Calibration

N. Regnault et al

(PCWG group)

PCWG

- Photometric Corrections Working Group
  - Interface between LSST Project (in charge of delivering the survey calibration) and DESC (end users)
- PCWG Home
  - Agenda & Tasks
  - lsst-desc-calib@slac.stanford.edu → inscrivez-vous !
- Telecons:
  - ~ once a month, on Thursdays 5pm (France)
- Recent meetings
  - Feb. 2017: Boston (DESC + project)
  - Mar. 2017: DESC collab week (SLAC)

Roadmap

Low hanging fruits

Challenging but critical

PC1
Required precision

LPNHE, LAL, ..
SLAC, Harvard, UW....

PC2
Galactic extinction

SLAC, ...

PC3
Instrument Model

SLAC, Brookhaven, ...

PC4
Survey Uniformity

CPPM, LPNHE, ...
SLAC, UW, Princeton, ...

PC5
Atmospheric
extinction

LAL..
SLAC, Harvard, ...

PC6
Physical
Flux Calibration

LPNHE, LUPM, CPPM, ...
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PC1 : “required precision”

- DESC version of LSST calibration requirements

  ⟶ important for LSS (via photo-z) : uniformity

  ⟶ crucial for SNIa science (flux calibration)

- X-project with SNWG
  - Estimate, for a “LSST-like SNIa survey”

    ⟶ the sensitivity of the SN luminosity distances to

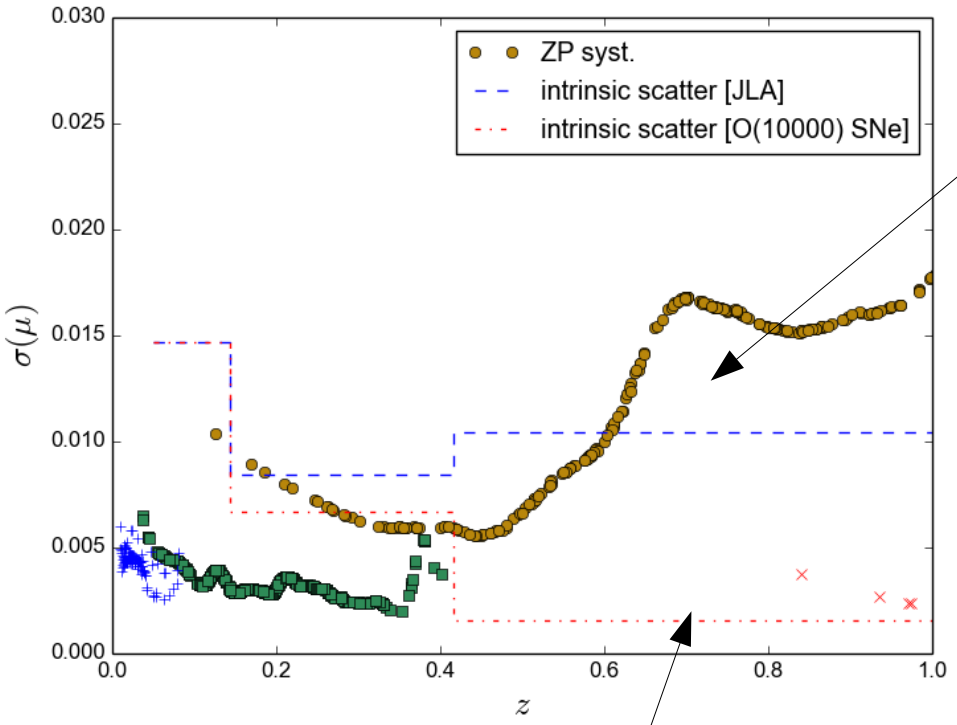
    - zero-points
    - filter positions / fronts

      (including the training of the SN light curve fitter (e.g. SALT)

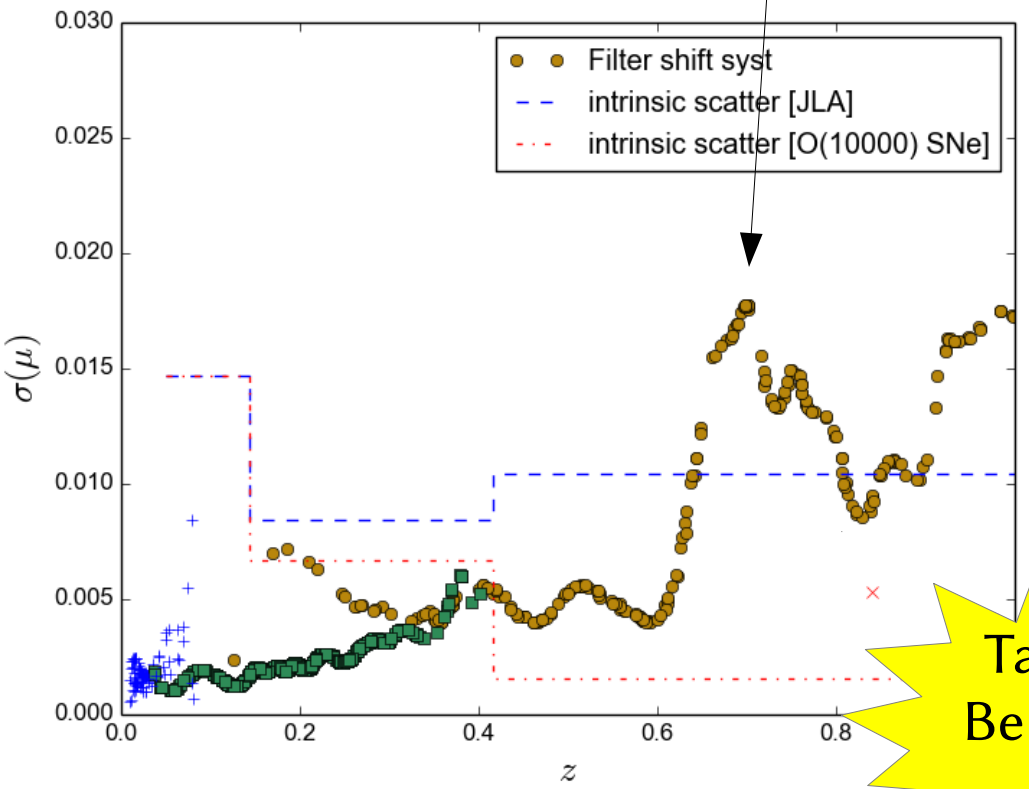
    ⟶ impact of calibration uncertainties on cosmology

As an illustration

JLA : propagation
of MegaCam ZP uncertainties
(5 mmag)



JLA : propagation
of filter position uncertainties
(1 nm, uncorrelated)

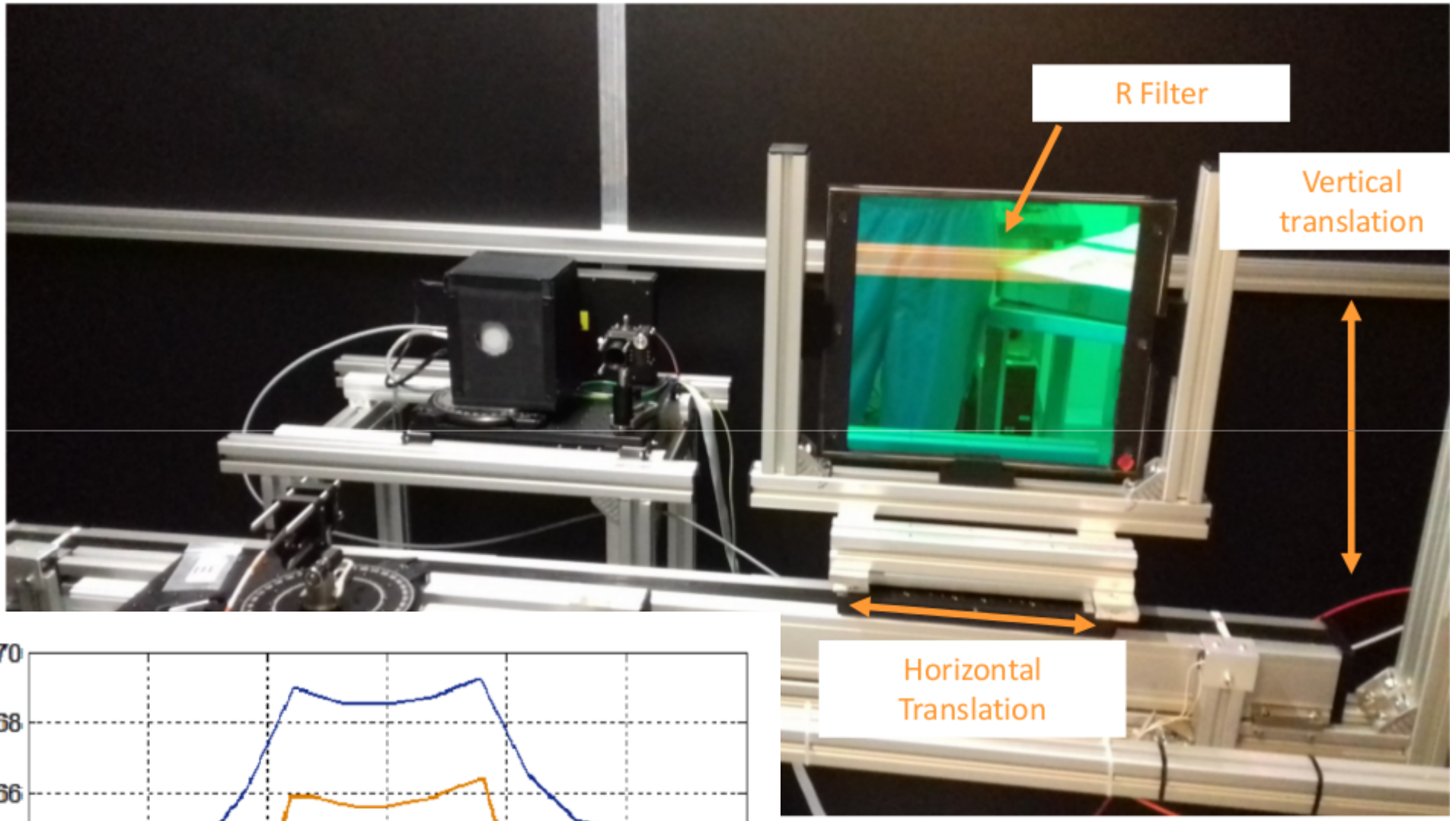


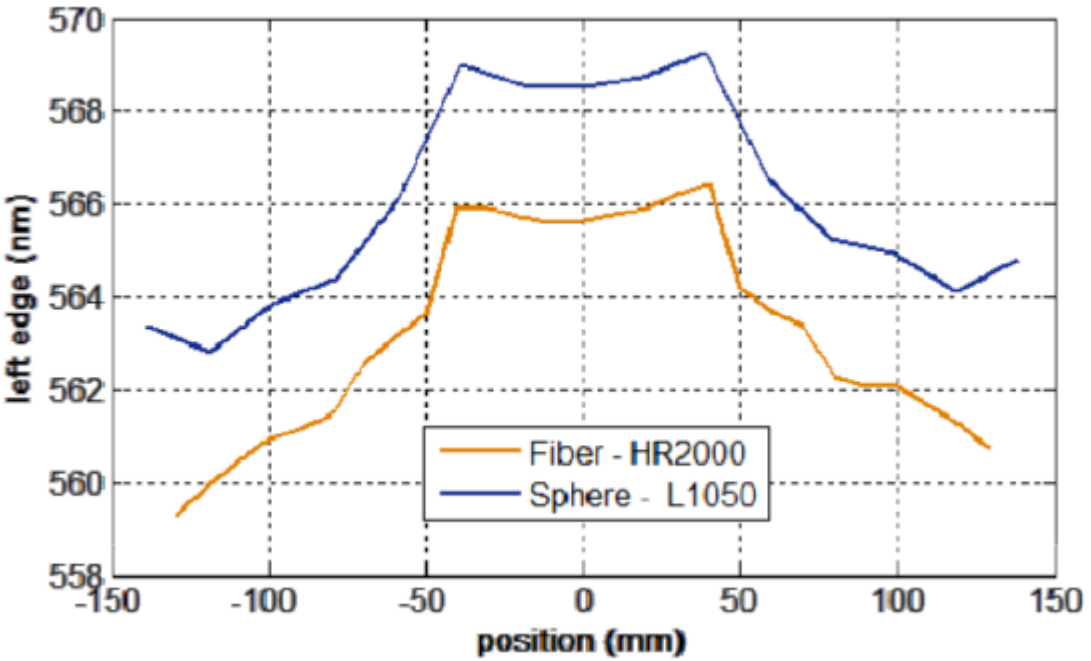
Level of statistical
uncertainties expected
with O(10^4) SNe

Talk
Benoit

PC1 : “required precision”

- Goal
  - Same analysis on a realistic LSST SN survey
  - Integrated with Metric Framework
- Project presented at Oxford (PCWG, SNWG)
  - Clermont (cadence / realistic survey Simulation)
  - LPNHE (SN simulation, FoM)


R Filter
Vertical translation
Horizontal Translation


570
568
566
564
562
560
558
left edge (nm)
-150
-100
-50
0
50
100
150
position (mm)
Fiber - HR2000
Sphere - L1050

Talk Benoit

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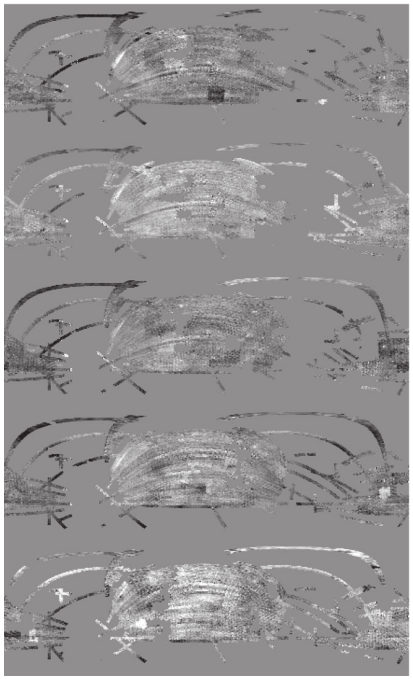
PC4 : survey uniformity

- Méthodes à la “Ubercal”
  - Utiliser redondance ⟶ déterminer
    - magnitudes
    - paramètres de calibration



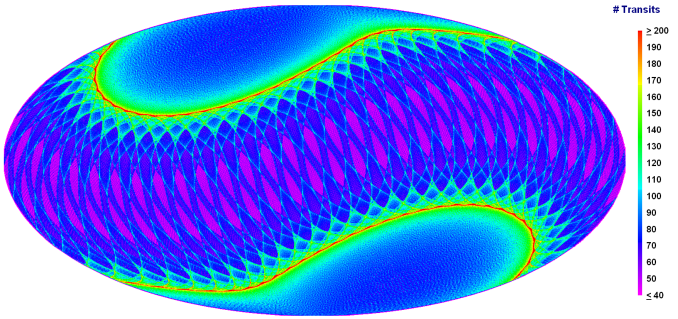
SDSS vs. PanSTARRS
(Schlafly et al, 2013)

~ 1%

mais

certains modes
mal contraints

- GAIA comme catalogue externe
  - Spectro basse résolution
  - Uniformité ~ 0.1%
  - Implications ⟶ cadence



~0.1% probable
(à démontrer)

PC4: survey uniformity

- Marseille group working on a Ubercal simulation:
  - Given a simulated survey:

$$m_i = m(ra,dec) + \delta zp(t,ra,dec) + constraints$$

Measurements $O(10^8)$

Parameters $(O(10^6))$

Parameters $(O(10^4))$

  - Build the Fisher matrix of the model above
  - extract the dominant error modes on the sky (i.e. diagonalize the zp matrix)
  - Compare with what GAIA expects

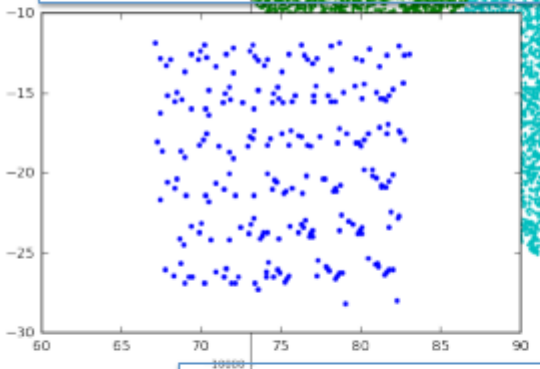
Talk Fabrice

PC4: survey simulation

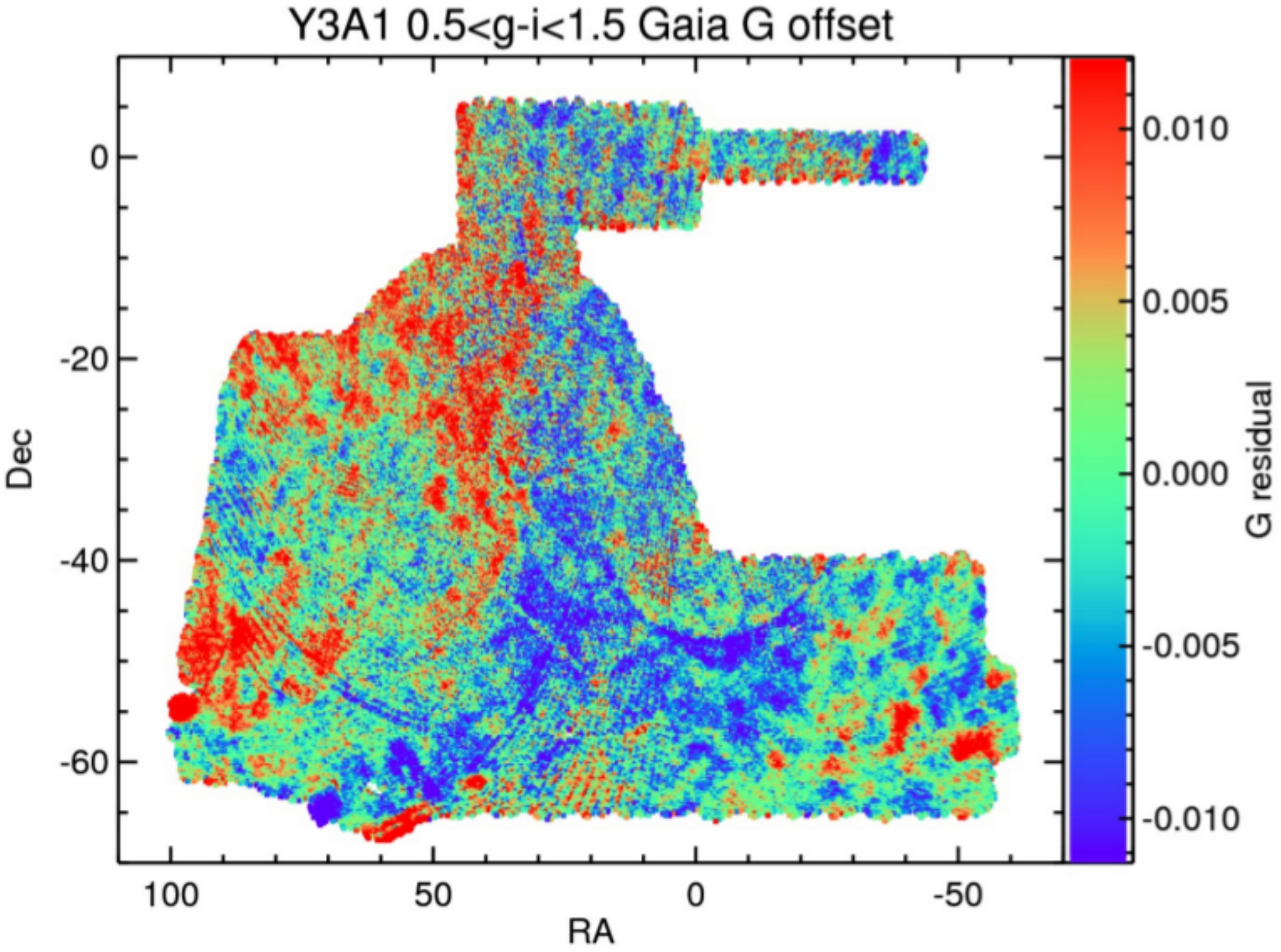
- Since the last SLAC meeting:
  - PCWG now in charge of discussions with GAIA
  - on behalf of the Project
- Roadmap
  - Push analysis presented above (modes of Ubercal)
  - Re-engage GAIA (our previous correspondants + Heidelberg)
  - Goal : obtain expected dominant modes from GAIA, or the information to estimate them.
  - Report at next DESC meeting (July)

Observation simulation

Opsim pointing, dithering
250 deg2 patch (1/100th sky)
night #: from 100 to 400



Simulated camera fields:
LSST focal plane with CCD #
HEALpix patches of GUM stars
=> star list for 426 visits
over 22 nights


Y3A1 0.5<g-i<1.5 Gaia G offset
0
-20
-40
-60
Dec
100
50
0
-50
RA
0.010
0.005
0.000
-0.005
-0.010
G residual

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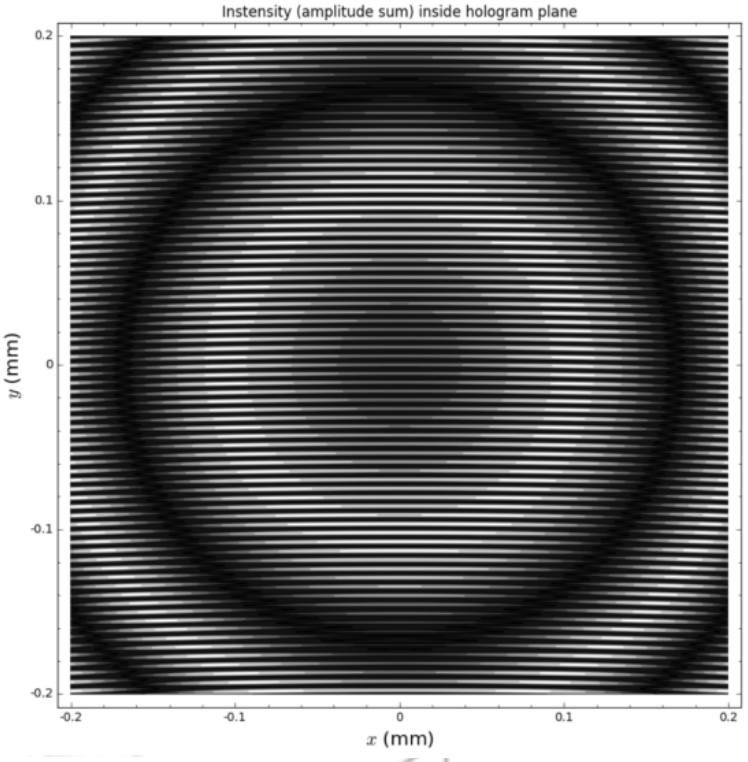
PC5 : Atmospheric Extinction

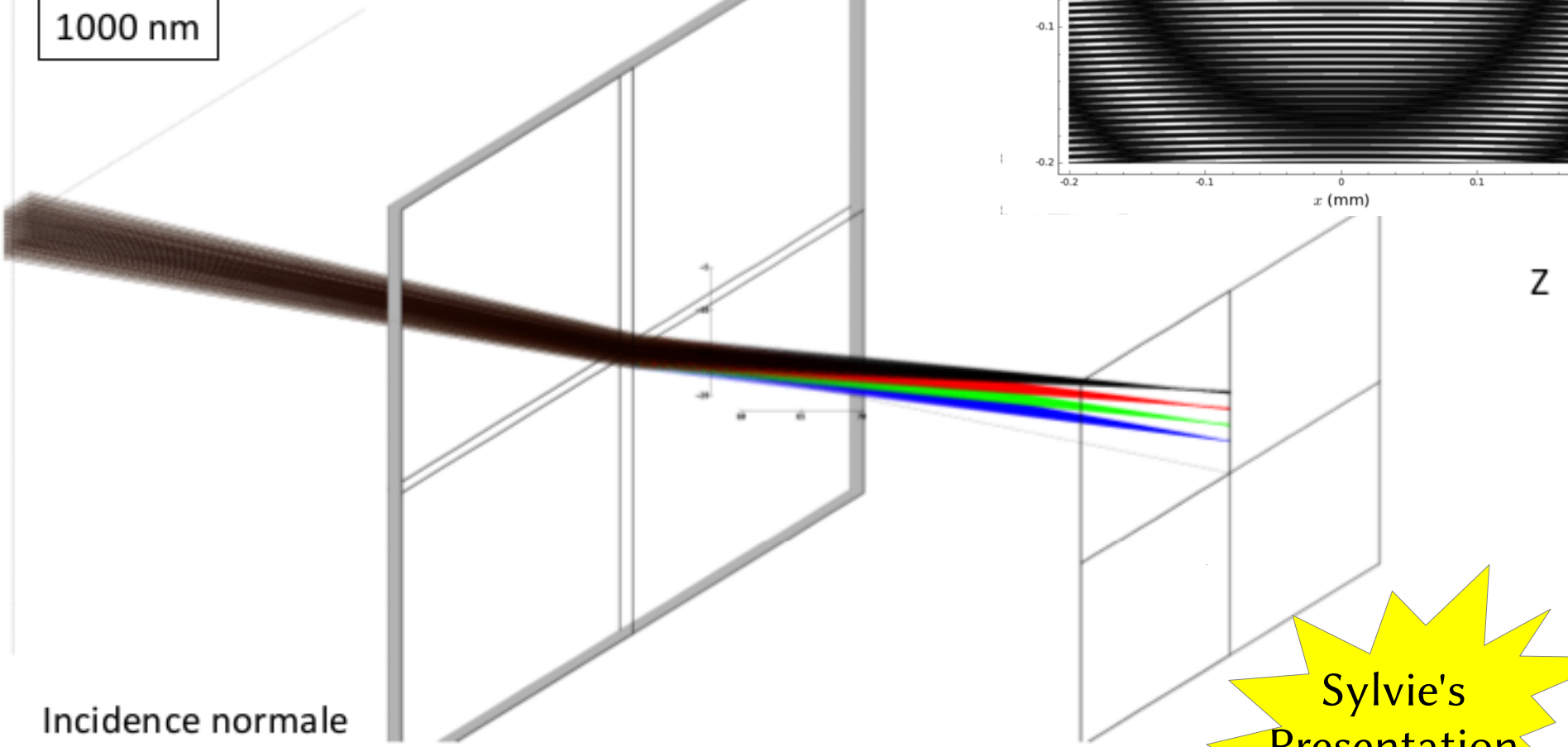
- Work by Sylvie and Kirk on model comparison
  - Modtran vs. libRadTran
  - To be concluded soon
- LAL group working in close connection with the Project (Stubbs group + Ingraham) on
  - Design of auxiliary telescope
  - Analysis of test data @ CTIO

Simulation de la dispersion du
l'hologramme « 200 lign

400 nm
600 nm
800 nm
1000 nm

BeamFour software





Incidence normale
// axe optique

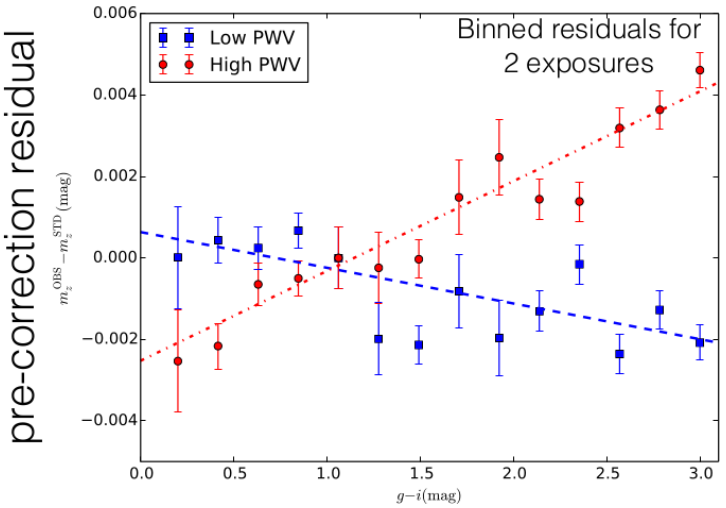
Sylvie's Presentation

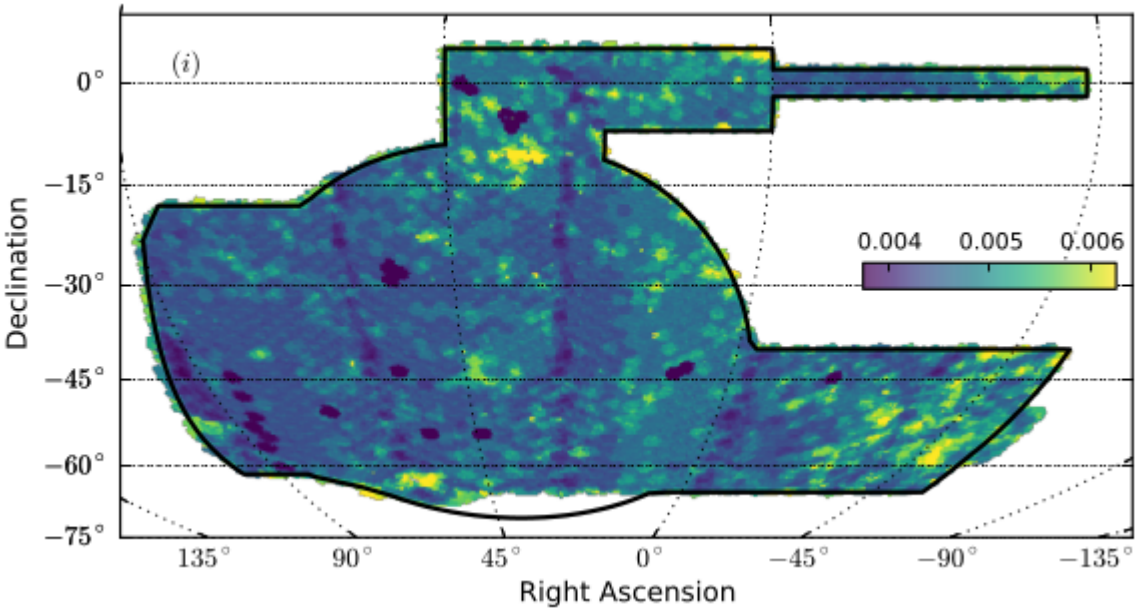
PC5: Atmospheric extinction

- Major progress reported by DES: FGCM

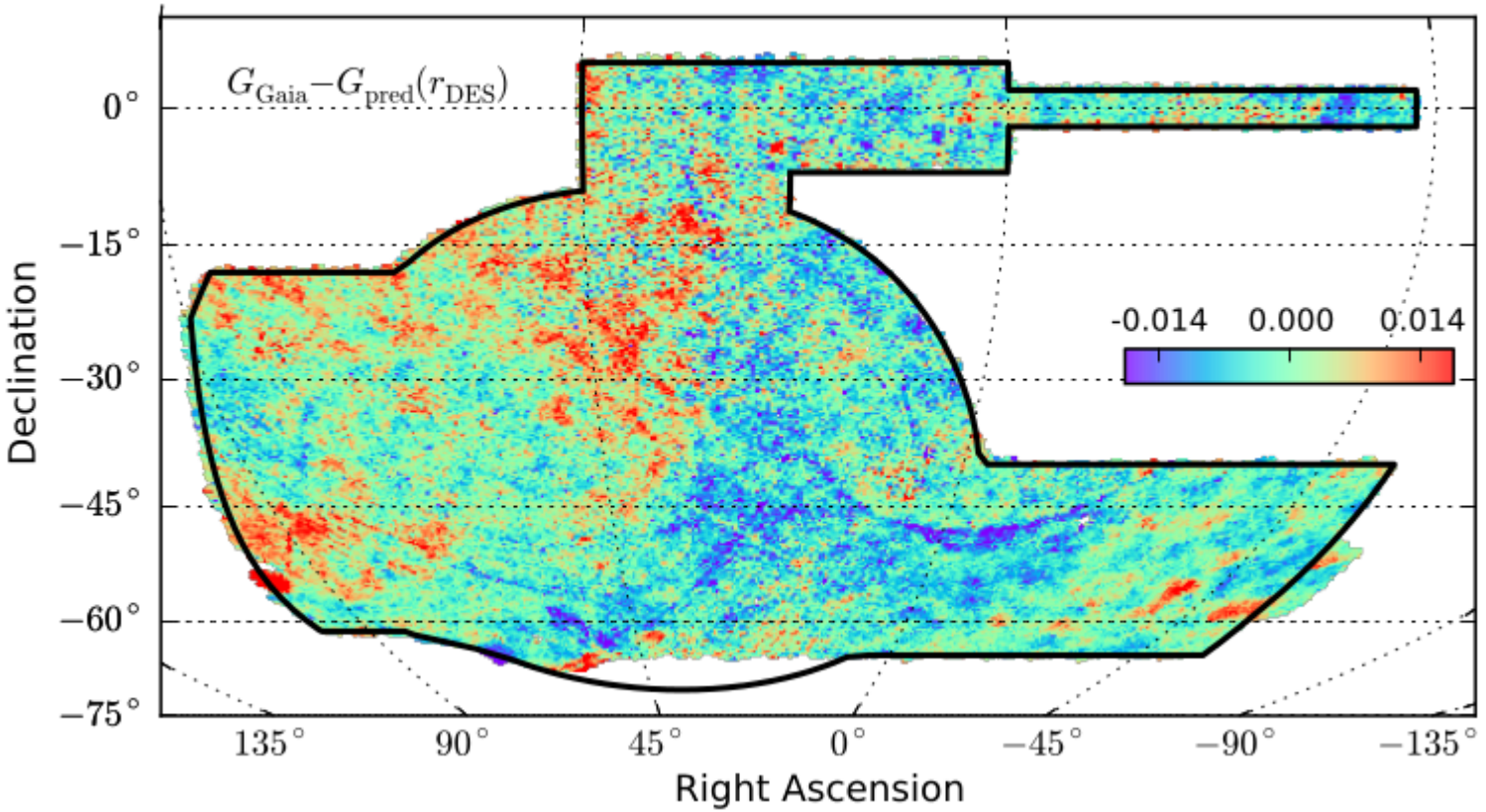
  (see E. Rykoff slides at the Boston Meeting)

- Ubercal + first order expansion of atmosph model
  - constraints on atmosphere model from survey photometry alone





Comparing to Gaia G



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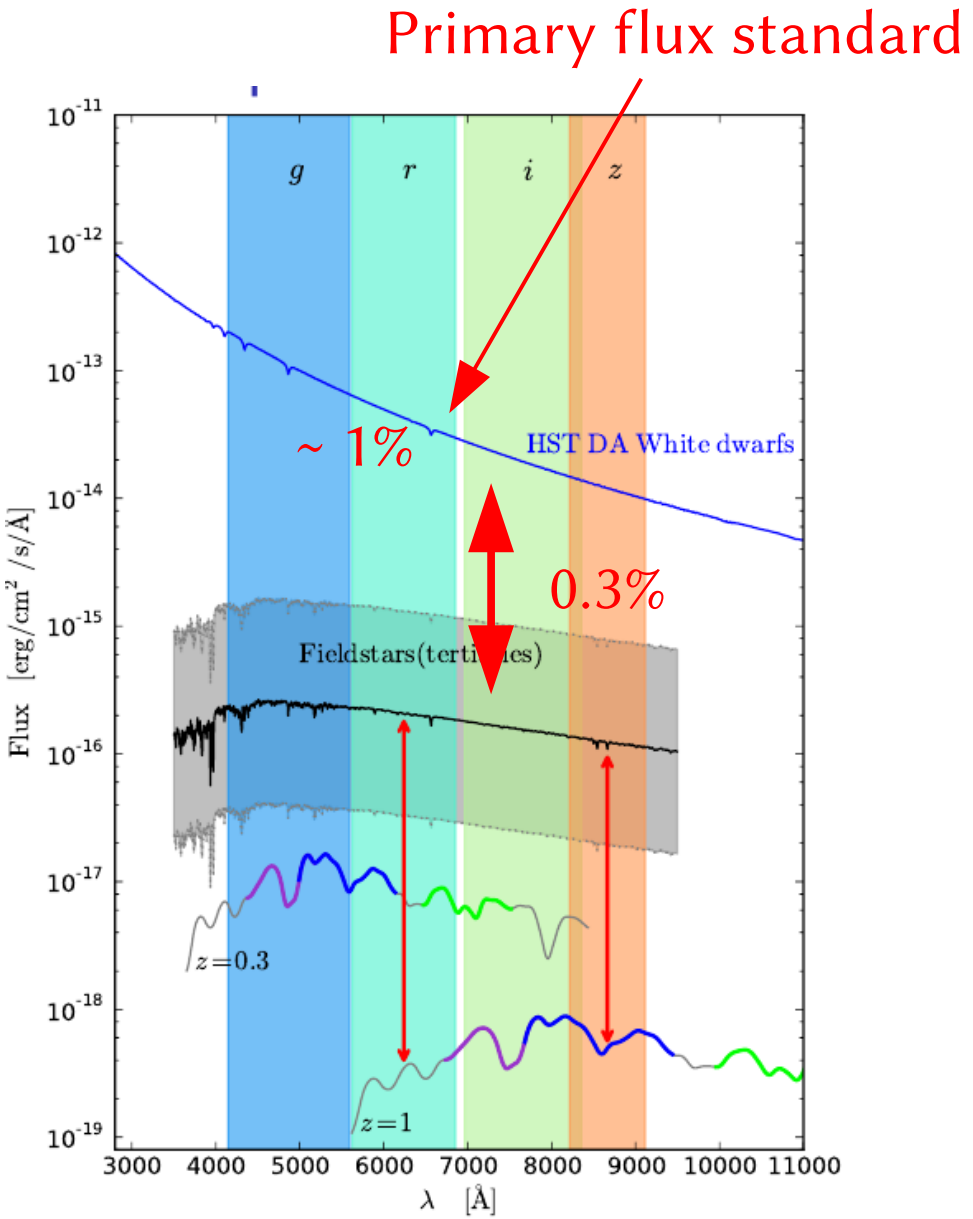
PC6 : Physical Flux Calibration

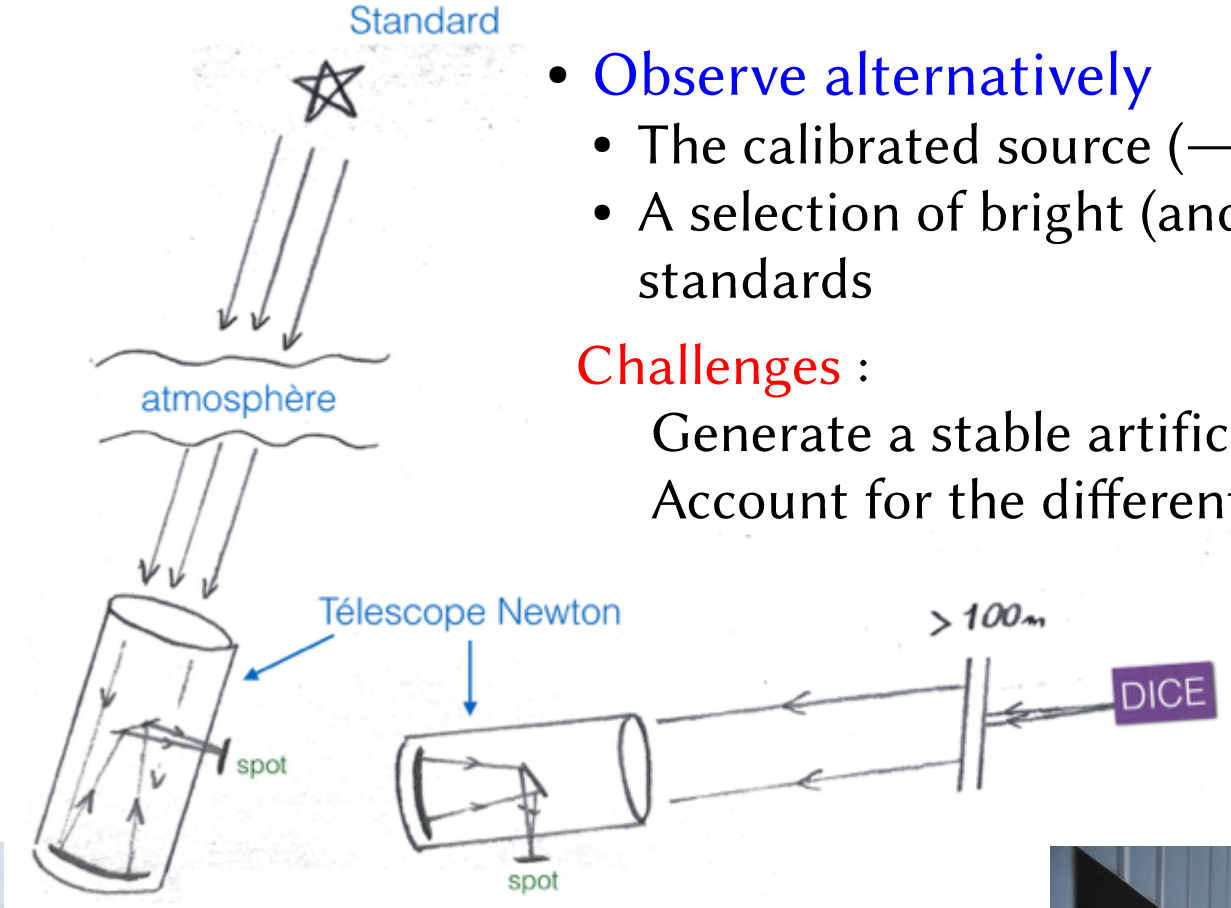
- Connecter
  - flux instrumentaux uniformisés (en pseudo ADU/s)
  - à des flux physiques (à une échelle grise près)

Francois' Presentation



... 2017

Methodology



- Observe alternatively
  - The calibrated source (⟶ star on the focal plane)
  - A selection of bright (and faint) CALSPEC standards

Challenges :

Generate a stable artificial point source

Account for the differential extinction

Progress

- Simultaneous observations of
  - LED source @ 250-m
  - CALSPEC stars

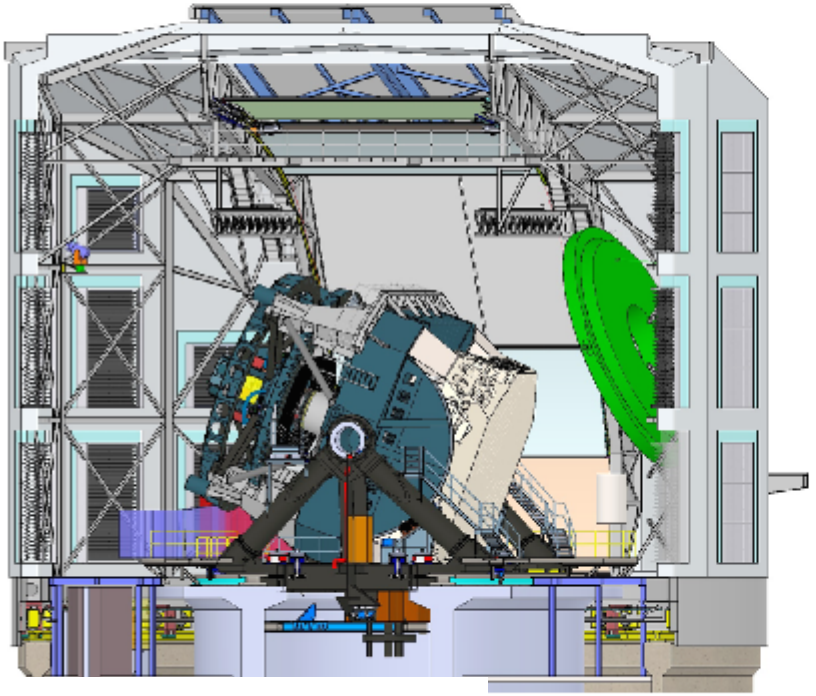
  $\longrightarrow$ analysis of the entire dataset (Bench + OHP data)

  $\longrightarrow$ ~ 5% reported so far (mainly because no model of the LED source at that time)
- Goals for this year
  - run(s) @ OHP in June with existing setup
  - Target : 1% (challenging!)

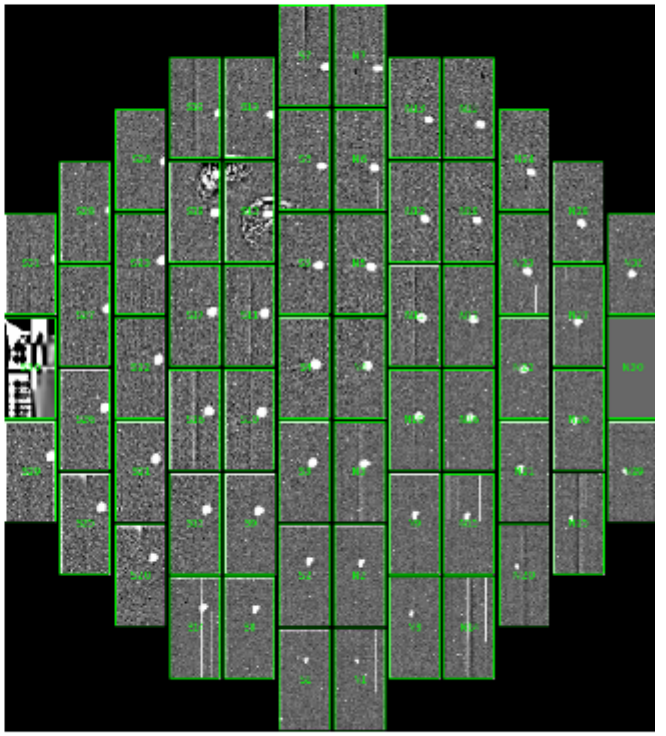
Demonstrated CBP Concept

www.lsst.org

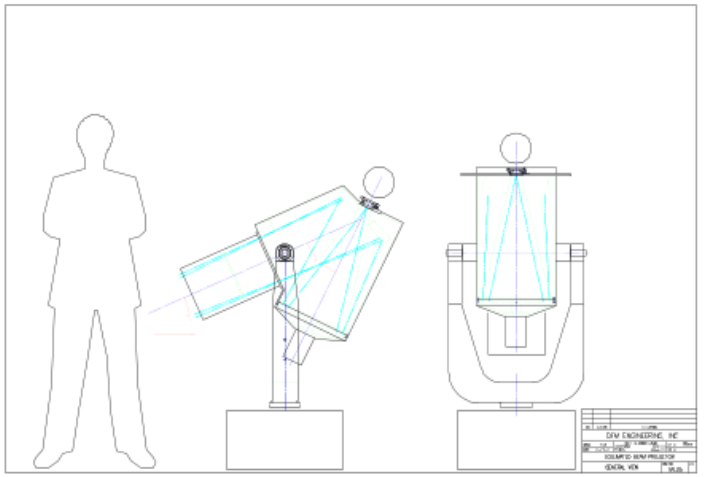
- Demonstrated concept for Collimated Beam Projector
  - See Coughlin et al SPIE paper



pe Devries



DECam data processed using the DM stack by Robert Lupton and Merlin Fisher-Levine



Iterating on design

→ switch back to tunable laser ?

→ goals:

- follow-up of filters
- uniformity tests

See P. Ingraham + N. Mondrik slides (Boston)

Conclusion

- Projects & teams well identified
- Collaborations at the Institute level
  - Ex: DICE (LPNHE+CCPM+LUPM+LAL), GAIA (CCPM+LUPM) ...
- Ambitious goals for 2017
  - Survey uniformity / GAIA (PC4)
  - Flux scale / DICE (PC6)
  - Requirements for SN survey (PC1)
- To discuss:
  - Level of integration with US community ?
  - telecons schedule ?