Overview of the XXL

The XXL survey is the largest XMM project approved so far (3Ms for XMM AO10/11, >6Ms in total).

By the end of XMM AO11, it will achieve a full 10ks coverage over two contiguous 25deg² fields. This is by a factor of 10 the largest contiguous survey ever performed at this depth, thus permitting unprecedented studies of the 3-D distribution of X-ray sources over large scales.

The primary goal of the survey is to obtain a sample of about 600 new galaxy clusters which is expected to yield competitive constraints on dark energy parameters. We will also detect more than 18,000 AGNs and be able to measure and the clustering of several different populations.

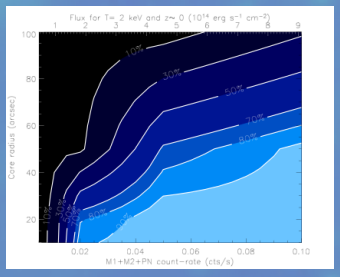
In the future an extension of the project is planned to increase the total coverage to 40ks.

The pilot XMM-LSS project

The first 10deg² of data were analyzed as part of the XMM-LSS survey (Pacaud et al. 2006, Pierre et al. 2007, Pacaud et al. 2007, Adami et al. 2011).

Our detection pipeline was extensively tested over realistic XMM simulations and the detection efficiencies were precisely estimated.
This lead us to show that the source selection in XMM newton depends strongly on their intrinsic extension (see plot on the right).
The XMM-LSS catalogue currently provides the only XMM cluster sample with a published selection function.

Selection function

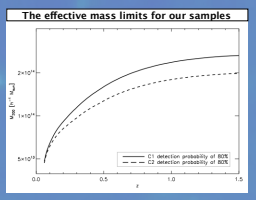


We defined 2 cluster samples:

- The C1 sample:
  Uncontminated - ~7cl./deg²
- The C2 sample:
  50% contaminated - 12cl./deg²

These numbers have been validated over real data and are compatible with ΛCDM expectations assuming some standard set of scaling relations.

The effective mass limits for our samples



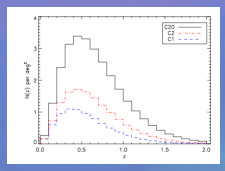
Our experience with these cluster samples enabled us to estimate, for each sample, the average mass uncertainty that can be obtained straight from the survey data. These assumptions are listed in the table on the left and were used to scale the XXL project

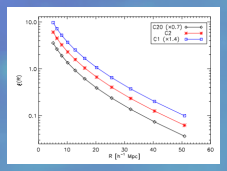
Selection	Adopted mass accuracy			
	Optimistic view		Pessimistic view	
	10ks	40ks	10ks	40ks
C1	0.5	0.1	0.8	0.5
C2	0.8	0.5	∞	0.8
$\sigma_{\ln(L_{obs})}$	0		0.2	

Cosmological forecasts for galaxy clusters

The cluster sample:

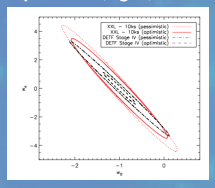
The plots below show the cluster number counts expected for the XXL, as well as the average correlation function of the detected sources, as extrapolated from XMM-LSS (C20 is scaled version of the C2 selection for 40ks images):

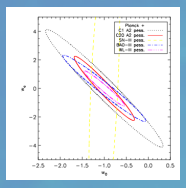




Fisher analysis:

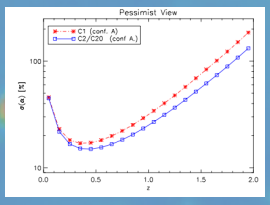
Detailed Fisher matrix predictions of the constraints on dark energy parameters were published in Pierre, Pacaud et al. 2011 (accepted by MNRAS). These made use of the cluster number counts and their average correlation function in several redshift/radial bins and accounted for cosmic variance in both observables.
The resulting constraints on the dark energy equation of state are shown below for a 10ks exposure time (left) and 40ks exposures (right)





Scaling relation assumptions:

The slope and scatter of cluster scaling laws were assumed constant, but the normalization of the M-L relation was left free and self-constrained by the mass determination for the XXL clusters. The plot below shows the constraints on this normalization for several redshift bins



Summary of Dark Energy constraints:

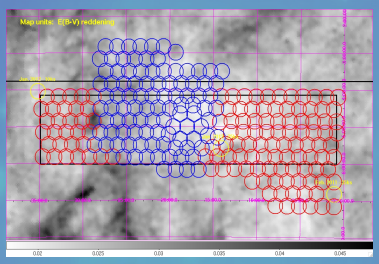
Predicted constraints for the XXL survey on the DE equation of state				1 - error on w_0/w_a	
After first 10ks scan					
Cluster selection	Redshift range	dn/dz + Planck	dn/dz +ξ + Planck		
C1/C2 (masses poorly constrained)	0 < z < 1	2.00/4.64	0.72/2.36		
At full 40ks depth		Pessimistic mass measurements		Optimistic mass measurements	
Cluster selection	Redshift range	dn/dz + Planck	dn/dz +ξ + Planck	dn/dz + Planck	dn/dz +ξ + Planck
C20	0 < z < 2	1.19/2.59	0.45/1.46	0.87/1.82	0.38/1.18

Constraints for cluster surveys from the DETF	1 - error on w_0/w_a	
	Pessimistic	Optimistic
Stage IV	0.73/2.18	0.24/0.73

Multi-wavelength coverage

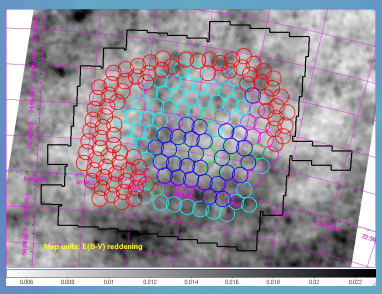
Northern field:

- X-ray coverage 25 deg²
- Optical imaging: CFHTLS
- Optical spectroscopy: VIPERS
- NIR: WIRDS survey
- Partial Herschel coverage
- Spitzer: SWIRE over 11 deg²



Southern field:

- X-ray coverage 25 deg²
- Current optical imaging: BCS
- Future optical imaging: DES
- NIR: VISTA survey
- Spitzer coverage over 14 deg
- Partial Herschel coverage
- Within the SPT mm deep field (and soon SPTpol)



Cluster targeted follow-up:

- Chandra guaranteed time over interesting systems
- Optical/NIR spectroscopy proposed to ESO

From a Poster by Florian Pacaud (KITP, March 14-18, 2011)

Detailed information can be found in Pierre et al. 2010