KBC

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MYSEP

Digital Twin supports optimization of FCC operations for changing operating conditions

Rodolfo Tellez-Schmill, KBC Advanced Technologies

Petro-SIM Product Champion

Tom Ralston, MySep Pte Ltd.

Digital Process Engineering Business Development

Wim Moyson, MySep Pte Ltd.

Consultant Separation Specialist

All about EXCELLENCE

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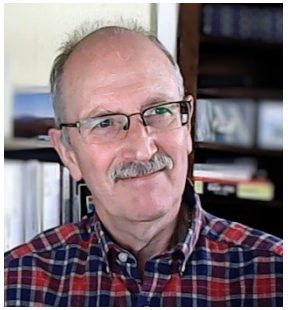
Your presenters

Rodolfo Tellez-Schmill

Petro-SIM Product Champion



Tom Ralston

Digital Process Engineering Business Development

Wim Moyson

Consultant

Agenda

- Introduction to MySep Pte Ltd
- Petro-SIM and Digital Twins
- MySep Engine in Petro-SIM
- Typical workflow
- FCC reactor in Petro-SIM
- Case Study: FCC unit separators – Retrofit Design
- Conclusion
- Q/A

MySep Pte Ltd

- Founded in 2013 by separation specialist consultancy – **Kranji Solutions.**

- Providing process operators and EPCs means of optimising operations
  - where phase separation is crucial

- Providing **The Standard Software**
  - For separation performance modelling and
  - Separator design or revamp

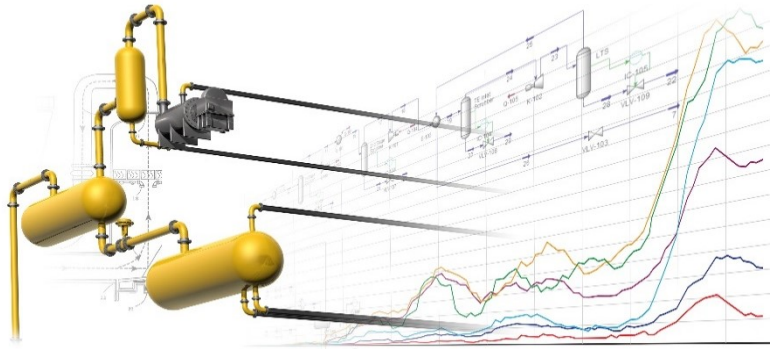
MySep Pte Ltd

MySep Studio

- Detailed representation of existing separators.
- Design of new separators or retrofit option evaluation.
- Incremental performance analysis:
  - Gas-liquid
  - Liquid-liquid
- Special analyses – sensitivity, operating envelope, motion.

MySep Engine

- Digital-twin in Petro-SIM with rigorous separation.
- Based on as-built geometry & internals selection.
- Gas-liquid separation.
- Dynamic and Steady-state.

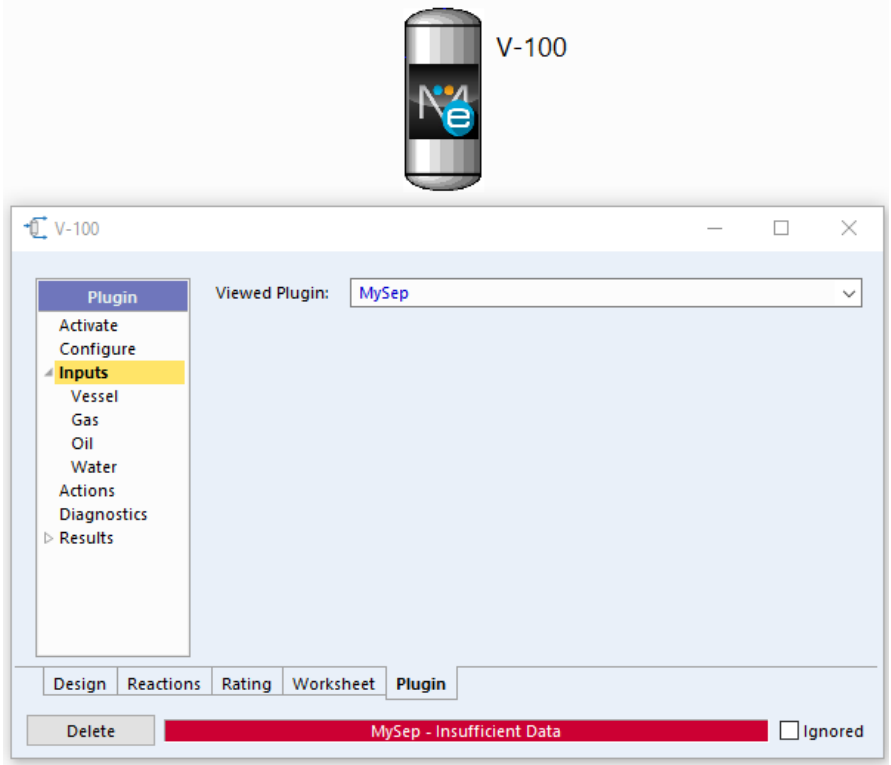


Petro-SIM and Digital Twins

- Petro-SIM is KBC's leading process simulation software and optimization platform.
- At the core of Petro-SIM's technology are rigorous process simulation models.
- Petro-SIM's open architecture collects real-time operations data from the site historian.
- Petro-SIM also delivers high-fidelity virtual representations of plant operating conditions.
- The Digital Twin provides a single source of the truth for what's going on inside the plant at an asset level.

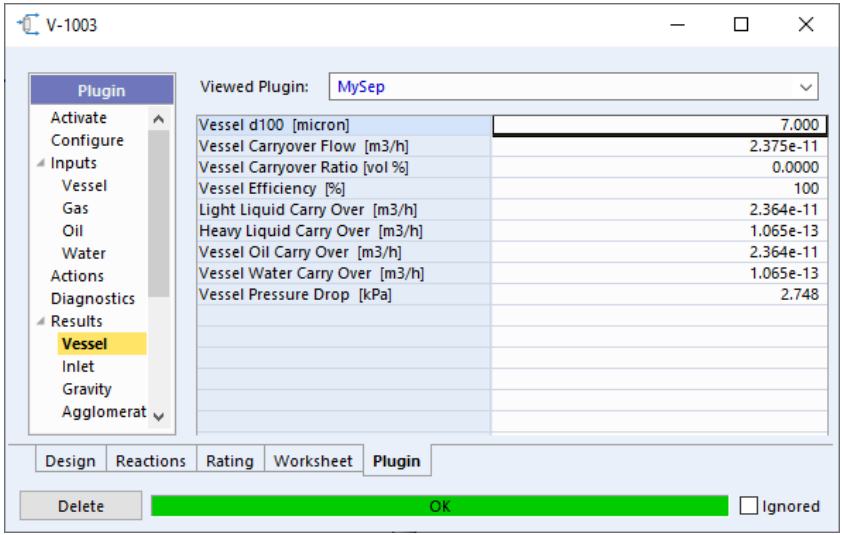
MySep Engine integration in Petro-SIM

- KBC and MySep formed a collaboration to offer a solution that helps operators manage processes subject to separation constraints.
- The Digital Twin evaluates process system performance based on actual operating data.
- Explore separation performance constraints on overall process operation.
- Evaluate optimum retrofit configurations.



MySep Engine integration in Petro-SIM

- The MySep Engine provides calculations with detailed separator performance results:
  - Liquid carry-over rate
  - Maximum droplet size
  - Pressure drop
- Results are displayed directly in the process simulation.
- The effect of the liquid carry-over propagates across the flowsheet.



Typical Workflow

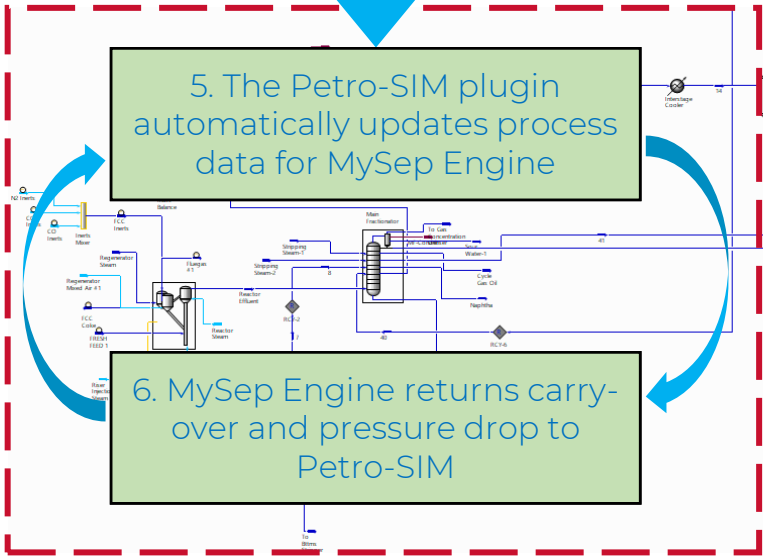
1. Build simulation case in Petro-SIM

2. Import simulation data into MySep Studio

3. Specify geometry of separator and internals in MySep Studio

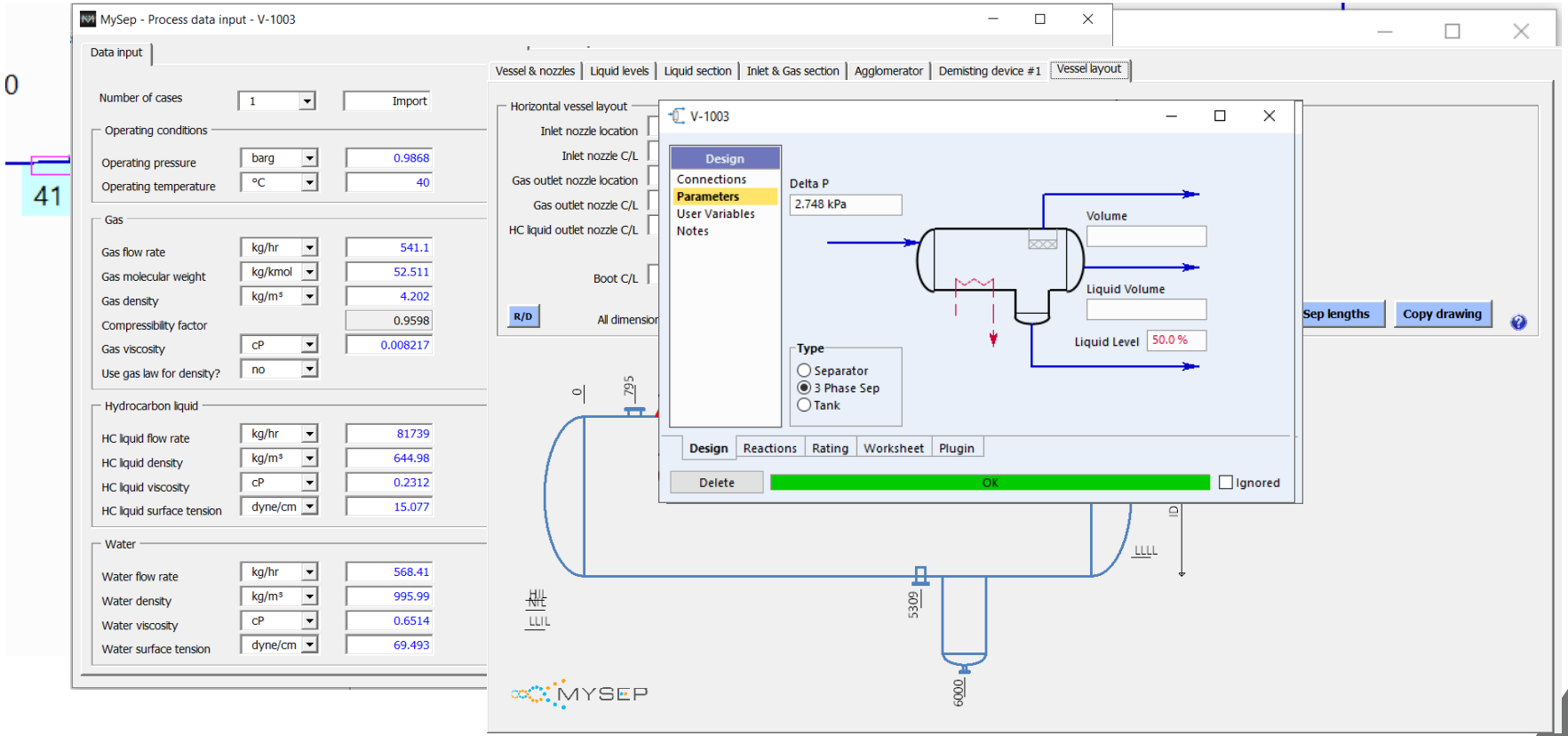
4. Import MySep geometry file into the Petro-SIM plugin

5. The Petro-SIM plugin automatically updates process data for MySep Engine



6. MySep Engine returns carry-over and pressure drop to Petro-SIM

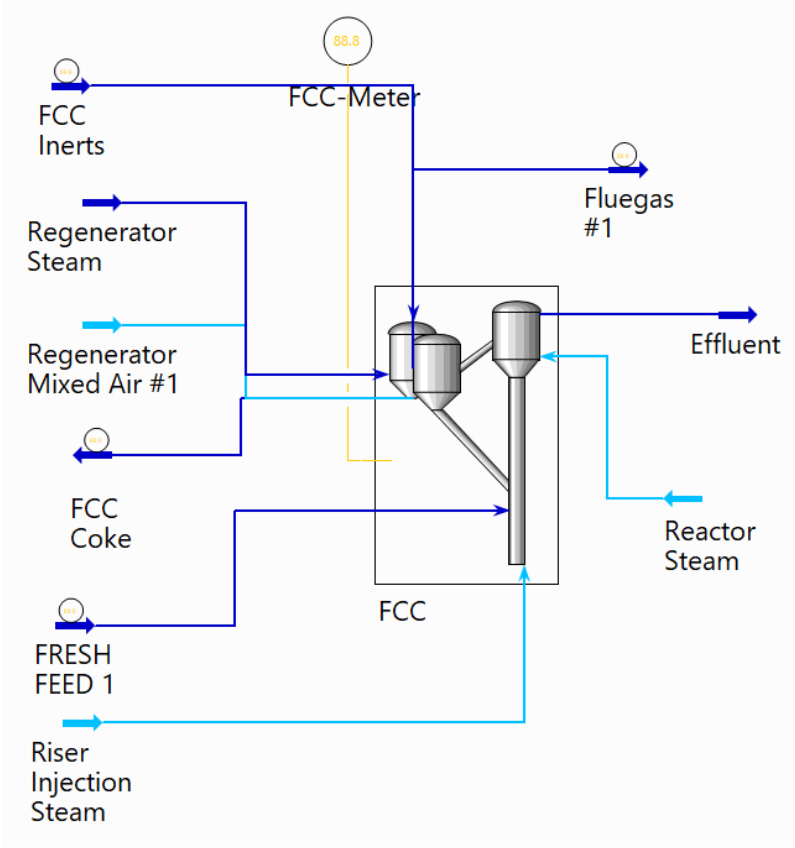
Typical Workflow Illustrated

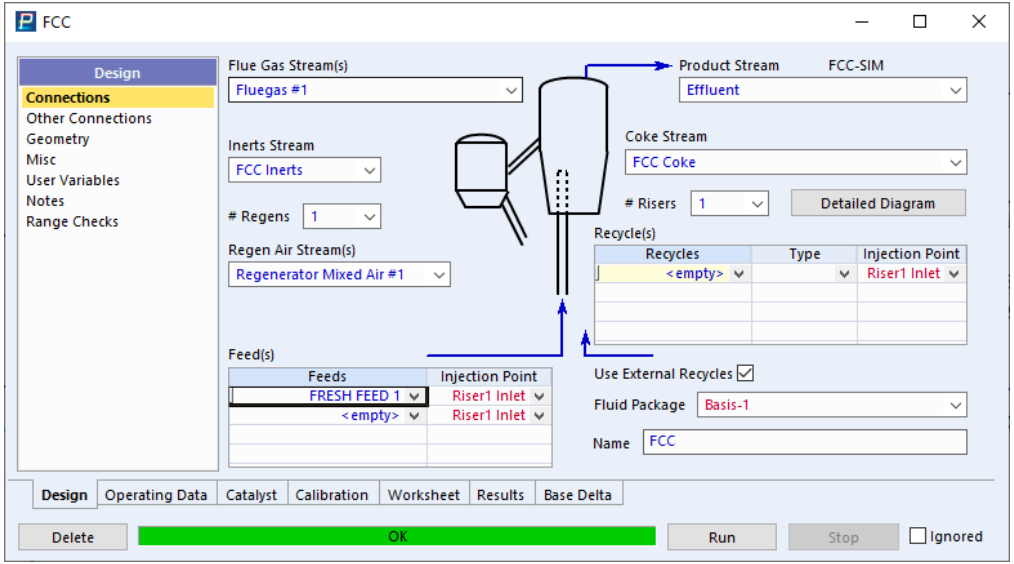


FCC reactor model in Petro-SIM

- Petro-SIM is the ideal simulation environment to build simulations that involve complex refining operations, like FCC Units.
- Our FCC reactor (FCC-SIM) is a state-of-the-art computer model, highly recommended by major refiners around the world.
- FCC-SIM allows the following:
  - Feeds/products/cutpoints evaluations
  - Operating target selection
  - Catalyst evaluation, selection and benefits
  - Unit optimization
  - Debottlenecking evaluation and benefits
  - Process monitoring
  - Data reconciliation
  - Etc.

FCC reactor model in Petro-SIM

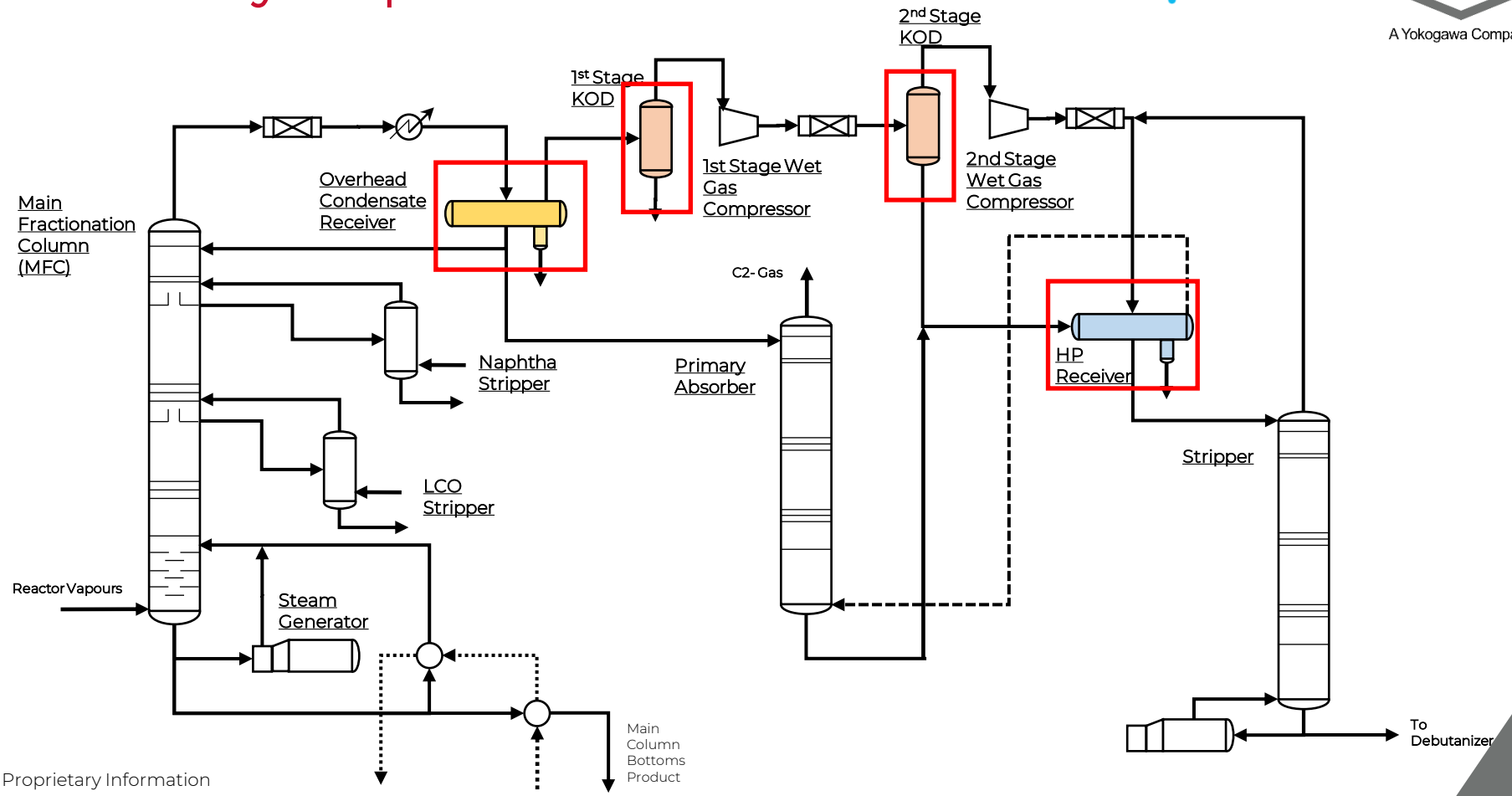




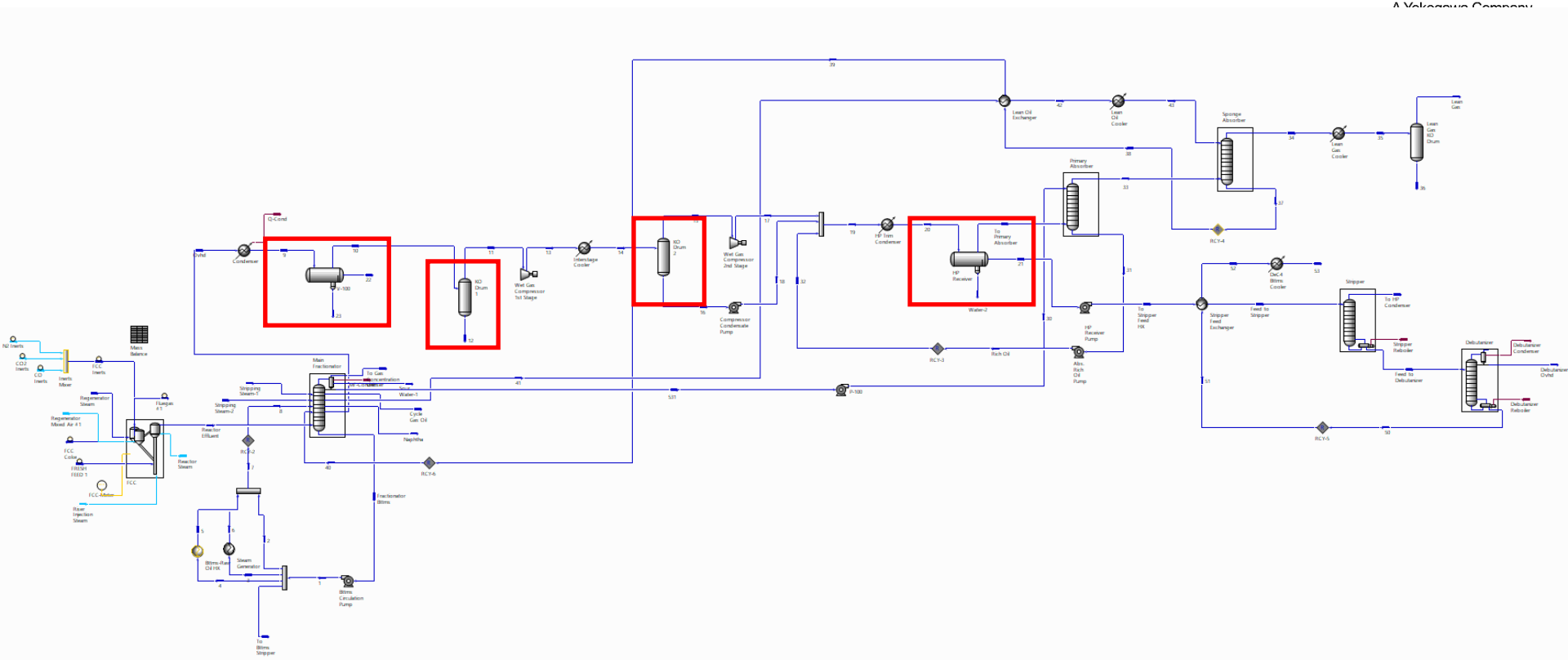
Case Study – Separators in an FCC unit

- Assuming a weakening market for naphtha and a strengthening demand for petrochemical feedstock.
- Planned targets consequently yield more propane and light products.
- The following operational changes were explored:
  - Case A - an increase of the throughput by 15%
  - Case B - increase the ZSM-5 catalyst addition to existing inventory and
  - Case C – increase the riser outlet temperature to 540°C (1004°F) to increase conversion

Case Study – Separators in an FCC unit



Case Study – Separators in an FCC unit



Case Study – Separators in an FCC unit

Separator	Configuration	Nozzles	Internals
MF Condensate Receiver	Separation type: 3-phase with boot Vessel dimensions: 3962 mm x 11888 mm Boot dimensions: 1524 mm x 2362 mm	Inlet: 32” Gas Outlet: 24” HC Liquid Outlet: 20” Water Outlet: 3”	Vane type inlet device No demisting device
1st Stage Compressor KOD	Separation type: 2-phase Vessel dimensions: 2515 mm x 5029 mm	Inlet: 24” Gas Outlet: 24” Liquid Outlet: 2”	Half pipe inlet device No demisting device
2nd Stage Compressor KOD	Separation type: 2-phase Vessel dimensions: 1575 mm x 4750 mm	Inlet: 12” Gas Outlet: 12” Liquid Outlet: 4”	Half pipe inlet device Mesh pad demisting device
HP Receiver	Separation type: 3-phase with boot Vessel dimensions: 2210 mm x 8840 mm Boot dimensions: 686 mm x 1219 mm	Inlet: 10” Gas Outlet: 8” HC Liquid Outlet: 10” Water Outlet: 2”	Vane type inlet device No demisting device

Case Study – Separators in an FCC unit

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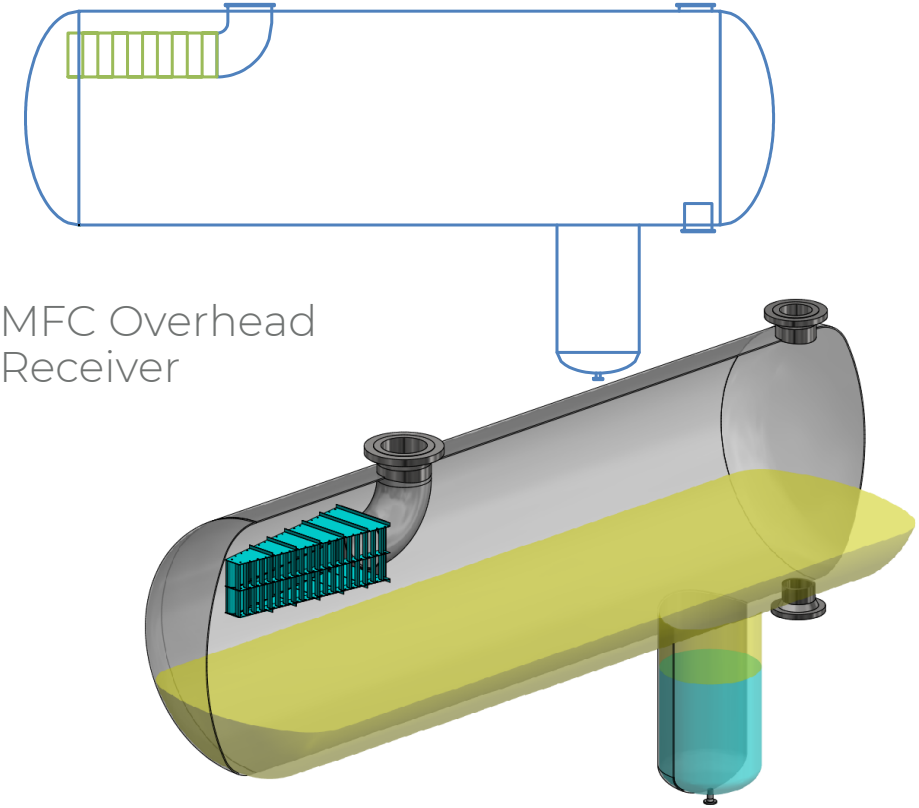
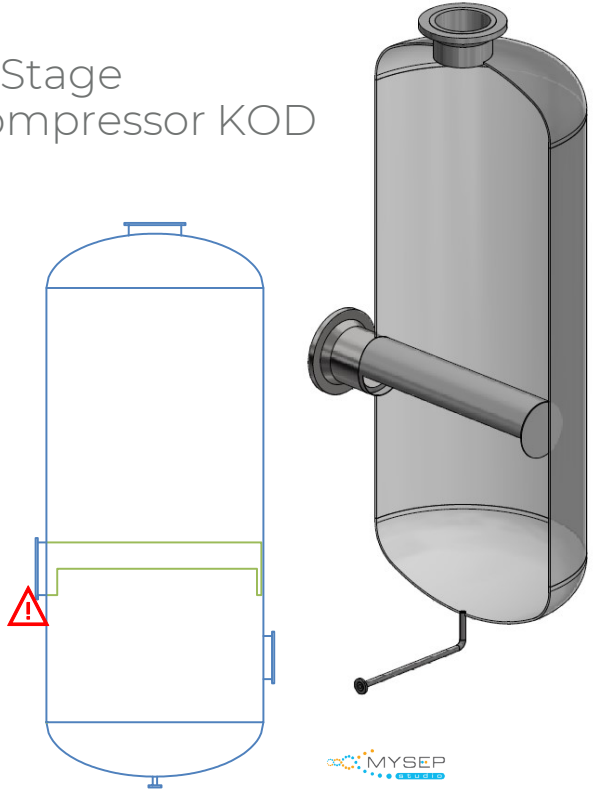


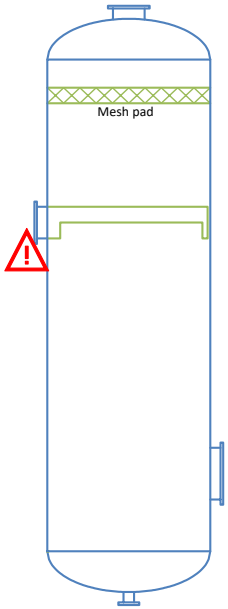
MFC Overhead Receiver

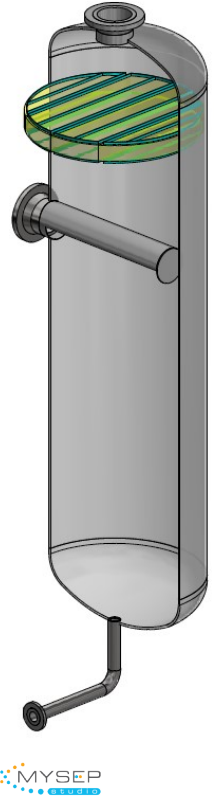
1st Stage Compressor KOD



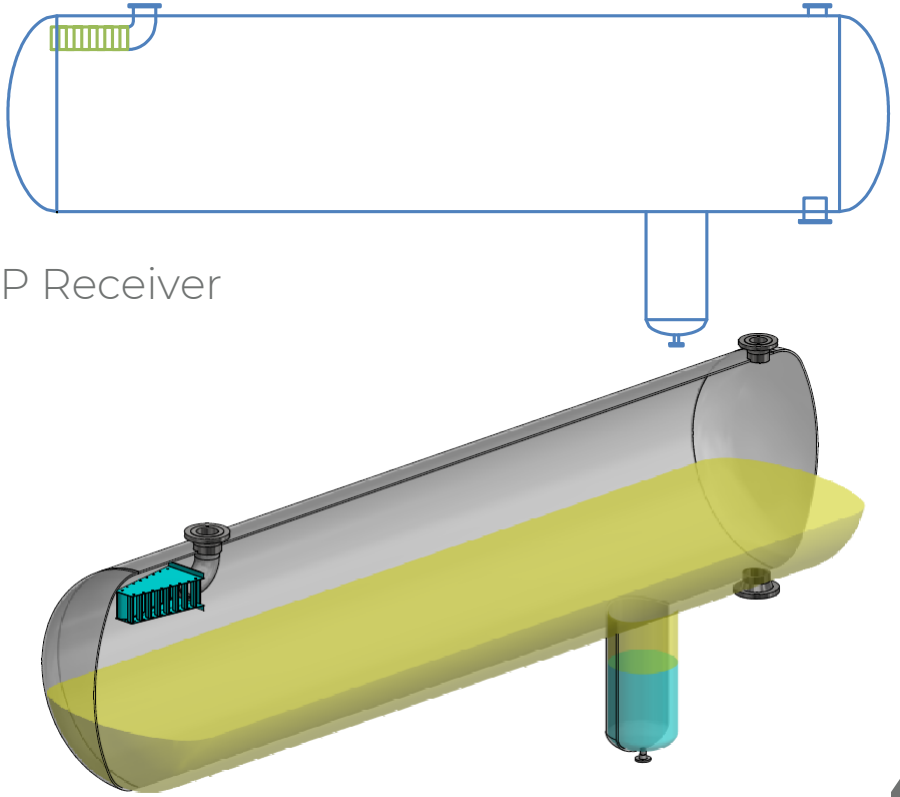
Case Study – Separators in an FCC unit

2nd Stage Compressor KOD



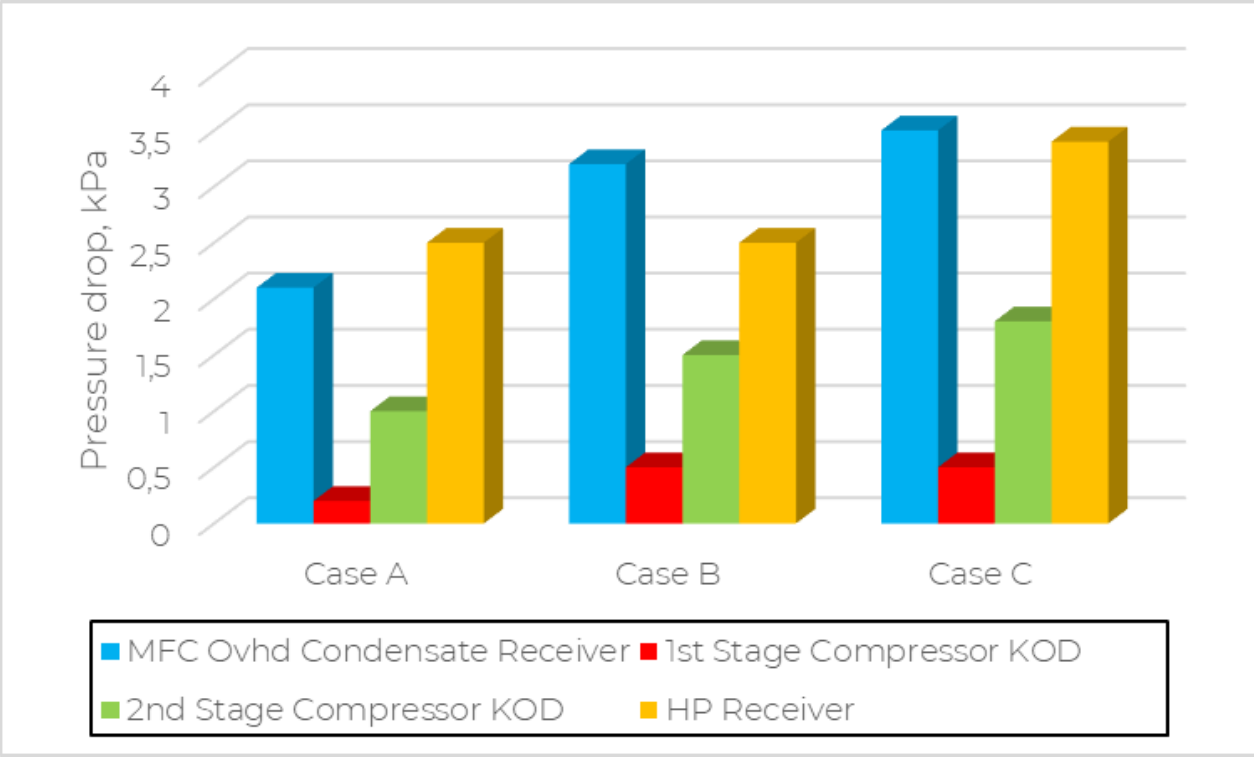


HP Receiver



Case Study – Separators in an FCC unit

- Simulation results using original separator designs.



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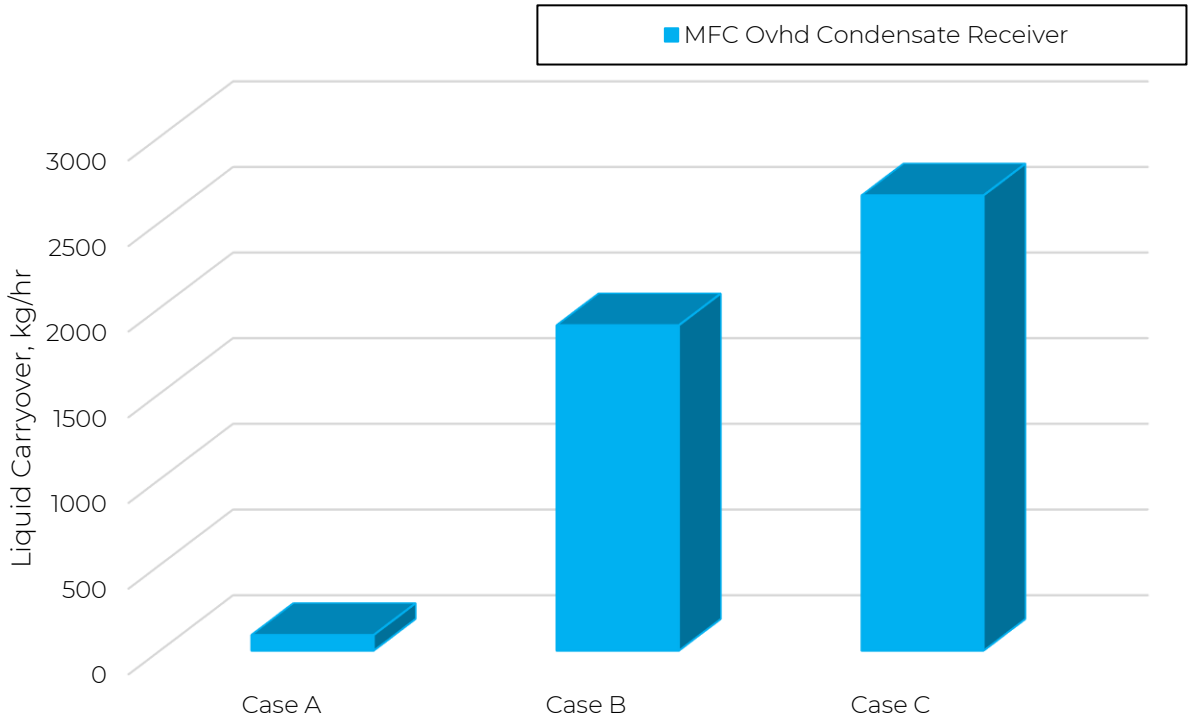

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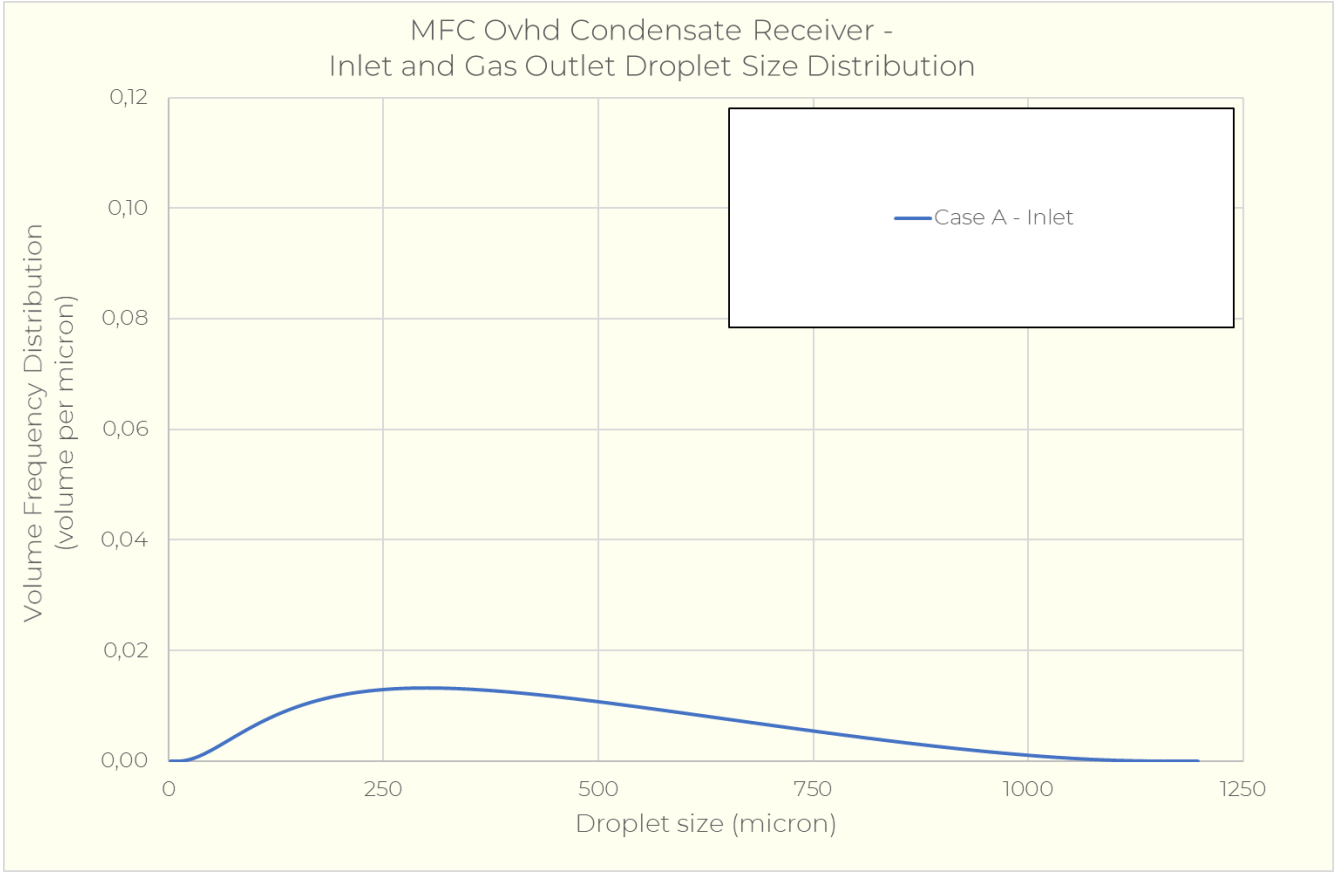

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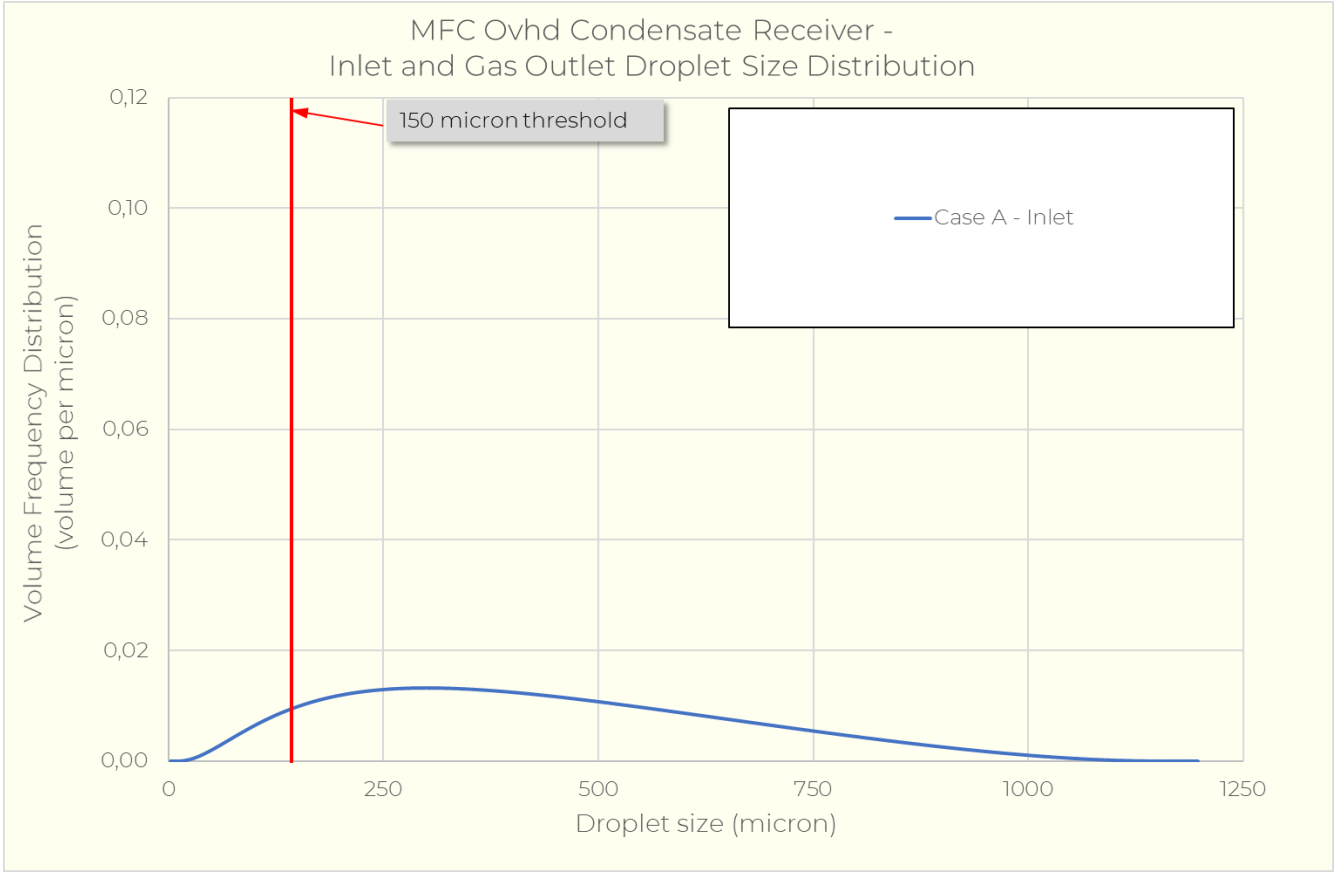

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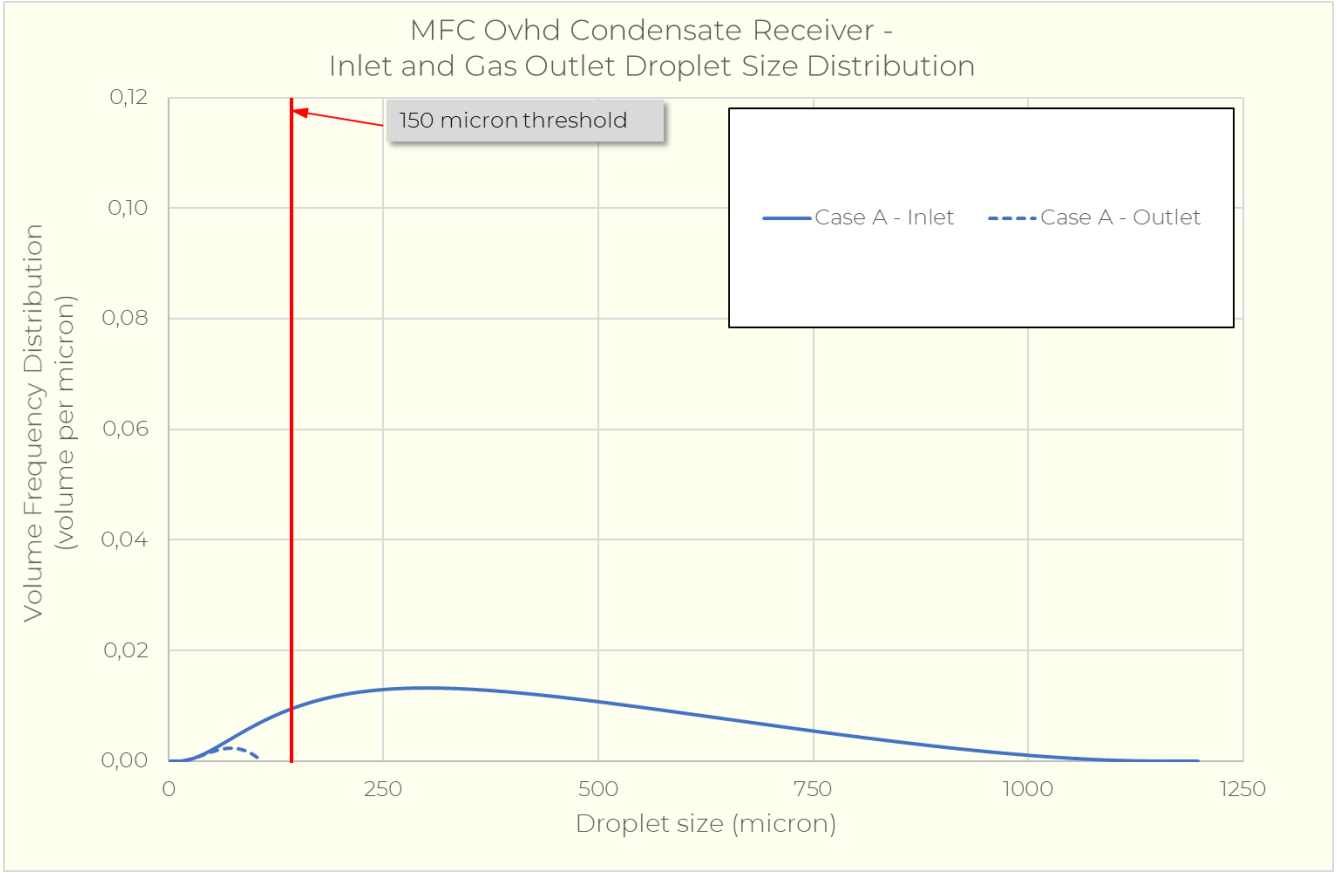

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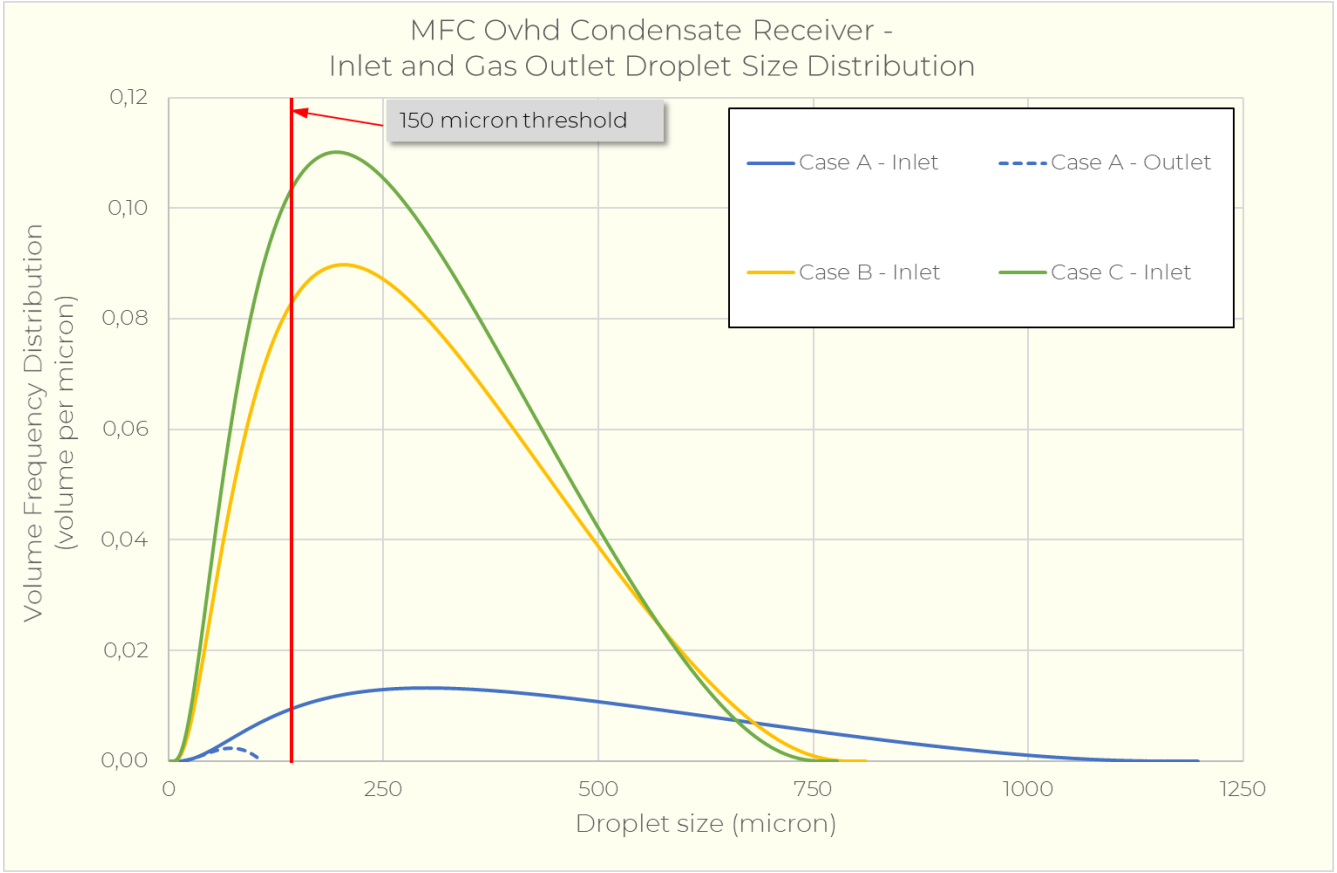

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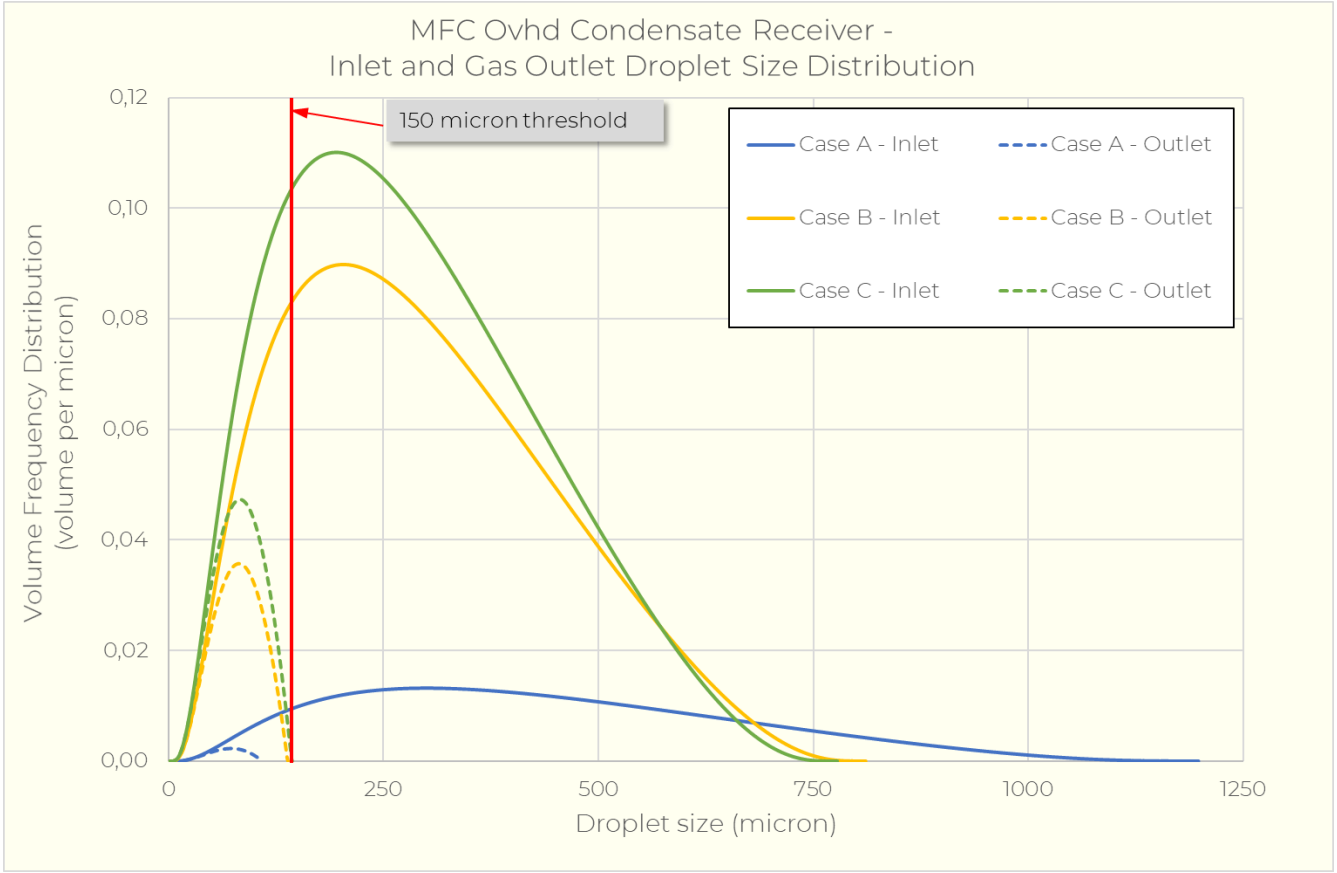
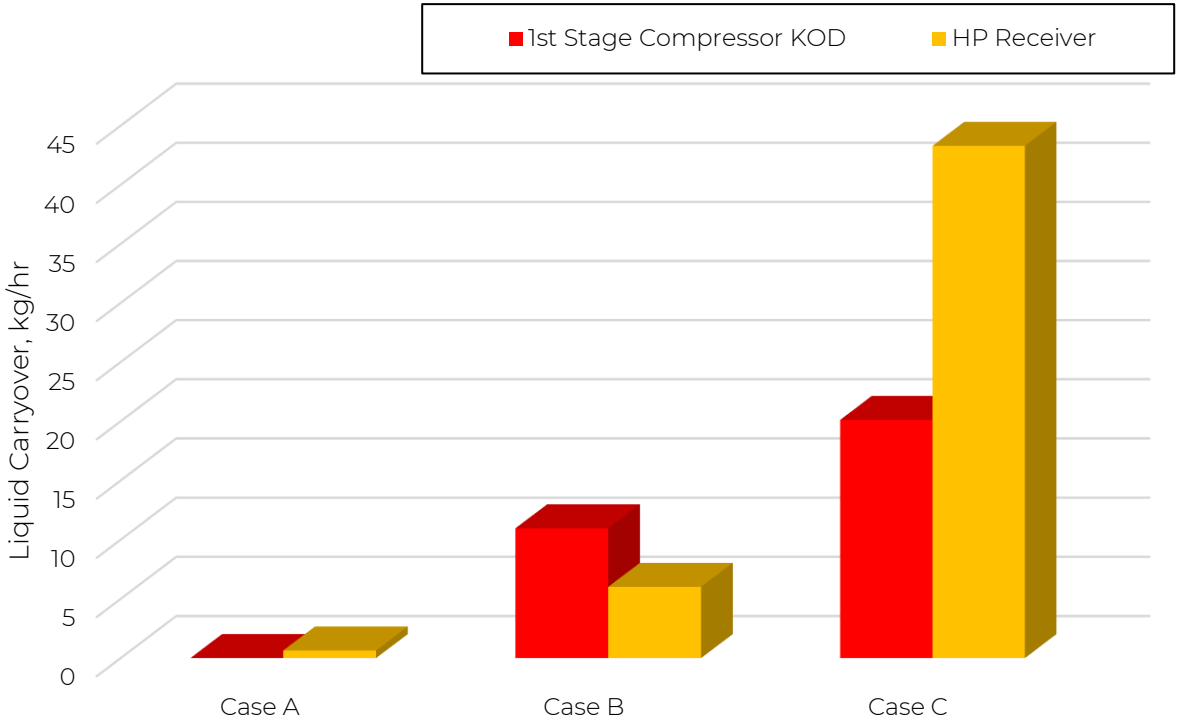


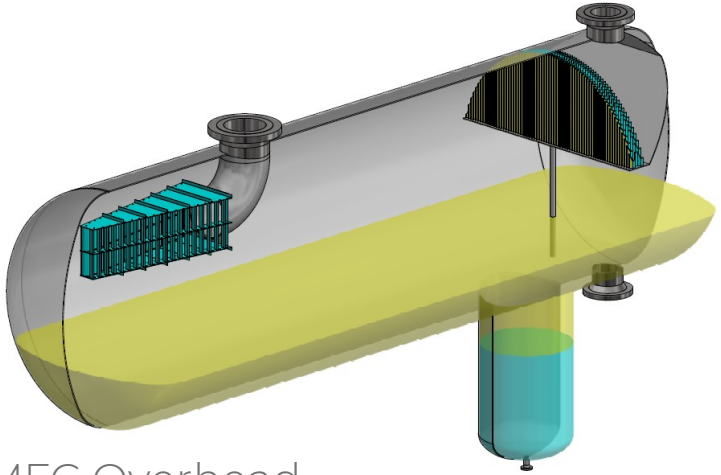
Case Study – Separators in an FCC unit

- Simulation results using original separator designs.

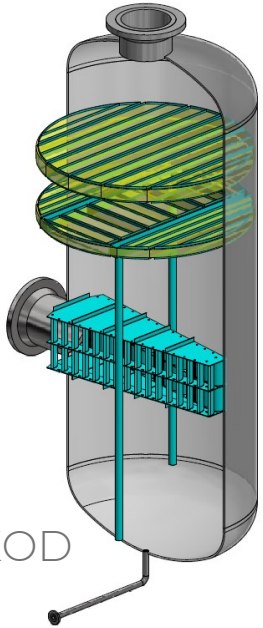


Case Study – Separators in an FCC unit

Separator	Internals
MF Condensate Receiver	Vane type for inlet device and a vane pack vertical demisting device
1st Stage Compressor KOD	Vane type inlet device a horizontal mesh agglomerator and a mesh pad demisting device
2nd Stage Compressor KOD	Vane type inlet device, a horizontal mesh agglomerator and a mesh pad demisting device

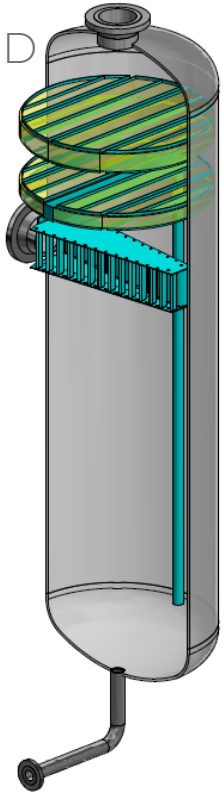


MFC Overhead Receiver



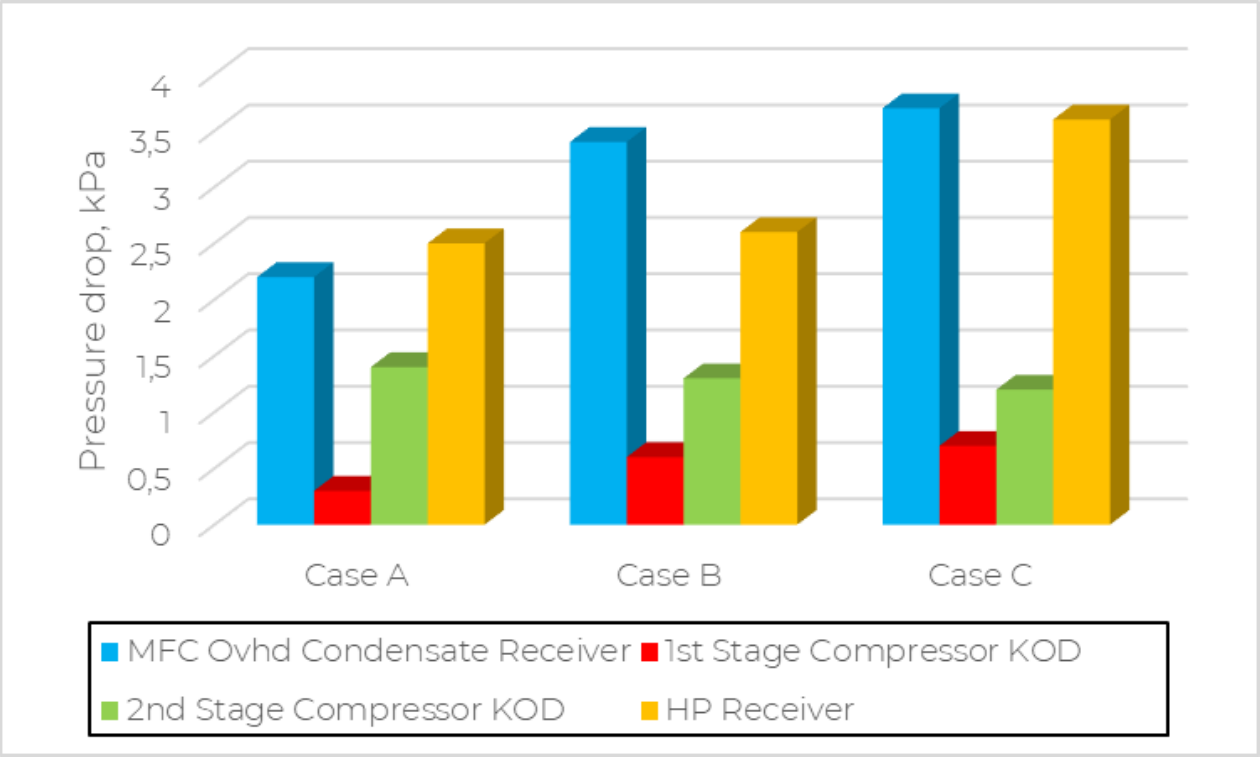
1st Stage Compressor KOD

2nd Stage Compressor KOD



Case Study – Separators in an FCC unit

- Simulation results using retrofitted designs.



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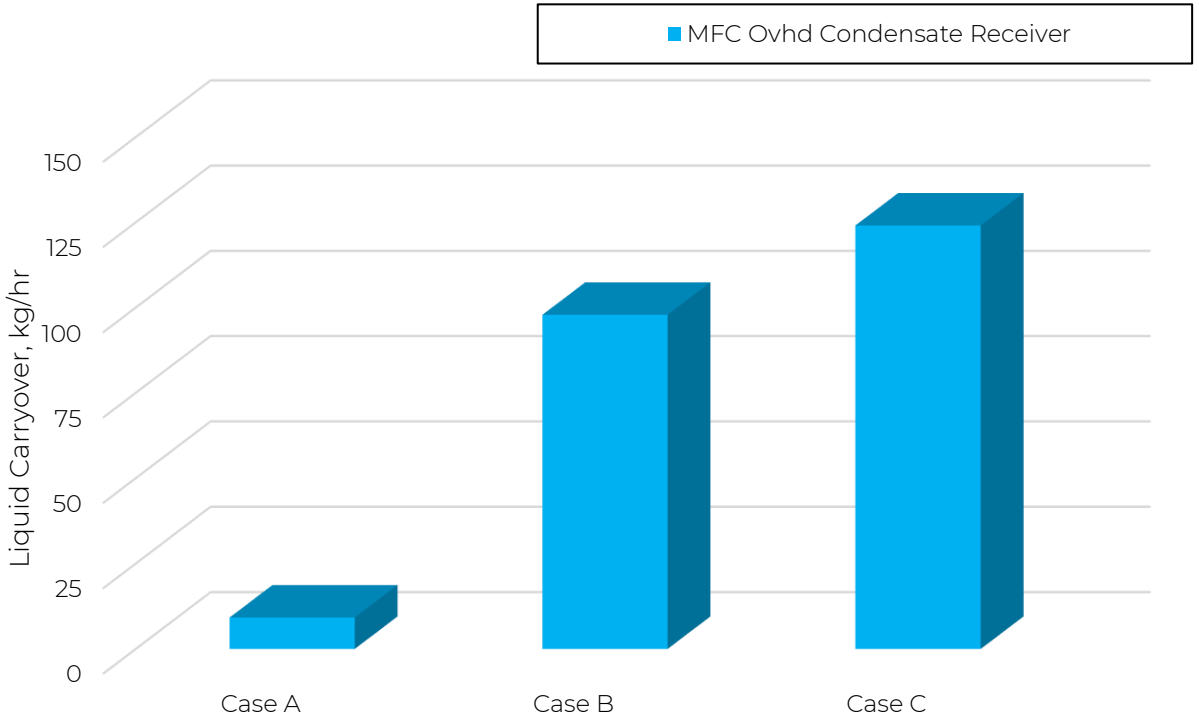

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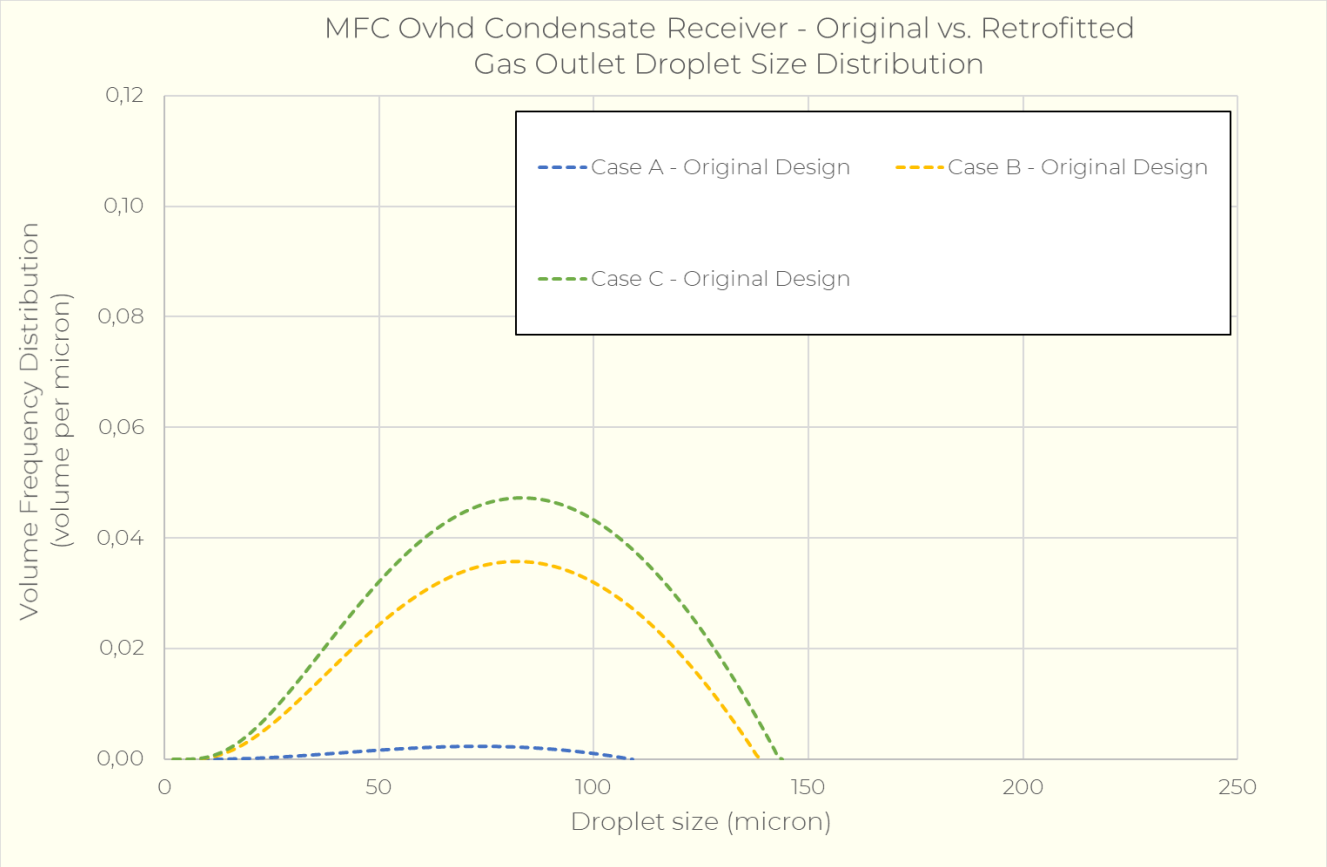

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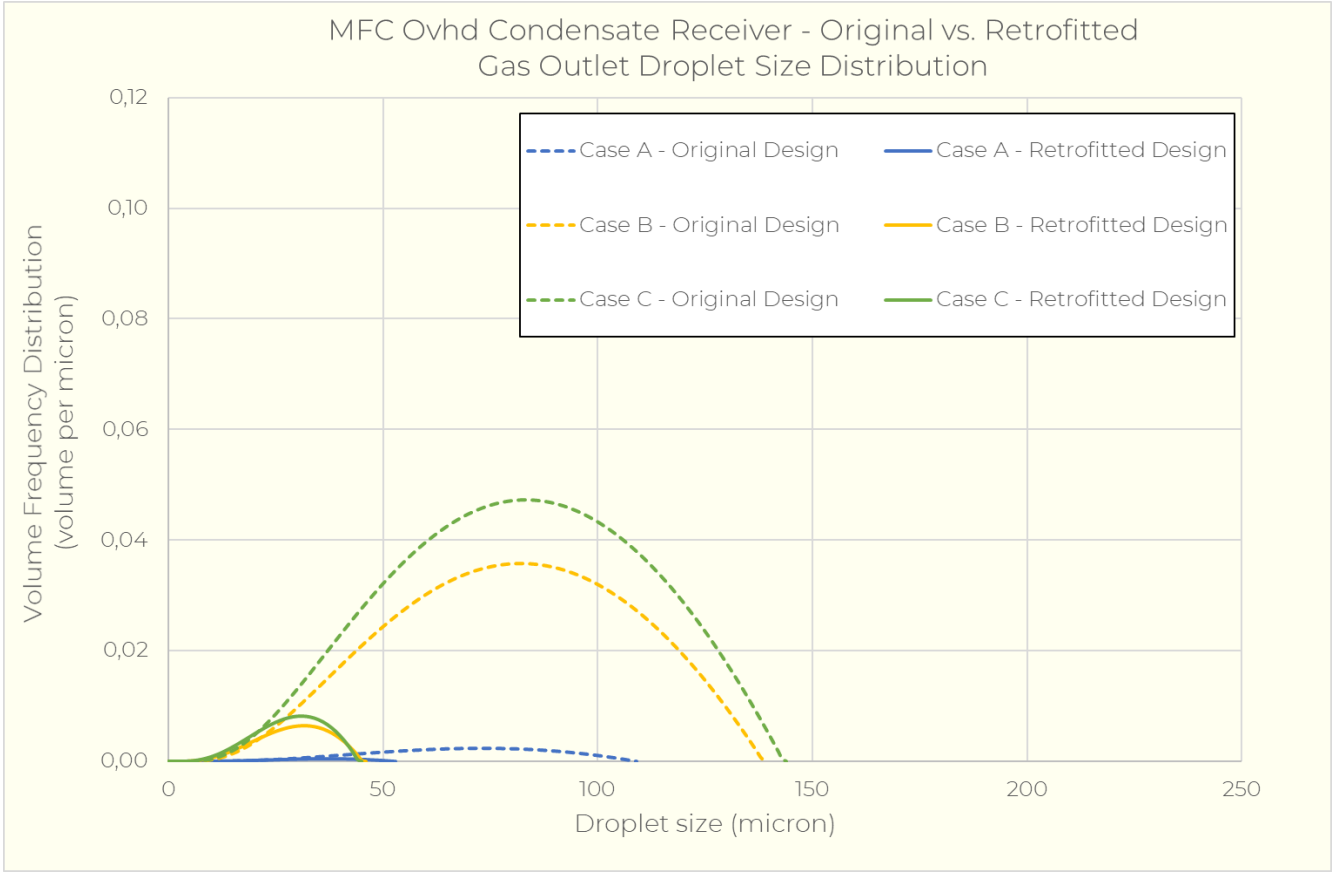

Conclusion

- Digital Twins, based on process simulation models have become a pre-requisite for optimizing operations and achieving production targets.

- Where phase separation processes are crucial to asset operation, it is essential the digital twin accesses rigorous separation modelling.

- From sand face, to topside facilities, and downstream processing, Petro-SIM digital twins, enhanced with MySep modelling, reveal opportunity for improved operation within physical constraints.

Q&A

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