Compact Single-Shot Hyperspectral Imaging Using a Prism

Supplemental Material #2

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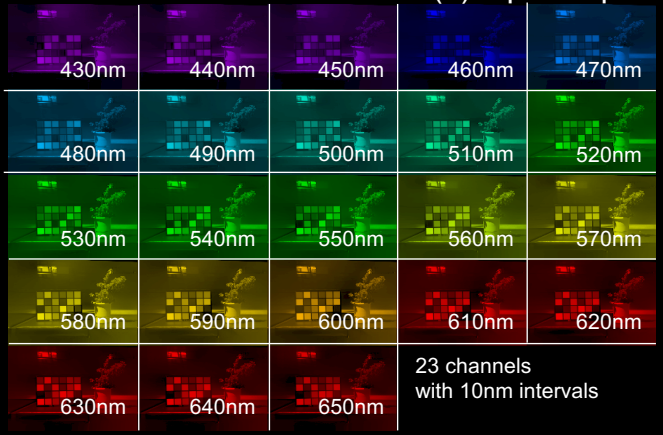
REAL SCENES

Extended Version of Figure 1

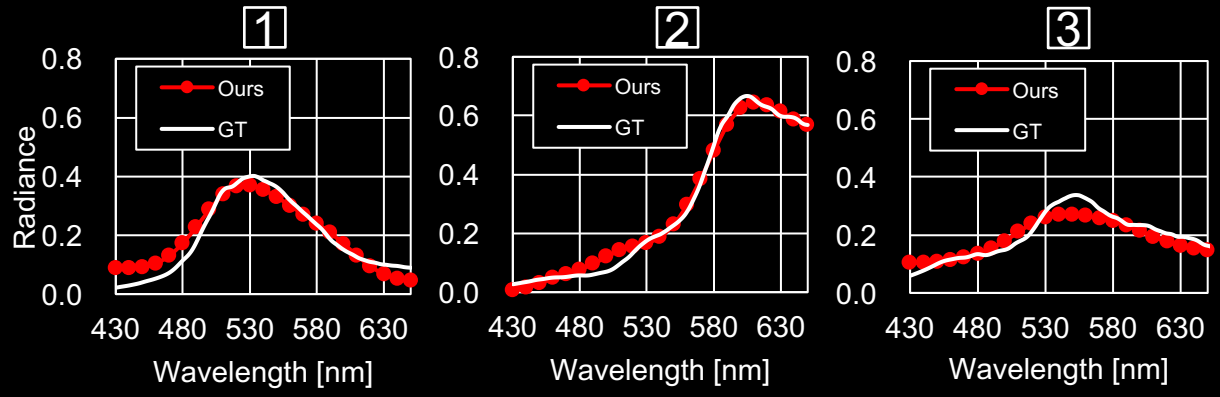
(a) Setup

(b) Input dispersed RGB image

(c) Reconstructed hyperspectral image

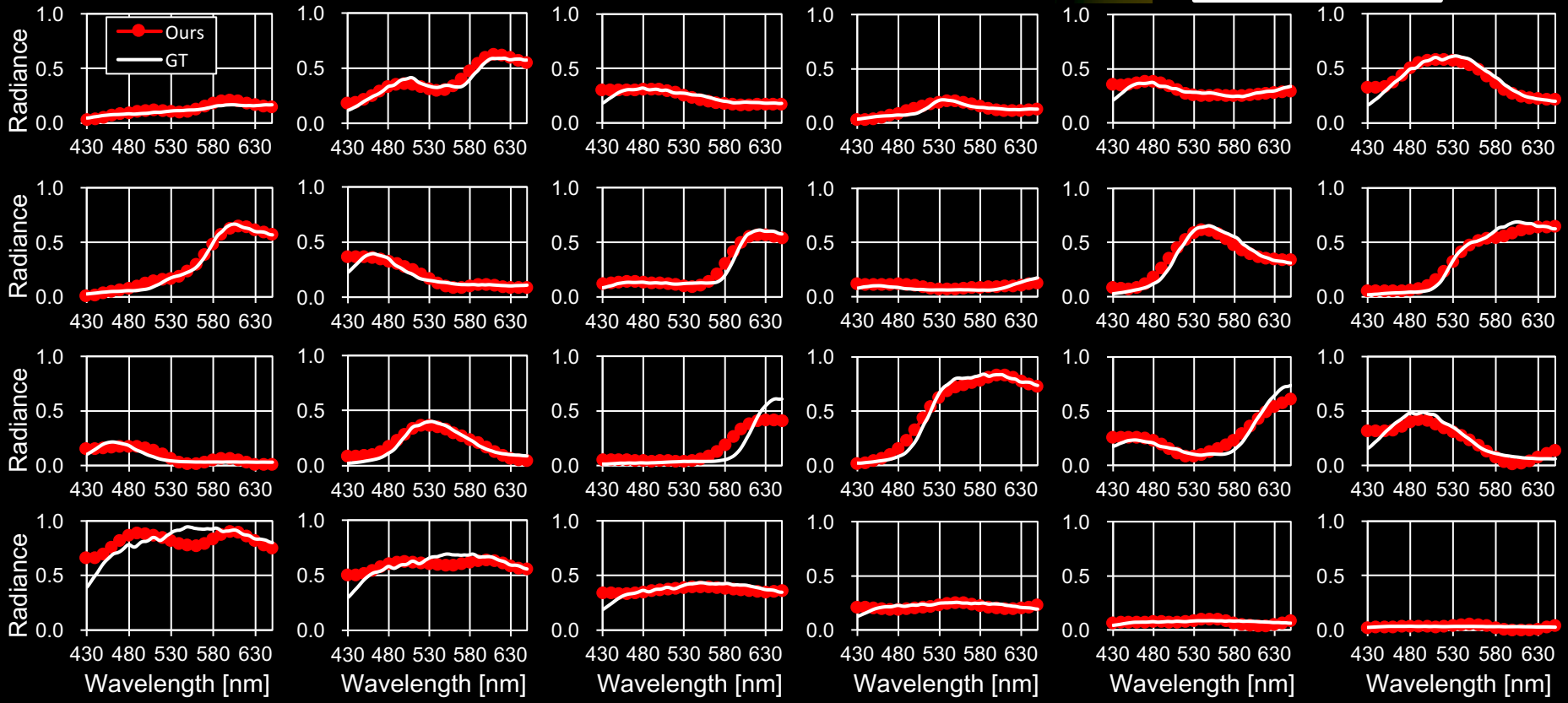


(d) Each spectral channel



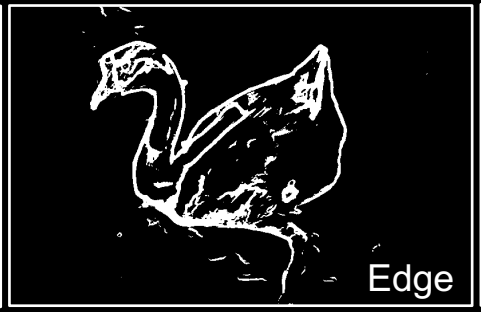
(e) Spectral power distribution

Color-checker Evaluation of Figure 1

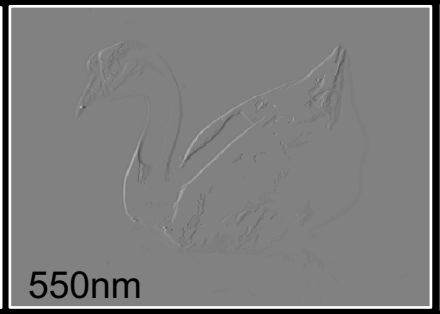


Extended Version of Figure 2

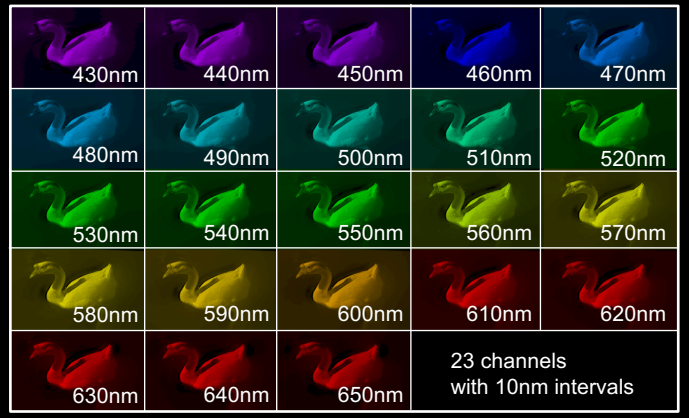
Dispersed input



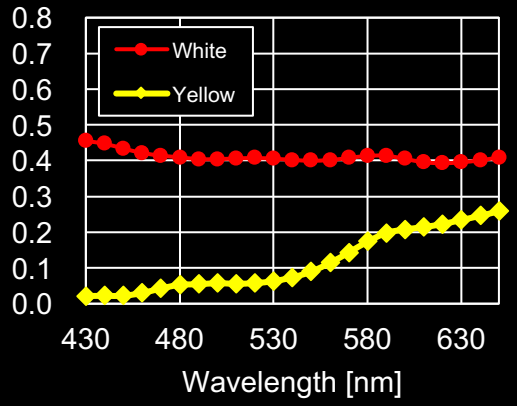
Edge restoration



Gradient estimation

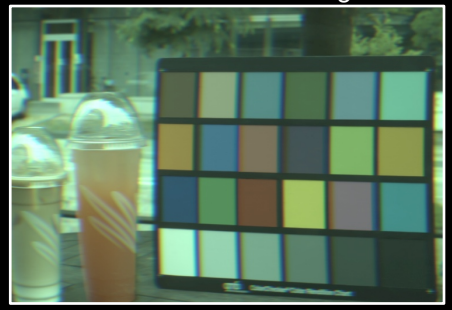


Spectral reconstruction and unwarping

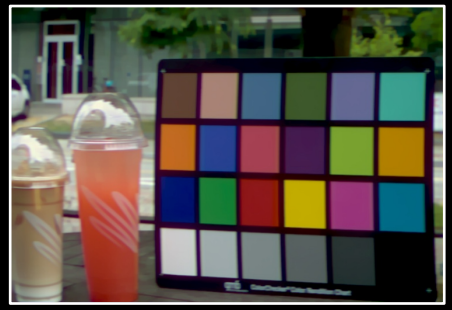


Spectral power distribution

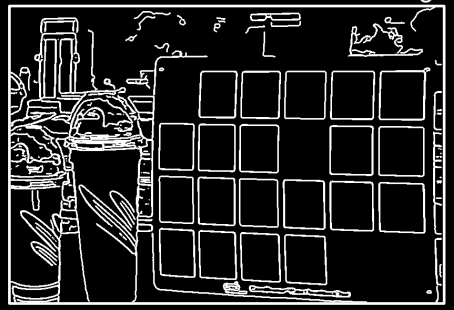
Extended Version of Figures 7 and 9

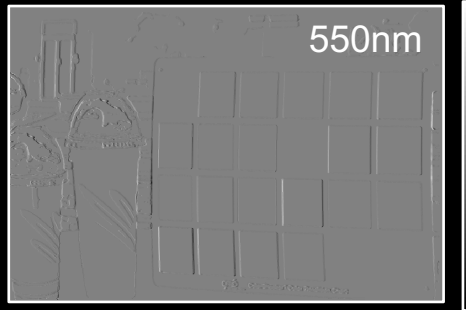


Dispersed input



Edge restoration

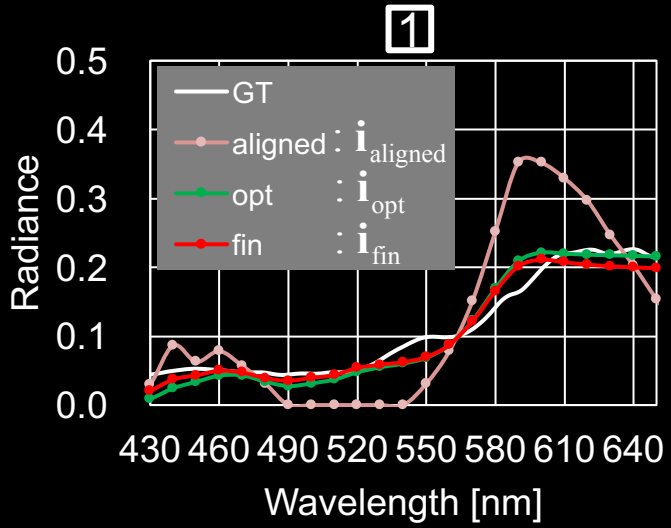




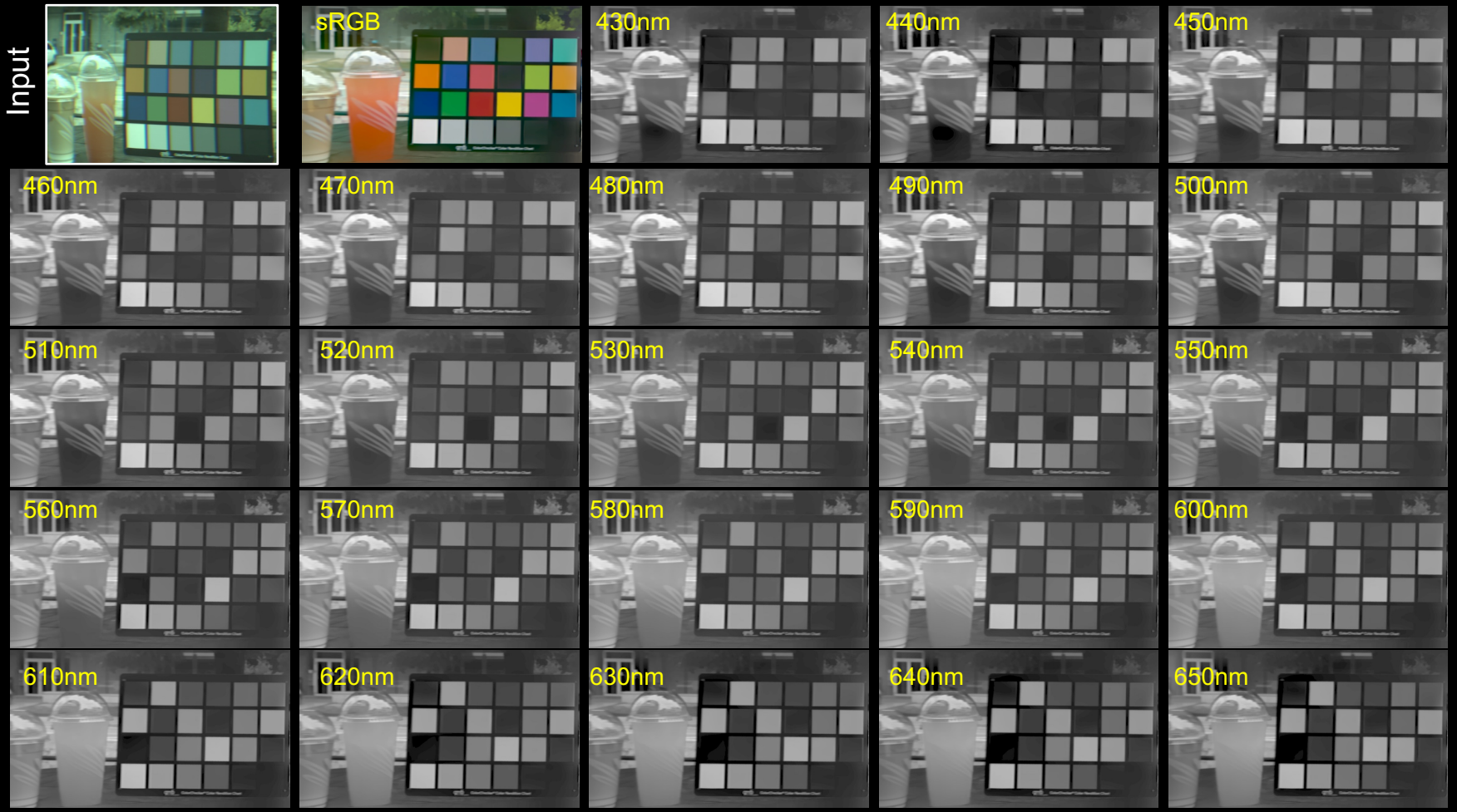
Gradient estimation

Spectrum reconstruction $\mathbf{i}_{opt}$

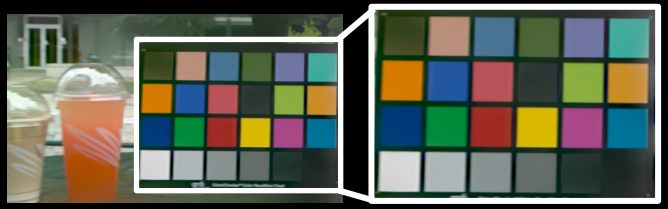
Detail-guided filtering $\mathbf{i}_{fin}$



Extended Version of Figure 14



Color-checker Evaluation of Figure 14



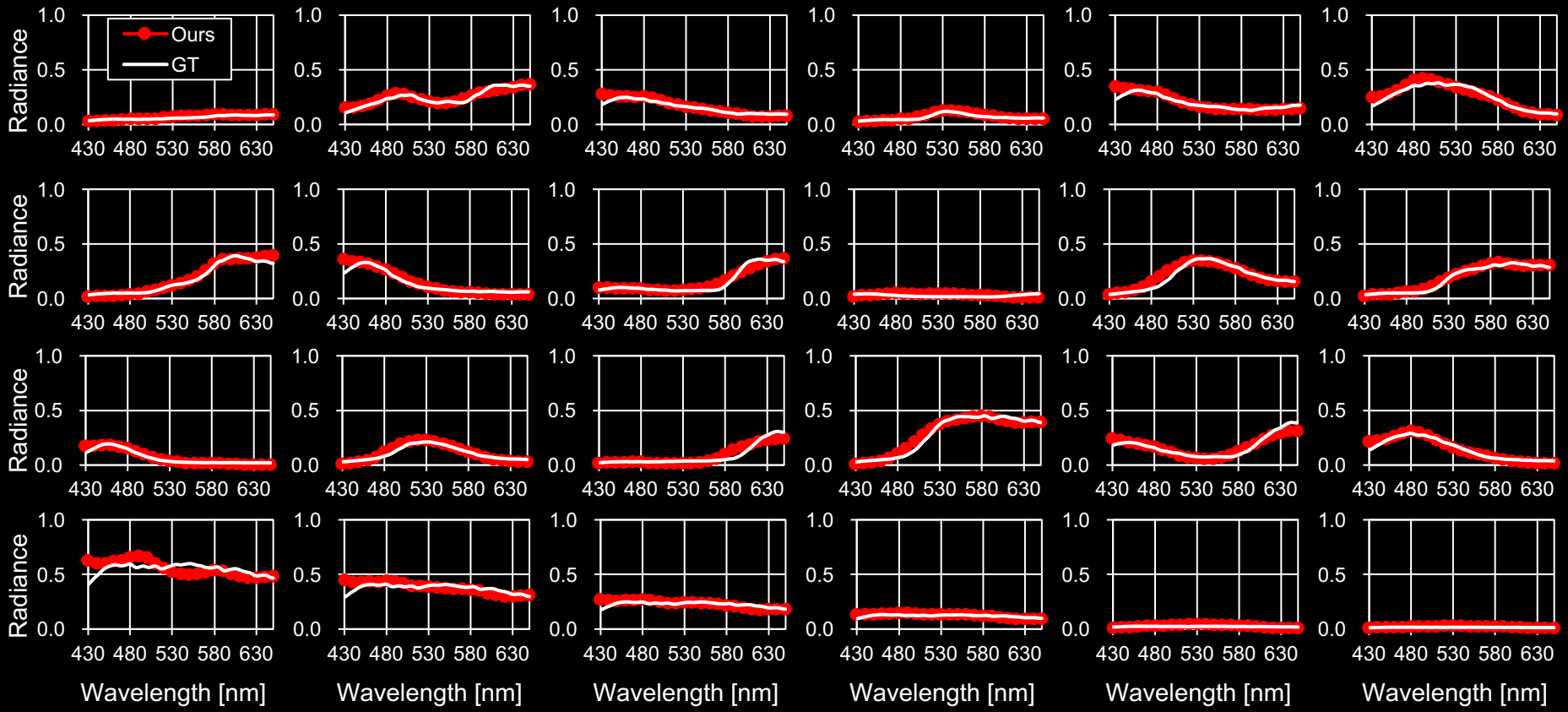
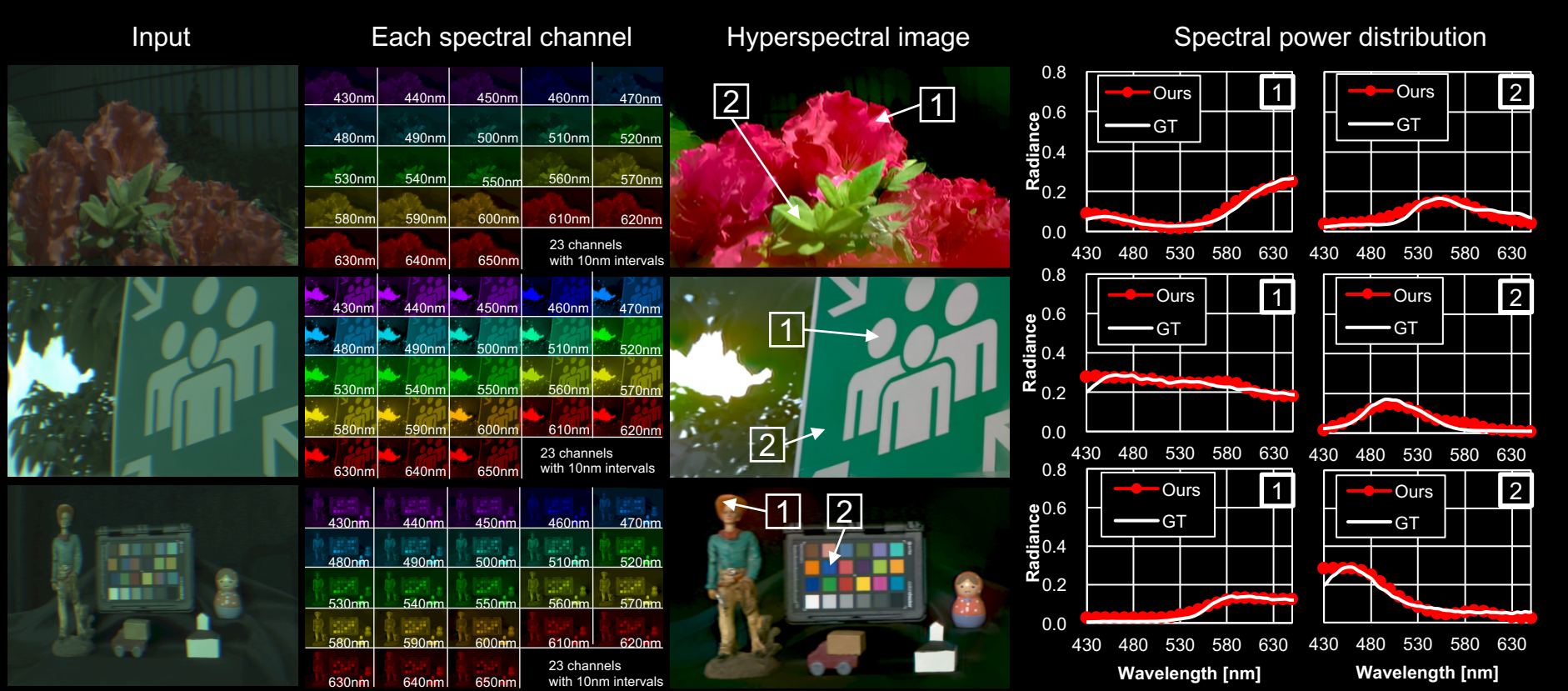
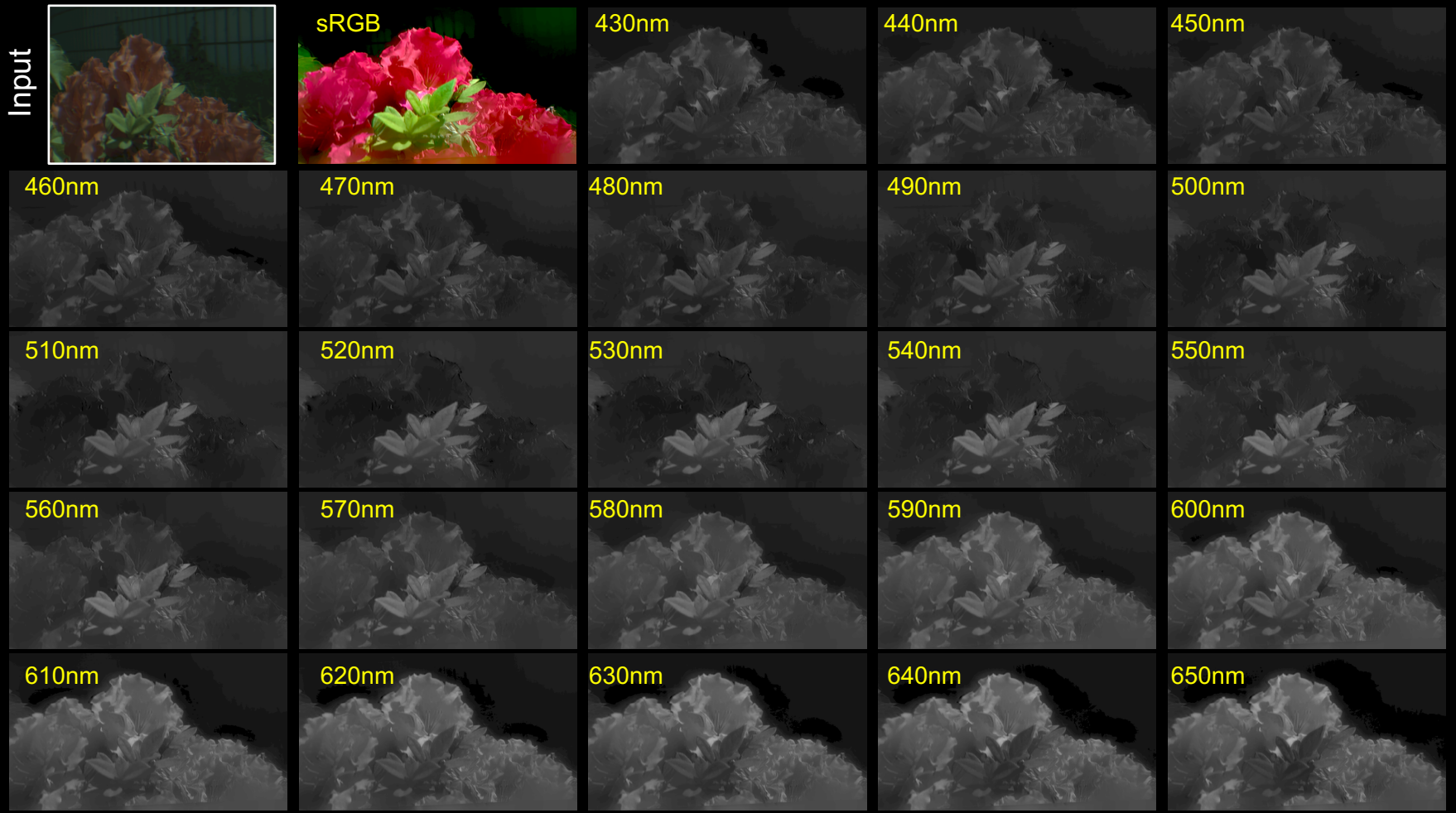


Figure 15


Input
Each spectral channel
Hyperspectral image
Spectral power distribution
430nm 440nm 450nm 460nm 470nm
480nm 490nm 500nm 510nm 520nm
530nm 540nm 550nm 560nm 570nm
580nm 590nm 600nm 610nm 620nm
630nm 640nm 650nm
23 channels with 10nm intervals
1
2
Ours
GT
Radiance
0.0 0.2 0.4 0.6 0.8
430 480 530 580 630
Wavelength [nm]

Extended Version of Figure 15



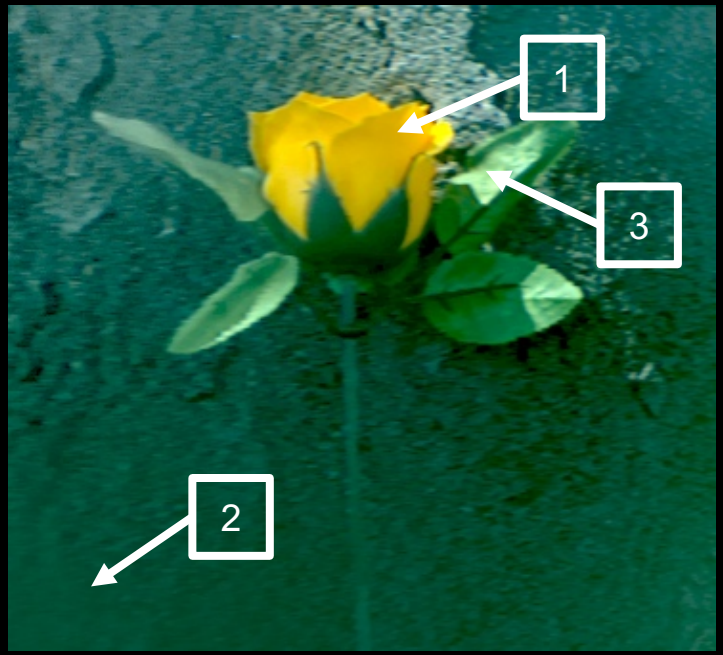
Extended Version of Figure 15

Extended Version of Figure 15

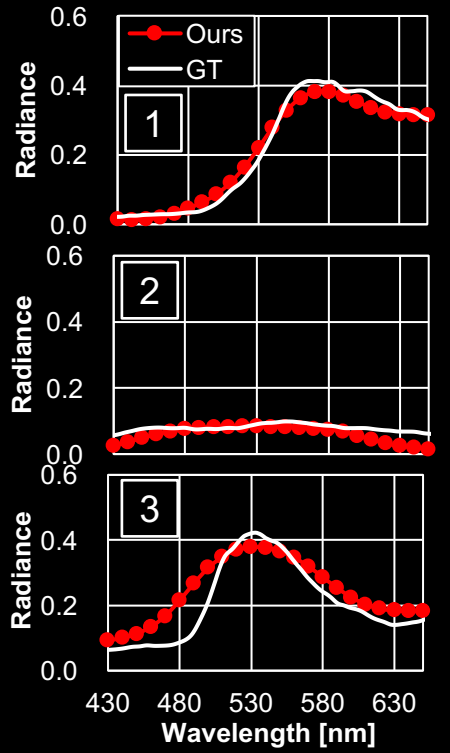
Extended Version of Figure 19

Input dispersed RGB image

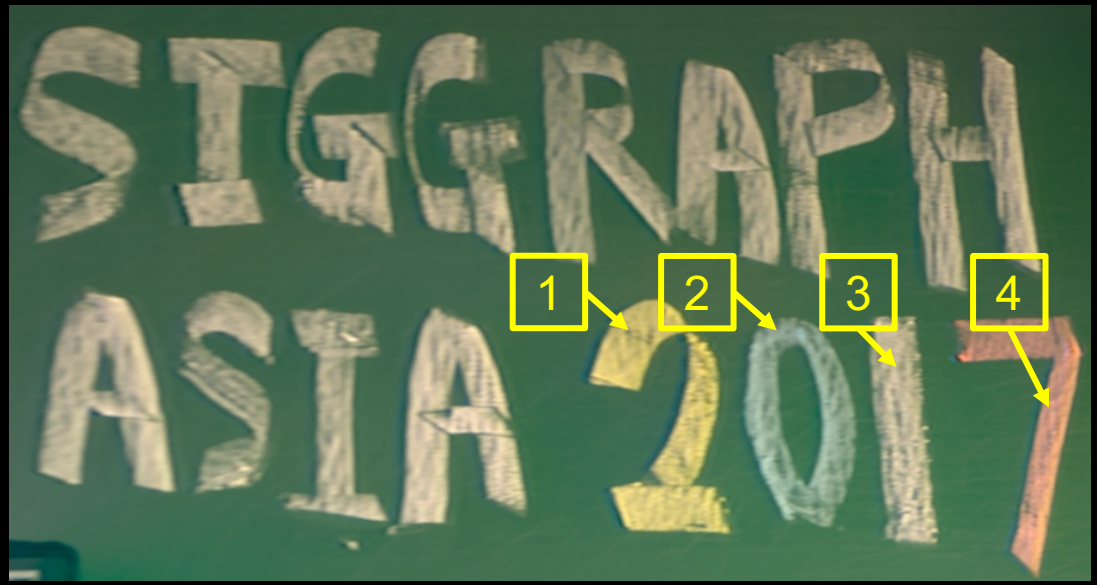
Reconstructed hyperspectral image

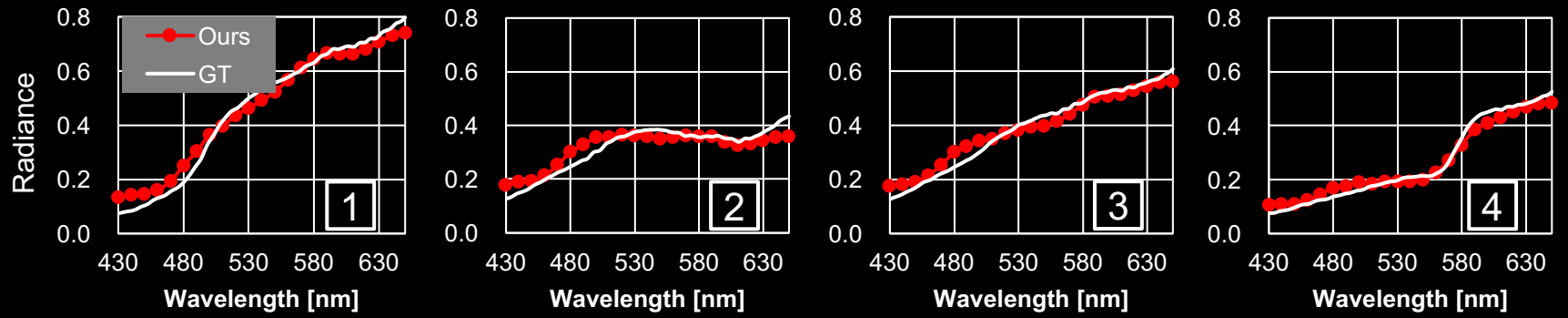


Spectral power distribution

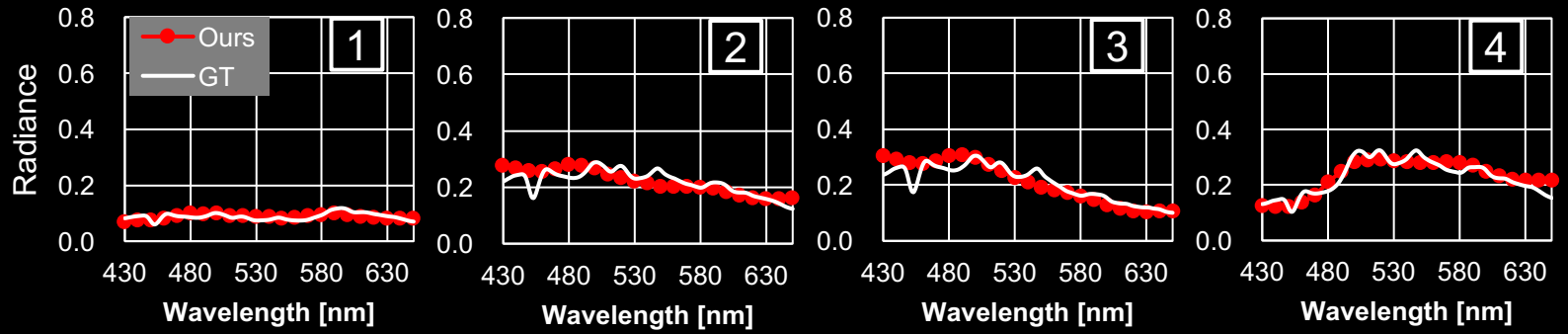


Extended Version of Figure 21 (Tungsten)



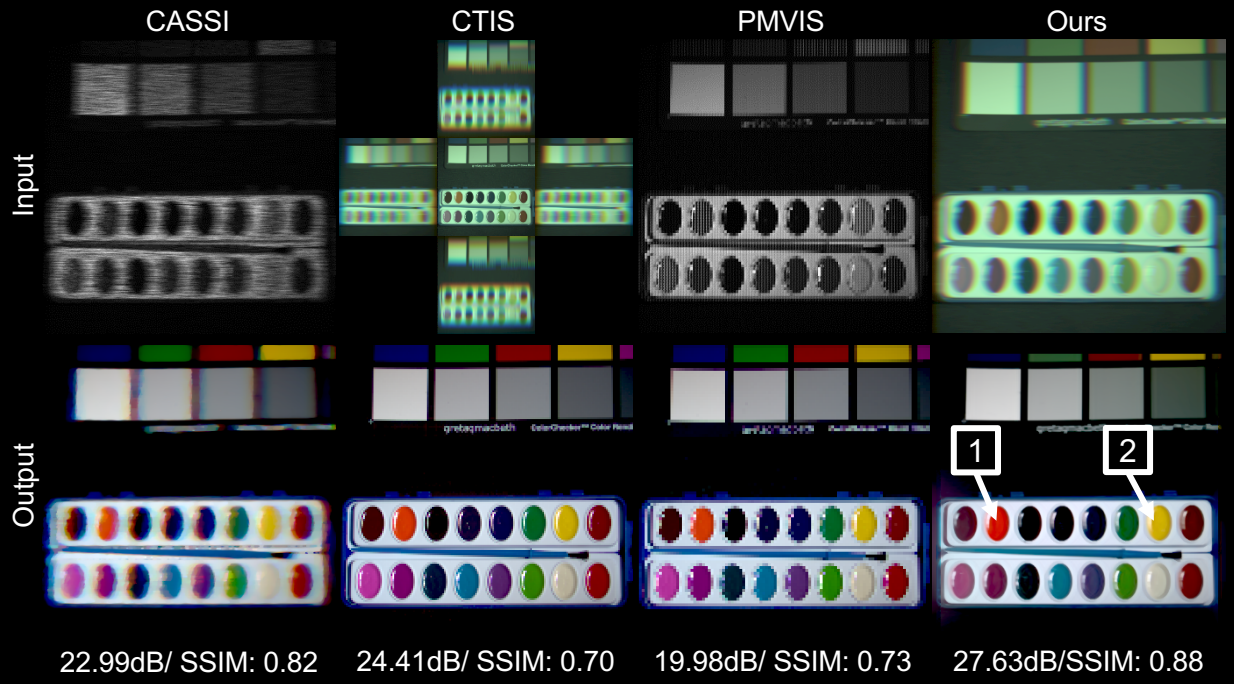


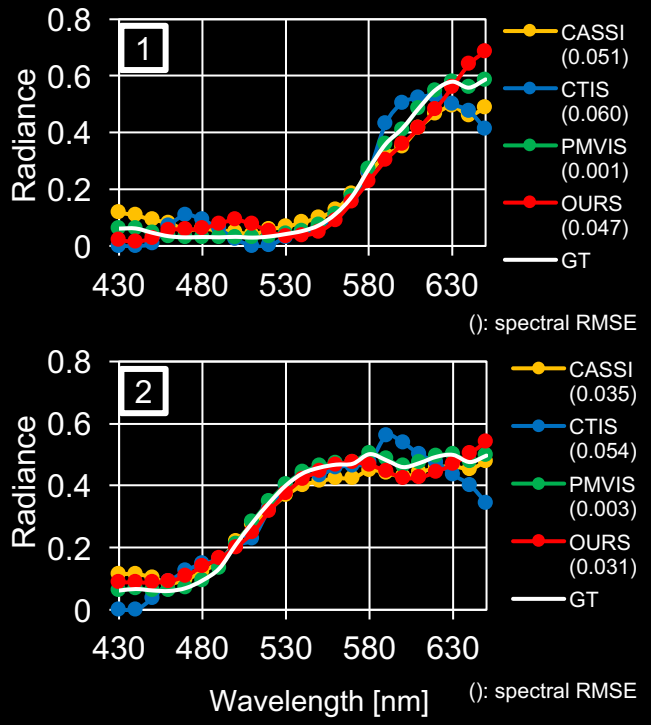
Extended Version of Figure 21 (Xenon)



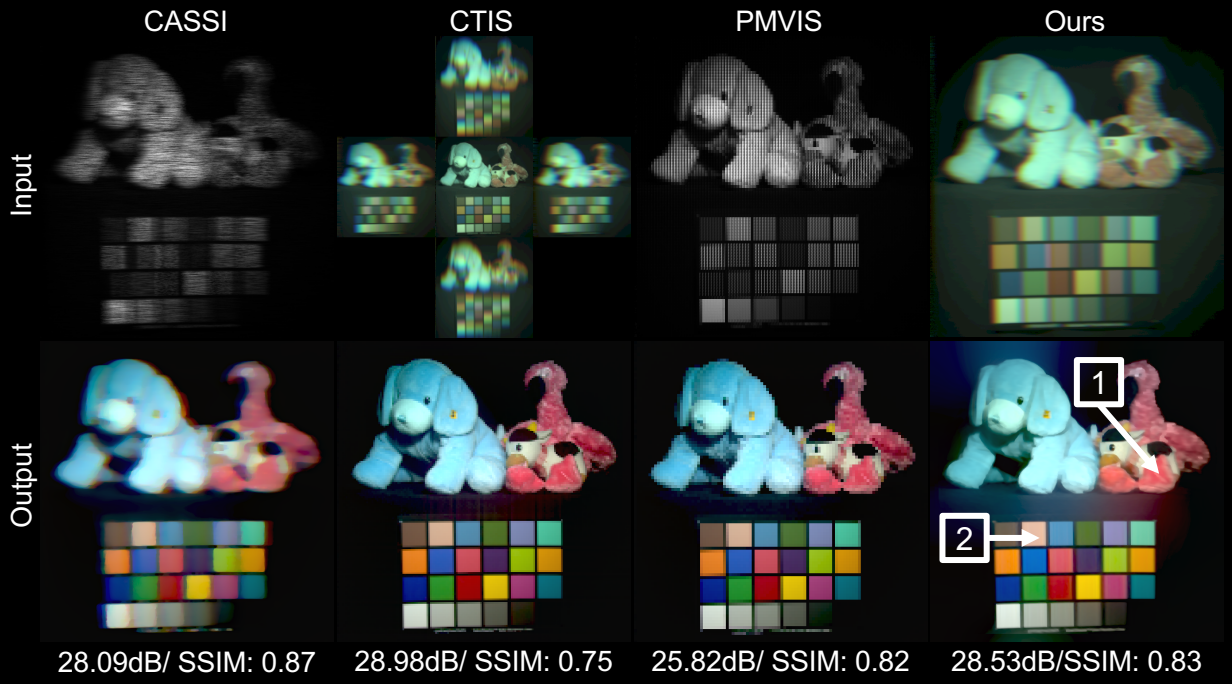
SYNTHETIC SCENES FOR COMPARISON

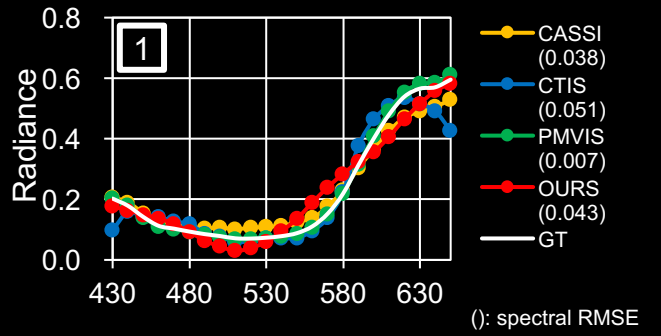
Extended Version of Figure 16 (paints)

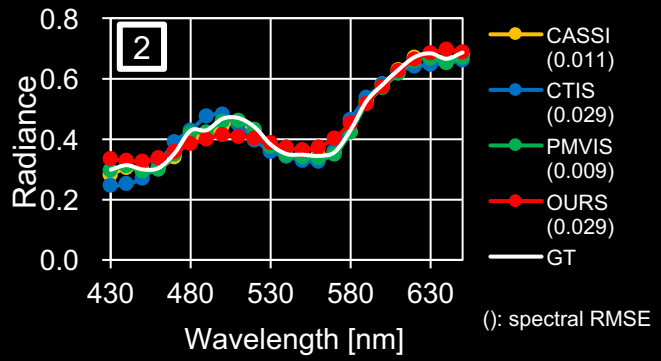




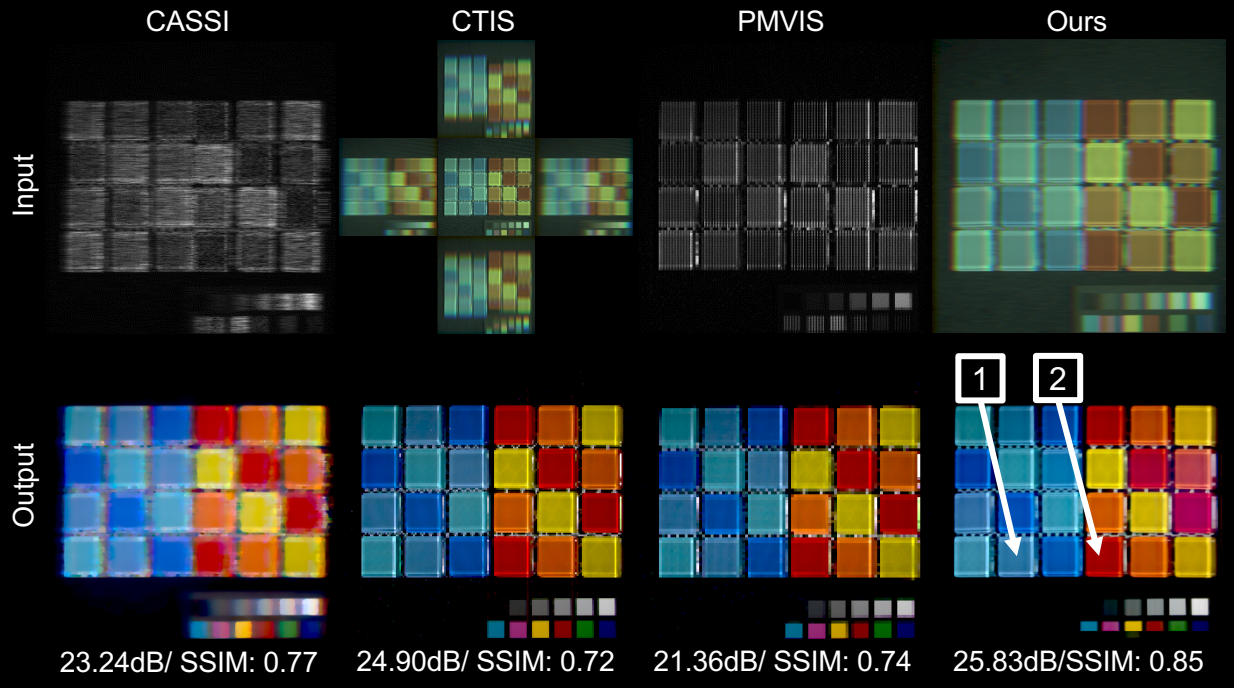
Extended Version of Figure 16 (stuffed toys)

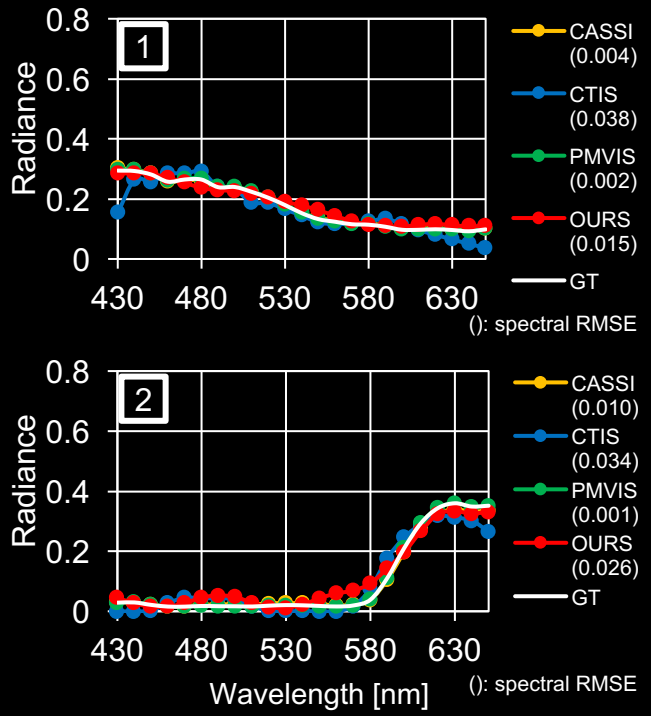






Extended Version of Figure 16 (glass tiles)

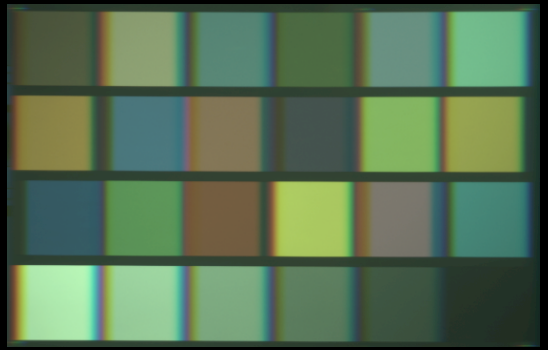




Extended Version of Figure 17 (color-checker)

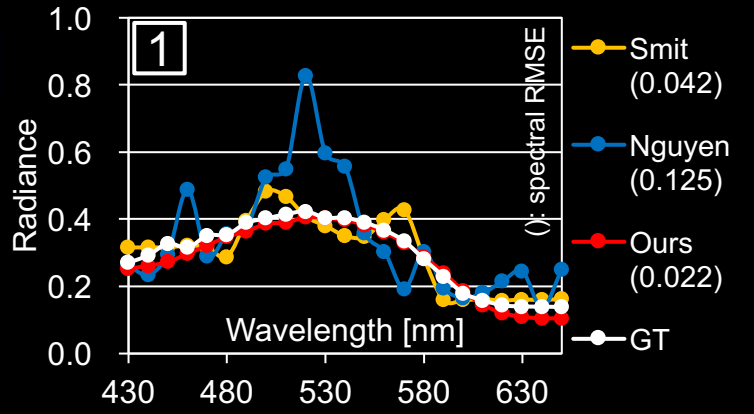
Smit (29.03dB/0.92)

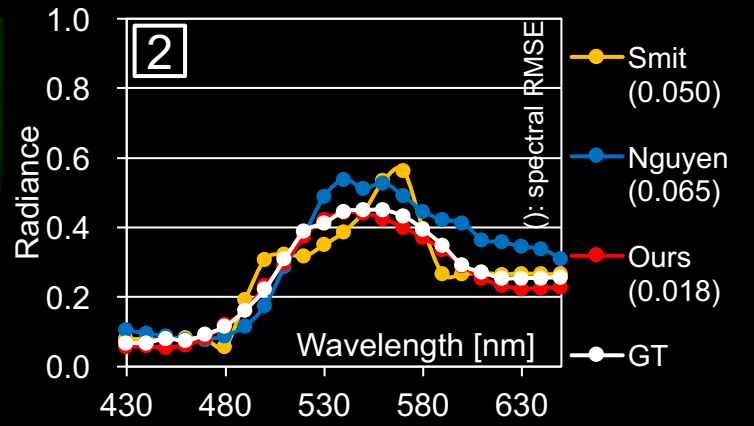
Nguyen et al. (26.09dB/0.92)



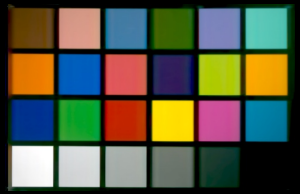
Input with dispersion

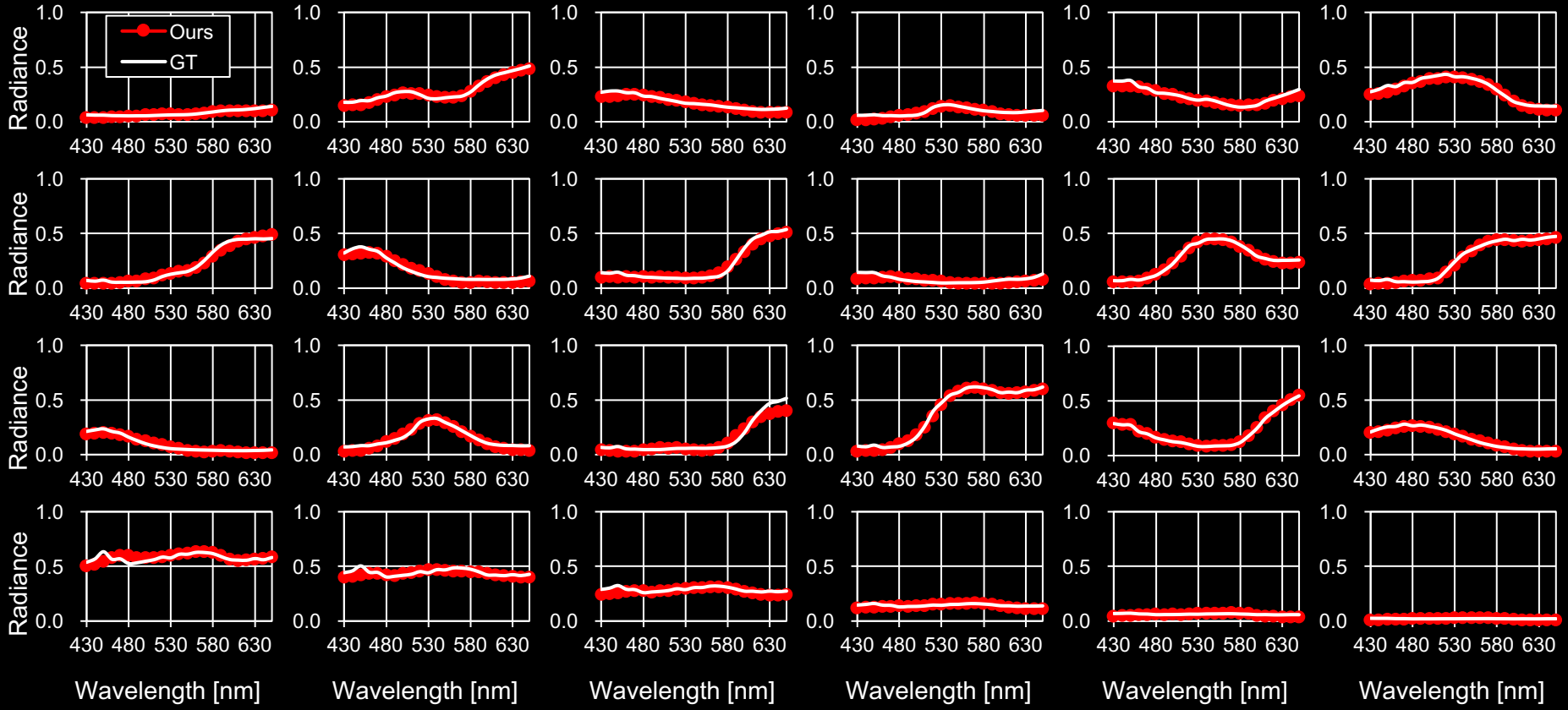
Ours (32.75dB/0.94)





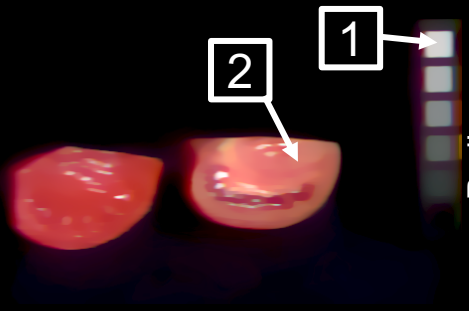
Color-checker Evaluation of Figure 17





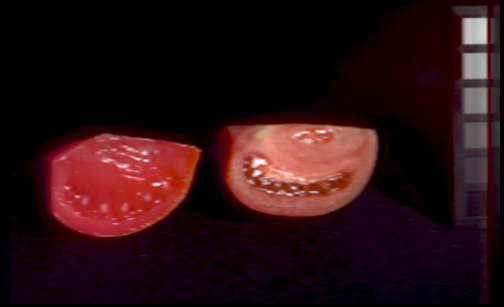
Extended Version of Figure 18 (tomatoes)

Input (PSNR/SSIM)

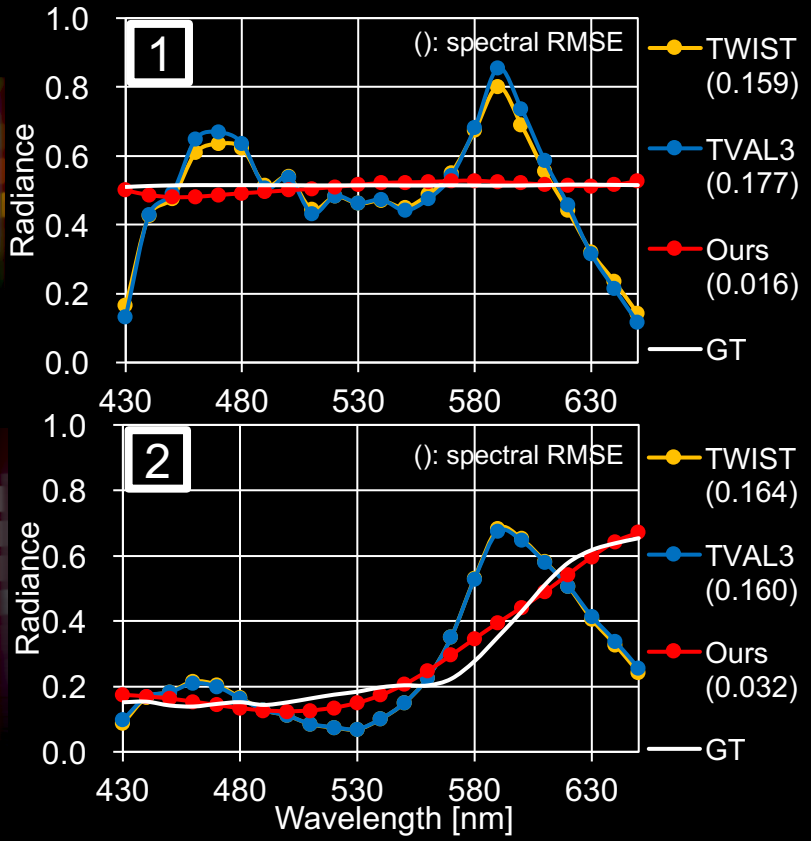


TwIST (27.67dB/0.86)

TVAL3 (28.90dB/0.91)



Ours (34.12dB/0.88)

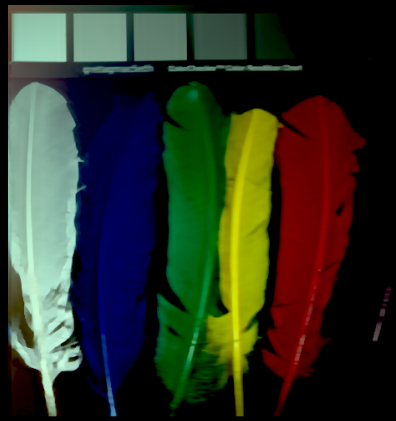


Extended Version of Figure 18 (feathers)

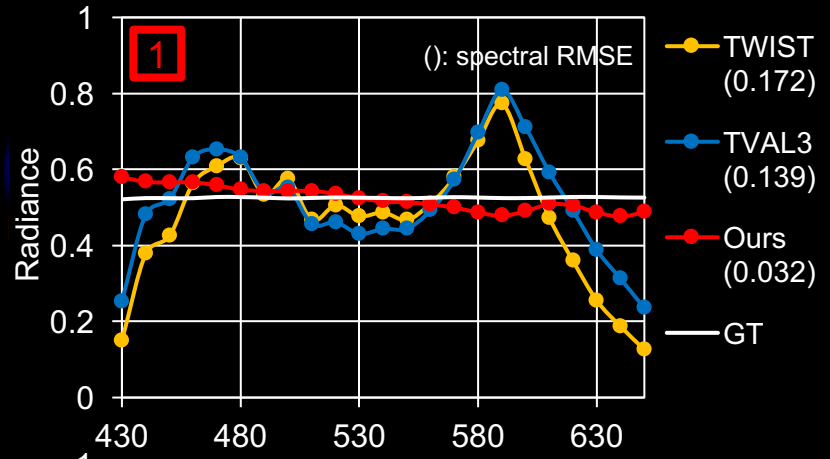
Input (PSNR/SSIM)

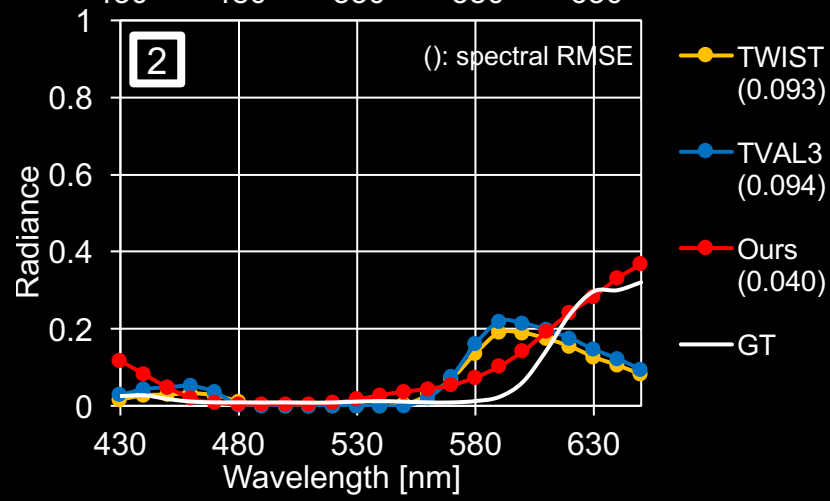
TwIST (22.13dB/0.70)

TVAL3 (23.71dB/0.77)

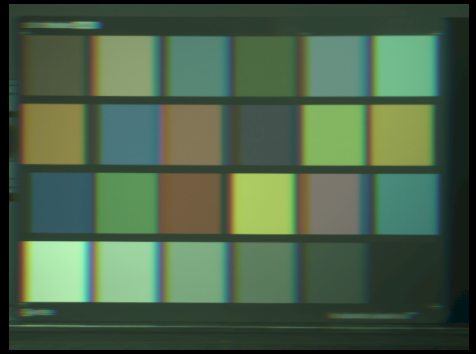


Ours (27.27db/0.80)





Extended Version of Figure 18 (color-checker)

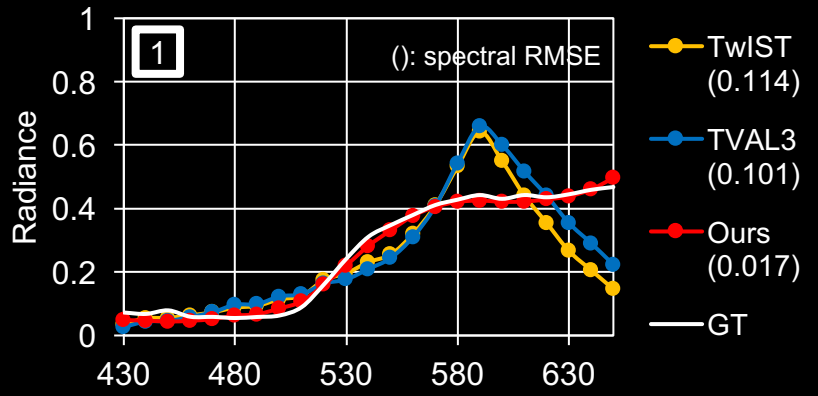


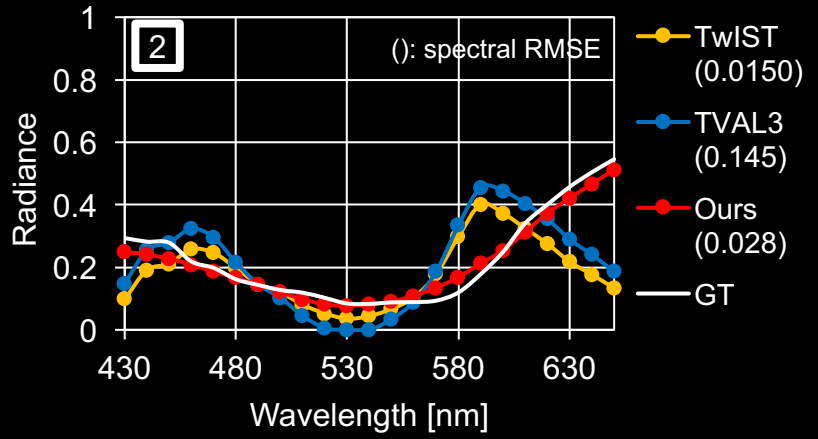
Input (PSNR/SSIM)

TwIST (23.56dB/0.80)

TVAL3 (25.17dB/0.86)

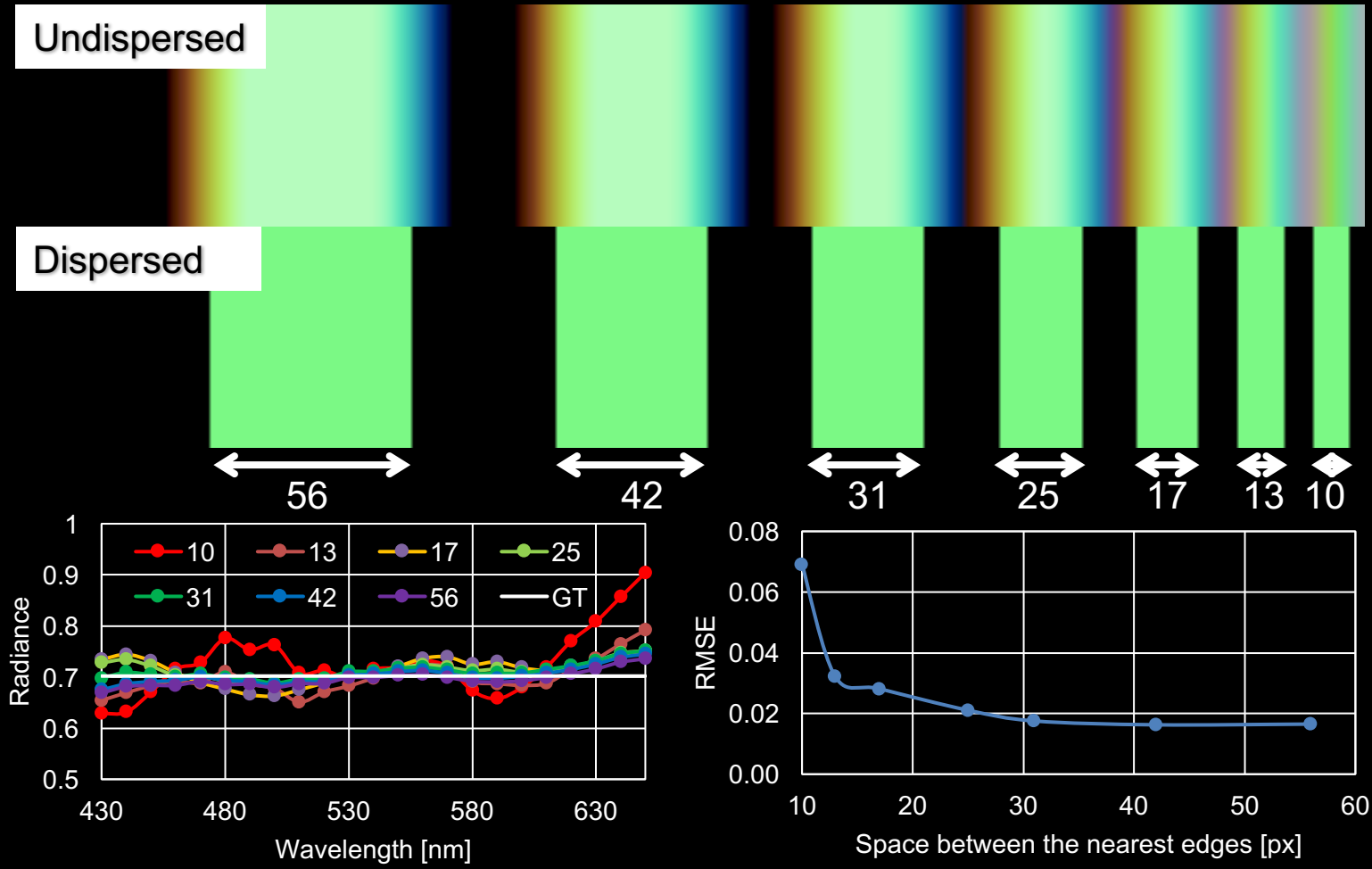
Ours (32.75dB/0.94)





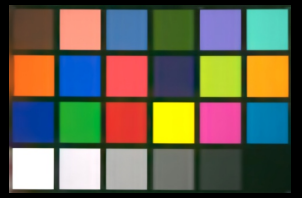
SYNTHETIC SCENES FOR SELF-EVALUATION

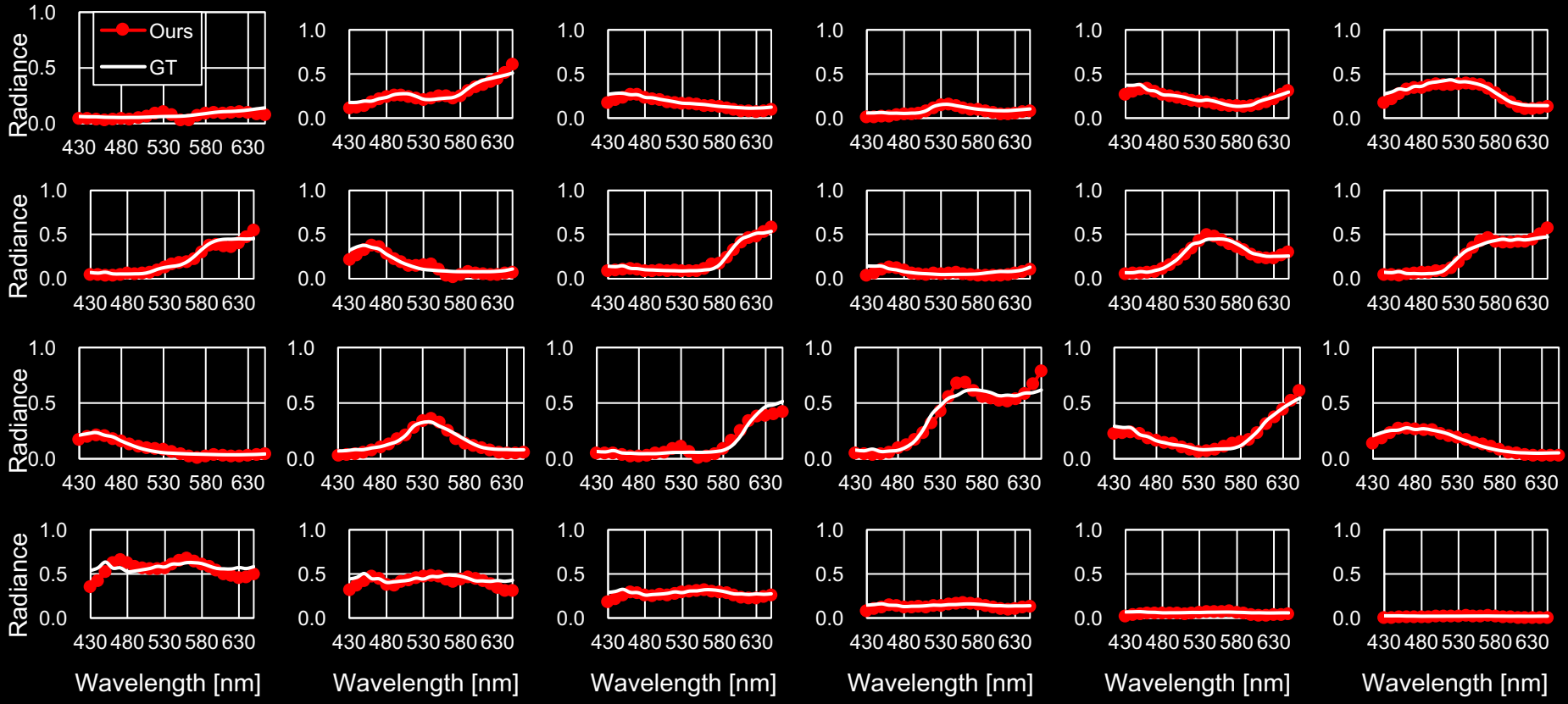
Extended Version of Figure 20



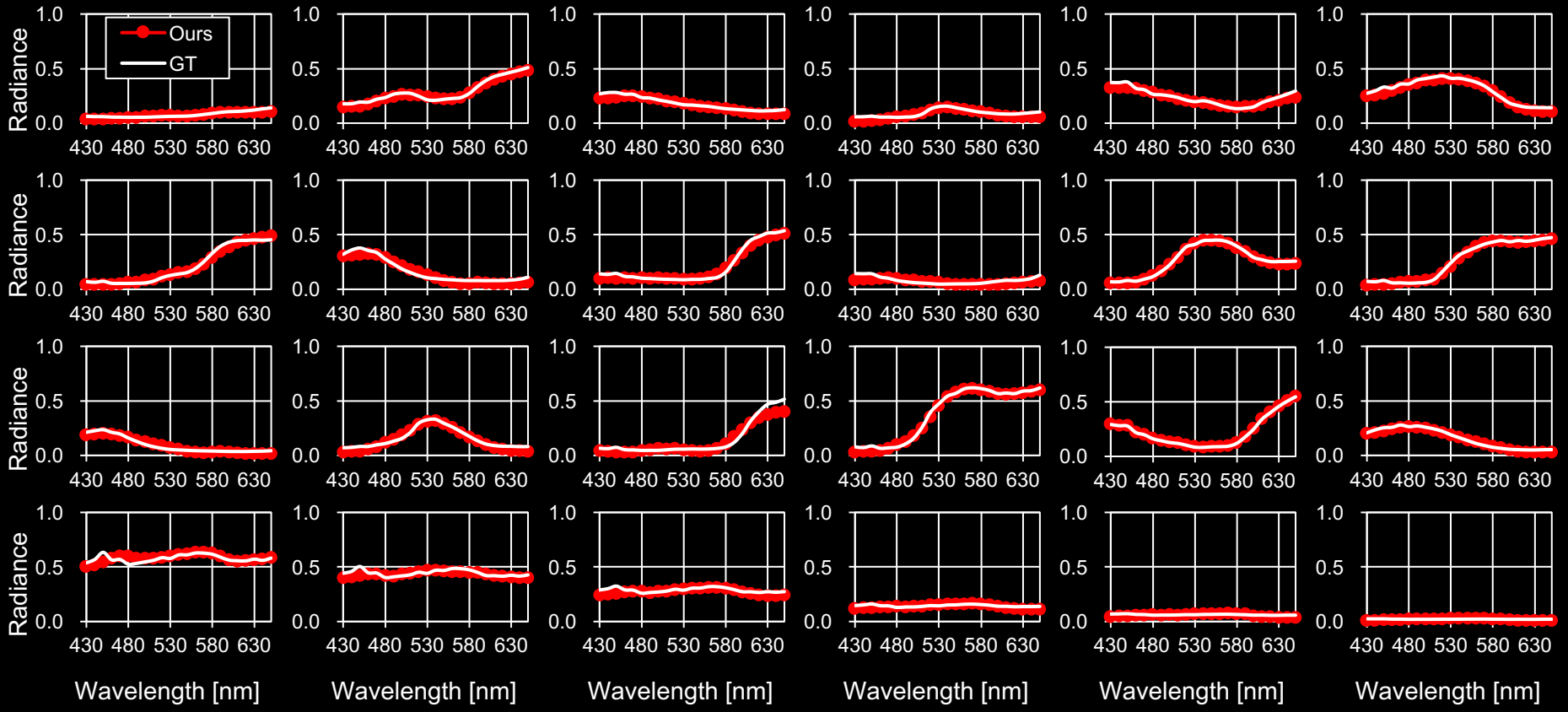
Spectral Smoothness Evaluation

*Without the spectral priors: $\alpha_2 = 0,\ \beta_3 = 0$





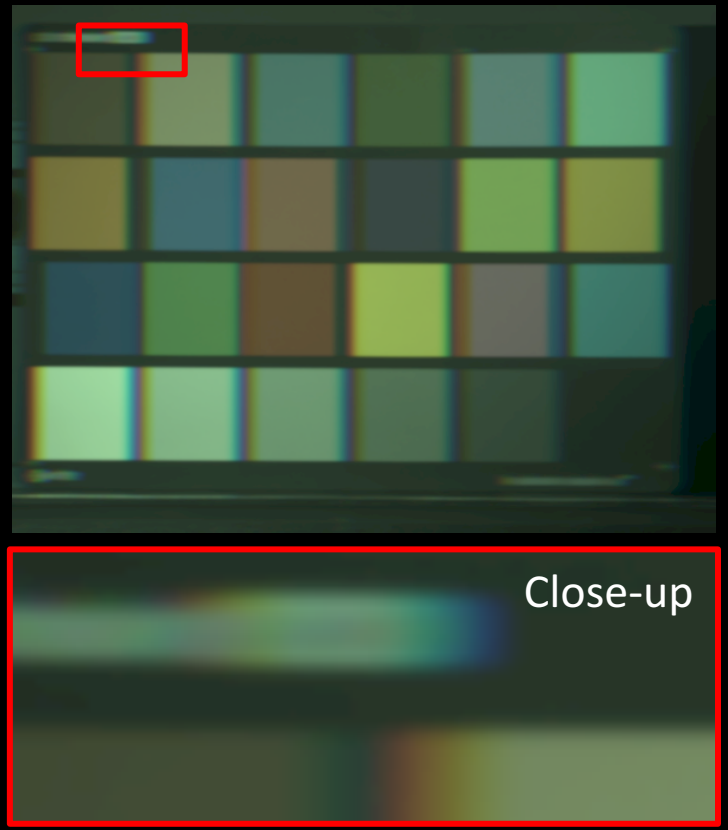
Spectral Smoothness Evaluation
*With the spectral priors



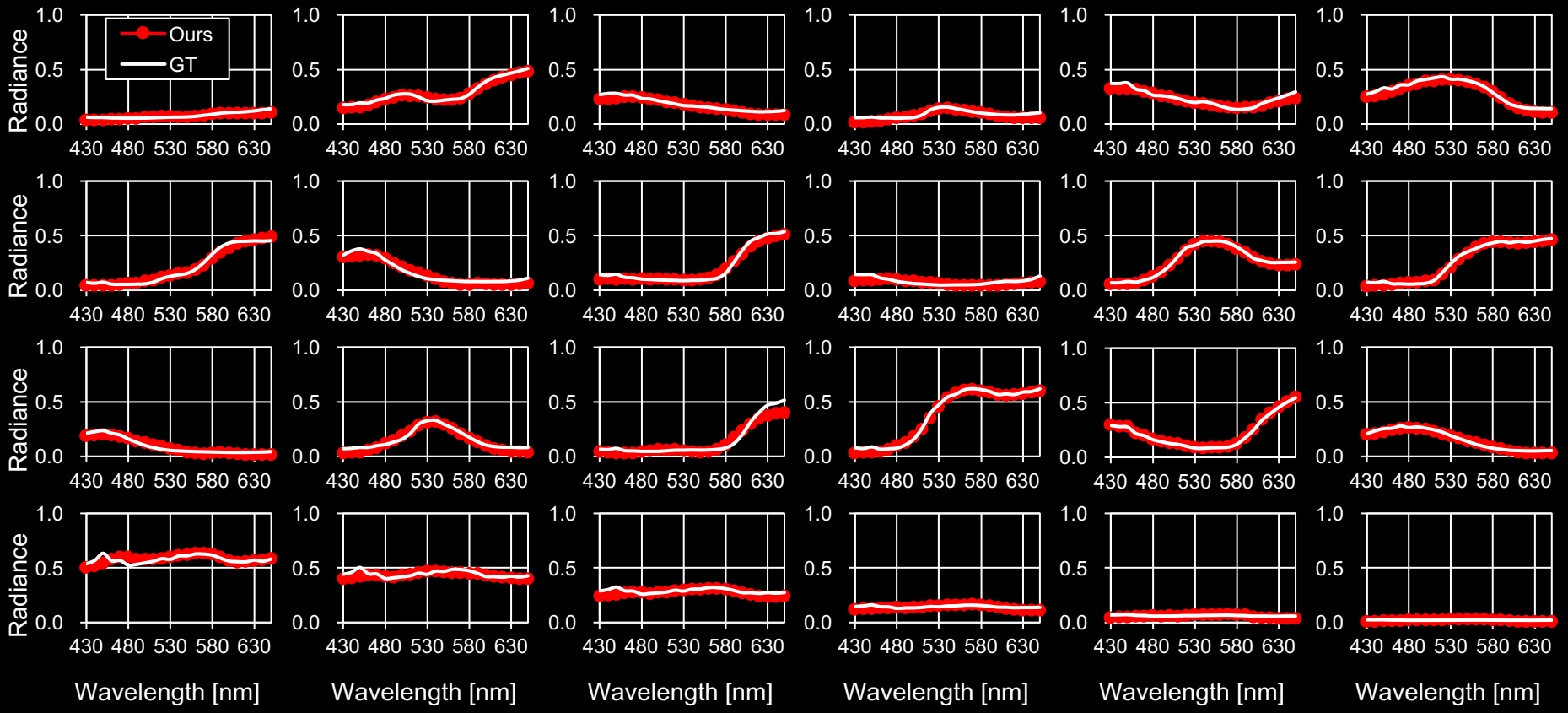
Blurriness Evaluation

Input image without blur

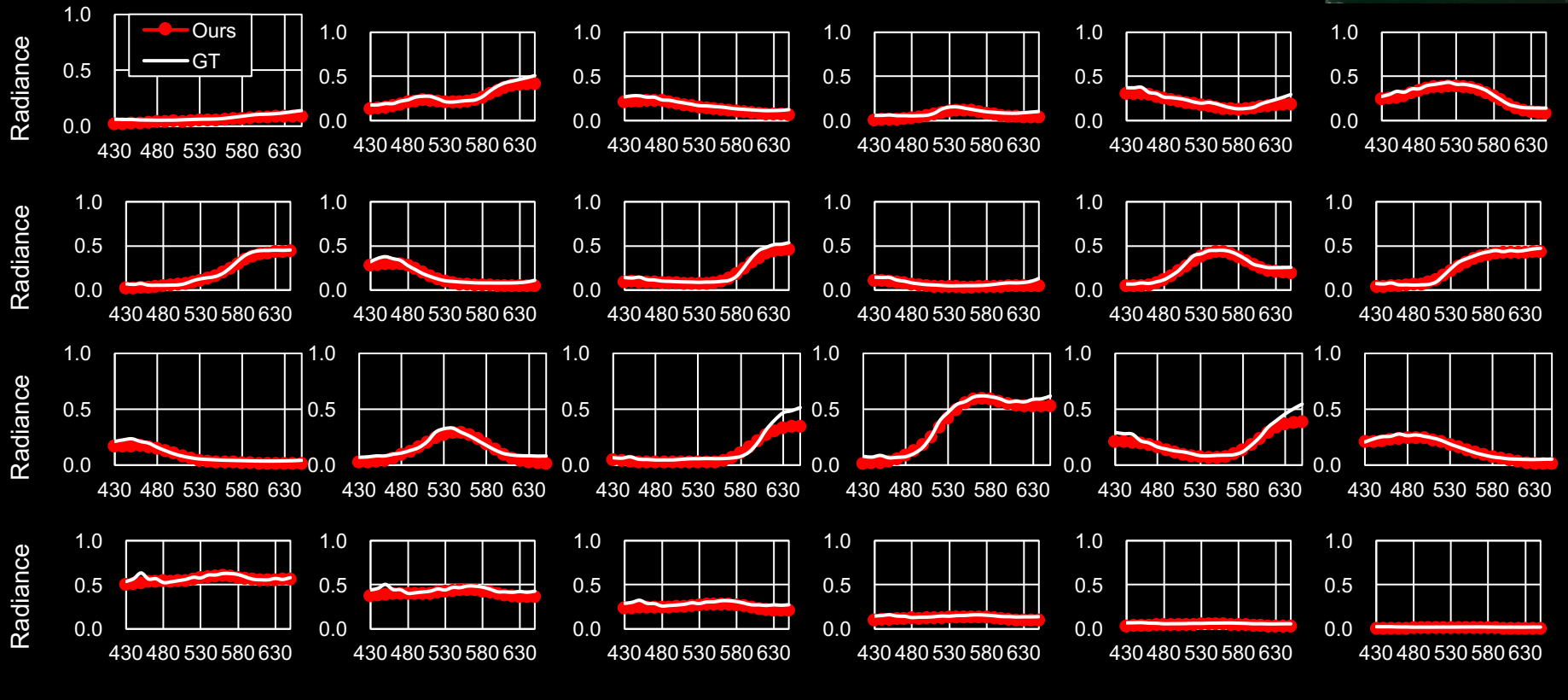
Input image with Gaussian blur of sigma 1



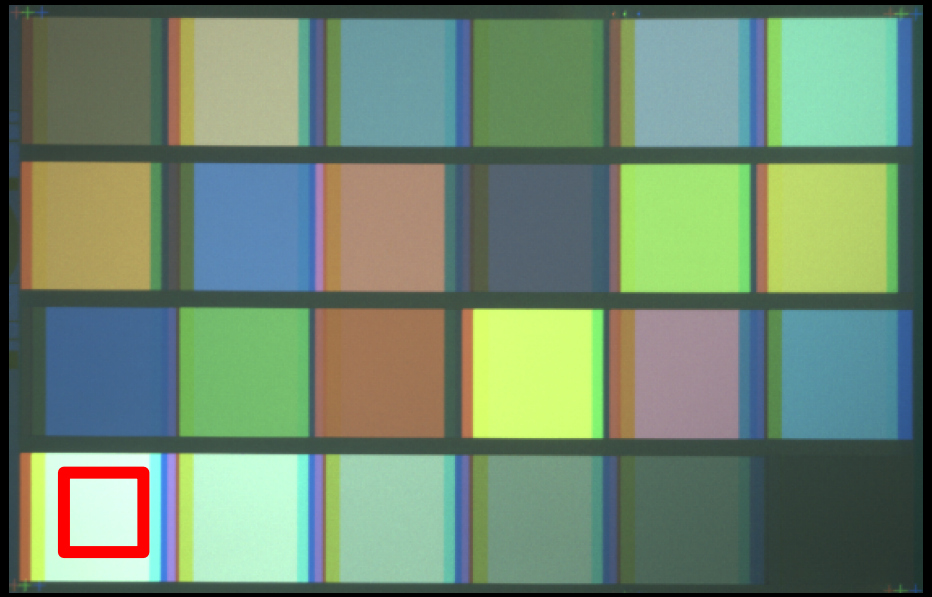
Blurriness Evaluation without blur



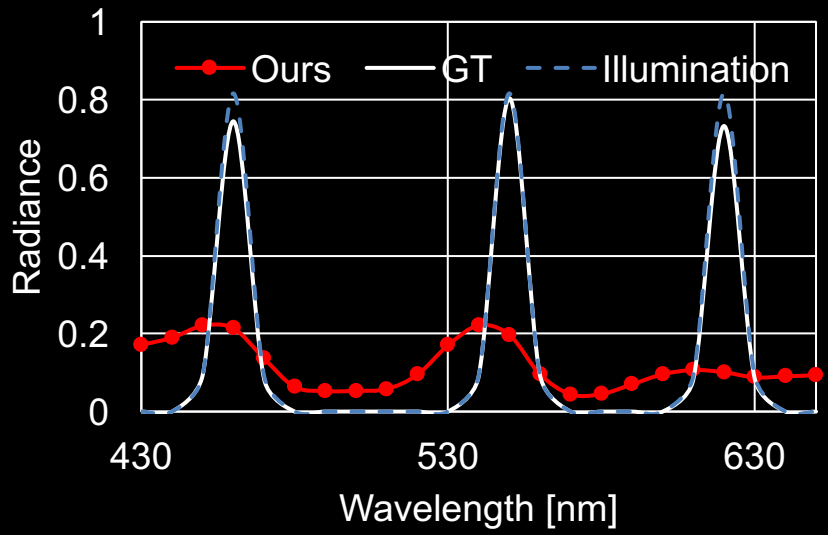
Blurriness Evaluation with blur (Sigma = 1)



Fluorescent Illumination

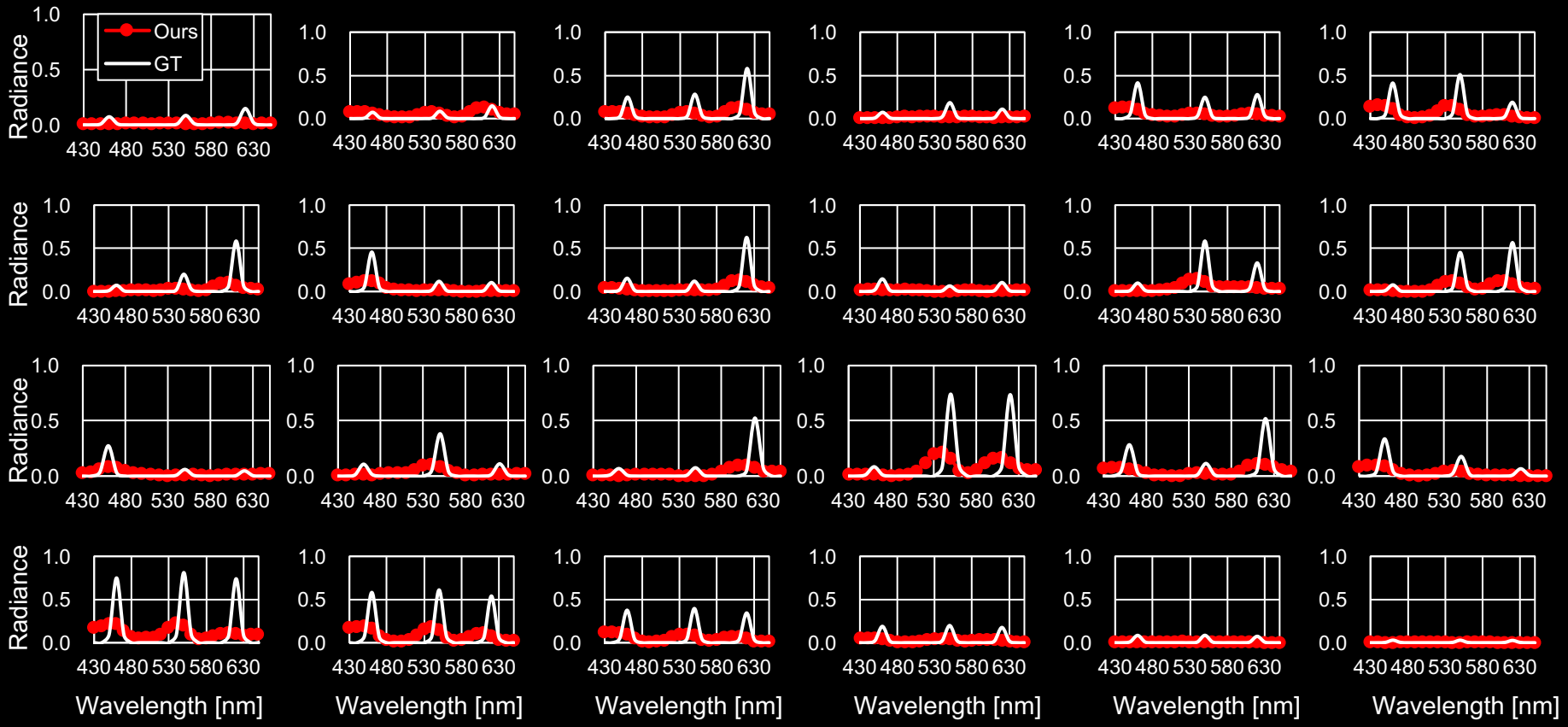


Input Image



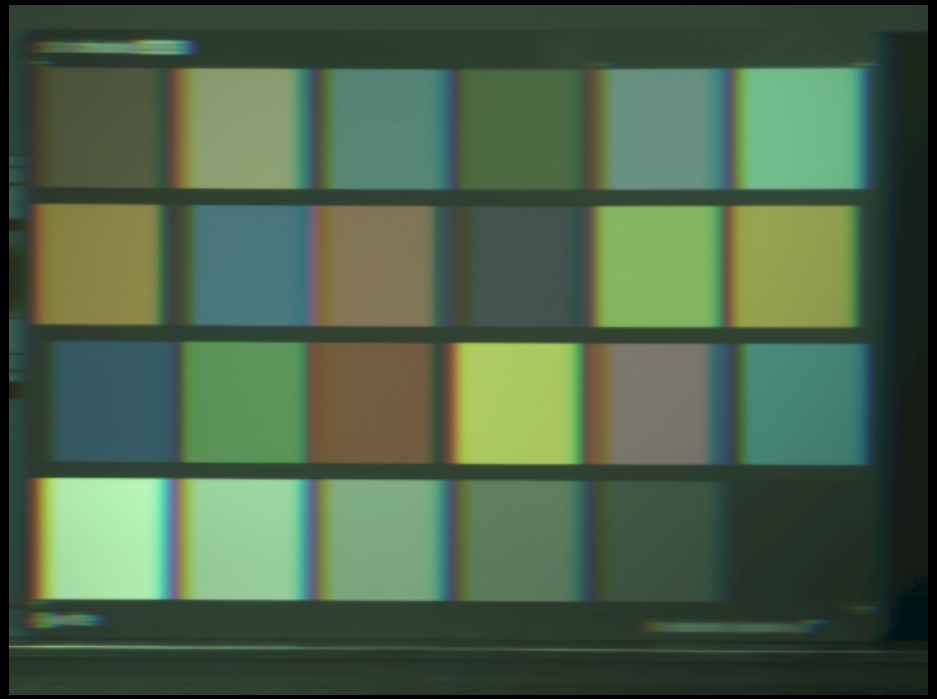
Reconstructed spectrum

Fluorescent Illumination

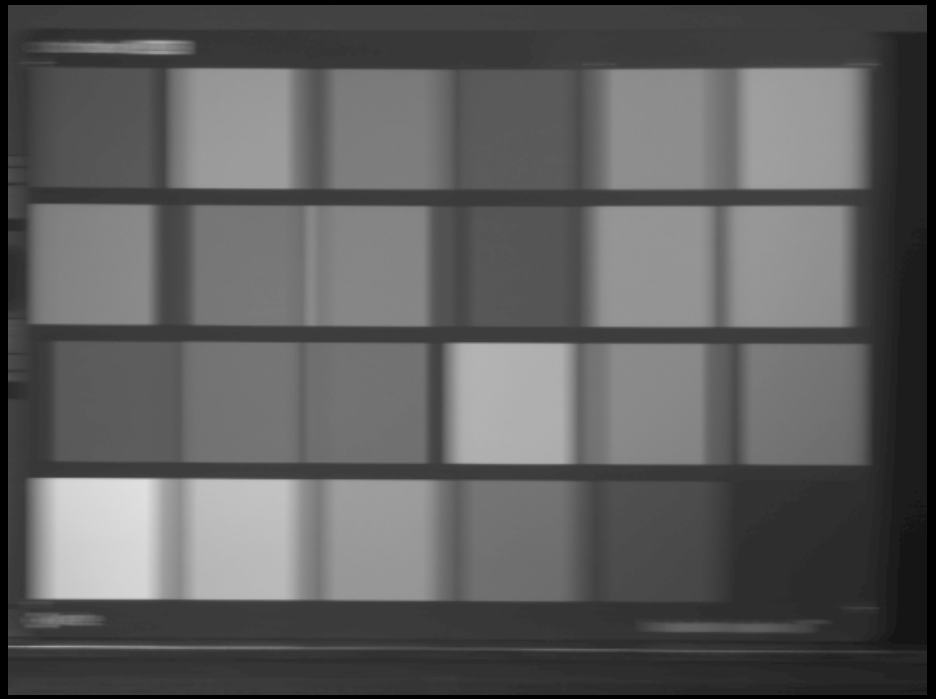


Monochrome sensor evaluation

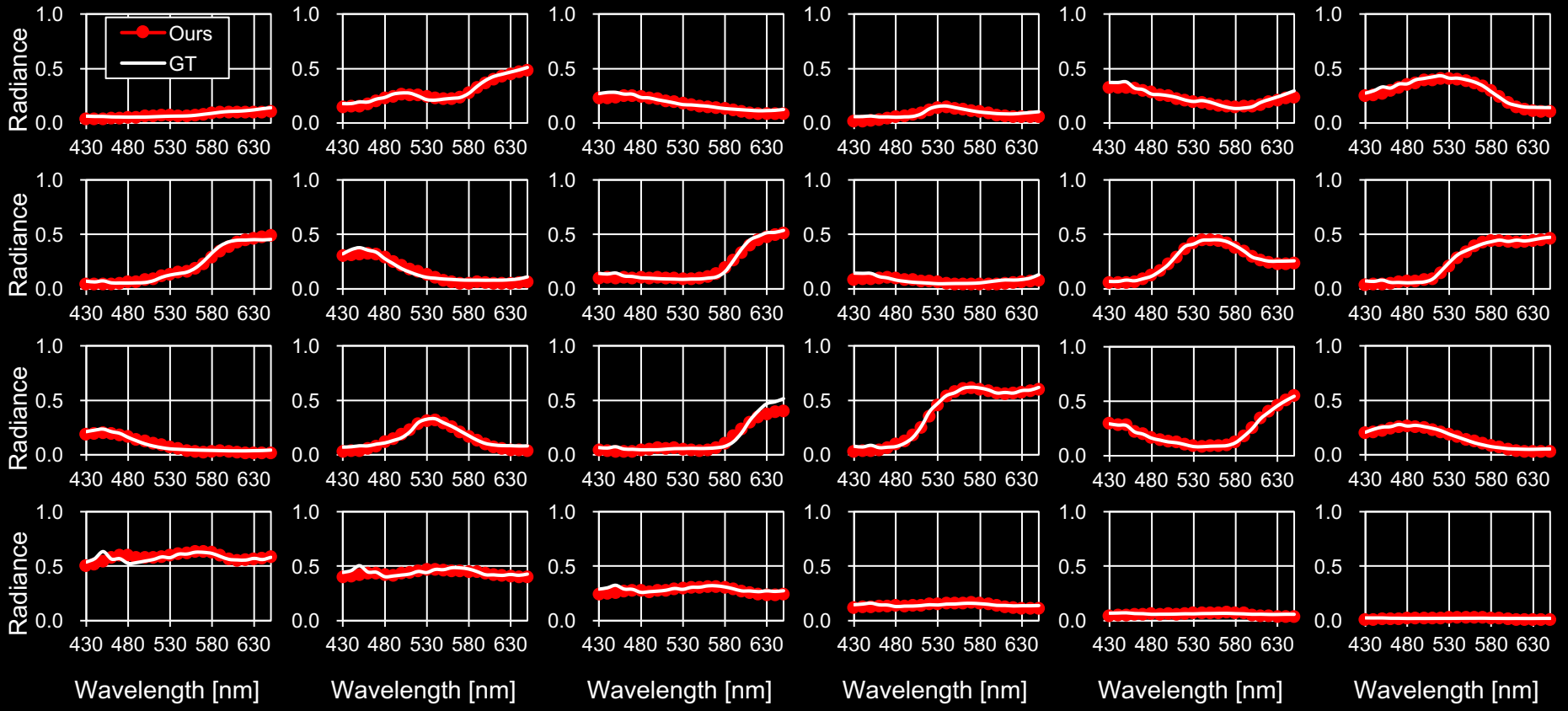
RGB input image



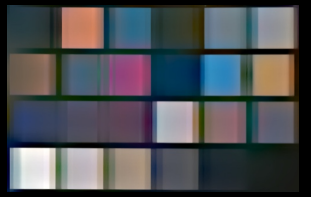
Gray input image

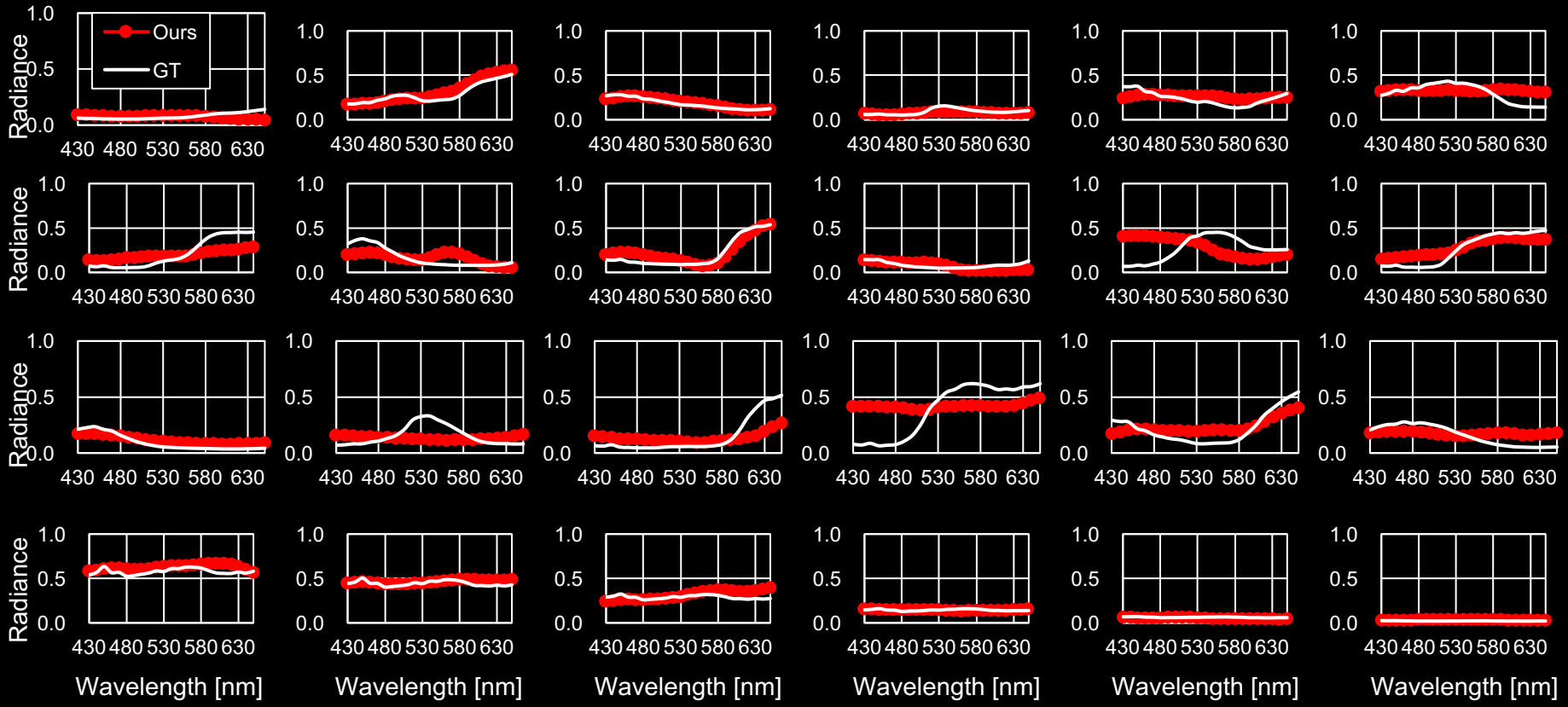


RGB sensor results



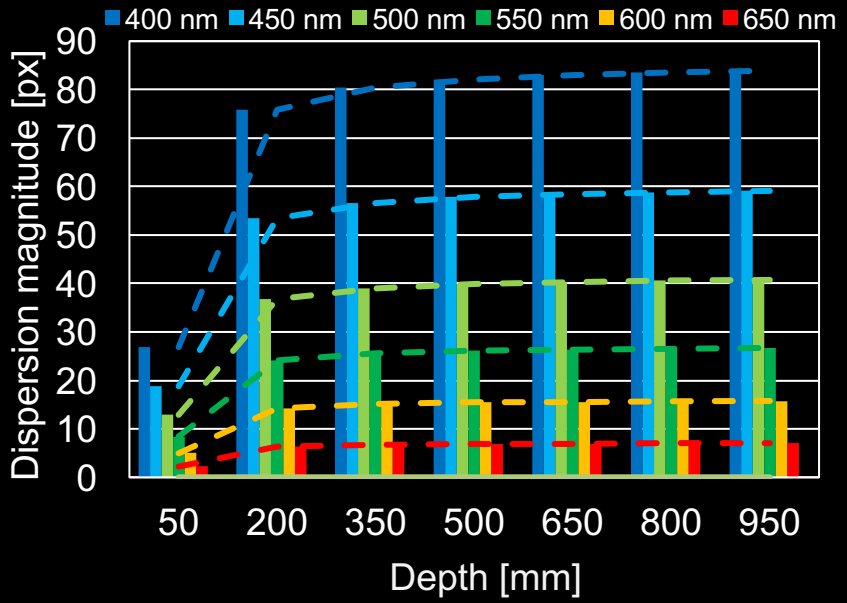
Monochrome sensor results



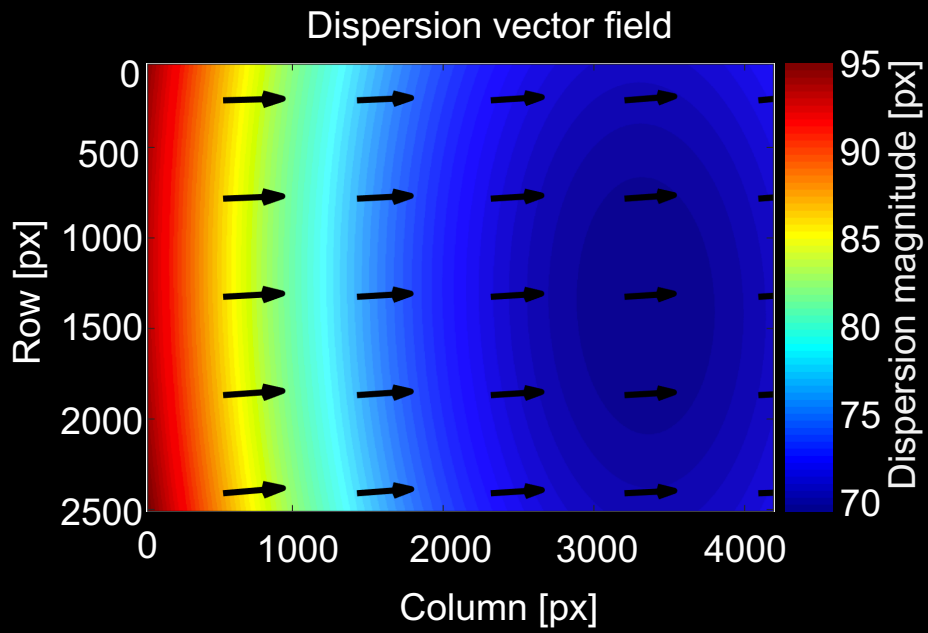


CALIBRATION

Figure 6

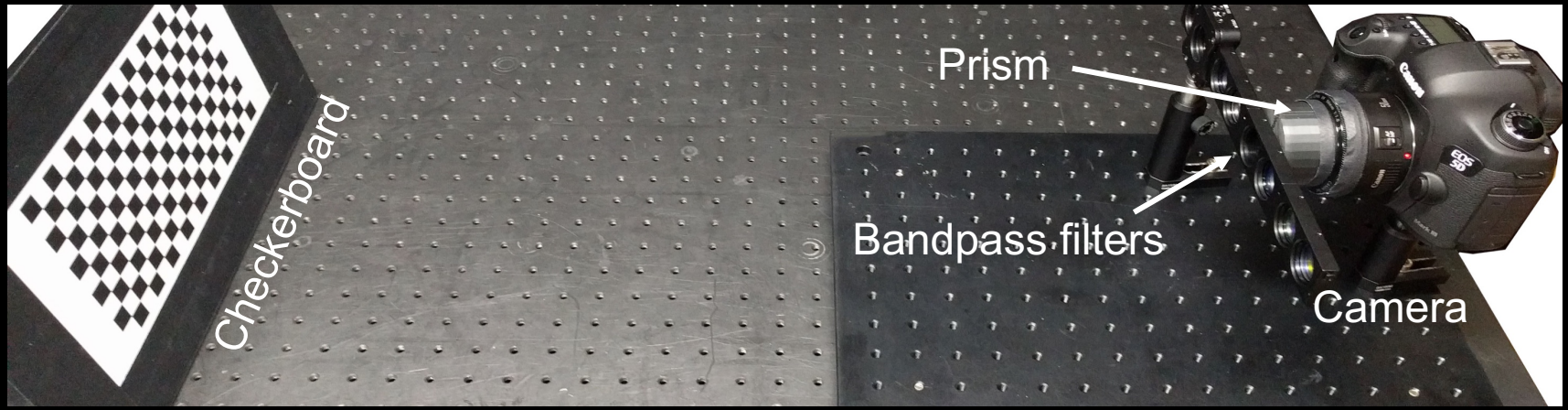


(a) Depth vs. dispersion

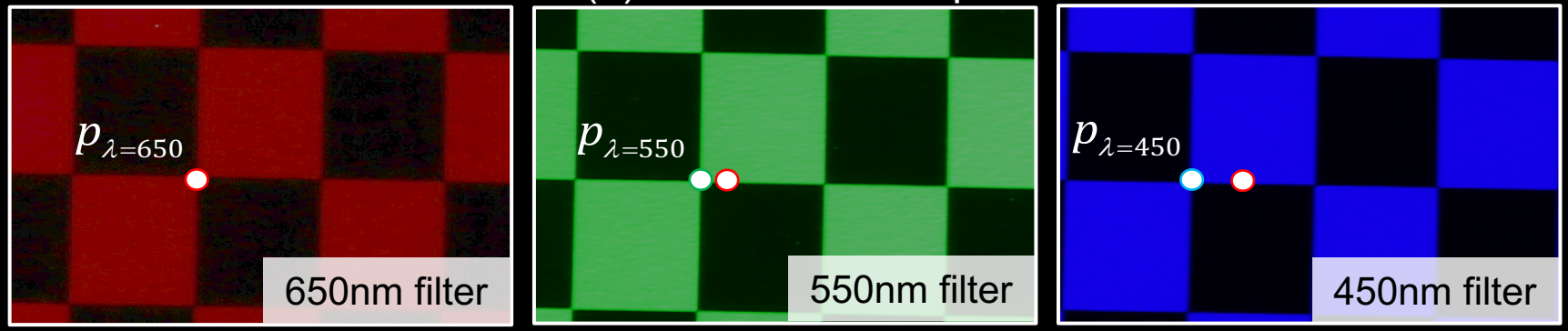


(b) Spatially-varying dispersion

Figure 11



(a) Calibration setup



(b) Captured images for dispersion calibration

Figure 12

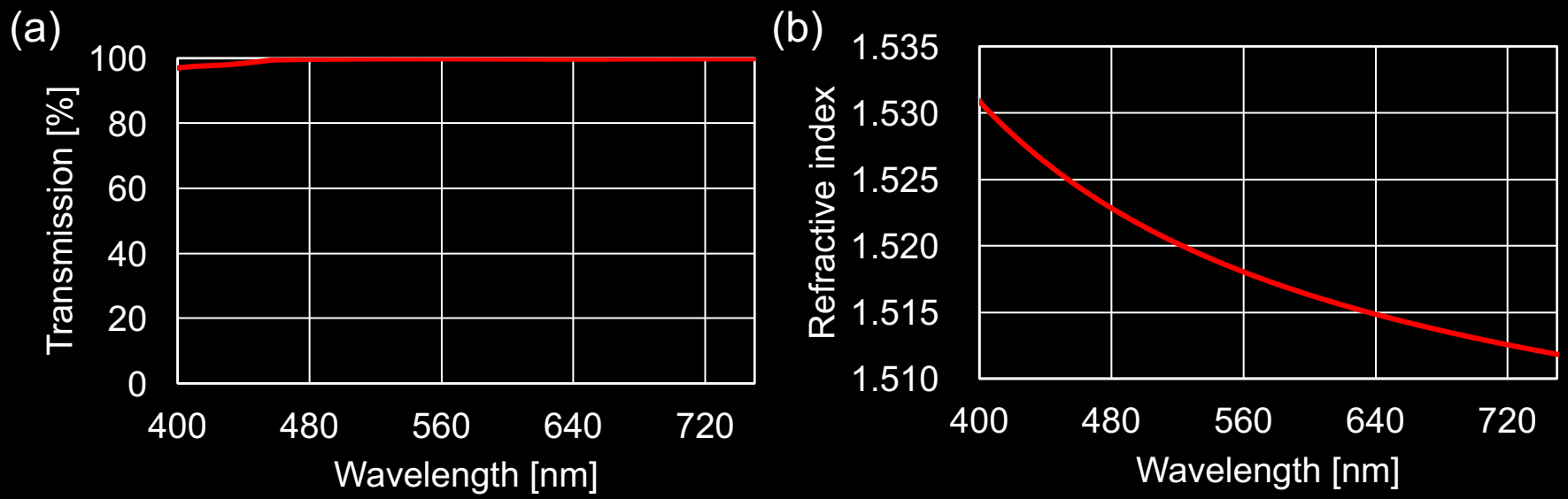
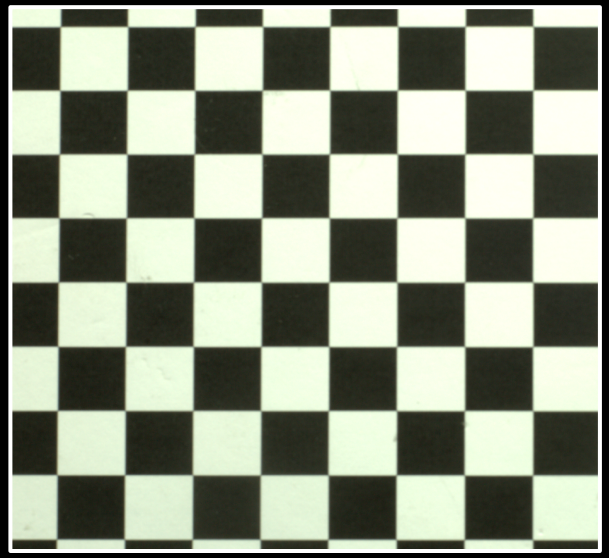
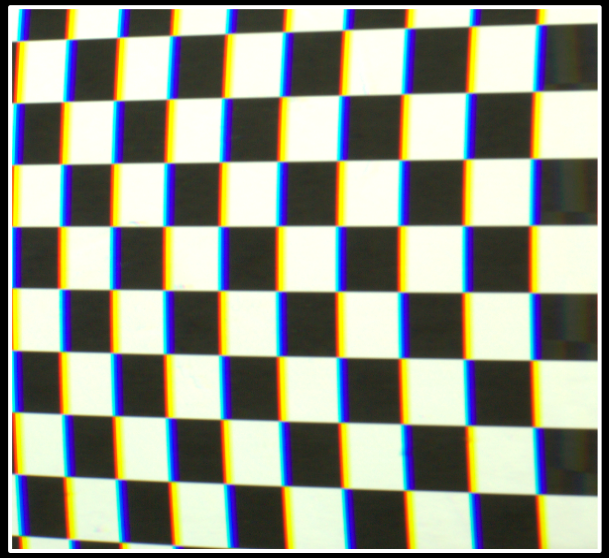

(a)
Transmission [%]
100
80
60
40
20
0
400
480
560
640
720
Wavelength [nm]
(b)
Refractive index
1.535
1.530
1.525
1.520
1.515
1.510
400
480
560
640
720
Wavelength [nm]

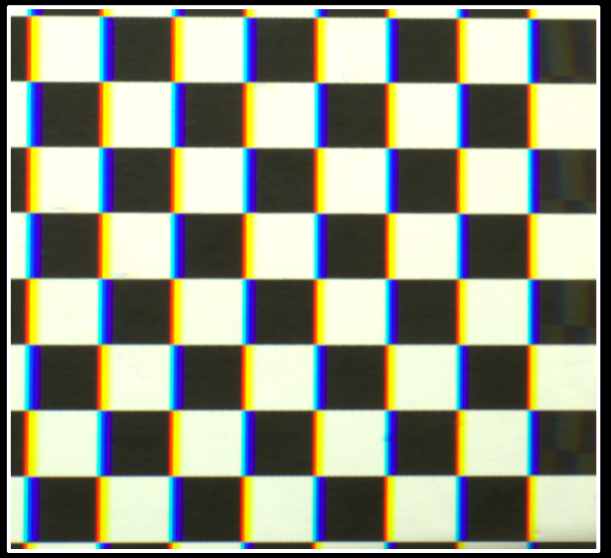
Figure 13



(a) Direct image (w/o prism)



(b) Distorted input (w/ prism)



(c) Distortion corrected