French CFHTLS Users Meeting November 06-07, 2006

CFHTLS… what next?

CFHTLS the current plan (from the Wide plan)

	Plan without 2+2					Plan with 2+2				
	W1	W2	W3	W4	Total	W1	W2	W3	W4	Total
07A	0	12	53	12	77	0	15	53	16	84
07B	64	28	0	26	118	88	22	0	18	128
08A	0	13	52	12	77	0	16	52	16	84
08B	58	0	0	8	64	34	0	0	8	42
Total	122	53	105	58		122	53	105	58	

CFHTLS beyond 2008A

- Completion of the current CFHTLS
- Extention of the current CFHTLS (FOV, depth, WIRCam)
- A totally new CFHTLS
- A mixture of those?
- Nothing

- If a completion/extention/new CFHTLS:
  - what, when, how long, how, with who?

CFHTLS completion beyond 2008A

- Wide
  - Minimum Wide: all fields for which we will have at least 2 filters should be completed to get the 5 filters
  - Optimum Wide: Full coverage of W1/W3/W4 fields in 5 filters
- Deep:
  - All fields at the same depth in all filters. Need to define the depth in each filter
  - All fields and all filters at the depth as defined in the CFHTLS document

CFHTLS Extention beyond 2008A

- Wide
  - Increase FOV
  - Increase depth
  - Increase wavelength coverage (WIRCam)
- Deep:
  - WIRCam
  - SNSL+

A new CFHTLS

- Megacam?
- WIRCam ?
- Espadon?
- Other? (e.g. time follow up)

Weak Lensing beyond 2008: international context

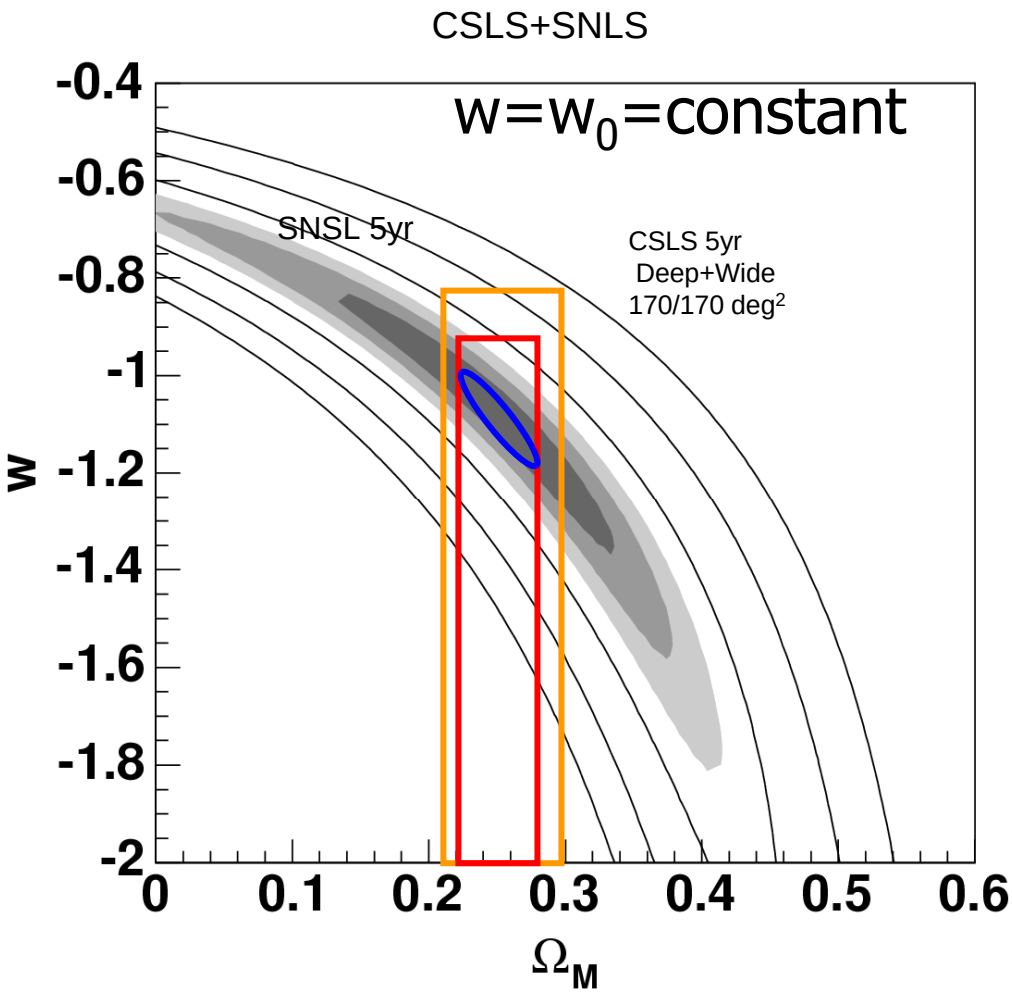
CFHTLS Completion/Extention beyond 2008A

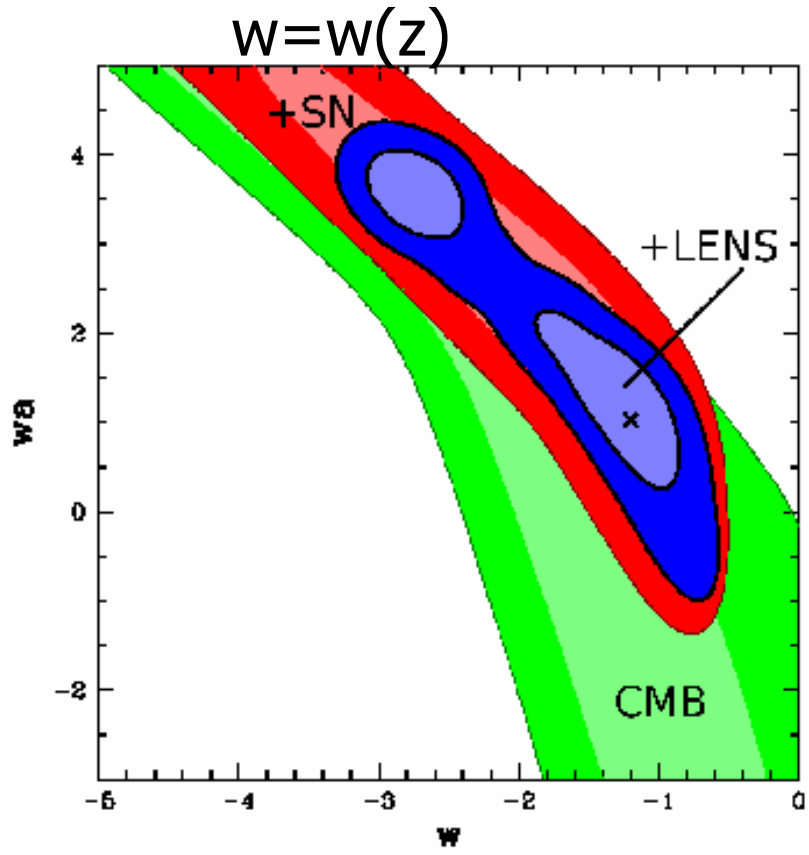
- Scientific motivations?
- What is the competition?

Scientific motivations and competition

Example: cosmic shear

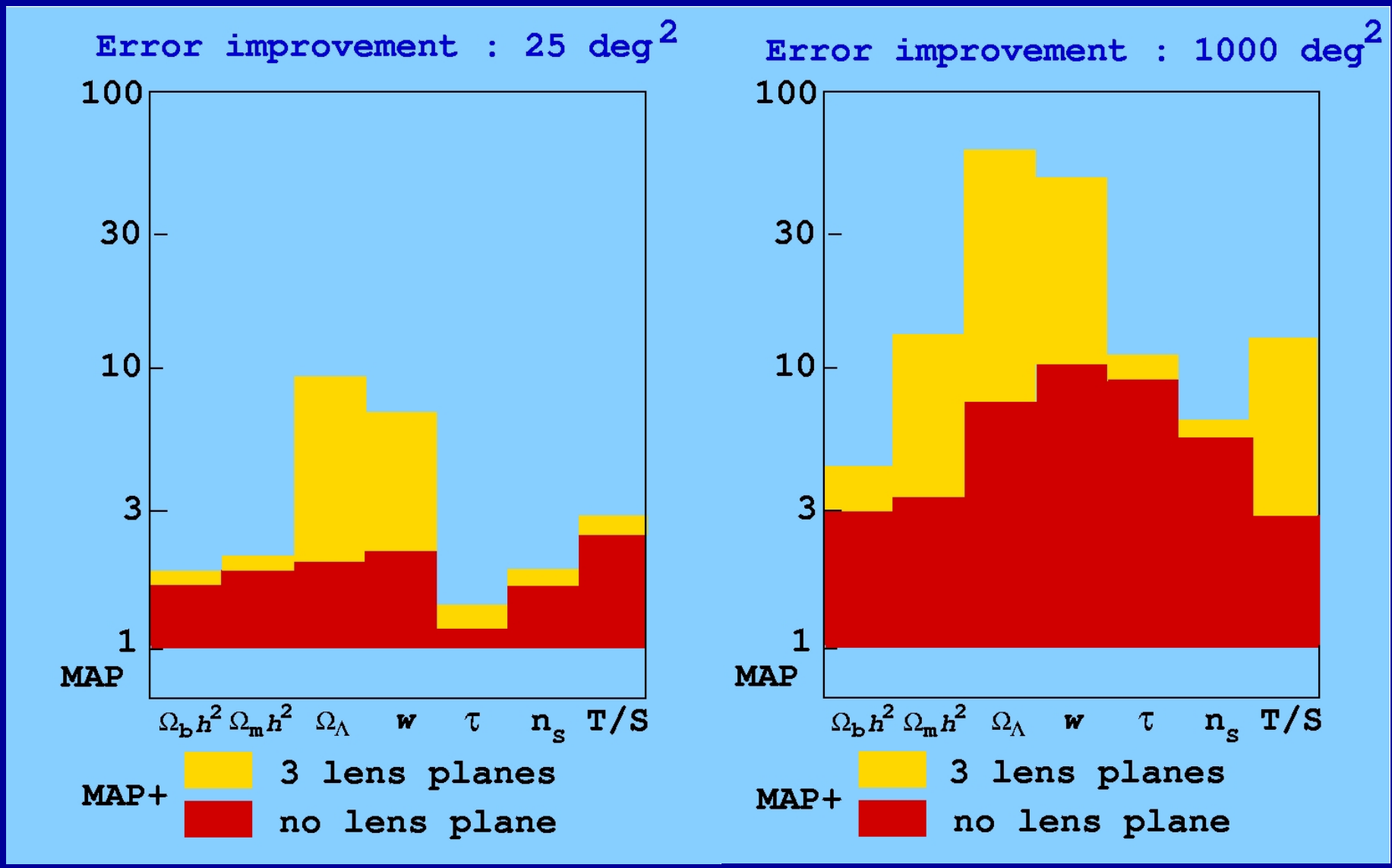
Exploring DE as function of redshift
: still far from getting w_a





Jarvis, Jain, Bernstein, Dolney 2005

Breaking degeneracies with tomography



Constraints on Dark Energy (II)

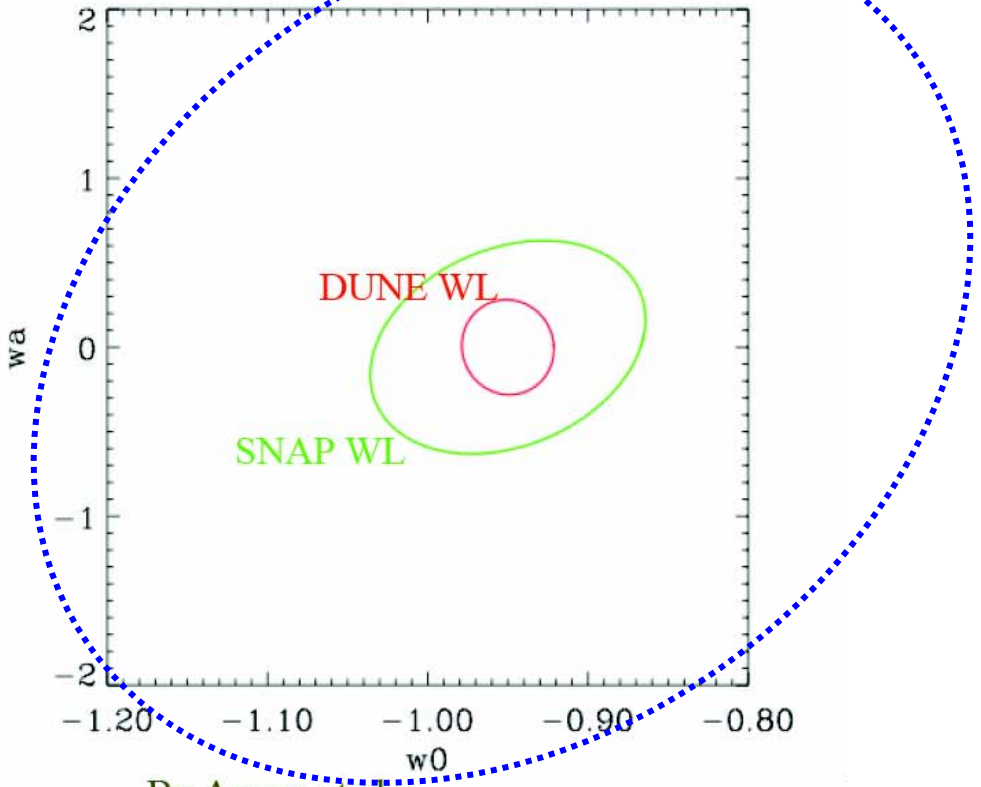
dapnia

Weak Lensing:

C_l measurement in 3 z-bins

Photo-z errors of $\Delta z=0.1$

No priors



CFHTLS-Wide

By Amara et al.

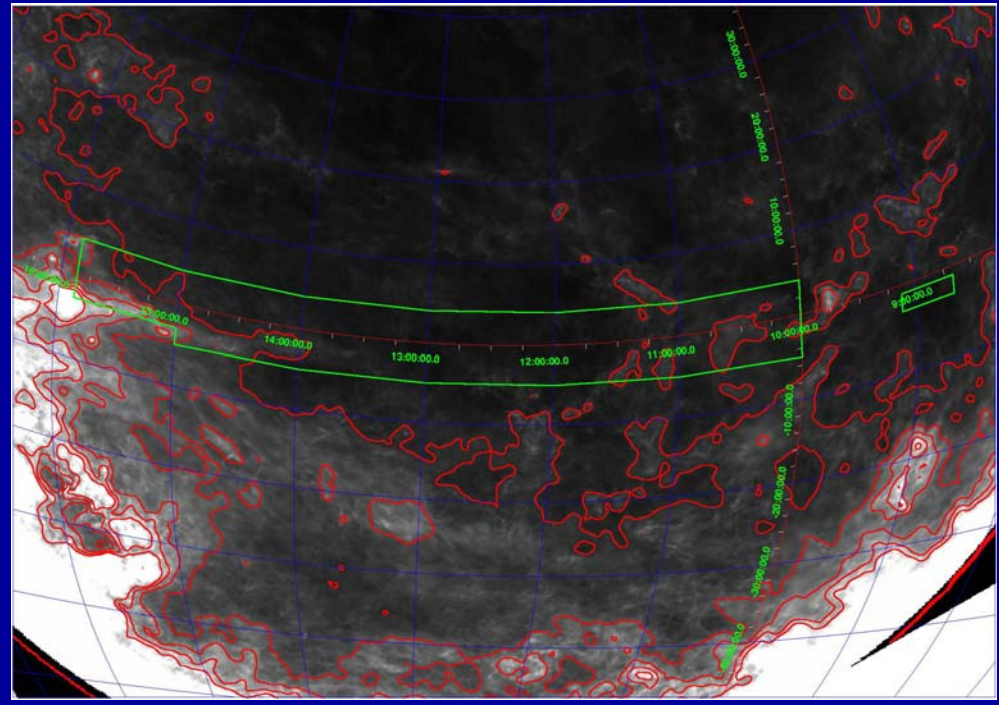
Dark energy evolution: $w(a)=w_0+(a_n-a)w_{a,}$ $a_n=0.6$ assume a flat universe

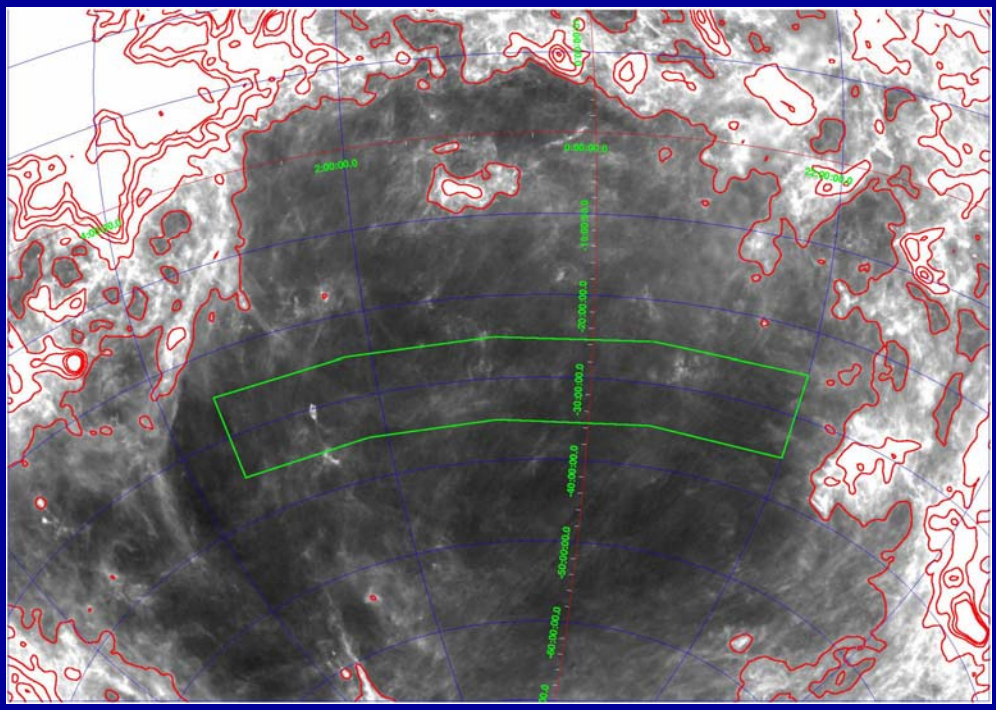
CFHTLS+ and the competition (zoom)

KIDS + CFHTLS Wide + CFHTLS Deep: 3 lens planes

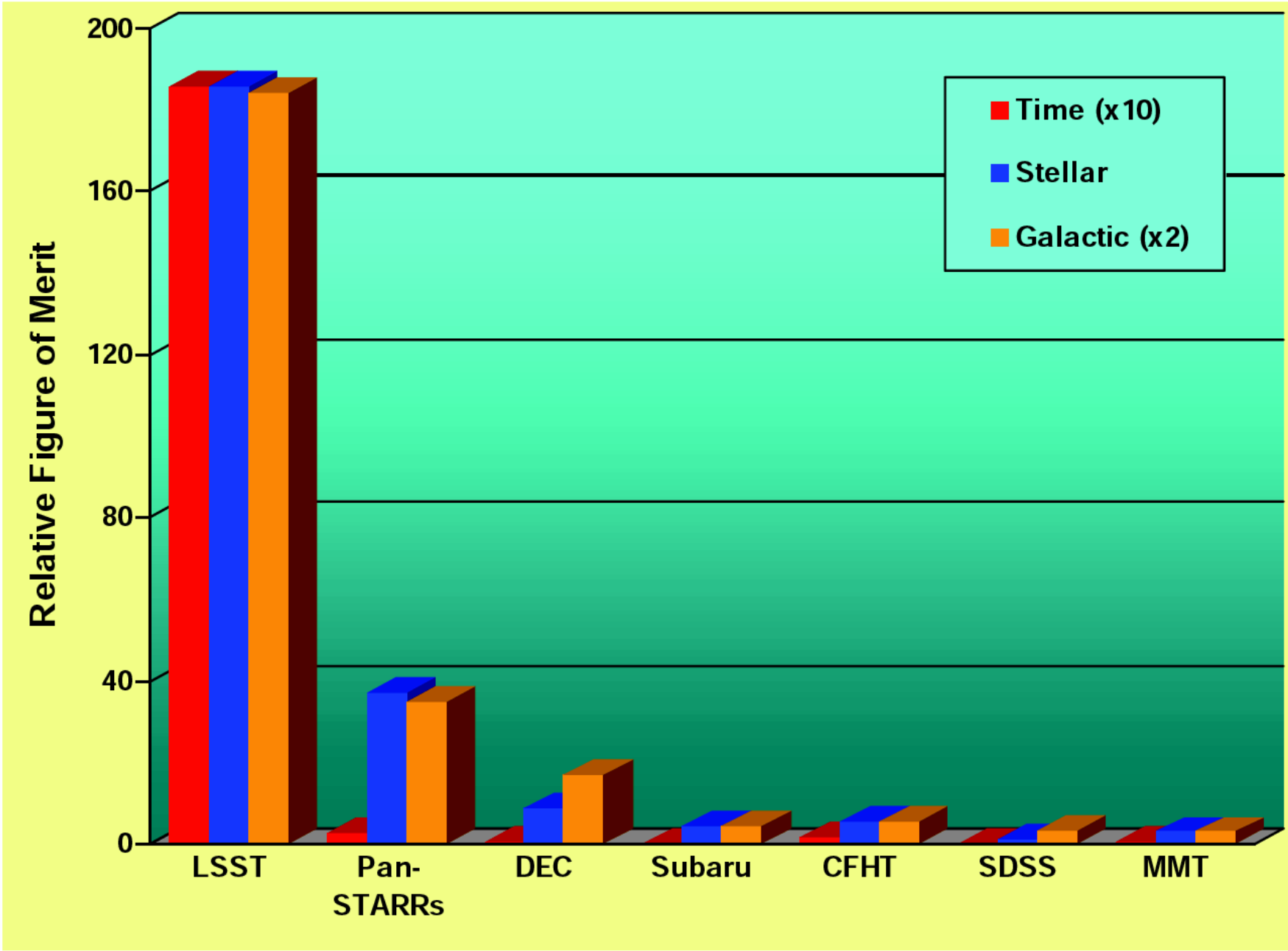
Survey	Sq. Degrees	Filters	Depth	Dates	Status
CTIO	75	1	shallow		published
VIRMOS	9	1	moderate		published
COSMOS	2 (space)	1	moderate		complete
DLS (NOAO)	36	4	deep		complete
Subaru	30?	1?	deep	2005?	observing
CFH Legacy	170	5	moderate	2004-2008	observing
RCS2 (CFH)	830	3	shallow	2005-2007	approved
SUBARU/Giga Cam	?	4/5?	deep	2010-2014?	?
DES (NOAO)	5000	4	moderate	2008-2012?	proposed
Pan-STARRS	~10,000?	5?	moderate	2006-2012?	~funded
LSST	15,000?	5?	deep	2014-2024?	proposed
JDEM/SNAP	1000+ (space)	9	deep	2013-2018?	proposed
VST/VISTA	1500/5000?	4+5	moderate	2010-2015?	proposed
DUNE	20000? (space)	2+1?	moderate	2012-2018?	proposed

KIDS-N





KIDS-S


Relative Figure of Merit
200
160
120
80
40
0
Time (x10)
Stellar
Galactic (x2)
LSST
Pan-STARRs
DEC
Subaru
CFHT
SDSS
MMT

How long does it takes to get 20000deg^2 As the CFHTLS-WL?

For all: same seeing and same fraction of good weather

5 filters: ugriz, same depth as CFHTLS-W (I_{AB}=24.5)

- CFHT/Megacam: 20000 nights
- SUBARU/SUPRIME: 25000 nights
- DES (3deg^2): 5400 nights
- SUBARU/HyperCAM (2deg^2): 2000 nights
- Pan-STARRS-4: 2700 nights (approx)
- LSST : 700 nights

BUT: efficiency depends on the scientific goals

Wide field surveys by 2009

- PanSTARR-1 / PanSTARR-4 ? (north)
- Subaru GigaCam (north)
- VST/VIKING (south)

- But Megacam+WIRCam:
- ready, strong experience,
- A new survey could start by 2008B

A CFHTLS-2 WIDE ?

- Beyong 2008:
  - continuing with Megacam (no development cost): camera/WFC works, experienced QSOs and data analysis teams, pipeline ready.
  - Can be started immediately: no delays due to funding or technical
  - 2008-2011 still competitive before next generation surveys

- Questions:
  - deep or wide?
  - Optical one band or optical+NIR bands ?

    - Option 1-4 : **assume 7 nights/months 5.5 hours/night, 3 years,**

      - Same as the wide but I=24-band only: 1160 deg^2
      - Same as the wide but u,g,r,i,z (3000+2500+2000+4300+3600sec): 324 deg^2
      - 0.7 mag. deeper than the wide : 80 deg^2 BUT NIR more and more important since more and more <z> > 1 galaxies.
      - or 0.7 mag. Less deep than the wide: I=23.3: N(z) well known, NIR not critical, 4600 deg^2

    - Option 5: decreasing depth by 0.5 mag would not be competitive with respect to KIDS: 1500 deg^2 u,g,r,i,z

    - Option 6: focus on WIRCAM follow up of CFHTLS-1 wide fields (2 wides ? Or J and H only?)

  - Usefull to explore deeper the scientific return expected of this low cost, easy-to-setup, until other facilities be operational.
  - The selected areas could also be followed by other surveys later.

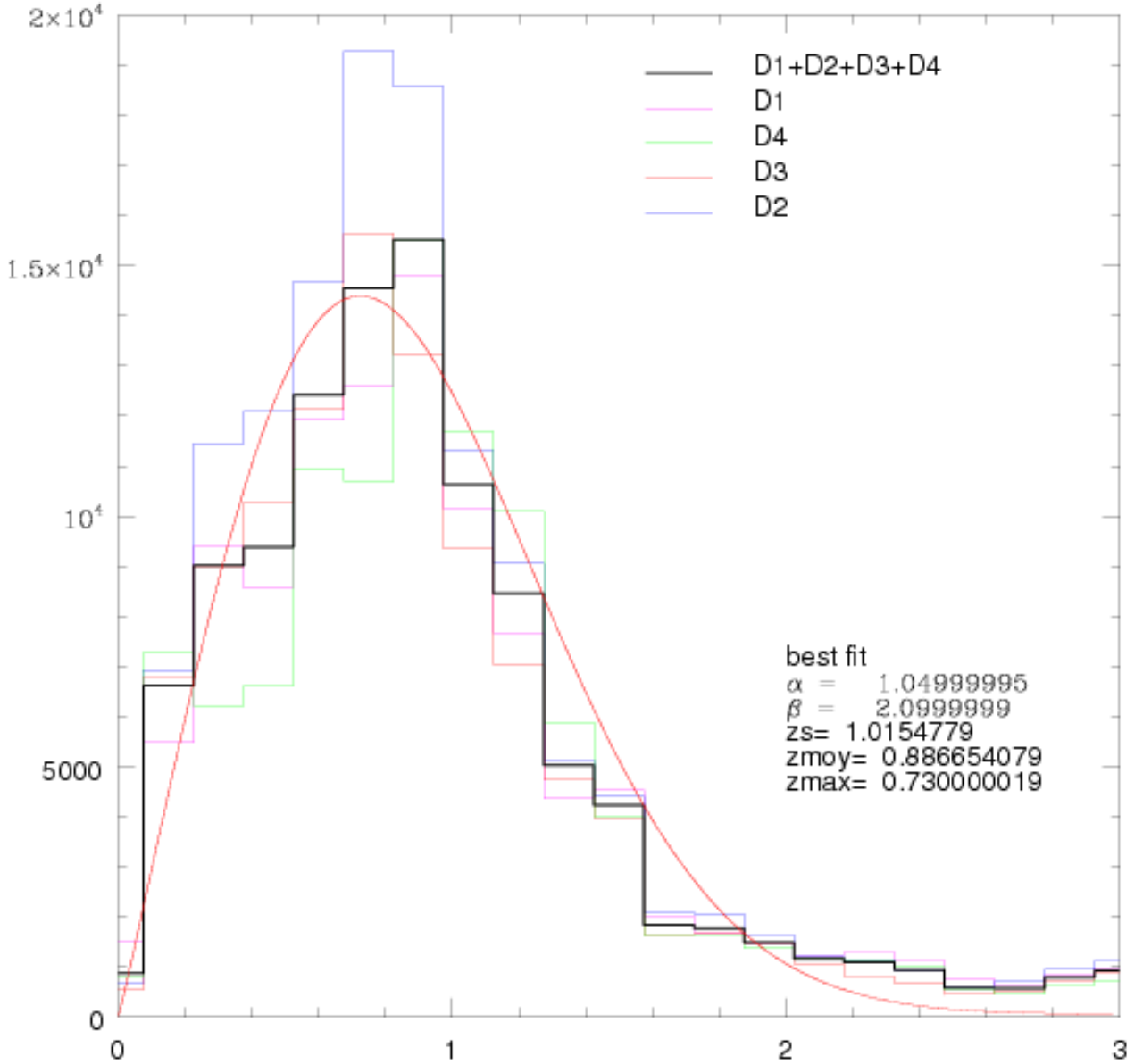
CFHTLS Wide by 2009

- RCS2 in all band or near? : seem less competitive than KIDS/VIKING but could be done faster
- CFHTLS Wide in WIRCam: hard to cover the whole filed, but seems attractive for photo-z if we focus on fields with spectro?
- CFHTLS deeper? Seems hard to compete with SUBARU
- A join SNLS+Wide for SNIa+WL ?

Errors and systematics uncertainties

- PSF corrections
- Redshift distribution
- Clustering
- Contamination by overlapping galaxies
- Intrinsic alignement
- Intrinsic foreground/backgound correlations
- Sampling variance
- Non-linear variance
- Non-linear dark matter power spectrum
- + cosmic variance (survey size, survey topology, depth)

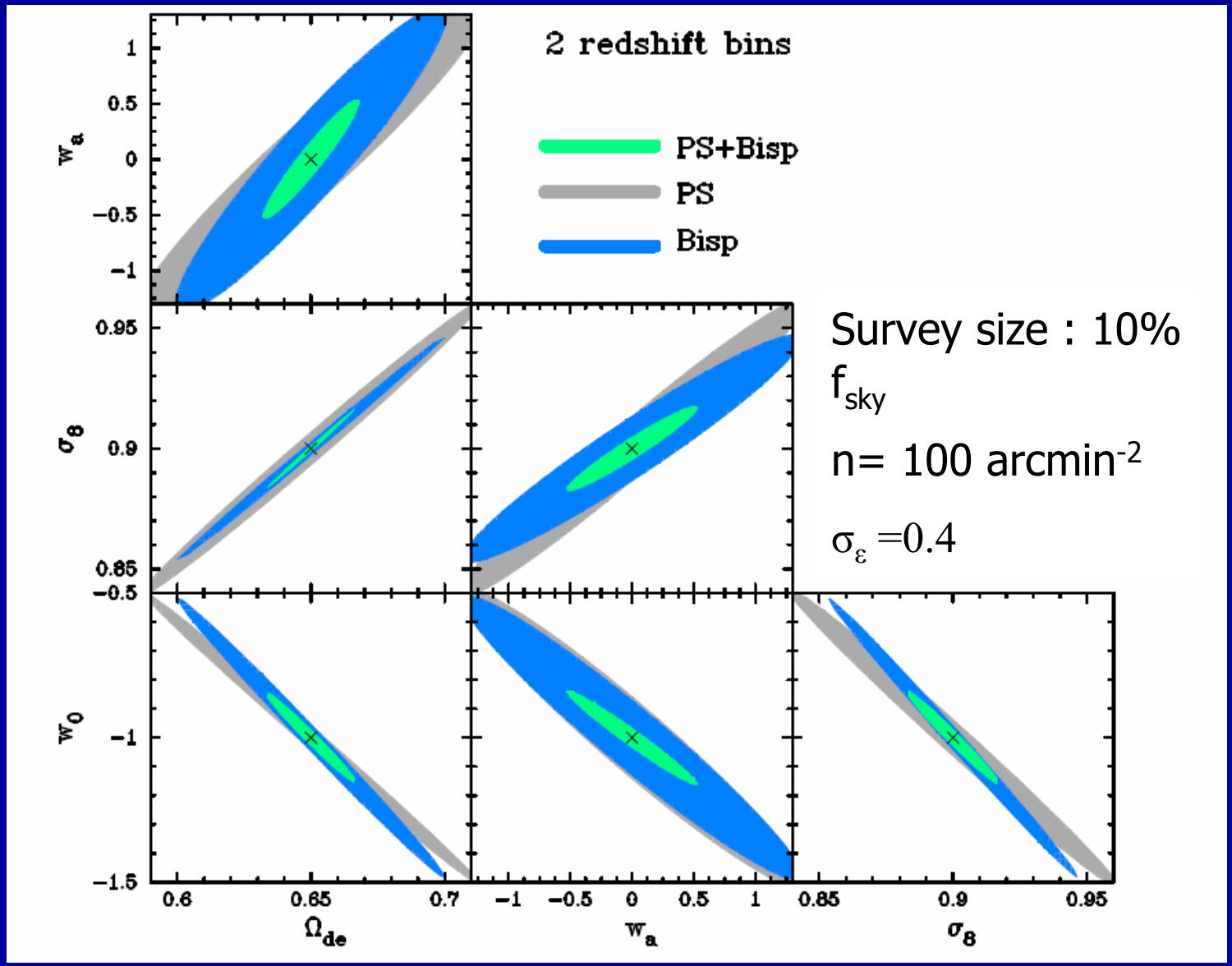
The uncertain n(z)



- HDF size too small as compared to CFHTLS: sampling variance increases error by 10% (van Waerbeke et al 2006)

- Photo-*z* from CFHTLS-Deep + VVDS: Seem to peak at higher *z* than our HDF *z*-calibration? Would decrease σ_8

Using high-order statistics and 2 redshift bins



Decoupling geometry and power spectrum

$$P_{g\gamma}(\ell; f, b) = \frac{3\Omega_{m0}H_0^2}{2c^2} \int \frac{d\chi_f}{a(\chi_f)} W_f(\chi_f) \int d\chi_b W_b(\chi_b) \times \frac{\chi_b - \chi_f}{\chi_b \chi_f} P_{gg}\left(\frac{\ell}{\chi_f}, \chi_f\right) \Theta(\chi_b - \chi_f)$$

$$P_{\gamma\gamma}(\ell; f; b) = \left(\frac{3\Omega_{m0}H_0^2}{2c^2}\right)^2 \times \int d\chi_f W_f(\chi_f) \int d\chi_b W_b(\chi_b) \times \int \frac{d\chi}{a(\chi)^2} \frac{\chi_b - \chi}{\chi_b} \frac{\chi_f - \chi}{\chi_f} P_{gg}\left(\frac{\ell}{\chi}, \chi\right) \Theta(\chi_b - \chi)\, \Theta(\chi_f - \chi).$$

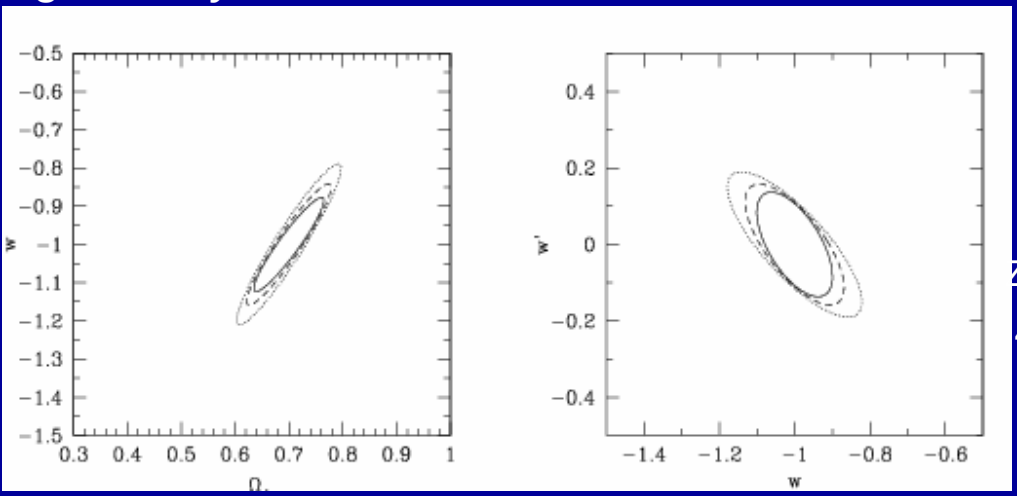
f= foreground ; *b*=background

If overlap between the 2 population is small:

$$P_{g\gamma}(\ell; f, b) \approx F(\ell; f) + G(\ell; f)/\chi_{\rm eff}(b)$$
$$P_{\gamma\gamma}(\ell; f, b) \approx A(\ell; f) + B(\ell; f)/\chi_{\rm eff}(b)$$

Scaling of lensing signal independent of the power spectrum but only depends on geometry

$$\frac{P(\ell; f, b) - P(\ell; f, b')}{P(\ell; f, b'') - P(\ell; f, b''')} = \frac{\chi_{\rm eff}(b)^{-1} - \chi_{\rm eff}(b')^{-1}}{\chi_{\rm eff}(b'')^{-1} - \chi_{\rm eff}(b''')^{-1}}$$



Need at least 3 source planes

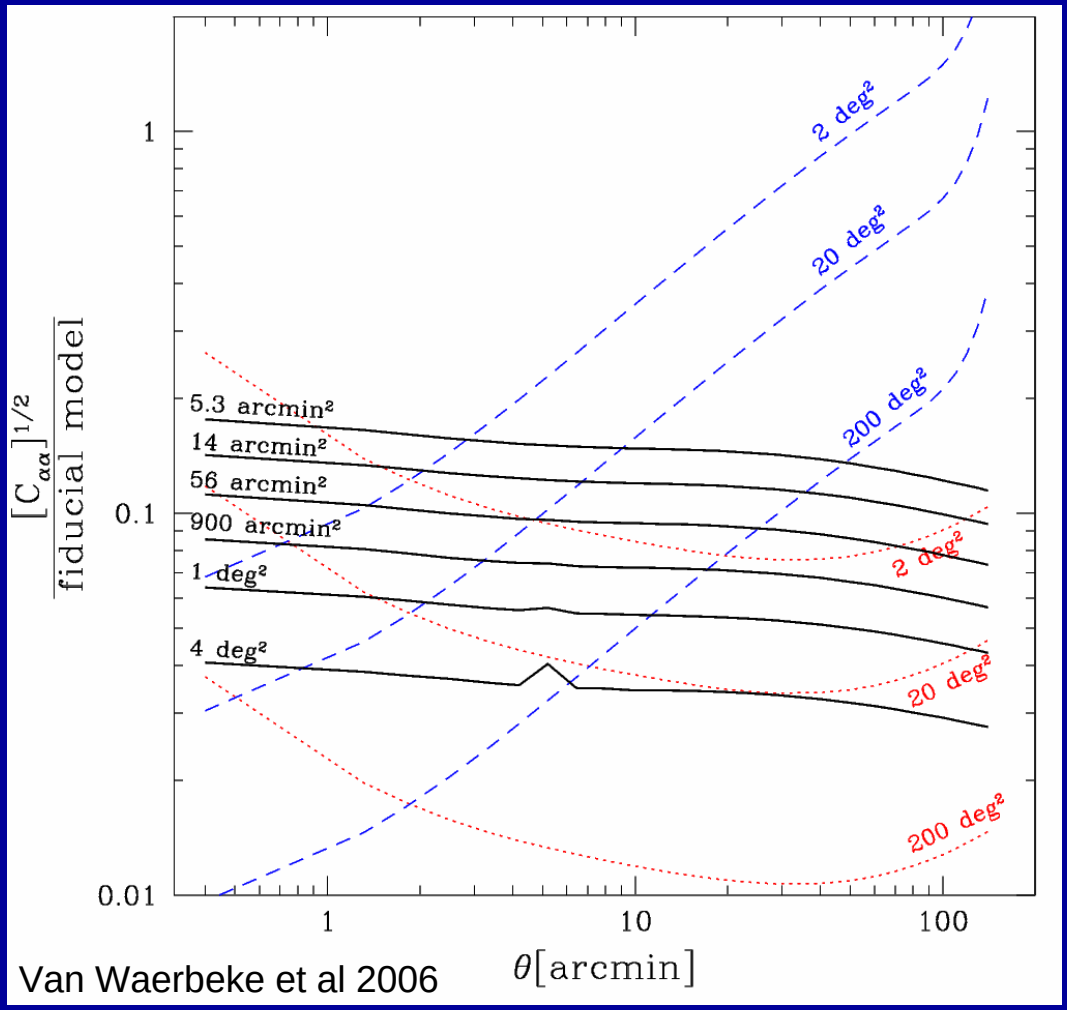
Zhang, Hui, Stebbins 2003:

4000 deg^2

Error on photo-z: 0.01, 0.02, 0.05

Sampling variance and survey properties: importance of well calibrated photo-z;

Wide: fraction spectro-calibrated almost ok



Van Waerbeke et al 2006

Most important needs for the future

- Sky coverage
- 5 bands
- NIR data WIRCam (get better accuracy on mean photo-z then individual photo-z)

- A bit less deep to have better control of n(z)?
- e.g. I_{AB}=23.8 + WIRCam
- **Note:** VST dalayed, survey cannot start before Dec. 2007

A tentative estimate of prediction in w with a CFHTLS-2 Wide

dapnia

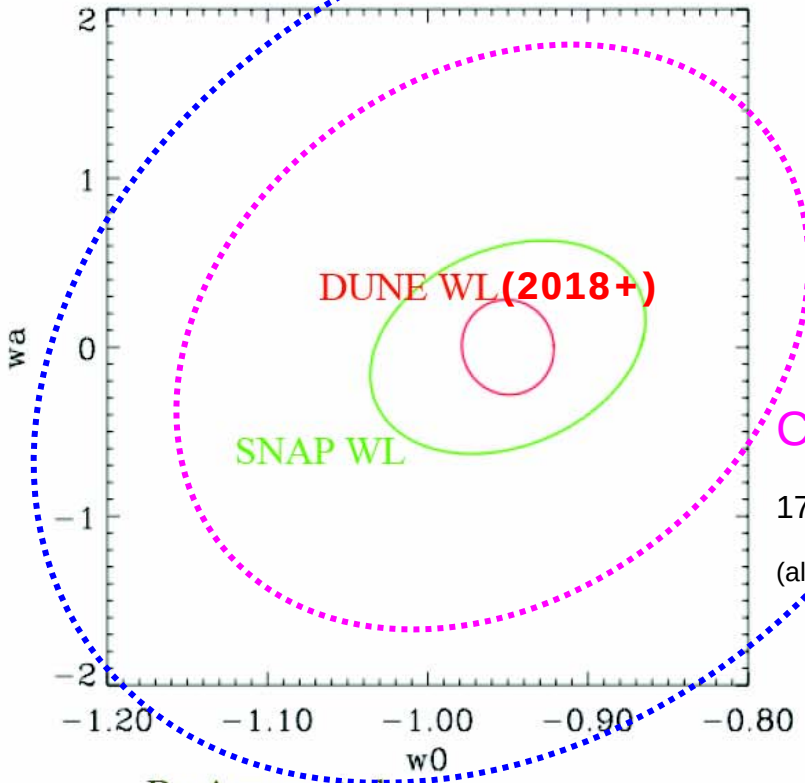
cea

Weak Lensing:

C_l measurement in 3 z-bins

Photo-z errors of Δz=0.1

No priors



By Amara et al.

CFHTLS-1-Wide (2008)

CFHTLS-1+2-Wide (2011)

170 deg^2(i_{AB}=24.5) + 500 (i_{AB}=23.8) deg^2 + WIRCam (50deg^2)

(all numbers are rough estimates)

Dark energy evolution: $w(a)=w_0+(a_n-a)w_{a,}$ $a_n=0.6$ assume a flat universe

CFHTLS beyond 2008

- Many options
- Nothing clear yet
- IMPORTANT : first complete CFHTLS-1
- PLEASE propose before May 2007 for the next CFHT users Meeting in Marseille