MANCHESTER 1824
The University of Manchester

COLOM Overview

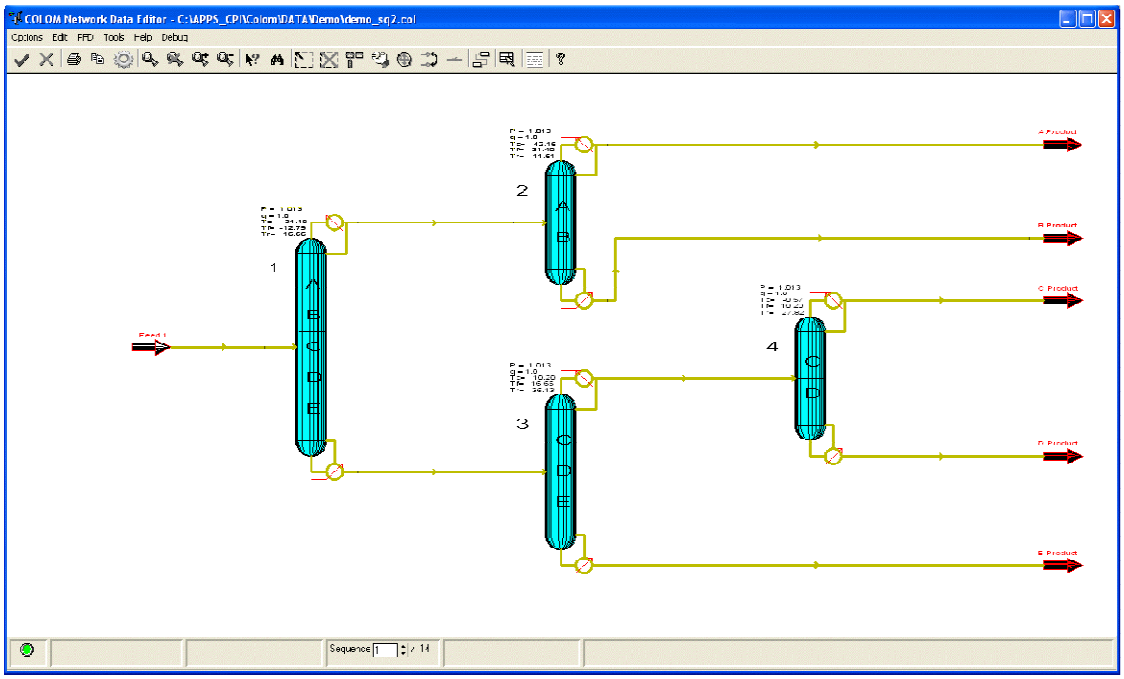
COLOM is the software package used for the design of distillation systems.
Physical property calculations can be carried out using its own facilities or through an interface to simulation software packages.
Sequences of simple or complex columns can be screened and optimised.
Simple columns (including sloppy separations), prefractionators, side-strippers, side-rectifiers and fully thermally coupled (Petlyuk and dividing wall) columns can all be studied. **COLOM** identifies the most appropriate combination of these for a given separation problem. Complex column designs that use stripping steam can also be studied. The energy integration implications of any given design can be investigated. **COLOM** also has facilities for the sequencing of distillation systems for azeotropic mixtures.

The thermodynamic efficiency of individual columns can be investigated through temperature-enthalpy and temperature-exergy profiles. These can be used for optimising feed condition and for improving efficiency through the use of inter reboiling and condensing. Debottlenecking for increased capacity can be carried out using hydraulic analysis.
Issues addressed by **COLOM** include:

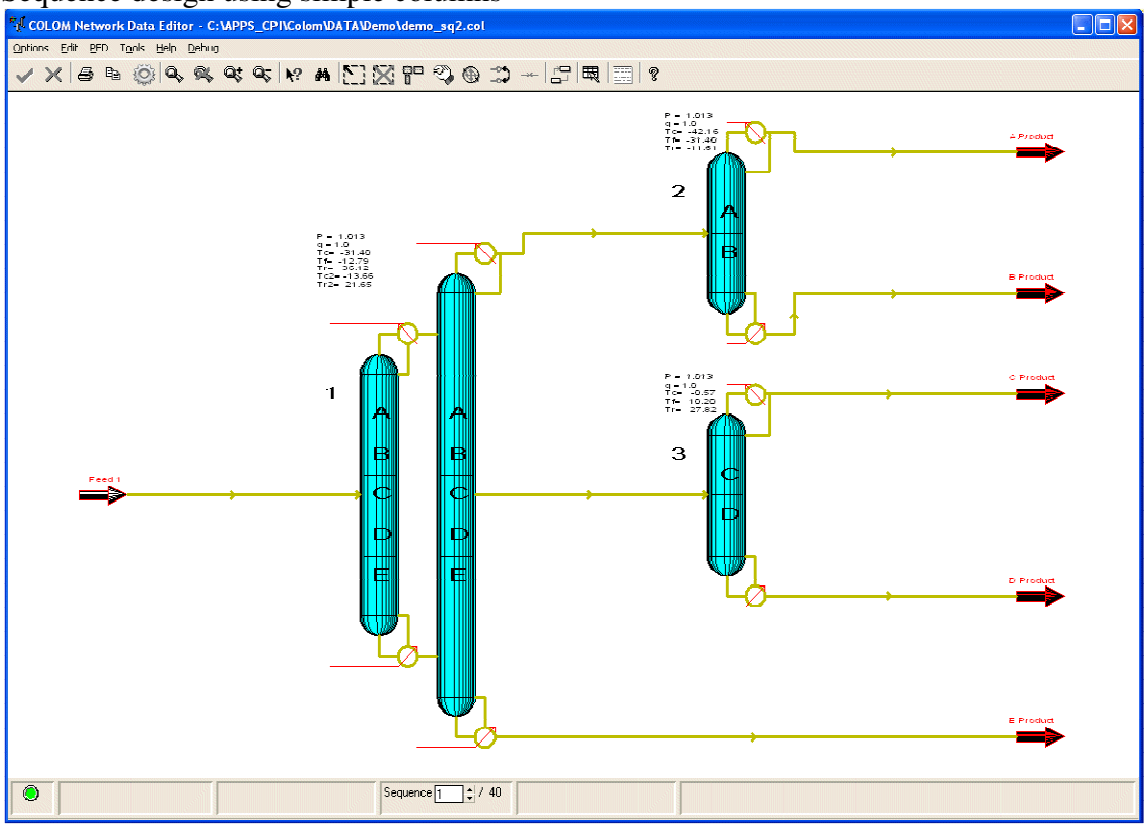
- Sequencing of simple distillation columns
- Sequencing of complex column arrangements
- Simultaneous optimisation of pressure with configuration
- Analysis of steam stripping columns
- Heat integration of distillation sequences
- Generation of residue curves, distillation lines and pinch point curves
- Sequencing of azeotropic distillation systems (homogeneous and heterogeneous) • Generation of temperature-enthalpy profiles
- Generation of temperature-exergy profiles
- Retrofit for increased throughput

Distillation System Design

COLOM can be used to screen sequences of simple and complex columns. The software identifies the most appropriate arrangement of simple columns (including sloppy separations), side strippers, side rectifiers, prefractionators, and fully thermally coupled (Petlyuk and dividing wall) columns. Column pressures are optimised simultaneously with configuration. Optimisation can be based on vapour load, energy consumption or utilities costs. This unique facility within COLOM allows novel distillation system designs to be identified and the interactions between the design of the distillation system and the utility system servicing it to be examined, together with the sensitivity of the design to changes in feedstock, etc.



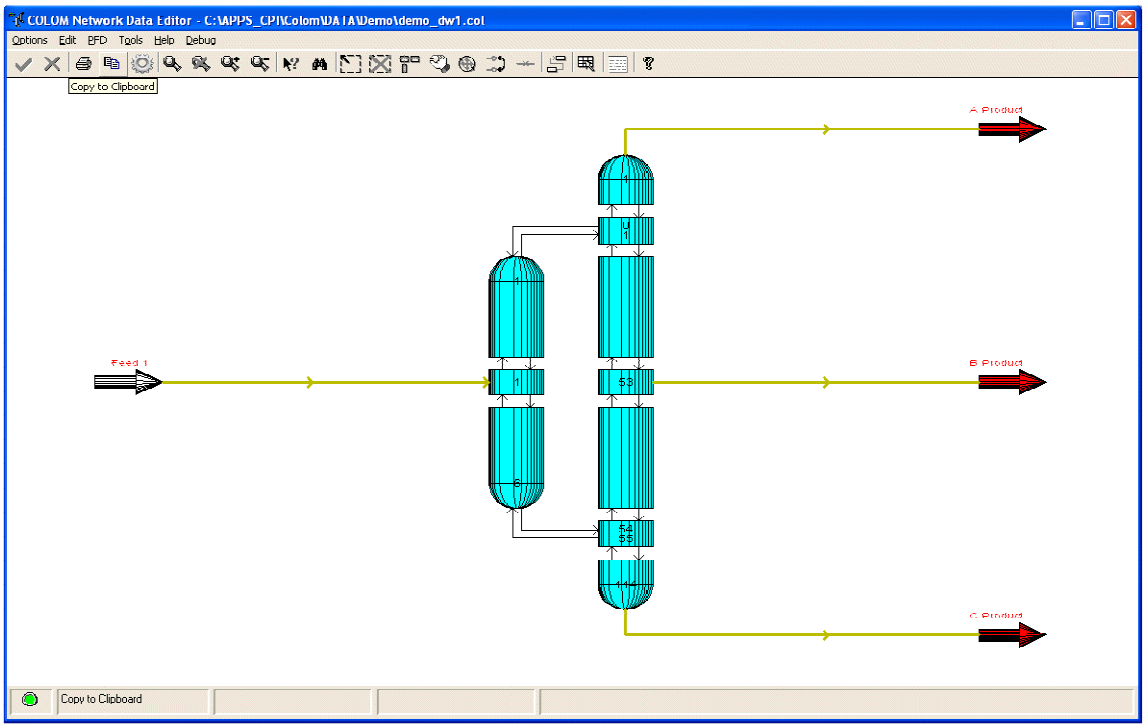
Sequence design using simple columns



Sequence design using simple and complex columns

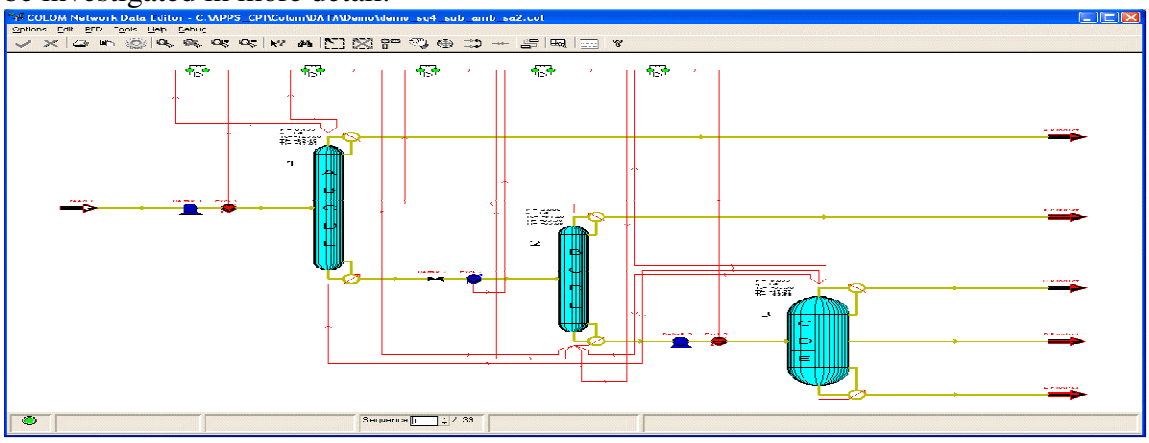
Dividing Wall Distillation

Dividing wall distillation feature additional degrees of freedom when compared with a conventional distillation. **COLOM** provides a facility to optimise these degrees of freedom to scope and screen design options and to initialise rigorous simulation.



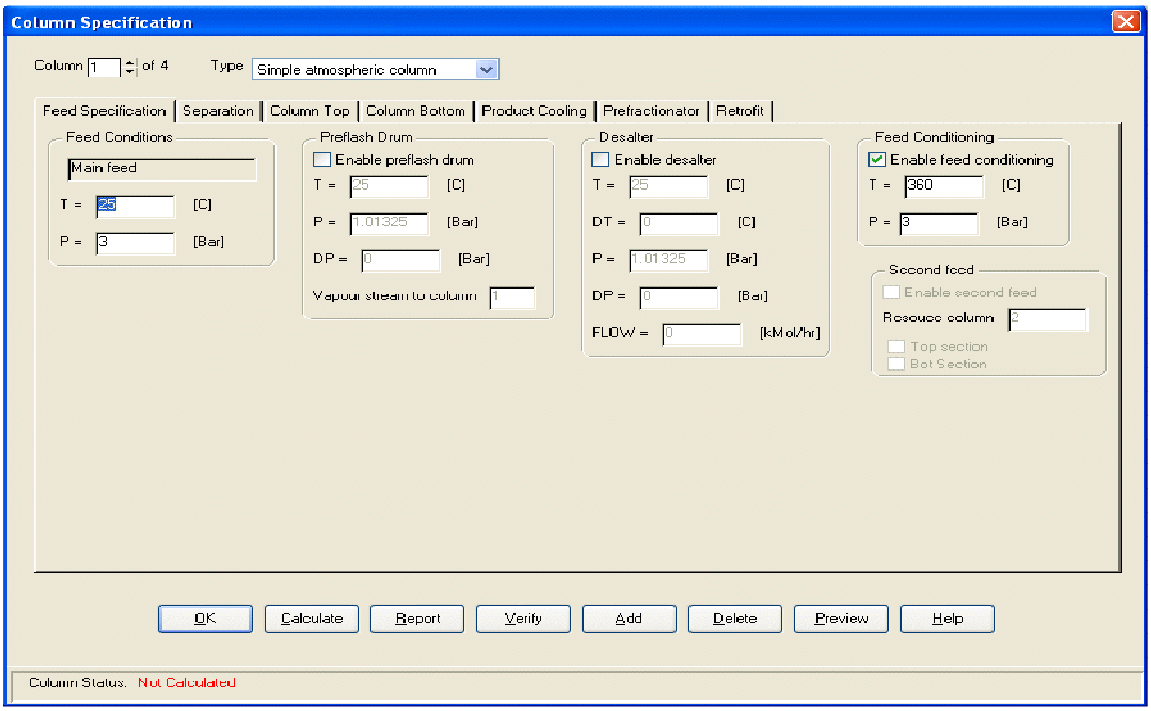
Heat Integration of Column Sequences

The energy integration implications of any given design can be considered within **COLOM**. Alternatively, **COLOM** can export data for the reboilers and condensers of a sequence to **STAR** or **SPRINT** so that the heat integration of a given sequence can be investigated in more detail.



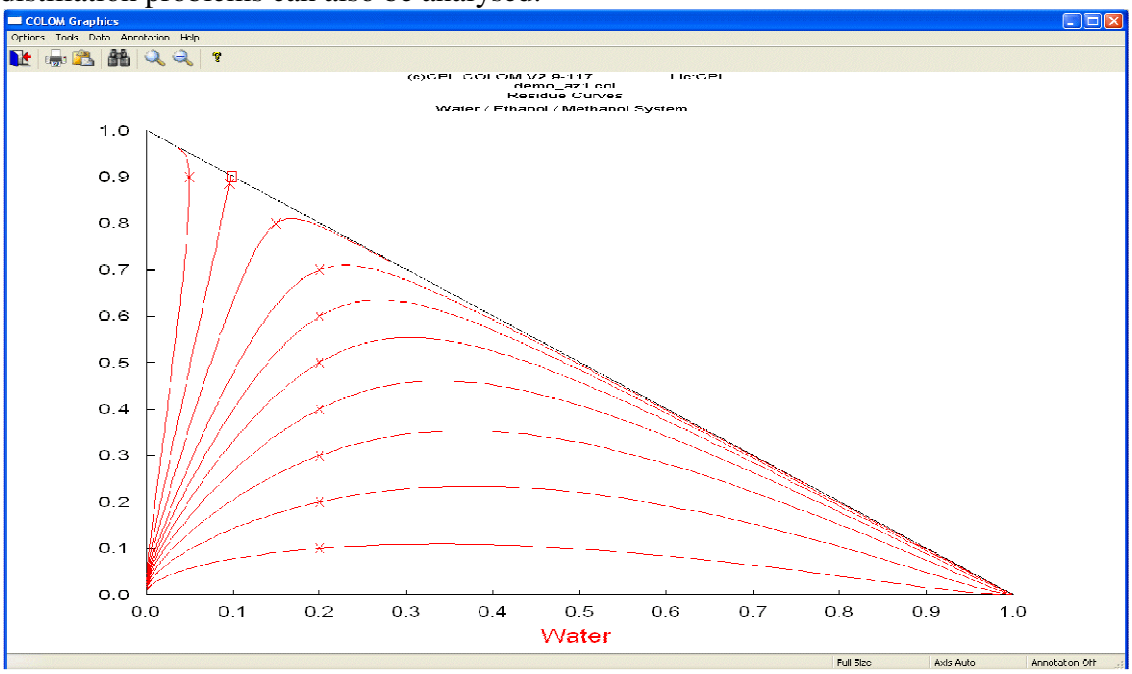
Steam Stripping

Stripping steam is widely used in petroleum refinery distillation. This presents important degrees of freedom to be optimised in the design. **COLOM** has facilities to allow these degrees of freedom to be explored and optimised to produce novel configurations.

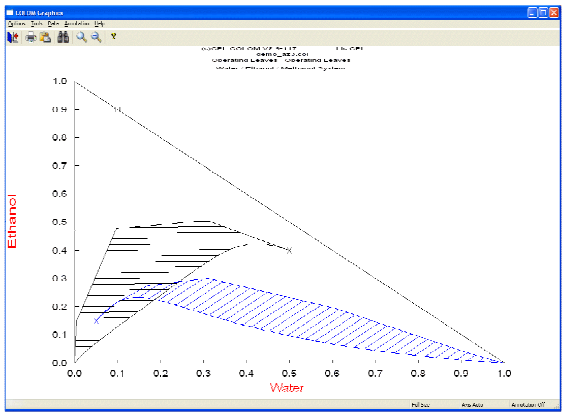


Azeotropic Distillation

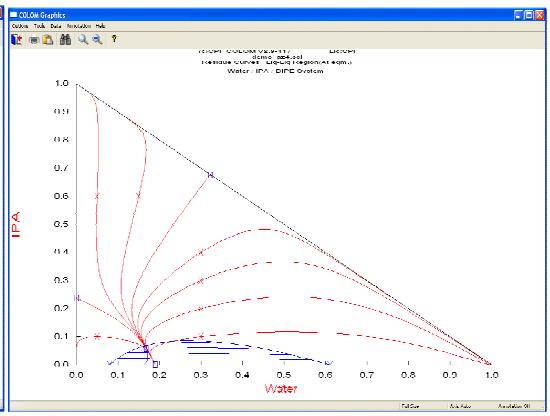
Azeotropic mixtures are most often separated in distillation by adding an entrainer. Residue curves, distillation lines (staged column at total reflux) and pinch point curves (minimum thermodynamic condition) can be plotted for any composition to produce the operating leaf which shows the feasible regions of the separation. Both homogeneous and heterogeneous systems can be considered. **COLOM** allows all curves to be plotted for equilibrium or for non-equilibrium conditions. Extractive distillation problems can also be analysed.



Residue curve maps



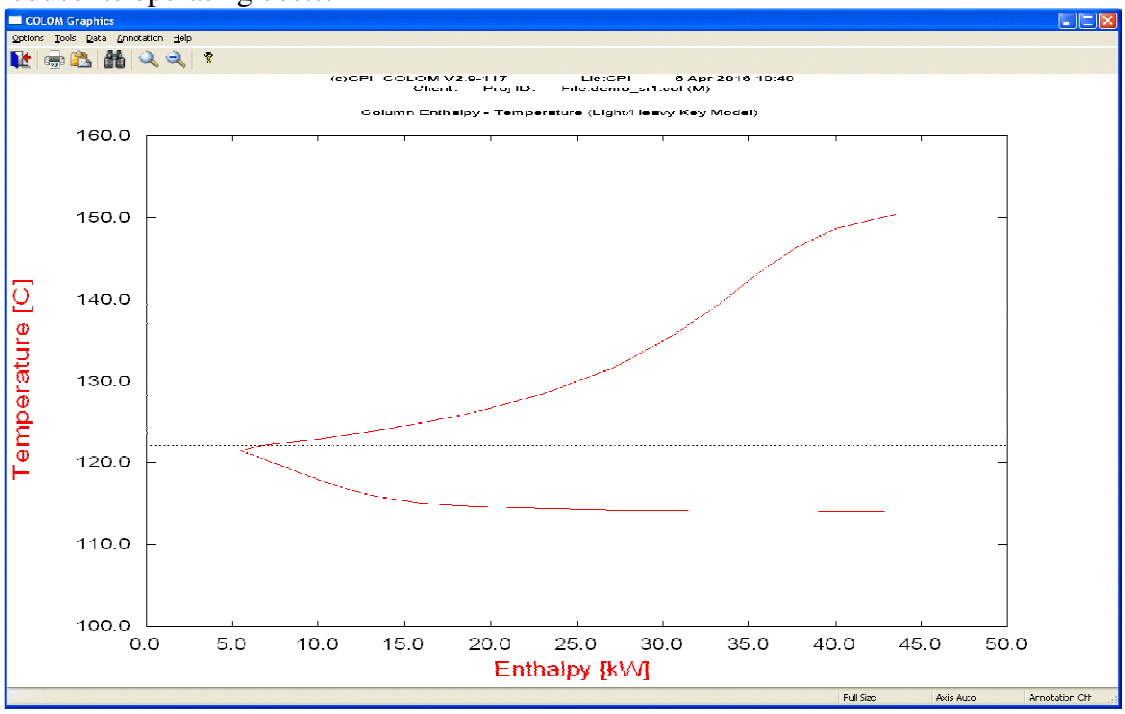
Operating leaves



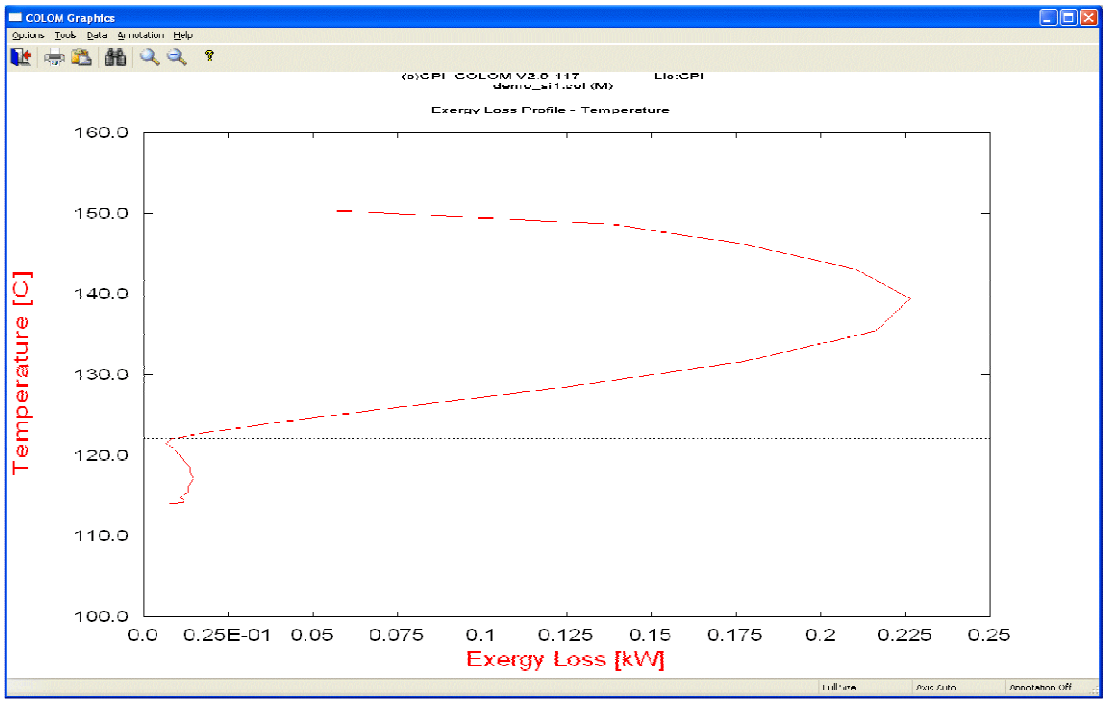
Residue curves with liquid-liquid region

Enthalpy and Exergy Profiles

COLOM can generate temperature-enthalpy profiles for a distillation column. The resulting profile can be used to assess the scope for inter-reboiling and inter-condensing. Two methods are available in **COLOM**. The first uses the results from a column simulation to generate a reversible column profile. The second method generates a column profile that has minimum heat and mass transfer driving forces included in its construction. The exergy loss profile presents the driving force distribution in the column and can be used to identify column modifications such as feed conditioning and side reboiling/condensing. The exergy profile directs modifications to improve the thermodynamic efficiency of the column and hence reduce its operating costs.



Temperature – Enthalpy profile for a column



Temperature –Exergy profile for a column

Retrofitting for Increased Throughput

Distillation columns are often the bottleneck when increased throughput is required in a process. **COLOM** incorporates a hydraulic analysis that allows column bottlenecks to be identified and options explored for increased throughput.