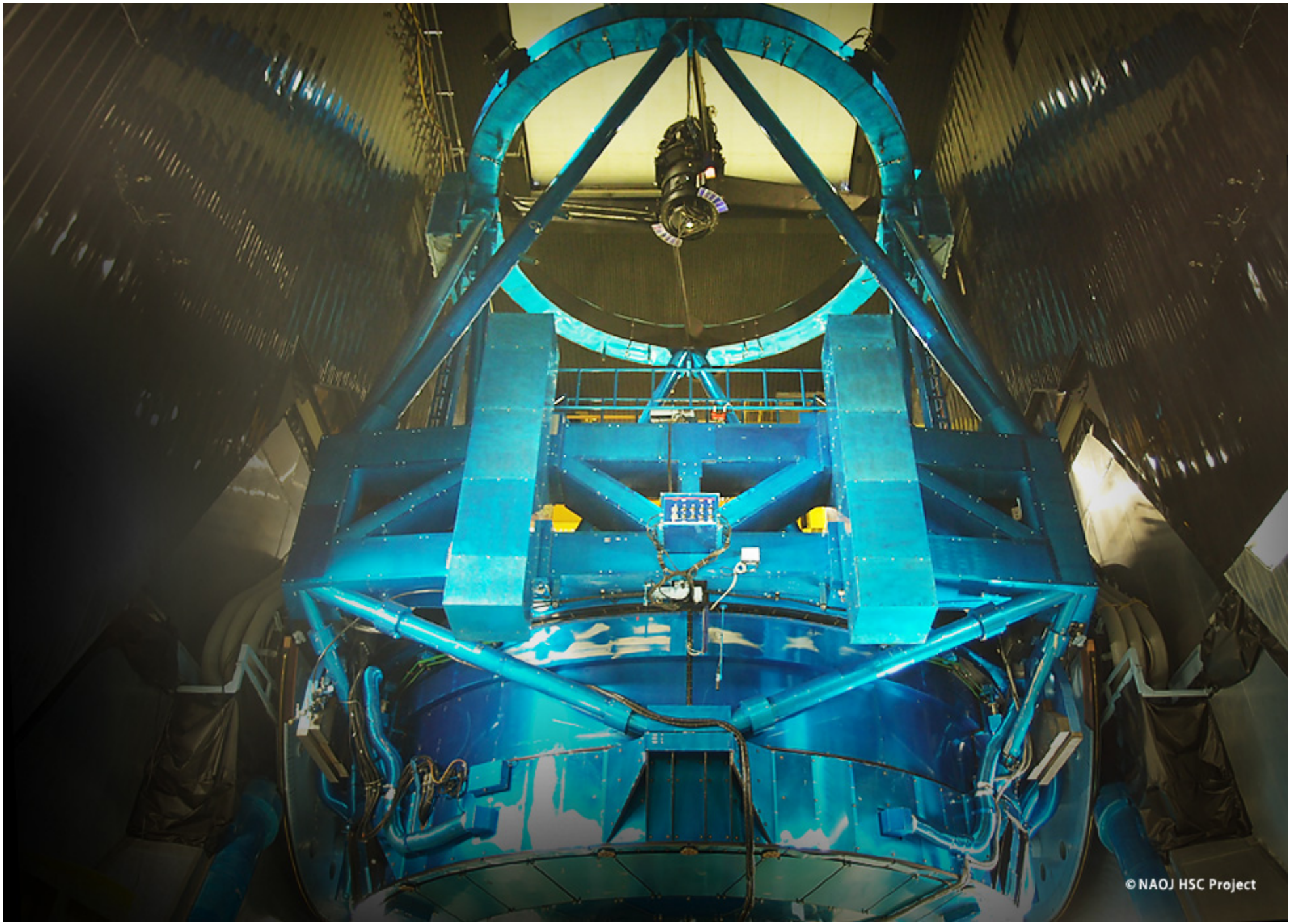
Supernovae Ia au Subaru

N. Regnault et al

(LPNHE, Paris)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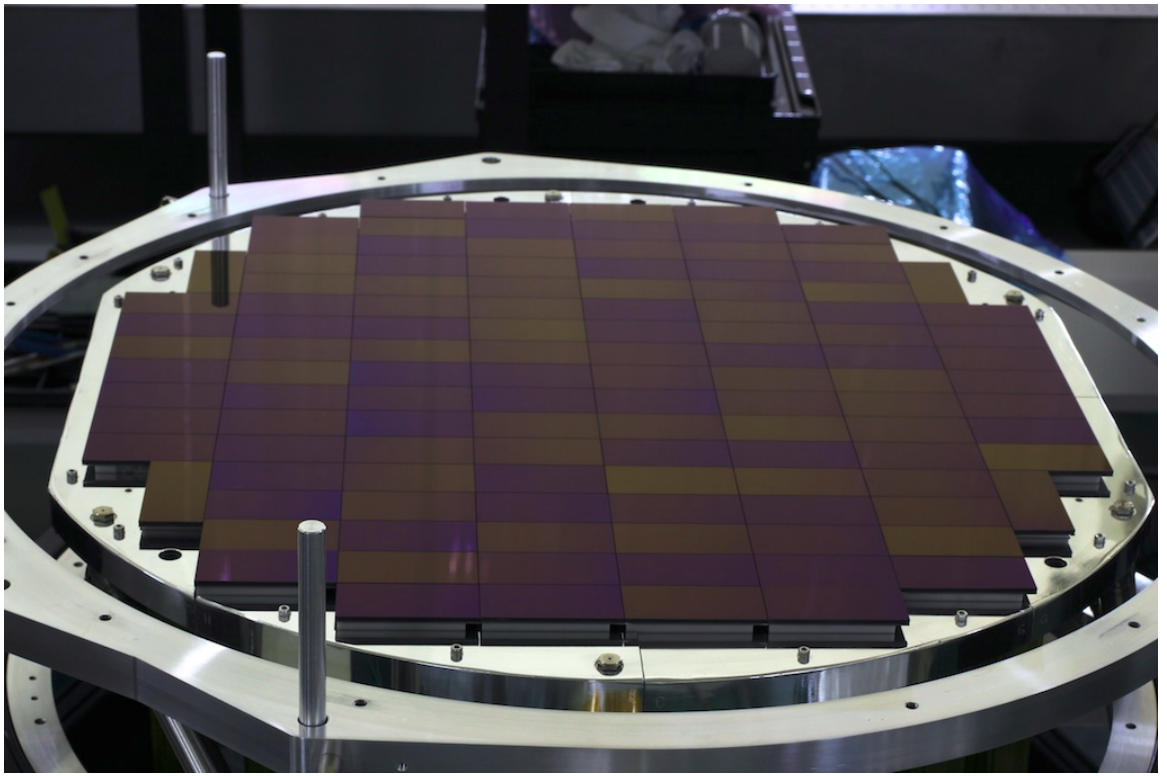
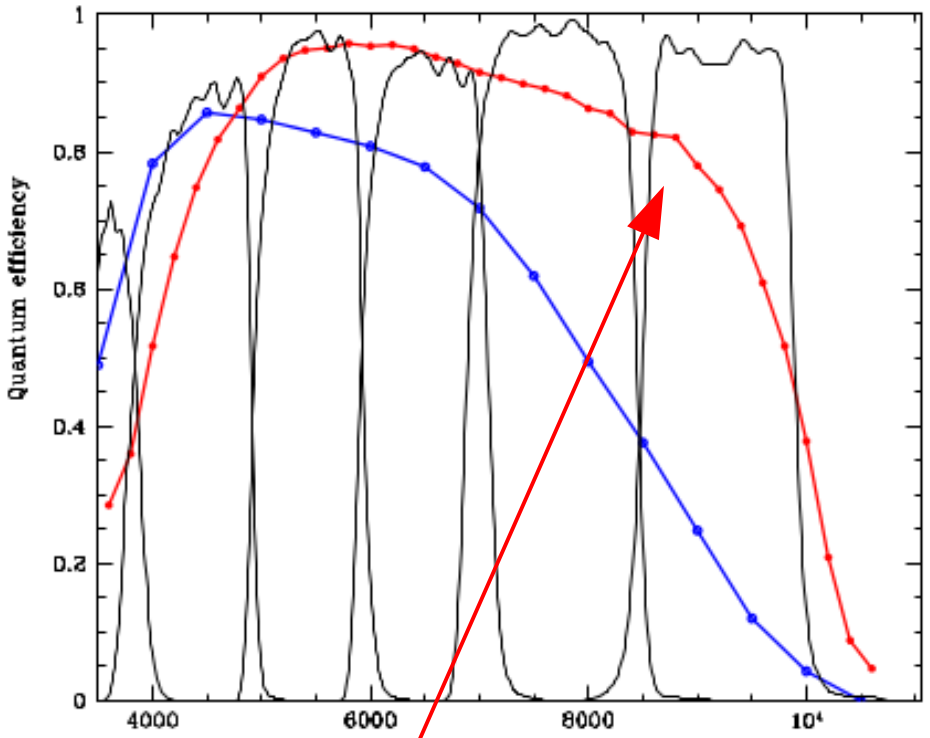
HyperSuprimeCam



- 1.8 deg^2 camera
- 116 red-sensitive CCDs
- Subaru 8.2-m telescope

The Subaru Imaging Survey

- 300 nights provisioned ⟶ Subaru Imaging Survey
- 3 layers
  - 1400 deg² *Wide* survey
  - 28 deg² *Deep* survey
  - 3.5 deg² *Ultra-Deep* survey
- Cosmology
  - Lensing (weak, strong)
  - Cluster
  - SNe Ia
- Ideal to detect SNe Ia at redshifts z > 0.8



Subaru Imaging Survey

- 300 nights
- 3 layer survey
  - Wide
  - Deep
  - Ultra-DEEP (UD)
- UD layer is cadenced
  - Low cadence
  - Need more time to implement a 6-month rolling search / pointing

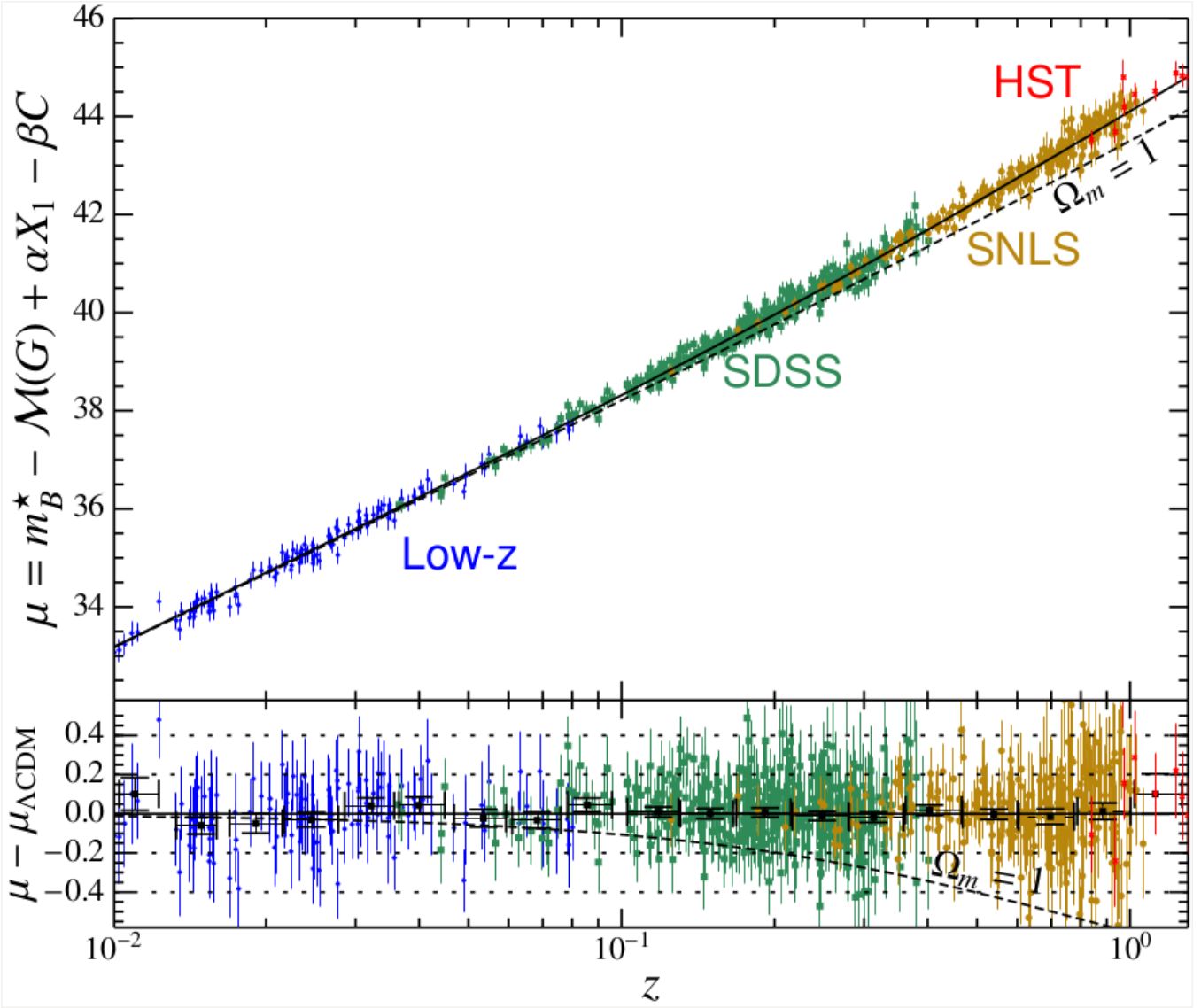
	field	RA (J2000)	DEC (J2000)	Area (deg^2)
Deep	XMM-LSS[a]	02 : 25 : 00	−04 : 30 : 00	5.3
	E-COSMOS[b]	10 : 00 : 29	+02 : 12 : 21	7.2
	ELAIS-N1	16 : 10 : 00	+54 : 00 : 00	7.2
	DEEP2-3	23 : 30 : 00	+00 : 00 : 00	7.2
UD	E-COSMOS[a]	02 : 18 : 00	−05 : 00 : 00	1.8
	COSMOS[b]	10 : 00 : 29	+02 : 12 : 21	1.8

[a] SNLS-D1
[b] SNLS-D2

	# pointings	hrs per night	g	r	i	z	y
			(hrs / pointing)				
Deep	15	**nights**[a]	3.65	3.65	5.4	9.1	5.4
		5.8	1.4	1.4	2.1	3.5	2.1
		8.3	2	2	3	5	3
UD	2	**nights**[a]	2.4	2.4	4.8	6.5	6.5
		5.8	7	7	14	18.9	18.9
		8.3	10	10	20	27	27

[a] As a reminder, total number of nights allocated to the layer, in each band. Taken from table C.1.

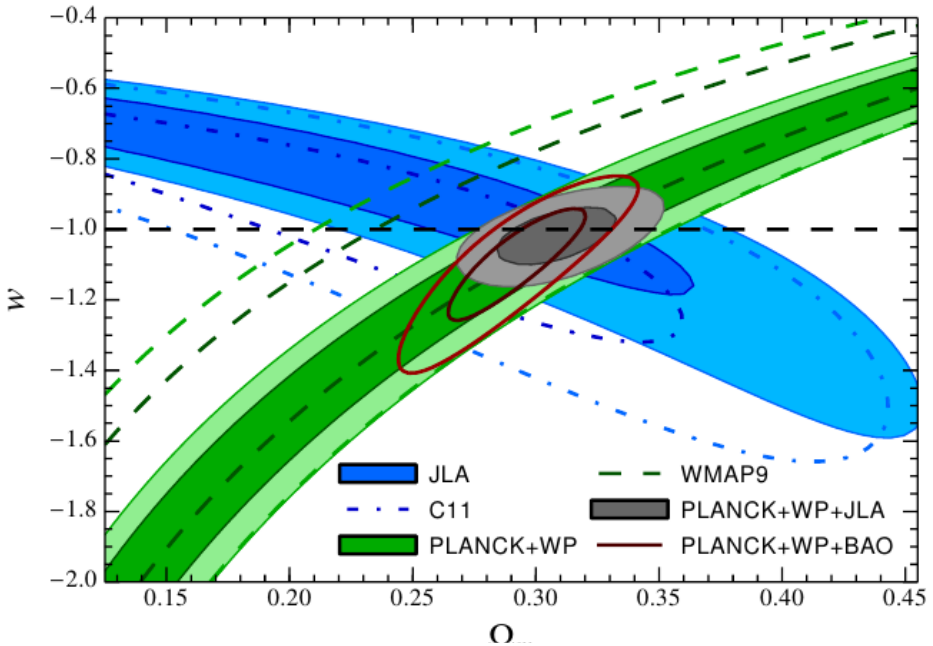
SNLS/SDSS-II Hubble diagram



(Betoule et al, 2014)

740 SNe Ia

SNLS/SDSS-II constraints on *w*

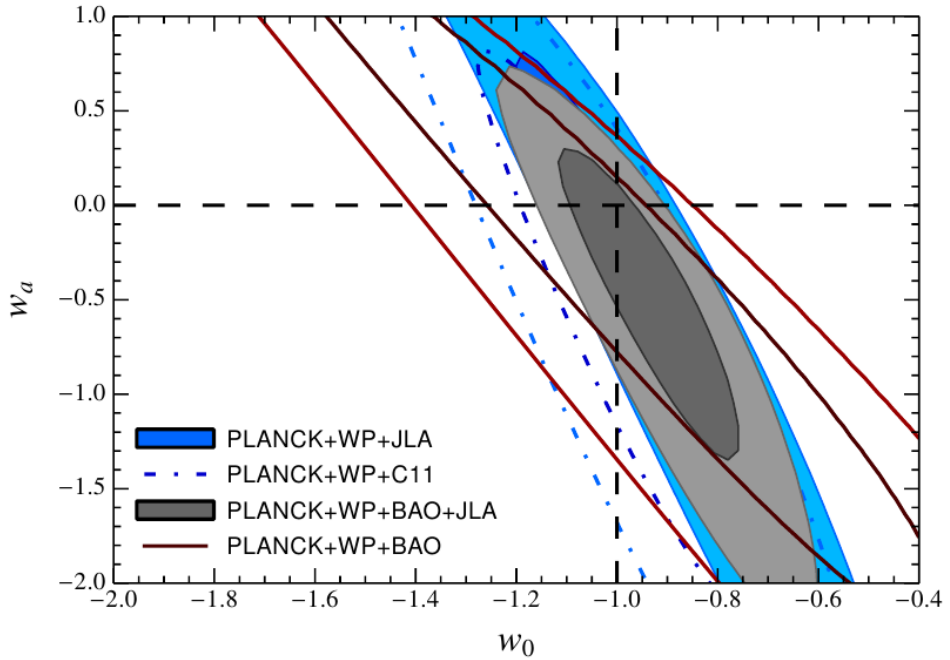


- Planck + SNe Ia

$$w = -1.018 \pm 0.057$$

- Note : Planck + BAO

$$w = -1.01 \pm 0.08$$

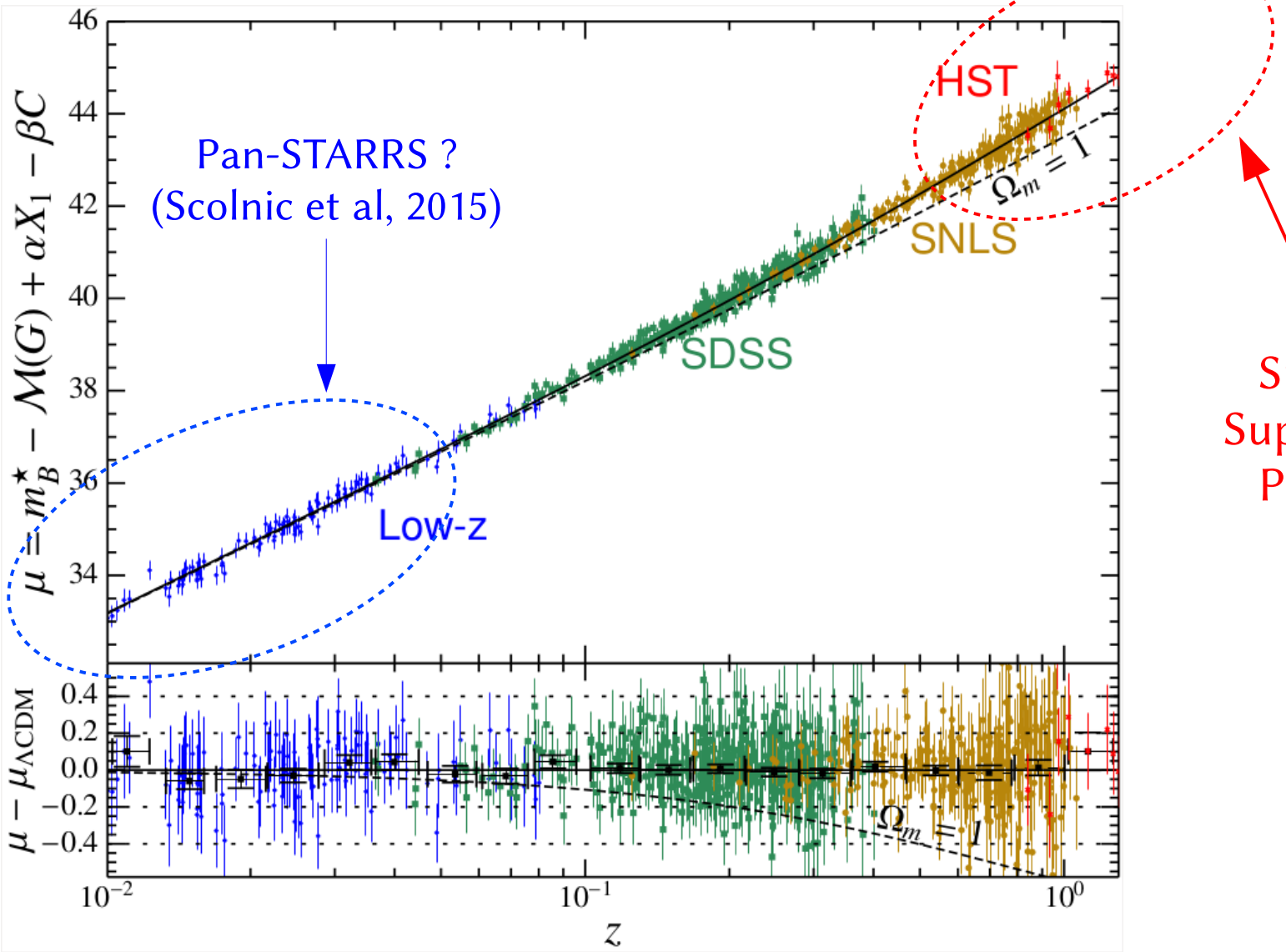


$$w(z) = w_0 - \frac{z}{1+z} w_a$$

No constraints (yet) on possible variations of w with redshift

(see also Suzuki et al '12, Rest et al '13, Scolnic et al '13...)

A SN rolling search with Subaru/HSC



Subaru Supernova Project

Betoule et al, 2014

Survey design

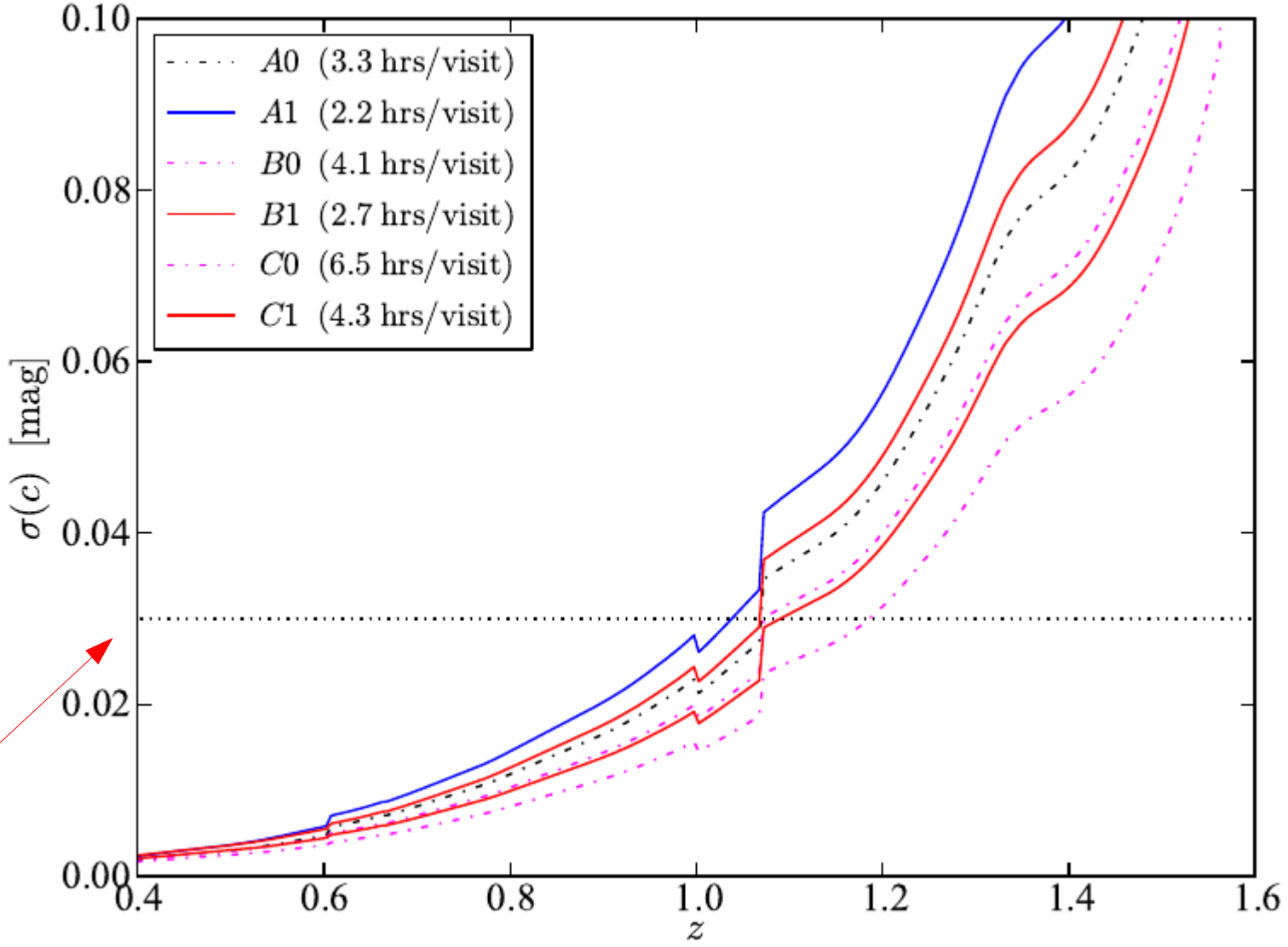
scenario	g	r	i	z	y	# hours / visit	cadence (days)	Δ (days)	# visits (nights)	$N_{\rm sem}$	# nights / sem / pt
	(seconds)										
SSP-A0	1254	1254	2508	3408	3408	3.3	10	120	12	2	6.8
SSP-A1	836	836	1672	2272	2272	2.2	10	180	18	2	6.8
SSP-B0	627	1671	3325	4497	4497	4.1	10	120	12	4	8.4
SSP-B1	418	1114	2217	2998	2998	2.7	10	180	18	4	8.4
SSP-C0	627	2715	5395	7289	7289	6.5	10	120	12	4	13.4
SSP-C1	418	1810	3597	4859	4859	4.3	10	180	18	4	13.4

Base plan

+5 nuits

+10 nuits

Resolution en couleur



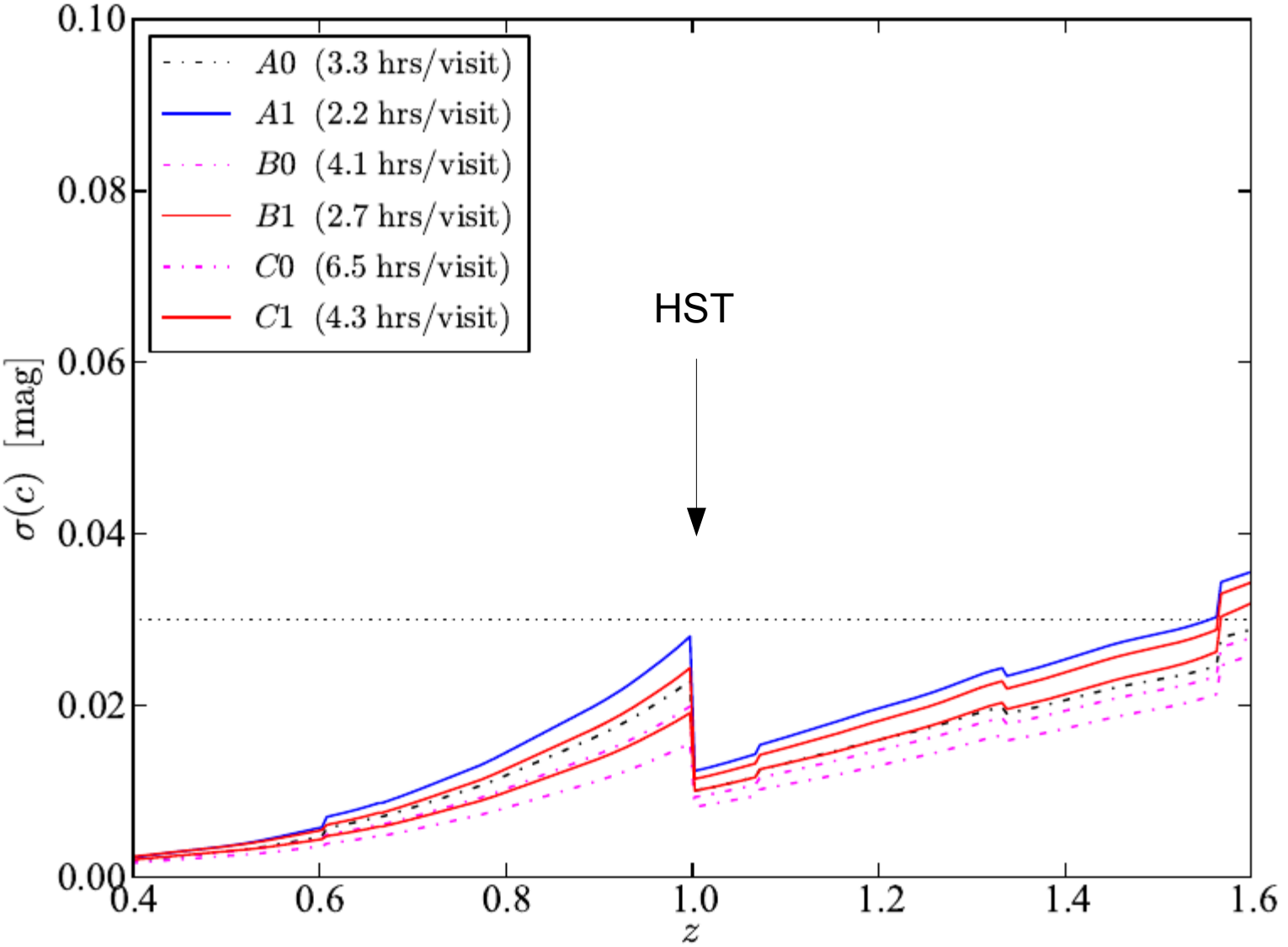
$\sigma_c \sim 0.03$

Survey design (preliminary)

- Retour equipe IPMU / Subaru
  - 2 semesters (6 months rolling / semester)
  - 2017A & 2017B
- Iteration sur le design en cours
  - Survey plus court mais plus profond
  - 150 – 200 SNe Ia jusqu'a $z \sim 1.1$ (Subaru seul)
  - Extension a l'etude : ~ 100 SNe Ia $1.2 < z < 1.5$

    (avec un point HST / SN)

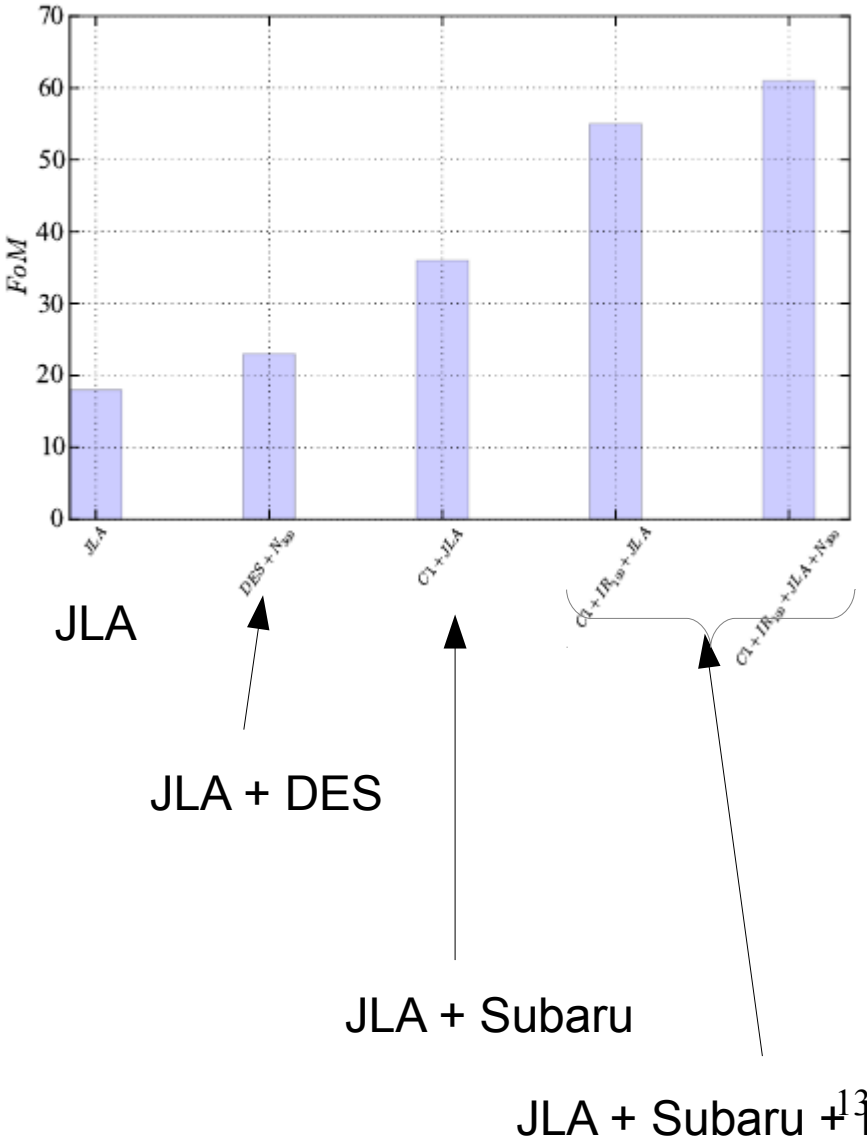
Resolution en couleur avec 1 pt HST (preliminary)



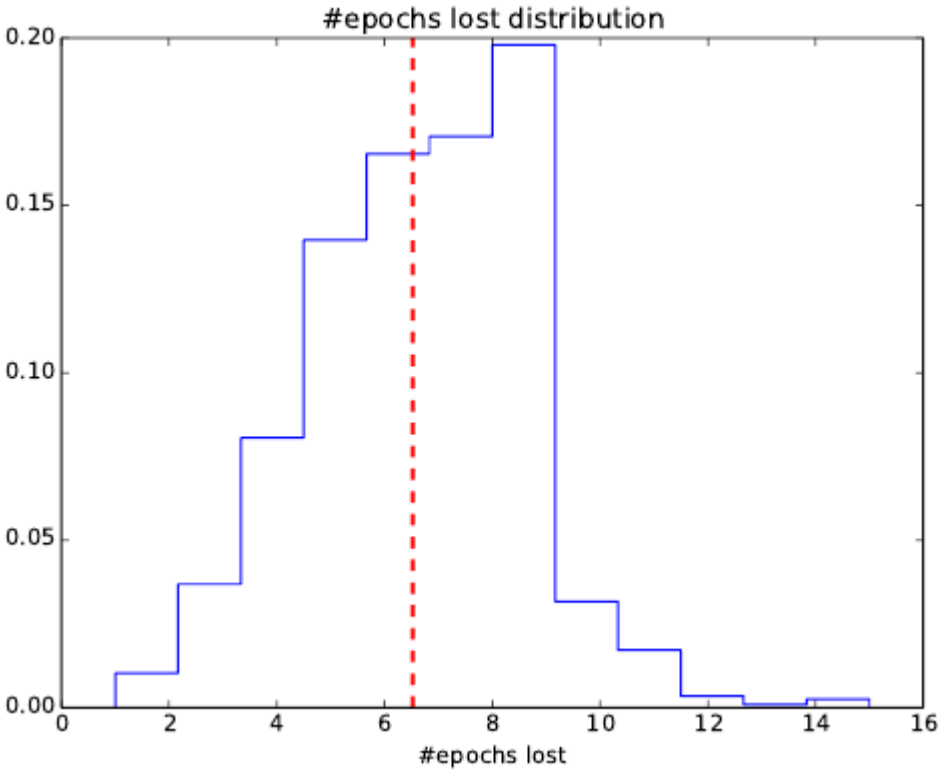
FoM attendue

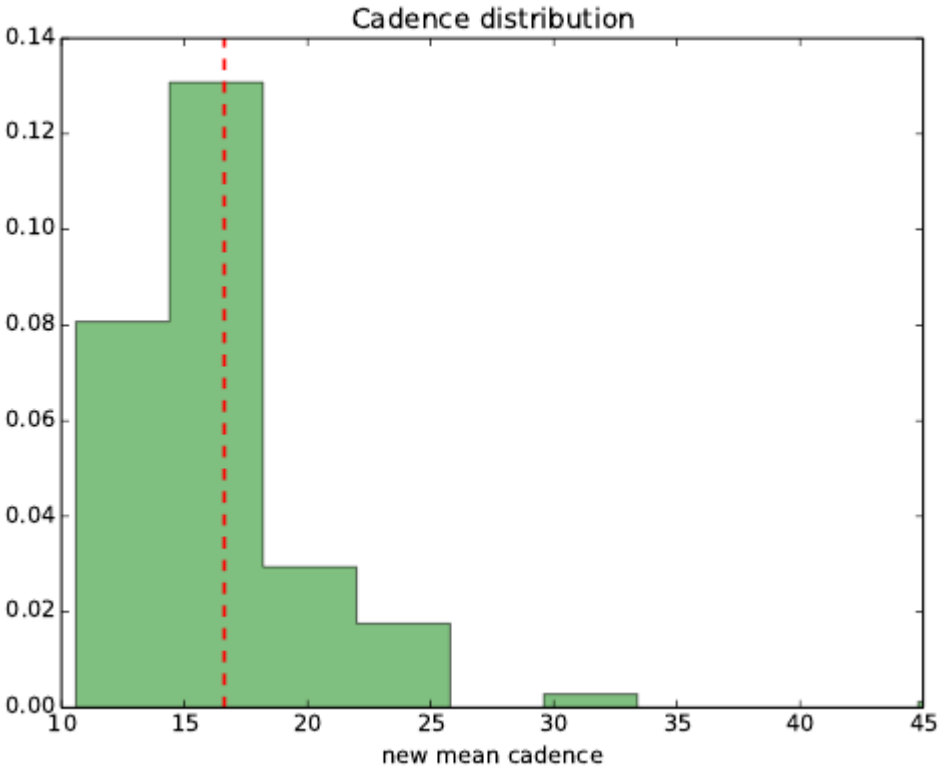
- FoM attendue :
  - JLA seul : 15
  - Subaru + JLA : 30 – 40
  - Subaru + JLA + JST : 60 – 70
- HSC competitif avec DES
- HSC + HST sensible a

  wa ≠ 0



Cadence and weather





Contributions discussed

- Participation to the survey design
- SN photometry + survey calibration
  - Code (derived from SNLS + early LSST pipeline)
- SN light curve analysis (SALT+)
- Spectroscopy @ VLT
  - FORS2 / VIMOS
  - No live spectral identification (too expensive)
  - But spectoscopic redshift of host galaxies

Timeline

- Short term plans (⟶ mid 2016)
  - Forecast paper (Suzuki, Regnault et al, in prep)
  - SNLS Photometry pipeline ⟶ Subaru/HSC dataset
  - mid 2016 : proposal Subaru (additional time)
  - External collaborator agreement(s)
- Then
  - Dec. 2016 ⟶ Jan 2018 : data taking
  - 2018 - 2019 : cosmology analysis