

## Gravitational separators tanks: plate device influence analysis

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# Topics

- **Problem Description**
- **Methodology**
- **Goals**
- **Results**
- **Conclusion and Next Steps**

## Problem Description

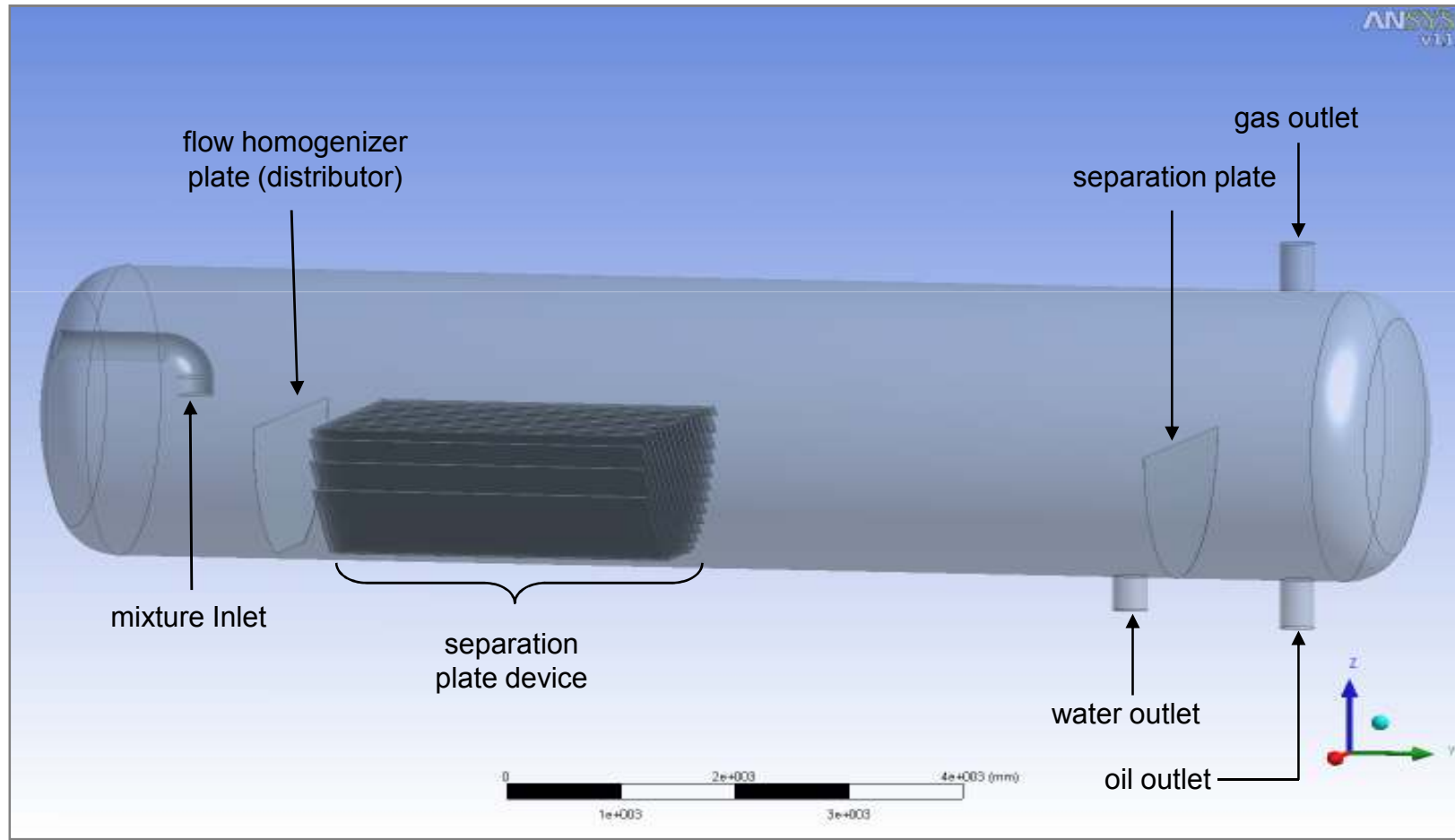
- **Continuous need to improve tank separators efficiency**
  - Increase production levels
    - Internal devices applied in design stages or during separator's lifetime
  - “Old” wells producing more water
    - Need to improve efficiency to maintain production levels

# Problem Description

- **Evaluate the influence of an internal plate device inside tank separators**
  - Analysed parameters
    - Inclination angle
    - Distance between plates
    - Device length inside the tank
  - Optimum point
    - Promotes the separation in the shortest time

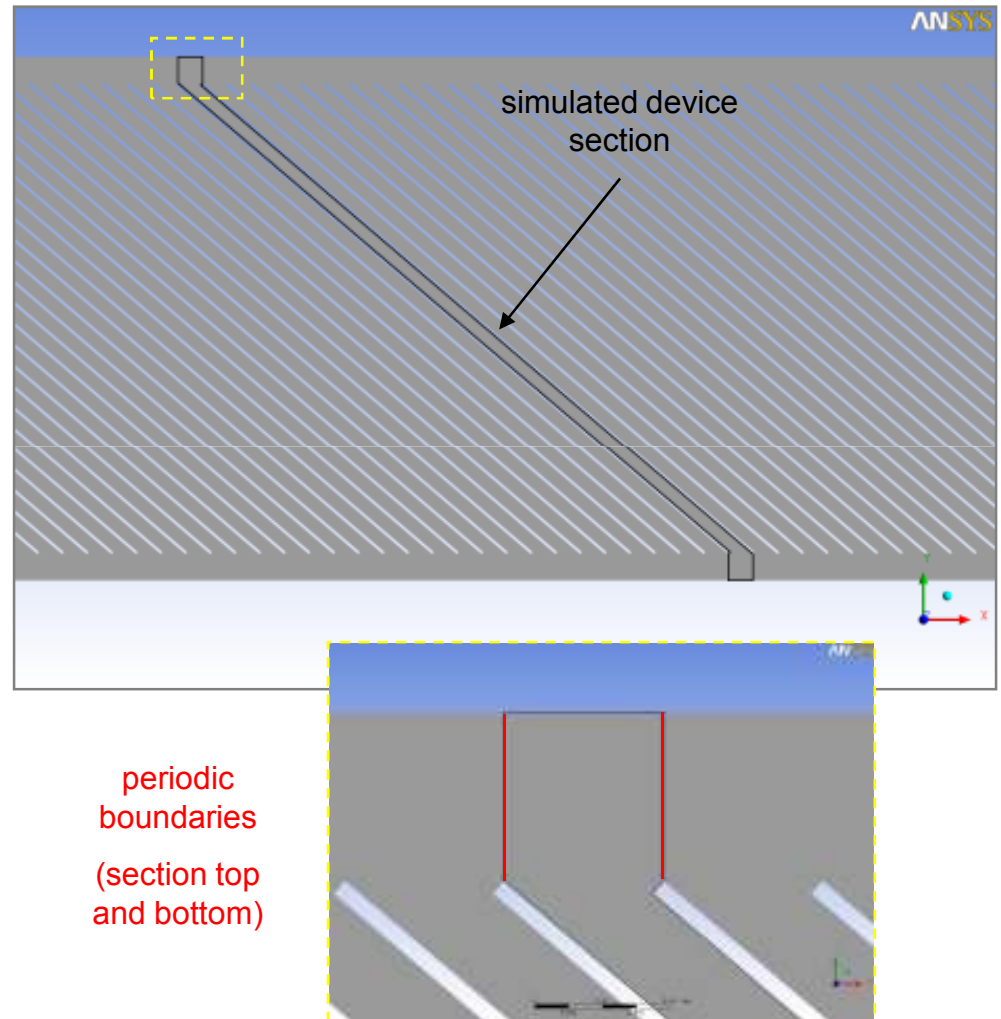
# Problem Description

- Model overview



# Methodology

- **First analysis**
  - Conceptual analysis
    - “Infinite” (in width) separator
    - Section between adjacent plates
    - Periodic domain (translational periodicity)



periodic  
boundaries  
(section top  
and bottom)

# Methodology

- **First analysis**

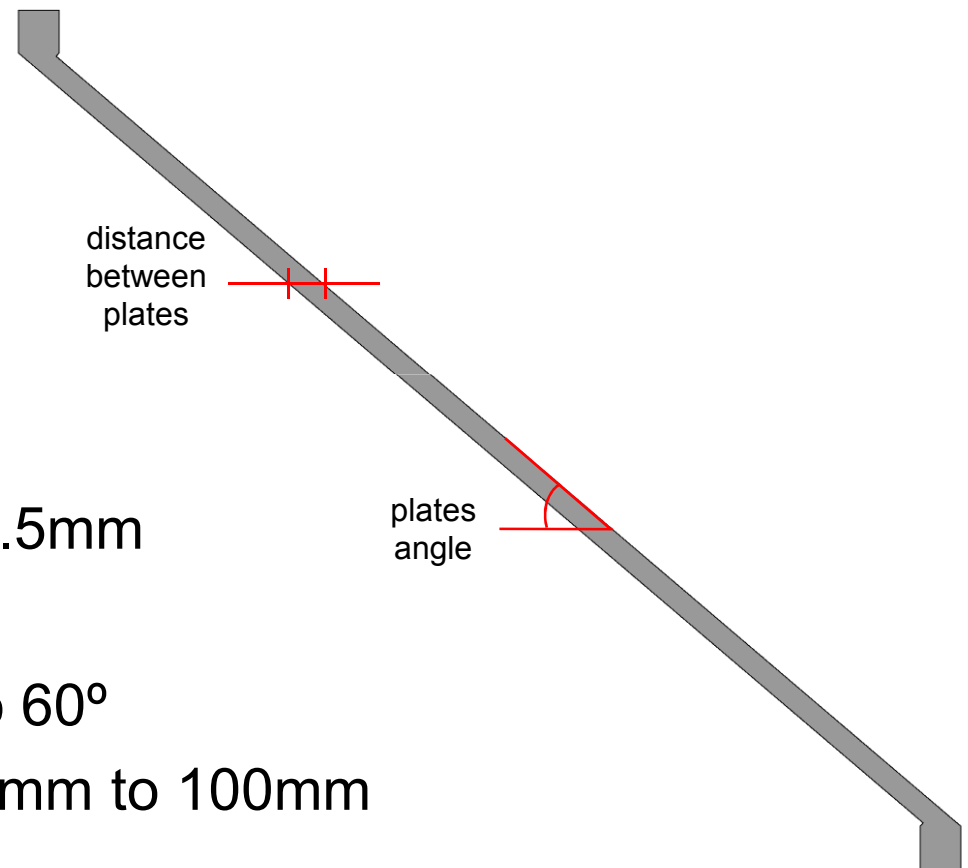
- Geometry

- Dimensions

- Height = 250mm
      - Up and bottom spacing = 25mm
      - Plate thickness = 2.5mm

- Parameters

- Angle range: 30° to 60°
    - Distance range: 20mm to 100mm



# Methodology

- **First analysis**

- Mesh

- Hexahedral elements

- Number of nodes between 20k and 30k

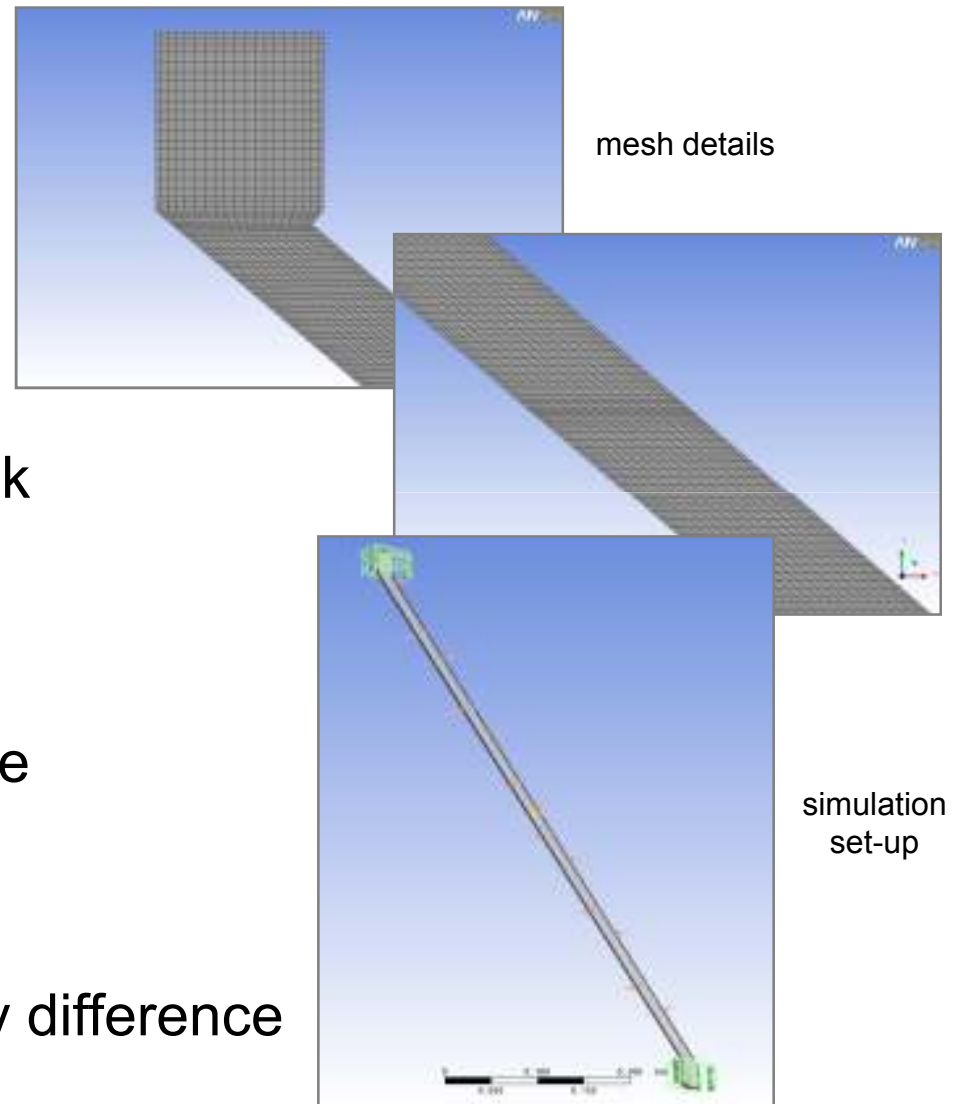
- Set-up

- Transient simulation

- Initial uniform mixture
      - » 50% of oil

- Mixture model

- Buoyancy by density difference

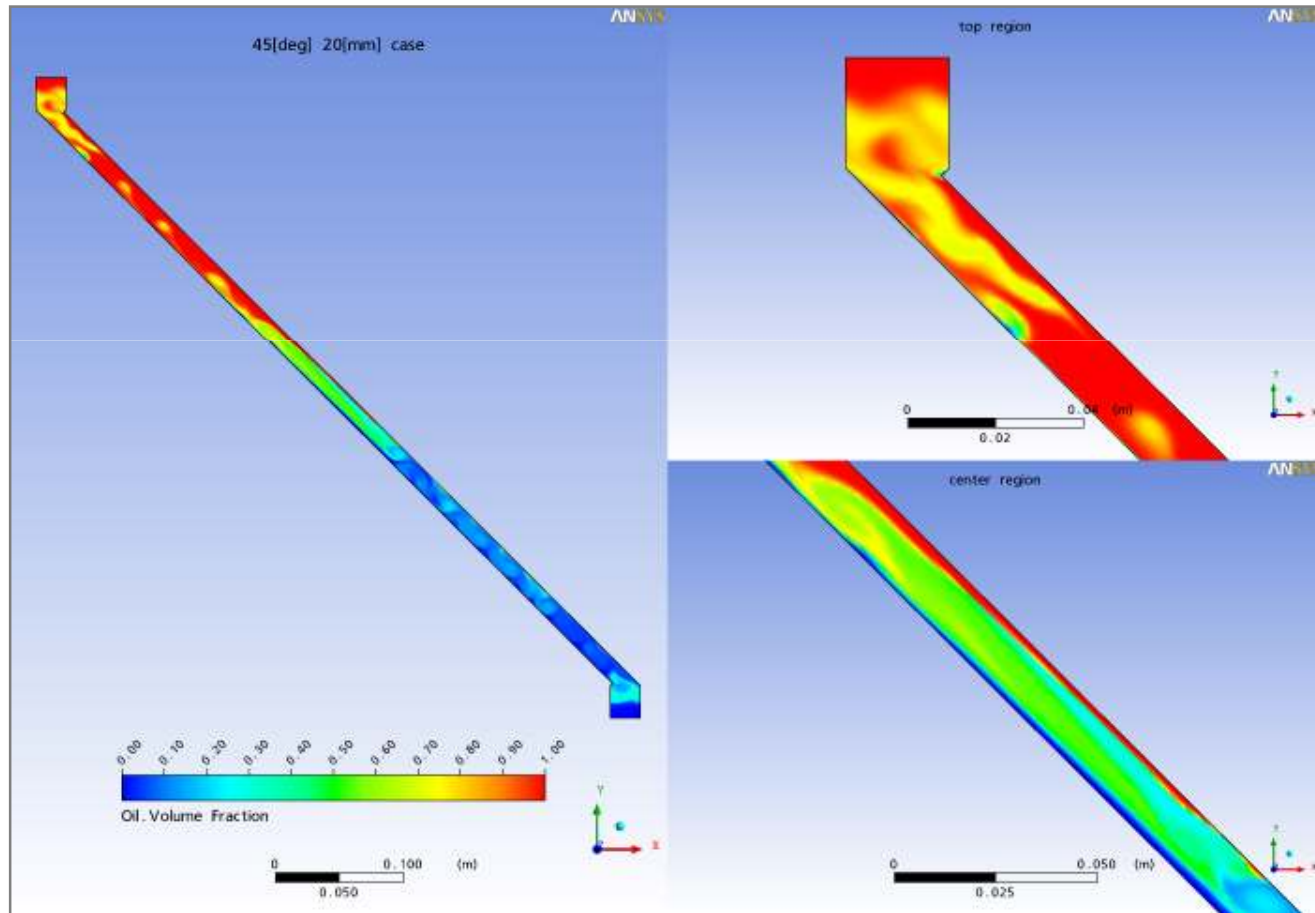


# Goals

- **First analysis**
  - Define the response surface to minimize separation time
    - Qualitative results expected to agree with “real” case
  - Restrict parameters range to second (complete) analysis
    - Second analysis
      - Conceptual 3D model of a separation tank
        - » Inclusion of device length as an additional parameter

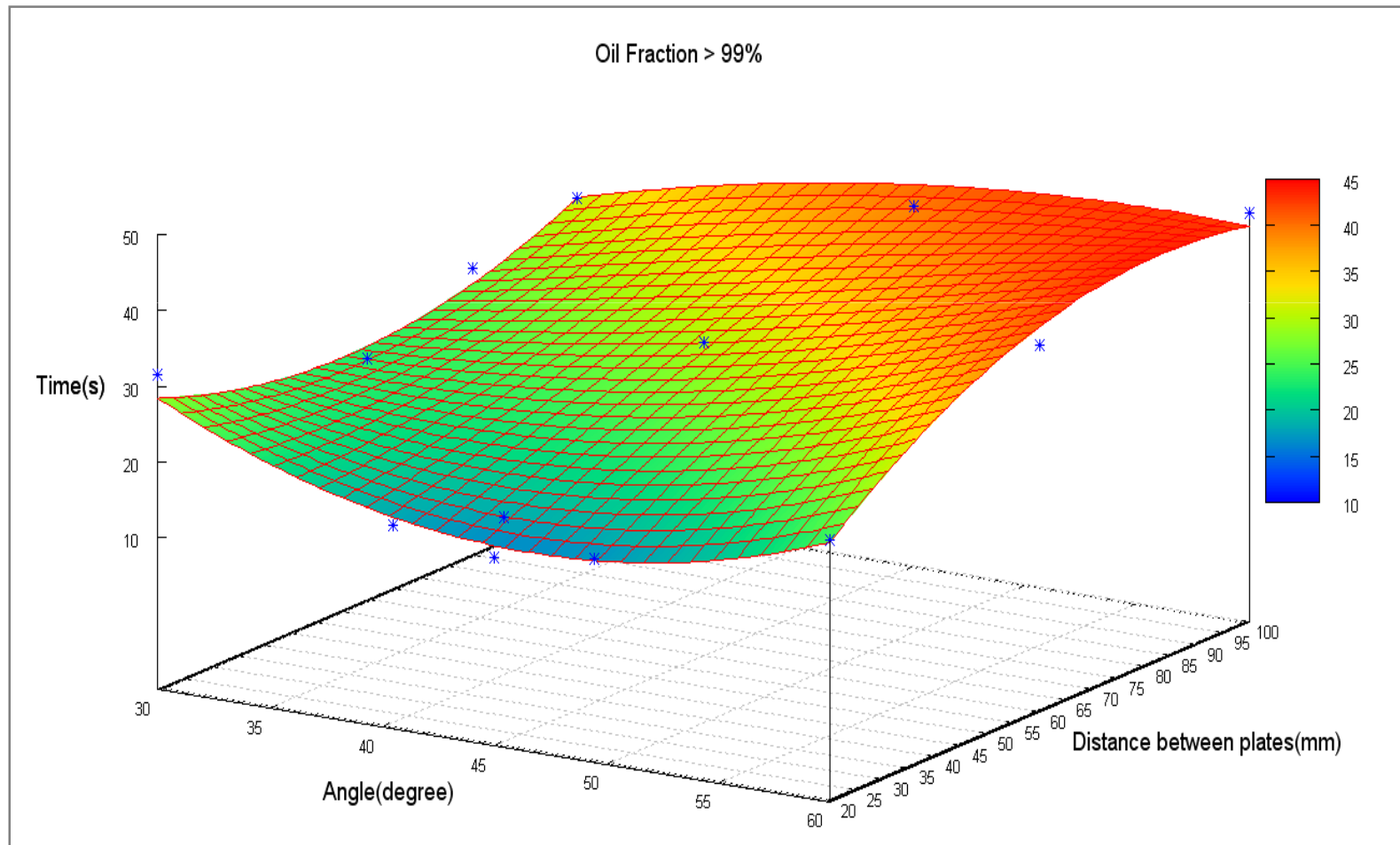
# Results

- Separation



# Results

- Response surface



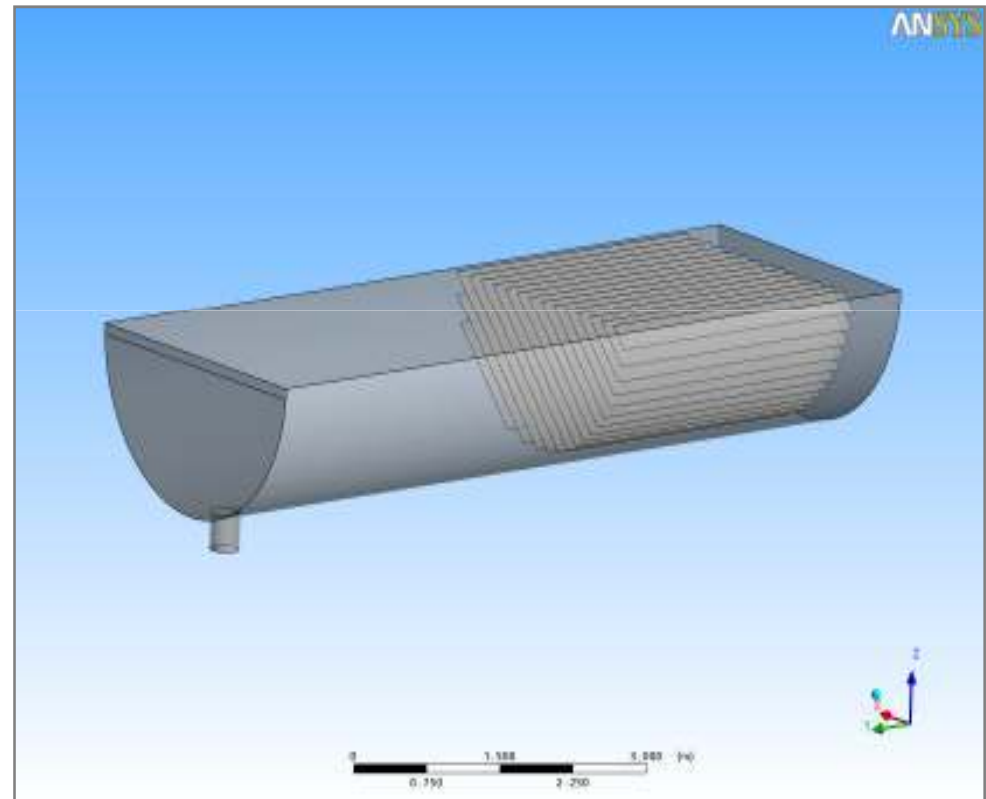
# Results

- **First analysis**
  - Optimal point
    - Plates angle of  $45^\circ$  and distance of 20mm
    - Simulations of points with 10% of variation in parameters values confirmed the location
    - Separation time considerably reduced
      - ~40% of the time needed with the domain without plates

# Conclusions and next steps

- **Second analysis**
  - Extension of the research done in the first analysis
  - Parameters optimization
    - Inclusion of the “device length” parameter

conceptual 3D geometry



# Conclusions and next steps

- **Second analysis**

- Mesh

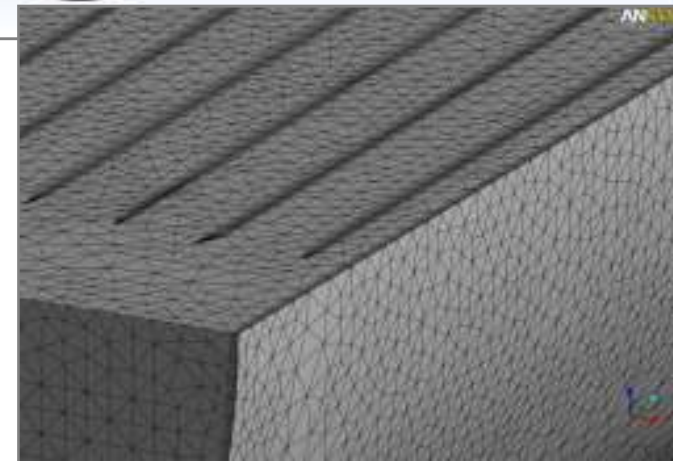
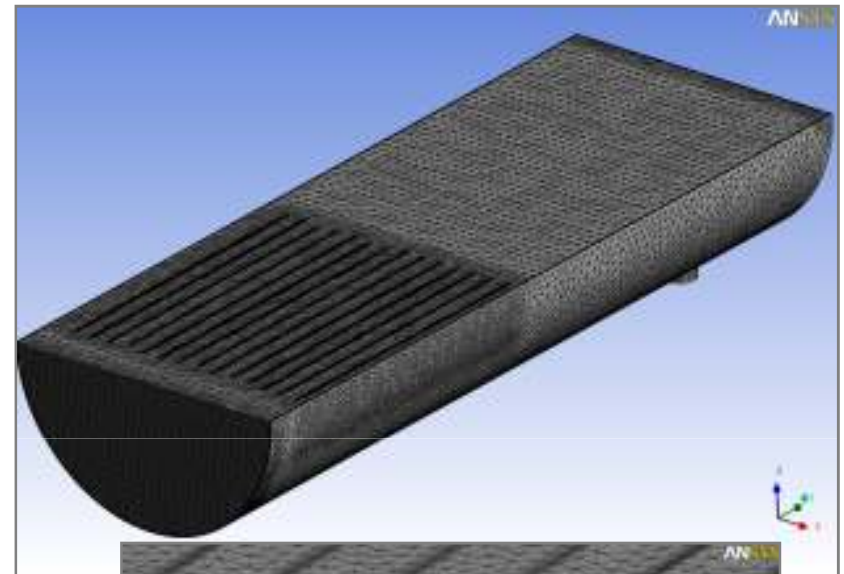
- Tetra/prism mesh

- Prism layers in walls and around plates

- Plates considered as thin walls

- $V_{\text{plates}} < 0.15\% V_{\text{tank}}$

3D tank mesh



prism layers detail

# Conclusions and next steps

- **Conclusions**

- Device influence can be modeled via CFD
  - More detailed quantitative results need detailed morphology data
- Optimum point captured in a first simplified analysis
  - Constraint to the complete analysis (3D) of the range of design parameters
- Detailed analysis in progress!