

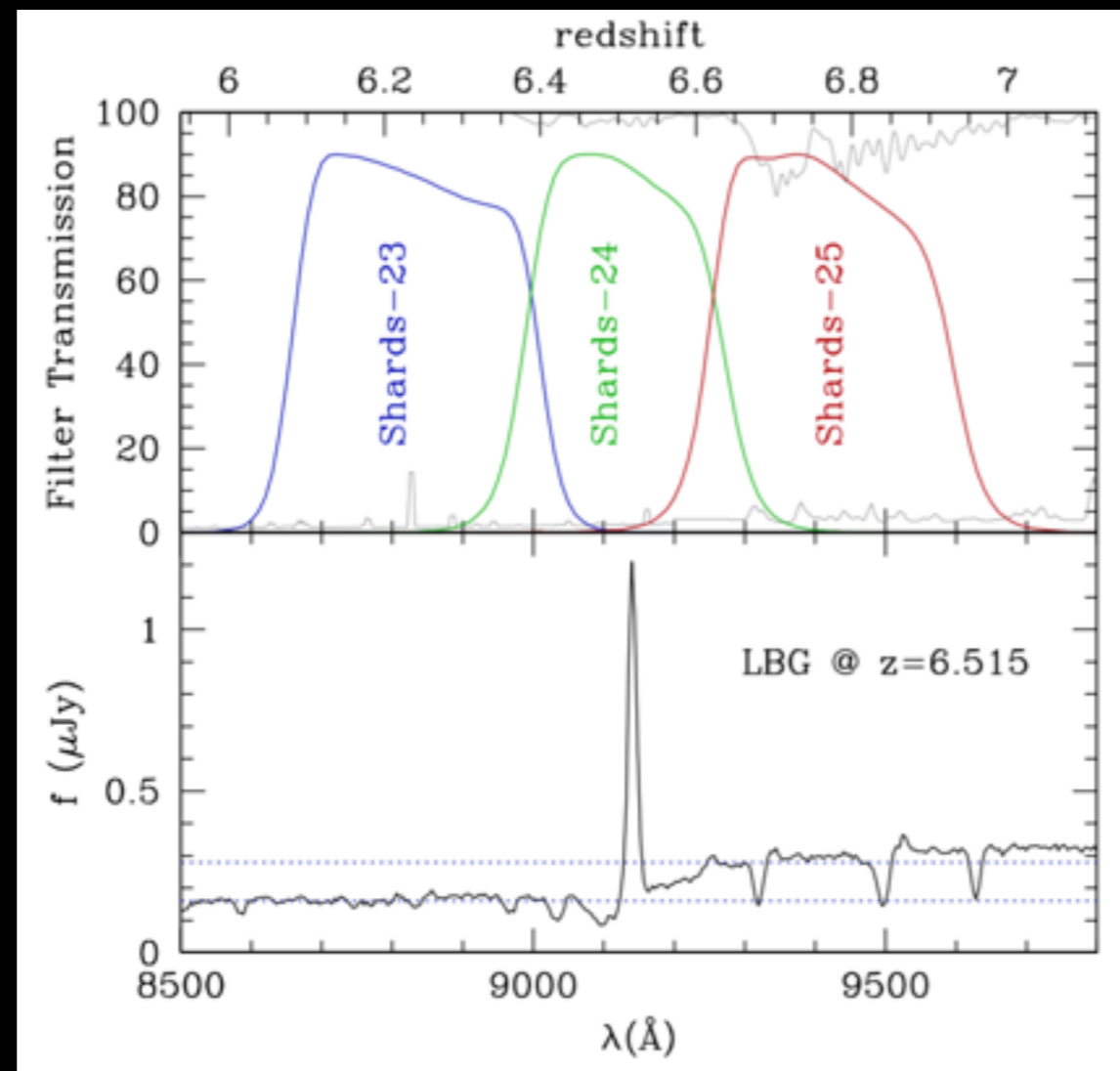


# A proto-cluster at $z \sim 6.5$ ?

J.M. Rodríguez Espinosa, R. Calvi, N. Castro  
&  
The Alba Team

# Not related to SHARDS

- Though we have used SHARDS filter



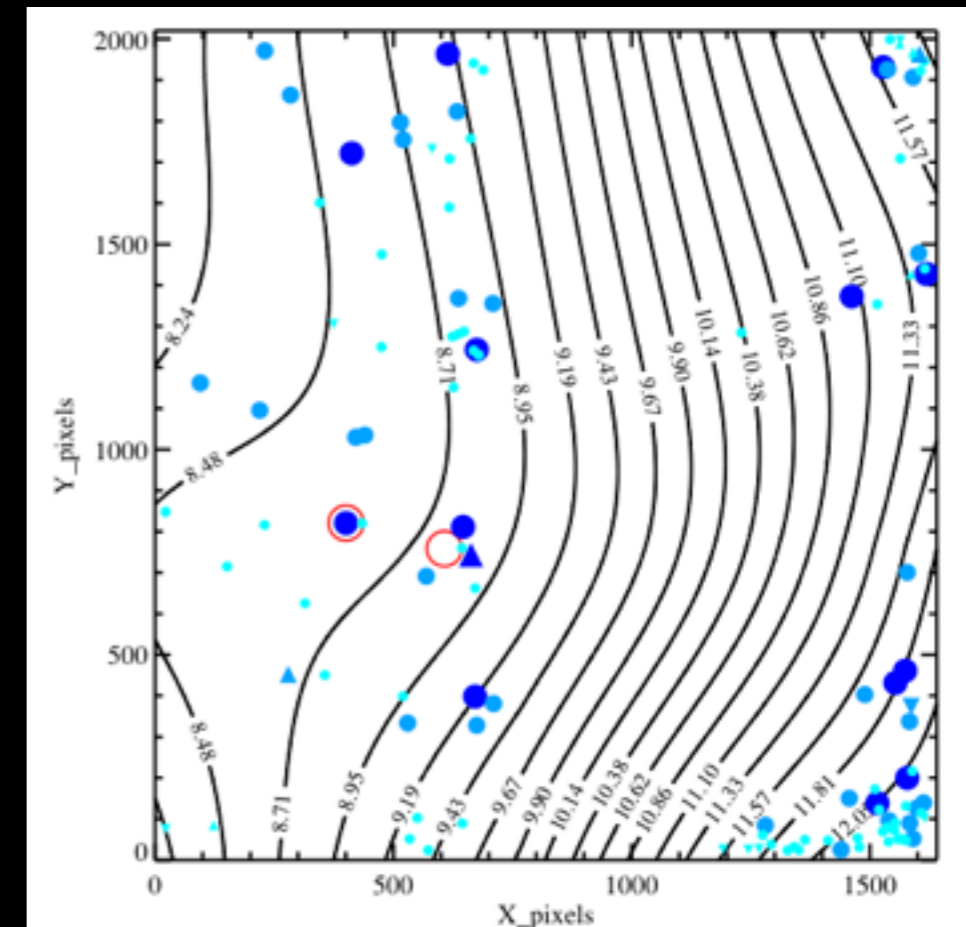
# Re-ionization of the Universe

- Thought to be accomplished by low luminosity sources (Yan et al. 2010; Bunker et al 2010; Dressler et al. 2014; Dressler et al. 2011)
- The visibility of these sources is boosted by clustering (Miralda-Escudé 1998, Mortlock et al. 2011)
- So we set up a strategy for observing those low luminosity sources at an epoch that re-ionization was being completed

- We looked for low luminosity sources around two strong star forming galaxies in the SXDX field
- Ouchi et al. 2010 had already hinted the occurrence of an cosmic over density.
- Over 37 hours of GTC deep imaging through the SHARDS filters
  - With emphasis on the F883w35

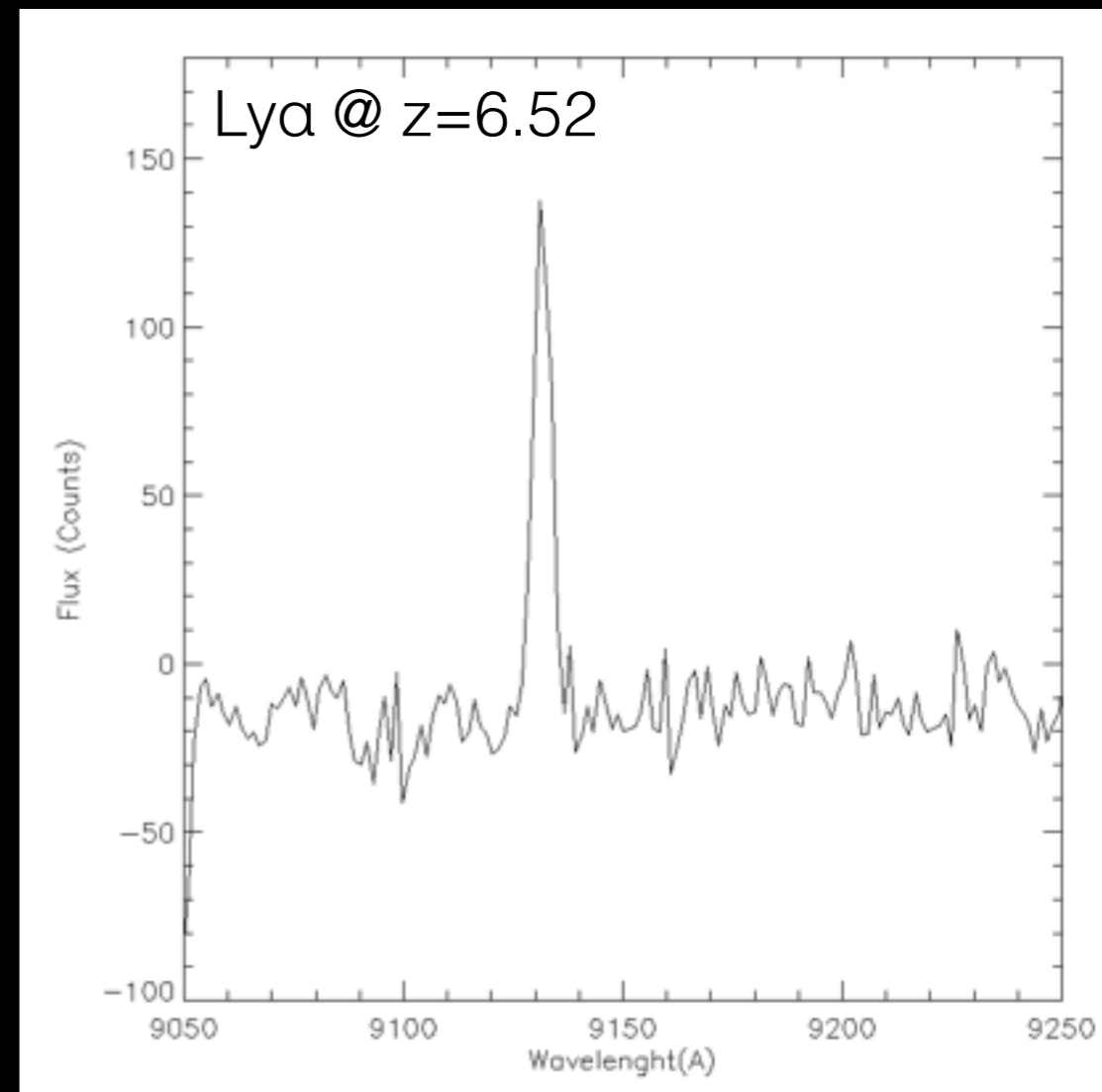
# Imaging

- The data have been quite tricky to deal with
- In particular some gradients in the images have been very difficult to eliminate
- We have also put extreme care to select our candidates
- First we have discarded any sources with detections in the F883W17 or bluer, including deep data from the Subaru Deep field and HST
- Then we have carefully analyzed the data for spurious sources
- Finally we have assigned to each candidate a probability of being spurious



# Next steps

- We have applied for GTC MOS time to confirm the candidates
- 46 hours were allotted out of which 13 were completed
- Not enough for detecting most of the sources, and in particular those without UV rest frame continuum
- Nonetheless we have been able to recover a few spectra from the brightest sources



# While we wait for the spectroscopy

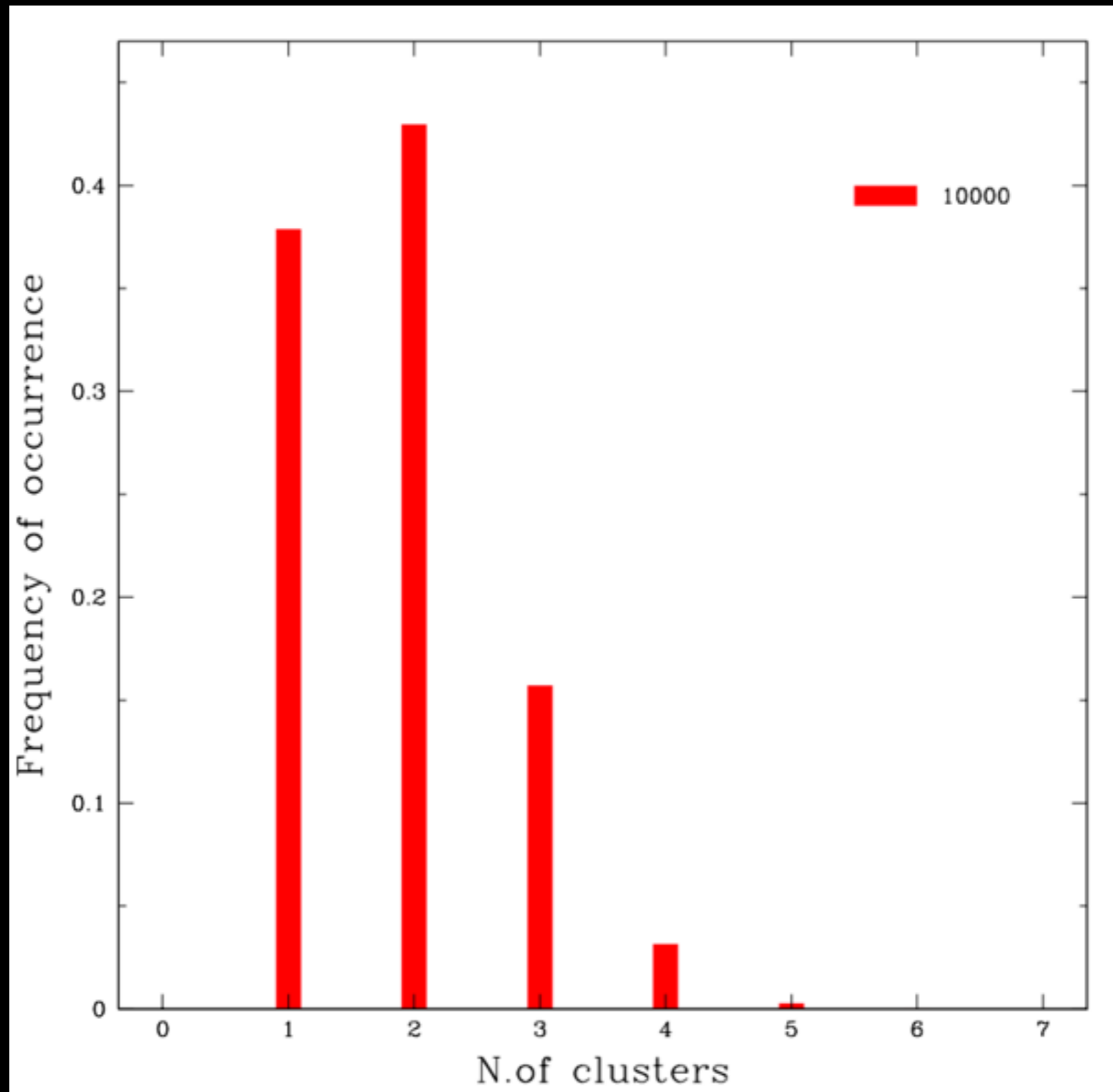
- We have noted that the surface density of the candidate sources is at least twice that of the field
- In particular we have 47 candidate sources, while the typical density in the field ( $< 0.4/\text{arcmin}$ , Yan et al. 2009) would provide less than 23 sources
- We have therefor run a Friend of Friend algorithm to test for grouping
- Lacking precise redshifts, we have used a Monte Carlo approach letting the redshifts free within the range defined by our central filter (F913W25)

# Clustering analysis

So the candidate sources tend to group together in one (38%) or two groups (43%)

The probability of being in one or two groups is 81%

Therefore, barring the spectroscopy, we think we have found proto-cluster at  $z \sim 6.5$





# Summary

- We have looked for the faint sources deemed to be responsible for the re-ionization of the Universe
- The search has been done around two strong star forming sources in the Subaru deep field
- The data reduction has been tricky and is still under scrutiny
- We have 47 candidate sources to which we have assigned spuriousness probabilities
- These 47 sources seems to cluster in one or two groups
- Indeed a FoF analysis and Monte Carlo run suggest that we have found a proto-cluster at  $z \sim 6.5$