



Matching Hydraulics Calculations: HYDPRO / MUDPRO

Summary:

Though Pegasus Vertex, Inc. (PVI) constantly modifies and upgrades its software programs, fundamental calculations like basic hydraulics will not change with time. There are, however, some nuances involved and additional optional considerations that can be selected in the software programs. MUDPRO contains the same hydraulics calculations as HYDPRO, but HYDPRO as a full drilling hydraulics and hole cleaning model has both additional calculations options and the potential for more detailed inputs.

When users of both MUDPRO and HYDRPO would like to compare results and ensure that the equivalent circulating density (ECD) and pump pressure (PP) values are similar, the input selections within the programs will need to be equivalent.

Software Versions:

MUDPRO 4.4.0 related hydraulics calculation update; version 4.6.4 or later recommended

HYDPRO 5.3 related update; version 5.4.4 or later recommended

To determine your software version, open the program and select Help > About. Release histories for the software can be viewed/discussed with the relevant PVI technical sales rep if desired.

Input Setup for Calculation Matching:

The mathematical model in HYDPRO and MUDPRO (MUDPRO+) are the same. Generally speaking if the inputs are equal, the results should be as well. However, differences in the survey/wellpath and small rounding differences in the background of the calculations will likely occur.

PVI recommends calculations between HYDPRO and MUDPRO with ECD and PP differences of $\leq 3\%$ or less than ± 0.3 ppg be considered a match.

1) Survey Data

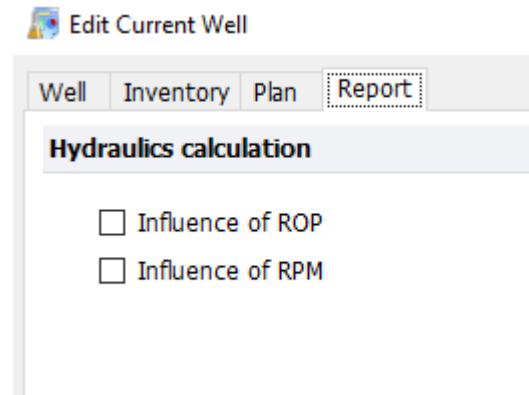
HYDPRO allows user to input detailed survey data, while MUDPRO uses the MD and TVD from all of the daily reports. This difference will allow HYDPRO surveys to contain more depth entries and therefore often has a more accurate well path for the simulation.

However, the impact of the survey data tends to be small in PVI's experience. If the MD and TVD values in MUDPRO match the survey data in HYDPRO, the results from both software will be close.

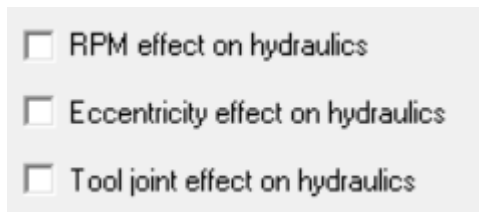


2) HYDPRO/MUDPRO Advanced Options (ROP, RPM, Eccentricity, Tool Joint Consideration)

MUDPRO has options for ROP and RPM considerations in the well setup/edit menus, shown below. When comparing MUDPRO and HYDPRO, the recommendation is to turn these off for the sake of simplicity.



HYDPRO has options to control RPM, eccentricity and tool joint effects, all of which are located together within the Hydraulics input tab. To match MUDPRO without worrying about locating the rpm values, it is recommended to turn off 'RPM effect on hydraulics' when running a comparison.



MUDPRO does not account for eccentricity or for the tool joint effect on hydraulics, and so need to be left off within HYDPRO when comparing the results with MUDPRO.

(Note: though MUDPRO doesn't account for drill string eccentricity, MUDPRO+ does)

3) Backpressure

MUDPRO does not consider back pressure, so it needs to be turned off in HYDPRO when comparing the ECD and pump pressure calculations. This is located in the Hydraulics tab.

