

Spectral Analysis with WFMOS

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Outline:

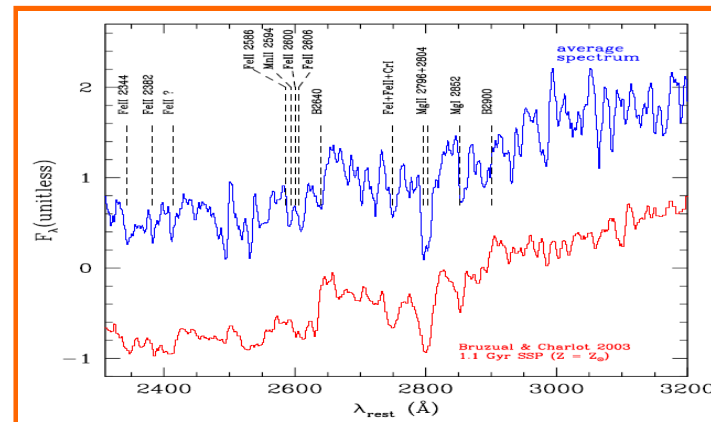
- **Motivation: why spectral analysis?**
- **Spectral synthesis of galaxy spectra**
- **Spectral predictions for survey design**
- **Summary**

The WFMOS opportunity

- **WFMOS should provide millions of galaxy spectra**
- **Galaxy spectrum:** encodes information on the galaxy stellar populations
- **Spectral analysis:** toolbox to extract information useful for studies on galaxy properties & evolution
- **The WFMOS data pipeline should include tools to deliver high-level spectral products**

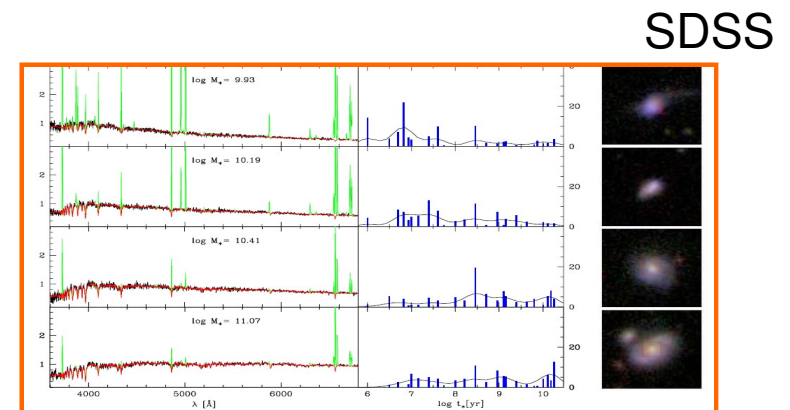
Two routes to study galaxy evolution

😊 The time-machine method: observe galaxies at several redshifts to trace their evolution



😊 The fossil method: Retrace history of each galaxy from its spectrum

WF MOS will allow both!

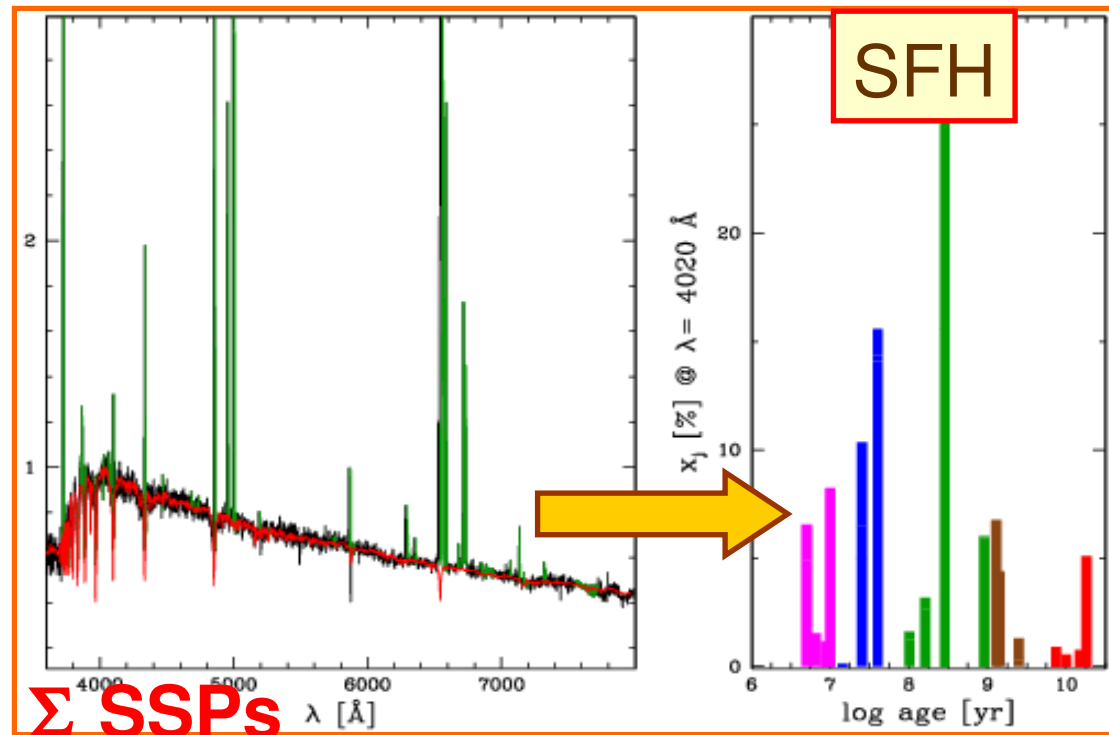




Fossil Methods: the basics



$$= W_1 \text{ [Image of blue stars]} + W_2 \text{ [Image of yellow stars]} + W_3 \text{ [Image of green stars]} + \dots$$



Decomposing galaxy spectra:



$$W_1 \text{ [Image of blue stars]} + W_2 \text{ [Image of a galaxy]} + W_3 \text{ [Image of a star cluster]} + \dots$$

$$L_{\text{gal}}(\lambda) = \sum_{t,Z} W_{\text{SSP}}(t,Z) \times \text{SSP}(\lambda; t,Z)$$



☺ **Observables**

Full spectrum,
colors or indices



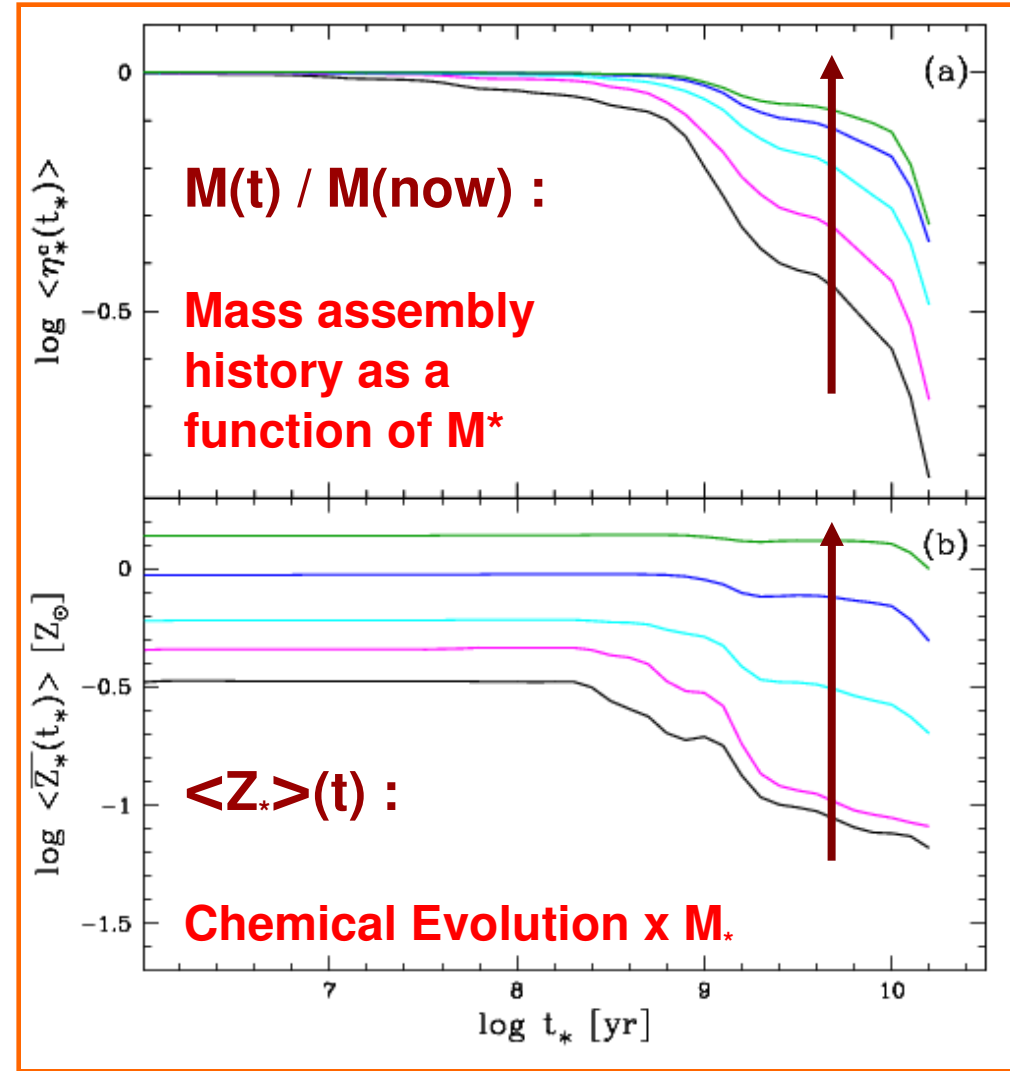
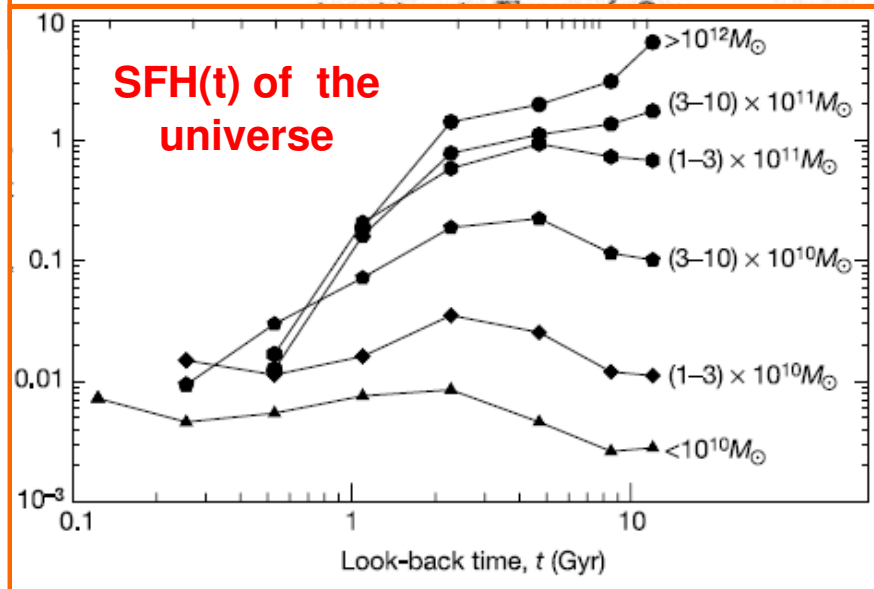
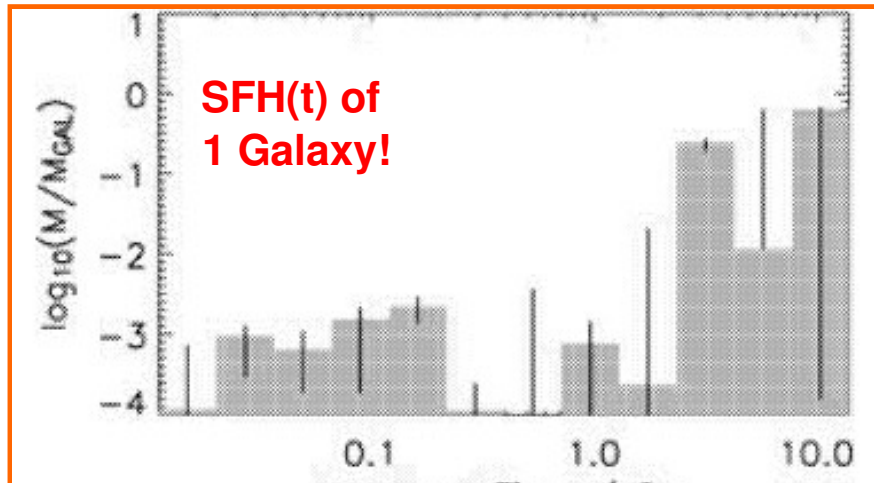
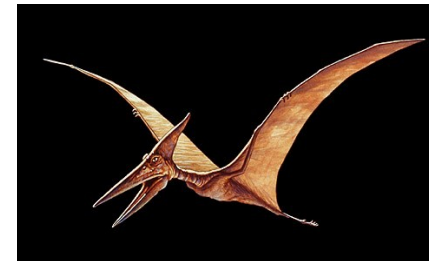
**Star Formation
History + Chemical
Evolution**



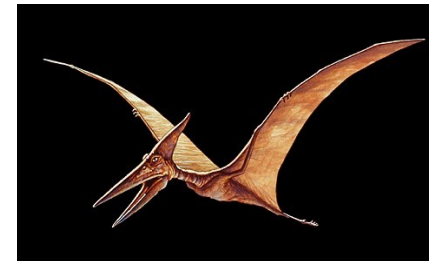
☺ **Spectral Base**

Model or Observed
SSPs / star-clusters

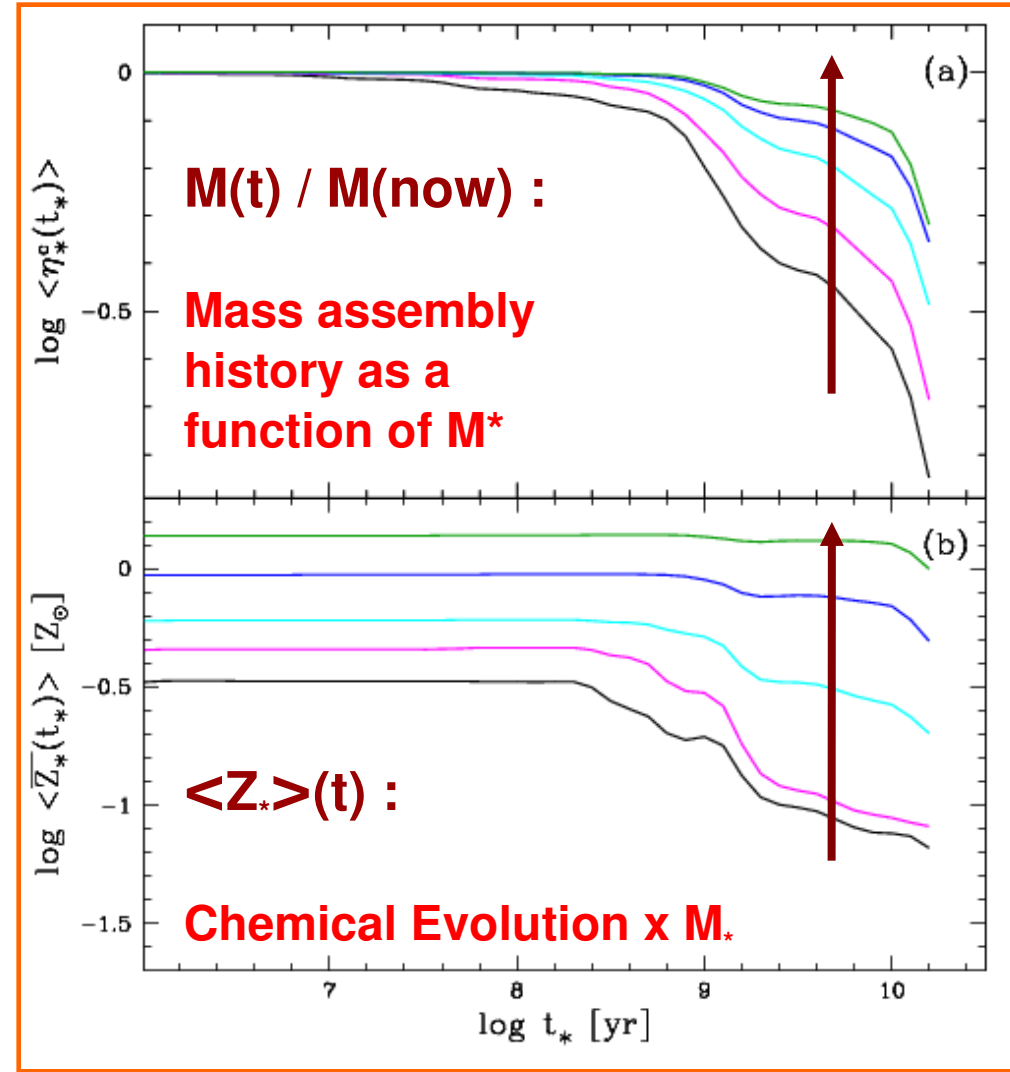
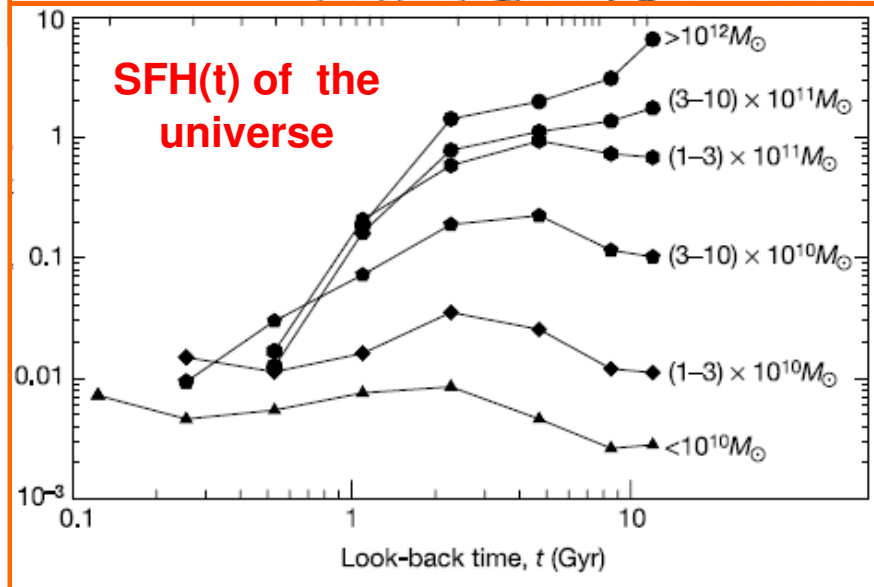
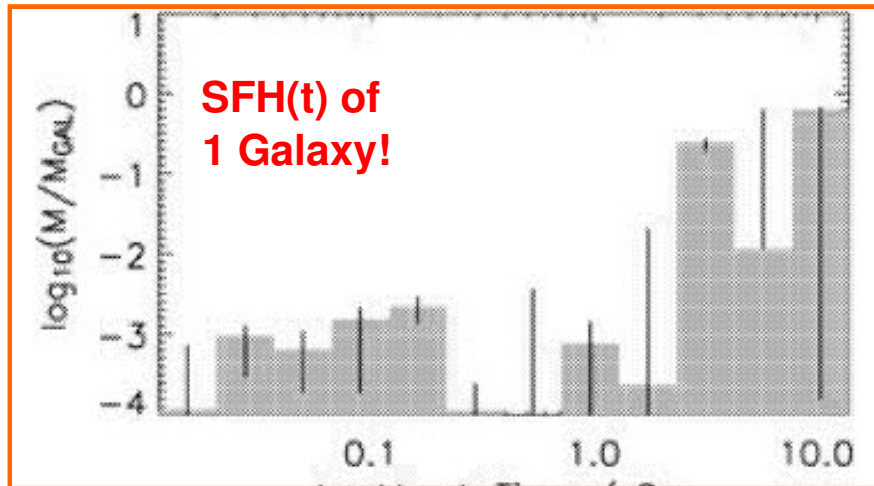
The fossil method: Example results



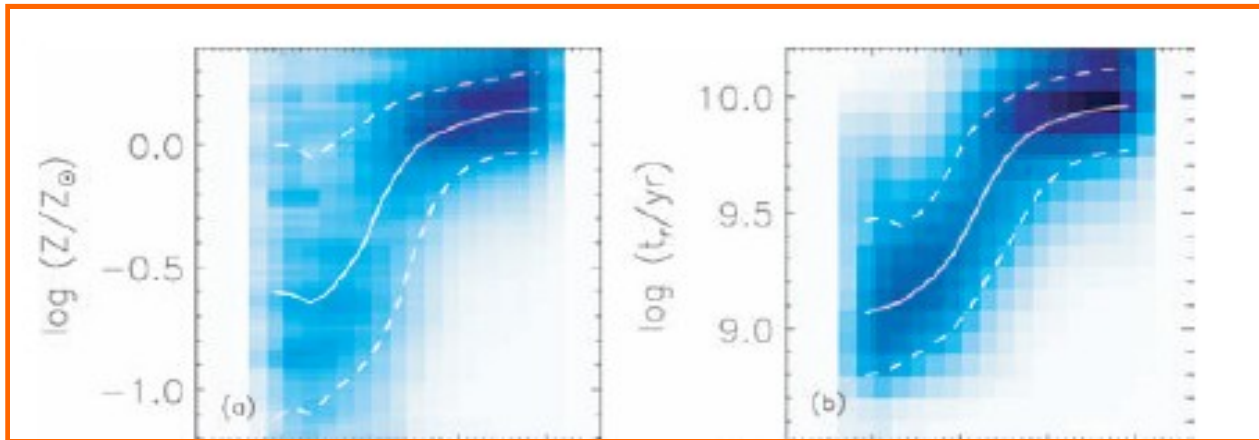
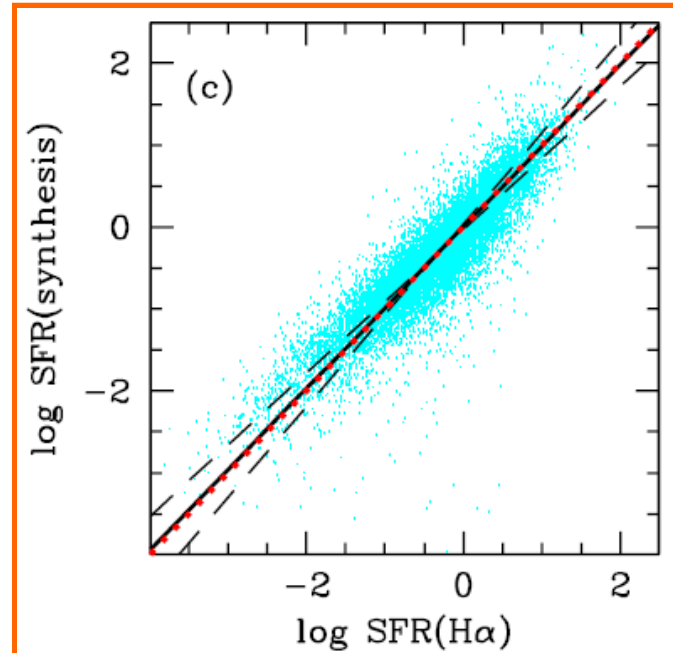
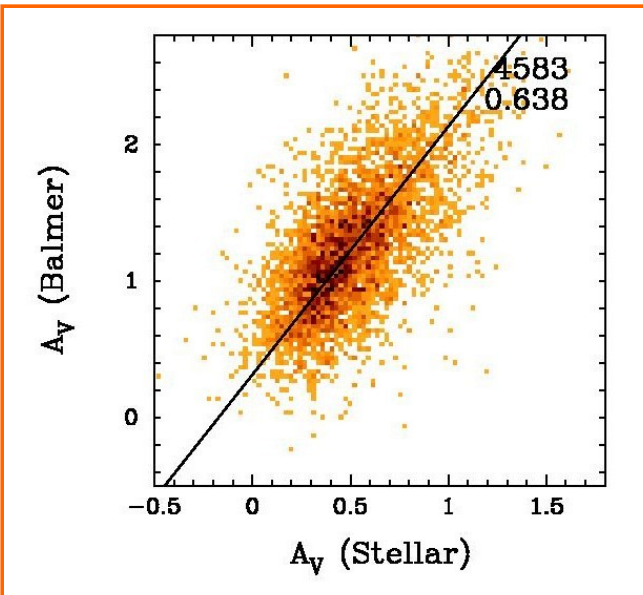
The fossil method: Example results



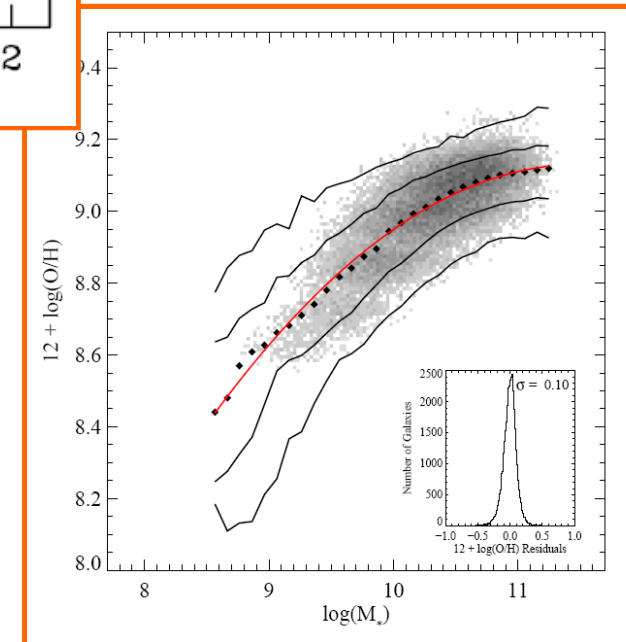
downsizing



Some results & sanity checks



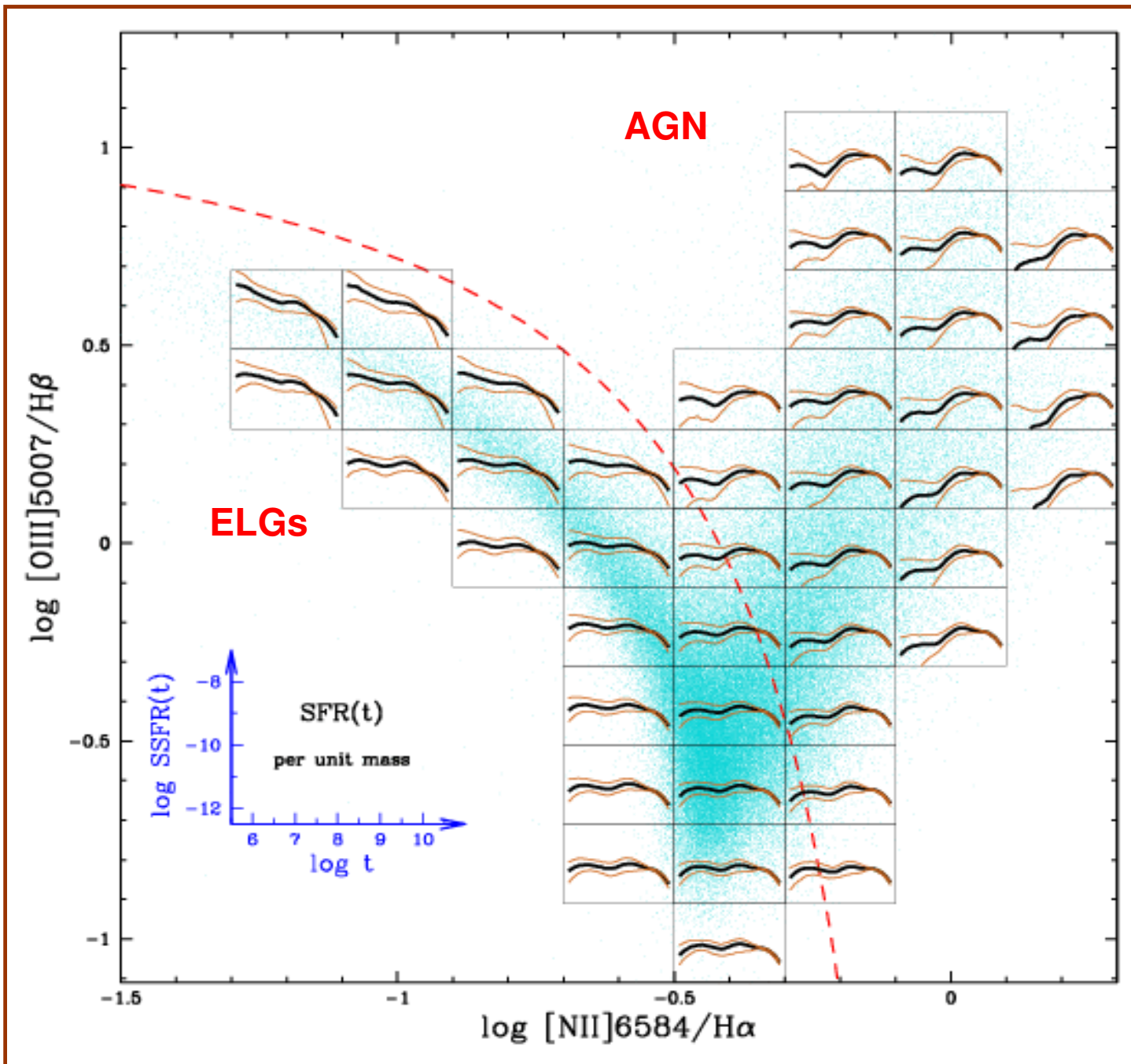
stellar mass





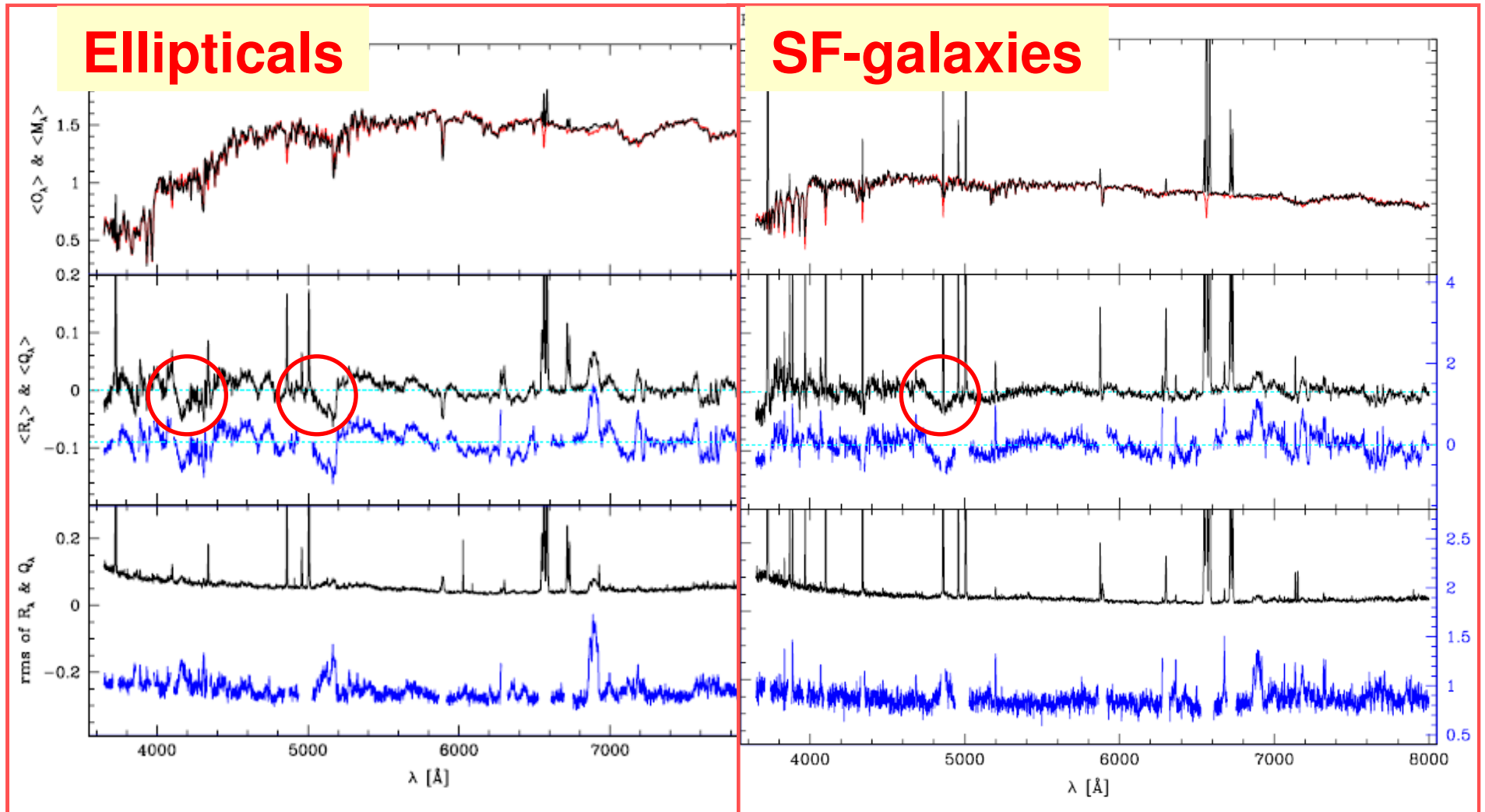
SFR in the BPT diagram

The stellar population mix becomes increasingly skewed towards old populations as one moves to the right



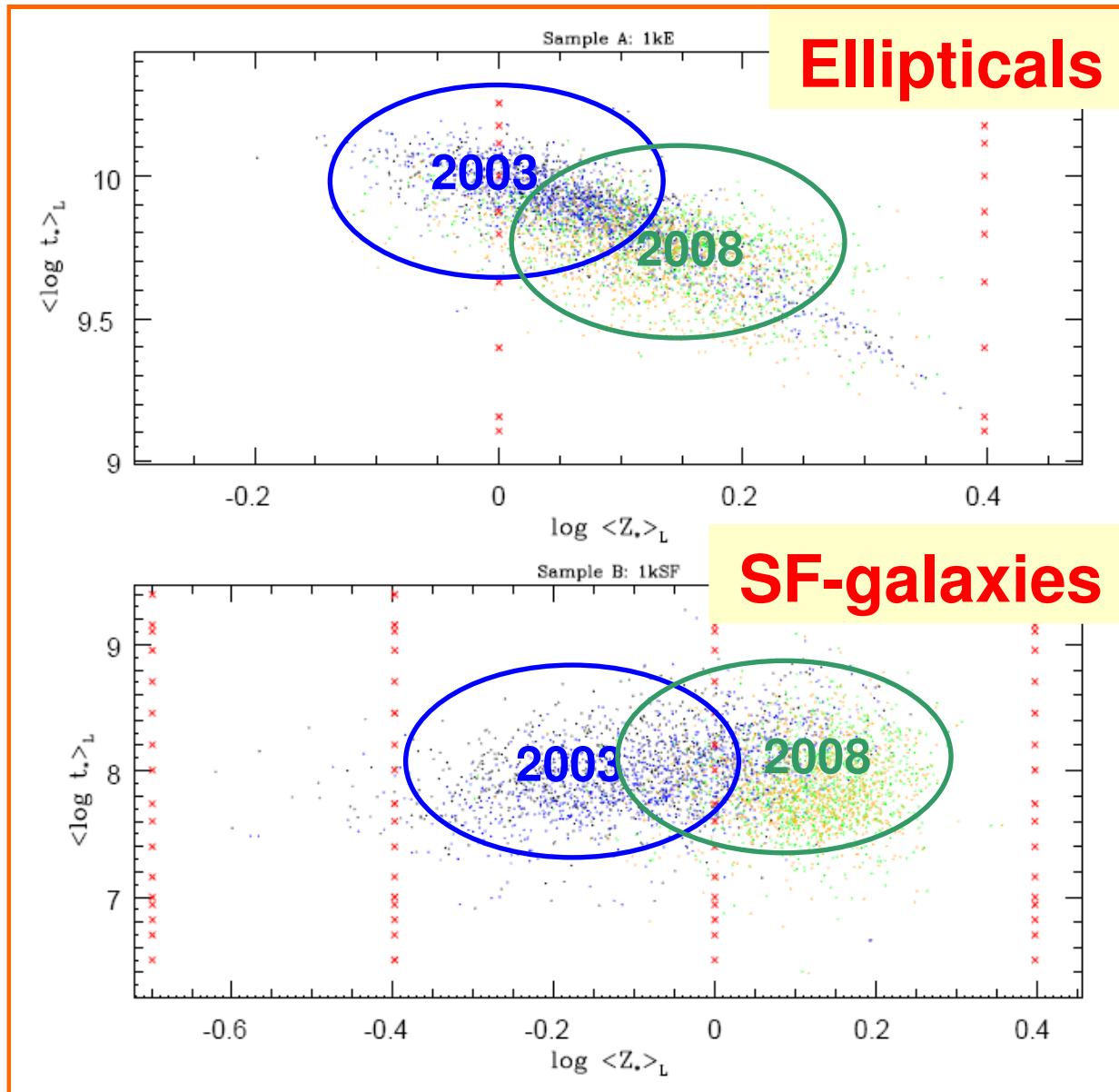
Sanity checks: problems & solutions!

Residuals ~ within errors, but systematic!



α -bands not fitted in massive ellipticals ... ☺ Models (e.g., P. Coelho) will 'fix' this!
 $H\beta$ -missfit with STELIB ... ☺ MILES fixes this!

What changes with the new C&B spectral bases?



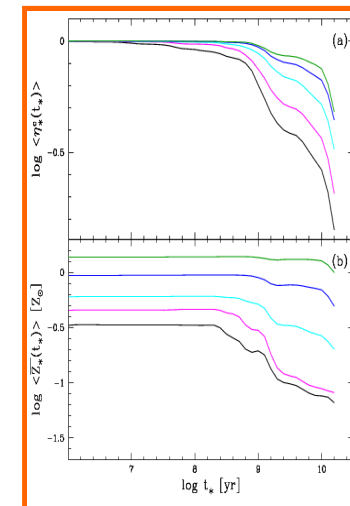
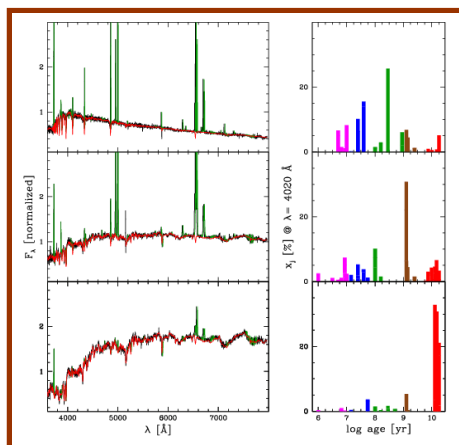
Refits using CB08 models
(MILES + Martins libraries)

Residuals are smaller
ie., spectral fits are better!!

- ☺ SFHs are smoother
 - ☺ Mean ages decrease a bit
 - ☺ $\langle Z \rangle$ increases a bit
- ... Jean Michel Gomes thesis...

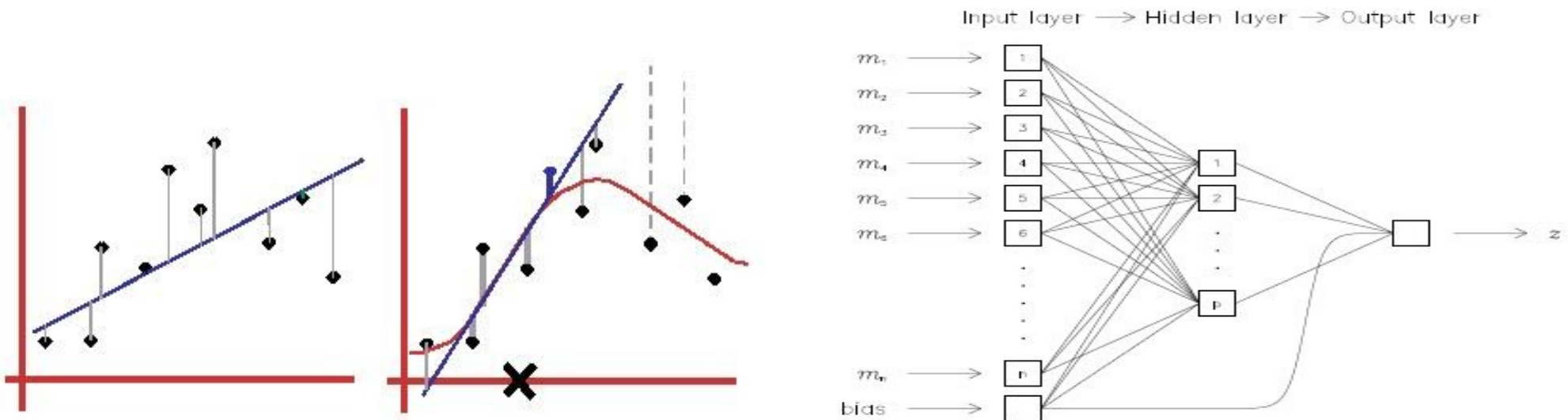
WF MOS data deliverables

- SDSS is providing a large range of spectral products (spectra, Ews, line intensities, ...)
- WF MOS should provide the 'next-generation' of value added data products, based on state-of-the-art algorithms and data models:
SFHs, mass assembling, gas and stellar metallicities, spectral types, ...



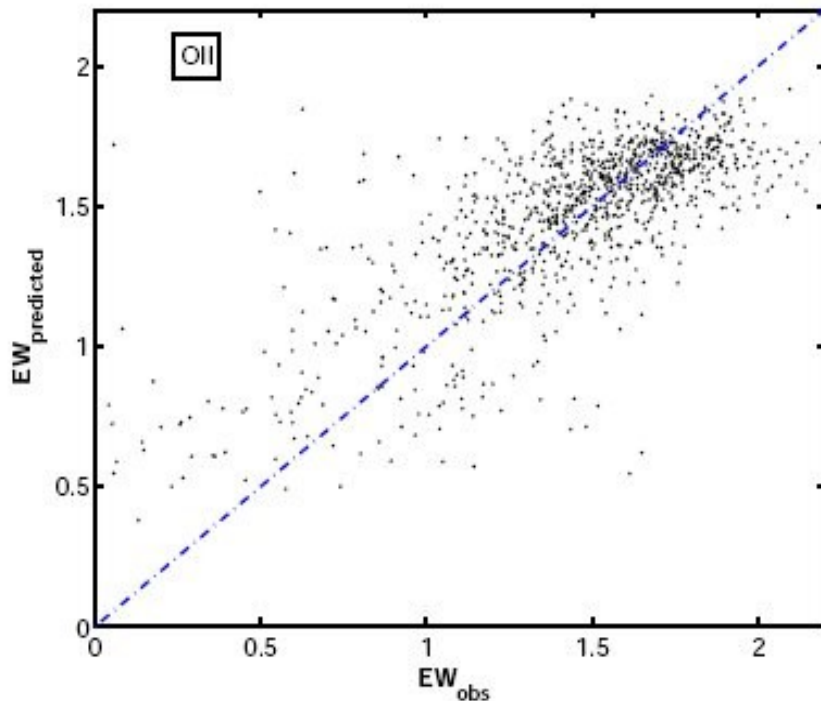
Spectral predictions from broad-band photometry

- If BAO estimates are invariant with respect to galaxy types, the WFMOS survey may be speed up by targeting emission-line galaxies
- But how to select ELGs without spectroscopy?
- Abdalla et al. (2008): application of machine-learning algorithms (LWR, ANN) to estimate EWs from SDSS galaxy magnitudes

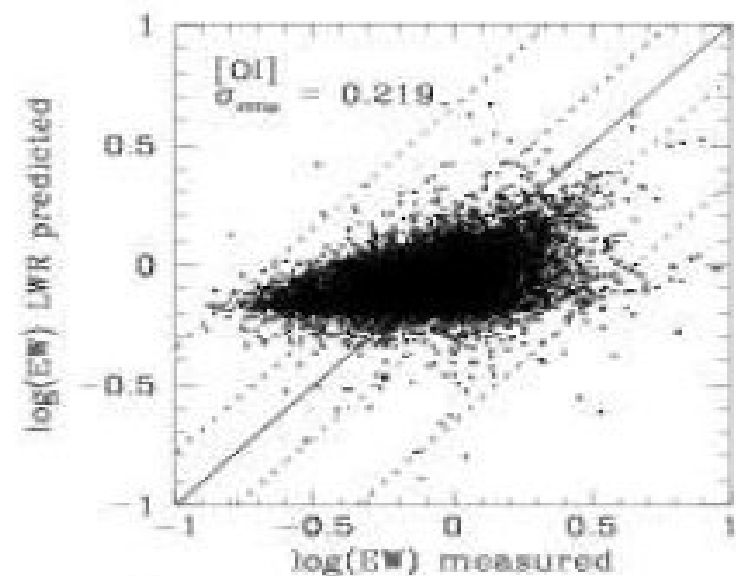


Spectral predictions from broad-band photometry

- Recombination lines can be predicted well!
- Collisional lines: mixed bag- ok for [OII]3727 at high z, but not for [OI]6300

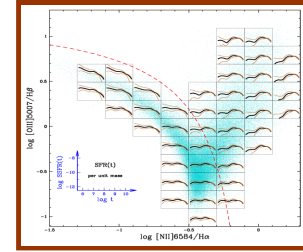


DEEP2 data



SDSS

summary:



- **WFMOS will provide an extraordinary amount of valuable data for studies on galaxy evolution**
- **High-level spectral data products: an opportunity for the WFMOS community!**
- **Survey design: targeting special classes of objects?**

