

Tunable Imaging Filters (TF)

Data Reduction Techniques

An introduction

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Setting the Scene:

- **Tunable Filters are good for emission-line surveys where sky (angular) coverage is as important as wavelength coverage despite low-resolution, e.g.**

OTELO

- **Only a few objects may be of scientific interest to the program from a field containing thousands**

Q: How can we select the right ones efficiently?

A: With a specific offline package, e.g. TFred (v 1.0)

Setting the Scene:

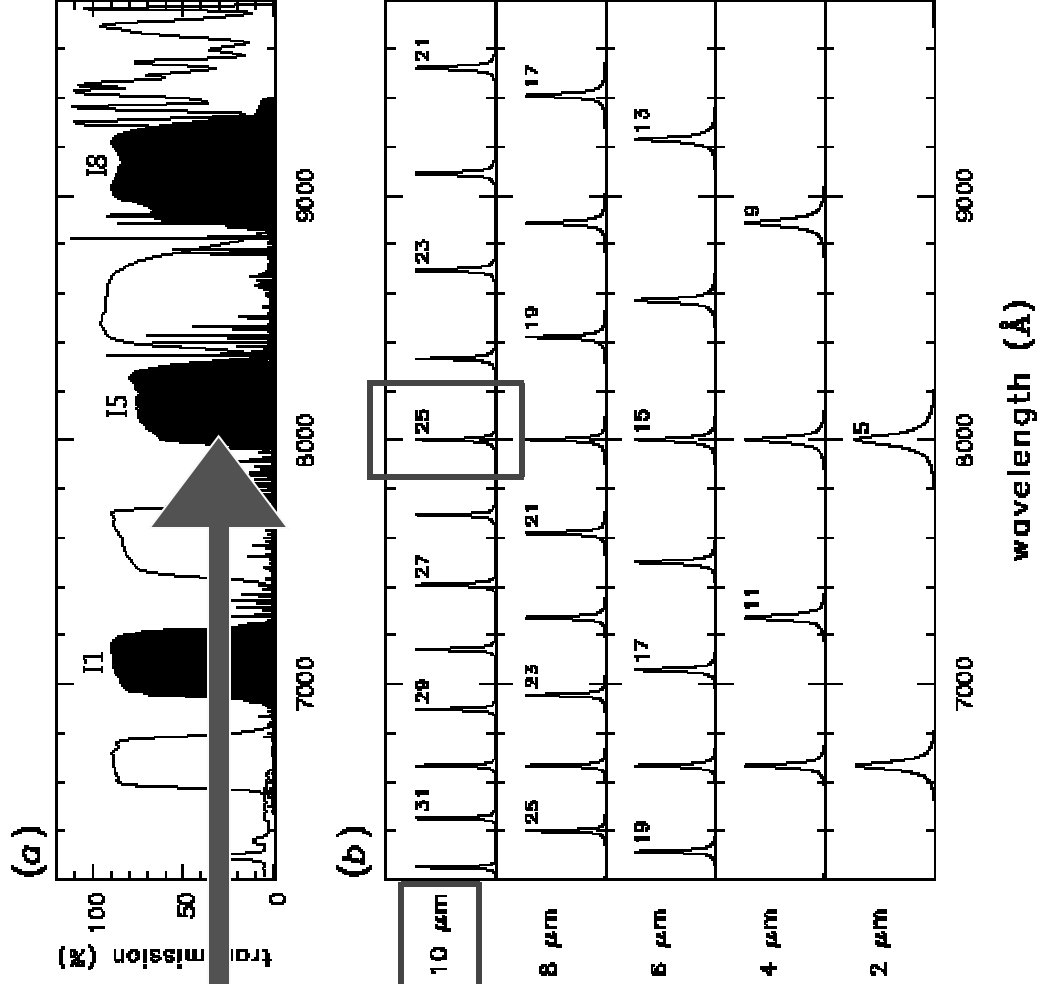
Goals: To acquire skills using TFred package (Jones, 1999). **To be aware about its possibilities and limitations:** essentially, it is conceived only for TF imaging and optimized for point-source data of emission-line surveys.

- **Worked example: data used by** Glazebrook et al. (2004) “*Cosmic Star Formation History to $z=1$ from a Narrow Emission Line-Selected Tunable-Filter Survey*”, *AJ*, 128, 2652 **(included in the TF Tutorial DOC dir.)**
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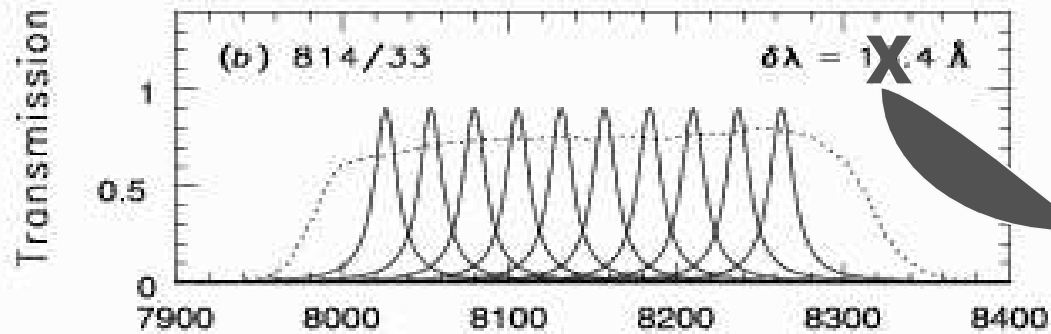
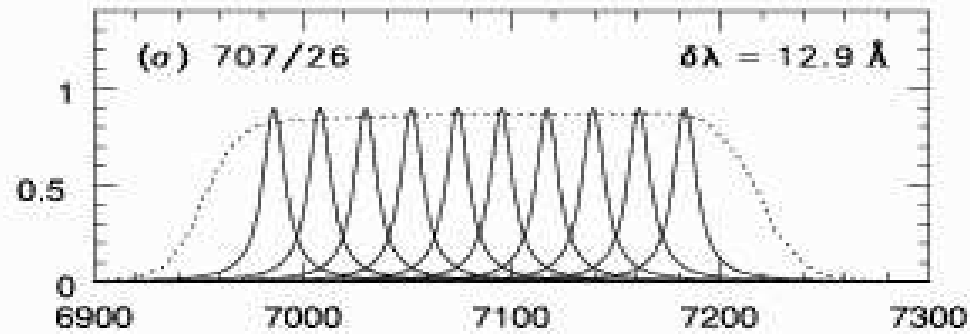
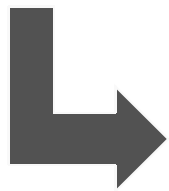
TABLE 1
ETALON SCAN PARAMETERS IN THE THREE DIFFERENT FILTERS

WAVELENGTH RANGE (Å)	NUMBER OF STEPS	$\Delta\lambda$ (Å)	FWHM (Å)	EXPOSURE TIME PER CHANNEL (s)		$H\alpha$		$H\beta$		$[O\text{ II}]$	
				z	Volume (Mpc ³)	z	Volume (Mpc ³)	z	Volume (Mpc ³)		
7058–7112	10	6.0	6.3	800	0.075–0.084	7	0.452–0.463	197	0.894–0.908	599	
8100–8133	5	8.3	8.9	1800	0.234–0.239	31	0.666–0.673	203	1.173–1.182	462	
9000–9033	10	9.3	13.5	5400	0.378–0.390	176	0.860–0.877	696	1.426–1.449	1340	

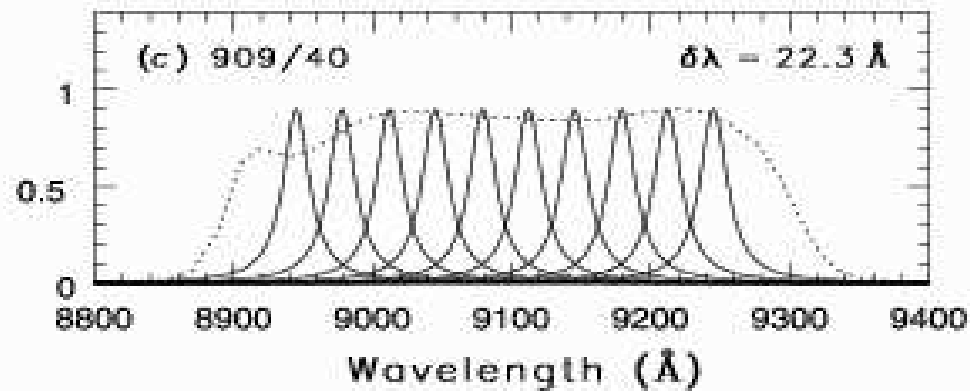
—Each wavelength range and emission-line identification define a redshift range and corresponding volume.

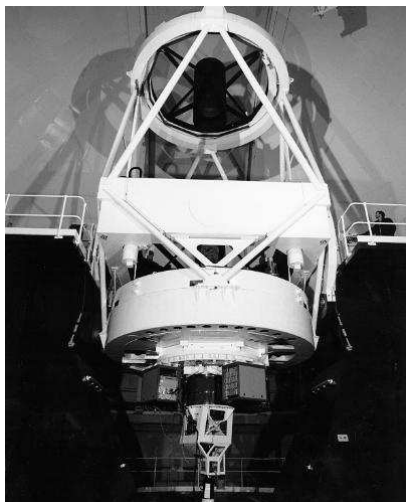


A scan ...



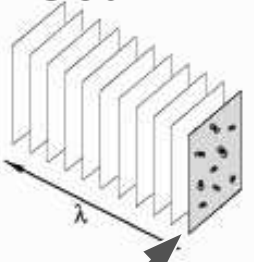
~1 nm



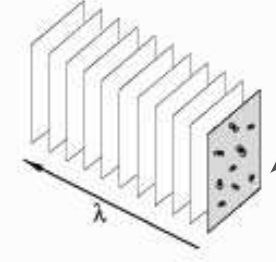


TFred in 3 slides

Scan-1

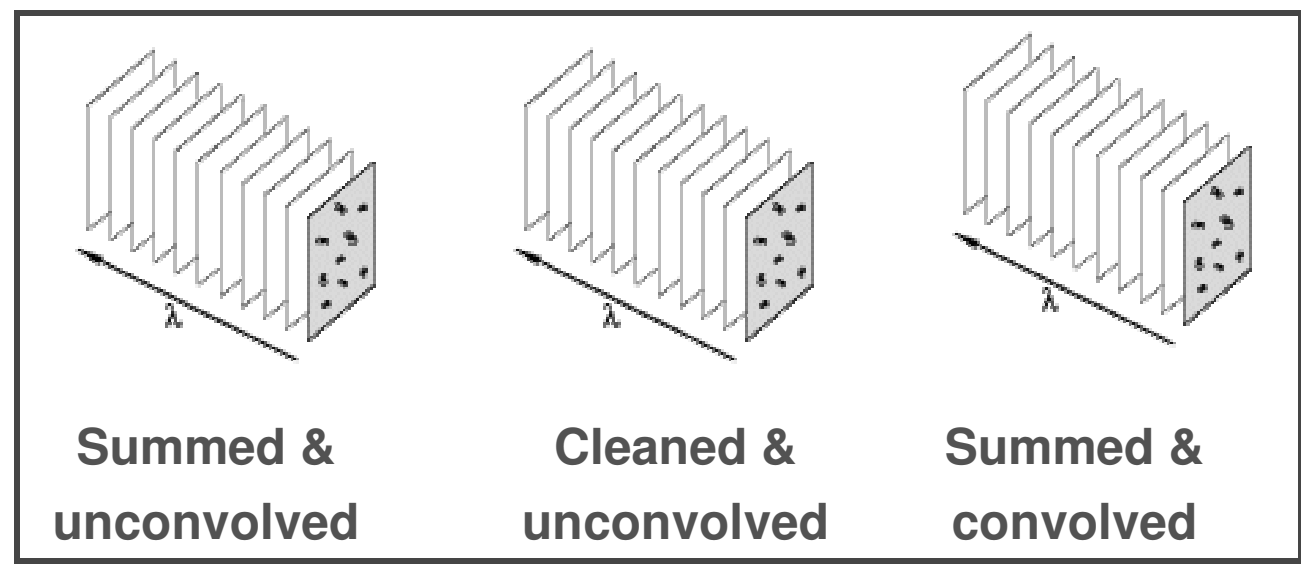


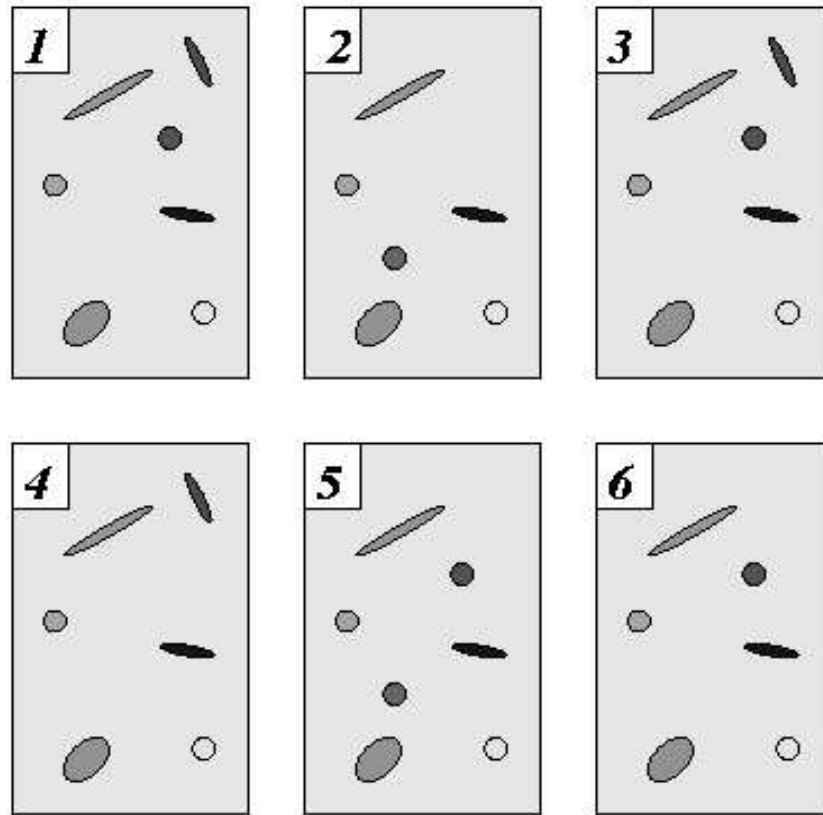
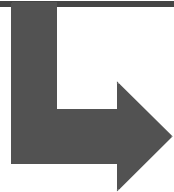
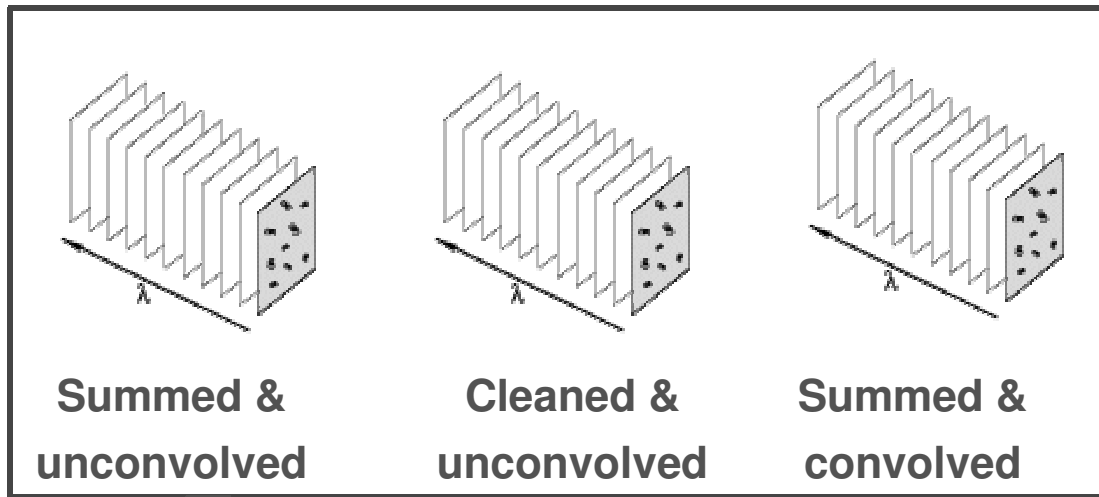
Scan-2



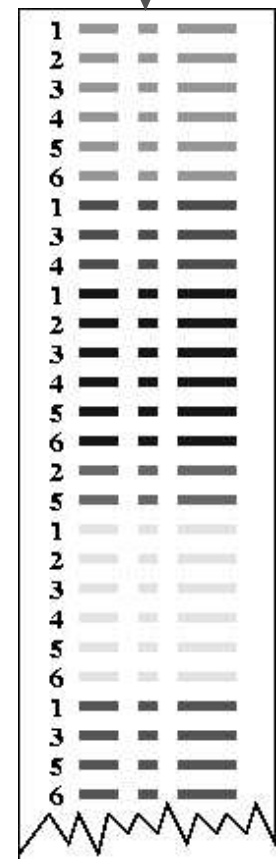
Scan-n

- Individual frame preparation
- Aligning
- Combination (sum, median, convolution)



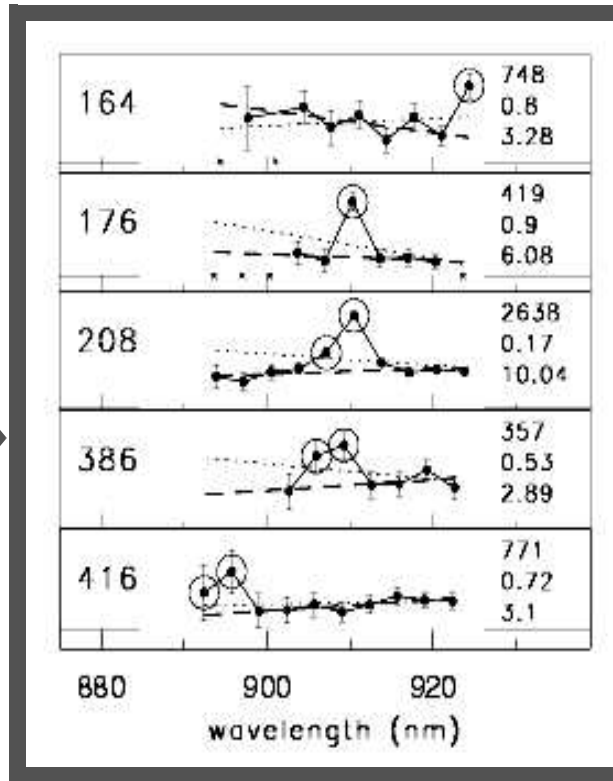
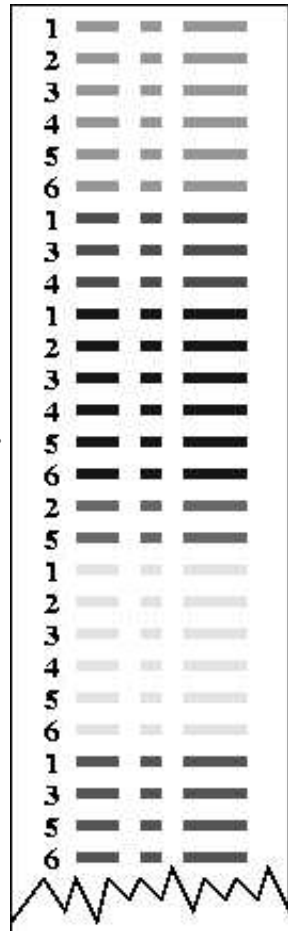
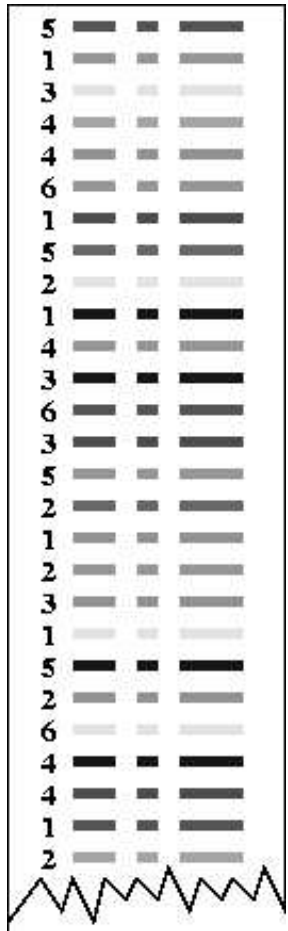


SExtractor



Raw (sorted)
catalogues:
xtn*, star*

CR, double-detections,
emission-line catalogues



Flux (relative)
calibration

Reducing Point-Source TF Data :

Systematic approach (3 stages):

- **Image Preparation (wavelength calibration, bias, flat-fielding, sky-subtraction, alignment, seeing profiling, image combination, edge fixing)**
 - **Detection and Selection of Candidates (detection, photometry, sorting, CR removal, phase correction)**
 - **Flux Calibration (reduction of standard star frames, airmass / aperture corrections, flux calibration of emission lines detected and fitted)**
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Before observations ...

Be careful with: order sort filter selection, effective width desired, wavelength calibration (including the optical center determination), number of slices to cover the spectral range of interest, spectrophotometric standards to be used and field limitations when nod and shuffling mode is used.
