Exercise objective:

To predict lithology logs using the ‘’*Lithology classification* tool’’, which is part of the machine learning plugin.

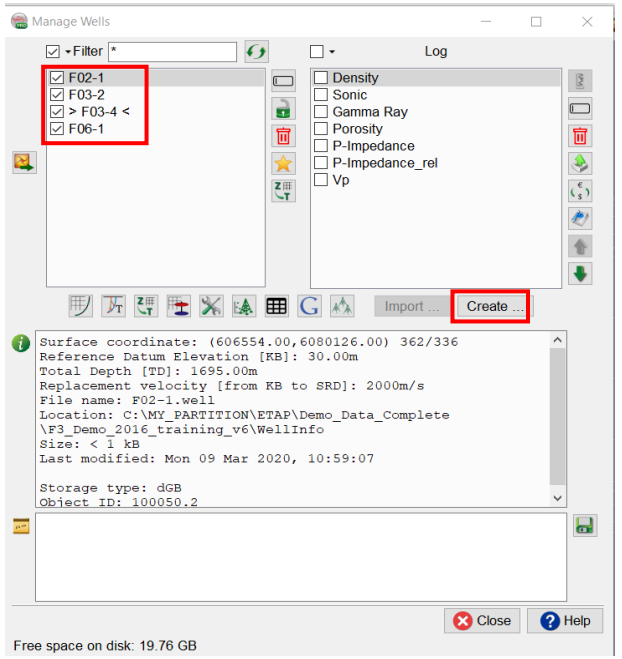
Well data Preparation
Well(s) need to be available in the survey. If not, **import** wells (track, logs, markers, optionally time-depth curve or checkshot).

Workflow:

For the purpose of this exercise, we will create a fake lithology log using Mathematics (as no lithology log exists in the survey)

1. **Open** the Well Manager  .

2. **Select** *All Wells in the* ‘’Well Manager’’*, and* **Hit** *Create.*



Workflow cont'd:

3. *In the "Calculate a New Well Log" window,* **Specify** the parameters as indicated *below to create a fake litho-log:*

    a. **Select**: MathFunctions.

    b. **Type** the Formula: *GR < 40 ? 1 : 2*

    c. **Hit** Set.

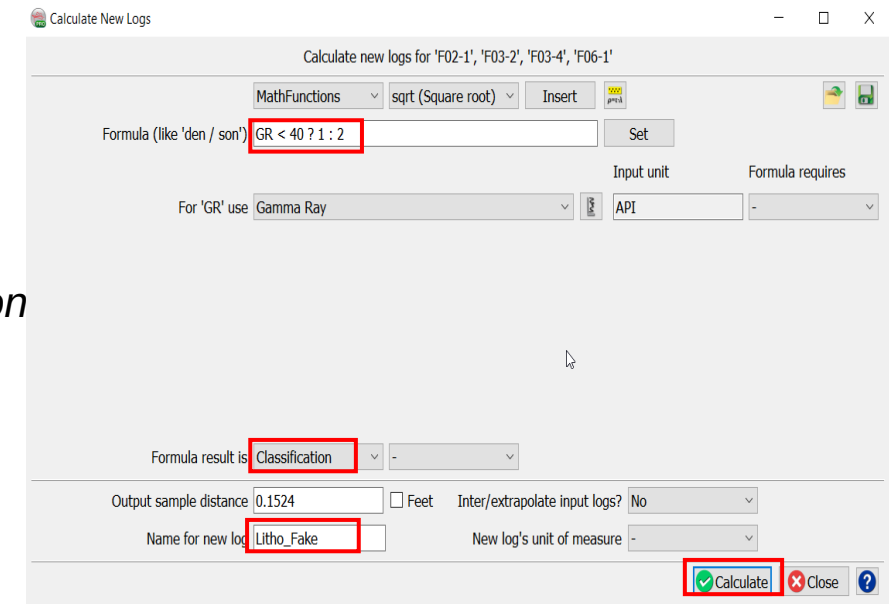
    d. **Select** Gamma Ray log.

    e. **Select** for the *Formula Results, Classification*

    f. **Type** Name for new log: Litho_Fake.

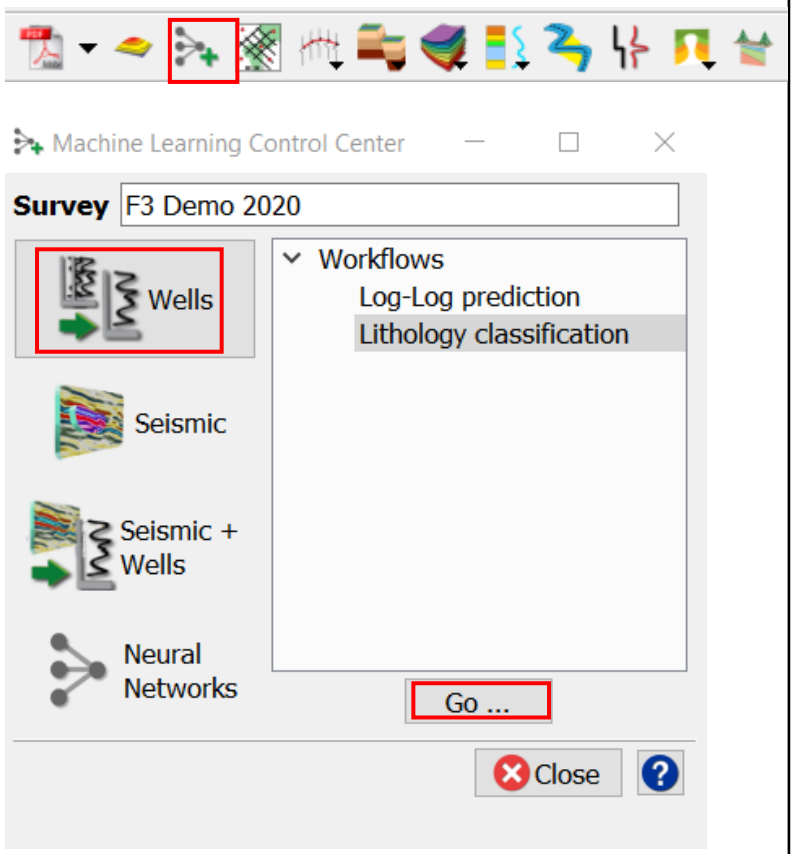
    g. **Select** Output Unit of Measures: None.

4. **Press** Calculate.



Workflow cont'd:

5. **Open** the Machine Learning Control Center with the  icon.
6. **Click** on Wells.
7. **Select** *Lithology classification.*
8. **Hit** Go.



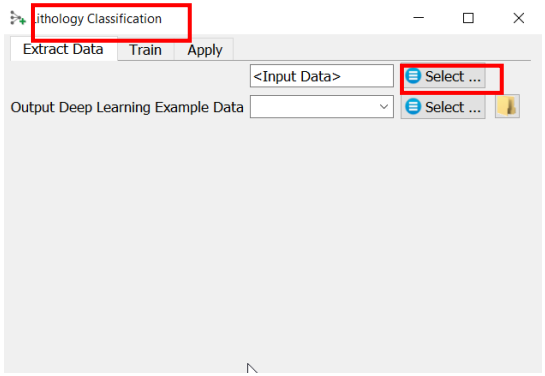
Workflow cont'd:

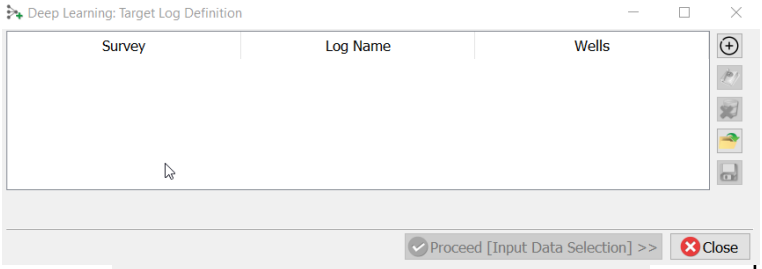
9. ''Lithology Classification'' window pops up. **Press** Select - Input Data. **Select**  icon in the ''Target Log Definition''.

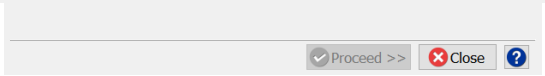
10. *''Log Data to predict'' window pops up.* **Select**: *Survey**, *Target Log,* and *Wells* as indicated in the window.
In this case the ''Litho_Fake'' log will be predicted.

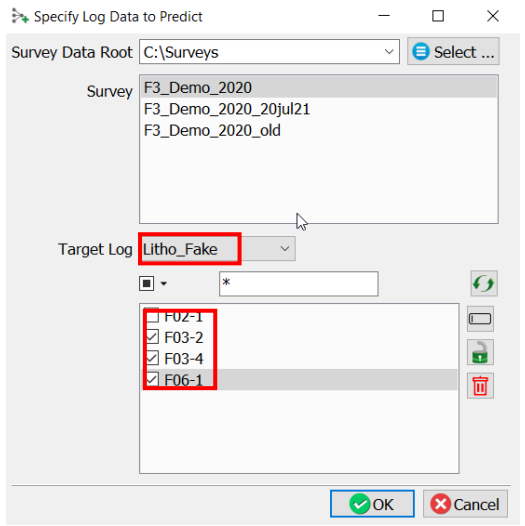
The well F02-1 is not selected, and will be used as a blind well.

11. Press OK.

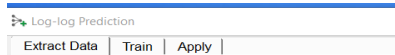








* The option to select data from other surveys is available only in commercial projects (not in the free demo project)



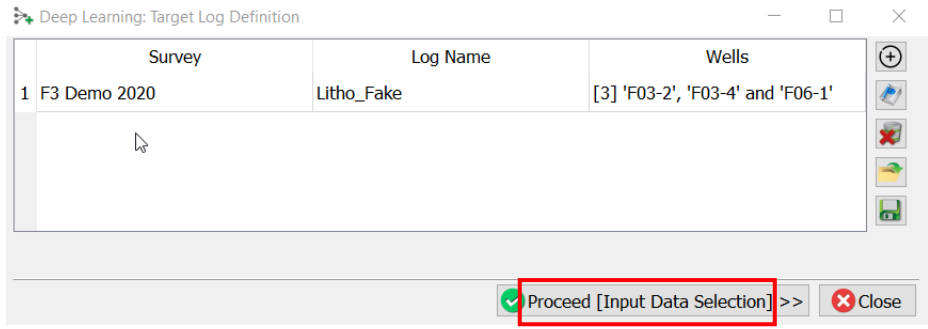
Workflow cont'd:

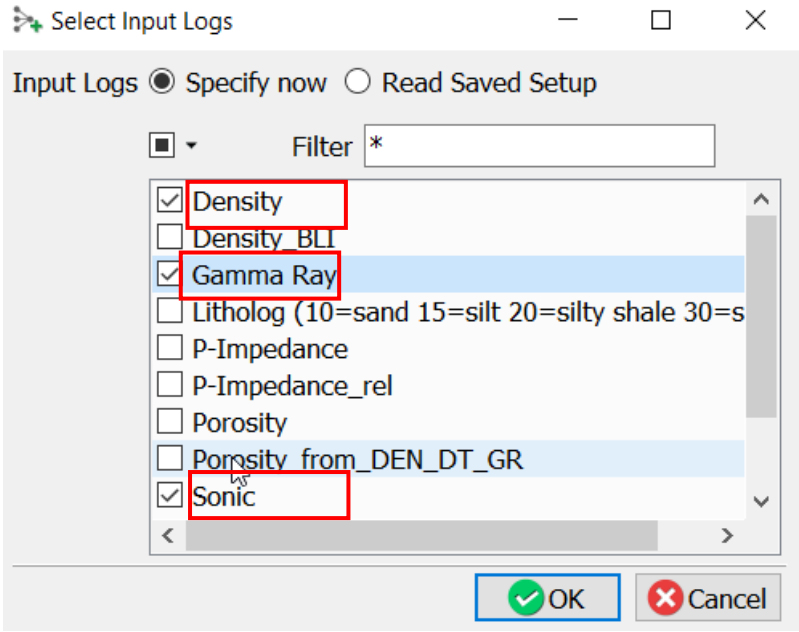
11. "*Deep Learning: Target Log definition"* window pops up.

12. **Press** Proceed [Input Data Selection].

13. In the *"Select Input Logs"* window, **Select** the Density, *Sonic* and *Gamma Ray l*ogs.

14. **Press** OK.





Workflow cont'd:

15. *"Input Log Selection"* window pops up.

Input Logs can be modified here. Keep the default parameters as indicated in the window.

16. **Specify** a new name for the ''*Output Deep Learning Example Data" (e.g. DL_Example_Data_Lithology_st10).*

17. **Press** Proceed.

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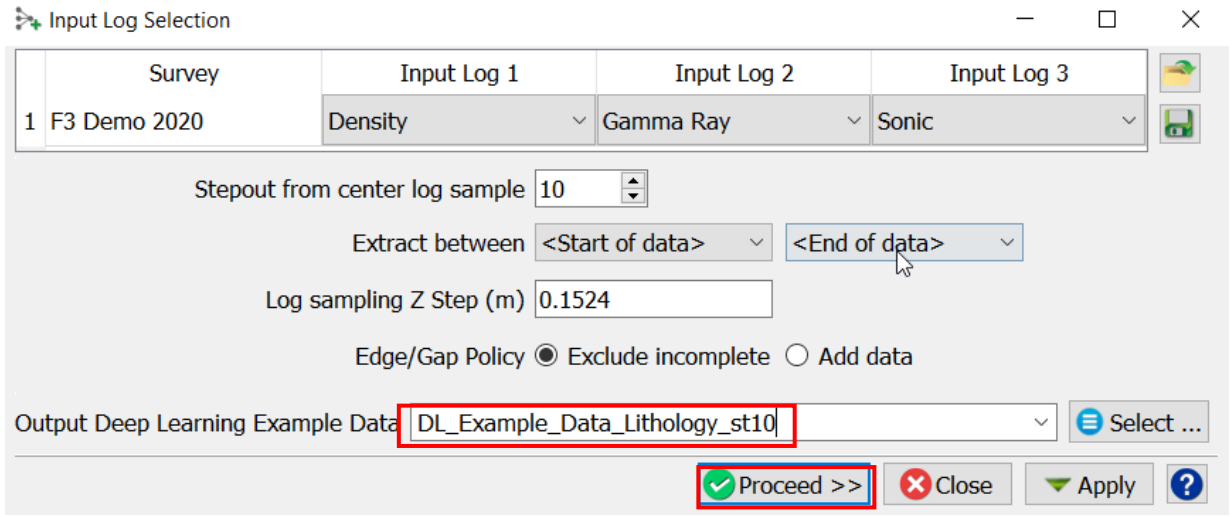


Workflow cont'd:

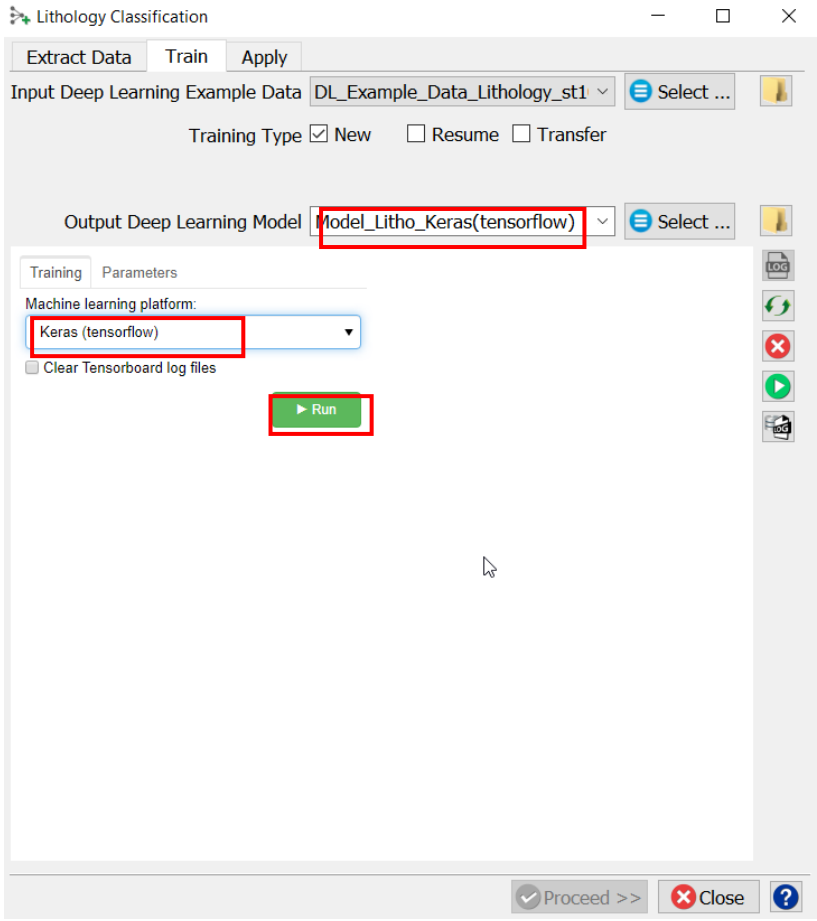
18. **Select** Training Type New.

19. *"Train" tab* becomes active. Train the extracted examples using the default learning algorithm (e.g. Keras (tensorflow).

Different machine learning platforms and parameters can be tested.

20. **Keep** the defaults parameters. **Specify** a new *Output mode*l name (Model_Litho_Keras(tensorflow).

21. **Press** Run.

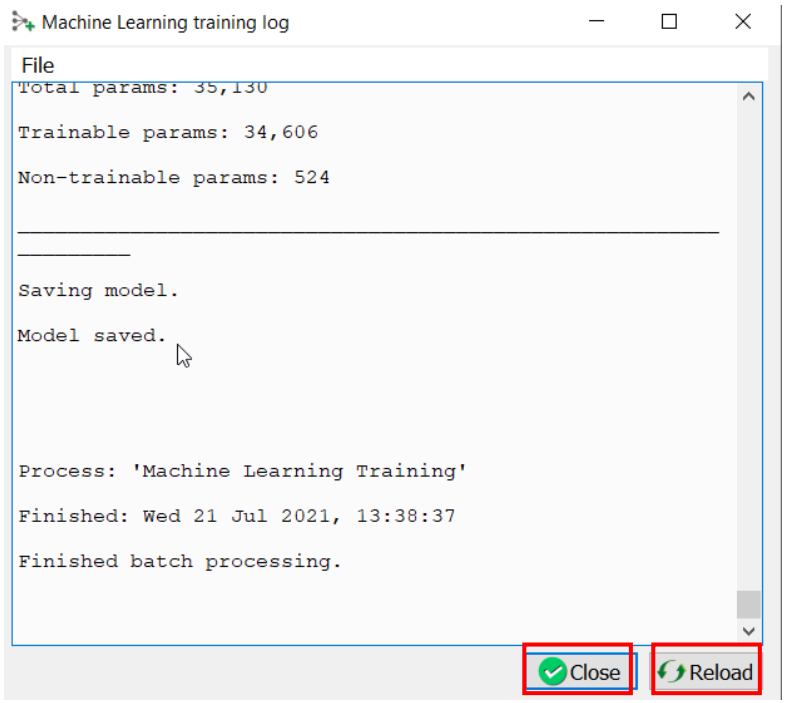


Workflow cont'd:

22. The Machine Learning training log file pops up. Otherwise **Click** on  icon.

23. **Hit** Reload to refresh the window.

24. When the processing is done, **Close** the training log file.



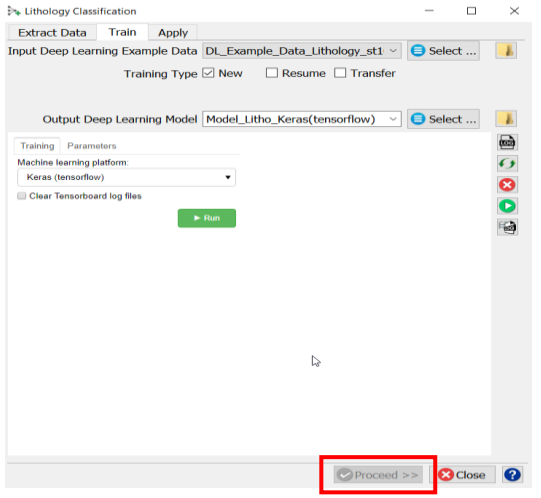
Workflow cont'd:

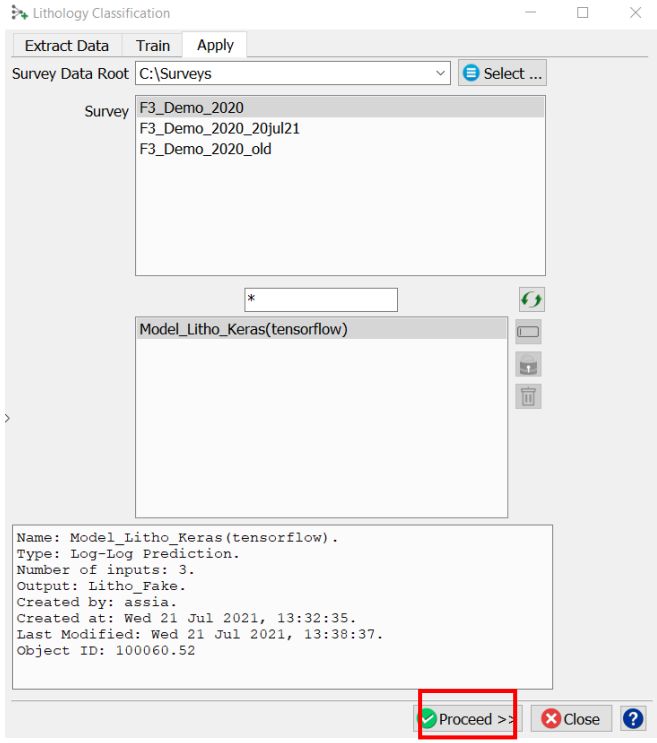
25. **Hit** Proceed in the 'Lithology Classification-Train' Window.

26. ''Apply'' tab get activated, **Verify** the Survey and Model are correct. Otherwise, modify accordingly.

> *The Survey, Training model can be modified here.

27. **Press** Proceed.





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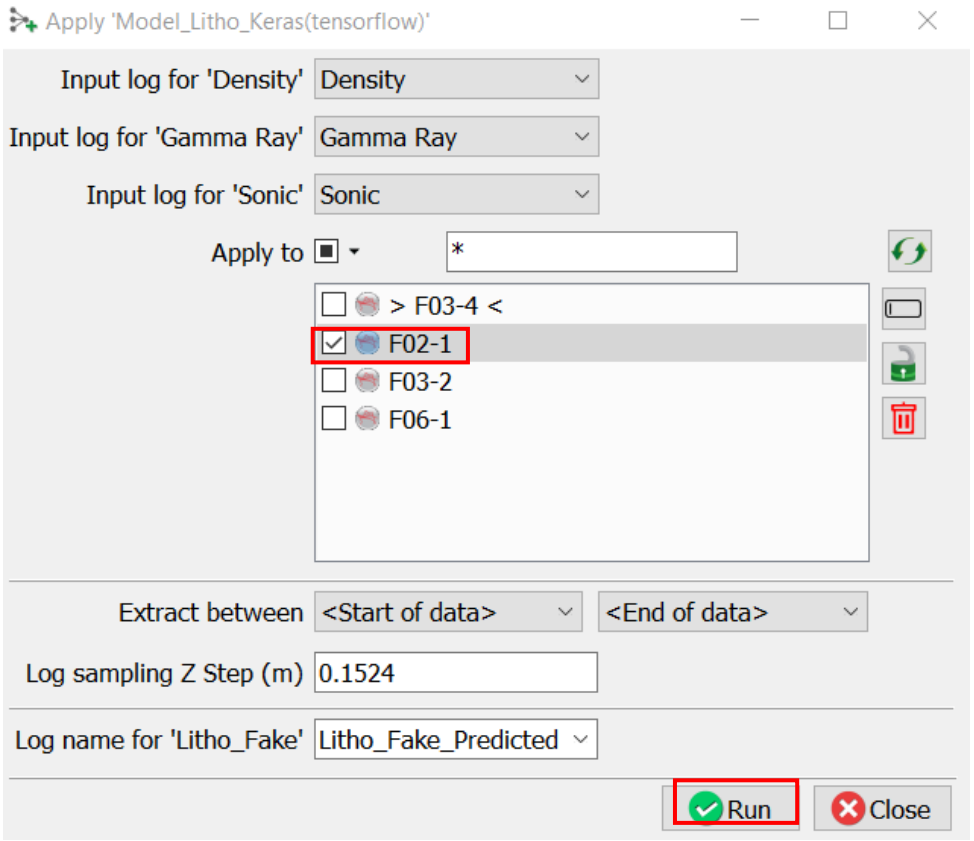
Workflow cont'd:

28. ''*Apply* created training model'' window pops up.

29. **Apply** the trained model to a blind well (not used in the training process). **Select** F02-1.

30. **Keep** default parameters. **Type** a new Log name for the predicted lithology log ''Litho_Fake_Predicted''.

31. **Press** Run to continue.



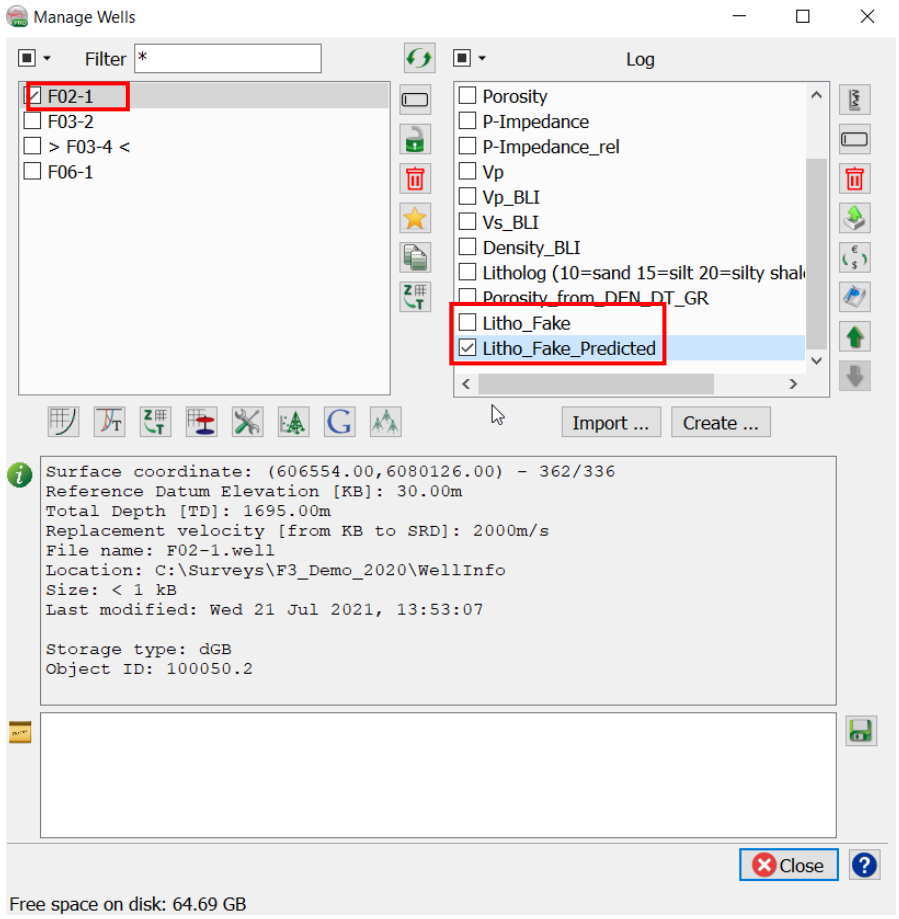
Workflow cont'd:

QC results by displaying the predicted log adjacent to the recorded log

32. **Click** on the Well Manager icon.

33. **Select** the blind well F02-1, Litho_Fake and Litho_Fake_Predicted logs.

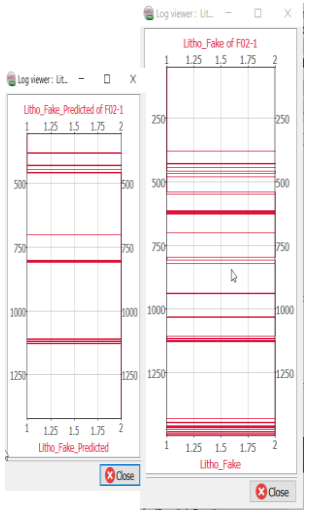
34. **Click** on view logs.



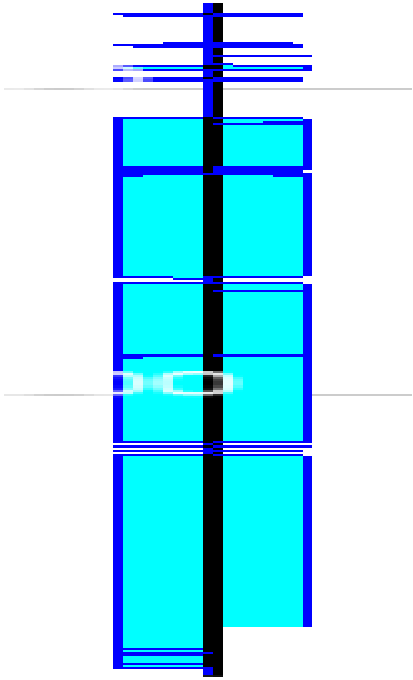
Workflow cont'd:

35. **Compare** the original vs predicted litho-log.

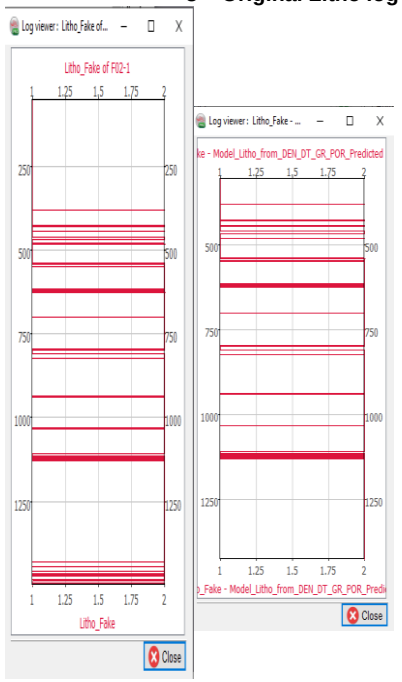
Note: The missing parts at the top and base of the predicted log are due to missing values in the input logs.



Predicted Litho log Original Litho log



Predicted Litho log Original Litho log



Workflow cont'd:

If result is satisfactory, go back to the previous step and Apply the trained model to all Wells

36. **Select** All Wells. Keep default parameters as indicated in the window.

37. **Press** Run to continue.