

A map of Antarctica and its surrounding regions, including South America, New Zealand, and Australia. The map shows the continent of Antarctica with labels for 'Lesser Antarctica' and 'Greater Antarctica', and the 'Transantarctic Mountains'. Surrounding waters include the Pacific Ocean, Ross Sea, Weddell Sea, and Atlantic Ocean. Various islands and archipelagos are labeled, such as the South Sandwich Islands, Phoenix Islands, and the Antarctic Peninsula. A scale bar at the bottom left indicates 1000 km.

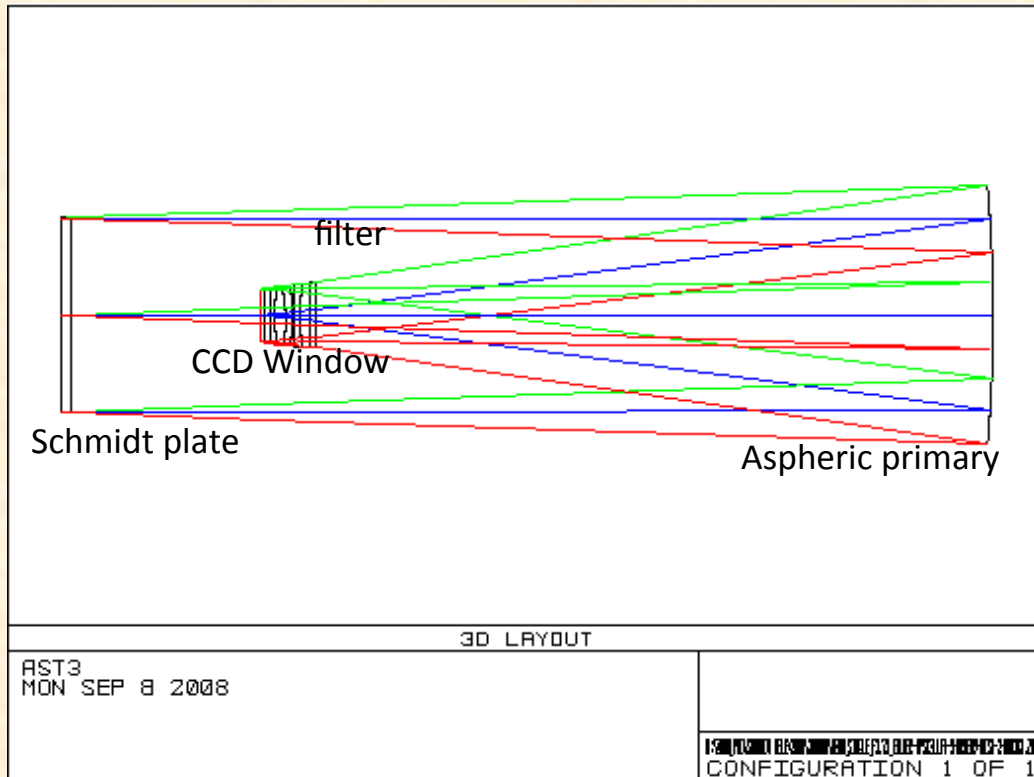
Updates of AST3 Survey

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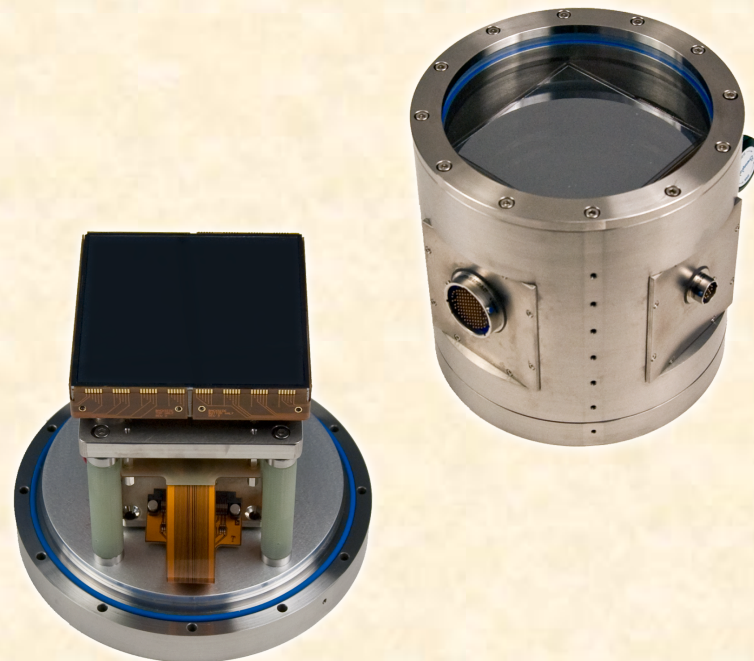
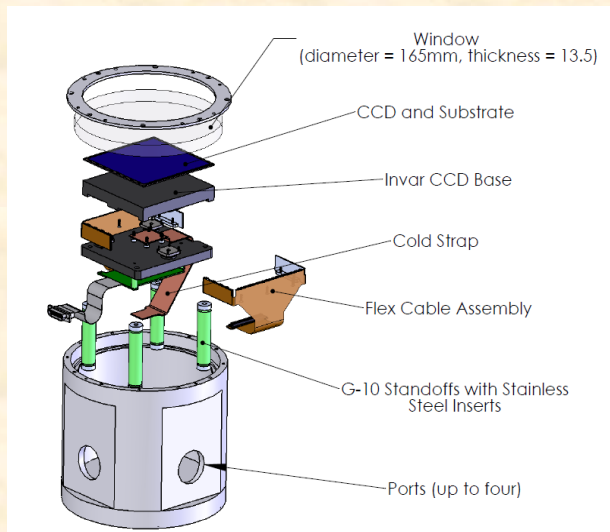
Antartic Survey Telescope x 3 (AST3)

- Three 50/68cm modified Schmidt Telescopes (NIAOT);
 - spherical corrector
 - short tube (optical length 2.4m)
 - aberration correction
 - atmosphere dispersion corrector (ADC)
- Filters: g, r, i



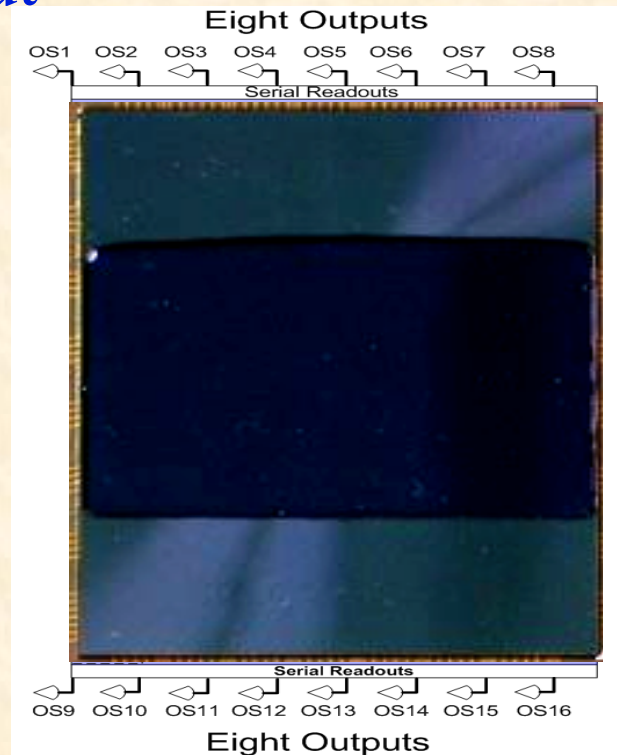
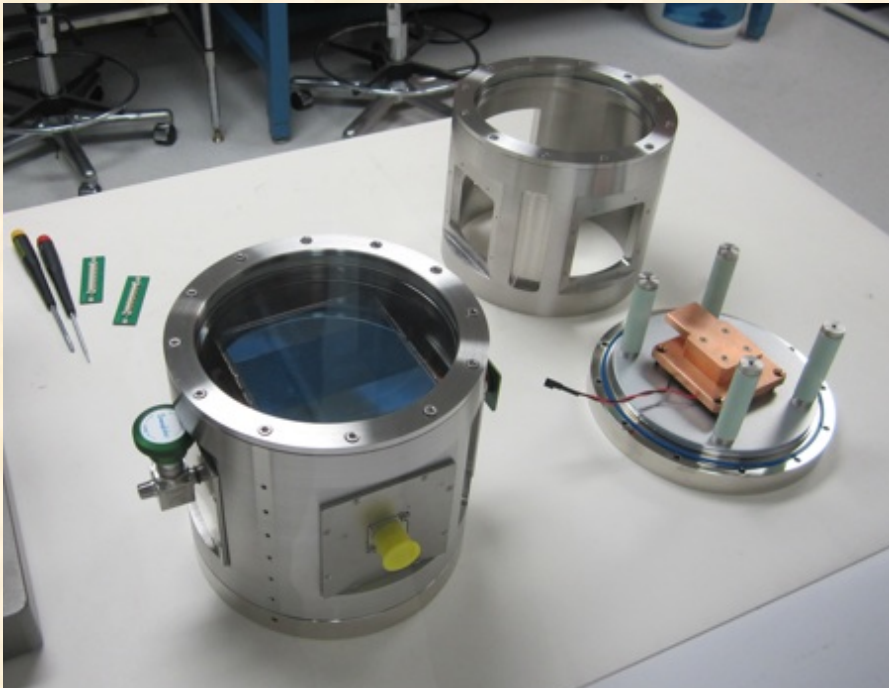
AST3 CCD Camera

- CCD camera (STA1600-FT)
 - 10k x 10k single chip CCD
 - Plate Scale: 1"/pixel



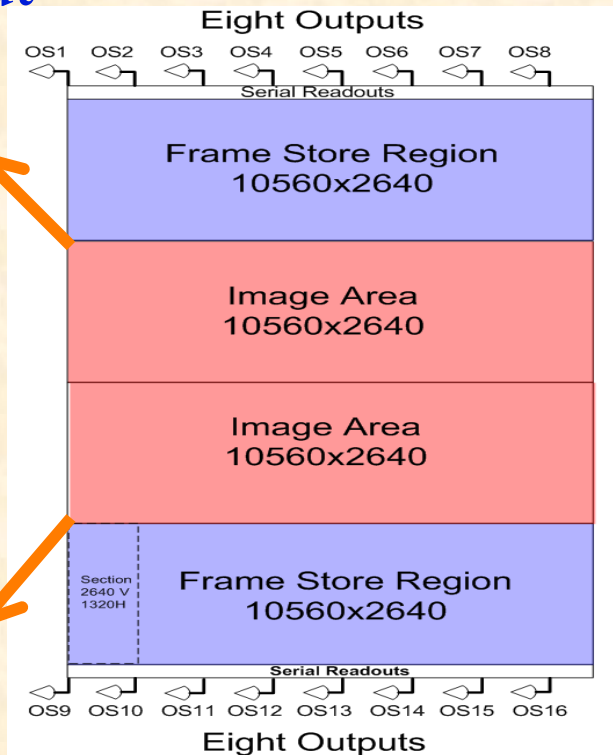
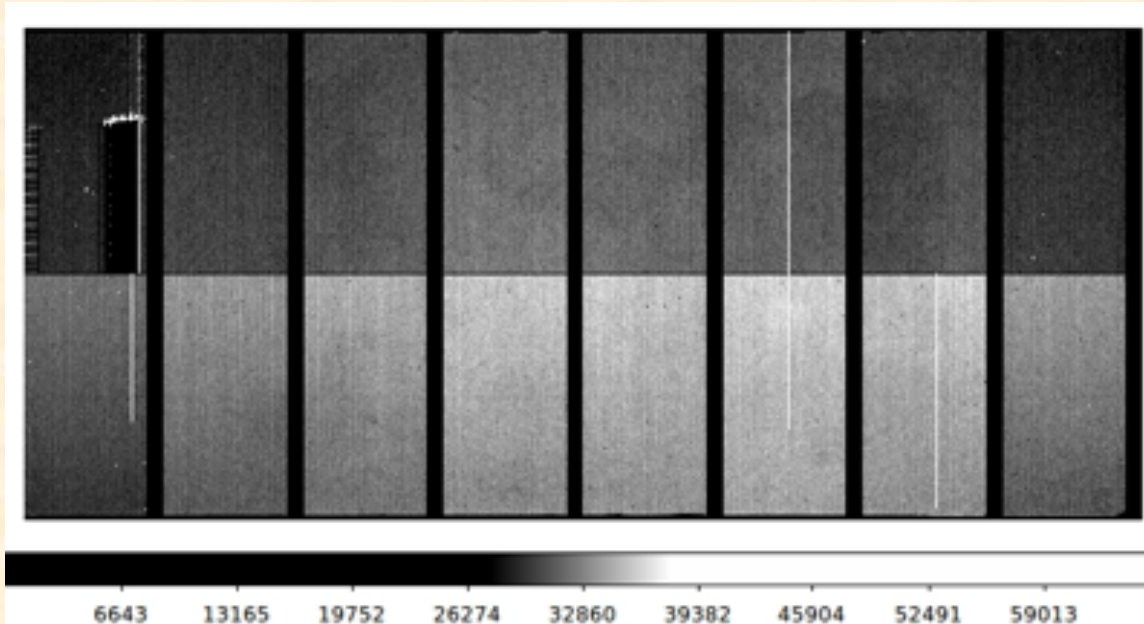
AST3 CCD Camera

- No shutter, to avoid mechanical failure
- To be operated in Frame Transfer mode, 10k x 5k
- FOV: ~ 4.3 sq. degree
- 16 readout channels for fast readout



AST3 CCD Camera

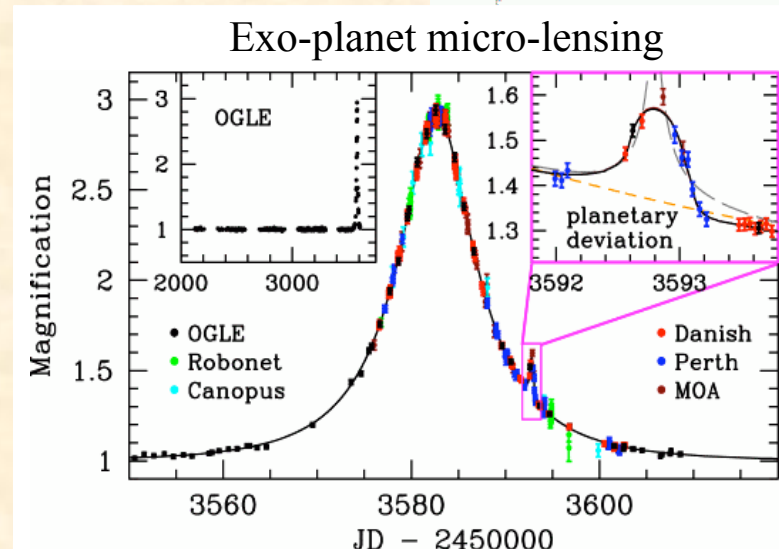
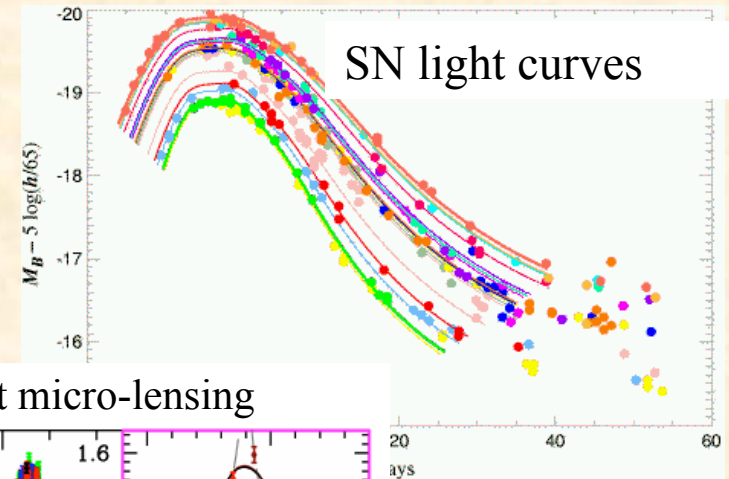
- No shutter, to avoid mechanical failure
- To be operated in Frame Transfer mode, 10k x 5k
- FOV: ~ 4.3 sq. degree
- 16 readout channels for fast readout



- Overscan: 180 columns/channel, 20 lines

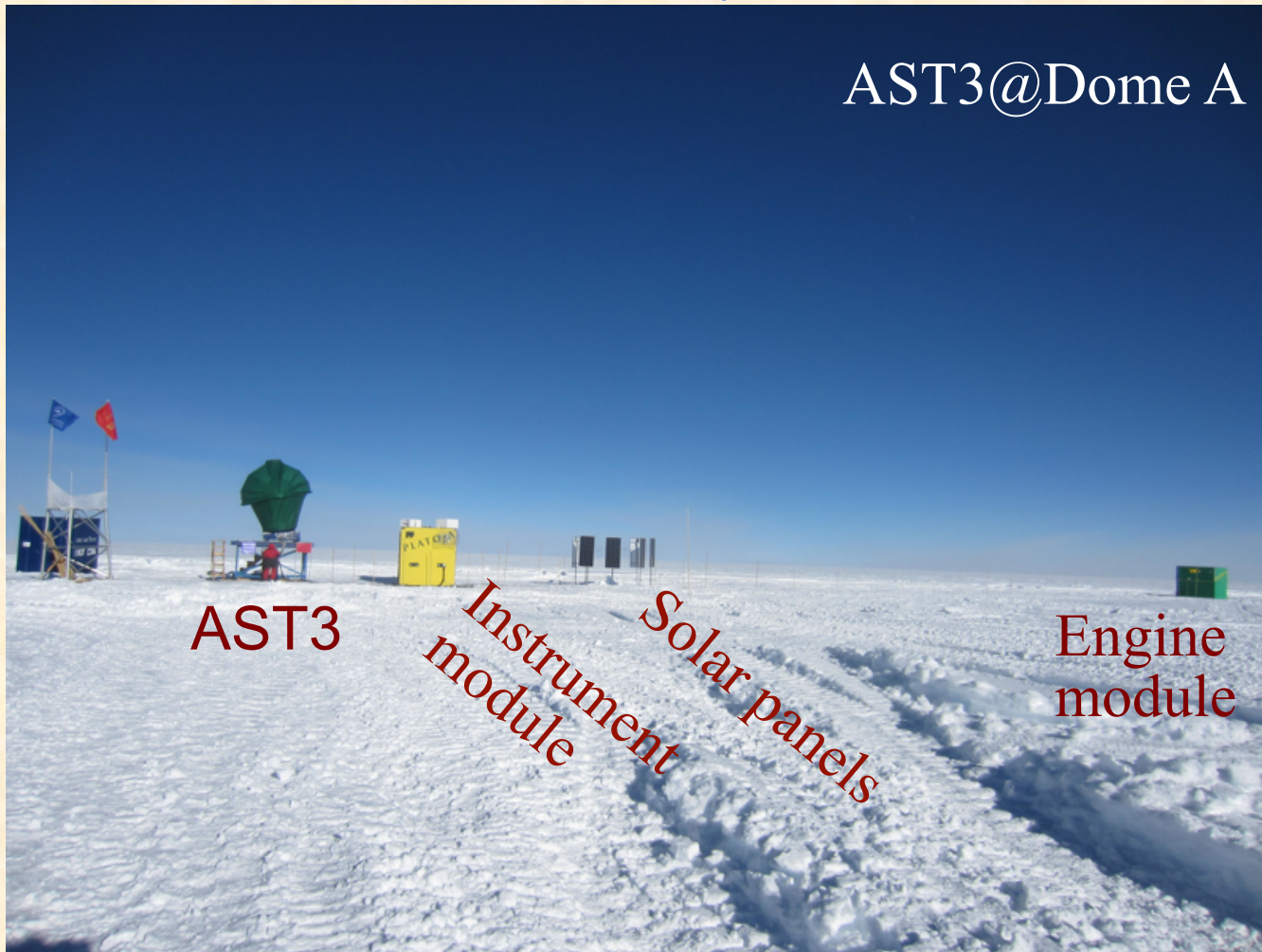
AST3 Sciences--- Time domain astronomy

- **Supernova**
 - Very early discovery
 - Uniform, multi-color light-curve
- **Exoplanets**
 - Transients
 - Micro-lensing
- **Variable stars**
- **Quasar, AGN**
- **Gamma-ray bursts**
- **LMC, SMC**
 - Nova
 - Micro-lensing
- ...

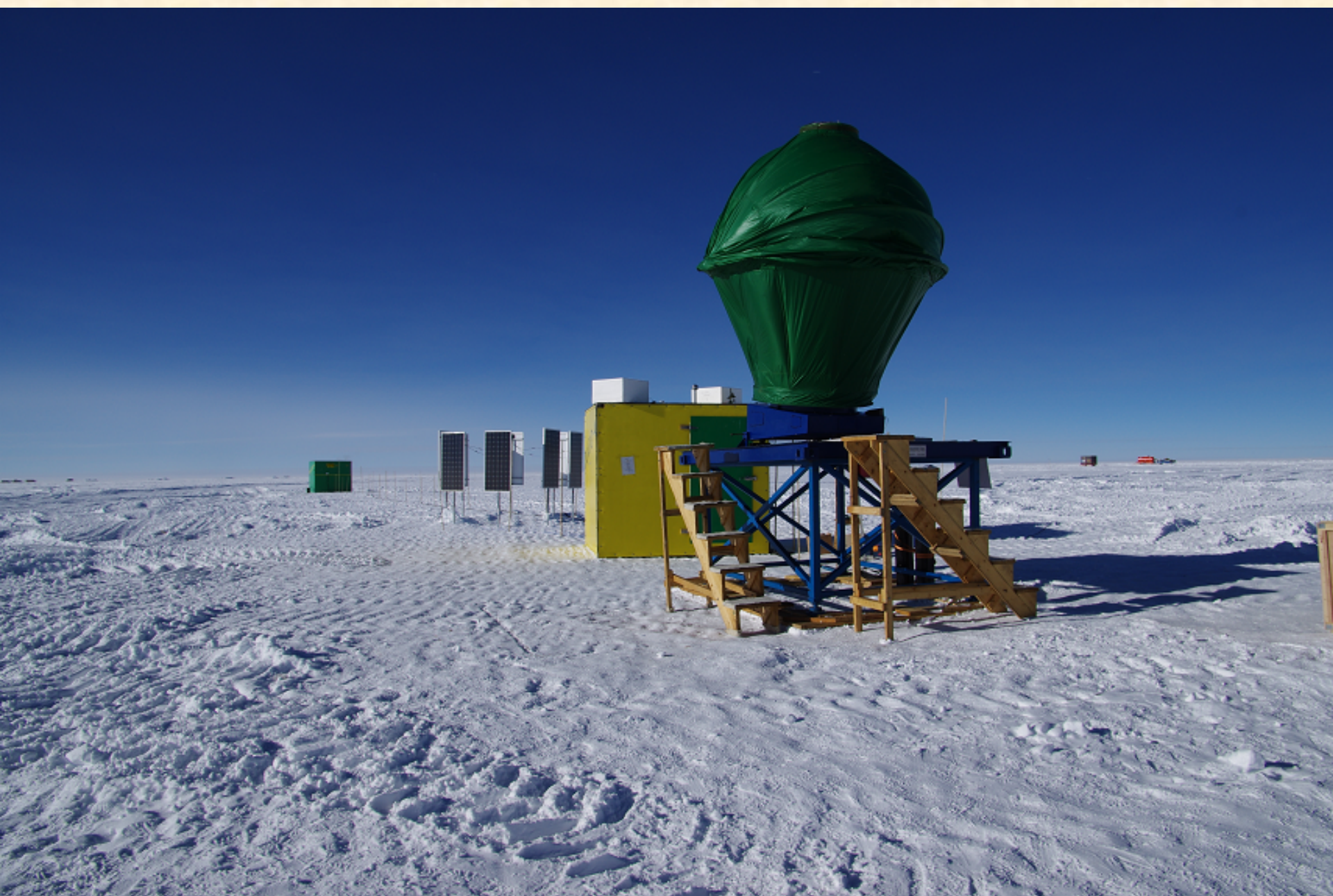


AST3-1

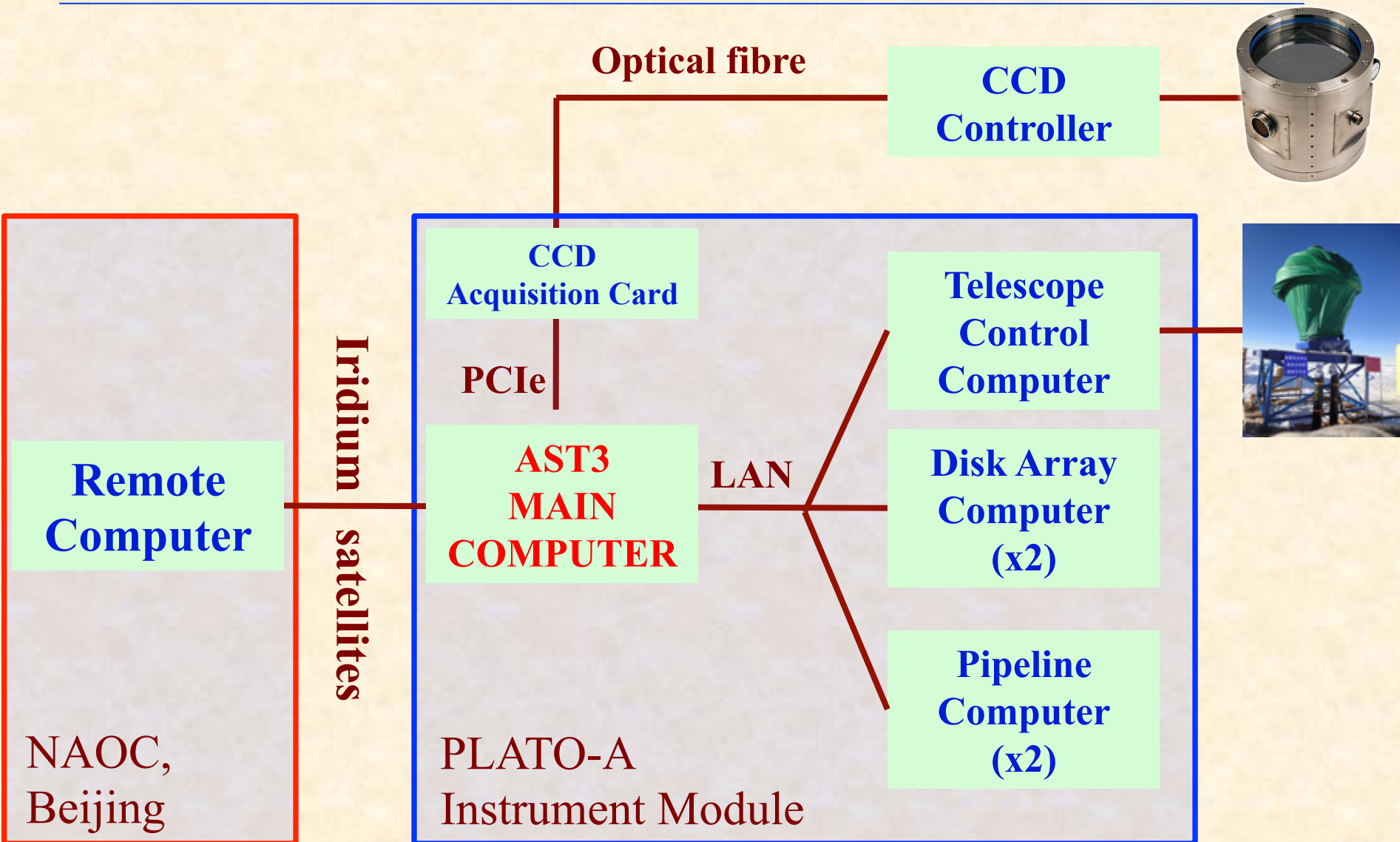
- Installed the 1st telescope at Dome A in January 2012
- Power and communication by PLATO-A (UNSW)



AST3-1



AST3 Operation in 2012

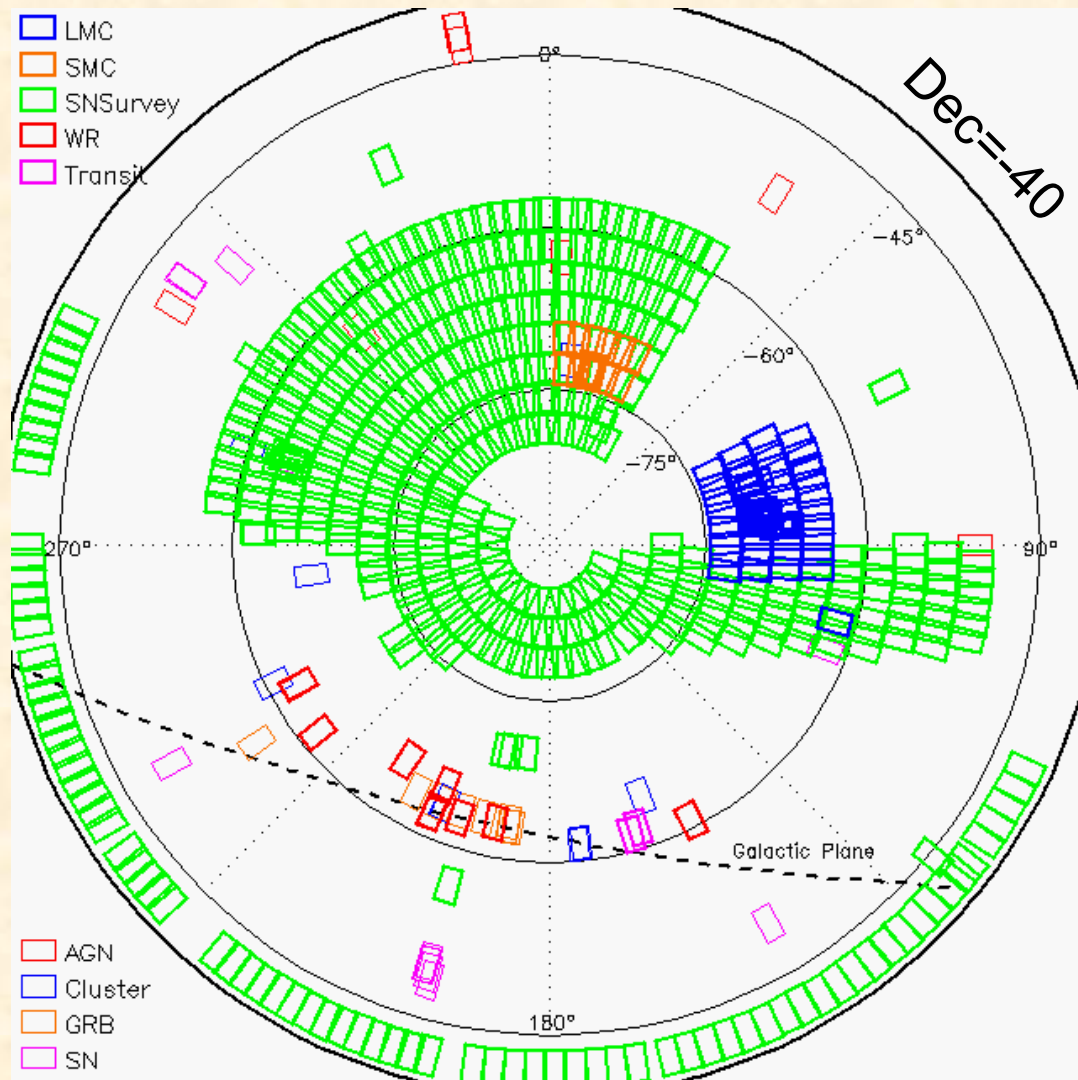


Observed Targets (pilot obs.)

- SNe search survey
- Exoplanet Transit
- LMC (full galaxy)
- SMC (full galaxy)

- LMC-center, LMC-center2, LMC-NOVA
- SMC-center
- Wolf–Rayet stars
- AGNs, GRBs, SNe ...

Sky coverage



Unfortunate Situation

2012 Operation

- Operated for only 56 days (March 13th to May 7th) due to a power failure.
- Collected ~26,000 frames including both testing and science images

2013 Traverse

- Fixed the power problem, maintained the telescope;
- But the CCD controller failed;
- Retrieved 3.2TB data (April 2013)



Summary of 2012 Data

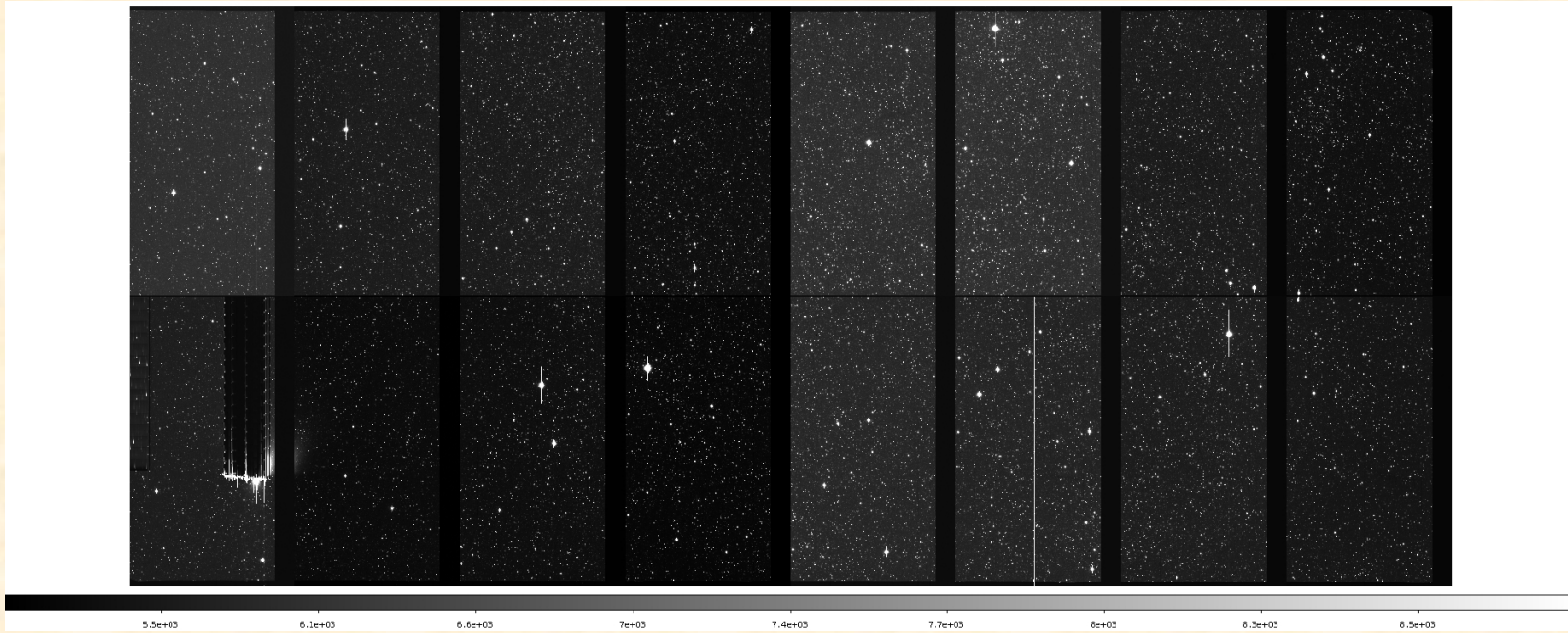
	Num of images	Total exptime (hour)
Testing	2908	21.64
Science	22875	221.33
Total	25783	242.97

Tests: twilight flats, sky background (twilight->dark), test
Science: most frames during dark time (including engineering data)

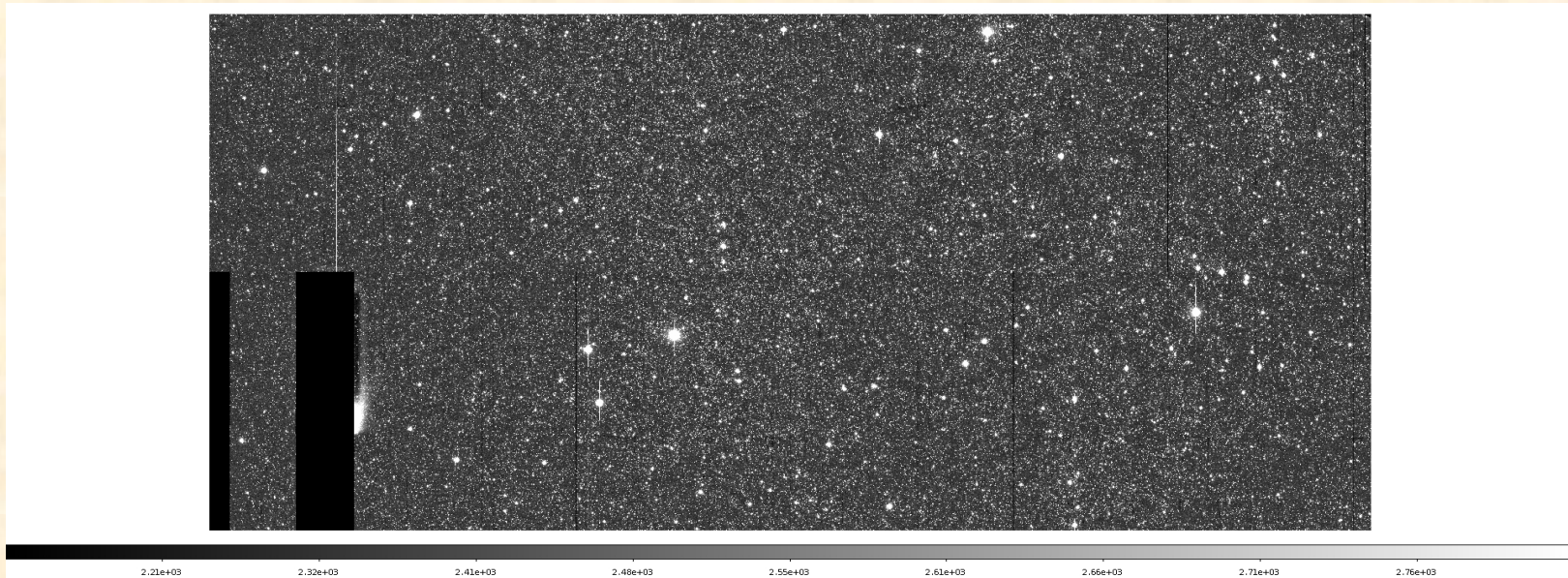
Evaluating the data (V0.1, preliminary)

- Update FITS headers based on observation logs;
- Apply simple overscan and flat field corrections;
- Run aperture photometry on all images and summarize the results

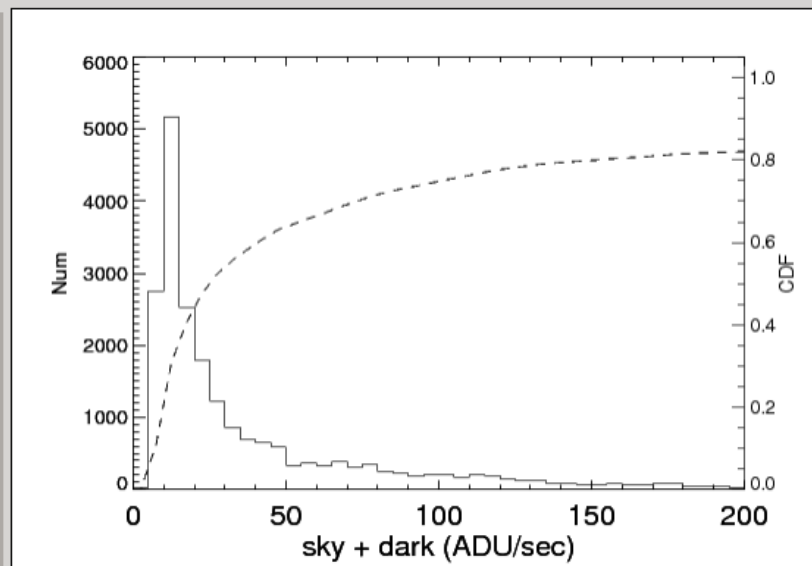
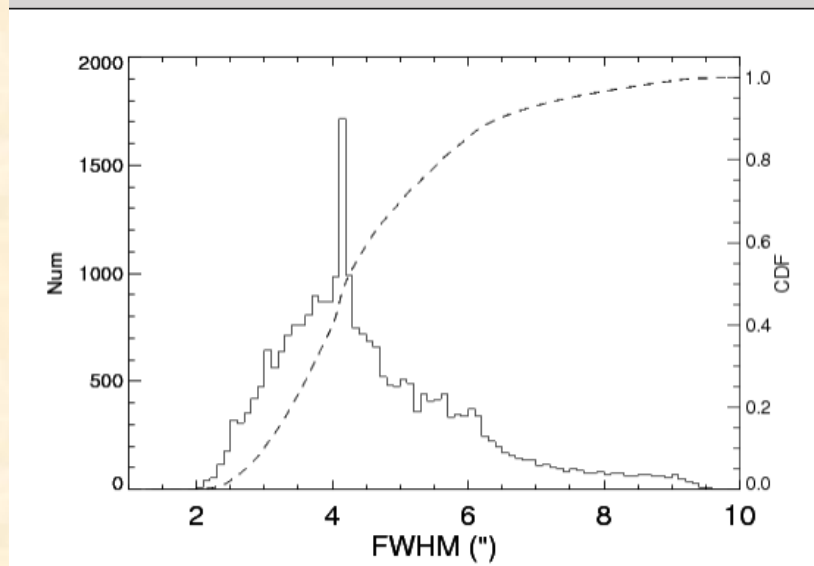
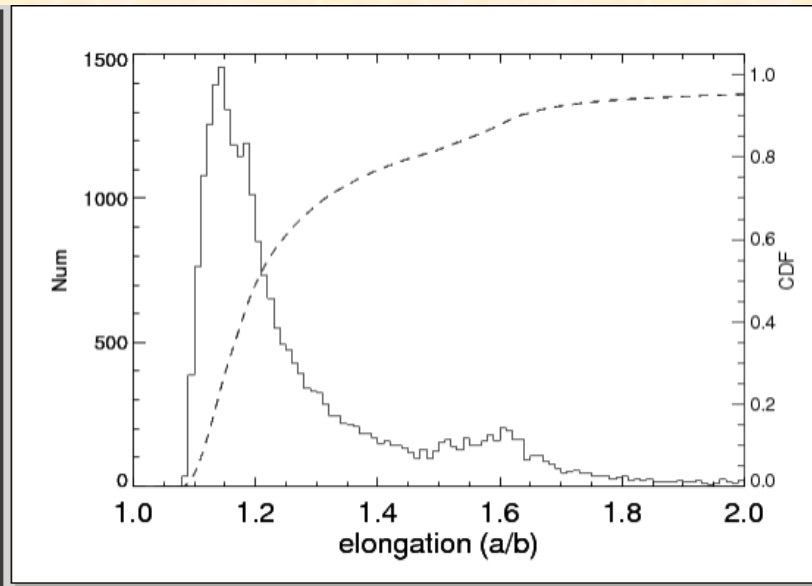
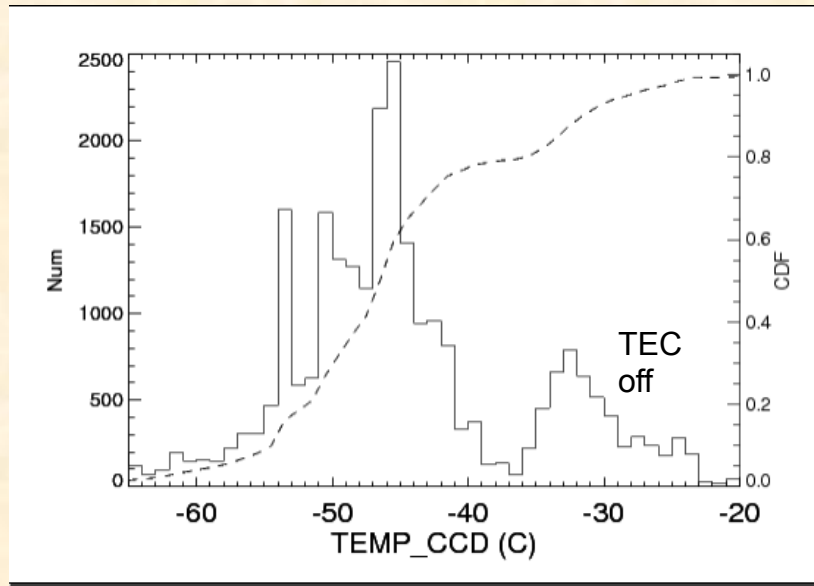
Before



After



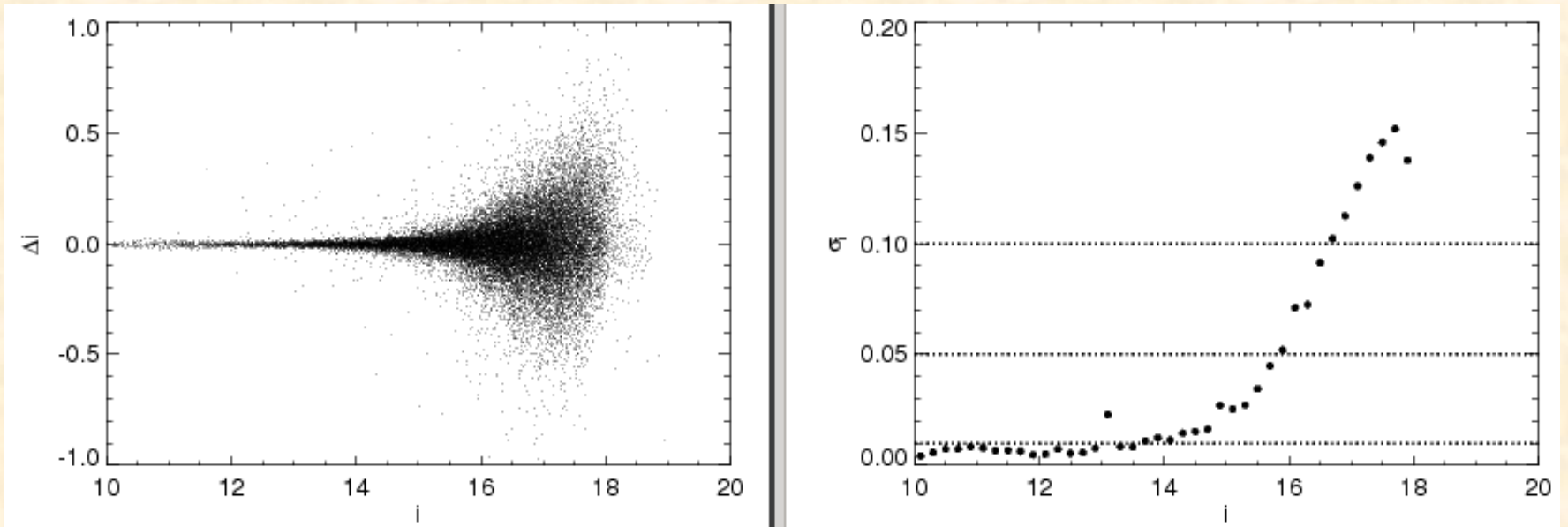
Statistics from the photometry



FWHM: seeing, optics, tracking

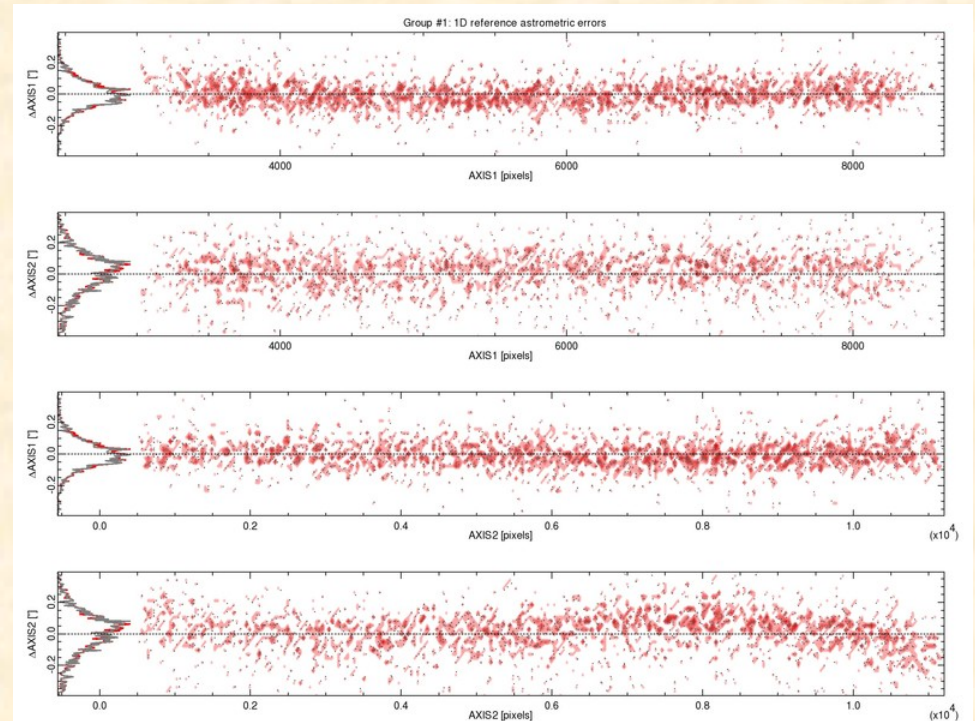
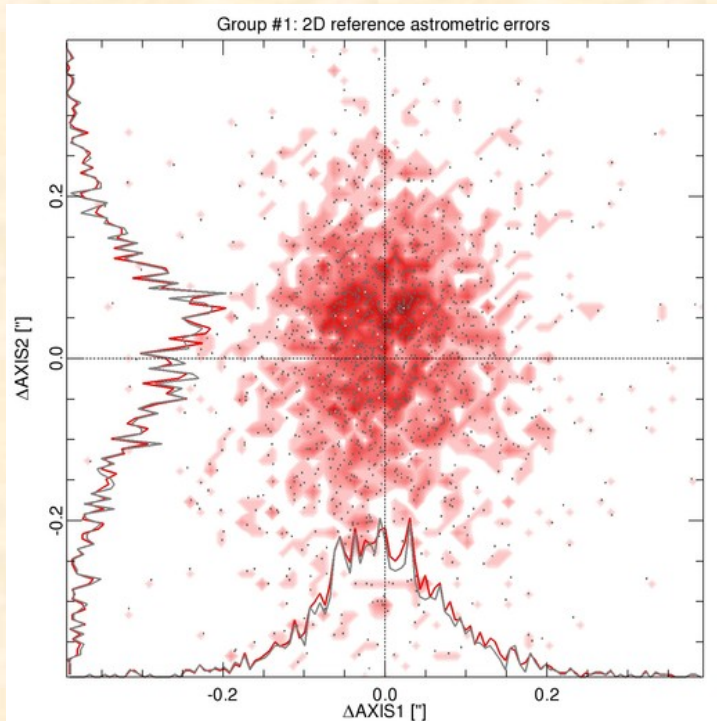
Dark: 1.5 ADU/s @ -45C
(Gain=1.8e-/ADU)

Photometry precision



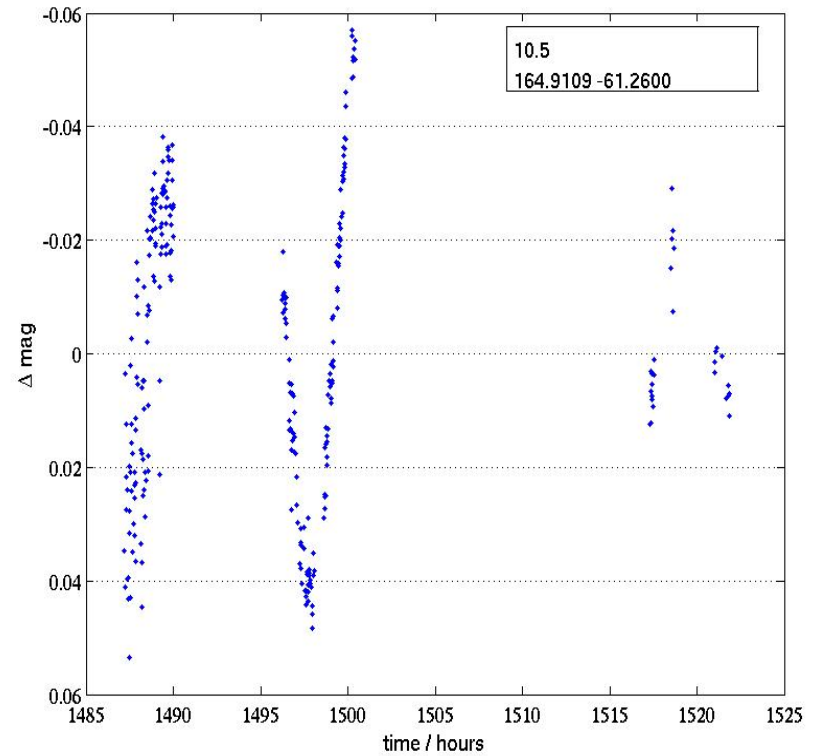
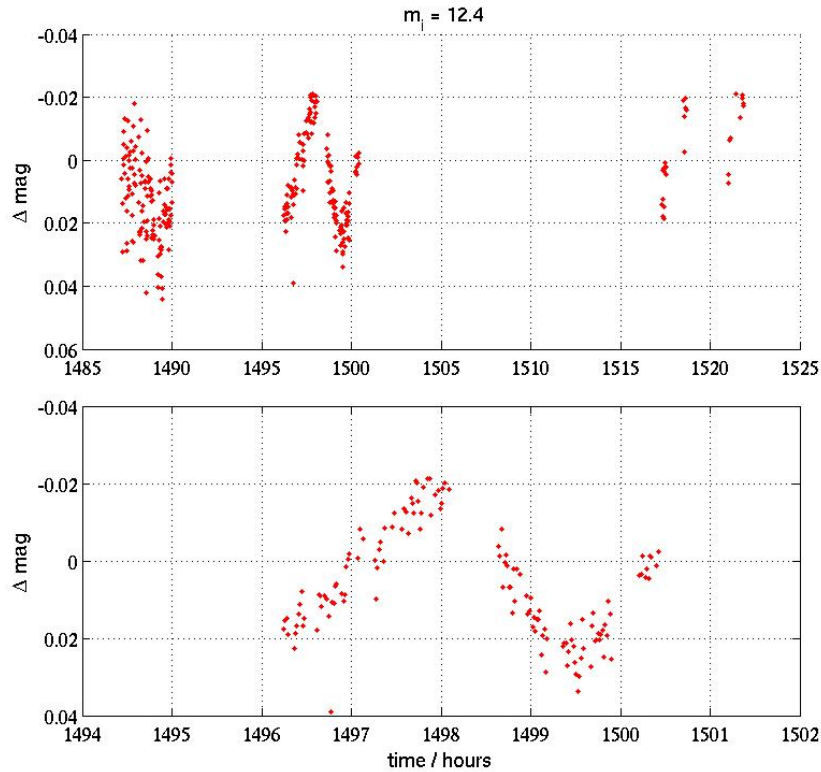
- 0331.116 (RA=280.4, Dec=-73.0), a very good image
- 60sec, sky+dark ~ 580 ADU, fwhm $\sim 2.8''$
- sky+dark RMS ~ 50 ADU
(rough flat, no dark correction)
- Rough photometric calibration to I-band (DENIS):
Lupton (2005): $I = i - 0.3780 \cdot (i - z) - 0.3974$
 $i \approx -2.5 \cdot \log(\text{flux}/t) + 21.8$
- Limiting mag ~ 18

Astrometry precision



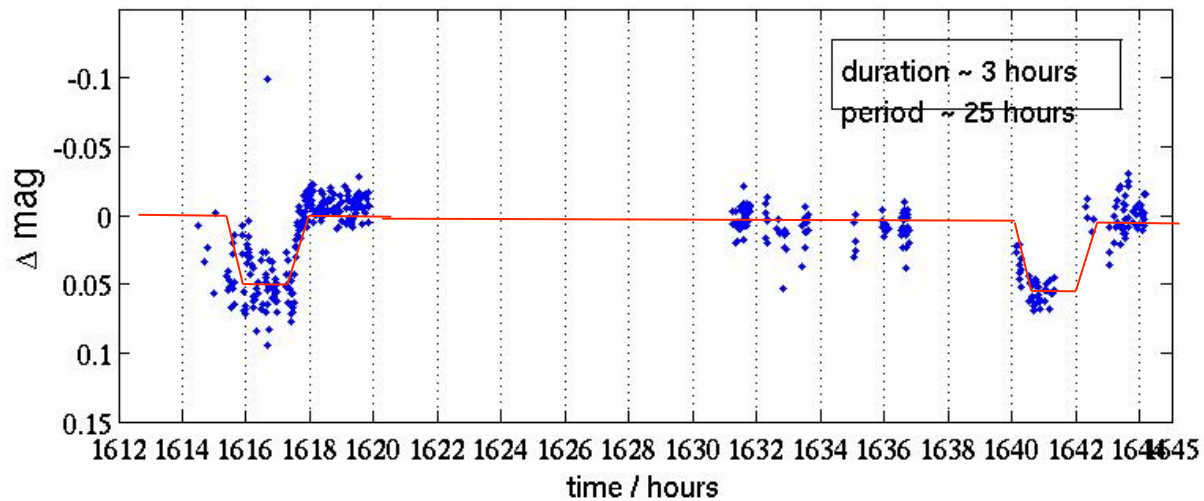
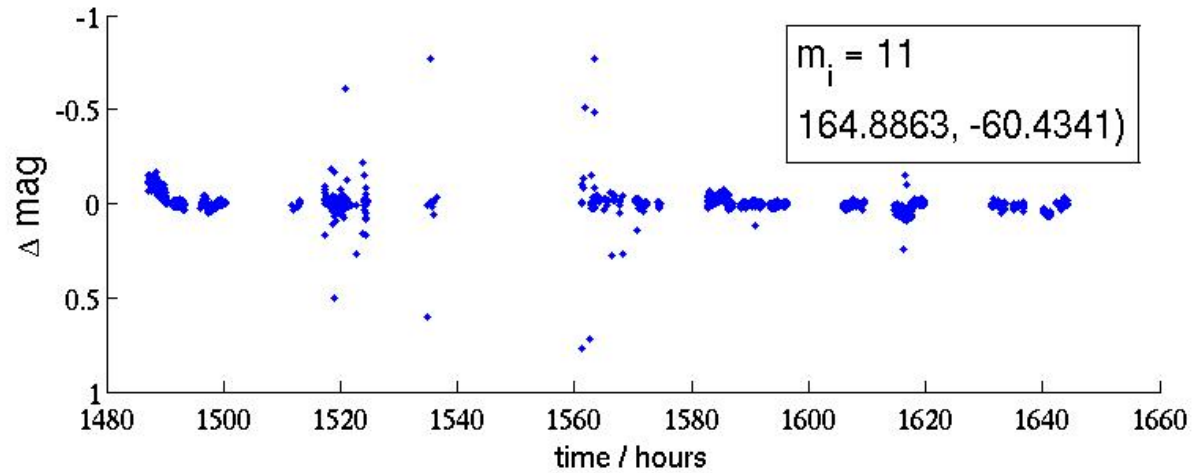
- 0331.116 (RA=280.4, Dec=-73.0)
- SCAMP reference catalog: PPMX (~0.04")
- $\Delta\text{RA RMS} \sim 0.09''$; $\Delta\text{DEC RMS} \sim 0.13''$

Bright Variables



In exoplanet search fields

Transit Brown Dwarf?



In exoplanet search fields

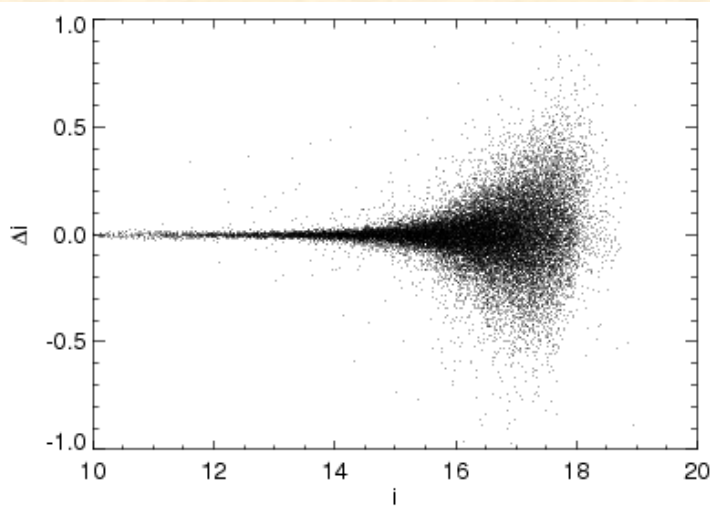
Progress since V0.1

More Corrections:

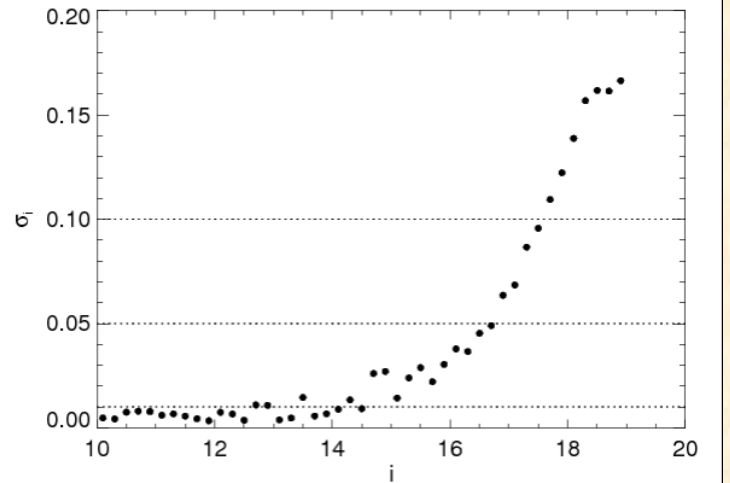
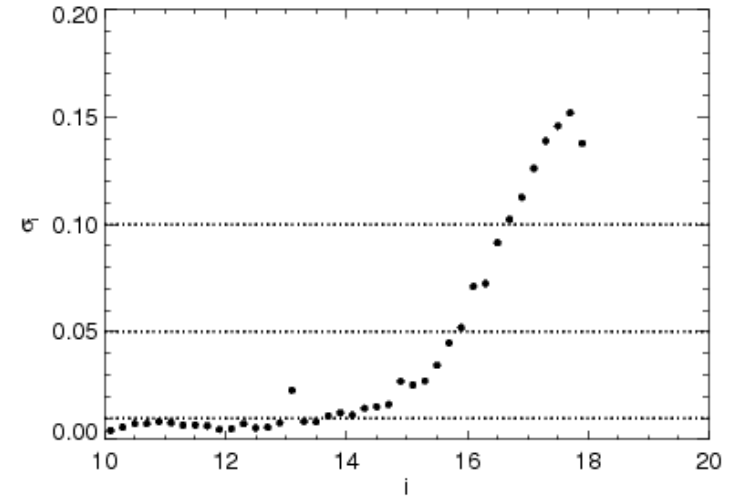
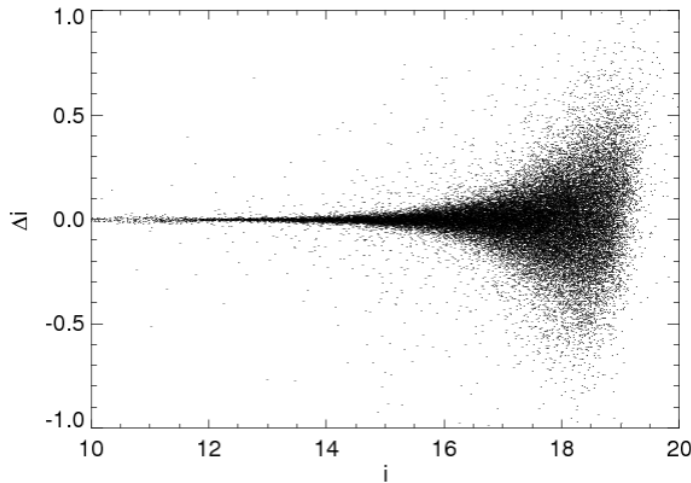
- Overscan
- Flat (improved)
- Crosstalk
- Dark
- Photometric Calibration
 - The AAVSO All-Sky Photometric Survey (APASS) will calibrate the entire sky in five passbands: Johnson B and V, and Sloan g' , r' , i' .
 - The magnitude range is $10 < V < 17$, with photometric accuracy near 0.02mag at the bright end.

Photometric Precision (improved)

V0.1:
Overscan
flat



Now:
Crosstalk
Overscan
Dark
Flat(revised)



A0331.116@-40C

~ 1 mag deeper

AST3-2 (2013.03, @Xinglong Station, NAOC)



AST3-1



Improvements for AST3-2

Reliability



Single-point failure



Improvements for AST3-2

Telescope

- Two filters at the focal plane (remote control)
- High resolution encoder (higher accuracy)
- Thermal dissipation of the CCD camera (better tube seeing)
- Supporting tower (minimize ground layer turbulence)
- Optimization of the enclosure
- Better anti-vibration design for the harsh transportation conditions
- ...

Hardware redundancy (operation system)

- Control Computers and Network
- Data Storage
- Power Supply
- CCD Fiber-optic Communication
- ...

Software (operation & pipeline)

- Adding daemon processes
- ...



To be tested in Mohe, China over the winter



Latitude: 52°N
T: $-30^{\circ}\text{C} \sim -40^{\circ}\text{C}$
(in winter)

Thanks !