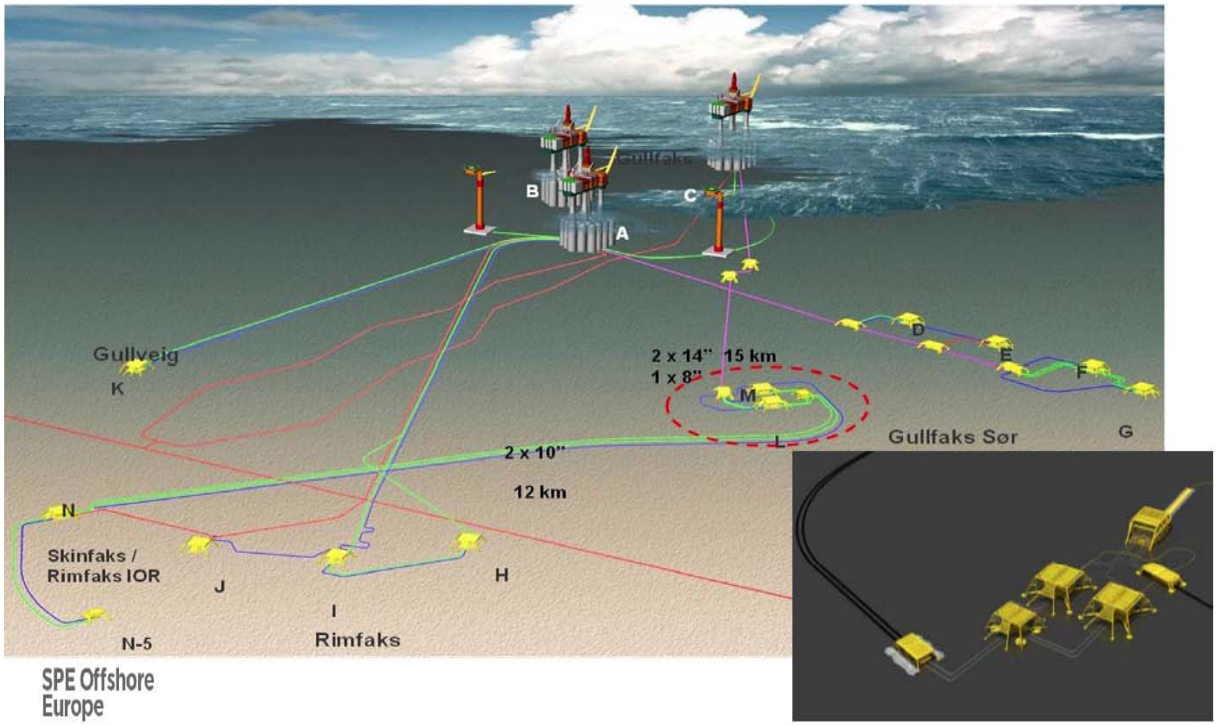
Draft: Exercise set 05

Problem 1: Determining operating conditions of the separator train of Gullfaks South.

Gullfaks South (GFS) is a group of subsea wells that are tied-back to the Gravity-Based platform Gullfaks C (GFC). Wells were initially completed in the oil layer, but due to depletion and high GOR, they have been recompleted in the gas layer. The production will be boosted with a subsea Wet Gas compressor (WGC). The field is expected to produce around 7 E06 Sm^3/d of gas for 10 years.



The separator train in GFC has three stages, and its operating conditions are presented in the table below.

Separator stage	pressure, p	Temperature
[-]	[bara]	[C]
1	65	70
2	20	65
3	2	60

Task 1: You have been asked to create a simple model of the processing facilities in Hysys (Use the Peng-Robinson EoS). You have to use just three separators. Place coolers between the stages to take the fluid to the specified pressure and temperature conditions. Take the separated oil and gas streams to standard conditions (with a cooler) to report the GOR (gas oil ratio). Plot the phase envelope of the fluid stream from the field and the phase envelopes of the oil and gas leaving the high pressure separator.

The composition of the fluid stream for 3 different years is given below (Estimated using a compositional reservoir simulator):

Time [year]	**0**	**5**	**12**
Name	**Zi**	**Zi**	**Zi**
Nitrogen	0.002421	0.002427	0.002437
CO2	0.015738	0.015872	0.015933
Methane	0.868644	0.878342	0.881809
Ethane	0.055993	0.056563	0.056763
Propane	0.021186	0.021270	0.021291
i-Butane	0.002926	0.002865	0.002850
n-Butane	0.006457	0.006360	0.006305
i-pentane	0.002018	0.001879	0.001832
n-pentane	0.002623	0.002402	0.002326
n-hexane	0.003228	0.002672	0.002470
n-heptane	0.002320	0.001659	0.001418
n-octane	0.002421	0.001445	0.001092
n-nonane	0.001816	0.000906	0.000583
n-decane	0.012207	0.005337	0.002892

Task 2: Your colleagues have been arguing that if the second stage separator is changed, this will increase significantly the condensate recovery from the field (This, however, entails a heavy investment and modifications to the topside facilities). To assess these claims, use the Hysys model and vary the pressure of the 2nd stage separator from 64-3 bar. Plot the GOR of the field vs the pressure of the second stage.

Task 3: How are your results affected by the pressure of the 1rst stage separator? Repeat your analysis for 75 bara and 55 bara.