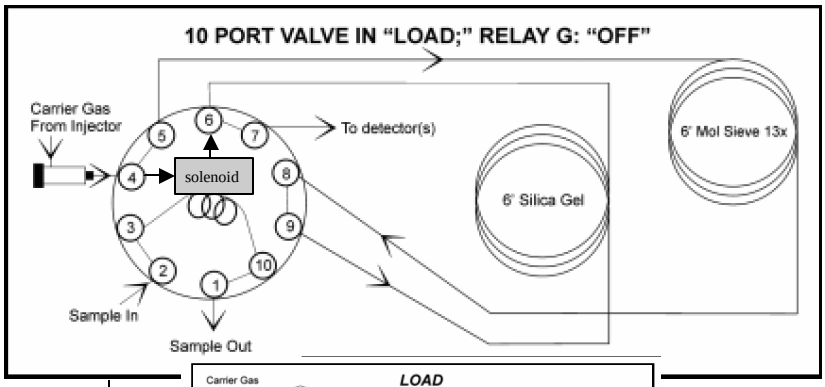
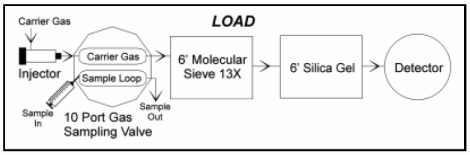
SRI 8610C Gas Chromatograph
Multiple Gas #3 GC configuration

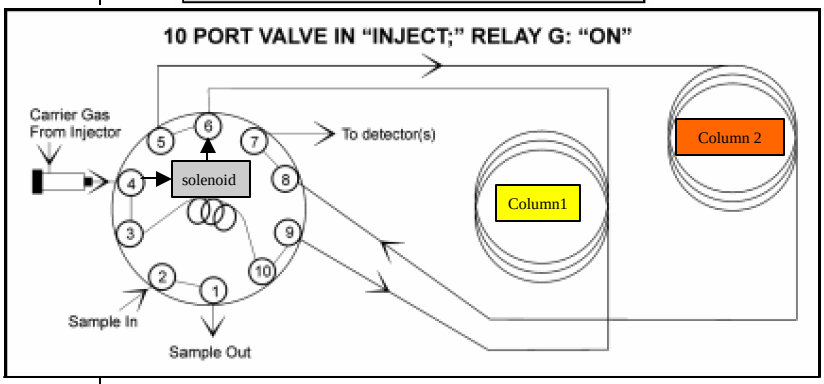
The SRI 8610C Gas Chromatograph Multiple Gas #3 GC configuration is a versatile low cost way of analyzing many different kinds of gas samples. The GC pictured at right has two Multiple Gas #3 (MG#3) configurations implemented in a single GC chassis so there are two gas sampling valves and four columns as well as four detectors. This is why the column oven looks so crowded.

The MG#3 GC configuration is almost identical to the MG#1 GC configuration except there is an additional solenoid valve which when activated by the PeakSimple data system stops the flow of carrier gas in column 1.



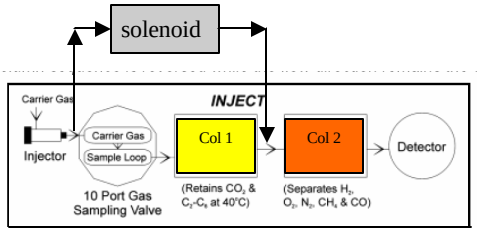
When the solenoid valve is actuated (typically while the gas sampling valve is in the INJECT position), column 1 has the same pressure applied to both its inlet and outlet. This stops the flow of carrier gas in column 1. The peaks which were in column 1 simply stop moving without broadening or distortion.





The flow of carrier gas in column 2 actually increases while the solenoid is actuated since the full carrier gas head pressure is now applied across a shorter restriction (one column instead of two in series).

The MG#3 GC configuration is slightly more flexible than the MG#1 because the stop flow capability allows a wider selection of columns to be used, where the MG#1 only works with silica gel as Column 1 and Mole-Sieve 13X as Column 2.



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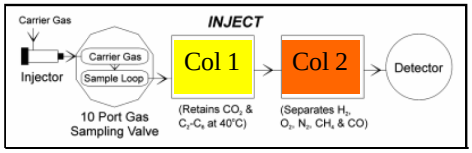
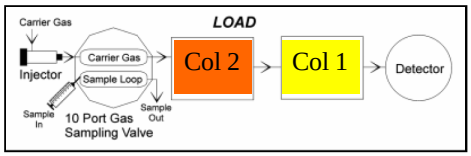
The chromatograms shown on this page are a mix of natural gas and sulfur compounds. The top chromatogram shows the sulfur selective FPD response.
The middle chromatogram shows the FID response.
The two lower chromatograms show the FPD response (black) overlaid with the FID response (red).

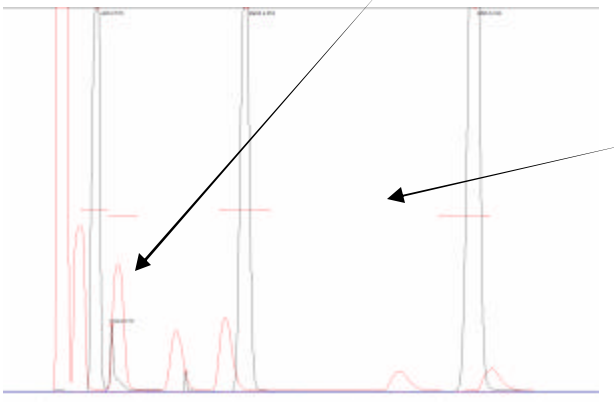
The PeakSimple event table shown at right rotates the valve from Load to Inject at .1 minutes and then back to Load at 1.00 minutes. Because even the first peak (methane) has not migrated from Column 1 though to Column 2 at this time, the equivalent effect is that the

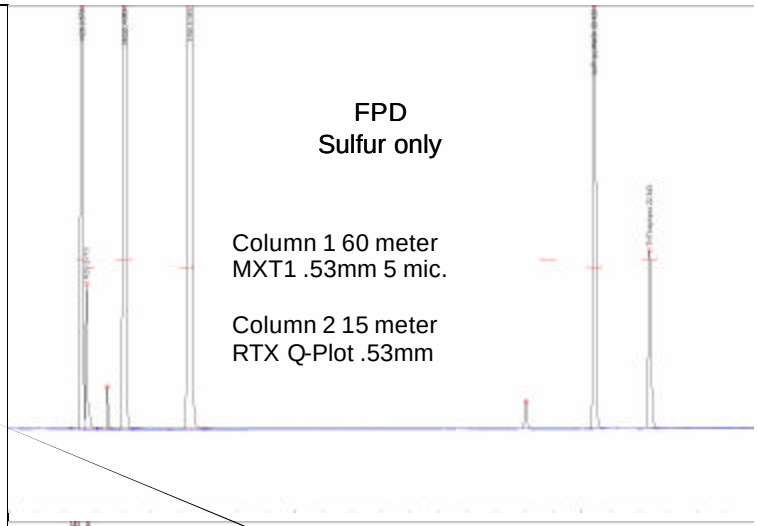


peaks are injected into and are separated by



Column 1 only, as if Column 2 was not even connected. You can see by the overlaid chromatograms that COS co-elutes with Propane quenching its FPD response.

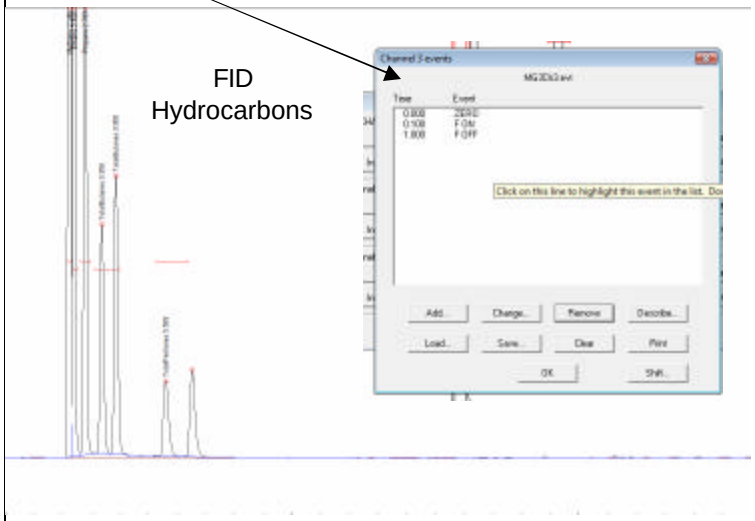




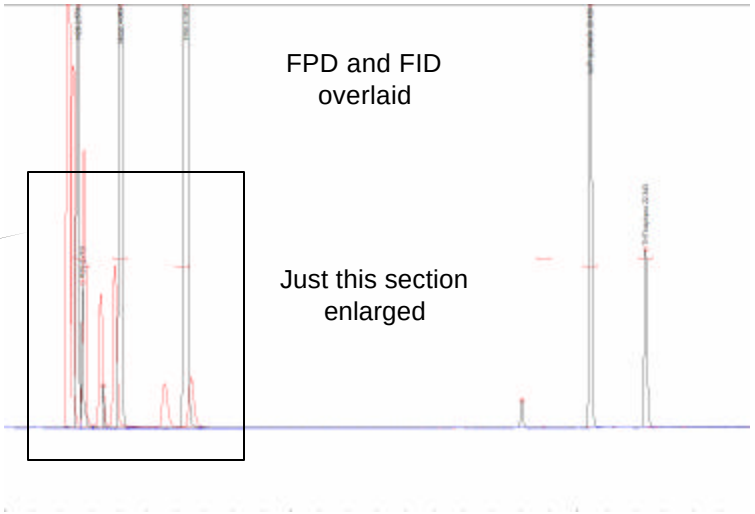
FPD
Sulfur only

Column 1 60 meter
MXT1 .53mm 5 mic.

Column 2 15 meter
RTX Q-Plot .53mm



FID
Hydrocarbons



FPD and FID
overlaid

Just this section
enlarged

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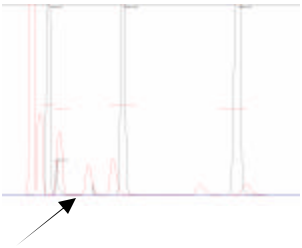
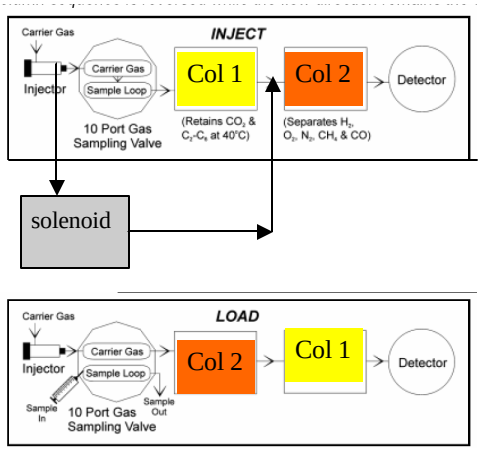
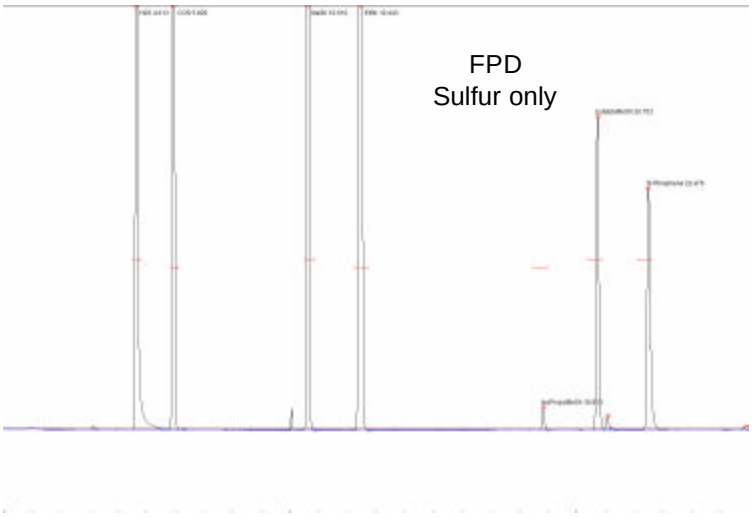
Instead, the MG#3 allows the Stop Flow solenoid to actuate at 3.5 minutes just after the Propane and COS migrate into Column 2 (15meter RTX QPlot .53mm).

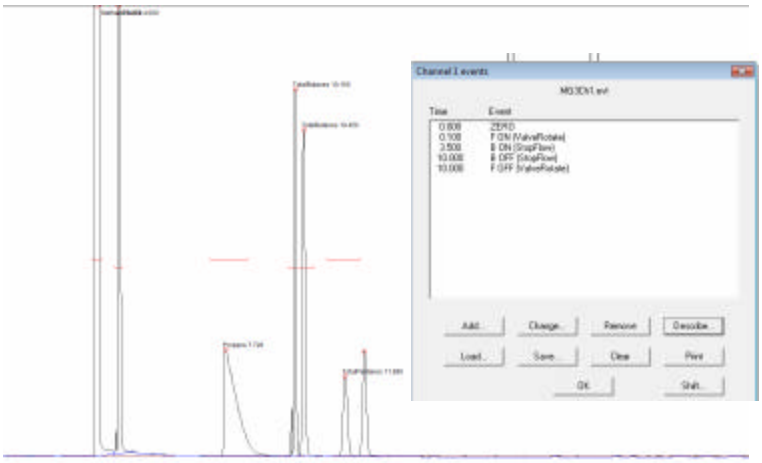




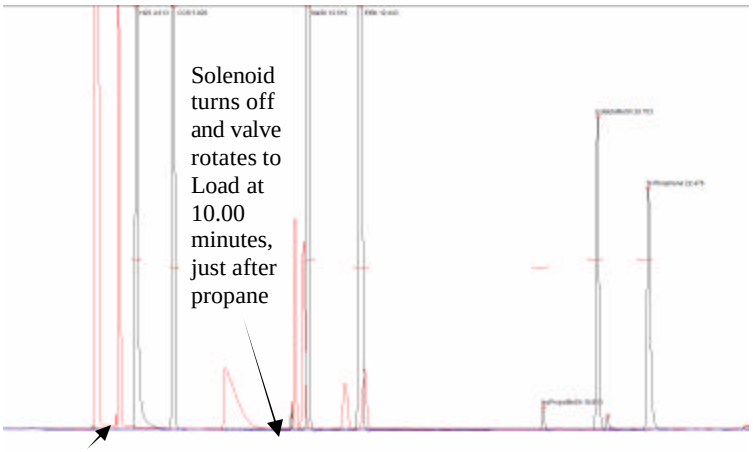
This traps the peaks after Propane in Column 1 while the peaks in Column 2 (Methane, Ethane, Propane, H2S and COS) separate and elute. Unlike column 1 which does not separate COS and Propane, the peaks are well separated on Column 2 so quenching does not occur.

Once Propane elutes from Column 2 (about 10 minutes) the valve rotates back to the Load position and the Stop Flow solenoid is de-energized. The peaks which were trapped on column 1 now elute to the detectors (Butanes, Pentanes, Mercaptans etc.)





Oven temperature 40C for 10 minutes then 20C/min to 200C



Solenoid turns on at 3.5 minutes, stopping flow in Col 1

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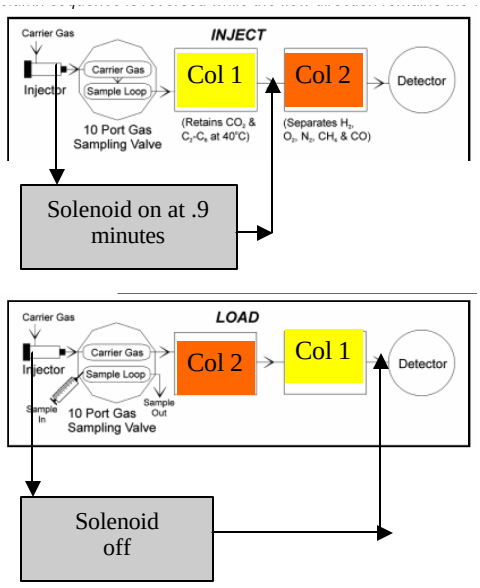
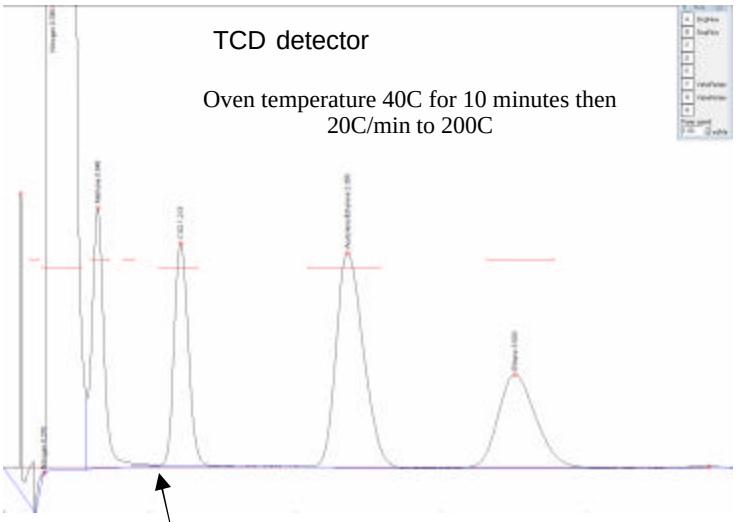
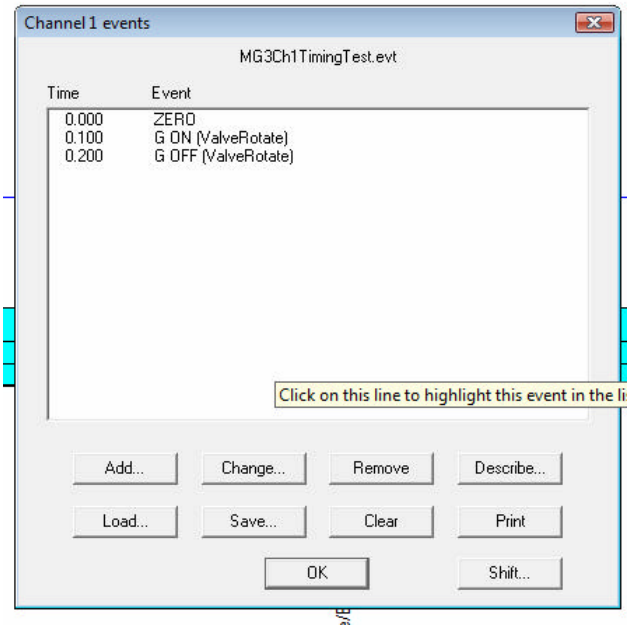
The MG#3 GC configuration is also useful with other column combinations. In this example, Column 1 is a 3' HaysepD and Column 2 is a 6' MS13X. The sample is first run on the 3' HaysepD using the event table shown at right. Because the valve is rotated back to the Load position almost immediately after injection



(.1 minutes) the separation occurs as if Column2 was not even connected. (no hardware changes are required to produce this effect). There is a convenient gap between Methane and CO2 where it would make sense to activate the stop-flow solenoid valve to immobilize the CO2 and heavier peaks in Column1 while the H2, O2, N2, Methane and CO peaks elute from Column1.



This would be a good time (.9 minutes) to activate the stop-flow solenoid. Just after the Methane migrates onto Column2 but before the CO2 and heavier peaks



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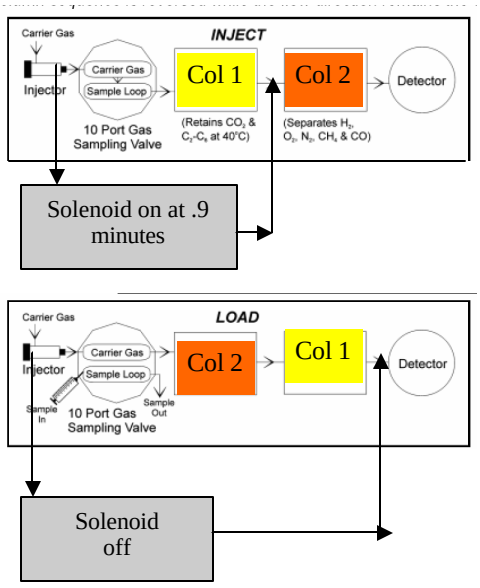
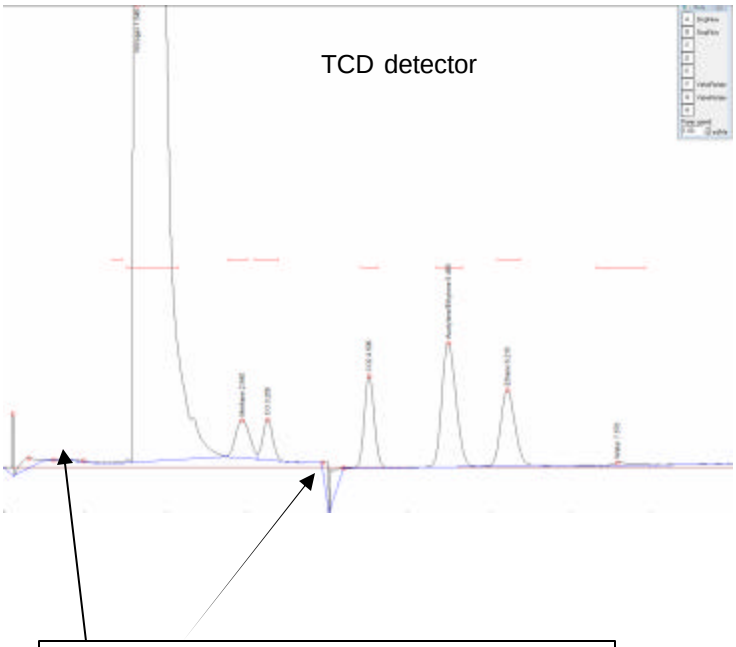
The same sample is injected again using the Event table shown at right. The valve stays in the Load position until 4.00 minutes. The Stop-Flow solenoid is actuated at .9 minutes (determined from the chromatogram on the previous page) and de-activated at 4.00 mintes. This results in H2, O2, N2, CH4 and

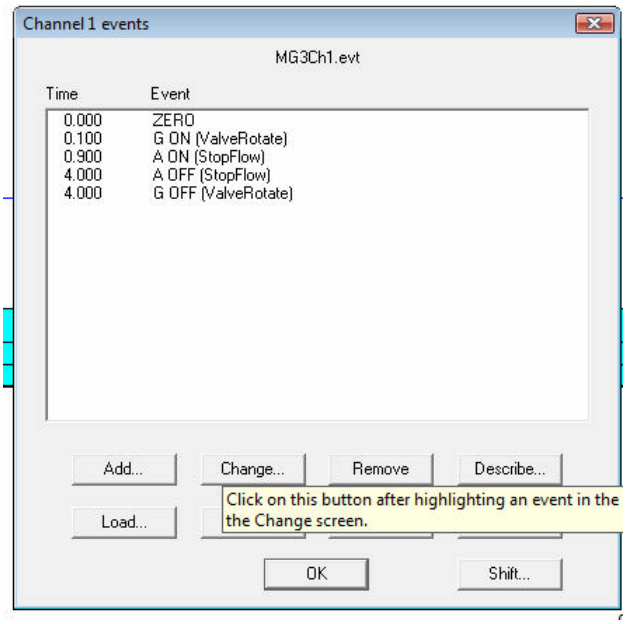


CO migrating onto Column2 (Mole-Sieve13X) where they separate and elute into the TCD detector. Once CO elutes (about 4.00 minutes), the valve is rotated back to the Load position and the Stop-Flow solenoid is de-energized.

The concept of immobilizing peaks by stopping the flow is applicable to many situations and many column combinations, not just the two examples presented here.



Stop-Flow solenoid on at .9 and off at 4.00 minutes.
Valve back to Load position at 4.00 minutes



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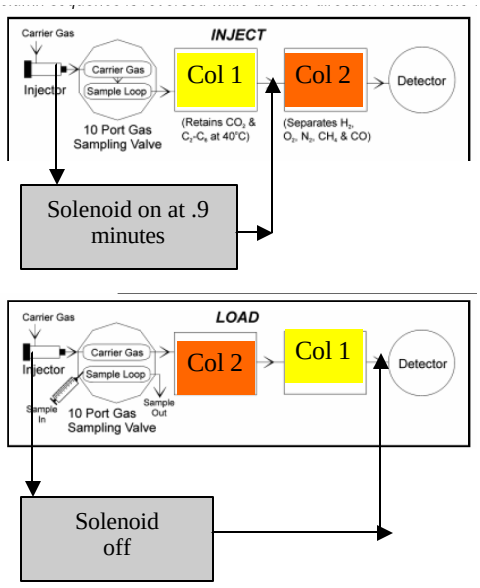
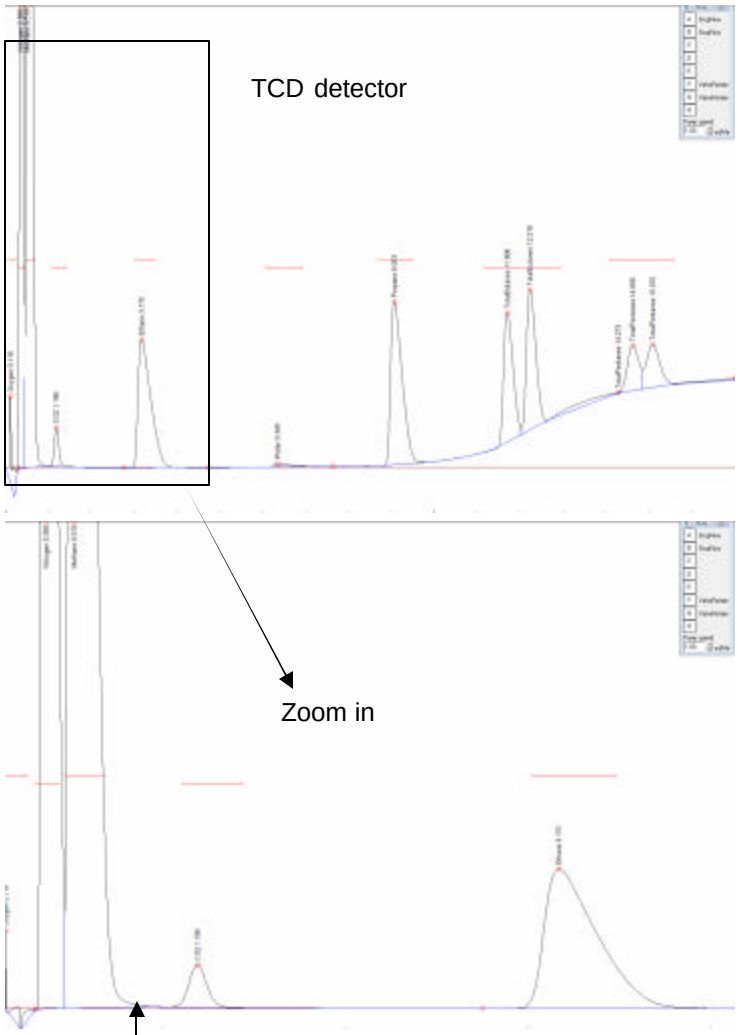
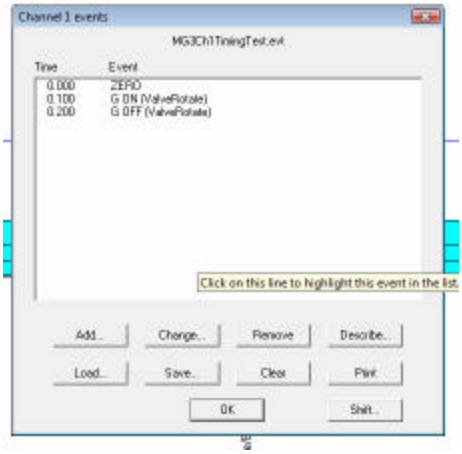
Another example is Natural Gas. Set the Event table up to inject and then immediately rotate the valve back to Load after .1 minutes in the Inject position. This has the effect of performing the analysis as if Column2 was not in the system.



Column 1 is a 3' Haysep D and Column 2 is a 6' MS13X. The Haysep D does not separate Oxygen and Nitrogen or CO. Set the Stop-Flow solenoid time by finding the gap between Methane and CO2, in this case about .9 minutes.



The gap between Methane and CO2 is a good time to actuate the Stop-Flow solenoid



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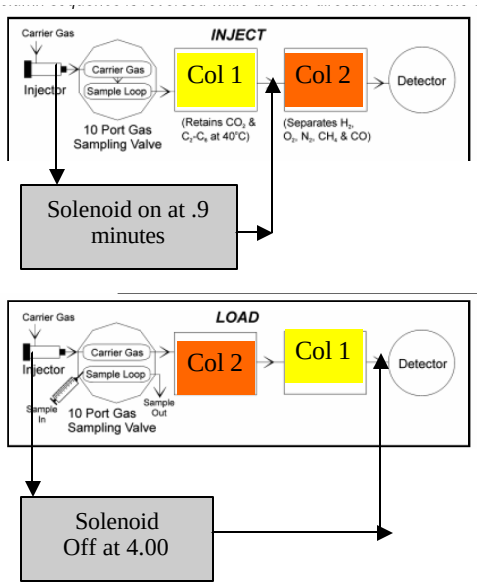
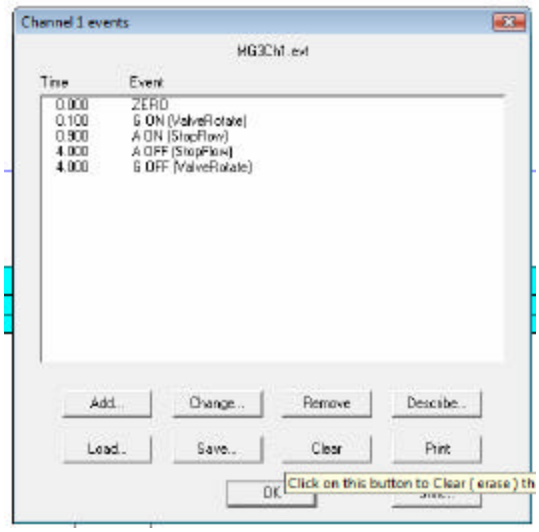
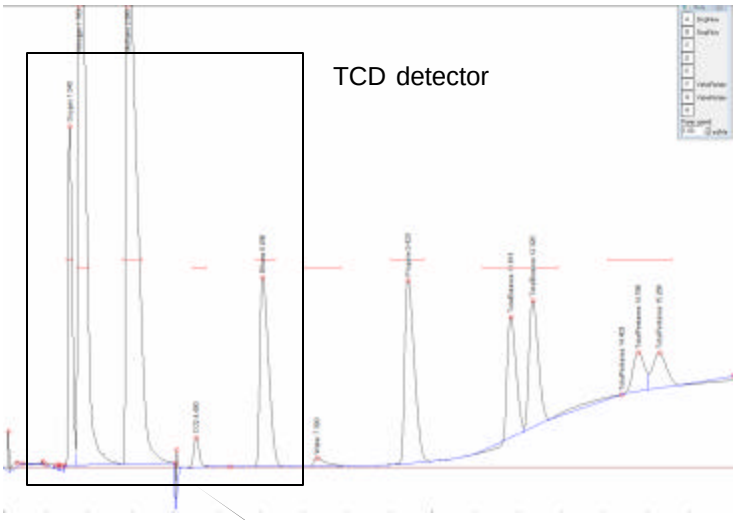
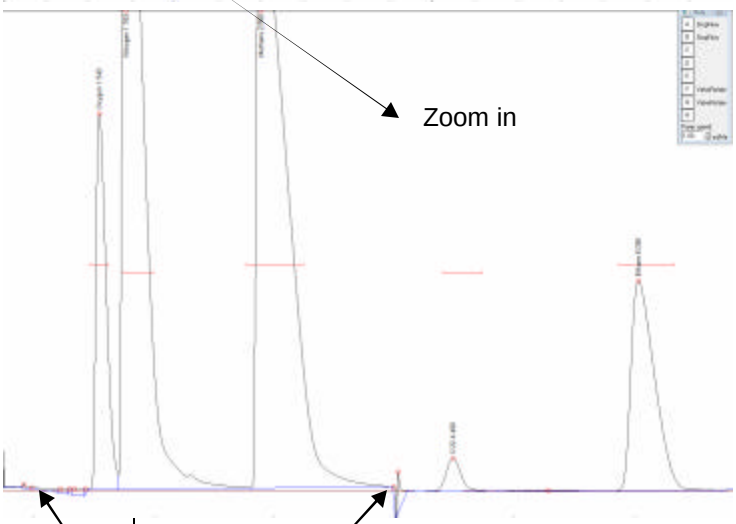
With the Event table modified, the Oxygen, Nitrogen and Methane separate on the MS13X. Then the Stop-Flow solenoid is de-energized and valve rotated back to Load position (both at 4.00 minutes) and the remaining peaks (Ethane, Propane, Water, Butanes, and Pentanes) which were immobilized on the



Haysep D (column 2) elute normally.







The Stop-Flow solenoid is actuated at .9 minutes and de-energized at 4.00 minutes. The valve is rotated back to Load also at 4.00 minutes