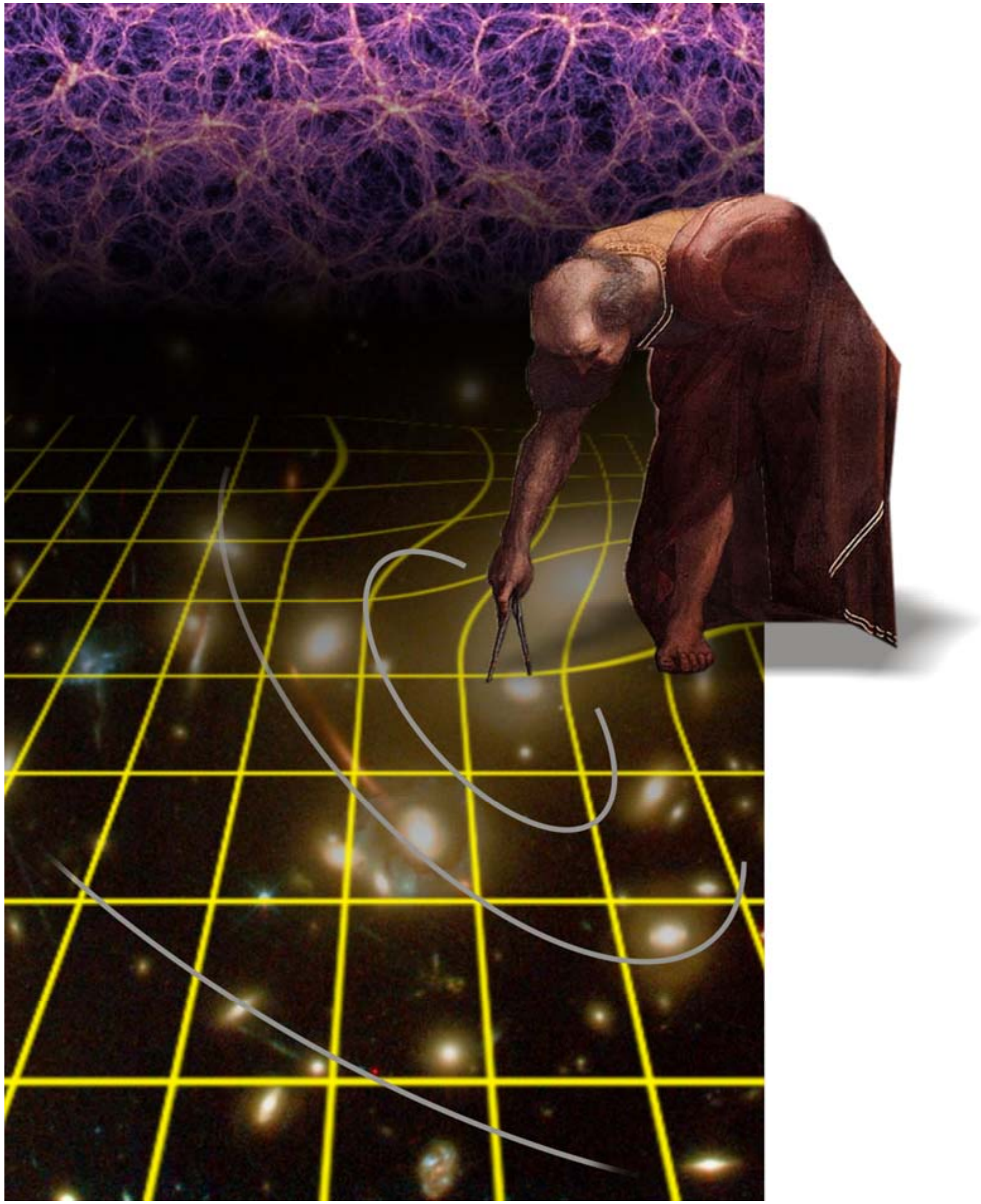
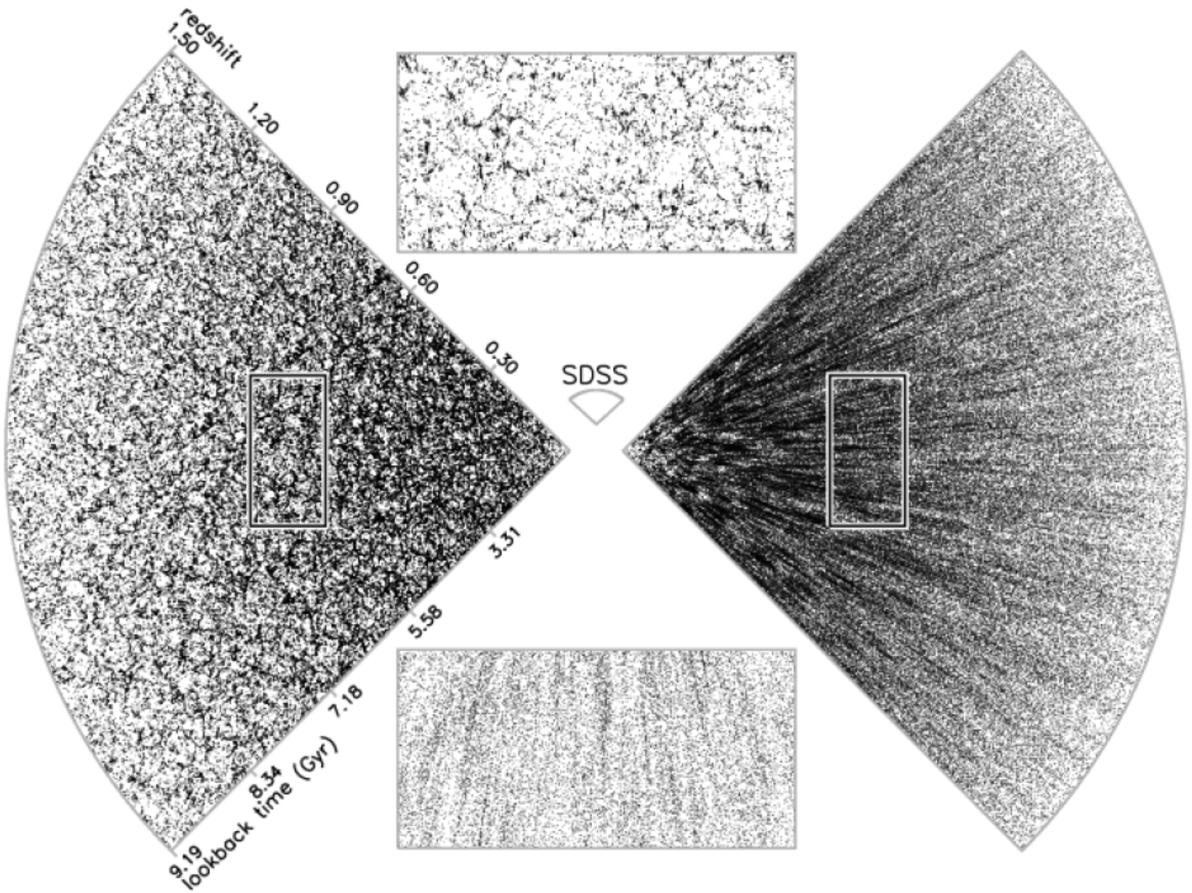


OU-SPE (OU-SIR) Spectroscopic measurements

- *Goals*
- *Challenges*

Redshift measurement: a key task for Euclid

- Main clustering probe: BAO, RSD
- Weak lensing: calibration for photometric redshifts
- Strong lensing: signatures from 2 galaxies in one spectrum



OU-SPE Goals

Euclid

Produce methods and algorithms for spectrophotometric measurements from NISP spectroscopy data:

- Develop the algorithms necessary to produce
  - Redshift measurements
  - Spectral features measurements
  - Quality assessment
- Performances vs. Requirements
  - Control measurement uncertainties
- Develop the data management structure
  - Data model, data flow
  - Data calibration
  - Data quality control
- Identify and handle interfaces
- Define infrastructure requirements

Redshift measurement

- key “number”:
  - 3D distribution of galaxies: BAO, RSD, higher order stats...
- Easy in principle
  - Correlate spectra with reference templates
- Difficult in practice
  - In the presence of variable noise sources
  - With restricted wavelength domain where spectral signatures may be few
  - Euclid NISP data are slitless, hence variable level of contamination by other objects for each spectrum
  - Estimate of the “success” in redshift measurement is complex

Combining spectra and measuring redshifts: the pedestian way

- Expert system building-up from acquired knowledge for each and all objects
- Plug-in to the classical way of measuring redshifts:
  - Use the best 1D spectrum
  - Produce noise spectrum
  - Use existing set of templates
  - Cross-correlate to get the redshift

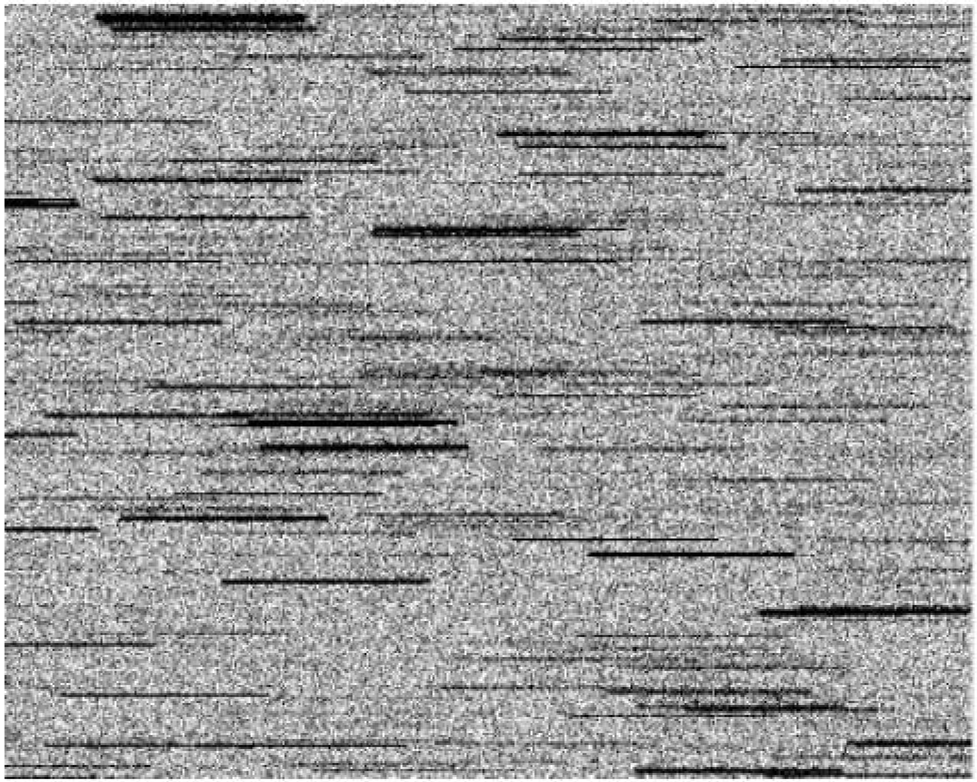
How do you get the best 1D spectrum and noise ?

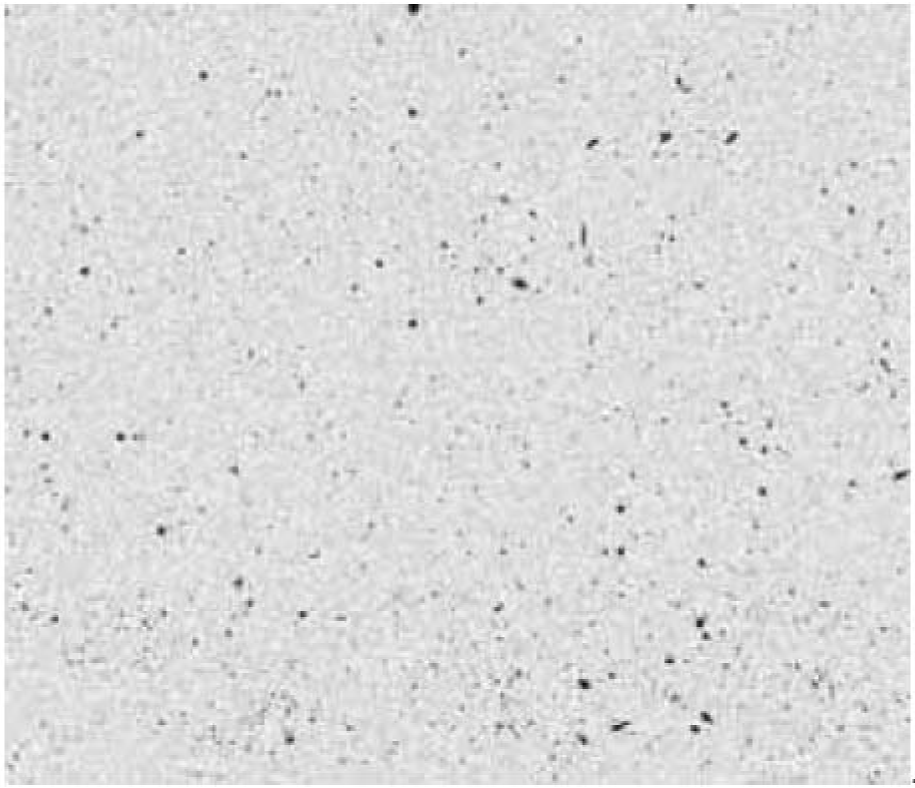
- From the 4 positions and knowledge of the positions of objects in the field: derive a map of the ‘clean’ pixels
- Obtain the spectra of the brighest objets (least subject to contamination)
  - Subtract them (using template fit ?)
  - Iterate
- Search for ‘obvious’ features: emission lines
  - Try redshift possibilities with apriori knowledge (Ha -> OIII; OIII -> OII, …)
- Assemble the ‘clean’ pixels
- Run template correlation
- Iterate

Challenge 1: crowding

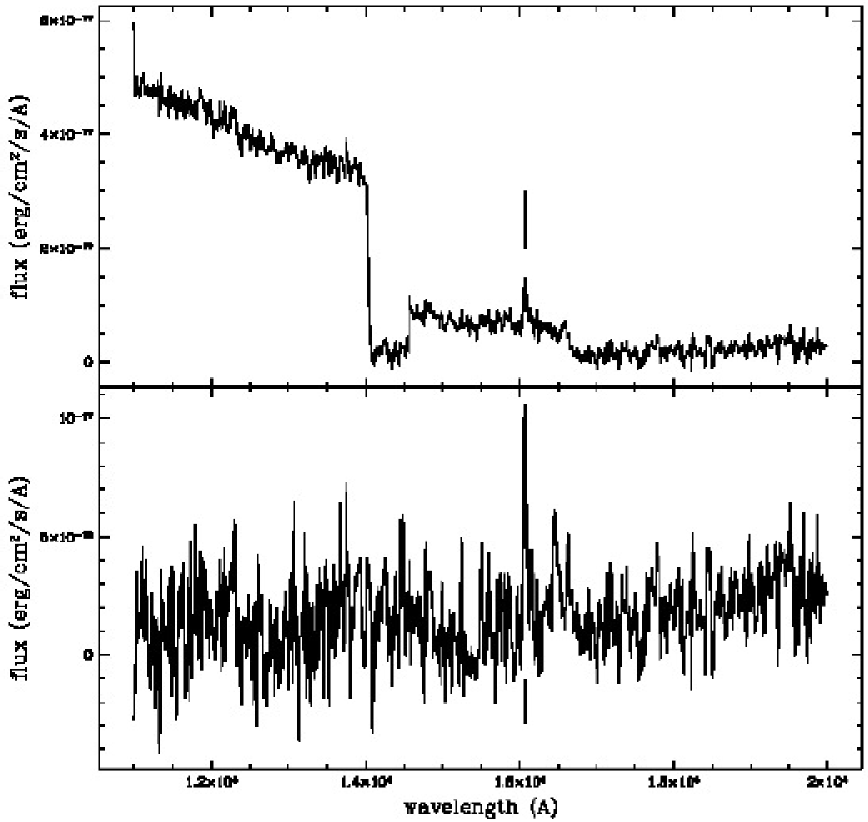
Interface SIR/SPE

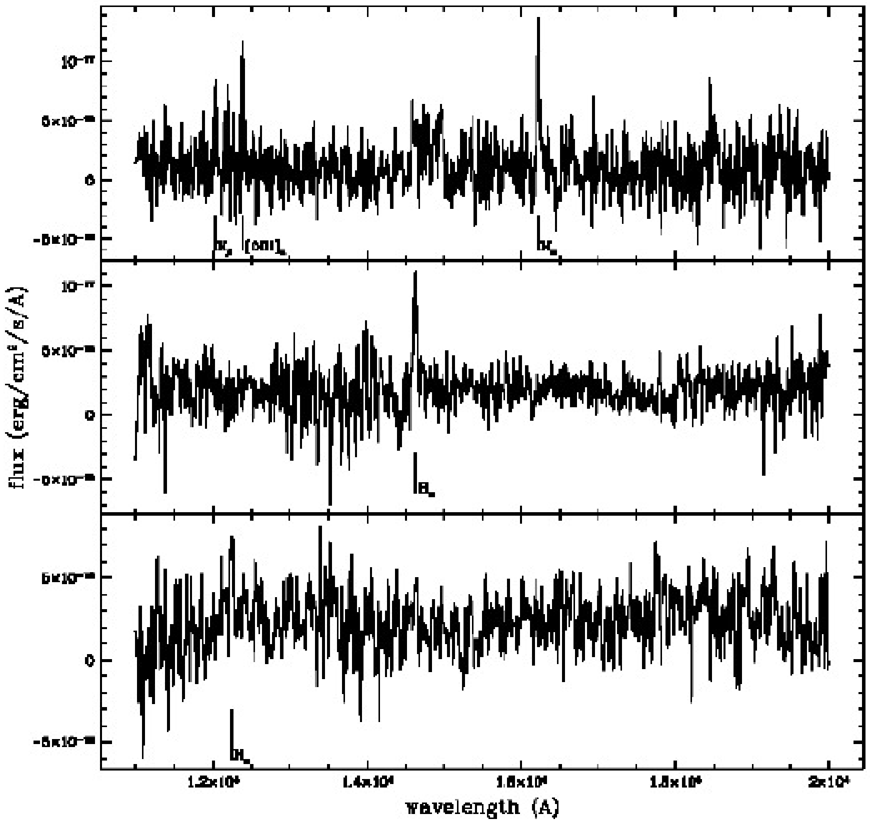
- NISP will produce slitless spectroscopy
- This implies superimposition of spectra from different objects (at different redshifts...).
- The challenge is to get rid of this contamination and ensure a robust redshift measurement





Measuring redshifts in a crowded environment

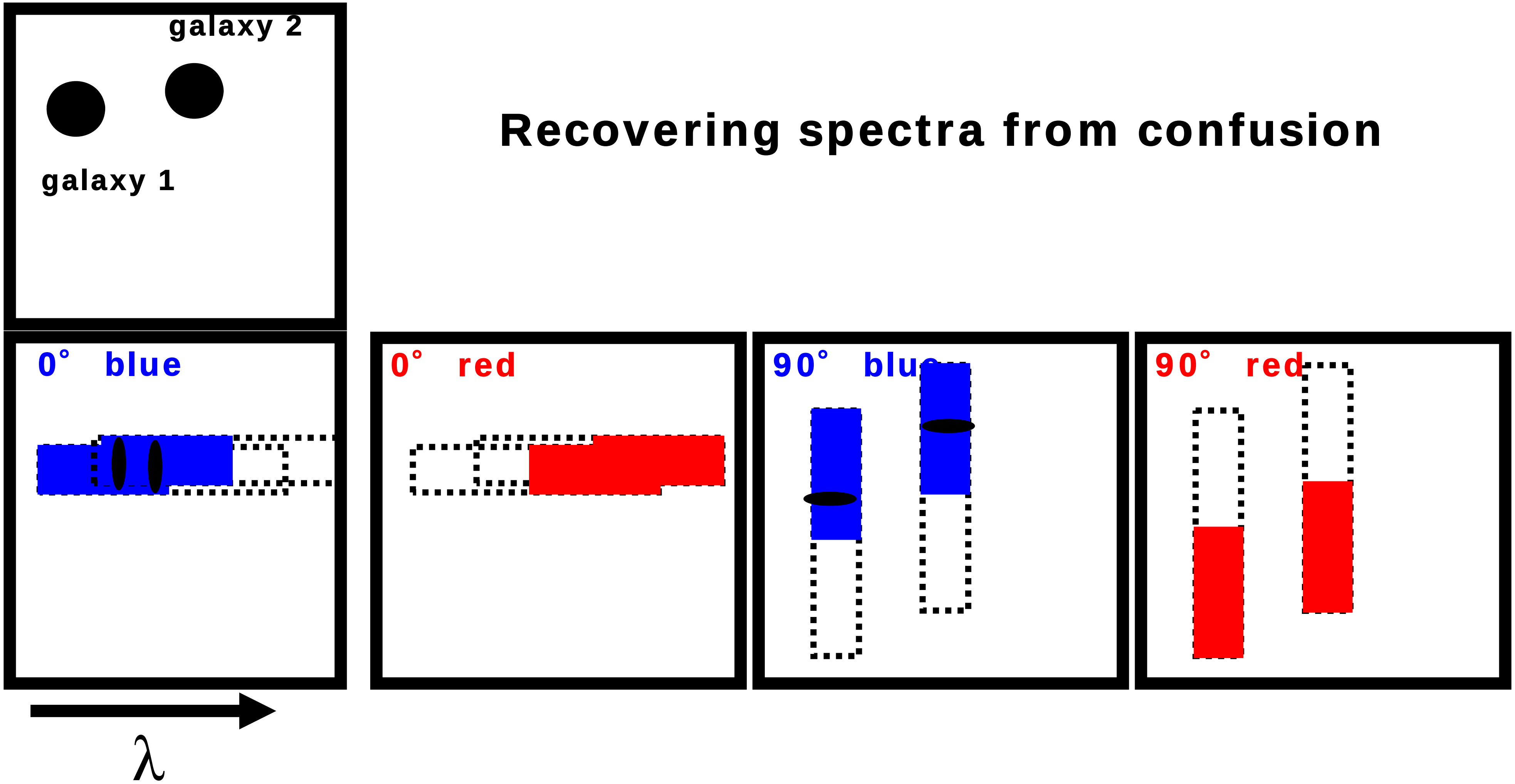




- Measuring redshifts may be done in two ways:
  - On 1D/2D spectra already combined/corrected
  - At the same time as spectra are being combined/corrected

Spectra: input data

Euclid



Recovering spectra from confusion

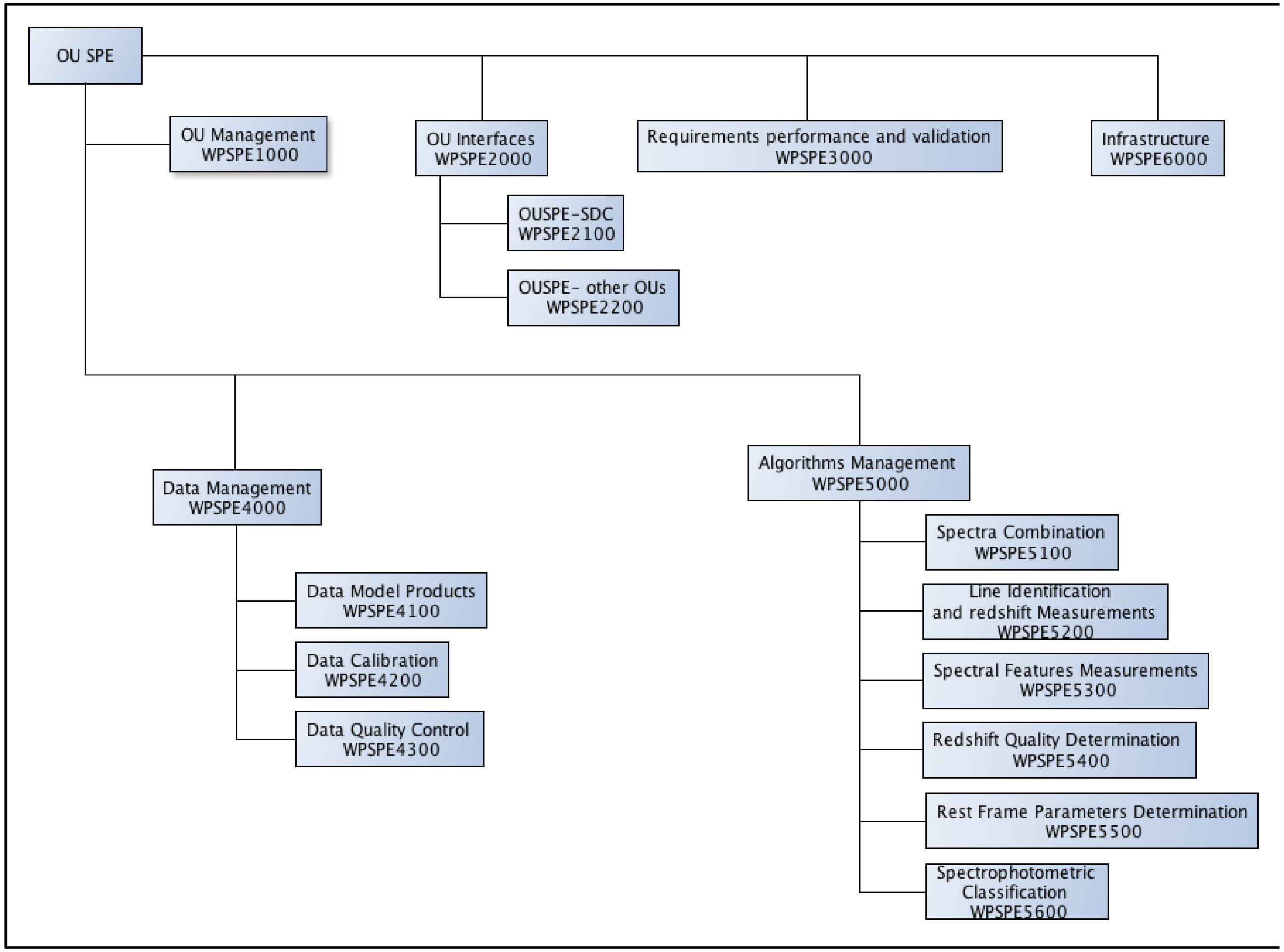
4 sub-integrations (dithers)
2 roll angles of the dispersion axis (0°, 90°)
2 spectral ranges (2 grisms) ➔ shorter spectra but same S/N
Sequence : 0° -blue – 0° -red – 90° -blue – 90° -red

Challenge 2: automated redshift measurement for ~50 million galaxies

- Basic technique: cross correlation with reference templates
  - Fully applicable to Euclid ?
- Need a robust noise model for each galaxy, after decontamination from projection effects
- Maximize redshift success rate
- Understand failure rate

Tasks

- Combine spectra produced by OU-SIR (interface TBD)
- Identify spectral features, noise model
- Use spectra (continuum, features) to measure redshifts
- Produce estimators of spectra / redshift quality
- Produce rest-frame parameters: k-correction, absolute magnitudes, ...
- Interface with OU-SIR, OU-PHZ, OU-LE3



Forte coordination avec OU-SIR
Mise à jour des WP en cours