

Mephisto数据处理介绍

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Mephisto Data

- Pilot survey (1/4 field view , single CCD)

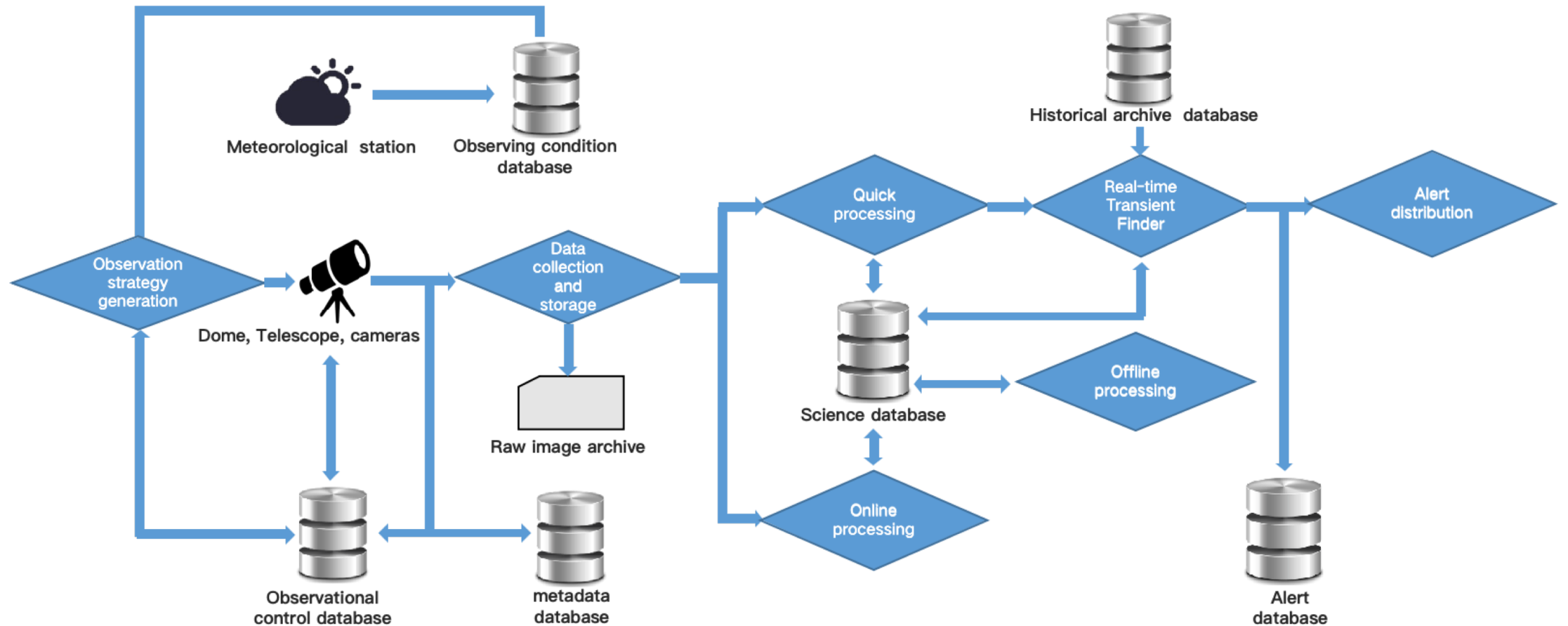
Pilot Andor 芯片 : 6144*6160 , CCD-290 : 9232*9216 (9400*10000 considering overscan region)
camera : single CCD
2 Andor+1 CCD-290 cameras , 16bit readout
Single Exposure : $6144*6160*2*2 + 9400*10000*2 = 72\text{MB} + 72\text{MB} + 174\text{MB} = 318 \text{ MB}$
Actually single image: andor*2 + single-e2v-ccd*1 = 73MB*2 + 180MB = 326M

- Mephisto Survey (full field view , 2*2 mosaic CCD)

E2v CCD芯片 : 9216*9232*4
3 cameras : 2*2 CCD-290 , 16bit readout
Single Exposure : $9400*10000*2* 4* 3 = 720\text{MB}*3 = 2.10 \text{ GB}$

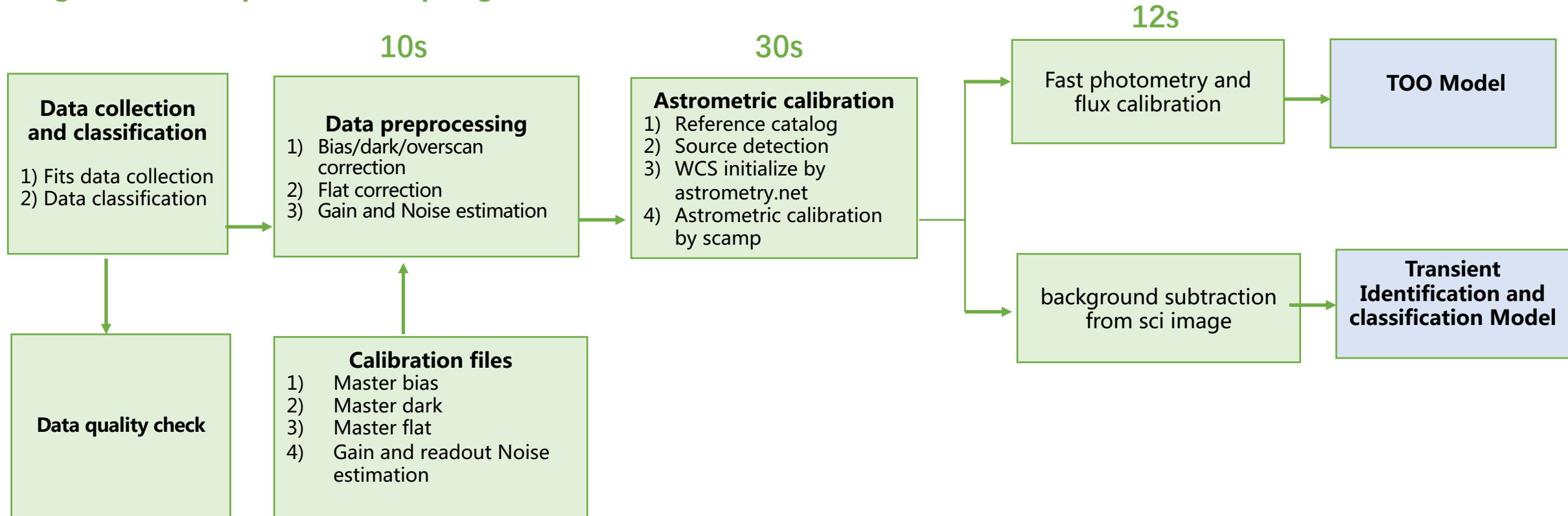
Mephisto data will be 7 times the amount of pilots survey today !

Mephisto data flow

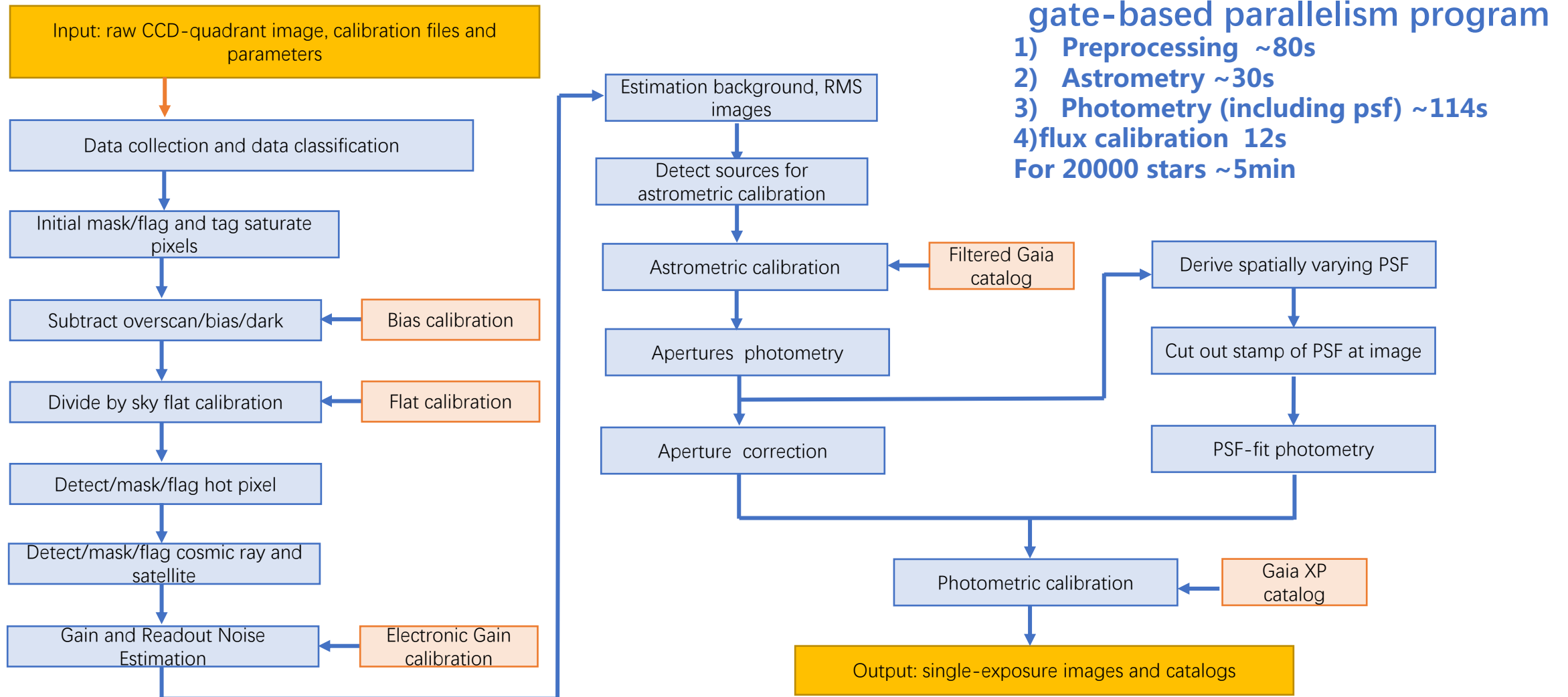


Mephisto Real-time processing

gate-based parallelism program



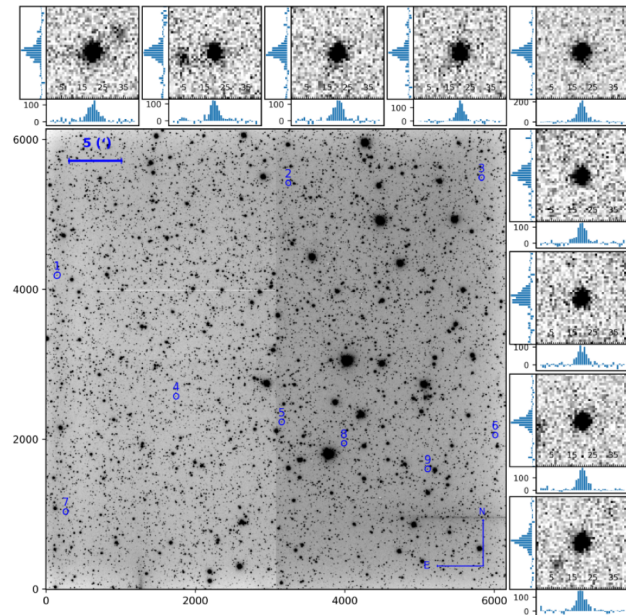
Regular single-exposure data processing



Mephisto data products

- ❑ **Level 0 Data (Raw Data)** Scientific data processing begins by reading the latest observation data records from the database and extracting the raw observation data (Level 0 data).
- ❑ **Level 1 Scientific Data** The Level 0 data undergoes preprocessing, including corrections for instrumental effects and removal of cosmic rays. This process involves detecting celestial objects and extracting important physical information such as their positions, flux, and morphology. The result of this data processing is Level 1 scientific data, which is used for scientific research.
- ❑ **Level 2 Scientific Data** The already processed Level 1 data undergoes further processing, such as catalog merging, image mosaicking, and estimation of additional celestial object parameters (e.g., stellar age, surface gravity, temperature). This forms the Level 2 data.

Mephisto data quality check



File = my_sc_tegn-39775_r_20240101170751_139.fits

Env_temp= -1.7(°C) Clouds= 0 R_humidity= 94(%)

D_seeing= 1.27('') Winddir= 215(°) Windspeed= 3.1(m/s)

Moon_phas= None(%) Moon_alt= 22.0(°) Moon_dist= None(°)

Object= egn-39775 RA= 06:08:44.00 DEC= 23:30:51

Airmass= 1.005 AZ= 238.(°) Alt= 84.1(°)

Time= 2024-01-01T17:07:52 Δd= 0.401(') Exptime= 20.0(s)

CCD_temp= -60.0(°C) Filter= r Im_quality= great

Med_FWHM= 4.98(pixel) Med_ρ= 0.074 Med_PA= 19.37(°)

Mean_FWHM= 5.35(pixel) Mean_ρ= 0.101 Med_Kurt= -1.1

Med_bg= 173(ADU) Skew_bg= 0.7 Std_bg= 4.2(ADU)

Mag_bg= 19.7(mag) Kurt_bg= -4.6 RMS_bg= 11.8(ADU)

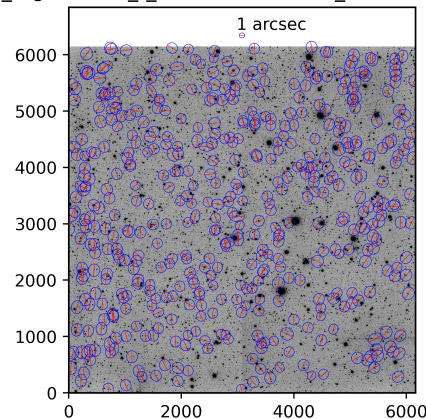
N_star(700<snr)= 257 N_star(150<snr<400)= 1080

N_star(50.<snr<150)= 3076 N_star(30.<snr<50)= 1903

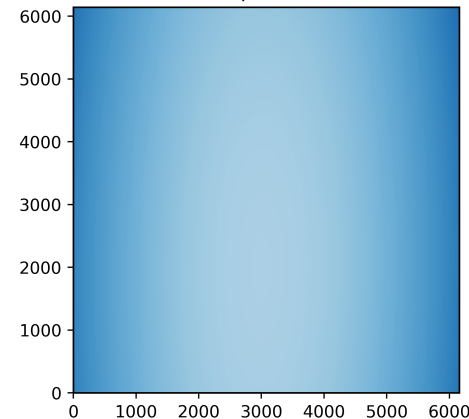
N_star(ρ > 0.5)= 39 N_star(ρ > 0.7)= 6

Limit_mag= 19.9±0.2(m) Limit_mag_20s= 19.9±0.2(m)

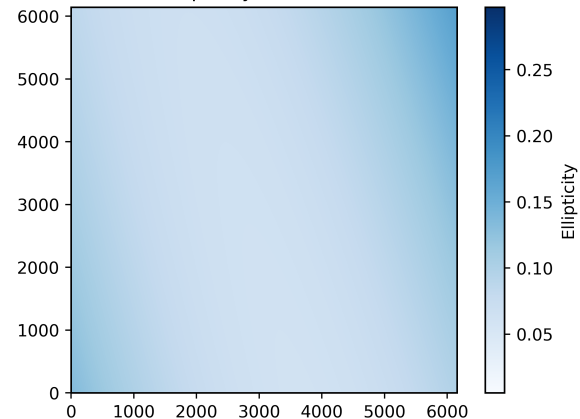
my_sc_tegn-39775_r_20240101170751_139.fits ($N_{star}= 486$)



FWHM = 4.916 pixels (2.109 arcsec)

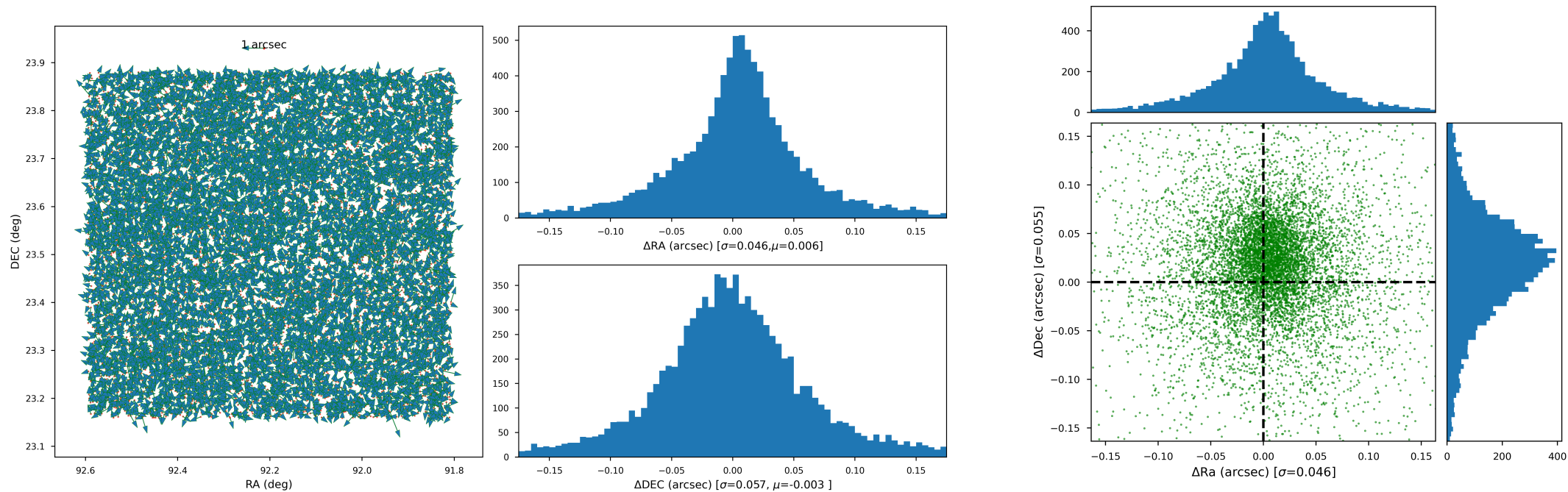


Ellipticity = 0.06884



Astrometric Calibration

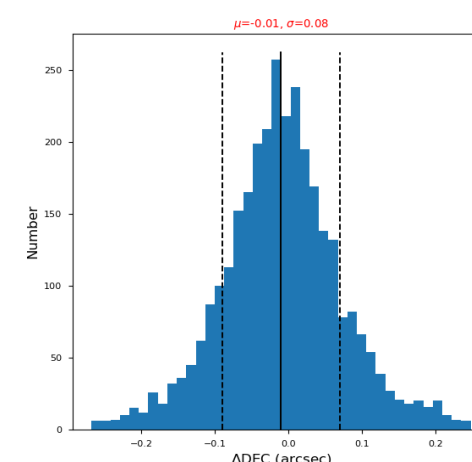
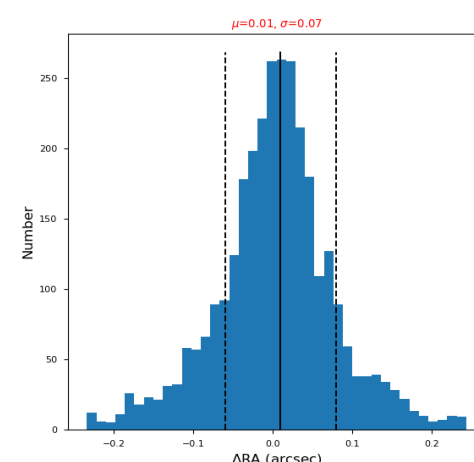
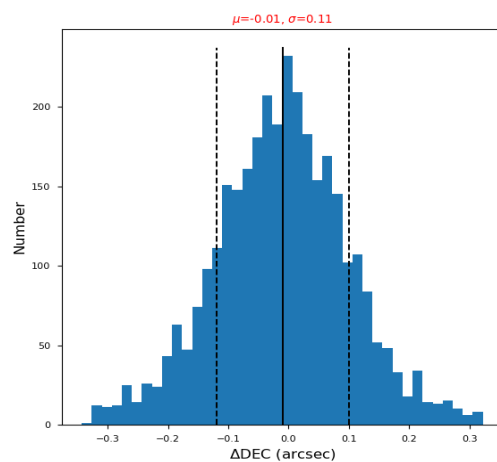
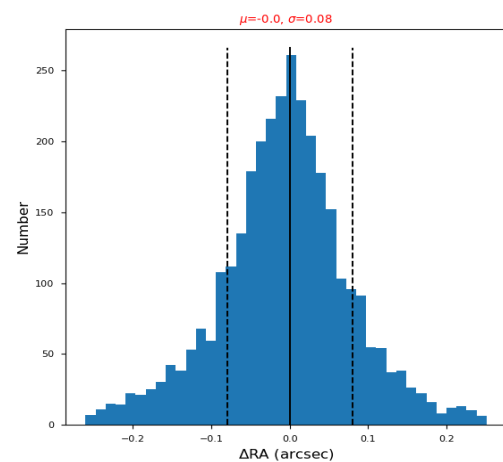
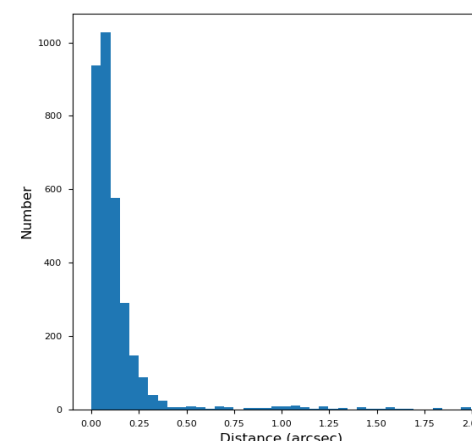
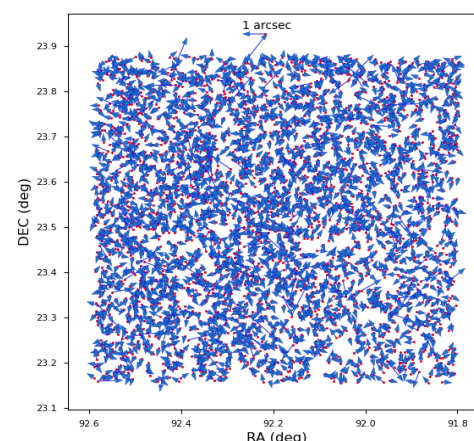
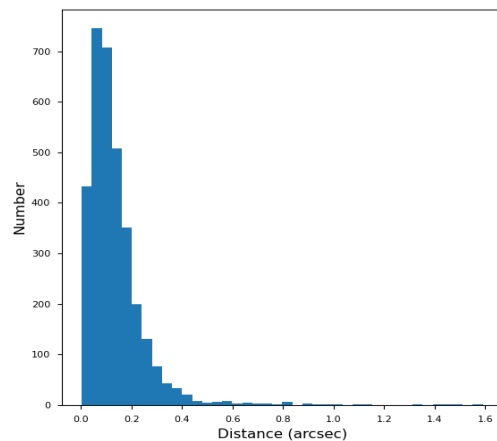
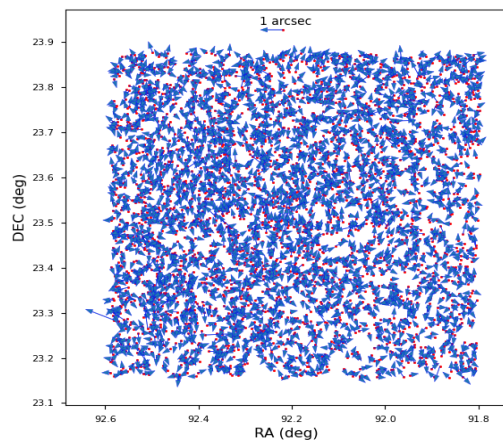
Single exposure astrometric calibration precision (with GAIA DR3)
The standard precision of astrometric is ~ 50 mas



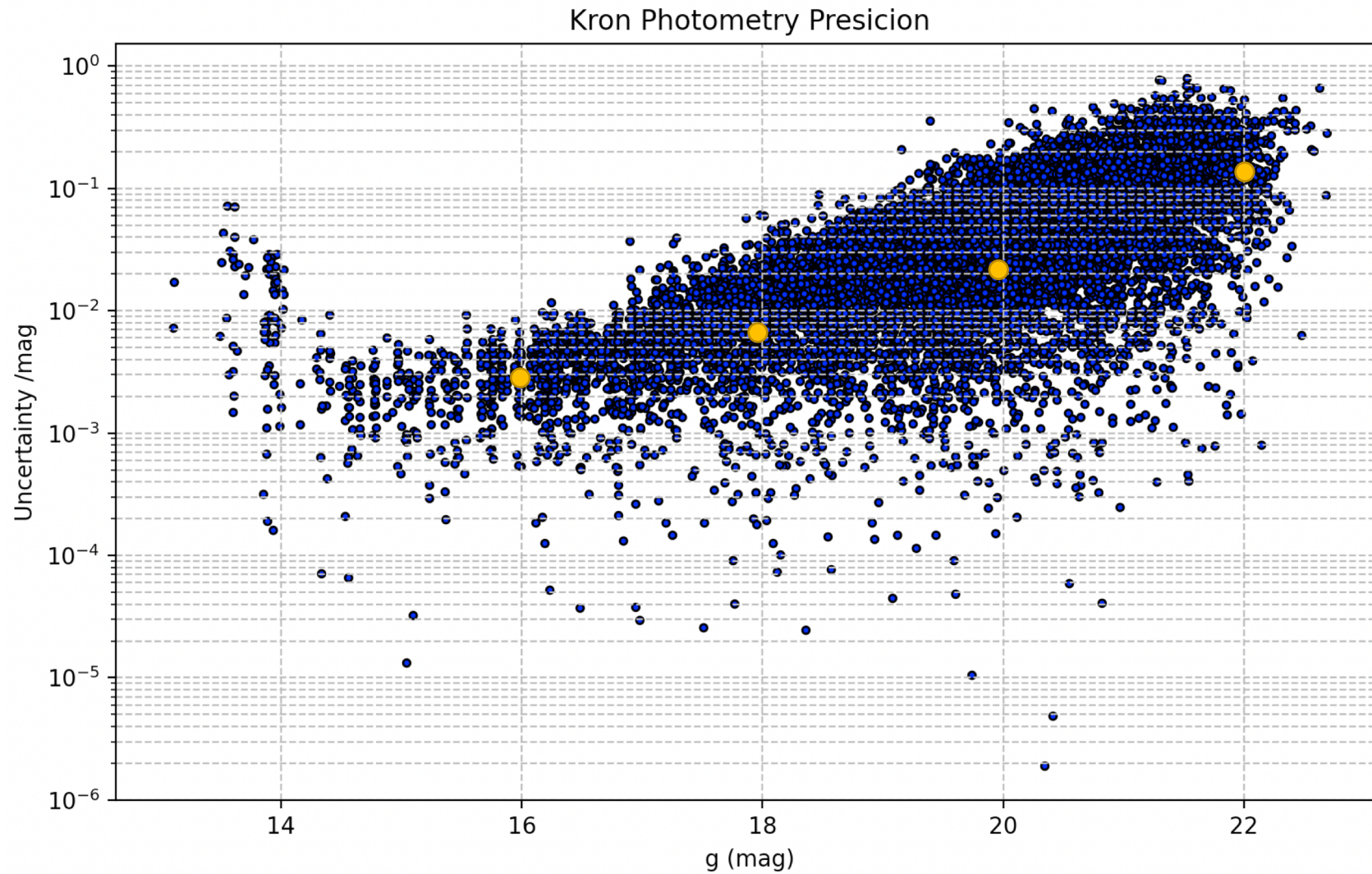
my_sc_tegn-39775_r_20240101170751_139.fits

Astrometric Calibration

Single exposure astrometric calibration precision (with 2MASS and Panstar)



Photometry



20240213_my_ztfj1406+1222_g 40 frames(300s exposure)

Limiting magnitudes

Filter	u	v	g	r	i	z
Single visit (30s)	20.45871	20.75179	21.0844	21.1567	20.3548	19.4523
Predict value (30s)	21.0035	21.1623	21.3849	21.6146	20.7200	19.3542

LightCurve

RA/Dec [Object Name](#)

RA: Dec: Band: Radius(arcsec):

Light Curve

u Band v Band g Band r Band i Band z Band



FROM GUOWANG DU

pipeline database

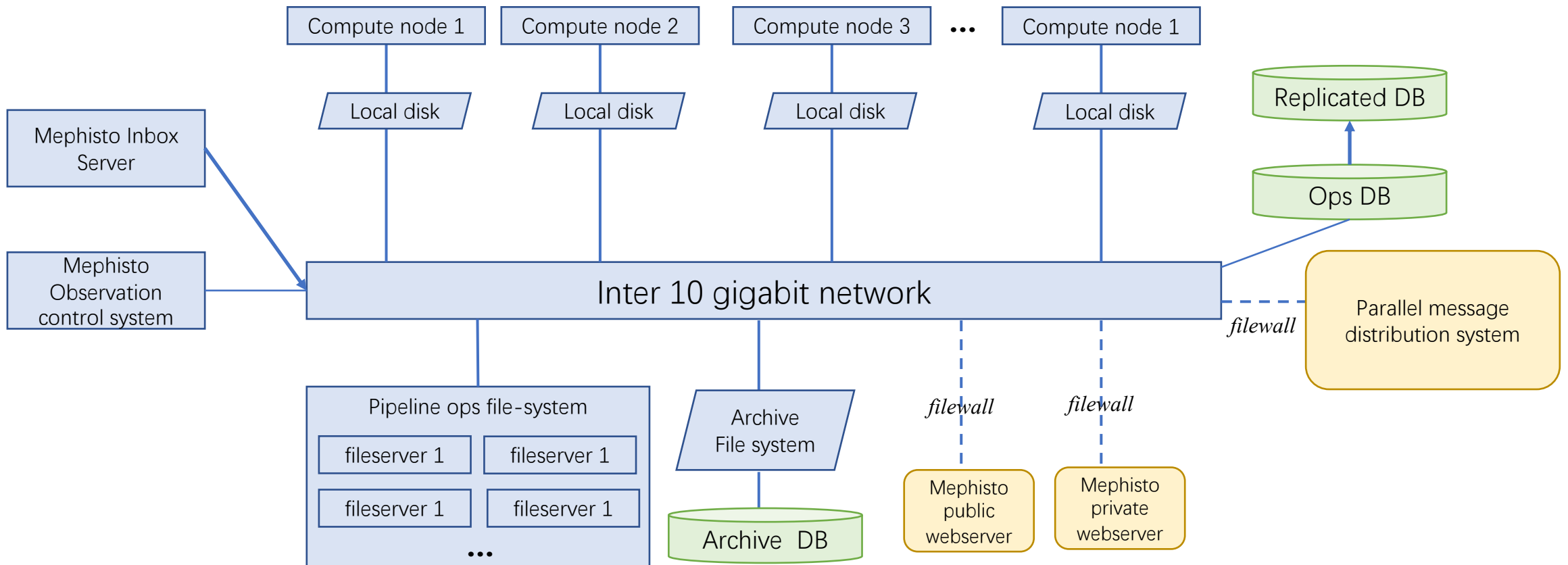
B
 Y
 R

sc

Field/Target	PanSTARRS	SDSS	Simbad	FWHM(arcsec) (>2.15: 2.15>=FWHM>1.72:)	FWHM	Ell	Preview	Data Products	Astrometric fit residual	Astrometry vs 2Mass	Astrometry vs PanSTARRS	RA_Target	DEC_Target	RA_Pointing	DEC_Pointing	Filter	Exposure	Obs Date (UT)	Minor Planet
sn2024jz 📄 🔍	PanSTARRS		Simbad		1.785	0.1						15:33:04.842	-01:37:30.64	15:32:58.84	-01:39:00	g	150	2024-02-13 23:01:39	SUN (9) SkyBot (7)
sn2024jz 📄 🔍	PanSTARRS		Simbad		2.094	0.09						15:33:04.842	-01:37:30.64	15:32:58.84	-01:39:00	g	150	2024-02-13 22:58:54	SUN (9) SkyBot (7)
sn2024jz 📄 🔍	PanSTARRS		Simbad		1.84	0.09						15:33:04.842	-01:37:30.64	15:32:58.84	-01:39:00	g	150	2024-02-13 22:55:48	SUN (9) SkyBot (7)
sn2024jz 📄 🔍	PanSTARRS		Simbad		1.899	0.12						15:33:04.842	-01:37:30.64	15:32:58.84	-01:39:00	g	150	2024-02-13 22:53:03	SUN (9) SkyBot (7)
sn2024jz 📄 🔍	PanSTARRS		Simbad		1.7	0.12						15:33:04.842	-01:37:30.64	15:32:58.84	-01:39:00	r	150	2024-02-13 22:49:00	SUN (9) SkyBot (8)
sn2024jz 📄 🔍	PanSTARRS		Simbad		1.709	0.11						15:33:04.842	-01:37:30.64	15:32:58.84	-01:39:00	r	150	2024-02-13 22:46:14	SUN (9) SkyBot (8)
sn2024jz 📄 🔍	PanSTARRS		Simbad		1.675	0.11						15:33:04.842	-01:37:30.64	15:32:58.84	-01:39:00	r	150	2024-02-13 22:43:09	SUN (9) SkyBot (8)
sn2024jz 📄 🔍	PanSTARRS		Simbad		1.662	0.11						15:33:04.842	-01:37:30.64	15:32:58.84	-01:39:00	r	150	2024-02-13 22:40:24	SUN (9) SkyBot (8)
ztfj1406+1222 📄 🔍	PanSTARRS		Simbad		1.717	0.12						14:06:56.17	+12:22:43.4	14:07:02.17	12:24:13	g	300	2024-02-13 22:34:01	SUN (5) SkyBot (5)
ztfj1406+1222 📄 🔍	PanSTARRS		Simbad		1.861	0.12						14:06:56.17	+12:22:43.4	14:07:02.17	12:24:13	g	300	2024-02-13 22:28:24	SUN (5) SkyBot (5)

FROM GUOWANG DU

Mephisto data processing infrastructure



A highly parallelized and high-throughput data processing infrastructure integrating **high-performance computing clusters**, **distributed storage**, and **databases** (10-minute end-to-end processing).

Next Tasks

- Multi-band data processing : including Multi-band combination, Multi-band photometry, Multi-band catalog
- Combine more methods of photometry for more precise measurements (i.e. DAOPHOT)
- More efficient algorithms and programming techniques developments for improve the quality and the processing speed prepared for full-view survey.

THANK YOU