The Cosmology Data Management System: Application to Processing of PS1 data

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Abstract: The Cosmology Data Management Pipeline (CosmoDM) is an autonomous and flexiible data management pipeline designed to run on supercomputers, which can process and calibrate data from optical photometric surveys, as part of external datasets calibration for the Euclid and eROSITA space-based missions. CosmoDM consists of two pipelines : The single-epoch pipeline, which does photometric and astrometric calibration of raw data from every night, as well as the co-addition pipeline, which combines the data from individual nights into deeper coadd images. A novel feature of CosmoDM is that it uses a modified stack of Astromatic software which can read and write tile compressed images. Since 2011, CosmoDM has been used to process data from DECam, CFHT MegaCam and Pan-Starrs. In this poster we shall describe how processed PS1 data from CosmoDM has been used to optically confirm and measure red-sequence redshifts of Planck-based SZE cluster candidates

Euclid and eROSITA

Euclid is a cosmology and fundamental physics space-based mission expected to be launched around 2019 whose primary goal is to measure Dark Energy equation of state using galaxy clustering and weak Lensing and is expected to be launched ~ 2020. Euclid requires External data from deep surveys to compute Photometric redshifts for background galaxies used for Weak Lensing
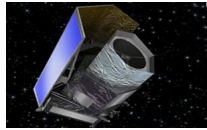
Euclid Satellite (ESA C.Carreau)
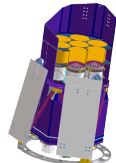
eROSITA Satellite (MPE)

eRosita will be the primary instrument on-board the Russian Spectrum-Roentgen-Gamma (SRG) satellite to be launched from Baikonur in 2016. It will perform an all-sky imaging survey to ~ 10 KeV and angular resolution of 13-28 arcsec. eRosita will be the 1st stage IV Dark Energy experiment which will measure w_o and w_a about 1.5 times more accurately than Stage 3 probes by discovering more than 100,000 galaxy clusters
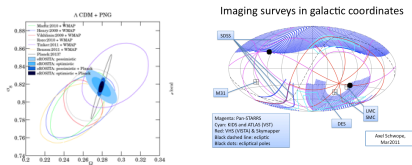
eRosita Forecasts (Merloni et al 2012)

Imaging Surveys for eRosita

- DES (5000 deg^2)
- KiDS (1500 deg^2)
- HSC (1200 deg^2)
- DECal (6700 deg^2)
- PS1 (30,000 deg^2)
- ATLAS (5000 deg^2)

Cosmology Data Management System

CosmoDM has its historical roots in the Dark Energy Data Management System, which was created around 2005. to process data from DES. CosmoDM has been further developed at LMU since 2011 to prepare for external data calibration for Euclid and eROSITA. It consists of two main pipelines: **single-epoch** pipeline followed by **co-addition** pipeline in which we create PSF-homogenized coadd images and catalogs as well as non-homogenized coadd images.

Desai et al (2011)
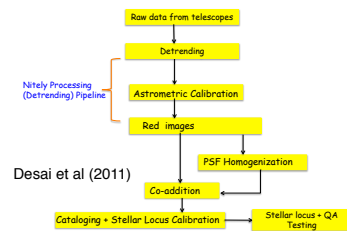
- o Extensive use of Astromatic software. Astromatic codes now CFITSIO compatible and can directly read (and write) fpacked images.

- o In order to speed I/O, all intermediate data products saved directly on Ramdisk.

- o Job submission and monitoring done using CondorG

- o Data Transfer currently done using Globus toolkit

- o Oracle database used to store all catalog and image metadata as well as object catalogs.

System is designed to be robust and flexible, which allows processing datasets from different cameras. The only change needed is in the code which converts raw data from telescopes to CosmoDM compatible format.

CosmoDM has analyzed data from the CFHT, DES, Pan-Starrs and XXL surveys and been run on LRZ and RZG supercomputers

PS1 data around Planck SZE candidates
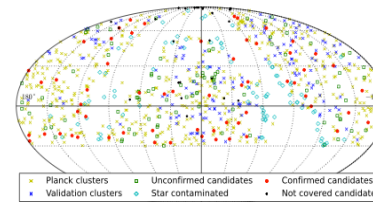
- ~ 400 Planck SZE candidates processed. Starting inputs for CosmoDM pipeline were PS1 warps downloaded from PS1 image server.

- PSF corrected Model-Fitting photometry was applied to the warps followed by co-addition.

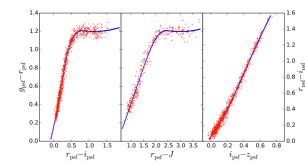- Absolute photometric calibration of coadd catalogs was done using the stellar locus.
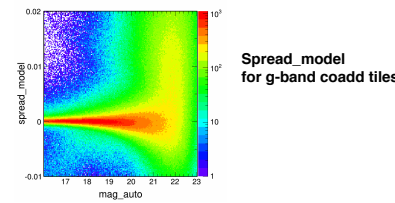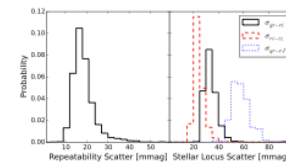
Spread_model for g-band coadd tiles

FWHM _mean (PSFex)
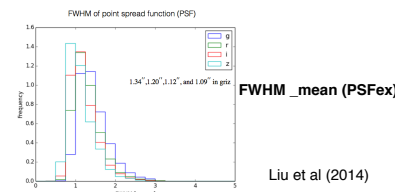
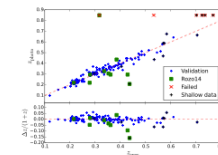Liu et al (2014)

PS1 data quality

PS1 Stellar Locus Calibration

- Repeatability scatter 16,18,19,17 mmag in griz.

Stellar Locus scatter :
gr-ri 33 mmag
gr -rJ 58 mmag
ri - iz 24 mmag

Red-Sequence Redshifts

$\sigma_{z/1+z} \sim 0.022$

References

- Desai et al. 2012 arxiv:1204.1210
- Liu et al, 2014 arxiv:1407.6001
- Merloni et al, arxiv:1209.3114
- Laureijs et al, arxiv:1110.3193