Use the Case Study Feature to Perform Sensitivity Studies

Often, a plant engineer is asked to consider the possibility of handling more feed to the amine unit or the SRU. This could be because another train is down due to an unplanned shutdown or there is a planned turn around event. On the other end of the spectrum, a design engineer is keen to understand the robustness of his design and ensure the process is not operating at a cliff point and there is enough margin for deviations from the design basis. In this context, one resorts to performing a sensitivity analysis of the simulated operating plant or the design. In such cases, ProTreat® has a "Case Study" feature to perform sensitivity studies.

Case Study in ProTreat®

The Case Study button in ProTreat® is located below the menu bar denoted by "Y = F(X)" as shown in Figure 1.
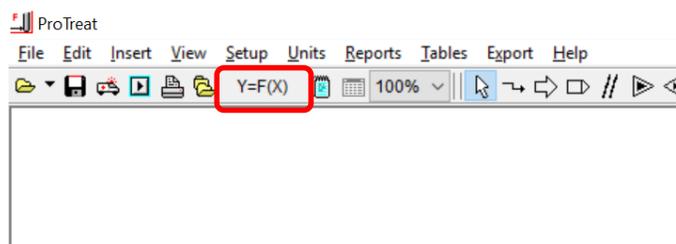

Figure 1. ProTreat® Case Study Button

Clicking on the Case Study button will prompt you to select between opening an existing Case Study file or creating a new Case Study as shown in Figure 2.
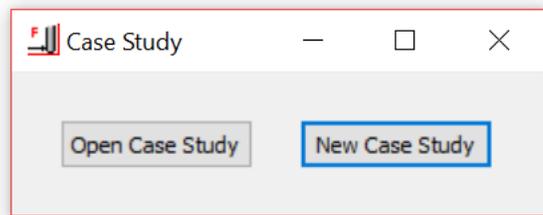

Figure 2. Setting up a Case Study

Selecting "New Case Study" prompts you to select an existing flowsheet on which you want to carry out a sensitivity analysis (see Figure 3). Case Study does not alter the source file itself. It only creates a copy from which ProTreat® can carry out the sensitivity studies.
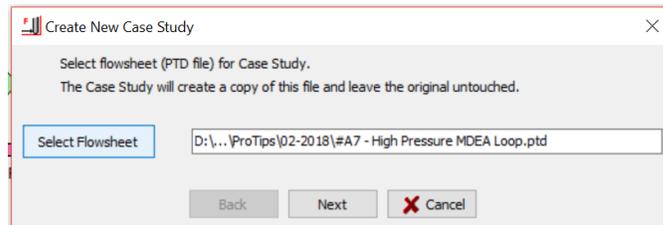

Figure 3. Selecting the PTD File for Case Study

The root PTD file simulation as shown in Figure 4 below contains an amine loop with feed gas containing 13 mol% CO_2 and 0.1 mole % H_2S. The solvent used is MDEA with 50 wt.% strength, and 50 USGPM circulation.
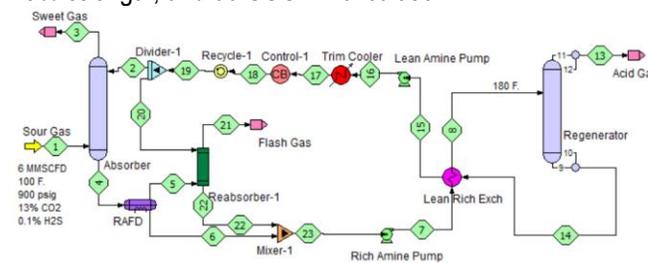

Figure 4. PFD of the Base Simulation

Subsequently, you will be prompted for a file directory location to save the Case Study, following which ProTreat®'s dialog will display the name of the root PTD file and the file directory as shown in Figure 5.
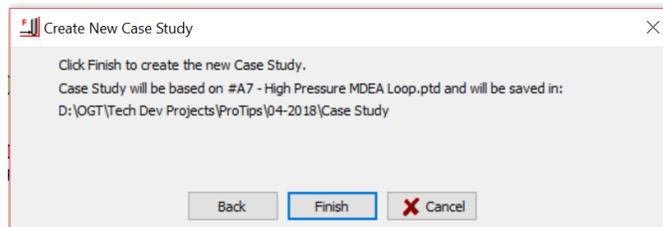

Figure 5. Confirming PTD File Name and Directory

Clicking on "Finish" will take you to the next dialog as shown in Figure 6. This is the main dialog of Case Study which involves specifying the block variable that you are interested in varying to perform your sensitivity study. In this case, we are interested in determining the sensitivity of the amine unit, specifically the H_2S in treated gas, to changes in the sour gas inlet. The total flow of the sour inlet gas is being varied from the initial 6 MMSCFD to 8 MMSCFD in 5 increments. This means

the interval between 6-8 MMSCFD is divided into 5 equal increments. The other option available is to specify the initial value, step size and number of increments. The next step is to click on "Save and Run Cases". When ProTreat® is running, it displays the status of the run on the top right of the dialog box.
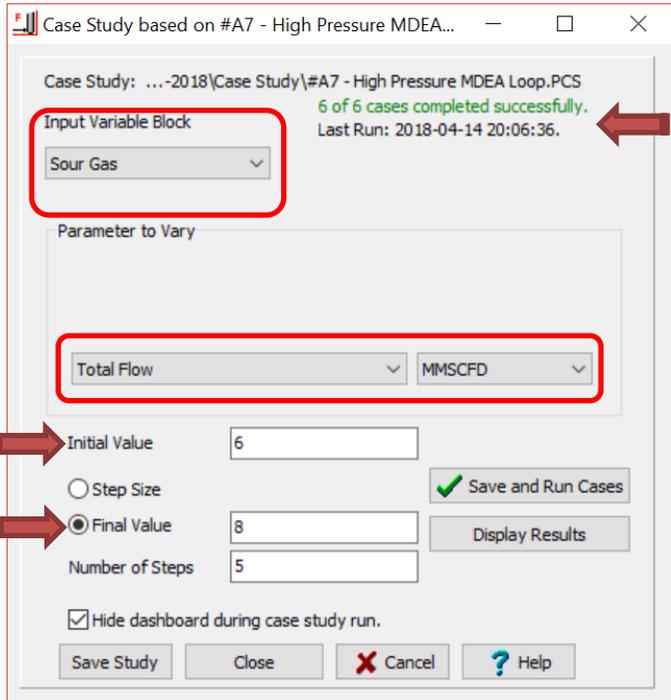

Figure 6. Specifying the Case Study Variable

Once all the Case Study simulations are complete, you can click on "Display Results" which opens the results display and plotting windows as shown in Figure 7. You may select any stream number, variable (such as physical properties), and component concentrations to be displayed. We are interested in the H_2S content in the treated gas (stream 3). Selecting this stream displays the concentration of H_2S in the treated gas for all the cases, from 6 MMSCFD to 8 MMSCFD of sour gas. The sections of the property selection and display are zoomed in and shown in Figures 7a and 7b. In Figure 7b, clicking on the "Plot" on the left of the table brings up the graph of sour gas feed rate vs H_2S mol% in treated gas as shown in Figure 8. Both the plot and the data may be exported to Excel® for further calculations or reporting needs.
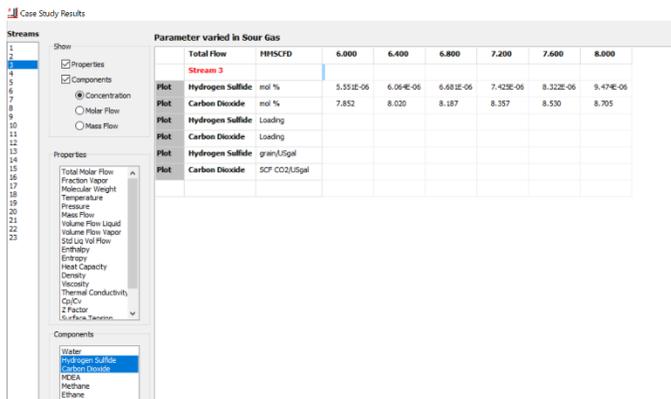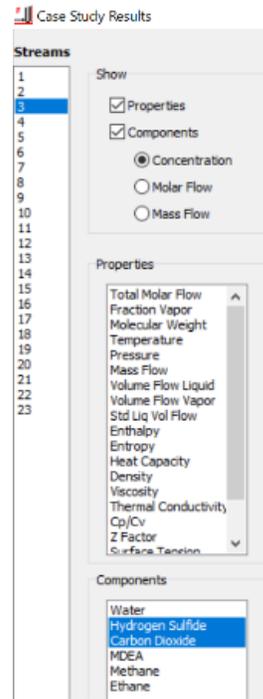

Figure 7. Case Study Results Display

Figure 7a. Stream, Property and Component Selection
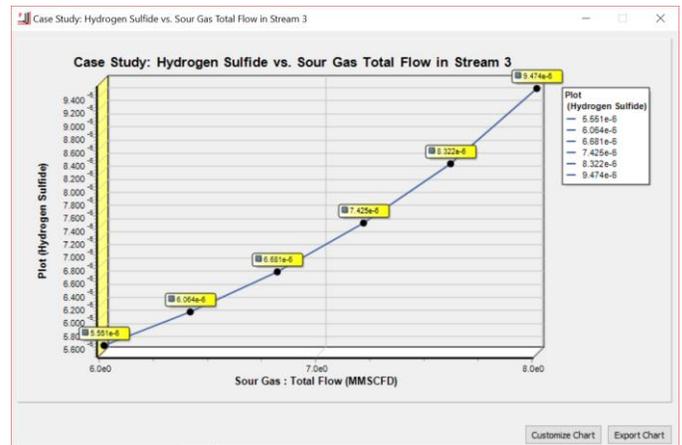

Figure 7b. Results Display Section

Figure 8. Case Study Plotting Feature

PROTIP: Although, only one variable is varied in the flowsheet, the impact on the entire flowsheet can be obtained. Each step of the Case Study is simulated as a separate PTD file, therefore the impact on every stream can be obtained. The PTD files themselves are stored in the file directory you specify, and can also be opened, investigated, or modified for further review.

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