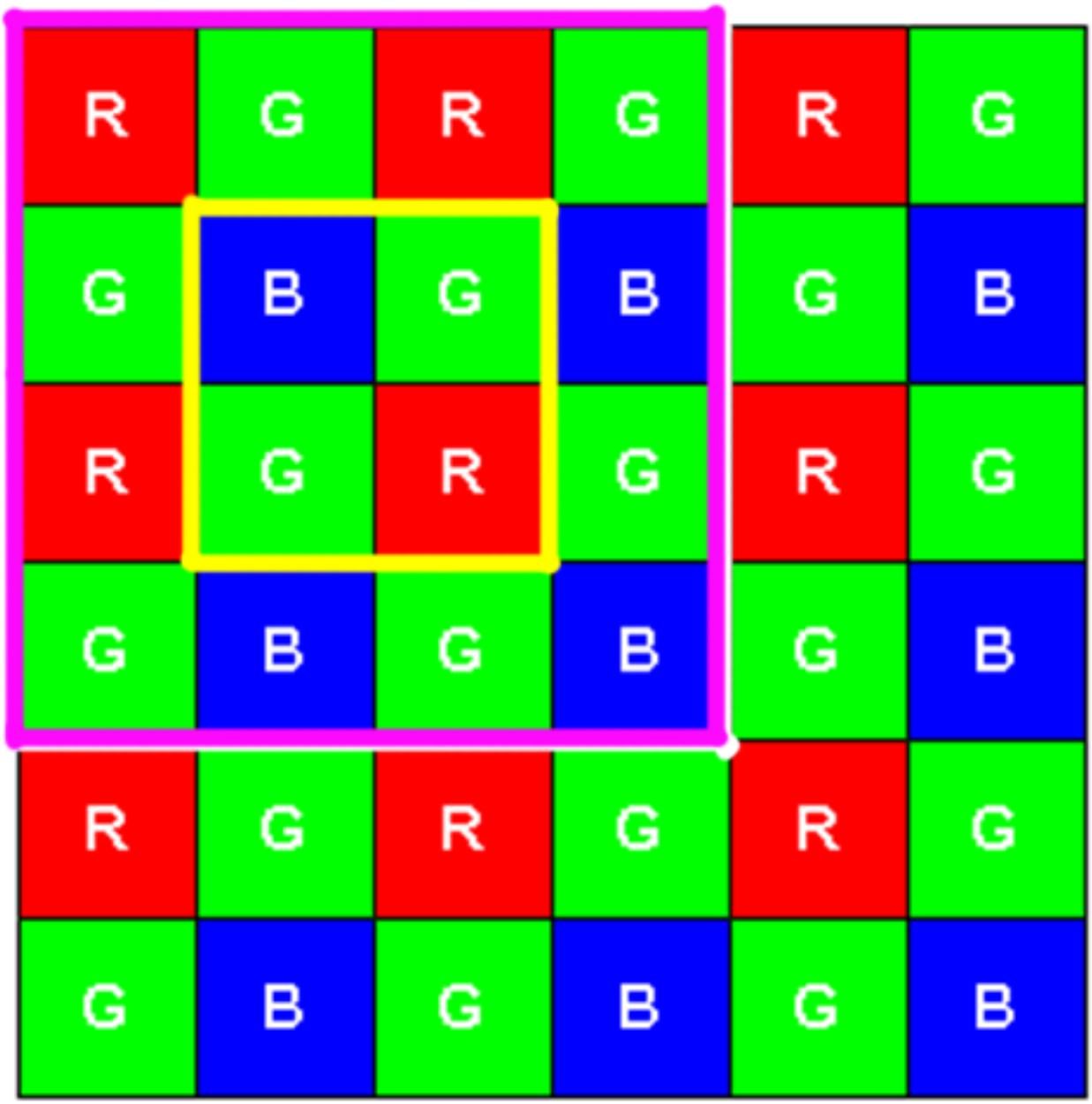
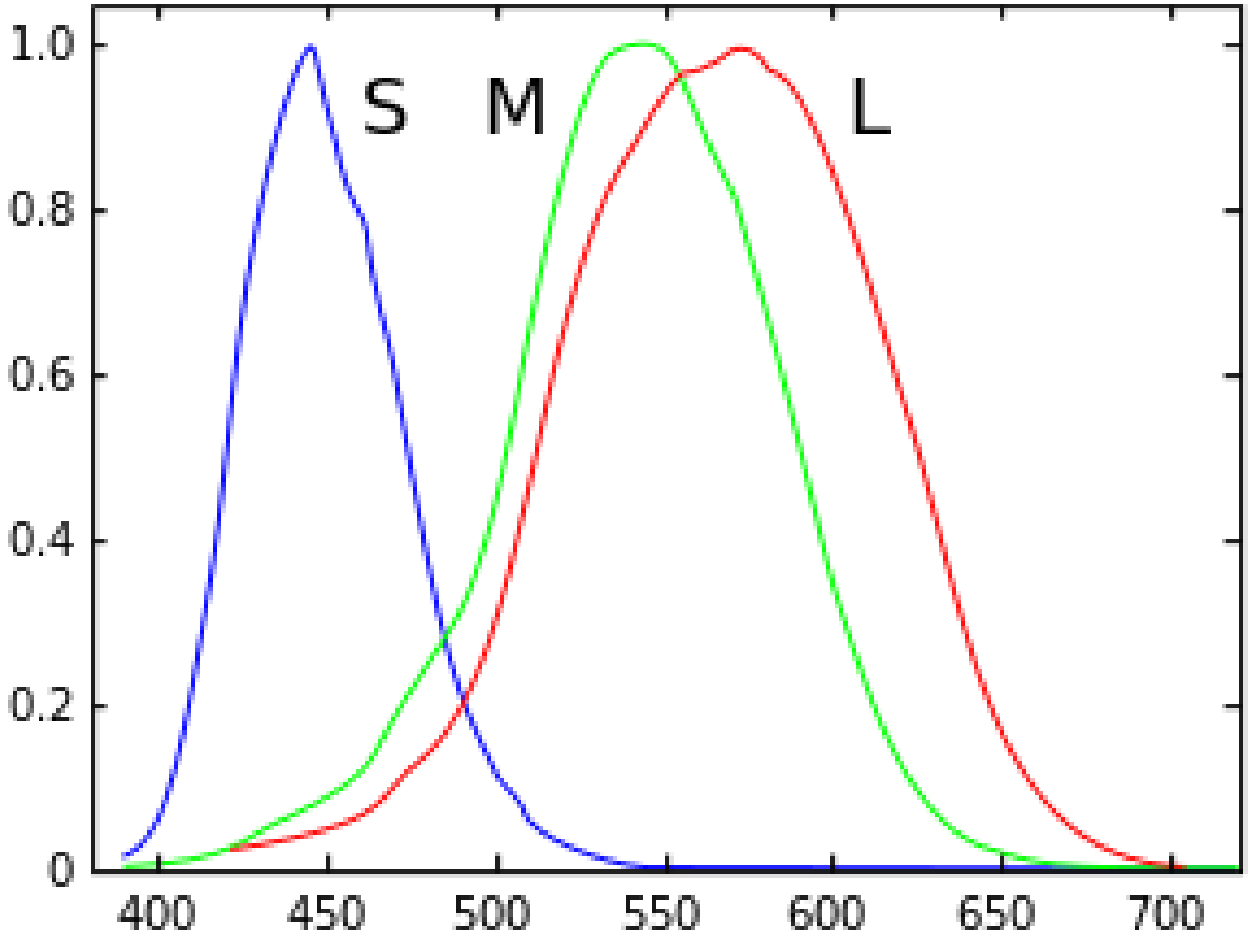
## Better CFA Interpolation

- Consider 4x4 array – 2x2 Bayer set (purple outline)
- Create an interpolation for the inner Bayer CFA (yellow outline)
- 4x4 has 16 pixels, each pixel has 3 colors potentially
- How many data points do we get – depends on the color response



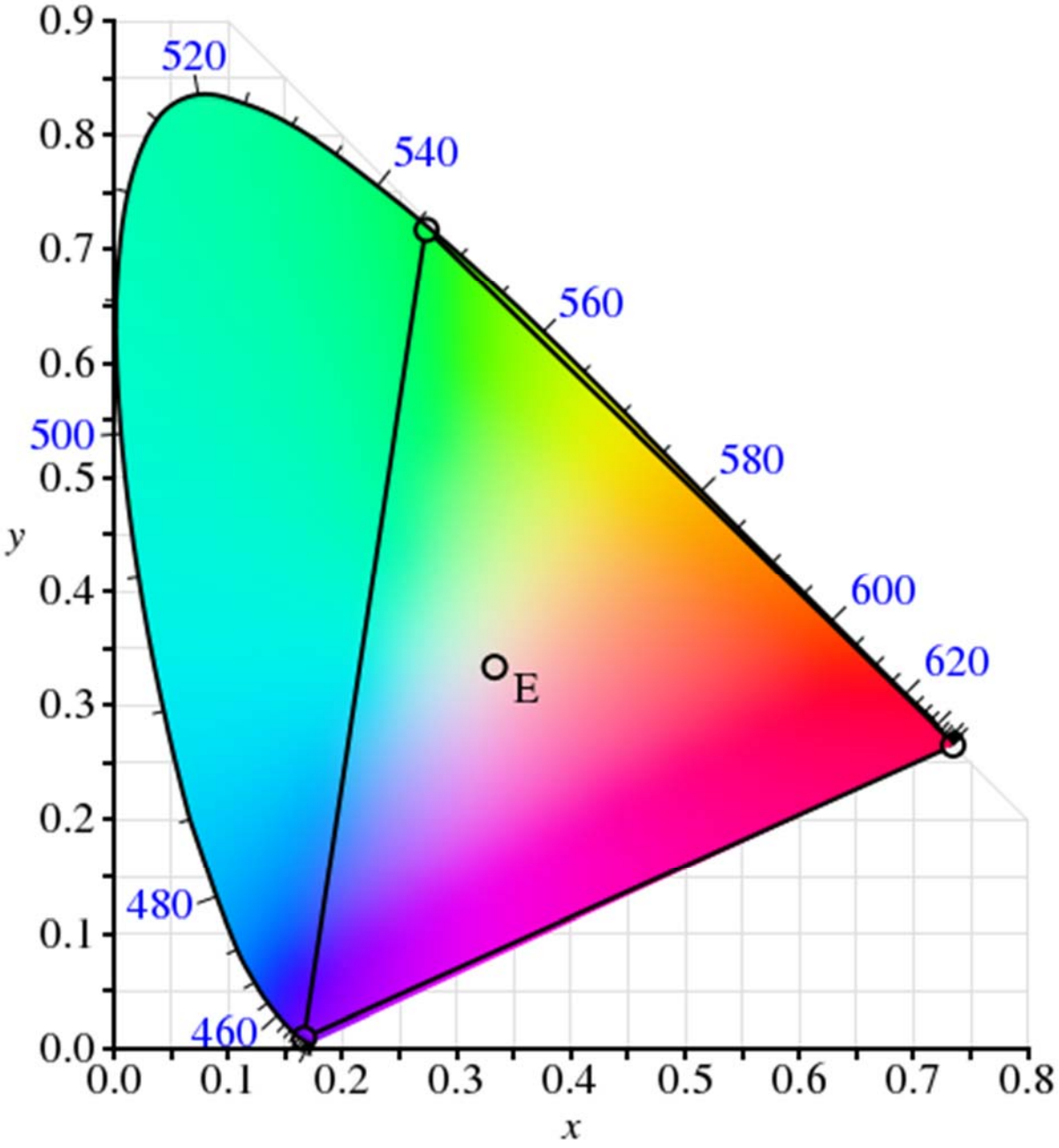
**First Note the human eye response**

- Human Eye has huge color overlap
- Note red and green large overlap
- Blue has both Red and Green overlap
- We will use this type of overlap in our response



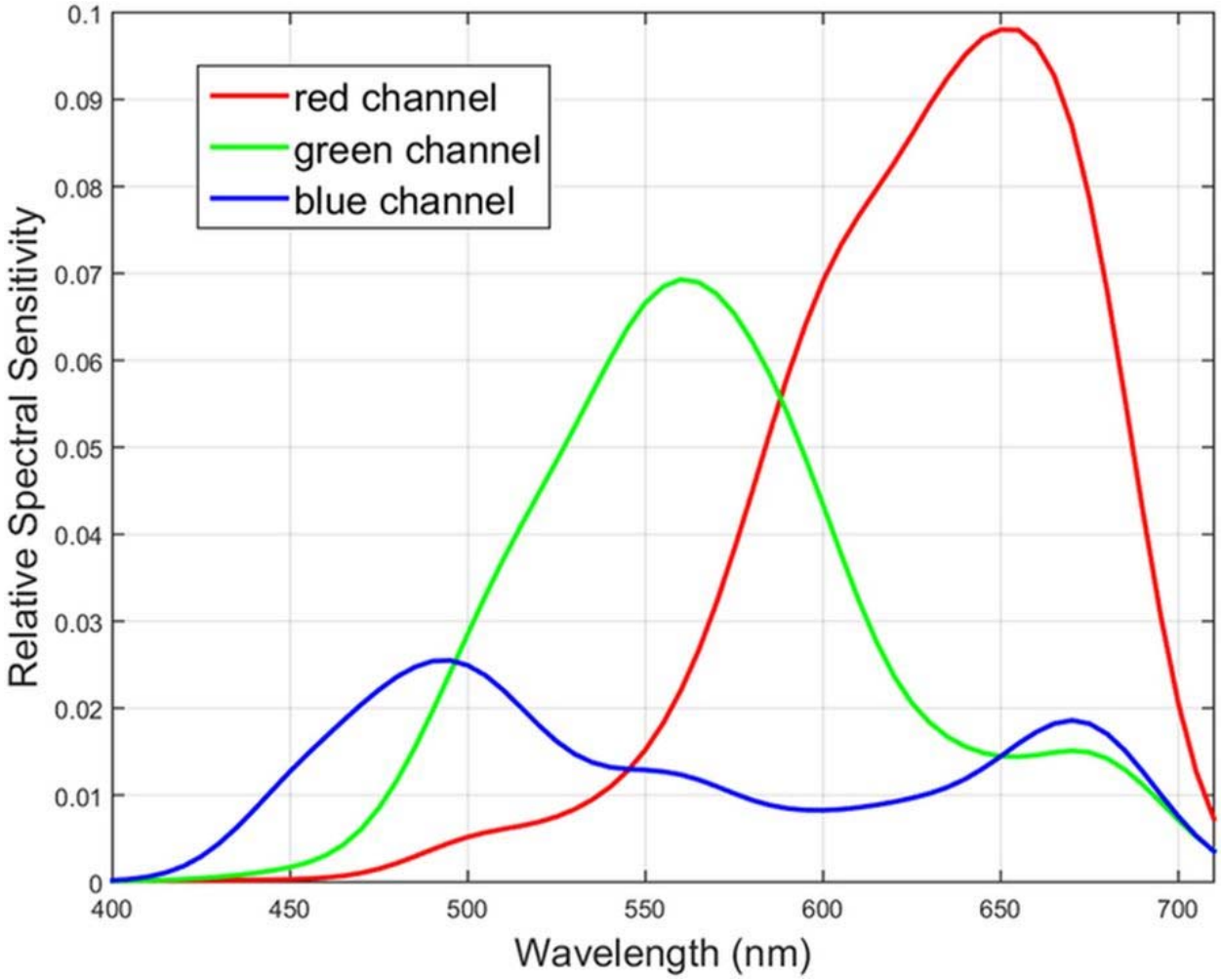
## CIE Color response and RGB response

- CIE 1931 is the standard response of the human eye
- RGB cannot do the full response – just triangle within it
- There are various RGB triangles but all are limited
- Hence our response is doing as the human eye does
- Not as the bilinear interpolation does

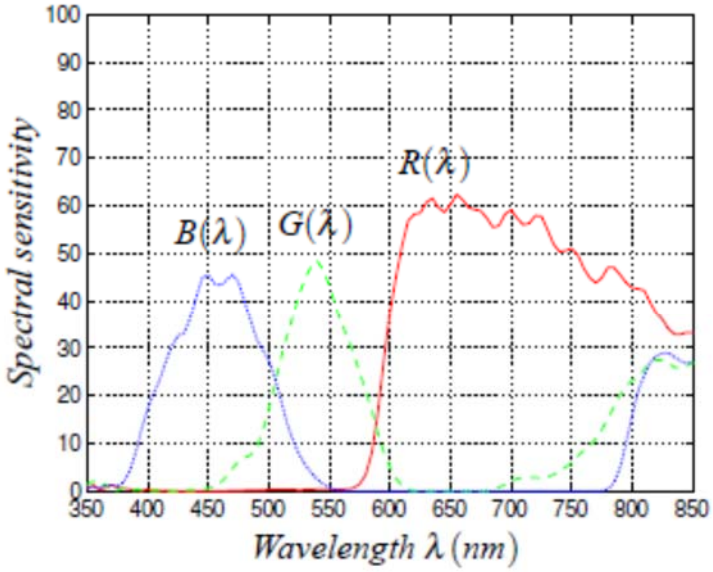


# True Camera Response

- Different Cameras have different overlaps or R,G,B



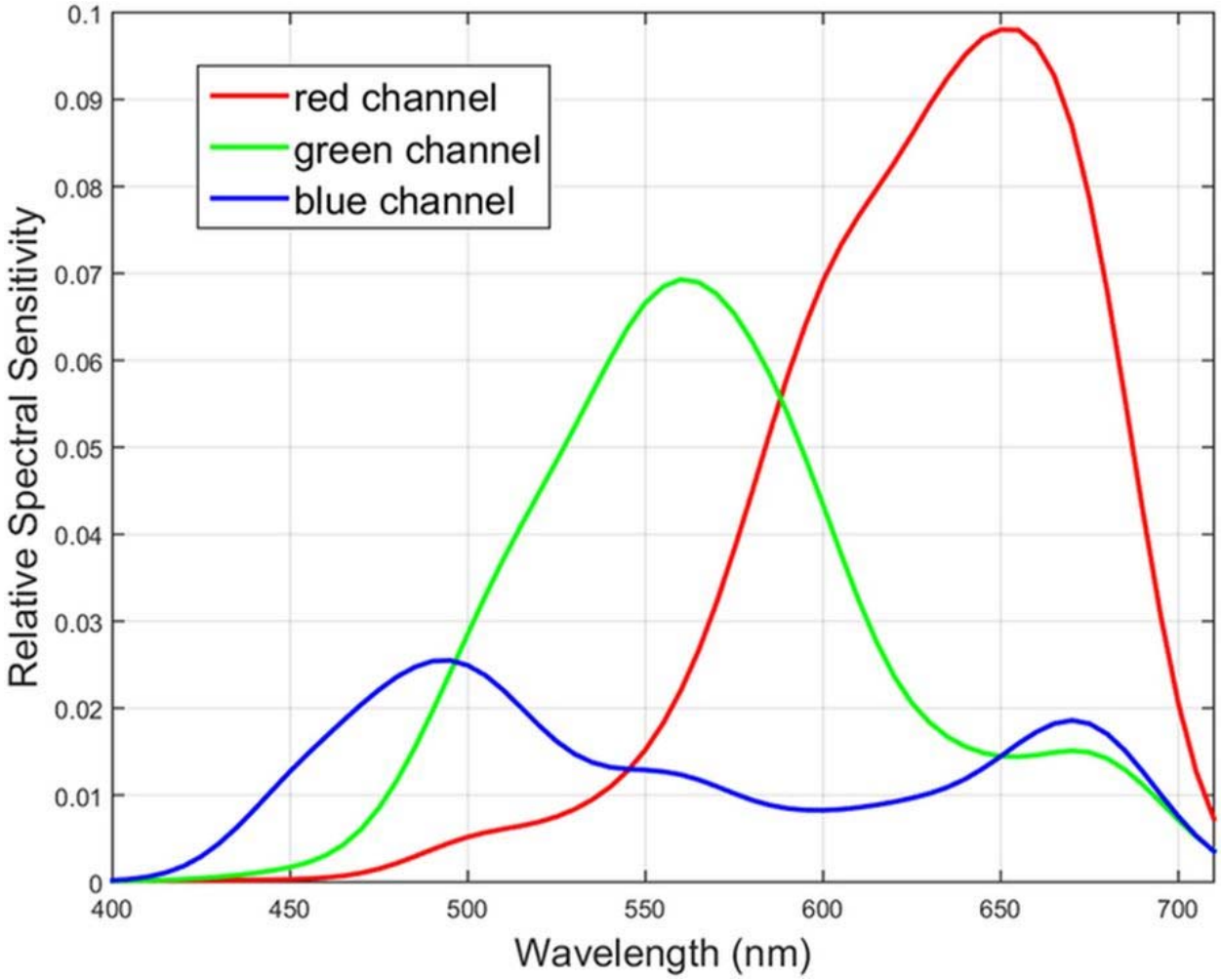

Canon T3i color response




(b) Relative spectral sensitivity of the Kodak KLI-2113 sensor.

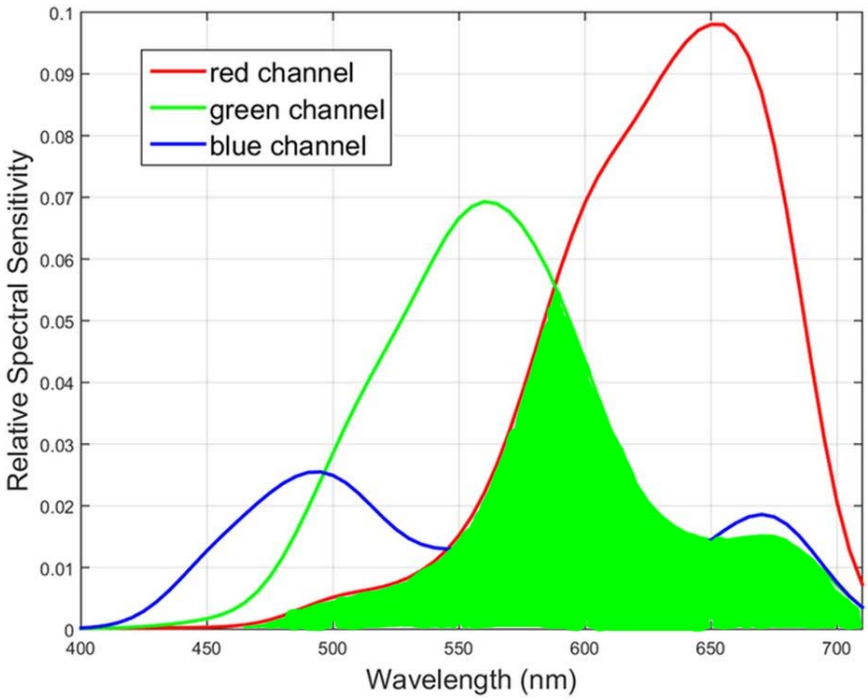
## First Calculate overlap response

- Canon T3i has all 3 colors responding to all color
- Kodak did not have same overlap
- Assume a white (gray) light source
- Now calculate each calculate the cross response
- This is the response seen by other colors

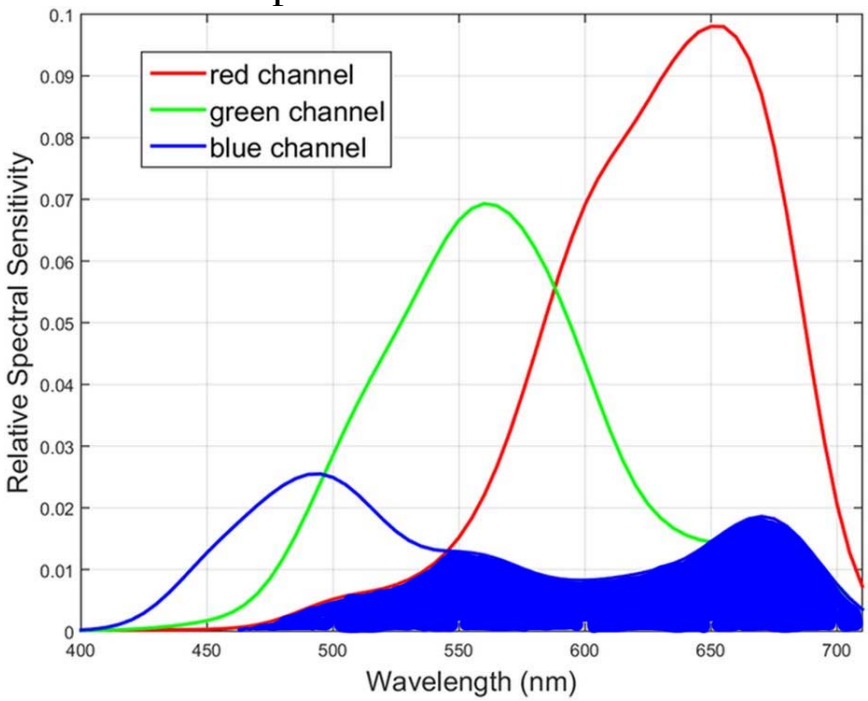


# Overlap Response

- Integrate under curves
- Eg Green pixel recording of Red
- Blue pixel recording of Red



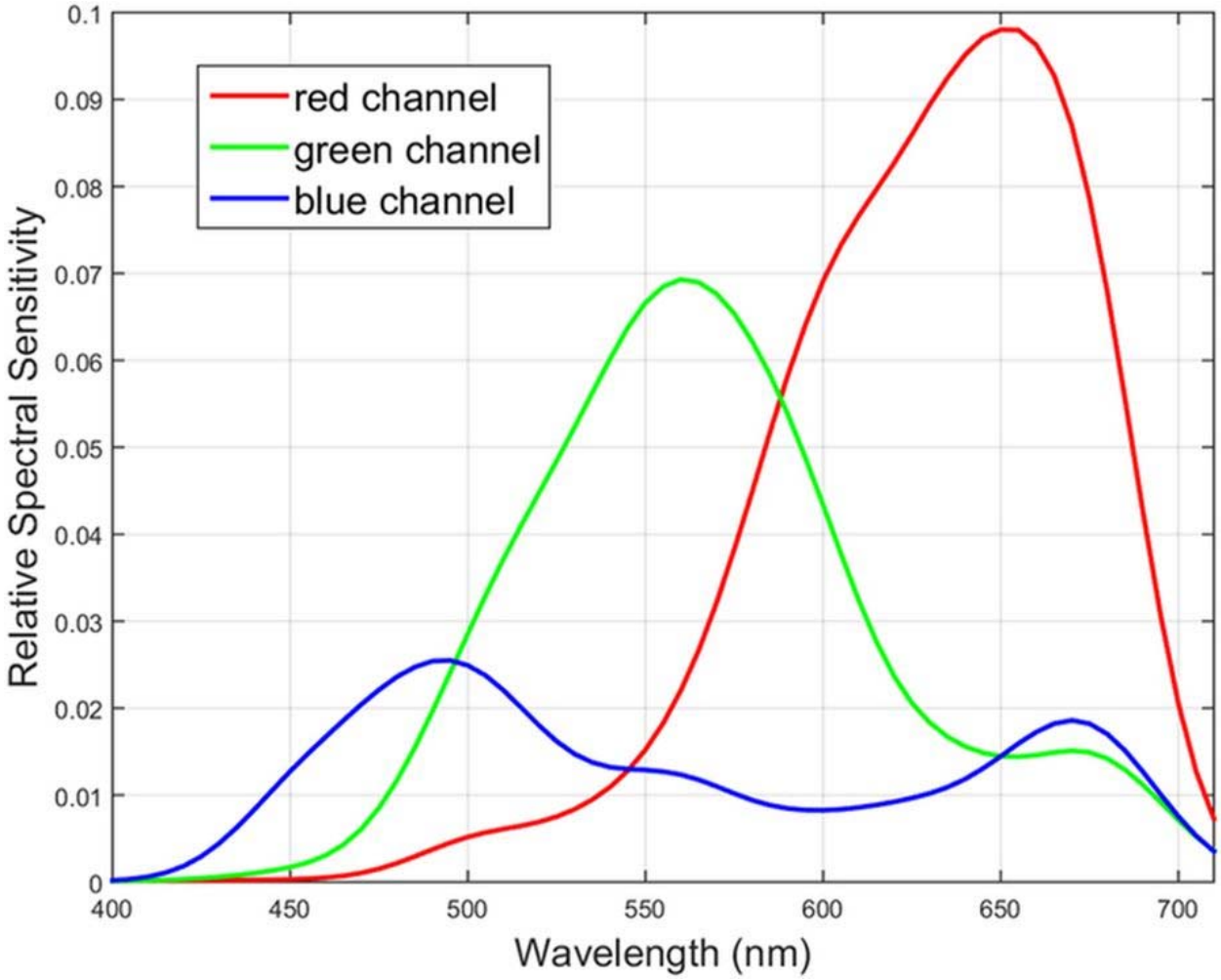

Red in Green pixel




Red in Blue pixel

# Color Balance

- Must take color balance into consideration
- Assume a white/grey
- Then assume B=G=R for that exposure
- Makes more difficult
- This gives the basic ratios of R in B & G etc
- Do same for B in G & R
- Also B in G and R



## Now applying the grey step

- Now apply the gray step used in bilinear
- Calculate the R,G,B values using the actual response
- Now do the 2D parabolic curve fit

$$F(x,y) = a_{00} + a_{10}x + a_{01}y + a_{20}x^2 + a_{11}xy + a_{02}\,y^2 + a_{21}x^2y + a_{12}xy^2 + a_{22}x^2y^2$$

- Do we do CFA shifting or single pixel shifting
- Do we do 3x3 set or 4x4