

Supporting Information

Table S1 Demographics and PFTs results of healthy volunteers for retrospective analysis.

Parameters	HV1	HV2	HV3	HV4	HV5	HV6
Demographics						
Age (years)	27	25	23	26	26	26
Sex (M/F)	M	M	M	M	F	M
BMI (kg/m ²)	21.1	17.9	18.9	22.5	18.0	22.0
PFTs						
FEV ₁ (L)	4.53	5.19	5.02	-	3.17	5.28
FVC (L)	5.60	5.49	5.47	-	3.71	5.89
FEV ₁ /FVC (%)	80.9	94.5	91.8	-	85.4	89.6

Note: M, male; F, female; BMI, body mass index; PFTs: pulmonary function tests; FEV₁, forced expiratory volume in 1 second; FVC, forced vital capacity.

Table S2 Demographics, pulmonary function tests (PFTs) and prospective VCS results of healthy volunteers.

Parameters	Healthy volunteers												
	HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8	HV9	HV10	HV11	HV12	HV13
Demographics													
Age (years)	29	57	55	52	54	57	52	64	48	52	47	44	24
Sex	M	F	F	F	F	F	F	F	F	F	F	F	M
BMI (kg/m ²)	25.7	23.3	24.2	24.1	26.6	24.3	24.4	22.5	21.9	26.0	28.9	26.7	18.0
PFTs													
FEV ₁ /FVC (%)	85.1	77.4	74.9	85.7	79.4	78.7	79.2	67.6	74.8	75.2	80.0	83.4	94.4
DL _{co} (% _{pred})	82.4	92.8	106.9	100.5	86.2	96.6	108.5	101.8	86.3	96.6	-	87.5	-
VCS DW-MRI													
R (μm)	337.06	356.51	347.84	339.67	339.39	358.29	362.8	337.06	340.4	323.13	351.9	312.52	351.3
L _m (μm)	195.55	219.16	196.7	201.04	199.39	225.3	220.65	189.43	197.08	178.84	216.26	169.4	219.01
SVR (cm ⁻¹)	212.08	191.23	209.66	208.59	207.04	185.88	188.4	215.81	210.34	230.23	196.54	243.34	188.28
ADC (cm ² /s)	0.0344	0.0376	0.0346	0.0347	0.0351	0.0393	0.0383	0.0327	0.0342	0.0309	0.037	0.0292	0.0387

Note: - Data not acquired. M, male; F, female; BMI, body mass index; PFTs: pulmonary function tests; FEV₁, forced expiratory volume in 1 second; FVC, forced vital capacity; DL_{co}, diffusing capacity of the lung for carbon monoxide; %_{pred}, percent-predicted; VCS: variable-sampling-ratio compressed sensing; DW: diffusion weighted; R, acinar duct radius; L_m, mean linear intercept; SVR, surface-to-volume ratio; ADC, apparent diffusion coefficient.

Table S3 Demographics, pulmonary function tests (PFTs) and prospective VCS results of cigarette smokers.

Parameters	Cigarette smokers													
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14
Demographics														
Age (years)	69	57	62	58	56	53	57	57	47	52	64	55	38	53
Sex	M	M	M	M	M	F	F	M	M	M	M	M	F	M
BMI (kg/m ²)	17.7	23.5	25.1	24.6	17.8	21.2	18.9	24.2	24.2	24.9	22.1	25.1	21.5	24.5
PFTs														
FEV ₁ /FVC (%)	76.6	82.7	77.2	71.3	54.0	74.8	72.5	77.5	71.6	77.8	74.5	64.9	75.2	53.9
DL _{co} (% _{pred})	91	101.2	87.9	96.1	52.9	79.2	-	69.2	96.6	76.4	95.4	88.3	96.0	57.0
VCS DW-MRI														
R (μm)	369.9	376.73	400.01	375.17	416.93	371.14	359.21	384.07	352.64	376.84	398.33	365.32	370.53	409.24
L _m (μm)	244.64	255.02	309.17	258.25	332.02	241.75	216.82	271	220.72	272.15	289.52	241.21	237.52	345.51
SVR (cm ⁻¹)	169.22	165.36	134.35	164.26	126.76	173.23	189.44	157.2	192.18	154.14	144.2	174.83	175.82	120.3
ADC (cm ² /s)	0.0428	0.0436	0.052	0.0441	0.055	0.0416	0.0381	0.0457	0.0379	0.0464	0.0489	0.0417	0.0415	0.0563

Note: - Data not acquired. M, male; F, female; BMI, body mass index; PFTs: pulmonary function tests; FEV₁, forced expiratory volume in 1 second; FVC, forced vital capacity; DL_{co}, diffusing capacity of the lung for carbon monoxide; %_{pred}, percent-predicted; VCS: variable-sampling-ratio compressed sensing; DW: diffusion weighted; R, acinar duct radius; L_m, mean linear intercept; SVR, surface-to-volume ratio; ADC, apparent diffusion coefficient.

Table S4 The calculated SNR of images with FS, rVCS and rCS for each subject.

Subject	Acquisition pattern	SNR			
		b=0 s/cm ²	b=10s/cm ²	b=20s/cm ²	b=30s/cm ²
HV1	FS	59	39	27	19
	rVCS	105	66	40	26
	rCS	76	50	34	24
HV2	FS	34	24	18	13
	rVCS	60	43	27	18
	rCS	47	33	25	19
HV3	FS	42	28	19	14
	rVCS	82	55	34	22
	rCS	54	39	28	20
HV4	FS	44	32	24	19
	rVCS	65	52	36	26
	rCS	47	36	28	22
HV5	FS	44	30	22	17
	rVCS	64	44	30	21
	rCS	44	34	26	20
HV6	FS	36	27	21	16
	rVCS	74	52	36	25
	rCS	52	37	28	22

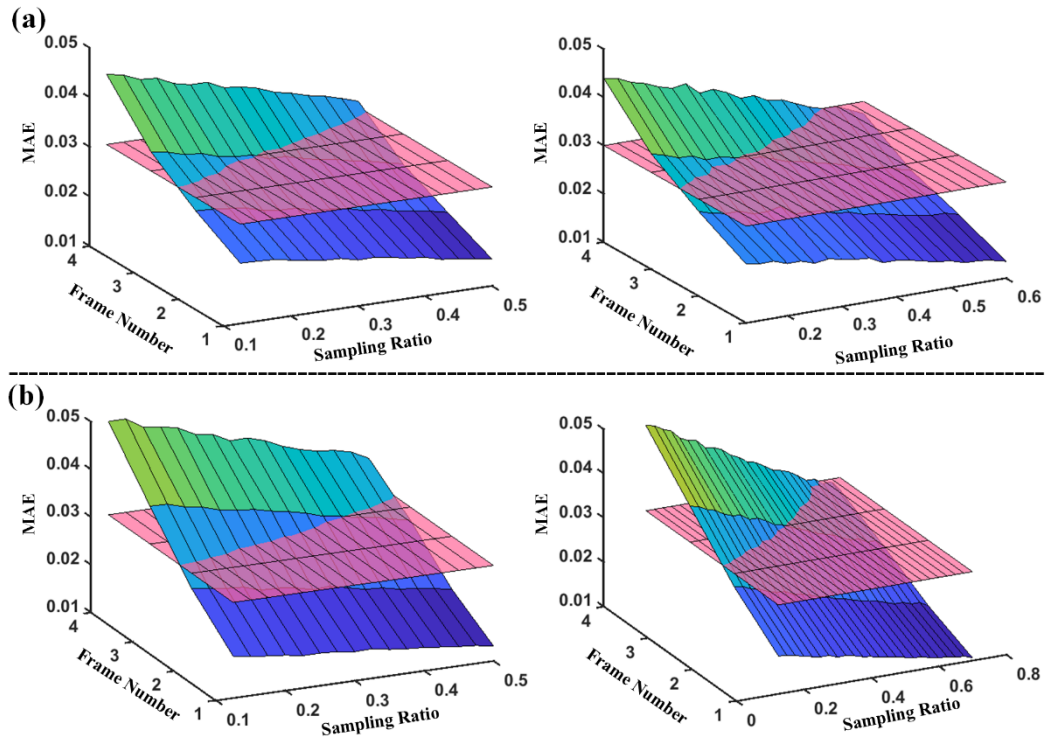


FIG. S1. The MAE values for different sampling ratios with multiple frame numbers (corresponding to b -values of 0, 10, 20, 30 s/cm^2) from two healthy volunteers (a-b). Left column represented the results of original sampling ratio from 0.125 to 0.5 and right column represented the results of increased sampling ratio to 0.6 (upper) or 0.7 (lower).

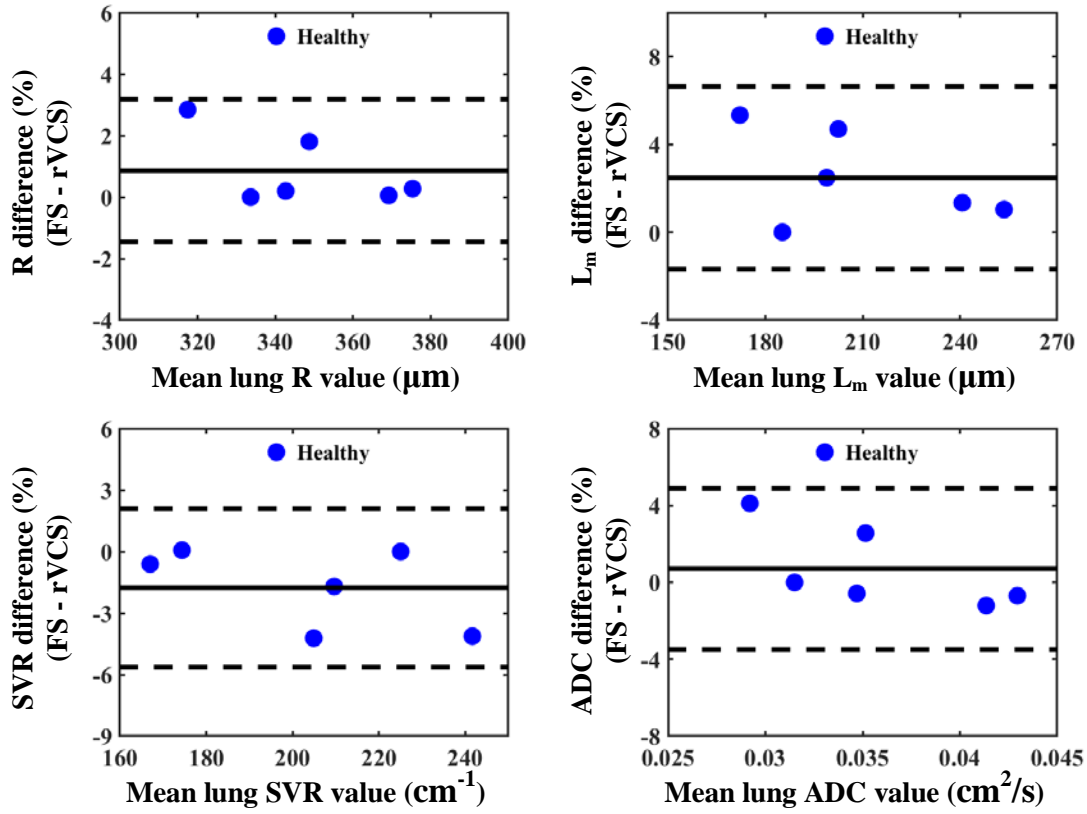


FIG. S2. Bland-Altman analysis of the morphological parameters measured with rVCS and FS measurements. The mean biases of the R, L_m , SVR and ADC values between the rVCS and FS measurements were 0.86%, 2.48%, -1.76%, and 0.70%, respectively.

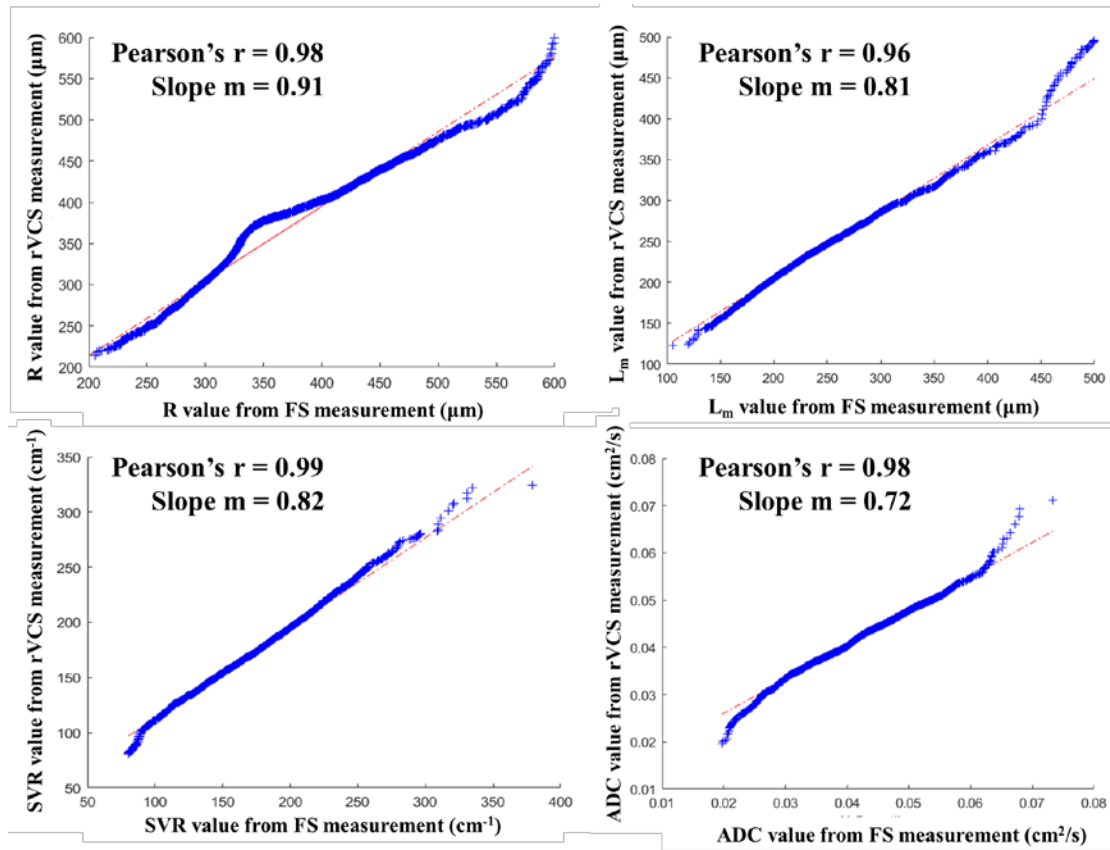


FIG. S3. Voxel-by-voxel quantile-quantile plots of the morphological parameters measured with rVCS and FS measurements. Most of the points lie on or near the line.