CLIMB Observing & Reduction

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Observing

- CLIMB = 3 telescopes
- Each bracket = cal obj cal
 - = $3 V^2$ points + 1 closure phase point

• Typically need 4+ brackets to do anything useful

• Calibrators need to be similar brightness to target (+/- 0.5 mag)

Observing

- 1. Operator slews to target & locks tracking
- 2. Align light on camera pixels (before each bracket)
- 3. Scan for fringes on a large scale (millimeters)
- 4. Search for fringes on a small scale (microns)
- 5. Check camera settings
- 6. Start exposure!

Telescope GUIs (old)

Cosmic Debris

S1 ACQU	* - • × 🗖	W1 ACQU + _ C	X ELACQU + . C X	COSMIC DEBRIS - PRIMARY + _ O >
				LOCAL TIME: 02:33 CHARA TIME: 10:32 SIDEREAL TIME: 08:05 OBJ: HD_89822 HOUR ANGLE: -02:20
				JOB QUEUE: 0 START JOB QUEUE STOP JOB QUEUE CLEAR JOB QUEUE PI: Lester Prog. 2018B-CL1
				CONTROL STARS CALIBRATORS CONFIGURE Camera settings
				Tiptilt (mS) 5 Center (m) 0.000 Range (m) 0.005 REF 0.0 0.0
				CLASSIC CLIMB_1 CLIMB_2 JOUFLU MIRC CHAMP PAVO VEGA
<u> </u>		 A set of the set of		DO LOG SKIP LOW SNR TARGET MEM Samp/Frg: 5 Acq: O None O Init • Tpoir
				K BAND 2 253/5&6 2 LONG SCAN 2 750Hz 2 DESTRUCT
				CHECK CLOCKS SYNC CLOCKS STAR ACQUIRED DATA ACQ BS DATA TT REPORT TT ON
				COMMENT ALIGN ACO ON SL * TIPTIT COMM NIBO 8000 6 LABAO FLAT
				SCAN FOR FRINGIL RECORD SCAN. 2 REAMS NEW REPEAT 3 REAMS NEW REPEAT OULCK LOOK MIRCY SAFE
51 A D X				Control and a control and a control and a control account of a control of a control of a control and a
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SPY1 SPY2 M10AL	Ema Ema Man	ERV1 ERV2 MIGAL	MODX/Y REMOTE	ople: Optimum reference cart position = 9.82m Observation time 2.99 hours
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SP13 BIAS ZBIAS	SPY3 BIAS ZBIAS	SPT3 BIAS ZBIAS	SEEING PING	Got star data 134793. Got OBLET star.
ON OFF ADJ	ON OFF ADJ	ON OFF ADJ	2.4 6.7 6.5 OFF	tipUit: 51 Det RMS 2.53" r0 0.0cm Seeing 0.00" 2D Corr $r0 = 0.0$ Seeing 0.00" tipUit: 41 Det RMS 1.63" r0 0.0cm Seeing 0.00" 2D Corr $u = 0.0$ Seeing 0.00"
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TV TRACKING:	TV TRACKING:	TV TRACKING:	RESTART SOCKET	tiptil: SZ Det RMS 51.13" 10 0.0cm Seeing 0.00" ZD Corr 10 = 0.0 Seeing 0.00" tiptil: W2 Det RMS 18.36" 10 0.0cm Seeing 0.00" ZD Corr 10 = 0.0 Seeing 0.00"
ON OFF 300	ON OFF 588	ON OFF SBB	REOPEN QUIT	tiptilit: E2 Det RMS 12.12" r0 0.0cm Seeing 0.00" ZD Corr r0 = 0.0 Seeing 0.00" climb 1: Using memorized OPLE positions 51 = -9580.5 E1 = -3356.1 um um.
SET CEN ADJ	SET CEN ADJ	SET CEN ADJ		climb 1: Saving data in /ctrscrut/chara/data/2018_12_12_HD_89822_climb1_001.fit
GET GRAB MOVE	GET GRAB MOVE	GET GRAB MOVE		Comp_1: Niko samples per second; 755,5
CCW STOP INIT CW	DOME ADJUST:	DOME ADJUST:		OPT DELAY HIGH SNR VERBOSE REOPEN PING END NIGHT REPORT QUIT
AUTODOME:	AUTODOME:	AUTODOME:	☐ / + _ □ X	
ON OFF HOME	ON OFF HOME	ON OFF HOME		Local Tr: 2:33:01 N SUM Drrs Mrrs SRV r0 SD ZD ZCr0 ZCSD MS Snd
POINTING SERVO:	POINTING SERVO:	POINTING SERVO:		CHARA TT: 10:33:01 51 1 5105 0.16 0.98 ON 2.4 3.26 37.9 3.1 2.68 ON
ACQ TIP/TILT	ACQ TIP/TILT	ACQ TIP/TILT		Lest Tr. nS: 1 5 E1 1 4795 0.1300.43 ON 0.5 1.42 37.8 8.3 1.13 ON
ACQ & T/T FINDER	ACQ & T/T FINDER	ACQ & T/T FINDER		Frms/Sec: 158.00 52 1 14 X.XX 0.00 OFF 0.0 0.00 0.0 0.0 0.00 ON Frame Tp: SUB_FRAME W2 1 12 X.XX 0.00 OFF 0.0 0.00 0.0 0.00 0.00 ON
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AzEI + 23.2 52.4	AzEI + 22.9 52.4	AzEL + 23.0 52.5		Local Trr: 02:33 TT Az : 0.0660 TV Dev : ACQU 1.87 F/S
16	ALL T 22.9 32.4	1421 + 2510 - 3215		CHARA TM: 10:33 TT ET : -0.0780 Frms/Sec: D-2:1.7 P-2:1.7 Lost T/S: 0/ 0 TCS RA : 10 24 07.92 Mn/Mx/To: 34 253 0
PING REOPEN	PING REOPEN	PING REOPEN		T/RH bnk: 9.8/ 18.0 TCS Dec : 65 34 04.88 Size/Rad: 640 480 10 huT Stat: Aut Dome Pos: +24.3 Origin : 340.00.260.00
QUIT	QUIT	QUIT		Star : HD_89822 TCS Az : +23.2 +23.2 Pos : 340.00,260.00
E1 Lurk OPLE	VEGA Central W1 Lu	rk		Period : 100 Crn Cube: Out BOX : (0, 0) (639,479)
Seconda	ry Control			Servo : Wobb 1 Sin : No / 1.0 Tracking: OFF OK



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SCOPE UT WIND DIR GUST DIR MEAN Tout Tbunk RH DP/P Ttel RHtel	LEATHER	IR(4)56B \$\$X = 0 UP Y = 0
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✓E1 10:32 0.0 264.4 W 9.6 254.5 0.0 8.0 19.4 33.9 -7.0 3	80 EI E -	INITIALIZE SMALLER DOWN BIGGER
🗹 E2 10:32 0.0 244.7 SW 0.0 0.0 0.6 8.8 16.4 21.6 -12.1		CLS CL1 CL2 25 OK
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✓ W2 10:32 0.0 71.7 E 0.0 0.0 0.0 8.8 15.0 16.8 -15.1		QUIT PICO: IR23 + X
NO PLOTS DUST PING REOPEN QUIT		
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51 C K BAND C GO STOP ZERO STOP HERE		PICO: IR123A 🔶 🗆 🗙
BACKWARD -1.20/ -0.80 cm S1: -2nm		X = 0 UP Y = 0
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Stop (m) +0.01000 FORWARD Scan: 1/ 30 E1: 14nm		
Inc (m) 0.001 DECREASE File: 000	FRINGE 12 SIGNAL + X	SUM + X
Freq (Hz) 200.0 EDGE Vel: 151.54 um/S 580 Da		
Number 30 INCREASE Time: 8 S Fri 10.2. Shares		
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2018_12_12_HD_89822_climb1_001.fit DATA SCAN 9 Scans 297 SERVO ON V12_0.51 10.061 V23_0.62 38.755 V31_0.43 64.612 Gain A -0.70 Gain 8 0.70		
Pos 4.9 Targ 0.0 Pos -8.4 Targ 0.0 Pos -3.4 Targ 0.0 Minwgt 1.00 Maxerr 3.000 S1: -9575.3um E1: -3334.4um Counts: 43.1 37.5 33.4		Power
POSA POSA++ POSB POSB++ SMALL LARGE BIG HUGE		
SERVO SAVE DIFF/SIG FILT AUTO UP DN FRGTRCK ABORT	Anonomore and the state of the	spectrum
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Reduction 1. Start the pipeline

John Monnier's code:

Run IDL script in .../Libraries/NIRO/CLIMB (where his programs are).

>> .run start_climb.pro

Reduce all exposures for one target simultaneously.

... will ask you where the data live and which stars are OBJ vs CAL

Reduction 2. Remove bad scans using waterfall plot



Reduction 3. Set PS integration range



Reduction 4. Visibilities & calibration

Calculate raw V² and uncertainty from PS using bootstrapping.

Calibrate V² using linear fit to the calibrator visibilities.

$$corrected \ V_{obj}^2 = raw \ V_{obj}^2 \times \frac{predicted \ V_{cal}^2}{raw \ V_{cal}^2}$$

Reduction 5. Output

Saves results in ".oifits" files.

see http://chara.gsu.edu/analysis-software/oifits-data-format

Read into analysis programs & do science!