Figures

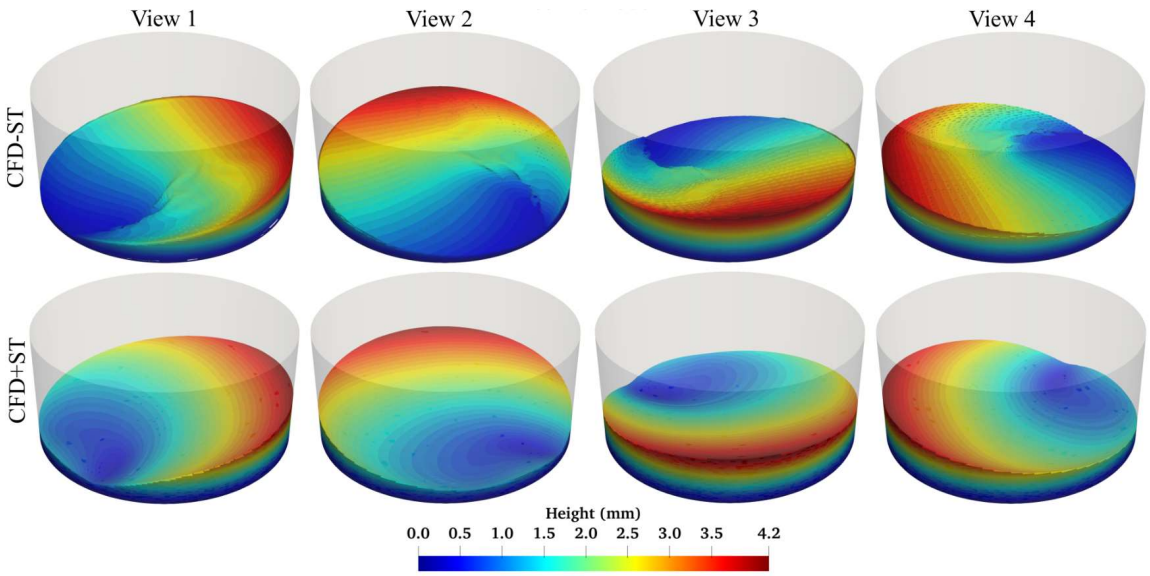


Figure 1

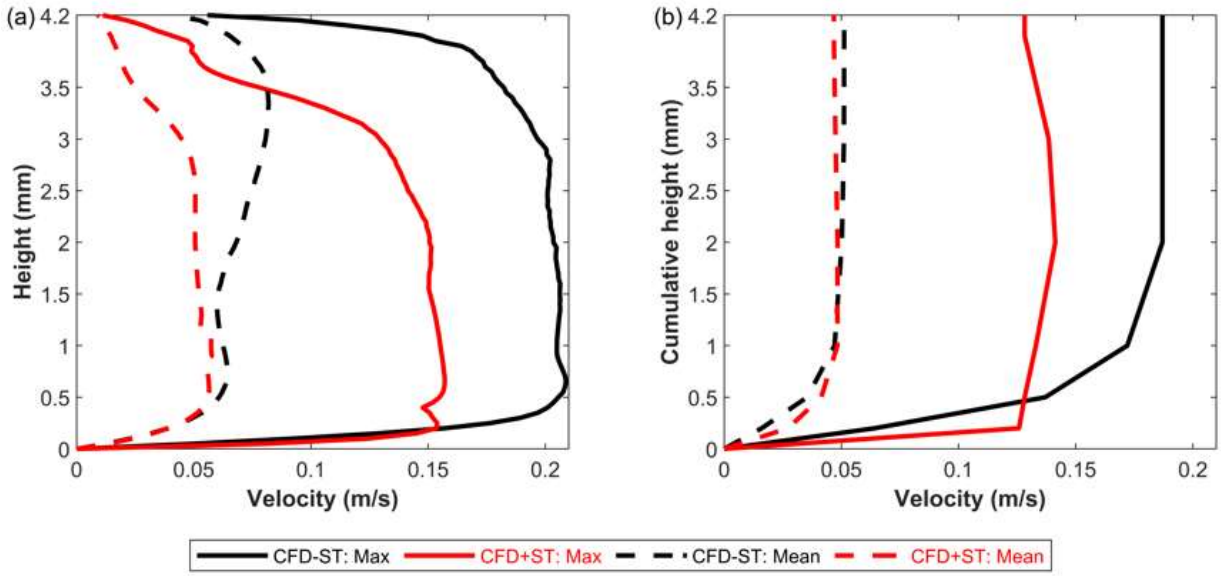

(a)
(b)
Height (mm)
Cumulative height (mm)
Velocity (m/s)
Velocity (m/s)
0
0.5
1
1.5
2
2.5
3
3.5
4.2
0.05
0.1
0.15
0.2
CFD-ST: Max
CFD+ST: Max
CFD-ST: Mean
CFD+ST: Mean

Figure 2.

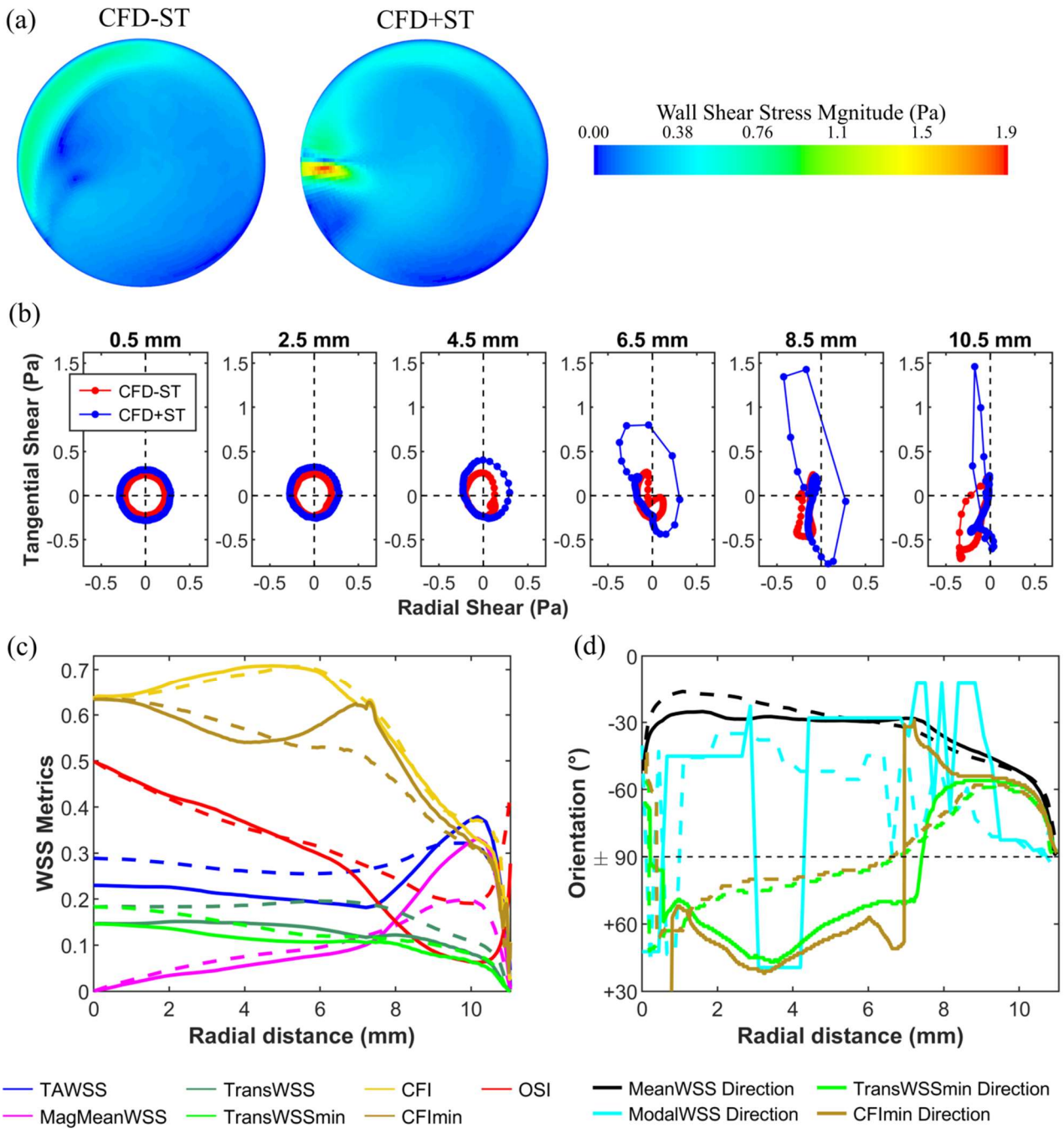

(a)
CFD-ST
CFD+ST
Wall Shear Stress Mgnitude (Pa)
0.00
0.38
0.76
1.1
1.5
1.9
(b)
0.5 mm
2.5 mm
4.5 mm
6.5 mm
8.5 mm
10.5 mm
CFD-ST
CFD+ST
Tangential Shear (Pa)
Radial Shear (Pa)
(c)
WSS Metrics
Radial distance (mm)
(d)
Orientation (°)
Radial distance (mm)
TAWSS
TransWSS
CFI
OSI
MagMeanWSS
TransWSSmin
CFImin
MeanWSS Direction
TransWSSmin Direction
ModalWSS Direction
CFImin Direction

Figure 3

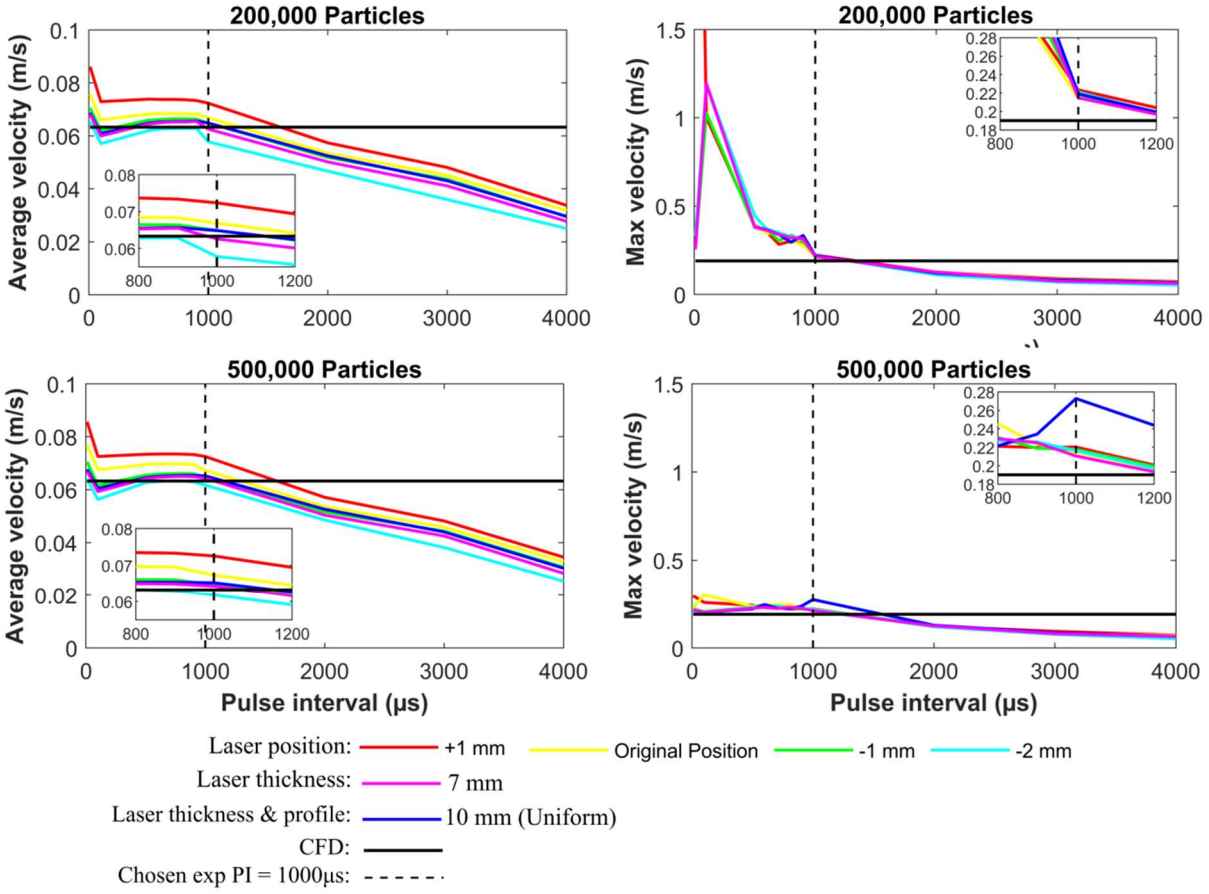

200,000 Particles
Average velocity (m/s)
200,000 Particles
Max velocity (m/s)
500,000 Particles
Average velocity (m/s)
Pulse interval (μs)
500,000 Particles
Max velocity (m/s)
Pulse interval (μs)
Laser position: +1 mm
Original Position
-1 mm
-2 mm
Laser thickness: 7 mm
Laser thickness & profile: 10 mm (Uniform)
CFD:
Chosen exp PI = 1000μs:

Figure 4

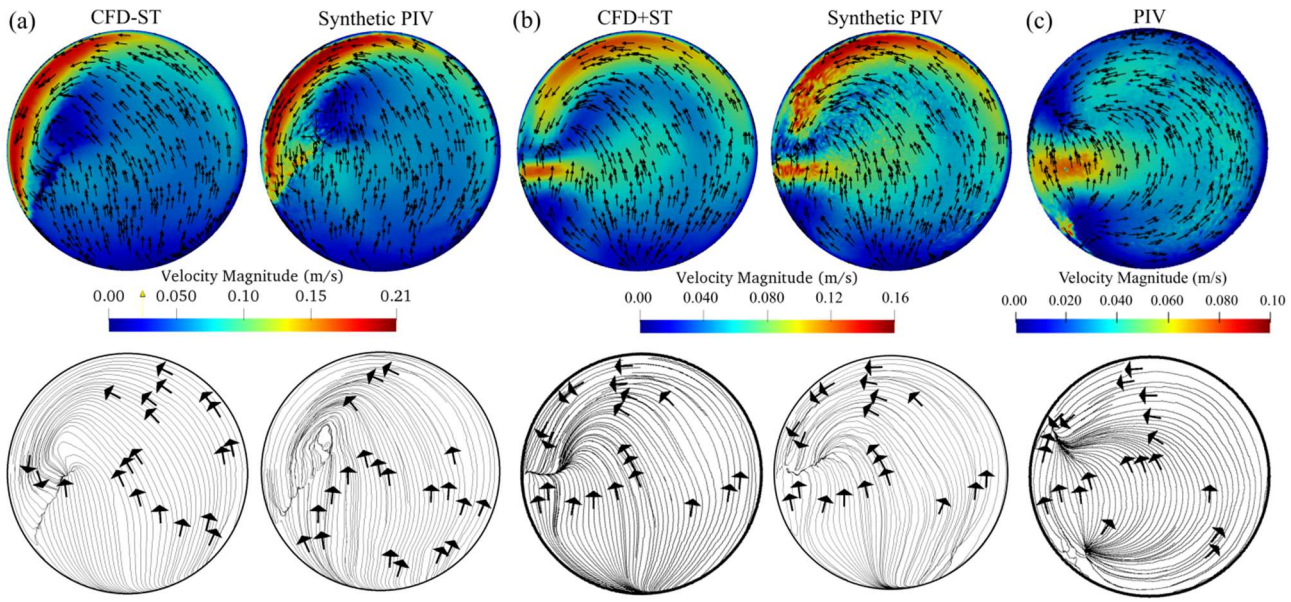

(a)
CFD-ST
Synthetic PIV
(b)
CFD+ST
Synthetic PIV
(c)
PIV
Velocity Magnitude (m/s)
0.00 0.050 0.10 0.15 0.21
Velocity Magnitude (m/s)
0.00 0.040 0.080 0.12 0.16
Velocity Magnitude (m/s)
0.00 0.020 0.040 0.060 0.080 0.10

Figure 5

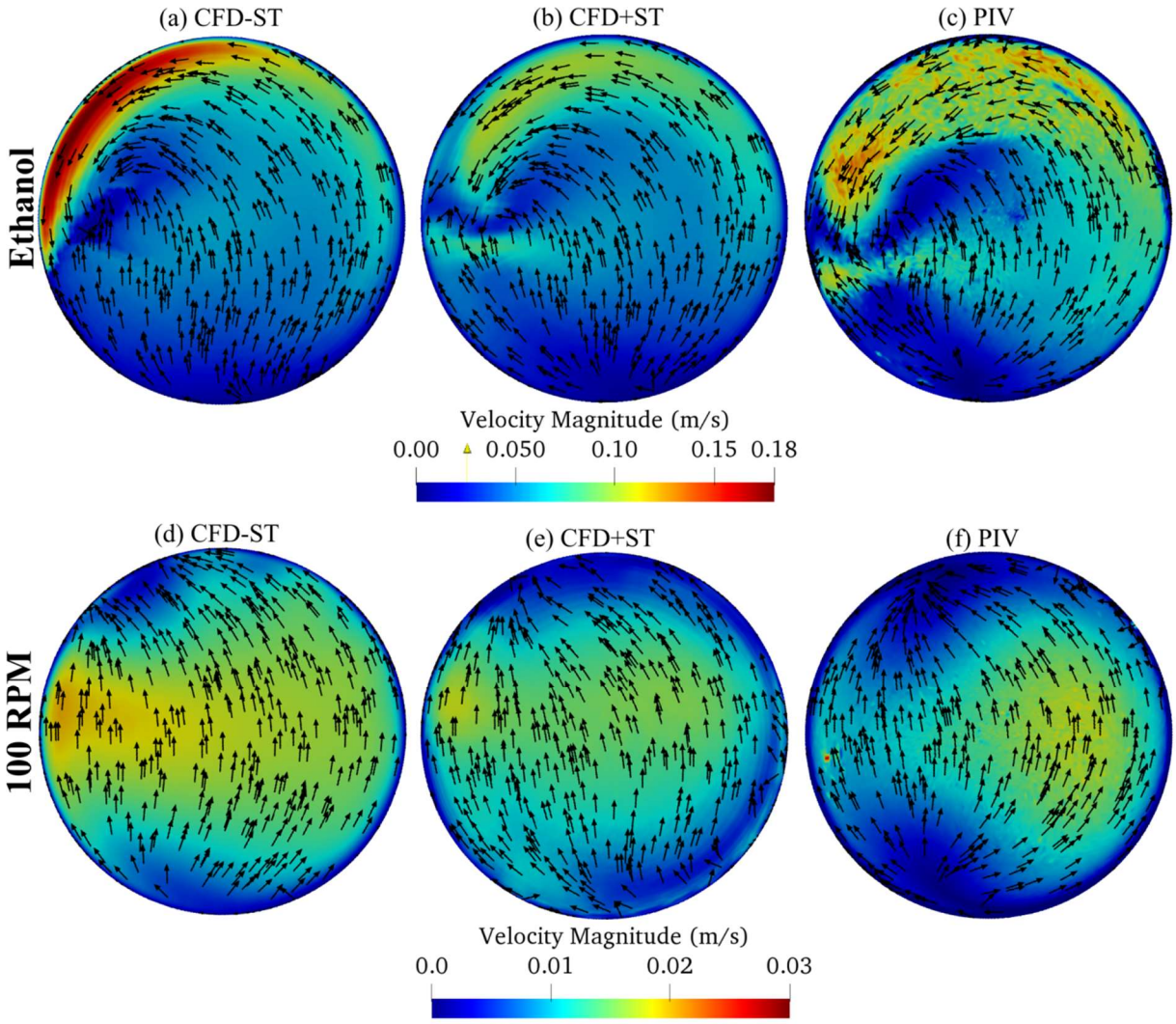

(a) CFD-ST
(b) CFD+ST
(c) PIV
Ethanol
Velocity Magnitude (m/s)
0.00
0.050
0.10
0.15
0.18
(d) CFD-ST
(e) CFD+ST
(f) PIV
100 RPM
Velocity Magnitude (m/s)
0.0
0.01
0.02
0.03

Figure 6

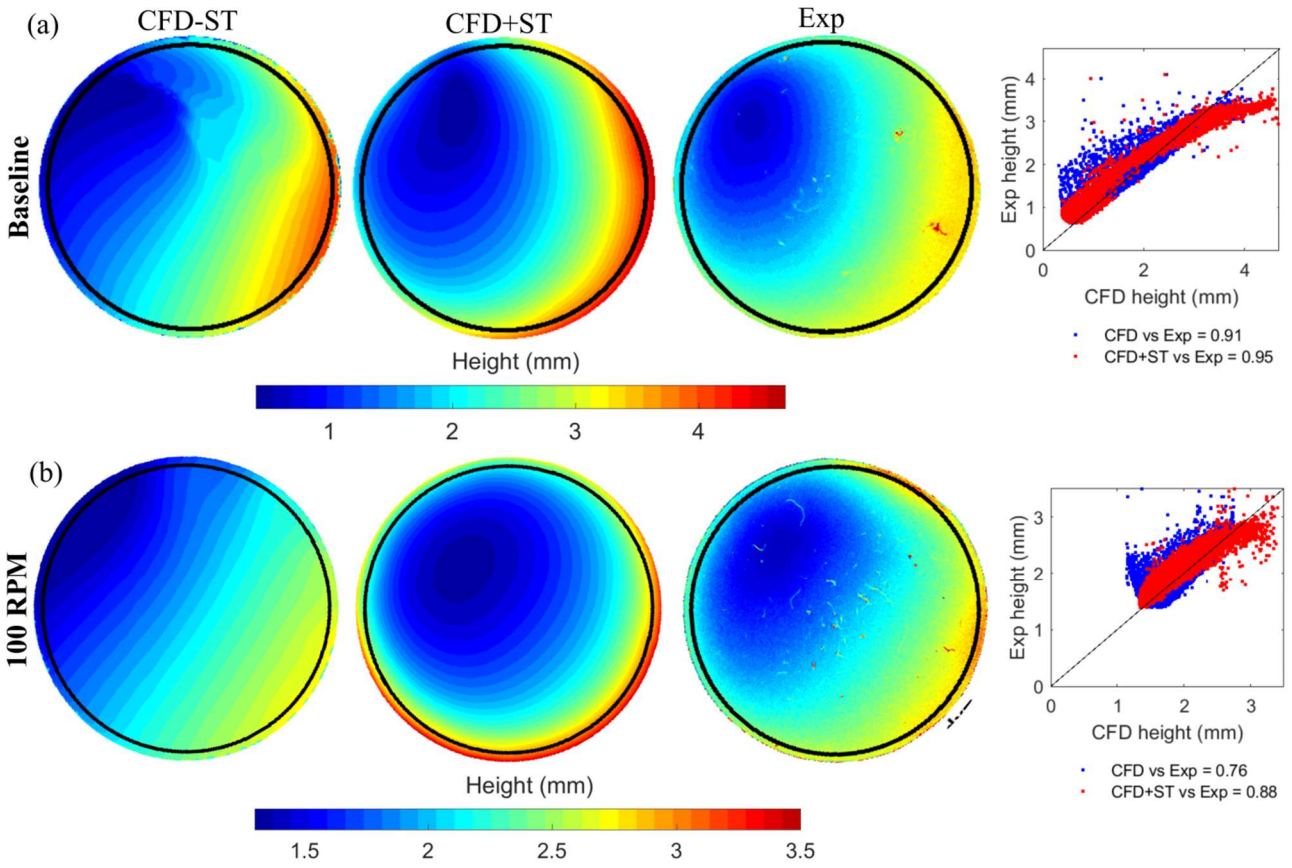
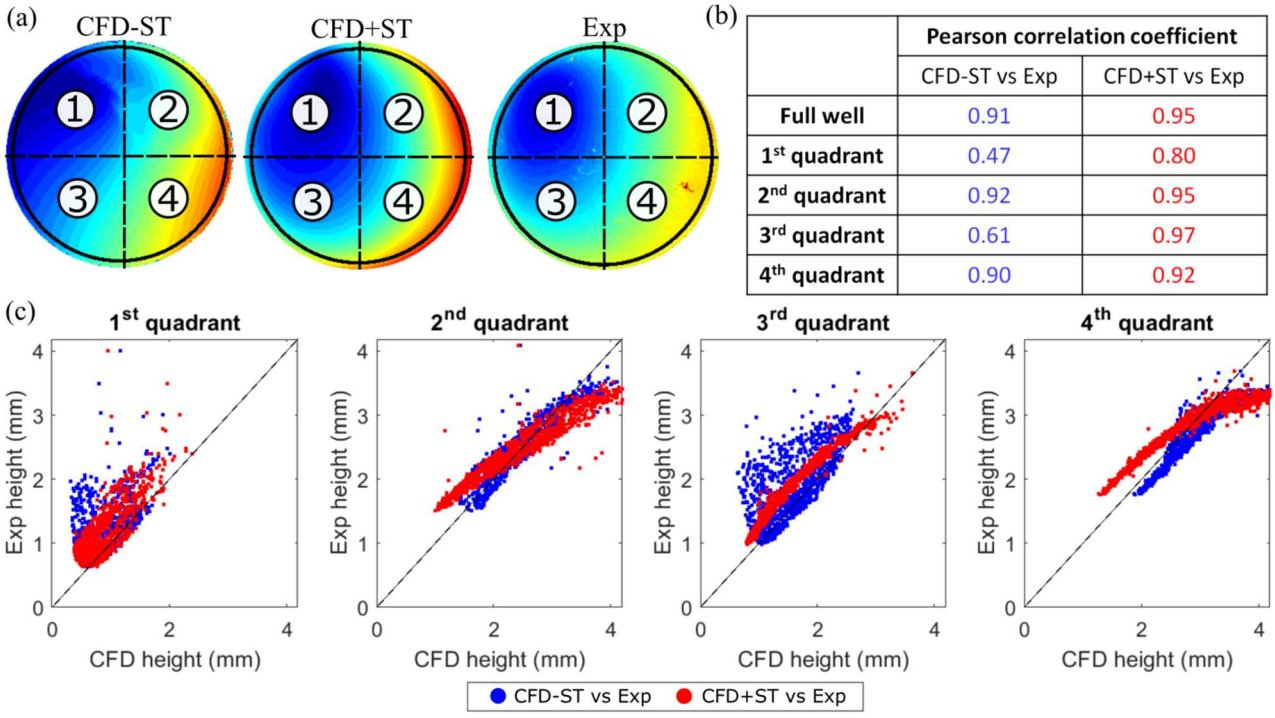

(a)
CFD-ST
CFD+ST
Exp
Baseline
Height (mm)
1
2
3
4
Exp height (mm)
CFD height (mm)
CFD vs Exp = 0.91
CFD+ST vs Exp = 0.95
(b)
100 RPM
Height (mm)
1.5
2
2.5
3
3.5
Exp height (mm)
CFD height (mm)
CFD vs Exp = 0.76
CFD+ST vs Exp = 0.88

Figure 7



	Pearson correlation coefficient	
	CFD-ST vs Exp	CFD+ST vs Exp
Full well	0.91	0.95
1st quadrant	0.47	0.80
2nd quadrant	0.92	0.95
3rd quadrant	0.61	0.97
4th quadrant	0.90	0.92

Figure 8