Three Arms

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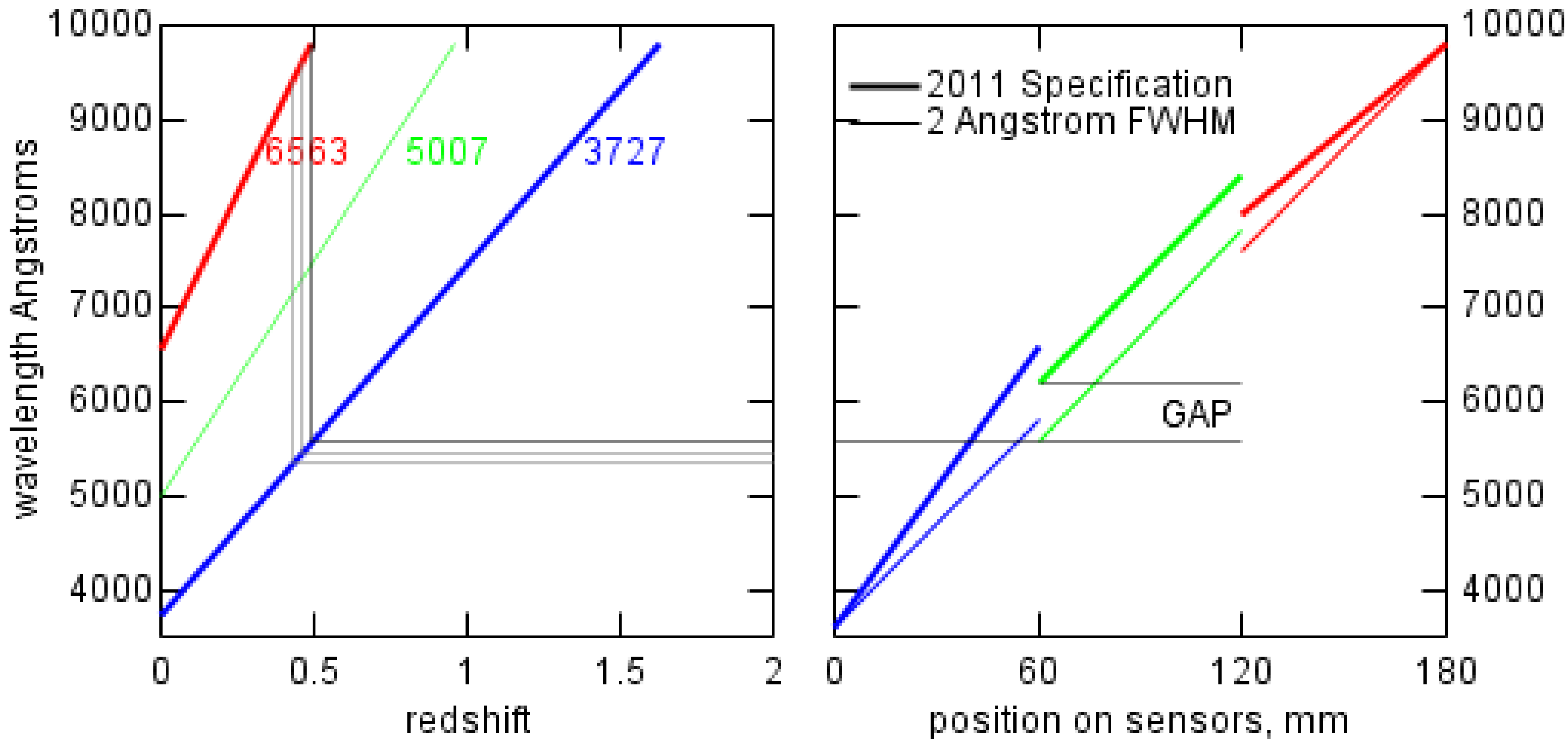
The Gap



- At redshifts below z=0.5: Hα is visible; 3727 need not be resolved.
- At redshifts above 0.5, Hα is lost; we need to resolve 3727.
- This abrupt change in requirement makes z=0.5 a better crossover than the existing Level 2 requirement "Resolve [OII] doublet for $0.76<z<1.6$".

Velocity Profile on [OII]

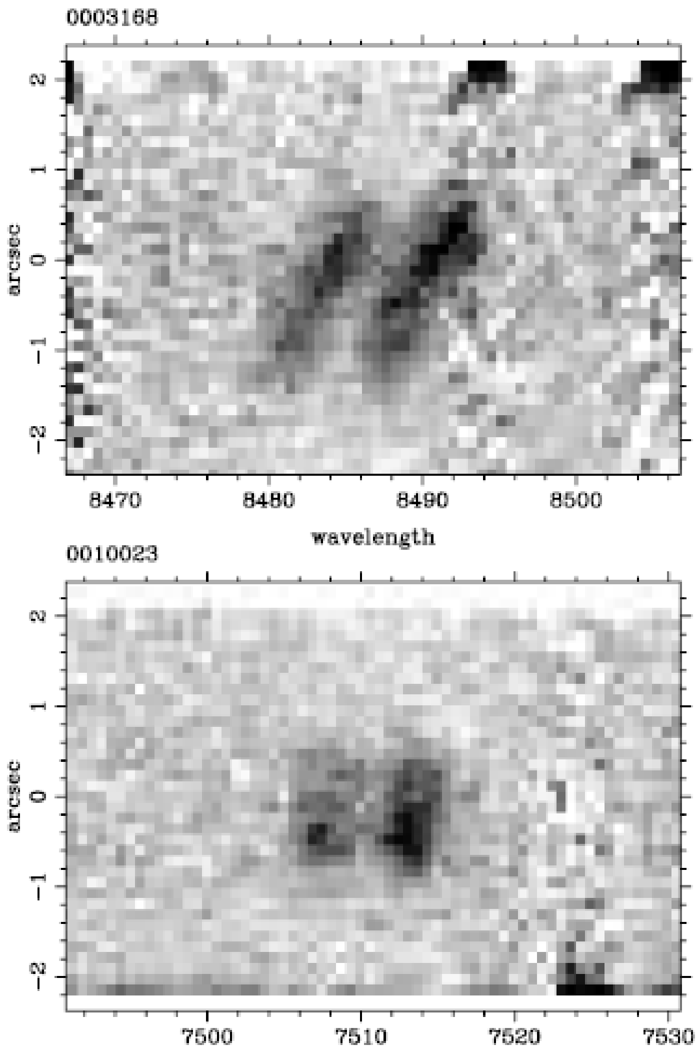
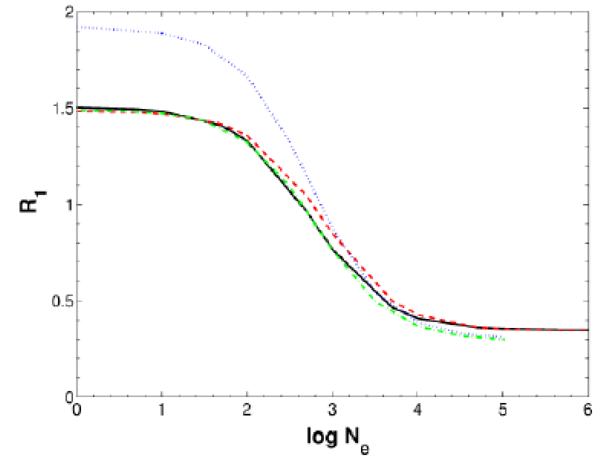


Fig 2 of Deimos GOODS survey Weiner et al arXiv 0609090 (2006)



[O II] 3729/3726 ratio: Pradhan et al astro-ph/0510099 (2005)

- singlet Vrms ~ 60 km/s
- Vfwhe =1.35*Vrms ~ 80 km/s
- Vfwhm = 2.35*Vrms ~ 150 km/s
- Vsep [OII] doublet = 217 km/s
- Independent of redshift
- Need to resolve doublet but not Vrms
- Instrumental Vfwhm < ½ Vsep
- Requires R≡λobs/λfwhm ≈ 3000
- More is better esp high z: atmospheric line rejection becomes very important

Instrumental Line Profile

Instrumental LSF contributors have various distributions...

- Fiber --- FWHM/Diam=0.866; RMS/Diam=0.5; FWHE/Diam=0.404.
- Spectrometer --- complicated but small compared to fiber or pixels
- Pixels ----FWHM/Pix=1.0; RMS/Pix=0.289; FWHE=0.5.

For today I adopt instrumental FWHM=0.9*FiberDiam and predict

$$R \cong \frac{\lambda obs \cdot FLcoll \cdot Gvph}{0.9 \cdot FiberDiam}$$

...so if FiberDiam is set by seeing, and if λobs is set by a bunch of galaxies, and if R is set by the [OII] doublet separation, then our only engineering tools are FLcoll and Gvph:

$$FLcoll \cdot Gvph = 0.9 \cdot FiberDiam \cdot (R / \lambda obs)$$

This makes it look easy to get R/λobs=10000! Really???

Three constraints on M ≡ FLcam/FLcoll

1. Fit slit height with 500 fibers & 500 spaces onto CCD height :

$$M < \frac{CCDheight = 60mm}{SlitHeight = 1000 \cdot 120\mu m = 120mm} \approx 0.5$$

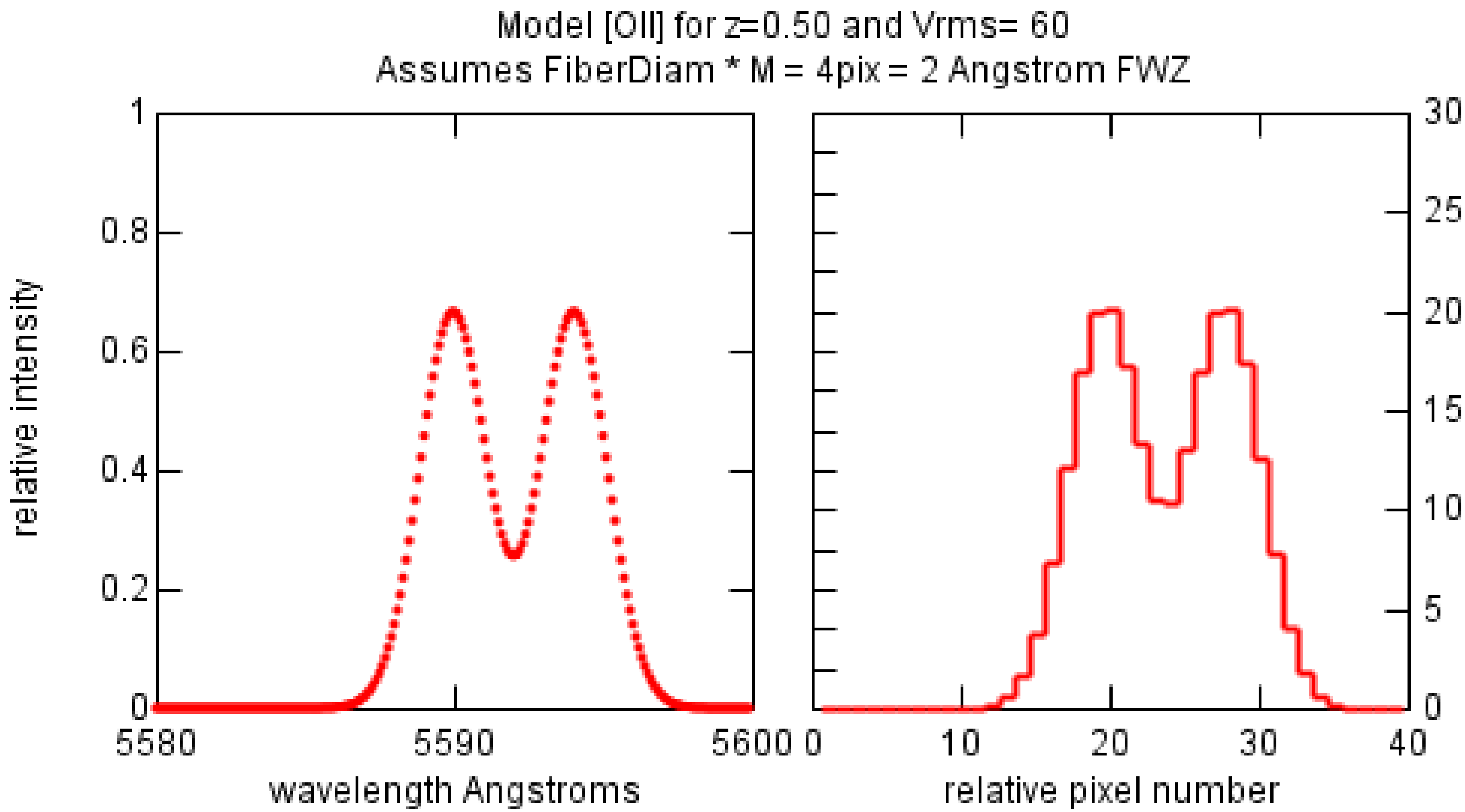
2. Sampling : insist on 3 pixels per FWHM, given CCD

$$M > \frac{3\,pixels \;=\; 45\mu m}{FWHM = 0.9 \cdot FiberDiam} \approx 0.4$$

3. Fit dispersed spectrum within width of CCD arm :

$$M < \frac{CCDwidth \;=\; 60mm}{0.9 \cdot FiberDiam \cdot (R/\lambda obs) \cdot \Delta\lambda arm} \approx 0.25 \text{ if } R/\lambda obs \approx 10000$$

Ouch. This #3 constraint is the only one that depends on R.
Reducing R allows this minimum M to grow.
But also my "0.9" fudge factor may shrink allowing M to grow.
Simulations are the key – and are already being worked.



Infinite instrumental resolution   Convolved with fiber and pixels

- Not yet horrible at 2 Å FWZ fiber and 0.5Å pixels