

Wide Dynamic Range Image Processing System
using Super CCD Honeycom SR

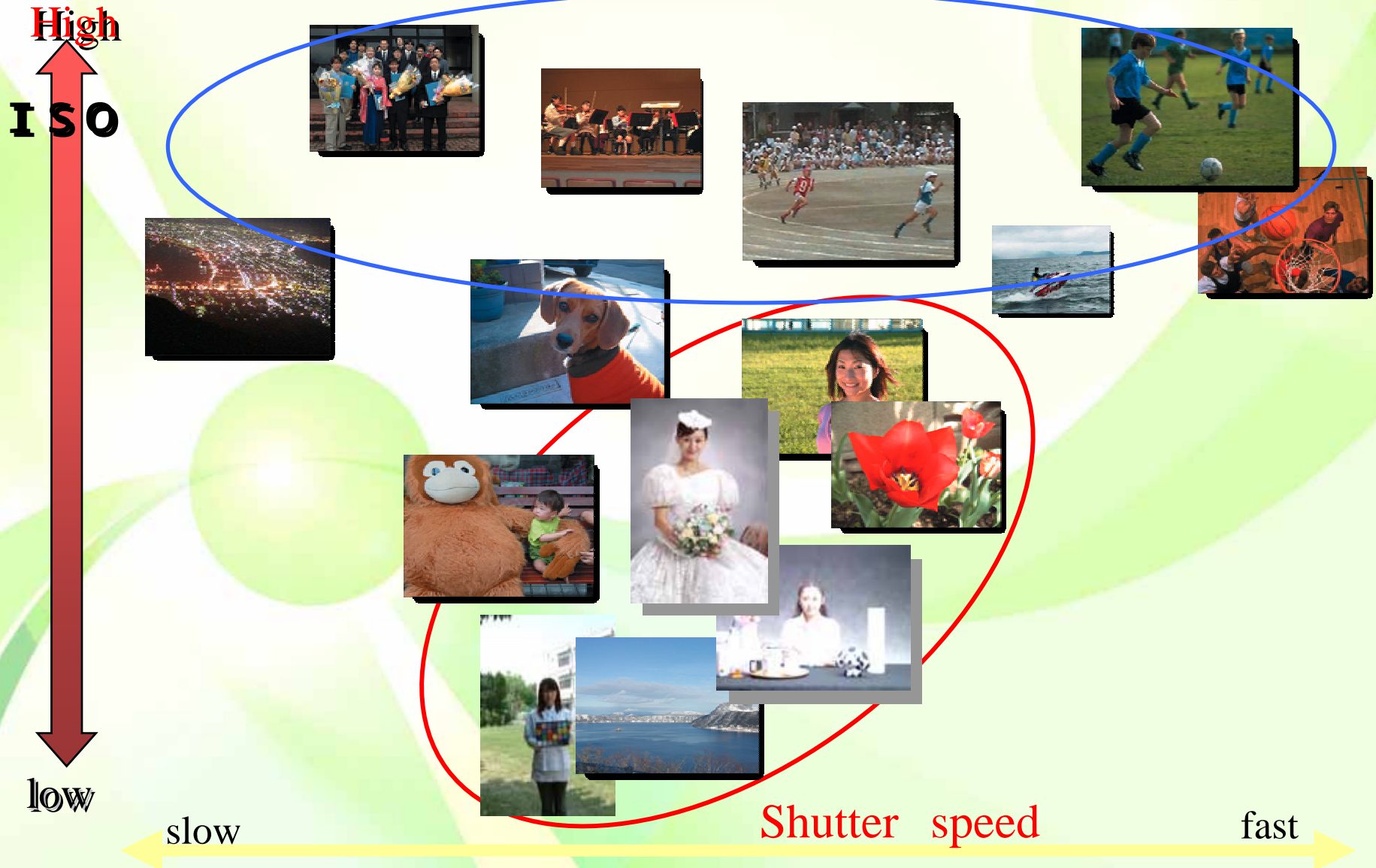
Feb . 14.2006

S. Minami

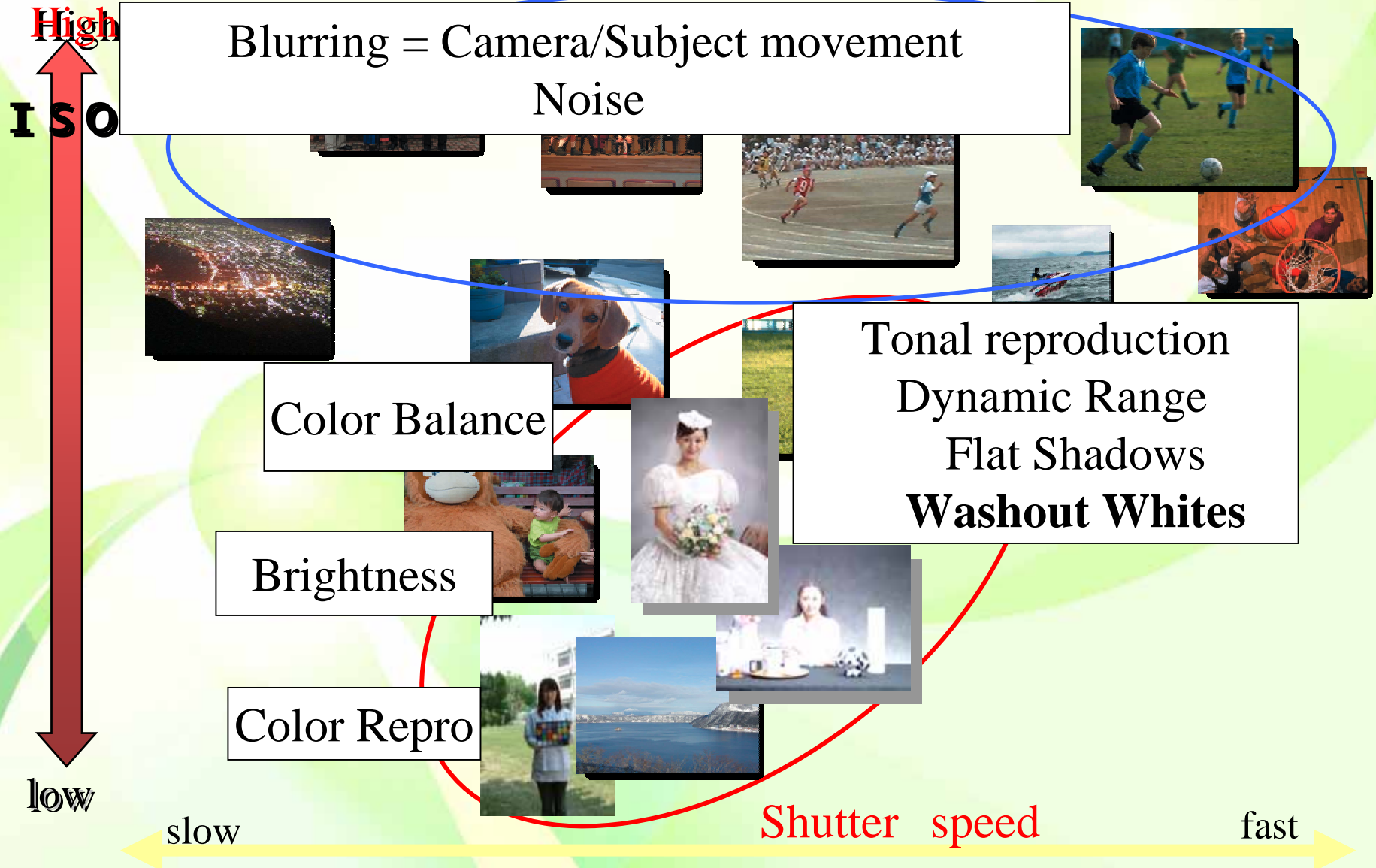
Fuji Photo Film Co.,Ltd.

Electronic Imaging Div.

Required Performance of Digital Still Camera



Common Image Quality Problems



Common Image Quality Problems

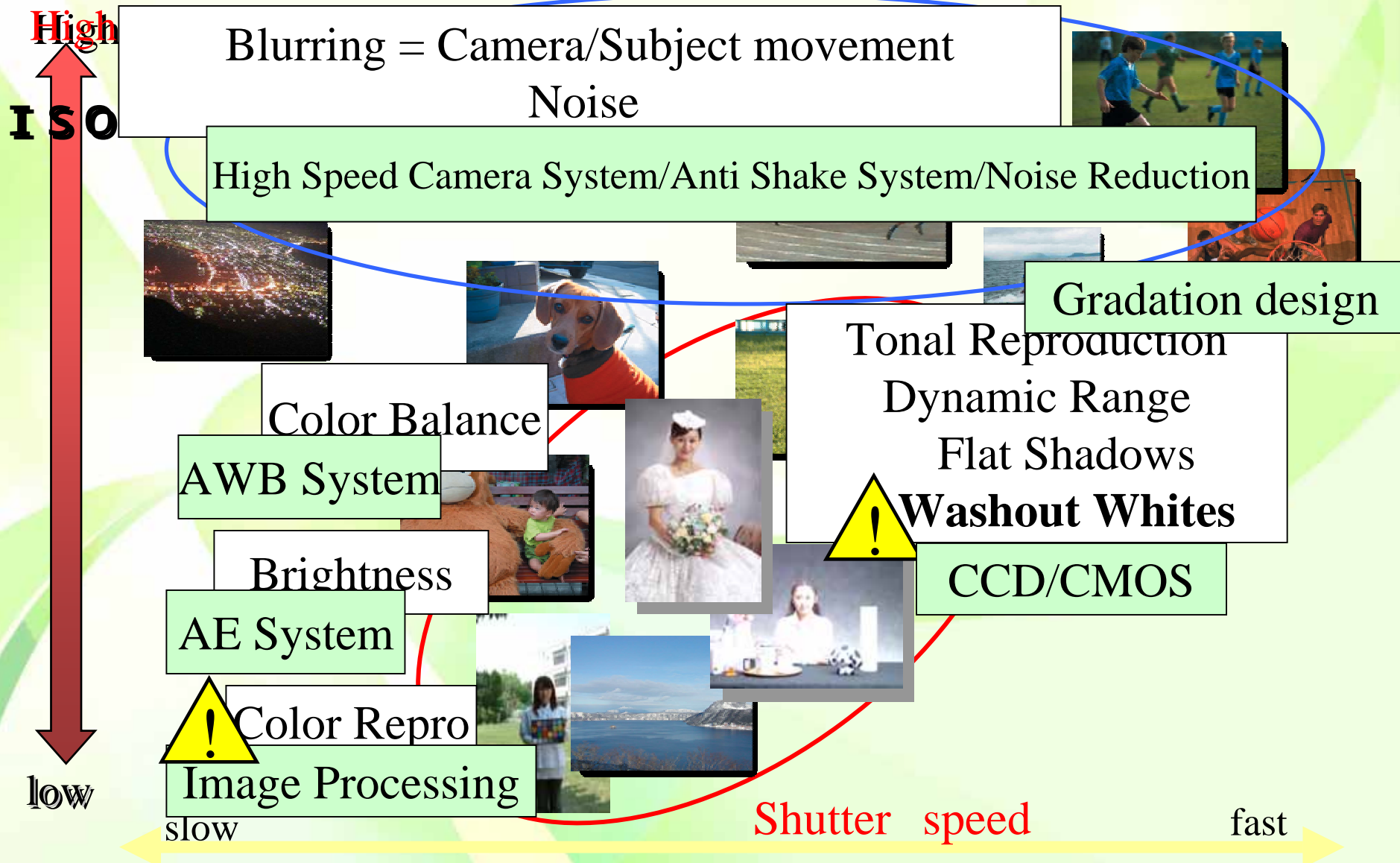


Image Quality

- Important factors

1. Resolution High pixel density CCD

2. Sensitivity, Noise(S/N)

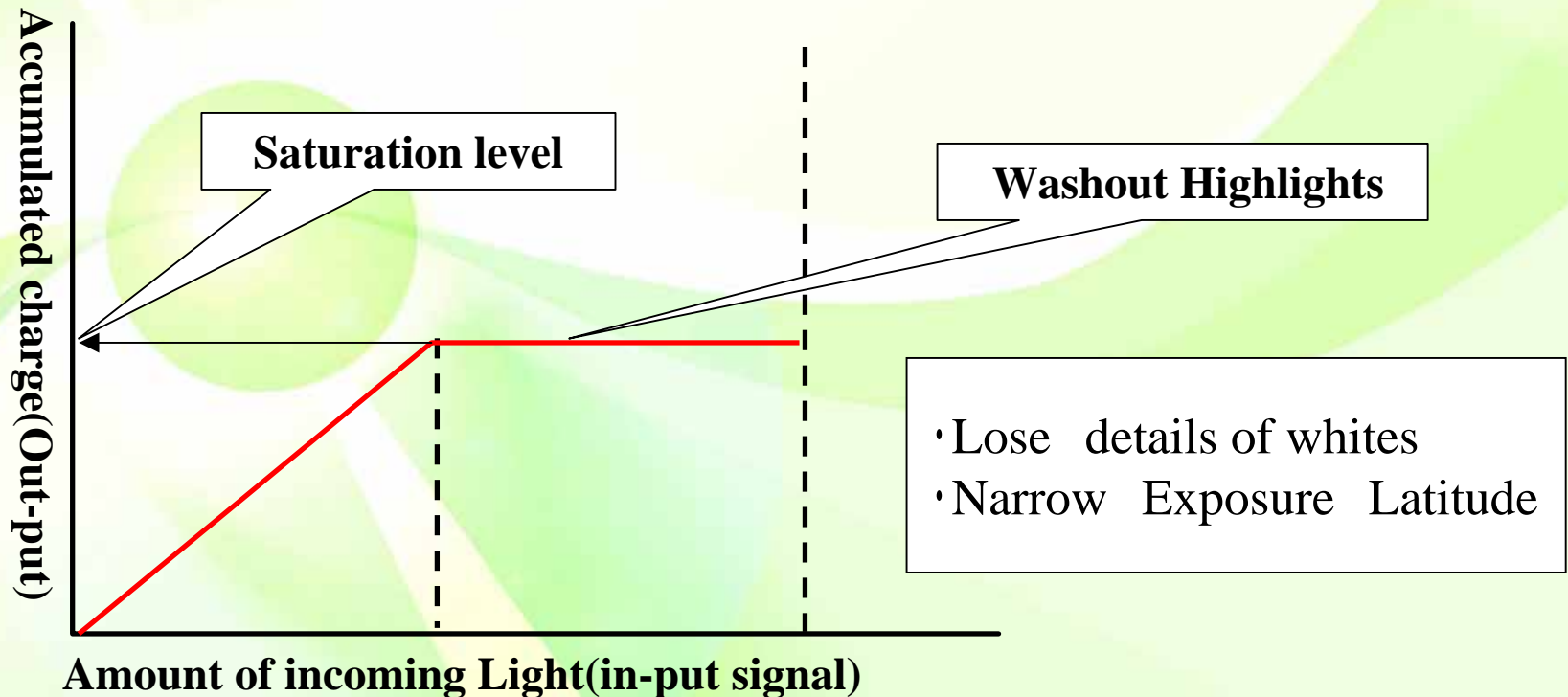
High sensitivity CCD, Noise Reduction

3. Dynamic Range CCD performance 

4. Color reproduction Image Processing 

Dynamic Range(DR) of Conventional CCD

- General characteristic of CCD

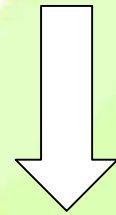


White Subjects



Face
Correct exposure

Dress
No texture



Face
Under exp.(Dark)

Dress
Correct exposure

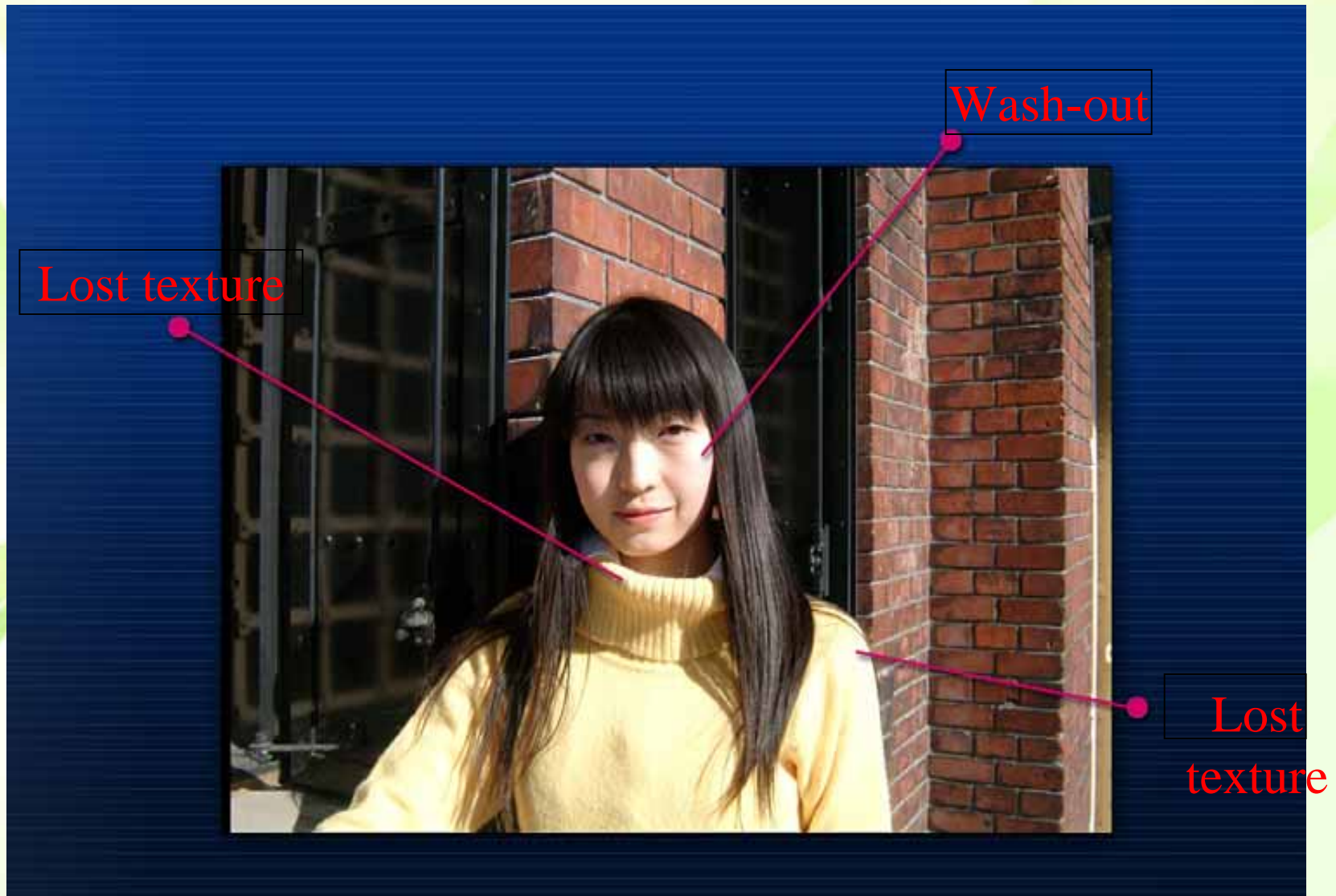
High Subject Contrast(Back-lit)



Wash-out

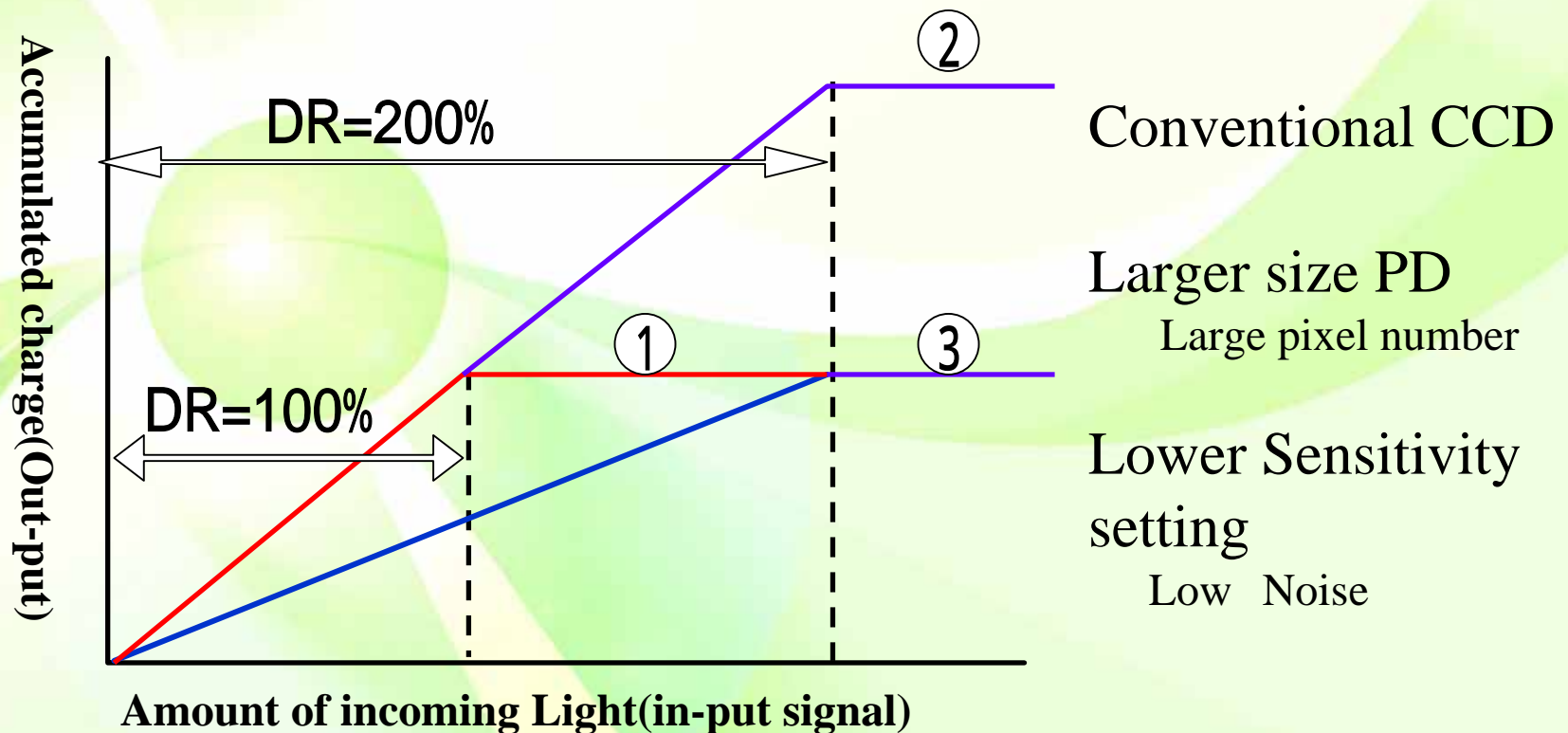
Exposure adjusted to face

High Contrast Lighting



How to improve Dynamic Range of CCD

- Characteristics of CCD/Photo Diode (PD)



Approach to Wider D-Range

Required Performance = Wide Dynamic Range

Low light condition

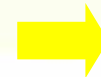
High Sensitivity to obtain shadow details

Bright condition

Low Sensitivity to obtain highlight details

Possible Solutions

Double Image Sensor Chip System



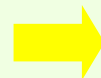
Bigger Size Camera

Compose 2 different exposure images



Still Photography Use
only

Hi-sensitive PD and low-sensitive PD
on the same CCD chip

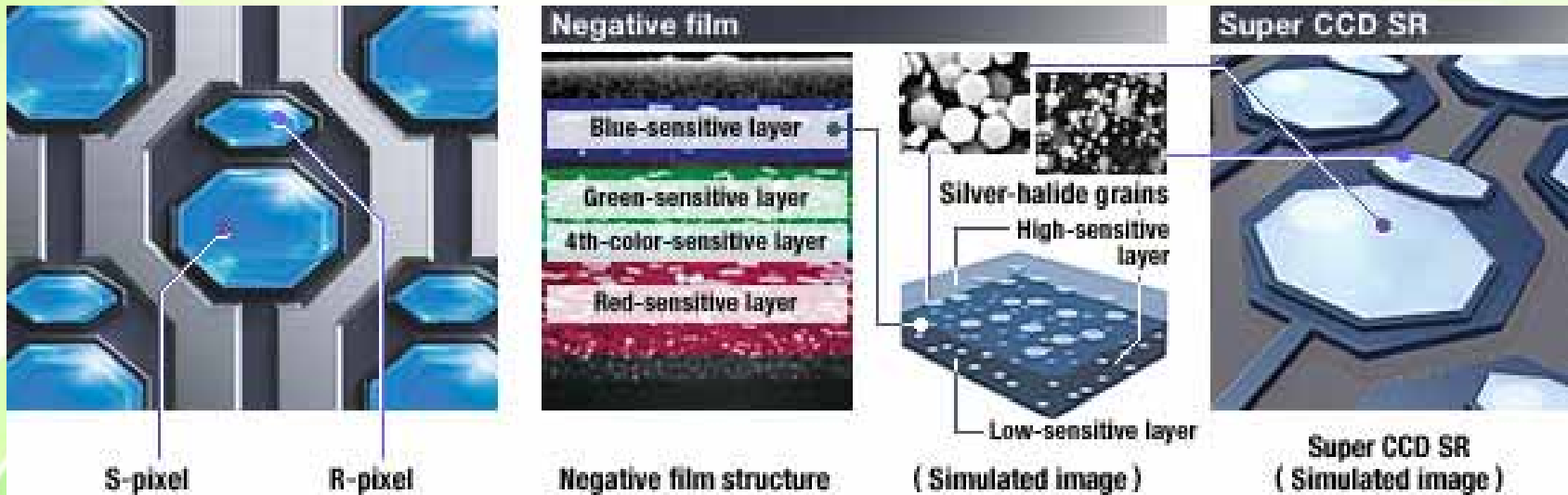


½ Resolution but...



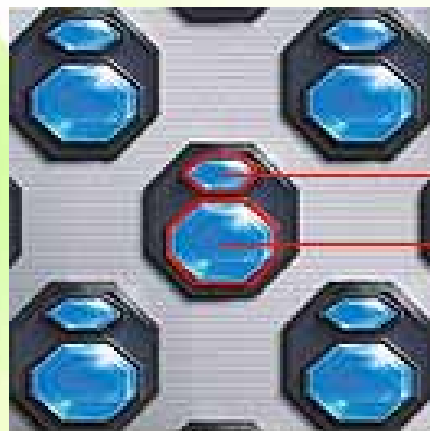
Super CCD Honeycom IV SR

(introduced in 2003)

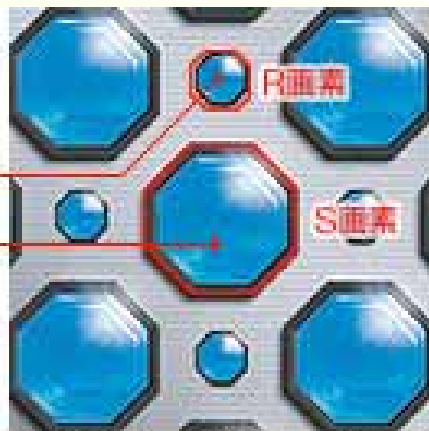


1st generation Wide D-Range CCD
Designed for Compact Digital Cameras

Super CCD Honeycom IV SR II (introduced in 2004)

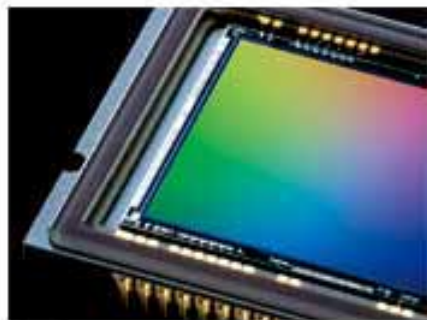


1/1.7型
スーパーCCDハニカムIV「SR」



大型(23.0mmX15.5mm)サイズ
スーパーCCDハニカム「SR II」

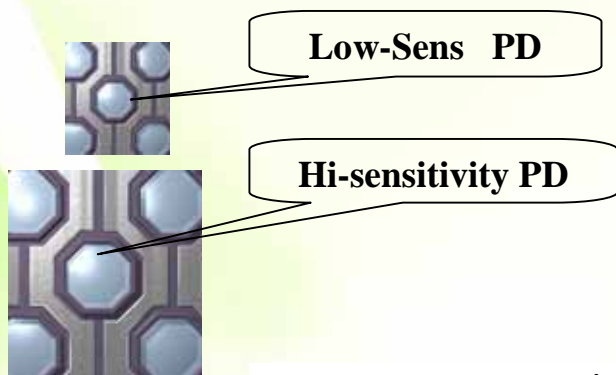
※図はイメージです



 SUPER CCD HONEYCOM SR II

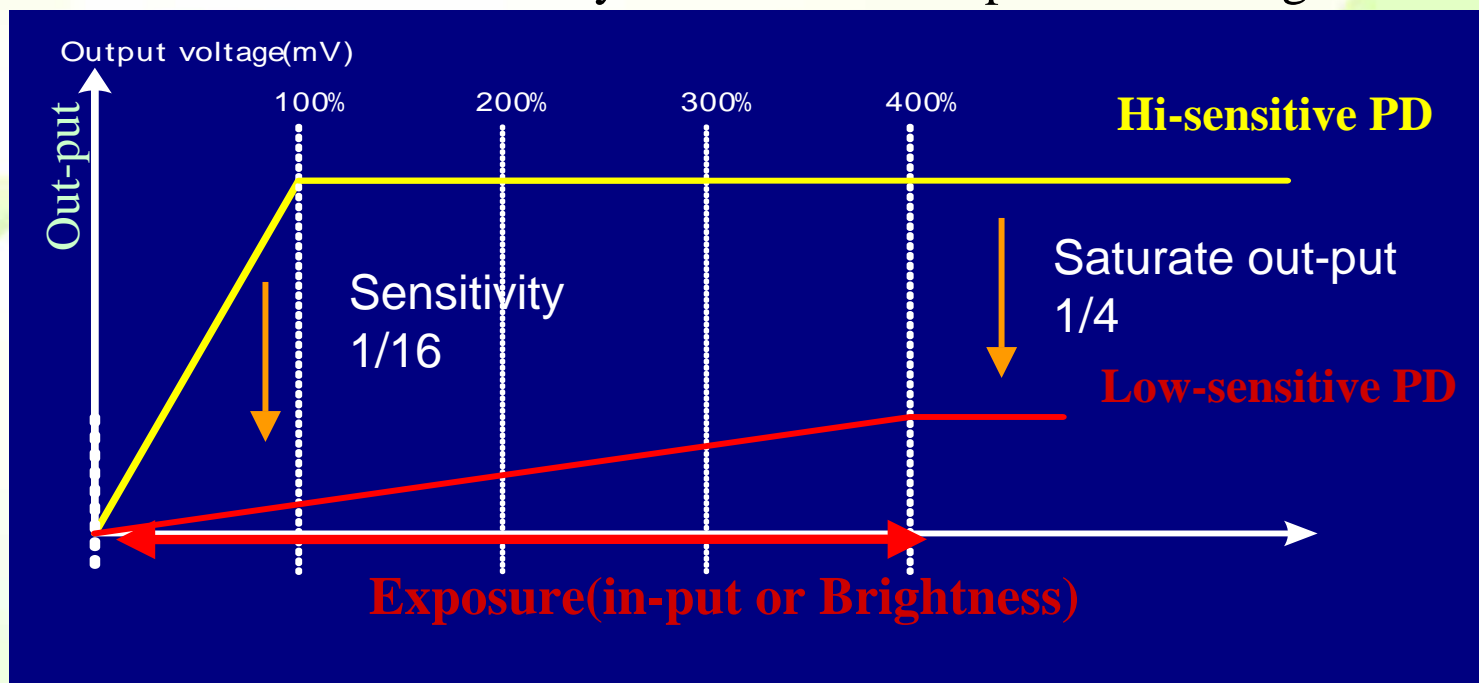
Specially designed for Digital SLR ,S3Pro
More optical flexibilities
(geometrical PD arrangement)

D-Range of Hi-sensitivityPD and low-sensitivityPD



	高感度PD	低感度PD
sensitivity	1	1/16
Saturated Out-put	1	1/4

Low-sensitivity PD has wider exposure D-Range



Blending image information

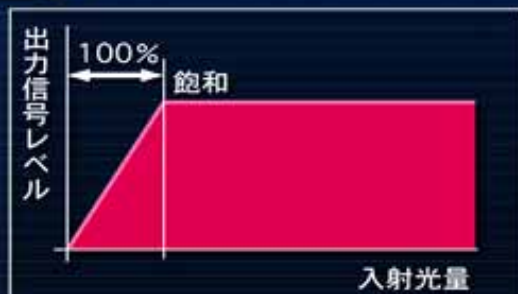
(Case of 1st generation SR sensor)



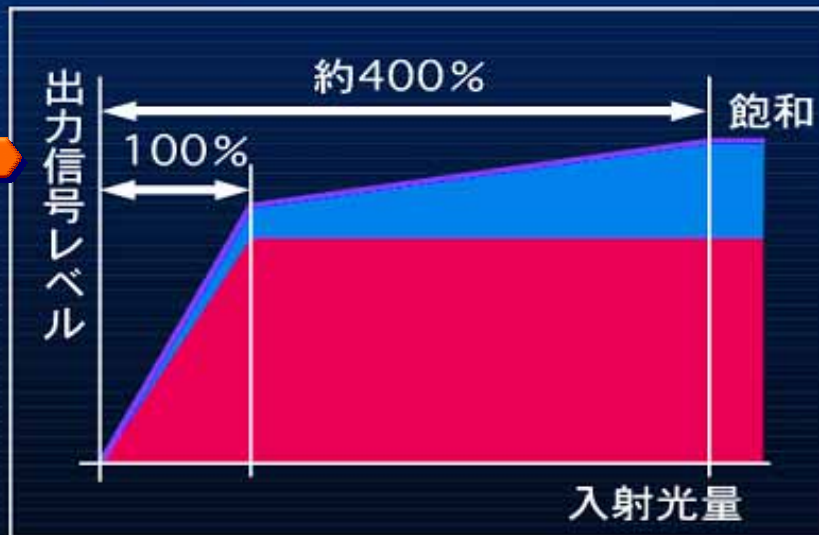
Low sensitivity
Wide D-Range
Sensor



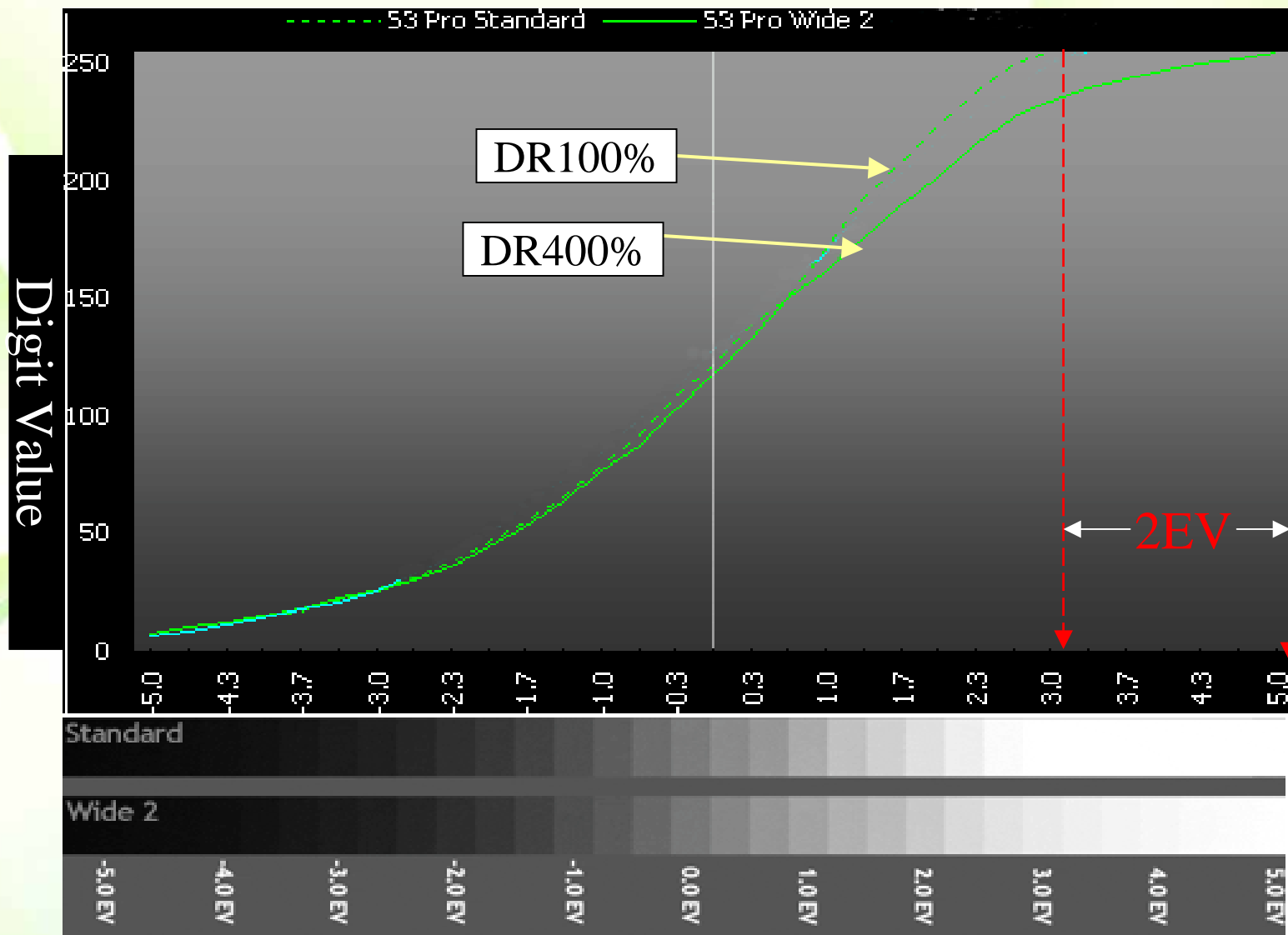
High sensitivity sensor



Combining information from both
Sensor elements, CCD SR is able
to deliver both higher sensitivity
and expanded D-Range.



Dynamic Range and Digital Image



Merit of Wide DR 1



100%

230%

400%

Merit of wide DR 2



100%



230%



400%

Merit of Wide DR 3

Exposure Level

+1 EV

0 EV

-1 EV

Super CCD



Super CCD Type SR



Merit of Wide DR 4

Exposure Level

+1 EV

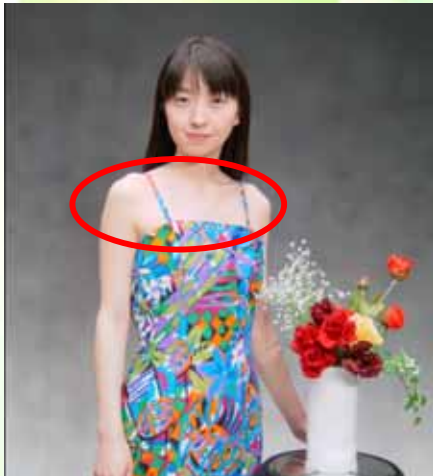
0 EV

-1 EV

Super CCD



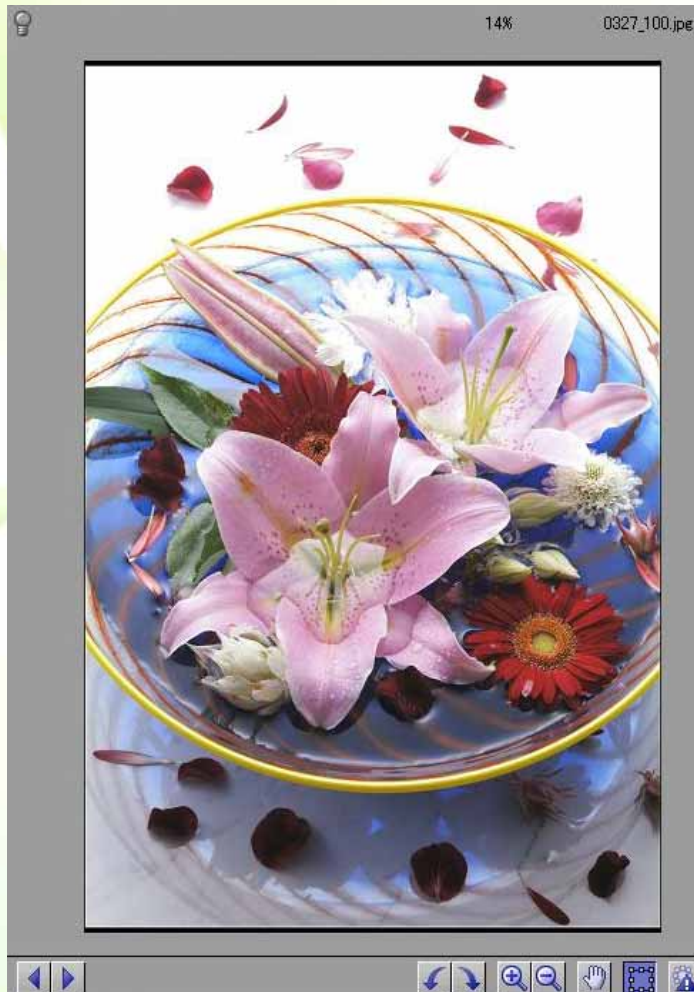
Super CCD Type SR



D range comparison

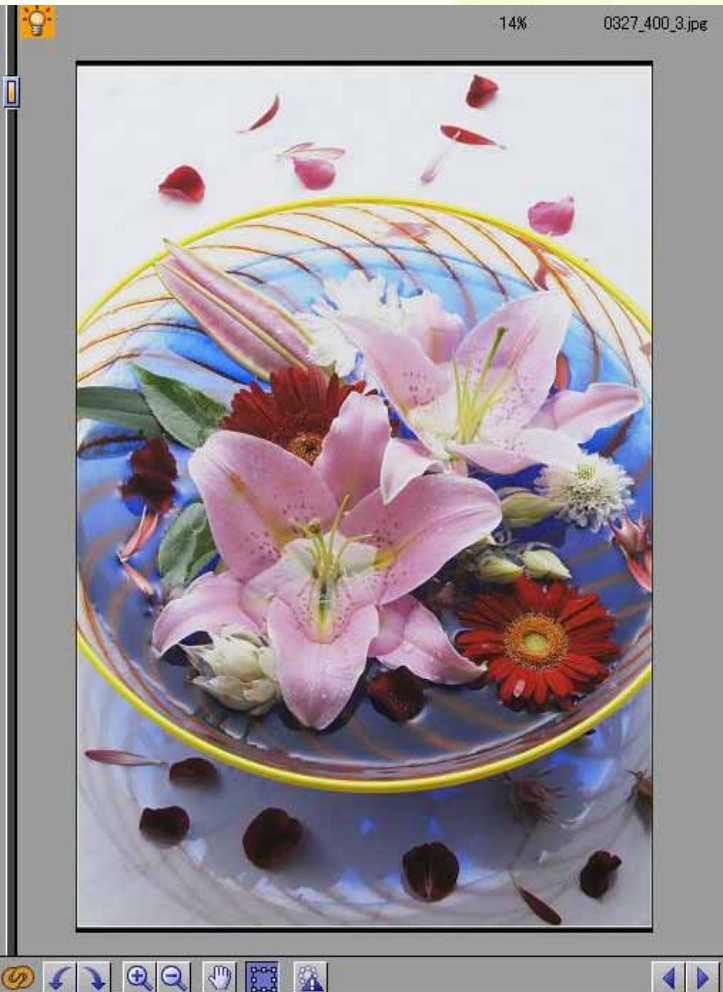
S2Pro

(Conventional CCD Honeycom)



S3Pro

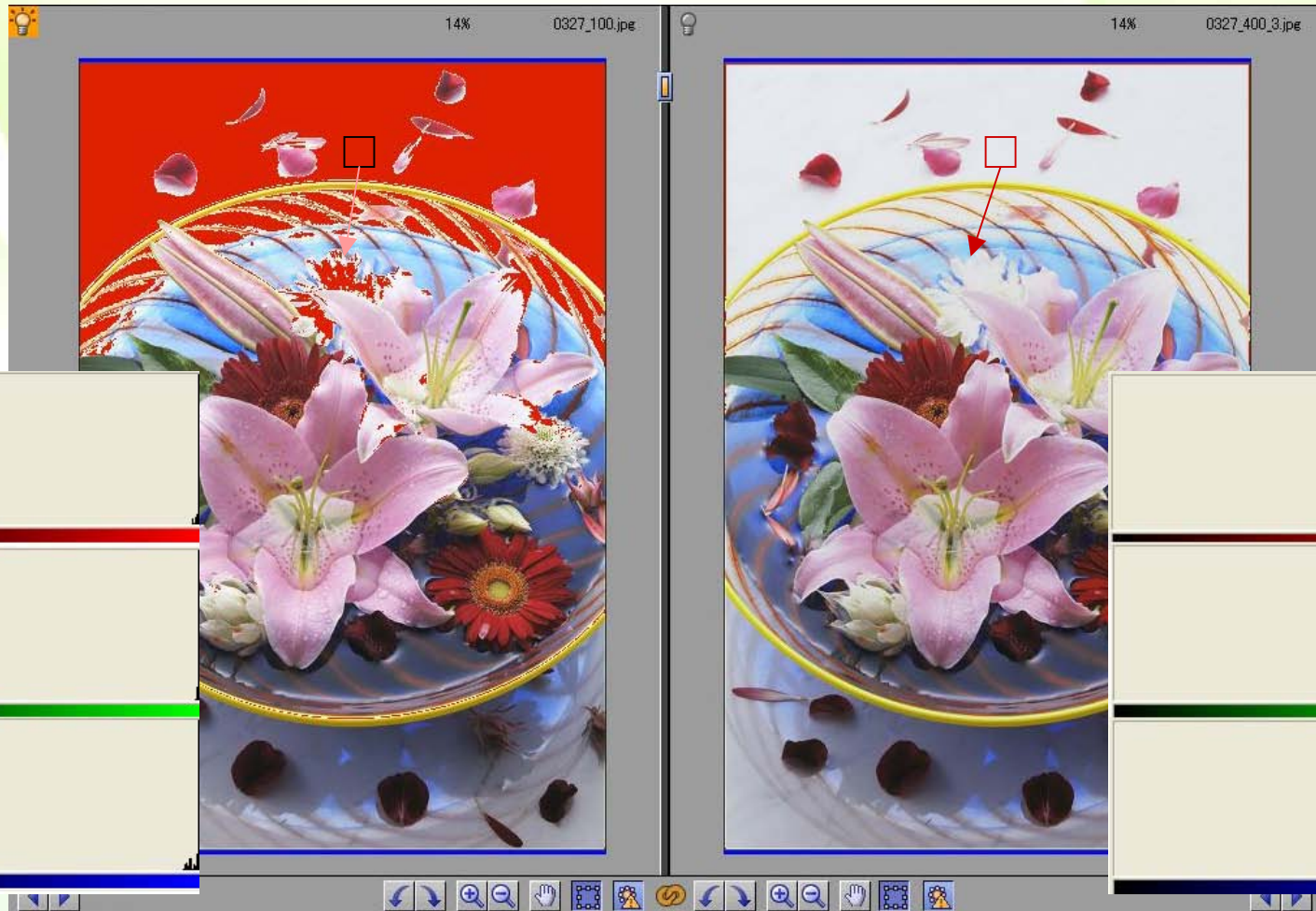
(Honeycom SR)



D range comparison

S2Pro

S3Pro



D range variation

230%(W1)



100%

400%(W2)



D range variation

230%(W1)



100%

400%(W2)



Wide D-range vs Low Contrast setting

Super CCD Honeycom SR



Conventional CCD
w/Low contrast



Thank you very much