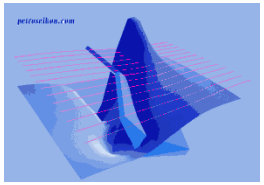
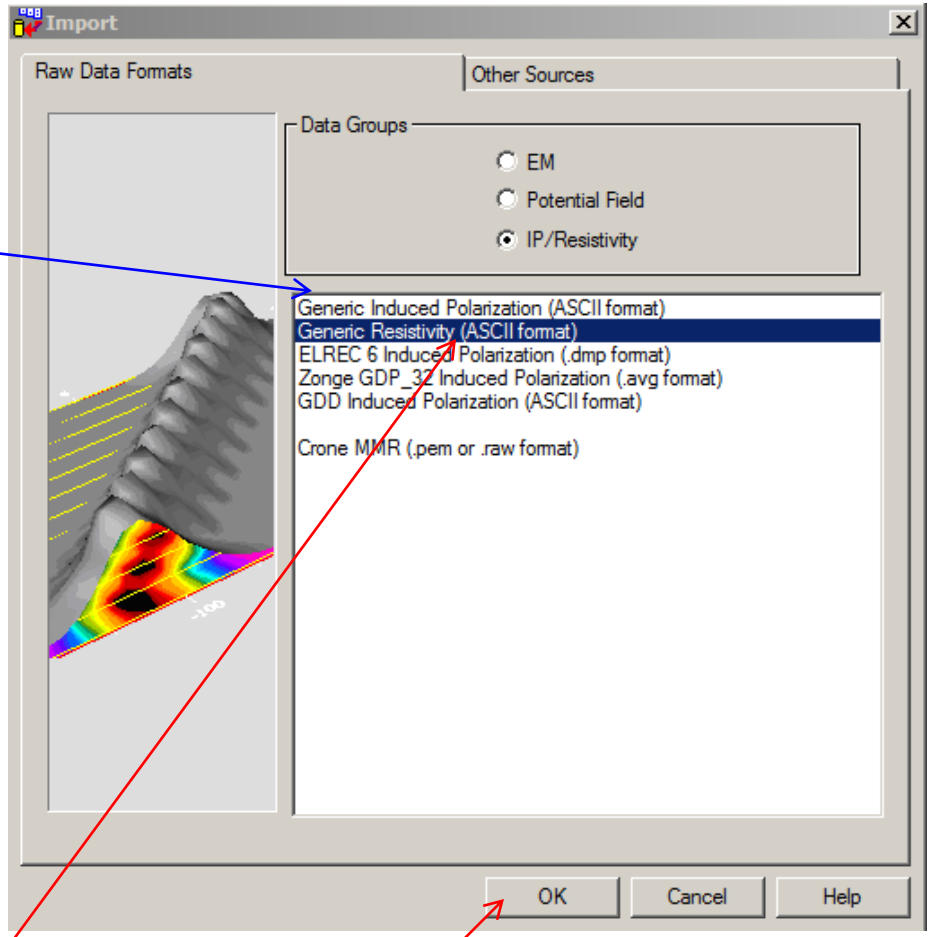
1D RESISTIVITY INVERSION TUTORIAL

Steps: ***Page***



1. **Import data**
2. Examine data
3. Perform initial modeling
4. Perform controlled Marquardt or Occam Inversions
5. Inversion evaluation

Select “Generic Induced Polarization” if your data is from IP survey



Select “Generic Resistivity” and click “OK” button

1. **Import data**
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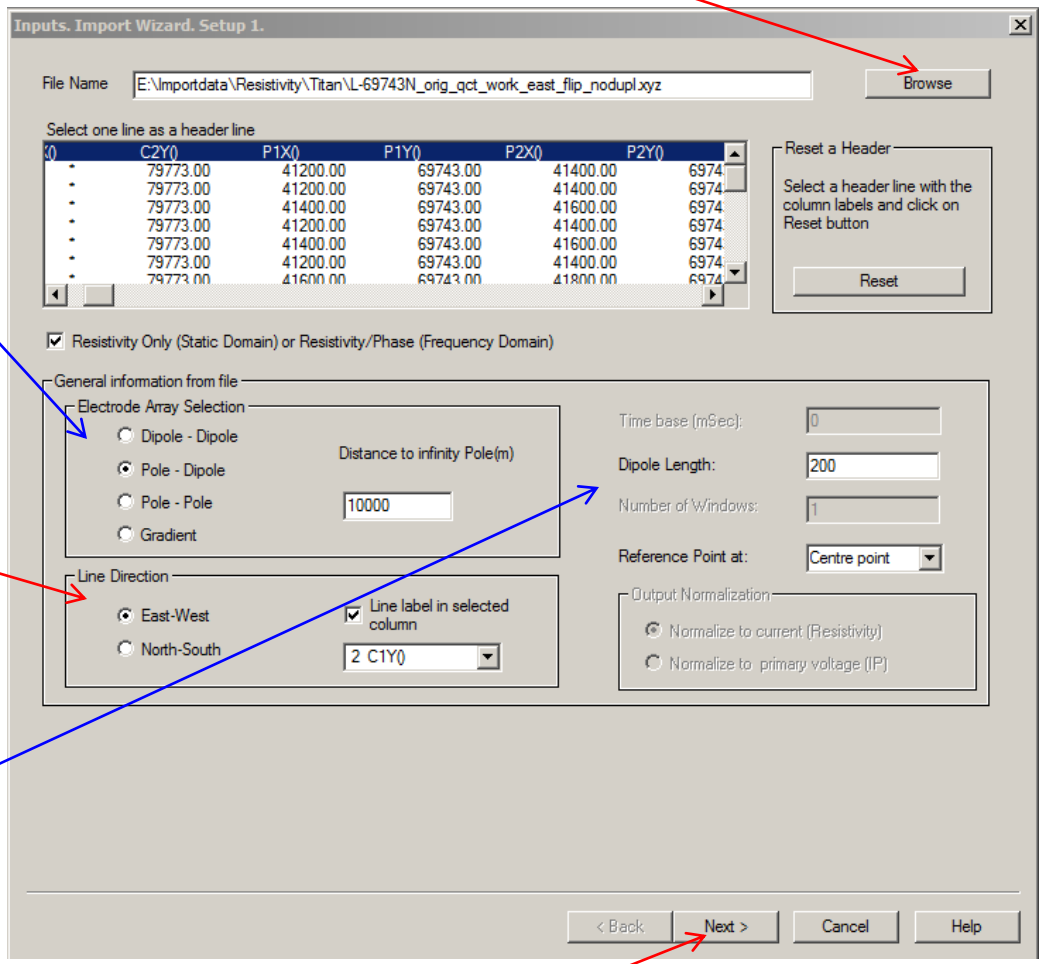
Browse and select data file for import

Select electrode array type and set the distance to infinity pole

Set line direction and select the data column for the line

Set dipole length and reference point position



Click “Next” button to proceed to next step

1. **Import data**
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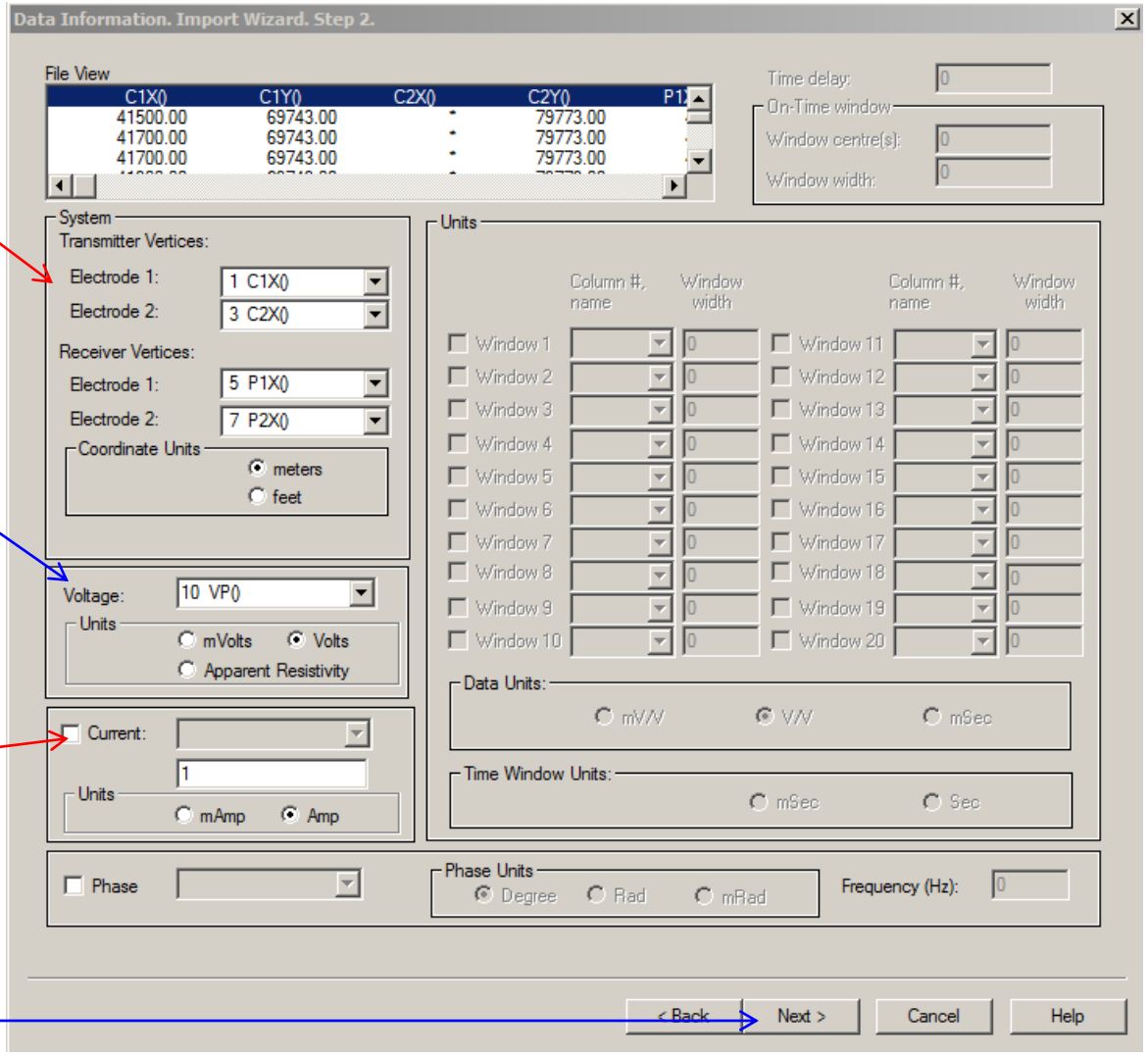
Select vertices for both transmitter and receiver, as well as the units of coordinate

Select the column which contains voltage data and set its units

If current is included in data file and you want to use it for normalization, check "Current" option and select the column label of current from the dropdown list. Otherwise, uncheck this option and input 1 in the box below

Click "Next" button to proceed to the next step



1. **Import data**
2. Examine data
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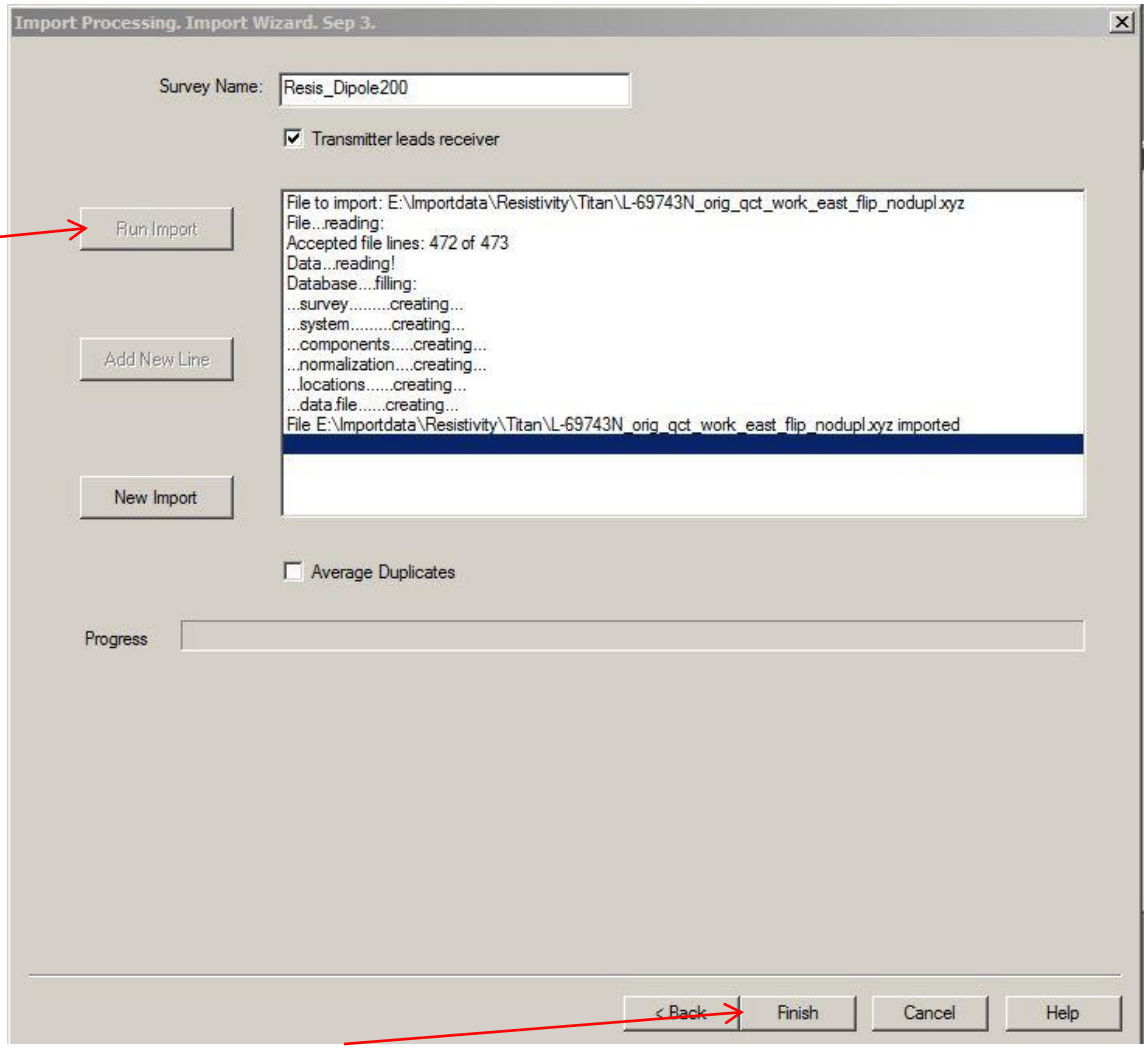
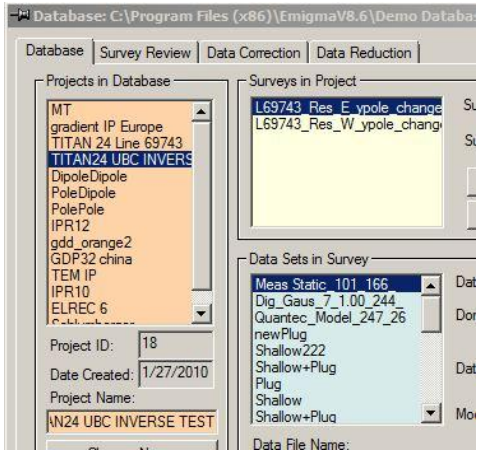
Click “Run Import” button to start importing data into database



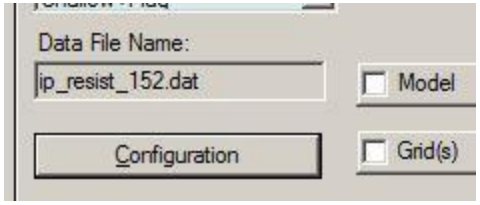
After processing is done, click “Finish” button to complete the import procedure

1. Import data
2. **Examine data**
3. Perform initial modeling
4. Perform controlled Marquardt or Occam Inversions
5. Inversion evaluation

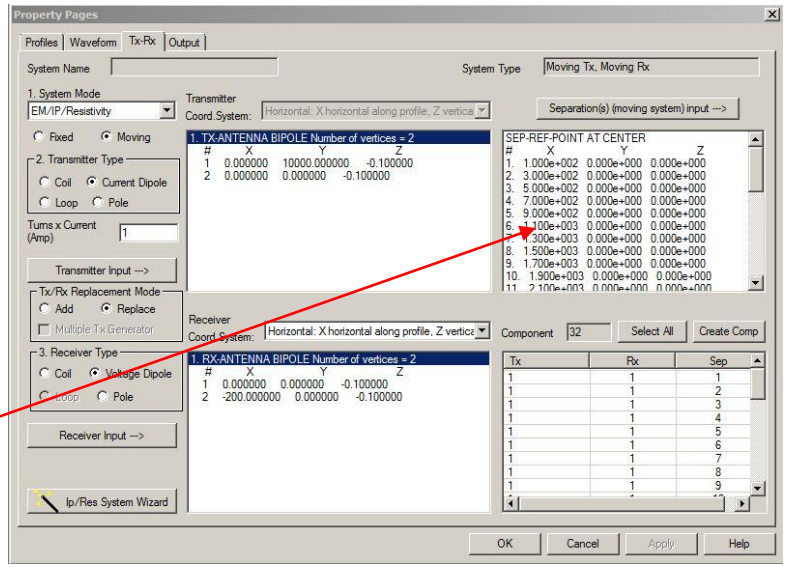
1. Check database for the survey



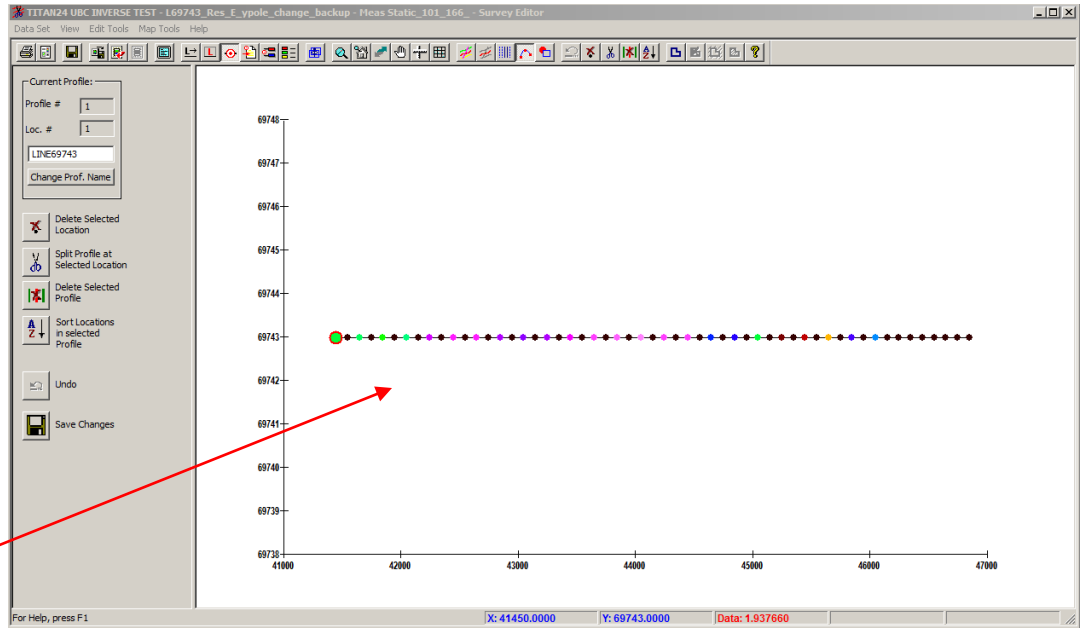
2. Click configuration



3. Check separations



4. Check lines and stations by clicking "Survey Editor" button

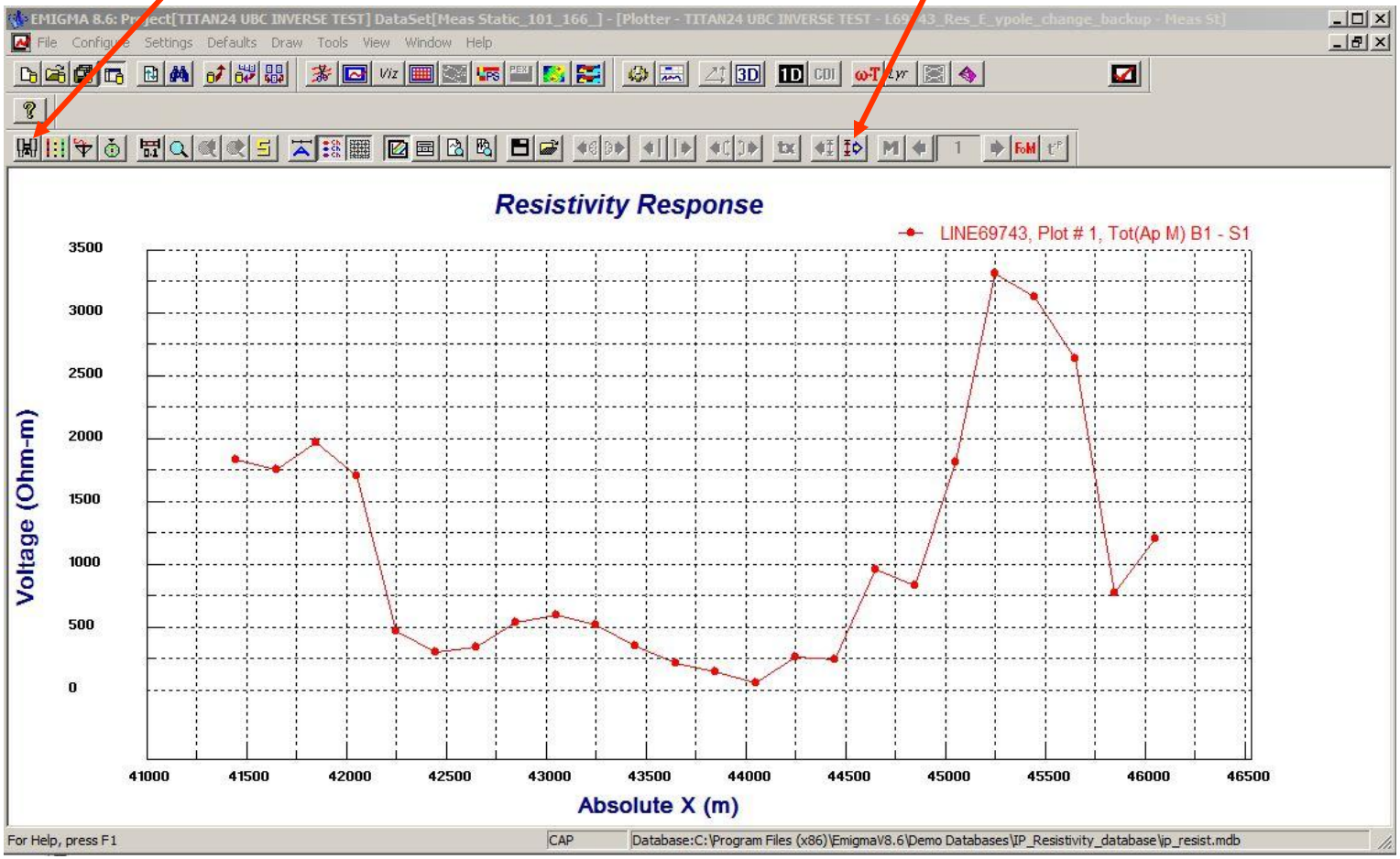


1. Import data
2. **Examine data**
3. Perform initial modeling
4. Perform controlled Marquardt or Occam Inversions
5. Inversion evaluation

Click "Plotter"…

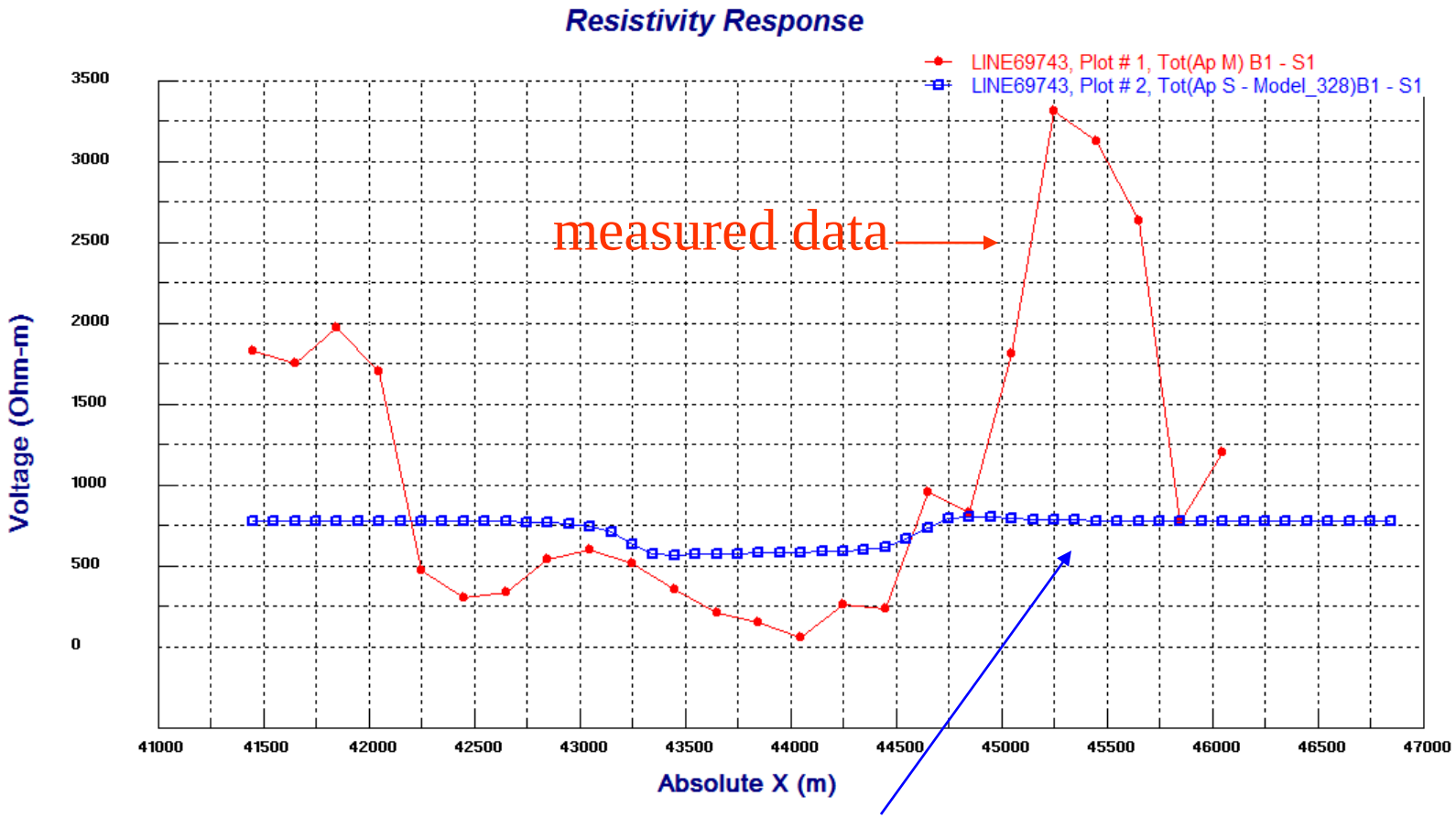
Load data set in plotter

Toggle between separations

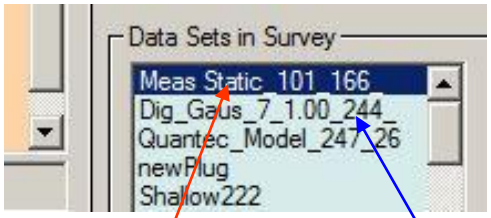


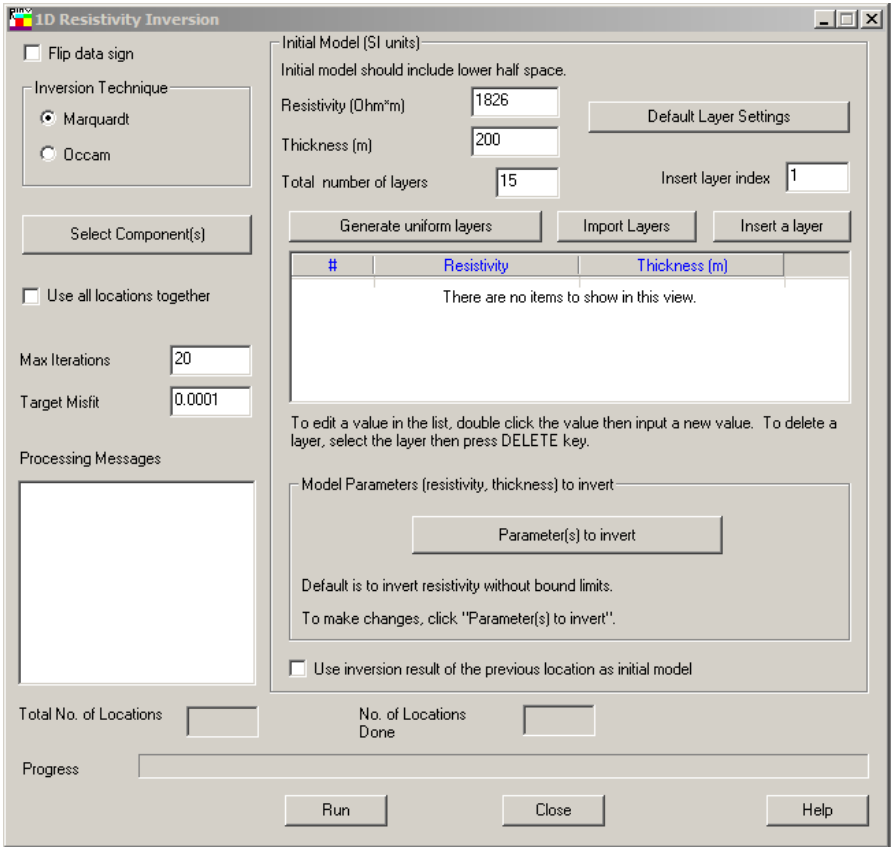
1. Import data
2. Examine data
3. **Perform initial modeling**
4. Perform controlled Marquardt or Occam Inversions
5. Inversion evaluation

Note: *Performed some initial modeling to get a "feel" of the background resistivity and estimate parameters of initial model for inversion.*



1. Import data
2. Examine data
3. Perform initial modeling
4. **Perform controlled Marquardt or Occam Inversions**
5. Inversion evaluation





Select survey data

Note: you can also use processed data, if processing such as interpolation is done on data

1. Import data
2. Examine data
3. Perform initial modeling
4. **Perform controlled Marquardt or Occam Inversions**
5. Inversion evaluation

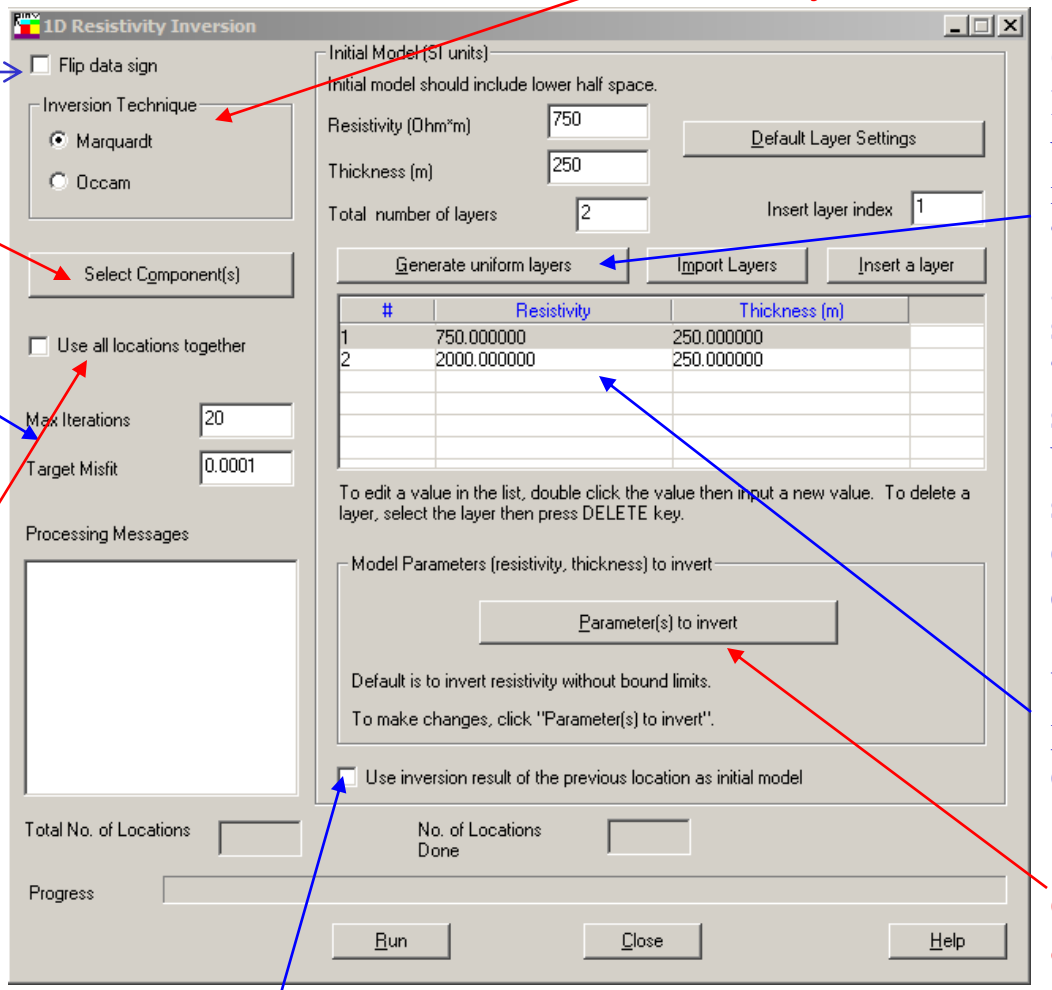
Inversion type:
Marquardt: each layer per data point consists of 2 model parameters: thickness and resistivity (both inverted).
Occam: each layer has a fixed thickness and the inversion only inverts for resistivity.

Flip data sign if it is not in accordance with system

Open a dialog for selecting components to be inverted

Set maximum number of iterations and data misfit

Check "Use all locations together" to do inversion with all locations at the same time, which creates more accurate model than using single locations.



Generate an initial model:
Input how many layers in total that you would like in the model, set the resistivity and thickness. Then click "Generate uniform layers" button to generate a series of uniform layers with specified parameters. If you click "Insert a layer" button, the layer with specified resistivity and thickness will be inserted to the layer with index specified in Insert layer index box. User could also import existing model by clicking "Import Layers" button.

User could directly change model parameters by double clicking their corresponding boxes in the table.

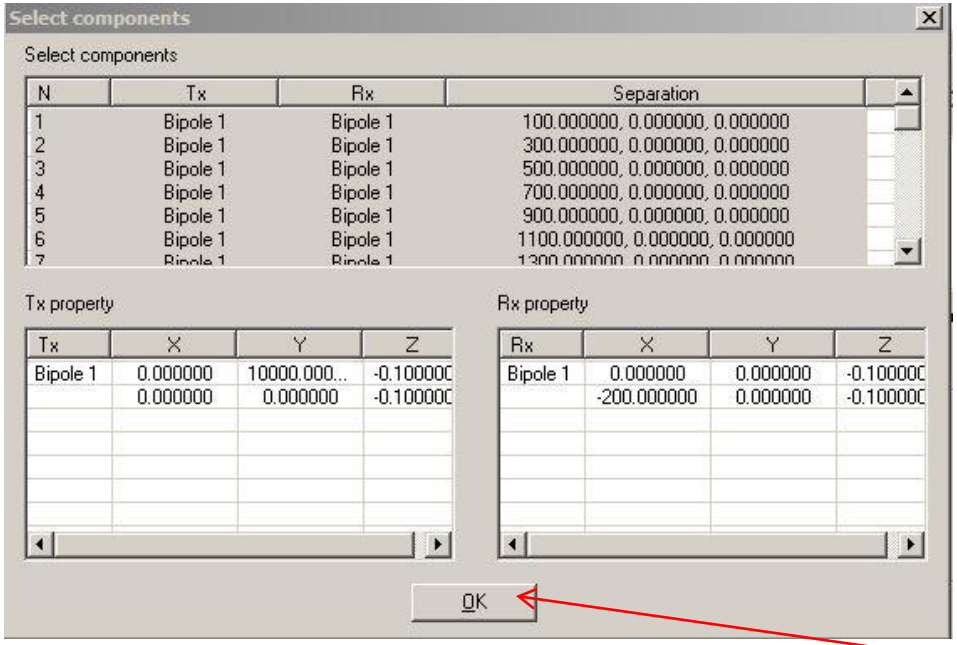
Set parameters to be inverted. Users could set bounds on parameters at appeared dialog

Use inversion result of the previous location as initial model will create smooth model

1. Import data
2. Examine data
3. Perform initial modeling
4. **Perform controlled Marquardt or Occam Inversions**
5. Inversion evaluation

Selection of components

Click “Select Component(s)” button

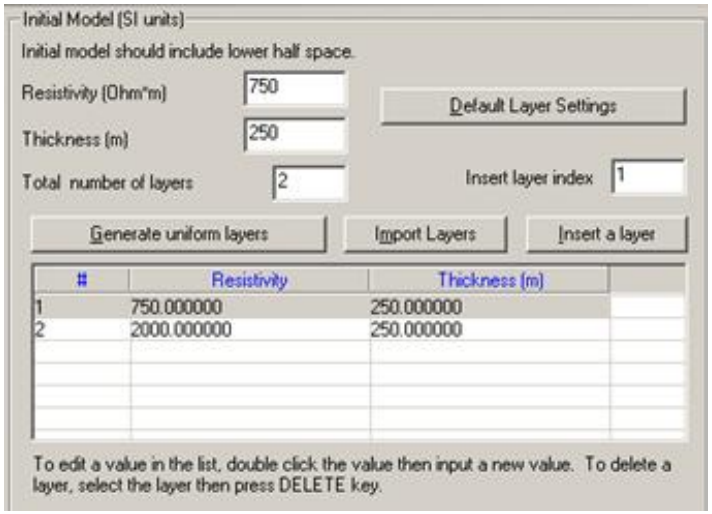


Click “OK” button after it is done

Users can select components involved with inversion. For the case of 1D resistivity inversion, different components are actually different separations. Use more components in inversion will make the inverted model more accurate

1. Import data
2. Examine data
3. Perform initial modeling
4. **Perform controlled Marquardt or Occam Inversions**
5. Inversion evaluation

Create a Starting Model



Import Layers: If you have created a forward model that you like, you may import it as a starting model or if you have a previous inversion that you like, you may import it as a starting model.

Insert a layer: You may insert additional layers at any stage.

Generate a Starting model:
First select how many layers in total that you would like in the model, set the initial resistivity and thickness. Then click "Generate Uniform Layers".

Editing Starting model:
After making a starting model (whether by importing or generating), the user may edit either the resistivity or the thickness of the layer. Simply double-click on the parameter setting.

1. Import data
2. Examine data
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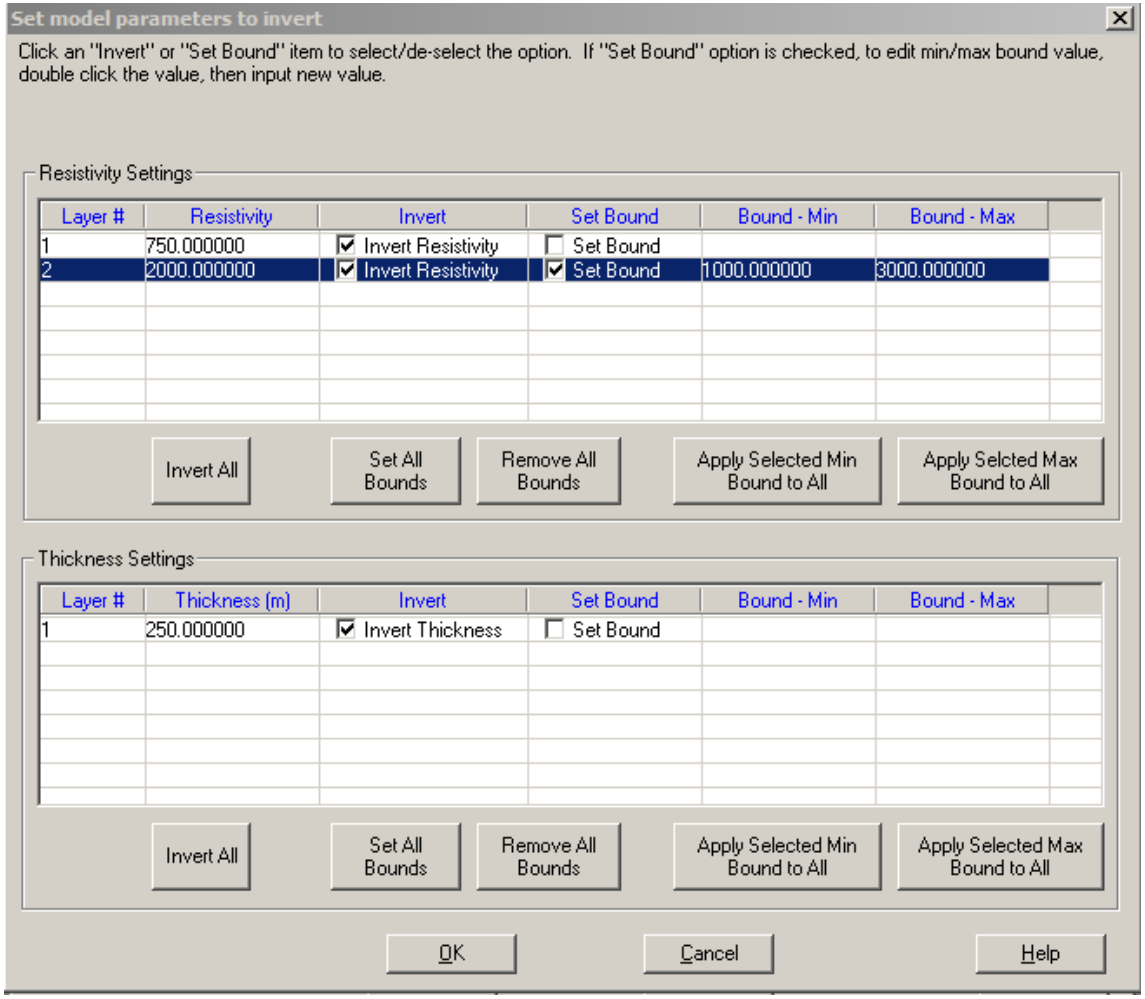
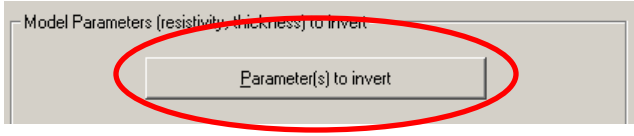
Constrain Model Parameters





Resistivity Constraints:
It is useful to constrain the layer resistivity to ranges that are possible in the geological environment.

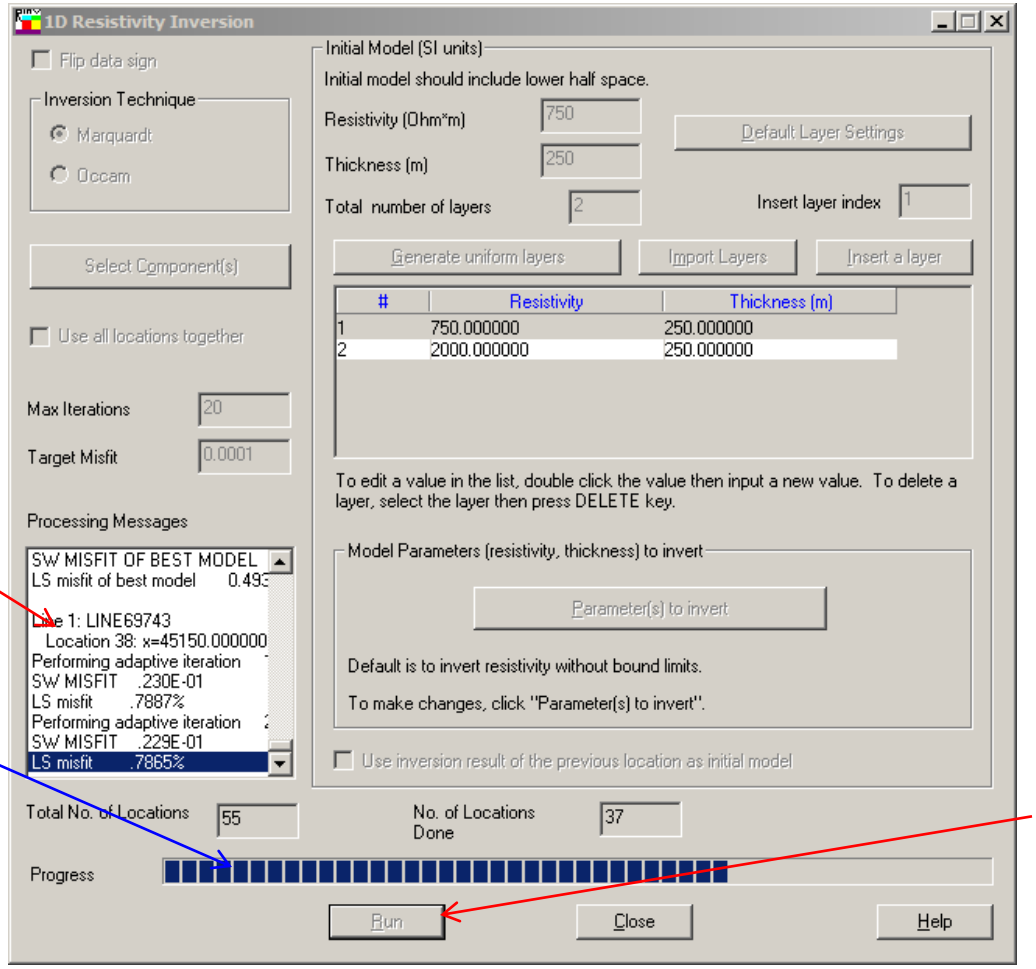
Thickness Constraints:
This option is only available under the Marquardt technique. Constraining the thickness to not be too large helps gain resolution. Constraining the thinness of the layer is a question of geological meaningfulness.

1. Import data
2. Examine data
3. Perform initial modeling
4. **Perform controlled Marquardt or Occam Inversions**
5. Inversion evaluation

Executing the Inversion

The left window (in white) shows each data point's progress.

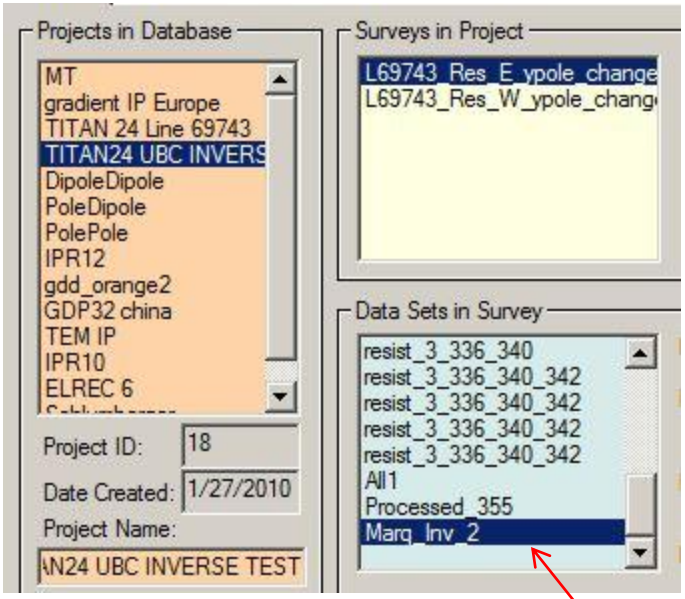
The "Processing progress" bar shows the total progress of this inversion.



Click "Run" button to start inversion process

1. Import data
2. Examine data
3. Perform initial modeling
4. Perform controlled Marquardt or Occam Inversions
5. **Inversion evaluation**

Inversion Evaluation



In each survey, there will be several data sets after modeling, inversion and processing. In this case, we have multiple forward models and one inversion model. Each forward model has a new data set containing the simulated data under the model. Similarly, each inversion contains a new dataset containing the simulated data set under the inversion model (for each point) and attached to that data set is the inversion model.

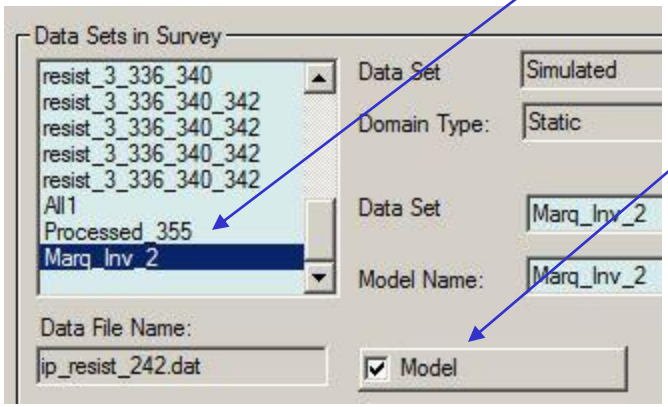
Our inversion model dataset (with Marquardt type inversion)

1. Import data
2. Examine data
3. Perform initial modeling
4. Perform controlled Marquardt or Occam Inversions
5. **Inversion evaluation**

Inversion Evaluation

An inversion is selected. You will note the "Model" button is checked.

If the model button is clicked…



1. Import data
2. Examine data
3. Perform initial modeling
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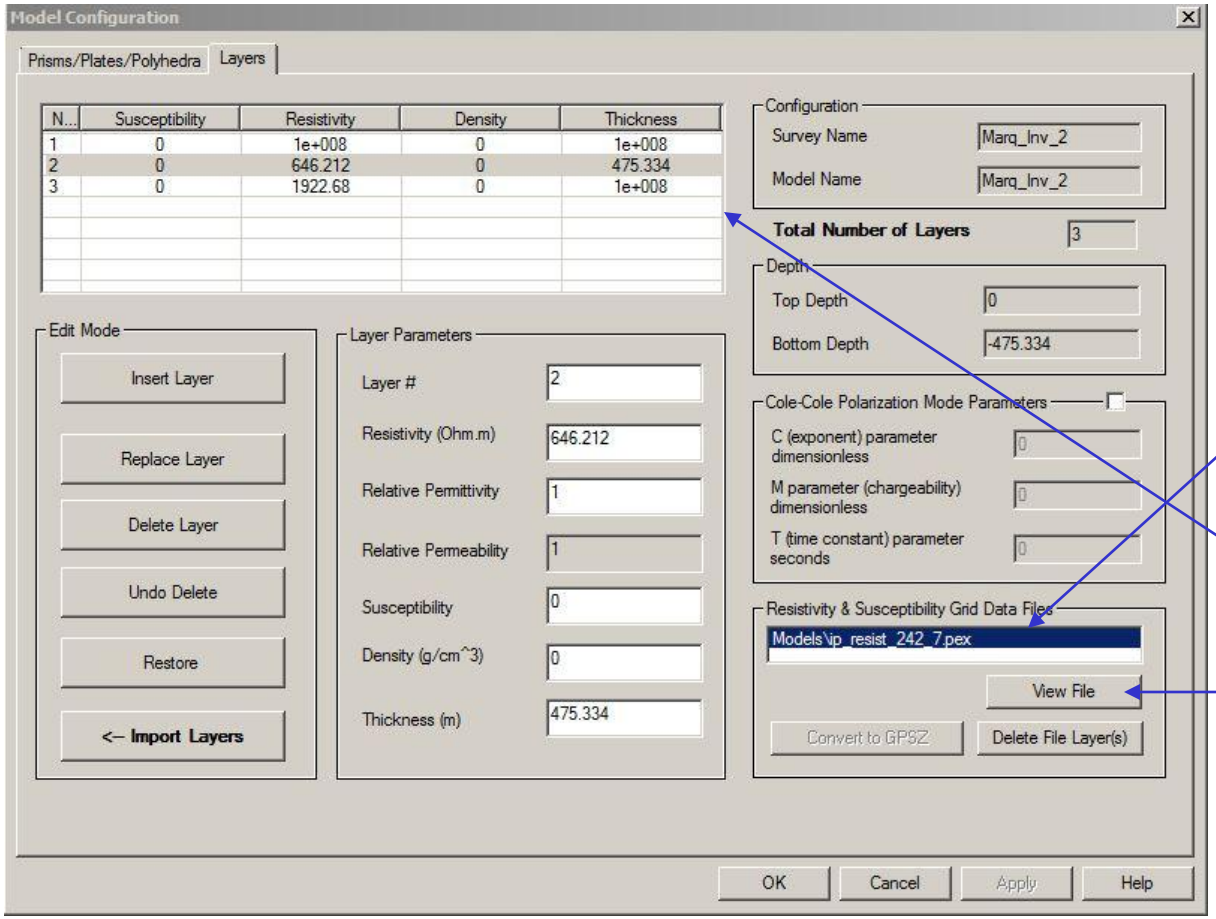
5. **Inversion evaluation**

Inversion Evaluation

a window will open



Attached to the database in a subdirectory called "Models" is the inversion results in a simple ASCII XYZ file (*.pex) which may be viewed here. This file may easily be imported to another application although graphical viewing tools are provided within EMIGMA.

The 1D model for the final data point is also included.

Click "View File" button to view the data file of the saved 1D layered model.

1. Import data
2. Examine data
3. Perform initial modeling
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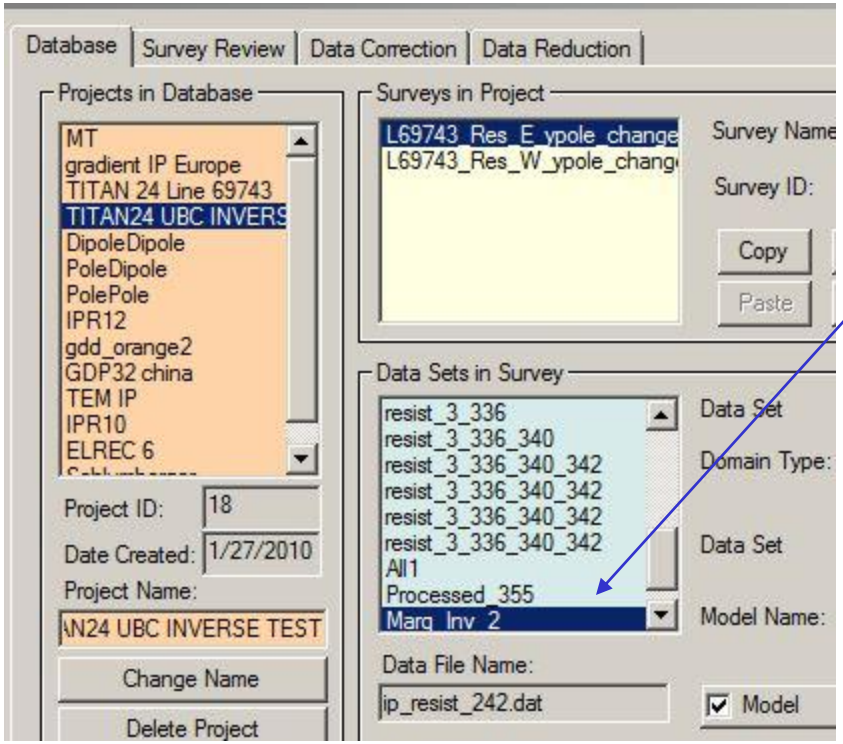
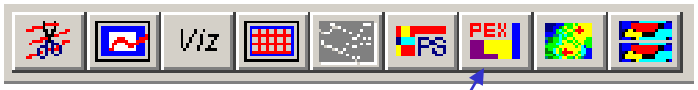
5. **Inversion evaluation**

Inversion Evaluation

Select the inversion.





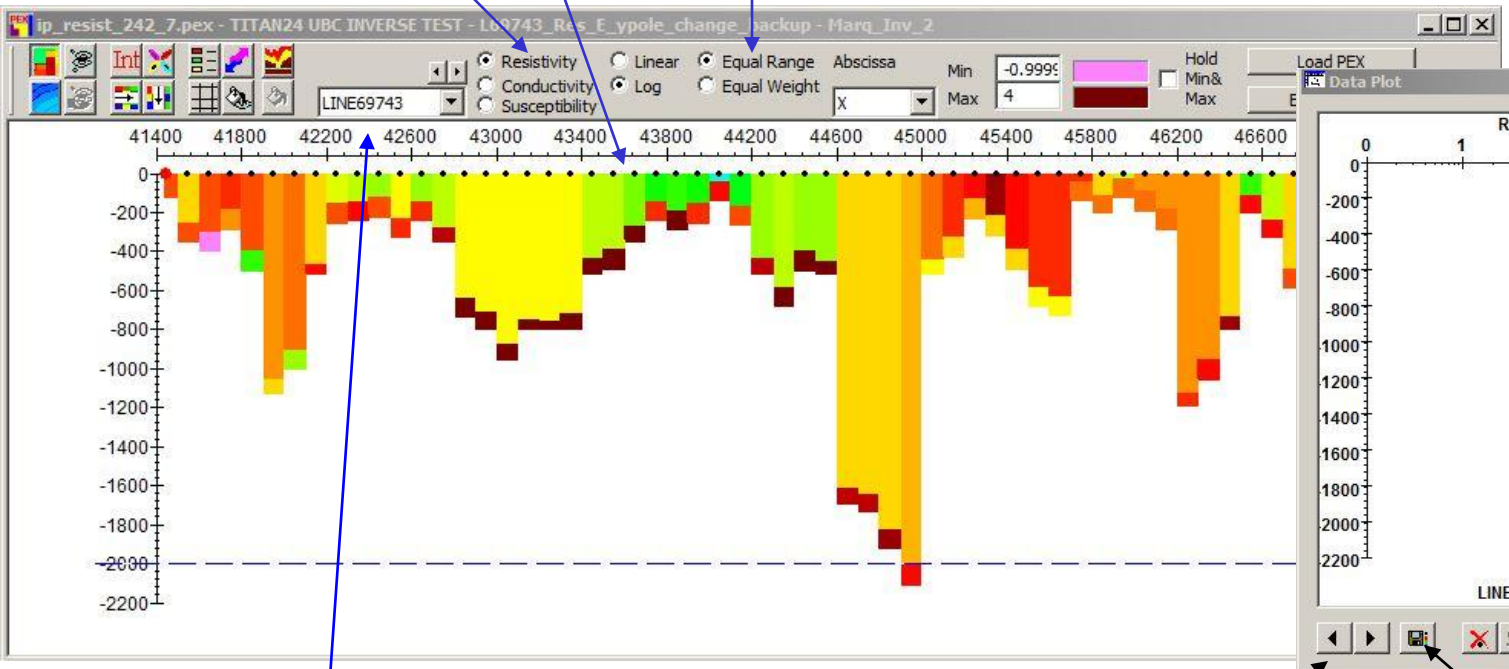
Choose CDI Viewer to view a stacked section of the results

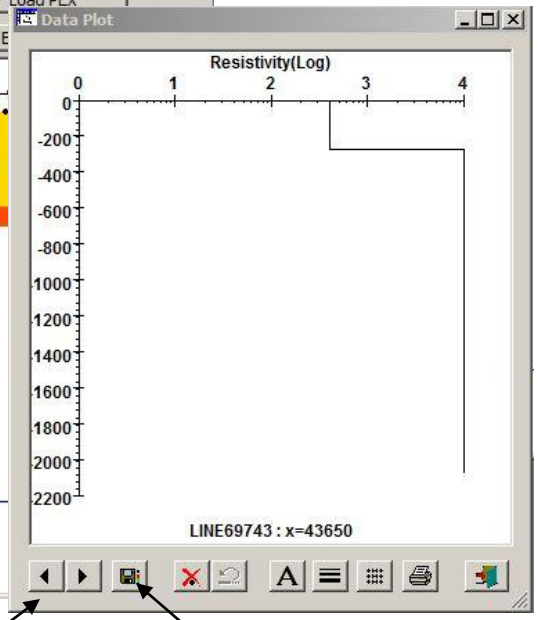
1. Import data
2. Examine data
3. Perform initial modeling
4. Perform controlled Marquardt or Occam Inversions
5. **Inversion evaluation**

Inversion Displays

Choose CDI viewer to graphically view the results

The results for each **data point** are shown (without interpolation) initially in **log(Resistivity)** with **Equal Range** display.





If there is more than one line then **other lines** may be selected.

A **simple line drawing** is also provided and you may **step** along the profile. You may also save the layered model of the current point by clicking 

1. Import data
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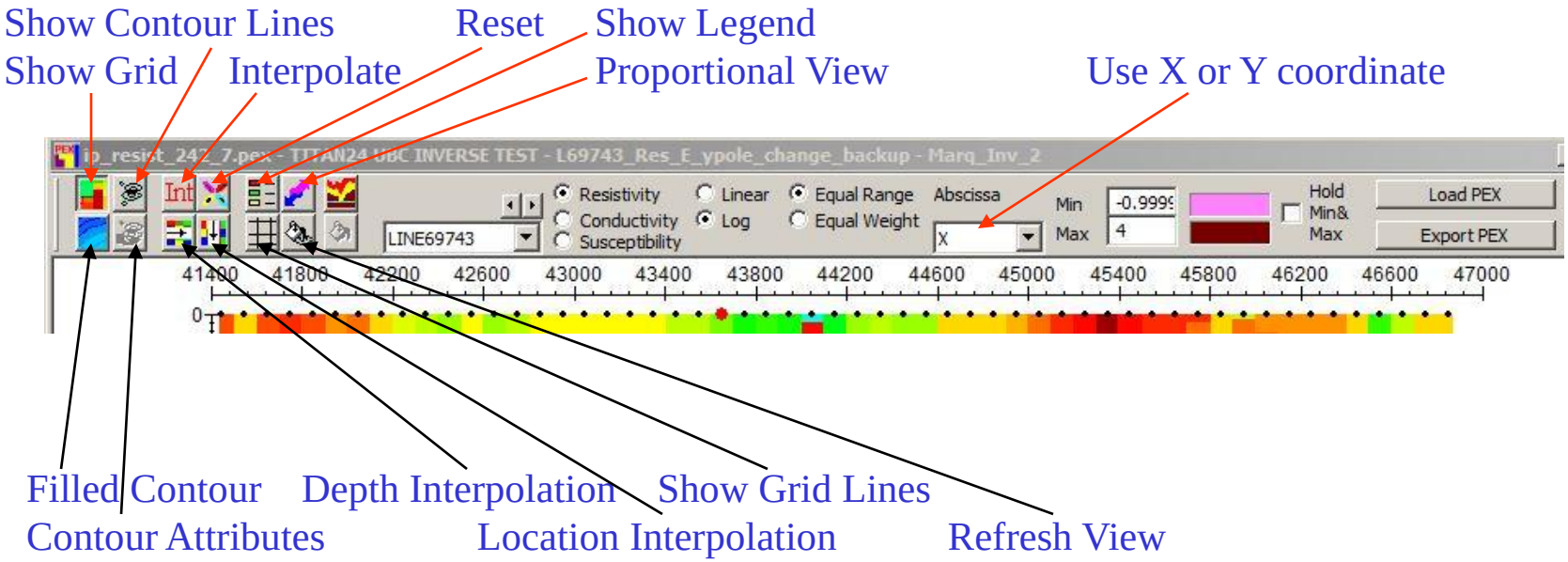
5. **Inversion evaluation**

Inversion Displays

Choose CDI viewer to graphically view the results



Equal Range: assign different colors to different ranges which are equal independently of the number of data falling within these ranges

Equal Weight: assign colors to different ranges which are unequal but covering the same number of data

Min: Any data values below Min will be displayed as the color to the right of the edit field

Max: Any data values above Max will be displayed as the color to the right of the edit field

1. Import data
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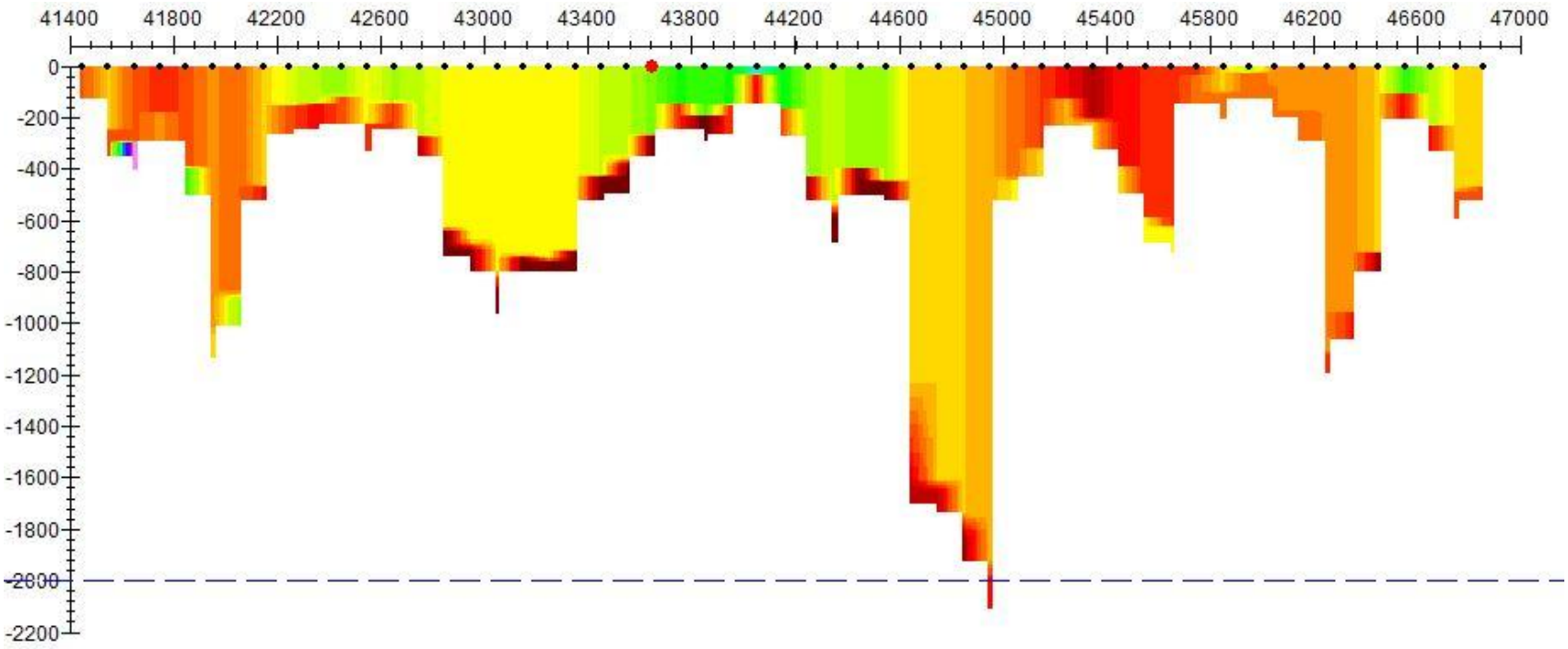
5. **Inversion evaluation**

Inversion Displays

Choose CDI viewer to graphically view the results



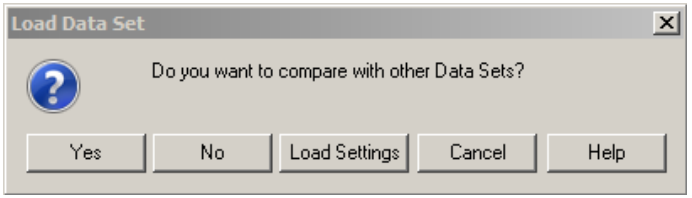
Axes may be edited by double-clicking on it, and you can change Max, Min, Labels and Titles etc. on the popup dialog

Depth and location interpolated may be repeated (note: the results of previous interpolations are used in the next interpolation so use with care)

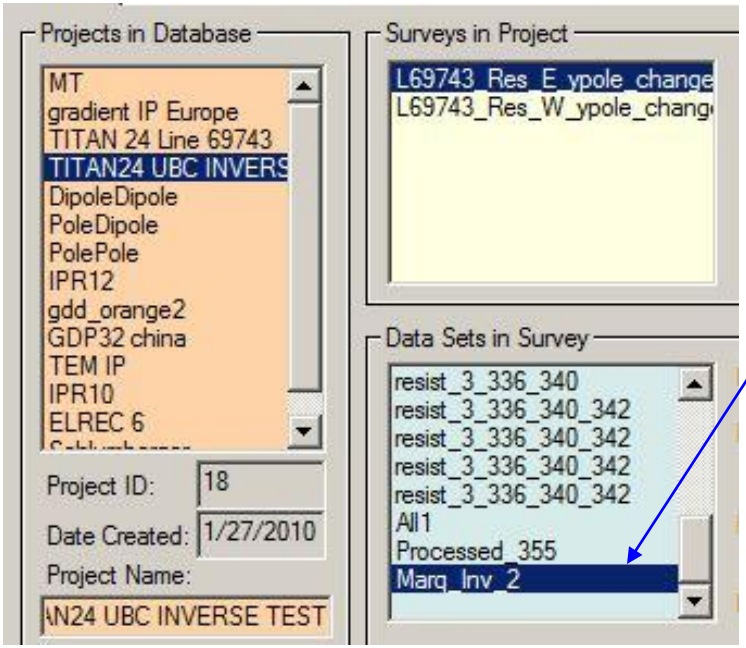
1. Import data
2. Examine data
3. Perform initial modeling
4. Perform controlled Marquardt or Occam Inversions
5. **Inversion evaluation**

Inversion Evaluation

To assess how well the inversion model fits the data at each station, select the inversion data set and then select the plotter.



Select "Yes", if this dialog is appeared



1. Import data
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3. Perform initial modeling
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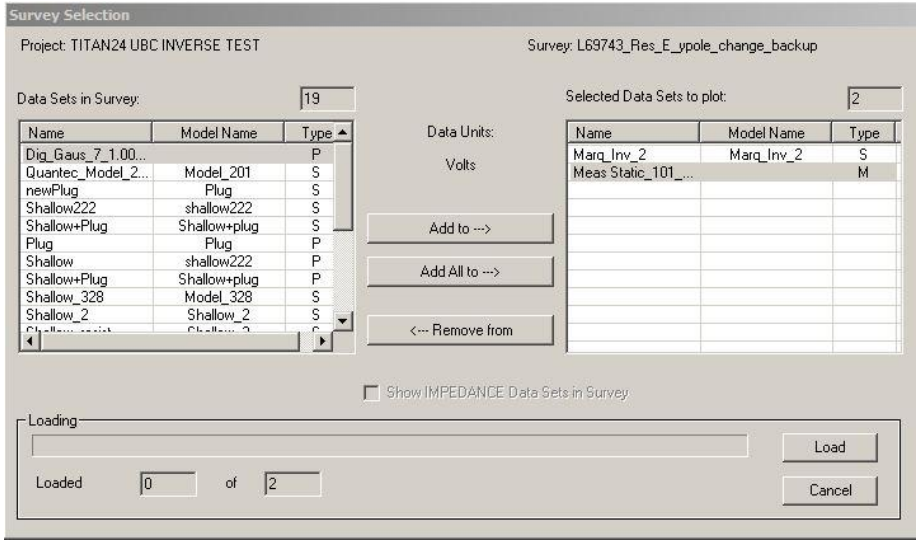
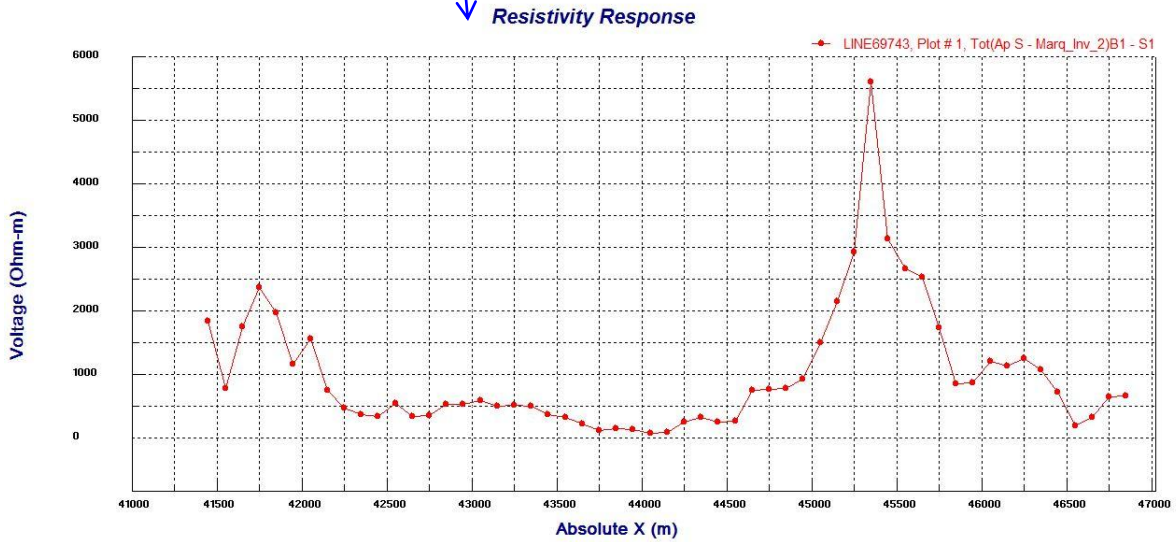
5. **Inversion evaluation**

Inversion Evaluation

Select the data sets required for comparison and then click “Load”



All selected data sets are then loaded to the Plotter application and the plot appears showing the simulated data of the first separation.



1. Import data
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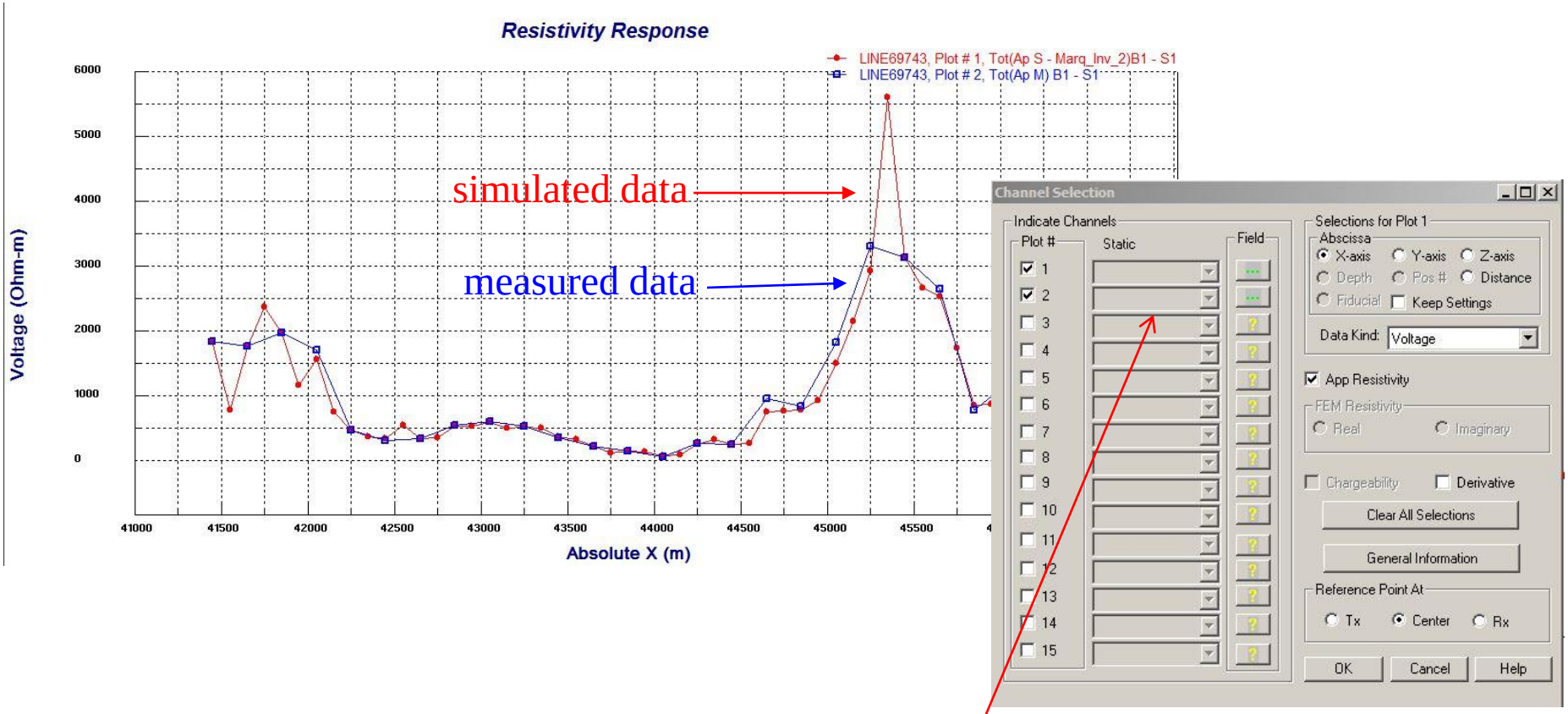
3. Perform initial modeling
4. Perform controlled Marquardt or Occam Inversions
5. **Inversion evaluation**

Inversion Evaluation

The user may select other data sets to plot by simply double clicking on the plot.



Select for the 2nd plot on measured data

1. Import data
2. Examine data
3. Perform initial modeling
4. Perform controlled Marquardt or Occam Inversions
5. **Inversion evaluation**

Inversion Evaluation

Multiple plots can be shown for various inversions and models in "Static" mode. The user may step through different separations by simply clicking the arrow.