



Schlumberger



# Symmetry

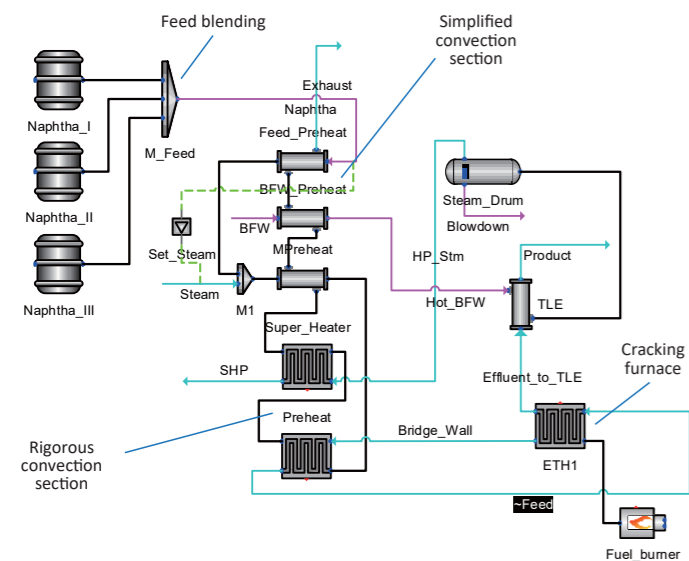
Tailored workspaces—optimized facility

Process Software Platform Steam Cracking Furnaces

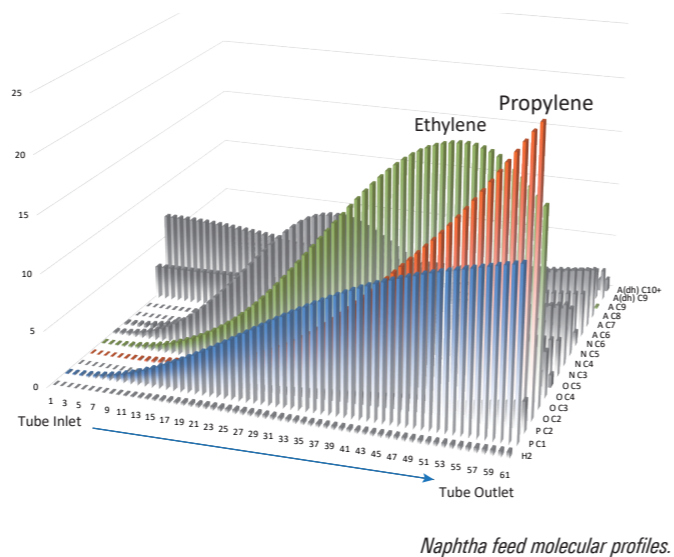


## Custom Furnace Geometry Input

The PIONA molecular-structure-characterization approach opens the door for rigorous reaction kinetics prediction. The cracking furnace's rigorous kinetic engine can describe any reaction pathway, including PIONA-based coke growth. Based on the detailed geometry input for both the radiant box and convection sections, the Symmetry platform will calculate the product yields, radiant/convection heat transfer, and pressure drop. This enables you to study and optimize the operation of cracking furnaces accounting for continuous coke formation across all furnace sections.



Cracking furnace in a full simulation environment.



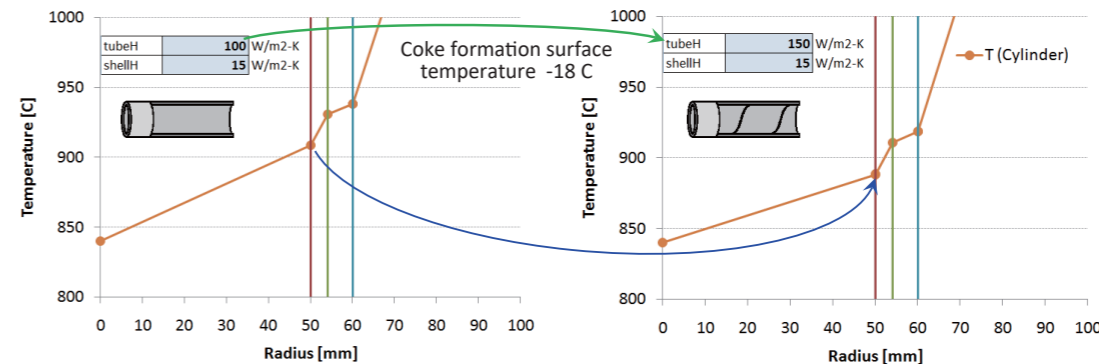
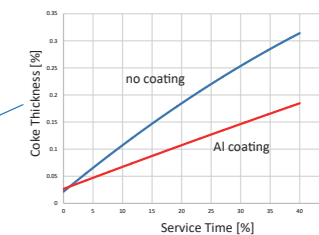
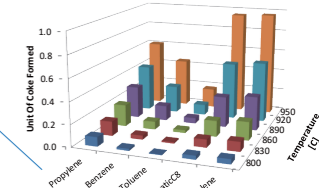
Naphtha feed molecular profiles.

## Rigorous Coke Growth Prediction

The Symmetry platform's coke growth prediction accounts for the different factors that could cause reduced service run times over the lifespan of a coil. The cracking furnace unit considers reduced tube cross section, heat flux, and yield changes as coke is formed. Coke also causes an increase in pressure drop and metal tube temperatures, reducing service time.

| Coke Formation Data    |                                     |
|------------------------|-------------------------------------|
| Name                   | Value                               |
| ▲ Coke Growth Kinetics |                                     |
| C Low O                | 1.00                                |
| C High O               | 1.00                                |
| C Low N                | 1.00                                |
| C High N               | 1.00                                |
| C Low A                | 1.00                                |
| C High A               | 1.00                                |
| ▲ Tube Metal Data      |                                     |
| Custom Alloy           | <input type="checkbox"/>            |
| Tube Fe wt [%]         | 71.00                               |
| Tube Ni wt [%]         | 12.00                               |
| Tube Cr wt [%]         | 17.00                               |
| ▲ Feed Inhibitor Data  |                                     |
| Disable Inhibitor      | <input checked="" type="checkbox"/> |
| Mult Catalytic         | 1.00                                |
| Mult Asymptotic        | 1.00                                |
| ▲ Tube Coating Data    |                                     |
| Tube Coating Type      | None                                |
| Mult Catalytic         | 1.00                                |
| Mult Asymptotic        | 1.00                                |

Coke growth kinetic model.



Heat transfer model.

# Furnace Scheduling

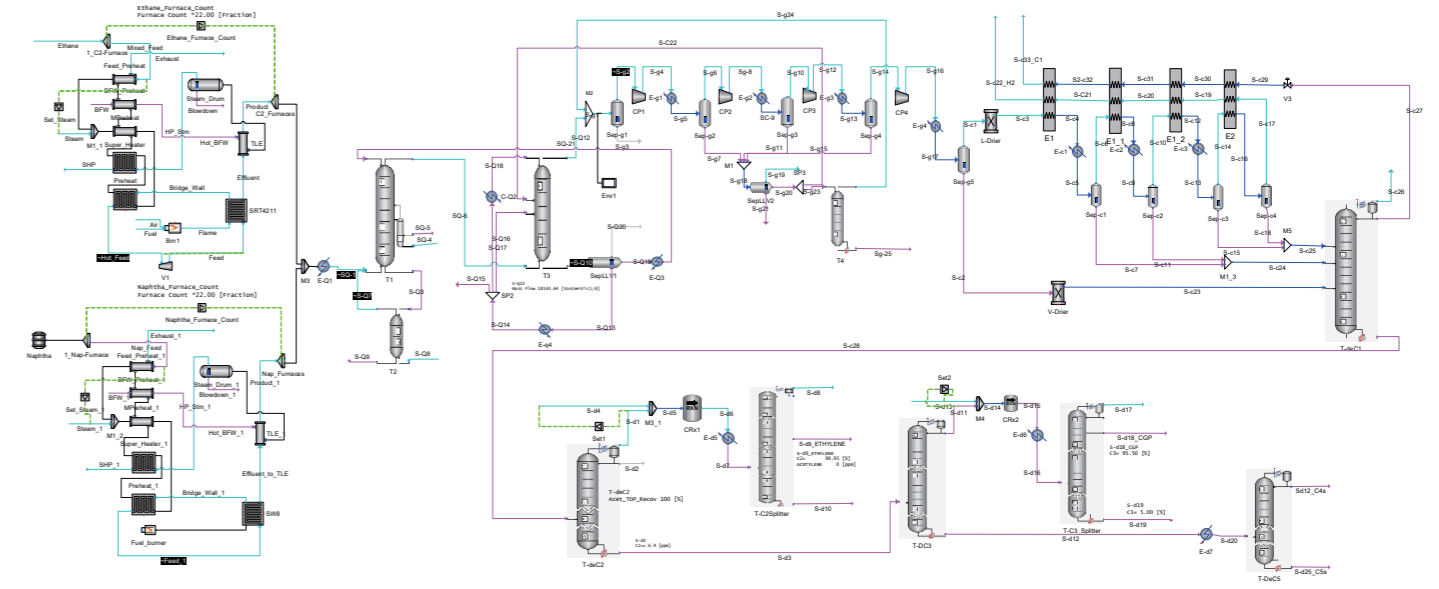
The Symmetry platform's rigorous yield prediction and simultaneous heat transfer and coke growth solution enables optimization studies on cracking furnace operation scheduling.

| Run All                   |               |                    |                 |            |                      |                 | 1-Jan-19 | 3-Jan-19 | 5-Jan-19 | 7-Jan-19 | 9-Jan-19 | 11-Jan-19 | 13-Jan-19 | 15-Jan-19 | 17-Jan-19 | 19-Jan-19 | 21-Jan-19 | 23-Jan-19 | 25-Jan-19 | 27-Jan-19 | 29-Jan-19 | 31-Jan-19 | 2-Feb-19 | 4-Feb-19 | 6-Feb-19 | 8-Feb-19 | 10-Feb-19 | 12-Feb-19 | 14-Feb-19 | 16-Feb-19 | 18-Feb-19 | 20-Feb-19 | 22-Feb-19 |
|---------------------------|---------------|--------------------|-----------------|------------|----------------------|-----------------|----------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|                           | Furnace       | Decocking Time [d] | COT Offset [°C] | Start Date | Total Run Length [d] | Profits [units] |          |          |          |          |          |           |           |           |           |           |           |           |           |           |           |           |          |          |          |          |           |           |           |           |           |           |           |
| Run C2 Furnace            | C2            | 13                 | 0               | 1-Jan-19   | 39                   | 37929           |          |          |          |          |          |           |           |           |           |           |           |           |           |           |           |           |          |          |          |          |           |           |           |           |           |           |           |
| Run C2-C3 Furnace         | C2-C3         | 13                 | -3              | 14-Jan-19  | 39                   | 37561           |          |          |          |          |          |           |           |           |           |           |           |           |           |           |           |           |          |          |          |          |           |           |           |           |           |           |           |
| Run Naphtha Furnace       | Naphtha       | 13                 | -6              | 27-Jan-19  | 39                   | 14494           |          |          |          |          |          |           |           |           |           |           |           |           |           |           |           |           |          |          |          |          |           |           |           |           |           |           |           |
| Run Heavy Naphtha Furnace | Heavy-Naphtha | 13                 | -5              | 10-Feb-19  | 40                   | -961            |          |          |          |          |          |           |           |           |           |           |           |           |           |           |           |           |          |          |          |          |           |           |           |           |           |           |           |
| <b>No. Unit Running</b>   |               |                    |                 |            |                      |                 | 1        | 1        | 1        | 1        | 1        | 1         | 2         | 2         | 2         | 2         | 2         | 3         | 3         | 3         | 3         | 3         | 3        | 3        | 3        | 3        | 3         | 3         | 3         | 3         | 3         |           |           |

Scheduling of cracking furnace operations.

# Total Ethylene Plant Model

The Symmetry platform's comprehensive and user-friendly process simulator enables seamless integration between different processes; it can model a complete ethylene plant in only one flowsheet. The use of rigorous thermodynamics enables proper hydrocarbon-water solubility trending in the quench section and also enables hydrate formation prediction in the cold-box section.



Ethylene plant example.



# Symmetry

Tailored workspaces—optimized facility

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[slb.com/symmetry](https://slb.com/symmetry)

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