

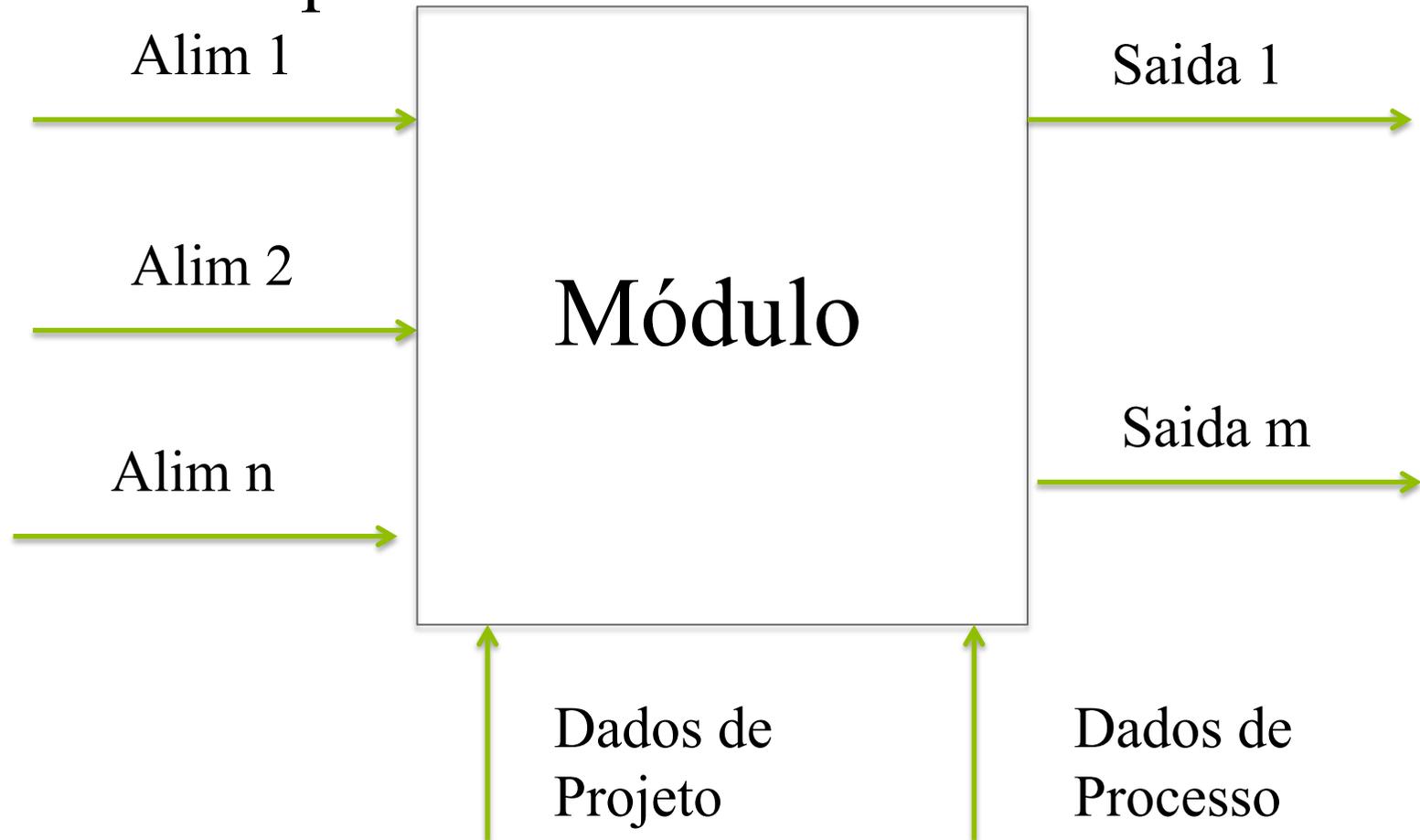
# Aula 3

## Trocadores de Calor e Flash

# TROCADORES DE CALOR

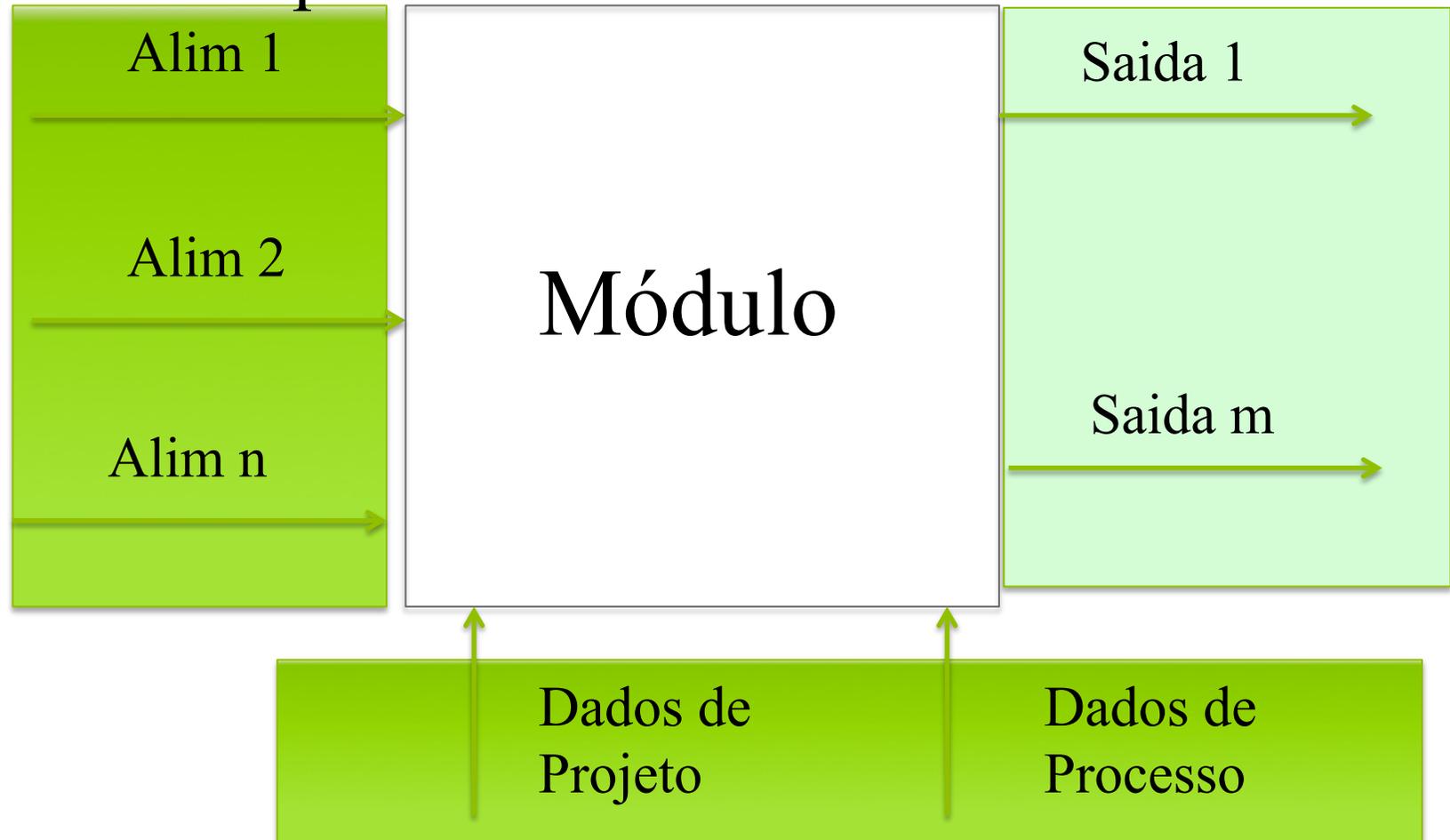
# Simulador Modular

- Princípio



# Simulador Modular

- Princípio



# Outline

- Correntes Materiais
- Trocadores de Calor
  - Simples - Heater
  - Entre correntes - HeatX

# Corrente Material

- Regra das fases de Gibbs

$$F = NC - NP + 2$$

- Estabelece graus de liberdade para variáveis intensivas, em sistemas em equilíbrios
- Corrente Material:

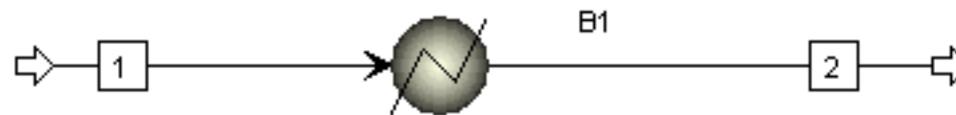
$$G.L. = NC + 2$$

sendo no máximo F variáveis intensivas

# Trocadores de Calor - Simples

## HEATER

Representa um sistema de aquecimento simplérrimo



Eqs:  $BM_s + BE = C + 1$

Incognitas :  $C + 2 + 1 (Q)$

GL: 2

# HEATER

Start Page x Main Howsheet x B1 (HeatX) x Control Panel x STR1 (MATERIAL) - Results x **b2 (heater)**

Specifications Flash Options Utility Information

Flash specifications

Flash Type: Temperature

Pressure

Temperature: C

Temperature change: C

Degrees of superheating: C

Degrees of subcooling: C

Pressure: bar

Duty: cal/sec

Vapor fraction:

Pressure drop correlation parameter:

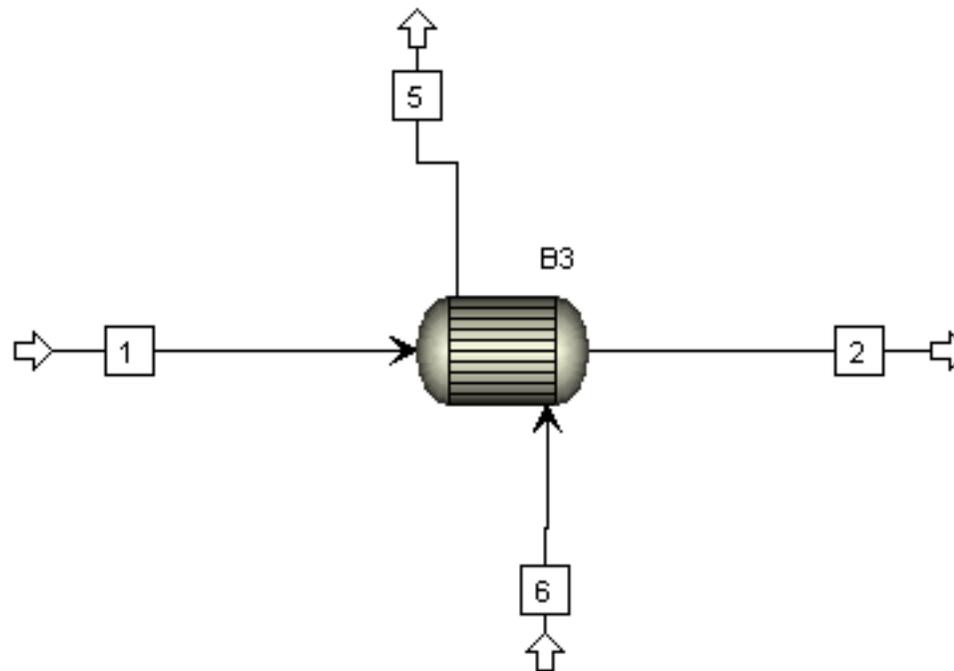
Valid phases

Vapor-Liquid

Duas especificações ...

Flash? Sim Flash, mas não separa as correntes

# Trocador - HeatX



Dois lados: quente e frio  
3 formas de utilização principais

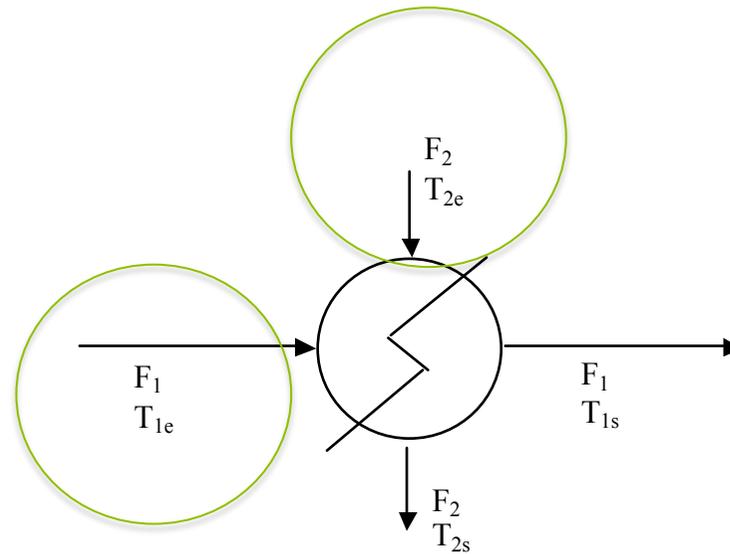
# Trocador - HeatX

The screenshot displays the 'Specifications' tab of the HeatX software. The interface is organized into several sections:

- Calculation:** Includes radio buttons for 'Shortcut' (selected), 'Detailed', and 'Rigorous'. Below these is a dropdown menu set to 'Size Shell&Tube' and a checkbox for 'Use Design Template File'.
- Flow arrangement:** Features dropdown menus for 'Hot fluid', 'Flow direction' (set to 'Countercurrent'), and 'No. shells in series' (set to '1'). A checkbox for 'Calculate number of shells' is present.
- Rigorous Model:** Includes radio buttons for 'Shell&Tube', 'AirCooled', and 'Plate', along with a 'Transfer UA to shortcut' button.
- Exchanger specification:** Contains dropdown menus for 'Specification' (set to 'Hot stream outlet temperature'), 'Value' (set to '70'), and 'C' (set to 'C'). It also includes fields for 'Exchanger area' (set to '10' and 'sqm'), 'Constant UA' (set to 'cal/sec-K'), and 'Minimum temperature approach' (set to '1' and 'C').

Usos diferentes: Simulation, design, rating  
À esquerda: Shortcut, detailed, ...

# Trocador – HeatX



# Trocador – HeatX

## Design + Shortcut:

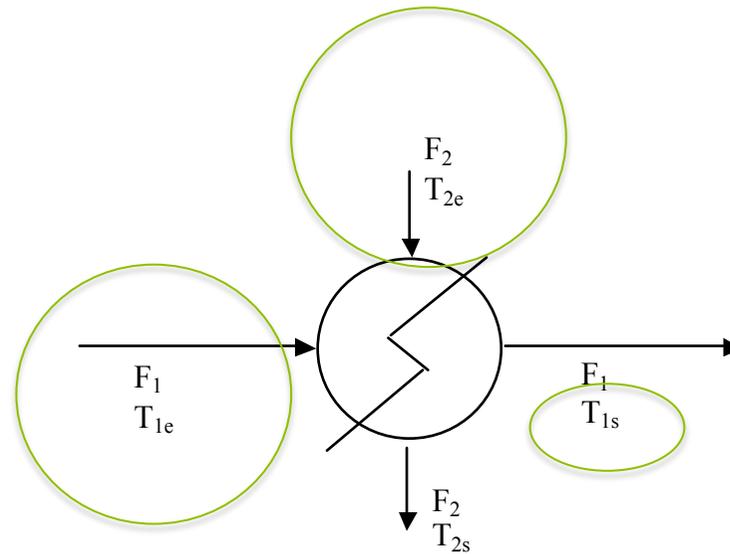
$$\begin{array}{ll} \text{Eqs: BMs lado frio:} & \text{NC} \\ \text{BMs lado quente:} & \text{NC} \\ \text{BE} & 1 \\ \text{Total} & = 2 \text{ NC} + 1 \end{array}$$

Incongnitas:  $2 \text{ NC} + 4$

GL: 3

# Trocador – HeatX - Design

**Design + Shortcut:**



1 especificação de saída, mais dois  $\Delta P$

Da equação  $Q = UA \Delta T_{LM}$ , calcula-se  $UA$

# Trocador – HeatX - Simulation

Simulation + Shortcut:

The screenshot displays the HeatX simulation software interface with the following settings:

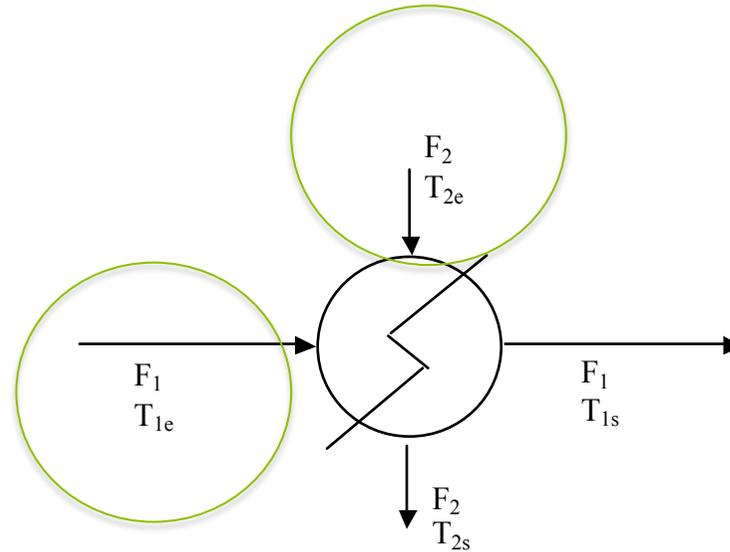
- Specifications:** Selected
- Calculation:** Shortcut (selected), Detailed, Rigorous. Sub-option: Size Shell&Tube.
- Flow arrangement:** Hot fluid: (empty), Flow direction: Countercurrent, No. shells in series: 1.  Calculate number of shells.
- Rigorous Model:** Shell&Tube, AirCooled, Plate. Button: Transfer UA to shortcut.
- Exchanger specification:** Specification: Hot stream outlet temperature, Value: 70 C, Exchanger area: 10 sqm, Constant UA: (empty) cal/sec-K, Minimum temperature approach: 1 C.
- Other tabs:** Streams, LMTD, Pressure Drop, U Methods (selected), Film Coefficients, Utilities, Information.

# Trocador – HeatX - Simulation

## Simulation + Shortcut:

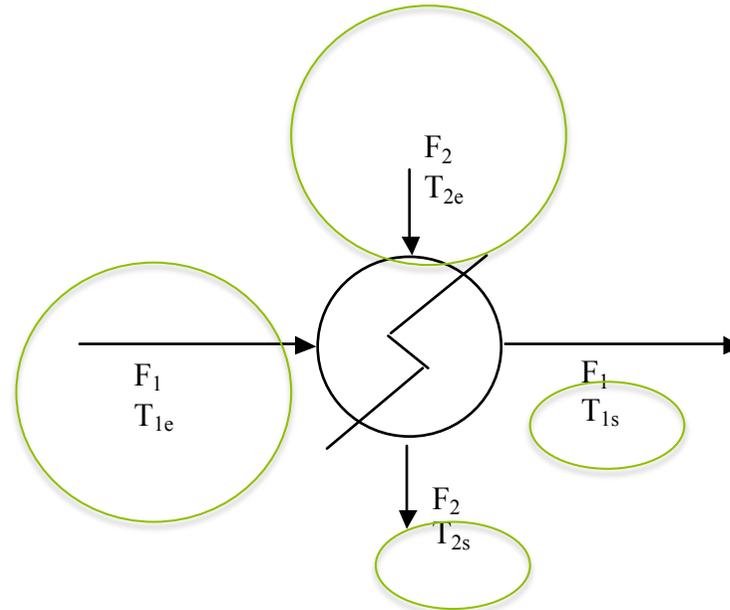
Tem que se fornecer  $\Delta P$

Tem que fornecer UA ou um meio de calculá-lo



# Trocador – HeatX - Rating

Rating+ Shortcut:



# SEPARADORES SIMPLES

# Outline

- Separador Matemático
  - Sep
- Flash

# Separador Matemático

Separa uma corrente em duas. Módulo Sep e Sep2.

NC balanços de massa

1 balanço de energia

$(N_s - 1) (N_C + 2) + 1$  Graus de Liberdade

Utilidade: estudo de balanços de massa globais

# Flash

Cálculo de equilíbrio de fases

Flash: LV

GL: 2 (Q incluído entre as variáveis)

Módulo Flash3: LLV

Módulo decanter: LL