Préparation Scientifique Legacy II

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APC – Université Paris Diderot

Euclid France 2014

Example Topics

- Galaxy Clusters and cosmology – see also talk by Maurogordato
- SNIa – see talk by Tao
- Lensing & structure formation
  - Weak lensing
  - Strong lensing – see talk by Gavazzi
- Cross-correlations
  - CMB
  - Other catalogs
- Exoplanets – see talk by Beaulieu

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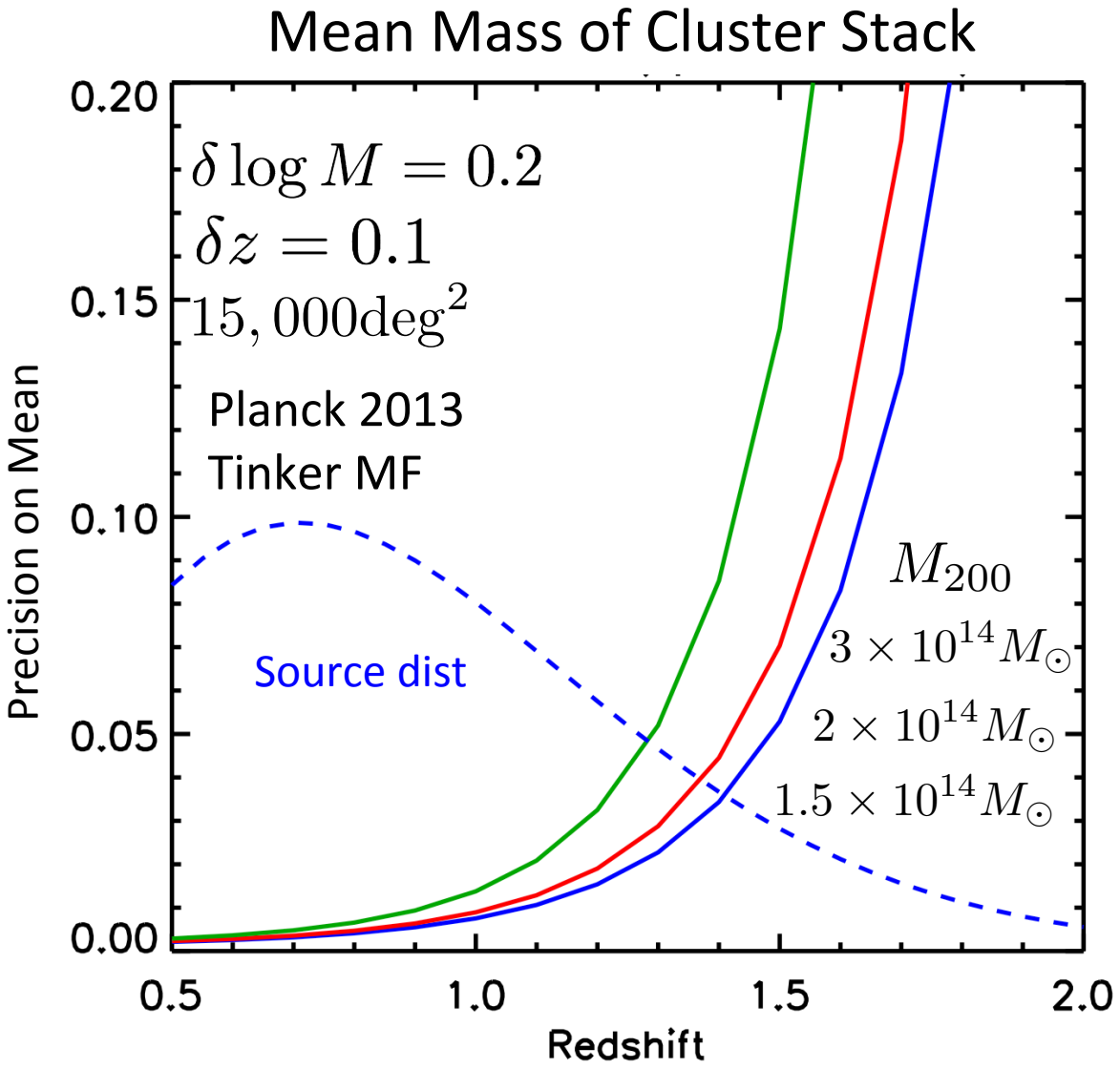
Galaxy Cluster Cosmology

- Catalog construction and characterization
  - Baseline – photometric survey: ~60,000 clusters

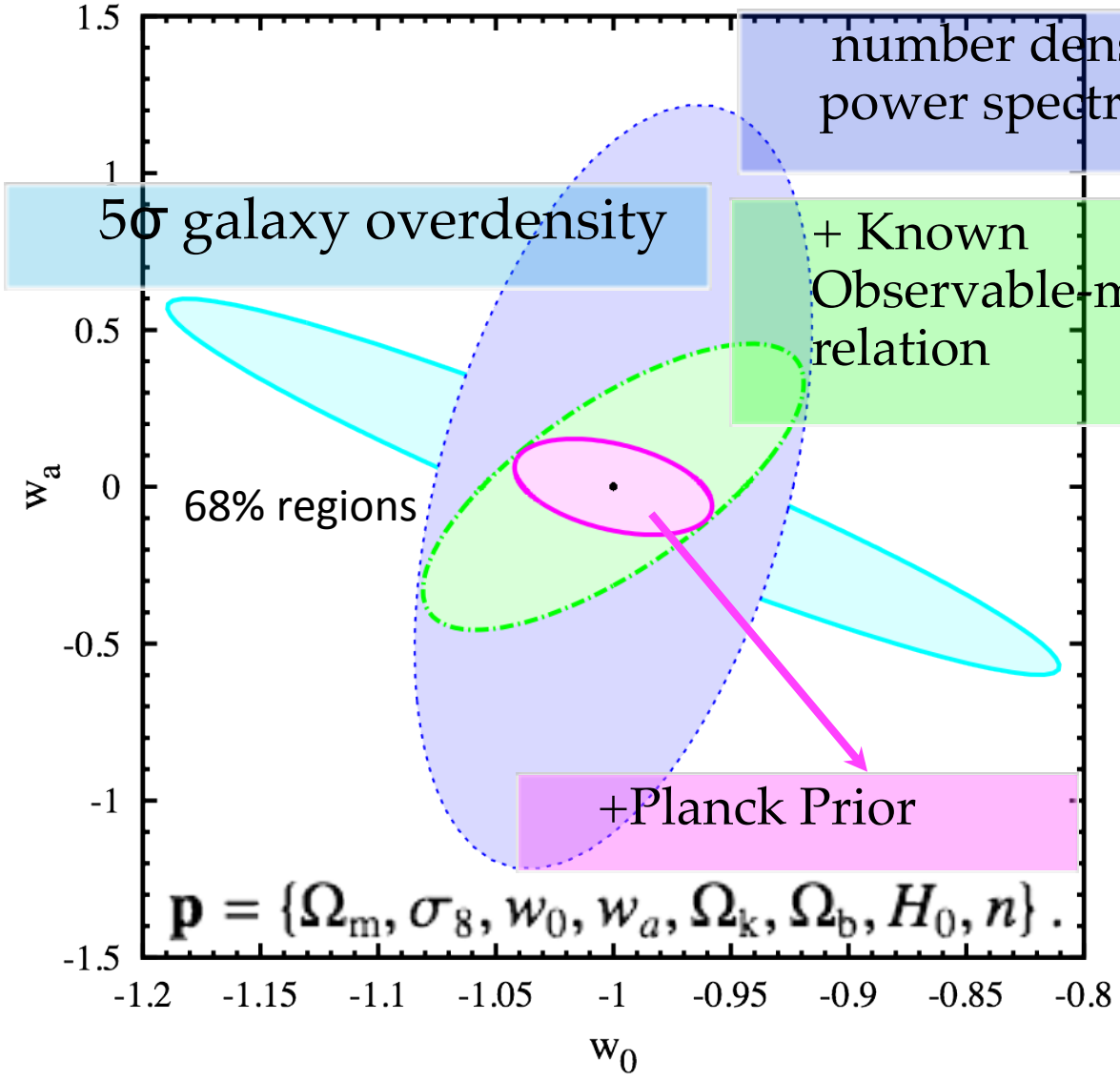
    $M \sim (1-2) \times 10^{14} \mathrm{M}_{\odot}$ out to $z > 1$
  - Catalog construction challenges on mocks
  - Studies using grism
- Cluster observable-mass distribution
  - Lensing masses
- Dedicated meeting in Sesto, July 2014
- Cosmology forecast paper being finalized

Mass Calibration from Shear

Stacks as a function of redshift
Shape noise only (Bartlett)



Cosmology with Euclid Clusters



$\mathrm{FoM}_{\mathrm{DEFT}} = (\det [Cov(p_i,p_j)])^{-1/2}$

FoM (3s)= 380
FoM (5s)= 70

Sartoris et al., in prep.

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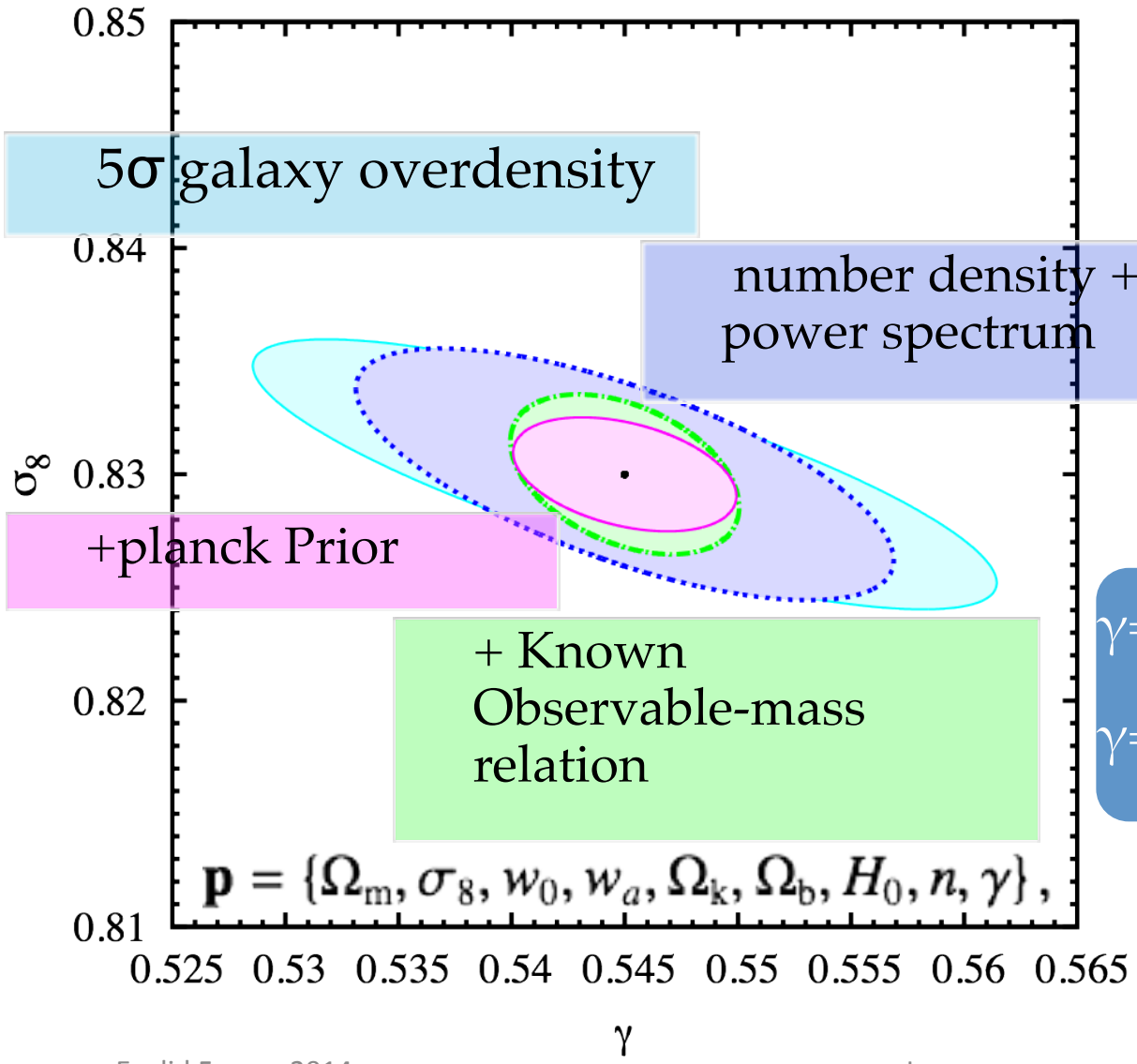


$$\frac{dln\delta}{dlna} = \Omega_m(a)^{\gamma}$$

γ=0.545 : standard GR

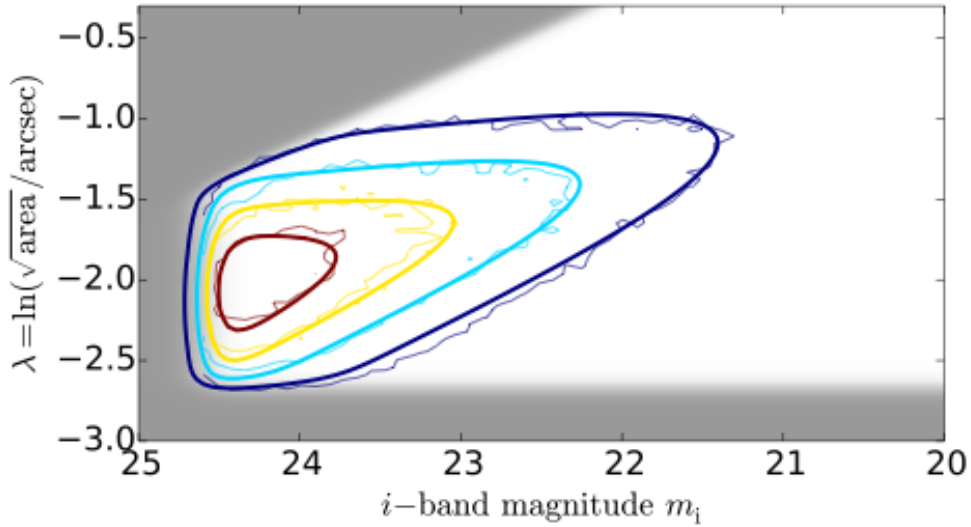
γ=0.68 : DGP brane-world model

Sartoris et al., in prep.

Legacy Weak Lensing

- Magnification (contact: Heavens)
  - Combine with shear
- Galaxy-Galaxy lensing (contact: Cacciato)
  - Dark-light matter connection
  - Working on review of subject
- Mass mapping (contact: Jullo & Pires)
  - Method development
- Peak statistics (Contact: Cluster SWG)
  - Cosmological constraints (Martinet et al., submitted)

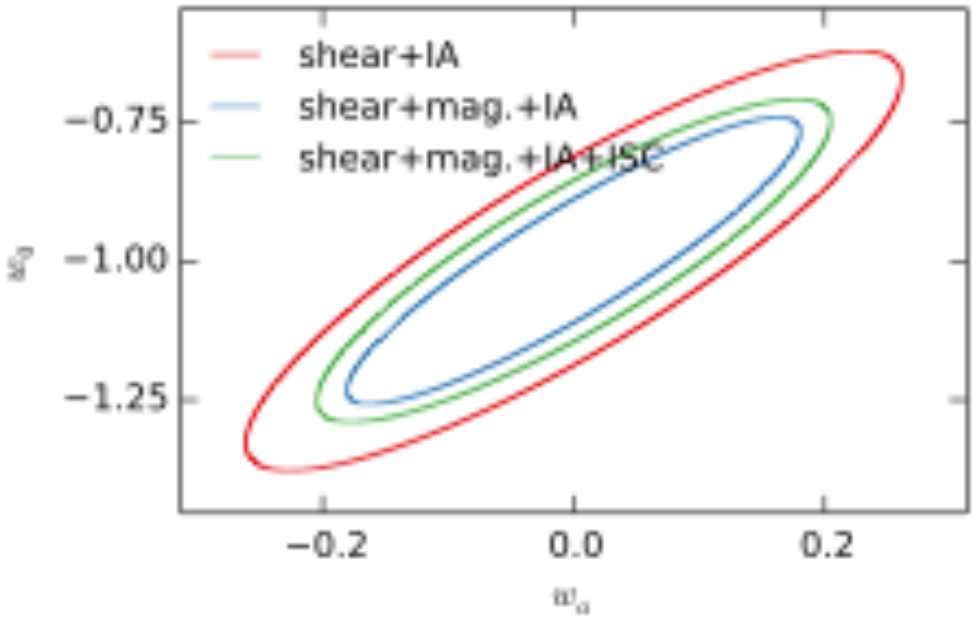
Size-Mag. Distribution



$$\sigma_\kappa \to 1/\sqrt{F_{\kappa\kappa}} \sim 0.8/\sqrt{N}$$

$$\sigma_\epsilon \sim 0.38/\sqrt{N}$$

Alsing et al. (2014)



FoM Gain:

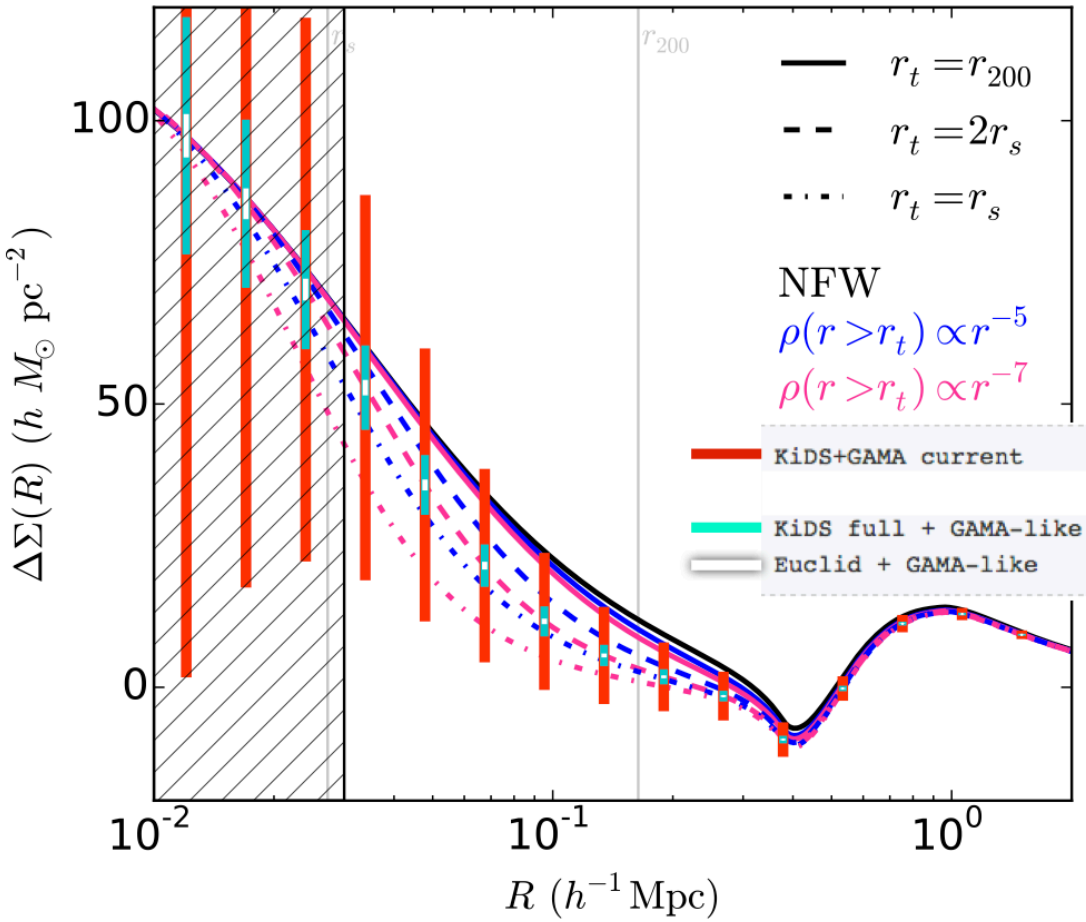
No sys. ~12%

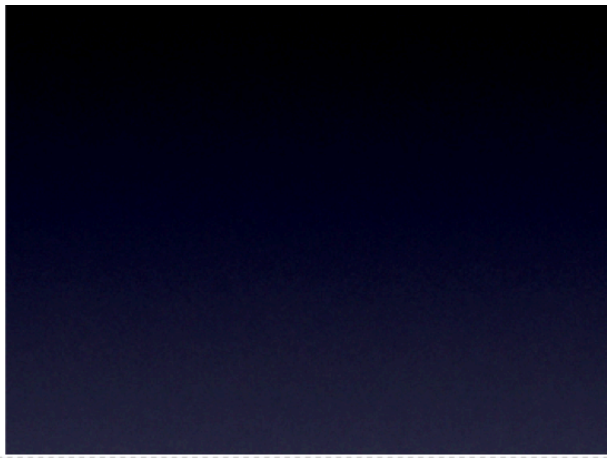
IA ~250%

IA+ISC ~25-65%

Galaxy-Galaxy Lensing

Example: Satellite Galaxy Halos
(coutesy M. Cacciato)

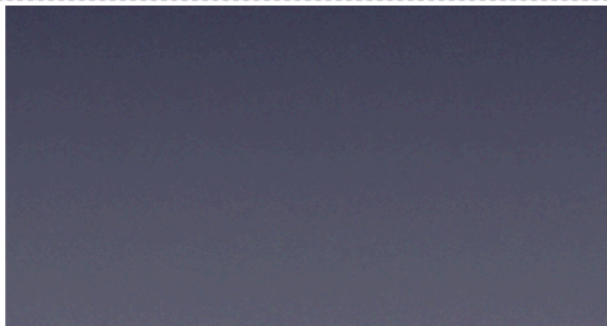




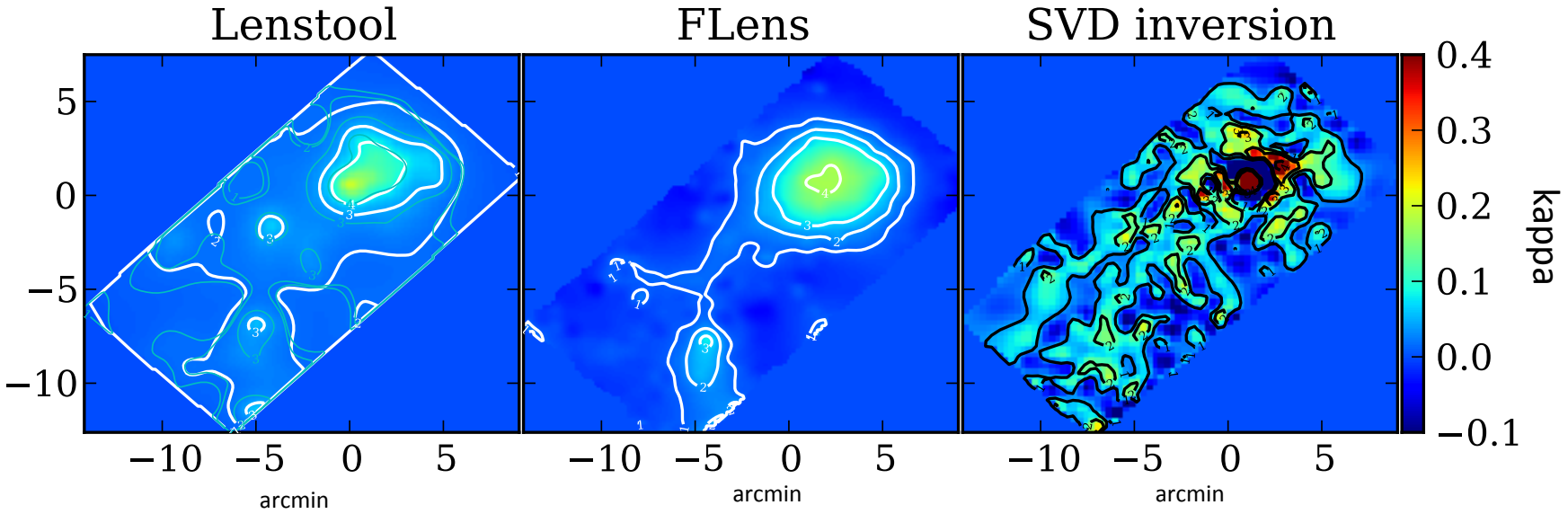
KiDS+GAMA current : 120 sq. deg.; n_s = 6 / sq. arcmin

KiDS full + GAMA-like : 1,500 sq. deg.; n_s = 10 / sq. arcmin

Euclid + GAMA-like : 15,000 sq. deg.; n_s = 30 / sq. arcmin



Mass Mapping: 2D



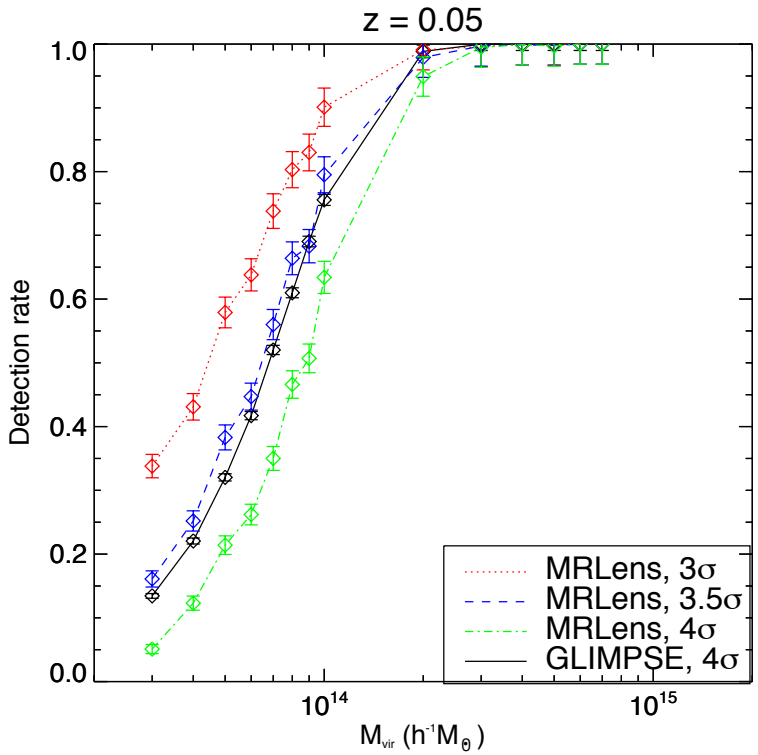
Jullo, E.; Pires, S.; Jauzac, M.; Kneib, J.-P., MNRAS, 2014

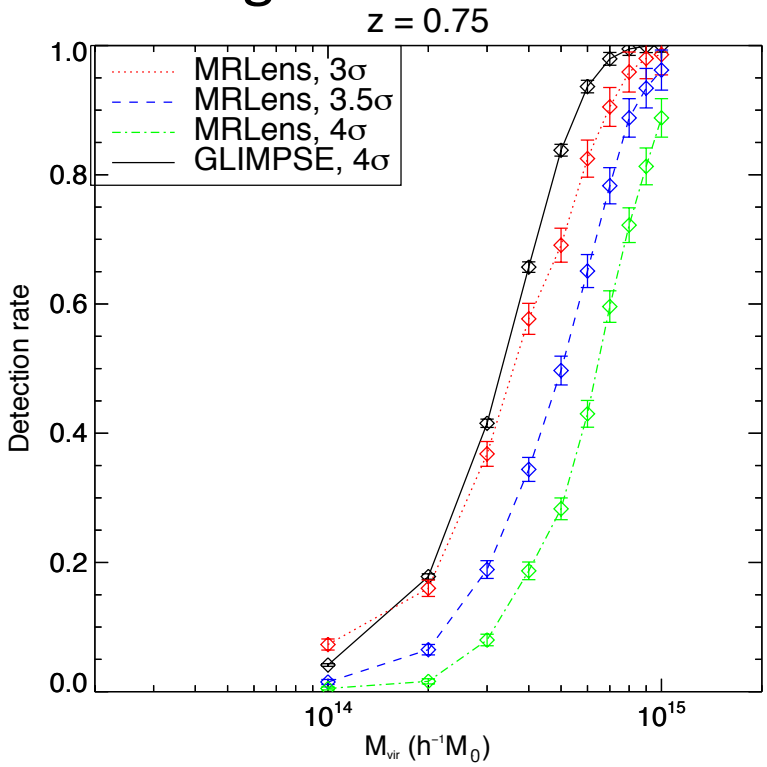
Comparison 2D mass map methods:

- on small fields : Application to MACSO7017
- on large fields : ongoing work

Mass Mapping: Cluster Detection

- 3D reconstructions (GLIMPSE) may offer an SNR advantage over 2D reconstructions (MRLens) for the detection of clusters.
- Improvement particularly significant at high redshift.





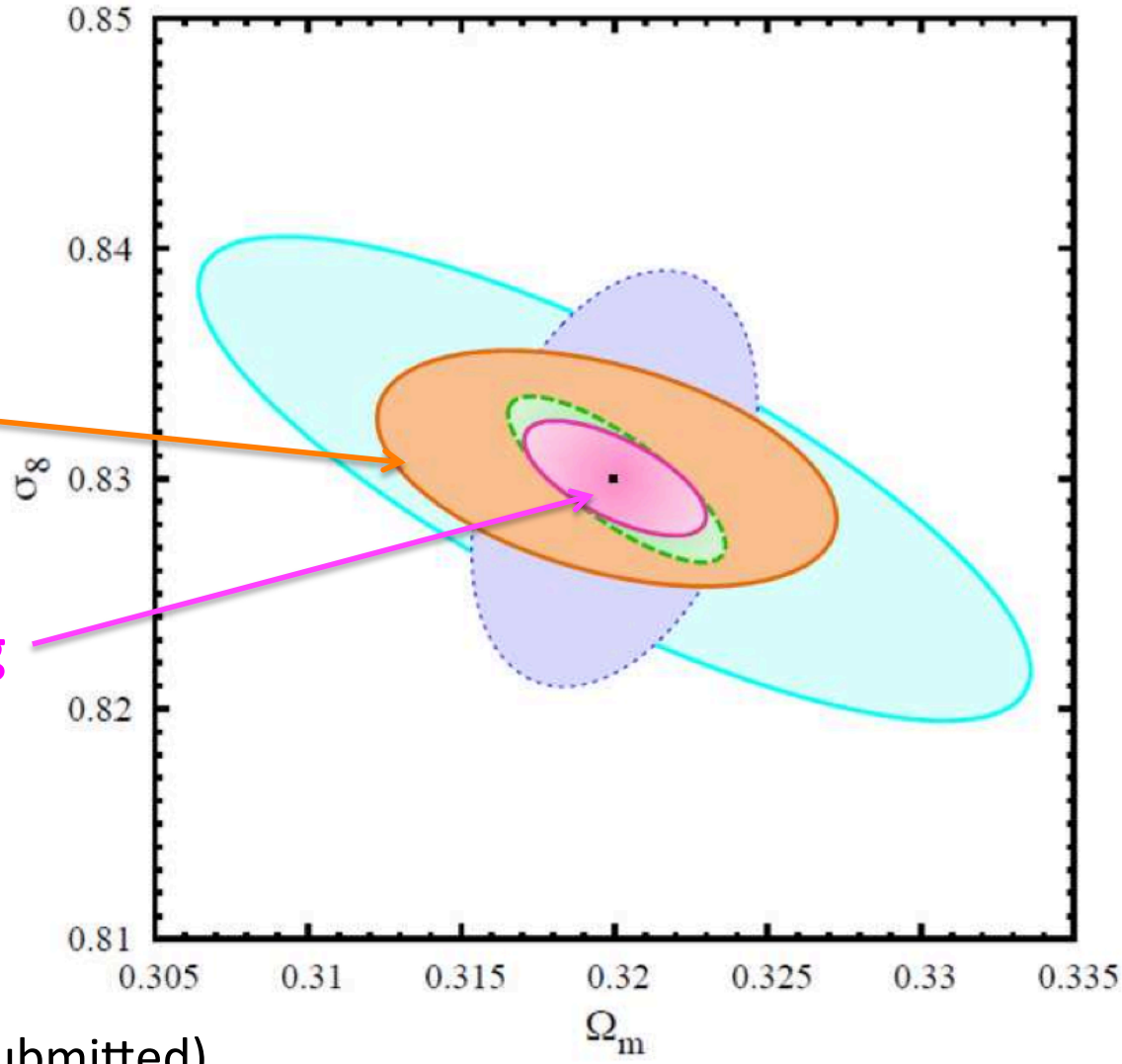
Leonard et al. 2015, MNRAS submitted

Peak Statistics

Tomographic peak counts

Peak counts

Clusters/known scaling



(Martinet, Bartlett & Kiessling, submitted)

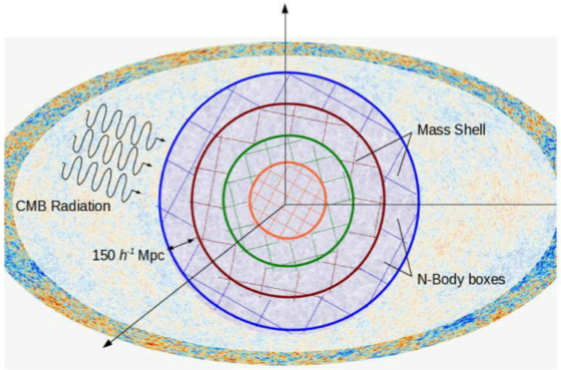
Cross Correlation with CMB

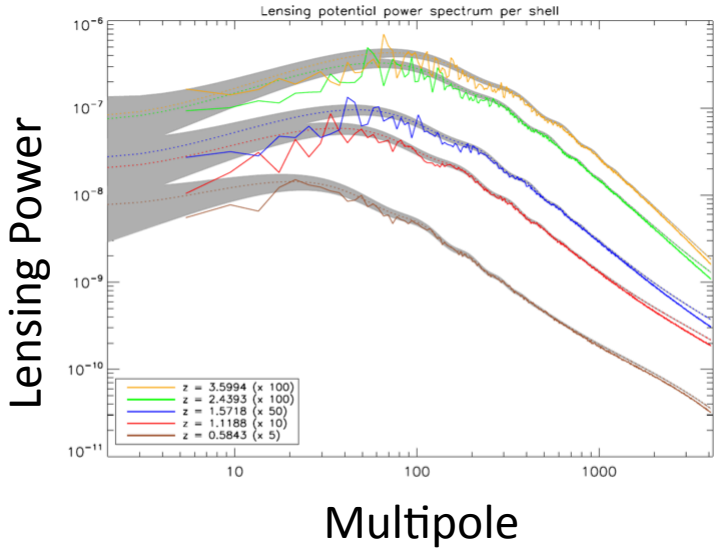
- SWG: Aghanim &Baccigalupi
- 60 members, lots of Planckians
- Cosmology with
  - Integrated Sachs-Wolf
  - Gravitational lensing of CMB
- Current work focused
  - CMB lensing simulations: multiple-lens plane approximation
  - All-sky CMB lensing reconstruction
  - Cross-correlation pipelines

CMB N-body lensing

Courtesy: Aghanim & Baccigalupi

- Ray tracing: Born and Multiple lens plane approximations, from last scattering to here
- Euclidean N-body sims (CODECs), 48 snapshots in redshift, 200 Mpc width, projected surface mass density for computing lensing angle
- Next:
  - evaluate cross-correlation spectra
  - feed with Euclidean redshift and population selections, propagate photometric redshift errors all the way to cross-correlation spectra
- Figures from Calabrese et al. 2014





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