Papers : ZTF release & Subaru

Outline

1) **Introduction**
2) **Subaru Strategic Program, SN detection**
   a) Cadence, COSMOS season, SXDS season
   b) SN detection
   c) Redshifts (AAT, DESI,)
   d) SN dataset -> plot of the redshift distribution
3) **Instrument and dataset**
   a) Instrument, CCDs and filters
   b) Dataset
      i) COSMOS (5 pointings)
      ii) SXDS (4 pointings)
      iii) References and reference depth
4) **Pipeline**

   Raw exposures -> lightcurves
   a) Detrending :
      i) detrend frames (master bias / master flat fields)
      ii) Defringing in Y
      iii) Scattered light in Y
      iv) Brighter-fatter
   b) Source detection, photometry & PSF
      i) PSF residuals ? << PFL ?

c) Scene modeling

   i) Explain the method
   ii) Image selection
   iii) Relative astrometry
   iv) Relative photometry
   v) Scene modeling loop

5) Calibration

   a) Standard calibration path (Lemaitre)
   b) Calibration aperture catalog

6) Light curve quality / data release description

   SALT fits

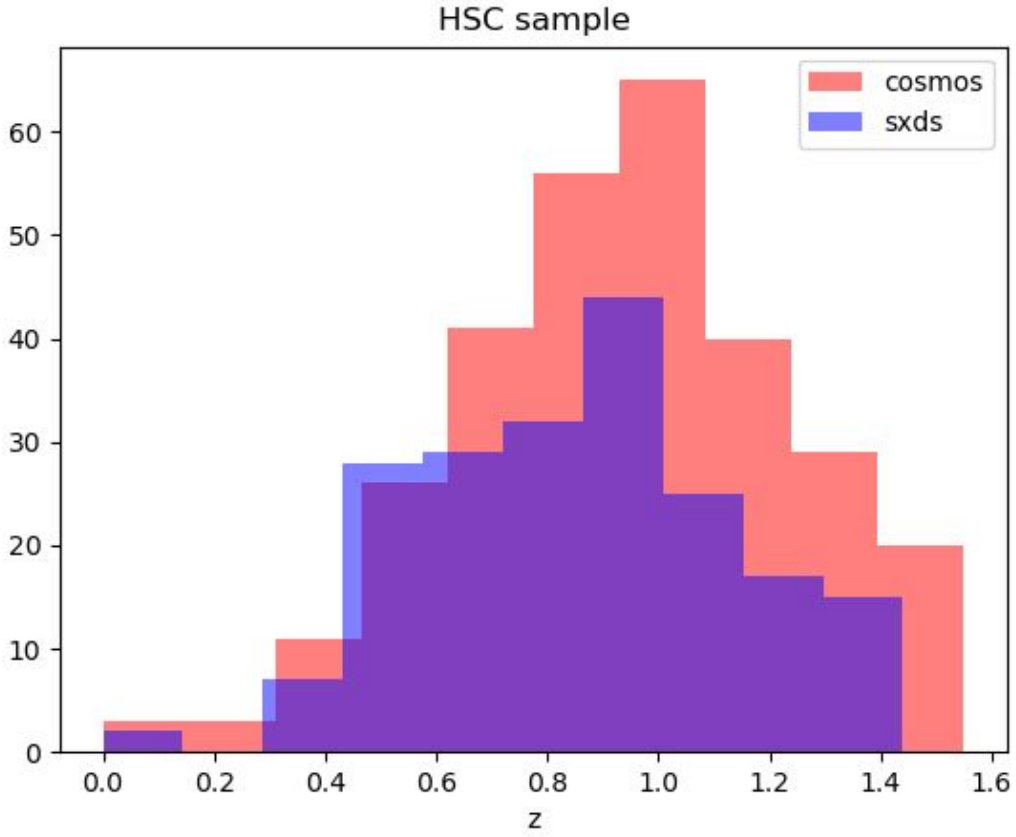
   Light curve quality (statistical)

7) Discussion

1) BF correction works well (double check)
2) Filters model the fluxes (color-color plots)
3) Uncertainty budget

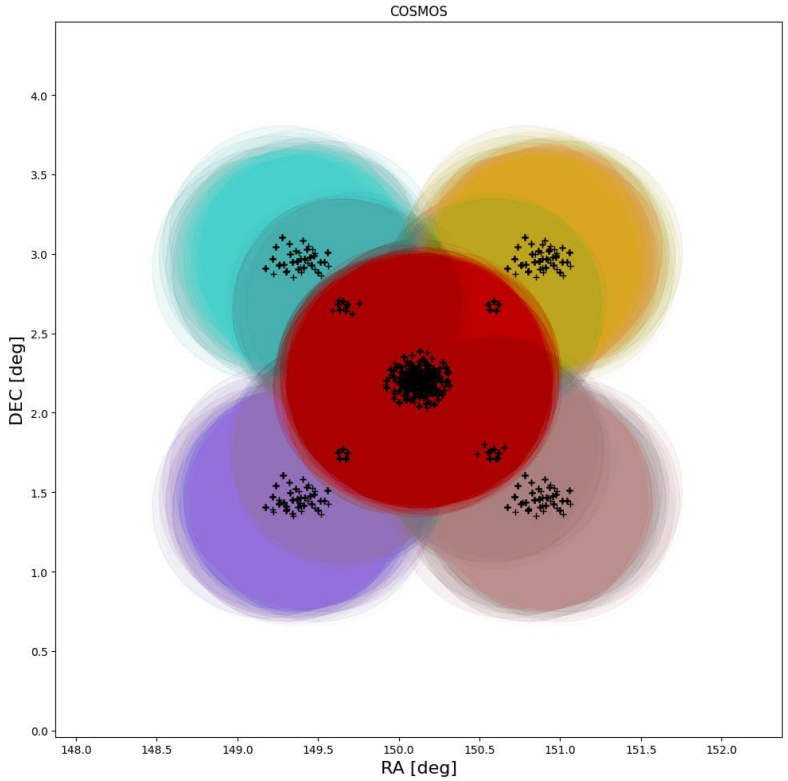
Subaru / HSC

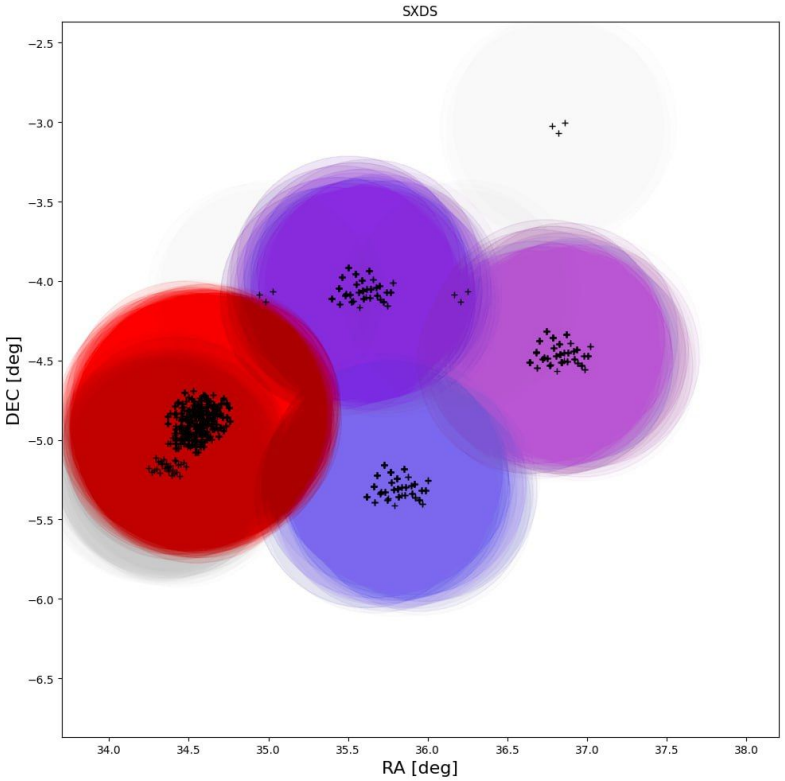
- Very high redshift dataset
- Discovered and followed-up with Subaru / HSC



Two pointings

- COSMOS & SXDS



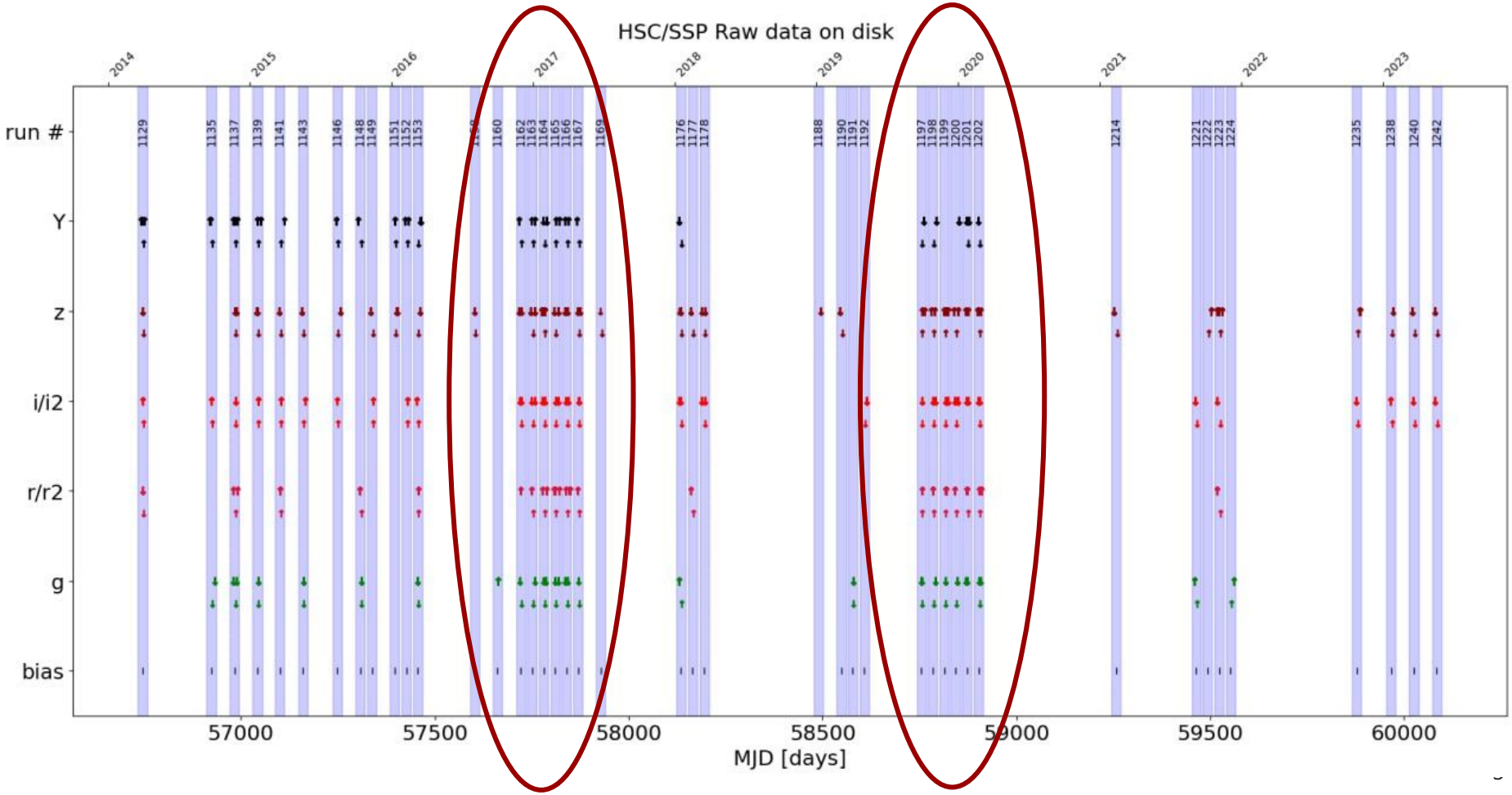


2 seasons

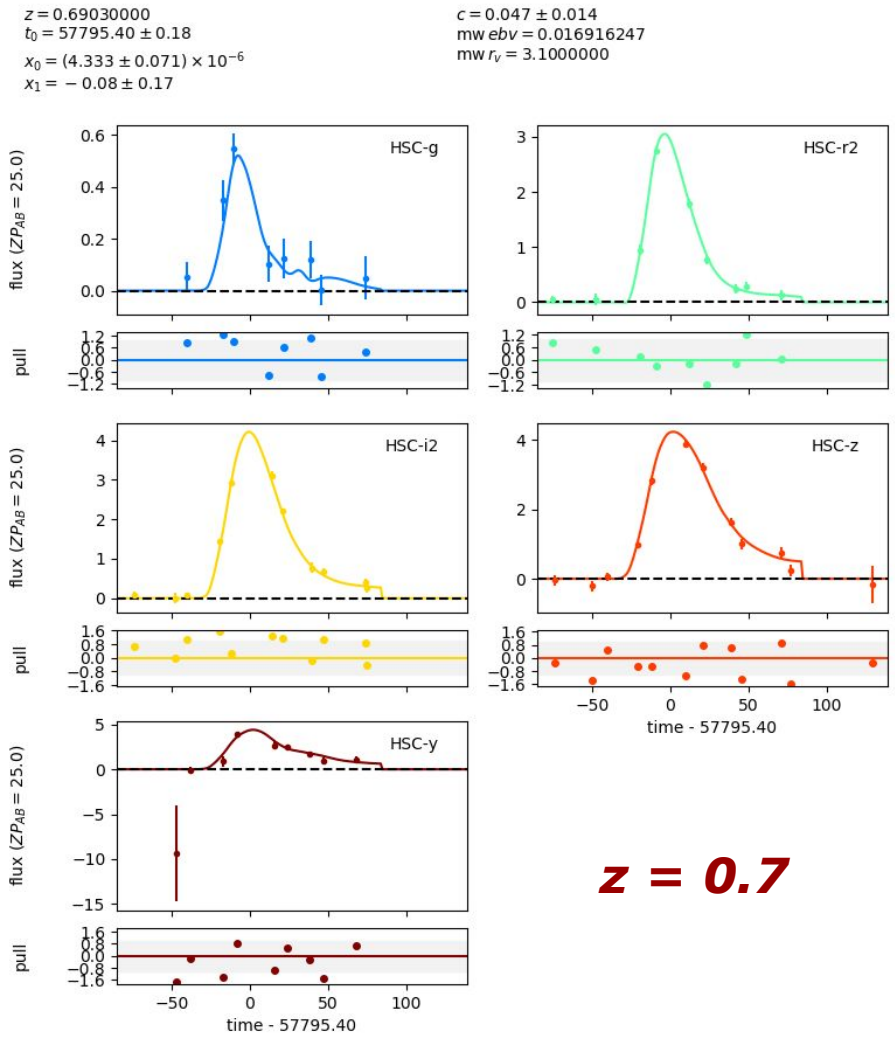
COSMOS

SXDS

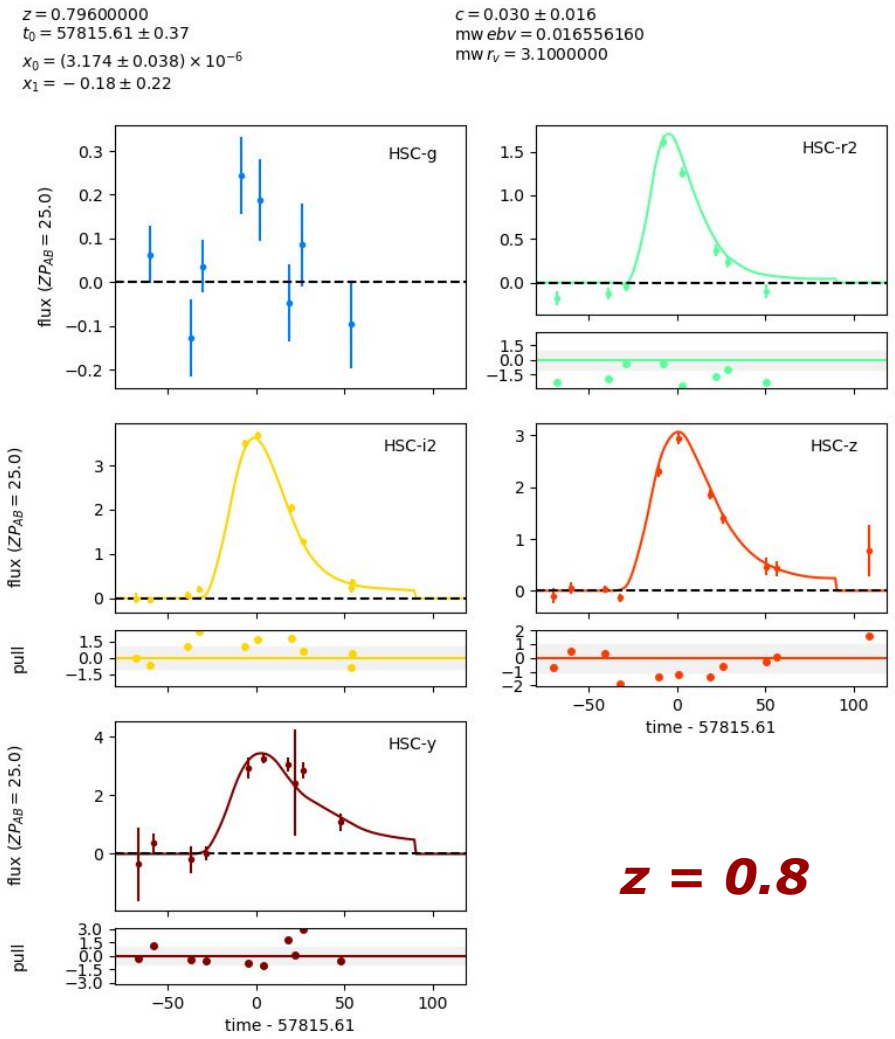
- => shallow references



Great light curves

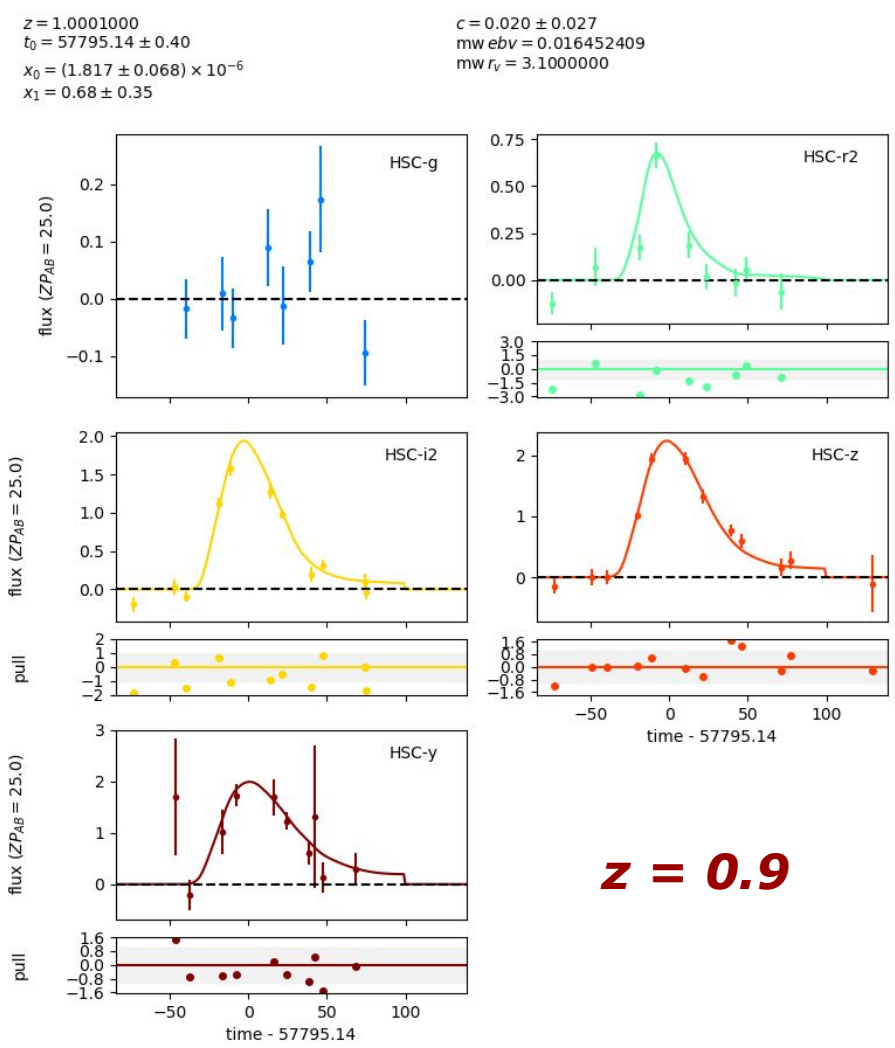


z = 0.7

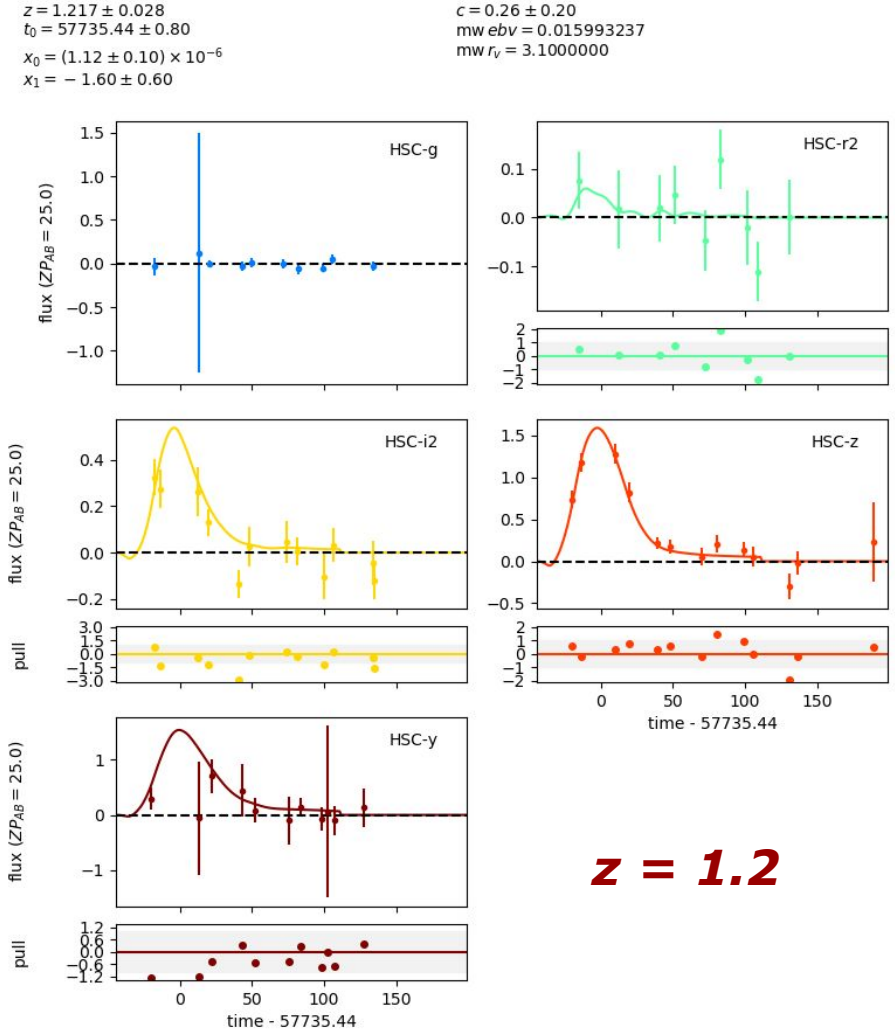


z = 0.8

Great light curves

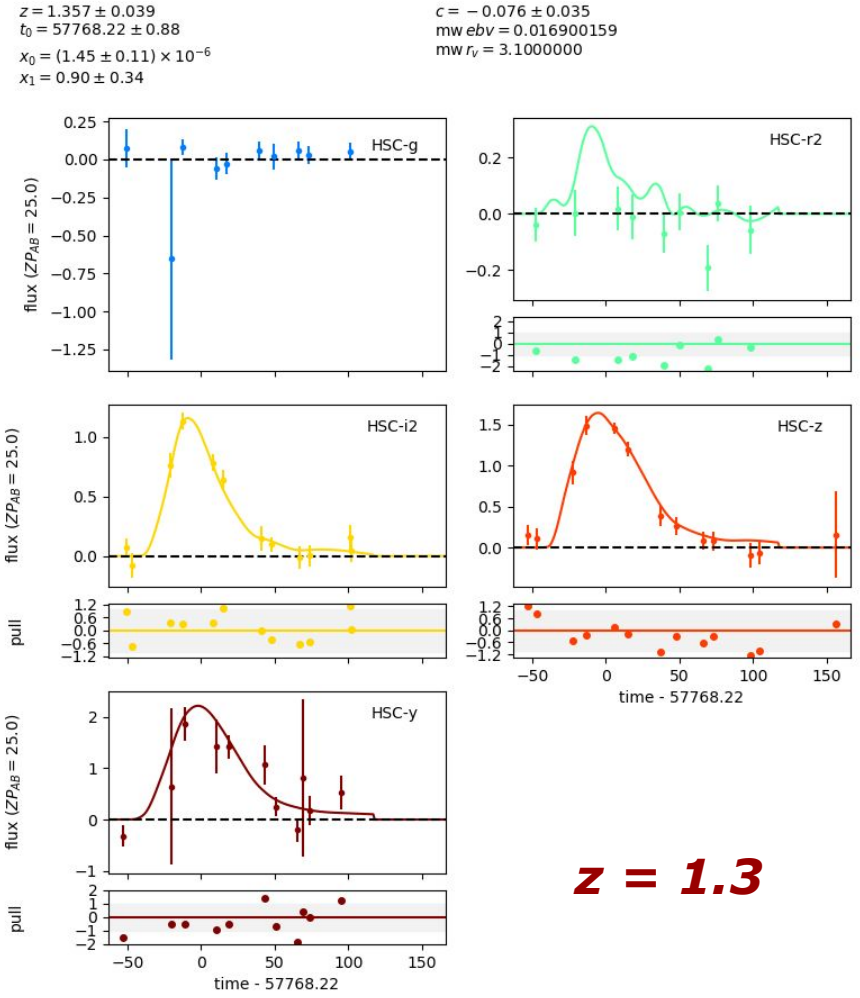


z = 0.9

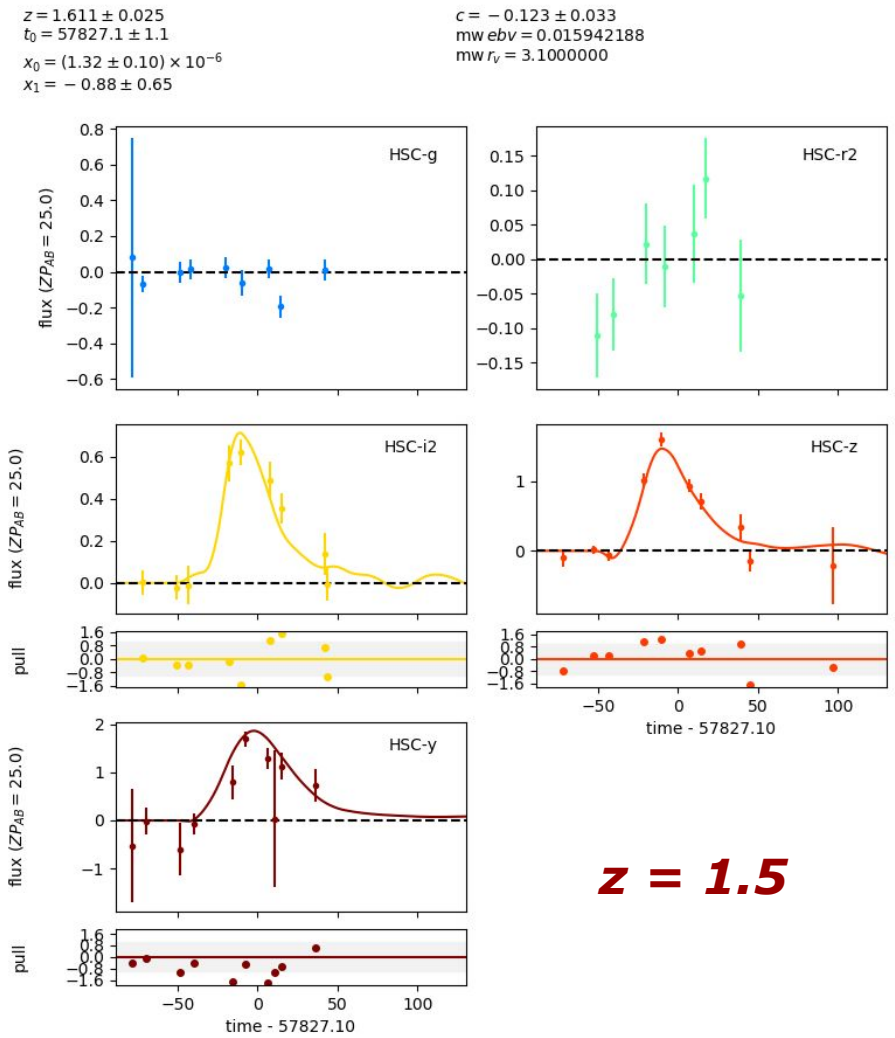


z = 1.2

Great light curves



z = 1.3

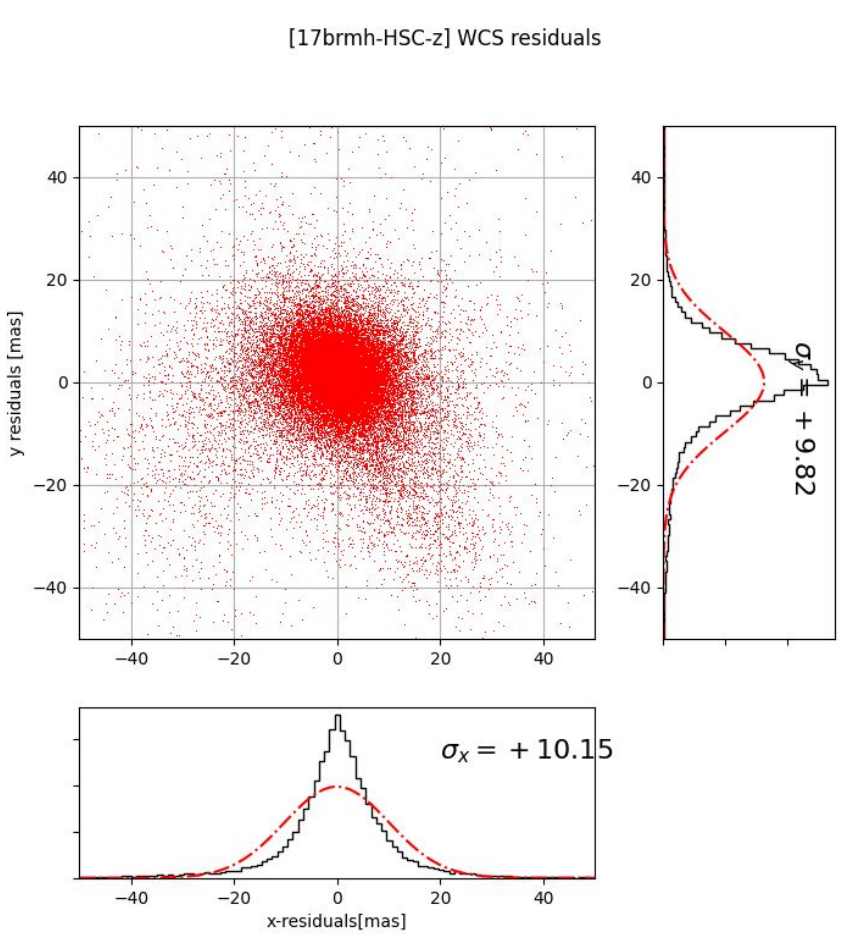


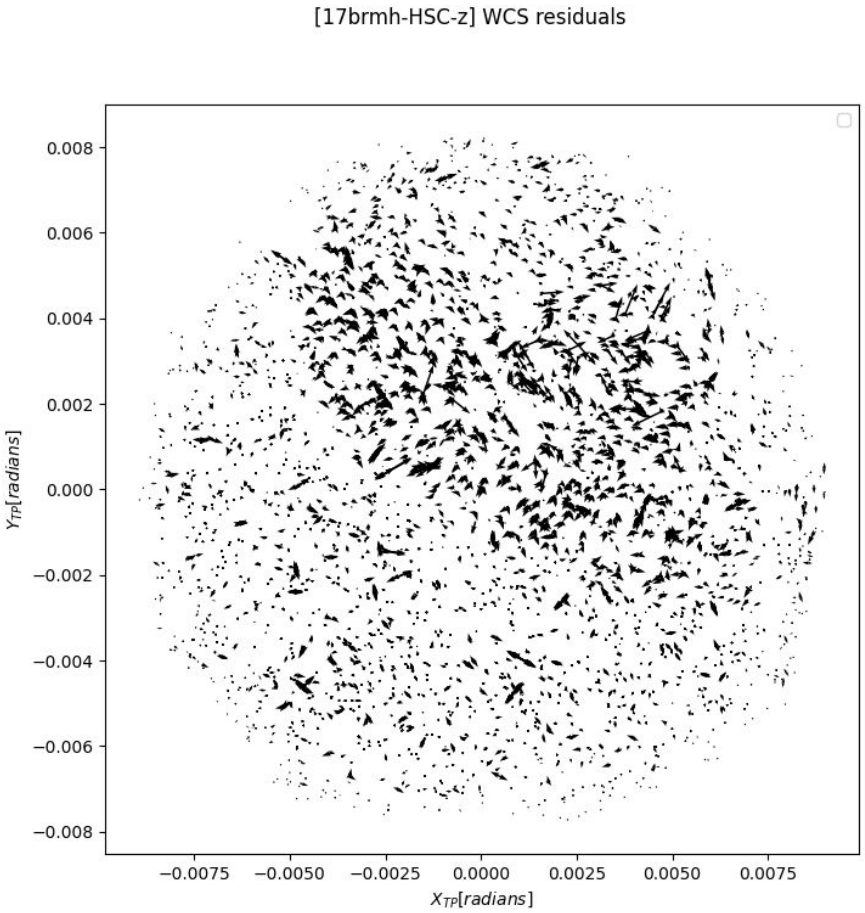
z = 1.5

Hardest dataset ever

- Very large ditherings
  - Same SN observed on many different CCDs
- Complex focal plane
  - 104 CCDs / Rotator
  - No star flat / dithered data observations
  - Lots of vigneting (variable) on the sides of the focal plane
  - Light pollution in Y (from rotator LED)
- Astrometry is very complicated
  - Resort to a local astrometry fit around each SN
- Lots of brighter-fatter
  - Deep depleted CCDs (200 microns)
  - Wavelength-dependent
- Linearity !

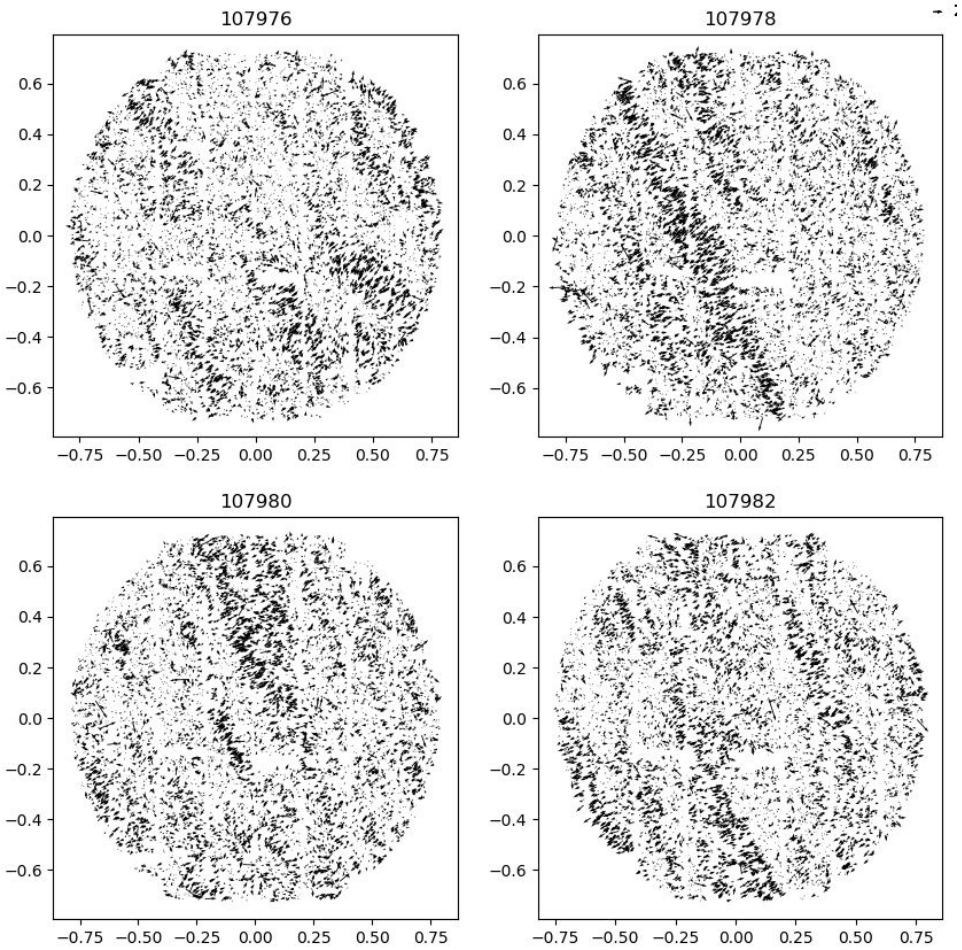
Astrometry


[17brmh-HSC-z] WCS residuals
y residuals [mas]
x-residuals[mas]
$\sigma_y = +9.82$
$\sigma_x = +10.15$

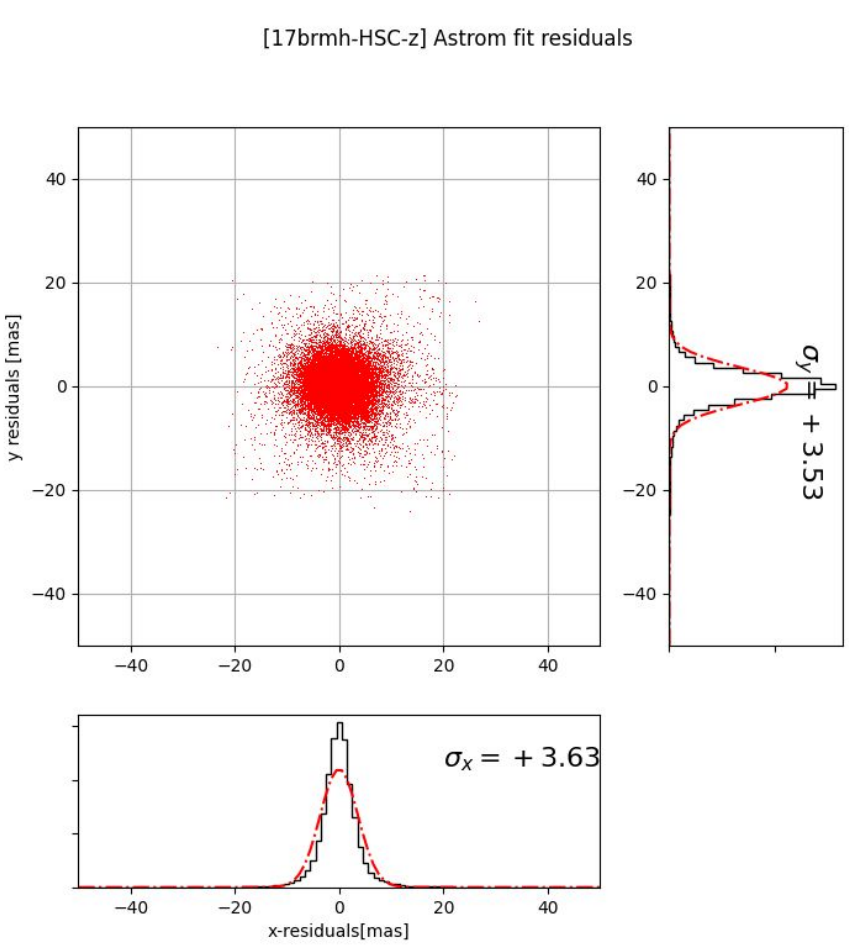

[17brmh-HSC-z] WCS residuals
$Y_{TP}[radians]$
$X_{TP}[radians]$

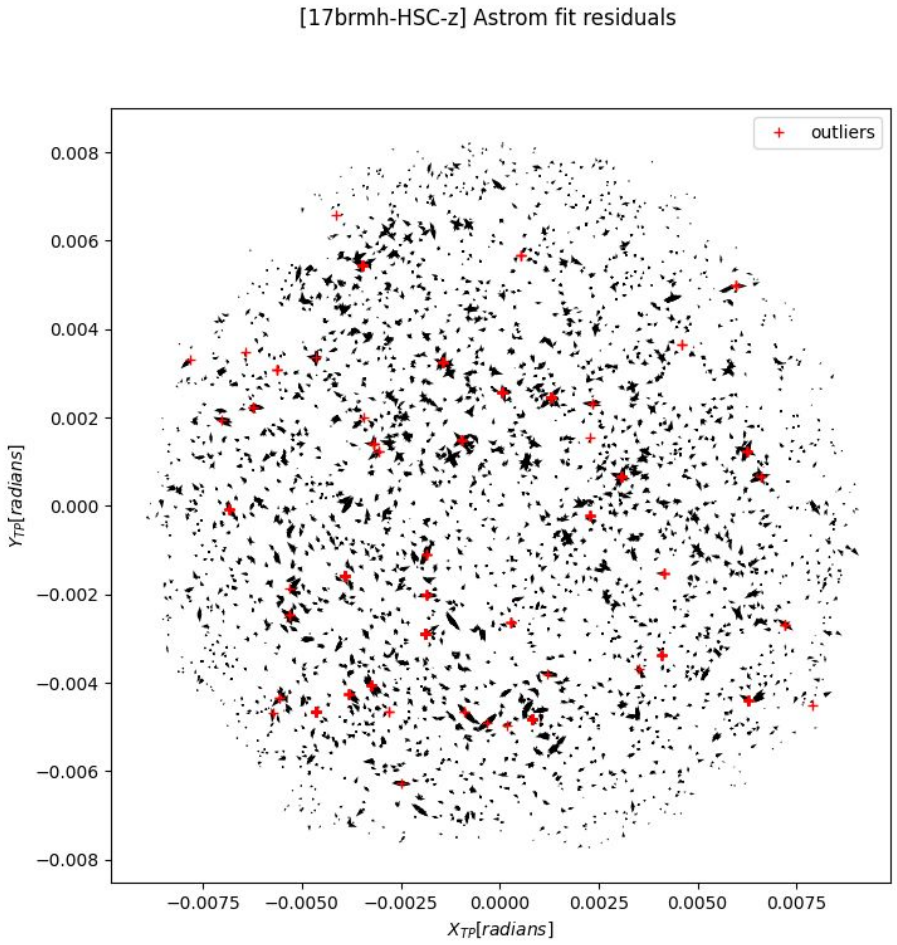
Astrometry

- Position uncertainties translate into photometry biases !
- Astrometry Anchored on GAIA DR2 catalog
- HSC specifics
  - Many GAIA stars are saturated
  - Simultaneous fit of WCS + star positions using GAIA stars as anchors
- State of the art
  - SNLS ~ 2.5 mas
  - HSC : 4-8 mas



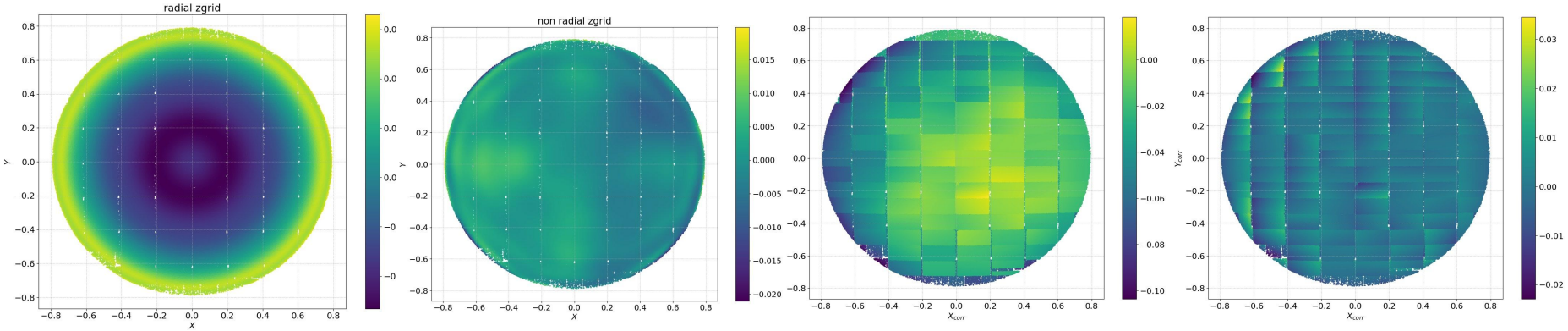
Astrometry


[17brmh-HSC-z] Astrom fit residuals
y residuals [mas]
x-residuals[mas]
$\sigma_y = +3.53$
$\sigma_x = +3.63$

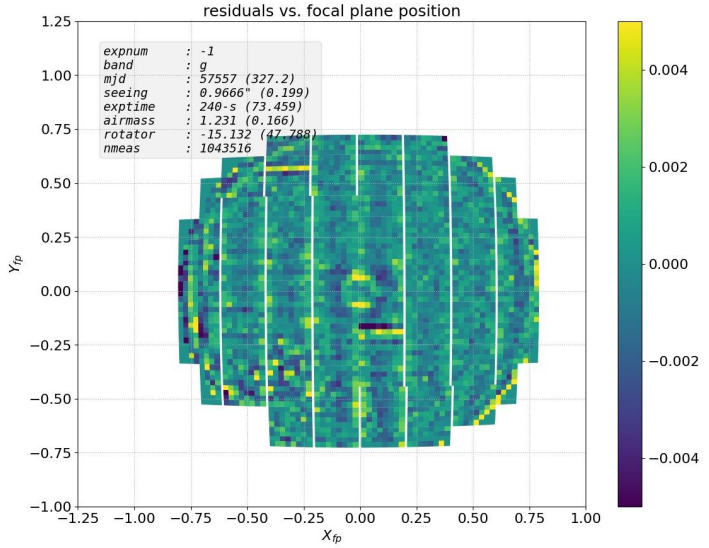

[17brmh-HSC-z] Astrom fit residuals
outliers
Y_{TP}[radians]
X_{TP}[radians]

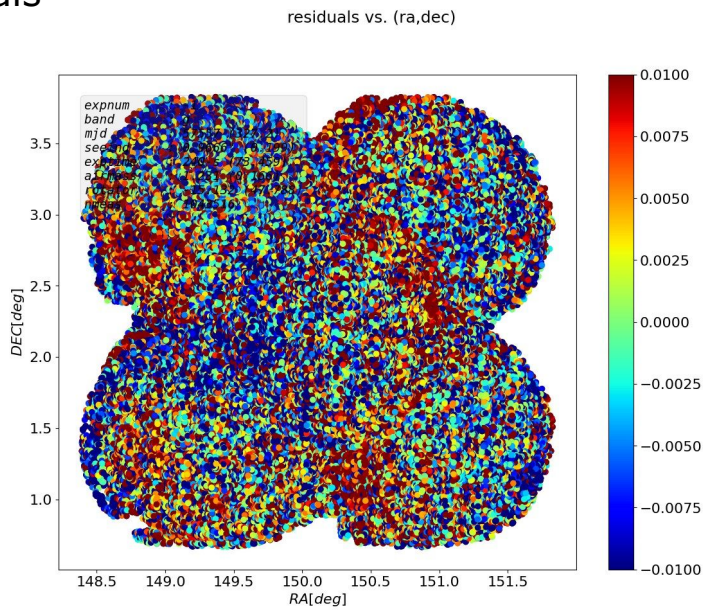
Focal plane uniformity: g-band

Corrections

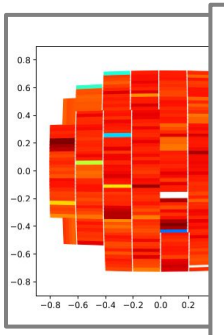


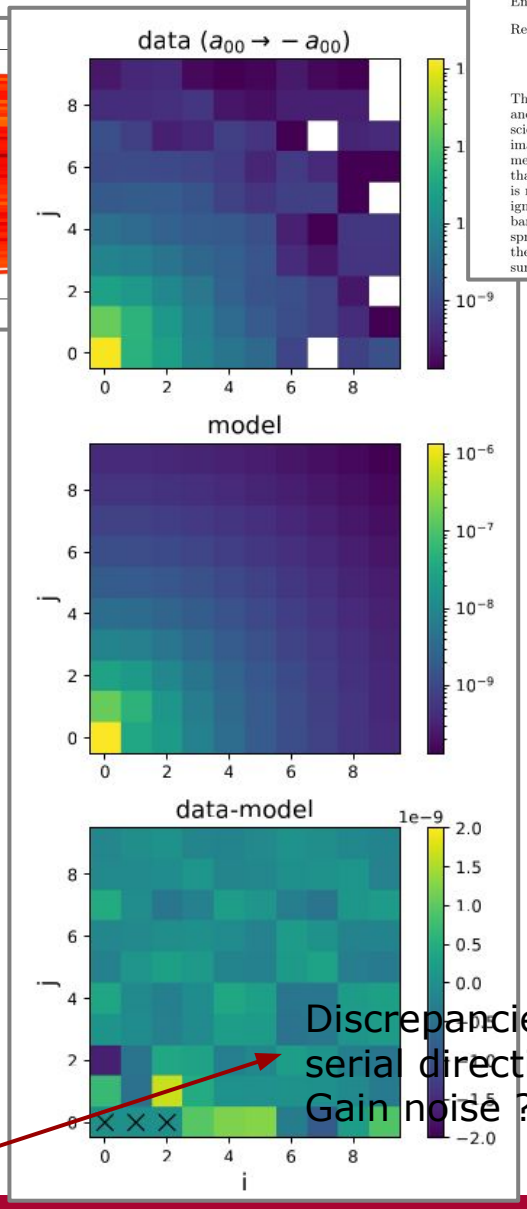
Residuals





Brighter-Fatter





Discrepancies for 3 pixels of the serial direction.
Gain noise ?

Correction of the brighter-fatter effect on the CCDs of Hyper Suprime-Cam

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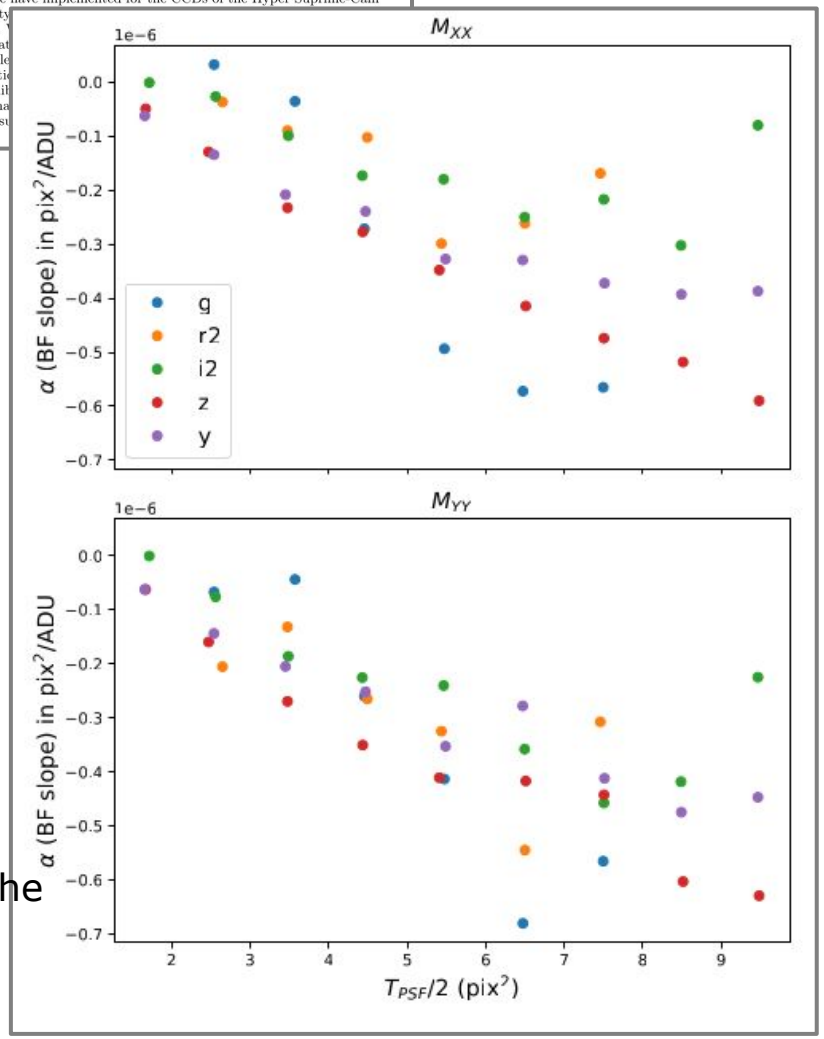
LPNHE, (CNRS/IN2P3, Sorbonne Université, Université Paris Cité), Laboratoire de Physique Nucléaire et de Hautes Énergies, F-75005, Paris, France

Received Mont DD, YYYY; accepted Mont DD, YYYY

ABSTRACT

The brighter-fatter effect affects all CCD sensors to various degrees. Deep-depleted thick sensors are seriously affected and the measurement of galaxy shapes for cosmic shear measurements requires an accurate correction of the effect in science images. We describe the whole correction chain we have implemented for the CCDs of the Hyper Suprime-Cam imager on the Subaru Telescope. We derive non linearity measure their statistics, namely their two-pixel function. that we use to correct science images. We find evidence that is not due to the combination of Poisson statistics and ele ignore some measurements when deriving the electrostati bands of the imager, stars in corrected science images exhil spread function for faint objects to an accuracy better tha the ellipticity and the fourth radial moment. This is a su surveys such as Rubin/LSST.



Status

- Final processing with all ingredients
  - Moved photometry pipeline to pixi / Snakemake structure
  - (so that Mathieu can take care of subsequent reprocessing)
- Final SN list revised
  - New candidates salvaged
  - More redshifts available
- Calibration catalog (HSC “ubercal equivalent”) processed by Maude
  - (see Maude’s talk)
- Final selection:
  - 908 candidates being processed now
  - Will go through lccalib

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ZTF lc release : status

- PSF error rate problem is solved

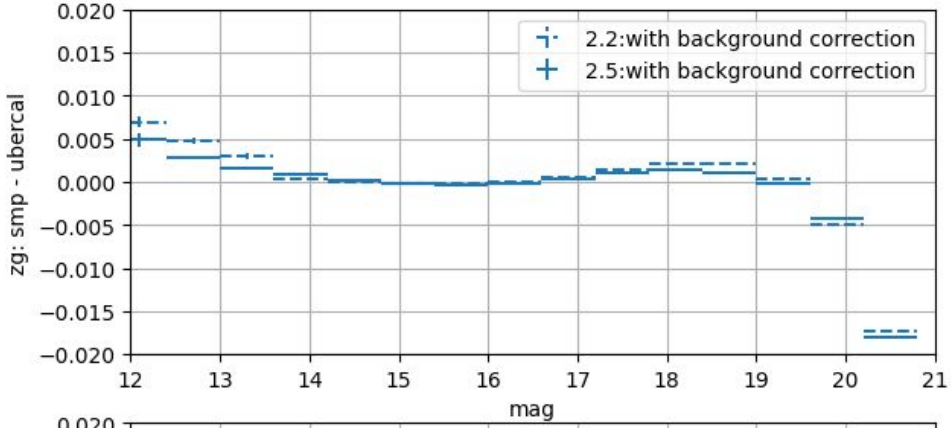
shape: (6, 4)

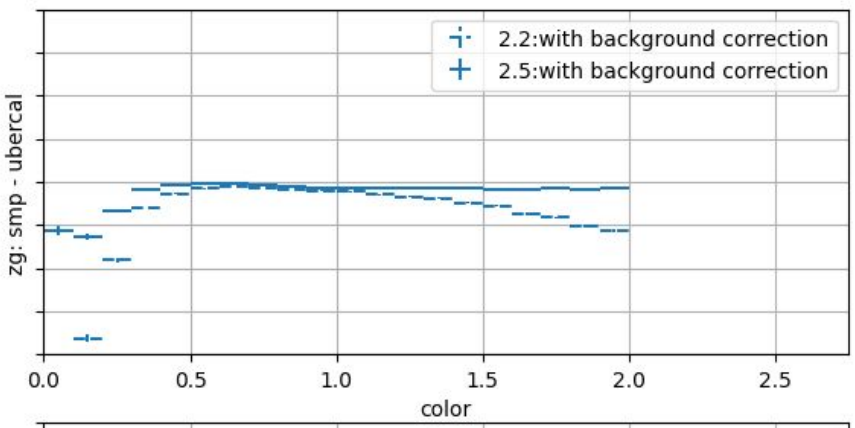
band	status	count	percent
str	str	u32	f64
zg	success	53897	98.676309
zg	failure	723	1.323691
zr	success	68539	98.469916
zr	failure	1065	1.530084
zi	failure	275	2.551967
zi	success	10501	97.448033

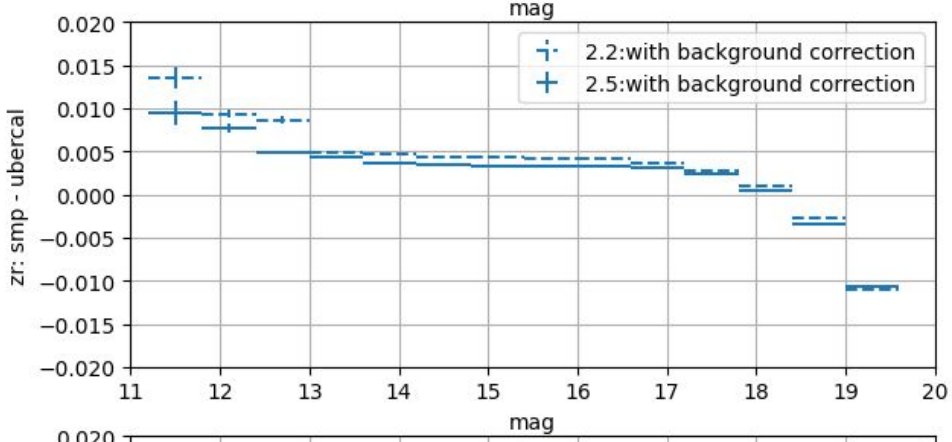
- Cosmic detection with undersampled PSF was going nuts
  - -> weight maps were full of vetoed pixels
- Cosmic was shut off in Leander’s prod
- Improperly shut off in Mathieu’s pipeline

ZTF lc release : status

- Full prod restarted
  - New PSF model (2nd order variations)
  - No Pocket / BF corrections (yet)
  - Should be much faster
    - low memory footprint => more jobs & fewer OOM’s
- What’s left
  - Test image-level pocket effect correction (not started)
  - Re-evaluate impact of BF effect (done on previous prod, should be redone with the new PSF)
  -


2.2:with background correction
2.5:with background correction
zg: smp - ubercal
mag


2.2:with background correction
2.5:with background correction
zg: smp - ubercal
color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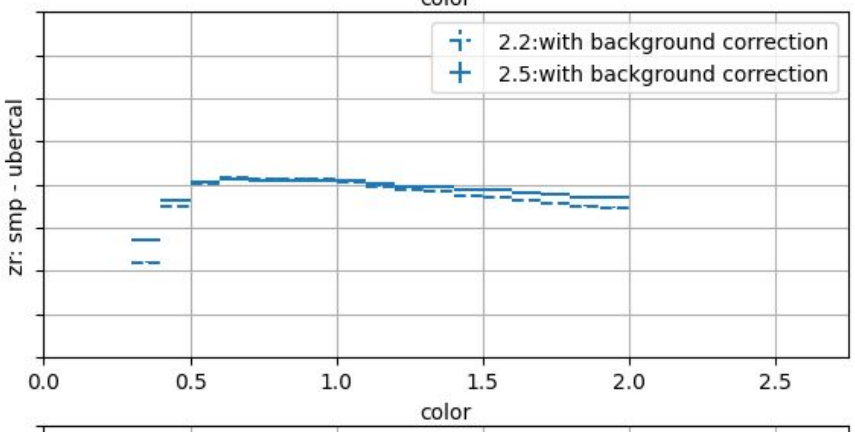
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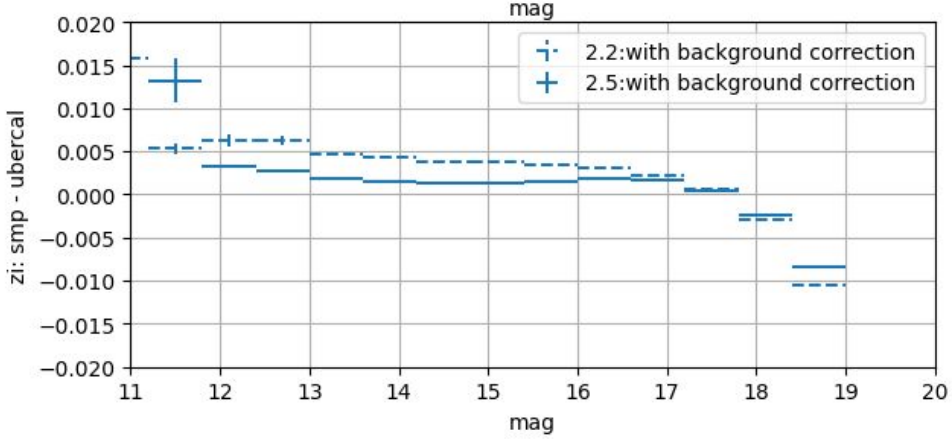
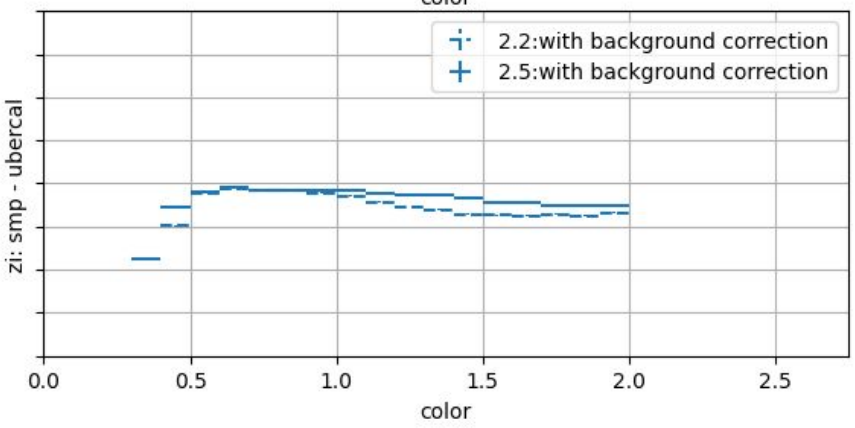
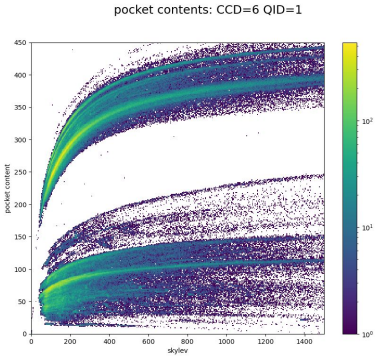

2.2:with background correction
2.5:with background correction
zi: smp - ubercal
mag


2.2:with background correction
2.5:with background correction
zi: smp - ubercal
color

Paper outline



- Intro
- Instrument / Dataset
- Mitigation of Sensor effects
  - BF
  - Pocket
- Photometry pipeline
- Pipeline Implementation & performances
- Light curves calibration
- Data release products
- Comparison with previous photometry releases
  - Previous processing > DR2.2
  - DR2.2
  - DR2
  - ATLAS
- Discussion
  - Typical uncertainties on distances

What should be done / discussed

- Main ongoing work :
  - sensor effects
  - Distance uncertainties
- Not staffed
  - Comparisons with previous processings
  - Environment studies