

WIRCam

CFHT's Wide Field Infrared Camera

Loïc Albert - Instrument Scientist

Thierry Forveille - Project Scientist

Greg Barrick / Pascal Puget - Project Managers

Jeff Ward, Marc Baril, Shiang-Yu Wang - Detector Specialists

Doug Teeple, Tom Vermeulen, Chi-Hung Yan - Software

Tom Benedict, Grant Matsushige, Bill Cruise, Yvan Look - Engineers

Pierre Martin, Billy Mahoney - Queue

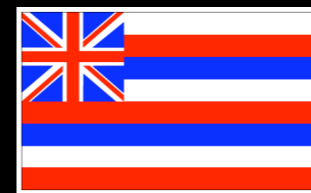
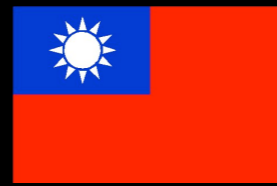
Current Status

Korea Astronomy
Observatory

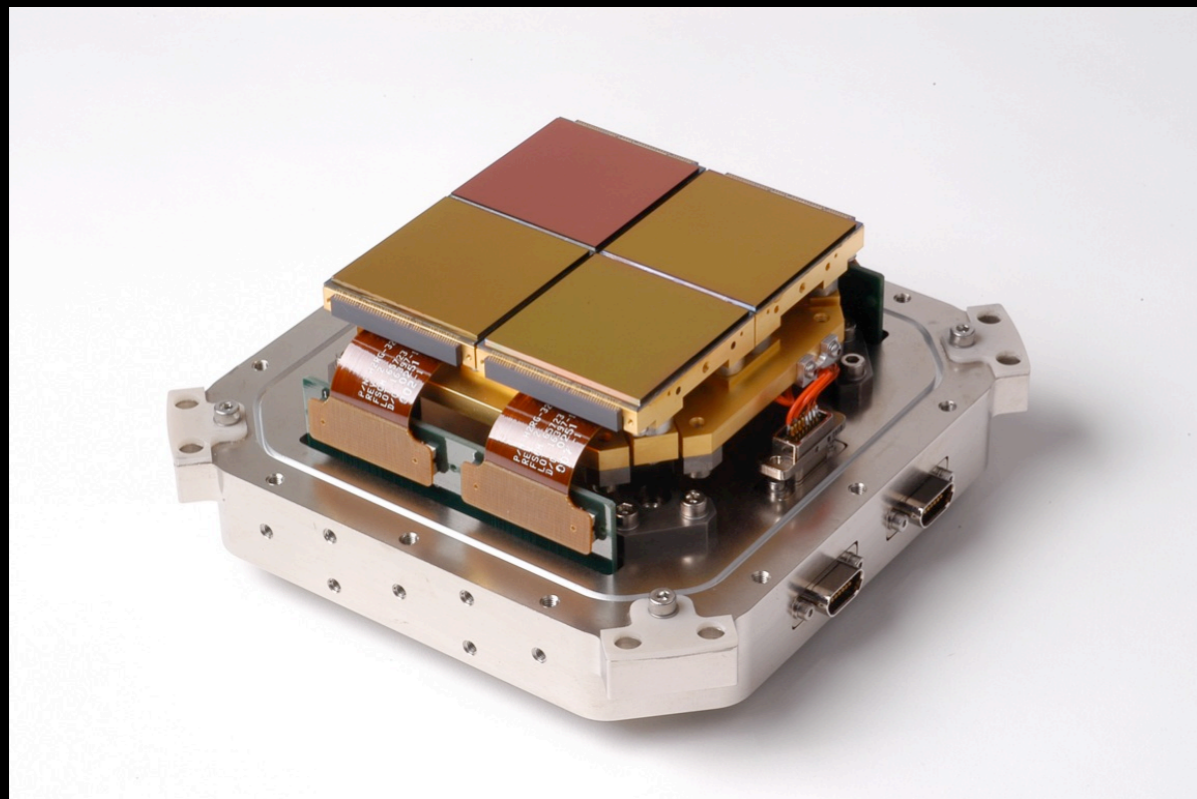
N. Korea 2000



Taiwan 2001



- Academia Sinica Institute of Astronomy and Astrophysics (ASIAA)
- National Taiwan University (NTU)
- National Central University (NCU)
- National Tsing Hua University (NTHU)



Detectors



Man Power

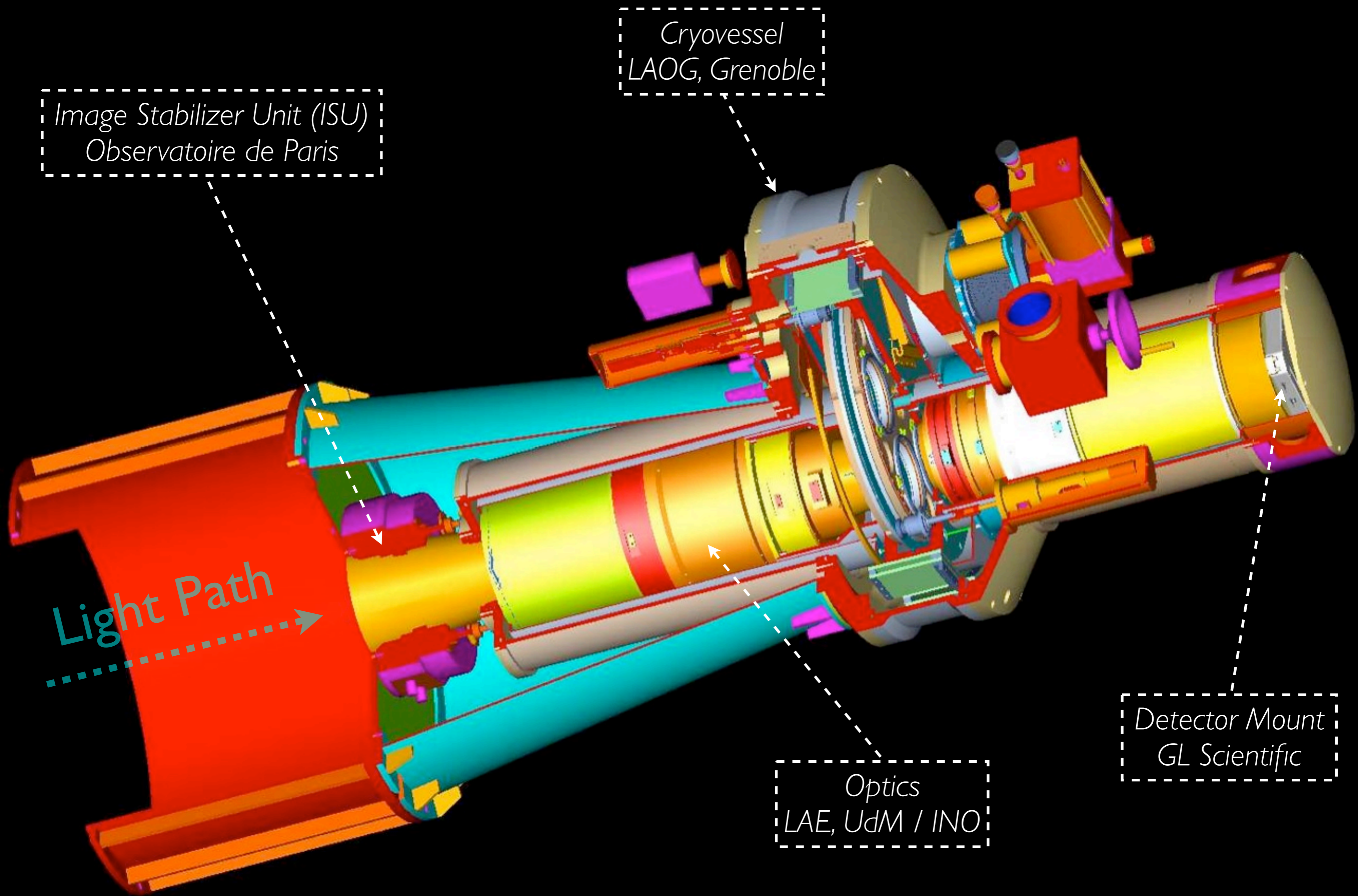


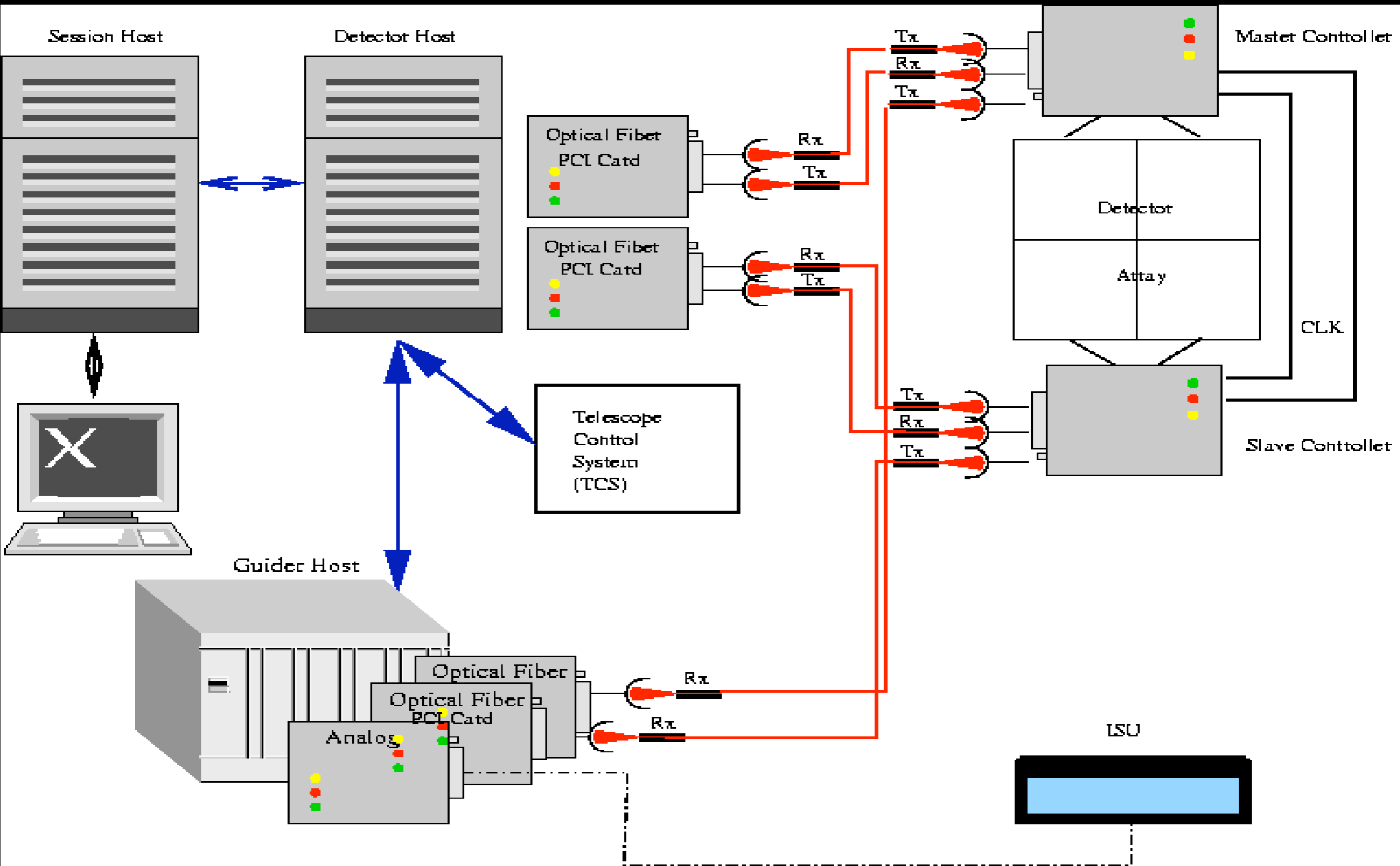
Image Stabilizer Unit (ISU)
Observatoire de Paris

Cryovessel
LAOG, Grenoble

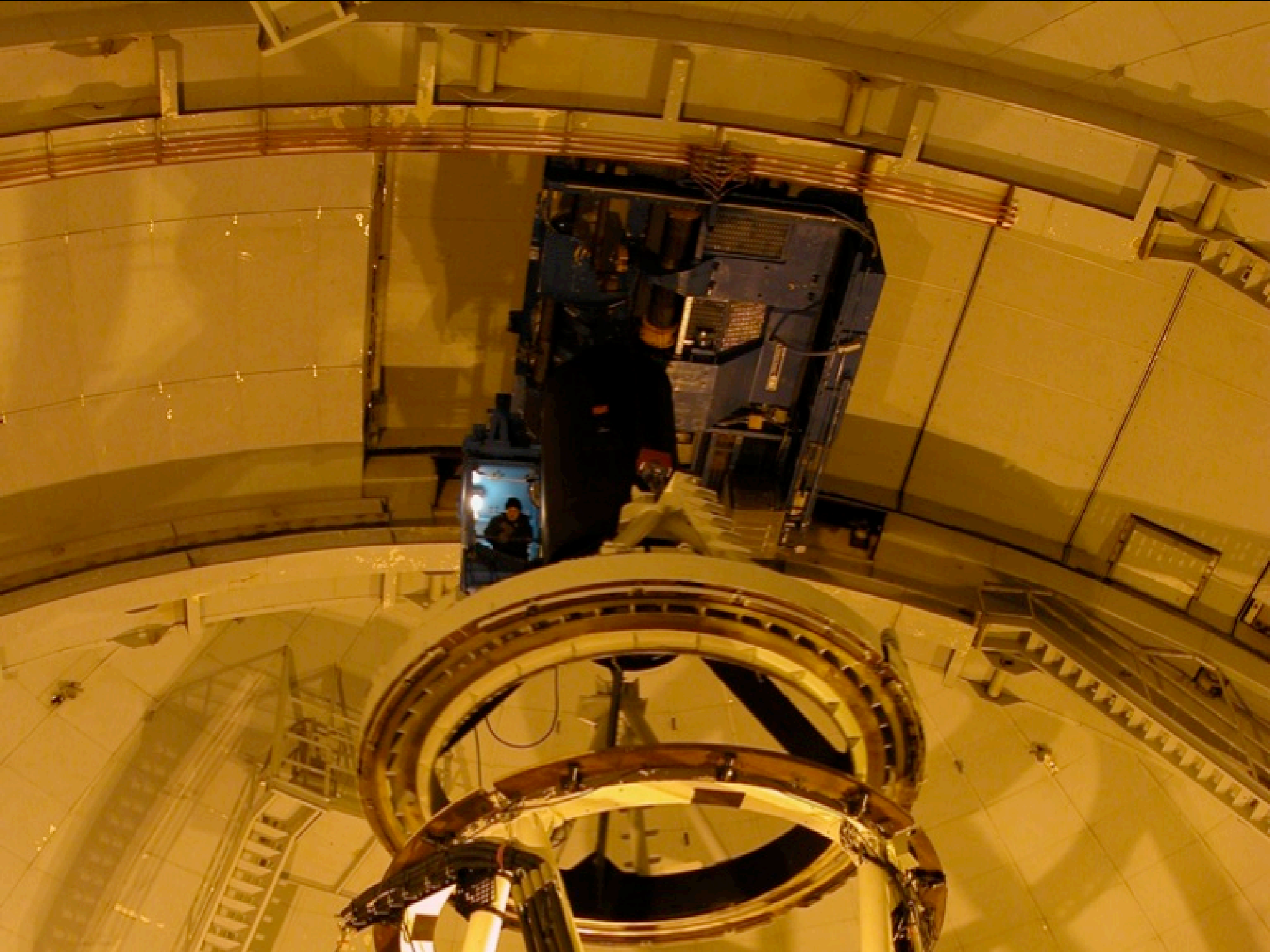
Light Path

Optics
LAE, UdM / INO

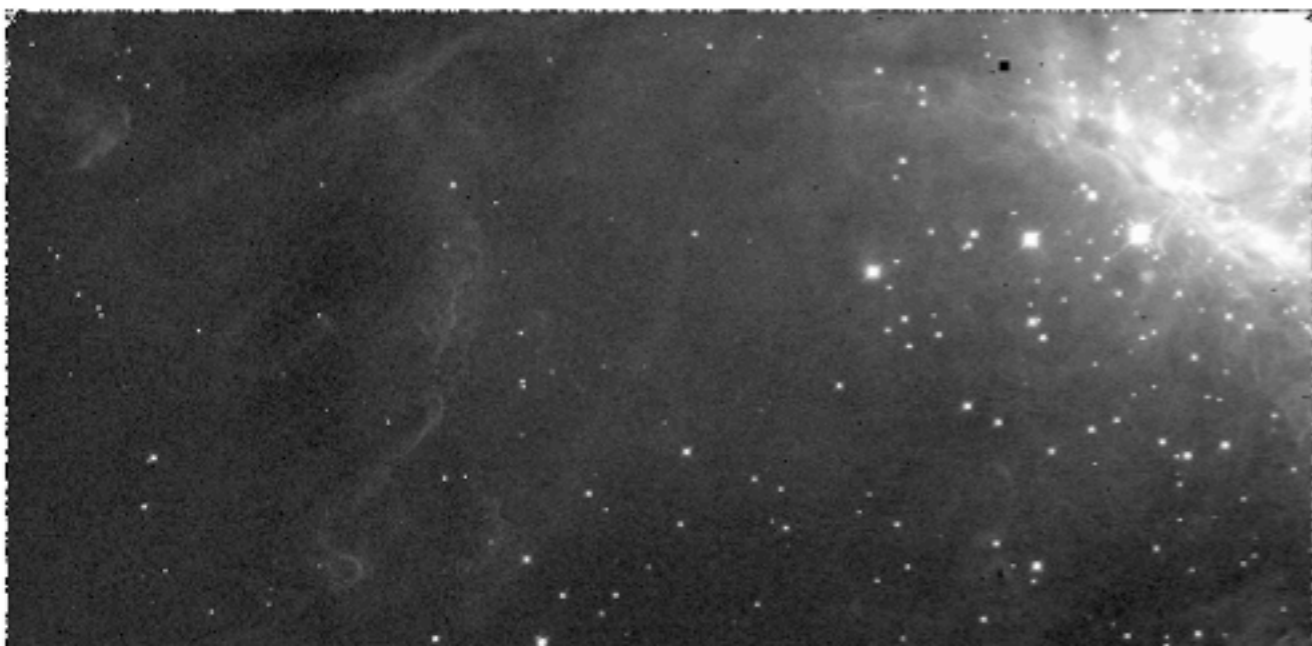
Detector Mount
GL Scientific







- 2000. Early Idea (f/8, single Hawaii-2)
- 2001. First conceptual design - Prime focus, 4 Hawaii-2 RG.
- Oct 2001. Kick-off meeting.
- 2002. Manufacturing contracts.
- Mar 2003. E-chips delivered - SDSU-III option.
- Nov 2003. Mosaic mount delivered.
- May 2004. Image Stabilizer Unit delivered.
- Oct 2004. Cryovessel delivered.
- Feb 2005. Optics delivered.
- Mar 2005. First light with 2 E-chips.
- Apr 2005. 4 Science grade chips delivered.
- Jun 2005. First light with full mosaic.



Filters:

Y (0.98-1.08um)

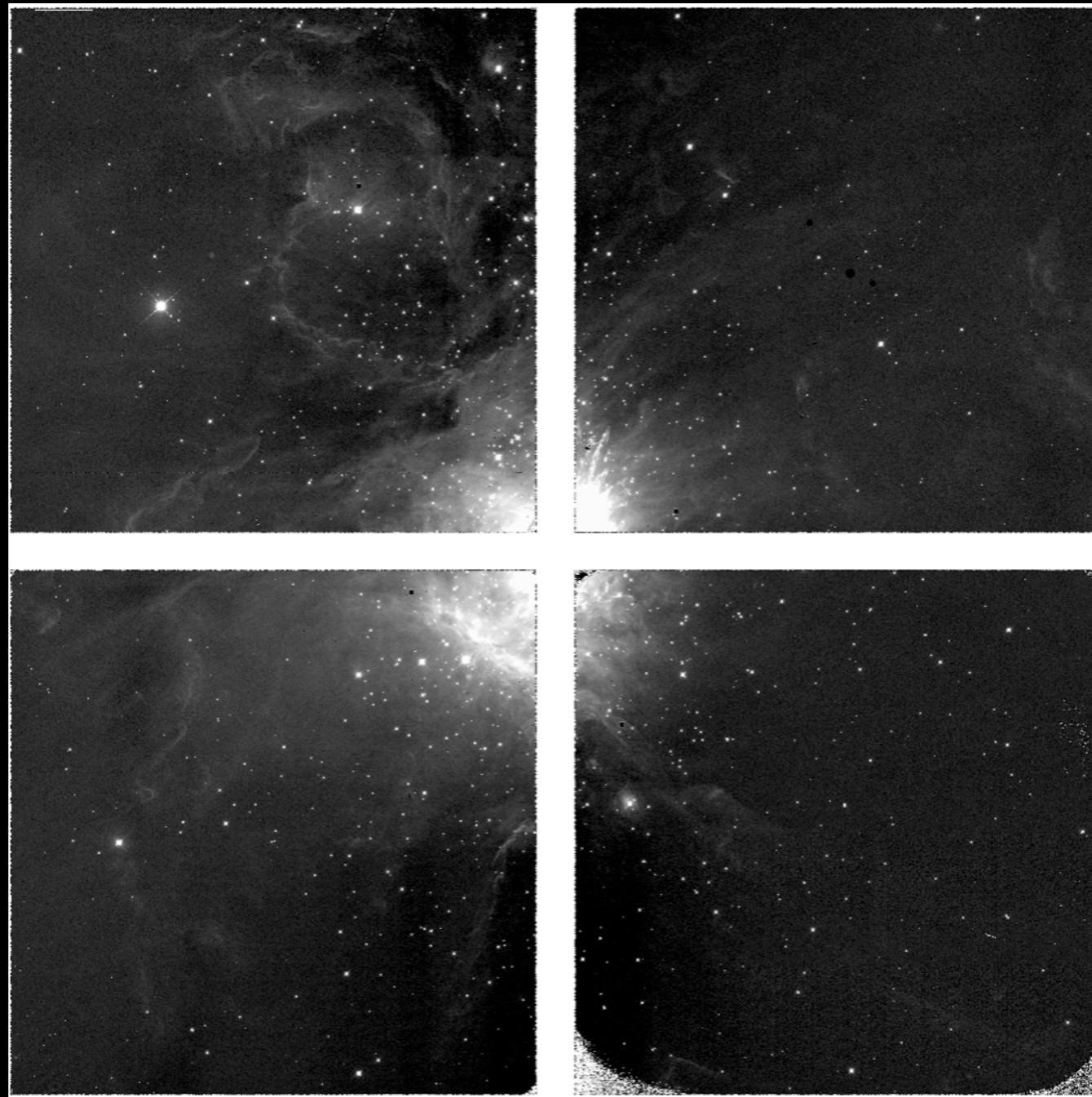
J, H, Ks

CH4 on/off

Low OH- 1 & 2

H2

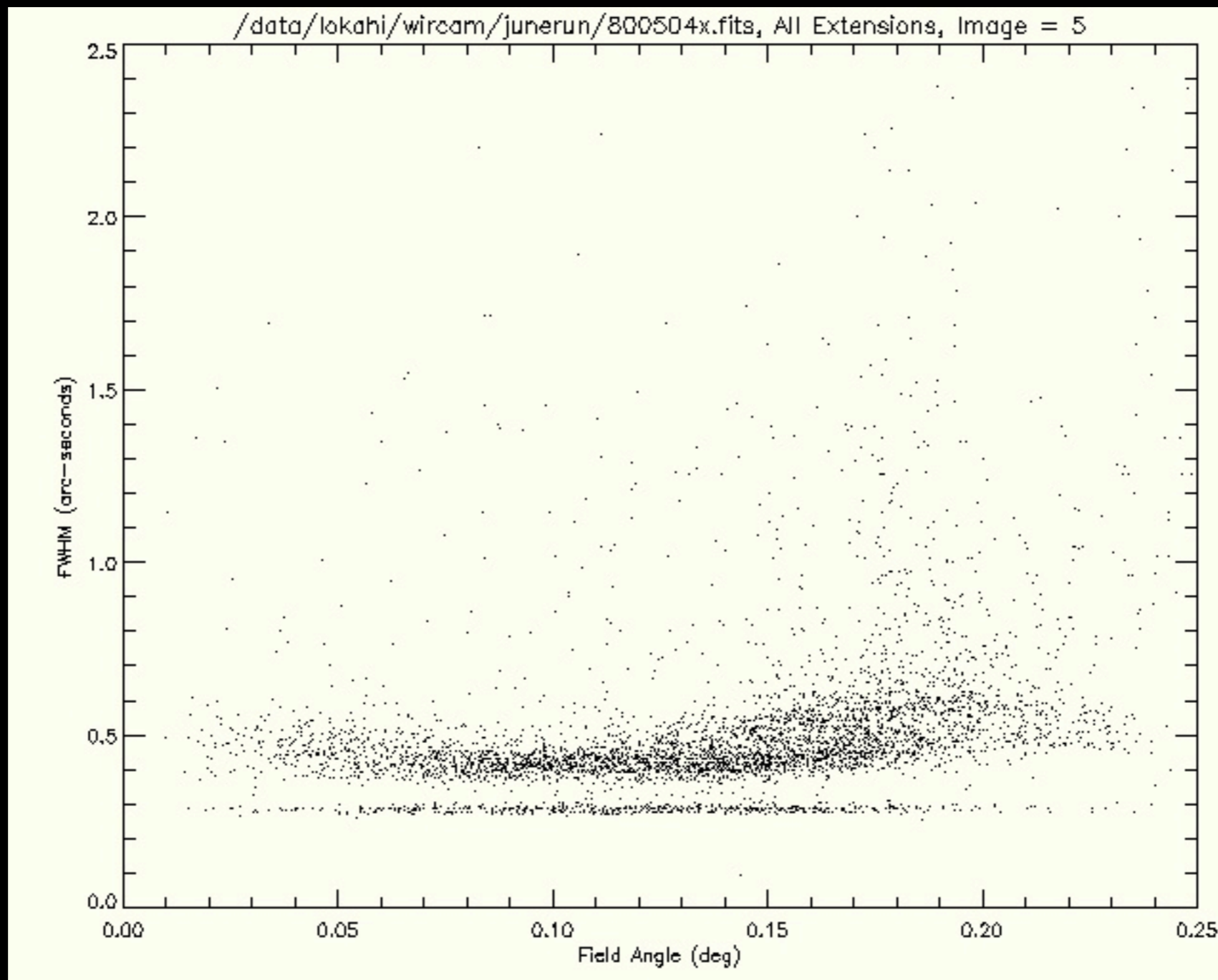
Kcont



↓
45''
↑



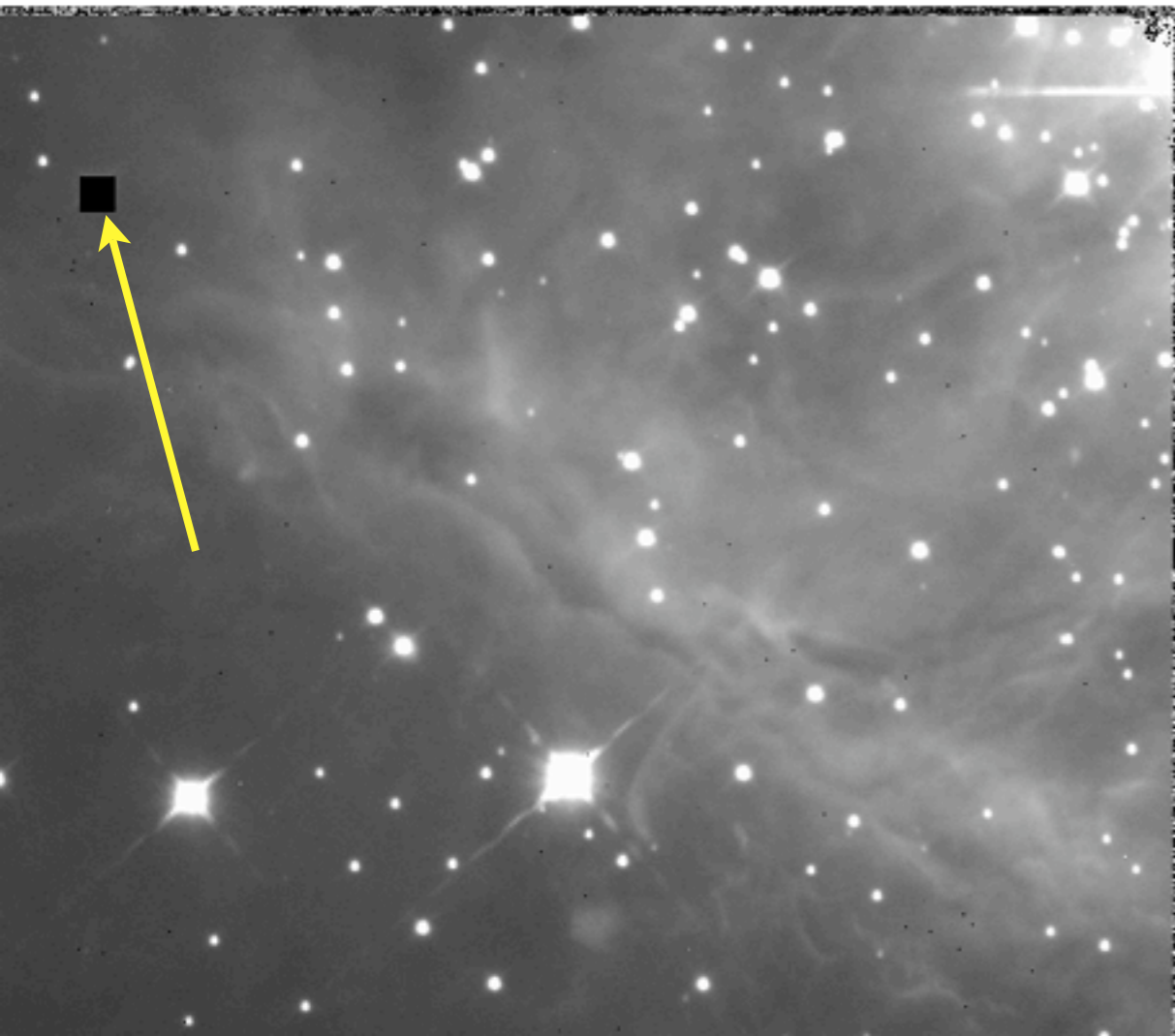
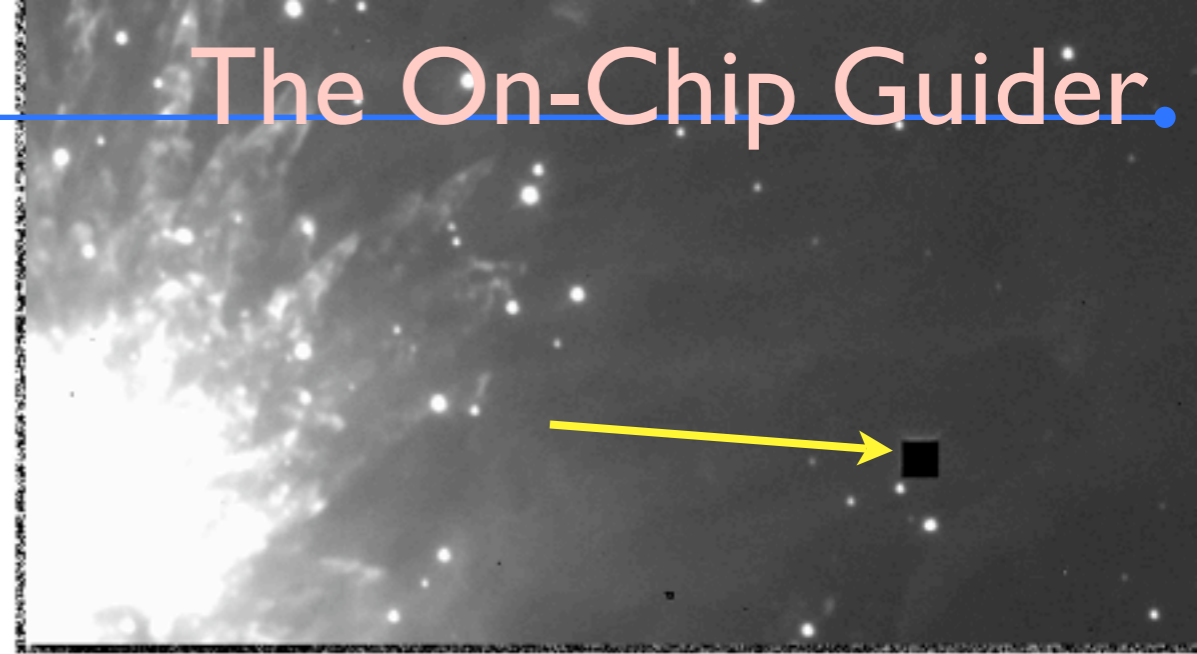
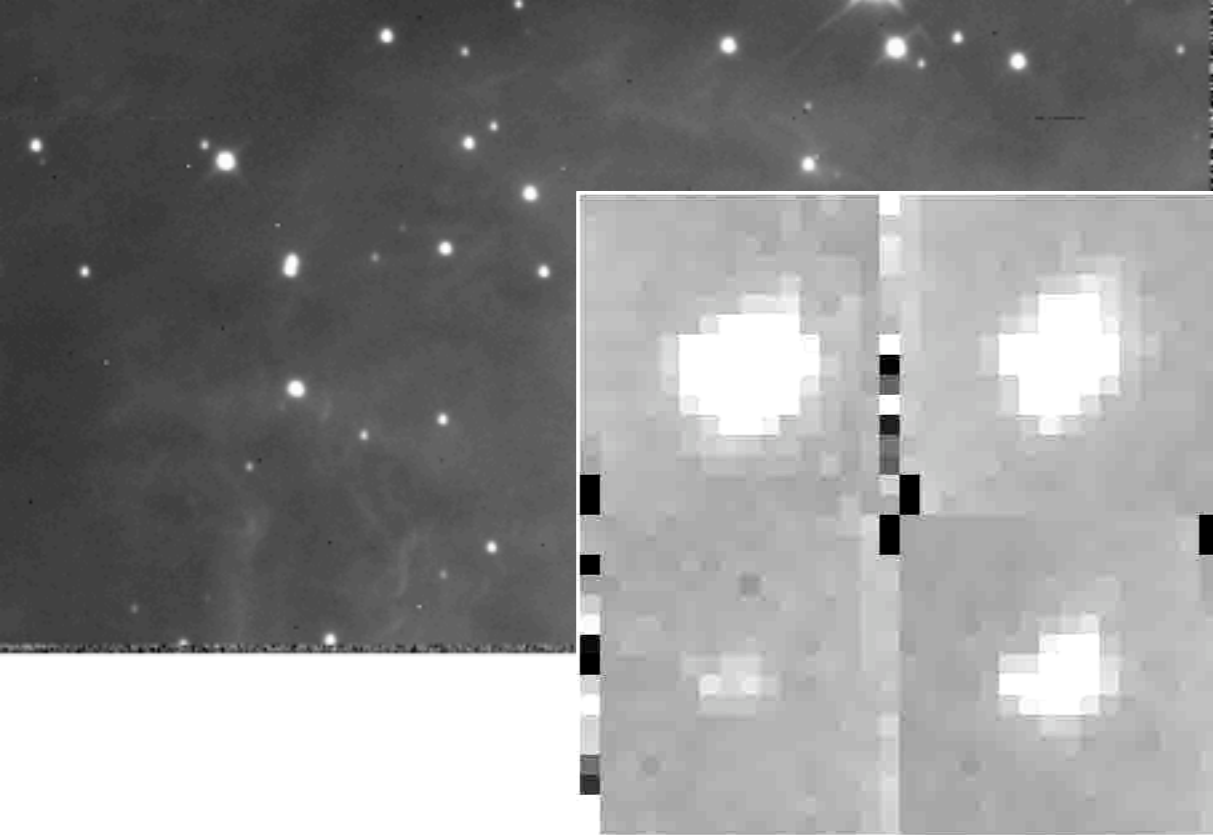
21.5'



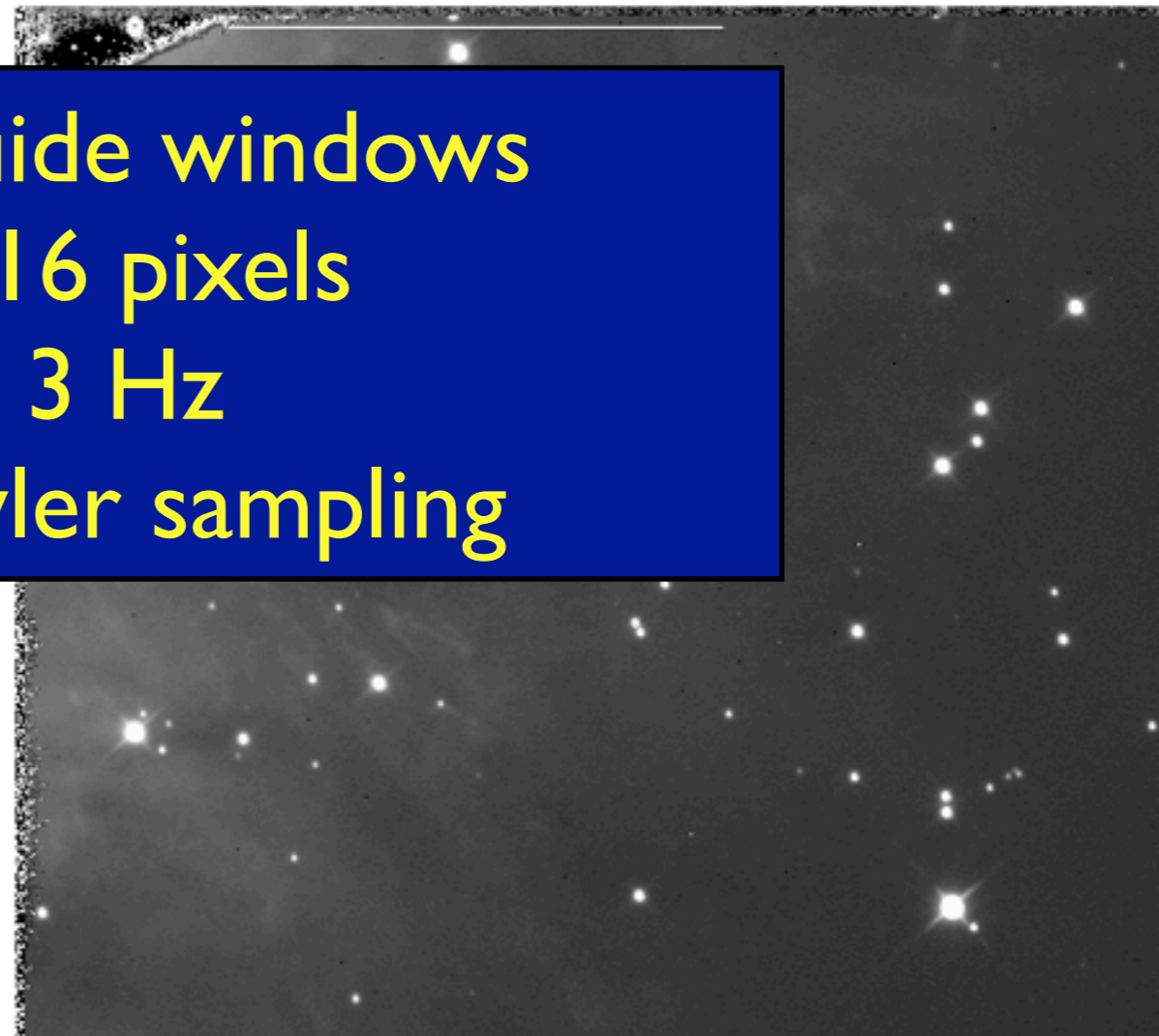
$$T = QE \times T_{opti} \times R_{mirror} \times T_{atm}$$

Filter	HAWAII-2-RG Q.E.	Optics Transmission	Expected Throughput (Optics+Detector+ Mirror+Atmosphere)	Expected Zero Point (1e-/sec) (Vega)	Measured Zero Point (gain = 2.9e-/adu)
Y	50% (?)	80%	27%	24.58	
J	75%	70%	39%	24.96	25.1
H	75%	75%	48%	25.12	25.3
K _s	80%	69%	49%	24.37	24.6

The On-Chip Guider.

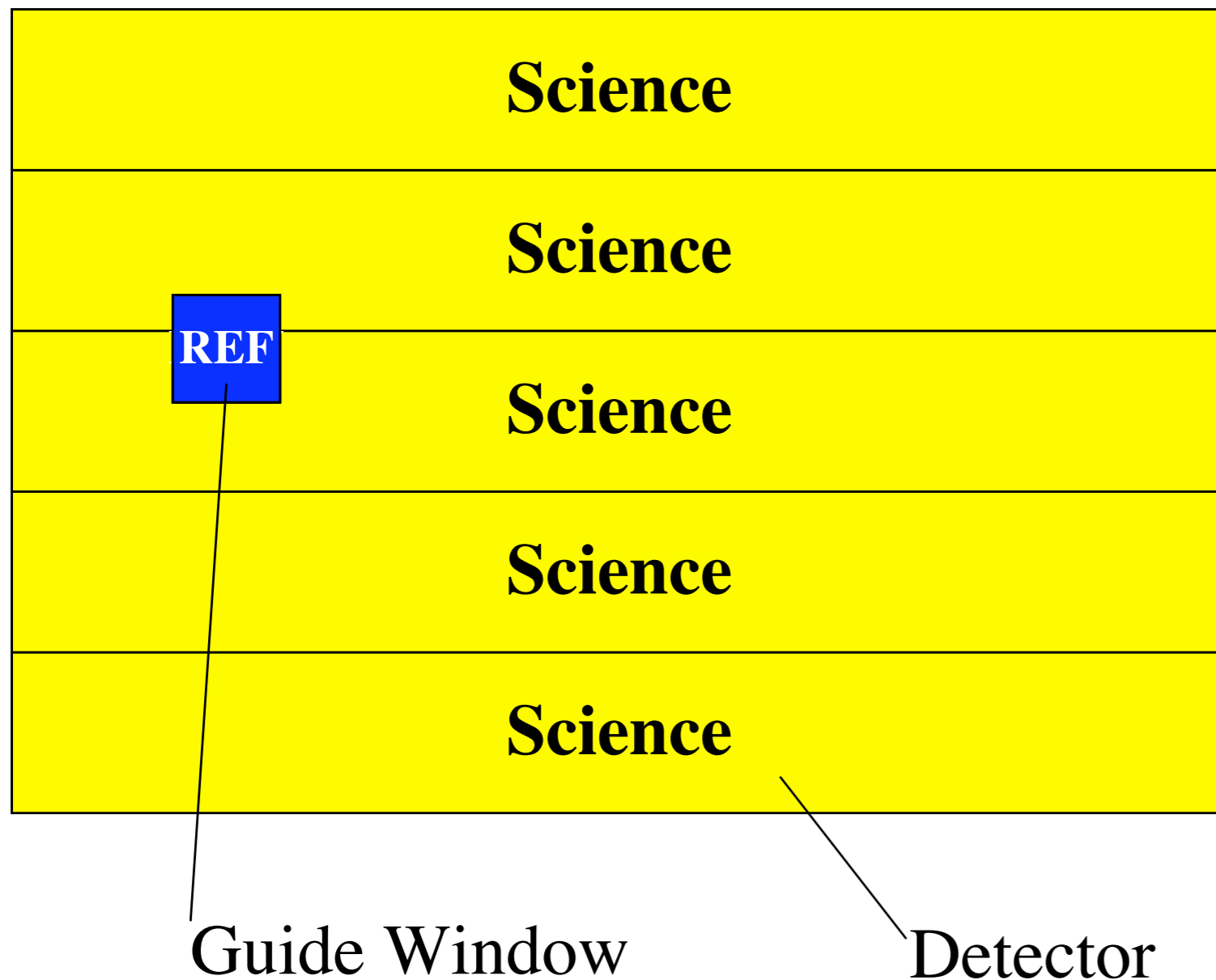


4 guide windows
16x16 pixels
50 - 3 Hz
Fowler sampling



Guide Window Readout Scheme

- Science block size (64x16 pixels @ 50 Hz, 25 microsec/pixel, 32 amps) determines guide frame exposure time.
- Changing the rate is obtained by clocking bigger blocks of science pixels.



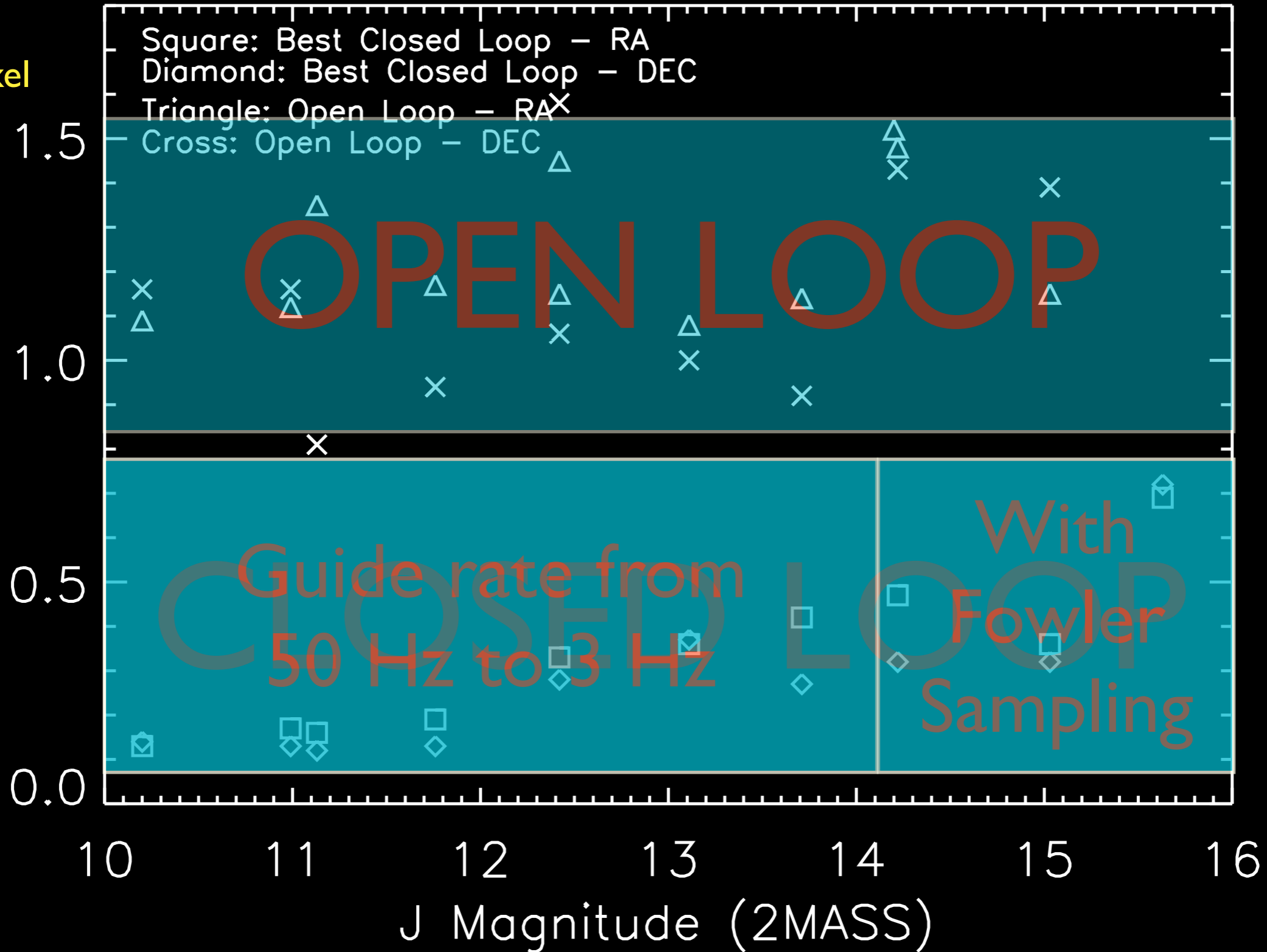
Signal Processing Sequence

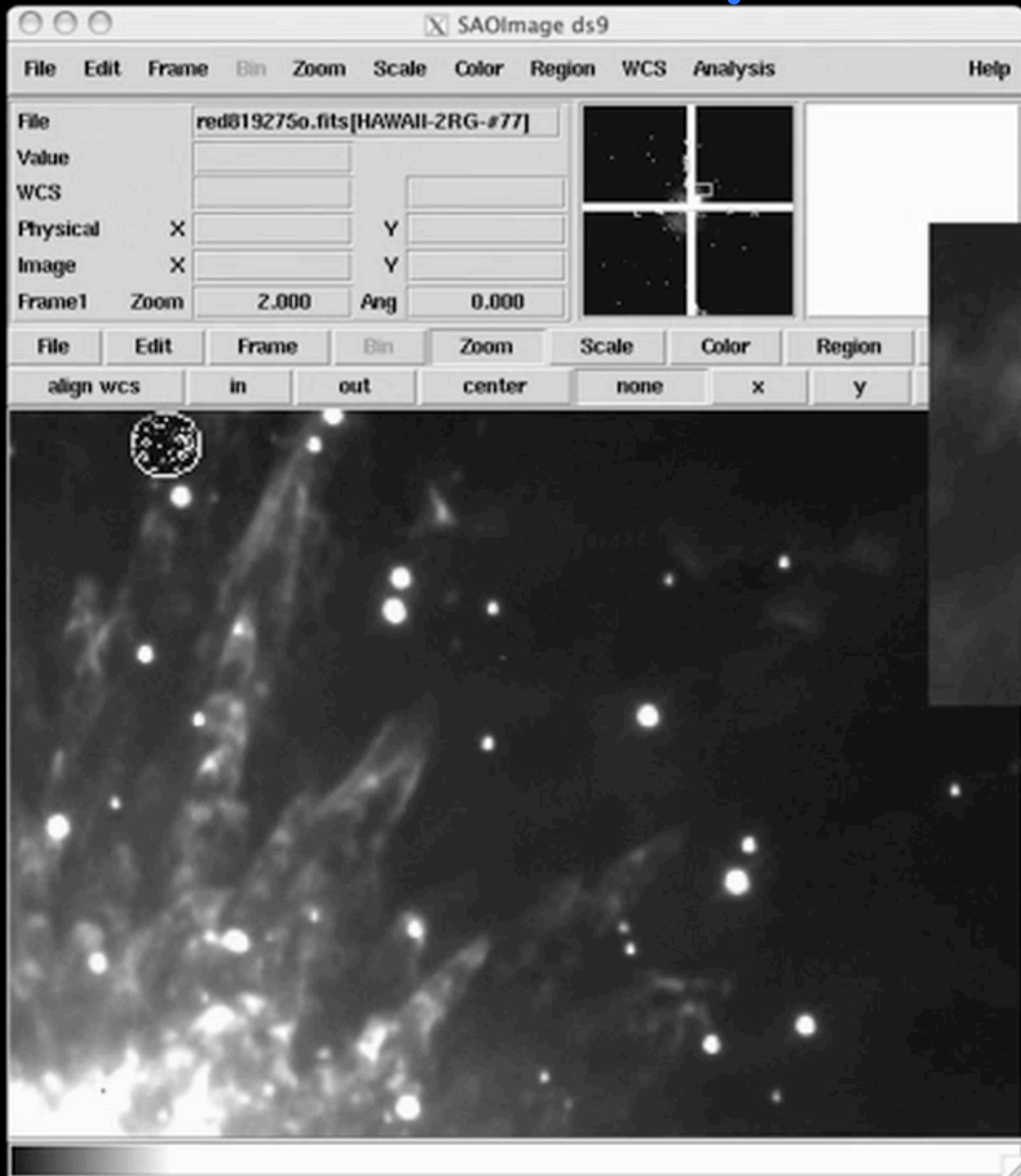
- Read RAW & REF guide pixels
- Construct CDS image
- Subtract background
- Convolution by gaussian to reduce noise
- Measure star barycenter
- Combine 4 stars corrections
- Feed correction to PID loop
- Send ISU voltage

Guiding Error vs. Star Magnitude

0.3"/pixel

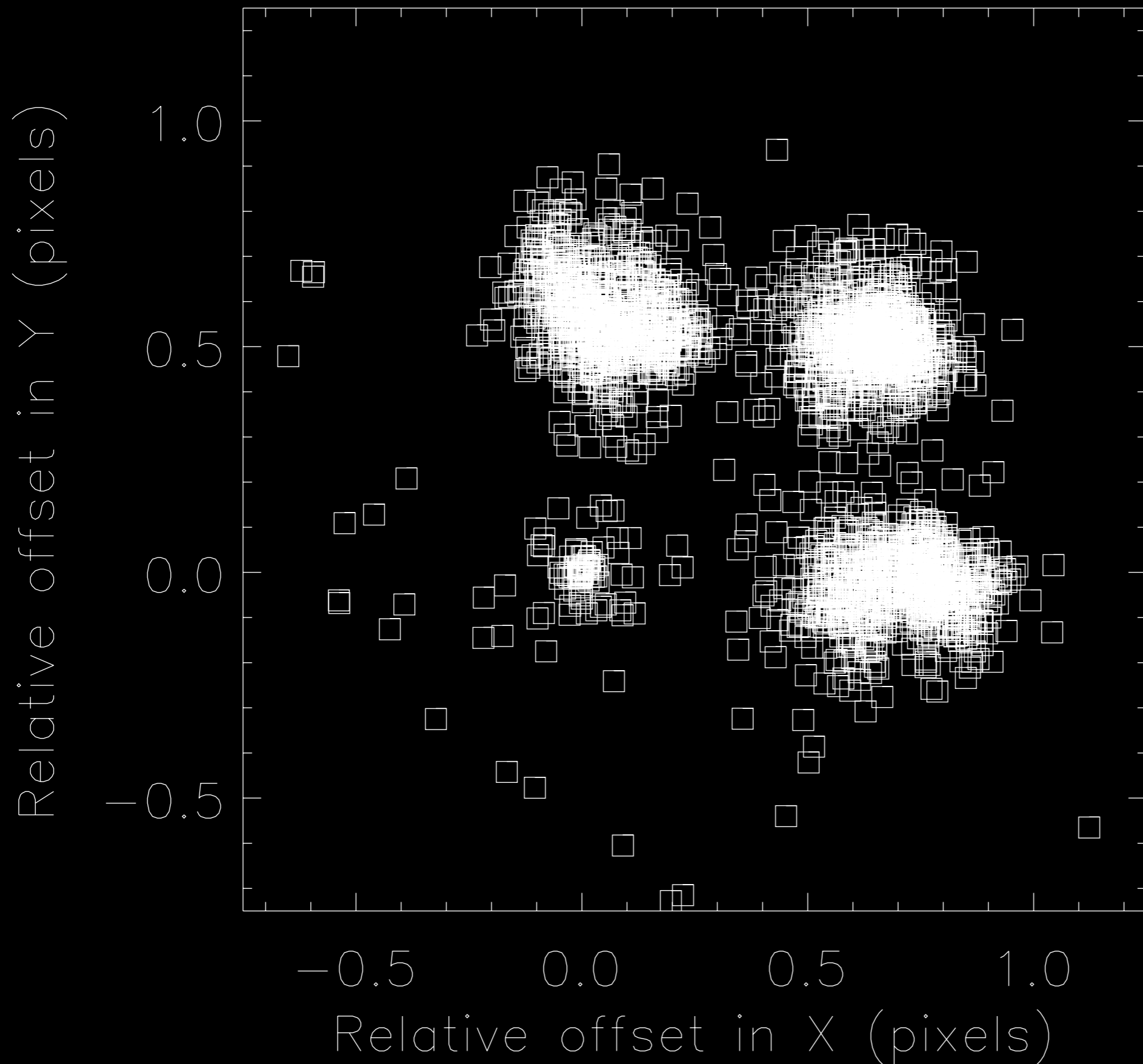
Standard Dev. (Pixels)





1/2 pixel dithering
with 0.3" pixels

Relative Offset Between Images (ext 1,2,3,4)



Queue Observing / Realtime Pipeline

Data Logs

File Options Tools Help

03-Nov-2005 @ 16:50:16 (HST)

Electronic Logbook Weather Log Time Accounting Calibration Plan
Iterations Reset Query Form WIRCAM From (date) Reload

From 19-Oct-2005 (HST)

Q Coord:

Observer:

Agency:

Semester:

RunId:

Prg Status:

OG Status:

OB Status:

IC Status:

Exp Status:

E Type:

Exp Grade:

Flag	Exp Date(HST)	Q Name	Exp ObsID	Exp Type	Exp File	Exp Status	Phot	Obs C
256 **	Oct-21 05:32:02	Q3	819267	OBJECT	819267o	OBSERVED	<input type="checkbox"/>	N/A
257 ***	Oct-21 05:34:41	Q3	819268	ACQUIRE	819268a	OBSERVED	<input type="checkbox"/>	N/A
258 **	Oct-21 05:35:26	Q3	819269	OBJECT	819269o	OBSERVED	<input type="checkbox"/>	N/A
259 ***	Oct-21 05:38:09	Q3	819270	OBJECT	819270o	OBSERVED	<input type="checkbox"/>	N/A
260 ***	Oct-21 05:40:50	Q3	819271	ACQUIRE	819271a	OBSERVED	<input type="checkbox"/>	N/A
261 **	Oct-21 05:41:37	Q3	819272	OBJECT	819272o	OBSERVED	<input type="checkbox"/>	N/A
262 **	Oct-21 05:44:22	Q3	819273	OBJECT	819273o	OBSERVED	<input type="checkbox"/>	N/A
263 ***	Oct-21 05:47:09	Q3	819274	ACQUIRE	819274a	OBSERVED	<input type="checkbox"/>	N/A
264 **	Oct-21 05:47:55	Q3	819275	OBJECT	819275o	OBSERVED	<input type="checkbox"/>	N/A
265 **	Oct-21 05:50:41	Q3	819276	OBJECT	819276o	OBSERVED	<input type="checkbox"/>	N/A
266 ***	Oct-21 05:53:43	Q3	819277	ACQUIRE	819277a	OBSERVED	<input type="checkbox"/>	N/A
267 **	Oct-21 05:54:30	Q3	819278	OBJECT	819278o	OBSERVED	<input type="checkbox"/>	N/A
268 *	Oct-21 18:37:59	Q1	819325	FOCUS	819325x	OBSERVED	<input type="checkbox"/>	Focus
269 **	Oct-21 19:03:02	Q1	819327	ACQUIRE	819327a	OBSERVED	<input type="checkbox"/>	N/A
270 *	Oct-21 19:03:49	Q1	819328	OBJECT	819328o	VALIDATED	<input checked="" type="checkbox"/>	N/A
271 *	Oct-21 19:06:18	Q1	819329	OBJECT	819329o	VALIDATED	<input checked="" type="checkbox"/>	N/A
272 *	Oct-21 19:08:48	Q1	819330	OBJECT	819330o	VALIDATED	<input checked="" type="checkbox"/>	N/A
273 *	Oct-21 19:11:13	Q1	819331	OBJECT	819331o	VALIDATED	<input checked="" type="checkbox"/>	N/A
274 *	Oct-21 19:13:34	Q1	819332	OBJECT	819332o	VALIDATED	<input checked="" type="checkbox"/>	N/A

Description	Value
Flag	**
Exp Date(HST)	Oct-21 05:47:55
Q Name	Q3
Exp ObsID	819275
Exp Type	OBJECT
Exp File	819275o
Exp Status	OBSERVED
Phot	false
Obs Comment	N/A
Seq Comment	Orion Nodding[9/10] - Re...
Exp Val/Req	0/10
Eval	null
IC Label	I39
IC Status	OBSERVED
IC Val/Req	0/1
IC O-Time	0.11
OB Label	OB44
OB Type	OBJECT
OB Status	OBSERVED
OB Val/Req	0/1
OB O-Time	0.11

E Time: (Req) (Act)

Filter:

IQ: (Req) (Act)

Sky BG: (Req) (Act)

AirM: (Req) (Act)

N Exp: (Req) (Act)

MD:

Slice:

Target Type:

Observer Comments:

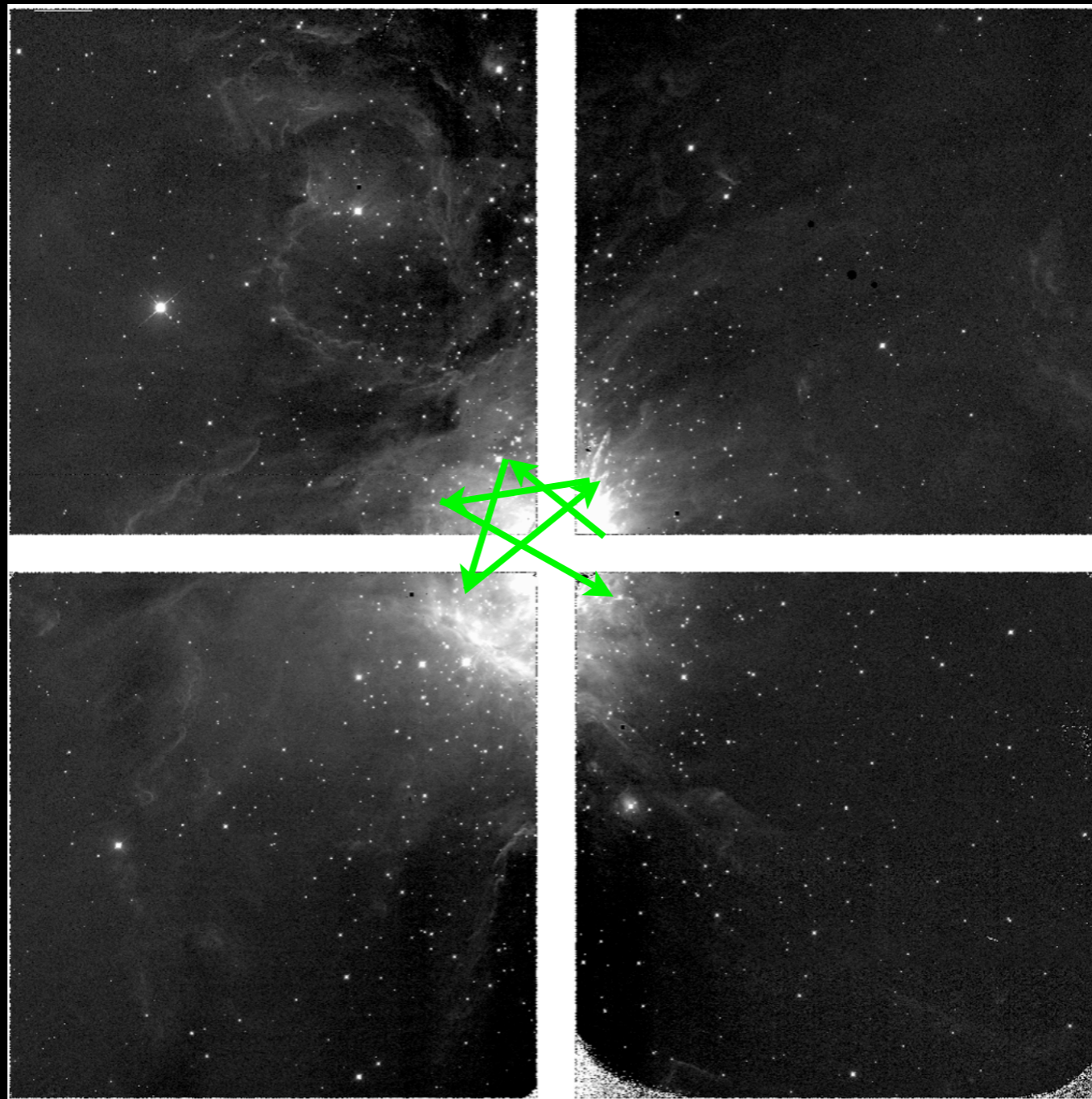
01: IQ=0.64, Sky BG=44, Absorp=-0.04
 02: IQ=0.65, Sky BG=43, Absorp=-0.05
 03: IQ=0.64, Sky BG=43, Absorp=-0.06
 04: IQ=0.69, Sky BG=44, Absorp=-0.06

1 2 3 4 5

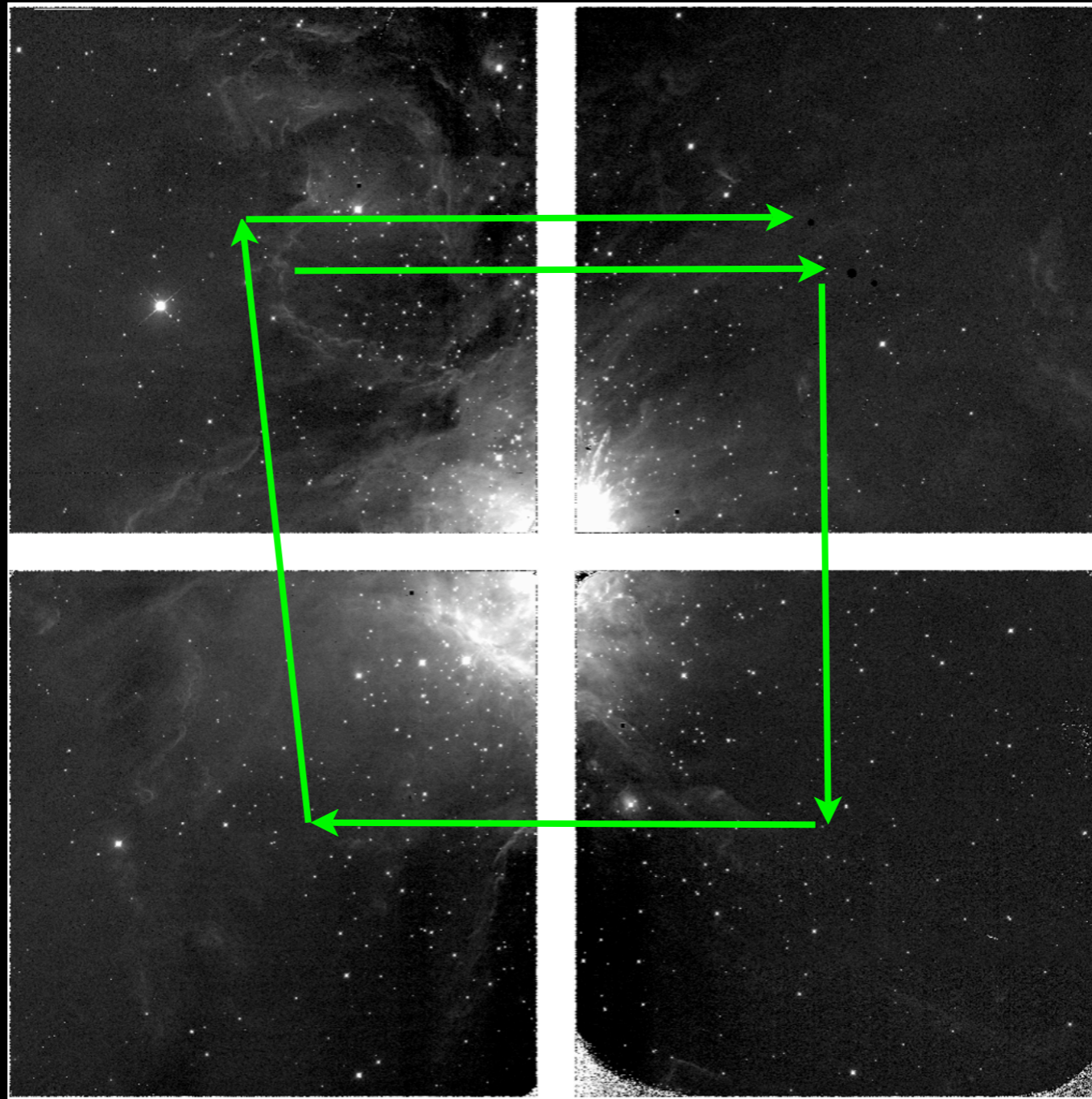
Coordinator Comments:

Photometric Validate

Standard dithering pattern

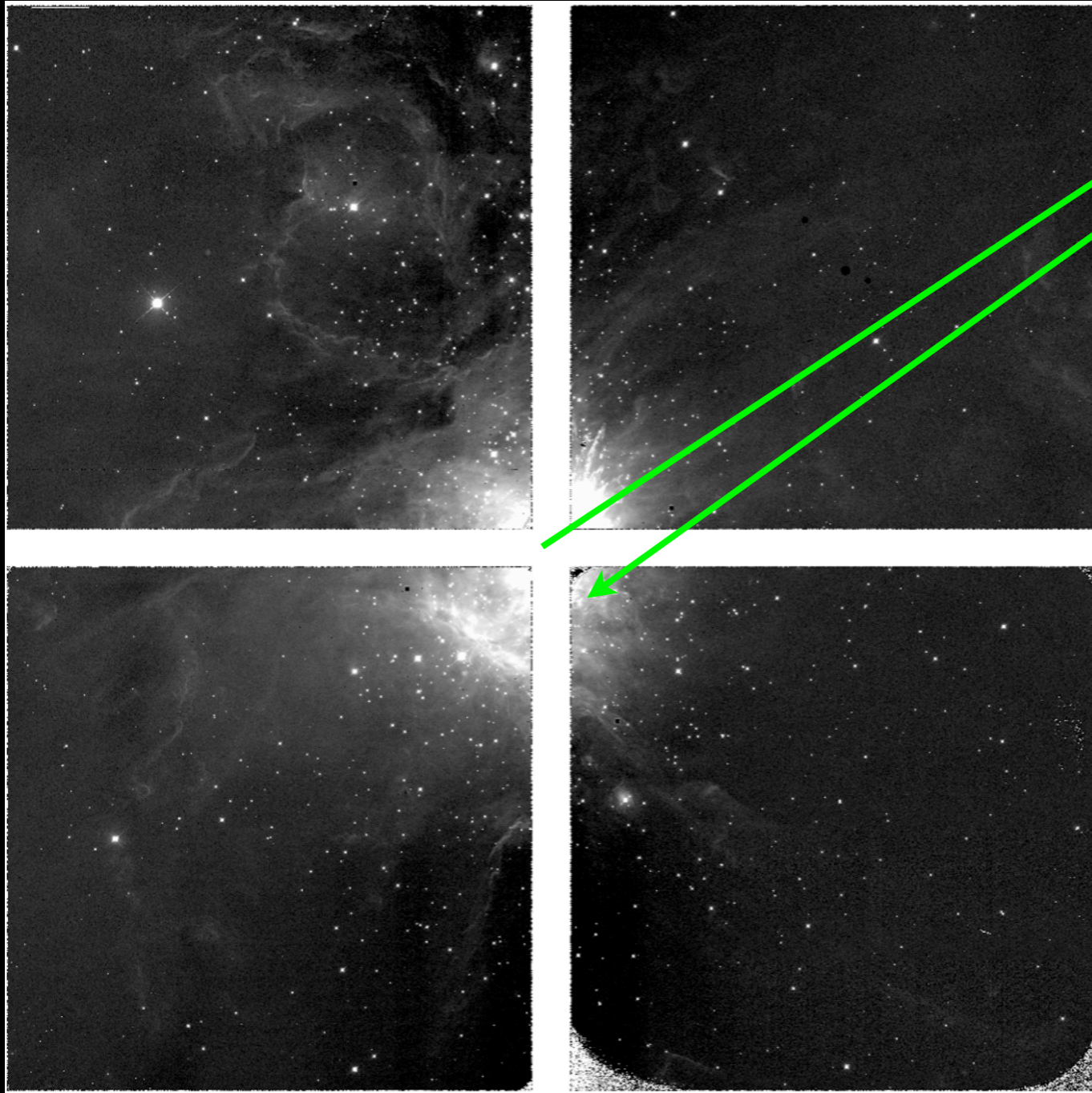


Array to array dithering



Nodding

SKY



Slew
Telescope
to Target

Take a
Snapshot

Determine
Astrometry /
Choose Guide
Stars

Apply
Pointing
Correction

Start Science
Exposure

Start On-
Chip
Guiding

Current Status:

Excellent Image quality (got $\sim 0.4''$).

Queue observing operational / Needs testing.

Realtime (fwhm / absorption / sky level) operational.

On-Chip Guider fully operational beyond specs.

Microdithering operational / Needs testing.

Excellent throughput.

Pipeline recipes under development.

Starting science (shared risk) in November.

Questions:

Large overheads 10s+ per image - priority ONE

Optimize the drizzle reconstruction to sample half $0.3''$

Port IDL pipeline to C (CFHT elixir)

WIRCam Science

⊙ CFHT Legacy Survey

- SN Ia Cosmology
- Weak Lensing
- KBO

100 nights

⊙ Other Megacam Projects (UofH)

~50 nights

⊙ ESPADONS - spectropolarimeter

100 nights

⊙ WIRCam

➔ Strong Pressure on Telescope Time

WIRCam likely to be scheduled for ~100 nights/year

Searching for $z \sim 8$ Galaxies with WIRCam.

Accepted

P.I. Jean-Gabriel Cuby

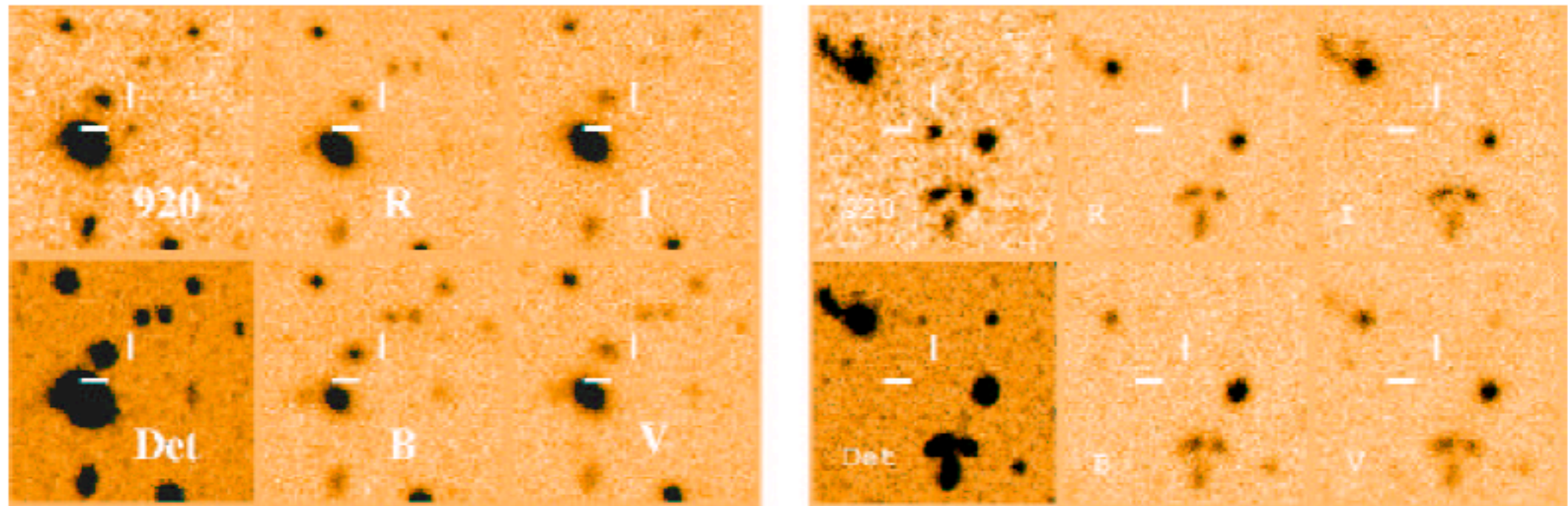


Figure 1: Thumbnail images in BVRI, NB920 nm and detection (composite χ^2 image) of $z > 6$ galaxies detected at CFHT. Thumbnails are $20''$ on a side. East is right, North is up. Left: $z = 6.17$ (see [8]), Right: $z = 6.58$. Source: CFH12K data with NB 920 custom filter.

- Use a low OH- emission narrow band filter (in J)
- Detect Lyman alpha emission indicative of star formation
- CFHTLS Deep field 3.

Isolated Planetary Mass Objects (IPMOs) : nearing the end of the IMF.

Proposed
Large Program

P.I. Jérôme Bouvier

Target	RA h m	Dec. deg.	Age (Myr)	Dist. (pc)	HBML		DBML	
					J_{AB} (mag)	T_{eff} (K)	J_{AB} (mag)	T_{eff} (K)
Pleiades	03 45	+24	120	120	16.3	2760	19.9	1270
IC 4665	17 40	+05	50	350	17.9	2850	21.2	1600
NGC 2264	06 40	+09	3	760	18.4	2950	21.6	2200
NGC 1333	03 30	+31	1	300	17.2	2920	20.0	2340
Rho Oph	16 30	-24	1	140	15.5	2920	18.4	2340
λ Ori	05 30	+10	5	400	16.3	2990	19.8	2040
IC 348	03 45	+32	2	315	16.0	2940	19.0	2300

- Aims at tracing the IMF to 3 M_{Jup}.
- Use the Y-J vs. J-H Color-Color Diagram.
- Use CH₄ On/Off to hunt for T dwarfs.