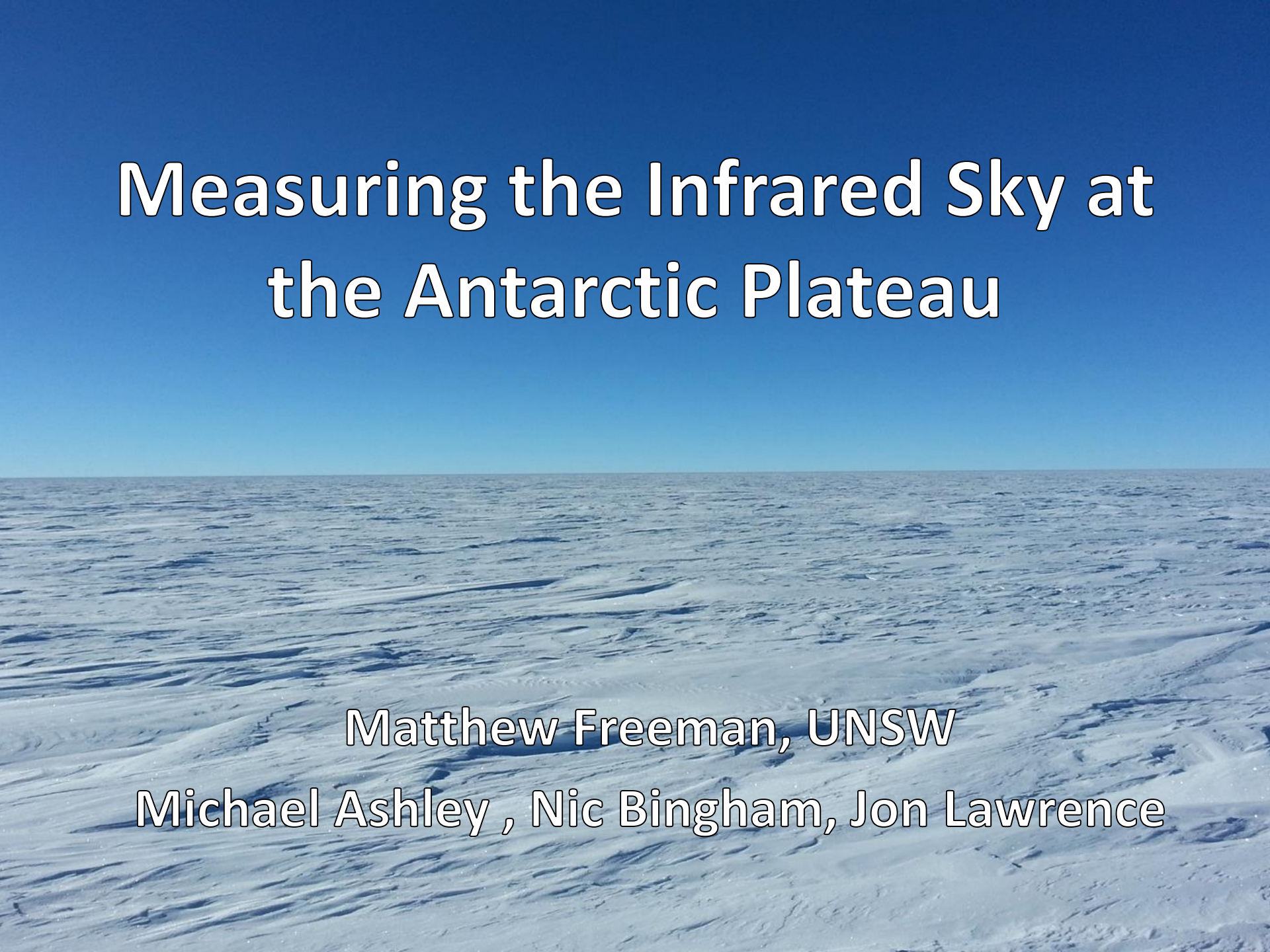
Measuring the Infrared Sky at the Antarctic Plateau



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Michael Ashley , Nic Bingham, Jon Lawrence

The Plateau

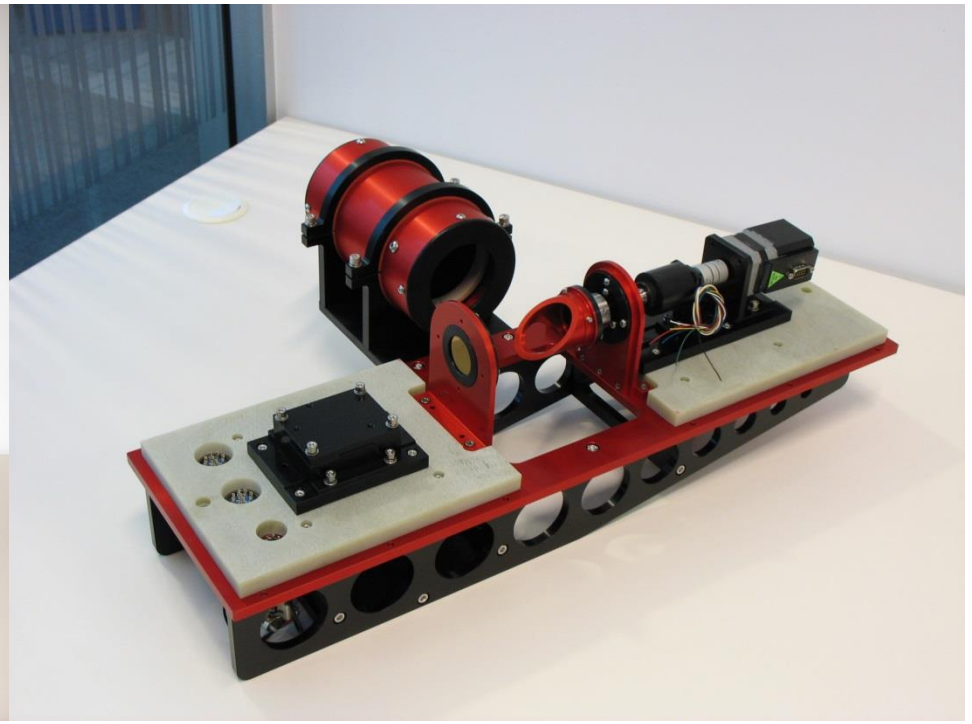
- The Antarctic plateau has fantastic conditions for astronomy.
- -70 C in winter
- 4000 m elevation
- < 1 mm precipitable water vapour
- Stable atmosphere.
- Should be a great place for infrared astronomy

South Pole

- Previous measurements from IRPS show that the South Pole has a low infrared sky background
- ~100 μJy arcsec^{-2}
- 20 times better than Temperate sites like Mauna Kea
- At the centre of the Antarctic Plateau the conditions should be even better.

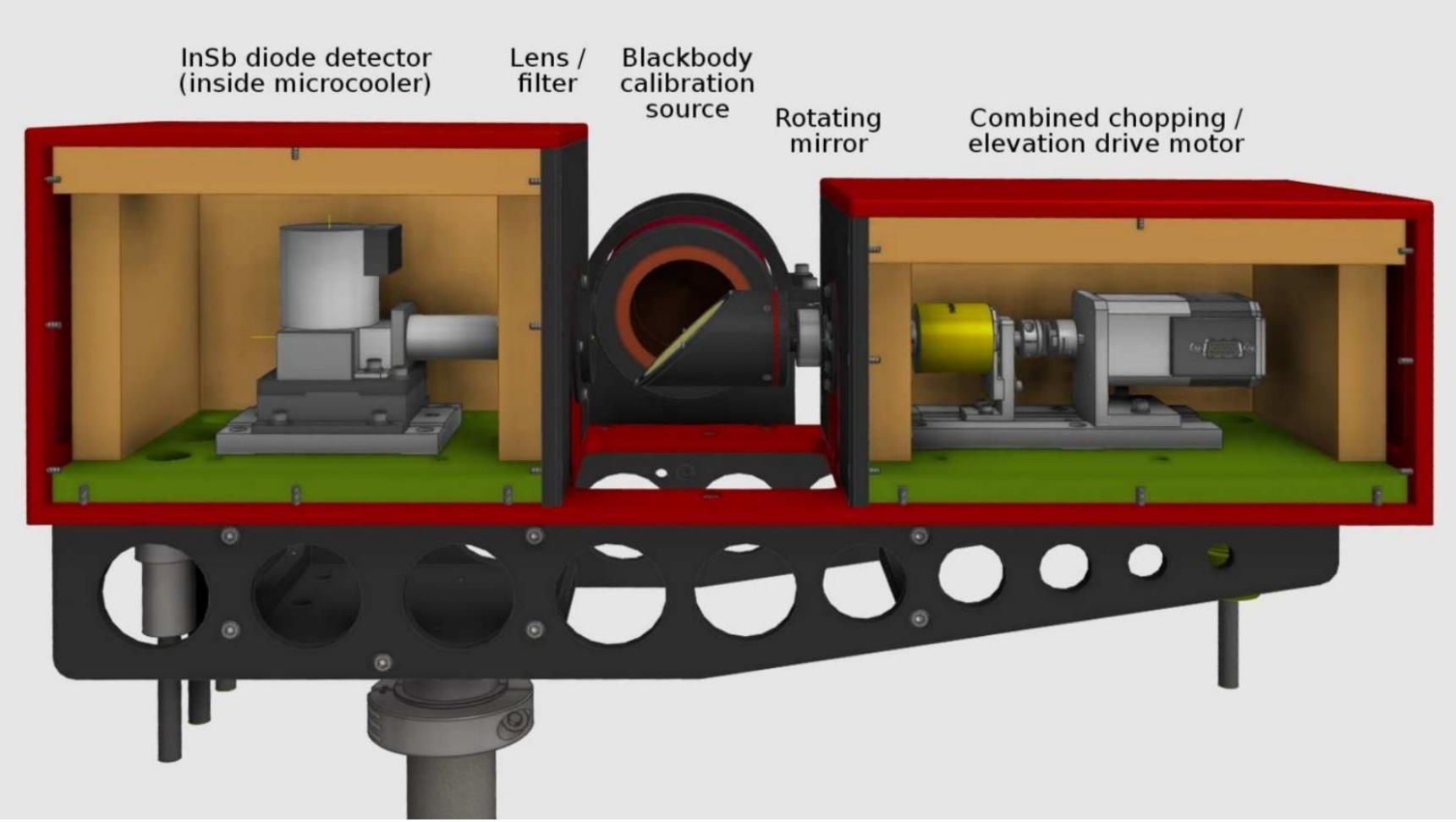
NISM – Near Infrared Sky Monitor

- Located near Dome A at the centre of the plateau.
- Observing at 2.4 microns, the ‘Kdark’ band.



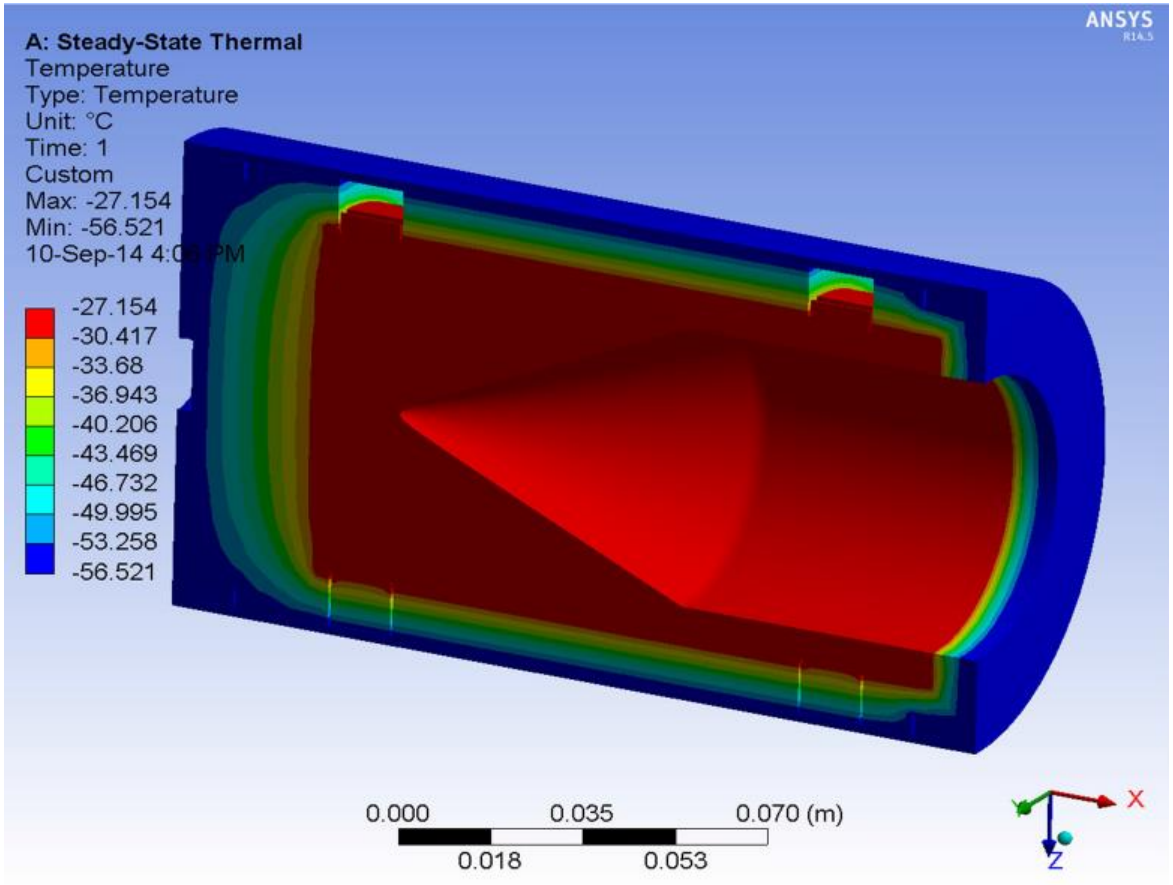
NISM Interior

- Mirror rotates to scan across the sky in elevation.



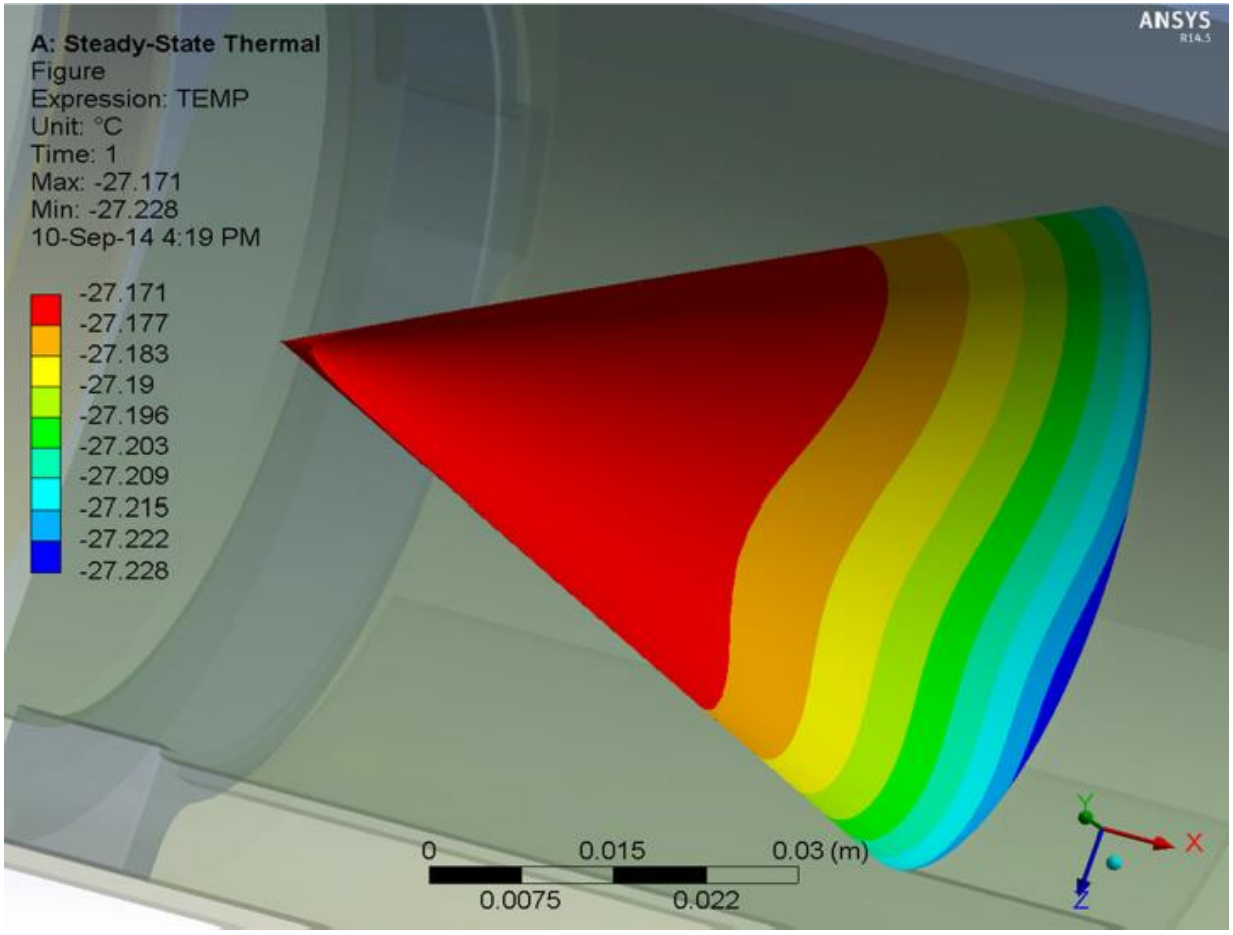
Black Body Reference

- Copper black body cone
- Kept 30 degrees above ambient



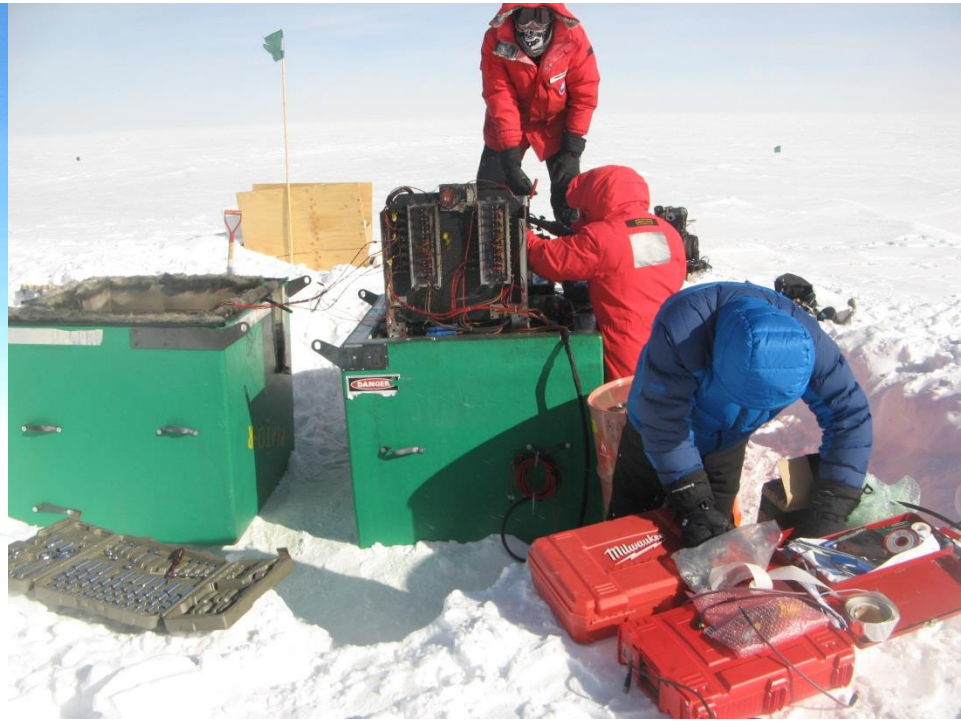
Black Body Reference

- Kept a uniform temperature.
- 0.06 degree variation across the surface



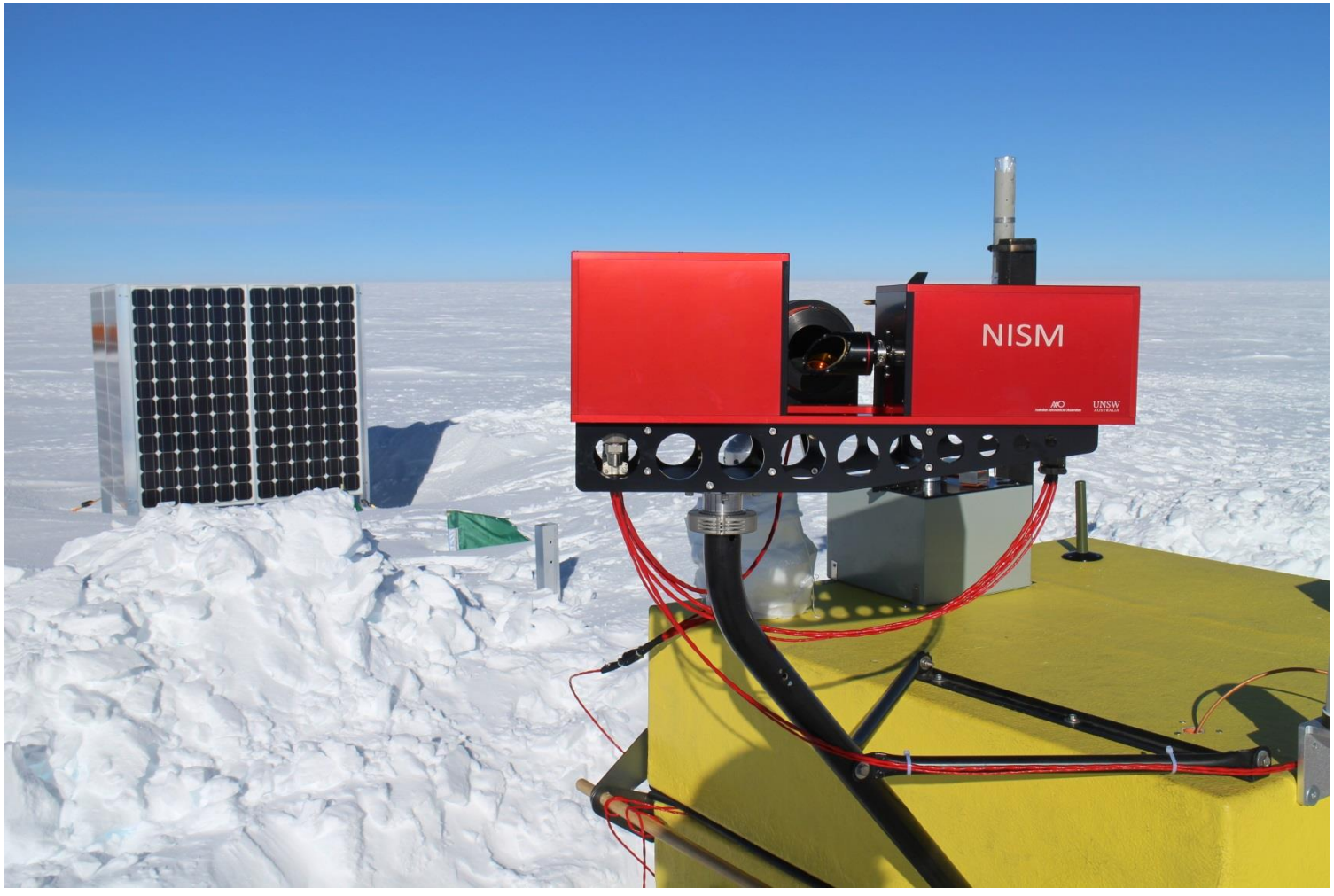
Installing NISM

- 5 days camping out at the plateau earlier this year, working on PLATO-R



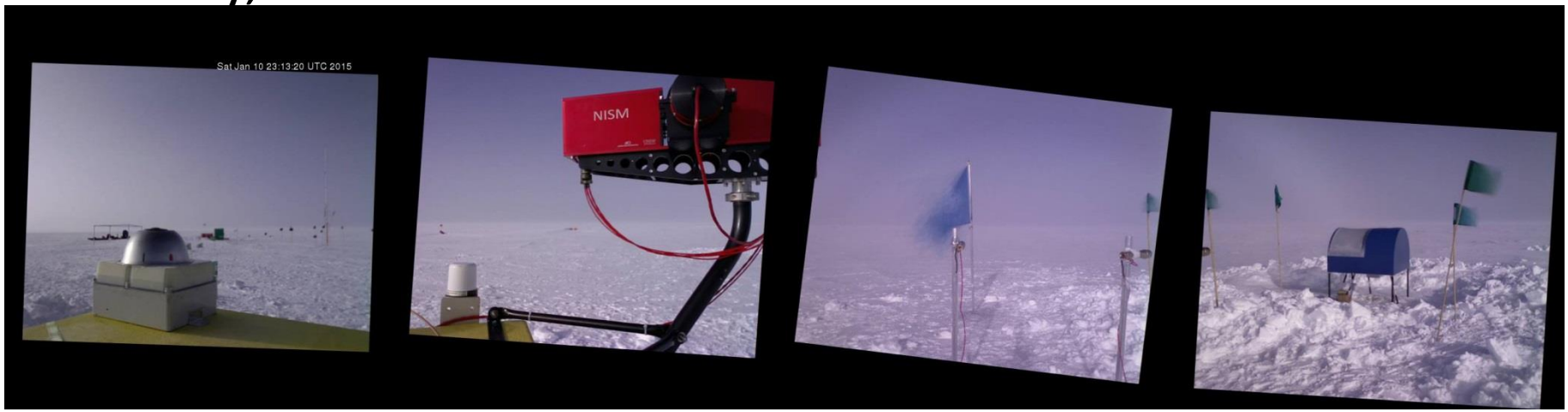
NISM Onsite

- Attached to the PLATO-R module

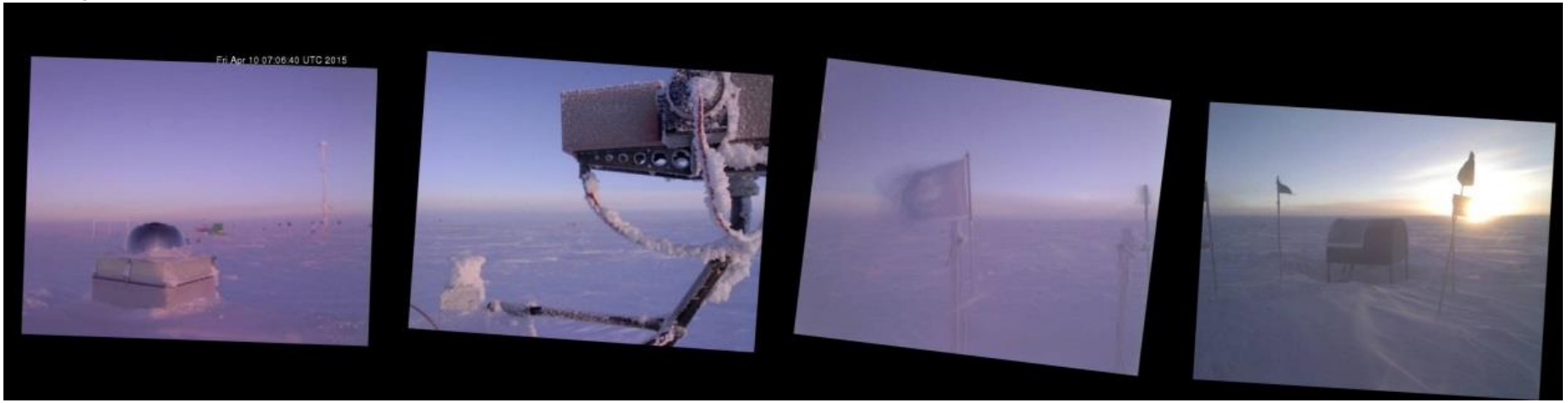


NISM Onsite

- January, after installation



- April, as the sun sets

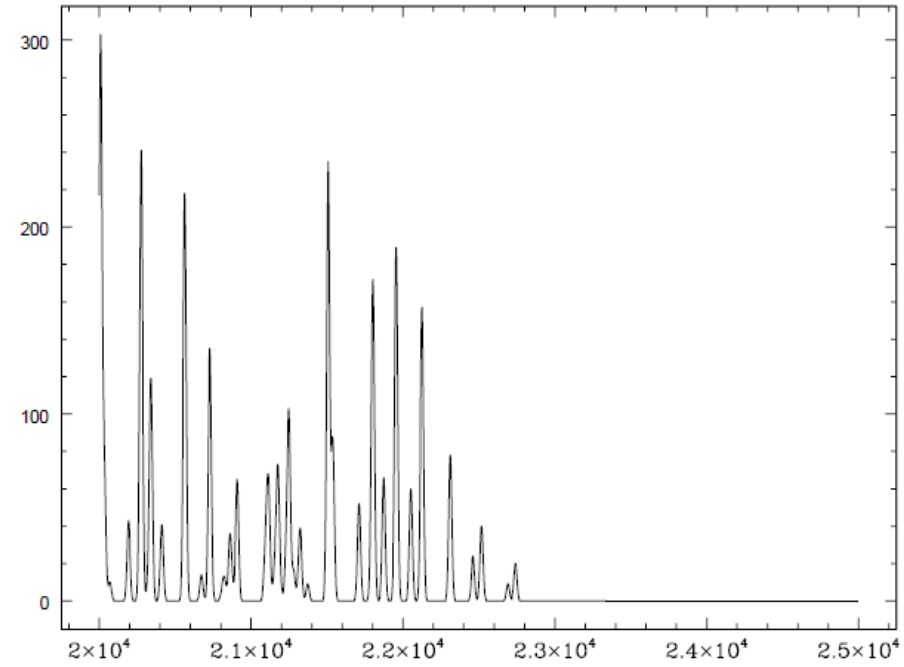


The infrared sky background

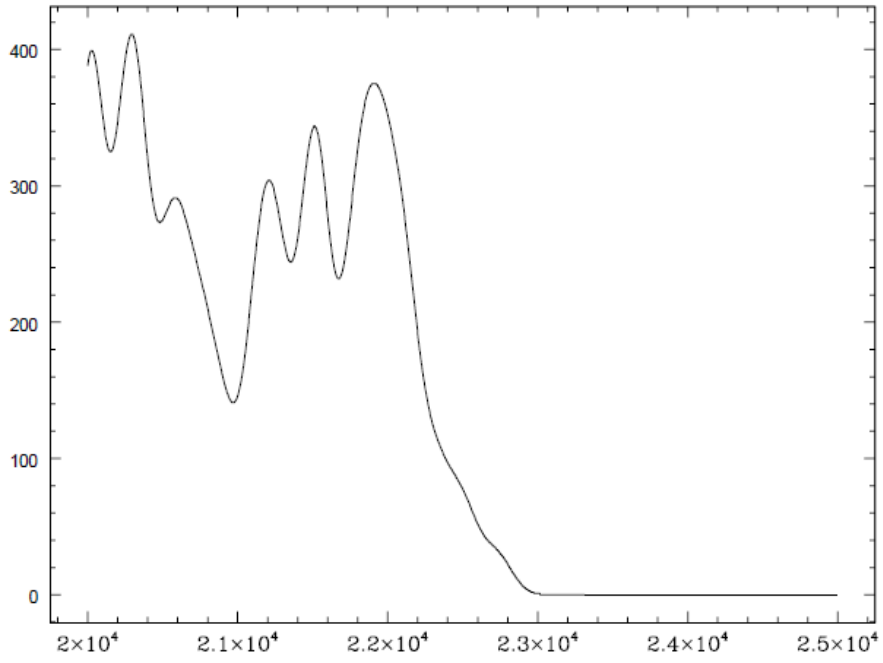
- Combination of airglow and thermal emission
- Few airglow spectral lines in the Kdark band
- Cold atmosphere means low thermal emission

Airglow

- OH airglow spectra - very little past 2.3 microns
- Data taken with an echelle spectrograph on TNG.



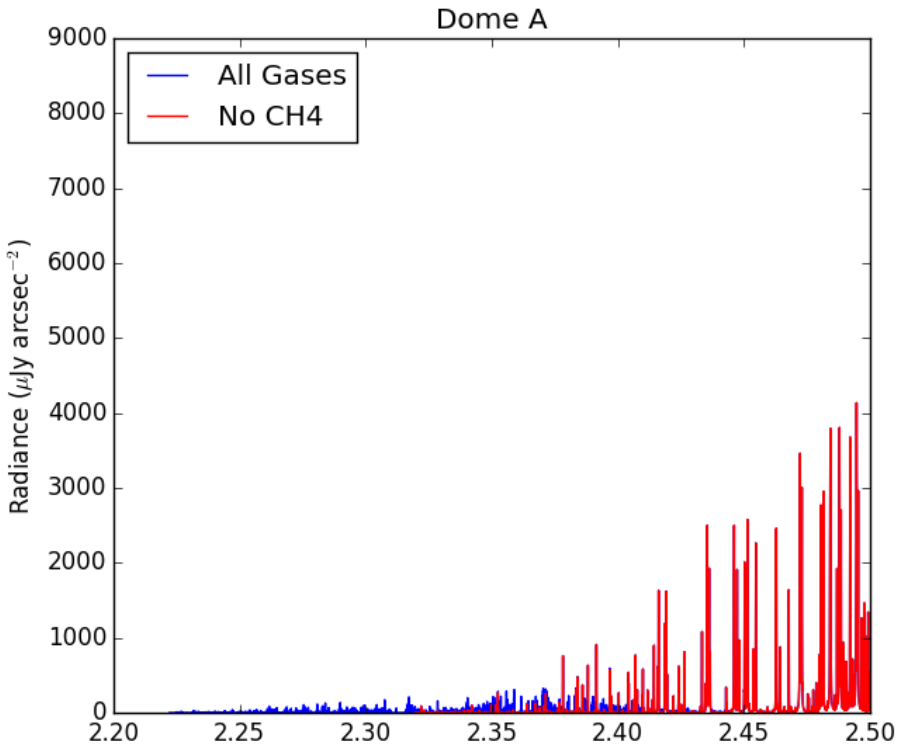
High resolution

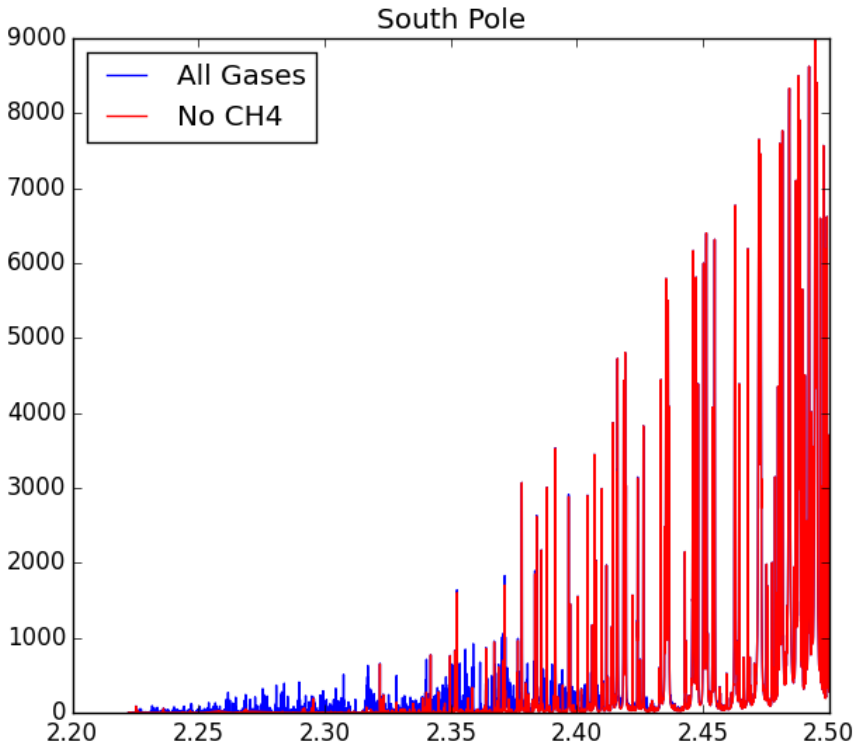


Low resolution

Thermal Lines

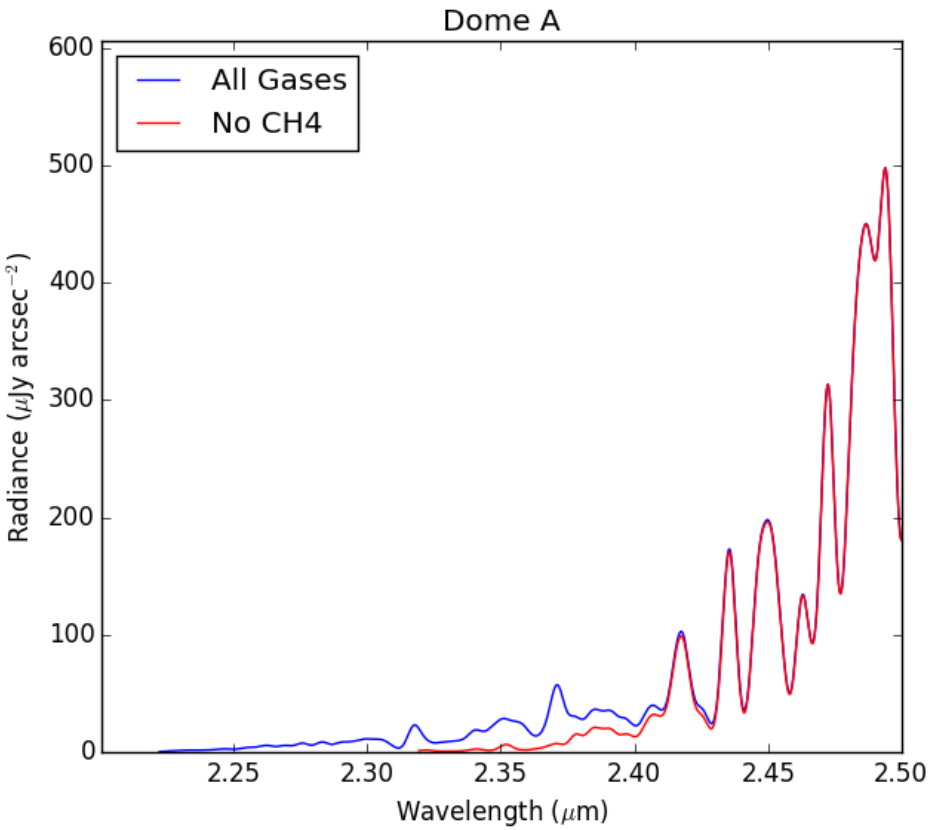
- Predicted thermal emission lines (by Jeremy Bailey)
- HITRAN line list.
- Primarily H_2O and CH_4

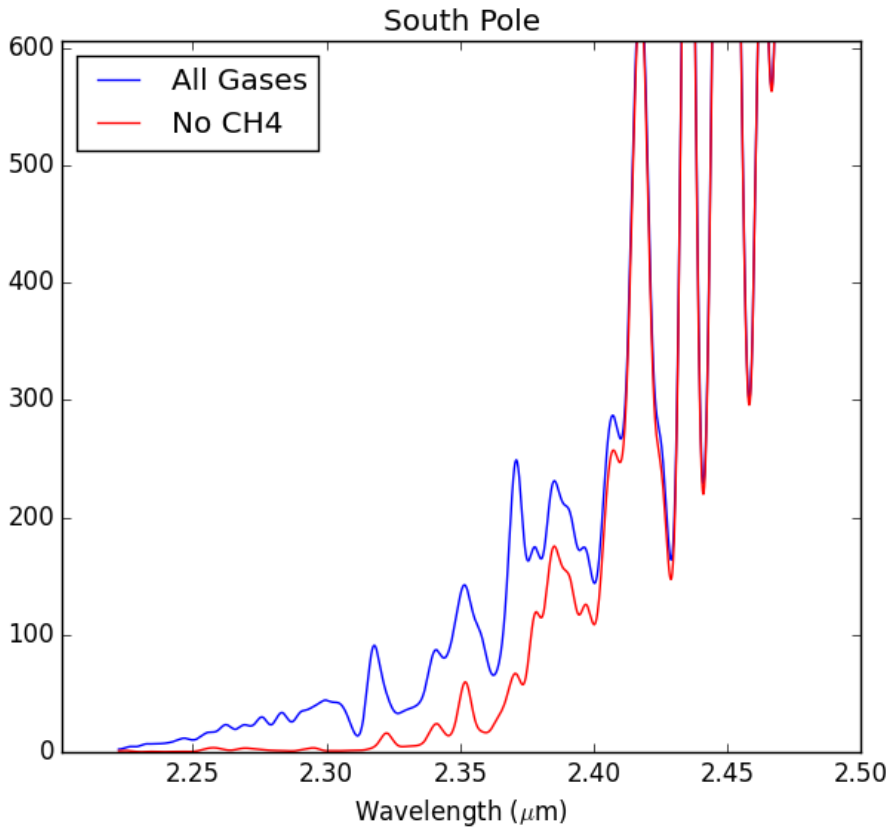




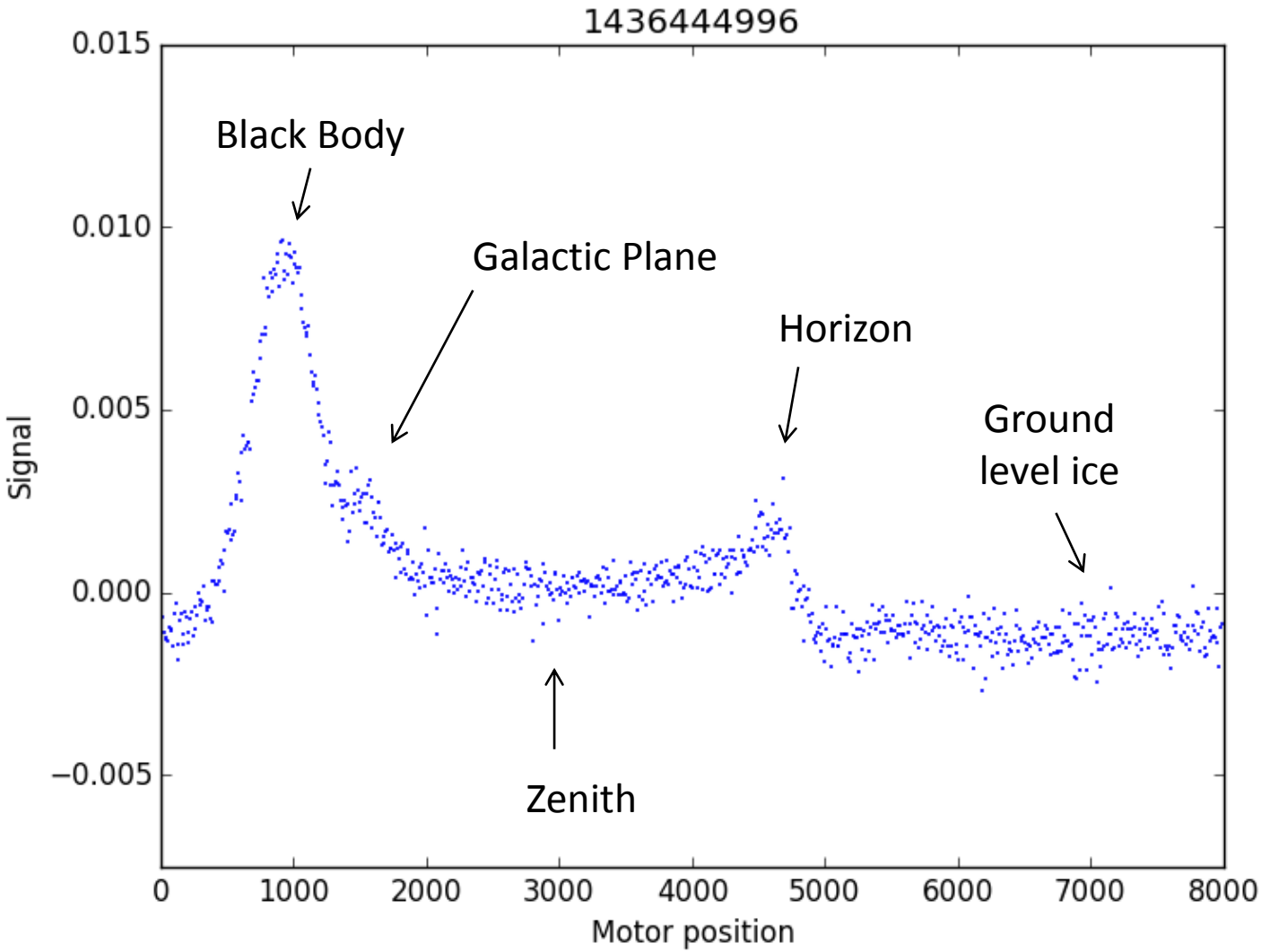
Thermal Lines

- Matches the 100 µJy arcsec^{-2} seen at the South Pole
- Predicts 25 µJy arcsec^{-2} at the Plateau



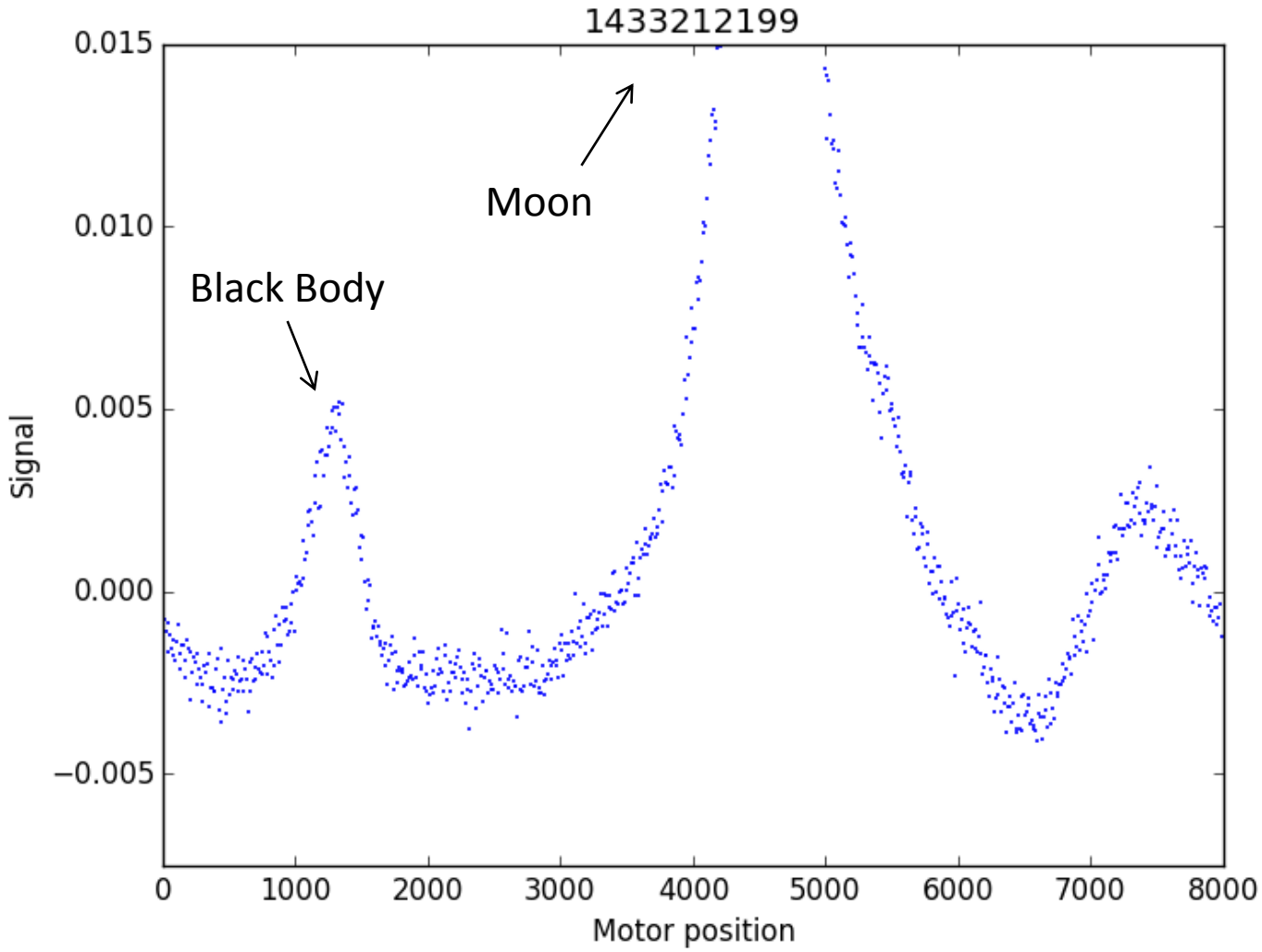


Results



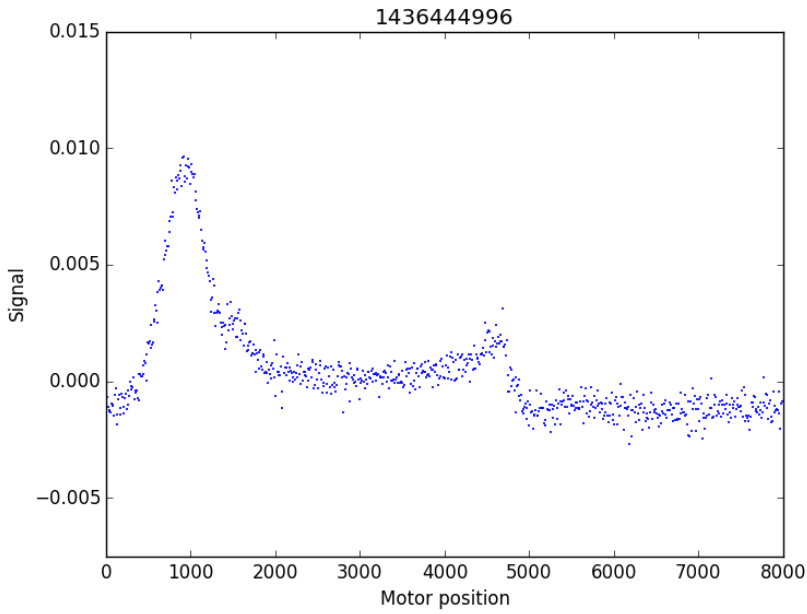
- Black body at -31 C

Results


1433212199
Moon
Black Body
Signal
0.015
0.010
0.005
0.000
−0.005
0
1000
2000
3000
4000
5000
6000
7000
8000
Motor position

Results

- First estimate from a single integration suggests a zenith flux of ~100 µJy arcsec^{-2}
- Comparable to the best results from the South Pole.
- Lots more data to look through.
- Have got some instrumental problems:
- Encoder slipping, missing pulses.
- Needs more work.



How SCAR AAA can help me

- Travel grants to attend conferences.
- That’s how I got here.