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# Heat Transfer Coefficient Correlations for Pumparound Sections of Petroleum Fractionation Towers

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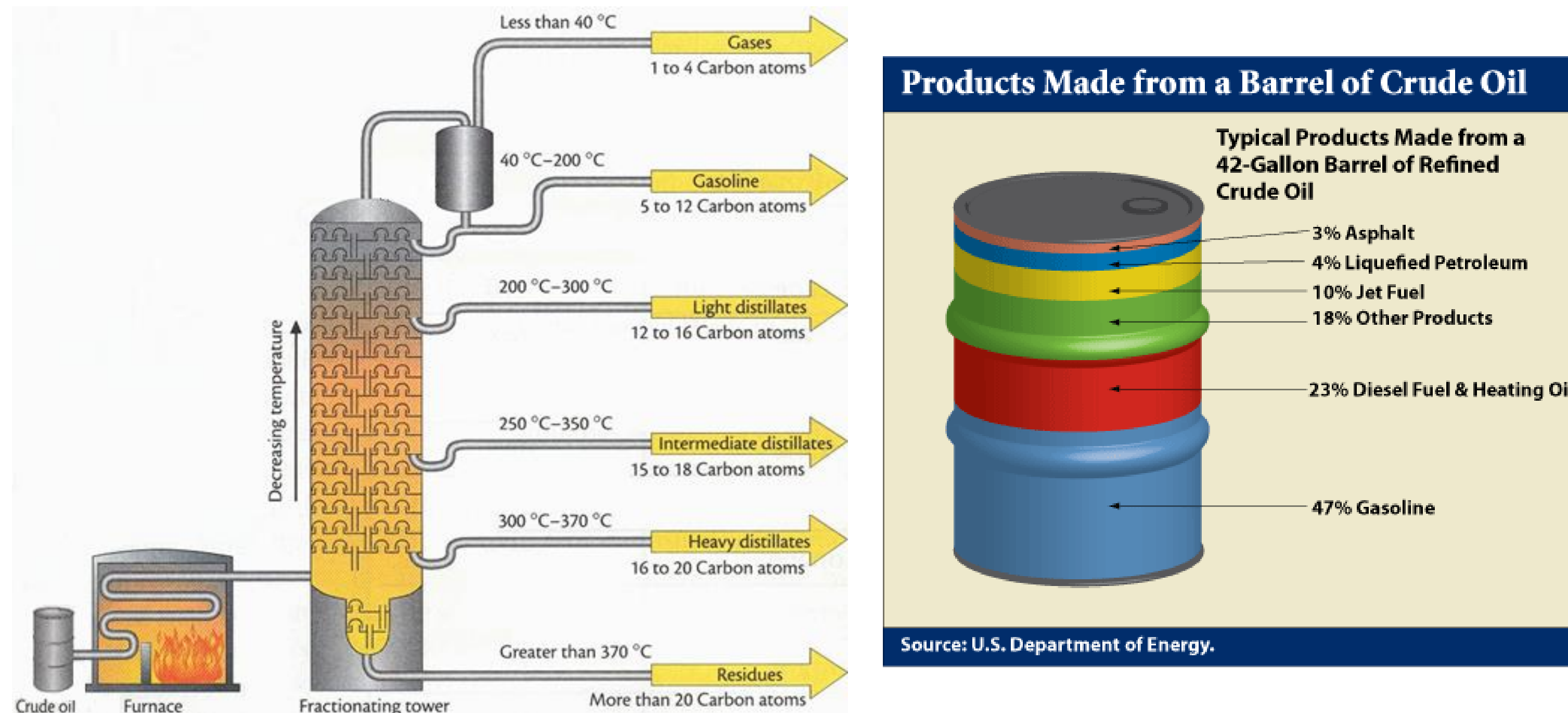
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# Heat Transfer Coefficient Correlations for Pumparound Sections of Petroleum Fractionation Towers

## Background

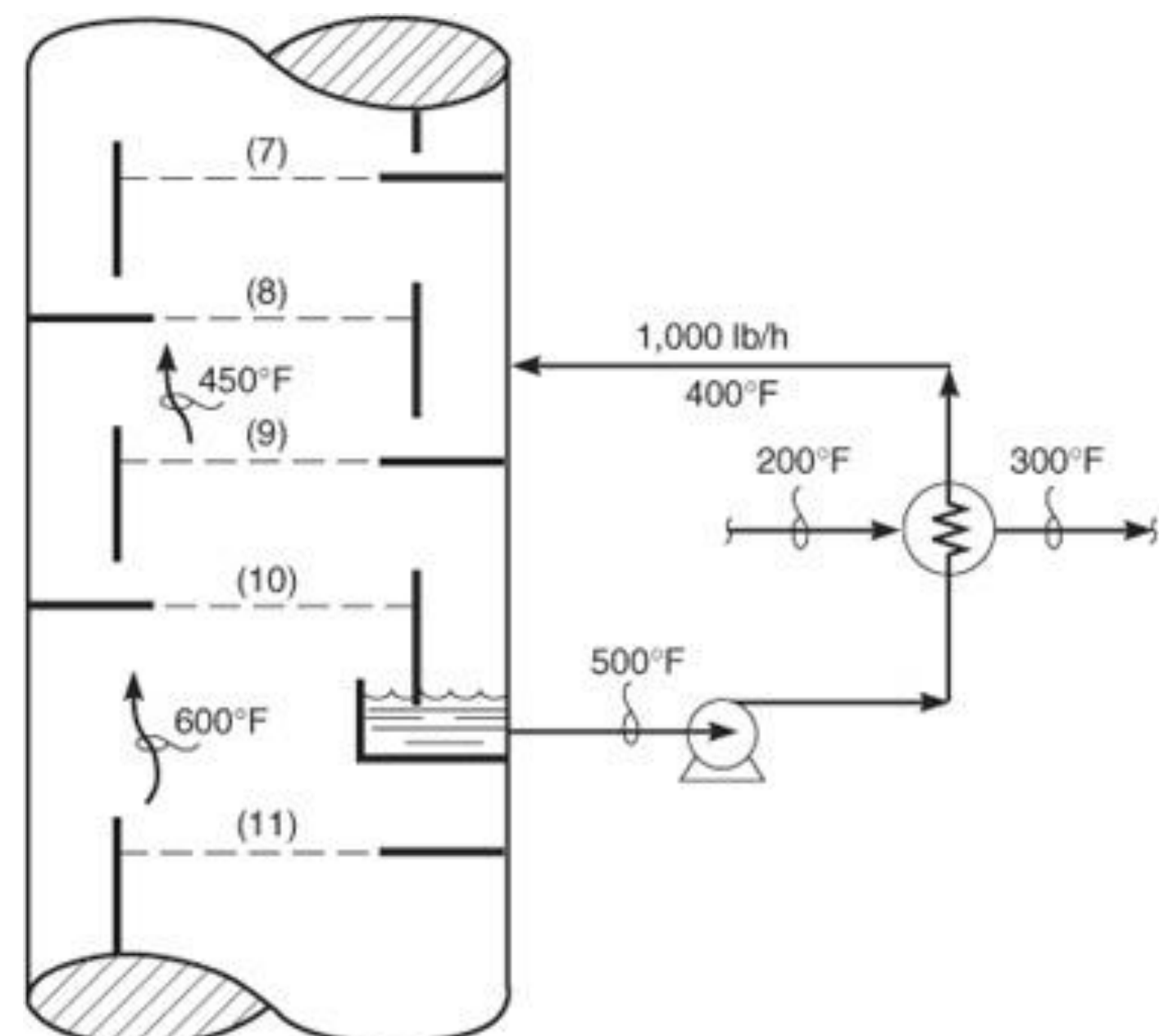
- Oil refineries separate crude oil into products based on boiling point in a fractionation column



- A pumparound (side reflux) removes heat from a fractionation column by subcooling a sidedraw that is then returned to the column

Advantage of pumparounds over top refluxes:

- Reduces column height
- Better control of column operation
- Heat more easily recovered for heat integration



Pumparound Diagram

## Objective

- Investigate the validity of several empirical heat transfer coefficient (U) correlations
  - general accuracy
  - conservative vs optimistic bias

Pumparound heat transfer coefficient uses:

- Used for sizing tower internals
- Determine operating limit for pumparound
- Aid in troubleshooting tower operation

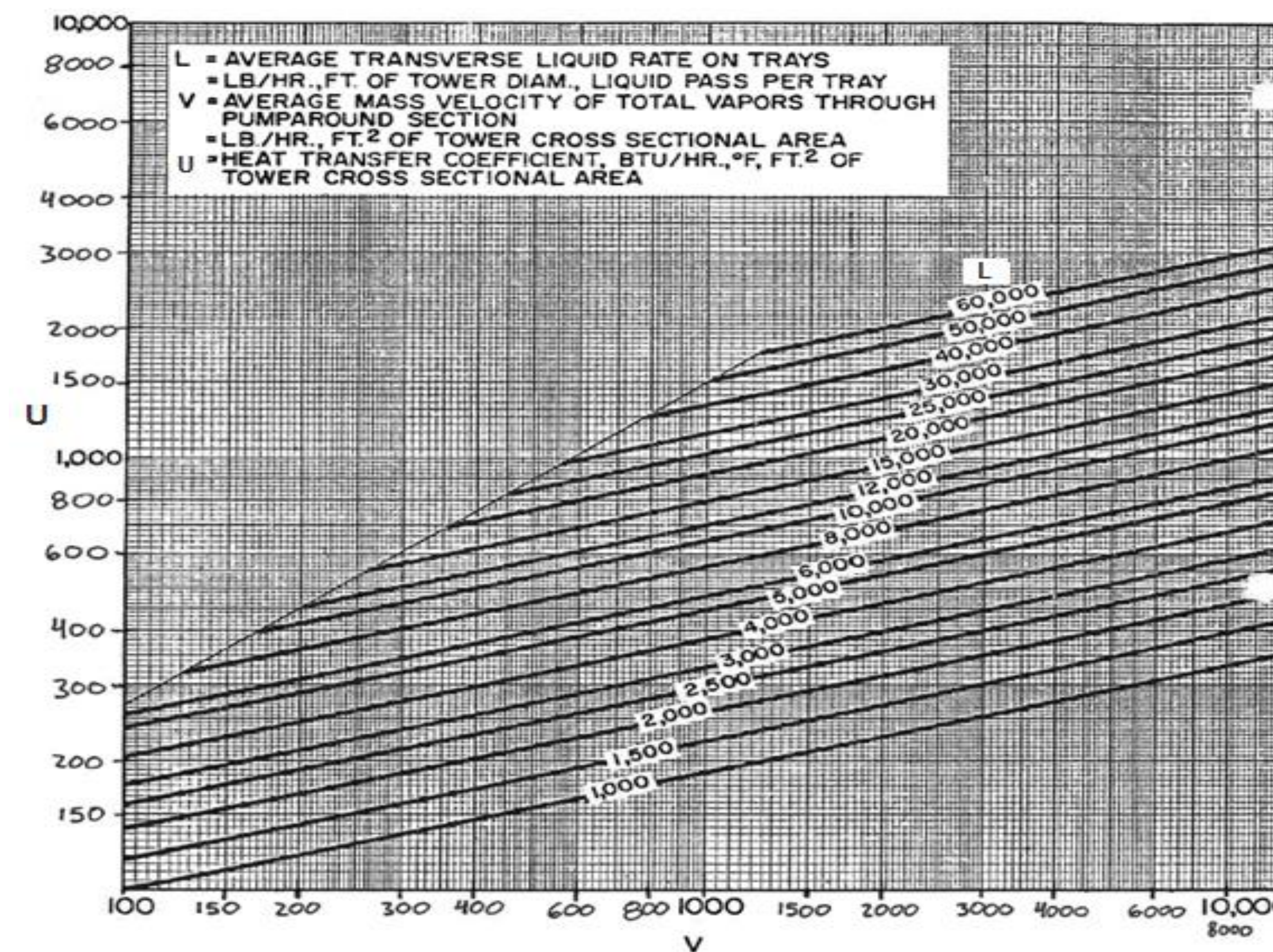
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## C.F. Braun Correlation: Trayed Pumparounds

$$L = \frac{[(R_i + P_a) + (R_o + P_o + P_a)]}{2DJ}$$

$$V = \frac{(M_i + M_o)}{2A_T}$$



## Glitsch Correlations: Packed Pumparounds

Atmospheric Correlation :  $U = 287 f_p C^{1.6} \left( \frac{\bar{q}}{A_T} \right)^{0.96}$

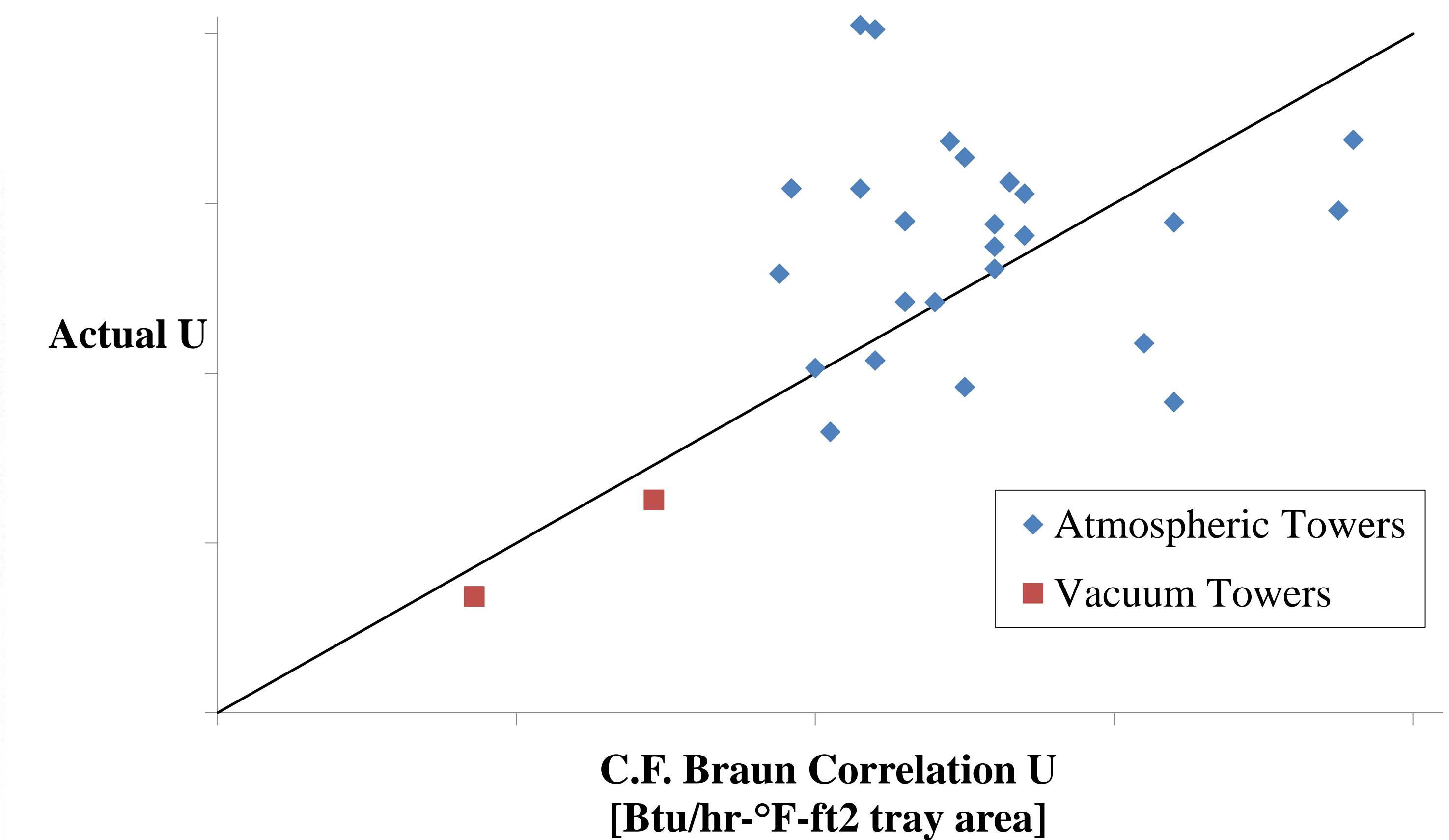
Vacuum Correlation :  $U = 421 f_p C^{0.8} \left( \frac{\bar{q}}{A_T} \right)^{0.58}$

$$C = u_V \sqrt{\frac{\rho_L}{\rho_L - \rho_V}}$$

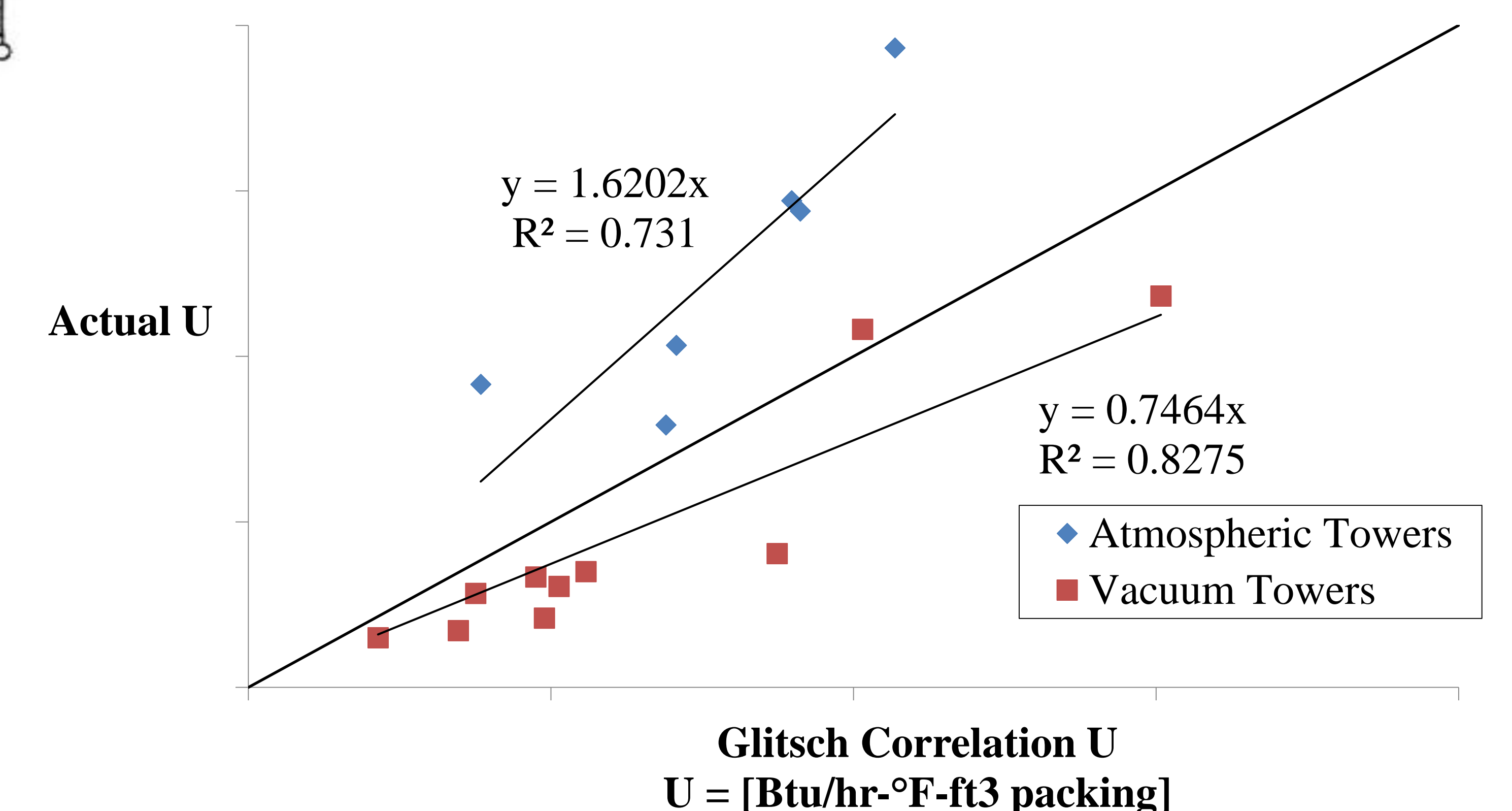
## Method

- Collect operating data for 43 pumparounds from fractionation towers in 9 different refineries around the globe
- Use data to tune Aspen HYSYS models
- Use models to get necessary data to calculate an estimated U from correlations
- Compare estimated U from correlation to actual U

## Results



- Accurate (no bias), but imprecise



- Noticeable biases; suggested corrections
  - Atmospheric correlation = conservative bias
  - Vacuum correlation = optimistic bias