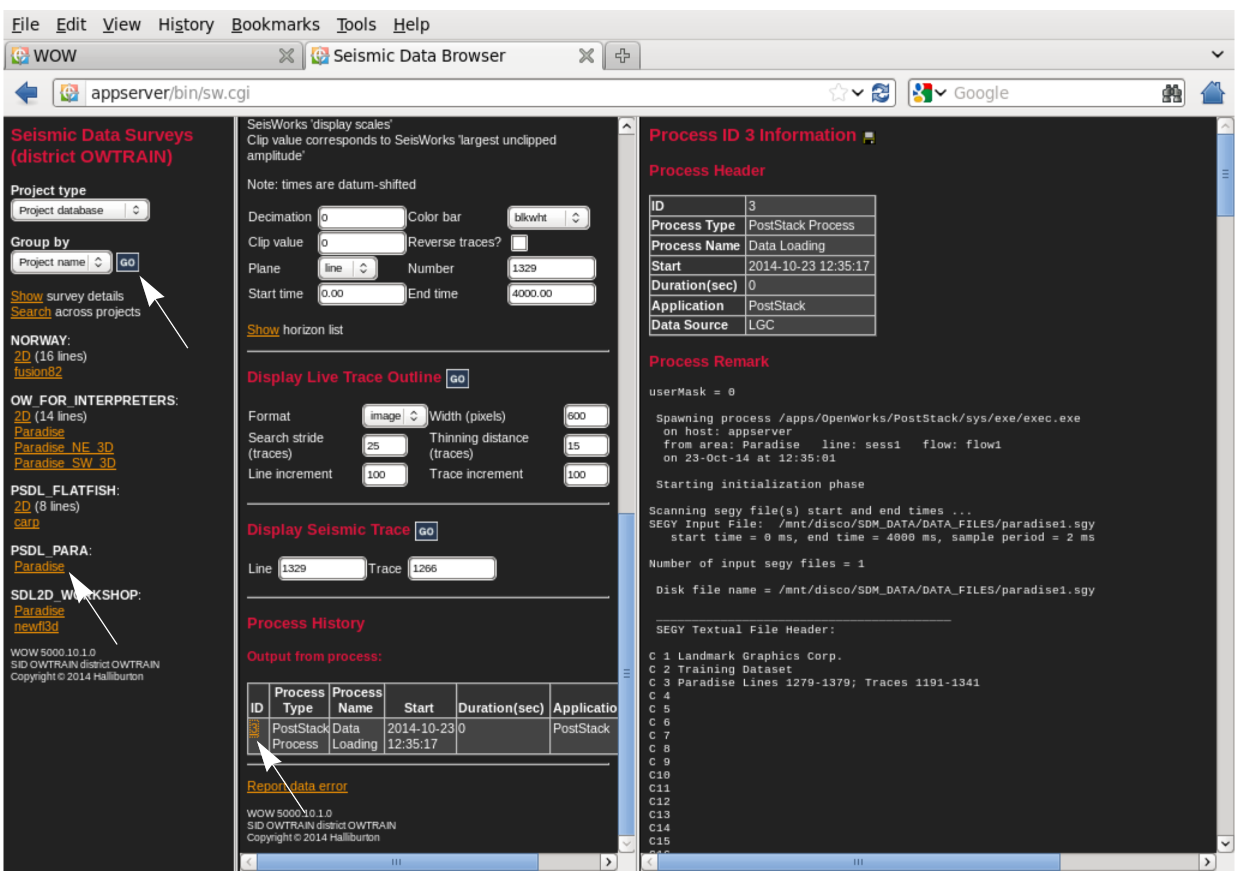
```
 Trace Amplitude Scan
 --------------------

 Total number of traces is  15251
 Total trace length is       2000. ms.

 Largest positive trace amplitude is   15041.9453
 Number of occurences of positive peak is  0

 Smallest positive trace amplitude is   0.000269456767

 Largest negative trace amplitude is  -16608.3047
 Number of occurences of negative peak is  0

 Smallest negative trace amplitude is  -0.000248068245

 RMS mean amplitude is   2140.68018


 Number of NaN values is 0



**** Histogram of Absolute Values (Log Scale) ****
  Maximum number of bins =  2500
  Logarithmic base used =     1.0568
  Hard zeros were excluded
 Last bin contains all values up to and including end amplitude


 AMPLITUDE RANGE       # SAMPLES   % IN  CUMULATIVE      HISTOGRAM
 LOW VALUE - HIGH VALUE  IN RANGE  RANGE  PERCENT         ---------

 0.337E+04 to 0.355E+04    226785   1.653  90.390  ************************************************
 0.356E+04 to 0.376E+04    205819   1.500  91.890  ************************************************
 0.377E+04 to 0.397E+04    185228   1.350  93.240  ************************************************
 0.398E+04 to 0.420E+04    163964   1.195  94.435  ***********************************************
 0.421E+04 to 0.444E+04    142715   1.040  95.475  ***********************************************
 0.445E+04 to 0.469E+04    122300   0.891  96.366  **********************************************
 0.470E+04 to 0.496E+04    102762   0.749  97.115  *********************************************
 0.497E+04 to 0.524E+04     85666   0.624  97.739  *********************************************
 0.525E+04 to 0.554E+04     69888   0.509  98.248  ********************************************
 0.555E+04 to 0.585E+04     56483   0.412  98.660  *******************************************
 0.586E+04 to 0.618E+04     43877   0.320  98.979  ******************************************
 0.619E+04 to 0.654E+04     34168   0.249  99.228  *****************************************
 0.655E+04 to 0.691E+04     26255   0.191  99.420  ****************************************
 0.692E+04 to 0.730E+04     20025   0.146  99.566  ***************************************
 0.731E+04 to 0.772E+04     15445   0.113  99.678  **************************************
 0.773E+04 to 0.816E+04     11923   0.087  99.765  *************************************
 0.817E+04 to 0.862E+04      9235   0.067  99.832  ************************************
 0.863E+04 to 0.911E+04      6831   0.050  99.882  ***********************************
 0.912E+04 to 0.963E+04      5256   0.038  99.920  **********************************
 0.964E+04 to 0.101E+05      3960   0.029  99.949  *********************************
 0.102E+05 to 0.107E+05      2831   0.021  99.970  *******************************
 0.108E+05 to 0.166E+05      4122   0.030 100.000  *********************************

  TOTAL NUMBER OF LIVE SAMPLES  13723290
  TOTAL NUMBER OF ZERO SAMPLES  1542961
  TOTAL NUMBER OF SAMPLES       15266251
```

- Close the terminal window.

Accessing the Process History in the WOW™ software

36. View the job.output file in the WOW software:

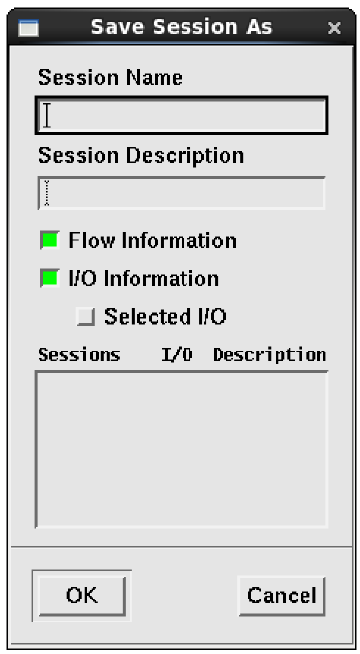
    - Open the WOW software.
    - Click **Seismic Data** in the sidebar on the left.
    - Select **Project database** for the OW project type; click **GO**.
    - Click **paradise** under **PSDL_PARA** project.
    - Click the number next to Seismic in the Survey Summary.
    - Click the number in the ID column for the seismic file PSDL16Float.
    - Scroll to Processing History and click the number in ID for the PostStack Process



PostStack session save instructions:

37. When your data has been successfully loaded, save your PostStack session by selecting **Session > Save As…**.

- Type a descriptive name in the Session Name field (up to 10 characters; do not use any symbols that have special meaning to Unix)
- Add a description in the Session Description field (useful for finding session if you have a lot of them)
- Make sure both Flow Information and I/O Information are toggled on.
- Click **OK**.



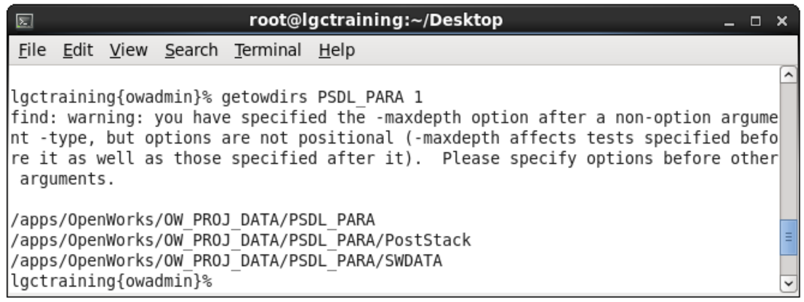
Sessions are saved a special PostStack subdirectory in the OW_PROJ_DATA directory.

The path is:

OW_PROJ_DATA/<OpenWorks Project Name>/PostStack/<survey name>

Find the location of the OW_PROJ_DATA using the command line utility *getowdirs* as you did when looking for the job.output file.

To use this utility, in an xterm, type: `getowdirs PSDL_PARA 1`.

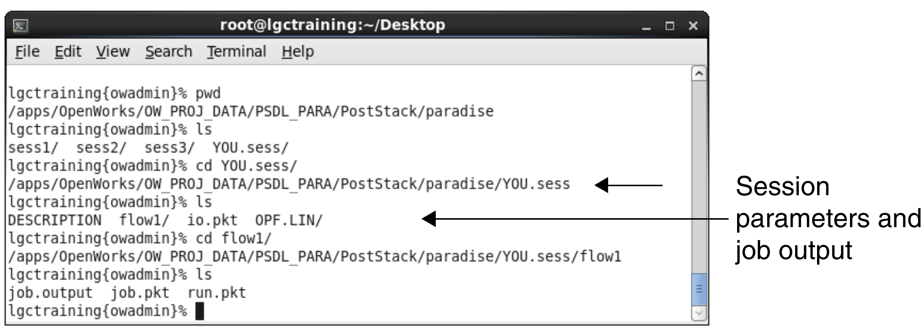


The location of the session information is saved in a subdirectory:

data/OW_PROJ_DATA/PSDL_PARA/PostStack/paradise/<Name you typed in the Session Name field>.sess/.

If you saved the session name as paradise1, the correct path would be:

data/OW_PROJ_DATA/PSDL_PARA/PostStack/paradise/paradise1.sess.



Most of the time you would not need to find the session location. The saved sessions are accessed when you select **Session > Open…** in the PostStack software.

Check the Data in the SeisWorks Software

3D Data Loading Task List

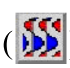
- Gather background information
- Create/Select an OpenWorks project database
- Create 3D seismic survey
- Create seismic storage directories
- Check base map (compare SeisWorks Map View to Horizon Image Map)
- Analyze SEG-Y data
- Load Data
- Check data load (view seismic in appropriate application)
- Backup

Exercise 6: Checking the Seismic Data with the SeisWorks and WOW™ Software

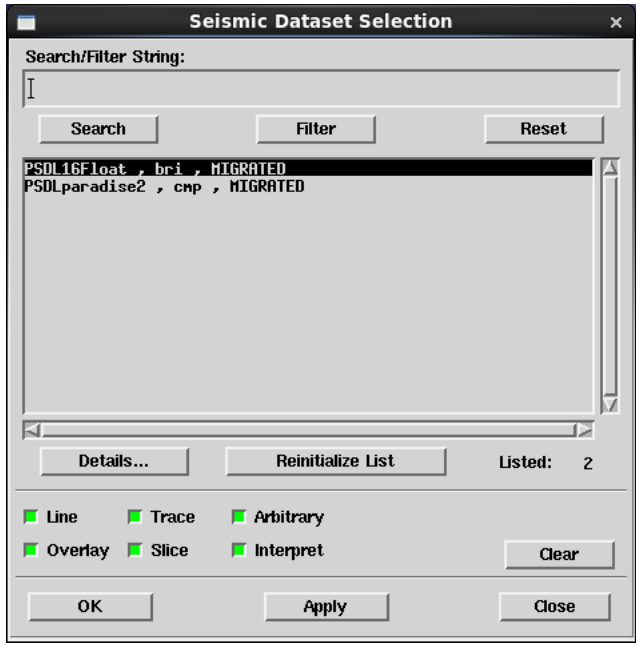
1. Start the SeisWorks software. Open the session you saved when you checked the base map (**Session > Open…**).

   View the data you just loaded in a Seismic View. If a Seismic View is not open in your session, open one now by following the instructions in the next step. Skip to step 3 if a Seismic View is already open.

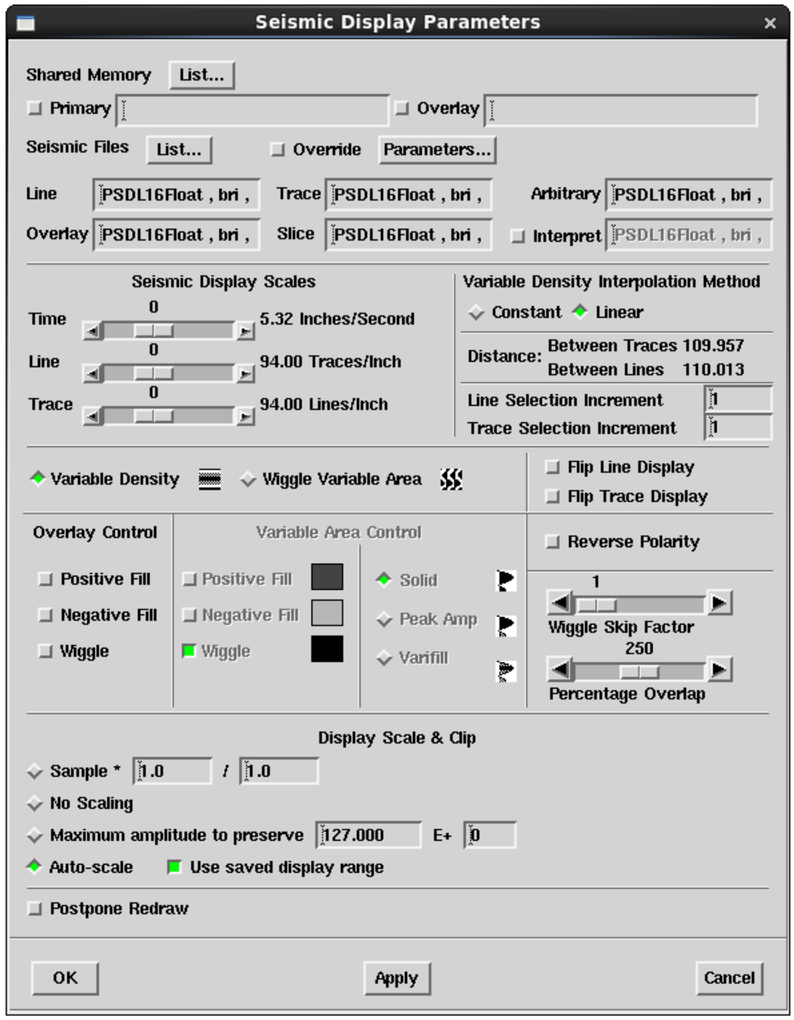
2. From the SeisWorks main menu, select **Interpret > Seismic…**.

3. Click the Seismic Parameters icon ().

4. Click the **List…** button next to Seismic Datasets. Select *PSDL16Float* from the list. Click **OK**.



The *Seismic Display Parameters* dialog box will show that PSDL16Float is selected for all display options.

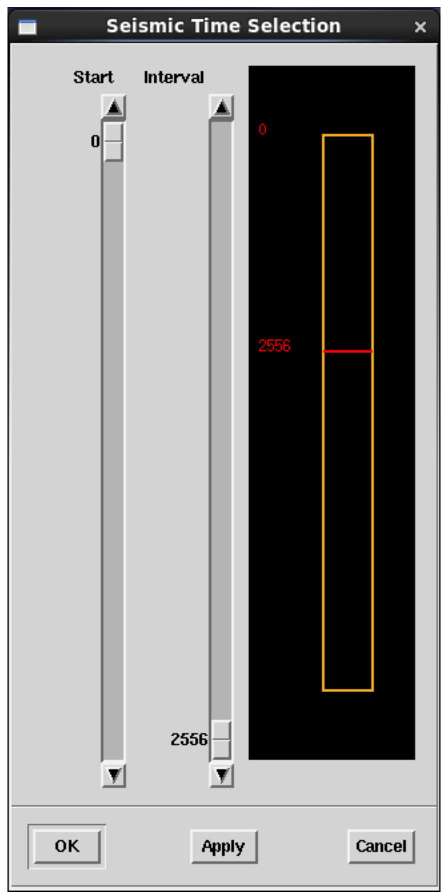


5. Click **OK** in the *Seismic Display Parameters* dialog box.

6. You should already have a Map View from your previous SeisWorks exercise. However, should you need to create one for any reason, select **Interpret > Map…** to create the MapView.

7. Display a line in your Seismic View by selecting it from the map using the **Midpoint** icon ( ).

   - Select the Midpoint icon in Seismic View.
   - In Map View, move your cursor to select a line inside the map.
   - Click **MB2** on your selected line (look in the Map View status area for cursor location information).
   - In the *Seismic Time Selection* dialog box, click **OK** to select the default time interval.

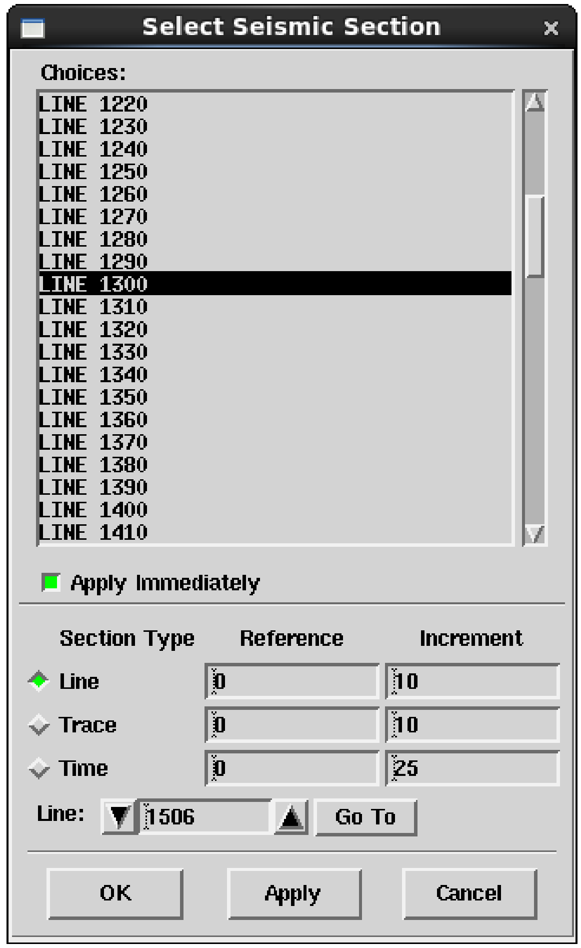


To see all four seconds of data, select the Seismic Display parameters icon and set the Time interpolation factor to -1.

> **Hint**
>
> Line range for this data set is 1279-1379.

Alternatively, to select a line or trace from the list:

- In Seismic View, select **Seismic** > **Select from List…**.



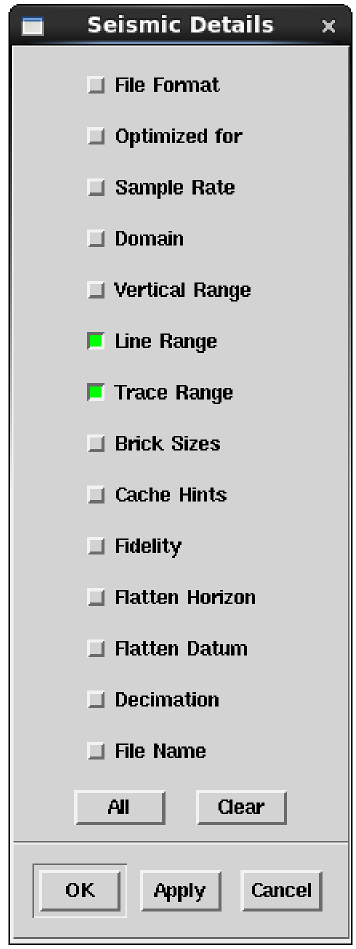
- Scroll through the list to select a line in the range.

If you don't remember the line and trace range of the data you loaded, the SeisWorks software has an easy way to view the line and trace range of the seismic volume using Details in the *Seismic Dataset Selection* dialog box.

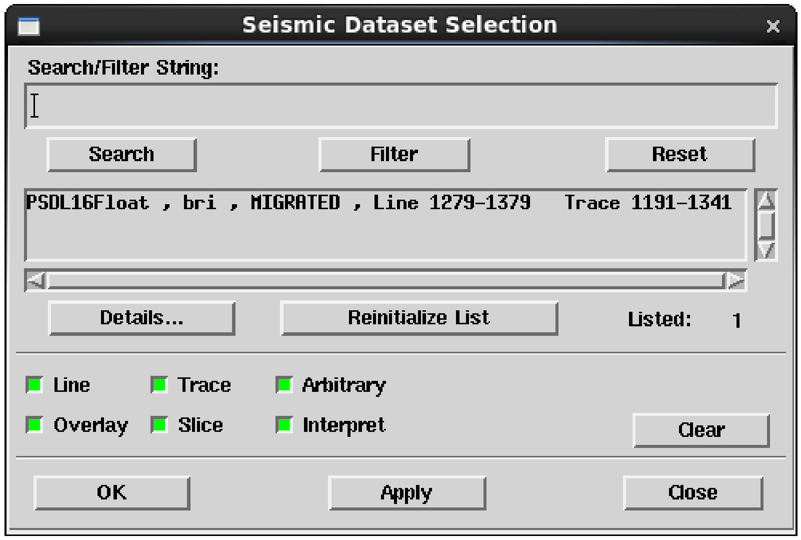
8. Click the Seismic Parameters icon () again.

9. Click the **List…** button next to Seismic Datasets. Click the **Details…** button. Toggle on *Line Range* and *Trace Range*; click **OK** in the Seismic Details dialog box. Scroll through the

PSDL16Float data set to see the reported line and trace ranges. Use these ranges to choose a line or trace to display.



The *Seismic Dataset Selection* dialog box reports the line and trace range.



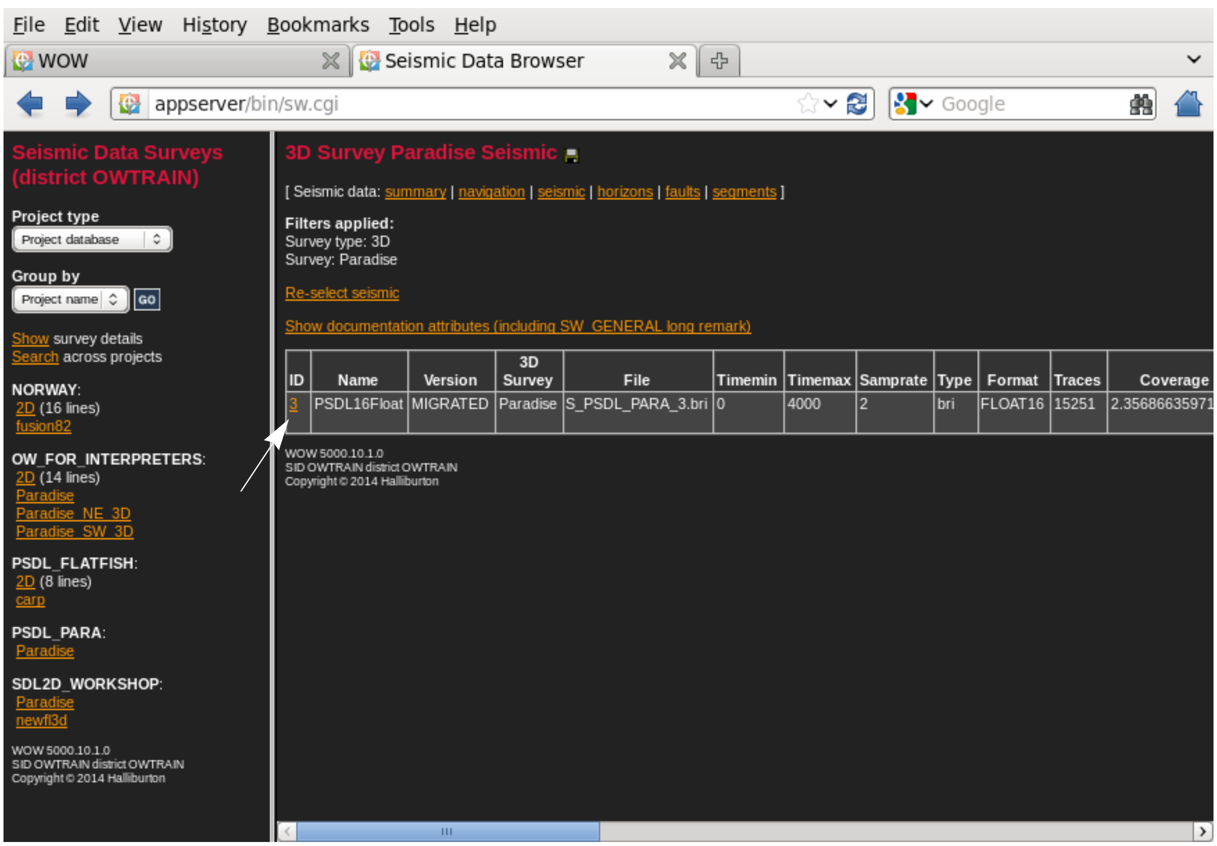
Other Ways to View the Loaded Line and Trace Range

Live Trace Outline in the WOW™ Software

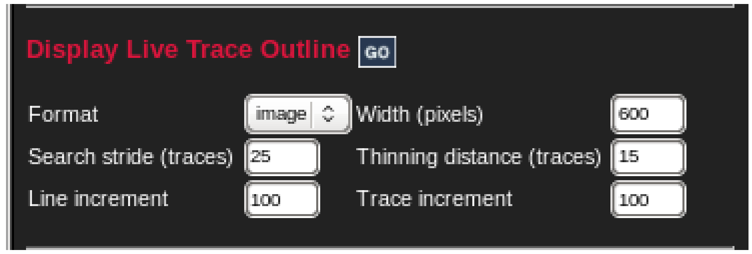
Another way to view the areal coverage of the seismic data is to use the WOW software to generate a live trace outline, which can be saved as a zgf file and display in SeisWorks Map View.

10. To display a live trace outline in the WOW software and create a zgf of the live traces outline to view in the SeisWorks software:

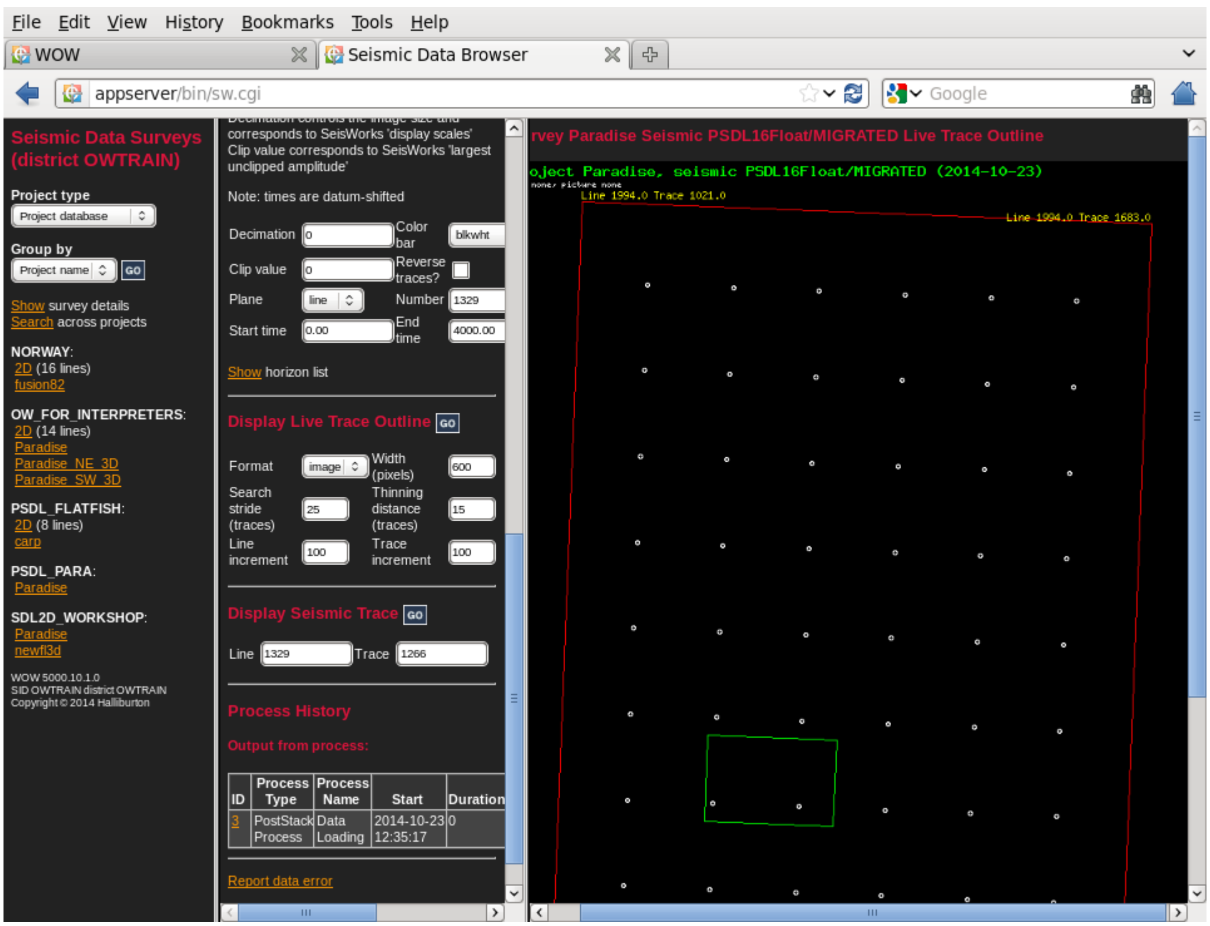
- Open the WOW software.
- Click **Seismic Data** in the sidebar on the left.
- Select **Project database** for the OW project type; click GO.
- Click **paradise** under **PSDL_PARA** project.
- Click the number next to Seismic in the Survey Summary.
- Click the number in the ID column for the seismic file PSDL16Float as shown in the screen below.



- Scroll down and click **GO** in the Display Live Trace Outline section.

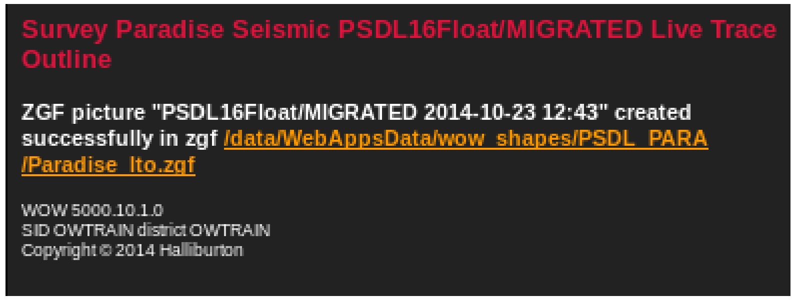


The data range for PSDL16Float is outlined in green.



Create a zgf of the outline to select as a Map Overlay in Map View:

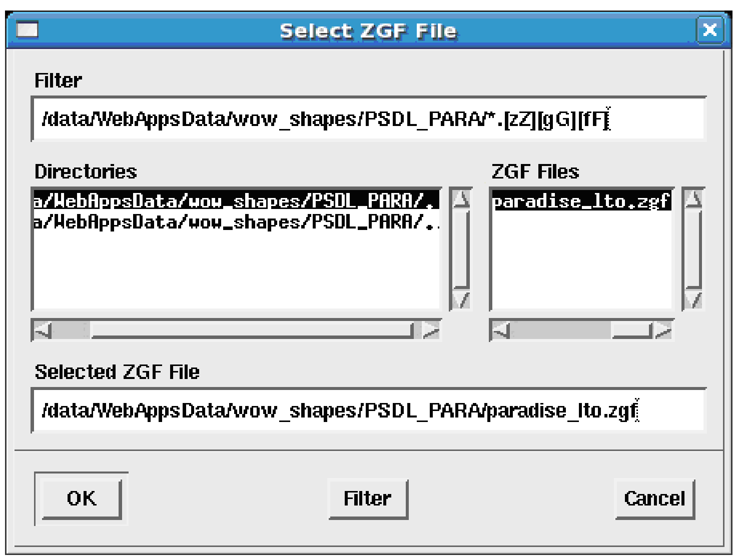
- Change Format to **zgf** in Display Live Trace Outline section.
- Click **GO**.



- Minimize the WOW software.

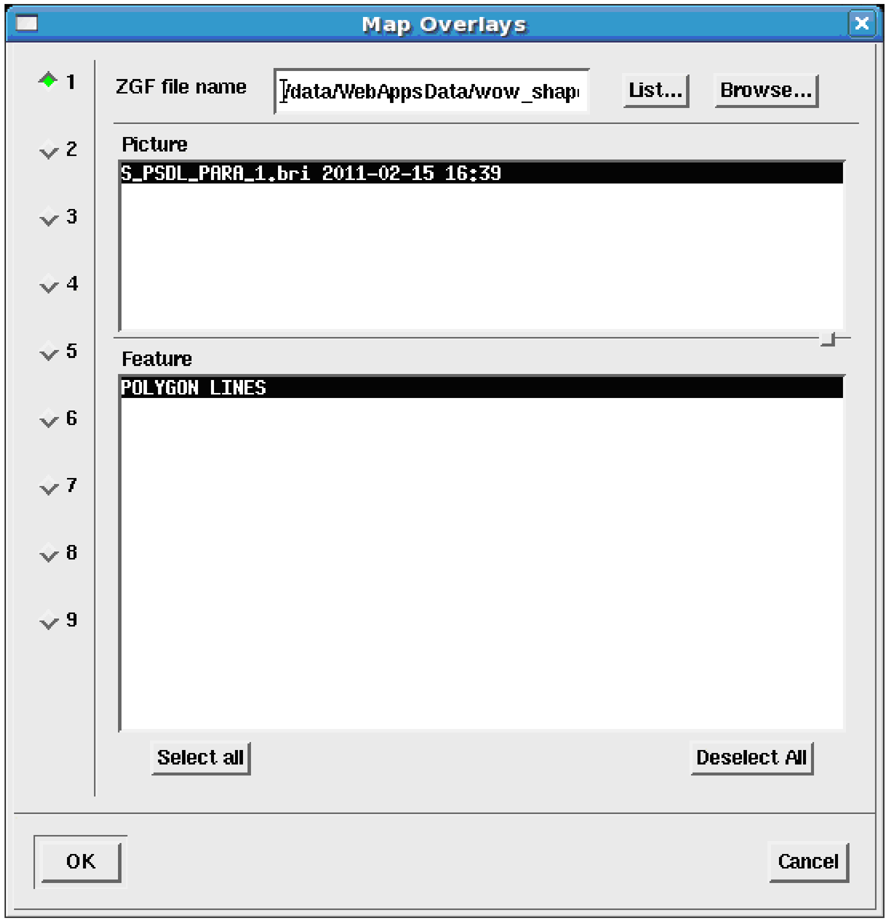
In the SeisWorks software, display the zgf in a Map View as a Map Overlay.

- In SeisWorks Map View, select the View Contents icon ().
- Click the **List…** button next to Map Overlays.
- Click the **Browse…** button next to ZGF file name.
- Browse to the directory path for the zgf created in the WOW software.

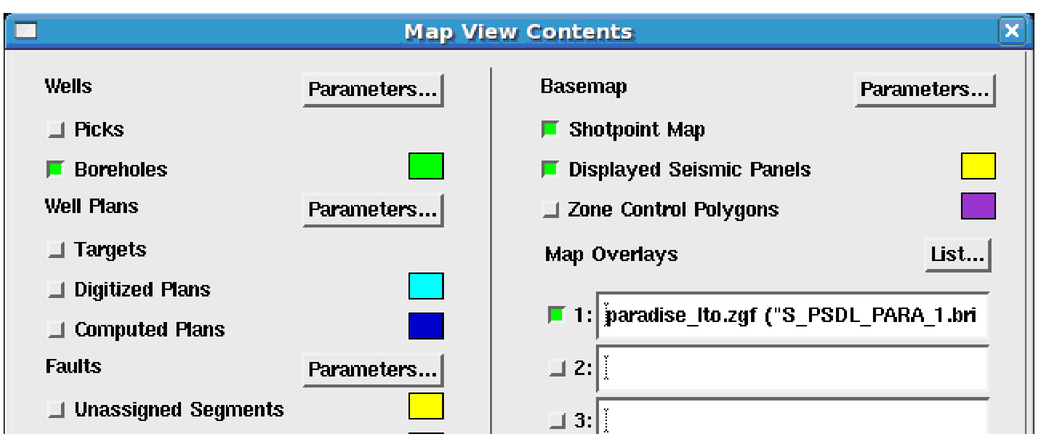


- Select the zgf file; click **OK**.

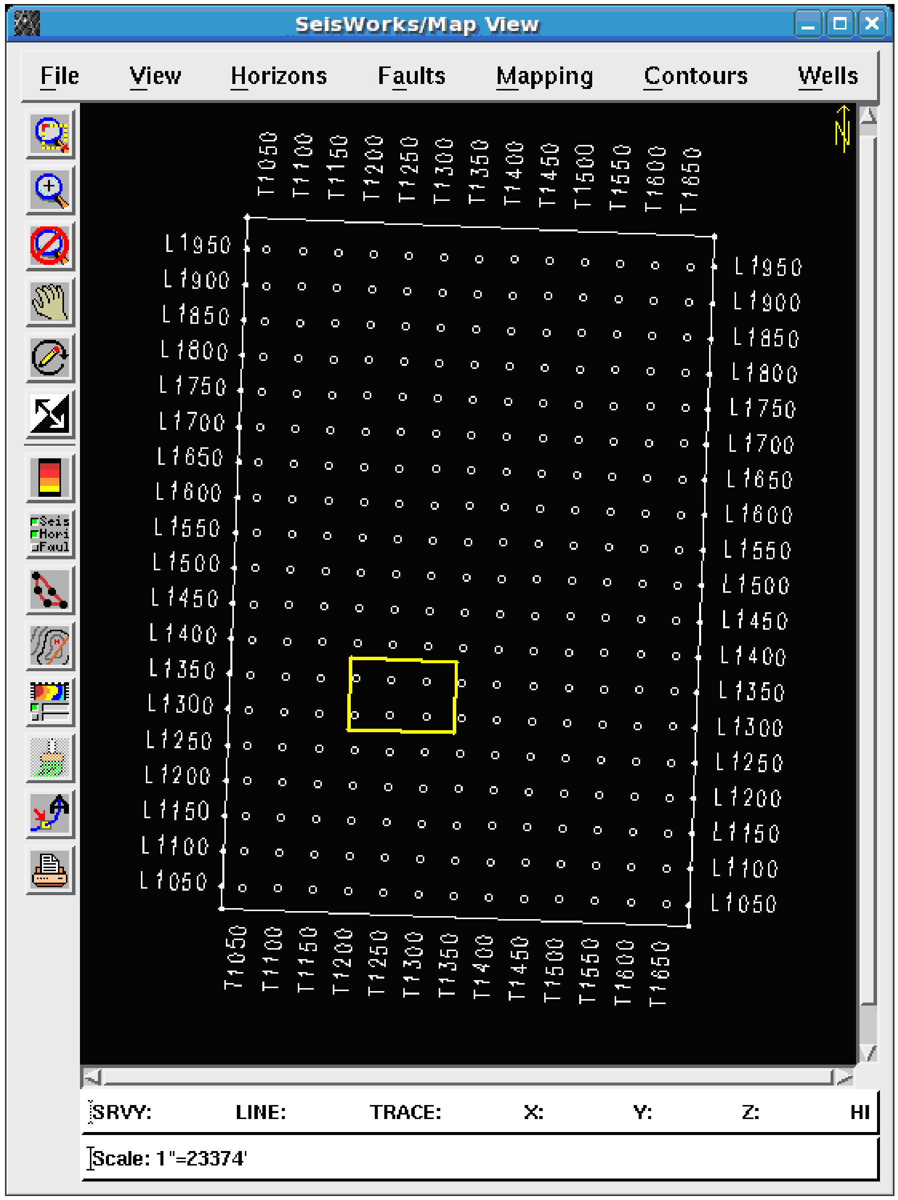
- Highlight POLYGON LINES (or click **Select all**) as the feature in *Map Overlays* dialog box; click **OK**.



- Toggle on the zgf file in Map Overlays for the Map View Contents; click **OK**.



The live trace area is outlined in Map View, so it is easy to see where the data actually is located.



View Time Slice in SeisWorks Software Map View

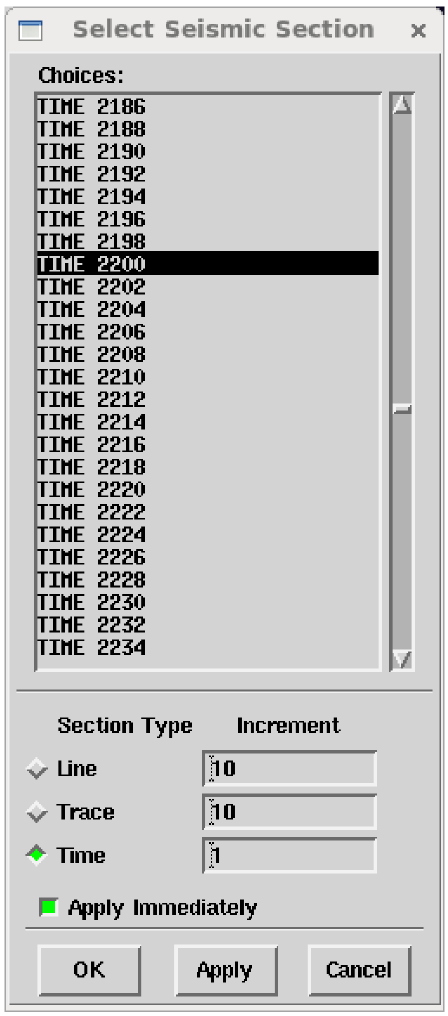
Another way to check the areal coverage of the seismic data is to display a time slice (use **Selected from List…** option). If Displayed Seismic Panels is toggled on, Map View will show an outline of the time slice.

11. To display a time slice, create a new seismic window by first selecting **File > New Task > Seismic** from the *Seismic View* window.

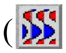
    - In the new *Seismic* Window, select **Seismic > Select from List…**.

    - Toggle on **Time**.

    - Select **2200** as the time to display.

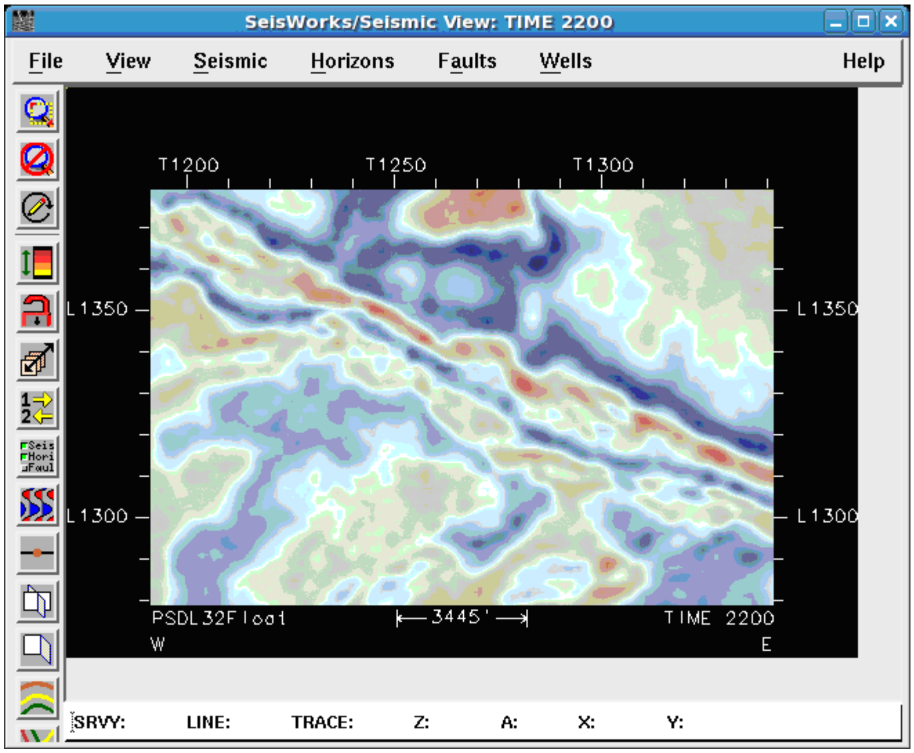


    - Click **OK**.

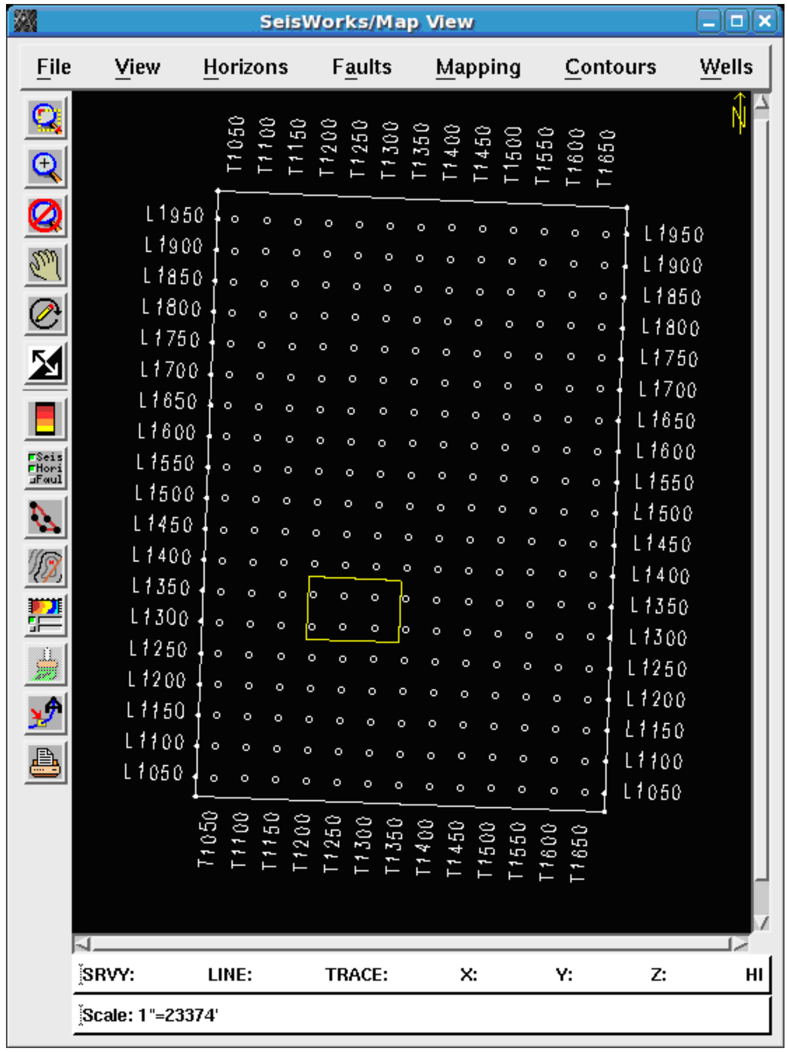
12. To enlarge the display, select the Seismic Parameters icon ().

    - Under Seismic Display Scales, change both the Line and Trace Display Scales to 2.

    - Click **OK**.



13. In Map View, the time slice is outlined as a seismic panel, indicating the areal extent of the data. Make sure Display Seismic Panels is toggled on in contents.



- Look at additional lines, traces, or time slices, using either new or open Seismic Views to QC the data.

14. When you are finished looking at the data that you loaded, save your session and exit the SeisWorks software.

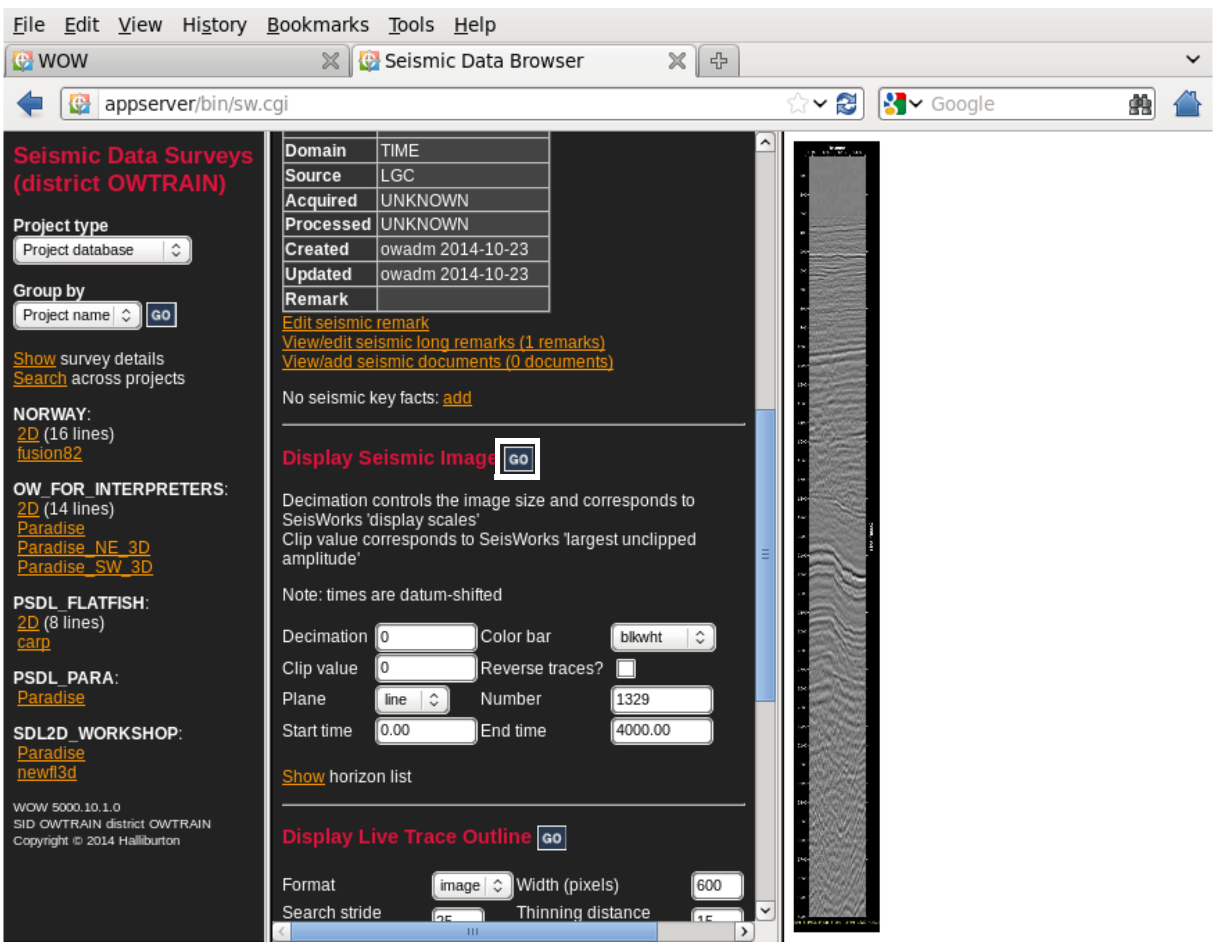
WOW™ Software Seismic Display

The WOW software can also display seismic data from the PSDL16Float data set.

15. Open the WOW software. You should be where you were when you created the live trace outline, and you can proceed with the next step. If not, first select:

    - **Seismic Data**
    - **Project database** (OW project type) > **GO**
    - **paradise** under **PSDL_PARA** project
    - Click the number next to seismic in the Survey Summary
    - Click the ID number for you seismic file

16. Click **GO** next to Display Seismic Image.



Change the line number and click GO to view various lines. Change the Plane to trace to view traces.

This exercise showed many ways to QC the seismic data you loaded in the SeisWorks and WOW software. Other Landmark applications that are used to view and interpret seismic data, such as DecisionSpace Geosciences, could have been used instead. When loading seismic data you can choose your favorite method to view the data.

17. In preparation for the next exercise, save and exit your SeisWorks session and close PostStack Data Loader and any job.output views you may have open.

Loading 3D Data Using SEG Y Import Utility

3D Data Loading Task List for SEG Y Import

- Gather background information
- Create/Select an OpenWorks project database
- Create 3D seismic survey, storage directories, analyze SEG-Y data, and load data with SEG Y Import Utility
- Check base map and data load (view seismic in appropriate application)
- Backup

SEG Y Data Import is a utility for loading the following data from disk:

- 2D and 3D navigation data
- 2D and 3D SEG-Y data
- 2D and 3D SEG-Y VSP data
- Prestack 3D SEG-Y, Prestack 3D ProMax and Prestack 3D JavaSeis data.

Into .2v2_glb format for 2D data or brick (.bri), compressed (.cmp) and vertical (.3dv) format for 3D data. This utility also has the ability to load navigation data directly and to analyze SEG-Y textural, binary, and trace headers.

Limits:

- Input data must be on disk (no tape input)
- No Process History saved

Advantages:

- SEG Y Data Import can be used in both Linux and Windows systems

- Creates a 3D survey, analyzes SEG-Y data and loads the data from one utility

The following OpenWorks session parameters must be set in order to use SEG Y Data Import:

- OpenWorks project
- Measurement system
- Session Interpreter

For Linux systems, this utility is launched from the OpenWorks

Command Menu by selecting **Data > Import > SEG Y Import**.

SEG Y Data Import is composed of three main tabs:

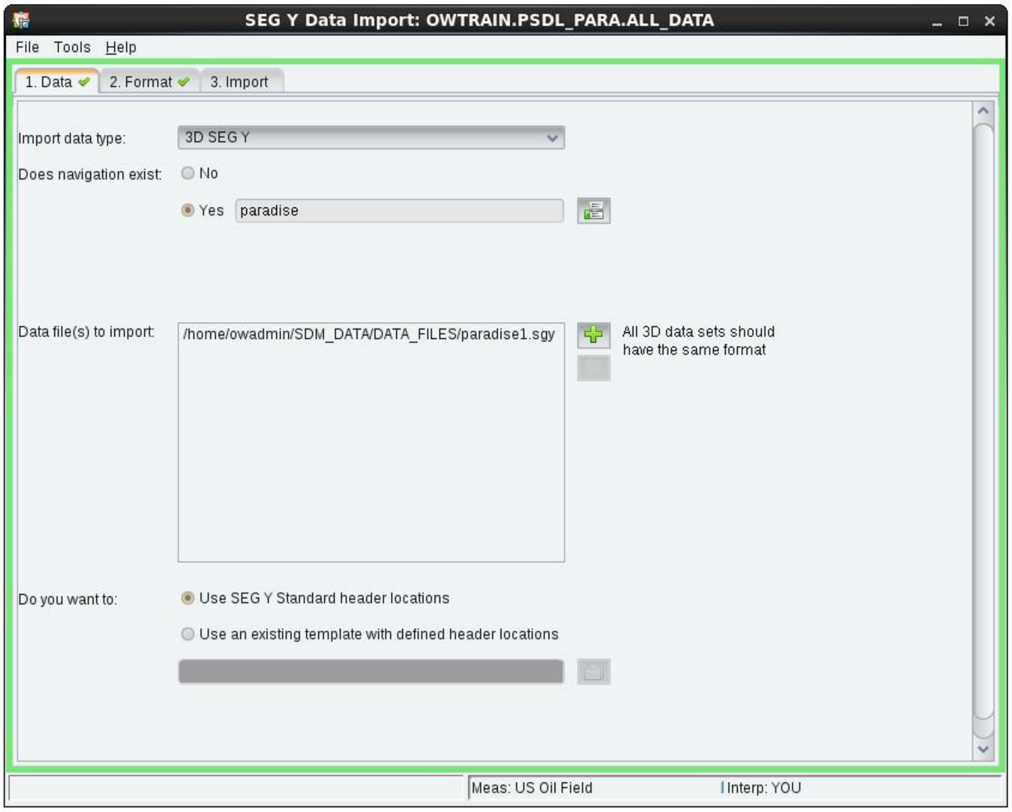
- Data
- Format
- Navigation (This tab appears when you select No in the option Does Navigation Exist)
- Import

Each main tab is described below.

Data - The Data tab is composed of sections. Address each of the following:

- Data Type: Select the data type of the data to be imported
- Navigation: Indicate whether the navigation data already exists in the OpenWorks Project, or whether it will be loaded
- Data Files: Select one or more data files containing the data to import
- Template: Indicate the file that defines the location of the header information and the format values

When you have completed the selections for the tab, a green check ( ) will appear in the label of the tab, and you can then proceed to the next tab.



Format — The Format tab allows you to:

- Review the SEG Y binary, textual, and trace headers.
- If not SEG Y Revision 1 standard, modify the locations of the headers. The modifications can be saved as a template for current and future use.

The tab has three basic tasks:

- **Verify the Binary/ASCII Headers**

After selecting Binary/ASCII Headers in the SEG Y Standard section, the right upper pane becomes the Data Set Overrides section, and the lower pane becomes the Binary And ASCII Headers section. The lower pane is divided into two subpanes: the left pane displays a readable version of the binary header for each selected file, and the right pane displays the ASCII header.

Data Set Overrides Section

This section allows you to override values in the binary header or values defined for the data:

- **Domain**: time or depth.
- **Units**: milliseconds for time; feet or meters for depth.
- **Attribute**: amplitude or velocity.
- **Sample start**: starting value of the first sample.
- **Sample interval**: unit measurement between samples. Milliseconds for time, and feet or meters for depth.

In general the binary values of sample start and sample interval does not need to be overridden. The domain, units, and attribute values are updated to reflect the nature of the data and saved to the OpenWorks project.

Check the **Byte Swap Data Set** box if the data is in the little-endian format. Most data is written in big-endian format.

Binary And ASCII Headers Section

The binary header pane (right, lower pane) provides the following information:

- format of the trace amplitude values
- number of samples per trace
- sample interval in seconds
- number of traces
- sample start time

The ASCII header pane (the left, lower pane) allows you to see the byte locations and formats if data in the file does not conform to the SEG Y Revision 1 standard. The pane also displays navigation information if it is not contained in the trace headers or provided by some other means.

- **Verify the Trace Headers**

After selecting Trace Headers in the SEG Y Standard section, the right upper pane becomes the Trace Selection And Overrides section, and the lower pane becomes two horizontal panes containing template and standard header information.

Trace Selection And Overrides Section

The Trace Selection And Overrides section allows you to navigate through the headers displayed in the lower pane (in the Input Selection group box), and to override some SEG Y standard header word functionality (in the Header Overrides group box).

Input Selection

Input Selection allows you to control the trace range for the header display in the lower section. By changing a value in the Start Trace, Trace Count, and Traces To Skip boxes, you can navigate through the trace headers to verify the correct header locations and header format.

Header Overrides

Header Overrides allows you to override some values in the trace headers. Since the SEG Y standard allows auxiliary header words to be applied to the primary header words for some values headers, and since some SEG Y authoring software may not account for these header words, Header Overrides is a means for disengaging them in the decoding of the header words. When checked the overrides do the following:

- Disable Trace Weighting Factor: turns off the header words 169-170. The header words are applied to the amplitude values when the amplitude format is integer.
- Disable Coordinate Scalar: turns off the header words 71-72. These header words are applied to the coordinate values when the coordinate format is integer. This header word is only applied to coordinate header word locations 73-76, 77-80, 81-84, 85-89, 181-184, and 185-189.
- Disable Delay Record Time: turns off the header words 109-110. These header words are applied as a delay in start time for the data. Currently only the first encounter of this header word is used, because variable start time for traces is not supported.

Template and Standard Header Section

The lower portion of the Trace headers display is subdivided into two sections. The top section lists the key header words that are critical for the SEG Y import and navigation extraction. The lower section is the complete listing of the trace headers based on the SEG Y Revision 1 specifications for header word descriptions, locations, and formats.

Only a limited number of header words matter when Importing SEG Y data. For 3D Data, inline (ILINE), crossline (XLINE), x-coordinate, and y-coordinate are important. The upper section allows you to scroll through the SEG Y data, and to determine if the default or selected template values are correct for properly loading the data. If the values that are listed are incorrect, you can scroll through the lower section to see if the header words were written to a different location. By changing the byte number, and if required, the format, you can see what the updated values are and if they corresponded to the data you expect from the file.

You can do the following:

- To add a header word to display in the Trace Display section, click the Add A New User Defined Trace Header toolbar button (add trace headr). A new row displays at the bottom of the Template Header Section. Enter its information.

- To remove a header word, select the row, and then click the Remove User Defined Trace Header toolbar button (remove trace).

- To change the start trace position, select the row, and then click the Page Backward to Previous Set of Selected Traces or the Page Forward to the Next Set of Selected Traces toolbar button (page backward or page forward).

- If the navigation has previously been loaded, and if the trace header values are incorrect or do not match the entry in the OpenWorks project, you can apply trace header math to modify the values (in a regular pattern).

To apply trace header math to modify the values, enter a value in Addend column of the Template Header section.

For example, if the inline numbers are 1-999 in the SEG Y file, but should be 1001-1999, enter 1000 in the Addend column of the header word for ILINE.

- **Verify the Trace Display**

After selecting Trace Display in the SEG Y Standard section, the right upper pane becomes the Trace Display And Scaling section, and the lower pane displays the graphical representation of the seismic data.

Trace Display And Scaling Section

This section is divided into three groups:

- Input Selection: navigate the data in the display.
- Display: change the display parameters and over plot the trace display with a header plot.
- Scaling: change the scaling of the data.

Input Selection

Input Selection allows you to navigate through the SEG Y file. By changing a value in the Start Trace and Trace Count boxes, you can change the starting trace and the number of traces to display. With the Traces To Skip box, you can step through the data set more rapidly without having to view every trace.

Display

Display allows you to see the effect on the display of the data as you change settings for

Display Type: set to either variable area or wiggle. When variable area is selected, you can change the color of the display to one of the color types in Palette in order to better view the data amplitudes.

Track Width: with variable area, set to a smaller value to view more traces to view in. With wiggle trace, set to a larger value to increase separation between traces to look at trace to trace amplitude variation.

Palette: select a color overlay to better view the data.

Sample Format: modify the binary header setting for the trace format.

Header Plot: over plot the data with a header value.

The lower pane allows you to view the amplitude values when the trace format is changed in the Trace Display And Scaling section, overriding the binary header of the trace format. Looking at the display of the seismic data may help you determine if the trace format in the file was correctly written to the SEG Y standard. A distinct change in the character of the data will be evident when the value is changed.

Generally, the reported format will be correct. Only on a rare occasion will the trace format code need to be updated. If a change is made here, it will be reflected on the Import tab.

Scaling

If additional scaling is desired for the SEG Y data, or if the data should be downscaled to a format of less than 32-bit, you can activate scaling by selecting an item other than None in the Scale Type drop-down list. When Trace or Global are selected the seismic displayed in the lower pane reflects the options chosen, indicating the effect of clipping on the data. For more details about scaling, see Scaling SEG Y Data.

Scale Type

- Trace: Scale Factor is calculated from the amplitudes of each individual trace and applied to each individual trace. Helps eliminate some of the trace to trace variations that may exist.

- Global: random subset of traces are scanned to calculate the Scale Factor and applied to every trace in the SEG Y file. Helps preserve some of the trace to trace variations.

Amplitude Extraction

Select the type of amplitude calculation used to compute the Scale Factor.

- Types of Extraction: Mean RMS or Maximum.

- For Mean and RMS: must specify the Percent of Max to position the calculated mean or RMS amplitude value in the output amplitude distribution. This value allows for some clipping of the high amplitude values.

- For Maximum: No data clipping. The maximum amplitude is the Scale Factor and the existing amplitude distribution is preserved in the output data.

Percent Of Max

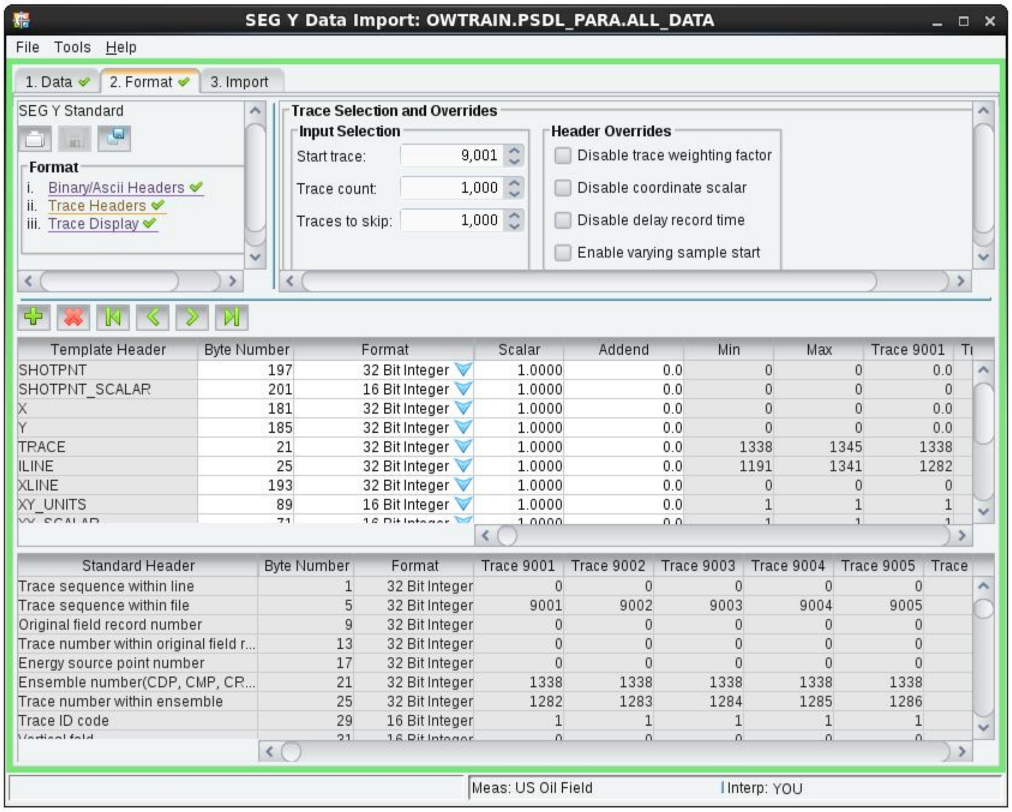
- Provides the ability to control the amount of clipping and the relative range of the amplitude spread resulting from the scaling process. The default is 15%.
- The parameters chosen or updated in the Format tab will be carried forward and be populated on the Import tab.
- As the Percent Of Max increases, the percentage of traces clipped will increase.

Mean Extracted Amp and Percent Clipped: If Mean or RMS extraction is selected, the effect is reflected on the amplitude and clipping in the display, and the value of the amplitude and clipping are reflected in these text boxes.

If the header mappings fit the SEG Y Revision 1 standard, or if they fit a template, you can just select through the three steps, proceed to the next tab, depending on your data, the Navigation tab, or the Import tab.

After reviewing the binary, ASCII, and trace headers, and seismic display, the Navigation or Import tab becomes active. Any modifications to the header overrides and to scaling will carry forward to the Import tab. Any modification to the headers and formats will be applied to the imported SEG Y data.

.



Navigation - This tab appears in SEG Y Data Import when you select No in the Does Navigation Exist section of the Data tab. The Navigation tab becomes active after you have completed both the Data and Format tab. A green check mark (✔) appears in the tab label when it is complete.

This tab provides some similar functionality to that found in Seismic Data Manager. Depending on whether you chose the 2D SEG Y or 3D SEG Y data type, the Navigation tab will have different settings.

- 2D Navigation Settings: Allows you to extract the 2D line navigation information from the SEG Y file and create the 2D line with navigation in an OpenWorks project.

  The Navigation tab for 2D SEG Y data is composed of two subtabs (Navigation and Log). The Navigation subtab is composed of an upper and lower pane. The upper pane lists all the data files you selected on the Data tab. In the lower pane, you select settings which allow you to ultimately extract and save navigation data to the OpenWorks project.

The tabs have the following buttons in its toolbar:

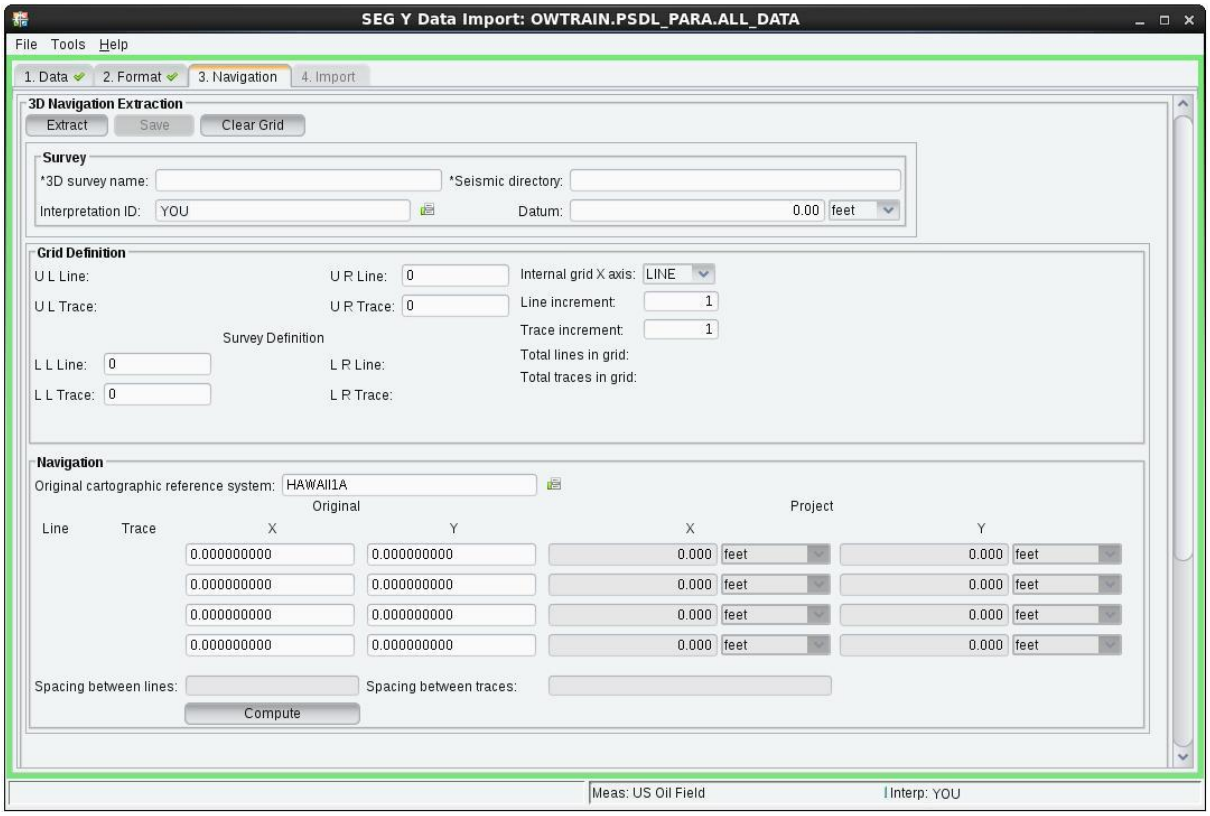
- **Select All**: Selects all rows in the table.
- **Deselect All**: Deselects all rows in the table
- **Extract**: After defining the survey and line name for each SEG Y data file, click the Extract button to read through the headers for each line and extract the navigation. As each line is completed, the value in the Min Trace and Max Trace columns is populated.
- **Save**: After the extraction of the navigation, click the Save button to save the navigation data to the OpenWorks project.

- **3D Navigation Settings**: Allows you to enter the grid corner points and coordinates of a 3D survey and save them to an OpenWorks project.

  After defining the header locations and formats for the data files on the Format tab, the Navigation tab activates. The Navigation tab for 3D SEG Y data is composed of three sections: Survey, Grid Definition, and Navigation.

  The tab has the following buttons in its toolbar:

  - **Extract**: Extracts the navigation data from the data files.
  - **Save**: Saves the survey and navigation data to the OpenWorks project.
  - **Clear Grid**: Resets the Navigation tab when the values on the tab look incorrect.



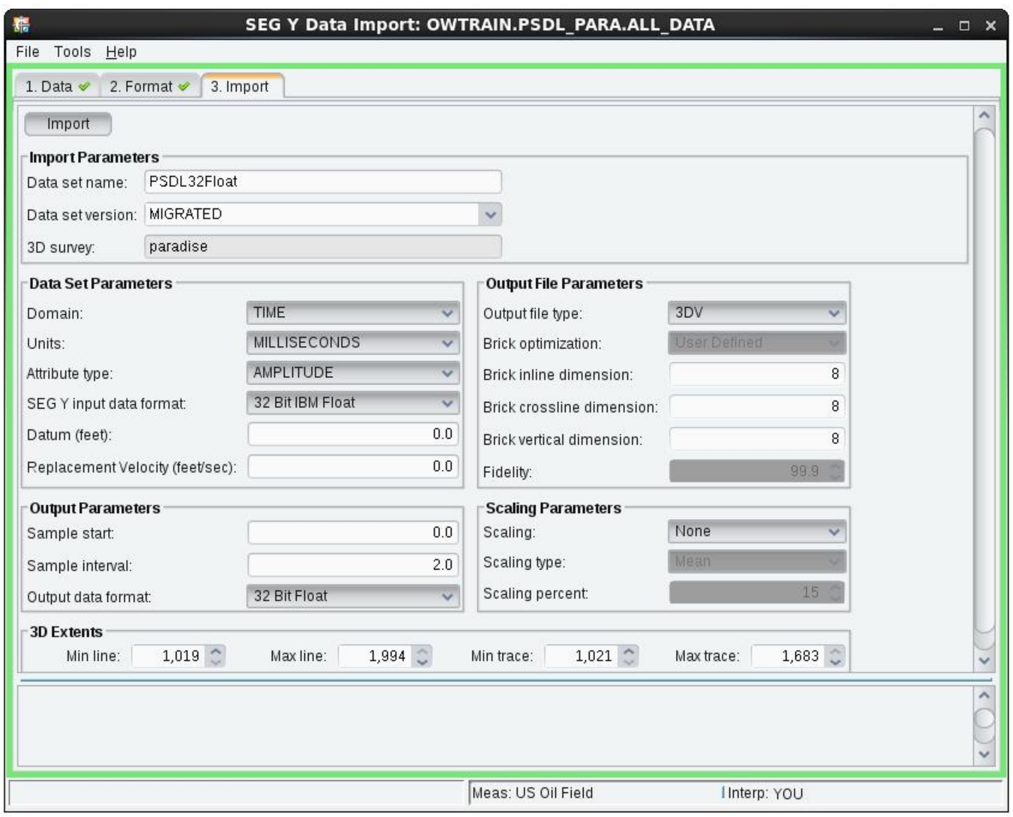
Import - After the SEG Y format and header locations of the data files have been reviewed and reconciled with the SEG Y Revision 1 standard or a template, and if required, after the navigation data has been extracted from the SEG Y data and loaded to the project, the Import tab becomes active. When the SEG Y data is imported into an OpenWorks project, the data is put into files of a Landmark format: for 2D data, the 2v2 vertical file format; and for 3D data, the brick (bri), compressed (cmp), and vertical (3dv) formats. The files are then stored in subdirectory of a directory determined by the configuration of dir.dat Configuration File.

When the data is imported, the project in the database instance contains references to the seismic files in the Landmark format. The data in these files are then accessed in the DecisionSpace Geosciences and other Landmark applications through the references in the project.

The tab has six basic tasks:

- **Import Parameters Section**: Allows you set the Data Set Name, Version and 3D Survey.

- **Data Set Parameters Section**: Allows you to change key SEG Y binary header values.
- **Output Parameters Section**: Allows you to set the sample start and sample interval extracted from the input file and set the possible data formats for the project file, these are based on the output file type selected in the Output File Parameters section.
- **Output File Parameters Section**: Allows you set the file types of the project data file are brick (bri extension), 3DV (3dv extension), compressed (cmp extension) or Indexed SEG-Y. Depending on your selection in the Output File Type drop-down list, a set of the parameters in the Output File Parameters section and parameters in other sections are enabled or disabled.
- **Scaling Parameters Section**: Allows you settings the parameters in this group that were set in the Scaling section of the Format tab.
- **3D Extents**: Allows you limit the extents 3D.



The next exercise will take you through loading a new 3D SEG-Y file using SEG Y Import Tool. You will need to create a new 3D survey and analyze the SEG-Y data for correct line and trace byte position and format.

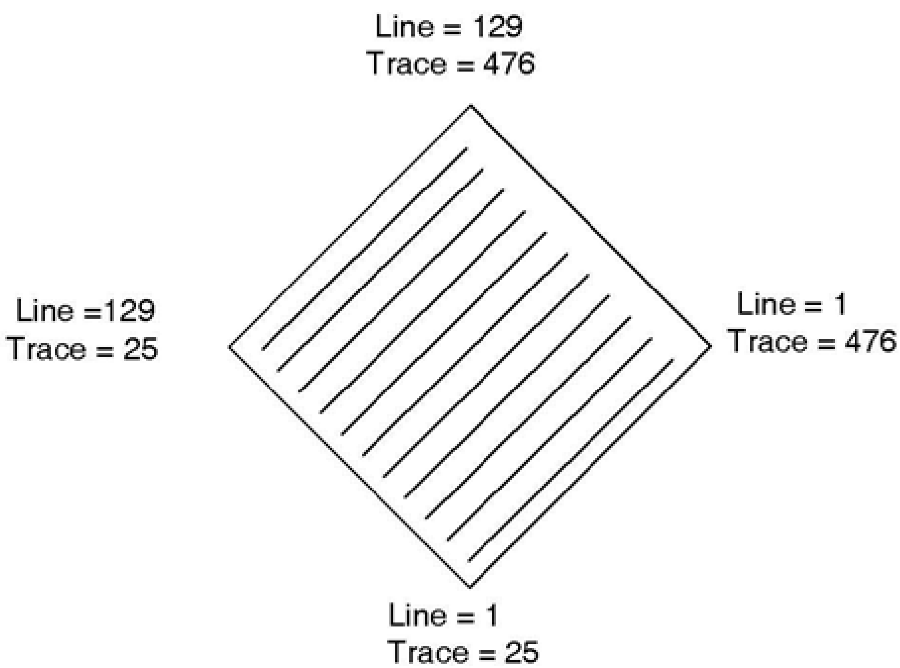
The 3D survey information sheet for this data load is on the following page. You will need to use a new utility, SeisWorks Grid Transform, to calculate the corner coordinates for this survey.

Project Name: sole3d

Area: Gippsland Basin

Projection type: UTM 55 South Meters; SPE Preferred Metric Measurement

Datum: Australian Geodetic 1984



World Co-ordinates:

Line	Trace	X	Y
1	280	631642.00	5755235.00
1	476	634340.00	5759200.00
129	30	620180.00	5755200.00

Line Spacing: 74.93 meters

Trace Spacing: 24.47 meters

Exercise 11: Loading 3D Data Using SEG Y Data Import

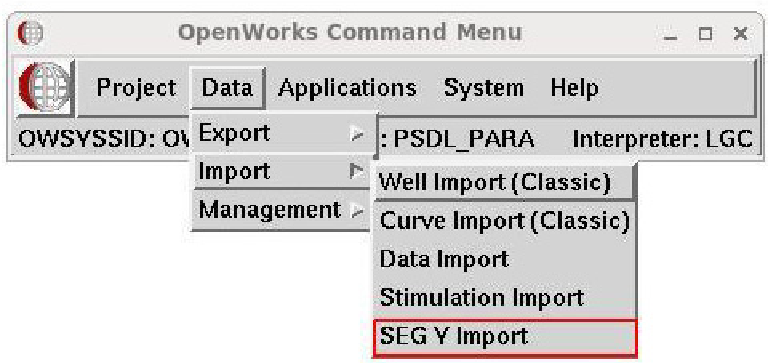
In this exercise you will set PSDL_FLATFISH as your current OpenWorks project, create a unique Interpreter ID for that project, and set it as the session interpreter. Refer to the 3D survey specification sheet as needed.

1. From the OpenWorks command menu, select Project > Project Status.

   - Select **OWTRAIN** as the district (if OWTRAIN is not listed, ask your instructor for the appropriate district).
   - Select **PSDL_FLATFISH** as the OpenWorks project.
   - Select **US Oil Field** as the session measurement system.
   - Close the *Project Status* window by selecting **File > Exit**.

2. Select **Project > Interpretation ID Manager** from the OpenWorks Command Menu and create an interpreter ID for this project. Use the same initials as you did for PSDL_PARA.

3. To start SEG Y Data Import, select **Data > Import > SEG Y Import** from the OpenWorks command menu.



Select the Data Type and Data File

In the **Data** tab, select **3D SEG Y** data type and select **newfl3d.sgy** in data files to import. For this exercise select **No** in the Does Navigation Exist section in order to read through the headers for each line and extract the navigation.

4. Click the **Format** tab. For this exercise you will create a template with the location of the following information on the SEG-Y file:

Summary of Information Required for 3D Data Loading

- How many header records are at the beginning of the tape?
- Are there EOF marker(s) between seismic lines?
- Are there header records between lines? If so, how many?
- What is the sample format?
- What is the sample rate?
- What is the number of samples per trace?
- Where is the line number in the trace header and what is its format?
- Where is the trace number in the trace header and what is its format?

5. Click the **Binary/ASCII Headers** in the format section to see the information from the binary and ASCII headers in the SEG-Y file.

You should be able to find answers to the following media and format questions:

- What is the sample format?

  Under the Binary Header, the sample format is listed as 4-byte IBM float.

- What is the sample rate?

  Under Binary Header, the sample interval is listed as 0.0040 seconds (4 milliseconds).

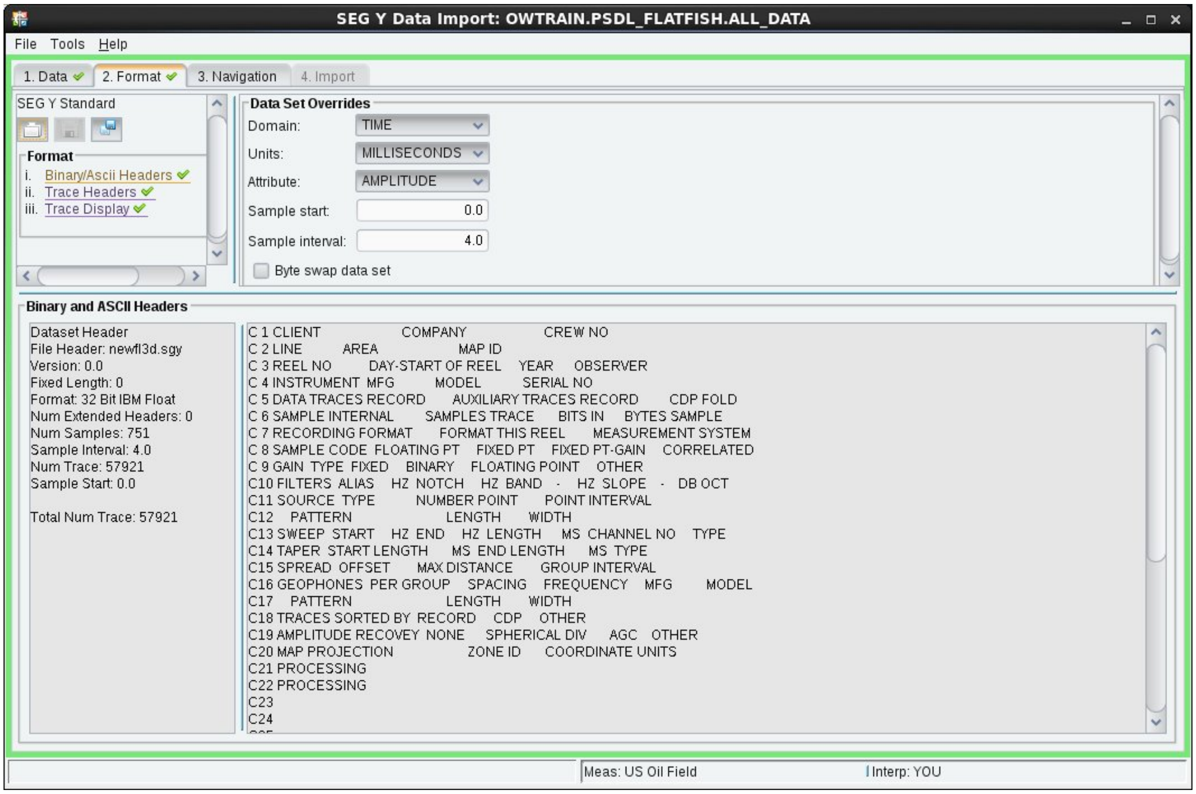
- What is the number of samples per trace?

  In the binary header, the Num Samples listed are 751.

  You can now calculate the total time in seconds using the equation:

Total Time = (sample/trace - 1) x sample rate (ms) x .001

For this data, Total Time = (751-1) x 4 x .001 = 3 seconds



This EBCDIC header appears to have a data acquisition and processing template with no actual information. The EBCDIC headers may be copied from other lines and not updated or they may contain no information at all. If there were information listed here you should verify from another source if you need to depend on it for parameter definition.

Sometimes the byte position and format for the 3D inlines and xlines will be listed in the EBCDIC header. You should check this information in SEG Y Import by changing the Trace Template (if necessary) and viewing the values reported in the Trace Header tab, or, verify by using SEGY Analyzer to graph the trace headers specified.

- How many header records are at the beginning of the tape?

  There appear to be 2 headers since there is information in both the binary header and ASCII header tabs.

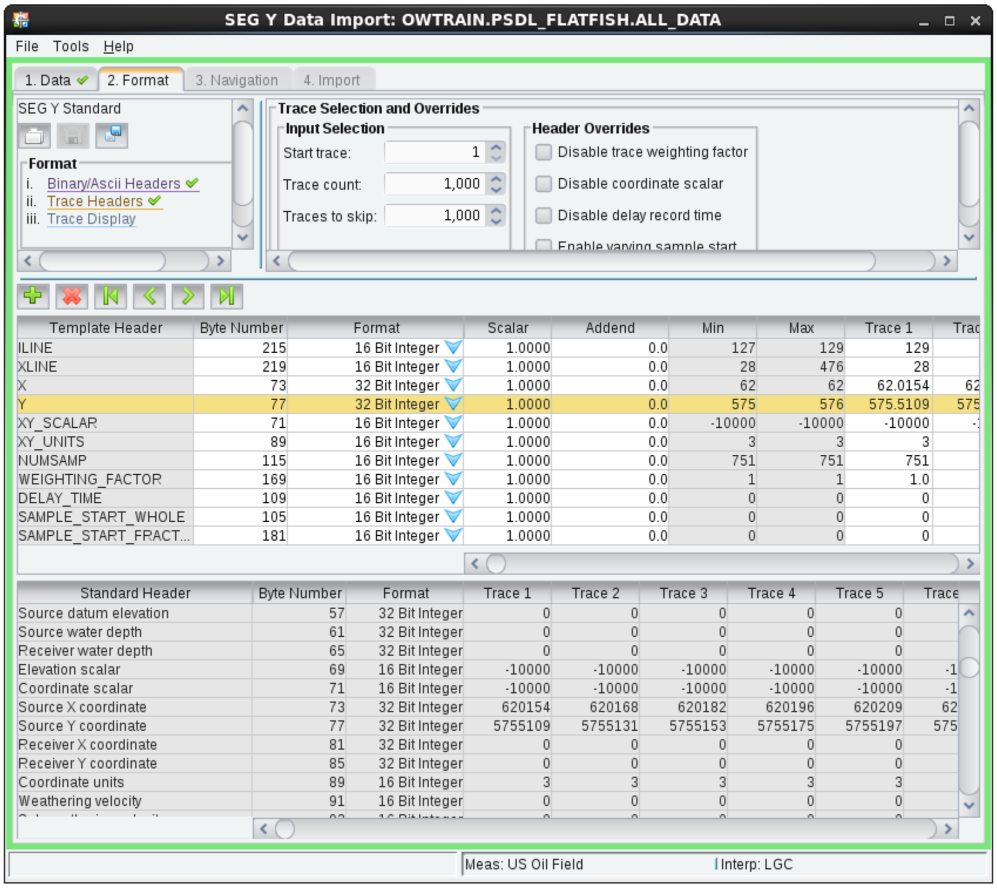
You still need to specify the byte position and format of the ILINE and XLINE information.

6. Click the **Trace Headers** in the format section. The right upper pane becomes the Trace Selection And Overrides section, and the lower pane becomes two horizontal panes containing template and standard header information. The byte number and format for key parameters are listed, meaning that the SEG-Y files is "decoded" using these values.

If, when looking at the Trace Headers section, the ILINE, XLINE, X, and Y match what you would expect from the survey specification sheet, you are OK to load.

Change the template to the correct value Byte Number positions and the Format for the **ILINE**, **XLINE**, **X** and **Y** in Template Trace Header section using the following values:

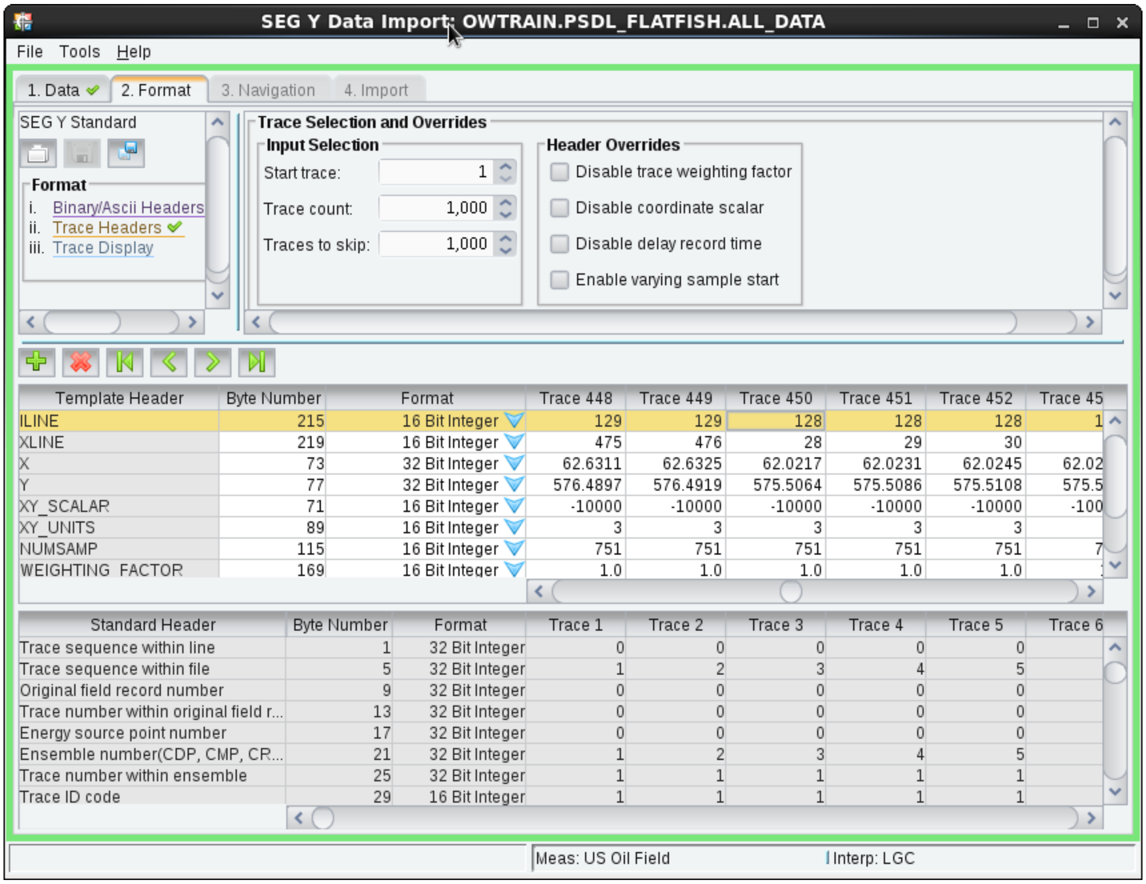
Line/Inline	215	16 Bit Integer
Trace/Xline	219	16 Bit Integer
X	73	32 Bit Integer
Y	77	32 Bit Integer



Remember the lines range from 1 to 129, and the traces ranges from 25 to 476.

The Line/Inline field reports 129, a valid line for this survey. The Trace/Xline field start at 28, which is also within survey limits. Scroll to where the line number changes and compare trace values around the line change.

7. Scroll to the ILine change.



When the line changes to 128, the xline restarts at 28. The row just before the line change reports line 129 and trace 476. You may also want to check the next line change to see if the pattern repeats.

It appears that these new byte positions and formats are correct. At this point you would save the template. Templates can be used for future data loads.

Templates are saved in a default location in the owdir.dat OW_SYS_DATA directory in a subdirectory called owsdlformats. These formats have a .syt (or .SYT) extension.

8. Click the **Save As** ( ) button in the format section to save changes to a user specified format file. Type **newfl3d.syt** for the template name in the *Save Template File* dialog box and then click **Save**.

9. Click the **Trace Display** in the format section to display the data.

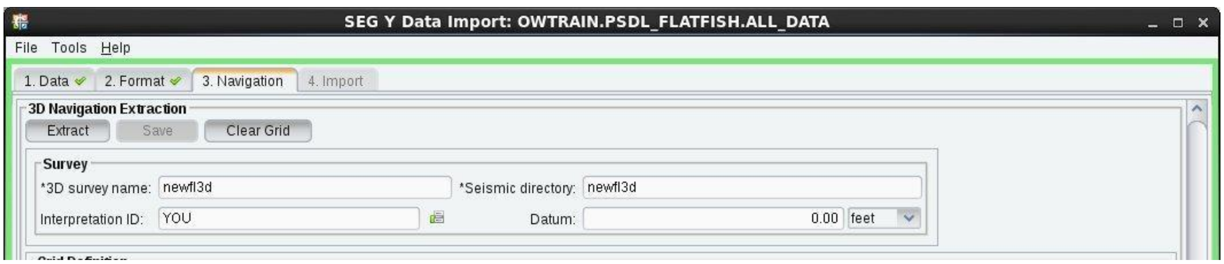
The next step in the data loading process is to create the 3D survey and extract the navigation data. You can use Seismic Data Manager to load the navigation data separately, but in this exercise we will go to create a 3D survey and load navigation data using the same tool SEG Y Data Import.

10. Click the **Navigation** tab.

11. Create a 3D Survey.

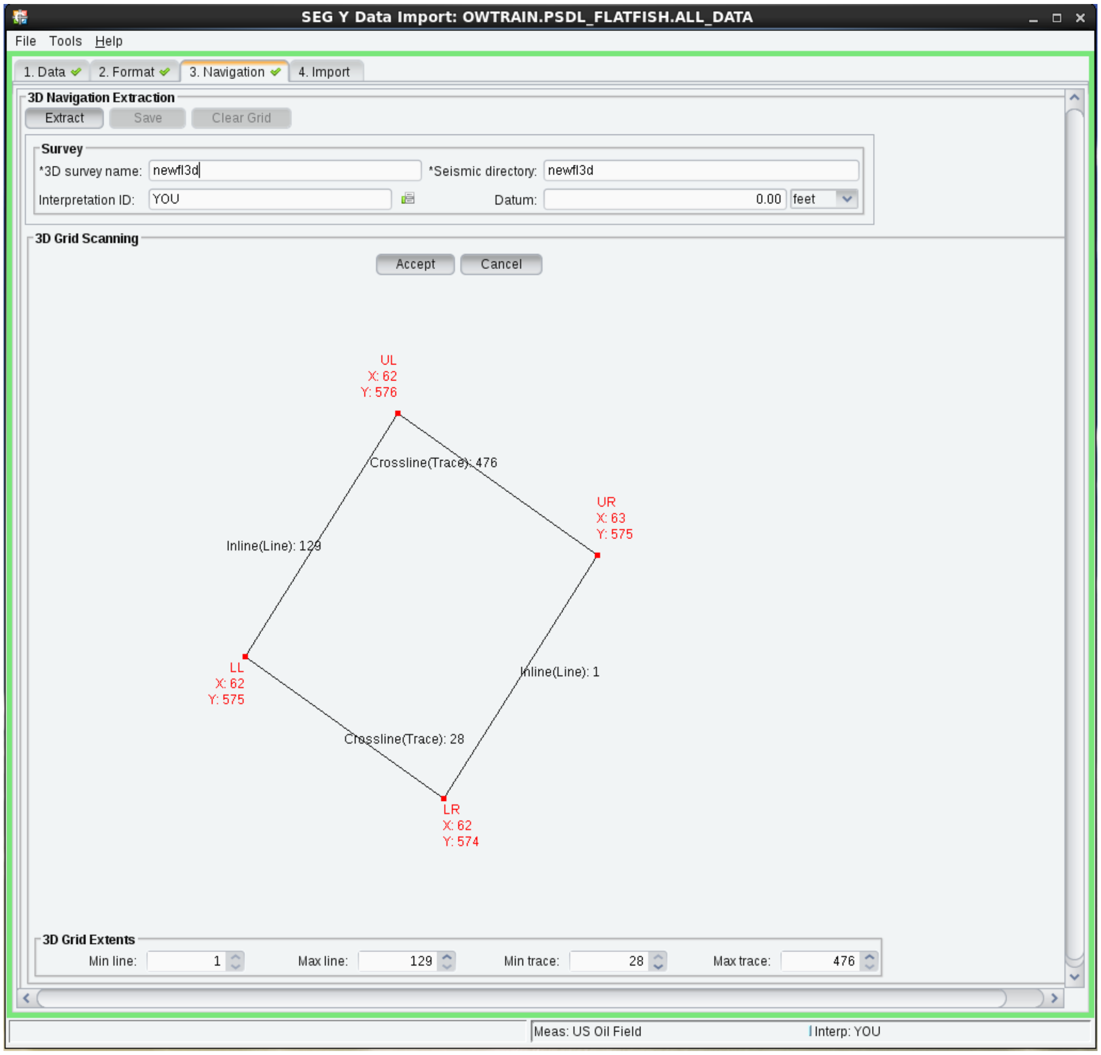
In the **Survey** section:

- Type in newfl3d for the 3D survey name. Automatically the seismic directory is assigned with the same survey name; you can change it if you want to assign another directory name.



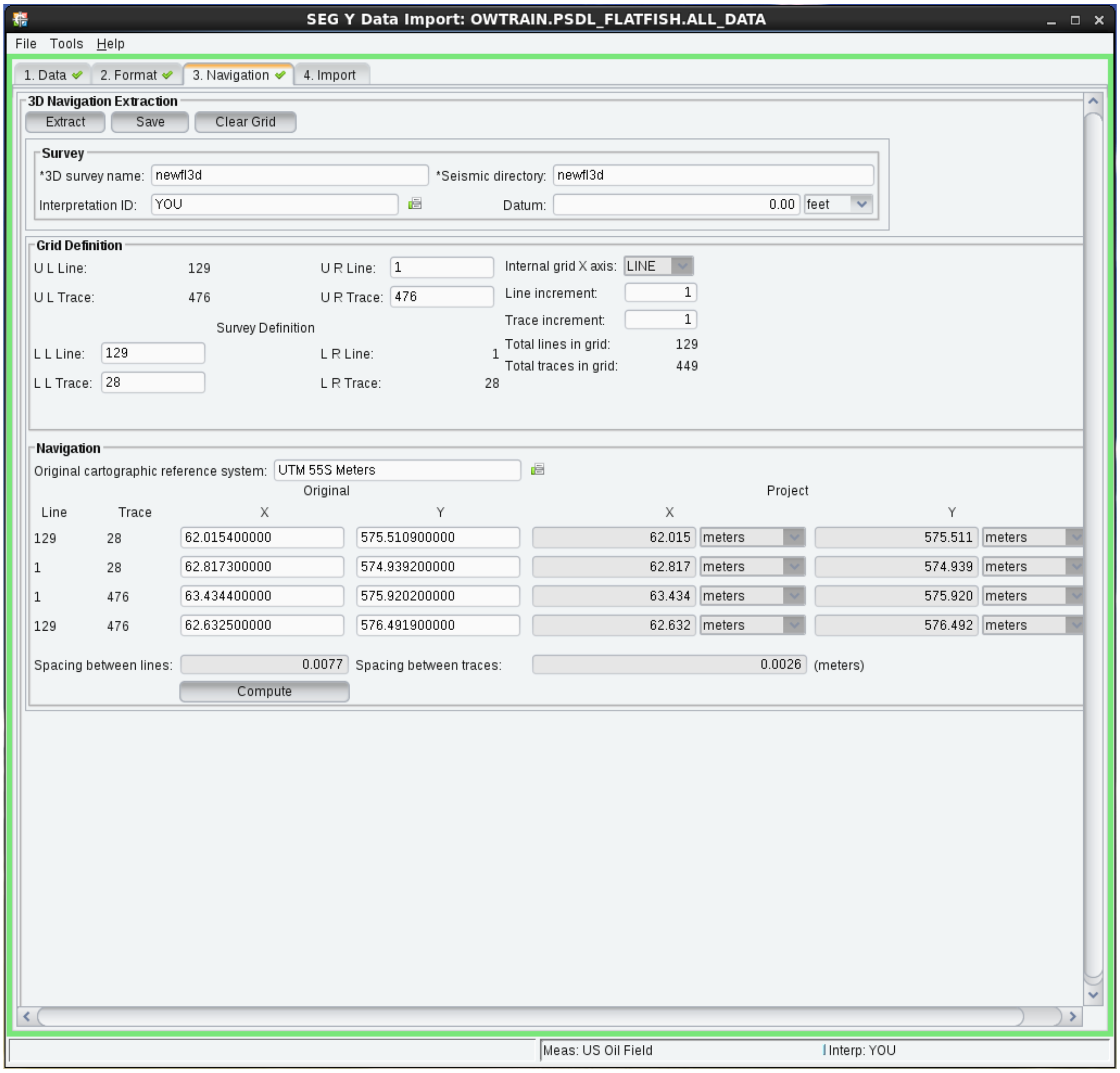
12. Extract the 3D Navigation.

- Click the Extract button to read through the headers for each line and extract the navigation.

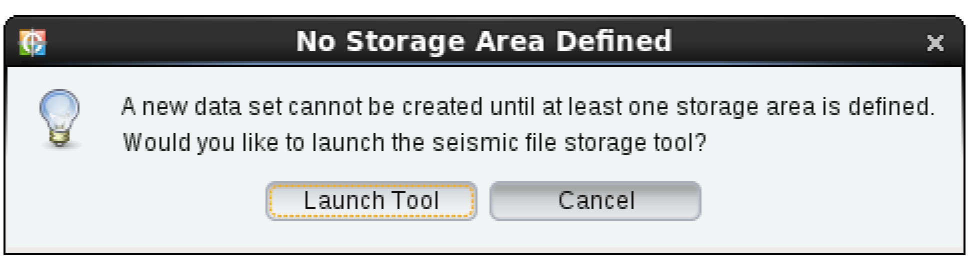


- The 3D Grid Scanning section displays all the Grid definition information. Click the Accept button.

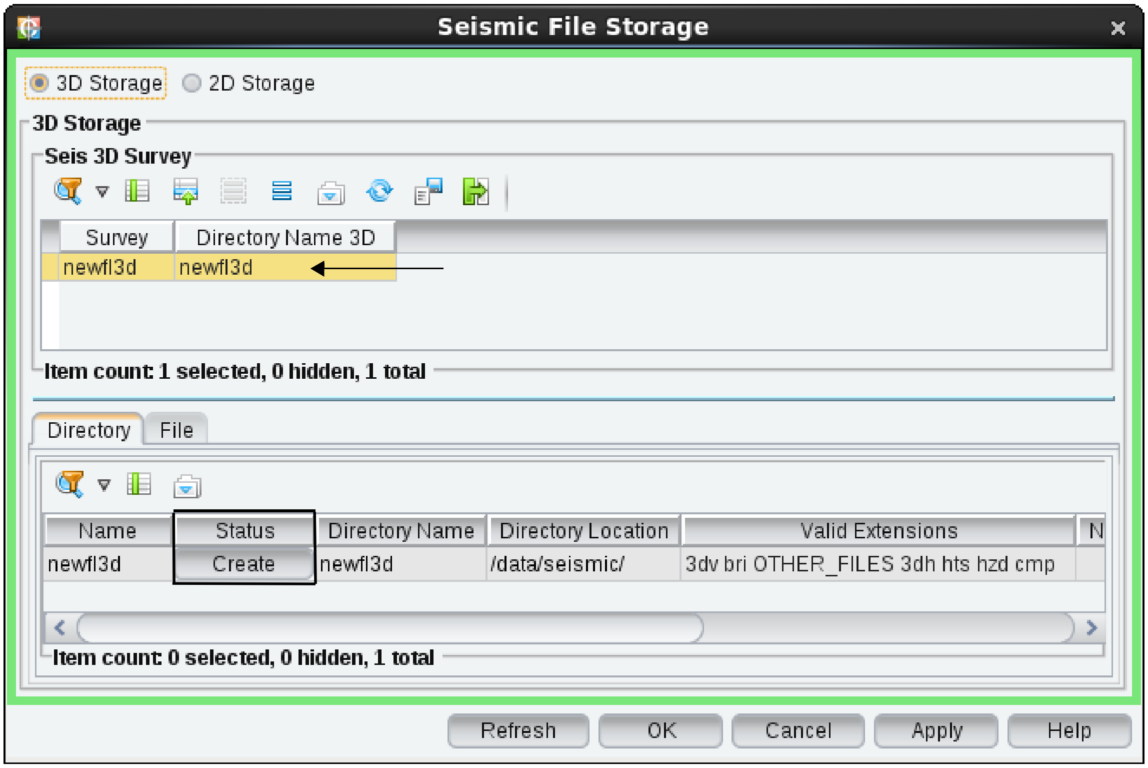
- Select **UTM 55S Meters** for the original cartographic reference system if it is not selected.



13. Click the Save button to save changes to the current 3D Survey definition.
    At this point you will be presented with an option to create the data directories for the survey.

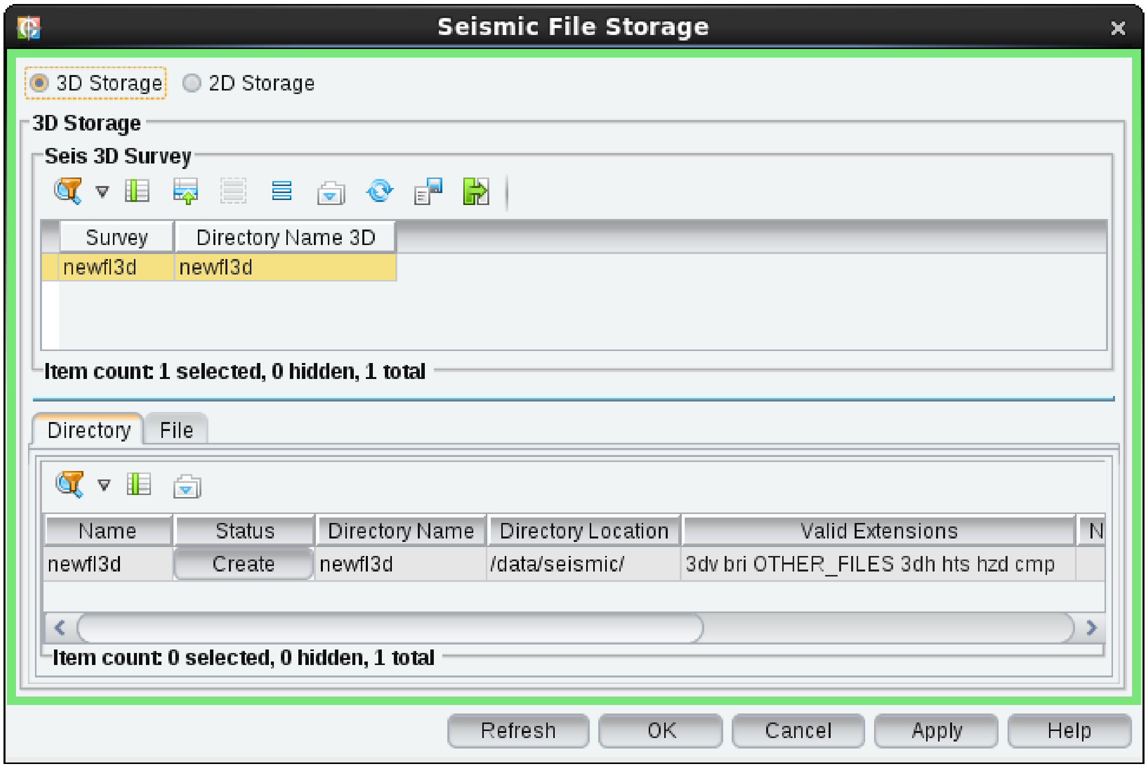


14. Click **Launch Tool**.
    The Seismic File Storage tool displays.



15. Select the **newfl3d** survey.

16. In the lower portion of the pane the available directories that you can write to are listed. Click the **Create** button, after that, the button description will change to **Created**.



Note

The survey must have storage directories before you can load data to the survey.

17. Click **OK** button.

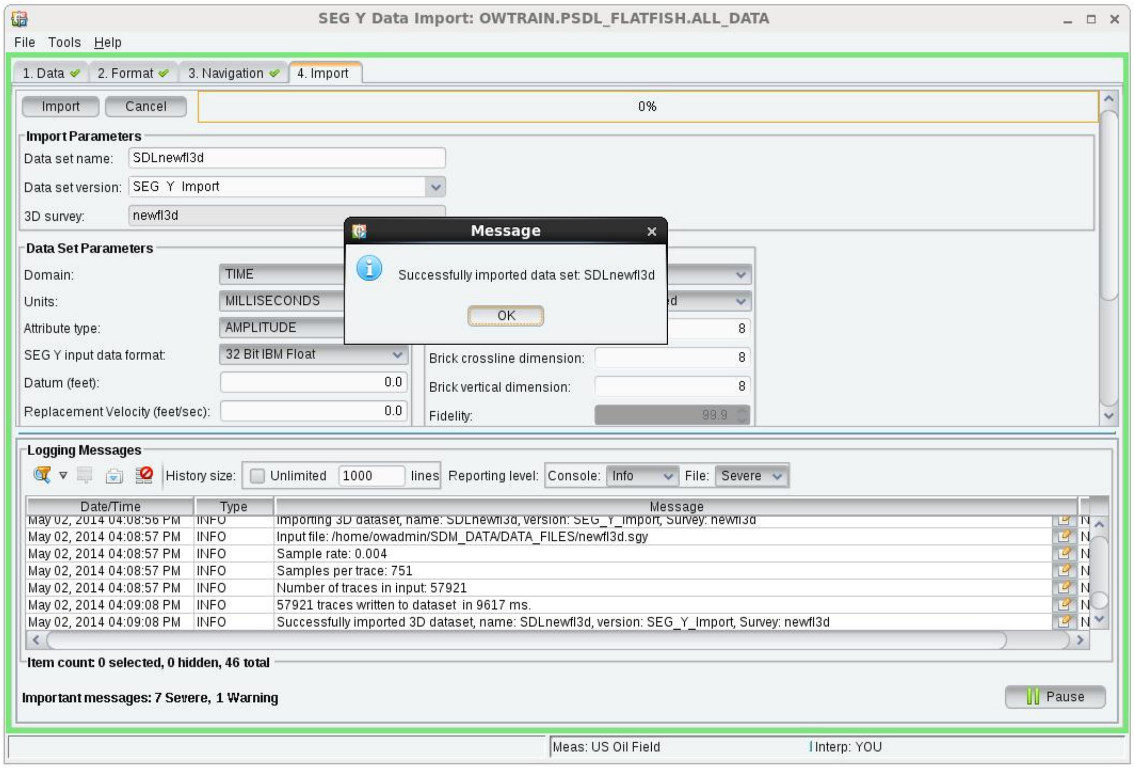
18. Click **Save** button on the popup message displayed and then **OK**.

19. Click the **Import** tab.

20. Specify the **Data Set Name**: **SDLnewfl3d**, under import parameters.

21. Click the 

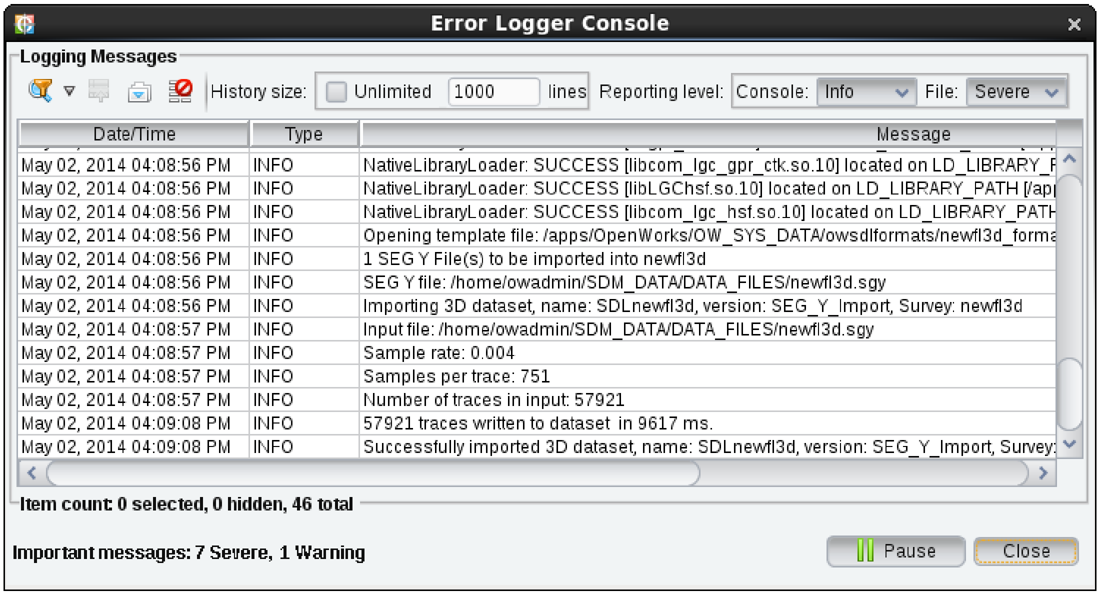
button.



22. Click the **OK** button on the displayed popup message.

- The Status field reports Complete when the job is finished, or Error if there was a problem. If you encounter an error, select

Tools > Error Logger Console... to find out more information about the error.



23. Select **File** and then **Exit** from the SEG Y Data Import tool.

Exercise 12: Check the Data Load in Seismic Data Manager and the SeisWorks Software

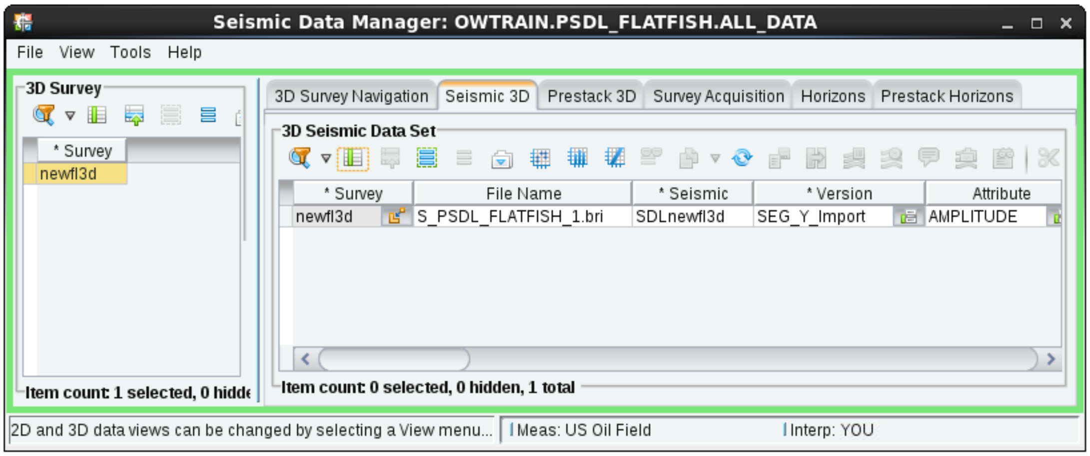
Now that the data is loaded, you will want to check the load in both Seismic Data Manager and view the data in the SeisWorks software. You can also use the WOW software to check the data load as you have done in previous exercises.

1. From the OpenWorks command menu, select **Data > Management > Seismic Data Manager**.

2. Select **View > 3D**.

3. Highlight **newfl3d**.

4. Click the **Seismic 3D** tab.



View the information for the data you just loaded.

If you have not already saved preferences to include the physical file name:

- Click the Column Management icon ().
- Toggle on File Name/Data File Name.
- Move this column near the survey name.
- Select **Tools > Save Application Preferences as User Default**.

The physical file name should be something like S_PSDL_FLATFISH_1.bri.

From the information listed here you can see that the brick dimensions are 8x8x8 and the output format is FLOAT32. These are automatically selected for output when using SEG Y Data Import.

Check process history:

5. Select **Tools > Process History…**.

6. Click the All Interpretation Data button.

Nothing is available as no process history is stored for SEG Y Data Loader.

Check the data in the SeisWorks software. Look at a Map View to check the survey input, Horizon Image View to check the X axis assignment, and several Seismic Views to confirm that the data loaded correctly.

7. Open the SeisWorks software:

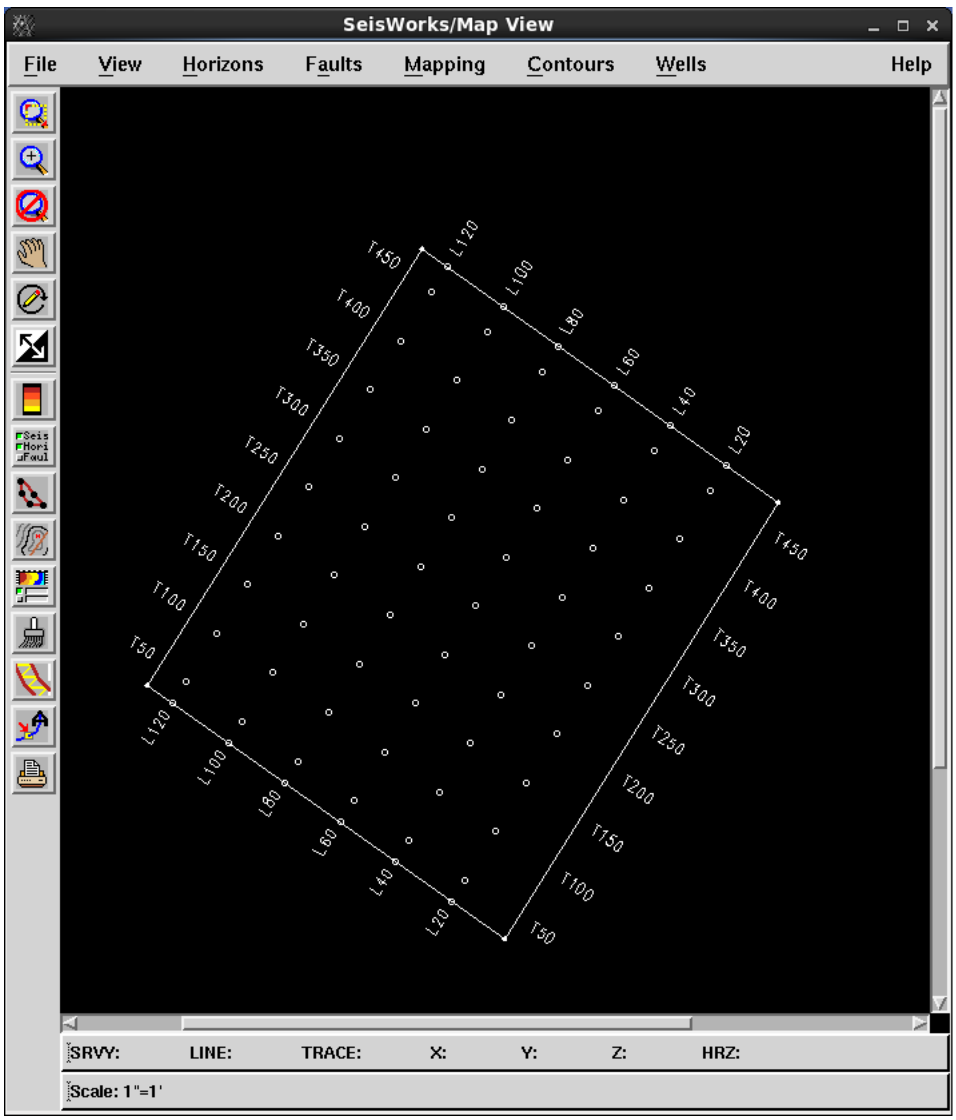
   - **OpenWorks Command Menu** > **Applications** > **SeisWorks**

8. In the SeisWorks menu, create a new session:

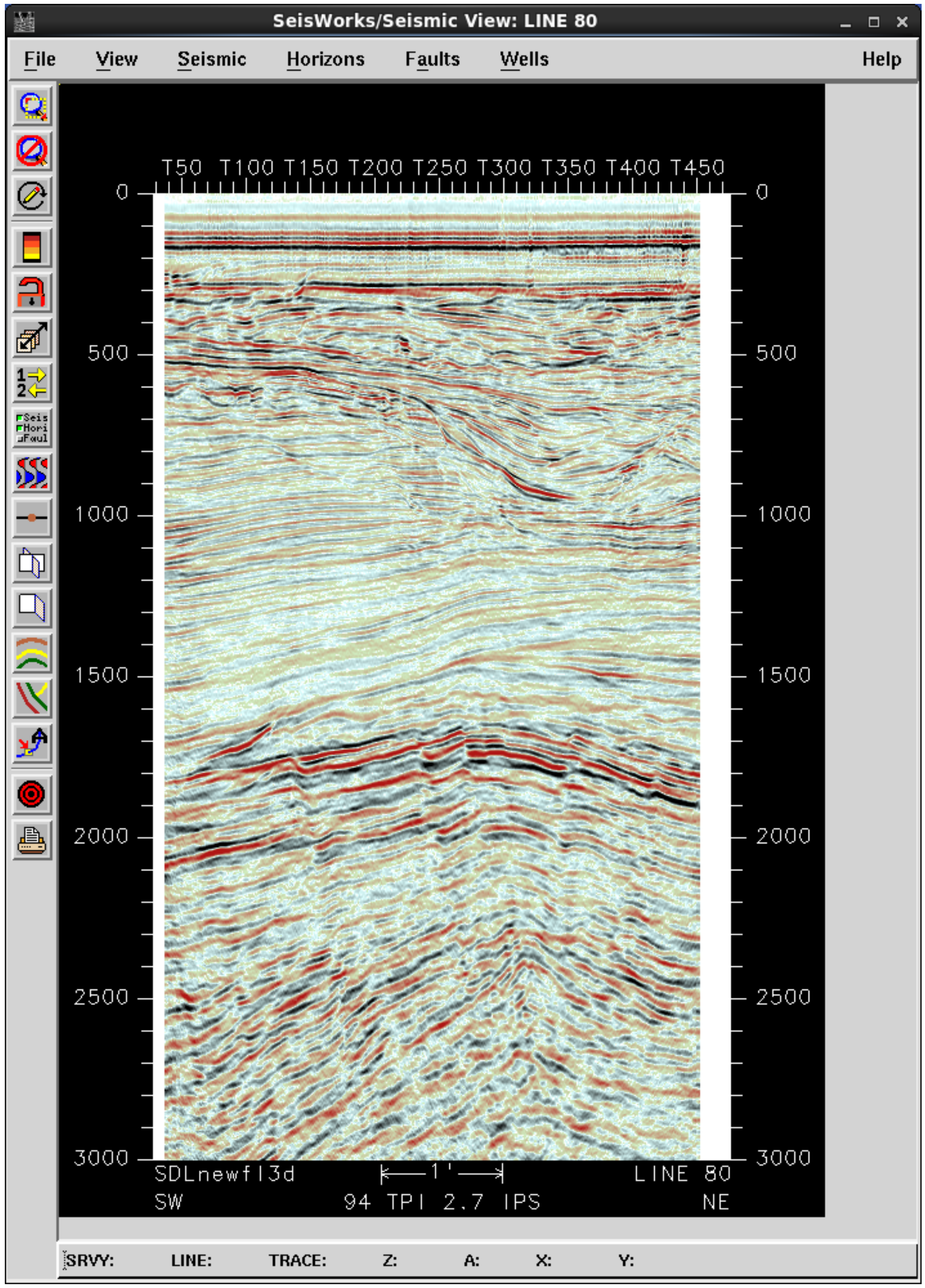
   - **Session** > **New** (no wells, no faults)

View the survey in the Map View that opens in your new session.

9. Select the View Contents icon () in the Map View and click **Basemap Parameters…** toggle on Survey Outline Box, and click **OK**. Refer to previous exercises for detailed instructions..



Use **Seismic > Select from List…** and choose a line to display (or choose a line using any method you like). Try a few lines, traces and time slices.

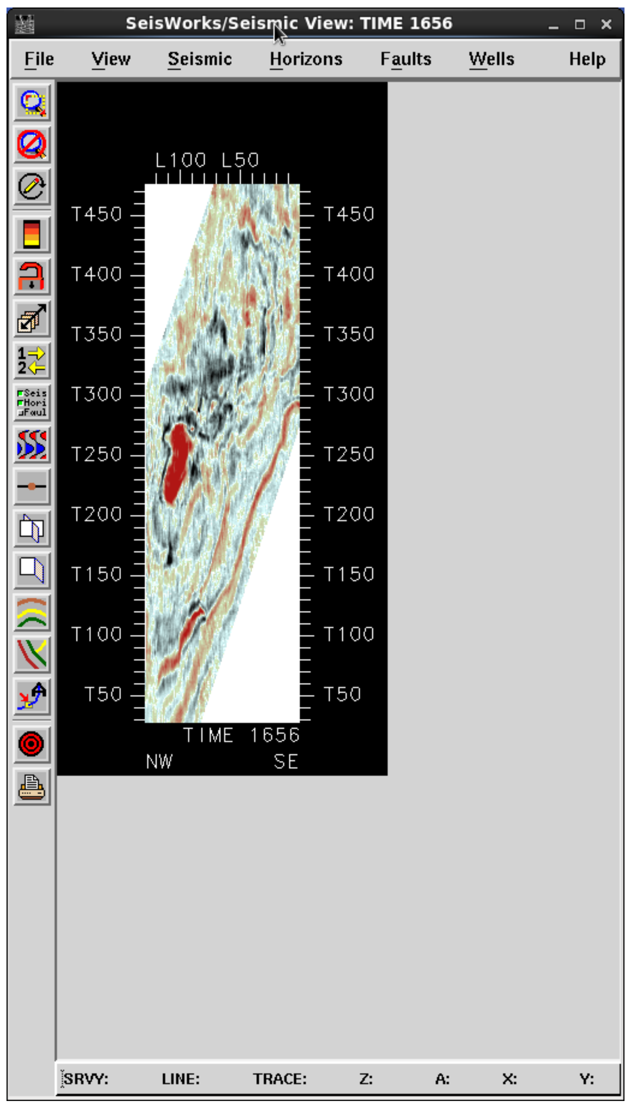


A note about scales for seismic views in the SeisWorks software:

Because the Seismic View does not use any coordinate information—only inline, crossline & shotpoint data (takes a trace from inline 1 and puts it right next to a trace from inline 2 etc., regardless of the distance between inline 1 and 2), the resulting data display will not reflect true relative distance in the trace and line directions if the distance between lines and the distance between traces are not the same.

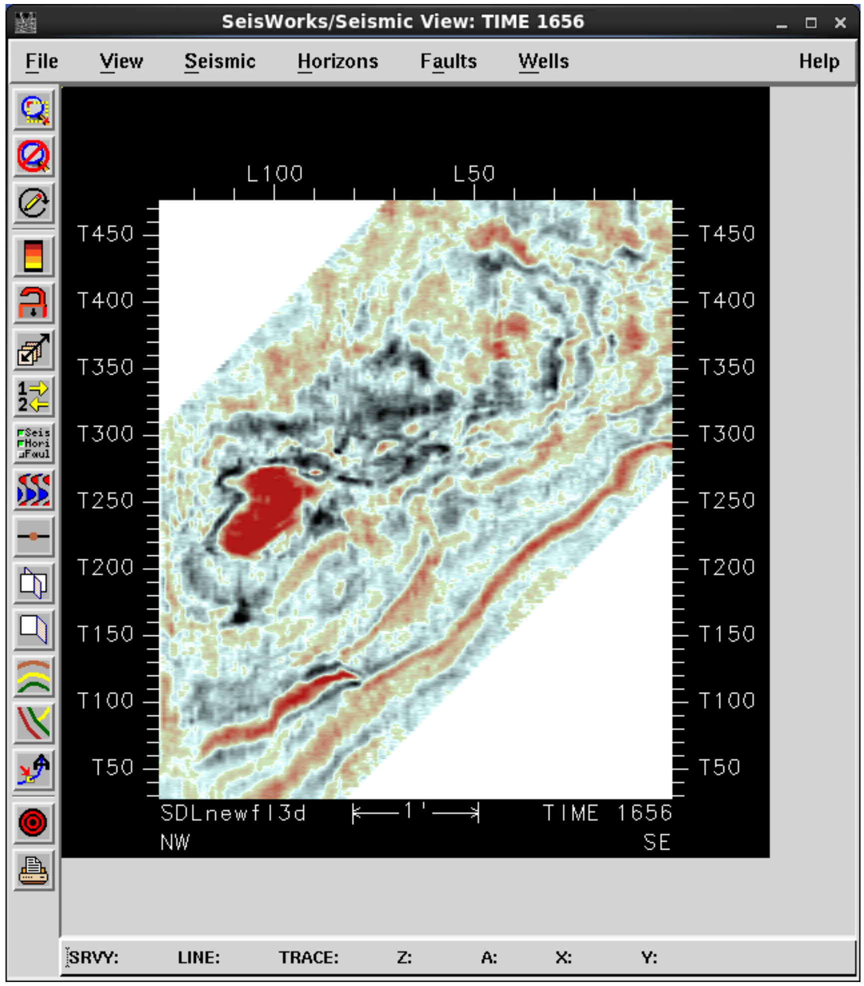
For time slices and arbitrary lines, the views may look distorted unless the Seismic Display Scales in Seismic Display Parameters are changes to reflect the ratio for the difference of distance between traces and lines. See the time slice below for an example of how to change the display scales.

Time Slice with Display Scales set to 0 for Line and Trace:



This view is distorted.

Time Slice with Display Scales set to 0 for Line and 2 for Trace:

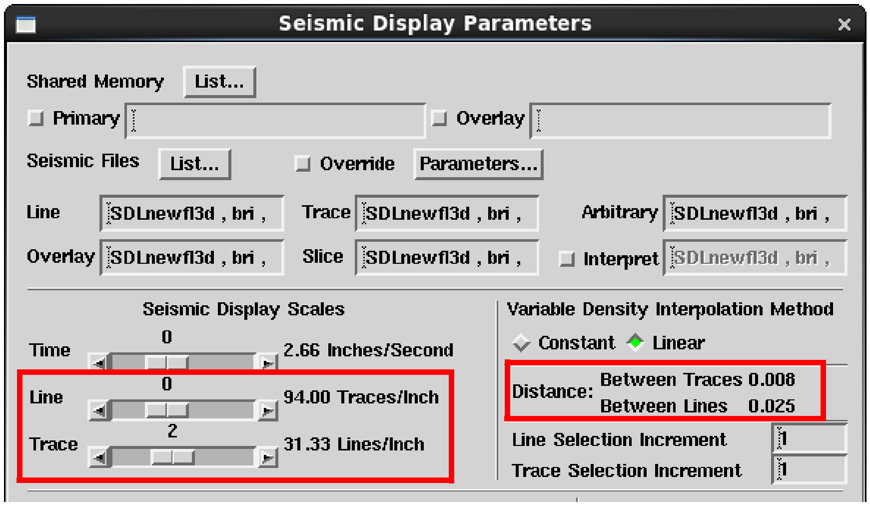


In this view, the scaling is set so the trace and line spacing represent the same distance.

Use this rule of thumb when you have surveys when the line and trace spacing are not the same:

Distance Between Lines = Ratio Setting to Use

Distance Between Traces



The ratio for the rule of thumb = 240 (lines)/80(traces) = 3, so setting the Trace display scale to 2 in Seismic Display Scales, preserves the ratio: 94 (Lines Display traces/in)/31.33 (Trace Display lines/in) = 3.

When you have finished checking the data, it is ready for the interpreter.

3D Data Loading Workshops

The 3D data loading exercises covered basic data loading in each of the two landmark options for loading seismic data. Several 3D workshops are available to practice the data loading workflow. The workshops cover different aspects of loading data with minimal instruction, giving you valuable practice for the unique data loading situations you may encounter.

These workshops are optional and you probably won't have a chance to do them all. If you have time, choose the workshop that you think you might benefit from the most. If you can't decide which one to do, ask your instructor for guidance.

Workshop 1: PSDL-Loading a Compressed Volume into the paradise survey

Workshop 2: PSDL-Complete 3D Workflow (including navigation definition)

Workshop 3: PostStack/SEG Y Import - Challenge Load

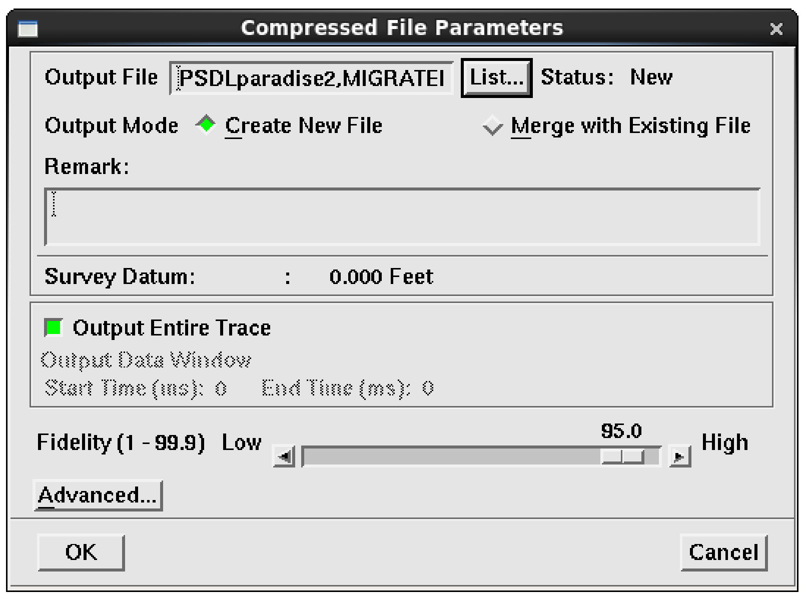
Workshop 1: PSDL—Loading a Compressed Volume

New to the workflow:

- *Create a Customized Template for the PostStack software*
- *Output Compressed Volume*
- *Merge Volumes in the PostStack software*
- Seismic Converter

The goal of this exercise is to load a second set of seismic data into the PSDL_PARA project database. Use the detailed information provided in previous exercises as a guide as well as the hints provided below to complete the load.

The data is to be loaded into a **compressed format** with a fidelity factor of **95**.



The data set to be loaded is called *paradise2.sgy*. Your instructor will provide the path to its location.

Background Information

The only information you have is the original survey transmittal sheet (from the previous paradise1.sgy data load). The data set fits within this paradise survey you previously loaded.

OpenWorks Software Project

Use **PSDL_PARA** as your OpenWorks Project. Use the Project Status Tool to set the project and interpreter.

3D Seismic Survey

Since your data set fits within the original seismic survey, you can use the *paradise* survey for this data load.

There is no need to check the base map since you checked it in a previous exercise.

Analyze SEG-Y Data

The SEG-Y format used for the first data load is not the same as this data set. You will need, therefore, to examine the tape information using the SEGY Analyzer.

In the *paradise1.sgy* data load, you entered line and trace format and byte position directly in the PostStack Data Loader. For this exercise, create a template that can be used to update the information in PSDL.

Creating a Customized SEGY Template

Access SEGY Analyzer from Seismic Tools from the OpenWorks Command Menu, **Data > Management > Seismic Tools**, to view the EBCDIC, binary, and trace headers and find the byte position and format for inlines and xlines.

1. From the *SEGY Analyzer* main window (**Seismic Tools > Seismic > SEGY Analyzer**).

   Select the *pardise2.sgy* file for analysis. Workflow steps include batch analysis, histogram creation, and interactive analysis using the trace header view and graphing the headers. Refer to the previous SEGY Analyzer exercise for details if you need help.

You are looking for the answers to the data loading questions summarized in the following table:

Question	Notes	Answers	Where
How many **Header Records** at beginning of file?	Standard: 2 3200-byte EBCDIC 400-byte binary		**The File**
What is the **Format** of the Seismic Amplitudes?	IBM Floating Point most common.	_____ IBM Floating Pt _____ IEEE Floating Pt _____ 32-bit integer _____ 16-bit integer _____ Other ____________	**Binary Header**
What is the **Sample** Rate?	Listed in microseconds (enter in milliseconds)	_______ ms	
What is the **Number of Samples per Trace**?	Include 1 sample for ‘time = 0’	_______ samples/trace	
What is the **Total Time**?	(sample/trace - 1) x sample rate x .001	_______ seconds total time	
Byte position and **format** of Line Numbers?	Standard: bytes 21-24 32-bit integer	Byte Position: Format:	**Trace Headers**
Byte position and Format of Trace Numbers?	Standard: bytes 25-28 32-bit integer	Byte Position: Format:	

If you have a tape you also need to know if there are EOFs between the seismic lines and if there any header records between the lines.

Using SEGY Analyzer, try to determine answers to the following questions:

Does the EBCDIC header have any useful information? Are the values found in the binary header reasonable? Where is the correct inline and xline information stored?

When you have found the information, create a customized template for use in the PostStack software, using the following procedure:

2. Click the **Browse/Edit template…** button found at the bottom of the window. The *SEGY Template Browser/Edit* window displays.

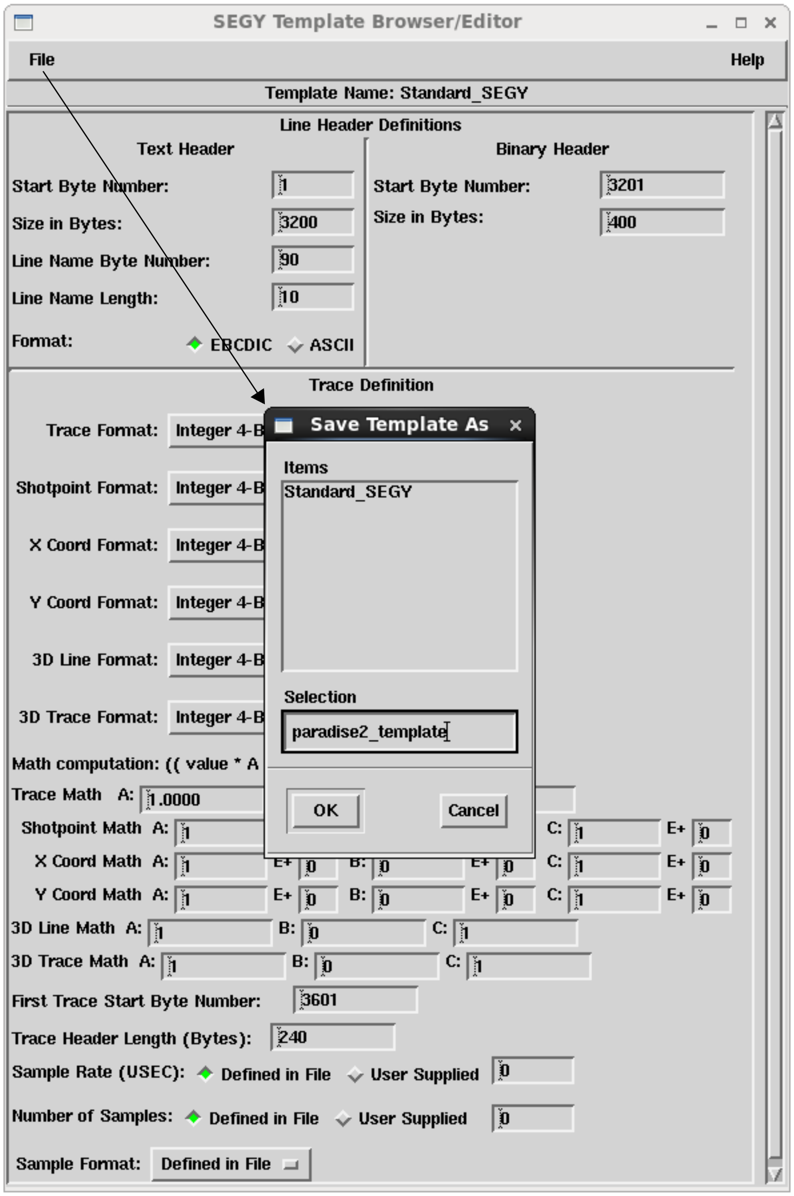
3. Fill out the template with the values you determined were correct for this data set:

   - Change the **3D Line Format** and **Byte Number** to the appropriate value

   - Change the **3D Trace Format** and **Byte Number** to the appropriate value

4. Select **File > Save As…**.

- Enter the new template name, (paradise2_template), in the Selection text field. Template names can be up to 30 alphanumeric characters.



5. Click **OK**.

> **Where seismic templates are saved.**
>
> New templates are saved in your $HOME directory with a .SegyTemplate extension.
>
> If you would like to share your templates with other users, you may move your templates to $SEISUTILSHOME/dat (or $OWHOME/SeisUtils/dat). The files with a .SegyTemplate extension in these locations are listed in the *Template Name* dialog box.

The template name is posted in the Template Name field at the top of the *SEGY Template Browser/Editor* window, and the fields in the window change to reflect the items defined by the template.

6. Select **File > Exit** to close the template editor.

7. Check your template by running a batch analysis of your data with your new template.

   To select the new template, click once in the Template Name field. A *Template Selection* dialog box pops up, listing all available templates.

Load into Compressed Format

Since compressed data is not scaled during loading you do not choose an output format (output is 32 bit floating point).

When working with a new data set, you may wish to load a portion of your data set using a range of fidelity factors to determine what the best fidelity factor is based on the quality of data and how it will be used. For example, regional structural interpretation does not require as high a degree of fidelity as does production work on a single well.

A compressed seismic volume can be analyzed by comparing its characteristics to the same portion of the volume loaded as a .bri file. There are a variety of methods for comparing the two volumes including visual inspection, creating attribute volumes, amplitude extraction, and workflow comparisons (for instance, run ZAP! on the same horizon using each volume).

seisMath, a new command line utility, allows you to subtract the compressed volume from the original volume to look at differences between the two. Another new utility, *seisRMS*, allows you to determine the actual fidelity over any part of a compressed volume. Both of the utilities are described in Seismic Utilities from the online manual, accessed from the **Help** menu on the Seismic Tools.

Use the instructions from the previous PostStack paradise1.sgy exercise to load *paradise2.sgy* into a compressed data file.

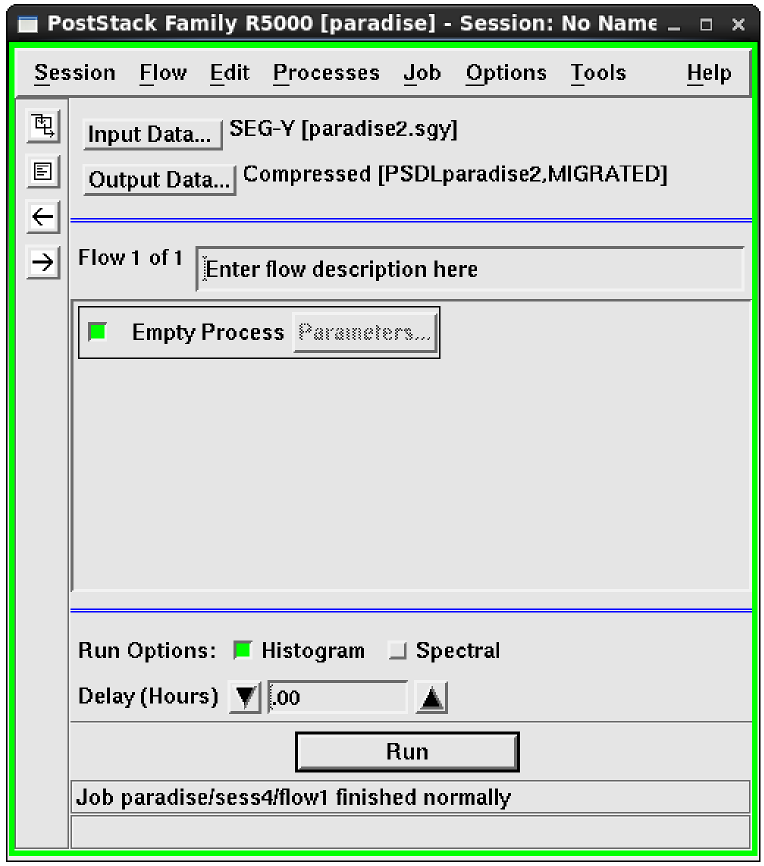
Several things to note include:

- When setting input parameters in the PostStack software, click the **Update from Template** button in the lower left corner of the window. Select the template that you created and click **OK**.

Check to see the updated information:

- Click on the **Parameters…** button next to Modify SEG-Y Headers. The starting byte numbers for the Line and Trace numbers should now match the values in your template.

- You can specify up to 40 characters for the name and 40 characters for the version when naming your compressed file. The PostStack software will generate a physical file name with the .cmp extension and add the appropriate numbers to the physical files if more than one extent is necessary.



- It will be helpful to have a histogram saved in the Process History with the job.output from this data load. Then, if you need to scale the data interactively (if not using the auto-scale option) while viewing it in the SeisWorks software, the histogram of the amplitude values will always be available for reference.

Note for displaying seismic data in the SeisWorks software:

The seismic display in the SeisWorks software is an 8 bit display. This means that the amplitude values in the seismic volume are displayed between the range of 127 to -128 and clipped outside of that range.

The SeisWorks software by default uses an Auto-scale option (in Seismic Display Parameters) to display the seismic data. The automatic option scales the highest value of amplitude in the data to 127, and applies that scaling factor to the rest of the data.

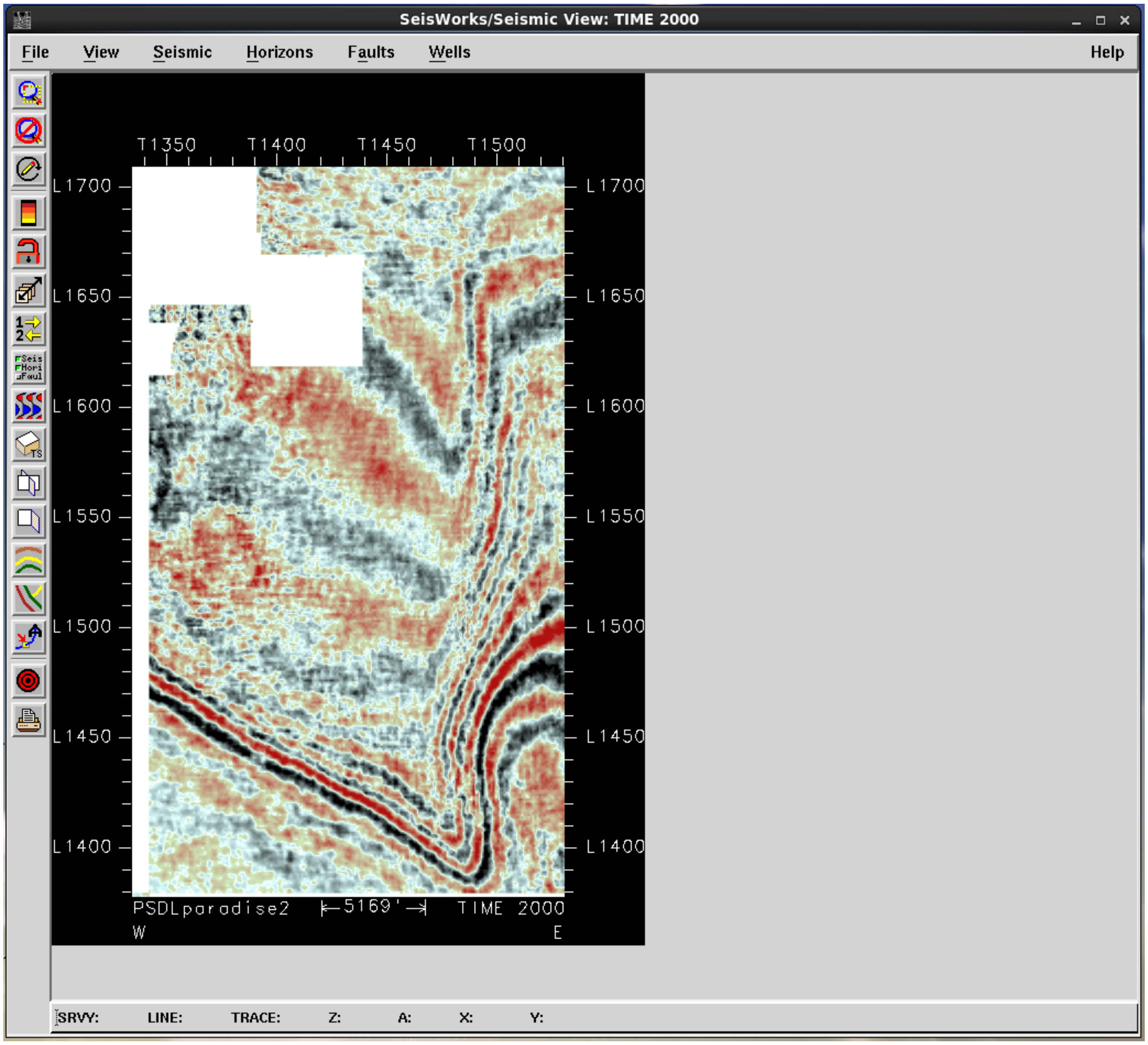
Sometimes, if a data set has very high amplitudes, the seismic view can look washed out. If this is the case, the maximum amplitude to preserve can be set in Seismic Display Parameters. The histogram output from the PostStack software can help to estimate a value for the maximum amplitude to preserve in the view.

Or, in the Seismic View, use **View > Show Position > Seismic >Parameters…** and toggle *on* Real Amplitude—as the cursor moves over the seismic data, the amplitude value is displayed in the status area.

Newer seismic applications such as DecisionSpace Desktop do not have this 8 bit display limit.

Time Slices

Horizontal views can be accessed from any .cmp file and, therefore, you do not need to generate a separate time slice volume.



If your view looks washed out, in Seismic Display Parameters, Display Scale and Clip, toggle on Maximum amplitude to preserve, and set the value to around 6000 (about the 98 percent value from the histogram).

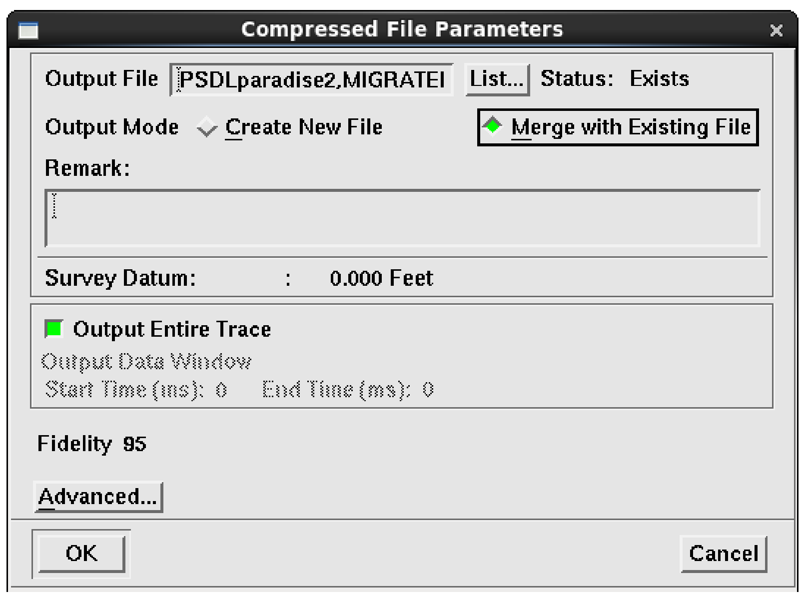
Optional: Creating a Single Seismic Volume for paradise *Survey*

In the first series of exercises, you loaded part of the paradise survey into a bricked seismic file. In this workshop, you loaded a second portion of the paradise survey into a compressed seismic file. Now you would like a single seismic volume for this survey so that the interpreters do not need to keep reselecting their seismic volume as they move from one area to another.

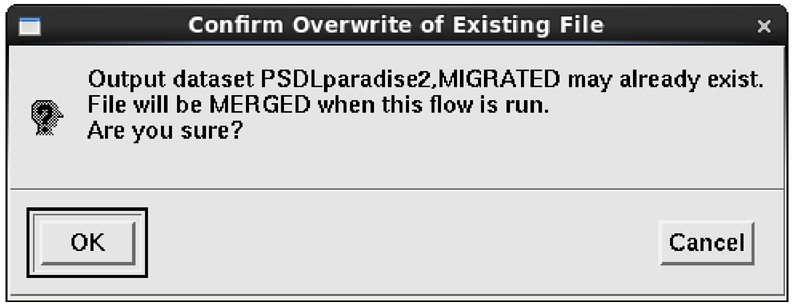
This discussion covers two methods to merge data, one method using the PostStack software and another method using Seismic Converter. Choose *one* of the methods if you would like to create a merged volume.

Method #1—Using the PostStack™ Software

If the SEG-Y data for paradise1.sgy is easily available, you can load the original 32-bit floating point data directly into the compressed volume you created with a different SEG-Y data file (paradise2.sgy) using the PostStack Data Loader. Remember to modify the trace headers in the SEG-Y input parameters. When setting up the PostStack output parameters use the existing .cmp file as the output file and select the **Merge with Existing File** radio button.

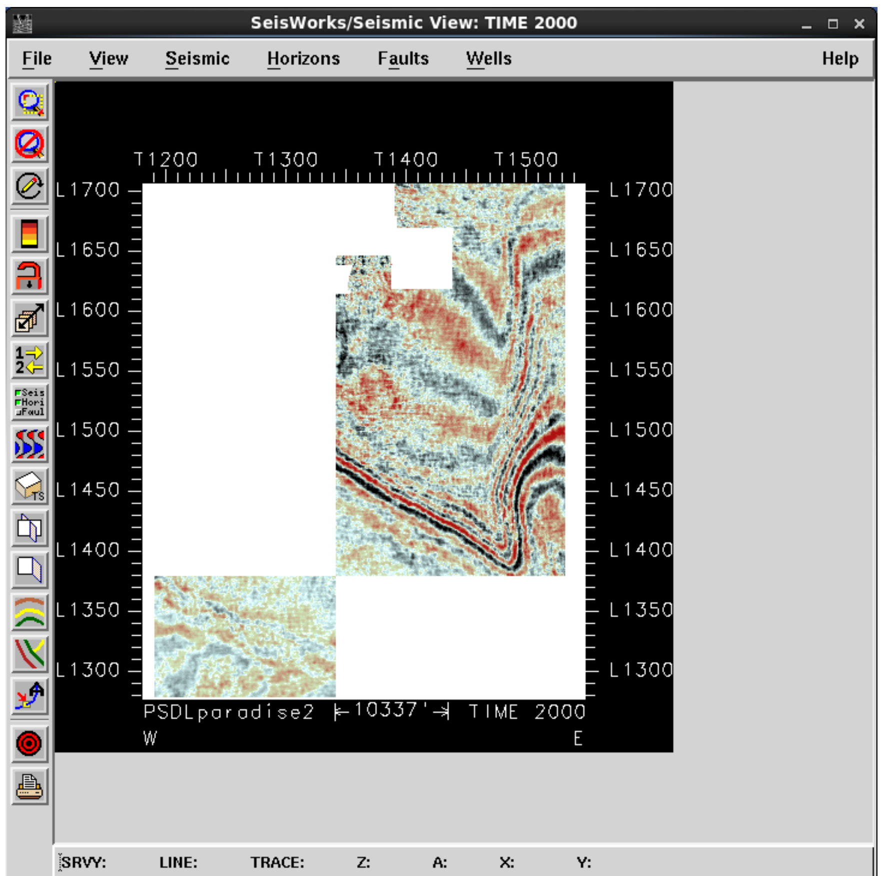


When you click OK in the dialog box above, you receive the following message:



Click **OK** in this confirmation message.

An easy way to check the merge is to generate a time slice in the SeisWorks software from the merged volume.



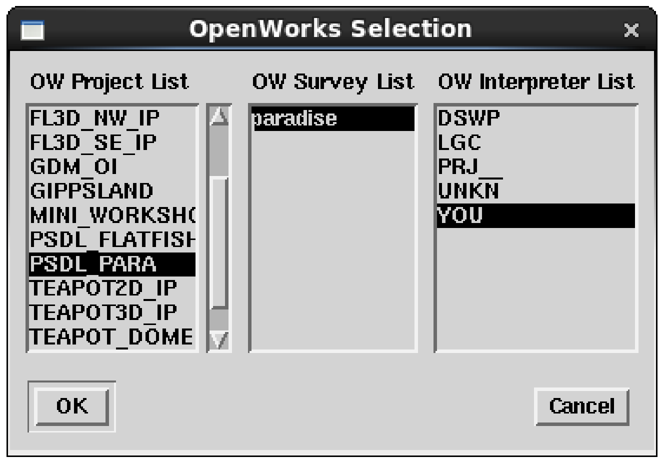
The time slice selected from the one merged volume covers both the paradise1.sgy area and the paradise2.sgy area.

Method #2—Using Seismic Converter

Alternatively, you can convert the 16-bit floating point volume (PSDL16Float.bri) that you created during the exercise into compressed data (generally you would want to do this only with 32 bit data), loading it directly into the .cmp file you created during this exercise by using the following steps:

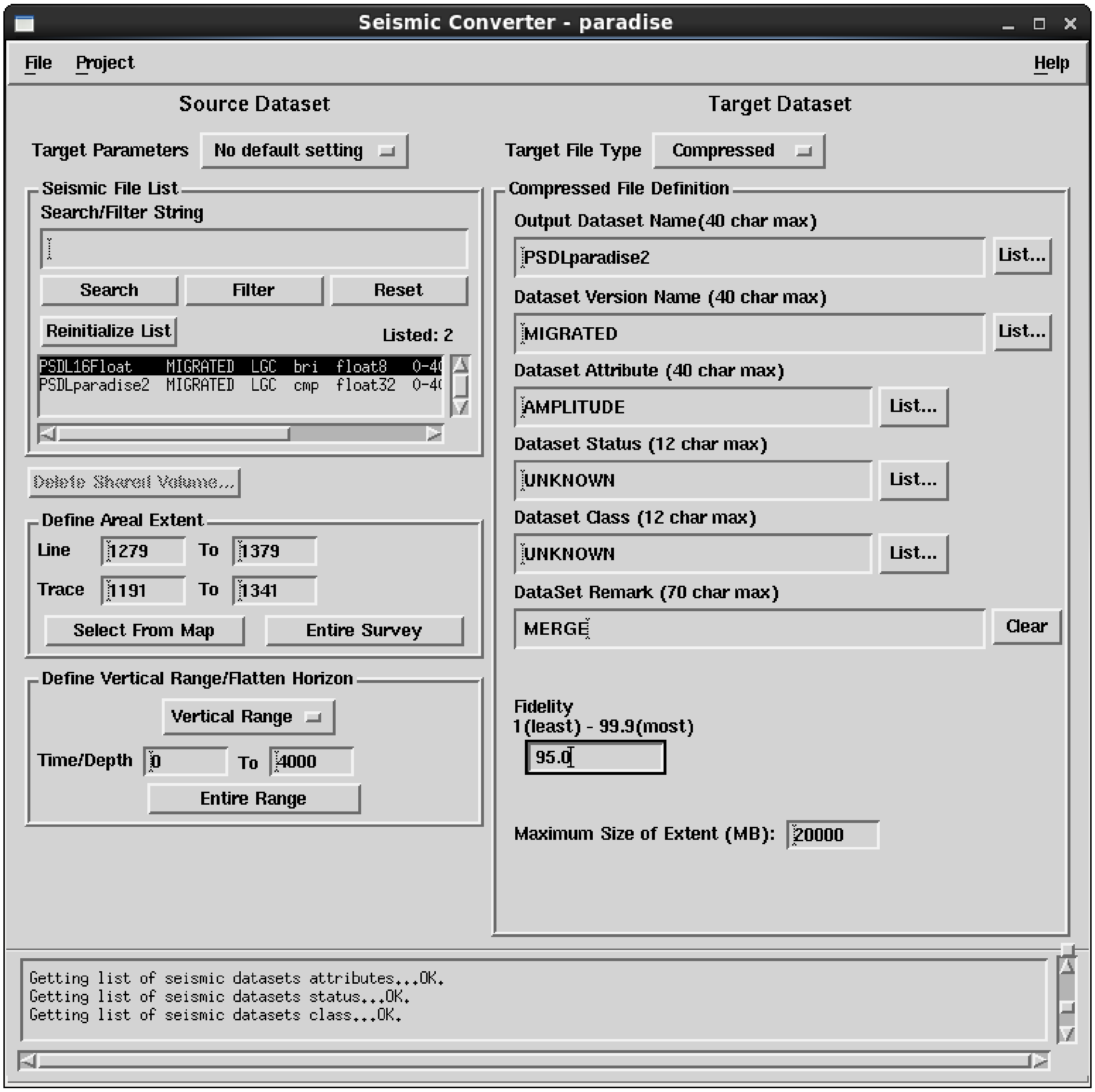
- Bring up the Seismic Converter and select paradise as your survey.

  Seismic Tools > Seismic > Seismic Converter



- Select *PSDL16Float* in the Seismic File List.
- Select **Compressed** as your Target Dataset.
- Next to the **Output Filename** text box, click **List…**. Select the compressed file that you just created.
- Set the remaining parameters to match the original file (you can find this information in Seismic Data Manager).

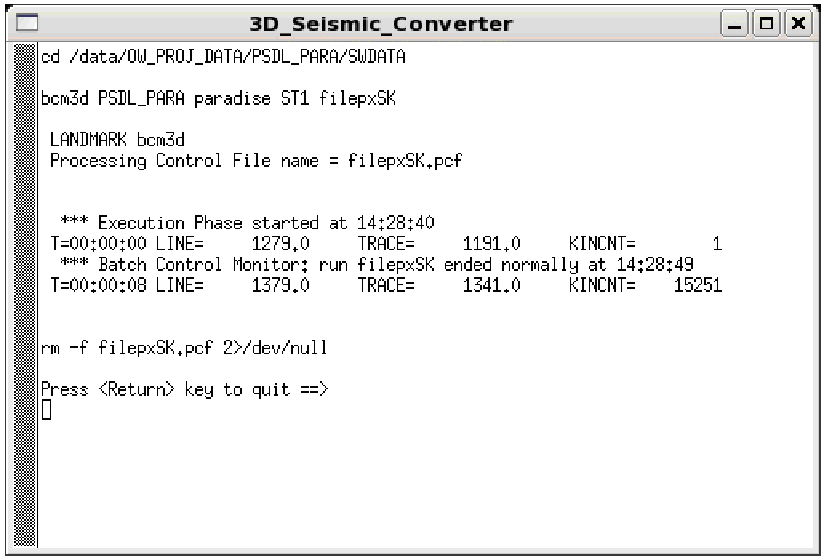
- Change the fidelity factor to 95. You cannot merge the volumes with different fidelity factors.



Converting Automatically

- Start the job by selecting **File > Convert Seismic File** or by pressing **Ctrl-c**.

The *3D_Seismic_Converter* dialog box displays. This display give When the job has run, the display directs you to press <*Enter*> on your keyboard. This display will also tell you if the job terminates abnormally.



- Press <*Enter*> key when you get this job confirmation.

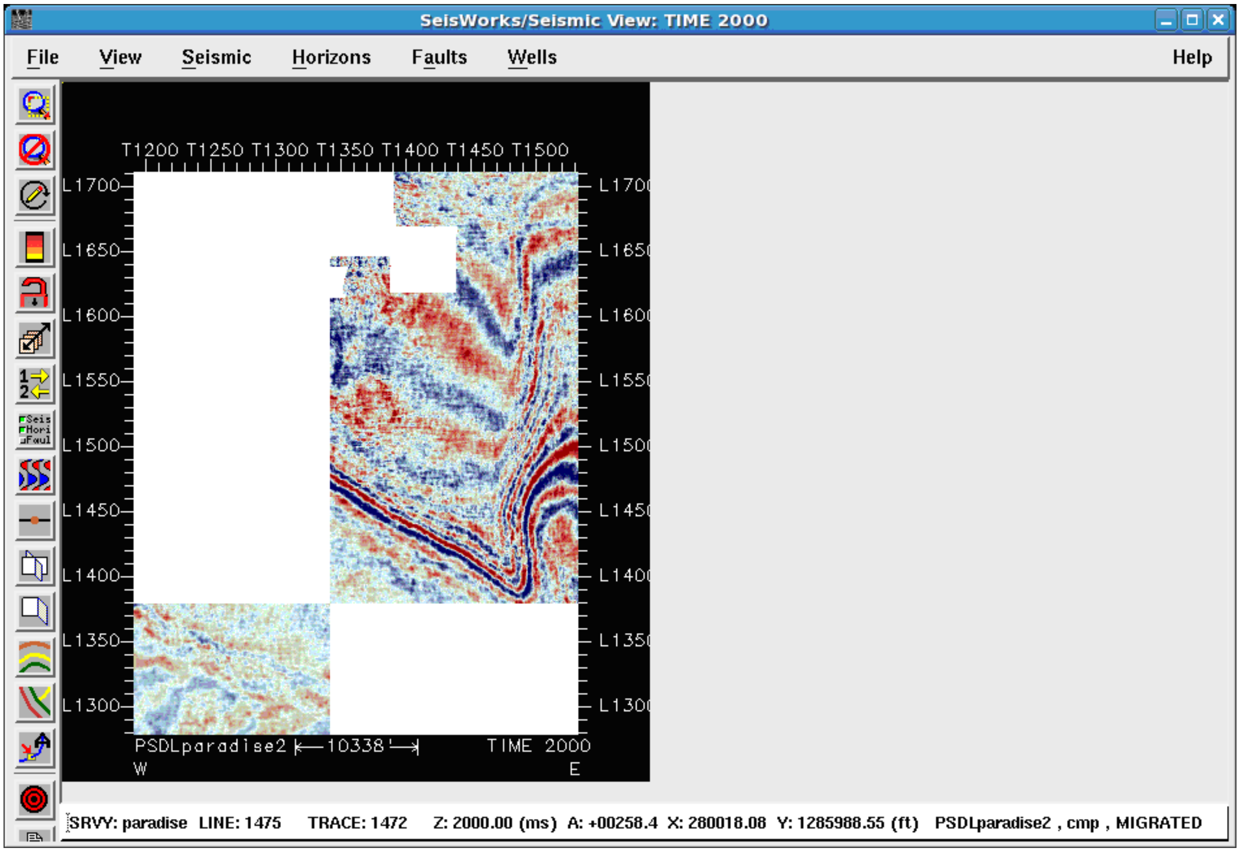
Notice the .pcf file name is *filepxSK.pcf*.

Seismic Converter sets up and executes a bcm job. If there is an error, look in the .lst file. This file is in the format <*survey*>*.pcf filename*.

In this example file, you would *cd* to the SWDATA directory and type:

```
more paradise.filepxSK.lst
```

- Display the seismic data in a SeisWorks time slice view.



Converting Manually

The manual conversion method allows you to create and save a .pcf file. To utilize the manual method, follow these steps:

- Select **File > Save As pcf File…** from the Seismic Converter menu.
- Enter a file name in the text field and click **OK**.

- In an xterm, change to the directory containing the .pcf file (SWDATA directory).

> **Unix Tip—Looking for the *.lst* file:**
>
> Whether the seismic data is converted automatically or manually, an .lst file is produced containing information on the conversion.
>
> If you wish to view the .lst file, change to the SWDATA directory for the OpenWorks project. Since the name of the file of interest may not be obvious, type:
>
> ```
> ls -altr *lst
> ```
>
> This command will show all the .lst files in reverse time order (most recently created file is last in list).

Use any of the other utilities and tools you have used, such as Seismic Data Manager and the WOW software, to check your data.

Workshop 2: PSDL—Complete 3D Workflow

Review of the PSDL workflow:

- *Create a 3D survey*
- *Create Seismic Storage Directories*
- *Check the Basemap/Horizon Image Map*
- *Analyze the SEG-Y file*
- *Output Landmark formatted volume (.bri)*
- Check the loaded data

New for this workflow:

- *Output normalized for horizontal views*
- Brickreorder utility

The goal of this workshop is to get additional practice in loading 3D seismic data using the PostStack Data Loader. The SEG-Y data file to be loaded is *salty.sgy*. Use the OpenWorks project *PDSL_SALT*.

- Load the data into 16 bit floating point bricked data set, optimized for any vertical display

- Also output a 16 bit floating point bricked volume optimized for horizontal display

- Run the Brickreorder Utility on the horizontally optimized display

Background Information

Use the survey information shown on the next page.

Select the OpenWorks Software Project

Use *PSDL_SALT* OpenWorks project database. Do not forget to create an interpreter.

Create a 3D Seismic Survey

Create a seismic survey using the information transmittal sheet.

Check Basemap

Check Basemap in SeisWorks Map View and Horizon Image Map.

Analyze SEG-Y Data

Use SEGY Analyzer to find the necessary information for loading 3D data.

Load Data and QC the Data

Use the PostStack software to load the data into bricked files.

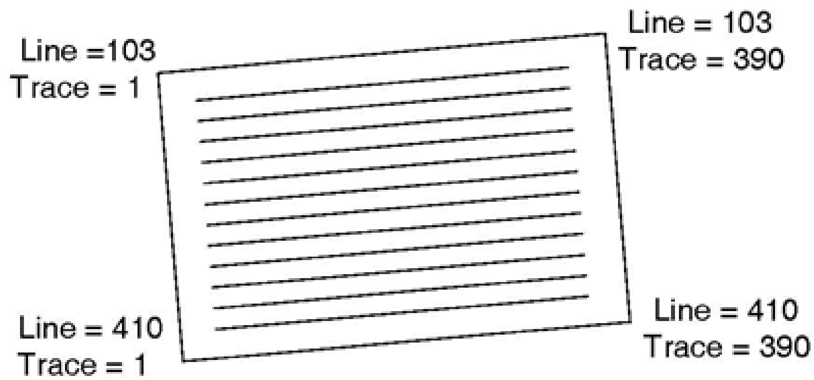
Run the Brickreorder utility on the horizontally optimized bricked file (instructions follow).

Project Name: salt3d

Area: Tabasco Basin

Projection type: TXSC4204; Feet

Datum:



World Co-ordinates:

Line	Trace	X	Y
103	390	422040.00	3189228.00
410	1	391100.00	3162504.00
410	390	423161.00	3163925.00

Line Spacing: 82.5 feet

Trace Spacing: 82.5 feet

After creating the horizontally optimized volume, run the Brickreorder utility, as described below.

Check both the volumes in the SeisWorks software.

Delete the original volume using Seismic Data Manager after you have created the reordered volume.

Bricked Seismic Format Reordering Utility

Brick dimensions are not the only determining factor in the performance of a bricked file along a given dimension. How the bricks are distributed in the file also affects performance.

When optimizing for vertical displays, the bricks are written so that all of the bricks that are needed for a display along a particular dimension are together in the file.

However, when a brick volume optimized for horizontal slice displays is generated, all of the bricks for a horizontal slice are not grouped together in the file. In order to achieve optimal display performance, brick files generated for optimal horizontal slice display performance should have their bricks "reordered" in the file. The Brickreorder utility does this.

Brickreorder allows users to reorder bricks along any dimension; however, it should only be necessary to use it to reorder along the Z dimension for horizontally optimized brick files.

Running Brickreorder

To run Brickreorder, enter the following on the command line in an xterm:

```
Brickreorder <ow project> <3d survey> <input data
set name> <input version> <output data set name>
<output version> <ordering (l, t, or z)>
```

The arguments are as follows:

ow project	Name of the OpenWorks project database
3d survey	Name of the 3D seismic survey
input data set name	Input bricked file (without the .bri extension)
input version	Input bricked file version
output data set name	Output bricked file (without the .bri extension)
output version	Output bricked version
ordering	Optimization direction: l = line t = trace z = horizontal slice

Example

If you have the following database, survey and horizontally optimized brick file:

- OpenWorks Project: PSDL_SALT
- 3D Survey: salt3d
- Horizontally Optimized Brick File
- Name: salt16float
- Version: HORIZONTAL

And want to output a reordered file with the new name and version:

- *Name: salt16float*
- Version: HORI_REORDER

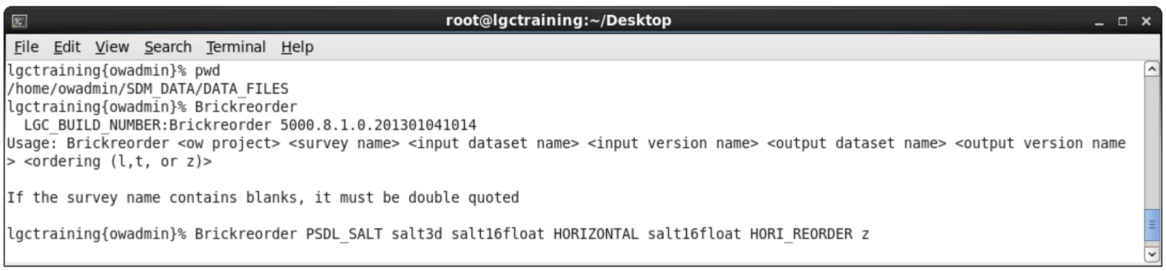
The Brickreorder command would look like the following:

```
Brickreorder PSDL_SALT salt3d salt16float HORIZONTAL salt16float HORI_REORDER
z
```

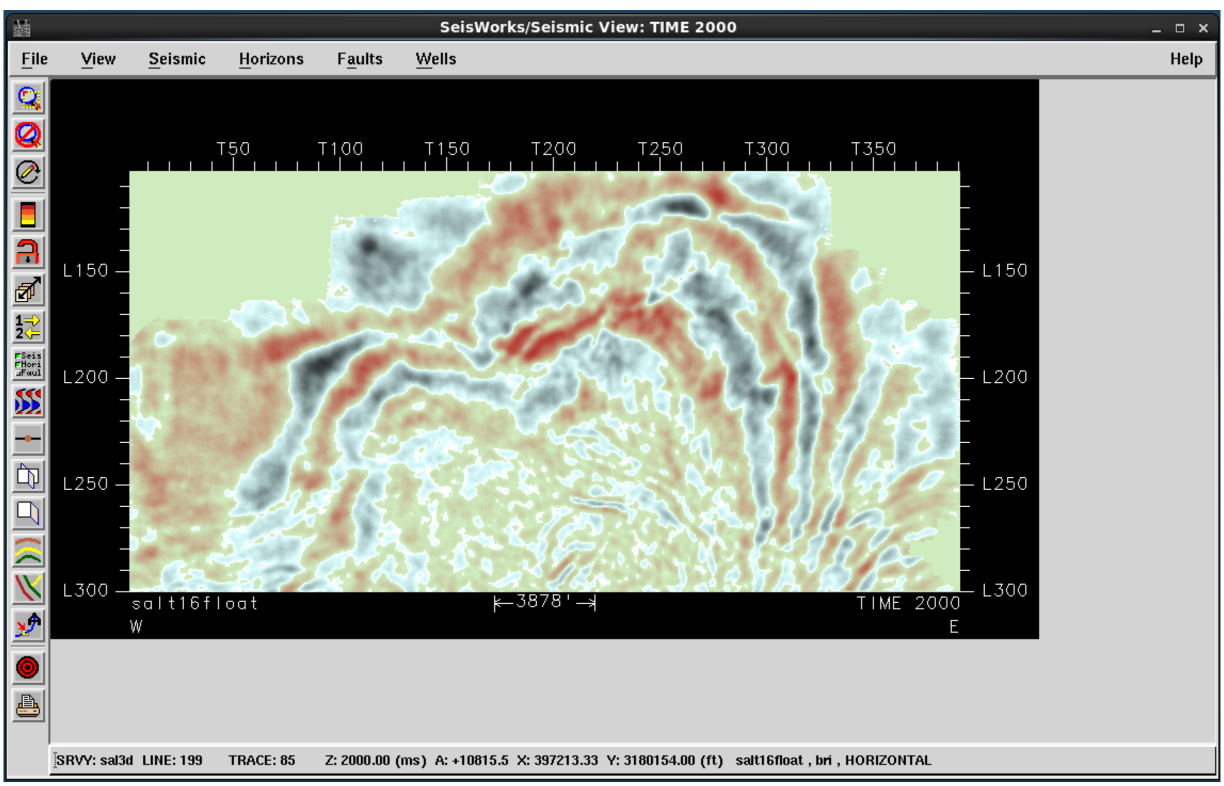
This will read *salt16Float*, *HORIZONTAL* bricked file in the 3D survey salt3d, reorder the bricks along the z direction, and write the output *salt16Float*, *HORI RECORDER* bricked file.

These two versions will be identical to each other except that all of the bricks for in each horizontal slice will be grouped together in the reordered version, which will improve display time.

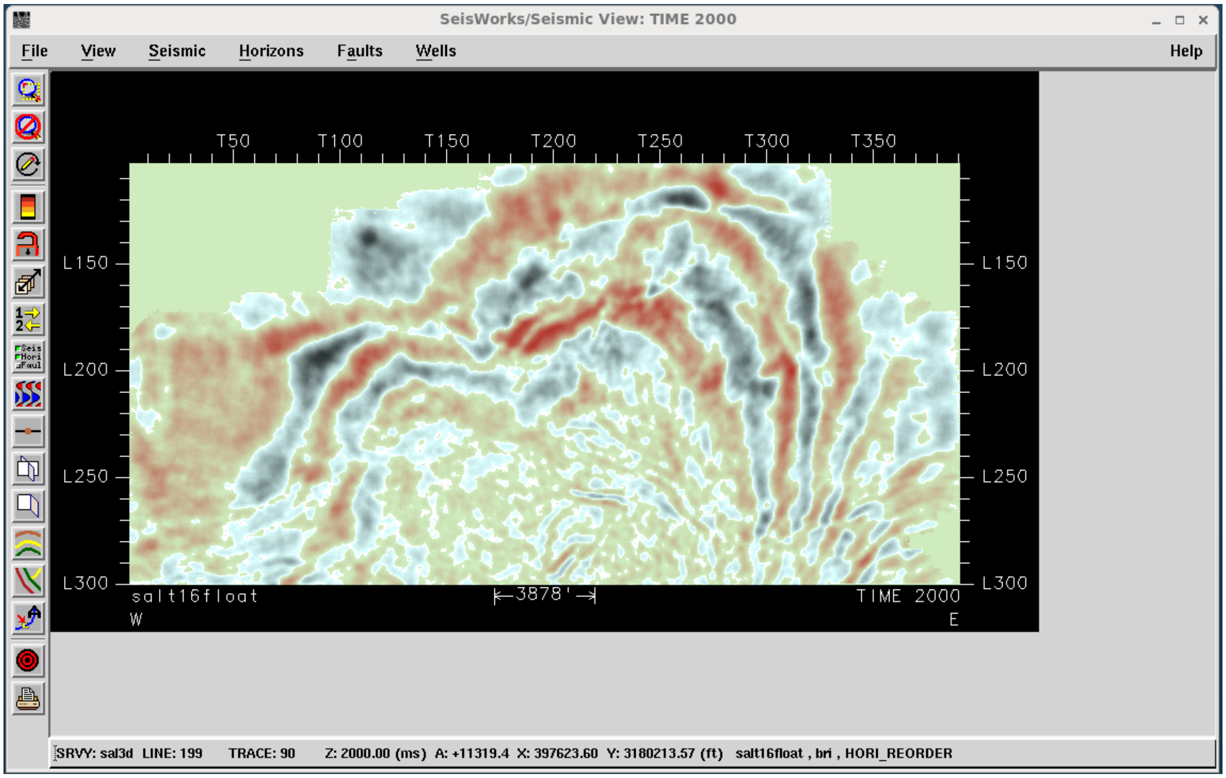
> **Note**
>
> Type Brickreorder in an xterm and press <*Enter*> to display in a line of text indicating the necessary command information.



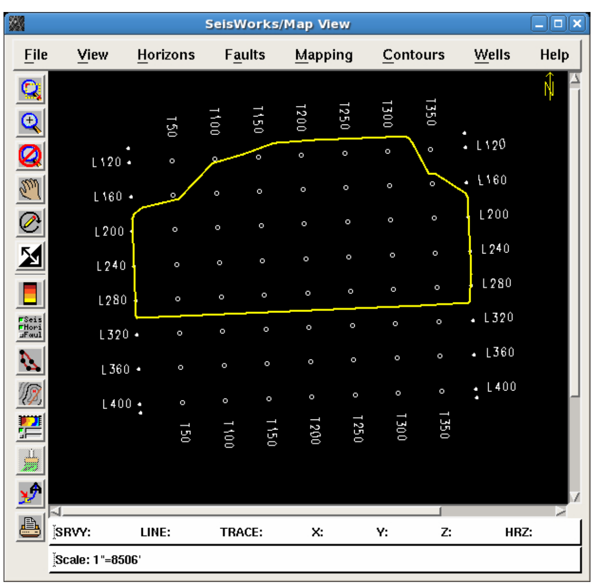
Time slice from the PostStack horizontally optimized view:



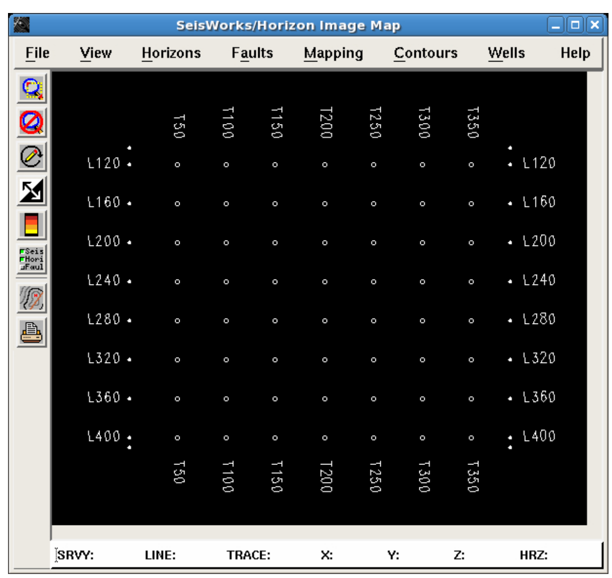
Time slice from the Brickreorder horizontally optimized view:



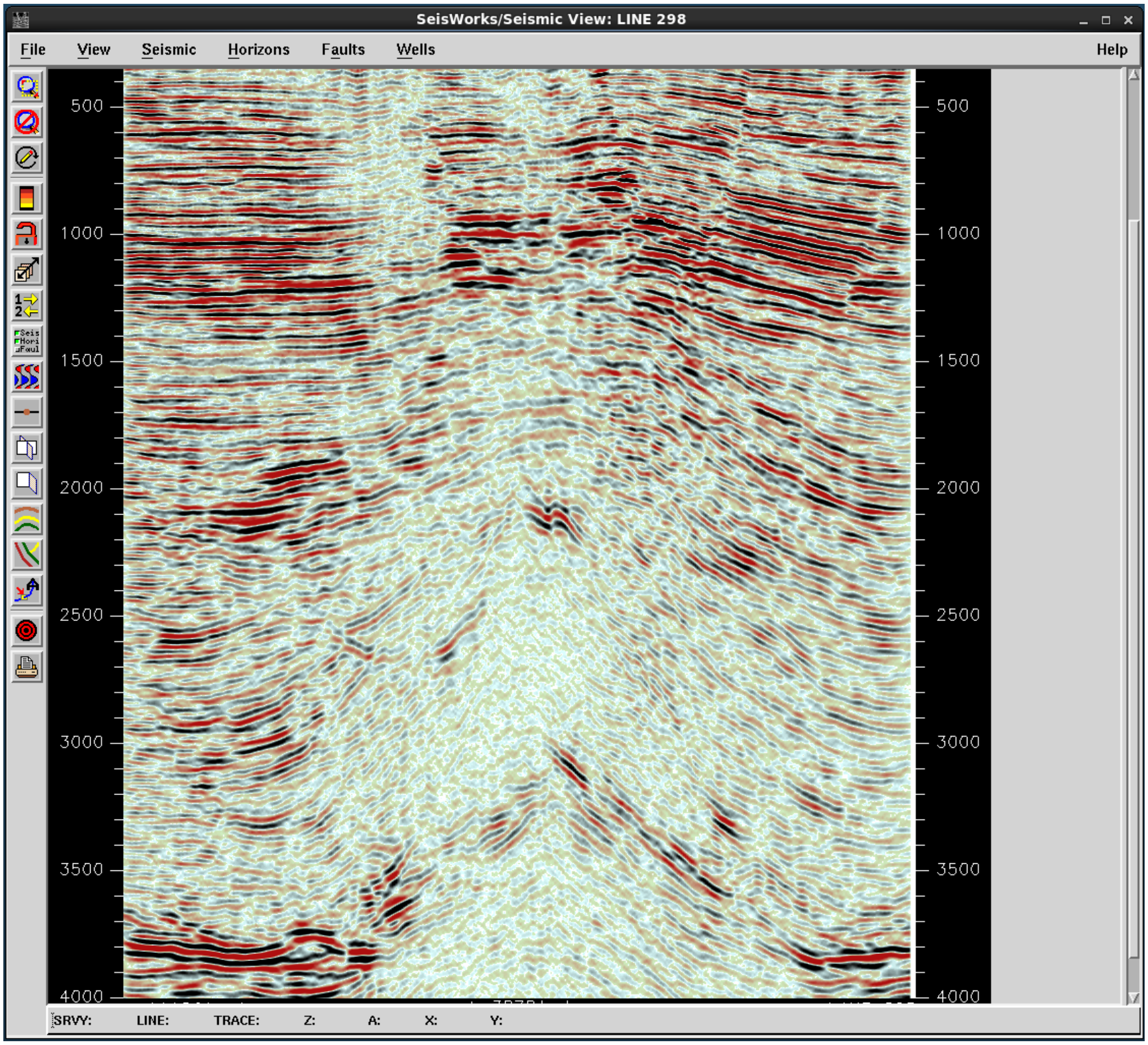
Map View with live trace outline (WOW zgf):



Horizon Image Map (check cursor tracking and annotation):



Seismic View (line 298):



Workshop 3: PostStack/SEG Y Import — Challenge Load

Review of the workflow:

- Create a 3D survey
- Create Seismic Storage Directories
- Check the Basemap/Horizon Image Map
- Analyze the SEG-Y file
- Output Landmark formatted volume using PostStack, or SEG Y Import
- Check the loaded data

New for this workflow:

- Output any Landmark format option—your choice.

OpenWorks Software Project

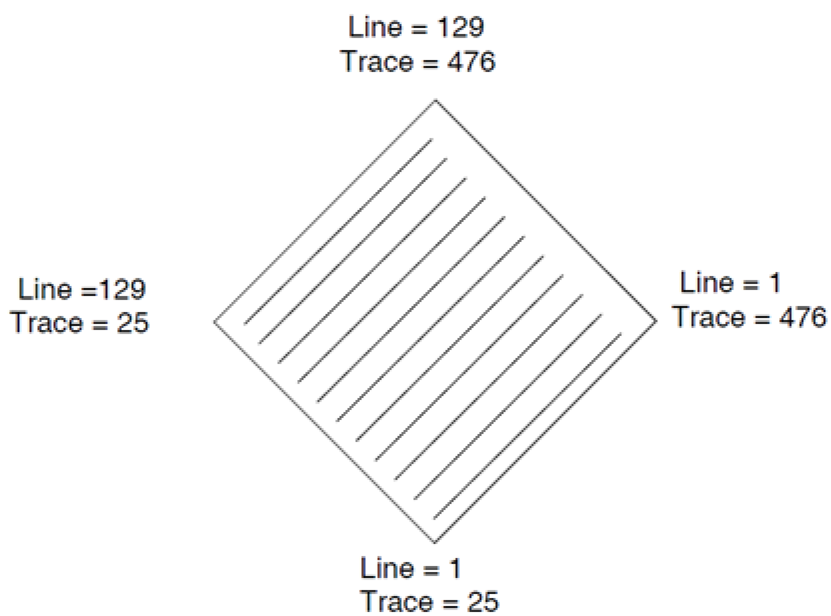
Use PSDL_FLATFISH as your OpenWorks project for this exercise. Load the *carp.sgy* SEG-Y file.

Create a 3D Survey

Survey information is provided on the next page. This is really the same survey loaded in the SEG Y Import exercise, with different corner coordinates listed. You can practice creating a new 3D survey here, or skip ahead to loading the data using the newfl3d survey you already created.

If you want to create a new survey, use either Seismic Data Manager or SEG Y Import. Use the information on the next page to create a new seismic survey. You will need to use the grid transform utility to calculate the corner coordinates for the survey (**Seismic Tools > Utilities > SeisWorks Grid Transform**), and you will also need to decide which way you want to rotate the survey.

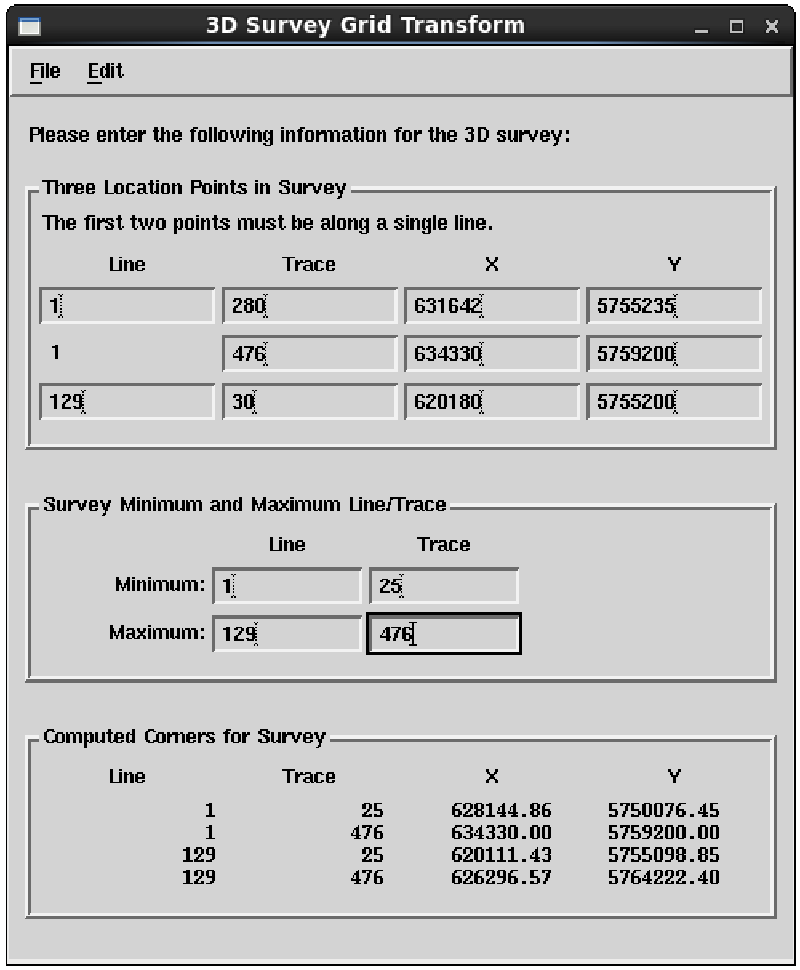
OW Project	: PSDL_FLATFISH
Survey Name	: carp
Area	: Gippsland Basin
Project Type	: UTM 55 South; Meters; SPE Preferred Metric Meaurement
Geodetic Datum	: Australian Geodetic 1984
Survey Datum	: 0.0 meters



World Coordinates:

Line	Trace	X	Y
129	30	620180.00	5755200.00
1	280	631642.00	5755235.00
1	476	634330.00	5759200.00

Calculate corner coordinates: **Seismic Tools > Utilities > SeisWorks Grid Transform** and **Edit** > **Compute Corners**.



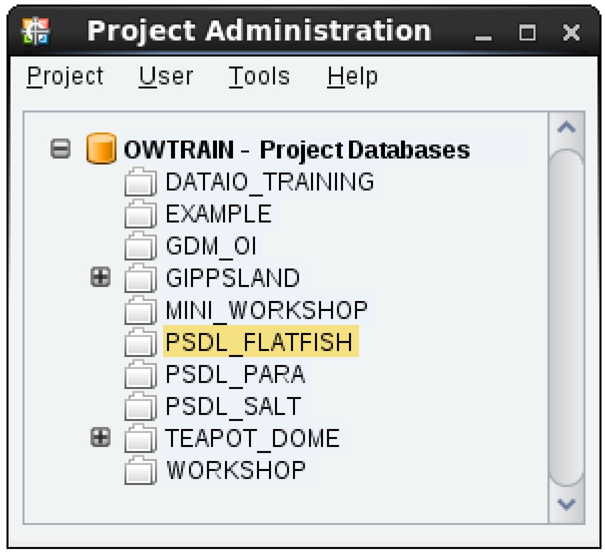
Check Basemap

Check Map View and Horizon Image Map in SeisWorks.

> **Note**
>
> Horizon Image Map is only available in projects with one 3D survey. You can create an interpretation project with only this survey to check the Horizon Image Map, and then delete this interpretation project after you have checked the Horizon Image Map. We will learn how to create interpretation projects later, but if you would like to check the Horizon Image Map now, use the following steps to set up the interpretation project.

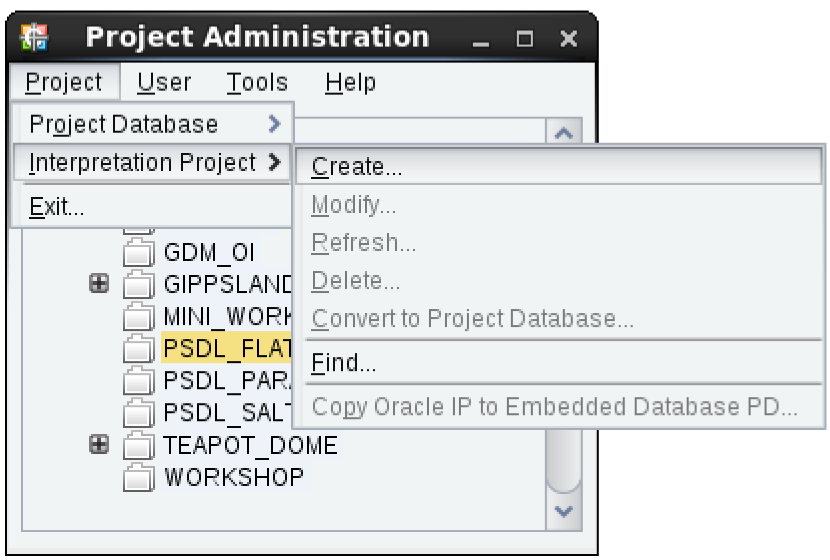
Steps to create an IP Project:

1. From the OpenWorks Command Menu, select **Project > Project Admin**.

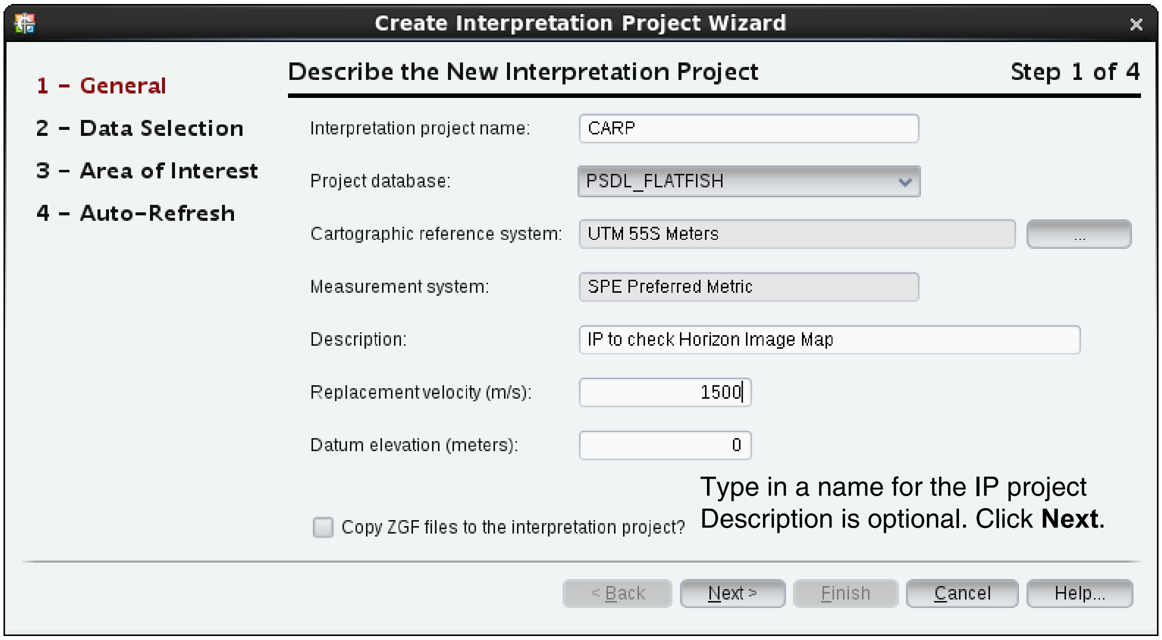


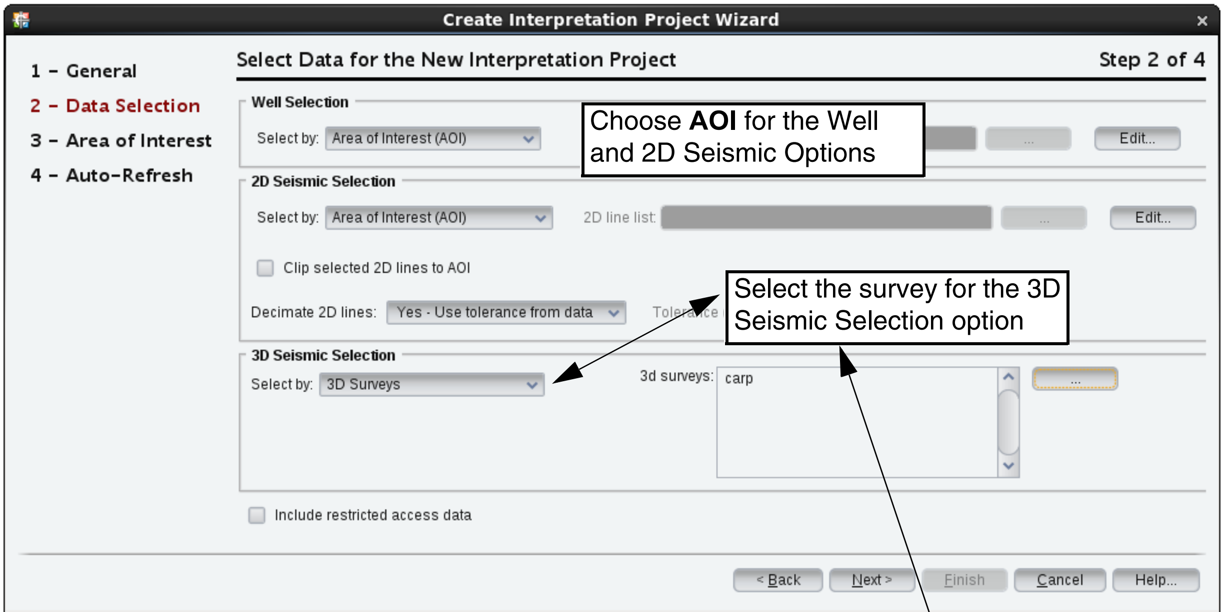
2. Highlight **PSDL_FLATFISH**.

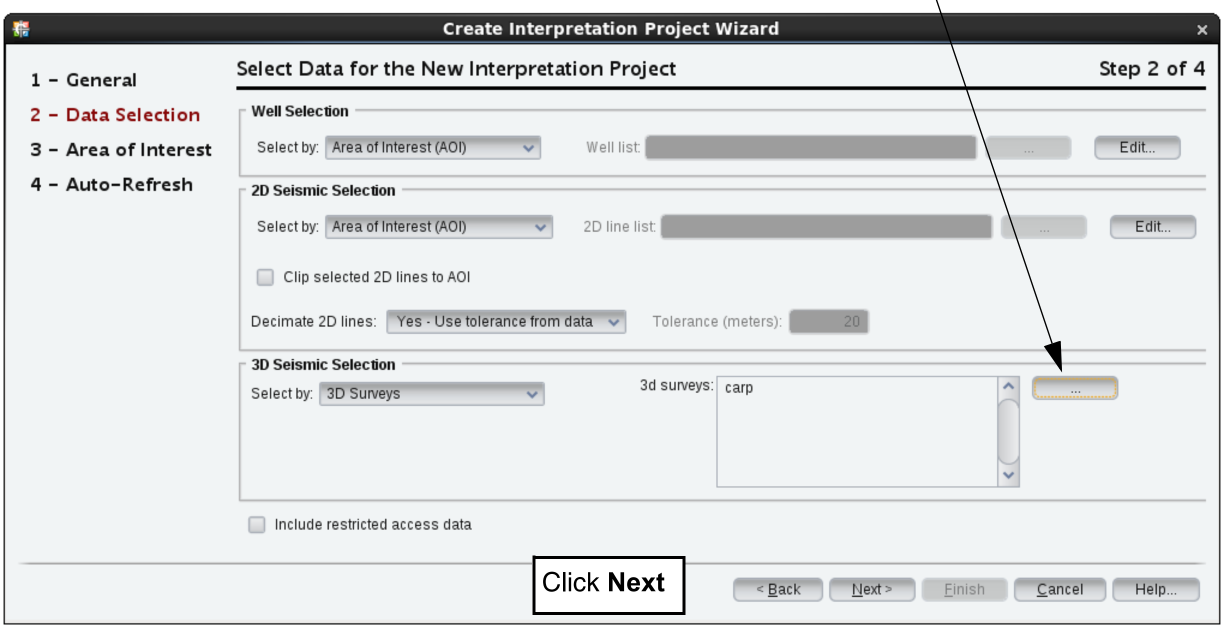
3. Select **Project > Interpretation Project > Create**.

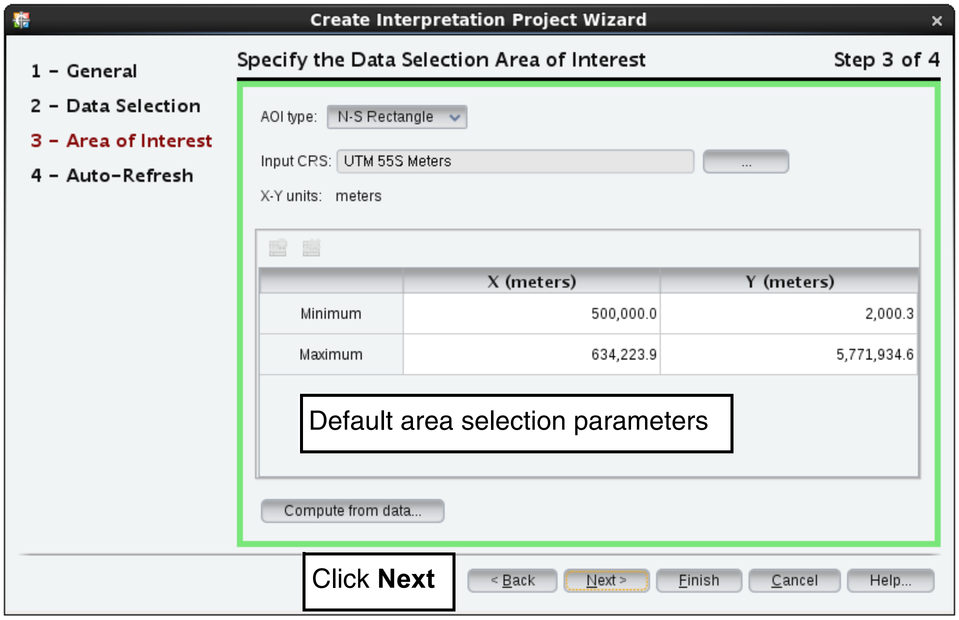


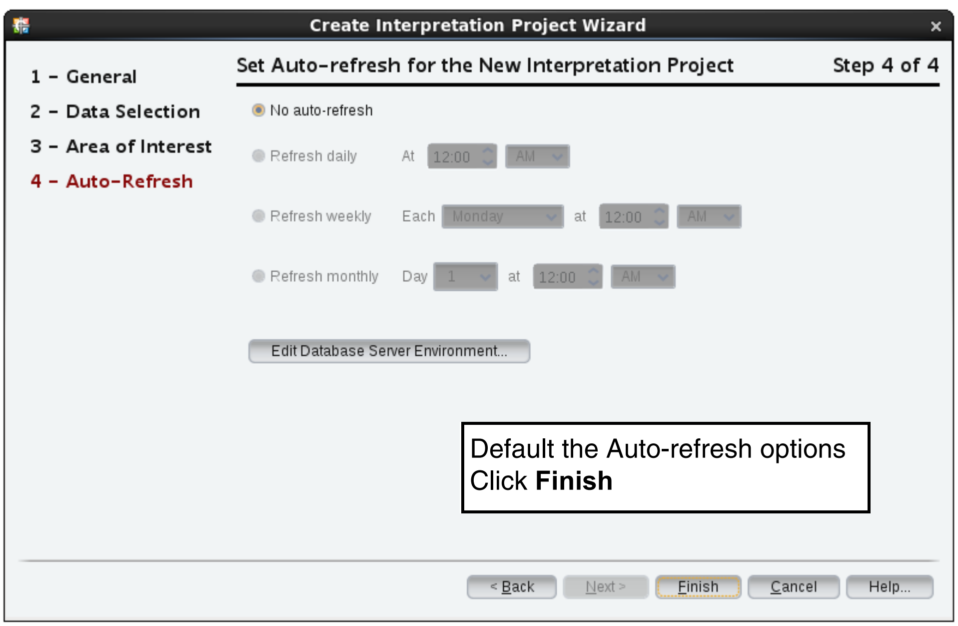
4. Fill out parameters in the interpretation wizard.

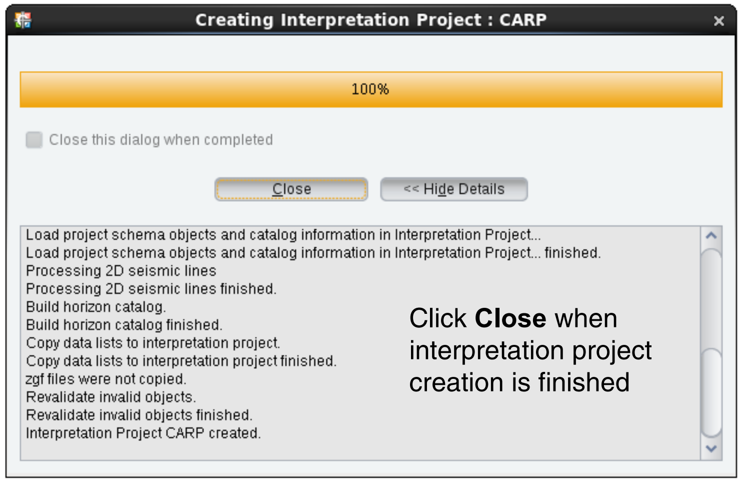



Create Interpretation Project Wizard
1 - General
2 - Data Selection
3 - Area of Interest
4 - Auto-Refresh
Select Data for the New Interpretation Project
Step 2 of 4
Well Selection
Select by: Area of Interest (AOI)
Edit...
Choose **AOI** for the Well and 2D Seismic Options
2D Seismic Selection
Select by: Area of Interest (AOI)
2D line list:
Edit...
Clip selected 2D lines to AOI
Decimate 2D lines: Yes - Use tolerance from data
Select the survey for the 3D Seismic Selection option
3D Seismic Selection
Select by: 3D Surveys
3d surveys: carp
Include restricted access data
< Back
Next >
Finish
Cancel
Help...

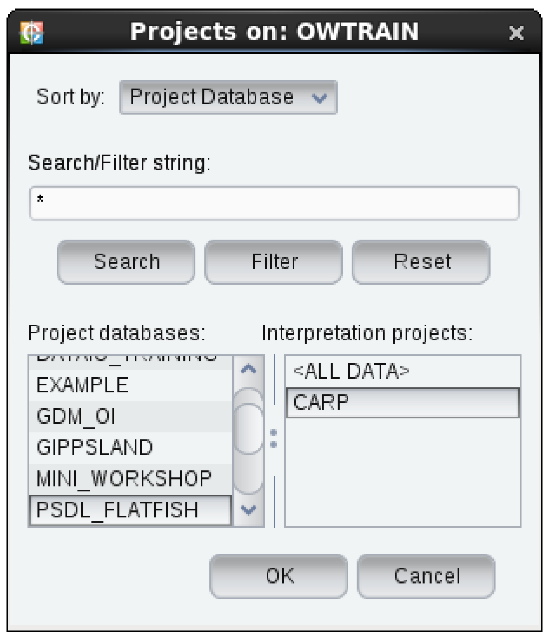

Create Interpretation Project Wizard
1 - General
2 - Data Selection
3 - Area of Interest
4 - Auto-Refresh
Select Data for the New Interpretation Project
Step 2 of 4
Well Selection
Select by: Area of Interest (AOI)
Well list:
Edit...
2D Seismic Selection
Select by: Area of Interest (AOI)
2D line list:
Edit...
Clip selected 2D lines to AOI
Decimate 2D lines: Yes - Use tolerance from data
Tolerance (meters): 20
3D Seismic Selection
Select by: 3D Surveys
3d surveys: carp
Include restricted access data
Click **Next**
< Back
Next >
Finish
Cancel
Help...


Create Interpretation Project Wizard
1 - General
2 - Data Selection
3 - Area of Interest
4 - Auto-Refresh
Specify the Data Selection Area of Interest
Step 3 of 4
AOI type: N-S Rectangle
Input CRS: UTM 55S Meters
X-Y units: meters
X (meters)
Y (meters)
Minimum
500,000.0
2,000.3
Maximum
634,223.9
5,771,934.6
Default area selection parameters
Compute from data...
Click **Next**
< Back
Next >
Finish
Cancel
Help...


Create Interpretation Project Wizard
1 - General
2 - Data Selection
3 - Area of Interest
4 - Auto-Refresh
Set Auto-refresh for the New Interpretation Project
Step 4 of 4
No auto-refresh
Refresh daily
At
12:00
AM
Refresh weekly
Each
Monday
at
12:00
AM
Refresh monthly
Day
1
at
12:00
AM
Edit Database Server Environment...
Default the Auto-refresh options
Click **Finish**
< Back
Next >
Finish
Cancel
Help...

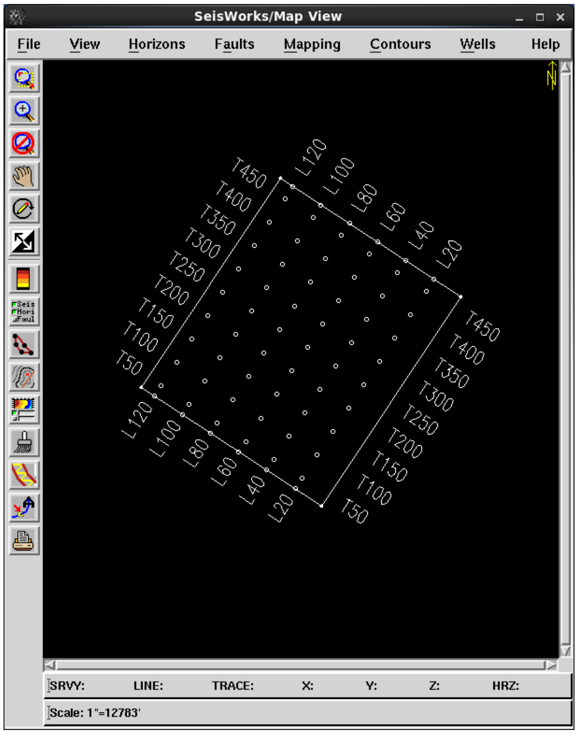


5. When the IP creation is complete, in the Project Status Tool, select the IP project instead of <All Data>.

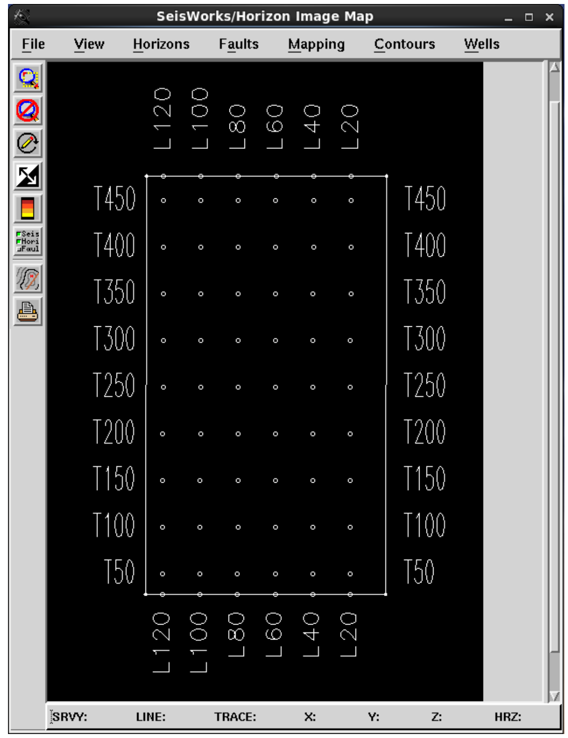


Start SeisWorks and compare Map View and Horizon Image Map.

Map View:



Horizon Image Map



Analyze SEG-Y Data

The SEG-Y data set to load is *carp.sgy*.

Load Data Using the PostStack™ software, or SEGY Import

> **IMPORTANT:**
>
> Before you load the data, make sure that you are in the project database, not the IP project you just created for navigation QC. Use Project Status Tool to select the project database name and the <ALL DATA> selection option.

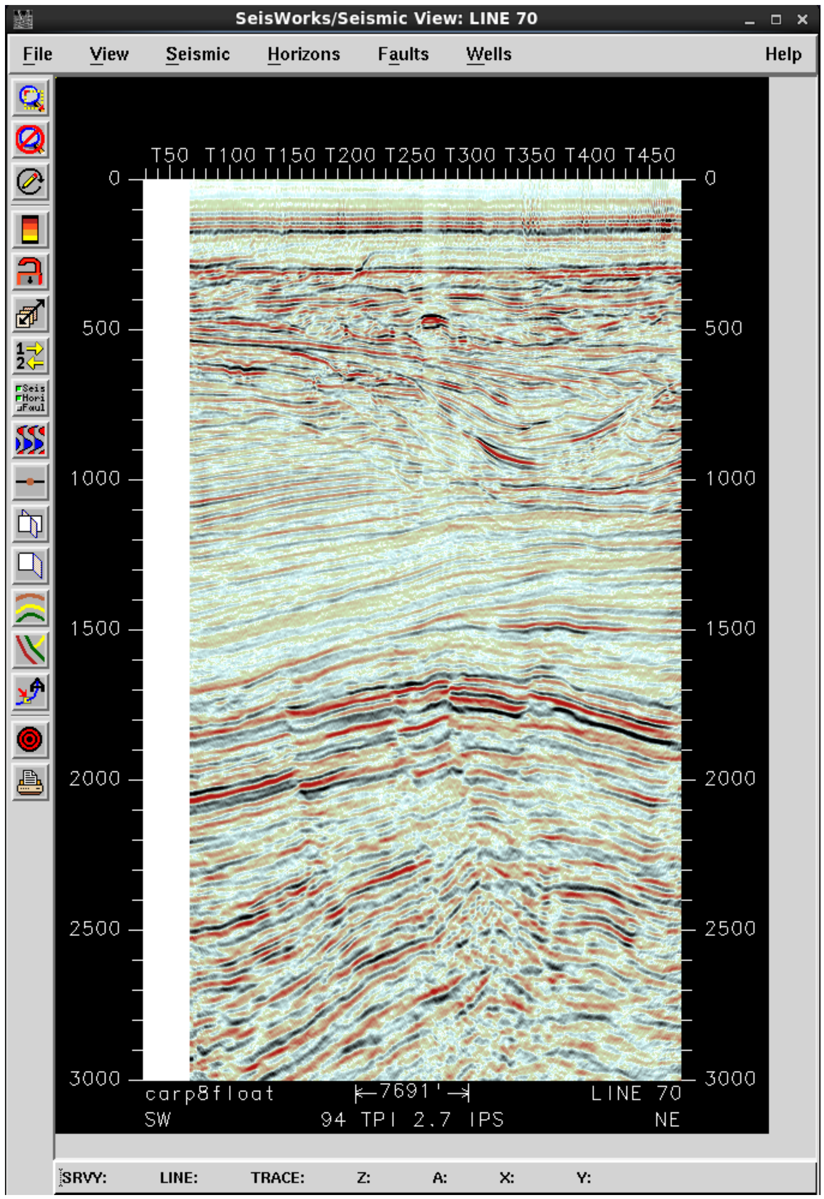
Load the data using the PostStack software or SEG Y Import. Or, you can try both, just output different file names or versions for each different load. For the PostStack load, choose the any output format and density.

View the Data

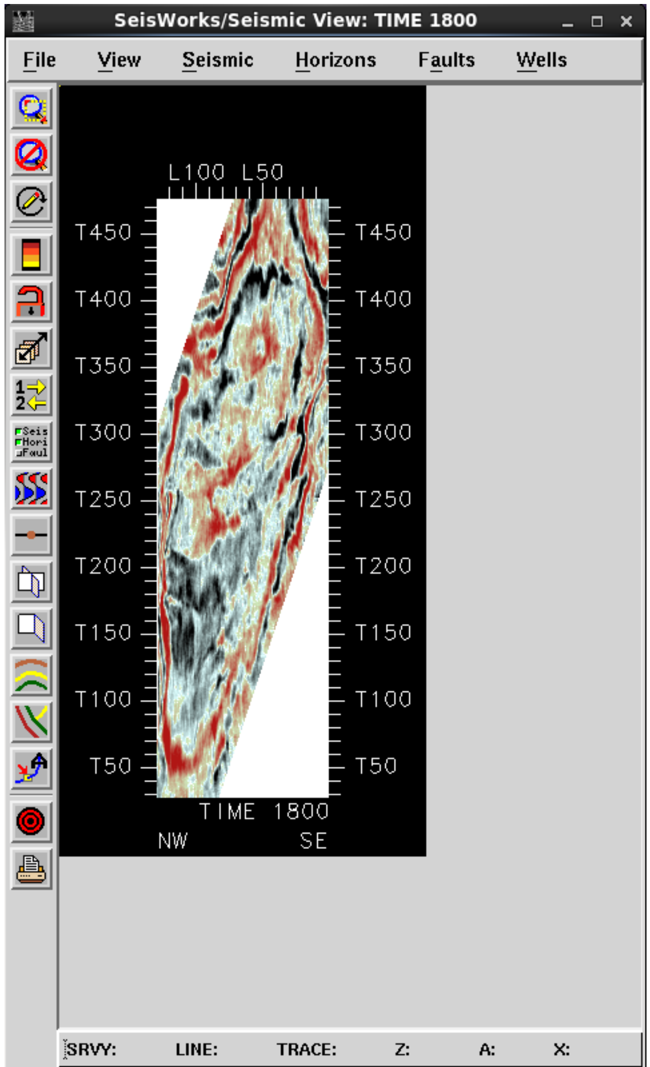
Check the data load using any of the techniques previously covered. We used a variety of utilities and views to make sure the data loaded correctly. As you become more experienced at loading data you can decided the best options for you to use.

Shown below are some views of the data. However you loaded it, the base map and seismic should look the same.

Seismic View:



Time slice:

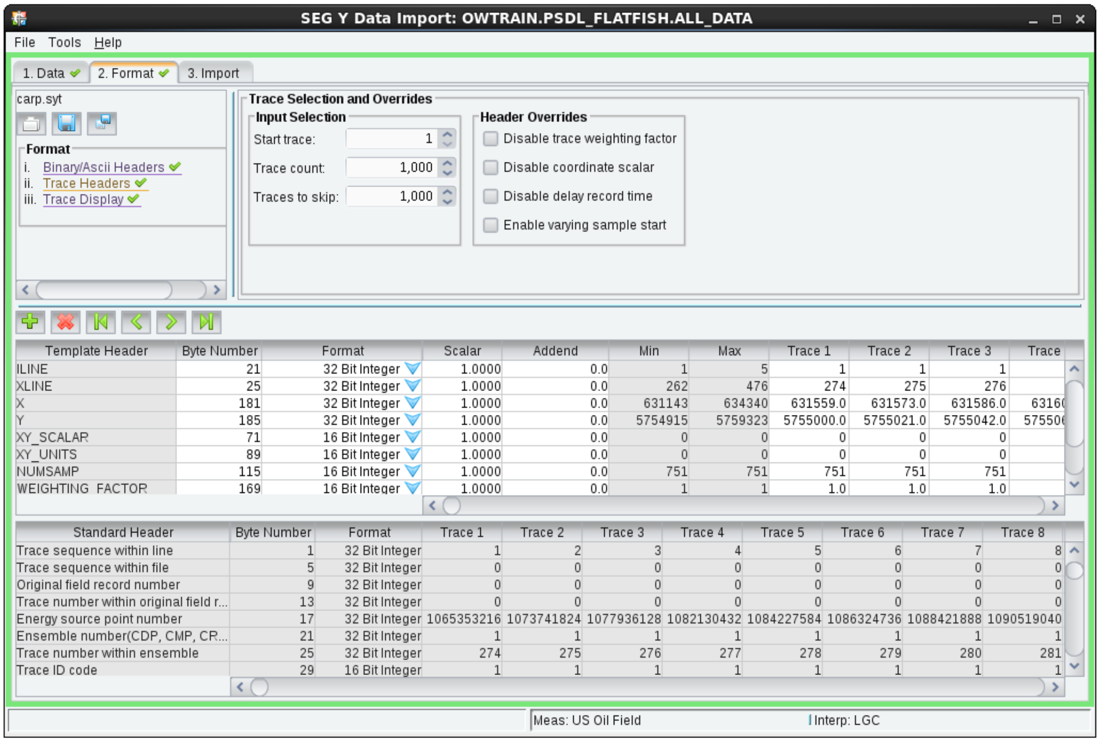


SEG Y Data Import Hints

If you want to use SEG Y Data Import tool:

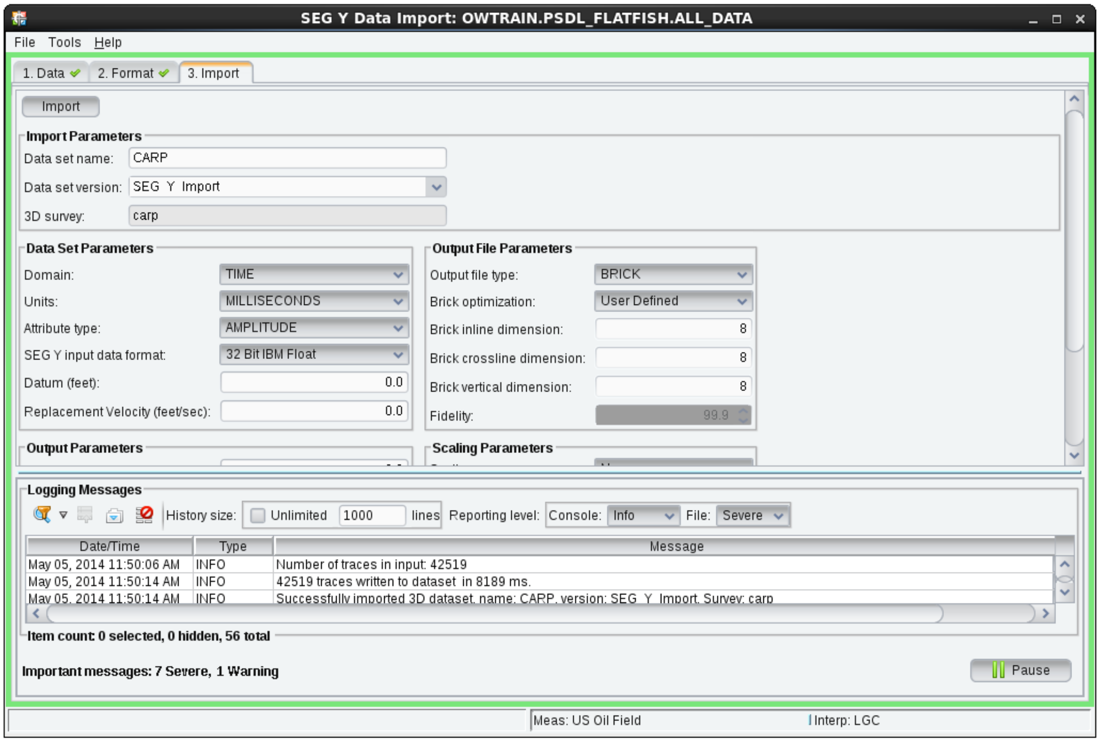
Create a template for the Inline an Xline in the Format tab (a template from the PostStack software will not work).

Define and save a template:



Import the data:

Either create the 3D survey in the navigation tab or select a survey that was previously created in Seismic Data Manager or a previous SEG Y Data Import session.



Check the data using the SeisWorks software, Seismic Data Manager, and the WOW software.