Example 3: Mass-Balance Only with One Constraint/Target (or Design-spec)

Now let's learn about the Design-Specification (Design-spec) feature in A+ to solve simulation problems that contain design targets, such as product flow, product purity, and component flow rate in an intermediate stream.

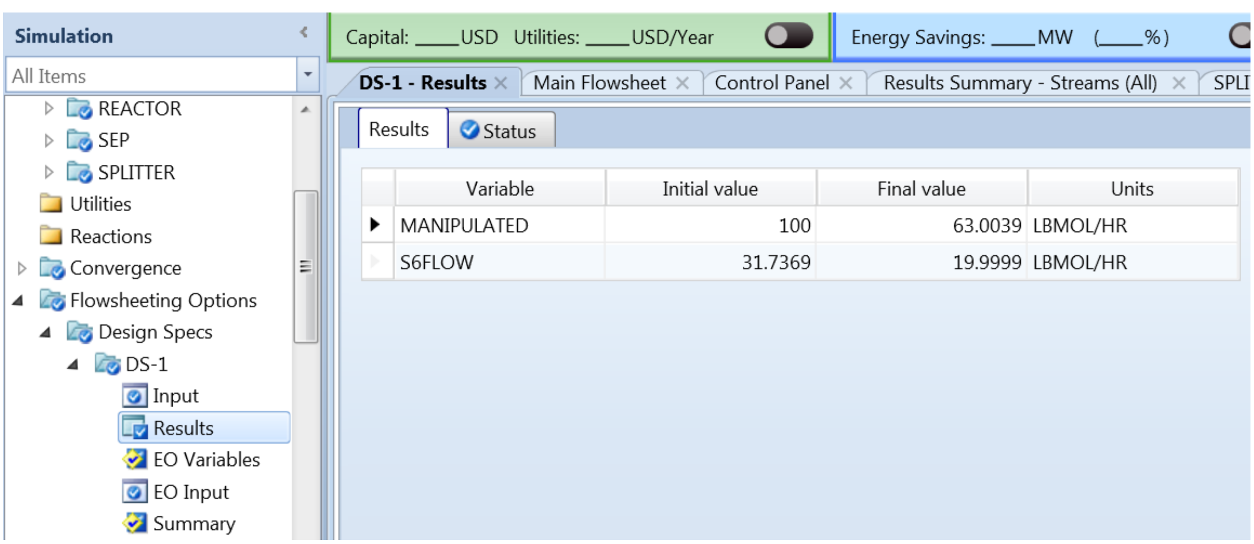
Notice that the total flow rate of S6 which leaves the process is 31.74 lbmol/hr. Suppose we like to fix this flow rate (target) at 20 lbmol/hr. This flow specification is a constraint which means that we must free up one input in the process to achieve this target. So we examine the process and identify the input parameters that affect the S6 total flow rate. One of them is the process feed flow rate of S1.

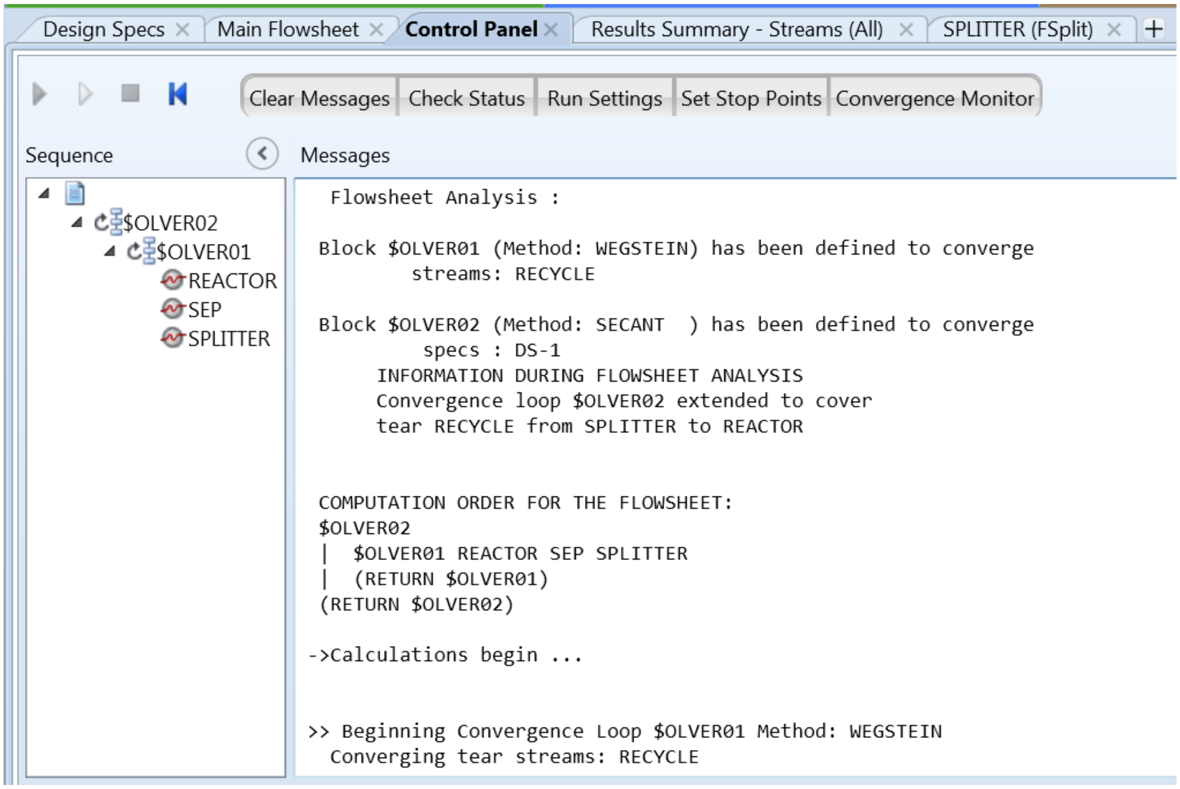
As a result, we need to set up a Design-Spec in A+ to:

1. Vary the total feed flow rate of S1 by specifying a range for A+ to adjust (50 – 200 lbmol/hr) while keeping the composition constant.
2. Specify the target/constraint to be a total flow of 20 lbmol/hr for S6.
3. Specify the tolerance of the target (plus/minus).

Points to observe:

1. Notice that there are now 2 convergence blocks, called $OLVER01 and $OLVER$02, created by A+ to converge the tear stream and the design-spec, respectively.
2. The Control Panel the tear stream loop being nested inside the design-spec loop.
3. The total number of iterations for the design-spec loop is 8.
4. The process feed flow (S1) was found to be 63.0039 lbmol/hr.





		S1	S2	S3	S4	S6	RECYCLE
From			REACTOR	SEP	SEP	SPLITTER	SPLITTER
To		REACTOR	SEP	SPLITTER			REACTOR
Stream Class		CONVEN	CONVEN	CONVEN	CONVEN	CONVEN	CONVEN
Average MW		22.618092	23.329181	23.578246	22.170921	23.578246	23.578075
Mole Flows	lbmol/hr	63.003908	243.00548	199.99902	43.006459	19.999902	180.00157
CH4	lbmol/hr	25.201563	66.325429	59.692886	6.6325429	5.9692886	53.724647
O2	lbmol/hr	31.501954	6.3003908	0	6.3003908	0	0
CO2	lbmol/hr	0	86.903182	82.558023	4.3451591	8.2558023	74.3024
H2O	lbmol/hr	0	25.663507	0.5132701	25.150237	0.051327	0.4619442
H2	lbmol/hr	6.3003908	57.81297	57.234841	0.5781297	5.7234841	51.51258
Mole Fractions							
CH4		0.4	0.272938	0.2984659	0.154222	0.2984659	0.2984677
O2		0.5	0.0259269	0	0.1464987	0	0
CO2		0	0.3576182	0.4127921	0.101035	0.4127921	0.4127875
H2O		0	0.1056088	0.0025664	0.5848014	0.0025664	0.0025663
H2		0.1	0.2379081	0.2861756	0.0134429	0.2861756	0.2861785
Mass Flows	lb/hr	1425.0282	5669.1188	4715.626	953.49282	471.5626	4244.0906