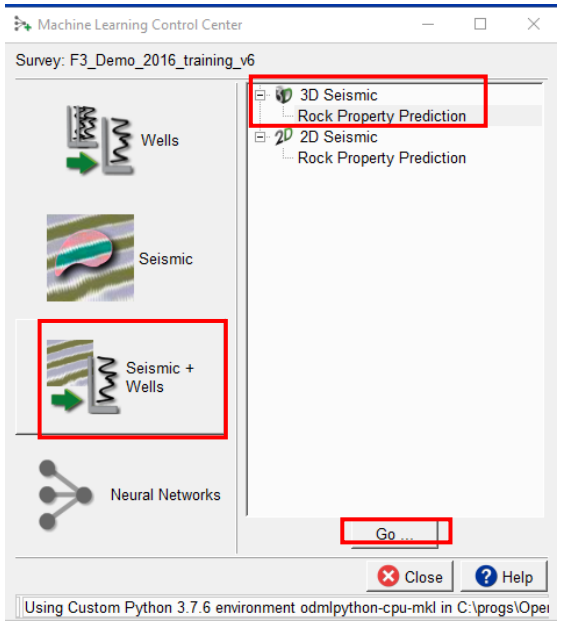
Exercise objective:

To predict rock property using the *3D Seismic + Wells, Rock Property Prediction* tool which is part of the Machine Learning plugin. In this exercise, we want to predict a Porosity cube.

Well data Preparation
Seismic (and/or attributes) and **Well**(s) need to be available in the survey. If not, **import** seismic and wells (track, logs, markers, time-depth curve or checkshot).

Workflow:

1. **Open** the Machine Learning Control Center with the  icon .
2. **Click** on Seismic + Wells > 3D Seismic
3. **Select** Rock Property Prediction, and **Press Go**.



Workflow cont'd:

4. The "Log-log prediction" window pops up.

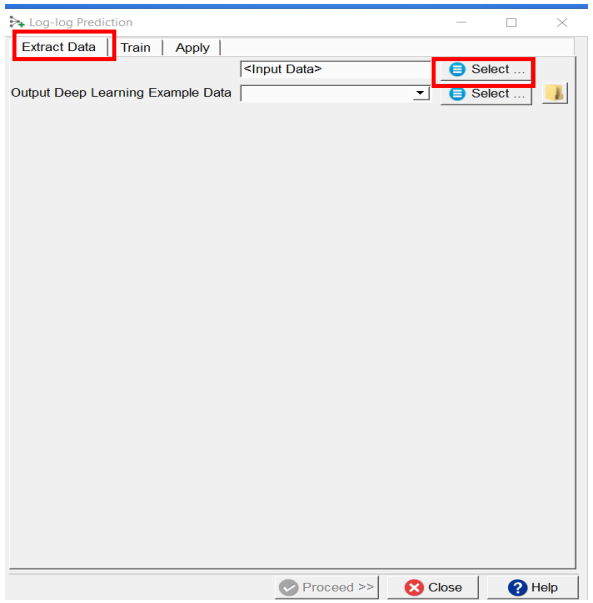
5. **Select** *Input Data.*

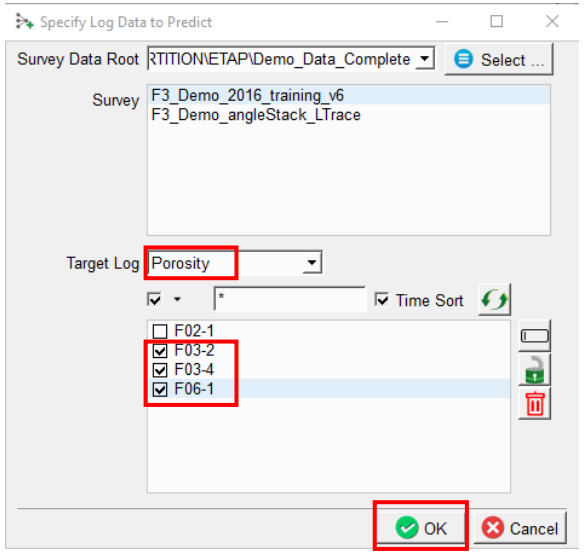
   The "*Specify Log Data to predict" window pops up.*

6. **Select**: *Survey*, *Target Log (e.g. Porosity)*, and *Wells* as indicated in the window.

   The well F02-1 is not selected, and will be used as a blind well.

7. **Press** OK.



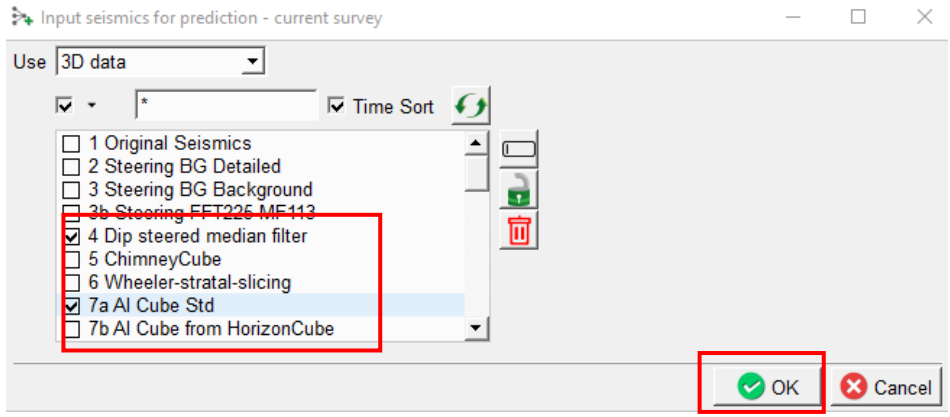


Workflow cont'd:

8. Deep Learning: Target Log definition window pops-up.

A new data selection from different survey can be added by clicking on ⊕

9. In the ''Input seismic for prediction'' window, **Select** a suitable 3D data to use as input for the training e.g. RMS attribute, Q Factor attribute, Instantaneous phase attribute, Dominant frequency attribute, Seismic volume etc.



10. **Press** OK.

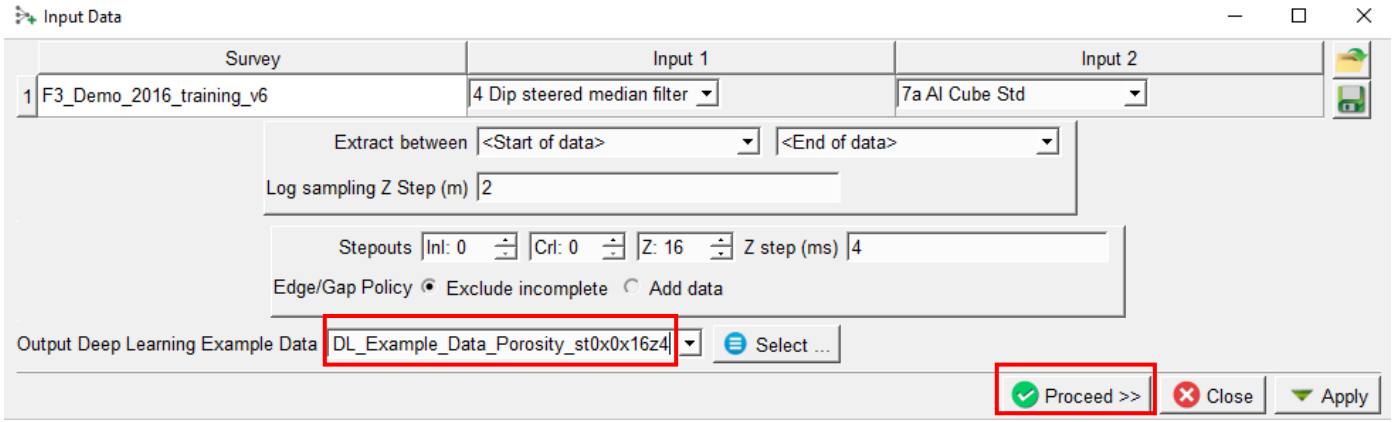
Workflow cont'd:

11. The *"Input Data"* window pops up.

Input data can be modified using the drop down selection. Keep the default parameters as indicated in this window.

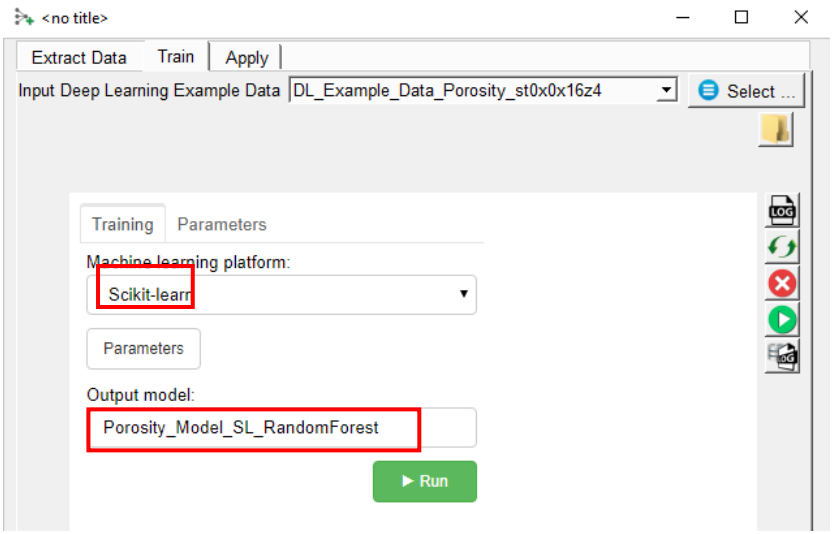
12. Specify a new name for the *Output Deep Learning Example Data (e.g. DL_Example_Data_Porosity_st0x0x16z4).*

13. Press Proceed.



Workflow cont'd:

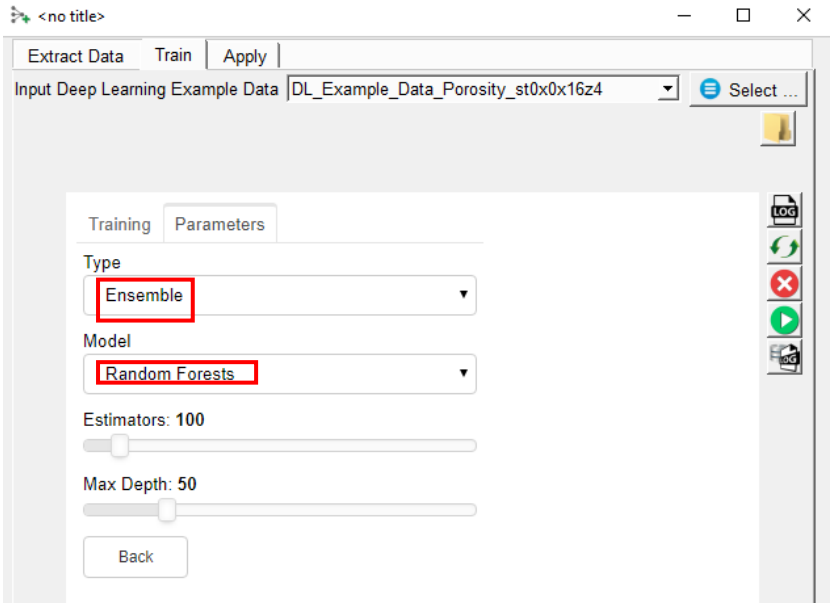
14. The *Train* tab gets activated. Train the extracted examples data using the default learning algorithm Scikit-learn (Ensemble: Random Forests).



Different machine learning platforms and parameters can be tested.
Keep the default parameters for this exercise.

15. **Specify** a new *Output model* name e.g. Porosity_Model_SL_RandomForests.

16. **Press** Run.

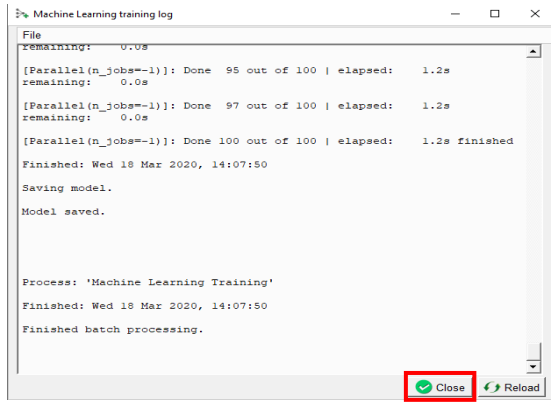


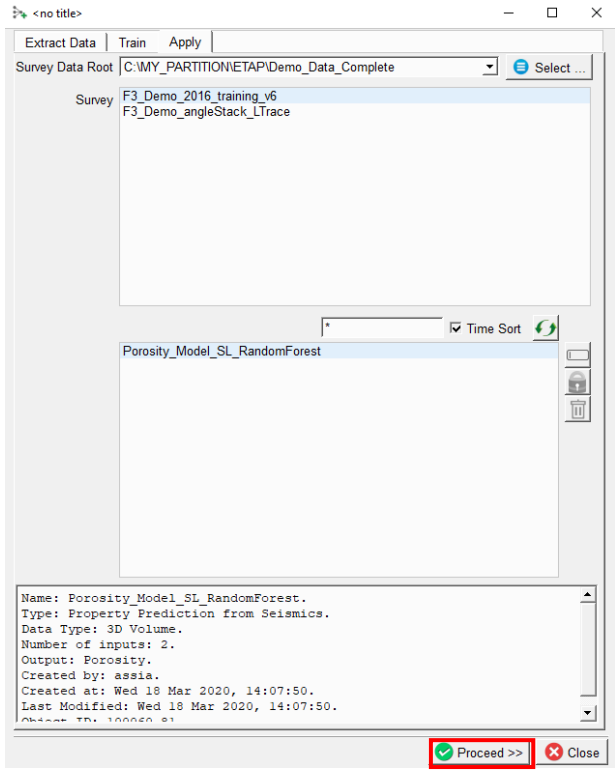
Workflow cont'd:

17. **Press** Close in the ''Machine Learning training log''
window, when the processing finishes.

18. The Apply tab get activated. The Survey, Training model can be modified here. Keep the default selection as indicated in the window.

Press Proceed.





Workflow cont'd:

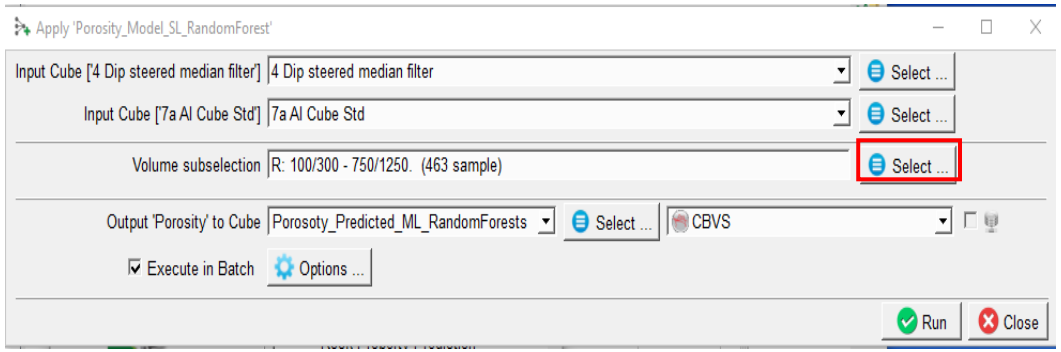
19. The ''Apply created training model'' window pops up. Apply first the trained model on 1 Inline.

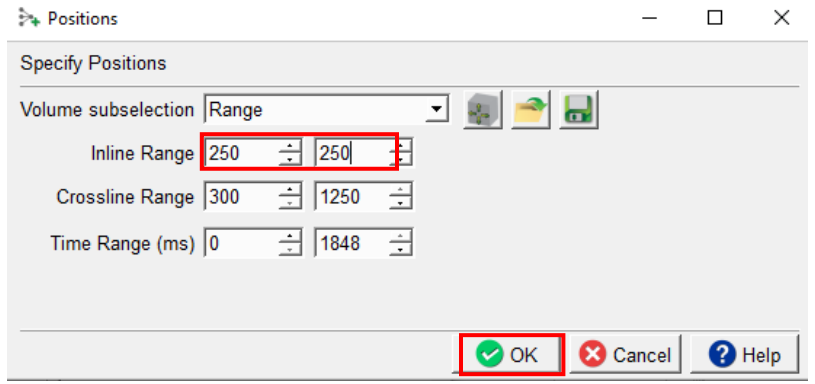
20. In the volume sub-selection, **Select** Inline range 362. Choose an Inline crossing a well with porosity log e.g. F02-1.

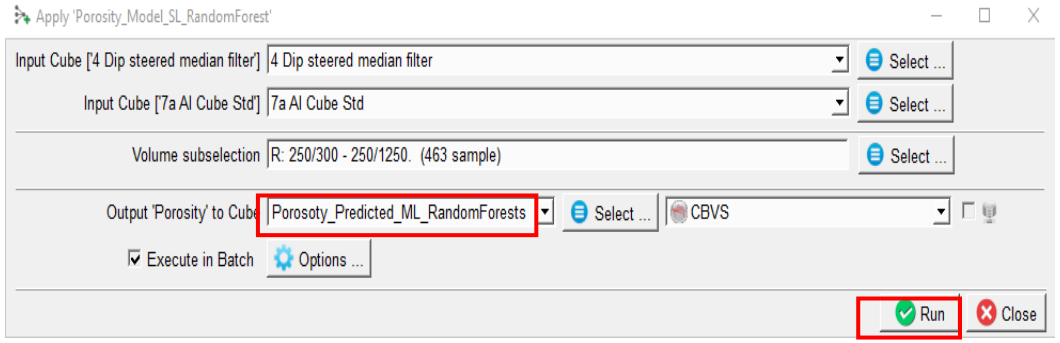
21. **Press OK**.

22. In the ''Apply the trained model'', Keep default parameters, **Specify** a new name for the output porosity to cube (e.g. Porosity_Predicted_ML _RandomForests).

23. **Press** Run to continue.



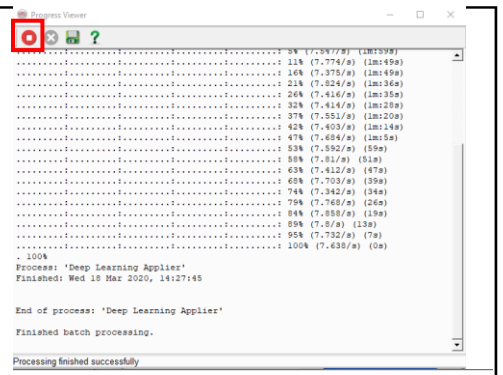


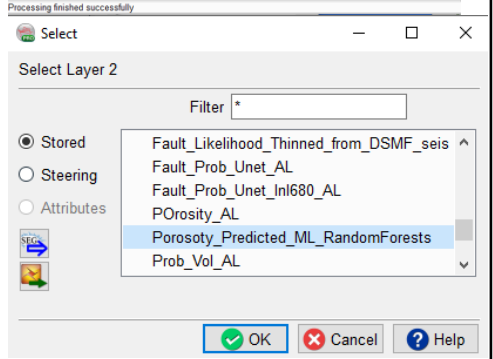


Workflow cont'd:

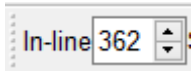
When the computation finishes, close the Progress Viewer window.

QC results by displaying the predicted Porosity on the test Inline (e.g. 362) and overlay the crossing well F02-1, with the porosity log.



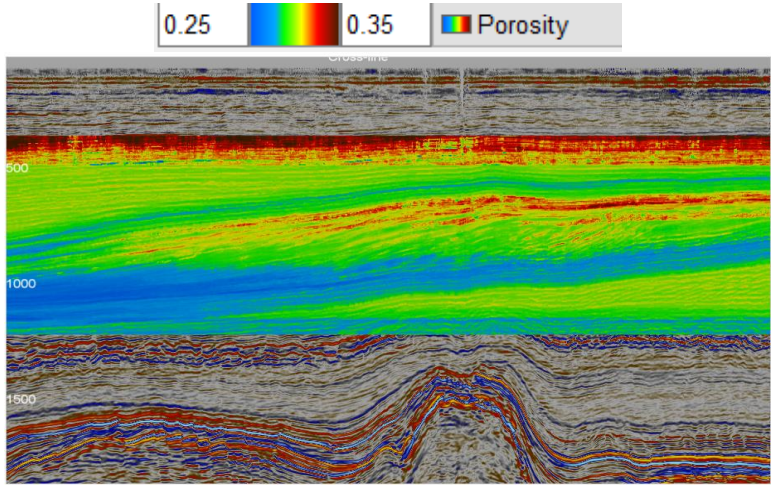


24. **Right Mouse Click** on the Inline folder > Add Default Data e.g. Deep Steered Median Filter. Type: 362 in the In-line field Change the In-line no to 362 .



25. **Right Mouse Click** on the In-line 362 > Add > Attributes. **Select** under Stored the new predicted porosity (e.g. Porosity_Predicted_ML_RandomForests), and **Press** **OK**.

26. **Modify** the Porosity colour limit to (0.25-0.35)

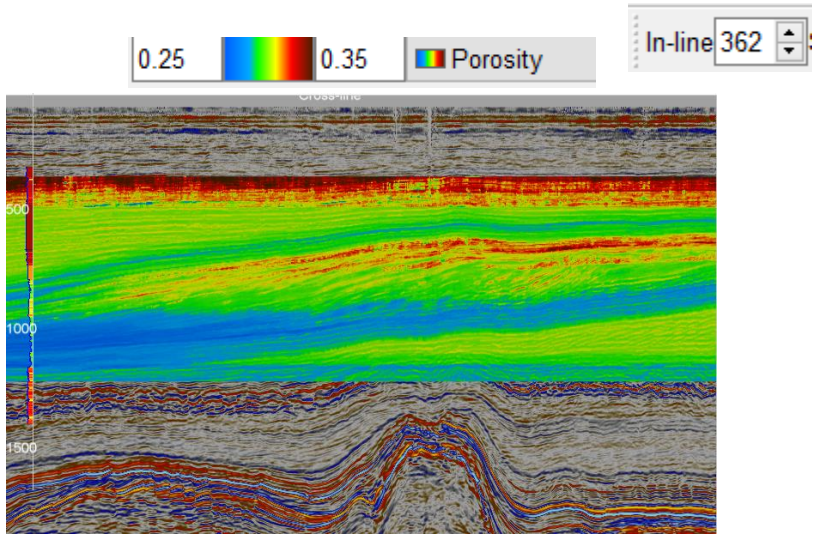


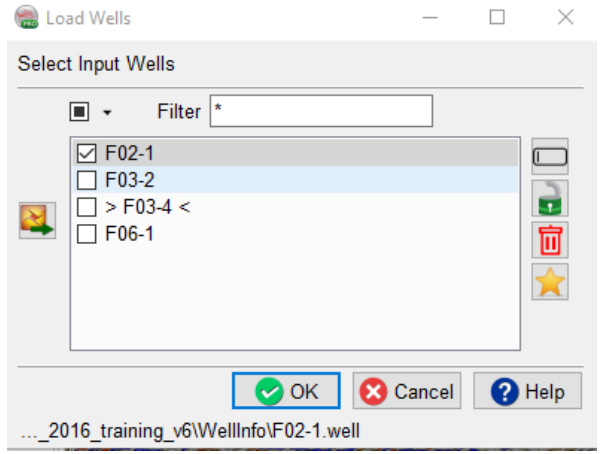
Workflow cont'd:

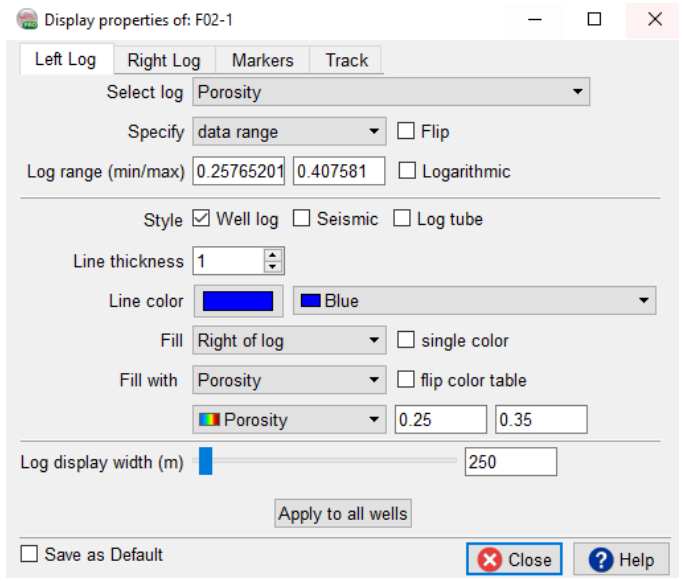
27. **Right Mouse Click** on the well folder> Add, **Select** the well F02-1, **Hit** Ok.

28. **Right Mouse Click** on the Well F02-1 > Display > Properties, **Select** Porosity log, **Change** the color bar to Porosity. **Modify** the Porosity color range similar to the predicted porosity cube range (0.25 - 0.35).

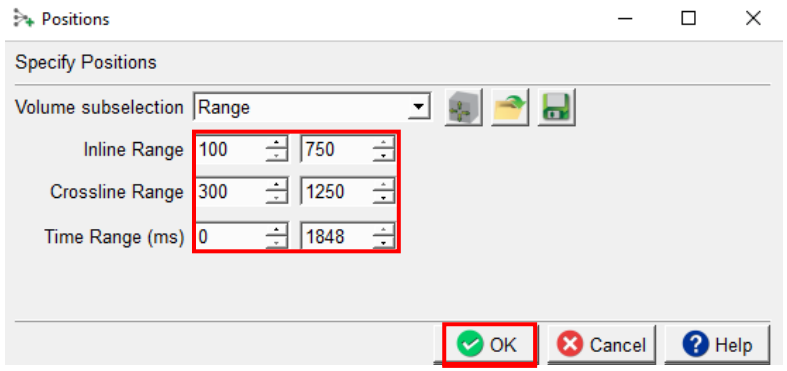
29. **Apply** to All Wells, and Hit Close.







Workflow cont'd:



If result is satisfactory, go back to the previous Step and **Apply** the trained model to the entire survey.

30. **Go back** to the Apply tab > Volume sub-selection > In-line range and reset of the entire range.

31. **Keep** all other default parameters and **Press** Run to continue.