DARK ENERGY
SURVEY

The PreCam Survey

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for the PreCam Team

DES Collaboration Meeting
PreCam Session

Fermilab, 20 October 2010

Overview

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PreCam Survey: a quick, bright survey in the DES footprint using a 4kx4k camera composed of DECam CCDs – the "PreCam" – mounted on the University of Michigan Dept. of Astronomy's Curtis-Schmidt Telescope at CTIO.
Observations are scheduled to take place in Aug/Sep 2010 and Nov 2010 - Jan 2011.
It is an important component of DES calibrations.

The Curtis-Schmidt Telescope

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Credit: The Argonne Guys

- 0.9m Primary Mirror + 0.6m Corrector Plate
- PreCam-related upgrades (TAMU):
  - New secondary mirror + mount
  - New flat-field screen and LED-based dome flat field lamps
- Agreement with University of Michigan Department of Astronomy granted the PreCam Survey 100 nights between Aug 2010 and January 2011 (which includes commissioning time).

The PreCam Camera

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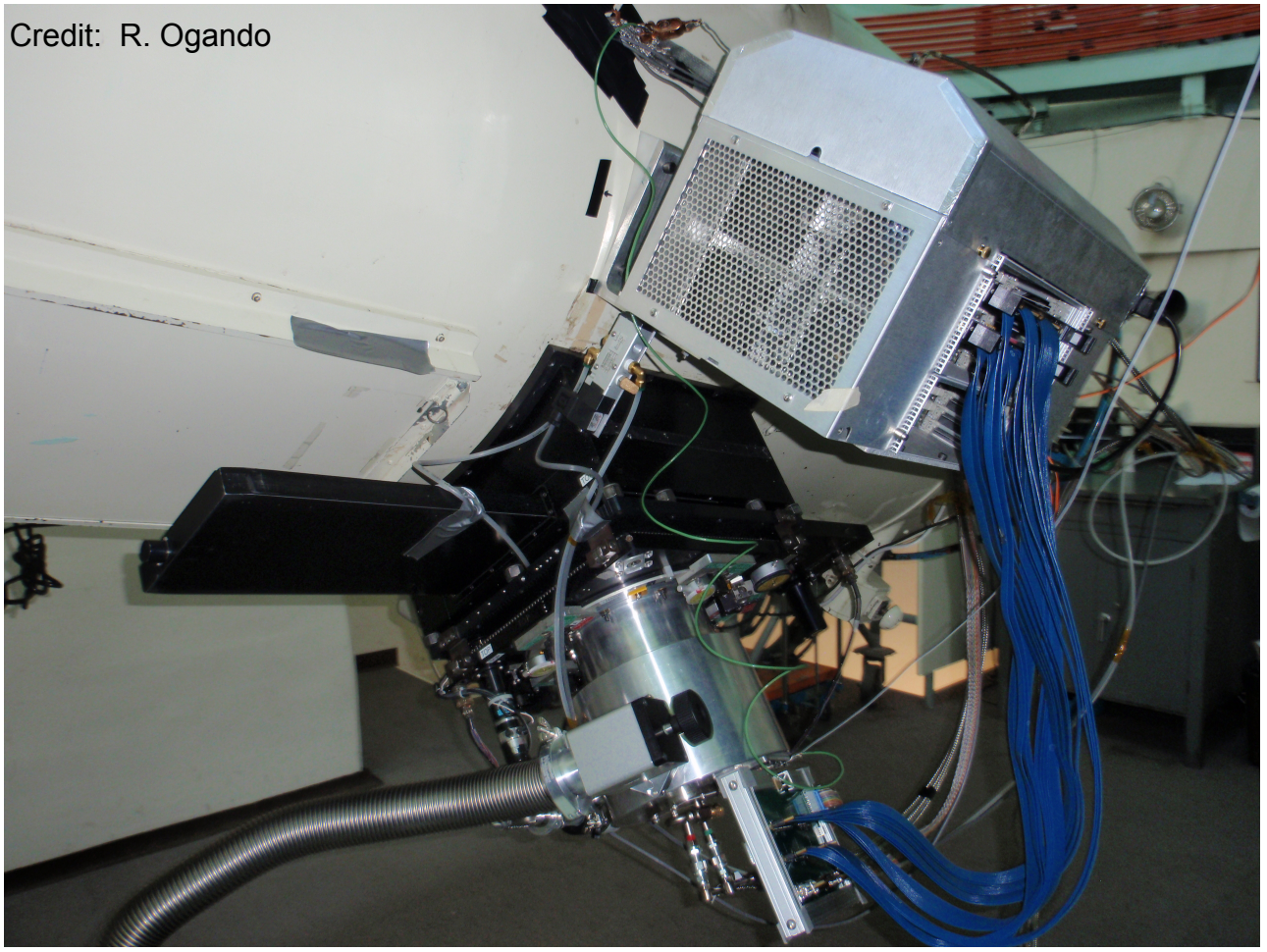
- Built by Argonne group (Kyler Kuehn, Steve Kuhlmann).
- PreCam FOV on C-S with TAMU secondary is 1.6°x1.6°.



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The PreCam Survey Exposure Times

Baseline PreCam Survey Point-Source Magnitude Limits (optimized to achieve S/N=50 at DES saturation + 1.5mag)

Band	Exposure time [seconds]	PreCam saturation limit	PreCam mag limit S/N=50	Number of usable stars per sq deg (SGP)
g	36	12.8	17.8	186
r	51	13.2	17.8	265
i	65	13.4	17.7	344
z	162	14.1	17.5	317
y	73	11.6	14.3	150

- Mag limits provide a good set of photometric calibration stars for DES.

Planned PreCam Survey Strategy

(Jim Annis, des-doc#4559-v9)

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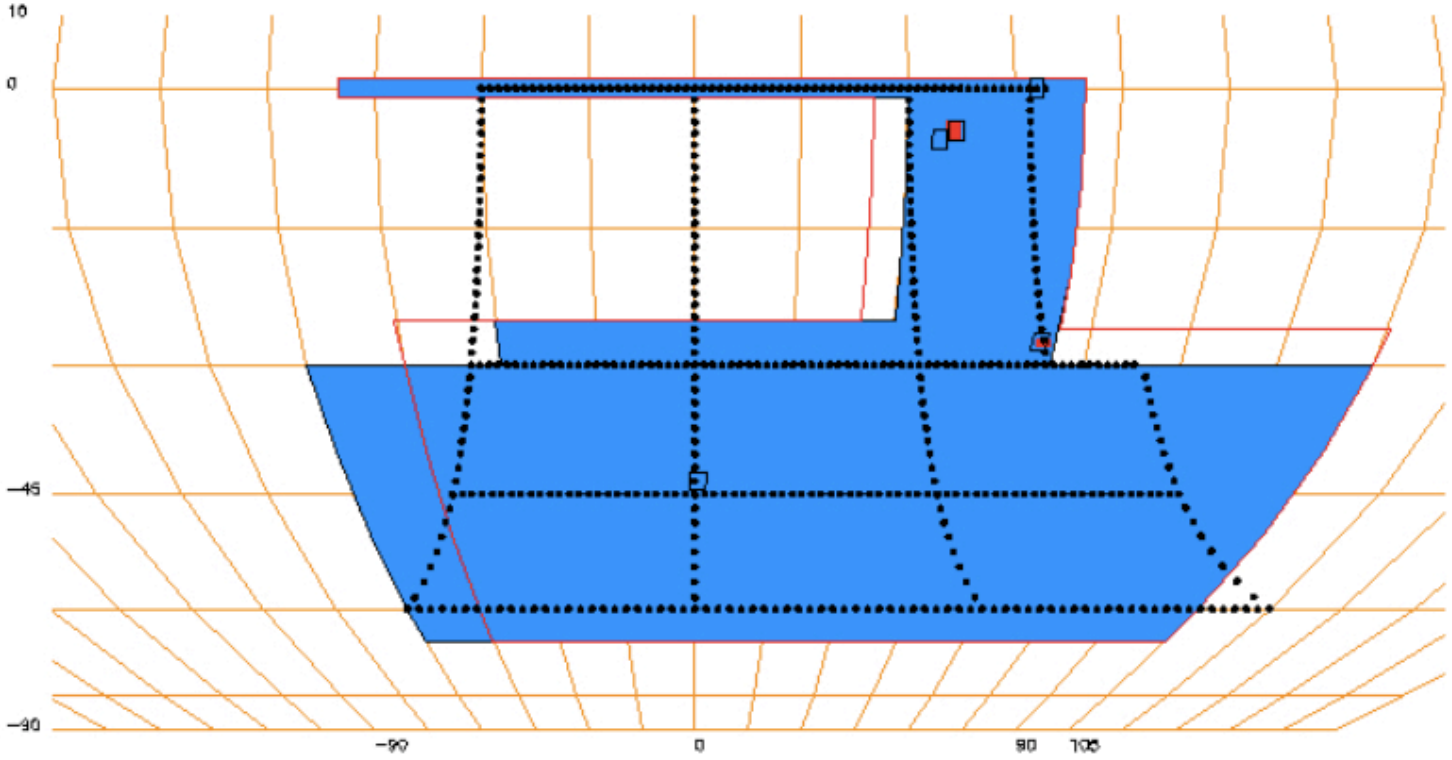
1. Sept 15-Sept 27, Nov 16-30, Dec 9-Jan 24 is devoted to observing 30° grid



version 5
modified 30° grid
454 hexes
~6 tilings

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August-September PreCam Run: Accomplishments and Lessons Learned

Were There Problems? Yes.

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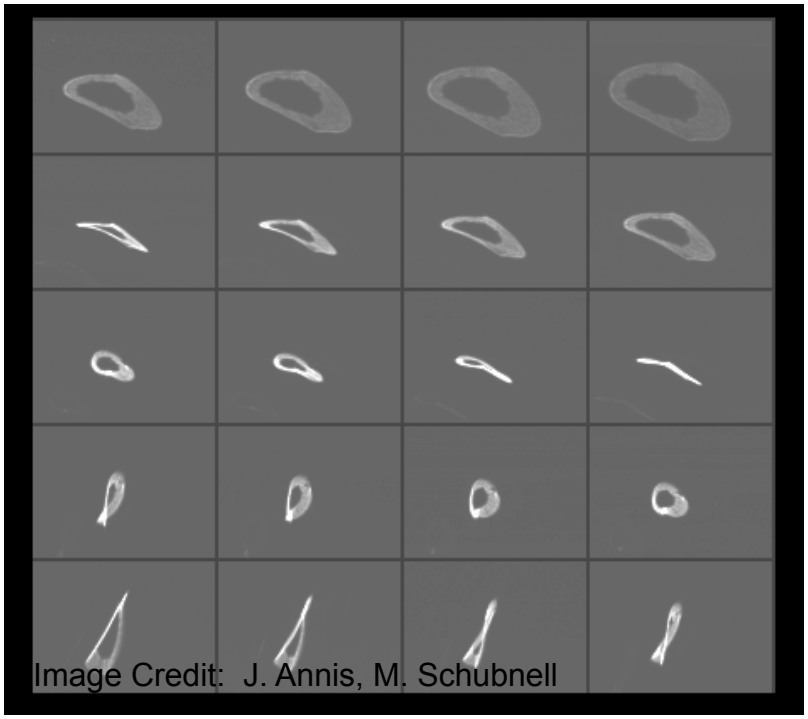
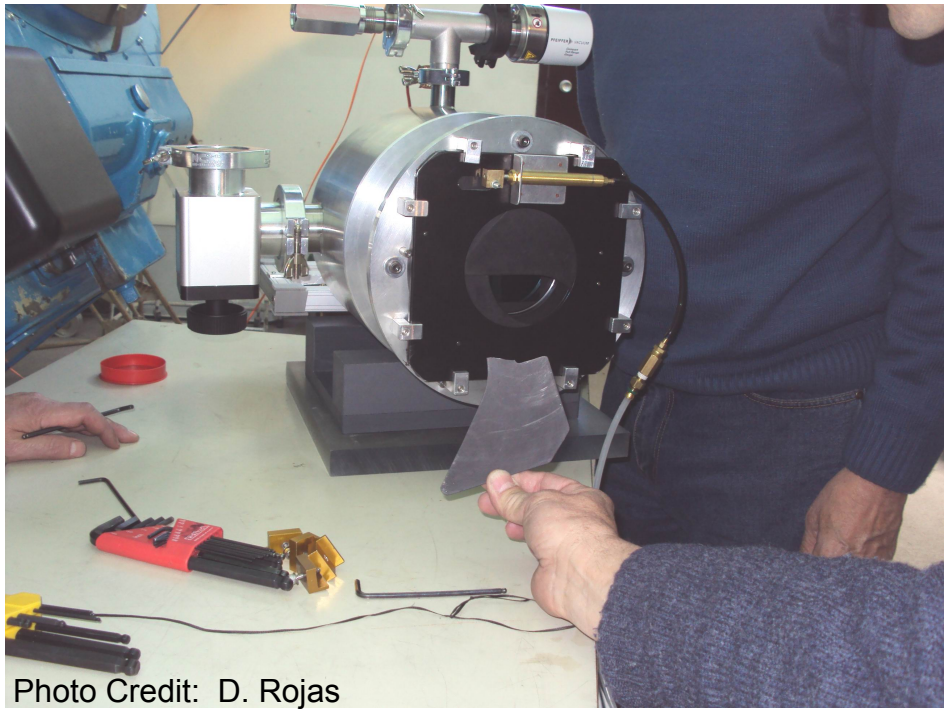
Poorly Manufactured 2ndary Mirror



Broken Shutter



FITS header problems,
(esp. w.r.t. adding RA,DEC from Curtis-Schmidt TCS)

```
SIMPLE  =                    T / conforms to FITS standard
BITPIX  =                   16 / array data type
NAXIS   =                    0 / number of array dimensions
EXTEND  =                    T
…
RA      = '25:0:0.0'         / [HH:mm:ss.ss] RA for center of this detector
DEC     = '91:0:0.0'         / [DD:mm:ss.ss] Dec for center of this detector
…
```

Were There Successes? Yes.

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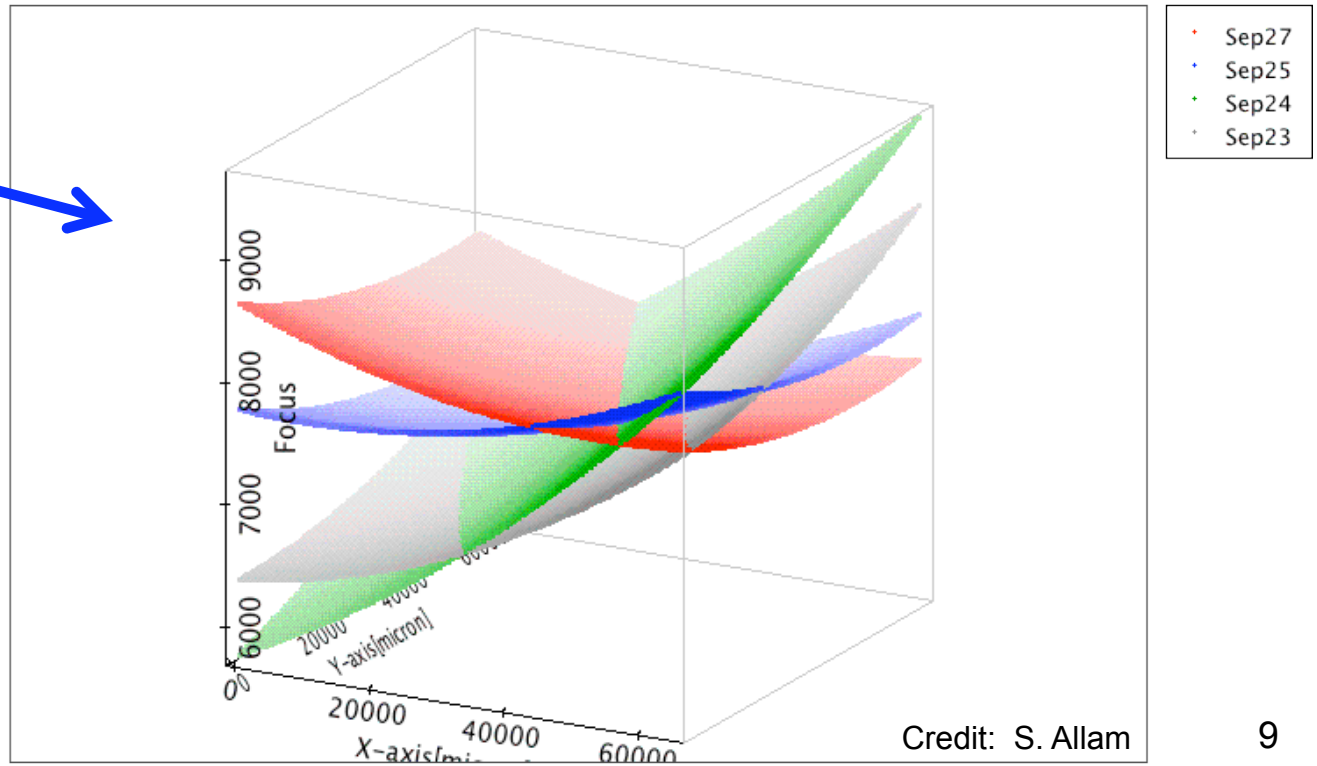
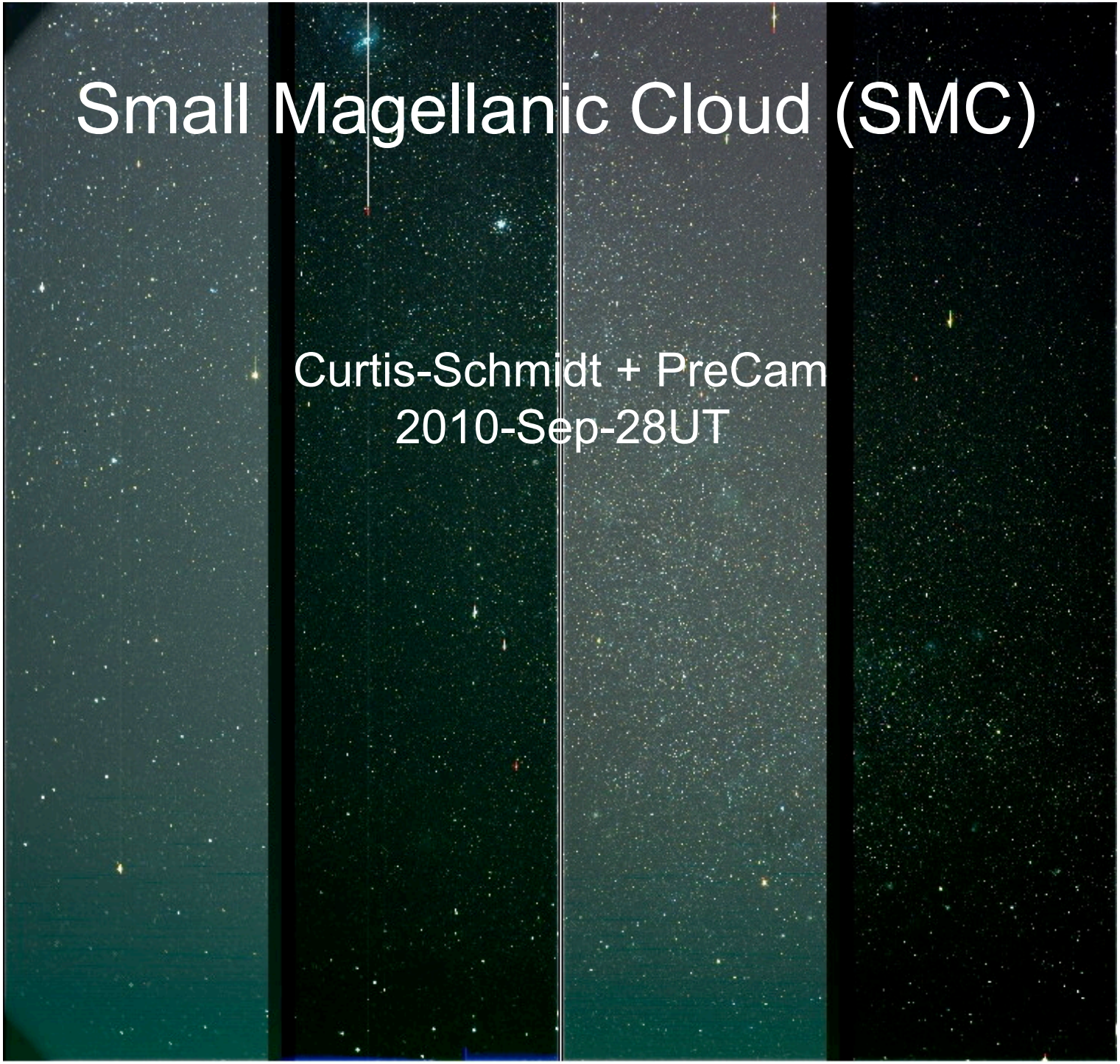
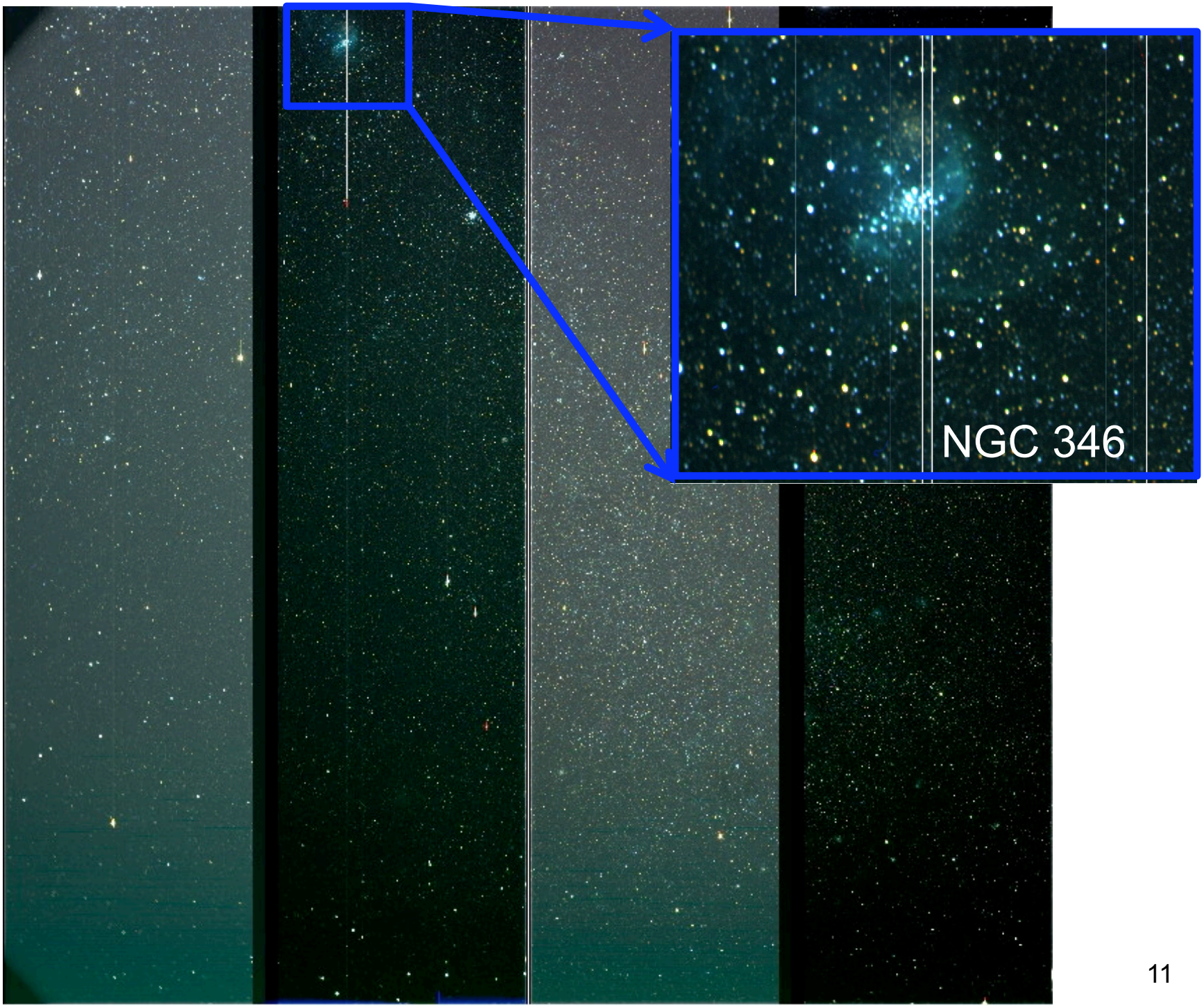
1. Safely shipped PreCam, PreCam computers, PreCam CCDs, and auxiliary equipment to CTIO and mounted on C-S.
2. Hardware upgrades to C-S, including new TAMU dome flat system.
3. Quick Reduce and data transfer installed on PreCam computers
4. Preliminary observing scripts written.
5. Realigned optics with powerful new quantitative technique.
6. Identified problems to be fixed.
7. **PreCam on sky!**
8. **Built successful PreCam team!**

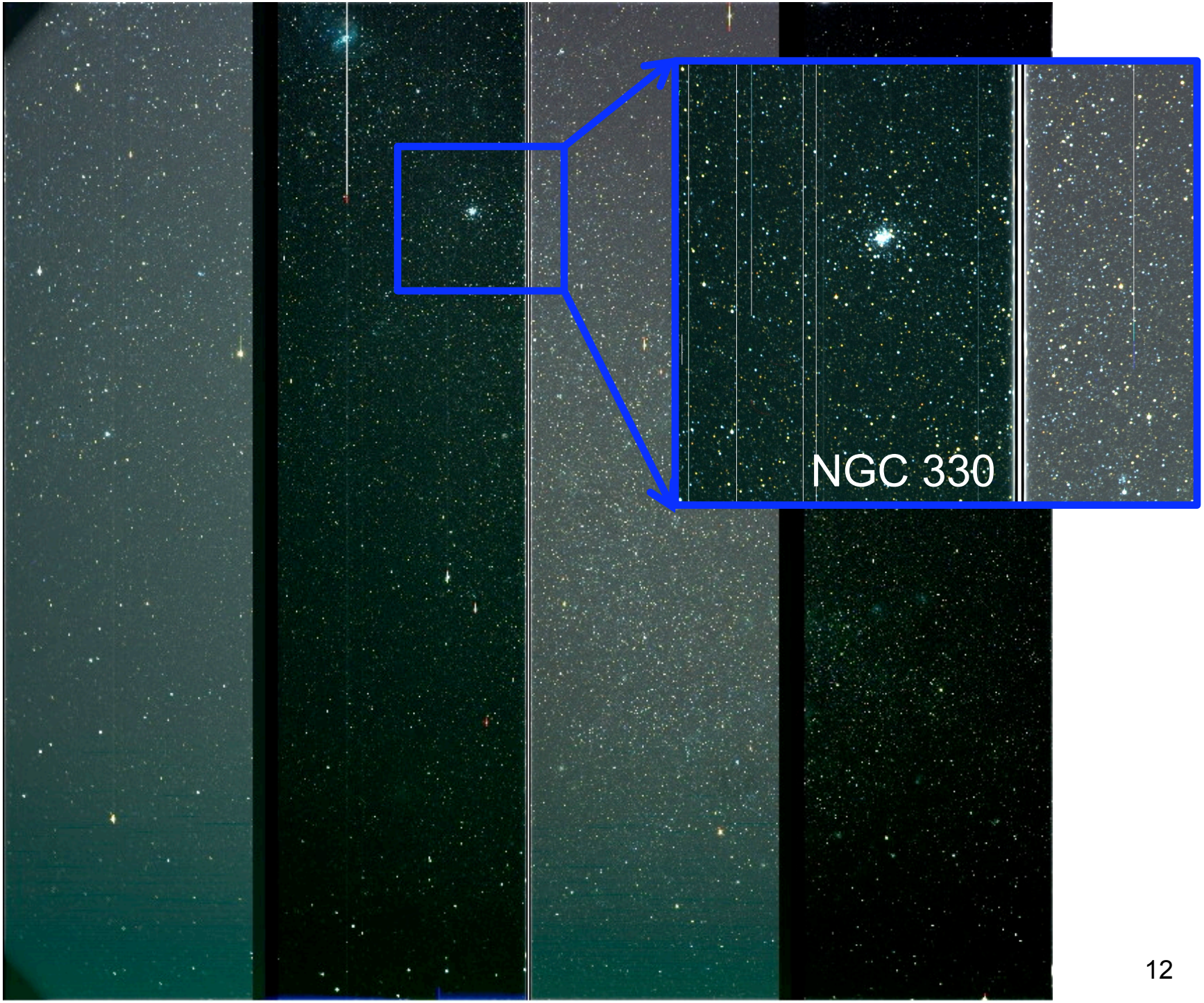


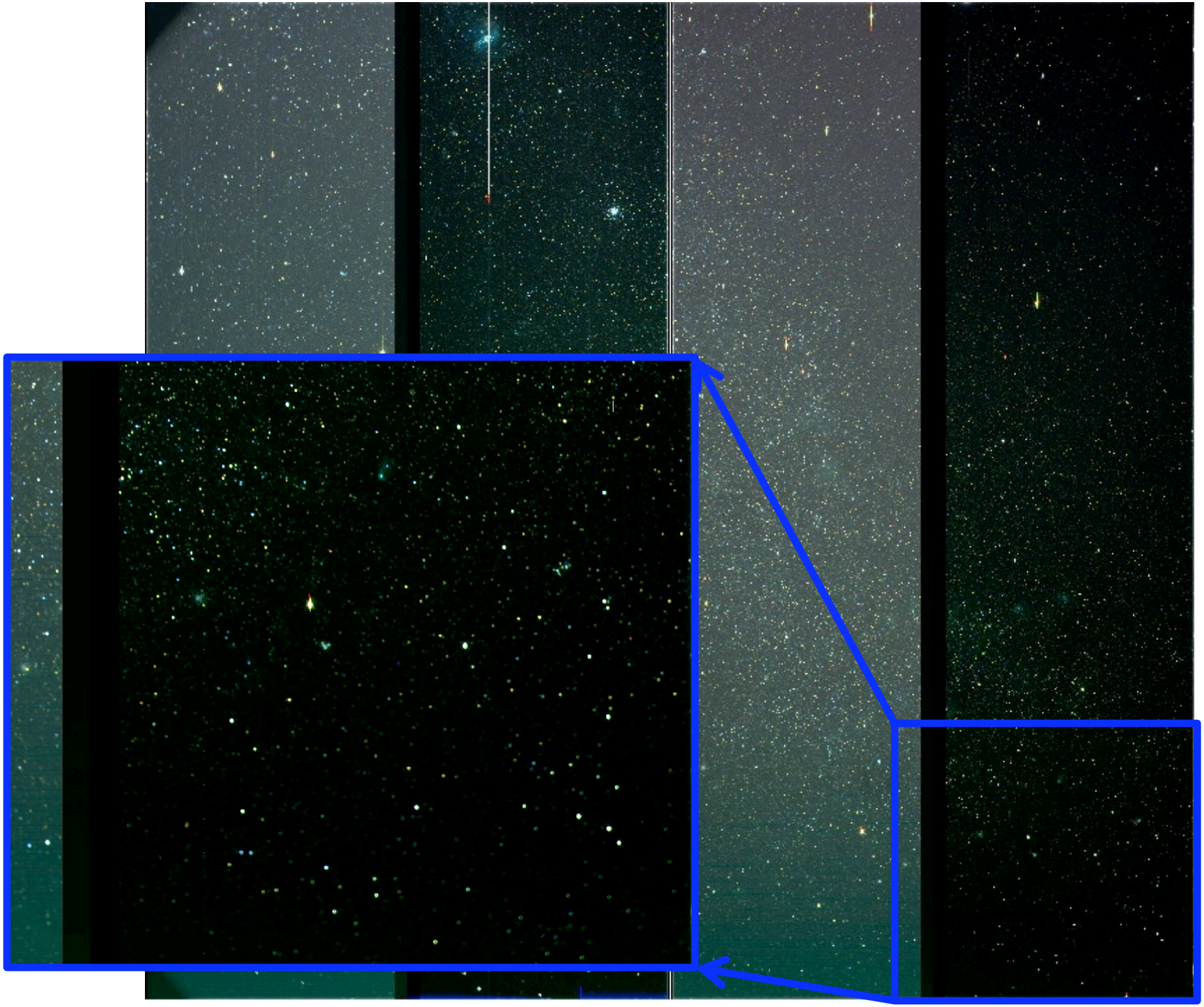
Credit: S. Allam

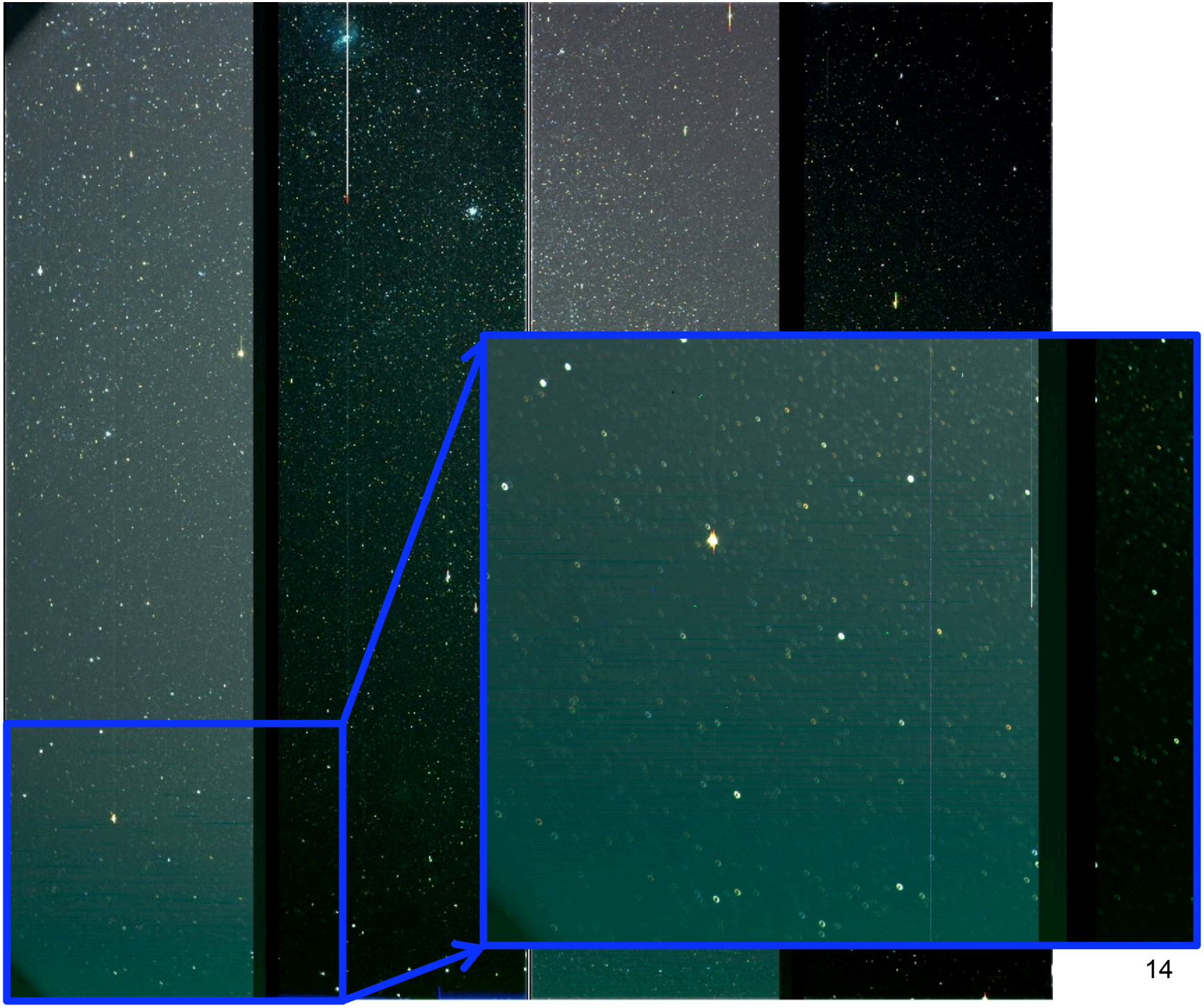
Small Magellanic Cloud (SMC)



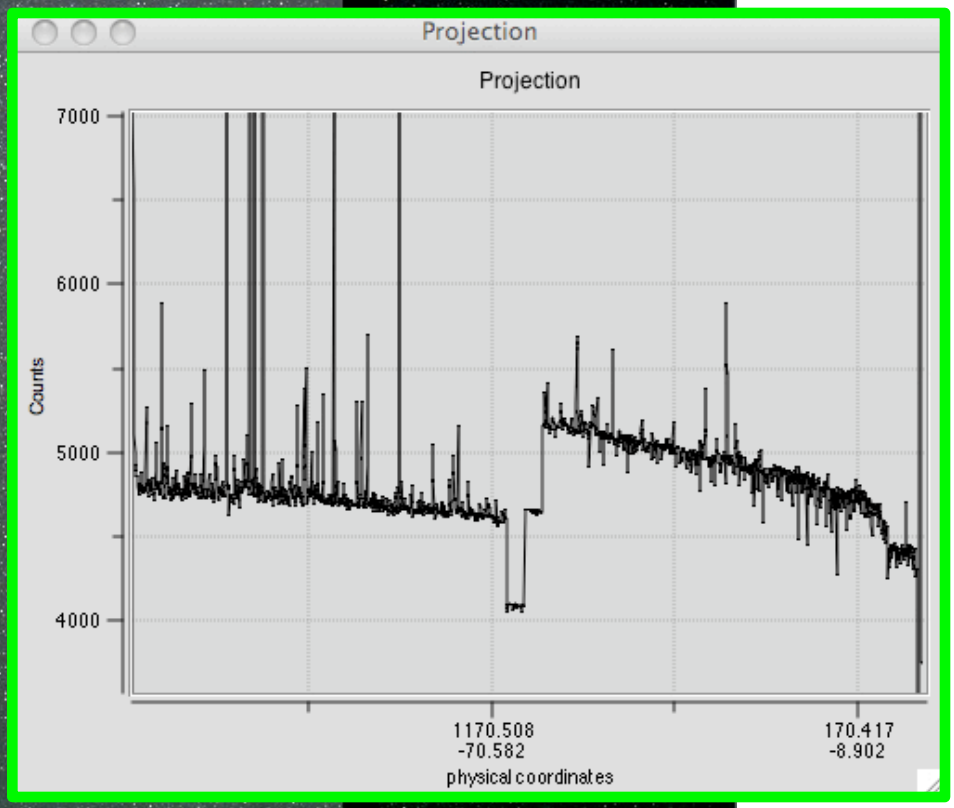

NGC 346


NGC 330





Simple Vignetting Test: Radial Projection



Lessons Learned (Also Useful for DECam Commissioning)

1. Don't rush commissioning.

2. Test hardware thoroughly before observers arrive.

3. Expect that problems will arise.

4. Don't skimp on human resources.

   a. Plan on having 1.5x - 2x more people on site during commissioning than you plan to have during operations.

   b. At least one of the extra persons would be in charge of debugging software.

5. Daily telecons are extremely useful, especially during the commissioning period. Videocons, if available -- especially in the dome -- would be even more useful.

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Observing Plans for the November-January Run

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Context

1. It is unlikely that the replacement flat mirror for the TAMU secondary will be available until after January.
2. Until the TAMU secondary mirror is replaced, PreCam observing must rely on the original Curtis-Schmidt secondary mirror and mount.
3. The TAMU secondary flat would have had an unvignetted field-of-view of 1.6°x1.6° (the field-of-view of the PreCam camera focal plane)
4. The original Curtis-Schmidt secondary has noticeable (~25%) vignetting in the corners of a 1.3°x1.3° field-of-view.
5. Vignetting can be flat-fielded out, but it reduces the S/N of stars where vignetting is significant.
6. With the original Curtis-Schmidt secondary, the PreCam camera's field-of-view is effectively reduced nearly in half (in area).
7. The MOU grants PreCam 100 nights (including the nights from this past August and September), but there is a possibility of negotiating for a few nights more.

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The Options

(Credit: Dave Burke and Jim Annis)

Using the original Curtis-Schmidt secondary, here are four viable options for PreCam Survey Strategy in November 2010 – January 2011:

1. Cover the same footprint with half the tilings.
2. Cover the same footprint without z- or y-band.
3. Cover half the footprint.
4. Cover the same footprint without z- or y-band but cover the SDSS Stripe 82 region in z and y.

These options were discussed at the Oct. 15 DES Survey Strategy Meeting.

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Results from the Oct. 15 SSM Meeting

(from Jim Annis's notes)

- Our new strategy is to ensure that we can demonstrate that the PreCam program will succeed so that in the next observing season we can pursue the program (assuming another observing season). This can be done by:
  a. performing the 5-filter, 10-tile, 30-degree stripe 82 test, which demonstrates that sqrt(N) can reach 1%, or alternatively what the root(N) floor is, and
  b. performing a test of the grid work approach. This will likely be 4 boxes of the "year 1 footprint", observing in just g,r,i (so that the test using the stellar locus can proceed), while performing standard star observations in all five filters (so that z & y standards can be developed).

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Original PreCam Survey Strategy

(Jim Annis, des-doc#4559-v9)

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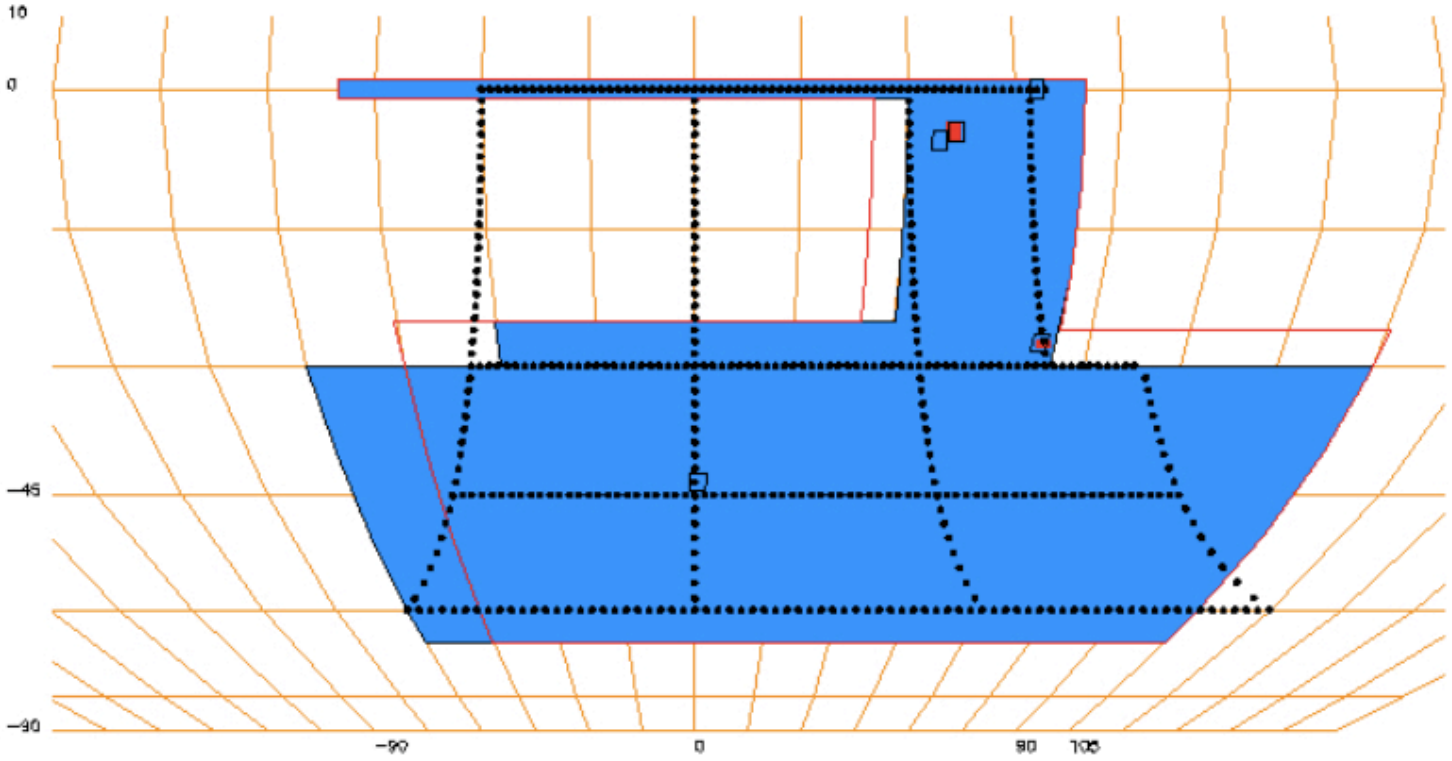

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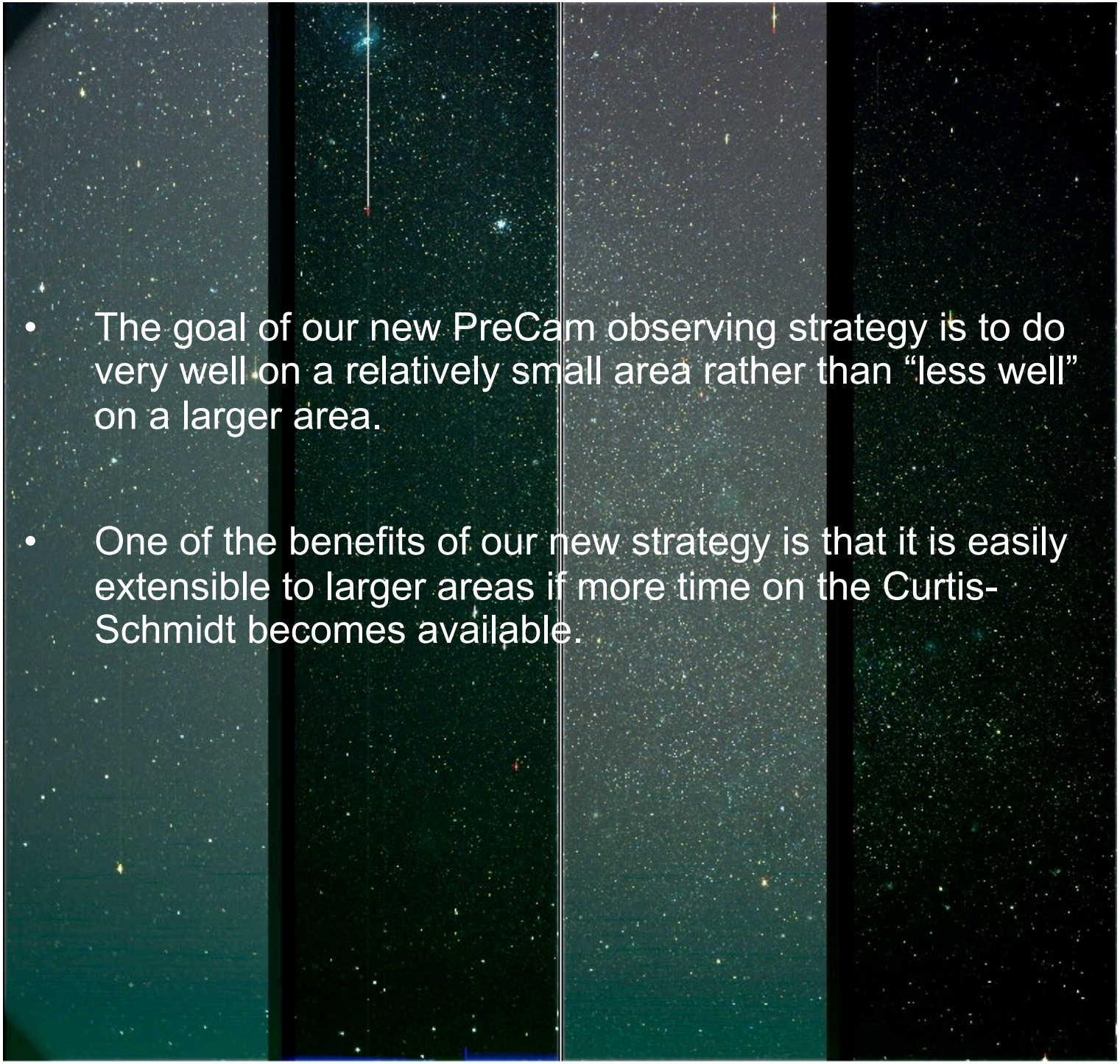

- The goal of our new PreCam observing strategy is to do very well on a relatively small area rather than “less well” on a larger area.

- One of the benefits of our new strategy is that it is easily extensible to larger areas if more time on the Curtis-Schmidt becomes available.

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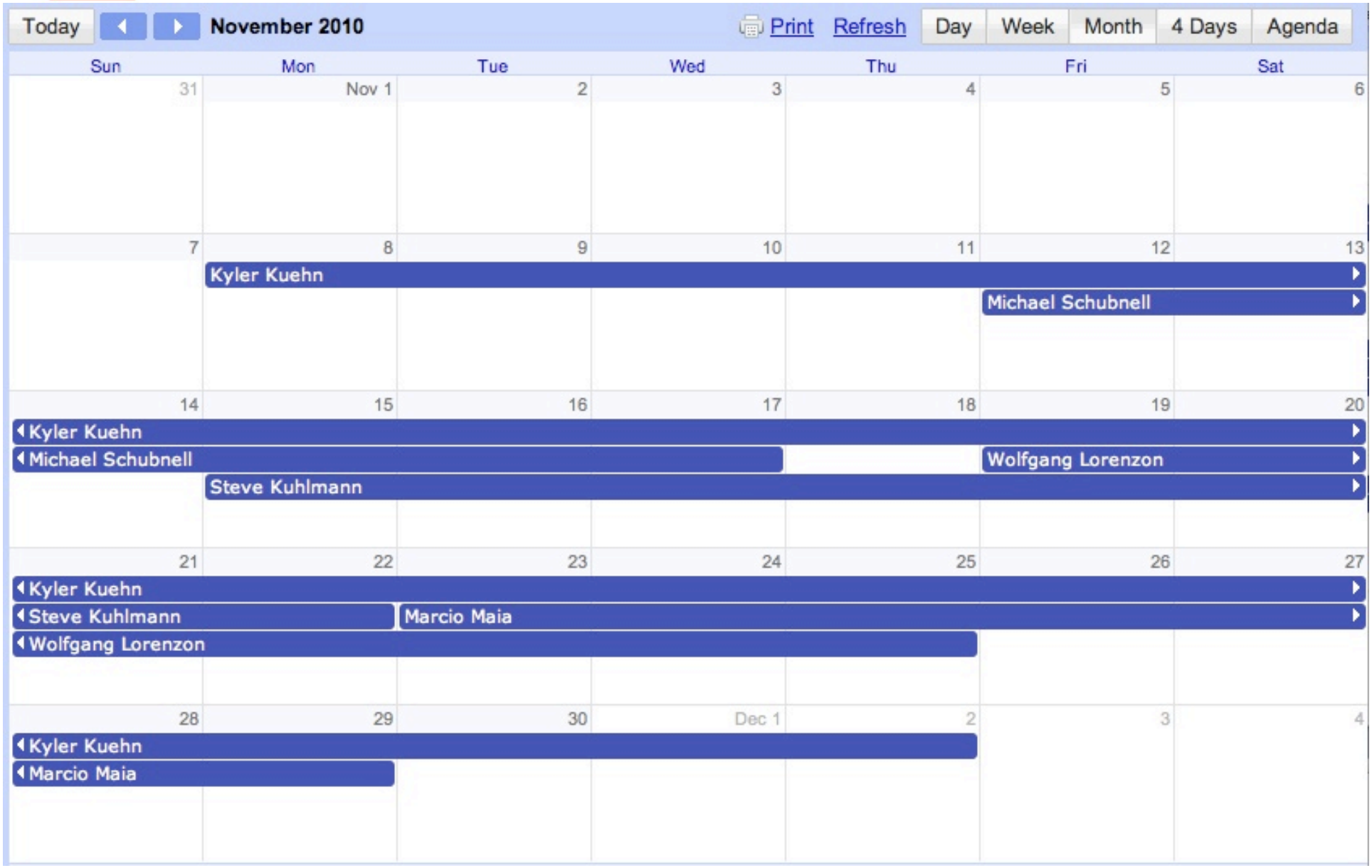
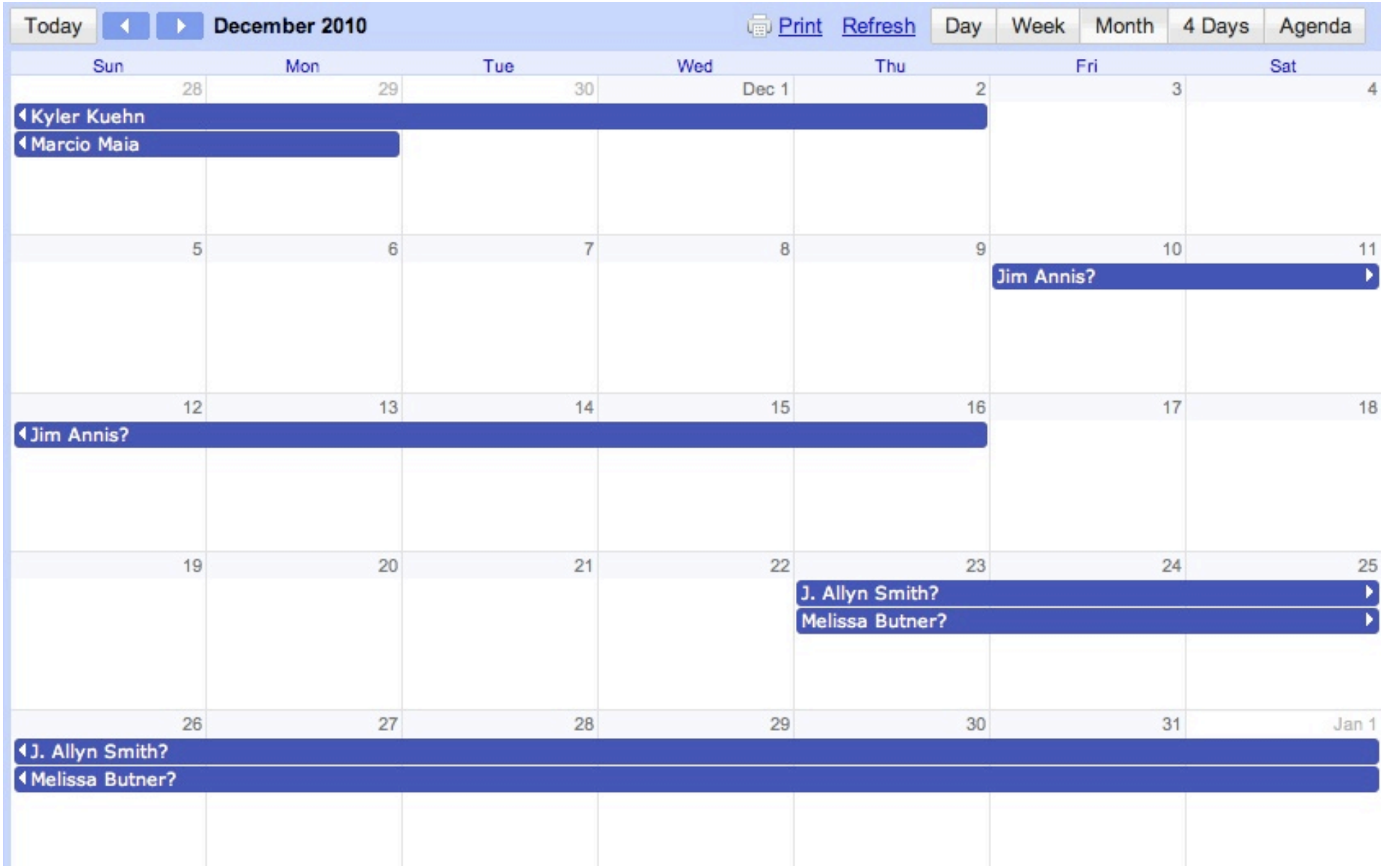
Extra Slides

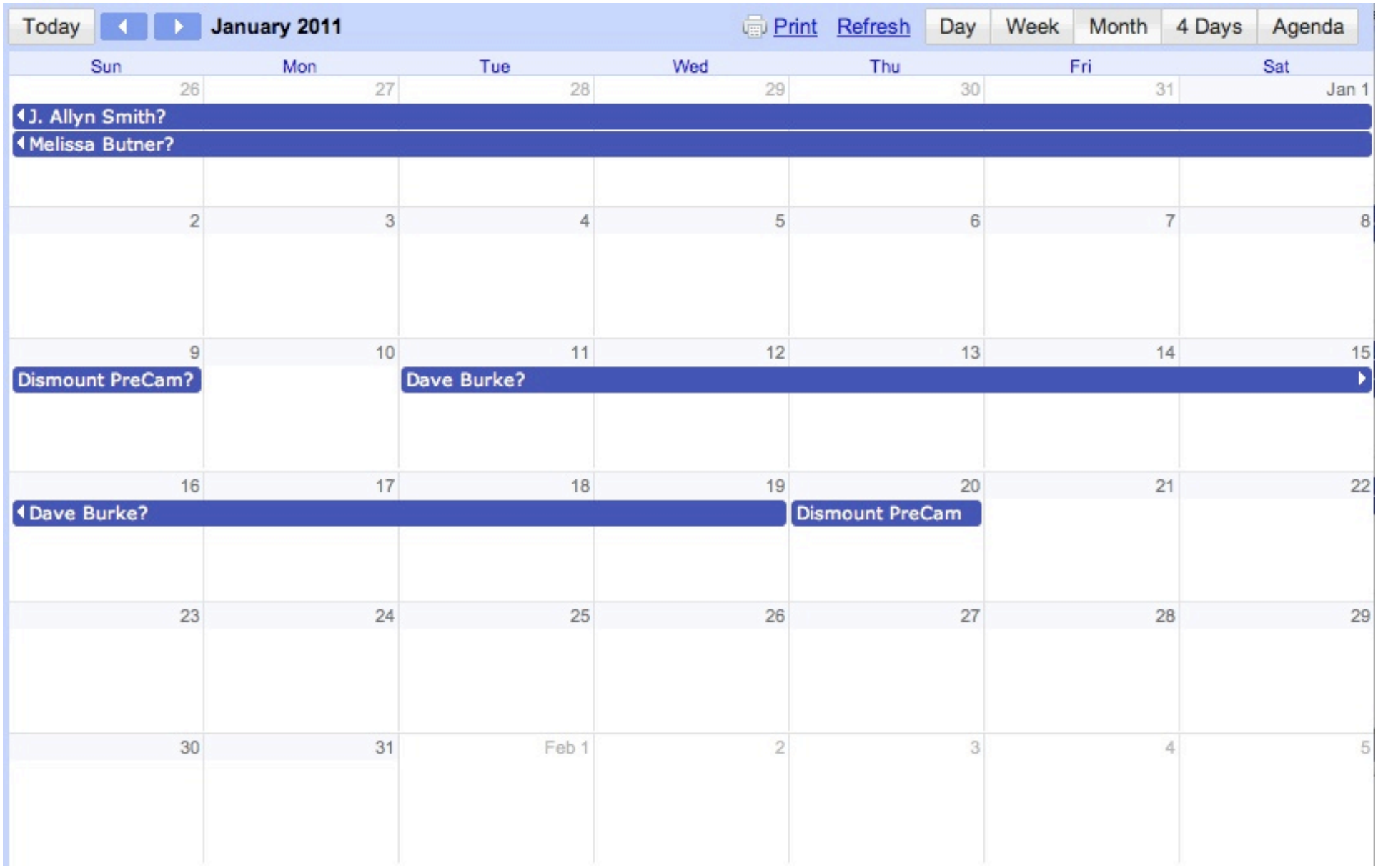
PreCam Observer Schedule: November 2010 (so far)



PreCam Observer Schedule: December 2010 (so far)



PreCam Observer Schedule: January 2011 (so far)



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PreCam on Curtis-Schmidt

Credit: R. Ogando

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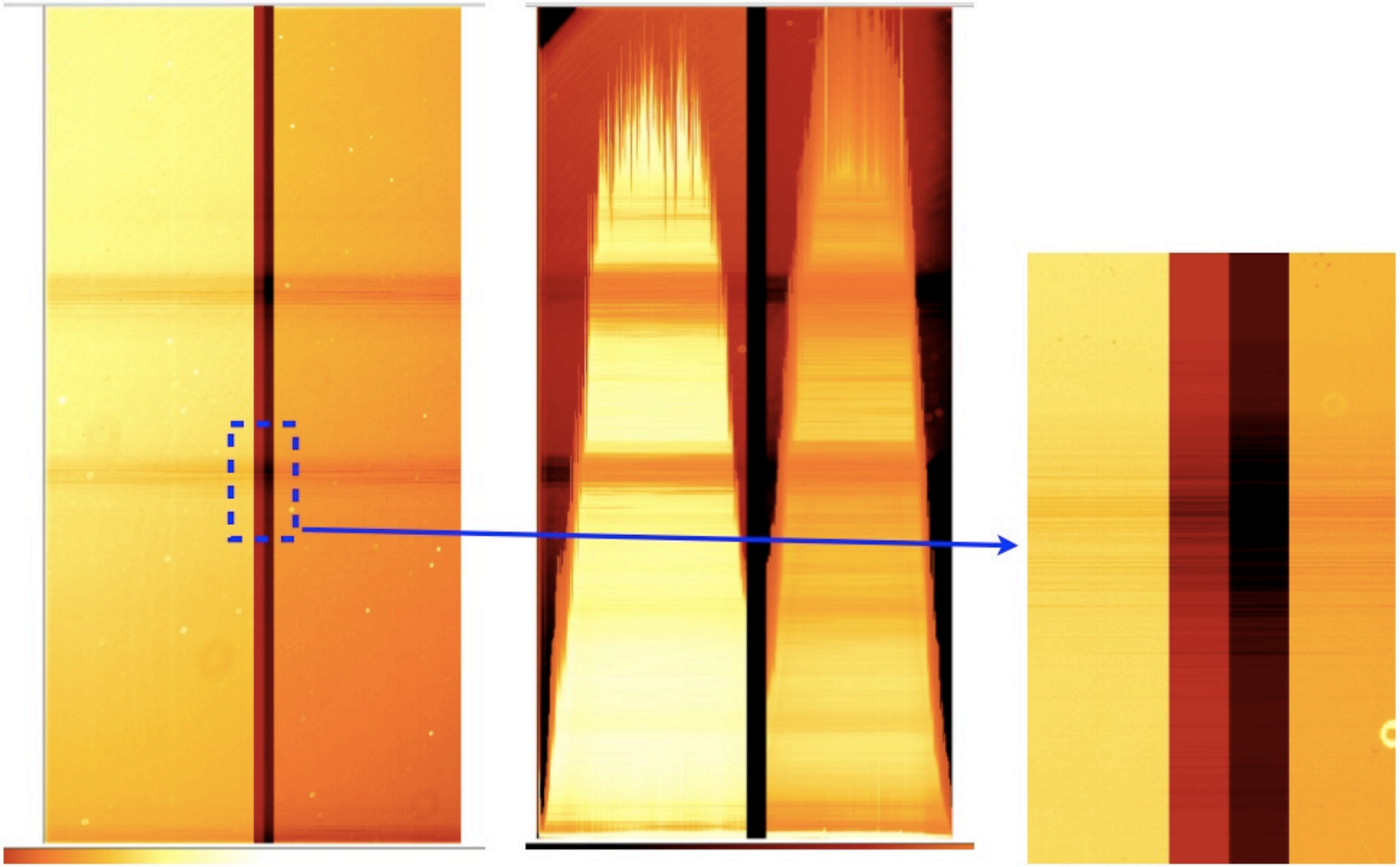

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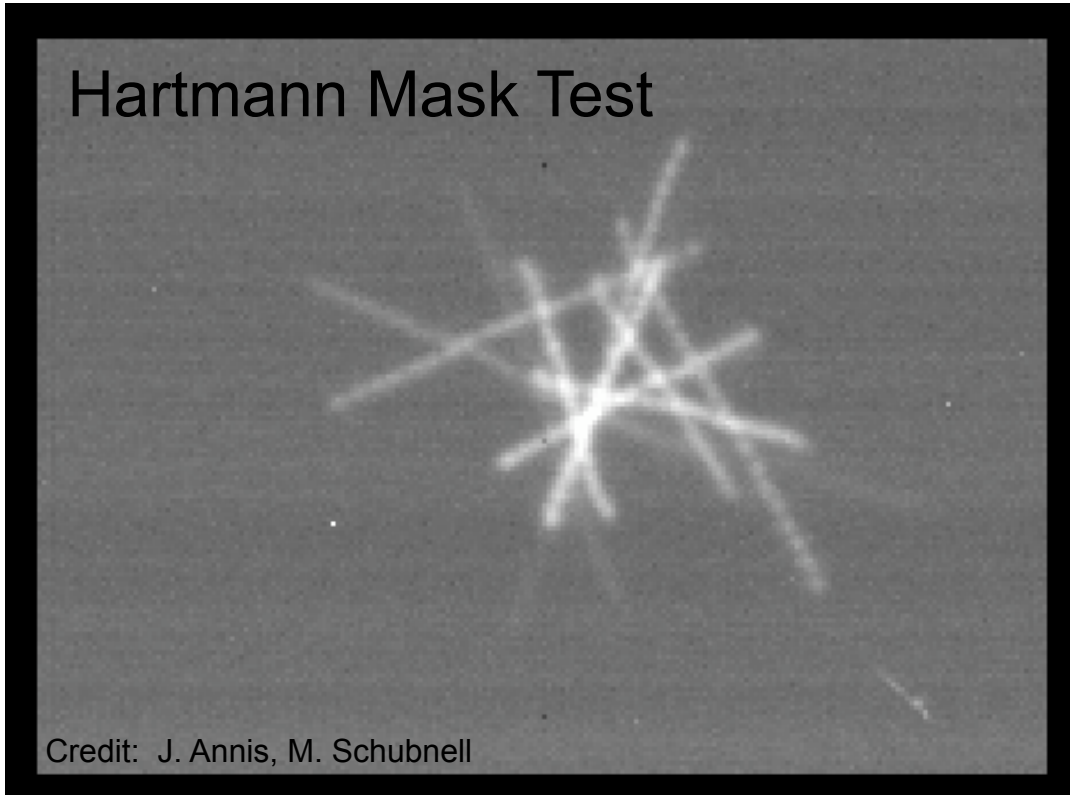

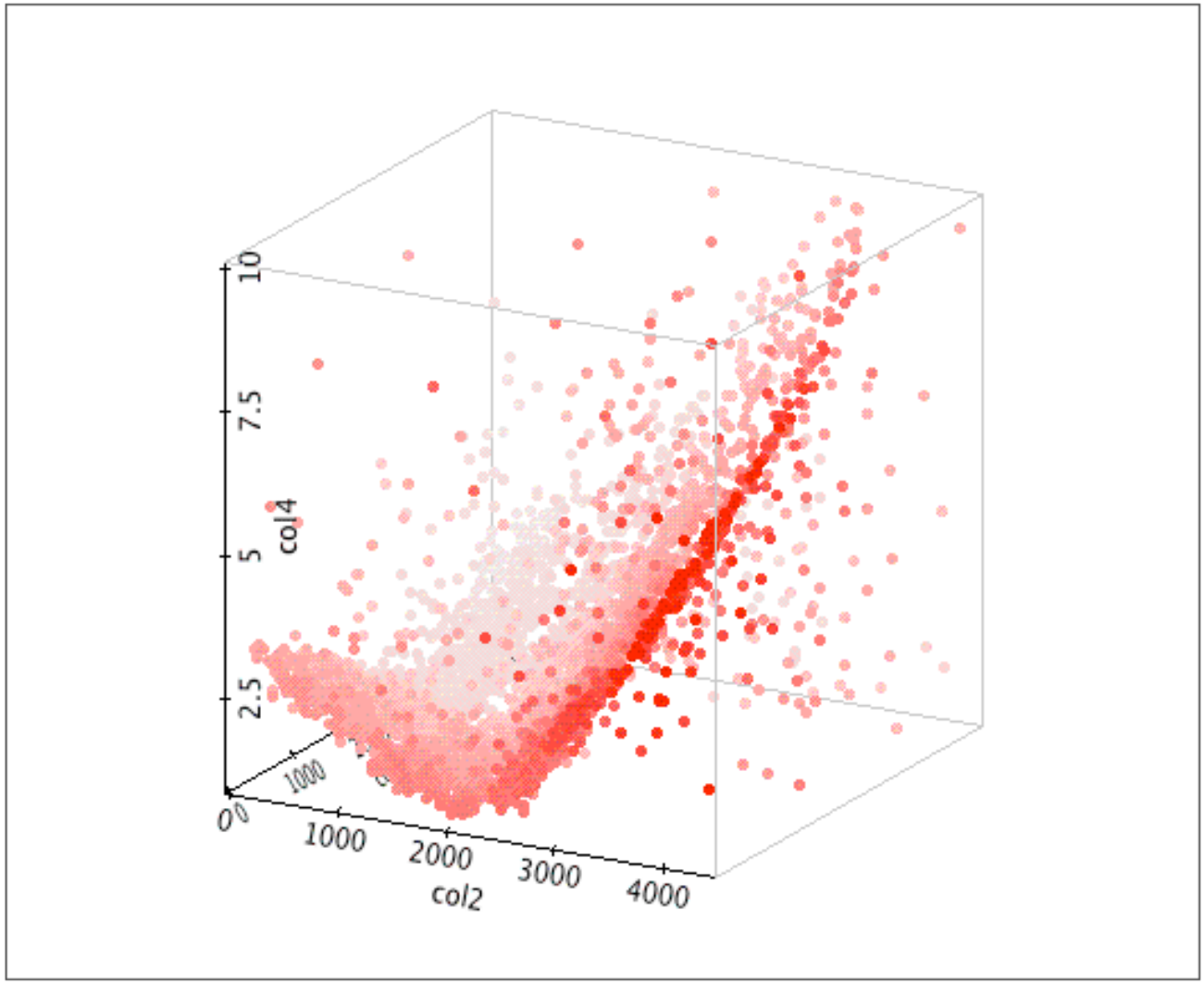
10
7.5
5
2.5
col4
0
1000
2000
3000
4000
col2