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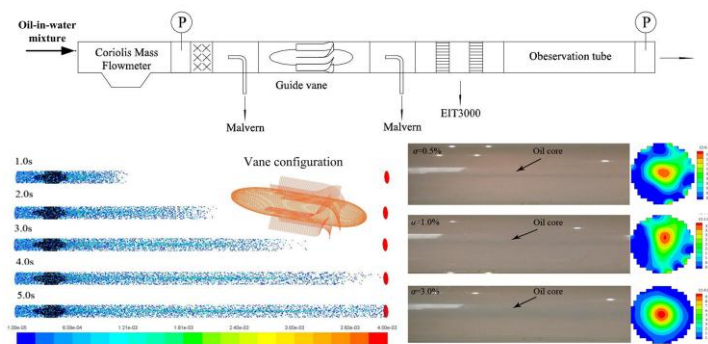
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### Graphical abstract



### Highlights

- An experimental and numerical study on non-dilute oil drop behavior in swirling flow field was performed.
- Malvern RTsizer and Electrical Resistance Tomography were used to obtain the drop size distribution and phase concentration.
- Renormalization-group  $k-\varepsilon$  turbulent model, coupled with a discrete phase model simulating oil phase was applied.
- Oil drop behavior including breakup, coalescence and trajectory in vane-type swirling flow field was obtained.
- Regularity of swirling intense distribution and drop-turbulence interaction in a swirling flow field was established.

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