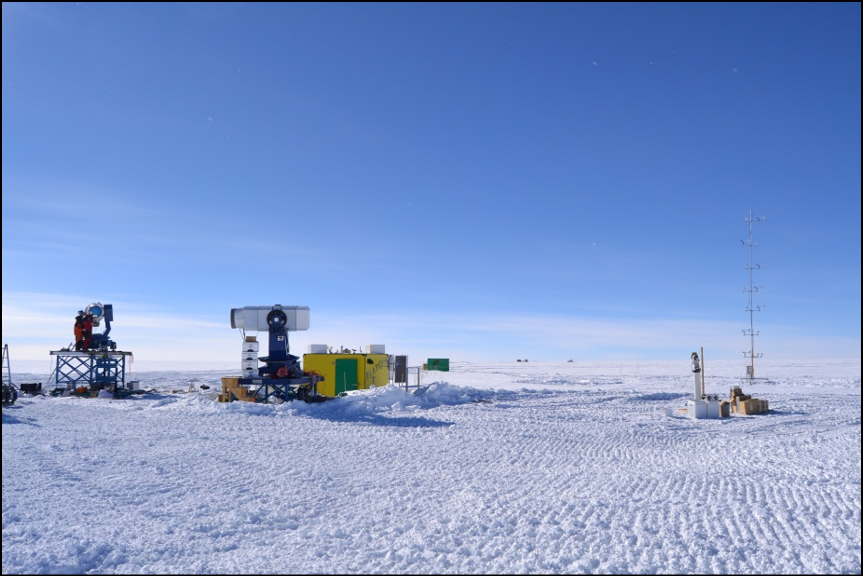
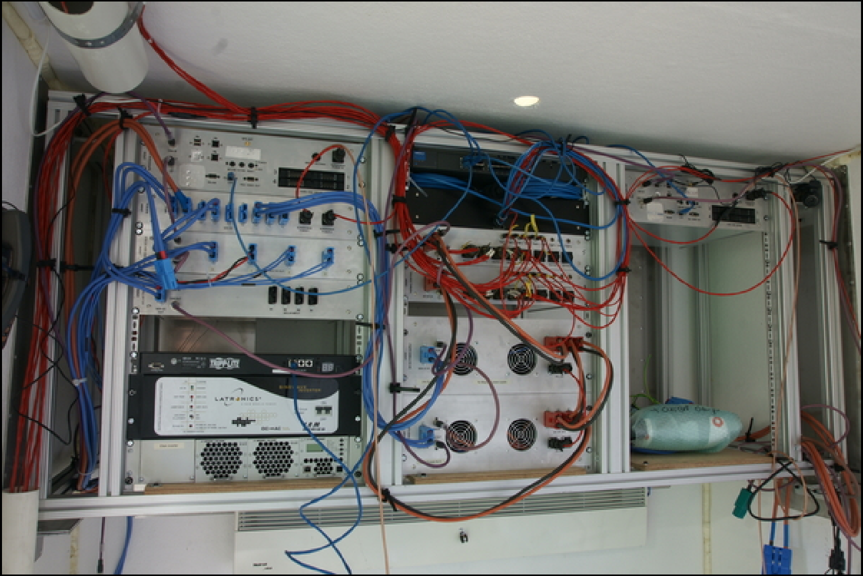
PLATO-A status and new instruments—Michael Ashley / UNSW

- PLATO-A introduction.
- The 2014/2015 servicing mission.
- Problems: battery pack, power limitations, CCD temperature stabilisation.
- PLATO-A website.
- New instruments: NIRSPEC, HRCAM, NISM (Ridge A).
- Evryscope: a proposed "almost all-sky" "almost gigapixel" telescope.



PLATO-A and AST3 telescopes at Kunlun Station 2015.

PLATO-A Engine Module, Dome A.

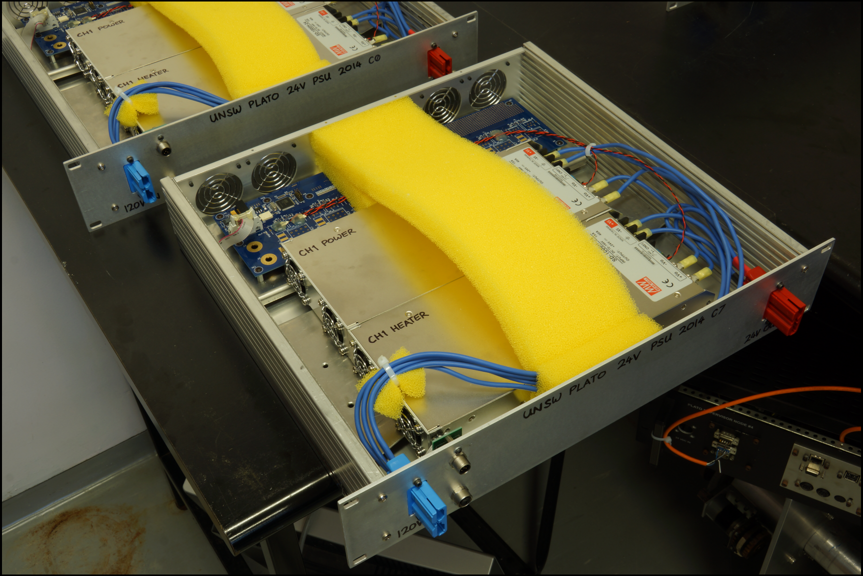


PLATO-A Instrument Module, Dome A.

PLATO-A tasks at Dome A 2014/2015

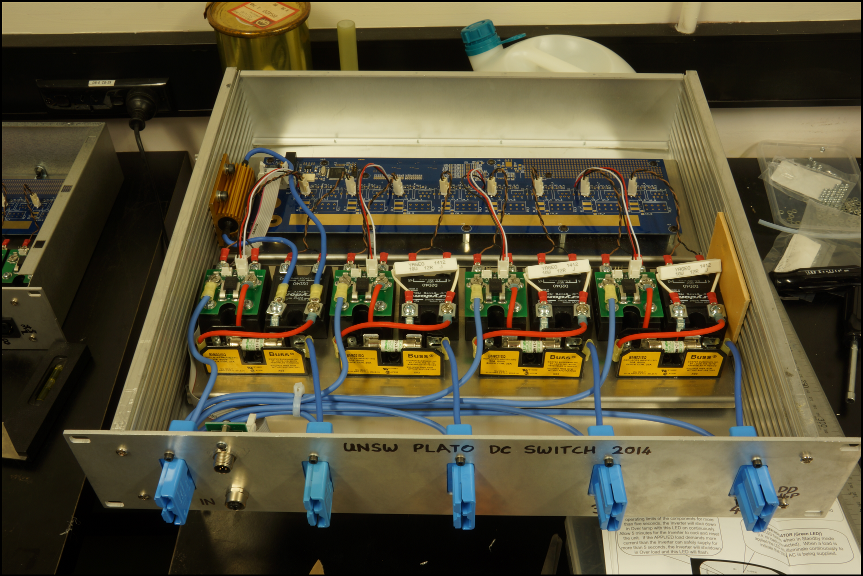
Fujia Du and Zhengyang Li

- Replace all five diesel engines.
- Add 6000 litres of fuel to the Engine Module.
- Replace all 108 LiFePO4 batteries, 250 kg.
- Replace battery management system.
- Replace all the 24VDC power distribution boxes, to increase reliability.
- Replace the 120VDC to 230VAC inverter.
- Add new AC and DC switch boxes.
- Replace the 24VDC power supplies.
- Add the new MOXA gigabit switches.
- Replace disk drives in the supervisor computers, including a 6TB He-filled drive.
- Install the new NIRSPEC spectrometer instrument.

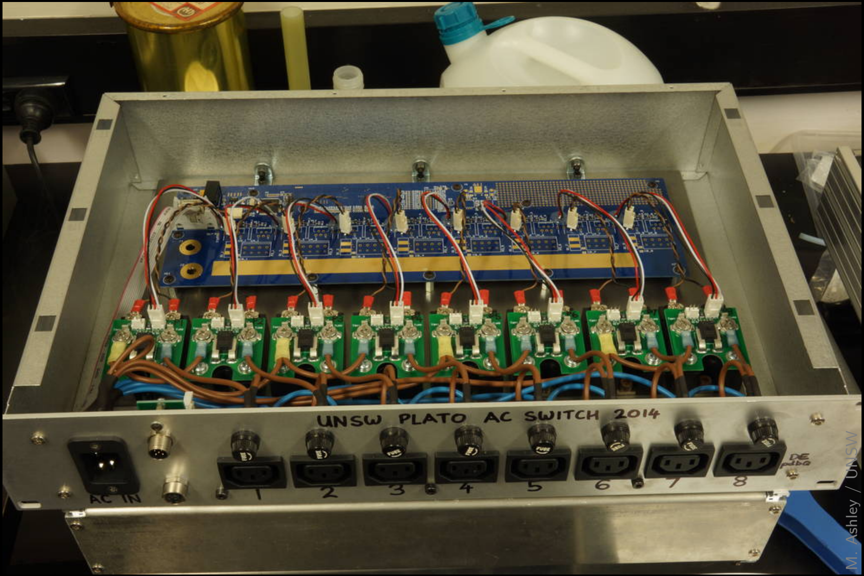


New 24VDC power supplies for Dome A, 2015.

120VDC to 230VAC inverter.

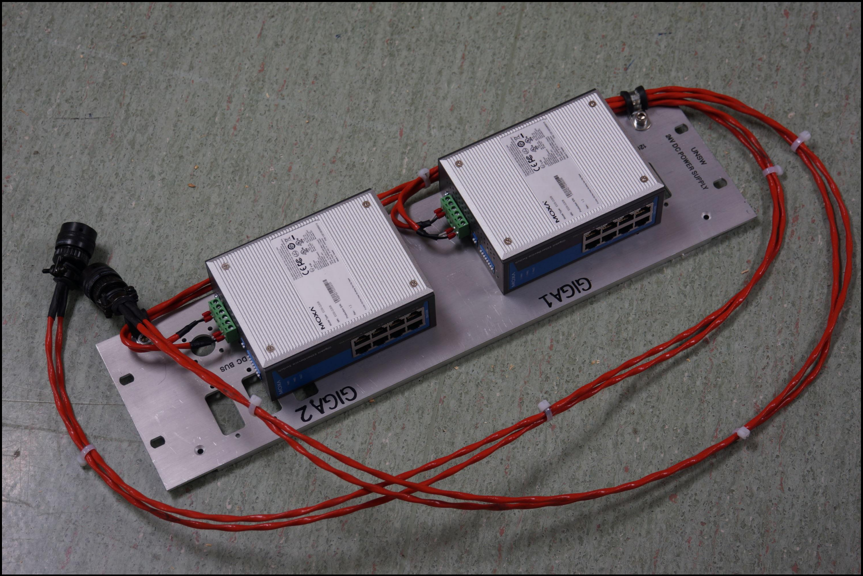


New 120VDC switch box for Dome A, 2015.



8-way 230VAC switch box.

New 24VDC Power Distribution Boxes for Dome A, 2015.



MOXA gigabit network switches, with dual power supplies.

6TB helium-filled disk drive

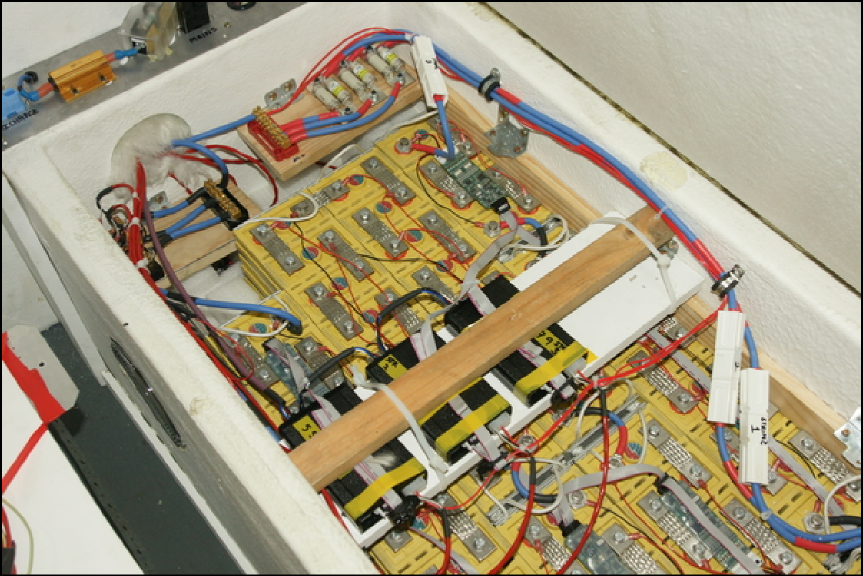
Problems at Dome A 2014/2015

- One of three battery strings has no cell voltage monitoring.
- One cell in one of the other two strings is basically dead.
- This leaves us with only 1/3rd of our battery capacity.
- PLATO-A is nominally a 1 kW continuous supply, but we are going to exceed that when AST3-1, AST3-2, and CSTAR are all operating.
- The optical fibre input into NIRSPEC broke. Fortunately, still usable.
- AST3 thermoelectric cooler temperature stability.
- ADT3-2 TEC cooling pump appears to have stopped.

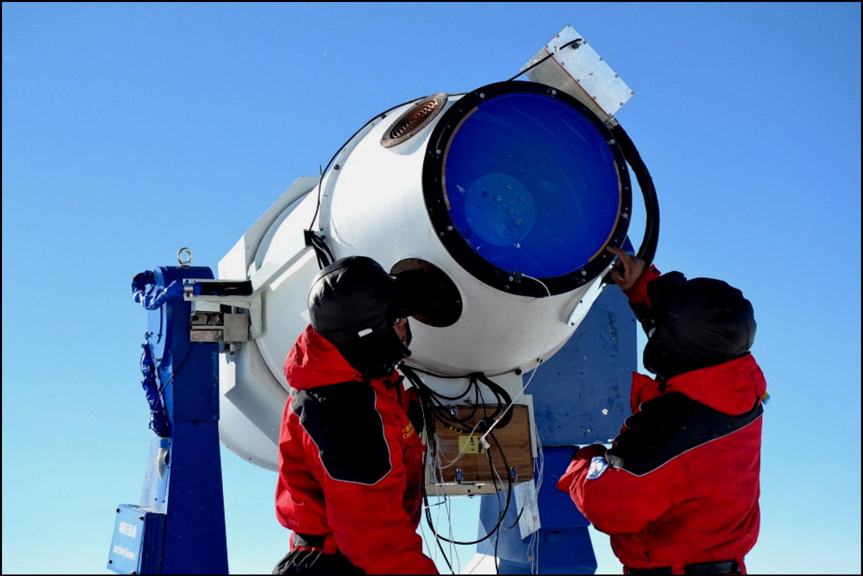
String 1					String 2					String 3				
-1	-1	-1	-1	-1	7423	5608	7422	7430	5598	6436	6438	6439	7419	7417
0	0	0	0	0	3311	3311	3312	3311	3311	3338	2377	3339	3338	3337
0	0	0	0	0	3314	3312	3312	3311	3313	3339	3340	3339	3339	3339
0	0	0	0	0	3311	3310	3314	3309	3312	3340	3335	3338	3337	3334
0	0	0	0	0	3313	3312	3309	3314	3311	3337	3338	3339	3336	3339
0	0	0	0	0	3310	3311	3314	0	3311	3335	3340	0	3338	3336
0	0	0	0	0	3312	3309	3306	0	3309	3336	3337	0	3337	3337
0	0	0	0	0	3306	3314	3315	0	3312	3344	3334	0	3331	3338
0	0	0	0	0	3311	3309	3308	0	3307	3331	3341	0	3347	3333
0.0	0.0	0.0	0.0	0.0	19.7	24.0	18.8	18.5	23.2	26.2	22.9	22.9	19.5	18.7
0.0	0.0	0.0	0.0	0.0	-40.0	-29.9	-40.0	-40.0	16.6	0.0	0.0	18.8	-40.0	-40.0
123.39V		0.00V		1.442A	123.21V		119.20V		1.459A	123.00V		119.19V		0.170A

PLATO-A cell voltages, 9 March 2015.

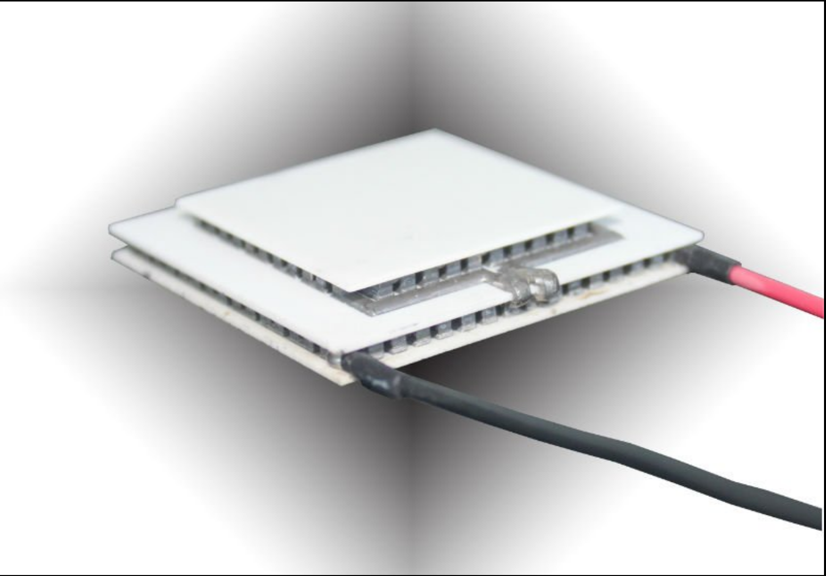
LiFePO4 battery pack, Dome A.



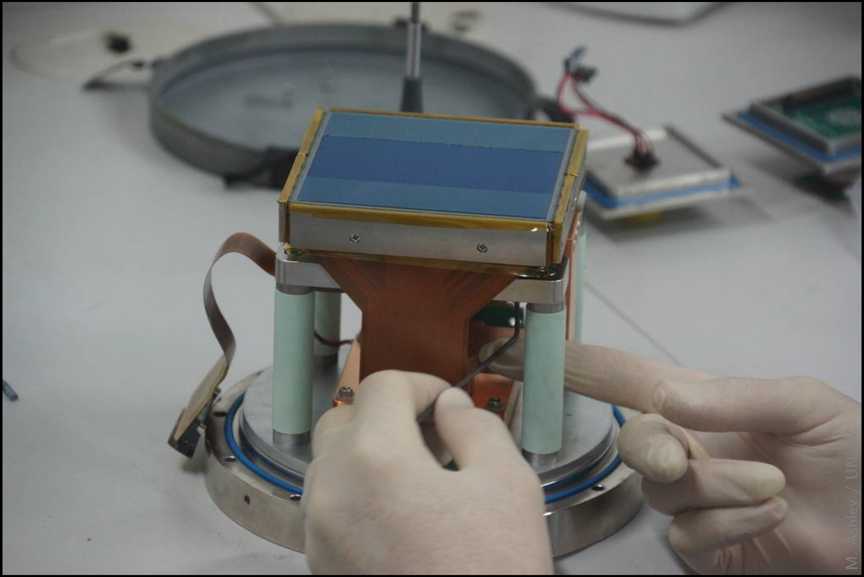
LiFePO4 battery pack, Dome A.



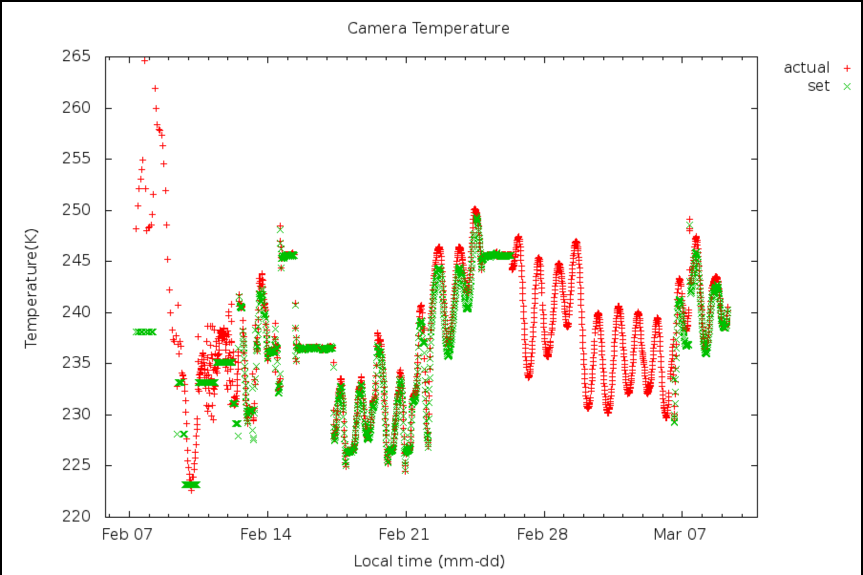
AST3-2 telescope at Dome A, 2015.



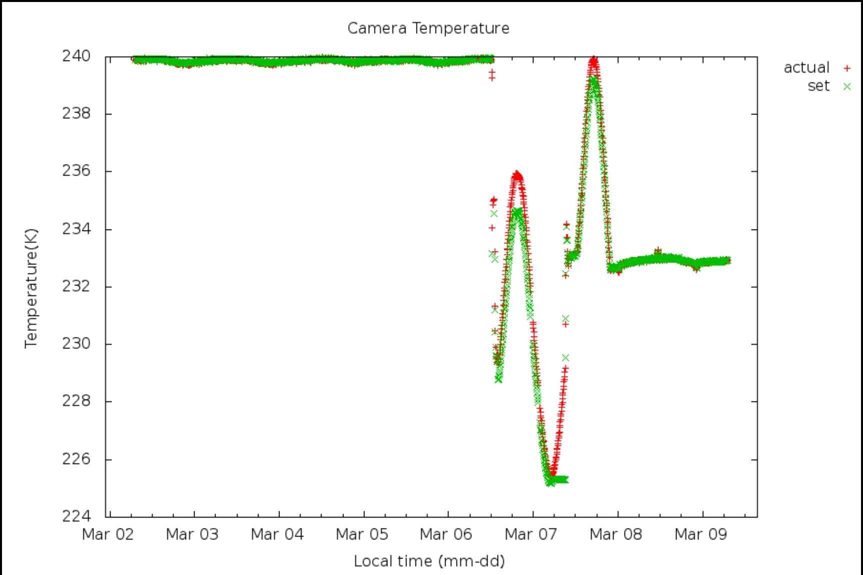
A two-stage thermoelectric cooler (TEC).



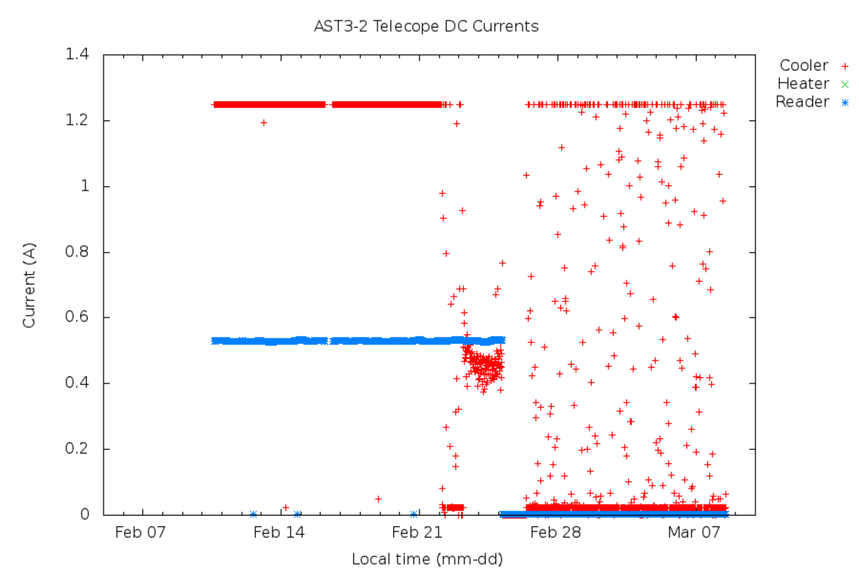
The STA CCD and mount from AST3-2, 2014.



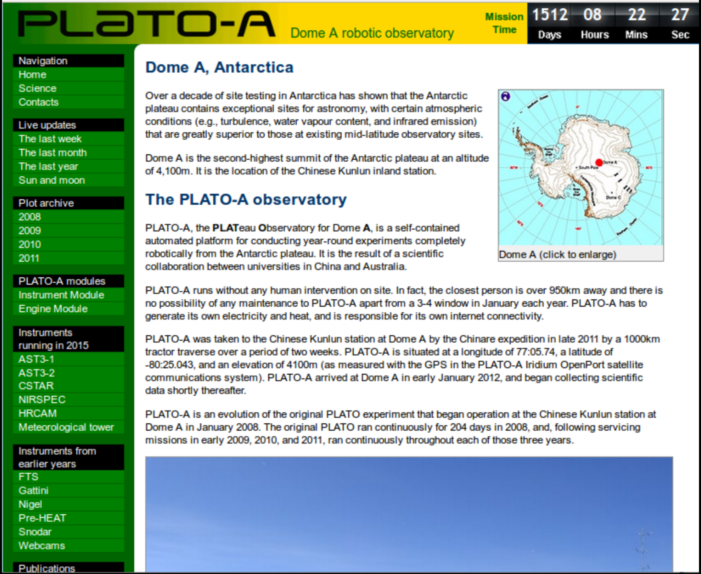
The AST3-2 CCD temperature.



The AST3-1 CCD temperature.



TEC cooling pump currents (red).


PLATO-A Dome A robotic observatory

Mission Time 1512 Days 08 Hours 22 Mins 27 Sec

Navigation
Home
Science
Contacts

Live updates
The last week
The last month
The last year
Sun and moon

Plot archive
2008
2009
2010
2011

PLATO-A modules
Instrument Module
Engine Module

Instruments running in 2015
AST3-1
AST3-2
CSTAR
NIRSPEC
HRCAM
Meteorological tower

Instruments from earlier years
FTS
Gattini
Nigel
Pre-HEAT
Snodar
Webcams

Publications

Dome A, Antarctica

Over a decade of site testing in Antarctica has shown that the Antarctic plateau contains exceptional sites for astronomy, with certain atmospheric conditions (e.g., turbulence, water vapour content, and infrared emission) that are greatly superior to those at existing mid-latitude observatory sites.

Dome A is the second-highest summit of the Antarctic plateau at an altitude of 4,100m. It is the location of the Chinese Kunlun inland station.

Dome A (click to enlarge)

The PLATO-A observatory

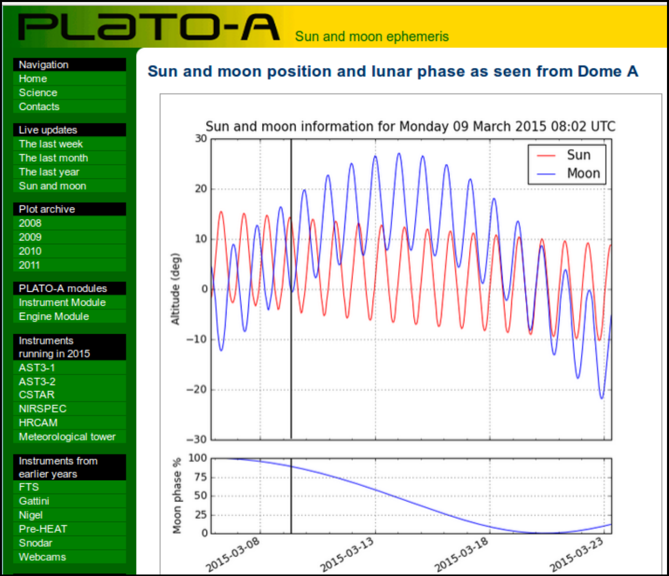
PLATO-A, the **PLAT**eau **O**bservatory for Dome **A**, is a self-contained automated platform for conducting year-round experiments completely robotically from the Antarctic plateau. It is the result of a scientific collaboration between universities in China and Australia.

PLATO-A runs without any human intervention on site. In fact, the closest person is over 950km away and there is no possibility of any maintenance to PLATO-A apart from a 3-4 window in January each year. PLATO-A has to generate its own electricity and heat, and is responsible for its own internet connectivity.

PLATO-A was taken to the Chinese Kunlun station at Dome A by the Chinare expedition in late 2011 by a 1000km tractor traverse over a period of two weeks. PLATO-A is situated at a longitude of 77:05.74, a latitude of -80:25.043, and an elevation of 4100m (as measured with the GPS in the PLATO-A Iridium OpenPort satellite communications system). PLATO-A arrived at Dome A in early January 2012, and began collecting scientific data shortly thereafter.

PLATO-A is an evolution of the original PLATO experiment that began operation at the Chinese Kunlun station at Dome A in January 2008. The original PLATO ran continuously for 204 days in 2008, and, following servicing missions in early 2009, 2010, and 2011, ran continuously throughout each of those three years.

PLATO-A website http://mcba11.phys.unsw.edu.au/~plato-a/



PLATO-A sun and moon emphemeris

PLATO-A Papers and publications

Navigation
Home
Science
Contacts

Live updates
The last week
The last month
The last year
Sun and moon

Plot archive
2008
2009
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2011

PLATO-A modules
Instrument Module
Engine Module

Instruments running in 2015
AST3-1
AST3-2
CSTAR
NIRSPEC
HRCAM
Meteorological tower

Instruments from earlier years
FTS
Gattini
Nigel
Pre-HEAT
Snodar
Webcams

Publications

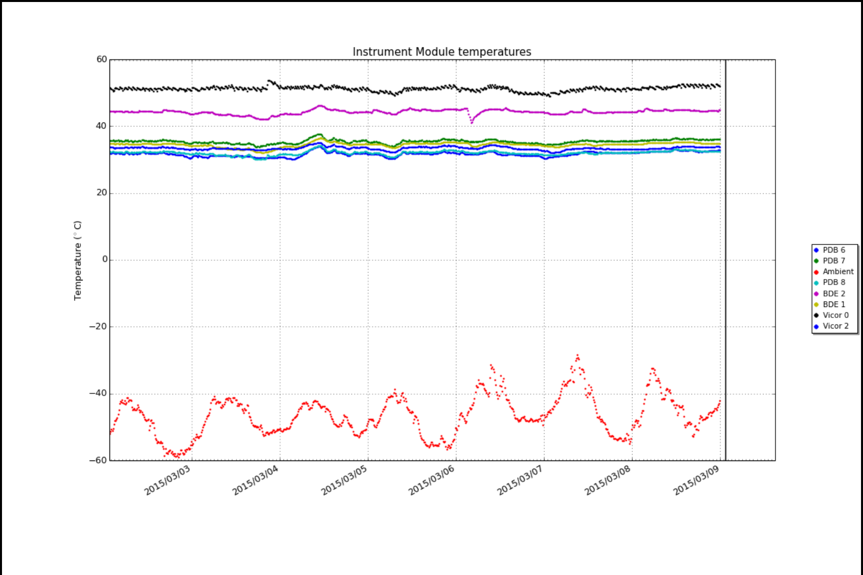
PLATO-A and PLATO papers and publications

In reverse chronological order within each category.

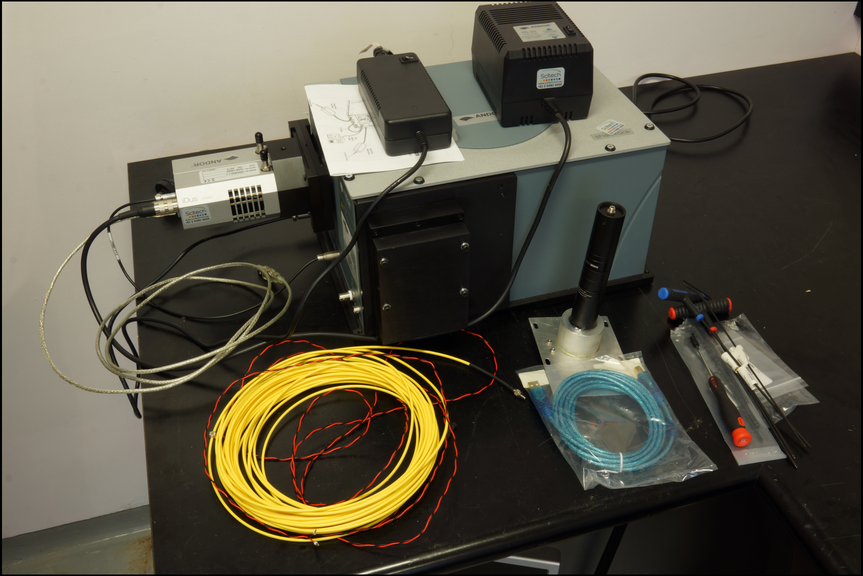
Refereed papers

1. Oelkers, R. J., Macri, L. M., Wang, L., Ashley, M. C. B., Cui, X., Feng, L.-L., Gong, X., Lawrence, J. S., Qiang, L., Luong-Van, D., Pennypacker, C. R., Yang, H., Yuan, X., York, D. G., Zhou, X., Zhu, Z., 2014, Difference Image Analysis of Defocused Observations with CSTAR, *Astronomical Journal*, **149:50**.
2. Burton, M. G., Ashley, M. C. B., Braiding, C., Storey, J. W. V., Kulesa, C., Hollenbach, D. J., Wolfire, M., Gluck, C., Rowell, G., 2014, The Carbon Inventory in a Quiescent, Filamentary Molecular Cloud in G328, *Astrophysical Journal*, **782**, 72.
3. Hu, Y., Shang, Z., Ashley, M. C. B., Bonner, C. S., Hu, K., Liu, Q., Li, Y., Ma, B., Wang, L., and Wen, H., 2014, Meteorological Data for the Astronomical Site at Dome A, Antarctica, *PASP*, **126**, 868–881.
4. Qian, S.-B., Wang, J.-J., Zhu, L.-Y., Snoonthornthum, B., Wang, L.-Z., Zhao, E. G., Zhou, X., Liao, W.-P., and Liu, N.-P., 2014, Optical Flares and a Long-lived Dark Spot on a Cool Shallow Contact Binary, *The Astrophysical Journal Supplement Series*, **212:4**.
5. Huang, Z., Fu, J., Zong, W., Wang, L., Macri, L. M., Wang, L., Ashley, M. C. B., Cui, X., Feng, L.-L., Gong, X., Lawrence, J. S., Liu, Q., Luong-Van, D., Pennypacker, C. R., Yang, H., Yuan, X., York, D., Xu, Z., Zhu, Z., Zhu, Z., 2015, Pulsations and Period Changes of the Non-Blazhko RR Lyrae Variable Y Oct Observed from Dome A, Antarctica, *Astronomical Journal*, **149**, 25.
6. Wang, S.-H., Zhou, X., Zhang, H., Zhou, J.-L., Liu, H.-G., Meng, Z.-Y., Ma, J., Zhang, T.-M., Fan, Z. and Zou, H., 2014, The correction of diurnal effects on CSTAR photometry, *Research in Astronomy and Astrophysics*, **14**, 345–356.
7. Wang, S., Zhang, H., Zhou, J.-L., Zhou, X., Yang, M., Wang, L., Bayliss, D., Zhou, G., Ashley, M. C. B., Fan, Z., Feng, L.-L., Gong, X., Lawrence, J. S., Liu, H., Liu, Q., Luong-Van, D. M., Ma, J., Meng, Z., Storey, J. W. V., Wittenmyer, R. A., Wu, Z., Yan, J., Yang, H., Yang, J., Yang, J., Yuan, X., Zhang, T., Zhu, Z., Zou, H., 2014, Planetary Transit Candidates in the CSTAR Field: Analysis of the 2008 Data, *The Astrophysical Journal Supplement Series*, **211**, 26.
8. Meng, Z., Zhou, X., Zhang, H., Zhou, J., Wang, S., Ma, J., Zhang, T., Fan, Z., Zou, H., 2013, Ghost Image Correction in CSTAR Photometry, *PASP*, **125**, 1015–1020.
9. Wang, L., Macri, L. M., Wang, L., Ashley, M. C. B., Cui, X., Feng, L.-L., Gong, X., Lawrence, J. S. , Liu, Q., Luong-Van, D., Pennypacker, C. R. and Shang, Z., Storey, J. W. V., Yang, H., Yang, J., Yuan, X., York, D. G., Zhou, X., Zhu, Z., Zhu, Z., 2013, Photometry of Variable Stars from Dome A, Antarctica: Results from the 2010 Observing Season, *Astronomical Journal*, **146**, 139.
10. Sims, G., Ashley, M. C. B., Cui, X., Everett, J. R., Feng, L., Gong, X., Hengst, S., Hu, Z., Lawrence, J. S., Luong-Van, D. M., Moore, A. M., Riddle, R., Shang, Z., Storey, J. W. V., Tothill, N., Travouillon, T., Wang, L., Yang, H., Yang, J., Zhou, X., and Zhu, Z., 2012, Airglow and Aurorae at Dome A, Antarctica, *Publications of the Astronomical Society of the Pacific*, **124**, 637–649.

PLATO-A publications



PLATO-A Instrument Module temperatures

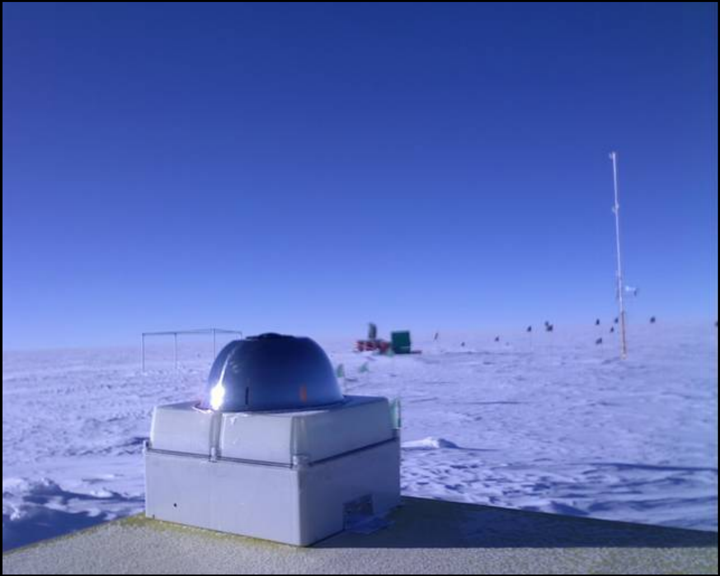


The NIRSPEC spectrometer and InGaAs camera.

The InGaAs camera, showing additional cooling fans.

NIRSPEC specifications

- 0.7 to 1.4 microns.
- 512 pixel InGaAs detector, cooled to -75C.
- Two gratings: $R \sim 600$ and $R \sim 3000$.
- In the high-resolution mode we will be able to see between the auroral/aiglow lines and measure the continuum.
- Fibre optic input.
- There was the ability to tilt the fibre to different airmasses, but this was lost when the fibre broke.

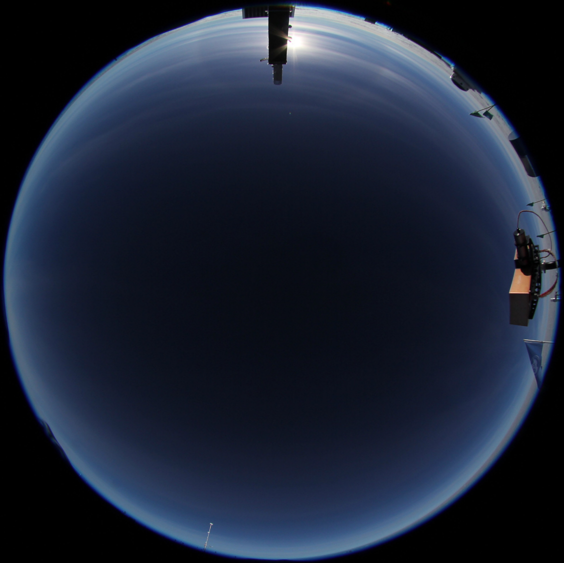


HRCAM3 at Ridge A, 2015.

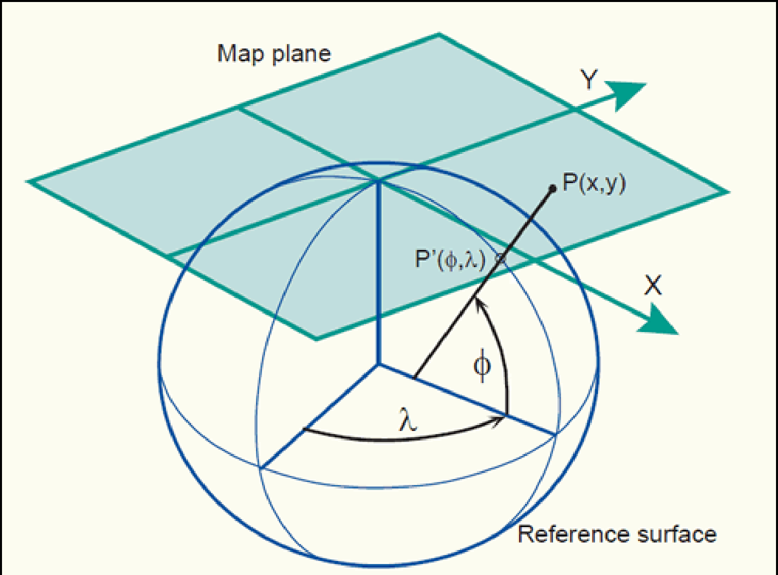
HRCAM1 image from Dome A, 4 March 2015.

HRCAM1 image from Dome A, 4 August 2010.

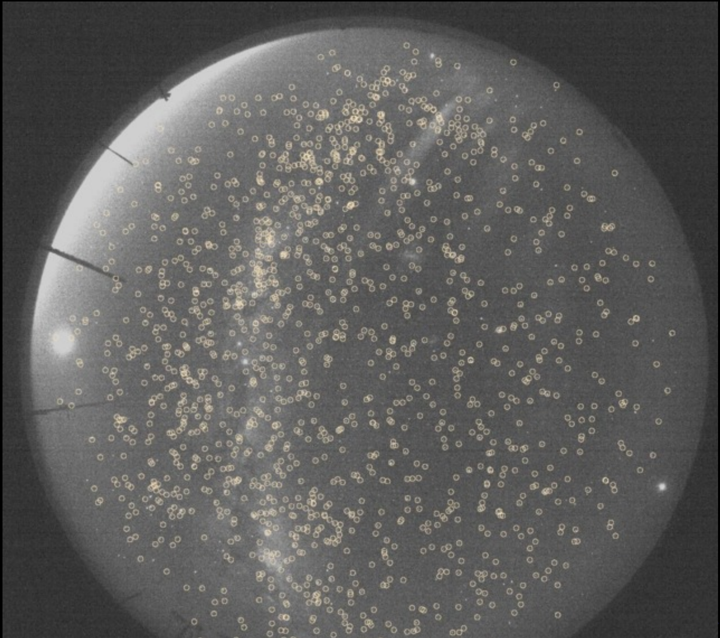
HRCAM1 image, unwrapped, from Dome A, 4 August 2010.



HRCAM3 image from Ridge A, 5 March 2015.



Standard astrometry routines break down with all-sky images.



NISM specifications

- Designed to measure the 2.35 micron sky background, which is expected to be 100 times darker than, e.g., Mauna Kea. This measurement has only been done in Antarctica at the South Pole—Dome A is possibly 4 times darker still.
- Single InSb diode detector (from 1970's IRPS instrument from the AAT).
- 2.35 ± 0.05 micron filter, with long-wavelength blocking.
- Four degree FOV on the sky.
- DC coupled electronics, very low noise.
- Sky dips using an external flat mirrors.
- Blackbody calibration.
- Will detect bright stars and the Milky Way.
- At Ridge A, 150km from Dome A.

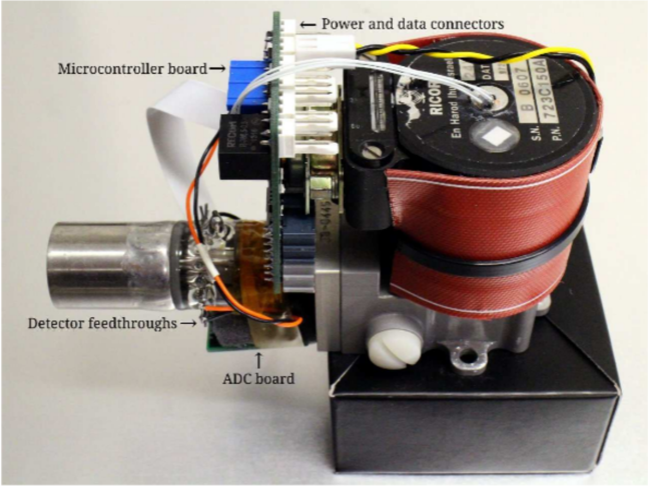
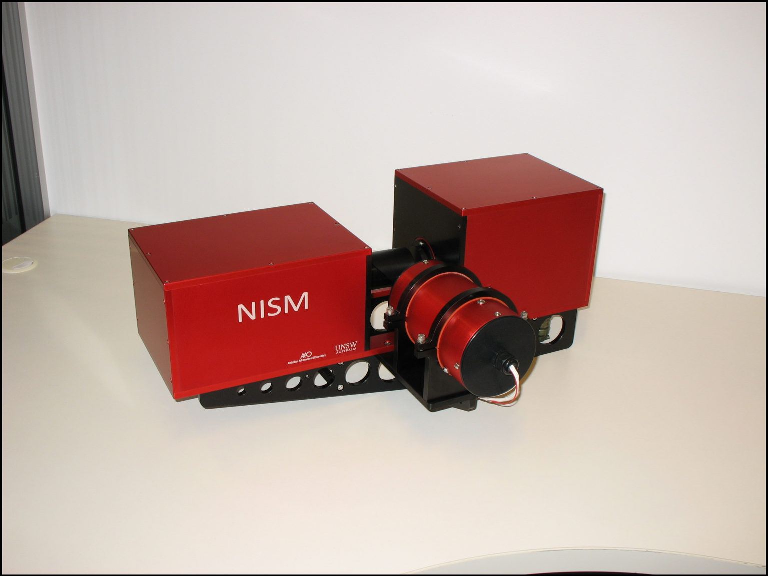
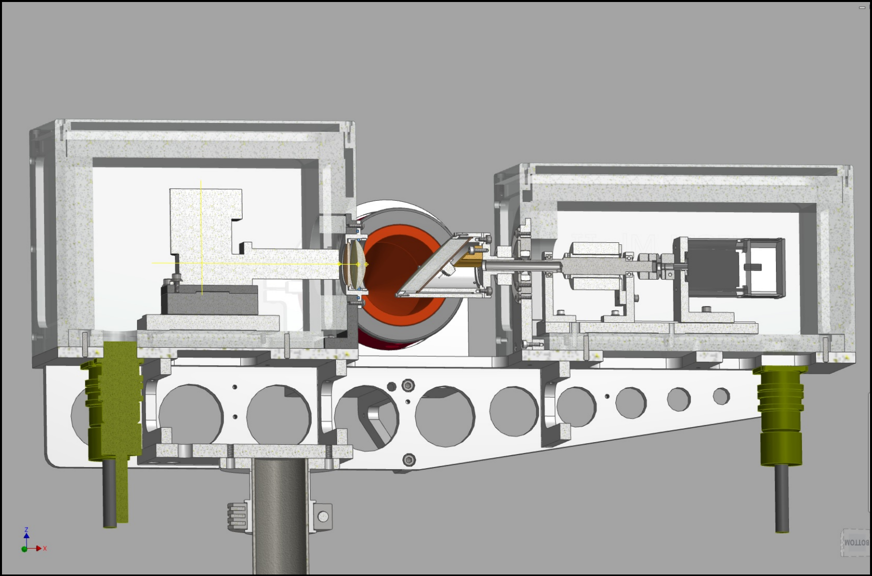


Figure 1. The Ricor K508 micro cooler with attached microprocessor and ADC boards linked by a flexible flat cable (FFC). The ADC board is soldered directly to the feedthroughs from the glass envelope of the cooler, to minimize wiring loops. The FFC carries only digital signals between the microprocessor and ADC boards.

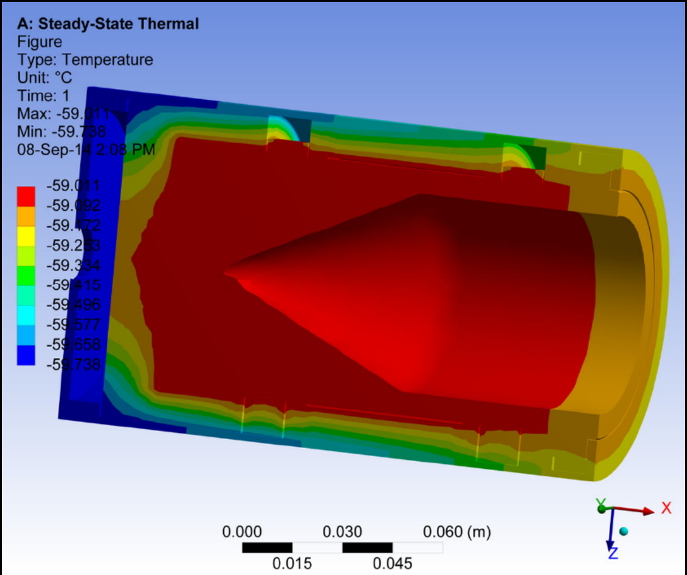
The NISM cooler and electronics.



The NISM instrument just before shipping in October 2014.



The NISM mechanical drawing, AAO, 2014.

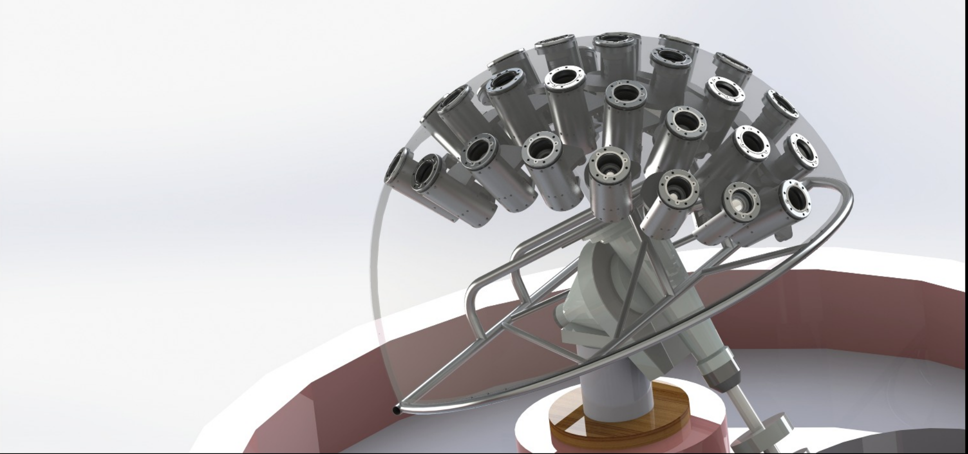


Thermal modelling of the NISM black-body source.

NISM at Ridge A with Nic Bingham, 2015.

Webcam montage from Ridge A, 2015.

EVRYSCOPE



Evryscope is an array of 27 telescopes, each with a 6.1 cm aperture based on a Rokinon 85 mm f/1.4 lens, and a 28.8 Mpix interline transfer CCD, with a 5-element filter wheel. It covers 8,660 square degrees in each 120 s

Evryscope—a cheap, gigapixel, all-sky telescope

Nicholas Law (U. North Carolina at Chapel Hill) and collaborators. For details, see the Evryscope webpage and papers, including a discussion of Antarctic advantages.

- two-minute-cadence multi-year light curves for every star brighter than $V = 16$ in the target range of declinations.
- milli-magnitude minute-cadence photometry for every star brighter than $V = 12$ in the target range of declinations.
- minute-by-minute record of all events in the sky down to $V = 16.5$, with only 3% deadtime for image readout.
- $V = 19$ in one-hour integrations; every part of the sky observed for at least 6.5 hours per night.